R&S®EMC32 EUT Monitoring with R&S® Digital Oscilloscopes Application Note

Products:

- I R&S®RTO
- I R&S®RTE
- I R&S®RTM
- R&S[®]EMC32

This application note describes how to use the mask and limit test features of the R&S®RTO, R&S®RTE and R&S®RTM Digital Oscilloscopes for EUT monitoring of signal forms, jitter etc. with the R&S®EMC32 Measurement Software. The mask test function allows autonomous characterization of digital signal integrity during EMS tests. R&S®EMC32 software records violations of userdefined limits or mask templates and evaluates the immunity threshold at frequencies of critical electromagnetic susceptibility.



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Table of Contents

	Overview	4
2	Hardware Configuration	5
3	RTx Mask Test Functionality for EUT Monitoring	6
3.1	RTO / RTE Oscilloscope Settings	6
3.1.1	Test Definition	6
3.1.2	Mask Definition	7
3.1.3	Event Actions / Reset	8
3.1.4	Mask Display	8
3.1.5	Test Examples	9
3.2	RTM Oscilloscope Settings	11
3.2.1	Test Definition	11
3.3	Device Setting in EMC32	13
3.3.1	Adding the Device to the Device List	13
3.4	EUT Monitoring Example	20
3.4.1	Oscilloscope Monitoring Settings	20
3.4.2	Actions	24
3.4.3	Start Test	24
4	RTO / RTE Limit Test Functionality for EUT Monitoring	28
4.1	Amplitude Measurement	29
4.1 4.1.1	Amplitude Measurement Oscilloscope Settings	
	-	29
4.1.1	Oscilloscope Settings	29 33
4.1.1 4.2	Oscilloscope Settings	29 33 33
4.1.1 4.2 4.2.1	Oscilloscope Settings Jitter Measurement Oscilloscope Settings EMC32 Settings	29 33 33 38
4.1.1 4.2 4.2.1 4.3	Oscilloscope Settings Jitter Measurement Oscilloscope Settings	
4.1.1 4.2 4.2.1 4.3 4.3.1	Oscilloscope Settings Jitter Measurement Oscilloscope Settings EMC32 Settings Adding the Device to the Device List	
4.1.1 4.2 4.2.1 4.3 4.3.1 4.4	Oscilloscope Settings	
4.1.1 4.2 4.2.1 4.3 4.3.1 4.4 4.4.1	Oscilloscope Settings	
4.1.1 4.2.1 4.3.1 4.3.1 4.4.1 4.4.2	Oscilloscope Settings	
4.1.1 4.2 4.2.1 4.3 4.3.1 4.4 4.4.1 4.4.2 4.4.3	Oscilloscope Settings	
4.1.1 4.2.1 4.3.1 4.3.1 4.4.1 4.4.2 4.4.3 5	Oscilloscope Settings Jitter Measurement Oscilloscope Settings EMC32 Settings Adding the Device to the Device List EUT Monitoring Example Oscilloscope Monitoring Settings Actions Start Test EMC32 Limit Testing	
4.1.1 4.2.1 4.3.1 4.4.1 4.4.2 4.4.3 5 5.1	Oscilloscope Settings	

5.3	EUT Monitoring Example	57
5.3.1	Oscilloscope Monitoring Settings	57
5.3.2	Actions	60
5.3.3	Start Test	60
6	Literature	64
7	Additional Information	65
8	Ordering Information	66

1 Overview

This application note describes how to use the mask and limit test features of the R&S®RTO, R&S®RTE and R&S®RTM Digital Oscilloscopes for EUT monitoring with the R&S®EMC32 EMS Measurement Software. A mask test monitors the integrity of digital signals while a limit test monitors a calculated value such as amplitudes (dB, A, V, etc.), rise times, jitter, etc. As soon as a user-defined mask or limit is violated, R&S®EMC32 records the violation and evaluates the immunity threshold at the current frequency.

The following abbreviations are used in the following text for R&S[®] test equipment:

- The R&S®EMC32 EMS Measurement Software for Conducted and Radiated Susceptibility is referred to as EMC32. The R&S®EMC32-S Software for immunity basic measurements is referred to as EMC32-S.
- The R&S®RTE1022, R&S®RTE1024, R&S®RTE1032, R&S®RTE1034, R&S®RTE1052, R&S®RTE1054, R&S®RTE1102, R&S®RTE1104 Digital Oscilloscopes are referred to as RTE.
- The R&S®RTO1002, R&S®RTO1004, R&S®RTO1012, R&S®RTO1014, R&S®RTO1022, R&S®RTO1024, R&S®RTO1044 Digital Oscilloscopes are referred to as RTO.
- The R&S[®]RTM2032, R&S[®]RTM2034, R&S[®]RTM2052, R&S[®]RTM2054 Digital Oscilloscopes are referred to as RTM.
- Digital Oscilloscopes RTO, RTE and RTM are referred to as RTx.
- The R&S[®]SMB100A Signal Generator is referred to as SMB.
- The R&S[®]BBA100 Power Amplifier is referred to as BBA100.
- R&S[®] stands for Rohde & Schwarz GmbH & Co KG.

2 Hardware Configuration

Fig. 2-1 shows a typical conducted EMS test environment, consisting of an oscilloscope (RTO, RTE or RTM), connected via a LAN interface to a PC that runs EMC32-S software, an SMB signal generator and a BBA100 power amplifier according to IEC/EN 61000-4-6 to monitor a defined EUT test point with the RTO / RTE / RTM mask or RTO / RTE limit test feature.

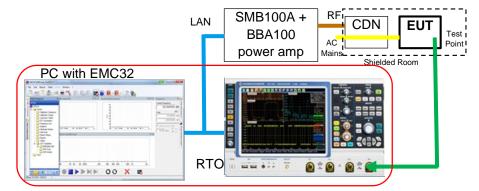


Fig. 2-1: Typical CDN setup for conducted EMS measurements according to IEC/EN 61000-4-6

The RTE / RTO requires firmware v2.30.1.0 or higher, the RTM v05.400 or higher.

3 RTx Mask Test Functionality for EUT Monitoring

The mask test feature of the RTO, RTE and RTM oscilloscopes allows to define a "masked" area around a signal (including uncertainties) taken from a relevant test point on the EUT.

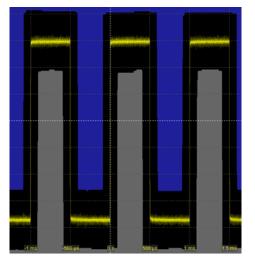


Fig. 3-1: Pulsed signal with masked area

During an EMS measurement the EUT is exposed to conducted and radiated interferers, which may have an effect on the signal at the test point. These measurements are usually unattended and therefore require automatic monitoring. The RTO / RTE / RTM mask test will notify the EMC32 software immediately in case the signal violated the mask and will also transmit the current interferer frequency.

3.1 RTO / RTE Oscilloscope Settings

A mask can be created by selecting the **MASKS** button on the front panel of the RTO or RTE and setting the parameters in the dialog boxes **TEST DEFINITION**, **MASK DEFINITION**, **EVEN ACTION / RESET**, **MASK DISPLAY**.

3.1.1 Test Definition

The following parameters shall be used:

Enable test: Enable / disable the mask test by clicking on this soft-key.

Definition type: If **WAVEFORM** is selected, a mask is created from an existing waveform. A given offset from the waveform builds the upper and lower limit lines of the mask, limits that can be moved and stretched. The result is a tolerance tube around the waveform used as mask.

Fail condition, Violation tolerance: The fail criteria for a mask test are set by two parameters: "Fail condition" and "Violation tolerance".

"Fail condition" defines the kind of hits to be considered for test evaluation:

- **SAMPLES**: Number of samples (VIOLATION TOLERANCE) that hit the mask.
- ACQUISITIONS: Number of acquisitions (VIOLATION TOLERANCE) that contain at least one sample hitting the mask.

Test	Definition Mask Definition Event Actions / Reset Mask Display	Masks 🕅
MaskTest1	Enable test	Result export +
MaskTest2	Source Definition type Used reference Waveform R1 Fail condition Violation tolerance Samples 10	
	Reference waveform: Save to or load from file	
	RefCurve_2013-07-16_2_130256.bin	
	Doad 🖉 Open) 🖃 Save 🗬 Save Asbin 😒	Delete

Fig. 3-2: RTO "Test Definition" Tab

3.1.2 Mask Definition

DEFINITION TYPE: Select **WAVEFORM** to create a mask from an existing waveform.

HORIZONTAL WIDTH: Sets the mask width (div).

VERTICAL WIDTH: Sets the mask height (div).

CREATE MASK: Creates the upper and lower mask limit from the selected reference waveform. If the reference waveform was not defined before, it is created automatically from the **Source** waveform, which is selected in the **TEST DEFINITION** tab.

Test	Definition Mask Refinition Event Actions / Reset Mask Display	Masks 🔀
U U	Definition type <mark>Waveform</mark>	
MaskTest2 M	Source Waveform arithmetic Create mask Used reference	-
	Horizontal width Vertical width Vertical stretch Vertical position 0.2 div 0 div	
-	Reference waveform: Save to or load from file	-
+ C X	RefCurve_2013-07-16_2_132213.bin Display Delete Delete	

Fig. 3-3: RTO "Mask Definition" Tab

3.1.3 Event Actions / Reset

This tab defines, which actions shall be taken in case the mask was violated or not. Most actions can be initiated either on violation or pass:

ON VIOLATION: The parameter **STOP ACQ** is set to **ON VIOLATION** in the **EVENT ACTIONS / RESET** tab. This action will be initiated (thus, the acquisition of samples will be stopped) as soon as the signal violates the mask and the fail criteria are fulfilled.

Test	Definition Mask I	Definition	Event Actions / Reset	Mask Display	Masks 💌
MaskTest2 MaskTest1	Actions on event Beep Stop acq Print Save Wfm Trigger Out Pulse	No act On vic No act No act	ilation vitin	Trigger Pulse Control	
	Rese	et all mask	test results		

Fig. 3-4: RTO / RTE "Event Actions / Reset" Tab

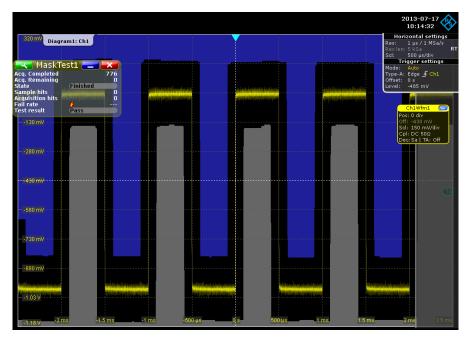
3.1.4 Mask Display

The **MASK DISPLAY** tab contains all settings for mask and hit display. Different colors can be assigned to the actions for better readability.



Fig. 3-5: RTO / RTE "Mask Display" Tab

3.1.5 Test Examples



The following example shows a signal that does not violate the mask.

Fig. 3-6: Test Example without mask violation

Fail Criteria "Samples":

This test has failed because 10 or more samples have violated the mask.

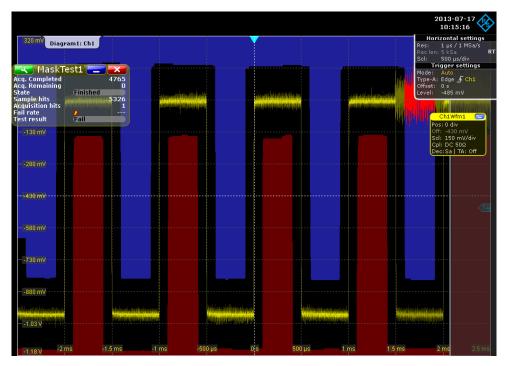


Fig. 3-7: Test example with fail criteria "Samples"

Fail Criteria "Acquisition":

This example test failed because the 7th acquisition violated the mask with at least one sample.

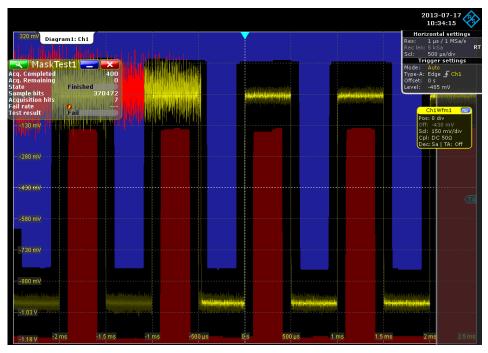


Fig. 3-8: Test example with fail criteria "Acquisition"

RTM Oscilloscope Settings

3.2 RTM Oscilloscope Settings

A mask can be created by selecting the **TOOLS** button, then the **MASK TEST** soft key.

3.2.1 Test Definition

The following parameters shall be used:

Test – Enable / disable the mask test by clicking on this soft-key.

New Mask \rightarrow **COPY CHANNEL** – Generates a mask surrounding the original waveform. Use Y-Position, Stretch Y, Width Y and Width X to define a custom mask area. Press Save to store the custom mask.

Masks Test			Total: 0	0	Pa	ssed: 0%
Mask			Os	0	Fai	led: 0%
Copy Channel	Y-Position	Stretch Y	Width Y	Width X	Save	
$\left[\wedge \cdot \wedge \right]$		100 %		±0 DIV		Back

Fig. 3-9: RTM New Mask

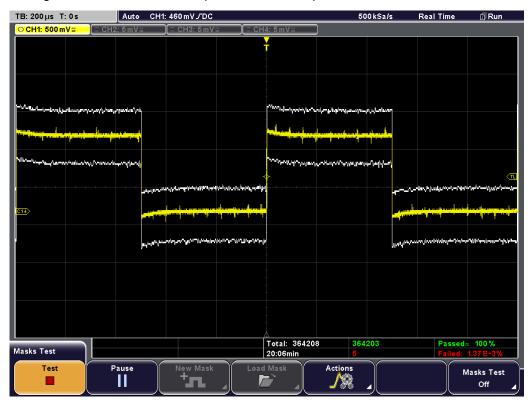
ACTIONS – Defines which events will be initiated in case the mask is violated:

- **SOUND** Alarm can be turned OFF, go off after each violation or after n mask violations.
- **STOP** Mask test can continue or be stopped after one or n mask violations.
- **SCREENSHOT** No screenshot, or one screenshot after each or n mask violations.
- PRINT Print waveform data after each or n violations.
- **WAVEFORM** Save waveform after each or n violations.
- **PULSE** Turn ON custom pulse at trigger output after each or n violations.



Fig. 3-10: RTM Mask Test Actions

RTM Oscilloscope Settings



The figure below shows an example mask test of a pulse curve.

Fig. 3-11: Mask Test running on RTM Oscilloscope

3.3 Device Setting in EMC32

3.3.1 Adding the Device to the Device List

The configuration is done in the Device List, which is accessible via the menu **EXTRAS -> DEVICE LIST ...**

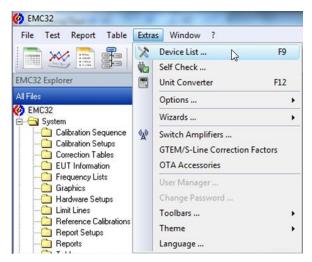


Fig. 3-12: Opening the Device List

or via the Device List icor

or with the function key shortcut "F9"



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evices:		Configured Devices:				🖻 🗙 🗮 👖	
Monitoring	~	Name	Device	Туре	Interfa	Addr/SN	State
bmcm USB-AD16f		SMB100A	Generators	SMB100A	GPIB0	29	Virtual
- 👁 CBT		🚫 SML 03	Generators	SML	GPIB0	28	Virtual
CE-CAM		C Interlock	Interlock	Interlock Circuit	None		
CMU for GPS		4-Line-LISN ENV	LISNs	LISN	None		
- CMU200		2-Line-LISN ENV	LISNs	LISN	None		
CMW for LBS		PCMON	Monitoring	Generic Monitor	LAN	LOCALHOST:1001	Virtual
CMW270 CMW500-CDMA		Video Inserter	Monitoring	Generic Monitor	COM1		Virtual
CMW500-CDMA CMW500-GSM		CMU200	Monitoring	CMU200	GPIBO	20	Virtual
CMW500-LTE		🕶 UPL	Monitoring	UPL	GPIBO	10	Virtual
CMW500-LTE		MAHA Roller Be	Monitoring	MAHA Roller B	LAN	:2000	Virtual
CMW500-UMTS		CMU200(1)	Monitoring	CMU200	GPIB0	20	Virtual
CMW500-WLAN		EMCAN32 Interf	Monitoring	EMCAN32 Inter	LAN	10.33.10.108:7800	Virtual
The EMCAN32 Interface		USB6009	Monitorina	NI USB 6009	USB	16C308F	Virtual
 Generic Monitoring 		Generic Monitoring	Monitoring	Generic Monitor	GPIBO	25	Virtual
IMS DIO	1	Generic Oscillos	Oscilloscop	Generic Oscillos	VISA	TCPIP::10.33.11.20::inst0::instr	Virtual
MAHA Roller Bench		NRVS	PowerMeters	NRVS	GPIBO	7	Virtual
meMADfo DAIO		Power Meter	PowerMeters	NRP Channel A	GPIBO	12	Virtual
meMPI0 DI0	-	PM Sensor	PowerMeters	NRP Channel B	GPIBO	12	Virtual
• NI USB 6009		ZVX for Calibration	PowerMeters	ZVX for Calibrati	VISA	TCPIP::10.33.10.105::INST0::INSTR	Virtual
Opsens ProSens	E	🔀 NRP Channel A	PowerMeters	NRP Channel A	GPIBO	14	Virtual
PTW70 W-LAN	-	NRP-Zxx (USB)	PowerMeters	NRP-Zxx (USB)	USB	?	Virtual
		Receiver	Receivers	ESU 40	GPIB0	20	Virtual
		ESIB 26 3dB	Receivers	ESIB 26 3dB	GPIB0	20	Virtual
- 💁 UPV MultiFieldProbes		ESU 8	Receivers	ESU 8	GPIB0	20	Virtual
Oscilloscopes		ESIB 7	Receivers	ESIB 7	GPIB0	20	Virtual
Positioners		Generic Receiver	Receivers	Generic Receiver	GPIBO	20	Virtual
PowerMeters		ESIB 40	Receivers	ESIB 40	GPIB0	20	Virtual
Receivers		ESU 40	Receivers	ESU 40	GPIBO	20	Virtual
Slidebars		ESL 3	Receivers	ESL 3	GPIB0	20	Virtual
SwitchUnits		🛱 Deisel Slidebar	Slidebars	Deisel Slidebar	GPIBO	7	Virtual
SystemControls		Switch Unit	SwitchUnits	TS-RSP	GPIB0	16	Virtual
Transducers		Generic RSU	SwitchUnits	Generic RSU	GPIBO	16	Virtual
TripleLoops		MS RSU	SwitchUnits	IMS RSU	USB	100027	Virtual
TurnTables		BBA100	SwitchUnits	BBA100	GPIBO	2	Virtual
	Ŧ	Standard Control	SustemCon	Standard Control	None		
I ■ 1		•			11		- P

Add the **GENERIC MONITORING** device to the right side of the **DEVICE LIST** as **CONFIGURED DEVICE**.

Fig. 3-13: "Generic Monitoring" device added to "Configured Devices"

Single click on the entry and rename **GENERIC MONITORING** to an appropriate Device Name, e.g. **RTO TEST MASK** (or RTE / RTM).

	💟 Interlock Urcuit	Interlock	Interlock Circuit	None		
	👁 RTM Test Mask	Monitoring	Generic Monitoring	VISA	TCPIP::10.85.0.137::INSTR	Physical
	👁 RTO Test Mask	Monitoring	Generic Monitoring	VISA	TCPIP::RT0-200159::INSTR	Physical
	👁 RTO Test Limit	Monitoring	Generic Monitoring	VISA	TCPIP::RT0-200159::INSTR	Virtual
	👁 RTE Test Mask	Monitoring	Generic Monitoring	VISA	TCPIP::RTE-100259::INSTR	Virtual
🕀 🚰 Transducers	👁 RTE Test Limit	Monitoring	Generic Monitoring	VISA	TCPIP::RTE-100259::INSTR	Virtual
🗄 🖸 🖸 Turn Tables						

Fig. 3-14: Rename "Generic Monitoring" to "RTO Test Mask"

<u>Note:</u> Please make sure that all necessary instrument drivers, e.g. SMB, NRP-Zxx have been installed, before running an EMS test. If some or all devices are missing, a message box allowing simulation mode enabling will appear.

3.3.1.1 Generic Monitoring Properties

Edit the RTO / RTE / RTM Test Mask properties by double clicking on the menu item. It is defined by six properties:

- General
- Interface Parameters
- General Commands
- Device Programming
- Measurement Queries
- EMS Information

3.3.1.2 General and Interface Parameters Tabs

In the General tab, select the appropriate **INTERFACE TYPE** from a list of addresses or by using the **VISA DEVICE IDENTIFIER** (see Fig. 3-15).

After editing this parameter, close the RTO / RTE / RTM Mask Test window by pressing OK. Also close the Device List by pressing OK. If there have been significant changes in the Device List, a window pops up, advising to close and restart EMC32-S. Re-open the Device List and activate the **RTO TEST MASK** (or RTE / RTM) device by changing the **STATE** from **VIRTUAL** to **PHYSICAL**.

🔁 RTO Te	est Mask - Generic Mo	onitoring - Monitori	ing
General	Interface Parameters	General Commands	Device Progra
Inte	erface		
	Гуре		
	VISA GPIBO	<u> </u>	
	GPIB1		_
	GPIB2 GPIB3		
	COM1 LAN		
Desi	VISA		

Fig. 3-15: Select Interface Type "VISA"

First Step	
Interface	State
Туре	
VISA	Physical C Virtual
VISA Device Identifier	
TCPIP::RT0-200159::INSTR	Second Step
Description	Serial number
	Firmware Version

Fig. 3-16: Set State to "Physical"

Change to **INTERFACE PARAMETERS** tab and set the parameters.

RTO Test Mask - Generic Monitoring - Monitoring	×
General Interface Parameters General Commands Device Programming Measurement Queries	EMS I
Timeout 1,0 s	
EMS-K1 Compatibility	
Export Settings	
Dwell Time after Import Settings receiving a WAIT to a 500 ms	
Measurement Query	
OK Cancel	

Fig. 3-17: Import settings

Import parameters by clicking IMPORT SETTINGS.

In the newly opened dialog box Import Settings, select predefined parameters by clicking the _____ button, selecting RTO / RTE / RTM MASK TEST and pressing OK.

🔁 Import Settings	
Configuration File	
<none></none>	
Import Close	
Open	<u> </u>
Path: L:\EMC32\Configuration\Monitoring	ОК
Agilent 34401 ØWTD81 Video Inserter	Cancel
Pluke 45 Multimeter	<u>H</u> elp
Keithley DMM2000	
S LeCroy PassFail	
SP B103 Monitoring PCMON	
RTO Mask Test	
File Name RTO Mask Test	

Fig. 3-18: Select "RTO Mask Test" configuration file, same for RTE/RTM

After pressing **OK**, the RTO / RTE / RTM Mask Test configuration file will be displayed in the **IMPORT SETTINGS** dialog.

C. Import Settings			4	x
Configuration File				
RTO Mask Test				<u></u>
	1			
Import		Clos	e	
		Clos	e	

Fig. 3-19: Configuration File to Import

Click on **IMPORT** to load the configuration. The import is completed by pressing OK on the following message window.

Import Settings	
The settings have been im	ported successfully.
	ОК

Fig. 3-20: Successful file import

The RTO / RTE / RTM Mask Test import file contains following lines.

3.3.1.3 General Commands

Commands for the basic configuration of the monitoring device are defined in this tab. The following commands are available:

General Interface Parameters General Commands Device Programming Measurement Queries EMS IL Identification Query *IDN? Identification Response RTO Trigger RUN Start Test Stop Test Stop EuT Reset EuT EuT Ready Query Test	RTO Test Mask - Generic Monitoring - Monitoring						
Reset / Initialize *IDN? Identification Query *IDN? Identification Response RTO Trigger RUN Start Test Stop Test Stop Test Stop EuT Reset EuT EuT Ready Query EuT Ready Query Test	General Interface Parameters Gene	ral Commands Device Programming Measurement Queries EMS I					
Reset / Initialize *IDN? Identification Query *IDN? Identification Response RTO Trigger RUN Start Test Stop Test Stop Test Stop EuT Reset EuT EuT Ready Query EuT Ready Query Test		Description					
Identification Response RTO Trigger RUN Stat Test Stop Test Stop Test Stop EuT Reset EuT EuT Ready Query	Reset / Initialize						
Trigger RUN Start Test Stop Test Start EuT Stop EuT Reset EuT EuT Ready Query Test Test	Identification Query	*IDN?					
Trigger RUN Start Test Stop Test Start EuT Stop EuT Reset EuT EuT Ready Query Test Test		RTO					
Stop Test Stat EuT Stop EuT Reset EuT EuT Ready Query		RUN					
Start EuT Stop EuT Reset EuT EuT Ready Query Test	Start Test						
Stop EuT Reset EuT EuT Ready Query Test	Stop Test						
Reset EuT EuT Ready Query Test	Start EuT						
EuT Ready Query Test	Stop EuT						
Test	Reset EuT						
	EuT Ready Query						
		Test					
OK Const							
OK Const							
OK Consel							
UN Lancei	OK Cancel						

Fig. 3-21: Generic Monitoring Commands

3.3.1.4 Device Programming

This tab is not used in this context and therefore skipped here.

3.3.1.5 Measurement Queries

This tab contains the SCPI command for executing a Mask Test measurement and reading the result.

	RTO '	Test Mask - Generic Mon	itoring - Mo	nitoring	— ×-
G	enera	al Interface Parameters G	eneral Comma	ands Devi	ce Programming Measurement Queries EMS I
	No	GPIB Command	Description	String	Header characters to delete
	1	MTES:RES? 'MaskTest1'	Get Result	PASS	0

Fig. 3-22: "Measurement Queries" tab with Mask Test Result SCPI command

3.3.1.6 EMS Information

This tab is not used and therefore left empty. However, you have to press the **Test** button in this dialog window, to get to the **GENERIC MONITORING** test dialog.

3.3.1.7 Generic Monitoring Test Dialog

After pressing the **Test** button in the **EMS INFORMATION** tab, the following dialog box will be opened, allowing to select an item from the **GENERAL COMMANDS** or **MEASUREMENT QUERIES** list. Select **IDENTIFICATION QUERY** from the **GENERAL COMMANDS** and enter the **TEST COMMAND** "*IDN?". After pressing **TEST COMMAND**, the command is sent to the oscilloscope and the response (RTO / RTE / RTM ID string) is received. Then, exit this dialog by pressing **CLOSE**.

RTO 1	fest Mask - Generic Monito	oring
	 General Commands 	Identification Query
	C Device Programming	V
	C Measurement Queries	V
	C EMS Information	_
•	Test Command	*IDN?
	Answer	Rohde&Schwarz,RT0,1316.1000k24/200159,2.30.0
		Close

Fig. 3-23: Generic Monitoring Test Dialog

3.4 EUT Monitoring Example

In order to perform the example, a test template for EUT monitoring with an RTO / RTE / RTM oscilloscope is required first.

3.4.1 Oscilloscope Monitoring Settings

To generate a new EUT Monitoring Test Template, proceed as shown in Fig. 3-23.

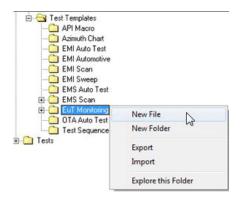


Fig. 3-24: EUT Monitoring Configuration: "New File"

In the EMC32 Explorer, select FILE -> TEST TEMPLATE OPEN/NEW.... Right-click on the EUT MONITORING menu item and select NEW FILE. A new window for configuring the RTO TEST MASK (or RTE / RTM) parameters pops up.

Eu	T Mo	nitoring	g - [EuT	Monitori	ng(1)] (*)						×
[- Opti	ions —									
	EL	JT Inforn	nation				lobile Phone 1				
	<1	none>								on Test Start	
						<u> </u>	ynchronize AB	31 Parame	eters on each	Test Start	
[No	Active	Name		Meas. Device		Conversion	NoGo		Actions	
	1	V	Channel	1	<no device=""></no>		MEAS	> 5		No Action	
1											
		Channel	Ľ	Hardwar	e Displa	ay ∐	NoGo	<u> </u>	Actions	Options	
		-	-			A.	ππ				
						\vee	RTM T	est Mask			
			•		,	Calls and	RTO T	est Mask			
	Γ	Kno	device>		<no device=""></no>		RTO T	est Limit			
	,				<no settings=""></no>		RTE Te	st Mask			
							RTE Te	est Limit			
							Field S	ensor			
							Power				
							PDWE PM Se				
	۵	ydd Char	nel	Delete	e Channel					ОК	1
		yuu onar	inci	Delete	signaturel		API M	acro			

Fig. 3-25: EUT Monitoring configuration: RTx Test Mask selection

Right-click on the oscilloscope device icon in the HARDWARE tab and select RTO TEST MASK (or RTE / RTM) from the list.

Channel Hardwar	re Display	NoGo
dB		
<no device=""></no>	RTO Test Mask	
	<no settings=""></no>	*
		~

Fig. 3-26: EUT Monitoring Configuration: Selected Device

Then (left-) click on the icon to configure the device in the following pop-up window, according to Fig. 3-26: select "Send Trigger Command", and specify the Measurement Query as "Get Result".

RTO Test Mask - Generic Monitoring - Monitori	ng	x
General Settings		
Additional Commands	Device Programming	
Measurement Queries Get Result Substitute placeholder %%% in query with		
Test		

Fig. 3-27: EUT Monitoring Configuration: Device Settings

Press **OK** to complete the RTO / RTE / RTM Test Mask configuration, which appears in the EUT Monitoring configuration in Fig. 3-27.

Channel Hardward	e Display	NoGo
dB <no device=""></no>	RTO Test Mask Send Trigger Commar MeasCmd: Get Result	

Fig. 3-28: EUT Monitoring Configuration

After configuring **RTO TEST MASK** (or RTE / RTM) go to the **CHANNEL** tab and select **TRIGGER MODE -> BEFORE DWELL**.

Channel	Hardware	Display	NoGo
Channel Name	Channel 1		
Trigger Mode	Before Dwell	•	
Visible Colu	mn in the Report		

Fig. 3-29: EUT Monitoring Configuration: "Trigger Mode" Selection

In the **NoGo** tab, set **NoGo Type** to **Above Limit**, set **Limit Value** = 0.50000 and press **OK** to save the **RTO Mask Test** (or RTE / RTM) configuration.

Dpti Fl	JT Inform	ation				M	bile Phone	Tesți				
_	none>	Glon					iow Audio Br		-			
						D Sj	nchronize Al	BT Para	meters on e	ach T	est St	art
١o	Active			eas. Di			Conversion	NoGo			Actior	
1	✓	Channel 1	R	TO Tes	st Mask		MEAS	> 0,5			No Ac	otion
											v	
	Channel	Har	dware	Υ	Display	ų T	NoGo	- <u>r</u>	Actions	;	(Options
	Channel - NoGo T		dware	Ŷ	Display		NoGo Value		Actions	1	<u> </u>	Options
	-NoGo T	ype	dware	Ŷ	Display				Actions 0,500000)	Options
	-NoGo T		dware	Υ	Display		Value Constant		0,500000	:)	
	NoGo T	ype	dware	Υ	Display		Value)	Options
	NoGo T Ab C Be	ype pove Limit		Υ	Display		Value Constant Shape		0,500000)	
	NoGo T Ab C Be	ype bove Limit		Ŷ	Display		Value Constani Shape e Range	[0,500000)]	
	NoGo T Ab C Be	ype pove Limit elow Limit utside Value R		<u>}</u>	Display		Value Constant Shape	[0,500000)	
	-NoGo T Ab C Be C Ou	ype pove Limit elow Limit utside Value R		<u>Т</u>	Display		Value Constani Shape e Range	.imit [0,500000)	
	-NoGo T Ab C Be C Ou	ype pove Limit elow Limit utside Value R		<u> </u>	Display		Value Constant Shape e Range Upper L	.imit [0,500000)	

Fig. 3-30: EUT Monitoring Configuration: "Limit Value"

3.4.2 Actions

If the measurement should be stopped after a limit violation occurred, add **STOP TEST** to the **ACTION ON NOGO** item.

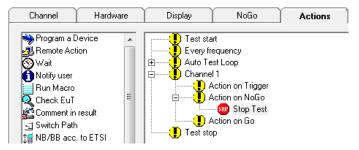


Fig. 3-31: Action on NoGo -> Stop Test

3.4.3 Start Test

Download DEVICECONFIGURATION_FILES.ZIP from the 1MA242 application note page and unzip EUT TEST.EMSCONFIGURATION to <EMC32 DIRECTORY>\EMC32\SYSTEM\TEST TEMPLATES\EMS SCAN\EN61000-4-3\.and RTO MASK TEST.EUTCONFIGURATION, RTE MASK TEST.* and RTM MASK TEST.* to <EMC32 DIRECTORY>\EMC32\SYSTEM\TEST TEMPLATES\EUT MONITORING\.

<u>Note:</u> In case of Windows7 and the default data directory C:\PROGRAMDATA it is necessary to make it visible first by unchecking the HIDE PROTECTED OPERATING FILES in the FOLDER OPTIONS.

In the EMC32 Explorer, right-click on the menu item **TEST TEMPLATE -> EMS SCAN -> EN61000-4-3** (EMS Radiated) **-> EUT TEST** and select **New TEST**.

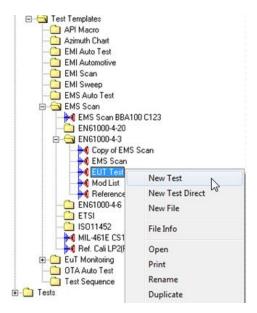


Fig. 3-32: Start EMS Scan Test Template as New Test

A New Test window with EMS Radiated specific default parameters pops up.

New Test - [EMS Radiated]		×
Test Definition	Test Level	Report
Test Control Parameter Test Name Test Method	Test EuT Qualification	
Immunity Parameter	EUT Test	
C Refe	erence Calibration	
EuT Monitoring Paramete	ers <none></none>	
		ancel

Fig. 3-33: New Test dialog

After pressing the **EUT MONITORING PARAMETERS** -> icon, the EuT Monitoring Open window pops up, which allows to select **RTO Mask Test** (or RTE / RTM).

1	uT Monitoring Open				٢
	Path: L:\EMC32\System\Test Templa	tes\EUT Monitoring		OK	
			<u>a</u> ª Ⅲ 1853	Cancel	
	RTO Mask Test	🗟 WR6100A	_10111_BG_GTEM_RxD_01		

Fig. 3-34: EUT monitoring File location

New Test - [EMS Radiated]	×
Test Definition Test Level Report	\neg
Test Control Parameter Test Name Test Test Method EuT Qualification	
Immunity Parameter	
Reference Calibration <none></none>	
EuT Monitoring Parameters Template RTO Mask Test	
<u>D</u> K Cancel	

Fig. 3-35: New Test dialog with "RTO Mask Test"

After pressing **OK**, the test is ready for execution.

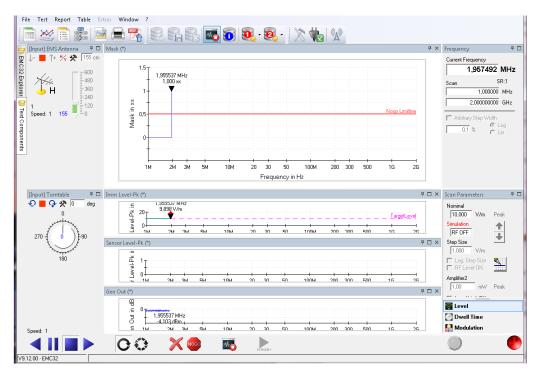


Fig. 3-36: EMC32 Test Execution

The upper graph in Fig. 3-35 (see also Fig. 3-36) shows how the Mask value jumps from 0 to 1 when the signal violates the test mask. With logical units (0 and 1) rather than a physical scale, any Mask value of 1 exceeds the pre-defined 0.5 limit line, thus rendering a **FAIL** result.

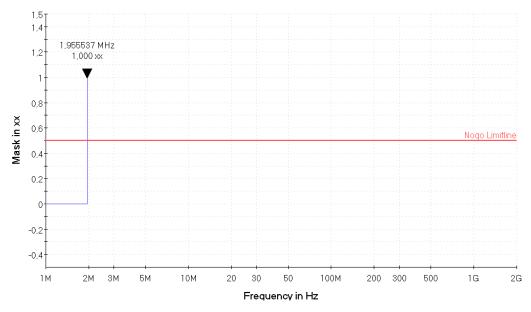


Fig. 3-37: EMC32 test execution

4 RTO / RTE Limit Test Functionality for EUT Monitoring

RTO / RTE oscilloscopes offer a wide range of measurement functions that are suitable for EUT monitoring tests. The measurement functions are divided in

AMP/TIME – Amplitude, Peak to peak, Mean, RMS, etc.

Setup Long Term/Track Gate	🕽 🗔 💌 Ŧ 📴 🖡 2/Display 🕻 QuickMeas	🚰 ൽ 🗊 ≓ Event Actions Šer	2014-07-07 16:11:27 💯 🚸 nsor ments 🔊 🎤 💶			
			esult export			
Hain measurement	Envelope	um Hist	Protocol			
Additional amplitude/time	A. Low A. Amplitude	Pos. pulse	Burst width			
-50 m Amplitude/Time measurement	 𝒜. Max 𝒜. Min 𝒜. Peak to peak 	<pre> Period Period Frequency Pos. duty cycle </pre>	Neg. switching Pulse train M Edge count			
Heas Hear	ん Mean れ <mark>RMS</mark>	机 Neg. duty cycle 玑 Cycle area	₩ Setup ₩ Hold			
9 set	 σ (S-dev/AC-RMS) 	M Cycle mean M Cycle RMS M Cycle σ (S-dev)	Setup/Hold Time			
200 r	Area √ Rise time	n Pulse count ∃ Delay	Trig.ProbeMeter			
File Horizontal Trigger Vertical Math Cursor Meas Masks Search Analysis Display						

Fig. 4-1: RTO / RTE Amplitude and Time Measurement Functions

JITTER – Period, Frequency, Cycle jitter, skew delay, etc.

	N ⁴ Period
	🖓 Frequency
Track Gat	∰ Setup
	네는 Hold
2nd CŽ	肸 Setup/Hold Time
	뷔 Setup/Hold Ratio
	M Cycle-cycle jitter
Jitter	🕅 N-cycle jitter
ent	À Cycle-cycle width
, k	A Cycle-cycle duty cycle
measurem	∯ Time-interval error
All on	∭ Unit interval
	🔊 Data rate
ment	∠/ Skew delay
	⊥ Skew phase

EYE – Extinction ratio (%), Q factor, Noise (RMS), S/N Ratio etc.

Eye M Spectru	ım 💕 Hist 🎆 Protoc
▶	
Extinction ratio (%)	XX Duty cycle distortion
Extinction ratio (dB)	XX Eye rise time
XX Eye height	XX Eye fall time
XX Eye width	🖾 Eye bit rate
XX Eye top	XX Eye amplitude
XX Eye base	Diltter (peak to peak)
XIX Q factor	$\int_{\sigma} Jitter (6 * \sigma)$
XXNoise (RMS)	Ditter (RMS)
XXS/N ratio	Ī

HISTOGRAM – Histogram peak, Mean, Standard Deviation, etc.

Eye M Spectrum	Hist Mrotocol
Probability domain m	arker settings
Maveform count	Median
ារ្ហា Waveform samples	📕 Max - Min
💺 Histogram samples	🕨 Mean
🖡 Histogram peak	🖈 σ (S-dev)
🕨 Peak value	🎾 Mean ± σ
🕨 Upper Peak value	🎥 Mean ± 2 * σ
📕 Lower Peak value	🎾 Mean ± 3 * σ
📕 Maximum	🟲 Marker - Probability %
📕 Minimum	🔭 Marker + Probability %

Some measurement groups are only accessible with the according option (see RTO / RTE manual for more details on available options).

4.1 Amplitude Measurement

The first example will focus on an **amplitude** measurement, using the oscilloscope as a EUT monitoring device in EMC32.

A 100 kHz sine signal (-10 dBm) from any signal generator is fed into Channel 1 of the RTO / RTE.

4.1.1 Oscilloscope Settings

- Press **PRESET** on the RTO / RTE to obtain a defined initial state.
- Press AUTOSET for optimized display.

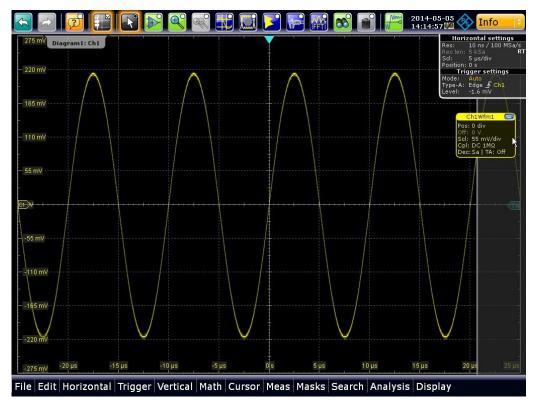


Fig. 4-1: The display shows an auto-triggered and auto-scaled measurement of amplitude over time

The peak-to-peak amplitude is approx. 440 mV.

Select MEAS -> SETUP in the RTO / RTE menu.

Setup		
Gate/Display		
Long Term/Statistics		
Horizontal		
Event Actions		
Histogram		
Reference Level		
Advanced Delay Setup		
Meas Masks Search Analysis		

Fig. 4-2: Selecting the Setup dialog from the Measurement menu

- Activate MEAS 1 STATE
- I Select the AMP/TIME tab
- Turn the Limit Check on by selecting LIMIT ONLY

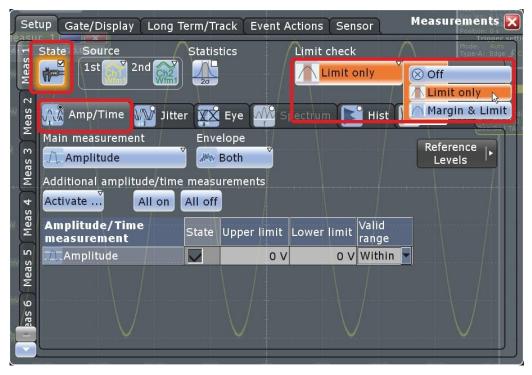


Fig. 4-3: Configuring the Setup dialog within the Measurement menu

Close the **MEAS** dialog to read an actual amplitude measurement value.

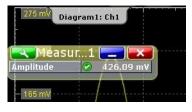


Fig. 4-4: Here, the measured amplitude value is 426.09 mV

- Select MEAS -> SETUP, again
- Enter appropriate upper and lower limit values that come close to the measured value, e.g. 426.1 mV and 426.0 mV

Amplitude/Time measurement	State	Upper limit	Lower limit	Valid range
⊅ Amplitude	K	426.1 mV	426 mV	Within 🔽

Fig. 4-5: Enter the upper and lower limit by double clicking on the values

If the amplitude exceeds the upper or lower limit, an alarm will be set. The amplitude measurement is now active.

To verify the measurement activity, the oscilloscope can be made to beep upon limit violation.

- Setup Gate/Display Long Term/Statistics Horizontal Event Actions Histogram Reference Level Advanced Delay Setup Meas Masks Search Analy
- Select MEAS -> EVENT ACTIONS in the RTO / RTE menu.

Fig. 4-6: Selecting the Event Actions dialog from the Measurement menu

Actions on event		Mode: Arright Edg
Веер	On violation	No action
Stop acq	Ӿ No action	✓ On successful completion
Print	🛞 No action	On violation
Save Wfm	🛞 No action	
유 	🗙 No action	Trigger Pulse Control

Fig. 4-7: In the Event Actions dialog, select Beep -> On violation

To monitor the measurement, proceed with chapter 4.3 on EMC32 settings.

4.2 Jitter Measurement

The next example will focus on a measurement of **jitter** (periodicity deviations, or phase noise) and show how to define it in the RTO / RTE and as EUT monitoring device in EMC32.

Again, a 100 kHz sine signal (-10 dBm) is fed into Channel 1 of the RTO / RTE.

4.2.1 Oscilloscope Settings

- Press **PRESET** on the RTO / RTE to obtain a defined initial state.
- Press **AUTOSET** for optimized display.
- Select **MEAS -> SETUP** in the RTO / RTE menu.



Fig. 4-8: Selecting the Setup dialog from the Measurement menu

Setup Gate/Display Long	Term/Track Event	Actions Sensor	Measurements 😿
State Source Source 1st 2nd ∰	Statistics	Limit check	Result export >
Deried	er XX Eye M s Envelope Both	Spectrum 🎦 Hist 🗰 Jitter Wizard 🕨	Protocol Sel: 500 mL/c Cal: DC 1M12 Reference Levels
Additional jitter measurer			017: 470 mV/a Sci: 500 mV/a Cpi: DC 1M2 Dec: Sa TA: (
* Activate All on * Jitter measurement	All off State Upper limit	Lower limit range	Ch34fm Pos:-3.44 dv Off: 1.1 V Scl: 1 V/div
က္ က္ဆ	0 :	s 0 s Within 💌	Cpl: DC 1MQ Dec:Sa TA:

Select the JITTER tab

Fig. 4-9: It is convenient to use the Jitter Wizard for defining the test, as this will guide you to the measurement with just three more clicks

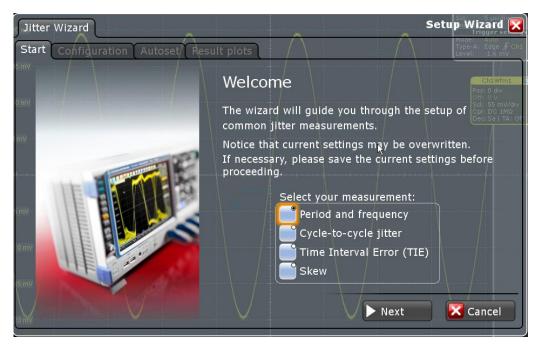


Fig. 4-10: Select a period and frequency measurement in the Jitter Wizard

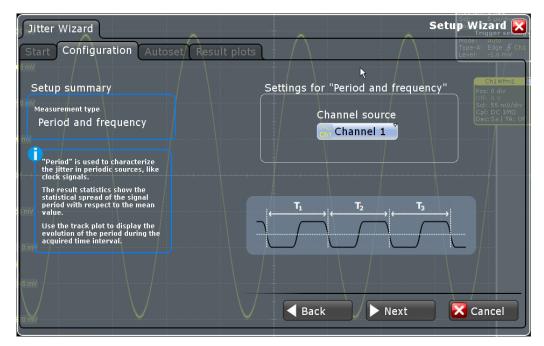


Fig. 4-11: Confirm the pre-selection of Channel 1 by clicking "Next"

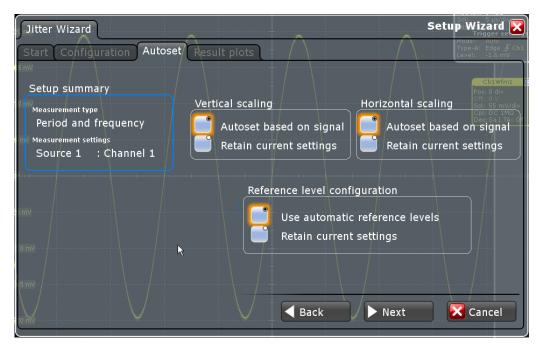


Fig. 4-12: Confirm automatic scaling and auto reference levels by clicking "Next"

Jitter Wizard		tup Wizard 🔀
Start Configuration Autoset R	esult plots	Type-A: Edge ∱ Ch1 Level: -1.6 mV
Setup summary		Ch1Wfm1 Pos: 0 div
Measurement type Period and frequency	Result plot selection	Off: 0 V Scl: 55 mV/div Cph DC 1MQ Dec Sa TA: Off
mV Measurement settings	Please select the plot types for	
Source 1 : Channel 1	displaying the measurement results.	
Autosetup configuration	Source signals	
Vertical : auto		
Horizontal : auto	Track of measurement	
Ref. levels : auto	Histogram of measurement	k
0 mV	FFT spectrum of track	
15 mV		
	Back Execute	Cancel

Fig. 4-13: Start the Jitter measurement with all the four suggested plot types by pressing "Execute"

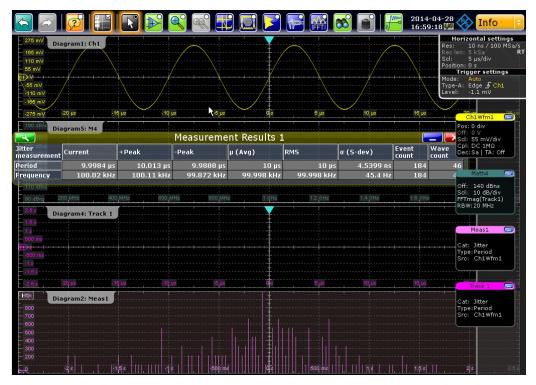
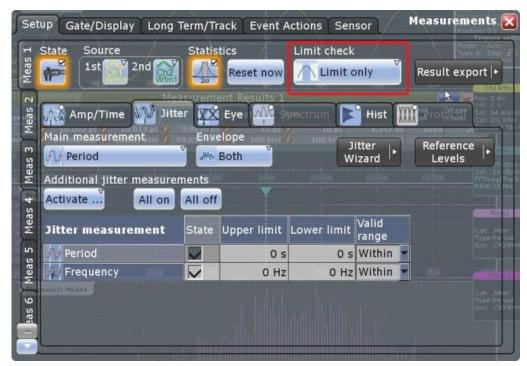


Fig. 4-14:Measurement results showing the period near 10 µs and the corresponding frequency near 100 kHz. The histogram in the lowest measurement window gives indication of the presence of some jitter



Select MEAS -> SETUP in the RTO / RTE menu.

Fig. 4-15: In the Setup dialog, select Limit Check

Jitter Measurement



Fig. 4-16: Turn the Limit Check on by selecting Limit Only

The pulse frequency of f = 100 kHz corresponds to a pulse repetition period of $T = 1/f = 10 \ \mu$ s. In order to measure jitter, it must be made sure that any small deviation (e.g., ±0.01 µs) from the 10 µs pulse period is detected.

Therefore, in the setup dialog, define the upper and lower limit of the period to be 10.01 μ s and 9.99 μ s, according to Fig. 4-17.

Jitter measurement	State	Upper limit	Lower limit	Valid range	
₩ Period		10.01 µs	9.99 µs	Within	-

Fig. 4-17: Enter the upper and lower limit by double clicking on the values

If the period exceeds the upper or lower limit, an alarm will be set. The jitter measurement is now active.

To verify the measurement activity, the oscilloscope can be made to beep upon limit violation.

Select MEAS -> EVENT ACTIONS in the RTO / RTE menu.



Fig. 4-18: Selecting the Event Actions dialog from the Measurement menu

Gate/Display	Long Term/Track Event Action	Positi	ents 🔀
ions on event		Mode	: Auto _
ep _{el6 µs}	On violation	😣 No action	Ch1 Wfm1
	Ӿ No action	On successful completion	Yos: 0 div Dff: 0 7 Scl: 54 mV/d
	Ӿ No action	On violation	ppl: DC 1MΩ Dec:Sa TA:
ve Wfm	🗙 No action 🌱		Math4
jger Out Pulse	🗙 No action 🗸	Trigger Pulse Control	Off: 35 dBns Scl: 10 dB/d FFTmac (Track RBW: 20 MHz
	cions on event ep op acq nt nt soat is a foot ve Wfm	cions on event P On violation p acq rt Peak No action ve Wfm No action	cions on event Don violation Pacq At Peak No action Con successful completion Con violation Con violatio

Fig. 4-19: Select Beep -> On violation

4.3 EMC32 Settings

4.3.1 Adding the Device to the Device List

The configuration is done in the Device List, which is accessible via the menu **EXTRAS -> DEVICE LIST ...**

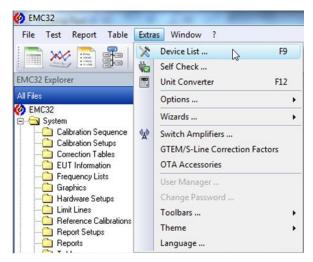
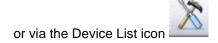


Fig. 4-2: Opening the Device List

or with the function key shortcut "F9"



)evices:		Configured Devices:				🖻 🗙 🔛 📾	
Monitoring	*	Name	Device	Туре	Interfa	Addr/SN	State
bmcm USB-AD16f		SMB100A	Generators	SMB100A	GPIB0	29	Virtual
- 👁 CBT		🚫 SML 03	Generators	SML	GPIB0	28	Virtual
CE-CAM		C Interlock	Interlock.	Interlock Circuit	None		
CMU for GPS		🙆 4-Line-LISN ENV	LISNs	LISN	None		
- CMU200		2-Line-LISN ENV	LISNs	LISN	None		
CMW for LBS		PCMON	Monitoring	Generic Monitor	LAN	LOCALHOST:1001	Virtual
-		Video Inserter	Monitoring	Generic Monitor	COM1		Virtual
- CMW500-CDMA - CMW500-GSM		CMU200	Monitoring	CMU200	GPIBO	20	Virtual
- CMW500-LTE		👁 UPL	Monitoring	UPL	GPIBO	10	Virtual
CMW500-TD-SCDMA		MAHA Roller Be	Monitoring	MAHA Roller B	LAN	:2000	Virtual
CMW500-UMTS		CMU200(1)	Monitoring	CMU200	GPIB0	20	Virtual
CMW500-WLAN		EMCAN32 Interf	Monitoring	EMCAN32 Inter	LAN	10.33.10.108:7800	Virtual
C EMCAN32 Interface		USB6009	Monitorina	NI USB 6009	USB	16C308F	Virtual
Generic Monitoring		Generic Monitoring	Monitoring	Generic Monitor	GPIBO	25	Virtual
IMS DIO		Generic Oscillos	Oscilloscop	Generic Oscillos	VISA	TCPIP::10.33.11.20::inst0::instr	Virtual
MAHA Roller Bench		NRVS	PowerMeters	NRVS	GPIBO	7	Virtual
🗠 👁 meMADfo DAIO	—	Power Meter	PowerMeters	NRP Channel A	GPIBO	12	Virtual
- 👁 meMPIO DIO	-	PM Sensor	PowerMeters	NRP Channel B	GPIBO	12	Virtual
- 👁 NI USB 6009		ZVX for Calibration	PowerMeters	ZVX for Calibrati	VISA	TCPIP::10.33.10.105::INST0::INSTR	Virtual
Opsens ProSens	=	🔀 NRP Channel A	PowerMeters	NRP Channel A	GPIBO	14	Virtual
PTW70 W-LAN	-	🔀 NRP-Zxx (USB)	PowerMeters	NRP-Zxx (USB)	USB	?	Virtual
• OPL		Receiver	Receivers	ESU 40	GPIB0	20	Virtual
		ESIB 26 3dB	Receivers	ESIB 26 3dB	GPIB0	20	Virtual
- 👁 UPV MultiFieldProbes		ESU 8	Receivers	ESU 8	GPIBO	20	Virtual
		ESIB 7	Receivers	ESIB 7	GPIB0	20	Virtual
Positioners		Generic Receiver	Receivers	Generic Receiver	GPIBO	20	Virtual
PowerMeters		ESIB 40	Receivers	ESIB 40	GPIB0	20	Virtual
Receivers		ESU 40	Receivers	ESU 40	GPIBO	20	Virtual
Receivers Slidebars		ESL 3	Receivers	ESL 3	GPIB0	20	Virtual
SwitchUnits		📇 Deisel Slidebar	Slidebars	Deisel Slidebar	GPIBO	7	Virtual
SystemControls		Switch Unit	SwitchUnits	TS-RSP	GPIB0	16	Virtual
Transducers		Generic RSU	SwitchUnits	Generic RSU	GPIBO	16	Virtual
TripleLoops		IMS RSU	SwitchUnits	IMS RSU	USB	100027	Virtual
TurnTables		BBA100	SwitchUnits	BBA100	GPIB0	2	Virtual
	*	Standard Control	SuetemDon	Standard Control	None		
4 III)		•			11		•

Add the **GENERIC MONITORING** device to the right side of the **DEVICE LIST** as **CONFIGURED DEVICE**.

Fig. 4-3: "Generic Monitoring" device added to "Configured Devices"

Single click on the entry and rename **GENERIC MONITORING** to an appropriate Device Name, e.g. **RTO TEST LIMIT**.

	👁 RTO Test Mask	Monitoring	Generic Mo	VISA	TCPIP::	Physical
🕀 🖓 SwitchUnits	S RTO Test Limit	Monitoring	Generic Mo	VISA	TCPIP:	Virtual

Fig. 4-4: Rename "Generic Monitoring" to "RTO Test Limit"

<u>Note:</u> Please make sure that all necessary instrument drivers, e.g. SMB, NRP-Zxx have been installed, before running an EMS test. If some or all devices are missing, a message box allowing simulation mode enabling will appear.

4.3.1.1 Generic Monitoring Properties

Edit the **RTO TEST LIMIT** properties by double clicking on the menu item. It is defined by six properties:

- General
- Interface Parameters
- General Commands
- Device Programming
- Measurement Queries
- EMS Information

4.3.1.2 General and Interface Parameters Tabs

In the General tab, select the appropriate **INTERFACE TYPE** from a list of addresses or by using the **VISA DEVICE IDENTIFIER** (see Fig. 4-5).

After editing this parameter, close the RTO Limit Test window by pressing OK. Also close the Device List by pressing OK. If there have been significant changes in the Device List, a window pops up, advising to close and restart EMC32-S. Re-open the Device List and activate the RTO Test Limit device by changing the **STATE** from **VIRTUAL** to **PHYSICAL**.

🛱 RTO Test Limit - Generic Monitoring - Monitoring	×
General Interface Parameters General Commands Device Interface Type VISA VISA VISA VISA VISA VISA Device Identifier TCPIP::RT0-200159::INSTR	Programming Measurement Queries EMS Ii
Description	Serial number Firmware Version Calibration valid until Configure
OK Cancel	

Fig. 4-5: Select Interface Type "VISA"

RTO Test Limit - Generic Monitoring - Monitoring	Programming Measurement Queries EMS I
First Step Interface Type VISA VISA Device Identifier TCPIP::RT0-200159::INSTR Description	State Physical O Virtual Second Step Serial number Firmware Version
OK Cancel	

Fig. 4-6: Set State to "Physical"

Change to **INTERFACE PARAMETERS** tab and set the parameters.

Ta RTO Test Limit - Generic Monitoring - Monitoring	
General Interface Parameters) General Commands Device Programming Measurement Queries EMS I.	ļ
Timeout 1,0 s	
EMS-K1 Compatibility	
Export Settings Dwell Time after	
Import Settings receiving a WAIT to a 500 ms Measurement Query	
	1
Cancel	

Fig. 4-7: Import settings

Import parameters by clicking IMPORT SETTINGS.

In the newly opened dialog box Import Settings, select predefined parameters by clicking the button, selecting **RTO LIMIT TEST** and pressing **OK**.

🖪, Import Settings	×
Configuration File	
RTO Limit Test	
Import	Close

Fig. 4-8: Configuration File to Import

Click on **IMPORT** to load the configuration. The import is completed by pressing OK on the following message window.

Import Settings	Z
The settings have been imp	ported successfully.
	ОК

Fig. 4-9: Successful file import

The RTO Limit Test import file contains following lines.

4.3.1.3 General Commands

Commands for the basic configuration of the monitoring device are defined in this tab. The following commands are available:

🛱 RTO Test Limit - Generic Monitoring - Monitoring				
General Interface Parameters General Corr	mands] Device Programming Measurement Queries EMS I			
	Description			
Reset / Initialize				
Identification Query	*IDN?			
Identification Response	RTO			
Trigger	RUN			
Start Test				
Stop Test				
Start EuT				
Stop EuT				
Reset EuT				
EuT Ready Query				
	Test			
OK Cancel				

Fig. 4-10: Generic Monitoring Commands

EMC32 Settings

4.3.1.4 Device Programming

This tab contains two commands for activating the limit test.

E	🛱 RTO Test Limit - Generic Monitoring - Monitoring				
0	General Interface Parameters General Commands Device Programming Measurement Queries EMS I				
	No	GPIB Command	Description		
	1	STAT:QUES:LIM:PTR 1	Positive Transition (0 to 1) on Limit Violation		
	2	STAT:QUES:LIM:ENAB 1	Enable Limit Function		

Fig. 4-11: Commands for activating Limit Test

4.3.1.5 Measurement Queries

This tab contains the Limit Test Result (0=PASS, 1=FAIL).

General Interface Parameters General Commands Device Programming Measurement Queries

No	GPIB Command	Description	String for PASS (=0)	Header characters to delete
1	STAT:QUES:LIM?	Get Result	0	0

Fig. 4-12: "Measurement Queries" tab with Status Byte Query

4.3.1.6 Generic Monitoring Test Dialog

After pressing the button in the EMS INFORMATION tab, the following dialog box will be opened, allowing to select an item from the GENERAL COMMANDS or MEASUREMENT QUERIES list. Select IDENTIFICATION QUERY from the GENERAL COMMANDS and enter the TEST COMMAND "*IDN?". After pressing TEST COMMAND, the command is sent to the oscilloscope and the response (RTO ID string) is received. Then, exit this dialog by pressing CLOSE.

RTO Test Limit - Generic Monitoring	
General Commands	Identification Query
O Device Programming	
C Measurement Queries	
C EMS Information	
Test Command TDN?	&Schwarz,RT0,1316.1000k24/200159,2.30.0
	<u>C</u> lose

Fig. 4-13: Generic Monitoring Test Dialog

4.4 EUT Monitoring Example

In order to perform the example, a test template for EUT monitoring with an RTO or RTE oscilloscope is required first.

4.4.1 Oscilloscope Monitoring Settings

To generate a new EUT Monitoring Test Template, proceed as shown in Fig. 4-14.

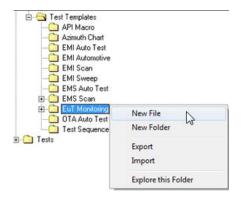


Fig. 4-14: EUT Monitoring Configuration: "New File"

In the EMC32 Explorer, select File -> Test Template open/new. Right-click on the **EUT MONITORING** menu item and select **New File**. A new window for configuring the RTO Test Limit parameters pops up.

EL	ions JT Inform	nation		Mobile Phone		arameters on Test Start
<1	none>					s on each Test Start
No 1	Active		Meas. Device	Conversion	NoGo	Actions No Action
1	V	Channel 1	<no device=""></no>	MEAS	>5	No Action
_	Channel	Hardy	vare Display	NoGo	A	ctions Options
	Channel	Hardy	ware Display	NoGo	A	ctions Options
_	Channel	Hardy	ware Display		A	ctions Options
	Channel	Hardy	ware Display			ctions Options
_	Channel	Hardy	ware Display		: Mask	ctions Options
	Ē	Hards	vare Display	RTM Test	: Mask Mask	ctions Options
[Ē			RTM Test	: Mask Mask Limit	ctions Options
[Ē		<no device=""></no>	RTM Test RTO Test RTO Test	Mask Mask Limit Mask	ctions Options
[Ē		<no device=""></no>	RTM Test RTO Test RTO Test RTE Test	Mask Mask Limit Mask Limit	ctions Options
ſ	Ē		<no device=""></no>	RTM Test RTO Test RTO Test RTE Test RTE Test	Mask Mask Limit Mask Limit sor	ctions Options
[Ē	device>	<no device=""></no>	RTM Test RTO Test RTO Test RTE Test Field Sen:	Mask Mask Limit Mask Limit sor eter	ctions Options

Fig. 4-15: EUT Monitoring configuration: RTO Test Limit selection

Right-click on the oscilloscope device icon in the **HARDWARE** tab and select **RTO TEST LIMIT** from the list.

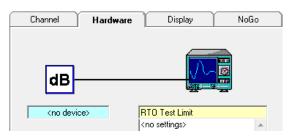


Fig. 4-16: EUT Monitoring Configuration: Selected Device

Then left-click on the icon to configure the device in the following pop-up window, according to Fig. 4-17: select "Send Trigger Command", and specify the Measurement Query as "Get Result". Check the **Device Programming** items **Positive Transition...** and **ENABLE LIMIT FUNCTION**.

💼 RTO Test Limit - Generic Monitoring - Monitorin	9
General Settings	
Additional Commands	Device Programming
	Set Command
Measurement Queries	Positive Transition (0 to 1) on Limit Violation Enable Limit Function
Get Result	
Substitute placeholder %%% in query with	
Test	
OK Cancel	

Fig. 4-17: EUT Monitoring Configuration: Device Settings

Press **OK** to complete the **RTO TEST LIMIT** configuration, which appears in the EUT Monitoring configuration in Fig. 4-18.

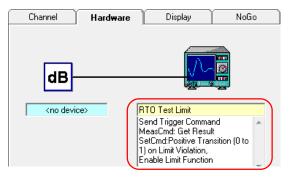


Fig. 4-18: EUT Monitoring Configuration

After configuring **RTO TEST LIMIT**, go to the **CHANNEL** tab and select **TRIGGER MODE -> BEFORE DWELL**.

Channel	Hardware	Display	NoGo	Actions
-			-	
Channel Name	Channel 1			
)	
Trigger Mode	Before Dwell	-		
)	

Fig. 4-19: EUT Monitoring Configuration: "Trigger Mode" Selection

In the **NoGo** tab, set **NoGo TYPE** to **ABOVE LIMIT**, set **LIMIT VALUE** = 0.50000 and press **OK** to save the **RTO LIMIT TEST** configuration.

Channel Hardware Disp	lay No	Go Actio	ns Option:
- NoGo Type	- Limit Value-		
Above Limit	🕥 Con	stant 0,500000	
C Below Limit	C Sha	pe <a>(none)	

Fig. 4-20: EUT Monitoring Configuration: "Limit Value"

4.4.2 Actions

If the measurement should be stopped after a limit violation occurred, add **STOP TEST** to the **ACTION ON NOGO** item.

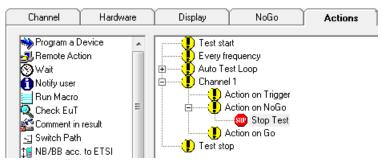


Fig. 4-21: Action on NoGo \rightarrow Stop Test

4.4.3 Start Test

Download DEVICECONFIGURATION_FILES.ZIP from the 1MA242 application note page and unzip EUT TEST.EMSCONFIGURATION to <EMC32 DIRECTORY>\EMC32\SySTEM\TEST TEMPLATES\EMS SCAN\EN61000-4-3\ and RTO LIMIT TEST.EUTCONFIGURATION, RTE LIMIT TEST.* to <EMC32 DIRECTORY>\EMC32\SySTEM\TEST TEMPLATES\EUT MONITORING\.

<u>Note:</u> In case of Windows7 and the default data directory C:\PROGRAMDATA it is necessary to make it visible first by unchecking the HIDE PROTECTED OPERATING FILES in the FOLDER OPTIONS.

In the EMC32 Explorer, right-click on the menu item **TEST TEMPLATE -> EMS SCAN -> EN61000-4-3** (EMS Radiated) **-> EUT TEST** and select **New TEST**.

Note: In case of Windows7 and the default data directory **C:\ProgramData** it is necessary to make it visible first by unchecking the **HIDE PROTECTED OPERATING FILES** in the **FOLDER OPTIONS**).

In the EMC32 Explorer, right-click on the menu item **TEST TEMPLATE -> EMS SCAN -> EN61000-4-3** (EMS Radiated) **-> EUT TEST** and select **New TEST**.

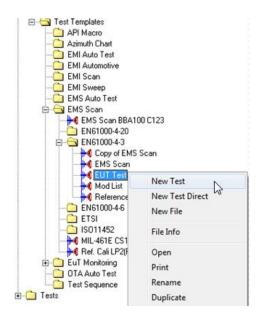


Fig. 4-22: Start EMS Scan Test Template as New Test

A New TEST window with EMS Radiated specific default parameters pops up.

New Test - [EMS Radiated]	x			
Test Definition Test Level Report				
Test Control Parameter Test Name Test Test Method EuT Qualification				
Immunity Parameter (++				
EuT Monitoring Parameters Template				
Cancel				

Fig. 4-23: New Test dialog

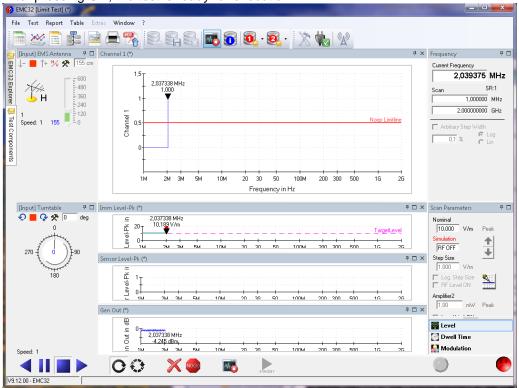
After pressing the **EUT MONITORING PARAMETERS** –> […] icon, the EuT Monitoring Open window pops up, which allows to select the **RTO LIMIT TEST**(.EUTConfiguration).

EuT Monitoring Open	×
Path: C:\Download\EMC32\System\Test Templates\EUT Monitoring	ОК
	Cancel
SEuT Monitoring EuT Monitoring (old)	<u>H</u> elp
SEuT Monitoring (old) RTO Limit Test RTO Mask Test	

Fig. 4-24: EUT monitoring File location

EuT Mon	itoring Parame Template	eters RTO Limit Test		
	<u>0</u> K		Cancel	

Fig. 4-25: New Test dialog with "RTO Limit Test"



After pressing **OK**, the test is ready for execution.

Fig. 4-26: EMC32 Test Execution

The upper graph in Fig. 4-26 (see also Fig. 4-27) shows how the Limit value jumps from 0 to 1 when the signal violates the limit. The logical units 0 and 1 are interpreted as 0.0 and 1.0 which exceeds the pre-defined 0.5 limit line, causing a **FAIL** result.

RTO / RTE Limit Test Functionality for EUT Monitoring

EUT Monitoring Example

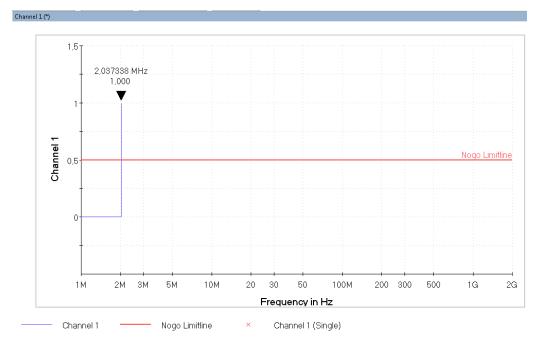


Fig. 4-27: EUT Channel 1 measurement result

5 EMC32 Limit Testing

In case an instrument does not have the limit test capability, e.g. RTM, EMC32 can handle the limit checking instead. The performance will slightly be reduced as compared to use of RTO / RTE.

5.1 RMS Measurement

This example shows how to set up the RTM oscilloscope for an RMS measurement and configure EMC32 to stop the measurement in case the RMS value drops below a certain limit.

5.1.1 Oscilloscope Settings

Press the **MEAS** button and select **MEAS. TYPE**, e.g. **RMS**. Connect the pulse output with **CH1** input via probe and press **AUTOSET**.

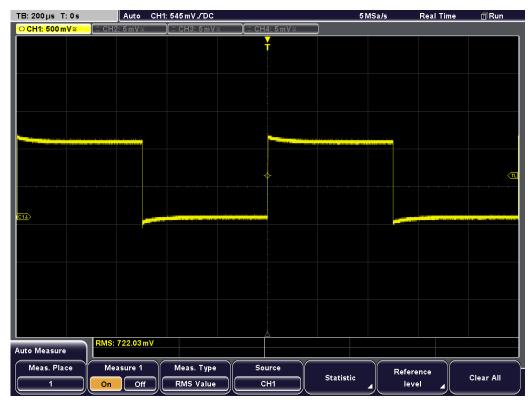


Fig. 5-1: RMS Measurement on RTM

5.2.1 Adding the Device to the Device List

The configuration is done in the Device List, which is accessible via the menu **EXTRAS -> DEVICE LIST ...**

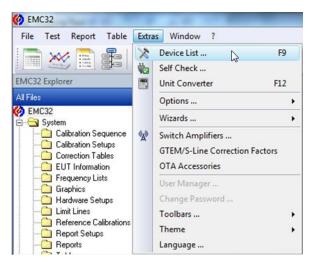


Fig. 5-2: Opening the Device List

or with the function key shortcut "F9"



or via the Device List icon

Monitoring bmcm USB-AD16/ CBT CE-CAM CMU for GPS CMU200 CMW for LBS CMW/270 CMW/200 CMW/200		Name SMB100A	Device	Туре	1			
CBT CE-CAM CE-CAM CMU for GPS CMU200 CMV/for LBS CMV/270 CMV/270		SMB100A		Type	Interfa	Addr/SN	State	1
CE-CAM CMU for GPS CMU200 CMW200 CMW270 CMW270			Generators	SMB100A	GPIB0	29	Virtual	1
CMU for GPS CMU200 CMV/ for LBS CMV/270		🚫 SML 03	Generators	SML	GPIBO	28	Virtual	
CMU200 CMW for LBS CMW270		Interlock	Interlock	Interlock Circuit	None			
CMU200 CMW for LBS CMW270 CMW270 CMW2600 CDMA		34-Line-LISN ENV	LISNs	LISN	None			
CMW for LBS CMW/270 CMW/500 CDMA		2-Line-LISN ENV	LISNs	LISN	None			
CMW270		PCMON	Monitoring	Generic Monitor	LAN	LOCALHOST:1001	Virtual	
		Video Inserter	Monitoring	Generic Monitor	COM1		Virtual	
CMW500-GSM		CMU200	Monitoring	CMU200	GPIBO	20	Virtual	
CMW500-GSM		👁 UPL	Monitoring	UPL	GPIB0	10	Virtual	
CMW500-LTE		MAHA Roller Be	Monitoring	MAHA Roller B	LAN	:2000	Virtual	
CMW500-UMTS		CMU200(1)	Monitoring	CMU200	GPIB0	20	Virtual	
CMW500-WLAN		EMCAN32 Interf	Monitoring	EMCAN32 Inter	LAN	10.33.10.108:7800	Virtual	
C EMCAN32 Interface		USB6009	Monitorina	NI USB 6009	USB	16C308F	Virtual	
Generic Monitoring		Generic Monitoring	Monitoring	Generic Monitor	GPIBO	25	Virtual	1
IMS DIO		Generic Oscillos	Oscilloscop	Generic Oscillos	VISA	TCPIP::10.33.11.20::inst0::instr	Virtual	1
👁 MAHA Roller Bench		, 🔛 NRVS	PowerMeters	NRVS	GPIBO	7	Virtual	
👁 meMADfo DAIO	-	Rower Meter	PowerMeters	NRP Channel A	GPIBO	12	Virtual	
👁 meMPIO DIO		M Sensor	PowerMeters	NRP Channel B	GPIBO	12	Virtual	
NI USB 6009		ZVX for Calibration	PowerMeters	ZVX for Calibrati	VISA	TCPIP::10.33.10.105::INST0::INSTR	Virtual	
Opsens ProSens		NRP Channel A	PowerMeters	NRP Channel A	GPIBO	14	Virtual	
👁 PIW/UW-LAN		🔀 NRP-Zxx (USB)	PowerMeters	NRP-Zxx (USB)	USB	?	Virtual	
O UPL O UPP		Receiver	Receivers	ESU 40	GPIBO	20	Virtual	
		ESIB 26 3dB	Receivers	ESIB 26 3dB	GPIB0	20	Virtual	
UPV MultiFieldProbes		ESU 8	Receivers	ESU 8	GPIBO	20	Virtual	
		ESIB 7	Receivers	ESIB 7	GPIB0	20	Virtual	
Positioners		Generic Receiver	Receivers	Generic Receiver	GPIBO	20	Virtual	
PowerMeters		ESIB 40	Receivers	ESIB 40	GPIB0	20	Virtual	
Receivers		ESU 40	Receivers	ESU 40	GPIBO	20	Virtual	
Slidebars		ESL 3	Receivers	ESL 3	GPIB0	20	Virtual	
SwitchUnits		🚝 Deisel Slidebar	Slidebars	Deisel Slidebar	GPIBO	7	Virtual	
SystemControls		Switch Unit	SwitchUnits	TS-RSP	GPIB0	16	Virtual	
Transducers		Generic RSU	SwitchUnits	Generic RSU	GPIB0	16	Virtual	
TripleLoops		IMS RSU	SwitchUnits	IMS RSU	USB	100027	Virtual	
TurnTables		BBA100	SwitchUnits	BBA100	GPIBO	2	Virtual	
	-	Standard Control	SuetemCon	Standard Control	None			

Add the **GENERIC MONITORING** device to the right side of the **DEVICE LIST** as **CONFIGURED DEVICE**.

Fig. 5-3: "Generic Monitoring" device added to "Configured Devices"

Single click on the entry and rename **GENERIC MONITORING** to an appropriate Device Name, e.g. **RTM TEST LIMIT**.





Fig. 5-4: Rename "Generic Monitoring" to "RTM Test Limit"

<u>Note:</u> Please make sure that all necessary instrument drivers, e.g. SMB, NRP-Zxx have been installed, before running an EMS test. If some or all devices are missing, a message box allowing simulation mode enabling will appear.

5.2.1.1 Generic Monitoring Properties

Edit the **RTM TEST LIMIT** properties by double clicking on the menu item. It is defined by six properties:

- General
- Interface Parameters
- General Commands
- Device Programming
- Measurement Queries

5.2.1.2 General and Interface Parameters Tabs

In the General tab, select the appropriate **INTERFACE TYPE** from a list of addresses or by using the **VISA DEVICE IDENTIFIER** (see Fig. 4-6).

After editing this parameter, close the RTM Limit Test window by pressing OK. Also close the Device List by pressing OK. If there have been significant changes in the Device List, a window pops up, advising to close and restart EMC32-S. Re-open the Device List and activate the RTM Test Limit device by changing the **STATE** from **VIRTUAL** to **PHYSICAL**.

🔁 RTM Test Limit - Generic Monitoring - Monitoring	
General Interface Parameters General Commands Device	Programming Measurement Queries EMS I
First Step	State
Type VISA ▼ VISA Device Identifier	Physical O Virtual
TCPIP::10.85.0.137::INSTR	Second Step

Fig. 5-5: Set State to "Physical"

Change to **INTERFACE PARAMETERS** tab and set the parameters.

RTM Test Limit - Generic Monitoring
General Interface Parameters General C
Timeout 10 s
Timeout 1,0 s
EMS-K1 Compatibility 📃
Export Settings
Import Settings

Fig. 5-6: Import settings

Import parameters by clicking IMPORT SETTINGS.

In the newly opened dialog box Import Settings, select predefined parameters by clicking the _____ button, selecting **RTM LIMIT TEST** and pressing **OK**.

🖪, Import Settings	×
Configuration File	
RTO Limit Test]
Import	Close

Fig. 5-7: Configuration File to Import

Click on **IMPORT** to load the configuration. The import is completed by pressing OK on the following message window.

Import Settings	
The settings have b	een imported successfully.
	ОК

Fig. 5-8: Successful file import

The RTM Limit Test import file contains following lines.

5.2.1.3 General Commands

Commands for the basic configuration of the monitoring device are defined in this tab. The following commands are available:

🔁 RT	M Test Limit - Generic Monitoring - M	onitoring
Gen	eral Interface Parameters General Com	mands Device Programming
		Description
	Reset / Initialize	
	Identification Query	*IDN?
	Identification Response	RTM
	Trigger	RUN

Fig. 5-9: Generic Monitoring Commands

5.2.1.4 Device Programming

Not used in this example.

4	R'	TM T	est Limit - Generic Monitoring - Monit	oring	
	Ge	neral	Interface Parameters General Command	Is Device Programming Measurement Queri	es
l		No	GPIB Command	Description	

Fig. 5-10: Commands for activating Limit Test

5.2.1.5 Measurement Queries

This tab contains the measurement query command.

	RTM	Test Limit - Generic	Monitoring	- Monitorii	ng	100.0
G	ienera	al Interface Paramete	rs General C	Commands	Device Programming	Measurement Queries
	No	GPIB Command	Description	String for PASS (=0)	Header characters to delete	
	1	MEAS:RES1? RMS	Get Result		0	

Fig. 5-11: "Measurement Queries" tab with RMS measurement command

Note: The **STRING FOR PASS** field is empty since the PASS / FAIL decision of a measurement result is made by the EMC32 software. In case a scope offers mask or limit detection feature, this field will contain usually either "PASS" or "0".

5.2.1.6 Generic Monitoring Test Dialog

After pressing the **Test** button in the **MEASUREMENT QUERIES** tab, the following dialog box will be opened. , allowing to select an item from the **GENERAL COMMANDS** or list. Select **GET RESULT** from the **MEASUREMENT QUERIES** and enter the command "MEAS:RES1? RMS". After pressing **TEST COMMAND**, the command is sent to the oscilloscope and the response "7.224944E-01" is received. Then, exit this dialog by pressing **CLOSE**.

RTM Test Limit - Generic Monit	oring
C General Commands	_
C Device Programming	Y
 Measurement Queries 	Get Result
C EMS Information	V
[MEAS:RES1? RMS
Answer	7.224944E-01
	Close

Fig. 5-12: Generic Monitoring Test Dialog

5.3 EUT Monitoring Example

In order to perform the example, a test template for EUT monitoring with an RTM oscilloscope is required first.

5.3.1 Oscilloscope Monitoring Settings

To generate a new EUT Monitoring Test Template, proceed as shown in Fig. 4-14.

COTA Auto Test OTA Auto Test Test Sequence New Folder	OTA Auto Test	OTA Auto Test Test Sequence Tests	Test Templates API Macro Arimuth Chart EMI Auto Test EMI Automotive EMI Scan EMI Sweep EMS Auto Test EMS Auto Test EMS Can	
Test Sequence New Folder	Tests Sequence New Folder	Tests Export		New File
		Export	- Test Sequence	New Folder

Fig. 5-13: EUT Monitoring Configuration: "New File"

In the EMC32 Explorer, select FILE -> TEST TEMPLATE OPEN/NEW.... Right-click on the EUT MONITORING menu item and select NEW FILE. A new window for configuring the RTM Test Limit parameters pops up.

EL	ionitoring ions JT Inform none>	g - [RTM Limit Te	est]		Test eakthrough Parame 3T Parameters on e	
<u>No</u> 1	Active	Name RTM Limit Test -	Meas. Device RTM Test Limit	Conversion MEAS	NoGo < 0.6 xx	Actions Stop the test
F	Channel	Hard w ar	e Display	NoGo	Actions	: Options
		B device>	RTM Test Limit Send Trigger Co MeasCmd: Get I	RTM Test I RTO Test I RTO Test L RTE Test L RTE Test L RTM Test I Field Senso	Mask .imit 1ask .imit Limit	
	∖dd Char	n el	e Channel	Power Met PM Sensor		ОК

Fig. 5-14: EUT Monitoring configuration: RTM Test Limit selection

Right-click on the oscilloscope device icon in the **HARDWARE** tab and select **RTM TEST LIMIT** from the list.

Channel Hardward	e Display NoGo
dB	
<no device=""></no>	RTM Test Limit

Fig. 5-15: EUT Monitoring Configuration: Selected Device

Then (left-)click on the icon to configure the device in the following pop-up window, according to Fig. 4-17: select "Send Trigger Command", and specify the Measurement Query as "Get Result". Check the **Device Programming** items **Positive Transition...** and **ENABLE LIMIT FUNCTION**.

EMC32 Limit Testing

EUT Monitoring Example

🔁 RTM Test Limit - Generic Monitoring - Monitorin	g	—X —)
General Settings		1	
Additional Commands	- Device	e Programming	
	Set	Command	
Measurement Queries			
Get Result			

Fig. 5-16: EUT Monitoring Configuration: Device Settings

Press **OK** to complete the **RTM TEST LIMIT** configuration, which appears in the EUT Monitoring configuration in Fig. 4-18.

Channel	Hardware	Display	NoGo
dB-			
	_		
<no devi<="" th=""><th>ce></th><th>RTM Test Limit</th><th></th></no>	ce>	RTM Test Limit	
		Send Trigger Comma MeasCmd: Get Resul	nd 🔺

Fig. 5-17: EUT Monitoring Configuration

After configuring **RTM TEST LIMIT**, go to the **CHANNEL** tab and select **TRIGGER MODE –> BEFORE DWELL**.

Channel	Hardware	Display	NoGo	Actions
Channel Name	Channel 1			
Trigger Mode	Before Dwell			
	J		J	

Fig. 5-18: EUT Monitoring Configuration: "Trigger Mode" Selection

In the **NoGo** tab, set **NoGo TYPE** to **BELOW LIMIT**, set **LIMIT VALUE** = 0.60000 and press **OK** to save the **RTM LIMIT TEST** configuration.

Channel	Hardware	Displa	y	ſ	NoGo	Actions		Option:
- NoGo Type-			Lir	nit Va	alue			
C Above I	Limit			œ	Constant	0,600000	_ v	
🕞 Below L	.imit			0	Shape	<none></none>		

Fig. 5-19: EUT Monitoring Configuration: "Limit Value"

5.3.2 Actions

If the measurement should be stopped after a limit violation occurred, add **STOP TEST** to the **ACTION ON NOGO** item.

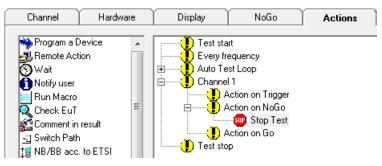


Fig. 5-20: Action on NoGo \rightarrow Stop Test

5.3.3 Start Test

Download DEVICECONFIGURATION_FILES.ZIP from the 1MA242 application note page and unzip EUT TEST.EMSCONFIGURATION to <EMC32 DIRECTORY>\EMC32\SYSTEM\TEST TEMPLATES\EMS SCAN\EN61000-4-3\ and RTO LIMIT TEST.EUTCONFIGURATION, RTE LIMIT TEST.* to <EMC32 DIRECTORY>\EMC32\SYSTEM\TEST TEMPLATES\EUT MONITORING\.

Note: In case of Windows7 and the default data directory **C:\ProgramData** it is necessary to make it visible first by unchecking the **HIDE PROTECTED OPERATING FILES** in the **FOLDER OPTIONS**.

In the EMC32 Explorer, right-click on the menu item **TEST TEMPLATE -> EMS SCAN -> EN61000-4-3** (EMS Radiated) **-> EUT TEST** and select **New TEST**.

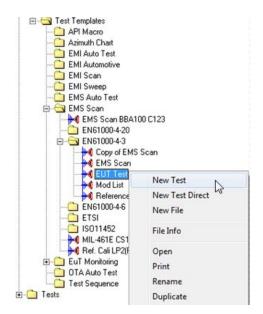


Fig. 5-21: Start EMS Scan Test Template as New Test

A New Test window with EMS Radiated specific default parameters pops up.

New Test - [EMS Radiated]	×
Test Definition Test Level Report	\neg
Test Control Parameter Test Name Test Test Method EuT Qualification	
Immunity Parameter	
C Reference Calibration	
EuT Monitoring Parameters	
Cancel	

Fig. 5-22: New Test dialog

After pressing the **EUT MONITORING PARAMETERS** –> icon, the EuT Monitoring Open window pops up, which allows to select the **RTM LIMIT TEST**(.EUTConfiguration).

Path: C:\Download\EMC32\Sy	stem\Test Templates\EUT Monitoring		ОК
SEuT Monitoring	1	0-0- :=== <u>-</u>	Cancel
SEuT Monitoring SEuT Monitoring (old)			<u>H</u> elp

Fig. 5-23: EUT monitoring File location

EuT Moni	toring Parame Template	RTM Limit Test		
	<u>0</u> K		Cancel	

Fig. 5-24: New Test dialog with "RTM Limit Test"

After pressing $\ensuremath{\text{OK}}$, the test is ready for execution.

File Test Report Table Ext				~ ~												
📄 💥 🖹 🐉 🖾	1 (=)	2			3 00		0, - 🧕	5 X	S 🛸	A A						
	RTM Li	imit Test	- RMS (*)												
Ar HT Limit Test - RMS cloaded: Gen Out Gen Nut G		RTM Limit Test - RMS	1 0.5	364.(028 MH 098 m∀ ♥										Nogo Lim	
Sensor Level-Pk		R I	1 M	21	1 3M	5M	10M	20	30 5	50	100M	200	300	500	1G	2G
🔄 Report Setups 🔄 Result Tables		Frequency in Hz														
Result Table	Imm L	evel-Pk (*	")													
Result Table_RTM_Limit Result Table_Single Result Table_Single Result Table_Single otti		mm Level-Pk i	20 T	9,72	7 ∨/m										Target	Level
EUT Test		L g	1M	2M	ЗМ	5М	10M	20	30	50	100M	200	300	500	1G	2G
B- 🦳 System		=							Frequ	iency in	Hz					
	Sensor	Level-Pk	(*)													ņ
		Sensor Level-Pk	1 0 1 M	2M	ЗМ	5М	10M	20	30 Frequ	50 ency in H	100M Hz	200	300	500	1G	2G
	Gen Ou	ut (*)														4
		Gen Out in dl	0 1 M	2,32002 -5.0,14 2M	l dBm	5м	10M	20	30	50	100M	200	300	500	1G	2G
		0 E	1 M	2M	ЗM	5M	10M	20	30	50	100M	200	300	500	1G	2G

Fig. 5-25: EMC32 Test Execution

The upper graph in Fig. 4-26 (also see Fig. 4-27) shows how the RMS voltage drops from 722 mV below the 600 mV limit line. The measurement is stopped immediately due to the **ACTION ON NOGO -> STOP TEST** (see Fig. 4-21)

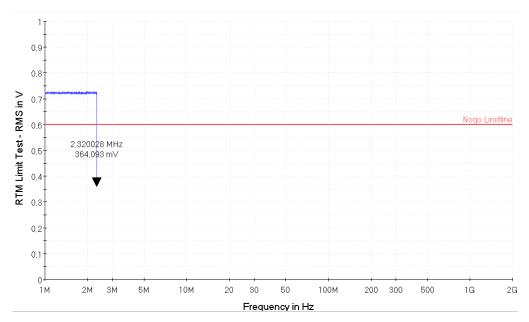


Fig. 5-26: EUT Channel 1 measurement result

6 Literature

- [1] R&S®RTO Digital Oscilloscope User Manual
- [2] R&S[®]RTE Digital Oscilloscope User Manual
- [3] R&S[®]RTM Digital Oscilloscope User Manual
- [4] R&S®EMC32 Measurement Software User Manual
- [5] Application Note 1MA212 Conducted EMS and EMI Measurements with R&S[®]EMC32
- [6] Application Note 1TD05 EMI Debugging with the R&S[®]RTO and R&S[®]RTE Oscilloscopes
- [7] Application Note 1SP06 Interactive EMI Measurements with R&S[©]EMC32-K24

7 Additional Information

Please send comments or suggestions about this application note to TM-Applications@rohde-schwarz.com.

8 Ordering Information

Ordering Informa	ation	
Digital Oscillosc	оре	
R&S [®] RTO1002	600 MHz, 10 Gsample/s, 20/40 Msamples, 2 channels	1316.1000.02
R&S®RTO1012	600 MHz, 10 Gsample/s, 20/40 Msamples, 2 channels	1316.1000.02
R&S®RTO1012	1 GHz, 10 Gsample/s, 20/40 Msamples, 2 channels	1316.1000.12
R&S®RTO1014	1 GHz, 10 Gsample/s, 20/80 Msamples, 4 channels	1316.1000.14
R&S®RTO1022	2 GHz, 10 Gsample/s, 20/40 Msamples, 2 channels	1316.1000.22
R&S®RTO1024	2 GHz, 10 Gsample/s, 20/80 Msamples, 4 channels	1316.1000.24
R&S®RTO1044	4 GHz, 10 Gsample/s, 20/80 Msamples, 4 channels	1316.1000.44
R&S [®] RTE1022	200 MHz, 5 Gsample/s, 10/20 Msamples, 2 channels	1316.2500.22
R&S®RTE1024	200 MHz, 5 Gsample/s, 10/40 Msamples, 4 channels	1316.2500.24
R&S®RTE1032	350 MHz, 5 Gsample/s, 10/20 Msamples, 2 channels	1316.2500.32
R&S [®] RTE1034	350 MHz, 5 Gsample/s, 10/40 Msamples, 4 channels	1316.2500.34
R&S®RTE1052	500 MHz, 5 Gsample/s, 10/20 Msamples, 2 channels	1316.2500.52
R&S [®] RTE1054	500 MHz, 5 Gsample/s, 10/40 Msamples, 4 channels	1316.2500.54
R&S®RTE1102	1 GHz, 5 Gsample/s, 10/20 Msamples, 2 channels	1316.2500.02
R&S [®] RTE1104	1 GHz, 5 Gsample/s, 10/40 Msamples, 4 channels	1316.2500.04
R&S®RTM2032	350 MHz, 2.5 Gsample/s, 10/20 Msamples, 2 channels	5710.0999.32
R&S®RTM2034	350 MHz, 2.5 Gsample/s, 10/20 Msamples, 4 channels	5710.0999.34
R&S®RTM2052	500 MHz, 5 Gsample/s, 10/20 Msamples, 2 channels	5710.0999.52
R&S®RTM2054	500 MHz, 5 Gsample/s, 10/20 Msamples, 4 channels	5710.0999.54
R&S®RT-ZS20	1.5 GHz, active probe, 1 M Ω , 0.8 pF, R&S®ProbeMeter, micro button	1410.3502.02
R&S®RT-ZD20	1410.4409.02	
Measurement So		
R&S®EMC32-S	EMS Measurement Software for Conducted and Radiated Susceptibility	1119.4638.02

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system



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