

**An economic way of upgrading an analog signal generator to a vector modulated signal generator, the 2029 offers a high performance solution for 2G, 2.5G and 3G radio systems.**



- **Converts an analog signal generator to a vector signal generator**
- **Wideband modulator supports new digital cellular systems**
- **High capacity internal ARB**
- **14 bit high sample rate D-A converter minimizes noise levels**
- **Fast waveform selection minimizes test time**
- **Excellent RF accuracy maximizes manufacturing yield**
- **Excellent ACP characteristics for amplifier and receiver measurements**

The 2029 Vector Modulator covers the frequency range 800 MHz to 2.51 GHz providing a vector modulated signal from an external local oscillator. The instrument can be used with a wide variety of signal generators to generate 2G, 2.5G and 3G digital cellular signals. Suitable signal generators for use with the 2029 include the IFR 2023/5 family and the 2030 and 2040 series.

The modulator includes an RF level control system to allow the output to be varied over a wide level range, ensuring it is suitable for measuring receiver performance. Careful attention to the control system and attenuator ensures excellent RF level accuracy which minimizes uncertainty and maximizes repeatability and yield in manufacturing.

The 2029 is an cost effective test solution for new and existing production lines for cellular devices, and is a particularly effective solution for board level testing of receiver sections.

#### **Modulation**

The IQ modulator provides excellent IQ accuracy with wide bandwidth to allow the accurate simulation of a variety of digital cellular signals. The excellent linearity of the modulator and RF system ensures the RF output has outstanding low adjacent channel power to enable high performance amplifiers to be tested for linearity and receivers to be measured for selectivity.

#### **ARB**

The innovative internal ARB can be loaded with customer defined waveforms to generate 2G, 2.5G or 3G modulated carriers.

The large memory size combined with the use of interpolation techniques allows the 2029 to generate long test sequences. For IS-95 signals the ARB can store 15 sequences, each capable of running 80 ms of IS-95 waveforms. Alternatively the files can be merged together to form longer sequences, if necessary taking up all 15 blocks.

The interpolator scheme ensures that the size of the source file for the ARB is minimized at the same time as preserving the quality of the ARB output signal. The use of a high sampling rate from the ARB, combined with the use of 14 bit converter technology, minimizes broadband noise and spurious signals.

The use of a non-volatile storage system to drive the ARB ensures that delays when changing between waveforms are minimized, thus reducing test times and manufacturing costs.

## Source files

The 2029 is supplied with a library of source files representative of modern digital cellular signals. Tools are provided to allow the importation of files from industry standard tools such as MathCad™ and Matlab™, or you can contact IFR to supply files to suit your application.

## Remote control

The 2029 is controlled via the GPIB and a soft front panel is provided to allow easy manual control.

Entering the operating frequency of the modulator ensures that calibration data optimizes the RF output accuracy.

## Specification

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### General Characteristics

#### Frequency range

800 MHz to 2.51 GHz

#### External Source Level

+7 dBm  $\pm$ 2 dB from an external generator connected to a Type N connector on the front panel

### RF Output

#### Level

0 dBm to -138 dBm for signals with 14 dB crest factor (+14 dBm Peak Envelope Power)

#### Connector

Type N on rear panel

#### RF output resolution

0.01 dB

#### RF level accuracy (CW)

$\pm$ 0.5 dB from 18°C to 28°C for CW signal levels greater than -110 dBm

#### RF level accuracy (modulated)

Typically  $\pm$ 0.15 dB level change from a CW signal level with IS-95 modulation multichannel signal applied, with 14.5 dB crest factor, from the internal arbitrary waveform generator.

#### Output VSWR

<1.2:1

#### Damage level

>+30 dBm damage level applied to the RF output connector  
>+27 dBm damage level applied to the LO input connector

#### Frequency standard

TCXO 10 MHz reference. Temperature stability better than  $\pm$ 7 in  $10^7$ , ageing rate less than  $\pm$ 1 in  $10^6$ /year.

External 10 MHz input on rear panel provided for phase locking the internal standard to an external reference of 300 mV to 1.8 VRMS

### Spectrual Purity

Specification excludes contribution from external LO

#### Harmonics

<-30 dBc, typically -40 dBc

#### Spurious

includes ARB clock, excludes ARB file content.

<-70 dBc

#### Noise floor

Typically -135 dBc/Hz from 800 MHz to 2.0 GHz when modulated with an ARB file having a crest factor of 14 dB, (to 2.51 GHz with 10 dB crest factor)

#### ACP

Typically -70 dBc for an IS-95 pilot channel file, optimized for ACP with a crest factor of 5.5 dB

### IQ Modulator

#### Origin offset (+13°C to +33°C)

-50 dBc, typically <-60 dBc (relative to peak)

#### Image suppression

Typically <-50 dBc

### Arbitrary Waveform Generator

#### D/A converter

14 bits

#### D/A sampling rate

44 to 66 Msamples/s

#### Bandwidth (1 dB)

DC to 10 MHz typical, including IQ modulator and ARB equivalent to 20 MHz of RF spectrum

#### Reconstruction filter cut off

9.5 MHz (internally digitally compensated for)

#### ARB file sampling rate

3.67 Msamples/s to 66 Msamples/s.

#### Total number of ARB samples

5.89824 Msamples of IQ pairs stored in non-volatile memory.

#### ARB samples per waveform

50 samples to 5.89824 Msamples

#### Oversampling ratio

4 times per symbol minimum

#### ARB file organization

15 blocks of 393 216 samples

#### Interpolator

The ARB includes an interpolator to increase the sample rate of the ARB file by factors of 1, 2, 3, 4, 6, 8 or 12. Increases the sample rate at the D/A converter to its specified range.

## Software

### Soft front panel

A soft front panel is supplied. Requires Windows 95/98/NT and a National Instruments GPIB card or equivalent.

### Loader

Provides facility for loading files into 2029

### Packager

Provides a facility for packaging files into a form suitable for loading into 2029

### Waveform library

Contains a selection of waveforms for testing 2G, 2.5G and 3G radio systems

Other waveforms can be supplied

## External Interfaces

### GPIB

GPIB for instrument configuration and control, including importation of ARB files, designed in accordance with IEEE488.1.

Uses rear-panel address switch.

### RS-232

RS-232 for downloading firmware and software upgrades into the instrument.

Default settings: 115 200 baud, 8 data bits, 1 stop bit, no parity.

Connector 9-way D-type, male.

## General

### Electromagnetic compatibility

Conforms with the protection requirements of EEC Council Directive 89/336/EEC.

Conforms with the limits specified in the following standards:

IEC/EN61326-1 : 1997, RF Emission Class B, Immunity Table 1, Performance Criteria B.

### Safety

Conforms with the requirements of EEC council Directive 73/23/EEC and Standard IEC/EN 61010-1 : 1993

## RATED RANGE OF USE (OVER WHICH FULL SPECIFICATION IS MET)

### Temperature

0 to 55°C (32 to 131°F)

### Humidity

Up to 93% at 40°C (104°F)

### Power supply

100 to 240 V AC (90 to 264 V AC absolute)

50 to 60 Hz (45 to 63 Hz absolute), 100 VA max.

### Calibration Interval

2 years recommended

## Dimensions and Weight

Occupies 2U of track height excluding feet

Height	Width	Depth	Weight
107 mm	419 mm	520 mm	<10 kg

height include feet, depth excludes handle.

## Options

### OPTION 1 - RF combiner

Adds a combiner, allowing the RF OUT to be combined with two further signals or used for connection to external measuring instruments.

### Connectors

RF IN: SMA on rear panel, linked to RF OUT.

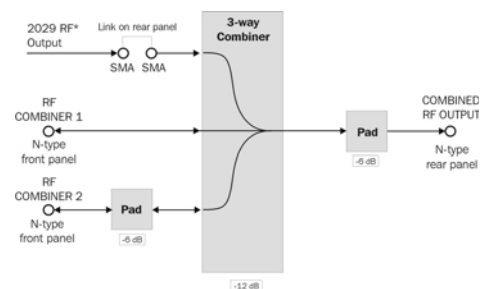
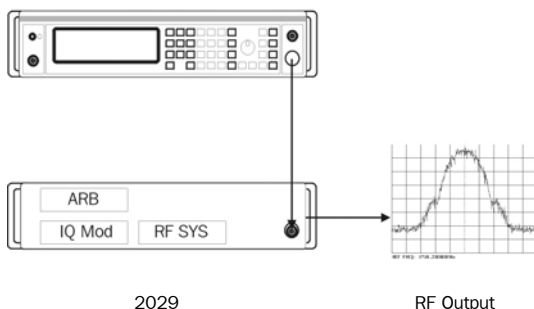
RF COMBINER 1 and 2 are inputs: type N on front panel.

COMBINED RF OUTPUT: type N on rear panel.

### Path loss

Typically 19 dB from RF OUT to COMBINER I/O. Typically 19 dB from COMBINER PORT 1 to COMBINER RF O/P.

Typically 25 dB from COMBINER PORT 2 to COMBINER RF O/P.



### Optional combiner system

\* RF OUT routed to N Type rear panel connector when Option 1 not fitted.

## Versions and Accessories

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When ordering please quote full ordering number information

### Ordering Numbers

#### Versions

2029 800 MHz to 2.51 GHz Vector Modulator.

#### Options

Option 1 RF Combiner

### Supplied Accessories

AC supply lead

46886/006 2029 CD-ROM resource including operating manual, soft front panel, loader and packager. Also includes sample waveform files.

### Optional Accessories

46882/440 Operating manual (paper version)

54351/022 Interconnection cable, LO-to-2029  
0.5 m Type N to N RF lead for LO to 2029 connection

43129/189 GPIB lead assembly, 1.5 m (5 ft)

46884/649 RS-232 cable, 9-way female to 25-way female, 1.5 m (5 ft)

46884/650 RS-232 cable, 9-way female to 9-way female, 1.5 m (5 ft)

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