RWC2010B DIGITAL RADIO Tester

Operating Manual

Version 1.70
(F/W Version 1.70)

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1 General Information

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

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

1.1 Warranty

RedwoodComm Warrants that this product will be free from defects in materials and workmanship for a period of two(2) years from the date of shipment. During the warranty period, RedwoodComm Company will, at its option, either repair or replace products that prove to be defective.
For warranty service or repair, customers must notify RedwoodComm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customers shall be responsible for packaging and shipping the defective product to the service center designated by RedwoodComm. Customers shall prepay shipping charge to RedwoodComm designated service center and RedwoodComm shall pay shipping charge to return the product to customer. Customer is responsible for all shipping charges including freight, taxes, and any other charge if the product is returned for service to RedwoodComm, if the customer is located outside of Korea.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate malignance by buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, accident or abnormal conditions of operations.
RedwoodComm responsibility to repair or replace deductive products is the sole and exclusive remedy provided to the customer for breach of this warranty. RedwoodComm will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether RedwoodComm has advance notice of the possibility of such damages

1.2 Safety Considerations

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

1.2.1 Injury Precautions

Use Proper Power Cord

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

Avoid Electric Overload

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

Ground the Product

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

the power outlet, it is recommended to provide a separate grounding path to the instrument by connecting wire
between the instrument ground terminal and an earth ground to avoid electric shock or instrument damage.
Before making connections to the input or output terminals of the product, ensure that the product is properly
grounded.

Do Not Operate Without Covers

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

Do Not Operate in Wet/Damp Conditions

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

Do not use in a manner not specified by the manufacturer

1.2.2 Product Damage Precautions

Use Proper Power Source

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

Provided Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

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

Environmental Conditions

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

1.2.3 Safety Symbols and Terms

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



Close	Open	ATTENTION	Indicates earth (ground) terminal

WARNING

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

CAUTION

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

1.3 General Information

RWC2010B Digital Radio Tester supports the **DAB**, **DAB+**, **DMB**, **DRM30**, **DRM+**, **AM**, **FM** and **RDS** system. It provides a very convenient working environment with full control over all system parameters. It supports various kinds of data services such as **BWS**, **TPEG, EWS, EPG, SLS** and more services will be added to adjust to changing markets. RWC2010B has **ETI** and **MDI** file player functions so that specific broadcasting station's DAB/DRM signal could be regenerated in the LAB. It also supports AM/FM radio test functions with fully editable RDS test functions.
In addition, it includes an **RF up-converter**, which supports RF output in a range between -10dBm ~ -120dBm (CW: 0dBm ~ -110dBm) with 0.1dB step adjustable and Band **LF**, **MF**, **HF**, **I**, **II**, **III** frequency ranges, so it can directly generate broadcasting signals to DUTs so that systems can be easily aligned.

1.3.1 Key Feature

- Support **DAB**, **DAB+**, **DMB**, **DRM30**, **DRM+**, **AM**, **FM**, **RDS** functions
- Built-in **Ensemble Multiplexer**
- 15 service components for DAB and 4 streams for DRM Support various kinds of data services such as **BWS**, **TPEG, EPG, SPI, SLS** and so on.
- **Reconfiguration, AF, Announcement**, **Time, EON, TMC** functional tests
- **ETI** and **MDI** file player function with **OFDM Modulator** and **RF up-converter**
- **Service(Seamless) Linking** Test: **DAB-DAB**, **DAB-DRM**, **DAB-FM**, **DRM-FM, FM-FM**
- Built-in 32Gbyte internal memory to store Contents
- **Real-Time File Streaming** function
- The contents stored in user PC can be transferred to RWC2010B in real-time to broadcast

- Useful to test various kind of contents and huge file contents
- Supports various frequency BAND
- **BAND I/ II/III** (47MHz ~ 68MHz, 87MHz ~ 108MHz, 174MHz ~ 250MHz)
- **LF/MF/HF BAND** (0.15MHz ~ 30MHz) -10dBm ~ -110dBm (OFDM: -10dBm ~ -120dBm) RF output range with 0.1dB step resolution

1.3.2 Specification

Frequency

LF/MF/HF Band : 0.15MHz ~ 30MHz
BAND I/II/III: 47MHz~68MHz, 87MHz~108MHz, 174MHz~250MHz
Resolution: 1kHz
Accuracy: 1.5ppm/year @ operating temperature

Output Level

-10dBm ~ -110dBm (OFDM: -10dBm ~ -120dBm) for BAND I/II/III
-20dBm ~ -110dBm (OFDM: -20dBm ~ -120dBm) for LF/MF/HF BAND
Resolution: 0.1dB
Accuracy: 1dB

VSWR

Better than 1:1.5

Modulation

OFDM (Orthogonal Frequency Division Multiplex)
D-QPSK(Differential Quadrature Phase Shift Keying), 16QAM, 64QAM
FM/AM

Frequency Reference

Internal Reference & Stability: 10MHz, 1.5ppm/year @ operating temperature
External Reference: 10MHz (0dBm ~ +20dBm MAX)

I-Q Out Port

Output voltage: 1Vpp

Remote Programming Ports

RJ45 (TCP/IP)
RS-232C

Miscellaneous

Operating temperature: 5 ~ 40℃
Line Voltage: 100 to 240 VAC, 50/60Hz
Dimension: 240(w) x 340(d) x 110(h) mm
Weight: 5.5Kg

1.4 Power Requirement

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

Items	Specifications
Provider	Mean Well Enterprise Co., Ltd.
Model	T-40B
Input voltage	100 VAC - 240 VAC
Input current	1.2A
Frequency	50/60 Hz
Power Consumption	Less than 20 watt

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

1.5 Operating Environment

Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the flat is not level. Also, do not use it where the ambient temperature is outside 5 °C to 40 °C, and altitude is more than 2000m.
The maximum relative humidity is 80% for temperatures up to 31 °C decreasing linearity to 50% relative humidity at 40 °C. Over voltage Installation Category II for mains supply. Pollution Degree 2
The storage temperature range for this equipment is -20 °C to 70 °C. When this equipment is not used for a long period of time, store it in a dry place away from direct sunlight, covered with vinyl or placed in a cardboard box

2. Basic Operation

This section describes the basic concepts and details of operating RWC2010B DIGITAL RADIO Tester. Understanding the basic concepts of your RWC2010B helps you use it effectively.

2.1 Front Panel View
2.2 Rear Panel View
2.3 Basic Operation
2.4 Display Screen
2.5 Frequency, Power setting
2.6 Ethernet Connection Method
2.7 Firmware Upgrade
2.8 Real-time File Streaming
2.9 Contents File Download
2.10 Management Contents Files
2.11 Save/Recall
2.12 Screen Capture Method
2.13 Setting IQ OUT port

2.1 Front Panel View

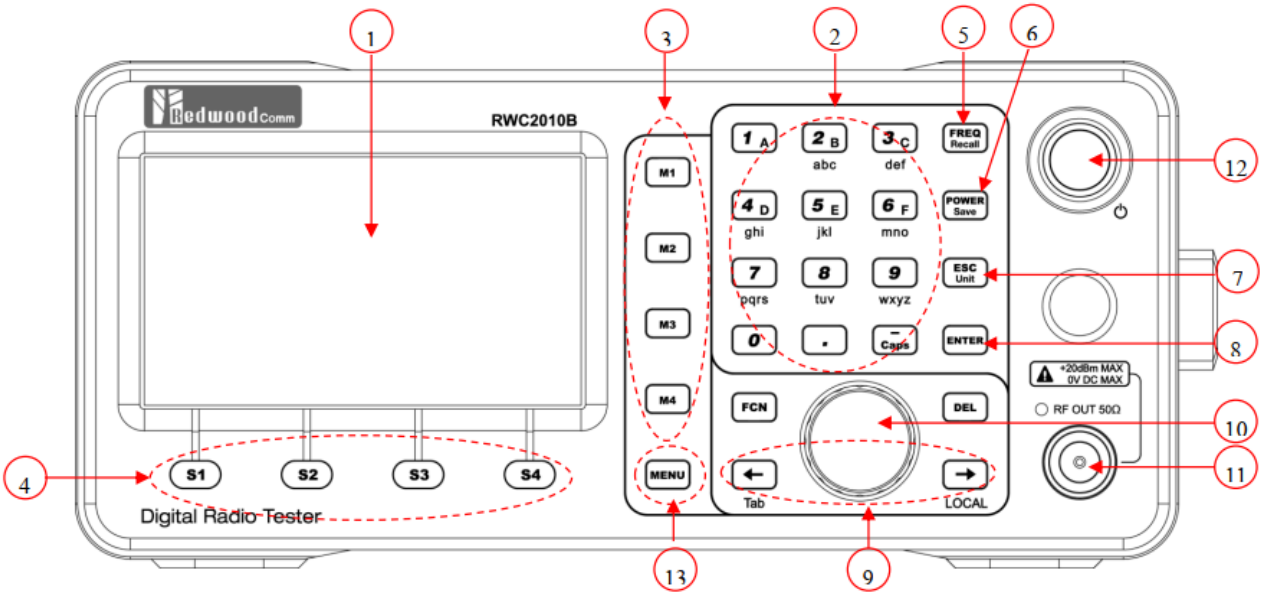


Fig. RWC2010B Front Panel View

2.1.1 Basic key function

1. LCD Display
2. 0 ~ 9 Number input
3. M1 ~ M4 Special Function Key
4. S1 ~ S4 Select Sub-menu
5. FREQ Shortcut key for frequency setting
6. POWER Shortcut key for power setting
7. ESC Input cancel, Popup window release, Return to the previous state
8. ENTER Data input, input mode switching
9. ← → Cursor move
10. Rotary knob Cursor move, value change at data input mode / Pushing ENTER function
11. RF Connector
12. Power switch
13. Main menu selection key

2.1.2 Selection of Secondary function

Combinational key functions with the blue colored FCN key.

- FCN + FREQ (= Recall) Call for stored settings

- FCN + POWER (= SAVE) Store the current instrument settings into memory
- FCN + ESC (= UNIT) Change the unit of parameter
- FCN + - (= Caps) Upper case input mode

2.2 Rear Panel View

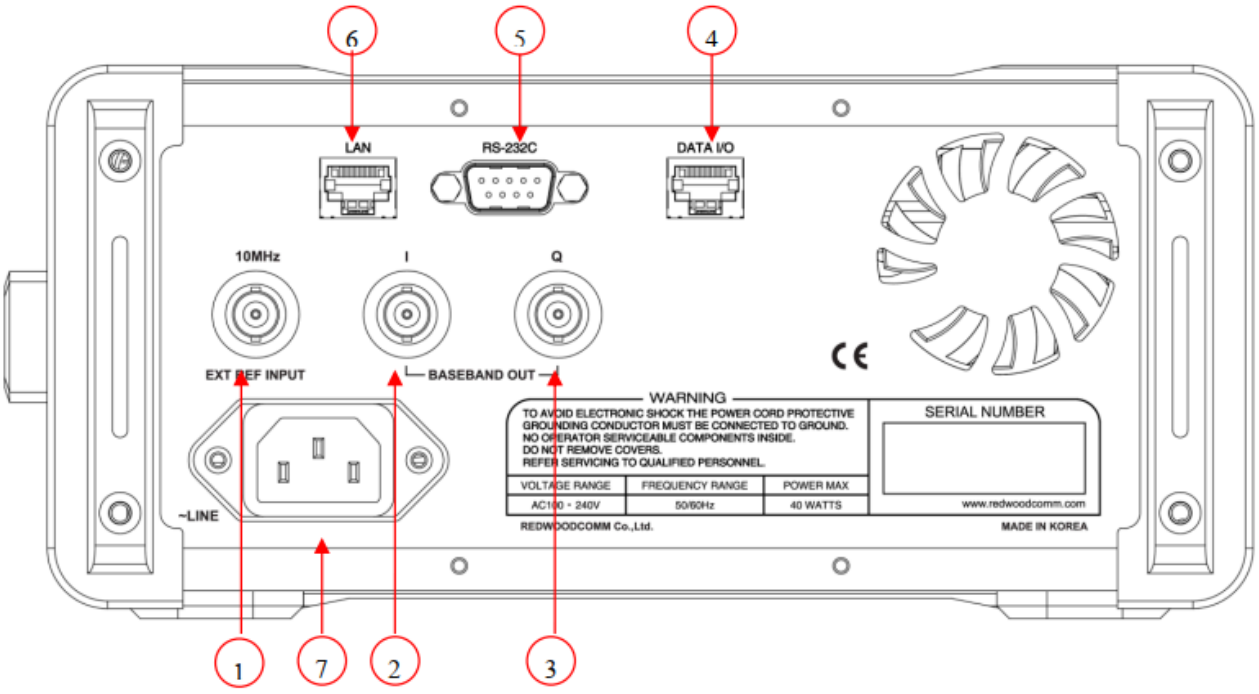


Fig. RWC2010B Rear Panel View

1. REF IN 10Mhz External reference signal input
2. I-OUT In-phase out
3. Q-OUT Quadrature out
4. DATA I/O Sync data in/out between RedwoodComm instruments
5. RS-232C RS-232C Interface
6. RJ45 Ethernet Interface
7. ~LINE 100V – 240V AC Power input

2.3 Basic Operation

2.3.1 Select Main Menu

RWC2010B DIGITAL RADIO Tester has a tree type menu structure and each major parameter seeing screen can be selected by pressing the MENU key. The following figure shows the main menu selection screen. Select test mode using the rotary key and press the **ENTER key**.

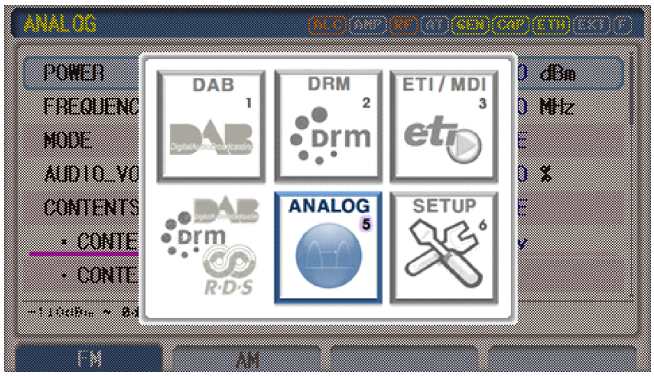


Fig. Screen to select test mode

2.3.2 Rotary Knob

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

2.3.3 Data Input and modify

- Move cursor to the desired input field using Rotary Knob or arrow keys
- Push Rotary Knob or **ENTER key** for data input mode. The cursor indicates data input position. If there are only two alternatives, push the rotary knob or **ENTER key** to toggle the data.
- Push Rotary knob to enter data and then the new data is entered.
- While entering the data, if you press **ESC** or **DEL** key, the input data shall be canceled or deleted.

2.3.4 Soft Keys

Soft keys allow you to instantly access and alter instrument settings without using the Rotary knob. You can use Soft keys to move quickly between submenus on the same main screen.
When the Soft key is pressed, the cursor instantly moves to the related submenu. Five Soft keys are available for each main screen: **S1** ~ **S4**

2.3.5 Edit string

- To edit the string of Ensemble Label, Service Label, Service Component Label, DLS, Save name and etc., mode cursor to the Label parameter and set it to input mode by pushing the rotary knob or **ENTER key.** Input cursor will be placed at the end of the string. Push the number key repeatedly, the number and characters are displayed repeatedly.
- When the desired number or character is displayed, please wait until the cursor is moved to the next position.
- RWC2010B provides HEX editing methods. Using this mode, users could test any kind of characters like Chinese or Korean. Press **FCN** and **ESC** for HEX editing mode. Place the cursor on the character which you want to modify and rotate the rotary knob.

2.3.6 Shortcut key

- Shortcut keys are used to move the screen quickly. When users press the shortcut key(**M1** ~ **M4**), the screen will be moved to the assigned screen. There are two methods to assign the screen to the shortcut key.
- The first method is using shortcut parameters. Move to the 'SETUP/SYSTEM' screen and assign the desired screen to "SHORTCUT_M1" ~ "SHORTCUT_M4" parameters.

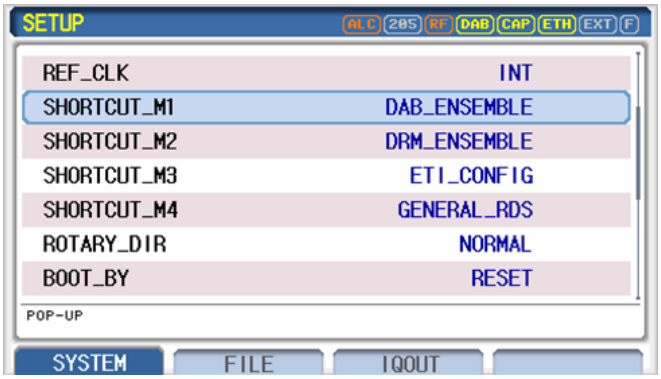


Fig. Screen for ShortCut key assignment

- The second method is using **FCN** and a shortcut key(**M1** ~ **M4**). Move the screen which you want to assign to the shortcut key and press **FCN** and shortcut key(**M1** ~ **M4**).

2.4 Display Screen

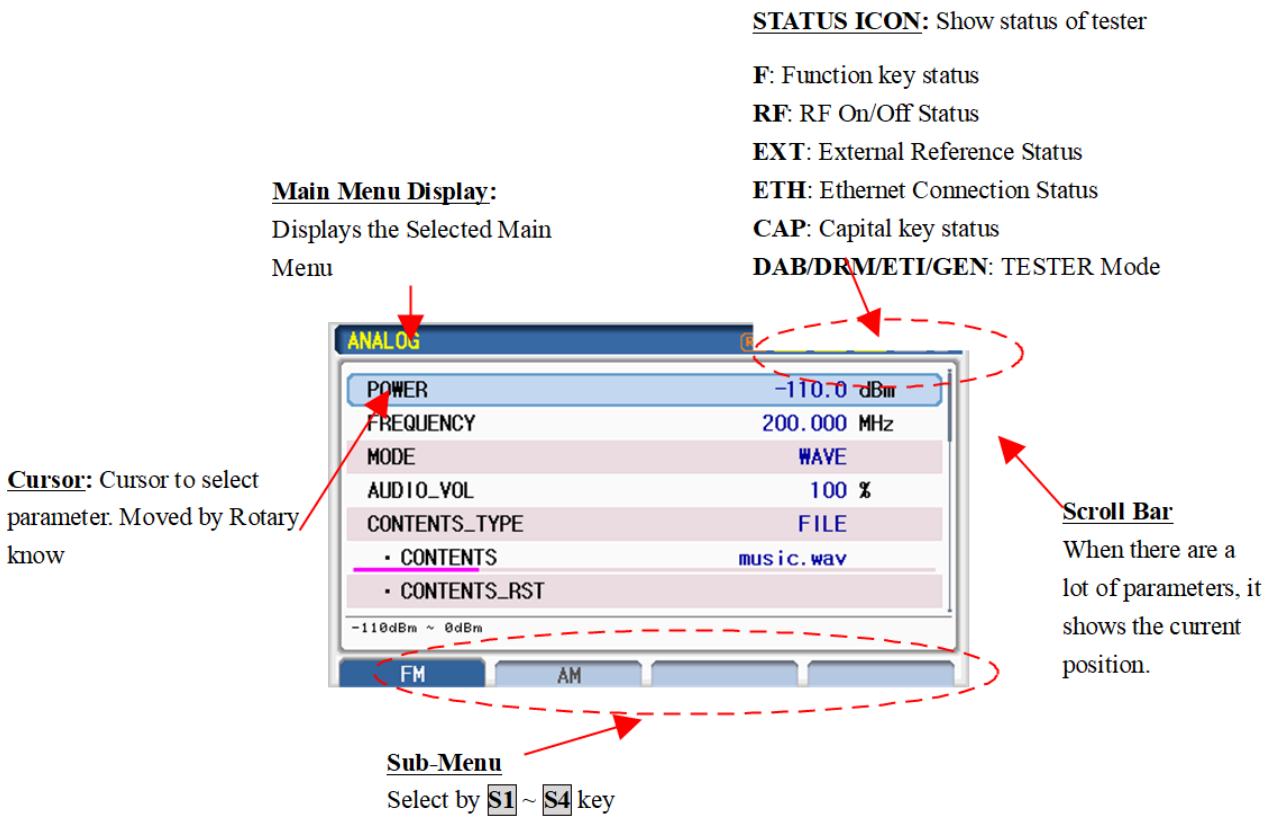


Fig. Information of the Equipment Screen

2.5 Frequency, Power setting

2.5.1 Overview

On the main screen of every protocol, there are frequency and power parameters. To change these values, place the cursor to the parameter and press **ENTER** key for input mode. “RF_OUT” parameter is for RF ON/OFF. Place the cursor on this parameter and press **ENTER** key to toggle the RF Output status. Using the FREQ hotkey, you can access the frequency parameter easier. Using the **POWER** hotkey, you can access the “RF_OUT” parameter easier.

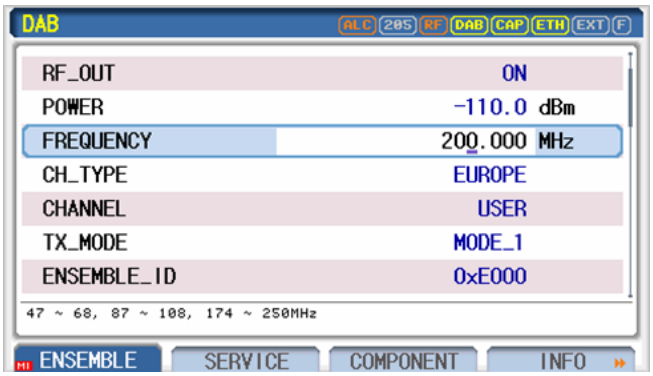


Fig. Screen to change frequency

To change the frequency or power values by step value, press **FCN** in cursor input mode and rotate Rotary Knob. The step value parameters are on the 'SETUP/SYSTEM' screen.



Fig. Screen to change power by step value

To change the unit of frequency or power parameters, place the cursor on the parameter and press the UNIT key (**FCN** + **ESC**).

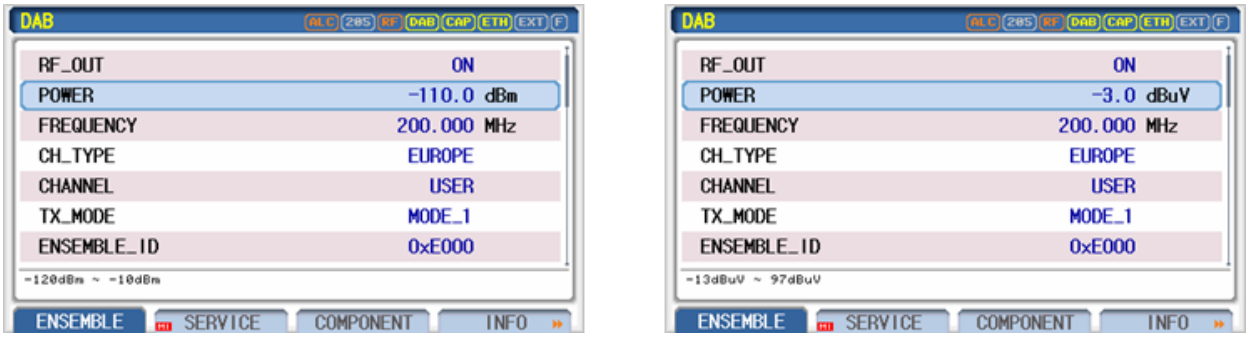


Fig. Screen to change Power Unit

2.5.2 Parameter setting

Frequency setting using CHANNEL Table

On the screen of 'CONFIG/BASIS', there are "CHANNEL" and "CH_TYPE" parameters. Select one of EUROPE, KOREA using the "CH_TYPE" parameter and select the channel table using "CHANNEL" parameter. Refer to Appendix for the value of Chanel Table.

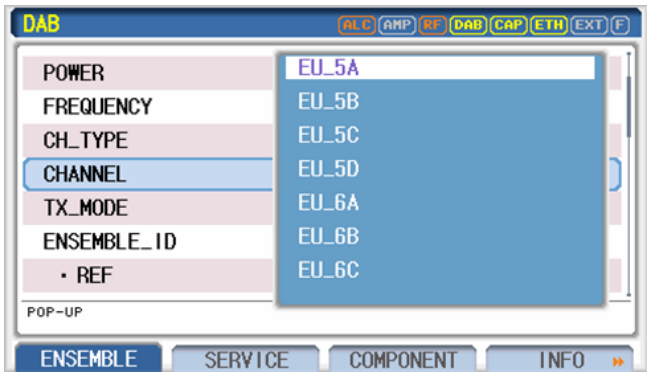


Fig. Screen to select channel

2.6 Ethernet Connection Method

For upgrading, Downloading Contents file, Remote controlling, RWC2010B should be connected to PC through Ethernet.

- Connect LAN port of PC and RWC2010B Ethernet port by RJ45 cable. If the PC and RWC2010B are connected directly, a cross cable must be used.
- Turn RWC2010B power ON, go to the 'SETUP/SYSTEM' screen and check the "IP_ADDR" value. Please be sure that the "IP_ADDR" value should be different from the PC's IP Address.



Fig. Screen for setup Remote Port and IP address

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

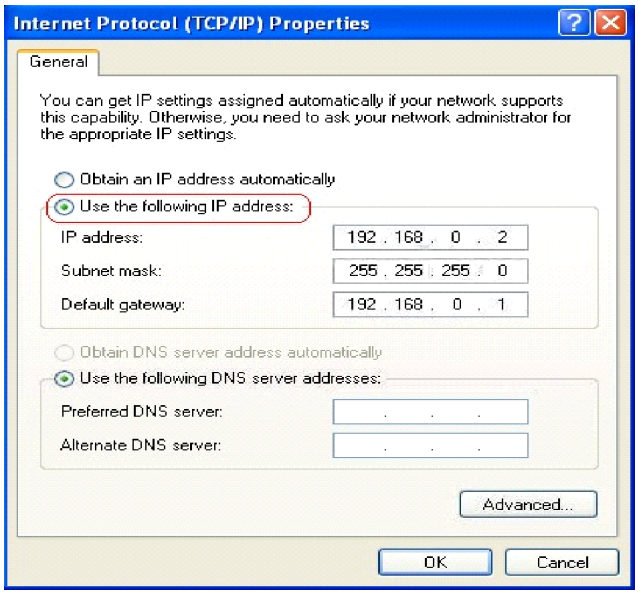


Fig. How to set up the static IP address of PC with Window OS

- Execute one of RWC2010 Application programs on the PC. If there is no application program, please download it from the Web site.
- Set up the IP address same as the RWC2010B's IP address.

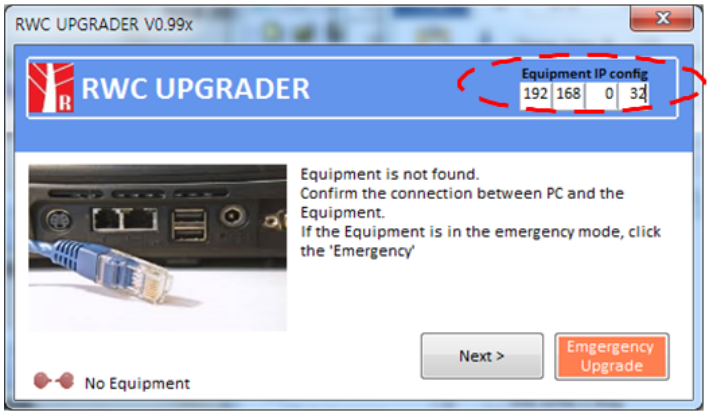


Fig. RWC2010B Application Program

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

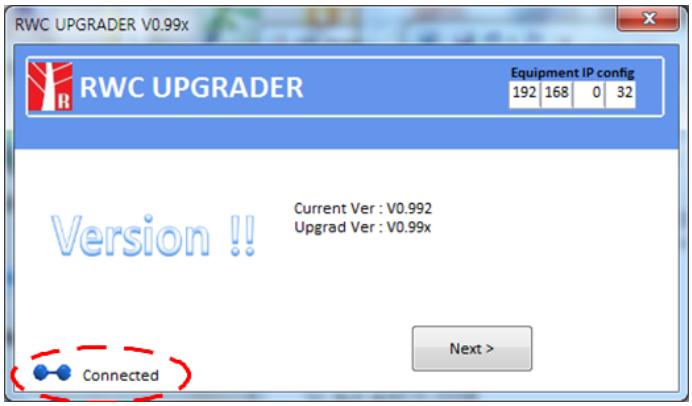


Fig. RWC2010B Application Program

2.7 Firmware Upgrade

As RWC2010B adapted Flash Memory, it is available to upgrade easily by using the PC without changing the Hardware. For upgrading, RWC2010B Application Program shall be used. The program is provided together with the product and it is available to download the upgrade data from RedwoodComm Website or provide it via post-mail. The information for upgrading shall be kept in providing to the user via email or website.

2.7.1 RWC2010B Firmware Upgrade Sequence

- Setup Ethernet connection between RW2010B and PC. Please refer to Clause 2.7 for Ethernet connection.
- Execute “RWC_upgrader.exe” file.
- Press the NEXT button to start Downloading.
- While upgrading, the proceeding status shall be displayed on the RWC2010B GUI screen.
- If Upgrading is completed, the RWC2010B will be rebooted automatically. Go to the ‘SETUP/SYSTEM’ screen to check the new Firmware version.

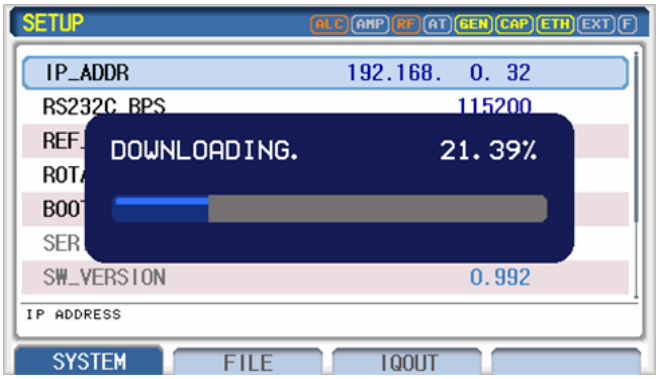


Fig. Upgrade status screen while upgrading

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

2.7.2 Emergency Firmware Upgrade Sequence

- Failing of Normal Upgrading can affect or disable RWC2010B. In this case, the RWC2010B should be booted in Emergency Upgrade mode.
- Keep pressing the key and turn the RWC2010B power ON. The RWC2010B will be booted on Emergency Upgrade mode as follows.
- Repeat the upgrading sequence from the beginning.

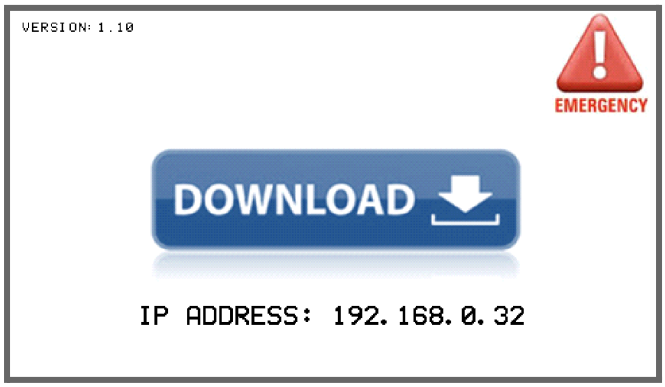


Fig. RWC2010B screen of Emergency Upgrade mode

2.8 Real-time File Streaming

The Content file in the user PC can be transmitted to the RWC2010B to broadcast in real-time. This function is very useful to test many different content files or huge size files without downloading them to the RWC2010B.

2.8.1 Setting

There is a parameter to set Contents type in each protocol test mode. In DAB mode, “CONTENTS_TYPE” parameter is on the ‘DAB/COMPONENT’ screen. For real-time file streaming, set this parameter as EXTERNAL. Before starting file transmission on the PC, there will be a red

dot which means that content data is not coming from the PC. If file transmission is started from PC to RWC2010B successfully, the red dot will be changed to green dot.

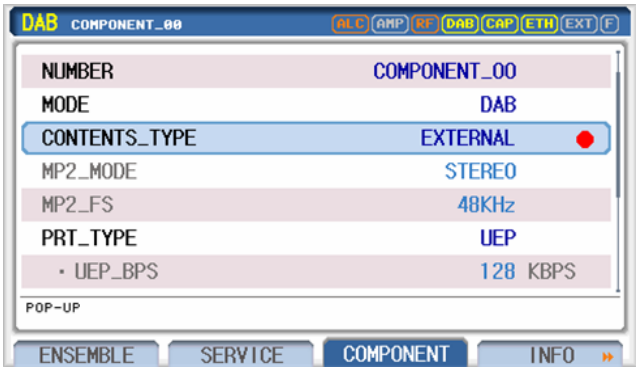


Fig. ETI Setup Screen

To start file transmission from PC, execute RWC2010 Utility program. Please set the IP Address with the same value of RWC2010B's IP address and select Streaming Tab in the program screen as the following figure. In the File List window, select one file which you want to transmit to the RWC2010B and click the PLAY button to start transmission. To stop transmission, press the Abort button.

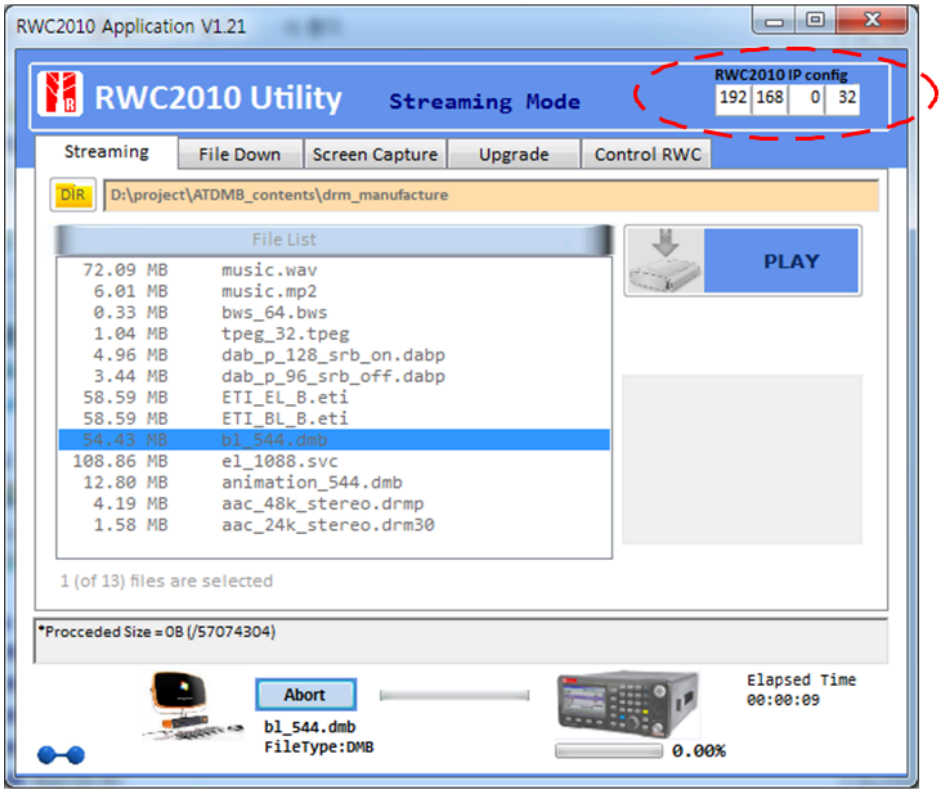


Fig. Real time file streaming with a PC application

2.9 Contents File Download

2.9.1 Downloading Files from RedwoodComm's Server

Click the UPDATE LIST button of SERVER, then the FILE MANAGER will update the file list.

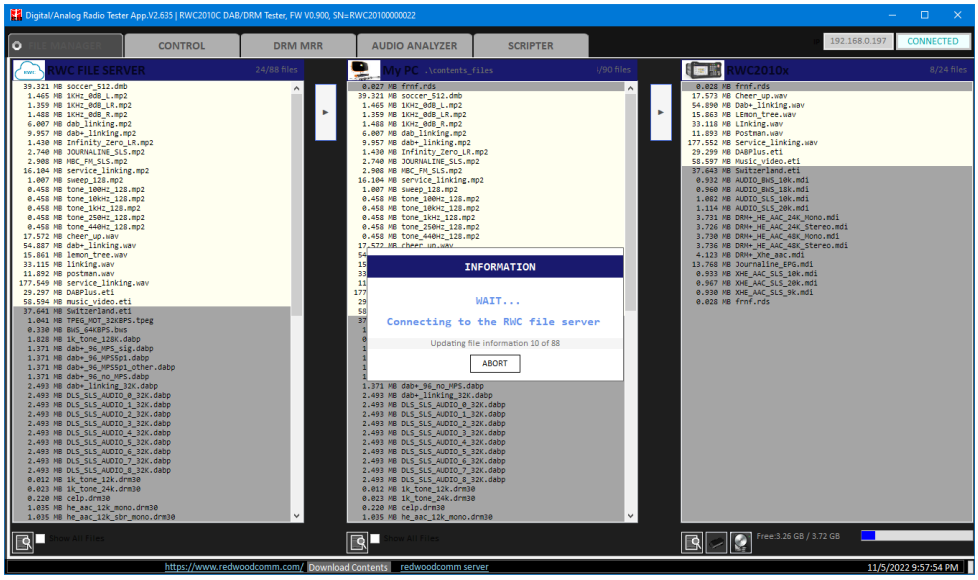


Fig. Updating file list of RWC file server

Users can download content files from the server to the users' PC by clicking the DOWNLOAD button(▸). All Files are selective. The FILE MANAGER shows duplicate files between server and PC with highlighted background color after selecting files.

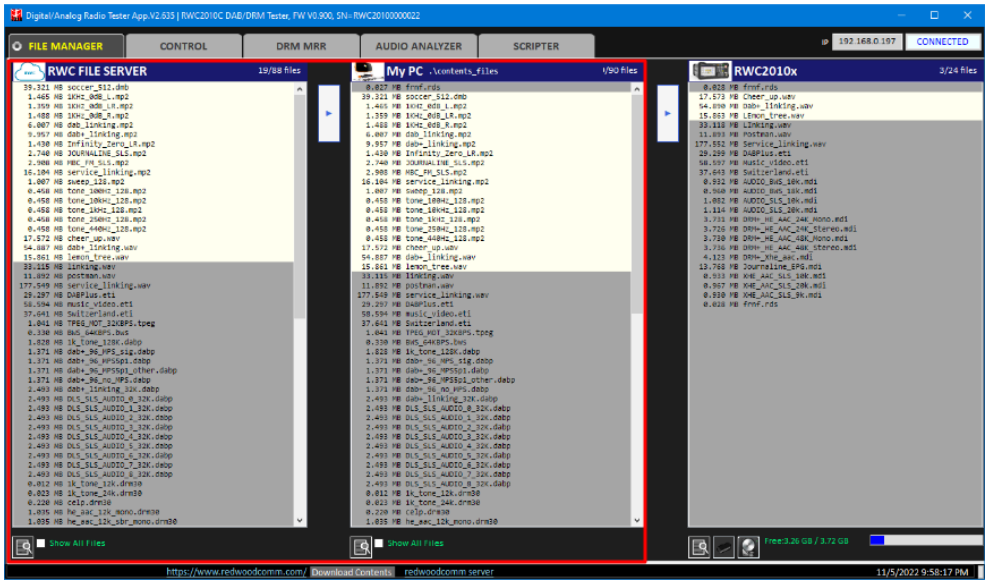


Fig. Getting content files from RWC file server

2.9.2 Downloading Files from PC to RWC2010B

Click the "UPDATE LIST" button of the PC before starting to download, then the FILE MANAGER will update the file list of the user PC. Users can download files from the PC to the RWC2010B by clicking the DOWNLOAD button(▸). All Files are selective. The FILE MANAGER shows replicated files between the PC and the RWC2010B with highlighted background color after selecting files.

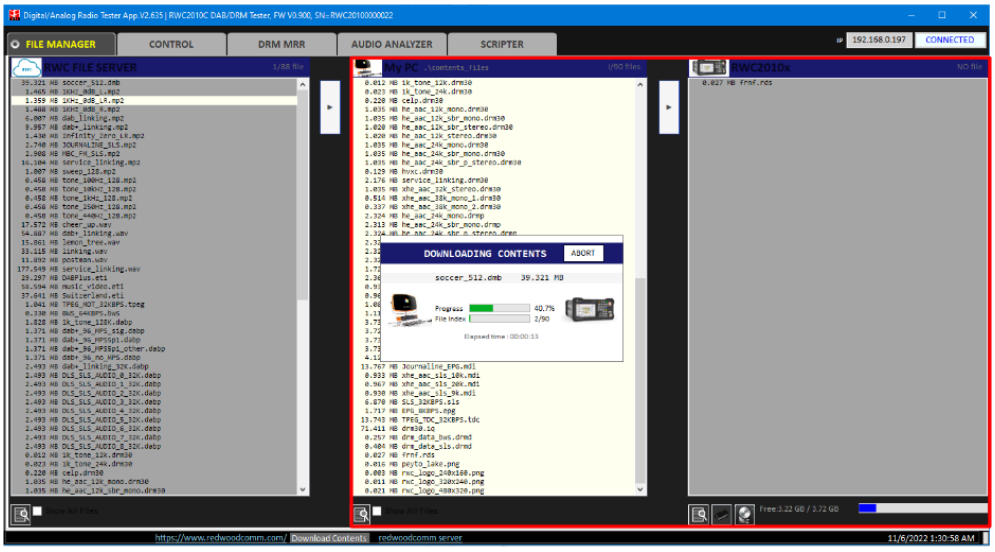


Fig. Downloading content files from User pc to RWC2010B equipment

While downloading, the proceeding status shall be displayed on RWC2010B GUI screen

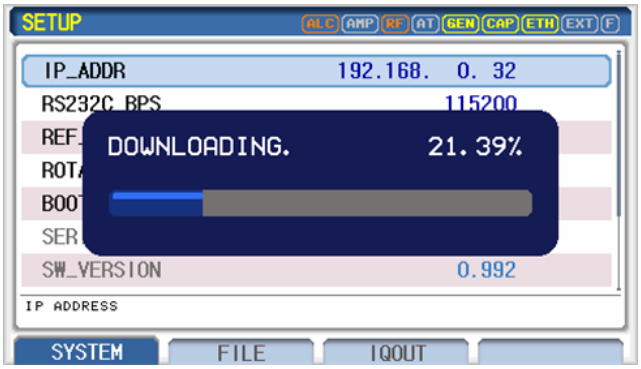


Fig. Upgrade status screen while upgrading

If downloading is completed, go to the 'SETUP/FILE' screen and verify the downloaded file name, file size and file type. If failed or not completed, delete the file and try again.

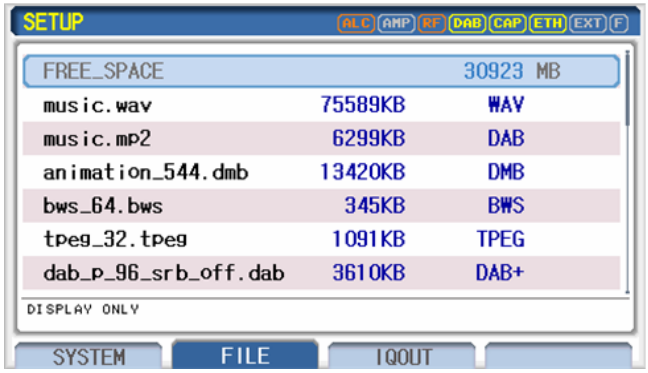


Fig. File information screen

2.9.3 Internal Storage

RWC2010B has 32 GByte internal storage. All types of content files are saved in it. Users can format it. Free space of the storage displayed in the FILE MANAGER tab.

2.10 Management Contents Files

All contents files are listed on the 'SETUP/FILE' screen. On this screen, you could modify file names or delete them.

2.10.1 File configuration

Change File Name

Original file name is assigned when the file is downloaded to the RWC2010B. But sometimes the user needs to change the downloaded file name. In this case, go to the 'SETUP/FILE' screen and place the parameter cursor on the file which you want to modify. Then press the ENTER key for the Pop-up menu. The last pop-up menu is the 'EDIT_NAME'. Select it then the name editor screen will appear as the following figure. Editing method is the same as the string editor.

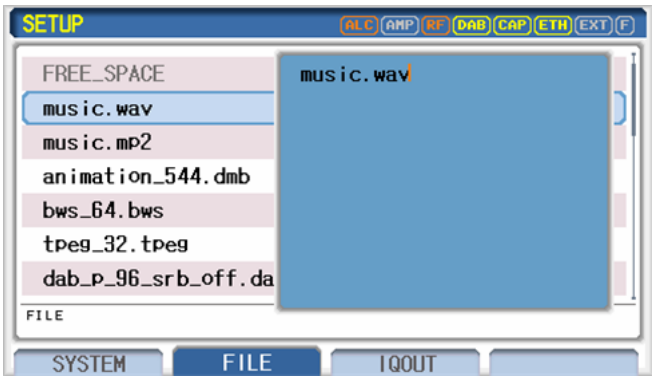


Fig. Screen for file name modifying

Delete file

To delete the file, please go to the 'SETUP/FILE' screen and place the parameter cursor on the file which you want to delete. Then press the ENTER key for the Pop-up menu. The first pop-up menu is the 'DELETE'. Select it then the file will be deleted.



Fig. Screen for file Delete

2.11 Save/Recall

The SAVE and RECALL functions allow you to store different instrument setups and retrieve them later. By saving test setups, you can save time by eliminating the task of re-configuring the RWC2010B. RWC2010B supports up to 60 save/recall sets.

2.11.1 Save Method

Make any changes to the instrument that you want to SAVE in a memory. Then press **FCN** + **POWER** key to execute the Save Pop-up screen as the following figure. Select SAVE buffer number and press **ENTER key**. It will show the name editor screen. Editing method is the same as the string editor.



Fig. The screen to save parameter configuration

2.11.2 Recall Method

Then press **FCN** + **FREQ** key to execute the Recall Pop-up screen as the following figure. Select RECALL buffer number and press **ENTER key**. The first recall buffer is RESET. If you select it, RWC2010B will be reset.



Fig. The screen to recall parameter configuration

2.11.3 Select Saved configuration for Booting

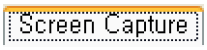
When restarting the system, one of the Saved configurations will be retrieved. To define saved configuration for booting, go to the 'SETUP/SYSTEM' 'screen and modify' 'BOOT_BY' parameter to desired Save buffer number.



Fig. Screen to setup the BOOT_BY parameter

2.12 Screen Capture Method

RWC2010B supports screen capture function. Connect the PC and RWC2010B by Ethernet cable. Execute RWC2010 Application program on the PC. If there is no application program, please download it from the Web site.

To start screen capture, select “Screen Capture 

” Tab and press the Screen Capture button.

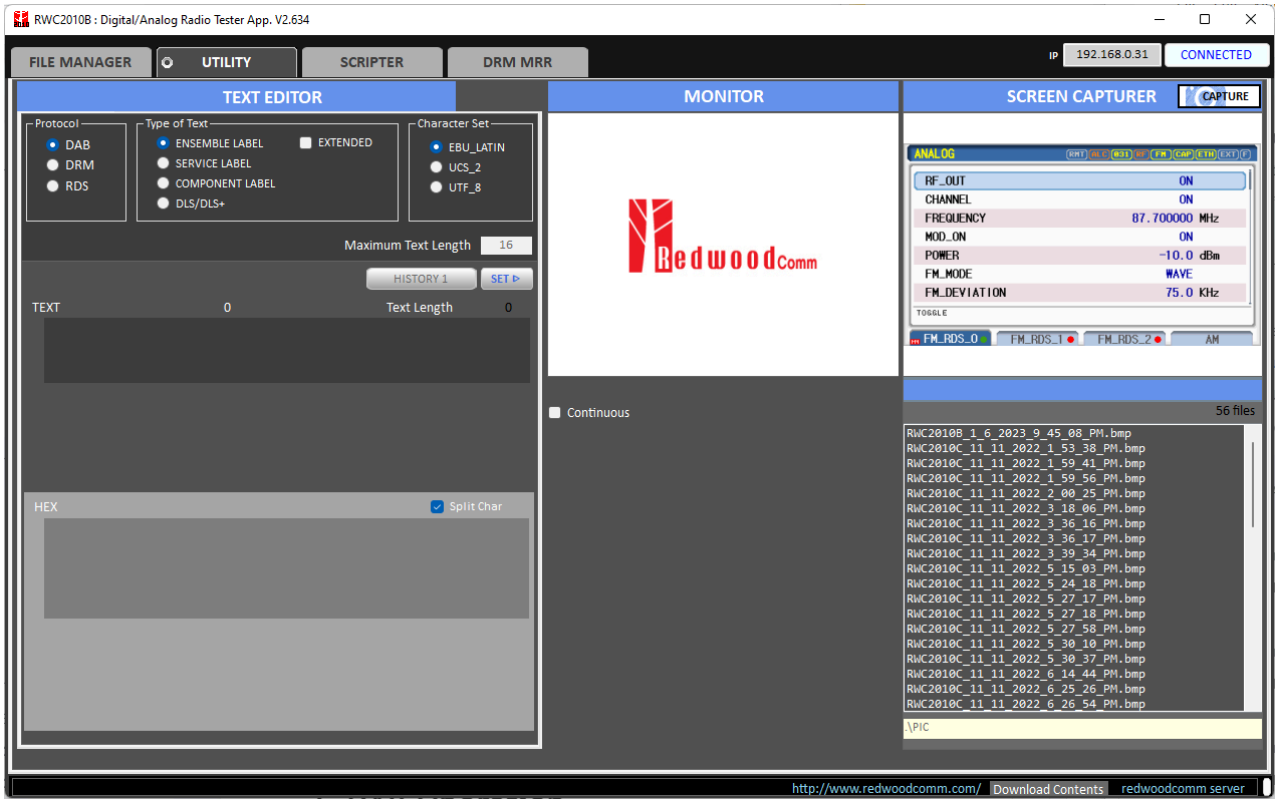


Fig. Screen capture screen of PC application program

2.13 Setting IQ OUT Port

There are baseband I and Q output ports in the rear panel of RWC2010B. Go to the ‘SETUP/IQOUT’ and set up the IQ related parameters. These parameters are saved in the memory and automatically retrieved from the memory when the system restarted.

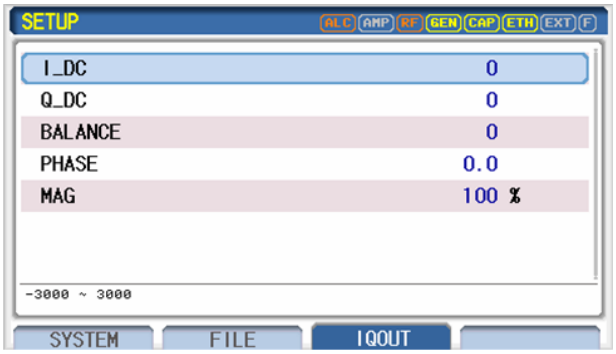


Fig. the screen of Baseband IQ OUT settin

2.13.1 Parameter

MAG

This parameter controls the magnitude of IQ output signal.

I_DC / Q_DC

These parameters are for compensating the DC mismatching between RWC2010B and IQ signal generator. If there is DC mismatching between them, the spectrum of IQ signal generator output will have a DC component as the following figure. To remove this spurious, adjust these parameters until the DC component becomes the minimum value.

BALANCE / PHASE

These parameters are for compensating the phase mismatching between RWC2010B and IQ signal generator. If there is phase mismatching between them, the spectrum of IQ signal generator output will have an image component as the following figure. To remove this spurious, adjust these parameters until the image component becomes minimum value.

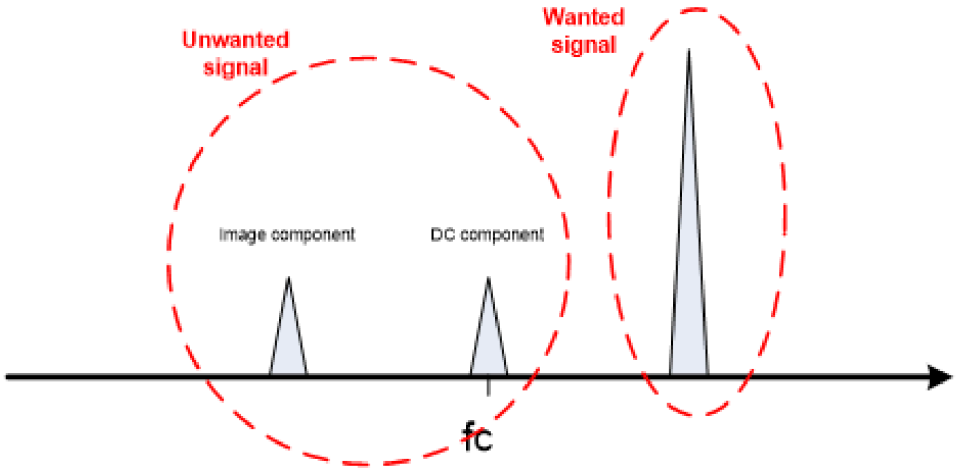


Fig. RF spectrum of External IQ SG with IQ Out of RWC2010B

3. DAB Operation

This section describes the basic concepts and details of DAB related operations. Understanding the basic concepts of your RWC2010B helps you use it effectively.

3.1 DAB Menu Structure
3.2 Editing DAB Ensemble Structure
3.3 Component Mode
3.4 PAD Test
3.5 Functional Test

3.1 DAB Menu Structure

The DAB menu consists of the ENSEMBLE, SERVICE, COMPONENT, FUNCTION and INFO submenu. The ENSEMBLE multiplexer is structured very intuitively with the DAB-ENSEMBLE structure as shown in the following figure. The built-in Ensemble Multiplexer supports up to 15 services and 15 service components. Each service and service component can be completely configured DAB-ENSEMBLE structure just by on and off. All parameters of each SERVICE and SERVICE COMPONENT are editable in each submenu tab.

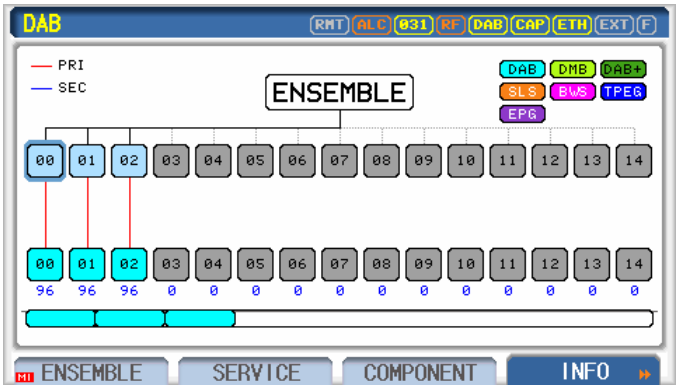


Fig. DAB menu structure of RWC2010B like DAB-ENSEMBLE structure

3.1.1 ENSEMBLE

This submenu contains RF-related parameters and Ensemble-related parameters.

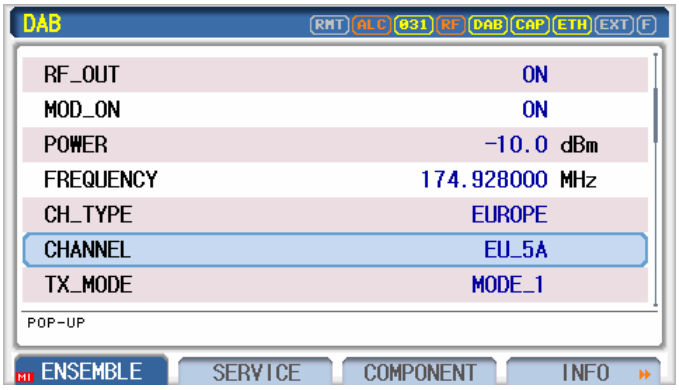


Fig. The screen of ENSEMBLE submenu

3.1.1.1 Parameters

POWER

RF output power for DAB Ensemble. Users can use the UNIT key to select power units in dBm or dBuV.

FREQUENCY

RF output frequency for DAB Ensemble. Users can use the UNIT key to select power units in MHz, kHz or Hz.

CH_TYPE

There are predefined channel tables for Europe and Korea. The user can use this parameter to select one of them.

CHANNEL

The frequency can be set to one of the predefined table values using this parameter. If the user sets the frequency variable, this parameter will display the channel number value if there is a matching value in the table, otherwise, it will be 'USER'.

TX_MODE

Four transmission modes are defined, each having its particular set of parameters. The use of these transmission modes depends on the network configuration and operating frequencies. The user can use this parameter to set the transmission mode of RWC2010B.

ENSEMBLE_ID

Unique 16-bit code, shall be allocated to the ensemble and allows unambiguous identification of the ensemble when associated with the Ensemble ECC.

ECC

Extended Country Code defined in TS 101 756.

NORMAL_LABEL

Normal Label of Ensemble can be turned on or off by this parameter.

EXTEND_LABEL

Extended Label of Ensemble can be turned on or off by this parameter.

LABEL

This parameter stands for the name of Ensemble. The maximum length of the string is 16 in normal mode and 32 in extended mode

CHAR_SET

This parameter stands for the type of Label. For example, setting it as 0 means ‘Complete EBU Latin based repertoire’.

ENCODING_FLAG

This parameter sets the character encoding method such as UTF-8 or UCS-2 for EXTEND_LABEL.

CHAR_FLAG

Sometimes DUTs require the abbreviation form of Label because of LCD limitation. This parameter gives the information of abbreviation of LABEL. There are some examples below.

LABEL: _RedwoodComm
CHAR_FLAG: 0x70F0
Abbreviation LABEL: REDComm

TEXT_CONTROL

The correct presentation of characters is non-trivial when going beyond basic ASCII: script direction, contextual forms, combining characters and so on make the correct presentation of e labels and text messages a complex task. Text control provides the base direction of the message and indications of the complexity of the text content. This allows receivers to better determine if they have the necessary capabilities to correctly present the text content.

BIDI_FLAG

This 1-bit flag shall indicate whether the text contains bidirectional text (excluding numerals) as follows: 0 if bidirectional text is not present or 1 if bidirectional text is present.

BASE_DIRECTION

This 1-bit flag shall define the Unicode base direction of the text as follows: 0 for left-to-right (LTR) or 1 for right-to-left (RTL).

CONTEXTUAL_FLAG

This 1-bit flag shall indicate whether contextual characters are used in the text as follows: 0 if contextual characters are not present (presentation characters only) or 1 if contextual characters are present.

COMBINING_FLAG

This 1-bit flag shall indicate whether combining characters are used in the text as follows: 0 if combining characters are not present or 1 if combining characters are present.

PROTOCOL_VER

RWC2010B supports DAB protocol V1.x.x and V2.x.x. The user can use this parameter to set the protocol version of RWC2010B.

SERVICE_00 - SERVICE_14

RWC2010B supports up to 15 services for DAB Ensemble. The user can use these parameters to turn on/off the services.

3.1.2 SERVICE

This submenu contains service-related parameters such as SID, service label, etc. Users can assign primary and secondary components to the service on this Screen.

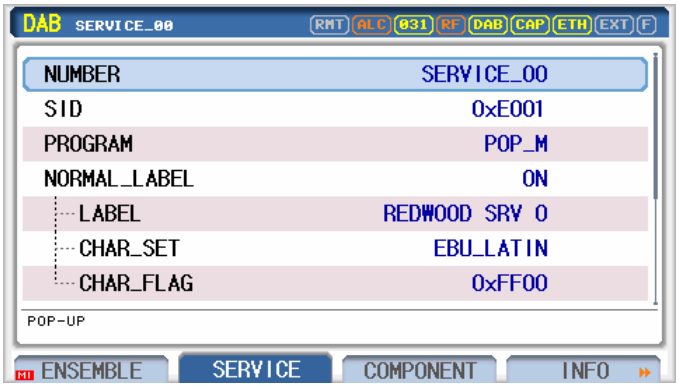


Fig. The screen of SERVICE submenu

3.1.2.1 Parameters

NUMBER

This parameter determines which service to modify.

PRIMARY

Set up the primary component for the service. After setting, users can check the connection on the INFO screen.

SECONDARY_1

Set up the first secondary component for the service. After setting, users can check the connection on the INFO screen.

SECONDARY_2

Set up the second secondary component for the service. After setting, users can check the connection on the INFO screen.

SECONDARY_3

Set up the third secondary component for the service. After setting, users can check the connection on the INFO screen.

SID

Unique 16-bit or 32-bit code, shall be allocated to the service and allows unambiguous identification of the service.

PROGRAM

Program type of the service.

NORMAL_LABEL

Normal Label of the service can be turned on or off by this parameter.

EXTEND_LABEL

Extended Label of the service can be turned on or off by this parameter.

LABEL

This parameter stands for the name of Service. The maximum length of the string is 16 in normal mode and 32 in extended mode

CHAR_SET

This parameter stands for the type of Label. For example, setting it as 0 means ‘Complete EBU Latin based repertoire’.

ENCODING_FLAG

This parameter sets the character encoding method such as UTF-8 or UCS-2 for EXTEND LABEL.

CHAR_FLAG

Sometimes DUTs require the abbreviation form of Label because of LCD limitation. This parameter gives the information of abbreviation of LABEL. There are some examples below.

LABEL: _RedwoodComm
CHAR_FLAG: 0x70F0
Abbreviation LABEL: REDComm

TEXT_CONTROL

The correct presentation of characters is non-trivial when going beyond basic ASCII: script direction, contextual forms, combining characters and so on make the correct presentation of e labels and text messages a complex task. Text control provides the base direction of the message and indications of the complexity of the text content. This allows receivers to better determine if they have the necessary capabilities to correctly present the text content.

BIDI_FLAG

This 1-bit flag shall indicate whether the text contains bidirectional text (excluding numerals) as follows: 0 if bidirectional text is not present or 1 if bidirectional text is present.

BASE_DIRECTION

This 1-bit flag shall define the Unicode base direction of the text as follows: 0 for left-to-right (LTR) or 1 for right-to-left (RTL).

CONTEXTUAL_FLAG

This 1-bit flag shall indicate whether contextual characters are used in the text as follows: 0 if contextual characters are not present (presentation characters only) or 1 if contextual characters are present.

COMBINING_FLAG

This 1-bit flag shall indicate whether combining characters are used in the text as follows: 0 if combining characters are not present or 1 if combining characters are present.

3.1.3 COMPONENT

This submenu contains component-related parameters such as component mode, content file, etc.

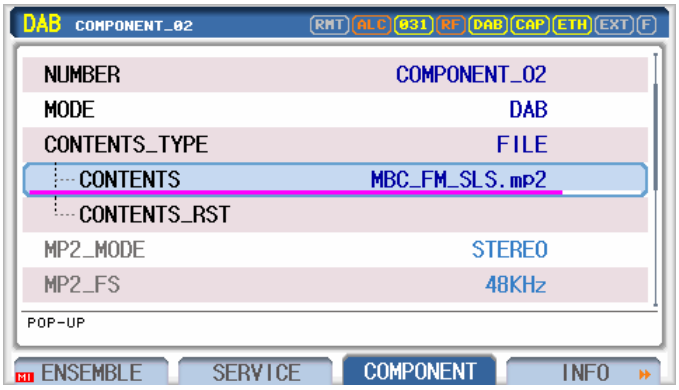


Fig. The screen of COMPONENT submenu

3.1.3.1 Common Parameters

NUMBER

This parameter determines which component to modify.

MODE

This parameter determines the type component. RWC2010B supports DAB, DMB, DAB+, BWS, TPEG, SPI, EPG and SLS.

CONTENTS

Users can download many content files to internal memory. This parameter determines which content file to play.

CONTENTS_RST

Users can use this parameter to jump to the beginning of the content.

PRT_TYPE

In DAB protocol, there are UEP and EEP in Protection Mode. UEP stands for Unequaled Error Protection and is used mainly for audio broadcasting. EEP stands for Equaled Error Protection and is used mainly for Data broadcasting. When the "PRT_TYPE" is changed, related Protection Level and BPS parameters will be displayed on the screen.

UEP_BPS, EEP_BPS

This parameter stands for bit rate of Service Component. In the MP2 case, this parameter is set automatically by selecting the content file.

UEP_LEVEL, EEP_LEVEL

This parameter stands for Channel Protection Level. Increasing the protection level to improve Error correction ability will increase the amount of data. So compromise is required.

EEP_OPTION

The DAB protocol defines two types of protection profiles (A and B). This parameter selects one of them for data protection.

NORMAL_LABEL

Normal Label of Service Component can be turned on or off by this parameter.

EXTEND_LABEL

Extended Label of Service Component can be turned on or off by this parameter.

LABEL

This parameter stands for the name of Service Component. The maximum length of the string is 16 in normal mode and 32 in extended mode

CHAR_SET

This parameter stands for the type of Label. For example, setting it as 0 means 'Complete EBU Latin based repertoire'.

ENCODING_FLAG

This parameter sets the character encoding method.

CHAR_FLAG

Sometimes DUTs require the abbreviation form of Label because of LCD limitation. This parameter gives the information of abbreviation of LABEL. There are some examples below.

LABEL: _RedwoodComm
CHAR_FLAG: 0x70F0
Abbreviation LABEL: REDComm

TEXT_CONTROL

The correct presentation of characters is non-trivial when going beyond basic ASCII: script direction, contextual forms, combining characters and so on make the correct presentation of e labels and text messages a complex task. Text control provides the base direction of the message and indications of the complexity of the text content. This allows receivers to better determine if they have the necessary capabilities to correctly present the text content.

BIDI_FLAG

This 1-bit flag shall indicate whether the text contains bidirectional text (excluding numerals) as follows: 0 if bidirectional text is not present or 1 if bidirectional text is present.

BASE_DIRECTION

This 1-bit flag shall define the Unicode base direction of the text as follows: 0 for left-to-right (LTR) or 1 for right-to-left (RTL).

CONTEXTUAL_FLAG

This 1-bit flag shall indicate whether contextual characters are used in the text as follows: 0 if contextual characters are not present (presentation characters only) or 1 if contextual characters are present.

COMBINING_FLAG

This 1-bit flag shall indicate whether combining characters are used in the text as follows: 0 if combining characters are not present or 1 if combining characters are present.

LANGUAGE

This parameter is the Language information of Service Component contents.

SUBCH_ID

This parameter is Physical ID of Service Component. The Service Component is recognized by this value in DUTs. In RWC2010B, this value is allocated automatically and just shows the value as unchangeable.

TRANSPORT_ID

This 16-bit value shall uniquely identify one data object (file and header information) from a stream of such objects, It may be used to indicate the object to which the information carried in the data group belongs or relates.

PKT_ADR

This 10-bit field shall identify packets carrying a particular service component within a sub-channel. Address 0 shall be used for padding packets and shall not be assigned to any service component. Up to 1 023 service components may be carried simultaneously in a sub-channel.

3.1.3.2 DAB (MP2) Parameters

MP2_MODE

RWC2010B will decode the selected mp2 content file to show if it is mono or stereo. This parameter is for display only.

MP2_FS

RWC2010B will decode the selected mp2 contents file to show the data rate. This parameter is for display only.

PAD_TYPE

Select the DLS type. When this parameter is set as OFF, RWC2010B does not send a PAD data. When this parameter is set as DLS, RWC2010B sends just a DLS string at the end of Audio Frame. When this parameter is set as DL+, RWC2010B sends not only DLS string but also tag information for enhanced display methods. When this parameter is set as SLS, RWC2010B sends the picture data(PNG) at the end of the Audio Frame. When this parameter is set as SPI, RWC2010B sends the RedwoodComm logo at the end of the Audio Frame.

DLS

DLS stands for Dynamic Label Service. At the end of the MP2 frame, the DLS data for various information such as the lyrics of the song is attached. The maximum length of DLS string is 128. The editing method is the same as the LABEL editing method.

HEADLINE

It can be set as the Headline part of the beginning of a DLS sentence. This parameter stands for Headline sentence.

HEADLINE_MODE

This parameter indicates whether the Headline is added to the DLS.

DLS_SET

This parameter stands for the type of DLS. For example, setting it as 0 means ‘Complete EBU Latin based repertoire’.

TAG_TYPE

DL+ provides subsidiary information for DLS named TAG. DAB protocol defines many kinds of TAG type and this parameter stands for one of them.

TAG_START

This parameter points to the start character in the DLS string for the TAG information.

TAG_LENGTH

This parameter stands for the length characters in the DLS string from the start point for the TAG information.

DRC

This value controls the Gain of receiver AMP. The range of this value is 0dB ~ 15.75dB. When this value is increased, the receiver sound will be increased.

XPAD_DATA_LEN

At the end of the audio frame there is a null field, so XPAD is transmitted using this field. The higher this value, the faster the data rate, but there is a risk that the mp2 audio data may be overwritten, so it should be set carefully.

CONTENTS (for XPAD)

Users can download PNG files to internal memory for SLS. This parameter determines which PNG file to play.

TRANSPORT_ID

This 16-bit value shall uniquely identify one data object (file and header information) from a stream of such objects, It may be used to indicate the object to which the information carried in the data group belongs or relates.

EPG_NUM

This value determines the number of EPG entries to send.

EPG_ID

The ID of EPG entry.

HOUR

The start time (hour) of EPG entry.

MINUTE

The start time (minute) of EPG entry.

DURATION

The duration of EPG entry.

ASCTY (for DAB)

This parameter stands for Audio Service Component Type and is fixed as 0 to indicate that the Component is DAB Audio.

3.1.3.3 DMB Parameters

DSCTY (for DMB)

This parameter stands for Data Service Component Type and is fixed as 24 to indicate that the Component is DMB mode.

APP_TYPE (for DMB)

This parameter is fixed as DMB to indicate that the Component is DMB mode.

3.1.3.4 DAB+ Parameters

ASCTY (for DAB+)

This parameter stands for Audio Service Component Type and is fixed as 63 to indicate that the Component is DAB+ Audio.

3.1.3.5 BWS Parameters

DSCTY (for BWS)

This parameter stands for Data Service Component Type and is fixed as 60 to indicate that the Component is MOT mode.

APP_TYPE (for BWS)

This parameter is fixed as MOT_BWS to indicate that the Component is BWS mode.

3.1.3.6 TPEG Parameters

DSCTY (for TPEG)

This parameter stands for Data Service Component Type and is fixed as 60 to indicate that the Component is MOT mode.

APP_TYPE (for TPEG)

This parameter is fixed as MOT_TPEG to indicate that the Component is in TPEG mode.

3.1.3.7 EPG Parameters

DSCTY (for EPG)

This parameter stands for Data Service Component Type and is fixed as 60 to indicate that the Component is MOT mode.

APP_TYPE (for EPG)

This parameter is fixed as SPI to indicate that the Component is in EPG mode.

EPG_NUM

This value determines the number of EPG entries to send.

EPG_ID

The ID of EPG entry.

HOUR
The start time (hour) of EPG entry.

MINUTE
The start time (minute) of EPG entry.

DURATION
The duration of EPG entry.

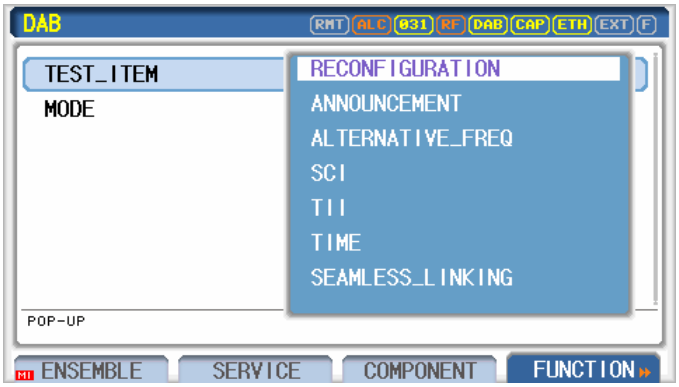
3.1.3.8 SLS Parameters

DSCTY (for TPEG)
This parameter stands for Data Service Component Type and is fixed as 60 to indicate that the Component is MOT mode.

APP_TYPE (for SLS)
This parameter is fixed as MOT_SLIDESHOW to indicate that the Component is SLS mode.

3.1.4 FUNCTION

This submenu contains parameters related to functional tests.



3.1.4.1 Parameters for Reconfiguration

MODE
RWC2010B can change protocol parameters without or according to the reconfiguration procedure. This parameter determines which method to use for changing the parameter.

EXECUTE

If you run this parameter after changing any reconfiguration-related parameters, the modified parameters will be applied to the reconfiguration procedure.

3.1.4.2 Parameters for Announcement

MODE

This parameter selects one of the announcement test modes: TUNED_ENSEMBLE or OTHER_ENSEMBLE.

SUPPORT

The announcement support information can be turned on or off using this parameter.

NUM_OF_SVC

Announcement information can be notified to specific services of the ensemble. This parameter determines how many services will carry the announcement information.

AN_SOURCE_SVC_00 ~ AN_SOURCE_SVC_15

Announcement information can be notified to specific services of the ensemble. These parameters allow users to select services associated with the announcement information.

ALARM

When this parameter is set as ON, Alarm Announcement support is signaling in this service.

TRAFFIC

When this parameter is set as ON, Traffic Announcement support is signaling in this service.

TRAVEL

When this parameter is set as ON, Travel Announcement support is signaling in this service.

WARNING

When this parameter is set as ON, Waring Announcement support is signaling in this service.

NEWS

When this parameter is set as ON, News Announcement support is signaling in this service.

WEATHER

When this parameter is set as ON, Weather Announcement support is signaling in this service.

EVENT

When this parameter is set as ON, Event Announcement support is signaling in this service.

SPECIAL

When this parameter is set as ON, Special Announcement support is signaling in this service.

RAD_INFO

When this parameter is set as ON, Radio Info Announcement support is signaling in this service.

SPORTS

When this parameter is set as ON, Sports Announcement support is signaling in this service.

FINANCE

When this parameter is set as ON, Finance Announcement support is signaling in this service.

NUM_OF_CLUSTER (for Support)

Announcement support can be assigned to multiple clusters, one of which is used to signal announcement switching. This parameter determines how many clusters this announcement support is allocated.

CLUSTER_ID_xx (for Support)

The unique number for the cluster. For Alarm Announcement, the cluster-ID is fixed at 0xFF.

AN_SWITCHING

When this parameter is set to ON, the announcement switching signal (FIG0/19) starts to be sent.

NUM_OF_CLUSTER (for Switching)

This parameter determines how many clusters will be used in announcement switching signal.

CLUSTER_ID_xx (for Switching)

The unique number for the cluster. For Alarm Announcement, the cluster-ID is fixed at 0xFF.

AN_SWITCH_TYPE

This parameter determines one of the enabled announcement support types. It is used for announcement switching signals.

TARGET_CH

It denotes the target channel when Announcement switching runs in Tuned Ensemble mode. The target channel should be in an active state. While this parameter is configured, the Pop-up screen displays the list of active and inactive components with different colors and only active components can be selected.

OE_EID

It denotes the other ensemble ID of the target channel when Announcement switching runs in Other Ensemble mode.

OE_SID

It denotes the Service ID of the target channel when Announcement switching runs in Other Ensemble mode.

3.1.4.3 Parameters for Alternative Frequency Test

NUM

The parameter determines how much alternative frequency information for other Ensembles or services which could have the same or similar as reference service.

TUNED_SVC

This parameter indicates the reference service for alternative frequency information.

OTHER_EID

This parameter is used for EID of Other Ensemble which carries the same or related program as reference service.

OTHER_SID

This parameter is used for SID of Other service which carries the same or related program as reference service.

OTHER_ECC

This parameter is used for Extended Country Code of Other service which carries the same or related program as reference service.

OTHER_FREQ

This parameter is used for frequency of other Ensemble or other systems which carry the same or related program as reference service.

CONTINUITY

This parameter shall indicate whether, or not, there is an appropriate time delay on the audio signal of an alternative service source.

CEI

This parameter stands for Change Event Indicates. If it is set as SHORT_TERM, FIG0/6, FIG0/21, and FIG0/24 will be transmitted in short form.

LSN

This parameter stands for Linkage Set Number which represents a number which shall be common to all Services linked together as a set

S/H

A linkage set is a collection of identifiers (DAB SIds, RDS PI codes, etc.) that correspond to alternative sources of the same content (hard link) or related content (soft link).

LA

Linkage sets are activated and deactivated according to the state of the LA flag. When a linkage set is activated, receivers may switch to any of the alternate sources of the content; when it is deactivated, they shall not. This feature allows service providers to signal linkage sets in advance of their use and control the receiver linkage behavior by changing the state of the LA flag for each linkage set.

ILS

This parameter stands for International Linkage Set indicator to indicate whether the link affects only one country (national) or several countries (international).

3.1.4.4 Parameters for SCI

MODE

SCI is used to provide information on pending ensemble reconfigurations ahead of time. SCI will be sent when this parameter is set to ON.

CHANGE_FLAG

This 2-bit field shall indicate future changes to a service element, as follows: REMAIN(the service will remain in the ensemble with a new SId or will be moved to or from another ensemble); ADD(the service element will be added to the ensemble); REMOVE(the service element will be removed from the ensemble); REMOVE_ALL(the service element will be removed from all ensembles).

SERVICE

This parameter determines the service for SCI information.

PART_TIME_FLAG

This 1-bit flag shall indicate whether the service element is on-air or off-air continuously or cycles through on-air and off-air periods, as follows: 24_HOUR: the service element is on-air or off-air continuously (i.e. 24 hours/day); PART_TIME: the service element cycles on-air and off-air (i.e. part-time).

SID_FLAG

This parameter determines whether the SID field is present.

SID
This 16-bit or 32-bit field shall identify the service.

EID_FLAG
This parameter determines whether the EID field is present.

EID
This 16-bit field shall identify the Ensemble.

YEAR, MONTH, DAY, HOUR, MINUTE, SECOND
These parameters are passed as the MJD for the specific time the service component change occurs.

3.1.4.5 Parameters for TII

TII
TII signal is transmitted instead of every second NULL signal when this parameter is set to ON.

TII_PATTERN, TII_COMB
These parameters set up a Transmitter ID.

3.1.4.6 Parameters for TIME

TIME
TIME information will be sent when this parameter is set to ON.

YEAR, MONTH, DAY, HOUR, MINUTE, LTO
To set up the current time.As time goes on, internal time related parameters are updated automatically but not refreshed on the screen. To refresh these parameters, go to another screen and return to this screen again.

3.1.5 INFO

The RWC2010B DAB sub-munu supports the INFO function so that the user can easily see the structure of the ENSEMBLE set by the user. This screen not only shows the structure, but also lets you edit the structure.
Go to the 'INFO' screen to see the current Ensemble structure graphically. In this example, there is a very simple Ensemble which consists of one Service (SERVICE_00) and one Component (COMPONENT_00). When you select or touch the SERVICE or COMPONENT block, the EDIT/ON(OFF)/ESC pop-up window and the connected primary and secondary component information are popped up. By selecting or touching the EDIT function, you can jump to the SERVICE or COMPONENT tab. And the service can be turned ON or OFF by toggling ON and OFF.

At the bottom of the screen, there is a bar which shows the occupied frame rate. Occupation Rate should be less than 100%, so be careful when you add components in the Ensemble. If the Occupation Rate is more than 100%, it shows a warning message on the screen.

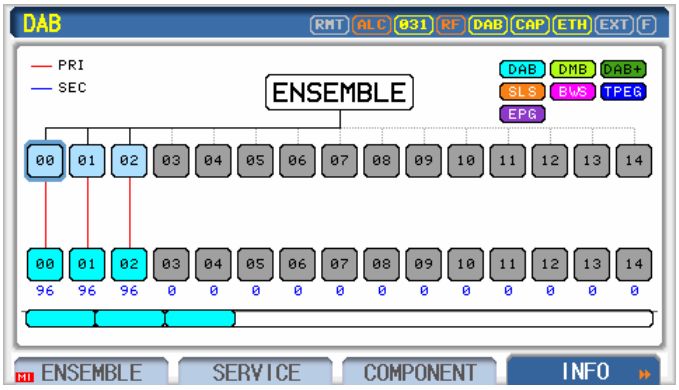


Fig. The INFO screen of DAB function

3.2 Editing the DAB Ensemble structure

3.2.1 Overview

RWC2010B supports 15 Services and 15 Components to consist of Ensemble. Go to 'INFO' screen to see the current Ensemble structure graphically. In this example, there is a very simple Ensemble which consists of one Service (SERVICE00) and one Component (COMPONET00). At the bottom of the screen, there is a bar which shows the occupied frame rate. Occupation Rate should be less than 100%, so be careful when you add components in the Ensemble. If the Occupation Rate is more than 100%, it shows a warning message on the screen.

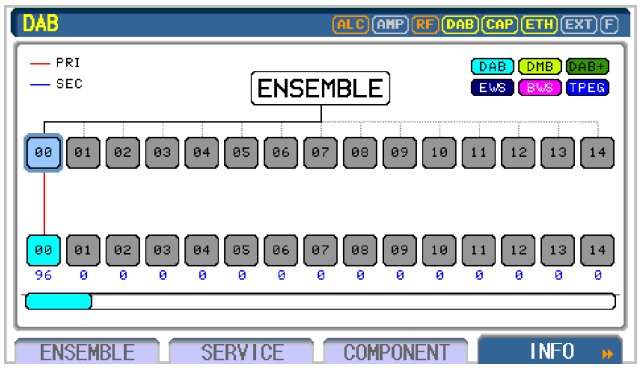


Fig. INFO screen to show Ensemble structure

3.2.2 Parameter setting

Add SERVICE

To add a new Service to the Ensemble, go to the 'DAB/ENSEMBLE' screen and place the cursor on the SERVICE parameter which you want to add., and press the ENTER key to turn it on. The following figure shows when the SERVICE_02 is added to the Ensemble.

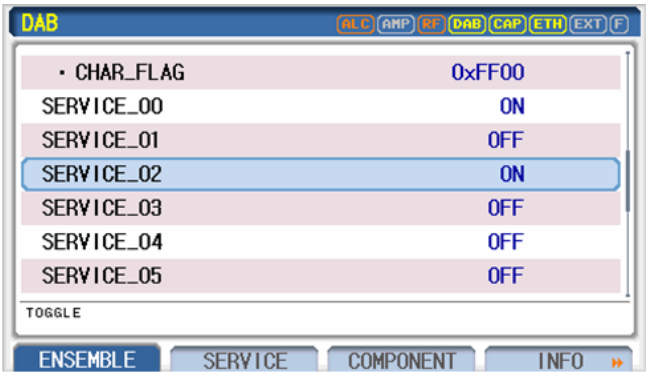


Fig. The screen of adding SERVICE to the Ensemble

After adding Services, go to the 'INFO' Screen to check the modified Ensemble structure. Using the same method, you can add or delete Services.

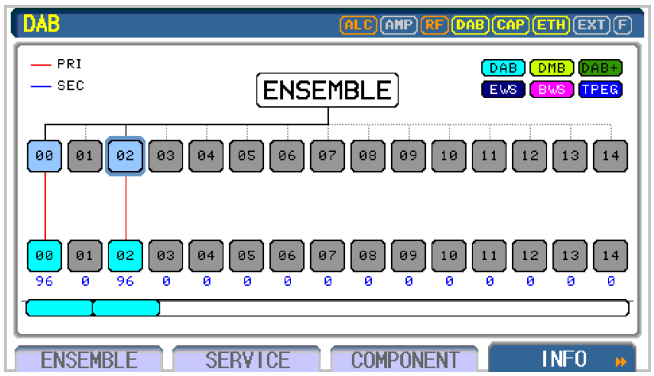


Fig. Screen of Ensemble structure after adding service

There is another way to add or delete SERVICE. On the INFO screen, please move cursor to the SERVICE which you want to add or delete using rotary knob and press **ENTER key**.

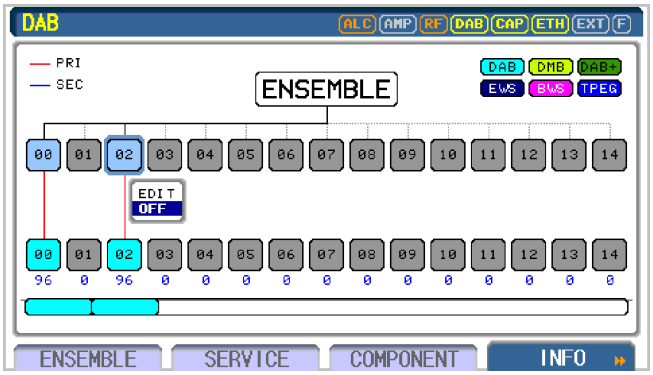


Fig. Screen of Editing Ensemble structure

Change SERVICE COMPONENT structure

Every SERVICE could have one Primary Service Component and several Secondary Service Components. RWC2010B can transmit 15 Services simultaneously. Each Service could have one Primary Service Component and one Secondary Service Component.

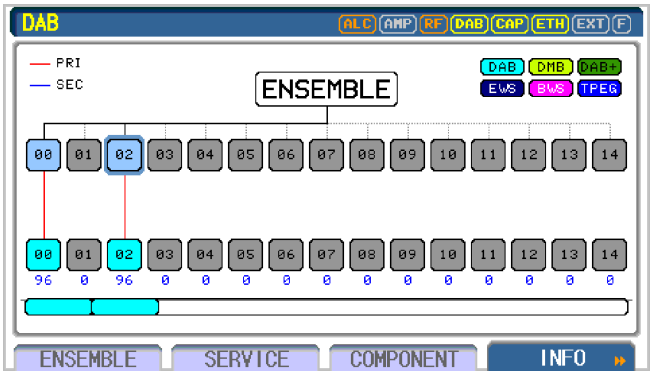


Fig. Screen of Ensemble structure after adding service

Upper figure shows that SERVICE00 has COMPONENT00 as Primary and does not have a secondary component. SERVICE02 also has COMPONENT02 as Primary and does not have Secondary Component. To change COMPONET07 as a primary component of SERVICE02, go to the screen of 'DAB/SERVICE' and select SERVICE02 using the "NUMBER" parameter. Move the parameter cursor on the "PRIMARY" and set it as COMPONENT07. After changing Components, go to the 'INFO' Screen to check the modified Ensemble structure.



Fig. The screen of changing SERVICE COMPONENT structure

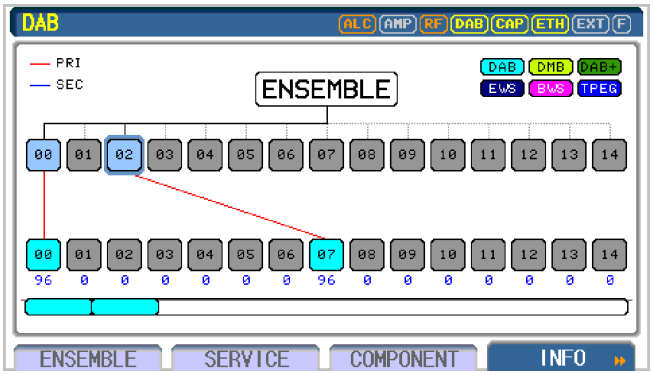


Fig. Screen of Ensemble structure after changing component

Secondary Components can be added or removed by the same method. On the information screen, the Primary component is connected by a red line and the Secondary component is connected by blue line..

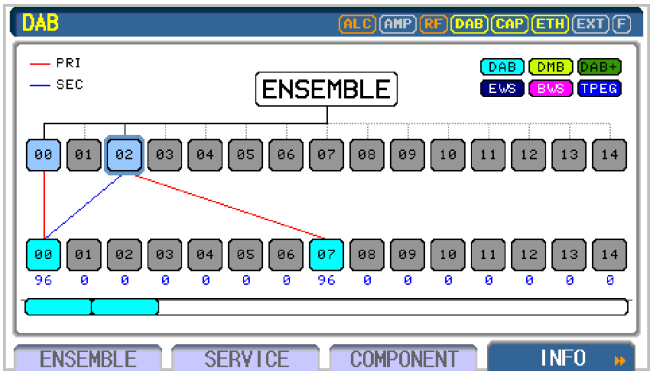


Fig. Screen of Ensemble structure after adding secondary component

3.3 Component Mode

3.3.1 DAB (MP2)

This section describes the method of setting the Service Component as DAB (MP2 Audio) mode. Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc…. By setting the MODE as DAB, the component is configured as the DAB and some parameters are automatically set for DAB mode. There is the "CONTENTS" parameter for selecting DAB contents downloaded in the memory. By selecting the desired file to transmit, RWC2010B will decode the file and set the audio related parameters automatically. The orange color bar below the CONTENTS parameter shows the status of file transmitting.

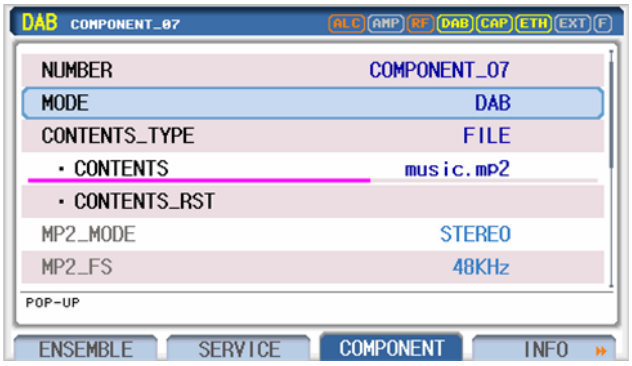


Fig. The screen of Service Component

Basic setting for DAB broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

3.3.2 DMB

This section describes the method of setting the Service Component as DMB mode. Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc…. By setting the MODE as DMB, the component is configured as the DMB and some parameters are automatically set for DMB mode. There is the "CONTENTS" parameter for selecting DMB contents downloaded in the memory. The orange color bar below the CONTENTS parameter shows the status of file transmitting

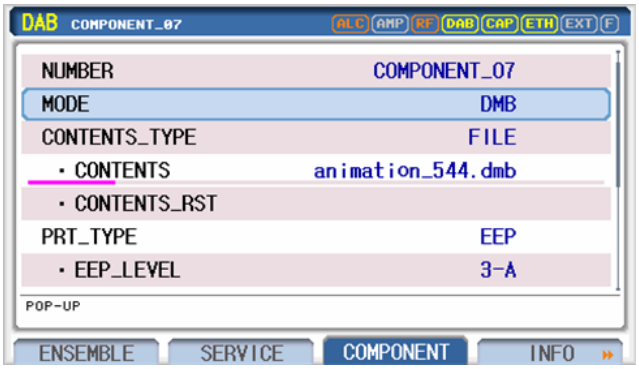


Fig. The screen of Service Component

Basic setting for DMB broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

▣ **CAUTION**: For proper operation, you should know the BPS of selected contents file and set "EEP_BPS" or "UEP_BPS" as the same value.

3.3.3 DAB+

This section describes the method of setting the Service Component as DAB+ mode. Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc…. By setting the MODE as DAB+, the component is configured as the DAB+ and some parameters are automatically set for DAB+ mode. There is the "CONTENTS" parameter for selecting DAB+ contents downloaded in the memory. The orange color bar below the CONTENTS parameter shows the status of file transmitting

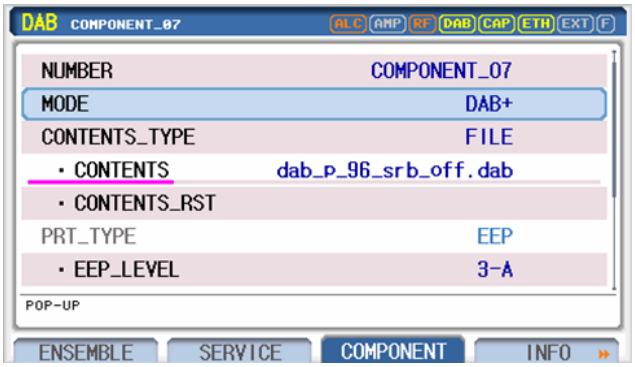


Fig. The screen of Service Component

Basic setting for DAB+ broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

▣ **CAUTION**: For proper operation, you should know the BPS of selected contents file and set "EEP_BPS" or "UEP_BPS" as the same value.

3.3.4 BWS

This section describes the method of setting the Service Component as BWS mode. BWS stands for Broadcasting Web Site. This data channel periodically broadcasts specific web site data for virtual internet service.

Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc…. By setting the MODE as BWS, the component is configured as the BWS and some parameters are automatically set for BWS mode. There is the "CONTENTS" parameter for selecting BWS contents downloaded in the memory. The orange color bar below the CONTENTS parameter shows the status of file transmitting



Fig. The screen of Service Component

Basic setting for BWS broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

▣ **CAUTION**: For proper operation, you should know the BPS of selected contents file and set "EEP_BPS" as the same value.

3.3.5 TPEG

This section describes the method of setting the Service Component as TPEG mode. BWS stands for Broadcasting Web Site. TPEG data channel periodically broadcasts traffic information.
Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc…. By setting the MODE as TPEG_MOT or TPEG_TDC, the component is configured as the TPEG and some parameters are automatically set for TPEG mode. There is the "CONTENTS" parameter for selecting TPEG contents downloaded in the memory. The orange color bar below the CONTENTS parameter shows the status of file transmitting

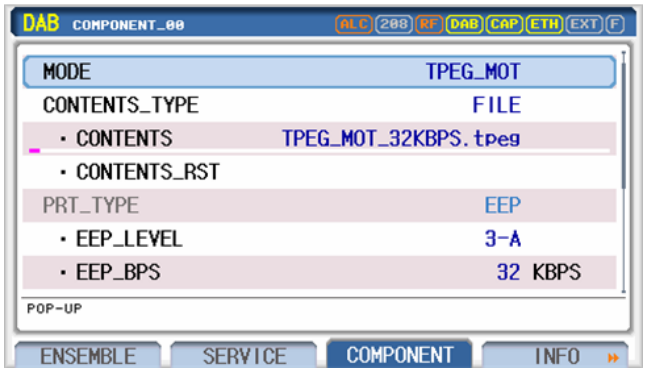


Fig. The screen of Service Component

Basic setting for TPEG broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

▣ **CAUTION**: For proper operation, you should know the BPS of selected contents file and set "EEP_BPS" as the same value.

3.3.6 EPG

This section describes the method of setting the Service Component as EPG mode. EPG stands for Electric Program Guide. This data channel periodically broadcasts future program schedules. Go to the ‘DAB/COMPONENT’ screen. The first parameter on this screen is "NUMBER" which determines which component to modify. Component type is configured by the "MODE” parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, SLS, SPI, EPG, BWS, TPEG, etc…. By setting the MODE as EPG, the component is configured as the EPG and some parameters are automatically set for EPG mode.

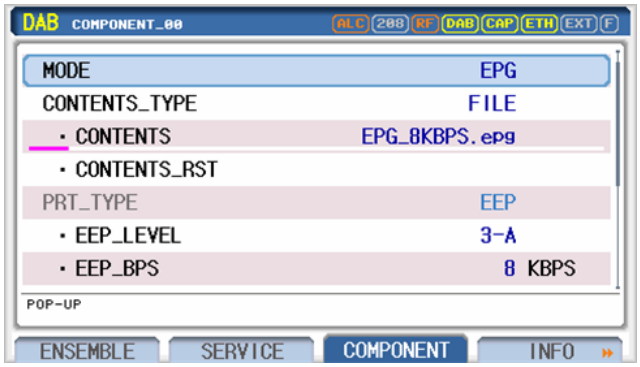


Fig. The screen of Service Component

The simple schedule of the program can be edited in the GUI by setting the EPG_ID, HOUR, MINUTE and Duration of each item.



Fig. The screen of EPG configuration

Basic setting for EPG broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

3.3.7 SPI

This section describes the method of setting the Service Component as SPI mode. Service Programme Information (SPI) is an application formerly known as electronic programme guide (EPG), but goes beyond a mere programme guide. SPI of RWC2010B provides service names, identification, frequencies and multimedia (RedwoodComm station logo).
Go to the 'DAB/COMPONENT' screen. The first parameter on this screen is "NUMBER" which determines which component to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, SLS, SPI, EPG, BWS, TPEG, etc…. By setting the MODE as SPI, the component is configured as the SPI and some parameters are automatically set for SPI mode.

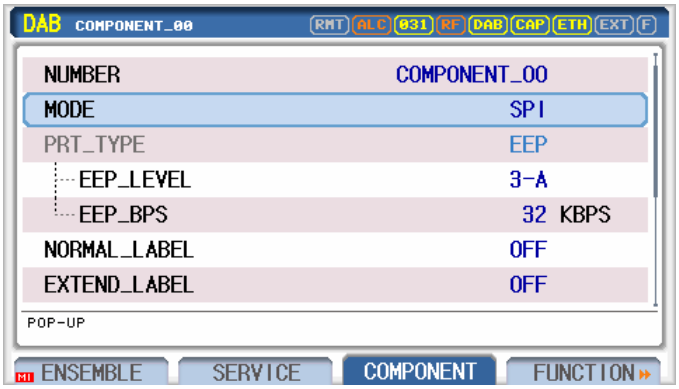


Fig. The screen of Service Component

3.3.8 SLS

This section describes the method of setting the Service Component as SLS mode. This data channel periodically broadcasts picture data which is related to the current service program. Go to the 'DAB/COMPONENT' screen. The first parameter of this screen is the "NUMBER" which decides the number of components. Set this parameter value as what you want to modify. Component type is configured by the "MODE" parameter. RWC2010B supports various types of components like DAB, DMB, DAB+, BWS, TPEG, etc. By setting the MODE as SLS, the component is configured as the SLS and some parameters are automatically set for SLS mode. There is the "CONTENTS" parameter for selecting SLS contents downloaded in the memory. The orange color bar below the CONTENTS parameter shows the status of file transmitting

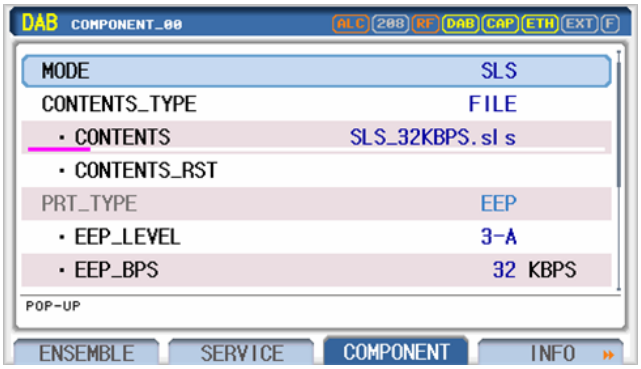


Fig. The screen of Service Component

Basic setting for SLS broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

3.4 PAD test

PAD stands for Program Associated Data. Data traveling in the PAD channel is intimately related to the audio program. RWC2010B provides DLS, DL+, DRC, SLS, and EPG through the PAD channel

3.4.1 DLS

DLS(Dynamic Label Service) allows the service provider to send text messages with information such as track playing, now/next, news headlines, weather, sport results, etc. To test the DLS, please set the Component as DAB (refer to 3.2) because the PAD service is provided in DAB mode. Set the PAD_TYPE parameter as DLS for DLS service through the PAD channel.



Fig. The screen for DLS setup

3.4.2 DL+

To serve all the different interests of listeners using the DLS, the service provider has to send DL messages frequently and with different contents, one after the other, each message replacing the one before. DL Plus solves this dilemma by allowing the Listener to select the kind of information he is interested in. For that purpose DL messages are complemented by tags which identify specific content of the DL message by its content type.
To test the DL+, please set the Component as DAB (refer to 3.2) because the PAD service is provided in DAB mode. Set the PAD_TYPE parameter as DL+ for DL Plus service through the PAD channel.



Fig. The screen for DL+ setup

3.4.3 EPG

EPG stands for Electric Program Guide. This data channel periodically broadcasts future program schedules via PAD channel. Set the PAD_TYPE parameter as EPS.

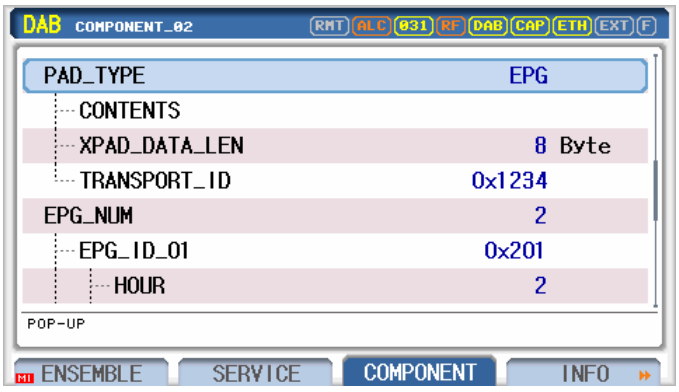


Fig. The screen for EPG setup

The simple schedule of the program can be edited in the GUI by setting the EPG_ID, HOUR, MINUTE and Duration of each item.

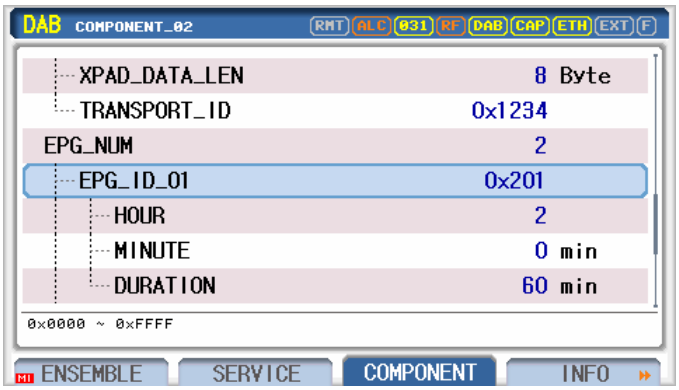


Fig. The screen of EPG configuration

3.4.4 SPI

This section describes the method of setting the PAD channel as SPI mode. Service Programme Information (SPI) is an application formerly known as electronic programme guide (EPG), but goes beyond a mere programme guide. SPI of RWC2010B provides service names, identification, frequencies and multimedia (RedwoodComm station logo).
By setting the PAD_TYPE as SPI, the PAD channel is configured as the SPI and some parameters are automatically set for SPI mode.

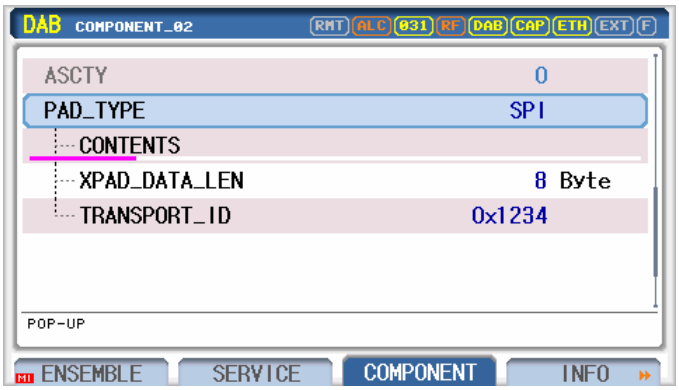
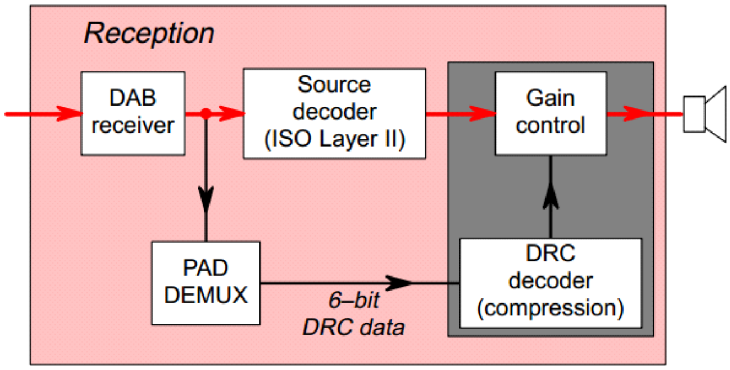


Fig. The screen for SPI setup

3.4.5 DRC

The DRC(Dynamic Range Control) data can be used in the receiver to set the gain of the variable gain amplifier. It can make quieter sounds easier to hear when the listener is in a noisy environment.



To test the DRC, please set the Component as DAB (refer to 3.2) because the PAD service is provided in DAB mode. Set the PAD_TYPE parameter as DRC for DRC service through the PAD channel.

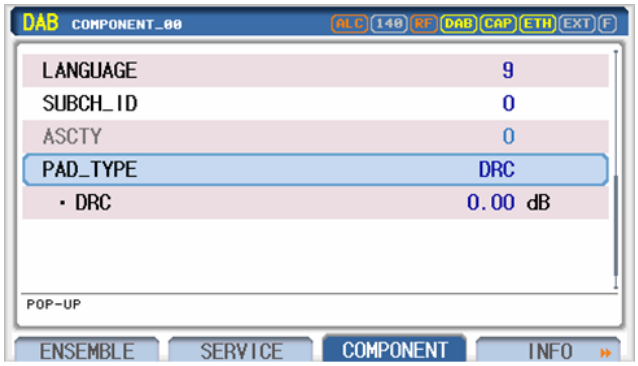


Fig. The screen for DRC setup

3.4.6 SLS

SLS (Slide Show) allows the service provider to send image files related to the audio program. To test the SLS in PAD mode, please set the Component as DAB (refer to 3.2) because the PAD service is provided in DAB mode. Select the Contents files which include SLS data and set the PAD_TYPE parameter as OFF. The contents files which include SLS data can be downloaded from RedwoodComm webhard.

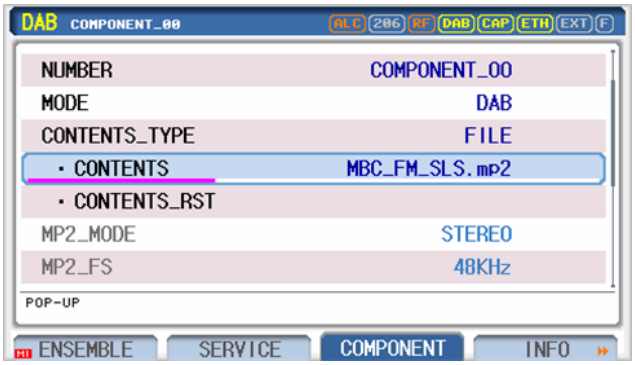


Fig. The screen for SLS setup

3.5 Functional Test

3.5.1 Announcement Test

Announcement is a period of elevated interest within an audio programme. It is typically a spoken audio message, often with a lead-in and lead-out audio pattern (for example, a musical jingle). It may refer to various types of information such as traffic, news, sports and others. The signaling of announcements is to allow a receiver to provide the user with an announcement mode, including specific functions such as raising a reduced volume during the announcement message or switching from another playback source to the radio programme for the announcement message and other features. The receiver resumes the original state and playback function after the end of the announcement. Regular announcements are signaled as one of general information, such as traffic, news or weather. Alarm announcements signal that an emergency message is broadcast which has a higher priority than regular announcements. Alarm announcements are treated separately in the present document, as both the signaling and the expected receiver behavior are different.
An announcement may occur during a service in the tuned ensemble, but may also occur during a service in another ensemble.

To test the announcement function, go to the ‘DAB/FUNCTION’ screen and set up the "TEST_ITEM” as ANNOUNCEMENT. The announcement test screen will be displayed as follows. RWC2010B supports turned ensemble announcement tests as well as other ensemble announcement tests by setting the MODE parameter.
Each service can have its own announcement support (FIG0/18) parameters. Select the service which will have announcement support features using AN_SOURCE_SVC_xx parameter. Enables or disables announcement support information types (alarms, traffic information, etc.). This announcement support configuration can be assigned to one or more clusters. Clusters are used for announcement switching signals (FIG0/19). If the announcement switching has the same cluster-ID, the radio may go to the target service defined in the announcement switching signal.

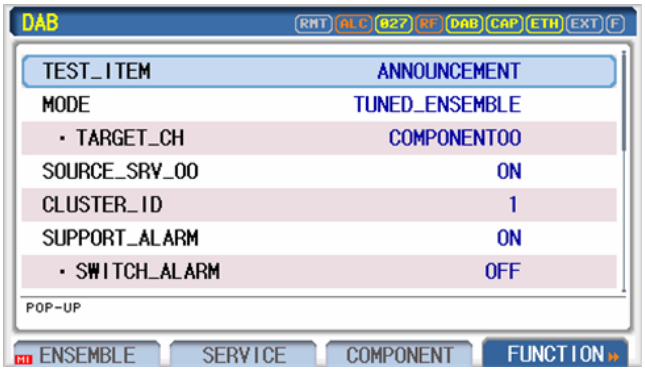


Fig. The screen for announcement support setting

For the announcement switching test in RWC2010B, the desired announcement switching type is set using the AN_SWITCH_TYPE parameter, and the target service is set using the TARGET_CH parameter. Set one of the cluster IDs used in the announcement support settings to the announcement switching cluster-ID. For Alarm Announcement, the cluster-ID is fixed at 0xFF. When all parameters are set as desired, set the AN_SWITCHING parameter to ON to start sending the signal of announcement switching.



Fig. The screen for announcement switching setting

3.5.2 Reconfiguration Test

The ensemble information provides the required mechanisms for changing the multiplexer configuration whilst maintaining continuity of services. Such a multiplexer re-configuration is achieved by sending at least the relevant part of the MCI of the future multiplexer configuration in advance as well as the MCI for the current configuration. When the sub-channel organization changes, the relevant part of the MCI is encoded in FIG 0/1 and, for sub-channels applying additional FEC for packet mode, FIG 0/14. When the service organization changes, the relevant part of the MCI is encoded in FIG 0/2, FIG 0/3, FIG 0/4, and FIG 0/8. Accordingly, every MCI message includes a C/N flag signaling whether its information applies to the current or to the next multiplexer configuration

To test the reconfiguration function with the RWC2010B, two steps are required. First of all, current ensemble configuration should be done with the same method explained in the preceding sections. Then go to the ‘DAB/FUNCTION’ screen and set the "TEST_ITEM parameter as RECONFIGURATION and” set the "MODE” parameter as ON.

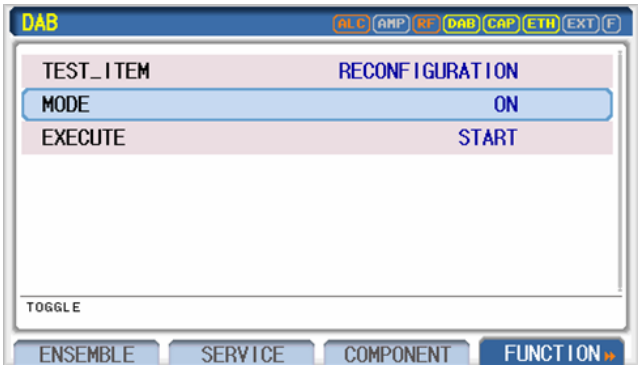


Fig. DAB menu screen for Reconfiguration setting

After that, go to the ENSEMBLE, SERVICE or COMPONENT screen. You will see the color of some parameters is in green. Those parameters are reconfiguration related parameters. So modify some of those parameters if you want to change the multiplexer configuration in future. You will see that the color of modified parameters is in Red. Following 2 figures show the screens before modifying parameters and after modifying parameters.

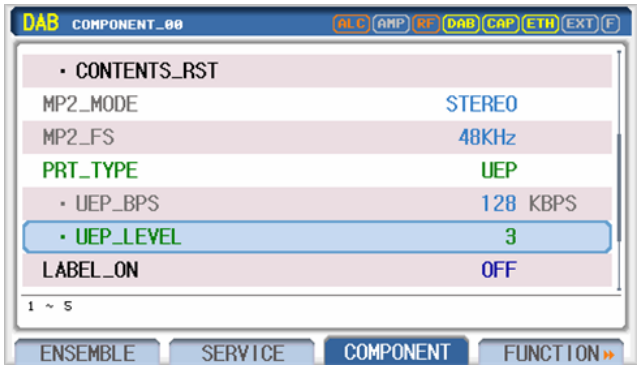


Fig. DAB COMPONENT screen (before modifying reconfiguration parameters)

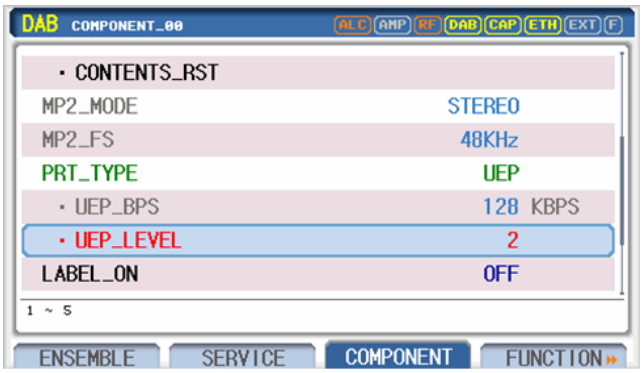


Fig. DAB COMPONENT screen (after modifying reconfiguration parameters)

Please keep in mind that the modified red color parameters are not applied to the broadcasting Ensemble. To apply them to the broadcasting Ensemble with proper reconfiguration procedures, go to the ‘DAB/RECONFIG’ screen again. And move the parameter cursor on the "EXECUTE” parameter and push the ENTER key. It takes about 5 seconds to finish the reconfiguration procedures. You will see an orange color bar below the "EXECUTE” parameter which shows the status of reconfiguration. During these procedures, the DUT should maintain continuity of service decoding.

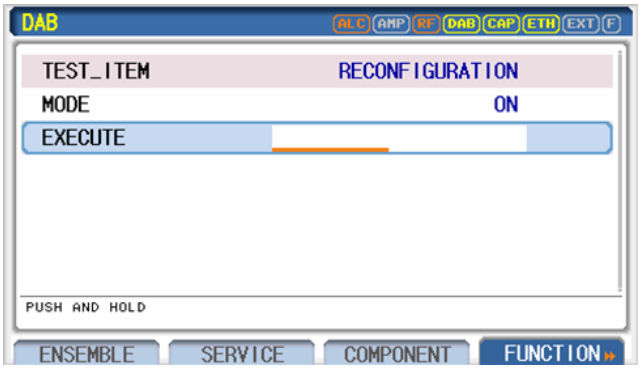


Fig. The screen during the Reconfiguration is running

3.5.3 Alternative Frequency (AF) Test

Alternative frequency (AF) is an option that allows a receiver to re-turn to a different frequency that provides the same station or related, when the first signal becomes too weak. The DAB system can signal alternative frequencies for the DAB system or other systems like DRM, FM_RDS, AM, DRM to allow the receiver to counter reception problems by automatically and quickly switching to an alternative frequency providing better reception conditions.

To test the alternative frequency function, go to the ‘DAB/FUNCTION’ screen and set up the "TEST_ITEM” as ALTERNATIVE_FREQ. The alternative frequency test screen will be displayed as

follows. RWC2010B signals alternative frequency information according to the setting of AF parameters.

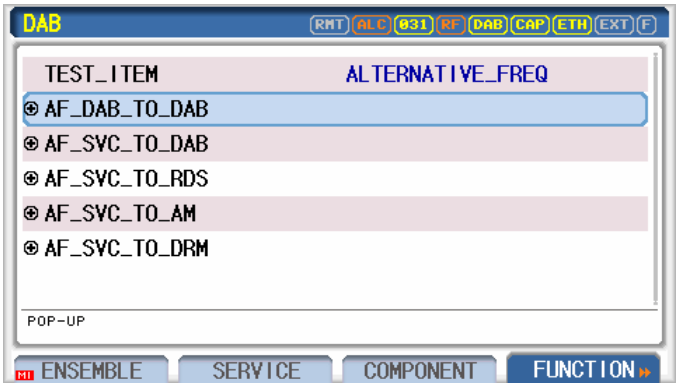


Fig. The screen for alternative frequency test

3.5.3.1 DAB to DAB AF Setting

The service provider may signal a list of geographically adjacent alternative ensembles using FIG 0/24 on which the current and other services can be found. The EID, frequency and other other ensemble related parameters are editable on GUI.

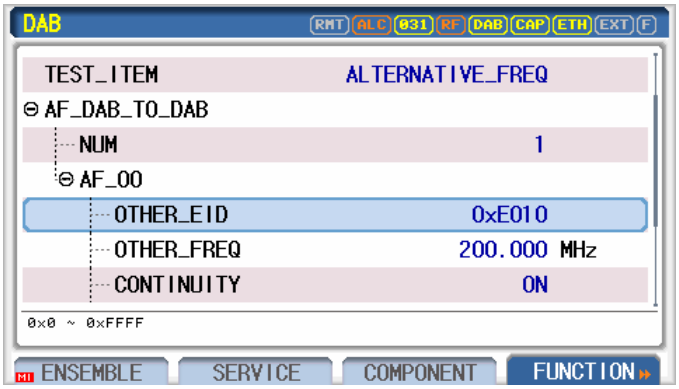


Fig. The screen for DAB to DAB AF setting

3.5.3.2 Service to DAB AF Setting

Although not identical to the current ensemble, if there is the same service or related to the current program, the service provider may provide the EID, frequency, and SID of the specific service in the other ensemble so that the target service can be found easier.

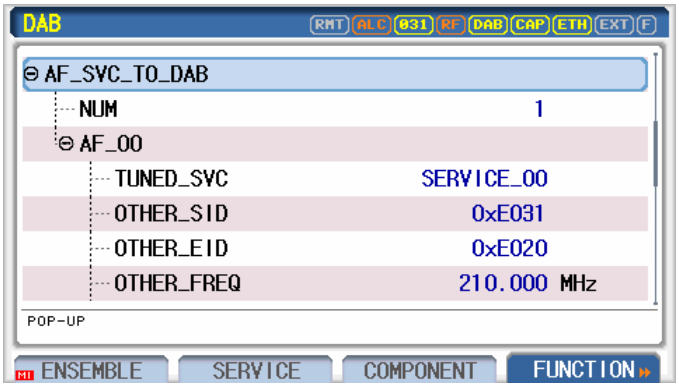


Fig. The screen for Service to DAB AF setting

3.5.3.3 Service to FM-RDS AF Setting

If there is the same program or related to the current program in FM RDS, the service provider may provide the PID and frequency of FM RDS.

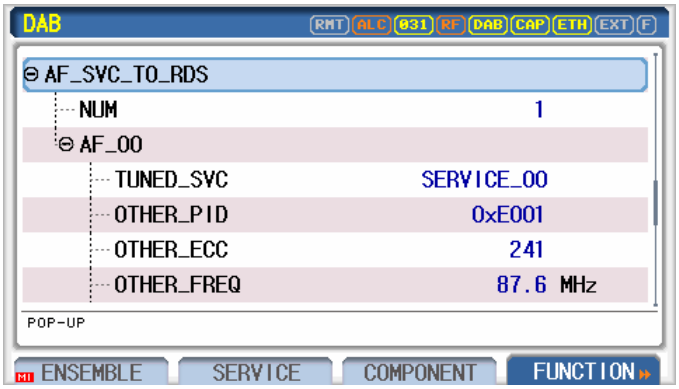


Fig. The screen for Service to FM-RDS AF setting

3.5.3.4 Service to AM AF Setting

If there is the same program or related to the current program in AM, the service provider may provide the frequency of AM.

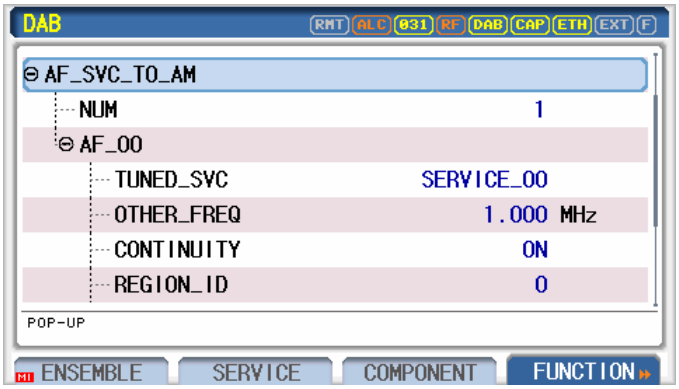


Fig. The screen for Service to AM AF setting

3.5.3.5 Service to DRM AF Setting

If there is the same program or related to the current program in DRM, the service provider may provide the SID and frequency of DRM.

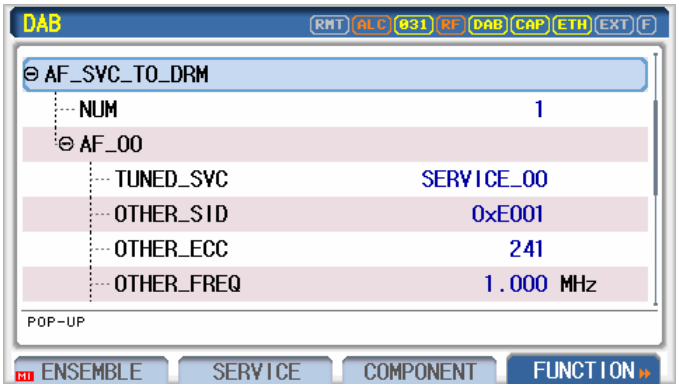


Fig. The screen for Service to DRM AF setting

3.5.4 SCI

SCI (Service Component Information) is used to provide information on pending ensemble reconfigurations ahead of time. Receivers should make use of advance information for user information, e.g. an upcoming service being added to the service list with a date and time of its coming into operation. SCI can also provide information on ensemble reconfigurations that have occurred already, in some cases this information is essential to a receiver to discover the change after the fact.
Either future or past changes can be edited in the GUI as follows:

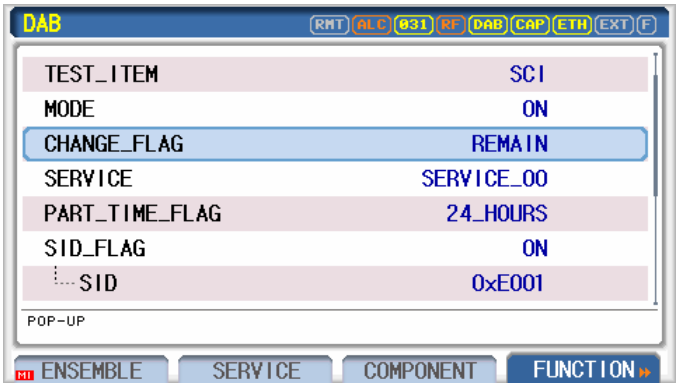
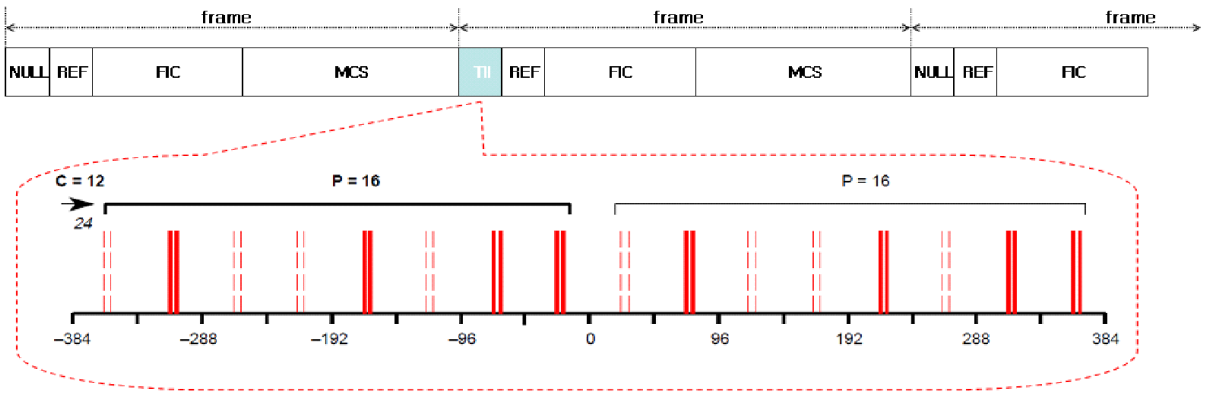


Fig. The screen for SCI setting

3.5.5 TII

TII (Transmitter Identification Information) stands for transmitter ID. TII signal is transmitted instead of every second NULL signal. This function is optional in specification. The RWC2010B supports on/off of the TII signal. It also supports "TII_PATTERN" and "TII_COMB" parameters to set up a Transmitter ID.

Go to the 'DAB/FUNCTION' screen and set up the "TEST_ITEM" as TII and "TII" as ON. Users could test TII using "TII_COMB", "TII_PATTERN" parameters.



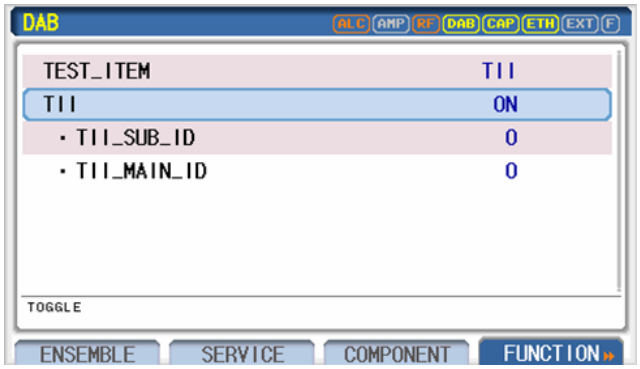


Fig. TII setup parameters in DAB/DMB Ensemble screen

3.5.6 Time Information

DAB specification supports transmitting time information. The RWC2010B transmits time information as follows.
To set up the current time, go to the 'DAB/FUNCTION' screen and set up the "TEST_ITEM" as TIME and "TIME" as ON. And set up "YEAR", "MONTH", "DAY", "HOUR", "MINUTE", "LTO" parameters. As time goes on, internal time related parameters are updated automatically but not refreshed on the screen. To refresh these parameters, go to another screen and return to this screen again.

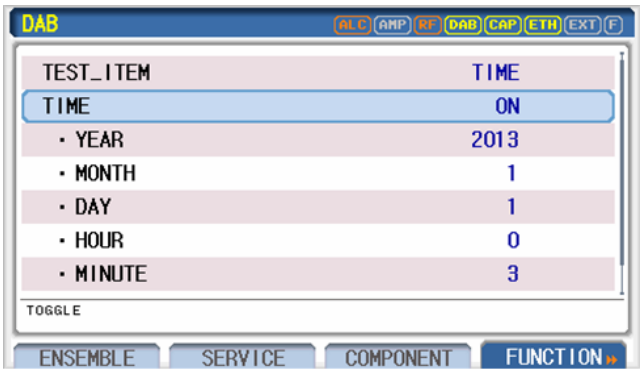


Fig. DAB/DMB menu screen for time information

4. DRM Operation

This section describes the basic concepts and details of DRM related operations. Understanding the basic concepts of your RWC2010B helps you use it effectively.

4.1 DRM Menu Structure
4.2 Editing the DRM Multiplex Structure
4.3 System Type
4.4 Functional Test

4.1 DRM Menu Structure

The DRM menu consists of the MULTIPLEX, SERVICE, STREAM, FUNCTION and INFO submenu. The multiplexer is structured very intuitively with the DRM multiplexer structure as shown in the following figure. The built-in Multiplexer supports up to 4 services and 4 streams. Each service and stream can be completely configured DRM multiplexer structure just by on and off. All parameters of each SERVICE and STREAM are editable in each submenu tab.

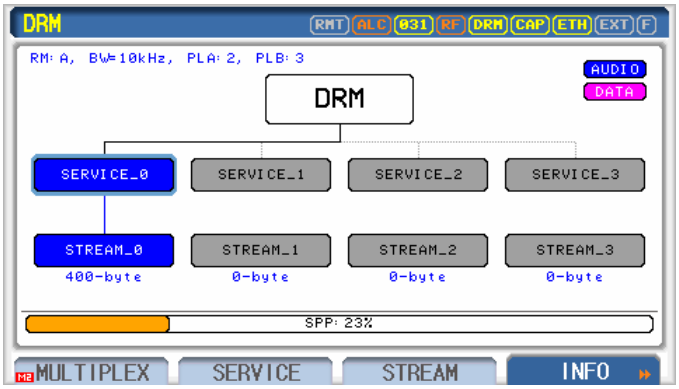


Fig. DRM menu structure of RWC2010B

4.1.1 MULTIPLEX

This submenu contains RF-related parameters and Multiplexer-related parameters.

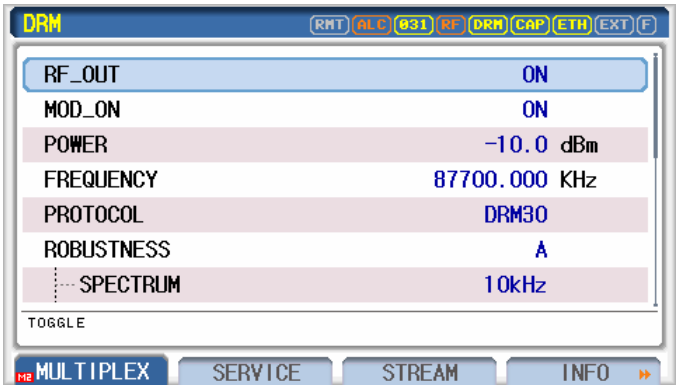


Fig. The screen of MULTIPLEX submenu

4.1.1.1 Parameters

POWER

RF output power for DRM Multiplexer. Users can use the UNIT key to select power units in dBm or dBuV.

FREQUENCY

RF output frequency for DRM Multiplexer. Users can use the UNIT key to select power units in MHz, kHz or Hz.

PROTOCOL

RWC2010B supports DRM30 for AM band and DRM+ for FM band broadcasting.

ROBUSTNESS

The OFDM parameter set (A, B, C, D and E) is defined in DRM specification. This parameter is defined for different propagation-related transmission conditions to provide various robustness modes for the signal. In a given bandwidth, the different robustness modes provide different available data rates.

SPECTRUM

This parameter specifies the nominal channel bandwidth.

INTERLEAVING

This parameter indicates the depth of the time interleaving as follows: long for 2 s or short for 400 ms.

MSC_MODE

This parameter indicates the modulation mode in use for the MSC.

SDC_MODE

This parameter indicates the modulation mode in use for the SDC.

PRT_LEVEL_A

This parameter indicates the protection level for higher protection part (part A).

PRT_LEVEL_B

This parameter indicates the protection level for lower protection part (part B).

SERVICE_0 - SERVICE_3

RWC2010B supports up to 4 services for DRM Multiplexer. The user can use these parameters to turn on/off the services.

4.1.2 SERVICE

This submenu contains service-related parameters such as SID, service label, etc. Users can assign streams to the service on this Screen.



Fig. The screen of SERVICE submenu

4.1.2.1 Parameters

NUMBER

This parameter determines which service to modify.

SHORT_ID

This 2-bit field indicates the short identifier assigned to this service and used as a reference in the SDC. The Short Id is assigned for the duration of the service and is maintained through multiplex reconfigurations.

SID

Unique 16-bit code which shall be allocated to the service and allows unambiguous identification of the service.

TYPE

This parameter indicates the type of service according to the stream type.

LABEL

This parameter stands for the name of Service. The maximum length of the string is 16-byte.

BIDI_FLAG

This 1-bit flag shall indicate whether the text contains bidirectional text (excluding numerals) as follows: 0 if bidirectional text is not present or 1 if bidirectional text is present.

BASE_DIRECTION

This 1-bit flag shall define the Unicode base direction of the text as follows: 0 for left-to-right (LTR) or 1 for right-to-left (RTL).

CONTEXTUAL_FLAG

This 1-bit flag shall indicate whether contextual characters are used in the text as follows: 0 if contextual characters are not present (presentation characters only) or 1 if contextual characters are present.

COMBINING_FLAG
This 1-bit flag shall indicate whether combining characters are used in the text as follows: 0 if combining characters are not present or 1 if combining characters are present.

LANGUAGE
This parameter is the Language information of Service.

LANGUAGE_CODE
This parameter identifies the language of the target audience of the service according to ISO 639-2.

COUNTRY_CODE
This parameter identifies the country of origin of the service according to ISO 3166.

PRG_TYPE
Program type of the service.

AUDIO_CA
This 1-bit flag shall indicate whether conditional access is used for the audio.

DATA_CA
This 1-bit flag shall indicate whether conditional access is used for the data.

LINK_1
Set up the first stream for the service. After setting, users can check the connection on the INFO screen.

LINK_2
Set up the second stream for the service. After setting, users can check the connection on the INFO screen.

4.1.3 STREAM

This submenu contains stream-related parameters such as stream type, contents, etc.

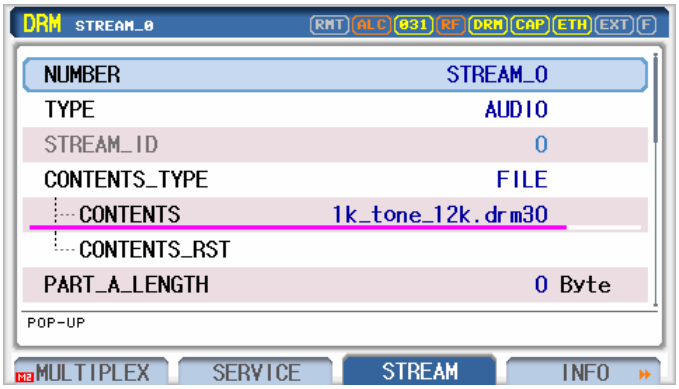


Fig. The screen of STREAM submenu

4.1.3.1 Common Parameters

NUMBER

This parameter determines which component to modify.

TYPE

This parameter determines the type stream. RWC2010B supports AUDIO, DATA_PRBS, and DATA_PACKET.

STREAM_ID

This parameter is Physical ID of Stream. The stream is recognized by this value in DUTs. In RWC2010B, this value is allocated automatically and just shows the value as unchangeable.

CONTENTS

Users can download many content files to internal memory. This parameter determines which content file to play.

CONTENTS_RST

Users can use this parameter to jump to the beginning of the content.

PART_A_LENGTH, PART_B_LENGTH

In DRM protocol, there are UEP and EEP in Protection Mode. UEP stands for Unequaled Error Protection and is used mainly for audio broadcasting. EEP stands for Equaled Error Protection and is used mainly for Data broadcasting. PART_A_LENGTH stands for Higher Protected Part and PART_B_LENGTH stands for Lower Protected Part. If users set the PART_A_LENGTH parameter as 0, DRM transmission mode will be EEP. Protection level of PART_A and PART_B is editable on ‘DRM/ENSEMBL’ screen using "PRT_LEVEL_A” and "RPT_LEVEL_B” parameters.

4.1.3.2 Audio Parameters

AUDIO_CODIG

RWC2010B will decode the selected DRM audio content file to show if it is HE-AAC or xHE-AAC. This parameter is for display only.

SBR

RWC2010B will decode the selected DRM audio content file to show if its SBR. This parameter is for display only.

AUDIO_FS

RWC2010B will decode the selected DRM audio content file to show the data rate. This parameter is for display only.

AUDIO_MODE

RWC2010B will decode the selected DRM audio content file to show if it is mono or stereo. This parameter is for display only.

SURROUND

RWC2010B will decode the selected DRM audio content file to show if it is surround mode. This parameter is for display only.

TEXT_FLAG

This parameter indicates whether a text message is present or not.

HEADLINE_MODE

This parameter indicates whether the Headline is added to the TEXT

HEADLINE

It can be set as the Headline part of the beginning of a TEXT sentence. This parameter stands for Headline sentence.

TEXT

At the end of the audio frame, the text data for various information such as the lyrics of the song is attached. The maximum length of the text string is 128. The editing method is the same as the LABEL editing method.

BIDI_FLAG

This 1-bit flag shall indicate whether the text contains bidirectional text (excluding numerals) as follows: 0 if bidirectional text is not present or 1 if bidirectional text is present.

BASE_DIRECTION

This 1-bit flag shall define the Unicode base direction of the text as follows: 0 for left-to-right (LTR) or 1 for right-to-left (RTL).

CONTEXTUAL_FLAG

This 1-bit flag shall indicate whether contextual characters are used in the text as follows: 0 if contextual characters are not present (presentation characters only) or 1 if contextual characters are present.

COMBINING_FLAG

This 1-bit flag shall indicate whether combining characters are used in the text as follows: 0 if combining characters are not present or 1 if combining characters are present.

4.1.3.3 DATA_PRBS Parameters

PATTERN

There are two PRBS test definitions in DRM specification (ETSI TS 102 349). Using this parameter, users could select SYNC or ASYNC PRBS test. Also fixed Patterns (all zero, all one and so on) are available.

4.1.3.4 DATA_PACKET Parameters

DATA_UNIT

This field indicates whether the data stream is composed of single packets or data units as follows: 0 for single packets or 1 for data units.

PACKET_ID

This two-bit field, coded as unsigned integer, indicates the Packet Id carried in the header of packets intended for this service. When FEC is added to a packet mode stream, packet Id = 3 is reserved for transporting error correction information for the whole packet mode data stream.

ENHANCEMENT FLAG

This field indicates whether enhancement data is available in another channel.

APPLICATION_DOMAIN

This field indicates the source of the data application specification. The interpretation of this field is given in ETSI TS 101 968.

4.1.4 FUNCTION

4.1.4.1 Parameters for Reconfiguration

MODE

RWC2010B can change protocol parameters without or according to the reconfiguration procedure. This parameter determines which method to use for changing the parameter.

EXECUTE

If you run this parameter after changing any reconfiguration-related parameters, the modified parameters will be applied to the reconfiguration procedure.

4.1.4.2 Parameters for Announcement

MODE

This parameter defines whether announcement information will be transmitted or not.

TARGET_SYSTEM

It denotes the target system when Announcement switching runs. The target system may be in an active state.

SOURCE_SERVICE

It denotes which service is related with Announcement signal. If set as ALL_SERVICE, all services will listen to the announcement signal.

TARGET_SERVICE

It denotes the target stream when Announcement switching runs. The target stream should be in an active state.

SWITCH_TRAVEL

When this parameter is set as ON, Travel Announcement switching is signaling in this service.

SWITCH_NEWS

When this parameter is set as ON, News Announcement switching is signaling in this service.

SWITCH_WEATHER

When this parameter is set as ON, Weather Announcement switching is signaling in this service.

SWITCH_WARNING

When this parameter is set as ON, Warning Announcement switching is signaling in this service.

SUPPORT_TRAVEL

When this parameter is set as ON, Travel Announcement switching is signaling in this service.

SUPPORT_NEWS

When this parameter is set as ON, News Announcement switching is signaling in this service.

SUPPORT_WEATHER

When this parameter is set as ON, Weather Announcement switching is signaling in this service.

SUPPORT_WARNING

When this parameter is set as ON, Warning Announcement switching is signaling in this service.

OTHER_FREQ

This parameter sets the frequency of other broadcast systems.

OTHER_SID

This parameter sets the SID of other broadcast systems.

REGION

Other broadcast systems can be restricted to certain geographic areas. The region definition feature allows the definition of geographic areas by longitude/latitude plus extent. When this parameter sets as NO_RESTRICTION, region related information will not be broadcasted. When this parameter sets as RESTRICTION, Region definition data will be broadcasted using SDC type 7. When this parameter sets as RESTRICTION_DETAIL, detailed region definition data will be broadcasted using SDC type 13.

LATITUDE

This parameter specifies the southerly point of the area in degrees, as 2’s complement number between -90 (south pole) and +90 (north pole).

LONGITUDE

This parameter specifies the westerly point of the area in degrees, as a 2's complement number between -180 (west) and +179 (east).

LATITUDE_EXT

This parameter specifies the size of the area to the north, in 1° steps; the value of Latitude plus the value of Latitude Extent shall be equal or less than 90.

LONGITUDE_EXT

This parameter specifies the size of the area to the east, in 1° steps; the value of Longitude plus the value of Longitude Extent may exceed the value +179.

SCHEDULE

Other broadcast systems can be restricted to certain times. The schedule definition feature is based on a weekly schedule. When this parameter sets as NO_RESTRICTION, schedule related information will not be broadcasted. When this parameter sets as RESTRICTION, schedule definition data will be broadcasted using SDC type 4.

START_TIME

This parameter indicates the time from when the frequency is valid. The time is expressed in minutes since midnight UTC. Valid values range from 0 to 1 439 (representing 00:00 to 23:59).

DURATION

This parameter indicates how long the frequency is valid starting from the indicated Start Time. The time is expressed in minutes. Valid values range from 1 to 16 383.

MONDAY

This parameter indicates whether the frequency schedule applies to Monday or not.

TUESDAY

This parameter indicates whether the frequency schedule applies to Tuesday or not.

WEDNESDAY

This parameter indicates whether the frequency schedule applies to Wednesday or not.

THURSDAY

This parameter indicates whether the frequency schedule applies to Thursday or not.

FRIDAY

This parameter indicates whether the frequency schedule applies to Friday or not.

SATURDAY

This parameter indicates whether the frequency schedule applies to Saturday or not.

SUNDAY

This parameter indicates whether the frequency schedule applies to Sunday or not.

4.1.4.3 Parameters for Alternative Frequency Test

NUM

The parameter determines how much alternative frequency information for other DRM or services which could have the same or similar as reference service. If it is set as 0, RWC2010B will not transmit AF information.

SYNC_MUX

This parameter indicates whether the AF multiplexer is broadcast synchronously or not.

SAME_SERVICE

This parameter indicates whether the specified other service should be considered the "same service" (e.g. carrying the identical audio program) or an "alternative service" (e.g. a different audio programme either from the same broadcaster offering a similar programme or from another broadcaster.

OTHER_SYSTEM

In SINGLE_SERVICE mode, other broadcast systems could be different systems like AM, FM, or DAB. This parameter sets the other broadcast system.

OTHER_FREQ

This parameter sets the frequency of other broadcast systems.

TUNED_SVC

This parameter indicates the reference service for alternative frequency information.

REGION

Other broadcast systems can be restricted to certain geographic areas. The region definition feature allows the definition of geographic areas by longitude/latitude plus extent. When this parameter sets as NO_RESTRICTION, region related information will not be broadcasted. When this parameter sets as RESTRICTION, Region definition data will be broadcasted using SDC type 7. When this parameter sets as RESTRICTION_DETAIL, detailed region definition data will be broadcasted using SDC type 13.

LATITUDE

This parameter specifies the southerly point of the area in degrees, as 2's complement number between -90 (south pole) and +90 (north pole).

LONGITUDE

This parameter specifies the westerly point of the area in degrees, as a 2's complement number between -180 (west) and +179 (east).

LATITUDE_EXT

This parameter specifies the size of the area to the north, in 1° steps; the value of Latitude plus the value of Latitude Extent shall be equal or less than 90.

LONGITUDE_EXT

This parameter specifies the size of the area to the east, in 1° steps; the value of Longitude plus the value of Longitude Extent may exceed the value +179.

SCHEDULE

Other broadcast systems can be restricted to certain times. The schedule definition feature is based on a weekly schedule. When this parameter sets as NO_RESTRICTION, schedule related information will not be broadcasted. When this parameter sets as RESTRICTION, schedule definition data will be broadcasted using SDC type 4.

START_TIME

This parameter indicates the time from when the frequency is valid. The time is expressed in minutes since midnight UTC. Valid values range from 0 to 1 439 (representing 00:00 to 23:59).

DURATION

This parameter indicates how long the frequency is valid starting from the indicated Start Time. The time is expressed in minutes. Valid values range from 1 to 16 383.

MONDAY
This parameter indicates whether the frequency schedule applies to Monday or not.

TUESDAY
This parameter indicates whether the frequency schedule applies to Tuesday or not.

WEDNESDAY
This parameter indicates whether the frequency schedule applies to Wednesday or not.

THURSDAY
This parameter indicates whether the frequency schedule applies to Thursday or not.

FRIDAY
This parameter indicates whether the frequency schedule applies to Friday or not.

SATURDAY
This parameter indicates whether the frequency schedule applies to Saturday or not.

SUNDAY
This parameter indicates whether the frequency schedule applies to Sunday or not.

4.1.4.4 Parameters for TIME

TIME
TIME information will be sent when this parameter is set to ON.

YEAR, MONTH, DAY, HOUR, MINUTE, LTO
To set up the current time.As time goes on, internal time related parameters are updated automatically but not refreshed on the screen. To refresh these parameters, go to another screen and return to this screen again.

4.2 Editing the DRM Multiplex Structure

4.2.1 Overview

RWC2010B supports 4 Streams to consist of Multiplex. Go to 'INFO' screen to see the current Multiplex structure graphically. In this example, there is a very simple Multiplex which consists of one Service (SERVICE_0) and one Stream (STREAM_0). At the bottom of the screen, there is a bar

which shows the occupied frame rate. Occupation Rate should be less than 100%, so be careful when you add components in the Multiplex. If the Occupation Rate is more than 100%, it shows a warning message on the screen.

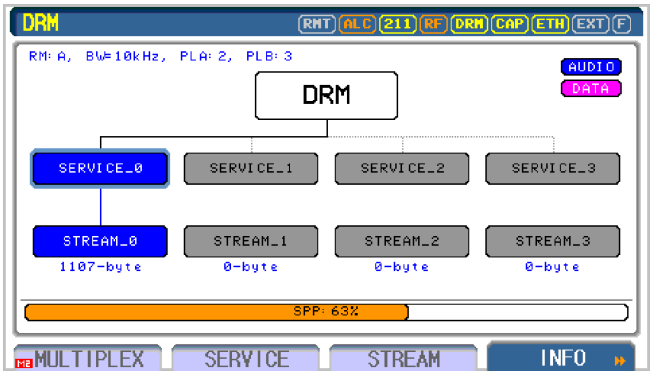


Fig. INFO screen to show Multiplex structure

4.2.2 Parameter setting

Add SERVICE

To add a new Service to the Multiplex, go to the 'DRM/MULTIPLEX' screen and place the cursor on the SERVICE parameter which you want to add., and press the ENTER key to turn it on. The following figure shows when the SERVICE_1 is added to the Multiplex.

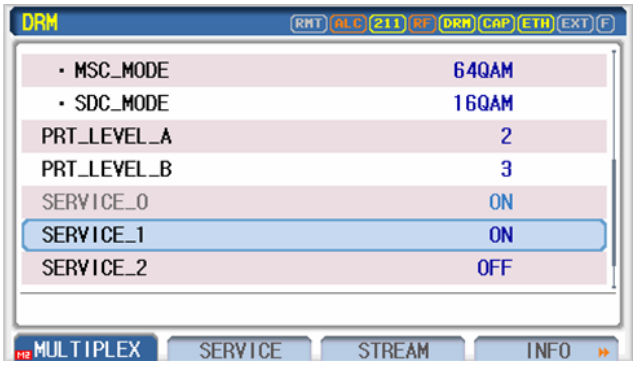


Fig. The screen of adding SERVICE to the Multiplex

After adding Services, go to the 'INFO' Screen to check the modified Multiplex structure. Using the same method, you can add or delete Services.

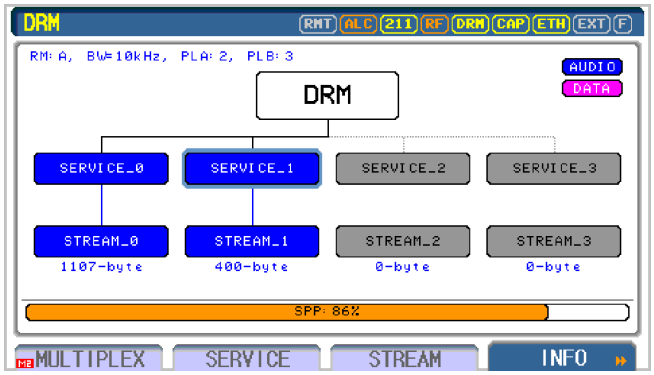


Fig. Screen of Multiplex structure after adding service

There is another way to add or delete SERVICE. On the INFO screen, please move cursor to the SERVICE which you want to add or delete using rotary knob and press **ENTER key**.

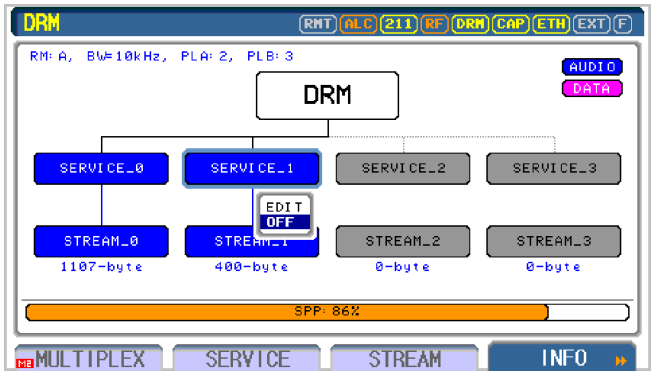


Fig. Screen of Editing Multiplex structure

Each Service could be connected to multiple Streams. To add one more Stream to the Service, go to the 'DRM/SERVICE' screen and place the cursor on the LINK_1 parameter and set it to any stream which users want to add to this service. The following figure shows when the STREAM_1 is added to the SERVICE_0

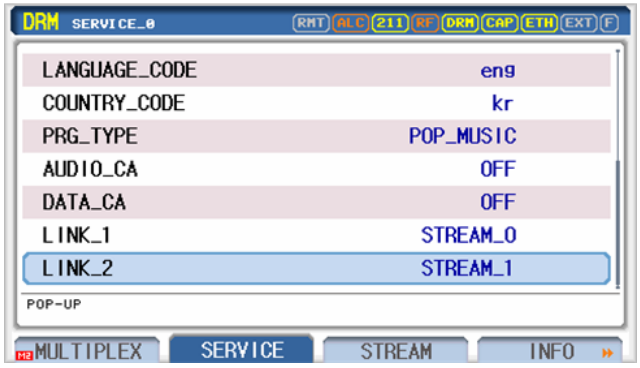


Fig. Screen of Editing Multiplex structure

After adding Stream, go to the ‘INFO’ Screen to check the modified Multiplex structure.

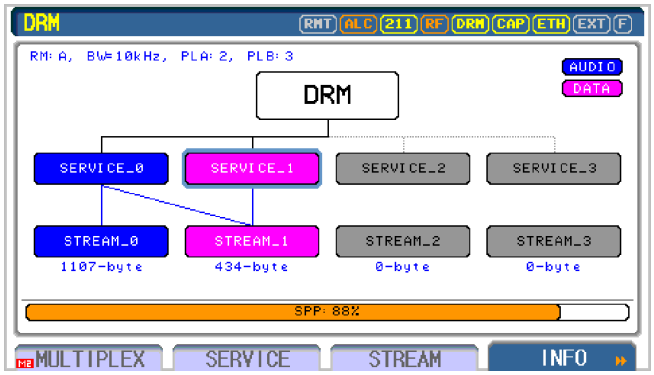


Fig. Screen of Multiplex structure after adding service

4.3 Stream Type

4.3.1 DRM Audio Test

This section describes the method of setting the Stream as DRM Audio mode. Go to the ‘DRM/STREAM’ screen. The first parameter of this screen is the “NUMBER” which decides the number of streams. Set this parameter value as what you want to modify. STREAM type is configured by the “TYPE” parameter. RWC2010B supports three types of stream like AUDIO, DATA_PRBS and DATA_PACKET. By setting the TYPE as AUDIO, the stream is configured as the AUDIO and some parameters are automatically set for AUDIO mode. There is the “CONTENTS” parameter for selecting DRM audio contents downloaded in the memory. By selecting the desired file to transmit, RWC2010B will decode the file and set the audio related parameters automatically. The orange color bar below the CONTENTS parameter shows the status of file transmitting.

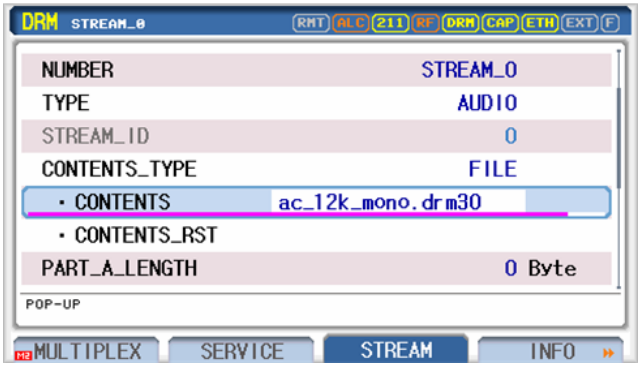


Fig. The screen of Stream Component

Basic setting for DRM audio broadcasting is completed. If required, modify other protocol related parameters and test them for your purpose.

4.3.2 DRM Packet Data Test

This section describes the method of setting the Stream as DRM PACKET Data mode. Go to the 'DRM/STREAM' screen. The first parameter of this screen is the "NUMBER" which decides the number of services. Set this parameter value as what you want to modify. STREAM type is configured by the "TYPE" parameter. RWC2010B supports three types of service like AUDIO, DATA_PRBS, DATA_PACKET. By setting the TYPE as DATA_PACKET, the stream is configured as a Data channel automatically. Select the proper contents file for SLS or BWS DATA Packet test.

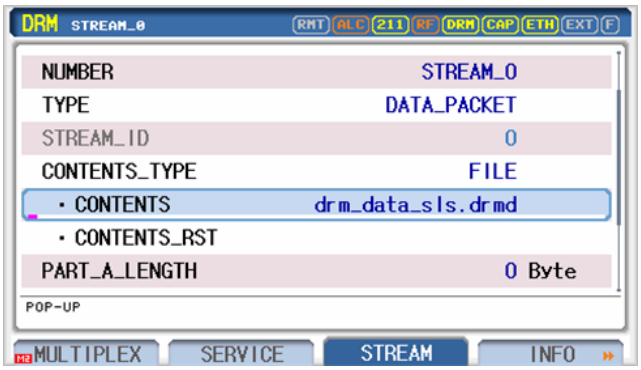


Fig. The screen of Stream Component

4.3.3 DRM PRBS Data Test

This section describes the method of setting the Stream as DRM PRBS Data mode. Go to the 'DRM/STREAM' screen. The first parameter of this screen is the "NUMBER" which decides the number of streams. Set this parameter value as what you want to modify. STREAM type is configured by the "TYPE" parameter. RWC2010B supports three types of stream like AUDIO, DATA_PRBS, DATA_PACKET. By setting the TYPE as DATA_PRBS, the stream is configured as the pattern data according to the setting of the PATTERN parameter and some parameters are automatically set for DATA mode. RWC2010B can transmit PRBS test pattern data according to the specification of ETSI TS 102 349. Using this mode, a BER test could be performed.

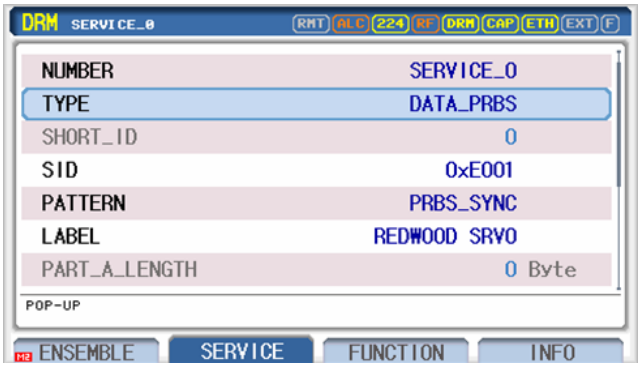


Fig. The screen of Stream Component

4.4 Functional Test

4.4.1 Announcement Test

Announcement is a function for a compulsory situation or automatic service switching functions. For example, if there is an emergency situation, then an announcement function is activated. This function changes the channel for every listener so that they can hear the emergency message or announcement. Alternatively, it can also be used by the user to set the channel to change to a specific program at a specific time.
To test the Announcement function, go to the ‘DRM/FUNCTION’ screen and set up the "TEST_ITEM” as ANNOUNCEMENT. The Announcement test screen will be displayed as follows. There are four support flags (TRAVEL, NEWS, WEATHER, WARNING) to indicate whether these are supported in this service or not. Please set some of these parameters as ON. To start Switching Announcement signals, set switch flags (TRAVEL, NEWS, WEATHER, WARNING) as ON. Target service systems could be various kinds of broadcasting systems like the same DRM Multiplexer, other DRM Multiplexer, AM, FM_RDS or DAB.

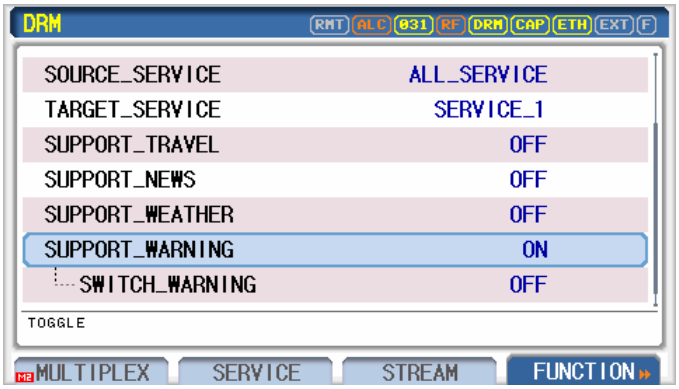


Fig. DRM menu screen for announcement test

This Announcement signal could be assigned to each one service or all services by the "SOURCE_SERVICE” parameter. To use the same DRM Multiplexer, target service should be turned on. For example,turn on two DRM services like the following figures. Please tune the DUT (Radio) on Service_0 and set the TARGET_SHORT_ID as 1. And set the START parameter as ON. Then the DUT should change the service from SERVICE_0 to SERVICE_1.
To use other systems, set the TARGET_SYSTEM parameter as the system which the user wants to use. In this case, one more RWC2010B or other system emulator is required.

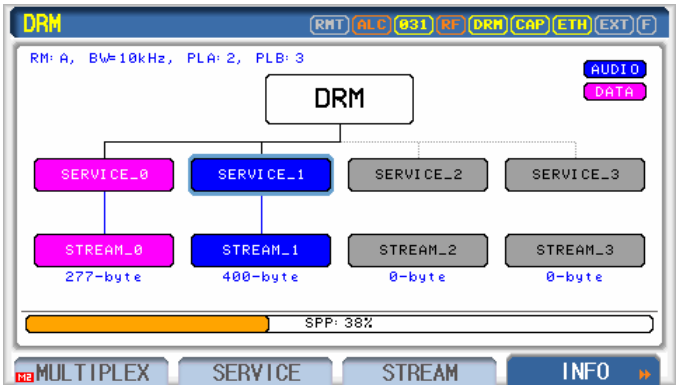


Fig. DRM INFO screen for announcement test

4.4.2 Reconfiguration Test

The ensemble information provides the required mechanisms for changing the multiplexer configuration whilst maintaining continuity of services. The multiplexer may be reconfigured at transmission super frame boundaries. A reconfiguration of the multiplexer occurs when the channel parameters in the FAC are changed, or when the services in the multiplexer are reorganized. The new configuration is signaled ahead of time in the SDC and the timing is indicated by the reconfiguration index in the FAC.

To test the reconfiguration function with the RWC2010B, two steps are required. First of all, current ensemble configuration should be done with the same method explained in the preceding sections. Then go to the ‘DRM/FUNCTION’ screen and set the "TEST_ITEM parameter as RECONFIGURATION and” set the "MODE” parameter as ON.



Fig. DRM menu screen for Reconfiguration setting

After that, go to the MULTIPLEX or SERVICE screen. You will see the color of some parameters is in green. Those parameters are reconfiguration related parameters. So modify some of those parameters if you want to change the multiplexer configuration in future. You will see that the color of modified parameters is in Red. Following 2 figures show the screens before modifying parameters and after modifying parameters.

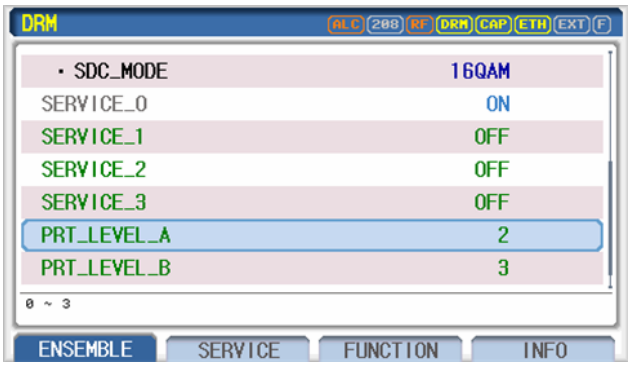


Fig. DRM MULTIPLEX screen (before modifying reconfiguration parameters)

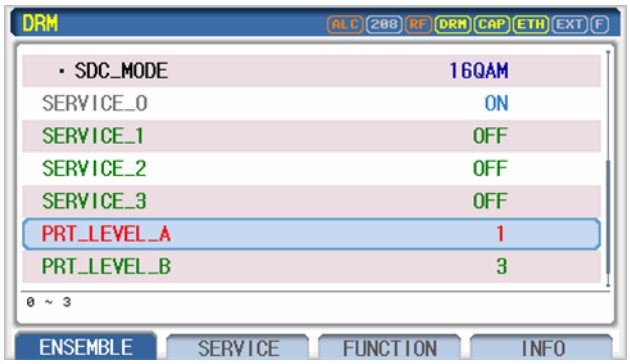


Fig. DRM MULTIPLEX screen (after modifying reconfiguration parameters)

Please keep in mind that the modified red color parameters are not applied to the broadcasting Multiplexer. To apply them to the broadcasting Multiplexer with proper reconfiguration procedures, go to the ‘DRM/FUNCTION’ screen again. And move the parameter cursor on the "EXECUTE” parameter and push the ENTER key to start it. It takes about 5 seconds to finish the reconfiguration procedures. You will see an orange color bar below the "EXECUTE” parameter which shows the status of reconfiguration. During these procedures, the DUT should maintain continuity of service decoding.
After checking the reconfiguration operation, click the "EXECUTE” parameter again to terminate the RECONFIGURATION test.

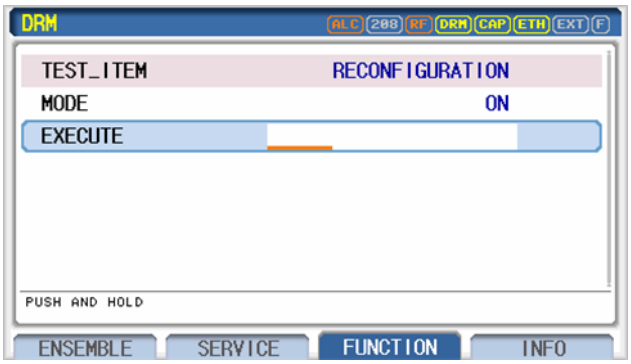


Fig. The screen during the Reconfiguration is running

4.4.3 Alternative Frequency Test

Alternative frequency (AF) is an option that allows a receiver to re-turn to a different frequency that provides the same station or related, when the first signal becomes too weak. The DRM system can signal alternative frequencies for the whole DRM multiplexer or some DRM services of the tuned DRM multiplexer to allow the receiver to counter reception problems by automatically and quickly switching to an alternative frequency providing better reception conditions.

To test the alternative frequency function, go to the ‘DRM/FUNCTION’ screen and set up the "TEST_ITEM” as ALTERNATIVE_FREQ. The alternative frequency test screen will be displayed as follows. RWC2010B signals alternative frequency information according to the setting of AF parameters.

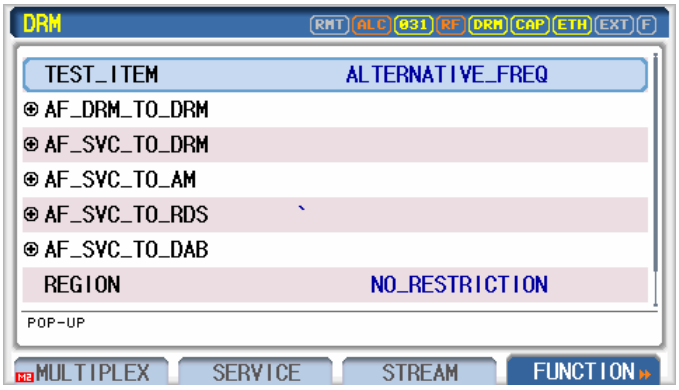


Fig. The screen for alternative frequency test

4.4.3.1 DRM to DRM AF Setting

The service provider may signal a list of geographically adjacent alternative DRM multiplexer. The frequency of other DRM multiplexer is editable on GUI.



Fig. The screen for DRM to DRM AF setting

4.4.3.2 Service to DRM AF Setting

Although not identical to the current multiplexer, if there is the same service or related to the current program, the service provider may provide the frequency, and SID of the specific service in the other multiplexer so that the target service can be found easier.

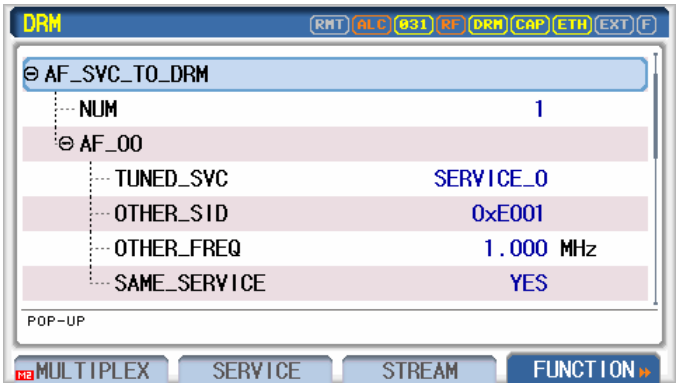


Fig. The screen for Service to DRM AF setting

4.4.3.3 Service to FM-RDS AF Setting

If there is the same program or related to the current program in FM RDS, the service provider may provide the SID and frequency of FM RDS.

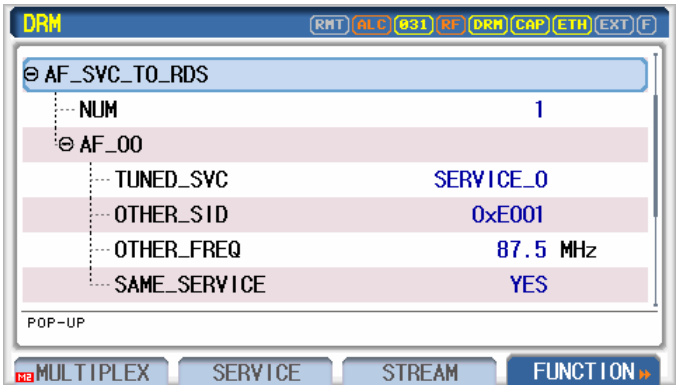


Fig. The screen for Service to FM-RDS AF setting

4.4.3.4 Service to AM AF Setting

If there is the same program or related to the current program in AM, the service provider may provide the frequency of AM.

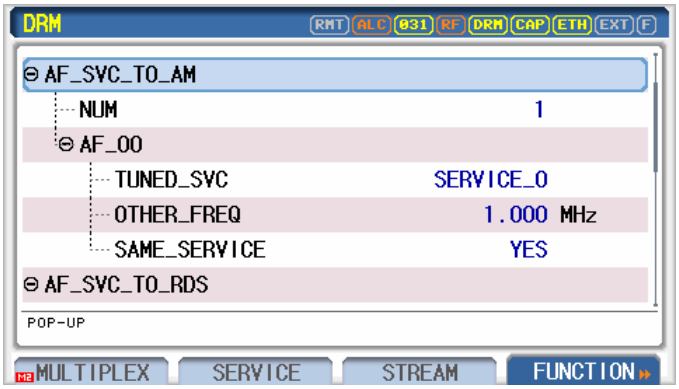


Fig. The screen for Service to AM AF setting

4.4.3.5 Service to DRM AF Setting

If there is the same program or related to the current program in DAB, the service provider may provide the SID and frequency of DAB.

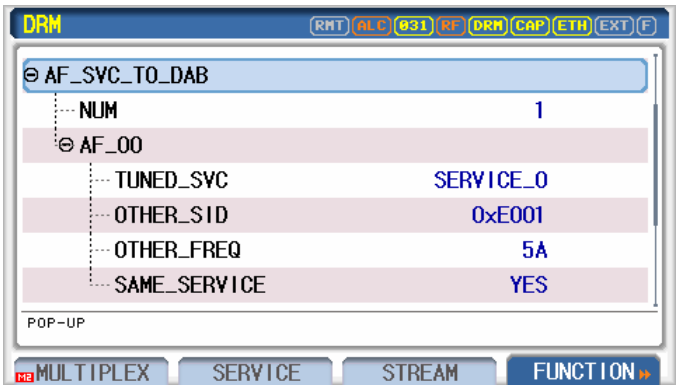


Fig. The screen for Service to DRM AF setting

4.4.3.6 AF Restriction

If there are regional restrictions and/or time restrictions of AF, the service provider may notify. Users can edit these restrictions as follows using RWC2010B:

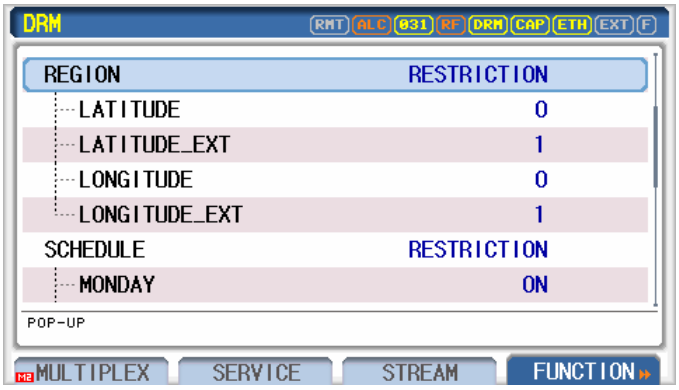


Fig. The screen for the restriction of region and schedule

4.4.4 Time Information

DRM specification supports transmitting time information. The RWC2010B transmits time information as follows.

To set up the current time, go to the 'DRM/FUNCTION' screen and set up the "TEST_ITEM" as TIME and "TIME" as ON. And set up "YEAR", "MONTH", "DAY", "HOUR", "MINUTE", "LTO" parameters. As time goes on, internal time related parameters are updated automatically but not refreshed on the screen. To refresh these parameters, go to another screen and return to this screen again.

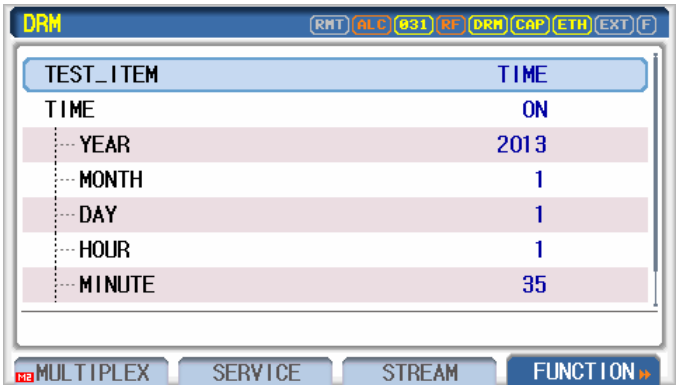


Fig. DRM menu screen for time information

5. ETI/MDI Operation

This section describes the test method using ETI file for DAB, MDI file for DRM or IQ file for DRM30. Understanding the basic concepts of your RWC2010B helps you use it effectively.

5.1 Setting for ETI file transmission
5.2 Setting for MDI file transmission
5.3 Setting for IQ file transmission

5.1 Setting for ETI file transmission

ETI stands for Ensemble Transport Interface. Using this function, the user can generate almost the same as a real Ensemble signal in the Lab. RWC2010B supports not only ETI(NI, G703) but also ETI(NI, V11).

5.1.1 Setting

To play ETI files, set the test mode as ETI/MDI using the MENU key and go to the ETI Configure screen, and set the “MODE” parameter as ETI. Then ETI file playing is started automatically. Select desired ETI contents file using the “CONTENTS” parameter.

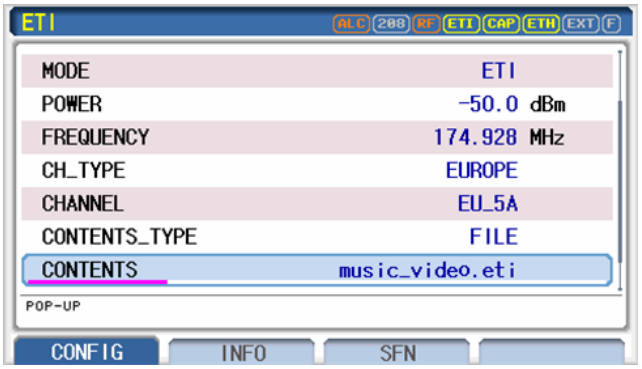


Fig. ETI Setup Screen

5.1.2 ETI File information

While the ETI is transmitting, you can check the file information and status such as TX Mode, Ensemble ID, Label, etc… To see the ETI file information, go to the ‘ETI/INFO’ screen by pressing **S2** key.

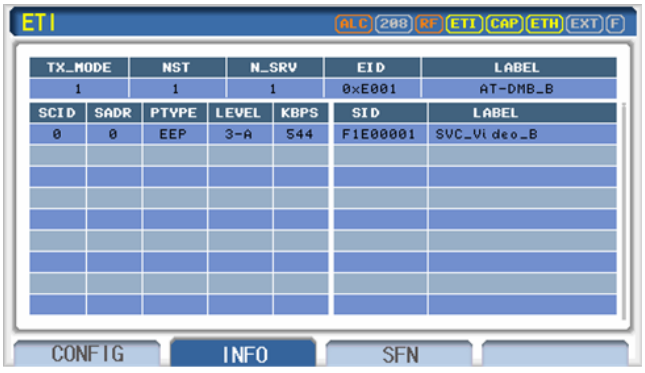


Fig. ETI INFO Screen

5.2 Setting for MDI file transmission

Using this function, the user can generate almost the same as a real DRM signal in the Lab.

5.2.1 Setting

To play ETI files, set the test mode as ETI/MDI using the MENU key and go to the ETI Configure screen, and set the “MODE” parameter as MDI. Then MDI file playing is started automatically. Select desired MDI contents file using the “CONTENTS” parameter.

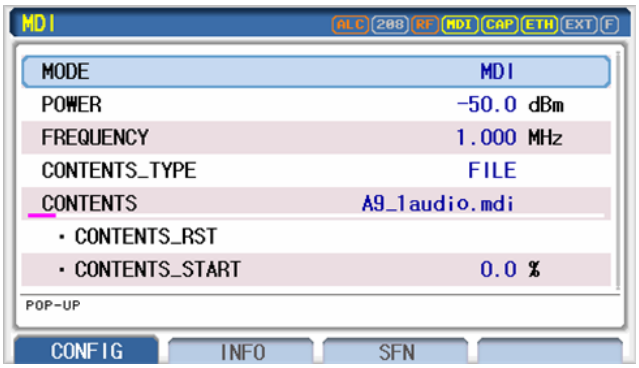


Fig. MDI Setup Screen

5.2.2 MDI File information

While the ETI is transmitting, you can check the file information and status such as Robustness Mode, Spectrum BW, Label, etc… To see the MDI file information, go to the ‘MDI/INFO’ screen by pressing **S2** key.

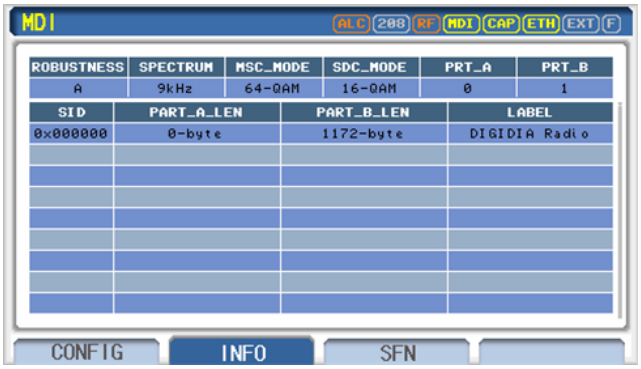


Fig. MDI INFO Screen

5.3 Setting for IQ file transmission

Using this function, users can play IQ files to generate DRM30 signals. RWC2010B supports only 48KHz sampling rate IQ files.

5.3.1 Setting

To play IQ files, set the test mode as ETI/MDI using the MENU key and go to the ETI/MDI Configure screen, and set the “MODE” parameter as DRM_IQ. Then IQ file playing is started automatically. Select desired IQ contents file using the “CONTENTS” parameter.

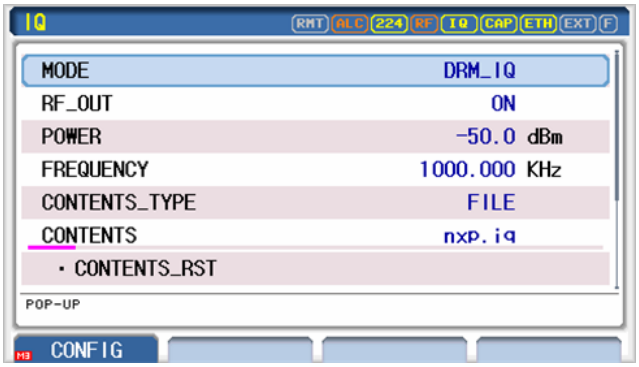


Fig. MDI Setup Screen

6. Analog Operation

This section describes the test method for FM, AM and RDS. Understanding the basic concepts of your RWC2010B helps you use it effectively.

6.1 Analog FM RDS Test
6.2 Analog AM Test

6.1 Analog FM RDS Test

RWC2010B provides Analog mode for FM/AM test purposes. Analog FM mode supports MONO FM test function, Stereo FM test function, Sweep FM test function and wave file player function. RWC2010B supports up to 4 multi-channel FM test functions. Each FM analog signal could have an independent RDS(Radio Data System) data channel.

6.1.1 Setting

Multi-channel FM_RDS_Test

Using the RWC2010B, up to 4 FM channels could be transmitted simultaneously. The Frequency of each FM channel could be set independently but the output power of each FM channel can not be set independently. All FM channels could have the same output power. From Channel 1 to Channel 4 frequencies could be set between CH0_FREQ – 3MHz and CH0_FREQ + 3MHz. Each FM_RDS channel parameter screen can be selected by the Submenu key. To configure FM_RDS_0 channel parameters, please go to FM_RDS_0 screen as follows.

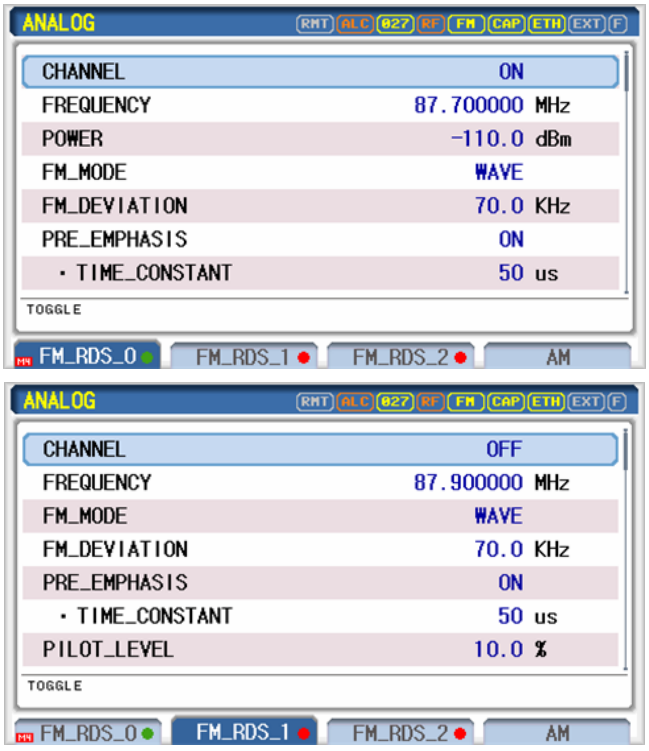


Fig. Multi channel FM test screen

To configure FM_RDS_1 channel parameters, please go to FM_RDS_1 screen as follows.

Each FM_RDS screen, there is CHANNEL parameter to turn-on or turn-off the channel independently and FREQUENCY parameter to configure the frequency independently.

6.1.2 FM MONO TEST

Set the MODE parameter as ‘MONO’ for FM Mono Mode test. In FM_MONO mode, one audio signal is FM modulated. To test it, go to the ‘FM_RDS_0’ screen and set the “MODE” parameter as MONO.

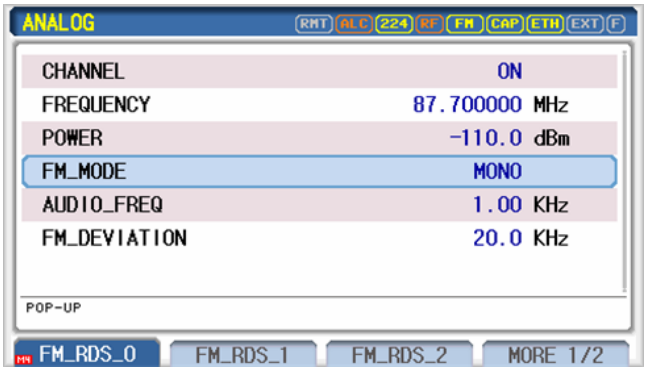


Fig. Mono FM test screen

6.1.3 FM STEREO TEST

Set the MODE parameter as ‘STEREO’ for FM Stereo Mode test. In FM_STEREOmode, two audio signals(LEFT/RIGHT) are FM modulated. For the stereo FM test, RWC2010B provides left audio parameters and right audio parameters separately.

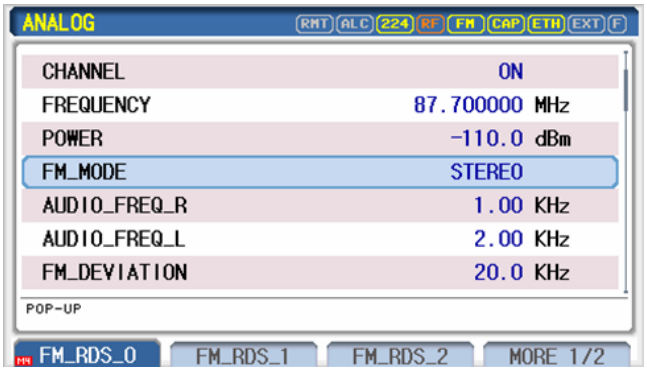


Fig. Stereo FM test screen

6.1.4 FM WAVE TEST

Set the MODE parameter as ‘WAVE’ for FM Wave Mode test. Downloaded wave file can be played with FM modulation. To test it, go to the ‘FM_RDS_0’ screen and set the “MODE” parameter as WAVE. Select the wave file using “CONTENTS” parameter. The orange color bar below the CONTENTS parameter shows the status of file transmitting

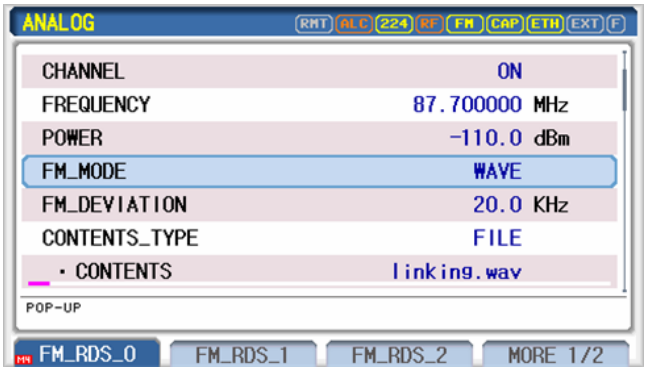


Fig. FM Wave mode test screen

6.1.4 FM SWEEP TEST

Set the MODE parameter as 'SWEEP' for FM SWEEP Mode test. In FM_SWEEP mode, RWC2010B sweeps FM audio tone frequency from the SWEEP_START to the SWEEP_STOP during SWEEP_TIME.



Fig. FM Sweep mode test screen

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

The setting of these two parameters stands for the 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

6.1.6 EON (Enhanced Other Networks information) Test

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, TA and TP. RWC2010B supports multi channel FM RDS signals then EON test could be done using just one unit. To set these EON parameters, please set the EON parameter as ON.

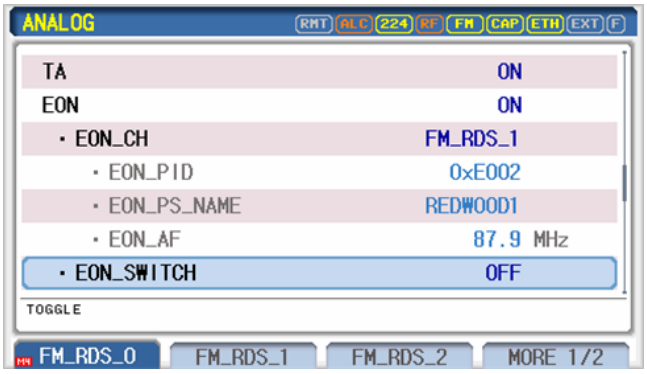


Fig. EON_SWITCH ON/OFF screen

Set the EON_CH parameter. The channel which EON_CH assigned should be turned on. In this example, the EON_CH parameter is FM_RDS_1. Then FM_RDS_1 channel should be turned on as follows. Other EON parameters will be set automatically.



Fig. Set up the Assigned EON Channel

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.

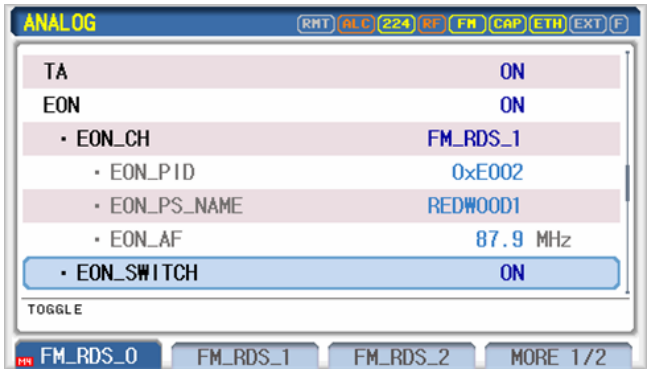


Fig. Set up the EON_SWITCH as ON

6.1.7 TMC (Traffic Message Channel)

RDS will enable traffic messages to be carried digitally and silently by a Traffic Message Channel (TMC), without necessarily interrupting the audio programme. To transmit a TMC message, please set the TRAFFIC_MESSAGE_CH parameter as ON.

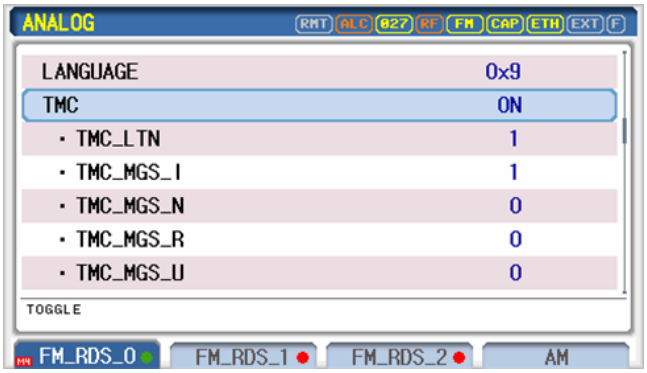


Fig. Screen for set up TMC parameters

Users could modify TMC messages using TMC related parameters. For more detailed information about these parameters, please refer to DD ENV 12313-1 document.

6.1.8 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. RWC2010B supports two methods of transmitting AFs by setting the AF_METHOD parameter.

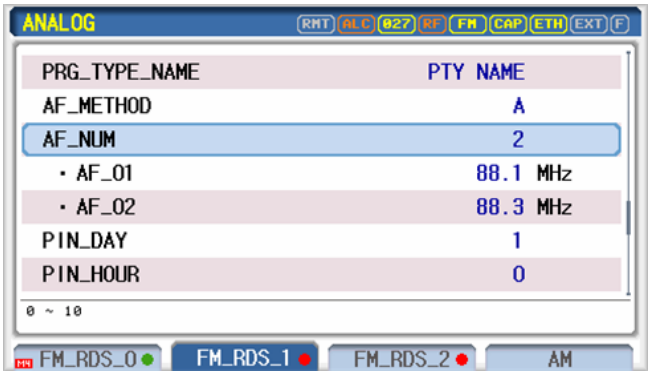


Fig. Screen for set up AF

6.1.9 Parameters

PID

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

PS_NAME

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

MUSIC_SPEECH

This parameter sets the type of program as Music or Speech.

TMC

This parameter sets the On/Off of the Traffic Message Channel. TMC is intended to be used for the coded transmission of traffic information.

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.

EON

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

EON_CH

RWC2010B can broadcast up to 4 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, RWC2010B transmits a stop switching signal to return to the turned channel.

RADIO_TEXT

RADIO_TEXT stands for text string Service. The maximum length of the TEXT string is 64. The editing method is the same as the LABEL editing method.

HEADLINE

It can be set as the Headline part of the beginning of a Radio Text sentence. This parameter stands for Headline sentence.

HEADLINE_MODE

This parameter indicates whether the Headline is added to the Radio Text.

RADIO_TEXT_MODE

RADIO TEXT could be turned off or turned on the RADIO TEXT as NORMA, RT+, eRT(Enhanced Radio Text), and eRT+ mode by this parameter.

TEXT_DIRECTION

This parameter indicates the text direction (LTR or RTL) of Enhanced Radio Text.

RADIO_TEXT_CH

RADIO TEXT could be broadcasted through one of 2A or 2B channels. Using this parameter, users can select a radio text channel.

TAG_TYPE, TAG_START, TAG_LENGTH

When the “RADIO_TEXT_MODE” is set as RT+, these parameters are displayed on the screen. Tag information could specify some sentences for special purposes like music titles. Please refer to the specification for more detailed information.

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.

AF_METHOD

Two methods of transmitting AFs are possible in specification. AF method A is used for lists up to 10 in number and AF method B is used where it is required to indicate frequencies of genetically related services.

AF_NUM, AF_NUM_VARIANT, AF_01~ AF_10

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” and “AF_NUM_VARIANT” parameters as how many alternative frequencies you want to test.

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.

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.

6.2 Analog AM Test

RWC2010B provides Analog mode for FM/AM test purposes. Analog AM mode supports MONO AM test function and wave file player function.

6.2.1 Setting

AM_MONO Mode

In AM_MONO mode, one audio signal is AM modulated. To test it, go to the ‘ANALOG/AM’ screen and set the “MODE” parameter as MONO. The “AM_INDEX” in this screen controls audio volume.

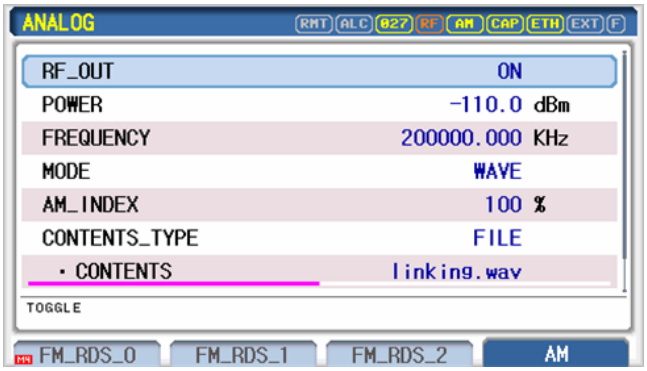


Fig. Mono AM test screen

AM_WAVE Mode

Downloaded wave file can be played with AM modulation. To test it, go to the 'ANALOG/AM' screen and set the "MODE" parameter as WAVE. Select the wave file using "CONTENTS" parameter. The orange color bar below the CONTENTS parameter shows the status of file transmitting

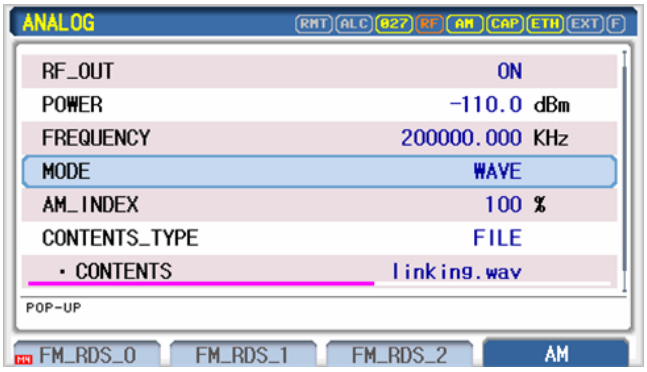


Fig. AM File mode test screen

AM_SWEEP Mode

Set the MODE parameter as 'SWEEP' for the AM SWEEP Mode test. In AM_SWEEP mode, RWC2010B sweeps AM audio tone frequency from the SWEEP_START to the SWEEP_STOP during SWEEP_TIME.

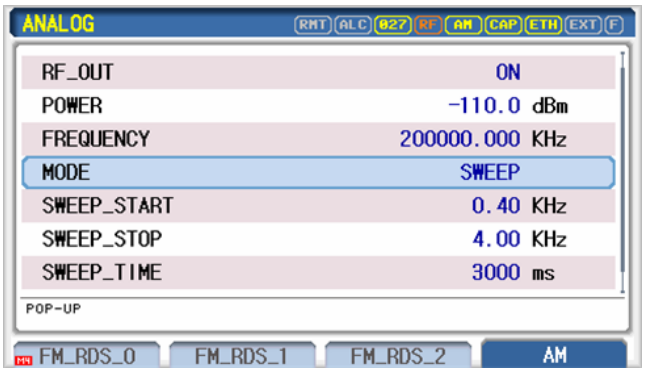


Fig. AM Sweep mode test screen

7. Linking Test

This section describes the test method for Seamless Linking test and SFN (Single Frequency Network) test using two RWC2010Bs. Understanding the basic concepts of your RWC2010B helps you use it effectively.

7.1 Seamless Linking Test
7.2 SFN(Single Frequency Network) Test

7.1 Service (Seamless) Linking Test

In a vehicle, DAB receivers experience a constantly varying coverage area. When the reception quality becomes weak in one transmitter, the receiver must be able to identify and intelligently switch to another transmitter and continue to play the same station with good reception quality. In general, even though the two transmitters are identical, they might have different transmission parameters (like signal delay etc…) or they might use different broadcast systems. In many cases, some of the DAB services are the simulcast of existing FM services with RDS. Sometimes, the same DAB service can be simulcast over two or three DAB ensembles emanating from different regions. So, in effect, a moving car can experience any of the below situations:

- DAB Broadcast Area 1 with DAB-1 ensemble containing service ABC, FM with RDS Broadcast Area with ABC
- DAB Broadcast Area 1 with DAB-1 ensemble containing service ABC, DAB Broadcast Area 2 with DAB-2 ensemble containing service ABC, DAB Broadcast Area 3 with DAB-3 ensemble containing service ABC

In these above situations, ordinary digital receivers that are able to do the switching usually make transient echoes like noise or "clicks”. But latest receivers can switch without transient echo using Seamless Linking algorithm.

To test the Seamless Linking algorithm in the Lab, two broadcasting emulators are required. And two broadcasting emulators should be synchronized with adjustable sync delay. Using two RWC2010Bs, many combinations of Seamless Linking tests (DAB to DAB, DAB to DRM, DAB to FM, DRM to DRM, DRM to FM) can be performed in the Lab very easily. In this manual, it explains DAB to FM seamless linking test method. Other combination test methods are very similar to it.

For detailed usage, please refer to the application manual of the RwcServiceLinkingTestTool.exe.

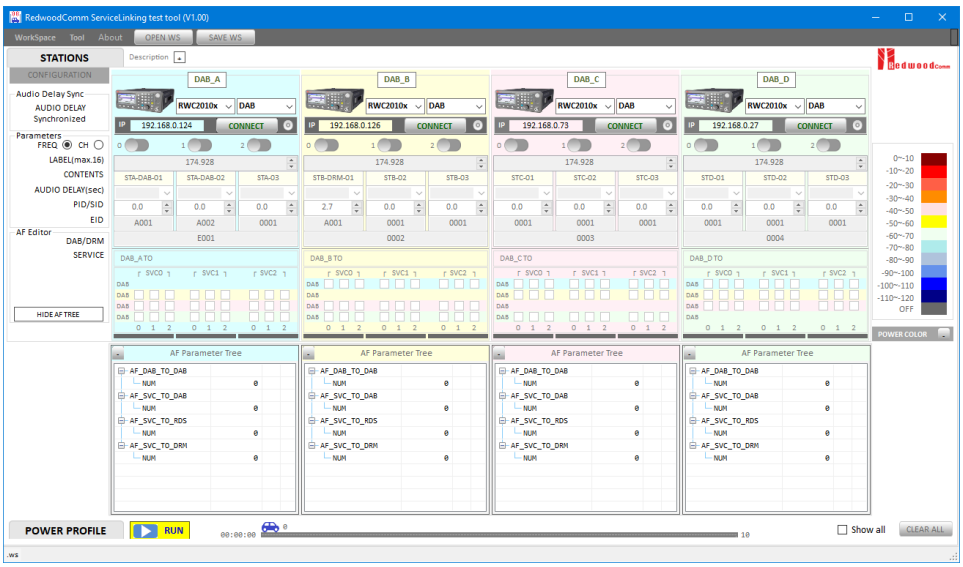


Fig. RwcServiceLinkingTestTool.exe

7.2 SFN(Single Frequency Network) Test

As a digital, OFDM radio system (DAB/DRM) is capable of transmitting in a single frequency network (SFN). Here several transmitters can work on the same frequency, due to a guard interval added after every symbol, differences in time of arrival from the different transmitters do not decrease the performance. This offers the possibility of covering a big area with several transmitters on only one frequency which saves bandwidth and simplifies frequency planning significantly. It also enhances the reception quality in areas with obstacles such as buildings, hills or mountains.

To test SFN in the Lab, two or more broadcasting emulators are required. Only two RWC2010B could be connected and synchronized, so in this manual will explain the test method of SFN using two RWC2010B.

7.2.1 Setting

Two RWC2010B units should be connected to the same External 10MHz Reference input and “REF_CLK” parameter in ‘SYSTEM/SETUP’ screen should be set as EXT as the following Figure.



Fig. External Reference Input Setup Screen

Two RWC2010B testers should be connected by RS232C Cable and Sync cable (Cross LAN cable) which are provided from RedwoodComm. On the rear panel, there are a RS232C port and a DATA_IO port. The RS232C Cable should be connected to the RS232C port of two RWC2010B testers. Sync cable (Cross LAN cable) should be connected to the DATA_I/O port of two RWC2010B testers. User could assign one RWC2010B for Master and the other RWC2010B for Slave. Master and Slave units should be configured for ETI mode with the same contents file for DAB SFN test. For DRM SFN test, both units should be configured for MDI mode with the same contents file. In this manual, the SFN test for DAB will be explained.

After setting the two units as ETI mode with the same contents file, please go to the ‘ETI/SFN’ screen and set the “SFN_MODE” parameter as MASTER in Master RWC2010B to start the SFN test. On this sreen, user can control not only Master unit but also Slave unit. Using the “SFN_DELAY” parameter, Sync delay between two transmitters are adjustable in 0.1us units.



Fig. SFN test screen

TII signal could be configured for Master and Slave unit independantly. To turn on the TII and configure the TII parameters, move to the ‘ETI/CONFIG’ screen and set the “TII” parameter as ON.

Fig. Connection block diagram for SFN Test

7.2.2 Parameter

MODE

Set the tester as Master or Slave for seamless linking test. Only master RWC2010B should be set as Master.

MASTER_SRV

In Ensemble there could be many services. For seamless Linking test, only one service should be selected by this parameter

MASTER POW

Set the TX Power of Master RWC2010B.

MASTER FREQ

Set the TX Frequency of Master RWC2010B.

SFN_DELAY

Set the SFN delay between Master RWC2010B and Slave RWC2010B with 0.1us resolution.

SLAVE POW

Set the TX Power of Slave RWC2010B.

SLAVE FREQ

Set the TX Frequency of Slave RWC2010B.

8 Remote Control Programming

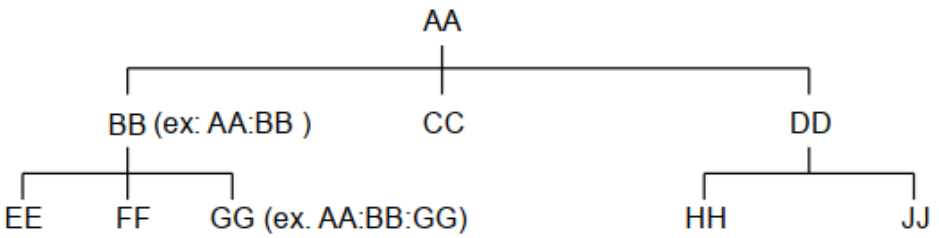
PC may control the RWC2010B remotely through Ethernet or RS232C interface using a comprehensive set of commands. This section provides the necessary information to operate the RWC2010B under Ethernet and RS232C control

8.1 Introduction
8.2 RS-232C Interface
8.3 ETHERNET Interface
8.4 Command Tables

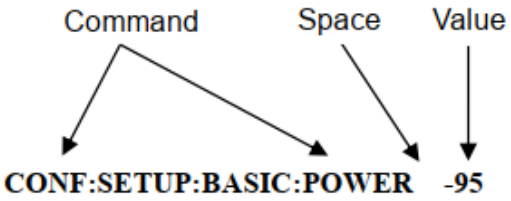
8.1 Introduction

The RWC2010B supports RS232C and Ethernet Interface, located at the rear panel for remote operation under PC control. Ethernet is used for high speed and flexible interfaces. To use Ethernet, socket programming is required. RS232C is a slow serial interface, but it does not need any special devices, and is easy to use

8.1.1 Command Structure



- Users must follow a particular path to reach lower level subcommands. For example, if you wish to access the GG command, you must follow the path AA to BB to GG (AA:BB:GG)
- Commands consist of *set commands* and *query commands* (usually simply called commands and queries). Set commands change instrument settings or perform a specific action. Queries cause the RWC2010B to return data and information about its status. Most commands have both a set form and query form. The query form of the command is started with “READ” and the set form of the command is started with “CONF”. For example, one of the set commands is **CONF:SETUP:BASIC:POWER -95** and one of the query commands is **READ:SETUP:BASIC:POWER?**
- When a *colon* is placed between two command mnemonics, it moves the current path down one level in the command tree
- A *space* is used to separate parameters from commands. AA:BB:FF 20
- Some commands require two parameters. Refer to the Command list.



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

8.1.2 Command Parameter Types

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

8.1.3 Response to Query

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

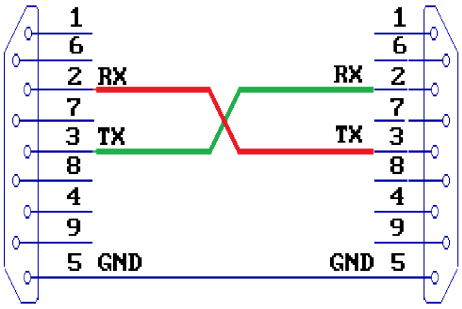
Command & Query	Response
READ:SETUP:BASIC:POWER?	-10
READ:SETUP:BASIC:RF?	ON

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

8.2 RS-232C Interface

8.2.1 Setting

RS-232C Connection



RWC2010B Remote PC

Set up RWC2010B

To use RS-232C, the parameters of the RWC2010B should be set up according to the following sequence.

- Got to the 'SYSTEM/SETUP' screen.
- Set the "RS232C_BPS"the same as the PC set-up.
- Other parameters related with RS-232C are fixed as follows

Parameter	Range	Description
DATA BITS	8-bit	Length of Data bit
PARITY	Off	Error check bit
STOP BIT	1-bit	Stop bit

8.2.2 Remote Programming guide using RS232C on a Windows system

Programming sequence

- Set Serial Port
- Set up Baud Rate, Parity Bit (None), Data Bit (8 bit), Stop Bit (1 bit).
- Open port.
- Send RS232C command through serial port.
- Check command execution result on the RWC2010B screen.
- Send the next command after successful execution of the previous command.

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

Tip for programming

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

8.3 ETHERNET Interface

8.3.1 Setup

- Connect LAN port of PC and RWC2010B Ethernet port by RJ45 cable. If the PC and RWC2010B are connected directly, Cross cable must be used.
- Set up the IP address as follows to use cross cable.

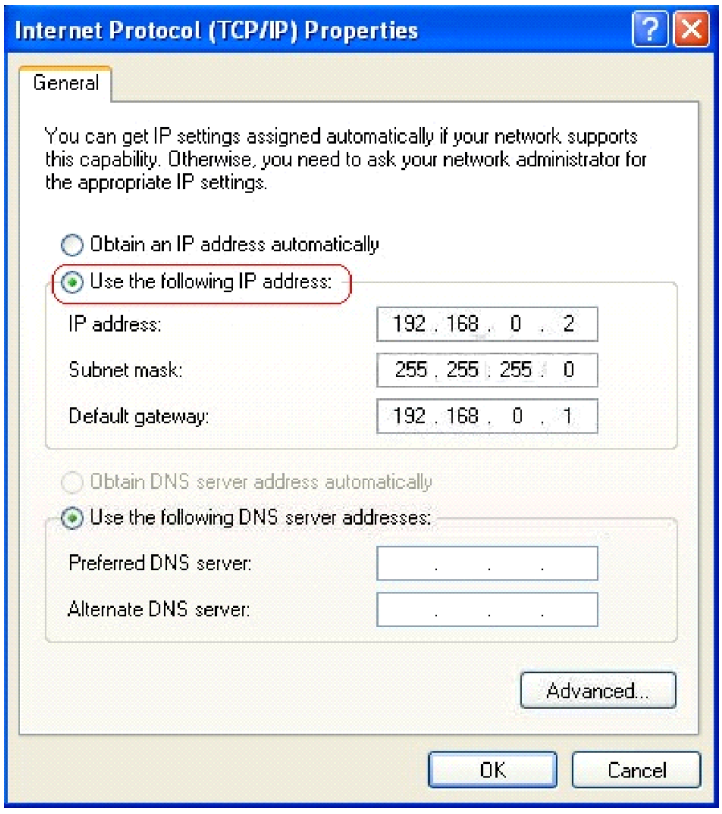


Fig. How to set up the static IP address of PC with Window OS

- Turn RWC2010B power ON, go to the 'SETUP/SYSTEM' screen and check the "IP_ADDR" value. Please be sure that the "IP_ADDR" value should be different from the PC's IP Address.



Fig. Screen for setup Remote Port and IP address

8.4 Command Tables

8.4.1 Common Commands

Command	<value> Range	Description
*IDN?		Query Identification
*RST		Full preset command
*SAVE	1 ~ 50	Save current parameters setting to memory
*RECALL	1 ~ 50	Recall saved parameters setting from memory
EXEC:REBOOT		Reboot Tester
EXEC:MOVE_SCREEN:REMOTE		Move to the SETUP/REMOTE screen
READ:SETUP:RF?		
CONF:SETUP:RF <value>	OFF, ON	RF On/Off
READ:SETUP:BASIS:MOD_ON?		
CONF:SETUP:BASIS:MOD_ON <value>	OFF, ON	RF On/Off
READ:SETUP:FREQUENCY?		
CONF:SETUP:FREQUENCY <value>	0.15 ~ 30 MHz 47 ~ 68 MHz 87 ~ 108 MHz 174 ~ 250 MHz	LF/MF/HF Band Band I Band II Band III
READ:SETUP:POWER?		Read Power(dBm)
CONF:SETUP:POWER <value>	-120.0 ~ 0.0	Set Power(dBm)
READ:SETUP:POWER:DBUV?		Read Power(dBuV)
CONF:SETUP:POWER:DBUV <value>	-13.0 ~ 97.0	Set Power(dBuV)
READ:SETUP:PATH_LOSS?		dB
CONF:SETUP:PATH_LOSS <value>	-60.0 ~ 60.0	dB
READ:SETUP:TESTER_MODE?		
CONF:SETUP:TESTER_MODE <value>	FM, AM, DAB, DRM, ETI, MDI, DRM_IQ	

8.4.2 DAB ENSEMBLE

Command	<val_1> Range	<val_2> Range
READ:DAB:ENSEMBLE:TX_MODE?		
CONF:DAB:ENSEMBLE:TX_MODE <val_1>	MODE_1 ~ MODE_4	
READ:DAB:ENSEMBLE:CH_TYPE?		
CONF:DAB:ENSEMBLE:CH_TYPE <val_1>	EUROPE, KOREA	
READ:DAB:ENSEMBLE:CHANNEL?		
CONF:DAB:ENSEMBLE:CHANNEL <val_1>		
READ:DAB:ENSEMBLE:ENSEMBLE_ID?		
CONF:DAB:ENSEMBLE:ENSEMBLE_ID <val_1>	0 ~ 0xFFFF	
READ:DAB:ENSEMBLE:ECC?		
CONF:DAB:ENSEMBLE:ECC <val_1>	0 ~ 255	
READ:DAB:ENSEMBLE:NORMAL_LABEL?		
CONF:DAB:ENSEMBLE:NORMAL_LABEL <val_1>	OFF, ON	
READ:DAB:ENSEMBLE:LABEL?	ASCII String	
CONF:DAB:ENSEMBLE:LABEL	Max16 characters	
READ:DAB:ENSEMBLE:LABEL_HEX?	Hexadecimal values	
CONF:DAB:ENSEMBLE:LABEL_HEX	Max 16 bytes hexadecimal values	
READ:DAB:ENSEMBLE:CHAR_FLAG?		
CONF:DAB:ENSEMBLE:CHAR_FLAG <val_1>	0x0 ~ 0xFF00	
READ:DAB:ENSEMBLE:CHAR_SET?		
CONF:DAB:ENSEMBLE:CHAR_SET <val_1>	EBU_LATIN, UCS_2, UTF_8	
READ:DAB:ENSEMBLE:EXTEND_LABEL?		
CONF:DAB:ENSEMBLE:EXTEND_LABEL <val_1>	OFF, ON	
READ:DAB:ENSEMBLE:E_LABEL?	ASCII String	
CONF:DAB:ENSEMBLE:E_LABEL	Max32 characters	
READ:DAB:ENSEMBLE:E_LABEL_HEX?	Hexadecimal values	
CONF:DAB:ENSEMBLE:E_LABEL_HEX	Max 32 bytes hexadecimal values	

READ:DAB:ENSEMBLE:E_CHAR_FLAG?		
CONF:DAB:ENSEMBLE:E_CHAR_FLAG <val_1>	0x0 ~ 0xFF00	
READ:DAB:ENSEMBLE:TEXT_CONTROL?		
CONF:DAB:ENSEMBLE:TEXT_CONTROL <val_1>	0x0 ~ 0xF	
READ:DAB:ENSEMBLE:ENCODING_FLAG?		
CONF:DAB:ENSEMBLE:ENCODING_FLAG <val_1>	UTF_8, UCS_2	
READ:DAB:ENSEMBLE:SERVICE? <val_1>	service number 0~14	
CONF:DAB:ENSEMBLE:SERVICE <val_1> <val_2>	service number 0~14	ON, OFF
READ:DAB:ENSEMBLE:PROTOCOL_VER?		
CONF:DAB:ENSEMBLE:PROTOCOL_VER <val_1>	V1x, V2x	

8.4.3 DAB SERVICE

Command	<val_1> Range	<val_2> Range
READ:DAB:SERVICE:SID? <val_1>	service number 0~14	
CONF:DAB:SERVICE:SID <val_1> <val_2>	service number 0~14	0 ~ 0xFFFF
READ:DAB:SERVICE:PROGRAM? <val_1>	service number 0~14	
CONF:DAB:SERVICE:PROGRAM <val_1> <val_2>	service number 0~14	Refer to appendix table
READ:DAB:SERVICE:NORMAL_LABEL? <val_1>	service number 0~14	
CONF:DAB:SERVICE:NORMAL_LABEL <val_1> <val_2>	service number 0~14	OFF, ON
READ:DAB:SERVICE:LABEL? <val_1>	service number 0~14	
CONF:DAB:SERVICE:LABEL <val_1><val_2>	service number 0~14	label 16 characters
READ:DAB:SERVICE:LABEL_HEX? <val_1>	service number 0~14	Hexadecimal values
CONF:DAB:SERVICE:LABEL_HEX <val_1>	service number 0~14	Max 16 bytes hexadecimal values
READ:DAB:SERVICE:CHAR_SET? <val_1>	service number 0~14	

CONF:DAB:SERVICE:CHAR_SET <val_1> <val_2>	service number 0~14	EBU_LATIN, UCS_2, UTF_8
READ:DAB:SERVICE:CHAR_FLAG? <val_1>	service number 0~14	
CONF:DAB:SERVICE:CHAR_FLAG <val_1> <val_2>	service number 0~14	0x0 ~ 0xFF00
READ:DAB:SERVICE:EXTEND_LABEL?	service number 0~14	
CONF:DAB:SERVICE:EXTEND_LABEL <val_1>	service number 0~14	OFF, ON
READ:DAB:SERVICE:E_LABEL? <val_1>	service number 0~14	
CONF:DAB:SERVICE:E_LABEL <val_1><val_2>	service number 0~14	label 32 characters
READ:DAB:SERVICE:E_LABEL_HEX? <val_1>	service number 0~14	Hexadecimal values
CONF:DAB:SERVICE:E_LABEL_HEX <val_1>	service number 0~14	Max 32 bytes hexadecimal values
READ:DAB:SERVICE:E_CHAR_FLAG? <val_1>	service number 0~14	
CONF:DAB:SERVICE:E_CHAR_FLAG <val_1> <val_2>	service number 0~14	0x0 ~ 0xFF00
READ:DAB:SERVICE:TEXT_CONTROL? <val_1>	service number 0~14	
CONF:DAB:SERVICE:TEXT_CONTROL <val_1> <val_2>	service number 0~14	0x0 ~ 0xF
READ:DAB:SERVICE:ENCODING_FLAG? <val_1>	service number 0~14	
CONF:DAB:SERVICE:ENCODING_FLAG <val_1> <val_2>	service number 0~14	UTF_8, UCS_2
READ:DAB:SERVICE:PRIMARY? <val_1>	service number 0~14	
CONF:DAB:SERVICE:PRIMARY <val_1> <val_2>	service number 0~14	COMPONENT_00 ~ COMPONENT_14
READ:DAB:SERVICE:SECONDARY_1? <val_1>	service number 0~14	
CONF:DAB:SERVICE:SECONDARY_1 <val_1> <val_2>	service number 0~14	COMPONENT_00 ~ COMPONENT_14
READ:DAB:SERVICE:SECONDARY_2? <val_1>	service number 0~14	
CONF:DAB:SERVICE:SECONDARY_2 <val_1> <val_2>	service number 0~14	COMPONENT_00 ~ COMPONENT_14
READ:DAB:SERVICE:SECONDARY_3? <val_1>	service number 0~14	
CONF:DAB:SERVICE:SECONDARY_3 <val_1> <val_2>	service number 0~14	COMPONENT_00 ~ COMPONENT_14

8.4.4 DAB COMPONENT

Command	<val_1> Range	<val_2> Range
READ:DAB:COMPONENT:MODE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:MODE <val_1> <val_2>	Component number 0~14	DAB, DMB, DAB+, BWS, TPEG, EWS
READ:DAB:COMPONENT:CONTENTS? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:CONTENTS <val_1> <val_2>	Component number 0~14	Name of Downloaded files
READ:DAB:COMPONENT:CONTENTS_TYPE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:CONTENTS_TYPE <val_1> <val_2>	Component number 0~14	EXTERNAL, FILE, 0000_0000, 1111_1111, 1010_1010, 1111_0000, ZERO_RS, ONE_RS
EXEC:DAB:COMPONENT:CONTENTS_RST <val_1>	Component number 0~14	
READ:DAB:COMPONENT:PRT_TYPE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:PRT_TYPE <val_1> <val_2>	Component number 0~14	UEP, EEP
READ:DAB:COMPONENT:UEP_LEVEL? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:UEP_LEVEL <val_1> <val_2>	Component number 0~14	1 ~ 5
READ:DAB:COMPONENT:UEP_BPS? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:UEP_BPS <val_1> <val_2>	Component number 0~14	8 ~ 384
READ:DAB:COMPONENT:EEP_LEVEL? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:EEP_LEVEL <val_1> <val_2>	Component number 0~14	1-A ~ 4-A, 1-B ~ 4-B
READ:DAB:COMPONENT:EEP_BPS? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:EEP_BPS <val_1> <val_2>	Component number 0~14	8 ~ 1072
READ:DAB:COMPONENT:PAD_TYPE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:PAD_TYPE <val_1> <val_2>	Component number 0~14	OFF, DLS, DL+, DRC
READ:DAB:COMPONENT:DLS? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DLS <val_1> <val_2>	Component number 0~14	String

READ:DAB:COMPONENT:DLS_HEX? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DLS_HEX <val_1> <val_2>	Component number 0~14	String in Hexadecimal format
READ:DAB:COMPONENT:DLS_HEADLINE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DLS_HEADLINE <val_1> <val_2>	Component number 0~14	String
READ:DAB:COMPONENT:DLS_HEADLINE_HEX? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DLS_HEADLINE_HEX <val_1> <val_2>	Component number 0~14	String
READ:DAB:COMPONENT:HEADLINE_MODE? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:HEADLINE_MODE <val_1> <val_2>	Component number 0~14	OFF, ON
READ:DAB:COMPONENT:DLS_SET? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DLS_SET <val_1> <val_2>	Component number 0~14	EBU_LATIN, UCS_2, UTF_8
READ:DAB:COMPONENT:DRC? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:DRC <val_1> <val_2>	Component number 0~14	0.00 ~ 15.75
READ:DAB:COMPONENT:NORMAL_LABEL? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:NORMAL_LABEL <val_1> <val_2>	Component number 0~14	OFF, ON
READ:DAB:COMPONENT:LABEL? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:LABEL <val_1> <val_2>	Component number 0~14	String
READ:DAB:COMPONENT:LABEL_HEX? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:LABEL_HEX <val_1> <val_2>	Component number 0~14	String in Hexadecimal format
READ:DAB:COMPONENT:CHAR_SET? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:CHAR_SET <val_1> <val_2>	Component number 0~14	EBU_LATIN, UCS_2, UTF_8
READ:DAB:COMPONENT:CHAR_FLAG? <val_1>	Component number 0~14	
CONF:DAB:COMPONENT:CHAR_FLAG <val_1> <val_2>	Component number 0~14	0x0 ~ 0xFF00
READ:DAB:COMPONENT:E_CHAR_FLAG? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:E_CHAR_FLAG <val_1> <val_2>	component number 0~14	0x0 ~ 0xFF00

READ:DAB:COMPONENT:E_LABEL? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:E_LABEL <val_1> <val_2>	component number 0~14	String
READ:DAB:COMPONENT:E_LABEL_HEX? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:E_LABEL_HEX <val_1> <val_2>	component number 0~14	String in Hexadecimal format
READ:DAB:COMPONENT:TEXT_CONTROL? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TEXT_CONTROL <val_1> <val_2>	component number 0~14	0x0 ~ 0xF
READ:DAB:COMPONENT:LANGUAGE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:LANGUAGE <val_1> <val_2>	component number 0~14	0 ~ 255
READ:DAB:COMPONENT:SUBCH_ID? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:SUBCH_ID <val_1> <val_2>	component number 0~14	0 ~ 63
READ:DAB:COMPONENT:ASCTY? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:ASCTY <val_1> <val_2>	component number 0~14	0 ~ 63
READ:DAB:COMPONENT:DSCTY? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:DSCTY <val_1> <val_2>	component number 0~14	0 ~ 63
READ:DAB:COMPONENT:FEC? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:FEC <val_1> <val_2>	component number 0~14	ON, OFF
READ:DAB:COMPONENT:DG? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:DG <val_1> <val_2>	component number 0~14	ON, OFF
READ:DAB:COMPONENT:APP_TYPE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:APP_TYPE <val_1> <val_2>	component number 0~14	0 ~ 2047
READ:DAB:COMPONENT:APP_DATA? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:APP_DATA <val_1> <val_2>	component number 0~14	0 ~ 255
READ:DAB:COMPONENT:CA_FLAG? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:CA_FLAG <val_1> <val_2>	component number 0~14	ON, OFF

READ:DAB:COMPONENT:TAG? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG <val_1> <val_2>	component number 0~14	OFF, ON
READ:DAB:COMPONENT:TAG0_TYPE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG0_TYPE <val_1> <val_2>	component number 0~14	DUMMY, ITEM_TITLE, …
READ:DAB:COMPONENT:TAG0_START? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG0_START <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG0_LENGTH? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG0_LENGTH <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG1_TYPE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG1_TYPE <val_1> <val_2>	component number 0~14	DUMMY, ITEM_TITLE, …
READ:DAB:COMPONENT:TAG1_START? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG1_START <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG1_LENGTH? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG1_LENGTH <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG2_TYPE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG2_TYPE <val_1> <val_2>	component number 0~14	DUMMY, ITEM_TITLE, …
READ:DAB:COMPONENT:TAG2_START? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG2_START <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG2_LENGTH? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG2_LENGTH <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:TAG3_TYPE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG3_TYPE <val_1> <val_2>	component number 0~14	DUMMY, ITEM_TITLE, …
READ:DAB:COMPONENT:TAG3_START? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG3_START <val_1> <val_2>	component number 0~14	0 ~ 127

READ:DAB:COMPONENT:TAG3_LENGTH? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TAG3_LENGTH <val_1> <val_2>	component number 0~14	0 ~ 127
READ:DAB:COMPONENT:XPAD_DATA_LEN? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:XPAD_DATA_LEN <val_1> <val_2>	component number 0~14	4, 6, 8, 12, 16, 24, 32, 48
READ:DAB:COMPONENT:TRANSPORT_ID? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:TRANSPORT_ID <val_1> <val_2>	component number 0~14	0 ~ 0xFFFF
READ:DAB:COMPONENT:PKT_ADR? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:PKT_ADR <val_1> <val_2>	component number 0~14	0 ~ 0x3FF
READ:DAB:COMPONENT:EPG_NUM? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:EPG_NUM <val_1> <val_2>	component number 0~14	1 ~ 3
READ:DAB:COMPONENT:EPG_ID? <val_1> <val_2>	component number 0~14	<val_2>:EPG index 0~2
CONF:DAB:COMPONENT:EPG_ID <val_1> <val_2> <val_3>	component number 0~14	<val_2>: EPG index 0~2 <val_3>: 0 ~ 0xFFFF
READ:DAB:COMPONENT:EPG_DURATION? <val_1> <val_2>	component number 0~14	<val_2>:EPG index 0~2
CONF:DAB:COMPONENT:EPG_DURATION <val_1> <val_2> <val_3>	component number 0~14	<val_2>: EPG index 0~2 <val_3>: 1 ~ 1000
READ:DAB:COMPONENT:EPG_HOUR? <val_1> <val_2>	component number 0~14	<val_2>:EPG index 0~2
CONF:DAB:COMPONENT:EPG_HOUR <val_1> <val_2> <val_3>	component number 0~14	<val_2>: EPG index 0~2 <val_3>: 0 ~ 23
READ:DAB:COMPONENT:EPG_MINUTE? <val_1> <val_2>	component number 0~14	<val_2>:EPG index 0~2
CONF:DAB:COMPONENT:EPG_MINUTE <val_1> <val_2> <val_3>	component number 0~14	<val_2>: EPG index 0~2 <val_3>: 0 ~ 59
READ:DAB:COMPONENT:DRC_VALUE? <val_1>	component number 0~14	
CONF:DAB:COMPONENT:DRC_VALUE <val_1> <val_2>	component number 0~14	0.00 ~ 15.75 (0.25dB step)

8.4.5 DAB FUNCTION

Command	<val_1> Range	<val_2> Range

READ:DAB:FUNCTION:TEST_ITEM?		
CONF:DAB:FUNCTION:TEST_ITEM <val_1>	RECONFIGURATION ANNOUNCEMENT ALTERNATIVE_FREQ TII TIME	
READ:DAB:FUNCTION:RC_MODE?		
CONF:DAB:FUNCTION:RC_MODE <val_1>	OFF, ON	
EXEC:DAB:FUNCTION:RC_EXECUTE		
READ:DAB:FUNCTION:AN_MODE?		
CONF:DAB:FUNCTION:AN_MODE <val_1>	TUNED_ENSEMBLE, OTHER_ENSEMBLE	
READ:DAB:FUNCTION:AN_NUM_OF_SVC?		
CONF:DAB:FUNCTION:AN_NUM_OF_SVC <val_1>	1~5	
READ:DAB:FUNCTION:AN_OE_EID? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_OE_EID <val_1> <val_2>	Announcement index 0~4	0 ~ 0xFFFF
READ:DAB:FUNCTION:AN_OE_SID? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_OE_SID <val_1> <val_2>	Announcement index 0~4	0 ~ 0xFFFF
READ:DAB:FUNCTION:AN_SUPPORT_ALARM? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_ALARM <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_TRAFFIC? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_TRAFFIC <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_TRAVEL? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_TRAVEL <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_WARNING? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_WARNING <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_NEWS? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_NEWS <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_WEATHER? <val_1>	Announcement index 0~4	

CONF:DAB:FUNCTION:AN_SUPPORT_WEATHER <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_EVENT? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_EVENT <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_SPECIAL? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_SPECIAL <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_RAD_INFO? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_RAD_INFO <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_SPORTS? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_SPORTS <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_SUPPORT_FINANCE? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SUPPORT_FINANCE <val_1> <val_2>	Announcement index 0~4	OFF, ON
READ:DAB:FUNCTION:AN_NUM_OF_SU_CLUSTER? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_NUM_OF_SU_CLUSTER <val_1> <val_2>	Announcement index 0~4	1 ~ 5
READ:DAB:FUNCTION:AN_SU_CLUSTER_ID? <val_1> <val_2>	Announcement index 0~4	Cluster index 0~4
CONF:DAB:FUNCTION:AN_SU_CLUSTER_ID <val_1> <val_2> <val_3>	Announcement index 0~4	<val 2>: Cluster index 0~4 <val 3> 0x01 ~ 0xFE
READ:DAB:FUNCTION:AN_TARGET_CH? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_TARGET_CH <val_1> <val_1>	Announcement index 0~4	COMPONENT_00 ~ COMPONENT_14
READ:DAB:FUNCTION:AN_SW_CLUSTER_ID? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SW_CLUSTER_ID <val_1> <val_1>	Announcement index 0~4	0x00 ~ 0xFF
READ:DAB:FUNCTION:AN_SOURCE_SRV? <val_1>	Announcement index 0~4	
CONF:DAB:FUNCTION:AN_SOURCE_SRV <val_1> <val_2>	Announcement index 0~4	SERVICE_00 ~ SERVICE_14
READ:DAB:FUNCTION:AN_SWITCH_TYPE? <val_1>	Cluster index 0~4	
CONF:DAB:FUNCTION:AN_SWITCH_TYPE <val_1> <val_2>	Cluster index 0~4	ALARM, TRAFFIC, TRAVEL, WARNING, NEWS, WEATHER, EVENT

		SPECIAL, RAD_INFO, SPORTS, FINANCE
READ:DAB:FUNCTION:AN_SUPPORT?		
CONF:DAB:FUNCTION:AN_SUPPORT <val_1>	OFF, ON	
READ:DAB:FUNCTION:AN_SWITCHING?		
CONF:DAB:FUNCTION:AN_SWITCHING <val_1>	OFF, ON	
READ:DAB:FUNCTION:AN_NUM_OF_SW_CLUSTER?		
CONF:DAB:FUNCTION:AN_NUM_OF_SW_CLUSTER <val_1>	1 ~ 5	
READ:DAB:FUNCTION:AF_DAB_TO_DAB:NUM?		
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:NUM <val_1>	0~10	
READ:DAB:FUNCTION:AF_DAB_TO_DAB:OTHER_EID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:OTHER_EID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFF
READ:DAB:FUNCTION:AF_DAB_TO_DAB:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.016 ~ 8388.529
READ:DAB:FUNCTION:AF_DAB_TO_DAB:CONTINUITY? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:CONTINUITY <val_1> <val_2>	AF index 0~14	OFF, ON
READ:DAB:FUNCTION:AF_DAB_TO_DAB:REGION_ID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:REGION_ID <val_1> <val_2>	AF index 0~14	0~2047
READ:DAB:FUNCTION:AF_DAB_TO_DAB:CEI? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_DAB_TO_DAB:CEI <val_1> <val_2>	AF index 0~14	LONG_TERM, SHORT_TERM
READ:DAB:FUNCTION:AF_SVC_TO_DAB:NUM?		
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:NUM <val_1>	0~10	
READ:DAB:FUNCTION:AF_SVC_TO_DAB:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_00 ~SERVICE_14
READ:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_SID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_SID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFFFF
READ:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_EID? <val_1>	AF index 0~14	

CONF:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_EID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFF
READ:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.016 ~ 8388.529
READ:DAB:FUNCTION:AF_SVC_TO_DAB:CONTINUITY? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:CONTINUITY <val_1> <val_2>	AF index 0~14	OFF, ON
READ:DAB:FUNCTION:AF_SVC_TO_DAB:REGION_ID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:REGION_ID <val_1> <val_2>	AF index 0~14	0~2047
READ:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_ECC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:OTHER_ECC <val_1> <val_2>	AF index 0~14	0 ~ 255
READ:DAB:FUNCTION:AF_SVC_TO_DAB:CEI? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:CEI <val_1> <val_2>	AF index 0~14	LONG_TERM, SHORT_TERM
READ:DAB:FUNCTION:AF_SVC_TO_DAB:LSN? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:LSN <val_1> <val_2>	AF index 0~14	1~4095
READ:DAB:FUNCTION:AF_SVC_TO_DAB:LA? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:LA <val_1> <val_2>	AF index 0~14	ACTIVE_LINK, FUTURE_LINK
READ:DAB:FUNCTION:AF_SVC_TO_DAB:S_H? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:S_H <val_1> <val_2>	AF index 0~14	HARD_LINK, SOFT_LINK
READ:DAB:FUNCTION:AF_SVC_TO_DAB:ILS? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DAB:ILS <val_1> <val_2>	AF index 0~14	NATIONAL, INTERNATIONAL
READ:DAB:FUNCTION:AF_SVC_TO_DRM:NUM?		
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:NUM <val_1>	0~10	
READ:DAB:FUNCTION:AF_SVC_TO_DRM:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_00 ~SERVICE_14
READ:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_SID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_SID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFF

READ:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.001 ~ 32.767
READ:DAB:FUNCTION:AF_SVC_TO_DRM:CONTINUITY? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:CONTINUITY <val_1> <val_2>	AF index 0~14	OFF, ON
READ:DAB:FUNCTION:AF_SVC_TO_DRM:REGION_ID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:REGION_ID <val_1> <val_2>	AF index 0~14	0~2047
READ:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_ECC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:OTHER_ECC <val_1> <val_2>	AF index 0~14	0 ~ 255
READ:DAB:FUNCTION:AF_SVC_TO_DRM:CEI? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:CEI <val_1> <val_2>	AF index 0~14	LONG_TERM, SHORT_TERM
READ:DAB:FUNCTION:AF_SVC_TO_DRM:LSN? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:LSN <val_1> <val_2>	AF index 0~14	1~4095
READ:DAB:FUNCTION:AF_SVC_TO_DRM:LA? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:LA <val_1> <val_2>	AF index 0~14	ACTIVE_LINK, FUTURE_LINK
READ:DAB:FUNCTION:AF_SVC_TO_DRM:S_H? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:S_H <val_1> <val_2>	AF index 0~14	HARD_LINK, SOFT_LINK
READ:DAB:FUNCTION:AF_SVC_TO_DRM:ILS? <val_1>	AF index 0~10	
CONF:DAB:FUNCTION:AF_SVC_TO_DRM:ILS <val_1> <val_2>	AF index 0~10	NATIONAL, INTERNATIONAL
READ:DAB:FUNCTION:AF_SVC_TO_RDS:NUM?		
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:NUM <val_1>	0~10	
READ:DAB:FUNCTION:AF_SVC_TO_RDS:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_00 ~SERVICE_14
READ:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_PID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_PID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFFFF
READ:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_FREQ? <val_1>	AF index 0~14	

CONF:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_FREQ <val_1> <val_2>	AF index 0~14	87.6 ~ 107.9
READ:DAB:FUNCTION:AF_SVC_TO_RDS:CONTINUITY? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:CONTINUITY <val_1> <val_2>	AF index 0~14	OFF, ON
READ:DAB:FUNCTION:AF_SVC_TO_RDS:REGION_ID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:REGION_ID <val_1> <val_2>	AF index 0~14	0~2047
READ:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_ECC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:OTHER_ECC <val_1> <val_2>	AF index 0~14	0 ~ 255
READ:DAB:FUNCTION:AF_SVC_TO_RDS:CEI? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:CEI <val_1> <val_2>	AF index 0~14	LONG_TERM, SHORT_TERM
READ:DAB:FUNCTION:AF_SVC_TO_RDS:LSN? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:LSN <val_1> <val_2>	AF index 0~14	1~4095
READ:DAB:FUNCTION:AF_SVC_TO_RDS:LA? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:LA <val_1> <val_2>	AF index 0~14	ACTIVE_LINK, FUTURE_LINK
READ:DAB:FUNCTION:AF_SVC_TO_RDS:S_H? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:S_H <val_1> <val_2>	AF index 0~14	HARD_LINK, SOFT_LINK
READ:DAB:FUNCTION:AF_SVC_TO_RDS:ILS? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_RDS:ILS <val_1> <val_2>	AF index 0~14	NATIONAL, INTERNATIONAL
READ:DAB:FUNCTION:AF_SVC_TO_AM:NUM?		
CONF:DAB:FUNCTION:AF_SVC_TO_AM:NUM <val_1>	0~10	
READ:DAB:FUNCTION:AF_SVC_TO_AM:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_AM:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_00 ~SERVICE_14
READ:DAB:FUNCTION:AF_SVC_TO_AM:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_AM:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.005 ~ 327.675
READ:DAB:FUNCTION:AF_SVC_TO_AM:CONTINUITY? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_AM:CONTINUITY <val_1> <val_2>	AF index 0~14	OFF, ON

READ:DAB:FUNCTION:AF_SVC_TO_AM:REGION_ID? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_AM:REGION_ID <val_1> <val_2>	AF index 0~14	0~2047
READ:DAB:FUNCTION:AF_SVC_TO_AM:CEI? <val_1>	AF index 0~14	
CONF:DAB:FUNCTION:AF_SVC_TO_AM:CEI <val_1> <val_2>	AF index 0~14	LONG_TERM, SHORT_TERM
READ:DAB:FUNCTION:SCI_MODE?		
CONF:DAB:FUNCTION:SCI_MODE <val_1>	OFF, ON	
READ:DAB:FUNCTION:SCI_SERVICE?		
CONF:DAB:FUNCTION:SCI_SERVICE <val_1>	SERVICE_00 ~SERVICE_14	
READ:DAB:FUNCTION:SCI_CHANGE_FLAG?		
CONF:DAB:FUNCTION:SCI_CHANGE_FLAG <val_1>	REMAIN, ADD, REMOVE, REMOVE_ALL	
READ:DAB:FUNCTION:SCI_PART_TIME_FLAG?		
CONF:DAB:FUNCTION:SCI_PART_TIME_FLAG <val_1>	24_HOURS, PART_TIME	
READ:DAB:FUNCTION:SCI_YEAR?		
CONF:DAB:FUNCTION:SCI_YEAR <val_1>	1900 ~ 2200	
READ:DAB:FUNCTION:SCI_MONTH?		
CONF:DAB:FUNCTION:SCI_MONTH <val_1>	1 ~ 12	
READ:DAB:FUNCTION:SCI_DAY?		
CONF:DAB:FUNCTION:SCI_DAY <val_1>	1 ~ 31	
READ:DAB:FUNCTION:SCI_HOUR?		
CONF:DAB:FUNCTION:SCI_HOUR <val_1>	0 ~ 23	
READ:DAB:FUNCTION:SCI_MINUTE?		
CONF:DAB:FUNCTION:SCI_MINUTE <val_1>	0 ~ 59	
READ:DAB:FUNCTION:SCI_SECOND?		
CONF:DAB:FUNCTION:SCI_SECOND <val_1>	0 ~ 59	
READ:DAB:FUNCTION:SCI_SID_FLAG?		
CONF:DAB:FUNCTION:SCI_SID_FLAG <val_1>	OFF, ON	
READ:DAB:FUNCTION:SCI_EID_FLAG?		
CONF:DAB:FUNCTION:SCI_EID_FLAG <val_1>	OFF, ON	
READ:DAB:FUNCTION:SCI_SID?		

CONF:DAB:FUNCTION:SCI_SID <val_1>	0~0xFFFF
READ:DAB:FUNCTION:SCI_EID?	
CONF:DAB:FUNCTION:SCI_EID <val_1>	0~0xFFFF
READ:DAB:FUNCTION:TII?	
CONF:DAB:FUNCTION:TII <val_1>	OFF, ON
READ:DAB:FUNCTION:TII_SUB_ID?	
CONF:DAB:FUNCTION:TII_SUB_ID <val_1>	0 ~ 23
READ:DAB:FUNCTION:TII_MAIN_ID?	
CONF:DAB:FUNCTION:TII_MAIN_ID <val_1>	0 ~ 69
READ:DAB:FUNCTION:TIME?	
CONF:DAB:FUNCTION:TIME <val_1>	OFF, ON
READ:DAB:FUNCTION:YEAR?	
CONF:DAB:FUNCTION:YEAR <val_1>	1900 ~ 2200
READ:DAB:FUNCTION:MONTH?	
CONF:DAB:FUNCTION:MONTH <val_1>	1 ~ 12
READ:DAB:FUNCTION:DAY?	
CONF:DAB:FUNCTION:DAY <val_1>	1 ~ 31
READ:DAB:FUNCTION:HOUR?	
CONF:DAB:FUNCTION:HOUR <val_1>	0 ~ 23
READ:DAB:FUNCTION:MINUTE?	
CONF:DAB:FUNCTION:MINUTE <val_1>	0 ~ 59
READ:DAB:FUNCTION:LTO?	
CONF:DAB:FUNCTION:LTO <val_1>	-24 ~ 24

8.4.6 DRM MULTIPLEX

Command	<val_1> Range	<val_2> Range
READ:DRM:MULTIPLEX:SERVICE? <val_1>	service number 0~3	

CONF:DRM:MULTIPLEX:SERVICE <val_1> <val_2>	service number 0~3	ON, OFF
READ:DRM:MULTIPLEX:PROTOCOL?		
CONF:DRM:MULTIPLEX:PROTOCOL	DRM30, DRM+	
READ:DRM:MULTIPLEX:ROBUSTNESS?		
CONF:DRM:MULTIPLEX:ROBUSTNESS	A, B, C, D, E	
READ:DRM:MULTIPLEX:SPECTRUM?		
CONF:DRM:MULTIPLEX:SPECTRUM <val_1>	4.5kHz, 5kHz, 9kHz, 10kHz, 18kHz, 20kHz	
READ:DRM:MULTIPLEX:INTERLEAVING?		
CONF:DRM:MULTIPLEX:INTERLEAVING <val_1>	LONG, SHORT	
READ:DRM:MULTIPLEX:MSC_MODE?		
CONF:DRM:MULTIPLEX:MSC_MODE <val_1>	64QAM, 64QAM_HIER_I, 64QAM_HIER_IQ, 16QAM	
READ:DRM:MULTIPLEX:SDC_MODE?		
CONF:DRM:MULTIPLEX:SDC_MODE <val_1>	16QAM, 4QAM	
READ:DRM:MULTIPLEX:PRT_LEVEL_A?		
CONF:DRM:MULTIPLEX:PRT_LEVEL_A <val_1>	0 ~ 3	
READ:DRM:MULTIPLEX:PRT_LEVEL_B?		
CONF:DRM:MULTIPLEX:PRT_LEVEL_B <val_1>	0 ~ 3	
READ:DRM:MULTIPLEX:PRT_LEVEL_HIER?		
CONF:DRM:MULTIPLEX:PRT_LEVEL_HIER <val_1>	0 ~ 3	

8.4.7 DRM SERVICE

Command	<val_1> Range	<val_2> Range
READ:DRM:SERVICE:SID? <val_1>	service number 0~3	
CONF:DRM:SERVICE:SID <val_1> <val_2>	service number 0~3	0x0 ~ 0xFFFFFF
READ:DRM:SERVICE:LABEL? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LABEL <val_1> <val_2>	service number 0~3	string

READ:DRM:SERVICE:LABEL_HEX? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LABEL_HEX <val_1> <val_2>	service number 0~3	String in hexadecimal format
READ:DRM:SERVICE:LANGUAGE? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LANGUAGE <val_1> <val_2>	service number 0~3	NO_SPECIFIED, ARABIC, BENGALI, CHINESE, DUTCH, ENGLISH, FRENCH, GERMAN, HINDI, JAPANESE, JAVANESE, KOREAN, PORTUGUESE, RUSSIAN, SPANISH, OTHER
READ:DRM:SERVICE:PRG_TYPE? <val_1>	service number 0~3	
CONF:DRM:SERVICE:PRG_TYPE <val_1> <val_2>	service number 0~3	Refer to appendix table
READ:DRM:SERVICE:LANGUAGE_CODE? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LANGUAGE_CODE <val_1> <val_2>	service number 0~3	string
READ:DRM:SERVICE:COUNTRY_CODE? <val_1>	service number 0~3	
CONF:DRM:SERVICE:COUNTRY_CODE <val_1> <val_2>	service number 0~3	string
READ:DRM:SERVICE:LINK_1? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LINK_1 <val_1> <val_2>	service number 0~3	STREAM_0 ~ 3
READ:DRM:SERVICE:LINK_2? <val_1>	service number 0~3	
CONF:DRM:SERVICE:LINK_2 <val_1> <val_2>	service number 0~3	STREAM_0 ~ 3
READ:DRM:SERVICE:DATA_CA? <val_1>	service number 0~3	
CONF:DRM:SERVICE:DATA_CA <val_1> <val_2>	service number 0~3	OFF, ON
READ:DRM:SERVICE:AUDIO_CA? <val_1>	service number 0~3	
CONF:DRM:SERVICE:AUDIO_CA <val_1> <val_2>	service number 0~3	OFF, ON
READ:DRM:SERVICE:BIDI_FLAG? <val_1>	service number 0~3	
CONF:DRM:SERVICE:BIDI_FLAG <val_1> <val_2>	service number 0~3	0, 1
READ:DRM:SERVICE:BASE_DIRECTION? <val_1>	service number 0~3	
CONF:DRM:SERVICE:BASE_DIRECTION <val_1> <val_2>	service number 0~3	0, 1

READ:DRM:SERVICE:CONTEXTUAL_FLAG? <val_1>	service number 0~3	
CONF:DRM:SERVICE:CONTEXTUAL_FLAG <val_1> <val_2>	service number 0~3	0, 1
READ:DRM:SERVICE:COMBINING_FLAG? <val_1>	service number 0~3	
CONF:DRM:SERVICE:COMBINING_FLAG <val_1> <val_2>	service number 0~3	0, 1

8.4.8 DRM STREAM

<val_1> Range	<val_2> Range	<val_1> Range
READ:DRM:STREAM:TYPE? <val_1>	stream number 0~3	
CONF:DRM:STREAM:TYPE <val_1> <val_2>	stream number 0~3	AUDIO, DATA_PRBS, DATA_PACKET
READ:DRM:STREAM:PART_A_LENGTH? <val_1>	stream number 0~3	
CONF:DRM:STREAM:PART_A_LENGTH <val_1> <val_2>	stream number 0~3	0 ~ 1200
READ:DRM:STREAM:PART_B_LENGTH? <val_1>	stream number 0~3	
CONF:DRM:STREAM:PART_B_LENGTH <val_1> <val_2>	stream number 0~3	0 ~ 1200
READ:DRM:STREAM:TEXT_FLAG? <val_1>	stream number 0~3	
CONF:DRM:STREAM:TEXT_FLAG <val_1> <val_2>	stream number 0~3	OFF, ON
READ:DRM:STREAM:TEXT? <val_1>	stream number 0~3	string
CONF:DRM:STREAM:TEXT <val_1>	stream number 0~3	string
READ:DRM:STREAM:TEXT_HEX? <val_1>	stream number 0~3	
CONF:DRM:STREAM:TEXT_HEX <val_1>	stream number 0~3	
READ:DRM:STREAM:CONTENTS? <val_1>	stream number 0~3	
CONF:DRM:STREAM:CONTENTS <val_1> <val_2>	stream number 0~3	Name of Downloaded files
READ:DRM:STREAM:CONTENTS_TYPE? <val_1>	stream number 0~3	
CONF:DRM:STREAM:CONTENTS_TYPE <val_1> <val_2>	stream number 0~3	EXTERNAL, FILE

EXEC:DRM:STREAM:CONTENTS_RST <val_1> <val_2>	stream number 0~3	Name of Downloaded files
READ:DRM:STREAM:HEADLINE? <val_1>	stream number 0~3	string
CONF:DRM:STREAM:HEADLINE <val_1> <val_2>	stream number 0~3	string
READ:DRM:STREAM:HEADLINE_MODE? <val_1>	stream number 0~3	
CONF:DRM:STREAM:HEADLINE_MODE <val_1> <val_2>	stream number 0~3	OFF, ON
READ:DRM:STREAM:HEADLINE_HEX? <val_1>	stream number 0~3	string
CONF:DRM:STREAM:HEADLINE_HEX <val_1> <val_2>	stream number 0~3	string
READ:DRM:STREAM:PATTERN? <val_1>	stream number 0~3	
CONF:DRM:STREAM:PATTERN <val_1> <val_2>	stream number 0~3	PRBS_SYNC, PRBS_ASYNC, 0000_0000, 1111_1111 1010_1010, 1111_0000
READ:DRM:STREAM:BIDI_FLAG? <val_1>	stream number 0~3	
CONF:DRM:STREAM:BIDI_FLAG <val_1> <val_2>	stream number 0~3	OFF, ON (or 0, 1)
READ:DRM:STREAM:BASE_DIRECTION? <val_1>	stream number 0~3	
CONF:DRM:STREAM:BASE_DIRECTION <val_1> <val_2>	stream number 0~3	LTR, RTL (or 0, 1)
READ:DRM:STREAM:CONTEXTUAL_FLAG? <val_1>	stream number 0~3	
CONF:DRM:STREAM:CONTEXTUAL_FLAG <val_1> <val_2>	stream number 0~3	OFF, ON (or 0, 1)
READ:DRM:STREAM:COMBINING_FLAG? <val_1>	stream number 0~3	
CONF:DRM:STREAM:COMBINING_FLAG <val_1> <val_2>	stream number 0~3	OFF, ON (or 0, 1)

8.4.9 DRM FUNCTION

Command	<val_1> Range	<val_2> Range
READ:DRM:FUNCTION:TEST_ITEM?		
CONF:DRM:FUNCTION:TEST_ITEM <val_1>	RECONFIGURATION ANNOUNCEMENT ALTERNATIVE_FREQ TIME	

	SEAMLESS_LINKING
READ:DRM:FUNCTION:RC_MODE?	
CONF:DRM:FUNCTION:RC_MODE <val_1>	OFF, ON
EXEC:DRM:FUNCTION:RC_EXECUTE	
READ:DRM:FUNCTION:AN_MODE?	
CONF:DRM:FUNCTION:AN_MODE <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SUPPORT_TRAVEL?	
CONF:DRM:FUNCTION:AN_SUPPORT_TRAVEL <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SUPPORT_NEWS?	
CONF:DRM:FUNCTION:AN_SUPPORT_NEWS <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SUPPORT_WEATHER?	
CONF:DRM:FUNCTION:AN_SUPPORT_WEATHER <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SUPPORT_WARNING?	
CONF:DRM:FUNCTION:AN_SUPPORT_WARNING <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SWITCH_TRAVEL?	
CONF:DRM:FUNCTION:AN_SWITCH_TRAVEL <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SWITCH_NEWS?	
CONF:DRM:FUNCTION:AN_SWITCH_NEWS <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SWITCH_WEATHER?	
CONF:DRM:FUNCTION:AN_SWITCH_WEATHER <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_SWITCH_WARNING?	
CONF:DRM:FUNCTION:AN_SWITCH_WARNING <val_1>	OFF, ON
READ:DRM:FUNCTION:AN_TARGET_SYSTEM?	
CONF:DRM:FUNCTION:AN_TARGET_SYSTEM <val_1>	SAME_DRM, OTHER_DRM, AM, FM_RDS, DAB
READ:DRM:FUNCTION:AN_SOURCE_SERVICE?	
CONF:DRM:FUNCTION:AN_SOURCE_SERVICE <val_1>	SERVICE_0 ~ SERVICE_3, ALL_SERVICE
READ:DRM:FUNCTION:AN_TARGET_SERVICE?	
CONF:DRM:FUNCTION:AN_TARGET_SERVICE <val_1>	SERVICE_0 ~ SERVICE_3
READ:DRM:FUNCTION:AF_REGION?	

CONF:DRM:FUNCTION:AF_REGION <val_1>	NO_RESTRICTION | RESTRICTION | RESTRICTION DETAIL
READ:DRM:FUNCTION:AF_LATITUDE?	
CONF:DRM:FUNCTION:AF_LATITUDE <val_1>	-90 ~ 90
READ:DRM:FUNCTION:AF_LATITUDE_EXT?	
CONF:DRM:FUNCTION:AF_LATITUDE_EXT <val_1>	1 ~ 90
READ:DRM:FUNCTION:AF_LONGITUDE?	
CONF:DRM:FUNCTION:AF_LONGITUDE <val_1>	-180 ~ 179
READ:DRM:FUNCTION:AF_LONGITUDE_EXT?	
CONF:DRM:FUNCTION:AF_LONGITUDE_EXT <val_1>	1 ~ 179
READ:DRM:FUNCTION:AF_SCHEDULE?	
CONF:DRM:FUNCTION:AF_SCHEDULE <val_1>	NO_RESTRICTION , RESTRICTION
READ:DRM:FUNCTION:AF_START_TIME?	
CONF:DRM:FUNCTION:AF_START_TIME <val_1>	0 ~ 1439
READ:DRM:FUNCTION:AF_DURATION?	
CONF:DRM:FUNCTION:AF_DURATION <val_1>	1 ~ 16383
READ:DRM:FUNCTION:AF_MONDAY?	
CONF:DRM:FUNCTION:AF_MONDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_TUESDAY?	
CONF:DRM:FUNCTION:AF_TUESDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_WEDNESDAY?	
CONF:DRM:FUNCTION:AF_WEDNESDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_THURSDAY?	
CONF:DRM:FUNCTION:AF_THURSDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_FRIDAY?	
CONF:DRM:FUNCTION:AF_FRIDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_SATURDAY?	
CONF:DRM:FUNCTION:AF_SATURDAY <val_1>	OFF, ON
READ:DRM:FUNCTION:AF_SUNDAY?	

CONF:DRM:FUNCTION:AF_SUNDAY <val_1>	OFF, ON	
READ:DRM:FUNCTION:TIME?		
CONF:DRM:FUNCTION:TIME <val_1>	OFF, ON	
READ:DRM:FUNCTION:YEAR?		
CONF:DRM:FUNCTION:YEAR <val_1>	1900 ~ 2200	
READ:DRM:FUNCTION:MONTH?		
CONF:DRM:FUNCTION:MONTH <val_1>	1 ~ 12	
READ:DRM:FUNCTION:DAY?		
CONF:DRM:FUNCTION:DAY <val_1>	1 ~ 31	
READ:DRM:FUNCTION:HOUR?		
CONF:DRM:FUNCTION:HOUR <val_1>	0 ~ 23	
READ:DRM:FUNCTION:MINUTE?		
CONF:DRM:FUNCTION:MINUTE <val_1>	0 ~ 59	
READ:DRM:FUNCTION:LTO?		
CONF:DRM:FUNCTION:LTO <val_1>	-24 ~ 24	
READ:DRM:FUNCTION:AF_DRM_TO_DRM:NUM?		
CONF:DRM:FUNCTION:AF_DRM_TO_DRM:NUM <val_1>	0~10	
READ:DRM:FUNCTION:AF_DRM_TO_DRM:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_DRM_TO_DRM:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.001 ~ 32.767
READ:DRM:FUNCTION:AF_DRM_TO_DRM:SYNC_MUX? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_DRM_TO_DRM:SYNC_MUX <val_1> <val_2>	AF index 0~14	NO, YES
READ:DRM:FUNCTION:AF_SVC_TO_DRM:NUM?		
CONF:DRM:FUNCTION:AF_SVC_TO_DRM:NUM <val_1>	0~14	
READ:DRM:FUNCTION:AF_SVC_TO_DRM:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DRM:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_0 ~ SERVICE_3
READ:DRM:FUNCTION:AF_SVC_TO_DRM:OTHER_SID? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DRM:OTHER_SID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFF

READ:DRM:FUNCTION:AF_SVC_TO_DRM:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DRM:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.001 ~ 32.767
READ:DRM:FUNCTION:AF_SVC_TO_DRM:SAME_SERVICE? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DRM:SAME_SERVICE <val_1> <val_2>	AF index 0~14	NO, YES
READ:DRM:FUNCTION:AF_SVC_TO_RDS:NUM?		
CONF:DRM:FUNCTION:AF_SVC_TO_RDS:NUM <val_1>	0~14	
READ:DRM:FUNCTION:AF_SVC_TO_RDS:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_RDS:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_0 ~ SERVICE_3
READ:DRM:FUNCTION:AF_SVC_TO_RDS:OTHER_SID? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_RDS:OTHER_SID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFF
READ:DRM:FUNCTION:AF_SVC_TO_RDS:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_RDS:OTHER_FREQ <val_1> <val_2>	AF index 0~14	87.5 ~ 107.9
READ:DRM:FUNCTION:AF_SVC_TO_RDS:SAME_SERVICE? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_RDS:SAME_SERVICE <val_1> <val_2>	AF index 0~14	NO, YES
READ:DRM:FUNCTION:AF_SVC_TO_DAB:NUM?		
CONF:DRM:FUNCTION:AF_SVC_TO_DAB:NUM <val_1>	0~14	
READ:DRM:FUNCTION:AF_SVC_TO_DAB:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DAB:TUNED_SVC <val_1> <val_2>	AF index 0~14	SERVICE_0 ~ SERVICE_
READ:DRM:FUNCTION:AF_SVC_TO_DAB:OTHER_SID? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DAB:OTHER_SID <val_1> <val_2>	AF index 0~14	0x0 ~ 0xFFFFFF
READ:DRM:FUNCTION:AF_SVC_TO_DAB:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_DAB:OTHER_FREQ <val_1> <val_2>	AF index 0~14	Channel Table (5A ~ 13F)
READ:DRM:FUNCTION:AF_SVC_TO_DAB:SAME_SERVICE? <val_1>	AF index 0~14	

CONF:DRM:FUNCTION:AF_SVC_TO_DAB:SAME_SERVICE <val_1> <val_2>	AF index 0~14	NO, YES
READ:DRM:FUNCTION:AF_SVC_TO_AM:NUM?		
CONF:DRM:FUNCTION:AF_SVC_TO_AM:NUM <val_1>	0~14	
READ:DRM:FUNCTION:AF_SVC_TO_AM:TUNED_SVC? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_AM:TUNED_SVC <val_1> <val_2	AF index 0~14	SERVICE_0 ~ SERVICE_3
READ:DRM:FUNCTION:AF_SVC_TO_AM:OTHER_FREQ? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_AM:OTHER_FREQ <val_1> <val_2>	AF index 0~14	0.15 ~ 30.0
READ:DRM:FUNCTION:AF_SVC_TO_AM:SAME_SERVICE? <val_1>	AF index 0~14	
CONF:DRM:FUNCTION:AF_SVC_TO_AM:SAME_SERVICE <val_1> <val_2>	AF index 0~14	NO, YES

8.4.10 ETI SETUP

Command	<val_1> Range	<val_2> Range
READ:ETI:CONFIG:MODE?		
CONF:ETI:CONFIG:MODE <val_1>	ETI, MDI, DRM_IQ	
READ:ETI:CONFIG:CONTENTS?		
CONF:ETI:CONFIG:CONTENTS <val_1>	Name of Downloaded files	
CONF:ETI:CONFIG:CONTENTS_TYPE <val_1>	EXTERNAL,FILE	
READ:ETI:CONFIG:IQ_FS?		
CONF:ETI:CONFIG:IQ_FS <val_1>	48, 192, 250	
READ:ETI:CONFIG:CONTENTS_TYPE?		
EXEC:ETI:CONFIG:CONTENTS_RST		
READ:ETI:CONFIG:IQ_SWAP?		
CONF:ETI:CONFIG:IQ_SWAP <val_1>	OFF, ON	
READ:ETI:CONFIG:IQ_POLARITY?		
CONF:ETI:CONFIG:IQ_POLARITY <val_1>	POSITIVE, NEGATIVE	

READ:ETI:CONFIG:AF_CRC_CHECK?	
CONF:ETI:CONFIG:AF_CRC_CHECK <val_1>	OFF, ON

8.4.11 ANALOG FM

Command	<val_1> Range	<val_2> Range
READ:ANALOG:FM:CHANNEL? <val_1>	channel number 0~2	
CONF:ANALOG:FM:CHANNEL <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:FM:FM_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:FM:FM_MODE <val_1> <val_2>	channel number 0~2	MONO, STEREO, WAVE, SWEEP
READ:ANALOG:FM:FREQUENCY? <val_1>	channel number 0~2	
CONF:ANALOG:FM:FREQUENCY <val_1> <val_2>	channel number 0~2	MHz 87.0 ~ 108.0
READ:ANALOG:FM:AUDIO_FREQ? <val_1>	channel number 0~2	
CONF:ANALOG:FM:AUDIO_FREQ <val_1> <val_2>	channel number 0~2	kHz 0 ~ 10.000
READ:ANALOG:FM:FM_DEVIATION? <val_1>	channel number 0~2	
CONF:ANALOG:FM:FM_DEVIATION <val_1> <val_2>	channel number 0~2	0 ~ 75
READ:ANALOG:FM:STEREO_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:FM:STEREO_MODE <val_1> <val_2>	channel number 0~2	LEFT_AND_RIGHT, LEFT_ONLY, RIGHT_ONLY
READ:ANALOG:FM:AUDIO_FREQ_R? <val_1>	channel number 0~2	
CONF:ANALOG:FM:AUDIO_FREQ_R <val_1> <val_2>	channel number 0~2	kHz 0 ~ 10.000
READ:ANALOG:FM:AUDIO_FREQ_L? <val_1>	channel number 0~2	
CONF:ANALOG:FM:AUDIO_FREQ_L <val_1> <val_2>	channel number 0~2	kHz 0 ~ 10.000
READ:ANALOG:FM:CONTENTS_TYPE? <val_1>	channel number 0~2	
CONF:ANALOG:FM:CONTENTS_TYPE <val_1> <val_2>	channel number 0~2	EXTERNAL,FILE

EXEC:ANALOG:FM:CONTENTS_RST <val_1>	channel number 0~2	
READ:ANALOG:FM:CONTENTS? <val_1>	channel number 0~2	
CONF:ANALOG:FM:CONTENTS <val_1> <val_2>	channel number 0~2	Name of Downloaded files
READ:ANALOG:FM:SWEEP_START? <val_1>	channel number 0~2	
CONF:ANALOG:FM:SWEEP_START <val_1> <val_2>	channel number 0~2	kHz 0 ~ 10.000
READ:ANALOG:FM:SWEEP_STOP? <val_1>	channel number 0~2	
CONF:ANALOG:FM:SWEEP_STOP <val_1> <val_2>	channel number 0~2	kHz 0 ~ 10.000
READ:ANALOG:FM:SWEEP_TIME? <val_1>	channel number 0~2	
CONF:ANALOG:FM:SWEEP_TIME <val_1> <val_2>	channel number 0~2	ms 20 ~ 10000
READ:ANALOG:FM:PILOT_LEVEL? <val_1>	channel number 0~2	
CONF:ANALOG:FM:PILOT_LEVEL <val_1> <val_2>	channel number 0~2	% 0 ~ 15.00
READ:ANALOG:FM:PRE_EMPHASIS? <val_1>	channel number 0~2	
CONF:ANALOG:FM:PRE_EMPHASIS <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:FM:TIME_CONSTANT? <val_1>	channel number 0~2	
CONF:ANALOG:FM:TIME_CONSTANT <val_1> <val_2>	channel number 0~2	25, 50, 75
READ:ANALOG:FM:AUDIO_VOLUME? <val_1>	channel number 0~2	
CONF:ANALOG:FM:AUDIO_VOLUME <val_1> <val_2>	channel number 0~2	0 ~ 100

8.4.12 ANALOG RDS

Command	<val_1> Range	<val_2> Range
READ:ANALOG:RDS:RDS_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RDS_MODE <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:PID? <val_1>	channel number 0~2	

CONF:ANALOG:RDS:PID <val_1> <val_2>	channel number 0~2	0x1 ~0xFFFF
READ:ANALOG:RDS:REF? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:REF <val_1> <val_2>	channel number 0~2	1 ~ 255
READ:ANALOG:RDS:COUNTRY? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:COUNTRY <val_1> <val_2>	channel number 0~2	1 ~ 15
READ:ANALOG:RDS:ECC? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:ECC <val_1> <val_2>	channel number 0~2	0 ~ 0xFF
READ:ANALOG:RDS:AREA_CODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AREA_CODE <val_1> <val_2>	channel number 0~2	LOCAL, INTERNATIONAL, NATIONAL, SUPRA-REGIONAL, REGIONAL_01 ~ REGIONAL_12
READ:ANALOG:RDS:PS_NAME? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PS_NAME <val_1> <val_2>	channel number 0~2	string
READ:ANALOG:RDS:PS_NAME_HEX? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PS_NAME_HEX <val_1> <val_2>	channel number 0~2	String in HEX format
READ:ANALOG:RDS:MUSIC_SPEECH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:MUSIC_SPEECH <val_1> <val_2>	channel number 0~2	MUSIC, SPEECH
READ:ANALOG:RDS:RADIO_TEXT? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT <val_1> <val_2>	channel number 0~2	String
READ:ANALOG:RDS:RADIO_TEXT_HEX? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT_HEX <val_1> <val_2>	channel number 0~2	String in HEX format
READ:ANALOG:RDS:RADIO_TEXT_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT_MODE <val_1> <val_2>	channel number 0~2	OFF,RT,RT+,eRT,eRT+
READ:ANALOG:RDS:RADIO_TEXT_HEADLINE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT_HEADLINE <val_1> <val_2>	channel number 0~2	String in HEX format

READ:ANALOG:RDS:RADIO_TEXT_HEADLINE_HEX? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT_HEADLINE_HEX <val_1> <val_2>	channel number 0~2	String in HEX format
READ:ANALOG:RDS:HEADLINE_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:HEADLINE_MODE <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:TEXT_DIRECTION? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TEXT_DIRECTION<val_1> <val_2>	channel number 0~2	LTR, RTL
READ:ANALOG:RDS:RADIO_TEXT_CH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:RADIO_TEXT_CH <val_1> <val_2>	channel number 0~2	2A, 2B
READ:ANALOG:RDS:TAG0_TYPE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG0_TYPE <val_1> <val_2>	channel number 0~2	DUMMY, ITEM_TITLE, …
READ:ANALOG:RDS:TAG0_START? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG0_START <val_1> <val_2>	channel number 0~2	0 ~ 63
READ:ANALOG:RDS:TAG0_LENGTH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG0_LENGTH <val_1> <val_2>	channel number 0~2	0 ~ 63
READ:ANALOG:RDS:TAG1_TYPE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG1_TYPE <val_1> <val_2>	channel number 0~2	DUMMY, ITEM_TITLE, …
READ:ANALOG:RDS:TAG1_START? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG1_START <val_1> <val_2>	channel number 0~2	0 ~ 63
READ:ANALOG:RDS:TAG1_LENGTH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TAG1_LENGTH <val_1> <val_2>	channel number 0~2	0 ~ 63
READ:ANALOG:RDS:PRG_TYPE_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PRG_TYPE_MODE <val_1> <val_2>	channel number 0~2	RDS, RBDS
READ:ANALOG:RDS:PRG_TYPE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PRG_TYPE <val_1> <val_2>	channel number 0~2	NO_TYPE, NEWS, …
READ:ANALOG:RDS:PRG_TYPE_NAME? <val_1>	channel number	

	0~2	
CONF:ANALOG:RDS:PRG_TYPE_NAME <val_1> <val_2>	channel number 0~2	string
READ:ANALOG:RDS:PIN_DAY? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PIN_DAY <val_1> <val_2>	channel number 0~2	1 ~ 31
READ:ANALOG:RDS:PIN_HOUR? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PIN_HOUR <val_1> <val_2>	channel number 0~2	0 ~ 23
READ:ANALOG:RDS:PIN_MINUTE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:PIN_MINUTE <val_1> <val_2>	channel number 0~2	0 ~ 59
READ:ANALOG:RDS:AF_MODE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_MODE <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:ENCODING_FLAG? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:ENCODING_FLAG <val_1> <val_2>	channel number 0~2	UTF_8, UTF_16
READ:ANALOG:RDS:EON_PTY? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_PTY <val_1> <val_2>	channel number 0~2	NO_TYPE, NEWS, ... (0 ~ 31)
READ:ANALOG:RDS:AF_METHOD? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_METHOD <val_1> <val_2>	channel number 0~2	A, B
READ:ANALOG:RDS:AF_NUM? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_NUM <val_1> <val_2>	channel number 0~2	0 ~ 24
READ:ANALOG:RDS:AF_NUM_VARIANT? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_NUM_VARIANT <val_1> <val_2>	channel number 0~2	0 ~ 12
READ:ANALOG:RDS:AF_01? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_01 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_02? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_02 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_03? <val_1>	channel number 0~2	

CONF:ANALOG:RDS:AF_03 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_04? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_04 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_05? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_05 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_06? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_06 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_07? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_07 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_08? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_08 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_09? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_09 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:AF_10? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:AF_10 <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:TP? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TP <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:TA? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TA <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:TMC? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:TMC_LOCATION? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_LOCATION <val_1> <val_2>	channel number 0~2	0 ~ 65535
READ:ANALOG:RDS:TMC_EVENT? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_EVENT <val_1> <val_2>	channel number	0 ~ 2047

	0~2	
READ:ANALOG:RDS:TMC_EXTENT? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_EXTENT <val_1> <val_2>	channel number 0~2	0 ~ 7
READ:ANALOG:RDS:TMC_LTN? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_LTN <val_1> <val_2>	channel number 0~2	0 ~ 63
READ:ANALOG:RDS:TMC_DIVERSION? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_DIVERSION <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:TMC_DIRECTION? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_DIRECTION <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:TMC_MSG_I? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_MSG_I <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:TMC_MSG_N? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_MSG_N <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:TMC_MSG_R? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_MSG_R <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:TMC_MSG_U? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TMC_MSG_U <val_1> <val_2>	channel number 0~2	0, 1
READ:ANALOG:RDS:EON? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:EON_CH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_CH <val_1> <val_2>	channel number 0~2	FM_RDS_0, FM_RDS_1, FM_RDS_2
READ:ANALOG:RDS:EON_PS_NAME? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_PS_NAME <val_1> <val_2>	channel number 0~2	string
READ:ANALOG:RDS:EON_PS_NAME_HEX? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_PS_NAME_HEX <val_1> <val_2>	channel number 0~2	String in hexadecimal format

READ:ANALOG:RDS:EON_AF? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_AF <val_1> <val_2>	channel number 0~2	87.6 ~ 107.9
READ:ANALOG:RDS:EON_SWITCH? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:EON_SWITCH <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:LANGUAGE? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:LANGUAGE <val_1> <val_2>	channel number 0~2	0 ~ 0xFF
READ:ANALOG:RDS:TIME? <val_1>	channel number 0~2	
CONF:ANALOG:RDS:TIME <val_1> <val_2>	channel number 0~2	OFF, ON
READ:ANALOG:RDS:YEAR?		
CONF:ANALOG:RDS:YEAR <val_1>	1900 ~ 2200	
READ:ANALOG:RDS:MONTH?		
CONF:ANALOG:RDS:MONTH <val_1>	1 ~ 12	
READ:ANALOG:RDS:DAY?		
CONF:ANALOG:RDS:DAY <val_1>	1 ~ 31	
READ:ANALOG:RDS:HOUR?		
CONF:ANALOG:RDS:HOUR <val_1>	0 ~ 23	
READ:ANALOG:RDS:MINUTE?		
CONF:ANALOG:RDS:MINUTE <val_1>	0 ~ 59	

8.4.13 ANALOG AM

Command	<val_1> Range	<val_2> Range
READ:ANALOG:AM:MODE?		
CONF:ANALOG:AM:MODE <val_1>		MONO, WAVE, SWEEP
READ:ANALOG:AM:AUDIO_FREQ?		

CONF:ANALOG:AM:AUDIO_FREQ <val_1>		0 ~ 10
READ:ANALOG:AM:AM_INDEX?		
CONF:ANALOG:AM:AM_INDEX <val_1>		0 ~ 100
READ:ANALOG:AM:CONTENTS_TYPE?		
CONF:ANALOG:AM:CONTENTS_TYPE <val_1>		EXTERNAL,FILE
EXEC:ANALOG:AM:CONTENTS_RST		
READ:ANALOG:AM:CONTENTS?		
CONF:ANALOG:AM:CONTENTS <val_1>	Name of Downloaded files	
READ:ANALOG:AM:SWEEP_START?		
CONF:ANALOG:AM:SWEEP_START <val_1>	0 ~ 10	
READ:ANALOG:AM:SWEEP_STOP?		
CONF:ANALOG:AM:SWEEP_STOP <val_1>	0 ~ 10	
READ:ANALOG:AM:SWEEP_TIME?		
CONF:ANALOG:AM:SWEEP_TIME <val_1>	20 ~ 10000	

8.4.14 SETUP SYSTEM

Command	<val_1> Range	<val_2> Range
READ:SETUP:SYSTEM:IQOUT_I_DC?		
CONF:SETUP:SYSTEM:IQOUT_I_DC <val_1>	-3000 ~ 3000	
READ:SETUP:SYSTEM:IQOUT_Q_DC?		
CONF:SETUP:SYSTEM:IQOUT_Q_DC <val_1>	-3000 ~ 3000	
READ:SETUP:SYSTEM:IQOUT_BALANCE?		
CONF:SETUP:SYSTEM:IQOUT_BALANCE <val_1>	-3000 ~ 3000	
READ:SETUP:SYSTEM:IQOUT_PHASE?		
CONF:SETUP:SYSTEM:IQOUT_PHASE <val_1>	-90 ~ 90	

READ:SETUP:SYSTEM:IQOUT_MAG?	
CONF:SETUP:SYSTEM:IQOUT_MAG <val_1>	0 ~ 200

Appendices

1. Language Table
2. Regional Frequency Table
3. Country Id
4. Character set

1. Language Table

Following table shows language information used for DAB/DMB.

[European languages]

Language	Code(hex)		Language	Code(hex)
Unknown/not applicable	00		Luxembourg	19
Albanian	01		Lithuanian	1A
Breton	02		Hungarian	1B
Catalan	03		Maltese	1C
Croatian	04		Dutch	1D
Welsh	05		Norwegian	1E
Czech	06		Occitan	1F
Danish	07		Polish	20
German	08		Portuguese	21
English	09		Romanian	22
Spanish	0A		Romansh	23
Esperanto	0B		Serbian	24
Estonian	0C		Slovak	25
Basque	0D		Slovene	26
Faroese	0E		Finnish	27
French	0F		Swedish	28
Frisian	10		Turkish	29
Irish	11		Flemish	2A
Gaelic	12		Walloon	2B
Galician	13		*rfu*	2C
Icelandic	14		*rfu*	2D
Italian	15		*rfu*	2E
Lappish	16		*rfu*	2F
Latin	17		Reserved for national assignment	30-3F
Latvian	18			

[Other language]

Language	Code (hex)		Language	Code (hex)
Amharic	7F		Marathi	5F
Arabic	7E		Ndebele	5E

Armenian	7D		Nepali	5D
Assamese	7C		Oriya	5C
Azerbaijani	7B		Papiamento	5B
Bambora	7A		Persian	5A
Belarusian	79		Punjabi	59
Bengali	78		Pushtu	58
Bulgarian	77		Quechua	57
Burmese	76		Russian	56
Chinese	75		Ruthenian	55
Churash	74		Serbo-Croatian	54
Dari	73		Shona	53
Fulani	72		Sinhalese	52
Georgian	71		Somali	51
Greek	70		Sranan Tongo	50
Gujarati	6F		Swahili	4F
Guarani	6E		Tadzhik	4E
Hausa	6D		Tamil	4D
Hebrew	6C		Tatar	4C
Hindi	6B		Telugu	4B
Indonesian	6A		Thai	4A
Japanese	69		Ukrainian	49
Kannada	68		Urdu	48
Kazakh	67		Uzbek	47
Khmer	66		Vietnamese	46
Korean	65		Zulu	45
Laotian	64		*ruf*	44
Macedonian	63		*ruf*	43
Malagasy	62		*ruf*	42
Malaysian	61		*ruf*	41
Moldavian	60		Background sound/clean feed	40

2. Regional Frequency Table

1) BAND-III

EU Band - III (MHz)	
5A	174.928
5B	176.640
5C	178.352
5D	180.064
6A	181.936
6B	183.648
6C	185.360
6D	187.072
7A	188.928
7B	190.640
7C	192.352
7D	194.064
8A	195.936
8B	197.648
8C	199.360
8D	201.072
9A	202.928
9B	204.640
9C	206.352
9D	208.064
10A	209.936
10N	210.096
10B	211.648
10C	213.360
10D	215.072
10	210.096
11A	216.928
11B	218.640
11C	220.352
11D	222.064
11	217.088
12A	223.936
12B	225.648
12C	227.360
12D	229.072
12	224.096
13A	230.784
13B	232.496

Korea Band - III (MHz)	
ROK 7A	175.280
ROK 7B	177.008
ROK 7C	178.736
ROK 8A	181.280
ROK 8B	183.008
ROK 8C	184.736
ROK 9A	187.280
ROK 9B	189.008
ROK 9C	190.736
ROK 10A	193.280
ROK 10B	195.008
ROK 10C	196.736
ROK 11A	199.280
ROK 11B	201.008
ROK 11C	202.736
ROK 12A	205.280
ROK 12B	207.008
ROK 12C	208.736
ROK 13A	211.280
ROK 13B	213.008
ROK 13C	214.736

China Band - III (MHz)	
CN 6A	168.160
CN 6B	169.872
CN 6C	171.584
CN 6D	173.296
CN 6N	175.008
CN 7A	176.720
CN 7B	178.432
CN 7C	180.144
CN 7D	181.856
CN 8A	184.160
CN 8B	185.872
CN 8C	187.584
CN 8D	189.296
CN 8N	191.008
CN 9A	192.720
CN 9B	194.432
CN 9C	196.144
CN 9D	197.856
CN 10A	200.160
CN 10B	201.872
CN 10C	203.584
CN 10D	205.296
CN 10N	207.008
CN 11A	208.720
CN 11B	210.432
CN 11C	212.144
CN 11D	213.856
CN 12A	216.432
CN 12B	218.144
CN 12C	219.856
CN 12D	221.568

13C	234.208
13D	235.776
13E	237.488
13F	239.200

2) Band L

Canada L - Band (MHz)	
L1	1452.816
L2	1454.560
L3	1456.304
L4	1458.048
L5	1459.729
L6	1461.536
L7	1463.280
L8	1465.024
L9	1466.768
L10	1468.512
L11	1470.256
L12	1472.000
L13	1473.744
L14	1475.488
L15	1477.232
L16	1478.976
L17	1480.720
L18	1482.464
L19	1484.280
L20	1485.952
L21	1487.696
L22	1489.440
L23	1491.184

L-Band(T-DAB) (MHz)	
LA	1452.960
LB	1454.672
LC	1456.384
LD	1458.096
LE	1459.808
LF	1461.520
LG	1463.232
LH	1464.944
LI	1466.656
LJ	1468.368
LK	1470.080
LL	1471.792
LN	1473.504
LM	1475.216
LO	1476.928
LP	1478.640
L-Band (S-DAB)	
LQ	148.352
LR	1482.064
LS	1483.776
LT	1485.488
LU	1487.200
LV	1488.912
LW	1490.624

3. Country Id

1) ITU Region 1 (European broadcasting area)

Country	ITU code	ECC	Country Id		Country	ITU code	ECC	Country Id
Albania	ALB	E0	9		Lebanon	LBN	E3	A
Algeria	ALG	E0	2		Libya	LBY	E1	D
Andorra	AND	E0	3		Liechtenstein	LIE	E2	9
Austria	AUT	E0	A		Lithuania (ex USSR)	LTU	E2	C
Azores (Portugal)	AZR	E0	8		Luxembourg	LUX	E1	7
Belgium	BEL	E0	6		Macedonia	mkd	E4	3
Belarus (ex USSR)	BLR	E3	F		Madeira	MDR	E2	8
Bosnia i Hercegovina	bih	E4	F		Malta	MLT	E0	C
Bulgaria	BUL	E1	8		Marocco	MRC	E2	1
Canaries (Spain)	CNR	E0	E		Moldova	MDA	E4	1
Croatia	HRV	E3	C		Monaco	MCO	E2	B
Cyprus	CYP	E1	2		Montenegro	men	E3	1
Czech Republic	czr	E2	2		Netherlands	HOL	E3	8
Denmark	DNK	E1	9		Norway	NOR	E2	F
Egypt	EGY	E0	F		Poland	POL	E2	3
Estonia (ex USSR)	EST	E4	2		Portugal	POR	E4	8
Faroe (Denmark)	DNK	E1	9		Roumania	ROU	E1	E
Finland	FNL	E1	6		Russian Federation	RUS	E0	7
France	F	E1	F		San Marino	SM	E1	3
Germany	D	E0	D		Serbia	srb	E2	D
		E0	1		Slovenia	SVN	E4	9
Gibraltar (UK)	GIB	E1	A		Slovak Republic	slr	E2	5
Greece	GRC	E1	1		Spain	E	E2	E
Hungary	HNG	E0	B		Sweden	S	E3	E
Iceland	ISL	E2	A		Switzerland	SUI	E1	4
Iraq	IRQ	E1	B		Syria	SYR	E2	6
Ireland	IRL	E3	2		Tunisia	TUN	E2	7
Israel	ISR	E0	4		Turkey	TUR	E3	3
Italy	I	E0	5		Ukraine	UKR	E4	6
Jordan	JOR	E1	5		United Kingdom	G	E1	C
Latvia (ex USSR)	LVA	E3	9		Vatican	CVA	E2	4

2) ITU Region 1 (African broadcasting area)

Country	ITU code	ECC	Country Id		Country	ITU code	ECC	Country Id
Ascension island	ASC	D1	A		Mauritius	MAU	D3	A
Angola	AGL	D0	6		Madagascar	MDG	D0	4
Algeria	ALG	E0	2		Malawi	MWI	D0	F
Burundi	BDI	D1	9		Mali	MLI	D0	5
Benin	BEN	D0	E		Marocco	MRC	E2	1
Burkina Faso	BFA	D0	B		Mauritania	MIN	D1	4
Botswana	BOT	D1	B		Mozambique	MOZ	D2	3
Cabinda	cba	D3	4		Niger	NGR	D2	8
Cameroon	CME	D0	1		Nigeria	NIG	D1	F
Canary Islands	CNR	E0	E		Namibia	NMB	D1	1
Central African Republic	CAF	D0	2		Rwanda	RRW	D3	5
Chad	TCD	D2	9		Sao Tome & Principe	STP	D1	5
Congo	COG	D0	C		Seychelles	SEY	D3	8
Comoros	COM	D1	C		Senegal	SEN	D1	7
Cape Verde	CPV	D1	6		Sierra Leone	SRI	D2	1
Côte d'ivoire	CTI	D2	C		Somalia	SOM	D2	7
Djibouti	DJI	D0	3		South Africa	AFS	D0	A
Egypt	EGY	EO	F		Sudan	SDN	D3	C
Ethiopia	ETH	D1	E		Swaziland	SWZ	D2	5
Gabon	GAB	D0	8		Togo	TGO	D0	D
Ghana	GHA	D1	3		Tunisia	TUN	E2	7
Gambia	GMB	D1	8		Tanzania	TZA	D1	D

Guinea-Bissau	GNB	D2	A		Uganda	UGA	D2	4
Equatorial Guinea	GNE	D0	7		Western Sahara	AOE	D3	3
Republic of Guinea	GUI	D0	9		Zaire	ZAI	D2	B
Kenya	KEN	D2	6		Zambia	ZMB	D2	E
Liberia	LBR	D1	2		Zanzibar	ZAN	D2	D
Libya	LBY	E1	D		Zimbabwe	ZWE	D2	2
Lesotho	LSO	D3	6					

3) ITU Region 1 (Former Soviet Union area)

Country	ITU code	ECC	Country Id		Country	ITU code	ECC	Country Id
Armenia	ARM	E4	A		LIthuania	LTU	E2	C
Azerbaijan	AZE	E3	B		Moldova	MDA	E4	1
Belarus	BLR	E3	F		Russian Federation	RUS	E0	7
Estonia	EST	E4	2		Tajikistan	TJK	E3	5
Georgia	GEO	E4	C		Turkmenistan	TKM	E4	E
Kazakhstan	KAZ	E3	D		Ukraine	UKR	E4	6
Kyrgyzstan	KGZ	E4	3		Uzbekistan	UZB	E4	B
Latvia	LVA	E3	9					

4) ITU Region 2 (North and South Americas)

Country	ITU code	ECC	Country Id		Country	ITU code	ECC	Country Id
Anguilla	AIA	A2	1		Guyana	GUY	A3	F
Antigua & Barbuda	ATG	A2	2		Haiti	HTI	A4	D

Argentina	ARG	A2	A		Honduras	HND	A4	2
Aruba	ABW	A4	3		Jamaica	JMC	A3	3
Bahamas	BAH	A2	F		Martinique	MRT	A3	4
Barbados	BRB	A2	5		Mexico	MEX	A4	F
Belize	BLZ	A2	6		Montserrat	MSR	A4	5
Bermuda	BER	A2	C		Netherlands Antilles	ATN	A2	D
Bolivia	BOL	A3	1		Nicaragua	NCG	A3	7
Brazil	B	A2	B		Panama	PNR	A3	9
Canada	CAN	A1	C		Paraguay	PRG	A3	6
Cayman Islands	CYM	A2	7		Peru	PRU	A4	7
Chile	CHL	A3	C		Puerto Rico	PTR	A3	8
Colombia	CLM	A3	2		St. KItts	SCN	A4	A
Costa Rica	CTR	A2	8		St. Lucia	LCA	A4	B
Cuba	CUB	A2	9		St. Pierre & Michelon	SPM	A6	F
Dominica	DMA	A3	A		St. Vincent	VCT	A5	C
Dominican Republic	DOM	A3	B		Surinam	SUR	A4	8
Ecuador	EQA	A2	3		Trinidad & Tobago	TRD	A4	6
EL Salvador	SLV	A4	C		Turks & Caicos islands	TCA	A3	E
Falkland Islands	FLK	A2	4		United States of America	USA	A0	1..9, A, B, D, E
Greenland	GRL	A1	F		Uruguay	URG	A4	9
Grenada	GRD	A3	D		Venezuela	VEN	A4	E
Guadeloupe	GDL	A2	E		Virgin islands (British)	VRG	A5	F
Guatemala	GTM	A4	1		Virgin islands (USA)	VIR	A5	F

5) ITU Region 3 (Asia and Pacific)

Country	ITU code	ECC	Country Id		Country	ITU code	ECC	Country Id
Afghanistan	AFG	F0	A		Korea(South)	KOR	F1	E
Saudi Arabia	ARS	F0	9		Korea(North)	KRE	F0	D
Australia:					Kuwait	KWT	F2	1
Capital Territory	act	F0	1		Laos	LAO	F3	1
New South Wales	ans	F0	2		Macau	MAC	F2	6
Victoria	avi	F0	3		Malaysia	MLA	F0	F
Queensland	aqu	F0	4		Maldives	MLD	F2	B
South Australia	asa	F0	5		Micronesia	mic	F3	E
Western Australia	awa	F0	6		Mongolia	MNG	F3	F
Tasmania	ata	F0	7		Nepal	NPL	F2	E
Northern Territory	ant	F0	8		Nauru	NRU	F1	7
Bangladesh	BGD	F1	3		New Zealand	NZL	F1	9
Bahrain	BHR	F0	E		Oman	OMA	F1	6
Myanmar (Burma)	BRM	F0	B		Pakistan	PAK	F1	4
Brunei Darussalam	BRU	F1	B		Philippines	PHL	F2	8
Bhutan	BTN	F1	2		Papua New Guinea	PNG	F3	9
Cambodia	CBG	F2	3		Qatar	QAT	F2	2
China	CHN	F0	C		Solomon Island	SLM	F1	A
Sri Lanka	CLN	F1	C		Western Samoa	SMO	F2	4
Fiji	FJI	F1	5		Singapore	SNG	F2	A
Hong Kong	HKG	F1	F		Taiwan	twn	F1	D
India	IND	F2	5		Thailand	THA	F3	2

Indonesia	INS	F 2	C		Tonga	TON	F3	3
Iran	IRN	F 0	8		United Arab Emirates	UAE	F2	D
Iraq	IRQ	E 1	B		Vietnam	VTN	F2	7
Japan	J	F 2	9		Vanuatu	VUT	F2	F
Kiribati	KIR	F 1	1		Yemen	YEM	F3	B

4. Character set

0 : complete EBU Latin based repertoire
1 : EBU Latin based common core, Cyrillic, Greek
2 : EBU Latin based core, Arabic, Hebrew, Cyrillic and Greek
3 : ISO Latin Alphabet No 2
15 : ISO 10646-1 using UTF-8 transformation format

The remaining codes are reserved for future definition .