NXDN Rx Test Solution

MG3710A
Vector Signal Generator
NXDN
Rx Test Solution

NXDN Technical Specifications

Common Air Interface
  NXDN TS 1-A Version 1.3 (Nov 2011)
Common Air Interface Type.D
  NXDN TS 2-A Version 1.1 (Mar 2012)
Transceiver Performance Test
  NXDN TS 1-E Version 1.1 (Jun 2012)

Note: For details, refer to the NXDN standard.

Version 1.00
May 2014
Anritsu Corporation
**[Anritsu] NXDN Rx Test Solution**

For Rx Evaluation

*Output multi-signals with one unit!*

MG3710A Vector Signal Generator

- **Single**
  - Single memory in one RF port
  - Wanted Signal
  - Normal

- **Dual**
  - Dual memory in one RF port
  - Wanted Signal + Unwanted Signal (Mod)
  - + Opt-048

- **Triple**
  - Dual memory in two RF ports
  - Wanted Signal + Unwanted Signal (Mod) + Unwanted Signal (CW)
  - + Opt-062 (2.7 GHz)

*Combination of Baseband Signal option:* (Two internal ARB memories)

Selects two waveform patterns per RF output for setting mutual frequency offset, level offset, delay time, etc., to output two signals from one RF port.

Frequency (recommended range: ±60 MHz) and level (CN: ±80 dB) can also be set at the screen.
### [Anritsu] NXDN Rx Test Solution

**Note:** For detail, refer to the NXDN standard.

<table>
<thead>
<tr>
<th><strong>NXDN</strong></th>
<th><strong>Receiver test items</strong></th>
<th><strong>Signal Generator</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TS 2-A</strong></td>
<td><strong>Wanted Signal</strong></td>
<td><strong>Unwanted Signal</strong></td>
</tr>
<tr>
<td>5.1.4</td>
<td>Reference Sensitivitiy (Static)</td>
<td>SMS/FSMS</td>
</tr>
<tr>
<td>5.1.5</td>
<td>Reference Sensitivitiy (Faded)</td>
<td>Faded SMS/Faded FSMS</td>
</tr>
<tr>
<td>5.1.6</td>
<td>Adjacent Channel Rejection</td>
<td>SMS/FSMS</td>
</tr>
<tr>
<td>5.1.7</td>
<td>Co-channel Rejection</td>
<td>SMS/FSMS</td>
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<tr>
<td>5.1.8</td>
<td>Spurious Rejection</td>
<td>SMS/FSMS</td>
</tr>
<tr>
<td>5.1.9</td>
<td>Intermodulation Rejection</td>
<td>SMS/FSMS</td>
</tr>
<tr>
<td>5.1.10</td>
<td>Sensitivity of Frequency Offset</td>
<td>SMS/FSMS</td>
</tr>
</tbody>
</table>

**SMS:** Standard Modulation State  
**FSMS:** Formatted Standard Modulation State  
**IMS:** Interfering Modulation State

Faded SMS/Faded FSMS: User can create Faded pattern by using Fading IQproducer (Option).

**CW:** User can output CW signal using non-modulation mode of main frame

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**MG3710A**  
Vector Signal Generator

<table>
<thead>
<tr>
<th><strong>NXDN TS 2-A</strong></th>
<th><strong>Pattern Name for SG</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.4</td>
<td>Standard Modulation State</td>
</tr>
<tr>
<td>4.1.4</td>
<td>Formatted Standard Modulation State</td>
</tr>
<tr>
<td>4.1.5</td>
<td>Interfering Modulation State</td>
</tr>
<tr>
<td>4.1.6</td>
<td>Non-modulation State</td>
</tr>
<tr>
<td>4.1.7</td>
<td>Maximum Frequency Deviation Symbol Stream</td>
</tr>
<tr>
<td>4.1.8</td>
<td>1/3 Frequency Deviation Symbol Stream</td>
</tr>
</tbody>
</table>

**TDMA IQproducer:** These patterns are uploaded in the Anritsu website. The user only purchases a license (TDMA IQproducer) and may omit work to create these patterns.
[Anritsu] NXDN Rx Test Solution

Built-in BER Measurement Function (Opt-021)

BER Measurement Example

Measure Mode
- Single: Measures selected data patterns until result reaches specified number of bits or specified number of error bits
- Continuous: Repeats single measurements (default)
- Endless: Measures data until result reaches upper limit of measurement count bit

Count Mode
- Data: Specifies number of measurement bits (default)
- Error: Specifies number of measurement error bits

Data Type
- PN9/11/15/20/23, ALL1, ALL0, Alternate (0101...), User Data, PN9fix/11fix/15fix/20fix/23fix

Error Rate
- Measure Mode
- Count Mode

Error Bit
- Measure Mode
- Count Mode

Measurement Bit
- Measure Mode
- Count Mode

Clears measurement result
- Measure Mode
- Count Mode

Start or Stop
- Measure Mode
- Count Mode
Receiver Performance Measurement Methods

Reference Sensitivity (Static)

Measures input level when BER = 3%

The Vector SG is supported as an MG2830A option.

The MS2830A is recommended when only “Reference Sensitivity” is included in the manufacturing Rx test.

Expected Value: BER of 3% when 2556 or more data bits captured

<table>
<thead>
<tr>
<th>Channel Spacing</th>
<th>Class</th>
<th>BE</th>
<th>ME</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.25 kHz (4800 bps)</td>
<td>A</td>
<td>−117 dBm</td>
<td>−117 dBm</td>
<td>−117 dBm</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>−114 dBm</td>
<td>−114 dBm</td>
<td>−114 dBm</td>
</tr>
<tr>
<td>12.5 kHz (9600 bps)</td>
<td>A</td>
<td>−115 dBm</td>
<td>−115 dBm</td>
<td>−115 dBm</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>−112 dBm</td>
<td>−112 dBm</td>
<td>−112 dBm</td>
</tr>
</tbody>
</table>

Note:
Class A performance levels are the recommended performance for transceivers with enhanced interference protection characteristics. Class B performance levels are the recommended minimum performance for transceivers.
Receiver Performance Measurement Methods

Reference Sensitivity (Static)

Choose NXDN signal you want from the list.
Receiver Performance Measurement Methods

Reference Sensitivity (Faded)

Measures input level when BER = 3%
A flat faded signal is input to the receiver via a Rayleigh fading simulator.

**Fading IQproducer:**
“Fading (Flat/Rayleigh)” pattern created by Fading IQproducer. This is supported only by the MG3710A.

**Expected Value:** BER of 3% when 2556 or more data bits captured

**Fading conditions**
- Flat faded signal
- Rayleigh fading
- Moving speed 8 km/h, 100 km/h

**Limits:**

<table>
<thead>
<tr>
<th>Channel Spacing</th>
<th>Class</th>
<th>BE</th>
<th>ME</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.25 kHz (4800 bps)</td>
<td>A</td>
<td>-109 dBm</td>
<td>-109 dBm</td>
<td>-109 dBm</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-106 dBm</td>
<td>-106 dBm</td>
<td>-106 dBm</td>
</tr>
<tr>
<td>12.5 kHz (9600 bps)</td>
<td>A</td>
<td>-107 dBm</td>
<td>-107 dBm</td>
<td>-107 dBm</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-104 dBm</td>
<td>-104 dBm</td>
<td>-104 dBm</td>
</tr>
</tbody>
</table>
Receiver Performance Measurement Methods

Reference Sensitivity (Faded)

- Wanted Signal (Faded)
- User creates Fading pattern using Fading IQproducer
- Load to Memory
- Load to Fading IQproducer
- Fading IQproducer: “Fading (Flat/Rayleigh)” pattern created by Fading IQproducer. This is supported only by the MG3710A.

Load to Memory

Standard Modulation State

Formatted Standard Simulcast Modulation
Receiver Performance Measurement Methods

Adjacent Channel Rejection

Measures ability to reject unwanted signal applied to adjacent channels of ±6.25 kHz or ±12.5 kHz

**Dual Memory:**
One RF port has two memories. Two signals are output at one RF port. The Frequency and Level can be set. This is supported only by the MG3710A.

**Expected Value:** BER of 3% when 2556 or more data bits captured

**Limits:**

<table>
<thead>
<tr>
<th>Channel Spacing</th>
<th>Class</th>
<th>BE</th>
<th>ME</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.25 kHz (4800 bps)</td>
<td>A</td>
<td>50 db</td>
<td>50 db</td>
<td>50 db</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>45 db</td>
<td>45 db</td>
<td>45 db</td>
</tr>
<tr>
<td>12.5 kHz (9600 bps)</td>
<td>A</td>
<td>55 db</td>
<td>55 db</td>
<td>55 db</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>55 db</td>
<td>55 db</td>
<td>55 db</td>
</tr>
</tbody>
</table>

**Note:** For details, refer to the NXDN standard.

**Reference Sensitivity Level**
- 3 dB

**Wanted Signal**

**Memory A @1stRF**

**Data / Clock**
Adjacent Channel Rejection

Merit of Dual Memory:
- Two signals of “Wanted signal” and “Unwanted signal” are output by one RF-port.
- Both Level and C/N set for each level.
- Frequency offset set by direct input.

- 12.5 kHz or 6.25 kHz
- Frequency Offset
- Wanted Signal
- Unwanted Signal
- Wanted Signal Level
- Unwanted Signal Level
- Wanted/Unwanted Level Ratio
Receiver Performance Measurement Methods

Co-channel Rejection

Measures ability to reject unwanted signal applied to same channel.

Expected Value: BER of 3% when 2556 or more data bits captured

Limits: ≤12 dB

Dual Memory:
One RF port has two memories. Two signals are output at one RF port. The Frequency and Level can be set. This is supported only by the MG3710A.

RF1 = Wanted signal (PN9)
- Level: 3 dB above reference sensitivity
RF2 = Unwanted signal (PN15)
- Frequency: Same as [RF1 Freq]

Note: For details, refer to the NXDN standard.

Reference
Sensitivity Level 3 dB
Wanted
Signal

Memory A @1stRF

Memory A @1stRF
Co-channel Rejection

**Merit of Dual Memory:**
- Two signals of “Wanted signal” and “Unwanted signal” are output by one RF-port.
- Both Level and C/N set for each level
- Frequency offset set by direct input.

![Diagram of MG3710A](image)

- **Wanted Signal**
- **Unwanted Signal**

![Graph showing the wanted and unwanted signal levels and ratios](image)

- **Wanted Signal Level**
- **Unwanted Signal Level**
- **Wanted/Unwanted Level Ratio**
Receiver Performance Measurement Methods

Spurious Rejection

Measures ability to reject specified unwanted signal applied to receiver under test. The frequency of the unwanted signal is varied over a range from half of the lowest IF frequency of the receiver under test to twice the highest receiver frequency or 1000 MHz, whichever is higher. Exclude all responses within ±50 kHz of the receiver frequency.

Expected Value: BER of 3% when 2556 or more data bits captured

Limits:

<table>
<thead>
<tr>
<th>Class</th>
<th>BE</th>
<th>ME</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75 dB</td>
<td>75 dB</td>
<td>70 dB</td>
</tr>
<tr>
<td>B</td>
<td>70 dB</td>
<td>70 dB</td>
<td>60 dB</td>
</tr>
</tbody>
</table>

Two RF Ports: The MG3710A supports two RF ports in one unit, cutting equipment costs.

Reference Sensitivity Level

Pu = Pref + SRR + 6 dB

Pu is the level of the signal generator [dBm]
Pref is the level of reference sensitivity [dBm]
SRR is the manufacturer specified limit for spurious rejection [dB]

Note: For details, refer to the NXDN standard.
Receiver Performance Measurement Methods

Spurious Rejection

Two RF Ports:
The MG3710A supports two RF ports in one unit, cutting equipment costs.

Wanted Signal

1stRF

Unwanted Signal

2ndRF

Spurious Rejection

Exclude ±50 kHz

Lowest IF Freq

Unwanted Signal

Receiver Freq x 2 or 1000 MHz (whichever is greater)

Unwanted Signal

Wanted Signal

2ndRF

1stRF
Receiver Performance Measurement Methods

Intermodulation Rejection

Measures ability to reject intermodulation caused by unwanted signals with offset frequency of +50 kHz/+100 kHz or −50 kHz/−100 kHz

**Dual Memory:**
One RF port has two memories. Two signals are output by one RF port. The Frequency, Level and Delay-Time can be set. This is supported only by the MG3710A.

**Two RF Ports:**
The MG3710A supports two RF ports in one unit, cutting equipment costs.

**Expected Value:** BER of 3% when 2556 or more data bits captured

**Limits:**

<table>
<thead>
<tr>
<th>Class</th>
<th>BE</th>
<th>ME</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75 dB</td>
<td>70 dB</td>
<td>65 dB</td>
</tr>
<tr>
<td>B</td>
<td>70 dB</td>
<td>65 dB</td>
<td>50 dB</td>
</tr>
</tbody>
</table>

**Note:** For details, refer to the NXDN standard.
Receiver Performance Measurement Methods

Intermodulation Rejection

**Wanted Signal**

Frequency Offset e.g. +50 kHz

**Unwanted Signal (CW: Mod = Off)** @2nd RF

**Two RF Ports:**
The MG3710A supports two RF ports in one unit, cutting equipment costs.

**Merit of Dual Memory:**
- Two signals of “Wanted signal” and “Unwanted signal” are output by one RF-port.
- Both Level and C/N set for each level.
- Frequency offset set by direct input.

*Combination of Baseband Signal option:* (Two internal ARB memories)
Frequency (recommended range: ±60 MHz) and level (CN: ±80 dB) can also be set at the screen.
Receiver Performance Measurement Methods

Frequency Offset Sensitivity

Measures ability to reject signal in standard modulation state with specified offset frequency from nominal frequency

Expected Value: BER of 3% when 2556 or more data bits captured

Limits:

<table>
<thead>
<tr>
<th>Channel Spacing</th>
<th>Frequency Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.25 kHz</td>
<td>±500 Hz</td>
</tr>
<tr>
<td>12.5 kHz</td>
<td>±1000 Hz</td>
</tr>
</tbody>
</table>

Note: For details, refer to the NXDN standard.
[Appendix] How to Create NXDN Pattern 1/2

TDMA IQproducer

Standard Modulation State (Non-Formatted)

PN9
[Appendix] How to Create NXDN Pattern 2/2

TDMA IQproducer

Formatted Standard Modulation State

TDMA IQproducer for MG3710E

Parameter File

PN9 Formatted Standard Modulation

State

TDMA IQproducer

Modulation Type

Maximum frequency deviation

Keep phase continuity

Mapping Edit

Filter

RMS

PN9

FSW

LICH

SACCH

VCH 72

VCH 72

VCH 72

FACCH1 144

FACCH1 144

The Number of Frames: 5
The Number of Slots per Frame: 1
The Number of Bits per Slot: 384
Data Rate: 480 kbps
Filter Type: ARIB ST-796
Roll Off: BIT 0.2
RMS: 1157

Slide 19
MG3710A-E-L-3
[Appendix] How to Create Faded Pattern  1/2

Start Fading IQproducer

[IQpro]
- Click [General Purpose] tab.
- Click [Fading] icon.

Set Fading Parameter
(Tx Antenna Configuration)

Click [Reference].
- Select [PN9-Form-Static] or [PN9-NonForm-Static].
- (C:\Anritsu\MG3710A\User Data\Waveform \NXDN-2400sps*) on MG3710A HDD
  *Or NXDN-4800 sps

Set RF Frequency (e.g.: 155.05 MHz)

Create different patterns for each evaluated frequency
[Appendix] How to Create Faded Pattern 2/2

Set Fading Parameter (Channel condition)
Click [Channel 1] tab.
Set [Fading Type] = Rayleigh.
Set [Moving Speed] = 8 km/h or 100 km/h.
Set [Spectrum Shape] = Flat.

Create Pattern (Calculation)
Click [Calculation].
Input [Package] name.
(e.g.: NXDN-4800sps-Faded-155MHz)
Input [Pattern] name.
(e.g.: PN9-Form-100kmh)
Click [OK].

Finish
**Base Configuration**

<table>
<thead>
<tr>
<th>Model</th>
<th>Product Name</th>
<th>One RF port</th>
<th>Two RF ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG3710A</td>
<td>Vector Signal Generator</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MG3710A-032</td>
<td>1stRF 100 kHz to 2.7 GHz</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MG3710A-042</td>
<td>Low Power Extension for 1stRF</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MG3710A-048</td>
<td>Combination of Baseband Signal for 1stRF</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MG3710A-062</td>
<td>2ndRF 100 kHz to 2.7 GHz</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MG3710A-021</td>
<td>BER Test Function</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MX370102A</td>
<td>TDMA IQproducer</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Additional Recommended Options**

<table>
<thead>
<tr>
<th>Model</th>
<th>Product Name</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG3710A-002</td>
<td>High Stability Reference Oscillator</td>
<td>Aging Rate: $\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-8}$/day</td>
</tr>
<tr>
<td>MG3710A-043/073</td>
<td>Reverse Power Protection</td>
<td>Protects signal output connector against reverse input power. 20 W @ &lt;2 GHz (Standard 2 W nominal)</td>
</tr>
<tr>
<td>MG3710A-045/075</td>
<td>ARB Memory Upgrade 256 Msample</td>
<td>Upgrades ARB size to 256 Msamples (1 GB)</td>
</tr>
<tr>
<td>MX370107A</td>
<td>Fading IQproducer</td>
<td>To create Faded signal</td>
</tr>
</tbody>
</table>

Required for Reference Sensitivity (Faded)