Marconi
Instruments

100 Hz – 400 MHz Spectrum Analyzer and Display

2382/2380

2382 Spectrum Analyzer. 15566/4

- ☐ 100Hz to 400MHz frequency range, covers audio to VHF
- ☐ ± 1dB total level accuracy, reduces measurement uncertainties. Includes ±0·4 dB frequency response
- ☐ Colour display option
- ☐ High resolution of 0·025 dB and 1 Hz
- ☐ Fully GPIB programmable for integration into ATE or assisted operation
- ☐ Two steerable markers for absolute & relative measurement of levels and frequencies
- ☐ Wide dynamic range for low-level intermodulation measurement
- ☐ Resolution bandwidths down to 3Hz allow close-in signal analysis
- ☐ Integral tracking generator gives precise response characterization
- ☐ Extensive range of special function keys to save time and effort
- ☐ Two independent traces for detailed signal analysis
- ☐ Comprehensive screen annotation on clear, convenient display
- ☐ Automatic comprehensive self-calibration for maintained measurement accuracy
- ☐ Keypad and dedicated rotary control of major parameters

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Two units, the 100Hz to 400MHz Spectrum Analyzer type 2382, and the Display type 2380, together form the high performance Spectrum Analyzer. Advanced RF design and microprocessor control are combined to provide outstanding accuracy, resolution and stability to meet the most exacting demands in all areas of signal and response analysis. The instrument offers a comprehensive measurement capability for a wide range of applications, including audio, ultrasonics, HF, VHF, and certain UHF measurements.

The local oscillator, which is synthesizer-controlled in 1 Hz steps, provides the stability required to make highly precise measurements. High instrument resolution is ensured by the extremely low noise sidebands, low internal drift and excellent filter design. Sweeps can be made on spans as narrow as 10 Hz/division, with resolution bandwidths down to 3 Hz.

Automatic self-calibration with digital correction contributes to the unprecedented total level accuracy of ± 1 dB which includes the frequency response of ± 0·4 dB. The level specification includes all sources of uncertainty such as RF attenuation, IF filters, logarithmic amplifier, temperature drift and display quantization.

The high-performance mixers used in the design provide the extremely high intermodulation rejection and wide dynamic range, which together enable intermodulation products to be measured to at least 90 dB down.

A wide choice of 12 resolution bandwidths (3Hz to 1MHz in a 1, 3, 10 sequence) ensures that the appropriate filter is always available to provide optimum resolution for any chosen frequency span. The good shape factors of the filters, better than 11:1, make possible the measurement of close-in signals. For example, 50Hz and 60Hz hum sidebands can be detected as low as 80dB down on the carrier. Careful RF design minimizes residual and spurious responses; it also ensures reduced RF interference generated by the instrument, to facilitate measurement of low-level signals.

TRACKING GENERATOR

The integral tracking generator, with an accuracy of ±1Hz referred to the tuned frequency, enables rapid swept frequency measurements to be made over a wide dynamic range of at least 115dB. Tracking generator accuracy provides the stability and resolution required to characterize highly precise devices such as crystal and SAW filters, to a resolution of 0·025 dB. The output level may be changed, allowing measurements of the frequency response of level-sensitive devices, such as amplifiers and mixers.

The instrument incorporates a normalize function to assist response measurements. This can be used to correct for frequency response and mismatch errors of interconnecting equipment, such as cables, probes or test fixtures. It allows precise measurement of the device under test even when the connecting network or interface has an unspecified electrical performance.

GPIB

The 2382 can be configured as both a talker and listener over the GPIB, so it can run either totally automatically as a stand-alone test system, or be incorporated in a more complex ATE system. All front-panel keys except the screen intensity, Marker 2 functions and on/off switch are remotely programmable. Where applicable, programming codes are mnemonic abbreviations of the front panel keys. This makes program writing easier. For ease of reference, the GPIB address can be flashed on the screen. Rear panel markings give the capability codes which identify the interface functions applicable to the 2382. Comprehensive status commands enable the current control settings of the instrument to be determined. A pull-out card on the instrument lists all the GPIB commands. The example program below shows how programs can be simply written. In this case, using the HP85 controller, the instrument is set up to measure a 10 MHz AM carrier together with a side band, and print out the results.

10 REM INSTRUMENT ADDRESS IS 703	
20 OUTPUT 703; "PR;CA"	Sets instrument to preset mode and performs self-calibration.
30 OUTPUT 703; "SW0; FR10MZ; SP10KZ; RL-10DB; TS"	Sets instrument to single sweep mode, reference frequency to 10 MHz, frequency span to 10 kHz, reference level to −10 dBm, and takes sweep.
40 OUTPUT 703; "PF1"	Marker peak find facility places a marker on the carrier signal.
50 OUTPUT 703; "OM"	Sends marker (carrier) amplitude and frequency to the controller.
60 ENTER 703; A1, F1	
70 OUTPUT 703; "PF2"	Places marker on the largest sideband.
80 OUTPUT 703; "OM"	Sends marker (side-band) amplitude and frequency to the controller.
90 ENTER 703; A2, F2	
100 PRINT "Amplitude of carrier is";A1;" dBm, frequency of carrier is ";F1;"Hz"	
110 PRINT "Amplitude of sideband is ";A2;" dBm, frequency of sideband is ";F2;" Hz"	Prints results.
120 END	

Block transfer

Current instrument settings, display parameters and trace data may be sent to the GPIB controller using fast block transfer. The fast binary format dumps trace data in a 1004

byte block in typically 600 ms; instrument settings take typically 630 ms in a 238 byte block, whilst display settings are dumped in a 198 byte block in typically 100 ms.

Trace data may also be sent in standard ASCII format for easy manipulation by the controller, for example where uncertainty values are to be added to the display.

Binary block data transferred from the 2382 may be retained in the controller's internal memory or in an external storage medium. It is then readily transferred back to the spectrum analyzer. Applications of this include the extension of 2382's on-board non-volatile memory to hold routine instrument set-ups and limit masks and the retention of standard filter responses for comparison.

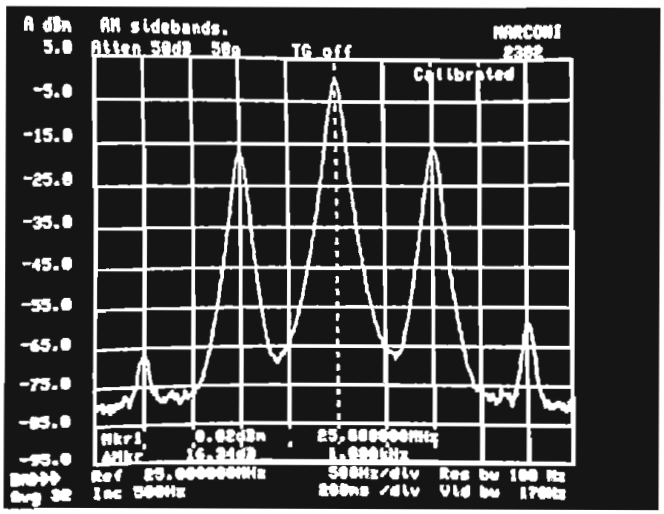
Write-to-screen facilities

GPIB control allows text to be written anywhere on the 2382's display area. For further user convenience the screen may be blanked to provide an easy-to-read format for showing menus, operator instructions, test messages and results. The text may be composed of ASCII characters, including both upper and lower case letters, numbers and scientific characters.

GPIB control from the 2382

In addition to assisted testing based on the GPIB, where the analyzer's front panel keys may disabled selectively to simplify operation, the instrument's SRQ-on-keypress facilities mean that fully automatic operation can take place without the need to use the controller keyboard. The controller can determine the last key pressed on the 2382, so that, for example, menu-driven operations can be executed entirely from the front panel of the instrument.

When combined with the comprehensive write-to-screen capability, this completely eliminates the fatigue that often occurs when the operator's attention is alternately transferred between instrument and controller.



Comprehensive display with full annotation and two independent markers.

OPERATION

Traditional "three knob" as well as keypad control of major functions is incorporated. Ease of operation is ensured for all levels of users. Automatic microprocessor control is provided for RF attenuation, video bandwidth, sweep time and resolution bandwidth, so that in AUTO mode the optimum performance with respect to distortion, speed of operation and noise is always obtained. Automatic control can be over-ridden for greater versatility and specialized measurements, for example to optimize the noise or intermodulation performance. In non-AUTO mode the controls can be rapidly adjusted using dedicated incremental keys.

Further aid is given to the operator by the logical layout of the front panel and distinctive labelling of all key functions. Second functions are easily identified by their blue lettering. Screen prompts, menus and instructions are displayed on the screen where applicable to assist in carrying out certain special functions. In addition, pull-out cards are provided for quick, easy access to operation and reference information. Used prior to commencing a new measurement routine the PRESET key automatically sets the instrument into a logical starting condition at a single key stroke. Alternatively any one of nine complete instrument settings can be stored and recalled from non-volatile memory. Titles may be added to identify the store locations.

Two methods are provided to set the reference frequency, span/div and reference level: keyboard entry for precise setting to predetermined conditions, and dedicated rotary controls for analog adjustment to provide the traditional "three-knob" operation. The reference level and reference frequency may also be rapidly adjusted using dedicated incremental keys. The reference frequency can be changed in increments from 1Hz to 400MHz.

Overload protection up to 50 W is provided, even with the instrument powered-down. Accidental overloading of the RF input is prevented, and the operator is warned with a flashing message and an optional beeper. Overload protection may be over-ridden by a protected function, for example to make measurements on pulsed signals.

The intermodulation identification (INTMD IDENT) function rapidly identifies any self-generated distortion products, and can be used to validate all level measurements and to check that the mixers are not overloaded or experiencing gain compression. When this key is pressed the signal level at the first mixer is also displayed on the screen, so that the user can then easily optimize the RF/IF gain ratio for a given measurement.

MARKERS

Two independently steerable markers can be superimposed on either the A or B trace for rapid and accurate measurement of absolute and relative levels and frequencies. The markers are moved using a dedicated rotary control and can be placed anywhere along either trace. The frequency of a signal identified by a marker is shown to the same resolution as the reference frequency, and the level to ± 0·01dB, irrespective of the vertical scale selected. Subsequent use of the FREQ COUNT key improves frequency accuracy. For greater resolution the RES 1Hz mode displays

the frequency to a resolution of 1Hz irrespective of selected span width.

If both Marker 1 and Marker 2 are displayed, additional screen annotation shows the relative amplitude and frequency difference between the two markers, providing a convenient method for the measurement of parameters such as insertion loss, harmonic levels and intermodulation products.

Three other keys, PEAK FIND, MKR1 SETS REF LEVEL and MKR1 SETS REF FREQ can be used to locate rapidly the largest signal on the screen, position it at the top of the screen, then move it to the reference frequency for analysis. The screen annotation alters accordingly. Subsequent use of the NEXT PEAK function moves the marker to the next largest signal on the screen and repeated use moves the marker onto successively lower signals, to quickly measure signals such as harmonics.

Incremental frequencies may be entered and stored for subsequent re-use. This is especially valuable for tests on multi-channel radios, or for measuring harmonically related signals. The MKR1 SETS INC FREQ key may also be used to set this incremental frequency to the same value as Marker 1 so that subsequent operation of the Incremental Frequency keys rapidly positions harmonically related signals at the reference frequency. Similarly △F SETS INC FREQ sets the incremental frequency to the difference between Marker 1 and Marker 2 for rapid location of evenly spaced signals such as modulation sidebands.

HORIZONTAL SCALES

Expansion of the spectrum is about the Reference Frequency, denoted by a dashed vertical line, which can be located at the centre, right or left of the screen by toggling the HORIZ POSN key. This is invaluable when viewing modulation, since the carrier can be shifted to just view either upper sidebands or lower sidebands.

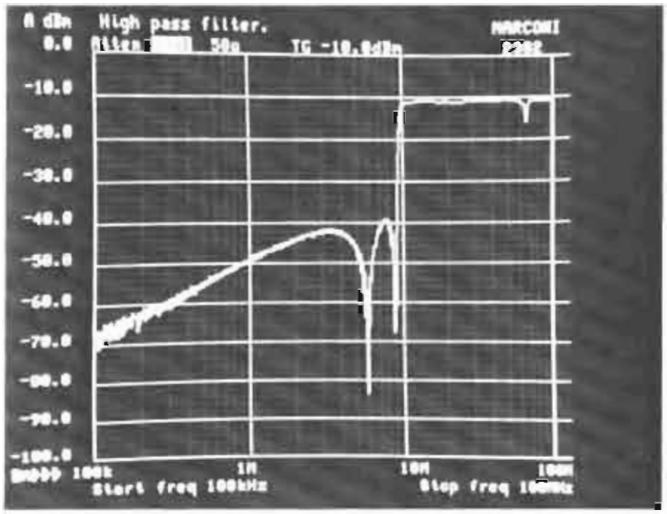
2382 employs two alternative methods of tuning the reference frequency with the dedicated rotary control. The traditional tuning method is still available, but it becomes time-consuming at slow sweep speeds, since its value is only up-dated every sweep, so it can take a long time to centralize a display.

2382's alternative tuning method automatically switches in for sweeps slower than 100 ms/division. The reference frequency control no longer moves the trace; instead it moves the reference frequency graticule line, and sweeping is suspended. Once the line is placed over the signal of interest a new sweep is initiated, which places the selected signal at the reference frequency after just one sweep, so speeding up the process.

Once located at the Reference Frequency a signal can be rapidly analyzed. The span can be reduced to display a frequency span as narrow as 10Hz/div. Selection of SIGNAL TRACK maintains the signal at the Reference Frequency at all times. Even if the frequency span is very rapidly reduced, a single sweep is automatically taken at intermediate values in order to keep track of the signal, providing a 'zoom' facility.

Whilst viewing a portion of the spectrum in a 'window' set by the SPAN/DIV controls, the entire input spectrum can be re-accessed by the single-key FULL SPAN operation. The previous SPAN/DIV setting is simply restored by selecting the /DIV key.

A LOG frequency display is simply initiated to provide a convenient format for displays such as audio and wideband responses. From one to seven decades of log frequency can be selected. The instrument automatically selects the optimum resolution filter bandwidth, sweep speed and video bandwidth for each decade, and sweeps the highest frequency decade first for the fastest display refresh. RF Attenuation can be also optimized for each decade.



LOG horizontal scale simplifies many measurements. User-defined text is available to label hard copies.

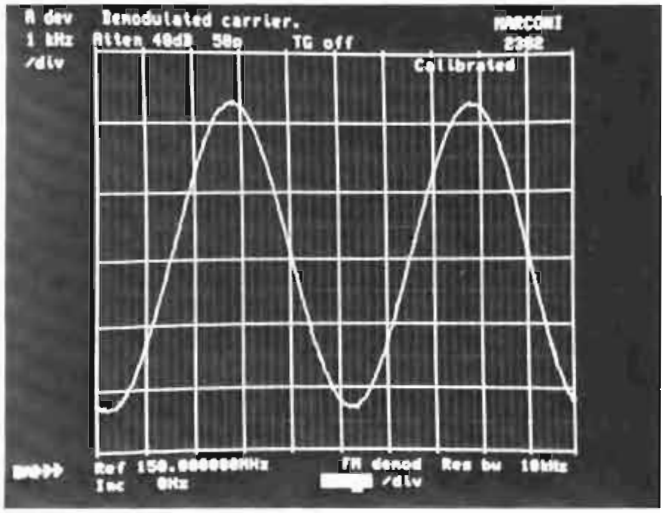
RECEIVER MODES

The analyzer acts as a fixed tuned variable bandwidth receiver in three modes: ZERO SPAN, FM DEMOD and METER.

Zero Span

This displays amplitude changes against a time axis, so it not only provides the capability to view AM demodulated signals directly, it also allows 'oscilloscope' type measurements on a wide variety of signals. The triggering modes available include external, video and line. The instrument time base is crystal-controlled, enabling highly accurate measurement to be made in the time domain. Applications include the settling times of RF signals and the mark-to-space ratios of pulses. Single sweeps can be triggered to capture transient or one-off events.

Audio as well as visual information can be obtained to help in surveillance applications and in the identification of unwanted interference, by simply selecting the AUDIO key which switches on an integral loudspeaker. A headphones output socket is also provided.



FM DEMOD mode to measure and view demodulated f.m. signals.

FM Demod

The FM DEMOD mode displays the demodulated signal on an axis of frequency deviation against time. Frequency deviation can be viewed and measured from 180kHz to less than 1Hz. Since very narrow deviations may be measured it is possible to measure spurious FM on a carrier.

Meter Mode

In METER mode the level of any signal identified by the marker is shown in real time as a vertical bar in the centre of the screen, and digitally as the marker readout. The level of the bar is up-dated continously rather than once per display sweep, so this feature saves time in many RF measurements where it is only necessary to monitor the level at a single frequency. Typical applications are tuning an FM carrier or sideband to a Bessel zero, or optimizing the level of a selected signal.

VERTICAL SCALES

dB

Signals can be measured from 27dBm down to lower than -- 135dBm. When both high and low power signals are present the wide displayed dynamic range of 100dB allows simultaneous display and measurement of both signals.

Annotation of the major graticule lines and the display of minor graticule lines enables signal levels to be interpolated directly from the screen to a resolution of 0.025dB. To ensure that the best resolution is always achieved, the vertical scale can be expanded about the reference level from 10dB/div to 0.5dB/div in steps of 10, 5, 2, 1. To fulfil a variety of applications, the units can be selected from dBm, dBV, dBmV and dBμV. Relative measurements can be made directly by selecting the dB scale. This is especially valuable, for example, when measuring intermodulation products, since the zero reference is still maintained even if the reference is then adjusted above the top of the screen.

Volts

For even greater flexibility a linear VOLTS scale can be selected. In this mode the scale can be set from 0.1μV/div to 500mV/div, suitable for example to show the amplitude modulation of signals in ZERO SPAN mode. A logarithmic volts scale is also available, with two and a half decades of display from 10mV to 10V, to provide a convenient format for measurements such as field strength.

DISPLAY AND STORAGE

All trace data is stored digitally to a resolution of 0.025dB. This method of storage ensures that the trace data is processed to the highest resolution irrespective of the vertical scale set from the front panel. Saved displays can be subsequently adjusted to display any vertical resolution required. A raster scanned screen provides a flicker-free image for all sweep speeds.

Colour display

The video output option provides RGB and sync signals for display on an external colour monitor. Different colours are used to identify A and B traces, graticule and annotation, giving a clear readout that is especially suitable in manufacturing test applications, or for demonstration and training. There is a choice of two colour palettes, easily selected from a menu. One palette is carefully chosen for minimum eyestrain in continuous use, the other provides bright, clear colours for maximum impact and clarity.

Screen display

Alpha-numeric annotation on the screen provides all the information necessary to define a trace including; the reference frequency, reference level, resolution bandwidth, sweep speed and video bandwidth. Reverse video annotation is used to alert the operator to settings not in AUTO mode. A supplementary operator-generated caption can be added along the top of the display to identify individual traces. Front-panel keys (identified by yellow lettering) can be used to enter both upper and lower case letters as well as numbers and selected symbols to provide titles, serial numbers and date information.

For ease-of-operation screen annotation is also used to display MENU driven facilities, keypad prompts and standard messages, which alert the operator to specified conditions.

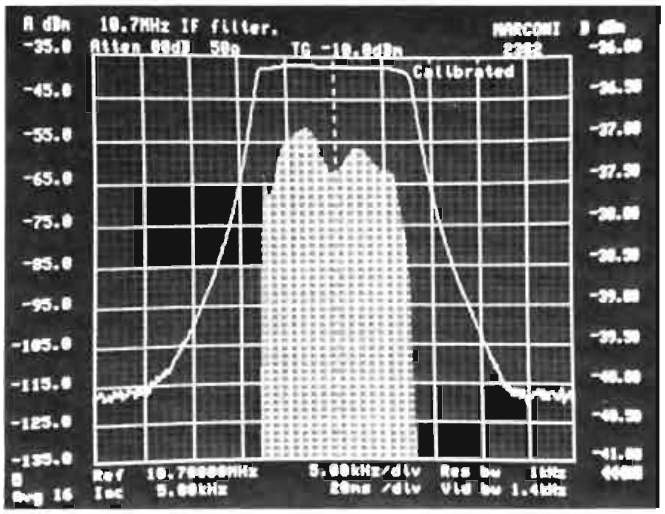
The graticule displayed on the screen is generated electronically, to ensure parallax-free readings are made under all operating conditions. However the operator has the option to remove the graticule and annotation, and to adjust their intensity as required.

Dual traces

Dual storage of data provides two traces, denoted A and B, which can be independently stored, refreshed and manipulated for comparison. Vertical scales and reference levels of both A and B traces can be adjusted independently. A useful application of this feature is the simultaneous live observation of two interactive parameters with different resolutions. For example, it is possible when tuning filters to observe the ripple at 0·5 dB/division and the overall response at 10dB/division. For easy reference the A and B vertical scales are separately annotated, the B trace on the

right and the A trace on the left of the screen.

A convenient method to identify the A and B trace is by adjusting the intensity or infilling one or other of the traces. In INFILL mode the trace is displayed in a blocked-in histogram format. When a colour monitor is used, the traces are shown in different colours.



Dual vertical scales allow for simultaneous analysis of filter pass-band and stop-band.

DIGITAL SIGNAL PROCESSING

The use of special keys to process trace data not only increases the versatility of the instrument, but also reduces operation time by automatically performing measurements which would previously have been time-consuming to perform.

In MAX HOLD mode the largest signal detected in successive traces is stored and displayed, for example so that transient signals, residual FM and signal drift are directly displayed.

The menu-driven VIDEO AVERAGE function helps to identify noisy signals or signals located near the noise floor by smoothing out the random noise. Averaging can be selected from 2 to 128 sweeps, depending upon the degree of smoothing required.

The A−B→A key displays the difference between the A and B traces about a 0dB line in the centre of the screen. This type of display provides a convenient method to accurately compare two traces. For example any differences between a test and standard response are directly shown in a clearly understandable format.

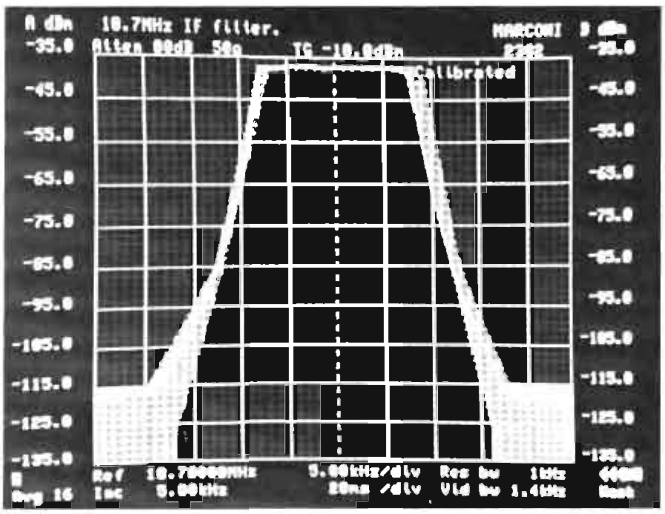
Self-calibration

Automatic calibration not only improves the accuracy and repeatability of measurements, but also eliminates the need for time-consuming manual adjustments since there are no front panel preset controls. This facility is essential for ATE applications, and is simply accessed because self-calibration may be initiated with a single GPIB command.

When the CAL key is pressed the progression of the calibration routine is displayed on the screen. All the resolution filters are first automatically adjusted to set their centre frequency and gain. Each step of the RF attenuator, and the overall frequency response, is then measured and stored for error correction of all subsequent measurements.

Limit mask

Specified limits of level and frequency may be entered from the keyboard (or over GPIB) and displayed on the screen, simplifying go/no go testing. This limit mask may be used to check the overall response of a filter, or expanded to look closely at a selected point. A mask may also be generated to check the level of spurious signals against limits.



Limit mask may be superimposed for rapid go/no-go testing.

Store and recall

Up to nine front panel settings or limit masks can be stored in non-volatile memory and rapidly recalled to set up frequently-used test conditions. The store location and associated text are listed for easy identification. The instrument automatically powers up in STORE 1 so that it is switched on in the desired setting. All stores may be protected to prevent accidental overwriting.

Noise in 1Hz bandwidth

Instantaneous readouts of the noise normalized to a 1 Hz bandwidth can be obtained at a single keystroke, eliminating the need to apply time-consuming correction and conversion factors.

Hard copies

Hard copies are available for permanent documentation. There is a variety of formats to suit particular applications; GPIB direct plot, video plotter, photograph, or X-Y analog pen plotter.

Direct digital output to an HP-GL compatible plotter eliminates the need for a controller just to make plots. Menu selection of plotting functions provides easy identification of traces, with text shown as well as graticule, annotation and traces. Up to 5 different pen colours can be used.

Monochrome video printouts can be provided in as little as 20 seconds.

OPTIONS

A conversion kit (part number 46883-735V) may be fitted to the 2380 to provide further options, which are selected by screen menus. The options provided are:–

- Colour video output (RGB and sync) to drive an external monitor
- Monochrome video to drive a video plotter or monochrome monitor
- X-Y analog output for direct copy of graticule and traces on an X-Y plotter
- Audio beeper for alerting the operator to non-standard conditions

COST OF OWNERSHIP

Thoughtful design not only reduces initial purchasing cost, but also reduces cost of ownership. The instrument is designed for high reliability, using techniques such as temperature-controlled cooling fans. Comprehensive fault-finding facilities assist in identifying any equipment failures. Rear panel status lamps give visual identification of possible faults including: overheat, low power, overload and over-voltage.

The self-calibration routine will quickly point to any problems, such as an IF filter beyond limits or degraded frequency response. Faults may be traced using the considerable diagnostic power available. Many routines monitor microprocessor activity, measure oscillator frequency and determine other functions.

Careful mechanical design ensures ease of access to all components within the instrument. An optional support kit includes board extenders and extended test cables to assist during maintenance and calibration.

REAR PANEL

On the rear of the instrument are output sockets to access the 47.4MHz IF, video and option board signals. In addition an audio output is provided for headphones which assist in monitoring or surveillance applications.

An input socket is provided for an external frequency standard where even greater accuracy is required. Alternatively the frequency of the internal standard may be adjusted by a small amount to compensate for possible long-term drift. External trigger sources can be applied via the EXT TRIG socket to trigger sweeps when EXT TRIGGER mode is selected by front panel or GPIB operation.

OPTIONAL ACCESSORIES

A comprehensive range of optional accessories is available to enhance the capability of the spectrum analyzer. These include:

- The 2388 1 GHz Active Probe and 2374 Zero Loss Probe, which provide a high input impedance to carry out measurements without loading the circuits
- Carrying cases for easy transportation
- Camera hood to take photographic hard copies
- Support kit

FREQUENCY

MEASUREMENT RANGE	100Hz to 400MHz in 1Hz steps set by means of keypad, dedicated rotary control or dedicated ↓ ↑ REF FREQ keys. Usable down to 50Hz.
FREQUENCY SPAN	
FULL SPAN	0 to 400MHz spanning the 10 division display, selected by FULL SPAN key.
/DIV	10Hz/div to 20MHz/div in a 1,2,5 sequence and 40MHz/div selected by means of keypad or dedicated rotary switch. Displayed accuracy is ±1% of separation frequency, ±1% of full span.
LOG	1 to 7 decade logarithmic display. User selects start and stop frequencies (decade values only). Instrument selects filter bandwidths and sweep speeds for each decade for optimum display. For optimum display refresh, the highest frequency decade is swept first. Displayed accuracy is ±5N% where N is the number of decades selected.
ZERO SPAN	Displays the amplitude modulation of any signal at the current reference frequency against a time axis. See Sweep section for specification.
METER	Selection of this mode executes a single sweep and leaves a 'bar chart' type display at the screen centre, whose amplitude indicates the instantaneous signal level at that frequency. Measurement frequency changed with MARKERS MOVE control. For frequency accuracy, see Marker section.
FM DEMOD (2nd FUNCT ZERO SPAN)	Displays the instantaneous frequency deviation of a single sinusoid against a time axis. This signal must be free from significant amplitude modulation since filter slope detection is used as the discriminator. See Sweep section for specification.
FREQUENCY STANDARD	The internal standard is a temperature-controlled crystal oscillator with zero warm-up time. Internal standard can be adjusted by means of a rear panel preset (SET INT STD), the annotation INT STD is shown in reverse video on the display when the internal standard has been adjusted.
Temperature stability	Better than ±2 parts in 10^6 from 0 to 50°C.
Ageing rate	Better than ±1 part in 10^6/year.
EXT STD INPUT	System will automatically switch to an external standard if a signal of 1,2,5 or 10MHz is applied at a level of between – 15dBm and +15dBm. The frequency must be within ±1 part in 10^6 for the system to lock. The annotation EXT STD is shown on the display when lock is achieved.
Connector	50Ω BNC type female.

REFERENCE FREQUENCY

FULL SPAN — A dashed vertical line may be moved across the display by operation of the keypad, REF FREQ rotary control or ↓ ↑ keys. The frequency of any signal on the display can be read to a resolution of better than 1 MHz. This facility permits signal selection made in this mode to be displayed at the reference frequency in any subsequent /DIV selection.

/DIV — The reference frequency can be positioned at the centre, left hand or right hand side of the display by operation of the HORIZ POSN key, the appropriate vertical graticule line being dashed to indicate this state. The value of the reference frequency can be read from the screen annotation to a resolution of ±0·2% of span and to an accuracy of ±[(Frequency Standard Error × Reference Frequency/10MHz) +2% of selected sweep span + oscillator drift]. See 'Stability' section for oscillator drift figures. This mode is also selected by operation of the PRESET key.

LOG — Reference frequency rotary control is inoperative in this mode.

ZERO SPAN, METER & FM DEMOD — Frequency accuracy as for /DIV mode but no allowance is needed for oscillator drift.

SIG TRACK — A signal at the reference frequency of the display is tracked. The tuning of the instrument is adjusted after every sweep to cancel out any drift in the signal being analyzed. The only restrictions are that the signal must be positioned sufficiently far up the skirt of the filter response to ensure capture and that the signal drift is not so fast that the response drifts off the display in one sweep interval. Operates only in HORIZ POSN centre mode.
If the frequency span is rapidly reduced a single sweep will be taken at appropriate intermediate values so as to not lose track of the signal.

MARKERS

Markers measure the frequencies of points on the display in FULL SPAN, /DIV and METER horizontal modes.

A B SELECT — Key toggles to place the markers on either the A or B trace.

MKR1, 1 2 MOVE & MKR2 — A dedicated rotary control permits a marker to be positioned anywhere on the selected A or B trace. The screen annotation displays the frequency of the marker to the resolution and accuracy of the reference frequency above. If both Marker 1 and Marker 2 are displayed, additional screen annotation shows the value of frequency difference between them to the same accuracy as in the Frequency SPAN/DIV mode.

FREQ COUNT — The frequency of any spectral line viewed on the screen may be measured by moving the marker to the signal of interest. The resolution of the screen readout is 10kHz on spans greater than 200kHz/division, 1Hz on spans less than 200Hz/division and 100Hz for all other spans. Accuracy: Frequency standard × displayed frequency ±2 x resolution.
Restrictions are that the selected filter must have a 3dB bandwidth >0·2% of span; that only one signal is present in this bandwidth and that the marker must be at least 20dB out of the noise up the filter skirt.

RES 1HZ (2nd FUNCT FREQ COUNT) — As for FREQ COUNT except resolution is 1Hz for all spans.

PEAK FIND — Marker 1 positions itself on the peak of the largest signal on the display and annotation gives this frequency to /DIV accuracy. This value may be transferred to the reference frequency or the incremental frequency by use of the MKR1 SETS keys.

NEXT PEAK (2nd FUNCT PEAK FIND) — A similar function to PEAK FIND except that the marker moves to successively lower amplitude peaks up to a maximum of 9 peaks.

MKR1 SETS REF FREQ — Sets the reference frequency to be that of the Marker 1 frequency.

MKR1 SETS INC FREQ — Sets the incremental frequency step to be that of the Marker 1 frequency.

ΔF SETS INC FREQ — Sets the incremental frequency step to be that of the difference between Marker 1 and Marker 2 frequencies.

RESOLUTION

Resolution bandwidths — Twelve filters with 3dB bandwidths of 3Hz to 1MHz in a 1,3,10 sequence. Optimally selected for chosen span in AUTO mode or manually selected by dedicated ↓ ↑ keys.

Accuracy — 3dB points within ±20% of their nominal value apart from the 1 MHz filter which is +0% −30%.

Shape factor — All bandwidths have a skirt selectivity for 60dB/3dB points of <11:1. All filters (apart from the 1MHz filter) are synchronously tuned five-pole Gaussian shaped filters. The 1MHz filter shape factor is <5:1.

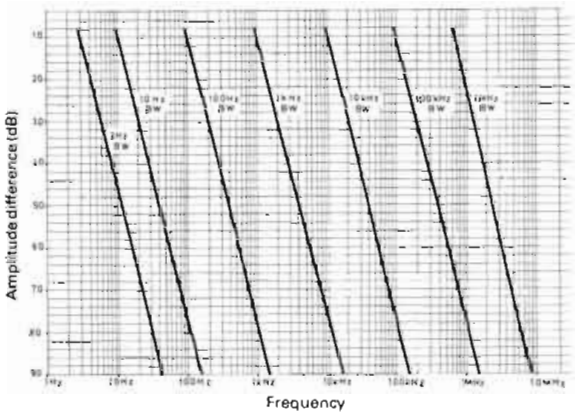


Figure 1: Typical Spectrum Analyzer resolution.

STABILITY

Residual FM — Less than 1·5 Hz peak-to-peak during a 10 second period for spans narrower than 20kHz, resolution bandwidth ≤ 30Hz, video bandwidth ≤ 43Hz.

Drift — After a 1 hour warm-up the oscillator drift rate is as follows:
< 10 Hz/min at 10 Hz/div increasing to
< 20 Hz/min at 2 kHz/div.
< 500 Hz/min at 5 kHz/div increasing to
< 1 kHz/min at 200 kHz/div.
< 50 kHz/min at 500 kHz/div increasing to
< 100 kHz/min at 40 MHz/div and FULL SPAN.
The drift is not cumulative; oscillators are reset every 10 seconds, or during each sweep retrace, whichever is the longer.

SPECTRAL PURITY

Displayed noise sidebands — At 100MHz:−

Offset from carrier	Displayed noise (Normalized to 1Hz bandwidth)
100 Hz	< −90 dBc
300 Hz	< −95 dBc
20 kHz	< −100 dBc

Hum (line related) sidebands — Better than −80dBc using 3Hz filter.

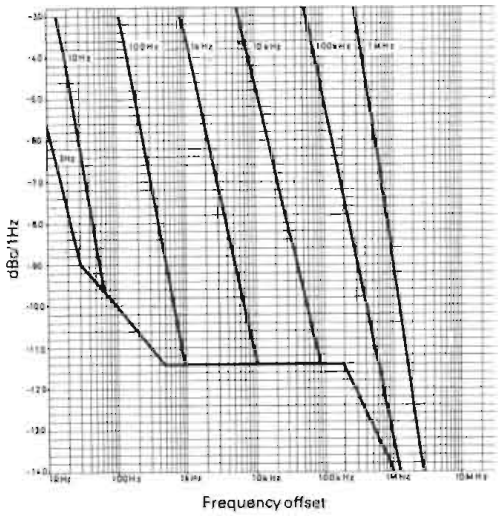


Figure 2 Typical SSB noise vs offset from carrier at 100MHz

AMPLITUDE

MEASUREMENT RANGE
−150dBm to +30dBm (100nV/div to 500mV/div.) Overload protected to +47dBm (50W) by means of a latching relay, which can be reset using the INTMD IDENT key.
Input protection may be over-ridden if required by means of an unlabelled second function for use on pulsed RF signals.
Input is protected when the instrument is switched off.
Two channels of display, A and B, may be selected so that either can display any compatible range, at any reference level, with separate annotation down each side of the display.

DISPLAYED RANGE
A and B displays can be independently set to give any of the ranges listed:

dB/DIVISION
100dB at 10dB/div.
50dB at 5dB/div.
20dB at 2dB/div.
10dB at 1dB/div.
5dB at 0·5dB/div.
Range selection is by means of dedicated keys and can be made on both live or stored displays. Expansion is around the reference level at the top of the graticule.

VOLTS/DIV
On stored displays, one vertical scale higher and one vertical scale lower may be recalled and displayed.

LOG VOLTS (2nd FUNCT VOLTS/DIV)
Electronic graticule is changed to give two and a half decades of logarithmic display calibrated at each decade boundary in units of volts.

DISPLAY FIDELITY

dB/DIVISION
Departure from true logarithmic relationship less than 0·3dB anywhere over the top 80dB of display. Typically less than 0·05 dB per dB.

VOLTS/DIV
Linearity of display better than ±2% f.s.d.

LOG VOLTS/DIV
Departure from true logarithmic relationship better than ±3% of measured value anywhere over the display.

REFERENCE LEVEL

dB/DIVISION
−150dBm to +30dBm in 0·025dB (average) steps or equivalent in dBV, dBmV or dBμV. The level may be set with either the keypad, dedicated rotary control or dedicated ↓ ↑ REF LEVEL keys. dB relative mode sets the top of screen to a zero reference for measurements of relative amplitudes; the reference is retained even when REF LEVEL or dB/DIVISION is changed. The A and B reference levels are normally locked together but they may be unlocked so that reference levels may be independently set. The REF LEVEL ↓ ↑ keys operate in 10dB steps.
The rotary control operates in increments according to the dB/DIVISION scale selected; minimum resolution is 0·025dB with 0·5dB/DIVISION scale.

Accuracy
Better than ±1dB at any frequency, IF gain setting, RF attenuator setting and resolution bandwidth, provided that the 'sweep uncal' message is not displayed.

VOLTS/DIV
100nV/div to 500mV/div in a 1,2,5 sequence on a 10 division graticule, selected by means of the keypad or ↓ ↑ REF LEVEL keys.

Accuracy
Better than ±12·5% at the selected reference frequency for any IF gain setting, RF attenuator setting and at any permitted filter selection but ±25% at other frequencies.
(Assumes the CAL key has been pressed at the reference frequency prior to making a measurement.)

LOG VOLTS/DIV
Two and a half decades of logarithmic display covering top of screen values of 100nV to 10V.

Accuracy
Better than ±12·5% for any frequency, IF gain setting, RF attenuator setting and at any permitted filter selection.

FREQUENCY RESPONSE
On all displayed ranges, the frequency response is ±0·4dB for RF attenuation ≥10 dB and ±0·5 dB for 0 dB RF attenuation. This uncertainty has already been included in the Reference Level accuracy given above.
Response is typically −3 dB at 50 Hz.
Accuracy and frequency response is degraded on LOG horizontal mode.

RF INPUT

Connector
50Ω N type female to military standard MIL-C-39012C, DC coupled.

Reflection coefficient
Better than 0·10 (1·22 v.s.w.r., 20 dB return loss) for RF attenuator settings of ≥10dB.
Better than 0·18 (1·44 v.s.w.r., 15dB return loss) for RF attenuator setting of 0dB.

Local oscillator leak
Typically less than −85 dBm at any input frequency and with any RF attenuation.

MARKERS
Markers measure the amplitudes of points on the display in FULL SPAN, /DIV, LOG, ZERO SPAN and METER horizontal modes.

A B SELECT
Key toggles to place the marker on either the A or B trace.

MKR1, 1 2 MOVE & MKR2
A dedicated rotary control permits a marker to be positioned anywhere on the selected A or B trace. The marker measures the amplitude at that point to a resolution of 0·025dB and the annotation displays the value to two decimal places. Accuracy is as specified in Reference Level above. If both Marker 1 and Marker 2 are displayed, additional screen annotation shows the value of the dB difference between them to an accuracy appropriate to the selected amplitude range.

MKR1 SETS REF LEVEL
Sets the reference level to be the same as the Marker 1 level, thus positioning the chosen response at the top of the display with the scale annotation altering appropriately.

PEAK FIND
The selected marker moves to the peak of the largest signal displayed on the selected A or B display. NEXT PEAK is also available, refer to Markers part of FREQUENCY section.

NOISE 1 Hz (2nd FUNCT FULL SPAN)

The displayed noise amplitude is corrected and normalized to a 1 Hz noise power bandwidth.

DYNAMIC RANGE

Harmonic Distortion

With a sinusoidal signal at −42dBm at the input mixer*, any internally generated harmonic distortion product is more than 80dB down on the fundamental. Refer to graph for other levels.

Non-harmonic Distortion

With a sinusoidal signal at −42dBm at the input mixer*, any internally generated non-harmonic distortion products are more than 75dB down on this signal.

Display

100dB.

Third-order Intermodulation

95dB for on-screen signals using the 3Hz filter at −42dBm at the input mixer*. Refer to graph for other levels.

* Press INTMD IDENT key to read input mixer level relative to the reference level.

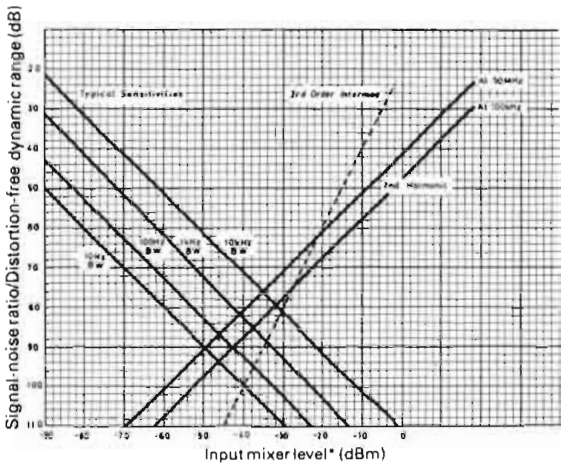


Figure 3: Optimum dynamic range.

Residual responses (no signal at input)

Less than −120dBm with 0dB RF attenuation.

Equivalent input noise sensitivity (3 Hz filter)

−135dBm for reference frequencies greater than 150 kHz; typically −145 dBm. Refer to graph for other resolution bandwidths.

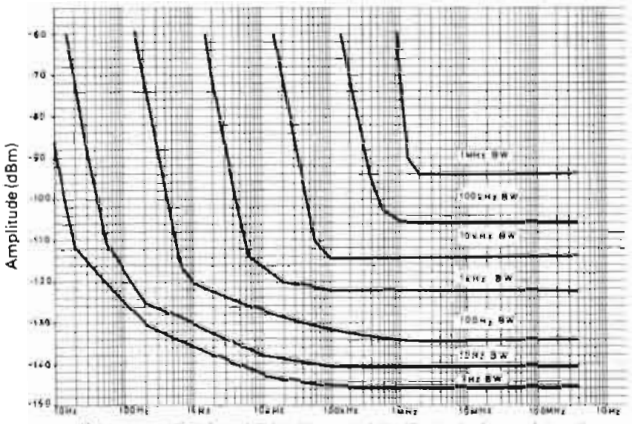


Figure 4: Typical sensitivity vs input frequency.

Tracking generator cross-coupling (displayed noise level in 3 Hz bandwidth)

Not greater than −125dBm from 150 kHz to 400 MHz, with both the Input and the Tracking Generator output terminated in 50 Ω.

VIDEO BANDWIDTH

When Auto mode is selected the detected signals are optimally digitally processed to give the equivalent of analog video filtering to smooth the noise level; the equivalent video bandwidth is shown on the display. The bandwidth may be changed either by dedicated ↓ ↑ keys or by changing the sweep time if Auto mode is selected. The video bandwidth range is 1Hz to 50kHz.

VIDEO AVG

Two keys are used to select sweep-to-sweep averaging on either or both A and B traces. 2 to 128 sweeps (binary intervals) may be averaged; menu selection is used. The display indicates the number of sweeps elapsed since the mode was selected. Available on FULL SPAN and /DIV horizontal modes.

SWEEP

TRIGGER SOURCE

VIDEO

Sweep is triggered by the detected envelope of the input signal within the frequency range 10Hz to 300kHz. Mark-to-space ratio to be in the range 10:1 to 1:10. Conditions for triggering depend on the VERTICAL scale selected:

dB/Division

Detected signal must be within 20dB of top of screen reference level and have a peak-to-peak displayed amplitude of at least 10dB.

Volts/Div

Detected signal must occupy at least 1 major graticule division.

Log Volts/Div

Detected signal must be above the first major graticule line, and have a peak-to-peak displayed amplitude of at least half a major division.

LINE

Sweep is triggered by power line frequency.

EXT

Sweep is triggered by external signals from the rear panel EXT TRIG BNC connector over the range 50mV p-p to 100V p-p from 10Hz to 300kHz. Input impedance 3MΩ shunted by 60pF. Triggering is normally derived from the positive-going edge but negative-going edge triggering may be selected by pressing 2ND FUNCT prior to the trigger source key.

TRIGGER MODE

AUTO TRIG

Sweep free runs in the absence of a trigger. Sweep will trigger normally in the presence of trigger signals at a rate in excess of 10Hz.

SWEEP MODE

NORM

Sweep re-arms after each retrace. Operation of the key during a sweep will abort that sweep and leave the sweep ready to be retriggered.

SINGLE ARM

Arms the sweep so that it runs on the next trigger and executes a single sweep.

START

Triggers a sweep; operation during a sweep will abort that sweep and start a new sweep. If EXT TRIGGER SOURCE and AUTO mode is selected, with no external signal applied, the sweep will run immediately on pressing the START key.

SWEEP TIME

/DIV

AUTO or ↓ ↑ keys select sweep times of 10ms/div to 20s/div in a 1,2,5,10. sequence. Accuracy as for Frequency Standard.

ZERO SPAN

AUTO or ↓ ↑ keys select real-time sweeps from 10ms/div to 20s/div and sampled sweeps from 5μs/div to 5ms/div.
Accuracy as for Frequency Standard, resolution is ±0.2% of full scale.
In ZERO SPAN, the vertical scale has the same units and range as the previous /DIV setting.

FM DEMOD (2nd FUNCT ZERO SPAN)	Displays six divisions of frequency deviation vertically against time horizontally. Demodulation uses filter skirt detection. Vertical sensitivity from 3Hz/div to 30kHz/div in a 1,3,10 sequence, set by FILTER BANDWIDTH ↓ ↑ keys. Deviation accuracy at zero deviation rate ±20% f.s.d. ±1Hz. Bandwidth depends on selected filter. The deviation sensitivity and modulation frequency response is a function of the selected resolution bandwidth. Since this relationship depends upon Bessel functions it is non-linear and dependent on the deviation magnitude. The sensitivity quoted is for low modulation frequencies, i.e. <5% of the selected resolution bandwidth.

TRACKING GENERATOR

Frequency range	100Hz to 400MHz.
Frequency Accuracy	Better than ±1Hz referred to the tuned frequency.
Amplitude	−9·7dBm to −20·3dBm in 0·1dB steps set from the keypad using SET TG (2nd FUNCT REF LEVEL).
Amplitude Accuracy	Better than ±0·5dB at −10 dBm at 10MHz.
Frequency response	Better than ±0·35dB at −10 dBm.
Harmonic distortion	All harmonics are more than 30dB down on the fundamental signal.
Non-harmonic distortion	All spurious signals are more than 30dB down on the main signal.
Residual signals	All residual signals are less than −70dBm with the Tracking Generator off.
TRACKING GENERATOR OUTPUT	
Connector	50Ω N type female to military standard MIL-C-39012C.
Reflection coefficient	Better than 0·10 (1·22 v.s.w.r., 20dB return loss).

DISPLAY

Display size 140 mm x 110 mm.

TRACE	Two stores (designated A and B) each having a horizontal resolution of 500 data points and a vertical resolution of 250 data points, record the trace data. The contents of either or both stores are used to refresh a scanned raster display (15·664kHz line frequency, 48·2Hz frame frequency) and are added to an annotated electronic graticule. Each of the facilities (A display, B display and graticule) have separate intensity controls and are available as monochrome or RGB colour drives for video monitors. (Video output is an additional option).
VIEW	Displays the contents of the selected memory.
SAVE	Stops the selected memory from being refreshed.
MAX HOLD	Retains the maximum signal level recorded at each memory location for as long as it remains active. Not available on ZERO SPAN and FM DEMOD modes.
INFILL (2nd FUNCT VIEW)	Permits either or both displays to be infilled instead of the normal outline representation. This can be used to highlight the difference between the two traces on A and B displays.
GRAT	Key toggles to switch the electronic graticule off or on.
ANNOT (2nd FUNCT GRAT)	Key toggles to switch the annotation on the display off or on.
A−B → A	Takes the A and B channels, and displays the difference as trace A. In dB/DIVISION mode the annotation is changed so that the centre of the vertical scale is equal to the difference between the A and B reference levels. In LOG VOLTS/DIV mode the difference is displayed about the "1" graticule line.
A ⇆ B	Exchanges A and B memory contents.
CAL	Starts an automatic self-calibration sequence to optimize measurement accuracy and cancel any temperature drift. All the resolution filters are adjusted to set their centre frequency and gain. Each step of the RF attenuator and the overall frequency response is measured and stored for error correction of all subsequent measurements. A 'Calibrated' message appears on the screen when the instrument is in a calibrated state. To ensure quoted accuracy CAL should be pressed after the controls have been set.
NORMALIZE	When using the Tracking Generator, with FULL SPAN, /DIV and LOG horizontal modes, this facility permits the normalization of the display to allow for the loss or gain and frequency response in an external network as well as for that in the instrument. This allows for precise measurements of the device under test. Any network with a response within the displayed range of the instrument may be normalized.

REMOTE OPERATION (GPIB)

	Complies with the following subsets as defined by IEEE 488-1978 and IEC Publication 625-1: SH1, AH1, T5, L4, SR1, RL1, PP0, DC1, DT1, C0 and E1. All front panel facilities (except INTENSITY, SUPPLY and MARKER 2 functions) are remotely programmable. Information can be written to or read from the display stores. REMOTE and ADDRESSED states are indicated by front panel lights.
User accessible display	Complete control of displayed text in two modes: text overlaying normal display in main screen mode; dedicated display giving full VDU facilities in alternative screen mode.
Service requests	The 2380 may be programmed to request interrupts for the following conditions: Error condition detected Calibration state changed End of sweep Any front panel key-press on the display un: Data available
TRANSFER FORMATS	Complies with IEEE 728-1982.
Trace data	ASCII: 502 point read of A or B trace using NR2 numeric data format. Binary: 502 point read/write from/to A or B trace, read/write from/to instrument setting store, and read/write from/to A or B trace (saved display store) using a block data format.
Display settings	Binary: 198 byte block data transfer.
Instrument settings	Binary: 238 byte block data transfer.
TRANSFER TIMES	
Trace data	ASCII: 1·5 s typical for 502 point transfer. Binary: 600 ms typical for 502 point transfer. (1004 byte block data transfer)
Display settings	Binary: 100 ms typical for 198 byte block data transfer.
Instrument settings	Binary: 630 ms typical for 238 byte block data transfer. These times are for an HP Series 200 controller using standard transfer techniques.
GPIB PLOT	The 2380 can be set to talk directly to an HP-GL compatible plotter to obtain a comprehensive hard copy print of traces with annotation. Both major and minor graticule lines may be plotted.

	Menu selection is used so that the user can select the parts of the display to be plotted, the pen colours to be used and the pen speed. The following sub-set of HP-GL commands is used: DP, LB, LT, PA, PD, PR, PU, SC, SM, SP, SR, UC and VS.

OTHER FEATURES

STORE	Used with a single numeric key (1 to 9), this permits up to nine sets of front panel control settings or masks to be stored in non-volatile memory for subsequent recall. Menu selection is enabled; the titles of selected settings, entered with the TEXT key, are shown. This defaults to display the reference frequency if text is not added. Stores may be protected to prevent accidental overwriting.
RECALL	Used with a single numeric key (1 to 9). Permits the instrument controls to be set to a previous configuration stored earlier at that location. Control settings stored in STORE 1 are automatically recalled whenever the instrument is switched on.
TEXT	When this key is pressed the front panel keys become alpha-numeric keys permitting a caption to be placed across the top of the display.
SECRET (2nd FUNCT TEXT)	Key toggles to remove reference frequency annotation from the display. This prevents unauthorised viewing of the operating frequencies.
INTMD IDENT	Used to identify any internally generated intermodulation or distortion when using dB/DIVISION mode. Operation of this key applies 3dB more RF attenuation and adds 3dB more IF gain, it also causes the input mixer level relative to the selected reference level to be displayed. If the trace is unaltered when this key is pressed, then any intermodulation being generated in the instrument is not significant to the measurement.
SELECT & PRESET	Operation of this key is equivalent to pressing all keys with green lettering, so that it sets the instrument to 10dB/division, 0dBm reference level, 40MHz/div, 200 MHz reference frequency, AUTO modes, Tracking Generator off, etc. If the input has been overloaded, operation of this key will clear the latched protected state unless the overload is still present.
MASK (2nd FUNCT SAVE B)	Enables user to enter upper and lower frequency and level limits from the keyboard in to the B store which can be overlaid upon the A display to produce a go/no go calibration. A menu prompts the operator to enter the required limits for each corner of the mask. Up to 8 maximum levels and frequencies and 8 minimum levels and frequencies can be entered.
AUDIO (2nd FUNCT METER)	Toggles to switch loudspeaker mounted on rear panel on or off. Associated with VOL (volume) control on rear panel.
IDENTIFY REFRESH (2nd FUNCT START)	The display is progressively brightened up to identify where the trace is being refreshed. When enabled it will operate automatically for sweep speeds slower than 100ms/division.
STD 10MHz OUTPUT	
Frequency	10MHz ± Frequency Standard Error.
Amplitude	−10dBm ± 0·3dB.
Connector	50Ω BNC type female.
47·4MHz OUTPUT (IF OUTPUT)	
Frequency	47·4MHz.
Bandwidth	Typically 3 MHz.
Amplitude	Proportional to the signal level at the first mixer. Nominally 5 dB greater than the RF input signal for 0 dB RF attenuation.
Connector	50Ω BNC type female.
PHONES (DEMODULATED OUTPUT)	
Frequency range	Nominally 50Hz to 50kHz.
Amplitude	Dependent on vertical scale range, modulation depth and volume control setting. The peak-to-peak output level corresponding to a full screen amplitude is nominally: 1 s volts/div range: 3·3 volts 2 s volts/div range: 3·3 volts 5 s volts/div range: 6·7 volts
Connector	6·35 mm standard jack socket.
PROBE SUPPLY	Supply available at front panel socket to power 1 GHz Active Probe 2388 and Zero Loss Probe 2374.
RADIO FREQUENCY INTERFERENCE	Conforms with the requirements of EEC Directive 76/889 as to limits of RF interference.
SAFETY	Complies with IEC 348.
RATED RANGE OF USE (over which full specification is met)	
Temperature	0°C to +50°C.
CONDITIONS OF STORAGE AND TRANSPORT	
Temperature	−40°C to +70°C.
Humidity	Up to 90% relative humidity.
Altitude	Up to 2500 m (pressurised freight at 27kPa differential i.e. 3·9lbf/in²)
POWER REQUIREMENTS	Switchable voltage ranges 105 to 120V, 210 to 240V, all ± 10%.
AC supply	45Hz to 440Hz. Power taken by both units together is approximately 180W, 340VA.

DIMENSIONS & WEIGHT

	Height	Width	Depth	Weight
2380	155 mm 6·1 in	418 mm 16·5 in	575 mm 22·5 in	13 kg 28·5 lb
2382	155 mm 6·1 in	418 mm 16·5 in	575 mm 22·5 in	17·3 kg 38 lb
2380 + 2382 when rack mounted	356 mm 14·0 in	418 mm 16·5 in	575 mm 22·5 in	30·3 kg 66·5 lb

NOTE The specification is only applicable if the measurement is made within 10 minutes of the CAL key being pressed, "sweep uncal" message is not displayed (sweeps faster than AUTO setting) and connections are made directly to the front panel N type connectors.

OPTIONS

The additional functions detailed below may be added to a standard 2380 by fitting Conversion Kit 46883-735V.

OPTNS (2ND FUNCT GPIB PLOT)	Selecting this function causes the display to list the menu of options available which can be selected by pressing numeric keys.
BEEPER	May be enabled or disabled for the following conditions, selected by menu. 1. Error 2. End of sweep 3. Overload
ANALOG PEN PLOT	Permits direct copy of A trace, B trace, major and minor graticule lines onto paper using an X-Y pen plotter. A menu is used which guides the operator through a setting-up procedure, which includes setting the bottom left and top right extremities.
Output	0 to +5V ± 10% into a load of 500Ω for both x and y axes, short-circuit protected. The software limits the pen velocity for maximum writing speed consistent with good accuracy.

Connector	15-way 'D' type socket.
VIDEO OUTPUT	Composite monochrome video signal, nominally 1 V peak-to-peak, positive-going. 300mV sync pulses 700mV video level. Used to drive an auxiliary TV display or a video plotter. Video amplitude depends on setting of intensity controls on front panel.
Connector	75Ω BNC type female.
RGB OUTPUTS	Three video drives at nominally 1V peak-to-peak positive-going into 75Ω DC coupled. Sync. drive 1V peak-to-peak negative-going into 75Ω AC coupled. This option allows an RGB video monitor to display the A store and the A annotation in one colour, the B store and B annotation in a second colour and the graticule and common annotation in a third colour. Two colour palettes selectable via the OPTNS menu. Note: The RGB colour monitor for use with this option should be capable of accepting a 250% over-drive on each RGB input without clipping, and of displaying a minimum of 54 µs active horizontal line time to avoid loss of displayed information. Horizontal sync. frequency is 15.664 kHz, vertical sync. frequency is 48·2 Hz non-interlaced.
Connector	15-way 'D' type socket. Option also includes RGB monitor connecting lead.

75 OHM VERSION

All specifications are the same as for the standard instrument except as detailed below:

AMPLITUDE

REFERENCE LEVEL	
dB/DIVISON	
Accuracy	Better than ±1·5 dB at any frequency, IF gain setting, RF attenuator setting and resolution bandwidth, provided that "sweep uncal" message is not displayed.
VOLTS/DIV	
Accuracy	Better than ±18·5% at the selected reference frequency for any IF gain setting, RF attenuator setting and at any permitted filter selection but ±25% at other frequencies.
LOG VOLTS/DIV	
Accuracy	Better than ±18·5% for any frequency, IF gain setting, RF attenuator setting and at any permitted filter selection.
FREQUENCY RESPONSE	On all displayed ranges, the frequency response is ±0·5 dB for RF attenuation ≥10 dB and ±0·6 dB for 0 dB RF attenuation.
RF INPUT	
Connector	75Ω BNC type female.

TRACKING GENERATOR

Amplitude Accuracy	Better than ±0·7 dB at −10 dBm at 10 MHz.
Frequency Response	Better than ±0·5 dB at −10 dBm.
TRACKING GENERATOR OUTPUT	
Connector	75Ω BNC type female.
STD 10 MHz OUTPUT	
Amplitude	−10 dBm ±0·4 dB.
Connector	75 ohm BNC type female.
47·4 MHZ OUTPUT (IF OUTPUT)	
Amplitude	Nominally 3 dB greater than the RF input signal for 0 dB RF attenuation.

VERSIONS

When ordering please quote eight-digit code numbers.

Ordering numbers	Versions
2380 Display	
52380-900E	Display. No options fitted.
52380-900E plus 46883-735V	Display with Conversion kit fitted (Beeper, Analog Pen Plot, Monochrome and RGB Video Outputs).
2382 100Hz–400MHz Spectrum Analyzer	
52382-900A	100Hz–400MHz Spectrum Analyzer, 50Ω.
2382/1 100Hz–400MHz Spectrum Analyzer	
52382-901Z	100Hz–400MHz Spectrum Analyzer, 75Ω.
ACCESSORIES	
Supplied accessories 2380 Display	
	AC supply lead. 43123-076Y Operating precautions, H 52380-900E Vol. 1. 46881-576Z
Supplied accessories 2382 100Hz–400MHz Spectrum Analyzer	
	Operating Manual. H 52382-900A Vol. 1. 46881-489W GPIB Operating Manual. H52382-900A Vol. 1A. 46881-583Y Operating Summary. 46881-646Z Cable Assembly (Power)*. 43130-369S Cable Assembly (Data)*. 43130-082H * To interconnect 2382 to 2380
Optional Probes	
52388-900D	1 GHz Active Prove 2388.
52374-900C	Zero Loss Probe 2374 (200 MHz) 50Ω.
52374-901R	Zero Loss Probe 2374/1 (200 MHz) 75Ω
Optional accessories	
46881-488S	Service Manual for 2380 Vol 2. H 52380-900E
46881-490V	Service Manual for 2382 Vol. 2. H 52382-900A
46881-365R	GPIB Manual (contains details of general GPIB protocols). H 54811-010P.
43129-189U	GPIB Lead
46883-408K	IEEE/IEC Adapter Block for GPIB Socket.
46883-735V	Conversion Kit. Beeper, Analog Pen Plot, Monochrome and RGB Video Outputs, Includes RGB monitor connecting lead.
46662-088D	Carrying case, 2 required for complete instrument.
46883-267B	Camera Hood for Polaroid type camera.
54127-305R	Rack Mounting Kit for 2380 and 2382.
54150-022P	Viewing Hood, may be required outdoors in high ambient light conditions.
43130-231J	6·35 mm Standard Jack Plug BNC Cable for phones output socket.
43126-012S	RF Connecting Cable, 50Ω BNC. 1520mm long.
54311-095C	RF Connecting Cable, Type N 50Ω 1000 mm long.
54431-021B	20W 20dB Attenuator.
54311-092P	Coaxial Adapter Type N male to BNC female.
54711-035Y	Support Kit. Comprises 3 extender boards for 2380, extended Power and Data cable assemblies and coaxial cables.
54481-042M	50/600Ω Transformer. Provides 600Ω balanced input. Frequency range 100 Hz to 620 kHz.
2382/1	100Hz–400Mhz Spectrum Analyzer.
Supplied Accessories 2382/1 (75Ω version)	
Same as for the standard instrument except for:	
46881-638C	Operating Manual H52382-901Z Vol. 1.
46881-700V	GPIB Operating Manual H52382-901Z Vol. 1A.
Optional Accessories (75Ω version)	
54351-011F	RF Connecting Cable, 75Ω BNC 1830 mm.
54481-041X	75/600Ω transformer. Provides 600Ω balanced input. Frequency range 100 Hz to 620 kHz.
46881-639R	Service Manual for 2382/1 H52382-901Z Vol. 2.

Zero Loss Probe 2374

2374 Zero Loss Probe is an alternative to the 2388 1 GHz Active Probe for applications below 50 kHz. The frequency response of the 2374 is from 50 Hz to 200 MHz (−3 dB points). 50 Ω and 75 Ω versions are available.

An accessory case is included along with a range of accessories such as voltage dividers, grounding leads and spare probe tips.

FREQUENCY RESPONSE	
(From 50 Ω source)	±0·5 dB from 500 Hz to 110 MHz. −3 dB at 50 Hz and 200 MHz.
INSERTION LOSS AT 10 MHz	0 dB ± 1 dB.
INPUT IMPEDANCE	
Probe alone, Power ON	Nominally 100 kΩ at d.c., shunt capacitance not greater than 5 pF at 10 MHz.
Probe alone, power OFF	Shunt capacitance not greater than 14 pF at 10 MHz.
Probe with voltage divider	Nominally 1 MΩ at d.c., shunt capacitance not greater than 2·5 pF at 10 MHz for 100:1 divider; not greater than 3·0 pF at 10 MHz for 10:1 divider.
OUTPUT IMPEDANCE	Suitable for operation into 50 Ω.
MAXIMUM SAFE INPUT	
Probe alone	4 V peak a.c. ± 100 V d.c.
Probe with voltage dividers	40 V peak a.c. ± 200 V d.c. with 10:1 divider. 80 V peak a.c. ± 200 V d.c with 100:1 divider.
PROBE SUPPLY	Available at 2382 front panel, or −7·5 V regulated at 60 mA d.c.
TERMINATIONS	Signal lead: BNC. Supply lead: Subminiature 3 pin.
SAFETY	Complies with IEC 348.

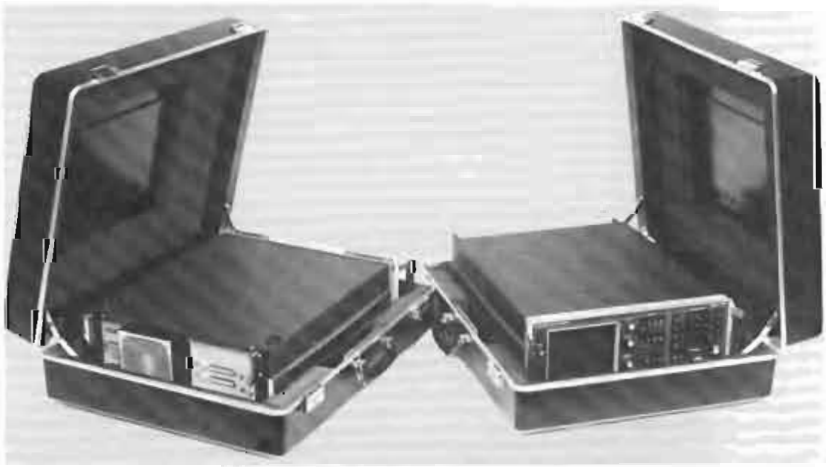
LIMIT RANGE OF OPERATION	
Temperature	0 to 55°C.
CONDITIONS OF STORAGE AND TRANSPORT	
Temperature	−40°C + 70°C.
Humidity	Up to 90% relative humidity.
Altitude	Up to 2500 m (pressurized freight at 27 kPa differential), i.e. 3·9 lbf/in².

DIMENSIONS AND WEIGHT (Accessory case with probe and all accessories)	Height	Width	Depth	Weight
	39 mm	223 mm	17 mm	480 gm
	1·5 in	8·8 in	7·0 in	1·1 lb

VERSIONS AND ACCESSORIES

When ordering please quote eight-digit code numbers

Ordering numbers	Versions
52374−900C	Zero Loss Probe 2374, for 50 Ω use.
52374−901R	Zero Loss Probe 2374/1, for 75 Ω use.
	Supplied Accessories
	Accessory Case.
	Voltage Divider 10:1.
	Voltage Divider 100:1.
	BNC probe input adapter.
	Probe hook tip.
	Earth lead (2 supplied).
	Sprung earthing bayonet.
	50 Ω or 75 Ω through termination.
	Spare probe tips (3 off).



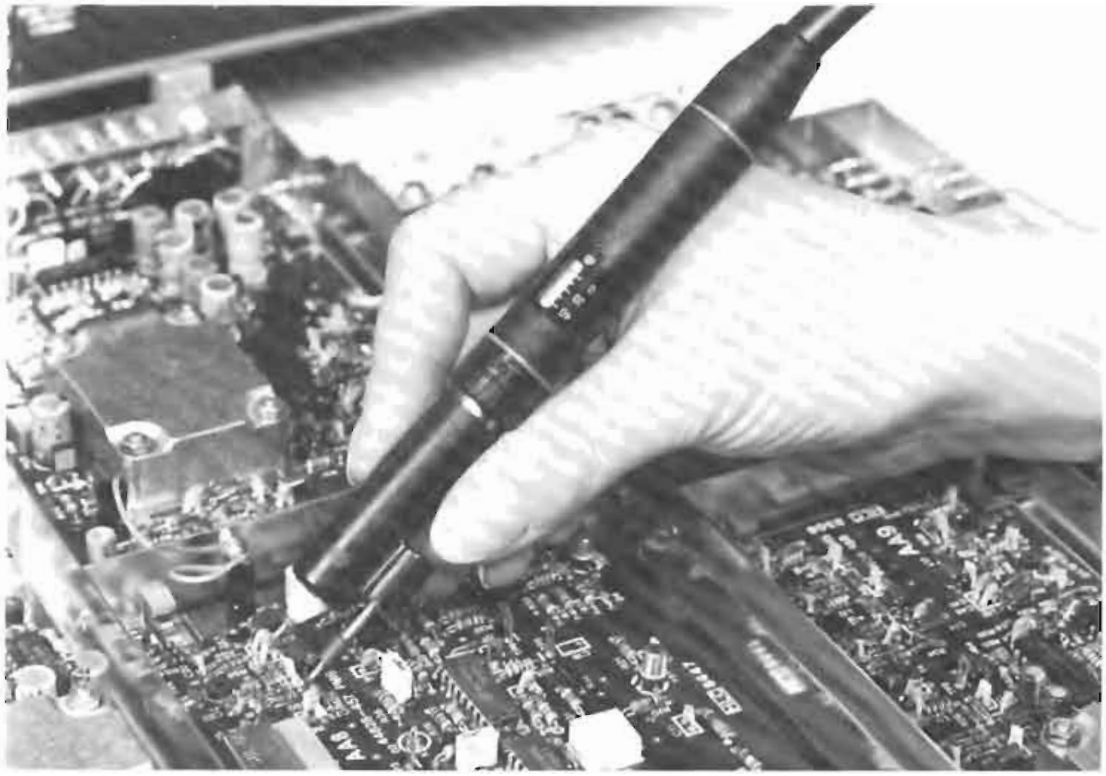
Optional carrying cases provide easy transportation. 15463/5

15463/4

A comprehensive support kit is also available for maintenance.

Marconi
Instruments

1 GHz Active Probe 2388



- ☐ **Wide frequency coverage: 50 kHz to 1·25 GHz, for IF, HF, VHF and UHF applications**
- ☐ **Attenuation adjustable to ensure operation at optimum dynamic range independent of signal levels**
- ☐ **Revolutionary design, with integral continuously variable attenuator**
- ☐ **Excellent intermodulation performance**
- ☐ **High input impedance gives minimal loading of circuit under test**

The 2388 1GHz Active Probe covers the very wide frequency range of 50 kHz to 1·25 GHz, for applications from HF to UHF, including intermediate frequencies. It converts the 50 Ω input impedance of RF test equipment to a high impedance, providing minimal loading of the circuit under test when bridging measurements are made.

Input capacitance is less than 2·5 pF, improving to 1·5 pF with maximum attenuation. Damping resistance is 250 kΩ at 10 MHz.

Intermodulation products are at least 75 dB down, permitting confident measurement of low-level intermodulation and harmonic distortion products. Distortion is low for a wide range of signal levels (see graph). A noise figure of better than 15 dB facilitates measurement of low-level signals.

The probe has been ergonomically designed to ensure comfortable operation.

Integral Attenuator

The 2388's revolutionary design eliminates the need for cumbersome clip-on voltage dividers, by incorporating a variable attenuator within the probe. Attenuation is readily set by rotating the probe barrel. It is continuously adjustable from 0 to 40 dB, and a locking ring is provided so that the chosen attenuation can be maintained. The adjustable attenuation ensures that the probe can be operated at an optimum dynamic range independent of the input signal level.

Marconi Instruments

2388

Power supply

DC supply for the probe is either derived from the test equipment, or via an external unit, available as an optional accessory. Marconi Instruments' 2382 100 Hz – 400 MHz Spectrum Analyzer has a probe output socket on its front panel, whilst the optional accessory Power Supply (order number 54441-012P) allows the probe to be used with other instruments. This makes the 2388 a truly universal device, which may be used with any spectrum analyzer, or other instrumentation such as oscilloscopes, frequency meters and modulation meters.

The probe is very rugged, and can withstand being dropped from bench to floor. In cases of extreme stress, however, the tip may be damaged, but is easily replaced, since a spare assembly simply screws to the probe barrel. A spare tip is included as a supplied accessory.

Accessories

The probe is supplied in a carrying case, which has storage space for the supplied accessories, including a Spring Grounding Pin, Terminated Type N (Male) Adaptor, and a spare probe tip.

The Spring Grounding Pin incorporates a universal joint to allow the probe to be grounded to any convenient point. A Grounding Clip Assembly is supplied to allow grounding by means of a short wire.

The Terminated Adaptor may be used to check the insertion loss and frequency response of the probe, and, when used with 2382 Spectrum Analyzer it allows these effects to be removed by means of its built-in Tracking Generator and NORMALIZE facilities. Accurate, absolute measurements can be made in this way.

FREQUENCY RESPONSE (When terminated in Adaptor type 43149-020E)	3 dB bandwidth 100 kHz to 1 GHz. Typically 50 kHz to 1.25 GHz. Gain flatness ±0.75 dB from 500 kHz to 400 MHz.
INSERTION LOSS AT 10 MHz	Continuously variable from 0 dB ± 1.5 dB to 40 dB, scaled in nominal 10 dB increments.
INPUT IMPEDANCE	
Input capacitance at 10 MHz	<2.5 pF for probe setting of 0 dB loss. <1.5 pF for probe setting of 40 dB loss.
Input damping resistance	>250 kΩ at 10 MHz for probe setting of 0 dB loss. >25 kΩ at 100 MHz for probe setting of 0 dB loss.
DISTORTION	
Two-tone intermodulation products	>75 dB down on the level of a single tone, where each tone has a level of −30 dBm at the probe output (i.e. <−105 dBm). See graph.
Output level at 1 dB gain compression	−6 dBm minimum at output.
NOISE	
Noise figure	<15 dB with probe setting of 0 dB loss at 100 MHz.
MAXIMUM VOLTAGES	
Max. DC level	200 V.
Max. AC level	10 V peak-peak at any setting.
SIGNAL TERMINATION	Type N male connector (50 Ω).
POWER REQUIREMENTS	
Probe supply	900 mW maximum, either from 2382 front panel socket or from the optional Accessory Power Supply.
Power termination	3 pin miniature connector.
ENVIRONMENTAL PERFORMANCE	
Limit range of operation	
Temperature	0 to +55°C.
Rated range of operation	
Temperature	+5 to +50°C.
Conditions of storage and transport	
Temperature	−40 to +70°C.
Humidity	Up to 90% relative humidity at 35°C.
Altitude	Up to 2500 m (pressurized freight at 27 kPa differential, i.e. 3.9 lbf/in²).

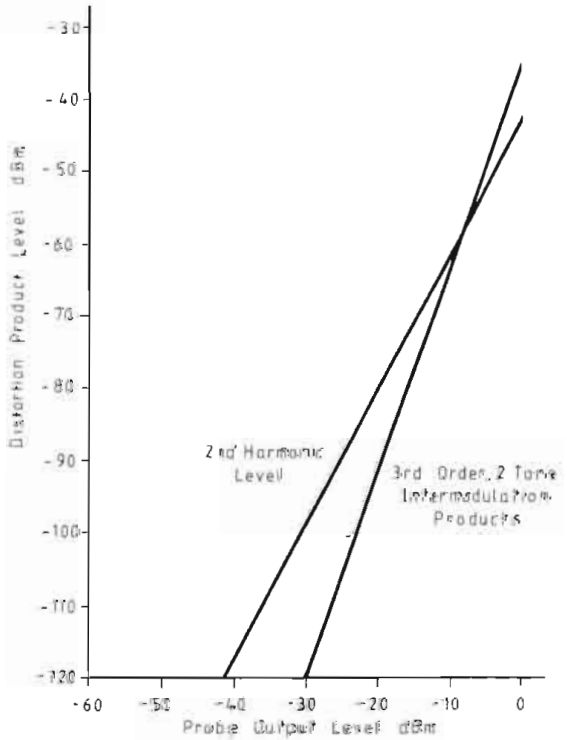
DIMENSIONS AND WEIGHT	Height	Width	Depth	Weight
	9.6 in	9.25 in	7.5 in	1.8 lb
	65 mm	236 mm	190 mm	0.8 kg

Dimensions are of carrying case, weight includes all supplied accessories.

VERSIONS AND ACCESSORIES

When ordering please quote eight-digit code numbers.

Ordering numbers	
52388-900D	1 GHz Active Probe 2388.
	Supplied Accessories
41700-517D	Spare Probe Tip.
41700-518T	Spring Grounding Pin.
43149-020E	Terminated 50 ohm Type N Male Adaptor.
41700-554P	Grounding Clip Assembly.
	Optional Accessories
54441-012P	Accessory Power Supply (for non-2382 applications).



Typical harmonic distortion and intermodulation performance