

GENERAL DESCRIPTION

This section provides an overview of the operation of the SG-811 Swept Signal Generator, a description of the options available, and the specifications to which it is built.

1.1 INTRODUCTION

The Micro-Tel SG-811 Swept Signal Generator is a small, compact signal source that covers the entire frequency range of 10 MHz to 18 GHz without plug-ins. It performs all the functions of a sweeper, and because of its effective shielding, modulation capability, and optional attenuator, it is a conventional signal generator.

A large number of options are available, including internal and external leveling with absolute power calibration, calibrated output attenuator, output filter, signal sample, high pulse on-off ratio, remote digital control, and limited frequency coverage.

A standard feature is the removable RF Unit. All RF components are contained in a single, shielded module within the main frame. This module may be removed from the generator and operated remotely through a control/power cable.

All standard units operate from 115/230 VAC, 50-400 Hz. Operation from 12 VDC is available as an option.

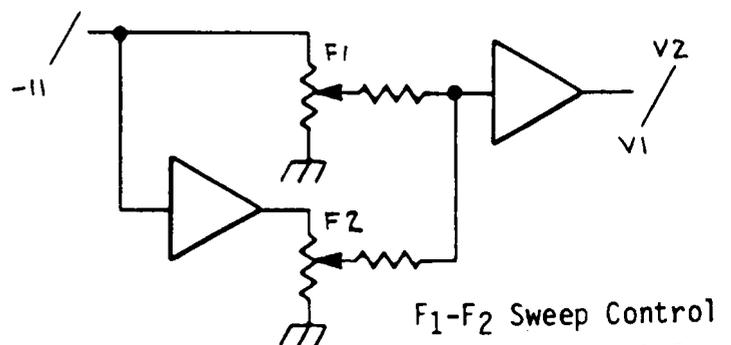
The SG-811A and SG-811B are the same except for power output. As an option, the SG-811C adds solid-state and TWT amplifiers in an external assembly to increase the power above the levels available directly from solid-state sources.

1.2 PRINCIPLES OF OPERATION

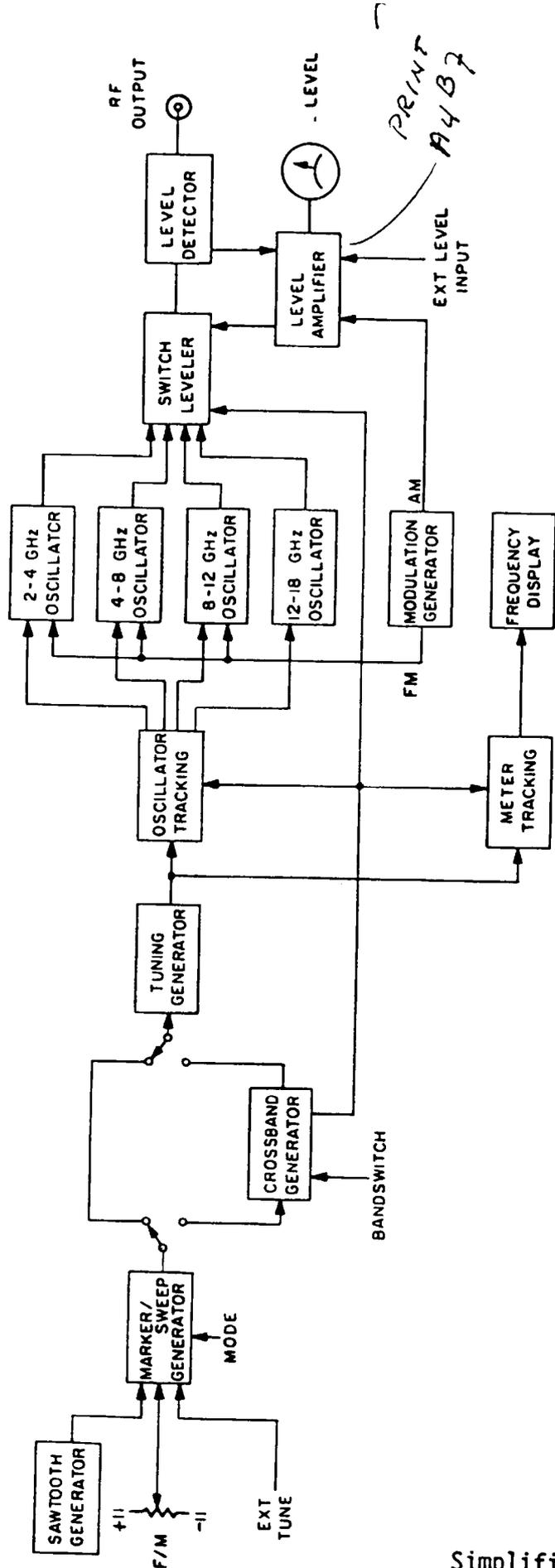
The simplified functional block diagram of the SG-811 is shown in

Figure 1.2. The RF sources are YIG oscillators which are electronically tuned and have a very linear tuning function. The RF output of the four YIG oscillators are switched to the single output port and leveled by a PIN switch. The RF output is sampled by the level detector and compared in the level amplifier circuits to a preset value; the difference is amplified to drive the PIN in the direction to zero this error. The preset value to the level amplifier is varied to produce amplitude modulation and to attenuate the RF output over a 20 dB range.

The composite tuning signal is synthesized in the Marker/Sweep Generator from two components. One is the DC manual tuning voltage at the arm of the selected F/M tuning control; the other is the output of the sawtooth generator. Both components vary from -11 to +11 volts at the low and high limits of each band respectively. The external tuning input may be substituted for either component. In the CW mode, only the DC component is used. In the BAND mode, the full band is swept, and only the sawtooth component is used. In the ΔF mode, the frequency is swept a small percentage about a center frequency, so the composite signal is the DC component summed to an attenuated, adjustable value of the sawtooth. In the F_1-F_2 mode, the generator may be swept between any two frequencies in the selected band, and the tuning signal is generated as shown in Figure 1.3. The F_1 control varies the amplitude of the sawtooth, and the F_2 control varies the amplitude of the inverted sawtooth. The output of both controls is summed to form the composite F_1-F_2 tuning signal.



F_1-F_2 Sweep Control
Figure 1.3



Simplified Functional Block Diagram

Figure 1.2

The marker controls connect between -11 and +11 volts. The marker pulses are generated by comparators which compare the sawtooth with the voltage at the arm of each marker control. The blanking signal is generated by the flyback portion of the sawtooth.

For single band operation the composite tuning signal drives the tuning generator directly, and bands are switched by the front panel control or an external signal. In the crossband mode, the -11 and +11 volt composite signal must tune from the low end of the lowest band to the high end of the highest band. Therefore the composite tuning signal is fed to the crossband generator where it is divided into segments, each segment proportional to one single band. The segments are selected by voltage comparators having their reference inputs set to voltages proportional to the band switch-over points. The comparator outputs are converted to BCD bandswitch commands to select the corresponding YIG oscillator and tracking circuits. Each segment of the original tuning excursion is amplified and offset to extend from -11 to +11 volts and therefore tune the selected oscillator over its full frequency range.

In both single band and crossband operation, the input to the tuning generator extends from -11 to +11 volts. The tuning generator converts this to extend from 0 to +9 volts so that it can be electronically switched to the tracking networks. The tracking networks modify the output of the tuning generator to match the tuning characteristics of each oscillator. Similar tracking networks adjust the input of the digital frequency display to compensate for variations in the individual YIG oscillator tuning characteristics. There is one oscillator tracking network and one meter tracking network for each band.

In addition to its main tuning coil, each YIG oscillator has a small

generator for FM.

If Option 1, coverage from .01 to 2.0 GHz, is included, the output of the 2-4 GHz YIG oscillator is extended to cover 2.31 to 4.3 GHz and is heterodyned by a stable 2.3 GHz source. The difference output of .01 to 2.0 GHz is filtered and amplified.

1.3 STANDARD EQUIPMENT AND OPTIONS

The basic SG-811A and SG-811B Swept Signal Generators contain four YIG oscillators multiplexed to a single output connector, and cover the frequency range of 1.9 to 18 GHz in a single band or four separate bands. Other standard features are:

- *Internal and external leveling
- *Calibrated power level variable over a 20 dB range.
- *Internal FM and squarewave modulation.
- *Remotable RF Unit.
- *Digital control of mode, band and power.
- *External analog frequency Control

label:
1.3.1 10 MHz TO 2.0 GHz - **OPTION 1**

This option adds internal components covering the .01 to 2.0 GHz range in one band. Output from .01-18 GHz is from a single connector with manual band-switching at 2 GHz. Automatic switching at 2 GHz is available on special order with a 3 dB loss of output power.

1.3.2 CALIBRATED OUTPUT ATTENUATOR
OPTIONS 2 and 2A *label*

This option offers the choice of a 70 dB (Option 2) or 110 dB (Option 2A) output attenuator adjustable in 10 dB steps. The attenuators are digital devices and are controlled manually

conjunction with the standard 20 dB continuous control, offers calibrated output to -80 or -120 dBm respectively. Attenuator accuracy is +4% of setting at 18 GHz. Maximum output power is reduced by 2 dB or less, and the variation in leveled output is increased to +1.5 dB.

1.3.3 FILTERED OUTPUT

OPTIONS 3 and 3A

*in. alt
d. abei*

The harmonic output of the YIG oscillators used in the SG-811 is typically 20 dB down. The addition of this automatically-tracked YIG filter reduces the harmonic output to 60 dB. Since the filter has an insertion loss of 6 dB, it can be switched out from the front panel when not in use. The filter is primarily for manually-tuned applications. Option 3 covers 1.9-18 GHz: Option 3A covers 0.4-18 GHz.

1.3.4 RF SAMPLE - OPTION 4

This option provides a signal sample at a nominal level of 0 dBm for use with frequency counters, synthesizers, and stabilizers. Option 4 RF Sample output is 1.9-18 GHz. In Band 1 the RF Sample output is 2.3 GHz above the RF output on the Front Panel.

1.3.5 INTERNAL PULSE GENERATOR

OPTION 5

d. abei

Option 5 adds a fully self-contained pulse capability to the SG-811

with pulse width from 0.1 to 100 usec and PRF from 100 to 10,000 Hz. Rise and fall times are less than 20 nanoseconds. On-Off ratio is 70 dB when using a filtered device such as a receiver with preselector. Means are provided to calibrate the pulse output amplitude. A sync pulse is available, and external pulsing may be employed.

1.3.6 DIGITAL CONTROL AND IEEE 488

OPTIONS 6 and 6A

Frequency of the standard SG-811 can be controlled by an external analog voltage. The standard generator also includes external digital control of band selection, amplitude in 1 dB steps over a 10 dB range, and Mode (CW, F, etc). If BCD digital frequency control is required, Option 6 adds a D-A Converter in the form of a plug-in circuit board. Alternatively, Option 6A provides the same control in the IEEE 488 format. All digital input signals terminate in a rear panel connector.

1.3.7 EXTERNAL DC POWER

OPTION 7

The standard SG-811 operates from 115/230 VAC, 50-400 Hz. This option adds the capability of operating from a negative-ground, DC input over the range of 11.0 to 14.0 volts.

1.4 SPECIFICATIONS

Band	1*	2	3	4	5	6
Frequency Range - GHz	.01-2	1.9-18	1.9-4	4-8	8-12	12-18
Frequency Display Accuracy	<u>+20MHz</u>	<u>+1%</u>	<u>+0.5%</u>	<u>+0.5%</u>	<u>+0.5%</u>	<u>+0.5%</u>
Harmonic Output						
Harmonic Output w/Option 3A						
Non-Harmonic Output						
Peak Residual FM - kHz	10	50	10	15	20	30
Residual AM - 100 kHz BW						
Output Power Control Range	-----20 dB Accuracy <u>+0.2 dB</u> (2)-----					
Frequency Stability - MHz/°C	.4	2.5	.4	.5	1.0	1.5
Leveled Power Output - dBm (3)						
		<u>SG-811A</u>		<u>SG-811B</u>		
.01-2 GHz		7 mW <u>+1 dB</u>		15 mW <u>+1 dB</u>		
2-12 GHz		8 mW <u>+1 dB</u>		15 mW <u>+1 dB</u>		
12-18 GHz		6 mW <u>+1 dB</u>		12 mW <u>+1 dB</u>		
RFI	Less than -80 dBm					
Modes:						
Band	Sweeps entire range selected by bandswitch. Five markers provided.					
F ₁ -F ₂	Sweeps between any two selected frequencies. R Three markers provided.					
ΔF	Sweeps 0-10% about any of five preselected frequencies.					
CW/Manual Sweep	Preset any five frequencies or manually tune entire band.					
Sweep Rate:	Continuously adjustable from .03 to 100 seconds per sweep, except 2-18 GHz is limited to 36 milliseconds minimum sweep time.					
Sweep Modes:	Internal External -- Sync Single Sweep					

Modulation: Internal/External
 - AM 100-10,000 Hz squarewave
 - FM 100-10,000 Hz, 0-5 MHz deviation
 - Pulse (Option 5) 100-10,000 Hz, .1-100 usec 70 dB on-off ratio. 20 ns rise and fall

Size: 5-1/2 x 17 x 18 inches

Weight: 45 pounds

Power Required: 115/230 volts, 50-400 Hz
 12 VDC with Option 7.

* Coverage from .01-2.0 GHz is optional

- (1) Harmonic output below 400 MHz is 20 dB.
- (2) Panel meter is calibrated linearly in dBm and reads output power, ahead of the attenuator if Option 2 or 2A is installed.
- (3) These are minimum leveled power output and maximum leveling variation when operated in crossband mode without options. Expect improvement in leveling to +0.7 dB for operation in single bands. Expect losses in power output of 1 dB per option at 18 GHz when options are switched out. Some variation can be expected because of the various combinations of options. Filtered output (Option 3A) limits at 0 dBm below 2 GHz.

NOMINAL INSERTION LOSS (dB)		
Option	In	Out
1	1.0	1.0
2, 2A	2.0	---
3, 3A	5.0	1.0
4	1.0	---
5	3.0	1.0