

Chapter 6 Specifications

This chapter describes the specifications of RF signal generator. Specifications are valid under the following conditions: the instrument in the calibration cycle is stored at least two hours at 0°C to 50°C temperature, and 40 minutes warm up. The specifications include measurement uncertainty. Data represented in this manual are specifications unless otherwise noted.

Typical (typ.): describes characteristic performance, which 80 percent of the measurement results will meet at room temperature (approximately 25 °C). This data is not warranted, does not include measurement uncertainty.

Nominal (nom.): indicates the expected mean or average performance, or an attribute whose performance is by design, such as the 50 ohm connector. This data is not warranted and is measured at room temperature (approximately 25 °C).

Measured (meas.): describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is not warranted and is measured at room temperature (approximately 25 °C).

NOTE: All values represented in this chapter are the measurement results of multiple instruments at room temperature unless otherwise noted.

Specifications

Frequency

Frequency		
Frequency range	DSG3030	9kHz to 3GHz
	DSG3060	9kHz to 6GHz
Frequency resolution	0.01Hz	
Frequency switching speed	<10ms ^[1] (typ.)	
Phase offset	Adjustable in 0.01° steps (nom.)	

Frequency Bands ^[2]		
Band	Frequency	N
1	$f \leq 23.4375\text{MHz}$	1
2	$23.4375\text{MHz} < f \leq 46.875\text{MHz}$	0.03125
3	$46.875\text{MHz} < f \leq 93.75\text{MHz}$	0.0625
4	$93.75\text{MHz} < f \leq 187.5\text{MHz}$	0.125
5	$187.5\text{MHz} < f \leq 375\text{MHz}$	0.25
6	$375\text{MHz} < f \leq 750\text{MHz}$	0.5
7	$750\text{MHz} < f \leq 1500\text{MHz}$	1
8	$1500\text{MHz} < f \leq 3000\text{MHz}$	2
9	$3000\text{MHz} < f \leq 6000\text{MHz}$	4

Internal Reference Frequency		
Reference frequency	10MHz	
Temperature stability	In temperature range 0°C to 50°C, reference to 25°C	< 0.5ppm
	With OCXO-A08 option	< 5ppb
Aging rate		< 1ppm/year
	With OCXO-A08 option	< 30ppb/year
Output for internal reference frequency	Frequency	10MHz
	Level	+8dBm (typ.)
	Output impedance	50Ω (nom.)
Input for external reference frequency	Frequency	10MHz
	Level	0dBm to +10dBm
	Maximum deviation	±5ppm
	Input impedance	50Ω (nom.)

NOTE: [1] Except in the case when band1 is switched with another band.

[2] N is a factor used to help define certain specifications within the document.

Frequency Sweep		
Operating modes	Step sweep (equally or logarithmically spaced frequency steps) List sweep (the list of arbitrary frequency steps)	
Sweep modes	Single, continuous	
Sweep range	Full frequency range	
Sweep shapes	Triangle, ramp	
Step change	Linear or logarithmic	
Number of points	Step sweep	2 to 65535
	List sweep	1 to 6001
Dwell time range	20ms to 100s	
Triggering	Auto, trigger key, external, bus (GPIO, USB, LAN)	

Spectral Purity ^[1]		
Harmonics	CW mode, $1\text{MHz} \leq f \leq 6\text{GHz}$, level $\leq +13\text{dBm}$	<-30dBc
Sub harmonics	CW mode	
	$f \leq 3\text{GHz}$	<-65dBc, <-80dBc (typ.)
	$3\text{GHz} < f \leq 6\text{GHz}$	<-52dBc, <-70dBc (typ.)
Non harmonics	CW mode, level > -10dBm, carrier offset > 10kHz	
	$f \leq 1.5\text{GHz}$	<-64dBc, <-70dBc (typ.)
	$1.5\text{GHz} < f \leq 3\text{GHz}$	<-58dBc, <-64dBc (typ.)
	$3\text{GHz} < f \leq 6\text{GHz}$	<-52dBc, <-58dBc (typ.)
SSB phase noise	CW mode, at 20kHz carrier offset, 1Hz measurement bandwidth	
	$f = 100\text{MHz}$	<-120dBc/Hz
	$f = 1\text{GHz}$	<-108dBc/Hz, <-110dBc/Hz (typ.)
	$f = 3\text{GHz}$	<-102dBc/Hz, <-104dBc/Hz (typ.)
	$f = 6\text{GHz}$	<-96dBc/Hz, <-98dBc/Hz (typ.)
Residual FM	RMS value at $f = 1\text{GHz}$, CW	
	0.3kHz to 3kHz	<5Hz rms, <1Hz rms (typ.)
	0.03kHz to 20kHz	<30Hz rms, <8Hz rms (typ.)

NOTE:[1] Without IQ-DSG3000 option.

Level

Setting Range			
		Specification level range	Setting range
Maximum output level	$9\text{kHz} \leq f < 100\text{kHz}$	+7dBm	+10dBm
	$100\text{kHz} \leq f < 1\text{MHz}$	+13dBm	+15dBm
	$1\text{MHz} \leq f \leq 3\text{GHz}$	+13dBm	+25dBm
	$3\text{GHz} < f \leq 6\text{GHz}$	+13dBm	+20dBm
Minimum output level	$9\text{kHz} \leq f < 100\text{kHz}$	-110dBm	-120dBm
	$100\text{kHz} \leq f \leq 6\text{GHz}$	-130dBm	-140dBm
Setting resolution	0.01dB		

Absolute Level Uncertainty ^[1]				
Level uncertainty		+13 to -60dBm	-60 to -110dBm	-110 to -130dBm
	$9\text{kHz} \leq f < 100\text{kHz}$	$\leq 0.5\text{dB (typ.)}$	$\leq 0.7\text{dB (typ.)}$	
	$100\text{kHz} \leq f \leq 3\text{GHz}$	$\leq 0.7\text{dB,}$ $\leq 0.5 \text{ (typ.)}$	$\leq 0.9\text{dB,}$ $\leq 0.5 \text{ (typ.)}$	$\leq 0.7\text{dB (typ.)}$
	$3\text{GHz} < f \leq 6\text{GHz}$	$\leq 0.9\text{dB,}$ $\leq 0.5 \text{ (typ.)}$	$\leq 1.1\text{dB,}$ $\leq 0.5 \text{ (typ.)}$	$\leq 0.9\text{dB (typ.)}$
VSWR ^[2]	$1\text{MHz} \leq f \leq 6\text{GHz}$	$< 1.8 \text{ (typ.)}$		

Level Setting		
Setting time	ALC state on, frequency fixed, temperature range: 20°C to 30°C	$\leq 5\text{ms (typ.)}$
Uninterrupted level setting range	ATT fixed mode, ALC state on, level range -110dBm to +13dBm	$> 20\text{dB (typ.)}$

Max. Reverse Power		
Max. reverse power	Max. DC voltage	50V
	$1\text{MHz} < f \leq 6\text{GHz}$	10W

NOTE: [1] ALC state: on or auto mode, 20°C to 30°C

[2] In 50Ω system, typical, level $\leq -10\text{dBm}$, ATT auto mode

Level Sweep		
Operating modes	Step sweep (equally spaced level steps) List sweep (the list of arbitrary level steps)	
Sweep modes	Single, continuous	
Sweep range	Full level range	
Sweep shape	Triangle, ramp	
Step change	Linear	
Number of points	Step sweep	2 to 65535
	List sweep	1 to 6001
Dwell time range	20ms to 100s	
Triggering	Auto, trigger key, external, bus (GPIB, USB, LAN)	

Internal Modulation Generator (LF)

Internal Modulation Generator (LF)		
Waveforms	Sine, square, triangle, ramp, sine sweep	
Frequency range	Sine, sine sweep	0.1Hz to 1MHz
	Square	0.1Hz to 20kHz
	Triangle, ramp	0.1Hz to 100kHz
Resolution	0.01Hz	
Frequency error	Same as RF reference source	
Output voltage ^[1]	Setting range	1mV to 3V
	Resolution	1mV
Output impedance	50Ω (nom.)	
Sine sweep	Sweep modes	Single, continuous
	Sweep range	Frequency range of LF output
	Sweep time	1ms to 1000s
	Sweep shapes	Triangle, ramp
	Triggering	Auto, trigger key, external, bus (GPIB, USB, LAN)

NOTE: [1] Measurement in high-impedance state.

Modulation ^[1]

Simultaneous Modulation					
	AM	FM	ØM	Pulse mod.	I/Q mod. (opt.)
AM	—	○	○	△	×
FM	○	—	×	○	○
ØM	○	×	—	○	○
Pulse mod.	△	○	○	—	○
I/Q mod.(opt.)	×	○	○	○	—

NOTE: ○:compatible; ×: incompatible; △:compatible with AM Performance reduced

Amplitude Modulation		
Operating modes	Internal, external, internal + external	
Modulation depth ^[2]	The modulation depth that can be set from +7dBm to +13dBm observing the AM specifications continuously decrease.	0% to 100%
Resolution	0.1%	
AM depth uncertainty	$f_{\text{mod}}=1\text{kHz}$	<4% of setting+1%
AM distortion	$f_{\text{mod}}=1\text{kHz}$, $m<30\%$, level=0dBm	<3% (typ.)
Modulation frequency response	$m<80\%$, 10Hz to 50kHz	<3dB (nom.)

Frequency Modulation		
Operating modes	Internal, external, internal + external	
Maximum deviation	$N \times 1\text{MHz}$ (nom.)	
Resolution	<0.1% of deviation, or 1Hz, whichever is greater (nom.)	
Setting uncertainty	$f_{\text{mod}}=1\text{kHz}$, internal mode	<2% of setting+20Hz
FM distortion	$f_{\text{mod}}=1\text{kHz}$, deviation= $N \times 50\text{kHz}$	<2% (typ.)
Modulation frequency response ^[3]	10Hz to 100kHz	<3dB (nom.)

NOTE: [1] The modulation source is sine waveform unless otherwise noted.

[2] Peak power of the envelope is no more than the maximum value of the specification output range.

[3] External operating mode, measured at 100 kHz deviation.

Phase Modulation		
Operating modes	Internal, external, internal + external	
Maximum deviation	$f \leq 23.4375\text{MHz}$	3rad(nom.)
	$f > 23.4375\text{MHz}$	$N \times 5\text{rad}$ (nom.)
Resolution	<0.1% of deviation, or 0.01rad, whichever is greater, (nom.)	
Deviation accuracy	$f_{\text{mod}}=1\text{kHz}$, internal modulation source	<1% of setting+0.1rad
ØM total harmonic distortion	$f_{\text{mod}}=1\text{kHz}$, deviation=5rad	<1% (typ.)
Modulation frequency response ^[1]	10Hz to 100kHz	<3dB (nom.)

Pulse Modulation		
Modulation source	External, internal	
On/off ratio	$25\text{MHz} \leq f < 3\text{GHz}$	>80dB
	$3\text{GHz} \leq f \leq 6\text{GHz}$	>70dB
Rise/fall time (10%/90%)	<50ns ^[1] , 10ns (typ.)	
Pulse repetition frequency	DC to 1MHz	

Pulse Generator		
Operating modes	Single pulse, double pulse, pulse train(option PUG-DSG3000)	
Pulse period	Setting range	40ns to 170s
	Resolution	10ns
Pulse width	Setting range	10ns to (170s-10ns)
	Resolution	10ns
Trigger delay	Setting range	10ns to 170s
	Resolution	10ns
Double-pulse spacing	Setting range	20ns to (170s-20ns)
	Resolution	10ns
Triggering	Auto, external trigger, external gate, trigger key, bus (GPIB, USB, LAN)	

Pulse Train Generator (Option PUG-DSG3000)		
Pulse train generator	Number of pulse patterns	1 ~ 2047
	On/off time range	20ns to 170s
	Repetition per pattern	1 to 256

NOTE: [1] External operating mode, measured at 5rad deviation.

[2]The state of ALC is off.

I/Q Modulation (Option IQ-DSG3000)		
Modulation source	External, internal	
Bandwidth (RF)	External modulation	
	Baseband (I or Q)	≤ 120MHz (nom.)
	RF (I + Q)	≤ 240MHz (nom.)
	Internal modulation	
	Baseband (I or Q)	≤ 30MHz (nom.)
	RF (I + Q)	≤ 60MHz (nom.)
Carrier suppression ^[1]	Carrier frequency range: 50MHz ≤ f ≤ 6GHz	≥ 40dBc (typ.)
Suppression of image sideband ^[2]	Modulation bandwidth up to ±10MHz	≥ 40dBc (typ.)
External I/Q inputs	VSWR	< 1.5
	Full scale input	$\sqrt{I^2 + Q^2} = 0.5V_{rms}$
Internal modulation		
EVM	16QAM , root cosine filter (α=0.22), 4MSps	
	50MHz ≤ f ≤ 3GHz (level≤4dBm)	≤ 0.7%rms (typ.)
	3GHz < f ≤ 6GHz (level≤0dBm)	≤ 1.2%rms (typ.)
	QPSK , root cosine filter (α=0.22), 4MSps	
	50MHz ≤ f ≤ 3GHz (level≤4dBm)	≤ 0.7%rms (typ.)
	3GHz < f ≤ 6GHz (level≤0dBm)	≤ 1.2%rms (typ.)
External modulation		
EVM	CDMA2000/1xEV-DO, 1.2288 Mcps, frequency 800 to 900MHz, 1800 to 1900MHz, level≤4dBm	≤ 1.2%, ≤ 0.8% (typ.)
ACPR		≥ 70dB

NOTE: [1] [2]The parameter is measured at room temperature. When the temperature is difference from room temperature, the specification will deteriorate.

I/Q Baseband Generator (Option IQ-DSG3000)			
Output impedance	50Ω (nom.)		
Output voltage	Setting range	0.1V _{DD} to 1.5V _{DD}	
	Resolution	1mV	
Frequency response	Referenced to 1MHz	≤ 10MHz	<0.5dB (nom.)
		≤ 30MHz	<1dB (nom.)
I/Q imbalance	Magnitude	≤ 10MHz	<0.1dB (nom.)
		≤ 30MHz	<0.2dB (nom.)
	Nonlinear phase	≤ 10MHz	200ps (nom.)
		≤ 30MHz	500ps (nom.)
SFDR	Sine	≤ 30MHz	>50dB (nom.)
Waveform memory	Waveform length	1 sample to 8 Msample in one-sample steps	
	Resolution	14 bits	
	Loading time 1Msample	<10 s ^[1] (nom.)	
	Nonvolatile memory	1G Bytes	
Sample rate	Setting range	1 kHz to 50 MHz, 100 MHz	
	Resolution	0.01 Hz	
Trigger	Triggering	Auto, trigger key, external, bus (GPIB, USB, LAN)	
	Operating modes	Retrig, armed auto, armed retrigger, single	
	External trigger delay		
	Setting range	0 to (2 ¹⁶ – 1)	
	Resolution	1	
	External trigger inhibit		
	Setting range	0 to (2 ¹⁶ – 1)	
	Resolution	1	
External trigger pulse width	>20 ns (nom.)		

NOTE: [1] Load from flash internal non-volatile memory.

Inputs and Outputs

Front Panel Connectors		
RF output	Impedance	50Ω (nom.)
	Connector	N female
External modulation signal input	Impedance	50Ω (nom.)
	Connector	BNC female
Internal modulation generator (LF) output	Impedance	50Ω (nom.)
	Connector	BNC female

Rear Panel Connectors		
External trigger in	Impedance	1kΩ (nom.)
	Connector	BNC female
	Trigger voltage	5V TTL level
Signal valid output	Connector	BNC female
	Output voltage	0V/3.3V (nom.)
Sweep out	Connector	BNC female
	Output voltage	0 to 10V (nom.)
Pulse input or output	Impedance	50Ω (nom.)
	Input/output voltage	0V/3.3V (nom.)
10MHz in (external frequency reference input)	Impedance	50Ω (nom.)
	Connector	BNC female
10MHz out (external frequency reference output)	Impedance	50Ω (nom.)
	Connector	BNC female
I/Q baseband input/output (option IQ-DSG3000)	Impedance	50Ω (nom.)
	Connector	BNC female

Rear Panel Communication Interface		
USB host	Connector	A plug
	Protocol	Version2.0
USB device	Connector	B plug
	Protocol	Version2.0
LAN	LXI core device 2011 class	10/100Base,RJ-45
IEC/IEEE bus (GPIB)		IEEE488.2

General Specifications

Display	
Type	TFT LCD
Resolution	480*272
Size	4.3"

Mass Memory		
Mass memory	Flash non-volatile memory (internal); USB disk (not supplied)	
Data storage space	Flash non-volatile memory (internal)	1G Bytes

Power Supply		
Input voltage range, AC	100V to 240V (nom.)	
AC supply frequency	45Hz to 440Hz	
Power consumption	With all options	50W (typ.), max. 60W

Electromagnetic Compatibility and Safety		
EMC	In line with EN61326-1:2006	
	IEC 61000-4-2:2001	$\pm 4.0\text{kV}$ (contact discharge), $\pm 4.0\text{kV}$ (air discharge)
	IEC 61000-4-3:2002	3V/m (80MHz to 1GHz) 3V/m (1.4GHz to 2GHz) 1V/m (2.0GHz to 2.7GHz)
	IEC 61000-4-4:2004	1kV power lines
	IEC 61000-4-5:2001	0.5kV (phase to Neutral) 0.5kV (phase to PE) 1kV (neutral to PE)
	IEC 61000-4-6:2003	3V, 0.15-80MHz
	IEC 61000-4-11:2004	Voltage dip: 0% UT during half cycle 0% UT during 1 cycle 70% UT during 25 cycles Short interruption: 0% UT during 250 cycles
Electrical safety	In line with UL 61010-1:2012 CAN/CSA-C22.2 No. 61010-1-12 EN 61010-1:2010	

Environmental		
Temperature	Operating temperature range	0°C to 50°C
	Storage temperature range	-20°C to 70°C
Humidity	0°C to 30°C	≤95% rel. humidity
	30°C to 40°C	≤75% rel. humidity
Altitude	Operating height	Up to 3,048m (10000ft)

Dimensions	
(W × H × D)	364 mm × 112 mm × 420 mm (14.33 in × 4.41 in × 16.54 in)

Weight	
	6.4kg (14.1lb)
With IQ-DSG3000 option	6.7kg (14.8lb)