RWC2100F Application Program

Operation Manual



Version 1.076

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1. GENERAL INFORMATION

This chapter explains how to download and start the RWC2100F application program.

1.1 RWC2100F Equipment
1.2 Download and Installation of the PC Application Program
1.3 Starting the PC Application Program
1.4 GUI Structure

1.1 RWC2100F Equipment

1.1.1 Warranty

1.1.1.1 General Description

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 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 Customer is located outside of Korea.

1.1.1.2 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's responsibility to repair or replace defective 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

1.1.2 Safety Considerations

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

1.1.2.1 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**

1.1.2.2 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 must not exceed ± 10% of the nominal voltage.

■ **Provide 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 linearly to 50% relative humidity at 40 °C. Over voltage Installation Category II for main supply. Pollution Degree 2.

1.1.2.3 Safety Terms

These terms may appear in this manual.

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.

1.1.3 General Information

1.1.3.1 Key Features

■ FM-RDS Transmitter

· Supports 3 independent transmission channels
· Supports various audio signals (MONO / STEREO / SWEEP / WAV File / EXT_AUDIO_IN)
· Supports fully configurable RDS (RBDS)
· Supports radio text (RT, RT+, eRT, eRT+) with RDS code, UTF-8 and UCS-2
· Supports transmission a recorded RDS file
· Supports EON, user configurable TMC function

■ RDS Analyzer

· Receives and analyzes one FM-RDS radio signal Displays RDS information such as PS_NAME, (e)RT(+), AF list, etc.
· Records the RDS data as files.

■ Audio Analyzer

· SINAD, THDN, SNR and frequency measurement function
· Waveform and spectrum display of audio signal

■ AM Transmitter

· Supports 3 independent transmission channels.
· Supports various audio signals (MONO / SWEEP / WAV File / EXT_AUDIO_IN).

■ PC Software

· It consists of 5 control panels such as Transmitter, RDS Analyzer, Audio analyzer, scripter and combination panel.
· All functions can be operated simultaneously from each control panel.

1.1.3.2 Specifications

■ Transmitter Characteristics

· Frequency range: 500kHz to 1,800kHz for AM, 76MHz to 108MHz for FM
· Frequency accuracy: ±3.5kHz
· Output level: -10dBm to -90dBm for AM, +0dBm to -90dBm for FM
· Output level resolution: 0.25 dB
· Output level accuracy: ±1 dB

· VSWR: Better than 1:1.5

■ Receiver Characteristics

· Input frequency: 76MHz to 108MHz

■ Audio Analyzer Characteristics

· Input frequency: 0.1 kHz to 20 kHz
· Input range: Single Ended 2.25 Vrms
· Bandwidth: 11 kHz
· Common-Mode rejection ratio (CMRR): 56 dB
· Connection type: 3.5 pi Stereo

■ Remote Programming Ports

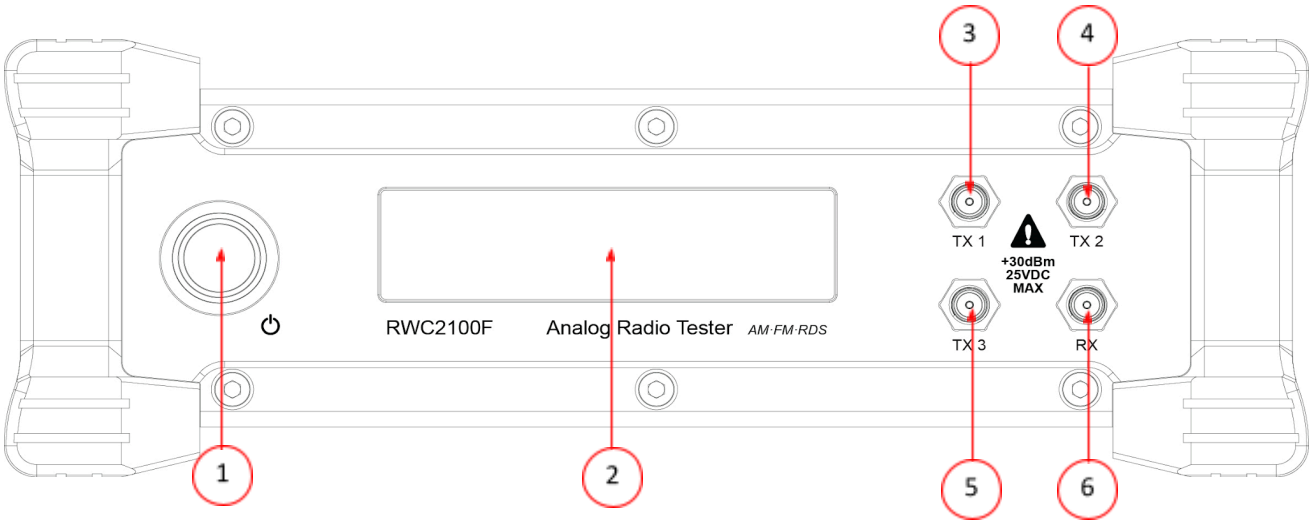
· RJ45 (Ethernet)
· RS-232C

■ Miscellaneous

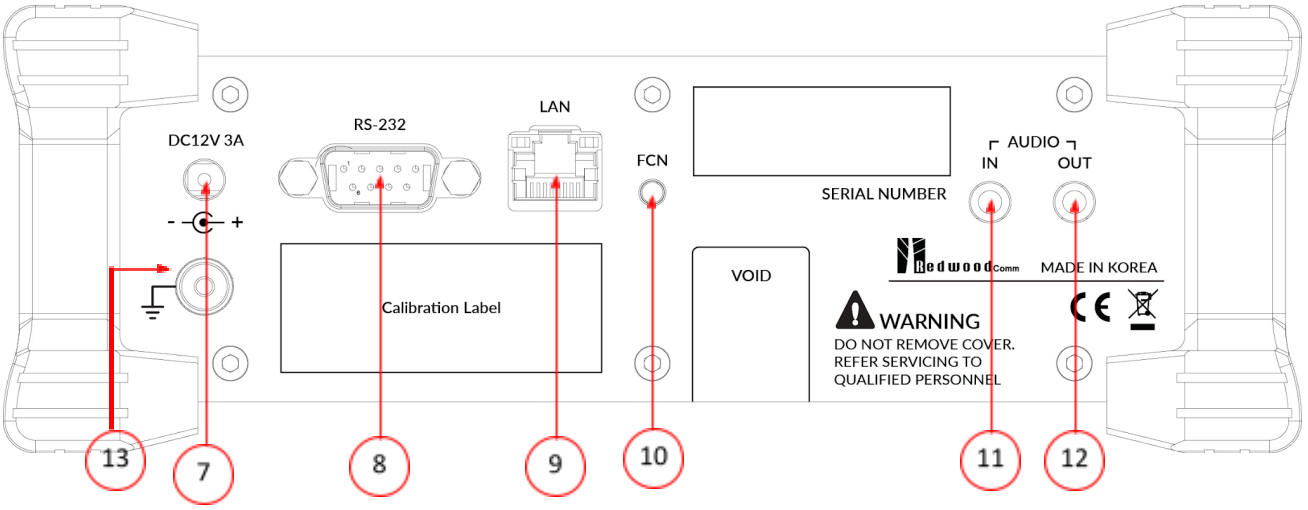
· Operating temperature: 5 to 40℃
· Input power: DC 12V, 3A
· Dimension: 166(w) x 50(h) x 194(d) mm
· Weight: 950g

1.1.3.3 Mechanical Features

■ Front panel



■ Rear panel



	Description	Description
	Power Switch	RS232 male connector
	OLED	RJ45 connector
	TX1 RF output port	Function button
	TX2 RF output port	Audio input 3.5pi
	TX3 RF output port	Audio output 3.5pi
	RX RF input port	GND Terminal
	12V DC power input	

1.2 Download and Installation of the PC Application Program

1.2.1 Downloading the Installer

RWC2100F application program is provided through emails or download link and the downloaded file can be unzipped into users' directory. The following figure shows an example.

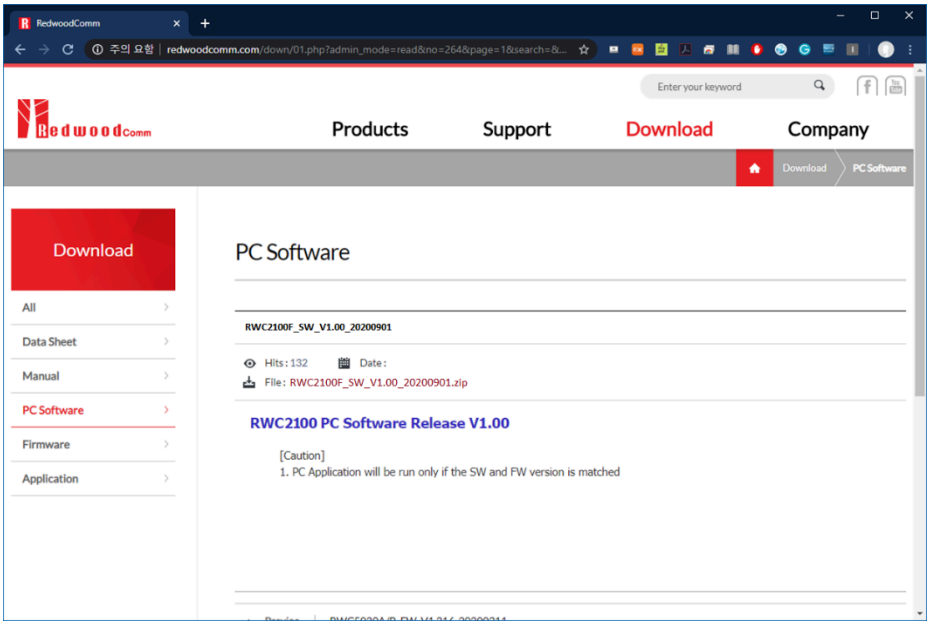


Figure 1.1 Downloading Zip file from the RedwoodComm website

1.2.2 Installation

Extract the zip file and install the executable file as the install wizard guides. It can be installed in any directories as users' want. If you install it in the C directory, you need to run it as administrator to give save permission to it for saving the environment file.

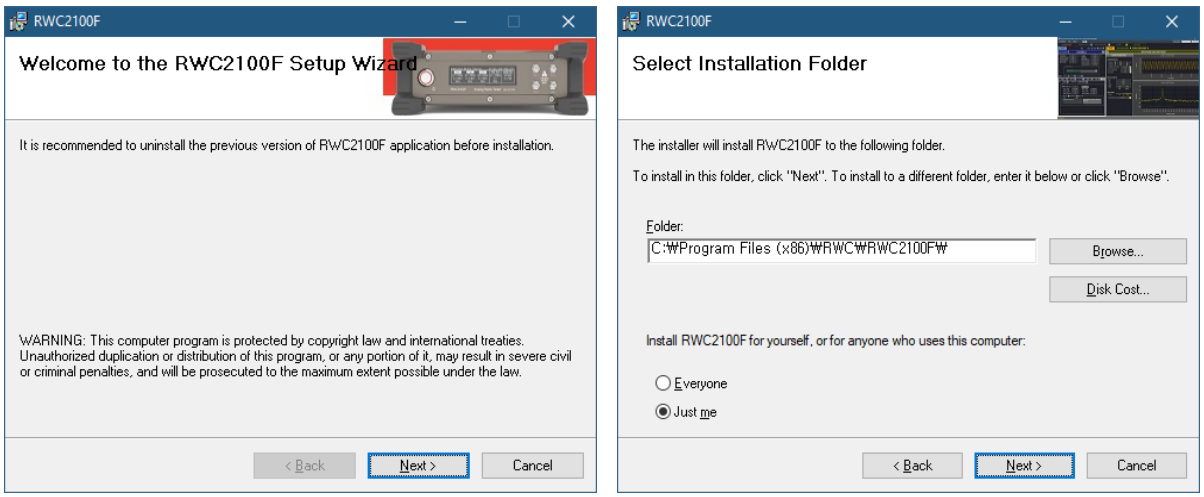


Figure 1.2 Installation wizard

After installation, you can see directories and files as follows:

./RWC2100F
    Executable file RWC2100F_App.exe
    DLL files
    RWC2100F.bin
./RWC2100F/Demo
./RWC2100F/Manual
./RWC2100F/Manual/App_release_note.pdf
./RWC2100F/Manual/RWC2100F_application_user_manul.pdf
./RWC2100F/Manual/RWC2100F_remote.pdf

Note: PC's OS

1. It supports Windows OS, but not Linux and iOS.
2. It is recommended to use windows11 or later ones.
3. If you want to avoid the authorization problem with your OS system, please install this application on a non-system disk, such as 'D drive'.

Language setup

1. It is strongly recommended to use '.' instead of ',' for decimal symbols.
2. It is strongly recommended to use ',' instead of '.' for digit grouping symbols.
3. It is strongly recommended to use English over other languages.

1.3 Starting PC Application Program

When you execute the application 'RWC2100F_App.exe', it will start as shown in Figure 1.3.

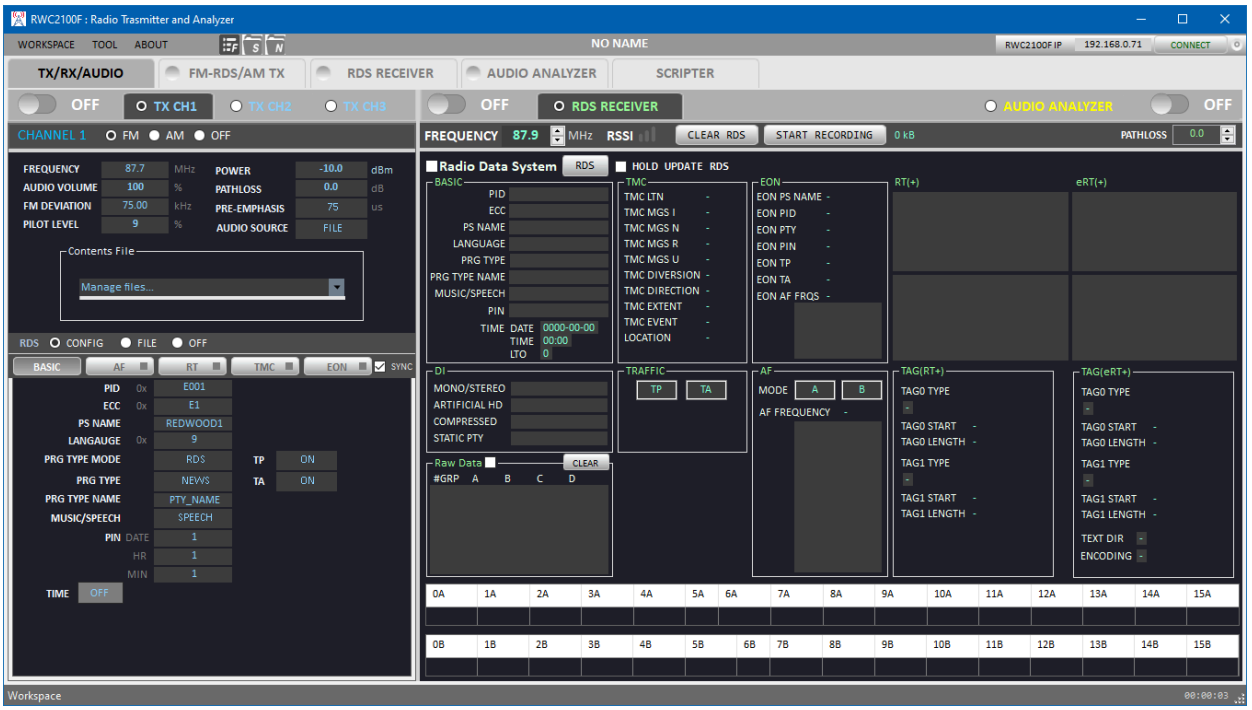


Figure 1.3 Initial screen of the application

1.3.1 Connection to the RWC2100F Equipment

Connect the RWC2100F to your internal network with LAN cable or PC with a crossover cable and click the [CONNECT] button to build a connection between the application and the RWC2100F. Connection means that the application finds the RWC2100F equipment via Ethernet and synchronizes all parameters of the application and the RWC2100F.

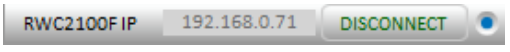


Figure 1.4 Connected status icon

When the PC application is connected to the RWC2100F, you can find the software version and model name at the top of the application. The color of the link indicator will be blue and the IP address will be unchangeable.
Another RWC2100F application cannot be connected with the same RWC2100F equipment. You must disconnect the application from RWC2100F for another connection.

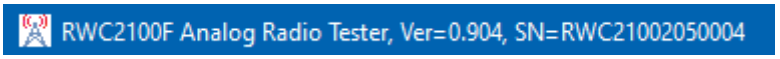


Figure 1.5 Application, version and Serial number

Once an application is connected to RWC2100F equipment, whenever you modify any parameters which are related to the control it will change the matched parameters of RWC2100F automatically and all status values of RWC2100F will be updated periodically.

If the connection between the application and the RWC2100F device was terminated abnormally, or if the device is already connected by another user, the following warning message will appear when a connection attempt is made.

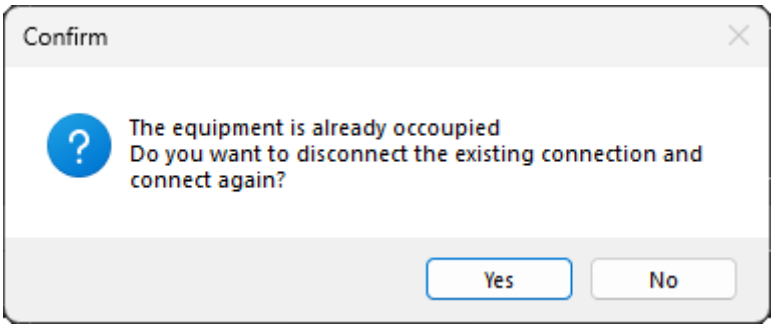


Figure 1.6 Application, version and Serial number

At this time, select **[YES]** to disconnect the existing connection and force a new connection.
Select **[NO]** to cancel the connection attempt.

1.3.2 Upgrading the FW of the RWC2100F

RWC2100F application checks the version of RWC2100F equipment whenever users run it. If it is needed to be upgraded, it will ask if you want to upgrade it. If the answer is “YES”, it will upgrade the equipment RWC2100F automatically. If the answer is “NO”, it will skip upgrade, but it will not be connected to the equipment due to the versions mismatched.

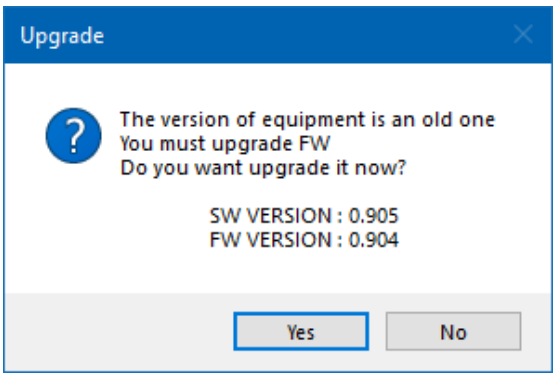


Figure 1.7 Upgrade warming window

After the upgrade is finished successfully, the power of the RWC2100F must be turned off and on for adoption of the new version. If any errors happen while upgrading FW, the application will retry upgrading automatically. The maximum number of retrial is 3.

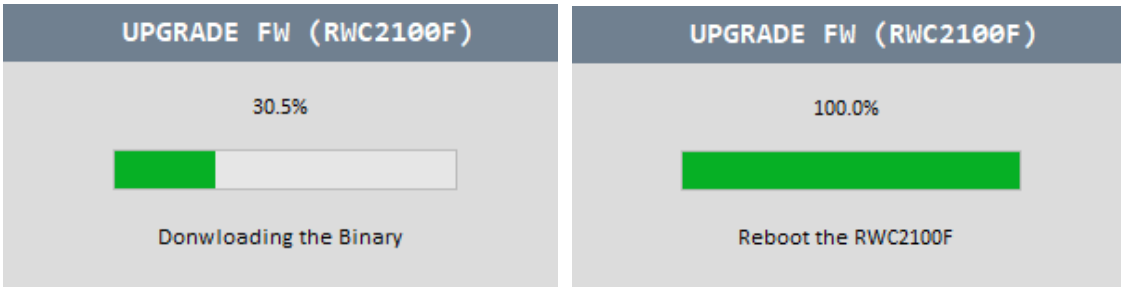


Figure 1.8 Upgrade progress bar

1.3.3 Manual

Clicking [Manual] on the ABOUT menu displays the operation manual, remote commands document, and release note.

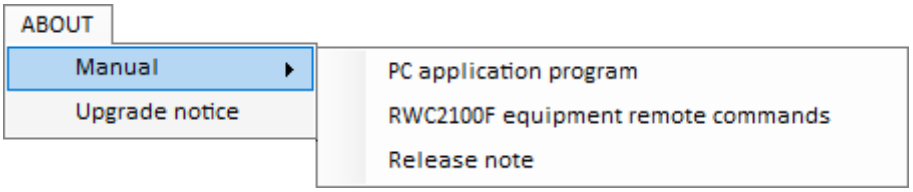


Figure 1.9 Menu for the manuals

1.4 GUI Structure

RWC2100F application program consists of 5 classified functional tabs: FM-RDS/AM Transmitter, RDS analyzer, audio analyzer, scripter and combination tab. The next chapters will include the detailed explanation about each function respectively.

The color of the running indicator of each tab will be changed if you turn on the correspondent function as follows.

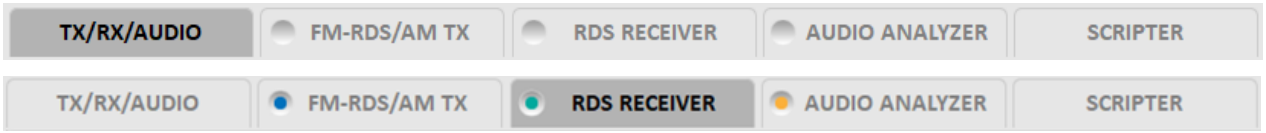


Figure 1.10 Function tab buttons and running indication

1.4.1 FM-RDS/AM Transmitter



Figure 1.11 FM-RDS/AM transmitter tab

1.4.2 RDS Receiver and Recorder

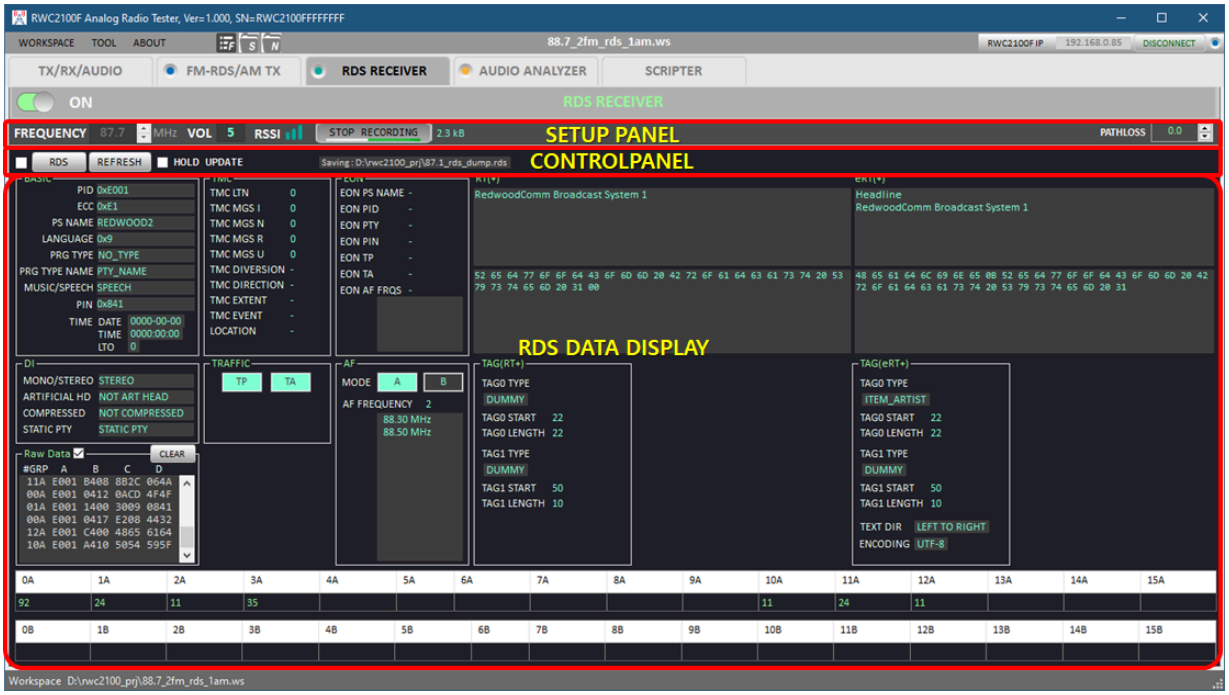


Figure 1.12 RDS Receiver tab

1.4.3 Audio Analyzer

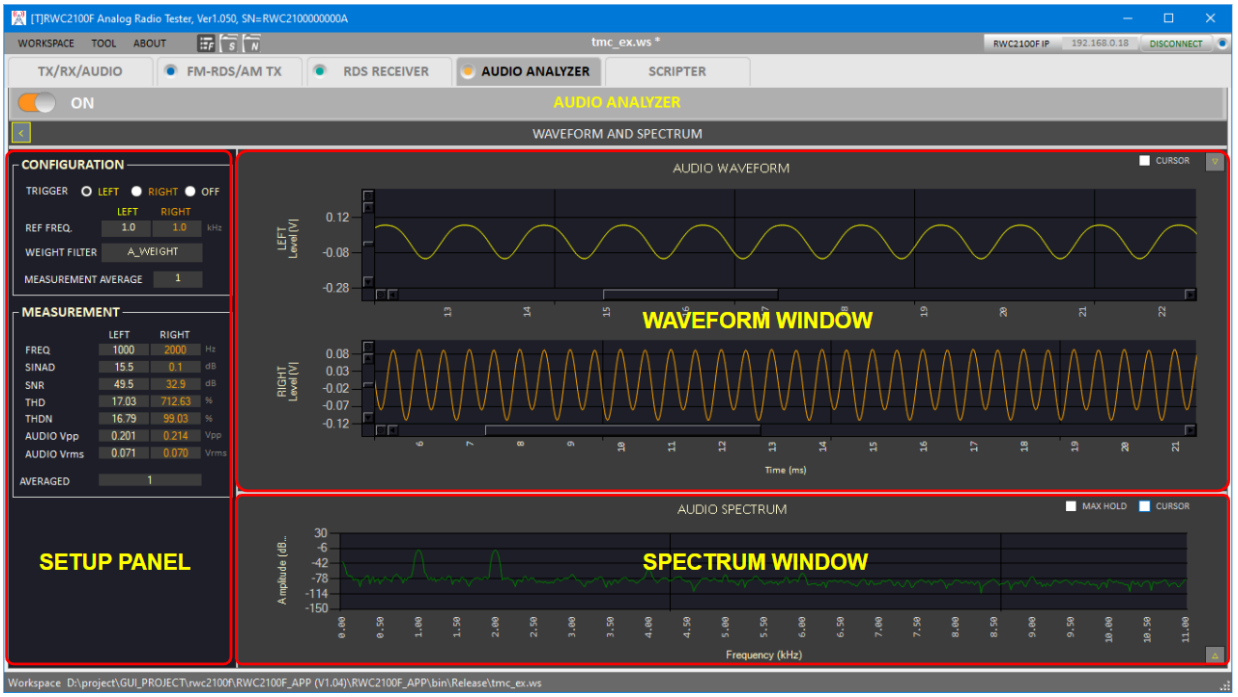


Figure 1.13 Audio Analyzer tab

1.4.4 Scripter

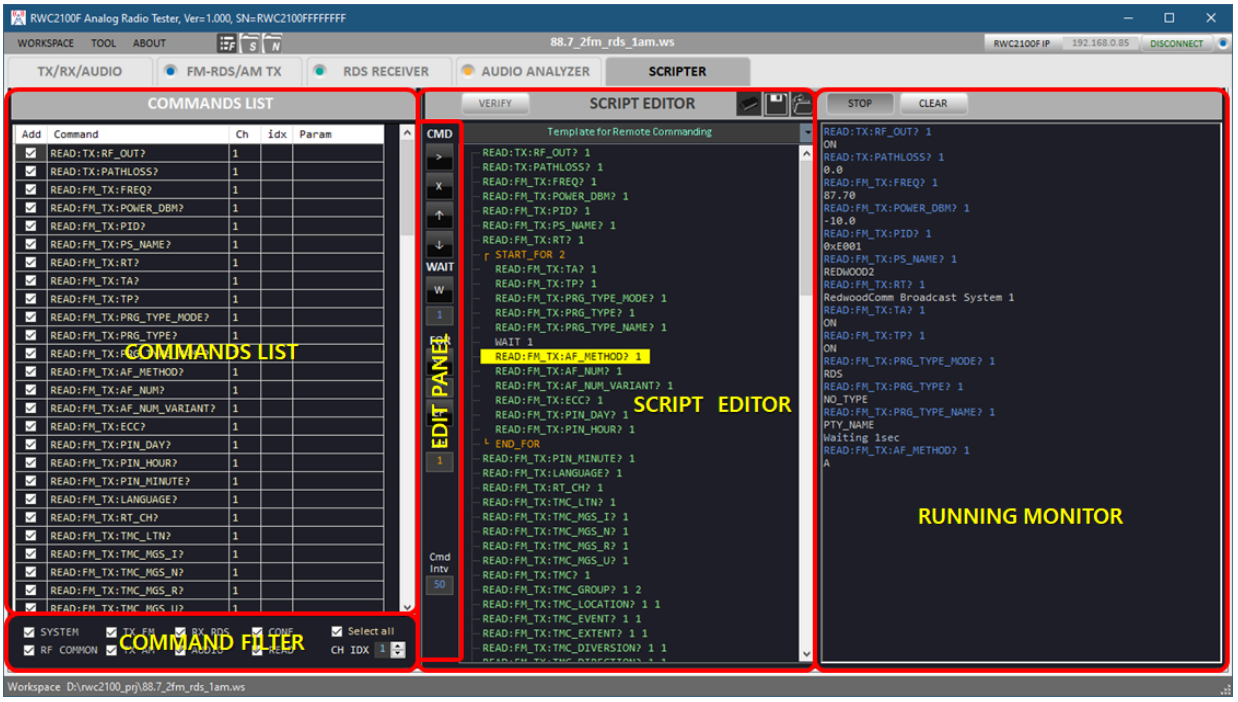


Figure 1.14 Scripter tab

1.4.5 Combination Window

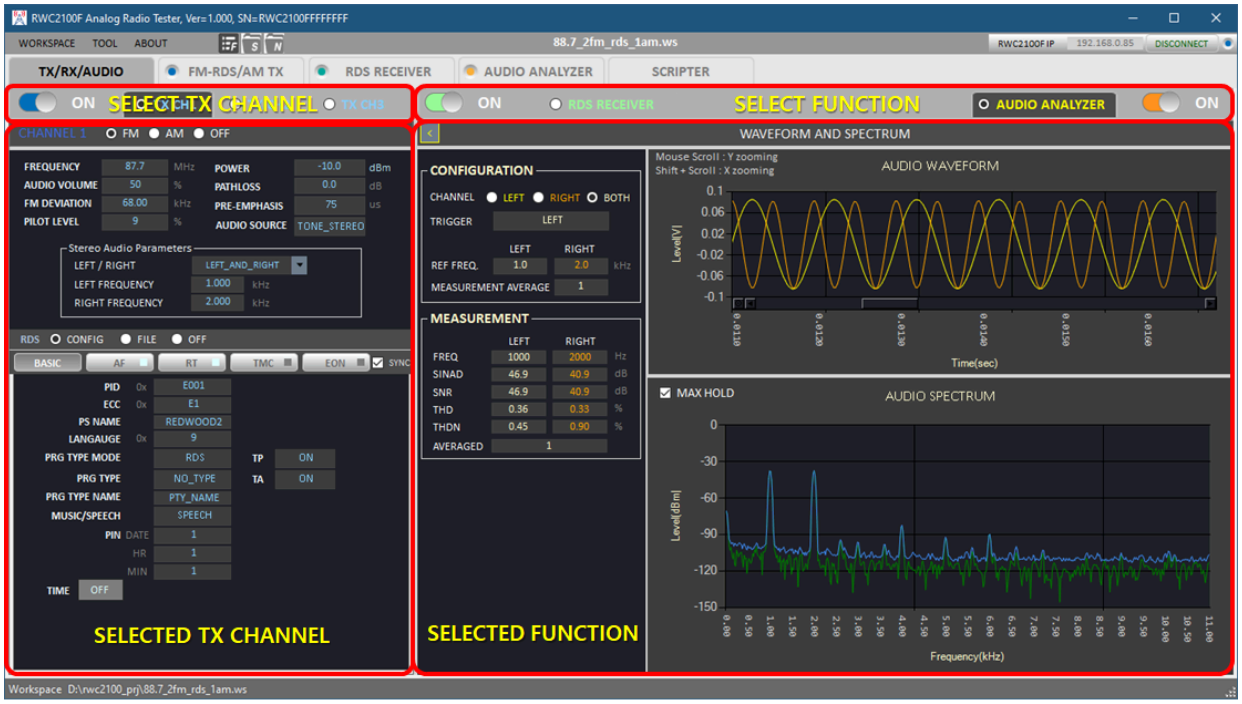


Figure 1.15 Combination window tab

2. MENUS

This chapter explains how to handle a workspace which saves and reloads users' test environment, tools for downloading wave and RDS files into RWC2100F, and information about the application.

2.1 WORKSPACE
2.2 TOOL
2.3 ABOUT

2.1 Workspace

The RWC2100F application program saves all control and protocol parameters to a workspace file. To handle the workspace, the application must be connected to the RWC2100F equipment. After connection, all workspace functions are activated. This means that without a connection with the equipment, you cannot operate the equipment properly and cannot create nor open a workspace. It is recommended to operate the equipment after saving the workspace for user convenience.

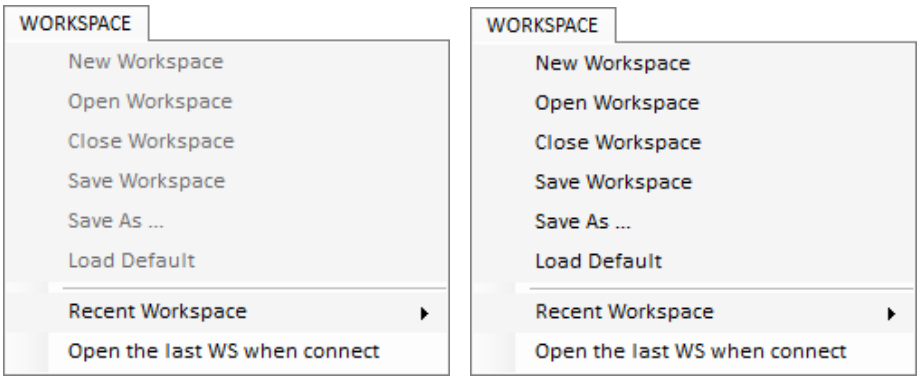


Figure 2.1 Menus for Workspace

2.1.1 Workspace Functions

2.1.1.1 New Workspace

It creates a new workspace. You can see the name of the created file at the top of the application. The full path of the workspace is displayed at the bottom of the application. You can also create a workspace by clicking [new] button .

2.1.1.2 Open Workspace

It opens an existing workspace file.

2.1.1.3 Close Workspace

It closes the opened workspace. After closing, the workspace name will be “NO NAME”.

2.1.1.4 Save Workspace

It saves the opened workspace without asking for a new name. If you click the [Save Workspace] without opening or creating a workspace, the Workspace File Naming dialog box opens.
If the parameters are changed, an asterisk appears in the workspace name, such as "my_workspace.ws *".

You can also save your workspace by clicking the [Save] button .

2.1.1.5 Save As

It saves the current workspace with a new workspace name.

2.1.1.6 Load Default.

It sets all parameters with factory's default values.

Be careful to use this function. The loaded parameters cannot be recovered to the previous ones.

2.1.1.7 Recent workspace

It saves and shows the last opened workspaces. You can open the one of listed files by clicking file name in the list. The maximum number is seven.



Figure 2.2 Recent workspaces list

2.1.1.8 Open the last WS when connect

If this option is checked, it opens the last workspace when you connect the application to RWC2100F equipment.

2.2 Tools

2.2.1 File Manager

You can pop up the file manager window by clicking [TOOL>File Manager] menu or button.

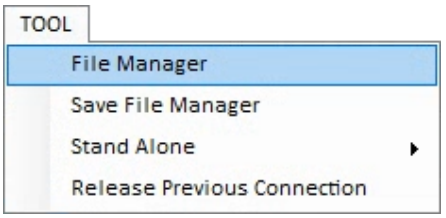


Figure 2.3 File manager menu

Before managing files, you must connect the application to the RWC2100F because the file manager handles the files located at RWC2100F equipment. With this function, users can download or delete wave or RDS files into RWC2100F equipment. After connecting the application to RWC2100F, It gathers and shows the information of the files saved into RWC2100F internal disk.

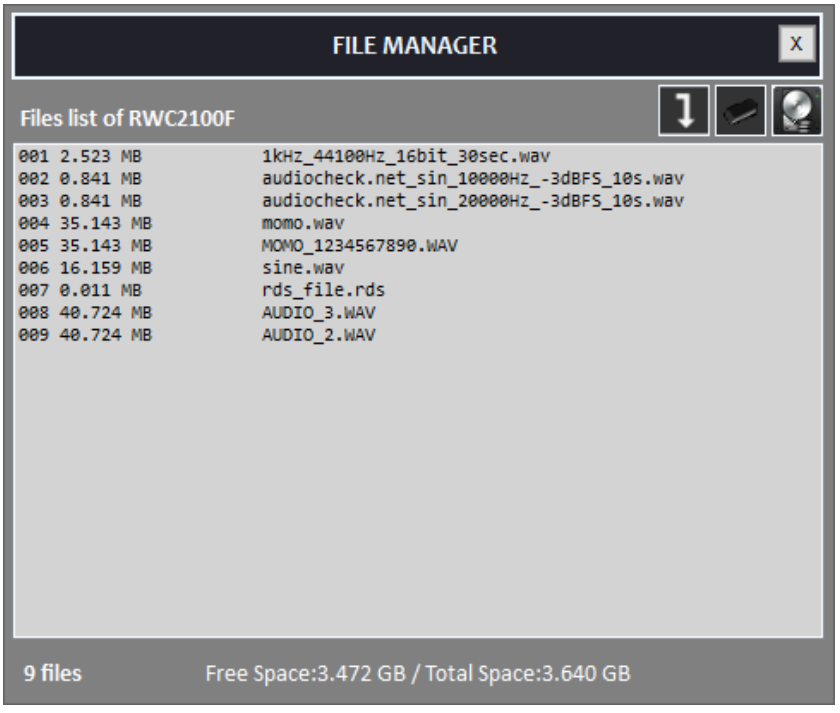


Figure 2.4 File manager popup window

All application functions such as FM/AM transmitter, RDS receiver, and audio analyzer must be stopped before starting the file manager.

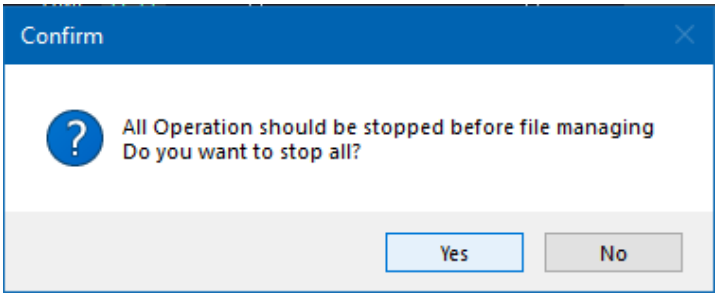


Figure 2.5 Confirm message before use the file manager

2.2.1.1 File manager functions

2.2.1.1.1 Downloading file(s)

Using download button , you can download wav files and radio data service files you dumped with the function of RWC2100F for saving RDS data. You can select multiple files using mouse drag action.

The filename must be written in English.

2.2.1.1.2 Type of files

The type of wave file must be a 44.1kHz sampled file.

The RDS file must be 8 bytes grouped ASCII formatted as [E001 A431 4E41 4D45]

2.2.1.1.3 Deleting file(s)

Using delete button , you can delete files one by one.

2.2.1.1.4 Formatting disk

Using format button , you can format the RWC2100F's internal disk.

Caution: Deleted files and formatted disks cannot be recovered. Ensure you have backups before proceeding.

2.2.2 Save File Manager

The Save File Management tool allows users to manage saved parameter files between a PC and the RWC2100F internal storage. This includes renaming files and overwriting internal storage data with PC files.

When you select "Save File Manager" from the TOOL menu, a confirmation dialog appears to ensure system safety.

YES

Stops the current operation of the RWC2100F and opens the Save File Management Window.

NO

Cancels the request and continues the current RWC2100F operation.

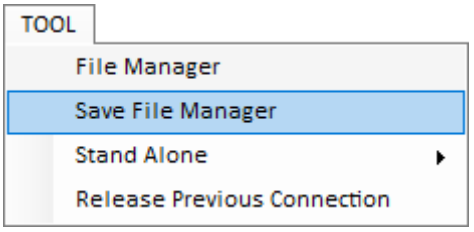


Figure 2.6 Save File Manager

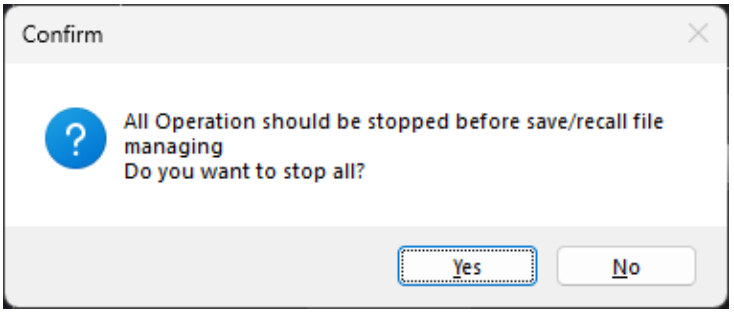


Figure 2.7 Confirm message before use the Save File Management Window

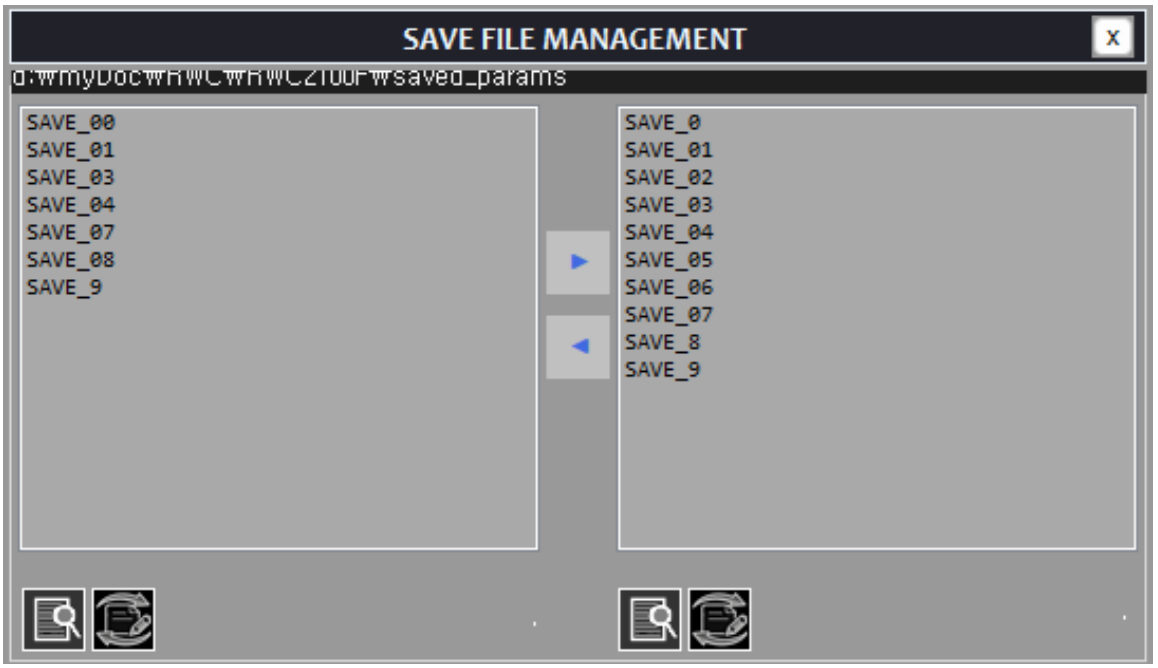


Figure 2.8 Save File Management Window

2.2.2.1 PC File Management (Left Pane)

This section displays and manages files stored on the local computer.

2.2.2.1.1 Directory Path

d:/myDoc/RWC/RWC2100F/Saved_params

2.2.2.1.2 Refresh List

Click the Update List icon to refresh the file list from the local directory.

2.2.2.1.3 Rename File

Click the Rename icon to modify the name of a selected file on the PC.

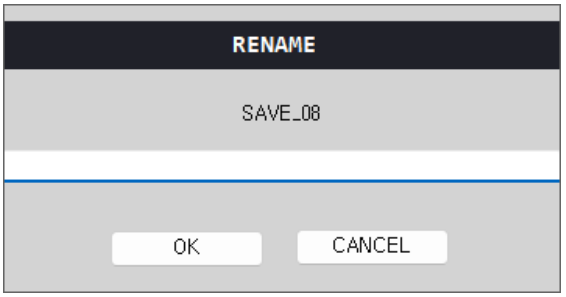


Figure 2.9 Save file File Rename window

2.2.2.2 RWC2100F Internal Storage Management (Right Pane)

This section displays files stored within the RWC2100F internal storage.

2.2.2.2.1 Fixed File Numbers

The system always has 10 saved files.

2.2.2.2.1 Refresh List

Click the Update List icon to synchronize and display the current internal file information.

2.2.2.2.1 Rename File

Click the Rename icon to change the display name of a file stored in the internal storage.

Note: Deleting files directly from the RWC2100F internal storage is not supported.

2.2.2.3 File Transfer and Synchronization

Users can transfer data between the PC and the device using the directional arrows located in the center.

2.2.2.2.1 Overwriting RWC2100F Files (PC → RWC2100F):

- Select a source file from the PC File list (Left).
- Select a target slot in the RWC2100F File list (Right).
- Click the Right Arrow [▸] button to overwrite the internal storage file with the selected PC file.

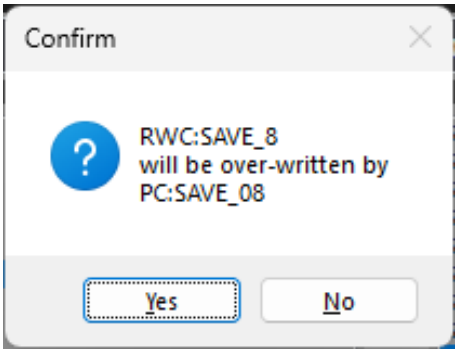


Figure 2.10 Confirmation window for overwrite warning

2.2.2.2.1 Exporting RWC2100F Files (RWC2100F ⟶ PC):

- Select a file from the RWC2100F File list (Right) that you wish to export.
- Click the Left Arrow [◂] button to save the internal file to the designated PC directory.

2.2.3 Stand Alone

RWC2100F provides a standalone function so that it can be used alone without a PC. If you open the saved workspace file on your PC and save it as a standalone parameter on the RWC2100F, you can transmit the radio broadcast signal according to the set parameters as soon as the RWC2100F is powered on.

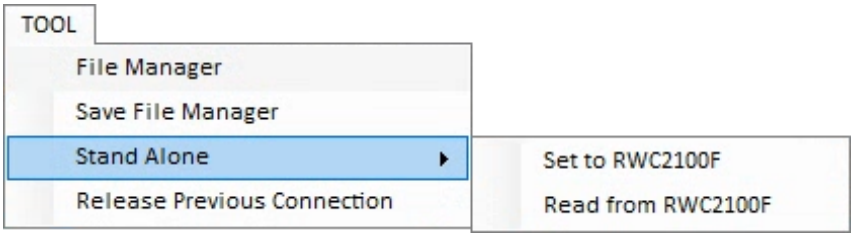


Figure 2.11 Stand Alone set and read

2.2.3.1 Set to RWC2100F

Set all parameters of the opened workspace to RWC2100F
The maximum length of the filename is 16

2.2.3.2 Read from RWC2100F

Read and all parameters from the RWC2100F and set them as parameters of the opened workspace

2.2.4 Release Previous Connection

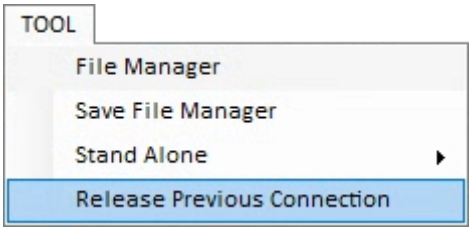


Figure 2.12 Release Previous Connection

It is a function used to forcibly disconnect an existing connection when the RWC2100F is already connected to another application.

This option can be useful when the previous application was not properly closed or when the connection remains occupied by another software instance.

2.3 About

2.3.1 Manual

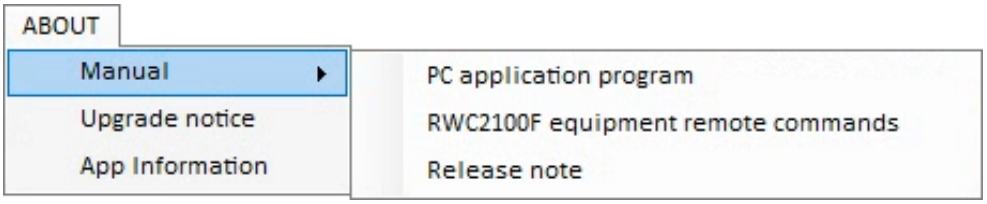


Figure 2.13 Opening the manual

The PC application program manual is intended to guide users on how to use the application program and the RWC2100F Analog Radio Tester equipment.

The RWC2100F Analog Radio Tester remote commands manual is intended to guide users on how to control the equipment using remote commands.

Both the application manual and the remote commands manual can be downloaded from the website. When the corresponding menu is selected, the default web browser is automatically launched and connected to the related web address.

The release note informs the release history and issues of the application and RWC2100F equipment.

2.3.2 Upgrade Notice

It shows the latest version information of the application.

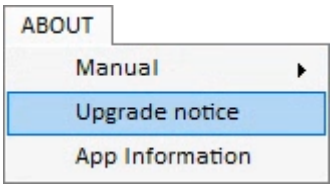


Figure 2.14 Upgrade notice

2.3.3 App Information

It shows the application information such as product name, software version, and build date/time.

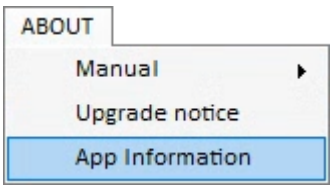


Figure 2.15 Upgrade notice

Product Name : Displays the current application name.
Version : Displays the installed software version.
Built Date : Displays the date and time when the application was built.

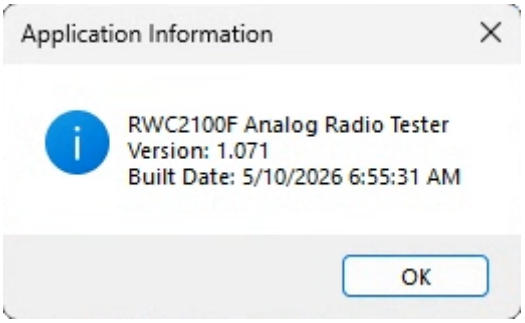


Figure 2.16 App Information window.

3. FUNCTIONS

This chapter explains how to use main functions such as FM-RDS/AM Transmitter, RDS Receiver, Audio analyzer and Scripter.

3.1 FM-RDS/AM Transmitter
3.2 RDS Receiver
3.3 Audio Analyzer
3.4 Scripter

3.1 FM-RDS/AM Transmitter

The FM-RDS/AM transmitter supports up to 3 independent FM/AM channels individually. Users can select and combine up to 3 FM and AM to transmit signals.

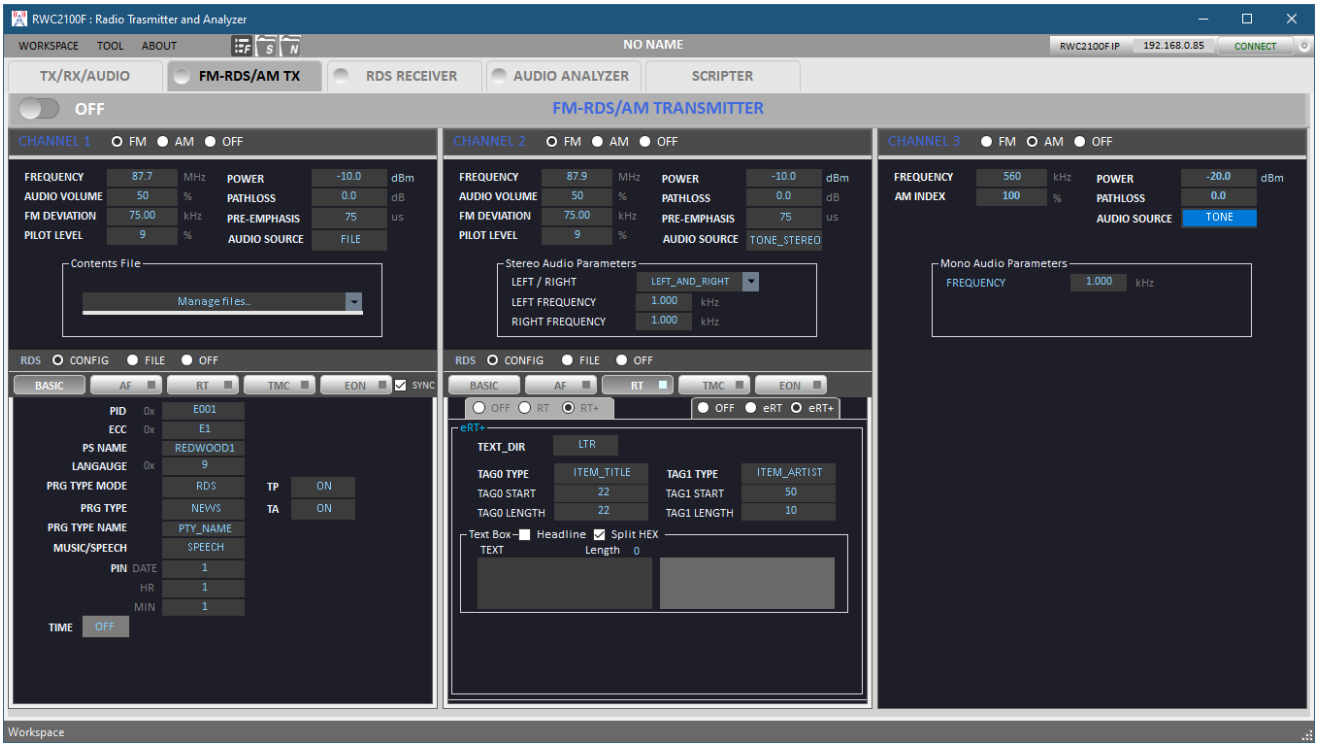


Figure 3.1 Transmitter tab with combination of FM and AM

3.1.1 FM-RDS Transmitter

3.1.1.1 Operation

FM-RDS transmitter separately supports up to 3 independent FM channels. Each FM signal has an independent RDS(Radio Data System) data channel. The Frequency and the power of each FM channel can be set by users. For each FM transmission, you can select RDS mode among CONFIG, FILE, and OFF.

You can select one of audio sources among FILE, TONE-MONO, TONE-STEREO, and SWEEP.

3.1.1.2 Parameters

FREQUENCY

FM local Frequency 85 to 107.9MHz

POWER

FM Transmission power level.

Users can toggle the power unit by clicking on the unit.

Range: 0 to -90 dBm (107 to 17dBuV)



a. Power in dBm unit b. Power in dBuV unit

Figure 3.2 Toggling the power unit

PATHLOSS

Pathloss between RWC2100F TX port and DUT

RWC2100F compensates the output power automatically according to the path-loss value.

Unit: dB

AUDIO VOLUME

The ratio used when converting the audio source signal to FM deviation.

Range: 0 to 100%

FM DEVIATION

The amount of the maximum difference between the FM modulation frequency and the nominal carrier frequency.

Range: 0 to 7kHz

PILOT LEVEL

The level of pilot tone of FM signal.

In FM stereo broadcast systems, a pilot tone (19 kHz) indicates that there is stereo information at 38 kHz.

Users can modify the level of pilot tone in % unit.

Range: 0 to 15%

PRE-EMPHASIS

Pre-emphasis is a process of amplifying specific frequencies, especially high frequencies, before transmission to reduce noise generated at high frequencies of FM signals.

The amount of pre-emphasis is defined as the time constant of the RC filter circuit.

Option: OFF, 50µs, 75µs

AUDIO SOURCE

Audio source which will be frequency modulated

Options: FILE, TONE-MONO, TONE-STEREO, SWEEP, and EXT_AUDIO_IN.

FILE: Set the MODE parameter as ‘FILE’ for FM Wave Mode test. Downloaded wav files can be played with frequency modulation. If you select this option, the content files box will be shown.

The green color bar below the CONTENTS file shows the status of file transmitting



Figure 3.3 Contents file box

FM-MONO: Set the MODE parameter as 'TONE-MONO' to set Mono single tone as audio source. In FM_MONO mode, one audio signal will be frequency modulated.

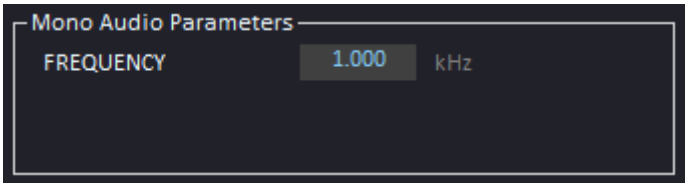


Figure 3.4 Frequency setup box for the mono audio parameter

FM-STEREO: Set the AUDIO SOURCE to 'TONE-STEREO' to transmit stereo two tones. In this mode, two audio signals(LEFT/RIGHT) will be frequency modulated and transmitted. RWC2100F provides left and right frequency separately.

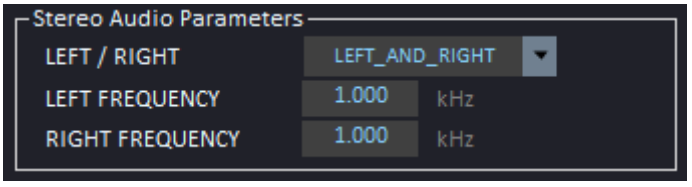


Figure 3.5 Frequency setup box for the stereo audio parameter

SWEEP: Set the AUDIO SOURCE to 'SWEEP' for FM SWEEP Mode transmission. In this mode, RWC2100F makes the chirp FM audio tone which has frequency range from the START FREQUENCY to STOP FREQUENCY during SWEEP_TIME.

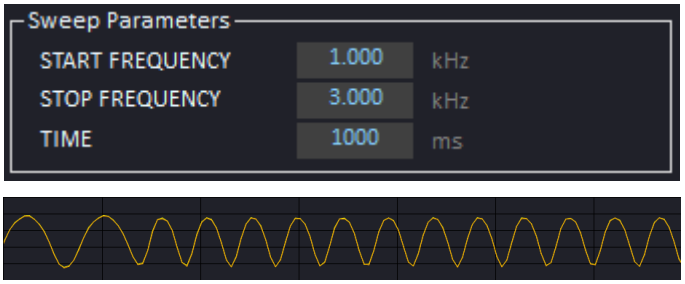


Figure 3.6 Frequency and time setup box for the sweep parameter

EXT_AUDIO_IN: Set AUDIO SOURCE to EXT_AUDIO_IN for FM transmission that modulates the rear panel audio input signal. In this mode, you can set the audio gain in the range of 0 - 50dB.



Figure 3.7 EXTERNAL AUDIO INPUT

3.1.2 RDS

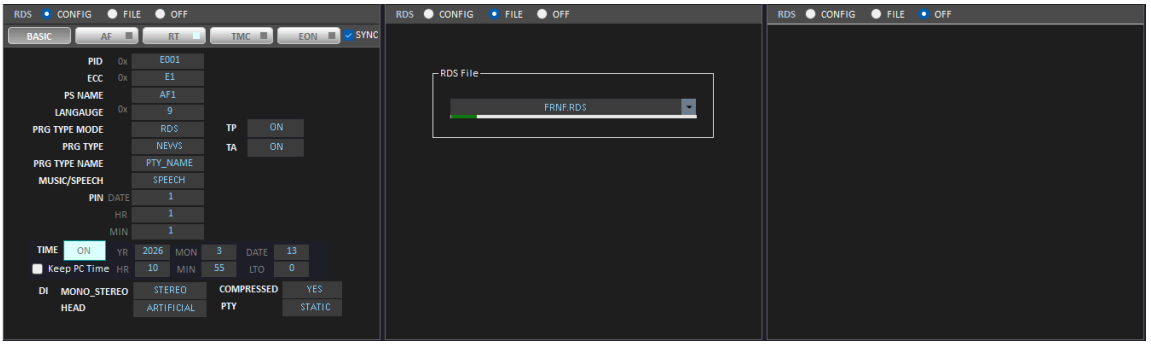
RDS (Radio Data System) is a communications-protocol standard used with FM Radio broadcasting. RWC2100F also provides 3 independent Radio Data System services for each FM transmitter respectively.



Figure 3.8 RDS parameter windows for each FM

3.1.2.1 Operation

You can select one of the configuration modes such as CONFIG, FILE, and OFF for each RDS respectively. You can configure all RDS parameters in CONFIG mode. You can also transmit an RDS recorded file by selecting the FILE option. Of course you can transmit FM broadcasting signals without RDS by selecting the OFF option.



a. CONFIG b. RDS file c. OFF

Figure 3.9 RDS options

There are 5 categorized tabs for easy setup such as BASIC, AF, RT, TMC and EON.
Users can be recognized which test function is turned on with the on or off indication box in each parameter button.



Figure 3.10 On / off Indication box of RDS

3.1.2.2 Basic parameters

PID

This parameter is the Physical ID of the program. The Program is recognized by this value in DUTs.

ECC (Extended Count Code)

RDS uses its own country codes, composed of a combination of a Country Identifier CI and an Extended Country Code ECC.
8bit HEX value

PS_NAME

This parameter stands for the name of Program. The maximum length of the string is 8.

LANGUAGE

To enable a broadcaster to indicate the spoken language he is currently transmitting, the 8 bit language identification codes shall be transmitted. The code 0x09 stands for English.



Figure 3.11 Basic parameters window of RDS

PRG_TYPE_MODE

RDS and RBDS have different tables of program type. For Europe broadcasting, please set this parameter as RDS. For American broadcasting, please set this parameter as RBDS.

PRG_TYPE

This is an identification number to be transmitted with each program item and which is intended to specify the current Program Type within 31 possibilities. This code could be used for search tuning. The code will, moreover, enable suitable receivers and recorders to be pre-set to respond only to program items of the desired type.

TP

This is a flag to indicate that the tuned program carries traffic announcements. The TP flag must only be set on programs which dynamically switch on the TA identification during traffic announcements. The signal shall be taken into account during automatic search tuning.

TA

This is an on/off switching signal to indicate when a traffic announcement is on air.

Traffic Program (TP) and Traffic Announcement (TA) Test

The setting of these two parameters stand for following condition of the program

TP	TA	Application
OFF	OFF	This program does not carry traffic announcements nor does it refer, via EON, to a program that does

OFF	ON	This program carries EON information about another program which gives traffic information
ON	OFF	This program carries traffic announcements but none are being broadcast at present and may also carry EON information about other traffic announcements
ON	ON	A traffic announcement is being broadcast on this program at present

MUSIC/SPEECH
Music or speech option in block 2 of Group type 0

PIN_DAY, PIN_HOUR, PIN_MINUTE
The PIN (Program Item Number) code should enable receivers and recorders designed to make use of this feature to respond to the particular program item(s) that the user has preselected. Use is made of the scheduled program time, to which is added the day of the month in order to avoid ambiguity.

DI
DI (Decoder Identification) is a 4-bit flag field that provides information about the audio characteristics of the transmitted program. It helps the receiver understand how the audio is produced and how the program type behaves.

DI information is transmitted mainly in RDS Group 0A or 0B together with the basic tuning information (PS name, AF, etc.).
MONO / STEREO
This flag indicates whether the broadcast audio is mono or stereo.

COMPRESSED / NOT COMPRESSED
This flag indicates whether dynamic range compression is applied to the audio signal.

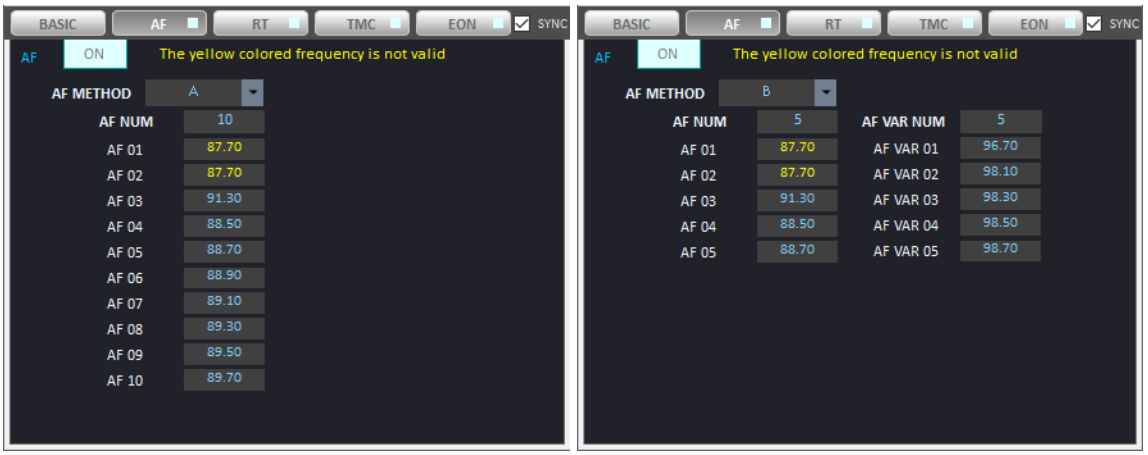
HEAD (ARTIFICIAL / NON-ARTIFICIAL)
This flag indicates whether the audio content is naturally produced or artificially generated.

PTY (STATIC / DYNAMIC)
This flag indicates whether the Program Type is expected to remain constant or change frequently.

3.1.2.3 AF (Alternative Frequency)

To facilitate the automatic tuning process in a receiver, a number of AFs shall be transmitted. The AF list shall only comprise frequencies of neighboring transmitters or repeaters. RWC2100F supports

two methods of transmitting AFs by setting the AF_METHOD parameter.



a. AF method A b. AF method B

Figure 3.12 AF parameters window of RDS

AF_NUM, AF_ 01 to AF_24

There are 2 AF methods; A and B in RDS AF mode.

AF_METHOD A

The maximum number of AF of method A is 24

AF_NUM, AF_01 to AF_24 in Mode A

Alternative Frequency information informs the list of frequencies which are broadcasting the same program in the same or adjacent reception areas, and enables receivers equipped with a memory to store the list(s), to reduce the time for switching to another transmitter. This facility is particularly useful in the case of car and portable radios. Set the “AF_NUM” parameter as how many alternative frequencies you want to test.

AF_METHOD B

The maximum number of AF and AF variant of method B is 12 respectively

AF_NUM, AF01 to AF12, and AF VAR 01 to AF VAR 12 in Mode B

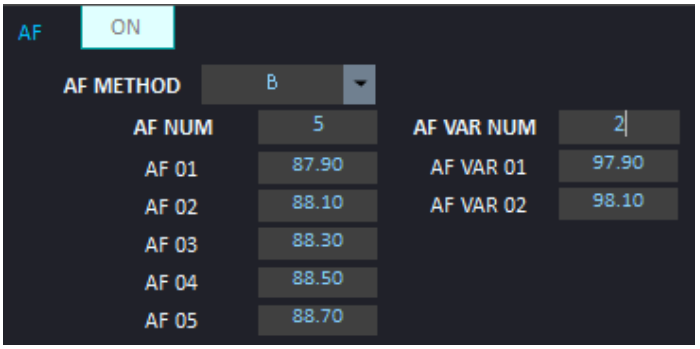


Figure 3.13 AF frequency setup of AF Method B

*Warning

The AF that is the same to FM transmission local Frequency and the other AFs is not allowed.

If there are the same AFs to transmit local frequency or to the other AFs, the application will warn as follows.

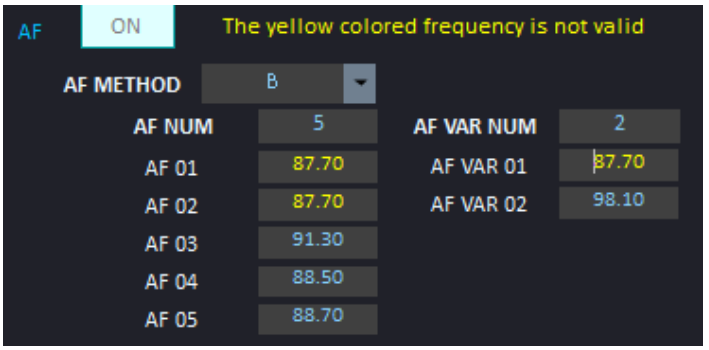


Figure 3.14 Invalid frequency of AF

3.1.2.4 RT (Radio Text)

RT stands for radio text string Service. The maximum length of the RT/RT+ TEXT string is 64 and the maximum length of eRT/eRT+ is 128 including the headline. RT editor supports all kinds of languages. And it checks the maximum available length of headline and text and shows the length violation in different colors for user convenience.

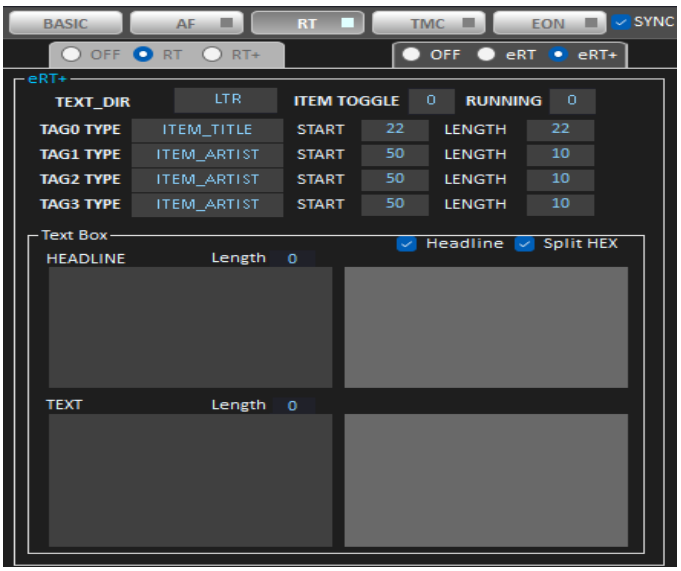


Figure 3.15 Radio text editor

RADIO_TEXT_MODE

RADIO TEXT could be turned off or turned on the RADIO TEXT as RT, RT+ which includes tag information, eRT (Enhanced Radio Text), and eRT+ which includes tag information.

RADIO_TEXT_CH

When the “RADIO_TEXT_MODE” is set as RT or RT+ this parameter will be displayed on the screen. RADIO TEXT could be broadcasted through one of 2A or 2B channels. Using this parameter, the user can select a radio text channel.

TAG_TYPE, TAG_START, TAG_LENGTH

When the “RADIO_TEXT_MODE” is set as RT+ or eRT+, these tag parameters will be displayed on the screen. Tag information can designate some sentences for special purposes such as music titles. Refer to the specification for more details.

TEXT DIR

When the “RADIO_TEXT_MODE” is set as eRT or eRT+, these parameters will be displayed in the parameter window. This flag specifies the direction of sentences with two options, LTR (Left to Right) or RTL (Right to Left)

HEADLINE

It can be set as the Headline part of the beginning of a Radio Text sentence.
Users have to check the checkbox □Headline to edit and transmit headline.

ITEM TOGGLE

The Item Toggle flag indicates that the content of the tagged item has changed. It is essentially a

change indicator for receivers.

RUNNING

The Item Running flag indicates whether the tagged item is currently active.
It tells the receiver whether the metadata refers to content that is currently being broadcast.

3.1.2.5 TMC (Traffic Message Channel)

3.1.2.5.1 Operation

Users can edit and set On/Off of the Traffic Message Channel. TMC is intended to be used for the coded transmission of traffic information.

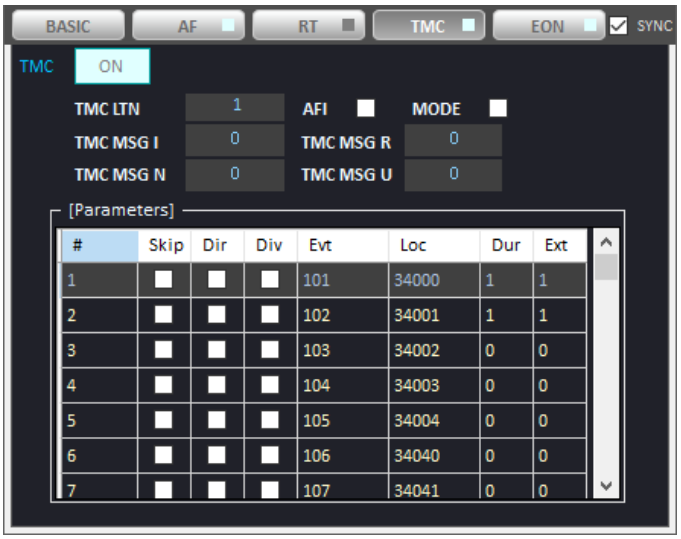


Figure 3.16 TMC parameter window

RDS will enable traffic messages to be carried digitally and silently by a Traffic Message Channel (TMC), without necessarily interrupting the audio programme. Users can transmit TMC messages by toggling the On-Off switch button as the [ON] in the RDS/TMC tab. All listed messages will be transmitted sequentially. If you select the Skip check box, all selected TMC messages will not be sent.

3.1.2.5.2 Parameters

TMC (ON / OFF)

This switch enables or disables TMC message transmission.

TMC LTN (Location Table Number)

This parameter specifies which location table is used to interpret location codes in TMC messages.

Range: 1–63

AFI (Alternative Frequency Indicator)

This flag indicates whether the same TMC service is available on other frequencies.

0 No alternative frequency for this TMC service

1 Alternative frequencies exist

MODE

This parameter selects the TMC service mode.

0 Standard TMC service

1 Enhanced or alternative service mode

TMC MSG R (Repetition Flag)

This flag controls message repetition behavior.

0 Normal transmission

1 Repeated message

TMC MSG N (Message Number)

This value identifies the sequence number of the TMC message.

Range: 0–15

TMC MSG U (Update Flag)

This flag indicates whether the message is a new event or an update of an existing event.

0 New traffic event

1 Update to an existing event

3.2.1.5.3 Editing TMC table

TMC messages can be added or deleted. Adding a TMC message is allowed only at the end line of the table.

You can modify TMC messages in the workspace(.ini) file directly. RWC2100F supports three TMC messages and all names are fixed as [TMC_1], [TMC_2], [TMC_3] which are assigned to each RDS_1, 2, 3 channels respectively.

One TMC message consists of 6 messages as Duration[2:0], {Diversion:Direction:Extent[2:0]}, Event[10:0] and Location[15:0].

It will be saved with [send or skip] option at the end of the each TMC message in a workspace(.ini) file

Example of one TMC message	TMC data in the workspace.ini

7 31 100 25000 Duration = 7 Diversion = 0x01&(31>>4) = 1 Direction = 0x01&(31>>3) = 1 Extend = 0x07&(31) = 7 Event = 100 Location = 25000	[TMC_1] NUM=2 0=7 31 100 25000 1 (send) 1=3 7 101 25000 0 (skip) [TMC_2] NUM=1 0=1 1 200 25001 1 [TMC_2] NUM=1 0=1 0 300 60001 1

3.1.2.6 EON (Enhanced Other Network)

3.1.2.6.1 Operation

EON CH shows the other FM transmission channels of RWC2100F. The other parameters of EON are dependent on the selected EON CH. So the EON editor will read the other parameters which are related with the selected EON_CH.

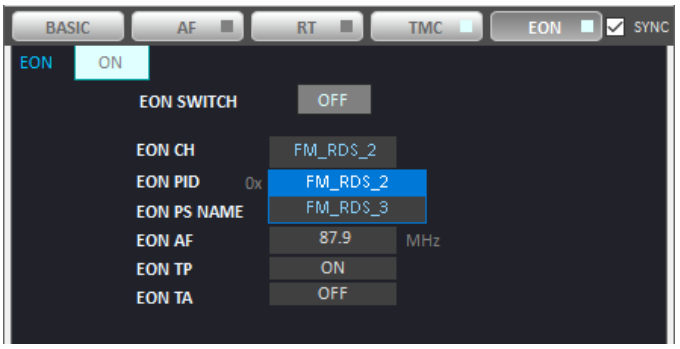


Figure 3.17 EON parameter window of RDS

The enhanced information about other networks consists of a collection of optional RDS features relating to other program services, cross-referenced by means of their PI codes. Features which may be transmitted using EON for other program services are: PID, AF, PS_NAME. RWC2100F supports multi channel FM RDS signals then EON test could be done using just one unit. To test these EON functions, just selecting the EON CH and switching on is enough.

The type 14B group is used to cause the receiver to switch to a programme service which carries a traffic announcement. To transmit the type 14B group, please set the EON_SWITCH as ON as follows.

3.1.2.6.2 Parameters

EON

EON stands for Enhanced Other Networks information. This parameter sets On/Off of EON.

EON_CH

RWC2100F can broadcast up to 3 independent FM RDS channels. Using this parameter, other channels are selected to transmit the information of those channels.

EON_SWITCH

This parameter is for transmitting a switching signal from the turned channel to other informed channel by setting it as ON. If this parameter is set as OFF, RWC2100F transmits a stop switching signal to return to the turned channel.

EON_PTYPE

This parameter selects the EON information transmission type or operating mode.
The DEFAULT mode transmits standard EON information according to the normal RDS EON operation.
Options: DEFAULT, NEWS, WEATHER, ALARM

EON_PID

This parameter sets the Program Identification (PID) code of the linked EON channel.
The PID code uniquely identifies the referenced FM station or service for EON switching operation.

EON_PS_NAME

This parameter sets the Program Service (PS) name of the linked EON channel.
The configured PS name is transmitted as the station name information of the referenced EON service.

EON_AF

This parameter sets the Alternative Frequency (AF) of the linked EON channel.
Receivers may use this information to retune to the referenced station frequency when EON switching occurs.

EON_TP

This parameter sets the Traffic Program (TP) status of the linked EON channel.
When enabled, the referenced EON service is indicated as a traffic information service.

EON_TA

This parameter sets the Traffic Announcement (TA) status of the linked EON channel.
When enabled, receivers supporting EON may temporarily switch to the referenced channel during active traffic announcements.

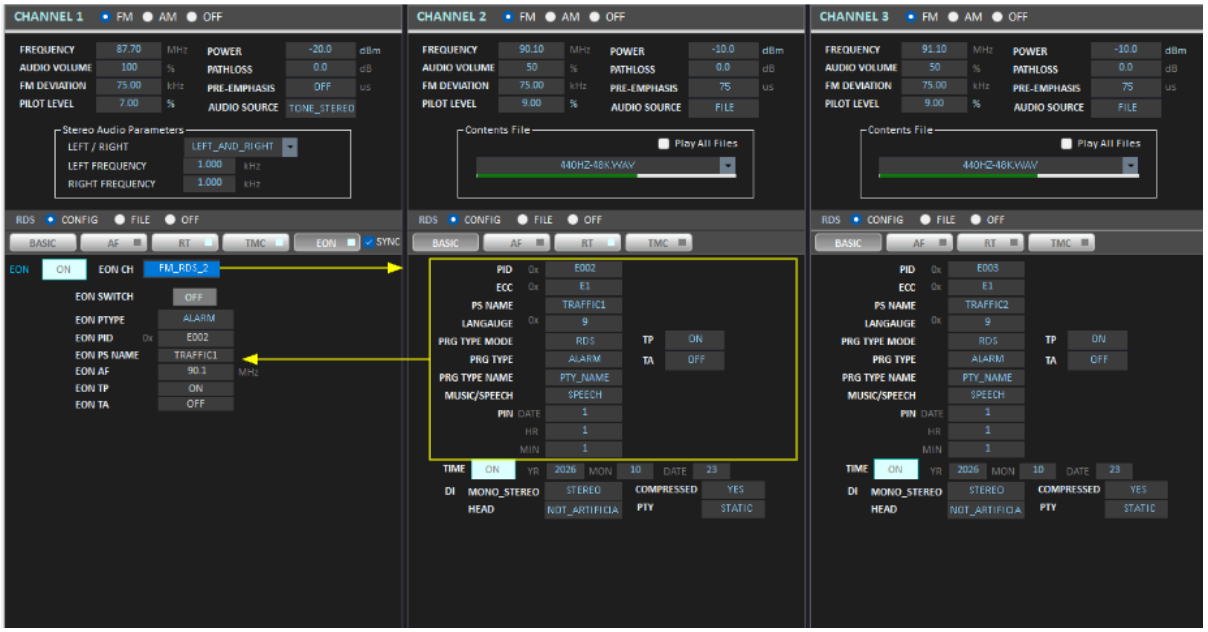


Figure 3.18 Example of EON CH

3.1.3 AM Transmitter

3.1.3.1 Operation

RWC2100F supports up to 3 independent AM channels. All parameters of each AM channel can be set by users individually. For each AM transmission users can select one of audio sources among FILE, TONE, and SWEEP.

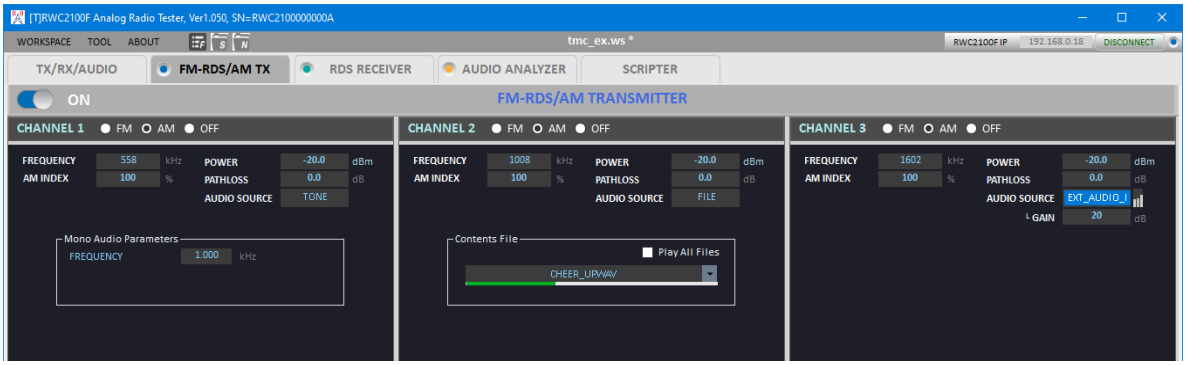


Figure 3.19 Independent AM channels

3.1.3.2 Parameters

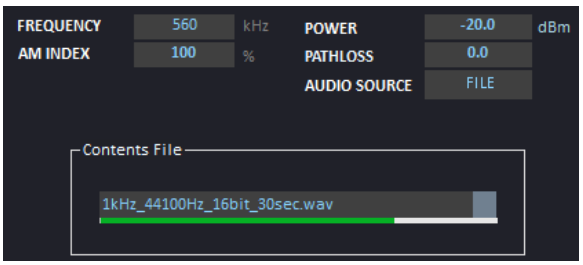


Figure 3.20 Parameters for AM

FREQUENCY

It is the carrier frequency of an AM signal.

Range: 560 to 1640kHz.

POWER

It is the output power of the AM signal at the end of the RWC2100F port.

Range: -90 to -10dBm (17 to 97dBuV)

You can toggle the unit by clicking dBm with a mouse pointer.

PATHLOSS

Pathloss value between RWC2100F and receiver

RWC2100F compensates the power difference with respect to the pathloss value automatically.

AM_INDEX

The amount of the measurement or extent of amplitude variation about an unmodulated carrier.

Range: 0 to 100%

AUDIO SOURCE

Users can select one of the AUDIO SOURCE parameters as an audio source for AM modulation.

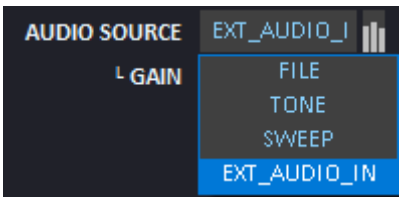


Figure 3.21 AUDIO SOURCE list

Audio source which will be amplitude modulated by the RWC2100F.

Options: FILE, TONE, SWEEP, EXT_AUDIO_IN

FILE : Set the AUDIO SOURCE parameter to ‘FILE’ for AM Wave Mode test. Downloaded wav files can be played with amplitude modulation. If you select this option, the contents files box will be shown. The green color bar below the CONTENTS file shows the status of file

transmitting



Figure 3.22 Wave file selection and transmission status

TONE : Set the AUDIO SOURCE parameter to 'TONE' to transmit a mono single tone. In this mode, mono single tone with a user-set frequency is amplitude modulated.

SWEEP : Set the AUDIO SOURCE parameter to 'SWEEP' to transmit a chirp audio signal. In this mode, RWC2100F chirps AM audio tone from the START FREQUENCY to STOP FREQUENCY during SWEEP_TIME.

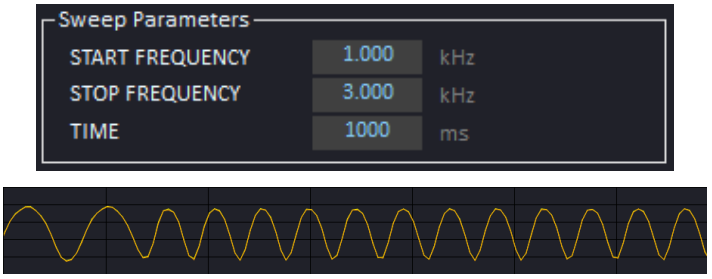


Figure 3.23 Frequency and time setup box for the sweep parameter

EXT_AUDIO_IN: Set AUDIO SOURCE to EXT_AUDIO_IN for FM transmission that modulates the rear panel audio input signal in real time. In this mode, you can set the audio gain in the range of 0 - 50dB.



Figure 3.24 Frequency and time setup box for the sweep parameter

3.2 RDS Receiver

RWC2100F supports the RDS receiver function. It shows all RDS(RBDS) parameters. Users can record RDS data in ASCII format and transmit the recorded data with RWC2100F's FM-RDS transmitter. Refer chapter 3.1 FM-RDS transmitter section for more detailed explanation about RDS file transmission and parameters.

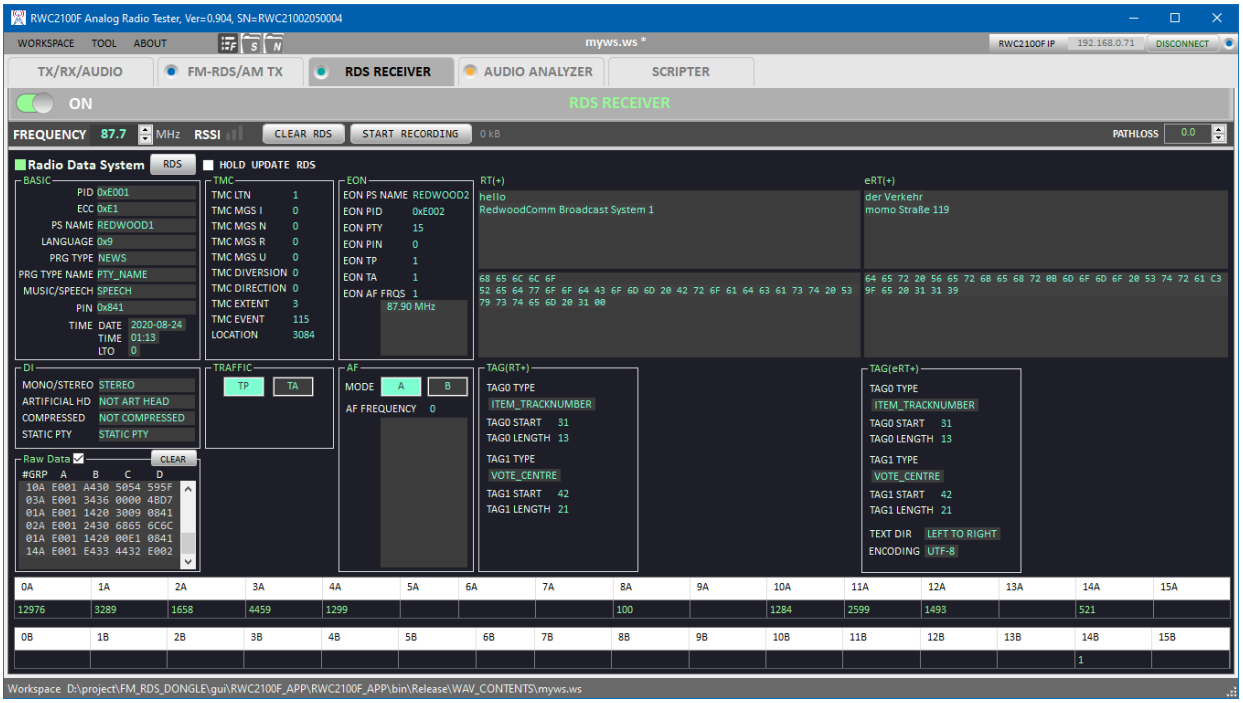


Figure 3.25 RDS receiver function

.

3.2.1 RDS Receiver

RWC2100F provides RDS receiver function. FM radio signal is received through the RX port.

3.2.1.1 Parameters

FREQUENCY

You can tune the receiver frequency using 

.

Unit: MHz

VOLUME

User can set receiver volume using 

.

The value 0 means mute.

Range: 0 to 10

PATHLOSS

Pathloss between RWC2100F RX port and transmitter.

RWC2100F compensates the output power automatically according to the path-loss value.

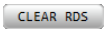
Unit: dB

3.2.1.2 Function

HOLD UPDATE

If you set the □HOLD UPDATE checkbox checked, it will stop updating receiving RDS data. You will lose all received RDS data while holding it.

CLEAR RDS DATA

If you click [CLEAR RDS] button 

, it will refresh all RDS information.

SHOW RDS DATA

If you click on the switch button, it will start receiving FM signals and show RDS data.

CHANGE PROGRAM MODE

By clicking [RDS] button 

, you can toggle program mode between RDS and RBDS.

DISPLAY RAW DATA

If you set the checkbox checked, it will show the latest 20 RDS data in ASCII format.

CLEAR RAW DATA

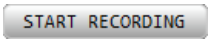
If you click [CLEAR] button 

, it will clear RDS raw data.

3.2.2 RDS Recorder

RWC2100F application program provides RDS recorder function.

3.2.2.1 Operation

While receiving FM signal, you can record RDS data by simple clicking [START RECORDING] button 

in the RDS function tab.

When the [save file dialog] window pops up, you can name the file.

While recording the RDS data, you can see the file name, size, recording time, and saving status as the following fig. If you click the [STOP RECORDING] button, you can stop recording RDS immediately.

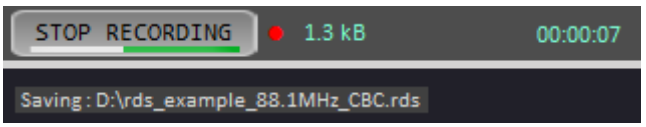


Figure 3.26 RDS recording information

3.2.3 FM LIST

The FM LIST function allows the receiver to automatically search the FM broadcast band and generate a list of broadcasting stations.

Click the [LIST] button to open the FM RX Channel List window. In this window, press the SCAN button to start scanning for available FM signals.

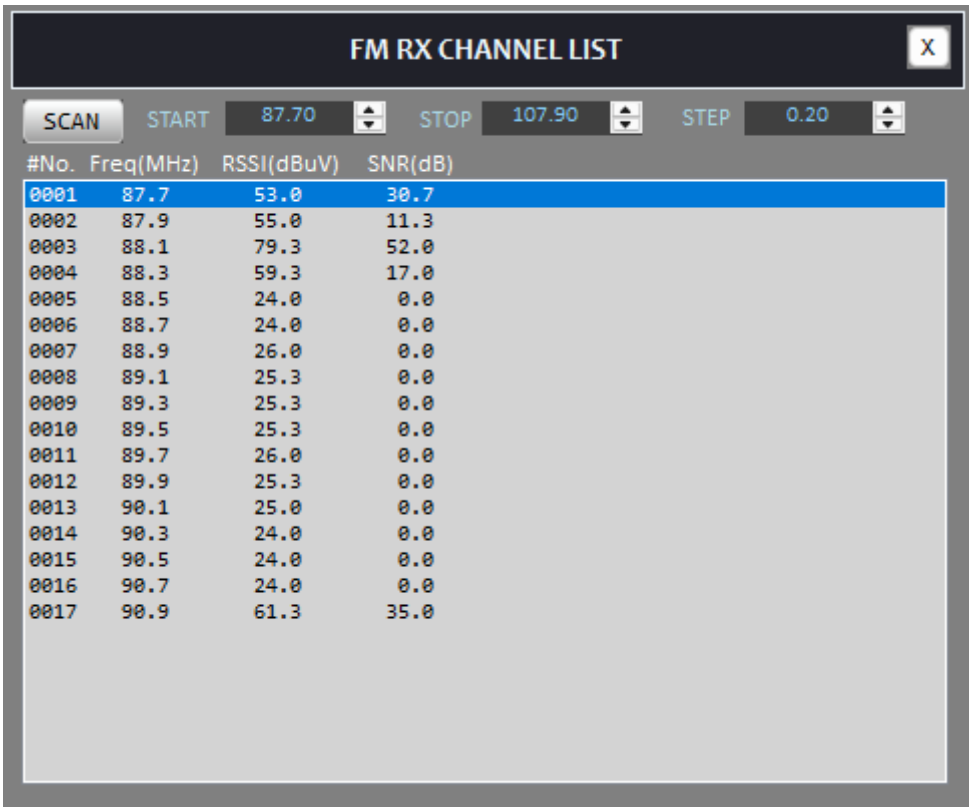


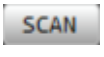
Figure 3.27 FM BroadCasting Service List Window

Before starting the scan, configure the following frequency parameters:

START – The starting frequency of the scan range

STOP – The ending frequency of the scan range

STEP – The frequency step size used during the scan

Once these parameters are set, 

press to begin the scanning process. The receiver will sweep through the specified frequency range and measure signal parameters such as RSSI (Received Signal

Strength Indicator) and SNR (Signal-to-Noise Ratio). Any detected signals will be added to the channel list in the window.

The scanning process can be stopped at any time if needed.

After the scan is completed, you can select a station from the generated list. Double-clicking an item in the list will automatically tune the receiver to that frequency, and the receiver will immediately start receiving the selected FM broadcast.

This function provides a convenient way to quickly identify and access available FM stations within a specified frequency range.

3.3 Audio Analyzer

RWC2100F provides an audio analyzer function. With this function, you can measure frequency, SINAD, THD and THDN. You have to input the audio signal into the 3.5mm audio input jack on the rear panel. SNR(Signal-to-Noise Ratio) can be determined using audio signal levels measured in dBu. With no input signal applied and the Delta checkbox unchecked, measure the baseline noise level. Next, enable the Delta checkbox to set this noise floor as the reference. When an audio signal is subsequently applied, the instrument displays the relative difference in dB, directly representing the SNR.

By clicking  button, you can start the audio analyzer of the RWC2100F.

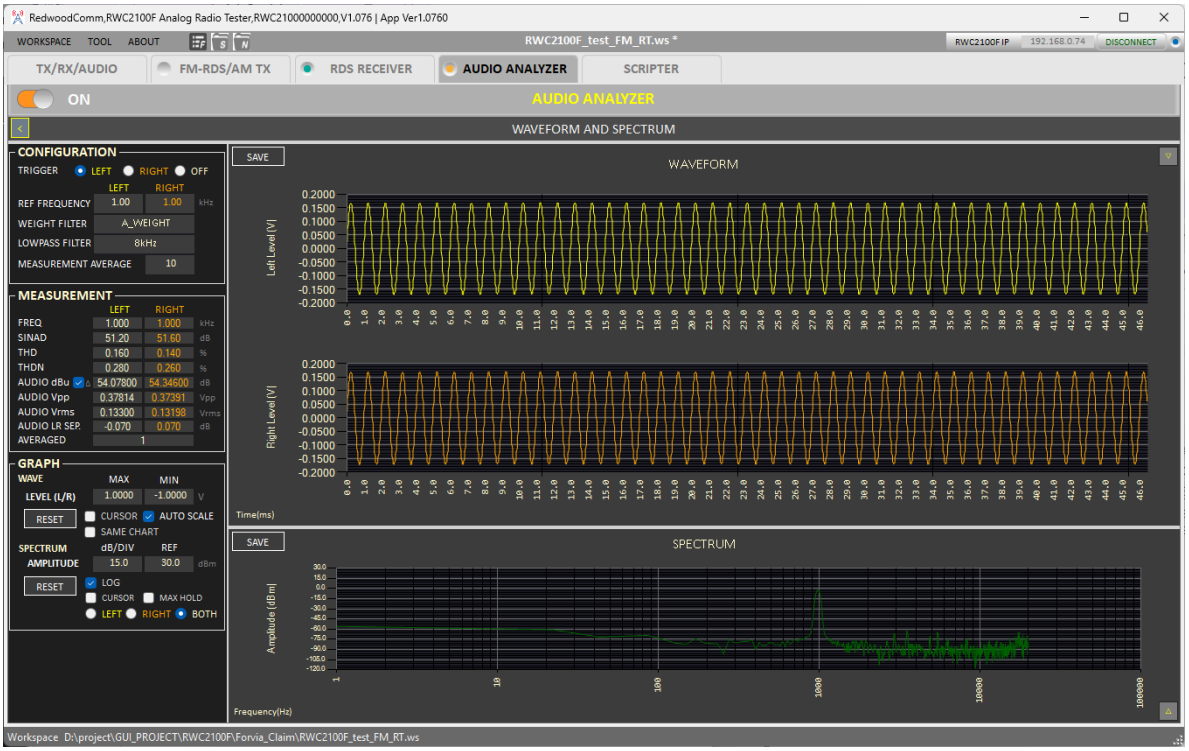


Figure 3.28 Audio analyzer function

3.3.1 Operation

3.3.1.1 Specification

The number of point: 2048

Displaying time duration: 46 msec

Displaying bandwidth: 11.025 kHz

3.3.1.2 Zooming audio waveform

Using mouse clicking and dragging the left button, you can zoom in the audio waveform and spectrum.

Using mouse double clicking the left button, you can zoom out to the previous zoom status. This behavior is the same for the spectrum function.

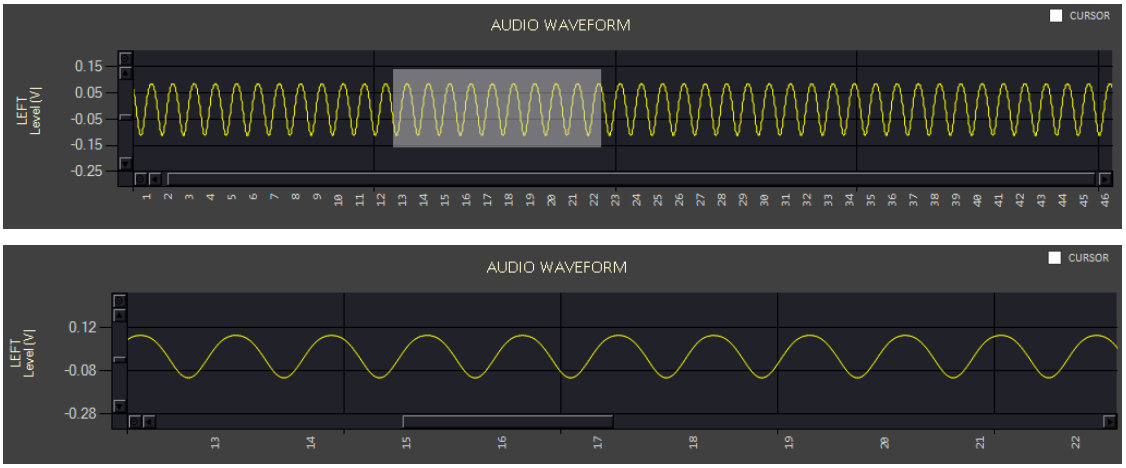


Figure 3.29 Zooming of the audio analyzer

3.3.1.3 Cursor

Audio waveform and spectrum analyzers provide cursor functionality.

Activate the cursor box to display a red cross line on the graph. When the cursor is near a waveform, the value of the waveform or spectrum is displayed.

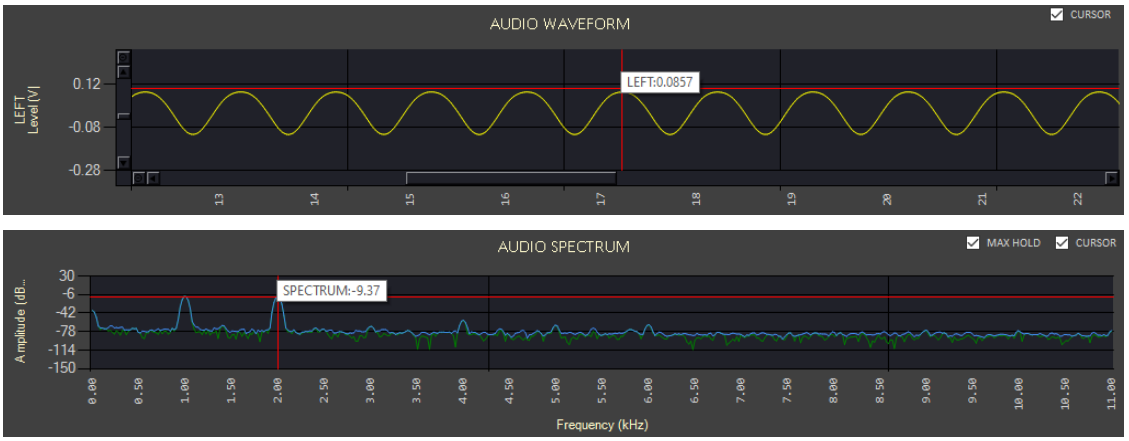


Figure 3.30 Zooming of spectrum analyzer

3.3.1.4 Max hold of spectrum analyzer

If you check the MAX HOLD option, it shows the maximum values of the spectrum.
If you want to reset the max value, uncheck and check the MAX HOLD check box.

3.3.2 CONFIGURATION

3.3.2.1 TRIGGER

It provides three types of trigger methods such as LEFT, RIGHT, and OFF.
With an OFF trigger, the audio waveform can be swung in x-axis because RWC2100F dumps audio data without any trigger.



Figure 3.31 Trigger option of audio analyzer

3.3.2.2 WEIGHT FILTER

It provides three types of audio weight filter, A_WEIGHT, C_WEIGHT, CCIR.
A and C weighting filters follow the ANSI S1.42 and IEC 61672-1 standards, and CCIR filter follows the ITU-R 468.

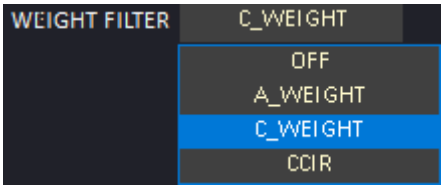


Figure 3.32 Weight filter option of audio analyzer

3.3.2.3 LOWPASS FILTER

It provides a low-pass filter with selectable options: Off, or 1 kHz to 20 kHz in 1 kHz steps.

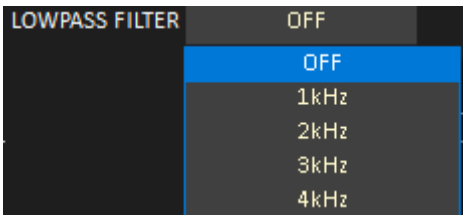


Figure 3.33 LowPAss filter option of audio analyzer

3.3.2.4 REFERENCE FREQUENCY

For accurate measurement, users need to set up correct left and right reference frequencies expected.

If the reference frequency and measuring frequency are mismatched, all measured quality values are not reliable.

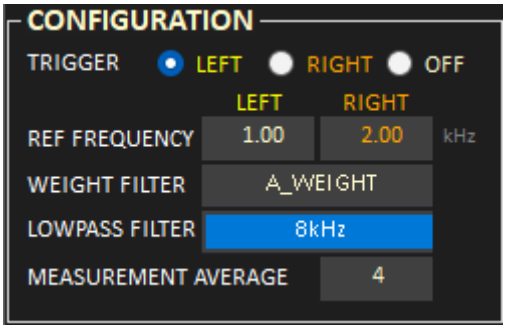


Figure 3.34 Mismatched reference example.

Transmitted frequency: 2kHz, Measured frequency: 2kHz, reference frequency: 1kHz

3.3.2.5 Measurement average

It indicates how many times the RWC2100F measures and averages the quality of the input audio signal.

3.3.3 MEASUREMENT

RWC2100F measures and displays values such as FREQUENCY, SINAD, SNR, THD, and THDN. All measured values will be displayed as left and right channels separately.

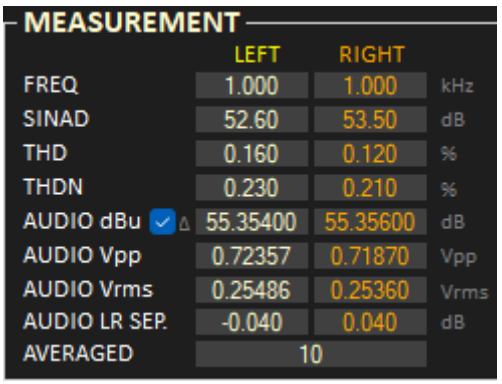


Figure 3.35 Measured quality value for audio signal

3.3.3.1 Frequency

A measured frequency of single tone from audio input port. The unit is kHz.

3.3.3.2 SINAD (Signal-to-noise and distortion ratio)

It is the measured value of SINAD of tone signal from the audio input port.

The quality of a signal from a communications device, often defined as

$$SINAD = \frac{P_{sig}+P_{noise}+P_{dist}}{P_{noise}+P_{dist}},\ where$$

P_{sig}: the average power of the signal

P_{noise}: the average power of noise

P_{dist}: the average power of distortion components

Unit: dB

3.3.3.3 THD (Total Harmonic Distortion)

THD is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

$$THD_F = \frac{\sqrt{V_2^2+V_3^2+V_4^2+\ldots}}{V_1},\ where$$

V_n: the RMS (Root Mean Squared) voltage of the n-th harmonic

n = 1: the fundamental frequency

Unit: %

3.3.3.4 THDN

It is THD plus noise value of sine wave at audio input port.

It is notch filtered output, and compared the ratio between the output signal with the sine wave

$$THDN = \frac{\sum_{n=2}^{\infty} harmonics+noise}{fundamental},\ where$$

V_n: the RMS (Root Mean Squared) voltage of the n-th harmonic

n = 1: the fundamental frequency

Unit: %

3.3.3.5 AUDIO dBu □Δ

Displays the audio level in dBu units. dBu is a voltage reference level expressed in decibels relative to 0.775

Vrms.

SNR can be determined using audio signal levels measured in dBu. With no input signal applied and the Delta checkbox unchecked, measure the baseline noise level. Next, enable the Delta checkbox to set this noise floor as the reference. When an audio signal is subsequently applied, the instrument displays the relative difference in dB, directly representing the Signal-to-Noise Ratio (SNR).

$SNR = \frac{P_{sig}}{P_{noise}}$, $where$

P_{sig}: the average power of the signal

P_{noise}: the average power of noise

Unit: dB

Measuring SNR Using dBu Levels and Delta Mode

- Measure Noise Floor: With no audio signal applied, ensure the Delta checkbox is unchecked, and record the baseline noise level in dBu.
- Set Reference: Check the Delta box to lock the current noise level as the reference point ($0dB_rel$).
- Apply Signal & Read SNR: Input the test audio signal. The display will show the relative level difference in dB, which corresponds to the Signal-to-Noise Ratio (SNR) relative to the noise floor.

3.3.3.6 AUDIO Vpp

AUDIO Vpp shows the level of the input waveform as a Voltage peak-to-peak value.

3.3.3.7 AUDIO Vrms

AUDIO LEVEL shows the level of the input waveform as a Voltage root-mean-square value.

3.3.3.8 AUDIO LR SEP.

Audio Left-Right Separation (commonly referred to as Channel Separation or Stereo Separation) measures the degree of isolation between the left and right channels in a stereo audio system. It quantifies how effectively a system prevents a signal driven into one channel from leaking (crosstalking) into the opposite channel.

$$Separation(dB) = 20\log_{10}\left(\frac{V_{driven}}{V_{leakage}}\right) = Level_{driven}[dBu] - Level_{leakage}[dBu]$$

3.3.3.9 AVERAGED

It is the value showing how many times have been averaged so far while measuring the SINAD, THD, THDN and SNR.

3.3.4 GRAPH

The Wave Graph typically shows the signal voltage level as a function of time, similar to an oscilloscope. Spectrum Graph Settings (Frequency Domain)The Spectrum Graph shows the amplitude of the signal as a function of frequency.

3.3.4.1 LEVEL (L/R)

It Sets the vertical axis (Y-axis) voltage level range displayed on the Wave graph.

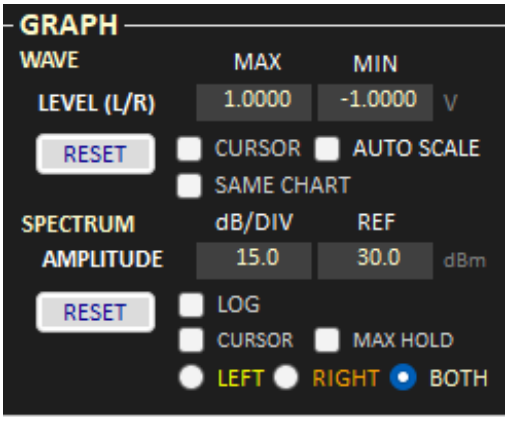


Figure 3.36 Measured quality value for audio signal

3.3.4.2 MAX/MIN

MAX sets the maximum positive voltage value (unit: V, Volts) that the vertical axis will display.
MIN sets the minimum negative voltage value (unit: V, Volts) that the vertical axis will display.
RESET resets the MAX and MIN values to their default factory settings (1.0000V).

3.3.4.3 CURSOR

□ CURSOR enables a cursor on the Wave graph, allowing precise measurement of time and voltage values at specific points on the waveform.

3.3.4.4 AUTO

□ AUTO SCALE automatically adjusts the MAX and MIN voltage levels based on the magnitude of the incoming signal to ensure the waveform is optimally displayed.

3.3.4.5 SAME CHART

□ SAME CHART sets the Left (L) and Right (R) channel waveforms to be displayed together on a single, unified chart, overlaid rather than in separate charts.

3.3.4.6 AMPLITUDE

AMPLITUDE settings related to the amplitude displayed on the vertical axis (Y-axis) of the Spectrum graph.

dB/DIV sets the amplitude scale per division on the vertical axis (dB/division). A smaller value increases the vertical resolution but narrows the visible dynamic range.
REF sets the Reference Level(dBm) for the graph. This typically corresponds to the top line of the graph, and all measured signal levels are displayed relative to this reference.


resets the dB/DIV and REF values to their default factory settings.

3.3.4.7 LOG

□ LOG sets the horizontal axis (X-axis, frequency) of the Spectrum graph to display on a Logarithmic Scale. This is useful for analyzing audio signals over a wide frequency range.

3.3.4.8 CURSOR

□ CURSOR enables a cursor on the Spectrum graph, allowing precise measurement of the amplitude value at a specific frequency.

3.3.4.9 MAX HOLD

MAX HOLD continuously displays and holds the highest amplitude peak measured over a period of time on the graph. This is useful for capturing transient or intermittent maximum peaks.

3.3.4.10 LEFT/RIGHT/BOTH

These radio buttons determine which channel's data is displayed on the graphs.
○ LEFT displays data only for the Left channel (L).
○ RIGHT displays data only for the Right channel (R).
○ BOTH displays data for both the Left (L) and Right (R) channels on the graph.

3.3.4.11 [SAVE] in Chart

By clicking the 

button, you can save the graph displayed on the chart as a PNG file.

3.3.4.12 [△][▽] Enlarge Button

By clicking the  button, you can enlarge, or shrink the waveform or spectrum chart.

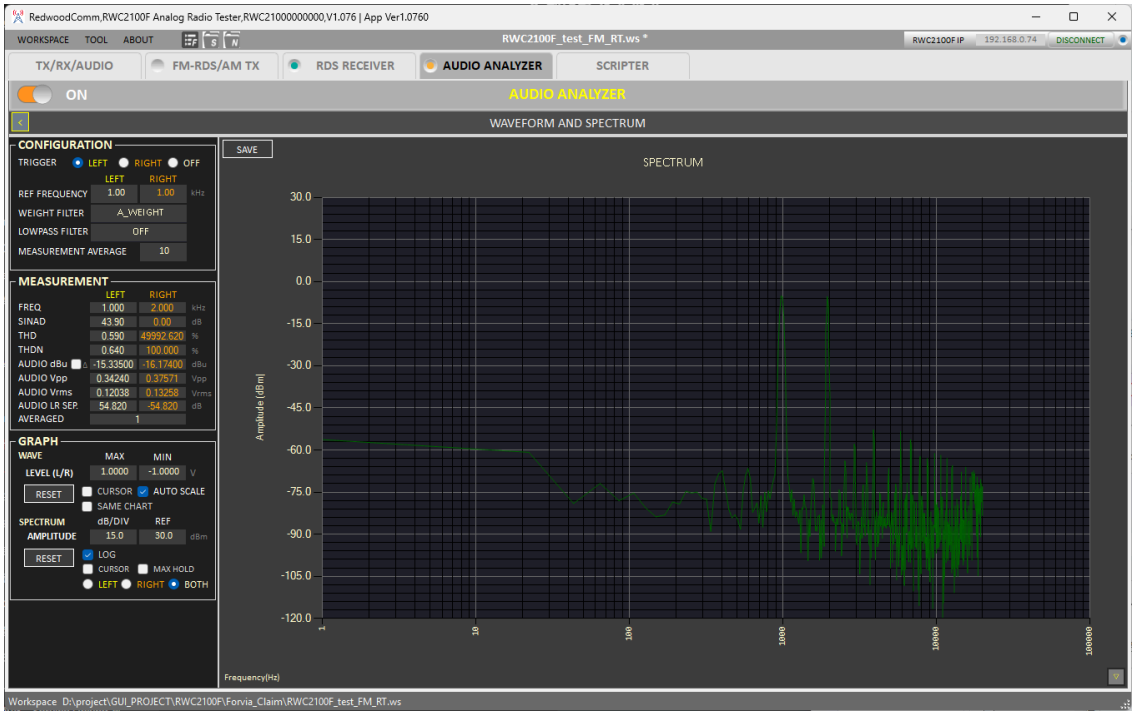


Figure 3.37 Enlarged Spectrum Graph

3.4 Scripter

This function provides a method to create a scenario that sends commands sequentially. Users can add, remove, or edit RWC2100F's remote commands and special syntax such as WAIT, FOR_START, and END_FOR.

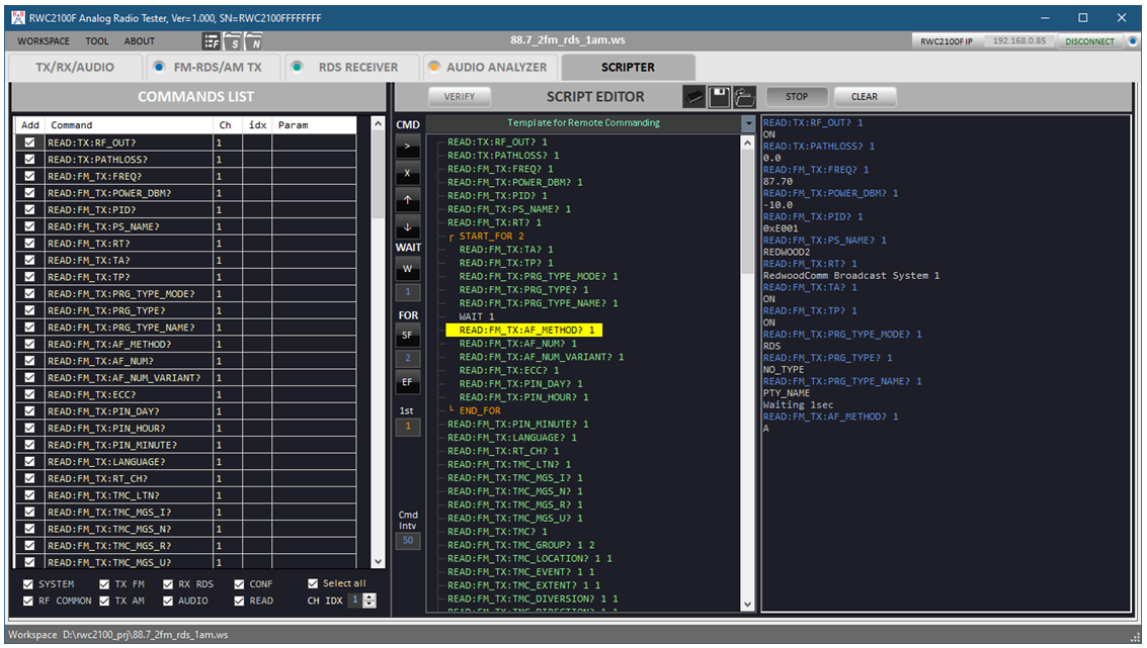


Figure 3.38 Scripter function

3.4.1 Command Editor

3.4.1.1 Selection commands

To add commands to the editor, you must select it from the command list. You can select all commands by checking the 'Select All' check, or you can select one by one.

3.4.1.2 Filtering commands

To filter commands, select the filter option check box and only commands of the desired class are listed.

Filtering option

□ SYSTEM: Filtering option to list system related commands

□ RF_COMMON: Filtering option to list common RF related commands

□ TX FM: Filtering option to list TX FM-RDS related commands

□ TX AM: Filtering option to list TX AM commands

□ RX RDS: Filtering option to list RS RDS related commands
□ AUDIO: Filtering option to list audio analyzer related commands
□ CONF: Filtering option to list configuration commands
□ READ: Filtering option to list reading commands

The □ CONF and □ READ options are '&&' operation with other options.

3.4.2 Script Editor

3.4.2.1 Addition of commands

If you click the > button, then all selected commands will be added to the script editor.

3.4.2.2 Deletion of a command

To delete a command, click X button or [DEL] key of your keyboard.

3.4.2.3 Movement of a command

To move a command, click ↑ or ↓ button or use dragging and dropping with your mouse.

3.4.2.4 Editing a command

A mouse clicking makes you edit the command.

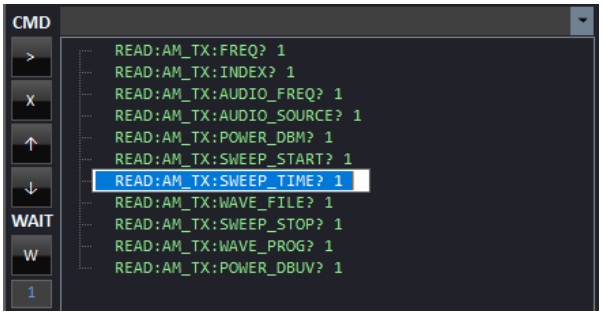


Figure 3.39 Example of edition a command

3.4.2.5 Addition of a wait action

By clicking the button, you can add a WAIT action in the second unit. It makes the scripter wait for the specific time before sending the next command.

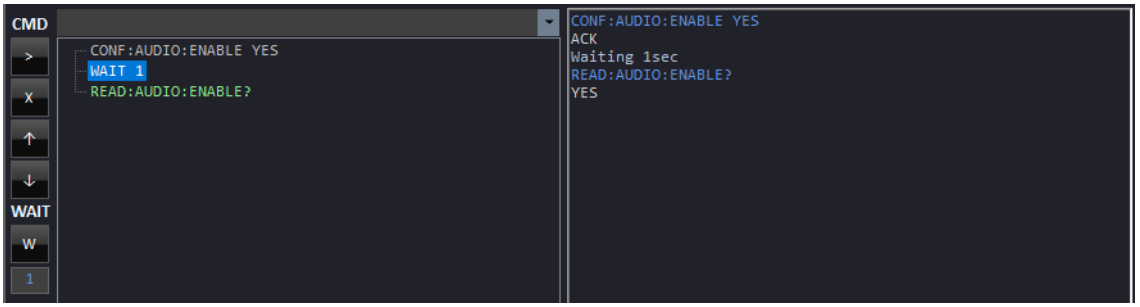


Figure 3.40 Example of addition a ‘wait 1’ syntax

3.4.2.6 Addition of a FOR action

Clicking SF buttons adds a START_FOR action. You can change the number of for iteration by modifying iteration value 3.

You must add an END_FOR syntax by clicking EF button. The number of START_FOR and END_FOR syntax must be the same. The maximum START_FOR and END_FOR syntax set is three.

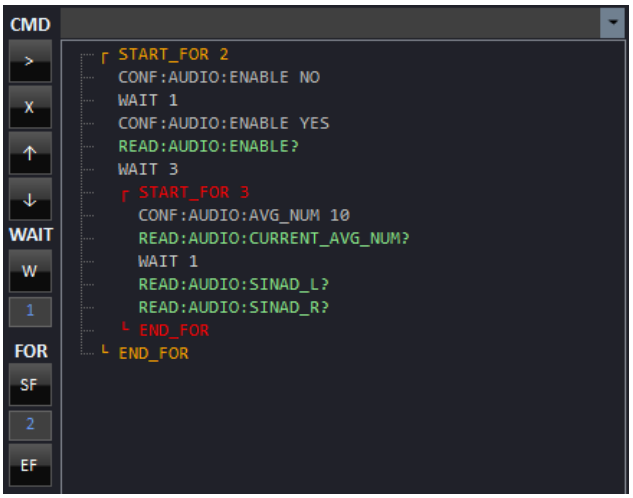


Figure 3.41 Example of Script edition

3.4.2.7 Run a script

Clicking RUN will make RWC2100F send the listed commands to RWC2100F. Before running the script, RWC2100F must be connected with the application. The time interval is configurable by users. Users can set the time interval by modifying the value of ‘CmdIntv’ in ms units. The yellow color box means the current running command or action.

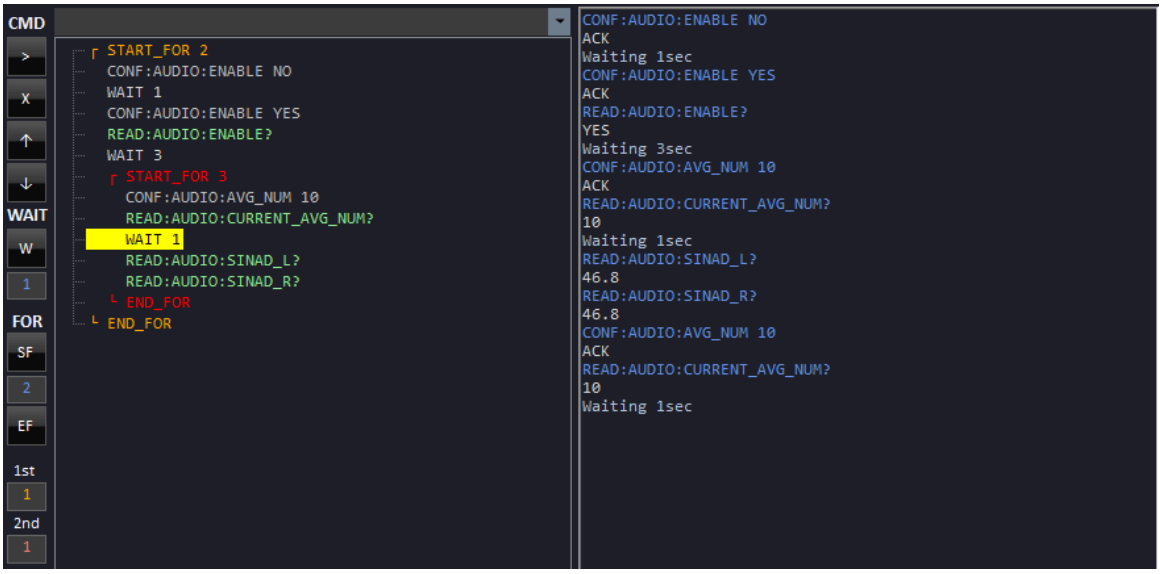


Figure 3.42 Example of Script running screen

3.4.2.8 Saving a Script

You can save the script to keep what you have edited. After modifying your script, click  and select a folder and specify the file name to save it.

3.4.2.9 Opening a Script

You can recall the saved script you edited previously. Just click  and select the saved script file.

3.4.2.10 Clearing a Script

To clear the all commands you added, Just click .

Caution: The deleted commands can never be recovered.

3.4.2.11 Template for remote commanding

RWC2100F application provides template for remote commanding. If you select one of the templates, it will add template commands to the scripter automatically.



Figure 3.43 Template box

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