The 2040 series of low noise signal generators covers a wide range of frequencies from 10 kHz to 1.35 GHz (2040), 10 kHz to 2.7 GHz (2041) and 10 kHz to 5.4 GHz (2042). With a choice of operating modes, two low noise modes for improved SSB phase noise and normal mode for increased flexibility, the 2040 series can be used in a wide variety of applications. Microprocessor control coupled with a large screen dot matrix display provides ease of use via menu driven displays. Set up time is further reduced by recalling previously stored instrument settings from the non-volatile memory. Remote programming via the GPIB is provided as a standard feature, allowing the instruments to be incorporated in automatic test systems.

EXCELLENT SPECTRAL PURITY
The excellent noise characteristics and the low level of spurious signals of the 2040 series enable the instruments to be used with confidence for a wide range of critical measurements.

Low SSB Phase Noise
With a specified SSB phase noise performance of better than –140 dBc/Hz at 20 kHz offset from a carrier of 1 GHz, the 2040 series of signal generators is easily able to measure UHF receiver selectivities beyond 90 dB. The low residual FM noise figure (less than 0.3 Hz RMS at 1 GHz) gives the 2040 series the capability of measuring UHF receiver signal to noise ratios as high as 80 dB.

Typical phase noise performance at 1 GHz

Low spurious signal content
A specified non-harmonic spurious signal content of –90 dBc ensures the suitability of the 2040 series for the most demanding measurements on modern receivers and RF systems.

http://www.ifrinternational.com
2040 series

the generator to produce RF levels above the normal operating range. A high output option is available to extend the maximum calibrated level to +19 dBm on 2040.

A low intermodulation mode can be selected which disables the RF level control system and improves the intermodulation performance when combining the outputs of two signal generators.

50 W Protection

An electronic trip protects the generator output against reverse power of up to 50 W, preventing damage to output circuits when RF or DC power is accidentally applied. This feature contributes to long unit life and low cost of ownership.

VERSATILE MODULATION CAPABILITIES

Comprehensive amplitude, frequency (plus Wideband FM), phase and optional high speed pulse modulation are provided for testing all types of receivers.

Modulation Oscillator

An internal modulation oscillator is provided with a frequency range of 0.1 Hz to 500 kHz, resolved to 0.1 Hz. In addition to a wide range waveform output, an alternative triangular or square waveform may be selected for sweep applications. A second oscillator may be added as an option. Two independent BNC inputs on the front panel allow external modulation signals to be mixed with the internal signal(s) allowing a maximum of four modulation channels to be active at one time.

Modulation Modes

Four modulation modes are provided – single, dual, composite and dual composite. In the single mode only one type of modulation can be active at any time. Selecting alternative modulation cancels any other active modulation. In the dual mode two types of modulation may be obtained allowing one form of frequency modulation to be combined with one form of amplitude modulation. In the composite mode, only one type of modulation can be active, fed by two independent channels. The dual composite mode combines the facilities of the dual mode with the composite mode and provides two types of modulation each fed from two sources.

Frequency and Phase Modulation

The wide range frequency modulation capability provides a 1 dB bandwidth of 10 MHz and provides FM deviation up to 1 MHz for frequencies up to 21 MHz, 1% of carrier frequency elsewhere. Phase modulation is also available with a 10 kHz bandwidth up to a maximum of 10 radians.

Both AC and DC coupled FM are available and in the DC coupled mode a patented offset correction system eliminates the large carrier frequency offsets that occur with normal signal generators. As a result the 2040 series signal generators can be used confidently for testing tone and message paging equipment.

Wideband FM

Broadband frequency modulation with a 3 dB bandwidth of 10 MHz is provided via a rear panel BNC socket. This is ideal for tests on equipment using frequency shift keying for high speed digital transmission.

Amplitude and Pulse Modulation

Amplitude modulation with a 1 dB bandwidth of 30 kHz and with modulation depths of up to 99.9% is available with a resolution of 0.1%. Fast pulse modulation is available as an option with rise and fall times of less than 25 ns and a 70 dB on/off ratio.

Modulation Levelling

An automatic level control facility is provided for both of the external modulation inputs and provides correctly calibrated input levels for input levels varying from 0.7 to 1.4 V RMS. HI and LO indicators show when the input level is outside the range of the ALC system.

Tone Signaling

The signaling facility allows testing of radios with DTMF, sequential and subaudible tone capability. A wide range of tone system standards are built in and provision is also made for user definable standards to cover special requirements. Tone sequences can be set up with up to 16 tones in length and the complete sequence can be sent from 1 to 9 times or set to repeat on a continuous basis. Subaudible tones are normally used in the composite modulation mode where the modulation level for the tone and the in-band modulation can be set independently.

FREQUENCY AND LEVEL SWEEP

Start/Stop

Markers and Ramp Output

Five markers may be defined and a marker output is provided on a rear panel socket together with a 0 to 10 V ramp signal for driving the X axis of an oscilloscope or X-Y plotter.

Option 8 provides additional sweep capabilities which allow the step size, step time and RF level to be entered.

In addition to storage and recall of measurement settings, the non-volatile memory contains data on instrument status and calibration. All calibration data on RF level, FM accuracy, internal frequency standard adjustment and modulation are retained and may be altered from the front panel or via the GPIB after disabling the software protection.

Calibration Data

In addition to storage and recall of measurement settings, the non-volatile memory contains data on instrument status and calibration. All calibration data on RF level, FM accuracy, internal frequency standard adjustment and modulation are retained and may be altered from the front panel or via the GPIB after disabling the software protection.

GPIB 488.2 PROGRAMMING

A GPIB interface is fitted as standard so that all functions are controllable over the bus. The instrument functions as talkers as well as listeners and the interface has been designed in accordance with the IEEE 488.2 standard.

SIMPLE CALIBRATION

The 2040 has a two year recommended calibration interval, with all routine calibration adjustments carried out without removing the instrument covers. The calibration display is available via soft key selection in the utilities menu.
Low Cost of Ownership

In keeping with the IFR philosophy of cost effectiveness with innovation, the 2040 series has been designed for minimal maintenance and low operating costs. The two year calibration interval combined with the high reliability ensures a low overall cost of ownership.

OPTIONS EXTEND RANGE OF APPLICATIONS

The standard features may be supplemented by taking advantage of the various options available.

Second Modulation Oscillator

An additional modulation oscillator can be fitted to the 2040 series to enable greater flexibility. This second oscillator has the same specification as the first and allows full use of complex modulation modes and is particularly useful where two tone modulation is required.

Pulse Modulation

This optional facility allows radar RF and IF stages to be tested and features rise and fall times of less than 25 ns with an on/off ratio of better than 70 dB.

+19 dBm RF Output Level

A high output option is available for 2040 and provides an extra 6 dB of output level making it ideal for use as a local oscillator or in testing passive components.

Avionics

This optional facility provides for the internal generation of modulation waveforms suitable for the testing of Instrument Landing Systems (ILS) and VHF Omni Range (VOR) beacons. Additional modes of operation support the testing of ADF, Marker Beacons and the SELCAL signaling system.

RF Profiles and Complex Sweep

The RF Profile facility allows the signal generator to compensate for frequency dependent level errors introduced by cables, amplifiers and signal combiners. The Complex Sweep facility allows for the generation of sweeps whose step size, step time and RF level changes while the sweep is in progress. These features are particularly useful for EMC, Tempest and ATE applications.

Electronic Attenuator

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

Speciation

General Description

2040 series signal generators cover the frequency ranges 10 kHz to 1.35 GHz, 10 kHz to 2.7 GHz and 10 kHz to 5.4 GHz. A large screen dot matrix display with soft key function selection allows flexibility of operation and ease of use. The output may be amplitude, phase or frequency modulated with pulse modulation available as an option. Modulation is available using a combination of an internal synthesized LF oscillator with up to two external signal inputs. A second internal source is available as an option.

Carrier Frequency

Range

10 kHz to 1.35 GHz (2040).
10 kHz to 2.7 GHz (2041).
10 kHz to 5.4 GHz (2042).

Overrange

Selectable overrange mode allows uncalibrated levels up to +19 dBm to be generated (typically up to +25 dBm for 2030/40 with Option 003 fitted). Selectable extended hysteresis provides for uncalibrated RF level control with up to 24 dB range without level interruption.

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 \( \pi/128 \) radians (approximately 1.4°) using the rotary control.

RF Output

Range

–144 dBm to +13 dBm.

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

Selection

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

Conversion between dB and voltage units may be achieved by pressing the appropriate units key (dB, µV, mV, V).

Indication

4 digits with unit annunciators.

Resolution

0.1 dB.

Accuracy

At 22°C ±5°C

<table>
<thead>
<tr>
<th>Resolution</th>
<th>&lt;1.35 GHz</th>
<th>&lt;2.7 GHz</th>
<th>&lt;5.4 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0 dBm</td>
<td>±0.5 dB</td>
<td>±0.7 dB</td>
<td>±1 dB</td>
</tr>
<tr>
<td>&gt;-100 dBm</td>
<td>±0.85 dB</td>
<td>±1 dB</td>
<td>±1.5 dB</td>
</tr>
<tr>
<td>&gt;-127 dBm</td>
<td>±0.85 dB</td>
<td>±1 dB</td>
<td>-</td>
</tr>
</tbody>
</table>

Temperature stability dB/°C

±0.005 ±0.01 ±0.02

VSIR

For output levels less than 0 dBm:

Less than 1.25:1 to 2.2 GHz.
Less than 1.4:1 to 2.7 GHz.
Less than 1.5:1 to 5.4 GHz.

Output Protection

Reverse power of 50 W from a source VSWR of up to 5:1.

Noise Modes

Three noise modes are offered with the following characteristics:

Low Noise Mode 1

Lowest phase noise with a restricted FM deviation capability and reduced AM bandwidth.

Low Noise Mode 2

Low phase noise with restricted FM deviation capability and full AM bandwidth.

Normal Mode

Full FM deviation capability and AM bandwidth.

Spectral purity

At RF levels up to +7 dBm:

Harmonics

2040, 2041:

Better than –30 dBc to 1 GHz;
Better than –27 dBc above 1 GHz.
2042:

Better than –30 dBc to 1 GHz;
Better than –27 dBc to 1.35 GHz;
Better than –25 dBc above 1.35 GHz.

Sub-Harmonics

Better than –90 dBc to 1.35 GHz.

Non-Harmonics (offsets greater than 3 kHz)

In low noise modes:

Better than –70 dBc up to 21.09375 MHz.
Better than –90 dBc from 21.09375 MHz to 2.7 GHz.
Better than –84 dBc above 2.7 GHz.

In normal modes:

Better than –70 dBc.

Residual FM (FM off)

Low noise mode: Less than 0.3 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at
**Carrier Frequency** | **1 kHz** | **3 kHz** | **5 kHz** |
---|---|---|---|
100 Hz | 1.0 Hz | 0.5 Hz |
1 kHz | 100 Hz | 50 Hz |
2 kHz | 500 Hz | 250 Hz |
5 kHz | 1 kHz | 500 Hz |
10 kHz | 0.5 Hz | 0.25 Hz |
20 kHz | 0.25 Hz | 0.125 Hz |
30 kHz | 0.125 Hz | 0.0625 Hz |

**Frequency Accuracy**

- **DC to 300 kHz (DC coupled).**
- **10 Hz to 300 kHz (AC coupled).**
- **Bandwidth is limited to 100 kHz in low noise modes.**

**Input Level**

- **1 V RMS** to achieve indicated deviation.

**Modulation Source**

- **Internal LF generator or external via front panel sockets.**

**Modulation Oscillator**

- **Frequency Range:** 0.1 Hz to 500 kHz.
- **Selection:** By keyboard entry of data. Variation by UP/DOWN keys and by rotary control.

**Indication**

- 3 digits with annunciators.

**Resolution**

- 0.1 Hz.

**Accuracy**

- ±0.5% at maximum deviation at 1 kHz.

**Distortion**

- Less than 0.5% additional distortion for frequencies up to 20 kHz.

**Signaling Tones**

- A triangular wave is available for frequencies up to 20 kHz.

**Level Range**

- 0.7 V RMS to 1.4 V RMS sine wave.

**Distortion**

- Less than 0.1% additional distortion for frequencies up to 20 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 UP/DOWN keys and by rotary control.

**Indication**

- 7 digits with unit annunciators for frequency and 4 digits with unit annunciators for level.
2040 series

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.

Common mode voltage ±0.5 V maximum.

Source impedance 5.6 Ω nominal.

Level Accuracy at 1 kHz With a load impedance of greater than 10 kΩ; +5% for levels above 50 mV and ±10% for levels from 500 µV to 5 mV.

Frequency Response Typically better than ±1 dB from 0.1 Hz to 300 kHz.

Sweep Not available in low noise mode.

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

Step Time 1 ms to 10 s per step.

Sweep Ramp Synchronized analog ramp with an amplitude of nominally 0 to 10 V peak on rear panel BNC connector.

Markers Five 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 or steps from point to point on the sweep. Socket is internally connected via 10 kΩ pull-up resistor to +5 V.

Frequency Standard

Frequency 10 MHz.

Temperature Stability Better than ±5 in 10° over the operating range of 0 to 50°C.

Warm up time Within 2 in 10° of final frequency within 10 minutes from switch on at 20°C ambient.

Ageing Rate Better than 2 in 10° 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.

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

GPB INTERFACE A GPIB interface designed in accordance with IEEE 488.2 is fitted as standard.

Capabilities Complies with the following subsets as defined in IEEE Std 488.1, SH1, AH1, TL4, LR1, RL1, PPO, DC1, DT1, CO, E2.

ELECTRO-MAGNETIC COMPATIBILITY: Conforms with the protection requirements of Council Directive 89/336/EEC. Complies with the limits specified in the following standards: EN55011 Class B CISPR 11 EN50082-1 IEC 801-2,3,4 EN60555-2 IEC 555-2

SAFETY Complies with IEC 348, HD401 for class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category 2 supply. Approved to UL 1244.

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 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 settings covering 90-115 V, 105-132 V, 188-242 V and 216-265 V. 45 Hz to 400 Hz. 120 to 180 VA depending on version and options fitted.

CALIBRATION INTERVAL 2 years.

DIMENSIONS AND WEIGHT

(Over projections but excluding front panel handles)

Height Width Depth Weight
152 mm 425 mm 525 mm 21 kg
6 in 16.6 in 20.5 in 46 lb

Options

SECOND MODULATION OSCILLATOR OPTION

Specification as Modulation Oscillator.

PULSE MODULATION OPTION

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

Rise Time Typically 80 ns from pulse input to RF pulse output.

Input Impedance 50 Ω nominal.

OPTION 105 Modifies pulse modulation option for a typical rise and fall time of 2 ns.

+19 dBm RF OUTPUT LEVEL OPTION

For 2040 model only.

RF Output Range −144 dBm to +19 dBm. When AM is selected the maximum output level reduces linearly with AM depth to +13 dBm at maximum AM depth. Overflow allows levels up to +25 dBm to be requested.

Harmonics At RF levels up to + 7 dBm; better than −27 dBc.

AVIONICS OPTION See separate sheet.

RF PROFILE AND COMPLEX SWEEP

See separate sheet.

ELECTRONIC ATTENUATOR

Carrier Frequency Range 250 kHz to 4.35 GHz (2040). 250 kHz to 2.7 GHz (2041).

* Useable to 10 kHz

RF Output Range −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.

Accuracy ±1.2 dB 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.

Versions and Accessories

When ordering please quote the full ordering number information.

Ordering Numbers Versions
2040 10 kHz to 1.35 GHz Signal Generator
2041 10 kHz to 2.7 GHz Signal Generator
2042 10 kHz to 5.4 GHz Signal Generator

Options Options are factory fitted only and must be specified at the time of ordering.

Option 001 Second internal modulation oscillator.

Option 002 Pulse Modalation.

Option 003 +19 dBm Output Level (2040 only).

Option 006 Avionics (requires Option 001, not with Option 003).

Option 008 RF Profile and Complex Sweep.

Option 012 Electronic attenuator (2040 and 2041 only). not available with option 003

Option 105 Modifies the pulse modulation option for slower rise and fall time (order with Option 002).

Option 112 Ext mod 2 Input 600 Ω


Optional Accessories

46880-050 Service manual.

43126-012 RF connector cable, TM 4969/3, 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.

54411-051 Impedance adapter, 50 to 75 Ω, BNC connectors.

54311-095 RF connector cable, 1 m, type N connectors.

43129-589 GRIP Lead assembly.

46884-408 IEEE/IEC Adapter block for GPIB socket.

46884-291 Rack mounting kit (with slides) for rack cabinets with depths from 480 mm to 580 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 bracket only.

46884-444 Maintenance kit 2030/40 series.

46662-525 Transit case.

46662-559 Soft carry case.

54499-044 DECT filter.
2040 series