# Advancing beyond

For Signal Analyzer MS2690A/MS2691A/MS2692A For Signal Analyzer MS2850A/MS2840A/MS2830A

# MX2690xxA series MX2830xxA series MX2840xxA series MX2850xxA series

# Measurement Software



# Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

The Signal Analyzer MS269xA is the high-end model supporting best-of-class high-accuracy, a wide dynamic range and 125 MHz wideband analysis. The MS2850A, MS2840A and MS2830A are the mid-range model with excellent cost performance supporting superior RF performance, best-of-class speed, and low power consumption.

| Model                              | Feature  | Frequency Range   | Analysis Bandwidth  |
|------------------------------------|--|---|---|
| <b>MS269xA</b><br>(High-end model) | High level accuracy up to 6 GHz expandable to 5G, and  | MS2690A<br>50 Hz to 6 GHz   | 31 .25 MHz (Standard)   |
|                                    | 125 MHz wideband<br>■ 177 dB dynamic range without external filter for spurious  | MS2691A*1<br>50 Hz to 13.5 GHz  | 62 .5 MHz (Option: MS269xA-077)   |
|                                    | measurements   | MS2692A*1<br>50 Hz to 26.5 GHz  | 125 MHz (Option: MS269xA-078)   |
| MS2850A<br>(Middle-range model)    | <ul> <li>Analysis bandwidth: 1 GHz max.</li> <li>For R&amp;D and manufacturing cost reduction of 5G and<br/>wideband systems including microwave/millimeter wave<br/>communications systems, such as satellite broadcasting</li> </ul> | 9 kHz to 32 GHz<br>9 kHz to 44.5 GHz  | 255 MHz (Standard)<br>510 MHz (Option: MS2850A-033)<br>1 GHz (Option: MS2850A-034)  |
| MS2840A<br>(Middle-range model)    | <ul> <li>Highest level phase noise performance among<br/>middle-range models</li> <li>High cost-performance ratio as replacement for aging<br/>high-end models</li> </ul>  | 9 kHz to 3.6 GHz<br>9 kHz to 6 GHz<br>9 kHz to 26.5 GHz<br>9 kHz to 44.5 GHz                    | 31 .25 MHz (Standard)<br>62 .5 MHz (Option: MS2840A-077)*2<br>125 MHz (Option: MS2840A-078)*2   |
| MS2830A<br>(Middle-range model)    | <ul> <li>High-speed, low-cost, low power consumption cuts<br/>manufacturing costs</li> <li>Environment-friendly energy saving design</li> <li>Multiple versatile measurement options</li> </ul>  | 9 kHz to 3.6 GHz<br>9 kHz to 6 GHz<br>9 kHz to 13.5 GHz<br>9 kHz to 26.5 GHz<br>9 kHz to 43 GHz | None (Standard)<br>10 MHz (Option: MS2830A-006)<br>31 .25 MHz (Option: MS2830A-005/009)<br>62 .5 MHz (Option: MS2830A-077)* <sup>2</sup><br>125 MHz (Option: MS2830A-078)* <sup>2</sup> |

\*1: The MS2691A main unit has been discontinued.

The MS2692A main unit is only for the Conformance Test System and cannot be purchased separately.

\*2: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2840A/MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

#### **Main Unit Measurement Functions**

The MS269xA, MS2850A, MS2840A and MS2830A series of signal analyzers has the following built-in spectrum analyzer and signal analyzer functions used in combination with measurement software.

| Spectrum                               | Channel Power   | <ul> <li>Occupied Bandwidth</li> </ul> | • Adjacent Channel Leakage Power |
|--|---|--|----------------------------------|
| Spectrum Emission Mask                 | Burst Average Power   | <ul> <li>Spurious Emission</li> </ul>  | • AM Depth                       |
| FM Deviation                           | <ul> <li>Multi-marker &amp; Marker List</li> </ul>              | <ul> <li>Highest 10 Markers</li> </ul> | • Limit Line                     |
| Frequency Counter                      | <ul> <li>2-tone 3rd-order Intermodulation Distortion</li> </ul> | <ul> <li>Annotation Display</li> </ul> | • Power vs. Time                 |
| <ul> <li>Frequency vs. Time</li> </ul> | Phase vs. Time  | <ul> <li>CCDF/APD*</li> </ul>          | Spectrogram                      |

\*: CCDF: Complementary Cumulative Distribution Function, APD: Amplitude Probability Density

#### Hardware Option (Measurement Functions)

The following measurement functions can be added as hardware options to the MS269xA, MS2850A, MS2840A and MS2830A series of signal analyzers (depending on the model). For details refer to the relevant main-frame brochure.

Phase Noise Measurement Function, Noise Figure Measurement Function, Precompliance EMI Function, etc.

# Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

The MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series of measurement software can be used by the MS269xA, MS2850A, MS2840A and MS2830A.

#### Required Analysis Bandwidth Options for Each Model

|          Control (Space)         Nume         Nume  |   |  |  |       |                       |                  |         |     |           |         | Can be ir             |          | i – nequ                              | 110,0 - | opgrad   |       |   |   |
|--|---|--|--|-------|-----------------------|------------------|---------|-----|-----------|---------|-----------------------|----------|---------------------------------------|---------|----------|-------|---|---|
| System         VCLMA/APSA/Deather         MCMM/APSA/Deather         MC   | Communications  |  |  |       |                       | MS269xA          |         | MS  | 52830A Op | tion    |                       | MS2840A  |                                       | MS2850  | A Option |       |   |   |
| WCDMAMPS         MC26011A         S         V         N         V         N  | Systems   | Name   | Model  | Page  | MS269xA               | <u> </u>         | MS2830A | 006 | 005 (000  | 077/070 | MS2840A               | <u> </u> | MS2850A                               | 022     | 024      |       |   |   |
| Watcher         Mache of the second sec  |   | W/ CDMA/HSDA Downlink  |  |       |                       | 0/7/078          |         | 006 | 005/009   | 077/078 |                       | 0/7/078  |                                       | 033     | 034      |       |   |   |
| HSDA Loging         MCLEMMINA         MCLEMIDIA         7         V         N         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         R         V         V         R         V        V         V         V </td <td>W-CDMA/HSPA/</td> <td></td> <td>MX269011A</td> <td>5</td> <td><ul> <li>✓</li> </ul></td> <td></td> <td>~</td> <td>R</td> <td></td> <td></td> <td></td> <td></td> <td>~</td> <td></td> <td></td>  | W-CDMA/HSPA/  |  | MX269011A  | 5     | <ul> <li>✓</li> </ul> |                  | ~       | R   |           |         |                       |          | ~                                     |         |          |       |   |   |
| Massamemet Solvage         MASSAMEME         MASSAMEME         I <thi< th=""> <thi< th=""> <thi< th="">         &lt;</thi<></thi<></thi<>  | HSPA Evolution  |  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| EDE brokelon<br>Machine         MOSS001A-001         9         -/         N         <  |   |  | MX269012A  | 7     | <b>↓</b>              |                  | ~       | R   |           |         |                       |          | ✓                                     |         |          |       |   |   |
| Dide balance         Mode space of a submate         Mode space         Mode space of a submate  | GSM/EDGE  | GSM/EDGE Measurement Software  | MX269013A  | 9     | ~                     |                  | ~       | R   |           |         |                       |          | ~                                     |         |          |       |   |   |
| Induce meth         Image   | EDCE Evolution  | EDGE Evolution   | MAX260012A 001*8   | 0     | ./                    |                  |         | р   | 1         |         | 1                     |          | ./                                    |         |          |       |   |   |
| T3-5CDM         T5-5CDM         Measurement Subware         MC28001A         13         /         /         /         R         /         /         /         /         /         /         /         /         /         /         /         /         R         //           | EDGE EVOlution  | Measurement Software   | WIX209015A-001   | 9     | ľ                     |                  | •       | ĸ   |           |         |                       |          | , v                                   |         |          |       |   |   |
| Vector Modulation Analysis Software<br>MSG SOFtwar | ETC/DSRC  | ETC/DSRC Measurement Software  | MX269014A  | 11    | ~                     |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| Verter<br>Modulation<br>(How/ADA)         APSE Auryla<br>(Hgher-Onder QAD Analysis)         MO269017A-011''         15         I   | TD-SCDMA  | TD-SCDMA Measurement Software  | MX269015A  | 13    | ~                     |                  | ✓       | R   |           |         |                       |          | ~                                     |         |          |       |   |   |
| Machal         Machal<  |   | Vector Modulation Analysis Software  | MX269017A  | 15    | ✓                     | U                | ✓       | R   | U         | U       | ~                     | U        | ~                                     |         |          |       |   |   |
| Higher-Chief QAM Analysis         MOX26017.411"         15         I <thi< th=""></thi<>   |   | APSK Analysis  | MX269017A-001*17   | 15    |                       |                  |         |     |           |         | √                     | U        | ~                                     |         |          |       |   |   |
| Introduction         Analog Measurement Software         MAGE MEASURAGE         S         I         <  | wouldtion   | Higher-Order QAM Analysis  | MX269017A-011*17   | 15    | 1                     |                  |         |     |           |         | √                     | U        | ~                                     |         |          |       |   |   |
| MMOM/M         Mode Ration         MODE Ration <t< td=""><td>5</td><td>Analog Measurement Software</td><td>MX2690184*9</td><td>25</td><td></td><td></td><td>~</td><td></td><td></td><td></td><td><ul> <li>✓</li> </ul></td><td></td><td></td><td></td><td></td></t<>   | 5   | Analog Measurement Software  | MX2690184*9  | 25    |                       |                  | ~       |     |           |         | <ul> <li>✓</li> </ul> |          |                                       |         |          |       |   |   |
| LTE / Laware         LTE Dewnink Messurement Software         MX269020A 001*0         37         -         U         -         R         R         U         -         -         U         -         R         R         U         -         U         -         R         R         U         -         U         -         R         R         U         -         U         -         R         R         U         -         C <thc< th=""> <thc< th="">         C         <thc< th=""></thc<></thc<></thc<>   |   | _  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| ITE-Advanced FDD Downlink         MX269020A 001***         37         v         U         v         R         R         R         U         v  | Pulse Radar   | Pulse Radar Measurement Function   | MX284059B*19   | 34    |                       |                  |         |     |           |         | ~                     |          |                                       |         |          |       |   |   |
| LTLF         Measurement Software         MKZ69021A         37         V         U         V         R         R         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         K         K         K         U         V         K         <   |   | LTE Downlink Measurement Software  | MX269020A  | 37    | <ul> <li>✓</li> </ul> |                  | ✓       | R   | R         |         |                       |          | <ul> <li>✓</li> </ul>                 |         |          |       |   |   |
| ITT - Advanced<br>(FDD)         Measurement Software         MC659021 A         3         -         -         -         R         R         R         L         -         -         -         -         -         -         -         -         -         R        R         R         R   |   |  | MX269020A-001*10   | 37    | <b>√</b>              | U U              | ~       | R   | R         | u       |                       |          | ~                                     |         |          |       |   |   |
| If E Upink Measurement Software         MX269021A         43         ✓         ✓         R         R         C         ✓         R         R         U         ✓         I           If E Upink Measurement Software         MX269021A         37         ✓         U         ✓         R         R         U         ✓         R         U         ✓         I         I         I         I         I         I         V         R         R         U         ✓         I         I         I         V         I         R         R         U         ✓         I         I         I         I         I         I         I         I         V         R         R         U         I <tdi< td=""></tdi<>  |   |  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         | <u> </u> |       |   |   |
| Massurement software         MX269021A-01***         43         V         U         K         K         U         V         V         V         V         V         V         V         V         V         K         K         U         V         V         V         V         V         V         V         V         V         V         V         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         V         K         K         U         K         K         U         V         Intervised         Intervised         Intervised         Intervised         K         K         K         K         U         Intervised         Intervised         Intervised         Intervised         Intervised <thintervised< th="">         Intervised         Intervised</thintervised<>   |   | LTE Uplink Measurement Software  | MX269021A  | 43    | ✓                     |                  | ✓       | R   | R         |         |                       |          | ✓                                     |         |          |       |   |   |
| Measurement Software         MX269022A         37         V         V         R         R         R         V  |   |  | MX269021A-001*13   | 43    | ~                     | U                | ~       | R   | R         | U       |                       |          | ~                                     |         |          |       |   |   |
| ITF / transment Software         Mackage/26.001*1         3'         V         U         V         R         R         U         V         V         I         V         I         V         I         V         I         R         R         U         V         I <thi< th=""></thi<>   |   |  | MX269022A  | 37    | ✓                     |                  | ~       | R   | R         |         |                       |          | ~                                     |         |          |       |   |   |
| LTE ToD uplink<br>Measurement Software<br>(TDD)         LTE TDD uplink<br>Measurement Software<br>MC269023A-001**         43         ✓         ✓         R         R         N         V         V         R         R         U         ✓         R         R         U         ✓         R         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         R         U         ✓         Z         ✓         Z         ✓         Z <thz< th="">         Z         Z</thz<>   | LTE/  |  | MX269022A-001*11   | 37    | ~                     | U                | ~       | R   | R         | U       |                       |          | ~                                     |         |          |       |   |   |
| LTE-Advanced TDD Uplink<br>Messurement Software         MX269023A.001***         43         ✓         U         ✓         R         R         U         ✓         I         ✓         I         ✓         I         ✓         I         ✓         I         ✓         I         ✓         I         ✓         I         ✓         I         I         ✓         I         I         ✓         I         I         ✓         I         I         ✓         I         I         ✓         I  |   |  | MX269023A  | 43    | ~                     |                  | ~       | R   | R         |         |                       |          | ~                                     |         |          |       |   |   |
| Measurement Software         MX2690284-001**         Add         V     <   |   |  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| Measurement Software         MM269024A         49         7         R <thr< td=""><td></td><td></td><td>MX269023A-001*14</td><td>43</td><td><ul> <li>✓</li> </ul></td><td>U</td><td>~</td><td>R</td><td>R</td><td>U</td><td></td><td></td><td>~</td><td></td><td></td></thr<>  |   |  | MX269023A-001*14   | 43    | <ul> <li>✓</li> </ul> | U                | ~       | R   | R         | U       |                       |          | ~                                     |         |          |       |   |   |
| All Measure Function         MX269024A-001         49         ✓         N        <   |   |  | MX269024A  | 49    | ~                     |                  | ~       | R   |           |         |                       |          |                                       |         |          |       |   |   |
| LxEV-DO         EV-DO Forward Link<br>Measurement Software         MX269026A         49         ✓         R         R         L <thl< th="">         L        L        &lt;</thl<>   | CDIVINEDOUD   |  | MX269024A-001  | 49    | ~                     |                  | √       | R   |           |         |                       |          |                                       |         |          |       |   |   |
| All Measure Function         MX269026A-001         49         ✓         N         N         R         I <thi< th="">         I         I         &lt;</thi<>   | 1.5/ 00   | EV-DO Forward Link   |  |       | ~                     |                  | ~       |     |           |         |                       |          |                                       |         |          |       |   |   |
| SG Standard Measurement Software<br>(Base License)         MX285051A<br>MX285051A-001**         64  <  | IXEV-DO   |  |  | 40    |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| Base License)         MX283051A         64         Image: Control of the con   |   |  | WIX269026A-001   | 49    | · ·                   |                  | v       | ĸ   |           |         |                       |          |                                       |         |          |       |   |   |
| Pre-Standard CP-OFDM Downlink         MX285051A-001**6         64  |   |  | MX285051A  | 64    |                       |                  |         |     |           |         |                       |          | ~                                     |         |          |       |   |   |
| Pre-Standard CP-OFDM Uplink         MX285051A-051**6         64  |   |  | MX285051A-001*16   | 64    | -                     |                  |         |     |           |         |                       |          | √                                     | U       | U        |       |   |   |
| SG         NR TDD sub-6 GHz Downlink         MX285051A-011**6         66   |   |  |  |       | -                     |                  |         |     |           |         |                       |          | √                                     |         |          |       |   |   |
| SG         NR TDD sub-6 GHz Uplink         MX285051A-061***         66  <  |   |  |  |       |                       |                  |         |     |           |         |                       |          | ·····                                 |         |          |       |   |   |
| NR FDD sub-6 GHz Downlink         MX285051A-031***         66   <  |   |  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| SG         NR FDD sub-6 GHz Uplink         MX285051A-021*16         66         Image: Constraint of the state of th  |   | ·····  |  | ····· |                       |                  |         |     |           |         |                       |          | · · · · · · · · · · · · · · · · · · · |         |          |       |   |   |
| 5G       NR TDD mmWave Downlink       MX285051A-021*16       66       Image: Constraint of the second s  |   |  |  |       |                       |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| NR TDD mmWave Uplink         MX285051A-071**6         66         Image: Constraint of the superscript of the supers   | 5G  | ·····  |  | ····· | -                     |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| 5G Standard Measurement Software<br>(Base License)       MX269051A       73       73       74       10       1  |   |  |  | ····· |                       |                  |         |     |           |         |                       |          |                                       | -       |          |       |   |   |
| (Base License)       MX269051A       /3       /2 <th 2<="" th="">       /2       <th 2<="" th="">       /2       /2       <th <="" td=""><td></td><td>······</td><td>MX285051A-071*16</td><td>66</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>·····</td><td>U</td><td>U</td></th></th></th>   | /2       /2 <th 2<="" th="">       /2       /2       <th <="" td=""><td></td><td>······</td><td>MX285051A-071*16</td><td>66</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>·····</td><td>U</td><td>U</td></th></th> | /2       /2 <th <="" td=""><td></td><td>······</td><td>MX285051A-071*16</td><td>66</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>·····</td><td>U</td><td>U</td></th> | <td></td> <td>······</td> <td>MX285051A-071*16</td> <td>66</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>·····</td> <td>U</td> <td>U</td> |       | ······                | MX285051A-071*16 | 66      |     |           |         |                       |          |                                       |         |          | ····· | U | U |
| NR TDD sub-6 GHz Uplink         MX269051A-061*19         73         ~         U         Image: Constraint of the sub-sub-sub-sub-sub-sub-sub-sub-sub-sub-  |   |  | MX269051A  | 73    | ~                     |                  |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| NR FDD sub-6 GHz Downlink       MX296051A-031*10       73       ~       U       Image: Constraint of the sub-sub-sub-sub-sub-sub-sub-sub-sub-sub-  |   | NR TDD sub-6 GHz Downlink  | MX296051A-011*18   | 73    | ✓                     | U                |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| NR FDD sub-6 GHz Uplink         MX269051A-081*18         73         ·         U         ·         I         ·         I         ·         I         ·         I         ·         I         ·         U         ·         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I  |   | NR TDD sub-6 GHz Uplink  | MX269051A-061*18   | 73    | ✓                     | U                |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| WLAN (802.11) Measurement Software<br>(Supports<br>IEEE 802.11a/11b/11g/11j/11n/11p)       MX269028A       52       ✓       R       R       R       I  |   | NR FDD sub-6 GHz Downlink  | MX296051A-031*18   | 73    | √                     | U                |         |     | 1         |         |                       |          |                                       |         |          |       |   |   |
| WLAN (802.11) Measurement Software<br>(Supports<br>IEEE 802.11a/11b/11g/11j/11n/11p)       MX269028A       52       ✓       R       R       R       I  |   | NR FDD sub-6 GHz Uplink  | MX269051A-081*18   | 73    | ✓                     | U                |         |     | 1         |         |                       |          |                                       |         |          |       |   |   |
| WLAN         802.11ac (80 MHz)<br>Measurement Software         MX269028A-001*12         52         ✓         R   |   | (Supports  |  | 52    | ~                     |                  | ~       | R   | R         |         |                       |          |                                       |         |          |       |   |   |
| Measurement Software         MX269028A-002*12         52         ✓         R         Image: Control of the second s  | WLAN  | 802.11ac (80 MHz)  | MX269028A-001*12   | 52    |                       |                  | ~       | R   | R         | R       |                       |          |                                       |         |          |       |   |   |
| Measurement Software   |   |  |  |       |                       | P                |         |     |           |         |                       |          |                                       |         |          |       |   |   |
| W-CDMA/HSPA W-CDMA BS Measurement Software MX269030A 62 🗸 R  | W-CDMA/HSPA   |  |  |       |                       | n n              | ✓       |     |           |         |                       |          |                                       |         | <u> </u> |       |   |   |

# Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

Note, the MS269xA, MS2830A, MS2840A and MS2850A require the following options:

| [MS269xA Options]<br>Analysis Bandwidth Extension to 62.5 MHz<br>Analysis Bandwidth Extension to 125 MHz   | MS269xA-077<br>MS269xA-078*1  |
|--|---|
| [MS2850A Options]<br>Analysis Bandwidth Extension 510 MHz<br>Analysis Bandwidth Extension 1 GHz  | MS2850A-033<br>MS2850A-034* <sup>17</sup>   |
| [MS2840A Options]<br>Analysis Bandwidth Extension to 62.5 MHz<br>Analysis Bandwidth Extension to 125 MHz   | MS2840A-077<br>MS2840A-078* <sup>2</sup>  |
| [MS2830A Options]<br>Analysis Bandwidth Extension to 31.25 MHz<br>Analysis Bandwidth 10 MHz<br>Bandwidth Extension to 31.25 MHz for Millimeter-wave<br>Analysis Bandwidth Extension to 62.5 MHz<br>Analysis Bandwidth Extension to 125 MHz | MS2830A-005*3<br>MS2830A-006<br>MS2830A-009*4<br>MS2830A-077*5,*7<br>MS2830A-078*6,*7 |

\*1: MS269xA-077 is necessary.

\*2: MS2840A-077 is necessary.

\*3: Available only when MS2830A-040/041/043/044 is installed. Requires MS2830A-006.

\*4: Available only when MS2830A-045 is installed. Requires MS2830A-006.

- \*5: Requires MS2830A-006 and MS2830A-005 (for MS2830A-040/041/043/044). Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).
- \*6: Requires MS2830A-006, MS2830A-005, and MS2830A-077 (for MS2830A-040/041/043/044). Requires MS2830A-006, MS2830A-009, and MS2830A-077 (for MS2830A-045).
- \*7: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

#### \*8: Requires MX269013A

- \*9: MS2830A-066 and A0086D required by MS2830A; A0086D required by MS2840A.
- \*10: Requires MX269020A
- \*11: Requires MX269022A
- \*12: Requires MX269028A
- \*13: Requires MX269021A
- \*14: Requires MX269023A
- \*15: Requires MS2850A-033
- \*16: Requires MX285051A
- \*17: Requires MX269017A
- \*18: Requires MX269051A

\*19: For MS2840A-044/046. MS2840A-046 requires MS2840A-019. Unavailable when MS2840A-069/068/067 is simultaneously installed.

# W-CDMA/HSPA Downlink Measurement Software MX269011A

The W-CDMA/HSPA Downlink Measurement Software MX269011A supports measurement of the RF Tx characteristics of W-CDMA/HSDPA/HSUPA/ HSPA Evolution base stations.

Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of base stations and base-station components.

#### Versatile Functions for W-CDMA/HSPA/HSPA Evolution Development

Modulation analysis, Tx Power measurements, etc., required for development of W-CDMA/HSPA/HSPA Evolution base stations and device components are performed at high speed with superior accuracy.

#### Modulation Analysis

- Frequency Error
- Mean Power
- Vector Error/Amplitude Error/Phase Error
- Origin Offset
- Peak Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Phase Error vs. Chip

#### Code Domain

#### Mean Power

- P-CPICH/P-SCH/S-SCH
- Vector Error/Amplitude Error/Phase Error
- Code Power
- Code Domain/Code Domain Error
- Constellation
   Vector Error/Amplitude Error/Phase Error/Code Power vs. Symbol

#### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

#### MS2830A Signal Analyzer MS269xA MS2850A W-CDMA, HSPA, HSPA Evolution Downlink **Target Signals** Supports QPSK, 16QAM, and 64QAM HS-PDSCH modulation methods (excludes MIMO Tx signals) 400 MHz to 3 GHz Measurement Frequency Range -15 to +30 dBm (Preamp Off, or Preamp not installed) Measurement Level Range -30 to +10 dBm (Preamp On) At 18°C to 28°C, after calibration, EVM = 1% signal Carrier Frequency Measurement Modulation/ $\pm$ (Accuracy of reference frequency × ± (Accuracy of reference frequency × Accuracy Frequency Carrier frequency + 6) Hz Carrier frequency + 5) Hz Measurement At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level Modulation Accuracy Residual Vector Error: ≤1.0% (rms) Residual Vector Error: ≤1.3% (rms) Waveform Display EVM vs. Chip, Amplitude Error vs. Chip, Phase error vs. Chip, IQ Constellation -15 to +30 dBm (Preamp Off, or Preamp not installed) -15 to +30 dBm (Preamp Off, or Preamp not installed) Measurement Level Range -30 to +10 dBm (Preamp On) Amplitude At 18°C to 28°C, After calibration, Input attenuator ≥10 dB Average Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit) Measurement When input signal within measurement level range and less than input level ±0.6 dB (Preamp Off, or Preamp not installed) ±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On) -15 to +30 dBm (Preamp Off or Preamp not installed) Measurement Level Range -30 to +10 dBm (Preamp On) At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level Relative Accuracy: ±0.02 dB (Code Power ≥10 dBc) Relative Accuracy: ±0.02 dB (Code Power ≥10 dBc) Code Domain Power ±0.05 dB (Code Power ≥20 dBc) $\pm 0.10 \text{ dB}$ (Code Power $\geq 20 \text{ dBc}$ ) ±0.10 dB (Code Power ≥30 dBc) $\pm 0.15$ dB (Code Power $\geq 30$ dBc) Code Domain At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level Measurement Residual Error: ≤-46 dB Residual Error: ≤-42 dB Code Domain Error Accuracy: $\pm 0.3$ dB (Code Domain Error $\geq -30$ dBc) $\pm 1.0$ dB (Code Domain Error $\geq -40$ dBc) EVM vs. Symbol, Amplitude Error vs. Symbol, Phase Error vs. Symbol, Symbol Constellation, Waveform Display Code Domain Power, Code Domain Error Spectrum **Measurement Functions** Adjacent Channel Leakage Power, Channel Power, Occupied Bandwidth, Spectrum Emission Mask Measurement

#### Code vs. Time

- Mean Power
   P-CPICH/P-SCH/S-SCH
- Vector Error/Amplitude Error/Phase Error
- Code Power
- Code vs. Time
- Code Domain/Code Domain Error

#### Spectrum

- Adjacent Channel Leakage Power
- Channel Power
- Occupied Bandwidth
- Spectrum Emission Mask

MS269xA MS2850A MS2830A

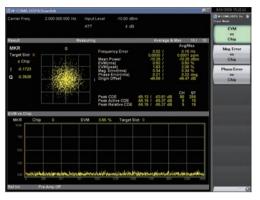
# W-CDMA/HSPA Downlink Measurement Software MX269011A (Continued)

MS269xA MS2850A MS2830A

#### **Measurement Functions**

#### • Frequency Error/Modulation Accuracy

This function supports modulation analysis of W-CDMA/HSDPA/ HSUPA/HSPA Evolution downlink signals with simultaneous display of max and mean values of frequency and vector error, etc., for up to 15 slots to evaluate DUT dispersion characteristics.



Modulation Analysis Screen

#### Code vs. Time

This function is convenient for monitoring time variations in Mean Power for all codes and Code Power for up to 300 slots. It is useful when performing tests specified by 3GPP TS 25.141, 6.4.1 Inner Loop Power Control and 6.4.2 Power Control Steps.



Code vs. Time

#### Code Domain

This function displays results for each code as a constellation and numeric table, making it easy to discover transient code-dependent signal degradation.

In addition, graphs can be displayed with any of Vector Error, Amplitude Error, and Phase Error on the vertical axis to discover transient timedependent (symbol units) signal degradation for a specific code.



Code Domain (Constellation)

| arrier F     |               | 2 000 000 000 Hz | Input Level<br>ATT       | -10.00 dBm<br>4 dB |   |                            | Code Domain                 |
|--------------|---------------|------------------|--------------------------|--------------------|---|----------------------------|-----------------------------|
| esult        | _             |                  |                          |                    |   |                            | Trace<br>Power Error        |
| ode Do       | main Powe     | er               |                          |                    |   | 2                          |                             |
|              | ode 129       |                  | 16 Modulat<br>17 dB Erro |                    | Target Slot 14<br>Mean Power<br>P-CPICH | -10,26 dBm<br>-11,03 dB    |                             |
|              | , <b>M</b> IN | ln l             | nhiimnr                  | 1                  | P-SCH<br>S-SCH                          | -14.16 dB<br>-14.16 dB     |                             |
| 000  <br>000 |               |                  |                          |                    | EVM(rms)<br>EVM(peak)<br>Mag.Error      | 0.53 %<br>1.44 %<br>0.37 % | Constellation               |
| CO I         | Symbol        |                  | - AND AND AND A          |                    | Phase Error<br>Code Power               | 0.22 deg.<br>-12.17 dB     | EVM<br>vs<br>Symbol         |
| MKR<br>530   | Symbol        |                  | EVM 0.57 1               | 4 Target Slot 14   |   |                            | Mag Error<br>VS<br>Symbol   |
|              |               |                  |                          |                    |   |                            | Phase Error<br>Vs<br>Symbol |
|              | A             |                  |                          | A                  | hor and                                 | A                          | Code Power                  |

Code Domain (Vector Error vs. Symbol)

# W-CDMA/HSPA Uplink Measurement Software MX269012A

The W-CDMA/HSPA Uplink Measurement Software MX269012A supports measurement of the RF Tx characteristics of W-CDMA/HSDPA/HSUPA/ HSPA Evolution mobile terminals.

Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of mobile terminals and mobile-terminal components.

#### Versatile Functions for W-CDMA/HSPA/HSPA Evolution Development

Modulation analysis, Tx Power measurements, etc., required for development of W-CDMA/HSPA/HSPA Evolution mobile terminals and device components are performed at high speed with superior accuracy.

#### Modulation Analysis

- Frequency Error
- Mean Power
- Vector Error/Amplitude Error/Phase Error
- Origin Offset
- Peak Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Phase Error vs. Chip

#### Code Domain

- Mean Power
- Vector Error/Amplitude Error
- Code Power
- Code Domain/Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Code Power vs. Symbol

#### Spectrum

- · Adjacent Channel Leakage Power
- Channel Power
- Occupied Bandwidth
- Spectrum Emission Mask

#### **Specifications**

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

| Signal Analyzer                         |  | MS269xA  | MS2830A   |  |  |  |
|---|--|--|---|--|--|--|
| Signal Analyzei                         |  | WISZUSZA   | MS2850A   |  |  |  |
| Target Signal                           |  | W-CDMA/HSPA/HSPA Evolution Uplink  |   |  |  |  |
| Measurement F                           | requency Range   | 400 MHz to 3 GHz   |   |  |  |  |
|   | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   |   |  |  |  |
|   | Carrier Frequency Measurement  | At 18°C to 28°C, After calibration, EVM = 1% signal  |   |  |  |  |
| Modulation/<br>Frequency<br>Measurement | Accuracy   | ± (Accuracy of reference frequency ×<br>Carrier frequency + 5) Hz  | ± (Accuracy of reference frequency ×<br>Carrier frequency + 6) Hz   |  |  |  |
| weasurement                             |  | At 18°C to 28°C, After calibration, When input signal withi  | n measurement level range and less than input level   |  |  |  |
|   | Modulation Accuracy  | Residual Vector Error: ≤1.0% (rms)   | Residual Vector Error: ≤1.2 % (rms)   |  |  |  |
|   | Waveform Display   | EVM vs. Chip, Amplitude Error vs. Chip, Phase Error vs. Ch   | ip, IQ Constellation  |  |  |  |
|   | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   | -15 to +30 dBm (Preamp Off, or Preamp not installed)  |  |  |  |
| Amplitude<br>Measurement                | Average Power Measurement<br>Accuracy (Found from root sum of  | At 18°C to 28°C, After calibration, Input attenuator ≥10 dB,<br>When input signal within measurement level range and less than input level |   |  |  |  |
|   | squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit) | ±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | ±0.6 dB (Preamp Off, or Preamp not installed)   |  |  |  |
|   | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   |   |  |  |  |
|   |  | At 18°C to 28°C, After calibration, When input signal withi  | n measurement level range and less than input level   |  |  |  |
| Code Domain                             | Code Domain Power  | Relative Accuracy: $\pm 0.02$ dB (Code Power ≥-10 dBc)<br>$\pm 0.05$ dB (Code Power ≥-20 dBc)<br>$\pm 0.10$ dB (Code Power ≥-30 dBc)       | Relative Accuracy: ±0.02 dB (Code Power ≥-10 dBc)<br>±0.10 dB (Code Power ≥-20 dBc)<br>±0.15 dB (Code Power ≥-30 dBc) |  |  |  |
| Measurement                             |  | At 18°C to 28°C, After calibration, When input signal withi  | n measurement level range and less than input level   |  |  |  |
|   | Code Domain Error  | Residual Error: ≤–46 dB  | Residual Error: ≤–42 dB   |  |  |  |
|   |  | Accuracy: ±0.3 dB (Code Domain Error ≥-30 dBc)<br>±1.0 dB (Code Domain Error ≥-40 dBc)   |   |  |  |  |
|   | Waveform Display   | EVM vs. Symbol, Amplitude Error vs. Symbol, Vector Error<br>Code Domain Error, Code Domain Power   | r vs. Symbol, Symbol Constellation,   |  |  |  |
| Spectrum<br>Measurement                 | Measurement Functions  | Adjacent Channel Leakage Power, Channel Power, Occup   | ied Bandwidth, Spectrum Emission Mask   |  |  |  |

MS269xA MS2850A

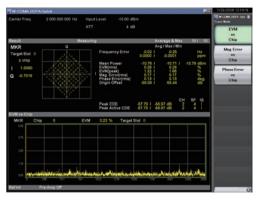
# W-CDMA/HSPA Uplink Measurement Software MX269012A (Continued)

MS269xA MS2850A MS2830A

#### **Measurement Functions**

#### • Frequency Error/Mean Power/Modulation Accuracy

The Frequency Error, Mean Power, and Modulation Accuracy are displayed simultaneously as a constellation and graphs showing changes in Vector Error/Amplitude Error/Phase Error over time (Chip units). Instantaneous characteristics can be measured due to the excellent residual EVM characteristics of the MS269xA.



Constellation and Vector Error vs. Chip

| 🖥 wi CDMA, HSPA<br>Carrier Fred. | 2 000 000 000 Hz | Input Level -10.0  | 0 d8m              |                            | 7/29/2008 131511          |
|----------------------------------|------------------|--|--------------------|----------------------------|---------------------------|
| Result                           |                  | ATT  | 4 cl)<br>Average I |                            | EVM<br>vs<br>Chip         |
| MKR<br>Target Slot 0<br>0 chip   | •                | Frequency Em   | 0.0000 / -0.00     |                            | Mag Error<br>vs<br>Chip   |
| Q 0.3190                         |                  | EVM(ms)<br>EVM(peak)<br>EVM(peak)<br>Mag.Error(ms<br>Phase Error(ms<br>Origin Offset |                    | 29 %<br>66 %<br>17 %       | Phase Error<br>VS<br>Chip |
| Phase Error vs C                 |                  | Peak CDE<br>Peak Active CD   |                    | CH 5F 10<br>2 4 0<br>2 4 0 |                           |
| MKR Chip                         | O Phase          | Error -0.12 deg. Ter   | getSlot 0          |                            |                           |
| 250                              |                  |  |                    |                            |                           |
|                                  |                  |  | ****               | -                          |                           |
|                                  |                  |  |                    |                            |                           |
|                                  |                  |  |                    |                            |                           |
| -210                             | 25. 171 2        | 1021 125   | 100 100 200        | 2001 2004                  |                           |

Constellation and Phase Error vs. Chip

#### Code Domain

Code Power and Code Errors can be displayed simultaneously as a specified code constellation and as graphs showing changes in Vector Error/Amplitude Error/Code Power over time (Symbol units). These time domain graphs allow the designer to find demodulation errors between RF and baseband.



**Code Domain Power and Constellation** 

|   |                            |                     |                 |                           | 10         | W COMA HEPA LLS                                  |
|---|----------------------------|---------------------|-----------------|---------------------------|------------|--|
| arrier Freq.  | 2 000 000 000 Hz           | Input Level         | -10.00 dBm      |                           |            | Trace Mode                                       |
|   |                            |                     | 4 dB            |                           |            | Code Domain Mo                                   |
|   |                            |                     |                 |                           |            | Department in suggest                            |
| tesult  |                            |                     |                 |                           |            | Power Error                                      |
| ode Domain Pr   |                            |                     |                 |                           |            |  |
| Power   | 28 CH/SF<br>-4.61 dB Error | 21 4<br>59.05 dB    | Modulation 4PAM | Branch I<br>Target Slot 0 |            |  |
| 40.00   |                            |                     |                 |                           |            |  |
| 22  |                            | - C                 |                 | Mean Power                | -10.74 dBm |  |
| and the second  | d                          | 100                 | 10 33           | EVM(rms)                  | 0.19.16    |  |
| Q Code  | 28 CH/SF                   |                     |                 | EVM(peak)                 | 0.58 %     |  |
| Power   | 4.78 dB Error              | 21 4<br>-58.47 dB   | Modulation 4PAM | Mag.Error                 | 0.19 %     |  |
| -20.00  |                            |                     |                 | Mag. crior                | 0.19 79    |  |
|   |                            |                     |                 |                           |            |  |
| 40.00   |                            |                     |                 | Code Power                | -4.61 dB   |  |
| 40.00   |                            |                     |                 | Code Power                | -4.61 dB   | Constellation                                    |
|   | Symbol                     | 12                  | 10 25           | Code Power                | 4.61 dB    | Constellation                                    |
| ode Power vs.)<br>MKR Symbol  |                            | 127.<br>Yower -2.16 |                 | Code Power                | 4.61 dB    |  |
| at to<br>at to |                            | 127<br>Tower -2.16  |                 | Code Power                | 4.61 dB    | Constellation<br>EVM<br>VS                       |
| ode Power vs  |                            | 127<br>Yower -2,16  |                 | Code Power                | 4.61 40    | EVM  |
| ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO<br>ALLO  |                            | tor<br>Nower 2.16   |                 | Code Power                | 4.61 40    | EVM<br>vs<br>Symbol                              |
| de Power val  |                            | 57<br>Power 2.16    |                 | Code Power                | 461 48     | EVM  |
| Mick Symbol<br>1000<br>1000<br>1000   |                            | 127<br>Yower 2.16   |                 | Code Power                | -61 48     | EVM<br>vs<br>Symbol<br>Mag Error                 |
| MCR Symbol<br>100<br>100<br>100<br>100<br>100<br>100  |                            | 127<br>Yowner 2.16  |                 | Code Power                | 451 48     | EVM<br>vs<br>Symbol<br>Mag.Error<br>vs<br>Symbol |
| All 10<br>All 10  | ol O Code P                | Cover 2.16          |                 | Code Power                | 4.61 48    | EVM<br>vs<br>Symbol<br>Mag Error<br>vs           |

Code Domain Power and Code Power vs. Symbol

# **GSM/EDGE** Measurement Software MX269013A EDGE Evolution Measurement Software MX269013A-001

The GSM/EDGE Measurement Software MX269013A and EDGE Evolution Measurement Software MX269013A-001 support measurement of the RF Tx characteristics of GSM/EDGE (EGPRS) and EDGE Evolution (EGPRS2) signals.

Installation in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of GSM/EDGE/ EDGE Evolution base stations, mobile terminals, and terminal components.

#### Versatile Functions for GSM/EDGE/EDGE Evolution R&D

Supports the fast, high-accuracy modulation analysis and mean power measurements required for development of GSM/EDGE/EDGE Evolution base stations, mobile terminals, and components.

#### Modulation Analysis (GMSK)

- Frequency Error
- Phase Error (Peak/rms)
- Constellation · Phase Error vs. Symbol
- Modulation Analysis (QPSK, 8PSK, 16QAM, 32QAM)
- Frequency Error
- Vector Error (EVM) [Peak/rms]
- Magnitude Error/Phase Error (rms)
- Origin Offset
- 95th percentile
- Droop
- Constellation
- EVM/Magnitude Error/Phase Error vs. Symbol

#### **Specifications**

The specification is the value after 30-minute warm-up at a constant ambient temperature. Unless otherwise noted, same specifications for MX269013A and MX269013A-001. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

| Signal Analyzer                      |  | MS269xA   | MS2830A   |  |  |  |
|--------------------------------------|--|---|---|--|--|--|
| Signar / maryzer                     |  |   | MS2850A   |  |  |  |
| Supported Sign                       | als  | MX269013A: GSM/EDGE Downlink and Uplink<br>MX269013A-001: EDGE Evolution Downlink and Uplink  |   |  |  |  |
| Modulation Me                        | thod   | MX269013A: GMSK, 8PSK, AQPSK (Normal Burst, Continuo<br>MX269013A-001: QPSK, 16QAM, 32QAM (Normal Burst, Hi   |   |  |  |  |
| Measured Frequ                       | iency Range  | 400 MHz to 2 GHz  | <u> </u>  |  |  |  |
|                                      | Measured Level Range   | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)  |   |  |  |  |
|                                      | Carrier Frequency  | At 18°C to 28°C, After calibration, with EVM = 1% signal  |   |  |  |  |
|                                      | Measurement Accuracy   | ± (Accuracy of reference frequency ×<br>Carrier frequency + 5) Hz   | ± (Accuracy of reference frequency ×<br>Carrier frequency + 8) Hz |  |  |  |
|                                      |  | At 18°C to 28°C, After calibration, With input signal in mea  | surement level range and less than Input level                    |  |  |  |
| Modulation/                          | MX269013A  | MX269013A   |   |  |  |  |
| Frequency                            |  | Residual Vector Error (8PSK/AQPSK): ≤0.6% (rms)<br>MX269013A-001  | Residual Vector Error (8PSK/AQPSK): ≤1.0% (rms)<br>MX269013A-001  |  |  |  |
| weasurement                          |  | Residual Vector Error: ≤0.6% (rms)  | Residual Vector Error: ≤1.0% (rms)                                |  |  |  |
|                                      |  | MX269013A   | MX269013A   |  |  |  |
|                                      |  | Residual Phase Error (GMSK): ≤0.5 degrees (rms)   | Residual Phase Error (GMSK): ≤0.7 degrees (rms)                   |  |  |  |
|                                      | Waveform Display   | Constellation, EVM vs. Symbol (8PSK/AQPSK), Magnitude<br>MX269013A-001<br>Constellation, EVM vs. Symbol, Magnitude Error vs. Symb<br>-15 to +30 dBm (Preamp Off, or Preamp not installed)   |   |  |  |  |
|                                      | Measured Level Range   | -30 to +10 dBm (Preamp On)  |   |  |  |  |
| Amplitude                            | Average Power Measurement<br>Accuracy (Found from root sum of  | At 18°C to 28°C, After calibration, With input attenuator ≥10 dB and input signal in measurement level range and less than input level  |   |  |  |  |
| Measurement                          | squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit) | $\pm 0.6 \text{ dB}$ (Preamp Off, or Preamp not installed)<br>$\pm 1.1 \text{ dB}$ (Preamp On)  | ±0.6 dB (Preamp Off, or Preamp not installed)                     |  |  |  |
|                                      | Waveform Display   | Rise, Fall, Slot, Frame   |   |  |  |  |
|                                      |  | At 18°C to 28°C, After calibration, With input attenuator $\ge 1$ no Preamp installed), Carrier frequency of 400 MHz to 2000  |   |  |  |  |
|                                      |  | Measurement Points: ±100, ±200, ±250, ±400, ±600, ±800,   | ±1000, ±1200, ±1400, ±1600, ±1800, ±3000, ±6000 kHz               |  |  |  |
| Output RF<br>Spectrum<br>Measurement | Modulation Part Measurement  | Measurement Range:<br><-41 dB (100 kHz detuning), <-66 dB (200 kHz detuning),<br><-74 dB (250 kHz detuning), <-79 dB (400 kHz detuning),<br><-80 dB (<1200 kHz detuning), <-83 dB (<1800 kHz<br>detuning), <-80 dB (≥1800 kHz detuning) | _   |  |  |  |
|                                      |  | Measurement Points: ±400, ±600, ±1200, ±1800 kHz  |   |  |  |  |
|                                      | Switching Transients<br>Measurement  | Measurement Range:<br><-71 dB (400 kHz detuning), <-72 dB (600 kHz detuning),<br><-75 dB (1200 kHz detuning),<br><-75 dB (1800 kHz detuning)  | _   |  |  |  |

#### Output Spectrum Measurement

- Spectrum due to Modulation
- Spectrum due to Switching Transients
- Power vs. Time
- Slot Power Slot Status
- Symbol Power Graph
- Time Offset

MS269xA MS2850A

# GSM/EDGE Measurement Software MX269013A EDGE Evolution Measurement Software MX269013A-001 (Continued)

#### MS269xA MS2850A MS2830A

#### **Measurement Functions**

#### • Frequency Error/Modulation Accuracy

As well as displaying frequency error, modulation accuracy and numeric average and maximum values, the constellation and temporal changes in vector, amplitude and phase errors can are displayed simultaneously as graphs (symbol units) to monitor symbol-dependent changes in modulation accuracy.

|  | 1 930 200 000 Hz |       | -10.00 dBm                                       |                      |                                   | Carlo Bode                 |
|--|------------------|-------|--|----------------------|-----------------------------------|----------------------------|
| land                                   | DL / PCS 1900    |       |  |                      |                                   | EVM                        |
| Fignal                                 | NB / 320AM       |       |  |                      |                                   |                            |
| Result                                 |                  |       |  | Average &            | Max 107 10                        | Symbol                     |
| MKR<br>40 Symbol                       | · · · ·          |       | Frequency Error                                  | 0.34 /               | Avg / Max<br>0.90 Hz<br>0.000 ppm | Mag Error<br>Vis<br>Symbol |
| 0.2275<br>0 1.1158                     |                  | • •   | EVM(rms)   |                      |                                   | Phase Error                |
|  |                  |       | EVM(peak)<br>Mag. Error(rms)<br>Phase Error(rms) | 0.54 / 0.11 / 0.09 / | 0.73%<br>0.13%<br>0.11 deg.       | 5ymbol                     |
|  |                  |       | Origin Offset<br>95th percentile                 | 62.80 /<br>0.37      | -69.13 dB                         |                            |
|  |                  |       | Droop  |                      | 3.65 neperals                     |                            |
|  |                  |       |  |                      |                                   |                            |
| VM vs Symbol<br>MKR Sym<br>Loo         | ibol 3           | EVM ( | 29.%   |                      |                                   |                            |
| MKR Sym                                | ibol 3           | EVM ( | 229 %  |                      |                                   |                            |
|  | ibol 3           | EVM ( | 23 %   |                      |                                   |                            |
| MKR Sym<br>5.00<br>3.75<br>200<br>1.25 |                  |       |  |                      |                                   |                            |

#### Output Spectrum Measurements

The power spectrum is measured from the center frequency to a specified offset frequency. Modulation measures the spectrum due to modulation near the burst center; Switching Transients measures the spectrum due to the burst wave rise/fall.



**Modulation Part** 



Switching Transients Part

#### • Power vs. Time

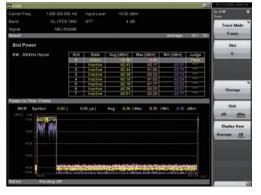
Variations in power with time are monitored at rise/fall, slot and frame displays to support Pass/Fail evaluation. The burst characteristics are easily understood from the single average, max. and min. display.



Rise/Fall (Average)



Slot (Average)



Frame (Average/Max./Min.)

# ETC/DSRC Measurement Software MX269014A

The ETC/DSRC Measurement Software MX269014A supports measurement of the RF Tx characteristics of ARIB STD T75 narrow-band wireless devices. Installing it in the MS269xA supports fast, high-accuracy measurements ideal for efficient R&D, early rollout, and evaluation of DSRC wireless devices.

#### High-accuracy and High-speed Measurements Support Higher Manufacturing Efficiency

The MS2690A series supports modulation analysis and spectrum measurement for manufacturing and servicing DSRC wireless equipment. High-accuracy measurements are supported by extending the baseband upper frequency limit to 6 GHz. The  $\pm$ 0.6 dB accuracy for Tx power measurement in the 5.8-GHz band using ETC/DSRC improves yield, while manufacturing and inspection times are cut to 110 ms\* and 190 ms\*, respectively, for analyzing  $\pi$ /4DQPSK and ASK modulation signals to improve production throughout.

\*: Average with graph display OFF (reference value); approximately 120 ms (π/4DQPSK) and 350 ms (ASK) with graph display ON.

#### Modulation Analysis (π/4DQPSK)

- Frequency Error
- Tx Power
- Vector Error (EVM) [Peak/rms]
- Origin Offset
- Droop Factor
- Constellation

#### Modulation Analyzer (ASK)

- Frequency Error
- Tx Power
- Peak Power
- Modulation Index
- Eye Opening
- Eye Diagram

#### Spectrum

- Adjacent Channel Leakage Power
- Occupied Bandwidth

#### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.

| Signal Analyzer          |   | MS269xA  |
|--------------------------|---|--|
| 6                        | Modulation Method   | π/4DQPSK, ASK  |
| Common<br>Specifications | Target Signals  | Downlink, Uplink   |
| specifications           | Target Channel  | MDC  |
|                          | Measurement Frequency Range   | 5700 MHz to 5900 MHz   |
| Modulation/              | Measurement Level Range   | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   |
| Frequency<br>Measurement | Carrier Frequency Measurement<br>Accuracy   | At 18°C to 28°C, after calibration, with EVM = 1% signal<br>± (Accuracy of reference frequency × Carrier frequency + 20) Hz  |
|                          | Residual Vector Error   | At 18°C to 28°C, after calibration, when modulation is $\pi/4DQPSK$ <1.0% (rms)  |
| Amplitude<br>Measurement | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | At 18°C to 28°C, after calibration, with input attenuator ≥10 dB and input signal in measurement level range and less than Input level<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On) |
|                          | Modulation/Frequency  | Constellation (π/4DQPSK), Eye Diagram (ASK)  |
| Waveform Display         | Spectrum  | Adjacent Channel Leakage Power, Occupied Bandwidth   |

MS269xA

# ETC/DSRC Measurement Software MX269014A (Continued)

MS269xA

#### **Measurement Functions**

#### Modulation Analysis (π/4DQPSK)

This analysis displays the  $\pi$ /4DQPSK modulation signal results along with a constellation graph. The dispersion of RF characteristics is measured easily using simultaneous display of maximum and average values.

| arrier Freq.       | 5 795 000 0 | 00 Hz | Input Level -10.00 | 68 M     |                     | Common Detting |
|--------------------|-------------|-------|--------------------|----------|---------------------|----------------|
|                    |             |       |                    |          |                     | Modulation     |
| esult              |             |       |                    | Av       | erage & Max 10 / 10 | #/4 DOPSK      |
|                    | ٩           |       |                    | Avg /    | Max                 |                |
|                    |             |       | Frequency Error    |          |                     |                |
|                    |             |       |                    |          |                     |                |
|                    |             |       | Tx Power           |          | -11,44 dBm          |                |
|                    |             |       | EVM(ms)            |          |                     |                |
|                    |             |       | EVM(peak)          |          |                     |                |
|                    |             |       | Origin Offset      | -64.82 / | -60.99 dB           |                |
|                    |             |       | Droop Factor       | 0.0000 / | 0.0000 dB/symbol    |                |
| 1 0.704<br>Q 0.705 | 10          |       |                    |          |                     |                |
|                    | Pre-Amp Off |       |                    |          |                     |                |

#### • Modulation Analysis (ASK)

This analysis displays the ASK modulation signal results along with an eye diagram.



# **TD-SCDMA Measurement Software MX269015A**

The TD-SCDMA Measurement Software MX269015A supports measurement of the TRx characteristics of TD-SCDMA 3G digital mobile devices. Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for R&D and early rollout of base stations, repeaters, mobile terminals, and components.

#### Supports Various Functions for R&D and Manufacturing of TD-SCDMA Wireless Equipment and Devices

Modulation analysis and spectrum measurement results can be displayed as both numeric values and graphs. The efficiency of base station and repeater tests is increased by using the Multi Carrier and Multi Slot Power measurement functions as well as the Multi Carrier Adjacent Channel Leakage Power measurement function.

#### Modulation Analysis

- Frequency Error
- Tx Power
- Vector Error (EVM) [Peak/rms]
- Origin Offset
- Peak Code Domain Error
- Constellation
- Code Domain Graph
  Multi-Carrier Power
- Multi-Slot Power
- Multi-Slot Fower

#### Spectrum

• Adjacent Channel Leakage Power (ACLR)

MS269xA MS2850A MS2830A

- Occupied Bandwidth (OBW)
- Spectrum Emission Mask (SEM)

#### Power vs. Time

- Time Mask
- Off Power
- On Power
- TSi Power
- Power vs. Time Graph

#### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

| Signal Analyzer                         |  | MS269xA  | MS2830A  |  |  |  |
|---|--|--|--|--|--|--|
| Signal Analyzer                         |  | WI5209XA   | MS2850A  |  |  |  |
| Channel Bandwi                          | dth  | 1.6 MHz  |  |  |  |  |
| Measurement Fi                          | requency Range   | 1850 MHz to 2620 MHz   |  |  |  |  |
|   | Measurement Level Range  | <ul> <li>-15 to +30 dBm (Preamp Off, or Preamp not installed)</li> <li>-30 to +10 dBm (Preamp On)</li> </ul>                           |  |  |  |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency Measurement<br>Accuracy  | At 18°C to 28°C, After calibration, with EVM = 1% signal $\pm$ (Accuracy of reference frequency × Carrier frequency + 20) Hz           |  |  |  |  |
| weasurement                             | Madulation Assurance   | At 18°C to 28°C, After calibration, With input signal in me  | easurement level range and less than input level     |  |  |  |
|   | Modulation Accuracy  | Residual Vector Error: ≤1.0% (rms)   | Residual Vector Error: ≤1.2% (rms)                   |  |  |  |
|   | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   | -15 to +30 dBm (Preamp Off, or Preamp not installed) |  |  |  |
| Amplitude<br>Measurement                | Average Power Measurement<br>Accuracy (Found from root sum of  | At 18°C to 28°C, After calibration, With input attenuator ≥10 dB and input signal in measurement level range and less than input level |  |  |  |  |
|   | squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit) | $\pm 0.6 \text{ dB}$ (Preamp Off, or Preamp not installed)<br>$\pm 1.1 \text{ dB}$ (Preamp On)   | ±0.6 dB (Preamp Off, or Preamp not installed)        |  |  |  |
|   |  | At 18°C to 28°C, After calibration, With input signal in me  | easurement level range and less than input level     |  |  |  |
|   | Code Domain Power  | Relative Accuracy: ±0.18 dB (Code Power ≥-10 dBc)<br>±0.32 dB (Code Power ≥-30 dBc)  |  |  |  |  |
| Code Domain                             |  | At 18°C to 28°C, After calibration, With input signal in me  | easurement level range and less than input level     |  |  |  |
| Measurement<br>Code Domain Error        |  | Residual Error: ≤-40 dB<br>Accuracy: ±1.0 dB (Code Domain Error ≥-40 dBc)  |  |  |  |  |
|   | Waveform Displays  | Code Domain Power, Code Domain Error, IQ Constellatio  | n  |  |  |  |
| Spectrum<br>Measurement                 | Measurement Functions  | Adjacent Channel Leakage Power, Occupied Bandwidth,  | Spectrum Emission Mask, Power vs. Time               |  |  |  |

# TD-SCDMA Measurement Software MX269015A (Continued)

# MS269xA MS2850A MS2830A

#### **Measurement Functions**

#### • Frequency Error/Tx Power/Modulation Accuracy

The Frequency Error, Tx Power, and Modulation Accuracy for the specified carrier slot are displayed simultaneously as constellation and code domain power graphs. Instantaneous characteristics can be measured due to the excellent residual EVM characteristics of the MS269xA.

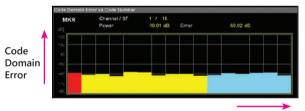


Constellation and Code Domain Power



Code Number

Code Domain Power vs. Code Number



Code Number

Code Domain Error vs. Code Number

#### • Multi Carrier/Multi Slot Power Measurements

The Multi Carrier measurement function simultaneously displays the Tx Power for all carriers and slots of the multi carrier signal, while the Multi Slot Power measurement function simultaneously displays the mean and partial Tx Powers for all slots.



Multi Carrier Power

|   |         | 010 000 00 |        | InputLeve |        | 10.00 dBm |        |         |        |        | TD-SODMA<br>Trace Mode |
|---|---------|------------|--------|-----------|--------|-----------|--------|---------|--------|--------|------------------------|
| Carrier Number                          |         |            |        |           |        | 8 d8      |        |         |        |        | Code Domain<br>Power   |
| Result<br>Multi Slot Powe               | er alka |            |        | _         |        |           |        | Average | & Max  | 107 10 | Power                  |
| Subframe                                | Avg     | -10,49     |        |           |        |           |        |         |        |        | Code Domai             |
| Continente                              |         | -10.49     |        |           |        |           |        |         |        |        | Una                    |
|   |         |            | DwPTS  |           |        |           |        |         |        |        | Multi Slot<br>Power    |
| Mean                                    |         | -10.49     |        |           | -10,49 | -10.49    | 10.49  | -10.49  | -10,49 | -10.49 |                        |
|   |         | -10.49     | -10.53 | -10.52    | -10.49 | -10.49    | -10.49 | -10.49  | -10.49 | -10.49 | MultiCarrie            |
| Data1                                   |         | -10,48     |        |           | -10.49 | -10,49    | -10.48 | -10.49  | -10.49 | -10.48 |                        |
| Clean                                   |         | -10.48     |        |           | -10,49 | -10,49    | -10.48 | -10.49  | -10.49 | -10.48 |                        |
| Midamble                                |         | -10.49     |        |           | -10.50 | -10.49    | -10.49 | -10.49  |        | -10.49 |                        |
| ALC |         | -10.49     |        |           | -10.49 | -10.48    | -10.48 |         |        |        |                        |
| Data2                                   |         | -10,49     |        |           |        | -10,49    |        | -10.49  | -10.49 | -10.60 |                        |
| C BLAC                                  |         | -10.49     |        |           | -10.49 | -10.49    | -10,49 | -10.49  | -10.49 | -10,49 |                        |
|   |         |            |        |           |        |           |        |         |        |        |                        |
| RefExt                                  |         |            |        |           |        |           |        |         |        |        |                        |

Multi Slot Power

#### • Power vs. Time Measurements

Provides measurements for Transmitter OFF Power and Time Mask. This function can be used only in MS269xA series.



Power vs. Time

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011

MS2850A MS2840A MS269xA MS2830A

The Vector Modulation Analysis software MX269017A supports various digital wireless modulation analyses. Installing it in the MS269xA/MS2850A/MS2840A/MS2830A supports fast, high-accuracy measurements ideal for R&D and early rollout of digital radio equipment and components serving a wide range of applications, ranging from public safety (PMR/LMR)\*1 to aerospace and satellite communications.

\*1: Can measure TETRA, DMR, dPMR, APCO-P25 Phase1/Phase2, NXDN, ARIB STD-T98, T102, etc.

#### Versatile Functions for Digital Wireless Communication Development

Fast and high-accuracy modulation analysis for R&D into digital radio equipment and components for public, aerospace, and satellite applications.

#### Numeric result display

#### BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, MSK, 16APSK, 32APSK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Vector Error (EVM) [Peak/rms]
- Offset Vector Error (EVM) [Peak/rms] (O-QPSK)
- Phase Error (Peak/rms)
- Magnitude Error (Peak/rms)
- Symbol Rate Error
- BER (only BER = On) Specific Word (Hex)
- Origin Offset
- Droop Factor (BPSK, π/4DQPSK, 8PSK, MSK)
- IO Gain Imbalance (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- Ouadrature Error (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- MER (Peak/rms)
- Offset EVM [Peak/rms] (O-QPSK)
- Timing Offset

#### 2FSK, 4FSK, H-CPM\*

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Magnitude Error (Peak/rms)
- FSK Error (Peak/rms)
- BER (only BER = On)
- Modulation Fidelity (Peak/rms)
- Symbol Rate Error
- Specific Word (Hex)
- Jitter (P-P Min., P-P Max.)
- Deviation (Average, +Peak, -Peak, (Peak-Peak)/2)
- Deviation rms [%] (2FSK)
- Deviation at Ts/2
- [Average, +Max, Peak, +Min, Peak, -Max, Peak, -Min, Peak, (Peak-Peak)/2, +Max, Peak%, -Min. Peak%] (2FSK, 4FSK)
- Timing Offset
- \*: Used at APCO-P25 Phase2 Inbound measurement

#### 2ASK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm) Vector Error (EVM) [Peak/rms]
- Magnitude Error (Peak/rms)
- BER (only BER = On)
- Specific Word (Hex)
- Droop Factor
- MER (Peak/rms)
- Symbol Rate Error
- Modulation Index (rms)
- Eye Opening (X-Time)
- Eye Opening (Y-Amplitude)
- Timing Offset

#### Graph display

BPSK. QPSK, O-QPSK,  $\pi$ /4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 2ASK, 4ASK, 16APSK, 32APSK

- Constellation
- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Trellis • Eye Diagram
- · I and Q vs. Symbol
- Magnitude vs. Symbol
- Phase vs. Symbol
- Signal Monitor
- Symbol Table
- Equalizer Amplitude
- Equalizer Phase
- Equalizer Group Delay
- Equalizer Impulse Response

#### 2FSK, 4FSK, H-CPM\*, MSK

- Constellation
- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Frequency vs. Symbol • Trellis
- Eye Diagram
- I and Q vs. Symbol
- · Magnitude vs. Symbol
- Phase vs. Symbol Signal Monitor
- Symbol Table
- FSK Error vs. Symbol
- Fidelity vs. Symbol (2FSK, 4FSK, H-CPM)
- Histogram
- \*: Used at APCO-P25 Phase2 Inbound measurement

# **Vector Modulation Analysis Software MX269017A** APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### MS269xA MS2850A MS2840A MS2830A

#### **Specifications**

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2840A/MS2830A)

#### Common Specifications

| Signal Analyze       | r   | MS269xA   | MS2850A   | MS2840A  | MS2830A  |  |
|----------------------|---|---|---|--|--|--|
| Measurement          | BPSK, QPSK, π/4DQPSK,<br>8PSK, 16QAM, 32QAM,<br>64QAM, 128QAM,<br>256QAM, 2ASK, 4ASK, MSK | 0.1 ksps to 12.5 Msps   | 0.1 ksps to 12.5 Msps                             | 0.1 ksps to 12.5 Msps<br>(MS2840A-006/009 installed) | 0.1 ksps to 12.5 Msps<br>(MS2830A-005/009, 006 installed)<br>0.1 ksps to 5 Msps<br>(MS2830A-006 installed)   |  |
| Symbol Rate<br>Range | 2FSK, 4FSK  | 0.1 ksps to 6.25 Msps   | 0.1 ksps to 6.25 Msps                             | 0.1 ksps to 6.25 Msps<br>(MS2840A-006/009 installed) | 0.1 ksps to 6.25 Msps<br>(MS2830A-005/009, 006 installed)<br>0.1 ksps to 2.5 Msps<br>(MS2830A-006 installed) |  |
| Modulation           | Standard  | 3PSK, DBPSK, π/2DBPSK, QPSK, O-QPSK, DQPSK, π/4 DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 2560<br>2FSK, 4FSK, H-CPM, 2ASK, 4ASK, MSK |   |  |  |  |
| Method               | Option  | _   | 16APSK, 32APSK (MX26901<br>512QAM, 1024QAM, 2048C |  | _  |  |

#### Frequency Setting Range

|                  | MS269xA                                       |                               |             |   |  |  |  |
|------------------|---|-------------------------------|-------------|---|--|--|--|
| Condition        |   |                               |             | Frequency Setting Range                     |  |  |  |
| Option           | Modulation Type                               | Measuring Object Symbol Ra    |             |   |  |  |  |
|                  | BPSK, QPSK, π/4DQPSK,                         | Frame Format                  | >12.5 Msps  | 100 MHz to the upper limit of the main unit |  |  |  |
| With             | 8PSK, 16QAM, 32QAM,<br>64QAM, 128QAM, 256QAM, | Non-Formatted (Span Up = On)  | >12.5 Msps  | 100 MHz to the upper limit of the main unit |  |  |  |
| MS269xA-067/167  | 2ASK, 4ASK, MSK                               | Non-Formatted (Span Up = Off) | >35 Msps    | 100 MHz to the upper limit of the main unit |  |  |  |
|                  | 2FSK, 4FSK                                    | —                             | >6.25 Msps  | 100 MHz to the upper limit of the main unit |  |  |  |
|                  | O-QPSK  | _                             | >3.125 Msps | 100 MHz to the upper limit of the main unit |  |  |  |
|                  | BPSK, QPSK, π/4DQPSK,                         | Frame Format                  | >12.5 Msps  | 100 MHz to 6 GHz                            |  |  |  |
| Without          | 8PSK, 16QAM, 32QAM,<br>64QAM, 128QAM, 256QAM, | Non-Formatted (Span Up = On)  | >12.5 Msps  | 100 MHz to 6 GHz                            |  |  |  |
| MS269xA-067/167  | 2ASK, 4ASK, MSK                               | Non-Formatted (Span Up = Off) | >35 Msps    | 100 MHz to 6 GHz                            |  |  |  |
|                  | 2FSK, 4FSK                                    | —                             | >6.25 Msps  | 100 MHz to 6 GHz                            |  |  |  |
|                  | O-QPSK  | —                             | >3.125 Msps | 100 MHz to 6 GHz                            |  |  |  |
| Other than above |   |                               |             | 100 kHz to the upper limit of the main unit |  |  |  |

|                  | MS2850A                                      |                                 |             |   |  |  |  |  |
|------------------|--|---------------------------------|-------------|---|--|--|--|--|
| Condition        |  |                                 |             | Frequency Setting Range                     |  |  |  |  |
| Modulation Type  |  | Measuring Object                | Symbol Rate | Frequency setting Range                     |  |  |  |  |
|                  | BPSK, QPSK, π/4DQPSK,                        | Frame Format                    | >12.5 Msps  | 300 MHz to the upper limit of the main unit |  |  |  |  |
| MS2850A-067      | 8PSK, 16QAM, 32QAM<br>64QAM, 128QAM, 256QAM, | Non-Formatted (Capture OSR = 4) | >12.5 Msps  | 300 MHz to the upper limit of the main unit |  |  |  |  |
| (standard)       | 2ASK, 4ASK, MSK                              | Non-Formatted (Capture OSR = 4) | >35 Msps    | 300 MHz to the upper limit of the main unit |  |  |  |  |
|                  | 2FSK, 4FSK                                   | —                               | >6.25 Msps  | 300 MHz to the upper limit of the main unit |  |  |  |  |
|                  | O-QPSK                                       | _                               | >3.125 Msps | 300 MHz to the upper limit of the main unit |  |  |  |  |
| Other than above |  |                                 |             | 100 kHz to the upper limit of the main unit |  |  |  |  |

|  |  | MS284                         | 40A         |  |
|--|--|-------------------------------|-------------|--|
|  |  | MS283                         | 30A         |  |
|  | Conc   | - Frequency Setting Range     |             |  |
| Option   | Modulation Type  | Measuring Object Symbol Rate  |             |  |
|  | BPSK, QPSK, π/4DQPSK,  | Frame Format                  | >12.5 Msps  | 300 MHz to the upper limit of the main unit                                  |
| With   | 8PSK, 16QAM, 32QAM,<br>64QAM, 128QAM, 256QAM,                    | Non-Formatted (Span Up = On)  | >12.5 Msps  | 300 MHz to the upper limit of the main unit                                  |
| MS2840A-067/167,<br>MS2830A-067/167            | 2ASK, 4ASK, MSK  | Non-Formatted (Span Up = Off) | >35 Msps    | 300 MHz to the upper limit of the main unit                                  |
| WIS2630A-067/167                               | 2FSK, 4FSK   | —                             | >6.25 Msps  | 300 MHz to the upper limit of the main unit                                  |
|  | O-QPSK   | —                             | >3.125 Msps | 300 MHz to the upper limit of the main unit                                  |
|  | BPSK, QPSK, π/4DQPSK,  | Frame Format                  | >12.5 Msps  | 300 MHz to<br>6 GHz or the upper limit of the main unit, whichever is lower. |
| Marken and                                     | 8PSK, 16QAM, 32QAM,<br>64QAM, 128QAM, 256QAM,<br>2ASK, 4ASK, MSK | Non-Formatted (Span Up = On)  | >12.5 Msps  | 300 MHz to<br>6 GHz or the upper limit of the main unit, whichever is lower. |
| Without<br>MS2840A-067/167,<br>MS2830A-067/167 |  | Non-Formatted (Span Up = Off) | >35 Msps    | 300 MHz to<br>6 GHz or the upper limit of the main unit, whichever is lower. |
| W32030A-007/107                                | 2FSK, 4FSK   | _                             | >6.25 Msps  | 300 MHz to<br>6 GHz or the upper limit of the main unit, whichever is lower. |
|  | O-QPSK   | —                             | >3.125 Msps | 300 MHz to<br>6 GHz or the upper limit of the main unit, whichever is lower. |
| Other than above                               |  |                               |             | 100 kHz to the upper limit of the main unit                                  |

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

#### Symbol Rate Setting Range

Firmware package version 12.00.00 and later:

| Model                             | Option       |               |                   |                          |           |                  |  |
|-----------------------------------|--------------|---------------|-------------------|--------------------------|-----------|------------------|--|
| MS2830A                           | With 006/106 | With 005      | /105/007/009      | With 077                 |           | With 078         |  |
| MS2840A                           | With 006/106 | With 005      | /105/009/109      | With 077/17              | 7         | With 078/178     |  |
| MS269xA                           |              | Except as de  | escribed on right | With 077/17              | 7         | With 004/078/178 |  |
| Maximum Sampling Rate (SP)        | 20 MHz       | 5             | 0 MHz             | 100 MHz                  |           | 200 MHz          |  |
| Maximum Analysis Bandwidth (SPAN) | 10 MHz       | 31.           | 25 MHz            | 62.5 MHz                 |           | 125 MHz          |  |
| "Capture OSR"                     | Maxi         | mum setting s | ymbol rate [symbo | l/s] (Min.: 0.1k Max.: S | P/Capture | OSR)             |  |
| "32"                              | 0.625 M      | 1.5           | 5625 M            | 3.125 M                  |           | 6.25 M           |  |
| "16"                              | 1.25 M       | 3.            | 125 M             | 6.25 M                   |           | 12.5 M           |  |
| "8"                               | 2.5 M        | 6             | 5.25 M            | 12.5 M                   |           | 25 M             |  |
| "4"                               | 5 M          | 1             | 2.5 M             | 25 M                     |           | 50 M             |  |
| "2"                               | 10 M         |               | 25 M              | 50 M                     |           | 100 M            |  |
| "1"                               | 20 M         |               | 50 M              | 100 M                    |           | 200 M            |  |
| Model                             |              |               | Opt               | tion                     |           |                  |  |
| MS2850A                           | With 032     |               | With              | 033                      |           | With 034         |  |
| Maximum Sampling Rate (SP)        | 325 MHz      |               | 650               | MHz                      |           | 1300 MHz         |  |
| Maximum Analysis Bandwidth (SPAN) | 255 MHz      |               | 510               | MHz                      |           | 1000 MHz         |  |
| "Capture OSR"                     | Maxi         | mum setting s | ymbol rate [symbo | l/s] (Min.: 0.1k Max.: S | P/Capture | OSR)             |  |
| "32"                              | 10.15625 M   |               | 20.31             | 25 M                     |           | 40.625 M         |  |
| "16"                              | 20.3125 M    |               | 40.62             | 25 M                     |           | 81.25 M          |  |
| "8"                               | 40.625 M     |               | 81.2              | 5 M                      |           | 162.5 M          |  |
| "4"                               | 81.25 M      |               | 162.              | 5 M                      |           | 325 M            |  |
| "2"                               | 162.5 M      |               | 325               | δM                       |           | 650 M            |  |
| "1"                               | 325 M        |               | 650               | ) M                      |           | 1300 M           |  |

#### Modulation/Frequency Measurement

| Signal Analyze   | r                             | MS269xA  | MS2850A   | MS2840A   | MS2830A  |
|--|-------------------------------|--|---|---|--|
| Measurement  | Level Range                   | <ul> <li>-15 to +30 dBm (Preamp Off, or Preading of the second secon</li></ul> | •   |   |  |
| BPSK, QPSK,<br>8PSK, 16QAM,<br>32QAM,<br>64QAM,<br>128QAM, |                               | Without MS269xA-001, With MS284<br>For firmware package version 12.00.0<br>± (Accuracy of reference frequency<br>× Carrier frequency + 10) Hz<br>(Center Frequency: 30 MHz to<br>6.0 GHz)<br>(Note that a range of 3 GHz or  | DA-002, With MS2830A-002, At 18°C t<br>10 and later, Capture OSR = 4<br>± (Accuracy of reference frequency<br>× Carrier frequency + 10) Hz<br>(Center Frequency: 30 MHz to<br>3.5 GHz, symbol rate: 4 ksps to<br>5 Msps)  | <ul> <li>2 28°C, after calibration, with EVM = 1% signal</li> <li>± (Accuracy of reference frequency × Carrier frequency<br/>10) Hz</li> <li>(Center Frequency: 30 MHz to 3.5 GHz)</li> </ul>   |  |
|  | 256QAM,<br>2FSK, 4FSK,<br>MSK | above is not available when<br>MS269xA-003 is installed and<br>with Frequency Band Mode set<br>to Spurious.)   | ± (Accuracy of reference frequency<br>× Carrier frequency + 10) Hz<br>(Center Frequency: 800 MHz to<br>3.5 GHz, symbol rate: 5 Msps to<br>50 Msps)  |   |  |
| Carrier<br>requency<br>Aeasurement<br>Accuracy             | П/4DQPSK,<br>2ASK, 4ASK       | <ul> <li>Without MS269xA-001, With MS2844</li> <li>For firmware package version 12.00.0</li> <li>± (Accuracy of reference frequency × Carrier Frequency + 10) Hz</li> <li>(Center Frequency: 30 MHz to</li> <li>6.0 GHz)</li> <li>(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)</li> </ul>  | DA-002, With MS2830A-002, At 18°C t<br>10 and later, Capture OSR = 4<br>± (Accuracy of reference frequency<br>× Carrier frequency: 30 MHz to<br>3.5 GHz, symbol rate: 4 ksps to<br>5 Msps)<br>± (Accuracy of reference frequency<br>× Carrier frequency + 10) Hz<br>(Center Frequency: 800 MHz to<br>3.5 GHz, symbol rate: 5 Msps to<br>50 Msps)  | <ul> <li>o 28°C, after calibration, with EVI</li> <li>± (Accuracy of reference freque<br/>10) Hz</li> <li>(Center Frequency: 30 MHz to<br/>± (Accuracy of reference freque<br/>10) Hz</li> <li>(Center Frequency: 5.7 GHz to</li> </ul> | ency × Carrier frequency +<br>9 3.5 GHz)<br>ency × Carrier frequency + |
|  | 512QAM<br>1024QAM<br>2048QAM  | With MS2840A-002, At 18°C to 28°C,<br>For firmware package version 12.00.  | after calibration, with EVM = 1% sign<br>00 and later, Capture OSR = 4<br>With MX269017-011<br>± (Accuracy of reference frequency<br>× Carrier frequency +10) Hz<br>(Center frequency: 30 MHz to<br>3.5 GHz, symbol rate: 500 ksps to<br>5 Msps)<br>With MX269017A-011<br>± (Accuracy of reference frequency<br>× Carrier frequency +10) Hz<br>(Center frequency: 800 MHz to<br>3.5 GHz, symbol rate: 5 Msps to<br>50 Msps, Equalizer = On) | al<br>with MX269017A-011<br>± (Accuracy of reference<br>frequency × Carrier<br>frequency +10) Hz<br>(Center Frequency:<br>30 MHz to 3.5 GHz)  | _  |

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

| Signal Analyze | r            | MS269xA   | MS2850A   | MS2840A  | MS2830A  |
|----------------|--------------|---|---|--|--|
|                |              |   | after calibration, with EVM = 1% sigr   | nal  |  |
|                |              | For firmware package version 12.00.0  |   |  |  |
|                |              |   | With MX269017A-001  | With MX269017A-001   |  |
|                |              |   | ± (Accuracy of reference frequency  | ± (Accuracy of reference   |  |
|                |              |   | × Carrier frequency +10) Hz   | frequency × Carrier  |  |
| arrier         | 104001       |   | (Center Frequency: 30 MHz to  | frequency +10) Hz  |  |
| requency       | 16APSK       |   | 3.5 GHz, symbol rate: 500 Ksps  | (Center Frequency:   |  |
| leasurement    | 32APSK       | _   | to 5 Msps)  | 30 MHz to 3.5 GHz)   | _  |
| ccuracy        |              |   | With MX269017A-001  |  |  |
|                |              |   | ± (Accuracy of reference frequency<br>× Carrier frequency + 10) Hz  |  |  |
|                |              |   | (Center frequency: 800 MHz to   | _  |  |
|                |              |   | 3.5 GHz, symbol rate 5 Msps to  |  |  |
|                |              |   | 50 Msps, Equalizer = On)  |  |  |
|                |              | Without MS269xA-001, With MS2840  |   | 1  |  |
|                |              |   | er type: Root Nyquist or Nyquist, whe   | en input signal within measureme   | nt level range and less thar   |
|                |              | input level, 20-times averaging   | - 51  | 1  | J  |
|                |              | For firmware package version 12.00.0  | 00 and later, Capture OSR = 4   |  |  |
|                |              | <0.5% (rms)   | <0.5 % (rms)  | <1.0% (rms)  |  |
|                |              | Symbol rate: 4 ksps to 500 ksps   | Symbol rate: 4 ksps to 500 ksps   | Symbol rate: 4 ksps to 500 ksp   | os   |
|                | BPSK, QPSK,  | Measurement time length:  | Measurement time length:  | Measurement time length: ≤5  |  |
|                | 8PSK, 16QAM, | ≤50 ms  | ≤50 ms  | Carrier Frequency: 50 MHz to   | 500 MHz  |
|                | 32QAM,       | Carrier Frequency:  | Carrier frequency:  | <1.5% (rms)  |  |
|                | 64QAM,       | 50 MHz to 500 MHz   | 50 MHz to 500 MHz   | Symbol rate: 500 ksps to 5 Ms  |  |
|                | 128QAM,      | <1.0% (rms)   | <1.0 % (rms)  | Carrier Frequency: 50 MHz to   | 3.5 GHz  |
|                | 256QAM       | Symbol rate: 500 ksps to 5 Msps   | Symbol rate: 500 ksps to 5 Msps   |  |  |
|                |              | Carrier Frequency:  | Carrier frequency:  |  |  |
|                |              | 50 MHz to 6 GHz   | 50 MHz to 3.5 GHz   |  |  |
|                |              | (Note that a range of 3 GHz or above  | <1.0 % (rms)  |  |  |
|                |              | is not available when MS269xA-003   | Symbol rate: 5 Msps to 50 Msps  |  |  |
|                |              | is installed and with Frequency   | Carrier frequency:  |  |  |
|                |              | Band Mode cot to Sourious)  |   |  |  |
|                |              | Band Mode set to Spurious.)   | 800 MHz to 3.5 GHz  |  |  |
|                |              | Without MS269xA-001, With MS2840  | DA-002, With MS2830A-002  |  | nt lovel range and loss that   |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt  | 1   | n input signal within measureme  | nt level range and less that   |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging  | DA-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe   | n input signal within measureme  | nt level range and less thar   |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0  | DA-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4  |  | nt level range and less that   |
|                |              | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)  | <1.0% (rms)  |  |
|                |              | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp  | DS   |
|                |              | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5   | os<br>0 ms   |
| Residual       |              | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp  | os<br>0 ms   |
|                | П/4DQPSK     | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to   | os<br>0 ms<br>500 MHz  |
|                | П/4DQPSK     | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)  | os<br>0 ms<br>500 MHz<br>;ps   |
|                | П/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>of and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz  |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>0 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms  | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | П/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br><50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>of and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | П/4DQPSK     | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.(<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br><50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above  | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>0 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms  | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS284(<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms  | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | П/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency  | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms  | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)   | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms  | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>sps   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840   | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3.5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3.5 GHz<br>OA-002, With MS2830A-002  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: <5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me   | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>OA-002, With MS2830A-002<br>pasurement Filter: None, Reference Fil  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: <5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,   | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>20-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: <5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz   |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>OA-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging<br>00 and later, Capture OSR = 4  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: <5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to<br>ter: Gaussian BT 0.5, when input s   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz   |
|                | П/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>OA-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging<br>00 and later, Capture OSR = 4<br><0.5 % (rms)   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to<br>ter: Gaussian BT 0.5, when input s<br><1.0% (rms)  | os<br>0 ms<br>500 MHz<br>ips<br>3.5 GHz<br>5.9 GHz<br>ignal within measurement                           |
|                | П/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps   | 0A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>OA-002, With MS2830A-002<br>assurement Filter: None, Reference Fil<br>20-time averaging<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp  | os<br>0 ms<br>500 MHz<br>ips<br>3.5 GHz<br>5.9 GHz<br>ignal within measurement                           |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:   | DA-002, With MS2830A-002         er type: Root Nyquist or Nyquist, whe         00 and later, Capture OSR = 4         <0.5 % (rms)   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sec.org"></a>   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz<br>ignal within measurement<br>os<br>0 ms             |
|                | Π/4DQPSK     | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms   | DA-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>DA-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging<br>10 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms  | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksj<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 4 ksps to 500 ksp <a href="https://www.sci.org"></a> <a href="https://www.sci.org">a</a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org">a</a> <a a="" href="https://www.sci.org"> <a a="" href="https://www.sci.org"> <a href="https:&lt;/td&gt;&lt;td&gt;os&lt;br&gt;0 ms&lt;br&gt;500 MHz&lt;br&gt;sps&lt;br&gt;3.5 GHz&lt;br&gt;5.9 GHz&lt;br&gt;ignal within measurement&lt;br&gt;os&lt;br&gt;0 ms&lt;/td&gt;&lt;/tr&gt;&lt;tr&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;П/4DQPSK&lt;/td&gt;&lt;td&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Filt&lt;br&gt;input level, 20-time averaging&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 6 GHz&lt;br&gt;(Note that a range of 3 GHz or above&lt;br&gt;is not available when MS269xA-003&lt;br&gt;is installed and with Frequency&lt;br&gt;Band Mode set to Spurious.)&lt;br&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Me&lt;br&gt;level range and less than input level,&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;/td&gt;&lt;td&gt;DA-002, With MS2830A-002&lt;br&gt;er type: Root Nyquist or Nyquist, whe&lt;br&gt;of and later, Capture OSR = 4&lt;br&gt;&lt;0.5 % (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 % (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 3 .5 GHz&lt;br&gt;&lt;1.0 % (rms)&lt;br&gt;Symbol rate: 5 Msps to 50 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;800 MHz to 3 .5 GHz&lt;br&gt;DA-002, With MS2830A-002&lt;br&gt;assurement Filter: None, Reference Fil&lt;br&gt;20-time averaging&lt;br&gt;00 and later, Capture OSR = 4&lt;br&gt;&lt;0.5 % (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier frequency:&lt;/td&gt;&lt;td&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksp&lt;br&gt;Measurement time length: &lt;5&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms) (nom.)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s &lt;a href=" https:="" www.sci.org"=""></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">https://www.sci.org</a> <a href="https://www.sci.org">a</a> <a a="" href="https://www.sci.org"> <a a="" href="https://www.sci.org"></a></a></a></a>   | os<br>0 ms<br>500 MHz<br>sps<br>3.5 GHz<br>5.9 GHz<br>ignal within measurement<br>os<br>0 ms<br>500 MHz  |
|                |              | Without MS269xA-001, With MS2840         At 18°C to 28°C, after calibration, Filt         input level, 20-time averaging         For firmware package version 12.00.0         <0.5% (rms)   | DA-002, With MS2830A-002         er type: Root Nyquist or Nyquist, whe         00 and later, Capture OSR = 4         <0.5 % (rms)   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">sci.org</a> <a href="https://www.sci.org"></a> sci.org <a href="https://www.sci.org"></a> sci.org  | 25<br>0 ms<br>500 MHz<br>3:55 GHz<br>3:5 GHz<br>ignal within measurement<br>05<br>0 ms<br>500 MHz<br>:ps |
|                |              | Without MS269xA-001, With MS2840         At 18°C to 28°C, after calibration, Filt         input level, 20-time averaging         For firmware package version 12.00.0         <0.5% (rms)   | DA-002, With MS2830A-002         er type: Root Nyquist or Nyquist, whe         00 and later, Capture OSR = 4         <0.5 % (rms)   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: <5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">https://www.sci.org</a> <a href="https://www.sci.org">a</a> <a a="" href="https://www.sci.org"> <a a="" href="https://www.sci.org"></a></a>   | 25<br>0 ms<br>500 MHz<br>3:55 GHz<br>3:5 GHz<br>ignal within measurement<br>05<br>0 ms<br>500 MHz<br>;ps |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps  | A-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>20-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging<br>10 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">sci.org</a> <a href="https://www.sci.org"></a> sci.org <a href="https://www.sci.org"></a> sci.org  | 25<br>0 ms<br>500 MHz<br>3:55 GHz<br>3:5 GHz<br>ignal within measurement<br>05<br>0 ms<br>500 MHz<br>;ps |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:  | DA-002, With MS2830A-002         er type: Root Nyquist or Nyquist, whe         00 and later, Capture OSR = 4         <0.5 % (rms)   | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">sci.org</a> <a href="https://www.sci.org"></a> sci.org <a href="https://www.sci.org"></a> sci.org  | 25<br>0 ms<br>500 MHz<br>3:55 GHz<br>3:5 GHz<br>ignal within measurement<br>05<br>0 ms<br>500 MHz<br>;ps |
|                |              | Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Filt<br>input level, 20-time averaging<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.)<br>Without MS269xA-001, With MS2840<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br><0.5% (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>≤50 ms<br>Carrier Frequency:<br>50 MHz to 500 MHz<br><1.0% (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 500 Msps to 5 Msps<br>Carrier Frequency:<br>50 MHz to 6 GHz | DA-002, With MS2830A-002<br>er type: Root Nyquist or Nyquist, whe<br>of and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>$\leq$ 50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3 .5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3 .5 GHz<br>DA-002, With MS2830A-002<br>asurement Filter: None, Reference Fil<br>20-time averaging<br>00 and later, Capture OSR = 4<br><0.5 % (rms)<br>Symbol rate: 4 ksps to 500 ksps<br>Measurement time length:<br>$\leq$ 50 ms<br>Carrier frequency:<br>50 MHz to 500 MHz<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3.5 GHz | <1.0% (rms)<br>Symbol rate: 4 ksps to 500 ksp<br>Measurement time length: ≤5<br>Carrier Frequency: 50 MHz to<br><1.5% (rms)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 50 MHz to<br><1.5% (rms) (nom.)<br>Symbol rate: 500 ksps to 5 Ms<br>Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">https://www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://wwww.sci.org"></a> sci.org <a href="https://www.sci.org&lt;/td&gt;&lt;td&gt;25&lt;br&gt;0 ms&lt;br&gt;500 MHz&lt;br&gt;3:55 GHz&lt;br&gt;3:5 GHz&lt;br&gt;ignal within measurement&lt;br&gt;05&lt;br&gt;0 ms&lt;br&gt;500 MHz&lt;br&gt;;ps&lt;/td&gt;&lt;/tr&gt;&lt;tr&gt;&lt;td&gt;Residual&lt;br&gt;/ector Error&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Filt&lt;br&gt;input level, 20-time averaging&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 6 GHz&lt;br&gt;(Note that a range of 3 GHz or above&lt;br&gt;is not available when MS269xA-003&lt;br&gt;is installed and with Frequency&lt;br&gt;Band Mode set to Spurious.)&lt;br&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Me&lt;br&gt;level range and less than input level,&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 6 GHz&lt;br&gt;(Note that a range of 3 GHz or above&lt;/td&gt;&lt;td&gt;DA-002, With MS2830A-002&lt;br&gt;er type: Root Nyquist or Nyquist, whe&lt;br&gt;of and later, Capture OSR = 4&lt;br&gt;&lt;0.5 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;&lt;math&gt;\leq 50&lt;/math&gt; ms&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 3 .5 GHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 5 Msps to 50 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;800 MHz to 3 .5 GHz&lt;br&gt;DA-002, With MS2830A-002&lt;br&gt;asurement Filter: None, Reference Fil&lt;br&gt;20-time averaging&lt;br&gt;00 and later, Capture OSR = 4&lt;br&gt;&lt;0.5 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50&lt;/math&gt; ms&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;/td&gt;&lt;td&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksp&lt;br&gt;Measurement time length: ≤5&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms) (nom.)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s &lt;a href=" https:="" www.sci.org"=""></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">https://www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://wwww.sci.org"></a> sci.org <a href="https://www.sci.org&lt;/td&gt;&lt;td&gt;25&lt;br&gt;0 ms&lt;br&gt;500 MHz&lt;br&gt;3:55 GHz&lt;br&gt;3:5 GHz&lt;br&gt;ignal within measurement&lt;br&gt;05&lt;br&gt;0 ms&lt;br&gt;500 MHz&lt;br&gt;:ps&lt;/td&gt;&lt;/tr&gt;&lt;tr&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Filt&lt;br&gt;input level, 20-time averaging&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 6 GHz&lt;br&gt;(Note that a range of 3 GHz or above&lt;br&gt;is not available when MS269xA-003&lt;br&gt;is installed and with Frequency&lt;br&gt;Band Mode set to Spurious.)&lt;br&gt;Without MS269xA-001, With MS2840&lt;br&gt;At 18°C to 28°C, after calibration, Me&lt;br&gt;level range and less than input level,&lt;br&gt;For firmware package version 12.00.0&lt;br&gt;&lt;0.5% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;≤50 ms&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 500 Msps to 5 Msps&lt;br&gt;Carrier Frequency:&lt;br&gt;50 MHz to 6 GHz&lt;/td&gt;&lt;td&gt;DA-002, With MS2830A-002&lt;br&gt;er type: Root Nyquist or Nyquist, whe&lt;br&gt;of and later, Capture OSR = 4&lt;br&gt;&lt;0.5 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;&lt;math&gt;\leq&lt;/math&gt;50 ms&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 3 .5 GHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 5 Msps to 50 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;800 MHz to 3 .5 GHz&lt;br&gt;DA-002, With MS2830A-002&lt;br&gt;asurement Filter: None, Reference Fil&lt;br&gt;20-time averaging&lt;br&gt;00 and later, Capture OSR = 4&lt;br&gt;&lt;0.5 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksps&lt;br&gt;Measurement time length:&lt;br&gt;&lt;math&gt;\leq&lt;/math&gt;50 ms&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 500 MHz&lt;br&gt;&lt;1.0 %&lt;/math&gt; (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Msps&lt;br&gt;Carrier frequency:&lt;br&gt;50 MHz to 3.5 GHz&lt;/td&gt;&lt;td&gt;&lt;1.0% (rms)&lt;br&gt;Symbol rate: 4 ksps to 500 ksp&lt;br&gt;Measurement time length: ≤5&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 50 MHz to&lt;br&gt;&lt;1.5% (rms) (nom.)&lt;br&gt;Symbol rate: 500 ksps to 5 Ms&lt;br&gt;Carrier Frequency: 5.7 GHz to ter: Gaussian BT 0.5, when input s &lt;a href=" https:="" www.sci.org"=""></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org"></a> Symbol rate: 500 ksps to 5 Ms <a href="https://www.sci.org"></a> <a href="https://www.sci.org">https://www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://www.sci.org"></a> <a href="https://www.sci.org">www.sci.org</a> <a href="https://wwww.sci.org"></a> sci.org |  |

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

| Signal Analyzer          |                              | MS269xA   | MS2850A  | MS2840A   | MS2830A                  |  |  |  |  |
|--------------------------|------------------------------|---|--|---|--------------------------|--|--|--|--|
|                          |                              | With MS2840A-002<br>At 18°C to 28°C, after calibration, Measurement Filter: Root Nyquist, Reference Filter: Nyquist, when input signal within measurement<br>level range and less than input level, 20-time averaging<br>For firmware package version 12.00.00 and later, Capture OSR = 4 |  |   |                          |  |  |  |  |
| Residual<br>Vector Error | 512QAM<br>1024QAM<br>2048QAM | _   | With MX269017A-011<br><1.0 % (rms)<br>Symbol rate: 500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3.5 GHz<br><1.0 % (rms)<br>Symbol rate: 5 Msps to 50 Msps<br>Carrier frequency:<br>800 MHz to 3.5 GHz<br>(Note that Equalizer = On) | With MX269017A-011<br><1.0 % (rms)<br>Symbol rate:<br>500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3.5 GHz                                       | _                        |  |  |  |  |
| vector Error             | 16APSK<br>32APSK             | With MS2840A-002<br>At 18°C to 28°C, after calibration, Me<br>level range and less than input level,<br>For firmware package version 12.00.0<br>—   |  | ence Filter: Nyquist, when input s<br>With MX269017A-001<br><1.0 % (rms)<br>Symbol rate:<br>500 ksps to 5 Msps<br>Carrier frequency:<br>50 MHz to 3.5 GHz | ignal within measurement |  |  |  |  |
| Symbol Rate Error        |                              | Modulation Type: 2FSK, Filter Type: 0   | according to the 10 MHz common re<br>Gaussian, BT = 0.5, Symbol Rate 100 k<br>easurement level range and less than<br>00 and later, Capture OSR = 4<br>30 MHz to 3.5 GHz<br><±1.0 ppm  | sps, slot length 160 symbol,  |                          |  |  |  |  |

\*: Connect 10 MHz Reference between signal source and signal analyzer

#### Amplitude Measurement

| Signal Analyzer   | MS269xA   | MS2850A  | MS2840A                         | MS2830A                       |
|---|---|--|---------------------------------|-------------------------------|
| Measurement Level Range   | -15 to +30 dBm (Preamp Off, or<br>Preamp not installed)<br>-25 to +10 dBm (Preamp On)   | –15 to +30 dBm (Preamp Off, or Prea                      | amp not installed)              |                               |
| Tx Power Measurement  | At 18°C to 28°C, after calibration, with than Input level   | h input attenuator ≥10 dB, SPAN ≤31.                     | 25 MHz and input signal in meas | surement level range and less |
| Accuracy<br>(This is found from root sum<br>of squares (RSS) of absolute<br>amplitude accuracy and<br>in-band frequency<br>characteristics of main unit.) | 30 MHz to 6 GHz<br>±0.6 dB (at Pre-Amp Off, or<br>Pre-Amp not installed.)<br>±1.1 dB (at Pre-Amp On)<br>(Note that a range of 3 GHz or above<br>is not available when MS269xA-003<br>is installed and with Frequency<br>Band Mode set to Spurious.) | 30 MHz to 3.5 GHz<br>±0.6 dB (at Pre-Amp Off, or Pre-Amp | not installed.)                 |                               |

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### **Measurement Functions (Trace Mode)**

#### (1) Modulation Analysis

A maximum of eight traces can be measured using the results for four traces displayed in four panes on one screen. Instantaneous toggling between two screens supports at-a-glance monitoring of eight traces.

#### **Measurement Functions**

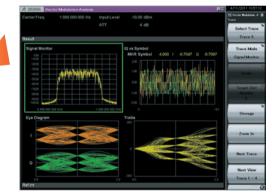
|                            | 1  | Modulation Type   | e                              |
|----------------------------|--|---|--------------------------------|
| Trace Mode                 | BPSK<br>QPSK<br>O-QPSK<br>π/4DQPSK<br>8PSK<br>2ASK<br>4ASK | 16QAM<br>32QAM<br>64QAM<br>128QAM<br>256QAM<br>512QAM<br>1024QAM<br>2048QAM<br>16APSK<br>32APSK | 2FSK<br>4FSK<br>H-CPM*1<br>MSK |
| Constellation              | ✓  | ✓   | ✓                              |
| EVM vs. Symbol             | ✓  | ~   | ✓                              |
| Magnitude Error vs. Symbol | ✓  | ~   | ✓                              |
| Phase Error vs. Symbol     | ✓  | ~   | ✓                              |
| Frequency vs. Symbol       | —  | —   | ✓                              |
| Trellis                    | ✓  | ~   | ✓                              |
| Eye Diagram                | ✓  | ~   | ✓                              |
| Numeric                    | ✓  | ~   | ✓                              |
| l and Q vs. Symbol         | ✓  | ~   | ✓                              |
| Magnitude vs. Symbol       | ✓  | ~   | ✓                              |
| Phase vs. Symbol           | ✓  | $\checkmark$  | ✓                              |
| Signal Monitor             | ✓  | ✓   | $\checkmark$                   |
| Symbol Table               | ✓  | ~   | ✓                              |
| Equalizer Amplitude        | ✓  | ✓   | —                              |
| Equalizer Phase            | ✓  | ✓   | —                              |
| Equalizer Group Delay      | ✓  | ✓   | —                              |
| Equalizer Impulse Response | ✓  | ~   | —                              |
| FSK Error vs. Symbol       | _  | _   | ✓                              |
| Fidelity vs. Symbol        | _  |   | √*2                            |
| Histogram                  | —  | —   | ✓                              |
| Custom Numeric             | ✓  | ~   | ✓                              |



MS269xA MS2850A MS2840A

MS2830A

4-pane Screen (Traces 1-4)



4-pane Screen (Traces 5-8)

✓: Displays measured results.

-: Does not display measured results.

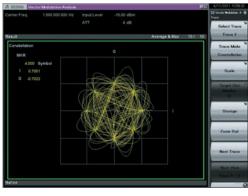
\*1: Used at APCO-P25 Phase2 Inbound measurement

\*2: Available when Modulation Type is set to 2FSK, 4FSK, H-CPM.

Double-clicking the screen toggles between the four-pane and zoom screens to raise design verification efficiency through optimized operability.



4-pane Screen



Zoom Screen

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### MS269xA MS2850A MS2840A MS2830A

#### • Numeric Display

The results of Frequency Error and EVM, etc., can be listed numerically. Selecting Avg/Max displays the average and worst value simultaneously, helping clarify signal dispersion at a glance.

# All status Variable & Market Advancementage V12/00120 G31 Carrier Frie, 1 000 000 000 Kr z Input Exet -1000 GBm ATT 4 m3 Research Market Advancementage Average & Market 201 201 Numeric Arg 1 Mark Trove 1 Numeric Arg 1 Mark Trove 1 Numeric Arg 1 Mark Trove 1 Prequency Error 115.0 g/m 05.0 g/m EVM(mark) 0.0 1 / 0.0 3 g/m Bark EVM(mark) 0.0 / 1.0 3 / 0.0 /

Modulation method: π/4DQPSK example

|                   | 1 000 000 000 Ha |               | -10.00 dBm        |           | White Makadam A  |
|-------------------|------------------|---------------|-------------------|-----------|--|
|                   |                  |               |                   |           | Select Trace   |
|                   |                  |               |                   |           | and the second second second   |
| esult.            |                  |               |                   |           | Trace I  |
| Numeric           |                  |               | Symbol Rate Error | man ppm   | Trace Made   |
| Tx Power          | -11.39 dBm       |               | Jitter P-P Min    | 34.27 %   | Trace Mode   |
|                   | 72.55 µW         |               | Jitter P-P Max    | 31.31 %   | Numeric  |
| Filtered Power    | -11.39 dBm       |               | Deviation         |           |  |
|                   | 72.56 µW         |               | Average           | 941.1 Hz  |  |
| Frequency Error   | -0.01 Hz         |               | +Peak             | 1.399 kHz | Scale  |
|                   | 0.00000663 ppm   |               | Peak              | 1.645 kHz | Sector 1   |
| Mag. Error(rms)   | 0.43 %           |               | (Peak-Peak)/2     | 1.522 kHz |  |
| Mag. Error(peak)  |                  | at symbol 165 |                   |           | Target Slot  |
| FSK Error(ms)     | 0.37 %           |               |                   |           | - Investore  |
| FSK Error(peak)   | 1.02 %           | at symbol 46  |                   |           |  |
| Deviation at Ts/2 |                  |               |                   |           | 0  |
| +3 Average        |                  |               | -3 Average        | -941.1 Hz |  |
| +3 + Max Peak     | 960.8 Hz         |               | -J + Max Peak     | -950.2 Hz |  |
| +3 + Min Peak     |                  |               | -3 + Min Peak     | -941.3 Hz | Storage  |
| +3 - Max Peak     | 941.0 Hz         |               | 3 - Max Peak      | -940.8 Hz |  |
| +3 - Min Peak     | 935.0 Hz         |               | -3 - Min Peak     | -934.3 Hz |  |
| +3 (Peak-Peak)/2  | 942.9 Hz         |               | J (Peak-Peak)/2   | -942.2 Hz | 2001032000   |
| +3 + Max Peak%    |                  |               | -3 + Max Peak%    | -100.96 % | Zoom Out   |
| +3 - Min Peak%    | 99.35 %          |               | J - Min Peak%     | -99.27 %  |  |
| +1 Average        | 313.6 Hz         |               | -1 Average        | 314.1 Hz  |  |
| +1 + Max Peak     | 319.8 Hz         |               | -1 + Max Peak     | -321.8 Hz | and the second s |
| +1 + Min Peak     | 313.6 Hz         |               | -1 + Min Peak     |           | Next Trace   |
| +1 - Max Peak     | 313.4 Hz         |               | -1 - Max Peak     | -314.0 Hz | A CONTRACTOR OF THE  |
| +1 - Min Peak     | 308.3 Hz         |               | -1 Min Peak       | -308.7 Hz |  |
| +1 (Peak-Peak)/2  |                  |               | -1 (Peak-Peak)/2  | -315.2 Hz | Next View  |
| +1 + Max Peak%    |                  |               | -1 + Max Peak%    | 34,19 %   |  |
| +1 - Min Peak%    | 32.76 %          |               | -1 - Min Peak%    | -32.90 %  | Trace 5 - 8  |

Modulation method: 4FSK example

| Carrier Freq. | tor Modulation Analysis | Input Level | -10.00 cBm     |                 | 6/7/2012 12-4152      |
|---------------|-------------------------|-------------|----------------|-----------------|-----------------------|
| tert.         | 1000 000 Ma             | ATT         | 4 48           |                 | VHA                   |
|               |                         |             | 4 dB           |                 | Select Trace          |
| Result        |                         |             |                |                 | Trace 1               |
| Numeric       |                         |             |                |                 |                       |
|               |                         |             |                |                 | Trace Mode            |
|               | Tx Power                |             | -11,46 dBm     |                 | Numeric               |
|               |                         |             | 71.51 µW       |                 |                       |
|               | Filtered Power          |             | -11.46 dBm     |                 |                       |
|               |                         |             | 71.52 µW       |                 | Scale                 |
| 1             | Frequency Error         |             | 0.11 Hz        |                 |                       |
| 1             |                         |             | 0.00011129 ppm |                 | Target Slot           |
|               | EVM(rms)                |             | 0.28 %         |                 | Target Slot           |
| 1             | EVM(peak)               |             | 0.53 %         | at symbol 686.0 |                       |
| 1             | OffsetEVM(rms)          |             | 0.35 %         |                 | summer a second       |
| 1             | OffsetEVM(peak)         |             | 0.54 %         | at symbol 136.0 |                       |
|               | Phase Error(rms)        |             | 0.10 deg.      |                 | Storage               |
| 1             | Phase Error(peak)       |             | 0.33 deg.      | at symbol 309.0 |                       |
|               | Mag. Error(ms)          |             | 0.25 %         |                 |                       |
|               | Mag. Error(peak)        |             | 40.47 %        | at symbol 136.5 | Zoom Out              |
|               | Origin Offset           |             | 46.97 dB       |                 | Zoom Out              |
|               |                         |             | 0.45 %         |                 |                       |
|               | IQ Gain Imbalance       |             | 0.01 dB        |                 | and the second second |
|               | Quadrature Error        |             | 4.03 deg.      |                 | Next Trace            |
|               | MER(ms)                 |             | 48.09 dB       |                 |                       |
|               | MER(peak)               |             | 68.61 dB       | at symbol 512.0 | and the second second |
|               | Symbol Rate Error       |             | ppm            |                 | Next View             |
|               |                         |             |                |                 | Trace 5 - 8           |
| Ref.M         | Pre-Amp Off             |             |                |                 | 142                   |

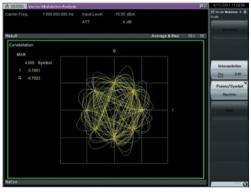
Modulation method: O-QPSK example

#### Constellation

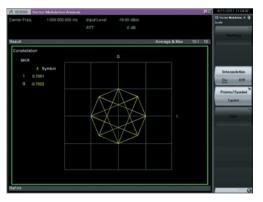
This displays the constellation for each modulation method. Interpolation On displays the state transition.



Interpolation: Off



Interpolation: On, Points/Symbol: 8points



Interpolation: On, Points/Symbol: 1 point

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### • vs. Symbol

This displays the temporal Symbol variation for each of nine characteristics.

- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Frequency vs. Symbol
- I and Q vs. Symbol
- Magnitude vs. Symbol
- Phase vs. Symbol
- FSK Error vs. Symbol
- Fidelity vs. Symbol



EVM vs. Symbol



Phase Error vs. Symbol



I and Q vs. Symbol

#### • Symbol Table

This displays the symbol decoding result. The display can be switched between binary and hexadecimal. When a synchronized word is detected, it is reverse-displayed.

MS269xA MS2850A MS2840A

MS2830A



**Binary** example



Hexadecimal example

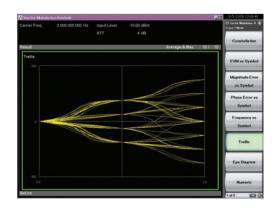
#### • Eye Diagram

Signal quality can be evaluated visually from the openness of the eye for each symbol at the Eye Diagram screen.

| Vector Modula | tion Analysis  |             |            | 9/5/2009 13:00:40            |
|---------------|--|-------------|------------|------------------------------|
| Carrier Freq. | 2 000 000 000 Hz   | Input Level | -10.00 dBm | Trace 7 Mode                 |
|               |  |             |            |                              |
| Result.       |  |             |            | Constellation                |
| 1             |  |             | Arro       | ge & Max 107 10              |
| Eye Diagram   |  |             |            | EVM vs Symbol                |
| V             |  |             |            | Magnitude Error<br>vs Symbol |
| - V           |  |             | S          | Phase Error vs<br>Symbol     |
|               |  |             |            | Frequency vs<br>Symbol       |
| •             | al contraction of the second sec |             |            | Trella                       |
| -             |  |             |            | Eye Diagram                  |
|               |  |             |            | 20 Numeric                   |

#### • Trellis

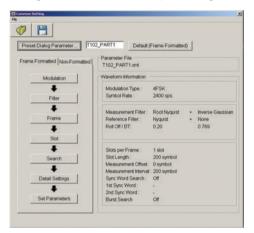
The Trellis screen is used to examine phase transitions of different symbols.



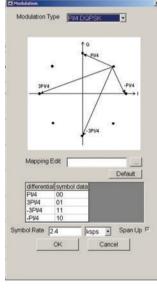
# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### Graphical Setting Display

Setting is easy using the simple GUI, and the setting parameter Save/ Recall function lightens the burden of complex settings.



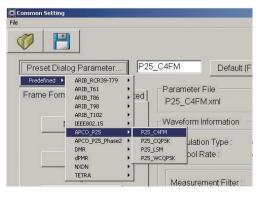
#### Common Setting



Modulation

#### Simple Parameter Setting Function

Simply selecting the standard name at [Preset Dialog Parameter...] Measurement parameters can be set easily for APCO-P25 Phase1/ Phase2, NXDN, TETRA, DMR, dPMR, IEEE 802.15.4/4d , RCR STD-28, 39, and ARIB STD-T61, T79, T86, T98, T102.



#### (2) Power vs. Time

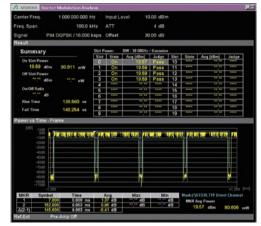
The measured-signal Rise and Fall, Slot, and Frame status can be confirmed using the time-axis graph, and a Mask can be drawn on the graph.

MS269xA MS2850A MS2840A

The numeric results indicate the On Slot average power, Off Slot average power, difference in each average power, and the Rise Time and Fall Time. In addition, the power for each Slot can be displayed as a list, while setting a Mask supports On Slot pass/fail evaluation. Moreover, the Marker function can be used to display the Max., Min., and Average power at the selected marker position as well as to display

the average power between markers. The marker start position for the analyzed section can be set in 0.125

symbol units as standard.



Frame Results Display

# Vector Modulation Analysis Software MX269017A APSK Analysis MX269017A-001 Higher-Order QAM Analysis MX269017A-011 (Continued)

#### • Wide Dynamic Range Function\*

This function is used mainly for measurements, such as Power Ramp Time and Off Slot Power specified by the LMR/PMR standards. This measurement finds the power of the On Slot and Off Slot as well as the power difference when the radio is transmitting.

For example, when measuring a power of 47 dBm (50 W) during the On Slot and –50 dBm or less during the Off Slot, a spectrum analyzer (signal analyzer) requires a wide dynamic range of at least 100 dB, taking the measurement margin into account. This is a severe requirement, but since the purpose of this function is to widen the measurement dynamic range, it is possible to measure the On Slot and Off Slot power once each by changing the setting of the signal analyzer built-in RF attenuator. In addition, the time-axis graph can display the combined results for the two measurements.

Furthermore, measurement by selecting the standard name using the previously described Simple Parameter Setting Function (Preset Dialog Parameter) enables confirmation that the input-signal On Slot and Off Slot satisfy the standard (Mask). The supported standards are as follows.

• Mask and Filter Standards Set Automatically at Preset Dialog Parameter

RCR STD-28, RCR STD-39, ARIB STD-T61, ARIB STD-T79, ARIB STD-T85, ARIB STD-T86

Other standards can also be measured by setting any Mask, filter, etc.



Measurement Results Example (WDR is displayed on the screen when this function is in use.)

\*: The Wide Dynamic Range Function is not supported by some units of the MS2830A 3.6 GHz/6 GHz models (MS2830A-040/041) shipped before November 2011 that do not have either the [M] or [M2] sticker attached to the back panel.

#### (3) Others

#### Power Meter Measurement Function

The power meter measurement can performed by calling the mainframe. Power meter function can connect a USB power sensor to the main-frame and read the measurement values. Settings of Carrier Frequency, Offset, and Offset Value are automatically reflected on the corresponding parameters.

MS269xA

MS2850A MS2840A

MS2830A



#### Compatible USB Power Sensors

| Model     | Frequency Range  | Dynamic Range    |
|-----------|------------------|------------------|
| MA24104A* | 600 MHz to 4 GHz | +3 to +51.76 dBm |
| MA24105A  | 350 MHz to 4 GHz | +3 to +51.76 dBm |
| MA24106A  | 50 MHz to 6 GHz  | –40 to +23 dBm   |
| MA24108A  | 10 MHz to 8 GHz  | –40 to +20 dBm   |
| MA24118A  | 10 MHz to 18 GHz | –40 to +20 dBm   |
| MA24126A  | 10 MHz to 26 GHz | –40 to +20 dBm   |

\*: MA24104A has been discontinued.

# Analog Measurement Software MX269018A

MS2840A MS2830A

The Analog Measurement Software MX269018A supports measurement of TRx characteristics of analog mobile radio. Installing this software in the MS2840A and MS2830A supports fast and accurate measurement, offering an ideal and efficient evaluation platform for development, production, and maintenance of analog wireless equipment.

#### The various functions for development, production and maintenance of analog mobile radio are supported

All the TRx performance tests (FM/ΦM/AM) required by analog mobile radio are supported.

#### Supported Signal Analyzer MS2830A Functions

Both RF and AF signal TRx functions can be implemented simultaneously by combining the MS2830A with the analog signal generator and audio analyzer options, supporting all-in-one tests of key analog mobile radio TRx characteristics. All the high-pass, low-pass, and band-pass (weighting) filters as well as de-mphasis functions required for measuring AF signals for each type of analog mobile radio are provided for monitoring demodulated audio signals. The Audio Analyzer option with PTT (Push To Talk) connector controls the analog mobile radio PTT On/Off function.

Table 1. Functions of Analog Measurement Software and Required Configuration (MS2830A)

|          | Analog Measurement Software Function*1     |   |     | ation Me<br>Irget Sig |    | Required Options<br>(Refer to details of each item in Table 2.)   |  |
|----------|--|---|-----|-----------------------|----|---|--|
|          |  |   | FM  | ΦМ                    | AM | (Refer to details of each item in Table 2.)   |  |
|          |  | Carrier Frequency and Carrier Frequency Error<br><i>RF Frequency</i><br>Transmit Power<br><i>RF Power</i>   |     | ~                     | ~  |   |  |
|          | RF Measurements                            |   |     | ~                     | ~  |   |  |
|          | Kr Weasurements                            | Modulation Measurement<br>Deviation (FM), Radian (ФМ), Depth (AM)   | ~   | ~                     | ~  | 1, 2, 3, 4 are mandatory  |  |
|          |  | Result of Analyzed DCS Code<br>DCS Code   | ~   | _                     | _  | Signal Analyzer (MS2830A-040/041/043*)     Low Phase Noise Performance (MS2830A-066)     Apples Maximum of Contemporation (MS260010A) |  |
|          |  | Demodulation Frequency<br>AF Frequency  | ~   | ~                     | ~  | <ol> <li>Analog Measurement Software (MX269018A)</li> <li>USB Audio (A0086D)</li> <li>Commercial loudspeaker</li> </ol>               |  |
|          |  | Effective Level Value at Demodulation Frequency<br>Level  | ~   | ~                     | ~  | *: As shown above, the analog signal generator 7  |  |
| Tx Tests | AF Measurements<br>(Demodulation)          | Distortion Ratio of Demodulation Frequency Distortion<br>Distortion, SINAD, THD   | ~   | ~                     | ~  | cannot be installed in the MS2830A-043 because the MS2830A-066 is required.   |  |
|          |  | Time vs. Level, Frequency vs. Level<br><i>Graph Result</i>  | ~   | ~                     | ~  |   |  |
|          |  | Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector* <sup>2</sup>  | √*3 | ~                     | ~  |   |  |
|          |  | Demodulates input RF signals from analog mobile radio and<br>outputs sound from internal speaker, headphone jack and<br>demodulation output connector | ∕*3 | _                     | _  |   |  |
|          | AF Output<br>(Audio Generator<br>Function) | AF Tone, DCS, White Noise (ITU-T Recommendation G.227),<br>DTMF   | ~   | ~                     | ~  | 1 + 2 + 3 + 4<br>+6 Audio Analyzer (MS2830A-018)  |  |
|          | PTT (Push To Talk)                         | Control   | ~   | ~                     | ~  |   |  |
|          |  | Modulation Signal Output (FM, ΦΜ, AM)   | ~   | ~                     | ✓  | 1 + 2 + 3 + 4   |  |
|          | RF Output                                  | Internal Modulation Signal Source (AF Tone)   | ✓   | ~                     | ✓  | +7 Analog Signal Generator  |  |
|          |  | Internal Modulation Signal Source (DCS)   | ~   |                       |    | (Refer to Table 3.)   |  |
|          |  | Frequency<br>AF Frequency   | ~   | ~                     | ~  |   |  |
| Rx Tests | AF Measurements<br>(Audio Analyzer         | Effective Level Value<br>Level  | ~   | ~                     | ~  | 1 + 2 + 3 + 4   |  |
|          | Function)                                  | Distortion Ratio<br>SINAD, THD, THD+N   | ~   | ~                     | ~  | +6 Audio Analyzer (MS2830A-018)<br>+7 Analog Signal Generator<br>(Refer to Table 3.)  |  |
|          |  | Graph (Time vs. Level, Frequency vs. Level)<br>Graph Result   | ~   | ~                     | ~  |   |  |
|          | PTT (Push To Talk)                         | Control   | ~   | ~                     | ✓  |   |  |

\*1: Spurious can also be measured using the standard spectrum analyzer measurement function.

\*2: Voice can be monitored by connecting a commercial loudspeaker using the A0086A, A0086B, A0086C or A0086D USB Audio option.

\*3: The Wide Band FM measurement mode is not supported.

MS2840A MS2830A

|             |  | Model       |             |  |  |
|-------------|--|-------------|-------------|--|--|
|             | Name   | New         | Retrofit    | Note   |  |
|             | 3.6 GHz Signal Analyzer                                  | MS2830A-040 | _           | 9 kHz to 3.6 GHz<br>This option cannot be retrofitted.   |  |
| Mandatory   | 6 GHz Signal Analyzer                                    | MS2830A-041 | _           | 9 kHz to 6 GHz<br>This option cannot be retrofitted.   |  |
| Wandatory   | 13.5 GHz Signal Analyzer                                 | MS2830A-043 | _           | 9 kHz to 13.5 GHz<br>This option cannot be retrofitted.<br>The MS2830A-066 and signal generator options cannot be<br>installed simultaneously. |  |
| Mandatory   | Low Phase Noise Performance                              | MS2830A-066 | _           | This option cannot be retrofitted.<br>It improves phase noise performance.   |  |
| Mandatory   | Analog Measurement Software                              | MX269018A   |             | Retrofit it is supported.  |  |
| Mandatory   | USB Audio  | A0086D      |             | Required for output of demodulated audio   |  |
|             | 3.6 GHz Analog Signal Generator                          | MS2830A-088 | MS2830A-188 | Frequency setting range: 100 kHz to 3 GHz<br>Required for Rx tests<br>Refer to the selection conditions in Table 3.                            |  |
|             | Audio Analyzer   | MS2830A-018 | MS2830A-118 |  |  |
|             | Vector Function Extension for Analog Signal<br>Generator | _           | MS2830A-189 | Add vector function to MS2830A-088/188   |  |
| Recommended | 3.6 GHz Vector Signal Generator                          | MS2830A-020 | MS2830A-120 | 250 kHz to 3.6 GHz   |  |
| Recommended | 6 GHz Vector Signal Generator                            | MS2830A-021 | MS2830A-121 | 250 kHz to 6 GHz   |  |
|             | Low Power Extension for Vector Signal Generator          | MS2830A-022 | MS2830A-122 | Extends lower output level limit<br>Mandatory for MS2830A-029  |  |
|             | Analog Function Extension for Vector Signal<br>Generator | MS2830A-029 | *           | Adds analog function to MS2830A-020/021 (Requires<br>MX269018A)<br>Required for Rx tests<br>Refer to the selection conditions in Table 3.      |  |

#### Table 2. Ordering Information for Analog Measurement Software (MS2830A)

\*: Please contact our sales representative

#### Table 3. Optional Combination Necessary for Mounting Analog Signal Generator (MS2830A)

Option model are decided by the MS2830A which required Analog Signal Generator (SG).

#### Please note that there is a case where an analog SG function cannot be installed for a part of MS2830A composition.

| MS2830A with Installed Analog SG |                       | New MS2830A   | When Retrofitting Analog SG in MS2830A                   |    |                     |
|----------------------------------|-----------------------|---|--|----|---------------------|
| MS2830A Frequency Option         |                       | Ļ   | MS2830A-040/041  |    | MS2830A-043         |
| Installed                        | Vector SG             | Ļ   | Not installed MS2830                                     |    | Ļ                   |
|                                  | Analog SG MS2830A-088 |   | MS2830A-188  | *1 |                     |
| Supported SG addition            | Analog SG + Vector SG | MS2830A-020 or<br>MS2830A-021 +<br>MS2830A-022 +<br>MS2830A-029 | MS2830A-188* <sup>2</sup> +<br>MS2830A-189* <sup>2</sup> | _  | Cannot be installed |

\*1: Please contact our sales representative

\*2: Can select only 3.6 GHz Vector SG/Analog SG

#### Supported Signal Analyzer MS2840A Functions

Combining the MS2840A with the analog signal generator option provides all-in-one support for tests of TRx characteristics of analog mobile radio. As well as RF measurements including Tx frequency, Tx power, FM deviation, etc., Tx tests can also be used to the demodulation frequency, distortion, etc., of demodulated AF signals. High-pass filters, low-pass filters, band-pass filters (weighting filters), and de-emphasis functions support measurement of demodulated signals for each wireless type. Additionally, at Rx tests, a modulation signal can be output from the analog signal generator and AF tones and DCS codes can also be output using the built-in modulation output function.

However, the audio analyzer option and analog wireless automatic measurement software are not supported.

#### Table 4. Supported Signal Analyzer MS2840A Frequency Options

|  |                  |                       | ✓: Supported, —: Not supported |
|--|------------------|-----------------------|--------------------------------|
|  | Frequency Option | MS2840A-040 (3.6 GHz) | MS2840A-044 (26.5 GHz)         |
| Option                                     |                  | MS2840A-041 (6 GHz)   | MS2840A-046 (44.5 GHz)         |
| Analog Measurement Software (MX269018A)    |                  | $\checkmark$          | $\checkmark$                   |
| Analog Signal Generator (MS2840A-088, 029) |                  | $\checkmark$          | _                              |
| Audio Analyzer                             |                  | _                     | _                              |

#### Table 5. Functions of Analog Measurement Software and Required Configuration (MS2840A)

|         |  |  | Modula | ation Me | thod of | ✓: Supported, — : Not support   |  |
|---------|--|--|--------|----------|---------|---|--|
|         | Ana  | log Measurement Software Function*1  |        | rget Sig |         | Required Options  |  |
|         |  |  | FM     | ФМ       | AM      | (Refer to details of each item in Table 6.)   |  |
|         |  | Carrier Frequency and Carrier Frequency Error<br>RF Frequency  | ~      | ~        | ~       |   |  |
|         | RF Measurements                            | Transmit Power<br><i>RF Power</i>  | ~      | ~        | ~       |   |  |
|         | Kr Weasurements                            | Modulation Measurement<br>Deviation (FM), Radian (ΦM), Depth (AM)  | ~      | ~        | ~       |   |  |
|         |  | Result of Analyzed DCS Code<br>DCS Code  | ~      | _        | _       | 1, 2, and 3 are mandatory   |  |
|         |  | Demodulation Frequency<br>AF Frequency   | ~      | ~        | ~       | 1. Signal Analyzer (MS2840A-040/041/044/046<br>2. Analog Measurement Software (MX269018A) |  |
|         |  | Effective Level Value at Demodulation Frequency<br>Level   | ~      | ~        | ~       | 3. USB Audio (A0086D)<br>4. Commercial loudspeaker  |  |
| x Tests | 45.44                                      | Distortion Ratio of Demodulation Frequency Distortion<br>Distortion, SINAD, THD  | ~      | ~        | ~       |   |  |
|         | AF Measurements<br>(Demodulation)          | Time vs. Level, Frequency vs. Level<br>Graph Result  | ~      | ~        | ~       |   |  |
|         |  | Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector* <sup>2</sup>   | √*3    | ~        | ~       |   |  |
|         |  | Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker <sup>*3</sup> , headphone jack <sup>*3</sup> and demodulation output connector <sup>*3</sup> | _      | _        | _       |   |  |
|         | AF Output<br>(Audio Generator<br>Function) | AF Tone, DCS, White Noise (ITU-T Recommendation G.227),<br>DTMF  | _      | _        | _       | Not supported by MS2840A  |  |
|         | PTT (Push To Talk)                         | Control  | _      | _        | _       |   |  |
|         |  | Modulation Signal Output (FM, ΦΜ, ΑΜ)  | ✓      | ~        | ~       | Not supported by MS2840A-044/046  |  |
|         | RF Output                                  | Internal Modulation Signal Source (AF Tone)  | ✓      | ~        | ~       | 1 + 2 + 3   |  |
|         |  | Internal Modulation Signal Source (DCS)  | ~      | —        | -       | + 5 Analog Signal Generator (Refer to Table 7.  |  |
|         |  | Frequency<br>AF Frequency  | _      | _        | _       |   |  |
|         | AF Measurements<br>(Audio Analyzer         | Effective Level Value<br>Level   | _      | _        | _       | Not supported by MS2840A  |  |
|         | Function)                                  | Distortion Ratio<br>SINAD, THD, THD+N  | _      | _        | _       | Not supported by MS2840A  |  |
|         |  | Graph (Time vs. Level, Frequency vs. Level)<br>Graph Result  | _      | _        | _       |   |  |

\*1: Spurious can also be measured using the standard spectrum analyzer measurement function.

\*2: Voice can be monitored by connecting a commercial loudspeaker using the A0086A, A0086B, A0086C or A0086D USB Audio option.

\*3: The Wide Band FM measurement mode is not supported.

MS2840A

MS2840A MS2830A

#### Table 6. Ordering Information for Analog Measurement Software (MS2840A)

This software cannot be installed in the MS2830A 26.5 GHz/43 GHz models, but can be installed in the MS2840A 26.5 GHz/44.5 GHz models. And the MS2830A requires the Low Phase Noise Performance MS2830A-066 but the MS2840A does not require the Low Phase Noise Performance MS2840A-066.

With 3.6 GHz Signal Analyzer (MS2840A-040) or 6 GHz Signal Analyzer (MS2840A-041)

| $\sim$      | Name   | Model       |             | Note  |  |
|-------------|--|-------------|-------------|---|--|
|             | Name   | New         | Retrofit    | Note  |  |
| Mandatory   | 3.6 GHz Signal Analyzer                                  | MS2840A-040 | _           | 9 kHz to 3.6 GHz<br>This option cannot be retrofitted.  |  |
| Mandatory   | 6 GHz Signal Analyzer                                    | MS2840A-041 | —           | 9 kHz to 6 GHz<br>This option cannot be retrofitted.  |  |
| Mandatory   | Analog Measurement Software                              | MX26        | 9018A       | Frequency range (Tx Tests): 100 kHz to 2.7 GHz<br>(At Wide Band FM measurement: 10 MHz to 2.7 GHz)<br>Retrofit is supported.              |  |
| Mandatory   | USB Audio  | A00         | 186D        | Required for output of demodulated audio  |  |
|             | Low Phase Noise Performance                              | MS2840A-066 | MS2840A-166 | Improves phase noise performance.<br>This option greatly improves SSB phase noise performance.  |  |
|             | 3.6 GHz Analog Signal Generator                          | MS2840A-088 | MS2840A-188 | 100 kHz to 3 GHz<br>Required for Rx tests<br>Refer to the selection conditions in Table 7.  |  |
|             | Vector Function Extension for Analog Signal<br>Generator | _           | MS2840A-189 | Add vector function to MS2840A-088/188  |  |
| Recommended | 3.6 GHz Vector Signal Generator                          | MS2840A-020 | MS2840A-120 | 250 kHz to 3.6 GHz  |  |
|             | 6 GHz Vector Signal Generator                            | MS2840A-021 | MS2840A-121 | 250 kHz to 6 GHz  |  |
|             | Low Power Extension for Vector Signal Generator          | MS2840A-022 | MS2840A-122 | Extends lower output level limit<br>Mandatory for MS2840A-029   |  |
|             | Analog Function Extension for Vector Signal<br>Generator | MS2840A-029 | MS2840A-129 | Adds analog function to MS2840A-020/021 (Requires<br>MX269018A)<br>Required for Rx tests<br>Refer to the selection conditions in Table 7. |  |

With 26.5 GHz Signal Analyzer (MS2840A-044) or 44.5 GHz Signal Analyzer (MS2840A-046)

| $\square$ | Name                        | Model         |          | Note   |  |
|-----------|-----------------------------|---------------|----------|--|--|
|           | Name                        | New           | Retrofit | Note   |  |
|           | 26.5 GHz Signal Analyzer    | MS2840A-044 — |          | 9 kHz to 22.5 GHz                                |  |
| Mandatory |                             | WIS2040A-044  |          | This option cannot be retrofitted.               |  |
| Wandatory | 44.5 GHz Signal Analyzer    | MS2840A-046   |          | 9 kHz to 44.5 GHz                                |  |
|           |                             | WI32040A-040  |          | This option cannot be retrofitted.               |  |
|           |                             |               |          | Frequency range (Tx Tests): 100 kHz to 2.7 GHz   |  |
| Mandatory | Analog Measurement Software | MX26          | 9018A    | (At Wide Band FM measurement: 10 MHz to 2.7 GHz) |  |
|           |                             |               |          | Retrofit is supported.                           |  |
| Mandatory | USB Audio                   | A0086D        |          | Required for output of demodulated audio         |  |

#### Table 7. Optional Combination Necessary for Mounting Analog Signal Generator (MS2840A)

Option model are decided by the MS2840A which required Analog Signal Generator (SG).

| MS2840A with Installed Analog SG |                       | New MS2840A                                       | When Retrofitting Ar          | alog SG in MS2840A          |  |
|----------------------------------|-----------------------|---|-------------------------------|-----------------------------|--|
| MS2840A Frequency Option         |                       | Ļ   | MS2840A-040/041               |                             |  |
| Installed Vector SG              |                       | Ļ   | Not installed                 | MS2840A-020/021             |  |
|                                  | Analog SG             | MS2840A-088                                       | MS2840A-188                   | MS2840A-129 + MS2840A-122*2 |  |
| Supported SG addition            | Analog SG + Vector SG | MS2840A-020 or 021 +<br>MS2840A-022 + MS2840A-029 | MS2840A-188*1 + MS2840A-189*1 | —                           |  |

\*1: Can select only 3.6 GHz Vector SG/Analog SG

\*2: Unnecessary when MS2840A-022 already installed

MS2840A MS2830A

#### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.

The specifications are defined under the following condition unless otherwise specified.

Attenuator mode: Mechanical Attenuator Only, The correct level is set for the input signal.

The Tx measurement specifications apply to the MS2840A, and the MS2830A with built-in MS2830A-062/066 Low Phase Noise Performance Option.

| ınal Analyzer            |                                 | MS2840A  | Ν  | MS2830A  |  |
|--------------------------|---------------------------------|--|--|--|--|
| Measurements             |                                 | No Audio Analyzer option   | Without MS2830A-018/118<br>Audio Analyzer Option   | With MS2830A-018/118<br>Audio Analyzer Option  |  |
|                          | Target Signal                   | FM, ΦM, AM signal  |  |  |  |
| Common                   | Frequency Range                 | 100 kHz to 2700 MHz<br>At Wide Band FM measureme                                   | ent: 10 MHz to 2700 MHz  |  |  |
| Specification            | Level Range                     | –15 to +30 dBm (Preamp Off, or Preamp not installed)<br>–25 to +10 dBm (Preamp On) |  |  |  |
|                          | Carrier Frequency Accuracy      | At 18°C to 28°C, after calibrat<br>± (Accuracy of reference freq                   | tion<br>uency × Carrier frequency + 1) Hz  |  |  |
|                          | Frequency Deviation             |  | $\leq$ 20 kHz, 20 kHz < Frequency Deviation<br>/ Deviation $\leq$ 20 kHz, 20 kHz < Frequency |  |  |
|                          | Demodulation Frequency<br>Range | 20 Hz to 20 kHz  |  |  |  |
| FM                       | Frequency Deviation Accuracy    | 1% of indicated value ± Resid  | dual FM  |  |  |
| Measurement              | Residual FM                     | 3.35 Hz rms, S/N: >50 dB (1.5  | kHz Deviation, Demodulation Band: 0.3  | kHz to 3 kHz)  |  |
|                          | Demodulation Distortion         | 0.3%<br>(Demodulation Frequency: 1   | kHz, Frequency Deviation: 5 kHz, Demo  | dulation Band: 0.3 kHz to 3 kHz)   |  |
|                          | DCS Measurement Function        | Digital Code Squelch demode  | ulated result display  |  |  |
|                          | ΦM Deviation                    | 0 to (20 kHz/Demodulation F  | requency [Hz]) rad   |  |  |
| ФМ                       | Demodulation Frequency<br>Range | 20 Hz to 20 kHz  | z to 20 kHz  |  |  |
| Measurement              | ΦM Deviation Accuracy           | 1% of indicated value ± Resid  | dual ΦM  |  |  |
|                          | Residual ΦM                     | 0.01 rad rms (Demodulation   | Band: 0.3 kHz to 3 kHz)  |  |  |
|                          | Demodulation Distortion         | 1% (Demodulation Band: 0.3   | kHz to 3 kHz)  |  |  |
|                          | AM                              | 0 to 98%   |  |  |  |
| AM                       | Demodulation Frequency<br>Range | 20 Hz to 20 kHz  |  |  |  |
| Measurement              | AM Accuracy                     | 1% of indicated value ± Resid  | dual AM  |  |  |
|                          | Residual AM                     | 0.3% (Demodulation Band: 0.  | 3 kHz to 3 kHz)  |  |  |
|                          | Demodulation Distortion         | 0.3% (Demodulation Band: 0.  | 3 kHz to 3 kHz)  |  |  |
|                          | Low Pass                        | 300 Hz, 3, 15, 20 kHz  |  |  |  |
| Elle                     | High Pass                       | < 1*, < 20*, 50, 300, 400 Hz, 3  | 30 kHz *: FM only  |  |  |
| Filter                   | Band Pass (Weighting filter)    | CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting                                  |  |  |  |
|                          | De-emphasis                     | 25, 50, 75, 500, 750 μs  |  |  |  |
| Amplitude<br>Measurement | Iransmit Power Accuracy         |  |  | -  |  |
| Audio Monitor            | (Demodulation Output)           |  | to USB Audio equipment connected to<br>ninal (Wide Band FM measurement not                   | FM/ФМ/AM:         Output demodulated signal to USB         audio equipment connected to         MS2830A USB terminal (Wide Band F         measurements not supported)         FM: Internal speaker, headphone jack o         demodulation output connector         (Wide Band FM measurements not supported) |  |

MS2840A MS2830A

| Signal Analyzer         |   | MS2840A  | MS2  | 2830A   |  |
|-------------------------|---|--|--|---|--|
|                         |   | No Audio Analyzer option   | Without MS2830A-018/118<br>Audio Analyzer Option   | With MS2830A-018/118<br>Audio Analyzer Option               |  |
| Rx Measurements         |   | This function is enabled either when the MS2830A/MS2840A-088 3.6 GHz Analog Signal Generator is installed, or when the MS2830A/MS2840A-020/021 Vector Signal Generator and MS2830A/MS2840A-022 Low Power Extension for Vector Signal Generator and MS2830A/MS2840A-029 Analog Function Extension for Vector Signal Generator are installed |  |   |  |
| RF Signal Output        |   | The performance specifications   | s are for the MS2830A-088 or MS2830A-020/0         | 021 when the MS2830A-029 is installed                       |  |
| Frequency Setting Range |   | 100 kHz to 3000 MHz  |  |   |  |
|                         | Frequency Setting Resolution                | 1 Hz   |  |   |  |
|                         | Output Setting Level                        | –136 to +15 dBm (Rx frequer<br>–136 to –3 dBm (Rx frequenc   |  |   |  |
|                         | Frequency Deviation Setting<br>Range        | 0 to 100 kHz   |  |   |  |
|                         | Frequency Deviation Setting<br>Resolution   | 0.1 Hz   |  |   |  |
|                         | Frequency Deviation Accuracy                | ±1% of set value (excludes Re  | esidual FM)  |   |  |
| FM                      | Internal Modulation Signal<br>Source        |  |  | AF Tone Source × 3<br>Digital Code Squelch Signal Generator |  |
|                         | Internal Modulation Frequency<br>Range      | Tone Frequency: 20 Hz to 40 kHz  |  |   |  |
|                         | Internal Modulation Frequency<br>Resolution | 0.1 Hz, Setting value ±3 Hz on use of Digital Code Squelch signal  |  |   |  |
|                         | DCS Code Setting Range                      | DCS Code: 000 to 777 (octal,   | 3-digit)   |   |  |
|                         | Phase Deviation Setting Range               | Settable with the range of 0 to  | o 50.0 rad. (internal modulation frequency $	imes$ | phase deviation) < 100 kHz                                  |  |
|                         | Phase Deviation Setting Resolution          | 0.01 rad.  |  |   |  |
|                         | Phase Deviation Accuracy                    | ±1% of set value (excludes Residual ΦM)  |  |   |  |
| ФМ                      | Internal Modulation Signal Source           | AF Tone Source × 2   |  | AF Tone Source × 3  |  |
|                         | Internal Modulation Frequency<br>Range      | Tone Frequency: 20 Hz to 40 kHz  |  |   |  |
|                         | Internal Modulation Frequency<br>Resolution | 0.1 Hz   |  |   |  |
|                         | Modulation Setting Range                    | 0 to 100%  |  |   |  |
|                         | Modulation Setting Resolution               | 1%   |  |   |  |
|                         | Modulation Accuracy                         | ±1% of set value (excludes Residual AM)  |  |   |  |
| AM                      | Internal Modulation Signal Source           | AF Tone Source × 2   |  | AF Tone Source × 3  |  |
|                         | Internal Modulation Frequency<br>Range      | Tone Frequency: 20 Hz to 40  | kHz  | ·   |  |
|                         | Internal Modulation Frequency<br>Resolution | 0.1 Hz   |  |   |  |

| Analog Signal Generator Option | MS2840A-029/129/088/188   | MS2830A-029/088/188  |  |  |  |
|--------------------------------|---|--|--|--|--|
| Max. Reverse Input             | 0 Vdc (max.)<br>+18 dBm (<20 MHz), +30 dBm (≥20 MHz)  |  |  |  |  |
| Function/Performance           | The following specifications (see MS2840A catalog) are<br>added to the specifications when the MS2840A-020/021<br>and MS2840A-022 are installed | The following specifications (see MS2830A catalog) are added to the specifications when the MS2830A-020/02 and MS2830A-022 are installed |  |  |  |
| Frequency Setting Range        | 100 kHz to 3000 MHz   | 100 kHz to 3000 MHz  |  |  |  |
| Frequency Setting Resolution   | 1 Hz  |  |  |  |  |
| Output Setting Level           | -136 to +15 dBm (Rx frequency > 25 MHz)<br>-136 to -3 dBm (Rx frequency ≤ 25 MHz)   |  |  |  |  |
|                                | MS2830A-029/088/188<br>MS2840A-029/129/088/188  |  |  |  |  |
|                                |   | Output level [p] (dBm)   |  |  |  |
|                                | ±3.0 dB (typ., 100 kHz ≤ f < 250 kHz)   | –110 ≤ p ≤ –3  |  |  |  |
| Output Level Accuracy          | ±1.0 dB (typ., 250 kHz ≤ f ≤ 25 MHz)  | -110 ≤ p ≤ -3  |  |  |  |
|                                | ±1.0 dB (typ., 25 MHz < f < 100 MHz)  | $-110 \le p \le +4$  |  |  |  |
|                                | ±0.5 dB (typ., 100 MHz ≤ f < 375 GHz)   | -110 ≤ p ≤ +4  |  |  |  |
|                                | ±0.5 dB (375 MHz ≤ f ≤ 3 GHz)   | –110 ≤ p ≤ +4  |  |  |  |
|                                | ±1.0 dB (100 MHz ≤ f ≤ 3 GHz)   | -120 ≤ p < -110  |  |  |  |
|                                | $\pm 1.0 \text{ dB}$ (typ., 100 MHz $\leq f \leq 3 \text{ GHz}$ )   | -127 ≤ p < -120  |  |  |  |
| Arbitrary Signal Generator     | Available when the MS2830A-020, 021 or 189 (Vector Si   | gnal Generator) is installed   |  |  |  |

MS2840A MS2830A

| udio Analyzer Opt                                     |                               | The sec if it is   | in also t            | MS2830A-018/118  |  |  |
|---|-------------------------------|--|----------------------|--|--|--|
| udio Analyzer Fun                                     |                               |  |                      | asurement are listed below   |  |  |
| Measurement F<br>Connection Typ                       |                               | Amplitude, Frequency, THD, THD+N, SINAD<br>Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm)<br>Unbalanced: BNC-J            |                      |  |  |  |
| Impedance   |                               | Balanced: $200 \text{ k}\Omega$ (AC coupled, nom.)<br>Unbalanced: $100 \text{ k}\Omega$ (AC coupled, nom.)                 |                      |  |  |  |
| Frequency Mea   | surement Range                | 20 Hz to 50 kHz  |                      |  |  |  |
| Level Measurem  | <b>y</b>                      | 1 mV rms to 25 V rms (   | (30 V rms, max       | K.)  |  |  |
| Input Range Set                                       | tting                         | 50 mV peak, 500 mV p   | eak, 5 V peak,       | 50 V peak  |  |  |
| Level Accuracy  |                               | $18^{\circ}C$ to $28^{\circ}C$<br>±0.4 dB (20 Hz ≤ f ≤<br>±3.0 dB (25 kHz < f ≤  | ≤50 kHz)             |  |  |  |
| THD + N (Total  | Harmonic Distortion + Noise)  | <–60 dB<br><–80 dB (nom.)  |                      | 0 kHz, Range: 5 Vp-p, 18°C to 28°C   |  |  |
|   | Low-pass                      | Off, 3, 15, 20, 30, 50 kH  |                      |  |  |  |
| Audio Filter  | High-pass                     | Off, 20, 50, 100, 300, 40  |                      |  |  |  |
|   | Bandpass (Weighting filter)   | Off, CCITT, C-Message,   |                      |  |  |  |
| udio Generator Fu                                     | inction                       |  |                      | measurements except White Noise (through ITU-T G.227 filter)                               |  |  |
| Connection Typ  | e                             | Balanced: 1/4-inch pho<br>Unbalanced: BNC-J  | one Jack (3-pol      | e, Φ6.3 mm)  |  |  |
| Interface   | ·                             | Balanced: 100 Ω/600 Ω<br>Unbalanced: 50 Ω/600  |                      |  |  |  |
| Output Wavefo   | rm                            |  | •                    | S, White noise (ITU-T G.227), DTMF   |  |  |
|   |                               | 20 Hz to 25 kHz  |                      |  |  |  |
| Guaranteed Frequency Range<br>Frequency Setting Range |                               | 10 Hz to 50 kHz  |                      |  |  |  |
| Frequency Resolution                                  |                               | 0.01 Hz  |                      |  |  |  |
|   |                               | Using Sub Supply/Audio Revision 2*1  |                      |  |  |  |
|   |                               | Single tone  |                      |  |  |  |
|   |                               |  | Palancad             | Off, 1 mV rms to 12.4 V rms  |  |  |
|   |                               | Open circuit voltage $(\geq 100 k\Omega \text{ termination})$  | Balanced             |  |  |  |
|   |                               |  | Unbalanced           | Off, 1 mV rms to 6.2 V rms   |  |  |
|   |                               | 600Ω termination*  | Balanced             | Off, -63 dBm (equivalent to 0.5 mV rms) to +18 dBm (equivalent to 6.2 V rms                |  |  |
|   |                               |  | Unbalanced           | Off, –63 dBm (equivalent to 0.5 mV rms) to +12 dBm (equivalent to 3.1 V rms                |  |  |
| Output Level Ra                                       | ange                          | White noise (through I   | TU-T G.227 filt      | er)  |  |  |
|   |                               | Open circuit voltage   | Balanced             | Off, 1.545 mV rms to 3.083 V rms (nom.)  |  |  |
|   |                               | (≥100k $\Omega$ termination)   | Unbalanced           | Off, 1.545 mV rms to 1.545 V rms (nom.)  |  |  |
|   |                               | 600Q termination*  | Balanced             | Off, –60 dBm (equivalent to 0.774 mV rms ) to<br>+6 dBm (equivalent to 1.545 V rms) (nom.) |  |  |
|   |                               | 60002 termination*   | Unbalanced           | Off, –60 dBm (equivalent to 0.774 mV rms) to<br>0 dBm (equivalent to 0.774 V rms) (nom.)   |  |  |
|   |                               | *: Output Impedance =  | = 600 Ω, and C       | Dutput Impedance Reference = $600 \Omega$  |  |  |
|   |                               | Single tone: 1 mV (350   | mV rms < Ou          | tput Level ≤ 6.2 V rms)  |  |  |
| Output Level Re                                       | esolution                     |  |                      | itput Level $\leq$ 350 mV rms)   |  |  |
|   |                               |  | tput Level $\leq 3!$ |  |  |  |
|   |                               | White noise (through ITU-T G.227 filter): 0.01 dB (nom.)<br>Single tone: ±0.3 dB (1 kHz, 100 kΩ termination, 18°C to 28°C) |                      |  |  |  |
| Level Accuracy  |                               | White noise (through I   |                      |  |  |  |
| Maximum Outp  | ut Currency                   | 100 mA (nominal, no sl   |                      |  |  |  |
| THD + N (Total Harmonic Distortion + Noise)           |                               | At 1 kHz, 0.7 V rms, Band: 20 Hz to 25 kHz, 100 kΩ termination, 18°C to 28°C<br><-60 dB<br><-80 dB (nom.)                  |                      |  |  |  |
| ther Function   |                               | N - 7  |                      |  |  |  |
| Connector Type  |                               | BNC-J  |                      |  |  |  |
| Demodulation  | Demodulation Output Level     | –10 dBm ±2 dB (Freque  | ency deviation       | : 3.5 kHz, 600 Ω)  |  |  |
| Output<br>(FM only)* <sup>2</sup>                     | Demodulation Output Impedance | 600 Ω  |                      |  |  |  |
|   | Sound Monitor                 | Internal speaker or 3.5  | mm phone jac         | :k (2-pole, monaural)  |  |  |
| Crosstalk   |                               | Crosstalk from Audio G<br>>80 dB   |                      | · ·  |  |  |
| PTT (Push To Ta                                       | Ik) Control                   | Banana jack (Φ4.0 mm, 30 V, 500 mA max.)   |                      |  |  |  |
| General Input/Output (Audio Function)                 |                               | Connector: D-Sub 15 pin (jack)<br>Function: Open Collector × 1 (5 V, 100 mA max.), TTL Output × 2, TTL Input × 2           |                      |  |  |  |

\*1: Sub Supply/Audio Revision is the MS2830A-018/118 printed-circuit board version.

<Sub Supply/Audio Revision Confirmation Method>

(1) MS2830A units with Sub Supply/Audio Revision 2 have a sticker marked 'A1' next to the main-frame serial number.

(2) The MS2830A Sub Supply/Audio Revision can be confirmed as follows: Press [System Config ] → [F5] System Information → [F4] Board Revision View to list the Board Revisions; check the displayed Sub Supply/Audio Revision number. (It may be either 1 or 2.)

\*2: For Tx test of analog mobile radio. Wide Band FM measurements not supported.

#### MS2840A MS2830A

#### Tx Tests

#### Inputting AF Signal to analog mobile radio and Measuring Characteristics of RF Signal Output from Radio

Combining the MS2830A with the audio analyzer option supports tuning of the AF signal output (AF signal input to the analog mobile radio) and testing of the radio RF transmission characteristics by monitoring at one screen.

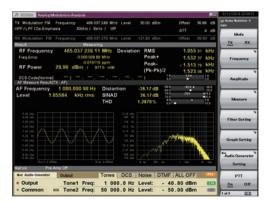
As well as outputting the AF signal simultaneously as up to three tones, tone + DCS, white noise (ITU-T G.227) and DTMF signals can be output too. At the analog mobile radio RF Tx characteristics test, the FM/ $\Phi$ M/ AM frequency, power, modulation degree, demodulated AF signal frequency, level, distortion, as well as time vs. level, and frequency vs. level graphs are displayed simultaneously. At FM modulation, the DCS (Digital Code Squelch) Code analysis is displayed as well. Moreover, frequency deviation measurement can be extended up to 1 MHz in the Wide FM measurement mode (usually up to 40 kHz in the normal FM measurement mode).

Various AF filters can be set according to the analog mobile radio when analyzing demodulated AF signals. As well as the common high-pass and low-pass filter settings, there are five CCITT, C-Message, CCIR 468, CCIR-ARM, and A-Weighting bandpass filters (weighting filters) plus five types of De-emphasis setting (25, 50, 75, 500, and 750  $\mu$ s). Other application software such as a spectrum analyzer can be used simultaneously at AF signal output. For example, in addition to outputting white noise (ITU-T G.227), both spurious and occupied bandwidth (OBW) measurements can be made using the spectrum analyzer display.

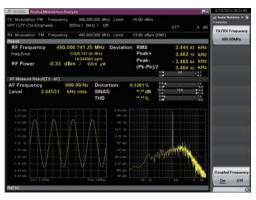
The Audio Analyzer option has a PTT (Push To Talk) connector for On/ Off control of the analog mobile radio PTT.



**Tx Characteristics Test Setup** 



Example of AF Signal Output and FM Modulation Signal Measurement Screen (with Audio Analyzer Option)



Example of FM Modulation Signal Measurement Screen (without Audio Analyzer Option)

#### **Rx Tests**

• Outputting FM/ФM/AM Signal to analog mobile radio and Measuring AF Signal Demodulated by Measuring Instrument

Combining the MS2830A with the analog signal generator and audio analyzer options supports tuning of the RF signal output (RF signal input to the analog mobile radio) and testing of the AF signal characteristics output from the radio by monitoring on one screen.

The RF signal output from the analog signal generator supports FM/ $\Phi$ M/ AM modulations, and in addition to outputting up to three AF tones from the internal modulation signal source simultaneously, can also output signals created as DCS (FM only) and Wave audio format files. At measurement of AF signals using the Audio Analyzer option, not only the frequency, level, and distortion (SINAD measurement, etc.), but also graphs of the time vs. level and frequency vs. level can be displayed simultaneously. The distortion display can either be as a numeric display or as a graph for easy SINAD tuning at the Rx sensitivity test. As well as high-pass and low-pass filter settings for AF filters, up to five types of CCITT, C-Message, CCIR 468, CCIR-ARM, and A-Weighting bandpass filters (weighting filters) can be set.

#### <About Internal Modulation Signal Source>

Up to three\*1 AF tone signal sources and one DCS signal source are provided.

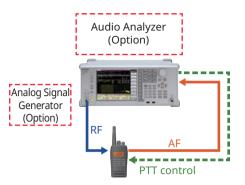
For example, the analog mobile radio operation confirmation test can use any of the following combinations:

- AF + AF + AF
- (1 kHz audio signal + Tone squelch signal + Audio signal of any frequency)
- AF + AF + DCS
- (1 kHz audio signal + Audio signal of any frequency + DCS signal)
- AF (Wave audio format)\*2
- \*1: Two when Audio Analyzer option not installed
- \*2: Output of a Wave audio format signal can also be set with the internal modulation signal source. An RF signal, such as DTMF (Dual Tone Multiple Frequency), can be output. The following limitations apply:

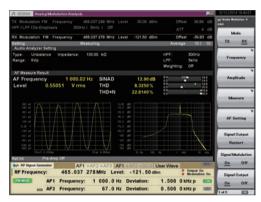
Linear PCM file

- (It is not possible to support ADPCM and the compressed format for enhanced PCM.)
- The reproduction is monaural or stereo.
- (Multi-channel is not supported and the L-Channel is used to reproduce stereo.) • The sampling quantization bit rate is 8 or 16 bits (full-scale at modulation
- and modulation depth set)
- Data replay of 10 s or less
- The sampling frequency is either 44.1, 48, or 96 kHz.
- Note: Sometimes, the Wave audio format file may not be loaded even if it meets the above specifications.

```
MS2840A MS2830A
```



**Rx Sensitivity Test Setup** 



Example of RF Signal Output and AF Signal Measurement Screen (with Analog Signal Generator and Audio Analyzer Options)

| A MISSERIA And                | log Modulation Ana      | lysia            |               |              |         |                  |            |
|-------------------------------|-------------------------|------------------|---------------|--------------|---------|------------------|------------|
| TX Modulation<br>HPF/LPF/De-E | FM Frequency<br>mphasis | 1000.000 000 MH  |               | 0 dBm        | ATT 4 d | gi Ante N<br>ANA |            |
| X Modulation                  | FM Frequency            | 1 000.000 000 MH | z Level -13.9 | 9 dBuV (EMF) |         |                  | de         |
| Setting<br>RX Setting         |                         |                  | SG OFF        |              | _       | TX               | RX         |
|                               |                         |                  |               |              |         | 1000             |            |
| RF Freque                     | ncy                     | 1 000.000 00     | DO MHZ        |              |         | Freq             | uency      |
| RF Level                      |                         | -13.9            | 99 dBµV (EMF  | )            |         |                  |            |
|                               |                         | 19               | 9.5 aW        |              |         | Amp              | litude     |
| Modulation                    |                         | F                | м             |              |         |                  |            |
| Deviation                     |                         | 0.000            | 0 kHz         |              |         |                  |            |
|                               |                         |                  |               |              |         | AF S             | otting     |
| AF Setting                    |                         |                  |               |              |         |                  | Output     |
| Signal                        | None(CW)                |                  |               |              |         | and shares where | dart       |
|                               |                         |                  |               |              |         |                  | itart.     |
|                               |                         |                  |               |              |         | Signal M         | lodulation |
|                               |                         |                  |               |              |         | 0.0              | 011        |
|                               |                         |                  |               |              |         | Signal           | Output     |
|                               |                         |                  |               |              |         | On               | 011        |
| Ref.int Unlock                | Pre-Amp Off             |                  |               |              |         | 1.42             | 100        |

Example of RF Output Measurement Screen (with Analog Signal Generator)

#### Using Meter Displays

 Useful Meter Displays for Rx Sensitivity Test and Frequency Deviation Measurements

Results can be displayed both as numeric and convenient meter values for confirming and tuning SINAD, THD, Distortion, and frequency deviation measurements.

Meters are split into upper and lower sections; setting a narrow range at the upper meter and a wider range at the lower meter makes it possible to clearly understand the range for tuning at the lower meter, as well as perform fine adjustments in a narrow range at the upper meter when approaching the required value.

Using these meters offers a more intuitive adjustment method than directly reading numeric values that fluctuate when adjusting SINAD at Rx sensitivity tests and frequency deviation at Tx tests (FM only).

| SINAD     | 13.39 di       | в          | 8.0<br>0.0             |            | 16.0<br>24.0 |
|-----------|----------------|------------|------------------------|------------|--------------|
|           | SINA           | O Met      | er                     |            |              |
| Deviation | RMS            | -          | 1.018 23               | kHz        |              |
|           | Peak+<br>Peak- |            | 1.478 73               |            |              |
|           | (Pk-Pk)/2      | 2          | - 1.451 15<br>1.464 94 |            |              |
|           |                | 1.4<br>0.0 |                        | 1.6<br>3.0 |              |

Frequency Deviation Meter (FM only)

#### • Pass/Fail Displays

Pass/Fail evaluations are displayed at all meters by setting the values for the pass range and number of measurement times.

| SINAD | 11.15 dB | 8.0 16.0<br>0.0 24.0              | → Pass |
|-------|----------|-----------------------------------|--------|
| SINAD | 7.96 dB  | 8.0, <u>12.0</u> 16.0<br>0.0 24.0 | → Fail |
|       |          | 🔫 🗕 Pass Ran                      | ge     |

#### **Demodulated Voice Output**

# Demodulating RF Signal from analog mobile radio to Output Audio Signal

The RF signal from the analog mobile radio is demodulated and the audio signal is output from the USB connector. The audio signal output from the USB Audio option can be monitored using a commercial loudspeaker.

Additionally, when the Audio Analyzer option is installed, the audio signal can be monitored either at the internal speaker, the headphone jack or the demodulation output connector.\*

\*: Only supports FM and Wide FM measurement mode not supported.

# Pulse Radar Measurement Function MX284059B

MS2840A

The Pulse Radar Measurement Function MX284059B software option for the Signal Analyzer MS2840A (26.5/44.5 GHz models) facilitates automated measurement of key transmission evaluation items for radar maintenance and manufacturing inspections. The MS2840A itself performs measurement by controlling the USB Peak Power Sensor according to the target signal and measurement items to support a wide range of radar types.

The measured results can be saved as both numeric values and waveform images with Pass/Fail evaluation. Emissions measurement calculates the ITU-R-recommended 40-dB bandwidth automatically.

#### Advantages of Introduction

- · Simple setup for easy test equipment transport and handling
- Pre-registered measurement parameters reduce measurement operation and setting mistakes as well as cut measurement times
- Automated PC-free measurement environment

#### **Function Outline**

- Supports wide pulse width range for S-, C-, X- and Ku-band meteorological, maritime, coastguard, aerospace, etc., radar
- Evaluates specific pulse-radar transmission items, including 40-dB bandwidth calculation, emissions measurement, and more (selectable from 20 dB, 30 dB, 40 dB/decade)
- · Supports short/long/multi-pulse conditions used by modern solid-state radar

#### **Modulation Type**

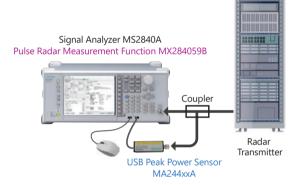
Non-FM Pulse Radar, FM Pulse Radar

#### **Key Measurement Items**

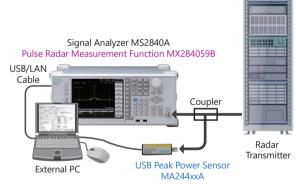
- Tx power
- Tx frequency
- Pulse time (pulse width, rise/fall time, pulse repetition frequency)
- Frequency deviation (for FM chirp)
- 40-dB bandwidth\*
- Emissions (out-of-band domain, spurious domain)
- Occupied bandwidth
- Graph display\*
  - Out-of-band mask and 40-dB bandwidth and limit
  - Spurious and limit
  - Occupied bandwidth
- \*: Supports 40-dB bandwidth calculation formula (39) for Non-FM Pulse Radars and (40) (44) for FM Pulse Radars described in ITU-R SM.1541-6 (08/2015) standard and Public Notice of Japan MIC No. 1232, October 2005/No. 67, June 2019.

#### Setup (With USB Peak Power Sensor)

Can install same application software in both MS2840A and external PC <a column="Automated Measurement with Standalone Signal Analyzer"></a>



<Automated Measurement with External PC and Signal Analyzer>



Can transfer measured data from signal analyzer to PC when using external PC

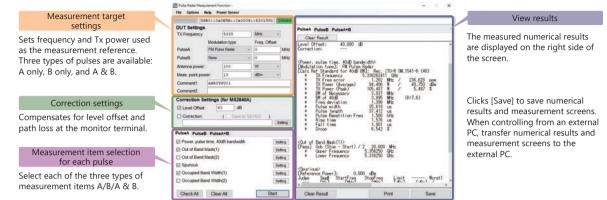
#### MX284059B Controllable USB Peak Power Sensors

| Model    | Fraguency Pango       | VBW (high/std)  | Power Measu    | rement Range   | RF Connector |
|----------|-----------------------|-----------------|----------------|----------------|--------------|
| Woder    | Model Frequency Range |                 | Pulse          | Average        | KF Connector |
| MA24406A | 50 MHz to 6 GHz       | 195 MHz/350 kHz | –50 to +20 dBm | –60 to +20 dBm | N (male)     |
| MA24418A | 50 MHz to 18 GHz      | 70 MHz/350 kHz  | –24 to +20 dBm | -34 to +20 dBm | N (male)     |
| MA24440A | 50 MHz to 40 GHz      | 70 MHz/350 kHz  | –24 to +20 dBm | –34 to +20 dBm | K (male)     |

The USB Peak Power Sensor MA244xxA cannot use the MS2840A Power Meter function.

# Pulse Radar Measurement Function MX284059B (Continued)

#### Measurement Screen Image (Settings, Numeric Results)

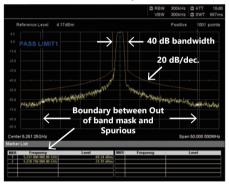


#### Measurement Screen Image (Waveform Display)

The screen displays the measured waveform as well as the mask at emissions measurement. The measurement screen can be saved as an image file.

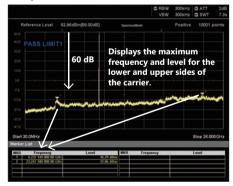
#### • 40 dB Bandwidth, Out of Band Mask

The 40-dB bandwidth and 20/30/40 dB decade mask are calculated and drawn automatically. Furthermore, the spurious area and out-of-band area are Pass/Fail evaluated automatically.



#### Spurious

MS2840A can measure 60 dBc as defined by Japanese Radio Law without a band rejection filter.



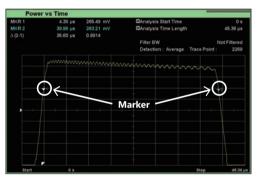
#### Average Power

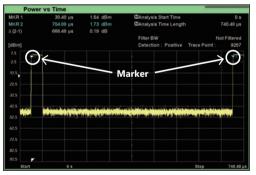
Automatically identifies the pulse duration and measures the average power.



#### • Pulse Time (Pulse Width, Pulse Repetition Interval)

Automatically identifies the pulse On section and measures the pulse duration and pulse period.





#### Frequency Deviation

The frequency deviation is measured using the standard function (FMCW function) of MS2840A.



# Pulse Radar Measurement Function MX284059B (Continued)

MS2840A

#### Specifications

| Item                           |                           | MS2840A   |  |  |
|--------------------------------|---------------------------|---|--|--|
| Carrier                        | Frequency Range           | MS2840A-044: 300 MHz to 26,500 MHz<br>MS2840A-046 300 MHz to 36,000 MHz   |  |  |
|                                | Amplitude Range           | -5 to +30 dBm<br>USB Peak Power Sensor MA244xxA measurement time depends on other specifications                      |  |  |
| Emissions                      | Frequency Range           | MS2840A-044: 30 MHz to 26,500 MHz<br>MS2840A-046: 30 MHz to 44,500 MHz  |  |  |
| Measurement Frequency A        | Accuracy (standard)       | $\pm 2.2 \times 10^{-8}$ (1 hour after power-on at 18°C to 28°C)  |  |  |
|                                | Pulse Types               | 2 (Pulse A, Pulse B)  |  |  |
|                                | Modulation Type           | Non-FM Pulse Radar, FM Pulse Radar  |  |  |
| Supported Signal<br>Conditions | Pulse Width               | 0.5 μs to 2000 μs (without USB Peak Power Sensor MA244xxA)<br>0.2 μs to 2000 μs (with USB Peak Power Sensor MA244xxA) |  |  |
|                                | Pulse Repetition Interval | 0.05 ms to 100 ms (PRF = 10 Hz to 20 kHz)   |  |  |
|                                | Frequency Deviation       | 0 to 31 MHz (with pulse width of $\ge 0.5 \ \mu s$ )  |  |  |

#### **Operating Environment**

Using MX284059B installed in MS2840A

Firmware Version: 21.01.00 or newer

To control the USB peak power sensor MA244xxA, the USB Peak Power Sensor application software MA24400A must be installed.

Using MX284059B installed in external PC

OS: Windows 10 English/Japanese 64 bit

Software: NI-VISA<sup>™</sup> 17.5

The installer is saved on the DVD-ROM provided with the MS2840A. It is also available from the National Instruments<sup>™</sup> website. To control the USB peak power sensor MA244xxA, the USB Peak Power Sensor application software MA24400A must be installed.

#### **Recommended Configuration**

Signal Analyzer

| Model       | Name                             | Note  |
|-------------|----------------------------------|---|
| MS2840A     | Signal Analyzer                  |   |
| MS2840A-044 | 26.5 GHz Signal Analyzer         | N-connector Requires N-SMA Adapter J1398A for measurement at $\geq$ 18 GHz using recommended configuration with N-connector |
| MX284059B   | Pulse Radar Measurement Function |   |

| Model       | Name                             | Note                  |
|-------------|----------------------------------|-----------------------|
| MS2840A     | Signal Analyzer                  |                       |
| MS2840A-046 | 44.5 GHz Signal Analyzer         | K-connector           |
| MS2830A-019 | 2 dB Steps Attenuator            | Installation required |
| MX284059B   | Pulse Radar Measurement Function |                       |

DANL is higher when the following options are installed. It is better not to install these options for emissions measurement.

MS2840A-067 Microwave Preselector Bypass

MS2840A-068 Microwave Band Preamplifier (MS2840A-046 only)

MS2840A-069 26.5 GHz Microwave Band Preamplifier (for MS2840A-044 only)

The MX284059B can be retrofitted to the customer's MS2840A. Note the above hardware option configuration conditions.

#### USB Peak Power Sensor

| Model    | Name                  | Note                          |
|----------|-----------------------|-------------------------------|
| MA24406A | USB Peak Power Sensor | N-connector, 50 MHz to 6 GHz  |
| MA24418A | USB Peak Power Sensor | N-connector, 50 MHz to 18 GHz |
| MA24440A | USB Peak Power Sensor | K-connector, 50 MHz to 40 GHz |

MS269xA MS2850A

### LTE Downlink Measurement Software MX269020A LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001

The LTE Downlink Measurement Software MX269020A and LTE TDD Downlink Measurement Software MX269022A support measurement of RF characteristics of 3GPP Release 8 LTE (Long Term Evolution) downlink signals.

The LTE-Advanced FDD Downlink Measurement Software MX269020A-001\*1 and LTE-Advanced TDD Downlink Measurement Software

MX269022A-001\*<sup>2</sup> support measurement of RF characteristics of 3GPP Release 10 LTE-Advanced downlink signals.

\*1: Requires MX269020A

\*2: Requires MX269022A

The MS269020A and the MS269020A-001 support FDD (Frequency Division Duplex) measurement systems while the MX269022A and the MX269022A-001 support TDD (Time Division Duplex) systems.

Installing these software applications in the MS269xA/MS2850A/MS2830A signal analyzers offers fast and accurate measurements for improving the quality and efficiency of 3GPP LTE base station and device component development and manufacturing.

### Features

### ■ Support Testing of 3GPP TS 36.141 Release 8 and Release 10 Downlink RF Characteristics

Easy Setting of Measurement Conditions

• At prototype signal measurement, measurement is performed simply by specifying the parameter test model.

• Synchronization to the input signal is performed automatically using a Synchronization Signal or Reference Signal.

#### Versatile Analysis Results Formats and Graphs

- Full Output Power, Frequency Error, and EVM
- Power and EVM for each Physical channel
- Both sub-carrier and symbol EVM and I/Q constellation displays
- Power, EVM and I/Q constellation displays for each RB
- Display of EVM and PHY channel type for each resource element
- Spectrum flatness/graph: Amplitude, Phase and Group Delay frequency characteristics

### MIMO Summary Function: Measures Timing Difference between up to 4 MIMO Tx Signal Antennas

- Batch Measurement Function: Batch measures and lists displays multiple items such as modulation accuracy and power spectrum
- Replay Function for Troubleshooting Faults

#### Supports LTE-Advanced Carrier Aggregation Signal Measurements (requires installed LTE-Advanced measurement option)

• Multi-band and multi-carrier measurements

- In-band continuous carrier batch measurement
- Inter-band discontinuous carrier measurement as one sequence
- Adjacent channel leakage power, spurious and continuous carrier occupied bandwidth measurements for each band

The LTE-Advanced Carrier Aggregation measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

| Main unit | Analysis Bandwidth<br>Extension Option | Maximum Analysis Bandwidth<br>(In-band carrier aggregation range) | Maximum Number of Band | Maximum Number of<br>Component Carrier |
|-----------|--|---|------------------------|--|
|           | MS269xA-078 installed                  | 125 MHz   | 3                      | 5                                      |
| MS269xA   | MS269xA-077 installed                  | 31.25 MHz   | 3                      | 5                                      |
|           | Standard                               | 31.25 MHz   | 3                      | 5                                      |
| MS2850A   | Standard                               | 125 MHz   | 3                      | 5                                      |
|           | MS2830A-078 installed                  | 125 MHz   | 1                      | 5                                      |
| MS2830A   | MS2830A-077 installed                  | 31.25 MHz   | 3                      | 5                                      |
|           | MS2830A-005/009 installed              | 31.25 MHz   | 3                      | 5                                      |

#### Measurement Items

- Frequency Error
- Output Power
- RSTP (RS TX power)
- OSTP (OFDM Symbol TX power)
- EVM (Peak/RMS)
- EVM of each Physical Channel: RS/P-SS/S-SS/PBCH/PCFICH/PHICH/PDSCH
- Origin Offset
- Timing Offset (External Trigger)
- MIMO Summary: Frequency Error, Power, Timing Offset, EVM based on RS of each antenna

### Graphical Display

- Constellation
- EVM vs. Subcarrier
- EVM vs. Symbol
- Spectral Flatness
- Power vs. Resource Block
- EVM vs. Resource Block
- Resource Element (RE) Map
- Power vs. Time (only MX269022A)

### LTE Downlink Measurement Software MX269020A LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

### **Measurement Functions**

• Easy Measurement of Test Model Signals

Test model signals defined in 3GPP TS 36.141 as test patterns for BTS Tx tests are easily measured by selecting the test model name.



### • Frequency Error/Transmit Power/EVM

This displays the frequency error, transmit power and EVM of all subcarriers in a specified measurement segment as a constellation. When averaging is performed, the maximum and mean values are displayed simultaneously.

In addition, the "Auto mode" automatically evaluates the modulation scheme of the input signal to support measurement of DL signals including different modulation schemes for each release block.

| Result        |      |                 | Average & Max |            |
|---------------|------|-----------------|---------------|------------|
| MKR           | 5    |                 |               | Avg/Max    |
| Subcarrier 0  |      | Frequency Error | 0.15 /        | 0.38 Hz    |
| Symbol Number |      | Output Power    | -15.77 /      | -15.77 dBm |
|               | <br> | Mean Power      | -15.77 /      | -15.77 dBm |
| 0.46327       |      | EVM(rms)        | 0.26 /        | 0.27 %     |
|               | <br> | i EVM(peak)     | 0.87 /        | 0.97 %     |
| Q -0.76673    |      | Symbol Numbe    |               | 5          |
|               |      | Subcarrier Nun  |               | 629        |
|               | <br> | Origin Offset   | -63.63 /      | -63.02 dB  |

#### • EVM vs. Subcarrier

This displays a graph of the vector errors for each subcarrier for a specified symbol or for all symbols in a specified segment. Simultaneous display of mean (rms) and peak values.

| RMS/Peak  | ) Subcarrier | 227 | EVM | 0.20 % | 1 0.4 | 19 % | <br> |
|-----------|--------------|-----|-----|--------|-------|------|------|
|           |              |     |     |        |       |      |      |
|           |              |     | -   |        |       |      |      |
| $\vdash$  |              |     | _   |        |       |      |      |
| $\square$ |              |     |     |        |       |      |      |

### • EVM vs. Symbol

This displays a graph of the vector errors for each symbol for a specified subcarrier or for all subcarriers.

Simultaneous display of mean (rms) and peak values.

| MKR(RMS/Peak) Symbol | 0 EVM 0 | 0.23 % / 0.75 % |
|----------------------|---------|-----------------|
| 5.00                 |         |                 |
| 3.76                 |         |                 |
| San                  |         |                 |
| 250                  |         |                 |
| 125                  |         |                 |
| mmm                  | mon     |                 |

### Spectral Flatness

This displays a graph of amplitude, amplitude difference, phase, and group delay for each subcarrier for all symbols in a specified measurement segment.

| MKR   | Subcarrier | 1 Amplitude | 0.00 dB |
|-------|------------|-------------|---------|
| 1.00  |            |             |         |
| 0.50  |            |             |         |
| 0.00  |            |             |         |
| -0.50 |            |             |         |
| -1.00 |            |             |         |

#### Summary Display

This displays a list of various information, such as EVM for each channel (PDSCH, PUSCH, PDCCH, RS, SS, PBCH) and the power of each slot.

| ummary               | Page No. 2 / 10 |
|----------------------|-----------------|
| PDSCH ALL EVM        | Page No. 23 To  |
| PDSCH ALL EVM (rms)  | 0.23 %          |
| PDSCH ALL EVM (peak) | 1.01 %          |
| Symbol Number        | 83              |
| Subcarrier Number    | 878             |
| PDSCH ALL EVM High   |                 |
| PDSCH ALL EVM (rms)  | 0.23 %          |
| PDSCH ALL EVM (peak) | 1.01 %          |
| Symbol Number        | 83              |
| Subcarrier Number    | 878             |
| PDSCH ALL EVM Low    |                 |
| PDSCH ALL EVM (rms)  | 0.23 %          |
| PDSCH ALL EVM (peak) | 1.01 %          |
| Symbol Number        | 83              |
| Subcarrier Number    | 878             |
|                      |                 |

PDSCH EVM Display

| RS Power      | -41.28 | dBm |            | Page No. | 10 / 1 |
|---------------|--------|-----|------------|----------|--------|
| Power vs Slot |        |     |            |          |        |
| Slot No.0     | -10.66 | dBm | Slot No.10 | -10.69   | dBm    |
| Slot No.1     | -10.61 | dBm | Slot No.11 | -10.59   | dBm    |
| Slot No.2     | -10.67 | dBm | Slot No.12 | -10.69   | dBm    |
| Slot No.3     | -10.60 | dBm | Slot No.13 | -10.60   | dBm    |
| Slot No.4     | -10.69 | dBm | Slot No.14 | -10.68   | dBm    |
| Slot No.5     | -10.60 | dBm | Slot No.15 | -10.59   | dBm    |
| Slot No.6     | -10.68 | dBm | Slot No.16 | -10.68   | dBm    |
| Slot No.7     | 10.59  | dBm | Slot No.17 | -10.59   | dBm    |
| Slot No.8     | -10.69 | dBm | Slot No.18 | -10.68   | dBm    |
| Slot No.9     | -10.60 | dBm | Slot No.19 | -10.58   | dBm    |

Power vs. Slot

### LTE Downlink Measurement Software MX269020A M5269xA LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

### Power vs. Resource Block

This displays the power of each resource block in a specified subframe or specified subframe segment. Power boosting over each resource block can be checked easily by visual monitoring of the power distribution.

Moreover, simultaneous display of the constellation for a specified resource block makes troubleshooting easy.

| MKR(RMS/Pe | ak)      |        | Subframe | Resource Block |     |
|------------|----------|--------|----------|----------------|-----|
| Modulation | 16QAM    |        |          |                |     |
| Power      | 5.00 dB  |        |          |                |     |
| EVM        | 0.30 % / | 0.77 % |          |                |     |
|            |          |        | -        |                |     |
|            |          |        |          |                |     |
| -30 200 1  |          |        |          |                |     |
|            |          |        |          |                | 993 |

Specified Subframe

| MKR(RMS/Pe  | ak)      | Subframe | Resource Block |          |
|---|----------|----------|----------------|----------|
| Modulation  | 16QAM    |          |                |          |
| Power   | 5.00 dB  |          |                |          |
| EVM   | 0.32 % / | 0.75 %   |                |          |
|   |          |          |                |          |
| 100000000000000000000000000000000000000   |          |          |                |          |
| 0.0   |          |          |                |          |
|   |          |          |                | 11111111 |
| The second se |          |          |                |          |

Power Display for Each Resource Block

| OGLITE Downlin             | -   |           |      |          |                                 |                  | 10                    | 7/22/2008 12 10 41    |
|----------------------------|-----|-----------|------|----------|---------------------------------|------------------|-----------------------|-----------------------|
| Carrier Freq.              | 20  | 00 000 00 |      | Input Le |                                 |                  |                       | Power vo Fill Vices   |
| fodulation                 |     |           | UTO  |          | 4 dB                            |                  |                       |                       |
| Channel Bandwi             | đīn | 20        | M942 |          |                                 | Reference Signal | Auto                  | Each Subframe         |
| Result                     |     |           |      |          |                                 |                  |                       |                       |
| MKR ,                      | _   | -         | 2    |          |                                 |                  |                       | and the second second |
| Resource<br>Element Number |     |           |      |          | Frequency Error<br>Output Power |                  | 0.48 Hz<br>-10.84 dBm | Overall               |
| Subcarrier 72              |     |           |      |          | Mean Power                      |                  | -10.75 dBm            | _                     |
| Symbol 43                  |     |           |      |          | EVM(rms)                        |                  | 0.34 %                |                       |
| Subhama                    |     |           |      |          | EVM(peak)                       |                  | 2.36 %                |                       |
| Number 3<br>Resource Black |     |           |      |          | Symbol Number                   |                  |                       |                       |
| Number 6                   |     |           |      |          | Subcarrier Num                  | ber              | 895                   |                       |
| 1.68966<br>0 -1.68569      |     |           |      |          | Origin Offset                   |                  | -49.64 dB             |                       |
| ower vs RB                 |     |           |      |          |                                 |                  | -                     |                       |
| MKR()                      |     |           |      |          | Subframe 3                      | Resource Block   |                       |                       |
| Modul                      |     | 160       |      |          |                                 |                  |                       |                       |
| Power                      |     | 6.00 d    |      |          |                                 |                  |                       |                       |
| EVM                        |     | 0.32 5    |      | 0.75 %   |                                 |                  |                       |                       |
|                            |     |           |      |          |                                 |                  |                       |                       |
| 111111                     |     |           |      |          |                                 |                  |                       |                       |
|                            |     |           |      |          |                                 |                  |                       |                       |
|                            |     |           |      |          |                                 |                  |                       |                       |
|                            |     |           |      |          |                                 |                  |                       | Graph View            |
|                            |     |           |      |          |                                 |                  |                       | RMS RMSEP             |
| at 14                      |     | ve Off    |      |          |                                 |                  |                       | The The start of      |

**Constellation for Specified Resource Block** 

### • EVM vs. Resource Block

This displays a graph of the EVM distribution for each resource block in a specified subframe segment, making it easy to check resource-block dependent EVM deterioration.

| MKR        |          |        | Subframe | Resource Block | 2        |
|------------|----------|--------|----------|----------------|----------|
| Modulation | 64QAM    |        |          |                |          |
| Power      | 0.00 dB  |        |          |                |          |
| EVM        | 0.22 % / | 0.51 % |          |                |          |
| 200        |          |        |          |                | 1        |
| 1.50       |          |        |          |                |          |
|            |          |        |          |                |          |
| 1.00       |          |        |          |                |          |
| 0.50       | Amon     | m      | - Avi    | mann           | $\simeq$ |
| 0.00       |          |        |          |                | -        |

### • Test Model Summary Display

This displays the analysis results for the signal types set at Test Model.

MS2850A

- RS boosting for each subframe
- EPRE for each channel for each subframe
- PDSCH EPRE for each modulation method for each subframe



| Model Sun | may        |           |       |                    | Pa        | ge No. 2 / | 3   | Scale       |
|-----------|------------|-----------|-------|--------------------|-----------|------------|-----|-------------|
| Subframe  | P.55       | 16-65     | EPRCH | Ene (db)<br>PCFICH | PHCHgroup | BACCUBEC   | - 1 |             |
| )         | 0.003      | 0.002     | 0.003 | 4.005              | -0.002    | 1.067      |     | Storage     |
|           | in         | - militar | mim   | 0.000              | 0.004     | 1,065      | _ 1 |             |
|           | min        |           | mim   | 4.003              | 0,005     | 1.070      |     |             |
|           | min        |           | min   | -0.010             | 0.007     | 1.063      |     |             |
| 1         | mim        |           | mim   | 0.002              | 0.012     | 1.074      |     |             |
|           | 0.000      | 0.004     | mim   | -0.010             | 0.003     | 1.564      | _ 1 |             |
|           |            | - min     | min   | 0.006              | -0.004    | 1.065      | _ 1 |             |
|           | im         |           |       | 0.006              | 0.010     | 1.068      |     |             |
|           |            | - minu    | mim   | 0.002              | -0.003    | 1.065      |     |             |
|           |            |           |       | 0.004              | 0.007     | 1.066      | - 1 | Page Number |
|           |            |           |       |                    |           |            | - 1 | 2           |
| 1         | Pre-Amp 01 |           |       |                    |           |            |     |             |

**Test Model Summary** 

#### • MIMO Summary Display

The results for each antenna port are displayed when measuring MIMO. The results are displayed for the number of antenna signals specified at Number of Antenna Ports.

| Carrier Freq.     | 2 110 000 000 Hz In   | put Level -10.00 | dBm           |               | State of the second sec |
|-------------------|-----------------------|------------------|---------------|---------------|--|
| Modulation        |                       |                  | d8.           |               | and the second se  |
| Channel Bandwidth | 10MHz                 |                  | Reference Sig | nai Auto      | Analysis   |
| Result            |                       |                  | Average I     | 5 Max 10 / 10 | Time   |
|                   |                       |                  |               |               |  |
|                   | Tx0/Rx<br>(Reference) | Tx1/Rx           | Tx21Rx        | Tx3/Rx        |  |
| RS Power          | 0.00 dB               |                  |               | dB            | Channel Bandwidt   |
| RS EVM (rms)      | 0.22 %                | ·····            |               | 10.8          | 1046   |
| RS Timing Offset  |                       | ·····            | ····· / na    | na            | 10.64  |
| RS Freq           | 0.00 Hz               | Here Har         | Here Ha       | Harris Ha     |  |
|                   |                       |                  |               |               |  |
|                   |                       |                  |               |               |  |

### LTE Downlink Measurement Software MX269020A LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

### • Power vs. Time Function (MX269022A and MS269xA)

Following numeric result is displayed in the upper part of the screen and displays time variation of signal in 1 Frame section in the lower part of screen.

- Off Power
  Transient Period
  - On Power • Power at Mask Edge
- Mask Judge



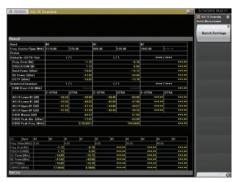
#### Batch Measurement Function

This function supports batch measurement and list display of the modulation accuracy and Tx power spectrum to shorten the measurement time and comprehensively check the measurement results. When the MS269020A-001 and MX269022A-001 are installed, multiple bands and multiple carriers can be measured at the batch-measurement function screen\*.

\*: If the LTE-Advanced option is not installed, measurement is limited to only one carrier.



Batch Measurement Screen (Measurement example for in-band 5 continuous carriers)



#### Batch Measurement Screen (Measurement example for carriers in 2 bands)

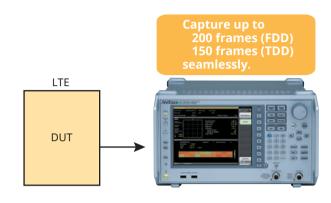
### Replay Function for Troubleshooting Faults

Up to 200 frames of LTE signals can be captured as a file for replay by the LTE measurement software to perform analyses such as EVM measurement.\*

MS269xA MS2850A

MS2830A

\*: Batch measurement is not supported when the MX269020A-001 is installed.





### Example of R&D use

Save data for comparing each DUT test version

→ Supports comparison of retrofitting improvement effects

### Example of production line use

Save delivery inspection data

→ Supports rechecking of performance data for troubleshooting postdelivery faults

### LTE Downlink Measurement Software MX269020A LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

### LTE Downlink Measurement Software MX269020A, LTE-Advanced FDD Downlink Measurement Software MX269020A-001

|  | Signal Analyzer  | MS269xA   | MS2830A<br>MS2850A   |
|--|--|---|--|
|  | Channel Bandwidth  | 1.4, 3, 5, 10, 15, 20 MHz   | ΙνισζόσυΑ  |
| Common   | Target Signals   | Downlink  |  |
| Specifications                                   | Capture Time   | Auto: 1 Frame<br>Manual: 1 to 200 Frame   |  |
|  | Measurement Frequency Range  | 600 MHz to 4 GHz  | MS2830A-041/043/044/045: 600 MHz to 4 GHz<br>MS2830A-040: 600 MHz to 3.6 GHz<br>MS2850A: 600 MHz to 4 GHz  |
|  | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-15 to +10 dBm (Preamp On)  |  |
|  |  | After CAL execution at 18°C to 28°C<br>For a signal of EVM = 1%<br>For Measurement Interval = 10 Subframe   |  |
| Modulation/                                      | Carrier Frequency Accuracy   | ± (Accuracy of reference frequency ×  | MS2830A (MS2830A-078 not installed), MS2850A:<br>± (Accuracy of reference frequency ×<br>carrier frequency + 3.5) Hz<br>(center frequency: 600 MHz to 2700 MHz)<br>± (Accuracy of reference frequency ×<br>carrier frequency + 8.0) Hz<br>(center frequency: 2700 MHz to 4000 MHz)   |
| Frequency<br>Measurement                         |  | Carrier frequency + 3) Hz<br>(Excluding the Batch Measurement when<br>MS269xA-004 is installed)   | MS2830A (At CC of center frequency when<br>MS2830A-078 installed. At input level of -4 dBm when<br>MS2830A-045 installed)<br>± (Accuracy of reference frequency ×<br>carrier frequency + 4.0) Hz<br>(center frequency: 600 MHz to 2700 MHz)<br>± (Accuracy of reference frequency ×<br>carrier frequency + 8.0) Hz<br>(center frequency: 2700 MHz to 4000 MHz) |
|  |  | After CAL execution at 18°C to 28°C<br>At measurement Interval = 10 subframe<br><1.0% (rms)   |  |
|  | Residual Vector Error  | (Excluding the Batch Measurement when MS269xA-078<br>is not installed or MS269xA-004 is installed)<br><1.3% (rms)<br>(In the CC of the center frequency when MS269xA-078<br>is installed) | <1.3% (rms)<br>(At the input level of –4 dBm when MS2830A-045 is<br>installed)   |
|  |  | After CAL execution, input attenuator ≥10 dB, at 18°C to  |  |
|  | Tx Power Measurement Accuracy  | the input signal is within the measurement level range  | · · · · · · · · · · · · · · · · · · ·  |
| Amplitude<br>Measurement                         | (This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency | Excluding the Batch Measurement when the<br>MS269xA-004 is installed.<br>±0.6 dB (at Preamp Off, or Preamp not installed.)  | MS2830A:<br>±0.6 dB (at Preamp Off or Preamp not installed)<br>MS2850A:  |
|  | characteristics of main unit.)   | ±1.1 dB (at Preamp On)  | ±0.6 dB (at Preamp Off or Preamp not installed)<br>±1.1 dB (at Preamp On)  |
| Waveform Display                                 |  | Provides functions for displaying waveforms below.<br>Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Po<br>Spectral Flatness  | wer vs. Resource Block, EVM vs. Resource Block,  |
| Adjacent Channel<br>Leakage Power<br>Measurement | Measurement Method   | Executes the adjacent channel power measurement fund  | ction of the Spectrum Analyzer or Signal Analyzer.   |
| Occupied<br>Bandwidth<br>Measurement             | Measurement Method   | Executes the occupied bandwidth measurement functio   | n of the Spectrum Analyzer or Signal Analyzer.   |
| Channel Power<br>Measurement                     | Measurement Method   | Executes the channel power measurement function of the  | ne Spectrum Analyzer or Signal Analyzer.   |
| Spectrum<br>Emission Mask<br>Measurement         | Measurement Method   | Executes the spectrum emission mask measurement fur   | action of the Spectrum Analyzer.   |
|  | Function Overview  | Capable of outputting captured waveform data to inter   | nal or external storage device.  |
| Digitize Function                                | Waveform Data  |   | and in-band frequency characteristics of the signal analyzer.  |
| Replay Function                                  | Function Overview  | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling rate: 50 MHz   |  |

MS269xA MS2850A MS2830A

## LTE Downlink Measurement Software MX269020A

### LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A

# LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

### LTE TDD Downlink Measurement Software MX269022A, LTE-Advanced TDD Downlink Measurement Software MX269022A-001

| Si   | gnal Analyzer  | MS269xA  | MS2830A<br>MS2850A   |  |  |  |
|--|--|--|--|--|--|--|
|  | Channel Bandwidth  | 1.4, 3, 5, 10, 15, 20 MHz  | WISCOUR  |  |  |  |
| Common   | Target Signals   | LTE TDD Downlink   |  |  |  |  |
| Specifications                                   | Capture Time   | Auto: 5 frame  |  |  |  |  |
|  | Measurement Frequency<br>Range   | Manual: 5 to 150 frame<br>600 MHz to 4 GHz   | MS2830A-041/043/044/045: 600 MHz to 4 GHz<br>MS2830A-040: 600 MHz to 3.6 GHz   |  |  |  |
|  | Measurement Level Range  | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)   | MS2850A: 600 MHz to 4 GHz  |  |  |  |
|  |  | After CAL execution at 18°C to 28°C<br>For a signal of EVM = 1%<br>When Downlink 10 Subframe is the measurement target   |  |  |  |  |
| Modulation/<br>Frequency<br>Measurement          | Carrier Frequency<br>Accuracy  | ± (Accuracy of reference frequency ×<br>Carrier frequency + 3) Hz<br>(Excluding the Batch Measurement when MS269xA-004 is<br>installed)  | MS2830A (MS2830A-078 not installed)<br>± (Accuracy of reference frequency ×<br>carrier frequency: 3.5) Hz<br>(center frequency: 600 MHz to 2700 MHz)<br>± (Acccuracy of reference frequency ×<br>carrier frequency: 2700 MHz to 4000 MHz)<br>MS2830A (At CC of center frequency when MS2830A-078<br>installed. At input level of -4 dBm when MS2830A-045<br>installed.), MS2850A:<br>± (Acccuracy of reference frequency ×<br>carrier frequency: 600 MHz to 2700 MHz)<br>± (Acccuracy of reference frequency ×<br>carrier frequency: 600 MHz to 2700 MHz)<br>± (Acccuracy of reference frequency ×<br>carrier frequency: 8.0) Hz<br>(center frequency: 2700 MHz to 4000 MHz) |  |  |  |
|  |  | After CAL execution at 18°C to 28°C<br>When Downlink 10 Subframe is the measurement target   |  |  |  |  |
|  | Residual Vector Error  | <1.0% (rms)<br>(Excluding the Batch Measurement when MS269xA-078 is<br>not installed or MS269xA-004 is installed)<br><1.3% (rms)<br>(In the CC of the center frequency when MS269xA-078 is<br>installed) | MS2830A:<br><1.3% (rms)<br>(With MS2830A-078 not installed, At input level of<br>-4 dBm when MS2830A-045 installed)<br><1.3% rms)<br>(At CC of center frequency when MS2830A-078 installed)<br>MC202061.2% (rms)   |  |  |  |
|  | Measurement Level Range  | -15 to +30 dBm (Preamp Off or Preamp not installed)<br>-30 to +10 dBm (Preamp On)  | MS2850A:         <1.3% (rms)           MS2830A:         -15 to +30 dBm (Preamp Off or Preamp not installe           MS2850A:         -15 to +30 dBm (Preamp Off or Preamp not installe           -30 to +10 dBm (Preamp On)  |  |  |  |
| Amplitude  | Tx Power Measurement<br>Accuracy (Found from   | At 18°C to 28°C, After calibration, Input attenuator ≥10 dB, With input signal within measurement level range and below value set at Input Level   |  |  |  |  |
| Measurement                                      | root sum of squares (RSS)<br>of absolute amplitude<br>accuracy and in-band<br>frequency characteristics<br>of main unit) | Excluding batch measurement when MS269xA-004 installed<br>±0.6 dB (at Preamp Off or Preamp not installed)<br>±1.1 dB (at Preamp On)  | MS2830A:<br>±0.6 dB (at Preamp Off or Preamp not installed)<br>MS2850A:<br>±0.6 dB (at Preamp Off or Preamp not installed)<br>±1.1 dB (at Preamp On)   |  |  |  |
| Waveform Displa                                  | y  | Provides functions for displaying waveforms below.<br>Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Power v   | s. Resource Block, EVM vs. Resource Block, Spectral Flatness   |  |  |  |
| Adjacent Channel<br>Leakage Power<br>Measurement | Measurement Method   | Executes the adjacent channel power measurement function   | of the Spectrum Analyzer or Signal Analyzer.   |  |  |  |
| Dccupied<br>Bandwidth<br>Measurement             | Measurement Method   | Executes the occupied bandwidth measurement function of t  | the Spectrum Analyzer or Signal Analyzer.  |  |  |  |
| Channel Power<br>Measurement                     | Measurement Method   | Executes the channel power measurement function of the Sp  | ectrum Analyzer or Signal Analyzer.  |  |  |  |
| pectrum<br>mission Mask<br>Jeasurement           | Measurement Method   | Executes the spectrum emission mask measurement function   | n of the Spectrum Analyzer.  |  |  |  |
|  | Function Overview  | Capable of outputting captured waveform data to internal or  | r external storage device.   |  |  |  |
| Digitize<br>Function                             | Waveform Data  | Format: I,Q (32 bit floating point binary format)<br>Level: Assumes as $\sqrt{(l^2 + Q^2)} = 1$ for 0 dBm input<br>Level accuracy: Same as the absolute amplitude accuracy and                           | l in-band frequency characteristics of the signal analyzer.  |  |  |  |
| Replay Function                                  | Function Overview  | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling rate: 50 MHz  |  |  |  |  |
| Power vs. Time                                   | Function Overview  | Provides measurements for Transmitter OFF Power, Time Ma<br>This function can be used only in the MS269xA series.  | sk, and Transmitter Transient Period.  |  |  |  |
|  | Dynamic Range  | 121.4 dB (nom.)* <sup>1, *2</sup>  |  |  |  |  |

This is the value when Channel bandwidth is 5 MHz. For the other channel bandwidth, the following formula can be used. 10log<sub>10</sub>(Channel bandwidth/5.0 MHz) dB 1:1

\*2: Wide Dynamic Range = On, Noise Correction = On

### LTE Uplink Measurement Software MX269021A LTE-Advanced FDD Uplink Measurement Software MX269021A-001 LTE TDD Uplink Measurement Software MX269023A LTE-Advanced TDD Uplink Measurement Software MX269023A-001

MS269xA MS2850A MS2830A

LTE Uplink Measurement Software MS269021A is for testing RF characteristics of 3GPP LTE FDD Uplink signal. LTE-Advanced FDD Uplink Measurement Software MX269021A-001 expands the Carrier Aggregation measurement function to MX269021A.

LTE Uplink Measurement Software MS269023A is for testing RF characteristics of 3GPP LTE TDD Uplink signal. LTE-Advanced TDD Uplink Measurement Software MX269023A-001 expands the Carrier Aggregation measurement function to MX269023A.

These applications improve the quality and efficiency of 3GPP LTE terminal and device component development and manufacturing.

### Features

### Support Testing of 3GPP TS 36.521-1 V10.5.0 (2013-03) Uplink RF Characteristics

#### ■ Versatile Analysis Results Formats and Graphs

- Full Output Power, Frequency Error, and EVM
- Power and EVM for each Physical channel
- Both sub-carrier and symbol EVM and I/Q constellation displays
- Spectrum flatness/graph: Amplitude, Phase and Group Delay frequency characteristics
- Time Based EVM
- EVM vs. Demod-Symbol
- In-Band Emission
- Power vs. Time

Replay Function for Troubleshooting Faults

Measurement Items

### [Text Display]

- Frequency Error
- Output Power
- EVM (rms)/(peak)
- Origin Offset
- Timing Offset (External Trigger)

#### [Graphical Display]

- Constellation
- EVM vs. Subcarrier
- EVM vs. Symbol
- Spectral Flatness
- Time Based EVM
- EVM vs. Demod-Symbol
- In-Band Emission

### [Summary Display]

- PUSCH EVM (rms)/(peak)
- DMRS EVM (rms)/(peak)
- Frequency Error
- Output Power, Mean Power
- EVM (rms)/(peak)
- Origin Offset
- Time Offset
- Total EVM (Time Based)
- PUSCH QPSK/16QAM/64QAM EVM (Time Based)
- Total EVM (Frequency Based)
- PUSCH ALL/QPSK/16QAM/64QAM EVM
- DMRS EVM
- Frequency Error vs. Slot
- Origin Offset vs. Slot
- In-Band Emission
- Inside/Outside Flatness
- EVM Equalizer Spectrum Flatness

### LTE Uplink Measurement Software MX269021A LTE-Advanced FDD Uplink Measurement Software MX269021A-001 LTE TDD Uplink Measurement Software MX269023A LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

### **Measurement Functions**

Constellation/Numerical Results

The Constellation/Numerical value results are displayed.

- Frequency Error
- Output Power (Mean power in 31.25 MHz bandwidth)
- Mean Power (Mean power in channel bandwidth)
- EVM [Peak/rms]
- Origin Offset
- Time Offset (time offset between the trigger input and head of the frame)

| 0.00 | <b>N</b> - | <br>Messu | rng |                   |            |
|------|------------|-----------|-----|-------------------|------------|
| MK   | R          | 0         |     |                   |            |
| Sabe | arelet 0   |           |     | Frequency Error   | -0.01 Hz   |
| Symi | of Number  |           |     |                   | 0,000 ppm  |
|      |            |           |     | Output Power      | -13.05 dBm |
| 1    | 0.80136    |           |     | Mean Power        | -13.05 dBm |
|      |            |           |     | EVM(rms)          | 0.27 %     |
| a    | 0.8002#    |           |     | EVM(peak)         | 1.02.%     |
|      |            |           |     | Symbol Number     |            |
|      |            |           |     | Subcarrier Number | 88         |
|      |            |           |     | Frame Number      | 2          |
|      |            |           |     | Origin Offset     | -47.93 dB  |
| Fran | ne o       |           |     | Time Offset       | -37,0 ms   |

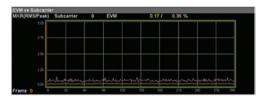
#### • EVM vs. Subcarrier

This displays the EVM vs. Subcarrier graph (horizontal axis = Subcarrier, vertical axis = EVM) at the bottom of the screen.

The following EVM can be selected by switching EVM vs. Subcarrier View.

Averaged over all Symbols: Mean value of all analysis symbols Each Symbol: Value of symbol selected by marker

It is useful for checking in-band interference signals.



#### • EVM vs. Symbol

This displays the EVM vs. Symbol graph (horizontal axis = Symbol, vertical axis = EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific symbol.

| VM vs Symbol |        | 28 EVM                | 0.21/ | 0.48 %     |    |
|--------------|--------|-----------------------|-------|------------|----|
| KR(RMS/Peak) | Symbol | 28 EVM                | 0.217 | 0.48 %     |    |
| 5.00         |        |                       |       |            |    |
| 375          |        |                       |       |            |    |
|              |        |                       |       |            |    |
| 250          |        |                       |       |            |    |
|              |        |                       |       |            |    |
| 125          |        |                       |       |            |    |
|              |        |                       |       |            |    |
| 0.00         |        |                       |       | Anna Maria |    |
| ame 0 0      |        | - Michael Constanting |       |            | 23 |

### Spectral Flatness

Four kinds of graphs are switched.

- 1. Amplitude vs. Subcarrier
  - Relative power of each subcarrier to average power of all subcarriers

MS269xA MS2850A

- 2. Difference Amplitude vs. Subcarrier Power difference between adjoined subcarriers
- 3. Phase vs. Subcarrier
  - Phase error of each subcarrier
- 4. Group Delay

Group delay between adjoined subcarriers

It is useful for checking frequency response (Amplitude and Group Delay).

| vg/Peak) | s(Amplitude vs<br>Subcarrier | 0 | -0.05 / | -0.05 / | -0.05 dB |      |
|----------|------------------------------|---|---------|---------|----------|------|
| 1000     |                              |   |         |         |          |      |
| 5.00     |                              |   |         |         | _        |      |
| 000      |                              |   | _       | _       | _        | <br> |
| -500     |                              |   |         |         | _        |      |
| -1000    |                              |   |         |         |          |      |

#### • Time Base EVM

This displays a graph of each measured symbol in the time domain (horizontal axis) vs. EVM (vertical axis) at the bottom of the screen. The results are displayed for symbols that have a PUSCH.

It is useful for checking characteristics in the time direction and faults at a specific symbol.

| e Based EVM                |        | TRACE STREET, ST |          | No. Contraction |
|----------------------------|--------|------------------|----------|-----------------|
| e Based EVM<br>R(RMS/Peak) | Symbol | 28 EVM           | 0.19/ 0. | 45 %            |
| 500                        |        |                  |          |                 |
| 375                        |        |                  |          |                 |
| 250                        |        |                  |          |                 |
| 125                        |        |                  |          |                 |
| 0.00                       |        |                  |          | ********        |
| me 0 🔍                     |        |                  |          |                 |

#### • EVM vs. Demodulation Symbol

This displays a graph of the EVM vs. Demodulation Symbol (horizontal axis = Demodulation Symbol, vertical axis = EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific symbol.

| M vs Demod-S<br>R(RMS/Peak) | Demo  | d-Symb | 0 10 | EVM  |          | 0.20 | / 0 | 43 % | _    | _      |
|-----------------------------|-------|--------|------|------|----------|------|-----|------|------|--------|
| 500                         |       |        |      |      |          |      |     |      |      |        |
| 375                         | _     |        |      | _    | _        | _    | _   |      | _    |        |
| 250 -                       | _     |        |      | _    | <u> </u> | _    | -   |      | _    |        |
| .125                        |       |        |      |      |          |      |     |      |      |        |
| 000                         | Marri | nn     | rdin |      | m        | m    | m   | mure | Mary | 2000   |
| ame 0 0                     |       | 2      | 10 I | k) 1 | 120 1    | 10 1 | 90  | 250  | 40 2 | 20 299 |

### LTE Uplink Measurement Software MX269021A LTE-Advanced FDD Uplink Measurement Software MX269021A-001 LTE TDD Uplink Measurement Software MX269023A LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

### In-Band Emission

The following two types of graph can be selected and displayed at the bottom of the screen by switching In-Band Emission View.

- Averaged over all Slots: Average of In-Band Emission for measured slots
- Each Slot: In-Band Emission value for each slot specified by Graph Slot Number

It is useful for checking in-band emission at a specific subcarrier and resource block.



### Summary Display Function

This function batch-displays the power and EVM for each channel.

| Carrier Freq. 1  | 920 000 000 Hz  | Input Lev  | vel -10.00 dBm   |                                      |   |                | Trace Made                       |
|--|---|--|--|--------------------------------------|---|----------------|----------------------------------|
| Modulation   |   |  |  |                                      |   |                |                                  |
| Channel Bandwidth  | 5M94z   |  |  | Terget Ch                            |   | PUSCH          | EVM vs Subcarrier                |
| Result   |   |  |  |                                      | Max   |                |                                  |
| PUSCH EVM (rms)<br>QPSK<br>16QAM<br>64QAM  | 0.21 %  |  | Frequency Error<br>Output Power<br>Mean Power                          |                                      | -0.26 Hz<br>0.000 ppm<br>-10.88 dBm<br>-10.89 dBm                     | 10<br>10<br>10 | EVM vs Symbol                    |
| PUSCH EVM (peak)<br>Demod-Symb<br>QPSK<br>16QAM                                    | *** ** % **** ]   | 43 1 0   | Mean Power<br>EVM(rms)<br>EVM(peak)<br>Demod-Symbol 1<br>Symbol Number |                                      | -10.89 dism<br>0.21 %<br>0.75 %<br>219<br>43                          |                | Time Based EVM                   |
| 64QAM<br>DMRS EVM (rms)  | ming my   |  | Frame Number   |                                      |   |                | EVM vs                           |
|  | 0.24 %<br>ubcarrier/Symbol/<br>0.63 % 2947                                  | 115 / 0  | Origin Offset  |                                      | -45.57 dB   |                | Demod-Symbol                     |
| DMRS EVM (peak) / S  | ubcarrientSymbolit  | rame<br>115 r 0  | Origin Offset  | Pa                                   |   | 10             | Demod-Symbol                     |
| DMRS EVM (peak) / S<br>Summary   | ubcarrier/Symbol/<br>0.63 % 294 /   | 1157 0   | EVM/De   |                                      |   | 10             | manufactorization and            |
| DMRS EVM (peak) / S<br>DMRS EVM (peak) / S<br>Summary<br>total EVM<br>(time based) | ubcarrier/Symboli<br>0.63 % 2947<br>EVM Fin<br>EVM Fin                      | al rms<br>peak<br>prms<br>peak   | EVM / Der<br>0.21 %<br>0.75 %<br>0.21 %<br>0.21 %                      |                                      | ge No. 1/<br>Symbol/Fre<br>1/0  | 10             | Demod-Symbol                     |
| DMRS EVM (p+ak) / S<br>Summary<br>total EVM  | ubcarrier/Symbol<br>0.63 % 2941<br>EVM Fin                                  | al rms<br>peak<br>prms<br>peak   | EVM / Der<br>0.21 %<br>0.75 %  | 219 / 4                              | geNo. 1/<br>Symbol/Fra<br>1/0<br>1/0                                  | 10             | Demod-Symbol<br>Spectral Flateen |
| DMRS EVM (p+ak) / S<br>Summary<br>total EVM  | Ubcarrier/Symbol<br>0.63 % 294 /<br>EVM Fin<br>EVM Fin<br>EVM Hig<br>EVM Lo | 115 / 0<br>al rms<br>peak<br>peak<br>rms<br>peak<br>al rms<br>peak<br>th rms<br>ceak | EVM / Der<br>0.21 %<br>0.75 %<br>0.75 %<br>0.75 %                      | nod Symbol /<br>219 / 40<br>219 / 40 | ge No. 1 /<br>Symbol/Fra<br>3 / 0<br>3 / 0<br>3 / 0<br>3 / 0<br>3 / 0 | 10             | Demod-Symbol<br>Spectral Flateen |

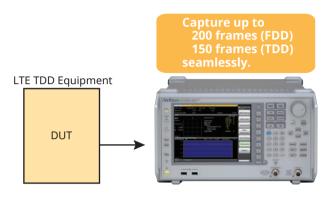
Page 1: List of EVM and Power for Each Channel Uplink (PUSCH) (MX269023A)

### **Replay Function for Troubleshooting Faults**

Up to 150 frames of LTE TDD signals can be captured as a file for replay by the LTE TDD Measurement Software to perform EVM measurement analyses, etc.\*

MS269xA MS2850A

\*: Batch measurement is not supported when the MX269022A-001 is installed.





#### Example of R&D use

Save data for comparing each DUT test version

→ Supports comparison of retrofitting improvement effects

### Example of production line use

Save delivery inspection data

 $\rightarrow$  Supports rechecking of performance data for troubleshooting post-delivery faults

### LTE Uplink Measurement Software MX269021A LTE-Advanced FDD Uplink Measurement Software MX269021A-001 LTE TDD Uplink Measurement Software MX269023A LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

### LTE Uplink Measurement Software MX269021A , LTE-Advanced FDD Uplink Measurement Software MX269021A-001

|  | Signal Analyzer               | MS269xA  | MS2830A<br>MS2850A  |  |
|--|-------------------------------|--|---|--|
|  | Channel Bandwidth             | 1.4, 3, 5, 10, 15, 20 MHz  |   |  |
|  | Target Signals                | Uplink   |   |  |
| Common                                     | Span Setting                  | MS269XA, MS2830A<br>LTE-Advanced can be selected when MX269021A-001 i<br>When LTE selected: Span = 31.25 MHz fixed<br>When LTE-Advanced selected and Option 077/177/078<br>When LTE-Advanced selected and Option 077/177 inst.<br>When LTE-Advanced selected and Option 078/178 inst.<br>MS2850A<br>When LTE selected: Span = 31.25 MHz  | /178 not installed: Span = 31.25 MHz<br>alled: Span = 62.5 MHz  |  |
| Specifications                             | Capture Time                  | The condition "When Span = 62.5 MHz and 125 MHz" is<br>• When Span = 31.25 MHz<br>Capture Time = Auto: 1 Frame<br>Capture Time = Manual: 1 to 200 Frame<br>• When Span = 62.5 MHz<br>Capture Time = Auto: 1 Frame<br>Capture Time = Manual: 1 to 100 Frame<br>• When Span = 125 MHz<br>Capture Time = Auto: 1 Frame<br>Capture Time = Manual: 1 to 50 Frame  | applied when MX269021A-001 is installed.  |  |
|  | Measurement Frequency Range   | 400 MHz to 5 GHz   | MS2830A-040: 400 MHz to 3.6 GHz<br>MS2830A-041/043/044/045: 400 MHz to 5 GHz<br>MS2850A: 400 MHz to 5 GHz   |  |
|  | Measurement Level Range       | –15 to +30 dBm (Preamp Off, or Preamp not installed.)<br>–15 to +10 dBm (Preamp On)  | MS2830A:<br>-15 to +30 dBm (Preamp Off or Preamp not installed)<br>MS2850A:<br>-15 to +30 dBm (Preamp Off or Preamp not installed)<br>-15 to +10 dBm (Preamp On)      |  |
|  |                               | After CAL execution at 18°C to 28°C. For a signal of EVM   | = 1%. For Measurement Interval = 10 Subframe  |  |
| Modulation/<br>Frequency<br>Measurement    | Carrier Frequency Accuracy    | ± (Accuracy of reference frequency × Carrier frequency<br>+ 8) Hz  | ± (Accuracy of reference frequency ×<br>Carrier frequency + 8) Hz<br>(At the input level is -4 dBm when MS2830A-045 is<br>installed)                                  |  |
|  |                               | After CAL execution at $18^{\circ}$ C to $28^{\circ}$ C. For Measurement In<br>The condition "When Span = 62.5 MHz or 125 MHz" is a  | oplied when MX269021A-001 is installed.   |  |
|  | Residual Vector Error         | <1.0% (rms) (When Span = 31.25 MHz)<br><1.3% (rms) (When Span = 62.5 MHz or 125 MHz)   | MS2830A:<br><1.2% (rms) (When Span = 31.25 MHz)<br><1.3% (rms) (When Span = 62.5 MHz or 125 MHz)<br>(At input level of -4 dBm when MS2830A-045 installed)<br>MS2850A: |  |
|  |                               |  | <1.3% (rms) (When Span = 31.25 MHz)   |  |
| Amplitude                                  | Tx Power Measurement Accuracy | Transmitter power accuracy is calculated from the RSS (root sum of squares) error of the absolute amplitud accuracy and the in-band frequency characteristics of the MS2690A/MS2691A/MS2692A or MS2830A. At 18°C to 28°C after calibration when the input attenuator = $\geq 10$ dB, the measured input signal is within t measurement level range and below the value set at Input Level when Span = 31.25 MHz. |   |  |
| Measurement                                | TAT OWER MEdsurement Accordey | ±0.6 dB (Preamp Off, or Preamp not installed.)<br>±1.1 dB (Preamp On)  | ±0.6 dB (Preamp Off or Preamp not installed)<br>MS2850A:<br>±0.6 dB (Preamp Off or Preamp not installed)<br>±1.1 dB (Preamp On)                                       |  |
| Measurement Tar <u>c</u><br>Channel Signal | jet                           | LTE Selected:<br>• PUSCH<br>• PUCCH<br>• SRS<br>• PRACH<br>LTE-Advanced Selected:<br>• PUSCH<br>• PUCCH<br>Measures and displays the result per channel. The channel   | el setting is mutually exclusive.   |  |

### LTE Uplink Measurement Software MX269021A LTE-Advanced FDD Uplink Measurement Software MX269021A-001 LTE TDD Uplink Measurement Software MX269023A LTE-Advanced TDD Uplink Measurement Software MX269023A-001

Waveform

| DD Up     | link Measurement So | oftware MX269023A<br>Jrement Software MX269023A-001  |   |
|-----------|---------------------|--|---|
|           |                     |  |   |
|           | Signal Analyzor     | MS269xA  | MS2830A                                       |
|           | Signal Analyzer     | INI3209XA  | MS2850A                                       |
| m Display |                     | Provides functions for displaying waveforms below.<br>Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Time<br>Spectral Flatness, In-Band Emission, Power vs. Time | e Based EVM, EVM vs. Demod-Symbol,            |
| Channel   | Measurement Method  | Evecutes the adjacent channel nower measurement funct  | ion of the Spectrum Analyzer or Signal Analyz |

| Adjacent Channel<br>Leakage Power<br>Measurement | Measurement Method                   | Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.  |
|--|--------------------------------------|--|
| Occupied<br>Bandwidth<br>Measurement             | Measurement Method                   | Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.  |
| Channel Power<br>Measurement                     | Measurement Method                   | Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.   |
| Spectrum<br>Emission Mask<br>Measurement         | Measurement Method                   | Executes the spectrum emission mask measurement function of the Spectrum Analyzer.   |
|  | Function Overview                    | Capable of outputting captured waveform data to internal or external storage device.   |
| Digitize Function                                | Waveform Data                        | Format: I, Q (32 bit floating point binary format)<br>Level: Assumes as $\sqrt{(l^2 + Q^2)} = 1$ for 0 dBm input<br>Level accuracy: Same as the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.  |
| Replay Function                                  |                                      | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling rate: The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed.<br>50 MHz (when Span = 31.25 MHz)<br>100 MHz (when Span = 62.5 MHz)<br>200 MHz (when Span = 125 MHz) |
| Component Carrier                                | Maximum Number of CCs                | 2  |
| (CC) Allocated                                   | Channel Bandwidth of Each CC         | 1.4, 3, 5, 10, 15, 20 MHz  |
| Condition (Using<br>MX269021A-001)               | Frequency Offset Range of<br>Each CC | – (Span – Channel bandwidth of each CC)/2 to (Span – Channel bandwidth of each CC)/2   |

### LTE TDD Uplink Measurement Software MX269023A, LTE-Advanced TDD Uplink Measurement Software MX269023A-001

| Signal Analyzer                          |                             | MS269xA   | MS2830A  |  |  |  |  |
|--|-----------------------------|---|--|--|--|--|--|
|  |                             |   | MS2850A  |  |  |  |  |
|  | Channel Bandwidth           | 1.4, 3, 5, 10, 15, 20 MHz   |  |  |  |  |  |
|  | Target Signals              | Uplink  |  |  |  |  |  |
| Span Setting                             |                             | MS269xA, MS2830A<br>LTE-Advanced can be selected when the MX269023A-001 is installed.<br>When LTE selected: Span = 31.25 MHz fixed<br>When LTE-Advanced selected and Option 077/177/078/178 not installed: Span = 31.25 MHz<br>When LTE-Advanced selected and Option 077/177 installed: Span = 62.5 MHz<br>When LTE-Advanced selected and Option 078/178 installed: Span = 125 MHz<br>MS2850A |  |  |  |  |  |
| Common                                   |                             | When LTE selected: Span = 31.25 MHz   |  |  |  |  |  |
| Common<br>Specifications<br>Capture Time |                             | The condition "When Span = 62.5 MHz and 125 MHz" is<br>• When Span = 31.25 MHz<br>Capture Time = Auto: 5 Frame<br>Capture Time = Manual: 5 to 150 Frame<br>• When Span = 62.5 MHz<br>Capture Time = Auto: 5 Frame<br>Capture Time = Manual: 5 to 100 Frame<br>• When Span = 125 MHz<br>Capture Time = Auto: 5 Frame<br>Capture Time = Manual: 5 to 50 Frame                                   | applied when MX269023A-001 is installed.   |  |  |  |  |
|  | Measurement Frequency Range | 400 MHz to 5 GHz  | MS2830A-040: 400 MHz to 3.6 GHz<br>MS2830A-041/043/044/045: 400 MHz to 5 GHz<br>MS2850A: 400 MHz to 5 GHz  |  |  |  |  |
| Modulation/<br>Frequency<br>Measurement  | Measurement Level Range     | –15 to +30 dBm (Preamp Off, or Preamp not installed.)<br>–15 to +10 dBm (Preamp On)   | MS2830A:<br>-15 to +30 dBm (Preamp Off or Preamp not installed)<br>MS2850A:<br>-15 to +30 dBm (Preamp Off or Preamp not installed)<br>-15 to +10 dBm (Preamp On) |  |  |  |  |

MS269xA MS2850A MS2830A

MS269xA MS2850A MS2830A

### LTE Uplink Measurement Software MX269021A

# LTE-Advanced FDD Uplink Measurement Software MX269021A-001

LTE TDD Uplink Measurement Software MX269023A

# LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

|  | Signal Analyzer                      | MS269xA  | MS2830A  |  |
|--|--------------------------------------|--|--|--|
|  |                                      |  | MS2850A  |  |
|  |                                      | After CAL execution at 18°C to 28°C. For a PUSCH signal<br>For Measurement Interval = 10 Subframe  | of EVM = 1% and Full RB.   |  |
| Modulation/<br>Frequency                         | Carrier Frequency Accuracy           | ± (Accuracy of reference frequency ×<br>Carrier frequency + 8) Hz  | MS2830A:<br>± (Accuracy of reference frequency ×<br>Carrier frequency + 8) Hz<br>(At input level of -4 dBm when MS2830A-045<br>installed)<br>MS2850A:<br>± (Accuracy of reference frequency ×<br>Carrier frequency + 8) Hz<br>(Span = 31.25 MHz) |  |
| Measurement                                      | Residual Vector Error                | After CAL execution at 18°C to 28°C. For Measurement Ir<br>The condition "When Span = 62.5 MHz or 125 MHz" is a<br><1.0% (rms) (When Span = 31.25 MHz)<br><1.3% (rms) (When Span = 62.5 MHz or 125 MHz)  |  |  |
| Amplitude<br>Measurement                         | Tx Power Measurement Accuracy        | Transmitter power accuracy is calculated from the RSS (r<br>accuracy and the in-band frequency characteristics of the<br>At 18°C to 28°C after calibration when input attenuator =<br>measurement level range and below the value set at Input<br>±0.6 dB (Preamp Off or Preamp not installed)<br>±1.1 dB (Preamp On)                            | oot sum of squares) error of the absolute amplitude<br>e MS2690A/MS2691A/MS2692A or MS2830A.<br>= ≥10 dB, the measured input signal is within the  |  |
| Measurement Targe                                | et Channel Signal                    | LTE Selected:<br>• PUSCH<br>• PUCCH<br>• PRACH<br>LTE-Advanced Selected:<br>• PUSCH<br>• PUCCH<br>Measures and displays the result per channel. The chann  | el setting is mutually exclusive.  |  |
| Waveform Display                                 |                                      | Provides functions for displaying waveforms below.<br>Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Time Based EVM, EVM vs. Demod-Symbol, Spectral Flatness,<br>In-Band Emission, Power vs. Time  |  |  |
| Adjacent Channel<br>Leakage Power<br>Measurement | Measurement Method                   | Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.  |  |  |
| Occupied<br>Bandwidth<br>Measurement             | Measurement Method                   | Executes the occupied bandwidth measurement function   | of the Spectrum Analyzer or Signal Analyzer.   |  |
| Channel Power<br>Measurement                     | Measurement Method                   | Executes the channel power measurement function of th  | e Spectrum Analyzer or Signal Analyzer.  |  |
| Spectrum<br>Emission Mask<br>Measurement         | Measurement Method                   | Executes the spectrum emission mask measurement fund   | ction of the Spectrum Analyzer.  |  |
| Digitize Function                                | Function Overview<br>Waveform Data   | Capable of outputting captured waveform data to internal or external storage device.<br>Format: I, Q (32 bit floating point binary format)<br>Level: Assumes as √(l <sup>2</sup> + Q <sup>2</sup> ) = 1 for 0 dBm input<br>Level accuracy: Same as the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer. |  |  |
| Replay Function                                  |                                      | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling rate: The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed.<br>50 MHz (when Span = 31.25 MHz)<br>100 MHz (when Span = 62.5 MHz)<br>200 MHz (when Span = 125 MHz)                                 |  |  |
| Component Carrier Maximum Number of CCs 2        |                                      |  |  |  |
| (CC) Allocated<br>Condition (Using               | Channel Bandwidth of Each CC         | 1.4, 3, 5, 10, 15, 20 MHz  |  |  |
| MX269021A-001)                                   | Frequency Offset Range of<br>Each CC | – (Span – Channel bandwidth of each CC)/2 to (Span – C   | hannel bandwidth of each CC)/2   |  |

### CDMA2000 Forward Link Measurement Software MX269024A All Measure Function MX269024A-001 EV-DO Forward Link Measurement Software MX269026A All Measure Function MX269026A-001

The CDMA2000 Forward Link Measurement Software MX269024A supports measurement of RF characteristics of 3GPP2 C.S0002/C.S0010 CDMA2000 Forward Link signals. The EV-DO Forward Link Measurement Software MX269026A supports measurement of RF characteristics of 3GPP2 C.S0024/C.S0032 EV-DO Forward Link signals.

Installing the All Measure Function MX269024A-001 in a unit in which the MX269024A has been installed supports single-capture batch-measurement of multiple CDMA2000 Tx characteristics, such as modulation analysis accuracy, power spectrum, etc.

Similarly, installing the All Measure Function MX269026A-001 in a unit in which the MX269026A has been installed supports single-capture batchmeasurement of multiple EV-DO Tx characteristics such as modulation accuracy, power spectrum, etc.

### Features

### Support Testing of 3GPP2 CDMA2000/EV-DO Revision 0, Revision A Forward Link RF Characteristics

- Easy Setting of Measurement Conditions
- Signal analyzer automatically synchronized to input signal
- CDMA2000 Rev. 0 (Subtype0/1) and Rev. A (Subtype2) switching: CDMA2000
- Data Tx and Idle state switching: EV-DO

### Versatile Analysis Results Formats and Graphs

- Text displays for Frequency Error, Output Power, Waveform Quality, ρ, Timing Error, etc.
- Code Domain Power Graph
- Conducted Spurious Emissions
- Occupied Bandwidth
- Power vs. Time (only EV-DO)

### All Measurement Function

Batch-measures and list displays multiple items, such as modulation accuracy and power spectrum (requires installation of All Measure Function option)

### MX269024A CDMA2000 Forward Link

### Code Domain Graph

The code domain analysis result (graph and numerical value) is displayed at the top of the screen. This is the result for the slot set as Target Slot Number.

The numeric modulation analysis result is displayed at the bottom of the screen as an average for the number of slots set as Measurement Interval.

In addition, the measurement result is averaged when Average is On.

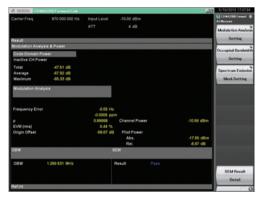


Code Domain Screen: CDMA2000 Forward Link

#### All Measure Screen

Installing the MX269024A-001 All Measure Function supports highspeed batch-measurement of CDMA2000 Forward Link multiple Tx characteristics, such as modulation accuracy, power spectrum, etc.

MS269xA



All Measure Screen: CDMA2000 Forward Link

### CDMA2000 Forward Link Measurement Software MX269024A All Measure Function MX269024A-001 EV-DO Forward Link Measurement Software MX269026A All Measure Function MX269026A-001 (Continued)

### MX269026A EV-DO Forward Link

#### Code Domain Graph

The code domain analysis result (graph and numerical value) is displayed at the top of the screen. "MAC" or "Data" is switched at the code domain screen.

The numeric modulation analysis result is displayed at the bottom of the screen.

| A MERSEN I   | /-DO Farment L  | ini.                                 |   |  |  | 10  | 5/18/2010                   | 150002                       |
|--|---|--------------------------------------|---|--|--|---|-----------------------------|------------------------------|
| Carrier Freq.  | 870 000   | 000 Hz                               | Input Level                                   | -10.00 dBm<br>8 dB   |  |   | Code Domain                 | medle 🗿                      |
| Result<br>Code Domain I<br>I Code<br>into<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>10  | Power(MAC)<br>O CH<br>Power<br>Power<br>O CH<br>Power | 0<br>-72.87 e8<br>-61.50 e8          | ¢   | 0.00000  | Branch I<br>Total Pilot Power<br>Total MAC Power<br>Total IOAS Power<br>I Avo. Active CH<br>I Max. Astive CH<br>I Max. Astive CH<br>I Max. Astive CH<br>G Max. Active CH<br>G Max. Active CH<br>G Max. Active CH<br>G Max. Active CH | 499988<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>49798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>40798<br>4000000000000000000000000000000000000 | Bra<br>L<br>Co<br>Nam<br>Co | 0<br>de<br>ber 1<br>de<br>de |
| -1000<br>-1000<br>Modulation An<br>Prequency En<br>p sins<br>p mac<br>p mac<br>p mac<br>p mac<br>p mac<br>p mac<br>p mac<br>t to<br>p mac<br>t to<br>p mac<br>t to<br>p mac<br>t to<br>t to<br>t to<br>t to<br>t to<br>t to<br>t to<br>t t | ror   | -0.0<br>0.99<br>0.99<br>0.99<br>0.99 | 998<br>998<br>998<br>998<br>1.45 %<br>7.79 dB | AT 5<br>Max. MAC inactive CI<br>Power<br>Max. Data Active CH<br>Power<br>Power<br>Power<br>P | 4<br>0.00000   | B (Q - 13)  |                             |                              |
| Ref.Int  |   | _                                    |   |  |  | _   | 1.42                        | <b>E</b>                     |

Code Domain Power Screen: EV-DO Forward Link

### • All Measure Screen

Installing the MX269026A-001 All Measure Function supports highspeed batch-measurement of EV-DO Forward Link multiple Tx characteristics, such as modulation accuracy, power spectrum, etc.

| A MERSON EVER                      |                      |                         |  | 5/18/2013 1628                  |
|------------------------------------|----------------------|-------------------------|--|---------------------------------|
| Carrier Freq.                      | 870 000 000 Hz       | Input Leve              | -10.00 eBm   | EV-00 Formed Las                |
|                                    |                      |                         | 1 d3   | Modulation Anal                 |
| Result                             |                      |                         |  | Setting                         |
| Modulation Analysi                 | a & Power            | _                       | Average & Max 5137 5   | 13                              |
| Power vs Time                      |                      |                         |  | Occupied Bandw<br>Setting       |
| Template Judge                     | AvgMaxiMin           |                         |  | Derive                          |
| OnPower                            | -10.40 / -10.24      | / -10.58 dBm            |  | Spectrum Emilie<br>Mask Setting |
| Modulation Analy                   | ais .                |                         |  |                                 |
|                                    |                      | AvgMax                  | AvgMax   |                                 |
| Channel Power                      | -10.49 /             | -10.37 dBm              |  |                                 |
| Frequency Error                    | -0.60 I<br>-0.0007 I | -1.56 Hz<br>-0.0018 ppm | Max. MAC Inactive CH   |                                 |
| p Paul                             | 0.99998 /            | 0.99997                 | Power 66.57 dB (1 - 22 )/ -58.76 dB (Q - 28<br>0.00000 / 0.00000 |                                 |
| p wac                              | 0.59998 /            | 0.99997                 | p 0.00000 / 0.00000<br>Max. Data Active CH                       |                                 |
| p bes                              | 0.99998 /            | 0.99998                 | Power -14.95 dB (Q- 0)/ -14.06 dB (1- 4                          |                                 |
| D Overall                          | 0.99998 /            | 0.99997                 | p 0.03199 / 0.02507  |                                 |
| EVMirms                            | 0.45 /               | 0.48 %                  | Min. Data Active CH  |                                 |
| Origin Offset<br>Data Modulation S | 47.93 I<br>Icheme    | -56.06 dB<br>16QAM      | Power -15.11 dB (1 - 0)/ -15.89 dB (Q - 2<br>p 0.03081 / 0.02679 | °                               |
| 08W                                |                      |                         | SFM  |                                 |
|                                    |                      |                         |  | 1 m                             |
| OBW 1                              | 274 414 MHz          |                         | Result Pass  | SEM Result                      |
|                                    |                      |                         |  | Detail                          |
| Retint                             |                      |                         |  |                                 |

All Measure Screen: EV-DO Forward Link

#### • Power vs. Time Graph

The Time Domain Graph (Avg./Max./Min. level) is displayed at the top of the screen. The three screens are switched as follows:

MS269xA

### Halfslot

Displays half slot time.

- 1st Half slot: Displays first half
- 2nd Half slot: Displays second half
- Full slot: Displays mean of first and second half

| A 1653590A                | V-DO Forward Link |                                      |                    |               | 10       | 5/18/2013 16:19:40                        |
|---------------------------|-------------------|--------------------------------------|--------------------|---------------|----------|---|
| Carrier Freq.             | 870 000 000 He    | input Level<br>ATT                   | -10.00 dBm<br>8 dB | Average & Max | 513/ 513 | Power of Time<br>Select<br>Reference Line |
| Power vs Tim              | eDia#slot)        | _                                    |                    | Average & Max | 5131 513 |   |
| MKR                       | 400.00 PNChips (  | 325.52 µm.) A                        | ng 0.19            |               | dB       | Reference Line<br>Level<br>0.00d8m        |
| -10.00 -                  |                   |                                      |                    |               |          | Select Mask                               |
| -600<br>-600<br>-600      |                   |                                      |                    |               |          | Mask Setup                                |
|                           |                   |                                      |                    |               |          | Unit<br>dD dDm                            |
| Result                    |                   |                                      |                    |               |          | -   |
| Template Ji<br>ReferenceP | udge Pass         | AvgMaxMin                            |                    |               |          | Display Item<br>Average All               |
| MeanPower<br>OnPower      | -10.41 / -1       | 0.25 / -10.59 dB<br>0.25 / -10.59 dB |                    |               |          | Smoothing<br>Filter<br>On <u>Off</u>      |
|                           |                   |                                      |                    |               |          | Filter Type<br>Flattop                    |
| Ref.int                   |                   |                                      |                    |               |          | 1.42 100                                  |



| A ME3690A     | V-DO Forward Link |                             |                    |               | 10       | 5/18/2013 16:16:16   |
|---------------|-------------------|-----------------------------|--------------------|---------------|----------|--|
| Carrier Freq. | 870 000 000 Hz    | Input Level<br>ATT          | -10.00 dBm<br>8 dB |               |          | Trace Hode   |
| Result        |                   | _                           |                    | Average & Max | 513/ 513 |  |
| Power vs Tim  | e(Haffslot)       |                             |                    |               |          | and the second s |
| MKR           | 400.00 PNChips (  | 325.52 µs) Av               | 0,17               |               | dB       | OnPortion  |
|               |                   | 1                           |                    |               |          |  |
| -1000         |                   |                             |                    |               |          |  |
| -25.60        |                   |                             |                    |               |          | Ramp   |
| -00.00        |                   |                             |                    |               |          | -  |
|               |                   |                             |                    |               |          |  |
|               |                   |                             |                    |               |          |  |
|               |                   |                             |                    |               |          |  |
| -7030         |                   | the second state in some of |                    |               |          |  |
| -90.00        |                   |                             |                    |               |          |  |
|               | -100              |                             |                    |               | 1124     |  |
| Result        |                   |                             |                    |               |          |  |
|               |                   | Nig/Max/Min                 |                    |               |          |  |
| Template .    | ludge Pass        |                             |                    |               |          |  |
| Reference     | Power -10.69 dBm  |                             |                    |               |          |  |
| MeanPowe      |                   | 197 / -17.32 dBr            |                    |               |          |  |
| OnPower       | -10.69 / -10      | 158 / -10.83 dBr            |                    |               |          |  |
|               |                   |                             |                    |               |          |  |
|               |                   |                             |                    |               |          |  |
|               |                   |                             |                    |               |          |  |
| Reflec        |                   |                             |                    |               |          |  |

Power vs. Time Screen (Idle state): EV-DO Forward Link

### OnPortion

Displays Pilot/MAC.

| A ME3690A       | DO Feirward Link            |                   | -              |                     | ولد      | 5/18/2013 161621 |
|-----------------|-----------------------------|-------------------|----------------|---------------------|----------|------------------|
| Carrier Freq.   | 870 000 000 Hz              | Input Level       | -10.00 dBm     |                     |          | Trace Nide       |
|                 |                             |                   | 8 d0           |                     |          |                  |
|                 |                             |                   |                |                     |          | Halfalot         |
| Result          |                             |                   |                | Average & Max       | 513/ 513 |                  |
| Power vs Time(0 |                             |                   |                |                     | -        | 100.0            |
|                 | 400.00 PNChips [            | 325.52 µs) Av     | 0.17           |                     | dB       | OnPortion        |
|                 |                             |                   |                |                     |          |                  |
|                 |                             |                   |                |                     |          | -                |
| 400             |                             |                   |                |                     |          | Ramp             |
| 200             | to this state the           | ALLEDBOUGH        | dennel det net | washing washing     | 44.      |                  |
| -000            | ALC: NOT A REAL PROPERTY OF | Mar has well a    | Should the A   | And And And And And | 41       |                  |
| -400            |                             |                   |                |                     |          |                  |
| -400            |                             |                   |                |                     |          |                  |
| -1000           |                             |                   |                |                     |          |                  |
| 141             |                             |                   |                |                     | 634      |                  |
| Result          |                             |                   |                |                     |          |                  |
| Template Judy   |                             | AvgMaxMin         |                |                     |          |                  |
| ReferencePow    |                             |                   |                |                     |          |                  |
| MeanPower       |                             | 1.97 / -17.32 dBm |                |                     |          |                  |
| OnPower         |                             | 0.68 / 10.83 dBm  |                |                     |          |                  |
|                 |                             |                   |                |                     |          |                  |
|                 |                             |                   |                |                     |          |                  |
|                 |                             |                   |                |                     |          |                  |
|                 |                             |                   |                |                     |          |                  |
| Refint          |                             |                   |                |                     |          | -                |

Power vs. Time Screen - OnPortion- (Idle state): EV-DO Forward Link

### CDMA2000 Forward Link Measurement Software MX269024A All Measure Function MX269024A-001 EV-DO Forward Link Measurement Software MX269026A All Measure Function MX269026A-001 (Continued)

### MS269xA MS2830A

### Ramp

Displays Ramp Part of Pilot/MAC.



Power vs. Time Screen - Ramp - (Idle state): EV-DO Forward Link

### **Specifications**

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

| Signal Analyzer            |   | MS269xA  | MS2830A   |  |  |
|----------------------------|---|--|---|--|--|
|                            | Frequency Range   | 400 MHz to 2700 MHz  | 1   |  |  |
| Madulation (               | Measurement Level Range   | <ul> <li>-15 to +30 dBm (Preamp Off, or Preamp not installed)</li> <li>-15 to +10 dBm (Preamp On)</li> </ul>   | -15 to +30 dBm (Preamp Off, or Preamp not installed)  |  |  |
| Modulation/<br>Frequency   | Carrier Frequency Measurement   | At 18°C to 28°C, after calibration, EVM = 1% signal  |   |  |  |
| Measurement                | Accuracy  | $\pm$ (Accuracy of reference frequency × Carrier frequency   | + 10) Hz  |  |  |
| Wiedsurennenne             | Residual Vector Error   | At 18°C to 28°C, after calibration   | ,   |  |  |
|                            |   | <1.0% (rms)  | <1.5% (rms)   |  |  |
|                            | Waveform Quality (p)  | >0.99990   | >0.99978  |  |  |
| Amplitude<br>Measurement   | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude | At 18°C to 28°C, after calibration, with input attenuator<br>less than Input level<br>±0.6 dB (Preamp Off, or Preamp not installed)  | ≥10 dB and input signal in measurement level range and<br>±0.6 dB (Preamp Off, or Preamp not installed) |  |  |
| Measurement                | accuracy and in-band frequency characteristics of main unit.)   | ±1.1 dB (Preamp On)  |   |  |  |
| Code Domain<br>Measurement | Power Accuracy  | At 18°C to 28°C, after calibration, input signal in measurement level range and less than Input level,<br>MAC region is average ≥ 16<br>±0.02 dB (Code Power ≥-10 dBc)<br>±0.05 dB (Code Power ≥-20 dBc)<br>±0.10 dB (Code Power ≥-30 dBc)   |   |  |  |
|                            | MX269024A   |  | r, Active CH Power, Inactive CH Power   |  |  |
| Measurement<br>Items       | MX269026A   | Code Domain Graph<br>Target Slot, Total Active CH, Output Power, Pilot Power, Active CH Power, Inactive CH Power<br>Adjacent Channel Leakage Power, Occupied Bandwidth, Channel Power, Spectrum Emission Mask<br>Modulation Analysis<br>• Frequency Error<br>• p (pilot/MAC/Data/Overall)<br>• Vector Error (Peak/rms)<br>• Origin Offset<br>• Data Modulation Scheme<br>• Timing Error<br>(Difference between "Set position of PN Offset of RF input" and "Trigger input")<br>• MAC Inactive CH<br>• Data Active CH<br>Code Domain Graph<br>I Code/CH/Power/p, Q code/CH/Power/p, Total Pilot Power, Total MAC Power, Total Data Power,<br>I Active CH, I Inactive CH, Q Inactive CH<br>Power vs. Time Graph<br>Average, Maximum, Minimum |   |  |  |

### WLAN (802.11) Measurement Software MX269028A 802.11ac (80 MHz) Measurement Software MX269028A-001 802.11ac (160 MHz) Measurement Software MX269028A-002

Installing the WLAN (802.11) Measurement Software MX269028A in the MS269xA/MS2830A main unit supports modulation analysis of IEEE 802.11a/ b/g/j/n/p signals with display of numerical and graphical results. The 802.11ac (80 MHz) Measurement Software MX269028A-001\*<sup>1</sup>, and 802.11ac (160 MHz) Measurement Software MX269028A-002\*<sup>2</sup> are MX269028A software options for modulation analysis of IEEE 802.11ac signals. Moreover, Tx tests of RF signals are supported when used in combination with MS269xA/MS2830A functions, such as adjacent channel leakage power, occupied bandwidth, spectrum emission mask, spurious, etc.

\*1: Only For MS2830A. Requires MX269028A.

\*2: Only For MS269xA. Requires MX269028A.

### Features

- One software package supporting IEEE 802.11a/b/g/j/n/p signal (MX269028A)
- Adding optional software supports modulation analysis of IEEE 802.11ac signal (MX269028A-001/002). MX269028A-001: Supports up to 80-MHz bandwidth. (Only for MS2830A)
- MX269028A-002: Supports up to 160-MHz bandwidth. (Only for MS269xA)
- Displays numerical results and analysis graphs (for R&D, quality assurance and manufacturing)
- Catch and replay function\*3 (saves\*4 signals for later modulation analysis troubleshooting)
- \*3: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz. \*4: Data for 1 burst signal

### Evaluation of Tx Characteristics for WLAN Modulation Accuracy (EVM)

The MX269028A supports WLAN modulation analysis and has an easy-to-use graph function for verification at Tx tests of WLAN equipment and parts.

### Measurement Signals MX269028A

- IEEE 802.11a
- IEEE 802.11b
- IEEE 802.11g ERP-DSSS/CCK
- IEEE 802.11g ERP-OFDM
- IEEE 803.11g DSSS-OFDM
- IEEE 802.11j
- IEEE 802.11n (HT-Mixed, HT-Greenfield, Non-HT)
- IEEE 802.11p

Measures both continuous and burst signals.

### MX269028A-001/002

• IEEE 802.11ac (VHT)

Measures burst signals only.

### ■ Supports IEEE 802.11ac signals up to 160-MHz bandwidth

The IEEE 802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

### Table 1. Supported measurement range for IEEE 802.11ac signals

|                       | Model                   |  |        | Bandwidth of IEEE 802.11ac Signal |             |         |                 |
|-----------------------|-------------------------|--|--------|-----------------------------------|-------------|---------|-----------------|
| Main unit             | Measurement software    | Analysis Bandwidth Extension<br>Option Configuration | 20 MHz | 40 MHz                            | 80 MHz      | 160 MHz | 80 MHz + 80 MHz |
|                       |                         | MS269xA-078*1 installed                              | ~      | ~                                 | ~           | ✓       | ∕*6             |
| MS269xA               | MS269xA MX269028A-002   | MS269xA-077/004*2 installed                          | ~      | ~                                 |             |         |                 |
|                       |                         | Standard   | ~      | ~                                 |             |         |                 |
|                       |                         | MS2830A-078*3 installed                              | ~      | ~                                 | <b>√</b> *7 |         |                 |
| MS2830A MX269028A-001 | MS2830A-077*4 installed | ~  | ~      |                                   |             |         |                 |
|                       |                         | MS2830A-005/009*5 installed                          | ~      | ~                                 |             |         |                 |

\*1: MS269xA-078 Analysis Bandwidth Extension to 125 MHz

\*2: MS269xA-077 Analysis Bandwidth Extension to 62.5 MHz

MS269xA-004 Analysis Bandwidth Extension to 125 MHz

\*3: MS2830A-078 Analysis Bandwidth Extension to 125 MHz

\*4: MS2830A-077 Analysis Bandwidth Extension to 62.5 MHz

\*5: MS2830A-005 Analysis Bandwidth Extension to 31.25 MHz MS2830A-009 Analysis Bandwidth Extension to 31.25 MHz for Millimeter-wave

\*6: Measurement is required for each carrier signal (80-MHz bandwidth)

\*7: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.

### ■ Capture & Replay Function\*5

When faults are detected, this function captures\*6 on-site signals to internal/external hard disk for later troubleshooting using analysis functions.

\*5: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz.

MS269xA

\*6: Data for 1 burst signal

### MS269xA/MS2830A Main Unit Functions

The following measurements are performed by calling the main-frame spectrum analyzer functions. These functions prepare each measurement standard templates.

- Adjacent Channel Leakage Power
- Occupied Bandwidth
- Spectrum Emission Mask
- Spurious Emission

MS269xA MS2830A

### Analysis Function (Numerical Results and Graph display)

|                    | ltem  | 11a/j/n/p<br>11g (ERP-OFDM)<br>11g (DSSS-OFDM) | 11b<br>11g (ERP-DSSS/CCK) | 11ac |  |  |  |  |
|--------------------|---|--|---------------------------|------|--|--|--|--|
|                    | Numerica  | l Result Display                               |                           |      |  |  |  |  |
|                    | Frequency Error   | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | Symbol Clock Error/Chip Clock Error                     | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | Transmit Power  | √  | ✓                         | ✓    |  |  |  |  |
|                    | Time Offset   | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | EVM [rms]   | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | Data EVM, Pilot EVM                                     | ✓  | _                         | ✓    |  |  |  |  |
|                    | SIG EVM (rms)   | √*1  | _                         | _    |  |  |  |  |
|                    | L-SIG EVM (rms)   | √*2  | _                         | ✓    |  |  |  |  |
|                    | HT-SIG EVM (rms)  | √*3  | _                         | _    |  |  |  |  |
|                    | VHT-SIG-A EVM (rms), VHT-SIG-B EVM (rms)                | _  | _                         | ✓    |  |  |  |  |
|                    | EVM [Peak]  | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | Symbol Number, Subcarrier Number/Chip Number            | √  | √                         | ✓    |  |  |  |  |
|                    | Quadrature Error  | √  |                           | √*6  |  |  |  |  |
|                    | IQ Gain Imbalance                                       | ✓  | _                         | √*6  |  |  |  |  |
|                    | Center Frequency Leakage                                | √  | _                         | ✓    |  |  |  |  |
| odulation Analysis | Spectral Flatness (Amplitude/Phase/Group Delay)         | √  | _                         | ✓    |  |  |  |  |
| Incuon             | Outside Subcarrier Amplitude Max and Min Value          | √  | _                         | ✓    |  |  |  |  |
|                    | Inside Subcarrier Amplitude Max and Min Value           | √  | _                         | ✓    |  |  |  |  |
|                    | Phase Error   | _  | ✓                         | _    |  |  |  |  |
|                    | Magnitude Error   | _  | ✓                         | _    |  |  |  |  |
|                    | IQ Origin Offset  | _  | ✓                         | _    |  |  |  |  |
|                    | Detect Parameter  | √  | ✓                         | ✓    |  |  |  |  |
|                    | Data Rate, Modulation Method, Symbol Length/Chip Length | √*4  | ✓                         | _    |  |  |  |  |
|                    | Preamble  | √*5  | ✓                         | _    |  |  |  |  |
|                    | MCS, Stream ID, Symbol Length, Guard Interval           | √*2  | _                         | ~    |  |  |  |  |
|                    | Graph Display   |  |                           |      |  |  |  |  |
|                    | Constellation   | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | EVM vs. Subcarrier                                      | ✓  | —                         | ~    |  |  |  |  |
|                    | EVM vs. Symbol/EVM vs. Chip                             | ✓  | ✓                         | ✓    |  |  |  |  |
|                    | Spectral Flatness (Amplitude/Phase/Group Delay)         | √  | —                         | ~    |  |  |  |  |
|                    | Phase Error vs. Chip                                    | _  | ✓                         | _    |  |  |  |  |
|                    | Eye diagram   | _  | ✓                         | —    |  |  |  |  |
|                    | Numerica  | l Result Display                               |                           |      |  |  |  |  |
|                    | Transmit Power  | ✓  | $\checkmark$              | _    |  |  |  |  |
|                    | Power Flatness Max                                      | ~  | ✓                         | —    |  |  |  |  |
|                    | Carrier Off Power                                       | ✓  | ✓                         | —    |  |  |  |  |
| ower vs. Time      | On/Off Ratio  | ✓  | ✓                         |      |  |  |  |  |
| inction            | Peak Power Spectrum Density (PSD)                       | ✓  | ✓                         | —    |  |  |  |  |
|                    | Transient time (power-on ramp, power-off ramp)          | _  | ✓                         |      |  |  |  |  |
|                    | Graph Display   |  |                           |      |  |  |  |  |
|                    | Burst   | ✓  | ✓                         | _    |  |  |  |  |
|                    | Transient   | ✓  | ✓                         | _    |  |  |  |  |

\*1: IEEE 802.11a

\*2: IEEE 802.11n

\*3: IEEE 802.11n (HT-Mixed, HT-Greenfield)

\*4: Exclude IEEE 802.11n

\*5: IEEE 802.11g DSSS-OFDM

\*6: Exclude Channel Bandwidth 160 MHz setting

MS269xA MS2830A

### **Common Setup Parameter**

| -                 |  |
|-------------------|--|
|                   | MX269028A: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g ERP-DSSS/CCK, IEEE 802.11g ERP-OFDM, |
| Standard          | IEEE 802.11g DSSS-OFDM, IEEE 802.11j, IEEE 802.11n, IEEE 802.11p,                        |
|                   | MX269028A-001 or MX269028A-002: IEEE 802.11ac  |
| Measuring Object  | Burst Signal, Continuous Signals: IEEE 802.11a/b/g/j/n/p                                 |
| Measuring Object  | Burst Signal: IEEE 802.11ac  |
|                   | MX269028A  |
|                   | IEEE 802.11n: 20 MHz, 40 MHz, 40 MHz (Upper), 40 MHz (Lower)                             |
|                   | IEEE 802.11j/p: 5, 10, 20 MHz  |
| Channel Bandwidth | MX269028A-001  |
|                   | IEEE 802.11ac: 20, 40, 80 MHz*   |
|                   | MX269028A-002  |
|                   | IEEE 802.11ac: 20, 40, 80, 160 MHz*  |
|                   | MX269028A  |
| PPDU Format       | IEEE 802.11n: Non-HT, HT-Mixed, HT-Greenfield  |
| PPD0 Format       | MX269028A-001  |
|                   | IEEE 802.11ac: VHT   |

\*: Refer to [Table1: Supported measurement range for IEEE 802.11ac signals]

### **Specifications**

The specification is the value after 30-minute warm-up at a constant ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°C to 28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

The specifications are defined under the following condition unless otherwise specified.

Attenuator mode: Mechanical Attenuator Only (MS2830A only)

### WLAN (802.11) Measurement software MX269028A

| Signal Analyzer                          |  |                                    | MS269xA MS2830A  |  |  |
|--|--|------------------------------------|--|--|--|
| Standard                                 |  |                                    | IEEE 802.11n HT Mixed, HT Greenfield, Non-HT, (Direc   | t Mapping supported), MCS = 0 to 76 supported  |  |
|  | Frequency Range  |                                    | 2.4 GHz band:<br>2412 MHz to 2472 MHz (channel No. 1 to 13)<br>2484 MHz (channel No. 14)<br>5 GHz band:<br>5180 MHz to 5320 MHz (channel No. 36 to 64)<br>5500 MHz to 5700 MHz (channel No. 100 to 140)<br>5745 MHz to 5825 MHz (channel No. 149 to 165)   |  |  |
| Modulation/<br>Frequency<br>Measurements | Measurement Level F  | Range                              | <ul> <li>2.4 GHz band: <ul> <li>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)</li> <li>-15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed)</li> <li>-9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed)</li> <li>-30 to +10 dBm (Preamp On)</li> </ul> </li> <li>5 GHz band: <ul> <li>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)</li> <li>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)</li> <li>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)</li> <li>-12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed)</li> <li>-6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed)</li> <li>-30 to +10 dBm (Preamp On)</li> </ul> </li> </ul> |  |  |
|  | Carrier Frequency<br>Accuracy  | 20 MHz<br>channel                  | Burst length $\geq$ 250 µs<br>± (Accuracy of reference frequency × Carrier frequency + 13) Hz (2.4 GHz band)<br>± (Accuracy of reference frequency × Carrier frequency + 16) Hz (5 GHz band)   |  |  |
|  |  | 40 MHz<br>channel                  | Burst length >250 $\mu$ s<br>± (Accuracy of reference frequency × Carrier frequency + 62) Hz (2.4 GHz band)<br>± (Accuracy of reference frequency × Carrier frequency + 102) Hz (5 GHz band)   |  |  |
|  |  | 20 MHz                             | Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal   |  |  |
|  | Residual Vector  | channel                            | ≤1.2% (rms) (2.4 GHz band)<br>≤1.6% (rms) (5 GHz band)   | ≤1.2% (rms) (2.4 GHz band) (Preamp Off)<br>≤1.6% (rms) (5 GHz band) (Preamp Off)   |  |
|  | Error  | 40 MHz<br>channel                  | Channel Estimation: SEQ, Phase Tracking: On, Amplitu<br>≤1.5% (rms) (2.4 GHz band)<br>≤1.9% (rms) (5 GHz band)   | de Tracking: Off, Burst signal<br>≤1.6% (rms) (2.4 GHz band) (Preamp Off)<br>≤2.0% (rms) (5 GHz band) (Preamp Off)   |  |
|  | Center Frequency Le  | akage Floor                        | ≤-50 dBc (nom.)  |  |  |
|  |  |                                    | Input attenuator ≥10 dB  |  |  |
| Amplitude                                | Tx Power Accuracy<br>(This is found from<br>root sum of squares<br>(RSS) of absolute | found from channel<br>m of squares | 2.4 GHz band:<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)<br>5 GHz band:<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | <ul> <li>2.4 GHz band:<br/>±0.6 dB (Preamp Off, or Preamp not installed)</li> <li>5 GHz band:<br/>±1.9 dB (Preamp Off, or Preamp not installed)</li> </ul> |  |
| Measurement                              | amplitude accuracy<br>and in-band  |                                    | Input attenuator ≥10 dB  |  |  |
|  | frequency<br>characteristics of<br>main unit.)                                       | 40 MHz<br>channel                  | 2.4 GHz band:<br>±0.7 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)  | 2.4 GHz band:<br>±0.8 dB (Preamp Off, or Preamp not installed)   |  |
|  |  | channer                            | 5 GHz band:<br>±0.7 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)  | 5 GHz band:<br>±2.0 dB (Preamp Off, or Preamp not installed)   |  |

MS269xA MS2830A

| Signal Analyzer<br>Standard              |   | MS269xA<br>IEEE 802.11p  | MS2830A   |  |  |  |
|--|---|--|---|--|--|--|
| Standard                                 | Frequency Range   | 5835 MHz to 5925 MHz (channel No. 167 to 185)  |   |  |  |  |
| Modulation/<br>Frequency<br>Measurements | Measurement Level Range   | 300 MHz to 862 MHz<br>5835 MHz to 5925 MHz (Channel No. 167 to 185):<br>-15 to +30 dBm (MS269xA Preamp Off, or Preamp no<br>-12 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-6 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-30 to +10 dBm (Preamp On)<br>300 MHz to 862 MHz:<br>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not<br>-15 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-9 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-30 to +10 dBm (Preamp On) | ot installed, MS2830A-045 not installed)<br>installed, MS2830A-045 installed)<br>ot installed)<br>ot installed, MS2830A-045 not installed)                                  |  |  |  |
|  | Carrier Frequency Accuracy  | 5 MHz channel: Burst length $\geq$ 1 ms, 10 MHz channel: Bu 20 MHz channel: Burst length $\geq$ 250 µs $\pm$ (Accuracy of reference frequency × Carrier frequency  | + 16) Hz  |  |  |  |
| Modulation/<br>Frequency<br>Measurements | Residual Vector Error   | Channel Estimation: SEQ, Phase Tracking: On, Amplitude<br>5835 MHz to 5925 MHz (channel No. 167 to 185):<br>≤1.5% (rms)<br>300 MHz to 862 MHz:<br>≤0.5% (rms)  | e Tracking: Off, Burst signal<br>5835 MHz to 5925 MHz (channel No. 167 to 185):<br>≤1.6% (rms) (Preamp Off)<br>300 MHz to 862 MHz:<br>≤0.8% (rms) (Preamp Off)              |  |  |  |
|  | Center Frequency Leakage Floor  | ≤–50 dBc (nom.)  |   |  |  |  |
| Amplitude<br>Measurement                 | Tx Power Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | Input attenuator $\ge$ 10 dB<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | 5835 MHz to 5925 MHz (Channel No.: 167 to 185)<br>± 1.9 dB (at Preamp Off, or Preamp not installed.)<br>300 MHz to 862 MHz<br>±0.7 dB (Preamp Off, or Preamp not installed) |  |  |  |
| Standard                                 |   | IEEE 802.11a   |   |  |  |  |
| Modulation/                              | Frequency Range<br>Measurement Level Range  | 5180 MHz to 5320 MHz (channel No. 36 to 64)<br>5500 MHz to 5700 MHz (channel No. 100 to 140)<br>5745 MHz to 5825 MHz (channel No. 149 to 165)<br>-15 to +30 dBm (MS269XA Preamp Off, or Preamp not<br>-12 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-6 to +30 dBm (MS2830A Preamp Off, or Preamp not in   | installed, MS2830A-045 not installed)   |  |  |  |
| Frequency<br>Measurements                |   | -30 to +10 dBm (Preamp On)<br>Burst length ≥250 µs   | Istalieu, WS2050A-045 Instalieu)  |  |  |  |
|  | Carrier Frequency Accuracy  | ± (Accuracy of reference frequency × Carrier frequency   |   |  |  |  |
|  | Residual Vector Error   | Channel Estimation: SEQ, Phase Tracking: On, Amplitude<br>≤1.5% (rms)  | $\leq 1.6\%$ (rms) (Preamp Off)   |  |  |  |
|  | Center Frequency Leakage Floor  | ≤–50 dBc (nom.)  |   |  |  |  |
| Amplitude<br>Measurement                 | Tx Power Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | Input attenuator $\geq 10 \text{ dB}$<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)  | ±1.9 dB (Preamp Off, or Preamp not installed)   |  |  |  |
| Standard                                 | characteristics of main unit.)  | IEEE 802.11b, IEEE 802.11g ERP-DSSS/CCK  |   |  |  |  |
|  | Frequency Range   | 2412 MHz to 2472 MHz (channel No.1 to 13)<br>2484 MHz (channel No.14)  |   |  |  |  |
| Modulation/<br>Frequency                 | Measurement Level Range   | -15 to +30 dBm (MS269xA Preamp Off, or Preamp not<br>-15 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-9 to +30 dBm (MS2830A Preamp Off, or Preamp not ir<br>-30 dBm to +10 dBm (at Preamp On)   | installed, MS2830A-045 not installed)   |  |  |  |
| Measurements                             | Carrier Frequency Accuracy  | Burst length $\geq$ 400 µs<br>± (Accuracy of reference frequency × Carrier frequency + 21) Hz  |   |  |  |  |
|  | Residual Vector Error   | Specify filter with same characteristics as used for meas ≤1.2% (rms)  | urement signal, Burst signal<br>≤1.9% (rms) (Preamp Off)  |  |  |  |
|  | Center Frequency Leakage Floor  | ≤-50 dBc (nom.)  |   |  |  |  |
| Amplitude<br>Measurement                 | Tx Power Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | Input attenuator $\geq$ 10 dB<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)  | ±0.6 dB (Preamp Off, or Preamp not installed)   |  |  |  |
| Standard                                 |   | IEEE 802.11g ERP-OFDM  | 1   |  |  |  |
|  | Frequency Range   | 2412 MHz to 2472 MHz (channel No.1 to 13)<br>2484 MHz (channel No.14)  |   |  |  |  |
| Modulation/<br>Frequency                 | Measurement Level Range   | -15 to +30 dBm (MS269xA Preamp Off, or Preamp not i<br>-15 to +30 dBm (MS2830A Preamp Off, or Preamp not<br>-9 to +30 dBm (MS2830A Preamp Off, or Preamp not ir<br>-30 to +10 dBm (Preamp On)  | installed, MS2830A-045 not installed)   |  |  |  |
| Measurements                             | Carrier Frequency Accuracy  | Burst length $\geq$ 250 µs<br>± (Accuracy of reference frequency × Carrier frequency   |   |  |  |  |
|  | Residual Vector Error   | Channel Estimation: SEQ, Phase Tracking: On, Amplitude<br>≤1.2% (rms)  | e Tracking: Off, Burst signals<br>≤1.2% (rms) (Preamp Off)  |  |  |  |
|  | Center Frequency Leakage Floor  | ≤-50 dBc (nom.)  | · · · · · · · · · · · · · · · · · · ·   |  |  |  |
| Amplitude<br>Measurement                 | Tx Power Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | Input attenuator ≥10 dB<br>±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)  | ±0.6 dB (Preamp Off, or Preamp not installed)   |  |  |  |

MS269xA MS2830A

| Signal Analyzer                          |  | MS269xA  | MS2830A                                       |  |  |  |  |
|--|--|--|---|--|--|--|--|
| Standard                                 |  | IEEE 802.11j   |   |  |  |  |  |
|  | Frequency Range  | 4920 MHz to 4980 MHz   |   |  |  |  |  |
| Modulation/<br>Frequency<br>Measurements | Measurement Level Range  | Level Range<br>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)<br>-12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed)<br>-6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed)<br>-30 to +10 dBm (Preamp On) |   |  |  |  |  |
| Measurements                             | Carrier Frequency Accuracy   | Burst length ≥1 ms (Channel Bandwidth: 5 MHz), or Burst length ≥500 $\mu$ s (Channel Bandwidth: 10 MHz),<br>Burst length ≥250 $\mu$ s (Channel Bandwidth: 20 MHz)<br>± (Accuracy of reference frequency × Carrier frequency + 16) Hz   |   |  |  |  |  |
| Modulation/                              | Residual Vector Error  | Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal   |   |  |  |  |  |
| Frequency                                | Residual vector Error  | ≤1.5% (rms)  | ≤1.6% (rms) (Preamp Off)                      |  |  |  |  |
| Measurements                             | Center Frequency Leakage Floor   | ≤-50 dBc (nom.)  |   |  |  |  |  |
|  | Tx Power Accuracy  | Input attenuator ≥10 dB  |   |  |  |  |  |
| Amplitude<br>Measurement                 | (This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | ±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | ±1.9 dB (Preamp Off, or Preamp not installed) |  |  |  |  |

#### 802.11ac (80 MHz) Measurement software MX269028A-001 (MS2830A Option) 802.11ac (160 MHz) Measurement software MX269028A-002 (MS269xA Option)

| Signal Analyzer           |   |                    | MS269xA  | MS2830A                                       |  |  |  |
|---------------------------|---|--------------------|--|---|--|--|--|
| Standard                  |   |                    | IEEE 802.11ac  |   |  |  |  |
|                           | Frequency Measurements                  |                    | 20 MHz Channel/40 MHz Channel<br>5180 MHz to 5320 MHz (channel No. 36 to 64)<br>5500 MHz to 5700 MHz (channel No. 100 to 140)<br>5745 MHz to 5825 MHz (channel No. 149 to 165)<br>80 MHz Channel/160 MHz Channel<br>5180 MHz to 5825 MHz (channel No. 36 to 165)   |   |  |  |  |
|                           | Measurement Level F                     | Range              | 20 MHz Channel/40 MHz Channel<br>-15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)<br>-15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed)<br>-9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed<br>-30 to +10 dBm (Preamp On)<br>80 MHz Channel/160 MHz Channel<br>-10 to +30 dBm (MS269xA Preamp Off, or Preamp not installed)<br>-10 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed)<br>-4 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed)<br>-20 to +10 dBm (Preamp On) |   |  |  |  |
|                           |   | 20 MHz<br>channel  | Burst length $\geq$ 250 µs<br>± (Accuracy of reference frequency × Carrier frequency   | + 16) H <del>7</del>                          |  |  |  |
| Modulation/               | Comion Francisco                        | 40 MHz<br>channel  | Example 1 contact of reference frequency × Carrier frequency $\pm$<br>Burst length $\geq$ 250 µs $\pm$ (Accuracy of reference frequency × Carrier frequency $\pm$  |   |  |  |  |
| Frequency<br>Measurements | Carrier Frequency<br>Accuracy           | 80 MHz<br>channel  | Burst length $\geq$ 250 µs<br>± (Accuracy of reference frequency × Carrier frequency   | + 102) Hz                                     |  |  |  |
|                           |   | 160 MHz<br>channel | Burst length $\geq$ 250 µs<br>± (Accuracy of reference frequency × Carrier frequency<br>+ 102) Hz  | _   |  |  |  |
|                           | Residual Vector Error                   | 20 1411-           | Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal   |   |  |  |  |
|                           |   | 20 MHz<br>channel  | ≤0.7% (rms) (Preamp Off)<br>≤0.9% (rms) (Preamp On)  | ≤0.9% (rms) (Preamp Off)                      |  |  |  |
|                           |   | 40 MHz             | Channel Estimation: SEQ, Phase Tracking: On, Amplitude   | Tracking: Off, Burst signal                   |  |  |  |
|                           |   | channel            | ≤0.8% (rms) (Preamp Off)<br>≤1.0% (rms) (Preamp On)  | ≤1.0% (rms) (Preamp Off)                      |  |  |  |
|                           |   |                    | Channel Estimation: SEQ, Phase Tracking: On, Amplitude   | Tracking: Off, Burst signal                   |  |  |  |
|                           |   | 80 MHz<br>channel  | ≤0.9% (rms) (Preamp Off)<br>≤1.1% (rms) (Preamp On)  | ≤1.1% (rms) (Preamp Off)                      |  |  |  |
|                           |   | 160 MHz<br>channel | Channel Estimation: SEQ, Phase Tracking: On,<br>Amplitude Tracking: Off, Burst signal<br>≤1.5% (rms) (Preamp Off)<br>≤1.7% (rms) (Preamp On)   | _   |  |  |  |
|                           | Center Frequency Lea                    | akage Floor        | ≤–50 dBc (nom.)  |   |  |  |  |
|                           |   | 20 MHz             | Input attenuator ≥10 dB  |   |  |  |  |
|                           | Tx Power Accuracy                       | channel            | ±0.6 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | ±1.9 dB (Preamp Off, or Preamp not installed) |  |  |  |
|                           | (This is found from root sum of squares | 40 MHz             | Input attenuator ≥10 dB  |   |  |  |  |
| Amplitude                 | (RSS) of absolute<br>amplitude accuracy | channel            | ±0.7 dB (Preamp Off, or Preamp not installed)<br>±1.1 dB (Preamp On)   | ±2.0 dB (Preamp Off, or Preamp not installed) |  |  |  |
| Measurement               | and in-band                             | 80 MHz             | Input attenuator ≥10 dB  |   |  |  |  |
|                           | frequency<br>characteristics of         | channel            | ±1.2 dB (Preamp Off, or Preamp not installed)<br>±1.6 dB (Preamp On)   | ±3.2 dB (Preamp Off, or Preamp not installed) |  |  |  |
|                           | main unit.)                             | 160 MHz<br>channel | Input attenuator ≥10 dB<br>±1.3 dB (Preamp Off, or Preamp not installed)<br>±1.7 dB (Preamp On)  | _   |  |  |  |

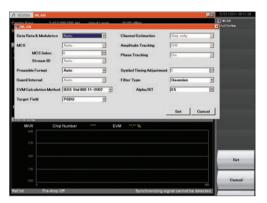
### WLAN (802.11) Measurement Software MX269028A 802.11ac (80 MHz) Measurement Software MX269028A-001 802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

### **Measurement Functions**

#### • Parameter Setting

Standard-compliant parameters as well as frequency/level are set at the following screen.

Parameters other than numerical values are set easily by selecting pulldown menus.



### **Modulation Analysis Function**

### Summary

This displays detected parameters as well as numerical results. The dispersion of RF characteristics is measured easily using simultaneous display of maximum and average values.

#### MX269028A (IEEE 802.11a, 11b, 11g, 11j, 11n, 11p)

|                    |            |        |            |            |               |        | E VIAN I         |
|--------------------|------------|--------|------------|------------|---------------|--------|------------------|
|                    | 000 000 Hz | Input  |            | 00 dBm     |               |        | Trace Mode       |
| indard I           | EEE802.11n |        |            | 4 dB       |               |        |                  |
| ndwidth            | 20MHz      |        |            | Mea        | surement Mode | Single | EVM vs Subcarrie |
| suit               |            |        |            |            | Average & Max | 10/10  |                  |
|                    |            |        | Avg/Max    |            |               |        |                  |
| Frequency Error    |            | 49 /   | 1.88 Hz    |            |               |        | EVM vs Symbo     |
|                    | 0.00       |        | 0.001 ppm  |            |               |        |                  |
| Symbol Clock Error |            |        | -0.051 ppm |            |               |        |                  |
| Transmit Power     | -10.3      |        | -10.71 dBm |            |               |        | 20               |
|                    |            |        |            |            |               |        | SpectralFlatee   |
| mary               |            |        |            |            |               | _      | 100000           |
| EVM(rms)           |            | 0,491  | 0.74 %     | Detect Par | emeter        |        | Summary          |
| Data EVM           |            | 0.501  | 0.75 %     | MCS In     | dex           |        | _                |
| Pilot EVM          |            | 0.401  | 0.56 %     | Str        | am ID         |        |                  |
| EVM(Peak)          |            |        | 2.98 %     | Length     |               |        |                  |
| Symbol Number      |            |        |            |            |               | Long   |                  |
| Subcarrier Num     | 247        |        |            |            |               |        |                  |
| Quadrature Error   |            |        | 0.20 deg.  |            |               |        |                  |
| IQ Gain Imbalance  |            | 0.001  | 0.00 dB    |            |               |        |                  |
|                    | eakage 4   | 67,511 | -67.07 dB  |            |               |        |                  |

- Frequency Error
- Symbol Clock Error/Chip Clock Error
- Transmit Power
- EVM [rms]
- (Data EVM, Pilot EVM, SIG EVM (rms), L-SIG EVM (rms), HT-SIG EVM (rms))
- EVM [Peak]
- (Symbol Number, Subcarrier Number/Chip Number)
- Quadrature Error
- IQ Gain Imbalance
- Center Frequency Leakage
   Phase Error
- Phase Error
- Magnitude Error
- IQ Origin Offset
- Detect Parameter

(Data Rate, Modulation Method, Symbol Length/Chip Length, Preamble, MCS Index, Stream ID, Symbol Length, GI)

#### MX269028A-001/002 (IEEE 802.11ac)



MS269xA

- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM [rms] (Data EVM, Pilot EVM, L-SIG EVM (rms), VHT-SIG-A EVM (rms), VHT-SIG-B EVM (rms))
- EVM [Peak] (Symbol Number, Subcarrier Number)
- Quadrature Error\*
- IQ Gain Imbalance\*
- Center Frequency Leakage
- Detect Parameter
- (MCS Index, Stream ID, Symbol Length, GI)
- \*: Exclude Channel Bandwidth 160 MHz setting

### Constellation/Numerical Result

The Constellation/numerical value results are displayed at the top of the screen. The Constellation screen displays IQ coordinates and subcarrier information for the position selected by the marker. The dispersion of characteristics is measured easily using simultaneous display of maximum and average values.

### MX269028A (IEEE 802.11a, 11b, 11g, 11j, 11n, 11p)



### Measurement signal:

- IEEE 802.11a, 11g (ERP-OFDM, DSSS-OFDM), 11j, 11n, 11p
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM [rms/peak]
- Center Frequency Leakage

| MS269xA | MS2830A |
|---------|---------|
|---------|---------|



### Measurement signal: IEEE 802.11b, 11g (ERP-DSSS/CCK)

- Frequency Error
- Chip Clock Error
- Transmit Power
- EVM [rms/peak]
- IQ Origin Offset

### MX269028A-001/002 (IEEE 802.11ac)



#### Measurement Signal: IEEE 802.11ac

- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM (rms/Peak)
- Center Frequency Leakage

#### • EVM vs. Subcarrier

This displays the EVM vs. Subcarrier graphs (horizontal axis: Subcarrier, vertical axis: EVM) at the bottom of the screen. The EVM calculation method can be selected from:

Averaged: Mean value of all analysis symbols Each: Symbol value selected by the marker

It is useful for checking in-band interference signals.

| MKR(AveJMax) St | bcarrier 17 | (5.3125MHz) EVM | 0.90 % / | 2.49 % | Symbol Number | 10 |
|-----------------|-------------|-----------------|----------|--------|---------------|----|
|                 |             |                 |          |        |               |    |
|                 |             |                 |          |        |               |    |
|                 |             |                 |          |        |               | V  |

#### • EVM vs. Symbol

This displays the EVM vs. Symbol graphs (horizontal axis: Symbol, vertical axis: EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific symbol.

| EVM v | s Symbol            |     |     |          |        |    |
|-------|---------------------|-----|-----|----------|--------|----|
|       | MKR(AveJMax) Symbol |     | EVM | 0.70 % / | 1.34 % |    |
|       |                     |     |     |          |        |    |
|       |                     |     |     |          |        |    |
|       |                     |     |     |          |        |    |
|       |                     | Ann |     |          |        | Т, |
|       |                     |     |     |          |        | 3  |

#### • EVM vs. Chip

This displays the EVM vs. Chip graphs (horizontal axis: Chip, vertical axis: EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific chip.

| MKR(AveJMax) Chip Number | 6168        | EVM             | 1.13 % / | 3.69 % |           |
|--------------------------|-------------|-----------------|----------|--------|-----------|
|                          |             |                 |          |        |           |
|                          | RETRA       | <b>Una</b> lski | iili, b. | in ar  | White Int |
| 15 March Back line       | 1.1.1.1.1.1 | 1.11            |          |        | THE LEAD  |

#### • Phase Error vs. Chip

This displays the Phase Error vs. Chip graphs (horizontal axis: Chip, vertical axis: Phase Error) at the bottom of the screen.

It is useful for checking a phase change in time direction.

| MKR   | Chip Number | 3698 | Phase Error      | 102  | den  |
|-------|-------------|------|------------------|------|------|
| 10.00 | Chip Humber | 0000 | Priese Enter     | 1.02 | ueg. |
|       |             |      |                  |      |      |
|       |             |      |                  |      |      |
|       |             |      |                  |      |      |
|       | -           |      | Alaritad Instant |      |      |
|       |             |      |                  |      |      |
|       |             |      |                  |      |      |
|       |             |      |                  |      |      |

### WLAN (802.11) Measurement Software MX269028A 802.11ac (80 MHz) Measurement Software MX269028A-001 802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

#### Spectral Flatness

A graph of Amplitude vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Amplitude), Phase vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Phase) and Group Delay vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Group Delay) can be selected.

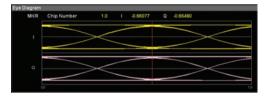
It is useful for checking frequency response (Amplitude, Phase, Group Delay).

| MKR.                   | Subcarrie    | -22  | (-6.875MH    | z) Amplitude | 0.04 0 | 1B       |           |
|------------------------|--------------|------|--------------|--------------|--------|----------|-----------|
| Flatn                  | ess(Outside) | Max: | 0.04 dB (Sub | -22)         | Min    | -0.05 dB | (Sub:26)  |
|                        | ess(inside)  | Max: | 0.02 dB (Sub |              | Min    | -0.03 dB | (Sub:-12) |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
|                        | -20          |      |              |              |        |          |           |
|                        |              |      |              |              |        |          |           |
| d Flatr                | ness(Phase   | _    |              | _            |        | _        |           |
| I Flatr<br>IKR         |              | _    |              | z) Phase     | -0.12  | ieg.     |           |
| I Flatr<br>IKR         | ness(Phase   | _    |              | z) Phase     | -0.12  | leg.     |           |
| i Flatr<br>/KR<br>1020 | ness(Phase   | _    |              | z) Phase     | -0.12  | ieg.     |           |
|                        | ness(Phase   | _    |              | z) Phase     | -0.12  | ieg.     |           |

| MKR | Subcarrier | -23 | (-7.1875MHz)Group Delay | 0.38 ns |
|-----|------------|-----|-------------------------|---------|
|     |            |     |                         |         |
|     |            |     |                         |         |
|     | ~~~        |     |                         |         |
|     |            |     |                         |         |
|     |            |     |                         |         |
|     |            |     |                         |         |

#### • Eye Diagram

This displays the I/Q vs. Chip graphs (horizontal axis: Chip, vertical axis: I/Q) at the bottom of the screen.



### **Power vs. Time Function\***

#### Numerical Results

The numerical results are displayed at the top of the screen.

\*: Supports IEEE 802.11a/b/g/j/n/p

- Transmit Power
- Power Flatness Max
- Carrier Off Power
- On/Off Ratio
- Peak PSD
- Transient Time Power-on Ramp
  - Power-off Ramp

The dispersion of characteristics is measured easily using simultaneous display of maximum and average values.

| A MS28MA WEAN             |                  |               |                |                  | -12     | 5/31/2011 08:36:34 |
|---------------------------|------------------|---------------|----------------|------------------|---------|--------------------|
| Carrier Freq.             | 2 412 000 000 Hz | Input Level   | -10.00 cBm     |                  |         | Pomor vo Timo      |
| Standard                  | EEE802.11b       |               |                |                  |         |                    |
|                           |                  |               |                | Measurement Mode | Single  | Analysis Time      |
| Result                    |                  |               |                | Average & Max    | 10/10   |                    |
|                           |                  |               |                | ,                | wg/Max  | Standard           |
| Transmit Power            | -11.64 /         | -11.63 dBm    | Transient Time |                  |         | IEEEB02.116        |
| Power Flatness N          | tex -10.04 /     | -10.02 dBm    | Power-on Re    | mp 0.93 /        | 1.00 µs | ALLONG THE         |
| Carrier Off Power         | -64.96 /         | -64.66 dBm    | Power-down     | Ramp 0.85 /      | 0.90 µs | Measuring Object   |
| On/Off Ratio              |                  | 53.90 dB      |                |                  |         | Burst Cost         |
| Peak PSD                  | -20.32 /         | -20.32 dBm/MH |                |                  |         |                    |
|                           |                  |               |                |                  |         | Channel Bandwidth  |
| Power vs Time - Bu<br>MKR |                  | -13.22 6      | -              |                  |         | 20141              |
|                           | 0.0 µs           | -13.22 et     | 310            |                  |         | PPOU Format        |
|                           |                  |               |                |                  |         |                    |
| -11.04                    |                  |               |                |                  |         | HT-Mont            |
|                           |                  |               |                |                  |         |                    |
|                           |                  |               |                |                  |         | Signal Setup       |
|                           |                  |               |                |                  |         | _                  |
|                           |                  |               |                |                  |         |                    |
| -                         |                  |               |                |                  | -       |                    |
|                           |                  |               |                |                  |         | _                  |
|                           |                  |               |                |                  |         |                    |
|                           |                  |               |                |                  |         |                    |
| Reline Pre                | -Amp Off         |               |                |                  |         | 1.42 610           |

#### • Burst

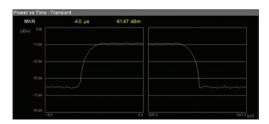
This displays the Power vs. Time graph (horizontal axis: Time, vertical axis: Power) for one burst waveform at the bottom of the screen.

| MKR    | 0.0 µs | -13.22 dBm |  |
|--------|--------|------------|--|
|        |        |            |  |
| -17.64 |        |            |  |
| -31.64 |        |            |  |
| -51.64 |        |            |  |
| -71.64 |        |            |  |
| -9164  |        |            |  |

#### Transient

This zoom-displays the rising and falling edges of a burst waveform (horizontal axis: Time, vertical axis: Power) at the bottom of the screen. Displayed time scale is adjustable.

It is useful for checking power-on ramp and power-down ramp of burst signal.



MS269xA MS2830A

### Powerful Capture & Replay Function for Fault Analysis\*1

When faults are detected on-site, this function captures<sup>\*2</sup> and saves<sup>\*2</sup> signals to a file for later replay by the WLAN Measurement Software to troubleshoot items, such as EVM measurements.

- \*1: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz.
- \*2: Data for 1 burst signal



### Example of R&D use

- Save data for comparing each DUT test version
- → Supports comparison of retrofitting improvement effects

### Example of production line use

- Save delivery inspection data
- → Supports rechecking of performance data for troubleshooting postdelivery faults

### WLAN (802.11) Measurement Software MX269028A 802.11ac (80 MHz) Measurement Software MX269028A-001 802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

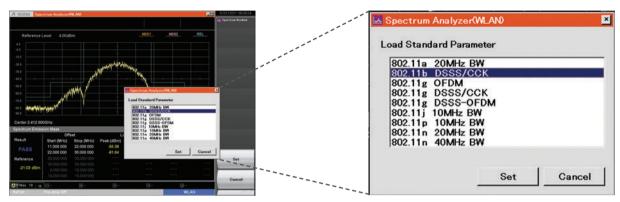
MS269xA MS2830A

### MS269xA/MS2830A Main Unit Measurement Functions

The following measurements are performed by calling the main-frame spectrum analyzer functions. These functions prepare each measurement standard templates.

• Adjacent Channel Leakage Power (ACP)

- Occupied Bandwidth (OBW)
- Spectrum Emission Mask (SEM)
- Spurious Emission



ex.) Template of Spectrum Emission Mask (SEM)

| Each Measurement | Standard | Temp | ates |
|------------------|----------|------|------|
|                  |          |      |      |

| Standard                     | Bandwidth |              | Supported                                     | Template         |   |
|------------------------------|-----------|--------------|---|------------------|---|
| Standard                     | Bandwidth | ACP          | OBW   | SEM              | Spurious  |
| IEEE 802.11n                 | 20 MHz    | ✓ TELEC T403 | ✓ TELEC T403<br>✓ ETSI                        | ✓ IEEE<br>✓ ETSI | <ul> <li>✓ TELEC T403</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
| IEEE 802.11n                 | 40 MHz    | ✓ TELEC T403 | ✓ TELEC T403<br>✓ ETSI                        | ✓ IEEE<br>✓ ETSI | <ul> <li>✓ TELEC T403</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
|                              | 5 MHz     | _            | ✓ ETSI  | ✓ ETSI           | <ul> <li>✓ TELEC T405</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
| IEEE 802.11p                 | 10 MHz    | _            | ✓ ETSI  | ✓ ETSI           | <ul> <li>✓ TELEC T405</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
|                              | 20 MHz    | ✓ TELEC T403 | ✓ TELEC T403<br>✓ ETSI                        | ✓ ETSI           | <ul> <li>✓ TELEC T403</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
| IEEE 802.11a                 | _         | ✓ TELEC T403 | ✓ TELEC T403<br>✓ ETSI                        | ✓ IEEE<br>✓ ETSI | <ul> <li>✓ TELEC T403</li> <li>✓ ETSI</li> <li>✓ FCC</li> </ul> |
| IEEE 802.11b                 | —         | —            | ✓ TELEC T401                                  | ✓ IEEE           | <ul> <li>✓ TELEC T401</li> <li>✓ ETSI</li> </ul>                |
| IEEE 802.11g<br>ERP-DSSS/CCK | _         | _            | ✓ TELEC T401                                  | ✓ IEEE           | ✓ TELEC T401<br>✓ ETSI  |
| IEEE 802.11g<br>ERP-OFDM     | _         | _            | ✓ TELEC T401<br>✓ ETSI                        | ✓ IEEE<br>✓ ETSI | ✓ TELEC T401<br>✓ ETSI  |
| IEEE 802.11g<br>DSSS-OFDM    | _         | _            | ✓ TELEC T401<br>✓ ETSI                        | ✓ IEEE<br>✓ ETSI | ✓ TELEC T401<br>✓ ETSI  |
|                              | 5 MHz     | _            | ✓ ETSI  | ✓ ETSI           | ✓ TELEC T405  |
| IEEE 802.11j                 | 10 MHz    | _            | ✓ ETSI  | ✓ IEEE<br>✓ ETSI | ✓ TELEC T405  |
| -                            | 20 MHz    | ✓ TELEC T403 | <ul><li>✓ TELEC T403</li><li>✓ ETSI</li></ul> | ✓ IEEE<br>✓ ETSI | ✓ TELEC T403  |
|                              | 20 MHz    | _            | ✓ ETSI  | ✓ IEEE<br>✓ ETSI | _   |
| IEEE 802.11ac                | 40 MHz    | _            | ✓ ETSI  | ✓ IEEE<br>✓ ETSI | _   |
|                              | 80 MHz    | _            | ✓ ETSI  | ✓ IEEE           | _   |
|                              | 160 MHz   | _            | ✓ ETSI  | ✓ IEEE           | _   |

### W-CDMA BS Measurement Software MX269030A

The W-CDMA BS Measurement Software MX269030A is targeted at manufacturing of W-CDMA/HSPA base stations, repeaters, and power amplifiers. It supports measurement of the RF Tx characteristics of high-speed W-CDMA/HSPA downlink signals. Installation in the MS269xA or MS2830A supports fast, high-accuracy measurements to cut tact times.

#### Functions Supporting Manufacturing of W-CDMA/HSPA Base Stations

Supports fast, high-accuracy modulation analyses and spectrum measurements for manufacturing W-CDMA/HSPA base stations, repeaters, and power amplifiers.

#### Modulation Analysis

- Mean Power
- CPICH Power
- Carrier Frequency Error
- Vector Error (EVM) [Peak/rms]
- Peak Code Domain Error (PCDE)
- IQ Origin Offset
- Relative Code Domain Error (RCDE)
- Scrambling Code
- PCDE CH/SF/Slot
- Constellation (all codes)
- Code Domain Graph

### Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. The specifications are defined under the following condition unless otherwise specified. Attenuator mode: Mechanical Attenuator Only (MS2830A only)

| Signal Analyzer          |   | MS269xA   | MS2830A  |  |  |
|--------------------------|---|---|--|--|--|
| _                        | Target Signal   | W-CDMA/HSPA Downlink  |  |  |  |
| Common<br>Specifications | Frequency Range   | 400 MHz to 3 GHz  |  |  |  |
| specifications           | Input Level Setting Range   | –24 to +30 dBm (Preamp Off, or Preamp not installed)  |  |  |  |
|                          | Carrier Frequency Measurement   | Input level range: Input Level to Input Level –10 dB (Inpu<br>EVM = 1%  | tt Level ≥–4 dBm), for 1 wave multiplexed signals with                         |  |  |
|                          | Accuracy  | ± (Accuracy of reference frequency ×<br>Carrier frequency + 4) Hz   | ± (Accuracy of reference frequency ×<br>Carrier frequency + 6) Hz              |  |  |
|                          | Residual Vector Error   | Input level range: Input Level to Input Level –10 dB (Inpu<br>conforming to 3GPP TS 25.141 TestModel1   | tt Level ≥–4 dBm), for 64DPCH multiplexed signals                              |  |  |
|                          |   | ≤1.0% (rms)   | ≤1.3% (rms)  |  |  |
| Modulation/<br>Frequency | Code Domain Power Relative  | Input level range: Input Level to Input Level –10 dB (Inpu<br>25.141 TestModel2   | tt Level ≥–4 dBm), for signals conforming to 3GPP TS                           |  |  |
| Measurement              | Value Accuracy  | $\pm 0.02$ dB (Code Domain Power ≥–10 dBc)<br>$\pm 0.10$ dB (Code Domain Power ≥–30 dBc)  | ±0.02 dB (Code Domain Power ≥–10 dBc)<br>±0.15 dB (Code Domain Power ≥–30 dBc) |  |  |
|                          | Residual Code Domain Error  | Input level range: Input Level to Input Level $-10 \text{ dB}$ (Input Level $\geq -4 \text{ dBm}$ ), for signals conforming to 3GPP TS 25.141 TestModel3  |  |  |  |
|                          |   | ≤-50 dB   | ≤–47 dB  |  |  |
|                          | Code Domain Error Accuracy  | Input level range: Input Level to Input Level $-10 \text{ dB}$ (Input Level $\geq -4 \text{ dBm}$ ), for signals conforming to 3GPP TS 25.141 TestModel3, with code domain error of $-40 \text{ dBc}$ |  |  |  |
|                          |   | ±0.75 dB  | ±0.79 dB   |  |  |
| Amplitude<br>Measurement | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | At 18°C to 28°C, after calibration, for signals with the inp (Input Level $\geq -4$ dBm)<br>±0.6 dB   | but level range of Input Level to Input Level –10 dB                           |  |  |
|                          | Occupied Bandwidth Measurement  | Attained with 99% method on spectrum waveforms atta   | ined by FFT calculation.   |  |  |
|                          | Adjacent Channel Leakage Power  | Performs RRC filter processing ( $\alpha = 0.22$ ) on spectrum waveforms attained by FFT calculation.<br>18°C to 28°C, for single carrier, Input Level $\geq -4$ dBm                                  |  |  |  |
| Spectrum<br>Measurement  | Measurement   | -65 dB (5 MHz offset)<br>-66 dB (10 MHz offset)   | –64 dB (5 MHz offset, nom.)<br>–65 dB (10 MHz offset, nom.)                    |  |  |
|                          | Spectrum Emission Mask  | 18°C to 28°C, for single carrier, Input Level ≥–4 dBm   | •  |  |  |
|                          | Measurement   | –78 dB/30 kHz (≥2.515 MHz offset)   | –77 dB/30 kHz (≥2.515 MHz offset, nom.)  |  |  |

### Spectrum

- Occupied Bandwidth (OBW)
- Adjacent Channel Leakage Power (ACLR)

MS269xA

Spectrum Emission Mask (SEM)

### W-CDMA BS Measurement Software MX269030A (Continued)

### **Measurement Functions**

### • Batch Modulation Analysis and Spectrum Measurements

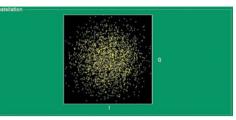
Measures all modulation analysis items (Mean Power, Carrier Frequency Error/EVM/PCDE, etc.), and spectrum measurements (ACLR/OBW/SEM) in about 100 ms to cut tact times.



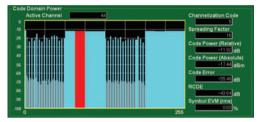
| MS38MA W-CDMAE     | 6 Maassarieri | eid -    |         |         |    | 7/13/2012 23 49:40          |
|--------------------|---------------|----------|---------|---------|----|-----------------------------|
| easure End         |               |          |         |         | 91 | W-COMATE: Minana<br>Minanam |
| Spectrum Emission  | Mask          |          |         |         | -  | Modulation Analysi          |
| Measure Count      |               | Pass     |         |         |    | Result                      |
|                    |               | dBm      |         |         |    | 1                           |
| -12.500MHz to      | -8.000MHz     | -7834    | -72.88  |         |    |                             |
| -8.000MHz to       | -4.000MHz     | -7655    | 71110   |         |    |                             |
| -4.000MHz to       | 3.515MHz      | -07.82   | -82.36  |         |    |                             |
| -3.515MHz to       | -2.716MHz     | -9028    | -54.92  |         |    |                             |
| -2.715MHz to       | 2.515MHz      | -65.64   | -008    |         |    |                             |
| 2.515MHz1          | 0 2.715MHz    | -0154    | -81.08  |         |    | Occupied Bandwidt           |
| 2.716MHz1          | 0 3.515MHz    | -88.11   | -81.65  |         |    | Result                      |
| 3.515MHz t         | 4.000MHz      | -47.22   | -01.05  |         |    |                             |
| 4.000MHz t         | 8.000MHz      | -75.23   | -7027   |         |    | Spectrum Emission           |
| B.000MHz to        | 12.500MHz     | -764     | -7096   |         |    | Mask Result                 |
| Adjacent Channel L | eekage poe    | er Ratio |         |         |    | Adjacent Channel            |
| Measure Count      |               | Average  | Minimum | Maximum |    | Ratio Result                |
|                    | -10MHz        | -0.23    | -0.73   | -47.23  | 68 |                             |
|                    | -6MHz         | -01.09   | -91,00  | -06.09  | 68 |                             |
|                    | 6MHz          | -65.18   | -6516   | -05.10  | 48 |                             |
|                    | 10MHz         | -0.55    | -14.55  | -06.52  | 68 |                             |

### Convenient Graph Display

Supports convenient graph function for checking signals to troubleshoot unexpected problems on production lines, etc., as quickly as possible.



Constellation (all codes)



Code Domain Display

### 5G Standard Measurement Software (Base License) MX285051A Pre-Standard CP-OFDM Downlink MX285051A-001 Pre-Standard CP-OFDM Uplink MX285051A-051

MS2850A

The MX285051A-001 and MX285051A-051 software packages are for measuring the RF characteristics of CP-OFDM modulation downlink and uplink signals expected to be used for 5G demonstration tests and test operations.

### Single Carrier Measurement

This function analyzes a 100 MHz band carrier to display the constellation, frequency error, Tx power, modulation accuracy (EVM), etc.

### **Multicarrier Measurement**

Combination with the Analysis Bandwidth Extension to 1 GHz MS2850A-034 option supports batch (all-at-once) analysis of up to eight 100 MHz band carriers to display the frequency error for each carrier, Tx power, EVM, timing difference, etc.

| Analysis Bandwidth | Batch Analysis Carrier Count |
|--------------------|------------------------------|
| 255 MHz (standard) | 2                            |
| 510 MHz (option)   | 5                            |
| 1 GHz (option)     | 8                            |

#### Numeric Results

| Name                  | Unit       | Single Carrier<br>Measurement | Multicarrier<br>Measurement | Remarks  |
|-----------------------|------------|-------------------------------|-----------------------------|--|
| Common                |            |                               |                             |  |
| Frequency Error       | Hz, ppm    | $\checkmark$                  | ✓                           | Displays frequency error   |
| Transmit Power        | dBm        | $\checkmark$                  | ✓                           | Displays Tx power  |
| Total EVM (rms/peak)  | %, dB      | $\checkmark$                  | ✓                           | Displays EVM rms/peak values   |
| Origin Offset         | dB         | $\checkmark$                  |                             | Displays Origin Offset value   |
| Time Offset           | ns         | $\checkmark$                  |                             | Displays time offset between Frame header and trigger in ns units<br>Displays Trigger Switch = On only when using external trigger |
| Timing Difference     | ns         |                               | √                           | Displays timing difference between reference carrier and each carrier  |
| Symbol Clock Error    | ppm        | ✓                             |                             | Displays Symbol Clock Error  |
| IQ Skew               | ns         | ✓                             |                             | Displays IQ Skew   |
| IQ Imbalance          | dB         | ✓                             |                             | Displays IQ Imbalance in dB units  |
| IQ Quadrature Error   | deg.       | ✓                             |                             | Displays IQ Quadrature Error   |
| Tx Total Power        | dBm        |                               | √                           | Displays total power of all carriers   |
| Tx Power Flatness     | dB         |                               | √                           | Displays maximum power difference between carriers   |
| Downlink              |            |                               |                             |  |
| xPDSCH EVM (rms/peak) | %, dB      | √                             |                             | Displays EVM rms/peak values for QPSK/16QAM/64QAM  |
| P-SS                  | %, dB, dBm | $\checkmark$                  |                             | Displays average EVM (rms) and maximum EVM (peak) as well as   |
| S-SS                  |            | $\checkmark$                  |                             | average power (dBm) for each PHY channel   |
| E-SS                  |            | √                             |                             |  |
| BRS                   |            | $\checkmark$                  |                             |  |
| хРВСН                 |            | $\checkmark$                  |                             |  |
| xPDSCH                |            | $\checkmark$                  |                             |  |
| xPDCCH                |            | √                             |                             |  |
| UE-RS (xPDSCH)        |            | $\checkmark$                  |                             |  |
| UE-RS (xPDSCH)        |            | $\checkmark$                  |                             |  |
| Uplink                |            |                               |                             |  |
| xPUSCH EVM (rms/peak) | %, dB      | $\checkmark$                  |                             | Displays EVM rms/peak value for QPSK/16QAM/64QAM   |
| xPUSCH                | %, dB, dBm | $\checkmark$                  |                             | Displays average EVM (rms) and maximum EVM (peak) as well as   |
| DM-RS (xPUSCH)        |            | ✓                             |                             | average power (dBm) for each PHY channel   |

#### **Graph Displays**

| Name                                | Single Carrier<br>Measurement | Multicarrier<br>Measurement |
|-------------------------------------|-------------------------------|-----------------------------|
| Constellation                       | ✓                             |                             |
| EVM vs. Subcarrier                  | ✓                             |                             |
| EVM vs. Symbol                      | ✓                             |                             |
| Spectral Flatness (Amplitude/Phase) | ✓                             |                             |
| Power vs. RB                        | ✓                             | √                           |
| EVM vs. RB                          | ✓                             | √                           |
| Summary                             | ✓                             | √                           |

### 5G Standard Measurement Software (Base License) MX285051A Pre-Standard CP-OFDM Downlink MX285051A-001 Pre-Standard CP-OFDM Uplink MX285051A-051 (Continued)

MS2850A

|   | Signal Analyzer   | MS2   | 2850A  |
|---|---|---|--|
| Option                                  |   | Pre-Standard CP-OFDM Downlink<br>MX285051A-001  | Pre-Standard CP-OFDM Uplink<br>MX285051A-051   |
|   | Target Signals  | TS V5G.211 compliant downlink signal  | TS V5G.211 compliant uplink signal   |
| Electrical                              | Channel Bandwidth   | MS2850A-032 installed: Max. 100 MHz × 2 carriers<br>MS2850A-033 installed: Max. 100 MHz × 5 carriers<br>MS2850A-034 installed: Max. 100 MHz × 8 carriers  |  |
| Characteristics                         | Capture Time  | 1 Frame   |  |
|   | Frequency Setting Range   | MS2850A-047: 800 MHz to 32 GHz<br>MS2850A-046: 800 MHz to 44.5 GHz  |  |
|   | Measurement Level Range   | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)  |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency<br>Measurement Accuracy   | At 18°C to 28°C, After calibration, EVM = 2% signal<br>50 subframes at downlink signal<br>Only 1 carrier of 100 MHz width at center frequency<br>± (Accuracy of reference frequency × carrier<br>frequency + 10) Hz (nom.)  | At 18°C to 28°C, After calibration, EVM = 2% signal<br>50 subframes at uplink signal<br>Only 1 carrier of 100 MHz width at center frequency<br>± (Accuracy of reference frequency × carrier<br>frequency + 10) Hz (nom.) |
|   | Residual Vector Error   | At 18°C to 28°C, After calibration<br>50 subframes at downlink signal<br>Only 1 carrier of 100 MHz width at center frequency<br><2.0% (nom.)  | At 18°C to 28°C, After calibration<br>50 subframes at uplink signal<br>Only 1 carrier of 100 MHz width at center frequency<br><2.0% (nom.)   |
|   | Measurement Level Range   | -15 to +30 dBm (Preamp Off, or Preamp not installed)<br>-30 to +10 dBm (Preamp On)  |  |
| Amplitude<br>Measurement                | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency<br>characteristics of main unit.) | At 18°C to 28°C, After calibration, Input attenuator ≥10<br>Input signal within measurement level range and below<br>Only 1 carrier of 100 MHz width at center frequency<br>±2.54 dB (nom.) (Preamp Off, or Preamp not installed)<br>±3.74 dB (nom.) (Preamp On)  | value set at Input Level   |
| Waveform Display                        |   | Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spec   | tral Flatness, Power vs. RB, EVM vs. RB  |
|   | Function Overview   | Supports output of captured waveform data to internal   |  |
|   | Waveform Data   | Format: I, Q (32 bit floating point binary format)<br>Level: Assumes as $\sqrt{(l^2 + Q^2)} = 1$ for 0 dBm input<br>Level accuracy: Same as absolute amplitude accuracy an  | d in-band frequency characteristics of the signal analyzer   |
| Digitize Function                       | Replay Function   | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling rate: 325 MHz<br>650 MHz (with MS2850A-033 installed)<br>1300 MHz (with MS2850A-034 installed)<br>Under the following conditions, Capture two times with<br>Center frequency <4.2 GHz<br>Carriers ≥6 |  |

### 5G Standard Measurement Software (Base License) MX285051A

| 5G Standard Weasurement Software (base License) | WIX20JUJIA    |                         |               | MS28 |
|---|---------------|-------------------------|---------------|------|
| NR TDD sub-6 GHz Downlink                       | MX285051A-011 | NR TDD sub-6 GHz Uplink | MX285051A-061 |      |
| NR FDD sub-6 GHz Downlink                       | MX285051A-031 | NR FDD sub-6 GHz Uplink | MX285051A-081 |      |
| NR TDD mmWave Downlink                          | MX285051A-021 | NR TDD mmWave Uplink    | MX285051A-071 |      |

The 5G measurement software are installed in the MS2850A for developing and manufacturing 5G radio equipment. They support analyses of both uplink and downlink signals used by the sub-6 GHz and mmWave bands in the 5G NR standards by specifying combinations of multiple component carriers (up to 400 MHz) and subcarrier spacing.

#### Features

#### • All-in-one sub-6 GHz and mmWave Coverage

Both 5G NR sub-6 GHz and mmWave are covered by installing the MX285051A options.

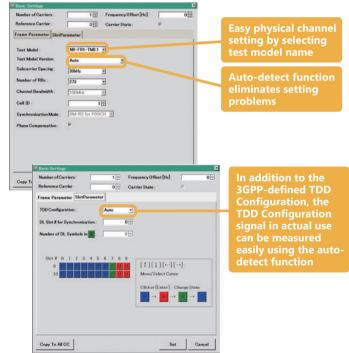
Setting Frequency Ranges: 100 MHz to 32 GHz (with MS2850A-047 installed), 100 MHz to 44.5 GHz (with MS2850A-046 installed)

Supported Measurement Functions

| Supported Software                      | Modulation Analysis | Carrier Aggregation Analysis | Power vs. Time |
|---|---------------------|------------------------------|----------------|
| NR TDD sub-6 GHz Downlink MX285051A-011 | ✓                   | ✓                            | $\checkmark$   |
| NR FDD sub-6 GHz Downlink MX285051A-031 | ~                   | ~                            | —              |
| NR TDD mmW Downlink MX285051A-021       | ✓                   | ✓                            | $\checkmark$   |
| NR TDD sub-6 GHz Uplink MX285051A-061   | ✓                   | —                            | —              |
| NR FDD sub-6 GHz Uplink MX285051A-081   | ✓                   | —                            | —              |
| NR TDD mmW Uplink MX285051A-071         | ✓                   | —                            |                |

### Easy Operability for Higher Measurement/Test Efficiency

• The Phy channel can be measured simply by specifying the measured test model.



 This function makes it easy to measure Channel Power, OBW, ACLR and SEM.
 The measurement software calls Signal Analyzer function and the

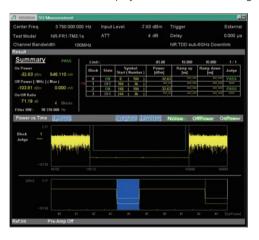
The measurement software calls Signal Analyzer function and the measurement performed according to the handed over parameter settings.

850A



• Power vs. Time measurements are supported.

Off power and Transient period measurements that are required for 3GPP TS 38.141-1/2 specified Transient On/Off Power are supported. The measurement results are displayed with Power vs. Time graph.



 The one-button Auto Range function optimizes the complex built-in attenuator settings, required for more accurate EVM measurement.



### 5G Standard Measurement Software (Base License) MX285051A

| 5G Standard Measurement Software (Base License) | ) MIX285051A  |                                       | MS2850A    |
|---|---------------|---------------------------------------|------------|
| NR TDD sub-6 GHz Downlink                       | MX285051A-011 | NR TDD sub-6 GHz Uplink MX285051A-061 |            |
| NR FDD sub-6 GHz Downlink                       | MX285051A-031 | NR FDD sub-6 GHz Uplink MX285051A-081 |            |
| NR TDD mmWave Downlink                          | MX285051A-021 | NR TDD mmWave Uplink MX285051A-071 (  | Continued) |

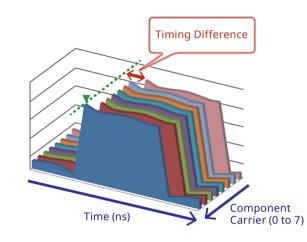
### • All-at-Once Measurement and Analysis of 8 CCs max in 1-GHz Analysis Bandwidth

Combined use with the Analysis Bandwidth Extension to 1 GHz option (MS2850A-034) supports all-at-once measurement of up to 8 CCs (8 carriers × 100 MHz). Since this eliminates individual measurement of multiple component carriers, the characteristics of single carriers can be evaluated in shorter times.

Additionally, all-at-once measurement of all carriers not only supports EVM and frequency error measurements for each carrier but also enables time difference measurements for each carrier.

| Tx Total Powe<br>Tx Power Flat |                 |                |           |            |                   |
|--------------------------------|-----------------|----------------|-----------|------------|-------------------|
|                                | Frequency Error | Transmit Power | EVM (rms) | EVM (peak) | Timing Difference |
| CC0 (Ref.)                     | 23.24 Hz        | -19.98 dBm     | 1.24 %    | 5.47 %     | 0.0 ns            |
| CC1                            | 24.13 Hz        | -20.02 dBm     | 1.15 %    | 5.24 %     | 0.0 ns            |
| CC2                            | 25.02 Hz        | -20.29 dBm     | 1.13 %    | 4.88 %     | 0.0 ns            |
| CC3                            | 25.92 Hz        | -20.54 dBm     | 1.18 %    | 4.99 %     | 0.0 ns            |
| CC4                            | 26.95 Hz        | -20.25 dBm     | 1.35 %    | 6.19 %     | 0.0 ns            |
| CC5                            | 27.82 Hz        | -20.06 dBm     | 1.03 %    | 4.53 %     | -1.5 ns           |
| CC6                            | 28.69 Hz        | -20.14 dBm     | 1.00 %    | 4.30 %     | 0.0 ns            |
| CC7                            | 29.57 Hz        | -20.25 dBm     | 1.01 %    | 4.80 %     | 0.0 ns            |

Batch (All-at-Once) Carrier Measurements (Numeric Results)



#### All-at-One Multi-carrier Measurement Software

| Supported Software   | Analysis Bandwidth Extension Option   | Channel Bandwidth   | Max. Component Carrier Count |
|--|---|---|------------------------------|
| NR TDD sub-6 GHz Downlink MX285051A-011<br>NR FDD sub-6 GHz Downlink MX285051A-031 | Not installed<br>(Max. Analysis Bandwidth: 255 MHz)<br>MS2850A-033<br>(Max. Analysis Bandwidth: 510 MHz)<br>MS2850A-034<br>(Max. Analysis Bandwidth: 1 GHz) | 5, 10, 15, 20, 25, 30, 40, 50, 60,<br>70, 80, 90, 100 MHz | 2                            |
|  |   | 50 MHz  | 5                            |
|  | Not installed<br>(Max. Analysis Bandwidth: 255 MHz)   | 100 MHz   | 2                            |
|  |   | 200 MHz   | 1                            |
|  |   | 50 MHz  | 8                            |
|  | MS2850A-033   | 100 MHz   | 5                            |
| NR TDD mmW Downlink MX285051A-021  | (Max. Analysis Bandwidth: 510 MHz)  | 200 MHz   | 2                            |
|  |   | 400 MHz   | 1                            |
|  |   | 50 MHz  | 8                            |
|  | MS2850A-034   | 100 MHz   | 8                            |
|  | (Max. Analysis Bandwidth: 1 GHz)  | 200 MHz   | 4                            |
|  |   | 400 MHz   | 2                            |

### 5G Standard Measurement Software (Base License) MX285051A

| NR TDD sub-6 GHz Downlink | Μ |
|---------------------------|---|
| NR FDD sub-6 GHz Downlink | Μ |
| NR TDD mmWave Downlink    | Μ |

NR TDD sub-6 GHz Uplink MX285051A-061 IX285051A-011 NR FDD sub-6 GHz Uplink MX285051A-081 IX285051A-031 NR TDD mmWave Uplink MX285051A-071 (Continued) MX285051A-021

MS2850A

### **Numeric Results**

| Name                              | Unit         | Modulation<br>Analysis | Carrier<br>Aggregation<br>Analysis | Power vs. Time | Remarks  |
|-----------------------------------|--------------|------------------------|------------------------------------|----------------|--|
| Common                            |              |                        |                                    |                |  |
| Frequency Error                   | Hz, ppm      | ~                      | ✓                                  |                | Displays frequency error   |
| Transmit Power                    | dBm          | ~                      |                                    |                | Displays Tx power  |
| Total EVM (rms/peak)              | %, dB        | ~                      | ✓                                  |                | Displays EVM rms/peak values   |
| Origin Offset                     | dB           | ~                      |                                    |                | Displays Origin Offset value   |
| Time Offset<br>(External Trigger) | ns           | ~                      |                                    |                | Displays time offset between Frame header and trigger in ns units<br>Displays Trigger Switch = On only when using external trigger |
| Timing Difference                 | ns           |                        | ~                                  |                | Displays timing difference between reference carrier and each carrier  |
| Symbol Clock Error                | ppm          | ~                      |                                    |                | Displays Symbol Clock Error  |
| IQ Skew                           | ns           | ~                      |                                    |                | Displays IQ Skew   |
| IQ Imbalance                      | dB           | ~                      |                                    |                | Displays IQ Imbalance in dB units  |
| IQ Quad Error                     | deg.         | ~                      |                                    |                | Displays IQ Quadrature Error   |
| Downlink                          |              | -                      | •                                  |                |  |
| P-SS                              |              | ~                      |                                    |                |  |
| S-SS                              |              | ~                      |                                    |                |  |
| РВСН                              |              | ~                      |                                    |                |  |
| DM-RS (PBCH)                      |              | ✓                      |                                    |                | Displays average EVM (rms) and maximum EVM (peak) as well as   |
| PDSCH                             | — %, dB, dBm | ~                      |                                    |                | S-SS · average power (dBm) for each PHY channel  |
| DM-RS (PDSCH)                     |              | ~                      |                                    |                |  |
| PDCCH                             |              | ~                      |                                    |                |  |
| DM-RS (PDCCH)                     |              | ✓                      |                                    |                |  |
| Cell ID                           | _            | ~                      |                                    |                | Displays Cell ID   |
| OFDM Symbol Tx Power              | _            | ~                      |                                    |                | Displays OSTP  |
| On Power                          | dBm, W       |                        |                                    | ✓              | Displays average On power  |
| Off Power                         | dBm, W       |                        |                                    | ✓              | Displays average Off power   |
| On/Off Ratio                      | dB           |                        |                                    | ✓              | Display On/Off power ratio   |
| Power                             | dBm          |                        |                                    | ✓              | Displays Block Tx power  |
| Ramp up                           | μs           |                        |                                    | ✓              | Displays signal rise time (only On sections)   |
| Ramp down                         | μs           |                        |                                    | ✓              | Displays signal fall time (only On sections)   |
| Uplink                            |              |                        |                                    | ·              |  |
| PUSCH                             | 0/ 10 10     | √                      |                                    |                | Displays average EVM (rms) and maximum EVM (peak) as well as   |
| DM-RS (PUSCH)                     | — %, dB, dBm | ~                      |                                    |                | S-SS · average power (dBm) for each PHY channel  |

### **Graph Displays**

| Name                                | Modulation<br>Analysis | Carrier<br>Aggregation<br>Analysis | Power vs. Time |
|-------------------------------------|------------------------|------------------------------------|----------------|
| Constellation                       | ~                      |                                    |                |
| EVM vs. Subcarrier                  | ~                      |                                    |                |
| EVM vs. Symbol                      | ~                      |                                    |                |
| Spectral Flatness (Amplitude/Phase) | ~                      |                                    |                |
| Power vs. RB                        | ~                      | ~                                  |                |
| EVM vs. RB                          | ~                      | ~                                  |                |
| Summary                             | ~                      | ~                                  |                |
| Power vs. Time                      |                        |                                    | ~              |

### 5G Standard Measurement Software (Base License) MX285051A NR TDD sub-6 GHz Downlink NR FDD sub-6 GHz Downlink

NR TDD mmWave Downlink

MS2850A NR TDD sub-6 GHz Uplink MX285051A-061 NR FDD sub-6 GHz Uplink MX285051A-081

MX285051A-011 MX285051A-031 MX285051A-021 NR TDD mmWave Uplink MX285051A-071 (Continued)

| Standard  |                              | 3GPP TS 38.211 (201                           | 9-06)                   |                          |  |                  |                                       |
|---|------------------------------|---|-------------------------|--------------------------|--|------------------|---------------------------------------|
| Model/Name  |                              | NR TDD sub-6 GHz<br>Downlink<br>MX285051A-011 | ownlink Downlink D      |                          | NR TDD sub-6 GHz<br>Uplink Uplink<br>MX285051A-061 MX285051A-081             |                  | NR TDD mmW<br>Uplink<br>MX285051A-071 |
| Measurement   | t Frequency Range            | 800 MHz to 5 GHz                              | 400 MHz to 6 GHz        | 28 GHz                   | 800 MHz to 5 GHz   | 400 MHz to 6 GHz | 28 GHz                                |
| Frequency Range         100 MHz to 32 GHz (MS2850A-047)           100 MHz to 44.5 GHz (MS2850A-046) |                              |   | ,                       |                          |  |                  |                                       |
| Test Model NR-FR1-TM2a, NR-F  |                              | NR-FR2-TM1.1,<br>NR-FR2-TM2,<br>NR-FR2-TM3.1  |                         | _                        |  |                  |                                       |
| Subcarrier Sp   | acing (SCS)                  | 15 kHz, 30 kHz, 60 k                          | Hz                      | 60 kHz, 120 kHz          | 15 kHz, 30 kHz, 60 k   | 60 kHz, 120 kHz  |                                       |
| Channel Banc  | dwidth                       | 5, 10, 15, 20, 25, 30, -<br>100 MHz           | 40, 50, 60, 70, 80, 90, | 50, 100, 200,<br>400 MHz | 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 50, 100, 200, 100 MHz 400 MHz |                  |                                       |
| Modulation  |                              | CP-OFDM<br>QPSK, 16QAM, 64QA                  | AM, 256QAM, Auto        |                          | CP-OFDM/DFT-S-OFDM<br>PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM, Auto            |                  |                                       |
| Measurement Channel   |                              | SS-Block, PDSCH, PD                           | OCCH, PT-RS for PDSC    | Ή                        | PUSCH, PT-RS for PL  | JSCH             |                                       |
| Commonant   | Maximum Number of CCs        | 2   | 2                       | 8                        | 1  | 1                | 1                                     |
| Component<br>Carrier  | Channel Bandwidth of each CC | dth of  |                         | 50, 100 MHz              | to 100 MHz   | to 100 MHz       | to 400 MHz                            |

### **RB Number Table**

The channel bandwidth is defined in accordance with SCS and RB.

|           |    | NR TDD/FDD sub-6 GHz DL/UL<br>Channel Bandwidth [MHz] (1CC) |    |    |     |     |     |     |     |     |     |     |     |     |
|-----------|----|---|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|           |    | 5   | 10 | 15 | 30  | 20  | 25  | 40  | 50  | 60  | 70  | 80  | 90  | 100 |
|           | 15 | 25  | 52 | 79 | 160 | 106 | 133 | 216 | 270 | N.A | N.A | N.A | N.A | N.A |
| SCS [kHz] | 30 | 11  | 24 | 38 | 78  | 51  | 65  | 106 | 133 | 162 | 189 | 217 | 245 | 273 |
|           | 60 | N.A   | 11 | 18 | 24  | 31  | 38  | 51  | 65  | 79  | 93  | 107 | 121 | 135 |

|           |               | N    | NR TDD mmWave DL/UL           |     |     |  |  |  |  |
|-----------|---------------|------|-------------------------------|-----|-----|--|--|--|--|
|           |               | Chan | Channel Bandwidth [MHz] (1CC) |     |     |  |  |  |  |
|           |               | 50   | 100                           | 200 | 400 |  |  |  |  |
|           | 60            | 66   | 132                           | 264 | N.A |  |  |  |  |
| SCS [KHZ] | SCS [kHz] 120 |      | 66                            | 132 | 264 |  |  |  |  |

### **Channel Bandwidth**

The maximum channel bandwidth is determined by the Analysis Bandwidth option.

|         |             | Maximum Analysis Bandwidth |
|---------|-------------|----------------------------|
|         | Standard    | 255 MHz                    |
| MS2850A | MS2850A-033 | 510 MHz                    |
|         | MS2850A-034 | 1 GHz                      |

### 5G Standard Measurement Software (Base License) MX285051A NR TDD sub-6 GHz Downlink MX285051A-011 NR TDD sub-6 GHz Uplink MX285051A-061

MS2850A

|   | Signal Analyzer  |  |   | MS2   | 850A  |  |  |  |
|---|--|--|---|---|---|--|--|--|
| Option                                  |  | NR TDD sub-6 GHz I<br>MX285051A-011  | Downlink  |   | NR TDD sub-6<br>MX285051A-06  |  |  |  |
|   | Target Signals   | TS 38.211 Sub-6 GHz  | compliant down  | ink signal  | TS 38.211 Sub   | 6-GHz compliant uplink signal  |  |  |
|   | Channel Bandwidth  | Subcarrier Spacing<br>15 kHz<br>30 kHz   | 15 kHz         5 MHz (RB: 25), 10 MHz (RB: 52), 15 MHz (RB: 79), 20 MHz (RB: 106), 25 MHz (RB 30 MHz (RB: 160), 40 MHz (RB: 216), 50 MHz (RB: 270)           5 MHz (RB: 11), 10 MHz (RB: 24), 15 MHz (RB: 38), 20 MHz (RB: 51), 25 MHz (RB: 24), 15 MHz (RB: 38), 20 MHz (RB: 51), 25 MHz (RB: 28), 20 MHz (RB: 51), 25 MHz (RB: 28), 20 MHz (RB: 51), 25 MHz (RB: 51), 35 MZ (RB: |   |   |  |  |  |
| Electrical<br>Characteristics           |  | 60 kHz   | 10 MHz (RB: 11<br>40 MHz (RB: 51  | , 15 MHz (RB: 18),  | 20 MHz (RB: 24)<br>60 MHz (RB: 79)  | 245), 100 MHz (RB: 273)<br>), 25 MHz (RB: 31), 30 MHz (RB: 38),<br>), 70 MHz (RB: 93), 80 MHz (RB: 107), |  |  |
|   | Capture Time   | 1 to 2 Frame   |   |   |   |  |  |  |
|   | Frequency Setting Range  | MS2850A-047: 100 MS2850A-046: 100 M  |   |   |   |  |  |  |
|   | Measurement Frequency Range                                      | 800 MHz to 5 GHz   |   |   |   |  |  |  |
|   | Measurement Level Range  | -10 to +30 dBm (Pre<br>-30 to +10 dBm (Pre   |   | np not installed)   |   |  |  |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency<br>Measurement Accuracy                        | At 18°C to 28°C, Afte<br>signal 1 Frame at do<br>Only 1 carrier of 100<br>30 kHz) or 50 MHz w<br>at center frequency<br>± (Accuracy of refe<br>frequency + 10) Hz  | wnlink signal<br>MHz width (Sub<br>vidth (Subcarrier s<br>erence frequency  | arrier Spacing:<br>pacing: 15 kHz)                          | At 18°C to 28°C, After calibration, EVM = 1% (rms)<br>signal 1 Frame at uplink signal<br>Only 1 carrier of 100 MHz width (Subcarrier Spacing:<br>30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz<br>at center frequency<br>± (Accuracy of reference frequency × carrier<br>frequency + 10) Hz |  |  |  |
|   | Residual Vector Error  | At 18°C to 28°C, After calibration<br>1 Frame at downlink signal<br>Only 1 carrier of 100 MHz width (Subcarrier Spacing:<br>30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz)<br>at center frequency<br>≤1.0%         |   |   | At 18°C to 28°C, After calibration<br>1 Frame at uplink signal<br>Only 1 carrier of 100 MHz width (Subcarrier Spacing:<br>30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz)<br>at center frequency<br>≤1.0%  |  |  |  |
|   | Measurement Level Range  | -10 to +30 dBm (Pre<br>-30 to +10 dBm (Pre   |   | mp not installed)   |   |  |  |  |
| Amplitude                               | Tx Power Measurement Accuracy<br>(This is found from root sum of | At 18°C to 28°C, Afte<br>Input signal within m<br>Only 1 carrier at cent   | neasurement leve  |   |   | ut Level   |  |  |
| Measurement                             | squares (RSS) of absolute amplitude accuracy and in-band         | Frequency  | / Range   | Preamp Off,<br>or without Preamp                            |   | Preamp On  |  |  |
|   | frequency characteristics of main                                | 800 MHz ≤ Frequ  | ency < 4 GHz  | ±0.74 dB  |   | ±1.27 dB (nom.)  |  |  |
|   | unit.)   | 4 GHz ≤ Frequenc   |   | ±1.48 dB  |   | ±2.11 dB (nom.)  |  |  |
|   |  | 4.2 GHz ≤ Freque   | ncy ≤ 5 GHz   | ±1.45 dB  | (nom.)  | ±1.94 dB (nom.)  |  |  |
| Waveform Display                        |  | Constellation, EVM v<br>EVM vs. RB, Power vs   |   |   |   |  |  |  |
|   | Function Overview  | Supports output of c   | aptured wavefor   | n data to internal  | storage or exteri   | nal storage  |  |  |
|   | Waveform Data  | Format: I, Q (32 bit floating point binary format)<br>Level: Assumes as $\sqrt{(l^2 + Q^2)} = 1$ for 0 dBm input<br>Level accuracy: Same as absolute amplitude accuracy and in-band frequency characteristics of the sid |   |   |   |  |  |  |
| Digitize Function                       | Replay Function  | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling Rate:   |   |   |   |  |  |  |
|   |  | Channel Ba<br>≤100 I   |   | Without MS2<br>162.5 N                                      |   | With MS2850A-033<br>162.5 MHz  |  |  |
| Power vs. Time<br>Measurement           | Displayed Average Noise  | This is calculated up<br>Average Noise Level<br>MS2850A-033/034 o<br>and an ambient tem<br>when Wide Dynamic<br>On, Pre-AMP = On.<br>-95 dBm/MHz (noi  | to 5 GHz from th<br>for the signal an.<br>ption installed at<br>perature range o<br>Range = On, No  | e Display<br>alyzer with<br>no signal input<br>18°C to 28°C |   |  |  |  |

### 5G Standard Measurement Software (Base License) MX285051A NR FDD sub-6 GHz Downlink MX285051A-031 NR FDD sub-6 GHz Uplink MX285051A-081

MS2850A

|   | Signal Analyzer   |  |   | MS2                                      | 850A  |  |  |
|---|---|--|---|--|---|--|--|
| Option                                  |   | NR FDD sub-6 GHz D<br>MX285051A-031  | ownlink   |  | NR FDD sub-6<br>MX285051A-0   | •  |  |
|   | Target Signals  | TS 38.211 Sub-6 GHz  | compliant down  | ink signal                               | TS 38.211 Sub   | 6-GHz compliant uplink signal  |  |
|   |   | Subcarrier Spacing   | 5 MHz (RB: 25) 10 MHz (RB: 52) 15 MHz (RB: 79) 20 MHz (RB: 106) 25  |  |   |  |  |
| Electrical                              | Channel Bandwidth   | 30 kHz   | 5 MHz (RB: 11)<br>30 MHz (RB: 78  | 10 MHz (RB: 24), 1<br>), 40 MHz (RB: 106 | 5 MHz (RB: 38),<br>), 50 MHz (RB: 1   | 20 MHz (RB: 51), 25 MHz (RB: 65),<br>33), 60 MHz (RB: 162),<br>245), 100 MHz (RB: 273) |  |
| Characteristics                         |   | 60 kHz   | 10 MHz (RB: 11<br>40 MHz (RB: 51  | ), 15 MHz (RB: 18),                      | 20 MHz (RB: 24<br>60 MHz (RB: 79  | ), 25 MHz (RB: 31), 30 MHz (RB: 38),<br>), 70 MHz (RB: 93), 80 MHz (RB: 107),          |  |
|   | Capture Time  | 1 to 2 Frame   |   |  |   |  |  |
|   | Frequency Setting Range   | MS2850A-047: 100 N<br>MS2850A-046: 100 N   |   |  |   |  |  |
|   | Measurement Frequency Range   | 400 MHz to 6 GHz   |   |  |   |  |  |
|   | Measurement Level Range   | -10 to +30 dBm (Pre<br>-30 to +10 dBm (Pre   | •   | mp not installed)                        |   |  |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency<br>Measurement Accuracy   | At 18°C to 28°C, After calibration, EVM = 1% (rms)<br>signal 1 Frame at downlink signal<br>Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz)<br>width or 50 MHz (Subcarrier Spacing: 15 kHz) width at<br>center frequency<br>However, Only 1 carrier of 25 MHz (Subcarrier Spacing:<br>15 kHz, 30 kHz, 60 kHz) width at 400 MHz≤ frequency<br>< 800 MHz<br>± (Accuracy of reference frequency × carrier |   |  | <ul> <li>15 kHz, 30 kHz, 60 kHz) width at 400 MHz≤ frequence</li> <li>800 MHz</li> <li>± (Accuracy of reference frequency × carrier frequency + 10) Hz</li> <li>At 18°≤ to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at uplink signal</li> <li>Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kH width or 50 MHz (Subcarrier Spacing: 15 kHz) width a center frequency</li> </ul> |  |  |
|   | Residual Vector Error   | signal 1 Frame at downlink signal<br>Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz)<br>width or 50 MHz (Subcarrier Spacing: 15 kHz) width at<br>center frequency<br>However, Only 1 carrier of 25 MHz (Subcarrier Spacing:<br>15 kHz, 30 kHz, 60 kHz) width at 400 MHz $\leq$ frequency  |   |  |   |  |  |
|   | Measurement Level Range   | -10 to +30 dBm (Pre<br>-30 to +10 dBm (Pre   |   | mp not installed)                        | 1   |  |  |
| Amplitude                               | Tx Power Measurement Accuracy   | At 18°C to 28°C, Afte<br>Input signal within m<br>Only 1 carrier at cent   | easurement leve   | I range and below                        | value set at Inp  | ut Level   |  |
| Measurement                             | (This is found from root sum of<br>squares (RSS) of absolute<br>amplitude accuracy and in-band<br>frequency characteristics of main | Frequency<br>400 MHz ≤ Freque  | ency < 800 MHz  | Preamp<br>or without<br>±0.72 dB         | Preamp<br>(nom.)  | Preamp On<br>±1.14 dB (nom.)   |  |
|   | unit.)  | 4 GHz ≤ Frequenc   | 00 MHz $\leq$ Frequency $<$ 4 GHz $\pm 0.74$ dB (           GHz $\leq$ Frequency $<$ 4.2 GHz $\pm 1.45$ dB (           .2 GHz $\leq$ Frequency $\leq$ 6 GHz $\pm 1.45$ dB ( |  | (nom.)  | ±1.27 dB (nom.)<br>±2.11 dB (nom.)<br>±1.94 dB (nom.)                                  |  |
| Waveform Display                        |   | Constellation, EVM vs<br>EVM vs. RB, Power vs  |   |  |   |  |  |
|   | Function Overview   | Supports output of c   | aptured wavefor   | m data to internal                       | storage or exter  | nal storage  |  |
|   | Waveform Data   | Format: I, Q (32 bit fl<br>Level: Assumes as √<br>Level accuracy: Same   | $\frac{1}{(l^2 + Q^2)} = 1$ for (   | dBm input                                | in-band freque  | ncy characteristics of the signal analyzer   |  |
| Digitize Function                       | Replay Function   | Analyzes traces of sa<br>Format: I, Q (32 bit fl<br>Sampling Rate:   | oating point bin  | ary format)                              |   |  |  |
|   |   | Channel Bandwidth         Without MS2850A-033         With MS2850A-033           ≤100 MHz         162.5 MHz         162.5 MHz  |   |  |   |  |  |

### 5G Standard Measurement Software (Base License) MX285051A NR TDD mmWave Downlink MX285051A-021 NR TDD mmWave Uplink MX285051A-071

MS2850A

|   | Signal Analyzer   |  |  | MS2  | 850A                       |   |  |
|---|---|--|--|--|----------------------------|---|--|
| Option                                  |   | NR TDD mmWave Do<br>MX285051A-021  | ownlink  |  | NR TDD mmW<br>MX285051A-07 | 1   |  |
|   | Target Signals  | TS 38.211 mmWave compliant downlink signal TS 38.211 mmWave compliant uplink sign  |  |  |                            |   |  |
|   |   | Subcarrier Spacing   | Channel Band   | width  |                            |   |  |
| -le stuised                             | Channel Bandwidth   | 60 kHz   | 3: 264)  |  |                            |   |  |
| Electrical<br>Characteristics           |   | 120 kHz  | 50 MHz (RB: 3  | 2), 100 MHz (RB: 6                                 | 6), 200 MHz (RB:           | 132), 400 MHz (RB: 264)   |  |
|   | Capture Time  | 1 to 2 Frame   |  |  |                            |   |  |
|   | Frequency Setting Range   |  | MS2850A-047: 100 MHz to 32 GHz<br>MS2850A-046: 100 MHz to 44.5 GHz           |  |                            |   |  |
|   | Measurement Level Range   | -15 to +30 dBm (Prea<br>-30 to +10 dBm (Prea   |  | mp not installed)                                  |                            |   |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency<br>Measurement Accuracy   | At 18°C to 28°C, After calibration, EVM = 2% (rms)<br>signal 1 Frame at downlink signalAt 18°C to 28°C, After calibration, EVM<br>signal 1 Frame at uplink signalOnly 1 carrier of 100 MHz width at center frequency<br>setting of 28 GHz<br>± (Accuracy of reference frequency × carrier<br>frequency + 10) HzAt 18°C to 28°C, After calibration, EVM<br>signal 1 Frame at uplink signal<br>Only 1 carrier of 100 MHz width at center frequency<br>setting of 28 GHz<br>± (Accuracy of reference frequency + 10) Hz |  |  |                            | at uplink signal<br>of 100 MHz width at center frequenc<br>Hz<br>of reference frequency × carrier |  |
|   | Residual Vector Error   | At 18°C to 28°C, After calibration       At 18°C to 28°C, After calibration         1 Frame at downlink signal       I Frame at uplink signal         Only 1 carrier of 100 MHz width at center frequency       Only 1 carrier of 100 MHz width at center frequency         setting of 28 GHz       \$2.0%   |  |  |                            | nk signal<br>of 100 MHz width at center frequence   |  |
|   | Measurement Level Range   | -15 to +30 dBm (Pre-<br>-30 to +10 dBm (Pre-   |  | mp not installed)                                  |                            |   |  |
| Amplitude<br>Measurement                | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute | At 18°C to 28°C, After calibration, Input attenuator $\geq$ 10 dB<br>Input signal within measurement level range and below value set at Input Level<br>Only 1 carrier of 100 MHz width at center frequency   |  |  |                            |   |  |
|   | amplitude accuracy and in-band<br>frequency characteristics of main                           | Frequency  | Range  | Preamp<br>or without                               | -                          | Preamp On   |  |
|   | unit.)  | 26.5 GHz < Freque  | ncy ≤ 40 GHz   | ±2.54 dB   | (nom.)                     | ±3.74 dB (nom.)   |  |
| Waveform Display                        | 1   | Constellation, EVM vs<br>Power vs. Time (NR T  |  |  |                            | ver vs. RB, EVM vs. RB,   |  |
|   | Function Overview   | Supports output of ca  | aptured wavefor  | m data to internal                                 | storage or exter           | nal storage   |  |
|   | Waveform Data   | Format: I, Q (32 bit fl<br>Level: Assumes as √(<br>Level accuracy: Same  | $\frac{   ^2}{  ^2} +   ^2  ^2} = 1$ for (                                   | ) dBm input  | l in-band frequer          | ncy characteristics of the signal analy   |  |
| Digitize Function                       |   | Analyzes traces of saved waveform data<br>Format: I, Q (32 bit floating point binary format)<br>Sampling Rate:   |  |  |                            |   |  |
|   | Replay Function   | Channel Ba   | ndwidth  | Without MS2  | 2850A-033                  | With MS2850A-033  |  |
|   |   | ≤100 N   | ИНz  | 162.5 I  | MHz                        | 162.5 MHz   |  |
|   |   | >100 N   | /Hz  | 325 N  | 1Hz                        | 650 MHz   |  |
| Power vs. Time<br>Measurement           | Displayed Average Noise   | This is calculated up t<br>Average Noise Level<br>MS2850A-033/034 o<br>and an ambient temp<br>when Wide Dynamic<br>On, Pre-AMP = On.<br>-86.2 dBm/MHz (no  | for the signal an<br>ption installed a<br>perature range o<br>Range = On, No | alyzer with<br>t no signal input<br>f 18°C to 28°C |                            | _   |  |

# MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

| 5G Standard Measurement Software (Base License) | MX269051A     |                         |               | MS269xA |
|---|---------------|-------------------------|---------------|---------|
| NR TDD sub-6 GHz Downlink                       | MX269051A-011 | NR TDD sub-6 GHz Uplink | MX269051A-061 |         |
| NR FDD sub-6 GHz Downlink                       | MX269051A-031 | NR FDD sub-6 GHz Uplink | MX269051A-081 |         |

The 5G measurement Software MX269051A are are installed in the MS269xA main unit to support development and production of 5G wireless communication device. The software support signal analysis and RF characteristics by supporting GPP-compliant sub-6 GHz uplink signal and downlink signal and specifying combinations from multiple component carriers and subcarrier spacing.

#### Features

#### • Supports Both Downlink and Uplink Signal Measurement in sub-6 GHz

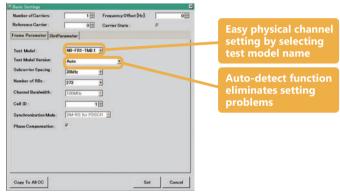
The 5G measurement Software MX269051A are are installed to support both Downlink and Uplink signal in 5G NR sub-6 GHz. Combining with MS269xA-x077/078 can analyze a carrier with up to 100 MHz bandwidth.

#### Supported Measurement Functions

| Supported Software                      | Modulation Analysis | Power vs. Time |
|---|---------------------|----------------|
| NR TDD sub-6 GHz Downlink MX269051A-011 | ✓                   | ✓              |
| NR FDD sub-6 GHz Downlink MX269051A-031 | ✓                   | —              |
| NR TDD sub-6 GHz Uplink MX269051A-061   | ✓                   | —              |
| NR FDD sub-6 GHz Uplink MX269051A-081   | ✓                   | _              |

#### Easy Operability for Higher Measurement/Test Efficiency

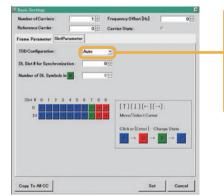
• The Phy channel can be measured simply by specifying the measured test model.



 $\bullet$  This function makes it easy to measure Channel Power, OBW, ACLR and SEM.

The measurement software calls Signal Analyzer function and the measurement performed according to the handed over parameter settings.





In addition to the 3GPP-defined TDD Configuration, the TDD Configuration signal in actual use can be measured easily using the autodetect function

• Power vs. Time measurements are supported.

Off power and Transient period measurements that are required for 3GPP TS 38.141-1/2 specified Transient On/Off Power are supported. Measurement results are displayed along with Power vs. Time graphs.

| Test Model         NR.FR1.TM3.1s         AT         4 dB         Delay         0.000 µs           Channel Bandwidth         100Mrg         NR TOD sub-GGHz Downlink         NR TOD sub-GGHz Downlink         NR TOD sub-GGHz Downlink           Summary<br>2038 16         DASS<br>68 100 wr<br>2038 16         DASS<br>7139 ml         A Downlink         NR TOD sub-GGHz Downlink           7013 81 cm         0.000 µs         100 ml         100 ml         100 ml         100 ml           7038 16         0.000 wr         100 ml   | M52850A 501   | Masurement    |        |       |         |              |       |                |                |                 |            |
|--|---------------|---------------|--------|-------|---------|--------------|-------|----------------|----------------|-----------------|------------|
| Channel Bandwidti         1004/2         PRIDD sub 6GH2 Downlink.           Hereit         905         905         100   | Center Freq.  | 3 750 000 000 |        | Input | Level   |              | -7,83 | dBm            | Trigger        |                 | External   |
| Summary<br>Devel         Constraint         Cons   | Test Model    | NR-FR1-TM3.1  |        |       |         |              | 4     |                | Delay          |                 | 0.000 µs   |
| Summary<br>02-53         PASS<br>23-53         Edd 10 u/d<br>54 51 00 u/d<br>01 0 versite 10 12 (12 Mas)         Line:         6 0 0 0 0 0 0 0 0 1.1           101 0 versite 10 12 (12 Mas)         10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | Channel Bandw | idth 100      | WHz    |       |         |              |       |                | NR TOD :       | sub-6GHz Do     | wnlink     |
| Drever<br>275.55 cm         Soft Hours<br>100 Structure<br>71.19 dm         Soft Hours<br>71.19 dm  | Result        |               |        |       |         |              |       |                |                |                 |            |
| 32.63         66.8110.0v         Umit Num Yun finanter, jungi  | Summary       |               | Limit  |       |         |              |       | -85.00         | 10.00          | 10.000          |            |
| Of Prover 1 MP (1 (M s)<br>Gri O Ant disc<br>Con Official<br>T 1.9 di<br>T |               | 545 110       | Block  | State | Start 1 | mbol<br>Numb | er)   | Pewer<br>[dBm] | Ramp u<br>[un] | P Ramp dov      | MR Judge   |
| -10381 mm     0.000 mm       0.010 mm     0.000 mm       0.000 mm <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>   |               |               |        |       |         |              |       |                |                |                 |            |
| Construction<br>71.19 60 4. Books<br>There for: 91.31800 fr:<br>Prover vs Time Sorry Construction Formation Form   |               |               |        |       |         |              | 1     |                |                |                 |            |
| 71.5 ml         4. Docks           Faire MP.         93.51.000 Hz           Power Van Time         Solyce           Object         1           Josephile         1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>  |               |               |        |       |         |              |       |                |                |                 |            |
|  | Power vs Time | (ESvice)      |        |       | Per     | Amp          | (Lim  | ited I         | Noise          | OffPower        | OnPower    |
|  | -187.8        |               | 114312 |       | -       |              | -     |                | 163            | en<br>Berekendt | 160010     |
|  |               |               |        |       |         |              |       |                |                |                 |            |
|  | Ref.Int       |               | 12     | 33    |         | **           | 25    | 25             | 22             |                 | (CLE/Vane) |

# MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

| 5G Standard Measurement Software (Base License) | MX269051A     |      |
|---|---------------|------|
| NR TDD sub-6 GHz Downlink                       | MX269051A-011 | NR ' |
| NR FDD sub-6 GHz Downlink                       | MX269051A-031 | NR   |

A-011 NR TDD sub-6 GHz Uplink MX269051A-061 NR FDD sub-6 GHz Uplink MX269051A-081 (Continued)

#### Numeric Results

| Name                           | Unit          | Modulation<br>Analysis | Power vs. Time | Remarks  |
|--------------------------------|---------------|------------------------|----------------|--|
| Common                         |               |                        |                |  |
| Frequency Error                | Hz, ppm       | ~                      |                | Displays frequency error   |
| Transmit Power                 | dBm           | ~                      |                | Displays Tx power  |
| Total EVM (rms/peak)           | %, dB         | ~                      |                | Displays EVM rms/peak values   |
| Origin Offset                  | dB            | ~                      |                | Displays Origin Offset value   |
| Time Offset (External Trigger) | ns            | ~                      |                | Displays time offset between Frame header and trigger in ns units<br>Displays Trigger Switch = On only when using external trigger |
| Symbol Clock Error             | ppm           | ✓                      |                | Displays Symbol Clock Error  |
| IQ Skew                        | ns            | ✓                      |                | Displays IQ Skew   |
| IQ Imbalance                   | dB            | ~                      |                | Displays IQ Imbalance in dB units  |
| IQ Quad Error                  | deg.          | ~                      |                | Displays IQ Quadrature Error   |
| Downlink                       |               |                        |                |  |
| P-SS                           |               | ~                      |                |  |
| S-SS                           |               | ~                      |                |  |
| РВСН                           |               | ✓                      |                |  |
| DM-RS (PBCH)                   |               | ✓                      |                | Displays average EVM (rms) and maximum EVM (peak) as well as S-SS · average  |
| PDSCH                          | — %, dB, dBm  | ✓                      |                | power (dBm) for each PHY channel   |
| DM-RS (PDSCH)                  |               | ✓                      |                |  |
| PDCCH                          |               | ✓                      |                |  |
| DM-RS (PDCCH)                  |               | ✓                      |                |  |
| Cell ID                        | —             | ✓                      |                | Displays Cell ID   |
| OFDM Symbol Tx Power           | _             | ✓                      |                | Displays OSTP  |
| On Power                       | dBm, W        |                        | ✓              | Displays average On power  |
| Off Power                      | dBm, W        |                        | ✓              | Displays average Off power   |
| On/Off Ratio                   | dB            |                        | ✓              | Display On/Off power ratio   |
| Power                          | dBm           |                        | ✓              | Displays Block Tx power  |
| Ramp up                        | μs            |                        | ✓              | Displays signal rise time (only On sections)   |
| Ramp down                      | μs            |                        | ✓              | Displays signal fall time (only On sections)   |
| Uplink                         |               |                        |                |  |
| PUSCH                          | — %, dB, dBm  | ✓                      |                |  |
| DM-RS (PUSCH)                  | 76, UD, UDITI | ✓                      |                |  |

#### **Graph Displays**

| Name                                | Modulation<br>Analysis | Power vs. Time |
|-------------------------------------|------------------------|----------------|
| Constellation                       | ~                      |                |
| EVM vs. Subcarrier                  | ~                      |                |
| EVM vs. Symbol                      | ~                      |                |
| Spectral Flatness (Amplitude/Phase) | ~                      |                |
| Power vs. RB                        | ~                      |                |
| EVM vs. RB                          | ~                      |                |
| Summary                             | $\checkmark$           |                |
| Power vs. Time                      |                        | ~              |

# MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

# 5G Standard Measurement Software (Base License)MX269051ANR TDD sub-6 GHz DownlinkMX269051A-011NR FDD sub-6 GHz DownlinkMX269051A-031

A-011 NR TDD sub-6 GHz Uplink MX269051A-061 A-031 NR FDD sub-6 GHz Uplink MX269051A-081 (Continued)

| Standard                    | 3GPP TS 38.211 (2   | 2019-06)   |   |       |  |   |  |  |  |
|-----------------------------|---|--|---|-------|--|---|--|--|--|
|                             | NR TDD sub-6 GF   | Ηz   |   |       |  |   |  |  |  |
| Model/Name                  | NR TDD sub-6 GF<br>Downlink<br>MX269051A-011  | Ηz   | NR FDD sub-6 GHz<br>Downlink<br>MX269051A-031   |       | NR TDD sub-6 GHz<br>Uplink<br>MX269051A-061                                  | <u>.</u>                                  | NR FDD sub-6 GHz<br>Uplink<br>MX269051A-081  |  |  |
| Measurement Frequency Range | 800 MHz to 5 GH   | Z  | 400 MHz to 6 GHz  |       | 800 MHz to 5 GHz   |   | 400 MHz to 6 GHz   |  |  |
| Frequency Setting Range     | MS2690A<br>MS2691A<br>MS2692A   | ≤31.25 M<br>≤62.5 M<br>≤125 M<br>≤31.25 M<br>≤62.5 M<br>≤125 M<br>≤31.25 M<br>≤62.5 M<br>≤62.5 M<br>≤125 M | ysis Bandwidth<br>Hz (Standard)<br>Hz (MS269xA-077)<br>Hz (MS269xA-078)<br>Hz (Standard)<br>Hz (MS269xA-077)<br>Hz (MS269xA-078)<br>Hz (Standard)<br>Hz (MS269xA-077)<br>Hz (MS269xA-078) | Witho | IS269xA-067<br>—<br>—<br>—<br>—<br>—<br>ut MS269xA-067/<br>lector Bypass off | 100 N<br>100 N<br>100 N<br>100 N<br>100 N | Iuency Range<br>IHz to 6 GHz<br>IHz to 6 GHz<br>IHz to 13.5 GHz<br>IHz to 6 GHz<br>IHz to 26.5 GHz<br>IHz to 6 GHz |  |  |
|                             |   |  | Hz (MS269xA-077)<br>Hz (MS269xA-078)  | Prese | lector Bypass on   | 100 MHz to 26.5 GHz                       |  |  |  |
| Test Model                  | NR-FR1-TM1.1,<br>NR-FR1-TM1.2,<br>NR-FR1-TM2,<br>NR-FR1-TM2a,<br>NR-FR1-TM3.1,<br>NR-FR1-TM3.1a,<br>NR-FR1-TM3.2,<br>NR-FR1-TM3.2 |  |   |       |  |   | _  |  |  |
| Subcarrier Spacing (SCS)    | 15 kHz, 30 kHz, 6   | 0 kHz  |   |       | 15 kHz, 30 kHz, 60   | kHz                                       |  |  |  |
| Channel Bandwidth           | 5, 10, 15, 20, 25, 3  | 30, 40, 50, 60   | ), 70, 80, 90, 100 MHz  |       | 5, 10, 15, 20, 25, 30  | , 40, 50, 6                               | 0, 70, 80, 90, 100 MHz   |  |  |
| Modulation                  | CP-OFDM<br>QPSK, 16QAM, 64  | 1QAM, 256C   | AM, Auto  |       | CP-OFDM/DFT-S-C<br>PI/2 BPSK, QPSK, 1  |   | QAM, 256QAM, Auto  |  |  |
| Measurement Channel         | SS-Block, PDSCH,  | PDCCH, PT  | -RS for PUSCH   |       | PUSCH, PT-RS for F   | PUSCH                                     |  |  |  |

#### **RB Number Table**

The channel bandwidth is defined in accordance with SCS and RB.

|           |    |     |    |    |     |     | -   |     | GHz DL/UL<br>MHz] (1CC) |     |     |     |     |     |
|-----------|----|-----|----|----|-----|-----|-----|-----|-------------------------|-----|-----|-----|-----|-----|
|           |    | 5   | 10 | 15 | 30  | 20  | 25  | 40  | 50                      | 60  | 70  | 80  | 90  | 100 |
|           | 15 | 25  | 52 | 79 | 160 | 106 | 133 | 216 | 270                     | N.A | N.A | N.A | N.A | N.A |
| SCS [kHz] | 30 | 11  | 24 | 38 | 78  | 51  | 65  | 106 | 133                     | 162 | 189 | 217 | 245 | 273 |
|           | 60 | N.A | 11 | 18 | 24  | 31  | 38  | 51  | 65                      | 79  | 93  | 107 | 121 | 135 |

#### **Channel Bandwidth**

The maximum channel bandwidth is determined by the Analysis Bandwidth option.

|         |             | Maximum Analysis Bandwidth |
|---------|-------------|----------------------------|
|         | Standard    | 31.25 MHz                  |
| MS269xA | MS269xA-077 | 62.5 MHz                   |
|         | MS269xA-078 | 125 MHz                    |

## 5G Standard Measurement Software (Base License) MX269051A NR TDD sub-6 GHz Downlink MX269051A-011 NR TDD sub-6 GHz Uplink MX269051A-061

MS269xA

#### Specifications

|                               | Signal Analyzer   |  |  |   | MS269xA  |  |                                      |  |  |  |  |  |  |  |
|-------------------------------|---|--|--|---|--|--|--------------------------------------|--|--|--|--|--|--|--|
| Option                        |   | NR TDD sub-6 GH<br>MX269051A-011   | Iz Downlink  |   | NR TDD sub-<br>MX269051A-  |  | k                                    |  |  |  |  |  |  |  |
|                               | Target Signals  | TS 38.211 Sub-6 G  | GHz compliar   | nt downlink signal  | TS 38.211 Sul  | o 6-GHz com  | npliant uplink signal                |  |  |  |  |  |  |  |
|                               |   | Subcarrier Spacir  | ng Channel   | Bandwidth   |  |  |                                      |  |  |  |  |  |  |  |
|                               |   | 15 kHz   | 30 MHz   | (RB: 160), 40 MHz (R  | B: 216), 50 MHz (RB  | : 270)   | B: 106), 25 MHz (RB: 133),           |  |  |  |  |  |  |  |
|                               | Channel Bandwidth   | 30 kHz   | 30 MHz   | (RB: 11), 10 MHz (RB:<br>(RB: 78), 40 MHz (RE<br>(RB: 189), 80 MHz (R                       | : 106), 50 MHz (RB:  | 133), 60 MH  |                                      |  |  |  |  |  |  |  |
|                               |   | 60 kHz   | 10 MHz (RB: 11), 15 MHz (RB: 18), 20 MHz (RB: 24), 25 MHz (RB: 31), 30 MHz (RB: 38),<br>40 MHz (RB: 51), 50 MHz (RB: 65), 60 MHz (RB: 79), 70 MHz (RB: 93), 80 MHz (RB: 107),<br>90 MHz (RB: 121), 100 MHz (RB: 135) |   |  |  |                                      |  |  |  |  |  |  |  |
|                               | Capture Time  | 1 to 2 Frame   |  |   |  |  |                                      |  |  |  |  |  |  |  |
| Electrical                    |   |  | Analys   | sis Bandwidth   | MS269xA-0  | 67   | Frequency Range                      |  |  |  |  |  |  |  |
| Characteristics               |   |  | ≤31.25 MH  | Iz (Standard)   |  |  | 100 MHz to 6 GHz                     |  |  |  |  |  |  |  |
|                               |   | MS2690A  | ≤125 MF  | Iz (MS269xA-077)<br>Iz (MS269xA-078)  | _  |  | 100 MHz to 6 GHz                     |  |  |  |  |  |  |  |
|                               |   | N462601A   |  | Iz (Standard)   |  |  | 100 MHz to 13.5 GHz                  |  |  |  |  |  |  |  |
|                               | Frequency Setting Range   | MS2691A  | ≤125 MF  | Iz (MS269xA-077)<br>Iz (MS269xA-078)  | —  |  | 100 MHz to 6 GHz                     |  |  |  |  |  |  |  |
|                               |   |  |  | Iz (Standard)   |  |  | 100 MHz to 26.5 GHz                  |  |  |  |  |  |  |  |
|                               |   | MS2692A  | ≤125 MF  | Iz (MS269xA-077)<br>Iz (MS269xA-078)  | Without MS269x<br>Preselector Bypa   |  | 100 MHz to 6 GHz                     |  |  |  |  |  |  |  |
|                               |   |  |  | Iz (MS269xA-077)<br>Iz (MS269xA-078)  | Preselector Bypa   | ass on   | 100 MHz to 26.5 GHz                  |  |  |  |  |  |  |  |
|                               | Measurement Frequency Range   | 600 MHz to 5 GHz<br>-10 to +30 dBm (Preamp Off, or Preamp not installed)                                 |  |   |  |  |                                      |  |  |  |  |  |  |  |
|                               | Measurement Level Range   | –25 to +10 dBm (l  | Preamp On)   | •   |  |  |                                      |  |  |  |  |  |  |  |
|                               | Carrier Frequency<br>Measurement Accuracy   | 1 Frame at downli<br>Only 1 carrier of 1<br>30 kHz) or 50 MHz<br>at center frequence<br>± (Accuracy of r | ink signal<br>00 MHz widt<br>z width (Subo<br>cy<br>reference frec   | on, EVM = 1% (rms) s<br>th (Subcarrier Spacin<br>carrier Spacing: 15 kl<br>quency × carrier | 1 Frame at up<br>g: Only 1 carrier<br>Hz) 30 kHz) or 50<br>at center freq<br>± (Accuracy | 1 Frame at uplink signal<br>Only 1 carrier of 100 MHz width (Subcarrier Spacing  |                                      |  |  |  |  |  |  |  |
| vleasurement                  |   | frequency + 10)  |  |   |  |  | hustion                              |  |  |  |  |  |  |  |
|                               | Residual Vector Error   |  | ink signal<br>00 MHz widt<br>z width (Sube   | th (Subcarrier Spacin<br>carrier Spacing: 15 kl   | g: Only 1 carrier<br>Hz) 30 kHz) or 50   | 1 Frame at uplink signal<br>Only 1 carrier of 100 MHz width (Subcarrier Spacing<br>30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kH<br>at center frequency |                                      |  |  |  |  |  |  |  |
|                               |   | ≤1.0%  |  | an Duaanan matimatal  | ≤1.0%  | ≤1.0%  |                                      |  |  |  |  |  |  |  |
|                               | Measurement Level Range   | –25 to +10 dBm (I  | Preamp On)   | or Preamp not instal  | -  |  |                                      |  |  |  |  |  |  |  |
| Amplitude<br>Measurement      | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude |  | n measureme  | on, Input attenuator<br>ent level range and b<br>ncy  |  | put Level  |                                      |  |  |  |  |  |  |  |
|                               | accuracy and in-band frequency characteristics of MS269xA main  |  | ncy Range  |   | or without Preamp  |  | Preamp On                            |  |  |  |  |  |  |  |
|                               | unit.)  | 600 MHz ≤ Fre  | quency < 5 C   | GHz ±1.9  | 1 dB (nom.)  | ±  | 2.20 dB (nom.)                       |  |  |  |  |  |  |  |
| Vaveform Display              |   | Constellation, EVN   | A vs. Subcarr  | ier, EVM vs. Symbol,  | Spectral Flatness, Po  | ower vs. RB,   | EVM vs. RB                           |  |  |  |  |  |  |  |
|                               | Function Overview   |  |  | vaveform data to inte   | ernal storage or exte  | ernal storage  | 1                                    |  |  |  |  |  |  |  |
|                               | Waveform Data   |  | $\sqrt{( ^2 + Q^2)} =$   | 1 for 0 dBm input   | cy and in-band frequ   | Jency charac   | teristics of the signal analyz       |  |  |  |  |  |  |  |
| Digitize Function             | Darlas Frantian   | Analyzes traces of<br>Format: I, Q (32 bi<br>Sampling Rate:  | saved wave   | form data   |  |  |                                      |  |  |  |  |  |  |  |
|                               | Replay Function   | Channel Ban  | dwidth   | Without MS269xA-0<br>Without MS269xA-0  |  |  | With MS269xA-077<br>With MS269xA-078 |  |  |  |  |  |  |  |
|                               |   | ≤100 MI  | Hz   | 50 MHz  | 100 N  | 1Hz  | 200 MHz                              |  |  |  |  |  |  |  |
| Power vs. Time<br>Measurement | Displayed Average Noise   | and an ambient te  | vel for the sig<br>8 option insta<br>emperature r<br>mic Range =   |   | ··· —  |  |                                      |  |  |  |  |  |  |  |

## 5G Standard Measurement Software (Base License) MX269051A NR FDD sub-6 GHz Downlink MX269051A-031 NR FDD sub-6 GHz Uplink MX269051A-081

MS269xA

#### Specifications

|   | Signal Analyzer   |  |   |  | 269xA                   |   |   |  |  |  |  |  |  |  |
|---|---|--|---|--|-------------------------|---|---|--|--|--|--|--|--|--|
| Option                                  |   | NR FDD sub-6GH<br>MX269051A-031  | z Downlink  |  |                         | NR FDD sub-6GHz I<br>MX269051A-081  | Jplink  |  |  |  |  |  |  |  |
|   | Target Signals  | TS 38.211 Sub-6 G  | Hz compliant  | downlink signal  |                         | TS 38.211 Sub 6-GH  | z compliant   | uplink signal  |  |  |  |  |  |  |
|   |   | Subcarrier Spacir  | 5   | Bandwidth  |                         |   |   |  |  |  |  |  |  |  |
|   |   | 15 kHz   | 30 MHz (  | RB: 160), 40 MHz (F  | RB: 21                  | 5 MHz (RB: 79), 20 M<br>6), 50 MHz (RB: 270)  |   |  |  |  |  |  |  |  |
|   | Channel Bandwidth   | 30 kHz   | 30 MHz (  | RB: 78), 40 MHz (RI  | B: 106)                 | 5 MHz (RB: 38), 20 M<br>), 50 MHz (RB: 133), 6<br>7), 90 MHz (RB: 245),   | 0 MHz (RB:  | 162),  |  |  |  |  |  |  |
|   |   | 60 kHz   | 40 MHz (  | ,, ,   | B: 65),                 | 20 MHz (RB: 24), 25<br>60 MHz (RB: 79), 70<br>35)   | . ,   |  |  |  |  |  |  |  |
|   | Capture Time  | 1 to 2 Frame   |   |  |                         |   |   |  |  |  |  |  |  |  |
| Electrical                              |   |  | Analysi   | s Bandwidth  |                         | MS269xA-067   | Fre   | quency Range   |  |  |  |  |  |  |
| Characteristics                         |   |  | ≤31.25 MH:  | z (Standard)   |                         | _   | 100   | MHz to 6 GHz   |  |  |  |  |  |  |
|   |   | MS2690A  |   | z (MS269xA-077)<br>z (MS269xA-078)   |                         | —   | 100   | MHz to 6 GHz   |  |  |  |  |  |  |
|   |   |  | ≤31.25 MH:  |  |                         | —   | 100 I   | MHz to 13.5 GHz  |  |  |  |  |  |  |
|   | Frequency Setting Range   | MS2691A  |   | z (MS269xA-077)<br>z (MS269xA-078)   |                         | _   |   | MHz to 6 GHz   |  |  |  |  |  |  |
|   |   |  | ≤31.25 MH   |  |                         | —   |   | MHz to 26.5 GHz  |  |  |  |  |  |  |
|   |   | MS2692A  | ≤125 MH   | z (MS269xA-077)<br>z (MS269xA-078)   |                         | ithout MS269xA-067,<br>reselector Bypass off  | 1 1001  | MHz to 6 GHz   |  |  |  |  |  |  |
|   |   |  |   | z (MS269xA-077)<br>z (MS269xA-078)   | P                       | reselector Bypass on  | 100 1   | MHz to 26.5 GHz  |  |  |  |  |  |  |
|   | Measurement Frequency Range   | 400 MHz to 6 GHz<br>-10 to +30 dBm (Preamp Off, or Preamp not installed)                               |   |  |                         |   |   |  |  |  |  |  |  |  |
|   | Measurement Level Range   | –10 to +30 dBm (l<br>–25 to +10 dBm (l   |   | r Preamp not insta   | lled)                   |   |   |  |  |  |  |  |  |  |
| Modulation/<br>Frequency<br>Measurement | Carrier Frequency<br>Measurement Accuracy   | signal 1 Frame at<br>Only 1 carrier of 1<br>width or 50 MHz (<br>center frequency<br>However, Only 1 c | downlink sign<br>00 MHz (Subo<br>Subcarrier Sp<br>arrier of 25 M<br>) kHz) width a<br>eference freq | arrier Spacing: 30<br>acing: 15 kHz) widt<br>IHz (Subcarrier Spa<br>t 400 MHz ≤ frequ                            | kHz)<br>th at<br>ncing: | width or 50 MHz (Su<br>center frequency<br>However, Only 1 car<br>15 kHz, 30 kHz, 60 k<br>< 800 MHz   | t uplink signal<br>100 MHz (Subcarrier Spacing: 30<br>z (Subcarrier Spacing: 15 kHz) widt<br>/<br>carrier of 25 MHz (Subcarrier Spa<br>60 kHz) width at 400 MHz ≤ freque<br>reference frequency × carrier |  |  |  |  |  |  |  |
|   | Residual Vector Error   | signal 1 Frame at<br>Only 1 carrier of 1<br>width or 50 MHz (<br>center frequency<br>However, Only 1 c | downlink sign<br>00 MHz (Subo<br>Subcarrier Sp<br>carrier of 25 M                                   | n, EVM = 1% (rms)<br>al<br>arrier Spacing: 30<br>acing: 15 kHz) widt<br>IHz (Subcarrier Spa<br>t 400 MHz ≤ frequ | kHz)<br>th at<br>ncing: | At $18^{\circ} \le to 28^{\circ}C$ , Aft<br>signal 1 Frame at up<br>Only 1 carrier of 100<br>width or 50 MHz (So<br>center frequency<br>However, Only 1 can<br>15 kHz, 30 kHz, 60 k<br>< 800 MHz<br>$\le 1.0\%$ | olink signal<br>) MHz (Subcoubcarrier Spa<br>rrier of 25 Mi   | arrier Spacing: 30 kl<br>Icing: 15 kHz) width<br>Hz (Subcarrier Spac |  |  |  |  |  |  |
|   | Measurement Level Range   | –10 to +30 dBm (l<br>–25 to +10 dBm (l   |   | r Preamp not insta   | lled)                   |   |   |  |  |  |  |  |  |  |
| Amplitude<br>Measurement                | Tx Power Measurement Accuracy<br>(This is found from root sum of<br>squares (RSS) of absolute amplitude<br>accuracy and in-band frequency | Input signal within<br>Only 1 carrier at c   | n measuremer<br>enter frequen   | cy   | oelow                   | value set at Input Lev  |   |  |  |  |  |  |  |  |
|   | characteristics of MS269xA main<br>unit.)   | Freque<br>400 MHz ≤ Fre  | ncy Range<br>quency < 6 G   |  | ,                       | thout Preamp<br>(nom.)  |   | np On<br>B (nom.)  |  |  |  |  |  |  |
| Waveform Display                        |   | Constellation, EVN   | / vs. Subcarrie   | er, EVM vs. Symbol,  | , Spect                 | tral Flatness, Power v  | s. RB, EVM vs   | s. RB  |  |  |  |  |  |  |
|   | Function Overview   |  |   |  |                         | storage or external st  |   |  |  |  |  |  |  |  |
|   | Waveform Data   | ,  | $\sqrt{(l^2 + Q^2)} = 1$<br>me as absolut   | for 0 dBm input<br>e amplitude accura  | icy and                 | d in-band frequency o   | characteristic  | s of the signal analy  |  |  |  |  |  |  |
| Digitize Function                       |   | Analyzes traces of<br>Format: I, Q (32 bi<br>Sampling Rate:  | t floating poir   | nt binary format)  |                         |   |   |  |  |  |  |  |  |  |
|   |   |  |   |  |                         |   |   |  |  |  |  |  |  |  |
|   | Replay Function   | Channel Ban  | dwidth I  | Vithout MS269xA-0<br>Vithout MS269xA-0   |                         | With MS269xA-0<br>Wihtout MS269xA-  |   | ith MS269xA-077<br>ith MS269xA-078                                   |  |  |  |  |  |  |

I = Can be installed. No = Cannot be installed. R = Require. U = Upgrade

## MS2850A/MS2840A/MS2830A Configuration

#### **Options Configuration**

Refer two table shown below about the hardware/software which each frequency model of MS2830A can implement.

#### MS2830A Hardware Configuration

Frequency range (MS2830A-040/041/043/044/045) not upgradable.

|      |  | fit      | Addition to Main unit Combination with "Option" (Refer to the left line) |        |     |     |     |     |              |     |          |              |          |     |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
|------|--|----------|--|--------|-----|-----|-----|-----|--------------|-----|----------|--------------|----------|-----|----------|-----------------|---|--------------|---|-------------|----|----|----|----|-------------|-----|----|----|-----------|-------------|--------------|-------------|-------------|-------------|--------------|
| Opt. | Name   | Retrofit | 040  | 041    | 043 | 044 | 045 | 001 | 002          | 005 | 900      | 600          | 220      | 078 |          |                 |   |              |   |             |    |    |    |    | 026         |     |    |    | 029       | 066         | 067          | 068         | 088         | 189         | 182          |
| 001  | Rubidium Reference Oscillator                                  |          | ~  | -<br>✓ | ~   | ~   | ~   | X   | *9           | -   | -        | -            | -        | -   | -        | -               | - | -            | - | -           | -  | -  | -  | -  | -           | -   |    | -  |           | -           |              |             | -           |             | _            |
| 002  | High Stability Reference Oscillator                            |          | ~  | ~      | ~   | No  | No  | *9  | $\mathbf{X}$ |     |          | No           |          |     |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             | No           | No          |             |             |              |
| 005  | Analysis Bandwidth Extension to 31.25 MHz                      |          | ~  | ~      | ~   | ~   | No  |     |              | X   | R        | No           |          |     |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 006  | Analysis Bandwidth 10 MHz                                      |          | ~  | ~      | ~   | ~   | ✓   |     |              | U   | $\times$ | U            | U        | U   |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 009  | Bandwidth Extension to 31.25 MHz for Millimeter-wave           |          | No   | No     | No  | No  | ~   |     | No           | No  | R        | $\mathbf{X}$ |          |     |          |                 |   |              |   |             | No | No | No | No |             |     | No | No | No        | No          |              |             | No          | No          |              |
| 077  | Analysis Bandwidth Extension to 62.5 MHz                       | No       | 1  | ~      | ~   | ~   | ~   |     |              | *5  | R        | *5           | $\times$ |     |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 078  | Analysis Bandwidth Extension to 125 MHz                        | No       | ~  | ~      | ~   | ~   | ~   |     |              | *5  | R        | *5           | R        | X   |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 008  | Preamplifier   |          | ~  | ~      | ~   | *1  | *1  |     |              |     |          |              | Í        |     | $\times$ |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              | *1          |             |             |              |
| 010  | Phase Noise Measurement Function                               |          | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     |          | $\triangleleft$ |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 011  | 2ndary HDD   |          | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     | Í        |                 | X |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 014  | Removable HDD, Win10   | *13      | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     |          |                 |   | $\mathbf{X}$ |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 016  | Precompliance EMI Function                                     |          | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     |          |                 |   |              | X |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             |              |
| 017  | Noise Figure Measurement Function                              |          | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     | U        |                 |   |              |   | $\boxtimes$ |    |    |    |    |             |     |    |    |           |             |              | U           |             |             |              |
| 018  | Audio Analyzer*4   |          | ~  | ~      | *7  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             | X  |    |    |    |             |     |    |    |           | R           | No           | No          |             |             |              |
| 020  | 3.6 GHz Vector Signal Generator                                |          | 1  | ~      | *2  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | X  | No |    |             | *11 |    |    |           | *2          | No           | No          | No          | No          |              |
| 021  | 6 GHz Vector Signal Generator                                  |          | ~  | ~      | *2  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | No | Х  |    |             | *11 |    |    |           | *2          | No           | No          | No          | No          |              |
| 022  | Low Power Extension for Vector Signal Generator                |          | ~  | ~      | ~   | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | F  | 2  | X  |             |     |    |    |           |             | No           | No          | No          | No          |              |
| 026  | BER Measurement Function                                       |          | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     |          |                 |   |              |   |             |    |    |    |    | $\boxtimes$ |     |    |    |           |             |              |             |             |             |              |
| 052  | Internal Signal Generator Control Function                     | *12      | ~  | ~      | *2  | No  | No  |     |              |     |          |              |          |     |          |                 |   |              |   |             |    | *  | 1  |    |             | X   |    |    |           | *2          |              |             | *11         |             |              |
| 027  | ARB Memory Upgrade 256 MSa for Vector Signal Generator         |          | ~  | ~      | ~   | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | F  | ł  |    |             |     | X  |    |           |             | No           | No          | *3          | *3          |              |
| 028  | AWGN   |          | 1  | 1      | ~   | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | F  | ł  |    |             |     |    | X  |           |             | No           | No          | *3          | *3          |              |
| 029  | Analog Function Extension for Vector Signal Generator*4        | *8       | ~  | ~      | No  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | F  | ł  | R  |             |     |    |    | $\square$ | R           | No           | No          | No          | No          |              |
| 066  | Low Phase Noise Performance                                    | No       | ~  | ~      | *2  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | *  | 2  |    |             | *2  |    |    |           | $\boxtimes$ | No           | No          |             |             |              |
| 067  | Microwave Preselector Bypass                                   |          | No   | No     | No  | ~   | ~   |     | No           |     |          |              |          |     |          |                 |   |              |   |             | No | No | No | No |             |     | No | No | No        | No          | $\mathbb{X}$ |             | No          | No          |              |
| 068  | Microwave Preamplifier   |          | No   | No     | No  | *1  | *1  |     | No           |     |          |              |          |     | *1       |                 |   |              |   |             | No | No | No | No |             |     | No | No | No        | No          |              | $\boxtimes$ | No          | No          |              |
| 088  | 3.6 GHz Analog Signal Generator*4                              |          | ~  | ~      | No  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | No | No | No |             | *11 | *3 | *3 | No        | R           | No           | No          | $\boxtimes$ | U           |              |
| 189  | Vector Function Extension for Analog Signal Generator Retrofit |          | ~  | ~      | No  | No  | No  |     |              |     |          | No           |          |     |          |                 |   |              |   |             |    | No | No | No |             |     | *3 | *3 | No        | R           | No           | No          | R           | $\boxtimes$ |              |
| 182  | CPU/Windows10 Upgrade Retrofit                                 | *10      | ~  | ~      | ~   | ~   | ~   |     |              |     |          |              |          |     |          |                 |   |              |   |             |    |    |    |    |             |     |    |    |           |             |              |             |             |             | $\mathbf{X}$ |

\*1: Cannot be installed simultaneously MS2830A-008 and MS2830A-068/168. When MS2830A-168 is added to Signal Analyzer with MS2830A-008, only MS2830A-168 becomes effective.

\*2: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.

\*3: MS2830A-027 and MS2830A-028 are not used in analog signal generator (MS2830A-088/188).

After vector function (MS2830A-189) was added, the vector signal generator function can add MS2830A-027 and MS2830A-028. \*4: Requires MX269018A.

\*5: MS2830A-040/041/043/044 require MS2830A-005.

MS2830A-045 requires MS2830A-009

\*6: An image response is received when setting the bandwidth to more than 31.25 MHz.

This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).

The Signal Analyzer MS2690A is recommended for other measurement purposes.

\*7: The MS2830A-018 can be installed with MS2830A-043 but cannot be installed simultaneously with a signal generator (MS2830A-088/020/021/029) because MS2830A-066 is required. Consequently, analog wireless Rx tests cannot be performed using the same main unit when the MS2830A-018 and MS2830A-043 are combined.

\*8: Please contact our sales representative when requesting retrofitting.

\*9: The Rubidium Reference Oscillator can be retrofitted to MS2830A-040/041/043 with installed High Stability Reference Oscillator.

In this case, the Rubidium Reference Oscillator is functional.

\*10: Replace the MS2830A CPU board with either Windows Embedded Standard 2009 (Windows XP) or Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019.

Windows XP is installed in MS2830A units ordered until August 2016.

Windows 7 is installed in MS2830A units ordered from September 2016 which have a label indicating C1 attached near the serial number.

Windows 10 is installed in MS2830A units ordered from September 2020 and has a label indicating C2 attached near the serial number.

\*11: Installing the MS2830A-052 requires any of the MS2830A-020/120, 021/121, or 088/188 options.

\*12: When retrofitting signal generator-linked functions (MS2830A-352), the license is delivered on an accessory DVD which is used to install the license in the MS2830A. It is not necessary to return the MS2830A to Anritsu for upgrading.

\*13: The CPU/Windows10 Upgrade Retrofit MS2830A-182/282 option is required when the MS2830A OS is not Windows 10.

#### MS2840A Hardware Configuration

Frequency range (MS2840A-040/041/044/046) not upgradable.

|      |   |          | Ac                  | dition to           | Main u              | nit                 | 1           |     |                        |                        |                               |              |             | Co          | mbi  | inati | on w     | ith "           | 'Opt."            | (Ref        | er to | Combination with "Opt." (Refer to the left line) |       |          |    |     |            |      |              |             |     |  |  |  |  |
|------|---|----------|---------------------|---------------------|---------------------|---------------------|-------------|-----|------------------------|------------------------|-------------------------------|--------------|-------------|-------------|------|-------|----------|-----------------|-------------------|-------------|-------|--|-------|----------|----|-----|------------|------|--------------|-------------|-----|--|--|--|--|
| Opt. | Name  | Retrofit | 040 (3.6 GHz)       | 041 (6 GHz)         | 044 (26.5 GHz)      | 046 (44.5 GHz)      | 001         | 002 | 005 (standard install) | 006 (standard install) | 009 (standard install)<br>077 | 078          | 008         |             |      |       |          |                 | 016               |             | 026   |  |       | 067      |    | 021 | 189<br>022 | 027  | 028          | 088         | 029 |  |  |  |  |
| 001  | Rubidium Reference Oscillator   | Yes      | √                   | √                   | ~                   | ~                   | $\boxtimes$ | *5  |                        |                        |                               |              |             |             |      |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 002  | High Stability Reference Oscillator                                     | Yes      | ~                   | ~                   |                     | valent<br>installed | *5          | Х   |                        | N                      | lo                            |              |             | No          | No   | No    |          |                 |                   |             |       |  |       | No       |    |     |            |      |              |             |     |  |  |  |  |
| 005  | Analysis Bandwidth Extension to 31.25 MHz                               | -        | Standard<br>install | Standard<br>install | Standard<br>install | No                  |             |     | X                      | N                      | lo                            |              |             |             | No   |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 006  | Analysis Bandwidth 10 MHz   | -        | Standard<br>install | Standard<br>install | Standard<br>install | Standard<br>install |             |     | X                      | $\langle \rangle$      |                               |              |             |             |      |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 009  | Bandwidth Extension to 31.25 MHz for<br>Millimeter-wave                 | -        | No                  | No                  | No                  | Standard<br>install |             | No  | No                     | $\langle \! \rangle$   | $\sqrt{-}$                    |              |             |             |      |       | T        |                 |                   |             |       |  | No    | 1        | No | No  | No N       | No   | No           | No          | No  |  |  |  |  |
| 077  | Analysis Bandwidth Extension to 62.5 MHz*1                              | Yes      | √                   | √                   | ✓                   | ~                   |             |     | X                      | $\checkmark$           | $\langle \rangle$             | 1            |             |             |      |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 078  | Analysis Bandwidth Extension to 125 MHz*1                               | Yes      | ~                   | ~                   | ✓                   | ✓                   |             |     | $\times$               | $\left \right\rangle$  | R                             | $\mathbb{X}$ | 1           |             |      |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 008  | Preamplifier  | Yes      | ~                   | ✓                   | ✓                   | ✓                   |             |     |                        |                        |                               |              | $\boxtimes$ | *6          | *6   |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 069  | 26.5 GHz Microwave Preamplifier   | Yes      | No                  | No                  | ~                   | No                  |             | No  |                        | N                      | lo                            |              | *6          | $\boxtimes$ | No   |       |          |                 |                   |             |       |  | No    | 1        | No | No  | No N       | o No | No           | No          | No  |  |  |  |  |
| 068  | Microwave Preamplifier  | Yes      | No                  | No                  | No                  | ~                   |             | No  | ١                      | ٧o                     |                               |              | *6          | No          | imes |       |          |                 |                   |             |       |  | No    | 1        | No | No  | No N       | o No | No           | No          | No  |  |  |  |  |
| 019  | 2 dB Step Attenuator for Millimeter-wave                                | Yes      | No                  | No                  | No                  | ~                   |             | No  | ٢                      | ٧o                     |                               |              |             | No          |      | X     |          |                 |                   |             |       |  | No    | 1        | No | No  | No N       | o No | No           | No          | No  |  |  |  |  |
| 010  | Preamplifier  | Yes      | ~                   | ✓                   | ✓                   | ✓                   |             |     |                        |                        |                               |              |             |             |      |       | $\times$ |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 011  | 2ndary SSD  | Yes      | ~                   | ✓                   | ~                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          | $\triangleleft$ |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 014  | Removable SSD, Win10  | Yes *7   | ~                   | ~                   | ~                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          |                 | $\langle  $       |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 016  | Precompliance EMI Function  | Yes      | ~                   | ~                   | ~                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          |                 | $\mathbf{\nabla}$ | ]           |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 017  | Noise Figure Measurement Function                                       | Yes      | ~                   | ~                   | ✓                   | ✓                   |             |     |                        |                        |                               |              | U           | U           | U    |       |          |                 |                   | $\boxtimes$ |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 026  | BER Measurement Function  | Yes      | ~                   | ~                   | ✓                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          |                 |                   |             | $\ge$ |  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 051  | Noise Floor Reduction   | Yes      | ~                   | ✓                   | ✓                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          |                 |                   |             |       | X  |       |          |    |     |            |      |              |             |     |  |  |  |  |
| 066  | Low Phase Noise Performance   | Yes      | ~                   | ✓                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  | $\ge$ |          |    |     |            |      |              |             |     |  |  |  |  |
| 067  | Microwave Preselector Bypass  | Yes      | No                  | No                  | ✓                   | ✓                   |             | No  |                        |                        |                               |              |             |             |      |       |          |                 |                   |             |       |  | K     | <u> </u> | -  | _   | No N       | o No | No           |             | No  |  |  |  |  |
|      | 3.6 GHz Vector Signal Generator   | Yes      | ~                   | ~                   | No                  | No                  |             |     |                        |                        | lo                            |              |             | No          |      |       |          |                 |                   |             |       |  | _     | No       |    |     |            |      |              | No          |     |  |  |  |  |
| 021  | 6 GHz Vector Signal Generator   | Yes      | √                   | √                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  |       | No       | ۷o | ХĮ  | No         |      |              | No          |     |  |  |  |  |
| 189  | Vector Function Extension for<br>Analog Signal Generator Retrofit       | Yes      | ~                   | ~                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  |       | No       | No | No  | Xn         | b    |              | R           | No  |  |  |  |  |
| 022  | Low Power Extension for<br>Vector Signal Generator                      | Yes      | ~                   | ~                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  |       | No       | R  |     | No         |      |              | No          |     |  |  |  |  |
| 027  | ARB Memory Upgrade 256 Msa for<br>Vector Signal Generator* <sup>2</sup> | Yes      | ~                   | ~                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       | T        |                 |                   |             |       |  |       | No       |    | R   |            |      |              |             |     |  |  |  |  |
| 028  | AWGN*2  | Yes      | √                   | √                   | No                  | No                  |             |     |                        | N                      | lo                            | 1            |             | No          | No   |       |          |                 |                   |             |       |  |       | No       |    | R   |            | Ť    | $\mathbb{X}$ |             |     |  |  |  |  |
| 088  | 3.6 GHz Analog Signal Generator*3                                       | Yes      | √                   | ~                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  |       | No       | No | No  | N          | 2    | Í            | $\boxtimes$ | No  |  |  |  |  |
| 029  | Analog Function Extension for<br>Vector Signal Generator* <sup>3</sup>  | Yes      | ~                   | ~                   | No                  | No                  |             |     |                        | N                      | lo                            |              |             | No          | No   |       |          |                 |                   |             |       |  |       | No       | R  |     | No R       |      |              | No          | X   |  |  |  |  |
| 182  | CPU/Windows10 Upgrade Retrofit*4  | Yes      | ~                   | ~                   | ~                   | ~                   |             |     |                        |                        |                               |              |             |             |      |       |          |                 |                   |             |       |  |       |          |    |     |            |      |              |             |     |  |  |  |  |

\*1: An image response is received when setting the bandwidth to more than 31.25 MHz.

This can be used when not inputting a signal frequency outside the MS2840A analysis bandwidth (125 MHz max.).

The Signal Analyzer MS2690A is recommended for other measurement purposes.

\*2: The ARB Memory Upgrade 256 Msa for Vector Signal Generator (MS2840A-027) and AWGN (MS2840A-028) are non-functional in the Analog Signal Generator (MS2840A-029/088).

\*3: Requires Analog Measurement Software (MX269018A).

\*4: Replace the MS2840A CPU board with Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019. Windows 7 is installed in MS2840A units ordered until August 2020.

Windows 10 is installed in MS2840A units ordered from September 2020 and has a label indicating C2 attached near the serial number.

\*5: The Rubidium Reference Oscillator can be retrofitted to the MS2840A-040/041 with installed High Stability Reference Oscillator.

In this case, the Rubidium Reference Oscillator is functional.

\*6: The 26.5 GHz Microwave Preamplifier or Microwave Preamplifier can be retrofitted to the MS2840A-044/046 with installed Preamplifier.

In this case, the 26.5 GHz Microwave Preamplifier or Microwave Preamplifier are functional.

\*7: The CPU/Windows10 Upgrade Retrofit MS2840A-182/282 option is required when the MS2840A OS is not Windows 10.

#### • MS2850A Hardware Configuration

Frequency range (MS2850A-046/047) not upgradable.

|             |   |          |                                 |                               |  | $\checkmark$ | = Ca        | n be i      | nstall      | ed, No                            | = Ca        | nnot        | be ins      | talled      | l, <mark>R</mark> = | Requi       | ire, U       | = Up        | grade       |
|-------------|---|----------|---------------------------------|-------------------------------|--|--------------|-------------|-------------|-------------|-----------------------------------|-------------|-------------|-------------|-------------|---------------------|-------------|--------------|-------------|-------------|
|             |   |          |                                 | ion to<br>1 unit              | Combination with "Option" (Refer to the left line) |              |             |             |             |                                   |             |             |             |             |                     |             |              |             |             |
| Option      | Name  | Retrofit | MS2850A-046<br>(44.5 GHz model) | MS2850A-047<br>(32 GHz model) | MS2850A-032<br>(standard install)                  | MS2850A-033  | MS2850A-034 | MS2850A-010 | MS2850A-017 | MS2850A-067<br>(standard install) | MS2850A-068 | MS2850A-072 | MS2850A-076 | MS2850A-051 | MS2850A-011         | MS2850A-014 | MS2850A-053  | MS2850A-054 | MS2850A-182 |
| MS2850A-032 | Analysis Bandwidth 255 MHz                                | —        | Standard<br>install             | Standard<br>install           | $\boxtimes$  |              |             |             |             |                                   |             |             |             |             |                     |             |              |             |             |
| MS2850A-033 | Analysis Bandwidth Extension to 510 MHz                   | Yes      | ✓                               | ✓                             |  | $\ge$        |             |             |             |                                   |             |             |             |             |                     |             |              |             |             |
| MS2850A-034 | Analysis Bandwidth Extension to 1 GHz                     | Yes      | ✓                               | ✓                             |  | R            | $\bowtie$   |             |             |                                   |             |             |             |             |                     |             |              |             |             |
| MS2850A-010 | Phase Noise Measurement Function                          | Yes      | √                               | ✓                             |  |              |             | $\succ$     |             |                                   |             |             |             |             |                     |             |              |             |             |
| MS2850A-017 | Noise Figure Measurement Function                         | Yes      | ✓                               | ✓                             |  |              |             |             | $\ge$       |                                   | U           |             |             |             |                     |             |              |             |             |
| MS2850A-067 | Microwave Preselector Bypass                              | —        | Standard<br>install             | Standard<br>install           |  |              |             |             |             | $\bowtie$                         |             |             |             |             |                     |             |              |             |             |
| MS2850A-068 | Microwave Preamplifier                                    | Yes      | ✓                               | ✓                             |  |              |             |             |             |                                   | $\ge$       | ]           |             |             |                     |             |              |             |             |
| MS2850A-072 | Extended Specifications                                   | Yes      | ✓                               | $\checkmark$                  |  |              |             |             |             |                                   |             | $\bowtie$   |             |             |                     |             |              |             |             |
| MS2850A-076 | Low Second Harmonic Distortion                            | Yes      | ✓                               | ✓                             |  |              |             |             |             |                                   |             |             | $\bowtie$   |             |                     |             |              |             |             |
| MS2850A-051 | Noise Floor Reduction                                     | Yes      | $\checkmark$                    | $\checkmark$                  |  |              |             |             |             |                                   |             |             |             | $\succ$     |                     |             |              |             |             |
| MS2850A-011 | Secondary Storage Device                                  | Yes      | ✓                               | ✓                             |  |              |             |             |             |                                   |             |             |             |             | $\bowtie$           |             |              |             |             |
| MS2850A-014 | Removable SSD, Win10                                      | Yes*1    | ✓                               | ✓                             |  |              |             |             |             |                                   |             |             |             |             |                     | $\ge$       |              |             |             |
| MS2850A-053 | External Interface for<br>High Speed Data Transfer PCIe   | Yes      | ~                               | ~                             |  |              |             |             |             |                                   |             |             |             |             |                     |             | $\mathbf{X}$ |             |             |
| MS2850A-054 | External Interface for<br>High Speed Data Transfer USB3.0 | Yes      | ~                               | ~                             |  |              |             |             |             |                                   |             |             |             |             |                     |             |              | $\times$    |             |
| MS2850A-182 | CPU/Windows10 Upgrade Retrofit*2                          | Yes      | ✓                               | ✓                             |  |              |             |             |             |                                   |             |             |             |             |                     |             |              |             | $\bowtie$   |

\*1: The CPU/Windows10 Upgrade Retrofit MS2850A-182/282 option is required when the MS2850A OS is not Windows 10.

\*2: Replace the MS2850A CPU board with Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019. Windows 7 is installed in MS2850A units ordered until August 2020. Windows 10 is installed in MS2850A units ordered from September 2020 and has a label indicating C2 attached near the serial number.

#### MS2830A Software Configuration

|               |  |              |      |             |     |                       |        |        |             |     | ,   | $\checkmark$ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade   |
|---------------|--|--------------|------|-------------|-----|-----------------------|--------|--------|-------------|-----|-----|---|
|               | Add  | lition       | to M | ain fra     | ame | A                     | nalysi | is Ban | dwidt       | th  |     |   |
| Model         | Name   | 040          | 041  | 043         | 044 | 045                   | 005    | 900    | 600         | 077 | 078 | Note  |
| MX269011A     | W-CDMA/HSPA Downlink Measurement Software      | ~            | ~    | ~           | ~   | ✓                     |        | R      |             |     |     |   |
| MX269012A     | W-CDMA/HSPA Uplink Measurement Software        | ~            | ~    | ~           | ✓   | ~                     |        | R      |             |     |     |   |
| MX269013A     | GSM/EDGE Measurement Software                  | ~            | ~    | ~           | ~   | ✓                     |        | R      |             |     |     |   |
| MX269013A-001 | EDGE Evolution Measurement Software            | ~            | ✓    | ~           | ✓   | ✓                     |        | R      |             |     |     | Requires MX269013A  |
| MX269015A     | TD-SCDMA Measurement Software                  | ~            | ~    | ~           | ~   | ✓                     |        | R      |             |     |     |   |
| MX269017A     | Vector Modulation Analysis Software            | ~            | ~    | ~           | √*3 | √*3                   | U      | R      | U*1         | U   | U   | U: Upgrade of the phase noise performance (MS2830A-066)<br>(Measured signal: Frequency <3.6 GHz, Bandwidth <1 MHz)  |
| MX269018A     | Analog Measurement Software                    | ~            | ~    | <b>√</b> *2 | No  | No                    |        |        | No          |     |     | Requires MS2830A-066 and A0086D<br>(See MX2690xxA series Measurement Software catalog for detail)<br>Note) MS2830A-043 cannot implement a signal generator for Rx test<br>(Because MS2830A-066 is required) |
| MX269020A     | LTE Downlink Measurement Software              | ~            | ~    | ~           | ~   | $\checkmark$          | R      | R      | <b>R</b> *1 |     |     |   |
| MX269020A-001 | LTE-Advanced FDD Downlink Measurement Software | ✓            | ✓    | ✓           | 1   | ✓                     | R      | R      | <b>R</b> *1 | U   | U   | Requires MX269020A  |
| MX269021A     | LTE Uplink Measurement Software                | ~            | ~    | ~           | ~   | <ul> <li>✓</li> </ul> | R      | R      | <b>R</b> *1 |     |     |   |
| MX269021A-001 | LTE-Advanced FDD Uplink Measurement Software   | ~            | ~    | ~           | ~   | ✓                     | R      | R      | <b>R</b> *1 | U   | U   | Requires MX269021A  |
| MX269022A     | LTE TDD Downlink Measurement Software          | $\checkmark$ | ~    | ~           | ~   | ✓                     | R      | R      | <b>R</b> *1 |     |     |   |
| MX269022A-001 | LTE-Advanced TDD Downlink Measurement Software | ~            | ~    | ~           | ~   | ✓                     | R      | R      | <b>R</b> *1 | U   | U   | Requires MX269022A  |
| MX269023A     | LTE TDD Uplink Measurement Software            | ✓            | ✓    | ✓           | ✓   | ✓                     | R      | R      | <b>R</b> *1 |     |     |   |
| MX269023A-001 | LTE-Advanced TDD Uplink Measurement Software   | ~            | ~    | ~           | ~   | ~                     | R      | R      | <b>R</b> *1 | U   | U   | Requires MX269023A  |
| MX269024A     | CDMA2000 Forward Link Measurement Software     | ~            | ~    | ~           | ✓   | ✓                     |        | R      |             |     |     |   |
| MX269024A-001 | All Measure Function                           | ~            | ~    | ~           | ~   | ✓                     |        | R      |             |     |     | Requires MX269024A  |
| MX269026A     | EV-DO Forward Link Measurement Software        | ✓            | ✓    | ~           | ✓   | ~                     |        | R      |             |     |     |   |
| MX269026A-001 | All Measure Function                           | ✓            | ~    | ~           | ~   | ✓                     |        | R      |             |     |     | Requires MX269026A  |
| MX269028A     | WLAN (802.11) Measurement Software             | ✓            | ~    | ~           | ~   | ~                     | R      | R      | <b>R</b> *1 |     |     |   |
| MX269028A-001 | 802.11ac (80 MHz) Measurement Software         | ✓            | ✓    | ~           | ✓   | ✓                     | R      | R      | <b>R</b> *1 | R   | R   | Only for MS2830A. Requires MX269028A  |
| MX269030A     | W-CDMA BS Measurement Software                 | ~            | ~    | ~           | ✓   | <ul> <li>✓</li> </ul> |        | R      |             |     |     |   |

\*1: MS2830A-045 cannot be installed MS2830A-005. Add MS2830A-009 in substitution for MS2830A-005.

\*2: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.

By the system that MS2830A-066 is necessary, MS2830A-020/021 is not added to MS2830A-043.

\*3: By the measurement of the narrowband signal, add MS2830A-066. (Channel bandwidth: x kHz to 100 kHz) MS2830A-044/045 cannot be installed MS2830A-066.

#### MS2840A Software Configuration

|               | - Can be installed, No - Cannot be installed, No - Cannot be installed, No - Cannot be installed, No - Connot be installed |               |             |                       |                |                |               |  |  |  |
|---------------|--|---------------|-------------|-----------------------|----------------|----------------|---------------|--|--|--|
| Model         | Name   |               | Addition to | Analysis<br>Bandwidth |                |                |               |  |  |  |
|               |  | 040 (3.6 GHz) | 041 (6 GHz) | 044 (26.5 GHz)        | 046 (44.5 GHz) | 077 (62.5 MHz) | 078 (125 MHz) |  |  |  |
| MX269017A     | Vector Modulation Analysis Software  | ~             | ~           | ~                     | ~              | ~              | $\checkmark$  |  |  |  |
| MX269017A-001 | APSK Analysis  | √             | ~           | ~                     | ~              | ~              | ✓             |  |  |  |
| MX269017A-011 | Higher-Order QAM Analysis  | ✓             | ~           | ~                     | ✓              | ~              | ✓             |  |  |  |
| MX269018A     | Analog Measurement Software*   | ~             | ~           | ~                     | ~              |                |               |  |  |  |
| MX284059B     | Pulse Radar Measurement Function   | No            | No          | ~                     | ~              |                |               |  |  |  |

\*: Requires USB Audio A0086D

#### ✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

#### MS2850A Software Configuration

| Ontion        | Name  |                                 | Main frame<br>be installed    |                          | dwidth option<br>pgrade | Note  |  |  |
|---------------|---|---------------------------------|-------------------------------|--------------------------|-------------------------|---|--|--|
| Option        | Name  | MS2850A-046<br>(44.5 GHz model) | MS2850A-047<br>(32 GHz model) | MS2850A-033<br>(510 MHz) | MS2850A-034<br>(1 GHz)  | Note  |  |  |
| MX285051A     | 85051A 5G Standard Measurement Software<br>(Base License) |                                 | ~                             | U                        | U                       | This license can't be used alone.<br>Requires any one of<br>MX285051A-001/011/021/031/051/<br>061/071/081 |  |  |
| MX285051A-001 | Pre-Standard CP-OFDM Downlink                             | √                               | $\checkmark$                  | U                        | U                       | Requires MX285051A  |  |  |
| MX285051A-051 | Pre-Standard CP-OFDM Uplink                               | √                               | ✓                             | U                        | U                       | Requires MX285051A  |  |  |
| MX285051A-011 | NR TDD sub-6 GHz Downlink                                 | √                               | √                             |                          |                         | Requires MX285051A  |  |  |
| MX285051A-061 | NR TDD sub-6 GHz Uplink                                   | √                               | ✓                             |                          |                         | Requires MX285051A  |  |  |
| MX285051A-031 | NR FDD sub-6 GHz Downlink                                 | √                               | ✓                             |                          |                         | Requires MX285051A  |  |  |
| MX285051A-081 | NR FDD sub-6 GHz Uplink                                   | √                               | ✓                             |                          |                         | Requires MX285051A  |  |  |
| MX285051A-021 | NR TDD mmWave Downlink                                    | √                               | ✓                             | U                        | U                       | Requires MX285051A  |  |  |
| MX285051A-071 | NR TDD mmWave Uplink                                      | √                               | ✓                             | U                        | U                       | Requires MX285051A  |  |  |
| MX269011A     | W-CDMA/HSPA Downlink<br>Measurement Software              | ~                               | ~                             |                          |                         |   |  |  |
| MX269012A     | W-CDMA/HSPA Uplink<br>Measurement Software                | ~                               | ~                             |                          |                         |   |  |  |
| MX269013A     | GSM/EDGE Measurement Software                             | ✓                               | ✓                             |                          |                         |   |  |  |
| MX269013A-001 | EDGE Evolution<br>Measurement Software                    | ✓                               | ~                             |                          |                         | Requires MX269013A  |  |  |
| MX269015A     | TD-SCDMA Measurement Software                             | √                               | ✓                             |                          |                         |   |  |  |
| MX269020A     | LTE Downlink Measurement Software                         | √                               | ✓                             |                          |                         |   |  |  |
| MX269020A-001 | LTE-Advanced FDD Downlink<br>Measurement Software         | ✓                               | ~                             |                          |                         | Requires MX269020A  |  |  |
| MX269021A     | LTE Uplink Measurement Software                           | ✓                               | ✓                             |                          |                         |   |  |  |
| MX269021A-001 | LTE-Advanced FDD Uplink<br>Measurement Software           | ✓                               | ~                             |                          |                         | Requires MX269021A  |  |  |
| MX269022A     | LTE TDD Downlink<br>Measurement Software                  | ~                               | ~                             |                          |                         |   |  |  |
| MX269022A-001 | LTE-Advanced TDD Downlink<br>Measurement Software         | √                               | √                             |                          |                         | Requires MX269022A  |  |  |
| MX269023A     | LTE TDD Uplink<br>Measurement Software                    | ~                               | ~                             |                          |                         |   |  |  |
| MX269023A-001 | LTE-Advanced TDD Uplink<br>Measurement Software           | ✓                               | ~                             |                          |                         | Requires MX269023A  |  |  |
| MX269017A     | Vector Modulation Analysis Software                       | √                               | ✓                             |                          |                         |   |  |  |
| MX269017A-001 | APSK Analysis   | √                               | ✓                             |                          |                         | Requires MX269017A  |  |  |
| MX269017A-011 | Higher-Order QAM Analysis                                 | √                               | √                             |                          |                         | Requires MX269017A  |  |  |

## **Ordering Information**

Please specify the model/order number, name and quantity when ordering. The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name. The MS2691A main unit has been discontinued. The MS2692A main unit is only for the Conformance Test System and cannot be purchased separately.

| Model/Order No  | Name  | Model/Order No     | Name   |
|-----------------|---|--------------------|--|
|                 | Main Unit   | MX285051A-031      | NR FDD sub-6 GHz Downlink  |
| MS2690A         | Signal Analyzer (50 Hz to 6 GHz)                              |                    | (MS2850A only, Requires MX285051A)   |
| MS2850A-047     | Signal Analyzer (9 kHz to 32 GHz)                             | MX285051A-081      | NR FDD sub-6 GHz Uplink (MS2850A only, Requires MX285051A)                             |
| MS2850A-046     | Signal Analyzer (9 kHz to 44.5 GHz)                           | MX285051A-021      | NR TDD mmWave Downlink   |
| MS2840A-040     | Signal Analyzer (9 kHz to 3.6 GHz)                            |                    | (MS2850A only, Requires MX285051A)   |
| MS2840A-041     | Signal Analyzer (9 kHz to 6 GHz)                              | MX285051A-071      | NR TDD mmWave Uplink (MS2850A only, Requires MX285051A)                                |
| MS2840A-044     | Signal Analyzer (9 kHz to 26.5 GHz)                           | MX269051A          | 5G Standard Measurement Software (Base License)  |
| MS2840A-046     | Signal Analyzer (9 kHz to 44.5 GHz)                           |                    | (MS269xA only, Requires any one of MX269051A-011/031/                                  |
| MS2830A-040     | Signal Analyzer (9 kHz to 3.6 GHz)                            |                    | 061/081)   |
| MS2830A-041     | Signal Analyzer (9 kHz to 6 GHz)                              | MX269051A-011      | NR TDD sub-6 GHz Downlink  |
| MS2830A-043     | Signal Analyzer (9 kHz to 13.5 GHz)                           |                    | (MS269xA only, Requires MX269051A)   |
| MS2830A-044     | Signal Analyzer (9 kHz to 26.5 GHz)                           | MX269051A-061      | NR TDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)                             |
| MS2830A-045     | Signal Analyzer (9 kHz to 43 GHz)                             | MX269051A-031      | NR FDD sub-6 GHz Downlink  |
|                 | Software Options  | NAV2COOF1A 001     | (MS269xA only, Requires MX269051A)   |
|                 | CD-ROM with license and operation manuals                     | MX269051A-081      | NR FDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)                             |
| MX269011A       | W-CDMA/HSPA Downlink Measurement Software                     | 14/200045          | Application Parts  |
| MX269012A       | W-CDMA/HSPA Uplink Measurement Software                       | W3098AE            | MX269011A Operation Manual (Operation)   |
| MX269013A       | GSM/EDGE Measurement Software                                 | W3099AE            | MX269011A Operation Manual (Remote Control)  |
| MX269013A-001   | EDGE Evolution Measurement Software                           | W3060AE<br>W3061AE | MX269012A Operation Manual (Operation)   |
|                 | (Requires MX269013A)  |                    | MX269012A Operation Manual (Remote Control)  |
| MX269014A       | ETC/DSRC Measurement Software (MS269xA only)                  | W3100AE            | MX269013A Operation Manual (Operation)   |
| MX269015A       | TD-SCDMA Measurement Software                                 | W3101AE<br>W3031AE | MX269013A Operation Manual (Remote Control)<br>MX269014A Operation Manual (Operation)  |
| MX269017A       | Vector Modulation Analysis Software                           | W3032AE            | MX269014A Operation Manual (Operation)<br>MX269014A Operation Manual (Remote Control)  |
| MX269017A-001   | APSK Analysis (Requires MX269017A)                            | W3044AE            |  |
| MX269017A-011   | Higher-Order QAM Analysis (Requires MX269017A)                | W3045AE            | MX269015A Operation Manual (Operation)<br>MX269015A Operation Manual (Remote Control)  |
| MX269018A       | Analog Measurement Software (For MS2840A and MS2830A.         | W3305AE            | MX269017A Operation Manual (Operation)   |
|                 | MS2830A-066 and A0086D are required for MS2830A.              | W3306AE            | MX269017A Operation Manual (Operation)<br>MX269017A Operation Manual (Remote Control)  |
|                 | A0086D is required for MS2840A.)                              | W3555AE            | MX269018A Operation Manual (Operation)   |
| MX269020A       | LTE Downlink Measurement Software                             | W3556AE            | MX269018A Operation Manual (Ceperation)<br>MX269018A Operation Manual (Remote Control) |
| MX269020A-001   | LTE-Advanced FDD Downlink Measurement Software                | W3014AE            | MX269020A Operation Manual (Operation)   |
| N/2000011       | (Requires MX269020A)  | W3064AE            | MX269020A Operation Manual (Remote Control)  |
| MX269021A       | LTE Uplink Measurement Software                               | W3015AE            | MX269021A Operation Manual (Operation)   |
| MX269021A-001   | LTE-Advanced FDD Uplink Measurement Software                  | W3065AE            | MX269021A Operation Manual (Remote Control)  |
| MX269022A       | (Requires MX269021A)<br>LTE TDD Downlink Measurement Software | W3209AE            | MX269022A Operation Manual (Operation)   |
| MX269022A       | LTE-Advanced TDD Downlink Measurement Software                | W3210AE            | MX269022A Operation Manual (Remote Control)  |
| WIX203022A-001  | (Requires MX269022A)  | W3521AE            | MX269023A Operation Manual (Operation)   |
| MX269023A       | LTE TDD Uplink Measurement Software                           | W3522AE            | MX269023A Operation Manual (Remote Control)  |
| MX269023A-001   | LTE-Advanced TDD Uplink Measurement Software                  | W3201AE            | MX269024A Operation Manual (Operation)   |
| 111/203023/1001 | (Requires MX269023A)  | W3202AE            | MX269024A Operation Manual (Remote Control)  |
| MX269024A       | CDMA2000 Forward Link Measurement Software                    | W3203AE            | MX269026A Operation Manual (Operation)   |
| MX269024A-001   | All Measure Function (Requires MX269024A)                     | W3204AE            | MX269026A Operation Manual (Remote Control)  |
| MX269026A       | EV-DO Forward Link Measurement Software                       | W3528AE            | MX269028A Operation Manual (Operation)   |
| MX269026A-001   | All Measure Function (Requires MX269026A)                     | W3529AE            | MX269028A Operation Manual (Remote Control)  |
| MX269028A       | WLAN (802.11) Measurement Software                            | W2860AE            | MX269030A Operation Manual (Operation)   |
| MX269028A-001   | 802.11ac (80 MHz) Measurement Software                        | W2861AE            | MX269030A Operation Manual (Remote Control)  |
|                 | (MS2830A only, Requires MX269028A)                            | W4101AE            | MX284059B Operation Manual   |
| MX269028A-002   | 802.11ac (160 MHz) Measurement Software                       | W3922AE            | MX285051A/MX269051A Operation Manual (Operation)                                       |
|                 | (MS269xA only, Requires MX269028A)                            | W3924AE            | MX285051A-001/MX285051A-051 Operation Manual   |
| MX269030A       | W-CDMA BS Measurement Software                                |                    | (Operation)  |
| MX284059B       | Pulse Radar Measurement Function (MS2840A-044/046 only)       | W3925AE            | MX285051A-001/MX285051A-051 Operation Manual   |
| MX285051A       | 5G Standard Measurement Software (Base License)               |                    | (Remote Control)   |
|                 | (MS2850A only, Requires any one of MX285051A-001/011/         | W3963AE            | MX285051A-011/MX269051A-011/MX285051A-021/   |
|                 | 021/031/051/061/071/081)                                      |                    | MX285051A-061/MX269051A-061/MX285051A-071  |
| MX285051A-001   | Pre-Standard CP-OFDM Downlink                                 |                    | Operation Manual (Operation)   |
|                 | (MS2850A only, Requires MX285051A)                            | W3964AE            | MX285051A-011/MX269051A-011/MX285051A-021/   |
| MX285051A-051   | Pre-Standard CP-OFDM Uplink                                   |                    | MX285051A-061/MX269051A-061/MX285051A-071  |
|                 | (MS2850A only, Requires MX285051A)                            |                    | Operation Manual (Remote Control)  |
| MX285051A-011   | NR TDD sub-6 GHz Downlink                                     | W4035AE            | MX285051A-031/MX269051A-031/MX285051A-081/   |
|                 | (MS2850A only, Requires MX285051A)                            |                    | MX269051A-081 Operation Manual (Operation)   |
| MX285051A-061   | NR TDD sub-6 GHz Uplink                                       | W4036AE            | MX285051A-031/MX269051A-031/MX285051A-081/   |
|                 | (MS2850A only, Requires MX285051A)                            |                    | MX269051A-081 Operation Manual (Remote Control)  |

# Advancing beyond

#### United States

Anritsu Americas Sales Company 450 Century Parkway, Suite 190, Allen, TX 75013 U.S.A. Phone: +1-800-Anritsu (1-800-267-4878)

#### • Canada Anritsu Electronics Ltd. 700-100 Queen Street Ottawa, Ontario K1P 1J9, Canada

Phone: +1-800-Anritsu (1-800-267-4878) • Brazil

**Anritsu Eletronica Ltda.** Praça Amadeu Amaral, 27 - 1 Andar 01327-010 - Bela Vista - Sao Paulo - SP, Brazil Phone: +55-11-3283-2511 Fax: +55-11-3288-6940

Mexico
 Anritsu Company, S.A. de C.V.

 Blvd Miguel de Cervantes Saavedra #169 Piso 1, Col. Granada
 Mexico, Ciudad de Mexico, 11520, MEXICO

 Phone: +52-55-4169-7104

United Kingdom

Anritsu EMEĀ Ltd. 200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K. Phone: +44-1582-433200 5ax: +44-1582-731303

• France

Anritsu S.A. 12 avenue du Québec, Immeuble Goyave, 91140 VILLEBON SUR YVETTE, France Phone: +33-1-60-92-15-50

#### • Germany

Anritsu GmbH Nemetschek Haus, Konrad-Zuse-Platz 1, 81829 München, Germany Phone: +49-89-442308-0 Fax: +49-89-442308-55

## • Italy

Anritsu S.r.l. Spaces Eur Arte, Viale dell'Arte 25, 00144 Roma, Italy Phone: +39-6-509-9711

#### • Sweden Anritsu AB

Kistagången 20 B, 2 tr, 164 40 Kista, Sweden Phone: +46-8-534-707-00

Finland
 Anritsu AB
 Technopolis Aviapolis, Teknobulevardi 3-5 (D208.5.),
 FI-01530 Vantaa, Finland
 Phone: +358-20-741-8100

#### • Denmark Anritsu A/S

Anrisu A/S c/o Regus Winghouse, Ørestads Boulevard 73, 4th floor, 2300 Copenhagen S, Denmark Phone: +45-7211-2200

• Russia Anritsu EMEA Ltd. Representation Office in Russia Tverskaya str. 16/2, bld. 1, 7th floor., Moscow, 125009, Russia Phone: +7-495-363-1694 Fax: +7-495-3935-8962

• Spain

#### Anritsu EMEA Ltd.

Representation Office in Spain Paseo de la Castellana, 141. Planta 5, Edificio Cuzco IV 28046, Madrid, Spain Phone: +34-91-572-6761

## • Austria

Anritsu EMEA GmbH Am Belvedere 10, A-1100 Vienna, Austria Phone: +43-(0)1-717-28-710

• United Arab Emirates Anritsu EMEA Ltd. Anritsu A/S

Office No. 164, Building 17, Dubai Internet City P. O. Box – 501901, Dubai, United Arab Emirates Phone: +971-4-3758479

#### • India Anritsu India Private Limited

Anrisu India Private Limited 6th Floor, Indiqube ETA, No.38/4, Adjacent to EMC2, Doddanekundi, Outer Ring Road, Bengaluru – 560048, India Phone: +91-80-6728-1300 Fax: +91-80-6728-1301 Specifications are subject to change without notice.

#### Singapore

Anritsu Pte. Ltd. 11 Chang Cham Road, #04-01, Shriro House, Singapore 159640 Phone: +65-6282-2400 Fax: +65-6282-2533

• Vietnam Anritsu Company Limited 16th Floor, Peakview Tower, 36 Hoang Cau Street, O Cho Dua Ward, Dong Da District, Hanoi, Vietnam Phone: +84-24-3201-2730

#### • P.R. China (Shanghai) Anritsu (China) Co., Ltd.

Room 2701-2705, Tower A, New Caohejing International Business Center No. 391 Gui Ping Road Shanghai, 200233, P.R. China Phone: +86-21-6237-0898 Fax: +86-21-6237-0899

• P.R. China (Hong Kong) Anritsu Company Ltd.

Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza, No. 1 Science Museum Road, Tsim Sha Tsui East, Kowloon, Hong Kong, P.R. China Phone: +852-2301-4980 Fax: +852-2301-3545

• Japan Anritsu Corporation 8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan Phone: +81-46-296-6509 Fax: +81-46-225-8352

#### • Korea

Anritsu Corporation, Ltd. 5FL, 235 Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13494 Korea Phone: +82-31-696-7750 Fax: +82-31-696-7751

## Australia Apritou Pty Ltd

**Anritsu Pty. Ltd.** Unit 20, 21-35 Ricketts Road, Mount Waverley, Victoria 3149, Australia Phone: +61-3-9558-8177 Fax: +61-3-9558-8255

2302

• Taiwan Anritsu Company Inc.

7F, No. 316, Sec. 1, NeiHu Rd., Taipei 114, Taiwan Phone: +886-2-8751-1816 Fax: +886-2-8751-1817