

AM/FM Signal Generators

2018A & 2019A



test & measurement instruments

- 2018A: 80 kHz to 520 MHz
2019A: 80 kHz to 1040 MHz
- Frequency resolution 10 Hz up to 520 MHz, 20 Hz above 520 MHz
- High output level: up to 2 V e.m.f. (+13 dBm)
- Excellent output level accuracy
- Reverse power protection up to 50 W
- Auxiliary f.m. input socket for combining modulation signals
- Choice of nine output calibration units
- Offset calibration
- Comprehensive amplitude, frequency and phase modulation
- Optional GPIB programmability
- Non-volatile memory with 100 settings
- Powerful fault diagnostic aid system
- Variable a.f. oscillator output level
- Variants available for enhanced f.m., avionics, 10 kHz carrier and pulse applications

Signal Generators 2018A and 2019A are synthesized generators similar except for their frequency range—80 kHz to 520 MHz and 80 kHz to 1040 MHz respectively. Microprocessor control provides simple and rapid operation by direct keyboard entry of settings and the non-

volatile memory, which can store up to one hundred settings, further reduces measurement time. Optional GPIB programmability extends the range of applications to include use in automatic test systems.

The excellent overall performance and wide range of

facilities provided ensure that the generators have many uses in development, production and maintenance areas and for military applications. These features are further enhanced in four variant models.

Frequency selection

Selection of carrier frequency is accomplished by direct entry via the keyboard or over the General Purpose Interface Bus (GPIB), with indication by an 8 digit liquid crystal display and units annunciators. Frequency resolution is 10 Hz up to 520 MHz, and 20 Hz above 520 MHz. Carrier frequencies can be stored in the non-volatile memory with immediate recall when required. A CARRIER ON-OFF switch is provided to completely disable the output. Provision is made for operation with an external reference frequency of 1 MHz or 10 MHz as required.

Selection of frequencies above the upper limit of each generator is inhibited, but carrier frequencies below 80 kHz can be set with a warning appearing on the display. The generators are usable down to 30 kHz with minimal degradation of performance. One of the variant options provides a lower carrier frequency limit of 10 kHz for tests on l.f. communications equipment.

An incrementing facility permits stepping of carrier frequency in precisely defined increments of any size with an indication of total shift by use of the TOTAL SHIFT key and with provision for instant return to the starting frequency.

Output

RF output levels up to 2 V e.m.f. (+13 dBm) can be set by direct keyboard entry or via the GPIB, with resolution of at least 0.1 dB over the entire range and a total accuracy of ± 1 dB from 80 kHz to 520 MHz and ± 2 dB above 520 MHz. Levels are indicated on a four-digit liquid crystal display with units annunciators. Output levels can be incremented in steps of any size and up to twenty level settings can be stored in the memory.

A choice of nine calibration units is available to the operator and provision is made for the simple conversion of units (e.g. dBm to μ V). Calibration data for the output level is held in the memory and may be altered from the front panel using a protected key sequence or over the interface bus.

The output level can be offset by up to ± 2 dB from the calibrated value to compensate for cable or switching losses external to the generator. The operator may also use this facility as a means of deliberately offsetting the output level to ensure that all generators in an area give identical measurements. While using the offsetting facility the main calibration of the generator is not lost and may be returned to at any time.

Modulation

Comprehensive a.m., f.m. and ϕ .m facilities are provided for testing all types of receivers. A MOD ON/OFF key is fitted to allow signal-to-noise ratio checks to be made, and a six-frequency a.f. oscillator is included to facilitate frequency response measurements. A front-panel socket provides a variable level output from the a.f. oscillator.

The wide range frequency modulation provides f.m. deviation up to 5.2 MHz for 2018A and up to 10.4 MHz

for 2019A. Excellent f.m. accuracy is ensured by the storage of calibration values in the memory. Phase modulation is available with a deviation range of up to 520 radians for 2018A and up to 1040 radians for 2019A. Amplitude modulation is provided up to 99% depth. Modulation settings can be stored in the memory for recall when required. It is also possible to increment the deviation and depth settings.

External modulation is possible with a wide band input of 50 Hz to 100 kHz for f.m., 50 Hz to 10 kHz for ϕ .m. and 20 Hz to 50 kHz (d.c. coupled) for a.m. A modulation levelling function is included which can be disabled when not required. HI and LO lights are provided as an aid to maintain calibrated modulation. They are extinguished when the input level is in the range $1V \pm 5\%$.

An auxiliary f.m. input is provided to allow a low level modulation signal to be mixed with either internal or external modulation. This facility is provided to allow sub-audible tones to be applied with standard modulation when testing military or commercial radio receivers which require such tones to lift the squelch.

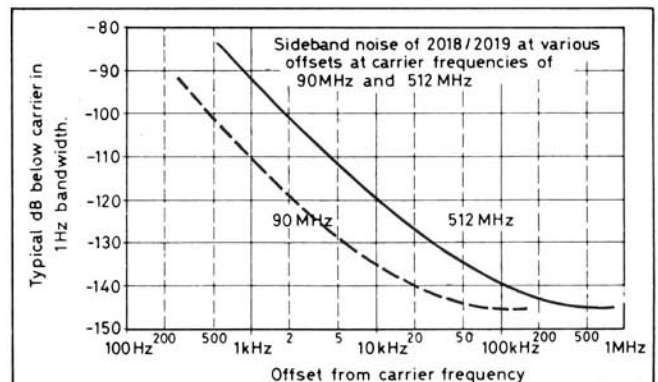
Enhancements offered by the variants provide pulse modulation, improved a.m. and extended f.m. bandwidth. Pulse modulation is intended for use in the testing of radar systems, and improved a.m. for testing avionics equipment. The extended f.m. bandwidth variant is ideal for stereo broadcast measurements and tests on mobile radio equipment fitted with digital signalling circuits.

Incrementing

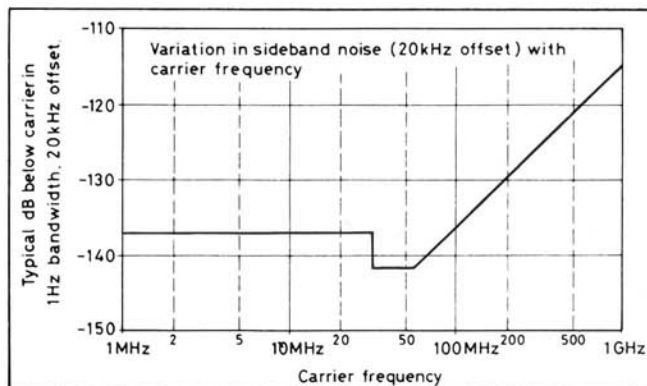
All parameters can be incremented or decremented in steps of any size, which may be simply entered via the keyboard of GPIB. If no step size is entered for a parameter the steps are pre-set to 1 kHz for carrier frequency, 1 kHz for f.m. deviation, 1 radian for ϕ .m. deviation, 1% for a.m. depth and 1 dB for output level.

A single tap on either the UP or DOWN key moves the parameter by one step. If the key is held down the parameter steps once, waits one second and then moves at three steps per second. For search purposes it is possible to reverse this stepping direction without the one second delay.

Operation of the TOTAL SHIFT key displays the variations in all parameters from their original settings. Use of the RETURN key sets the selected parameter back to its start value.



2018A & 2019A



Spectral purity

Good in-band and sideband noise performances allows the generators to be used for all in-band tests and many out-of-band tests. Sideband noise figures better than -130 dBc/Hz at 20 kHz offset and at 90 MHz are obtained. Sideband noise improves at a rate of 6 dB per octave as carrier frequency is reduced. Typical sideband noise curves are shown below.

Harmonically related signals are better than -30 dBc for carrier frequencies up to 520 MHz and better than -20 dBc above 520 MHz. Non-harmonics are better than -70 dBc above 2.03126 MHz and -60 dBc below.

Non-volatile memory

The inclusion of a non-volatile semiconductor memory for storage of up to twenty complete generator settings and a further eighty carrier frequencies ensures that settings are retained even when the generator is switched off, without relying on a battery. Any of the sets of data can be instantly recalled when required for later use and the UP/DOWN keys may be used to step through a sequence of tests. A further feature enables a single group of preset measurement values to be recalled automatically at switch-on.

In addition to storage and recall of measurement settings, non-volatile memory contains other useful data. Calibration data — on r.f. level, f.m. accuracy and r.f. calibration units—are retained in these stores and may be altered using protected Second Functions. Output level offset values are also retained in the instrument's memories and may be selected or deselected by Second Function operation.

Status information stored includes type and serial number, internal/external standard and GPIB address. Elapsed time indicators are also accessed via the internal memories. One stores the number of operational hours since the instrument was manufactured and cannot be altered. The other records the number of elapsed hours since the clock was last reset; re-setting being accomplished using a secure Second Function.

In GPIB operation the non-volatile memory may also be used to store a user-defined string. Up to 32 ASCII characters may be written to, or read from the 2018A or 2019A, for example to record the instrument's inventory information, date of last calibration, normal instrument location etc.

Programming

2018A and 2019A can be simply fitted with the optional GPIB interface so that all functions can be controlled

over the bus. The instruments function as talkers as well as listeners. In the listen mode the generator's functions are set by simple instructions, and in the talk mode, strings of information containing details of the instrument's settings can be sent back over the bus, allowing the controller to check that information has been transferred without error or to learn settings for later use.

Ease of programming is ensured by careful selection of mnemonics. For example to send a carrier frequency of 123.456 MHz a frequency deviation of 3.5 kHz and an output level of $1.74 \mu\text{V}$, and to place these settings in store 10 of the memory, it is only necessary to send over the bus the instruction:

CF123.456MZ, FM3.5KZ, LV1.74UV, ST10.

The use of commas as delimiters in the instruction string is not essential but often aids interpretation of program lines.

Service requests (SRQs) are sent for a variety of reasons including reverse power protection tripped and illegal characters received. SRQs may be inhibited if desired by setting flags in the generators using a Second Function.

Programming speed is enhanced by the provision of a buffer memory which stores GPIB commands and allows the controller to continue with other tasks whilst the received data is processed by the generator.

To ensure compatibility with existing systems using 2018 or 2019, a Second Function command may be invoked that allows software written for the earlier models to be used with 2018A and 2019A.

Second Functions

The front panel Second Function key gives access to a number of different features available with 2018A and 2019A. Some of these are related to maintenance, calibration and programmable operation via GPIB. To prevent accidental interference with the contents of internal memories, those Second Functions that enable the internal data to be altered are protected by a secure key sequence.

Two levels of protection are offered, appropriate to the Second Function being accessed. The most secure is reserved for Second Functions that alter the instrument's calibration data, change its identity string, protect its store settings or blank the displays when memories are recalled. Less severe is the first level of protection, which enables the user to access those Second Functions that do not affect the fundamental calibration, but which may be relevant to normal operation. Examples include the selection of: r.f. level calibration units, r.f. level offsets, external standard frequency and switch-on status.

In addition, unprotected Second Functions provide a range of additional operating features, such as the ability to display status information, elapsed time, type and serial number, as well as controlling the auxiliary output socket on the GPIB module.

Maintenance and calibration

The generators have been designed to have excellent reliability. The use of liquid crystal displays to reduce power consumption ensures cool running without the need for a cooling fan, and eliminates all the associated

routine maintenance and cleaning of filters. The packing density of the instruments has been deliberately kept low to aid cooling and to improve access.

The Second Function mode provides powerful fault diagnostic aid facilities from the front panel or via the GPIB by allowing the operator to send data directly to individual latches in the instrument. The resulting changes in output conditions can be monitored and the area in which the fault lies can be localized quickly.

RF level, f.m. accuracy and frequency accuracy can be adjusted without removing the instrument's covers. Level and f.m. accuracy can be adjusted over the GPIB, leading to fully automatic calibration routines.

Careful mechanical design of the instruments ensures rapid access to all circuits for p.c.b. or component replacement. The main r.f. assembly is hinged and the front panel can be lowered as shown in the photograph. Printed boards interconnect by means of plugs and sockets and all except the r.f. oscillator board can be changed without significant re-calibration, so simplifying first-line maintenance.

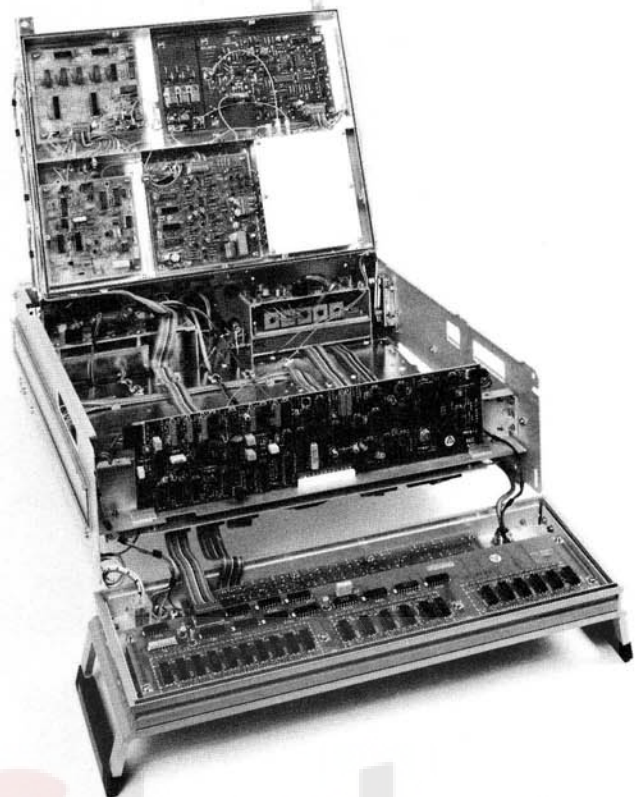
A full servicing manual is available and an optional maintenance kit provides the necessary r.f. extension cables, l.c.d. insertion and extraction tools, etc.

Variants

The 2018A/2019A range of signal generators is extended by the addition of four optional variants, which may be mixed to obtain a combination of performance features.

An extended f.m. bandwidth variant gives improved stereo separation for broadcast applications and adds digital signalling capabilities for tests on pagers and mobile radio receivers.

A second variant offers an enhanced a.m. performance, making it suitable for avionics applications. In particular, VOR/ILS signals can be handled with a specified d.d.m. performance of better than 0.045%.



Provision is made in another variant for operation down to 10 kHz, and this v.l.f. option is fully compatible with all other variants with the exception of the avionics variant.

Radar r.f. and i.f. stages can be tested with the aid of a variant that offers the extra facility of pulse modulation. The pulse mode is selected by pressing the AM PULSE and FM PULSE keys simultaneously. Pulse modulation can then be switched on and off using the MOD ON/OFF key.

GENERAL DESCRIPTION		2018A and 2019A are synthesized signal generators covering the frequency range 80 kHz to 520 MHz and 80 kHz to 1040 MHz respectively. The output may be amplitude, phase or frequency modulated using either the built-in a.f. oscillator or an external source. All control settings are entered from a front panel keyboard. Three liquid crystal displays give simultaneous readout of frequency, modulation and output level. Remote control via the General Purpose Interface Bus is available as an option.	Selection	By keyboard entry. Units may be μV , mV, V e.m.f. or p.d.; dB relative to 1 μV , 1 mV, 1 V e.m.f. or p.d.; dBm.
CARRIER FREQUENCY			Indication	4 digit l.c.d. with units annunciators.
Range	2018A: 80 kHz to 520 MHz, usable down to 30 kHz. 2019A: 80 kHz to 1040 MHz, usable down to 30 kHz.		Resolution	0.1 dB or better over entire voltage range.
Selection	By keyboard entry.		Output level accuracy	± 1 dB from 80 kHz to 520 MHz. ± 2 dB above 520 MHz.
Indication	8 digit l.c.d.		Output impedance	50 Ω , type N female socket to MIL 39012/3D. For output levels below 300 mV e.m.f. the VSWR is better than 1.2 : 1 for carrier frequencies up to 520 MHz and better than 1.5 : 1 for carrier frequencies above 520 MHz.
Resolution	10 Hz up to 520 MHz, 20 Hz from 520 to 1040 MHz.		Reverse power protection	An electronic trip protects the generator output against reverse power of up to 50 W from d.c. to 1 GHz. The trip may be reset from the front panel or via the GPIB.
Accuracy	Equal to the frequency standard accuracy. See FREQUENCY STANDARD.		SPURIOUS SIGNALS	
RF OUTPUT			Harmonically related signals	For output levels less than 1 V e.m.f., better than -30 dBc for carrier frequencies up to 520 MHz and better than -20 dBc for carrier frequencies above 520 MHz.
Level	0.2 μV to 2 V e.m.f. (-127 to $+13$ dBm) in c.w., f.m. and ϕ .m. modes. 0.2 μV to 1 V e.m.f. (-127 to $+7$ dBm) in a.m. mode.			

2018A & 2019A

Sub-harmonics	None for carrier frequencies up to 520 MHz. -20 dBc for carrier frequencies above 520 MHz.
Non-harmonically related signals	Better than -70 dBc for carrier frequencies from 2.03126 MHz to 1040 MHz. Better than -60 dBc for carrier frequencies from 80 kHz to 2.03125 MHz. (At offsets from the carrier of 3 kHz or more.)
Residual f.m.	Less than 6 Hz r.m.s. in CCITT telephone psophometric band at 520 MHz and improving by approximately 6 dB per octave with reducing carrier frequency down to 2.03126 MHz.
Single sideband phase noise	Better than -130 dBc/Hz at 90 MHz and 20 kHz offset from the carrier. Typical performance curves are shown in the text.
RF leakage	Less than 0.5 μ V p.d. generated in a 50 Ω load by a two-turn, 25 mm loop, 25 mm or more from the case of the generator with the output level set to less than -10 dBm and the output terminated in a 50 Ω sealed load.
FREQUENCY MODULATION	
Range	Peak deviation from 0 to 100 kHz for carrier frequencies up to 2.03125 MHz. Peak deviation from 0 to 1% of carrier frequencies above 2.03125 MHz.
Selection	By front panel keyboard. Internal source (see AF OSCILLATOR) or external input may be selected.
Display	3 digit l.c.d.
Deviation accuracy	\pm 5% of deviation at 1 kHz modulating frequency excluding residual f.m.
Frequency response	\pm 1 dB from 50 Hz to 100 kHz relative to 1 kHz. Usable down to 10 Hz with reduced deviation.
Distortion	Less than 3% total harmonic distortion at 1 kHz modulating frequency and a deviation of up to 70% of maximum available at any carrier frequency. Less than 0.3% total harmonic distortion at 75 kHz deviation at carrier frequencies from 88 MHz to 108 MHz at 1 kHz modulating frequency using internal a.f. oscillator or external source with ALC OFF.
External modulation	With modulation a.l.c. on the deviation is calibrated for input levels between 0.8 V p.d. With modulation a.l.c. off, the deviation is calibrated for an input level of 1 V p.d. HI and LO LEDs are provided as an aid to maintaining calibrated modulation in the ALC OFF mode. When the HI and LO l.e.d.'s are extinguished, the input voltage will be in the range 1 V \pm 5%. Input impedance: 100 k Ω nominal.
PHASE MODULATION	
Range	Modulation index: 0 to 10 radians for carrier frequencies below 2.03125 MHz; 0 to a value in radians equal to the carrier frequency in MHz, for frequencies above 2.03125 MHz.
Selection	By front panel keyboard. Internal source (see AF OSCILLATOR) or external input may be selected.
Display	3 digit l.c.d.
Accuracy	\pm 5% excluding residual ϕ .m.
Frequency response	\pm 1 dB from 50 Hz to 10 kHz w.r.t. 1 kHz.
Distortion	Less than 3% total harmonic distortion at 1 kHz modulating frequency.
External modulation	With modulation a.l.c. on the deviation is calibrated for input levels between 0.8 V and 1.2 V p.d. With modulation a.l.c.
AMPLITUDE MODULATION	
Range	0 to 99% in 1% steps.
Selection	By front panel keyboard. Internal source (see AF OSCILLATOR) or external input may be selected.
Display	2 digit l.c.d.
Accuracy	Better than \pm (4% of depth setting + 1%) for modulation depths up to 95% at 1 kHz modulating frequency and carrier frequencies up to 400 MHz.
Frequency response	\pm 1 dB from 20 Hz to 50 kHz relative to 1 kHz at 80% depth d.c. coupled.
Envelope distortion	Less than 3% total harmonic distortion for modulation depths up to 80% at 1kHz modulating frequency and carrier frequencies up to 400 MHz. Less than 2% total harmonic distortion for modulation depths up to 90% at 1 kHz modulating frequency for carrier frequencies up to 32 MHz.
External modulation	With the modulation a.l.c. on the modulation depth is calibrated for input levels between 0.8 V and 1.2 V p.d. With the modulation a.l.c. off, the modulation depth is calibrated for an input level of 1 V p.d. HI and LO l.e.d.'s are provided as an aid to maintaining calibrated modulation in the ALC OFF mode. When the HI and LO l.e.d.'s are extinguished, the input voltage will be in the range 1 V \pm 5%. Input impedance; 100 k Ω nominal, d.c. coupled.
AF OSCILLATOR	
Frequencies	300 Hz, 400Hz, 500 Hz, 1 kHz, 3kHz and 6 kHz selected sequentially by repetitive pressing of the AF OSC key.
Display	Six l.e.d.'s indicate selected frequency.
Frequency accuracy	\pm 5%
Output level	0.1 mV to 5 V into a load of 2 k Ω or greater, selected by keyboard entry. Output may be entered in mV, V or as dBm into 600 Ω . Capable of driving a 600 Ω load for levels below 2V. Source impedance less than 10 Ω .
Level accuracy	\pm 5% for output levels above 50 mV. \pm 10% for levels from 0.5 to 50 mV.
Distortion	Better than 0.1% total harmonic distortion for a 1 kHz output frequency at an audio level of 5 V r.m.s. into 100 k Ω .
FREQUENCY STANDARD	
Frequency standard Input/Output	Internal or external frequency standard may be selected from the front panel. Annunciators show which is selected. A rear-panel BNC socket provides an output from the internal frequency standard at either 1 MHz or 10 MHz when internal standard is selected. This socket becomes the external standard input when external standard is selected.
INTERNAL FREQUENCY STANDARD	
Frequency	10 MHz.
Temperature stability	Better than \pm 0.1 p.p.m. over the temperature range 0 to 40°C.
Warm-up time	Within 0.5 p.p.m. of final frequency 5 minutes from switch-on at 20°C ambient.

Ageing rate	Better than 0.1 p.p.m. per month after 1 month's continuous use at constant ambient temperature.	↑ and ↓	Increment or decrement the selected function (including memories).
Internal standard output	Either 1 MHz or 10 MHz at nominally 3 Vp-p square wave. Source impedance 100Ω nominal.	TOTAL Δ	Display total shift from last keyed-in value.
EXTERNAL FREQUENCY STANDARD		RETURN	Return setting to last previously keyed-in value for the selected function. (In remote operation requests return to local control).
External standard input	Accepts either a 1 MHz or 10 MHz signal of at least 1 V r.m.s. Frequency is selected by Second Function control. Maximum input 2.5 V. Input impedance: 100 Ω nominal.	INT EXT	If pressed after Carrier Freq., toggles between internal and external frequency standard. If pressed after AM, FM, or ΦM, toggles between internal and external modulation.
AUXILIARY INPUTS AND OUTPUTS		MOD ON-OFF	Toggle AM, FM or ΦM between ON and OFF.
Modulation input	A front panel BNC socket accepts an external modulation input. The input signal may be levelled by selecting the MOD ALC ON/OFF key. Two l.e.d. indicators, HI and LO, provide an aid to maintain calibrated modulation in the ALC OFF mode.	AF ON-OFF	Toggle between a.f. oscillator ON and OFF.
Internal a.f. oscillator output	The output can be set between 0.1 mV and 5 V into 2 kΩ or greater, selected by keyboard entry. Output may also be entered in dBm into 600 Ω by means of the keyboard selection. The output frequency is always that of the AF OSC and is short-circuit proof. At switch-on the AF level is set to 1 V. Capable of driving a 600 Ω load for levels below 2 V. Output impedance: less than 10 Ω.	CARRIER ON-OFF	Toggle between r.f. output ON and OFF.
External modulation input	ALC ON: Input level nominally 1 V into 100 kΩ. ALC OFF: 1 V is required for calibrated conditions. When the HI and LO l.e.ds are extinguished the input voltage will be in the range 1 V ± 5%.	AF OSC	Sequentially select one of six internal a.f. oscillator frequencies.
Alternative RF output and modulation sockets	Blanked holes are provided so the RF output socket and modulation input/output sockets can be fitted to the rear panel for systems use.	MOD ALC	Toggle between modulation a.l.c. ON and OFF.
Auxiliary FM input	Deviation: With the FM on (INT or EXT) the application of 1 V to the AUX FM INPUT will result in a f.m. deviation of 10% of that indicated on the modulation display. With φ.m. selected (INT or EXT) the application of 1 V will result in an f.m. deviation in kHz equal to the phase deviation in radians shown in the modulation display. Accuracy: ± 15% Impedance: 600 Ω nominal. This facility is intended to allow the insertion of sub-audible tones used in receiver testing.	STORE and RECALL	Provide storage and recall of instrument settings in non-volatile memory. Up to 20 complete instrument settings and up to 80 carrier frequencies may be stored.
KEYBOARD AND DISPLAYS		SECOND FUNCT.	Select Second Function entry mode.
Main keyboard functions	All instrument settings are controlled by the front panel keyboard. The main key functions are: CARRIER FREQ FM 7 8 9 MHz/V AM ΦM 4 5 6 kHz/mV RF LEVEL AF LEVEL 1 2 3 Hz/μV STORE RECALL 0.-%/rad/dB Settings are entered by selecting the required function, keying in the value and pressing the appropriate units key. Other functions provided are: △ Increment key. When pressed before a function key, increment values may be displayed and, if required, may be changed.	Secondary keyboard functions	The following secondary functions may be selected using the Second Function key followed by one or more number keys.
		Unprotected functions	0 Second Function protection 1 Display instrument status (GPIB address, calibration offsets, 1 or 10 MHz external standard, level of protection, RF output level units etc.) 2 Display/change GPIB address 3 Direct addressing of internal latches (servicing aid) 4 Display/change GPIB SRQ mask 9 Elapsed time display (since last reset) 11 Read identity string (type and serial number) 12 Write a user-defined string (GPIB only) 13 Read a user-defined string (GPIB only) 18 Set data on GPIB auxiliary output pins
		Protected functions	5 Display/change RF level units 6 Display/change RF level offset 14 Select 1 or 10 MHz external frequency standard 15 Select old/new GPIB command set 16 Select start-up with settings recalled from Store 10
		Doubly protected functions	7 RF calibration 8 FM calibration 9 Reset elapsed time display 10 Display total instrument operating time 17 Reserved for calibration 190 Write identity string setting 191 Protect store settings 192 Blank display of recalled stores

2018A & 2019A

Displays	Three liquid crystal displays provide simultaneous read out of Carrier Frequency, Modulation and RF Level. Carrier frequency display: 8 digit display with annunciators to show frequency units, external frequency standard, frequency limit exceeded and remote operation. Modulation display: 3 digit display with annunciators to show modulation units, FM, Φ M, AM, modulation off, external modulation selected and modulation limit exceeded. Level display: 4 digit display with annunciators to show level units, output off, reverse power trip operated and level limit exceeded.												
GPIB INTERFACE	A GPIB interface is available as an option. All functions except the supply switch are remotely programmable. In addition to allowing full GPIB control of the instrument, the GPIB module has an auxiliary output socket which can be used to control relays etc.												
Capabilities	Complies with the following subsets as defined in IEEE 488-1978 and IEC Publication 625-1. SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1.												
RADIO FREQUENCY INTERFERENCE	Conforms with the requirements of EEC directive 76/889 as to limits of r.f. interference.												
SAFETY	Complies with IEC 348.												
RATED RANGE OF USE (Over which full specification is met)													
Temperature	0 to 55°C.												
CONDITIONS OF STORAGE AND TRANSPORT													
Temperature	-40°C to +70°C.												
Humidity	Up to 90% relative humidity.												
Altitude	Up to 2500m (pressurised freight at 27 kPa differential, i.e. 3.9lb/in ²).												
POWER REQUIREMENTS													
AC supply	Switchable voltage ranges 105 to 120 V, 210 to 240 V, all \pm 10% 45 to 440 Hz. 85 VA maximum.												
DIMENSIONS AND WEIGHT (over projections but excluding optional front panel handles)	<table border="1"> <thead> <tr> <th>Height</th> <th>Width</th> <th>Depth</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>152 mm</td> <td>425 mm</td> <td>525 mm</td> <td>16 kg</td> </tr> <tr> <td>6 in</td> <td>16.7 in</td> <td>20.7 in</td> <td>35.2 lb</td> </tr> </tbody> </table>	Height	Width	Depth	Weight	152 mm	425 mm	525 mm	16 kg	6 in	16.7 in	20.7 in	35.2 lb
Height	Width	Depth	Weight										
152 mm	425 mm	525 mm	16 kg										
6 in	16.7 in	20.7 in	35.2 lb										

EXTENDED FM BANDWIDTH VARIANTS

FREQUENCY MODULATION	Specification is the same as for the standard models with the following exceptions.										
Stereo separation	For carrier frequencies between 88 MHz and 108 MHz. Better than 50 dB at 1 kHz. Typical separation:-										
	<table border="1"> <caption>Stereo Separation Data</caption> <thead> <tr> <th>Modulation frequency (kHz)</th> <th>Stereo Separation (dB)</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>47</td> </tr> <tr> <td>30</td> <td>56</td> </tr> <tr> <td>8</td> <td>56</td> </tr> <tr> <td>15</td> <td>51</td> </tr> </tbody> </table>	Modulation frequency (kHz)	Stereo Separation (dB)	20	47	30	56	8	56	15	51
Modulation frequency (kHz)	Stereo Separation (dB)										
20	47										
30	56										
8	56										
15	51										

Frequency response	\pm 1 dB from 50 Hz to 100 kHz relative to 1 kHz. Usable down to 1 Hz with reduced deviation. The instrument is suitable for testing receivers requiring signalling tones with a frequency content down to 1 Hz.
Carrier frequency settling time (FM ON)	The fitting of the extended FM bandwidth option results in the settling time of the instrument in the FM ON mode being approximately 5 s to within 100 Hz of the final frequency.

AVIONICS VARIANTS

	Specification is the same as for the standard models with the following exceptions.
CARRIER FREQUENCY	
Range	2018A: 1.5 MHz to 520 MHz. 2019A: 1.5 MHz to 1040 MHz.
RF OUTPUT	
Level accuracy	\pm 2 dB from 1.5 MHz to 5 MHz. \pm 1 dB from 5 MHz to 520 MHz. \pm 2 dB from 520 MHz to 1040 MHz (2019A only).
AMPLITUDE MODULATION	
Envelope distortion	Less than 3% total harmonic distortion for modulation depths up to 80% at 1 kHz modulating frequency for carrier frequencies up to 400 MHz.
DDM performance	Better than 0.045% a.m. difference in depth of modulation for ILS tones at 90 Hz and 150 Hz each of 40% modulation depth.

PULSE MODULATOR VARIANTS

	Specification is the same as for the standard models with the following exceptions.
RF OUTPUT	
Level accuracy	With pulse modulation not selected: \pm 1 dB from 80 kHz to 520 MHz, \pm 3 dB from 520 MHz to 1040 MHz (2019A only). With pulse modulation selected and +5 V applied to pulse modulation input (i.e. carrier on): \pm 1.5 dB from 80 kHz to 520 MHz, \pm 4.5 dB from 520 MHz to 1040 MHz (2019A only). N.B. With pulse modulation selected the maximum output level is reduced to +3 dBm.
PULSE MODULATION	
Carrier pulse response	Rise time less than 100 ns. Fall time less than 100 ns.
Carrier on/off ratio	Better than 65 dB at 70 MHz carrier frequency reducing linearly to better than 50 dB at 520 MHz carrier frequency, and then to better than 35 dB at 800 MHz carrier frequency.
Propagation delay pulse input to carrier pulse	Typically 280 ns.
Input	Rear panel BNC connector. Input impedance: 50 Ω nominal. Nominal signal levels: 0 V for carrier off, +5 V for carrier on.
Selection and display	Pulse modulation is selected by pressing the AM PULSE and Φ M PULSE keys simultaneously. It is then switched on and off using the MOD ON/OFF key.

EXTENDED LF CARRIER RANGE VARIANTS

CARRIER FREQUENCY	Range	2018A: 10 kHz to 520 MHz. 2019A: 10 kHz to 1040 MHz.
RF OUTPUT	Level accuracy	± 1 dB from 10 kHz to 520 MHz. ± 2 dB from 520 MHz to 1040 MHz (2019A only).

Specification is the same as for the standard models, with the following exceptions:

VERSIONS AND ACCESSORIES

VERSIONS

	Single Option			
Standard Version	52018-910P 52019-910E			
Avionics	52018-402B 52019-402J	Avionics		
10 kHz carrier	52018-404A 52019-404G	Combination not available	10 kHz carrier	
Pulse Modulation	52018-408U 52019-408D	52018-410E 52019-410W	52018-412Y 52019-412T	Pulse Modulation
FM Extension	52018-401R 52019-401L	52018-403K 52019-403F	52018-405Z 52019-405V	52018-409Y 52019-409T
FM Extension with Pulse Modulation		52018-411U 52019-411D	52018-413N 52019-413P	

ACCESSORIES

When ordering please quote eight digit code numbers

Ordering numbers	Supplied Accessories
	AC supply lead 43129-076Y Operating manual 46881-511A (H52018-910P Vol. 1) for 2018A and 2019A.
54433-001U 43129-189U 46881-365R	Optional Accessories GPIB Module. GPIB Lead Assembly. GPIB Manual H554811-010P (contains details of general GPIB protocols). IEEE/IEC Adapter Block for GPIB socket. Maintenance Kit. Front Handle Kit. Rack Mounting Kit. RF Connecting Cable TM4969/3) 50 Ω 1.5m, BNC.
46883-408K 54711-033E 46883-511R 46883-506M 43126-012S	Impedance Adapter 50/75 Ω, BNC Connectors.
54411-051X	Service Manual H52018-910P Vol. 2 (for 2018A and 2019A).
46881-512Z	Coaxial Adapter N Male to BNC Female. Connector cable, 1m, Type N Connectors.
54311-092P 54311-095C	Carrying Case.
46662-086S	

