# 3D Evaluation for EMI Auto Test with R&S©EMC32-K23 EMC32 Application Note

#### **Products:**

- | R&S®EMC32-EB
- | R&S®EMC32-K10
- | R&S®EMC32-K23

The option R&S®EMC32-K23 extends the emission measurement of the EMI Auto Test (R&S®EMC32-K10) with 3D measurement capabilities. This extension is useful to display the 3D radiation pattern of each frequency. This Application Notes shows all necessary settings for 3D measurement.

Application Note EMC32-K23 - 1SP08\_0e



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EMI Auto Test 3D Graphical

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## 1 Introduction

This application note gives an introduction to the 3D evaluation with the extension R&S®EMC32-K23 for R&S®EMC32-EB EMI section with R&S®EMC32-K10 EMI Auto Test.

The purpose of the 3D graphics component in EMC32 is to provide a means of displaying the data acquired over a full cylinder in an intuitive way as designers are used to.



## Principle of search for worst case setting

Figure 1: Measurement Setup

Key features are the possibility to rotate and zoom the view by simple mouse movements. A wide range of display of functions for modifying and scaling the display according to the user's preferences and needs.

This option for the EMC32-K10 EMI Auto Test sequence provides additional functions for the graphical presentation of the radiated emission measurement results. This additional graph will be created in 3D which can be configured as follow.

3D measurement can be performed for two types of measurements

- **1.** Open-Area-Test-Site (level vs. azimuth vs. height  $\rightarrow$  cylindrical coordinates)
- **2.** E(I)RP (level vs. azimuth vs. elevation  $\rightarrow$  spherical coordinates)

EMI Auto Test Tem	nplate - [3D Auto Test]	[EMI radiated]		
General Settings	📯 General Settings			×
	Hardware Setup	3D_LogPer_ESF	}	
		Execute hard ranges separ	ware setup ately	
Previev Measurem	EuT Information File	<none></none>		
	Measurement Type	E(IIBP Open-Area-Test- E(IIBP MIL-STD 461 C. MIL-STD 461 (C. EN 55025 (2002) EN 55025 (2008)	Site with Narrowband /D/E/F) ) Automotive ) Automotive	
Accessories	Minimum Level of Gr Maximum Level of Gr	aphics Diagram aphics Diagram	-200,000	dBm dBm
			, .	

These measurements can be selected in the General Settings of EMI Auto Test Template.

#### Figure 2: Measurement Types

After selecting the required measurement type, the 3D evaluation option will be activated in settings of the Preview Measurements and Maximization Measurements. The accessories settings for preview and maximization measurement shall also be configured and checked when activating the 3D option.



Figure 3: Preview, Maximization and Final measurement settings

### 1.1 Preview Measurements Settings

In order to activate the 3D evaluation for Preview Measurement results the check box "Save Preview Results for 3D chart Evaluation" has to be checked in the Preview Measurements Dialog of the EMI Auto Test Template.

Preview Measurements	X
Preview Scan/Sweep Template	
C Scan Test Template	
<none></none>	
<ul> <li>Sweep Test Template</li> <li>3D Sweep pre</li> </ul>	
Prepare 3D Chart Evaluation	
Save Preview Results for 3D Chart Evaluation	)
OK Cancel	

Figure 4: Preview Measurement, 3D selection

The parameters of the accessories can be configured as required for the 3D evaluation. They are important for better 3D graphical view since the 3D resolution depends on the accessories step size.

In order to get a sufficient resolution for the 3D evaluation the accessories step size need to be adjusted. These values have to be 8 or more azimuth positions and 3 or more height / elevation positions.

The stop value of the azimuth needs to be less than 360 degree because azimuth values greater or equal than 360 it will be replaced at 0 degree.



Figure 5: Step size requirement for 3D Evaluation

This 3D preview measurement message will appear if the required step size is not selected in the accessories settings.

The step size needs to be adjusted if the message dialog appears. This can be done by clicking on the accessories button which is below the Preview Measurement button (refer to figure 2).

X Accessories (*)
Position 1 2 3 4 5 6 7 8
Start Step Size Stop 0 Deg. 30 Deg. 300 Deg.
Height 1 2 3 4 5 6 7 8
Start Step Size Stop 558 cm 0 cm 158 cm
Polarization Set Horizontal Set Vertical I ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
Elevation 1 2 3 4 5 6 7 8 Positioning Speed
Start Step Size Stop 0 Deg. 45 Deg. 180 Deg.
<u>D</u> K <u>C</u> ancel

Figure 6: Preview Measurement, settings of Accessories

## **1.2 Maximization Measurements Settings**

In order to activate the 3D evaluation for Maximization Measurement results the check box "Save Maximization Results for 3D Chart Evaluation" has to be selected in the Maximization Measurement Dialog of the EMI Auto Test Template.

Maximization Measurements
Scan Template for Single Measurements 3D Scan_LogPer_ESR
Options Delete Maximization Results
Prepare 3D Chart Evaluation
OK Cancel

#### Figure 7: Maximization Measurement, 3D selection

In order to get a sufficient resolution for the 3D evaluation the accessories step size need to be adjusted. These values have to be 8 or more azimuth positions and 3 or more height / elevation positions.

This can be done by clicking on the accessories button which is below the Maximization Measurement button (refer to figure 2).

& Accessories	s (*)
Position	Positioning Speed
Start 0	Deg. 30 Deg. 300 Deg.
Height	1 2 3 4 5 6 7 8 Positioning Speed
Start 58	Step Size Stop cm 0 cm 158 cm
Polarization Set Horizon	tal Set Vertical 5⁄∞ I⊽ €
Elevation	Positioning Speed
Start 0	Deg. Step Size Stop Deg. 45 Deg. 180 Deg.
	<u>QK</u> <u>C</u> ancel

Figure 8: Maximization Measurement, settings of Accessories

### 1.3 3D Evaluation Procedure

3D graphics shows the radiation pattern of the EUT measured during the preview or maximization measurement. The frequency for 3D evaluation graphics can be easily set by drag and drop from the measurement graph or the measurement result tables.

#### Drag and drop from Full Spectrum Graphics:

Move the mouse pointer over frequency trace in the Full Spectrum Graphics until the trace tooltip for the desired frequency appears. Left mouse click on the trace, hold it, then drag it to the 3D evaluation window and drop it (i.e. release the mouse button). This will generate the 3D graphical view of the selected frequency.



Figure 9: 3D evaluation Graphical view by drag and drop

This 3D graph can be viewed from different angles, by placing the mouse cursor on the graph. Click the right mouse button, hold it and rotate it into different directions.

#### Drag and drop from Critical Frequency or Final Result Table

As an alternative option to the drag & drop method the 3D chart can be also show via the critical frequency or final result table when the measurement mode is on by selecting the frequency row and clicking on the marked toolbar button.

Final_Re	sult														ųΧ
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		_							1						
Name	Frequency	Shows	3D	chart for	1axPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	Comment	
Unit	MHz	selecte	a ne	equency	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB		
1	32,328000	FINAL	-	29,62		30,00	0,38	1000,0	120,000	250,0	V	90,0	20,5	15:52:57 - 07.03.2012	
2	80,052000	FINAL	-	34,40		30,00	-4,40	1000,0	120,000	350,0	V	180,0	9,4	15:53:09 - 07.03.2012	
3	1749,600000	FINAL	-		53,91	37,00	-16,91	200,0	120,000	400,0	Н	315,0	26,5	15:53:27 - 07:03:2012	
4	1928,000000	FINAL	-		39,23	37,00	-2,23	200,0	120,000	250,0	Н	315,0	27,3	15:53:24 - 07:03:2012	
4	17														
📄 Criti	cal_Freqs 🗎	Final_Resu	lt												

Figure 10: 3D evaluation Graphical view by table editor

#### 1.3.1 Data Interpolation

Different interpolation schemes can be used for displaying additional grid points and smoothing the 3D graph.

Three different interpolation schemes are available for graphical view.

- 1. No interpolation
- 2. Single Interpolation
- **3.** Double Interpolation

A better graphical view can be achieved by selecting the "Double Interpolation" in the 3D tab. The default value can be selected via Options ----> Graphics ----> 3D tab.



Figure 11: Path to the Data Interpolation

0	ptions: Graphics					<u> </u>	۲
	Graphics	Labels	Marker	Grid	Traces	3D	1
	Data Int	erpolation No Sir Do	Interpolation Interpolation Igle Interpolation uble Interpolation				

Figure 12: Data Interpolation Types



Different interpolation schemes can also be selected from the 3D evaluation window.

Figure 13: Data Interpolation Types

#### **1.3.2 Mouse interactions**

- A *left click* on a data point sets a marker at this position. Additionally, the corresponding information to this point is displayed. If the user has enabled the marker cuts, the horizontal and vertical cuts are displayed too.
- Right mouse button clicked while moving the mouse, rotates the data plot.
- According to the mouse motion. With the help of this, it is possible to navigate to every data point. If the view information is enabled, the current view direction will be displayed.
- Left and right mouse button clicked while moving the mouse up and down will perform a zoom in and out.

#### 1.3.3 3D Graphics Toolbar



Toolbar buttons are described in the following from left to right:

- Save button: Saves the 3D graphic in JPG format to a selectable folder.
- **Copy button**: Copies the 3D graph to the Windows clipboard in WMF format. From there, it can be pasted to any standard application like eg. Word.
- View button: Allows to set the Phi and Theta angles from which to view the 3D plot. Six fixed vies (top, bottom, front, back, right and left) are available as well as the possibility to enter any angle combination. Default view angles are Phi = 45 degree, Theta = 60 degree.



• **Data button**: Allows to define the interpolation scheme for displaying additional grid points and smoothing the 3D picture.



• **Options button**: The 3D graph can display additional elements when a marker has been set. These include the phi and theta cuts for the current marker position and the current phi, theta and level values. This menu allows to enable and disable this display.



• **Scale button**: Allows to define the level scale. Available settings are: Scale to value range, Auto scale (next multiple of 10 dB for minimum and maximum), and a user definable level scale.

3D Evaluation	
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Freq: 992,364 MHz	Scale to Value Range
	Autoscale
	User Scale

### 1.3.4 3D Graphics with Different Interpolation





## 2 Ordering Information

Designation	Туре	Order No.	
EMI measurement Software	R&S®EMC32-EB	1119.4638.02	
EMI Auto Test	R&S®EMC32-K10	1117.6840.02	
3D Evaluation for EMI Auto Test	R&S®EMC32-K23	1504.9190.02	

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