

6800 MINI OPERATIONS MANUAL

TMR 11/01/01

<u>HARD KEYS</u>	<u>SOFT KEYS</u>	<u>FUNCTION</u>
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THE SOURCE, USING IT AS A SEPARATE INSTRUMENT

Connect cable from source output to spectrum analyzer input.

- | | | |
|------------------|------------------------|---|
| 1. PRESET | | Brings up preset soft key display |
| 2. | FULL | Resets instrument to factory defaults |
| 3. SOURCE ON/OFF | | Turns on RF source output (Signal at middle of screen) |
| 3. SOURCE | | Displays source soft keys |
| | SET FREQ | Enables setting of the frequency (Change to 3 GHz
Note: second harmonic is in the noise.) |
| | SET OUTPUT LEVEL | Enables setting of Source Level (Change to -10 dBm) |
| 4. | MORE | Displays source soft keys |
| 5. | ENTER SOURCE ONLY MODE | Displays a screen for setting up the source |
| 6. | EXIT SOURCE MODE ONLY | Returns to the spectrum analyzer display |

SPECTRUM ANALYZER, USING IT AS A SEPARATE INSTRUMENT

Continuing from setup above.

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|----------------------|------------------------|--|
| 1. SPECTRUM ANALYZER | | Brings up S/A soft keys |
| 2. | AUTO TUNE | Will tune to the 3 GHz signal and span down to fill the screen |
| 2. | MORE | Brings up soft key screen |
| 3. | COUPLED RES BW | Uncouples RBW setting |
| 4. | SET RES BW | Use the up/down keys to select a RBW (1 KHz to 3 MHz) |
| 5. MARKERS | | Displays marker screen Listed below are only the marker highlights. |
| 6. | PEAK SEARCH FUNCTIONS | Displays peak search functions |
| 7. | IDENTIFY PEAKS | Will place 8 marker on the 8 top peaks and add a marker table to the bottom of the screen (can be relative or absolute) |
| 8. | REMOVE MKR TABLE | Removes the marker table and 7 markers |
| 9. | MKR FUNCTIONS | Displays marker function soft key |
| 10. | FREQUENCY COUNTER | Turns on frequency counter (Counter counts the frequency at the marker using the RBW as a filter) |
| 11. | MORE | Displays marker soft keys |
| 12. | LARGE READOUT | Increases the size of the level reading for easy viewing |
| 13. | LARGE READOUT | Toggles the large readout off |
| 14. | PLACE MKR AT ACTIVE | Places a marker at the active marker |
| 15. | POSITION ACTIVE MARKER | Places marker at a specific frequency |
| 16. | RETURN TO PRIOR MENU | |
| 17. SOURCE | | Displays source soft keys |
| 18. | TRACKING GENERATOR | Turns the source into a tracking generator (NOTE: you may have to go to SCALE/FORMAT and then SET LEVEL and use the ARROW KEYS to bring |

19.

the trace on the screen OR **SET OUTPUT POWER**
to **-10 dBm (-10 ENTER)**)

SETTING UP A RETURN LOSS, INSERTION LOSS, AND FAULT LOCATION MEASUREMENT, FOR A CABLE, USING THE FAULT LOCATOR TEST HEAD

- | | | |
|--------------------------|----------------------------|---|
| 1. <u>PRESET</u> | | Displays preset soft keys |
| 2. | <u>FULL</u> | Presets instrument to factory defaults |
| 3. <u>SCALAR</u> | | Displays scalar initiation soft keys |
| 4. | <u>YES</u> | Initiates scalar preset |
| 5. <u>SOURCE</u> | | Displays source soft keys |
| 6. | <u>SET START FREQUENCY</u> | Enter Start Frequency (800 MZ) |
| 7. | <u>SET STOP FREQUENCY</u> | Enter stop frequency (900 MZ) |
| 8. <u>RF ON/OFF</u> | | Turns on RF source |
| 9. <u>CAL</u> | | Displays calibration soft keys |
| 10. | <u>SHORT AND OPEN CAL</u> | Selects short and open process (will turn on RF if not already on.) |
| 11. <u>CONNECT SHORT</u> | | Dialogue box instructs you to connect short to test port of Fault Locator |
| 12. | <u>CONTINUE</u> | Continues the calibration process |
| 13. <u>CONNECT OPEN</u> | | Dialogue box instructs you to connect short to test port of Fault Locator |
| 14. | <u>CONTINUE</u> | Concludes the calibration process |
| 15. <u>MARKER</u> | | Displays marker soft keys |
| 16. | <u>MARKER FUNCTIONS</u> | Displays marker functions soft keys |
| 17. | <u>MARKER MAX/MIN</u> | Displays marker max/min soft keys |
| 18. | <u>MARKER TO MAX</u> | Moves marker to maximum point on the trace |

CONNECT LOAD TO CHECK SETUP AND CALIBRATION – MARKER SHOULD READ <- 35 dB AT 1 GHz

TO ADD INSERTION LOSS TO THE SCREEN: CONNECT SCALAR DETECTOR TO RF OUTPUT OF FAULT LOCATOR AND INPUT “C”

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|---------------------------------|-------------------------|--|
| 15. <u>DISPLAY</u> | | Displays display soft keys |
| 16. | <u>CHANNEL 1 MEAS 2</u> | Turns on Channel 2 |
| 17. <u>SCALAR</u> | | Displays scalar soft keys |
| 18. | <u>INPUT SELECTION</u> | Displays input soft keys |
| 19. | <u>“C”</u> | Selects “C” input |
| 20. <u>CAL</u> | | Displays calibration soft keys |
| 21. | <u>THROUGH CAL</u> | Selects a through path calibration |
| 22. <u>CONNECT THROUGH PATH</u> | | Dialog box instructs you to connect scalar detector to test port of fault locator. |
| 23. | <u>CONTINUE</u> | Concludes the calibration process |

TO ADD FAULT LOCATION TO THE SCREEN:

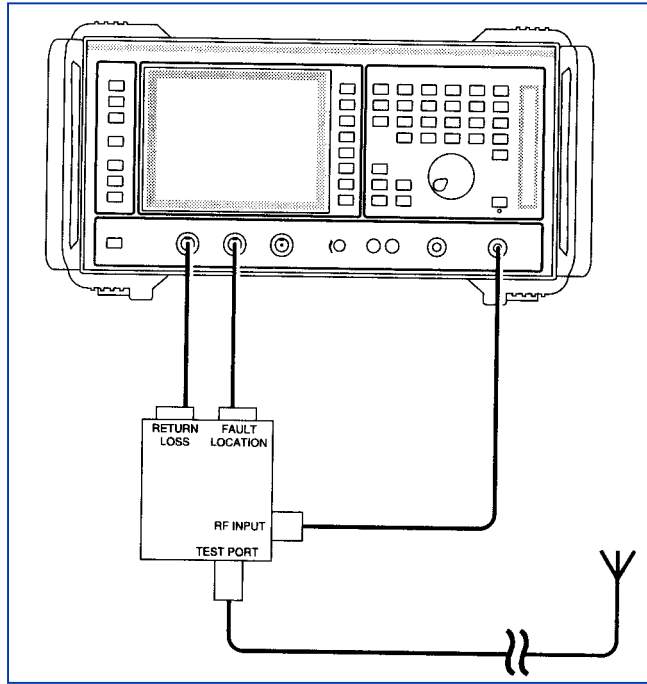
- | | | |
|----------------------------------|--------------------|---|
| 24. <u>SWITCH CHANNEL</u> | | Selects channel 2 |
| 25. <u>FAULT LOCATION</u> | | Selects fault location measurement |
| 25. | <u>YES</u> | Confirms fault location setup |
| 26. <u>CONFIGURE MEASUREMENT</u> | | Displays fault location setup table |
| 27. | <u>ENTRY MODE</u> | Select entry mode |
| 28. | <u>RANGE</u> | Select Range / Frequency |
| 29. | <u>ENTER RANGE</u> | Enter cable length NOTE: enter a length that is 25% longer to prevent aliasing (cable measuring shorter |

29.	CENTRE FREQUENCY	than it is). Enter center frequency NOTE: Table will select the best center if it does not like what you enter.
22.	<u>DISPLAY UNITS</u>	Select units desired.
22.	<u>FEET</u>	Selects feet
22.	<u>NUMBER OF POINTS</u>	Select resolution desired for trace
22.	<u>312 ENTER</u>	Table will select it for you if you do not make an entry (suggest 312 to 401).
22.	<u>RELATIVE VELOCITY</u>	Enter relative velocity desired
22.	<u>0.88 ENTER</u>	Enter .01 to 99. Number is provided by cable manufacturer. Good cable with a diameter of 1 7/8 will generally be 0.88 or a little better 0.91
22.	<u>ATTENUATION (/FT)</u>	Enter attenuation desired
22.	<u>.0123 / ENTER</u>	Enter attenuation /foot. Number is provided by cable manufacturer, generally in dB / 100 feet. Generally good cable will be 1.5 or less per 100 feet.
22.	<u>RETURN TO FAULT LOC</u>	Displays fault location soft keys
25. <u>CAL</u>	<u>FAULT LOCATION CAL</u>	Displays fault location calibration soft keys Selects fault location calibration
26.	<u>CONNECT LOAD</u>	Dialogue box instructs you to connect t the load to the fault locator test port
26.	<u>CONTINUE</u>	Concludes fault location calibration.
22.	<u>SCALE/FORMAT</u>	Displays scaling and format soft keys
22.	<u>SET FORMAT</u>	Select format VSWR. Fault location displays faults better in the VSWR mode since it is a linear display.
22.	<u>SET SCALE</u>	Enter scale or just use knob or up/down keys to fill display with the trace.
<u>CONNECT CABLE UNDER TEST TO FAULT LOCATOR TEST PORT AND THE SCALAR DETECTOR TO THE OTHER END OF THE CABLE.</u>		

TO DISPLAY ALL 3 TRACES ON THE SCREEN AT ONCE:

27.	<u>DISPLAY</u>	Displays display soft keys
28.	<u>DUAL CHANNEL DISPLAY</u>	Selects dual channel display. Will display return loss and insertion loss traces in the top window and the fault location trace in the bottom window. All will be live.

SETUP FOR RETURN LOSS, INSERTION LOSS, AND FAULT LOCATION MEASUREMENT FOR CABLE.



CONVERSION GAIN AND GROUP DELAY OF A DOWN – CONVERTER USING THE TUNED INPUT MODE

Note: IT IS EASIER TO SET UP THE INSTRUMENT WITH THE DEVICE UNDER TEST CONNECTED AND GET A VALID DISPLAY, BEFORE CALIBRATING THE SETUP.

The example uses a 6840 series instrument to measure the conversion gain of a down-converter, which has an integral 1.7 GHz local oscillator. The device operates over an input frequency range of 2.2 GHz \pm 50 MHz and the down-converted output is 500 MHz \pm 50 MHz with a gain of approximately 20 dB. The down-converted output is passed through an internal bandpass filter to select the appropriate sideband (input frequency - LO frequency). The instrument's source provides the RF input signal for the down-converter under test. The measurement setup is shown below.

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|-----|---------------------------------------|---|
| 1. | <u>PRESET</u> | To preset the instrument to a factory defaults |
| 2. | <u>Full</u> | Sets the instrument to its factory default |
| 3. | <u>SCALAR</u> | To change channel 1 to scalar mode |
| 4. | <u>Yes</u> | Changes channel 1 to scalar mode |
| 5. | <u>SOURCE ON</u> | Turns on RF, Light will be illuminated |
| 6. | <u>INPUT SELECT</u> | To select input |
| 7. | <u>Tuned Input</u> | To change to tuned input soft keys |
| 8. | <u>Tuned Input</u> | To select tuned input (NOTE: this is where you would change resolution bandwidth in tuned input mode) |
| 9. | <u>Return to Input Sel</u> | Returns to input select soft keys |
| 10. | <u>Return to Scalar</u> | Returns To scalar soft keys |
| 11. | <u>Conversion Measurements</u> | Will bring up frequency converter menu screen |

SETUP FOR DEMO FREQ CONVERTER

- | | | |
|-----|---------------------------------|---|
| 12. | <u>Mixer Meas Set-up</u> | Displays |
| 13. | <u>Down converter</u> | Selects the device to be tested as a down converter
Display the Mixer Measurement Set-up form and specify that the measurement is to be performed on a down-converter. |
| 14. | <u>Down Arrow</u> | |
| 15. | <u>Output Frequency</u> | Enter output frequency (500 MHz) (Whenever a value is entered for the input start or stop frequency, frequency/span the other (output) will be set automatically so that the frequency span is the same as that of the output start and stop.) |
| 16. | <u>Down Arrow</u> | |
| 17. | <u>Center/Span</u> | Enter Frequency span (100 MHz) |
| | <u>Down Arrow</u> | |
| 18. | <u>Gain of Device</u> | No need to enter a gain for the demo converter.
Note: instrument must have -30 dBm input to measure group delay |
| 19. | <u>LO Frequency</u> | Enter LO frequency of device (1.7 GHz) Whenever a value is entered for the input start or stop frequency, frequency/span the output will be set automatically so that the frequency span is the same as that of the output start and stop frequencies. (Note: Generally whenever a trace is not on the screen a wrong LO frequency has been entered.) |

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|-----|----------------------------|--|
| 20. | <u>Upper</u> | Selects the sideband to test |
| 21. | <u>Input level</u> | Activates the Input Level field. This parameter is set to ensure that the source does not overload the down-converter input; in this example the DUT requires an input of about -10 dBm. |
| 22. | Return to Conv Meas | Returns to the Conversion Meas menu. |

CHECK TO SEE IF THE TRACE ON THE SCREEN IS SIMILAR TO THE EXPECTED TRACE (PICTURED BELOW). IF NOT LO FREQUENCY IS GENERALLY WRONG. IF YOU USE THE CHANNEL SWITCH AND SET UP CHANNEL (2) AS A SPECTRUM ANALYZER YOU CAN THEN USE THE S/A TO LOOK AT THE LO AND USE THE S/A COUNTER MODE TO MEASURE IT. THEN USE THE NEW NUMBER AS THE LO FREQUENCY.

TO CALIBRATE, DISCONNECT THE FREQUENCY CONVERTER AND CONNECT A CABLE FROM THE RF OUTPUT TO THE SPECTRUM ANALYZER INPUT FOR CALIBRATION

- | | | |
|-----|--------------------|---|
| 23. | CAL | Displays the calibration soft keys |
| 24. | Through Cal | Calibrates with a through path calibration |
| 25. | Continue | Calibrates the instrument. Turns on the RF power and initiates a through path cal, and automatically applies the path cal data to the measurement. Two options are available when performing a through calibration for a measurement on a frequency conversion device. The first is to perform the calibration with the spectrum analyzer receiver set to the range required for the measurement; the source frequency range is moved to cover the output range that the spectrum analyzer receiver would expect to see if the DUT were present (i.e. the displayed range). This is the default and is the option that would normally be used (as in this example). The alternative method is to leave the source and re-tune the receiver to the source frequency range during calibration; this option is selected using the <i>[Source Freq Range]</i> soft key. Now connect the down-converter between the source output and the spectrum analyzer input, using the cables used during calibration: |

CONNECT THE FREQUENCY CONVERTER AS THE DUT

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|-----|---------------------|---------------------------------------|
| 26. | SCALE/FORMAT | Select appropriate scaling and format |
| 27. | Autoscaling | Selects Auto scaling menu |
| 28. | Autoscale | Auto scales display |

IF NOT SATISFIED WITH THE DISPLAY USE THE SCALE, REFERENCE POSITIONS AND REFERENCE LEVEL TO RE POSITION THE TRACE.

TO USE THE MARKERS TO DETERMIN THE -3 dB BANDWIDTH OF THE FREQUENCY CONVERTER'S OUTPUT

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|-------------------|------------------------------|--|
| 29. MARKER | | |
| 30. | Active Mkr to Maximum | Moves marker to peak level |
| 31. | Mkr Functions | More marker functions |
| 32. | Bandwidth | Band width search functions |
| 33. | Set n dB Value | Factory default is -3 dB. Press to change it. (-10 |

- | | | |
|-----|------------------------------|---|
| 34. | Bandwidth Search | Enter for units)
Will automatically measure and show results of -3 dB bandwidth and center frequency |
| 35. | Remove Results window | Will remove results display from screen |

TO ADD A GROUP DELAY MEASUREMENT TO THE SAME SCREEN

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|----|------------------------------|--------------------------------|
| 1. | <u>DISPLAY</u> | Displays, Display soft keys |
| 2. | <u>Channel Meas 2</u> | Selects Measurement 2 |
| 3. | <u>SCALAR</u> | Displays Scalar soft keys |
| 4. | <u>Group Delay</u> | Displays Group Delay soft keys |
| 5. | <u>Group Delay</u> | Selects Group Delay |

CONNECT A CABLE FROM THE SOURCE PORT TO THE SPECTRUM ANALYZER PORT

- | | | |
|----|---------------------------|-------------------------------------|
| 6. | <u>CAL</u> | Displays Calibration soft keys |
| 7. | <u>Through Cal</u> | Selects calibration for Group Delay |
| 8. | <u>Continue</u> | Completes calibration |

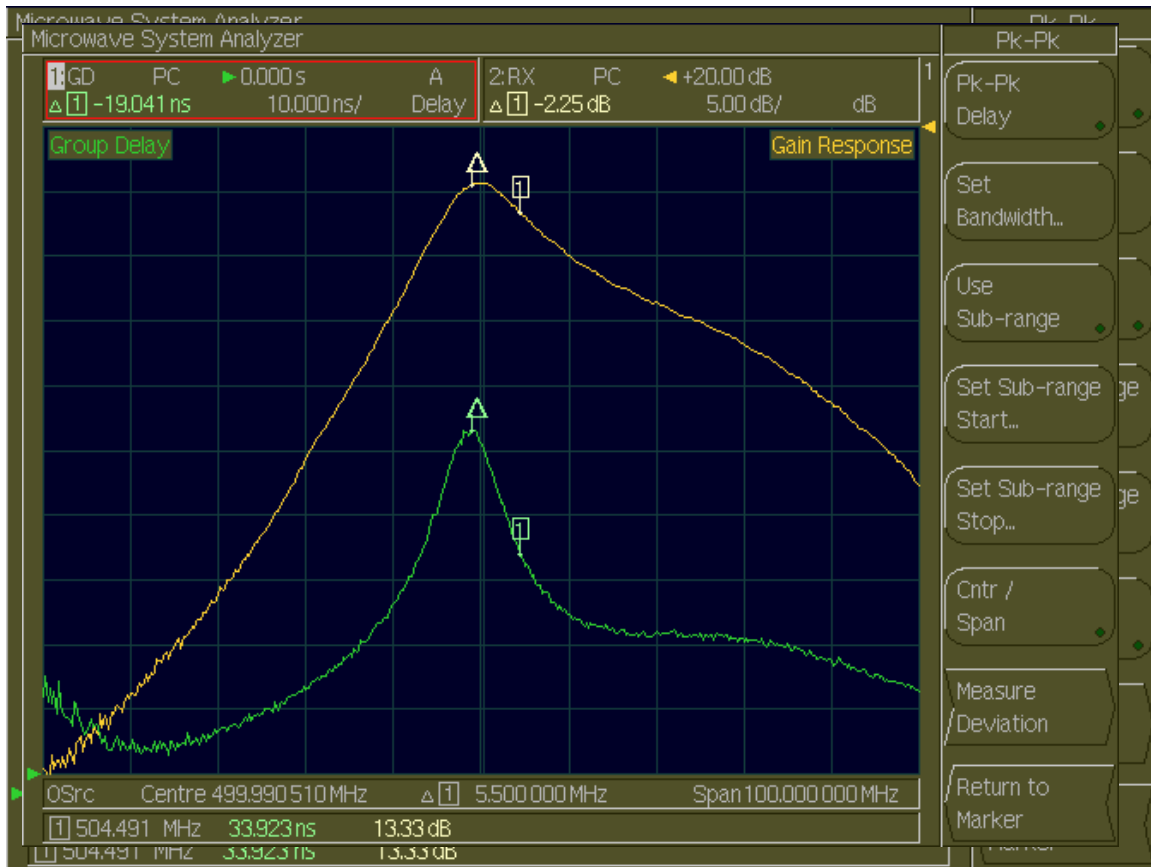
CONNECT THE DEVICE UNDER TEST BETWEEN THE SOURCE AND S/A PORT

- | | | |
|-----|-------------------------------------|---|
| 9. | <u>SCALE/FORMAT</u> | Displays Scale and Format soft keys |
| 10. | <u>Set Scale..</u> | Use arrow keys to select required scale (2 nSec) |
| 11. | <u>MARKERS</u> | Displays Marker soft keys |
| 12. | <u>PK-PK</u> | Displays Peak to Peak soft keys |
| 13. | <u>PK-PK Delay</u> | Selects Peak to Peak Group Delay reading |
| 14. | <u>Set Bandwidth</u> | Set bandwidth to the width of the band pass of the device under test (OR) |
| 15. | <u>Use Sub-range</u> | Selects the use of a Sub-range for PK-PK reading |
| 16. | <u>Set Sub-range Start..</u> | Use the knob to set the Sub-range Start Flag to the beginning of the flat area of the group delay trace |
| 17. | <u>Set Sub-range Stop..</u> | Use the knob to set the Sub-range Stop Flag to the end of the flat area of the group delay trace |

THE MARKERS WILL THEN MEASURE THE PEAK TO PEAK DELAY OF THE AREA BETWEEN THE FLAGS

- | | | |
|----------------------|------------------------------------|--|
| 18. | <u>Measure Deviation</u> | Measures deviation from linear |
| <u>Linear</u> | Measures the greatest peak to peak | change in the selected bandwidth |
| 19. | <u>Parabolic</u> | Measures the greatest rate of change in the selected bandwidth |

BIT MAP OF FREQUENCY CONVERTER BAND PASS AND GROUP DELAY MEASUREMENT



BIT MAP IS OF DEMO FREQUENCY CONVERTER

TESTING FILTER BANDWIDTH AND GROUP DELAY USING THE TUNED PORT

- | | | |
|----|-------------------------------|---|
| 1. | <u>PRESET</u> | Brings up preset soft key display |
| 2. | <u>Full</u> | Resets instrument to factory defaults |
| 3. | <u>SCALAR</u> | |
| 4. | <u>Yes</u> | Changes instrument from S/A to Scalar |
| 5. | <u>Input Selection</u> | Displays input to be measured |
| 6. | <u>Tuned Input</u> | Displays tuned port input soft keys (S/A Port) |
| 7. | <u>Tuned Input</u> | Selects Tuned Port input (S/A Port) |
| 8. | <u>SOURCE</u> | |
| 9. | <u>Set Start Freq</u> | Press the hard key numbers and a G, H, K, or Enter key to execute the start frequency (8.5 GHz) |
| 9. | <u>Set Stop Freq</u> | Press the hard key numbers and a G, H, K, or Enter key to execute the stop frequency (9.5 GHz) |

CONNECT A CABLE FROM THE SOURCE PORT TO THE SPECTRUM ANALYZER PORT

- | | | |
|-----|---------------------------|----------------------------------|
| 10. | <u>CAL</u> | |
| 11. | <u>Through Cal</u> | Make through connection as above |
| 12. | <u>Continue</u> | Press continue to calibrate |

TEST SET WILL THEN BE READY TO LOOK AT THE THROUGH PASS OF THE FILTER

- | | | |
|-----|-------------------------------------|--|
| 13. | <u>MARKER</u> | Displays marker soft keys |
| 14. | <u>Active Marker to Max</u> | Takes active marker to peak on trace |
| 15. | <u>Marker Functions</u> | Displays marker functions |
| 16. | <u>Bandwidth</u> | Displays bandwidth soft keys |
| 17. | <u>Bandwidth Search</u> | Measures bandwidth at -3 dB default value |
| 18. | <u>Remove Results Window</u> | Will remove bandwidth information off the screen |

DECREASE THE RESOLUTION BANDWIDTH FOR BETTER VIEWING OF THE FILTER SKIRTS

- | | | |
|-----|-------------------------------|--|
| 19. | <u>SCALAR</u> | Displays scalar soft keys |
| 20. | <u>Input Selection</u> | Displays input selection soft keys |
| 21. | <u>Tuned Input</u> | Displays Tuned Input soft keys |
| 22. | <u>Set Res BW..</u> | Use arrow keys to select RBW required (3 MHz to 1 KHz) |

TO ADD A GROUP DELAY MEASUREMENT TO THE SAME SCREEN

- | | | |
|----|------------------------------|--------------------------------|
| 1. | <u>DISPLAY</u> | Displays, Display soft keys |
| 2. | <u>Channel Meas 2</u> | Selects Measurement 2 |
| 3. | <u>SCALAR</u> | Displays Scalar soft keys |
| 4. | <u>GROUP DELAY</u> | Displays Group Delay soft keys |
| 5. | <u>GROUP DELAY</u> | Selects Group Delay |

CONNECT A CABLE FROM THE SOURCE PORT TO THE SPECTRUM ANALYZER PORT

- | | | |
|----|---------------------------|-------------------------------------|
| 6. | <u>CAL</u> | Displays Calibration soft keys |
| 7. | <u>THROUGH CAL</u> | Selects calibration for Group Delay |
| 8. | <u>CONTINUE</u> | Completes calibration |

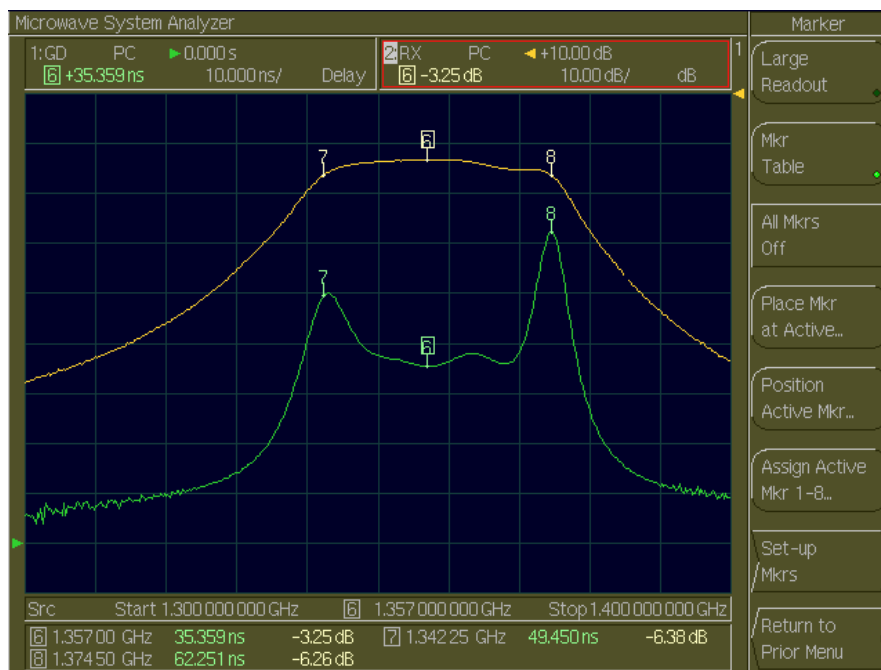
CONNECT THE DEVICE UNDER TEST BETWEEN THE SOURCE AND S/A PORT

- | | | |
|-----|-----------------------------------|---|
| 9. | <u>SCALE/FORMAT</u> | Displays Scale and Format soft keys |
| 10. | <u>SET SCALE</u> | Use arrow keys to select required scale (2 nSec) |
| 11. | <u>MARKERS</u> | Displays Marker soft keys |
| 12. | <u>PK-PK</u> | Displays Peak to Peak soft keys |
| 13. | <u>PK-PK DELAY</u> | Selects Peak to Peak Group Delay reading |
| 14. | <u>SET BANDWIDTH</u> | Set bandwidth to the width of the band pass of the device under test (OR) |
| 15. | <u>USE SUB RANGE</u> | Selects the use of a Sub-range for PK-PK reading |
| 16. | <u>SET SUB-RANGE START</u> | Use the knob to set the Sub-range Start Flag to the beginning of the flat area of the group delay trace |
| 17. | <u>SET SUB-RANGE STOP</u> | Use the knob to set the Sub-range Stop Flag to the end of the flat area of the group delay trace |

THE MARKERS WILL THEN MEASURE THE PEAK TO PEAK DELAY OF THE AREA BETWEEN THE FLAGS

- | | | |
|-----|--|---|
| 18. | <u>MEASURE DEVIATION
LINEAR</u> | Measures deviation from linear
Measures the greatest peak to peak change in the selected bandwidth |
| 19. | <u>PARABOLIC</u> | Measures the greatest rate of change in the selected bandwidth |

The above setup for band pass and group delay traces of the included 9 GHz filter, display should look similar to the picture below.

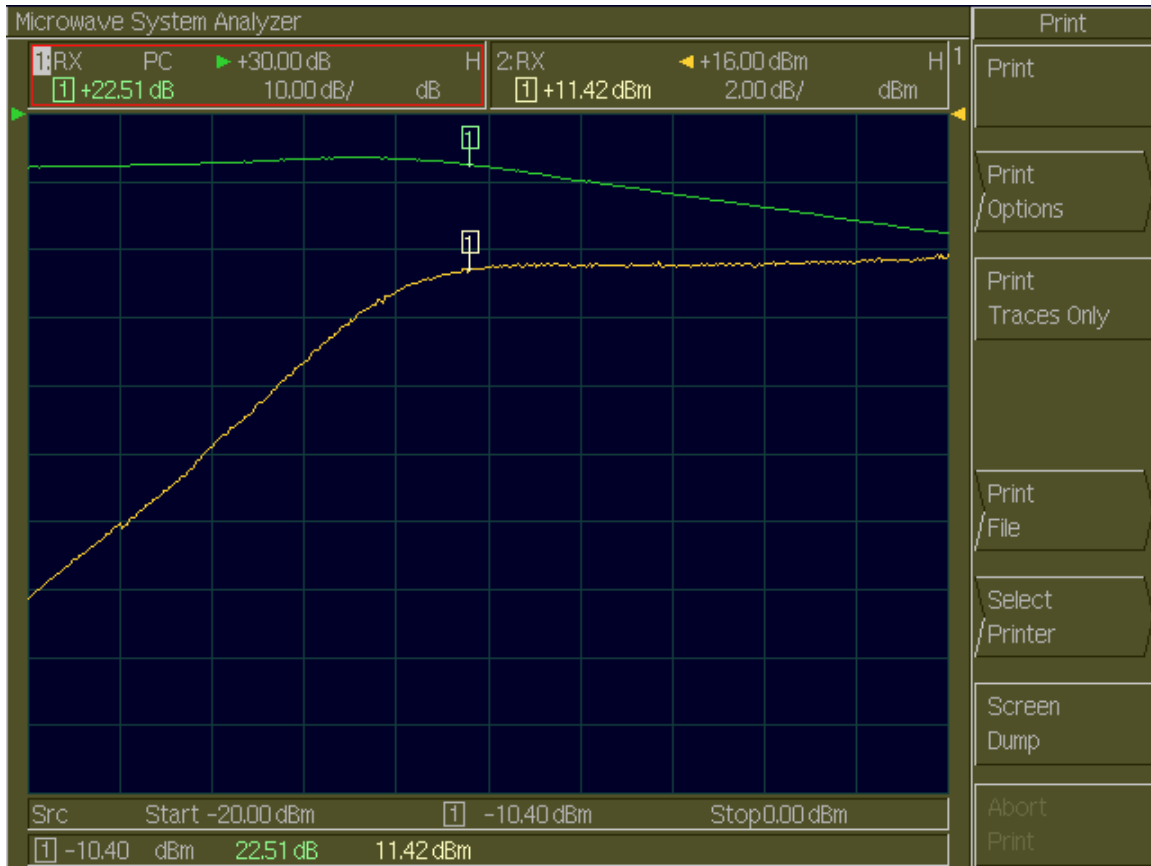


The difference will be the green trace (trace 1, channel 1) will be insertion loss and the yellow trace will be the group delay trace. The trace shapes should look similar.

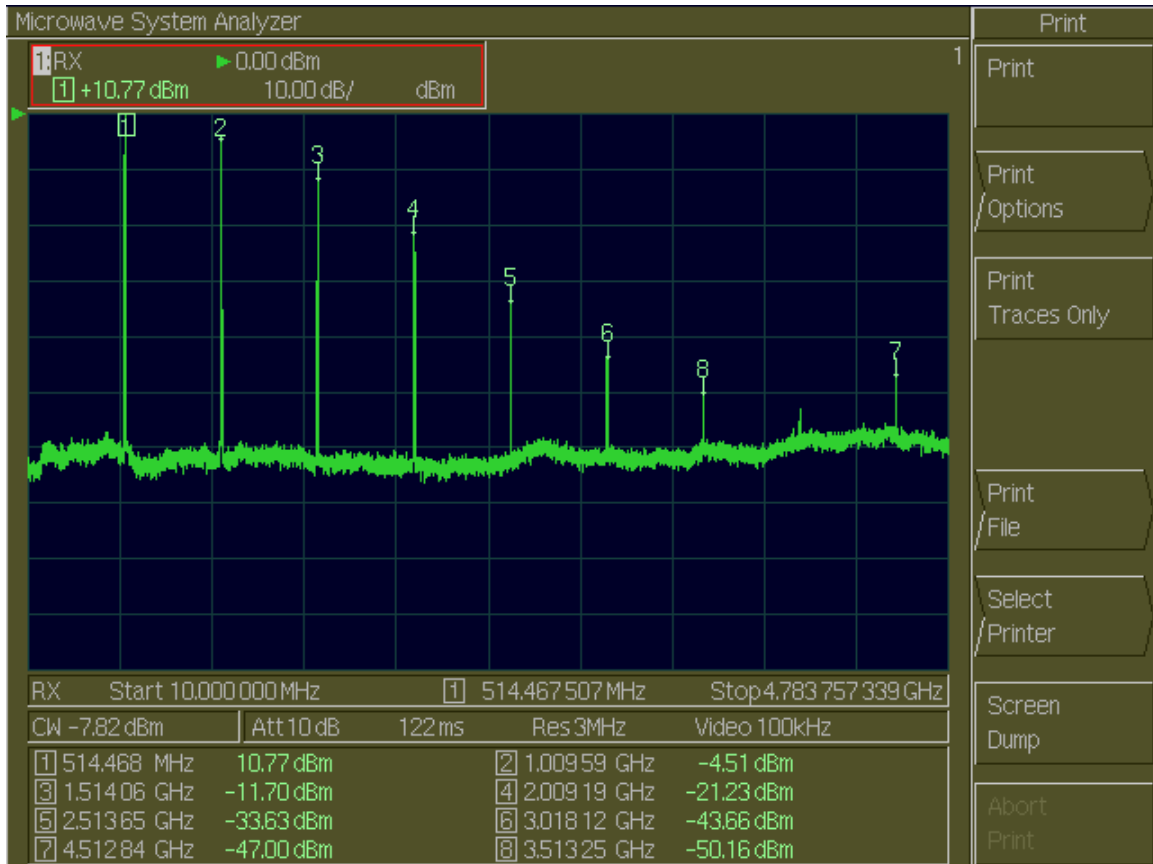
NARROW BAND VIEW OF A FILTER



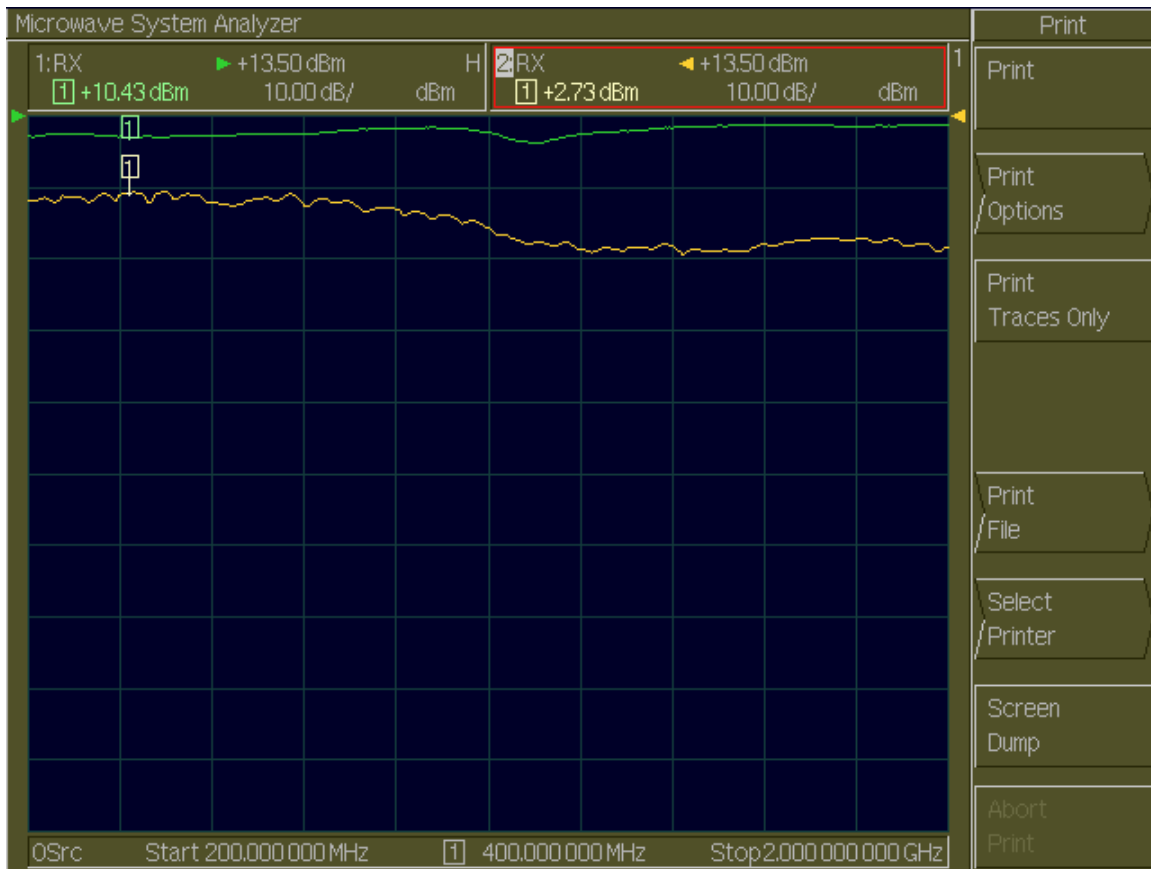
TESTING AMPLIFIERS FOR GAIN, COMPRESSION, HARMONICS, AND HARMONIC SWEEPS USING THE TUNED PORT



Gain and Compression measurements are a simple set up. The display shows the 1 dB Compression point as -10.40 dBm, the Gain is 22.51 dB, and the actual output power is 11.51 dBm.



Harmonics can be evaluated using the Spectrum Analyzer with the source set at an independent frequency and level. The harmonic content of the source is better than -55 dBc.



The Green trace is a trace on hold showing the amplifier output level from 100 MHz to 1 GHz. The Yellow trace shows the level of the second harmonic. The source is swept from 100 MHz to 1 GHz and the spectrum analyzer looks at 200 MHz to 2 GHz. The scale can be easily changed in the Converter Measurement Advances Setup Screen.