

# Microwave

## 6810 Series Microwave Generators

**AEROFLEX**  
A passion for performance.



### Low Phase Noise Synthesized Source with 1Hz resolution

- Models covering frequencies:
  - 10 MHz to 20 GHz
  - 10 MHz to 40 GHz
  - 10 MHz to 46 GHz
- Optional step attenuators
- CW, CW List and swept frequency and power modes of operation
- Optional trigger board
- Modular design for rapid service
- Built-in user level calibration
- Modulation: external FM standard, option generation of internal FM and pulse modulations

#### Synthesized Generator

The synthesized generator has low phase noise and 1 Hz frequency resolution.

VCOs are used for frequencies above 3 GHz and an integrated RF synthesizer for the 10 MHz to 3 GHz range. Internal filtering results in excellent harmonic performance of <-50 dBc.

Optional step attenuators are available to set low output powers for amplifier or receiver testing.

In CW mode the generator can be used for local oscillator substitution. A power sweep is provided for amplifier gain compression testing.

When used with a scalar analyzer the generator provides a swept synthesized output for frequency characterization of components and systems.

#### Modulation

External FM can be applied by connecting an AF source to the rear panel modulation input. With the internal modulation generator option, a modulation generator provides frequency modulation of the source or generates pulse trains that can be applied to a pulse modulator to pulse modulate the source. Pulse trains can be generated as repeating single pulses or as complex multi-pulse patterns. An option for an internal pulse modulator is available, the pulse modulator can be driven with either the optional internal generator or from an external pulse generator connected to the rear panel input connector.

#### List Mode

Frequency list mode provides up to 1024 frequencies that can be entered into a list and output on receipt of a trigger command. The trigger modes comprise: internal continuous, internal single step, RS-232 control lines and external. The trigger sources can be from either: menu softkey, GPIB or RS-232 command (GET or \*TRG) or a TTL trigger if the optional trigger board is fitted.

List mode can be enabled in either forward or reverse direction through the frequency list.

Several lists can be stored as instrument settings to internal memory or floppy disks.

By using a 6230A or L series detector it is possible to perform a recalibration of the source output level.

# SPECIFICATION

## SOURCE

### Functionality

Synthesized CW                      Synthesized sweeper  
 Frequency List mode              CW Power sweep

External Modulation    Optional Internal Modulation, FM + Pulse Driver  
 (Option 23)

Optional Internal Pulse Modulator (Option 025)

### Frequency Range

6813    10 MHz to 20 GHz  
 6815    10 MHz to 46 GHz  
 6815R   10 MHz to 40 GHz

### Resolution (Settable)

6813    1 Hz to 20 GHz  
 6815    1 Hz to 46 GHz

### CW Accuracy

(Frequency Standard error x Frequency) ± 10 Hz

### Swept Accuracy (Typical)

300 ms Step Time  
     10 MHz to 3 GHz                      <20 kHz  
     3 GHz to 46 GHz                      <200 kHz

1 ms Step Time  
     10 MHz to 3 GHz                      <1 kHz  
     3 GHz to 46 GHz                      <10 kHz

10 ms Step Time  
     10 MHz to 3 GHz                      <100 Hz  
     3 GHz to 46 GHz                      <1 kHz

### List Mode Step Time

<500 µs minimum step time per point  
     10 MHz to 3 GHz                      <4 kHz  
     3 GHz to 46 GHz                      <40 kHz

### Levelled Power Range

6813	10 MHz to 20 GHz	-10 to +10 dBm	
6815	10 MHz to 8 GHz	-10 to +8 dBm	+10 dBm typ
	8 GHz to 20 GHz	-10 to +5 dBm	+7 dBm typ
6815R	20 GHz to 24 GHz	-10 to +4 dBm	+6 dBm typ
	24 GHz to 40 GHz	-10 to 0 dBm	+3 dBm typ
	40 GHz to 46 GHz	-10 to 0 dBm typ*	

\* Excluding the effect of connector moding

6813 + Option 011 (70 dB Step Attenuator)  
     10 MHz to 3 GHz                      -80 to +8 dBm  
     3 GHz to 20 GHz                      -80 to +7 dBm

6813 + Option 012 (90 dB Step Attenuator)  
     10 MHz to 3 GHz                      -100 to +8 dBm  
     3 GHz to 20 GHz                      -100 to +7 dBm

6815/6815R + Option 013 (70 dB Step Attenuator)  
     10 MHz to 8 GHz                      -10 to +6 dBm                      +8 dBm typ  
     8 GHz to 20 GHz                      -10 to +2 dBm                      +4 dBm typ  
     20 GHz to 24 GHz                      -10 to +1 dBm                      +3 dBm typ  
     24 GHz to 40 GHz                      -10 to -3 dBm                      0 dBm typ

Note: 1) For option 002 (Field Replaceable connectors) guaranteed levelled output is reduced by 0.5 dB.

2) For option 025, (Internal Pulse Modulation) the guaranteed levelled output is reduced as detailed under the option specification

### Settable Power Range\*

-110 dBm to +20 dBm \*dependant on attenuator option

### Settable Power Resolution

0.01 dB

### Power Sweep Range (from Maximum Levelled Power) Without

### Attenuator

>20 dB

### Internal Levelling Accuracy at 0 dBm (no options fitted)

10 MHz to 3 GHz, ± 0.7 dB  
 3 GHz to 24 GHz, ± 1.0 dB  
 24 GHz to 40 GHz, ± 1.5 dB

### Levelled Power Accuracy With Options 011, 012 and 013

10 MHz to 3 GHz < ±1 dB  
 (± 0.3 dB ± 2% of attenuator setting in dB whichever is greater)  
 3 GHz to 24 GHz < ±1 dB  
 (± 1 dB ± 4% of attenuator setting in dB whichever is the greater)  
 24 GHz to 40 GHz < ±1.5 dB  
 (± 1 dB ± 4% of attenuator setting in dB whichever is the greater)

### Linearity (No Options Fitted) Over Levelled Power Range Relative to 0 dBm

10 MHz to 40 GHz                      < ±0.5 dB

### Power Stability With Temperature (Typical)

10 MHz to 40 GHz                      < 0.1 dB/°C

### Harmonics and Sub-Harmonics Over Levelled Power Range

#### Harmonics

<70 MHz,                      <-25 dBc  
 70 MHz to 24 GHz, <-55 dBc  
 24 GHz to 40 GHz, <-20 dBc

#### Sub-Harmonics

10 MHz to 3 GHz, <-60 dBc  
 3 GHz to 20 GHz, none  
 24 GHz to 40 GHz, <-40 dBc

### Spurious Signals (Typical)

For carrier frequencies                      <375 MHz  
 Offset: 30 kHz to 150 kHz,                      <-50 dBc  
 >150 KHz                      <-55dBc

For carrier frequencies                      >375 MHz  
 Offset: 30 kHz to 150 kHz,                      <-50 dBc  
 >150 KHz                      <-60 dBc

### Phase Noise <dBc/Hz in CW Mode

#### Phase Noise <dBc/Hz in CW mode - guaranteed

CW Freq	Frequency offset		
	1 kHz	10 kHz	100 kHz
0.25 GHz	-86	-95	-108
0.5 GHz	-98	-112	-134
1 GHz	-92	-106	-128
2 GHz	-86	-100	-122
4 GHz	-80	-92	-100
10 GHz	-72	-84	-90
20 GHz	-66	-78	-822
40 GHz	-63	-75	-79

#### Typical Phase Noise <dBc/Hz in CW mode

CW Freq (GHz)	Frequency offset				
	100Hz	1kHz	10kHz	100kHz	1MHz
0.3	-88	-90	-101	-110	-135
0.6	-90	-99	-114	-130	-140
1	-87	-92	-109	-129	-140
3	-76	-86	-100	-120	-138
4	-75	-82	-97	-111	-120
6	-71	-80	-94	-101	-110
10	-68	-73	-87	-100	-110
20	-60	-74	-84	-93	-105
24	-58	-64	-76	-80	-103
40	-55	-63	-75	-79	-100

3 GHz - 46 GHz

DC to >500 kHz typical

**Option 023 Internal Modulation Generator**

**FM Source**

Modulation signal: sinewave, 0.1 Hz to 500 kHz, resolution 0.1 Hz  
Other specifications as for External Frequency Modulation except:  
Accuracy (1 kHz modulating frequency) 20 - 400 kHz deviation  $\pm 5\%$  of indication  $\pm 1$  Hz excluding residual FM

**Pulse Generator Source**

**Modes** Single Pulse

**Pulse Pattern** Pulse patterns comprising up to 256 pulse width/PRI pairs can be set up, stored and recalled.

**Trigger Modes** External, Internal continuous

**Pulse Widths (PW)** 120 ns to >1 second

**Resolution** 120 ns

**Pulse Period (PRI)** 240ns to 7 seconds (PRF <1 Hz to 4.16 MHz)

**Resolution** 120 ns

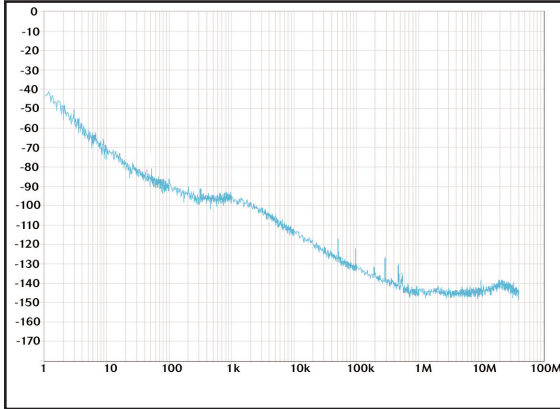
**Pulse Delay** Zero to 100 ms where zero is <120 ns referred to trigger or sync pulse falling edge

**Resolution** 120 ns

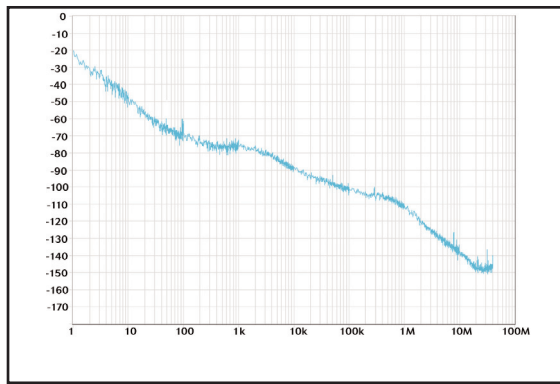
**Sync Output** 120 ns pulse referred to trigger. Available at trigger socket

**Inputs/Outputs**

**Trigger in/out** Rear panel BNC connector provides either trigger input or sync output dependent upon trigger mode. TTL level



Measured Phase Noise at 1 GHz



Measured Phase Noise at 10 GHz

**Options 025a & 025b Internal Pulse Modulator**

**Option 25a (6813)**

**Frequency Range** 50 MHz to 18 GHz  
Usable to 20GHz

**RF Output Range** The levelled power range is reduced by:  
< 3 dB up to 6 GHz  
< 4 dB up to 14 GHz  
< 4.5 dB up to 18 GHz  
when pulse modulation is selected

**RF Level Accuracy** Adds  $\pm 0.3$  dB to the levelled power accuracy specification when pulse modulation is enabled and for powers of < -1 dBm

**Source Harmonics (with Pulse Modulation enabled)**

50 MHz - 2 GHz < -35 dBc  
2 GHz - 20 GHz < -50 dBc

**On/Off Ratio**

50 MHz - 1 GHz > 55 dB  
1 GHz - 9 GHz > 60 dB  
9 GHz - 17 GHz > 70 dB  
17 GHz - 18 GHz > 80 dB  
18GHz - 20GHz > 80 dB (typical)

**Rise/Fall Times** (measured at 10% and 90% of edge)

Rise Time < 8 ns (Typically < 5 ns)  
Fall Time < 12 ns (Typically < 9 ns)

**Option 25b (6815 and 6815R)**

**Frequency Range** 50 MHz to 40 GHz (24 GHz for 6815)

**RF Output Range** The levelled power range is reduced by:  
< 4 dB up to 12 GHz  
< 5 dB up to 20 GHz  
< 6 dB up to 30 GHz  
< 8 dB up to 40 GHz  
when pulse modulation is selected

**RF Level Accuracy** Adds  $\pm 0.3$  dB to the levelled power

**Source Match (Typical)**

1 MHz to 3 GHz, <-15 dB  
3 GHz to 20 GHz, <-10 dB  
20 GHz to 40 GHz, <-8 dB

**Output Connector**

6813 Precision N type, female (standard) or Precision 3.5 mm, female (option)

6815 Precision 2.92 mm female or Field replaceable connectors (option)

**Modulation**

**External Frequency Modulation**

Peak deviation (1 V peak input)

10 MHz - 375 MHz 1 kHz to 5 MHz  
375 MHz - 750 MHz 250 Hz to 1.25 MHz  
750 MHz - 1.5 GHz 500 Hz to 2.5 MHz  
1.5 GHz - 3 GHz 1 kHz to 5 MHz  
3 GHz - 46 GHz 20 kHz to 1 MHz

Accuracy (1 kHz modulating frequency) 20-400 kHz deviation  $\pm 3\%$  of indication  $\pm 1$  Hz excluding residual FM

-3 dB bandwidth, AC coupled mode

10 MHz - 3 GHz <100 Hz to >1 MHz typical  
3 GHz - 46 GHz <100 Hz to >500 kHz typical

-3 dB bandwidth, DC coupled mode

10 MHz - 3 GHz DC to >1 MHz typical

accuracy specification when pulse modulation is enabled and for output powers of < -3 dBm

**Source Harmonics** (with Pulse Modulation enabled)

50 MHz - 375 MHz	< -40 dBc
375 MHz - 24 GHz	< -50 dBc
24 GHz - 40 GHz	< -20 dBc

**On/Off Ratio**

50 MHz - 10 GHz	> 60 dB
10 GHz - 26.5 GHz	> 60 dB (typically > 70 dB)
26.5 GHz - 40 GHz	> 60 dB (typically > 80 dB)

**Rise/Fall Times** (measured at 10% and 90% of edge)

Rise Time	< 7 ns (Typically < 6 ns)
Fall Time	< 1.1 ns (Typically < 10 ns)

**Pulse Modulation Control**

**Modes** Pulse, Pulse CW

External (via rear panel BNC connector)

Internal (if Opt 23 fitted)

**Control**

Control of pulse modulation is:

Internal via soft key menu when the modulation generator option (Opt 023) is fitted or

External via the rear panel BNC Mod in/out socket.

Level is TTL, High = On, Low = Off.

When pulse mod Off is selected the output is the selected CW output level

**Pulse CW** In both internal or external modes, allows setting of output level in the 'On' condition for reference or calibration.

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**FREQUENCY STANDARD**

**Internal 10 MHz OCXO**

**Drift**

± 5 in 10<sup>8</sup> over 0 to 55°C

**Ageing**

± 2 in 10<sup>7</sup> per year (OCXO)

**External Frequency Standard**

1 MHz or 10 MHz, Connector: BNC

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**REAR PANEL CONNECTORS**

**RS-232**

9 way D-type connector, male, Baud rate 300 to 9600

**GPIB Interface**

GPIB is IEEE 488.1 and 488.2 compatible.

**Frequency Standard In/Out BNC**

1 MHz or 10 MHz input and 10 MHz output selectable from front panel

**Mod In/Out BNC**

Mod in/out

Rear panel BNC connector, TTL level. Impedance approx 100 Ω

**External Monitor**

Standard VGA, 640 by 480 color output, 15 way high density D-type female connector

**Voltage Output**

Auxiliary 9-pin connector. Settable for 0 to 10 V ramp, fixed voltage

**External Levelling Input**

Input voltage range: 0 to +1 V, Connector: BNC (f)

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**TRIGGER BOARD OPTION 24**

**External Trigger Input**

Connector: BNC (f)

TTL input to trigger sweep in frequency list mode, Connector: BNC (f)

**Lock Output**

Connector: BNC (f)

TTL output indicating source locked

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**GENERAL FEATURES**

**Display**

Color active matrix TFT liquid crystal display with 16.5 cm (6.5") visible diagonal

**Data Storage and Firmware Upgrade**

3.5" floppy disc drive, 1.44 Mb

**Weight – Model and Option Dependent**

16 kg (35 lb)

Size (Not including front handles)

230 mm H x 430 mm W x 570 mm D (9" H x 17" W x 22" D)

**Power Supply**

Auto-sensing 90 V to 265 V, 45 Hz to 65 Hz AC. Plus 90 V to 110 V, 400 Hz AC. Consumption 150 W

**Rated Range of Use**

Temperature	6813	0 to +50°C
	6815	+5°C to +45°C
Humidity		Up to 93% RH at +40°C

**Conditions of Storage and Transportation**

Temperature	-40 to +71°C
Humidity	Up to 93% RH at +40°C
Altitude	Up to 4570 m (15000 ft)

**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 environment. The instrument is designed to be operated from an Installation Category 2 supply.

## VERSIONS AND OPTIONS

When ordering please quote the full ordering number information.

### Ordering Numbers

Ordering Numbers	Versions
6813	10 MHz to 20 GHz Generator
6815	10 MHz to 46 GHz Generator
6815R	10 MHz to 40 GHz Generator

### Supplied Accessories

46882/662	Operating Manual
43123/076	AC Supply Lead
37591/755	Front Panel Cover

### Options

002	Field Replaceable Precision N (f) or 3.5 mm (f) RF Connectors (6813), 2.92 mm (f) 6815, 6815R
011	20 GHz 70 dB Step Attenuator (only available for 6813)
012	26.5 GHz 90 dB Step Attenuator (only available for 6813)
013	40 GHz 70 dB Step Attenuator (only available for 6815)
023	Internal Modulation
024	Trigger board
025	Internal Pulse Modulator (Opt 25a 6813), (Opt 25b 6815R)

### Complementary Product

6146	500 MHz to 18 GHz Pulse Modulator
6147	70 MHz to 40 GHz Pulse Modulator
54441/019	AC Power Supply for 6146 & 6147

Note : All specifications quoted are for operation at calibration temperature  $\pm 3^{\circ}\text{C}$ .

Specifications involving Type N connectors above 18 GHz are not traceable to national standards as these do not exist at present.

Specifications involving 2.92 mm connectors above 40 GHz are not traceable to national standards as these do not exist at present.

Typical specifications are non-warranted.

## ACCESSORIES

### 6230A/L SCALAR DETECTORS

#### Accessories for level calibration

6230A series Standard Detectors (-65 dBm to +20 dBm) typical

### ACCESSORIES

#### Miscellaneous Electrical Cables

43129/189	GPIB Cable
43139/042	BNC (m) to BNC (m) 1.5 m

#### Standard Microwave Cables

54351/022	0.5 m, 18 GHz, N (m) to N (m)
54351/025	0.5 m, 26.5 GHz, 3.5 mm (m) to 3.5 mm (m)
54351/027	0.5 m, 40 GHz, 2.92 mm (m) to 2.92 mm (m)

#### Attenuators

56534/901	Precision Fixed Coaxial Attenuator 3 dB DC to 18 GHz 5 W, N(m) to N(f)
56534/902	Precision Fixed Coaxial Attenuator 6 dB DC to 18 GHz 5 W, N(m) to N(f)
56534/903	Precision Fixed Coaxial Attenuator 10 dB DC to 18 GHz 5 W, N(m) to N(f)

56534/904	Precision Fixed Coaxial Attenuator 20 dB DC to 18 GHz 5 W, N(m) to N(f)
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### MISCELLANEOUS

46885/038	Rack Mount Kit for 6800
46880	Service Manual
46882/351	Maintenance Manual
84501	Soft Carrying Case
46662/695	Flight Case
54152/001	3.5 mm Torque Wrench
54211/008	Compact Keyboard



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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.

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