discover...

ML2490A Series
Peak Power Meters

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Anritsu
Discover What’s Possible™
ML2490A Series Peak Power Meter
Higher Resolution Rise Time Measurements

- Suitable for Radar Rising Edge signals
- 65 MHz Bandwidth Mainframe
- 1 ns Settable display resolution
- Internal or External trigger facilities
- 50 MHz/1 GHz calibrator calibrates all Anritsu sensors
- 50 ns to 7 s display range
- CW Meter Mode High Dynamic Range accurate CW measurements
- Preset key for common measurement set ups
- Sensor Inputs Compatible with all Anritsu MA2400A sensors
- Colour Graphical Display Displays Peak, average and crest of any signal
- Fast Rise Time Sensors Optimised for Fast Rise Time High Video bandwidth measurements
  - MA2411B 40 GHz 8 ns Rise Time
  - MA2490A/91A 8 GHz/18 GHz 18 ns Rise Time Sensors
- Sensor EEPROM
  All MA2400 Series sensors have built-in EEPROMS with factory calibration data.
  Up to 9 User Calibration Factor Tables allow on-site calibration, extra frequency points or compensation for attenuators and couplers
The ML2490A is the ideal companion for other Anritsu Test equipment such as the MG3690B series and the MG3700A series.
Features

● **1ns Settable Display Resolution**
The ML2490A has 1ns settable resolution on time based measurements from 50ns to 3.2 µs.

● **50ns minimum time display**
See and measure the detail on narrow pulse width signals.

● **8ns typical Rise time with MA2411B sensor**
The ML2490A rise time is typically 8ns with the MA2411B pulse sensor providing a fast measurement on the most demanding of radar signals.

● **65MHz Bandwidth**
The power meter mainframe has 65MHz bandwidth. Wide enough for accurate rise time measurements on radar signals or for measuring the peak signal of the latest 4G OFDM signals.

● **Two Sample modes**
For time durations up to 3.2 µs, the ML2490A series samples continuously. This can be set either automatically or the sample rate can be adjusted directly by the user.
For time durations of 50ns to 3.2µ s the power meter uses repetitive sampling to build up the trace to 1ns settable display resolution. Changeover between the two modes is automatic.

● **External Video Connector**
The ML2490A has a video connector on the rear panel as standard. The power meter can be connected to a standard CRT VGA monitor. The power meter can be located remotely in a test rack and the video screen located close to where the adjustments are taking place.

● **50MHz and 1GHz Calibration signals**
The ML2490A has 50MHz and 1GHz calibrators as standard. Frequency is automatically selected for the sensor in use.

● **Dual Display Channel**
The ML2490A supports dual display channels. Each display channel is a measurement set up and can use any selection or combination of the sensor inputs. The instrument can be configured to view one display channel or two. It can be switched between display channels quickly and simply via the Ch1/Ch2 Hard 'hot' key on the front panel. The user can also choose to view the measurement results as a graph profile or numerical readout.

● **Measurement Gates**
At the heart of the power meter's signal processing lies the measurement gate facility. The new power meter supports up to 4 independently set gates or 8 gates repeated in a pattern. The gate allows the user to capture the relevant information from the signal under test. The wide bandwidth and high speed A/D allows the positioning of the gate very accurately within the signal profile. The user can choose between several measurements performed within the gate, average, peak, crest, max and min. The max and min data are time stamped so that the position of these signals is recorded within the gate and can be used to record the overshoot and undershoot of a pulsed signal.

● **Markers**
4 independent markers are available for denoting points of interest on the signal profile. The active marker can be scrolled directly from the front panel. A delta marker can be set independently from the active marker to read the difference or the average power result. The delta marker function can be linked to provide continuous scrolling through the signal.
- **Special Marker features**
  A set of specialised automatic marker functions has been provided to ease the measurement of pulsed systems. These functions are automatic pulse rise time, pulse fall time, off time and pulse repetition interval.

- **Trigger facilities**
  High speed measurements require precise triggering therefore the trigger level can be set manually or automatically.

  **The ML2490A series offer the following trigger modes:**
  Continuous, internal trigger on the rising or falling edge of either input A or input B and external TTL trigger.

  The external trigger allows the power meter to be synchronised to external equipment. Data collection can be delayed for a pre-determined time after the trigger point. The internal trigger facility incorporates a settable frame arming facility which enables the power meter to synchronise to multi-pulse signals. A pre-trigger facility allows the capture and display of information on the signal before the trigger. The single shot trigger facility can be used to capture specific one off events with a bandwidth of 20MHz. Long duration pulses can also be measured in CW mode and the trigger sensitivity extends to <-30dBm.

- **Test Limits**
  The ML2490 series has two different types of automatic test limits. For many applications a simple power limit can be set up to test the upper and /or lower boundaries of the signal. For pulsed systems such as RADAR a time varying limit line can be set to test all aspects of the pulse profile. The power meter can be set up to indicate pass or fail and to hold the measurement display on failure which is important when trying to track down intermittent faults. An internal limit editor enables the user to create and select his or her own limit profiles.

- **Presets**
  The ML2490 offers a number of radio system presets. Each preset configures the power meter settings to measure a radio system. GSM, GPRS, WCDMA, WLAN, Bluetooth and radar are some of the examples of radio systems supported by this facility.

- **Settings stores**
  The power meter has 20 settings stores. These provide a convenient way of having application specific measurement set ups for easy recall by the user.

- **Remote Interfaces**
  The ML2490A series supports GPIB and RS 232 as standard.

- **Secure mode**
  The ML2490A series has a secure mode for operations in security sensitive areas. Once activated the secure mode wipes all information stored in the non-volatile RAM on power up.

- **CW Meter Mode**
  Functions as a dual purpose high accuracy, high dynamic range CW power meter
The high bandwidth and sample rate of the ML2490A provide accurate peak measurements on a variety of RADAR, Radio-navigation and Radio-location systems. The ML2490A series has a number of features tailored for peak power measurement on pulsed systems. With a typical 8ns rise time, and a 1ns resolution on the measurement, the ML2490A and MA2411B have the performance to look at the rising edge of radar signals.

The power meter can be easily set up to trigger on a pulse or sequence of pulses. Up to 4 independent gates can be set to measure the average, max and min powers on a sequence of pulses. The data for the max and min includes the timestamp and gives the user automatic display of the position and value of the maximum overshoot and minimum undershoot in each pulse.

A set of automatic marker functions gives pulse rise time, fall time, off time and Pulse Repetition Interval. The Delta marker can be set up to measure the droop of the pulse top.

The Trigger event display is available as either arrows on the border of the screen or as an adjustable trigger event waveform on the display.

All timings for the gates and markers are taken from the trigger event.

The offset table function corrects the power meter reading to read the true output power when the power meter is being used with a coupler or high power attenuator in the radar test system.
The ML2490A has been designed to measure the peak power of wideband OFDM systems currently under development. The display can be configured to measure Average, Peak and Crest Factor. Dithered sampling ensures accurate measurements on wideband high data rate carriers under continuous transmission.

The 65MHz mainframe bandwidth enables high accuracy peak measurements on the most demanding power envelope conditions. A preset is available to instantly set the power meter up to measure continuous OFDM.

CCDF, CDF and PDF statistical functions are supported on the OFDM measurements and enable the designers of power amplifiers to correctly estimate the margins on the peak power handling capabilities of the amplifiers.

PAE, Power Added Efficiency can be measured on the dual input ML2496A. Amplifier Bias Voltage can be entered manually or over the GPIB. Bias current can also be measured using a current probe connected directly to the power meter.
A Power Sensor for every application

Anritsu manufactures 7 different families of power sensors, where each design has been optimised for a specific application.

Power sensors are based on either thermal converters or diode detectors.

Diode power sensors are based on half or full wave diode rectifiers constructed from zero bias Schottky diodes. The rectifier output is low-pass filtered forming an envelope detector. This post detection bandwidth is sometimes referred to as the video bandwidth and is a measure of how quickly the power sensor can respond to a changing input signal such as a Radar pulse or a multi-carrier OFDM signal.

The power meter has two modes, pulsed modulated and CW. Most sensors can work in either mode. The trade off between the modes is dynamic range; increases of bandwidth are traded off for reduction in overall sensitivity.

The choice of sensor is dictated by several considerations, frequency range, dynamic range and the modulation. The rise time of the sensor should be chosen to match the rise time of the modulation.

● Pulse and Wideband Sensors:- MA2490/1A and MA2411B
The MA2490A and MA2491A sensors have been designed as dual purpose Wideband and CW sensors. These sensors have a 18ns rise time in the pulse modulated mode setting on the power meter and can be used to make average, peak and crest measurements on signals with rapid amplitude change such as WCDMA, WLAN, WiMax and Radar. These sensors have a video bandwidth of 20MHz. These sensors have a built in CW mode, there is a FET switch which chops the signal from the sensor at low power levels when CW mode is selected on the power meter.

The pulse sensor MA2411B has been specifically designed for the widest possible bandwidth. This sensor has the fastest rise time and does not contain a FET switch for low level CW applications. Use this sensor for the most demanding rising edge measurements and wideband measurements on OFDM multi-carrier signals.

● Standard Diode Sensors:- MA2470D
The MA2470D series Standard Diode Sensors have been designed for high dynamic range, high accuracy CW and TDMA measurements. The sensors have 90dB dynamic range and linearity better than 1.8% making them the choice for precision measurements. The rise time of these sensors is fast enough for power measurements on GSM and similar TDMA systems that use GMSK modulation.

● High Accuracy Diode Sensors:- MA2440D
The MA2440D series high accuracy diode sensors have a built in 3dB attenuator to minimise input VSWR. They are used where the best measurement accuracy is required over a large dynamic range, for example when measuring amplifiers. High accuracy diode sensors have a dynamic range of 87dB compared to the 90dB of standard diode sensors. In all other respects the performance of the sensors is identical to the standard diode sensor.

● Universal Power Sensors:- MA2480D
The MA2480A series universal sensors are true RMS sensors that have a dynamic range of 80dB. These sensors can be used for average power measurements on multi-tone or WCDMA signals. The sensor architecture consists of three pairs of diodes, each one configured to be working in its square law region over the dynamic range of the sensor. Anritsu's three stage approach leads to a faster measurement as the signal to noise ratio is better than earlier two diode pair architectures.

Option 01 provides TDMA measurement capability. This calibrates one of the diode pairs for linearity over a wide dynamic range.

● Fast Thermal Sensors:- MA2420D
Anristu's thermal sensors provide excellent power measurement accuracy over 50dB dynamic range with more speed than any other thermal sensor available. Thermal sensors measure the true RMS power regardless of the input waveform, so are suitable for measuring the power of a variety of continuous waveforms such as WCDMA, multi-tone signals and CW. The MA2420D series have excellent linearity and low VSWR, making them good choices for laboratory applications. The thermal power sensor includes a version without a DC block which can measure down to 100KHz.
## Sensor Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Dynamic Range (dBm (CW))</th>
<th>SWR</th>
<th>Rise Time</th>
<th>Sensor Linearity</th>
<th>RF Conn</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse Sensor</strong></td>
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</tr>
<tr>
<td>MA2471A</td>
<td>500MHz to 40GHz</td>
<td>-30dBm to +20dBm</td>
<td></td>
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<tr>
<td>MA2472D</td>
<td>10MHz to 18GHz</td>
<td>-30dBm to +20dBm</td>
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<tr>
<td>MA2473D</td>
<td>10MHz to 32GHz</td>
<td>-30dBm to +20dBm</td>
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<tr>
<td>MA2474D</td>
<td>10MHz to 40GHz</td>
<td>-30dBm to +20dBm</td>
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<tr>
<td>MA2475D</td>
<td>10MHz to 50GHz</td>
<td>-30dBm to +20dBm</td>
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<tr>
<td>Max Power Input</td>
<td>+23dBm Continuous +30dBm ±20V dc</td>
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</tr>
<tr>
<td>Temperature Accuracy</td>
<td>-2.0% to 45°C</td>
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<tr>
<td>Notes</td>
<td>Requires option 15 when used with ML2487/8A</td>
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<tr>
<td><strong>Wideband Sensors</strong></td>
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<tr>
<td>MA2421D</td>
<td>0.1 MHz to 18GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2480/01</td>
<td>Adds Fast CW mode to Universal Power sensors for high speed measurements of CW signal plus TDMA and pulse measurement</td>
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<tr>
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<tr>
<td><strong>Standard Diode Sensors</strong></td>
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<tr>
<td>MA2422D</td>
<td>10MHz to 18GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2423D</td>
<td>10MHz to 32GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2424D</td>
<td>10MHz to 40GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2425D</td>
<td>10MHz to 50GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>Max Power Input</td>
<td>+23dBm Continuous +30dBm ±20V dc</td>
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<tr>
<td>Temperature Accuracy</td>
<td>-1.0% to 45°C</td>
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<tr>
<td>Notes</td>
<td>MA2421D No DC block, response to DC. All other sensors have dc blocks</td>
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<tr>
<td><strong>High Accuracy Diode Sensors</strong></td>
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<tr>
<td>MA2442D</td>
<td>10MHz to 18GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2444D</td>
<td>10MHz to 40GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2445D</td>
<td>10MHz to 50GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>Max Power Input</td>
<td>+23dBm Continuous +30dBm ±20V dc</td>
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<tr>
<td>Temperature Accuracy</td>
<td>-1.0% to 45°C</td>
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<td></td>
</tr>
<tr>
<td>Notes</td>
<td>For linearity on MA2475D only applicable -60dBm to +20dBm 3% -60dBm to +20dBm 3% -60dBm to +20dBm 3% -60dBm to +20dBm 3% -60dBm to +20dBm 3% -60dBm to +20dBm</td>
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<tr>
<td><strong>Fast Diode Sensors</strong></td>
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<tr>
<td>MA2462D</td>
<td>10MHz to 6GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>MA2463D</td>
<td>10MHz to 18GHz</td>
<td>-60 to +20dBm</td>
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<tr>
<td>Max Power Input</td>
<td>+23dBm Continuous +30dBm ±20V dc</td>
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</tr>
<tr>
<td>Temperature Accuracy</td>
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<tr>
<td>Notes</td>
<td>Not for use on ML2430A series power meters</td>
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<tr>
<td><strong>Universal Power Sensors</strong></td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Temperature Accuracy</td>
<td>-1.0% to 35°C</td>
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</tbody>
</table>
### Specifications

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>100 kHz to 65 GHz, sensor dependant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Sensors</td>
<td>Meter compatible with all MA2400A/B/C/D Sensors</td>
</tr>
<tr>
<td>Display Measurement Range</td>
<td>-70 to +200dBm dependant upon sensor range, external coupler or attenuator</td>
</tr>
<tr>
<td>Display Resolution</td>
<td>Selectable from 0.1 to 0.001 dB in Readout Mode 0.01dB in profile mode</td>
</tr>
<tr>
<td></td>
<td>Time Axis 1ns settable resolution Pulse/Modulated Mode &lt;200ns capture time (200 points) 15μs CW Mode</td>
</tr>
<tr>
<td>Display Units</td>
<td>Linear: nW to GW,%,Volts Log: dBm, dBW, dB, dBmV, dBmV</td>
</tr>
<tr>
<td>Measurements</td>
<td>Power:-Average, Peak, Crest, Maximum, Minimum Statistics:- PDF, CDF and CCDF PAE:- Power Added Efficiency</td>
</tr>
<tr>
<td>Measurement Modes</td>
<td>Pulse/Modulated for wideband measurements CW for CW measurements Peaking Meter ±5dB range Readout/CW mode only</td>
</tr>
<tr>
<td>Measurement Display</td>
<td>Profile (Graph) for Pulse/Modulated Mode Readout (Numerical) for Pulse/Modulated and CW Display Average, Max, Min, Max and Min Measurement Hold, Max, Min Hold</td>
</tr>
</tbody>
</table>

### Power Measurement Dynamic Range

<table>
<thead>
<tr>
<th>Overall Dynamic Range</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Standard Diode Sensors</td>
<td>-70 dBm to +20 dBm CW mode -34dBm to +20dBm Pulse Modulated Mode</td>
</tr>
<tr>
<td>Wideband Sensors</td>
<td>-60 dBm to +20 dBm CW mode -30 dBm to +20 dBm Pulse Modulated Mode</td>
</tr>
<tr>
<td>Power Meter Amplifier Range</td>
<td>Pulse modulated mode dynamic range covered by 3 overlapping amplifier ranges, R7,R8 &amp; R9 CW mode dynamic range covered by 5 overlapping amplifier ranges, R1,R2,R3, R4 &amp; R5 Universal Sensor MA2481/82D ranges 1 to 6</td>
</tr>
</tbody>
</table>

#### Pulse Modulated Amplifier Dynamic Range Performance

<table>
<thead>
<tr>
<th>Range 7 Dynamic Range</th>
<th>Maximum normal nominal operational value to Bottom nominal limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2dBm to +20dBm MA2491A -6dBm to +20dBm MA2472D</td>
</tr>
<tr>
<td>Range 8 Dynamic Range</td>
<td>Maximum normal nominal operational value to Bottom limit</td>
</tr>
<tr>
<td></td>
<td>-20dBm to +10dBm MA2491A -24dBm to +6dBm MA2472D</td>
</tr>
<tr>
<td>Range 9 Dynamic Range</td>
<td>Maximum normal nominal operational value to Bottom limit</td>
</tr>
<tr>
<td></td>
<td>-30dBm to -4dBm MA2491A -34dBm to -9dBm MA2472D</td>
</tr>
</tbody>
</table>

#### Range Control

Automatic or manual. When in manual clear indication given to user (display and GPIB) of fault conditions (under or over-range)

### Power Measurement Accuracy

<table>
<thead>
<tr>
<th>Instrumentation Accuracy CW Mode</th>
<th>&lt;0.5% ±0.02 dB absolute accuracy ±0.04 dB relative accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero set CW mode (each range)</td>
<td>Equivalent Noise Power 256 Moving Average</td>
</tr>
<tr>
<td></td>
<td>MA2472D MA2491A</td>
</tr>
<tr>
<td>Range 1</td>
<td>0.5μW 2μW</td>
</tr>
<tr>
<td>Range 2</td>
<td>50nW 100nW</td>
</tr>
<tr>
<td>Range 3</td>
<td>0.5nW 2nW</td>
</tr>
<tr>
<td>Range 4</td>
<td>0.2nW 1nW</td>
</tr>
<tr>
<td>Range 5</td>
<td>50μW 0.5nW</td>
</tr>
<tr>
<td>Instrumentation Accuracy Pulse/Modulated Mode</td>
<td>&lt;0.8% Nominal range 7,8</td>
</tr>
<tr>
<td>Zero Set</td>
<td>Equivalent Noise Power</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Pulse/Modulated Mode (each range)</td>
<td>Range 7</td>
</tr>
<tr>
<td></td>
<td>Range 8</td>
</tr>
<tr>
<td></td>
<td>Range 9</td>
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</tbody>
</table>

**Bandwidth**

<table>
<thead>
<tr>
<th>Nominal Bandwidth</th>
<th>Mainframe 3dB point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse/Modulated mode</td>
<td>Repetitive Sampling</td>
</tr>
<tr>
<td>&gt;65 MHz range 7</td>
<td>&gt;38 MHz range 8</td>
</tr>
<tr>
<td>&gt;16 MHz range 9</td>
<td>One shot 20 MHz</td>
</tr>
<tr>
<td>Nominal Bandwidth</td>
<td>17 kHz range 1,2,3,4</td>
</tr>
<tr>
<td>CW mode</td>
<td>36 Hz range 5</td>
</tr>
<tr>
<td>Nominal Bandwidth with MA2411B Sensor</td>
<td>Combined B/W</td>
</tr>
<tr>
<td>MA2411B Sensor nominal Bandwidth</td>
<td>&gt;39 MHz range 7</td>
</tr>
<tr>
<td>50MHz</td>
<td>&gt;29 MHz range 8</td>
</tr>
<tr>
<td>&gt;12 MHz range 9</td>
<td>Rise Time with MA2411B sensor</td>
</tr>
<tr>
<td>10% to 90% at +10dBm</td>
<td>Typical 8ns</td>
</tr>
<tr>
<td>System Rise Time</td>
<td>Maximum 12ns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rise Time Measurement Dynamic Range</th>
<th>The ML249XA will be able to functionally measure 10% to 90% rise times over the following dynamic range with the MA2491A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overshoot Pulsed Modulated Mode</td>
<td>&lt;= 3% in linear power at +10dBm</td>
</tr>
</tbody>
</table>

**Sampling**

<table>
<thead>
<tr>
<th>Sampling Modes</th>
<th>Random Repetitive Sample Mode (display set to 200 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50ns-3.2μs Trigger Capture (Display) time</td>
</tr>
<tr>
<td></td>
<td>Continuous Sampling Mode (display set to 200 points)</td>
</tr>
<tr>
<td></td>
<td>3.2μs-7μs Trigger Capture (Display) time</td>
</tr>
<tr>
<td></td>
<td>Automatic selection, with current mode indicated on display.</td>
</tr>
<tr>
<td></td>
<td>Conflicts between setting selected and other instrument setting are indicated through user warnings (displayed and GPIB)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling Rate</th>
<th>62.5 MS/s pulse/modulated mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75 kS/s in CW mode</td>
</tr>
<tr>
<td></td>
<td>Manual Setting (Pulse Modulated mode only)</td>
</tr>
<tr>
<td></td>
<td>62.5 MS/s to 30.5 kS/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Rate Clock Accuracy</th>
<th>± 100ppm</th>
</tr>
</thead>
</table>

**Time Display**

<table>
<thead>
<tr>
<th>Trigger Capture Time</th>
<th>50 ns to 7s</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Settable Time Measurement Resolution</th>
<th>Trigger capture time 50ns to 3.2μs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger Time Resolution Uncertainty</td>
<td>±2ns or display resolution, whichever is the larger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trigger Time Resolution Uncertainty</th>
<th>±16ns or display resolution whichever is the larger</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Trigger Capture Time settable Resolution</th>
<th>Display points = 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ns or 0.5% of trigger capture time, which ever is the larger.</td>
<td></td>
</tr>
<tr>
<td>Display Points = 400</td>
<td></td>
</tr>
<tr>
<td>1ns or 0.25% of trigger capture time (400points), which ever is the larger.</td>
<td></td>
</tr>
</tbody>
</table>
### Triggering

<table>
<thead>
<tr>
<th><strong>Trigger Sources</strong></th>
<th><strong>Signal Triggers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous (not in Random Repetitive Sampling mode)</td>
<td></td>
</tr>
<tr>
<td>Internal, External TTL</td>
<td></td>
</tr>
<tr>
<td>Rising or falling Edge</td>
<td></td>
</tr>
<tr>
<td><strong>Remote Bus Triggers</strong> (TR1,TR2,TR3)</td>
<td></td>
</tr>
<tr>
<td>GPIB or external Bus</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Arming Sources</strong></th>
<th><strong>Repetitive Sampling Modes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Frame for QAM and multi-pulse</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Continuous Sampling Mode</strong></th>
<th>Single Automatic Frame for QAM and multi-pulse</th>
</tr>
</thead>
</table>

| **Frame Arming Time Range** | 0 to 64 x trigger capture time range or 120μs whichever is the greater. |

<table>
<thead>
<tr>
<th><strong>Trigger Modes</strong></th>
<th>Manual Single power value set to cover entire measurement dynamic range of sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auto</strong></td>
<td>Automatically sets trigger level for signal over measurement dynamic range</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Internal Trigger Dynamic Range</strong></th>
<th>-18 dBm to +14 dBm with MA2491A in Pulse/Modulated mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-30 dBm to +10 dBm with MA2472D in Pulse/Modulated mode</td>
</tr>
<tr>
<td></td>
<td>-28 dBm to +10 dBm with MA2472D in CW mode</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Internal Trigger Settable Resolution</strong></th>
<th>0.1dB</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Nominal Internal Trigger Bandwidth</strong></th>
<th>Variable-auto set and manual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20MHz, 2MHz, 200KHz, 20KHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>External Trigger Maximum Trigger Rate</strong></th>
<th>10 MHz minimum</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger / Display Capture Range</strong></th>
<th>50 ns to 7s</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger Capture Settable Resolution</strong></th>
<th>Display points = 200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1ns or 0.5% of trigger capture time, which ever is the larger.</td>
</tr>
<tr>
<td></td>
<td>Display Points = 400</td>
</tr>
<tr>
<td></td>
<td>1ns or 0.25% of trigger capture time (400points), which ever is the larger.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger Delay Range</strong></th>
<th>Pulse Modulated Mode Pretrigger (-ve): 95% of the Trigger Capture range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Post Trigger: Set by 256K buffer and sample rate</td>
</tr>
<tr>
<td></td>
<td>CW mode Post Trigger Only: 0-999ms depending on Trigger Capture period setting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger Delay Settable Resolution</strong></th>
<th>Display points = 200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1ns or 0.5% of trigger capture time, which ever is the larger.</td>
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<tr>
<td></td>
<td>Display Points = 400</td>
</tr>
<tr>
<td></td>
<td>1ns or 0.25% of trigger capture time (400points), which ever is the larger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger Delay Uncertainty</strong></th>
<th>+/-2ns for pre and post trigger Trigger capture time set to 50ns.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trigger latency (20MHz trigger BW)</strong></td>
<td>+/-15ns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Trigger point waveform displayed on screen</strong></th>
<th>Trigger point depicted by trigger edge waveform. Edge represents trigger point of signal. Display position of trigger edge waveform adjustable.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Power Reference</strong></th>
<th><strong>ML2480A-15 specification</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard in ML2495/6A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Output Power</strong></th>
<th>1.00 mW Traceable to National standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>50MHz Frequency Accuracy</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>50MHz VSWR</td>
<td>1.12</td>
</tr>
<tr>
<td>50MHz Output Power Accuracy</td>
<td>±1.2% per year, 0.9% RSS Traceable to National Standards</td>
</tr>
<tr>
<td>1GHz Frequency Accuracy</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>1GHz VSWR</td>
<td>1.2</td>
</tr>
<tr>
<td>1GHz Output Power Accuracy</td>
<td>±1.2% per year, 0.9% RSS Traceable to National Standards</td>
</tr>
</tbody>
</table>

| **Connector** | Type N female |
## Sensor/Channel Control

| Limit Lines | Simple pass fail for CW  
| Complex limits for pulsed and TDMA systems  
| Limits can be stored in the instrument  |
| Markers | 4 Markers and 1 Delta Marker  
| Marker to Max/Min  
| Pulse Rise Time  
| Pulse Fall Time  
| Pulse Width  
| Off Period  
| Pulse Repetition Interval  |
| Gates | 4 Independently set Gates or 8 repeated Gates  
| 1 Fence per Measurement Gate  
| Gate Measurement supports Average, Peak, Crest, Max and Min  |

## System Configuration

| Display | LCD, Colour 1/4 VGA  |
| Save /Recall | 20 settings stores  
| Preset accessible on Front Panel  
| Offset tables  |
| Secure Mode | Wipes non-volatile memory on power up when active  |

### Interfaces

| GPIB Speed  
| CW Mode | >400 Readings/second  
| TR3 mode  |
| GPIB speed Pulse Modulated Mode  
| Continuous Sampling | >350 Readings/second  
| 1µs pulse, readout mode, Display turned off  
| TR3 Mode  |
| GPIB speed Pulse Modulated Mode  
| Profile data | 200 points per sweep:-Binary Float Output  
| 5µs Trigger Capture Time  
| >10 profile transfers/sec  |
| GPIB speed Pulse Modulated Mode  
| Repetitive sampling | >20 Readings/sec  
| 50ns pulse, readout mode, Display turned off  
| TR3 Mode  |
| GPIB Compatibility | Back Compatible with ML2480A products. All equivalent functionality supported, and uses identical GPIB commands. Additional functionality added.  |
| RS232 | 1200,2400,4800,9600,19200,38400,57600 Baud rates supported  |
| External Video Display | CRT VGA Compatible timing output, display size is 1/4 of VGA screen size  |

### BNC I/O Rear Panel

| V/GHz | Can be configured for  
| Cal factor correction from synthesiser  
| Ext Voltage Voltmeter  
| Connection: current probe for PAE applications  |
| External Trigger | External TTL trigger Input. Maximum Trigger frequency 10MHz  |
| Output 1 | Can be configured for  
| Analog Output  
| Pass/Fail TTL o/p Limits  
| Levelling:- Sensor Input A  |
| Output 2 | Can be configured for  
| Analog Output  
| Pass/Fail TTL o/p Limits  
| Levelling:- Sensor Input B  
| Trigger Output  |

## General Specifications

| General | MIL-128800F, Class 3  |
| Operating Temperature Range | 0 to 50°C, Mainframe only. See sensor specification for performance of sensors.  |
| Storage Temperature Range | -40 to 70°C  |
| Power Requirements | AC 90V to 250V  
| 47 to 440Hz  |
| EMC and Safety | Complies with requirements for CE marking  
| EN 61326  
| EN61010-1  |
| Non Volatile RAM Battery Type | Lithium  |
| Non Volatile RAM Battery Life | 5 years  |
| Warranty | 1 year standard  
| 3 year optional  |
| Dimensions | Width 213mm (8.39 inches)  
| Height 88mm (3.46 inches)  
| Depth 390mm (9.84 inches)  |
| Weight | 3kg  |
ML2430A Series
Power Meters Ideal for CW applications

The ML2430A Series Power Meters combine the advantages of thermal meter accuracy, diode meter speed and peak power meter display graphics.

The result is a single instrument that samples at more than 35k per second and achieves 90 dB dynamic range with a single sensor.

The ML2430A Series includes graphics display capability as a standard feature. The ruggedised housing and optional high-capacity NiMH battery bring laboratory quality accuracy to field service applications.

Accessories

ML2419A Range Calibrator
Reduce annual calibration expense with Anritsu’s precision range calibrators.

The ML2419A Range Calibrator verifies the ML2400A Series Power Meter’s measurement channels.

The meter’s 50 MHz Oscillator level is verified by comparison method. When the calibrator is connected, user operation prompts appear on the meter’s screen.

Soft Carry Case
The soft carry case protects the power meter and has pockets for all common accessories making it the ideal carry bag for field use.

50MHz Reference Oscillator
When power sensors must be located a long distance from the power meter, the MA2418A Reference Oscillator provides a remote, traceable 0dBm power reference.

MA2418A is DC powered from a 16 to 24 volt jack plug.

Bail Arm & Protective Front Cover
A bail arm is available as a convenient carry handle and is suitable for angling the meter on a workbench.
**Accessories**

**Power Attenuators**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Rating</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>42N50-20</td>
<td>DC - 18 GHz</td>
<td>20 dB, 5W, 50 ohm</td>
<td>N male to N female</td>
</tr>
<tr>
<td>42N50-30</td>
<td>DC - 18 GHz</td>
<td>30 dB, 50W, 50 ohm</td>
<td>N male to N female</td>
</tr>
<tr>
<td>42KC-20</td>
<td>DC - 40 GHz</td>
<td>20 dB, 50W, 50 ohm</td>
<td>K male to K female</td>
</tr>
</tbody>
</table>

**Precision Coaxial Adapters**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Rating</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>510-90</td>
<td>DC - 3.3 GHz</td>
<td>N male to 7/16 DIN female</td>
<td>K male to K female</td>
</tr>
<tr>
<td>510-91</td>
<td>DC - 3.3 GHz</td>
<td>N female to 7/16 DIN male</td>
<td>K male to K female</td>
</tr>
<tr>
<td>510-92</td>
<td>DC - 3.3 GHz</td>
<td>N male to 7/16 DIN male</td>
<td>V male to V female</td>
</tr>
<tr>
<td>510-93</td>
<td>DC - 3.3 GHz</td>
<td>N female to 7/16 DIN male</td>
<td>V male to V female</td>
</tr>
<tr>
<td>K220B</td>
<td>DC - 40 GHz</td>
<td>K male to K male</td>
<td>K male to K female</td>
</tr>
<tr>
<td>K222B</td>
<td>DC - 40 GHz</td>
<td>K female to K female</td>
<td>K male to K female</td>
</tr>
</tbody>
</table>

**Precision Waveguide to Coaxial Adapters**

Contact your local Anritsu sales office for details of our range of precision waveguide to coaxial adapters.

Please see back page for your local Anritsu representative, or email:

info@eu.anritsu.com

**Coaxial Adapters**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1091-26</td>
<td>DC to 18 GHz</td>
<td>N male to SMA male</td>
</tr>
<tr>
<td>1091-27</td>
<td>DC to 18 GHz</td>
<td>N male to SMA female</td>
</tr>
<tr>
<td>1091-80</td>
<td>DC to 18 GHz</td>
<td>N female to SMA male</td>
</tr>
<tr>
<td>1091-81</td>
<td>DC to 18 GHz</td>
<td>N female to SMA female</td>
</tr>
</tbody>
</table>

**Ordering Information**

**Models**

ML2495A Power Meter, Single Input
ML2496A Power Meter, Dual Input

**Included Accessories**

Power Cord for Destination
One 1.5m sensor cord per meter input
Operation Manual
GPIB Manual
Certificate of calibration, also included with sensors

**Options and Accessories**

ML2400A-01 Rack Mount, single unit
ML2400A-03 Rack Mount, side by side
ML2400A-05 Front Bail Handle
ML2490A-06 Rear Mount input A
ML2490A-07 Rear Input A and Reference
ML2490A-08 Rear Mount inputs A,B and Reference
ML2490A-09 Rear Mount Inputs A and B
ML2400A-12 Front Panel Cover
ML2400A-20 Spare 1.5m Sensor Cable
ML2400A-21 0.3m Sensor Cable

ML2490A-33 Extra Operating Manual
ML2490A-34 Extra Programming Manual
ML2490A-37 Electronic Manuals-Deletes paper version from shipment
ML2490A-98 Premium Cal to Z540 ISO guide 25
ML2490A-99 Service Cal to Z540 ISO guide 25
ML200-209 Hardside Transit Case
D41310 Soft Carry Case with Shoulder Strap
MA2418A 50MHz Reference Oscillator with Power Supply
MA2497A Agilent 8480 series sensor adapter
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Fax: +886-2-8751-1817

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