# Application Note 3, Multiprobe EUT-Monitoring using EMC32

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# 1 Introduction

Using multiple E-field probes can improve both speed and accuracy of EMC measurements. This application note describes the EMC32 setup procedure for four LSProbe 1.2 E-field probes and one LSPM 1.0 powermeter. EMC32 supports using multiple E-field probes in two scenarios, both use cases are detailed in this document. :

- Additional E-field probes can be used as monitoring devices outside the E-field control loop.
- E-field values of four probes can be averaged for use inside the E-field control loop.

The E-field probes are identified using the unique serial numbers of the four Computer Interfaces. The serial numbers can be found out using either of the following methods.

- Find the serial number on the bottom side of each Computer Interface.
- As shown in Figure 1, use the serial numbers displayed in the table after starting the LSProbe 1.2 TCP server.
- As also shown in Figure 1, query the serial numbers using the "syst:cis? 0" command.

The use of the LSPM 1.0 powermeter is optional, its serial number is not required for the setup.

+  Device#	CI#	CI Devices : Hardware Rev.	Summary  CI-Firmware	Server Firmware
0  1	1   2	CI250 1.2 CI250 1.2	2846  2846	2846 2846 2846
2	3   4	CI250 1.2 CI250 1.2	2846  2846	2846   2846
+ syst:cis? @ 1,2,3,4	)			+

Figure 1: Obtaining list of connected Computer Interfaces' serial numbers

## 2 Preparation of the EMC32 .DeviceConfiguration Files

In a Multiprobe setup each E-field probe requires a unique .DeviceConfiguration file containing the Computer Interface's serial number. Create one .DeviceConfiguration file for each E-field probe using the following steps:

- Copy 'LSProbe\_1v2\_Mode0.DeviceConfiguration' found in ..\EMC32\Configuration\Others to 'LSProbe\_1v2\_Mode0\_Clxxx.DeviceConfiguration' where "xxx" is the serial number of the Computer Interface.
- Edit the .DeviceConfiguration file and change line 34 from VisaLine1=\*IDN? to VisaLine1=\*IDN?;syst:cis xxx where "xxx" is the serial number of the Computer Interface.
- Edit the .DeviceConfiguration file to reflect other field probe settings such as low-pass filter frequency (line 66) and E-field probe mode (line 45 and 56).
- four new device configuration files needed, one for each enumerated CI of the Field Probes (see Figure 2(a))
- measurement in Mode 0
  - $\rightarrow$  EMC32 device configuration file 'LSProbe\_1v2\_Mode0.DeviceConfiguration' located in subdirectory of the EMC32 installation path as template used
- the following four files where created with the respective change in line 34 to set the active CI for the EMC32 field probe device using the specific configuration file:
- LSProbe\_1v2\_Mode0\_Cl1.DeviceConfiguration line 34: VisaLine1=\*IDN?;syst:cis 1
- LSProbe\_1v2\_Mode0\_Cl2.DeviceConfiguration line 34: VisaLine1=\*IDN?;syst:cis 2
- LSProbe\_1v2\_Mode0\_Cl3.DeviceConfiguration line 34: VisaLine1=\*IDN?;syst:cis 3
- LSProbe\_1v2\_Mode0\_Cl4.DeviceConfiguration line 34: VisaLine1=\*IDN?;syst:cis 4
- measurement mode is set to 0 and validated in line line 45 resp. 56 in each file
- E-LP filter set to 150 in line 66 in each file (see Figure 2(b))

## 3 Preparation of the EMC32 Configured Devices list

- four Generic Field Probes to Configured Devices List added, named
  - LSProbe\_1
  - LSProbe\_2
  - LSProbe\_3
  - LSProbe\_4
- settings for each device:
  - General Tab: Interface Type: VISA

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(a) EMC32 decive configuration folder, new configuration files

Figure 2: Preparation of LSProbe 1.2 device configuration files

VISA Device Identifier: TCPIP0::127.0.0.1::10000::SOCKET as environment variables LSPROBE\_HOST and LSPROBE\_PORT are set to localhost and 10000

- Properties Tab:

RF Parameters: according to LSProbe 1.2 manual CI specific configuration file loaded

(see Figure 3)

- LSProbe\_1, LSProbe\_2, LSProbe\_3, LSProbe\_4 are each set from virtual to physical ⇒ serial number field in General Tab: string LUMILOOP, LSPRobe,1.2,Mar 6 2018.. turned blue, for each new physical Field Probe a client connection was opened in LSProbe\_TCP\_Server, four in total, see Figure 4
- **Combined Field Probes** device out of **MultiFieldProbes** to Configured Devices List added, see Figure 5
- settings:
  - Properties Tab:

Field Probe Device Selection: LSProbe\_1, LSProbe\_2, LSProbe\_3, LSProbe\_4 set, see Figure 6

- Test Tab:

set Field Probe Combination to Average to compute averaged E-field value over all selected Field Probe Devices, see Figure 6

Additional devices needed for simulated EuT test (see Figure 7)

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Figure 3: Four Generic Field Probe devices added, specific properties set and device configuration file loaded



Figure 4: State of Field Probe devices changed from virtual to physical, four TCP client connections are established

Amplifiers     Anternas     Anternas		ne SProbe_4 SProbe_3 SProbe_2 SProbe_1 SProbe_1 SPM SProbe_1 SPM General Properties Test   Field Probe Device	Device FieldProbes FieldProbes FieldProbes PowerMeters FieldProbes MultiFieldProbes MultiFieldProbes ombined Field Probes -	Type         Interface           Generic Fiel         VISA           Combined Fi         None           Combined Fi         None           MultiFieldProbes         MultiFieldProbes	Addr/SN State TCPIPO Virtue TCPIPO Virtue TCPIPO Virtue TCPIPO Virtue TCPIPO Virtue 	i le le le le le le k k k k k k k k k k k
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		SProbe_3 SProbe_2 SProbe_1 SPM ieneric Field Probe ombined Field Probes Pobe-Setup Combined Field Probes - C General Properties   Test   Field Probe Device	FieldProbes FieldProbes FieldProbes PowerMeters FieldProbes MultiFieldProbes ombined Field Probes -	Generic Fiel VISA Generic Fiel VISA Generic Fiel VISA Generic Piel VISA Generic Fiel VISA Combined Fi None Combined Fi None MultiFieldProbes	TCPIP0 Virtue TCPIP0 Virtue TCPIP0 Virtue TCPIP0 Virtue TCPIP0 Virtue	al al al al
Image: Construction           Image:		SProbe_2 SProbe_1 SProbe_1 SPM aeneric Field Probe Combined Field Probes General Properties Test Field Probe Device	FieldProbes FieldProbes PowerMeters FieldProbes MultifieldProbes ombined Field Probes -	Generic Fiel VISA Generic Fiel VISA Generic Po VISA Generic Fiel VISA Combined Fi None Combined Fi None MultiFieldProbes	TCPIP0 Virtua TCPIP0 Virtua TCPIP0 Virtua TCPIP0 Virtua 	
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TripeLoops • TripeLoops • TurnTables		Probe 1 Probe 2 Probe 3 Probe 4	LSProbe_1 LSProbe_2 LSProbe_3 LSProbe_3	• • •		

Figure 5: Combined Field Probe device added

Combined Field Probes - Combined Field Probes - N	lultiFieldProbes	×
Iconbined Field Probes - Combined Field Probes - M         General       Properties         Field Probe Combination <ul> <li>Maximum</li> <li>Minimum</li> <li>Average</li> </ul>	Measured Value 41.781 V/m Measure	×
OK Cancel		

Figure 6: Field Probe combination set to Average

- Signal Generator: SMB100A
- Powermeter: NRP ChannelA
- Amplifier: Generic Amplifier
- Antennae
- Interlock Circuit

Jevice List						
Devices:	Configured Devices:		G	¥ ×   ⊞	1111 ° <u>°</u> 111	🔍
🕀 🕨 Amplifiers	Name	Device	Туре	Interface	Addr/SN	State
I Antennas	SMB100A	Generators	SMB100A	GPIB0	28	Virtual
AntennaTowers	NRP Channel A	PowerMeters	NRP Chann	GPIB0	12	Virtual
AwgGenerators	LSProbe_4	FieldProbes	Generic Fiel	VISA	TCPIP0:	Physical
FieldProbes	LSProbe_3	FieldProbes	Generic Fiel	VISA	TCPIP0:	Physical
E 🖸 Lienerators	SProbe_2	FieldProbes	Generic Fiel	VISA	TCPIP0:	Physical
E-O Interlock	LSProbe_1	FieldProbes	Generic Fiel	VISA	TCPIP0:	Physical
El LISNS	LSPM	PowerMeters	Generic Po	VISA	TCPIP0:	Virtual
Multiple Probas	C Interlock Circuit	Interlock	Interlock Cir	None		
E S Asciloscopes	Generic Amplifier	Amplifiers	Generic Am	None		
Positioners	Combined Field Probes	MultiFieldProbes	Combined Fi	None		
	(王 Antenna	Antennas	Antenna	None		
<ul> <li>⊕ 2 Switch/Infa</li> <li>⊕ 3 SystemContole</li> <li>⊕ 3 Frankducera</li> <li>⊕ 1 Tainducera</li> <li>⊕ 1 Tainducera</li> <li>⊕ 2 Tainducera</li> <li>⊕ 3 Tainducera</li> </ul>						
OK Cancel						

Figure 7: Final EMC32 Device list

### 4 Configuration of EMC32 EuT Monitoring Setup

Monitoring of four separate isotropic E-field values, named "4Probe\_EuT\_Monitoring+AVG", see Figure 8(a):

- four Channels added, named LSProbe 1, LSProbe 2, LSProbe 3 and LSProbe 4
- Measurement Axis each set to XYZ(isotropic)
- Display tab: each Y-Axis Maximum set to 100, Unit to be displayed set to V/m

Monitoring of averaged isotropic E-field value over the four field probes, see Figure 8(b):

- fifth Channel added, named AVG LSProbe1-4
- Measurement Axis to XYZ(isotropic)
- Display tab: each Y-Axis Maximum set to 100, Unit to be displayed set to V/m

#### 5 Configuration of Hardware Setup for EMS radiated

• new Hardware Setup for EMS radiated named "HW Setup 100M-1GHz" added



Ø EMC32			- 🗆 X	EuT N	Monitoring - [4Probe_EuT_	Monitoring+AVG]		×
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🚊 😋 System	1 SProbe 1 LSProbe_1	MEAS > 5 No	ction	2	2 V ISProbe 2	ISProbe 2	4EAS > 5	No Action
- Calibration Sequence	2 LSProbe 2 LSProbe_2	MEAS > 5 No.	ction	3	3 V ISProbe 3	ISProbe 3 h	dEAS >5	No Action
- Calibration Setups	3 ⊻ LSProbe 3 LSProbe_3	MEAS > 5 No.	ction	4	I SProbe 4	LSProbe_0 h	JEAS S	No Action
Correction Tables	4 V LSProbe 4 LSProbe_4	MEAS >5 Nor	chon	5	AVG I SProbe1.4	Combined Field Probes In	4EAS 5V/m	No Action
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5 4Probe_EuT_Monitoring						Lombo Mode: AVG	^	
- AProbe_EuT_Monitoring+AVG						ISProhe 1		
4Probe_EuT_Monitoring+AVG_2_Plots						LSProbe_2		
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(a) Single probe monitoring

(b) Averaged E-field monitoring



- frequency sweep is to be done between 100MHz and 1GHz
  - $\Rightarrow$  in Modify Freqs subdirectory
    - Start Frequency set to 100MHz
    - Stop Frequency set to 1GHz

see Figure 9

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	Add Subrange Delete Subrange	Cancel
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V10.35.02 - EMC32		

Figure 9: Hardware Setup "HW Setup 100M-1GHz"

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## 6 Configuration of Template for EMS Scan

- new EMS Scan for EMS radiated added, named "EMS Scan 100MHz-1GHz", see Figure 10
- General Settings tab:
  - Harware Setup: "HW Setup 100M-1GHz"
- Frequency Tab: Subrange added
  - Start Frequency: 100 MHz
  - Stop Frequency: 1 GHz
  - Setp Mode: LIN
  - Step Size: 100MHz
  - Dwell Time: Os
  - $\Rightarrow$  10 Measurment points
- Leveling Mode Tab:
  - LevelOn: Transducer Power
  - Power Measurement: Forward Power
- Level tab:
  - Immunity Level Unit: W
  - Constant Immunity Level: 50 Watt

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EMS Auto Test	Frequency Level Device Setups Actions		
EMS Scan 100MHz-1GHz      Monitoring     EVT Monitoring     Probe_EUT_Monitoring     Probe_EUT_Monitoring     Probe_EUT_Monitoring	Start Frequency     100     MHz     Step Mode     LIN     Image: Control of the step of	Delete Subrange       Add Subrange       System Monitoring	]
Hrobe_Lul_Monitoring+AVG_2_Plots □- ☐ Tests ↓ 4 Probe_Lul_Monitoring+AVG_2_Plots □- ☐ Tests ↓ 4 Probe_Lul_Monitoring+AVG_2_Plots	Exclude Frequency Bands Meas. Points 10		
	Use Frequency Table Frequency Table	OK	
	Use Frequency Table only (none)	Cancel	
V10.35.02 - EMC32			_

Figure 10: EMS Scan Template setup "EMS Scan 100MHz-1GHz"

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## 7 Configuration of EMS radiated Test

- EMS radiated Test added, named "Const. Power 100MHz-1GHz", see Figure 11
- Template for Immunity Parameter: EMS Scan 100MHz-1GHz
- template for EuT Monitoring Parameters: 4Probe\_EuT\_Monitoring+AVG

Test De	finition	Test Level	Benort
1030 00	anneon	100020101	nopole
Test Contr	rol Parameter-		
	Test Name	Const. Power 100MHz-1GHz	
	Test Method	EuT Qualification	-
Immunity F	<sup>o</sup> arameter		
<b>₩</b> -))	Template	EMS Scan 100MHz-1GHz	
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E Li	imit Power to F	Reference Calibration Table	
		<none> Add Offset 0,0</none>	 dB
EuT Monit	toring Paramet	ers	
٥	Template	4Probe_EuT_Monitoring+AVG	

Figure 11: EMS radiated Test setup "Const. Power 100MHz-1GHz"

#### 8 EMS radiated Test "Const. Power 100MHz-1GHz" results

After the Test was run in simulation mode the resulting plots depicted in Figure 12 were obtained.

The EuT Monitoring setup can be adapted to show the E-field values of the single probes in one graph and the averaged values in another one.

- duplicate "4Probe\_EuT\_Monitoring+AVG", named "4Probe\_EuT\_Monitoring+AVG\_2\_Plots"
- Display tab for Channel LSProbe 2, LSProbe 3, LSProbe 4:
  - uncheck Display Graphics Diagram by Default
  - check Show Trace in Graphics Channel with channel 1 selected, see Figure 13

Create new EMS radiated Test:

- EMS radiated Test added, named "Const. Power 100MHz-1GHz 2 Plots"
- template for Immunity Parameter: EMS Scan 100MHz-1GHz
- template for EuT Monitoring Parameters: "4Probe\_EuT\_Monitoring+AVG\_2\_Plots"



Figure 12: Test result of EMS radiated Test "Const. Power 100MHz-1GHz"

	IT Inform	nation				
k	none>	10001				
lo	Active	Name	Meas. Device	Conversion	NoGo	Actions
1	~	LSProbe 1	LSProbe_1	MEAS	> 100 V/m	No Action
2	<b>~</b>	LSProbe 2	LSProbe_2	MEAS	> 100 V/m	No Action
3	~	LSProbe 3	LSProbe_3	MEAS	> 100 V/m	No Action
4	~	LSProbe 4	LSProbe_4	MEAS	> 100 V/m	No Action
5	~	AVG LSProbe1-4	Combined Field Probes	MEAS	> 100 V/m	No Action
	Channel	Hardwar	e Display	NoGo	Action	s Options
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Figure 13: Plot all single field probe E-field values in single graph

After the Test is run the plots can be personalized, e.g. plot legend, symbol on trace at measurment points,... see Figure 14



Figure 14: Test result of EMS radiated Test "Const. Power 100MHz-1GHz 2 Plots"