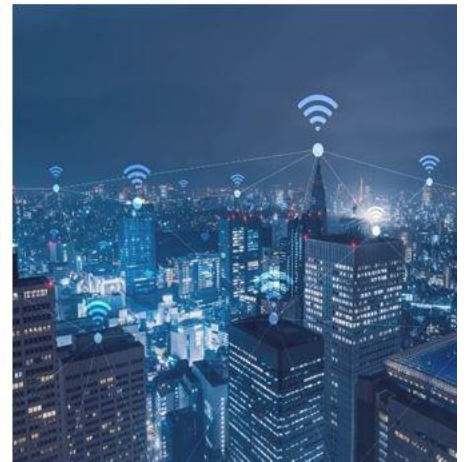
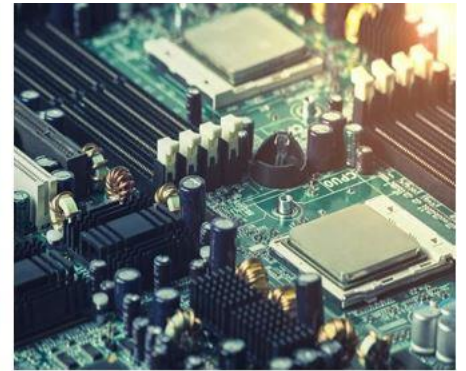


Model 835 Microwave/RF Signal Generator

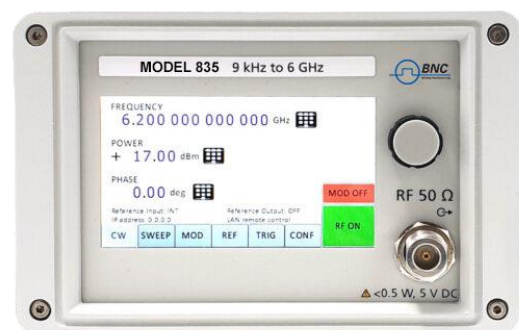


Features

- High Output Power, Low Phase Noise
- Comprehensive AM, Low-Distortion
- Wideband DC-FM, and High-Speed Pulse Modulation
- Powerful Trigger and Sweeping Modes
- Portable Battery Operation

Applications

- R&D Low Noise Signal Source
- Production Testing
- Service and Maintenance
- Signal Simulation
- Aerospace and Defense
- Installation and Maintenance



Model 835 Datasheet

9 kHz to 6 GHz RF / Microwave Signal Generator

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DEFINITIONS

The specifications in the following pages describe the warranted performance of the instrument for 23 ± 5 °C after a 30-minute warm-up period (unless otherwise stated).

Min/Max: Parameter range that is guaranteed by product design, and/or production tested. Warranted performance specifications include guard-bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Typical: Expected mean values, not warranted performance.

INTRODUCTION

Model 835 models comprise a set of very compact, portable analog signal generator models from 9 kHz up to 6100 MHz. A combination of good signal purity, fast switching speed and wide dynamic range makes these units useful for a variety of applications.

The Model 835 is a series of low-noise and fast-switching analogue signal generators covering a frequency range from 9 kHz up to 4.0, and 6.1 GHz, respectively.

The Model 835 provides full RF signal generator capabilities including OCXO-stabilized low phase-noise signal with micro-Hz frequency resolution, wide and accurately levelled output power range, extensive modulation capabilities, and fast switching. It is targeted for a wide range of applications where a high-quality analogue signal is mandatory, offering an alternative to expensive high-end RF signal generators, where small size and excellent RF performance at an attractive cost is required.

The very compact and rugged design of the Model 835 operates at very low DC power consumption (only 12 watts), with minor heat dissipation and not requiring a noisy fan. This gives the Model 835 a great advantage in laboratories or production test facilities. The low power design allows the use of optional internal battery modules which make it a truly portable instrument, ideally suited for field testing, installation, and maintenance.

Available Options:

- **Option PE3** is an optional power level extension to accurately level below -120 dBm
- **Option B3** adds an internal rechargeable battery module
- **Optional AVIO** adds dedicated avionics modulation like VOR/ILS
- **Option 1URM** modifies form-factor to a 19" rack-mountable 1U enclosure
- **Option EB6** adds an external power bank adapter cable with voltage converter for 12 to 25 V supply

The Model 835 supports various standard interfaces such as USB (USBTMC), LAN (VXI-11), or GPIB and extensive API with programming examples are available.

SPECIFICATIONS

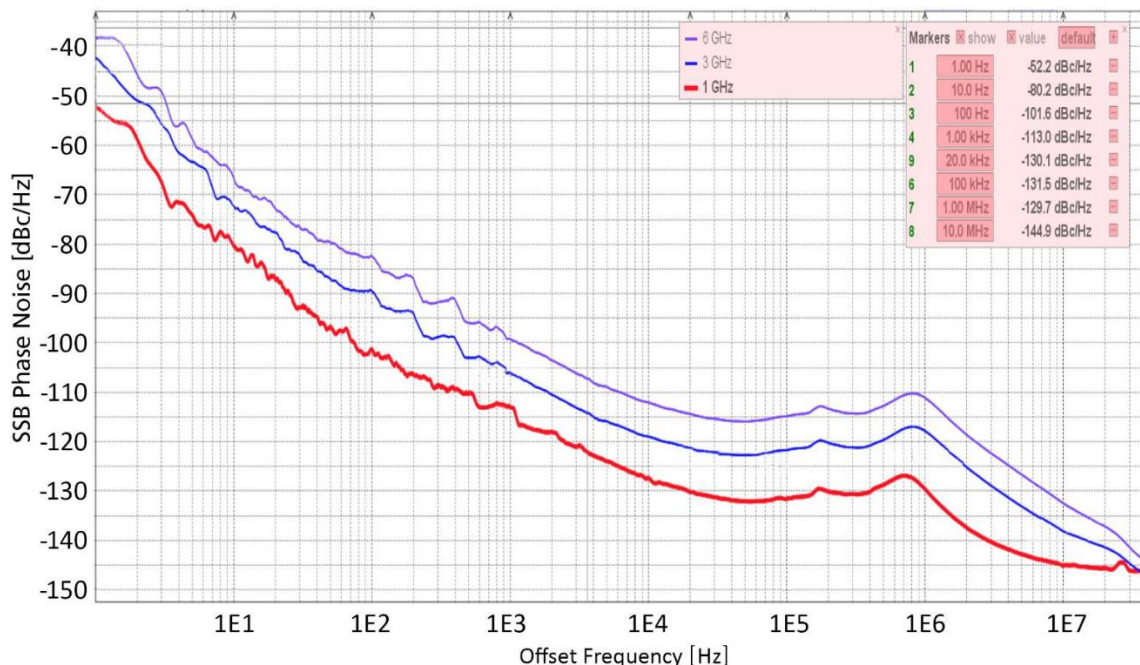
Frequency Parameters / Range

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Range	9 kHz		4 GHz 6 GHz	835-4 835-6
Resolution		0.001 Hz		
Phase Resolution		0.1 deg		
Settling Time		20 μ s 20 μ s	100 μ s 200 μ s	<= SN xx-xxx2xxxxx-xxxx >= SN xx-xxx3xxxxx-xxxx
Frequency update rate		400 μ s		time from receipt of SCPI command firmware
List/sweep mode		400 μ s		
Total Jitter		68 fs RMS		10 Hz to 1 MHz BW
Reference frequency input	8 MHz		200 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			+/- 1.0 ppm	
Reference input impedance		50 Ω		
Internal reference frequency output		10 MHz		
Initial accuracy of internal reference		\pm 40 ppb		calibrated at 23 \pm 3 $^{\circ}$ C at time of calibration
Temperature stability (0 to 50 degC)			\pm 100 ppb	
Aging 1 st year		0.5 ppm		
Aging per day (after 30 days operations)			5 ppb	
Warm-Up time		5 min		
Output of internal reference		+0 dBm 50 Ω		

Phase Noise

PARAMETER	MIN	TYPICAL	MAX	NOTE
SSB Phase noise				
At 20 kHz from carrier		-130 dBc/Hz	-128 dBc/Hz	See measured phase noise plots

Figure 1: Phase Noise Performance (3 and 6 GHz)



Level Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Power Level				See plots on page 8
Without Option PE3	-30 dBm		+18 dBm	>50 MHz & <6 GHz
With Option PE3	-120 dBm		+10 dBm	<= 50 MHz
Resolution		0.01 dB		>50 MHz & <6 GHz
Level Uncertainty		0.3 dB	< 0.8 dB	<= 50 MHz
		0.5 dB	< 1.3 dB	-20 to + 10 dBm
		0.8 dB		-80 to -20 dBm
				< -80 dBm

Figure 2: Typical Maximum Output Power (without Option PE3)

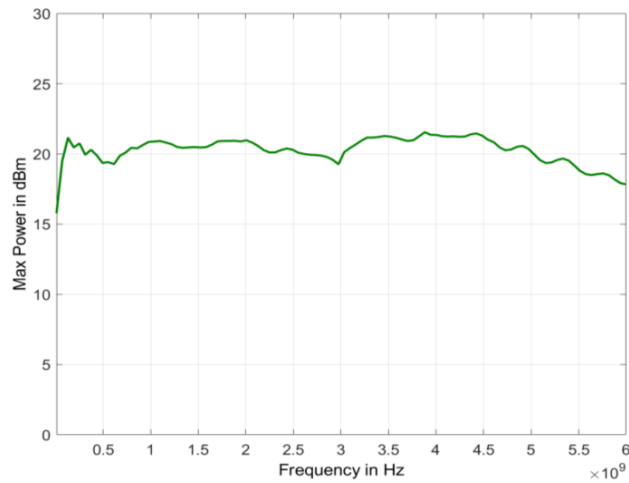
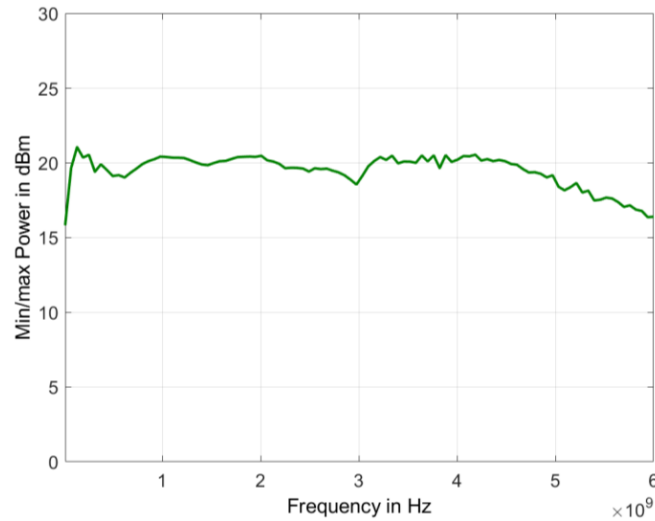


Figure 3: Typical Maximum Output Power (with option PE3)



Reverse Power Protection and VSWR

PARAMETER	MIN	TYPICAL	MAX	NOTE
Reverse Power Protection				
DC Voltage		30 V		
RF Power			36 dBm	
Output Impedance		50 Ω		
VSWR		1.5	1.8	< 3 GHz
		1.7	2.0	> 3 GHz

Spectral Purity

PARAMETER	MIN	TYPICAL	MAX	NOTE
Spectral Purity				
Output Harmonics > 3.7 GHz		-40 dBc	-30 dBc	$P_{out} = +10$ dBm Option FILT
Sub-harmonics		-80 dBc	-70 dBc	
Non-harmonic spurious < 1 MHz		-70 dBc	-60 dBc	$P_{out} = +10$ dBm
1 MHz to 5.8 GHz		-65 dBc	-55 dBc	
5.8 GHz to 6.1 GHz		-60 dBc	-50 dBc	
Residual FM @ 1 GHz			3 Hz	0.3 kHz to 3 kHz, weighted (ITU-T)
			12 Hz	0.03 kHz to 23 kHz

Figure 4: Harmonic Performance at + 10 dBm

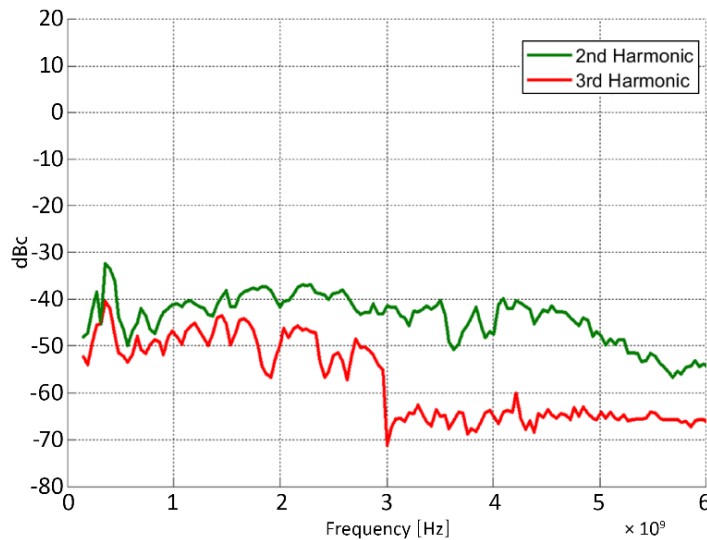
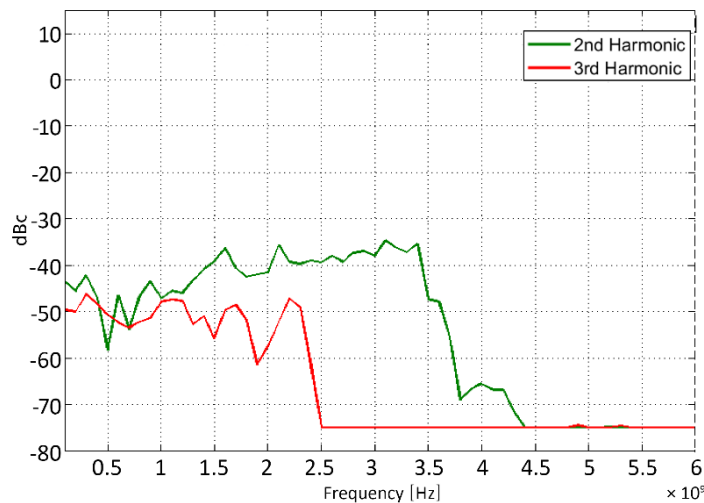


Figure 5: Harmonic Performance with option FILT



Sweeping Capability

Sweeps can be performed with combined internal or external AM/FM/PM/Pulse modulation running. With modulation enabled, the minimum step time increases to 2 ms.

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Sweep				

Sweep type: linear, logarithmic, random

Step time (t_{stop})	400 μ s		19998 s	
Dwell time (t_{dwell})	50 μ s		9999 s	
Off-time (incl. transient time)(t_{off})	0 / 50 μ s		9999 s	
Timing accuracy per point		1 μ s		

Generalized List Sweep

Allows individual setting of frequency, power, dwell-time, and off-time for each point

List size	2		20.000	
Step time (t_{step})	200 μ s		19998 s	
Dwell time (t_{dwell})	50 μ s		9999 s	
Off-time (incl. transient time) (t_{off})	0 / 50 μ s		9999 s	
Time resolution		0.1 μ s		
Timing accuracy per point		1 μ s		

Modulation Capabilities

All modulation types (FM, PM, AM, and pulse modulation) may be simultaneously enabled except: FM and phase modulation cannot be combined. For example, AM and FM can run concurrently and will modulate the output RF.

Pulse Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Modulation				
On/Off ratio		70 dB		
Repetition Frequency	DC		33 MHz	
Pulse width	30 ns 50 μ s		20 s 20 s	ALC hold ALC on
Pulse rise/fall time		25 ns		
Pulse trainlength (pulses)	2		4192	
Video crosstalk		-40 dB		
External input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External input voltage range	-0.5 V		+5.5 V	TTL compatible
External input hysteresis		60 mV		
Delay (to RF)		20 ns	40 ns	

Frequency Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Modulation				
Maximum Frequency deviation (peak)	0 0		0.05·f N·200 MHz	< 0.25 GHz 0.25 GHz to 0.75 GHz (N=0.125) 0.75 GHz to 1.5 GHz (N=0.25) 1.5 GHz to 3 GHz (N=0.5) > 3 GHz to 6.1 GHz (N=1)
Modulation waveforms	Sine, triangle, FSK			
Modulation Rate	1 Hz/DC		800 kHz	-3dB frequency response Max. phase deviation degrades above 20 kHz modulation rate
External input sensitivity	< N · 100 MHz for 1 Vpp			settable in AC mode discrete values in DC mode
Total harmonic distortion	< 1%			1 kHz rate & N · 100 kHz deviation

Frequency Chirps

(linear ramp, up/down)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Span			10%	
Dwell time (t_{chirp})	10 ns		60 s	
Slope			100 MHz/ μ s	
Total duration of finite repeated chirps (t_{chirp} * repetitions)			64.1 s	

Number of frequencies			20.000	
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Phase Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Phase Modulation				
Phase deviation (peak)	0		N·80 rad	
Modulation rate	1 Hz		800 kHz	> -3dB frequency response
Modulation waveforms	Sine, triangle, FSK			
External Input sensitivity	N · 40 rad for 1 Vpp			
Total Harmonic distortion	< 1%			1 kHz rate & N · 20 rad deviation

Amplitude Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Amplitude Modulation				
Modulation Rate	10 Hz		20 kHz	applies for internal and external >= SN xx-xxx5xxxxx-xxxx
	10 Hz		50 kHz	
Modulation Depth	0%		95%	
Modulation Waveforms	Sine, triangle, square			
Accuracy (f<10 MHz)		1.3%	2%	f-carrier, modulation depth <80% & 1 kHz modulation rate, power 0 dBm
Distortion (f<10 MHz)		1.6%	3%	
Accuracy (f>10 MHz)		0.6%	1.4%	
Distortion (f>10 MHz)		1%	2%	
External input sensitivity	X% per 1 Vpp			settable

Avionics Modulation (Option AVIO)

PARAMETER	TYPICAL	NOTE
ILS		
Localizer RF frequency	108 to 112 MHz	
Nominal tone frequencies	90 & 150 Hz	
Frequency accuracy	< 0.02 Hz	
Centerline (in %)	DDM: 0 ± 0.1; SDM: 40 ± 2.0	
Fly left (in %)	DDM: 15.5 ± 0.5; SDM: 40 ± 2.0	
Fly right (in %)	DDM: -15.5 ± 0.5; SDM: 40 ± 2.0	
Flag (in %)	DDM: 0 ± 0.1; SDM: 30 ± 2.0	
Glide Path RF frequency	328.6-335.4 MHz	
Angle of Descent (in %)	DDM: 0 ± 0.1; SDM: 80 ± 3.0	
Fly up (in %)	DDM: 17.5 ± 0.5; SDM: 80 ± 3.0	
Fly down (in %)	DDM: -17.5 ± 0.5; SDM: 80 ± 3.0	
Flag (in %)	DDM: 0 ± 0.1; SDM: 70 ± 2.5	
VOR RF frequency	108 - 118 MHz	
Subcarrier Frequency	9960 ± 2.0 Hz	
FM deviation	480 Hz	
AM tone	30 ± 0.02 Hz	
Bearing north	TDM: 30 ± 2.0 %	
Bearing south	Phase: 180 ± 0.5 deg TDM: 30 ± 2.0 %	
Bearing East	Phase: 90 ± 0.5 deg TDM: 30 ± 2.0 %	
Bearing West	Phase: 0 ± 0.5 deg TDM: 30 ± 2.0 %	
Test 1	Phase: 270 ± 0.5 deg TDM: 20 ± 1.5 %	
Test 2	Phase: 0 ± 0.5 deg TDM: 40 ± 2.0 % Phase: 0 ± 0.5 deg	

Multi-Purpose Output (FUNC OUT)

Output in FUNC OUT at rear panel

PARAMETER	MIN	TYPICAL	MAX	NOTE
MULTIFUNCTION GENERATOR				
Sine, triangle, square wave				
Frequency range	10 Hz 10 Hz 10 Hz		3 MHz 1 MHz 50 kHz	Sing Triangle square
Frequency resolution		0.6 Hz		
Output voltage amplitude peak-peak	10 mV		2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1%		< 100 kHz, 1 Vpp
Output impedance		50 Ω CMOS		Sine, triangle Squarewave
VIDEO OUTPUT (of internal pulse modulator)				
Output		CMOS		
Period	30 ns		50 s	
Pulse width	15 ns		50 s	
RF delay		10 ns		
TRIGGER OUT Synchronization mode for multiple sources				
Modes	Trigger on sweep start Trigger on each point			
Trigger waveform pulse width		100 ns		

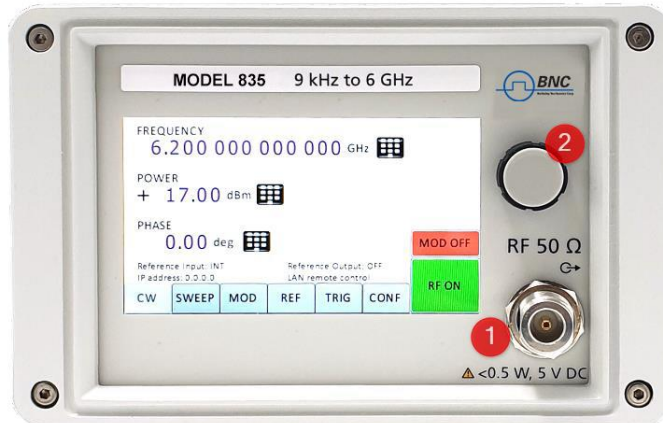
Trigger (TRIG IN)

Input is TRIG IN at rear panel

PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger Types	Continuous, single, gated, gated Direction			
Trigger Source	RF key, external, bus (GPIB, LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset and run			
Trigger Latency		Tbd		
Trigger Uncertainty		5 μs		
External trigger delay	50 μs		40 s	
External Delay resolution		15 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			
External Trigger input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External Trigger input voltage range	-0.5 V		+5.5 V	TTL compatible
External trigger input hysteresis		60 mV		

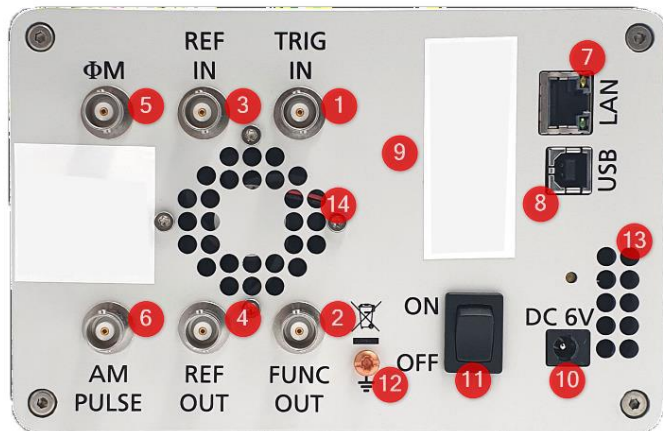
CONNECTORS

Front (with Touch Screen Display)



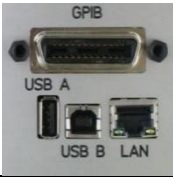

1. RF output N female
2. Rotary knob

Rear



- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Trigger input BNC female 2. Function output BNC female 3. External reference input BNC female 4. Internal reference output BNC female 5. FM/PM modulation input BNC female 6. AM and Pulse modulation BNC female 7. LAN connection RJ-45 8. USB 2.0 device | <ol style="list-style-type: none"> 9. GPIB IEEE-488.2, 1987 with listen and talk (optional) 10. DC Power plug (6V, 6 A) 11. DC Power switch 12. Ground screw 13. Vent Holes: Air Intake. 14. Vent Holes: Air Exhaust |
|--|--|

ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
835	835	9 kHz – 4000 MHz Signal Generators
835	835	9 kHz – 6100 MHz Signal Generators
835	Option B3	Internal rechargeable battery module
835	Option PE3	Mechanical step attenuator
835	Option FILT	Harmonic Filtering
835	Option FLASH	MicroSD card slot for removable SD memory
835	Option GPIB	GPIB interface 
835	Option EB6	External power bank adapter cable with voltage converter for 12 to 25 V supply Required input connector: Inner / outer diameter 2.1 / 5.5 mm
835	Option AVIO	Avionics modulation capability (VOR/ILS)
835	Option 1URM	1U rack-mount module Dimensions 1.7 in H x 16.8 in W x 18.1 in L (42 mm H x 426 mm W x 460 mm L) 
835	Option RM	19" 3 U rack-mount kit
835	Option REAR	Move output to the rear panel
835	Option OEM	OEM package
835	Option IEC	IEC 17025 calibration with certificate
835	Option Bag	Portable Bag
835	Option Retrofit	Applies when options are back-ordered

GENERAL CHARACTERISTICS

Remote Programming Interfaces:

- Ethernet 100BaseT LAN interface
- USB 2.0 host & device
- GPIB (IEEE-488.2, 1987) with listen and talk (optional)
- Control language SCPI Version 1999.0

Power requirements: 6 VDC; 20 W maximum

Mains adapter supplied: 100-240 VAC/ 6 V 6.0 A DC out

Storage temperature range: -40 to 70 °C

Operating temperature range: 0 to 45 °C

Operating and storage altitude: up to 15,000 feet

CE Safety/EMC complies with applicable Safety and EMC regulations and directives.

Weight 6 lbs (≤ 2.5 kg) net, 8 lbs (≤ 4 kg) shipping

Dimensions (W x L x H)

Excluding connectors: 6.83 x 9.84 x 4.60 in [172 x 250 x 106 mm]

Including connectors: 6.83 x 10.66 x 4.60 in [172 x 273 x 106 mm]

Recommended calibration cycle: 24 months

Compatibility languages supporting commonly used commands

Agilent Technologies N5181A MXG, Aeroflex, Rohde & Schwarz SMA and SML models

Document History

Version	Date	Author	Notes
V10	2010-06-01	Jk	First release
V11	2010-08-01	Jk	Mechanical information added
V12	2010-11-01	Jk	options
V13	2010-12-30	Jk	Measurements added
V131	2011-03-10	Jk	Concurrent sweeps / modulation
V140	2011-04-28	Jk	Front panel, measurement plots
V142	2011-05-20	Jk	Reference output 10 MHz, Pmax adjusted
V143	2011-09-01	Jk	Phase noise plot
V144	2012-09-15	Jk	Reference input range adjusted
V145	2012-09-15	Jk	Added trigger, chirps, pulse trains
V146	2013-08-26	Db	Modified sweep timing specs
V147	2013-10-04	Db	Added frequency settling time specs
V148	2014-01-21	Jk	Corrected dimensions
V149	2014-02-06	Jk	Maximum power plot added
V150	2014-06-30	Jk	New phase noise plot
V200	2014-12-10	Jk	Unified data sheet for 835 series
V210	2015-05-10	Jk	Updated sweeping timing parameters
V211	2015-06-23	Db	Added >= SN xx-xxx5xxxxx-xxxx AM bandwidth data
V212	2016-07-05	db	Added option PE data
V214	2016-12-15	jk	Refine power level accuracy
V215	2017-05-15	jk	Option AVIO
V216	2017-08-15	jk	VSWR Spec refined
V217	2019-01-30	mm	Dimension update
V218	2019-03-25	Mm	New layout
V219	2019-07-10	Ee	Minor corrections
V220	2020-09-15	Db	Clarified Power accuracy at > + 10 dBm
V221	2020-11-11	Ee	Updated product images
V222	2021-01-10	Jk	New power plots
V223	2021-02-25	Db	Pulse and trigger input electrical specifications
V224	2021-05-10	Ee	Added option EB6 & images for option GPIB and 1URM
V225	2023-04-05	Ee/mh	Removed Option LH, updated non-harmonic spur data
V226	2023-05-16	Ap	Added Option FILT
V227	2023-11-27	Ap	Refined AM modulation
V228	2023-11-30	db	Multi-Purpose Output (FUNC OUT) and RF out VSWR specifications
V228	2024-03-20	At	Edited options and lower fr models
V229	2024-04-03	At	Updated level uncertainty
V230	2024-06-05	At	Refined chirp modulation

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