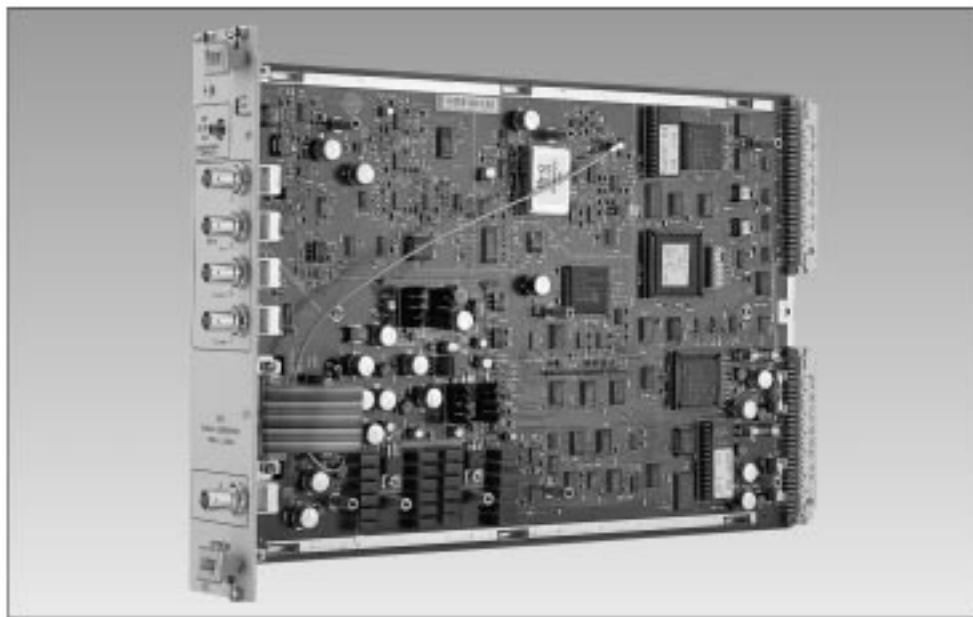




## SIGNAL SOURCES

# 2.4GHz VXIbus Signal Generator Model 3271



- **9kHz to 2.4GHz (1Hz Resolution)**
- **-137dBm to +25dBm RF Output (0.1dB resolution)**
- **Sweep Mode (Lin or Log), and Two Tone Generation**
- **Reverse Power Protection to 50W**
- **Sine, Triangular and Square Wave Modulation Source**
- **Modulation—Amplitude, Frequency, Phase, Pulse, and 2 or 4 Level FSK**

The Racal 3271 VXIbus signal generator packs high-performance signal synthesis and modulation capability into a C-size, dual-slot VXIbus instrument.

The 3271 signal generator, with its wide bandwidth and high level range capability, is ideal for many general-purpose RF laboratory or production test applications required by a wide range of modern digital and analog test systems. The 3271 also provides a compact alternative to GPIB instruments especially where large numbers of signal sources are required,

such as in the testing of Frequency Division Multiplexing (FDM) links. Sophisticated features such as mixed mode modulation and swept carrier mode are available.

### Operation

The message-based 3271 instrument can be programmed by its high level command language or controlled locally using its soft front panel supplied with the VXIplug&play drivers.

Settings of frequency or complete instrument setup can be conveniently stored within the module's memory allowing fast and easy recall.

### Features

Features which provide enhanced operation include non-volatile memories, extensive modulation capability, reverse power protection, internal two tone source, memory sequencing and VXIbus triggering for test sequencing.

## Frequency Selection

Frequency resolution of 1Hz across the complete frequency range of 9kHz to 2.4GHz ensures ample resolution to characterize narrow band communication systems and components.

## RF Output

Output levels up to +19dBm (+25dBm below 1.2GHz) can be set with a resolution of 0.1dB over the entire range. An attenuator hold function allows control of the RF output without introducing RF level dropouts from the step attenuator to facilitate testing of receiver squelch systems.

Output level can be programmed as a voltage, as power into  $50\Omega$ , or in units of dBm (decibels relative to 1mv).

## 50W Protection

A reverse polarity trip mechanism protects the generator output against reverse power of up to 50W and from source VSWRs of up to 5:1. This feature prevents damage if an RF transmitter or DC power supply is accidentally applied to the output contributing to long service life and low cost of ownership.

## Modulation

Comprehensive amplitude, frequency, phase and pulse modulation capabilities are provided for testing all types of receivers.

### Modulation Oscillator

The 3271 internal modulation oscillator system provides the capability of generating one or two tones in the frequency range of 0.01Hz to 20kHz. As an alternative to a sine wave, a triangular or square wave signal can be provided. Two-tone modulation can be used to simulate marker beacon, position localizer and glide slope path signals needed to test and exercise aircraft avionics radio equipment.

### Frequency and Phase Modulation

With a 1dB FM bandwidth of 100kHz and a deviation range of 0 to 100kHz, the 3271 signal generator offers wide frequency modulation capability. AC or DC coupled FM can be selected with low carrier frequency error and drift in the DC coupled mode. The DC coupled mode accurately tests tone and message paging type equipment. Phase modulation is ideal for testing narrow band analog radios with a deviation range of 0 to 10 radians and a 3dB bandwidth of up to 9kHz.

By combining the 3271's phase modulation feature with a Racal Model 3151 or 3152 Waveform Generator, direction finding signals can be produced which can simplify calibration of shipboard navigational equipment.

### Amplitude and Pulse Modulation

Amplitude modulation with a 1dB bandwidth of 30kHz and modulation depths of up to 99.9% with a resolution of 0.1% accommodates testing AM systems and taking EMC immunity measurements. The pulse modulation mode has an on/off ratio of better than 45dB up to 1.2GHz and a rise time of less than 10 $\mu$ s enabling characterization of TDMA or TDD bursts in RF amplifiers and modules.

### 2 and 4 Level FSK

In addition to generating analog FM waveforms, the 3271 signal generator transforms external logic levels into 2 or 4 level frequency shift keying (FSK) waveforms. FSK mode is ideal for testing paging receivers and RF modems. Simple programmed commands set FM deviation level.



Complex Modulation Setup Screen from VXIplug&play Driver Soft Front Panel

### Complex Modulation

A front panel input enables an external source such as a Racal Instruments Model 3151/3152 Waveform Generator to be combined with the internal modulation to simplify the testing of complex receiver systems. Modulation modes may be combined simultaneously to simulate environmental degradation effects on RF signals.

### Sweep Mode

The start and stop frequency, step size, time per step, and mode (linear or logarithmic) for sweep are programmed by the user. Sweep mode operates as a single sweep, continuous sweep or in a single-step mode. Sweep mode can be controlled by software or by using a trigger signal from the front panel or VXIbus backplane.



Sweep Mode Setup Screen from the 3271's VXIplug&play Drivers Soft Front Panel

## Spectral Purity

Measurement of receiver selectivity and ultimate signal to noise ratio requires good spectral purity. The 3271's low residual FM of 4.5Hz and typical sideband noise of 124dBc/Hz (at an offset of 20kHz) allows demanding measurements to be made at an affordable cost.

## EMC

The frequency sweep feature simplifies the making of EMI measurements. A square wave modulation source allows the generation of square wave AM to simulate the effect of TDMA bursts from communication systems. The +25dBm RF output power minimizes the need for external amplifiers when using small test cells or can drive an amplifier for testing large cell components.

## Instrument Setup Memory

The 3271 signal generator provides extensive data storage for simplifying repetitive test scenarios. Up to 100 carrier frequency values and 100 complete instrument setups can be safely stored in non-volatile memory. An additional one hundred complete instrument setups can also be stored in volatile memory allowing access to setup information on-the-fly. This quick access mode produces fast ATE systems.

## Sequencing

A software feature allows sequences of stored instrument settings to be defined. The trigger commands, front panel trigger or backplane trigger can then be used to cycle through the sequence of settings to give the highest throughput rates in automatic test systems.

## Calibration Data

All alignment data, including the internal frequency standard adjustment, is digitally derived. Realignment can be accomplished with protected functions and does not require disassembly of the unit. An elapsed time feature allows the monitoring of the number of hours the product has been in use. The recommended calibration interval of two years keeps ownership costs low.

# 3271 Specifications

## CARRIER FREQUENCY

### Range

9kHz to 2.4GHz

### Resolution

1Hz

### Accuracy

Equal to frequency standard used.

## RF OUTPUT

### Range (FM and PM)

≤1.2GHz: -137dBm to +25dBm  
(20dBm in pulse mode)

>1.2GHz: -137dBm to +19dBm  
(14dBm in pulse mode)

AM: Reduced with increasing modulation.

### Resolution

0.1dB

### Level Accuracy (> -127dBm, 17°C to 27°C)

≤1.2GHz: ± 1dB  
(± 1.5dB in pulse mode)

>1.2GHz: ± 2dB  
(± 2.5dB in pulse mode)

## Temperature Stability (0 to 55°C)

≤1.2GHz: ± 0.02dB/°C

>1.2GHz: ± 0.04dB/°C

### VSWR (< -5dBm output level)

≤1.2GHz: < 1.3:1

>1.2GHz: < 1.5:1

### Output Impedance

50Ω (Female SMA),  
75Ω via external converter

### Reverse Power Protection (into 50Ω)

50 Watts (LED indicated)

### Attenuator Hold (step attenuator inhibit)

Allows a 28dB range (except at min/max levels)

## SPECTRAL PURITY

### Harmonics (7dBm output level)

<-30dBc, typical

### Non-harmonics (offsets > 3kHz)

≤1GHz: <70dBc

<2GHz: <64dBc

≥2GHz: <60dBc

### Residual FM (FM off, RMS)

$f_c = 1\text{GHz}$  (300Hz to 3.4kHz BW): <4.5Hz  
 $f_c < 249\text{MHz}$ : <1Hz (typical)  
 $f_c < 501\text{MHz}$ : <2Hz (typical)  
 $f_c < 1001\text{MHz}$ : <3Hz (typical)

### SSB Phase Noise (at 20kHz offset)

$f_c = 470\text{MHz}$ : <-124dBc/Hz

$f_c = 1\text{GHz}$ : -121dBc/Hz (typical)

## FREQUENCY MODULATION

### Deviation

0 to 100kHz

### Accuracy (at 1kHz)

±5%

## 1dB Bandwidth

DC to 100kHz (DC coupled)  
10 Hz to 100kHz (AC coupled)  
20 Hz to 100kHz (AC coupled with ALC)

### Carrier Frequency Offset (DC coupled)

<1% of set frequency deviation

### Distortion (1kHz rate)

Frequency deviations 10kHz: <0.5%, typical  
Frequency deviations 100kHz: <3%

### Group Delay (<100kHz)

<5 μs

## PHASE MODULATION

### Deviation

0 to 10 radians

### Accuracy (at 1kHz, excluding residual PM)

±5%

## 3dB Bandwidth

100Hz to 10kHz

### Distortion (at 1kHz rate)

phase deviations ≤1radian: <0.5% (typical)  
phase deviations ≤10 radians: <1%

### Resolution

3 digits or 0.01 radians

## AMPLITUDE MODULATION

( $f_c < 500\text{MHz}$ , usable to 2GHz)

### Range

0 to 99%

### Resolution

0.1%

### Accuracy (at 1kHz rate, 17°C to 27°C)

±5% of set depth

### Temperature Stability

<0.02% / °C

## 1dB Bandwidth

DC to 30kHz (DC coupled)  
10Hz to 30kHz (AC coupled)  
20Hz to 30kHz (AC coupled with ALC)

### Distortion (at 1kHz rate)

<2.5% @ depths <80%  
<1.5% @ depths <30%

### PM on AM

0.1 radians (typical)

## PULSE MODULATION

(May be combined with all other modulation modes.)

### Frequency Range

32MHz ≤  $f_c \le 2.4\text{GHz}$ , usable down to 10MHz

### Modulation Input (TTL/CMOS, $R_i = 10\text{k}\Omega$ )

Logic '0' (carrier off): 0 to 1 Volt  
Logic '1' (carrier on): 3.5 to 5 Volts  
Max/Min: ±15 Volts

### On/Off Ratio

RF level reduced by 5dBm and accuracy by ±0.5dB

## EXTERNAL MODULATION

(front panel BNC input)

### Input Level

1 Volt RMS (1.414 Volts pk-pk)

### Input Impedance

100 kΩ nominal

### Modulation ALC (applied modulation level shift)

0.75 to 1.25 Volts RMS

## INTERNAL MODULATION

## OSCILLATOR

(single channel, 1 tone or sum of 2 independent tones)

### Frequency Range

0.01Hz to 20kHz

### Resolution

<100Hz: 0.01Hz

<1kHz: 0.1Hz

<20kHz: 1Hz

### Distortion

<0.1% at 1kHz

### Sine Wave Frequency Response

<20kHz: 1dB (typical)

### Waveforms

Sine: <20kHz

Triangle: <3kHz

Square: <3kHz

(< 6.4μs jitter on any edge)

### Output (front panel BNC)

2 Volts RMS, 600Ω output impedance

## FSK

### Modes

2 level and 4 level

### Data Stream Source (logic level)

2 level: Trigger input connector

4 level: Trigger and Pulse input connectors

### Frequency Shift Range

-100kHz to +100kHz

### Accuracy (at 1kHz)

±5%

### Timing Jitter

±3.2 μs

### Filter

8<sup>th</sup> order Bessel (-3dB at 20kHz)

## SWEEP MODE

### Modes

Linear or Logarithmic

### Step Size (min)

Log Sweep: 0.01% to 50%

Linear Sweep: 1Hz

### Control Parameters

Start Frequency, Step Size, Sweep Type, Stop Frequency, Step Time

### Control Modes

Single Step, Continuous Sweep, Single Sweep

# 3271 Specifications Continued

## Trigger Modes

VXIbus Backplane (0-7)  
External  
Software

## Time Step Increments

50ms to 10s

## INTERNAL FREQUENCY STANDARD

### Frequency Source

10MHz TCXO

### Aging Rate

±1 ppm/year

### Temperature Stability (0°C to 55°C)

±0.5 ppm

## EXTERNAL FREQUENCY STANDARD

### Input Frequency

1MHz or 10MHz

### Input Level

220 mV to 1.8 Volts RMS

### Input Impedance

1kΩ

## CALIBRATION

### Interval

2 years

### Realignment

Remote

### Mechanical Adjustments

None

## FRONT PANEL I/O

### Inputs

Frequency Standard: BNC, 1KΩ, 220mW to 1.8Vrms, 1MHz or 10MHz  
Inputs  
External Modulation: BNC, 100KW  
Trigger/FSK: BNC, TTL/CMOS  
Pulse: BNC, TTL/CMOS

## Outputs

RF: SMA (female), 50Ω, 50W  
Reserve Power Protection  
LF: BNC, 600Ω, 2Vrms  
Internal Frequency Standard: BNC, 50W, 10MHz

## VXIbus INTERFACE DATA

(Message based, VXIbus specifications. 1.3/1.4 compliant)

### Protocol

Word serial , IEEE-488.2  
VXIplug&play Compliant Drivers  
WIN Framework (includes  
LabWindows/CVI driver and soft front  
panel)

### Status Lights

Red: System Failure  
Red: Reverse Power Protection  
Tripped  
Green: Power OK

### Cooling (10°C rise)

Airflow: 2.4l/s  
Backpressure: 1mm H<sub>2</sub>O

### Peak Current & Power Consumption

	+24	+12	+5	-12
I <sub>pm</sub> (A)	1.2	1.0	2.0	0.6
I <sub>dm</sub> (A)	0.1	0.1	1.3	0.1

**Total Power:** 60 Watts

### MTBF (per MIL-HDBK-217F)

23,008 hours

## ENVIRONMENTAL DATA

### Temperature Range

Operating: 0° to 55°C  
Storage: -40°C to +70°C

### Relative Humidity (at 40°C)

Operating: 93%  
Storage: 95%

### Altitude

Operating: 10,000 ft (3050 m)  
Storage: 15,000 ft (4600 m)

### RFI Compatibility

<1GHz: VXIbus Spec. Rev. 1.3/1.4

### EMC (Council Directive 89/336/EEC)

EN55011 Class B EN50082-1 CISPR  
11IEC 801-2,3,4

### Safety (Low Voltage Directive 73/23/EEC)

EN61010-1/IEC1010-1 Class III  
portable equipment, UL3111-1, CSA  
222#1010

### Weight

8.8lbs (< 4 kg)

### Dimensions

C-size, double-wide VXIbus module

 The CE Mark indicates that the product has completed and passed rigorous testing in the area of RF Emissions, Immunity to Electromagnetic Disturbances and complies with European electrical safety standards.

## ORDERING INFORMATION

Model	Description	Part Number
3271	9kHz to 2.4GHz VXIbus Signal Generator	R-3271



<http://www.racalinst.com>

