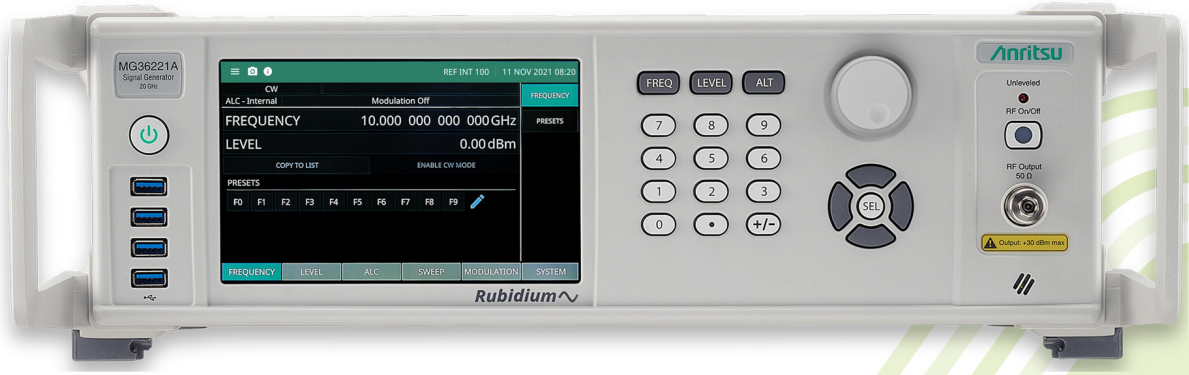
Anritsu Advancing beyond

Rubidium™

RF/Microwave Signal Generator

MG36221A	MG36241A
9 kHz to 20 GHz	9 kHz to 43.5 GHz



Introduction

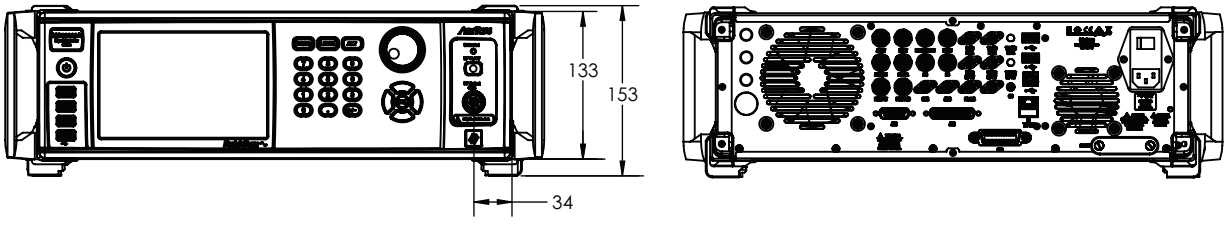
The Rubidium™ MG362x1A is a microwave signal generator offering industry's lowest phase noise, best in class harmonics and spurious, excellent frequency stability, high output power, upgradability, reliability, and service. Our signal generators are configurable for a broad range of applications from 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 43.5 GHz, even at high output power levels.

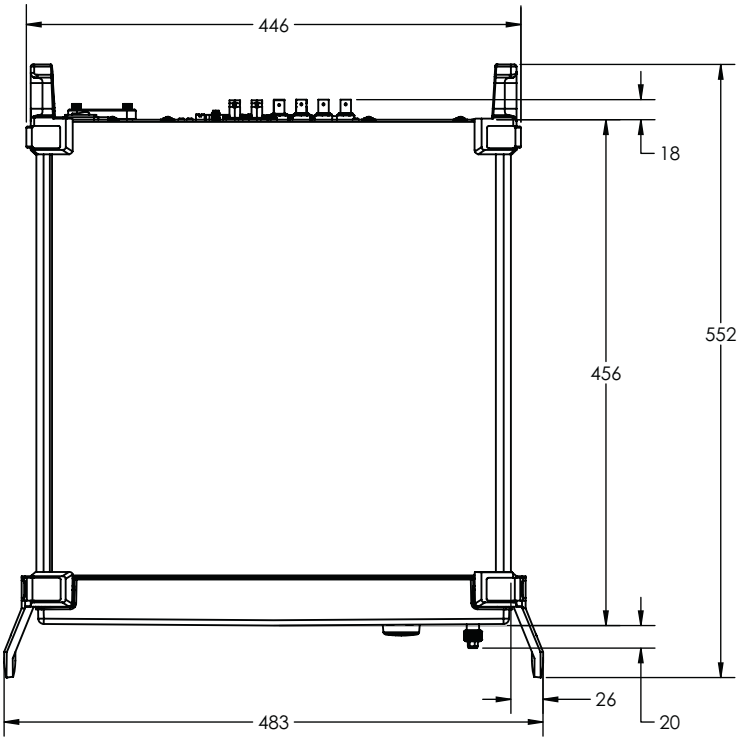
The Rubidium MG362x1A provides two tiers of phase noise performance as options in addition to the standard tier. The Low Phase Noise option delivers improved close-in phase noise than the standard Rubidium along with better frequency stability. The Ultra Low Phase Noise Option provides improved phase 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. Alternatively, customers can also get exceptional frequency stability by locking an internal oven controlled crystal oscillator (OCXO) reference to an external GNSS/GPS signal. The exceptional frequency stability coupled with low phase noise performance makes the Rubidium MG362x1A the ideal choice for many measurement applications.

The Rubidium MG362x1A modulation capabilities include AM, FM, phase, and pulse to address simple to complex signal simulation requirements. It offers comprehensive pulse generation capabilities for testing pulse radar systems. It also supports Anritsu's True-RMS and CW USB power sensors.

Anritsu provides you a total solution including proven reliability and standard 3-year warranty plus pre-sale and post-sale support that is the best in the industry.





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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: • After 30 minutes of warm-up time, where the instrument is left in the on state. • 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)

Frequency Resolution	0.001 Hz
Frequency Accuracy	Same as internal or external time base

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	< 8×10^{-12}

Internal Reference Output

Provides a sinewave signal derived from the internal time base 50 Ω nominal impedance connectors, rear panel.

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

External Reference Input

	Standard	Option 3
Input Frequency	10 MHz	1 Hz (PPS), 10 MHz, 100 MHz, 1,600 MHz
10 MHz REF IN	Accepts an external 10 MHz ± 2 ppm (± 0.3 ppm for Option 3), 0 dBm to +10 dBm (+20 dBm no-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 no-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 no-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 apply at the lesser of +10 dBm output or maximum specified leveled output power unless otherwise noted.

Harmonic and Harmonic Related

Frequency Range	Standard	(Option 15) +10 dBm	(Option 15) +15 dBm	(Option 15) +20 dBm
9 kHz to ≤ 31.25 MHz	–35 dBc	–35 dBc	–30 dBc	–30 dBc
> 31.25 MHz to ≤ 1.3 GHz	–58 dBc	–58 dBc	–55 dBc	–50 dBc
> 1.3 GHz to < 2 GHz	–60 dBc	–60 dBc	–60 dBc	–55 dBc
≥ 2 GHz to ≤ 20 GHz	–60 dBc	–60 dBc	–60 dBc	–58 dBc
> 20 GHz to ≤ 24 GHz (MG36241A)	–60 dBc	–20 dBc	–20 dBc	–15 dBc
> 24 GHz to ≤ 43.5 GHz (MG36241A)	–60 dBc	–35 dBc	–35 dBc	–30 dBc

Non-Harmonic

Frequency Range	Standard
9 kHz to ≤ 31.25 MHz	< –65 dBc
> 31.25 MHz to ≤ 20 GHz	< –70 dBc
> 20 GHz to 43.5 GHz	< –63 dBc

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

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

CW and Step Sweep modes

Frequency Range	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)
9 kHz to ≤ 1 GHz	80 mHz	75 mHz	70 mHz
> 1 GHz to ≤ 10 GHz	360 mHz	350 mHz	280 mHz
> 10 GHz to ≤ 20 GHz	800 mHz	770 mHz	620 mHz
> 20 GHz to ≤ 43.5 GHz (MG36241A)	2.5 Hz	2.25 Hz	2.2 Hz

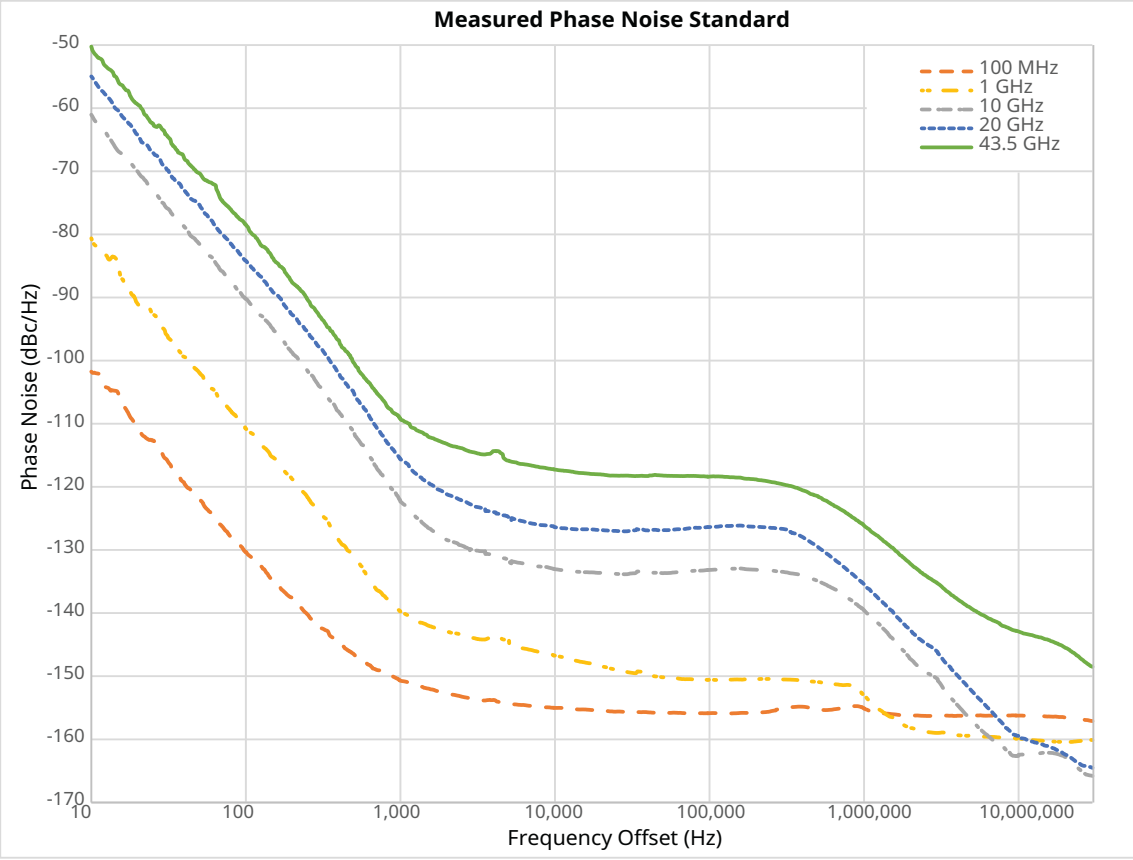
Single–Sideband Phase Noise

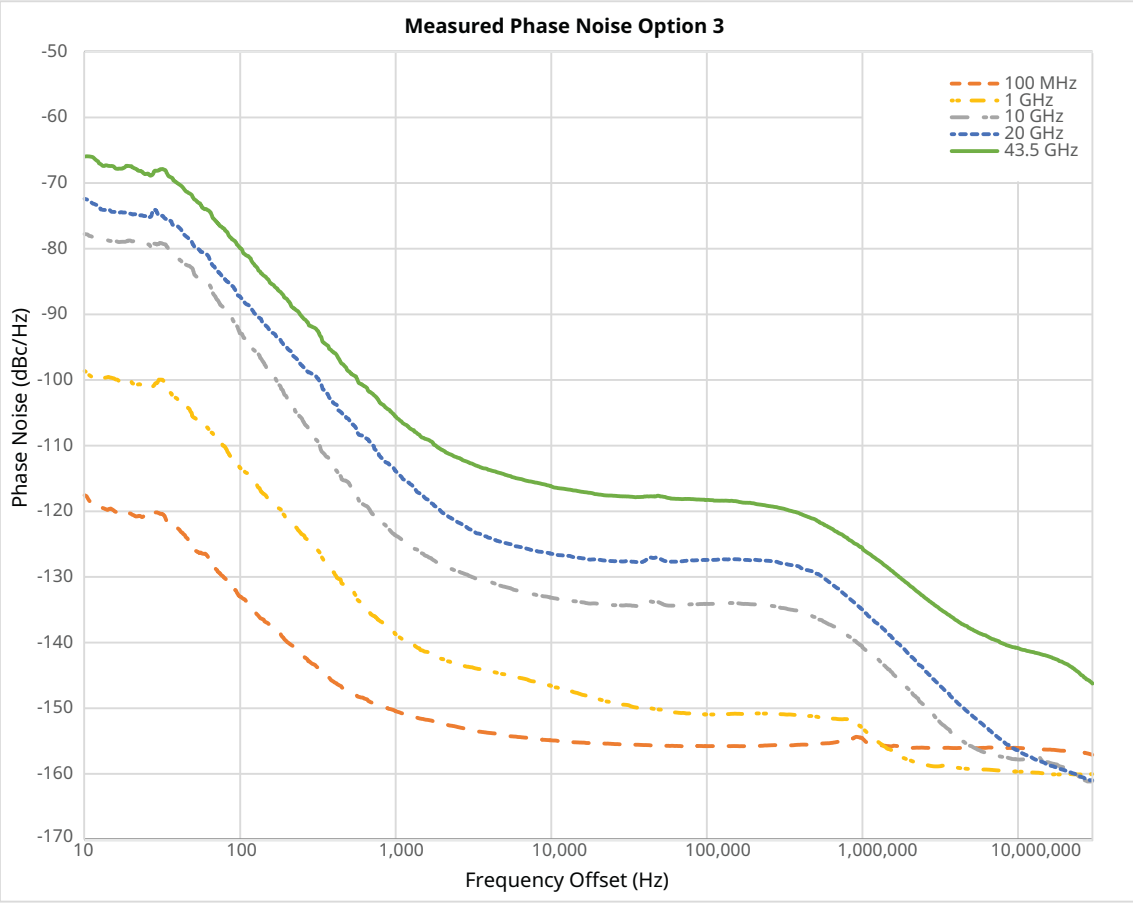
Phase noise is specified and guaranteed only with internal reference. In External Reference mode, the phase noise of the external supplied reference, and the selected external reference bandwidth, will dictate the instrument phase noise performance. Phase noise is not degraded when adding high power Option 15. Phase noise measured at +10 dBm.

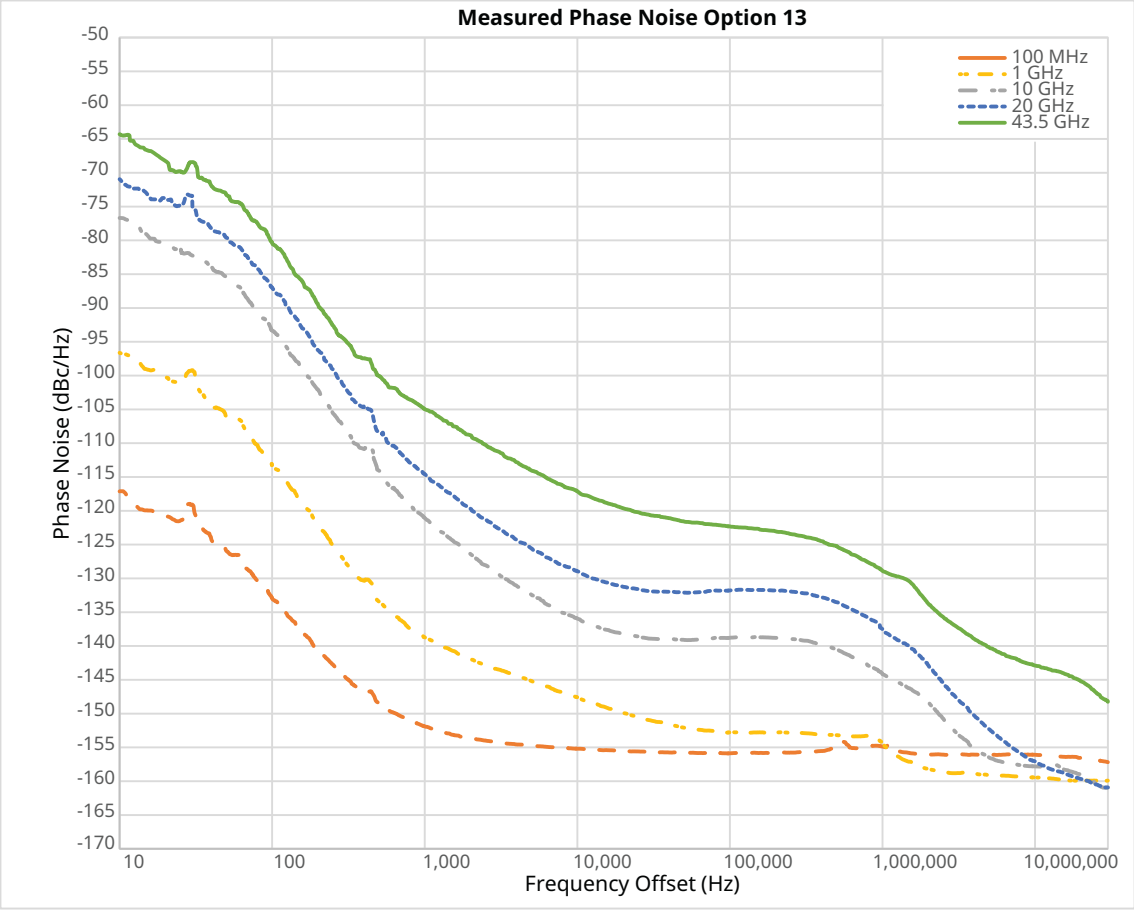
Standard Phase Noise Specification (typ), dBc/Hz	Offset from Carrier							
Frequency	**10 Hz**	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**	**30 MHz**
100 MHz	–94 (–99)	–123 (–128)	–142 (–147)	–149 (–154)	–150 (–155)	–147 (–153)	–150 (–156)	–150 (–156)
1 GHz	–74 (–79)	–103 (–108)	–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)

Low Phase Noise (Option 3) Specification (typ), dBc/Hz	Offset from Carrier							
Frequency	**10 Hz**	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**	**30 MHz**
100 MHz	–110 (–116)	–126 (–132)	–145 (–151)	–150 (–155)	–151 (–156)	–147 (–153)	–150 (–156)	–151 (–157)
1 GHz	–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)

Ultra Low Phase Noise (Option 13) Spec (typ), dBc/Hz	Offset from Carrier							
Frequency	**10 Hz**	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**	**10 MHz**	**30 MHz**
100 MHz	–110 (–116)	–126 (–132)	–145 (–151)	–150 (–155)	–151 (–156)	–148 (–154)	–150 (–156)	–151 (–157)
1 GHz	–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)


Measured Phase Noise Standard
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)
100 MHz
1 GHz
10 GHz
20 GHz
43.5 GHz


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)
100 MHz
1 GHz
10 GHz
20 GHz
43.5 GHz


Measured Phase Noise Option 13
100 MHz
1 GHz
10 GHz
20 GHz
43.5 GHz
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)

Premium Phase Noise, CW (Option 23)

For CW applications between 2 GHz to 20 GHz, Rubidium provides even lower phase noise than the Ultra Low Phase Noise option (by another 3 to 4 dB at certain offsets) on a separate RF output port at the rear panel (Option 23). Option 23 unlocks ultimate phase noise characteristics by bypassing the output signal processing circuits (amplitude leveling and control, amplitude modulation, output amplifier, harmonic filtering, and step attenuator) that prevent agreement: circuits prevent phase noise degradation as well as amplitude to phase noise conversion effects in these circuits. The signal is routed directly from the synthesizer core to the RF OUT connector at the rear panel and is available in the 2 to 20 GHz range between +14 to +23 dBm. This option is only available for the MG36221A model.

Phase Noise (measured) dBc/Hz

	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

Output Power Unleveled (typical)

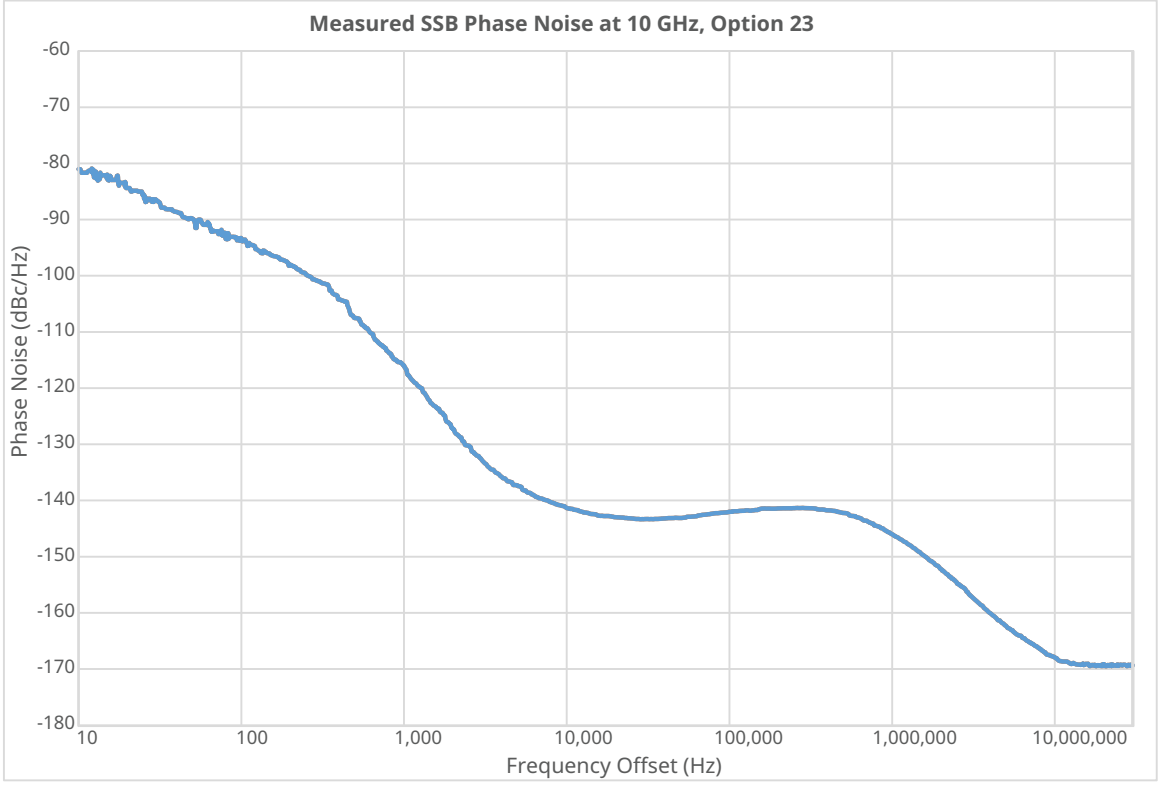
Frequency	**dBm**
2 GHz to ≤ 18 GHz	> 15
> 18 GHz to ≤ 20 GHz	> 14

Harmonics (typical)

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

Spurious

< –70 dBc

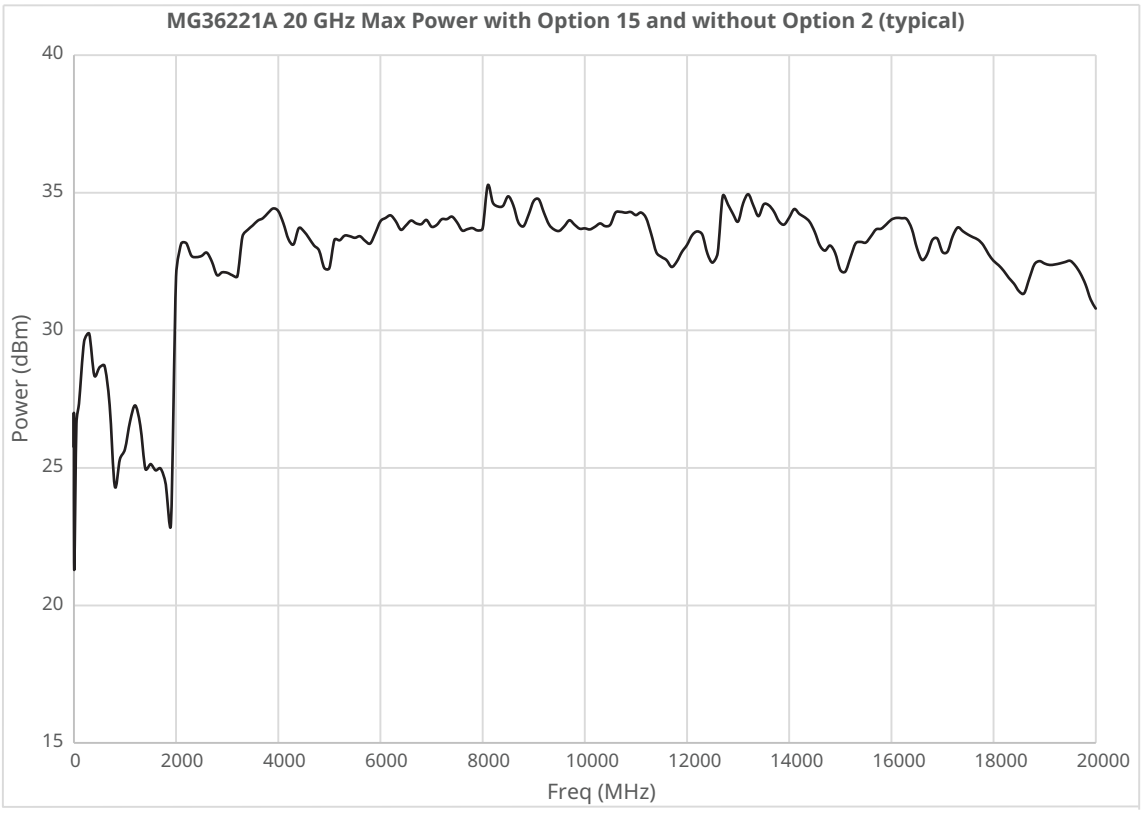


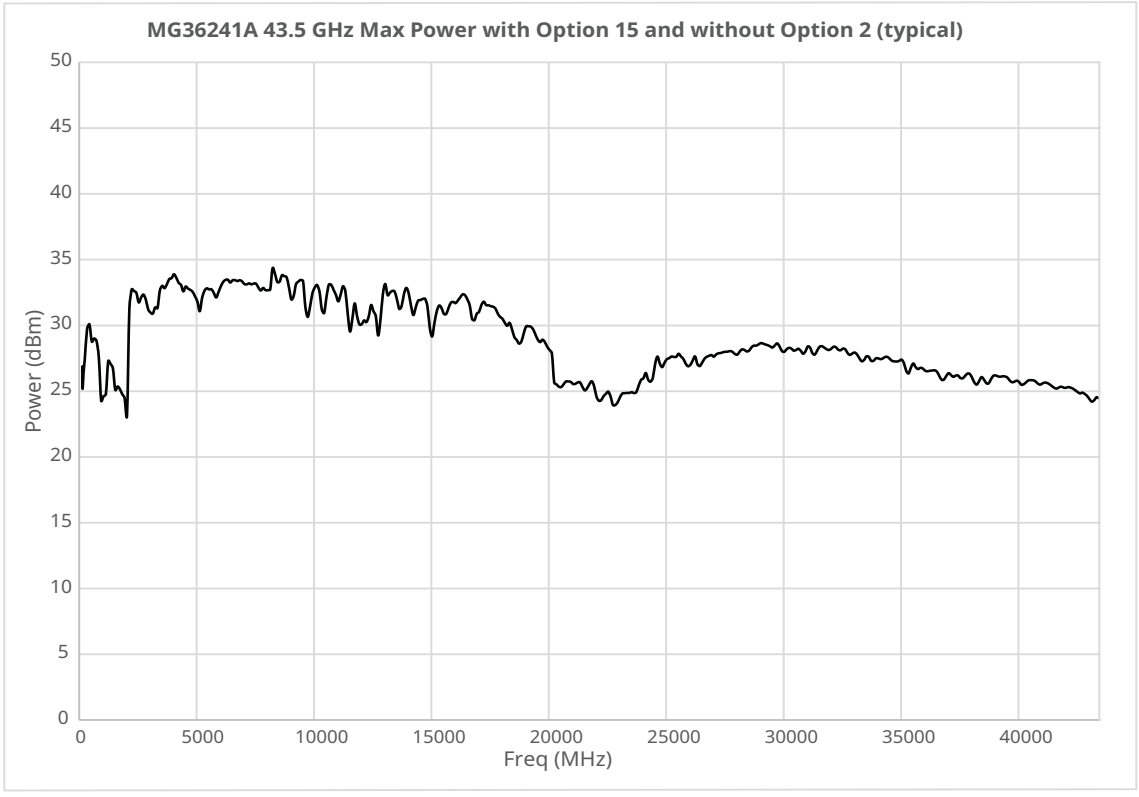
Output Power

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

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


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
Freq (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
Freq (MHz)

Accuracy and Flatness (Flatness is included within the accuracy specification.)

Power Range	Frequency	Accuracy
Maximum Power to -90 dBm	9 kHz to 40 GHz	± 1 dB
Maximum Power to -90 dBm	> 40 GHz to 43.5 GHz	± 1.4 dB

Minimum Settable Output Power

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

Minimum Leveled Output Power

Without an Attenuator	–15 dBm
With an Attenuator	–120 dBm (–70 dBm from 9 kHz to 70 kHz)

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

General Output Power Specifications

Output Units	Output units selectable as either 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. During the Off state, the RF oscillator is turned off. The On or Off state is indicated by an LED button located above the RF Output connector on the front panel.
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.

Power Modes

CW Power Sweep

Range	Sweeps between any two power levels at a single CW frequency.
Operating Modes	Step, List
Triggering Modes	Auto, Single
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 us 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 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 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 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

Frequency Switching Time

Switching time is from Unlocked indication to frequency settled to within < 1 kHz of final.

T, msec = T1 + abs [(F1 + K1)*N1 – (F2 + K2)*N2]*1 msec/GHz where:
T1 = 5 msec
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 43.5	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, or via the front panel, 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 (pos/neg) 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

Sweep Triggering

Sweep triggering is provided for Analog Frequency Sweep, Step Frequency Sweep, List Frequency Sweep, and CW Power Sweep.

Auto	Triggers sweep automatically.
External	Triggers a sweep (pos/neg) through BNC connector, Bus.
Single Sweep	Triggers, aborts, and resets a single sweep. 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 ohms 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) Log: 0 dB to 20 dB (nominal)
Accuracy	±5 % relative to readout
AM Bandwidth (3 dB)	DC to > 50 kHz (nominal)
Harmonic Distortion	< 5 % at 1 kHz: (typical)
External AM Input	Log AM or Linear AM input Rear-panel BNC (50 Ω input impedance)
Sensitivity	Log AM: Continuously variable from 0 dB per volt to 25 dB per volt. Linear AM: Continuously variable from 0 % per volt to 100 % per volt.
Maximum Input	±1 Vpk
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.

Fout (MHz)	Nmod
> 0.009 to ≤ 20	0.0625
> 20 to ≤ 31.25	0.125
> 31.25 to ≤ 40	0.0078125
> 40 to ≤ 80	0.015625
> 80 to ≤ 160	0.03125
> 160 to ≤ 320	0.0625
> 320 to ≤ 640	0.125
> 640 to ≤ 1,280	0.25
> 1,280 to < 2,000	0.5
≥ 2,000 to ≤ 2,560	0.5
> 2,560 to ≤ 5,120	1
> 5,120 to ≤ 10,240	1
> 10,240 to ≤ 20,000	1
> 20,000 to ≤ 40,000	2
> 40,000 to ≤ 43,500	4

Fout (MHz)	Nrf
≥ 0.009 to ≤ 31.25	0.125
> 31.25 to ≤ 62.5	0.015625
> 62.5 to ≤ 125	0.03125
> 125 to ≤ 250	0.0625
>250 to ≤ 500	0.125
> 500 to ≤ 1,000	0.25
> 1,000 to ≤ 2,000	0.5
> 1,000 to ≤ 2,000	0.5
≥ 2,000 to ≤ 20,000	1
> 20,000 to ≤ 40,000	2
> 40,000 to ≤ 43,500	4

Frequency Modulation

Parameter	Modes	Specifications	Conditions, Int or Ext @ 1V pk AC, 0V DC, DC HPF, sinewave, except as noted
Max Deviation	Low Noise	10 MHz *Nmod (see Nmod table)	Rate = 1 kHz to lesser of (8 MHz or 0.03 *RF) RF ≥ 2 MHz
	Wide (unlocked)	100 MHz *Nrf, typical (see Nrf table)	Rate = 10 Hz RF > 31.25 MHz
Min Deviation	Low Noise	640 Hz *Nmod, nominal (less if Ext FM < ±1V)	Rate = 1 kHz
	Wide (unlocked)	3.2 kHz *Nrf, nominal, (less if Ext FM < ±1V)	Rate = 10 kHz
Deviation Accuracy	Low Noise	Internal: ±2 %, External: ±3 % of indication	Rate = 1 kHz, Deviation Setting =2 MHz *Nmod RF > 2 MHz
External Sensitivity	Low Noise	(1.28 kHz/V to 20 MHz/V) *Nmod	
	Wide (unlocked)	(3.2 kHz/V to 105 MHz/V) *Nmod	
External Sensitivity Accuracy	Low Noise	3 % nominal	Rate = 1 kHz
Flatness vs. Modulation Rate	Low Noise	± 1dB, typical	1 kHz to 1 MHz rate vs. 1 kHz, for RF > 31.25 MHz Deviation setting = 2 MHz *Nmod
3 dB Bandwidth	Low Noise	DC to 10 MHz	vs. 1 kHz rate, DC couple, Deviation setting = 2 MHz *Nmod For RF > 250 MHz
	Wide (unlocked)	DC to > 500 Hz, nominal	vs. 10 Hz rate, Deviation setting = 10 MHz *Nrf
	Highpass Filter	DC, 63 Hz, 1 kHz, nominal	
Harmonic distortion (THD)	Low Noise	1 %	Rate = 1 kHz, 50 kHz. Deviation = 300 kHz, 50 kHz RF ≤ 160 MHz, RF > 1 MHz
Incidental AM	Low Noise	≤ 0.3 % rms	50 Hz to 15 kHz integration BW, Rate = 1 kHz, Dev = 50 kHz
Residual FM	Low Noise	≤ 3 kHz rms	50 Hz to 15 kHz integration BW, Rate = 1 kHz, Dev = 50 kHz

Phase Modulation

Parameter	Modes	Specifications	Conditions, except as noted: Int or Ext@1VpkAC, 0VDC, DC HPF, sinewave
Max Deviation	Low Noise	±[lesser of 5 rad or 7 MHz/modrate] *Nmod (see Nmod table)	DC to 7 MHz rate
	Wide Deviation	±[lesser of 640 rad or 7 MHz/modrate] *Nmod	DC to 1 MHz rate
Min Deviation	Low Noise	1 m rad at Nmod = 0.5 to 2, (< 1m rad if Ext ΦM input < 1Vpk), nominal	1 kHz rate
	Wide Deviation	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	Internal: ±5 %, External: ±5 % of indication	1 kHz rate, Phase deviation setting = 5 rad/Nmod
	Wide Deviation	Internal: ±5 %, External: ±5 % of Indication	100 Hz rate, Phase deviation setting = 640 rad/Nmod
Ext Sensitivity	Low Noise	Nmod *6.28 rad/V to (1m rad/V for Nmod = 0.5 to 2)	
	Wide Deviation	Nmod *804 rad/V to (0.1 rad/V for Nmod = 0.5 to 2)	
External Sensitivity Accuracy	Low Noise	±5 %	1 kHz rate, Phase deviation setting = 5 rad/Nmod
	Wide Deviation	±5 %	100 Hz rate, Phase deviation setting = 640 rad/Nmod
Flatness vs. Modulation Rate	Low Noise	±1 dB typical	1 kHz to 1 MHz rate vs. 1 kHz, dev setting = 0.2 rad *Nmod
3 dB Bandwidth	Low Noise	DC to 10 MHz	vs. 1 kHz rate, Phase deviation setting = 0.2 rad *Nmod
	Wide Deviation	DC to 1 MHz	vs. 100 Hz rate, Phase deviation setting = 10 rad *Nmod
	Highpass Filter	DC, 63 Hz, 1 kHz, nominal	

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 via rear panel 50 ohms BNC connectors. It can also be driven from 50 ohms BNC connectors on the front panel with Option 29. Pulse modulation is not available < 10 MHz.

On/Off Ratio	> 80 dB (70 dB for frequencies < 2 GHz)
Minimum Leveled Pulse Width	100 ns, ≥ 1 GHz
	1 μs, < 1 GHz
Minimum Unleveled Pulse Width	< 10 ns
Level Accuracy Relative to CW (100 Hz to 1 MHz PRF)	
	± 0.5 dB, ≥ 1 μs pulse width
	± 1.0 dB, < 1 μs pulse width
Pulse Delay	50 ns in External Mode (typical)
PRF Range	DC to 10 MHz, unleveled
	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
	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)

Millimeter-wave Frequency Coverage

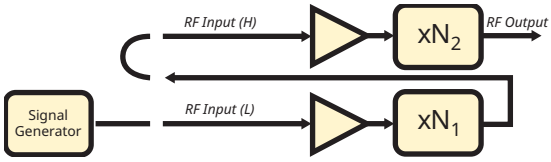
Millimeter-wave Multiplier 2000-2087-R Through 2000-2098-R Series

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, FM, and Phase modulation.

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

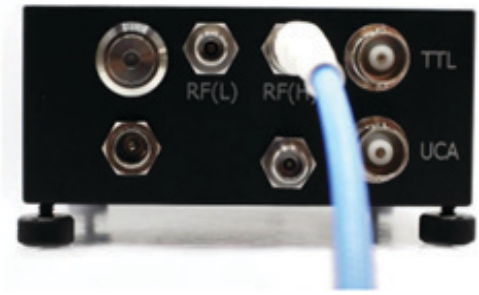
- Low frequency input for < 20 GHz and 10 dBm input level

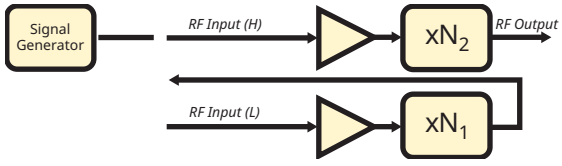
  In this configuration the RF output from Rubidium is input into the K(f) input port on the rear panel of the multiplier module. The port is designated as RF(L). The low frequency band input configuration uses both N_1 and N_2 multipliers, as shown below.



- 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 harmonic 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)	100-240 VAC, 3.5 A, 50-60 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 Lbs. (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

	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

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.

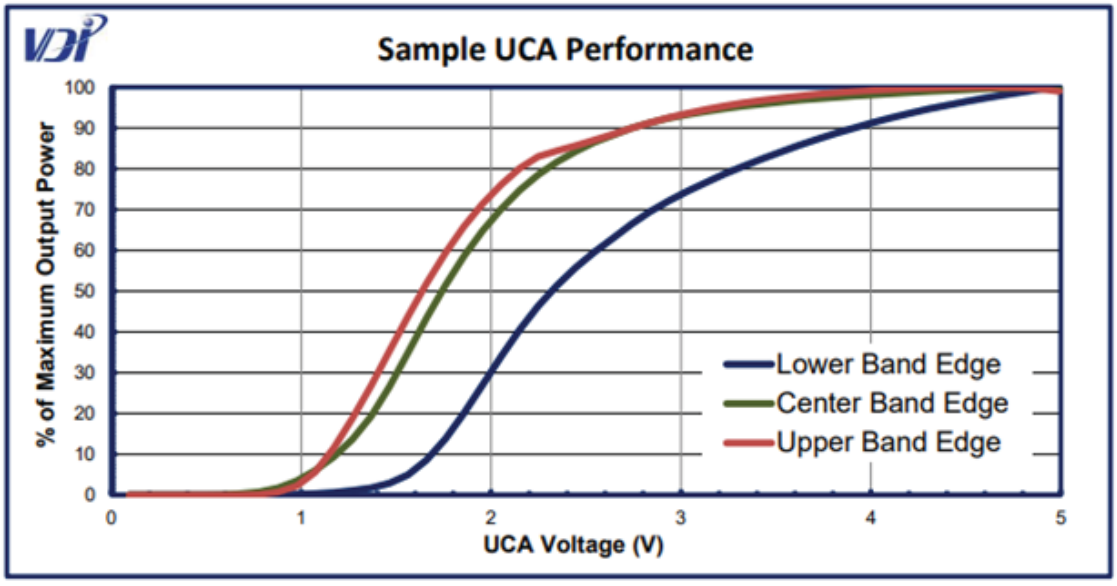
c. Warranty period for 2000-2087-R through 2000-2098-R multiplier modules is one year.

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	85 VAC to 264 VAC, 48 Hz to 440 Hz, 250 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	3 years 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		
GPIB Commands	SCPI, Native (MG369xC compatible proprietary command set)		
GPIB Address	Selectable from a system menu		
IEEE -488 Interface Function Subset	Source Handshake: SH1 Acceptor Handshake: AH1 Talker: T6 Listener: L4	Service Request: SR1 Remote/Local: RL1 Parallel Poll: PP1 Device Clear: DC1	Device Trigger: DT1 Controller Capability: C0, C1, C2, C3, C28 Tri-State Driver: E2
Remote Lockout	While operating on the GPIB or via Ethernet, all instrument front panel keys are not locked and work as normal.		
Emulations	The instrument responds to the published native (Anritsu proprietary) commands and responses of the Anritsu Models 6600, 6700, 6XX00, and MG3690 series signal sources. When emulating another signal source, the instrument will be limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument.		

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 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS directives 2011/65/EU & Amendment 2015/863
United Kingdom	EMC SI 2016/1091; BS EN 55011 & BS EN 61000-4-2/3/4/5/6/8/11 Consumer Protection (Safety) SI 2016/1011; BS EN 61010-1:2010 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	KCC-REM-A21-0004

Rear Panel

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

Inputs and Outputs	Description
AM OUT	Provides the amplitude modulation waveform from the internal LF generator. Enabled with Option 0027. BNC type, rear panel.
PULSE OUT	Provides a video modulating signal from the internal pulse generator. Enabled with Option 0027. BNC type, rear panel.
FM OUT	Provides the frequency or phase modulation waveform from the internal LF generator. Enabled with Option 0027. BNC type, rear panel.
PULSE SYNC	Provides a TTL compatible signal, synchronized to the internal pulse modulation output. Enabled with Option 0026. 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.
PPS	1PPS input/output from either GNSS/GPS atomic clock receiver or internal rubidium reference option. 3.3V CMOS I/O.
FM IN	Accepts an external signal to frequency or phase modulate the RF output signal. Enabled with Option 0012. 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 0012. 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 0026. 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 0003 or 0013. 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 0003 or 0013. 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 0003 or 0013. 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 0003 or 0013. 50 Ω impedance SMA type, rear panel.
GPS	Accepts GNSS/GPS antenna input.
RF OUTPUT	Provides for RF output from 50 Ω source impedance. Option 0009 moves the RF Output connector from the front to the rear panel. K Connector (male) fmax ≤ 43.5 GHz.
ETHERNET (1000 Base-T)	Provides input/output connections for a Gigabit Ethernet interface. RJ45 type, 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. One USB 2.0 Type-B for USB-TMC.
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 (Required for Option 13)
MG36221A-0009	Option 9, Rear Panel K(m)-Connector RF Output
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
MG36221A-0018	On-site Level and Frequency Calibration (Requires Option 66 and MA24330A USB power sensor, sold separately)
MG36241A-0023	Option 23, Premium Phase Noise, CW (Requires Option 3 and 13)
MG36221A-0026	Option 26, Pulse Modulation, Internal/External (Requires Option 27)
MG36221A-0027	Option 27, Modulation Hardware (Requires Option 12, 26, or both for functionality)
MG36221A-0029	Option 29, Front Panel Modulation Input Output Access (Requires Option 27)
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-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, 90 dB
MG36241A-0003	Option 3, Low Phase Noise and High Stability (Required for Option 13)
MG36241A-0009	Option 9, Rear Panel K(m)-Connector RF Output
MG36241A-0011	Option 11, Rack Mount without Slides (Shelf Mount)
MG36241A-0012	Option 12, Amplitude, Frequency, and Phase Modulation, Internal/External (Requires Option 27)
MG36241A-0013	Option 13, Ultra Low Phase Noise (Requires Option 3)
MG36241A-0015	Option 15, High Power Output
MG36241A-0018	On-site Level and Frequency Calibration (Requires Option 66 and MA24350A USB power sensor, sold separately)
MG36241A-0026	Option 26, Pulse Modulation, Internal/External (Requires Option 27)
MG36241A-0027	Option 27, Modulation Hardware (Requires Option 12, 26, or both for functionality)
MG36241A-0029	Option 29, Front Panel Modulation Input Output Access (Option 27 required when ordering Option 12, 26, or both)
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-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

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. 3 Year Factory Warranty Options and Accessories.

Accessories

790-297-R	Transit case (16 kg, 79.4 cm x 61.5 cm x 44.4 cm, roll-away on four wheels)

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**	**2**	**3**	**9**	**11**	**12**	**13**	**15**	**18**	**23**	**26**	**27**	**29**	**56**	**66**	**97**	**98**	**99**
MG36221A	X[a]	X	X	X	X[a]	X[b]	X[c]	X	X[d]	X[e]	X[b]	X[f]	X[g]	X[h]	X[h]	X	X	X
MG36241A	X[a]	X	X	X	X[a]	X[b]	X[c]	X	X[db]	NA	X[b]	X[f]	X[g]	X[h]	X[h]	X	X	X

a. Options 1 and 11 cannot be ordered together.
b. Requires Option 27 (Modulation Hardware).
c. Must be ordered with Option 3.
d. Requires Option 66 (GNSS atomic clock receiver).
e. Must be ordered with Option 3 and 13.
f. Requires Option 12, 26, or both for functionality.
g. Requires Option 27.
h. Must be ordered with Option 3 or 13.

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