Dual Receiver Measurement Application Note

Products:

- R&S[®]EMC32
- R&S®EMC32-K27

This application note shows all necessary settings for performing Dual Receiver Measurement using the R&S $^{\circ}$ EMC32-K27 option via R&S $^{\circ}$ EMC32

Measurement Software.

Note:

Please find the most up-to-date version of this document on our homepage https://www.rohde-schwarz.com/appnote/1SP20



Table of Contents

| 1 | Overview | 3 |
|---|---|--|
| 2 | Introduction | 4 |
| 3 | Test Configuration | 5 |
| 3.1 | Instrumentation | 6 |
| 3.2 | Naming Convention for DRM devices | 8 |
| 3.3 | Special Configuration for DRM devices | 9 |
| 3.4 | Hardware Setup | 11 |
| 3.5 | DRM Mode | 12 |
| 3.6 | Instrument placement in DRM Mode | 13 |
| 4 | Test Template Configurations | 14 |
| | | |
| 4.1 | EMI Scan & Sweep Test Templates | 14 |
| 4.1 4.1.1 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template | 14 15 |
| 4.1 4.1.1 4.2 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template EMI Auto Test Template | 14 15 18 |
| 4.1.1 4.1.1 4.2 4.2.1 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template EMI Auto Test Template EMI Auto Test for DRM | 14 15 18 19 |
| 4.1 4.1.1 4.2 4.2.1 5 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template EMI Auto Test Template EMI Auto Test for DRM Interactive Measurement for DRM | 14 15 18 19 20 |
| 4.1.1 4.2.1 4.2.1 5 5.1 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template EMI Auto Test Template EMI Auto Test for DRM Interactive Measurement for DRM Interactive Measurement: Accessories movement control | 14 15 18 19 20 21 |
| 4.1 4.1.1 4.2 4.2.1 5 5.1 6 | EMI Scan & Sweep Test Templates Important parameter configuration for EMI Scan & Sweep Test Template EMI Auto Test Template EMI Auto Test for DRM Interactive Measurement for DRM Interactive Measurement: Accessories movement control Appendix | 14 15 18 19 20 21 22 |

1 Overview

This document describes the functionalities for R&S[®]EMC32-K27 option in R&S[®]EMC32 platform that have to be done to support the Dual Receiver Measurement.

The R&S[®]EMC32 software offers the following applications:

- Provide control for instruments (RF antenna, antenna mast, turntable, spectrum analyzer, network analyzer, EMI receiver)
- Perform reference level testing of system and measurement protocol as recommended by test standard
- Perform EUT Test and Measurement automatically
- Evaluate and display real-time value of the measurement
- Generate report

The R&S[®]EMC32-K27 option requires R&S[®]EMC32-EB Main Option (EMI Scan & Sweep Templates) and R&S[®]EMC32-K10 option (EMI Auto Test).

The following abbreviation are use in the following text:

- R&S[®]EMC32 software is referred to as EMC32
- R&S[®]EMC32-EB software option is referred to as EMC32-EB
- R&S[®]EMC32-K10 software option is referred to as EMC32-K10
- R&S[®]EMC32-K27 software option is referred to as EMC32-K27
- Dual Receiver Measurement is referred to as DRM
- Equipment under test is referred to as EUT
- Radio frequency is referred to as RF
- Electromagnetic interference is referred to as EMI
- Electromagnetic susceptibility is referred to as EMS
- Rohde & Schwarz GmbH & Co. KG is referred to as R&S®

2 Introduction

DRM setup in the chamber includes both horizontal and vertical antenna polarization mounted on individual masts, with respective EMI receivers connected and EUT on the turntable. EMI Auto Test measurement is then used to control both antennas simultaneously, thus reducing measurement time. EMC32 software is used.

Refer to the general block diagram below on the setup for DRM system.





The system above consists of the following:

- Two EMI receivers or spectrum analyzers of the same model for receiving signal from respective antennas
- Two Antennas for receiving signal at respective antenna masts
- I Two Antenna Masts for height movement of respective antennas
- I Turntable for respective antennas to receive the signal 360° from DUT

3 Test Configuration

Before performing DRM measurements in EMC32, setup the test configuration as described in the following sections:

- Instrumentation
- Naming Convention for DRM devices
- Special Configuration for DRM devices
- Hardware Setup
- DRM Mode
- Instrument placement in DRM Mode

3.1 Instrumentation

Refer to EMC32 "Online Help" by pressing "F1". In Online Help, select the **Index** tab, search for "Device list" to show a detailed description on setting up the instruments.

| ontents Index Search Glossary | Device list |
|---|---|
| pe in the keyword to find: | |
| evice list Generic | If some device is required for a measurement, it needs to be registered in EMC32. For this purpose a file EMC32. DeviceList is created in the folder \Execute\Configuration. This file is written in a text format and contains all information for the used devices. In each EMC32 installation this file exists only once. It describes all components of the system hardware. |
| OSP PSU RSU SCIU | In order to facilitate the generation of this device list, EMC32 is delivered with a Configuration Wizard assisting in the creation of a simple device list. As a second possibility, a device list editor is incorporated in EMC32 which allows modification of the device list. |
| TS-RSP evice Class Transducers evice Class Turntables | The device list editor is invoked through the main menu function Extras >> Device List |
| Adding a new device Defining the properties of a device Displaying devices in the device list Find not referenced devices Modifying the layout of the device list Removing a device Search references to a device | [Picture] The main elements of the device list editor is the device overview on the left side, containing the devices sorted by device classes, and the list of configured devices on the right side, containing all registered devices. |
| Special dependencies Why does it take so long to cancel the d | See also: |
| evice status How to set a device status to physical | Displaying devices in the device list |
| May I start a measurement with virtual de | Modifying the layout of the device list |
| evices | Registering a device |
| Driver Installer Tool Existing device drivers | Removing registered devices |
| New device drivers | Defining the properties of a device |
| igital I/O | Find and remove not referenced devices |
| Mem-PIO NI-DIO | Grand Bath administration |
| NI-USB6009 | |

EMC32 supports a wide range of receiver & spectrum analyzer models, antenna, antenna mast controller, and turntable controller.

In DRM, the following seven devices are required:

- 2x Antennas Device of any Antenna type,
- 2x Antenna Towers Device of any Mast type,
- 2x Receivers or Spectrum Analyzer Device of any receiver / spectrum analyzer type but **both have to be the same model** and
- Turntables Device of any Turntable type.

| Device List | | | | | | × |
|---|--|---|---|--|--|--|
| Devices: | Configured Devices: | | | 1 | × | <u>₩</u> <u></u> B |
| Amplifiers Antennas Antennas Antennar overs Antenar overs | Name Antenna_H Antenna_V SU 40_H SU 40_V Generic Turntable ESU 8_H ESU 26 V Generic Mast2_H Generic Mast2_V ODS1200 Positioner CMaturo NCD Turntable Maturo NCD Turntable SU 26_H | Device Antennas Antennas Receivers TumTables Receivers AntennaTowers AntennaTowers TumTables TumTables TumTables Receivers | Type Antenna Antenna ESU 40 ESU 40 Generic Tur ESU 8 ESU 26 Generic Mast DST200 Po Maturo NCD ESU 26 | Interface None GPIB0 GPIB0 LAN GPIB0 LAN LAN COM1 GPIB0 GPIB0 GPIB0 | Addr/SN 20 21 172.25 21 20 172.25 9 7 22 | State . Virtual Virtu |
| OK Cancel | , | | | | | |

Fig. 3-2: Device list dialog box

3.2 Naming Convention for DRM devices

It is recommend to practice following while configuring DRM in EMC32 as to have clarity on the actual device been physical.

- ► Antenna name the antenna with fixed polarization to be configured as that polarization. As show in Fig. 4-2 in green box.
- Antenna Towers Name the antenna tower with fixed polarization that to be mount with the antenna of that polarization. As show in Fig. 4-2 in blue box
- EMI Receiver / Spectrum Analyzer Name the Receiver or Spectrum Analyzer with fixed polarization that been connected to the antenna of that polarization. As show in Fig. 4-2 in orange box.

3.3 Special Configuration for DRM devices

While setting up following instruments, in DRM, those parameters will affect the measurement result accuracy. Therefore, need to configure the parameter accurately and correctly.

Antenna Tower -

Specify the offset value when actual position of the antenna is not at the starting position (0 deg) of the turntable.

| Horizontal Polarization | | | N | DTE: |
|---------------------------|-----|-----|-----------------------------------|---|
| Min. Height 🛛 | 98 | cm | Please define the anten | na as an additional device |
| Max. Height | 410 | cm | of type ' The antenna tower ca | 'Antenna''. n then be selected in this |
| Vertical Polarization | | | antenna | s properties. |
| Min. Height 🛛 | 98 | cm | | |
| Max. Height | 410 | cm | Remote Control Capat | pilities |
| Tolerance | 3.0 | cm | | |
| Add Tolerance to Limits 🕟 | 7 | | Polarization | E Bead Only |
| Min. Speed | 1 | | V Height | E Bead Only |
| Max. Speed | 8 | | Je Hogh | 1_ mode only |
| Angle Offset | 0 | deg | | |
| | | | | |

Fig. 3-3: Antenna Towers dialog box

Antenna: -

Select polarization according to naming convention of that antenna. **Only a polarization to be select.**

Assign the antenna tower according to naming convention that tie to that antenna polarization.

| Tower Movements | |
|--|--|
| | Tower Device |
| it in the second s | C No Tower |
| ng Height 155 cm | C Manual Tower (Position Notification) |
| ontal 🗖 Vertical | |
| | Use an Automatic Tower Device |
| evice for Tower Positioning | Generic Mast_H 📃 |
| Antenna Change | Use Generic Tripod for Polarization |
| | |
| | |
| | |
| evice for Tower Positioning special Positioning Device Antenna Change | Generic Mast_H |

Fig. 3-4: Antenna dialog box

3.4 Hardware Setup

Refer to EMC32 "Online Help" by pressing "F1". In Online Help, select the **Index** tab, search for "Hardware Setup" to show a detailed description on setting up the hardware.

| P HTML Help | |
|--|--|
| 1 (가 다) | |
| Hide Back Forward Print Contents Index Search Glossary Type in the keyword to find: Hardware Setup Hardware setup ettor Hardware setup ettor EMI hardware setup EMS hardware setup KNSA Peverberation Chamber System Check Hardware Markares Hardware Markares Kite Calibration Data Field Probe Monitoring Clamp Informati Input protection Input protect | Hardware Setup Once an EMC32 installation contains a complete <u>device list</u> , and before building test templates, it must be defined how the devices registered in the device list shall be combined to perform EMC measurements. For example, an EMS system designed to perform both radiated and conducted measurements may typically contain one signal generator, but at least two RF amplifiers. It must be defined which amplifier is to be used for which type of measurement. Moreover, if an RF switch unit is available which will automatically switch the generator's output to one of the amplifiers' input, it must also be defined which relays shall be set to which state for which type of measurement. Moreover, if an RF switch unit is available which will automatically switch the generator's output to one of the amplifiers' input, it must also be defined which relays shall be set to which state for which type of measurement. Moreover, if an RF switch unit is available which will automatically switch the generator's output to one of the amplifiers' input, it must also be defined which relays shall be set to which state for which type of measurement. Moreover, if an RF switch unit is available which will also be defined which relays shall be set to which state for which type of measurement. All these informations can not be supplied in the Device List, as there only single devices are defined. In a Test Template such informations are also out of place, as this kind of file is meant to contain information about how to use a subsystem during a test, but not which devices make up this subsystem. As a general principle, there will be more than one Test Template referring to the same hardware, but using it with different set s of parameters. As a consequence, some intermediate setup information must exist between the pure listing of devices in the Device List and a Test Template. This intermediate link is provided by the Hardware Setup File. Hardware Setups are defined in a special purpose editor and |
| ISO11452 LAN Language Line Impedance and Stabilization Network live data reduction LTE Carter Aggregation OTA Tests Macro Main Settings Public Variables Working with the Macro Editor | see also: Hardware setup editor |

Fig. 3-5: Online help for hardware setup

Hardware setup can be configure for splitting into different frequency subranges to suit different antennas, and receiver & spectrum analyzer models. It is recommend to splitting into different frequency subranges according to the antenna frequency ranges.

A typical DRM system setup consist of two receive antennas, antenna towers, receivers and a turntable (see chapter 2. "Introductions" on page 4).

3.5 DRM Mode

Switch the mode to DRM by check on "Dual Receiver Meas." from "Select the View(s)"

Fig. 3-6: DRM mode in hardware setup

Move the mouse cursor to the receiver icon and right click on the mouse and a range of receivers for selection. (Devices must be added in device list in order to appear here) Than repeat the steps for another receiver.

Fig. 3-7: Input device (receiver) in detail

3.6 Instrument placement in DRM Mode

While setting up the hardware, do input the accurate device to respective space provide in the hardware setup as for the software to register the device to be use in this hardware setup. As DRM measurement makes use of both polarizations, **the bottom devices icon MUST be input with vertical polarization devices.**

| Hardware Setup - [EMI radiated\Hardware Setu 30 MHz - 1 GHz] | p(1)] [EMI radiated] (*) | × |
|--|--|---|
| EuT | Antenna_H Genetin Mast H ESR 7_HAntenna ESR 7_H | Add Subrange Modify Freqs Delete Subrange Select the View(s): ✓ Normal System Check ✓ NSA ✓ Dual Receiver Meas. ✓ Mobile Phone Test |
| | Antenna_V Generic Mast_V | ОК |

Fig. 3-8: Bottom devices MUST be Vertical polarization device

4 Test Template Configurations

Before performing DRM measurements in EMC32, setup the test template configuration as described in the following sections:

- EMI Scan & Sweep Test Template
- Important parameter configuration for EMI Scan & Sweep Test Template
- EMI Auto Test Template
- EMI Auto Test for DRM

4.1 EMI Scan & Sweep Test Templates

Refer to EMC32 "Online Help" by pressing "F1". In Online Help, select the **Index** tab, search for "EMI Scan/Sweep editor" to show a detailed description on setting up the EMI Scan & Sweep test template.

Fig. 4-1: Online help for EMI Scan & Sweep test template

The purpose of scan & sweep test for DRM is to capture interference emitted from EUT and check whether scan / sweep results fulfil the CISPR standard requirement. Those not fulfilling, will be captured in result table for further processing.

4.1.1 Important parameter configuration for EMI Scan & Sweep Test Template

This section describes parameters that need to be set in order to perform DRM.

4.1.1.1 Detector Tab: Selection of Detector

Select the required detector for the test/measurement in this Scan & Sweep test template.

| Scan Setup - [DRM_30M-1GHz_fi | n] [EMI radiated] (*) | | | × |
|---|-------------------------|-----------------|---------|---------------------------|
| General Setting Detector Gra | phics Report Option | ns | | |
| 1st Detector 2nd Detec MaxPeak ▼ Average | stor 3rd Detecto | or 4th Detector | Y | I ClearWrite I MaxHold |
| No Subrange | Receiver | Detectors | IF BW | Comment |
| | Douise Setti | | Actions | |
| riequency | Device Settin | igs | Actions | Delete Subrence |
| Start Frequency 30 | MHz | 🔽 MaxPeak | | |
| Stop Frequency 1 | GHz | ✓ Average | | Accept Subrange |
| | | Γ | | |
| Comment | | | | ок |
| | | | | Cancel |

Fig. 4-2: Detector Tab in detail

MaxHold must be check if continuous turntable is used.

4.1.1.2 Device Settings Tab: Configure the device

Click on the device icon and a dialog box will appear for input by user or according to standard. This device configuration will tied with the frequency test range.

In DRM, this device configuration will be duplicate to the other EMI receiver of the other polarization.

| Scan Setup - [DRM_30M-1GHz_fi | n] [EMI radiated] (*) | | | × |
|---|--------------------------|--------------|---------|--|
| General Setting Detector Gra | phics Report Options | 1 | | |
| 1st Detector 2nd Detec MaxPeak 💽 Average | tor 3rd Detector | 4th Detector | ¥ | I✓ ClearWrite I✓ MaxHold |
| No Subrange | Receiver | Detectors | IF BW | Comment |
| | | | | |
| Frequency | Device Setting | s | Actions | |
| Antenna_V | ESR 3-Antenna_V | ESR | 3_V | Delete Subrange Accept Subrange OK |
| | | | | Cancel |

Fig. 4-3: Device Setting Tab in detail

Input all the parameter in this dialog box as per user requirements or as stated in the standard, exclude 'General' tab. Except for 'Input/Repetition' tab on the Repetition section, must click on the 'Single' button.

| ESR 3_V - ESR 3 - Receivers | Number Tree | × |
|--|--|---|
| General Input / Repetition Time | / Bandwidth Gain / Attenuation Demod. / T.G. | |
| Input Selection | 1 DC | |
| Ext. Mixer: Frequency Band | <n\a></n\a> | |
| Ext. Mixer: Auto ID Threshold | 0.0 <n\a></n\a> | |
| Repetition Single User defined Continuously | 1 | |
| OK Cancel | | |

Fig. 4-4: Input / Repetition Tab in detail

If user wishes to have a longer sweeping time, the configuration files of this receiver need to be configured. Please refer to appendix.

4.2 EMI Auto Test Template

Refer to EMC32 "Online Help" by pressing "F1". In Online Help, select the **Index** tab, search for "EMC32-K10" than enter and select "EMI editor for automatic tests" to show a detailed description on setting up the EMI Auto test template.

| S EMC32 Online Help | | ж |
|---|---|---|
| 11 (구 라) Hide Back Forward Print | | |
| Contents Index Search Glossary | ЕМС32-К10 | ſ |
| Type in the keyword to find: EMC32-K10 EMI Auto Test Template Editor | | |
| EMC32-K10 The EMI Auto Test Editor is only available when EMC32-K10 is installed. Further for Radiated Spurio EMC32-K10 EMI Auto Test allows The EMI Auto Test Editor is only available when EMC32-K10 is installed. Further for Radiated Spurio use Chamber Measurements EMC32-K2, for parts of MIL-STD 461E/F EMC32-K56 and for Reverberation | | |
| Topics Found | The <u>EMI Auto(matic) Test</u> enables to run certain measurement tasks as a fully automatic sequence automatic sequence always consists of preview measurements, surements, final measurements and reporting. | |
| Click a topic, then click Display | Illowing types of measurements: | |
| Title Local EMC32 Extensions for TS8997 WMS EMC32-K10A in connection with EMC32. WMS | tion interference: | |
| EML editor for automatic tests EMC Meaurements for EN300328 / EN 301.8 WMS | 32 EMI-Editor for automatic tests e. I ISN (multi-line systems) | |
| | SN (single phase current systems) | |
| | SN (three phase current systems) | |
| J. | damp (single line) | |
| | Display Cancel I clamp, optionally with slidebar | |
| | plamp according to MIL-STD 461 C | |
| ODBC Connection | Current with current clamp according to MIL-STD 461 D/E/F | |
| Report Setup Connection Test Plan | Voltage /Current according to EN 55025 (2008) Automotive (2008 edition of the standard !) | |
| Test Requirement TestLab Plus EMC32-K84 | System Check with direct or with coupled injection of the signal (requires <u>EMC32-K56</u>) | |
| dotx Templates Field Text Commands Single Text Report to Word | Measurement of radiated interference: | |
| Summary Report Editor Dialog + | Electric field strength on an open area test site (OATS) with antenna tower and EuT turntable | |
| Display | Electric field strength with S-LINE cell (including OATS correlation) | |
| | Electric field strength with GTEM cell (including OATS correlation) | |

Fig. 4-6: Online help for creating a new EMI Auto test

This template is used for measuring interference emitted from EUT in 360 degree, different polarization and height position to determine which point or position that emit the worst interference thru sequence process. DRM is to help reduce such process time by simultaneously measure two polarization at the beginning of sequence process than continue to find the worst interference emitted.

4.2.1 EMI Auto Test for DRM

This section shows the GUI for DRM in V10.xx onwards.

Click on **Click** to start measurement once it complete loading into measurement mode

Fig. 4-7: Measurement mode in detail

Click to exit measurement mode once the measurement had ended.

5 Interactive Measurement for DRM

Interactive Measurement functionalities can refer to the application note as the link provided below:

https://www.rohde-schwarz.com/sg/applications/interactive-emi-measurements-with-r-s-emc32-k24-application-note_56280-64768.html

The Interactive Measurement for DRM is abit different for the accessories movement control as described in the following sections:

Interactive Measurement: Accessories movement control

5.1 Interactive Measurement: Accessories movement control

Moving accessories to different position for obtain different result. First, select the accessories that want to be move from Accessories window on left side.

Accessories been selected can be identify with orange on the accessory's button and accessory's name will appear in Interactive Device Control window.

Fig. 5-1: Accessories & Interactive Device Control windows

From Interactive Device Control window, the selected accessory can be move according to user preference.

This feature still executable during measuring.

6 Appendix

6.1 Receiver configuration file for longer sweeping time

Amend the values of this parameter (FastBound) in the configuration file of that receiver been use in the hardware setup.

Fig. 6-1: Receiver Configuration file

Open the file as Notepad so it is editable. Than search for the "Fastbound" parameter and change to a recommended values (30).

| [Constants] | |
|---------------------|-----|
| FastBound= | 0.5 |
| SCANNUMRESUITSMAX= | 160 |
| BlupOffsetScan_s= | 0 |
| BlupOffsetFast_s= | 0 |
| BlupOffsetQpScan_s= | 0 |
| BlupOffsetOpFast_s= | 0 |
| TmoScanPrep_s= | 0 |

Fig. 6-2: "FastBound" parameter

With the values 30, it approximate 29s sweep time.

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