S-Series

SGD Fast, Low Noise, Digital Signal Generator

AEROFLEX
A passion for performance.

Compact, easy to use, high performance signal generator for R&D, manufacturing and the field

Features

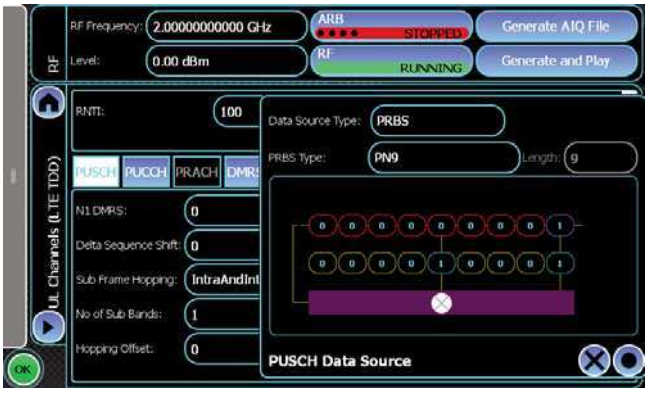
- Wide band cover:
  - SGD-3 - 100 kHz to 3 GHz
  - SGD-6 - 100 kHz to 6 GHz
- +13 dBm output (+20 dBm option)
- 3GPP ACLR -70 dBc
- IQ modulator with 300 MHz RF bandwidth, 200 MHz with internal AWG
- Up to 250 MS/s dual channel arbitrary waveform generator with memory options up to 4 GBytes
- Embedded IQCreator® waveform creation and generic modulation tool
- Low SSB phase noise: –135 dBc/Hz at 1 GHz 20 kHz offset
- Noise floor >10 MHz offset, <-150 dBc/Hz at 1 GHz
- Fast frequency settling time: 100 µs
- Comprehensive frequency and amplitude sweep capabilities
- List mode including ARB sequence mode
- Internal Analog Modulation
- Internal pulse modulator/generator (option)
- Carrier phase control
- Half-rack width, 4U high with 8.5 inch touch-screen user-interface
- Synchronization and interaction with S-Series modules and instruments
- "Aerolock™ interlocking mechanism for multiple instrument applications
- LAN and GPIB remote control
- Low cost of ownership through modular design

The SGD employs a large touch-screen user-interface to provide a digital signal generator with unparalleled ease of use. The small form-factor and light weight ensure minimum footprint on the bench or test system and maximum portability. The wide bandwidth IQ modulator exhibits excellent dynamic range enabling the most demanding amplifier and receiver selectivity measurements to be performed. The use of Aeroflex's Fast Low Noise Synthesis (FLNS) technology, added to the experience gained through decades of developing leading-edge signal source products, ensures that signal purity and integrity have not been sacrificed in the quest for speed; the SGD excels in all respects. With a comprehensive range of features and options, the SGD meets the needs for a general-purpose signal generator while offering the high performance required of demanding, critical receiver measurements or rapid manufacturing.

Display and User-Interface

A large 8.5 inch touch-screen LCD enables all relevant set-up information to be displayed on one screen, and without the need to select configurations from lower level menu structures. It is quick to learn, easy to use, clear, with large characters and a wide viewing angle. Touch targets are sufficiently large to ensure usability even when wearing gloves.

A mouse and keyboard may also be connected to allow ease of use when using Windows™ features.



Using the touch-screen to define PUSCH data source in LTE FDD uplink signal

Vector Modulation

High quality wide bandwidth vector modulation is available with a maximum vector modulation bandwidth of 300 MHz at the RF output. With the internal dual channel arbitrary waveform generator fitted, an internal user initiated IQ calibration routine ensures carrier suppression of 55 dB and image suppression of 50 dB. In addition to this, a factory IQ filter coefficient calibration ensures that image rejection is maintained up to 80 MHz offset, ensuring 802.11ac 160 MHz EVM of <1.0% is achieved. The high dynamic range of the IQ modulators provides for an ACLR of better than70 dB on WCDMA signals.

Arbitrary Waveform Generator (AWG)

With sample rates up to 250 MHz per channel, high quality digital modulation is provided with I and Q bandwidths of up to ±100 MHz, ideal for testing multi-channel power amplifiers and support for all forthcoming wideband wireless systems. The AWG has up to 4 GBytes (1 Gsample) sample memory, each 32-bit sample word consisting of 14-bit I, 14-bit Q, and up to 8 markers. The AWG memory can be used to store multiple waveforms up to the limit of the sample memory. Once loaded in the AWG, switching between waveforms is near instantaneous.

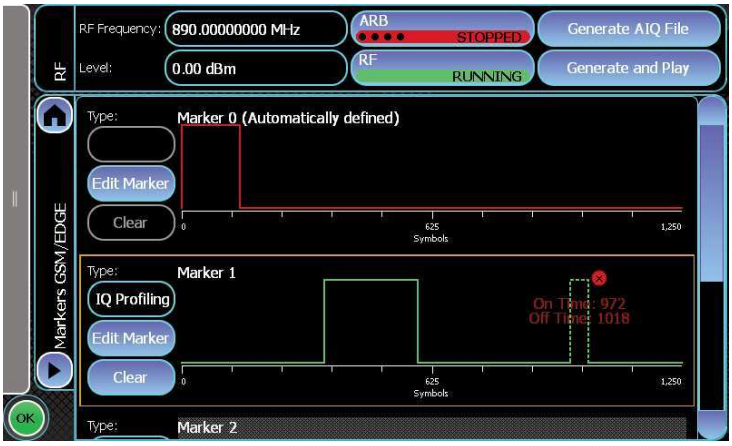
The hard disk drive has up to 60 GB available to store AWG waveforms.

Embedded Waveform Creation Tool, IQCreator® (included with AWG option)

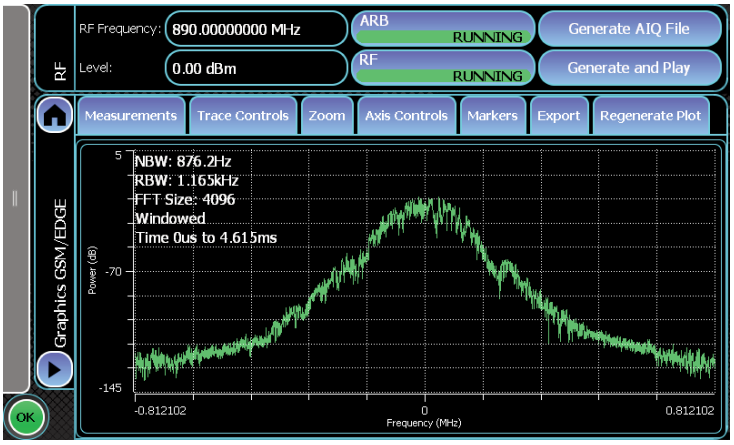
IQCreator® is a software utility that enables a user to set up a modulation scheme and then create an AWG file using modulation templates. The resulting file is downloaded into the AWG. All SGDs have generic modulation creation enabled which includes FM (RDS), FSK, MSK, PSK,QAM (up to 1024 QAM) and multi-carrier mode. Options to enable various wireless technologies are available including LTE FDD and TDD, and 802.11ac 160 MHz VHT. Because IQCreator is embedded in the SGD's user interface, it is not necessary to transfer waveforms from an external controller/pc. Waveforms may be created and then played almost instantly with one touch of the "Generate and Play" button. It is also possible to be creating multiple waveforms concurrently and to simply switch between them.

SGD UMTS DL configuration

All IQCreator functions are controllable from the user-interface. Waveforms designed in IQCreator® can include signal impairments and time markers to aid synchronization. Graphical displays of the waveform, FFT, vector, constellation, I and Q phase and amplitude vs. time etc. can be previewed before playing.



Using the touch-screen to add, move and adjust markers



Graphical preview of GSM FFT

IQCreator® includes a utility which allows user-defined waveforms, created using simulation tools such as MATLAB, to be converted and packaged into a form that can be downloaded into the SGD's AWG.

IQCreator® is continually updated to include new modulation capabilities and facilities as standards are updated or new standards released.

IQCreator® is also available as a Windows based software tool in its traditional form for the creation of waveforms remote from the instrument. See separate IQ Creator® brochure for more details at www.aeroflex.com/IQCreator.

Analog Modulation

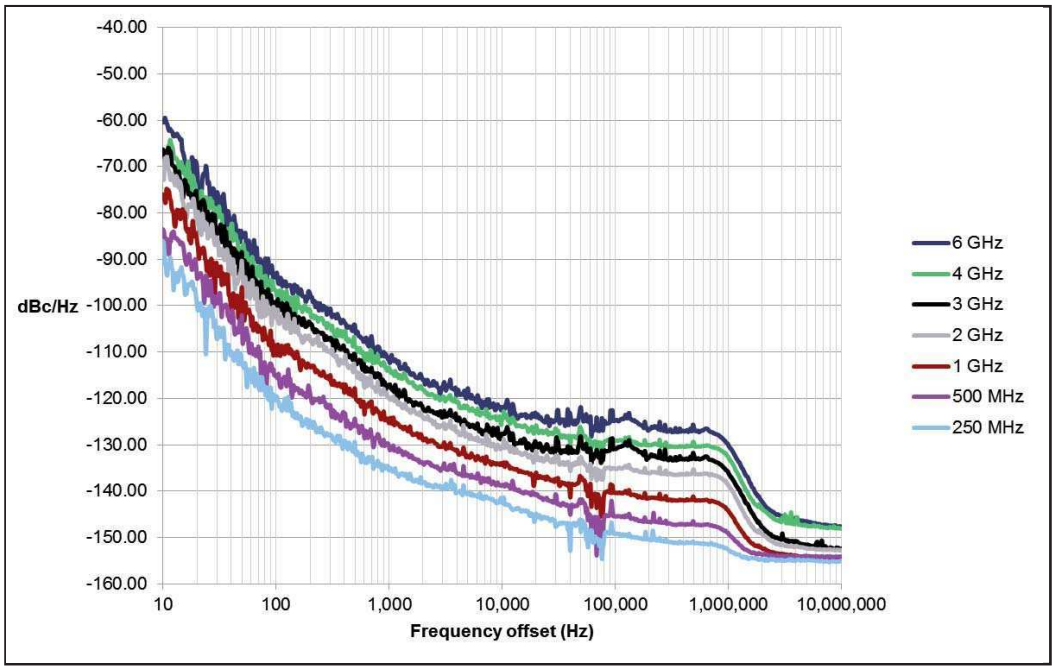
Included with the AWG option is the ability to internally generate dual channel, wide bandwidth AM, FM and Phase modulation using function generators within the AWG.

Excellent Spectral Purity

The excellent noise characteristics and the low level of spurious signals of the SGD enable the instruments to be used with confidence for a wide range of critical measurements for the most demanding measurements on modern receivers and RF systems and A-D converters.

Low SSB Phase Noise

With SSB phase noise performance of -135 dBc/Hz at 20 kHz offset from a carrier of 1 GHz, the SGD signal generator is easily able to measure receiver selectivity beyond 80 dB. The low residual FM noise figure or less than 1 Hz RMS at 1 GHz gives the SGD the capability of measuring receiver signal-to-noise ratios as high as 80 dB.



Graph of typical phase noise performance

Fast Frequency and Level Settling Times

These are critical parameters to ensure maximum throughput in production applications. With frequency settling times of <5 ms in conventional frequency selection mode, or 100 μs in list mode, the SGD is ideally suited for frequency hopping and semiconductor production test applications.

Carrier Phase Control

This controls the phase of the carrier with respect to reference frequency standard and allows multiple SGD to be locked in frequency with controlled phase.

RF Output

RF output up to +13 dBm can be set to a resolution of 0.01 dB. A high power option is available to extend the maximum calibrated RF level to +20 dBm.

In the tradition of Aeroflex's excellence in RF signal generation, the ultimate attention has been given to ensure the quality of the RF performance extends beyond the specification. Such attributes are:

- that no positive RF level transients generated as a result of changing between any frequency or level
- class-leading source VSWR specification helps to ensure that the specified RF level accuracy is more likely to be met, particularly when the load match is not ideal
- excellent linearity and monotonicity even over fine RF level steps
- repeatability ensures the same RF level is produced every time

The fastest level switching speed with a long life is achieved by the use of an electronic attenuator ensuring suitability for use in the most demanding production test applications.

Sweep

The comprehensive sweep mode provides a digital sweep of carrier frequency and RF level in discrete steps. It is possible to set the start, stop, number of steps (or step size) and step time, up to a maximum of 65536 steps.

A sweep can be externally triggered via a rear panel BNC connector for Start, Start/Stop and Step, while up to six markers can be used to identify specific events within the sweep.

List Mode Sweep

With a minimum dwell time of 100 μs, list mode provides the ultimate in frequency switching speed. A table of up to 1000 carrier frequency and RF level values may be created. Start address, stop address and dwell time can be controlled and can be externally triggered from a rear panel BNC connector, or internally using an AWG waveform marker.

Creating a list in List Mode

List Mode control screen showing a List sweep in action

ARB Sequence Mode

For rapid device test, it is possible to create a sequence of AWG waveforms. Each waveform can be set for carrier frequency and RF level and may be played a given number of times.

ARB Sequence Mode screen

Pulse Modulation (Option)

An optional pulse modulator with internal pulse generator allows the generation of fast rise time RF signals with on/off ratios that meet the most demanding tests on radar RF and IF stages and EMC/ECCM test applications.

Modular Instrument Concept Employing Aeroflex's "Aerolock" Interlocking Mechanism

The SGD is complemented by the SVA Vector Signal Analyzer and the two instruments are designed to work as a pair. The two instruments may be connected physically, using the "Aerolock" interlocking mechanism, and electrically via a USB interface. Such a test system may be further enhanced with the addition of one or more of a selection of S-Series modules which mount above or below instruments.

The addition of an SCO Combiner module can create a multisource test system for intermodulation testing or receiver selectivity. With such a system it is possible to couple the settings of one SGD (or SGA) with another, allowing quick and simple control across any frequency or level range where two sources with a defined relationship are required.

"Aerolock" is an ingenious, simple and strong interlocking mechanism allowing S-Series instruments and a full-rack width module, or two half-rack width modules, to be joined as one, creating a bespoke test solution. Weighing-in at only 8 kg each, two S-Series instruments joined together may be easily carried within the laboratory, the factory or the field without necessitating a 2-person lift.

Many applications will be supported including tests for power amplifiers, receiver selectivity, intermodulation, adjacent channel power and mixer testing, with many more to come in the future.

Aerolock™ interlocking mechanism

Two SGDs joined together as one with SCO combiner

Remote Operation

LAN and GPIB interfaces are all supported using SCPI format commands where possible. Remote desktop and VNC are also supported allowing off-site remote control.

Non-Volatile Memory

Hundreds of full instrument setting stores may be configured. Each store may be independently named allowing quick search of required memory.

Removable Hard Disk (Option)

For use in secure areas, the optional removable hard disk allows easy removal of all sensitive instrument settings stores in the event the instrument has to leave the secure area. No settings data is stored in any other memory location within the instrument.

Low Cost of Ownership

The SGD comes with a standard 2-year warranty and recommended 2-year calibration periodicity. Options to extend the warranty to five years are available.

The instrument's software may be installed simply from a USB port so that upgrades can be performed with the minimum down-time and maximum convenience. The latest software version will always be available for download on Aeroflex's web site.

SPECIFICATION

All specifications apply after a warm-up period of 20 minutes. Parameters with measured performance are not warranted. They have been measured during the product's development to give an indication of expected performance.

FREQUENCY

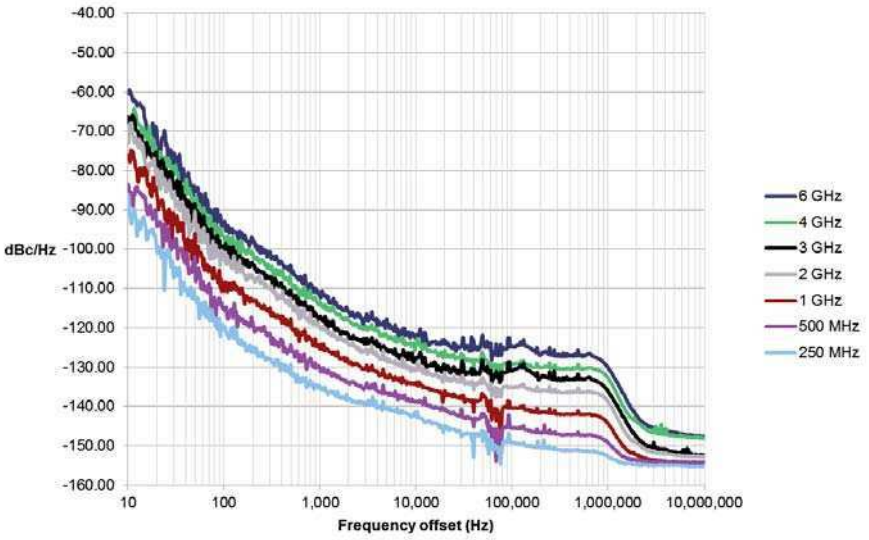
Range	100 kHz to 3 GHz (SGD-3) 100 kHz to 6 GHz (SGD-6)
Resolution	0.01 Hz
Accuracy	As frequency reference
Switching Time (CW Mode)	Switching time to within 0.1 ppm of final frequency: 5 ms nominal
Settling Time (List Mode)	Typical settling time to within 0.1 ppm of final frequency after trigger pulse in List Mode: <100 µs for frequency changes exceeding 1.6 GHz within the frequency range above 3.2 GHz: >101 µs <150 µs, typ 100 µs to within 0.1 ppm of final frequency (or 30 Hz, whichever is greater)
Carrier Phase	0 – 359.9 degrees in 0.01 degree steps Carrier phase controls the phase of the carrier with respect to the reference frequency standard, be it internal or external.

RF LEVEL

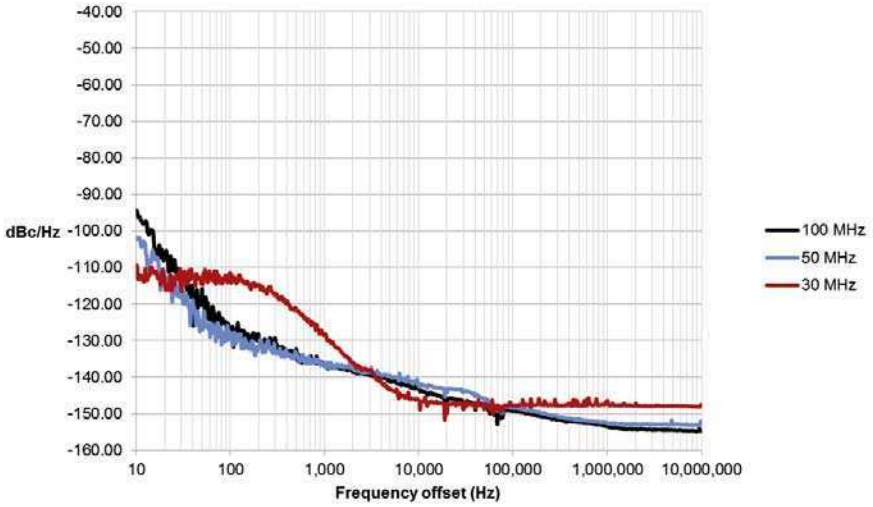
Range	-130 to +13 dBm Step attenuator: 0 to 132.5 dB in 0.25 dB steps Note: Performance is not guaranteed below -120 dBm
Range (option 003)	-130 to +20 dBm -130 to +17 dBm below 50 MHz -130 to +15 dBm below 10 MHz -130 to +13 dBm below 1 MHz Note: Performance is not guaranteed below -120 dBm
Resolution	0.01 dB
Accuracy (18°C-28°C)	100 kHz to 50 MHz <±0.7 dB <±1.0 dB below -110 dBm >50 MHz to ≤3 GHz <±0.5 dB <±0.6 dB from -90 to -110 dBm <±1.0 dB from -110.01 to -120 dBm >3 GHz <±0.7 dB <±0.9 dB from -100.01 to -110 dBm <±1.2 dB from -110.01 to -120 dBm Temperature stability 0.01 dB/˚C above 1 MHz, 0.02 dB/˚C below 1 MHz (CW mode) Add 0.2 dB for complex modulated signals or when AM is enabled
Repeatability	Better than ±0.05 dB after warm up following a return from a change of frequency or level valid for at least 2 hours and excluding temperature influence
Monotonicity	Typically better than 0.05 dB (-30 dBm to +13 dBm or to +20 dBm with option 003) Better than 0.2 dB typ. at an RF level between +3.0 and +4.5 dBm and between +9.0 dBm and +10.5 dBm.
Switching Time (18°C-28°C)	<100 µs to within 0.1 dB of final value after trigger pulse in List Mode <150 µs when changing carrier frequency
Output Impedance	50 Ω nominal
Output VSWR	>1 MHz - 3 GHz <+3.5 dBm <1.4:1 <+9.5 dBm <1.5:1 typ. >3 GHz <+2.5 dBm <1.6:1 <+8.5 dBm <1.7:1 typ.
Reverse Power Damage Level	+25 dBm, ±16 V DC
RF Level Offsets	Up to maximum output level range. A given RF level offset over a given frequency band A profiled RF level offset between two given frequencies A selection of both of the above

SPECTRAL PURITY

SSB Phase Noise	*Carrier freq.*	*1 kHz*	*20 kHz*	*10 MHz*
(CW Mode)	*100 MHz*	*-132 typ.*	*-142 typ.*	*-150 typ.*
	250 MHz	*-131 typ.*	*-142 typ.*	*-150 typ.*
	500 MHz	*-125 typ.*	*-138 typ.*	*-150 typ.*
	1 GHz	*-117*	*-130 (-135 typ)*	*-148 (-152 typ.)*
	2 GHz	*-111*	*-124*	*-148*
	4 GHz	*-105*	*-118*	*-140*
	6 GHz	*-101*	*-115*	*-135*
	Phase noise below 100 Hz offset is dependent upon reference phase noise.			
Non-Harmonic Related Spurious	*At offsets >10 kHz:*			
(CW Mode)	*≤1 GHz, better than -80 dBc*			
	≤2 GHz better than -70 dBc			
	≤2.6 GHz better than -68 dBc			
	≤5.8 GHz better than -65 dBc			
	>5.8 GHz better than -60 dBc			
Sub-harmonics	*≤1.5 GHz, better than -80 dBc*			
	≤3 GHz, better than -75 dBc			
	>3 GHz, better than -40 dBc			
Harmonics (CW Mode)	*1 MHz – 6 GHz*	*≤-1 dBm, better than -30 dBc*		
		≤+8 dBm, better than -30 dBc typ.		
Residual FM (CW Mode)	*Less than 1 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at 1 GHz.*			
RF Leakage	*Less than 0.5 µV at the carrier frequency into a single turn 25 mm loop 25 mm or more from the case*			
RMS Jitter	*Carrier Freq.*	*RMS Jitter Bandwidth*	*RMS Jitter (measured performance)*	
	1 GHz	*1 Hz – 10 MHz*	*450 fs*	
	155 MHz	*100 Hz – 1.5 MHz*	*58 fs*	
	622 MHz	*1 kHz – 5 MHz*	*31 fs*	
	2.488 GHz	*5 kHz – 15 MHz*	*25 fs*	



Typical phase noise performance at 250 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz and 6 GHz



Typical phase noise performance at 30 MHz, 50 MHz and 100 MHz

MODULATION

Allowable Combinations:

	AM1	AM2	FM1	FM2	PM1	PM2	Pulse*	Int Vect	Ext Vect
AM1		Y	N	Y	N	Y	Y	N	N
AM2	Y		Y	N	Y	N	Y	N	N
FM1	N	Y		Y	N	N	Y	N	N
FM2	Y	N	Y		N	N	Y	N	N
PM1	N	Y	N	N		Y	Y	N	N
PM2	Y	N	N	N	Y		Y	N	N
Pulse	Y	Y	Y	Y	Y	Y		Y	Y
Int Vect	N	N	N	N	N	N	Y		N
Ext Vect	N	N	N	N	N	N	Y	N	

Note 1 – Pulse modulation can be internal or external

Note 2 - Analog Modulation (AM, FM, PM) is internal only

EXTERNAL VECTOR MODULATION

Carrier Frequency	*50 MHz – 6 GHz*
Input Impedance	*100 Ω differential*
Coupling	*DC*
Input Voltage	*±0.707 Vpk on 'I or Q' or ±0.5 Vpk 'I and Q' for calibrated output*
I and Q Bandwidth (3 dB) at RF Output	*Carrier Frequency — Bandwidth* *≤30 MHz — up to 20 MHz* *≤46.875 MHz — 20 MHz* *≤93.75 MHz — 30 MHz* *≤187.5 MHz — 80 MHz* *≤375 MHz — 100 MHz* *>375 MHz — 300 MHz*

INTERNAL VECTOR MODULATION (OPTIONS 010 - 012)

The following specifications apply when using one of the internal AWG options (010-012)

I and Q bandwidth (3 dB) at RF Output	*Carrier Frequency — Bandwidth* *≤30 MHz — up to 20 MHz* *≤46.875 MHz — 20 MHz* *≤125 MHz — 30 MHz* *≤187.5 MHz — 40 MHz* *≤375 MHz — 100 MHz* *>375 MHz — 200 MHz*
Residual Carrier Leak	*After IQ self-cal* *-55 dBc typ. ≤3.5 GHz, -50 dBc typ >3.5 GHz*
IQ Image Suppression	*After IQ Self Cal* *Carrier frequencies >187.5 MHz* *Tone Frequency* *100 kHz — -55 dBc typ.* *10 MHz — -50 dBc typ.* *30 MHz — -46 dBc typ.* *50 MHz — -43 dBc typ.* *80 MHz — -40 dBc typ.* *Carrier frequencies ≤187.5 MHz, -40 dBc typ.* *Carrier frequencies ≤125 MHz, -43 dBc typ.*
Third order intermodulation distortion	*2 tones at 0 dBm per tone* *≤1 GHz — <-45 dBc* *≤3.5 GHz — <-50 dBc* *>3.5 GHz — <-40 dBc*

Channels	*2 differential channels*
Modes	*Single ended / differential*
DAC Resolution	*16 bits*
Sample Rate	*40 kHz – 250 MHz per channel*
Memory	*512 MB, 128 Msamples (option 010)* *2 GB, 512 Msamples (option 011)* *4 GB, 1 Gsample (option 012)*
Waveform Formats	*IQ* 14-bit + 4 markers*
AWG Triggering	
AWG File Selection Time	*AWG completion On – Seamless* *AWG completion Off – Defined by sample rate*
Trigger Sources	*Internal; Software AWG marker* *External; TTL*
Trigger Modes	*Start only; Start & stop; Re-trigger*
Start only; Start & stop; Re-trigger	*Immediate*
Immediate / End of file	*+ve, -ve, ANY*
Trigger delay	*0 to 17 s, resolution 4 ns*

Spectral Purity	
Spurious Free Dynamic Range	*>70 dB up to 80 MHz, >62 dB up to 100 MHz*
SSB Phase Noise	*<-130 dBc/Hz typ, 20 kHz offset, 100 MHz sine*
Floor Noise (no output)	*<-140 FS/Hz*
Intermodulation Distortion	*<-70 dBc (100 kHz spacing at 1 MHz, 200 kHz tone spacing at 40 MHz)*

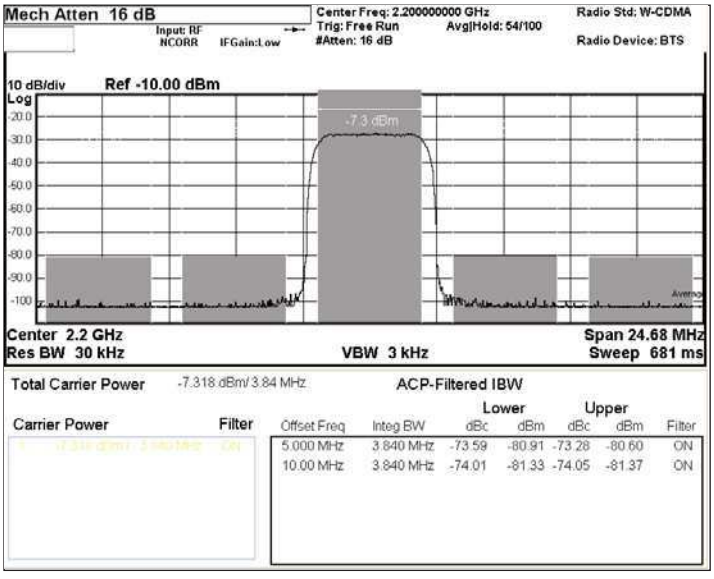
Frequency Response of AWG	
Bandwidth	*±0.35 dB, DC -40 MHz per channel* *±0.5 dB above 40 MHz*

MODULATION PERFORMANCE

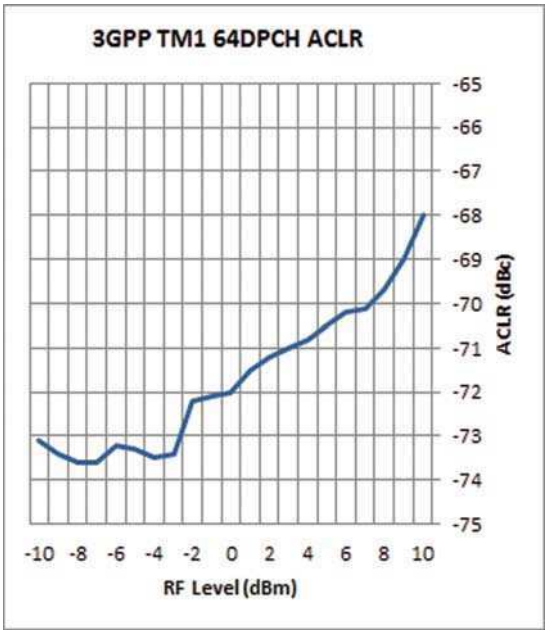
ACLR (18°C-28°C)		
3GPP W-CDMA, *1800 MHz to 2200 MHz* *≤0 dBm* *TM1, 64DPCH*	*adjacent ch.* *alternate ch.*	*-68 dBc, -70 dBc typ.* *-72 dBc typ.*

EVM

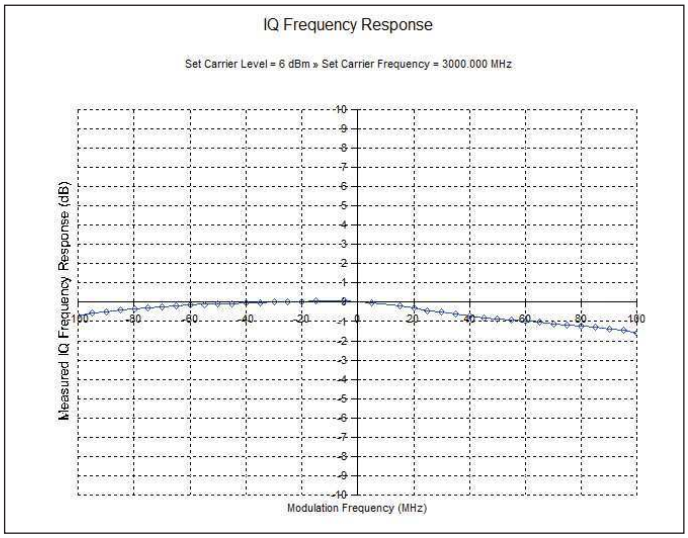
Standard	*GSM*	*EDGE*	*cdma2000 1xEV-DO*	*W-CDMA TM1*	*LTE E-TM3.1*	*IEEE 802.11*			
Mod Type	*GMSK*	*3pi/8PSK*	*QPSK*	*QPSK*	*64 QAM*			*256 QAM*	
Bandwidth	*200 kHz*		*1.23 MHz*	*3.84 MHz*	*10 MHz*	*20 MHz*	*40 MHz*	*80 MHz*	*160 MHz*
Mod Rate	*270.833 ksps*	*270.833 ksps*	*1.2288 Mcps*	*3.84 Mcps*		*54 Mbps*	*HT MSC?*	*VHT MSC9*	
Frequency (MHz)	*849-1910*					*2412-2484*	*5170-5825*		
Level (PEP)	*<7 dBm*								
Measured	*0.3 degrees (rms)*	*0.32%*	*0.99 Rho*	*0.7%*	*0.2%*	*0.25%*	*0.5%*	*0.6%*	*0.8%*

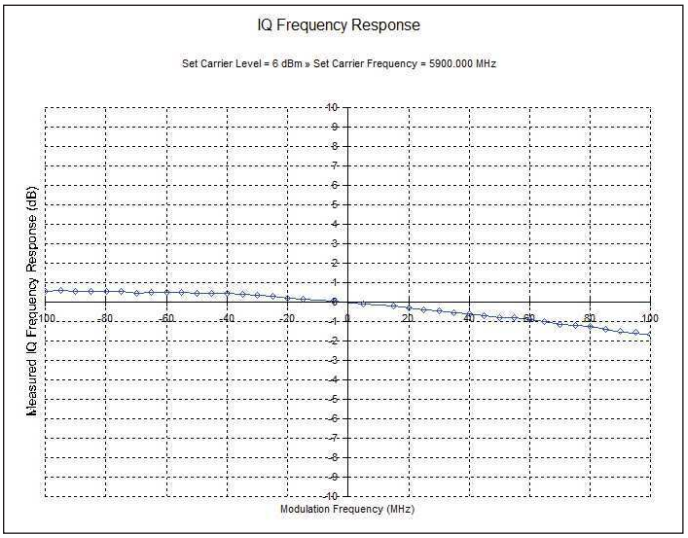


Measured performance of ACLR at -6 dBm, TM1, 64 DPCH

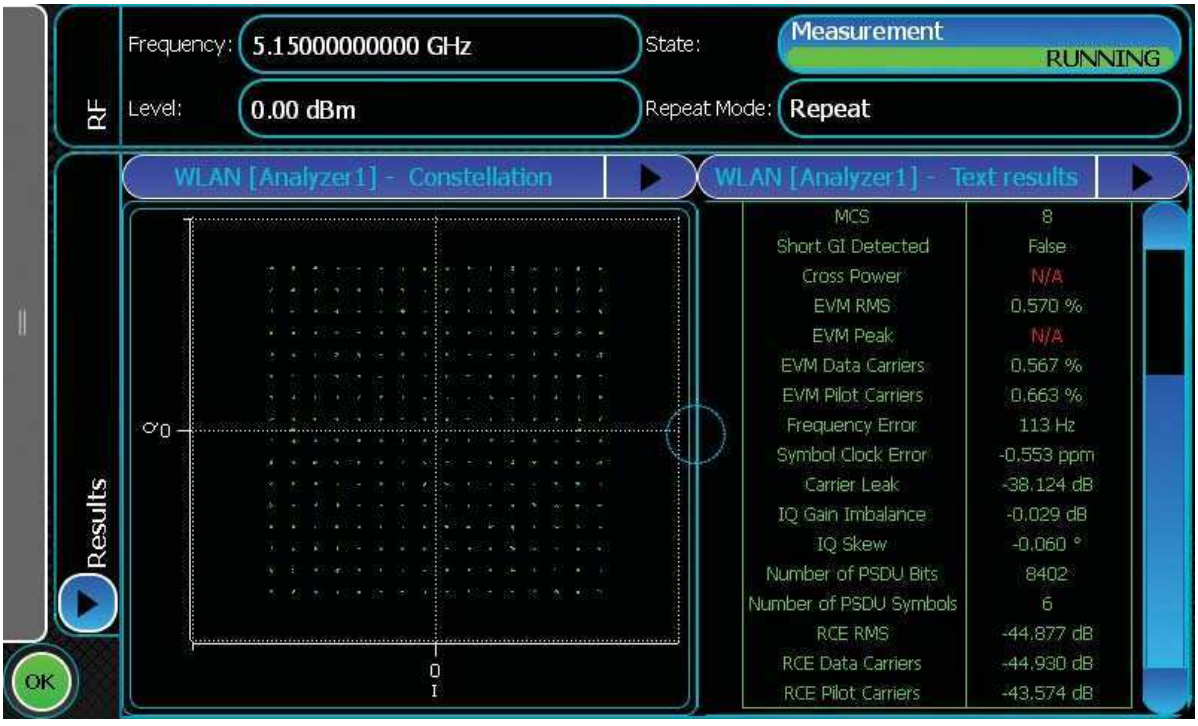


Measured performance of ACLR v. RF Level





Measured performance of IQ modulation bandwidth using internal AWG at 3000 MHz and 5900 MHz



Measured performance of 802.11ac 80 MHz VHT MCS8 EVM

SWEEP

Provides a digital sweep of carrier frequency, RF level and modulation source in discrete steps.

Control of start, stop, number of steps and step time.

Sweep can be externally triggered from a rear panel BNC connector (TTL) for Start, Start/Stop and Step.

Modes	*Continuous; single; externally triggered*
Carrier sweep type	*Linear, logarithmic*
RF level step size	*0.01 dB minimum*
Maximum number of steps	*65536*
Marker event output	*A TTL pulse will appear on the sweep marker output when specified parameter values have been reached. Up to 6 markers can be set.*

List Mode Sweep Facility

Provides a table of carrier frequency, RF level values and AWG files.

Start address, stop address and dwell time can be controlled.

Can be externally triggered from a rear panel BNC connector (TTL), or internally using AWG file marker.

Dwell time	*161 µs to 10 s*
List size	*Up to 1000 entries*

ARB Sequence Mode

Provides a table of AWG file, Frequency, Level, RF State and Play Count.

Start address and stop address can be controlled.

Can be externally triggered from rear panel BNC connector (TTL), or internally

Maximum play count = 1000

REFERENCE FREQUENCY OSCILLATOR

Type	*OCXO*
Frequency	*10 MHz*
Temperature stability (0 to 40˚C)	*$<\pm 1 \times 10^{-8}$ typ.*
Ageing rate	*<1 in 10^{9} per day (<0.001 ppm)* *<1 in 10^{7} per year (<0.1 ppm)*

PULSE MODULATOR/GENERATOR (OPTION 004)

Pulse Modulator	
On/off ratio	*>80 dB*
Rise/fall time	*<10 ns*
Maximum PRF	*10 MHz*
Video Breakthrough	*<100 mV*

Internal Pulse Generator	
Modes	*Free-run; triggered; single pulse; double pulse; adjustable doublet; external trigger*
PRF/pulse period	*0.01 Hz-10 MHz/100 ns-100s*
Width	*10 ns-60 s*
Delay	*0-60 s*
Double-pulse spacing	*10 ns-60 s*
Resolution (delay/width/period)	*10 ns*

Effects of Option 004 on RF Level Specification	
Instruments not fitted with option 003 (high power)	*Maximum specified RF level reduced to +7 dBm with pulse enabled*
	Maximum specified RF level reduced to +10 dBm with pulse disabled
Instruments fitted with option 003	*Maximum specified RF level reduced by 6 dB with pulse enabled*
	Maximum specified RF level reduced by 3 dB with pulse disabled
RF Level Accuracy	*Add 0.2 dB* *<25 MHz, >7 dBm (units with option 003, high power), add 0.5 dB* *Temperature stability:* *≤3 GHz, additional 0.005 dB/°C* *>3 GHz, additional 0.01 dB/°C*
Output VSWR (all output levels)	*Pulse disabled* *<3 GHz <1.6:1 typ.* *>3 GHz <1.8:1 typ.* *Pulse enabled (on state) Pulse enabled (off state)* *<5 GHz <1.7:1 typ. <2.3:1 typ.* *5-6 GHz <2.1:1 typ. <2.3:1 typ.*
Carrier harmonics	*Unspecified below 50 MHz*

All other RF level dependent limits reduced by 3 dB with pulse disabled, and 6 dB with pulse enabled.

INTERNAL ANALOG MODULATION (OPTIONS (010 - 012)

Two internal modulation channels are available which provide the following allowable combinations:

2 x FM (FM1 and FM2)

2 x AM (AM1 and AM2)

2 x ØM (ØM1 and ØM2)

1 x AM and 1 x FM

1 x AM and 1 x ØM

FREQUENCY MODULATION (OPTIONS 010 - 012)

Max Deviation above 375 MHz[12]	*25 MHz sine* *2.5 MHz square* *3.125 MHz triangle* *2.5 MHz+ve and -ve ramp*
Resolution	*1 Hz*
Accuracy	*±3% of set deviation (1 kHz mod rate)*
Total Harmonic Distortion	*<0.15 % typ. (at 1 kHz mod rate up to 125 kHz deviation)*
Frequency Response (1 dB)	*DC to 25 MHz*

PHASE MODULATION (OPTIONS 010 - 012)

Max Deviation above 375 MHz[3]	*3.1 rad*
Resolution	*0.1 rad*
Accuracy	*±3% of set deviation (1 kHz mod rate)*
Total Harmonic Distortion	*<0.1 % typ. (at 1 kHz mod rate and 1 rad deviation)*
Frequency Response (1 dB)	*100 Hz - 25 MHz*

AMPILTUDE MODULATION (OPTIONS 010 - 012)

Depth	*0 - 99.9%*
Resolution	*0.1%*
Accuracy	*±3% of set depth ±1%*
Total Harmonic Distortion	*(1 kHz mod rate, carrier frequency below 2 GHz)* *<1% for depths <30%* *<2% for depths <80%*
Frequency Response (3 dB)	*DC to 25 MHz*

[1] Below 375 MHz, the maximum deviations are reduced in accordance with the restrictions of the IQ Modulator bandwidth:
<375 MHz divide by 2
<187 MHz divide by 5
<125 MHz divide by 6 ⅔
<46 MHz divide by 10

[2] The relationship between the max deviation for the modulating waveform relative to a standard sine wave is square/ramp = divide by 10, triangle = divide by 8

[3] Below 375 MHz, the maximum values are reduced in accordance with the restrictions of the IQ Modulator bandwidth.

INTERNAL MODULATION GENERATOR (OPTIONS 010 - 012)

Two internal modulation sources

Waveforms	*Sine, 0 - 25 MHz* *Triangle, 0 - 3.125 MHz* *Square, 0 - 2.5 MHz* *+ve and -ve Ramp, 0 - 2.5 MHz*
Resolution	*0.01 Hz*
Accuracy	*As reference frequency oscillator*
Total Harmonic Distortion	*<0.1%*
Frequency Response (1 dB)	*DC to 25 MHz (sine)*

GENERAL DATA

Remote Control	
Systems	*GPIB (IEEE 488)* *Ethernet (TCP/IP)*
GPIB (IEEE 488) *Ethernet (TCP/IP)*	*SCPI compatible command set*
Interface functions	*SH1; AH1; T6; L4; SR1; RL1; PP0; DC1; DT1; C0; E2*

Memory (80 GB Hard Disk)

Up to 500 full instrument setting stores

Each memory store can be given a unique name

Storage medium for all AWG files

Removable Hard Disk – (Option 005)

For use in secure areas, the removable hard disk may be extracted from the rear panel by releasing two screws.

The removable hard disk also contains the instrument's operating software.

Recommended Calibration Cycle

24 months

Weight

8 kg (17.6 lbs) standard

<9 kg (19.8 lbs) with all options fitted

Dimensions - H x W x D

177 mm (4U) x 222 mm x 490 mm, not including feet. (6.97 x 8.74 x 19.29 in.)

Height 195 mm inc. feet. (7.67 in.)

Instrument includes side strap handle and front tilt feet.

Instrument includes interlocking mechanism with modules mounted above and below, and to another S-Series instrument on either side.

FRONT PANEL CONNECTOR

RF Output	*50 Ω N-type*
4 x differential IQ inputs	*I+, I-, Q+, Q-, 100 Ω differential BNC* *Damage levels: ±2 V*
2 x USB 2.0	*Used with a memory stick for transferring memory stores, AWG waveforms or other files in or out of the instrument* *Mouse or keyboard input*

REAR PANEL CONNECTORS

RF Output	*50 Ω N-type (option 007)* *Note: Rear panel RF output is not available with the standard instrument.*
Pulse Modulation Input *(Option 004)*	*50 Ω BNC – TTL and CMOS compatible* *Damage levels: TBA*
4 x USB 2.0	*Used with a USB flash drive for transferring memory stores, AWG waveforms or other files in or out of the instrument* *Module plug & play connection*
Sweep out	*BNC – Generates 0 – 10 V when the generator is sweeping into Zin >1 kΩ*
Event marker (Trig 1, 2, 3) Output	*BNC - User selectable markers for frequency or level provide an indication when the specified parameter values have been reached. LVTTL logic output levels.* *Damage levels: -5 / +10 V*
Trigger / Pulse (Trig 1) input	*BNC – User selectable for AWG waveform trigger, sweep/list trogger or pulse enable (opt 004) LVTTL logic input thresholds.* *Damage levels: -5 / +10 V*
Reference frequency input	*BNC- accepts 10 MHz at 200 mV to 2 V RMS into 50 Ω or 100 kΩ nominal.* *Damage levels: -2.5 V/+2.5 V*
Reference frequency output	*BNC – 10 MHz at 1.5 V pk-pk into 50 Ω* *Damage levels: -0.5 / +3 V*
GPIB Interface	*As described under Remote Control*
LAN Interface	*As described under Remote Control*

ENVIRONMENTAL

Rated Range of Use	
Temperature	*0 to 50˚C*
Humidity	*Up to 93% at 40˚C*
Altitude	*Up to 3050 m*
Conditions of Storage and Transport	
Temperature	*-40 to +71˚C*
Humidity	*Up to 95% at 40˚C*
Altitude	*Up to 4600 m*
EMC	*EN 61326-1, Emissions Class B, Immunity Table 1 – Performance Criteria B*
Safety	*EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use-Part 1, General requirements.*
Mechanical	*MIL-PRF-28800F Class 3*

POWER REQUIREMENTS

AC Supply	*100 – 240 V ~ (Limit 90 - 264 V)* *50 - 60 Hz ~ (Limit 45 - 66 Hz)* *160 VA max.*

USER INTERFACE

Screen size	*8.5 inch, 16:9 aspect ratio, colour touch-screen*
Keys / switches	*Power on / standby* *Home key*

Supports Remote Desktop and VNC.

MODULATION FORMATS

Digital Standards					
Application	Standard	Specification	Access Method	Modulation Type	Embedded IQCreator
Cellular	LTE	3GPP TS 36.211/212/213	OFDMA/SC-FDMA	BPSK, QPSK, 16 & 64 QAM	Yes
	W-CDMA	3GPP TS 25.211/212/213	CDMA	QPSK, 64 QAM	Yes
	TD-SCDMA	3GPP TS 25.221/222/223	CDMA	GMSK, 8PSK	Yes
	GSM/EDGE	3GPP TS 45.005*	TDMA	QPSK, 8PSK	Yes
	cdma2000	3GPP2 C.S00002-C	CDMA	QPSK	Yes
	1xEV-DO	3GPP2 C.S0024 v4 3GPP2 C.S0025-A v2	CDMA	O-QPSK, QPSK	Yes
	cdmaOne	3GPP2 IS-95	CDMA	O-QPSK, QPSK	Yes
WMAN	WiMAX	IEEE 802.16D (2004) IEEE 802.16E (2005)	OFDM OFDMA	BPSK, QPSK, 16 QAM, 64 QAM	No
WLAN	WiFi	IEEE 802.11a,b,g,n,ac IEEE 802.11a-1999 IEEE 802.11b-1999 IEEE 802.11g-2003 IEEE 802.11n-2009 IEEE P802.11ac/D1.0 20, 40, 80, 80+80, 160 MHz	DSSS, OFDM	BPSK, QPSK, 16 QAM, 64 QAM, 256 QAM	Yes
WPAN	Bluetooth®	IEEE 802.15.1-2005**		FSK, QPSK	Yes
	ZigBee®	IEEE 802.15.4-2003		O-QPSK, MPSK	Yes
Cordless	DECT	ETSI EN300 175	TDD	2 & 4FSK, MSK	No
Digital PMR	TETRA	ETSI EN300 392	TDMA	π/4DQPSK	No
Avionics	VDL	mode 2 & 3 mode 4		D8PSK, 2FSK	No
Broadcast	FM Stereo			FM	Yes

* Formerly 3GPP TS 05,05
** Bluetooth Specification 2.1+EDR (Vol 2) +
Bluetooth low energy RF PHY test specification (RF-PHY.TS/4.0.0)

Generic Modulation			
Formats	Selection	Filtering	
PSK	BPSK, π/2BPSK QPSK, DQPSK, π/4DQPSK, O-QPSK 8PSK, D8PSK, π/8D8PSK 16PSK	None Ideal low pass Nyquist, Root Nyquist Gaussian User	Yes
FSK	2FSK 4FSK MSK		
QAM	(2^N) where N = 4 to 10		
UDSK	User defined PSK/QAM shift keying		No

Modulation formats included with Embedded IQCreator® are indicated in the table above. Other modulation formats are supported using external IQCreator® which generates .aiq files which are transferred to the SGD.

ORDERING INFORMATION

SGD-3	100 kHz to 3 GHz digital RF signal generator
SGD-6	100 kHz to 6 GHz digital RF signal generator
Option 003	High Power (+20 dBm)
Option 004	Fast Pulse Modulation
Option 005	Removable Storage Disk
Option 007	Rear panel connectors

Arbitrary Waveform Generator options (Each AWG option includes IQCreator with PSK, QAM, multi-carrier and analog modulation enabled):

Option 010	AWG with 128 MSamples memory
Option 011	AWG with 512 MSamples memory
Option 012	AWG with 1 GSample memory

IQCreator waveform creation options:

Option 101	Waveform creation package- Basic (options 111 to 115)
Option 102	Waveform creation package- Advanced (options 101, 117 and 118)
Option 111	3GPP (GSM, EDGE, EGPRS, EGPRS2, WCDMA, HSPA, HSPA+)
Option 112	3GPP2 (IS-95, CDMA2000, 1xEVDO (0+A))
Option 113	TD-SCDMA (3GPP TDD-LCR)
Option 114	Bluetooth V.11 + V.21 + EDR + Version 4 and LR-WPAN (802.15.4)
Option 115	WLAN (a, b, g, n, p, ac)
Option 117	LTE FDD and TDD Rel. 8

Extended Warranty Options

Option 203	3 year warranty
Option 204	4 year warranty
Option 205	5 year warranty

Supplied Accessories

AC supply lead

Getting Started manual

CD-ROM containing operating manual

CD-ROM containing factory test results

Optional Accessories

47000/132	Operating manual (paper format)
46880/124	Service manual supporting repair to module level (includes semi-automatic adjustment software)
43129/189	1.5 m GPIB lead
46662/836	Soft carry case
46662/835	Hard transit case
23448/030	USB Type A - Type B cable, 1.5 m
46885/505	Single instrument rack mounting kit (front panel brackets)
46885/506	Double instrument rack mounting kit (front panel brackets)
43139/042	RF double screened connector cable 50 Ω, 1.5 m, BNC (m)
54311/095	RF double screened connector cable 50 Ω, 1 m, type N connectors
54311/092	Coaxial adapter N male to BNC female
59999/163	Precision coaxial adapter N male to SMA female
TBA	2 x 50 Ω BNC terminations

Complementary S-Series Modules (see separate datasheets)

SVA-6/13	250 kHz to 6/13 GHz Vector Signal Analyzer
SCO-6	10 MHz - 6 GHz Combiner module
SPA-6	10 MHz - 6 GHz Power Amplifier module

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AEROFLEX
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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

Part No. 46891/462, Issue 6, 02/14