Description

RF signal generator modules that incorporate the essential features required for most development, test and service work, including high frequency accuracy and stability, wide dynamic range, low phase noise and leakage, and flexible modulation capabilities.

Features

Graphical user Interface

Both modules feature a simple and straightforward, user friendly, touch operated GUI. The 4.3 inch colour LCD screen displays key information alongside readings for added efficiency. Each parameter is directly editable from the menu screen, reducing the number of steps required to complete a setup. Parameters can also be edited using the hard keys and the rotary knob, providing ultimate flexibility.

Sweep

The sweep function enables signals of varying frequency and/or amplitude to test a full range of input conditions, quickly and efficiently. Step sweeps are created according to a formula over a specified number of points, in the range 2 - 1000. Formula specifics include: start and stop values and dwell time following SYNC at each point. Sweeps can be set to run in either direction, with linear or logarithmic spacing.

Alternatively, list mode can be used to analyse the response at set frequencies and amplitude - dwelling on set values for specified amounts of time; useful for testing at known problematic frequencies within a setup.

The list can be created within the instrument or downloaded via the remote interfaces. The sweep setups can either be run through as a single sweep or in a continuous loop and prompted by an internal, external or manual trigger.

Complex sweep triggering is available to control complete sweeps and/or each point within a sweep.

Analog Modulation

A built-in DDS generator provides Sine, Square, +Ramp, -Ramp and triangle waves, these can be applied in the forms of AM, FM or PM from the internal modulation source; at frequencies ranging from 1mHz to 1MHz.

External analog modulation signals can be applied to the carrier waveform via the MOD in/out on the rear panel.

Features

- 7048: 150 kHz to 1.5 GHz frequency range

- 7049: 150 kHz to 3 GHz frequency range

- 10 Hz setability, ± 1 ppm frequency stability

- 5 ms sweep settling time

- User selectable low spur mode setting

- -127 dBm to +13 dBm amplitude, 0.1 dB steps

- AM, FM & Phase modulation, internal/external

- 4.3 inch colour LCD screen display

- Keyboard and rotary encoder control

Digital Modulation Option

An extensive range of digital modulations available: FSK, GFSK, MSK, GMSK, HMSK, 3FSK, 4FSK, PSK, ASK and OOK. Built in NRZ patterns include Square wave, 7, 9, 11 & 15-bit PRBS. Digital modulation capabilities also include advanced filtering: Gaussian, Raised Cosine, Root Raised Cosine and Half Sine as well as Grey Code and Binary Encoding.

Internal Modulation Pattern

A user defined pattern generator is included, in which patterns can be created and used to modulate the carrier signal. This allows a uniquely tailored pattern of up to 16384 states to be created from the front panel, alternatively these can be imported using the digital interfaces or USB Flash drive port. Digital modulation and modulation patterns can be continuous or triggered externally, internally, manually or remotely.

Technical Specifications

Frequency

Frequency range .... 7048: 150 kHz to 1500 MHz / 7049: 150 kHz to 3000 MHz.

Setting resolution .... 10 Hz / 1 MHz in Low Spur Mode

Phase noise .... 500 MHz Carrier: < -124 dBc/Hz (typ) @ 10 kHz offset. 1 GHz Carrier: <-117 dBc/Hz (typ) @ 10 kHz offset.

Residual FM .... < 2 Hz @ 1 GHz - Equivalent peak deviation in a 300 Hz to 3.4 kHz bandwidth.

Reference frequency

Internal accuracy .... ± 1 ppm over temperature range 15 °C to 30 °C; ± 2 ppm over 5 °C to 40 °C.

Internal stability .... < ± 1 ppm/year.

Reference OUT .... 10 MHz, 50 Ω output impedence, > 2 V pk-pk into 50 Ω.

Reference IN .... 10 MHz ± 25 ppm, 50 Ω input impedence, 2 V pk-pk to 5 V pk-pk.

Output level

Output level range .... -127 dBm to +13 dBm.

Setting resolution .... 0.1 dB (or 0.01 μV to 1 mV).

Accuracy .... ± 1dB output levels > -53 dBm, ± 2 dB output levels <= -53 dBm. Additional Uncertainty AM, ASK & OOK ON: ± 0.5 dB.

Harmonics related signals .... < -25 dBc @ +13 dBm, <-30 dBc @levels <=0 dBm.

Sub-harmonics .... < -25 dBc at +7 dBm.

Non-harmonic spurii .... < -50dBc >10 kHz offset 1.5 GHz – 3 GHz, < -56 dBc > 10 kHz offset 150 kHz - 1.5 GHz.

Output impedance .... 50 Ω.

Output connector .... Type N.

Reverse protection .... 50 V DC.

Output switch .... RF OUT on-off switch with LED for ON status.

Analog Modulation

Source

Type .... Internal from built-in DDS generator , or external from front panel BNC.

Internal .... sine, square, + Ramp, - Ramp, triangle, 1 mHz – 1MHz, Resolution 1mHz. Signal available at MOD IN/OUT, 150Ω source impedance.

External .... 100 Hz – 1 MHz, 1 dB relative to 1 kHz, 1 Vp-p for full scale. 10 kΩ input impedance AC coupled.

Frequency Modulation

Deviation .... 1 mHz – 1 MHz subject to carrier frequency.

Setting resolution .... 1 mHz.

Deviation accuracy .... Ref freq accuracy ± 1 mHz for internal modulation. ± 2 % for external modulation @ 1 kHz, 1 V p-p.

Distortion .... <1% @ 1kHz modulation, 300 – 3.4kHz bandwidth.

Phase Modulation

Deviation .... 0 – 25.00 rad.

Setting resolution .... 0.01 rad.

Deviation accuracy .... Ref freq accuracy ± 0.1 rad for internal modulation. ± 2 % for external modulation @ 1 kHz, 1V p-p.

Distortion .... <1 % @ 1 kHz modulation, 300 – 3.4 kHz bandwidth.

Amplitude Modulation (levels ≤ +7 dBM)

Modulation depth .... 0 – 100 %.

Setting resolution .... 0.1 %.

Accuracy .... ± 1 % for internal modulation, ± 2 % for external modulation @ 1 kHz, 1 V p-p.

Distortion .... ≤ 1 % @ ≤ 90 % depth.

Frequency and Amplitude Sweep

Frequency settling time .... to within 10 0Hz or 0.1ppm offinal frequency if greater: < 5 ms*, typ < 2 ms

Amplitude settling time .... to within 0.2 dB: < 5 ms*, typ <4 ms.

Rear panel SYNC .... pulse width (defines guaranteed settling period): 5 ms *.

*Settling time and SYNC pulse width is extended to 15ms for all points in the sweep if the frequency crosses 250.00000MHz between any points in the sweep.

Step Sweep

Step frequency and/or amplitude according to a formula over a specified number of points.

Number of points .... 2 – 1000

Formula specifies .... Sweep Start and Stop Frequencies / Sweep Start and Stop Amplitudes / Dwell time following SYNC at each point.

Dwell Time .... 0.01 – 10.000 sec

Sweep Mode .... Continuous or Single

Sweep Direction .... Up or Down

Sweep Point Spacing .... Linear or Logarithmic

Sweep Trigger .... Sweep start held until trigger event: Manual, ext signal +ve or –ve edge, timed (0.01 – 999.9sec) or via remote interface.

Point Trigger .... Sweep point stepping held until trigger event: Manual, ext signal +ve or –ve edge, or via remote interface

Point Trigger timing .... >=10 ms after SYNC signal.

SYNC signal ('output stable') .... Available after output has settled at each point until next point. Programmable high or low logic.

List Sweep

As per Step Sweep except that a user defined table of frequency, amplitude and dwell time values defines the points.
The table can be created within the instrument or downloaded via the remote interfaces. Max 1000 points.

Technical Specifications (continued)

Digital Modulation Option

Source

Internal	NRZ Patterns: Square Wave, User Defined Pattern, 7-bit PRBS, 9-bit PRBS, 11-bit PRBS, 15-bit PRBS.
	User Defined Pattern: 16384 states can be created in the instrument or downloaded via the remote interfaces.
	Bit rate: 1mbits/sec – 1Mbits/sec
	Modulation signal available at MOD IN/OUT, 150 Ω source impedance
External	Input via MOD IN/OUT: DC – 1 Mbits/sec, >=2 Vp-p, logic threshold +1.5 V nominal.
	10 kΩ input impedance

Internal Modulation Pattern Trigger

Source	External +ve edge, External –ve edge, Manual, via remote interface or Internal.
	Internal trigger repeats at a programmable rate of 1 per 1us – 999.999999s
Modes	Immediate: Modulation starts immediately.
	Triggered: Modulation waits for a trigger event.
Trigger Types	Infinite: First trigger event starts the modulation pattern, which repeats indefinitely.
	Finite: Each trigger event starts one modulation pattern (one 'block') or a count of bits in the modulation pattern. The bit count is . programmable and can be greater than a pattern length.
	Bit count range: $1 – 2^{31}$
Trigger Delay	<500ns from specified edge of external trigger signal to modulation start.

Internal Modulation Pattern SYNC

Signal available from the rear panel SYNC BNC to synchronise internally produced modulation patterns.

SYNC modes	OFF, Start, Bit Rate, Bit Rate/2
SYNC polarity	High going SYNC pulse
Start SYNC	SYNC pulse 1 bit period wide at the start of the modulation pattern.
Bit Rate SYNC	½-bit period wide pulses at the modulation bit rate repeated indefinitely or for a programmed repeat count from the start of the modulation pattern in triggered mode.
Bit Rate/2 SYNC	As for Bit Rate SYNC but at half the modulation bit rate..

Frequency Shift Keying

Modes	FSK, GFSK, MSK, GMSK, HMSK, 3FSK, 4FSK. Continuous phase frequency modulation.
Filter Settings	None, Gaussian (BT=0.3, 0.5 or 0.7), Raised Cosine (α =0.5 or 0.7), Root Raised Cosine (α =0.5 or 0.7), Half sine.
Deviation	1 mHz – 1MHz subject to carrier frequency
Deviation Setting Resolution	1 mHz
Deviation Accuracy	Ref freq accuracy ± 1 mHz for internal and external modulation
4FSK Encoding	Gray Code or Binary.
Encoding Synchronisation	Internal Modulation Source: 3FSK - Start SYNC output indicates the start of encoding.
	4FSK - Bit Rate/2 SYNC output indicates the start of encoding
Encoding Synchronisation	External Modulation Source: 3FSK / 4FSK - The external Trigger input can be used to define the start of encoding for both.

Phase Shift Keying

Modes	PSK.
Deviation	0 – 25.00 rad.
Deviation Setting Resolution	0.01 rad.
Distortion Accuracy	Ref freq accuracy ±0.1 rad for internal and external modulation.

Amplitude Shift Keying (ASK)

ASK Depth	0 – 100 %
Setting Resolution	0.1 %
Accuracy	± 1 % for internal and external modulation
Internal Rate	1 mb/s - 1 Mb/s
External Rate	DC – 1 Mb/s.

On-Off Keying (OOK) (Basic Pulse Modulation)

On-Off Ratio	> 80 dB
External Input	Logic high = Carrier On
Internal Rate	1 mB/s - 1 Mb/s
External Rate	DC – 1 Mb/s
Rise/Fall Time	50 ns.

General Specifications

Display	4.3 inch (10.9 cm) backlit TFT LCD, 480 x 272 pixels total, 16 colours, resistive touch screen.
Remote Control Interface	Digital remote control facilities are available through the USB, LAN interfaces using SCPI style command set.
Storage	4 G bytes internal storage available for 1000's of instrument setups, sweep lists and user defined modulation patterns.
Digital Modulation Option	Makes available all digital modulation schemes with full trigger and SYNC capabilities (see additional specifications).
Module width	295 mm (primary console fitting only).
Ordering information	**7048: 1.5 GHz RF Signal Generator Module** / **7048/DM1: 1.5 GHz RF Signal Generator Module** (with digital modulation option)
	7049: 3 GHz RF Signal Generator Module / **7049/DM1: 3 GHz RF Signal Generator Module** (with digital modulation option)

Due to continuous development Time Electronics reserves the right to change specifications without prior notice.