3410 Series

Digital RF Signal Generators

An agile signal generator that combines wide frequency cover and high performance vector modulation in a small package, making it ideal for testing wireless communication systems and components

- ***Wide frequency coverage***

  250 kHz to 2 GHz (3412)
  250 kHz to 3 GHz (3413)
  250 kHz to 4 GHz (3414)

- ***Fast RF frequency and level settling for high speed testing***
- ***High performance vector modulation for improved component test***
- ***Optional dual channel arbitrary waveform generator (ARB)***
- ***Low adjacent channel power for receiver selectivity and amplifier linearity testing***
- ***Fast GPIB response to maximize ATE system performance***
- ***IQCreator™ RF waveform creation software***
- ***Wide bandwidth FM and AM modulation capability***
- ***Optional high speed pulse modulation capability***
- ***Compact and lightweight package***
- ***Simple to use touch panel interface***
- ***RF optimization modes - Low Noise, Low ACP and Higher Power***

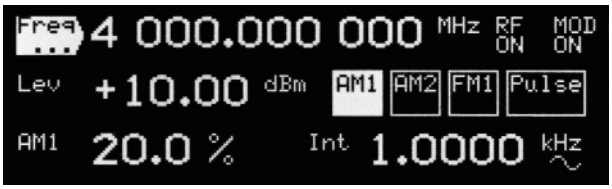
The 3410 series are portable, lightweight signal generators covering a wide range of carrier frequencies to 4 GHz. High quality analog and vector modulation capabilities make these signal generators ideal for research, development and manufacturing applications.

Careful attention to the design of the modulators and the RF system ensures that these signal generators exhibit low levels of adjacent channel power, making them suitable for the most demanding amplifier linearity and receiver selectivity measurements.

The use of IFR fractional N synthesis techniques, combined with fast level control and an electronic attenuator, ensures the 3410 series signal generators are both frequency and level agile for high speed ATE testing.

Operation

A flexible but intuitive user interface based on a touch panel display system ensures that the signal generator meets the needs of unskilled as well as skilled operators. The instrument can be configured to the required mode of operation very simply, with numerical data being entered by the keyboard or via a rotary control. The display shows the primary parameters in a clear and unambiguous format, minimizing the risk of operator error.



RF Output

The 3410 series signal generators provide peak output power of up to +16 dBm. With a level resolution of 0.01 dB, repeatable and accurate testing of wireless components can be performed.

The 3410 series are available with a choice of two attenuator types. The high reliability mechanical attenuator ensures excellent output VSWR and linearity combined with higher output power up to +19 dBm.

The electronic attenuator is ideal for high volume applications where attenuator life is critical. A user defined RF level limit can be entered to ensure that the signal generator cannot provide damaging signal levels when testing less robust components. Careful attention to the level control system guarantees that positive level transients cannot be generated. The fast responding electronic reverse power protection system helps ensure long life and high reliability when testing high power systems.

Spectral Purity

Receiver measurements require good spectral purity from a signal generator. The 3410 series have excellent performance with typically 4.5 Hz residual FM at 1 GHz and a floor noise of typically better than -148 dBc / Hz.

Modulation

Comprehensive modulation facilities are provided for supporting the testing of analog or digital RF systems. A single key press turns the modulation on and off, providing a fast method for signal to noise checking.

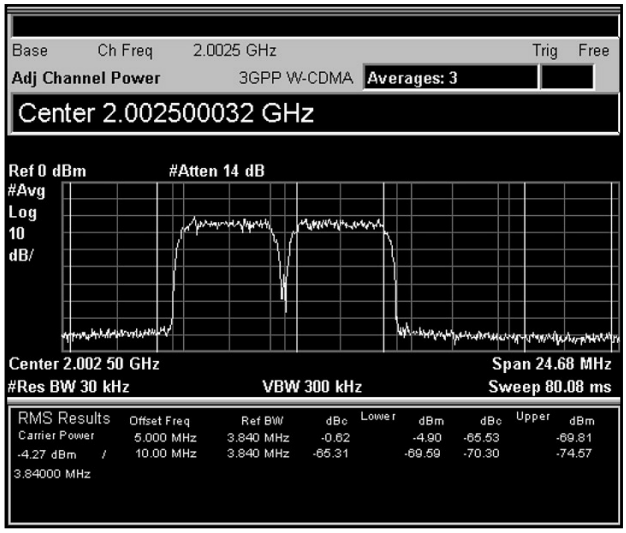
	Int AM1	Int (AM1 + AM2)	Ext AM1	Int FM1	Int (FM1 + FM2)	Ext FM1	Int PM1	Int (PM1 + PM2)	Ext PM1	Internal IQ	External IQ	Pulse	Burst
Int AM1				✓	✓	✓	✓	✓	✓			✓	
Int (AM1 + AM2)				✓		✓	✓		✓			✓	
Ext AM1				✓	✓	✓	✓	✓	✓			✓	
Int FM1	✓	✓	✓									✓	
Int (FM1 + FM2)	✓		✓									✓	
Ext FM1	✓	✓	✓									✓	
Int PM1	✓	✓	✓									✓	
Int (PM1 + PM2)	✓		✓									✓	
Ext PM1	✓	✓	✓									✓	
Internal IQ												✓	✓
External IQ												✓	✓
Pulse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Burst										✓	✓		

Modulation Modes

Vector Modulation

The built-in IQ modulator provides state-of-the-art vector modulated signals with excellent level linearity, low vector error and low noise. With a typical vector bandwidth up to 50 MHz, the modulator is able to support wideband as well as narrow-band wireless standards. Internal calibration systems ensure the modulator performance can be quickly optimized to reduce vector errors and ensure low carrier leak at all operating frequencies.

The linearity of the modulator and the RF output system is reflected in the excellent adjacent channel power when generating multi-carrier non-constant envelope signals such as cellular CDMA and TETRA.



Typical 3GPP 2 carrier test model 1 (64 channels)

Analog Modulation

With typical AM bandwidth to 30 MHz and typical FM bandwidth to 20 MHz, the 3410 series signal generators are ideal tools for testing broadcast systems. The wide bandwidths allow video signals to modulate the carrier with minimal distortion.

The wideband FM facilities allow the generation of fast-swept signals, while the use of an IFR-patented DC FM system ensures that carrier frequency errors when the FM are DC coupled is minimal.

The specifications for AM are maintained to high carrier frequencies to support the use in modern EMC testing applications. The signal generator maintains excellent phase noise performance even when generating wideband modulated signals.

Modulation Oscillator

An internal modulation oscillator is provided which can be used to generate two tones in the frequency range 0.1 Hz to 50 kHz. In addition to sine waves, the modulation oscillator can provide square waves, triangular and sawtooth waveforms for narrow band sweeping.

Digital Modulation

A dual channel arbitrary (ARB) waveform generator is available as an option. Fitted internally this allows the user to select from a library of pre-stored IQ modulator drive waveforms to provide accurately modulated carriers simulating the characteristics of digitally modulated communication systems.

Using a patented technique, the dual channel ARB is able to take waveform files typically four times oversampled and run them through a real time interpolation system to raise the sampling rate

of the file. This ensures the generation of low adjacent channel power and low spectral noise density. The dual channel ARB is suited for the generation of both narrow band and wideband signals, including WCDMA signals, without the use of switched reconstruction filters.

Combining a large ARB memory with the smaller file size required to define a waveform allows the ARB to store up to 180 waveforms. Alternatively the whole of the memory can be devoted to a single file. One such file would store over 1.5 seconds of a 3GPP WCDMA waveform signal. The use of interpolation techniques ensures that when narrow band systems are simulated the waveform generator can still operate at a high sample rate without requiring excessively large amounts of data to be loaded or restricting the repetition time. The library waveforms are structured in a directory form to ease their selection and the optimization of the user's generator. The modulation waveforms can be simply changed by selection from a file list with the changeover between waveforms occurring in a few milliseconds rather than the many seconds required in more traditional waveform generators.

The file name can be determined by the user to convey a useful description of the contents of the file.

The 3410 series are supplied with ***IQCreator***™, a software support package to aid the creation and download of files to the ARB. ***IQCreator***™ is a Windows™ based software utility that enables a user to set up a modulation scheme and then create an ARB file using modulation templates. The resulting file may be saved on a PC or downloaded into the ARB. User-defined configurations can also be saved. Consequently, it is possible to load previously saved setups to regenerate the ARB files quickly and easily. The capabilities of ***IQCreator***™ include:-

Generic Modulation Types:

PSK, FSK, MSK, QAM modulation types

Nyquist, Root Nyquist and Gaussian filters

PRBS, fixed pattern and user defined data sources

IQ errors - residual carrier, IQ imbalance, quadrature offset

Also included are 2G, 2.5G and 3G cellular TDMA and CDMA digital standards along with WLAN and other cordless phone standards. ***IQCreator***™ also allows users to package and download their own I/Q data pair files into the 3410 series.

Pulse Modulator

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

Remote Control

The 3410 series include a fast GPIB system ensuring minimum elapsed time to receive instructions over the bus. Combined with the agile RF hardware this ensures fast and effective operation in ATE applications. Frequency switching speed is typically less than 4 ms and level switching is typically accomplished in under 5 ms. The protocol and syntax of the GPIB commands have been designed in accordance with IEEE 488.2 to simplify program generation. Plug and play drivers are available that include a soft front panel for remote instrument supervision and debug.

Frequency Standard

The 3410 series include a high stability OCXO as standard. The inclusion of a main input power standby mode maintains the oscillator at working temperature while the rest of the instrument is powered down. Time to full specification working is thereby minimized for equipment facilities held on standby.

Size

The 2U rack height ensures the 3410 series occupy minimal space in a manufacturing rack or on the engineer's bench, allowing the provision of more compact test systems. The full rack width ensures easy stacking of instruments while the light weight allows for easy carrying in the laboratory or the field.

SPECIFICATION

CARRIER FREQUENCY

Range

250 kHz - 2 GHz (3412)

250 kHz - 3 GHz (3413)

250 kHz - 4 GHz (3414)

Resolution

1 Hz, accuracy as frequency standard

The carrier output phase can be advanced or retarded in increments of 0.036°.

RF OUTPUT

The RF output is controlled by an ALC system in normal operation. When IQ modulation is enabled alternative control modes are available to optimize the performance of the signal generator.

Range

Electronic Attenuator

≤10 MHz	*-140 to +13 dBm*
≤2 GHz	*-140 to +16 dBm*
≤3 GHz	*-140 to +16 dBm*
≤3.75 GHz	*-140 to +13 dBm*
≤4 GHz	*-140 to +10 dBm*

Mechanical Attenuator

≤10 MHz	*-140 to +16 dBm*
≤2 GHz	*-140 to +19 dBm*
≤3 GHz	*-140 to +16 dBm*

No Attenuator

≤10 MHz	*0 to +21 dBm*
≤2 GHz	*0 to +22 dBm*
≤3 GHz	*0 to +22 dBm*
≤3.75 GHz	*0 to +20 dBm*
≤4 GHz	*0 to +17 dBm*

When AM is selected the maximum RF output is linearly reduced by up to 6 dB depending on the requested AM depth.

Resolution

0.01 dB

RF level units

Units can be set to µV, mV, V EMF or PD; dB relative 1 µV, 1 mV, 1 V EMF or PD; or dBm. Conversion between dB and linear units may be achieved by pressing the appropriate units key (dB or V, mV or µV).

RF Output Accuracy @ 23°C ± 5°C

Electronic Attenuator

RF Optimization Mode		***-127 to -24 dBm***	***>-24 dBm***
LO (Normal)	*≤2 GHz*	*±0.75 dB*	*±0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*
		-110 to -24 dBm	***>-24 dBm***
	≤4 GHz	*±1.25 dB*	*±1.00 dB*
		-127 to -30 dBm	***>-30 dBm***
Low Noise	*≤2 GHz*	*±0.75 dB*	*± 0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*
		-110 to -30 dBm	***>-30 dBm***
	≤4 GHz	*±1.25 dB*	*±1.00 dB*
		-127 to -40 dBm	***>-40 dBm***
Low ACP	*≤2 GHz*	*±0.75 dB*	*±0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*
		-110 to -40 dBm	***>-40 dBm***
	≤4 GHz	*±1.25 dB*	*±1.00 dB*

Mechanical Attenuator

RF Optimization Mode		***-127 to -22 dBm***	***>-22 dBm***
LO (Normal)	*≤2 GHz*	*±0.75 dB*	*± 0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*
		-127 to -28 dBm	***>-28 dBm***
Low Noise	*≤2 GHz*	*±0.75 dB*	*± 0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*
		-127 to -38 dBm	***>-38 dBm***
Low ACP	*≤2 GHz*	*±0.75 dB*	*±0.50 dB*
	≤3 GHz	*±1.00 dB*	*±0.75 dB*

No Attenuator

RF Optimization Mode		***>0 dBm***
LO (Normal)	*≤ 2 GHz*	*±0.50 dB*
Low Noise	*≤ 3 GHz*	*±0.75 dB*
Low ACP	*≤ 4 GHz*	*±1.00 dB*

Level Accuracy with IQ Modulation

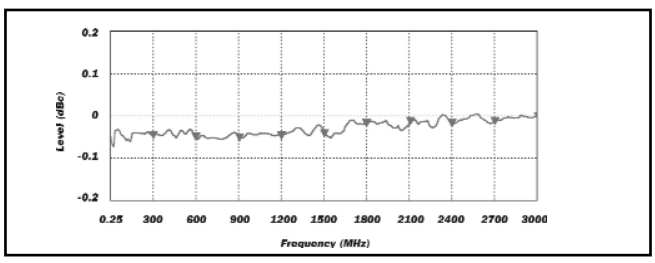
For constant envelope modulation systems: typical standard level error ±0.15 dB

For non-constant envelope modulation systems: typical standard level error ±0.25 dB

Temperature Stability

±0.02 dB/°C

RF Flatness



Typical flatness at 0 dBm

Output VSWR

Electronic attenuator

For output levels <0 dBm	***Frequency***	***Output VSWR***
	≤2 GHz	1.25:1
	≤3 GHz	1.40:1
	≤4 GHz	1.50:1

For output levels >0 dBm VSWR is <1.5:1, ≤4 GHz

Mechanical Attenuator

For output levels <0 dBm	***Frequency***	***Output VSWR***
	≤3 GHz	1.33:1

No attenuator

<1.5:1 VSWR

Attenuator Repeatability

Mechanical attenuator typically 0.1 dB

Output Connector

Front panel 50 Ω type N female to MIL 390123D

Output Protection

Protects the instrument from externally applied RF power (from a 50 Ω source) of 50 W up to 3 GHz and 25 W up to 4 GHz.

The RPP trip may be reset from the front panel or via the remote interface. For safety, the protection is also provided when the instrument is switched off.

SPECTRAL PURITY

All parameters stated at RF level ≤+7 dBm in Low Noise and Low ACP modes

Harmonics

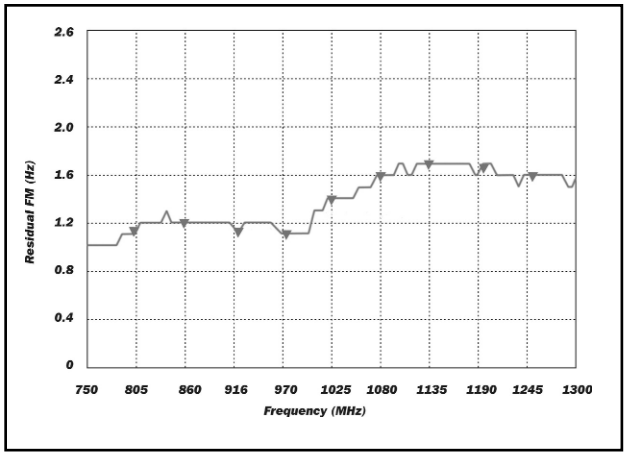
Less than -30 dBc, typically less than -40 dBc.

Sub and Non-Harmonics

For offsets >10 kHz
<-60 dBc for carrier frequencies ≤375 MHz
<-70 dBc for carrier frequencies ≤3 GHz
<-60 dBc for carrier frequencies ≤4 GHz

Residual FM (FM on CW)

<4.5 Hz RMS at 1 GHz in a 300 Hz to 3.4 kHz unweighted bandwidth

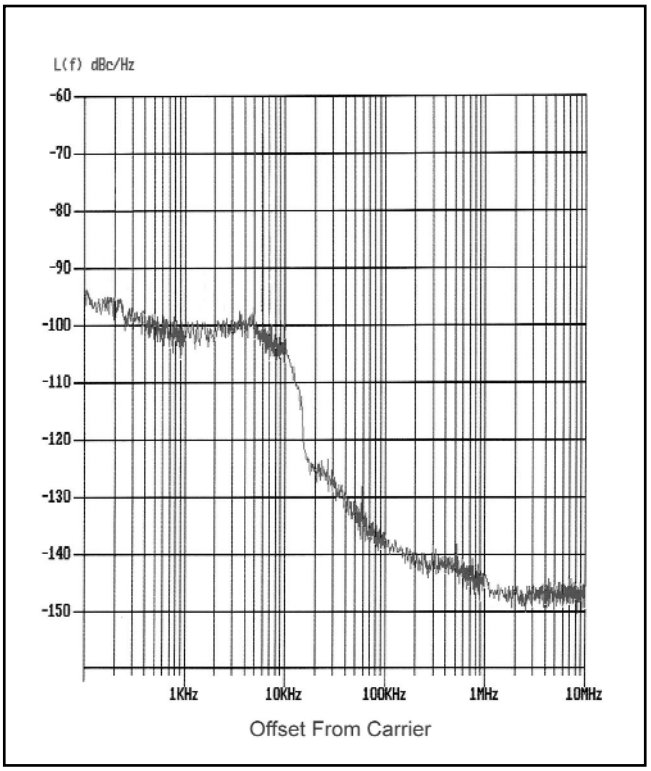


Typical Residual FM

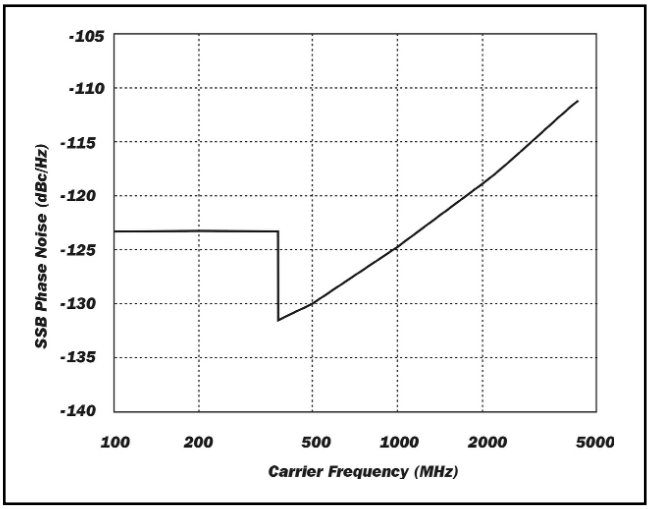
SSB Phase Noise

For 20 kHz offset, Noise Optimized mode

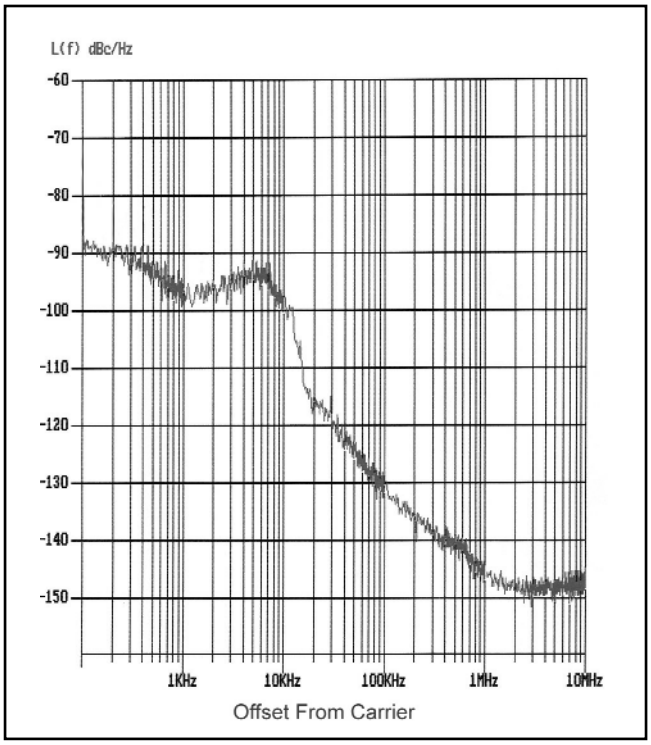
	CW	IQ
≤375 MHz	<-115 dBc/Hz	<-115 dBc/Hz
500 MHz	<-124 dBc/Hz	<-124 dBc/Hz
1 GHz	<-118 dBc/Hz	<-118 dBc/Hz
2 GHz	<-112 dBc/Hz	<-112 dBc/Hz
3 GHz	<-108 dBc/Hz	<-108 dBc/Hz
4 GHz	<-106 dBc/Hz	<-106 dBc/Hz



Typical SSB Phase Noise at 1 GHz



Typical SSB Phase Noise Performance at 20 kHz Offset

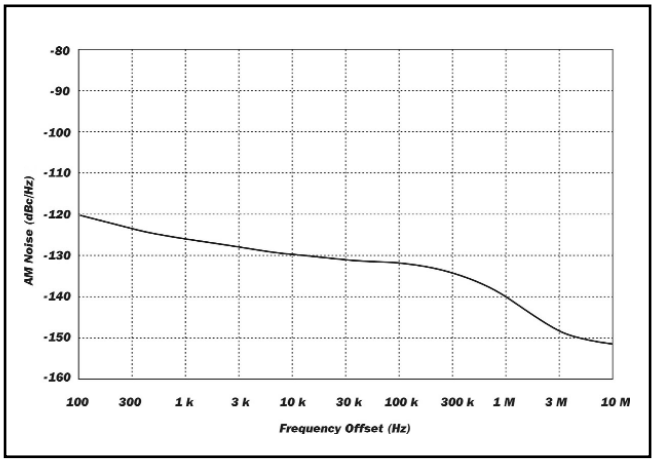


Typical Phase Noise at 2.1 GHz

SSB AM Noise

SSB AM noise at 20 kHz offset (Typical values) measured at levels >0 dBm

Frequency MHz	CW/IQ (dBc/Hz)
≤ 375	-130
500	-130
1000	-130
2000	-130
3000	-130
4000	-125



Typical AM Noise at 1 GHz

RF Leakage

<0.5 µV PD at the carrier frequency into a single turn 25 mm loop 25 mm or more from the case of the signal generator

Wideband Noise

Applicable for carrier frequencies <3 GHz at offsets of (5 MHz <offset <50 MHz) and all levels excluding thermal noise (23°C ±5°C)

Mode	<375 MHz	>375 MHz
LO (Normal)	<-138 dBc/Hz	<-142 dBc/Hz (typ <-148 dBc/Hz)
Low Noise	<-138 dBc/Hz	<-142 dBc/Hz (typ <-148 dBc/Hz)
Low ACP	<-135 dBc/Hz	<-140 dBc/Hz

MODULATION

FM, AM and ΦM can be applied to the carrier using internal or external modulation sources. The internal modulation source is capable of generating two simultaneous signals into any one of the modulation channels. The internal and external modulation sources can be simultaneously enabled in order to produce combined amplitude and frequency (or phase) modulation.

Internal and external IQ modulation can be applied. In this mode, FM, AM and ΦM are not permitted.

Optional Pulse modulation can be used in combination with FM, AM, ΦM and IQ from an external pulse source.

FREQUENCY MODULATION

Peak Deviation

Frequency	Maximum Peak Deviation
250 kHz to 375 MHz	7.5 MHz
375 MHz to 750 MHz	3.75 MHz
750 MHz to 1.5 GHz	7.5 MHz
1.5 GHz to 3 GHz	15 MHz
3 GHz to 4 GHz	30 MHz

Displayed resolution is 4 digits or 1 Hz

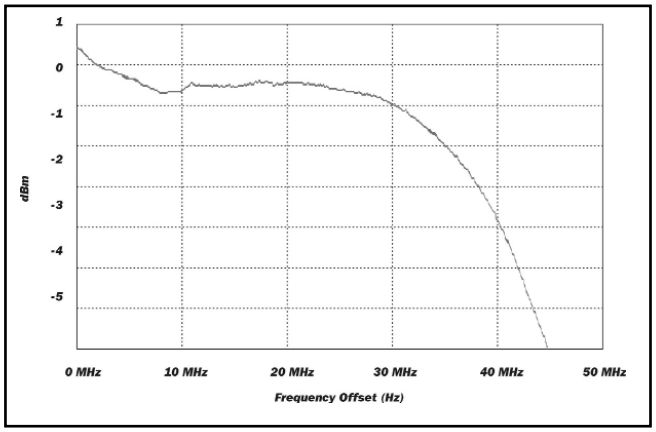
FM Accuracy (at 1 kHz rate)

±4% of set deviation excluding residual FM

FM Bandwidth

1 dB DC to 200 KHz (DC coupled, 100 kΩ)
10 Hz to 200 KHz (AC coupled, 100 kΩ)

3 dB DC to typically 20 MHz (DC or AC coupled, 50 Ω)



Typical FM Bandwidth

Carrier Frequency Offset

For DC coupled FM ±(1 Hz + 0.1% of set deviation) after performing a DCFM null operation

Total Harmonic Distortion

At 1 kHz rate
<0.2% for deviations up to 2% of maximum allowed deviation
<1% for deviations up to 20% of maximum allowed deviation
<3% at maximum deviation

PHASE MODULATION

Phase Deviation

0 to 10 radians
Displayed resolution is 4 digits or 0.01 radians

Accuracy (at 1 kHz rate)

±4% of set deviation excluding residual phase modulation

Bandwidth

0.5 dB 100 Hz to 10 kHz (AC coupled, 100 kΩ)

Total Harmonic Distortion

At 1 kHz rate
<1% at 10 radians deviation
Typically <0.5% at 1 radian deviation

AMPLITUDE MODULATION

Specifications apply for carrier frequencies from 2 MHz up to 2 GHz, usable to 4 GHz.

Modulation Depth

0 to 99.9%, Displayed resolution is 3 digits or 0.1%

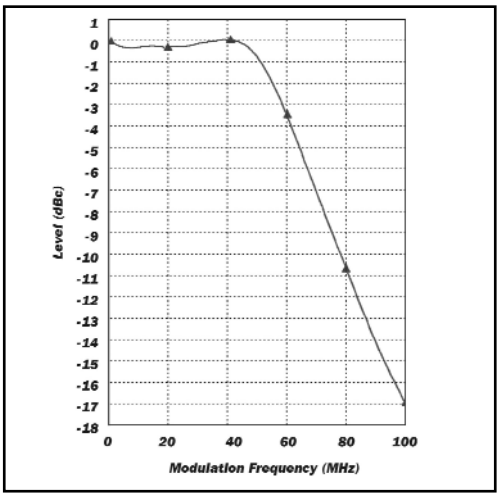
Accuracy at 1 kHz rate

±4% of set depth, ±1% excluding residual AM

AM Bandwidth

1 dB DC to 200 kHz (DC coupled, 100 kΩ)
10 Hz to 200 kHz (AC coupled, 100 kΩ)

3 dB DC to typically 30 MHz (DC or AC coupled, 50 Ω)



Typical AM Bandwidth

Total Harmonic Distortion

For 1 kHz modulation rate
<1% for depths ≤30%
<2% for depths ≤80%

FM on AM

Typically <20 Hz for 30% AM depth at a modulation rate of 1 kHz and carrier frequency of 500 MHz

ΦM on AM

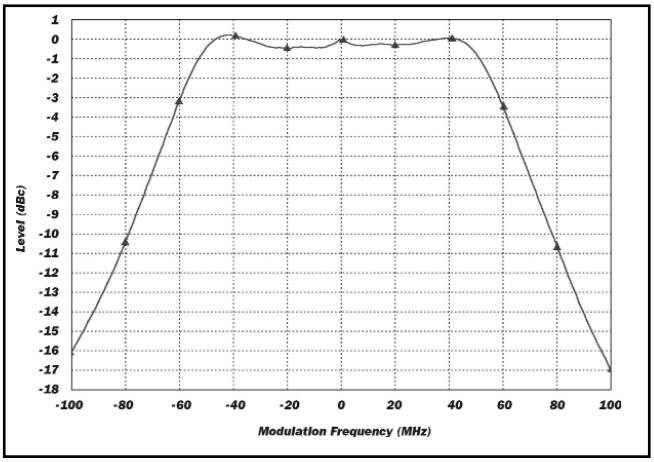
Typically <0.02 radian for 30% AM depth at a modulation rate of 1 kHz and carrier frequency of 500 MHz

IQ MODULATION

IQ inputs

BNC connector inputs, selectable 50 Ω/100 kΩ input impedance

Full scale input $(I^2+Q^2)^{0.5}$ occurs for 0.5 V rms (The level requested is obtained by applying 0.5 DC to either the I or Q input)



Typical IQ Bandwidth

Modulation Bandwidth Relative to DC

At 23°C ± 5°C:-

±0.5 dB for frequencies up to 5 MHz

3 dB:-

Mode	***≤3 GHz***	***>3 GHz***
Low Noise	>35 MHz, 45 MHz typ	>30 MHz, 40 MHz typ
Low ACP	>40 MHz, 50 MHz typ	>35 MHz, 45 MHz typ

DC Vector Accuracy

Relative to full scale (0.5 V RMS), RF level ≤+7 dBm:-

Static Error Vector Magnitude (EVM)	<1% RMS at full scale
Magnitude error	<0.5% RMS at full scale
Phase error	<0.5° RMS at full scale

Residual Carrier Magnitude:-

For 0 V input voltage, relative to full scale

Low Noise	<-45 dBc, typically <-50 dBc
Low ACP	<-40 dBc, typically <-45 dBc

Valid for 12 hours after executing an IQ self-calibration and within ±5°C of the calibration temperature. The instrument displays a warning if the time or temperature limits are exceeded.

Static EVM and phase error measured with residual carrier magnitude removed.

IQ Image Suppression

Typically <-50 dBc @ 10 kHz

Linearity

Adjacent Channel Performance (ACP) for continuous and discontinuous signals at RF output levels ≤0 dBm, over the temperature range 23°C ± 5°C:-

See chart below

	TETRA	***GSM 900 / 1800 / 1900***	***GSM EDGE (Enhanced Data rate for GSM Evolution)***	***IS-95 (CDMAone)***
Frequency Range(s)	130 MHz - 1 GHz	850 MHz - 1 GHz 1700 - 1900 MHz	850 MHz - 1 GHz 1700 - 1900 MHz	824 - 894 MHz 1850 - 2000 MHz
ACP (Continuous & Discontinuous)	*<-70 dBc @ 25 kHz offset* *<-80 dBc* @ 50 kHz offset* *<-80 dBc* @ 75 kHz offset*	*<-35 dBc @ 200 kHz offset* *<-70 dBc @ 400 kHz offset* *<-80 dBc @ 600 kHz offset*	*<-35 dBc @ 200 kHz offset* *<-70 dBc @ 400 kHz offset* *<-80 dBc @ 600 kHz offset*	*<-65 dBc @ 885 kHz offset* *<-75 dBc @ 1.25 MHz offset* *<-80 dBc @ 1.98 MHz offset*

	WCDMA (UMTS)	***NADC (IS - 54, IS - 136)***	***JDC/PDC***	***PHP/PHS***
Frequency Range(s)	1855 - 2200 MHz	824 - 894 MHz 1850 - 2000 MHz	810 - 826 MHz 940 - 956 MHz 1429 - 1513 MHz	1895 - 1918 MHz
ACP (Continuous & Discontinuous)	<-65 dBc @ 5 MHz offset <-68 dBc @ 5 MHz offset	<-40 dBc @ 30 kHz offset <-78 dBc* @ 60 kHz offset <-80 dBc* @ 90 kHz offset	<-65 dBc @ 50 kHz offset <-80 dBc* @ 100 kHz offset	<-75 dBc @ 600 kHz offset <-80 dBc @ 900 kHz offset

* denotes typical value

RF BURST CONTROL

A digital control bit is used to generate an analog ramp (up or down) of the RF output. The Burst Gate control signal can either be generated internally as part of the optional internal base-band source, or provided externally by the user on the rear panel connector. When internally generated, the Burst Gate control signal appears on the rear panel auxiliary connector that then serves as an output.

On/Off Ratio

For the temperature range 23°C ± 5°C
>80 dB for carriers ≤3 GHz
>70 dB for carriers >3 GHz

Ramp Profile

Rise and fall time after the L-H and H-L transitions of the burst control bit respectively, can be defined by the user from 10 µs to 999 µs in 0.1 µs steps.

Burst Gate control input is a TTL level (HCT), 50 Ω impedance BNC input on the rear panel.

RF ramp can be adjusted in time by ±50 µs in increments of 0.1 µs with respect to the trigger event.

RF BURST ATTENUATION CONTROL

A digital attenuation control bit (in conjunction with the ramp control bit) is used to decrease the RF level from the set level to an alternative level during burst modulation. The Burst Attenuation Trigger signal can be provided internally as part of the optional dual arbitrary waveform generator (ARB), or externally on a rear panel connector. When internally generated, the Burst Attenuation Trigger control signal appears on the rear panel auxiliary connector that then serves as an output.

Attenuation range available is 0 to 70 dB.

Additional level error <0.5 dB.

Burst Attenuation Trigger control is a TTL level (HCT), 50 Ω impedance signal available on the rear panel Auxiliary connector.

RF burst attenuation requires Electronic Attenuator Opt 003.

INTERNAL MODULATION OSCILLATOR

The internal modulation source is capable of generating up to two simultaneous signals into any one of the modulation systems.

Frequency Range

0.1 Hz to 50 kHz with 0.1 Hz or 5 digits of resolution

Accuracy

As frequency standard

Distortion

<0.1 % for a sine wave at 1 kHz

In addition to a sine wave the following waveforms can be generated:

Triangle 0.1 Hz to 10 kHz

Ramp 0.1 Hz to 10 kHz

Square 0.1 Hz to 5 kHz

(Note: modulation frequency can be set to 50 kHz irrespective of waveform type)

Modulation source signals are available on the rear panel I/AM OUT and Q/FM OUT at a level 1 Vrms from 50 Ω source impedance.

EXTERNAL MODULATION SOURCE

External inputs are available with a selectable input impedance of 50 Ω or 100 kΩ (default setting), AC or DC coupled.

Apply 1 V RMS (default) or 1 V peak for the set modulation.

A HI/LO indicator when the applied signal is greater than ±6% from nominal

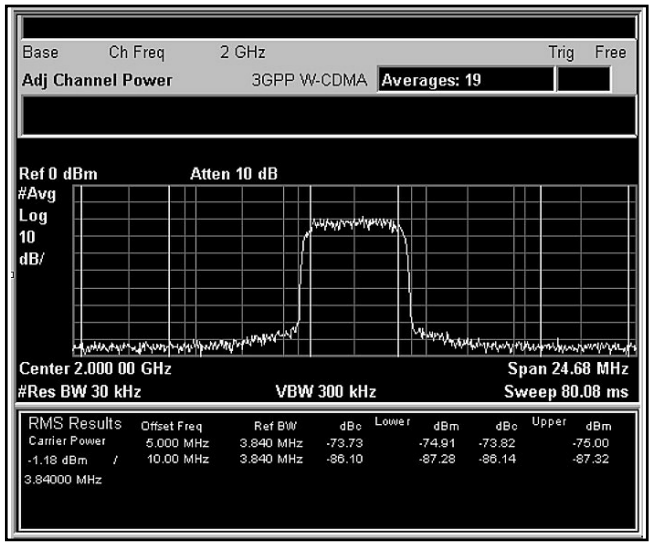
External AM is input to EXT I/EXT AM front panel BNC connector.

External FM is input to EXT Q/EXT FM front panel BNC connector.

INTERNAL DUAL CHANNEL ARB SOURCE (OPTION 005)

A high performance Dual Arbitrary (ARB) Waveform Generator that provides IQ signals for the IQ modulator

The ARB enables files to be downloaded with sample rates from 17 kHz to 66 MHz. The ARB uses an interpolation system to increase the digital to analog converter sample rate and avoid the use of re-construction filters.



Typical 3GPP test model 1 (64 channels)

ARB CHARACTERISTICS

Flash Memory Size

23,592,960 sample pairs

Maximum Number of Files

180

Sample Format

32 bits of data - 14 bits I, 14 bits Q, 3 associated marker bits

Sample Rate Tuning

± 20 ppm, 0.1 ppm step resolution

D-A Converter Resolution

14 bits

D-A Sample Rate

44 to 66 Msamples/s

Interpolation Factor

Automatically selected

Reconstruction Filter Stop Band Attenuation

>70 dB

ARB Spectral Purity

Spurious free dynamic range	>70 dB, typically >80 dB
20 kHz offset phase noise	<-120 dBc/Hz
Floor noise	<-140 dBc/Hz

IQCreator ™ *Windows based software package is provided for the creation, formatting and downloading of ARB waveform files to the signal generator.*

A waveform library is provided on a CD containing a selection of files for testing 2G, 2.5G and 3G systems. Files can be downloaded from www.ifrsys.com.

Marker Control Bits

Up to 3 marker bits (1-3) can be attached to each sample of IQ data. These can be used to indicate significant points in the waveform and are available as outputs via the rear panel Aux IN/OUT connector. Marker bit 1 can be used as RF Burst Control signal. Marker bit 2 can be used as Burst Attenuation Trigger signal to decrease (attenuate) the RF level from its nominal value.

Waveform Switching Time

Time to change between files with different sampling rates: <5 ms

Control Mode

Continuous, single or triggered operation of the ARB

An external trigger input signal is available on the AUX IN/OUT rear panel connector.

IQ Outputs

The IQ signals produced by the ARB are available on the rear panel I/AM OUT and Q/FM OUT BNC connectors. Output level is 1 Vrms EMF from a source impedance of 50 Ω.

SWEEP FACILITY

Provides a digital sweep of RF frequency or RF level in discrete steps

Start, stop, step size, number of steps and step time can be controlled. Step time may be set from 2.5 ms to 10 s with 0.1 ms resolution. (20 ms for mechanical attenuator opt 2)

The sweep can be set to be continuous, single or externally triggered from the rear panel.

Frequency Sweep

Linear step size: 1 Hz minimum step

Logarithmic: 0.01% to 50%, 0.01% step

Level Sweep

0.01 dB minimum step

FAST PULSE MODULATOR

Pulse modulator Option 006 requires Electronic Attenuator Option 003 to be fitted.

ON/Off Ratio

>80 dB for carrier levels ≥ -60 dBm

Rise/Fall time

<20 ns typical (10 to 90%)

Pulse Delay

Typically <50 ns

RF level accuracy standard level error ±0.2 dB

Video Breakthrough

LO	*<±50 mV for RF levels >+10 dBm*
(Normal)	*<±25 mV for RF levels in the range -10 dBm to +10 dBm*
	<±10 mV for RF levels ≤-10 dBm
Low	*<±50 mV for RF levels >+4 dBm*
Noise	*<±25 mV for RF levels in the range -16 dBm to +4 dBm*
	<±10 mV for RF levels ≤-16 dBm
Low	*<±50 mV for RF levels >-6 dBm*
ACP	*<±25 mV for RF levels in the range -26 dBm to -6 dBm*
	<±10 mV for RF levels ≤-26 dBm

Modulation Source

PULSE IN BNC (female) connector rear panel

Input Impedance

50 Ω

Input Level

TTL level (HCT)

Control Voltage

A HCT logic 0 (0 V to 0.8 V) turns the carrier OFF
A HCT logic 1 (2 V to 5 V) turns the carrier ON

Max. Safe Input Level

±10 V

NON-VOLATILE MEMORY STORES

Full instrument configurations can be saved to 100 memory stores (0 - 99)

FREQUENCY STANDARD

10 MHz OCXO fitted as standard

Ageing Rate

<±0.8 x 10^{-7} per year after 30 days continuous use

Temperature Coefficient

<±5 x 10^{-8} over the temperature range 0°C to 50°C

Output Frequency

Within 2 x 10^{-7} of final frequency after 10 minutes from connecting supply power and switching on at a temperature of 20°C

Standby power is provided while the instrument is off but connected to the supply.

Output of 2 V pk-pk from 50 Ω is provided on a rear panel BNC connector.

EXTERNAL STANDARD INPUT

1 MHz or 10 MHz at a level of 300 mV RMS to 1.8 V RMS into 1 kΩ on the rear panel BNC connector

REAR PANEL OUTPUTS OPTION 007

With this option fitted RF output, EXT I/EXT AM input and EXT Q/EXT FM input connectors are transferred to the rear panel. The standard signal generator specification remains unaltered.

GENERAL

WARRANTY

2 years with options for 3, 4 and 5 years

CALIBRATION INTERVAL

Recommended at 2 years

REMOTE CONTROL INTERFACES

RS-232

All functions except the supply switch are remotely programmable.

Can be used for upgrading the firmware without removal of the instrument covers.

GPIB

All signal generator parameters except the supply switch are remotely programmable.

The GPIB is designed in accordance with the IEEE 488.2.

Interface Functions

SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2

SETTLING TIME

After receipt of the GPIB interface deliminator (terminator)

Frequency

Typically <5 ms

RF Level

In CW operation or with constant envelope modulation applied, the RF Level is typically set to within 0.1 dB of the specified value in <5 ms. With non-constant envelope modulation applied, the RF Level is typically set to within 0.1 dB in <10 ms. Electronic attenuator, Option 003 is assumed in both cases.

DIMENSIONS AND WEIGHT

	Height	Width	Depth
Overall	107 mm	468 mm (19")	510 mm
Rackmount *	89 mm	425 mm	520 mm

* Occupies 2U of rack height excluding feet

Weight

10.5 kg

RATED RANGE OF USE

MIL-T-28800E Class 5

Temperature

0 to 50°C

Humidity

45%, 0°C to 50°C

95%, 30°C to 40°C

Altitude

700 mbars (3050 m, 10,000 feet)

CONDITIONS OF STORAGE AND TRANSPORT

MIL-T-28800E Class 5
Temperature -40°C to +71°C
Altitude 570 mbar (4570 m, 15,000 feet)

POWER REQUIREMENTS

AC Supply

90 to 132 V or 188 to 264 V, 47 to 63 Hz

185 VA max

ELECTROMAGNETIC COMPATIBILITY

Conforms to EC directives 89/336/EEC and standard IEC/EN 61326-1:1997;RF emission class B, immunity table 1 and performance criterion B

SAFETY

Conforms to EC directives 72/23/EEC and standard IEC/EN 61010-1 for class 1 portable equipment for use in pollution degree 2 environment. The instrument is designed to operate from an installation category 2 supply.

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers	Versions
3412	250 kHz to 2 GHz Digital RF Signal Generator
3413	250 kHz to 3 GHz Digital RF Signal Generator
3414	250 kHz to 4 GHz Digital RF Signal Generator

Supplied with AC power supply lead and CD-ROM containing:

- Operating Manual
- Data Sheet
- Factory Test Results (for the unit supplied) and Certificate of Calibration
- ***IQCreator***™ ARB data file creation and download software
- VISA Plug 'n' Play driver software
- Performance Verification Software
- Library of common data files for dual ARB option

Attenuator Options

3410 must be ordered with one of the following attenuator options. Refer to main specification for details

Option 001	No attenuator
Option 002	Mechanical attenuator (Not available on 3414)
Option 003	Electronic attenuator

Further Options

Option 005	ARB waveform generator
Option 006	Pulse Modulation (Requires Option 003)
Option 007	Rear panel outputs
Option 020	2G CDMA software licence
Option 021	3G CDMA software licence

Warranty Options

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

Optional Accessories

46882/499	Operating manual (paper format)
46880/103	Service manual (includes semi-automatic diagnostic and adjustment software)
43129/189	1.5 m GPIB lead
46662/745	Soft carry case
46884/650	RS-232 cable, 9 way female to female, 1.5 m
46884/649	RS-232 cable, 9 way to 25 way female, 1.5 m
46885/138	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

IFR - "Working together to create solutions for the world of communications."

IFR is a world leader in developing leading edge test and measurement equipment. The priority at IFR is to understand your communications test needs and respond to them. IFR has the flexibility and expertise to create just the right test solution for you. We understand that just as you are the expert in designing wireless products, we are expert in wireless test.

Combining the quality of our test products with their reliability, excellent price/performance ratio and minimal requirements for maintenance, every IFR test system represents an outstanding lifetime value.

IFR - "Working together with our customers to be flexible and innovative in providing effective test solutions for the rapid design, manufacture and maintenance of communications systems."

The added value IFR includes with each and every test set we sell will make you more productive. We offer a two-year standard warranty on all products and we will continue to support your product for five years beyond its final production. Our outstanding Customer Service Department offers calibration, out-of warranty repairs and consulting. Our Sales and Training Departments offer clear and concise product information with realistic performance specifications, technology training and application training. Our experienced engineers will help you develop application software and through continuous improvement programs, upgrades are always available.

IFR will continue to build upon our technology resources with an aggressive commitment that will enable you to excel in some of the world's most dynamic, high growth markets.

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