

RWC2500A Modulation Analyzer

Operating Manual



Version 1.00
(FW Version 1.00)

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1 General Information

This chapter covers instrument Specifications, Key Features and Safety Consideration.

- 1.1 Warranty
- 1.2 Safety Considerations
- 1.3 General Information
- 1.4 Power Requirement
- 1.5 Operating Environment

1.1 Warranty

RedwoodComm Warrants that this product will be free from defects in materials and workmanship for a period of two(2) years from the date of shipment. During the warranty period, RedwoodComm Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, customers must notify RedwoodComm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customers shall be responsible for packaging and shipping the defective product to the service center designated by RedwoodComm. Customers shall prepay shipping charge to RedwoodComm designated service center and RedwoodComm shall pay shipping charge to return the product to customer. Customer is responsible for all shipping charges including freight, taxes, and any other charge if the product is returned for service to RedwoodComm, if the customer is located outside of Korea.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate malignance by buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, accident or abnormal conditions of operations.

RedwoodComm responsibility to repair or replace deductive products is the sole and exclusive remedy provided to the customer for breach of this warranty. RedwoodComm will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether RedwoodComm has advance notice of the possibility of such damages

1.2 Safety Considerations

Review the following safety precautions to avoid injury and prevent damage to this product or any product connected to it.

1.2.1 Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is specified beyond the range.

Ground the Product

This product is grounded through the grounding conductor of the power cord. In case no ground is available at

the power outlet, it is recommended to provide a separate grounding path to the instrument by connecting wire between the instrument ground terminal and an earth ground to avoid electric shock or instrument damage.

Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or product damage, do not operate this product with protective covers removed.

Do Not Operate in Wet/Damp Conditions

To avoid injury or fire hazard, do not operate this product in wet or damp conditions.

Do not use in a manner not specified by the manufacturer

1.2.2 Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified. Main supply voltage fluctuations not to exceed $\pm 10\%$ of the nominal voltage.

Provided Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If there is damage to this product, have it inspected by qualified service personnel.

Environmental Conditions

Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the flat is not level. Also, do not use it where the ambient temperature is outside 5 °C to 40 °C, and altitude is more than 2000m. The maximum relative humidity is 80% for temperatures up to 31 °C decreasing linearity to 50% relative humidity at 40 °C. Over voltage Installation Category II for mains supply. Pollution Degree 2

1.2.3 Safety Symbols and Terms

Symbols on the Product : The following symbols may appear on the product



Close



Open



ATTENTION



**Indicates earth
(ground) terminal**

WARNING

Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION

Caution statements identify conditions or practices that could result in damage to this product or other property.

1.3 General Information

The RWC2500A is an advanced instrument specifically designed to offer valuable functionalities for analyzing and measuring FM/AM modulation characteristics with great precision. Its exceptionally low oscillator tolerance and high Signal-to-Noise Ratio (SNR) enable it to accurately measure broadcast transmission signals. This equipment offers remarkable performance as a monitoring device for broadcasters' quantitative analysis values, including transmission level, frequency error, FM deviation, and pilot level of FM broadcasting signals. Furthermore, it can provide MPX power and peak deviation measurements in line with the ITU-R SM.1268-1 standard. Its user-friendly touch screen function makes it incredibly easy to select the desired demodulation method or switch to the desired screen, further enhancing its usability.

1.3.1 Key Feature

- High SNR measurement: > 80dB
- Left-Right Audio Isolation: > 70dB
- Very Low oscillator tolerance 1ppb
- FM/AM signal analysis and measurement
- RF and MPX spectrum measurement
- FM deviation distribution analysis
- Integrated audio analyzer (optional)
- Audio spectrum and waveform measurement
- Stereo crosstalk measurement and frequency response measurement
- Reference audio signal output and demodulated audio output
- Modulation and audio measurement data logger

1.3.2 Specification

Input Frequency

- AM: 500kHz - 30MHz
- FM: 76 - 108MHz
- Resolution: 1Hz

Input Power Level

- 30dBm ~ -30dBm

Measurement

- Power Measurement Error : < Typ. 0.5dB
- Frequency Measurement Error: <200Hz @100MHz
- Audio Frequency Resolution: down to 1Hz

Oscillator

- Stability of 10MHz OSC: < 1.0ppb, aging of < 1x10⁻⁹/day
- Low Noise Local Oscillator: < Typ. -130dBc @1GHz

1.3.3 Interface

RF signal Input

- 1 N type (50 Ohm)

Demodulated Audio Output Port

- Balanced: 2 XLR (50 Ohm, 600 Ohm)
- Unbalanced: 2 BNC (75 Ohm)
- Digital: 1 BNC (AES/EBU)

Reference Audio Out Port (optional)

- Balanced: 2 XLR (Left, Right, High-Z)
- Unbalanced: 2 BNC (Left, Right, High-Z)
- Digital: 1 BNC (AES/EBU)

10MHz Reference Clock Port

- Input: 1 BNC (50 Ohm)
- Output: 1 BNC (50 Ohm)

Digital IO

- LAN : RJ45
- USB-C : RS-232(VCOM)

1.3.4 Miscellaneous

- Display: 5" Graphic LCD (800x480, touch enabled)
- Operating temperature: 5 ~ 40°C
- Line Voltage: 100 to 240 VAC, 50/60Hz
- Dimensions: 250(w) x 110(h) x 348(d) mm
- Weight: 5kg

1.4 Power Requirement

This Tester is a portable instrument and requires no physical installation other than connection to a power source.

| Items | Specifications |
|-------------------|--------------------------------|
| Provider | Mean Well Enterprise Co., Ltd. |
| Model | LRS-75-12, 72W |
| Input voltage | 100 VAC - 240 VAC |
| Input current | 1.52A |
| Frequency | 50/60 Hz |
| Power Consumption | Less than 20 watt |

CAUTION: If AC power is beyond the range of operation, the equipment may malfunction or could be permanently damaged. Main supply voltage fluctuations should be not to exceed $\pm 10\%$ of the nominal voltage.

1.5 Operating Environment

Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the flat is not level. Also, do not use it where the ambient temperature is outside 5 °C to 40 °C, and altitude is more than 2000m.

The maximum relative humidity is 80% for temperatures up to 31 °C decreasing linearity to 50% relative humidity at 40 °C. Over voltage Installation Category II for mains supply. Pollution Degree 2.

The storage temperature range for this equipment is -20 °C to 70 °C. When this equipment is not used for a long period of time, store it in a dry place away from direct sunlight, covered with vinyl or placed in a cardboard box.

2. Basic Operation

This section describes the basic concepts and details of operating RWC2500A Digital Radio Tester. Understanding the basic concepts of your RWC2500A helps you use it effectively.

- 2.1 Front Panel View
- 2.2 Rear Panel View
- 2.3 Basic Operation
- 2.4 Display Screen
- 2.5 Ethernet Connection Method
- 2.6 Firmware Upgrade
- 2.7 Management of Report Files
- 2.8 Exporting Report Files
- 2.9 Save/Recall

2.1 Front Panel View

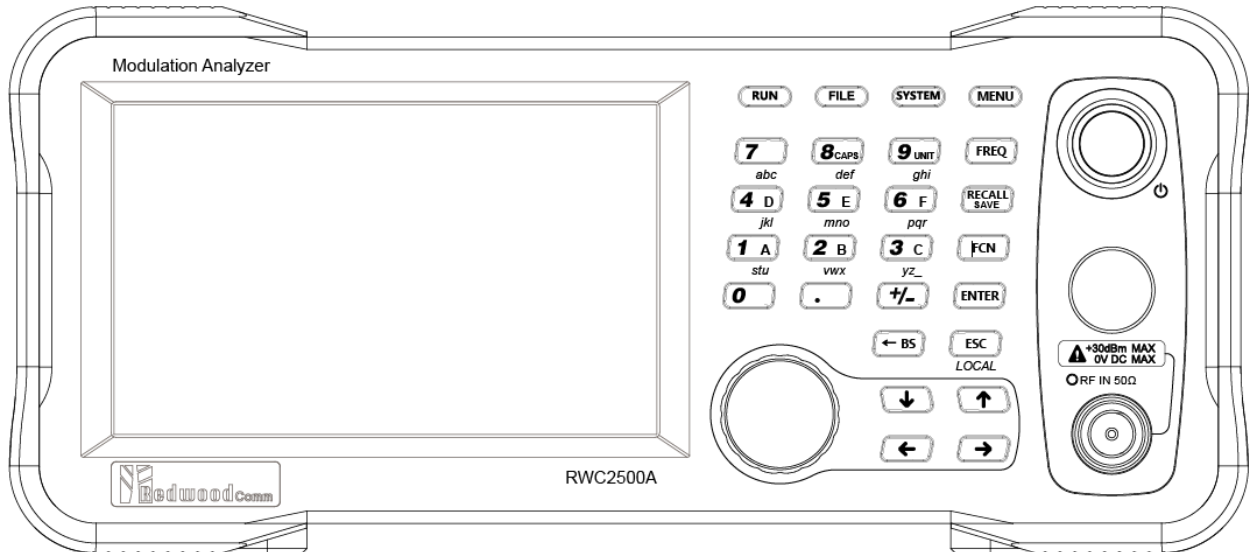


Fig. RWC2500A Front Panel View

2.1.1 Basic Key Function

- | | |
|---------------------------------|---|
| 1. LCD Display and touch sensor | |
| 2. 0 - 9, ., +/- | Number input, dot, plus/minus, Hexadecimal input key with FCN |
| 3. RUN | Shortcut key for RUN toggle |
| 4. FILE | Shortcut key for file manager and report config |
| 5. SYSTEM | Shortcut key for system setup |
| 6. MENU | Main menu selection key |
| 7. Power switch | |
| 8. FREQ | Shortcut key for modifying the RX frequency |
| 9. RECALL/SAVE | Shortcut key for modifying the Recall/Save function key with FCN |
| 10. FCN | Function key for secondary function with another key |
| 11. ENTER | Key for selecting a function, or entering values |
| 12. ESC | Key for canceling a function, or values |
| 13. RF Connector | |
| 14. ← BS | Backspace key for deleting a character |
| 15. ↑ ↓ → ← | Keys for moving the cursor |
| 16. Rotary knob | Cursor move, value change at data input mode / Pushing ENTER function |

2.1.2 Selection of Secondary Function

1. Combinational key functions with the blue colored FCN key.
2. FCN + FREQ (= RECALL) Recall one of the stored instrument settings
3. FCN + POWER (= SAVE) Store the current instrument settings into memory
4. FCN + 8 (= CAPS) Upper case input mode
5. FCN + 1 (= A) Hexadecimal A value
6. FCN + 2 (= B) Hexadecimal B value
7. FCN + 3 (= C) Hexadecimal C value
8. FCN + 4 (= D) Hexadecimal D value
9. FCN + 5 (= E) Hexadecimal E value
10. FCN + 6 (= F) Hexadecimal F value

2.2 Rear Panel View

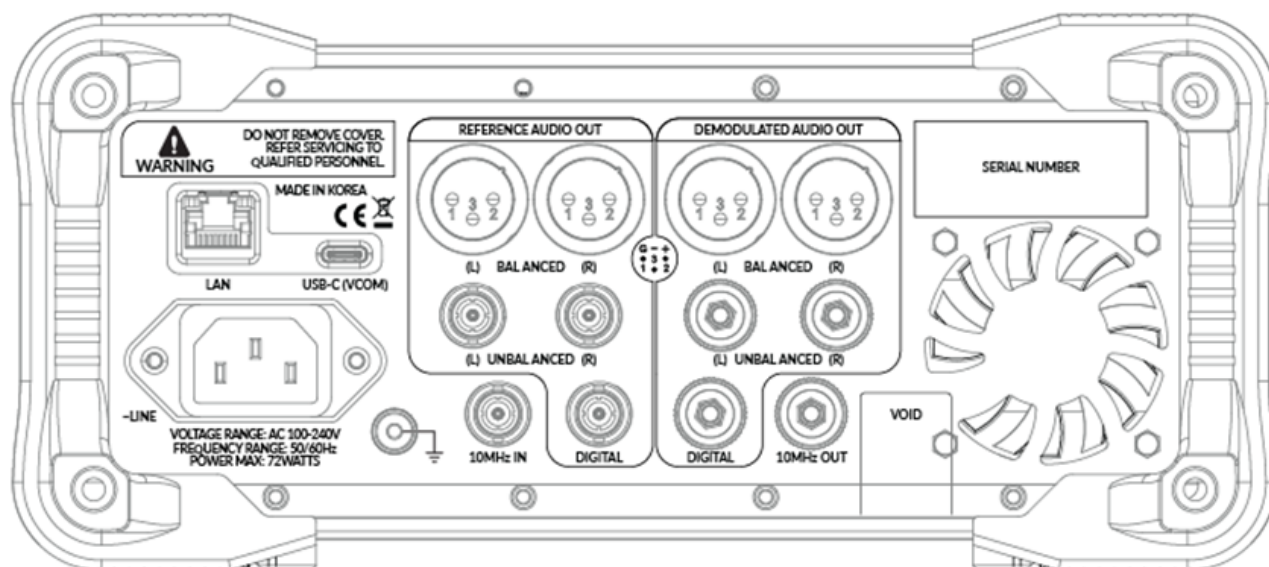


Fig. RWC2500A Rear Panel View

- | | |
|---|----------------------------|
| 1. LAN | Ethernet Interface (RJ45) |
| 2. USB-C(VCOM) | VCOM Interface(USB-C type) |
| 3. -LINE | 100V - 240V AC Power input |
| 4. GROUND | Ground port |
| 5. Reference Audio Balanced Out Left | 600 Ohm or 8 Ohm (XLR) |
| 6. Reference Audio Balanced Out Right | 600 Ohm or 8 Ohm (XLR) |
| 7. Reference Audio UnBalanced Out Left | 75 Ohm (BNC) |
| 8. Reference Audio Balanced Out Right | 75 Ohm (BNC) |
| 9. Reference Audio Digital Out | AES/EBU, 110 Ohm(BNC) |
| 5. Demodulation Audio Balanced Out Left | 600 Ohm or 8 Ohm (XLR) |

| | |
|---|-----------------------------------|
| 6. Demodulation Audio Balanced Out Right | 600 Ohm or 8 Ohm (XLR) |
| 7. Demodulation Audio UnBalanced Out Left | 75 Ohm (BNC) |
| 8. Demodulation Audio Balanced Out Right | 75 Ohm (BNC) |
| 9. Demodulation Audio Digital Out | AES/EBU, 110 Ohm(BNC) |
| 15. REF In | 10MHz reference signal input(BNC) |
| 16. REF Out | 10MHz reference signal Out(BNC) |

2.3 Basic Operation

2.3.1 Main Menu Selection

RWC2500A Modulation analyzer has two analyzer modes such as FM and AM and each mode can be selected by the MENU key. The following figure shows the main mode selection screen. Select a function using the rotary key and press the **ENTER** key.

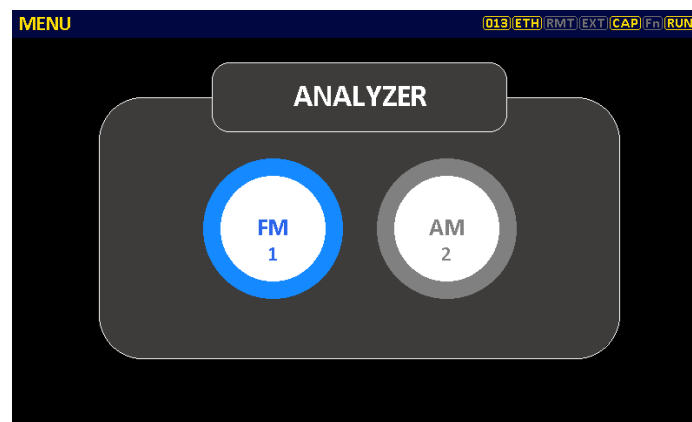


Fig. Screen to select analyzer mode

2.3.2 Rotary Knob

The Rotary Knob moves the cursor to every field on the screen that can be changed. By positioning the cursor in front of a field and pushing the knob to select that field, you can alter that field's setting.

2.3.3 Data Input and Modify

Move the cursor to the desired input field using rotary knob, arrow keys, or screen touching. With rotary knob or keys, push the rotary knob or **ENTER** key for data input mode. The cursor indicates data input position. If there are only two alternatives, push the rotary knob or **ENTER** key to toggle the data. Push Rotary knob to enter data and then the new data is

entered. While entering the data, if you press **ESC** or **BS** key, the input data shall be canceled or deleted.

2.3.4 Touch Screen Input

Touch screen allows you to instantly access and alter instrument settings without using the Rotary knob or keying. You can edit parameters or jump to other screens or functions by touching the LCD screen.

2.3.5 Edit String

To edit the string of parameters, move the cursor to the Label parameter and set it to input mode by pushing the rotary knob or **ENTER** key. Input cursor will be placed at the end of the string. Push the number key repeatedly, the number and characters are displayed repeatedly. When the desired number or character is displayed, please wait until the cursor is moved to the next position.

2.4 Display Screen

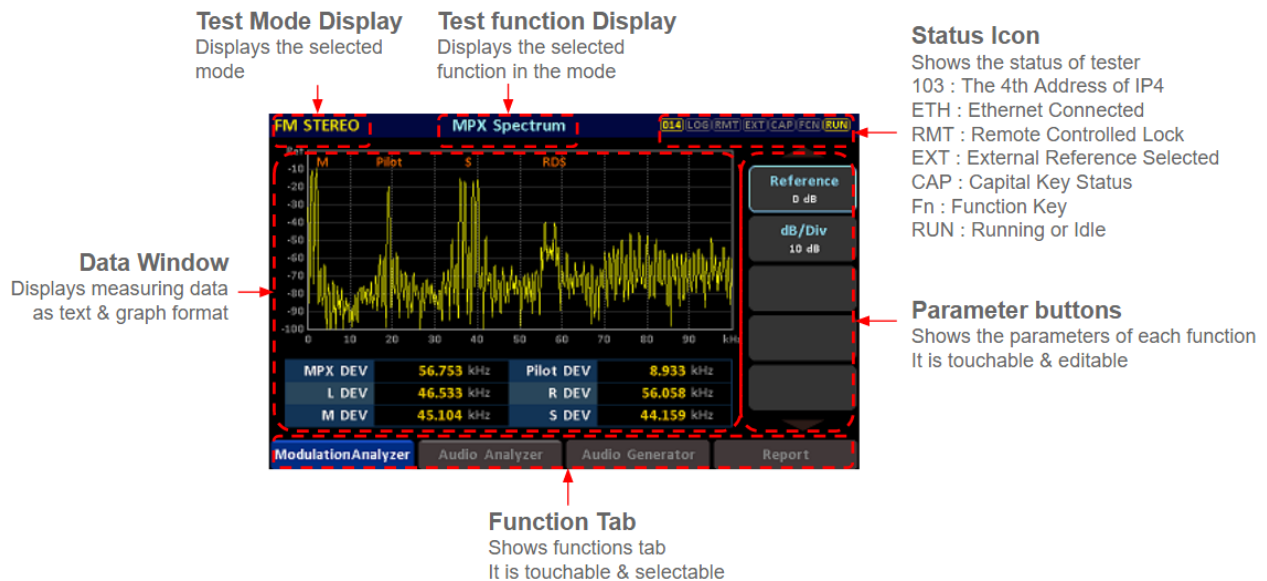


Fig. Information of the Equipment Screen

2.5 Ethernet Connection Method

For upgrading, downloading contents files, or remote controlling, RWC2500A should be connected to PC through Ethernet.

- Connect LAN port of PC and RWC2500A Ethernet port by RJ45 cable. If the PC and RWC2500A are connected directly, a crossover cable may be used.
- Turn RWC2500A power ON, go to the 'SYSTEM/SETUP' screen and check the "IP_ADDR" value. Please be sure that the "IP_ADDR" value should be different from the PC's IP Address.

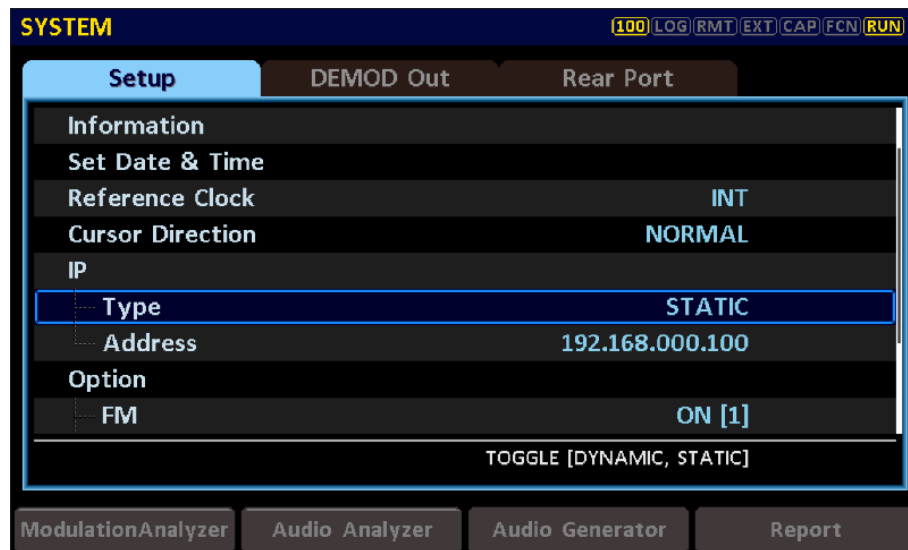


Fig. Screen for setup Remote Port and IP address

- Set up the IP address as follows to use crossover cable.

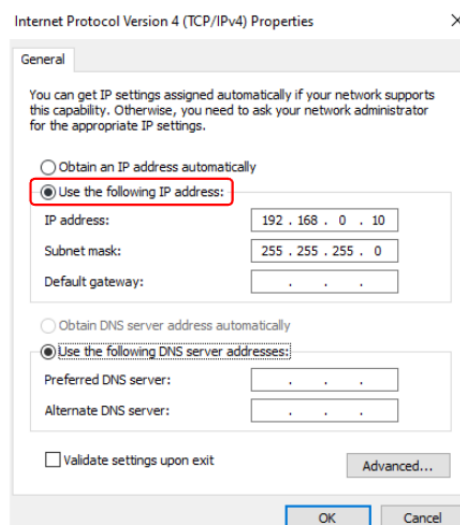


Fig. How to set up the static IP address of PC with Window OS

- Execute one of RWC2500A Application programs on the PC. If there is no application program, please download it from the Web site.
- Set up the IP address same as the RWC2500A's IP address.

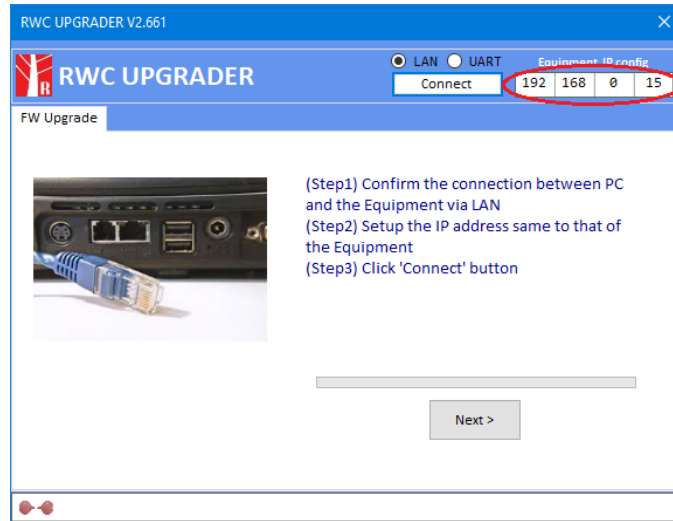


Fig. RWC2500A Application Program

- If the IP setting and connection is done successfully, there will be a "Connected" icon displayed in the left bottom of screen. If there is no "Connected" icon, please try again step 1~5.

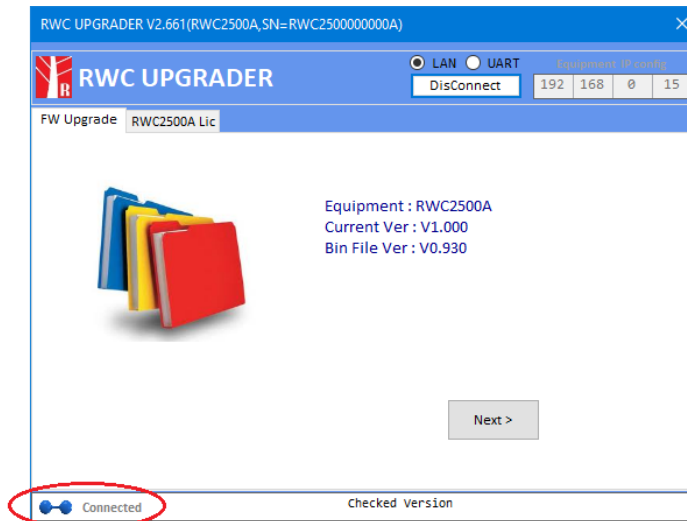


Fig. RWC2500A Application Program

2.6 Firmware Upgrade

As RWC2500A adapted Flash Memory, it is available to upgrade easily by using the PC without changing the Hardware. For upgrading, RWC2500A Application Program shall be used. The program is available to download the upgrade data from RedwoodComm Website or provide it via email. The information for upgrading shall be kept in providing to the user via email or website.

2.6.1 RWC2500A Firmware Upgrade Sequence

- Setup Ethernet connection between RW2500A and PC. Please refer to Clause 2.5 for Ethernet connection.
- Execute "RWC_upgrader.exe" file.
- Press the NEXT button to start Downloading.
- While upgrading, the proceeding status shall be displayed on the RWC2500A GUI screen.
- If Upgrading is completed, the RWC2500A must be rebooted manually. Go to the 'SYSTEM/SETUP' screen to check the new Firmware version.

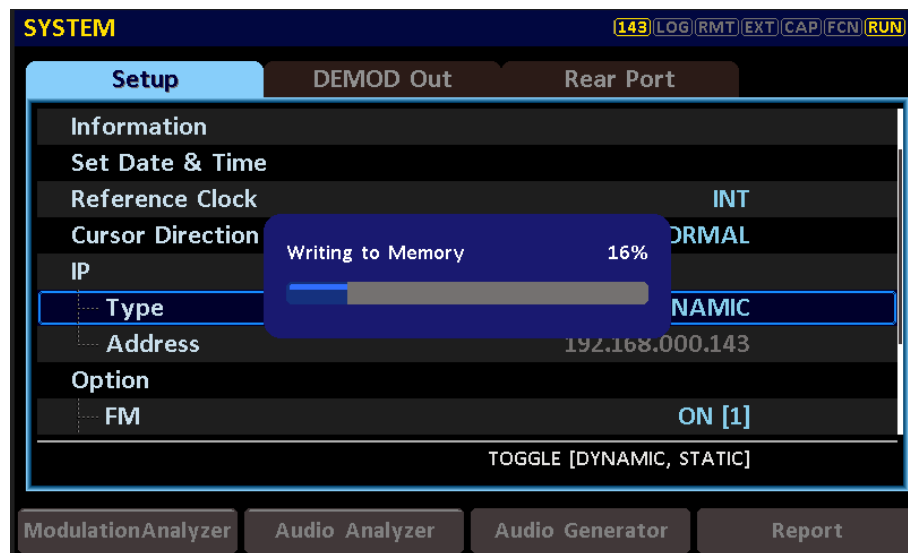


Fig. Upgrade status screen while upgrading

■ **CAUTION:** If upgrading fails, repeat the upgrading in Emergency Upgrade Mode. Refer to Emergency Upgrade for detail.

2.6.2 Emergency Firmware Upgrade Sequence

- Failing of Normal Upgrading can affect or disable RWC2500A. In this case, the RWC2500A will be booted in Emergency Upgrade mode.
- If the normal program of the RWC2500A goes into unknown status and cannot enter the emergency upgrade mode, you must first remove the normal program. Keep pressing the 'RF ON' key and 'MENU' key together and turn the RWC2500A power ON. The RWC2500A displays whether the normal program is removed. Please select YES and reboot the RWC2500A for Emergency Upgrade mode booting.
- Repeat the upgrading sequence from the beginning as shown in 2.6.1.

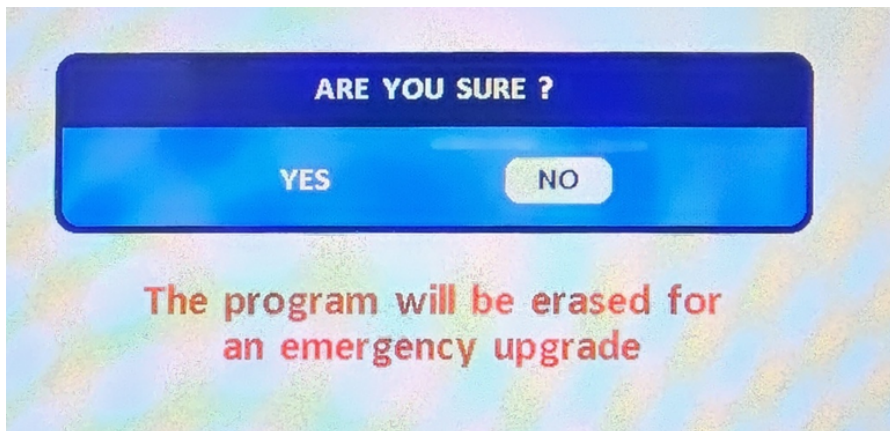


Fig. RWC2500A screen of Emergency Upgrade mode

2.7 Management of Report files

All report files(.rpt) are listed on the 'SETUP/FILE' screen of the RWC2500A. RWC2500A has 256 GByte internal storage. On this screen, it displays the Disk Size and Free Space of the internal storage. It also provides a list of the stored report files, allowing the user to manage the files. All types of content files are saved in it. Users can format it. Free space of the storage displayed in the FILE MANAGER tab.

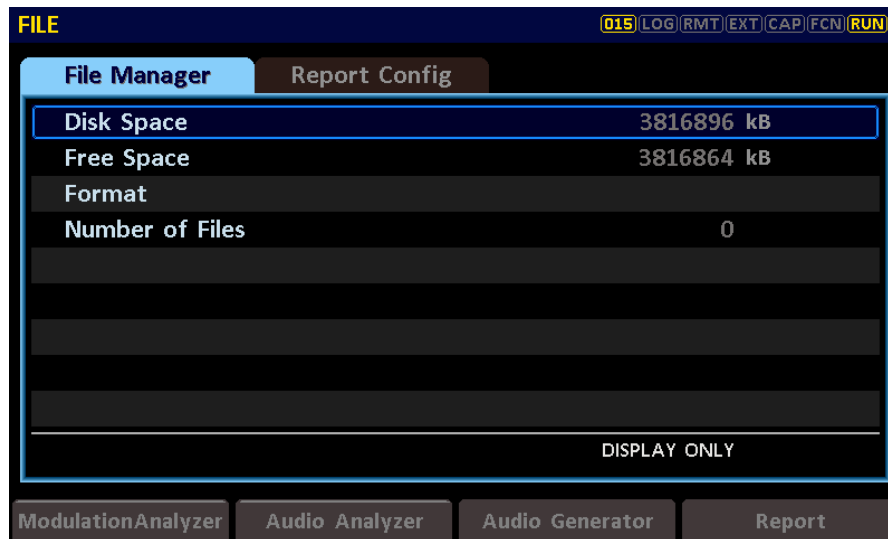


Fig. File manager screen when file is missing



Fig. File manager screen when file exists

2.8 Exporting Report Files

2.8.1 Downloading report files from RWC2500A into User PC

To download the report file to PC, PC Application program must be executed. Click the "UPDATE LIST" button of the PC before starting to download, then the FILE MANAGER will update the file list of the user PC. Users can download files from the PC to the RWC2500A by clicking the [Copy to PC] button. The location to which the file will be copied is the subdirectory of the executable.Fixed as \REPORT_FILE" and cannot be changed. The FILE MANAGER shows

replicated files between the PC and the RWC2500A with highlighted background color after selecting files.

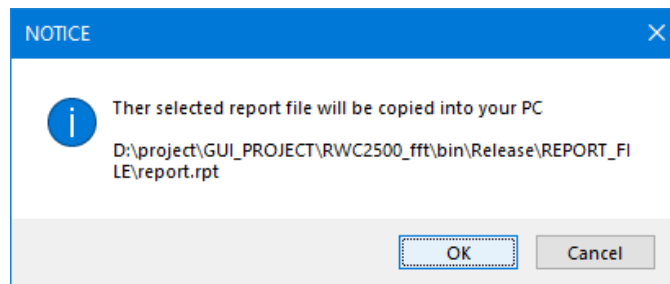


Fig. Downloading content files from User pc to RWC2500A equipment

2.9 Save/Recall

The SAVE and RECALL functions allow you to store different instrument setups and retrieve them later. By saving test setups, you can save time by eliminating the task of re-configuring the RWC2500A. RWC2500A supports up to 10 save/recall sets.

2.9.1 Save Method

Make any changes to the instrument that you want to SAVE in a memory. Then press **FCN** + **RECALL** key to execute the Save Pop-up screen as the following figure. Select SAVE buffer number and press **ENTER** key.

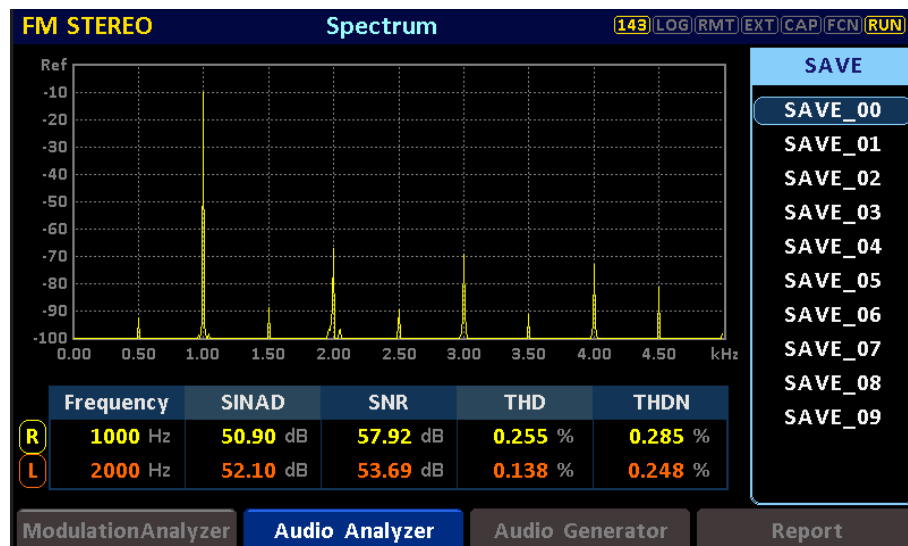


Fig. The screen to save parameter configuration

2.9.2 Recall Method

Then press **RECALL** key to execute the Recall Pop-up screen as the following figure. Select RECALL buffer number and press **ENTER** key. The first recall buffer is RESET. If you select it, RWC2500A will be reset.

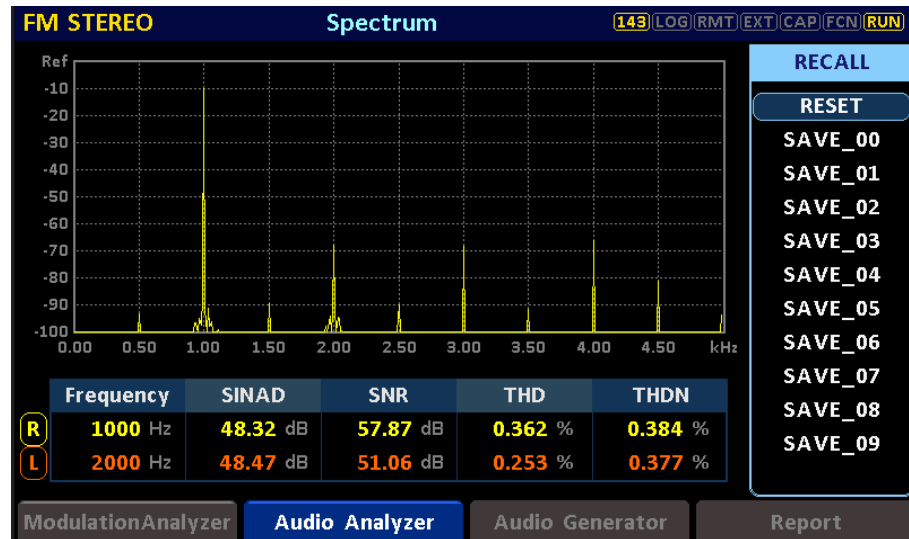


Fig. The screen to recall parameter configuration

2.9.3 Select Saved Configuration for Booting

When restarting the system, one of the Saved configurations will be retrieved. To define saved configuration for booting, go to the 'SYSTEM/SETUP' screen and modify 'BOOT_BY' parameter to desired Save buffer number.



Fig. Screen to setup the BOOT_BY parameter

3. Modulation Analyzer

RWC2500A provides several sub-function in the modulation analyzer.

Users can select one of them by touching the modulation analyzer function tab.

- 3.1 RF Settings
- 3.2 RF Spectrum
- 3.3 RF Envelope
- 3.4 MPX Spectrum
- 3.5 Deviation Distribution
- 3.6 Modulation Results

3.1 RF Settings

This is the screen where you can set up the RF Parameter. You can move using a rotary or above and below the rudder key. It can also be moved by touching each row. The range of each RF parameter is displayed at the bottom and may be edited using a keypad.

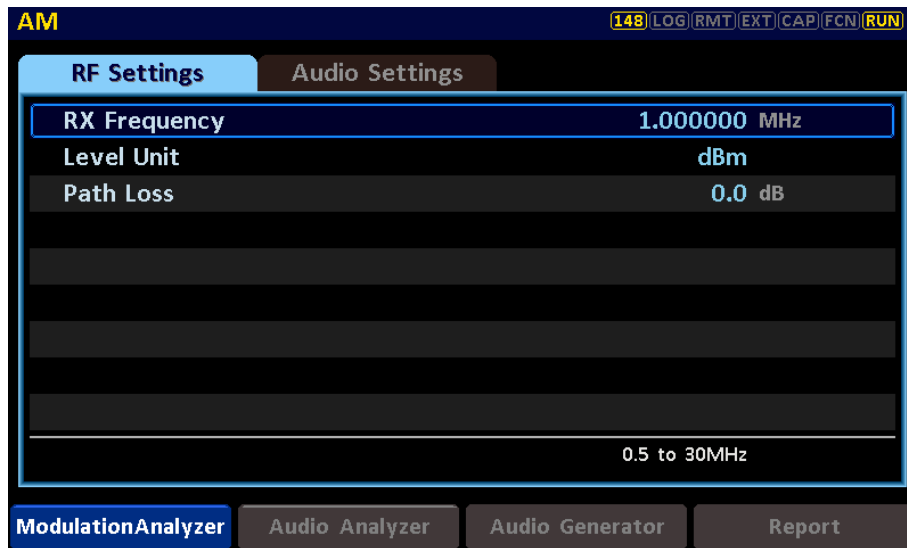


Fig. RF Settings - RX Frequency

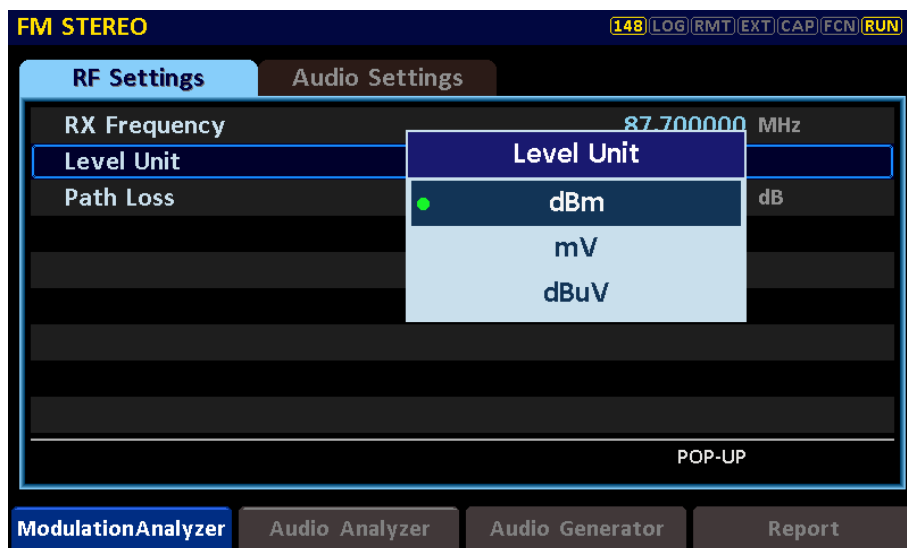
Parameters

RX Frequency

It is the frequency to which the RWC2500A is tuned to capture and analyze the modulated signal.

Path Loss

Path loss refers to the attenuation or reduction between the RWC2500A's RF port and the DUT's RF port.



3.2 RF Spectrum

This shows the RF spectrum of the FM or AM input signal. In this case, the carrier frequency offset and level are automatically measured and displayed at the bottom of the graph.

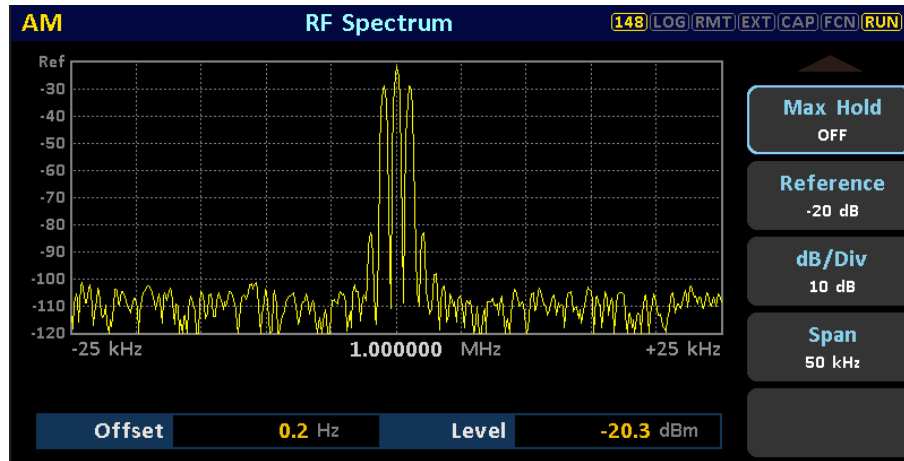


Fig. RF Spectrum

Parameters

Max Hold

This parameter determines whether to display the max hold graph. The Max Hold trace accumulates and retains the highest amplitude values encountered during the measurement.

Reference

Reference level is the top edge of display and represents the maximum expected level at the spectrum analyzer input.

dB/Div

dB/div represents the scale of the vertical axis in a spectrum. It determines how detailed the signals will be displayed in a spectrum analyzer. A higher dB/div value shows smaller signal details, while a smaller dB/div value displays a wider range of signals.

Span

This parameter refers to the frequency range or bandwidth that is displayed on the horizontal axis of a spectrum analyzer. By adjusting the span, users can zoom in or out on the frequency axis to analyze signals of interest within a narrower or wider frequency range.

Measurement Result

Offset

Measures and displays the difference between the actual frequency of a signal and the tuned frequency of the RWC2500A.

Level

Measures and displays the input the signal level.

3.3 RF Envelope (AM mode only)

The RWC2500A demodulates the AM signal to provide an RF envelope screen. In this case, the positive peak, negative peak, positive peak modulation, and negative peak modulation are automatically measured and displayed at the bottom of the graph.

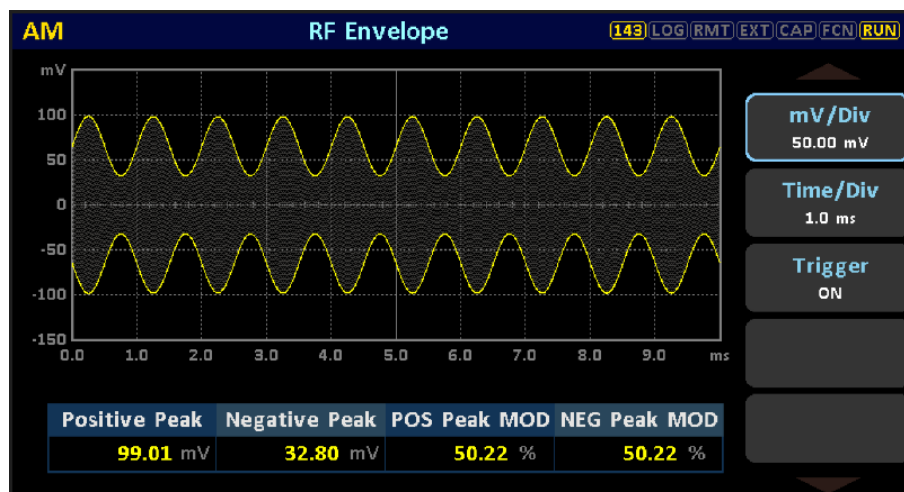


Fig. RF Envelope

Parameters

Graph

In the case of stereo FM, where both the left and right audio signals can be simultaneously measured, users can use this parameter to select whether the graph displayed on the screen represents the left channel, right channel, or both.

Trigger

As a function to prevent horizontal shaking of the graph displayed on the screen, if set to ON, the zero crossing of the RF envelope signal is displayed as the starting point of the graph. If set to OFF, the trigger function is OFF.

mV/Div

mV/div represents the scale of the vertical axis in a RF envelope screen.

Time/Div

Time/div represents the scale of the horizontal axis in a envelope screen.

Measurement Result

Positive Peak

Displays the maximum value of the RF envelope signal.

Negative Peak

Displays the minimum value of the RF envelope signal.

3.4 MPX Spectrum (FM mode only)

This shows the MPX spectrum of the FM input signal. The MPX analyzer integrated into the RWC2500A is capable of analyzing the frequency characteristics of MPX composite signals, thereby enabling broadcasters to detect and eliminate any potential issues with utmost precision. The results table provides the following deviation values. MPX, Pilot, L(left), R(right), M(L+R), S(L-R)

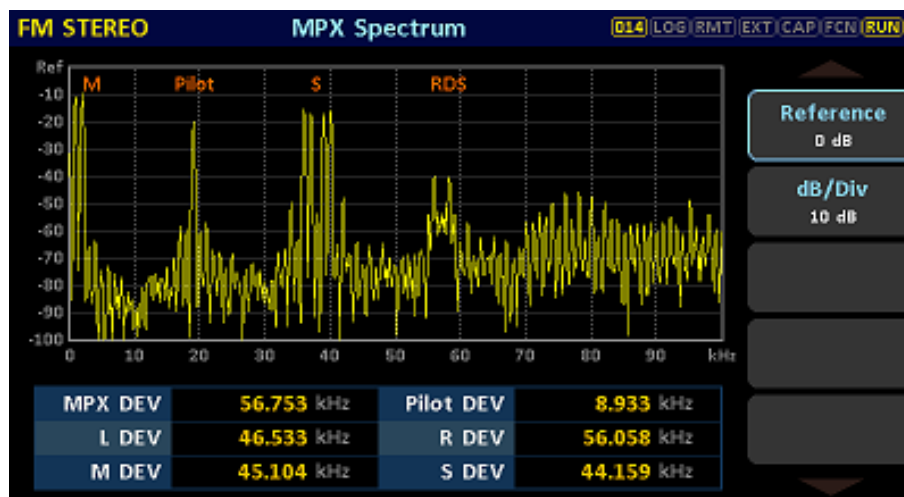


Fig. MPX Spectrum

Parameters

Reference

Reference level is the top edge of display and represents the maximum expected level at the spectrum analyzer input.

dB/Div

dB/div represents the scale of the vertical axis in a spectrum. It determines how detailed the signals will be displayed in a spectrum analyzer. A higher dB/div value shows smaller signal details, while a smaller dB/div value displays a wider range of signals.

Measurement Result

MPX DEV

Displays the total deviation of MPX composite signal.

Pilot DEV

Displays the deviation of 19KHz Pilot signal.

L DEV

Displays the deviation of Left audio signal.

R DEV

Displays the deviation of Right audio signal.

M DEV

Displays the deviation of L+R signal.

S DEV

Displays the deviation of L-R signal.

3.5 Deviation Distribution (FM mode only)

RWC2500A can provide peak deviation and modulation power measurements in line with the ITU-R SM.1268-1 standard.

The yellow line shows the histograms of frequency deviation processed by obtaining N peak hold values of the deviation each taken during a measuring time of 50 ms. This measuring time is adjustable.

The orange lines represent counts added to each bin from left to right, normalized to N. The result is a plot of the cumulative distribution starting with a probability of 100% on the left and ending with a probability of 0% on the right side.

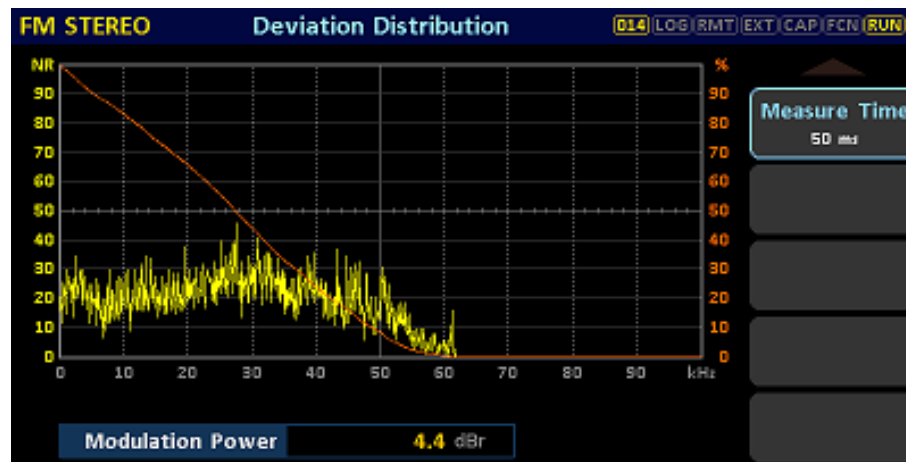


Fig. Deviation Distribution

Parameters

Measure Time

Set the measuring time for the histograms of frequency deviation.

Measurement Result

Modulation Power

Displays the modulation power of MPX composite signal. Modulation power refers to the power or energy contained in the modulated signal compared to the power of the original unmodulated pilot(19kHz) signal.

3.6 Modulation Results

This shows the main result values measured by the Modulation analyzer as a table. The cursor can be moved by rotary, rudder, and touch. The top left shows the current RX frequency of RWC2500A. If the result value is within the limit value range, it is expressed in green and vice versa in red.

FM STEREO

Modulation Results

[D14] LOG [RMT] [EXT] [CAP] [FCN] [RUN]

FREQ 87.700000 MHz

| Item | Limit | < | Results | < | Limit | Unit |
|--------------------------|--------|---|---------|---|--------|------|
| ▶ Level | -50.0 | | -10.8 | | 20.0 | dBm |
| Carrier Frequency Offset | -500.0 | | -181.0 | | 500.0 | Hz |
| AM Depth | - | | 10.6 | | 150.0 | % |
| MPX Deviation | 0.000 | | 56.715 | | 75.000 | kHz |
| L Deviation | 0.000 | | 46.282 | | 67.500 | kHz |
| R Deviation | 0.000 | | 55.799 | | 67.500 | kHz |
| M Deviation | 0.000 | | 45.023 | | 67.500 | kHz |
| S Deviation | 0.000 | | 44.412 | | 67.500 | kHz |
| Pilot Deviation | 6.000 | | 8.928 | | 7.500 | kHz |
| Pilot Frequency Offset | -2.00 | | 0.61 | | 2.00 | Hz |

Fig. Modulation Results

You can edit the upper and lower limit values and units for each result value. A pop-up window appears when you press the Enter key or touch on that item. When the unit changes, the limit value and the result value are automatically converted.

FM STEREO

Modulation Results

014

LOG

RMT

EXT

CAP

FCN

RUN

FREQ 87.700000 MHz

| Item | Limit | < | Results | < | Limit | Unit |
|--------------------------|-------|---|---------|---|-------|------|
| ▶ Level | -50.0 | | -108.4 | | 20.0 | dBm |
| Carrier Frequency Offset | | | | | | Hz |
| AM Depth | | | | | | % |
| MPX Deviation | | | | | | kHz |
| L Deviation | | | | | | kHz |
| R Deviation | | | | | | kHz |
| M Deviation | | | | | | kHz |
| S Deviation | | | | | | kHz |
| Pilot Deviation | | | | | | kHz |
| Pilot Frequency Offset | -2.00 | | 10.93 | | 2.00 | Hz |

Level

Upper Limit

20.0

dBm

Lower Limit

-50.0

dBm

Unit

● dBm

○ mV

○ dBuV

Fig. Modulation Results - Edit pop-up window

4. Audio Analyzer

RWC2500A provides several sub-function in the audio analyzer.

Users can select one of them by touching the audio analyzer function tab.

- 4.1 Audio Settings
- 4.2 Spectrum
- 4.3 Waveform
- 4.4 Crosstalk
- 4.5 Frequency Response
- 5.6 Audio Results

4.1 Audio Settings

This is the screen where you can set up the Audio Analyzer Parameters. You can move using a rotary or above and below the rudder key. It can also be moved by touching each row. The range of each Audio parameter is displayed at the bottom and may be edited using a keypad.

- FM Mode**
 In FM mode, the Audio Settings has 5 parameters ; FM Demodulation, Reference FREQ Mode , HPF Cut-off , LPF Cut-off, and De-emphasis
- Am Mode**
 In AM mode, the Audio Settings has 3 parameters;s Reference FREQ Mode, HPF Cut-off, LPF Cut-off

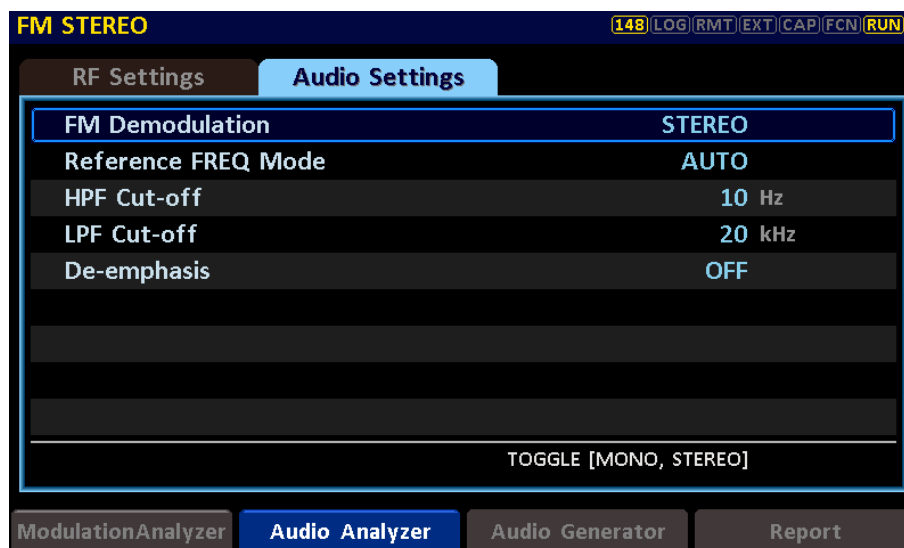


Fig. Audio Settings in FM mode

Parameters

FM Demodulation

The parameter selects the FM demodulation mode [STEREO/MONO] determines the configuration of each measurement screen.

Reference FREQ Mode

When calculating parameters like SINAD (Signal-to-Noise and Distortion Ratio) and SNR (Signal-to-Noise Ratio) in an Audio Analyzer, a reference frequency is needed as a basis for measurement. This variable can be set to "Manual," allowing the user to directly set the Reference Frequency, or "AUTO," where the RWC2500A automatically sets the measured frequency of the received signal as the Reference Frequency.

HPF Cut-off

The RWC2500A provides a feature to remove low-frequency components from the demodulated audio signal, and this parameter allows the user to select the cut-off frequency. This filter applies to both the audio output on the rear panel and the audio input for the Audio Analyzer.

LPF Cut-off

The RWC2500A provides a feature to remove high-frequency components from the demodulated audio signal, and this parameter allows the user to select the cut-off frequency. This filter applies to both the audio output on the rear panel and the audio input for the Audio Analyzer.

De-emphasis

In FM transmitters, a pre-emphasis filter is often employed to reduce noise in the high-frequency components of the audio signal. Conversely, in RWC2500A, a de-emphasis filter is used to compensate for this pre-emphasis and restore the original audio signal. This parameter allows the user to select the time constant value for the de-emphasis filter.

4.2 Spectrum

This shows the audio spectrum of the FM or AM input signal. RWC2500A can quantify the signal quality using a tone audio signal, generating numerical data on critical parameters such as Signal-to-Noise Ratio (SNR), Signal-to-Noise and Distortion Ratio (SINAD), Total Harmonic Distortion (THD), and Total Harmonic Distortion plus Noise (THDN). In the FM stereo mode, it displays the results of the right and left of the audio signal, respectively.

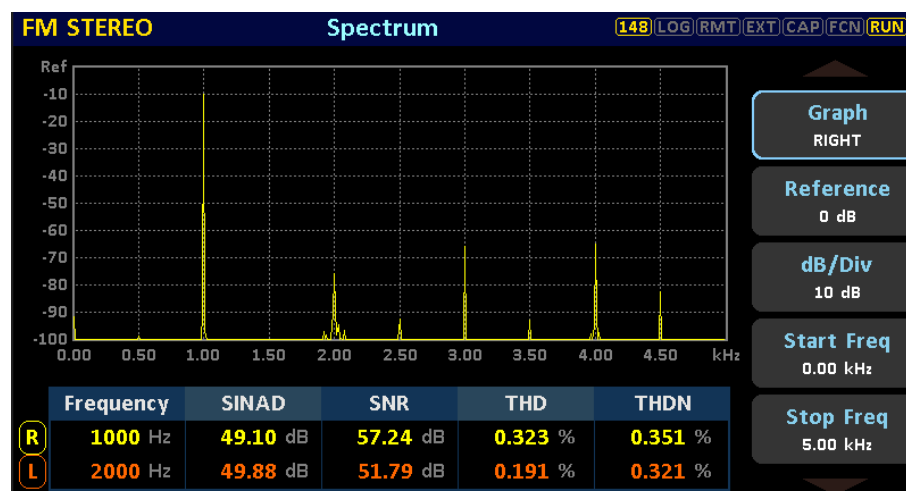


Fig. Audio Spectrum

Parameters

Graph

In the case of stereo FM, where both the left and right audio signals can be simultaneously measured, users can use this parameter to select whether the graph displayed on the screen represents the left channel, right channel, or both.

Reference

Reference level is the top edge of display and represents the maximum expected level at the spectrum analyzer input.

dB/Div

dB/div represents the sensitivity or scale of the vertical axis in a spectrum. It determines how detailed the signals will be displayed in a spectrum analyzer. A higher dB/div value shows smaller signal details, while a smaller dB/div value displays a wider range of signals.

Start Freq

The "start frequency" in spectrum refers to the beginning or lowest frequency point of a given frequency range being analyzed.

Stop Freq

The "stop frequency" in spectrum analysis refers to the ending or highest frequency point of a given frequency range being analyzed.

Measurement Result**Frequency**

Measure and display the frequency value of the demodulated audio signal.

SINAD

Measure and display the SINAD value of the demodulated audio signal.

SNR

Measure and display the SNR value of the demodulated audio signal.

THD

Measure and display the THD value of the demodulated audio signal.

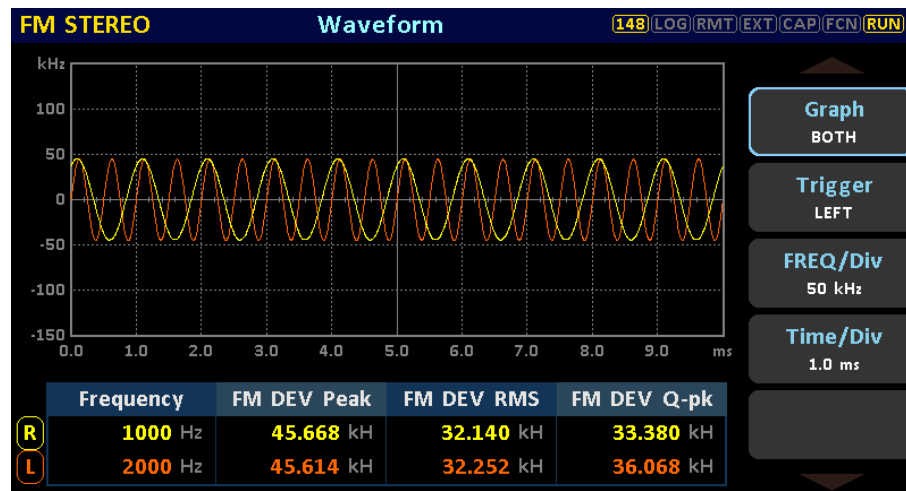
THDN

Measure and display the THDN value of the demodulated audio signal.

4.3 Waveform

An audio waveform analyzer is used to analyze and display the characteristics of an FM or AM demodulated audio signal. It is designed to provide insights into various parameters and attributes of an audio signal, allowing for detailed analysis and assessment of its properties.

4.3.1 FM demodulation



Parameters

Graph

In the case of stereo FM, where both the left and right audio signals can be simultaneously measured, users can use this parameter to select whether the graph displayed on the screen represents the left channel, right channel, or both.

Trigger

As a function to prevent horizontal shaking of the graph displayed on the screen, if set to LEFT, the zero crossing of the Left Audio signal is displayed as the starting point of the graph, and if set to RIGHT, the zero crossing of the Right Audio signal is displayed as the starting point of the graph. If set to OFF, the trigger function is OFF.

Freq/Div

Freq/div represents the scale of the vertical axis in a waveform screen.

Time/Div

Time/div represents the scale of the horizontal axis in a waveform screen.

Measurement Result

Frequency

Measure and display the frequency value of the demodulated audio signal.

FM DEV Peak

Measure and display the Peak deviation of FM demodulated Audio signal.

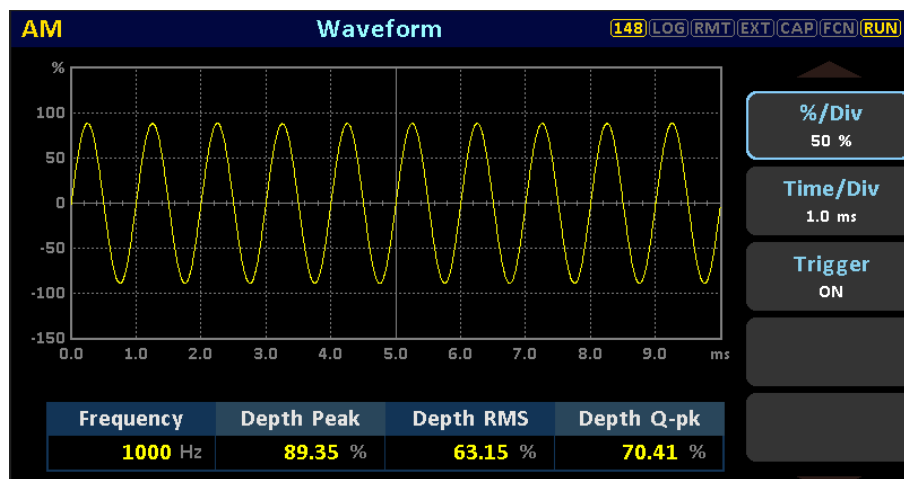
FM DEV RMS

Measure and display the RMS deviation of FM demodulated Audio signal.

FM DEV Q-pk

Measure and display the Quasi-Peak deviation of FM demodulated Audio signal.

4.3.2 AM demodulation



Parameters

Trigger

As a function to prevent horizontal shaking of the graph displayed on the screen, if set to ON, the zero crossing of the Audio signal is displayed as the starting point of the graph. If set to OFF, the trigger function is OFF.

%/Div

%/div represents the scale of the vertical axis in a waveform screen.

Time/Div

Time/div represents the scale of the horizontal axis in a waveform screen.

Measurement Result

Frequency

Measure and display the frequency value of the demodulated audio signal.

FM DEV Peak

Measure and display the Peak deviation of FM demodulated Audio signal.

FM DEV RMS

Measure and display the RMS deviation of FM demodulated Audio signal.

FM DEV Q-pk

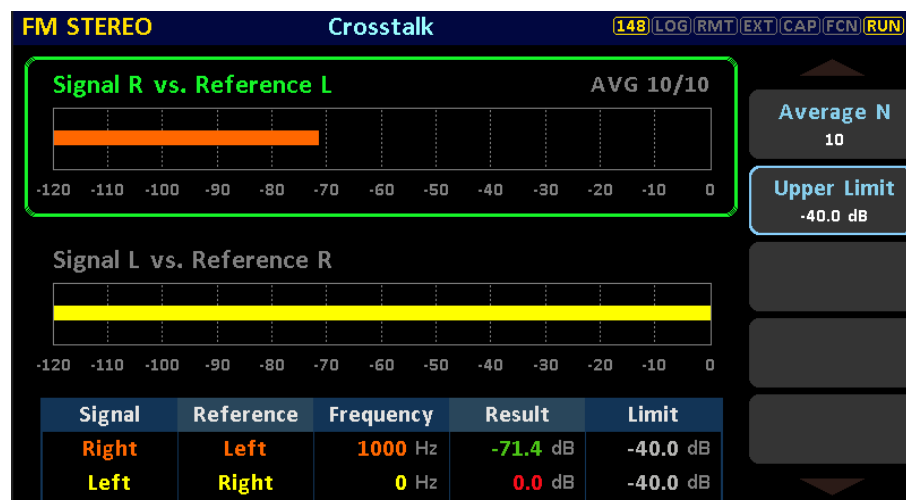
Measure and display the Quasi-Peak deviation of FM demodulated Audio signal.

4.4 Crosstalk

In FM demodulation analysis, crosstalk can occur due to various factors, such as imperfect isolation between channels or improper demodulation techniques. It can result in the mixing of signals from one channel into another, leading to distorted or degraded audio quality.

RWC2500A's crosstalk measurement function in an FM demodulation analyzer allows for the detection and analysis of this interference.

The RWC2500A measures the frequencies of the left and right audio signals and automatically calculates the crosstalk between the left and right channels. When a green box is displayed, it indicates that the measurement is currently valid. For accurate measurements, it is recommended to input either a left-only or right-only signal.



Parameters

Average N

Average N represents the number of measurements to be averaged. Increasing the value of "Average N" will result in a higher degree of averaging and better noise reduction, but it may also lead to slower update rates and increased measurement time. Conversely, using a lower value of "Average N" will provide faster updates but with less noise reduction.

Upper Limit

A measured crosstalk value above the upper limit indicates that the signal or device does not meet desired quality or performance standards. This can trigger a "fail" verdict and display the value in red.

Measurement Result

Frequency

Measure and display the frequency value of the demodulated audio signal.

Signal & Reference

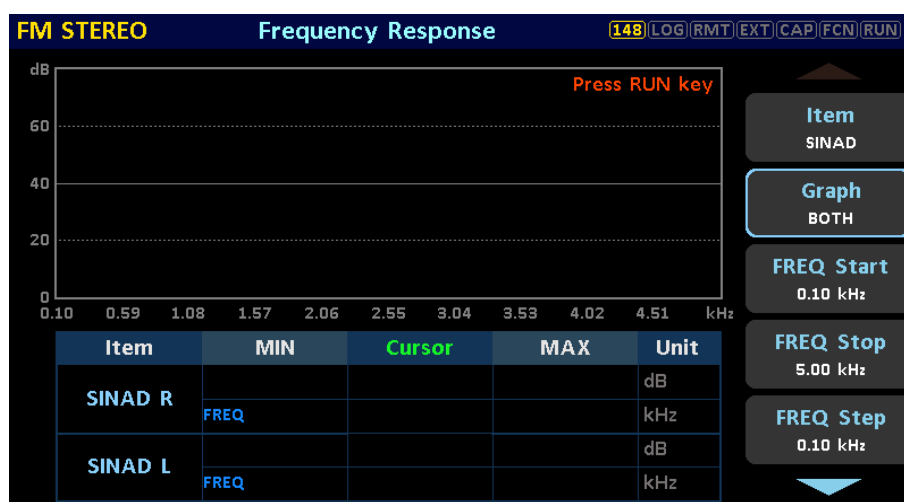
The reference represents the desired level of isolation or performance, while the signal represents the primary audio content or channel that should be free from interference.

Result

Measured Crosstalk value in dB

4.5 Frequency Response

In Frequency Response, audio signal characteristics are measured using the Audio Generator of RWC2500A. After selecting the item to be measured, the user sets the frequency of the Audio Generator to start, end, and step size.



Parameters

Item

Select the parameters you want to measure.

Graph

In the case of stereo FM, where both the left and right audio signals can be simultaneously measured, users can use this parameter to select whether the graph displayed on the screen represents the left channel, right channel, or both.

FREQ Start

The "FREQ Start" refers to the beginning or lowest audio frequency point.

FREQ Stop

The "FREQ Stop" refers to the ending or highest audio frequency point.

FREQ Step

The "FREQ Step" refers to the step size between audio frequency points.

Sweep Type

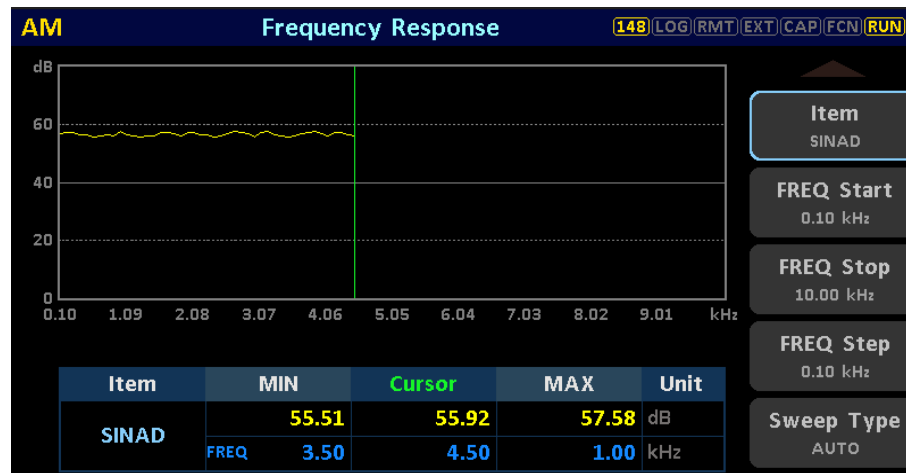
When sweeping the audio frequency, a method of moving the next audio frequency is selected. The user can select AUTO and MANUAL.

Sweep Delay

This parameter is enabled when "Sweep type" is manual. The user sets a time to wait until the next audio frequency is moved.

4.5.1 Run Mode

When the RUN key is pressed, the equipment outputs the result of the item while sweeping the audio frequency. In RUN mode, the parameters on the right are disabled.



4.5.2 Cursor Mode

After all audio frequency sweeps are completed, the user enters the cursor mode. You can move using a rotary or left and right rudder key. Update the audio frequency and result value at the point pointed by the cursor. When the user touches the FREQ area box, the editing mode is activated. You can input the desired frequency using the keypad.

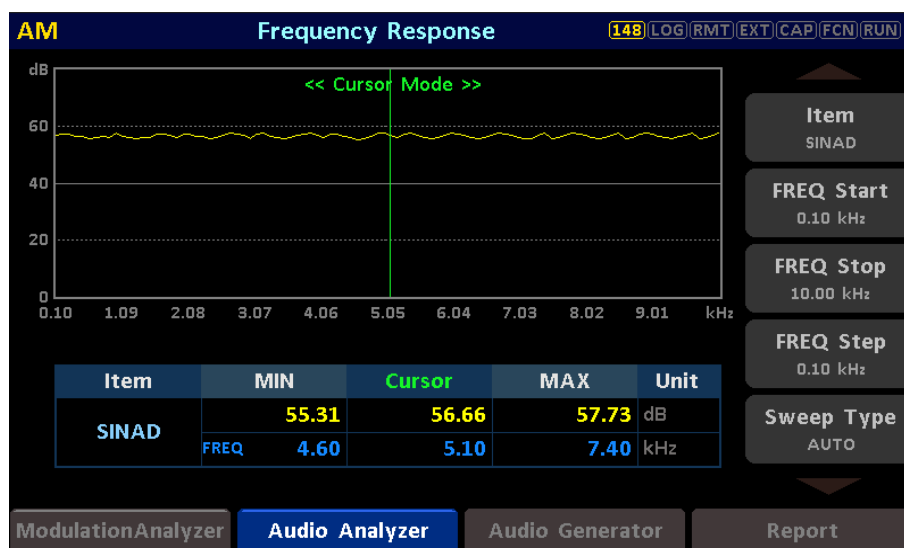


Fig. Initial screen in cursor mode

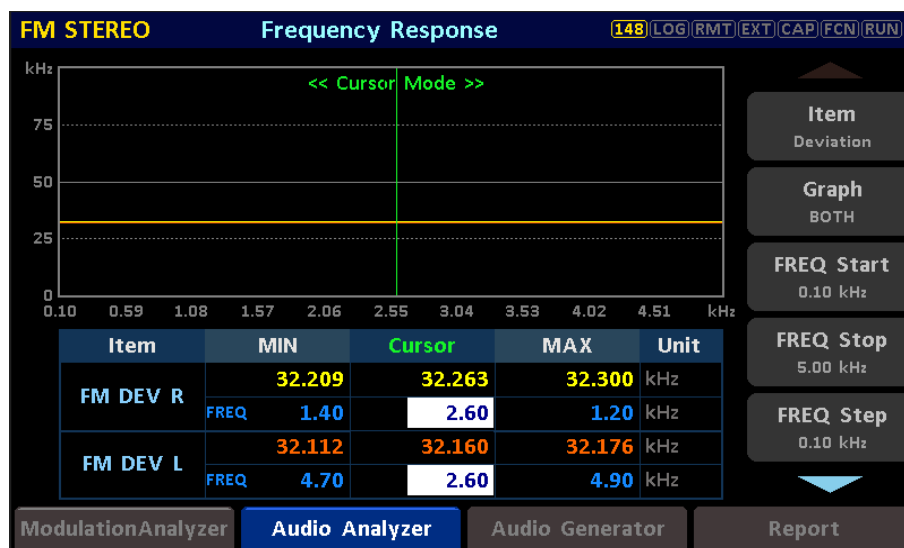


Fig. Edit FREQ screen in cursor mode

4.6 Audio Results

This shows the main result values measured by the Audio analyzer as a table. The cursor can be moved by rotary, rudder, and touch. The top left shows the current RX frequency of RWC2500A. If the result value is within the limit value range, it is expressed in green and vice versa in red.

FM STEREO

Audio Results

148

LOG

RMT

EXT

CAP

FCN

RUN

FREQ 87.700000 MHz

| Item | Limit | < | Results | < | Limit | Unit |
|-----------|-------|---|---------|---|-------|------|
| ▶ L SINAD | 50.00 | | 48.90 | | - | dB |
| R SINAD | 50.00 | | 49.53 | | - | dB |
| L SNR | 50.00 | | 57.41 | | - | dB |
| R SNR | 50.00 | | 50.85 | | - | dB |
| L THD | 0.000 | | 0.333 | | 0.500 | % |
| R THD | 0.000 | | 0.170 | | 0.500 | % |
| L THDN | 0.000 | | 0.359 | | 0.500 | % |
| R THDN | 0.000 | | 0.334 | | 0.500 | % |

ModulationAnalyzer

Audio Analyzer

Audio Generator

Report

Fig. Audio Results

The user can edit the upper and lower limit values and units for each result value. A pop-up window appears when you press the Enter key or touch on that item. When the unit changes, the limit value and the result value are automatically converted.

AM

Audio Results

148

LOG

RMT

EXT

CAP

FCN

RUN

FREQ 1.000000 MHz

| Item | Limit | < | Results | < | Limit | Unit |
|-------|-------|---|---------|---|-------|------|
| SINAD | 50.00 | | 55.62 | | - | dB |
| SNR | | | | | - | dB |
| ▶ THD | | | | | | % |
| THDN | | | | | | % |

THD

Upper Limit

0.500

%

Lower Limit

0.000

%

Unit

☒

%

ModulationAnalyzer

Audio Analyzer

Audio Generator

Report

Fig. Audio Results - Edit pop-up window

5. Audio Out

5.1 Reference Audio Out

The RWC2500A offers a Reference Audio Signal Generator feature that can serve as a reference for AM/FM transmitter testing. It can generate independent two-channel audio signals and provide a balanced signal output through the MPX port and an unbalanced signal output through the BNC port. Additionally, it also offers a digital audio output in AES/EBU format.

The MPX output impedance can be selected as either 600 ohms or 8 ohms.

5.1.1 Config



| AUDIO GENERATOR | |
|--|----------|
| 148 LOG RMT EXT CAP FCN RUN | |
| Config Rear Port | |
| Audio Frequency | |
| Left | 1.00 kHz |
| Right | 2.00 kHz |
| Balanced | BOTH |
| Impedance | 8 Ohm |
| Level Left | 6.0 dBu |
| Level Right | 6.0 dBu |
| Unbalanced | BOTH |
| Impedance | 75 Ohm |
| ModulationAnalyzer Audio Analyzer Audio Generator Report | |

Parameters

Audio Frequency - Left

Sets the left audio frequency for balanced, unbalanced and digital output.

Audio Frequency - Right

Sets the Right audio frequency for balanced, unbalanced and digital output.

Balanced - Impedance

Select the output impedance for balanced output.

Balanced - Level Left

Sets the left audio level in dBu for balanced output.

Balanced - Level Right

Sets the right audio level in dBu for balanced output.

Unbalanced - Impedance

Shows the output impedance for unbalanced output. Not editable.

Unbalanced - Level Left

Sets the left audio level in dBu for unbalanced output.

Unbalanced - Level Right

Sets the right audio level in dBu for unbalanced output.

Digital - Impedance

Shows the output impedance for digital output. Not editable.

Digital - Level Left

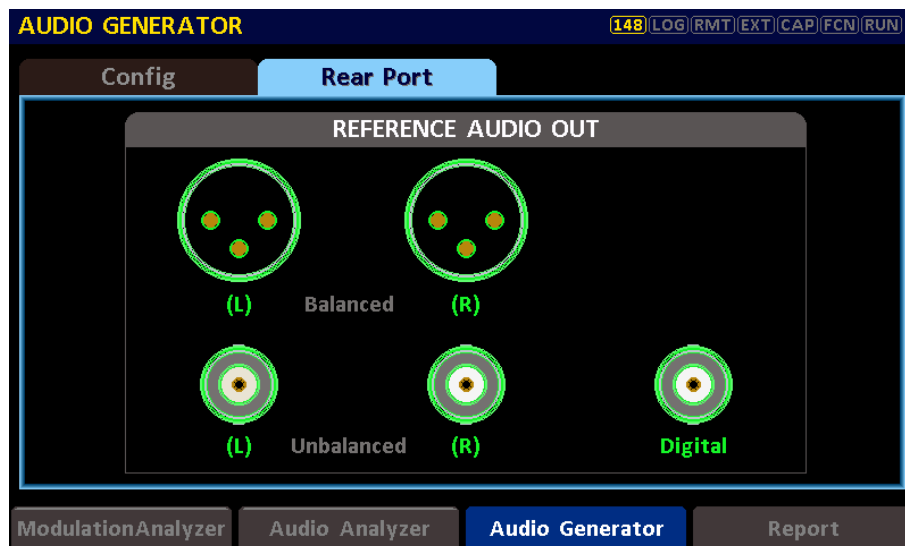
Sets the left audio level in dBFS for digital output.

Digital - Level Right

Sets the right audio level in dBFS for digital output.

5.1.2 Rear Port

The rear panel ports are displayed graphically, and the touch screen functionality allows the user to toggle each port on/off.

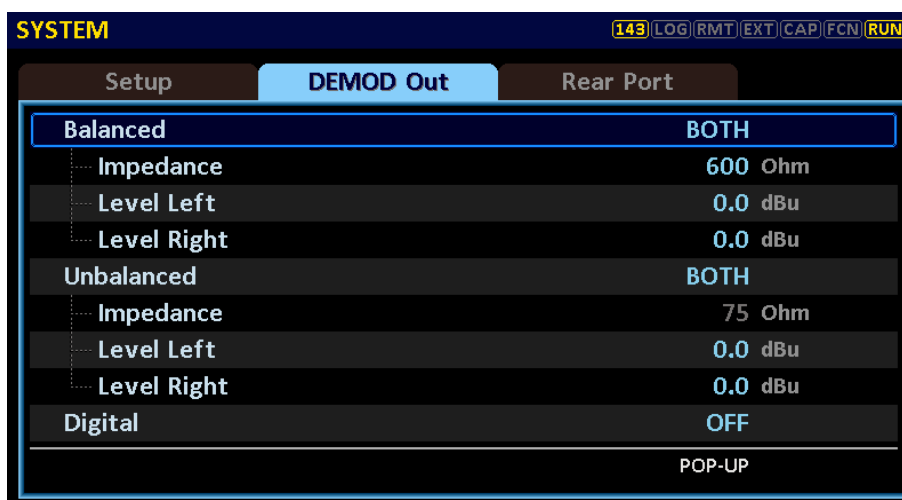


5.2 Demodulated Audio Out

The RWC2500A not only demodulates and analyzes received AM/FM signals but also allows the output of the demodulated signals through various ports on the rear panel. A balanced signal output can be generated through the MPX port and an unbalanced signal output can be generated through the BNC port. It also provides digital audio output in AES/EBU format.

The MPX output impedance can be selected as either 600 ohms or 8 ohms

5.2.1 Config



The screenshot shows the 'SYSTEM' menu with the 'DEMOD Out' tab selected. The menu is divided into three sections: 'Setup', 'DEMOD Out', and 'Rear Port'. The 'DEMOD Out' section contains the following settings:

| Balanced | | BOTH |
|-------------|--|---------|
| Impedance | | 600 Ohm |
| Level Left | | 0.0 dBu |
| Level Right | | 0.0 dBu |
| Unbalanced | | BOTH |
| Impedance | | 75 Ohm |
| Level Left | | 0.0 dBu |
| Level Right | | 0.0 dBu |
| Digital | | OFF |

At the bottom of the menu, there is a 'POP-UP' button.

Parameters

Balanced

The user can determine how to output the demodulated audio signal to the balanced (MPX) port.

Balanced - Impedance

Select the output impedance for balanced output.

Balanced - Level Left

Sets the left audio level in dBu for balanced output. This setting value corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

Balanced - Level Right

Sets the right audio level in dBu for balanced output. This setting value corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

Unbalanced

The user can determine how to output the demodulated audio signal to the unbalanced (BNC) port.

Unbalanced - Impedance

Shows the output impedance for unbalanced output. Not editable.

Unbalanced - Level Left

Sets the left audio level in dBu for balanced output. This setting value corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

Unbalanced - Level Right

Sets the right audio level in dBu for balanced output. This setting value corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

Digital

The user can determine how to output the demodulated audio signal to the digital output port.

Digital - Impedance

Shows the output impedance for digital output. Not editable.

Digital - Level Left

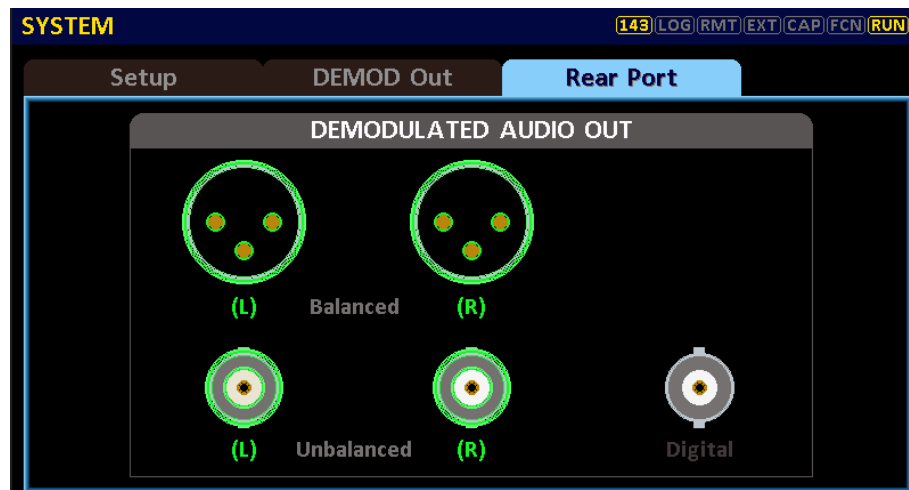
Sets the left audio level in dBFS for digital output. 0 dBFS corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

Digital - Level Right

Sets the right audio level in dBFS for digital output. 0 dBFS corresponds to a deviation of 75 kHz for FM and 100% depth for AM.

5.2.2 Rear Port

The rear panel ports are displayed graphically, and the touch screen functionality allows the user to toggle each port on/off.



6. Report

6.1 Report Table

This shows the main result values measured by the Audio analyzer and Modulation analyzer as a table. The cursor can be moved by rotary, rudder, and touch. The top left shows the current RX frequency of RWC2500A. If the result value is within the limit value range, it is expressed in green and vice versa in red.

FM STEREO

Overview

148

LOG

RMT

EXT

CAP

FCN

RUN

FREQ 90.000000 MHz

18/18 selected

| Item | Limit | < | Results | < | Limit | Unit |
|--|--------|---|---------|---|--------|------|
| <input checked="" type="checkbox"/> Level | -50.0 | | -10.3 | | 20.0 | dBm |
| <input checked="" type="checkbox"/> Carrier Frequency Offset | -500.0 | | 4.2 | | 500.0 | Hz |
| <input checked="" type="checkbox"/> AM Depth | 0.0 | | 5.5 | | 150.0 | % |
| <input checked="" type="checkbox"/> MPX Deviation | 0.000 | | 58.194 | | 75.000 | kHz |
| <input checked="" type="checkbox"/> L Deviation | 0.000 | | 54.208 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> R Deviation | 0.000 | | 48.054 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> M Deviation | 0.000 | | 45.252 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> S Deviation | 0.000 | | 49.735 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> Pilot Deviation | 6.000 | | 4.213 | | 7.500 | kHz |
| <input checked="" type="checkbox"/> Pilot Frequency Offset | -2.00 | | 0.00 | | 2.00 | Hz |

ModulationAnalyzer

Audio Analyzer

Audio Generator

Report

Fig. Overview screen at full selection

FM STEREO

Overview

148

LOG

RMT

EXT

CAP

FCN

RUN

FREQ 90.000000 MHz

15/18 selected

| Item | Limit | < | Results | < | Limit | Unit |
|--|--------|---|---------|---|--------|------|
| <input checked="" type="checkbox"/> Level | -50.0 | | -10.3 | | 20.0 | dBm |
| <input type="checkbox"/> Carrier Frequency Offset | -500.0 | | 4.2 | | 500.0 | Hz |
| <input type="checkbox"/> AM Depth | 0.0 | | 6.0 | | 150.0 | % |
| <input type="checkbox"/> MPX Deviation | 0.000 | | 58.308 | | 75.000 | kHz |
| <input checked="" type="checkbox"/> L Deviation | 0.000 | | 54.348 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> R Deviation | 0.000 | | 48.009 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> M Deviation | 0.000 | | 44.971 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> S Deviation | 0.000 | | 50.053 | | 67.500 | kHz |
| <input checked="" type="checkbox"/> Pilot Deviation | 6.000 | | 4.208 | | 7.500 | kHz |
| <input checked="" type="checkbox"/> Pilot Frequency Offset | -2.00 | | 0.00 | | 2.00 | Hz |

ModulationAnalyzer

Audio Analyzer

Audio Generator

Report

Fig. Unselect the item

6.2 Report Config

The RWC2500A provides a functionality to save various measurements in real-time to a file. On this screen, the user can configure the report file name, saving interval, saving duration, and initiate the saving process.



Parameters

Report File Name

The file name of the report is displayed, and the user can edit it if desired. The number in the file name automatically increases each time it is saved.

Interval

The user can set the saving interval for periodically saving the selected measurement items to the report file.

Duration

When the report file saving begins, the measurement items are saved for the duration set in this parameter. If the user set this value to 0, the current measurement values will be saved only once.

Start Logging

Start the report file saving.

Stop Logging

Stop the report file saving.

Elapsed time

Display the elapsed time of the ongoing file saving.

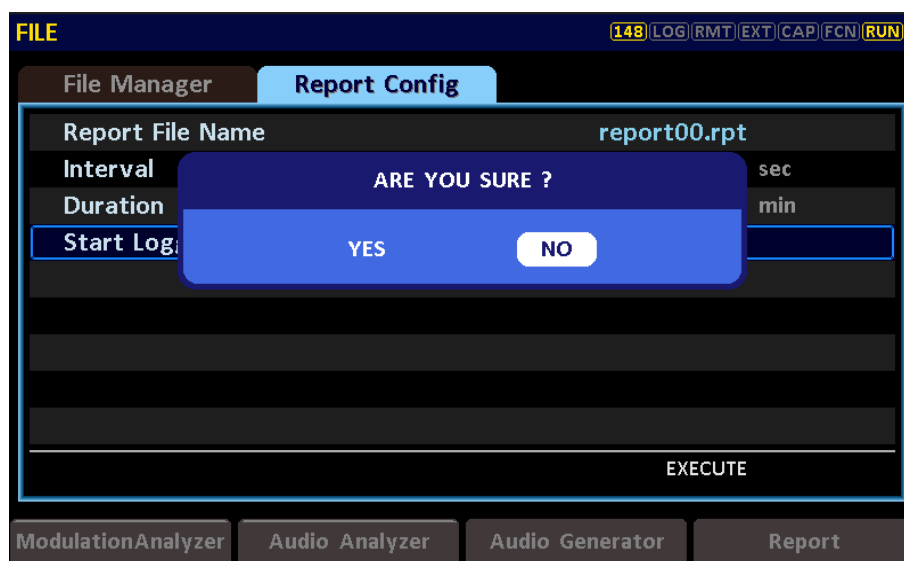


Fig. Start Logging screen

When the user presses the ENTER key or touches “Start Logging”, a pop-up window appears. If “YES”, it starts logging. And then it displays the “Elapsed time”. During logging, the top status icon “LOG” is activated and blinks.

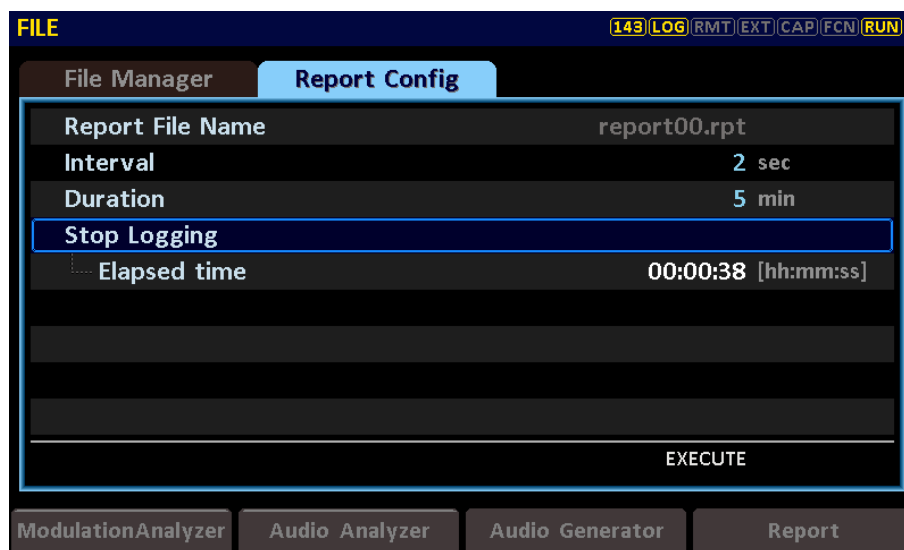


Fig. Elapsed time

7. PC Application

This application program is a dedicated program designed to assist with the use of the RWC2500A. Please note that it is not compatible with other equipment from RedwoodComm.

The application provides monitoring and controlling of the RWC2500A, managing report files, managing the internal storage of the RWC2500A, displaying real-time measured data, and viewing stored report files in detail.

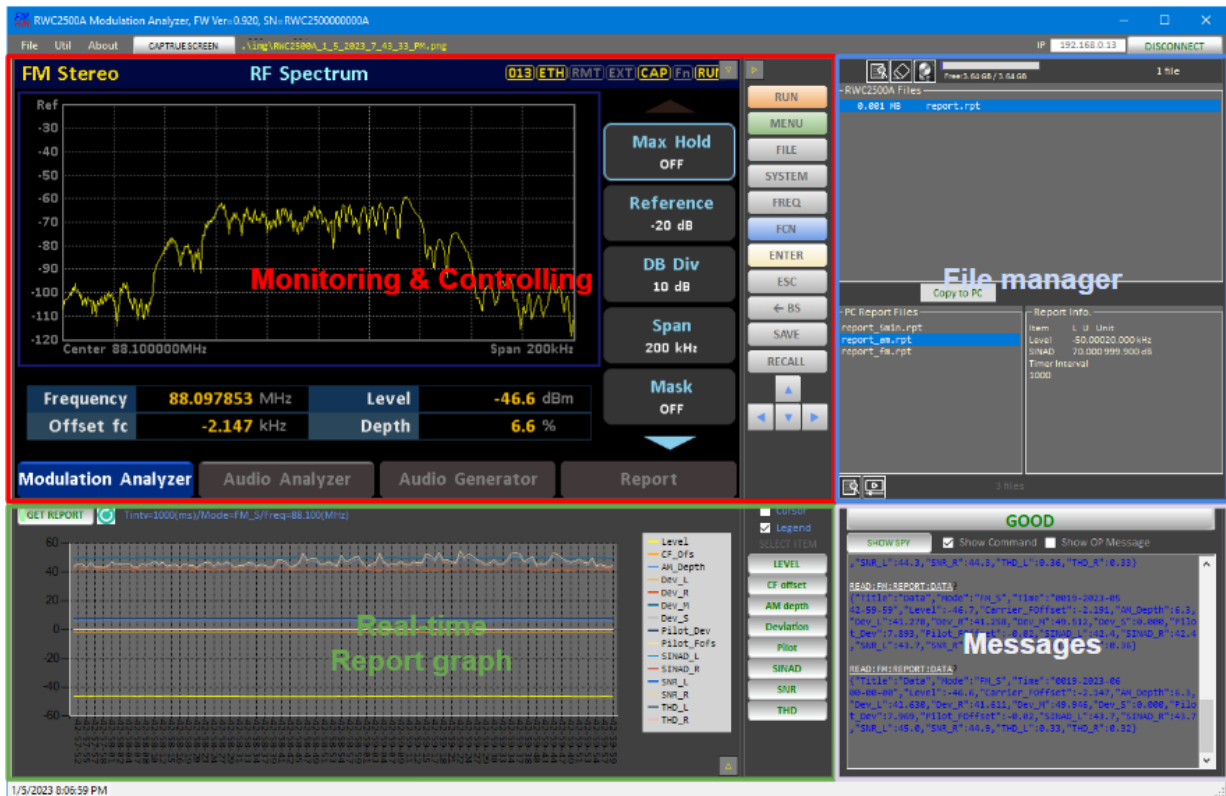


Figure. Application Functionalities

Functions

Theme

Toggle between the two modes: bright and dark.

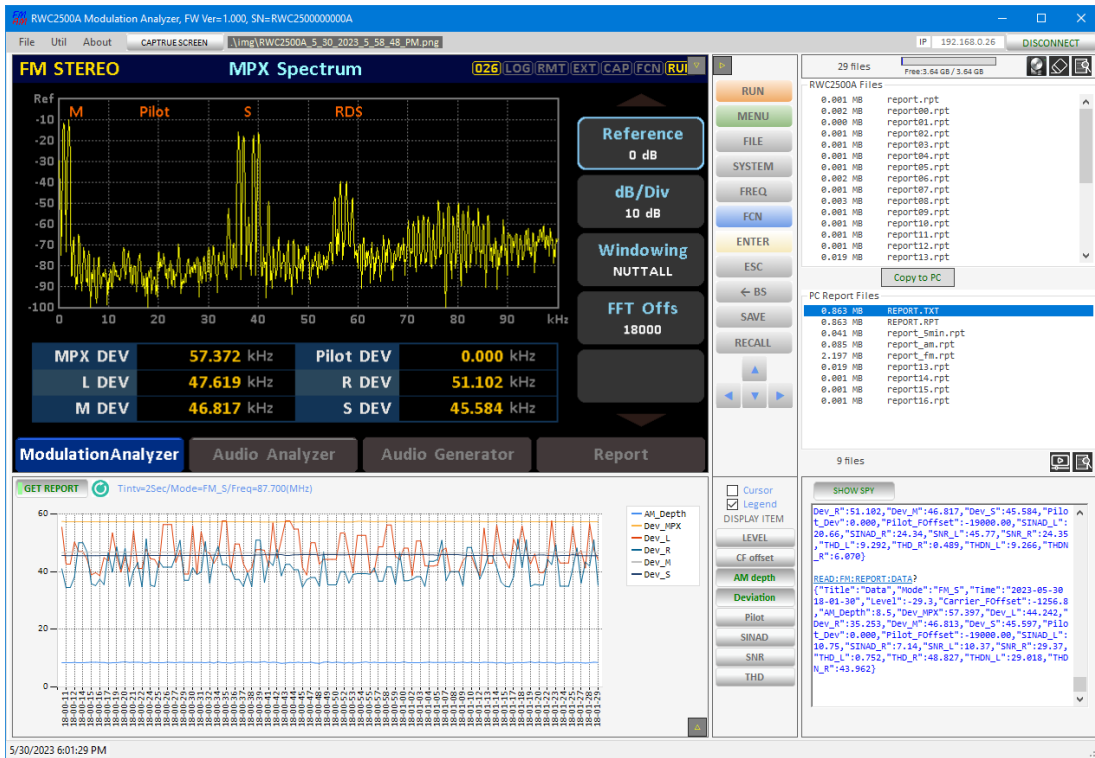
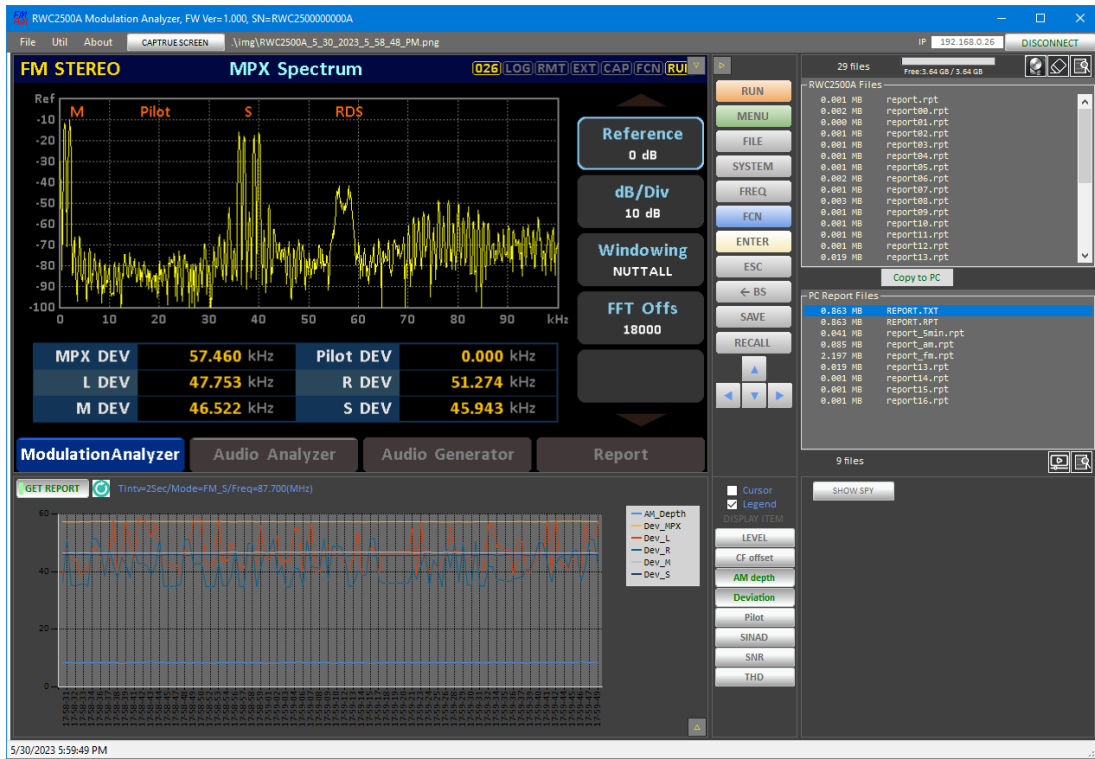





Figure. Black and White theme

Resizing Sub-window

Enlarging monitoring window: Press the button  on the top right of the monitoring window to zoom in/out the monitoring window.

Enlarging graph window: Press the button  on the bottom right of the graph window to zoom in/out the graph window.

Enlarging file manager window: Press the button  on the top left of the file manager window to zoom in/out the file manager window.

7.1 Remote Monitoring Screen

This program allows you to remotely monitor the screen of the RWC2500A and control it using either the mouse or the key buttons.

When using the mouse for control, simply move the mouse into the monitoring area on the screen. You will notice that the window's outline becomes thicker, indicating that control is activated. You can then proceed to use it. If the outline does not become thicker, you can activate control by clicking anywhere on the screen with the mouse.

If you need to interact with other buttons or elements while maintaining control (such as interacting with a graph), you can click on the monitoring screen with the mouse again. This action functions similarly to a touchscreen and will also produce a beep sound. Therefore, please ensure that the system's beep sound settings for touch actions are appropriately configured (on/off).

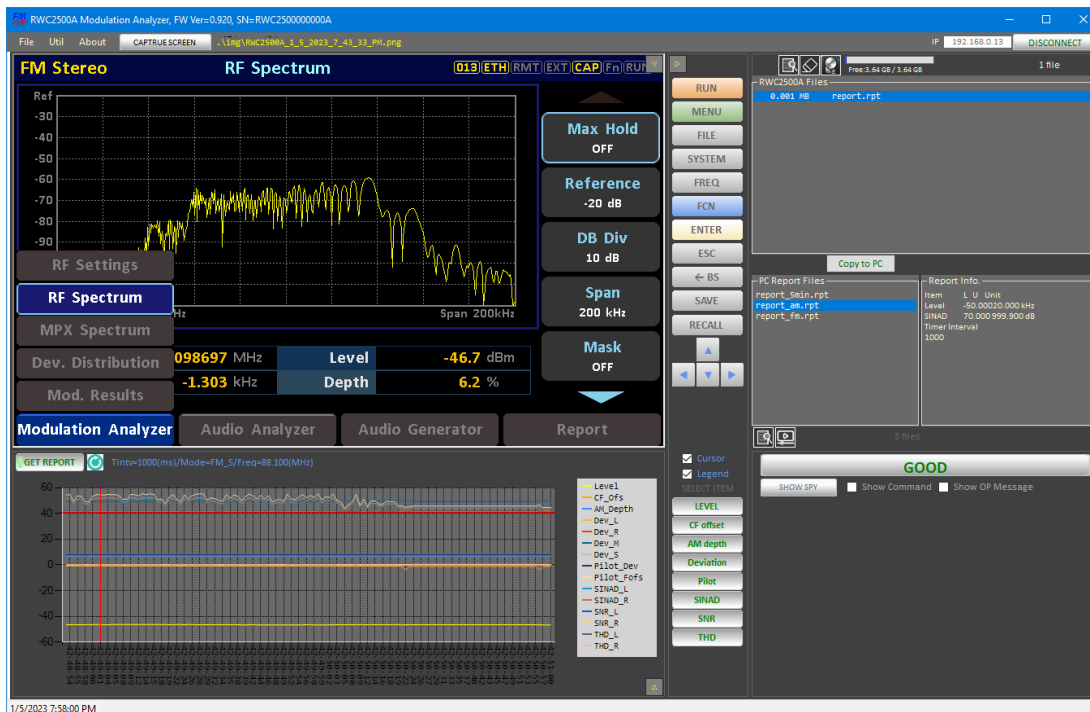


Figure. Monitoring and controlling the RWC2500A

When using the buttons, you can simulate pressing the keypad of RWC2500A. This action can also be observed on the monitor screen.

7.2 Capturing screen

You can save the currently displayed screen as a PNG image file using the **CAPTURE SCREEN** button. The saved file name is displayed next to the button, and you can click on the file name to automatically open the directory where the file is saved (.\img\)

7.3 Real-time Monitoring Measured Data

By using this application, you can display the data being measured in real-time from RWC2500A. The displayed data is shown in the form of graphs but is not saved simultaneously. To save the data, utilize the storage function of the RWC2500A device and use the storage capability on the internal storage of RWC2500A.

Functions

Start/Stop getting report

Press the [GET REPORT] button to receive real-time measurement data from the device and display it. It is a button with the toggle feature.

Enable/disable measuring items

You can selectively display the measurement data on the graph by pressing buttons with their respective names.

Zooming chart

You can zoom in on the area inside the graph by clicking and dragging with the mouse. When you zoom in on an area, horizontal and vertical scroll bars appear based on the selected area, allowing you to scroll horizontally and vertically. To return to the previous display, simply double-click the left mouse button.

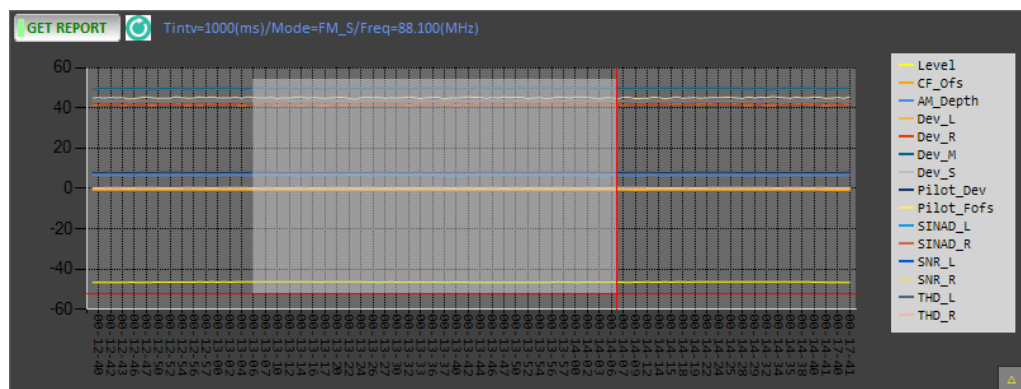


Figure. Zooming using clicking and dragging the left mouse button

☐ Cursor Control

By using the [CURSOR] checkbox, you can check the values at the positions displayed on the graph. When you bring the mouse close to the display line of the graph, it recognizes the values of each measurement item and displays them on the right side of the mouse.

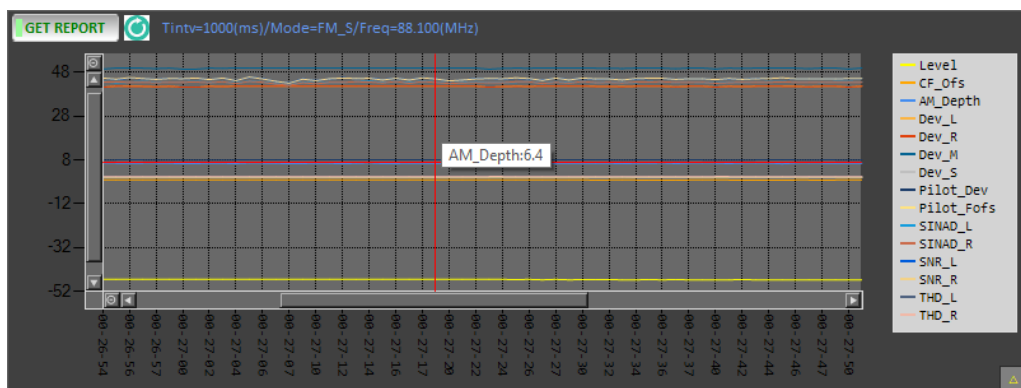


Figure. Showing the measured value at the cursor position

☐ Legend Control

Unlike selectively displaying measurement items, it is a function that turns the legend display on/off in the graph.

7.4 Managing Report files

You can use this application to list, delete, and download reports files stored on RWC2500A. Additionally, you can format the internal storage of the RWC2500A.

Functions

Storage free space

After connecting the device with the application by pressing the [Connect] button, the total capacity and available space of the internal storage in the device will be automatically displayed.

Update report file list

By clicking on the [Update] icon, you can check the report files stored internally on the device. This function also updates the total capacity and available space of the internal storage. Please note that if you use the device's report file storage function to save report files, the application will not automatically update the file list and available space. Therefore, it is recommended to update the file list after creating report files using the device.

Delete report file

By clicking on the [Delete] icon, you can delete report files stored internally on the device. Please be cautious as deleted files cannot be restored.

Format internal storage

By clicking on the [Format] icon, you can format the internal storage of the device. Please note that formatting will result in permanent data loss, so exercise caution.

Copy report files into the User PC

By clicking [Copy to PC], you can download the report files stored inside the device to your PC. During this process, the files inside the device will not be deleted.

7.5 Report file Viewer

The report file viewer feature allows you to load stored report files and display them as graphs. This viewer includes functionalities such as zooming in/out and selecting measurement items for display. Press the [REPORT VIEWER] button to activate the viewer pop-up window.

Functions

Loading a report file

By clicking the [Load] button, you can load the desired report file into the viewer. The file list displays files stored on the user's PC.

Chart functions

All chart functions are the same as the real-time monitoring data function. Please refer to the monitoring data function chapter.

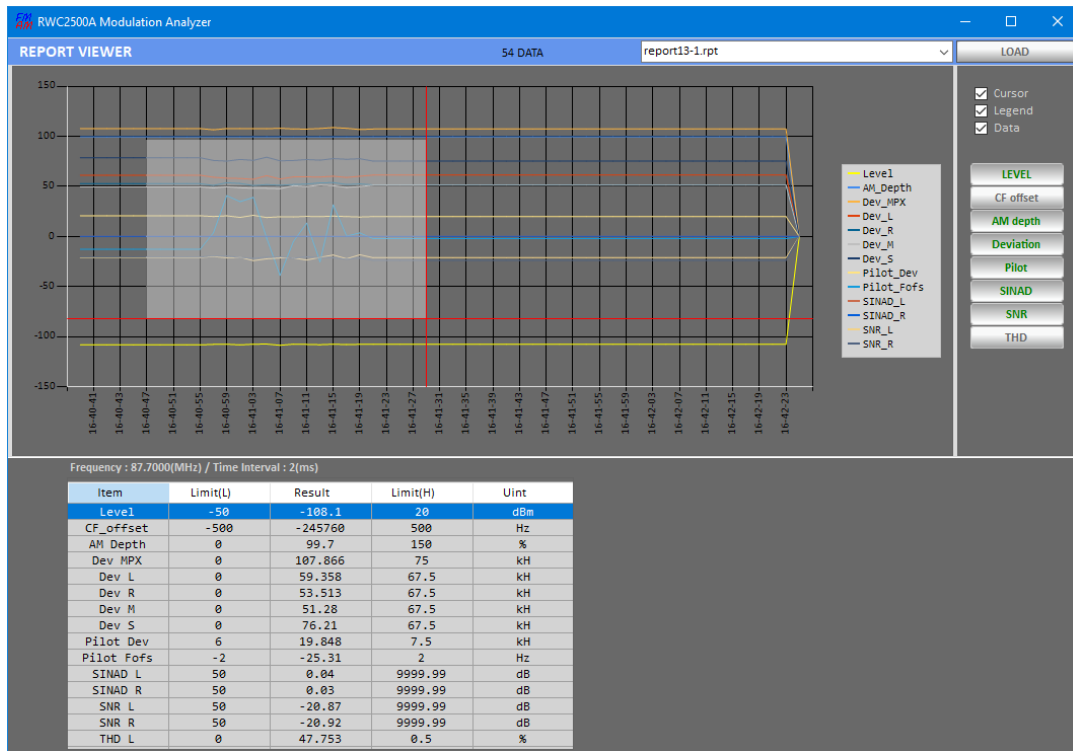


Figure. Report Viewer

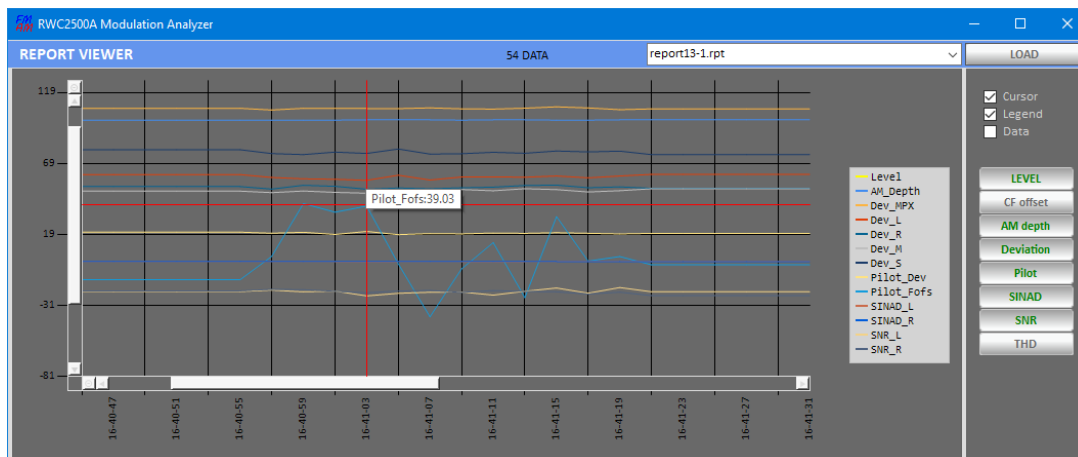


Figure. Zoomed in chart

8 Remote Control Programming

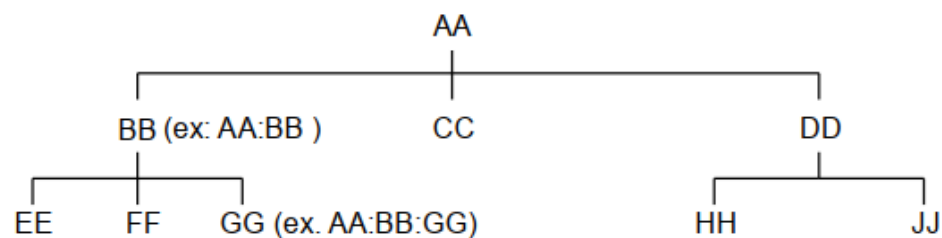
PC may control the RWC2500A remotely through Ethernet or RS232C interface using a comprehensive set of commands. This section provides the necessary information to operate the RWC2500A under Ethernet and RS232C control

- 8.1 Introduction
- 8.2 USBC(V-COM) Interface
- 8.3 Ethernet Interface
- 8.4 Command Tables

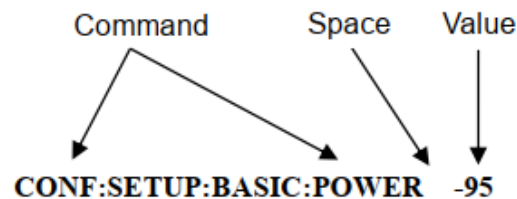
8.1 Introduction

The RWC2500A supports RS232C and Ethernet Interface, located at the rear panel for remote operation under PC control. Ethernet is used for high speed and flexible interfaces. To use Ethernet, socket programming is required. RS232C is a slow serial interface, but it does not need any special devices, and is easy to use

8.1.1 Command Structure



- Users must follow a particular path to reach lower level subcommands. For example, if you wish to access the GG command, you must follow the path AA to BB to GG (AA:BB:GG)
- Commands consist of *set commands* and *query commands* (usually simply called commands and queries). Set commands change instrument settings or perform a specific action. Queries cause the RWC2500A to return data and information about its status. Most commands have both a set form and query form. The query form of the command is started with "READ" and the set form of the command is started with "CONF". For example, one of the set commands is **CONF:SETUP:BASIC:POWER -95** and one of the query commands is **READ:SETUP:BASIC:POWER?**
- When a *colon* is placed between two command mnemonics, it moves the current path down one level in the command tree
- A *space* is used to separate parameters from commands. AA:BB:FF 20
- Some commands require two parameters. Refer to the Command list.



■ **Note:** All command s should be finished by LF (Line Feed, Char(10)) or semicolon(;).

8.1.2 Command Parameter Types

- Integer Parameter : CONF:SETUP:BASIC:POWER <Value> <LF>
- Double Integer parameter : CONF:SETUP:BASIC:POWER <Value> <Value> <LF>
- Discrete Parameter : CONF:SETUP:BASIC:RF {ON | OFF} <LF>

8.1.3 Response to Query

- Integer: Return an integer value, e.g. 0, 100, 256, -230.
- Discrete: Return a selection.

| Command & Query | Response |
|-------------------------|----------|
| READ:SETUP:BASIC:POWER? | -10 |
| READ:SETUP:BASIC:RF? | ON |

■ **Note:** All responses are finished by LF (Line Feed, Char(10))

8.2 USBC(V-COM) Interface

8.2.1 Setup

To use V-COM, the parameters of USB-Serial of the PC should be set up according to the following sequence.

| Parameter | Range | Description |
|-----------|--------|--------------------|
| DATA BITS | 8-bit | Length of Data bit |
| PARITY | Off | Error check bit |
| STOP BIT | 1-bit | Stop bit |
| BPS | 115200 | Baud Rate |

8.3 Ethernet Interface

8.3.1 Setup

- Connect LAN port of PC and RWC2500A Ethernet port by RJ45 cable. If the PC and RWC2500A are connected directly, crossover cable must be used.
- Set up the IP address as follows to use crossover cable.

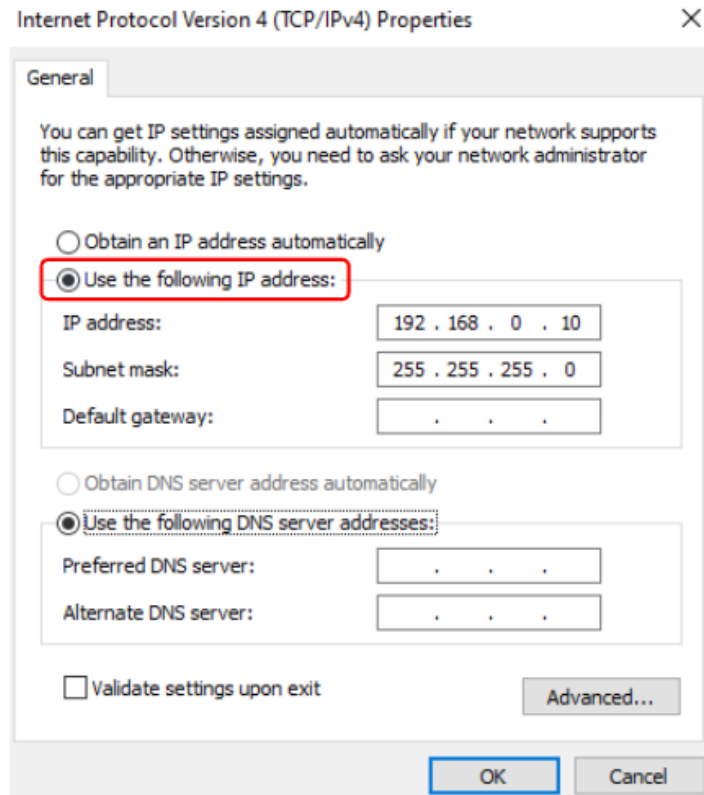


Fig. How to set up the static IP address of PC with Window OS

- Turn RWC2500A power ON, go to the 'SETUP/SYSTEM' screen and check the "IP_ADDR" value. Please be sure that the "IP_ADDR" value should be different from the PC's IP Address. Refer to section 2.5 Ethernet Connection Method.

8.2.2 Remote Programming Guide

- Set Serial Port
- Set up Baud Rate, Parity Bit (None), Data Bit (8 bit), Stop Bit (1 bit).
- Open port.
- Send RS232C command through serial port.
- Check command execution results on the RWC2500A screen.

- Send the next command after successful execution of the previous command.

If it is difficult to check the execution of the previous command, the next command should be sent after a few milliseconds.

Tip for programming

- A colon is used between commands.
- A space is only used between parameter values and commands.
- All commands should be finished by LF (Line Feed, char(10)).

8.4 Command Tables

8.4.1 Common Commands

| Command | <value> Range | Description |
|-------------------|------------------|--|
| *IDN? | N/A | Query Identification |
| *RST | N/A | Full preset command |
| *SAVE | 00 ~ 09 | Save current parameters setting to memory |
| *RECALL | 00 ~ 09 | Recall saved parameters setting from memory |
| *ALIVE | | |
| CONF:REMOTE:LOCK | | Lock or Unlock the key input during Remote Control |
| READ:REMOTE:LOCK? | | |

8.4.2 System Setup

| Command | <value> Range | Description |
|-------------------------|------------------|------------------------------------|
| READ:SYSTEM:SERIAL_NUM? | Query only | Read the serial number of RWC2500A |
| READ:SYSTEM:SW_VERSION? | Query only | Read the software version |

| | | |
|-------------------------------------|-------------------------|---|
| CONF:SYSTEM:SETUP:TESTER_MODE | FM_MOD_SETTINGS | |
| | FM_MOD_RF_SPECTRUM | |
| | FM_MOD_MPX_SPECTRUM | |
| | FM_MOD_DEV_DISTRIBUTION | |
| | FM_MOD_RESULTS | |
| | FM_AUDIO_SETTINGS | |
| | FM_AUDIO_SPECTRUM | |
| | FM_AUDIO_WAVEFORM | |
| | FM_AUDIO_CROSSTALK | |
| | FM_AUDIO_FREQ_RSP | |
| | FM_AUDIO_RESULTS | |
| | FM_REPORT | |
| | AM_MOD_SETTINGS | |
| | AM_MOD_RF_SPECTRUM | |
| | AM_MOD_RF_ENVELOPE | |
| | AM_MOD_RESULTS | |
| | AM_AUDIO_SETTINGS | |
| | AM_AUDIO_SPECTRUM | |
| | AM_AUDIO_WAVEFORM | |
| | AM_AUDIO_RESULTS | |
| | AM_REPORT | |
| CONF:SYSTEM:IP_TYPE | DYNAMIC STATIC | Configure/Read the ip type. This command should be executed via RS232C. |
| READ:SYSTEM:IP_TYPE? | Query only | |
| CONF:SYSTEM:IP_ADDR | xxx.xxx.xxx.xxx | Configure/Read the ip address (IPv4). This command should be executed via RS232C. |
| READ:SYSTEM:IP_ADDR? | Query only | |
| CONF:SYSTEM:SETUP:REF_CLK | INT, EXT | Configure/Read the selection of source for the reference clock |
| READ:SYSTEM:SETUP:REF_CLK? | Query only | |
| CONF:SYSTEM:SETUP:CURSOR_DIR | NORMAL INVERSE | Configure/Read the direction of cursor |
| READ:SYSTEM:SETUP:CURSOR_DIR? | Query only | |
| READ:SYSTEM:SETUP:OPTION_FM? | Query only | |
| READ:SYSTEM:SETUP:OPTION_AM? | Query only | |
| READ:SYSTEM:SETUP:OPTION_ANALYZER? | Query only | |
| READ:SYSTEM:SETUP:OPTION_GENERATOR? | Query only | |

| | | |
|--|--------------|---|
| READ:SYSTEM:SETUP:YEAR? | Query only | |
| CONF:SYSTEM:SETUP:YEAR | 1900 ~ 2200 | |
| READ:SYSTEM:SETUP:MONTH? | Query only | |
| CONF:SYSTEM:SETUP:MONTH | 1 ~ 12 | |
| READ:SYSTEM:SETUP:DAY? | Query only | |
| CONF:SYSTEM:SETUP:DAY | 1 ~ 31 | |
| READ:SYSTEM:SETUP:HOURL? | Query only | |
| CONF:SYSTEM:SETUP:HOURL | 0 ~ 23 | |
| READ:SYSTEM:SETUP:MINUTE? | Query only | |
| CONF:SYSTEM:SETUP:MINUTE | 0 ~ 59 | |
| READ:SYSTEM:SETUP:SECOND? | Query only | |
| CONF:SYSTEM:SETUP:SECOND | 0 ~ 59 | |
| READ:SYSTEM:SETUP:TIME? | Query only | |
| READ:SYSTEM:DEMOD:UNBAL_LEVEL_LEFT_DBU? | Query only | Demodulated Audio Out Unbalanced Left Level |
| CONF:SYSTEM:DEMOD:UNBAL_LEVEL_LEFT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:DEMOD:UNBAL_LEVEL_RIGHT_DBU? | Query only | Demodulated Audio Out Unbalanced Right Level |
| CONF:SYSTEM:DEMOD:UNBAL_LEVEL_RIGHT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:DEMOD:BAL_LEVEL_LEFT_DBU? | Query only | Demodulated Audio Out Balanced Left Level |
| CONF:SYSTEM:DEMOD:BAL_LEVEL_LEFT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:DEMOD:BAL_LEVEL_RIGHT_DBU? | Query only | Demodulated Audio Out Balanced Right Level |
| CONF:SYSTEM:DEMOD:BAL_LEVEL_RIGHT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:DEMOD:AES_LEVEL_LEFT_DBFS? | Query only | Demodulated Audio Out Digital Left Level |
| CONF:SYSTEM:DEMOD:AES_LEVEL_LEFT_DBFS | -40.0 ~ 0.0 | |
| READ:SYSTEM:DEMOD:AES_LEVEL_RIGHT_DBFS? | Query only | Demodulated Audio Out |

| | | |
|--|------------------------------|--|
| CONF:SYSTEM:DEMOD:AES_LEVEL_RIGHT_DBFS | -40.0 ~ 0.0 | Digital Right Level |
| READ:SYSTEM:DEMOD:UNBAL_OUT_STATUS? | Query only | |
| CONF:SYSTEM:DEMOD:UNBAL_OUT_STATUS | OFF LEFT RIGHT BOTH | Demodulated Audio Out Unbalanced Status |
| READ:SYSTEM:DEMOD:BAL_OUT_STATUS? | Query only | |
| CONF:SYSTEM:DEMOD:BAL_OUT_STATUS | OFF LEFT RIGHT BOTH | Demodulated Audio Out Balanced Status |
| READ:SYSTEM:DEMOD:AES_OUT_STATUS? | Query only | |
| CONF:SYSTEM:DEMOD:AES_OUT_STATUS | OFF ON | Demodulated Audio Out Digital Status |

8.4.3 System File

| Command | <value> Range | Description |
|----------------------------------|------------------|--------------------------|
| READ:SYSTEM:FILE:NAME? | Query only | Read file name |
| READ:SYSTEM:FILE:NUM? | Query only | Read quantity of files |
| CONF:SYSTEM:FILE:DELETE | file name | Delete a file |
| READ:SYSTEM:FILE:DISK_SIZE? | Query only | Read total disk size |
| READ:SYSTEM:FILE:FREE_SPACE? | Query only | Read disk free size |
| READ:SYSTEM:FILE:FORMAT_STATUS? | Query only | DONE/START/BUSY |
| CONF:SYSTEM:FILE:INTERVAL | 1 ~ 3600 | Interval in second |
| READ:SYSTEM:FILE:INTERVAL? | Query only | |
| CONF:SYSTEM:FILE:DURATION:HOURL | 1 ~ 345600 | Total duration in hour |
| READ:SYSTEM:FILE:DURATION:HOURL? | Query only | |
| CONF:SYSTEM:FILE:DURATION:MIN | 1 ~ 240 | Total duration in minute |
| READ:SYSTEM:FILE:DURATION:MIN? | Query only | |
| EXEC:SYSTEM:FILE:START_LOGGING | Execution | Start logging |

EXEC:SYSTEM:FILE:SAVE_CURRENT_REPORT

Execution

Save current report

8.4.4 Audio Generator

| Command | <value> Range | Description |
|--|------------------|---|
| READ:SYSTEM:AUDIO_GEN:FREQUENCY_LEFT? | Query only | Reference Audio Out Frequency in kHz |
| CONF:SYSTEM:AUDIO_GEN:FREQUENCY_LEFT | 0.10 ~ 20.00 | |
| READ:SYSTEM:AUDIO_GEN:FREQUENCY_RIGHT? | Query only | Reference Audio Out Frequency in kHz |
| CONF:SYSTEM:AUDIO_GEN:FREQUENCY_RIGHT | 0.10 ~ 20.00 | |
| READ:SYSTEM:AUDIO_GEN:BAL_LEVEL_LEFT_DBU? | Query only | Reference Audio Out Balanced Left Level |
| CONF:SYSTEM:AUDIO_GEN:BAL_LEVEL_LEFT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:AUDIO_GEN:BAL_LEVEL_RIGHT_DBU? | Query only | Reference Audio Out Balanced Right Level |
| CONF:SYSTEM:AUDIO_GEN:BAL_LEVEL_RIGHT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:AUDIO_GEN:UNBAL_LEVEL_LEFT_DBU? | Query only | Reference Audio Out Unbalanced Left Level |
| CONF:SYSTEM:AUDIO_GEN:UNBAL_LEVEL_LEFT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:AUDIO_GEN:UNBAL_LEVEL_RIGHT_DBU? | Query only | Reference Audio Out Unbalanced Right Level |
| CONF:SYSTEM:AUDIO_GEN:UNBAL_LEVEL_RIGHT_DBU | -40.0 ~ 10.0 | |
| READ:SYSTEM:AUDIO_GEN:AES_LEVEL_LEFT_DBFS? | Query only | Reference Audio Out Digital Left Level |
| CONF:SYSTEM:AUDIO_GEN:AES_LEVEL_LEFT_DBFS | -40.0 ~ 0.0 | |
| READ:SYSTEM:AUDIO_GEN:AES_LEVEL_RIGHT_DBFS? | Query only | Reference Audio Out Digital Right Level |
| CONF:SYSTEM:AUDIO_GEN:AES_LEVEL_RIGHT_DBFS | -40.0 ~ 0.0 | |
| READ:SYSTEM:AUDIO_GEN:BAL_STATUS? | Query only | Reference Audio Out Balanced Status |
| CONF:SYSTEM:AUDIO_GEN:BAL_STATUS | OFF | |
| | LEFT | |
| | RIGHT | |
| | BOTH | |
| READ:SYSTEM:AUDIO_GEN:UNBAL_STATUS? | Query only | Reference Audio Out Unbalanced Status |
| CONF:SYSTEM:AUDIO_GEN:UNBAL_STATUS | OFF | |
| | LEFT | |
| | RIGHT | |
| | BOTH | |

| | | |
|---------------------------------------|------------|---------------------------------------|
| READ:SYSTEM:AUDIO_GEN:AES_OUT_STATUS? | Query only | Reference Audio Out Digital Status |
| CONF:SYSTEM:AUDIO_GEN:AES_OUT_STATUS | OFF ON | |

8.4.5 Settings Commands

| Command | <value> Range | Description |
|---------------------------------------|----------------------------|--|
| READ:FM:RF_SETTINGS:RX_FREQ? | Query only | Read/Configure RX frequency in MHz for FM tester mode |
| CONF:FM:RF_SETTINGS:RX_FREQ | 76 ~ 108 | |
| READ:AM:RF_SETTINGS:RX_FREQ? | Query only | Read/Configure RX frequency in MHz for AM tester mode |
| CONF:AM:RF_SETTINGS:RX_FREQ | 0.5 ~ 30 | |
| READ:FM:RF_SETTINGS:LEV_UNIT? | Query only | Read/Configure the unit of level for FM tester mode |
| CONF:FM:RF_SETTINGS:LEV_UNIT | dBm | |
| | mV dBuV | |
| READ:AM:RF_SETTINGS:LEV_UNIT? | Query only | Read/Configure the unit of level for AM tester mode |
| CONF:AM:RF_SETTINGS:LEV_UNIT | dBm | |
| | mV dBuV | |
| READ:FM:RF_SETTINGS:PATH_LOSS? | Query only | Read/Configure the path loss in dB for FM tester mode |
| CONF:FM:RF_SETTINGS:PATH_LOSS | -60.0 ~ 60.0 | |
| READ:AM:RF_SETTINGS:PATH_LOSS? | Query only | Read/Configure the path loss in dB for AM tester mode |
| CONF:AM:RF_SETTINGS:PATH_LOSS | -60.0 ~ 60.0 | |
| READ:FM:AUDIO_SETTINGS:FM_DEMOD? | Query only | Read/Configure the demodulation mode for FM tester mode |
| CONF:FM:AUDIO_SETTINGS:FM_DEMOD | MONO STEREO | |
| READ:FM:AUDIO_SETTINGS:REF_FREQ_MODE? | Query only | Read/Configure the reference frequency mode for FM tester mode |
| CONF:FM:AUDIO_SETTINGS:REF_FREQ_MODE | AUTO MANUAL | |
| READ:FM:AUDIO_SETTINGS:LPF_FREQ? | Query only | Read/Configure LPF cutoff frequency in kHz for FM tester mode |
| CONF:FM:AUDIO_SETTINGS:LPF_FREQ | 2 ~ 20 | |
| READ:FM:AUDIO_SETTINGS:HPF_FREQ? | Query only | Read/Configure HPF cutoff frequency in Hz for FM tester mode |
| CONF:FM:AUDIO_SETTINGS:HPF_FREQ | OFF,10,20, 300,500,1000 | |

| | | |
|---------------------------------------|----------------------------|---|
| READ:FM:RF_SETTINGS:DE_EMPHASIS? | Query only | Read/Configure de-emphasis value |
| CONF:FM:RF_SETTINGS:DE_EMPHASIS | OFF 50us 75us | |
| READ:AM:AUDIO_SETTINGS:REF_FREQ_MODE? | Query only | Read/Configure the reference frequency mode for AM tester mode |
| CONF:AM:AUDIO_SETTINGS:REF_FREQ_MODE | AUTO MANUAL | |
| READ:AM:AUDIO_SETTINGS:LPF_FREQ? | Query only | Read/Configure the cutoff frequency of low pass filter for FM tester mode |
| CONF:AM:AUDIO_SETTINGS:LPF_FREQ | 2 ~ 20 | |
| READ:AM:AUDIO_SETTINGS:HPF_FREQ? | Query only | Read/Configure HPF cutoff frequency in Hz for AM tester mode |
| CONF:AM:AUDIO_SETTINGS:HPF_FREQ | OFF,10,20, 300,500,1000 | |

8.4.6 FM Tester Mode

| Command | <value> Range | Description |
|-------------------------------|------------------|---|
| READ:FM:RF_SPECTRUM:REF? | Query only | Read/Configure the reference in dB for FM tester mode |
| CONF:FM:RF_SPECTRUM:REF | -100 ~ 100 | |
| READ:FM:RF_SPECTRUM:DB_DIV? | Query only | Read/Configure the dB/division value for FM tester mode |
| CONF:FM:RF_SPECTRUM:DB_DIV | 1 ~ 100 | |
| READ:FM:RF_SPECTRUM:SPAN? | Query only | Read/Configure the span in kHz for FM tester mode |
| CONF:FM:RF_SPECTRUM:SPAN | 10 ~ 200 | |
| READ:FM:RF_SPECTRUM:MAX_HOLD? | Query only | Read/Configure the max hold for FM tester mode |
| CONF:FM:RF_SPECTRUM:MAX_HOLD | OFF, ON | |
| READ:FM:RF_SPECTRUM:RX_POWER? | Query only | |
| READ:FM:RF_SPECTRUM:CFO? | Query only | |
| READ:FM:RF_SPECTRUM:DEPTH? | Query only | |
| READ:FM:MPX_SPECTRUM:REF? | Query only | Read/Configure the reference in dB for FM tester mode |
| CONF:FM:MPX_SPECTRUM:REF | -100 ~ 100 | |

| | | |
|---------------------------------------|-----------------------|--|
| READ:FM:MPX_SPECTRUM:DB_DIV? | Query only | Read/Configure the dB/division value for FM tester mode |
| CONF:FM:MPX_SPECTRUM:DB_DIV | 1 ~ 100 | |
| READ:FM:MPX_SPECTRUM:MPX_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:L_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:R_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:M_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:S_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:PILOT_DEV? | Query only | |
| READ:FM:MPX_SPECTRUM:PILOT_FREQ_OFFS? | Query only | |
| READ:FM:DEVIATION:MEASURE_TIME? | Query only | Read/Configure the measure time in ms for FM tester mode |
| CONF:FM:DEVIATION:MEASURE_TIME | 1 ~ 60 | |
| READ:FM:DEVIATION:MOD_POWER? | Query only | |
| READ:FM:AUDIO_SPECTRUM:GRAPH? | Query only | Read/Configure the graph type for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:GRAPH | LEFT RIGHT BOTH | |
| READ:FM:AUDIO_SPECTRUM:MAX_HOLD? | Query only | Read/Configure the max hold for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:MAX_HOLD | OFF, ON | |
| READ:FM:AUDIO_SPECTRUM:REF? | Query only | Read/Configure the reference in dB for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:REF | -100 ~ 30 | |
| READ:FM:AUDIO_SPECTRUM:DB_DIV? | Query only | Read/Configure the dB/division value for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:DB_DIV | 1 ~ 100 | |
| READ:FM:AUDIO_SPECTRUM:START_FREQ? | Query only | Read/Configure the start frequency in kHz for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:START_FREQ | 0.00 ~ 19.50 | |
| READ:FM:AUDIO_SPECTRUM:STOP_FREQ? | Query only | Read/Configure the stop frequency in kHz for FM tester mode |
| CONF:FM:AUDIO_SPECTRUM:STOP_FREQ | 0.05 ~ 20.00 | |
| READ:FM:AUDIO_SCOPE:GRAPH? | Query only | Read/Configure the graph type for FM tester mode |
| CONF:FM:AUDIO_SCOPE:GRAPH | LEFT RIGHT BOTH | |

| | | |
|-------------------------------------|----------------------|--|
| READ:FM:AUDIO_SCOPE:STEREO_TRIGGER? | Query only | Read/Configure the trigger type for FM Stereo mode |
| CONF:FM:AUDIO_SCOPE:STEREO_TRIGGER | OFF LEFT RIGHT | |
| READ:FM:AUDIO_SCOPE:MONO_TRIGGER? | Query only | Read/Configure the trigger type for FM Mono mode |
| CONF:FM:AUDIO_SCOPE:MONO_TRIGGER | OFF, ON | |
| READ:FM:AUDIO_SCOPE:FREQ_DIV? | Query only | Read/Configure the freq/division value in kHz for FM tester mode |
| CONF:FM:AUDIO_SCOPE:FREQ_DIV | 1 ~ 100 | |
| READ:FM:AUDIO_SCOPE:TIME_DIV? | Query only | Read/Configure the time/division value in ms for FM tester mode |
| CONF:FM:AUDIO_SCOPE:TIME_DIV | 0.1 ~ 5.0 | |
| READ:FM:AUDIO_SCOPE:REF_FREQ_L? | Query only | Read/Configure the reference left frequency value in kHz for FM tester mode |
| CONF:FM:AUDIO_SCOPE:REF_FREQ_L | 0.05 ~ 20.00 | |
| READ:FM:AUDIO_SCOPE:REF_FREQ_R? | Query only | Read/Configure the reference right frequency value in kHz for FM tester mode |
| CONF:FM:AUDIO_SCOPE:REF_FREQ_R | 0.05 ~ 20.00 | |
| READ:FM:AUDIO_SCOPE:SINAD_L? | Query only | |
| READ:FM:AUDIO_SCOPE:SINAD_R? | Query only | |
| READ:FM:AUDIO_SCOPE:SNR_L? | Query only | |
| READ:FM:AUDIO_SCOPE:SNR_R? | Query only | |
| READ:FM:AUDIO_SCOPE:THD_L? | Query only | |
| READ:FM:AUDIO_SCOPE:THD_R? | Query only | |
| READ:FM:AUDIO_SCOPE:THDN_L? | Query only | |
| READ:FM:AUDIO_SCOPE:THDN_R? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_RMS_L? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_RMS_R? | Query only | |
| READ:FM:AUDIO_SCOPE:FREQ_L? | Query only | |
| READ:FM:AUDIO_SCOPE:FREQ_R? | Query only | |
| READ:FM:AUDIO_SCOPE:POS_PK_L? | Query only | |

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| READ:FM:AUDIO_SCOPE:POS_PK_R? | Query only | |
| READ:FM:AUDIO_SCOPE:NEG_PK_L? | Query only | |
| READ:FM:AUDIO_SCOPE:NEG_PK_R? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_PEAK_L? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_PEAK_R? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_QP_L? | Query only | |
| READ:FM:AUDIO_SCOPE:LEVEL_QP_R? | Query only | |
| READ:FM:FREQ_RESP:GRAPH? | Query only | Read/Configure the graph type for FM tester mode |
| CONF:FM:FREQ_RESP:GRAPH | LEFT RIGHT BOTH | |
| READ:FM:FREQ_RESP:TYPE? | Query only | Read/Configure the freq. response measure type for FM tester mode |
| CONF:FM:FREQ_RESP:TYPE | SINAD SNR THD THDN Deviation | |
| READ:FM:FREQ_RESP:START_FREQ? | Query only | Read/Configure the start frequency in kHz for FM tester mode |
| CONF:FM:FREQ_RESP:START_FREQ | 0.10 ~ 10.00 | |
| READ:FM:FREQ_RESP:STOP_FREQ? | Query only | Read/Configure the stop frequency in kHz for FM tester mode |
| CONF:FM:FREQ_RESP:STOP_FREQ | 0.10 ~ 20.00 | |
| READ:FM:FREQ_RESP:STEP_FREQ? | Query only | Read/Configure the step frequency in kHz for FM tester mode |
| CONF:FM:FREQ_RESP:STEP_FREQ | 0.01 ~ 1.00 | |
| READ:FM:FREQ_RESP:SWEEP_TYPE? | Query only | Read/Configure the freq. response sweep type for FM tester mode |
| CONF:FM:FREQ_RESP:SWEEP_TYPE | AUTO MANUAL | |
| READ:FM:FREQ_RESP:SWEEP_DELAY? | Query only | Read/Configure the freq. response delay in ms for FM tester mode |
| CONF:FM:FREQ_RESP:SWEEP_DELAY | 100 ~ 9000 | |
| READ:FM:FREQ_RESP:RESULT_L? | Query only | |
| READ:FM:FREQ_RESP:RESULT_R? | Query only | |
| READ:FM:CROSSTALK:AVG_N? | Query only | |

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| CONF:FM:CROSSTALK:AVG_N | 1 ~ 100 | |
| READ:FM:CROSSTALK:UP_LIMIT? | Query only | Read/Configure the upper limit in dB for FM tester mode |
| CONF:FM:CROSSTALK:UP_LIMIT | -120.0 ~ 0.0 | |
| READ:FM:CROSSTALK:RESULT_L? | Query only | |
| READ:FM:CROSSTALK:RESULT_R? | Query only | |
| READ:FM:REPORT:CONFIG? | Query only | |
| READ:FM:REPORT:DATA? | Query only | |

8.4.7 AM Tester Mode

| Command | <value> Range | Description |
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| READ:AM:RF_SPECTRUM:SPAN? | Query only | Read/Configure span of RF spectrum in kHz for AM tester mode |
| CONF:AM:RF_SPECTRUM:SPAN | 20 ~ 50 | |
| READ:AM:RF_SPECTRUM:RX_POWER? | Query only | |
| READ:AM:RF_SPECTRUM:DEPTH? | Query only | |
| READ:AM:RF_SPECTRUM:CFO? | Query only | |
| READ:AM:RF_ENVELOPE:MV_DIV? | Query only | Read/Configure mV/division value for AM tester mode |
| CONF:AM:RF_ENVELOPE:MV_DIV | 0.01 ~ 100.00 | |
| READ:AM:RF_ENVELOPE:POS_PEAK? | Query only | |
| READ:AM:RF_ENVELOPE:NEG_PEAK? | Query only | |
| READ:AM:RF_ENVELOPE:POS_PK_MOD? | Query only | |
| READ:AM:RF_ENVELOPE:NEG_PK_MOD? | Query only | |
| READ:AM:AUDIO_SPECTRUM:MAX_HOLD? | Query only | Read/Configure the max hold for AM tester mode |
| CONF:AM:AUDIO_SPECTRUM:MAX_HOLD | OFF, ON | |
| READ:AM:AUDIO_SPECTRUM:REF? | Query only | Read/Configure the reference in dB for AM tester mode |
| CONF:AM:AUDIO_SPECTRUM:REF | -100 ~ 30 | |
| READ:AM:AUDIO_SPECTRUM:DB_DIV? | Query only | Read/Configure dB/division value for AM tester mode |
| CONF:AM:AUDIO_SPECTRUM:DB_DIV | 1 ~ 100 | |

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| READ:AM:AUDIO_SPECTRUM:START_FREQ? | Query only | Read/Configure start frequency in kHz for AM tester mode |
| CONF:AM:AUDIO_SPECTRUM:START_FREQ | 0.05 ~ 19.50 | |
| READ:AM:AUDIO_SPECTRUM:STOP_FREQ? | Query only | Read/Configure stop frequency in kHz for AM tester mode |
| CONF:AM:AUDIO_SPECTRUM:STOP_FREQ | 0.05 ~ 20.00 | |
| READ:AM:AUDIO_SCOPE:PERCENT_DIV? | Query only | Read/Configure %/division value for AM tester mode |
| CONF:AM:AUDIO_SCOPE:PERCENT_DIV | 1 ~ 100 | |
| READ:AM:AUDIO_SCOPE:TRIGGER? | Query only | Read/Configure trigger type for AM tester mode |
| CONF:AM:AUDIO_SCOPE:TRIGGER | OFF, ON | |
| READ:AM:AUDIO_SCOPE:REF_FREQ? | Query only | Read/Configure reference frequency in kHz for AM tester mode |
| CONF:AM:AUDIO_SCOPE:REF_FREQ | 0.05 ~ 20.00 | |
| READ:AM:AUDIO_SCOPE:SINAD? | Query only | |
| READ:AM:AUDIO_SCOPE:SNR? | Query only | |
| READ:AM:AUDIO_SCOPE:THD? | Query only | |
| READ:AM:AUDIO_SCOPE:THDN? | Query only | |
| READ:AM:AUDIO_SCOPE:FREQ? | Query only | |
| READ:AM:AUDIO_SCOPE:DEPTH_RMS? | Query only | |
| READ:AM:AUDIO_SCOPE:DEPTH_PK? | Query only | |
| READ:AM:AUDIO_SCOPE:DEPTH_QPK? | Query only | |
| READ:AM:FREQ_RESP:TYPE? | Query only | |
| CONF:AM:FREQ_RESP:TYPE | SINAD SNR THD THDN Depth POS Peak NEG Peak | Read/Configure freq. response measure type for AM tester mode |
| READ:AM:FREQ_RESP:START_FREQ? | Query only | Read/Configure start frequency in kHz for AM tester mode |
| CONF:AM:FREQ_RESP:START_FREQ | 0.10 ~ 10.00 | |
| READ:AM:FREQ_RESP:STOP_FREQ? | Query only | Read/Configure stop frequency in kHz for AM tester mode |
| CONF:AM:FREQ_RESP:STOP_FREQ | 0.10 ~ 20.00 | |

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| READ:AM:FREQ_RESP:STEP_FREQ? | Query only | Read/Configure step frequency in kHz for AM tester mode |
| CONF:AM:FREQ_RESP:STEP_FREQ | 0.01 ~ 1.00 | |
| READ:AM:FREQ_RESP:RESULT? | Query only | |
| READ:AM:REPORT:CONFIG? | Query only | |
| READ:AM:REPORT:DATA? | Query only | |
