Service Linking Test Application Program Using RWC2010B and RWC2100F

Operation Manual

Version 0.9

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Redwood Comm

Contents

I. Getting Started

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

1.1 Download and Installation

The SLinking application program is provided as a compressed file via email or download link. Uncompress the zip file and install it.

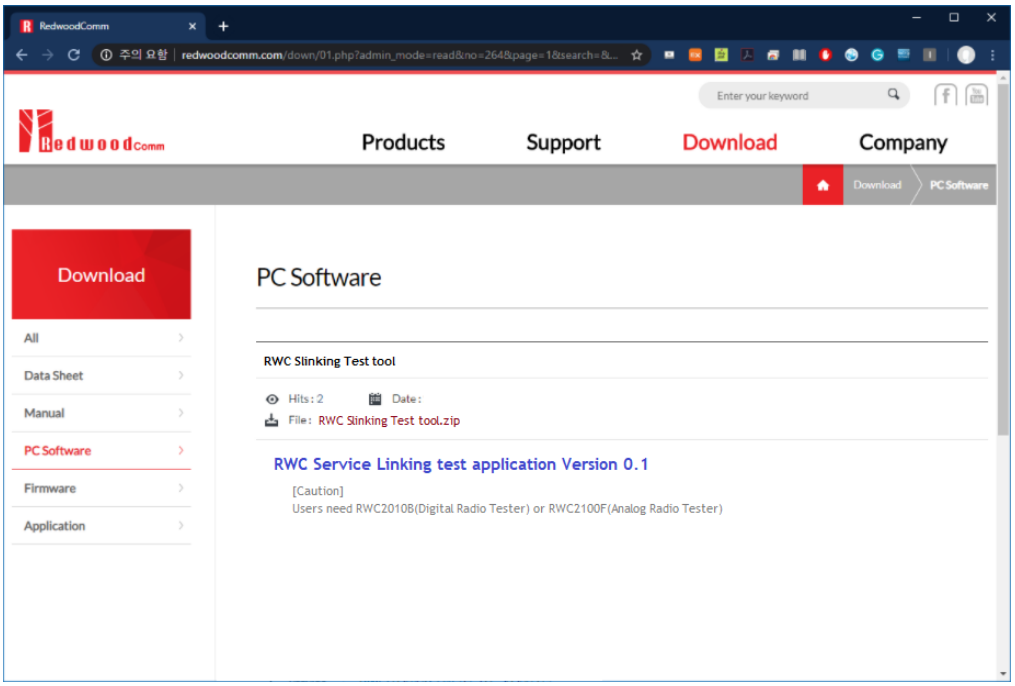


Fig 1.1 Downloading the compressed file from the RedwoodComm website

Figure 1.2 shows an executed screen of the application ‘ServiceLinking test tool.exe’.

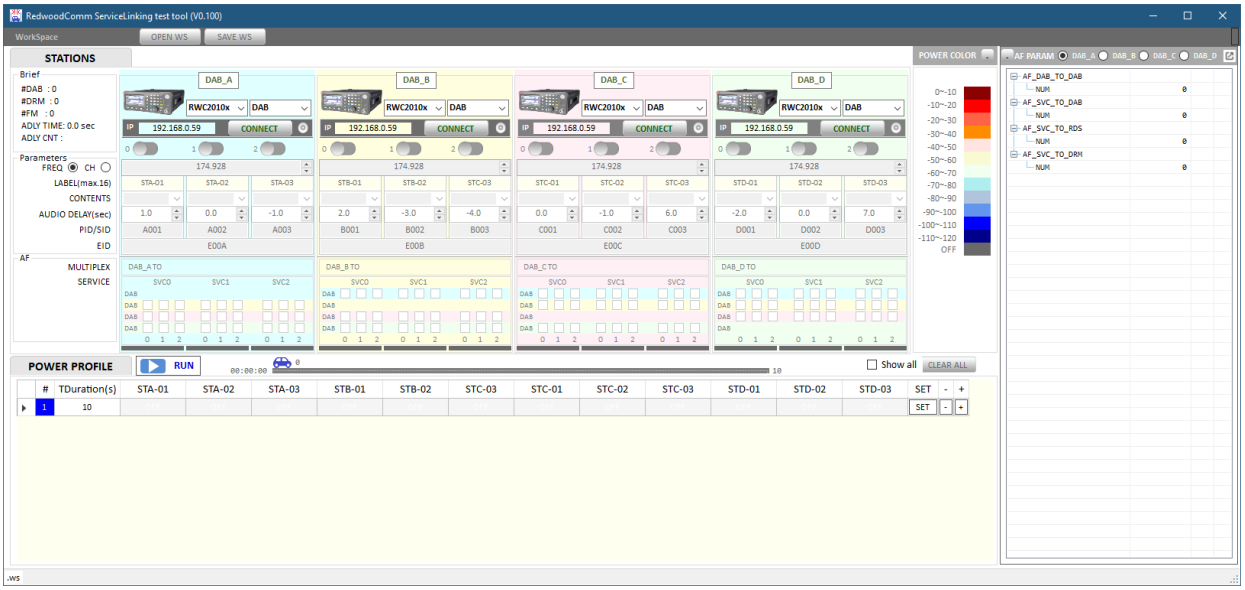


Fig 1.2 Execution screen of the application

Note: PC’s OS

1. It only supports Windows, not Linux or IOS .
2. Users are recommended to use windows7 or later versions as OS.
3. To avoid the authorization problem with the OS system, please install this application on a non-system disk, such as 'D drive'.

Language setup

1. Users are strongly recommended to use ‘.’ than ‘,’ for floating expression.
2. Users are strongly recommended to use ‘,’ than ‘.’ for decimal expression.
3. Users are strongly recommended to use English over other languages.

1.2 General Description

1.2.1 Application Concept

This application provides an easier way to perform service linking testing with AF (Alternate Frequency) of DAB, DRM and FM using RedwoodComm's digital and analog radio testers RWC2010A/B and RWC2100F.
It can handle up to four equipments. Only FM AF test can be done with one equipment. You can use one or more RWC2010Bs and RWC2100F to test any kind of service linking test. Using RWC2010Bs and RWC2100Fs, users can set 12 FM transmitters, 4 DAB or DRM transmitters. Of course any combination is available.

It provides a simple way to inform AF of other transmitters with checkboxes. It is quite intuitive to create a real AF environment with only clicking checkboxes.
And it provides a simple way to make a multi-broadcast signal's power field environment in users lab with power profiling.

It automatically sets all AF parameters of connected DAB, DRM and FM transmitters of RWC2010B or RWC2100F according to the testers protocol parameters.
The most important thing is to make an audio delay among services or transmitters.

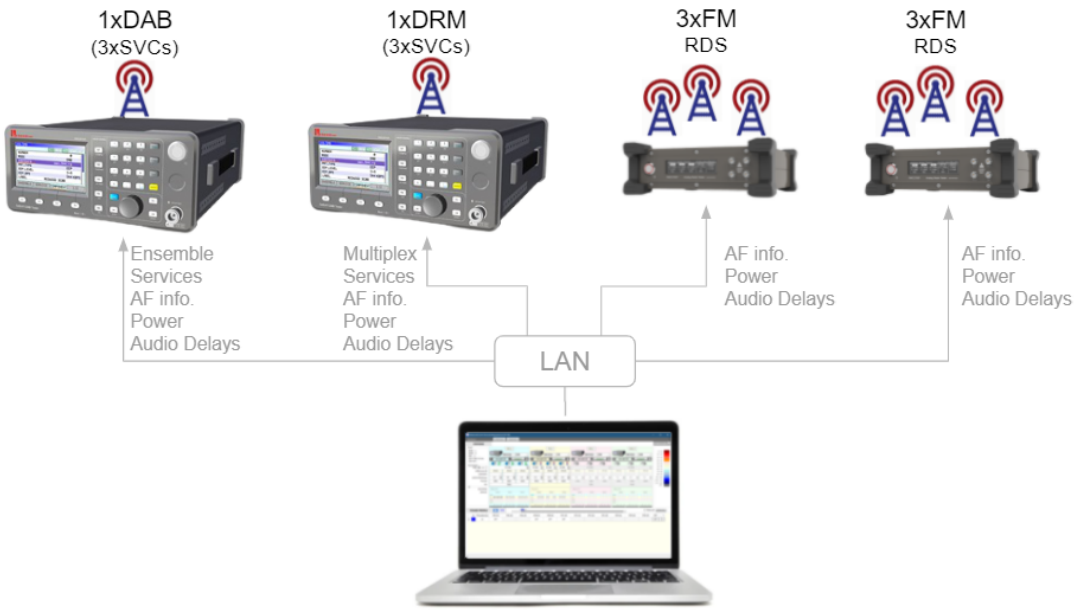


Figure 1.3 Service Linking test environment using RWC2010Bs and RWC2100Fs

1.2.2 GUI structure

The SLinking test application program consists of 3 classified functional windows: Station setup, parameter display, and power profile editor window.
In the station setup window, least parameters for AF information can be set. Parameters of RWC2010B and/or RWC2100F are configurable such as label, contents file, audio delay, frequency (or service channel

index), PID (or SID), and EID. The physical time delay can be defined for each service using the audio delay parameter to emulate a real field broadcasting environment.
In the power profile editor window, transmit power levels of each station can be defined with configurable time duration. In order to test with sequential power values, users can add, remove, or edit power profile data line by line.
In the AF parameter display window, AF parameter trees will be displayed in tree format according to the checked linking connection for all stations and equipments.

All parameters and power profile data can be saved or loaded using the workspace function.

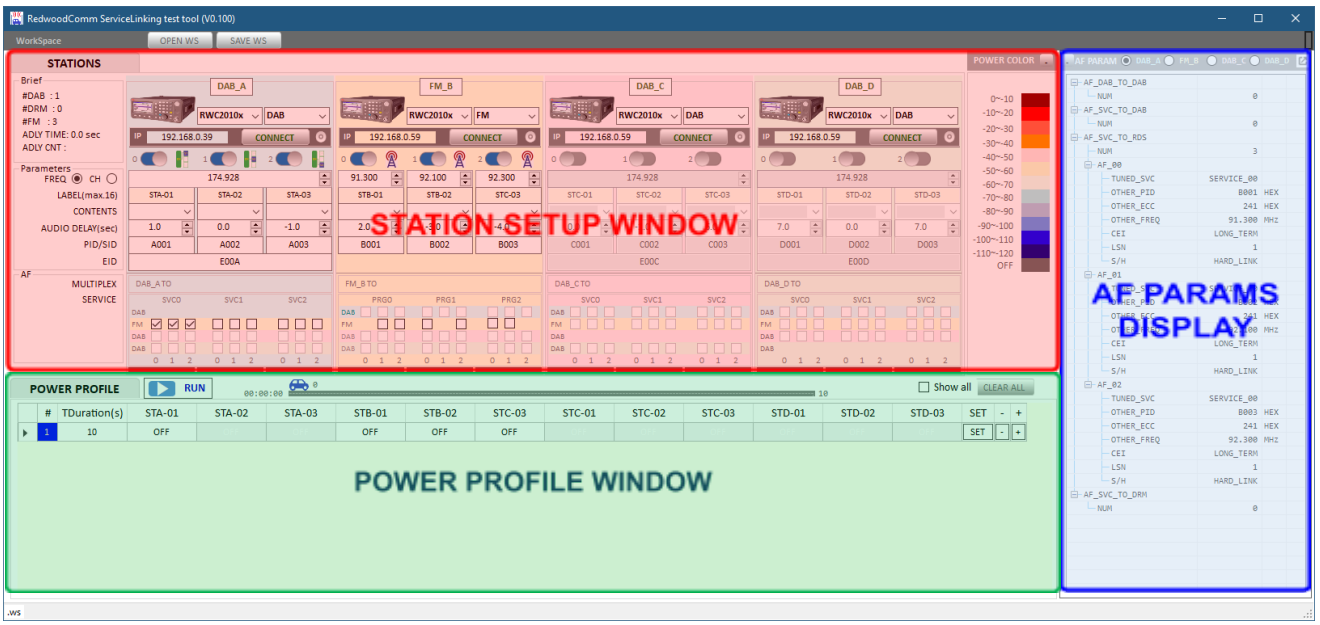


Fig 1.4 Function window classification

1.2.3 Station Setup Window

In the Station setup window, you can connect this application program with each equipment via ethernet. Each equipment group has 3 on/off buttons, which have different meanings depending on the transmission mode of it. In the case of DAB or DRM, it means 3 services in one multiplex, and in FM transmission mode, it means 3 FM transmitters.

In the DAB mode of RWC2010B, 15 services can be connected to one ensemble. However, for this test application, one ensemble with up to 3 services can be transmitted for test convenience. In the DRM mode of RWC2010B, 4 services can be connected to one multiplex. But for convenience of implementation, one multiplexer including up to 3 services can be transmitted. Each service can be turned on or off respectively.

All parameters may look different or have different properties depending on whether the connected equipment is RWC2010B or RWC2100F. Some parameters will be visible/invisible, enable/disable according to the on/off status of station, service, and transmit mode of equipment. Some parameters are not editable

because of limitations of protocol or equipment RWC2010B/RWC2100F.
So refer to the detailed description of each parameter.

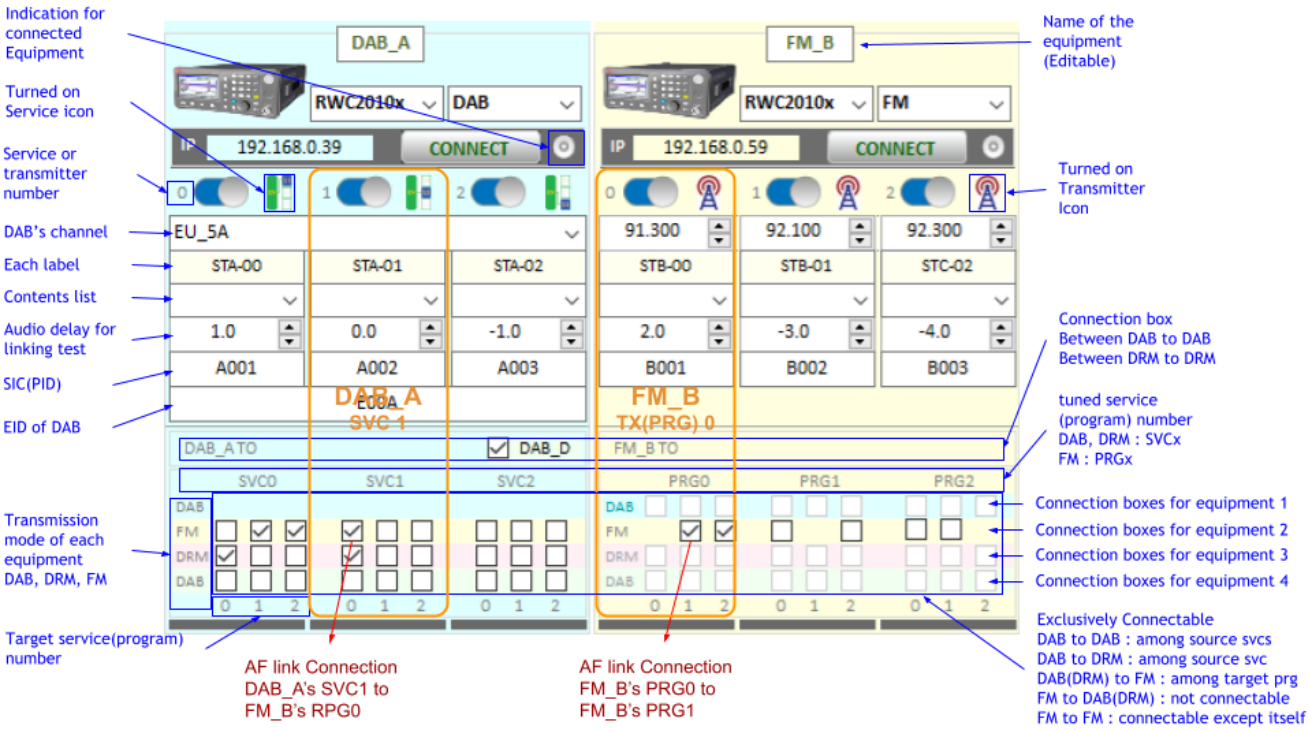
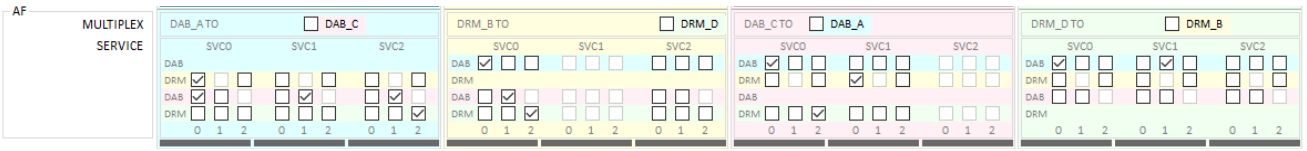


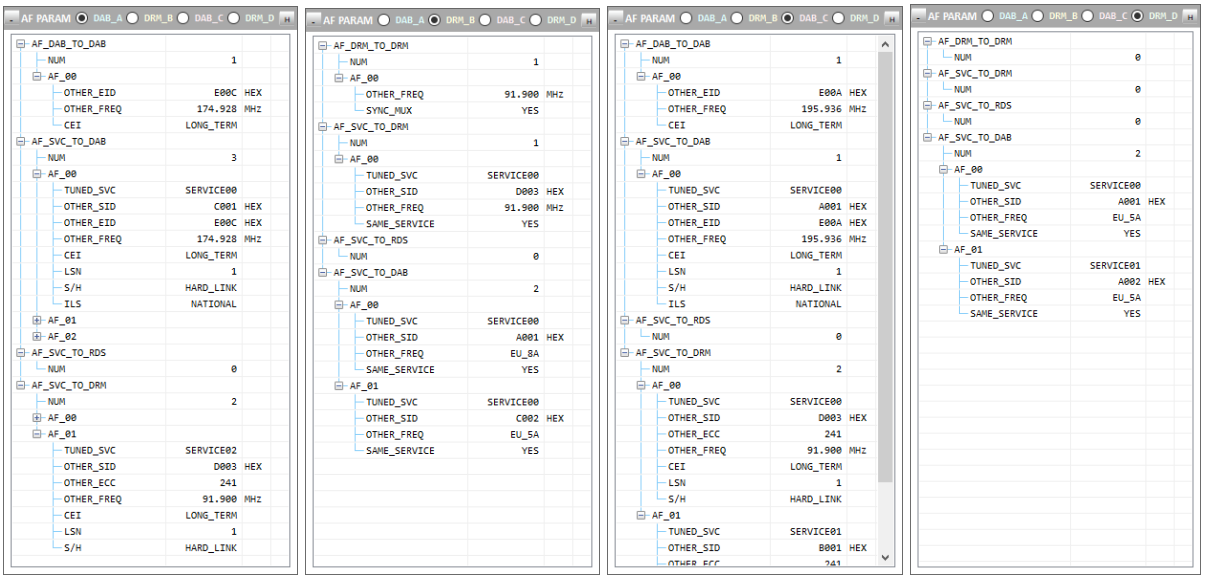
Figure 1.5 Indications and parameters for stations

1.2.4 AF parameter display window

The AF parameter display window automatically creates and shows all AF parameters for each equipment according to the linking connection checkbox. Editing AF parameters in the display window is not allowed.



a. An example of AF link connections of DAB, and DRM



b. AF parameters trees according to checked link connections

Figure 1.6 AF parameters display window

1.2.5 Power Profile editor

It provides the power profile window so that users can create a radio broadcasting signal environment of various transmitters that can occur in the real field. In the power profile window, the power levels of each transmitter can be set to emulate the real field situation. All power values are automatically checked and limited to fit the characteristics of RWC2010B or RWC2100F.

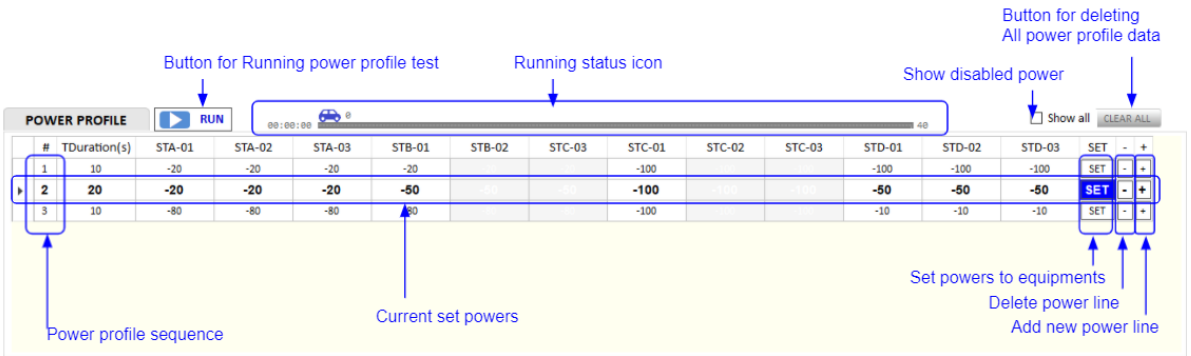


Figure 1.7 Power profile editor

II. Menu

The parameters and power profile can be saved into and recalled from the users' workspaces. This chapter explains how to use workspaces.

2.1 Workspace

This program provides workspace functions. The workspace can be used to store all parameters of equipment and power profiles. All features of this application can also work without a workspace. However, if the program is closed without saving the workspace, only the parameters data will be saved automatically but all link connections and power profile data will be lost.

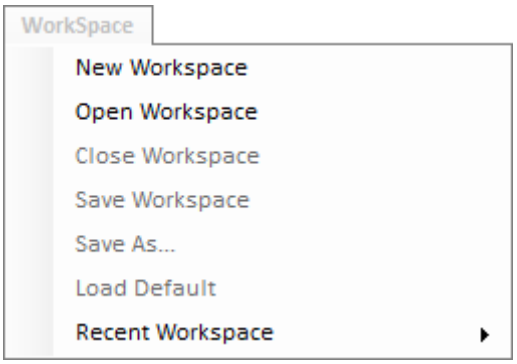


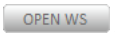
Figure 2.1 Menus for Workspace

2.1.1 Workspace Functions

2.1.1.1 New Workspace

It creates a new workspace. The name of the created file is shown at the top of the application. The full path of the workspace is displayed at the bottom of the application.

2.1.1.2 Open Workspace

It opens an existing workspace file. It can be done by clicking the [Open] button 

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2.1.1.3 Close Workspace

It closes the opened workspace. After closing, the current workspace name will be changed to "NO NAME".

2.1.1.4 Save Workspace

It saves the opened workspace without asking for a new name. Clicking the [Save Workspace] without opening or creating a workspace, the Workspace File Naming dialog box will open. If any parameters are

modified, an asterisk appears on the workspace name, e.g., "my_workspace.ws *". Saving can be done by clicking the [Save] button SAVE WS.

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 since they cannot be restored to the previous ones once loaded to default.

2.1.1.7 Recent Workspace

It saves and shows the last opened workspaces. One of the listed files will be opened by clicking file name in the list. The maximum number is seven.

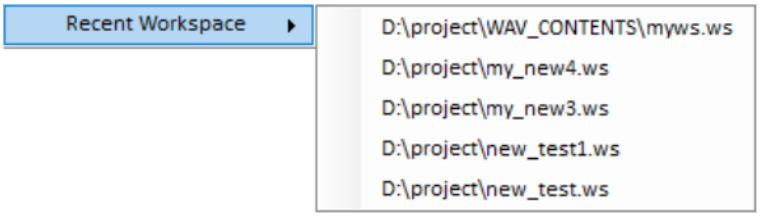


Figure 2.2 Recent workspaces list

2.1.1.8 Open the last WS when connect

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

III. Operation

3.1 Station Setup

3.1.1 Equipment setup

3.1.1.1 Connecting equipment to the application

To use this application, at least one RedwoodComm's equipment RWC2010B, or RWC2100F(hereinafter referred to as Equipment) must be connected. It doesn't matter if the equipment is RWC2010B or RWC2100F.

After setting the IP and clicking the [CONNECT] button, this application program sends the command "*IDN?" to the connected equipment, and from the returned response, distinguishes whether the connected equipment is RWC2010B or RWC2100F. It is not allowed to connect a different equipment to the same IP address, showing the warning message shown as Figure 3.1.

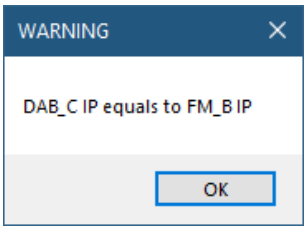


Figure 3.1. Warning message about attempts to connect to the same IP address

After connecting correctly, it updates the basic information of the equipment such as its name and image, and connection status, and the list of contents files. If there is no RWC2010B or RWC2100F information from the response, it will ignore the connection and every parameter will not be changed.
If the connected equipment is not same with workspace data, a warning message will be popped. Figure 3.2.

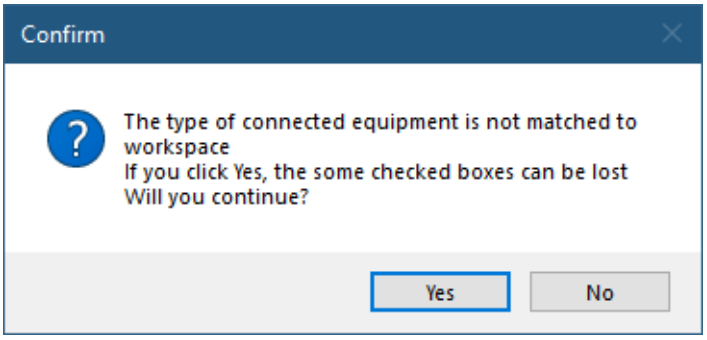


Figure 3.2 Warning message about different equipment to be connected.

3.1.1.2 Transmission mode

If the connected equipment is RWC2010B, the mode option is set to FM, DAB, and DRM. In the case of RWC2100F, only a FM mode option is available.

a. Transmission mode of RWC2010B b. Transmission mode of RWC2100F

Figure 3.3. Transmission of equipment

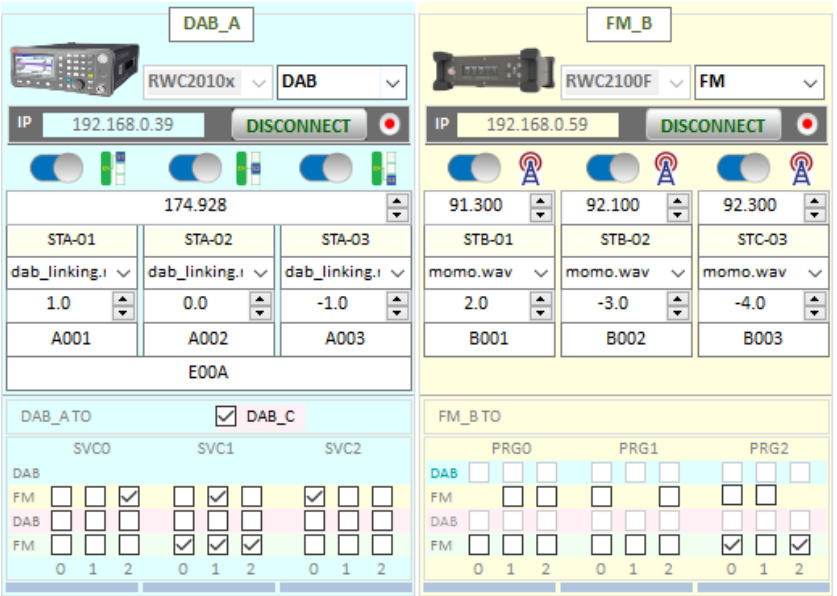
3.1.1.3 Turning on/off service or transmitter.

Users can turn on or off each service or transmitter of equipment using the button .

In the case of DAB or DRM, turning on/off the object means adding or removing a service, Figure 3.4.a. In the case of FM, turning on/off the object means turning on/off a FM transmitter, Figure 3.4.b.

Any combinations of DAB, DRM, and FM are allowed. For example, if 2 RWC2010B and 2 RWC2100F are connected and one DAB, one DRM, and 6 FMs are selected, the service-linking test can be performed with 8 transmitters. If 4 pieces of any equipment are connected and set as FMs, the service-linking test can be set up with up to 12 FM transmitters.

Checking the checkbox means to add related AF information for service linking. This application program adds AF parameters according to the checked link connection and updates all equipment's AF information.



a. DAB/DRM multi-services b. FM stations

Figure 3.4. Sub-stations of each transmission mode.

3.1.2 Parameters

This application program only provides least parameters for the service linking test. Therefore, in order to set detailed parameters, it is necessary to set each equipment by remote control or use the application program of the equipment. Each AF frequency and the number of AF for the service linking test is set automatically by the application program when the power profile is executed.

To configure the detailed parameters of RWC2100F, we recommend using the application program designed for RWC2100F shown as Figure 3.5. The application program for each equipment is available for download on the RedwoodComm website.

For remote commands of each equipment, refer to the remote control section of its operating manual. The operating manuals are also available for download on the website.

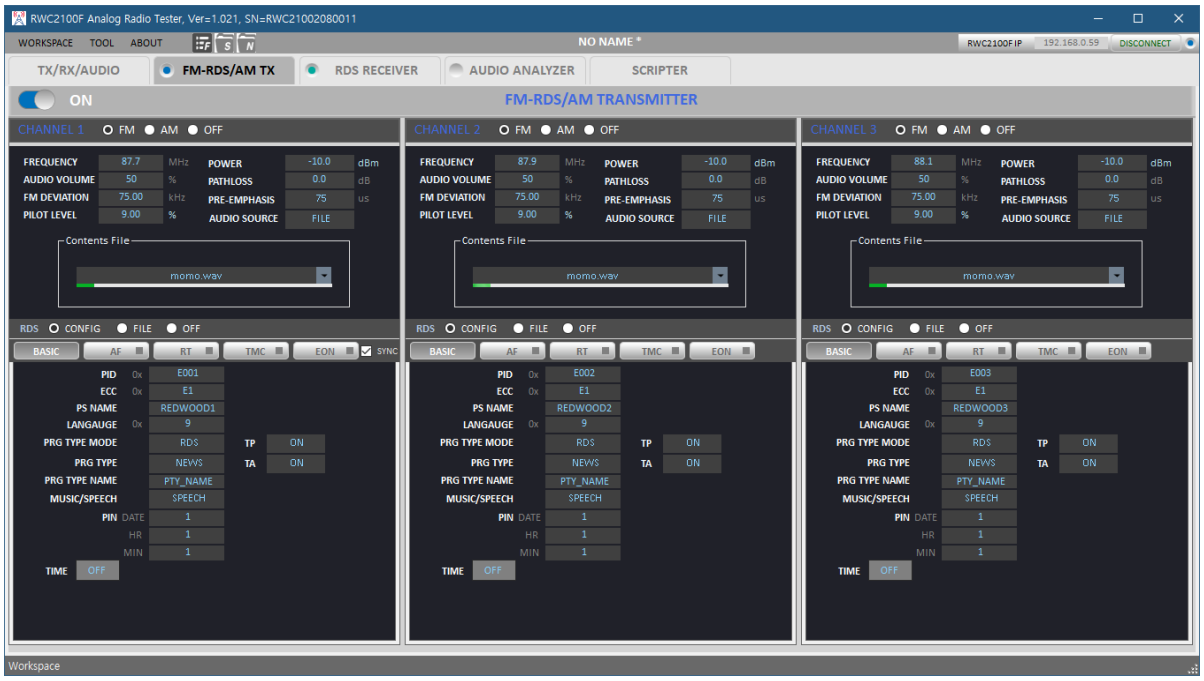


Figure 3.5. Application program of RWC2100F

CHANNEL

FREQ ○ CH ◉

DAB : European channel list of DAB

It can be used if there is a DAB mode equipment of four.

FREQUENCY

FREQ ◉ CH ○

Frequency parameter can be used in any transmit mode of the instrument. However, there are DRM and DAB mode equipments at the time, so the frequency selection button is not visible because the DRM AF information stores DAB channel information with only channel information not with frequency. At this

DAB : local frequency :
DRM : local frequency
FM local Frequency 76 to 107.9MHz

LABEL

DAB, DRM : This parameter stands for the name of Program. The maximum length of the string is 16.
FM : This parameter stands for the name of Program. The maximum length of the string is 8.

CONTENTS

Users can select one of the AUDIO SOURCE parameters as an audio source.
Application lists up compatible contents files according to the transmission mode after connection with equipment.

AUDIO DELAY

This parameter can be used to emulate the asynchronous nature of each station's contents file due to the physical distance of each station or processing delay. The service linking characteristics of the receiver can be emulated by using the received signals with different audio delays. This parameter is processed by the application automatically, sending the audio reset command in turn, starting with the station with the smallest number of audio delays when the power profile is executed.
Unit: 100 ms

PID(SID)

PID : FM
This is the Physical ID of a program. The Program is recognized by this value in DUTs.

SID : DAB, DRM
This is the Service Identifier of a Program in DAB/DRM transmitter. The maximum digit is 16 in HEX.

EID

This is the Ensemble Identifier of a DAB transmitter. The maximum digit is 8 in HEX.

For more detailed information, refer to the manual of RWC2010B and RWC2100F.

3.1.3. Alternative Frequency

3.1.3.1 Editing alternative frequency

This program can perform service linking tests using all AF functions of RWC2010B and RWC2100F. Use the checkbox to set the number of AFs and connect them. To enable CheckBox, enable the station of each equipment using

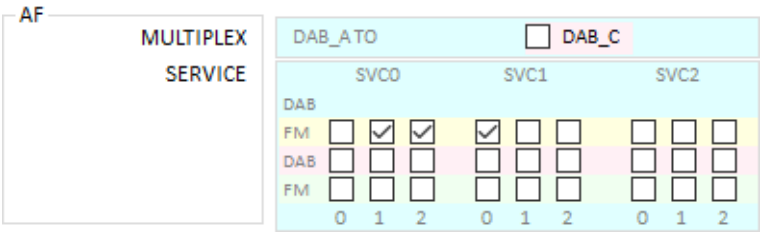


Figure 3.6. AF parameter Editor

3.1.3.2 AF parameter tree for DAB

There is 4 AF parameter trees for DAB, such as AF_DAB_TO_DAB, AF_SVC_TO_DAB, AF_SVC_TO_ RDS, AF_SVC_TO_DRM.

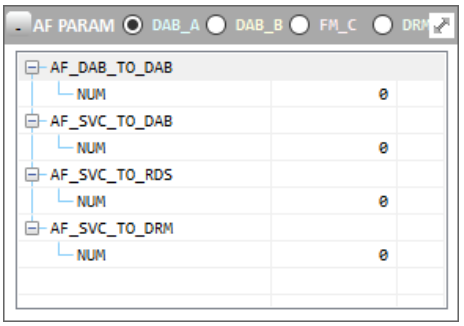
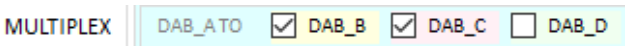


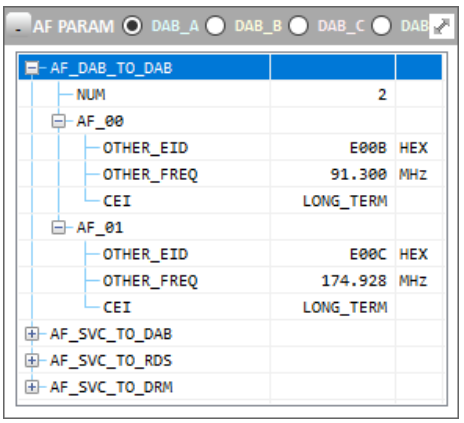
Figure 3.7 DAB mode AF parameter tree

AF_DAB_TO_DAB

This tree for indicating a dab system to other dab systems. It will be created if MULTPLEX link connection checkboxes are checked.



a. DAB to DAB link connection

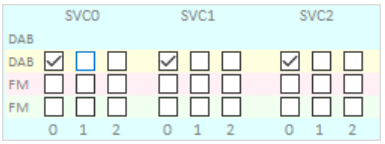


b. DAB to DAB AF parameter tree

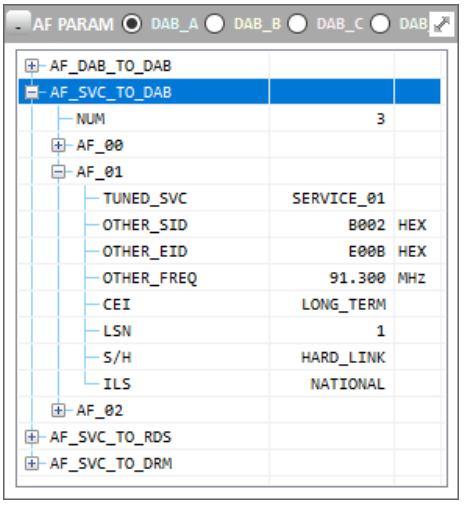
Figure 3.8 DAB to DAB AF parameter tree

AF_SVC_TO_DAB

This tree is for indicating dab services to other dab services. It will be created if SVC to DAB link connection checkboxes are checked.



a. DAB SVC to DAB link connection

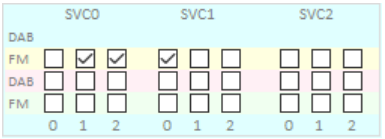


b. DAB SVC to DAB AF parameter tree

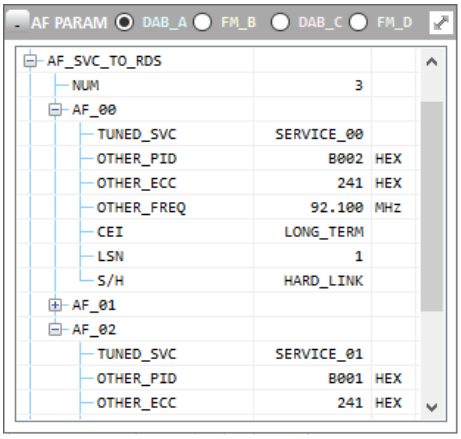
Figure 3.9 DAB SVC to DAB AF parameter tree

AF_SVC_TO_RDS

This tree is for indicating dab services to other dab services. It will be created if SVC to FM link connection checkboxes are checked.



a. DAB SVC to RDS link connection

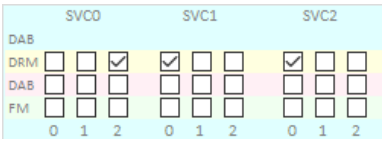


b. DAB SVC to RDS AF parameter tree

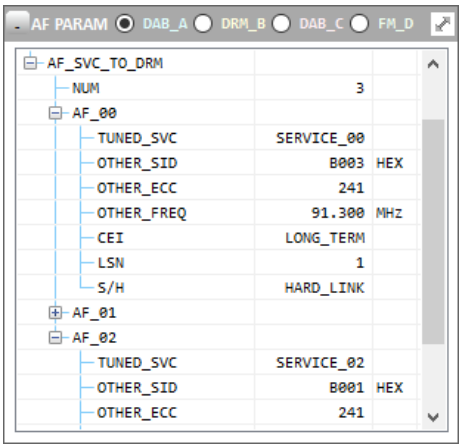
Figure 3.10 DAB SVC to RDS AF parameter tree

AF_SVC_TO_DRM

This tree is for indicating dab services to other drm services. It will be created if SVC to DRM link connection checkboxes are checked.



a. DAB SVC to DRM link connection



b. DAB SVC to DRM AF parameter

Figure 3.11 DAB SVC to DRM AF parameter tree

3.1.3.3 AF parameter tree for DRM

There is 4 AF parameter trees for DRM, such as AF_DRM_TO_DRM, AF_SVC_TO_DRM, AF_SVC_TO_ RDS, AF_SVC_TO_DAB.

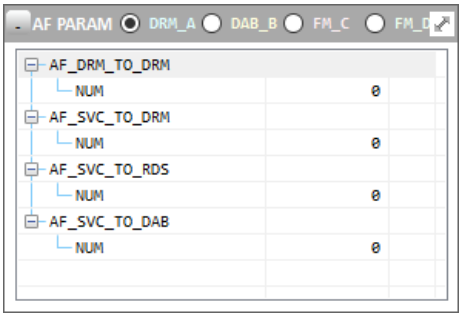
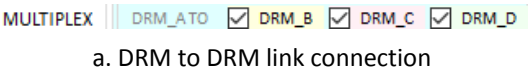


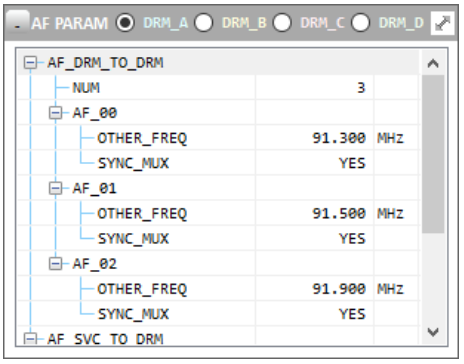
Figure 3.12 DRM AF parameter tree

AF_DRM_TO_DRM

This tree for indicating a drm system to other drm systems. It will be created if MULTPLEX link connection checkboxes are checked



a. DRM to DRM link connection

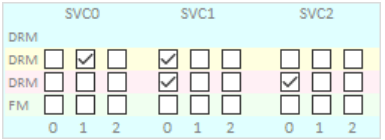


b. DRM to DRM AF parameter tree

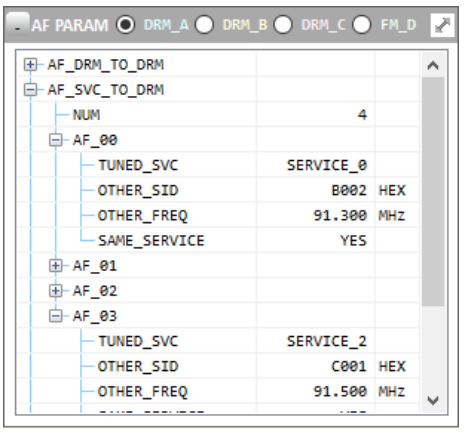
Figure 3.13 DRM to DRM AF parameter tree

AF_SVC_TO_DRM

This tree for indicating a drm system to other drm systems. It will be created if any SVC to DRM link connection checkboxes are checked



a. DRM SVC to DRM link connection

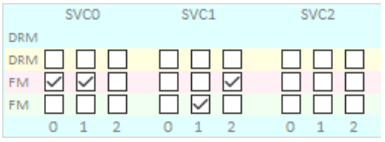


b. DRM SVC to DRM AF parameter tree

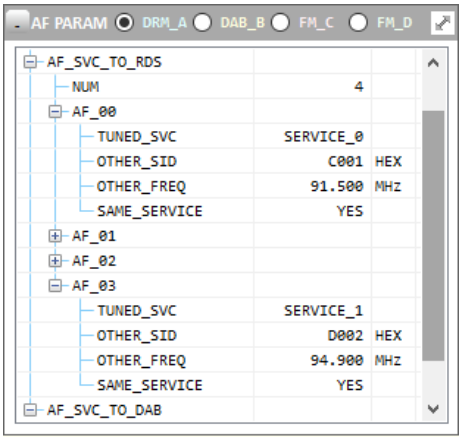
Figure 3.14 DRM SVC to DRM AF parameter tree

AF_SVC_TO_RDS

This tree for indicating a drm system to other drm systems. It will be created if any SVC to FM link connection checkboxes are checked



a. DRM SVC to RDS link connection

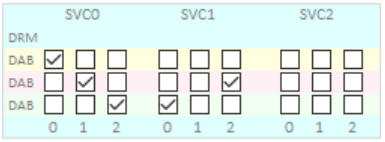


b. DRM SVC to RDS AF parameter tree

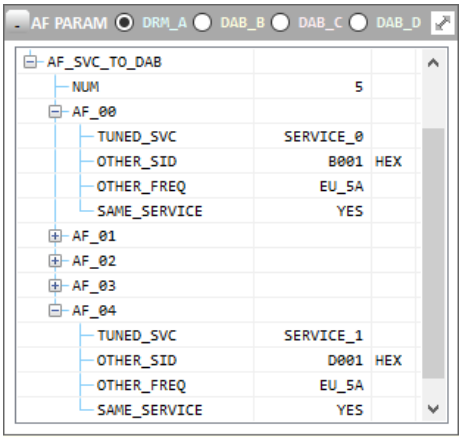
Figure 3.15 DRM SVC to RDS AF parameter tree

AF_SVC_TO_DAB

This tree for indicating a drm system to other drm systems. It will be created if any SVC to DAB link connection checkboxes are checked



a. DRM SVC to DAB link connection



b. DRM SVC to DAB AF parameter tree

Figure 3.16 DRM SVC to DAB AF parameter tree

3.1.3.4 AF parameter tree for FM-RDS

There is only one AF parameter tree for FM-RDS, but it shows 3 transmitters AF respectively.

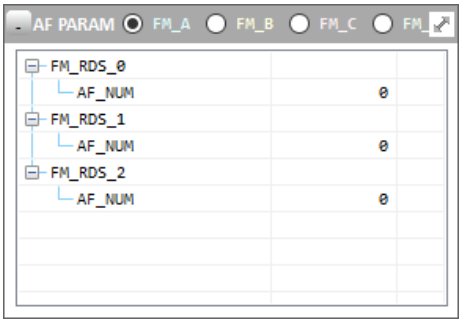
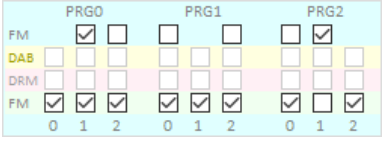


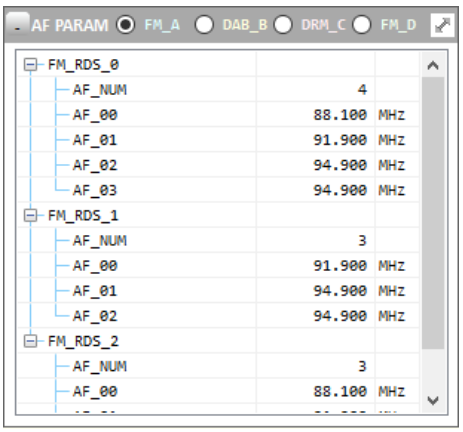
Figure 3.17 FM AF parameter tree

FM_RDS_x

This tree is for indicating other FM transmitter's numbers and frequencies. It will be created if PRG to FM link connection checkboxes are checked



a FM link connections



b FM AF parameter tree with 3 transmitters

Figure 3.18 FM AF parameter tree with 3 transmitters

3.1.3.5 Exclusive link connections

Some link connections are not available among transmission mode DAB, DRM, and FM. And some are exclusive to each other. When the exclusive checkbox is checked, the application will make them unchecked automatically in the following way.

Exclusiveness DAB to DAB, and DAB to DRM

If the transmission mode of source equipment is DAB (DRM) and the transmission mode of target is also DAB (DRM), linking from the same source service to different target services is not allowed. This is because it means that the target services are the same service in one ensemble. Different source services to the same target service link connection or different source services to different target service link connections are allowed as the following figure 3. That is, SVC0(DAB_A) to SVC0(DAB_B) and SVC1(DAB_A) to SVC0(DAB_B) at the same time is not allowed.

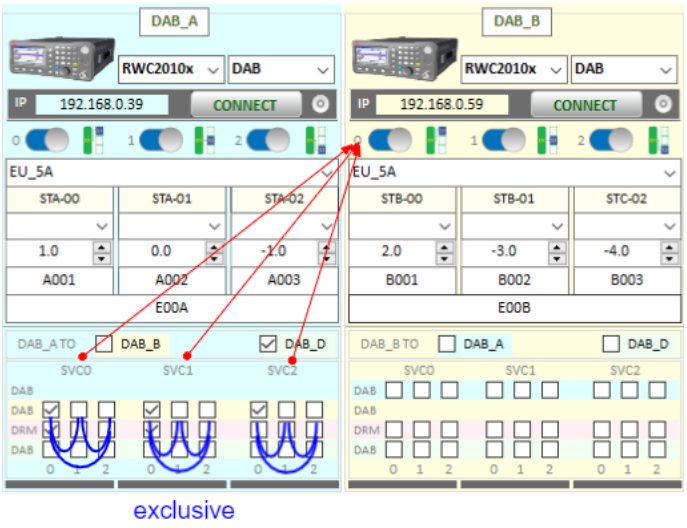


Figure 3.19 Exclusive link connection DAB to DAB

Exclusiveness DAB(DRM) to FM

In this case, the target is a separate FM transmitter's program even though FM transmitters are in the same equipment. A link connection from different services in the same ensemble to the same FM program is not allowed. For example, the link connection SVC0(DAB_A) to PRG0(FM_B1) and the link connection SVC1(DAB_A) to PRG0(FM_B1) at the same time is not allowed.

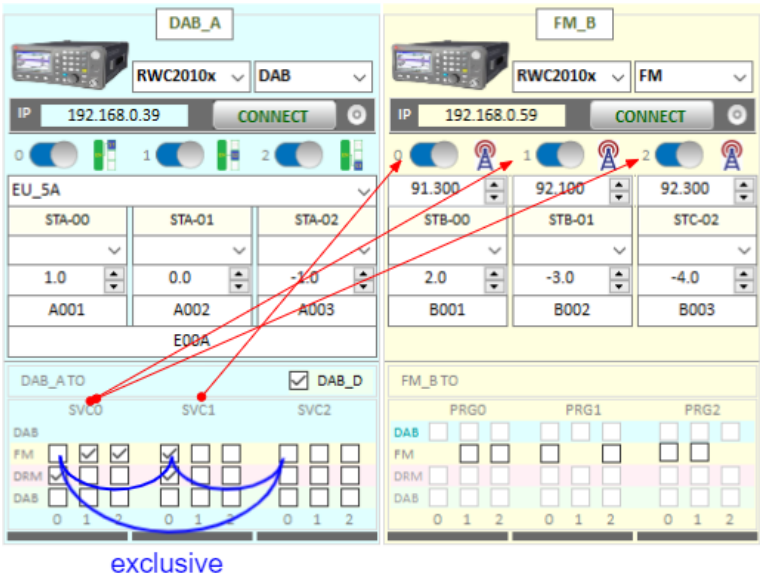


Figure 3.20 Exclusive link connection DAB to FM

Exclusiveness FM to DAB(DRM)

For example, if there are one DAB transmitter and three FM transmitters, only the AF information checkbox of DAB is active. This is because the DAB can have FM information around it, but it cannot give DAB information to the FM.

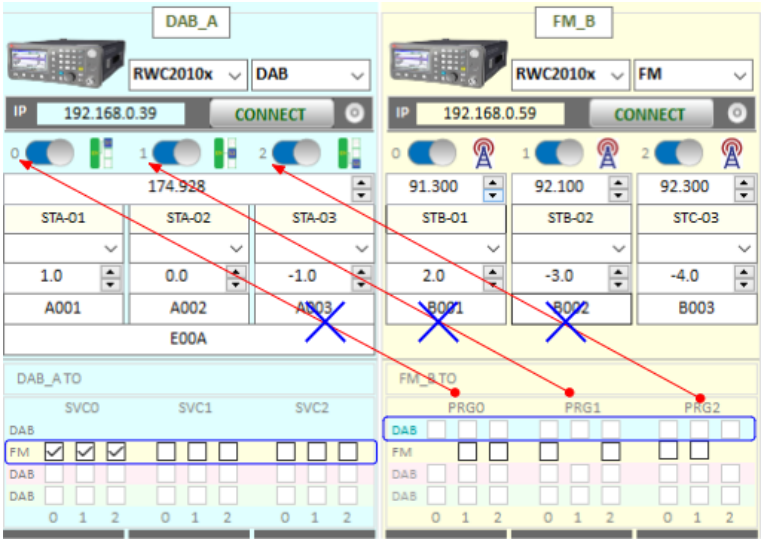


Figure 3.21 Exclusive link connection FM to DAB

Exclusiveness FM to FM

There is no exclusiveness in FM to FM system. All FM AF link connections can be checked except itself.

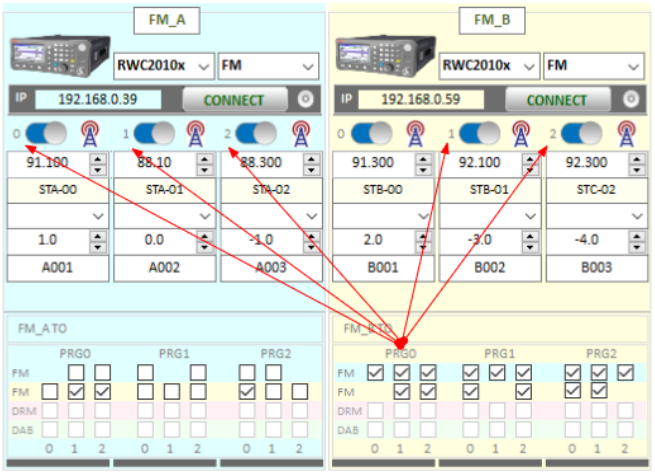


Figure 3.22 Link connection FM to FM

3.2 Power Profile Setup

3.2.1 Editing Power Profile

3.2.1.1 Creating power profiles

Power profiles can be created by adding or removing power profile lines with power profile editor.

3.2.1.2 Adding a power profile

Clicking a [+] button in the power profile editor will add a new power profile line. If there is not any power profile line, clicking the mouse button in empty space will add a new line. Be aware that default power values are all 'OFF' for safety. If the edited value is invalid, the application will set it as 'OFF' automatically.

3.2.1.3 Removing a power profile

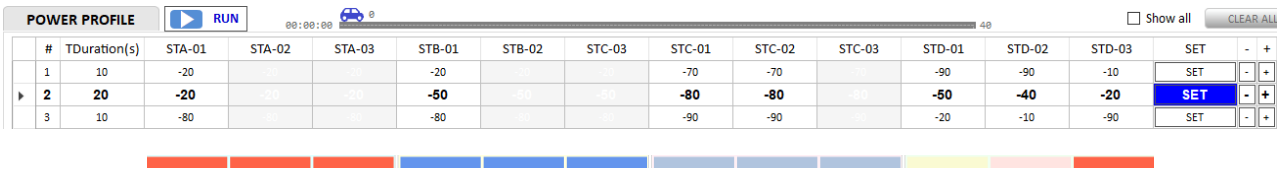
Clicking a [-] button in the power profile editor will remove the power profile line.

3.2.1.4 Modifying values

Double clicking a specific cell that needs to change will make the cell editable. The sequence number cannot be modified but will be updated after adding or deleting power profile lines automatically.

3.2.1.5 Setting power value

Clicking a [SET] button will set the powers of all stations respectively according to the selected profile. The set power profile line is displayed in bold, and each station in the parameter window displays a different color bar according to the set power.



#	TDuration(s)	STA-01	STA-02	STA-03	STB-01	STB-02	STC-03	STC-01	STC-02	STC-03	STD-01	STD-02	STD-03	SET	-	+
1	10	-20			-20			-70	-70		-90	-90	-10	SET	-	+
2	**20**	**-20**			**-50**			**-80**	**-80**		**-50**	**-40**	**-20**	**SET**	-	+
3	10	-80			-80			-90	-90		-20	-10	-90	SET	-	+

Figure 3.23 Setting power levels in the power profile table

3.2.1.6 Show all values

Setting ☐ Show all checked will show all power values of all stations even including stations that are turned off.

3.2.1.7 Clearing all power profile lines

Clicking CLEAR ALL button will clear all power profile lines with one warning message. Once cleared, they cannot be recovered.

3.2.2 Parameters

Time duration and transmission power of each station can be set.

Time Duration

The time duration indicates the time the corresponding power profile lasts. All stations maintain their set power during this amount of time.
Unit: second

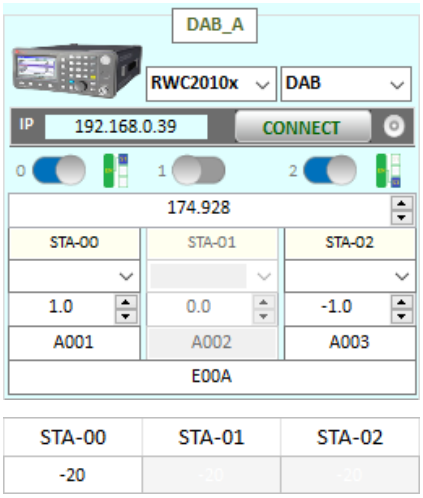
Power

Transmission power level of each station.
With the RWC2010B FM transmitter, it is not possible to set different power levels of the three channels. If incorrect values are entered, it will be corrected automatically. In addition, the power can be set to OFF rather than a number, which can emulate that a signal is not received along the moving path by turning the power OFF even if the station is ON. The enable/disable of each station's profile follows the enable/disable of the station setup panel.
Unit: dBm
Range for RWC2010B : OFF, 0 to -120 dBm
Range for RWC2100F : OFF, 0 to -90 dBm
OFF can be set.

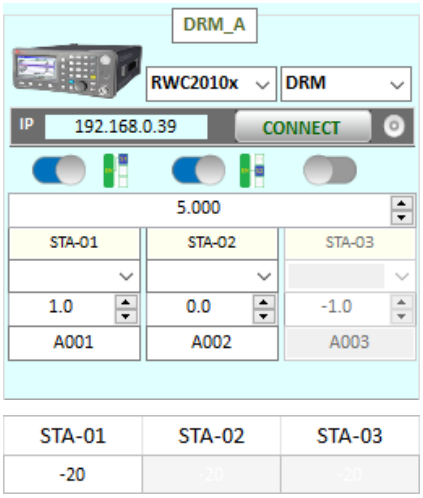
3.2.3 Power limitation

With the RWC2010B FM transmitter, it is not possible to set different power levels of each transmitter. If different values are set, it will be corrected automatically. With RWC2100F FM transmitter, it is possible to set different power levels of each transmitter independently.

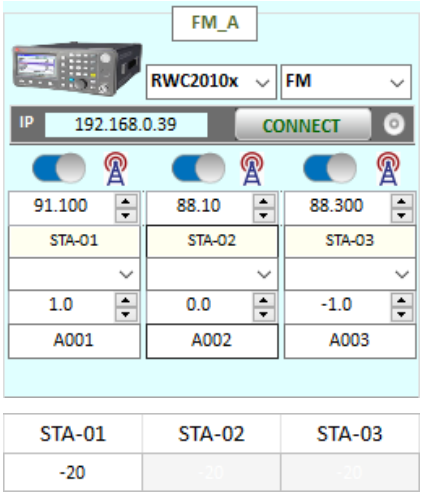
The following are examples by transmission mode and equipment.
Although the RWC2010B is set as a DAB and three services are enabled, only one transmit power setting is active because it is one ensemble. Figure 3.24.a
Although the RWC2010B is set as a DRM and two services are active, only one transmit power setting is active because it is one multiplex. Figure 3.24.b
Although the RWC2010B is set as FM mode and two transmitters are active, all power levels of each FM transmitter will be synchronized. Figure 3.24.c
In the case of the RWC2100F, 3 different power sources can be set when all 3 transmitters are enabled, even optionally setting the transmit power to OFF respectively. Figure 3.24.d



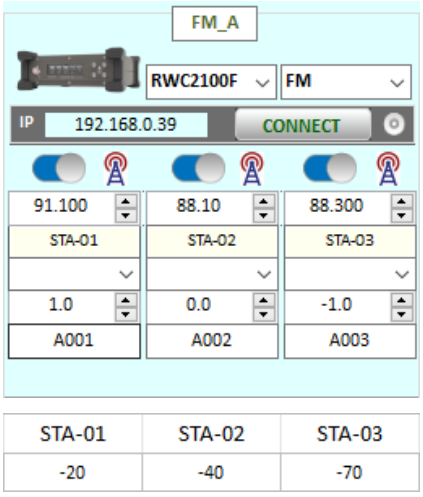
a. DAB mode power setup for RWC2010B



b. DRM mode power setup for RWC2010B



c. FM mode power setup for RWC2010B



d. FM mode power setup for RWC2100F

Figure 3.24 An example of power level setup according the equipment and mode

3.2.4 Running Power Profile

Clicking the RUN button on the Power profile tab will let the program run the profile sequence one by one. While running power profile, the current set power profile line is displayed in bold, and the car icon is animated in the power profile tab according to the time in seconds unit. The total elapsed time after [run] is displayed on the left side of the animation, and the remaining time and total test time is displayed on the right side, and the remaining time of the current power profile is displayed right next to the car icon.

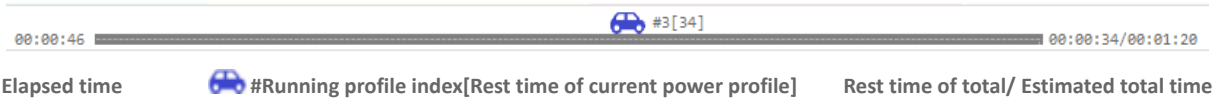


Figure 3.25 Animating running time information during power profile test

3.2.4.1 Sending parameter commands

All commands for parameters will be sent to each equipment automatically the very after clicking the [RUN] button. But if you want to set power level and parameters to each equipment, click the [SET] button in the power profile table that you want to set. While sending parameters commands, it will pop up a waiting message window.

Figure 3.26 Message window for common

3.2.4.2 Audio delay synchronization

While running power profile, audio delay synchronization will be started after sending parameter commands. During synchronizing, a waiting message window will be popped up. It takes the total time which you set audio delay time for each station of each equipment.

Figure 3.27 Message for waiting audio delay synchronization

Total audio delay synchronization time is the time difference between minimum and maximum audio delay values. This application software calculates the reset sequence, resets them one by one, and displays the current reset station in yellow during synchronization.

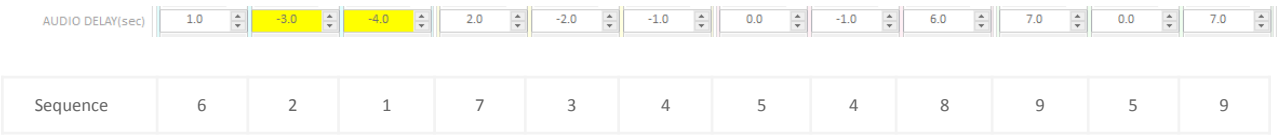


Figure 3.28 Audio delay synchronization sequence

3.2.4.3 Sending power commands

While running the power profile, power commands for each transmitter are automatically sent according to the power profile table and wait for a specified amount of time [Time Duration] before sending the next power profile.

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