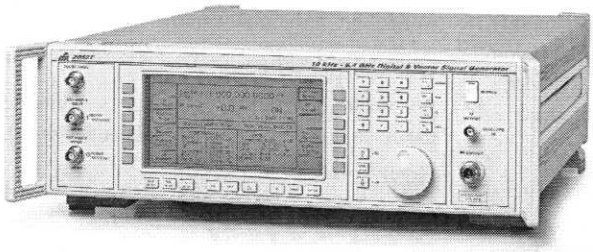
Signal Sources

2050 Series Digital & Vector Signal Generator

AEROFLEX
A passion for performance.



Designed to meet the needs of modern digital radio technologies up to 5.4 GHz

- PSK, FSK, QAM, GMSK
- I and Q modulation to 10 MHz (1 dB bw.)
- External digital data input
- Internal PRBS data source
- Excellent accuracy and stability
- Envelope control for RF bursts
- Programmable channel filter characteristics
- Variable data rate control
- NADC, PDC, GSM, TETRA plus others
- Wide band DCFM for fast FSK
- Baseband I & Q outputs
- Electronic attenuator option

The 2050 series of digital and vector signal generators covers the frequency range 10 kHz to 1.35 GHz (2050), 10 kHz to 2.7 GHz (2051) and 10 kHz to 5.4 GHz (2052). These instruments are suitable for a wide range of applications including the testing of new digital communication systems.

Modulation Capability

The 2050 combines comprehensive analog modes, AM, FM, PM and Pulse (optional), with I Q vector modulation. A digital mode using internal DSP (digital signal processing) is provided to convert digital data into complex modulation formats as shown in the following table.

FSK	2 and 4 level
GMSK	
PSK	2, 4 and 8 level
DPSK (Differential)	2, 4 and 8 level
Phase Offset DPSK	2, 4 and 8 level
Time Offset PSK	4 level
QAM	4, 16, 64 and 256 level

Two FM modes are available, wideband FM (>10 MHz) for fast FSK or video applications and a 1 MHz bandwidth mode. Both modes offer FM deviations up to 1% of carrier frequency. FM is available as either DC or AC coupled. A patented FM nulling correction system eliminates carrier frequency offsets that occur with lesser generators when using DCFM, and allows the 2050 to be used confidently with Wireless LAN or paging equipment such as POCSAG, FLEX™ and ERMES.

Vector Modulation

In Vector mode the signal generator accepts I and Q modulation inputs with 10 MHz, 1 dB bandwidth. This precision modulator enables any modulation characteristic to be simulated with a high degree of accuracy, typical vector errors of less than 0.5% are possible. The excellent temperature stability and drift characteristics of the modulator ensure calibrated signals are always available making this the ideal choice for demanding research and development applications as well as in manufacturing of digital communications systems.

The wide IQ bandwidth allows the generation of Direct Sequence Spread Spectrum signals as used in CDMA as well as QAM and OFDM signals as used in new broadcasting formats such as DAB (Digital Audio Broadcast).

Precision radar Chirp signals can be simulated in conjunction with an Arbitrary Waveform Generator to test radar receivers.

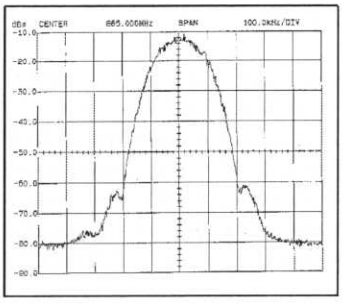
Digital Modulation

In digital mode, the signal generator is able to produce a wide array of digital modulation types and in each case the user is free to modify the data rate and filter characteristics to suit individual application needs. This level of control and flexibility means that the 2050 series is fully prepared today for the digital formats of tomorrow's narrow band digital radio communications equipment.

For common standards, the 2050 is already pre-programmed to generate the required modulation format from a single key press and so aid ease of use. Proprietary schemes can be created and stored into non volatile user memories.

Mod Type	System
π/4 DQPSK	NADC (DAMPS), PDC (JDC), TETRA, TFTS, APCO25
GMSK	GSM, Mobitex, CDPD, MC9, DSRR, MD24-192N/W, Modacom
OQPSK	Inmarsat M
FSK	POCSAG, CITYRUF
4FSK	ERMES, APCO25
8DPSK	VDR (VDL)

Data rates up to 34 ksymbols/sec can either be generated internally from a pseudo random sequence generator or supplied externally as a serial or parallel data stream into a flexible digital interface. A burst control input allows TDMA or TDD bursts to be generated synchronously with the data. A separate analog envelope control input allows linear control of the RF level to simulate bursted modulation conforming to power time template and adjacent channel spectrum requirements.



In digital mode the user can introduce defined errors to the modulation as skew, gain imbalance and carrier leakage, and so aid investigation of design limitations.

Fading Simulation

The built-in Rician and Rayleigh fading simulator with programmable path ratio and Doppler speed allows testing of receivers under 'real life' propagation conditions in which receivers must operate. The availability of fading simulation at the early design stages of new communications equipment simplifies the development of more robust designs and reduces the time taken for full compliance testing.

Software Assisted Calibration

All calibration and re-alignment procedures can be carried out without removal of the instrument covers and can be performed either manually or automatically via the GPIB. No internal adjustments are necessary; even the frequency standard is adjusted via the front panel or GPIB. During manual alignment full instructions are given on the instrument display. In digital and vector modes a self calibration system optimizes the performance of the vector modulator; a warning is displayed when environmental changes or elapsed time warrant a re-calibration of the modulator.

Electronic Attenuator

An electronic attenuator option is available to meet demanding extended life requirements for repetitive switching, found in high volume production applications.

SPECIFICATION

GENERAL DESCRIPTION

2050 series signal generators have a large screen dot matrix display with softkey function selection which allows flexibility of operation. Hardkey and data entry key together with a rotary control knob are also provided. The output may be modulated using ΦM, FM, AM, IQ vector or complex digital modulation. Pulse modulation is optional.

CARRIER FREQUENCY

Range

10 kHz to 1.35 GHz (2050)
10 kHz to 2.7 GHz (2051)
10 kHz to 5.4 GHz (2052)

In digital and vector modes the lowest frequency is 10 MHz and for 2052 the highest frequency is reduced to 2.7 GHz.

Selection

By keyboard entry of data. Variation by up/down keys and by rotary control.

Indication

11 digits with annunciators.

Resolution

0.1 Hz.

Accuracy

As frequency standard.

Phase incrementing

The carrier phase can be advanced or retarded in steps of 1.5° using the rotary control.

RF OUTPUT

Range (Analog mode)

–144 dBm to +13 dBm
Max guaranteed output above 2.7 GHz is +11 dBm.

With AM selected, the maximum output level reduces linearly with AM depth to +7 dBm at maximum AM depth.

Range (Digital or Vector mode)

–138 to +6 dBm peak envelope power.
RF level is defined with a PRBS modulation applied in digital mode or with 0.5 V applied to either the I or Q input in vector mode.

Selectable Overrange Mode

Uncalibrated levels up to +19 dBm.

Selectable Extended Hysterisis

Uncalibrated RF level control over a range of 24 dB (maximum) without level interruption.

Selection

By keyboard entry of data. Variation by ⇧⇩ keys and by rotary control. Units may be µV, mV, V, EMF or PD; dB relative to 1 µV, 1 mV, EMF or PD; dBm.

Indication

4 digits with unit annunciators.

Resolution

0.1 dB.

Accuracy

At 22°C ±5°C in non Digital or Vector modes:

	<1.35 GHz	<2.7 GHz	<5.4 GHz
>0 dBm	±0.5 dB	±0.7 dB	±1 dB
>–100 dBm	±0.85 dB	±1 dB	±1.5 dB
>–127 dBm	±0.85 dB	±1 dB	–
Temperature stability dB/°C	0.005	0.01	0.02

In Digital or Vector Mode (Auto IF Selection)

At a temperature of 22°C ±5°C

<2 GHz	±1.5 dB
<2.7 GHz	±2 dB

Temperature coefficient : <0.04 dB/°C

OUTPUT VSWR

For output levels less than 0 dBm:

<2.2 GHz	<1.25:1 (19.1 dB return loss)
<2.7 GHz	<1.4:1 (15.6 dB return loss)
<5.4 GHz	<1.5:1 (14 dB return loss)

SPECTRAL PURITY

At RF levels up to +7 dBm in CW and analog modulation modes:

Harmonics	≤1 GHz	1 GHz to 1.35 GHz	>1.35 GHz
2050 & 2051	<-30 dBc	<-27 dBc	<-27 dBc
2052	<-30 dBc	<-27 dBc	<-25 dBc

Sub-Harmonics

< –90 dBc to 1.35 GHz, < -40 dBc to 2.3 GHz, < –30 dBc to 5.4 GHz.

Non-Harmonics

< –70 dBc at offsets from the carrier frequency of 3 kHz or greater.

Residual FM

Less than 7 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at 470 MHz.

SSB phase noise

Less than –116 dBc/Hz (typically –122 dBc/Hz) at an offset of 20 kHz from a carrier frequency of 470 MHz.

RF Leakage

Less than 0.5 µV PD at the carrier frequency in a two turn 25 mm loop, 25 mm or more from any part of the case.

FM on AM

Typically less than 100 Hz for 30% AM depth at a modulation frequency of 1 kHz and a carrier frequency of 500 MHz.

ΦM on AM

Typically less than 0.1 radians at a carrier frequency of 500 MHz for 30% AM depth for modulation rates up to 10 kHz.

In digital and vector modes of operation:

Modulation is generated by converting a 120 MHz, 132 MHz, 160 MHz or 176 MHz intermediate frequency (IF) to the required carrier frequency.

Additional signals are present at the local oscillator frequency, image frequency and frequencies equivalent to the harmonics of the IF mixed with the local oscillator.

Phase noise

In vector mode: As analog modulation and CW modes.

In digital mode: As analog modulation modes for offsets >100 kHz; <–108 dBc/Hz at 20 kHz offset from a 1 GHz carrier.

MODULATION MODES

Six modulation modes are available:

Single

FM, Wideband FM, ΦM, AM or pulse (optional).

Dual

Two independent channels of differing modulation type (e.g. AM with FM).

Composite

Two independent channels of the same modulation type (e.g. FM1 with FM2).

Dual composite

A combination of Dual and Composite modes providing four independent channels (e.g. AM1 with AM2 and FM1 with FM2).

Vector

Provides IQ modulation facility.

Digital

Accepts digital inputs and converts the signal to QAM, PSK, GMSK or FSK formats.

FREQUENCY MODULATION

Deviation

Peak deviation from 0 to 1 MHz for carrier frequencies up to 21.09375 MHz. Peak deviation from 0 to 1% of carrier frequency above 21.09375 MHz.

Selection

By keyboard entry of data. Variation by ⇧⇩ keys and by rotary control.

Indication

3 digits with annunciators.

Displayed Resolution

1 Hz or 1 least significant digit, whichever is greater.

Accuracy at 1 kHz

±5% of indication ±10 Hz excluding residual FM.

Bandwidth (1 dB)

DC to 300 kHz (DC coupled).
10 Hz to 300 kHz (AC coupled).

Input is capable of accepting external sources of FSK signals. Typical 3 dB bandwidth is >1 MHz.

Group delay

Less than 1 µs from 3 kHz to 500 kHz.

Carrier Frequency Offset

In DC FM less than ± (1 Hz + 0.1% of set deviation) after using DC FM nulling facility.

Distortion

Using external modulation without ALC: Less than 3% at maximum deviation for modulation frequencies up to 20 kHz. Less than 0.3% at 10% of maximum deviation for modulation frequencies up to 20 kHz.

Modulation source

Internal LF generator or external via front panel sockets.

WIDEBAND FM

Deviation

As FM.

Indication

3 digits with annunciators.

Selection

By keyboard entry of data. The sensitivity is controlled in 3 dB steps and the display will indicate the nearest value of deviation to that requested.

Input level

1.414 V peak (1 V RMS sine wave) to achieve indicated deviation.

Accuracy

As FM.

3 dB Bandwidth

Typically 10 MHz (DC or AC coupled).

Group Delay

Less than 0.5 ms from 3 kHz to 10 MHz.

Modulation Source

External via rear panel socket (50 Ω impedance).

PHASE MODULATION

Deviation

0 to 10 radians.

Selection

By keyboard entry of data. Variation by up/down keys (or ⇧⇩) and by rotary control.

Indication

3 digits with annunciators.

Resolution

0.01 radians.

Accuracy at 1 kHz

±5% of indicated deviation excluding residual phase modulation.

3 dB Bandwidth

100 Hz to 10 kHz.

Distortion

Less than 3% at maximum deviation at 1 kHz modulation rate.

Modulation Source

Internal LF generator or external via front panel sockets.

AMPLITUDE MODULATION

For carrier frequencies up to 1 GHz.

Range

0 to 99.9%.

Selection

By keyboard entry of data. Variation by up/down keys (or ⇧⇩) and by rotary control.

Indication

3 digits with annunciator.

Resolution

0.1%.

Accuracy

±4% of setting ±1%.

1 dB Bandwidth

With modulation ALC off; DC to 30 kHz in DC coupled mode and 10 Hz to 30 kHz in AC coupled mode.

Typical modulation bandwidth exceeds 50 kHz.

Distortion

For a modulation rate of 1 kHz: Less than 1% total harmonic distortion for depths up to 30%, less than 3% total harmonic distortion for depths up to 80%.

Modulation source

Internal LF generator or external via front panel connectors.

DIGITAL MODULATION

In digital mode the instrument can be used over the carrier frequency range 10 MHz to 1.35/2.7 GHz and accepts internal or external data to modulate the RF output. The modulation can be applied in common digital formats and the channel filter characteristics specified.

Internal Data

All 0's, 1's or selectable PN 2 to 7, 9, 10, 11 or 15 PRBS sequence.

Note with GSM selected PRBS is limited to PN9 & 15. All 0's and all 1's are available.

External data

Accepts data as a serial input or parallel input from a 25 way auxiliary D Type connector on the rear panel. Accepts symbols containing 1 to 8 data bits with internally or externally generated clock sources. All inputs and outputs are TTL/CMOS logic compatible.

Note, in GSM mode, external data must be supplied as 8 bit parallel.

Symbol Rate

Mod Type	*min sym/s*	*max sym/s*	*Filter*
PSK, QAM	1900	34000	Nyquist/Root Nyquist
PSK, QAM	1900	25000	Gaussian
FSK,	1900	25000	Nyquist/Root Nyquist
FSK, GMSK	512	25000	Gaussian
OQPSK	1900	16000	All filters

Symbol source can be internal or external, internal symbol rate is adjustable in steps of 0.1 symbols/s. Symbol rate must be within 2% of external symbol rate to maintain modulation accuracy.

Generic Modulation types

Can select PSK, Differential PSK, Differential Phase Offset PSK (i.e π/4DQPSK), Time Offset QPSK, QAM, GMSK and FSK. The number of bits per symbol can be selected from 2 to 8 for QAM, 1 to 3 for PSK and 1 or 2 for FSK systems.

RF Channel Filters

Root raised cosine, raised cosine or Gaussian. Filter bandwidth can be selected as follows: Raised cosine or root raised cosine for α from 0.2 to 0.8 in 0.01 steps. Gaussian 3 dB bandwidth from 0.4 of the symbol rate (0.2 of symbol rate as IQ baseband filter) up to a maximum of 22.6 kHz.

Pre-defined Modulation Types

The following can be selected:

Mod Type	*System*
π/4 DQPSK	ADC (DAMPS), PDC (JDC), TETRA, TFTS, APCO25
GMSK	GSM, Mobitex, CDPD, MC9, DSRR, MD24-192N/W, Modacom
OQPSK	Inmarsat M
FSK	POCSAG, CITYRUF
4FSK	ERMES, APCO25
8DPSK	VDR (VDL)

Modulation Accuracy

At the decision points with the envelope input at 1 V or disabled and filter above 0.25 for raised cosine filters and 0.3 for root raised cosine filters:

- *PSK & QAM* *<1.5% RMS vector error*
- *NADC, PDC* *<1% RMS vector error (EIA, RCR 27A method)*
- *GSM & CDPD* *<3° RMS phase error (typical)*

FSK/GMSK

Frequency deviation can be set with 1 Hz resolution across the range 100 Hz to 20 kHz.

Accuracy: <1% of set deviation.

Modulation errors

Modulation errors can be added to simulate:
IQ skew from 0 to ± 20° in 0.1° steps
IQ imbalance from 0 to ±10 dB in 0.1 dB steps
Carrier leak from 0 to 10% in 0.1% steps
Range of errors allowed is limited by the peak envelope power.

Note: modulation errors are not available in either GSM or OQPSK modes.

IQ Outputs

Baseband IQ output signals available on the front panel at a level of 0.5 V p.d. nominal into 50 Ω.

Burst control

Available on the rear panel D Type connector. A logic 1 on the burst control turns the RF on over a time interval corresponding to 3 data symbols. Propagation delay is matched to the data path delay. Can be used with the Envelope input.

Burst control is not available with GMSK and FSK modulation types.

ON/OFF Ratio

Greater than 80 dB.

VECTOR MODULATION

Provides for IQ modulation of the carrier output from an external source for carrier frequencies of 10 MHz to 1.35/2.7 GHz.

Carrier Leakage and SSB Image Rejection

Following self-calibration, the RF carrier leakage and SSB image rejection are typically 50 dB.

Vector inputs

IQ inputs on the front panel. The RF level requested is obtained with 0.5 V DC applied to one of the inputs. Input impedance is selectable between 50 Ω and 300 Ω.

DC Vector accuracy

For carrier frequencies up to 2 GHz:
±1% amplitude of FS.
±1° at FS.

For carrier frequencies above 2 GHz:
±1.5% amplitude of FS.
±1.5° at FS.

Vector bandwidth

±0.5 dB wrt DC for modulation frequencies up to 3 MHz.

±1 dB wrt DC for modulation frequencies up to 10 MHz and carrier frequencies up to 2 GHz. ±1.3 dB wrt DC for carrier frequencies up to 2.7 GHz.

IQ MODULATION CALIBRATION

The signal generator can calibrate the IQ modulator automatically. After a 0.5 hour warm up period the calibration remains valid for at least 3 hours over a temperature range of ±5°C. The instrument displays a warning if the calibration validity time or temperature range has been exceeded. Calibration is valid for both digital and vector modes.

FADING SIMULATION

Rayleigh and Rician fading can be simulated in both Vector and Digital modulation modes. Doppler speed can be entered from 0 to 200 Hz with a maximum ratio of 2:1 between direct and scattered speed. Path ratio can be set to ±50 dB.

Note: Fading is not available in either GSM or OQPSK modes.

ENVELOPE CONTROL

The RF level can be varied by applying a control voltage to the envelope input in digital and vector modes. The input may be used to shape the rise and fall of an RF burst and simulate the effect of varying RF levels being received from mobiles in TDMA systems. Applying 1 V gives the set RF level and 0 V suppresses the carrier.

Linear range

Greater than 30 dB.

Linearity typically better than 0.5 dB at –20 dBV (100 mV input).

ON/OFF ratio

Greater than 80 dB.

Envelope delay

< 10 µs, typically 6 µs.

Rise/fall time

Less than 13 µs to −70 dBc.

IF OUTPUT

An IF output is available on the rear panel which is modulated by the selected digital or vector modulation. The IF output can be inhibited by software control. The IF output can be used to provide modulated carriers at higher frequencies by external frequency conversion. The RF output from the front panel connector can be used as an LO for external frequency conversion.

MODULATION OSCILLATOR

Frequency range

0.1 Hz to 500 kHz.

Selection

By keyboard entry of data. Variation by ⇧⇩ keys and by rotary control.

Indication

7 digits with annunciators.

Resolution

0.1 Hz.

Frequency accuracy

As frequency standard.

Distortion

Less than 0.1% THD in sine wave mode at frequencies up to 20 kHz.

Alternative waveform

A triangular wave is available in addition to the sine wave for frequencies up to 100 kHz.

Signaling tones

The modulation oscillator can be used to generate sequential (up to 16 tones) or sub-audible signaling tones in accordance with EIA, ZVEI, DZVEI, CCIR, EURO 1, EEA, NATAL and DTMF* standards.

Facilities are also available for creating and storing user defined tone systems.

* Requires second modulation oscillator (option 001) to be fitted.

EXTERNAL MODULATION

Two independent inputs on the front panel with BNC connectors, EXT MOD 1 and EXT MOD 2. The modulation is calibrated with 1.414 V peak (1 V RMS sine wave) applied. Input impedance 100 kΩ nominal.

MODULATION ALC

The EXT MOD 1 and EXT MOD 2 modulation inputs can be levelled by an ALC system.

Level Range

1 V to 2 V peak (0.7 to 1.4 V RMS sine wave).

Distortion

Less than 0.1% additional distortion for frequencies up to 20 kHz (typically less than 0.1% up to 50 kHz).

1 dB Bandwidth

Typically 10 Hz to 500 kHz.

LF OUTPUT

Front panel BNC connector. The output may be configured in the LF Generator Mode to give an output from the internal modulation oscillator and in the LF Monitor Mode to give an output from the internal modulation signal paths.

Selection

By keyboard entry of data.

Variation by ⇧⇩ keys and by rotary control.

Indication

7 digits with unit annunciators for frequency and 4 digits with unit annunciators for level.

Level

100 µV to 5 V RMS with a load impedance of greater than 600 Ω.
100 µV to 1.4 V RMS with a load impedance of greater than 50 Ω.

Source impedance

5.6 Ω nominal.

Level accuracy at 1 kHz

With a load impedance of greater than 10 kW: LF ±5% for levels above 50 mV LF ±10% for levels from 500 µV to 50 mV.

Frequency Response

Typically <±1 dB from 0.1 Hz to 300 kHz.

SWEEP

Control modes

Start/stop values of selected parameter. Number of steps. Time per step.

Step time

1 ms to 20 s per step.

Sweep ramp

Synchronized analog ramp with a nominal amplitude of 0 to 10 V peak on rear panel BNC connector.

Markers

User selectable markers for frequency or level provide an indication when specified parameter values have been reached. Output 0 V to +5 V from 600 Ω on rear panel BNC socket.

Trigger

Rear panel BNC connector. Applying 0 V or a switch closure starts the sweep. Connector is internally connected via 10 kΩ pull-up resistor to +5 V.

FREQUENCY STANDARD (OCXO)

Frequency

10 MHz.

Temperature stability

Better than ±5 in 10^8 in the operating range of 0 to 50°C.

Warm up time

Within 2 in 10^7 final frequency within 10 minutes from switch on at 20°C ambient.

Ageing rate

Better than 2 in 10^7 per year.

Output

Rear panel BNC socket provides an output at frequencies of 1, 5 or 10 MHz with a nominal 2 V pk-pk level into 50 Ω. Output can be dis-

abled.

External input

Rear panel BNC socket accepts an input at 1, 5 or 10 MHz with an input level in the range 220 mV to 1.8 V RMS into 1 kΩ

GENERAL

GPIB INTERFACE

A GPIB interface is fitted. All functions except the supply switch and display contrast are remotely programmable.

Capabilities

Designed in accordance with IEEE488.2.
Complies with the following subsets as defined in IEEE Std. 488.1. SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2.

ELECTROMAGNETIC COMPATIBILITY

Conforms with the protection requirements of the 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 (as amended) and the product safety standard IEC / EN 61010-1 : 2001 + C1 : 2002 + C2 : 2003 for class 1 portable equipment, for use in a Pollution Degree 2 environmen. The instrument is designed to be operated from an Installation Category 2 supply.

RATED RANGE OF USE *(Over which full specification is met)*

Temperature

0 to 55°C.

Humidity

Up to 93% at 40°C.

CONDITIONS OF STORAGE AND TRANSPORT

Temperature

–40°C to +71°C.

Humidity

Up to 93% relative humidity at 40°C.

Altitude

Up to 4600 m (15,000 ft).

POWER REQUIREMENTS

AC supply

Four voltage settings covering:

100 V~ (Limit 90 - 115 V~)
120 V~ (Limit 105 - 132 V~)
220 V~ (Limit 188 - 242 V~)
240 V~ (Limit 216 - 264 V~)

Frequency: 50 - 400 Hz (Limit 45 - 440 Hz) 180 VA max

CALIBRATION INTERVAL

2 years.

DIMENSIONS AND WEIGHT

(Over projections but excluding handles)

Height	Width	Depth	Weight
152 mm	425 mm	525 mm	21 kg

OPTIONS

OPTION 1 - SECOND MODULATION OSCILLATOR OPTION

Specification as Modulation Oscillator.

OPTION 2 - PULSE MODULATION OPTION

Modulation Modes

Pulse modulation may be used alone or in conjunction with ΦM, FM, Wideband FM, Vector or Digital Modulation.

Rise/Fall Time

25 ns.

Control

0 V for carrier off, +5 V for carrier on.
Threshold level is typically +2.5 V.

ON/OFF Ratio

Better than 70 dB. Input impedance 50 Ω.

OPTION 105 - SLOW RISE TIME PULSE MODULATION

Modifies pulse modulation option for a typical rise and fall time of 1 µs.

OPTION 6 - AVIONICS OPTION

See separate sheet.

OPTION 8 - RF PROFILE AND COMPLEX SWEEP

See separate sheet.

OPTION 12 - ELECTRONIC ATTENUATOR

Carrier Frequency Range

250 kHz to 1.35 GHz (2050),*
250 kHz to 2.7 GHz (2051).*

** Useable to 10 kHz (50 MHz in Digital or Vector modes, useable to 10 MHz)*

RF Output

Range (Analog mode)

-138 dBm to +10 dBm When AM is selected the maximum output level reduces linearly with AM depth to +4 dBm at maximum AM depth.

Range (Digital or Vector mode)

-132 dBm to +3 dBm peak envelope power.

Accuracy

±1.2 dB in non Digital or Vector modes for output levels > -127 dBm at 22°C ±5°C

Temperature Stability

±0.01 dB/°C

VSWR

< 1.5:1 for output levels less than 0 dBm.

Reverse Power Handling

1 W from a source VSWR of up to 5:1.

Amplitude Modulation

Standard specification applies for carrier frequencies above 50 MHz (Above 100 MHz for Option 6).

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

Versions

2050	10 kHz to 1.35 GHz Digital and Vector Signal Generator
2051	10 kHz to 2.7 GHz Digital and Vector Signal Generator
2052	10 kHz to 5.4 GHz Digital and Vector Signal Generator

Supplied with

AC supply lead

Operating Manual

Options

Option 001	Second modulation oscillator
Option 002	Pulse modulation
Option 006	Avionics (must be ordered with Option 001)
Option 008	RF Profiles and complex sweep
Option 012	Electronic attenuator (2050 and 2051 only)
Option 105	Increased pulse modulation rise and fall time (must be ordered with Option 002)
Option 112	External modulation inputs (2) 600 Ω impedance

Optional Accessories

44991/144	Break out box. Converts auxiliary D type -connector to 8 data, 1 burst line, and a it/symbol clocks on BNC connectors. Daisy chain connection allows the monitoring of the signals (on BNC connectors).
43126/012	RF connector cable, 50 Ω, 1.5 m, BNC
54311/092	Coaxial adapter N male to BNC female
59999/163	Precision coaxial adapter N male to SMA female
54311/095	RF connector cable, 1 m, type N connectors
43129/189	GPIB Lead assembly
46883/408	IEEE/IEC Adapter block for GPIB socket
46884/291	Rack mounting kit (with slides) for rack cabinets with depths from 480 mm to 680 mm
46884/292	Rack mounting kit (with slides) for rack cabinets with depths from 680 mm to 840 mm
46884/541	Rack mounting kit containing front mounting brackets only
46884/444	Maintenance kit 2030/40/50 series
46662/525	Transit case
54112/164	Soft carry case
54499/044	DECT Filter
46880/062	Service manual

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A passion for performance.

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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. 46891/007, Issue 11, 02/04

Signal Sources

Option 6 Avionics Signal Generator (2030/40/50 series)

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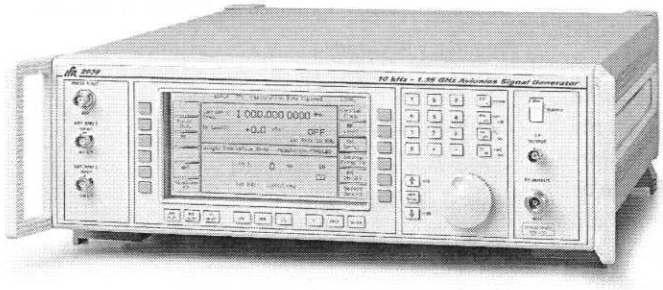

Setting the standard in avionics testing. Option provides accurate ILS, VOR, ADF, marker beacon and SELCAL signals for testing avionics receivers

- Accurate ILS and VOR RF waveforms
- Wide frequency coverage
- SELCAL calling tones
- Internal ILS and VOR waveform generators
- 0.0001 DDM resolution
- 0.01% bearing resolution
- Marker beacon
- Optional pulse modulation
- Automatic direction finder testing
- Comprehensive memory facilities

The Aeroflex family of Avionics Signal Generators provides internal generation of waveforms suitable for testing Instrument Landing Systems (ILS), VHF Omni-directional Radio Range (VOR) systems, Marker Beacons and SELCAL radio receivers. Avionics parameters are presented in the same form as described in the ICAO standards. The family offers an ideal single instrument solution for the testing of avionics receivers and airfield alarm monitors. The use of Direct Digital Synthesis techniques ensures excellent accuracy and stable performance under all operating conditions.

Option 6 is available for all 2030, 2031, 2032, 2040, 2041, 2042, 2050, 2051 and 2052 signal generators have become the solution of choice for testing avionics receivers. It offers a range of high performance signal generators for the testing of ILS, VOR and aircraft communications systems. For bench testing of navigation receivers the 2030 series provides exeptional accuracy, allowing even high performance receivers used for airfield alarm monitors to be tested with confidence. The 2040 series signal generators offer the same high levels of performance with the added advantage of exceptionally low carrier phase noise to allow the rigorous testing of the receiver selectivity and intermodulation, an important factor in today's crowded spectrum for a safety critical industry.

The 2050 series has the same performance as the 2030 series but with the additional benefit of being able to provide digitally modulated carriers.

All models can be supplied with a fast pulse modulator and the 2030 series can be supplied with an internal pulse generator to aid radar testing. A further option for 2030 series is a DME option which allows the signal generator to provide Gaussian shaped double pulse for DME testing.

ILS

In ILS mode, the Sum of Depth of Modulation (SDM) of the 90 Hz and 150 Hz tones can be entered to a resolution of 0.1% AM depth. The Difference in Depth of Modulation (DDM) is entered to a resolution of 0.01% depth for a DDM up to 20% and 0.1% for higher DDM settings. A choice of which tone is dominant is available to the user.

The 30 Hz repetition frequency of the ILS waveform can be adjusted in 0.1 Hz steps. For 0% DDM, additional modulation signals can be added to the ILS waveform.

Changing between localizer and glide-slope operation is accomplished with a single key stroke.

Marker Beacons

In the Marker Beacon mode, signals are generated simulating the outer, middle and inner marker beacons. A single key press selects which marker beacon is simulated. Carrier frequency, modulation depth and modulation frequency can be varied from the default settings. Using the normal calling tones menu enables pulsed marker beacon modulation signals to be generated.

VOR

In VOR mode, the AM depth of the subcarrier and 30 Hz tone can be independently set and the relative phase of the 30 Hz tone and the modulation tone on the subcarrier is set by directly entering the bearing information in degrees. The VOR repetition rate of 30 Hz can be adjusted in 0.1 Hz steps. For a fixed bearing, additional modulation can be applied to simulate voice/identity signal. A To/From Beacon key provides a rapid means of reversing a bearing entry and accounting for different bearing conventions.

SELCAL

SELCAL selective calling tone signals are used on the radios providing communication between the aircraft operator and the flight crew. The Avionics Signal Generator provides facilities for generating the SELCAL codes and the modulation signals to test the radio receiver.

Simple Operation

Major parameters can be adjusted by keyboard entry of data, using the UP/DOWN keys or using the rotary control. The use of a large screen dot matrix display ensures clear and unambiguous readout of the avionics parameters.

Instrument settings can be stored in nonvolatile memories. A sequence of test settings can be stored and, using the external trigger facility, the currently recalled memory can be incremented to step through the stored test sequence.

The power up sequence of the generator can be defined such that it always switches on in avionics mode.

SPECIFICATION

Specifications are as 2030, 2031, 2032, 2040, 2041, 2042, 2050, 2051 or 2052 with the following additions

ILS MODE

Tone Frequencies

90 Hz, 150 Hz nominal. Tone frequency may be changed by varying the ILS repetition rate of 30 Hz in 0.1 Hz steps. Tone frequencies maintain 3:1 and 5:1 relationships with the ILS rate.

Frequency Accuracy

As frequency standard

Tone Suppression

Either tone can be suppressed

Additional Modulation

Available for 0% DDM from an internal or external modulation source

Sum of Depth of Modulation (SDM)

SDM Range

0 to 99.9% in 0.1% steps representing the arithmetic sum of each tone depth

SDM Selection

By keyboard entry of data and variation by UP/DOWN keys or rotary control

RF Accuracy of SDM

±2% of SDM setting for carrier frequencies up to 400 MHz (from 100 MHz to 400 MHz with Option 12)

At 40% SDM accuracy is ±0.8% depth

At 80% SDM accuracy is ±1.6% depth

Difference in Depth of Modulation (DDM)

DDM Range

0 to 20% in 0.01% steps

20 to 99.9% in 0.1% steps

DDM Selection

By keyboard entry of depth in %, mA or index and variation by UP/DOWN keys or rotary control

RF Accuracy of DDM

±0.02 of DDM setting ±0.0003 DDM (0.03% depth)

At 0 DDM (on course) accuracy is ±0.0003 DDM (0.03% depth)

At 0.155 DDM accuracy is ±0.0034 DDM (0.34% depth)

LF Output

Available from the LF Output connector

LF Accuracy of DDM

Equivalent to ±0.0003 DDM ±0.005 of setting

At 0 DDM (on course) accuracy is ±0.0003 DDM

MARKER BEACON MODE

Provides default carrier of 75 MHz, 95% AM depth and a modulation frequency of 400 Hz, 1.3 kHz or 3 kHz corresponding to Outer, Middle and Inner Markers. Carrier frequencies, AM depth and modulation frequency can be adjusted from the default values.

VOR MODE

Selection

By keyboard entry of depth and variable by UP/DOWN keys and rotary control

Bearing Control

Relative phase of 30 Hz tone and subcarrier modulation adjustable from 0° to 359.9° in 0.01° steps by entering VOR bearing. Bearing can be entered as TO or FROM the beacon.

Bearing Accuracy

±0.05°

Additional modulation

Available on 0° bearing from an internal or external modulation source

AM Depth Accuracy

±3% of setting ±0.5% for carrier frequencies up to 400 MHz (from 100 MHz to 400 MHz with Option 12)

Frequency

The VOR repetition frequency of 30 Hz may be varied in 0.1 Hz steps. The subcarrier frequency and deviation maintain a fixed relationship with the VOR repetition rate

Frequency Accuracy

As frequency standard

9.96 kHz subcarrier

AM Range

0 to 49.9% depth in 0.1% steps

Modulation

Frequency modulated by a 30 Hz tone with settable

deviations of 420 Hz, 450 Hz, 480 Hz, 510 Hz and 540 Hz

30 Hz Tone

AM Range

0 to 49.9% depth in 0.1% steps

Arithmetic sum of 30 Hz tone and sub carrier limited to 99.8%

ADF MODE

(Does not apply with Option 12 fitted)

Provides default carrier of 190 kHz with 30% AM depth at 1 kHz rate. Carrier frequency, AM depth, modulation rate and RF level can be varied from the default values.

SELCAL MODE

Provides a facility for modulating the RF carrier with sequential calling tones defined by the SELCAL protocol. Allows the entry of two character pairs to define the SELCAL code generated to open the audio path of aircraft radios. Default tone duration and gap are 1 s and 250 ms respectively and can be varied from nominal values.

VERSIONS AND ACCESSORIES

For the full Signal Generator performance specifications please refer to the 2030/40/50 signal generator datasheets. When ordering please quote the full ordering number information.

The NAV-750C is functionally identical to 2030 1.35 GHz Signal Generator fitted with Option 1 and 6.

Option 6 Avionics Signal Generator

Ordering Numbers

To order an avionics signal generator specify which model is required and order with Option 1 and Option 6 fitted.

Versions

2030	10 kHz to 1.35 GHz Signal Generator
2031	10 kHz to 2.7 GHz Signal Generator
2032	10 kHz to 5.4 GHz Signal Generator
2040	10 kHz to 1.35 GHz Low Noise Signal Generator
2041	10 kHz to 2.7 GHz Low Noise Signal Generator
2042	10 kHz to 5.4 GHz Low Noise Signal Generator
2050	10 kHz to 1.35 GHz Digital and Vector Signal Generator
2051	10 kHz to 2.7 GHz Digital and Vector Signal Generator
2052	10 kHz to 5.4 GHz Digital and Vector Signal Generator
Option 001	Second Internal Modulation Oscillator
Option 006	Avionics (must be ordered with Option 001)

Supplied with

AC Power Lead and Operating Manual

Other Options

Option 002	Pulse Modulation
Option 008	RF Profile and complex sweep
Option 009	Internal Pulse Generator (cannot be used with Option 005) only available on 2030, 2031, 2032
Option 010	DME avionics (only available on 2030, 2031, 2032)
Option 012	Electronic Attenuator (not available on 2032, 2042, 2052, 2052T, not available with Options 03 or 010)
Option 105	Modifies the pulse modulation Option for slower rise time (order with Option 002)
Option 112	External modulation inputs (2) 600 Ω impedance
NAV-750C	VOR/LOC/GS/COMM/MKR Bench Test Equipment

Signal Sources 2030/40/50 Series

Option 8 RF Profile & Complex Sweep

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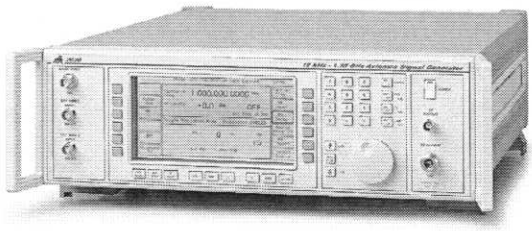

Ability to offset for insertion loss or gain of external devices, and provides complex carrier sweeps. Particularly useful for EMC testing and for ATE applications.

- Calibration of RF power at a remote connector
- Frequency dependent RF output power
- Complex sweep capability
- 20 ms to 20 s step time
- Sine, triangle and square wave modulation

Option 8 RF Profile and Complex Sweep provides additional software features which are particularly well suited for Electromagnetic Immunity, Tempest testing and other applications using signal generators with external devices which introduce frequency dependent RF level errors.

Careful attention to transient states ensures that positive overshoots that could damage power amplifiers are not generated.

RF Profile and Offset

The RF Profile and Offset facility allows the user to reduce RF level errors introduced by using external amplifiers, attenuators or signal combiners. The signal generator accepts and displays RF level requests for the power referred to the output of the external device. The facility reduces the calibration effort required in ATE systems and minimizes the probability of operator induced errors when performing manual tests. The RF Profile facility allows the entry of 10 profiles containing up to 100 correction points with linear interpolation to minimize the RF level frequency response errors introduced by the external device.

The use of a large LCD panel and a flexible menu driven user interface provides a simple means of rapidly generating, selecting and editing profiles in an intuitive way whilst minimizing any ambiguity in the setting of the generator.

Segmented Sweep

The Segmented Sweep facility allows the generation of sweeps with up to 10 segments, each of which can have independent sweep parameter settings. The ability of each segment to have a different RF level permits swept immunity tests to be undertaken which follow the frequency dependent immunity limits specified in EMC standards. The independent frequency step size allows the sweep speed to be increased at higher carrier frequencies to minimize the test time.

The independent stop and start frequencies for adjacent segments also allows the generation of sweeps which deliberately omit sections of the RF spectrum to test systems with on-line signals or to speed up tests on multiband systems.

The sweep can be halted at any time if a device response is obtained and the signal generator settings can then be varied to explore the

device response before then continuing with the sweep from the point where the sweep was halted.

Programmable frequency step times between 20 ms and 10 s combined with frequency step sizes down to 0.1 Hz allow the generation of fast swept signals or the slow sweeps associated with EMC testing.

Complex Sweeps

The segmented sweep can be combined with the RF Offset and RF Profile facility to produce complex sweeps which manipulate the RF output level of the signal generator to correct for the frequency response of amplifiers, cables, combiners and antenna characteristics. The ability to include correction factors in sweep mode allows the signal generator to be used in computer controlled test system which allow for manual intervention of the test without losing the system calibration information.

The use of the extended hysterisis facility with the sweep facility to minimize the number of attenuator level transients during a swept test is particularly useful for testing devices which are susceptible to large rapid changes in RF level.

Options

The Option 8 software is available on all versions of the 2030/40/50/50T series signal generators and can be combined with the second modulation oscillator, pulse modulation and generation, GSM PCN and Avionics options to provide a flexible signal generator capable of undertaking tests on most RF and receiver systems.

SPECIFICATION

GENERAL DESCRIPTION

Option 8 software provides additional sweep, RF offset and RF level profiling facilities to support the use of 2030, 2040A 2050 and 2050T series Signal Generators with external amplifiers and attenuators. The RF output from the external device can be calibrated and displayed on the front panel of the signal generator using the RF Offset and RF Profile facilities.

RF OFFSETS

Displayed signal generator output level can be offset by +80 dB to –40 dB from the actual RF output level.

RF Offsets may be used in normal signal generator modes or combined with segmented sweeps.

RF PROFILE

RF output level can be adjusted by ±40 dB from its nominal value without changing the displayed RF output level. Ten profiles can be created each containing up to 100 correction points and the RF output level is linearly interpolated between correction points.

RF Profiles can be used in normal signal generator modes or combined with the segmented sweep.

SEGMENTED SWEEP

Carrier frequency sweeps can be generated which contain defined segments each of which can have a different step size, start and stop frequency, step time and RF level.

Sweep facility is available for 2030 and 2050(T) series in analog modes and for 2040 series in Normal Noise mode.

Start and Stop

Start and stop frequency for each segment can be freely defined within the frequency capability of the signal generator.

Step Size

Minimum step size is 0.1 Hz.

Number of steps is implied by the step size and the start and stop frequencies.

Step Time

20 ms to 20 seconds per step.

Segments

Up to 10 segments may be freely combined together in any order.

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

Versions

2030	10 kHz to 1.35 GHz Signal Generator
2031	10 kHz to 2.7 GHz Signal Generator
2032	10 kHz to 5.4 GHz Signal Generator
2040	10 kHz to 1.35 GHz Low Noise Signal Generator
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2050	10 kHz to 1.35 GHz Digital and Vector Signal Generator
2051	10 kHz to 2.7 GHz Digital and Vector Signal Generator
2052	10 kHz to 5.4 GHz Digital and Vector Signal Generator
2050T	10 kHz to 1.35 GHz Digital and Vector Signal Generator.
2051T	10 kHz to 2.7 GHz Digital and Vector Signal Generator.
2052T	10 kHz to 5.4 GHz Digital and Vector Signal Generator.
Option 008	RF Profile and Complex Sweep

Supplied with

AC power lead

Operating manual

Options

Option 001	Second internal modulation oscillator
Option 002	Pulse Modulation
Option 003	+19 dBm Output (2030 and 2040 only)
Option 005	GSM PCN PCS (GMSK Bt 0.3) (2030 series only)
Option 006	Avionics Option (must be ordered with Option 001)
Option 009	Internal Pulse Generator (cannot be used with Option 005) only available on 2030 series
Option 010	DME (requires Option 001 and 006, only available on 2030 series, cannot be fitted with Option 005)
Option 105	Modifies the pulse modulation for slower rise and fall time (order with Option 002)

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