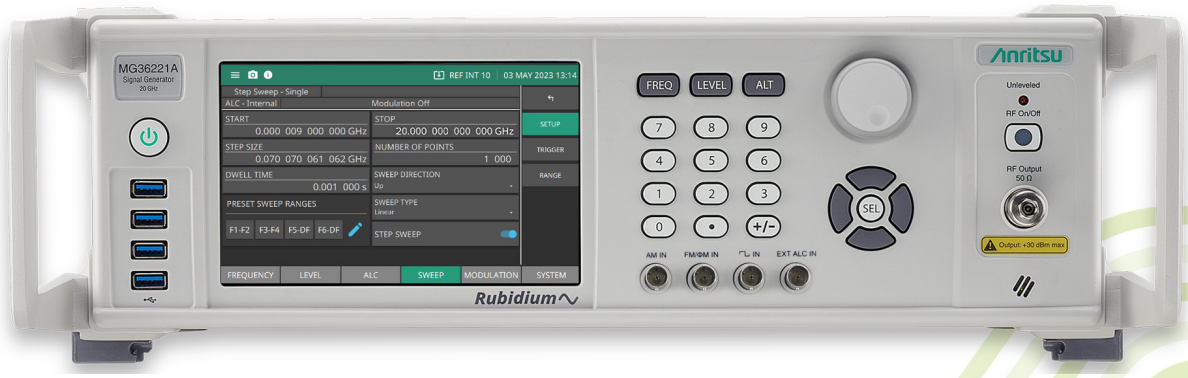
Anritsu Advancing beyond

# Rubidium™

## RF/Microwave Signal Generator

| MG36221A | MG36241A | MG36271A |
|---|---|---|
| 9 kHz to 20 GHz | 9 kHz to 43.5 GHz | 9 kHz to 70 GHz |



## Introduction

The Rubidium™ MG362x1A is a microwave signal generator offering industry's lowest phase noise, best in class harmonics and spurious, excellent frequency stability, high output power, upgradability, reliability, and service. Our signal generators are configurable for a broad range of applications from R&D to manufacturing and depot repair. The Rubidium MG362x1A signal generator product line is built to deliver outstanding signal purity and frequency stability across a broad frequency range of 9 kHz to 70 GHz, even at high output power levels. The exceptional frequency stability coupled with low phase noise performance makes the Rubidium MG362x1A the ideal choice for many measurement applications. Anritsu provides a total solution including proven reliability and standard 1 year warranty plus pre-sale and post-sale support that is the best in the industry.

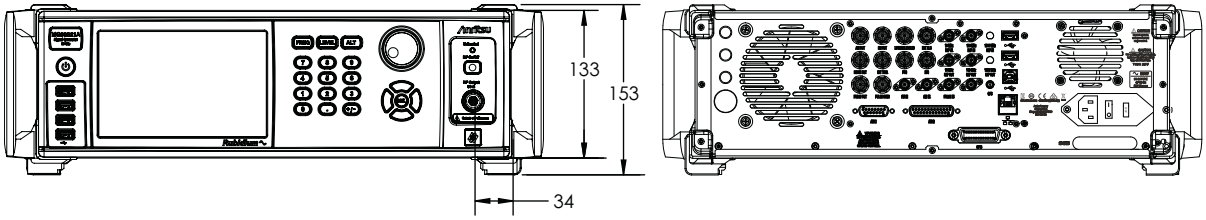
## Instrument Highlights

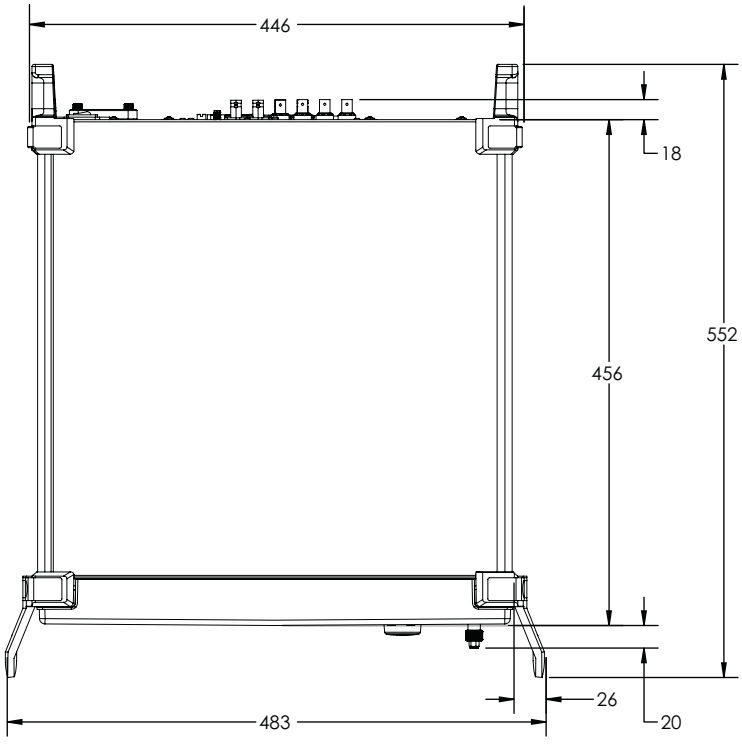
- Frequency range: 9 kHz to 20/43.5/70 GHz
- Operable to 72 GHz
- Frequency resolution: 0.001 Hz
- SSB phase noise: –136 dBc/Hz (typical) and –140 dBc/Hz (measured) at 10 GHz output, 10 kHz offset
- Internal time base stability – Aging: < ±2.0 x $10^{-8}$ per year with Option 3
- Frequency range extendable to 1.1 THz
- Reference frequency input/output: 10 MHz, 100 MHz, 1600 MHz
- Up to +30 dBm leveled output power
- Output power:
  –130 dBm to +20 dBm (20 GHz standard output)
  –130 dBm to +16 dBm (43.5 GHz, standard output)
  –100 dBm to +6 dBm (70 GHz, standard output)
- Harmonics: (20/43.5/70 GHz) –55 dBc
- Non-harmonics: (20/43.5/70 GHz) –63 dBc
- Modulation: AM, FM, PM, and Pulse
- Leveled pulse modulation
- Pulse modulation: Rise/Fall times 5 ns (typical)
- Pulse train generator option to simulate complex pulse radar signals.
- LF signal generator waveforms: Sine, square, pulse, triangle, ramp, GN/UN noise, User defined
- Frequency sweep modes: Analog, Step, List
- Frequency sweep width: 9 kHz to full frequency range (step, list), 100 MHz to full frequency range (Analog)
- Power sweep: Analog, Step and List
- Power sweep resolution: 0.01 dB/step
- On-site User Level Calibration

## Capabilities and Functional Highlights

- The Low Phase Noise option delivers improved close-in phase noise from the standard Rubidium along with better frequency stability.
- The Ultra Low Phase Noise Option provides improved phase noise at higher offsets.
- For CW only applications between 2 GHz to 20 GHz, Rubidium provides even lower phase noise than the Ultra Low Phase Noise option, by another 3 dB on a separate RF output port at the back panel.
- The low noise RF/microwave signal generator Rubidium MG362x1A offers atomic clock frequency stability with an internal rubidium frequency reference option.
- Modulation capabilities include AM, FM, phase, and pulse to address simple to complex signal simulation requirements.
- Comprehensive pulse generation capabilities for testing pulse radar systems.
- On-site user level calibration capabilities helps maintain level accuracy over time, saves time and cost, and improves instrument availability.

## MG362x1A Dimensions




Dimensions in mm

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## Definitions

Supplemental characteristics, denoted as (typical), measured, or nominal, provide additional (non-warranted) information, helpful in the application of the product.

| | |
|---|---|
| Warranted Performance | All specifications and characteristics apply under the stated conditions below, unless otherwise stated:<br>• After 30 minutes of warm-up time, where the instrument is left in the on state.<br>• Over the 25 °C ± 5 °C temperature range. |
| Typical Performance | Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted. |
| Measured Performance | Represents characteristic performance not warranted, but most likely to occur. |
| Nominal Performance | Represents representative performance not warranted or statistically derived from measurements, but by design. |
| Calibration Cycle | Recommended calibration cycle is 2 years from the date of shipment (Standard Warranty). |
| | All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com. |

## Frequency

| Model | Frequency Coverage | Output Connector |
|---|---|---|
| MG36221A | 9 kHz to 20.0 GHz | 2.92 mm K(m) |
| MG36241A | 9 kHz to 43.5 GHz | 2.92 mm K(m) |
| MG36271A | 9 kHz to 70 GHz | 1.85 mm V(m) |
| Frequency Resolution | 0.001 Hz | |
| Reference Frequency Accuracy (when instrument leaves the factory) | $1 \times 10^{-8}$ | |
| Phase Offset | Adjustable in 0.1 degree steps | |

### Internal Time Base

| | Standard | Option 3 | Option 56 |
|---|---|---|---|
| Time Base Type | OCXO | OCXO | Rubidium |
| Aging Rate per Year | $< \pm 5 \times 10^{-7}$ | $< \pm 2 \times 10^{-8}$ | $< \pm 1 \times 10^{-9}$ |
| Temperature Effects from 0 to 55 °C | $< \pm 3 \times 10^{-7}$ | $< \pm 2 \times 10^{-9}$ | $< \pm 3 \times 10^{-10}$ |
| Short-term Stability (Allan Deviation per 100 s after 2 hours warm up) | NA | NA | $< 8 \times 10^{-12}$ |

**Internal Reference Output** Provides a sine wave signal derived from the internal time base 50 Ω nominal impedance connectors, rear panel.

| | Standard | Option 3 or 13 | Option 3 or 13 |
|---|---|---|---|
| Frequency (nominal) | 10 MHz | 100 MHz | 1600 MHz |
| Output Level, ±3 dB | 10 dBm | 12 dBm | 5 dBm |

### External Reference Input

| | Standard | Option 3 |
|---|---|---|
| Input Frequency | 10 MHz | 1 Hz (PPS), 10 MHz, 100 MHz, 1600 MHz |
| 10 MHz REF IN | Accepts an external 10 MHz ± 2 ppm (± 0.03 ppm for Option 3), 0 dBm to +10 dBm (+20 dBm damage level) reference signal (50 Ω nominal impedance, BNC type connector, rear panel). | |
| 100 MHz REF IN (Option 3) | Accepts an external 100 MHz ± 2 ppm, +10 to +14 dBm (+20 dBm damage level) reference signal (50 Ω nominal impedance, BNC type connector, rear panel). | |
| 1600 MHz REF IN (Option 3) | Accepts an external 1600 MHz ± 2 ppm, +3 to +7 dBm (+20 dBm damage level) reference signal (50 Ω nominal impedance, SMA, rear panel). | |
| PPS (Option 3) | Supports +3.3 V CMOS input/output selectable from reference menu. CMOS high-impedance input, BNC type connector, rear panel. | |

**Electronic Frequency Control** Provides the capability to frequency modulate the internal crystal oscillator allowing phase locking of the synthesizer inside an external lock loop. High impedance (1 MΩ nominal), BNC type connector, rear panel. Accepts –4 to +4 VDC input voltage, 30 Hz bandwidth in wide reference PLL mode, 5 Hz/V minimum for standard reference, 0.75 Hz/V minimum for Option 3.

## Signal Purity

In CW Mode. All specifications for < 40 GHz at the lesser of +10 dBm output or maximum specified leveled output power unless otherwise noted.

### Harmonic and Harmonic Related (dBc)

| Frequency Range | Standard + 10 dBm | Standard (Option 15) + 5dBm | (Option 15) +10 dBm | (Option 15) +15 dBm | (Option 15) +20 dBm |
|---|---|---|---|---|---|
| 9 kHz to < 31.25 MHz | –35[a] | – | –35 | –30 | –23 |
| 31.25 MHz to ≤ 1.3 GHz | –57[a,b] | – | –57[c] | –50 | –47 |
| > 1.3 GHz to < 2 GHz | –60[a] | – | –60 | –57 | –52 |
| ≥ 2 GHz to ≤ 20 GHz | –60 | – | –60 | –60 | –58 |
| > 20 GHz to ≤ 24 GHz | –60 | – | –20 | –20 | –15 |
| > 24 GHz to ≤ 40 GHz | –60 | – | –35 | –35 | –30 |
| > 40 GHz to ≤ 43.5 GHz | –60 | –55[d] | –35 | –35 | –30 |
| > 43.5 GHz to ≤ 70 GHz | | –55[d] | | | |

a. Without Option 6. For harmonics with Option 6, see "Analog Sweep Mode (Option 6)" on page-18.
b. –55 for MG36241A and MG36271A models
c. –53 for MG36241A and MG36271A models
d. For MG36271A model

### Non-harmonic (dBc)

| Frequency Range | Standard |
|---|---|
| 9 kHz to < 31.25 MHz | –65 |
| 31.25 MHz to ≤ 20 GHz | –70 |
| > 20 GHz to ≤ 43.5 GHz | –63 |
| > 43.5 GHz to ≤ 70 GHz | –63[a] |

a. Measured at + 5 dBm for MG36271A model

### Sub-harmonics (dBc) Sub-harmonics are defined as fout/N, where N is an integer.

| Frequency Range | MG36221A | MG36241A | MG36271A |
|---|---|---|---|
| 9 kHz to ≤ 20 GHz | -83 | -83 | -83 |
| > 20 GHz to ≤ 32.5 GHz | | -83 | -75 |
| > 32.5 GHz to ≤ 40 GHz | | -83 | -63 |
| > 40 GHz to ≤ 43.5 GHz | | -52 | -63[a] |
| > 43.5 GHz to ≤ 70 GHz | | | -63[a] |

a. Measured at +5dBm.

### Power Line and Fan Rotation Spurious Emissions (dBc) (measured)

| | Offset From Carrier | |
|---|---|---|
| Frequency | ≤ 300 Hz | > 300 Hz to 1 kHz |
| 9 kHz to ≤ 500 MHz | –90 | –100 |
| > 500 MHz to < 2 GHz MHz | –80 | –100 |
| > 2 GHz to ≤ 20 GHz | –60 | –90 |
| > 20 GHz to ≤ 43.5 GHz | –53 | –83 |
| > 43.5 GHz to ≤ 70 GHz | –50 | –79 |

### Residual FM (Hz RMS) In CW, Step Sweep modes, all specifications apply at the lesser of +10 dBm output or maximum specified leveled output power unless otherwise noted. (Residual FM spec does not apply to modulation modes)

| | Residual FM (kHz RMS) | | |
|---|---|---|---|
| Frequency | Standard (0.05 to 15 kHz BW) | Low Phase Noise (0.05 to 15 kHz BW) | Ultra Low Phase Noise (0.05 to 15 kHz BW) |
| 100 MHz | 0.07 Hz[a] | 0.06 Hz[a] | 0.06 Hz[a] |
| 1 GHz | 0.25 Hz[a] | 0.18 Hz[a] | 0.17 Hz[a] |
| 10 GHz | 0.93 Hz | 0.70 Hz | 0.55 Hz |
| 20 GHz | 1.9 Hz | 1.8 Hz | 1.2 Hz |
| 43.5 GHz | 5.5 Hz | 5.5 Hz | 4.2 Hz |
| 70 GHz | 6.5 Hz | 6.0 Hz | 5.0 Hz |

a. 14 Hz with Option 6.

### Single–Sideband Phase Noise

Phase noise is specified and guaranteed only with internal reference. In External Reference mode, the phase noise of the external supplied reference, and the selected external reference bandwidth, will dictate the instrument phase noise performance. Phase noise is not degraded when adding high power Option 15. Phase noise measured at +10 dBm for frequencies ≤ 43.5 GHz; otherwise, measured at + 5 dBm or maximum power, whichever is lower.

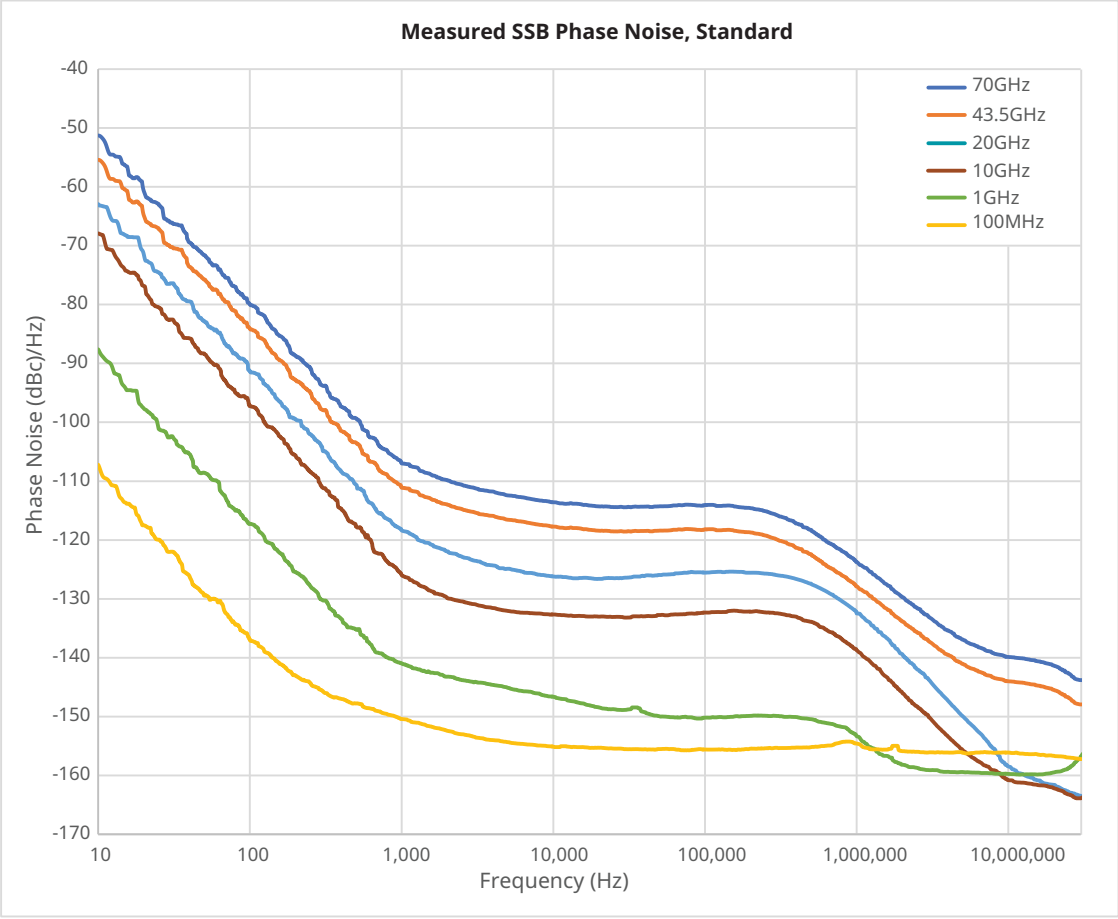
| Standard Phase Noise (typical), (dBc/Hz) | Offset from Carrier | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** | **1 MHz** | **10 MHz** | **30 MHz** |
| 100 MHz[a] | –94 (–99) | –123 (–128) | –142 (–147) | –149 (–154) | –150 (–155) | –147 (–153) | –150 (–156) | –150 (–156) |
| 1 GHz[a] | –74 (–79) | –103 (–108) | –132 (–138) | –140 (–146) | –144 (–150) | –145 (–151) | –153 (–159) | –153 (–159) |
| 10 GHz | –54 (–59) | –83 (–88) | –113 (–119) | –127 (–132) | –127 (–132) | –132 (–138) | –151 (–157) | –153 (–159) |
| 20 GHz | –48 (–53) | –77 (–82) | –107 (–113) | –120 (–125) | –118 (–123) | –127 (–133) | –150 (–156) | –153 (–159) |
| 43.5 GHz | –41 (–46) | –71 (–76) | –100 (–106) | –110 (–115) | –111 (–116) | –118 (–124) | –136 (–142) | –137 (–143) |
| 67 GHz | –37 (–42) | –66 (–71) | –96 (–102) | –110 (–115) | –110 (–115) | –115 (–121) | –134 (–140) | –136 (–142) |
| 70 GHz | –36 (–41) | –65 (–70) | –95 (–101) | –109 (–114) | –109 (–114) | –114 (–120) | –133 (–139) | –135 (–141) |

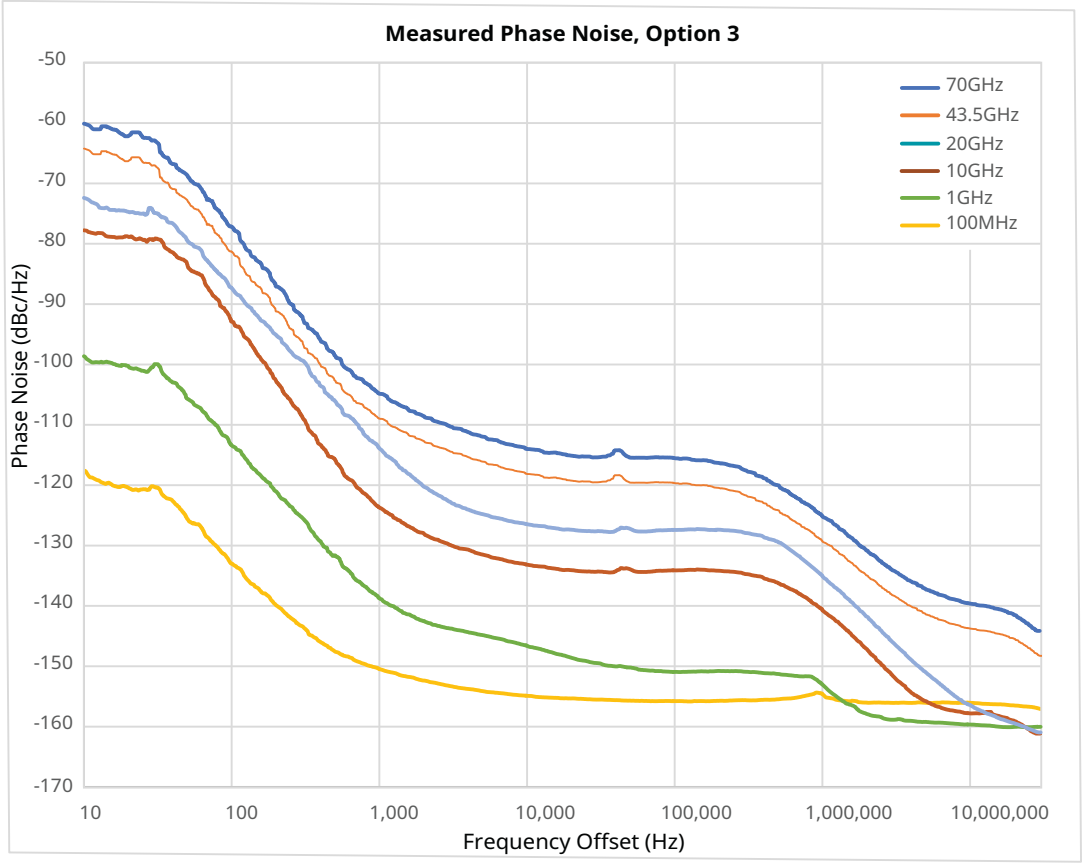
| Low Phase Noise (Option 3) (typical), (dBc/Hz) | Offset from Carrier | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** | **1 MHz** | **10 MHz** | **30 MHz** |
| 100 MHz[a] | –110 (–116) | –126 (–132) | –145 (–151) | –150 (–155) | –151 (–156) | –147 (–153) | –150 (–156) | –151 (–157) |
| 1 GHz[a] | –90 (–96) | –106 (–112) | –133 (–139) | –140 (–146) | –145 (–151) | –145 (–151) | –153 (–159) | –153 (–159) |
| 10 GHz | –70 (–76) | –86 (–92) | –113 (–119) | –128 (–133) | –128 (–133) | –134 (–140) | –151 (–157) | –153 (–159) |
| 20 GHz | –64 (–70) | –80 (–86) | –107 (–113) | –120 (–125) | –120 (–125) | –127 (–133) | –150 (–156) | –153 (–159) |
| 43.5 GHz | –57 (–63) | –73 (–79) | –100 (–106) | –110 (–115) | –113 (–118) | –121 (–127) | –137 (–143) | –140 (–146) |
| 67 GHz | –53 (–59) | –69 (–75) | –96 (–102) | –111 (–116) | –111 (–116) | –117 (–123) | –134 (–140) | –136 (–142) |
| 70 GHz | –52 (–58) | –68 (–74) | –95 (–101) | –110 (–115) | –110 (–115) | –116 (–122) | –133 (–139) | –135 (–141) |

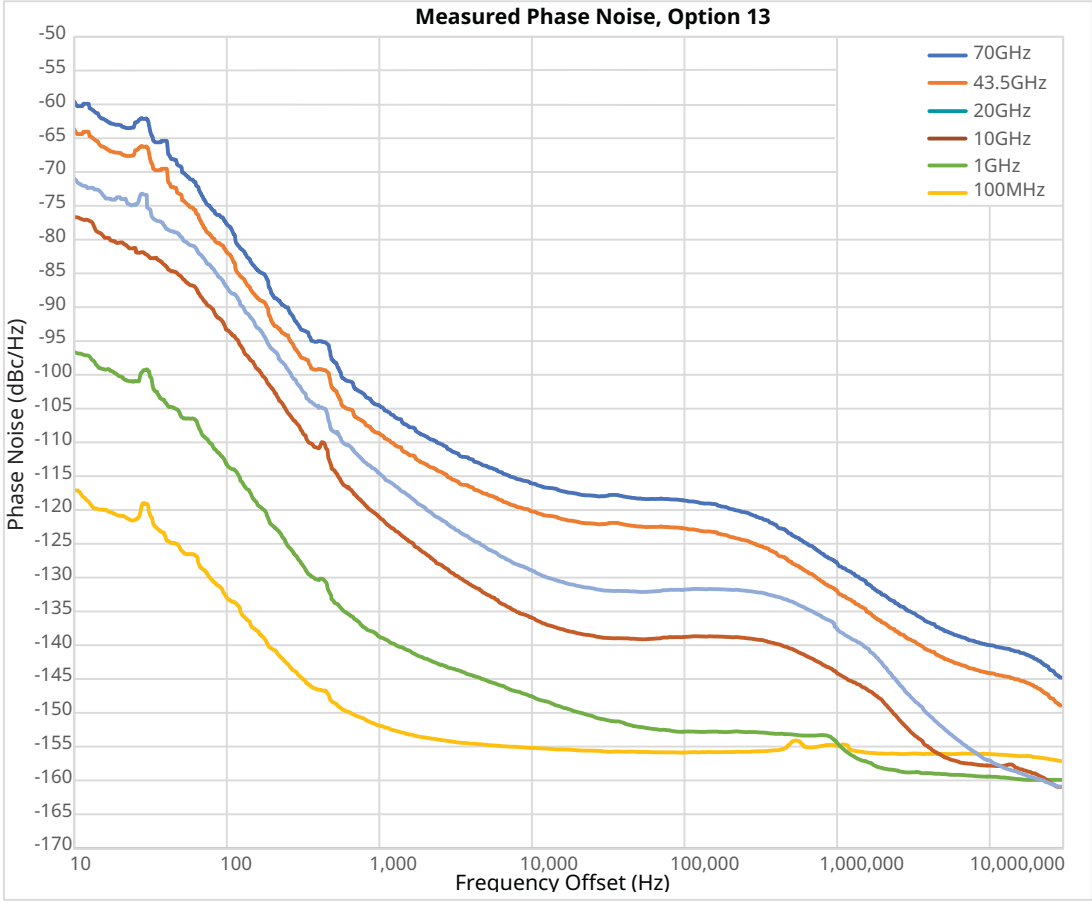
| Ultra Low Phase Noise (Option 13) (typical), (dBc/Hz) | Offset from Carrier | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** | **1 MHz** | **10 MHz** | **30 MHz** |
| 100 MHz[a] | –110 (–116) | –126 (–132) | –145 (–151) | –150 (–155) | –151 (–156) | –148 (–154) | –150 (–156) | –151 (–157) |
| 1 GHz[a] | –90 (–96) | –106 (–112) | –133 (–139) | –141 (–147) | –146 (–152) | –146 (–152) | –153 (–159) | –153 (–159) |
| 10 GHz | –70 (–76) | –86 (–92) | –113 (–119) | –131 (–136) | –132 (–137) | –135 (–141) | –151 (–157) | –153 (–159) |
| 20 GHz | –64 (–70) | –80 (–86) | –107 (–113) | –124 (–129) | –124 (–129) | –129 (–135) | –150 (–156) | –153 (–159) |
| 43.5 GHz | –57 (–63) | –73 (–79) | –100 (–106) | –112 (–117) | –115 (–120) | –122 (–128) | –137 (–143) | –140 (–146) |
| 67 GHz | –53 (–59) | –69 (–75) | –96 (–102) | –114 (–119) | –115 (–120) | –118 (–124) | –134 (–140) | –136 (–142) |
| 70 GHz | –52 (–58) | –68 (–74) | –95 (–101) | –113 (–118) | –114 (–119) | –117(–123) | –133 (–139) | –135 (–141) |

| | |
|---|---|
| **Export Phase Noise (Option 33)** | Rubidium instrument providing high quality phase noise without needing Export license.<br>Option 33 provides the best phase noise performance possible for export to other countries, thereby eliminating the logistics associated with obtaining an export license. Contact your sales representative for details. |

a. Without Option 6. For phase noise with Option 6 refer to "Single–Sideband Phase Noise - Option 6" on page-18.


Measured SSB Phase Noise, Standard
Phase Noise (dBc)/Hz)
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
10
100
1,000
10,000
100,000
1,000,000
10,000,000
Frequency (Hz)
70GHz
43.5GHz
20GHz
10GHz
1GHz
100MHz


Measured Phase Noise, Option 3
Phase Noise (dBc/Hz)
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
10
100
1,000
10,000
100,000
1,000,000
10,000,000
Frequency Offset (Hz)
70GHz
43.5GHz
20GHz
10GHz
1GHz
100MHz


Measured Phase Noise, Option 13
Phase Noise (dBc/Hz)
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-105
-110
-115
-120
-125
-130
-135
-140
-145
-150
-155
-160
-165
-170
10
100
1,000
10,000
100,000
1,000,000
10,000,000
Frequency Offset (Hz)
70GHz
43.5GHz
20GHz
10GHz
1GHz
100MHz

### Premium Phase Noise, CW (Option 23)

A user-controlled switch routes signal directly from the synthesizer core to a Rear Panel RF output connector, eliminating the noise contribution of power amplifiers and leveling circuits. Output is 2 GHz to 20 GHz, unleveled, nominally +14 to +23 dBm. Phase noise at intermediate offsets is reduced by about 3 dB relative to front panel output. (Front panel RF output is disabled while the Rear Panel output is in use).

### Phase Noise, (Option 23) (dBc/Hz) measured

| | Offset from Carrier | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** | **1 MHz** | **10 MHz** | **30 MHz** |
| 2 GHz | –90 | –106 | –132 | –150 | –150 | –148 | –165 | –169 |
| 10 GHz | –76 | –92 | –118 | –140 | –140 | –145 | –163 | –166 |
| 20 GHz | –70 | –86 | –112 | –134 | –134 | –139 | –157 | –160 |

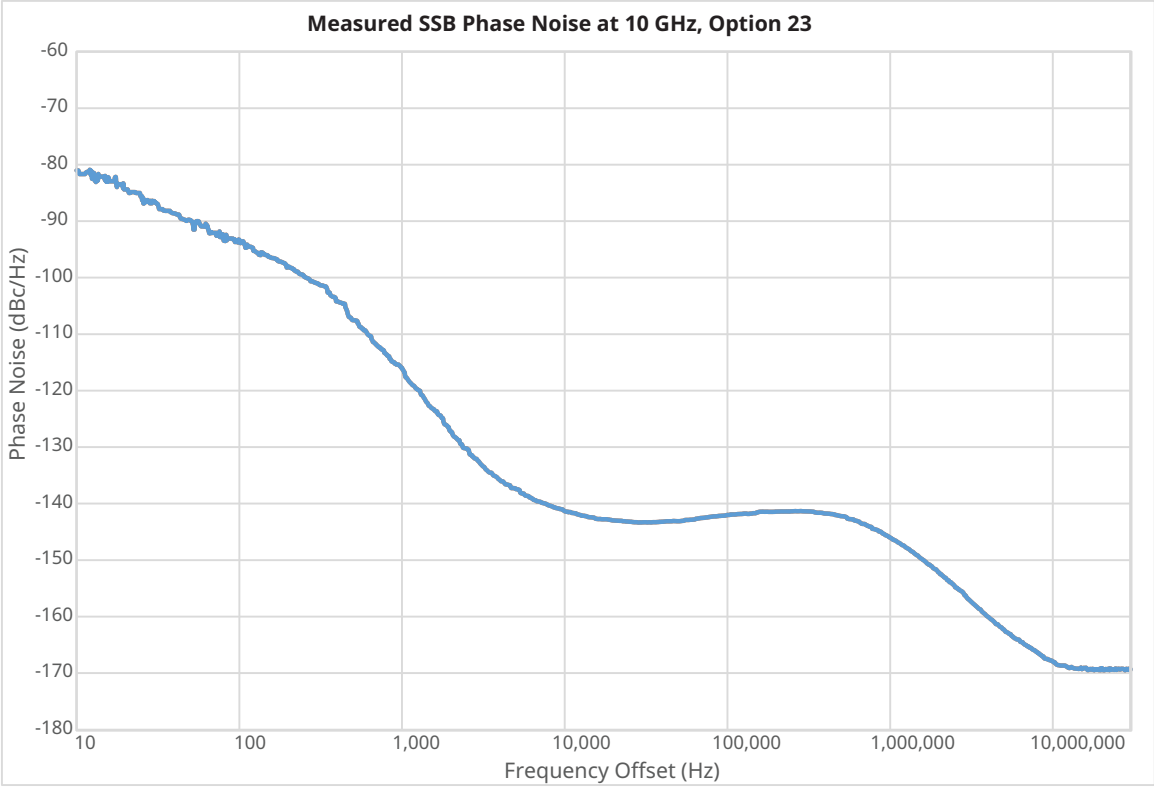
### Harmonics, (Option 23) (typical)

| Frequency | dBc |
|---|---|
| 2 GHz to ≤ 14 GHz | < –10 |
| > 14 GHz to ≤ 20 GHz | < –25 |

### Output Power Unleveled (Option 23)

| Frequency | dBc |
|---|---|
| 2 GHz to ≤ 18 GHz | > 15 |
| > 18 GHz to ≤ 20 GHz | > 14 |

**Spurious (Option 23)** < –70 dBc

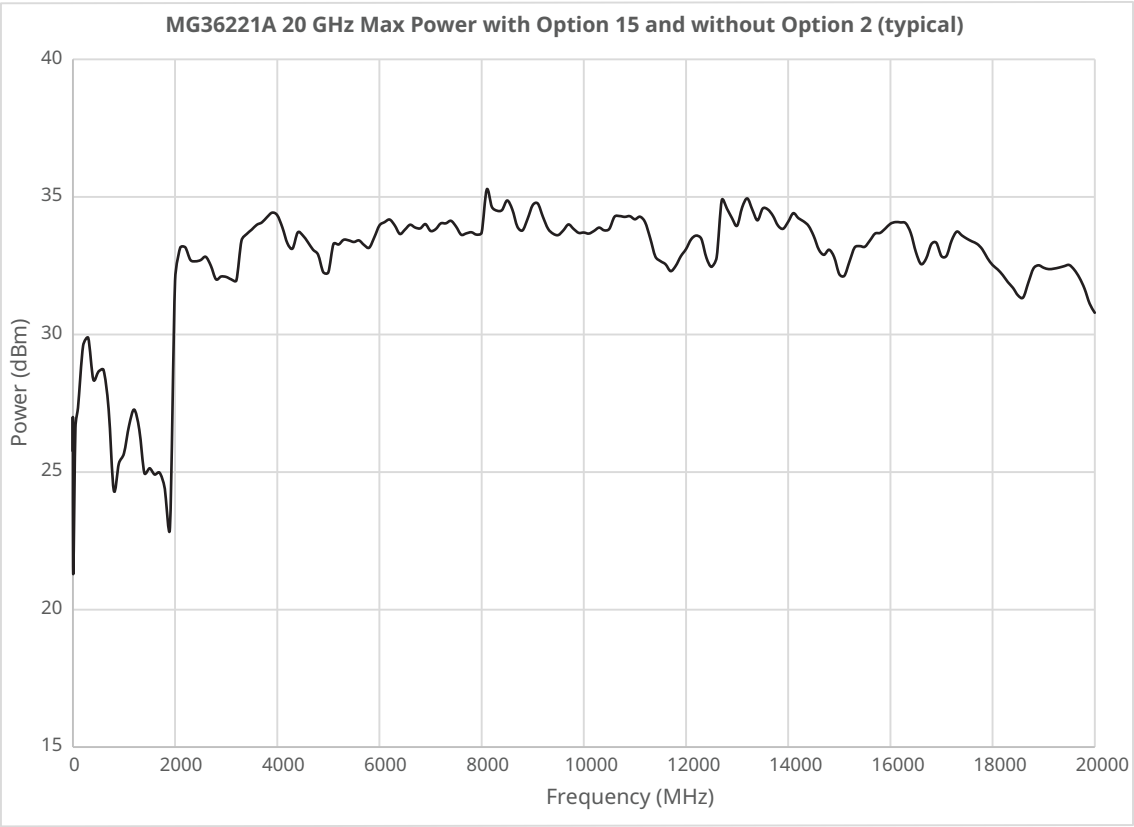


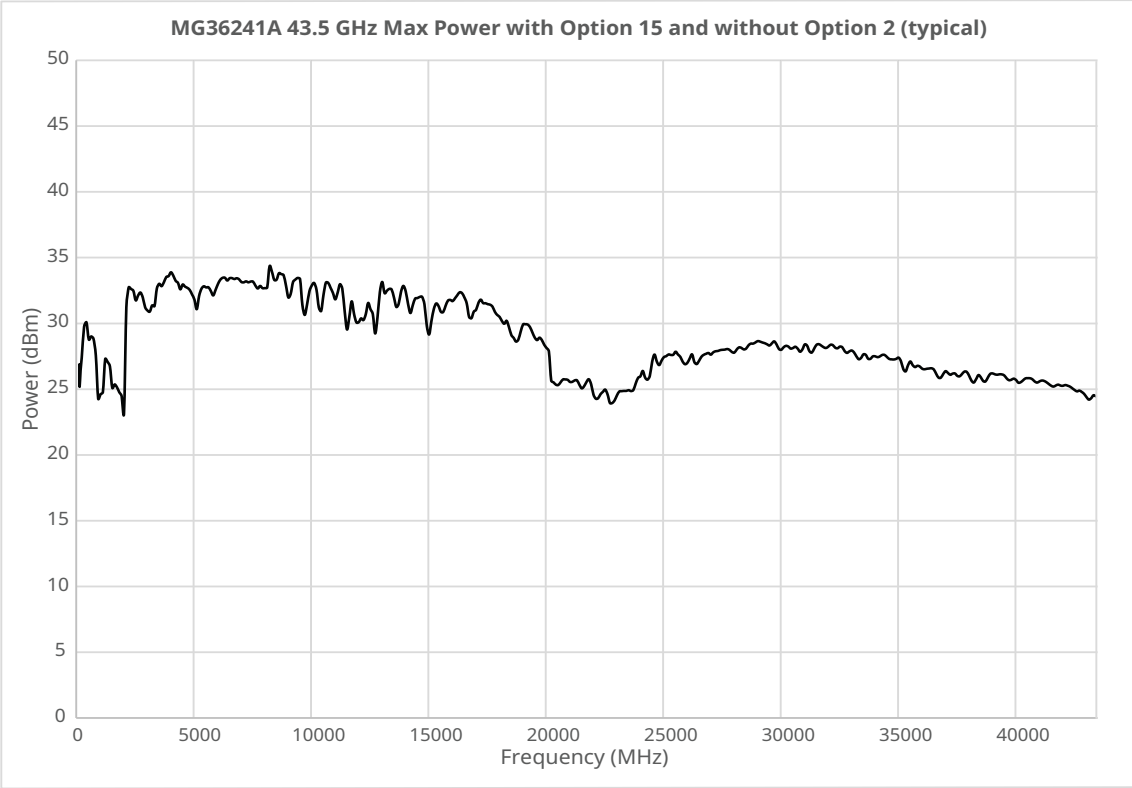
## Output Power

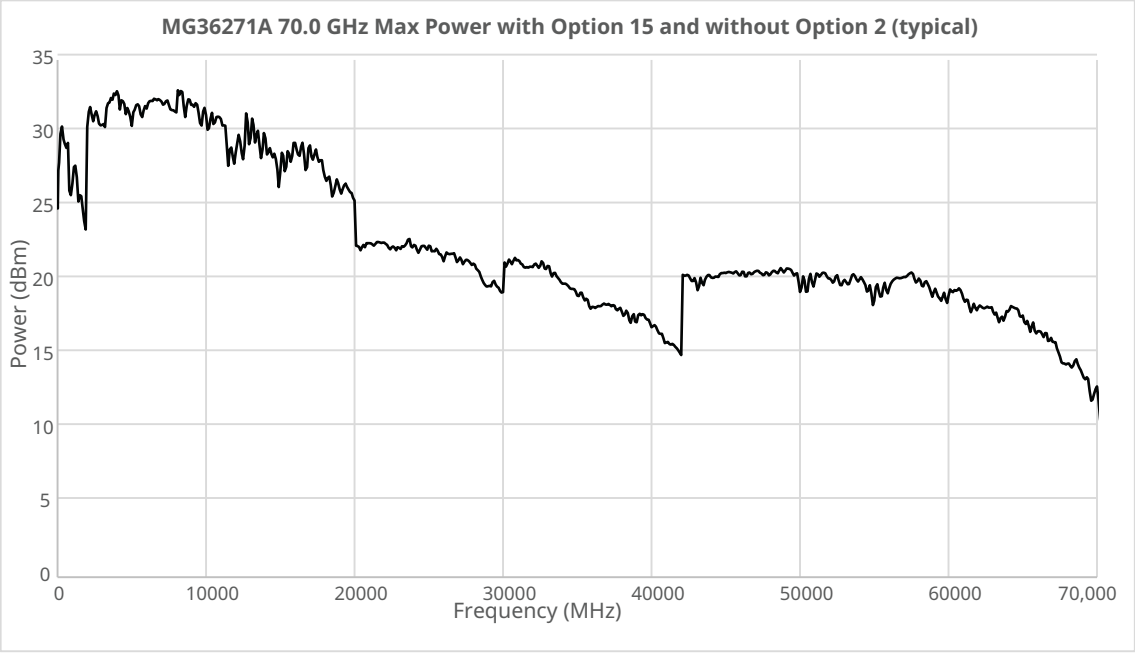
### Maximum Leveled Output Power

| Standard Power | Frequency Range | Output Power (dBm) | Output Power With Step Attenuator (dBm) |
|---|---|---|---|
| **MG36221A** | 9 kHz to < 2 GHz | +20 | +19 |
| | ≥ 2 GHz to ≤ 10 GHz | +21 | +20 |
| | > 10 GHz to ≤ 20 GHz | +20 | +19 |
| **MG36241A** | 9 kHz to ≤ 2 GHz | +19 | +18 |
| | > 2 GHz to ≤ 10 GHz | +19 | +18 |
| | > 10 GHz to ≤ 20 GHz | +16 | +15 |
| | > 20 GHz to ≤ 43.5 GHz | +16 | +15 |
| **MG36271A** | 9 kHz to ≤ 13 GHz | +18 | +18 |
| | > 13 GHz to ≤ 37 GHz | +13.5 | +11.5 |
| | > 37 GHz to ≤ 65 GHz | +10.5 | +9.5 |
| | > 65 GHz to ≤ 67 GHz | +9 | +5 |
| | > 67 GHz to ≤ 70 GHz | +6 (typical) | +3 (typical) |

| High Power (Option 15) | Frequency Range | Output Power (dBm) | Output Power With Step Attenuator (dBm) |
|---|---|---|---|
| **MG36221A** | 9 kHz to < 2 GHz | +20 | +19 |
| | ≥ 2 GHz to ≤ 10 GHz | +30 | +30 |
| | > 10 GHz to ≤ 18 GHz | +30 | +28 |
| | > 18 GHz to ≤ 20 GHz | +28 | +27 |
| **MG36241A** | 9 kHz to < 2 GHz | +20 | +19 |
| | ≥ 2 GHz to ≤ 10 GHz | +29 | +27 |
| | > 10 GHz to ≤ 20 GHz | +23 | +22 |
| | > 20 GHz to ≤ 25 GHz | +20 | +19 |
| | > 25 GHz to ≤ 35 GHz | +23 | +21 |
| | > 35 GHz to ≤ 40 GHz | +20 | +18 |
| | > 40 GHz to ≤ 43.5 GHz | +20 | +15 |
| **MG36271A** | 9 kHz to ≤ 2 GHz | +20 | +19 |
| | ≥ 2 GHz to ≤ 10 GHz | +27 | +21 |
| | > 10 GHz to ≤ 20 GHz | +23 | +21 |
| | > 20 GHz to ≤ 37 GHz | +14.5 | +11.5 |
| | > 37 GHz to ≤ 42 GHz | +11 | +8.5 |
| | > 42 GHz to ≤ 60 GHz | +15 | +11.5 |
| | > 60 GHz to ≤ 65 GHz | +13 | +9.5 |
| | > 65 GHz to ≤ 67 GHz | +9 | +5 |
| | > 67 GHz to ≤ 70 GHz | +9 (typical) | +3 (typical) |


MG36221A 20 GHz Max Power with Option 15 and without Option 2 (typical)
Power (dBm)
40
35
30
25
20
15
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Frequency (MHz)


MG36241A 43.5 GHz Max Power with Option 15 and without Option 2 (typical)
Power (dBm)
50
45
40
35
30
25
20
15
10
5
0
0
5000
10000
15000
20000
25000
30000
35000
40000
Frequency (MHz)


MG36271A 70.0 GHz Max Power with Option 15 and without Option 2 (typical)
Power (dBm)
35
30
25
20
15
10
5
0
0
10000
20000
30000
40000
50000
60000
70,000
Frequency (MHz)

## Accuracy and Flatness

Flatness is included within the accuracy specification.

### Step Sweep and CW Modes

| Model | Power Range | Frequency | Accuracy |
|---|---|---|---|
| **MG36221A, MG36241A** | To –90 dBm | 9 kHz to ≤ 40 GHz | ± 1 dB |
| | | > 40 GHz to 43.5 GHz | ± 1.4 dB |
| **MG36271A** | To –70 dBm | 9 kHz to ≤ 40 GHz | ± 1 dB |
| | | > 40 GHz to ≤ 67 GHz | ± 1.5 dB |
| | | > 67 GHz to 70 GHz | ± 1.5 dB (typical) |
| | <–70 dBm to –90 dBm | 9 kHz to ≤ 40 GHz | ± 2 dB |
| | | > 40 GHz to ≤ 67 GHz | ± 2.5 dB |
| | | > 67 GHz to 70 GHz | ± 2.5 dB (typical) |

### Minimum Settable Output Power

| | |
|---|---|
| Without an Attenuator | –20 dBm |
| With an Attenuator | –130 dBm |

### Minimum Leveled Output Power

| | |
|---|---|
| Without an Attenuator | –15 dBm (MG36221A and MG36241A) |
| | –20 dBm (MG36271A) |
| With an Attenuator | –120 dBm (MG36221A and MG36241A) |
| | –100 dBm (MG36271A) |

### Unleveled Output Power Range

(typical)

| | |
|---|---|
| Without an Attenuator | > 40 dB below max power |
| With an Attenuator | > 130 dB below max power |

### Power Level Switching Time

(to within specified accuracy)

| | |
|---|---|
| Without Change in Step Attenuator | < 3 ms (typical) |
| With Change in Step Attenuator | < 20 ms (typical) |

### Step Attenuator (Option 2)

Adds a 10 dB/step attenuator
110 dB range on models ≤ 43.5 GHz
90 dB range on models > 43.5 GHz to 70 GHz

### General Output Power Specifications

| | |
|---|---|
| Output Units | Selectable units are dBm, dBµV, and V. Selection of V assumes a 50 Ω load. All data entry and display are in the selected units |
| Output Power Resolution | 0.01 dB or 0.000 001 V |
| Output Impedance | 50 Ω nominal |
| Output SWR (Internal Leveling) | < 2.0 (typical) |
| Power Level Stability with Temperature | ± 0.04 dB/°C |
| Level Offset | Offsets the displayed power level to establish a new reference level |
| RF On/Off | Toggles the RF output between an Off and On state |
| RF On/Off Between Frequency Steps | System menu selection of RF On or RF Off during frequency switching in CW, Step Sweep, and List Sweep modes |
| RF On/Off During Retrace | System menu selection of RF On or RF Off during retrace |
| Internal Leveling | Power is leveled at the output connector in all modes |

### On-site User Level Calibration (Option 18)

The on-site user level calibration option provides an internal level calibration interface with a level and flatness accuracy of ± 1dB (typical). Connecting a MA24330A, MA24340A, or MA24350A USB power sensors to the RF output connector of the Rubidium signal generator and connecting the power sensor USB cable to the front or rear panel Type-C USB ports provides an internal level flatness calibration user interface controlled through the MG362x1A front panel.

## Power Modes

### CW Power Sweep

| | |
|---|---|
| Range | Sweeps between any two power levels at a single CW frequency |
| Operating Modes | Step, List and Analog (Option 16) |
| Triggering Modes | Auto, Single |
| Analog Sweep Range | -20 dBm (typical) to maximum leveled power with the step attenuator set to 0 dBm |
| Triggering Source | Internal Free run, External (pos/neg) through BNC connector, Bus |
| Resolution | 0.01 dB/step (Log) or 0.000 001 V (Linear) |
| Accuracy | Same as CW power accuracy |
| Log/Linear Sweep | Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in V |
| Sweep Shape | Sawtooth |
| Step Size | User-controlled, 0.01 dB (Log) or 0.000 001 V (Linear) to the full power range of the instrument |
| Step Dwell Time | Variable from 10 µs to 100 seconds. If the sweep crosses a step attenuator setting, there will be a sweep dwell of approximately 20 ms to allow setting of the step attenuator |

## Frequency Modes

### Phase-Locked Step Sweep

| | |
|---|---|
| Sweep Width | Independently selected, 9 kHz to full range<br>Every frequency step in sweep range is phase-locked |
| Accuracy | Same as internal or external time base |
| Linear/Log Sweep | User-selectable linear or log sweep<br>In log sweep, step size logarithmically increases with frequency |
| Steps | User-selectable number of steps or the step size |
| Number of Steps | Variable from 2 to 65535 |
| Step Size | 0.001Hz to the full frequency range of the instrument<br>If the step size does not divide into the selected frequency range, the last step is truncated |
| Resolution (Minimum Step Size) | 0.001 Hz |
| Sweep Mode | Auto, Manual |
| Triggering Mode | Auto, Single |
| Trigger Source | Auto, Single, External, Manual |
| Dwell Time Per Step | Variable from 10 µS to 100 S |

### Analog Sweep Mode (Option 6)[1]

| | |
|---|---|
| | Available for MG36221A and MG36241A only. |
| Sweep Range | Start frequency during analog sweep is ≥ 100 MHz and Stop frequency is less than or equal to max. frequency.<br>A range error will be displayed if any of these analog sweep start/stop limits are exceeded. Analog sweep is not available < 100 MHz. |
| Triggering | Auto, Single, External |
| Sweep Time Range | 30 ms to 99 s |
| Sweep Speed | ≤ 50 MHz/ms nominal |
| Harmonics Specification at +10 dBm Out | |
| 10 MHz to < 50 MHz | –23 dBc (typical) |
| 50 MHz to < 2 GHz | –33 dBc (typical) |

### Single–Sideband Phase Noise - Option 6

| **Phase Noise[a] (dBc/Hz), typical** | | | **Offset from Carrier** | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **10 Hz** | **100 Hz** | **1 kHz** | **10 kHz** | **100 kHz** | **1 MHz** | **10 MHz** | **30 MHz** |
| 100 MHz | (–80) | (–90) | (–100) | (–110) | (–110) | (–120) | (–145) | (–150) |
| 1 GHz | (–80) | (–90) | (–100) | (–110) | (–110) | (–120) | (–145) | (–150) |

a. For frequencies above 2 GHz, the Phase Noise remains unaffected by the Option 6. Refer to "Single–Sideband Phase Noise" on page-8.

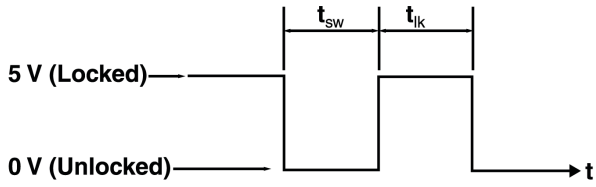
1. Adding Option 6 changes minimum CW frequency of MG362x1A from 9 kHz to 10 MHz.

## Frequency Switching Time

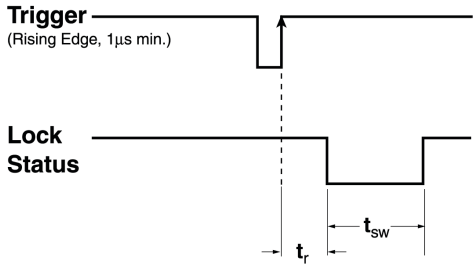
### Definitions

Free Running Mode: Step or List Sweep
$t_{sw}$=Switching Time, Unlocked

Lock Status Indicator: Rear Panel AUX I/O connector (pin 11)
The lock status indicator goes high when the output is within 1 kHz of the final frequency
$t_{lk}$ = Locked Time = 1 ms + $t_{dw}$
$t_{dw}$ = Dwell Time, after locking. Selectable, 1 ms minimum
$t_{lk}$ (min) = 2 ms




Single Frequency Trigger Mode: (List, non-sequential, and CFx modes)
$t_r$ = Trigger Response Time = 2 ms
(Applies to GPIB, Ethernet and External TTL triggers)




### Switching Time

Switching time is from Unlocked indication to frequency settled to within < 1 kHz of final.
$T_{msec}$ = T1 + T2 + abs [(F1 + K1)*N1 – (F2 + K2)*N2]*1 msec/GHz, where:
T1 = 7.5 ms
T2 = 3 msec if F2 is < 2 GHz, otherwise T2 = 0
F1 = RF output frequency, GHz, at beginning of the frequency step
F2 = RF output frequency, GHz, at end of the frequency step
Kx = LO frequency, GHz, (internal to the DDC or HET downconverter) for given Fx.
Nx = YIG frequency division ratio, per the chart below, for given Fx

| RF Output (GHz) | YIG Divider (N) | Downconverter LO, GHz (K) |
|---|---|---|
| > 40 to 70 | 0.25 | 0 |
| > 20 to 40 | 0.5 | 0 |
| 2 to 20 | 1 | 0 |
| > 1 to < 2 | 2 | 0 |
| > 0.5 to 1 | 4 | 0 |
| > 0.25 to 0.5 | 8 | 0 |
| > 0.125 to 0.25 | 16 | 0 |
| > 0.0625 to 0.125 | 32 | 0 |
| 0.03125 to 0.0625 | 64 | 0 |
| 0.000009 to < 0.03125 | 8 | 0.3 |

| | |
|---|---|
| **List Sweep** | Manual, GPIB, or Ethernet control, up to 10 tables with 4000 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. All tables are stored in non-volatile memory. Only one table is exposed on the GUI. |
| Triggering Mode | Auto, Single, External, Manual |
| Trigger Source | Internal free run, external through BNC connector, timer, Bus |
| Rate (list mode switching) | See Frequency Switching Time |
| Sweep Range | 9 kHz to full frequency range and amplitude range |
| Dwell Time | 10 µs to 100 s |
| Minimum Step Size | 0.001 Hz |

| | |
|---|---|
| **Frequency Markers (Option 6 required)** | |
| Description | Up to 20 independent, settable markers (F0 – F9 and M0 – M9) |
| Video Markers | +5 V or –5 V marker output, selectable from system menus<br>AUX I/O connector, rear panel |
| Intensity Markers | Produces an intensity dot on analog display traces, obtained by a momentary dwell in RF sweep, in analog sweeps of < 1 second. |
| Marker Accuracy | Same as sweep frequency accuracy |
| Marker Resolution: | Analog Sweep: 1 MHz or Sweep Width/4096, which ever is greater<br>Step Sweep: 0.01 Hz |

| | |
|---|---|
| **Sweep Triggering** | Sweep triggering is provided for Step Frequency Sweep, List Frequency Sweep, and CW Power Sweep |
| Auto | Triggers sweep automatically |
| External | Triggers a sweep through BNC connector, Bus |
| Single Sweep | Triggers, aborts, and resets a single sweep<br>Reset sweep may be selected to be at the top or bottom of the sweep |
| Single Step | Triggers each step of the sweep and waits for next trigger |

## AM, FM, ΦM, and Pulse Modulation, Internal/External

Option 12 adds amplitude, frequency and phase modulation. Option 26 adds pulse modulation. Modulation can be driven internally or externally. Internal modulation requires Option 27. External modulation is driven via rear panel 50 Ω BNC connectors, one each for AM and FM/ΦM. External modulation can also be driven from 50 Ω BNC connectors on the front panel with Option 29. AM, FM, ΦM, and Pulse modulation types may be simultaneously enabled except FM with ΦM.

**Amplitude Modulation (Option 12)** All amplitude modulation specifications apply at 50 % depth, 1 kHz rate, sine wave, leveled ALC, with RF level set 6 dB below maximum specified leveled output power, unless otherwise noted

| | |
|---|---|
| AM Depth | Linear: 0 % to 90 % (nominal)<br>Log: 0 dB to 20 dB (nominal) |
| Accuracy | ±7 % relative to readout |
| AM Bandwidth (3 dB) | DC to > 50 kHz<br>DC to 100 kHz (nominal) |
| Harmonic Distortion | < 5 % at 1 kHz: (nominal) |
| External AM Input | Log AM or Linear AM input<br>Rear-panel BNC (50 Ω input impedance) |
| Sensitivity | Log AM: Continuously variable from 0 dB per volt to 25 dB per volt<br>Linear AM: Continuously variable from 0 % per volt to 100 % per volt |
| External AM Input | ±1 Vpk maximum, Rear Panel BNC<br>50 Ω input impedance (Standard)<br>600 Ω input impedance (Option 30) |
| Damage Level | ±5 V |

**Frequency/Phase Modulation (Option 12)** In the table below, Nmod and Nrf are multipliers that affect FM deviation at the measured frequency.

| Option | Fout (MHz) | Nmod |
|---|---|---|
| 0006 | > 10 to < 2000 | 1 |
| Standard | > 0.009 to ≤ 20 | 0.0625 |
| Standard | > 20 to < 31.25 | 0.125 |
| Standard | ≥ 31.25 to ≤ 40 | 0.007813 |
| Standard | > 40 to ≤ 80 | 0.015625 |
| Standard | > 80 to ≤ 160 | 0.03125 |
| Standard | > 160 to ≤ 320 | 0.0625 |
| Standard | > 320 to ≤ 640 | 0.125 |
| Standard | > 640 to ≤ 1.280 | 0.25 |
| Standard | > 1,280 to < 2000 | 0.5 |
| All | ≥ 2000 to ≤ 2,560 | 0.5 |
| All | > 2,560 to ≤ 5,120 | 1 |
| All | > 5120 to ≤ 10,240 | 1 |
| All | > 10,240 to ≤ 20,000 | 1 |
| All | > 20,000 to ≤ 40,000 | 2 |
| All | > 40,000 to ≤ 43,500 | 4 |

| Option | Fout (MHz) | Nrf |
|---|---|---|
| 0006 | ≥ 10 to < 2000 | 1 |
| Standard | ≥ 0.009 to < 31.25 | 0.125 |
| Standard | ≥ 31.25 to ≤ 62.5 | 0.015625 |
| Standard | > 62.5 to ≤ 125 | 0.03125 |
| Standard | > 125 to ≤ 250 | 0.0625 |
| Standard | > 250 to ≤ 500 | 0.125 |
| Standard | > 500 to ≤ 1,000 | 0.25 |
| Standard | > 1,000 to ≤ 2,000 | 0.5 |
| All | ≥ 2,000 to ≤ 20,000 | 1 |
| All | > 20,000 to ≤ 40,000 | 2 |
| All | > 40,000 ≤ 43,500 | 4 |

### Frequency Modulation

| Parameter | Modes | Options | Specifications | Conditions, Int or Ext @ 1V pk AC, 0V DC, DC HPF, sinewave, except as noted |
|---|---|---|---|---|
| Max Deviation | Low Noise | Standard<br>Option 6<br>Option 6 | 10 MHz *Nmod (see Nmod table)<br>10 MHz *Nmod (see Nmod table)<br>1 MHz | RF ≥ 2 MHz, Rate = DC[a] to lesser of (8 MHz or 0.03*RF)<br>RF ≥ 50 MHz, Rate = DC[a] to 8 MHz<br>RF < 50 MHz, Rate = DC[a] to 8 MHz |
| | Wide (unlocked) | Standard<br>Option 6<br>Option 6 | 100 MHz *Nrf, typical<br>100 MHz *Nrf, typical<br>10 MHz, typical | RF > 31.25 MHz, Rate = DC[a] to 10 Hz<br>RF ≥ 200 MHz, Rate = DC[a] to 10 Hz<br>RF = 40 MHz to < 200 MHz, Rate = DC[a] to 10 Hz |
| Min Deviation | Low Noise | Standard, Opt. 6 | 640 Hz *Nmod, nominal, (less if Ext FM < ± 1 V | Rate = 1 kHz |
| | Wide (unlocked) | Standard, Opt. 6 | 3.2 kHz *Nrf, nominal, (less if Ext FM < ±1 V) | Rate = 10 kHz |
| Deviation Accuracy | Low Noise | Standard<br>Option 6 | Internal: ±2 %, External: ±3 % of indication<br>Internal: ±2 %, External: ±3 % of indication | RF ≥ 2 MHz, Rate = 1 kHz, Deviation set 2 MHz*Nmod<br>RF ≥ 50 MHz, Rate = 1 kHz, Deviation set 2 MHz*Nmod |
| External Sensitivity | Low Noise | Standard<br>Option 6<br>Option 6 | (1.28 kHz/V to 20 MHz/V) *Nmod<br>(1.28 kHz/V to 20 MHz/V) *Nmod<br>(1.28 kHz/V to 20 MHz/V) | <br>RF ≥ 50 MHz<br>RF < 50 MHz |
| | Wide (unlocked) | Standard<br>Option 6<br>Option 6 | (3.2 kHz/V to 105 MHz/V) *Nrf<br>(3.2 kHz/V to 105 MHz/V) *Nrf<br>3.2 kHz/V to 105 MHz/V | <br>RF ≥ 200 MHz<br>RF 40 MHz to < 200 MHz |
| External Sensitivity Accuracy | Low Noise | Standard, Opt. 6 | 3 % nominal | Rate = 1 kHz |
| Flatness vs. Modulation Rate | Low Noise | Standard<br>Option 6 | ± 1dB, (typical) | 1 kHz - 1 MHz Rate vs. 1 kHz, Deviation set 2 MHz*Nmod, RF ≥ 2 MHz<br>1 kHz - 1 MHz Rate vs. 1 kHz, Deviation set 2 MHz*Nmod, RF ≥ 50 MHz |
| 3 dB Bandwidth | Low Noise | Standard<br>Option 6 | DC[a] to 10 MHz | -3 dB vs. 1 kHz Rate, Deviation set 2 MHz*Nmod, RF > 80 MHz<br>-3 dB vs. 1 kHz Rate, Deviation setting = 2 MHz*Nmod, RF ≥ 50 MHz |
| | Wide (unlocked) | Standard<br>Option 6 | DC[a] to > 500 Hz, nominal | -3 dB vs. 10 Hz Rate, Deviation set 10 MHz*Nrf, RF > 31.25 MHz<br>-3 dB vs. 10 Hz Rate, Deviation set 10 MHz*Nrf, RF ≥ 40 MHz |
| | Highpass Filter | Standard, Opt. 6 | DC[a], 63 Hz, 1 kHz, nominal | |
| Harmonic distortion (THD) | Low Noise | Standard<br>Option 6 | 1 % | Rate = 1 kHz and 50 kHz, Deviation = 300 kHz if RF > 80 MHz, 50 kHz if RF = 1MHz to ≤ 80 MHz<br>Rate = 1 kHz and 50 kHz, Deviation = 300 kHz |
| Incidental AM | Low Noise | Standard, Opt. 6 | ≤ 0.3 % rms | 50 Hz-15 kHz integration BW, Deviation = 50 kHz, Rate = 1 kHz, RF ≥ 2 MHz |
| Residual FM | Low Noise | Standard, Opt. 6 | ≤ 3 kHz rms | 50 Hz-15 kHz integration BW, Deviation = 50 kHz, Rate = 1 kHz |

a. Minimum settable modulation rate for Internal FM/PM is 100 mHz. External FM/PM inputs are DC-capable.

### Phase Modulation

| Parameter | Modes | Option | Specifications | Conditions, except as noted: Int or Ext@1VpkAC, 0VDC, DC HPF, sine wave |
|---|---|---|---|---|
| Max Deviation | Low Noise | Standard | ±[lesser of 5 rad or 7 MHz/modrate] *Nmod | RF ≥ 1 MHz + Rate*(1+Deviation, Rad), Rate = DC[a] to lesser of (7 MHz or 0.03*RF) |
| | | Option 6 | ±[lesser of 5 rad or 7 MHz/modrate] *Nmod | RF ≥ 10 MHz + Rate*(1+Deviation, Rad), Rate = DC[a] to 7 MHz |
| | Wide Deviation | Standard | ±[lesser of 640 rad or 7 MHz/modrate] *Nmod | RF ≥ 1 MHz + Rate*(1+Deviation, Rad), Rate = DC[a] to lesser of (1 MHz or 0.001*RF) |
| | | Option 6 | ±[lesser of 640 rad or 7 MHz/modrate] *Nmod | RF ≥ greater of (120 MHz, 10 MHz + Rate*(Deviation, Rad)), Rate = DC[a] to 1 MHz |
| Min Deviation | Low Noise | Standard, Opt. 6 | 1 m rad at Nmod = 0.5 to 2, (< 1m rad if Ext ΦM input < 1Vpk), nominal | Rate = 1 kHz |
| | Wide Deviation | Standard, Opt. 6 | 0.1 rad at Nmod = 0.5 to 2, (< 0.1 rad if Ext ΦM input < 1Vpk), nominal | By design, not tested, 100 Hz rate |
| Deviation Accuracy | Low Noise | Standard | Internal: ±5 %, External: ±5 % of indication | RF ≥ 2 MHz, Rate = 1 kHz, Phase Dev setting = 5rad*Nmod |
| | | Option 6 | Internal: ±5 %, External: ±5 % of indication | RF ≥ 10 MHz, Rate = 1 kHz, Phase Dev set 5rad*Nmod |
| | Wide Deviation | Standard | Internal: ±5 %, External: ±5 % of Indication | RF ≥ 2 MHz, Rate = 100 Hz, Phase Dev set 640rad*Nmod |
| | | Option 6 | Internal: ±5 %, External: ±5 % of Indication | RF ≥ 10 MHz, Rate = 100 Hz, Phase Dev set 640rad*Nmod |
| Ext Sensitivity | Low Noise | Standard, Opt. 6 | Nmod *6.28 rad/V to (1mrad/V for Nmod = 0.5 to 2) | |
| | Wide Deviation | Standard, Opt. 6 | Nmod *804 rad/V to (0.1 rad/V for Nmod = 0.5 to 2) | |
| External Sensitivity Accuracy | Low Noise | Standard | ±5 %, nominal | RF ≥ 2 MHz, Rate = 1 kHz, Phase Dev set 5rad*Nmod |
| | | Option 6 | ±5 %, nominal | Rate = 1 kHz, Phase Dev set 5rad*Nmod |
| | Wide Deviation | Standard | ±5 %, nominal | RF ≥ 2 MHz, Rate = 100 Hz, Phase Dev set 640rad*Nmod |
| | | Option 6 | ±5 %, nominal | Rate = 100 Hz, Phase Dev set 640rad*Nmod |
| Flatness vs. Modulation Rate | Low Noise | Standard | ±1 dB (typical) | 1 kHz-1 MHz Rate vs. 1 kHz, Phase Dev set 0.2rad*Nmod, RF ≥ 2 MHz |
| | | Option 6 | ±1 dB (typical) | 1 kHz-1 MHz Rate vs. 1 kHz, Phase Dev set 0.2rad*Nmod |
| 3 dB Bandwidth | Low Noise | Standard | DC[a] to 10 MHz | -3 dB vs. 1 kHz Rate, Phase Dev set 0.2 rad*Nmod, RF > 80 MHz |
| | | Option 6 | DC[a] to 10 MHz | -3 dB vs. 1 kHz Rate, Phase Dev set 0.2 rad*Nmod, RF ≥ 25 MHz |
| | Wide Deviation | Standard | DC[a] to 1 MHz, nominal | -3 dB vs. 100 Hz Rate, Phase Dev set 10 rad*Nmod, RF ≥ 2 MHz |
| | | Option 6 | DC[a] to 1 MHz, nominal | -3 dB vs. 100 Hz Rate, Phase Dev set 10 rad*Nmod |
| | Highpass Filter | Standard, Opt. 6 | DC[a], 63 Hz, 1 kHz, nominal | |

a. Minimum settable modulation rate for Internal FM/PM is 100mHz. External FM/PM inputs are DC-capable.

### External FM/Phase Mod Input

| | |
|---|---|
| Connector type | BNC |
| Impedance | 50 Ω, nominal |
| Full-scale Input | ± 1Vpk |
| Damage Level | ± 5V |

### Pulse Modulation (Option 26)

Option 26 adds Pulse modulation, driven internally or externally. Requires Option 27. External modulation is driven from a rear panel BNC connector. It can also be driven from a BNC connector on the front panel with Option 29. Pulse modulation is not available for RF < 10 MHz.

| | |
|---|---|
| On/Off Ratio | > 80 dB (70 dB for frequencies < 2 GHz) |
| Minimum Leveled Pulse Width | 100 ns, ≥ 2 GHz<br>1 µs, < 2 GHz |
| Minimum Unleveled Pulse Width | 10 ns for 2 GHz to 20 GHz (external)<br>50 ns for > 20 GHz (external) |
| Level Accuracy Relative to CW (100 Hz to 1 MHz PRF) | ±0.5 dB, ≥ 2 GHz, Pulse widths ≥ 1 µs<br>±1 dB, ≥ 2 GHz, Pulse widths 100 ns to < 1 µs<br>±1 dB, < 2 GHz, Pulse widths ≥ 1 µs |
| Pulse Delay | 60 ns in External Mode (typical) |
| PRF Range | DC to 10 MHz, unleveled<br>100 Hz to 5 MHz, leveled |
| External Input | Rear-panel BNC |
| Drive Level | TTL compatible input |
| Input Logic | Positive-true or negative-true, selectable from modulation menu |

| Frequency Range | Rise and Fall Time (10% to 90%) | Overshoot | Video Feedthrough |
|---|---|---|---|
| ≥ 10 MHz to < 31.25 MHz | 400 ns | 33 % | ± 70 mV |
| ≥ 31.25 MHz to < 125 MHz | 90 ns | 22 % | ± 130 mV |
| ≥ 125 MHz to < 500 MHz | 33 ns | 11 % | ± 70 mV |
| ≥ 500 MHz to < 2000 MHz | 15 ns | 10 % | ± 50 mV |
| > 2 GHz | 10 ns (5 ns, (typical) | 10 % | ± 30 mV |

### Modulation Hardware (Option 27)

| | |
|---|---|
| Description | Modulation hardware that includes an internal pulse generator and two internal waveform generators, one providing a frequency or phase modulating signal and the other an amplitude modulating signal. This modulation hardware option can only be ordered in combination with either FM/ΦM, AM, or Pulse modulation Options 12 and 26, respectively. |
| Waveforms | Sinusoid, square, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise |
| Rate | 0.1 Hz to 10 MHz sinusoidal<br>0.1 Hz to 1 MHz square-wave, triangle, ramps |
| Resolution | 0.1 Hz |
| Waveform Outputs | Two BNC connectors on the rear panel, FM/ΦM OUT and AM OUT |
| Pulse Modes | Singlet, doublet, triplet, quadruplet |
| Pulse Triggers | Freerun, triggered, gated, delayed, triggered with delay |
| Pulse Inputs/Outputs | Video pulse and sync out, rear-panel BNC connectors |
| **Pulse Parameter** | |
| Pulse Width | 10 ns to 42 s |
| Pulse Period | 100 ns to 42 s (Period must be longer than 10 ns + sum of pulse widths and delays) |
| Variable Delay: Singlet | 20 ns to 42 s |
| Doublet | 20 ns to 42 s |
| Triplet | 20 ns to 42 s |
| Quadruplet | 20 ns to 42 s |
| Resolution | 10 ns |
| Accuracy | 10 ns (5 ns, (typical)) |

### Pulse Train (Option 25)

| | |
|---|---|
| Description | Pulse train adds ability to generate an arbitrary pulse pattern to simulate complex pulse radar signals. Up to 2048 pulse patterns or bursts can be generated with this option. Requires Option 26 and 27. |
| Number of pulse patterns/bursts | 1 to 2047 |
| No of pulses per burst | 1 to 65535 |
| Pulse ON/OFF period range | 100 ns to (42 s) |
| PRF Range | 0.024 Hz to 10 MHz |
| Resolution | 10 ns |
| Accuracy | 10 ns, (5 ns typ.) |
| Triggering mode | Auto, Single Step, Single Sweep, Breakpoint, Multiple Sweep |
| Triggering source | Single, external, external gate and time |
| No of Breakpoints | Up to 10 |

### User Defined Modulation (Option 10)

User Defined Modulation option provides the ability to create arbitrary waveforms using Rubidium's remote GUI client. Waveform created in the remote GUI client can be downloaded into the internal look-up tables of 8191 points in LF generator's memory. The download files are in Anritsu proprietary wfm format containing integer numbers between 0 and 16383, where 0 corresponds to the minimum modulation level and 4095 the maximum. The arbitrary waveforms can be used for AM, FM/PM modulation. Alternatively, they can also be made available at the rear panel for external use.

In addition to the capability of creating and generating arbitrary waveforms, user defined modulation option enables Rubidium to synchronize between FM modulation and Pulse modulation. The synchronization between FM and Pulse modulation enables generation of linear and non linear chirp signals. Requires Option 12, 26 and 27.

## Millimeter-wave Frequency Coverage

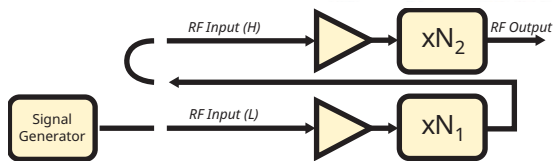
### Millimeter-wave Multiplier 2000-2087-R Through 2000-2098-R Series

2000-2087-R through 2000-2098-R series of waveguide output multipliers are available for banded frequency coverage from 50 GHz (WR15) to 1.1 THz (WR1.0). These modules offer high test port power, voltage-controlled RF attenuation, and TTL controlled ON/OFF modulation rates to a few kHz as standard. The frequency multiplier modules are intended to be used in CW mode and do not preserve AM.

Frequency multiplier modules have two multipliers that can be configured to allow input signals in two frequency bands:

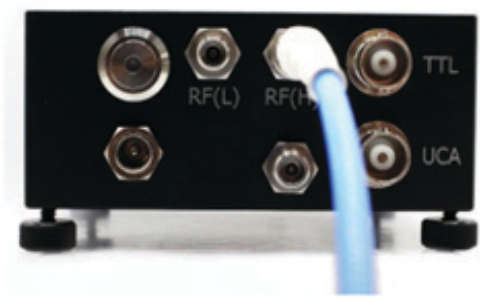
- Low frequency input for < 20 GHz and 10 dBm input level

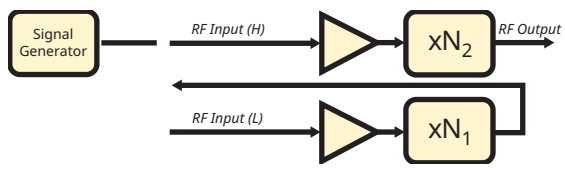
  In this configuration the RF output from Rubidium is input into the K(f) input port on the rear panel of the multiplier module. The port is designated as RF(L). The low frequency band input configuration uses both $N_1$ and $N_2$ multipliers, as shown below.




- High frequency input for < 50 GHz and 0 dBm input level

  In this configuration the RF output from Rubidium is input into the 2.4 mm(f) input port on the rear panel of the multiplier module. The port is designated as RF(H). The high frequency band input configuration uses an $N_2$ multiplier, as shown below. This results in a lower multiplication factor and reduces unwanted subharmonic signals within the band.



### General Specifications

| Parameter | Description | Specification | Connector |
|---|---|---|---|
| RF Input [a, b] | Low Frequency (typical / damage) | 10 dBm ± 3dB / 16 dBm | 2.92 mm(f) |
| | High Frequency (typical / damage) | 0 dBm ± 3dB / 6 dBm | 2.4 mm(f) |
| RF Output | VDI Precision Flange | | UG-387/U-M |
| AC Inputs [c] | Single-Volt Power Supply (+9 V/4 A) | 100 to 240 VAC, 3.5 A, 50 to 60 Hz | U.S. or E.U. |
| RF Power Control | User Controlled Attenuation (UCA) | 0 V-off, 5 V-full power | BNC (f) |
| Voltage Bias Port | For Use with External Components | +9 V | LEMO 00 |
| Operating Temperature | Typical / Recommended | 25°C / 20-30°C | |
| Maximum Weight | – | 2.0 lb (0.91 kg) | |
| Dimensions | Typical (Length x Width x Height) | 5.00 x 3.50 x 1.50 inches | |

a. For low frequency input operation a K(f) to K(m) RF cable is included as standard.

b. For high frequency band input operation, a 34VFKF50A V(f) to K(f) adapter and a V120mm RF cable are required and must be ordered separately. The 34VFKF50A adapter is used at Rubidium output to convert to a V(f). This is then connected to 2.4mm (f) input port of multiplier module with a V120MM RF cable.

c. It is recommended to turn the power ON only after all connections to the multiplier are made, such as RF input, AC inputs, and DC inputs. When turning power OFF, it is recommended to turn OFF the RF input from signal generator first, and then turn OFF/disconnect all other inputs and outputs of the multiplier.

### Performance Specification

| | Multiplier Model [a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **2000-2087-R** | **2000-2088-R** | **2000-2089-R** | **2000-2090-R** | **2000-2091-R** | **2000-2092-R** |
| Frequency Band (GHz) | WR -15 | WR-12 | WR-10 | WR-8.0 | WR-6.5 | WR-5.1 |
| Output Frequency[d, e] | 50 GHz to 75 GHz | 60 GHz to 90 GHz | 75 GHz to 110 GHz | 90 GHz to 140 GHz | 110 GHz to 170 GHz | 140 GHz to 220 GHz |
| Output Power (dBm (typical)/ Minimum) | 20 / 17 | 20 / 17 | 20 / 17 | 19 / 13 | 18 / 15 | 10 / 6 |
| Multiplier Factors (Low/High Frequency) | 6 / 3 | 6 / 3 | 6 / 3 | 12/6 | 12/6 | 12/6 |
| RF input - Low Frequency | 8.33 GHz to 12.5 GHz | 10 GHz to 15 GHz | 12.5 GHz to 18.33 GHz | 7.5 GHz to 11.66 GHz | 9.166 GHz to 14.166 GHz | 11.66 GHz to 18.33 GHz |
| RF input - High Frequency | 16.66 GHz to 25 GHz | 20 GHz to 30 GHz | 25 GHz to 36.66 GHz | 15 GHz to 23.33 GHz | 18.33 GHz to 28.33 GHz | 23.33 GHz to 36.66 GHz |

| | Multiplier Model [a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **2000-2093-R** | **2000-2094-R** | **2000-2095-R** | **2000-2096-R** | **2000-2097-R** | **2000-2098-R** |
| Frequency Band (GHz) | WR-4.3 | WR-3.4 | WR-2.8 (WM-710) | WR-2.2 (WM-570) | WR-1.5 (WM-380) | WR-1.0 (WM-250) |
| Output Frequency[d, e] | 170 GHz to 260 GHz | 220 GHz to 330 GHz | 260 GHz to 400 GHz | 330 GHz to 500 GHz | 500 GHz to 750 GHz | 750 GHz to 1100 GHz |
| Output Power (dBm (typical)/ Minimum) | 8 / 3 | 6 / 3 | 5 / -1 | 0 / -6 | -7 / -13 | -16 / -26 |
| Multiplier Factors (Low/High Frequency) | 18 / 6 | 18 / 9 | 27 / 9 | 36 / 18 | 54 / 18 | 81 / 27 |
| RF input - Low Frequency | 9.44 GHz to 14.44 GHz | 12.22 GHz to 18.33 GHz | 9.62 GHz to 14.81 GHz | 9.16 GHz to 13.88 GHz | 9.25 GHz to 13.88 GHz | 9.25 GHz to 13.58 GHz |
| RF input - High Frequency | 28.33 GHz to 43.33 GHz | 24.44 GHz to 36.66 GHz | 28.88 GHz to 44.44 GHz | 18.33 GHz to 27.77 GHz | 27.77 GHz to 41.66 GHz | 27.77 GHz to 40.74 GHz |

a. These millimeter-wave modules are produced by VDI Inc. located in Charlottesville, VA. For detailed and up-to-date specifications, please call VDI, Inc. or visit their website at http://www.vadiodes.com.

b. Multipliers require power from an external power supply (+9 VDC, 4 A typical). The power supply adapter is a standard accessory and included with modules.

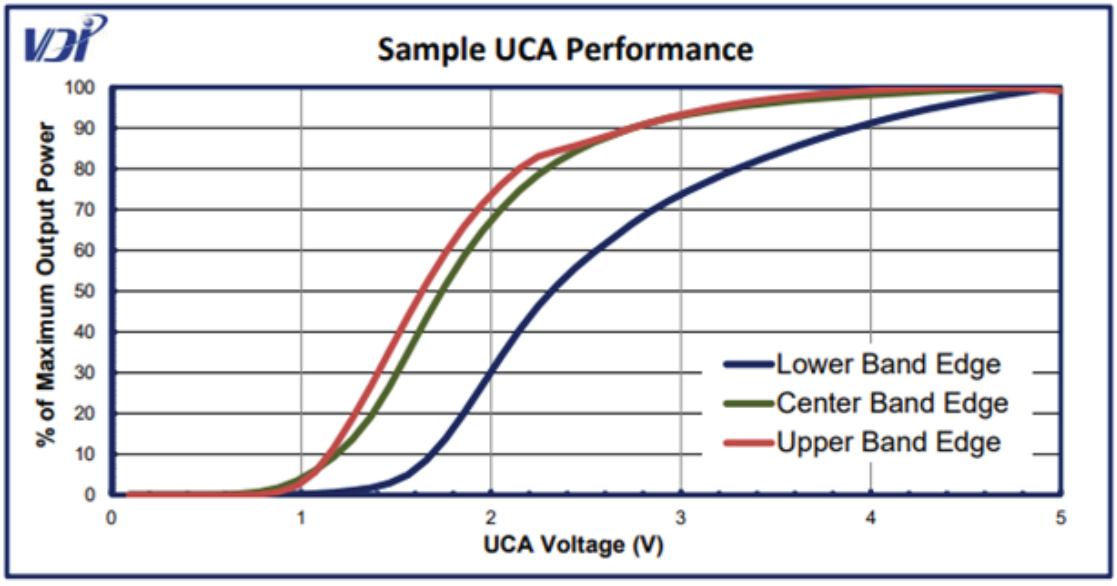
c. Warranty period for 2000-2087-R through 2000-2098-R multiplier modules is one year.

d. Unwanted harmonic content is better than -20 dBc (typical).

e. Frequency stability of input is degraded at the output by multiplier factor N (N1 x N2) and phase noise by 20log(N). For high frequency operation N1 = 1.

**Output Attenuation**

Frequency multiplier modules offer voltage-controlled RF output attenuation capability as standard. Users can input 0 to 5 V a DC voltage from an external source into the BNC connector on the rear panel designated as UCA. The output power can be varied from 90% to 10% through the UCA port. A sample curve of UCA control voltage vs. output power is shown below. The curve is subject to some variation due to measurement conditions, such as temperature and load impedance, and should be considered as representative only.



## General

| | |
|---|---|
| Calibration Cycle | Recommended calibration cycle is 2 years from the date of shipment (standard warranty). |
| | All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com |
| Stored Setups | Stores front panel settings in user file system with named set up files. The location of set up files can be internal memory or external pluggable memory. The number of set up files is only limited by memory size. Whenever the instrument is turned on, control settings come on at the same functions and values existing when the instrument was turned off. |
| Self Test | Instrument self-test is performed when Self-Test under diagnostics in the sandwich menu is selected. If an error is detected, an error message is displayed in a window on the touch screen identifying the probable cause. |
| Parameter Entry | Instrument-controlled parameters can be entered in multiple ways: touchscreen, keypad, rotary data knob, or the touch pads of the cursor-control key. Keypad entries are terminated by pressing the appropriate key or touchscreen. Edits are terminated by exiting the edit menu. |
| Reset | Returns all instrument parameters to predefined default states or values. |
| | Any pending GPIB or Ethernet I/O is aborted. |
| | Selectable from the system menu |
| | Five user tables are available with up to 65535 points/table. |
| Warm Up Time | From Standby: 30 minutes |
| | From Cold Start (0 °C): 120 hours to achieve specified frequency stability with aging. |
| | Instruments disconnected from AC line power for more than 72 hours require 30 days to return to specified frequency stability with aging. |
| Power | 90 VAC to 264 VAC, 47 Hz to 63 Hz, 350 VA maximum |
| Standby | With AC line power connected, unit is placed in standby |
| Weight | 20.5 kg |
| Dimensions (WxHxD) | 483 mm x 133 mm x 552 mm |
| Warranty | 1 year from shipment date |

### Remote Operation

| | | | |
|---|---|---|---|
| Description | All instrument functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external computer via sockets over Ethernet, or GPIB (IEEE-488 interface bus). | | |
| | Note: For users who wish to use a USB control interface, the following USB adapter, available from National Instruments is recommended: NI GPIB-USB-HS | | |
| Ethernet Port | 1000 Base-T (Gbit Ethernet) | | |
| Ethernet Address | DHCP or static IP | | |
| Commands | SCPI, Native (MG369xC compatible proprietary command set) | | |
| GPIB Address | Selectable from a system menu | | |
| IEEE -488 Interface Function Subset | Source Handshake: SH1 | Service Request: SR1 | Device Trigger: DT1 |
| | Acceptor Handshake: AH1 | Remote/Local: RL1 | Controller Capability: C0, C1, C2, C3, C28 |
| | Talker: T6 | Parallel Poll: PP1 | Tri-State Driver: E2 |
| | Listener: L4 | Device Clear: DC1 | |
| Remote Lockout | While operating on the GPIB, all instrument front panel keys are locked. | | |
| Backward Compatibility | The instrument responds to the published native (Anritsu proprietary) commands and responses of the Anritsu Models 6600, 6700, 6XX00, and MG3690 series signal sources. | | |
| HiSLIP | Support available | | |

### Environmental (MIL-PRF-28800F, class 3)

| | |
|---|---|
| Storage Temperature Range | –40 °C to +75 °C |
| Operating Temperature Range | 0 °C to +50 °C |
| Relative Humidity | 5 % to 95 % at 40 °C (non-condensing) |
| Altitude | 4,600 m, 43.9 cm-Hg |
| Vibration | Random, 5 Hz to 500 Hz, 0.015 to 0.0039 $g^2$/Hz PSD; Sinusoidal, 5 Hz to 55 Hz, 0.33 mm displacement |

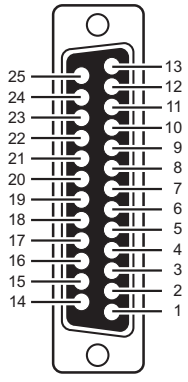
### Regulatory Compliance

| | |
|---|---|
| European Union | EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11<br>Low Voltage Directive 2014/35/EU<br>Safety EN 61010-1:2010<br>RoHS directives 2011/65/EU and 2015/863 |
| United Kingdom | EMC SI 2016/1091; BS EN 55011 & BS EN 61000-4-2/3/4/5/6/8/11<br>Consumer Protection (Safety) SI 2016/1101; BS EN 61010-1:2010<br>Environmental Protection SI 2012/3032; 2011/65/EU & 2015/863 |
| Canada | ICES-1(A)/NMB-1(A) |
| Australia and New Zealand | RCM AS/NZS 4417:2012 |
| South Korea | R-R-A2J-1004 |

## Rear Panel

**Rear Panel Connectors** (may be present but not active if option is not ordered)

**Aux1 I/O Pin Descriptions**




| Pin | Description | Pin | Description |
|---|---|---|---|
| **1** | Horizontal Output | **14** | V/GHz Output |
| **2** | Chassis Ground | **15** | N/C |
| **3** | Sequential Sync Output | **16** | N/C |
| **4** | N/C | **17** | N/C |
| **5** | N/C | **18** | Sweep Dwell Input |
| **6** | Retrace Blanking Output | **19** | N/C |
| **7** | N/C | **20** | Bandswitch Blanking Output |
| **8** | Chassis Ground | **21** | N/C |
| **9** | N/C | **22** | N/C |
| **10** | Sweep Dwell Output | **23** | N/C |
| **11** | Lock Status Output | **24** | Chassis Ground |
| **12** | N/C | **25** | N/C |
| **13** | External Trigger Input | | |

| Inputs and Outputs | Description |
|---|---|
| AM OUT | Provides the amplitude modulation waveform from the internal LF generator. Enabled with Option 27. BNC type, rear panel. |
| HORIZ OUT | Requires Option 6 (available for MG36221A only). Horizontal Sweep Output provides a 0V at beginning and +10 V at end of sweep for all sweep modes, regardless of sweep width. In CW mode, the voltage is proportional to frequency between 0 V at low end and +10V at the high end of range. In CW mode, if CW Ramp is enabled, a repetitive 0V to +10V ramp is provided. The ramp speed is adjusted by the Sweep Time function. BNC type, rear panel. |
| PULSE OUT | Provides a video modulating signal from the internal pulse generator. Enabled with Option 27. BNC type, rear panel. |
| FM OUT | Provides the frequency or phase modulation waveform from the internal LF generator. Enabled with Option 27. BNC type, rear panel. |
| PULSE SYNC | Provides a TTL compatible signal, synchronized to the internal pulse modulation output. Enabled with Option 26. BNC type, rear panel. |
| LOCKED/LEVELED | TTL high/low output signal when in internal ALC mode that is a logical AND of frequency locked condition and output leveled condition. When in Fixed Gain mode this signal indicates only frequency locked/unlocked condition. BNC type, rear panel. |
| PPS | 1PPS input/output from either GNSS/GPS atomic clock receiver or internal rubidium reference option. 3.3V CMOS I/O. BNC type, rear panel. |
| FM IN | Accepts an external signal to frequency or phase modulate the RF output signal. Enabled with Option 12. 50 Ω impedance. BNC type, rear panel. |
| EXT ALC | Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF Output specifications. BNC type, rear panel. |
| EFC | ±4 VDC 30 Hz bandwidth in wide reference PLL mode 1 MEG Ohm input impedance. Provides the capability to frequency modulate the internal crystal oscillator, allowing phase locking of the synthesizer inside an external lock loop. BNC type, rear panel. |
| AM IN | Accepts an external signal to amplitude modulate the RF output signal. Enabled with Option 12. 50 Ω impedance. BNC type, rear panel. |
| 10 MHZ REF IN | Accepts an external 10 MHz ± 3 Hz, 0 dBm to +10 dBm (20 dBm no-damage level) time-base signal. Automatically disconnects the internal high-stability time-base option, if connected. 50 Ω impedance BNC type, rear panel. |
| 10 MHZ REF OUT | Provides a 10 dBm, AC coupled, signal derived from the internal frequency standard. 50 Ω impedance BNC type, rear panel. |
| PULSE IN | Accepts an external TTL compatible signal to pulse modulate the RF output signal or to trigger or to gate the optional internal pulse generator. Enabled with Option 26. BNC type, rear panel. |
| 100 MHZ REF IN | Accepts an external 100 MHz ± 200 Hz or 2 ppm 12 ± 1 dBm (20 dBm no-damage level) reference signal. Enabled with Option 3 or 13. Automatically disconnects the internal high-stability time-base option, if connected. 50 Ω impedance BNC type, rear panel. |
| 100 MHZ REF OUT | Provides a 12 dBm, AC coupled, 100 MHz signal derived from the internal frequency standard. Enabled with Option 3 or 13. 50 Ω impedance BNC type, rear panel. |

| | |
|---|---|
| 1600 MHZ REF IN | Accepts an external 1600 MHz ± 3.2 kHz or 2 ppm, 4 ± 1 dBm (20 dBm no-damage level) reference signal. Enabled with Option 3 or 13. Automatically disconnects the internal high-stability time-base option, if connected. 50 Ω impedance SMA type, rear panel. |
| 1600 MHZ OUT | Provides a 5 dBm, AC coupled, 1600 MHz signal derived from the internal frequency standard. Enabled with Option 3 or 13. 50 Ω impedance SMA type, rear panel. |
| GPS | Accepts GNSS/GPS antenna input. Requires Option 66. |
| RF OUTPUT | Provides for RF output from 50 Ω source impedance. Option 9 moves the RF Output connector from the front to the rear panel. K Connector (male) fmax ≤ 43.5 GHz. V Connector (male) fmax 70 GHz. |
| ETHERNET (1000 Base-T) | Provides input/output connections for a Gigabit Ethernet interface. Accepts RJ45 type connectors, rear panel. |
| GPIB (IEEE-488) | Provides input/output connections for the General Purpose Interface Bus. |
| USB | Two USB 3.0 Type-A for peripherals such as memory device. |
| SD CARD | Accepts an external SDIO memory card. |
| AC POWER INPUT | AC Input connector, with On/Off switch, and fuses 350 VA maximum, 90 to 264 VAC, 47 Hz to 63 Hz. |
| AUX 1 | Future capability |
| AUX 2 | Future capability |

## Ordering Information

### MG36221A Options

| | |
|---|---|
| MG36221A-0001 | Option 1, Rack Mount with Slides (Cannot be ordered with Option 11) |
| MG36221A-0002 | Option 2, Mechanical Step Attenuator, 110 dB |
| MG36221A-0003 | Option 3, Low Phase Noise and High Stability |
| MG36221A-0006 | Option 6, Analog Sweep, Frequency |
| MG36221A-0009 | Option 9, Rear Panel K(m)-Connector RF Output |
| MG36221A-0010 | Option 10, User Defined Modulation (Always requires Option 27. Also requires Option 26 and Option 12 when ordering without Option 15. When ordering with Option 15, requires Option 45 and Option 12.) |
| MG36221A-0011 | Option 11, Rack Mount without Slides (Shelf Mount) |
| MG36221A-0012 | Option 12, Amplitude, Frequency, and Phase Modulation, Internal/External (Requires Option 27) |
| MG36221A-0013 | Option 13, Ultra Low Phase Noise (Requires Option 3.) |
| MG36221A-0015 | Option 15, High Power Output (Cannot be ordered with Option 26. Choose Option 45 when ordering with Option 26.) |
| MG36221A-0016 | Option 16, Analog Power Sweep |
| MG36221A-0017 | Option 17, Delete Front Panel (Requires Option 1 or 11. Cannot be ordered with Option 29.) |
| MG36221A-0018 | Option 18, On-site User Level Calibration (Requires accessory kit 2000-2166-R, and MA24330A or MA24350A USB power sensor, each sold separately.) |
| MG36221A-0023 | Option 23, Premium Phase Noise, CW (Requires Option 3 and 13.) |
| MG36221A-0025 | Option 25, Pulse Train Modulation (Always requires Option 27. Also requires Option 26, or When ordered with Option 15, requires Option 45.) |
| MG36221A-0026 | Option 26, Pulse Modulation, Internal/External (Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.) |
| MG36221A-0027 | Option 27, Modulation Hardware (Requires at least one of Option 12 and/or Option 26, or Option 45.) |
| MG36221A-0029 | Option 29, Front Panel Modulation Input Output Access (Always requires Requires Option 27. Requires either Option 12 and/or Option 26. Cannot order with Option 17. When ordered with Option 15, requires Option 45 and/or Option 12.) |
| MG36221A-0030 | Option 30, 600 Ω External AM/FM Input Impedance (Requires Option 12 and 27.) |
| MG36221A-0033 | Option 33, Phase Noise, Export Option (Cannot be ordered with Options 3, 13, 23 and 56.) |
| MG36221A-0037 | Option 37, Removable SDIO memory |
| MG36221A-0045 | Option 45, High Power Pulse Modulation (Requires Option 27, cannot be ordered with option 15 or Option 17.) |
| MG36221A-0056 | Option 56, Ultra Stability Time Base (Requires Option 3 or 13.) |
| MG36221A-0066 | Option 66, GNSS Atomic Clock Receiver (Requires Option 3 or 13.) |
| MG36221A-0082 | K(f) Connector |
| MG36221A-0097 | Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |
| MG36221A-0098 | Standard Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate |
| MG36221A-0099 | Premium Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |

**MG36241A Options**

| | |
|---|---|
| MG36241A-0001 | Option 1, Rack Mount with Slides (Cannot be ordered with Option 11) |
| MG36241A-0002 | Option 2, Mechanical Step Attenuator, 110 dB |
| MG36241A-0003 | Option 3, Low Phase Noise and High Stability |
| MG36241A-0006 | Option 6, Analog Sweep, Frequency |
| MG36241A-0009 | Option 9, Rear Panel K(m)-Connector RF Output |
| MG36241A-0010 | Option 10, User Defined Modulation (Always requires Option 27. Also requires Option 26 and Option 12 when ordering without Option 15. When ordering with Option 15, requires Option 45 and Option 12.) |
| MG36241A-0011 | Option 11, Rack Mount without Slides (Shelf Mount) |
| MG36241A-0012 | Option 12, Amplitude, Frequency, and Phase Modulation, Internal/External (Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.) |
| MG36241A-0013 | Option 13, Ultra Low Phase Noise (Requires Option 3.) |
| MG36241A-0015 | Option 15, High Power Output (Choose option 45 when ordering with Option 26.) |
| MG36241A-0016 | Option 16, Analog Power Sweep |
| MG36241A-0017 | Option 17, Delete Front Panel (Requires Option 1 or 11. Cannot be ordered with Option 29.) |
| MG36241A-0018 | Option 18, On-site User Level Calibration (Requires accessory kit 2000-2166-R and MA24350A USB power sensor, each sold separately.) |
| MG36241A-0025 | Option 25, Pulse Train Modulation (Always Requires Option 27. Also requires Option 26, or When ordered with Option 15, requires Option 45.) |
| MG36241A-0026 | Option 26, Pulse Modulation, Internal/External (Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.) |
| MG36241A-0027 | Option 27, Modulation Hardware (Requires at least one of Option 12 and/or Option 26, or Option 45.) |
| MG36241A-0029 | Option 29, Front Panel Modulation Input Output Access (Always requires Requires Option 27. Requires either Option 12 and/or Option 26. Cannot order with Option 17. When ordered with Option 15 requires Option 45 and/or Option 12.) |
| MG36241A-0030 | Option 30, 600 Ω External AM/FM Input Impedance (Requires Option 12 and 27.) |
| MG36241A-0033 | Option 33, Phase Noise, Export Option (Cannot be ordered with Options 3, 13, and 56.) |
| MG36241A-0037 | Option 37, Removable SDIO memory |
| MG36241A-0045 | Option 45, High Power Pulse Modulation (Requires Option 27, cannot be ordered with Option 15 or Option 17.) |
| MG36241A-0056 | Option 56, Ultra Stability Time Base (Requires Option 3 or 13.) |
| MG36241A-0066 | Option 66, GNSS Atomic Clock Receiver (Requires Option 3 or 13.) |
| MG36241A-0082 | K(f) Connector |
| MG36241A-0097 | Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |
| MG36241A-0098 | Standard Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate |
| MG36241A-0099 | Premium Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |

### MG36271A Options

| | |
|---|---|
| MG36271A-0001 | Option 1, Rack Mount with Slides (Cannot be ordered with Option 11) |
| MG36271A-0002 | Option 2, Mechanical Step Attenuator, 90 dB |
| MG36271A-0003 | Option 3, Low Phase Noise and High Stability |
| MG36271A-0010 | Option 10, User Defined Modulation (Always requires Option 27. Also requires Option 26 and Option 12 when ordering without Option 15. When ordering with Option 15, requires Option 45 and Option 12.) |
| MG36271A-0011 | Option 11, Rack Mount without Slides (Shelf Mount) |
| MG36271A-0012 | Option 12, Amplitude, Frequency, and Phase Modulation, Internal/External (Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.) |
| MG36271A-0013 | Option 13, Ultra Low Phase Noise (Requires Option 3.) |
| MG36271A-0015 | Option 15, High Power Output (Cannot be ordered with Option 26. Choose Option 45 when ordering with Option 26.) |
| MG36271A-0016 | Option 16, Analog Power Sweep |
| MG36271A-0017 | Option 17, Delete Front Panel (Requires Option 1 or 11. Cannot be ordered with Option 29.) |
| MG36271A-0025 | Option 25, Pulse Train Modulation (Always requires Option 27. Also requires Option 26, or When ordered with Option 15, requires Option 45.) |
| MG36271A-0026 | Option 26, Pulse Modulation, Internal/External (Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.) |
| MG36271A-0027 | Option 27, Modulation Hardware (Requires at least one of Option 12 and/or Option 26, or Option 45) |
| MG36271A-0029 | Option 29, Front Panel Modulation Input Output Access (Always requires Requires Option 27. Requires either Option 12 and/or Option 26. Cannot order with Option 17. When ordered with Option 15 requires Option 45 and/or Option 12.) |
| MG36271A-0030 | Option 30, 600 Ω External AM/FM Input Impedance (Requires Option 12 and 27.) |
| MG36271A-0033 | Option 33, Phase Noise, Export Option (Cannot be ordered with Options 3, 13, and 56.) |
| MG36271A-0037 | Option 37, Removable SDIO memory |
| MG36271A-0045 | Option 45, High Power Pulse Modulation (Requires Option 27, cannot be ordered with Option 15 or Option 17.) |
| MG36271A-0056 | Option 56, Ultra Stability Time Base (Requires Option 3 or 13.) |
| MG36271A-0066 | Option 66, GNSS Atomic Clock Receiver (Requires Option 3 or 13.) |
| MG36271A-0097 | Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |
| MG36271A-0098 | Standard Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate |
| MG36271A-0099 | Premium Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data |

### Standard Accessories (included)

| | |
|---|---|
| 11410-00976 | Getting Started with Anritsu Products and Services Flyer |
| 2000-1732-R | CAT-7 shielded, twisted-pair, Ethernet cable, 10 ft |
| Miscellaneous | Power cord with plug-type and rating determined by destination country |
| | 1-year Factory Warranty Options and Accessories |

### Upgrades

Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

### MG362x1A Option Configuration Matrix

| | Options | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Models** | **1[a]** | **2** | **3** | **6** | **9** | **10[b]** | **11[a]** | **12[c]** | **13[d]** | **15[e]** | **16** | **17[f]** | **18** | **23[g]** |
| **MG36221A** | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **MG36241A** | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| **MG36271A** | X | X | X | | X | X | X | X | X | X | X | X | | |
| | | | | | | | | | | | | | | |
| | **25[h]** | **26[i]** | **27[j]** | **29[k]** | **30[l]** | **33[m]** | **37** | **45[n]** | **56[o]** | **66[i]** | **82** | **97** | **98** | **99** |
| **MG36221A** | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **MG36241A** | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **MG36271A** | X | X | X | X | X | X | X | X | X | X | | X | X | X |

a. Options 1 and 11 cannot be ordered together.
b. Always Requires Option 27. Also requires Option 26 and Option 12 when ordering without Option 15. When ordering with Option 15, requires Option 45 and Option 12.
c. Always requires Option 27. When ordered with Option 15, choose Option 45 instead of 26.
d. Must be ordered with Option 3.
e. Cannot be ordered with Option 26. Choose option 45 when ordering with option 26.
f. Requires Option 1 and 11, cannot be ordered with Option 29.
g. Must be ordered with Option 3 and 13.
h. Always Requires Option 27. Also requires Option 26, or When ordered with Option 15, requires Option 45.
i. Always requires Option 27. When ordered with Option 15, choose Option 45 instead of Option 26.
j. Requires at least one of Option 12 and/or Option 26, or Option 45.
k. Always requires Requires Option 27. Requires either Option 12 and/or Option 26. Cannot order with Option 17. When ordered with Option 15 requires Option 45 and/or Option 12.
l. Must be ordered with option 12 and 27.
m. Cannot be ordered with Options 3, 13, 23, and 56.
n. Requires option 27, cannot be ordered with option 15 or option 17.
o. Must be ordered with Option 3 or 13.

## USB Power Sensors

| Accessory | Description |
|---|---|
| | MA24330A<br>USB Power Sensor, CW Avg, 10 MHz to 33 GHz USB Power Sensor, 10 MHz, –70 dBm to +20 dBm. |
| | MA24340A<br>USB Power Sensor, CW Avg, 10 MHz to 40 GHz USB Power Sensor, 10 MHz, –70 dBm to +20 dBm. |
| | MA24350A<br>USB Power Sensor, CW Avg, 10 MHz to 50 GHz USB Power Sensor,10 MHz, –70 dBm to +20 dBm. |

## Transit Case

| Accessory | Description |
|---|---|
| | 760-297-R<br>Transit case (16 kg, 79.4 cm x 61.5 cm x 44.4 cm, roll-away on four wheels) |

## Accessories

| Accessory | Description |
|---|---|
| | 2000-2166-R<br>MG36221A/41A Opt 18 kit includes:<br>110-145-R, DC to 43.5 GHz, 50 Ω, 5W, K(f) to K(m) attenuator<br>33KFKF50C, DC to 43.5 GHz, 50 Ω, K(f) to K(f) adapter (Use with the MG36221A)<br>34VFKF50A, DC to 43.5 GHz, 50 Ω, V(f) to K(f) adapter (Use with the MG36241A) |
| | 01-200<br>Calibrated Torque End Wrench, GPC-7 and Type N |
| | 01-201<br>Torque End Wrench, 5/16 in, 0.9 N.m (8 lbf·in) (for tightening male devices, for SMA, 3.5 mm, 2.4 mm, K, and V connectors) |
| | 01-203<br>Torque End Wrench, 13/16 in, 0.9 N.m (8 lbf·in) (for tightening ruggedized SMA, 2.4 mm, K and V test port connectors) |
| | 01-204<br>End Wrench, 5/16 in, Universal, Circular, Open-ended (for SMA, 3.5 mm, 2.4 mm, K, and V connectors) |

## Coaxial Adapters

| Accessory | Description |
|---|---|
| | 1091-26-R<br>SMA(m) to N(m), DC to 18 GHz, 50 Ω |
| | 1091-27-R<br>SMA(f) to N(m), DC to 18 GHz, 50 Ω |
| | 1091-80-R<br>SMA(m) to N(f), DC to 18 GHz, 50 Ω |
| | 1091-81-R<br>SMA(f) to N(f), DC to 18 GHz, 50 Ω |
| | 1091-172-R<br>BNC(f) to N(m), DC to 1.3 GHz, 50 Ω |
| | 1091-315-R<br>DC to 18 GHz, TNC(m) to N(f), 50 Ω |
| | 33KFKF50C<br>Calibration Grade Adapter, K(f) to K(f),<br>DC to 43.5 GHz, 50 Ω |
| | 33KKF50C<br>Calibration Grade Adapter, K(m) to K(f),<br>DC to 43.5 GHz, 50 Ω |
| | 1091-323-R<br>DC to 18 GHz, TNC(m) to TNC(f), 50 Ω |
| | 1091-325-R<br>DC to 18 GHz, TNC(m) to N(m), 50 Ω |
| | 1091-465-R<br>DC to 6 GHz, 4.3-10(f) to N(f), 50 Ω |
| | 71693-R<br>DC to 18 GHz, Ruggedized adapter, K(f) - N(f), 50 Ω |
| | 34NK50<br>Precision Adapter, N(m) to K(m), DC to 18 GHz, 50 Ω |

| Accessory | Description |
|---|---|
| | 510-102-R<br>N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle |
| | 510-90-R<br>7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω |
| | 510-91-R<br>7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω |
| | 510-92-R<br>7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω |
| | 510-93-R<br>7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω |
| | 510-96-R<br>7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω |
| | 510-97-R<br>7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50 Ω |
| | 33KKF50C<br>Calibration Grade Adapter, K(m) to K(f),<br>DC to 43.5 GHz, 50 Ω |
| | 1091-324-R<br>DC to 18 GHz, TNC(f) to N(m), 50 Ω |
| | 1091-326-R<br>DC to 8 GHz, TNC(m) to TNC(m), 50 Ω |
| | 1091-467-R<br>DC to 6 GHz, 4.3-10(m) to N(f), 50 Ω |
| | 33KK50C<br>Calibration Grade Adapter, K(m) to K(m),<br>DC to 43.5 GHz, 50 Ω |
| | 34VFK50A<br>DC to 43.5 GHz, V(f) to K(m), 50 Ω |

| Accessory | Description |
|---|---|
| | 34NKF50<br>Precision Adapter, N(m) to K(f), DC to 18 GHz, 50 Ω |
| | 34NFK50<br>Precision Adapter, N(f) to K(m), DC to 18 GHz, 50 Ω |
| | 34NFKF50<br>Precision Adapter, N(f) to K(f), DC to 18 GHz, 50 Ω |
| | 34VV50<br>DC to 65 GHz, V(m) to V(m), 50 Ω |
| | 34VVF50<br>DC to 65 GHz, V(f) to V(m), 50 Ω |
| | 34VFVF50<br>DC to 65 GHz, V(f) to V(f), 50 Ω |

| Accessory | Description |
|---|---|
| | 34VFKF50A<br>DC to 43.5 GHz, V(f) to K(f), 50 Ω |
| | 34VKF50A<br>Precision Adapter, V(m) to K(f), DC to 43.5 GHz, 50 Ω |
| | 34VK50A<br>Precision Adapter, V(m) to K(m), DC to 43.5 GHz, 50 Ω |
| | 2000-1880-R<br>DC to 18 GHz, N(m) to V(f), 50 Ω |
| | 2000-1881-R<br>DC to 18 GHz, N(f) to V(f), 50 Ω |

## Precision Adapters

| Accessory | Description |
|---|---|
| | 34NN50A<br>N(m) to N(m), DC to 18 GHz, 50 Ω |
| | K220B<br>DC to 40 GHz, K(m) to K(m), 50 Ω |
| | K224B<br>DC to 40 GHz, K(m) to K(f), 50 Ω |

| Accessory | Description |
|---|---|
| | 34NFNF50<br>N(f) to N(f), DC to 18 GHz, 50 Ω |
| | K222B<br>DC to 40 GHz, K(f) to K(f), 50 Ω |

## Attenuators (up to 18 GHz)

| Accessory | Description |
|---|---|
| | 1010-121-R<br>40 dB, 100 W, D to 18 GHz, N(f) to N(m), Uni-directional |
| | 3-1010-122<br>20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f) |
| | 3-1010-123<br>30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f) |
| | 3-1010-124<br>40 dB, 100 W, DC to 8.5 GHz, N(f) to N(m), Uni-directional |
| | ANO 62-0502-20<br>Attenuator 1.85mm Female to 1.85mm Female, 5W Bi Directional, DC - 67 GHz |

| Accessory | Description |
|---|---|
| | 42N50-20<br>20 dB, 5 W, DC to 18 GHz, N(m) to N(f) |
| | 42N50A-30<br>30 dB, 50 W, DC to 18 GHz, N(m) to N(f) |
| | 1010-127-R<br>30 dB, 150 W, DC to 3 GHz, N(m) to N(f) |
| | 1010-128-R<br>40 dB, 150 W, DC to 3 GHz, N(m) to N(f) |

## Fixed Attenuators

| Accessory | Description |
|---|---|
| | 41KB-3<br>Precision, K(m) to K(f), 3 dB, DC to 26.5 GHz, 2W |
| | 41KB-6<br>Precision, K(m) to K(f), 6 dB, DC to 26.5 GHz, 2W |
| | 41KB-10<br>Precision, K(m) to K(f), 10 dB, DC to 26.5 GHz, 2W |
| | 41KB-20<br>Precision, K(m) to K(f), 20 dB, DC to 26.5 GHz, 2W |
| | 41KC-3<br>Precision, K(m) to K(f), 3 dB, DC to 40 GHz, 2W |
| | 41KC-6<br>Precision, K(m) to K(f), 6 dB, DC to 40 GHz, 2W |
| | 41KC-10<br>Precision, K(m) to K(f), 10 dB, DC to 40 GHz, 2W |
| | 41KC-20<br>Precision, K(m) to K(f), 20 dB, DC to 40 GHz, 2W |

| Accessory | Description |
|---|---|
| | 41VA-3<br>DC to 70 GHz, 2W, 3 dB, V(m) to V(f) |
| | 41VA-6<br>DC to 70 GHz, 2W, 6 dB, V(m) to V(f) |
| | 41VA-10<br>DC to 70 GHz, 2W, 10 dB, V(m) to V(f) |
| | 41VA-20<br>DC to 70 GHz, 2W, 20 dB, V(m) to V(f) |
| | 43KC-3<br>DC to 26.5 GHz, 2W, 3 dB, K(m) to K(f) |
| | 43KC-6<br>DC to 26.5 GHz, 2W, 6 dB, K(m) to K(f) |
| | 43KC-10<br>DC to 26.5 GHz, 2W, 10 dB, K(m) to K(f) |
| | 43KC-20<br>DC to 26.5 GHz, 2W, 20 dB, K(m) to K(f) |

## Test Port Cables, Flexible, Ruggedized, Phase Stable

| Accessory | Description |
|---|---|
| | N120-6<br>RF Cables, Semi-Rigid, 0.01 to 18 GHz, N(m) to N(m), 15 cm (5.9 in), 50 Ω, 1 each |
| | NS120MF-6<br>RF Cables, Semi-Rigid, 0.01 to 18 GHz, N(f) to N(f), 15 cm (5.9 in), 50 Ω, 1 each |
| | 15NNF50-1.0B<br>Test Port Cable, Flexible, Phase Stable, DC to 18 GHz, N(m) to N(f), 1.0 m (39 in), 50 Ω |
| | 15NNF50-1.5B<br>Test Port Cable, Flexible, Phase Stable, DC to 18 GHz, N(m) to N(f), 1.5 m (59 in), 50 Ω |
| | 15NN50-1.0B<br>Test Port Cable, Flexible, Phase Stable, DC to 18 GHz, N(m) to N(m), 1.0 m (39 in), 50 Ω |
| | 15LLF50-1.0A<br>Test Port Cable, Armored, Phase Stable, DC to 20 GHz, 3.5 mm(m) to 3.5 mm(f), 1.0 m (39 in), 50 Ω |
| | 15KKF50-1.0A<br>Test Port Cable, Armored, Phase Stable, DC to 20 GHz, K(m) to K(f), 1.0 m (39 in), 50 Ω |
| | 3670K50A-1<br>0.3 m (12 in), DC to 40 GHz, K(f) to K(m), 50 Ω |
| | 3670K50A-2<br>0.6 m (24 in), DC to 40 GHz, K(f) to K(m), 50Ω |
| | 3670NN50-1<br>0.3 m (12 in), DC to 18 GHz, N(m) to N(m), 50 Ω |
| | 3670NN50-2<br>0.6 m (24 in), DC to 18 GHz, N(m) to N(m), 50 Ω |

| Accessory | Description |
|---|---|
| | 3671KFK50-60<br>Test Port Cable, Flexible, Phase Stable, DC to 40 GHz, K(f) to K(m), 63.5 cm (25 in), 50 Ω |
| | 3671KFKF50-60<br>Test Port Cable, Flexible, Phase Stable, DC to 40 GHz, K(f) to K(f), 63.5 cm (25 in), 50 Ω |
| | 3671KFK50-100<br>Test Port Cable, Flexible, Phase Stable, DC to 40 GHz, K(f) to K(m), 1 m (38 in), 50 Ω |
| | 806-206-R<br>Cable, Flexible, Phase Stable, DC to 70 GHz, V(m) to V(f), 61 cm (24 in), 50 Ω |
| | 806-209-R<br>Cable, Flexible, Phase Stable, DC to 70 GHz, V(m) to V(f) 91.5 cm (36 in), 50 Ω |
| | 806-304-R<br>Cable, Flexible, Phase Stable, DC to 40 GHz, K(m) to K(f), 91.5 cm (36 in), 50 Ω |
| | 806-396-R<br>Cable, Flexible, Low Loss, Phase Stable, DC to 70 GHz, V(m) to V(f), 91.5 cm (36 in), 50 Ω |
| | 3670N50-1<br>0.3 m (12 in), DC to 18 GHz, N(f) to N(m), 50 Ω |
| | 3670N50-2<br>0.6 m (24 in), DC to 18 GHz, N(f) to N(m), 50 Ω |
| | 3671KFS50-60<br>Test Port Cable, Flexible, Phase Stable, DC to 26.5 GHz, K(f) to 3.5 mm (m), 63.5 cm (25 in), 50 Ω |

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