INSTRUCTION MANUAL

EN



PSA SERIES 4

PSA1304, PSA2704, PSA2704RT

Handheld Real Time Spectrum Analyzers

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1. PRODUCT DESCRIPTION

The spectrum analyzers described in this document are designed to be used as general purpose test and measurement equipment

User manuals, additional support and service information can be found at: www.aimtti.com

Items Supplied

- Portable Spectrum Analyzer with detachable bench-stand/screen protector
- AC power-supply/charger universal voltage, interchangeable plugs for various countries.
- Spare stylus
- USB lead- mini B plug to standard A plug.
- Trigger input converter plug- 3.5mm jack to BNC.
- Safety Documentation & Quick Start Guide multi-language (English, French, German, Italian and Spanish).
- Optional Accessories, see *'Appendix A: Optional Accessories'*

Model Variations

This manual covers the PSA2704RT, PSA2704 and PSA1304 spectrum analyzers. Within the text they may be referred to jointly as PSA Series 4. The tables below shows the differences between the model variants.

		PSA1304	PSA2704	PSA2704RT
Frequency Range	Swept & Zero Span Mode	1MHz to 1300MHz	1MHz to 2700MHz	1MHz to 2700MHz
	FFT Sweep Mode	10MHz to 1300MHz	10MHz to 2700MHz	10MHz to 2700MHz
	Real Time Mode	-	-	10MHz to 2700MHz

1 - Product Description

	PSA1304	PSA2704	U03	PSA2704RT
Better than ±1dB amplitude flatness	*	*		*
Resolution and video bandwidth filters, selectable in 1:2:3:5 sequence, or auto, and variable detectors	*	*		*
Harmonics <-50dBc (typ.)	*	*		*
Spurs <-60dBc, residual spurs <-70dB below ref. level	*	*		*
IP3 <65dBc (typ.)	*	*		*
Advanced digital processing	*	*		*
Instant start up and ready for the first sweep in less than 3 seconds	*	*		*
Frequency Counter	*	*		*
FFT sweep with frequency bin resolutions selectable in 1:2:4:5:8 sequence, variable detectors and window functions	*	*		*
Data Logging			*	*
Automatic measurements: CP, ACR & OBW			*	*
Modulation waveform display			*	*
Triggering			*	*
Limits, offsets & tables			*	*
Custom presets			*	*
Remote control and analysis tools with Test Bridge PSA software			*	*
Triggering including Frequency Mask trigger			*	*
10.8MHz Real Time bandwidth				*
37.5us min. duration for 100% POI				*
Realtime acquisition with variable FFT length, count, overlap, and window functions				*
62.5ns min. detectable signal duration				*

2. SAFETY

Symbols

This document contains information and warnings which must be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

The following symbols are displayed on the instrument and throughout the manual, to ensure the safety of the user and the instrument, all information must be read before proceeding.

WARNING



Indicates a hazard that, if not avoided, could result in injury or death.

CAUTION



Indicates a hazard that could damage the product and may result in loss of important data or invalidation of the warranty.

NOTE



Indicates a helpful tip.

EXAMPLE



Indicates an example to show further details.

WARNING - Indicates a hazard that, if not avoided, could result in injury or death.	'**CE**' marking is a certification mark that affirms the goods conformity with European health, safety, and environmental protection standards.
CAUTION - Indicates a hazard that could damage the product and may result in loss of important data or invalidation of the warranty.	**UKCA** 'UK Conformity Assessed' marking is a certification mark that affirms conformity with the applicable requirements for products sold within Great Britain.
Power ON/OFF	**WEEE** (do not dispose in household waste)
Direct Current	

Safety notices

THIS INSTRUMENT IS:

- A safety Class I instrument according to IEC classification and has been designed to meet the requirements of EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use).
- An Installation Category II instrument intended for operation from a normal single-phase supply.
- Tested in accordance with EN61010-1 and has been supplied in a safe condition.
- Designed for indoor use in a Pollution Degree 2 environment in the temperature range 5°C to 40°C,20%- 80% RH (non-condensing) and less than 2000M. It may occasionally be subjected to temperatures between +5° and-10°C without degradation of its safety.

WARNING



This instrument is fitted with a rechargeable Lithium ion polymer battery; do not expose the instrument to heat sources or high-temperature environments such as an unattended vehicle in the sun. Only recharge the battery, in the instrument, using the charger supplied. Do not incinerate the instrument and/or battery; refer to the Service Guide for information on battery replacement and disposal. Use of this instrument in a manner not specified by these instructions may impair the safety protection provided.

All accessible parts will be at the same voltage as the outer body of the N-type input socket. In particular, note that the shells of both USB connectors are galvanically connected to the body of the N-type input and will therefore be at earth ground potential when either USB port is connected to a desktop PC. To maintain user safety under all other circumstances it is essential that the input is not connected to a voltage above 30Vdc or 30Vrms with respect to earth ground which is the limit of Safe Extra Low Voltage (SELV) by IEC definition.

The instrument shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair. Any adjustment, maintenance and repair of the opened instrument shall be carried out only by a skilled person in conjunction with the Service Guide

CAUTION



Do not wet when cleaning. Use only a soft dry cloth to clean the screen.

Do not use sharp or pointed objects to operate the touch screen.

3. INSTRUMENT OVERVIEW

Input and Output Connections



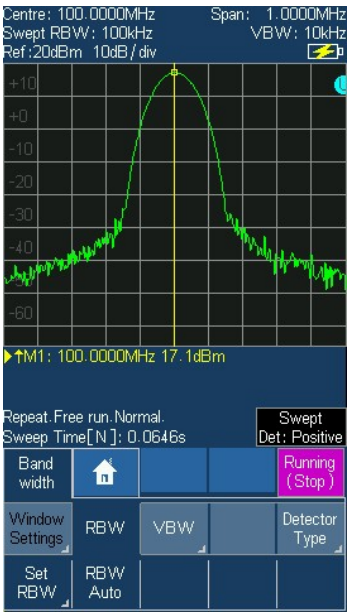
DC Power Input	DC power to operate and/or recharge the instrument is connected via a 1.3mm power socket. **CAUTION** The adaptor/charger supplied has a universal input voltage rating of 100-240VAC, 50/60Hz. It is a Class II (double insulated) device, fully approved to EN 60950-1 and UL 60950-1 (UL listing E245390). **Use ONLY the power-supply/charger provided by Aim-TTi with the unit. Use of any other power source will void the warranty.**
Signal Input	The signal to be measured is connected via a standard N connector. The input impedance is 50 Ohms. **CAUTION** The maximum useable signal input is +17dBm or +123dBuV. **The absolute maximum signal input level is +23dBm or +130dBuV of RF power or 50V DC. Applying a signal above this level could damage the unit and such damage would not be covered by the product warranty.**
Demodulated Audio Output	Demodulated audio (when in Zero Span Mode) is available via the built-in speaker, the signal is also provided via a 3.5mm stereo jack socket. Maximum power output is 30 milliwatts into 32 Ohms. The signal is mono, but connection can be made using either a mono or stereo plug. In the latter case the signal will be present on both channels. Connecting the jack plug automatically disconnects the internal speaker.
USB Host Socket	For USB Flash Memory.
USB Device Socket	USB Mini-B for connection to a PC.
Trigger In/Output	A 3.5mm mono jack socket is mounted at the top of the instrument for trigger signals. This has no function unless option U03 is fitted. An adaptor is provided that converts from the jack socket to a standard BNC connector.

Signal Input

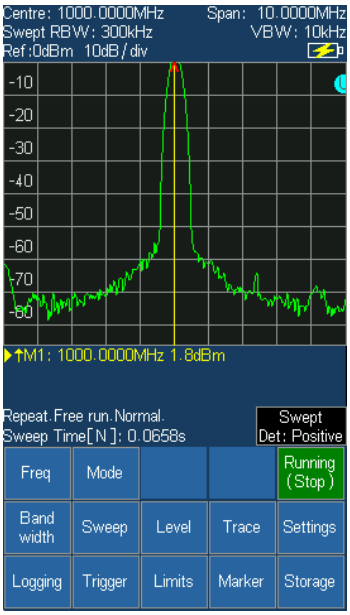
Connect the signal to be measured to the N-type connector at the top of the instrument.

CAUTION

The maximum allowable signal without damage is +23dBm (+130dBuV). The maximum measurable signal is +17dBm (+123dBuV) with the Reference level set to +20dBm. If there is a possibility of the signal exceeding these levels, add suitable in-line attenuation.



Signal Overload Levels and Indication



Signals that would cause the trace to rise above the reference level are indicated by a red arrow at the top of the graticule.

However, no indication is given if the trace is above (or below) the graticule as a result of Scale/Shift, Offset or Compensation Table, provided that it is below the reference level.

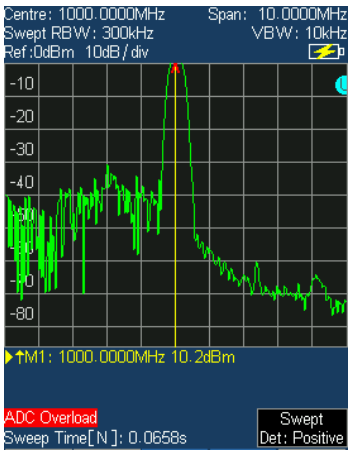
Large signals outside of the displayed span can cause measurement errors because of overload in the analog mixers and amplifiers. Consequently, a full-span sweep should be run to check for any high-level signals within the frequency range of the analyzer.

ADC Overload

Overload of the ADC is indicated by a red background warning message below the graticule area.

NOTE

For spans below 10MHz, overload of the ADC can occur from signals that do not cause a normal overload indication (the red arrow at the top of the graticule).



Signals that are more than 10MHz away from the centre of the current span will have a rapidly decreasing effect. Possible causes of overload can be checked by performing a sweep with a span of 40MHz or wider. As a general guide, signals of up to 40dB above the chosen reference level (absolute maximum +23dBm (above 50MHz)), that are more than 20MHz away from the centre of the desired span, should not cause ADC overload.

Radiated and Injected Signals

Self-radiated Signals

In common with most handheld spectrum analyzers, low level signals generated from the internal circuitry can be picked up with an antenna.

Indicative measurements made with a 30cm (12”) whip antenna, mounted directly onto the signal connector and extending in line with the instrument, showed self-radiated peaks typically around-90dBm. Connecting the same antenna at the end of a 1m (3ft) extension cable and moving it away from the instrument reduced these to below the noise floor at maximum sensitivity.

External Signal Injection

The RF circuitry of the instrument is extensively screened in order to avoid signals being picked up via any route other than through the signal connector. Nevertheless, very high field strengths, as might be created by a transmitter in close proximity, could cause measurement errors through direct radiated signal injection. The vulnerability to this increases with increasing frequency.

If such measurement errors are suspected, a measurement should be done with a N-Type shorting connector in place, in order to quantify the effect.

4. GETTING STARTED

Switching on

The instrument is turned on or off by pressing the small round key marked Power for about one second. When turning on, the screen backlight will flash briefly and a short beep will sound to indicate that the key press has been recognised, there is then a short delay prior to operation starting.

If the battery is too far discharged to allow operation, the instrument will turn off again and a second short beep will be sounded.

Setting Date And Time

The instrument contains a real-time clock that is used for time stamping of files. As supplied, the date and/or time may be incorrect.

Date and time can be checked from the Status screens or can be checked and altered from **Settings > Power/ Clock > Set Date & Time**.

NOTE



The date format is DD-MM-YY, and the time format is 24 hours.

Battery and AC Line Operation

Battery Operation

The instrument operates from an internal Lithium-ion rechargeable battery which can provide more than 4.5 hours of continuous operation (screen brightness dependent). The battery is charged from the supplied 5V/2A charger which can recharge a fully discharged battery in under 3 hours.

NOTE



As supplied, the internal battery is likely to be partially charged. The instrument should therefore be plugged into its charger for at least two hours before first use. The instrument can still be used during this period.

CAUTION



Use ONLY the power-supply/charger provided by Aim-TTi with the unit. Use of any other power source will void the warranty.

When the battery is being charged, the red LED next to the charging socket flashes. When charging is complete, flashing ceases but the lamp remains illuminated while the charger is connected.

It is also possible to slow charge the instrument from the USB port of a personal computer provided that the instrument is turned off. Charge time may be up to 10 hours. Connection to the PC must be made from the mini USB device port of the instrument using the supplied cable. It is not possible to operate the instrument from USB power.

Battery Status

The battery condition is indicated on the display via a multi-segment battery symbol. When fully charged the battery is shown as a solid grey symbol. When it changes colour to yellow, expected battery life has fallen below 30 minutes. When it turns red, expected battery life has fallen below 10 minutes, and the analyzer should be recharged.

The approximate battery life remaining is also displayed in hours and minutes within the Status information screens.

AC Line Operation

For bench-top operation, the instrument can be operated continuously from the supplied ac-line operated charger. The internal power management circuitry ensures that the battery cannot be overcharged.

Power Saving Tips

The battery life of the instrument is affected by the screen brightness which can be adjusted over a wide range. Setting the brightness to maximum, for example, will reduce battery life by up to 1 hour relative to the normal setting (40%).

To conserve the battery the instrument should be turned off when not in use. In addition, Auto-Off mode can be selected whereby the unit turns off automatically after a defined period from the last key press. The period can be set between 5 and 60 minutes. Auto-Off is automatically disabled when external power is connected, and when data-logging is enabled. All data is retained when the instrument is off. See '*Settings*' for more details.

A short beep is sounded when the instrument turns off.

Bench-top and Portable Use

The instrument is intended for both hand-held and bench-top applications. It has rubber feet for horizontal or vertical use or can be angled using the tilt stand.



Tilt Stand

The instrument is supplied with the tilt stand folded away and magnetically latched at the bottom of the instrument. It can be hinged outwards to tilt the unit at an angle of about 40 degrees.

USB sliding cover

The USB slots are protected by a sliding cover.

CAUTION

If the Mini-B USB is plugged into the Flash-Drive Socket can short out the internal 5V Supply with unpredictable results.

Screen Protector and Sun Shield

To protect the screen when in transit, the tilt stand can be detached from the bottom of the instrument and re-attached on the top to act as a screen protector.

The stand is removed by flexing it outwards at the hinged end until the lugs disengage from the sockets.

For outdoors use, the screen protector can be hinged upwards to form a sun shield which improves the screen visibility in direct sunlight.

When not required, it can be detached and stowed away on the back of the instrument where it functions as a tilt stand.



Display and Controls Layout

Overview



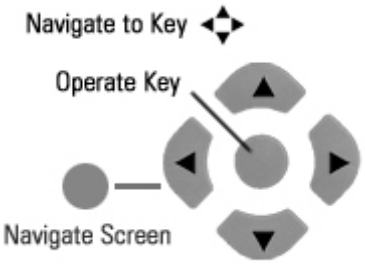
5. USING THE INSTRUMENT

Touch Screen Operation

The normal mode of operation of the spectrum analyzer is by using the touch-screen keys within the display supplemented, when required, by the hard keys below.

The touch screen keys are normally operated by pressing with the finger or thumb, but can alternatively be operated using the supplied stylus.

Operation using the Hard Keys Only



Although the instrument is designed to be operated via the touch screen, it is also possible to operate it using only the hard keys. This may be appropriate in particular circumstances such as when the user is wearing gloves.

Hard-key-only operation is activated by pressing the circular button marked Navigate Screen which then illuminates. This changes the function of the five Navigator keys from controlling the Markers to controlling the position of the on-screen key highlight.

The highlight position is shown by a change in the key colour to purple. Pressing the centre button operates the key.

Normal menu functions can be operated in this way. Pop-up menus and other special function screens can be exited by pressing the EXIT hard key. An exception is the Set by Tab/Jog function, described in '*Set by Tab/Jog'*, where the horizontal and vertical navigator keys operate the tab and jog functions respectively.

NOTE

The navigator does not effect touch operation, both can be used together.

Numeric entry

Numeric entry is available for settings such as Frequency or Level. Numeric values can be entered in one of two ways, by keypad or tab/jog.

NOTE

The method of numeric entry last used becomes the default entry method whenever that menu is accessed.

Set by Keypad



When accessing a menu that requires numeric entry, e.g. Frequency > Set Centre, the numeric keypad replaces the menu with a 0 to 9 keypad. The frequency is entered in MHz using the decimal point if required (maximum resolution 0.0001MHz). Frequencies can be entered just to the resolution required – following digits become zeros.

Entry errors can be corrected with the back-space key (←).

NOTE

In scenarios where a '←' & '+/-'key are valid, the ← key will appear after the first digit is entered, replacing the +/- key. The default setting is a negative (-) number.

OK: Set the entered frequency without leaving the control screen. The frequency value is cleared ready for entering a new value.

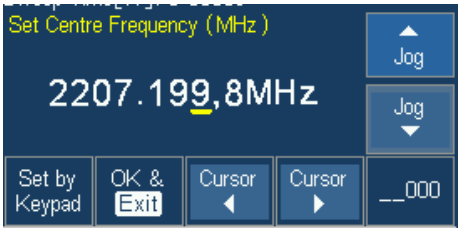
OK & Exit: Set the entered frequency and returns to the menu.

Cancel/ Exit: Return to the menu without setting the entered frequency.

Toggle Last: Returns the frequency to the value directly prior to the last frequency entry.

Set by Tab/Jog: Change to the alternate control screen as detailed below.

Set by Tab/Jog



This control screen replaces the menu with a display of the existing frequency and enables it to be changed.

Pressing either of the **Cursor** keys moves the arrows left or right along the digits.

The **__000 key** will set to zero digits to the right of the yellow cursor. (or the minimum allowed value).

Pressing either of the **Jog** keys directly increments or decrements the value of that digit live.

The Jog keys auto-repeat, and the new frequency is accepted and executed after a delay of around two seconds.

OK & Exit: Action the change and return to the menu.

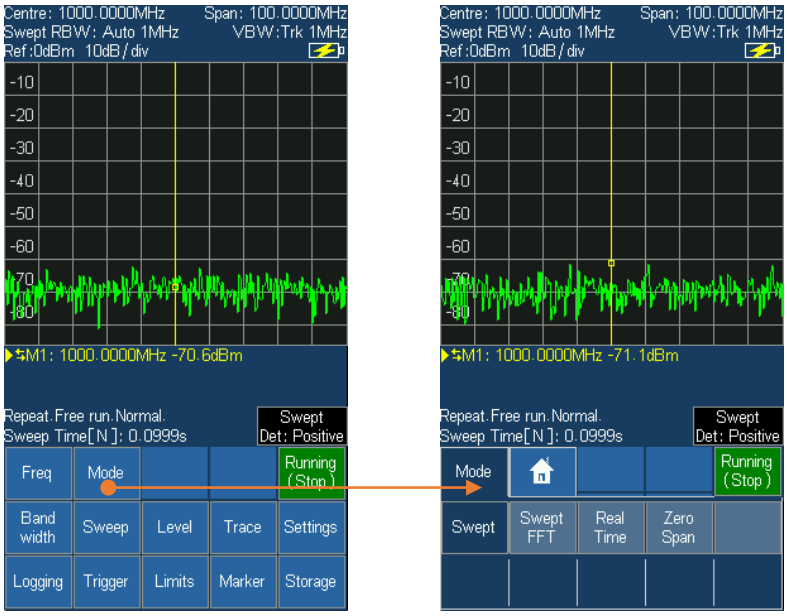
Set by Keypad: Change to the alternate control screen as detailed above.

NOTE

When Navigate Screen mode is selected, the navigator keys perform the tab/jog function directly.

Menu Structure

When the instrument is powered on for the first time, it defaults to Swept mode with the Home menu selected.



To change the mode of operation, open the Home menu, select Modes, and choose from one of the following: Swept, Swept FFT, Real Time, or Zero Span. See '*Modes*' for more details . The functions associated with the mode will populate the menus.

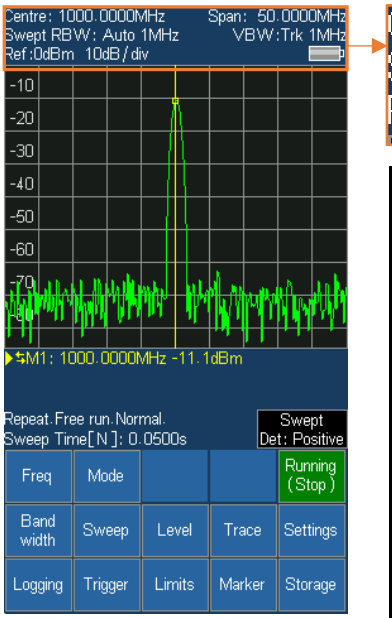
Although navigation is consistent, some parameters are mode-specific. For example, in Swept & Swept FFT mode the Set Span setting is found under **Frequency > Span**, whereas in Real Time mode this changes to Set RT Divider. This setting is unavailable for Zero Span.

Detailed descriptions of all parameters, along with full menu structures, are provided at the beginning of each menu section.

In all modes, measurement results can be viewed using a range of complementary display formats. These displays support effective spectrum analysis and are particularly useful for characterising signals that vary over time, as well as for analysing transient and dynamic signals. See '*Graph Settings*' for more details.

Primary Status information area

The Primary Status information area displays information based on the set mode, alongside the battery status icon.





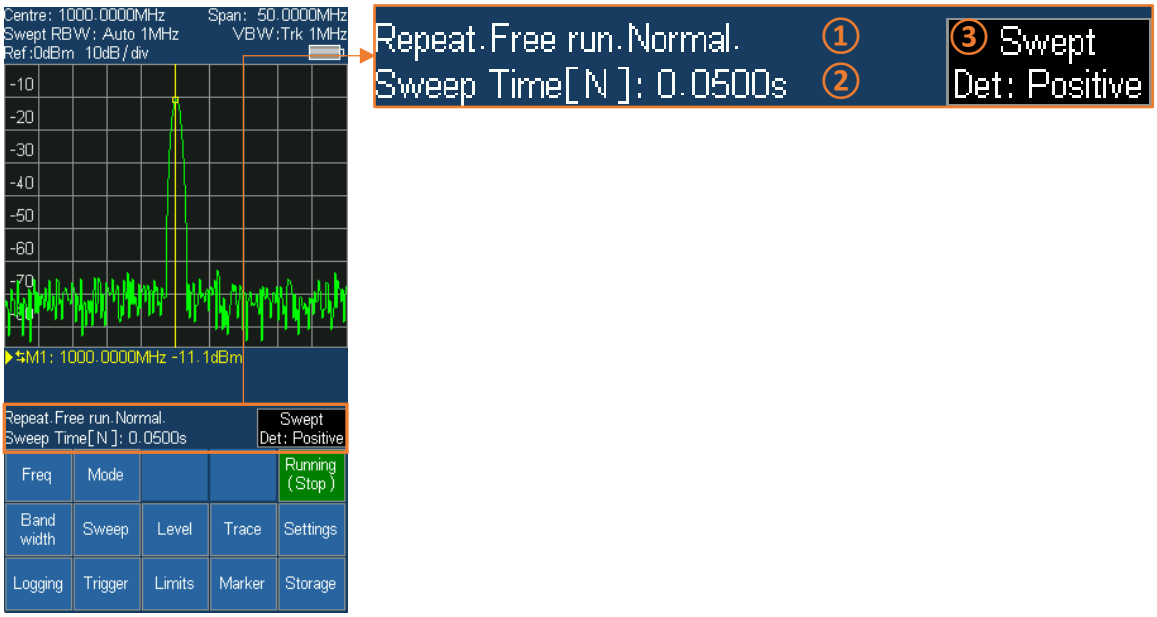
Swept	1	Centre or Start	Span or Stop
	2	Swept RBW	VBW
	3	Reference Level	Battery Status
Swept FFT	1	Centre or Start	Span or Stop
	2	FFT Window	FBR
	3	Reference Level	Battery Status
Real Time	1	Centre	RT Span
	2	RT Window, Length, Overlap & Count	
	3	Reference Level	Battery Status
Zero Span	1	Centre	Zero Span
	2	ZS RBW	VBW
	3	Reference Level	Battery Status

When in Swept or Swept FFT mode; pressing **Centre** or **Span** will cause the frequency range to be displayed at the top of the screen in terms of a centre frequency and a span. Pressing **Start/Stop** will cause it to be displayed in terms of a start frequency and a stop frequency.

When in Real Time mode, the set RT window, RT length, RT Overlap and RT Count are shown simultaneously on the second row.

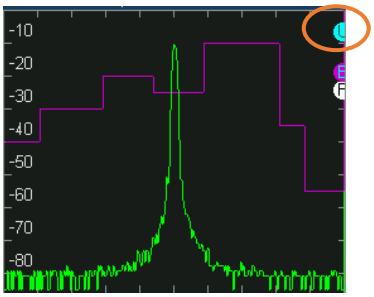
Secondary status information area

The normal sweep time and update rate is automatically set from the Span and the RBW and is displayed within the secondary status information area.



	Status	Menu where Set
①	Repeat or Single	Trigger->Sweep Control
	Free Run or Triggered	Trigger->Sweep Control->Sweep Trigger
	Normal or Average (n/m) or Peak Hold	Trace->Trace Mode
	Auto Sleep Never	Settings->Power/Clock->Auto Off
	Mins (CHARGER Disconnected)	Settings->Power/Clock->Auto Off
	FMT On/Off,	Trigger->Freq Mask-FMT on/off
	Running / Ext-+ / Manual / Pat Entry / Pat Exit/	Trigger->Freq Mask->Start On
	Free run / Ext-+ / Manual / Pat Entry / Pat Exit / Single	Trigger->Freq Mask->Stop On
②	Sweep Time	Sweep->Time
	Trace Status	Trace->Trace Control
	Limits Status	Limits->Limits->Set Limits
	+Burst nnnnn	Trigger->Freq Mask->Burst Count
	Pattern File Name	Trigger->Freq Mask->Load Pattern
	Demod AM/FM	Demod (Zero Span)
	Offset On/Off/75 Ohm/Fixed/Filename	Level->Offset->Set Offset
	"Markers on View trace." (Dual trace Mode)	Trace->Trace Mode->More(2)
	Beep On/Off Nav pmt Off/Msg/Flag	Settings->Alerts/Comms
③	New View Created	Pressing View/Save View
	Hold For Fast	Marker Move buttons
	Limit (not) Met	Limits->Limits->Limit Action->Message
	Mode and Detector	Demod (zero Span)
	Volume %	Settings
	Brightness %	
	Step	Freq

Error, Warning and Status indicators

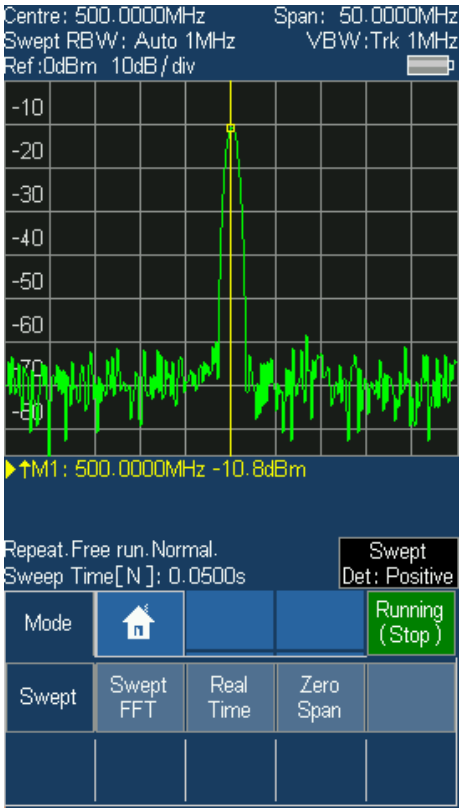


The Error, Warning and Status indicators are shown down the right-hand side of the trace area. Touch the indicator to view the message in full. When the side of the indicator is rounded (as show) they pop-out momentarily and the return to the 'closed' position. To lock the position to 'open', press and hold the indicator, the side of the indicator will become squared to show the 'locked' position. Press and hold again to 'unlock'.

Indicator	Description	Further information
USB-CDC	USB is connected	*'Understanding USB Connections'*
USB-CDC	USB socket is open	
Comp. Table	Compensation Table applied	*'Creating and using Compensation Tables'*
Offset: %0.1fdB	Offset applied	*'Amplitude Offset and Compensation Tables'*
75 Ohm	75 Ohm source impedance applied	
Lim 1 out of Range	Limit 1 is out of range	*'Limit Lines & the Limits Comparator | Creating Limit Patterns'*
Lim 2 out of Range	Limit 2 is out of range	
Lim 1 Fix	Limit 1 is fixed (relative to the display)	*'Limit Fix/Unfix'*
Lim 2 Fix	Limit 2 is fixed (relative to the display)	
Live OFF	The Live trace is off	*'Displaying Traces; Controlling the View Trace'*
Waterfall	Trace area graph type	*'Graph Settings'*
Heatmap		
Full		
Begin FM Trg?	Frequency Mask: Waiting for start trigger.	*'Freq. Mask'*
End FM Trg?	Frequency Mask: Waiting for stop trigger	
Burst FM Trg	Frequency Mask: Burst trigger active	
Single Trace	Single trace mode	*'Trace Mode'*
Stopped	The Live trace has been stopped	*'Displaying Traces; Controlling the View Trace'*
Waiting	Waiting for internal communication on power up.	
Paused	Trace paused. For example, when saving a trace file.	
Marker Control	Control markers selected	*'Controlling Markers'*
Navigate Selection	Navigate screen selected	*'Operation using the Hard Keys Only'*
Keys Shortcut	When step up/down, left/right is an option on the bottom row keys, the hard keys can be used to control these parameters when 'Keys shortcut' is shown.	

6. MODES

To change the mode of operation, open the **Home** menu, select **Modes,** and choose from one of the following:



Swept

Mode > Swept

In Swept mode, the instrument operates as a conventional spectrum analyser. It measures the frequency spectrum of the input signal across the selected frequency range, using the defined resolution bandwidth (RBW), video bandwidth (VBW), and detector settings.

Swept FFT

Mode > Swept FFT

Swept FFT mode is useful when the bandwidth to be examined exceeds the real-time bandwidth (10.8MHz) Multiple spectra generated using FFT are stitched together to provide coverage over the entire span. This technique significantly reduces measurement time compared to Swept mode, particularly when using narrow resolution bandwidths.

Real Time (PSA2704RT)

Mode > Real Time

In Real Time mode, the analyser performs measurements in the frequency spectrum of the input signal without losing any data. Analysis operation is performed fast enough to accurately process all signal components in the frequency band of interest.

Zero Span

Mode > Zero Span

Zero span is a special case of frequency range setting which removes the normal sweep display and enables audio and waveform measurement functions for demodulating AM and FM signals.

7. FREQUENCY

Setting the Frequency Range

The frequency range can be set in terms of either a centre frequency plus a span width, or in terms of a start frequency and a stop frequency depending on the mode.

Model	Mode	Min. Frequency	Max. Frequency	Min. Centre	Max. Centre	Min. Span	Max. Span
1304	Swept	1MHz	1300MHz	1.0013MHz	1299.9986MHz	2.7kHz	1299MHz
2704 & 2704RT		1MHz	2700MHz	1.0013MHz	2699.9986MHz	2.7kHz	2699MHz
1304	FFT Swept	10MHz	1300MHz	10.0014MHz	1299.9986MHz	2.7kHz	1290MHz
2704 & 2704RT		10MHz	2700MHz	10.0014MHz	2699.9986MHz	2.7kHz	2690MHz
2704RT	Real Time	-	-	10MHz	2700MHz	1.35kHz	10.8MHz
1304	Zero Span	-	-	1MHz	1300MHz	-	-
2704 & 2704RT				1MHz	2700MHz		

Centre/ Span

Centre

Set Centre: Set the centre frequency to a specific value.

Model	Mode	Min. Centre	Max. Centre
1304	Swept	1.0013MHz	1299.9986MHz
2704 & 2704RT		1.0013MHz	2699.9986MHz
1304	FFT Swept	10.0014MHz	1299.9986MHz
2704 & 2704RT		10.0014MHz	2699.9986MHz
2704RT	Real Time	10MHz	2700MHz
1304	Zero Span	1MHz	1300MHz
2704 & 2704RT		1MHz	2700MHz

Set C=M1: Set the centre frequency to the frequency value of the M1 marker (when active).

SetPk: Set the centre frequency to the frequency value of the highest amplitude point in the current sweep.

Step Up / Step Down: Change the centre frequency by the value of the step size - see '*Step Size'*.

Span

Set Span: Set the span to a specific value.

Model	Mode	Min. Span	Max. Span
1304	Swept	2.7kHz	1299MHz
2704 & 2704RT		2.7kHz	2699MHz
1304	FFT Swept	2.7kHz	1290MHz
2704 & 2704RT		2.7kHz	2690MHz
2704RT	Real Time	1.35kHz	10.8MHz
Not applicable for Zero Span mode			

Zoom [M1-M2]: Set the span equal to the frequency difference between the M1 and M2 markers (if active).

Zoom In / Zoom Out: Set the span to a higher or lower value in a 1-2-5 sequence starting from the existing span value.

(Example: if the existing span is 1.7MHz, the first press of Zoom Out will take it to 2MHz and the next press to 5MHz).

Set RT Divider:

Set the Real Time span divider value. The span is equal to 10.8MHz divided by the RT Divider value.

When the mode of operation is set to Real Time, the user can analyse the full real time span (10.8MHz). To analyse a lower span, set the RT Divider value.

Real time span is equal to 10.8MHz divided by the RT Divider value. Frequency bin resolution is directly coupled to the span. Bin resolution is equal to 40kHz divided by the RT divider value.

Start/ Stop

Model	Mode	Min. Frequency	Max. Frequency
1304	Swept	1MHz	1300MHz
2704 & 2704RT		1MHz	2700MHz
1304	FFT Swept	10MHz	1300MHz
2704 & 2704RT		10MHz	2700MHz
Not applicable for Real Time or Zero Span mode			

Set Start / Set Stop: Enables the start or stop frequency to be set to a specific value.

Zoom [M1-M2] Set the start frequency to the frequency of the M1 marker and the stop frequency to the frequency of the M2 marker. M1 and M2 must both be active.

Undo: Revert to the start and stop frequencies that existed directly before the **Zoom [M1-M2]** key was pressed.

Fix Start, Fix Stop: Change the action of the Step Up/Down keys so that only the stop frequency or start frequency respectively is changed by the step value. The fixed start or stop frequency is preceded by the word Fix.

Pressing the key again or leaving this function-set (by pressing -**more- 2 of 2** or any group or sub-group key) will cancel the fixed start or stop frequency.

Step Down, Step Up: Change the start and/or stop frequencies by the value of the step size (see next section). The action of the Fix Start/Fix Stop keys determines whether both are stepped or only one is stepped.

NOTE



If the start or stop frequency is "fixed" and the step size is set to Auto, the step size will change on each press of step up/down so that it is always equal to one graticule division.

Step Size

Set the size of frequency stepping using the Step Up/Down keys. When relevant, the current step size is displayed within a black box above the keys.

Set Step: Enable the step size to be set to a specific value.

Auto Span/10: Automatically link the step size to the width of the span. Step Up/Down will cause the centre frequency to change in steps of one graticule division. Auto step size is indicated by the word Auto above the step size value.

Set to Mdelta: Set the step size equal to the frequency difference between the M1 and M2 markers (if active).

Set to Centre: Set the step size equal to the centre frequency.

Set to M1: Set the step size equal to the frequency of the M1 marker (if active).

This can be useful for observing the harmonics of a fundamental frequency.

Frequency Presets

Enable up to six frequency ranges to be quickly stored and recalled. The centre and span (or equivalent start and stop frequencies) are stored.

This differs from a Trace State or Set-up file for which more parameters are stored (see '*Trace Files*' or '*Setup Files*' respectively). Frequency presets are retained when the instrument is off.

Store Preset: A menu of six preset numbers (1 to 6) into which the current value of the sweep frequency range can be stored. Existing values are over-written.

Recall Preset: A menu of six preset numbers (1 to 6) which recall previously stored frequency ranges.

Toggle Last: Switch between the current sweep frequency range and the last range to be recalled from a preset (or from Full Span).

Full Span: Set the sweep to the full frequency range of the instrument.

Frequency Shortcuts

Repetitive Operations

A common requirement for a spectrum analyzer user is to change repetitively between two or more frequency ranges. The PSA provides several methods for doing this.

1. When setting the centre frequency using the keyboard, the **Toggle Last** key can be used to toggle between two centre frequencies. The same facility is provided for Set Span, Set Start and Set Stop.
2. Frequency Presets enable up to six frequency spans to be stored and
3. rapidly recalled. Only Centre/Span or the equivalent Start/Stop frequencies are stored. Other parameters such as RBW are not affected (unless set to Auto).
4. Trace States are files which contain not only the frequency span, but the RBW, the Level setting and the graticule scale and units. Up to 999 trace files can be stored and are recalled from the Traces or Storage menus.
5. The hard key marked PRESETS brings up a menu of set-up states. Note, however, that these change many parameters of the instrument simultaneously.

Narrower Span

Having set a frequency span in which the signals of interest are visible, the user may wish to examine a specific part of the span at greater resolution.

1. If the point of interest is the highest level within the current sweep, it can be moved to the centre of the screen from the Centre sub-group menu (**Freq > Centre > SetPk**).
2. Marker M1 can be placed at the point of interest and moved to the centre of the screen from the Centre sub-group menu (**Freq > Centre > Set C=M1**). Once the point of interest is in the centre of the screen, the resolution can be increased using the Zoom In function from the Span sub-group menu (**Freq > Span > Zoom In/Out**).
3. To set a more precise span, place marker M1 at the start of the area of interest and marker M2 at its end. The new span is then set from the Start/Stop sub-group menu (**Freq > Start/Stop > Zoom [M1-M2]**).

Wider Span

Having set a frequency span in which the signals of interest are visible, the user may wish to examine a wider span in order to see further signals not currently visible.

1. One method of doing this is to zoom out from the Span sub-group menu (**Freq > Span > Zoom)** which shows frequencies both above and below the current span.
2. Alternatively, the user may wish to look only at frequencies above (or below) the current span. This can be done from the Start/Stop sub-group menu (**Freq > Start/Stop > Fix Start or Stop**). Once the start or stop frequency is fixed, the word Fix is displayed next to its frequency at the top of the screen. The Step Up and Step-down keys can then be used to increase or decrease the opposite frequency only. Pressing the key again will cancel the condition. See section '*Start/ Stop*

Using Custom Presets (U03)

Applications for which Custom Presets might be used include frequency selection via channel numbers, or repetitive steps within a test environment.



Custom Presets is accessed using the Presets hard key or **Menu > Storage > Setups > Presets**.

Pressing the **Custom Presets** key brings up a menu as shown.

Custom Presets is an extended version of the User Preset from which multiple presets can be saved or recalled by entering just a number. To save a new preset, set up the instrument as required and press the **Save Preset** key followed by a number.

Each Preset is a special type of Setup file stored in the SETUPS directory with a file name of the form $PST0001 where the $ is fixed and the next three characters (default PST) can be changed to create multiple groups of presets. The last four characters represent the number by which the preset is saved or recalled. Any number in the range 1 to 9999 can be used, although the number of presets simultaneously available is set by the directory limit of 999 files.

Creating Channel Markers (U03)

Channel Markers provide a convenient method of showing multiple fixed frequency points on the display via vertical lines that overlay or replace the graticule.

They are created via a special type of limit pattern file. See section *'Creating and Loading Channel Markers'* for details.

8. BANDWIDTH

Setting the Bandwidth

This menu controls the resolution bandwidth filters and the detector modes where applicable, enabling the resolution bandwidth of the sweep filter and the subsequent video filtering to be controlled.

RBW

Controls the resolution bandwidth of the sweep filter prior to the detector (RBW) A narrower RBW provides greater frequency resolution and lower noise but increases the sweep time.

RBW Auto: Change the RBW to automatically suit the frequency span. The RBW value is displayed at the top of the screen and is preceded by the word Auto.

RBW Set: Cancel Auto mode and creates a pop-up menu from which a specific RBW value can be selected. The range is 300Hz to 10MHz in a 1:2:3:5 sequence. The selected value is displayed at the top of the screen.

VBW

Controls the filter that follows the detector (VBW). A narrower VBW reduces noise but increases sweep time

VBW Track: Causes the VBW to be automatically changed to track the RBW value subject to the VBW offset. The VBW value is displayed at the top of the screen and is preceded by the word Trk.

VBW Offset: Set the relationship between VBW and RBW for VBW Track mode. Positive numbers set a VBW one or more steps higher while negative numbers set it one or more steps lower. The default is zero

VBW Set: Cancel Track mode and creates a pop-up menu from which a specific VBW value can be selected. The range is 300Hz to 10MHz in a 1:2:3:5 sequence. The selected value is displayed in the primary status area..

FBR

Frequency bin resolution (FBR) determines the frequency resolution of a measurement. A narrower FBR provides greater frequency resolution and lower noise but increases the sweep time.

FBR Auto: Change the FBR to automatically suit the frequency span. The FBR value is displayed at the top of the screen and is preceded by the word Auto.

FBR Set: Cancel Auto mode and creates a pop-up menu from which a specific FBR value can be selected. The range is 10Hz to 40kHz in a 1:2:4:5:8 sequence. The selected value is displayed at the top of the screen.

Detector Types

The detector converts the signals captured during the sweep into the set of DC levels that are shown on the display. A full explanation of detector types is outside the scope of this manual, but some basic explanation is given here.

Positive

The default detector type of Positive Peak displays the highest signal value found within the bucket. This is the most commonly used detector type and gives the most accurate result for the majority of measurement situations whilst guaranteeing not to miss any signals.

Certain types of measurement, however, benefit from different detector types, and the PSA Series 4 offers six other detector options. The degree to which the results differ from the default detector depend not only on the signal but on the relationship between the RBW and the bucket width.

Negative

The Negative Peak detector uses the lowest value found within the bucket. This is occasionally used for comparative purposes in noise and EMC measurements.

Sample

The Sample detector uses the value found at the end of the bucket. It can have advantages over the default detector when measuring CW levels close to the noise floor but risks missing signals if the RBW is narrow relative to the bucket width.

Average (Linear, Logarithmic, RMS)

The Lin and Log Average and RMS detectors use a level related to the average or root mean square value of signals within the bucket. They are used for signal accumulation measurements such as channel power.

Alternative peak

The Alternate Peak detector distinguishes between signal and noise found within the bucket by detecting whether the level both rises and falls within the bucket. It gives a more accurate indication of noise than a peak or sample detector. However, under some circumstances signal peaks can be displaced one sample point to the right.

Window Settings

Real Time and FFT Windows

In the Real Time and swept FFT modes, the user can select one of several FFT window types. The window type is coupled to the resolution bandwidth. The following window types are available:

Blackman Harris, Flattop, Gaussian, Rectangle, Hanning, and Kaiser.

The following table gives information on which window function is suitable for certain applications.

Window Type	Spectral Leakage	Amplitude Accuracy	Frequency Resolution
Blackman Harris	Excellent	Good	Moderate
Flattop	Good	Excellent	Poor
Gaussian	Moderate	Good	Moderate
Rectangle	Poor	Poor	Excellent
Hanning	Good	Moderate	Good
Kaiser	Good	Good	Moderate

Window function can be set independently for Real Time and FFT sweep modes.

9. SWEEP

This menu group controls the sweep time (normal or fast) for the Swept mode

RT Settings

This menu group controls the sweep settings for the Real Time mode.

Set RT count: Define the number of FFT spectrums combined in one frame resulting in a spectrum trace**.**

Set RT overlap: Define the amount of data that is overlapped to get the measurement results

Overlapping FFTs is a distinctive feature of a real time spectrum analyser and improves the timing resolution for frequency domain events. The overlap can be set to 50%, 66% or 75%. 75% overlap means that the second data block over which FFT is performed covers the last 75% of the data of the first FFT with 25% new data.

Set RT length: Define the number of points used in the transformation from the time domain to the frequency domain. The user can set the FFT length to 64, 128, 256, 512, or 1024.

Set RT Divider: Set the Real Time span divider value. The span is equal to 10.8MHz divided by the RT Divider value.

When the mode of operation is set to Real Time, the user can analyse the full real time span (10.8MHz). To analyse a lower span, set the RT Divider value.

Real time span is equal to 10.8MHz divided by the RT Divider value. Frequency bin resolution is directly coupled to the span. Bin resolution is equal to 40kHz divided by the RT divider value.

Set RT Detector: Define the way the FFT spectrums are combined to generate a spectrum trace.

Positive: Maximum value within a measurement point is selected

Negative: Minimum value within a measurement point is selected

Sample: First value within a measurement point is selected

Average: The linear average power within a measurement point is selected.

Sweep Time

In Swept mode, the normal sweep time and update rate is automatically set from the Span and the RBW and is displayed within the lower annotation area. Narrower RBW settings create longer sweep times. For each RBW, the normal sweep time is broadly proportional to the frequency span. The sweep time can be manually reduced at the expense of amplitude accuracy.

Auto (Norm): Select the normal sweep time and ensures the highest degree of level accuracy. The sweep time is dependent upon the span and the RBW/VBW settings and is displayed in seconds within the lower annotation area followed by [N].

Manual Up/ Manual Down: Enable the sweep time to be reduced in order to speed up the response to changing events. Three levels of speed up are available indicated by [F1], [F2], [F3] replacing the [N] after the sweep time display. To warn the user of reduced level measurement accuracy, a yellow background is applied. The maximum levels of sweep time reduction are 2, 5 or 10 but the actual reductions are dependent upon span and RBW/VBW settings, see '*Setting the Bandwidth*'.

For sweep times longer than about 1 second, a yellow indicator line below the graticule indicates the progress of the sweep.

Sweep Times

Sweep times are a function of frequency span and RBW/VBW. Generally, the sweep time varies in a direct relationship with the span and an inverse relationship with the RBW. For narrow spans and/or wide RBWs, the minimum sweep time of just under 0.1 seconds will apply. Note, however, that the maximum display update rate is limited to about five per second.

Where the sweep time is significantly longer than the minimum, the user is able to decrease the sweep time by a target factor of 2, 5 or 10 (F1, F2 or F3) from the Sweep Time menu. This has a relatively small effect upon signal amplitude accuracy and can be very useful when faster response is important.

The degree of speed up actually achieved is dependent primarily on the RBW. For a 1kHz RBW and 1MHz span the normal sweep time is 12.8 seconds, but this can be reduced to 1.2 seconds by selecting F3. However, for wider RBWs the degree of speed up is reduced.

10. LEVEL

Setting the Level Attenuator and Amplitude Scale

This menu group controls the input attenuator, thus changing the reference level, and controls the measurement units and scaling of the amplitude display.

Reference Level

The reference level represents the maximum signal that can be displayed. The top line of the graticule is at the reference level unless Scale/Shift is being used.

The reference level is variable between-70dBm (37dBuV) and +20dBm (127dBuV) to a resolution of 1dB. Its current value is displayed in the top annotation area.

Ref Level: The reference level for amplitude measurement can be set either numerically or by increment/decrement keys:

Set Ref: Open a numeric keyboard from which the reference level can be set directly as a numeric value in dBm or dBuV, depending on what units are set in Settings > Graticule Units > Graticule dBm/uV.

Ref. Step: Create a pop-up menu from which the increment/decrement step size can be set as 1dB, 2dB or 5dB.

Ref-, Ref+: Increment or decrement the reference level value by the step size set with the Set **(Ref.) Step** key.

Vertical Scaling

Scale/ Shift: Enable the vertical amplitude scaling to be changed.

Scale: Create a pop-up menu enabling the vertical scaling to be set to 10dB/div (the default) through to 1dB/div.

Normal 10dB / div: Set the scale to the default scale of 10dB/div.

Shift Up/Shift Down: Pan the trace through the amplitude range of the graticule. These keys auto-repeat.

Amplitude Offset and Compensation Tables

CAUTION



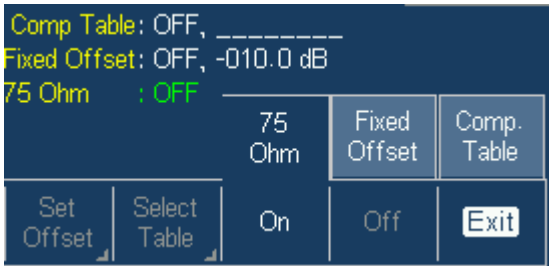
Adding offset or compensation can create confusion as to the maximum and minimum signal levels that can be viewed.

This could result in the instrument being in amplitude overload even when the displayed amplitude value is apparently within the instrument range. Where an offset is set to a large negative value (to compensate for an external gain element) there is a danger that the absolute maximum signal level could be exceeded resulting in damage to the instrument.

Offset levels and compensation tables should therefore be used with care!

Set Offset: Open a control menu that enables compensation for a 75 Ohm source impedance, a fixed attenuation or gain, or a frequency dependent compensation table to be used. The functions can be used individually or together.

The three keys on the upper line select which function is to be controlled.



For 75 Ohm source, the options are On or Off.

When set to On, readout is adjusted by +1.9dB and readout is unchanged to indicate values in a 75 Ohm system.

For Fixed Offset, the Set Offset key creates a dialogue box by which an offset can be set between-50.0dB and +50.0dB. The set figure is added to the displayed reference level and to the graticule values and marker readout.

Set Offset is available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03'* for more details.

Select Table: Open a file list of stored compensation tables that can be loaded.

They enable the amplitude scaling to be offset to match external attenuation or gain, or to add frequency dependent amplitude compensation tables to match transducers or antennae.

Select Table is available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03'* for more details.

Creating and using Compensation Tables

Compensation tables are normalised files of amplitude versus frequency that are used to compensate for frequency related non-linearity in antennae or transducers.

The files contain lists of up to 49 frequency/amplitude points. When a file is used by the instrument, linear interpolation is employed between the points.

Every point on the trace is then changed by the amount calculated from the interpolated compensation table. This could result in parts of the trace being outside of the graticule area.

Compensation Tables must be created outside of the instrument using Test Bridge PSA software, see *'Appendix B: Test Bridge PSA Software*'.

Compensation Table files have the extension .CMP and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC. See '*USB Connections | File System & File Types*' for an explanation of copying and transferring files.

A compensation table file is loaded in a similar way to other types of files using a File Recall screen, see '*Recalling Setups'* for more details .

NOTE



Compensation tables and limit patterns are both placed in a folder called Tables and can therefore appear within the same File Utilities screen. It is possible to toggle between the two file types by pressing the key marked Tables (toggle).

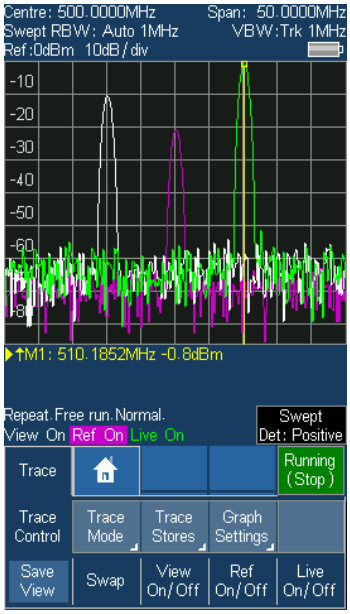
Whenever offsets or compensations are active, a warning message is displayed at the top right of the graticule. See '*Error, Warning and status indicators'* for more details

Clear All: Cancel any offset or compensations that have been set and returns the amplitude scaling to normal.

11. TRACE

This menu group controls the traces that appear on the screen.

Trace Control



There are three traces: Live (green), View (white) and Reference (purple). Only the Live trace is updated from the sweep. The View trace is a temporary copy of the live trace created whenever the View key is pressed. The reference trace is recalled from a trace file stored within the instrument. Trace files can be saved from either the live trace or the view trace. Complete images of the screen can also be saved.

A further version of the Live trace is available when the Trace Mode is set to Peak-hold or Average, see '*Dual Trace Mode*'.

Displaying Traces; Controlling the View Trace

Trace Control: Enable each of the three trace types to be turned on or off, controls the View trace, and enables traces and screen images to be stored and recalled.

Save View: Copy the current Live trace to the View trace and turns the View trace on if it was off. The View trace sits behind the live trace and can therefore be partly obscured by it. This key duplicates the View hard key.

Swap: Halt the live trace and swap the order of the traces on the screen. Thus, the View trace (white) sits in front of the halted live trace enabling it to be observed and analyzed using the markers. When the sweep is restarted with the Sweep Control key, the traces are swapped back so that the Live trace sits in front again.

View Off/ On: Toggle the View trace off, or back on without creating a new View.

Ref Off/On: Toggle the Reference trace on or off.

Live Off/On: Toggle the Live trace on or off. If dual trace mode is selected both traces will be turned on or off.

Understanding the Live, View and Reference Traces

The instrument can display three traces- Live, View and Reference which can be turned on or off individually using the **On/Off** keys. Only the Live trace is updated from the sweep.

NOTE

A further version of the live trace is available when the Trace Mode is set to Peak-hold or Average, in which case up to four traces can be displayed, see '*Dual Trace Mode*'.

The Live trace is green and is normally on-top of the other traces. The Live trace can be "frozen" at any time by pressing the **Sweep Control** key directly under the graticule (see '*Display and Controls Layout*') or the hard key marked Run/Stop. This also stops the sweep.

The Live trace can be duplicated to the View trace by pressing View. This enables an "instance" of the sweep to be captured without stopping the sweep. The View trace is white and is normally located behind the Live trace. The View trace is retained when the instrument is turned off.

The measurement markers normally operate on the Live trace. However, the Live and View traces can be "swapped" by pressing the **Swap Traces** key. This stops the sweep and causes the View trace to be placed in front of the Live trace. When the traces are swapped, the measurement markers operate on the View trace.

When the sweep is re-started (or the Swap key pressed again), the View and Live traces are swapped back.

Either the Live trace or the View trace can be saved to a trace file see *'Storing Traces or Screens*' for more details.

The Reference trace is purple and is always underneath the other traces if they are on. The reference trace is created by recalling a trace file from the memory. Measurement markers cannot be used on a Reference trace.

NOTE

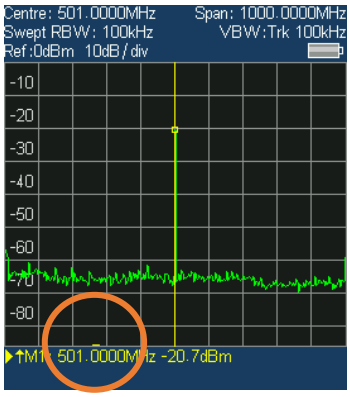


The View and Reference traces relate to the frequency span, RBW and level settings that existed when they were stored. Changing these parameters will result in the graticule values and annotations no longer being correct for these traces.

However, it is possible to recall a Reference trace along with its State. This restores the frequency span, RBW and level settings that existed when it was stored, see '*Recalling Setups*' for more details.

Sweep Progress Indicator Line

There are two modes by which the live trace is updated from the sweep. For sweep times below approximately 1 second, the trace is updated at the end of the sweep. For longer sweep times, the trace is updated continuously while the sweep is taking place.



In this latter mode a yellow line appears at the bottom of the graticule indicating the progress of the sweep through its span.

Trace Mode

Setting the Trace Writing Mode

Trace Mode: Provides control of the way in which the sweep is written to the Live trace.

Normal: Each frequency point of the trace is written with the amplitude obtained from the current sweep, with the exception of Zero Span mode, see *Demodulation (Zero Span)* for more details.

Peak Hold: The trace is written with the highest amplitude value found for each frequency point since the sweep mode was selected and sweeping commenced.

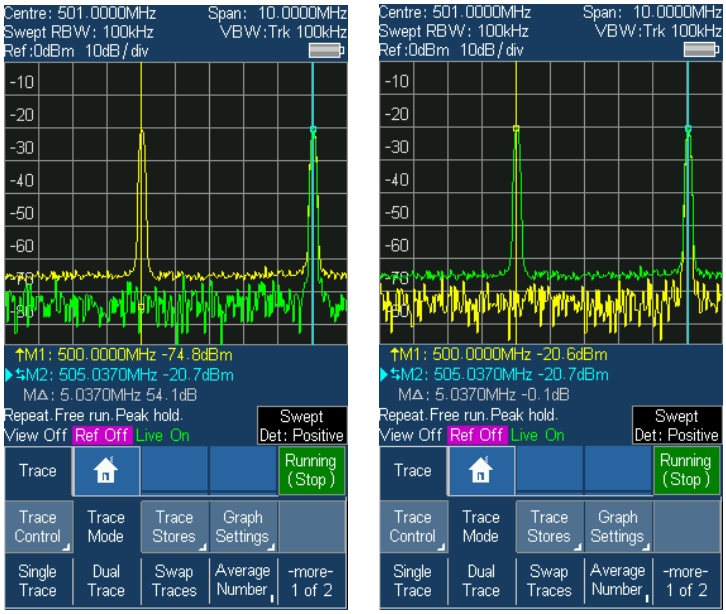
Average: The trace is written with the average amplitude value over a number of sweeps.

Reset: Operate in both Average and Peak hold modes and re-starts the averaging or peak hold process from zero.

Single Trace: This is the default mode in which the "processed" trace (Peak Hold or Average) is displayed in place of the Normal trace.

Dual Trace: Enable the Normal trace and the "processed" trace (Peak Hold or Average) to be displayed simultaneously. The default is for the Normal trace to be displayed in front of the "processed" trace.

Dual Trace Mode



When the trace writing mode is set to Peak Hold or Average, a dual trace mode can be selected whereby the processed and un-processed traces are displayed simultaneously.

When first selected, the processed trace (Peak Hold or Average) will be shown in yellow with the un-processed (Normal) trace shown in green in front of it. Pressing Swap Traces changes this so that the processed trace is shown in green with the un-processed trace in yellow.

The green trace is always at the front and represents the true live trace. The yellow trace is updated only at the end of each sweep which can result in it lagging the green trace.

Markers operate only on the green trace. Store functions (Store Trace and Log Trace) operate only on the green trace.

Swap Traces: Swap the traces so that the "processed" trace is in front of the Normal trace, see '*Understanding the Live, View and Reference Traces*' for more details.

Average Number: Enable the number of sweeps averaged to be set between 2 and 48 .

Trace Stores

Traces or complete Screen Images can be stored as files under automatically incrementing names or user assigned names.

Store: Enable the Live trace, the View trace, or a complete screen image, to be saved as a file. See '*Traces.*' for a full description of the Store function.

Recall: Enable a stored trace to be recalled to the Reference trace on the screen. The Ref trace is purple and is always behind both the Live trace and the View trace. Recall also enables stored screen images to be viewed. See '*Recalling Traces and Images*' for a full description of the Recall function.

Trace CSV: The trace is saved as a CSV file. There are two options when saving:

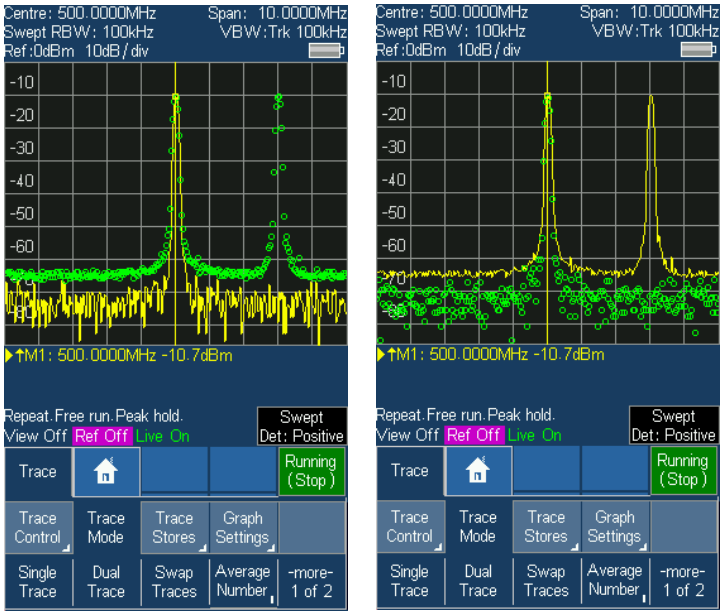
Relative to Ref: Save values with respect to the reference level.

Absolute (Default): Save as absolute values.

Graph Settings

The measurement results can be evaluated in several ways. In addition to the conventional frequency spectrum display, this instrument offers Waterfall and Heatmap displays.

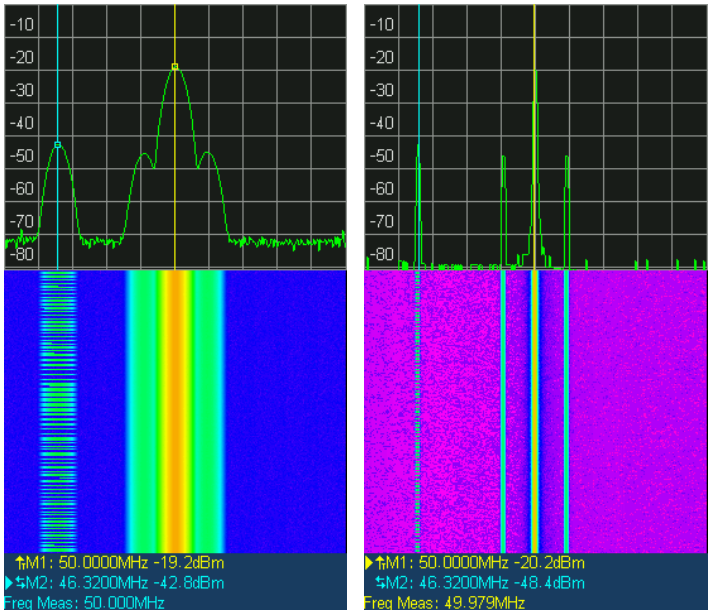
Graph



Normal: Display the trace as a continuous line. This is the default mode in which the trace is displayed.

Lollypop: Display the trace as individual points. Lollypop trace only works with live trace.

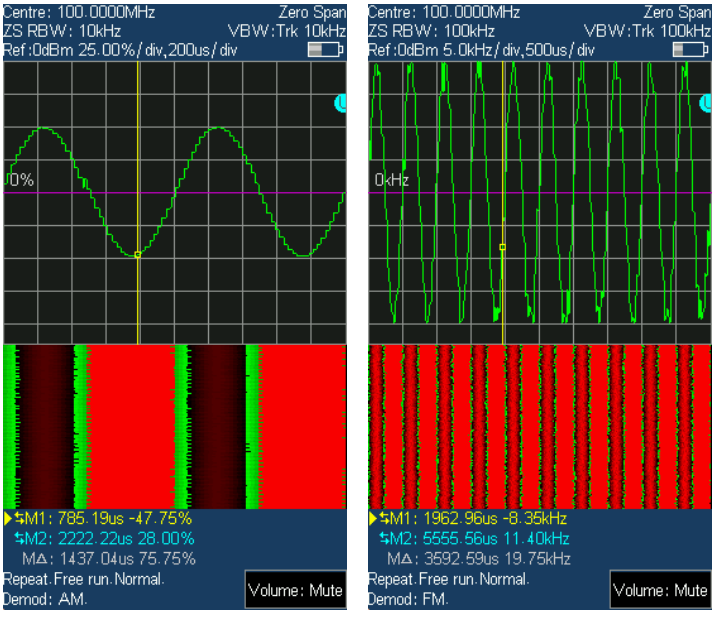
Waterfall



The Waterfall display shows the spectral density of a signal in the frequency domain, over time. The horizontal axis represents the frequency span. The vertical axis represents time, with the top showing the most recently recorded trace. Waterfall contains several horizontal lines, and each line is a sweep trace. To represent the most up to date information, the latest acquired trace is added to the waterfall after each sweep. The total level range is represented by 256 colours – resolution is approx. 0.3dB.

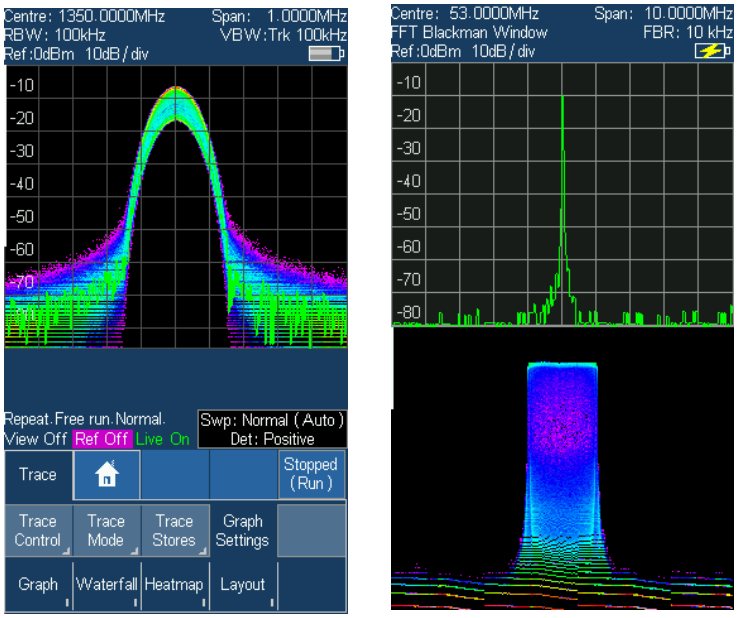
The level information is shown using colours. Each colour in the waterfall corresponds to a particular level. There are four colour schemes to choose from, see *'Palettes'* for more details.

The Waterfall is activated by selecting a palette option from the pop-up menu, select **Waterfall Off** to disable the Waterfall.



In Zero Span mode, Waterfall shows the amplitude or frequency demodulated signal in the time domain, over time.

Heatmap



The heatmap display shows for every point on the frequency/level plot how often that sample point occurs in the signal.

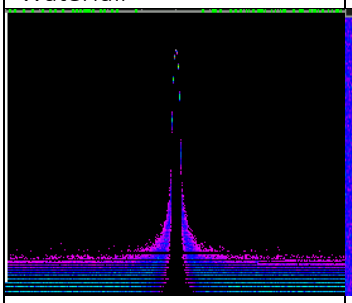
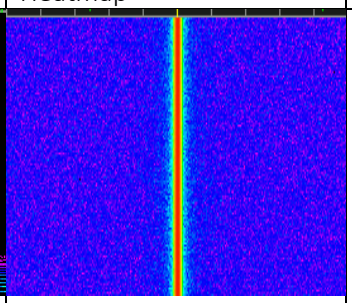
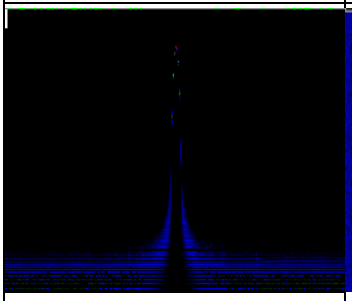
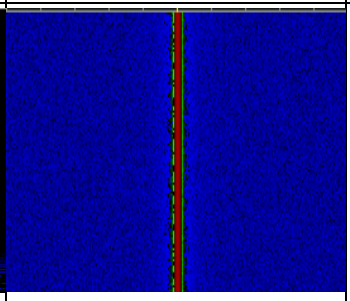
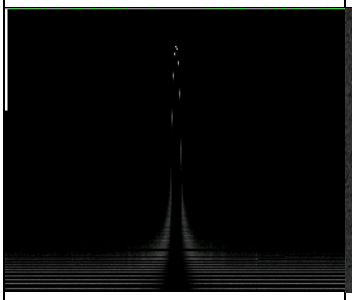
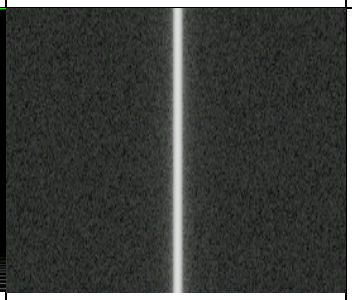
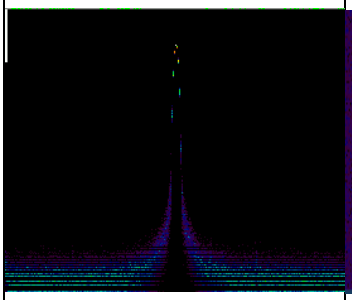
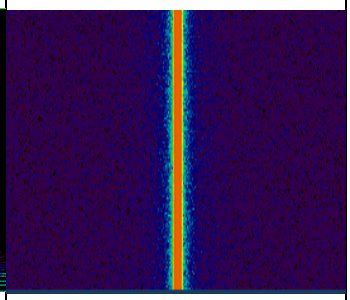
The frequency span is divided into 271 slices along X, and the amplitude range is divided into 224 levels in Y. Hit regularity at each level accumulates over each sweep and the hit count at each level gives rise to a different colour pixel at that point being displayed. the colour "heat" representing how often the same level is hit.

Vertical amplitude resolution is approximately 0.4dB. The maximum theoretical hit count per level is 4294967295 . The count is normalised so it always spans a range of 256 colours. preventing overflow and keeping the display consistent over time.

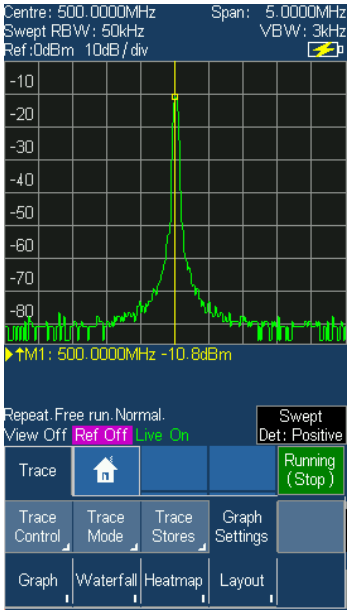
The heatmap is activated by selecting one of four palette options from the pop-up menu, select Heatmap **Off** to disable the Heatmap, see '*Palettes*' for more details.

11 - Trace

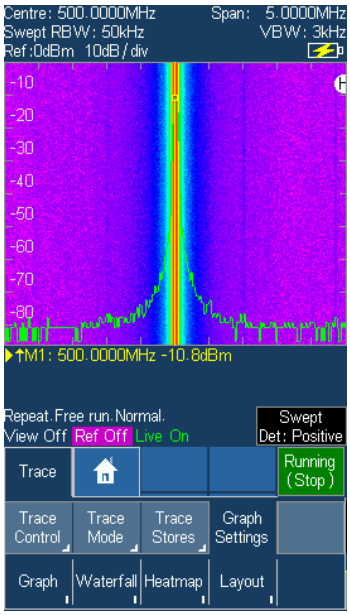
Palettes

Waterfall	Heatmap	Description
		**Palette 1 (Violet based):** In situations where interest is more in the lower noise levels, the Violet based spectrum should be used. It shows bright low level changes compared to changes in black that would be less visible/invisible in the Black based spectrum.
		**Palette 2: (RGB):** The RGB palette provides a dis-continuous range of three primaries that classify intensity range by colour and has high contrast change around the middle (green part) of the range. It allows identification of excessive changes in level above or below the middle range. Low power levels are displayed in cold colours (blue/green) and high levels are displayed in warm colours (red/ yellow).
		**Palette 3 (Greyscale):** The Greyscale palette directly maps the signal level to display intensity where black is the lowest and white is the greatest.
		**Palette 4 (Black based):** The Black based Spectrum provides a continuous organised range of colours that more clearly shows level variation in the middle of the range, but the spectrum level is still scaled so it changes from black to white.

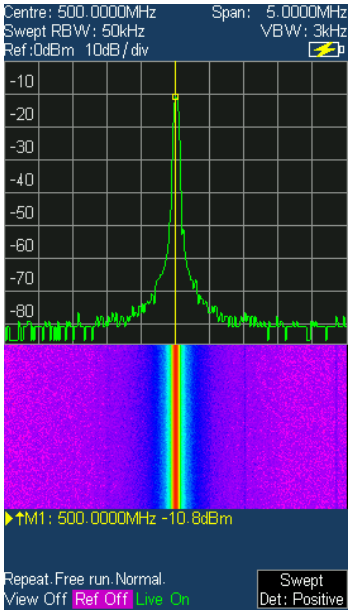
Layout



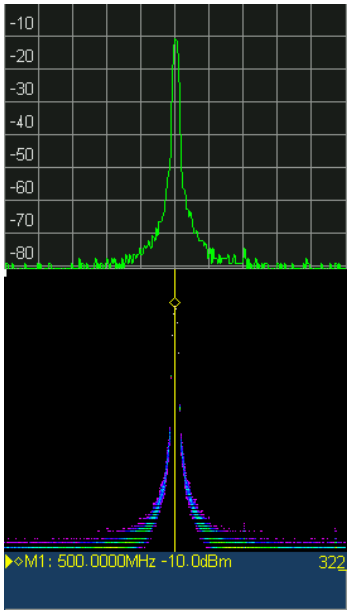
Normal: Trace only



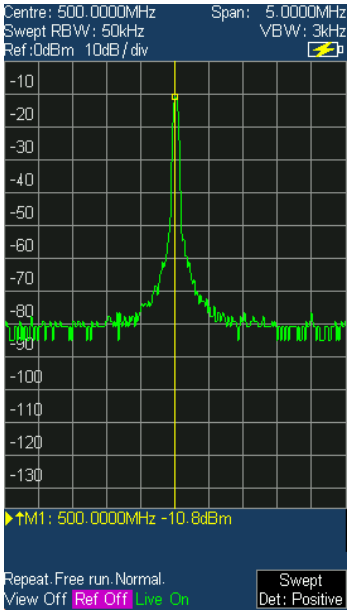
Combined: Waterfall or Heatmap is displayed behind the trace



Waterfall: Full screen divided between Waterfall and trace, press the EXIT hard key to return to menu screen. The display will return to combined view when exiting full screen. In split mode, the currently shown trace corresponds to the latest acquired trace in the waterfall display.



Heatmap: Full screen divided between Heatmap and trace, press the EXIT hard key to return to menu screen. The display will return to combined view when exiting full screen. In split mode, the currently shown trace corresponds to the latest acquired trace used in the construction of the heatmap display.

 **Full:** Full screen trace, press the EXIT hard key to return to menu screen.	

12. DEMODULATION (ZERO SPAN)

Selecting the Zero Span mode removes the normal sweep display and enables audio demodulation of AM and FM signals using the Demodulation meu.

Signal

Audio Demod: A sub-menu from which audio demodulation of AM and FM signals can be controlled.

The demodulated audio is routed to a built-in loudspeaker. Alternatively, the audio can be outputted via a 3.5mm jack socket- see *'Input and Output Connections'*.

Display Type: Select the type of demodulation as AM or FM.

Depth / Dev: Enable the AM depth or FM deviation to be adjusted using Up/Down keys.

The range is 1.25%/div to 25%/div equivalent to +/-5% to +/-100% full scale (AM) or 0.25kHz/div to 250kHz/div equivalent to +/-1kHz to +/-1MHz full scale (FM).

NOTE



The RBW needs to be set appropriately for the modulation. As a broad guide the RBW should be set greater than the channel bandwidth. However, setting an excessively wide RBW will introduce unnecessary noise.

Wave Demod: A sub-menu from which waveform demodulation of AM and FM signals can be controlled.

The waveform of the modulation can be displayed for AM or FM signals. Alternatively, the carrier level can be displayed against time. If option U03 is not installed on the PSA1304 or PSA2704, only the carrier level is displayed.

Display Type: Select the display to be either the modulation (AM or FM) or the carrier. The carrier display can be either the carrier level regularly sampled, or the carrier waveform against a timebase.

NOTE



The selection of AM or FM is also applied to Audio Demodulation.

Depth / Dev.: Enable the AM depth or FM deviation to be adjusted using Up/Down keys. The range is 1.25%/div to 25%/div equivalent to +/-5% to +/-100% full scale (AM) or 0.25kHz/div to 250kHz/div equivalent to +/-1kHz to +/-1MHz full scale (FM).

NOTE



This selection is also applied to Audio Demodulation.

Time / Div.: Set the display timebase within the range 5us/div to 20ms/div using Up/Down keys. The timebase is used for AM, FM and Carrier Waveform display types.

Trigger: The modulation waveform can be triggered to create a stable display for a tone or other repetitive waveform. The trigger level is shown by a purple line on

the screen that can be shifted up or down. When the mode is set to Auto, the waveform will trigger at that level on the rising or falling edge. In Free Run mode the trigger is ignored.

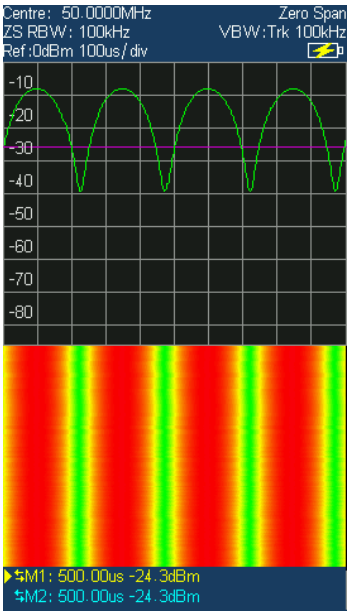
NOTE

The RBW needs to be set appropriately for the modulation. As a broad guide the RBW should be set greater than the channel bandwidth in order to avoid waveform clipping.

Audio Volume: Control the volume in 15 steps as shown on a bar graph. The audio can also be muted and a hiss reducing filter applied.

Graph Display

The Graph Display menu in Demodulation contains all the relevant parameters from the Trace> Graph Settings submenu (available in other modes)., see '*Graph Settings*' for more details.



13. LOGGING

Data Logging

The Data logging function is available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03'* for more details.

The logging function saves results into log files within the memory of the instrument. The type of result saved can be Centre Level, Peak Level , Full Trace or Screen Image.

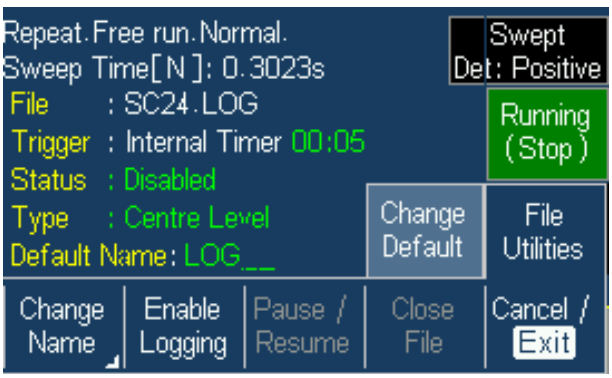
The saving of an entry into the file can be after every sweep (continuous) or in response to a Timer, a key press (manual trigger), the external trigger input, or the Limits function.

Each entry within the file includes the time of the entry as read from the instrument's real time clock. Up to 25,000 entries can be saved within a single file with the exception of Screen Image logging where the entries are limited to 2,500. The saving of an entry takes a finite length of time varying from 0.1 seconds (centre amplitude or peak value) up to 1.5 seconds (screen image). Entries are only saved after the sweep has been completed, and the sweep cannot re-start until the entry has been saved.

NOTE

When a logging file is "enabled", the sweep mode is automatically set to Repeat, and the sweep trigger is set to Free Run. No changes can be made to the set-up of the analyser while logging is in progress.

The Logging Control Menu



The type of data to be logged, the trigger type, and the timer interval (if used) must be set prior to entering Logging Control. This information is shown within the area above the keys.

Similarly, the spectrum analyzer state (frequency span, level etc). must also have been set-up in advance.

Once logging has commenced it is not possible to make any changes to the instrument's set-up without closing the logging file. It is also not possible to turn the instrument power to off without closing the file first.

Change Name: the name of the logging file that will be created is displayed at the top of the menu area. The file name is an auto-incrementing numeric of the default file name.

Change Name: Open an alpha-numeric keypad from which a user-chosen name of up to 8 characters can be entered.

Change Default: Enable the default file name that will be automatically allocated to the next logging file to be changed. Standard default file name rules apply, see '*Default File Name Rules*' for more details.

Enable Logging: Opens a logging file under the currently displayed name. An information message is displayed, and logging is actually enabled after confirming with the Status hard key.

Pause/Enable: New entries into the current logging file will be suspended and re-started. However, it is not possible to exit from the logging control menu without closing the current file.

Close File: Close and save the current logging file. Once closed the file cannot be re-opened (although it can be renamed or deleted). The Log File name changes to the next default name ready for the next logging file to be enabled.

Cancel/Exit: Exit the logging control menu provided that a logging file is not currently enabled or paused, in which case a warning message is displayed telling the user that exiting will disable logging and close and save the current file.

File Utilities: A list of logging files currently within the instrument. Operates similarly to other file utilities screens, see *'File Utilities Screen'*.

Log type

The logging function saves results into log files within the memory of the instrument. The type of result saved can be Centre Level, Peak Level , Full Trace or Screen Image.

Centre Level: Log only the amplitude at the centre frequency.

Peak Level: Log the frequency and amplitude of the highest peak in every sweep.

Full Trace: Log the whole trace.

Screen Image: Log the whole screen as a bit-map image.

Manual Logging

The logging function can be set via the Log Trigger key to save entries in response to a manual key press. Both the Run/Stop hard key and the sweep control touch-screen key act as the manual trigger.

The data that is logged will relate to the sweep that was in progress when the key was pressed.

The Run/Stop key and Sweep Control key

When logging, the Run/Stop hard key and sweep control touch-screen key have no function unless the Log Trigger has been set to Manual, in which case both act as a manual trigger key.

In all other trigger modes (timer, external, limits or continuous) the keys are inactive. However, the touch-screen key does provide visual feedback of the stages of the logging process. When no trigger event has yet occurred, the key is green and marked **Awaiting Trigger.** When a trigger has occurred, but the sweep has yet to complete it becomes yellow and is marked **Triggered**. When the sweep is completed, and the log file entry is being made it becomes red and is marked **Writing File**.

Logging from the Timer

The logging function can be set via the **Log Trigger** key to save entries triggered at a fixed time interval.

The **Timer Setup** key enables a time between trigger events to be set between 5 seconds and 100 minutes. However, if the timer interval is set to a short period, the actual time between logging entries may be considerably longer than the trigger interval. This is because, for each entry, a sweep must be completed, and the data must be saved. If the sweep is set to a wide span and/or narrow RBW, the sweep time could be several tens of seconds.

The timer is asynchronous with respect to the sweep. Consequently, the time between logging entries will be longer than the timer interval by a variable amount which is a function of the sweep time. The log entry time stamp represents the time at the end of the logged sweep.

To achieve the fastest possible logging use Continuous trigger, see '*Logging Every Sweep (Continuous)'* for more details.

Logging from External Trigger

The logging function can be set via the **Log Trigger** key to save entries on either a positive or negative going edge applied to the Trigger socket, see *'External Trigger Input*' for more details.

The data that is logged will relate to the sweep that was in progress when the trigger signal occurred.

Logging from Amplitude Limits

The logging function can be set via the **Log Trigger** key to save entries when a trigger is generated by the Amplitude Limits Comparator. The data that is logged will relate to the sweep that was in progress when the limit condition occurred.

The Limits function must be set to have a potentially valid condition as set by Limit Condition; however, the logging trigger is independent of the Limit Action which can be set to any value including none. See '*Limits'* for an explanation of the Limits function.

Logging Every Sweep (Continuous)

The logging function can be set via the **Log Trigger** key to save entries continuously, i.e., after every sweep. The actual speed will depend upon the sweep rate and the type of data being logged. The fastest possible logging rate is about two per second.

File Sizes and Maximum Logging Times

Logging files can vary in size from a few kB to more than 100MB depending upon the number of entries and the type of data being logged.

Although the filing system allows up to 999 .LOG files to be stored, the practical number may be limited by the internal memory size (approximately 1.8GB). Where large files are being created, care must be taken not to overflow the memory. Memory space can be restored by copying files to a Flash drive or directly to a PC, and then deleting them on the instrument.

13 - Logging

The instrument has the potential to log over very long periods. Where it is required to log for a period close to or exceeding the battery life, the instrument must be operated from external AC power.

In the event of the memory becoming full or the power being lost, the current logging file will be automatically closed.

Viewing and Analyzing Logging Files

The instrument has no capability for viewing the contents of a logging file. Instead, the file must be copied to a Windows based PC where the file can be viewed and analyzed using the Test Bridge PSA software- see *'Appendix B: Test Bridge PSA Software*'.

Log files have the extension .LOG and are located in the folder named LOGS. Up to 999 logging files can be stored within the memory of the instrument. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

See '*File Utilities Screen'* for an explanation of copying and transferring files.

14. TRIGGER

Triggered operation is available on the PSA2704RT and when the upgrade optio3 is fitted on a PSA1304 or PSA2704 see '*Upgrade Option U03'* for more details.

Triggering is used either to start or stop the sweep, or to initiate logging of sweeps or screen images. The trigger can be generated manually (by a key press), externally (from the trigger input) or internally from the sweep in combination with a limit line or limit pattern.

Sweep Control

Controls how and when the sweep runs.

Repeat: The sweep will be automatically restarted after the completion of the previous sweep unless halted by the Sweep Control key (or the Sweep Trigger settings).

Single: Single sweeps that are commenced by the Sweep Control key (or the Sweep Trigger settings).

NOTE



Whenever the sweep is stopped, whether in repeat or single mode, changing the frequency span or the reference level will re-run the sweep once.

Sweep Trigger: How the sweep is started or stopped. The trigger source can be manual, external, or internal from limit lines or patterns.

Single ReArm: Automatic or manual re-arming of the trigger when triggering is enabled, and the sweep mode is set to Single.

When the menu system is set to Sweep/BW the sweep status is displayed in the lower annotation area directly above the keys.

Sweep triggering

(Single or Repeat).

If the sweep mode is set to Single, the effect of the trigger is to start the sweep. When a trigger event occurs, a single sweep will be initiated. The trigger options are None, Ext +ve (trigger from a positive going edge on the external trigger input) or Ext-ve.

If Single ReArm is set to Auto, a sweep will be initiated every time a trigger event occurs. If Single ReArm is set to Manual, further trigger inputs are ignored after the first sweep. The Sweep Control key turns yellow and is labelled Stopped (Arm). Pressing the key changes the labelling to Run on Trigger, and a further sweep will be initiated when a trigger event occurs.

If the sweep mode is set to Repeat, the effect of the trigger is to stop the sweep. The options are Free Run (no triggering), Ext +ve (trigger from a positive going edge on the external trigger input), Ext-ve, and Limits (trigger from the Limits comparator, see *'The Limits Comparator'*). The key marking becomes Stop on Trigger.

When a trigger occurs the current sweep will be completed after which the sweep control key will become blue and the sweep will remain stopped until it is restarted with the sweep control key. There is no separate Arming function for repeat mode sweeps.

Sweep triggering is turned off whenever the sweep mode is changed between Single and Repeat or vice versa. Note that, when a Logging file is initiated, triggered sweep is automatically cancelled and set to Repeat mode and Free Run.

For a description of Triggered Logging see *'Logging from External Trigger'*.

External Trigger Input

The external trigger input is provided via the 3.5mm jack socket at the top of the instrument. This can be converted to a standard BNC socket using the adaptor provided. The selection between positive or negative transition triggering is made from the Sweep Trigger or Logging Trigger functions. It has a TTL threshold and a high input impedance.

CAUTION



Maximum input voltage is limited to +/-20V. Voltages above this level could damage the instrument.

Trigger Output

A trigger output pulse can be generated using the same socket as trigger input (see above). The signal is generated by the Limits comparator function (see '*The Limits Comparator*') and is a positive going TTL level pulse of approximately 10ms duration from a 1kΩ source impedance.

NOTE

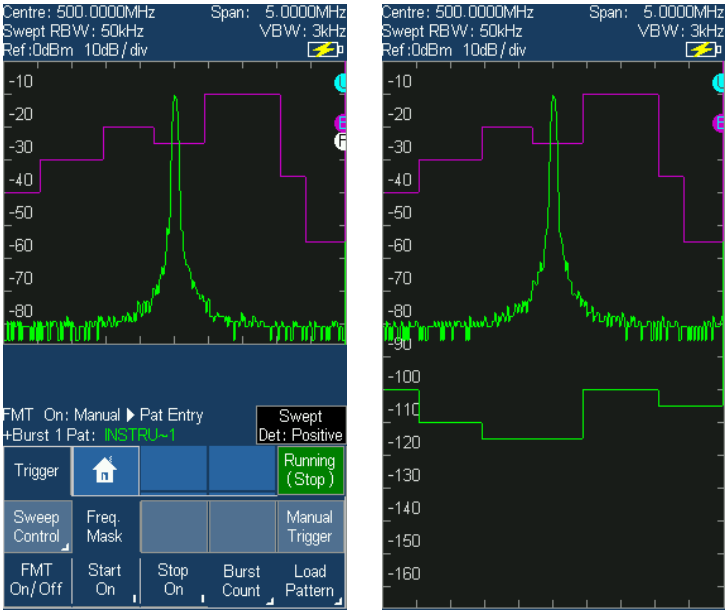


The trigger output is not available if either sweep trigger or log trigger is set to external triggering.

Freq. Mask

The Frequency Mask is a predefined mask, designed to trigger measurements if the signal appears inside or outside of this predefined area. The trigger can also be setup to start or stop on an external trigger or manual trigger..

Frequency mask triggering responds to certain events and triggers a measurement when that event happens. Each FFT, Swept or demodulated result is checked against the frequency mask and therefore is particularly useful to capture and then analyse short duration RF events. The captured event(s) can be analysed using the waterfall history (see '*Waterfall History*') or histogram (see *'Heatmap)*' modes.



A frequency mask has multiple points which can be set freely across the 271 pixels of the display and from min to max power pixels can be disabled to remove areas of the mask.

The frequency mask has no concept of frequency and will stay in the same position on the screen when centre, span or start, stop is edited.

Frequency Mask files are created using Test Bridge PSA software. This is described further in *'Appendix B: Test Bridge PSA Software'.*

FMT On/Off: Activate or Deactivate the Frequency Mask. The status of the Mask is shown in the secondary information display area

Start on: A pop-up menu to define the criteria for the trigger to start the spectrum measurements. The options are:

Pattern Exit: Trigger occurs when the spectrum leaves the mask.

Pattern Entry : Trigger occurs when the spectrum enters the mask.

Start On Manual: Trigger occurs when the **Manual Trigger** button is pressed.

Start On Ext -ve: Trigger occurs when the external trigger input is negative

Start On Ext +ve: Trigger occurs when the external trigger input is positive.

Always On: Spectrum is shown, no trigger required.

Stop on: A pop-up menu to define the criteria for the trigger to stop the spectrum measurements. The options are:

Single Trace: Stop after a single trace.

Pattern Exit: Stop when the spectrum leaves the mask.

Pattern Entry: Stop when the spectrum enters the mask.

Stop On Manual: Stop when the **Manual Trigger** button is pressed.

Stop On Ext -ve: Stop when the external trigger input is negative.

Stop On Ext +ve: Stop when the external trigger input is positive.

Free Run: Never stop.

Burst Count:

Set the number of measurement bursts (sweeps) to capture when the stop trigger is activated, this can be set from 1 to 2048.

Load Pattern: Bring up a list of files from which a Frequency Mask can be loaded. Frequency Mask files have the default prefix FMT and are placed in the Tables folder. Pressing **Recall** from the **Load Pattern** files screen will load the mask.

File Utilities: see '*File Utilities Screen'* for more details.

Other available Triggers and Limits

Sweep Trigger

The Sweep trigger function enables sweeps or logging to be triggered in response to an internal or external trigger event. The internal trigger event can be generated by the Limits function.

See *'Trigger*' or *'Limits'* for more information.

Limit Lines, Limit Patterns & Channel Markers

Limit lines and patterns can be shown on the display and compared with the trace. They can be used to trigger a logging event, generate an audible warning, or output a trigger pulse.

Limit lines are simple horizontal lines whereas limit patterns are frequency dependent amplitude limits that are stored as files. Two limits can be used simultaneously. Channel markers are a special version of a limit pattern that creates only vertical lines at frequencies defined within the file.

See '*Limits*' for more information.

15. LIMITS

Limit Lines & the Limits Comparator | Creating Limit Patterns

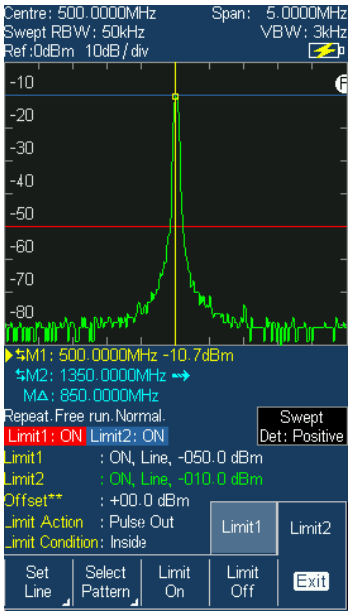
Limits are available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see '*Upgrade Option U03*' for more details.

Two types of limits are available, Lines and Patterns. Up to two limits can be displayed, Limit 1 in red and Limit 2 in blue.

A Line is a simple horizontal line (single amplitude level) that can be set to any value.

A Pattern can have multiple levels and can include vertical steps and angled lines. Patterns are contained within files that are lists of up to 49 frequency/amplitude points. When a file is used by the instrument, linear interpolation is employed between the points.

Lines or patterns may be used as simple visual aids to determine whether a signal is within a specific level range, or they may be used in conjunction with the Limits Comparator to create an automatic action.



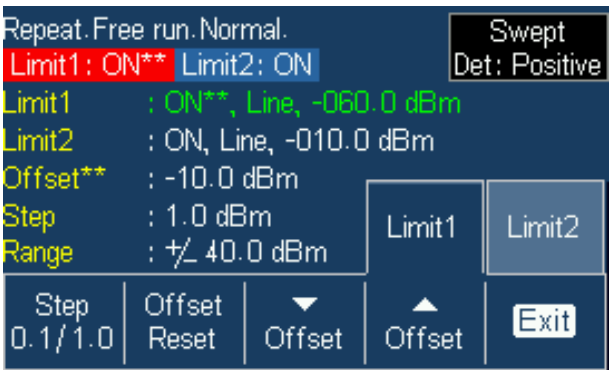
Set Limits: Bring up a control screen as shown.

The keys on the top line select which limit is to be controlled by the bottom row keys. Where a limit line or pattern has already been set, it can be turned on or off using **Limit On/Limit Off**.

The status of the two limits is displayed within the area directly above the keys.

Set Line: Define the currently selected limit as a line (if it was previously a pattern) and brings up a numeric entry keypad or tab/jog system by which the level of the line can be set numerically in graticule units.

Select Pattern: Bring up a list of files from which a limit pattern can be loaded. Limit pattern files have the default prefix PTN and are placed in the Tables folder. Pressing **Recall** from the Recall Limits files screen will load the pattern as the selected limit.



Limit Offset: Bring up a control screen as shown.

The Limit Offset function enables a limit to be offset from its initial value. It is intended primarily for limit patterns (which would otherwise have to be regenerated) but can also be used with limit lines.

The Limit Offset control screen enables a limit to be "nudged" up or down in steps of 1dB or 0.1dB.

Where a limit has had an offset applied to it, a ** symbol is displayed within the Set Limits control screen.

The Limits Comparator

The limits comparator enables automated actions to be selected in response to specified limit conditions. The actions include audible warning, pulse output from the trigger socket, stopping of the sweep, or entry into a logging file.

The limit condition is created from the trace being either above or below the limit line/pattern. If the measurement markers are turned off, or if only M1 is turned on, any part of the swept trace being above or below the line will create the condition. If both M1 and M2 are turned on, the limits comparison takes place only on the part of the trace between the markers

Limit Condition: A pop-up menu that selects the criteria upon which a limit condition is created. The options are None, Above, Below, Outside, or Inside. Where two limits are being displayed, the limit conditions of Inside or Outside can be used.

NOTE

There is no concept of an upper or lower limit line. Above means above the higher point of the two limit lines, Below means below the lower point of the two limit lines, Outside means either above the higher point or below the lower point of the two limit lines, while Inside means between the higher and lower points.

Limit Action: A pop-up menu that selects an action that will be performed when the limit condition occurs. The options are None, Beep, Pulse Out, Beep + Pulse Out or Message. The action only takes places when the sweep has completed. The Pulse Out is provided at the Trigger socket, see '*Input and Output Connections*' for more details.

NOTE

Other actions (sweep triggering or log file entry) can also be created from the limits condition. See '*Sweep Trigger*' for more details.

Creating and Loading Limit Patterns

Limit Patterns must be created outside of the instrument using Test Bridge PSA software , see *'Appendix B: Test Bridge PSA Software'*.

Limit Patterns files have the extension .CSV and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC. See *'Understanding USB Connections'* for an explanation of copying and transferring files.

A limit pattern table file is loaded in a similar way to other types of files using a File Recall screen, (see ''). Up to 999 pattern files can be held within the memory of the instrument.

NOTE



Limit patterns and compensation tables are both placed in a folder called Tables and can therefore appear within the same File Utilities screen. It is possible to toggle between the two file types by pressing the key marked Tables (toggle).

Limit Fix/Unfix

Limit patterns use absolute frequency points. Whenever the frequency range is changed, the pattern on the screen is recalculated to be correct for the new frequency range.

In some circumstances, however, it is useful to avoid this recalculation taking place. If, for example, a limit pattern had been created for the modulation around a specific centre frequency, it may be useful to be able to apply that same pattern to a different centre frequency.

Pressing the **Limit Fix/Unfix** key fixes the pattern relative to the screen and displays a message of "Lim Fix" on the top RH side of the graticule, see *'Error, Warning and Status indicators'* for more details. Changes can now be made to centre frequency without the pattern changing.

NOTE



The pattern is fixed on the screen and will become incorrect if the span or the reference level is changed. Pressing the key again cancels the fix mode and recalculates the limit pattern to be correct for the current centre frequency, span, and reference level.

Creating and Loading Channel Markers

A special type of limit pattern file is available which consists only of vertical lines at frequency points defined within the file. These can be displayed as an alternative to limit lines/patterns. Up to two files can be displayed simultaneously in differing colours. Each file can contain up to 49 frequency points.

Channel Marker files are created using Test Bridge PSA software. This is described further in *Appendix B: Test Bridge PSA Software*.

Overload Indication

Signal levels that are greater than the reference level can not be displayed and may cause errors in the measurement.

Two types of overload indication are provided. Signals that cause the trace to rise above the reference level are indicated by a red arrow at the top of the graticule. Overload of the ADC is indicated by a red background warning message below the graticule area. More information about signal overload and measurement error is provided in '*Signal Overload Levels and Indication*'.

16. MARKERS

Using Measurement Markers

This menu group controls the markers that are used for measurement

There are two markers M1 and M2 which provide a readout of amplitude at any frequency point on the trace. M2 can only be on if M1 is on, and the frequency difference between the two is also shown. Markers can be set to automatically find peaks or track the largest peak.

The current mode of a marker is shown on the left-hand side of the marker read out.

▸⇆M1: 80.0000MHz -64.7dBm	Marker in Scroll mode
▸↑M1: 80.0000MHz -64.7dBm	Marker in Peak Find mode
▸↑M1: 80.0000MHz -64.7dBm	Marker in Peak Track mode
▸FxM1: 80.0000MHz -64.7dBm	Marker in Fixed mode
▸◇M1: 80.0000MHz -64.7dBm	Marker in Heatmap mode
▸↑M1: 80.0000MHz →	Marker above Stop frequency
▸↑M1: 80.0000MHz ←	Marker below Start frequency

Controlling Markers

Marker Control: Control the frequency position of the markers. Creates a set of bottom-row function keys as follows:

Set M1 (M2) Freq.: Set the frequency position of the active marker numerically using similar frequency entry screens as for Set Centre (see *'Centre/ Span'*).

NOTE

The marker position can be set outside of the current span and therefore off the screen.

Toggle Active: Select which marker is controlled by the marker movement keys. The active marker is indicated by an arrow (>) in front of its readout.

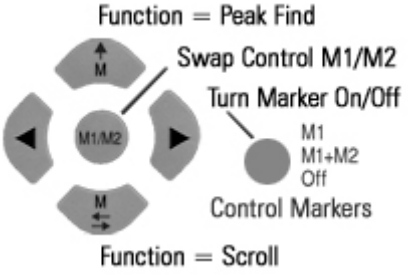
Set M1 (M2) to Centre: Move the active marker to the sweep centre frequency (i.e., the centre of the trace). This is particularly useful if the active marker is off the screen.

Move Left / Move Right: Move the active marker left or right either in frequency steps or from peak to peak of the trace depending on the Marker Mode (Scroll or Peak Find). In Scroll mode, a single press moves one pixel on the display and holding the key down causes it to move continuously in steps of about ten pixels.

Controlling Markers with the Hard Keys

The normal function of the five "navigator" hard keys in the centre of the instrument is to control the markers. This allows control at all times without the need to select the Marker Setup or Marker Control sub-group menus.

When the navigator keys are in this mode, the round key marked Control Markers is illuminated.



If not, pressing the key will restore this mode. Pressing the key repeatedly cycles through selection of the visible markers (Both Off > M1 Only > M1 and M2 > Both Off).

Pressing the centre button on the navigator toggles the active marker between M1 and M2 or turns M2 on if it is off. Pressing the Up key selects Peak Find function, while pressing the Down key select Scroll function. Whenever the Up key is pressed, the selected marker will jump to the highest peak.

The Left and Right keys move the active marker left or right either in screen resolution steps or from peak to peak of the trace depending on the function.

Whenever the navigator mode is changed, an information box appears. This alert can be turned off if preferred, see *'Settings'*.

Setting-up Markers

Marker Setup: Control the visibility of the markers, their function, and their measurement units. Creates a set of bottom-row function keys as follows:

Select Visible: A pop-up menu that enables the markers, M1 and M2, the be turned on or off.

NOTE



M2 can only be on if M1 is also on.

Units: A pop-up menu that enables the marker measurement units to be set.

Graticule Units: Logarithmic measurements in dBm or dBuV (as set within the Level/Limits > Units/Graticule menu).

uW: (micro watts) or **mV:** (millivolts) change the marker measurement to the appropriate linear scaling.

Function: A pop-up menu with a choice of Scroll, Peak Find, or Peak Track modes.

Scroll:

Scroll mode is selected from Marker Setup > Function or from the Navigate Down hard key and is indicated by two horizontal arrows on the left-hand side of the marker readout. The mode is selected for the marker that is currently active.

In Scroll mode a single press of the Move Left/Right keys cause the selected marker to move in one-pixel steps (i.e., a frequency step of span/270), whilst holding a key down auto-repeats in larger steps.

Peak Find:

Peak Find mode is selected from Marker Setup > Function or from the Navigate Up hard key and is indicated by an upwards arrow on the left-hand side of the marker readout. The mode is selected for the marker that is currently active.

Pressing the Navigate Up hard key places the currently selected marker on the largest peak of the trace. Pressing the Move Left/Right keys will cause the instrument to attempt to position the marker on the next peak of the trace in that direction. The peak-find algorithm may sometimes place the marker on the rising or falling edge of a peak and its performance will depend upon signal and noise levels.

In Peak Find mode the Move Left/ Right keys cause the selected marker to jump to the next peak of the trace in that direction. In Peak Track mode, the marker will attempt to maintain its position on the highest peak of the trace even when the peak frequency is changing.

Peak Track:

Peak Track mode can only be selected for M1. It is selected from Marker Setup > Function and is indicated by an upwards arrow followed by a capital T on the left-hand side of the marker readout.

When selected the marker will attempt to track the highest peak of the live trace.

Counter On/ Off:

A frequency counter can be selected to operate at the active marker point, see '*Frequency Counter Options*' for more details.

Fix/Unfix M1: Fix the amplitude reading of the M1 marker so that it no longer follows level changes from the sweep. The marker readout is preceded with the word Fx. Pressing it again, or pressing either marker "move" keys, restores normal operation.

Move M2 to M1: Move the M2 marker to the frequency position of the M1 marker (also turns M2 on if it was off). This is intended for use with the Fix M1 function to enable amplitude changes at a specific frequency to be monitored.

Further Notes on the Use of Markers

Marker Frequency Precision

The frequency position of a marker is always shown to a resolution of 0.0001MHz (100Hz). However, the actual position of the marker is a function of the span. If, for example, the span is set to 50MHz, each frequency point on the trace represents a "bucket" of frequencies 185kHz wide (span/270).

If the marker is set using the Move Left/Right keys, it will give a frequency readout equal to the upper frequency of the bucket. If the marker is set numerically to a specific frequency using Manual Set, the marker position on screen will jump to the upper frequency of the bucket that contains that numerical value.

If the span is reduced, the accuracy of the marker frequency readout improves. However, it is only when the span is reduced to 27kHz that the marker frequency position becomes accurate to 100Hz.

The Frequency Counter function can be used to measure the carrier signal frequency at the marker point precisely.

"Off Screen" Markers

Markers are positioned by absolute frequency. Consequently, when the frequency span of the sweep is changed, the marker may no longer appear within the trace area. This is indicated by an arrow within the marker readout replacing the amplitude value.

The frequency position of the marker is retained, but no amplitude information is available. If the frequency span is subsequently changed to include the marker frequency, it will reappear in the correct position.

Pressing the Navigate Up hard key (Peak Find mode) will bring the marker on screen at the highest level in the trace.

Re-positioning a marker using the Move Left/Right keys will cause it to reappear immediately from the appropriate side of the graticule. Alternatively pressing Marker>Centre in the Marker Control sub-group menu will cause it to appear in the centre of the screen.

Marker Difference Readout

If both markers are turned on, the difference in frequency and level is shown in grey underneath as Mdelta. The readout represents the M2 values minus the M1 values (M2- M1).

Measuring Relative Amplitude

When both measurement markers are turned on, a readout is provided of the difference between them in terms of both frequency and level.

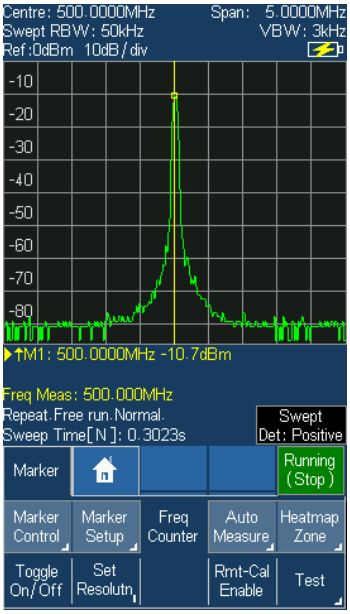
A common requirement is to measure the signal amplitude at a specific frequency under different conditions. The PSA provides a convenient method of doing this.

Having measured the amplitude in the initial condition using marker M1, the value can be fixed from the Marker Setup sub-group menu (Markers > Marker Setup > Fix/Unfix M1). The M1 readout shows Fx at the left-hand side. With the new condition applied, the measurement can be made again by moving M2 to the same frequency using the key Move M2 to M1. The difference in amplitude level can then be read directly.

To return M1 to normal operation, press Fix/Unfix M1 again.

Frequency Counter Options

A frequency counter can be selected to operate at the active marker point causing a short pause as the measurement takes place. The counter provides much higher accuracy than the marker readout since the latter is related to the span (accuracy = span/270).



Toggle On /Off turns the counter function on or off. Note that the counter can also be turned on or off from the Marker Function key pop-up, see *'Controlling Markers.'*

Set Resolution enables the resolution of the counter to be set to 1kHz, 100Hz or 10Hz. The measurement time is approximately 200ms for 1kHz resolution, 210ms for 100Hz resolution, and 300ms for 10Hz resolution.

Frequency measurement is performed at the active marker frequency at the end of the sweep.

NOTE

The counter requires a signal to be continuously present at the marker point during the period when the measurement is made. Modulation and other signal disturbances will cause the counter reading to jitter.

Automatic Measurements

Auto Measure Automatic measurements are available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03'* for more details.

The options are:

Channel Power (CP), Adjacent Channel Power Ratio (ACPR) and Occupied Bandwidth (OBW).

When turned on, the automatic measurement function reduces the sweep update rate substantially.

The measurement result is calculated at the end of each sweep and is based on the 271 measurement points of data collected per sweep.

When automatic measurement is turned on, the standard moveable markers are disabled and replaced by markers which are positioned by either the measurement setup or the measurement result. The calculated results or setup parameters (as chosen with the Mode key) are displayed within the area below the graticule normally used for marker readouts.

The measurement function can run continuously or as a single measurement, as set by the Mode key. The measurement sweeps are controlled with the Run/Stop as normal.

NOTE



The choice of single or continuous within the Auto Measure function overrides the setting within the Sweep Control menu and will remain set when the function is turned off.

For all measurement types the user must start by setting the desired centre frequency for the channel of interest and choosing a span appropriate for the bandwidth. These are set from the normal Frequency/Span menus.

The RBW would normally be set to Auto, and typically the span would be set to be a sufficient amount wider than the channel bandwidth(s) so as to fully display the skirts.

An excessively wide span would reduce accuracy because of the lower number of measurement points. If the span is set below the necessary bandwidth, the result will be shown as "Setup Error".

Depending upon the signal type that is being measured it may be beneficial to set the trace write mode to Average, or to Peak Hold.

On/ Off turns the measurement function (as selected with the Measure Type key) On or Off. When turned On, the markers are disabled and the measurement results are displayed within the marker readout area.

Mode creates a pop-up menu that enables selection both the measurement mode (single or continuous) and the display mode (Results or Setup)

Measure Type creates a pop-up menu from which the three measurement types can be selected.

Channel Power (CP):

This measures the total power, in dBm, within a channel of a user specified bandwidth at a user specified centre frequency.

Setting the channel bandwidth and turning the measurement function on causes two yellow markers to be positioned at the channel limits, equidistant from the centre frequency. The Channel Power is shown in dBm.

Adjacent Channel Power Ratio (ACPR):

This measures the relative power, in dBm, of a main channel to its higher and lower adjacent channels.

Setting the channel bandwidth, channel spacing and turning the measurement function on causes two yellow markers to be positioned at the channel limits of the central channel, and two pairs of light blue markers to be positioned at the limits of the upper and lower channels.

The main channel power is shown in dBm, followed by the ACPR of the lower and upper channels in dB.

Occupied Bandwidth (OBW):

This measurement determines the channel bandwidth necessary to achieve a user specified percentage of the total power found across the span. The measurement is made relative to the start and stop frequencies of the span.

Setting the required percentage of total power and turning the measurement function on causes two yellow markers to be positioned at the frequency points that contain that power. These will not necessarily be symmetrically placed around the centre frequency.

The bandwidth between the markers (OBW) is displayed in MHz along with the centre frequency calculated from the mid-point of the markers and the error between this and the chosen centre frequency.

Set Channel B/W appears for measure types of CP and ACPR.

Set % of Power appears for measure type OBW. Opens a numeric entry screen enabling the channel bandwidth to be entered in MHz or the % of total power to be entered in %.

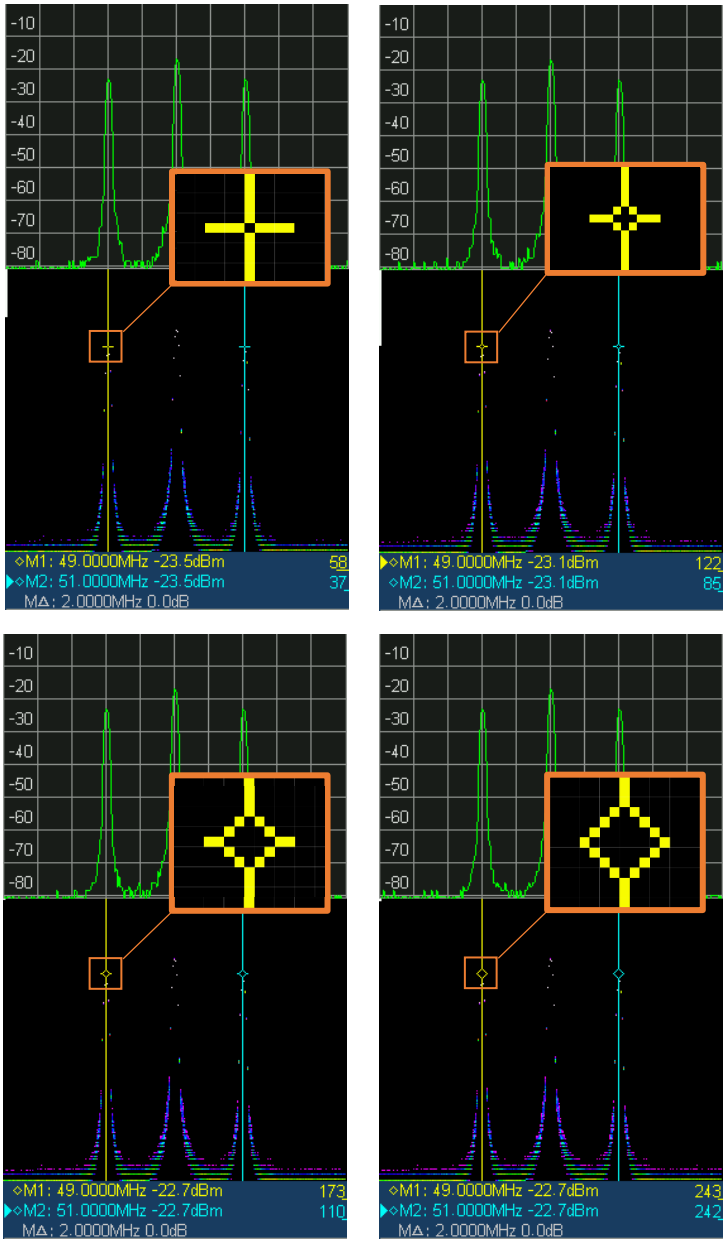
Set Chn Spacing only appears for ACPR measurement type. Opens a numeric entry screen enabling the channel spacing to be entered in MHz.

NOTE



Span and associated RBW/VBW are not set by the Automatic Measurement function but must be set manually to an appropriate value.

Heatmap Zone



Marker interaction

M1 Zone Size / M2 Zone Size: It is possible to read the heatmap value anywhere in the plot using a heatmap zone marker, the size can be set from 1 – 4 , with 1 being the smallest size, to 4 being the largest. The zone includes the point at the zone marker plus surrounding values according to the size of the zone, as shown.

NOTE

If the marker zone is off of the horizontal /vertical edge of the display, only the visible pixels are included in the count.

The count is displayed on the right of the marker information area. The bar under the digits gives a log representation of changing in readings since the last readings where taken (approx 100mS between readings).

The default zone sizes when engaging the heatmap mode are 1(M1) and 4(M2).

By setting the zone size to **Off** it is possible to disable the zone readings and use the marker in the usual way (i.e. to measure amplitude). The normal marker appears in the upper trace plot in split heatmap mode.

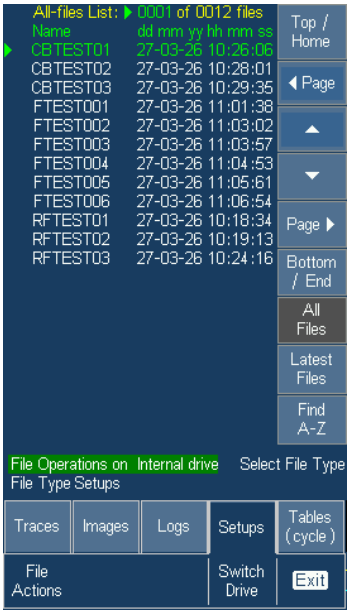
The marker zone positions can be specified using Set Frequency/Set Level. They can be moved using the navigator keys or interactively positioned by touching and dragging in the plot area.

As they can be positioned anywhere they can be used for interactive relative measurement using the M-delta value.

Set M1 Level / Set M2 Level: Set the Zone Marker Level (amplitude).numerically using similar frequency entry screens as for Set Centre (see *'Centre/ Span'*).

17. STORAGE

Files



File Ops: File management; in terms of renaming, deleting, and copying of files to or from a Flash Memory Drive or a PC using the USB. It can be used for all types of files and supports external Flash memory drives.

The upper row of keys enables the file type to be selected (Traces, Images, Setups etc.).

The upper section of the screen shows a file list for the selected file type and is similar to the File Utilities screen except that the options of Latest Files and Find A-Z are not available. To select a file, change using Up/Down or touch/drag pointer to highlight the required item.

Top/ Home: Press once, goes to top of this page, press again goes to top of first page

Bottom/ End: Press once goes to bottom entry on this page, press again goes to last item on last page

Entry Sorting: Ascending or descending by repeat press of category buttons.

Latest Files: Sorted By Date & Time the latest 20 files are shown

All Files: Sorted by Name, all files are shown.

Find A-Z: Search files beginning with specified letter.or word. Matching files contain the same initial letters. For example, if you entered TRACE9, the file-list would contain TRACE900, TRACE901, TRACE902 etc.

The lower row of keys provides further options and actions.

File Actions: change the screen to provide options of **Rename**, **Delete** or **Copy**.

Rename: Bring up an alpha-numeric keypad from which the file name can be changed.

See *'Editing File Names'* for an explanation of file renaming.

Delete: Delete the file; confirmation is required before permanently deleting the selected file.

Copy: Copies a file from the currently selected drive. Files can therefore be copied from the internal drive to the external drive or vice versa by using Switch Drive on the previous screen.

It is also possible to copy all files of the selected file type using **Copy All**.

Switch Drive: Enable the files present on an external USB Flash drive to be listed in place of the internal drive. If no external drive is connected, the key will have no effect.

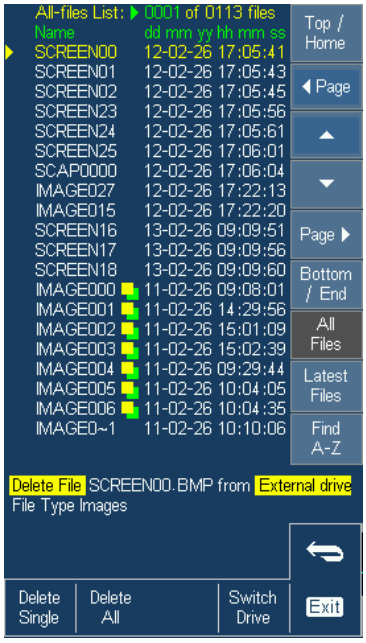
Pressing the key repeatedly alternates between the two drives. The currently selected drive is displayed within the green (Internal) or yellow (External) box.

On the first occasion that the external drive is accessed there will be a delay and a warning message will be displayed.

If the "selected" drive is internal the highlighted filename will be Green. When the USB is the selected drive the filename will be yellow.

If a file exists on both internal and external drives a pair of boxes appears next to the name.

The upper box colour again reflects the "selected" drive Green over Yellow when internal drive is selected and Yellow over Green when USB is selected. Files that have no box-pair adjacent are on the selected drive only.



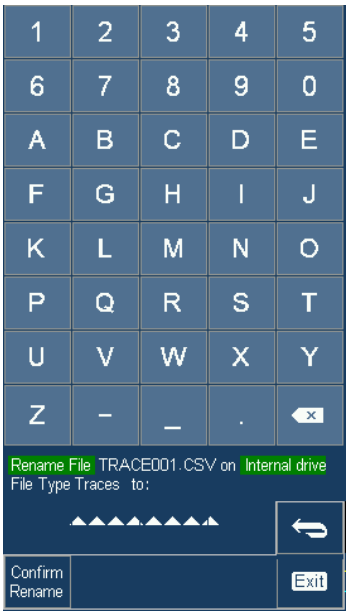
File Names Created or Renamed Externally

Files may be created externally or created within the instrument and renamed externally (e.g., using Test Bridge PSA). Such files may have long file names and/or include lower case characters and additional characters such as ?.

The instrument will correctly list all such files that conform with an 8.3 naming system, and which have the correct extension for the relevant folder. Where the file name exceeds eight characters, it will truncate the file name using a ~1 convention.

Files with the wrong extension, or which have been placed in the wrong folder will not be visible to the instrument filing system. See *'File Types'* for a description of file types and their file extensions.

Editing File Names



Editing a file name (Store File screen) or renaming a file (File Utilities or File Ops screens) uses an alpha numeric key matrix. The matrix replaces the upper screen area.

The whole of the required name must be entered. It is not possible to edit an existing name character by character.

The new name appears at the bottom of the screen replacing the eight triangles shown in the illustration.

Names can be from one to eight characters long and can include upper case letters, numbers, dash (-), and underscore (_).

Corrections can be made during entry using the back-space key.

In the event that a file with that name already exists, a warning message will be displayed.

Confirm Rename: Apply the new name and return to the previous screen.

Back: Return to the previous screen without applying the new name.

Exit: Leave the selected filing system function immediately.

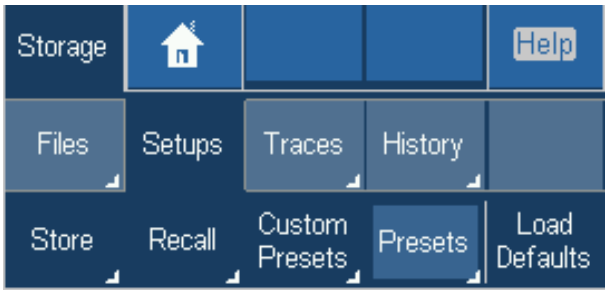
Default File Name Rules

Default names are always five characters long, but the user can choose to enter less than five characters, and the system will add the appropriate number of underscores at the end. The five characters are followed by a three-digit number that starts at 001 and auto-increments up to 999.

Deleting files will have no effect on the increment system so that, if the user had created fifteen files and then deleted them all, the next file saved would still have the number 016. Should the number reach 999, the auto increment will start again at 001. If this file already exists, the user will be prompted to delete or rename files or to change the default name.

If the user needs to check the list of existing stored files, or to rename or delete files, this can be done by pressing **File Utilities**, see '*File Utilities Screen*'.

Setups



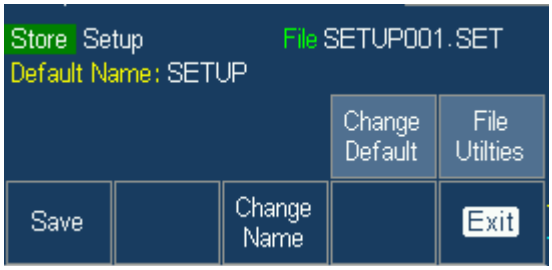
This menu group controls storing and recalling complete instrument set-ups, and access to Custom Presets, Presets and Load Defaults.

Storing Set-ups

Store: This function enables a complete instrument set-up to be stored as a file within the internal memory.

NOTE

External memory cannot be used to store files directly, although files can be copied to external memory later.



The menu keys are replaced by a control screen as shown.

The auto-allocated file name is shown (based upon the current default file name).

Quick Save: Store the file under the default name. However, the option also exists to change the name before saving.

Save As: An alpha-numeric keypad which can be used to enter any name of up to eight characters that the user may choose.

If a file with that name already exists, a warning message is displayed.

The default name can also be changed by pressing **Change Default**. Any name of up to five characters can be used, see '*Default File Name Rules*'.

It is also possible to delete or rename files from this screen by pressing **File Utilities**.

File Utilities Screen

Store and Recall screens include a **File Utilities** key which enables files to be renamed or deleted.

The layout is similar to a File Recall screen, see '*Recalling Setups*' .

Rename: Alpha-numeric keypad from which the file name can be changed.

Delete: Permanently deletes the selected file. Confirmation via po-up is required to complete the action.

Recalling Setups



Recall: Enable a complete instrument set-up to be recalled as a file from the internal memory.

The recall screen for any file type uses the whole of the display area in order to include a file list. The list consists of the file name (without its extension) the date of storage (in format dd/mm/yy) and the time of storage (in 24-hour format hh:mm). A moveable pointer operated by the Up and Down keys shows which file is to be executed.

The keys that control the file selection are in a vertical list on the right-hand side.

One screen can show 20 files simultaneously. **Page Up** / **Page Down:** Scroll through the files in blocks of twenty.

By default, files appear within the list in date/time order with the oldest files at the top.

All Files: Return to this listing type at any time.

Latest Files: Show a screen of up to 20 files that represent the most recently stored or recalled files.

Files can also be found from their starting character using File A-Z.

Find A-Z: An alpha numeric keyboard. When a character is pressed the keypad disappears and the listing then shows only files that start with that character.

Recall: Execute the file operation.

It is also possible to delete or rename files from this screen by pressing **File Utilities** - see '*File Utilities Screen*'.

Custom Presets

Custom Presets: Custom Presets are available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03'* for more details.

Pressing the Custom Presets key brings up a menu as shown. Custom Presets is an extended version of the User Preset from which multiple presets can be saved or recalled by entering just a number. To save a new preset, set up the instrument as required and press the Save Preset key followed by a number. Each Preset is a special type of Setup file stored in the SETUPS directory with a file name of the form $PST0001 where the $ is fixed and the next three characters (default PST) can be changed to create multiple groups of presets. The last four characters represent the number by which the preset is saved or recalled. Any number in the range 1 to 9999 can be used, although the number of presets simultaneously available is set by the directory limit of 999 files. Applications for which Custom Presets might be used include frequency selection via channel numbers, or repetitive steps within a test environment. It enables multiple presets to be saved/recalled just by entering a number.

Presets

This special menu is accessed using the hard key marked PRESET (Presets/Auto). Its function is to enable the overall setup of the instrument to be changed quickly to suit specific requirements.

Standard Preset: Set the frequency, level and sweep parameters back to known state and cancels the more complex functions of the instrument (see '*Standard Preset'*).

User Preset: Set the frequency, level and sweep parameters back to defined state as set by the user. The User Preset is a user-modified version of the Standard Preset. To change the action of the user preset, set up the spectrum analyzer as required and select Save Current from the User Preset function keys. The parameters as described in '*Standard Preset*' will be overwritten by their current values.

If preferred, the User Preset can be loaded whenever the instrument is switched back on from off , see '*Settings'* for more details.

Auto Set: Perform a maximum-span sweep at the widest RBW and then sets the centre frequency, span, RBW and Level to create a useful display of the highest amplitude point found within the initial sweep. The Auto Set function takes several seconds to complete.

Recall Setup: Go to the Recall Setup control screen, from which any setup file can be recalled.

Restore Previous: Restore the setup to its condition at the point that the Presets hard key was pressed.

Execute: Execute the operation selected by any of the above keys.

Load Defaults

Load Defaults: Load the factory default setup, thus restoring the instrument status to its original ex-factory settings, see '*Appendix C: Factory Default Settings'* No user-created files are modified or deleted.

Traces

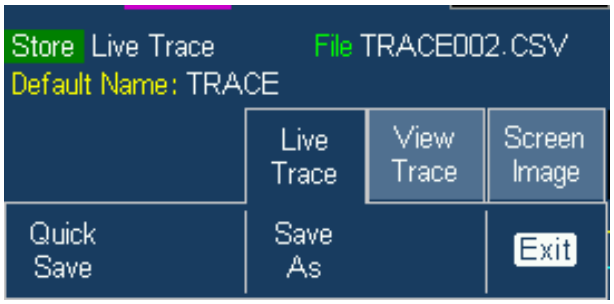
Storing Traces or Screens

Store: Enable the Live trace, the View trace, or a complete screen image, to be saved as a file within the internal memory.

NOTE



External memory cannot be used to store files directly, although files can be copied to external memory later).



The menu keys are replaced by a control screen as shown.

The top row of keys sets what will be stored: the Live Trace, the View Trace, or a Screen Image. The currently selected file type is shown in the green box above the keys.

There are two methods for saving to a file: **Quick Save** and **Save As**

Quick Save: Store the trace or screen under an automatically incrementing name (e.g., TRACE001 etc.) as set by the Default name.

The key can be pressed repeatedly to store traces/images as they appear. The next name that will be used is shown in yellow within the area above the keys.

Save As: Halt the trace update (causing the sweep status key to go to Pause) and enters the next screen as shown.

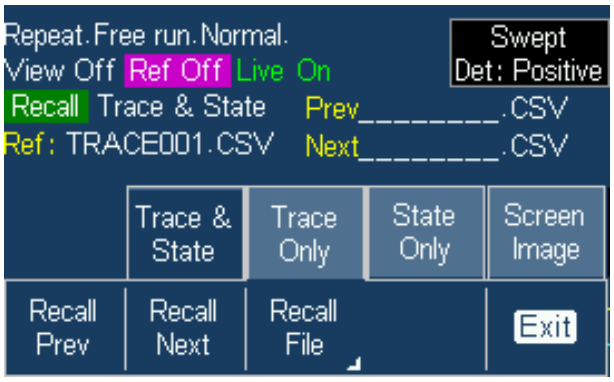
Change Name: Bring up an alpha-numeric keypad which can be used to enter any name of up to eight characters that the user may choose.

If a file with that name already exists, a warning message is displayed.

Change Default: Change the default name, any name of up to five characters can be used, see '*Default File Name Rules*'.

File Utilities: Delete or rename files - see '*File Utilities Screen*'.

Recalling Traces and Images



Recall: Enable a stored trace to be recalled to the Reference trace on the screen. The Ref trace is purple and is always behind both the Live trace and the View trace. Recall also enables stored screen images to be viewed.

The top line of keys enables the selection of the type of file to be recalled.

Trace files can be recalled in three different ways, Trace & State, Trace Only, or State Only.

A trace file represents the swept trace as it appears upon the screen along with information that defines the frequency span, RBW, VBW and reference level at the time that it was stored. The latter information is referred to as the State.

When a trace file is recalled, the user can choose to recall the whole file (Recall Trace & State), the trace amplitude values only (Recall Trace) or the State values only (Recall State). Whenever the State is recalled, the spectrum analyser set-up is changed to match the parameters within the recalled file.

Screen images can also be recalled from this screen. A recalled screen image overwrites the existing graticule and annotation area. Recalling an image takes around three seconds, with the image building from the bottom upwards.

Recall File: Open a file list which can show any of the currently stored files of the selected type. See '*Recalling Setups*' for more details.

Recall Next / Recall Prev. Recall the next or previous file in the list without the need to re-enter the File *'Recall screen'*. This is particularly useful when searching through stored screen images.

NOTE

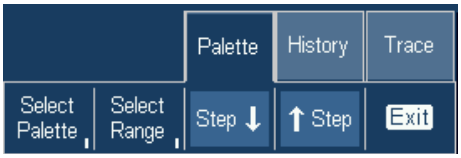


When Viewing an Image file You can recall the previous / next image by pressing the left and right navigator keys.

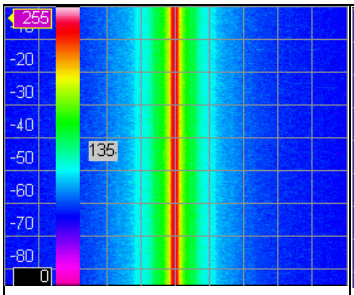
Waterfall History

The Waterfall History allows the Data Acquisition memory to be examined in an advanced Waterfall display and Trace mode. A maximum of 2047 samples are stored for analysis, up to 224 lines of data can be viewed simultaneously on the display. The samples are numbered from 0-2047 where 0 represents the oldest acquired sample.

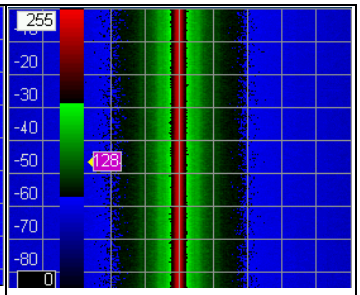
Palette: Select and adjust the waterfall colour mapping levels.



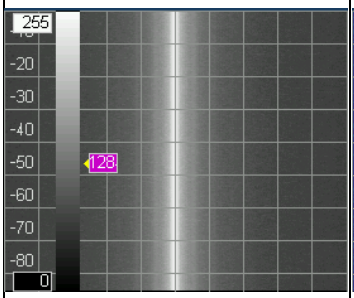
Select Palette: Select which palette to use to display the waterfall data. Palettes are numbered 1-4 , see *'Palettes'* for more details.



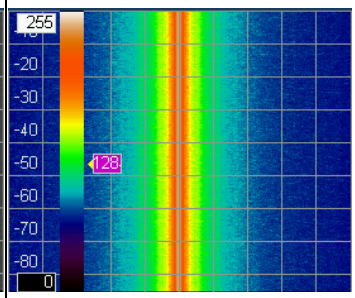
Palette 1



Palette 2

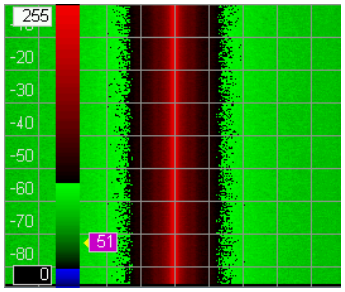


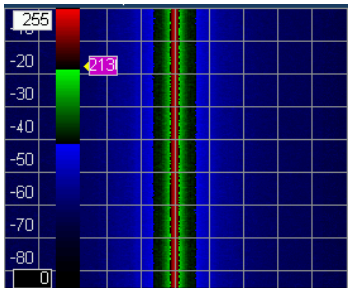
Palette 3

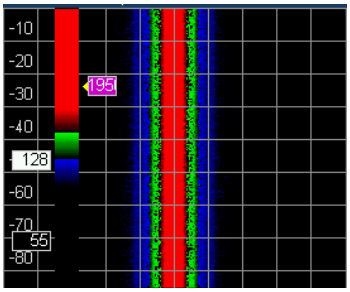


Palette 4

Select Range: Select the Start (bottom), curve (middle) or Stop (top) to adjust using the Step Up and Step Down keys. These can also be adjusted using the up and down hard keys, or using the touch screen to drag the slider up and down.

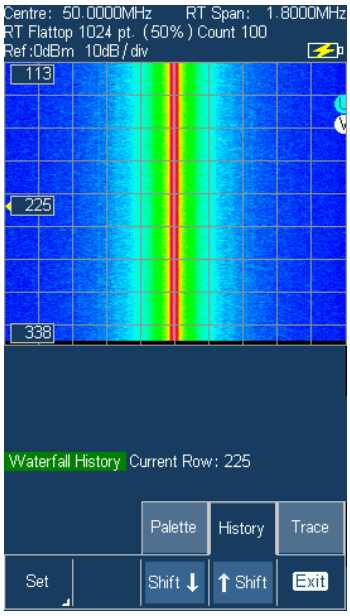






Step Up/ Down: Step the selected range up or down.

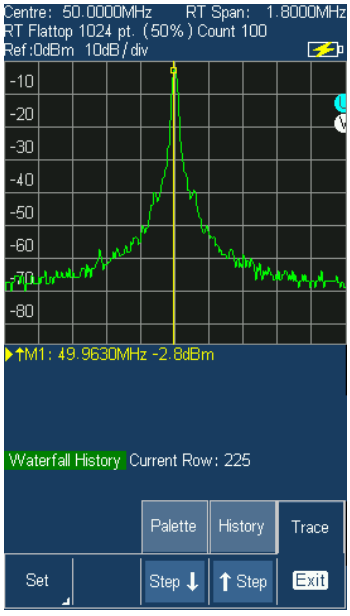
History: Adjust the sample range of traces shown as the waterfall result.



Set: Set the centre sample row number, this can be set from 0 to 2047.

Step Up/Down: Step the sample row up and down. The **Shift Up/ Down** buttons move the page background up and down and the navigator keys, adjusts the current line on the page. if the current line approaches the page top or bottom the view will shift to centre the view.

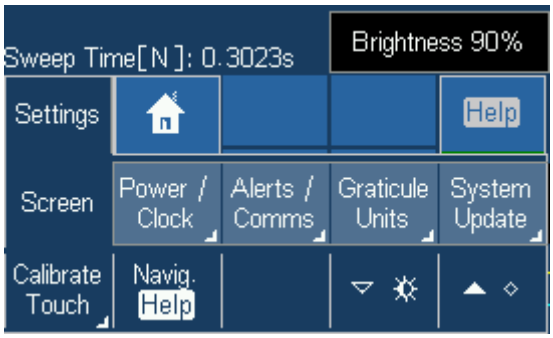
Trace: View the trace for the selected row.



Set: Set the sample row to display**.**

Step Up/ Down: Step the sample row up and down.

18. SETTINGS



This menu group provides access to the system settings. It is also available via the Status/Help hard key see *'Display and Controls Layout'.*

Screen: Enable aspects of the TFT colour screen to be adjusted.

Calibrate Screen: Open a calibration screen for the touch screen. (The touch screen is a resistive layer which overlays the TFT screen. From time to time, it may be necessary to re-calibrate the positional accuracy of the system).

Calibration must be done using a stylus, and the centre of the "bulls' eye" must be touched accurately in each of three positions. To abort the calibration, press the Exit hard key.

Display Darker / Brighter: Change the screen brightness, the brightness is displayed in the black box above the sweep control key.

Power/ Clock: Power on-off system settings, along with the real-time clock.

Set Date & Time: Open a dialogue box from which the date and time can be set for the real-time clock. Times are in 24-hour format and dates are day-month-year.

When the dialog is opened the Clock keeps running until a change is made, at which point the "Paused" indicator appears and the clock is stopped,

Pressing **Cancel** will exit the dialog and the RTC will not be effected from the prior setting even if paused.

Set and Exit will update the real-time clock with the current setting.

If the cursor is moved to the right of the seconds digits, the clock trim can be adjusted. This is indicated by "Adj nn ppm Trim" display, a typical starting value for trim is +23ppm.

Auto Off: Create a pop-up menu that enables the instrument to be automatically turned off after a period of inactivity. Options are Never and 5 mins to 60 mins. Auto Off ceases to operate when the instrument is externally powered.

Pwr-ON State: (Power- on state) Create a pop-up menu that enables the condition of the instrument at switch-on to be set. Options are Last Used (restore the settings that existed at switch off), or User Preset (over-ride previous settings with those defined in the User Preset – see *'Presets'* for more details.

Alerts / Comms: Enable certain elements of the user interface to be turned on or off.

Beep: Turn the warning beep on or off. Beeps are created in response to illegal operations such as setting an out-of-range value.

Navigation Prompt: Turn the information boxes that confirm and explain the current mode of the navigator keys (control markers or navigate touch screen) on or off.

Link Int to PC: All spectrum analyzer operation is suspended and a connection can be made to a personal computer.

NOTE



It is not possible to connect a USB Flash Drive if the USB Link to PC connection is in place.

The USB Type Mini B connector on the left-hand side of the instrument is arranged as USB "device" and is intended exclusively for connection to the USB port of a personal computer for the transfer of files to or from the internal memory of the instrument.

The connection should be made using the cable supplied, which is a standard USB Mini B plug to USB Standard A plug.

"Link Int to PC" mode is selected via Settings > Alerts / Comms > Link Int to PC. When the key is pressed all spectrum analyzer activity is suspended and the instrument waits for the PC to recognise its Flash based disc drive and "log it on".

When the link is enabled, the internal drive of the instrument appears on the PC as a removable disc drive. When in this condition, the PC is in control of the link and file operations are performed on the PC using Windows Explorer or a similar file system manager.

CAUTION



When in this mode, all of the user area of the internal drive becomes accessible. It is therefore possible to rename files and directories, delete directories or to add invalid files. Care must be taken NOT to do this.

The internal drive contains a master folder named PSA within which are five folders: TRACES, IMAGES, SETUPS, LOGS, and TABLES. Only the correct file types must be placed into these folders, no files should be placed in the Root folder and no additional folders created.

NOTE



It is possible to place files with long filenames into the folders provided that the extension is correct and the files themselves are valid.

The link can be closed by pressing the EXIT hard key. When this happens, the instrument re-checks its filing system in order to ensure that changes have not been made that would cause system problems. This may take several seconds.

When this has been completed, normal spectrum analyzer operation resumes.

View on PC: View on PC is available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704 see *'Upgrade Option U03.'* for more details. It places the instrument into a special mode in which the graphics of the display are sent to a PC via USB The screen can then be viewed at any size using Test Bridge PSA PC software.

Graticule Units: Update how the graticule is displayed.

Graticule dBm: Graticule measurement in dBm (dB milliwatts into 50 Ohms, where 0dBm = 1mW) and sets the graticule and graticule markings accordingly.

Graticule dBuV: Graticule measurement in dBuV (dB micro volts across 50 Ohms, where 0dBuV = 1uV) and sets the graticule and graticule markings accordingly.

Graticule Grid: Dim the Graticule, set to horizontal lines only, or turned off completely.

NOTE



When the measurement units are set to dBuV, the top graticule division is reduced to 7dB in order that subsequent graticule lines correspond to whole decade values.

Graticule Digits: Set the graticule digits to a brightness percentage of 20%, 40%, 60%, 80% or 100%. The default is 100%.

System Update: Update the instrument firmware or recalibrate the instrument. Creates a set of bottom-row function keys as follows:

Calibrate Analyzer: Recalibrate the instrument. Recalibration should only be performed by skilled personnel with access to precision equipment and in conjunction with the Service Guide.

Install Options: Install firmware-based options.

Installing option U03 is done in a similar way to a firmware update, but an additional step of entering an activation code will be needed. Full details are provided with the option purchase.

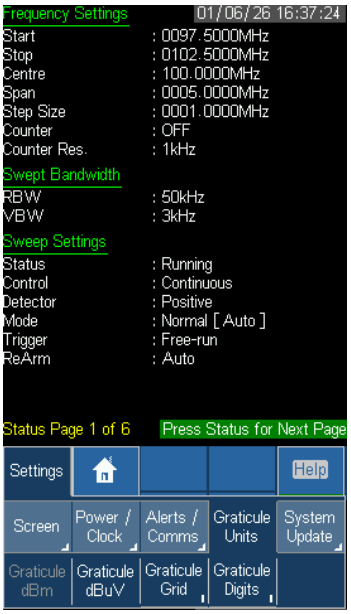
Update Firmware: Update instrument firmware.

From time-to-time Aim-TTi may make updated versions of the instrument firmware available in order to add new features or to correct “bugs”. These will be downloadable from the Aim-TTi website (www.aimtti.com/support) without charge. The current version is displayed within the Status display screens.

The method of updating requires the use of a USB Flash drive. Full information on how to perform the update will be provided with the firmware file.

Status Information | On-screen Help | System Utilities

This menu group is accessed using the hard key marked STATUS/Help. When the key is pressed, the display is replaced by the Status menu, as shown opposite.



Status Display

When the Status/System key is selected, the top part of the screen is replaced by the 'status' of the instrument, which consists of a detailed listing of the current instrument setup conditions.

The status information is split over multiple pages. Press Status again to access the next page or press Exit to return to normal operation and restore the menu group and sub-group that were in place when the Status hard key was pressed.

Help Screens

Help information is available from the same menu system as is status, by pressing the Help key.

Topics: brings up a topics list from which all of the individual help screens can be selected. Select the required menu sub-group using Move Up/Down and confirm with Select Topic, or Touch/Drag the current topic pointer from the touch screen, or using the NAV Up/down buttons.

Context Help: brings up a help screen relevant to the menu sub-group that was in use prior to the Status/Help key being pressed. Context Help may cover several pages, these are selected with the Next/Prev Page keys.

System Help: brings up a help screen describing the utilities menu.

Pressing Exit when displaying a Help screen returns the analyzer to normal operation.

19. UPGRADE OPTION U03

The following features are available on the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704.

Option U03 is a firmware upgrade which can be downloaded from the Aim-TTi website. This can be installed by the user without any requirement to return the instrument to its supplier. Activation of the upgrade is achieved via an activation code which can be purchased from Aim-TTi, or from our distributors and agents across the world.

Further functions may have been added since this manual was written- see the Aim-TTi website for up-to-date information.

Logging of Values, Traces or Screens

The Logging function enables results to be saved into log files in response to a timer or to a trigger event. Individual amplitude values, complete traces, or full screen images can be saved. See '*Logging*' for more information.

Triggering

The triggering function enables sweeps or logging to be triggered in response to an internal or external trigger event. The internal trigger event can be generated by the Limits function. See '*Trigger*' for more information.

Limit Lines, Limit Patterns & Channel Markers

Limit lines and patterns can be shown on the display and compared with the trace. They can be used to trigger a logging event, generate an audible warning, or output a trigger pulse.

Limit lines are simple horizontal lines whereas limit patterns are frequency dependent amplitude limits that are stored as files. Two limits can be used simultaneously. Channel markers are a special version of a limit pattern that creates only vertical lines. See '*Limits*' for more information.

Frequency Mask Triggering

The Frequency Mask is a predefined mask, designed to trigger measurements if the signal appears inside or outside of this predefined area . See *'Freq. Mask'* for more information.

Level Offsets

The level offset function enables the level values for the graticule and markers to be corrected for external attenuation or gain. Compensation can also be made for signals coming from a 75Ω source. See '*Amplitude Offset and Compensation Tables*' for more information.

Compensation Tables

Compensation tables are lists of amplitude versus frequency which enable frequency related amplitude variations from antennae or transducers to be compensated for within the spectrum analyzer. Compensation tables are stored as files. See *'Creating and using Compensation Tables*' for more information.

Custom Presets

Custom Presets enables multiple presets (set-ups) to be saved/recalled just by entering a number. See '*Custom Presets*'.

View on PC

View on PC places the instrument into a special mode in which the graphics of the display are sent to a PC via USB. The screen can then be viewed at any size using Test Bridge PSA PC software. See '*View on PC*' for more information.

Test Bridge PSA Software

Test Bridge PSA is a Windows based software application which is used in conjunction with the instrument. It provides the capability for displaying and printing Traces and Screen Images, display and analysis of Log files, and creation of Limit Patterns and Compensation Tables. See '*Appendix B: Test Bridge PSA Software*' for more information.

20. USB CONNECTIONS | FILE SYSTEM & FILE TYPES

Understanding USB Connections

The instrument has two USB ports only one of which may be used at a time. The required port is accessed by a sliding shutter which ensures that only the exposed port can be used.

The Type A port presents a USB host interface which will accept flash drives conforming to the USB Mass Storage Class (MSC). Drives with capacities from 32MB to 32GB are supported. USB Hard Disk Drives are not supported, and this port is not compatible with any other class of device including the HUB class.

If any unsupported device type is connected a message will be displayed to alert the user.

NOTE



Certain small capacity USB flash drives have been seen that try to connect as a hub before exposing the MSC device. This type of flash drive is not compatible and cannot be used with this instrument.

When a compatible flash drive is connected to the instrument there will be no activity until the **Files**> **File Ops** control screen is called up, then the Disk light will flash, and the **Switch Drive** key will become active. This key will allow access to the files stored on the flash drive. The **Copy** key in the File Actions control screen will also become available. See *'Using an External Flash Drive'* for more information on reading and writing the flash drive.

The Mini B port is for connection to a PC and has two possible uses, each will cause the instrument to expose a different device type to the PC. When the instrument is powered on the Mini B port is inoperative and the PC, if connected, will not be able to 'see' the instrument. The correct device type will be exposed when the user performs an appropriate action. The two types of devices that the instrument can expose are Mass Storage Class (MSC) and Communications Device Class (CDC). These classes and their uses are discussed in the following paragraphs.

The PSA will expose the MSC when the user executes **Settings > Alert/ Comms** and then chooses the **Link Int to PC** option from the File Ops control screen. The instrument will expose the CDC when the user executes **Settings > Alert/ Comms** and then chooses the **View on PC.** See *'Settings'* for more details.

It should be noted that CDC is used only for screen data exchange when View on PC is selected. It is not possible to transfer file data while in this mode. To exchange files between instrument and PC requires MSC and in this mode View on PC is not available.

The user can, however, switch freely between these modes by executing the key sequences above but connection to the View on PC application will be lost when Link to PC is selected.

Using an External Flash Drive

The USB Type A connector on the left-hand side of the instrument is arranged as USB Host and is intended exclusively for the connection of a USB Flash Drive. This enables files to be copied to and from the internal memory of the instrument. Note that files cannot be loaded from or saved to external memory directly.

Copy operations are performed using the File Ops (File Operations) function, see *'Files'.*

The instrument pre-defines a folder system for the USB Flash Drive whereby different file types are placed in specific folders. These folders are automatically created when the File Ops function is selected with a Flash Drive plugged in.

A master folder is created called PSA within which are sub-folders named TRACES, IMAGES, SETUPS, LOGS, and TABLES. Files copied from the instrument onto the external drive are automatically placed into the correct folder. However, where files are being placed onto the external drive from a personal computer, they must be put into the correct folder, or it will not be possible to copy them onto the instrument.

NOTE



Whenever the File Ops function is first used after a USB Flash Drive has been plugged in or the instrument has been switched off, the files on the Flash Drive will be interrogated and an information message will appear asking the user to wait for this to take place.

If the Flash Drive is of large capacity and/or contains a large number of files, the interrogation could take a long time. If the user wishes to abort this procedure, they may do so by simply unplugging the Flash Drive. To avoid long delays, it is recommended that Flash Drives containing large numbers of un-related files are not used.

File System and File Types

Internal Filing System Organisation

The organisation of the instrument filing system is not visible to the user from within the instrument. Although a folder system exists, files are automatically placed into, or retrieved from, the correct folder whenever a particular type of file is being used.

Similarly, when an external flash drive is connected, the instrument will automatically select the correct external folder for the current file type.

The folder structure of the internal drive is only visible when linked to a PC , see *'Understanding USB Connections'*.

File Types

The basic instrument uses three file types: Traces, Images and Setups. If option U03 is installed, several further file types become available, many of which are created and viewed in the Aim-TTi Test Bridge PSA software, which can be downloaded from www.aimtti.com/support. See which is available to download from the Aim-TTi web site, see *'Appendix B: Test Bridge PSA Software'* for more details.

Trace Files

A trace file represents the swept trace as appears upon the screen. A trace file can be recalled to the screen as a reference trace (purple).

The file consists of a set of 271 values representing the trace amplitude from left to right across the screen in CSV (comma separated variable) format, plus additional information that defines the frequency span, RBW, VBW and reference level. Values are always in dBm.

The latter information is referred to as the State. When a trace file is recalled, the user can choose to recall the whole file (Recall Trace & State), the trace amplitude values only (Recall Trace) or the State values only (Recall State). Whenever the State is recalled, the spectrum analyser set-up is changed to match the parameters within the recalled file.

Trace files are small being a few kilobytes each. Within the instrument they use an 8.3 naming format with the extension .CSV. A maximum of 999 files can be stored within the internal memory of the instrument. Trace files can be copied to a PC and viewed in Test Bridge PSA.

Screen Image Files

A screen image file is "snapshot" of the whole of the screen. A screen file can be recalled from traces stores and viewed. It can also be exported to a PC and printed for documentation purposes.

Screen files are indexed colour bitmaps of about 50 kilobytes in size. Within the instrument they use an 8.3 naming format with the extension .BMP A maximum of 999 files can be stored within the internal memory of the instrument. Image files can be displayed using Test Bridge PSA software.

Setup Files

A setup file records the complete state of the instrument at the point that it was saved, including marker positions, the view trace, and the reference trace.

When option U03 is installed, additional files such as Limit Patterns and Compensation Tables are also included.

A setup file contains all of the parameters listed within the Factory Default Setup listing (see '*Appendix C: Factory Default Settings*') with the exception of screen brightness and Auto power-off timer settings.

Setup files are small being a few kilobytes each. Within the instrument they use an 8.3 naming format with the extension. SET. A maximum of 999 files can be stored within the internal memory of the instrument. Setup files can be copied to a memory stick or onto a PC for backup purposes but have no function outside of the instrument.

Other File Types

When Option U03 is fitted (see '*Upgrade Option U03'*) five other file types can exist. These are Scan files, Compensation Table files, Limit Pattern files, Channel Marker files, and Logging files. See *'Files*' for more details.

Compensation Tables

Compensation tables are normalised files of amplitude versus frequency which must be created outside of the instrument using Test Bridge PSA software. They are a few kilobytes in size.

The files have the extension .CMP and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

Limit Pattern and Channel Marker Files

Limit pattern tables are normalised files of amplitude versus frequency which must be created outside of the instrument using Test Bridge PSA software. They are a few kilobytes in size.

They have the extension .CSV and are located in the folder named TABLES. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

A channel marker file is a special version of a limit pattern file designed to create only vertical lines. Channel marker file names start with a $ symbol.

Frequency Mask files.

Frequency Mask files are similar to Limit files and have the PFM extension, but are actually .CSV files. The File has 271 bin entries, consisting of an integer 0 or 1 to disable/enable the mask at this bin, followed by the upper and lower real amplitude values in dBm.

Logging Files

Logging Files record multiple entries of sweep data in response to a variety of trigger signals. They can contain several types of data and are variable in size up to tens of megabytes. They have the extension .LOG and are located in the folder named LOGS.

Amplitude values contained within a logging file are always in dBm.

The files are created within the instrument and must be transferred to a PC for analysis using Test Bridge PSA software. Files can be transferred using either a USB Flash drive, or by direct connection to the USB port of a PC.

21. DEFAULT SETTINGS | POWER ON STATE | HARD RESET

Restoring to Factory Defaults

When shipped from the factory, the set-up of the instrument is as described within '*Appendix C: Factory Default Settings*'. The instrument can be returned to its factory defaults condition from **Storage > Setups > Load Defaults**

Standard Preset

The standard preset is accessed by pressing the hard key marked Preset. It returns the instrument to a set of known conditions as below:

NOTE



Some parameters are relevant only if option U03 is fitted.

Frequency/Span (Mode = Centre/Span)	Centre = 1000MHz	Span = 100MHz
Sweep/Bandwidth	RBW = Auto (1MHz)	VBW = Track (1MHz),
	Sweep Control = Repeat Trigger = Free Run, Auto Rearm	Sweep Time = Auto
	Mode = Swept	Detector Type = Default (+ve)
Level/Limits	Ref Level = 0dBm	Units = dBm, Graticule = Normal
	Scale = Normal (10db/div)	
	75Ohm Compensation = Off Fixed Offset = Off	Compensation Table = Off
	Limit 1 = Off, Limit 2 = Off	
Traces/Markers	Live Trace = On, View Trace = Off	Reference Trace = Off
	Mode = Normal	Display = Single Trace
	Marker 1 = On, Marker 2 = Off M1 = 1000MHz	Markers Function = Scroll M1 Fix = Off
	Frequency Counter = Off Automatic measurement = Off	
Setup/Functions	Logging = Disabled	
RealTime Parameters	Count = 16 RT Divider = 1 RT Detector Type = Default (+ve) RT Length = 1024 RT Overlap = 50% RT Window = Kaiser Window	
Display Parameters	Layout = Normal Waterfall Off Heatmap Off M1 and M2 Heatmap Zone Size = 1 Colour mapping = Normal	

Parameters not included within the listing above are left unchanged.

The User Preset is a customisable version of the Standard Preset whereby any of the parameter values of the standard preset can be changed to match the requirements of the current user, see *'Presets'* for more details.

Unrecoverable Fault Condition - Hard Reset

If the spectrum analyzer gets into a condition in which normal operation is not possible, it can be returned to normal operation by reloading the Factory Default settings, see '*Restoring to Factory Defaults'.*

However, if it "locks up" (i.e., will not respond to key presses) or cannot be recovered by using Load Defaults, it can be put through a Hard Reset.



The reset button is accessed through a small hole at the top right-hand side of the case. It can be operated using the stylus (or another thin rigid object). Press and hold for longer than 1 second.

Hard Reset will re-load the operating system, return all parameters to their factory defaults, and clear all of the non-volatile buffers. User data and settings that have been saved as files will not be affected.

Power-On State

The set-up of the instrument each time that it is turned on (from off) is normally set to "Last Used". This results in no change occurring when the instrument is powered off and then back on.

Alternatively, the user can choose to load the User Preset which overwrites the major settings with ones chosen by the user (see *'Presets'*). This choice is made from: **Settings > Power/Clock > Pwr-On State** - see *'Settings'*.

22. MAINTENANCE

Updating the Firmware

From time-to-time Aim-TTi may make updated versions of the instrument firmware available in order to add new features or to correct “bugs”. These will be downloadable from the Aim-TTi website without charge. The current version is displayed within the Status display screens.

The method of updating requires the use of a USB Flash drive. Full information on how to perform the update will be provided with the firmware file.

Upgrading the Firmware (Option U03)

Installing option U03 is done in a similar way to a firmware update, but an additional step of entering an activation code will be needed. Full details are provided with the option.

Maintenance, Re-calibration & Cleaning

To ensure that the accuracy of the instrument remains within specification, the calibration should be checked (and if necessary adjusted) annually. Aim-TTi or their agents overseas will provide a calibration service for any PSA1304/2704/2704RT and will repair any PSA developing a fault.

Where owners wish to undertake their own recalibration, this should only be done by skilled personnel in conjunction with the Service Guide which may be obtained directly from Aim-TTi or their agents overseas. Recalibration requires the use of a precision signal generator as specified in the Service Guide

Cleaning: If the unit requires cleaning, use a cloth that is only lightly dampened with water or a mild detergent. Take particular care in cleaning the touch screen area.

Battery Replacement

The instrument is fitted with a rechargeable Lithium-ion polymer battery which should only be recharged using the charger supplied.

The battery requires no maintenance, but capacity will reduce over time, and it may eventually require replacement. The battery is a custom design and replacements are only available from Aim-TTi or from our authorised distributors or agents.

Refer to the Service Guide for detailed information on battery replacement and disposal.

23. SPECIFICATION

Frequency Measurement

Frequency Range:

Frequency Range:	PSA1304	Conventional Sweep and Demodulation	1MHz to 1300MHz
		FFT Sweep	10MHz to 1300MHz
	PSA2704	Conventional Sweep and Demodulation	1MHz to 2700MHz
		FFT Sweep	10MHz to 2700MHz
	PSA2704RT	Conventional Sweep and Demodulation	1MHz to 2700MHz
		FFT Sweep and Real Time	10MHz to 2700MHz
Frequency Accuracy:	See Reference Frequency		

Phase Noise

Phase Noise at 500MHz:	Conventional Sweep	100kHz offset	-88dBc/Hz (Typ.)
		1MHz offset	-115dBc/Hz (Typ.)
	FFT Sweep (Blackman Harris Window)	100kHz offset	-91dBc/Hz (Typ.)
		1MHz offset	-120dBc/Hz (Typ.)

Reference Frequency

Initial Accuracy:	<± 1ppm at 20°C
Stability:	<± 1ppm over 10°C to 30°C
Ageing:	<± 1ppm per year

Amplitude Measurement

Amplitude Range

Units:	Selectable as dBm or dBµV
[1]Reference Level:	Selectable between-70dBm and +20dBm (37dBµV to 127dBµV) in 1dB steps
Display Range:	90dB from [1]reference level
Magnification:	Stepped between x1 and x10 per division

Amplitude Accuracy

Calibration Level Accuracy:	Better than ± 1dB at 10dB below [1]reference level 1350MHz (20°C ± 5°C).
Flatness:	Better than ± 1dB relative to 1350MHz over the full operating frequency range
Linearity:	Better than ± 1dB over 60dB range down from the [1]reference level

Displayed Average Noise Level (DANL)

DANL: (sweep mode, ref. level =-70dBm, RBW = 1kHz, VBW = 300 Hz, span 0.027MHz)	1MHz to 10MHz	<-121dBm
	> 10MHz to 2700MHz	<-131dBm

Noise per Hz:	1MHz to 10MHz	<-161dBm/Hz equivalent;
	> 10MHz to 2700MHz	<-171dBm/Hz equivalent;

Distortion and Spurii

3rd Order Intermodulation:	<-60dBc for two signals at 10dB below reference level, (500MHz and 502MHz); [2]Typically, <-65dBc
Harmonic:	<-50dBc at 10dB below [1]reference level (100MHz)
Other Signal Related Spurii:	<-45dBc for signals 10dB below the [1]reference level
Residual Spurii:	<-70dB below the [1]reference level
Signal Image:	<-55dBc, [2]Typically <-60dBc

Sweep

Sweep Modes:	Conventional or FFT		
Sweep Method:	Detection for 271 points per sweep. The amplitude value (as determined by the detection mode) from each sub-span is stored (sub-span = span/270)		
Signal Detection Modes:	Alternate Peak (default), Positive Peak, Negative Peak, Sample, Linear Average, Log Average or RMS		
Sweep Time:	Sweep time is an automatic function of span and RBW/VBW in conventional sweep, or span and frequency bin resolution in FFT sweep. A speed-up function enables the time to be reduced by a factor of up to ten.		
Sweep Control:	Repeat (continuous) or Single Shot or Triggered (Triggered only with option U03).		
Sweep Trigger (PSA2704RT standard, U03 option):	Trigger Source:	Free run, Frequency Mask (Pattern), Time Domain (for demodulation), Internal system event, External input or Limits Comparator	
	Frequency Mask Triggering	Trigger Level Resolution	1dB
		Minimum necessary mask distance to floor	30dB
		Dynamic range	0 to 90dB (with respect to [1]reference level)
		Trigger conditions	Enter / leave mask area
		Trigger modes	Rearm or stop on
		Trigger mask length	3 to 271 points
		Trigger mask frequency resolution	Span/270
Automatic measurements (PSA2704RT standard, U03 option):	Automatic measurement calculation of Channel Power, Adjacent Channel Power Ratio, and Occupied Bandwidth.		

Measurement

Frequency Span:

Setting Modes:	Centre frequency plus Span, or Start frequency plus Stop frequency

Maximum Span:	PSA1304	Conventional Sweep and Demodulation	1299MHz
		FFT Sweep	1290MHz
	PSA2704	Conventional Sweep and Demodulation	2699MHz
		FFT Sweep	2690MHz
	PSA2704RT	Conventional Sweep and Demodulation	2699MHz
		FFT Sweep and Real Time	2690MHz
Minimum Span:	Conventional and FFT Sweep	2.7kHz	
	Real Time	1.35kHz	
Setting Resolution:	100Hz at any frequency		

Resolution Bandwidth:

RBW:	Conventional	Selectable between 10MHz and 300Hz. Selectable in 1:2:3:5 sequence, or Auto.	
	FFT	Frequency bin resolution:	Selectable between 40kHz and 10Hz. Selectable in 1:2:4:5:8 sequence, or Auto.
		FFT Window	Selectable between Blackman Harris, Flattop, Gaussian, Rectangular, Hanning, and Kaiser
Video Filtering:	Conventional	Selectable between 10MHz and 300Hz. Selectable in 1:2:3:5 sequence, or Auto	
	FFT	Not applicable	

Markers:

No. of Markers:	One, Two (or None)	
Resolution:	Frequency	0.1kHz at all frequencies
	Amplitude	0.1dB
	Trace	Available for waterfall history. Trace number selects the scanned trace from history.
	Count	Available for heatmap display. Displays the occurrence of the selected frequency-amplitude marker point. User selectable pixels included in the count (1,5,13, or 25).
Marker Frequency Accuracy:	1/271st of Span ±10Hz plus reference frequency accuracy.	
Readout:	The frequency, level, time and count at the marker points, and the frequency, level, and time differences are displayed	
Amplitude Displayed Units:	dBm, dBuV, mV or uW	
Functions:	Normal (Scroll Mode) and Peak Find Mode (as standard) Peak Track Mode and Frequency Measurement (as standard)	

Marker Frequency Counter:

Frequency counted at the current active marker (M1 or M2) in sweep or zero-span mode (not available in real-time mode)

Resolution:	1Hz, 10Hz, 100Hz or 1kHz
Accuracy:	Reference Frequency Accuracy **±1 count for signal > noise level +25dB**

Channel Markers (PSA2704RT standard, U03 option):

Channel markers are a special case of Limit Patterns (see Amplitude Limits). Channel markers are vertical lines at frequency points defined within a file. Most commonly they will be used to mark channel centre frequencies or channel boundaries.

Number of Points:	Up to two files, each containing up to 49 points, can be displayed in differing colours.
Marker Files:	Files are created using Test Bridge PSA software. Up to 999 files can be stored.

Amplitude Limits (PSA2704RT standard, U03 option):

Limit Types:	Limit lines from numeric values or limit patterns from files.
Number of Limits:	Up to two limits can be displayed in differing colours.
Limit Patterns:	Pattern files are created using Test Bridge PSA software. Patterns are linearly interpolated from up to 40 frequency/amplitude points. Up to 999 patterns can be stored.
Limits Comparator:	Conditions of above, below, inside or outside of limits, creating actions of message, beep, stop sweep, log sweep and pulse out.

Amplitude Compensation (PSA2704RT standard, U03 option) :

Offset:	Amplitude can be offset by up to +/-50dB to compensate for external attenuation or gain.
75 Ω Compensation:	Compensation can be made for inputs from 75Ω source impedance.
Tables:	Linearly interpolated compensation tables of up to 40 frequency- amplitude points can be used. Up to 999 tables can be stored. Table files are created using Test Bridge PSA software.

Data Logging (PSA2704RT standard, U03 option)

Data Types:	Peak level, Centre Level, Full Trace or Screen Image.
Data Entries:	Up to 25,000 entries per file (2500 for Images).
Trigger Source:	Entries can be made every sweep or in response to Manual Trigger key, External Trigger, Internal Timer or Limits Comparator
Internal Timer:	Adjustable from 2 secs. to 100 mins per entry.

Demodulation (Zero Span Mode)

Audio Demodulation

Modes:	AM or FM
Internal Audio:	Internal loudspeaker with adjustable volume and mute.
Audio Out:	30mW into 32Ω mono or stereo headphones, adjustable volume, 3.5mm jack socket
Audio Filter:	Switchable 3kHz low pass filter
Carrier Display:	Horizontal line at carrier level.

Waveform Demodulation (PSA2704RT standard, U03 option)

Display Modes:	AM modulation waveform, FM modulation waveform, Carrier waveform (against time-base), Carrier level (horizontal line), Waterfall (demodulated waveform over time)	
Time-base:	5us/div to 200ms/div (1:2:5 sequence)	
Trigger:	Rising Edge / Falling Edge, Auto or Free Run	
Markers:	Twin markers with delta readout	
Marker Readout:	AM:	Absolute depth and difference depth
	FM:	Absolute deviation and difference deviation
	Carrier:	Absolute time and difference time
Marker Resolution:	0.01% AM, 10Hz FM	
AM Measurement:	Modulation rate:	35 Hz to 100kHz
	Modulation depth:	5 % to 100 %
	Scale:	5 % to 100 % full scale, 1:2:5 sequence
FM Measurement:	Modulation rate:	35 Hz to 100kHz
	Deviation:	1kHz to 1MHz
	Scale:	1kHz to 1MHz full scale, 1:2:5 sequence

Real Time Spectrum Analysis (PSA2704RT only)

Span Range:	1.35kHz to 10.8MHz
Span Divider Value:	Integer value between 1 (for 10.8MHz span) and 8000 (for 1.35kHz span)
Number of Sweep Points:	271
Marker Step Size:	Span / 270
Sweep Time:	Sweep time is a function of Span, FFT length and FFT count (number of FFTs combined in a single trace) Minimum: 100us, Maximum: 1s

Data Acquisition

ADC Sampling rate:	40.96Msa/s
Maximum FFT Processing Rate:	81.92Msa/s
ADC Resolution:	14 bits
FFT Length:	Selectable between 64, 128, 256, 512 and 1024 (sweep time restrictions apply)
FFT Window:	Selectable between Blackman Harris, Flattop, Gaussian, Rectangular, Hanning, and Kaiser
FFT Overlap Factor:	Selectable between 50%, 66.66% and 75%
FFT Count:	Number of FFTs combined in one trace, 1 to 80000. The combining is determined by FFT detector selection.
FFT Detector:	Positive Peak, Negative Peak, Sample, or Linear Average
Spectrum Processing Rate:	80000 /s (10.8MHz span)

23 - Specification

Measurement

Minimum signal duration necessary for specified level measurement uncertainty (100% POI):	37.5us ([2]Typical) (10.8MHz span, 1024-point FFT, 50% overlap factor, positive peak detector)
Minimum detectable signal duration:	62.5ns ([2]Typical)
FFT bin resolution:	10 Hz to 40kHz (span / 270)
Amplitude flatness:	±1.0dB ([2]Typical)

Display

Displayed Modes:	Full screen, split 1, split 2	
	Conventional sweep, FFT sweep and Real time sweep	Sweep, sweep plus waterfall, and sweep plus heatmap display
	Demodulation (Zero span)	Amplitude vs time, amplitude depth vs time, frequency deviation vs time, amplitude vs time plus waterfall, amplitude depth vs time plus waterfall, frequency deviation vs time plus waterfall.

Sweep Trace

Trace Area:	232 x 271 pixels (full screen mode)
Graticule:	8.5 x 10 divisions, light grey graticule (full screen mode)
Displayed Points:	271 points per sweep.
Live Trace:	Dot-joined, point-sample, and persistence traces
Trace Modes:	Normal (overwrite), Peak Hold, or Average (2 to 48 sweeps).
View Trace:	Buffered “instance” of the live trace.
Reference Trace:	Stored trace recalled from a trace file.
Dual Trace Mode:	For Peak Hold and Average modes, processed and un-processed traces can be displayed simultaneously.

Waterfall Trace

Result:	Colour graded amplitude values
Colour Depth:	256
Trace Area:	232 x 271 points (full screen mode)
History Depth:	2048 (maximum)

Heatmap Trace

Result:	Colour graded number of hits
Colour Depth:	256
Trace Area:	232 x 271 points (full screen mode)
Accumulation Duration:	100us to > 24 hours

Signal Input

Input Connector:	N Type, 50 Ω

VSWR:	1.4:1 [2]Typical
Maximum Level:	+ 23dBm, (130dBµV) >50MHz; +/-50V DC

Display

Display Type:	4.3 inch (10.9 cm) backlit TFT LCD, 480 x 272 pixels total, 65536 colors (5-6-5 RGB), resistive touch screen.

Internal Storage

Internal Disk:	1.8 GB of internal memory.
External Storage:	USB host interface for removable USB Flash drives (maximum 32GB).
Store Trace:	Up to 999 traces can be stored under either default file names or user entered file names. Traces are stored as tables of amplitude versus frequency and can be imported into other programs, as well as being recalled to the screen.
Recall Trace:	Recalls any stored trace to the reference trace of the display.
Store Set-up:	Up to 999 instrument set-ups can be stored under either default file names or user entered file names. All settings of the instrument are saved.
Recall Set-up:	Recalls any stored set-up, overwriting the existing settings of the instrument.
Store Screen:	This function copies the whole screen area to memory as a bitmap. Up to 999 screens can be stored under either default file names or user entered file names.
Recall Screen:	Recalls any stored screen as an image.

Connectors

RF Input:	Standard N Type connector.
DC Power:	1.3 mm power socket for external power supply/charger 5V-2A-Centre Positive
USB Host:	Standard USB type A connector for connection of USB Flash drives.
USB Device:	Mini USB connector for connection to a PC. Limited digital remote-control facilities are available through this USB interface. Content of Spectrogram / Histogram RAM can be accessed via remote control. Also enables the screen of the spectrum analyser to be sent to a PC and displayed at a user-defined size.
Audio Out:	3.5 mm jack socket for demodulated audio out (accepts mono or stereo plugs).
Trigger In/Out (for use with option U03 only):	3.5 mm jack socket; Input for external trigger event, status output.

Power Sources

Battery

Battery Type:	Li-ion 3.7V 3000mA-hour
Battery Life:	Up to 4.5 hours continuous (in conventional sweep mode)
Recharge Time:	< 3 hours from fully discharged
Auto Off Mode:	To conserve battery life, the system can be set to automatically switch off after a defined time from the last key press. This can be set between 5 mins and 60 mins (or never).
Battery Status:	Multi-segment battery status indicator.

23 - Specification

AC Line Operation/ Charging

The instruments can be operated continuously from mains power using the AC line adaptor provided. This powers and recharges the instrument simultaneously.

Voltage Range:	100V to 240V nominal 50Hz / 60Hz

Mechanical

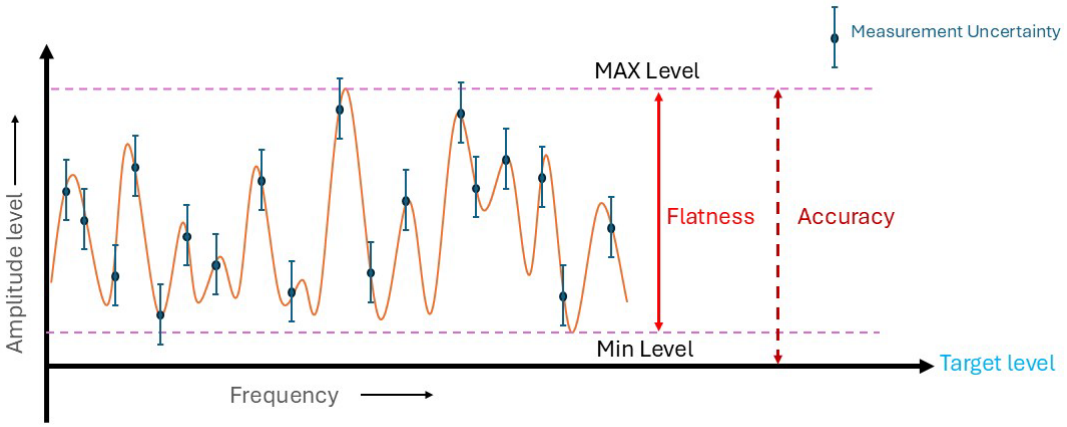
Size:	192mm x 92mm x 49mm (HxWxD) (height excludes RF input connector)
Weight:	580 grams.
Tilt Stand:	Built-in tilt stand, for bench use which angles the unit at 40 degrees to the horizontal.
Stylus:	Casing incorporates plug-in stylus.

Environmental and Safety

Operating Range:	+5°C to + 40°C, 20% to 80% relative humidity and non-condensing
Storage Range:	-10°C to +50°C
Environmental:	Use at altitudes to 2000m, Pollution Degree 2.
Electrical Safety:	Complies with EN61010-1.
EMC:	Complies with EN61326.

[1] Reference level: *calibrated range is between +10dBm to -40dBm.*

[2]Typical (Typ): *Refers to the performance values that represent the expected behaviour of a unit under standard operating conditions. These values are not guaranteed but are indicative of what most units will achieve during normal use. Typically, they are derived from testing and are meant to reflect the performance that can be expected from approximately 80% of the units produced with a 95 percent confidence level, Typical measurement does not factor in measurement uncertainty.*



NOTE: Specifications apply after storage at 20°C to 25°C for a minimum of 2 hours prior to use.

Thurlby Thanadar instruments Ltd, operated a policy if continuous development and reserves the right to alter specifications without prior notice.

24. APPENDIX A: OPTIONAL ACCESSORIES

Firmware Upgrade (PSA-U03) – provides increased capabilities- see *'Upgrade Option U03'* .

Fitted Soft Case (PSA-SC2) – protective carrying case with space for accessories

Telescopic Antenna (PSA-ANT2) – wideband telescopic antenna with adaptor for N-type connection direct to the PSA.

Vehicle Charger (PSA-VC) – charger operating from 12V or 24V.

NOTE: All of the above items are included within the PSA1304USC, PSA2704USC and PSA2704RT products.

Connection Kit (PSA-CK) – high quality SMA connection cable along with adaptors to and from N-Type connectors, plus N to BNC adaptor for lower frequency cable connections.

25. APPENDIX B: TEST BRIDGE PSA SOFTWARE

Test Bridge PSA is a Windows PC application for the creation, editing, analysis, and management of PSAxx04 files. It is compatible with versions of Windows 10 onwards (including 32- and 64-bit versions).

Test Bridge PSA software is free to download from the software or support section of the Aim-TTi website. It has limited functionality for instruments that do not have option U03 fitted but can be useful for displaying and printing traces and screen images. An explanation of how to use Test Bridge PSA is provided within the program's own Help function.

Test Bridge PSA Functions

Trace File Display

Trace files downloaded from the instrument can be viewed on the PC.

Limit Patterns Creation

Limit pattern files can be used within the Limits function of the instrument on PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704. Limit patterns are tables of amplitude against frequency that are created within Test Bridge PSA and uploaded to the instrument.

Limit pattern table files can be created from scratch or imported and edited from CSV files. Editing tools include both numeric entry and graphical editing.

Channel Marker List Creation

Channel Marker List files are a special type of limit pattern file that contain only vertical lines. They can be particularly useful for showing channel position frequencies. Test Bridge PSA provides an editor that enables them to be created by entering a list of frequencies. They have the same extension as a limit pattern file (.CSV) but the file name commences with $ symbol.

Compensation Tables Creation

Compensation tables files can be used within the Offset/Tables function of the instrument PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704. Compensation tables are normalised tables of amplitude against frequency that are created within Test Bridge PSA and uploaded to the instrument.

Compensation table files can be created from scratch or imported and edited from CSV files. Editing tools include both numeric entry and graphical editing.

Log File Analysis

Logging files can be viewed and analysed when downloaded from the PSA2704RT and when the upgrade option U03 is fitted on a PSA1304 or PSA2704.

View-on-PC function

The View on PC function places the instrument into a special mode in which the graphics of the display are sent to a PC via USB. The screen can then be viewed at any size using the Test Bridge PSA application.

26. APPENDIX C: FACTORY DEFAULT SETTINGS

When shipped from the factory, or following a reset to factory defaults, or operation of the hard reset button, the instrument will be set up as follows: (note that some parameters are relevant only if Option U03 is fitted) Square brackets '[xxx]' show PSA1304 variations.

To reset to factory defaults, select: **Storage > Setups > Load Defaults**

Frequency/Span (Mode = Centre/Span)	Centre = 1000MHz Start = 950MHz	Span = 100MHz Stop = 1050MHz
	Fix Start/Fix Stop = Off Freq. Presets = Empty	Step Size = 1.0000MHz Auto Step Size = Off
Zero Span Demodulation Setup	Demod = AM, Depth = +/-100%	Audio Filter Off, Audio Volume = 6, Mute = On
Sweep/Bandwidth	RBW = Auto (1MHz)	VBW = Track (1MHz), Trk Offset = 0
	Sweep Time = Auto	Sweep Control = Repeat Trigger = Free Run, Auto Rearm
	Mode = Swept	Detector Type = Default (+ve)
Level/Limits	Ref Level = 0dBm	Units = dBm, Graticule = Normal
	Scale = Normal (10db/div)	
Offset/Tables	75Ohm Compensation = Off Fixed Offset = Off (set to-10dB)	Compensation Table = Off Compensation File = None
Limits	Limit 1 = Off (set to-50dBm) Limit 2 = Off (set to-60dBm) Pattern Files = None	Limit Condition = None Limit Action = None Limit Offsets = 0, Step = 1dB
Traces/Markers Trace Control	Live Trace = On View Trace = Off	Reference Trace = Off Ref. Trace File = None
Trace Mode	Mode = Normal	Average Number = 16 Display = Single Trace
Trace Stores	Store Type = Live Trace Recall Type = Trace Only	Default File Names = TRACE and IMAGE
Marker Setup	Marker 1 = On, Marker 2 = Off M1 = 1000MHz M2 = 1350MHz [650MHz] Frequency Counter = Off Automatic Measurement = Off	Marker Units = As Graticule Markers Function = Scroll M1 Fix = Off
Setup/Functions Logging	Status = Disabled Type = Centre Level Default File Name = LOG_	Trigger =Timer Timer Interval = 5 sec.
Frequency Counter	Status = Off	Resolution = 1kHz
Setups	Default File Name = SETUP	
System/File Ops	Selected Folder = TRACES	Brightness = 40%
System Utilities	View on PC = Disabled	Auto Power Off = Never Power-On State = Last Used
RealTime Parameters	Count = 16 RT Divider = 1 RT Detector Type = Positive RT Length = 1024	

26 - Appendix C: Factory Default Settings

	RT Overlap = 50% RT Window = Kaiser Window	
FFT Sweep Parameters	FBR = 40kHz Window = Kaiser Window	
Display Parameters	Layout = Normal Waterfall Off Heatmap Off M1 and M2 Heatmap Zone Size = 1 Colour mapping = Normal	

27 - Appendix D: Menu Tree Diagram

PSA SERIES 4:

The Menu Structure shows the associated functions for each mode.

KEY:

	S	FFT	RT	ZS
2 FREQUENCY				
3 Centre				
4 Set Centre	●	●	●	●
4 Set C=M1	●	●	●	
4 Set Pk	●	●	●	●
4 Step Down	●	●	●	
4 Step Up	●	●	●	

1 Modes:

To change the mode of operation; open the Home menu, select the Mode menu, and choose from one of the following:

S	Swept
FFT	Swept FFT
RT	Real Time
ZS	Zero Span

2 Menus:

The main menus are selectable from the Home screen.

3 Sub-Menus:

The sub-menus are available on the second row of buttons, these change depending on what menu is selected.

4 Functions:

The functions are available on the third row of buttons, these change depending on what sub-menu is selected.

- ● The function is avaliable for the mode, in all models.
- ◊ The function is avaliable for the mode when U03 is installed, or the standard model of PSA2704RT.

FREQUENCY																				
Centre	S	FFT	RT	ZS	**Span**	S	FFT	RT	ZS	**Start / Stop**	S	FFT	RT	ZS	**Step Size**	S	FFT	RT	ZS	**Presets**	S	FFT	RT	ZS
Set Centre	●	●	●	●	Set Span	●	●			Set Start	●	●			Set Step	●	●	●	●	Full Span	●	●	●	
Set C=M1	●	●	●		Set RT Divider				●	Set Stop	●	●			Auto Span/ 10	●	●	●		Store Preset	●	●	●	●
Set Pk	●	●	●		Zoom M1 M2	●	●	●		Zoom M1 M2	●	●			Set to MΔ	●	●	●	●	Recall Preset	●	●	●	●
Step Down	●	●	●	●	Undo	●	●	●		Undo	●	●			Set to Centre	●	●	●	●	Toggle Last	●	●	●	●
Step Up	●	●	●	●	Zoom Out	●	●	●		Fix Start	●	●			Set to M1	●	●	●	●					
					Zoom In	●	●	●		Fix Stop	●	●												
										Step Down	●	●												
										Step Up	●	●												

BANDWIDTH																				
Window Settings	S	FFT	RT	ZS	**RBW**	S	FFT	RT	ZS	**FBR**	S	FFT	RT	ZS	**VBW**	S	FFT	RT	ZS	**Detector Type**	S	FFT	RT	ZS
Set FFT Window		●			Set RBW	●			●	Set FBR		●			Set VBW	●			●	Set Std. Detector	●			
Set RT Window			●		RBW Auto	●			●	FBR Auto		●			Set Offset	●			●	Set FFT Detector		●		
															Track RBW	●			●	Set RT Detector			●	
																				Default +ve Det.	●	●	●	

SWEEP										LEVEL										
RT Settings	S	FFT	RT	ZS	**Time**	S	FFT	RT	ZS	**Ref.**	S	FFT	RT	ZS	**Scale / Shift**	S	FFT	RT	ZS	**Offset**	S	FFT	RT	ZS
Set RT Count			●		Auto	●				Set Ref.	●	●	●	●	Set Scale	●	●	●	●	Set Offset	◊	◊	◊	◊
Set RT Overlap			●		Manual up	●				Ref. Step	●	●	●	●	Normal 10dB/div	●	●	●	●	Clear All	◊	◊	◊	◊
Set RT Length			●		Manual down	●				Ref. Up	●	●	●	●	Shift Down	●	●	●	●					
Set RT Divider			●							Ref. Down	●	●	●	●	Shift Up	●	●	●	●					
Set RT Detector			●																					

TRACE																				
Trace Control	S	FFT	RT	ZS	**Trace Mode**	S	FFT	RT	ZS	**Trace Stores**	S	FFT	RT	ZS	**Graph Settings**	S	FFT	RT	ZS	
Save View	●	●	●		Normal	●	●	●		Store	●	●	●		Graph	●	●	●		
Swap	●	●	●		Peak Hold	●	●	●		Recall	●	●	●		Waterfall	●	●	●		
View On/ Off	●	●	●		Average	●	●	●		Trace CSV	●	●	●		Heatmap	●	●	●		
Ref. On/ Off	●	●	●		Reset	●	●	●							Layout	●	●	●		
Live On/ Off	●	●	●		Single Trace	●	●	●												
					Dual Trace	●	●	●												
					Swap Traces	●	●	●												
					Average Number	●	●	●												

DEMOD										
Signal	S	FFT	RT	ZS	**Graph Display**	S	FFT	RT	ZS	
Audio Demod.				●	Graph				●	
Wave Demod.				◊	Waterfall				●	
Volume Down				●						
Volume Up				●						

SETTINGS																				
Screen	S	FFT	RT	ZS	**Power/ Clock**	S	FFT	RT	ZS	**Alerts / Comms**	S	FFT	RT	ZS	**Graticule Units**	S	FFT	RT	ZS	**System update**	S	FFT	RT	ZS
Calibrate touch	●	●	●	●	Set Time & Date	●	●	●	●	Beep	●	●	●	●	Graticule dBm	●	●	●	●	Calibrate Analyzer	●	●	●	●
Navig. Help	●	●	●	●	Auto Off	●	●	●	●	Navigation prompt	●	●	●	●	Graticule dBuV	●	●	●	●	Install options	●	●	●	●
Brightness Down	●	●	●	●	Pwr-on State	●	●	●	●	Link Int to PC	●	●	●	●	Graticule Grid	●	●	●	●	Update Firmware	●	●	●	●
Brightness Up	●	●	●	●						View on PC	●	●	●	●	Graticule Digits	●	●	●	●					

LOGGING					TRIGGER										LIMITS					
Data Logging	S	FFT	RT	ZS	**Sweep Control**	S	FFT	RT	ZS	**Freq. Mask**	S	FFT	RT	ZS	**Manual Trigger**	S	FFT	RT	ZS	**Limits**	S	FFT	RT	ZS
Log Control	◊	◊	◊	◊	Repeat	◊	◊	◊	◊	FMT On/ Off	◊	◊	◊							Set Limits	◊	◊	◊	◊
Log Type	◊	◊	◊	◊	Single	◊	◊	◊	◊	Start On	◊	◊	◊							Limit Offset	◊	◊	◊	◊
Log Trigger	◊	◊	◊	◊	Sweep Trigger	◊	◊	◊	◊	Stop On	◊	◊	◊							Limit Condition	◊	◊	◊	◊
Timer Setup	◊	◊	◊	◊	Single ReArm	◊	◊	◊	◊	Burst Count	◊	◊	◊							Limit Action	◊	◊	◊	◊
										Load Pattern	◊	◊	◊							Limit Fix/Unfix	◊	◊	◊	◊

MARKER																				
Marker Control	S	FFT	RT	ZS	**Marker Setup**	S	FFT	RT	ZS	**Freq. Counter**	S	FFT	RT	ZS	**Auto Measure**	S	FFT	RT	ZS	**Heatmap zone**	S	FFT	RT	ZS
Set M1 Freq.	●	●	●		Select Visible	●	●	●		Toggle On/ Off	●	●	●	●	Mode	◊				M1 Zone size	●	●	●	
Toggle Active	●	●	●		Units	●	●	●		Set Resolutn	●	●	●	●	View	◊				M2 Zone Size	●	●	●	
Set M1 to Centre	●	●	●		Function	●	●	●							Measure Type	◊				Set M1 Level	●	●	●	
Move Left	●	●	●		Fix /Unfix M1	●	●	●							Set Chn BW	◊				Set M2 Level	●	●	●	
Move Right	●	●	●		Move M2 to M1	●	●	●																

STORAGE																				
Files	S	FFT	RT	ZS	**Setups**	S	FFT	RT	ZS	**Traces**	S	FFT	RT	ZS	**History**	S	FFT	RT	ZS	
File Ops	●	●	●	●	Store	●	●	●	●	Store	●	●	●	●	Waterfall	●	●	●	●	
					Recall	●	●	●	●	Recall	●	●	●	●						
					Custom Presets	◊	◊	◊	◊	Trace CSV	●	●	●	●						
					Presets	●	●	●	●											
					Load Defaults	●	●	●	●											

EXCELLENCE THROUGH EXPERIENCE

Aim-TTi is the trading name of Thurlby Thandar Instruments Ltd. (TTi), one of Europe's leading manufacturers of test and measurement instruments.

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