8663A Specifications

Frequency

Range: 100 kHz to 2.56 GHz (2.5599999996 GHz).

Resolution: 0.1 Hz for f_c< 640 MHz;
0.2 Hz for 640 MHz ≤f_c<1280 MHz;
0.4 Hz for 1280 MHz ≤f_c<2560 MHz.

Accuracy and stability: Same as reference oscillator.

Reference oscillator

Internal: 10 MHz quartz oscillator. Aging rate $<5 \times 10^{-10}$/day after a 10 day warm-up.

Supplemental characteristics — frequency

Internal: *Internal reference oscillator accuracy is a function of calibration, ± aging rate, ± temperature effects, ± line voltage effects. Typical temperature and line voltage effects are* $<3.5 \times 10^{-11}/^{\circ}C$ *and* $<1 \times 10^{-10}/\pm10\%$ *line voltage change. Typical warm-up time is 24 hours.*

External: *Any 10 MHz (±0.005%) frequency standard at a level of 0.5 to 0.7* V_{rms} *into 50 ohms (rear panel connector) or any 5 MHz (± 0.005%) frequency standard at a level of 1* V_{rms} *±0.1 V.*

Reference output (source impedance 65 ohms): *Reference signal (internal or external) available from rear panel connector at a level of >0.5* V_{rms} *into 50 ohms. Output is always 10 MHz even with 5 MHz external reference frequency.*

Frequency switching speed[5]: *Total switching time depends on the programming mode used. The 8663A RF settling time is 250 µs to be within 1 kHz and 400 µs to be within 100 Hz. The table below gives typical total switching time to be within 100 Hz of final frequency for various programming modes. (All data for 11-digits of frequency change).*

Programming mode	*Microprocessor time*	*Settling time*	*Total switching time*
String	*12. 1 ms*	*400 µs*	*12.5 ms*
Character	*8.3 ms*	*400 µs*	*8.7 ms*
Remote sweep	*In these modes, microprocessor*		*700 µs*
Fast learn	*time and RF time overlap.*		*510 µs*
Frequency hop	*130 µs*	*400 µs*	*530 µs*

Spectral purity

Front panel absolute SSB phase noise (dBc/Hz):

	Frequency range (MHz)											
	0.01 to 119.9[1]		120 to 159.9[2]		160 to 319.9[2]		320 to 639.9[2]		640 to 1279.9[3]		1280 to 2559.9[4]	
	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ
1 Hz	-68	-78	-66	-76	-60	-70	-54	-64	-48	-58	-42	-52
10 Hz	-98	-108	-96	-106	-90	-100	-84	-94	-78	-88	-72	-82
100 Hz	-116	-126	-115	-125	-109	-119	-103	-114	-97	-108	-92	-102
1 kHz	-126	-132	-129	-135	-124	-130	-118	-125	-112	-119	-106	-113
3 kHz	-126	-135	-129	-138	-124	-133	-118	-127	-112	-121	-106	-115
5 kHz	-128	-138	-131	-141	-126	-136	-120	-130	-114	-124	-108	-118
10 kHz	-132	-138	-142	-148	-136	-142	-131	-136	-124	-130	-118	-124
100 kHz	-132	-139	-142	-148	-136	-142	-131	-136	-124	-130	-118	-124

Residual SSB phase noise (dBc/Hz):

	Frequency range (MHz)											
	0.01 to 119.9[1]		120 to 159.9[2]		160 to 319.9[2]		320 to 639.9[2]		640 to 1279.9[3]		1280 to 2559.9[4]	
	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ	Spec	typ
10 Hz	-108	-114	-112	-119	-106	-113	-100	-107	-93	-101	-88	-95
100 Hz	-121	-126	-122	-129	-118	-124	-112	-119	-105	-112	-100	-106
1 kHz	-128	-133	-131	-138	-127	-134	-121	-128	-115	-122	-109	-116
3 kHz	-128	-136	-131	-139	-127	-135	-121	-129	-115	-123	-109	-117
5 kHz	-129	-138	-133	-141	-129	-136	-123	-130	-117	-124	-111	-118
10 kHz	-132	-137	-142	-147	-136	-142	-131	-136	-124	-130	-118	-124
100 kHz	-132	-137	-142	-147	-136	-142	-131	-136	-124	-130	-118	-124

1 Specifications extend up to and including 119.9999999 MHz.
2 Specifications extend up to and including 0.1 Hz less than the starting frequency of the next band.
3 Specifications extend up to and including 1279.9999998 MHz.
4 Specifications extend up to and including 2559.9999996 MHz.
5 Due to bandwidth switching of the automatic internal leveling loop, brief level inaccuracies (i.e., typically <30 ms) may occur when switching through exactly 150 kHz and exactly 1 MHz RF output frequencies.

8663A Specifications

Spurious signals, CW, AM and FM modes:

Spurious signals	Carrier frequency range (MHz) 0.1 to 120	120 to 160	160 to 320	320 to 640	640 to 1280	1280 to 2560
Spurious non-harmonically related.[2]	<-90 dBc	<-100 dBc	<-96 dBc	<-90 dBc	<-84 dBc	<-78 dBc
Sub-harmonically related (f/2, 3f/2, etc.).	none	none	none	none	<-70 dBc	<-40 dBc
Power line (60 Hz) related or microphonically generated (within 300 Hz).[3]	<-90 dBc	<-85 dBc	<-80 dBc	<-75 dBc	<-70 dBc	<-65 dBc
Harmonics	<-30 dBc, ≤+13 dBm output <-25 dBc, +13 dBm to +16 dBm output					<-25 dBc

Spectral purity options

Option 003 specified SSB phase noise for rear panel 640 MHz output

	spec	typ
1 Hz	-54	-64
10 Hz	-84	-94
100 Hz	-104	-114
1 kHz	-121	-126

	spec	typ
3 kHz	-121	-127
5 kHz	-129	-138
10 kHz	-145	-149
100 kHz	-157	-159

Special Option H40 - enhanced absolute SSB phase noise specifications in 1 Hz BW:

	Frequency range (MHz)						
	Front Panel						Rear Panel
Offset from carrier	0.01 to 119.9	120 to 159.9	160 to 319.9	320 to 639.9	640 to 1279.9	1280 to 2559.9	640
1 Hz	-76	-74	-68	-62	-56	-50	-62
10 Hz	-106	-104	-98	-92	-86	-80	-92
100 Hz	-124	-123	-117	-111	-105	-100	-112
1 kHz	-126	-129	-124	-118	-112	-106	-121
3 kHz	-126	-129	-124	-118	-112	-106	-121
5 kHz	-128	-131	-126	-120	-114	-108	-129
10 kHz	-132	-142	-136	-131	-124	-118	-145
100 kHz	-132	-142	-136	-131	-124	-118	-157

2 In the remote mode it is possible to have microprocessor clock related spurious signals spaced 3 MHz apart at levels typically <-80 dBc.

3 At a 50 Hz line frequency, power line or microphonically related spurious signals may be up to 3 dB higher and appear at offsets as high as 1 kHz from the carrier.

4 The 8663A uses a microprocessor level accuracy enhancement routine to achieve ±1 dB absolute level accuracy and flatness for levels between +16 dBm and -119.9 dBm. This enhancement can be disabled with a special function.

5 Includes flatness, attenuator error, detector error, and measurement uncertainty.

6 In the sweep mode, the normal microprocessor level accuracy enhancement routine is defeated. Level accuracy enhancement can be selected during sweep with a special function, but minimum sweep time is limited to typically 10 ms/step.

Output

Range: +16 dBm to –129.9 dBm (1.41 V to 0.072 µV across 50 Ω).

Resolution: 0.1 dB.

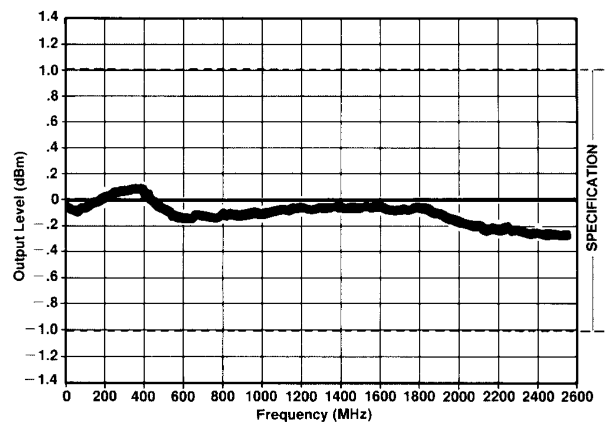
Absolute level accuracy[4,5]: <±1 dB, +16 dBm to –119.9 dBm; <±3 dB, –120 dBm and below.

Flatness[4]: Same as absolute level accuracy.

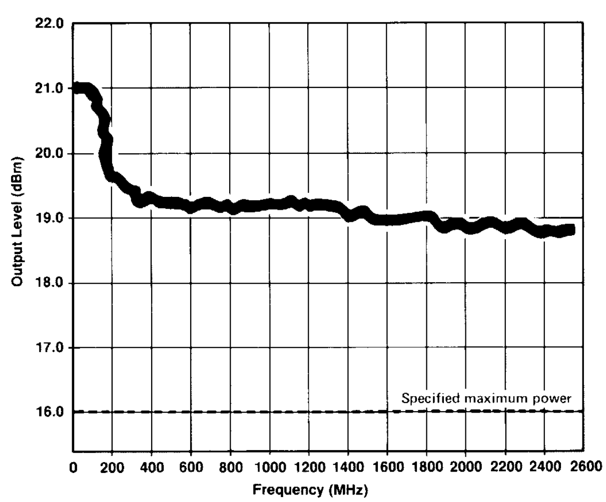
Flatness in sweep mode, +16 dBm to –119.9 dBm[6]: <±1.1 dB, 0.1 MHz to 1280 MHz; <± 1.5 dB, 0.1 MHz to 2560 MHz.

Supplemental characteristics — output

Maximum displayed output level: +19.9 dBm.
Impedance: 50 ohms.
SWR: <1.5
Level switching time: <60 ms.



Typical absolute level accuracy. 0 dBm output setting.



Typical output level. +19.9 dBm overrange setting.

8663A Specifications

Amplitude modulation

AM depth: 0% to 95%, output level ≤+10 dBm.
AM resolution: 0.1%.
AM indicator accuracy: ±(6% of setting +1% AM), 400 Hz and 1 kHz rates, depth ≤90%.
AM bandwidth (1 dB), depth ≤90%:
DC to >1.5 kHz, 0.15 MHz $\leq f_c <$ 1 MHz;
DC to >5 kHz, 1 MHz $\leq f_c \leq$10 MHz;
DC to >10 kHz, $\leq f_c >$ 10 MHz; for external dc coupling. For external ac coupling or internal modulation, low frequency limit is 20 Hz.
AM distortion for 400 Hz AND 1 kHz rates:
<2%, 0 to 30% AM;
<3%, 30 to 70% AM;
<4%, 70 to 90% AM.
Incidental phase modulation, 30% AM, 1 kHz rate:
<0.15 radians peak, 0.1 MHz $\leq f_c <$ 640 MHz;
<0.1 radians peak, 640 MHz $\leq f_c <$ 1280 MHz;
<0.33 radians peak, 1280 MHz $\leq f_c <$ 2560 MHz.

Supplemental characteristics — AM

External input impedance: *600 ohms.*

External input level required for calibrated operation: *1V peak. Front panel input level annunciator indicates 1V peak ± 2%.*

Pulse modulation

On/off ratio: > 80 dB, 50 MHz < $f_c <$ 2560 MHz[7].
Rise and fall time (10%, 90%):
<250 ns, 50 MHz f_c < 120 MHz;
<780 ns, 120 MHz $\leq f_c$ < 640 MHz.
<100 ns, $f_c \geq$ 640 MHz.

Pulse repetition frequency (50% duty cycle)[8]
Internal: 10 Hz to 99.9 kHz.
External: 10 Hz to 2 MHz, 50 MHz < f_c < 640 MHz;
10 Hz to 5 MHz, $f_c \geq$ 640 MHz.

Supplemental characteristics — pulse modulation

Pulse delay time: *<150 ns.*
External input impedance: *50 Ω, dc coupled.*
External input level required: *>2.5 V-on, <0.5 V-off, not to exceed ±10 V.*

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7 Pulse modulation is available for carrier frequencies below 50 MHz but is unspecified.
8 For duty cycle other than 50%; minimum repetition frequency = 100 Hz, minimum pulse width = 1 μs.

Frequency modulation

FM deviation:

Center frequency (MHz)	Maximum peak deviation AC mode (kHz)	DC mode (kHz)
	the smaller of	
0.1-120	100 or f_{mod} kHz × 500	100
120-160	25 or f_{mod} kHz × 125	25
160-320	50 or f_{mod} kHz × 250	50
320-640	100 or f_{mod} kHz × 500	100
640-1280	200 or f_{mod} kHz × 1000	200
1280-2560	400 or f_{mod} kHz × 2000	400

FM resolution:

Frequency range	FM deviation resolution ≤100 kHz dev.	>100 kHz dev.
0.1 to 640 MHz	0.1 kHz	n/a
640 to 1280 MHz	0.2 kHz	1 kHz
1280 to 2560 MHz	0.4 kHz	1 kHz

FM indicator accuracy: ±(7% of setting +10 Hz), rates 50 Hz to 20 kHz.

FM bandwidth (1 dB): dc to 100 kHz, dc coupled FM; 20 Hz to 100 kHz, ac coupled FM and internal FM.

FM distortion: <1.0% for 400 Hz and 1 kHz rates; <1.7% for rates ≤20 kHz.

Incidental AM, 20 kHz peak deviation, 1 kHz rate: <–72 dBc sidebands, 10 MHz $\leq f_c <$2560 MHz.

Supplemental characteristics — FM

Typical center frequency stability in dc mode.

fc(MHz)	*Center frequency accuracy*	*Measured center frequency stability*
0.1- 120	*±10 kHz*	*±200 Hz/hr*
120- 160	*±2.5 kHz*	*±50 Hz/hr*
160- 320	*±5 kHz*	*±100 Hz/hr*
320- 640	*±10 kHz*	*±200 Hz/hr*
640-1280	*±20 kHz*	*±400 Hz/hr*
1280-2560	*±40 kHz*	*±800 Hz/hr*

External input impedance: *600 ohms.*

External input level required for calibrated operation: *1 V peak. Front panel input level annunciator indicates 1 V peak ±2%.*

Auxiliary FM input: *Rear panel connector for FM modulation. Operates independently allowing simultaneous FM modulation with two tones. Input impedance: 5.1 kΩ; 4 V peak yields maximum allowable deviation.*

8663A Specifications

Binary phase shift keying[9]

Carrier null, 100 kHz square wave:
>20 dB, 120 MHz < f_c ≤640 MHz;
>17 dB, f_c ≥640 MHz, Option 002,
(+15 to +35 ˚C).

Supplemental characteristics — BPSK

External input impedance: *50 ohms, dc coupled.*

External level required: *> 2.5 V-on, <0.5 V-off, not to exceed ± 10 V.*

Phase modulation (Option 002)[9]

Phase deviation/resolution:

Carrier frequency	Maximum peak phase deviation	Resolution
0.1- 120 MHz	100 deg.	1 deg.
120- 160 MHz	25 deg.	1 deg.
160- 320 MHz	50 deg.	1 deg.
320- 640 MHz	100 deg.	1 deg.
640-1280 MHz	200 deg.	2 deg.
1280-2560 MHz	400 deg.	4 deg.

Phase modulation accuracy: ±(12% of setting +3% of full scale), for rates given in table below, (+15 to +35 ˚C).

Phase modulation rate table:

Carrier frequency	Rates	
	50 Ω	**600 Ω**
0.15-10 MHz	10 kHz	10 kHz
10-50 MHz	100 kHz	100 kHz
50-220 MHz	2 MHz	2 MHz
220-640 MHz	5 MHz	2 MHz
640-2560 MHz	10 MHz	2 MHz

Distortion: <10% for rates given in table.

Supplemental characteristics — phase modulation

External input impedance: *50 Ω, 600 Ω selected with a special function. AC or dc coupling.*

Low frequency ac coupling limit: *200 Hz, 50 Ω; 20 Hz, 600 Ω.*

External level required for calibrated operation: *50 ohm input: +10 dBm from source with SWR<1.21:1; 600 ohm input: 1 V peak. Front panel annunciator indicates calibrated level ±5% for rates ≤100 kHz.*

Internal modulation synthesizer

Frequency range: 10 Hz to 99.9 kHz.
Frequency resolution: 3 digits.
Frequency accuracy: Same as reference oscillator.

Supplemental characteristics — modulation synthesizer

Output level: *1 V peak into 600 Ω, available on rear panel.*
Output impedance: *600 Ω.*
Flatness: *<±1% referenced to 1 kHz.*
Distortion: *<1%.*

9 BPSK is standard for carrier frequencies up to 640 MHz. With Option 002, BPSK is available at all carrier frequencies. For carrier frequencies up to 640 MHz, the standard BPSK is available, at rates above 100 kHz but is unspecified. BPSK can not be simultaneously selected with Option 002 phase modulation at 640 MHz and above or with pulse modulation.

Digital sweep

Digitally stepped sweep is available for the carrier frequency and the internal modulation synthesizer frequency.

Sweep functions

Start-stop sweep: sweeps between two selected frequencies.

Span sweep: symmetrical sweep about center frequency selected.

Sweep width: determined by frequency resolution and frequency range of instrument; i.e., 0.1 Hz to 1280 MHz.

Step size: choice of 100 or 1000 points per sweep, or settable to any value within the frequency resolution of the instrument.

Sweep speed: Carrier frequency: 0.5 ms, 1 ms, 2 ms, 10 ms and 100 ms per step. (0.5 ms is nominal value which will vary depending on use of markers or log sweep.) Modulation synthesizer: 2 ms per step is the shortest available sweep time.

Log sweep: two choices available in increasing steps of 10% or 1% of the last frequency.

Frequency markers: five digital markers. Resolution and accuracy same as RF output.

Intensity markers:[10] Z axis modulation (-5 V pulse) of CRT display coordinated with frequency markers, available at rear panel.

Amplitude markers:[10] rear panel signal (5 kHz triangle wave) can be applied to AM input connector to provide adjustable amplitude markers.

Marker sweep:[10] start/stop sweeps between any two frequency markers can be selected.

Display blanking:[10] 250 µs positive pulse (TTL levels) available at rear panel for display blanking during frequency switching.

Sweep output: 0 to 10 V nominal stepped ramp. Zero at start of sweep; approximately +10 V at end of sweep regardless of sweep width. 10,000 points maximum.

Sweep modes

Auto: sweep repeats automatically.

Single: single sweep activated by front panel key board.

Manual: sweep controlled by front panel knob.

10 Not available for modulation synthesizer sweep.

8663A Specifications

Remote programming

Interface: GPIB.
Functions controlled: All functions controlled from the front panel with the exception of the line switch are programmable with the same accuracy and resolution as in manual mode.
GPIB capability: as defined in IEEE-488-1978 is: SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1.

Rear panel auxiliary control connector

Functions controlled

Step up/step down: Same as increment keys on keyboard.
Stop sweep: Sets sweep in manual mode.
Continue sweep: Puts sweep in auto mode.
Single sweep: Initiates single sweep.
Sequence: Same as sequence key on keyboard.
Input required: Contact closure to ground or 5 µs negative true TTL pulse. Internally installed jumper determines mode.
Outputs: 5 µs negative true TTL pulse output under following conditions: 1) Change in signal parameter, for example frequency, amplitude, modulation; 2) End of sweep.
Frequency hop: A special function reconfigures the auxiliary connector allowing the generator to hop among frequencies set in storage registers 1 to 6. A 5 µs negative true TTL pulse initiates hop.
Connector: 14 pin.

General

Operating temperature range: 0˚ to +55 ˚C.
Leakage: Meets radiated and conducted limits of MILSTD461A methods RE02 and CE03 as well as BVDE 0871.
Power requirements: 115 (90-126) V or 230 (198-252) V; 48 to 66 Hz; 450 VA maximum.
Weight: Net 33.8 kg (74 lbs); shipping 40 kg (88 lbs).
Dimensions: 178mm[H] × 425mm[W] × 642mm[D]; (7” × 16.75” × 25.3”).
Note: Depth includes front panel depth of 45mm(1.75”).
System II module size: 7H × 1 MW × 23D.

Specifications describe the instrument’s warranted performance and apply after a 30-minute warm-up.

Supplemental characteristics (shown in italics) are intended to provide information useful in applying the instrument by giving typical, but non-warranted performance parameters.

Complementary equipment

11714A service support kit. (Required for service).
11729C microwave down converter.
3048A phase noise measurement system.
9211-2662 transit case.
1490-0913 caster kit for transit case.

Ordering information

8663A synthesized signal generator

Options: **001** rear panel RF output and modulation inputs
002 phase modulation
003 specified SSB phase noise for rear panel 640 MHz output
700 "MATE" language compatibility
907 front handle kit
908 rack flange kit
909 rack flange kit and front handle kit
910 extra manual

11714A service support kit

Dimensions in millimeters and (inches).