SCHNEIDER ELECTRIC IT BUSINESS INDIA PVT. LTD.

REPORT NUMBER: 4786291043-1

PROJECT NUMBER: 4786291043 & 4786580123

Location (A)
UL India Pvt. Limited,
Kalyani Platina
(Phase 1) III Floor,
No.24, EPIP Zone,
Phase II, Whitefield,
Bangalore – 560 066

::::::::::::::::::::::::::::::::::

Location (B)
TARANG, Wipro
Technologies, Survey
No. 70, 77, 78/8A,
Doddakannelli,
Sarjapur Road,
Bangalore - 560035

TEST DISCIPLINE: ELECTRONICS- EMC

General details

Customer	SCHNEIDER ELECTRIC IT BUSINESS INDIA PVT. LTD.		
Customer Address	BEARYS GLOBAL RESEARCH TRIANGLE SY NO 63/3B, GORVIGERE VILLAGE, VIDARAHALLI HOBLI, BANGALORE EAST TALUK, WHITEFIELD ASHARAM ROAD, BANGALORE, KA, INDIA - 560067		
Manufacturer Name	SCHNEIDER ELECTRIC IT BUSINESS INDIA PVT. LTD.		
Manufacturer Address	CAV 1, 2ND STREET, PEZA, CAVITE ECONOMIC ZONE, ROSARIO, CAVITE, PHILIPINES. CAV 2, LOT 10, BLOCK 16, Phase IV, PEZA, ROSARIO, CAVITE, PHILIPINES. CAV 3, LOT 3, BLOCK 14, Phase III, PEZA, ROSARIO, CAVITE, PHILIPINES.		
Item Under Test	UPS 2G SRT 5kVA (Category C2)		
Type / Model Tested	SRT5KRMXLI		
Additional Similar Model	SRT5KXLT, SRT5KRMXLT, SRT5KXLT-IEC, SRT5KRMXLT-IEC, SRT5KXLI, SRT5KRMXLW-HW, FJRT5KXLI, FJRT192BP, DLRT5KRMXLI, DLRT5KRMXLT, DLRT192RMBP (defined by the customer)		
Sample Identification	1805782		
Serial Number (If any)	QS1318170061		
Condition of IUT on receipt	Good		
Date of Receipt	28 January 2014		
Applicable Standard	EN/IEC 62040-2:2006		
Date of Testing (Start date)	28 January 2014	**End Date**	25 February 2014
Lab general* ambient condition	**Temperature in °C**		23±5°C
	Relative humidity in %		<60%
Date of Reporting	17 March 2014		
Test In-charge	Manish Kumar		

Reviewed by signature:

 Balaguru A Project Engineer	 Vivekananda Bhat Engineering Manager
Reviewed by	**Authorized signatory**

Disclaimer

*The results of testing in this report apply only to the sample product/item, which was tested. UL Lab has not participated in the sample selection. This Test report shall not be reproduced except in full or partial without the written approval of the Lab. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. *The applicable standard ambient condition supersedes the lab general ambient conditions.*

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Details of Lab used for Testing

Sl. No.	Name of The Lab	Address	NABL Certificate No.
1.	UL India Pvt. Ltd.	K Platina (Phase 1) III Floor, No.24, EPIP Zone, Phase II, Whitefield, Bangalore, Karnataka – 560 066, India	T-1432
2.	TARANG- Product Qualification & Compliance Planet	Wipro Technologies, Survey No. 70, 77, 78/8A, Doddakannelli, Sarjapur Road, Bangalore, Karnataka – 560035, India	T-1533

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Test Results

Test Parameter	Standard Number	Date of testing	Result	Remarks
Emission				
Conducted Emission	CISPR 22	4 February 2014	**P**	--
Conducted Emission (Telecommunication port)	CISPR 22	4 February 2014	**P**	--
Radiated Emission	CISPR 22	4 February 2014	**P**	--
Harmonic Current Emission	IEC 61000-3-12	4 February 2014	**P**	--
Voltage Fluctuation and Flicker Emission	IEC 61000-3-11	NA	**NA**	Not required as per standard
Immunity				
Electrostatic Discharge (ESD)	IEC 61000-4-2	6 February 2014	**P**	--
Radiated RF Electromagnetic Field	IEC 61000-4-3	5 February 2014	**P**	--
Electrical Fast Transients	IEC 61000-4-4	29 January 2014	**P**	--
Surges	IEC 61000-4-5	6 February 2014	**P**	--
Continuous Conducted RF	IEC 61000-4-6	28 January 2014	**P**	--
Power Frequency Magnetic Field	IEC 61000-4-8	4 February 2014	**P**	--
Voltage Dips & Short Interruption	IEC 61000-4-11	4 February 2014	**P**	--
Immunity to Low Frequency Signals	IEC 61000-2-2	25 February 2014	**P**	--

P: Meets the requirements **F: Does not meet the requirement** **NA: Not applicable**

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1. EQUIPMENT UNDER TEST (EUT)

1.1 EUT Description:

Uninterrupted power supply designed to use in installation category II.
UPS is Class 1 & pollution degree-2.It has hardwired input connection and outlets for connecting the appliance load. For input connection we are recommending two pole MCB UL listed. UPS has SELV signal connectors on rear side.

UPS 2G SRT 5kVA with XBP

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1.2 Equipment Marking Plate:

UPS – 2GSRT 5kVA

Resistive Load

Network-Switch

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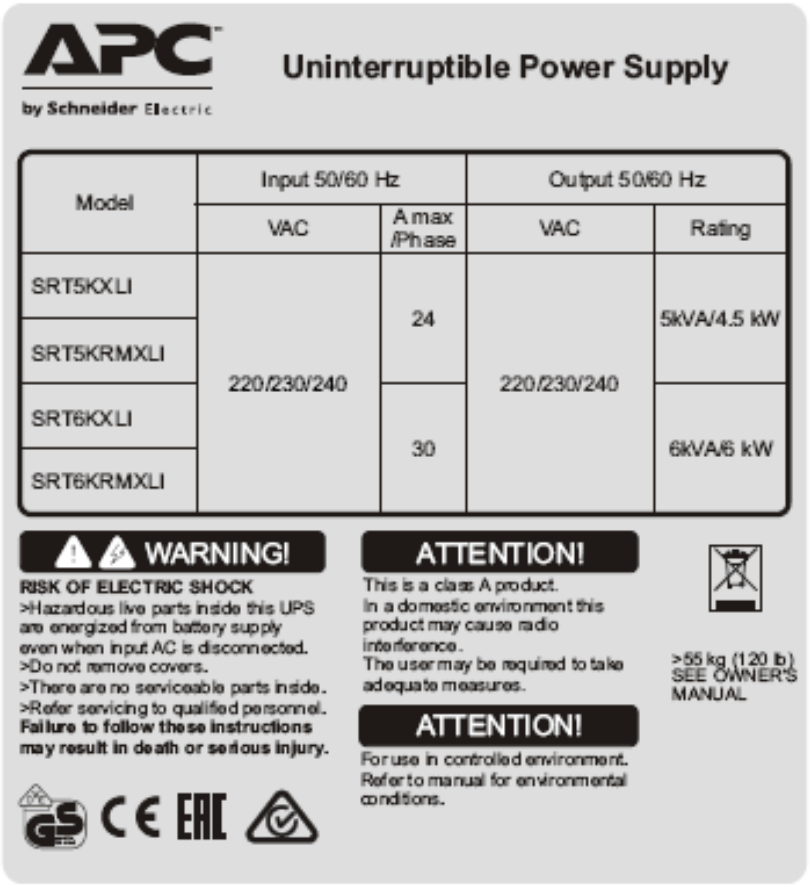
XLI MODELS



APC by Schneider Electric

Uninterruptible Power Supply

Model	Input 50/60 Hz		Output 50/60 Hz	
	VAC	A max /Phase	VAC	Rating
SRT5KXLI	220/230/240	24	220/230/240	5kVA/4.5 kW
SRT5KRMXLI				
SRT6KXLI		30		6kVA/6 kW
SRT6KRMXLI				

WARNING!

RISK OF ELECTRIC SHOCK
>Hazardous live parts inside this UPS are energized from battery supply even when input AC is disconnected.
>Do not remove covers.
>There are no serviceable parts inside.
>Refer servicing to qualified personnel.
Failure to follow these instructions may result in death or serious injury.

ATTENTION!

This is a class A product.
In a domestic environment this product may cause radio interference.
The user may be required to take adequate measures.

ATTENTION!

For use in controlled environment.
Refer to manual for environmental conditions.

>55 kg (120 lb)
SEE OWNER'S MANUAL

SYSTEM LEVEL TAG

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1.3 Equipment used during Test:

Use*	Product Type	Manufacturer	Model No	Serial No	Comments
EUT	5 kVA UPS	APC by Schneider Electric	SRT5kRMXLI	QS1318170061	None
EUT	External Battery Pack	APC by Schneider Electric	SRT192BP	5S1331TO2903	External battery 192Vdc
AE	PC	DELL	OptiPlex GX 620	5VXDJ1S	Desktop
AE	Network Switch	D-Link	DES-1008A	QS0U1C40025538	Used for S/W interface
AE	Resistive Load	Ohmark Control Pvt. Ltd.	------	2012-13/J242/11457	None
Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, **SIM** - Simulator (Not Subjected to Test)					

- Below external battery pack is an alternate component as defined by the customer

  Product Type: External Battery Pack
  Manufacturer: APC by Schneider Electric
  Model No. : SRT192RMBP

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1.4 Input/output Ports:

Port #	Name	Type*	Cable Max. >3m	Cable Length	Cable Shielded	Comments
0	Enclosure	NE	NA	NA	No	None
1	Input Mains	AC	NO	2m	No	None
2	Output	AC	No	2m	No	None
3	RS232 Serial Com (RJ 45)	I/O	Yes	4.5	No	None
4	EPO	I/O	Yes	5m	No	None
5	Ethernet	TP	Yes	15m	No	2 Nos.
6	Console	I/O	No	1m	No	None
7	USB	I/O	Yes	5m	Yes	None
8	Universal I/O	I/O	Yes	4m	No	3 Nos.

Note:***AC*** = AC Power Port, ***DC*** = DC Power Port, ***N/E*** = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control),
TP = Telecommunication Port

1.5 Power Interface Mode

Mode #	Voltage (V)	Current (A)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated-1	220/230/240VAC	21	50/60Hz	Single phase	NA
Tested-1	230VAC	21	50Hz	Single phase	NA

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1.6 EMI Critical components details

Sr. No.	Description/ Part No.	Location	Quantity
1	L1201 common mode Choke, PN: 422-1120 (APC Part)	Input filter section	1
2	C1201, PN:232-0475 (APC Part)	Input filter section	1
3	C1203 common mode choke, PN:232-0105 (APC Part)	Input filter section	1
4	C1204 & C1205, PN: 221-0472 (APC Part)	Input filter section	1
5	L1202, PN: 422-1121 (APC Part)	DM filter section	1
6	C1208, PN: 234-6016 (APC Part)	DM filter section	1

1.7 EUT Internal Operating Frequencies:

Sr. No.	Frequency (MHz)	Description/ Part No.
1	0.080	Charger frequency
2	0.035	PFC & inverter frequency
3	0.04 -0.1	LPS frequency
4	8	Main controller
5	25	Crystal/Switching in NMC AP9631

2. EUT Operation Modes:

Mode #	Description
1	Normal mode :Load is supplied by utility ac input supply, also provides voltage regulation
2	Battery mode: When ac input supply goes off or outside the tolerance battery and the inverter continuity in supply of power to load with very short time
3	Bypass Mode; Load is supplied by utility ac input supply, also provides unregulated voltage.

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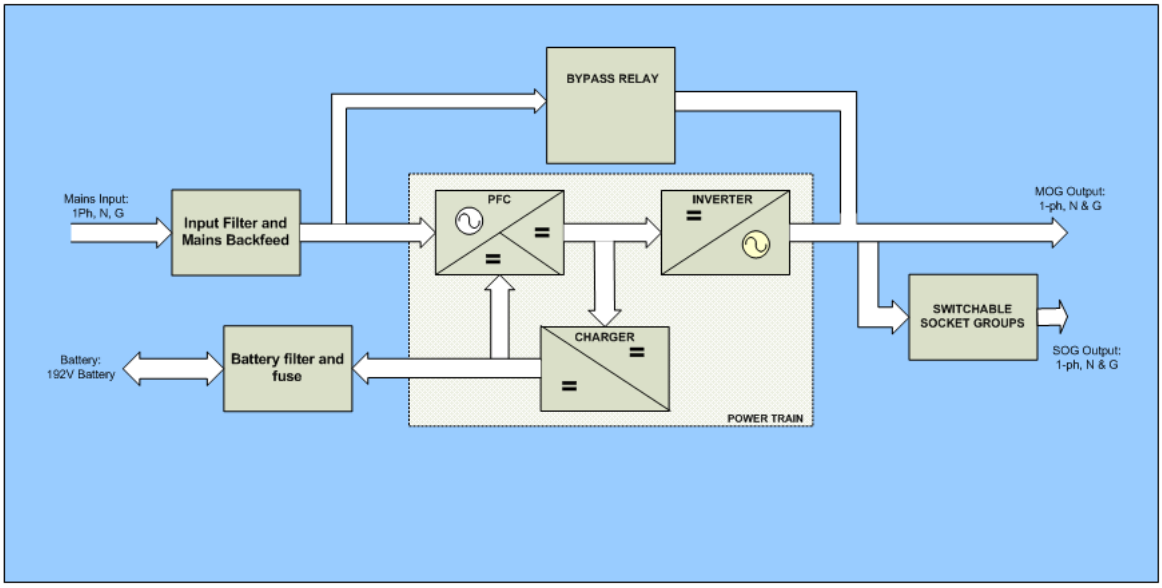
3. EUT Configurations: Block Diagram



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4 Compliance Criteria

4.1 General Performance Criteria Description for Immunity Test

SL. No.	Description	Criterion A	Criterion B
1	Output characteristics	Voltage permitted to vary only within the steady-state characteristics applicable (≥100 m sec limits in Figures 1, 2 or 3 of IEC 62040-3)	Voltage permitted to vary within the inverse time characteristics applicable (<100 m sec limits in Figures 1, 2 or 3 of IEC 62040-3)
2	External and internal indications and metering	Change only during test	Change only during test
3	Control signals to external devices	No change	Change only temporarily in consistency with the actual UPS mode of operation
4	Mode of Operation	No change	Change only temporarily

4.2 Parameters or Functions monitored during & after Immunity tests to decide compliance criteria

- UPS Output
- Micro link Communication (using micro link simulator)
- Ethernet web browser (Temperature, humidity, UPS data)
- Command prompt with ping command (For Ethernet ports)
- Device manager for USB
- Display (recovery time = max 2 min)
- XBP communication (using micro link simulator)

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5. Equipment and Calibration details

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration status (Valid up to)
UL Lab Instruments				
Ultra Compact Simulator	EM test	UCS500N7	V1232113320	4 November 2014
Capacitive Coupling Clamp	EMC Partner	CN-EFT 1000	682	NA
Continuous Wave Generator	EM Test	CWS500N1	V1019106601	27 September 2014
CDN	EM Test	CDN-M2/M3	0610-09	4 October 2014
EM Clamp	LUTHI	EM101	35917	4 October 2014
WIPRO Lab Instruments				
EMI Test Receiver	R&S	ESIB40	100306	25 September 2014
Hybrid log periodic Antenna	TDK RF solution Inc.	HLP-3003C	130334	17 July 2014
Preamplifier	Sonoma	310	270817	30 May 2014
V-LISN	SCHWARZBECK MESS - ELEKTRONIK	NSLK 8128	8128-243	11 July 2014
ISN	Teseq	ISN T800	28603	13 September 2014
RF Current Probe	FCC	F-52	321	13 August 2014
AC Power Source	EM Test	ACS 503	V0705102204	30 May 2014
Digital Power Analyzer	EM Test	DPA 503	V0705102202	30 May 2014
ESD Generator	Noise ken	ESS-2002	ESS0685879	25 March 2014
ESD GUN	Noise ken	TC-815R	ESS0685971	25 March 2014
Immunity Test Generator	KeyTek	EMCPRO-PLUS	712273	26 September 2014

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Test Equipment	Manufacturer	Model No.	Serial No.	Calibration status (Valid up to)
Telecom Line CDN	KeyTek	CM-TELCD	612303	NA
Earth Bond Tester	Kukusui	T0S6-6210	NH003403	11 December 2014
Magnetic Field Immunity Loop	FCC	F-1000-4-8-9, 10-L-1M	6022	NA
Power Failure Simulator	EM Test	PFS 503	V0705102205	20 September 2014
PSG Analog Signal generator	Agilent Technologies	E8257D	MY46410511	1 March 2014
E-Series Power sensor	Agilent Technologies	E9326A	MY44420234	14 December 2014
E-Series Power sensor	Agilent Technologies	E9326A	MY44420249	14 December 2014
Dual Power Meter	Agilent Technologies	E4417B	MY45100718	6 September 2014
RF Power Amplifier	AR	50S1G4AM1	324080	9 May 2014
RF Power Amplifier	AR	250W1000AM1	323535	9 May 2014
RF Power Amplifier	AR	20T4G18A	323682	9 May 2014
V-Log Antenna	TDK RF Solutions	VLA-8001	130365	NA
Horn Antenna	AR	AT4002A	324686	NA
Horn Antenna	AR	AT4003A	324731	NA
Semi anechoic chamber	TDK RF solution Inc.	NA	NA	NA
Robert Bosch Lab Instruments				
Auto Wave Generator	EM Test	Auto Wave	V0745103099	28 January 2015
Multifunction AC/DC source	EM Test	AMP200N1	P1151168243	26 June 2014
Coupling Network	EM Test	CN200N1	P1309114390	27 February 2014

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6. Test Details

6.1 CONDUCTED DISTURBANCE AT THE MAINS PORTS (Emission)

TEST	CONDUCTED DISTURBANCE (Conducted Emission)		
Method	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). The AMN placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. Conducted voltage measurements on mains lines were made at the output of the AMN.		
TEST ENVIRONMENT			
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C	
	Relative Humidity	56 %	
	Frequency range on each side of line	Measurement Point	
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains Power Input	
Basic Standard	CISPR 22: 2010		

Limits - Class A

Frequency (MHz)	Limit (dBµV)			
	Quasi-Peak	Results	Average	Results
0.15 - 0.50	79	Pass	66	Pass
0.50 - 5	73	Pass	60	Pass
5 - 30	73	Pass	60	Pass

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1 & 2

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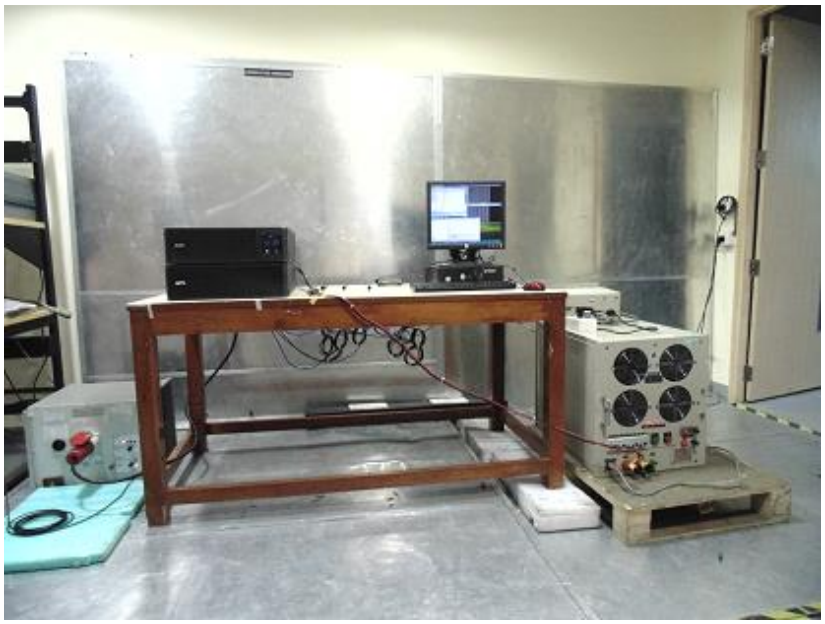
Figure 1: Conducted Emission Test Setup

Conducted Emission Measurement: AC Input power Lines (On Line Mode)



Conducted Emission Measurement: AC Input power Lines (Battery Mode)

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Table 1: Conducted emission test data on Line (on line mode)

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Quasi Peak measurement					
0.175	36.80	9.90	46.70	79	-32.3
1.496	33.78	10.00	43.78	73	-29.22
5.882	39.98	10.21	50.19	73	-22.81
6.740	36.40	10.24	46.64	73	-26.36
13.561	39.52	10.58	50.1	73	-22.9
20.403	40.91	10.78	51.69	73	-21.31
23.010	39.30	10.88	50.18	73	-22.82
Average measurement					
0.175	29.24	9.90	39.14	66	-26.86
1.496	20.64	10.00	30.64	60	-29.36
5.882	28.82	10.21	39.03	60	-20.97
6.740	29.48	10.24	39.72	60	-20.28
13.561	32.17	10.58	42.75	60	-17.25
20.403	33.84	10.78	44.62	60	-15.38
23.010	32.7	10.88	43.58	60	-16.42

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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Table 2: Conducted emission test data on Neutral (on line mode)

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Quasi Peak measurement					
0.173	34.43	9.90	44.33	79	-34.67
1.613	31.03	10.02	41.04	73	-31.96
5.75	40.02	10.21	50.23	73	-22.77
6.355	37.12	10.23	47.35	73	-25.65
6.503	35.63	10.23	45.87	73	-27.13
6.766	35.98	10.24	46.22	73	-26.78
23.133	40.17	10.78	50.95	73	-22.05
Average measurement					
0.173	27.41	9.90	37.31	66	-28.69
1.613	18.87	10.02	28.88	60	-31.12
5.75	27.16	10.21	37.36	60	-22.64
6.355	25.5	10.23	35.72	60	-24.28
6.503	25.85	10.23	36.08	60	-23.92
6.766	26.9	10.24	37.14	60	-22.86
23.133	33.78	10.78	44.56	60	-15.44

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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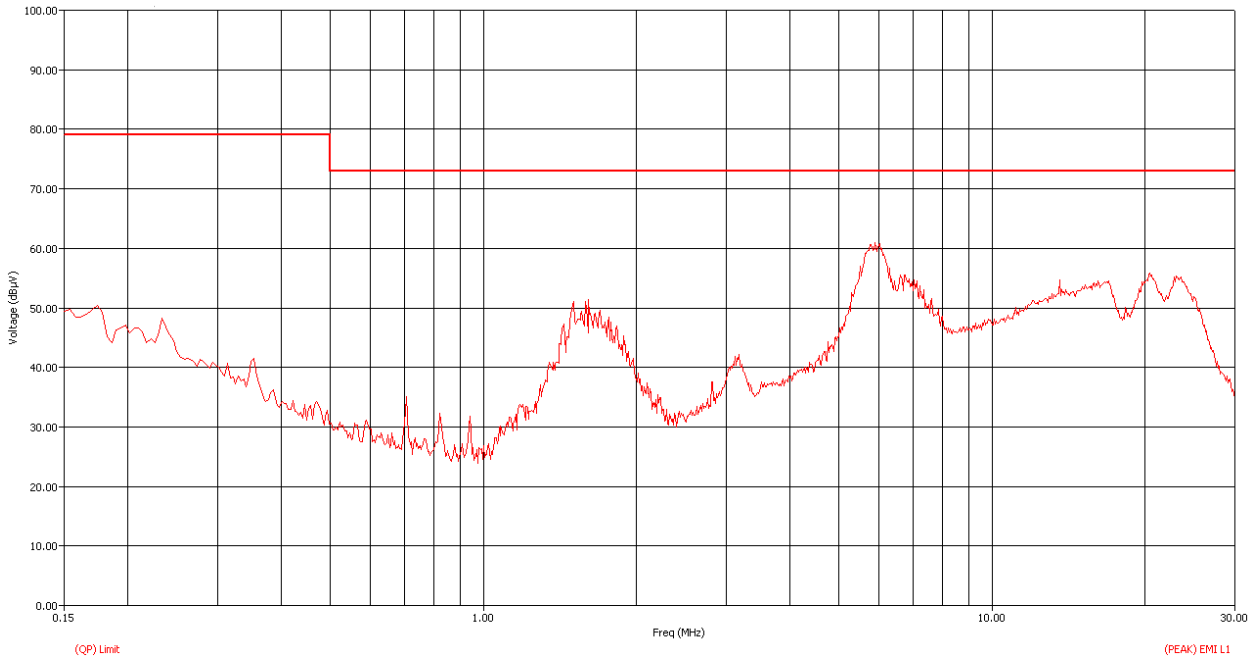
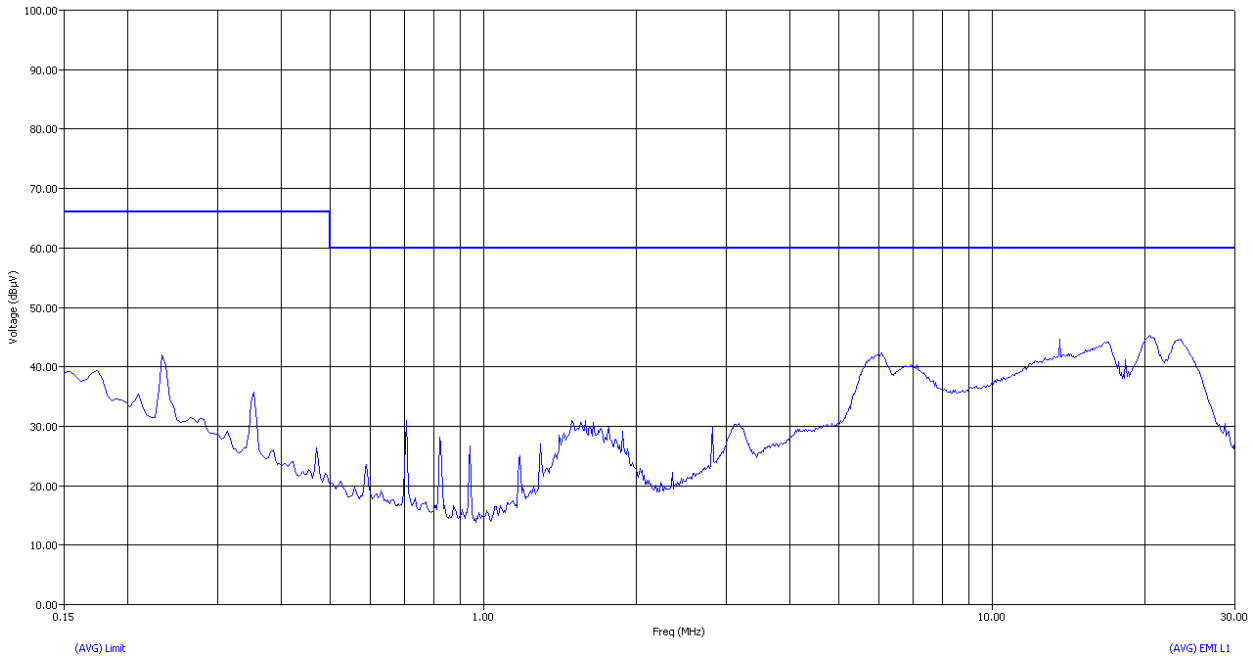
Figure 2 : Graphical representation of conducted emissions (on line mode)



Peak Measurements on Line



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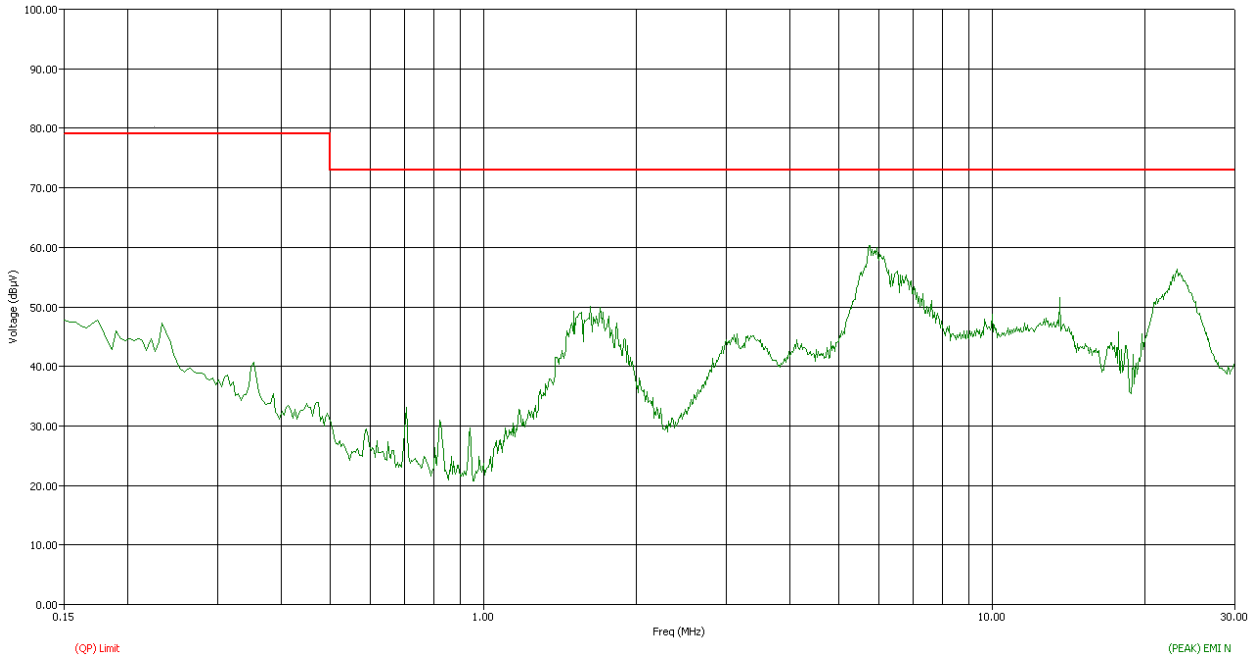
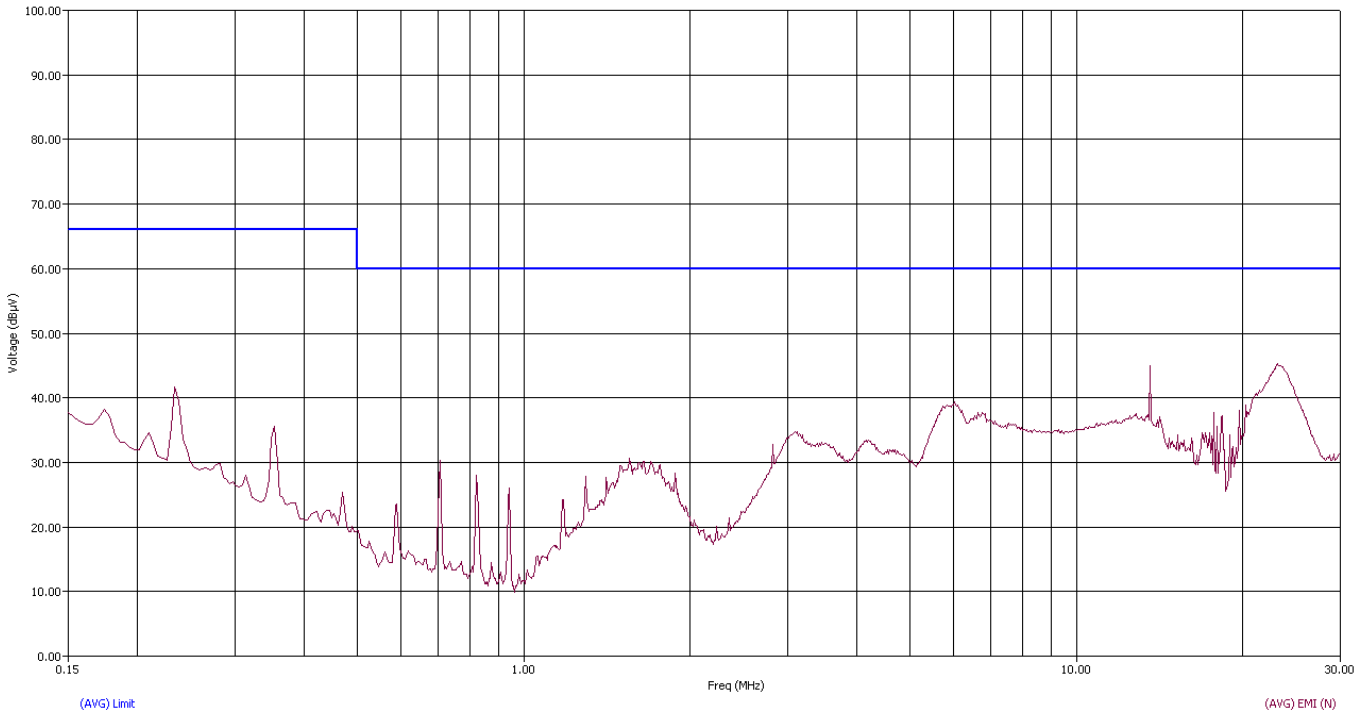
Average Measurements on Line



Peak Measurement on Neutral



Average Measurement on Neutral

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Table 3: Conducted emission test data on Line (on battery mode)

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Quasi Peak measurement					
0.234	32.73	9.75	42.49	79	-36.51
1.499	33.88	10.00	43.88	73	-29.12
6.059	40.15	10.21	50.37	73	-22.63
12.949	49.16	10.55	59.71	73	-13.29
20.424	44.66	10.78	55.44	73	-17.56
Supplementary information: Total Emission (c) = Emission Level (a) + Transducer (b) Margin Level (e) = Total Emission (c) - Limit Line (d)					

Table 4: Conducted emission test data on Neutral (on battery mode)

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Quasi Peak measurement					
1.522	33.3	10.00	43.31	73	-29.69
6.082	40.5	10.21	50.72	73	-22.28
6.574	34.55	10.23	44.78	73	-28.22
6.74	34.67	10.24	44.91	73	-28.09
12.857	45.12	10.55	55.67	73	-17.33
20.899	40.6	10.76	51.36	73	-21.64
Supplementary information: Total Emission (c) = Emission Level (a) + Transducer (b) Margin Level (e) = Total Emission (c) - Limit Line (d)					

Note: Sample scanned over 150 kHz – 30MHz only with Peak detector, UPS backup in battery mode did not support for Average detector. All the peaks on the graph were well below the Quasi-Peak & Average limits. Final measurements were done with QP detector on those peaks selected on the peak measurements graph.

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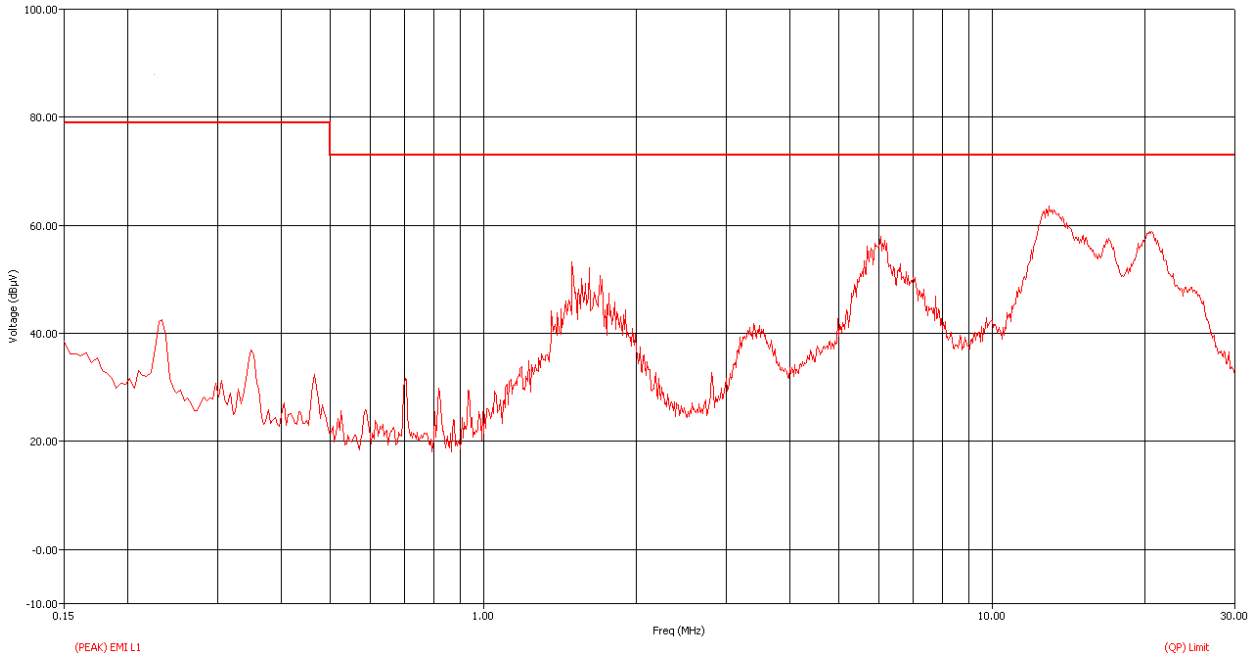
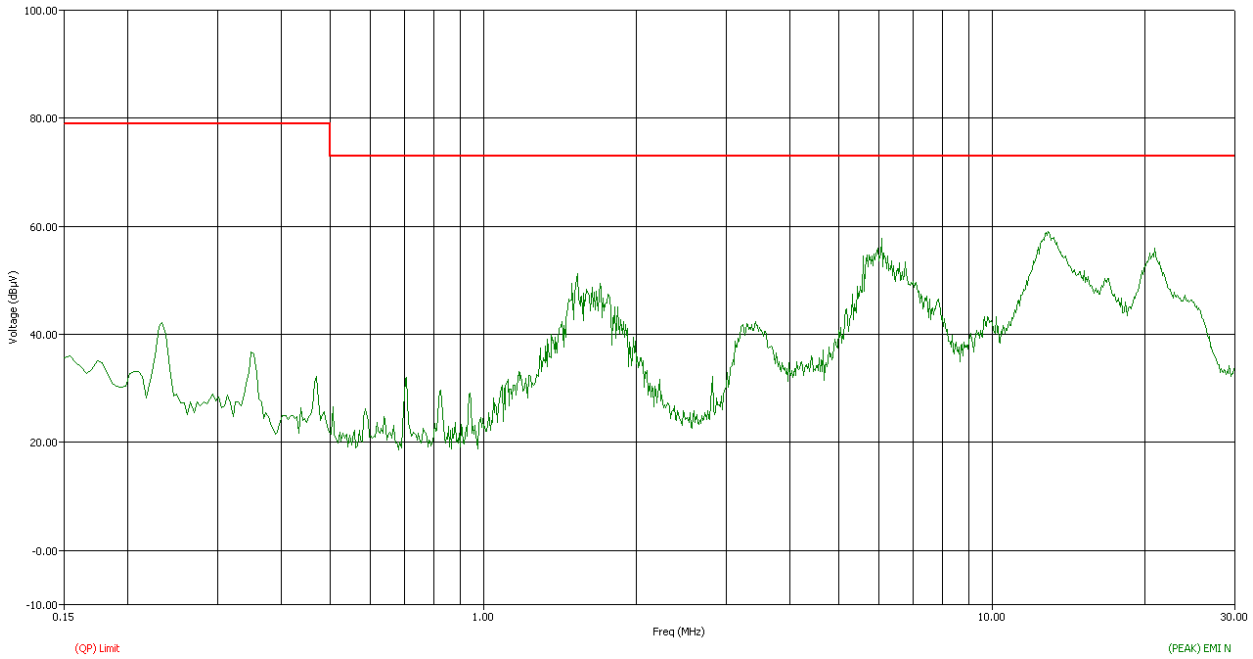
Figure 3: Graphical representation of conducted emissions (on battery mode)



Peak Measurement on Line



Peak Measurements on Neutral

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6.2 CONDUCTED DISTURBANCE AT TELECOMMUNICATION PORT

TEST	Conducted Common mode disturbance at telecommunication ports			
Method	Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All tested telecommunications lines were connected to an Impedance Stabilization Network (ISN) and conducted voltage measurements on telecommunication lines were made at the output of the ISN. Where an ISN was not appropriate or available measurements were made using a Capacitive voltage probe and Current probe.			
Test Environment				
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C		
	Relative Humidity	56 %		
	Frequency range on each side of line	Measurement Point		
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Ethernet Ports		
Basic Standard	CISPR 22: 2010			
Limits - Class A				
Frequency (MHz)	Voltage Limit (dBµV)			
	Quasi-Peak	Results	Average	Results
0.15 - 0.50	97 – 87	Pass	74 – 64	Pass
0.5 -30	87	Pass	64	Pass
Frequency (MHz)	Current Limit (dBµA)			
	Quasi-Peak	Results	Average	Results
0.15 - 0.50	53 – 43	Pass	40 - 30	Pass
0.5 -30	43	Pass	30	Pass

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 4: Conducted Emission Test Setup for Telecommunication ports

Conducted Emission Measurement: Ethernet on NMC

Conducted Emission Measurement: Ethernet on Mini-rohdes

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Table 5: Test data for conducted emission on Ethernet Port (Mini-rohdes) – Voltage Method

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Voltage - Quasi Peak measurement					
0.533	12.28	20.06	32.33	87	-54.67
1.687	59.76	19.84	79.60	87	-7.40
5.737	53.32	19.81	73.13	87	-13.87
9.882	34.51	19.72	54.23	87	-32.77
20.198	29.84	19.77	49.60	87	-37.40
29.850	8.59	20.00	28.58	87	-58.42
Voltage - Average measurement					
0.533	0.95	20.06	21.01	74	-52.99
1.687	44.8	19.84	64.64	74	-9.36
5.737	40.37	19.81	60.18	74	-13.82
9.882	17.37	19.72	37.09	74	-36.91
20.198	23.02	19.77	42.78	74	-31.22
29.85	4.02	20.00	24.01	74	-49.99

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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Table 6: Test data for conducted emission on Ethernet Port (Mini-rohdes) - Current Method

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµA) (c)	Limit Line (dBµA) (d)	Margin Level (dB) (e)
Current - Quasi Peak measurement					
0.157	6.48	13.53	20.00	52.63	-32.63
1.512	33.51	1.78	35.29	43.00	-7.71
1.623	35.55	1.54	37.09	43.00	-5.91
1.666	33.64	1.45	35.09	43.00	-7.91
5.576	32.2	-1.66	30.54	43.00	-12.46
5.646	32.7	-1.71	31.00	43.00	-12.00
5.719	32.93	-1.75	31.18	43.00	-11.82
5.773	32.59	-1.79	30.80	43.00	-12.20
10.087	12.60	-3.48	9.13	43.00	-33.87
Current - Average measurement					
0.157	1.04	13.53	14.57	39.63	-25.06
1.512	19.58	1.78	21.36	30.00	-8.64
1.623	20.03	1.54	21.57	30.00	-8.43
1.666	19.47	1.45	20.91	30.00	-9.09
5.576	19.62	-1.66	17.96	30.00	-12.04
5.646	20.16	-1.71	18.46	30.00	-11.54
5.719	20.08	-1.75	18.32	30.00	-11.68
5.773	20.05	-1.79	18.26	30.00	-11.74
10.087	-1.16	-3.48	-4.64	30.00	-34.64

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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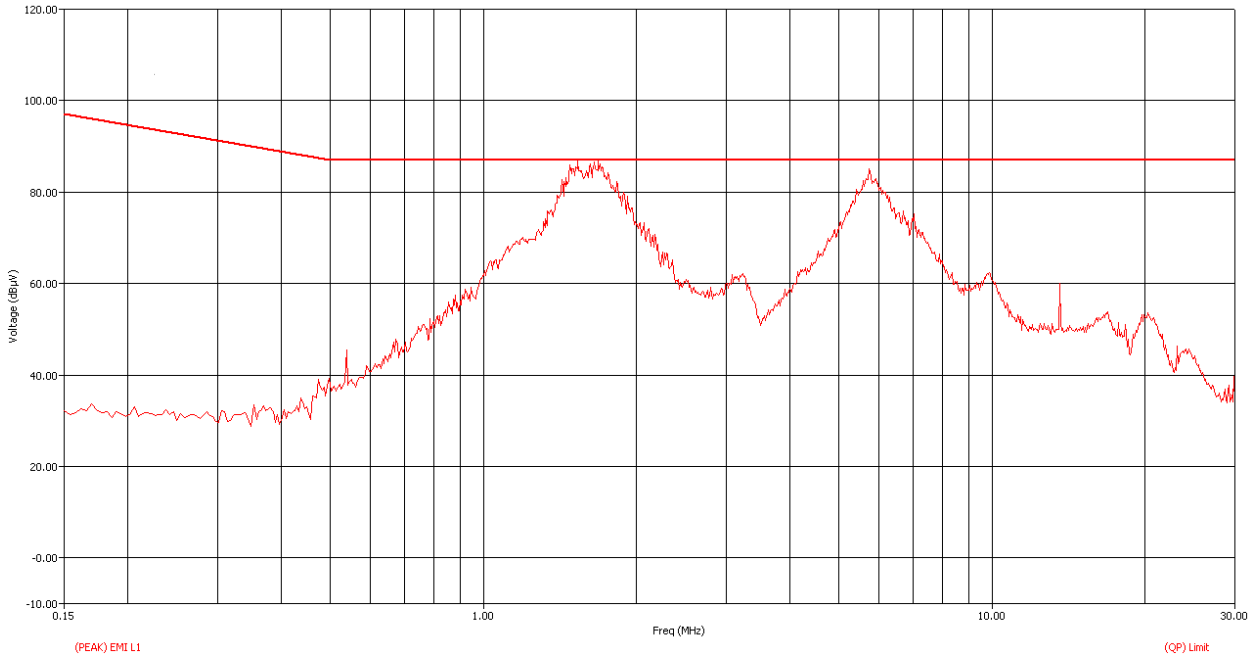
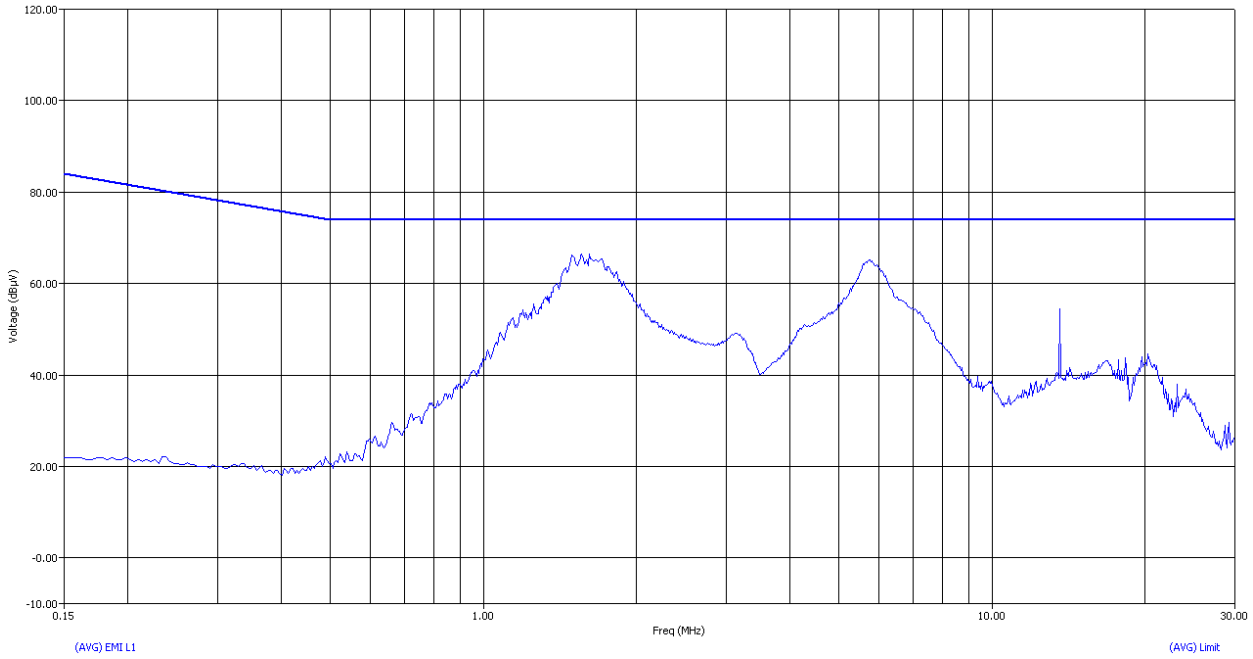
Figure 5: Graphical representation of conducted emissions for Ethernet Port (Mini-rohdes)



Voltage – Peak Measurement



Voltage – Average Measurement

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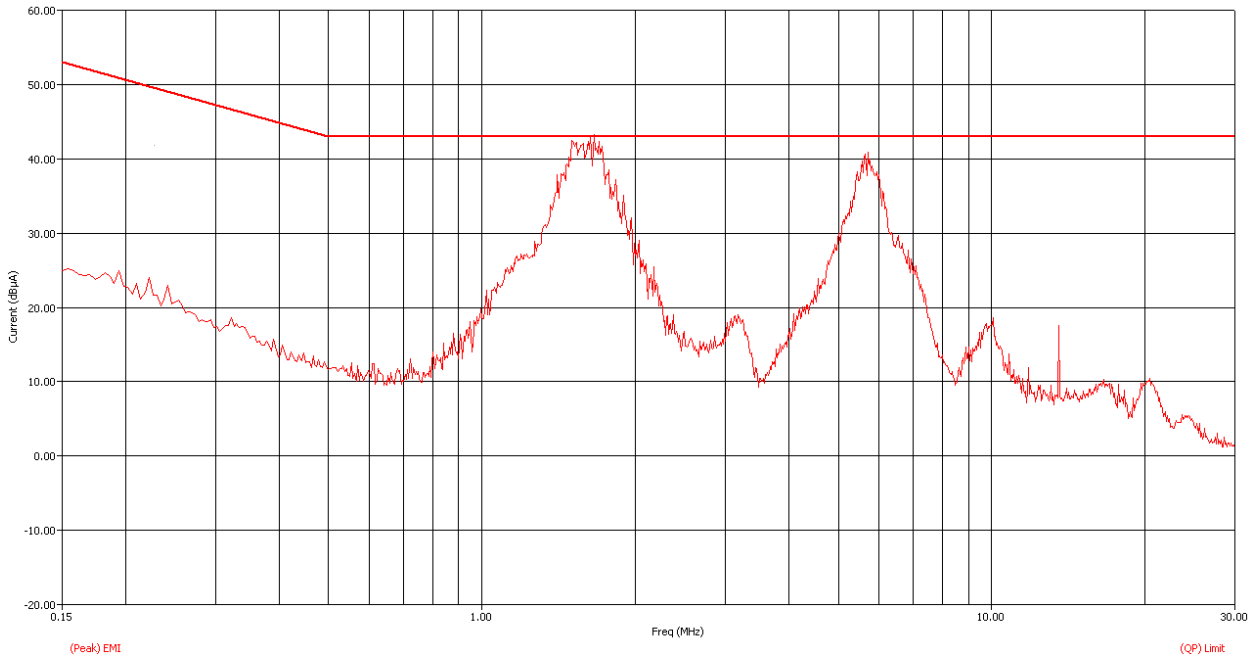
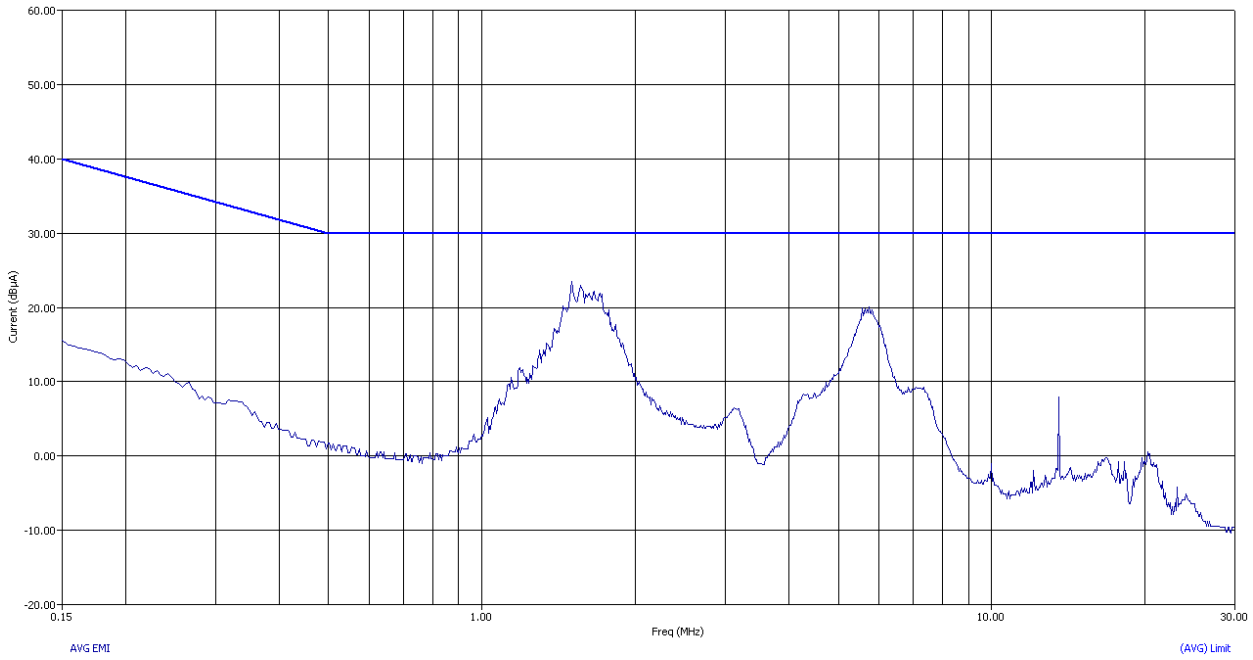


Current – Peak Measurement



Current – Average Measurement

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Table 7: Test data for conducted emission on Ethernet Port (NMC) – Voltage Method

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµV) (c)	Limit Line (dBµV) (d)	Margin Level (dB) (e)
Voltage - Quasi Peak measurement					
1.547	58.93	19.84	78.78	87.00	-8.22
1.669	58.72	19.85	78.56	87.00	-8.44
5.700	52.75	19.81	72.56	87.00	-14.44
13.561	37.09	19.77	56.86	87.00	-30.14
18.242	35.4	19.78	55.18	87.00	-31.82
20.258	35.23	19.76	54.99	87.00	-32.01
23.129	35.36	19.80	55.16	87.00	-31.84
Voltage - Average measurement					
1.547	45.51	19.84	65.36	74.00	-8.64
1.669	44.18	19.85	64.02	74.00	-9.98
5.700	40.28	19.81	60.08	74.00	-13.92
13.561	26.89	19.77	46.67	74.00	-27.33
18.242	30.09	19.78	49.87	74.00	-24.13
20.258	30.32	19.76	50.08	74.00	-23.92
23.129	29.07	19.80	48.88	74.00	-25.12

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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Table 8: Test data for conducted emission on Ethernet Port (NMC) - Current Method

Frequency (MHz)	Emission Level (dBµV) (a)	Transducer (dB) (b)	Total Emission (dBµA) (c)	Limit Line (dBµA) (d)	Margin Level (dB) (e)
Current - Quasi Peak measurement					
0.153	6.48	13.7	20.17	52.82	-32.65
1.560	35.43	1.67	37.10	43.00	-5.9
5.890	31.12	-1.87	29.26	43.00	-13.74
9.738	12.28	-3.34	8.93	43.00	-34.07
13.56	19.04	-4.40	14.64	43.00	-28.36
Current - Average measurement					
0.153	1.1	13.7	14.8	39.82	-25.02
1.560	21.15	1.67	22.83	30.00	-7.17
5.890	18.45	-1.87	16.58	30.00	-13.42
9.738	-1.17	-3.34	-4.52	30.00	-34.52
13.56	8.70	-4.40	4.29	30.00	-25.71

Supplementary information:
Total Emission (c) = Emission Level (a) + Transducer (b)
Margin Level (e) = Total Emission (c) - Limit Line (d)

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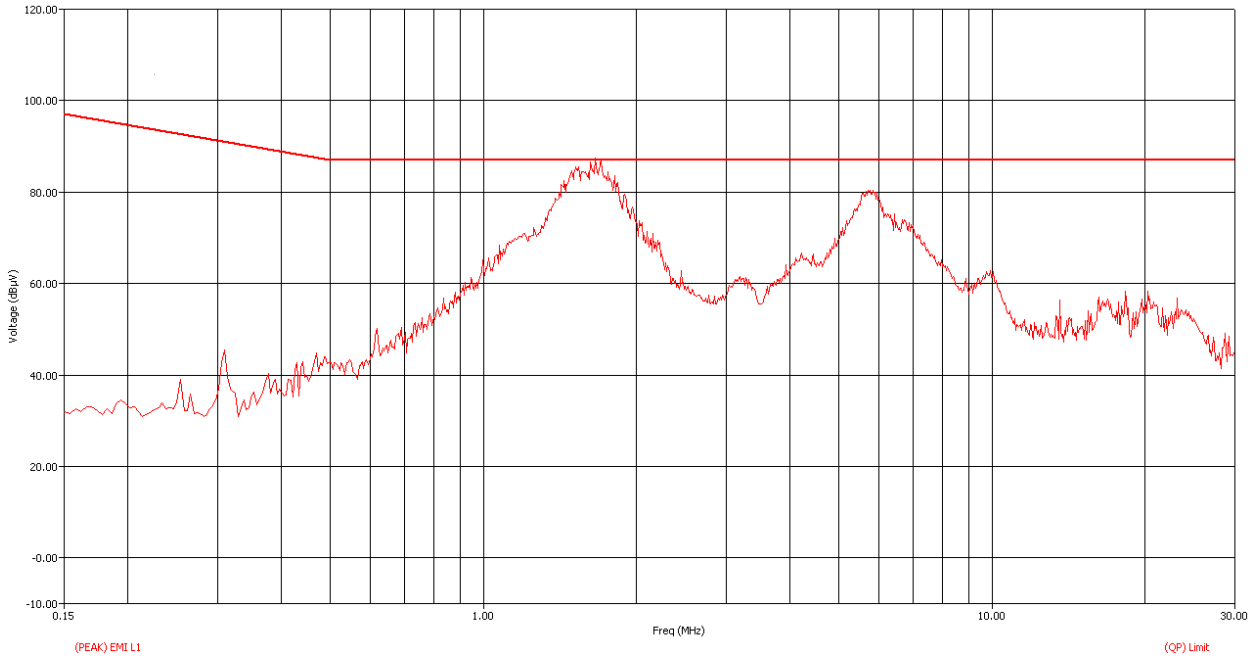
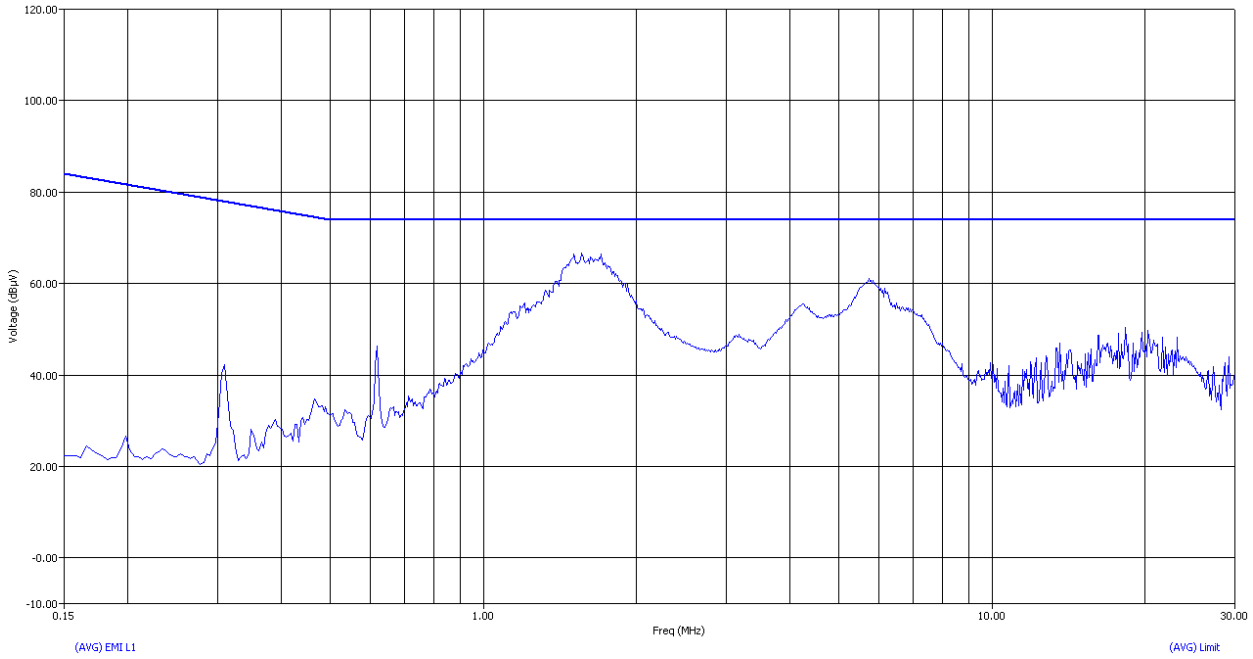
Figure 6: Graphical representation of conducted emissions for Ethernet Port (NMC)



Voltage – Peak Measurement



Voltage – Average Measurement

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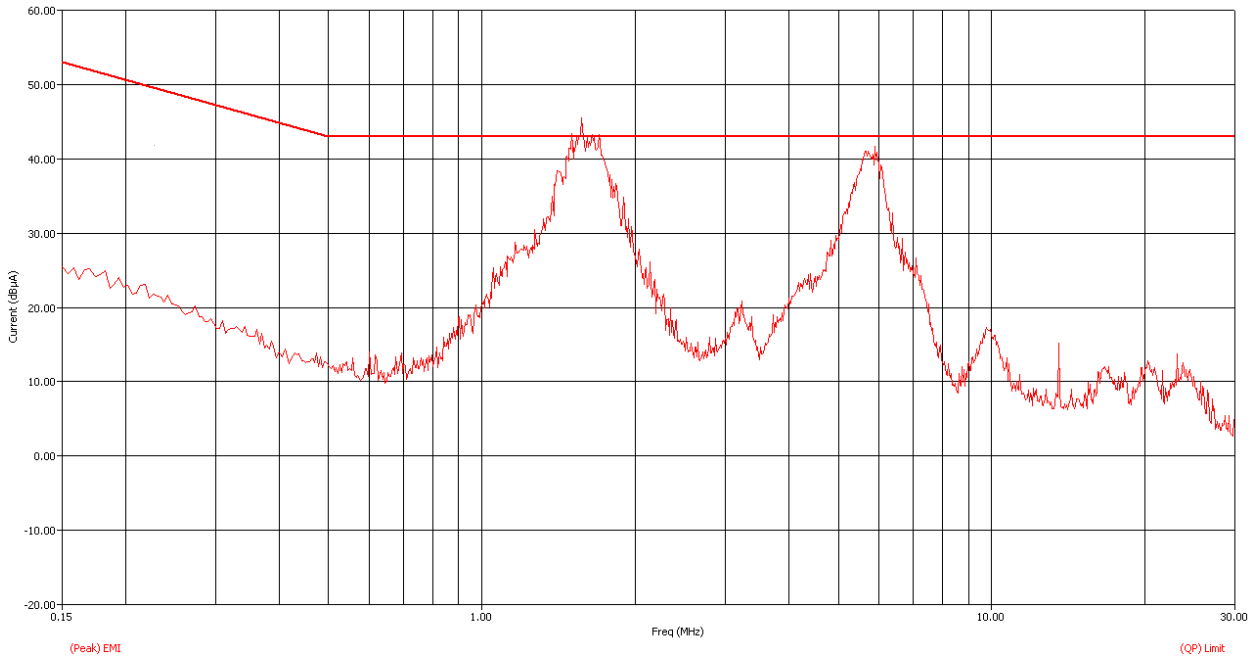
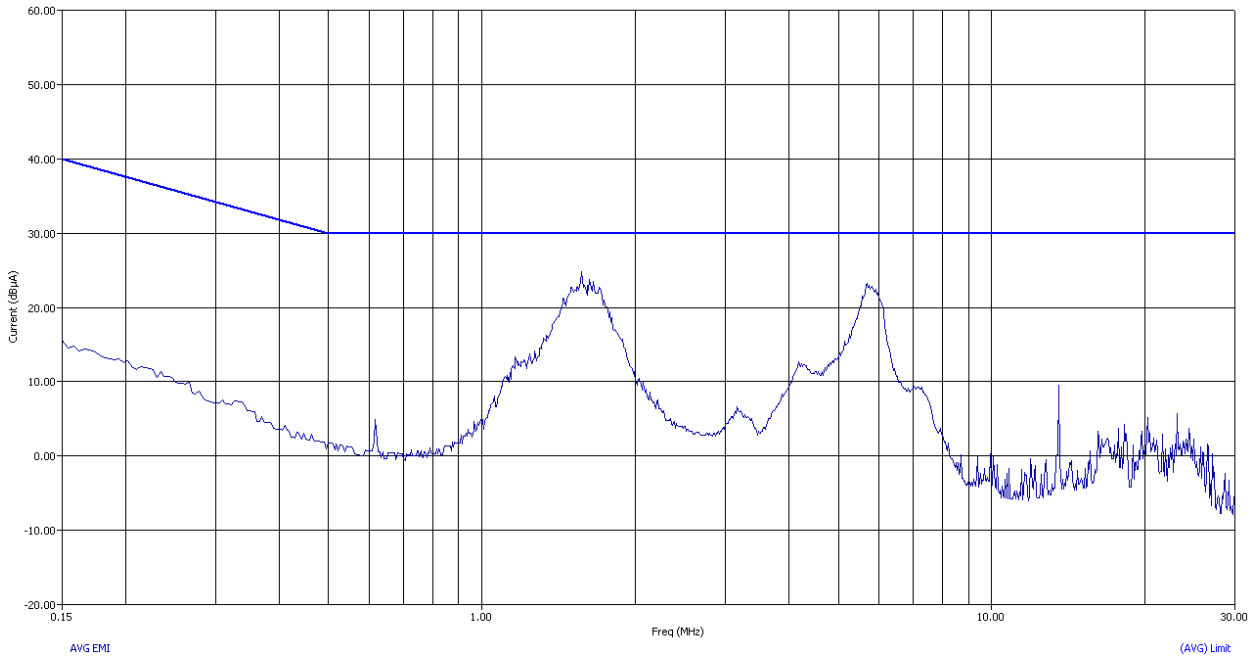


Current – Peak Measurement



Current – Average Measurement

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6.3 RADIATED DISTURBANCE (Radiated Emission)

TEST	RADIATED DISTURBANCE (Radiated Emission)		
Method	Measurements were made in Semi Anechoic Shielded Chamber. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at 1, 2, 3 and 4 meter heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
TEST ENVIRONMENT			
Parameters recorded during the test	Laboratory Ambient Temperature	22.0°C	
	Relative Humidity	58.0 %	
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	Product Enclosure	
Basic Standard	CISPR 22: 2010		
Limits - Class A			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Results	
30 to 230	40	Pass	
230 to 1000	47	Pass	

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1 & 2

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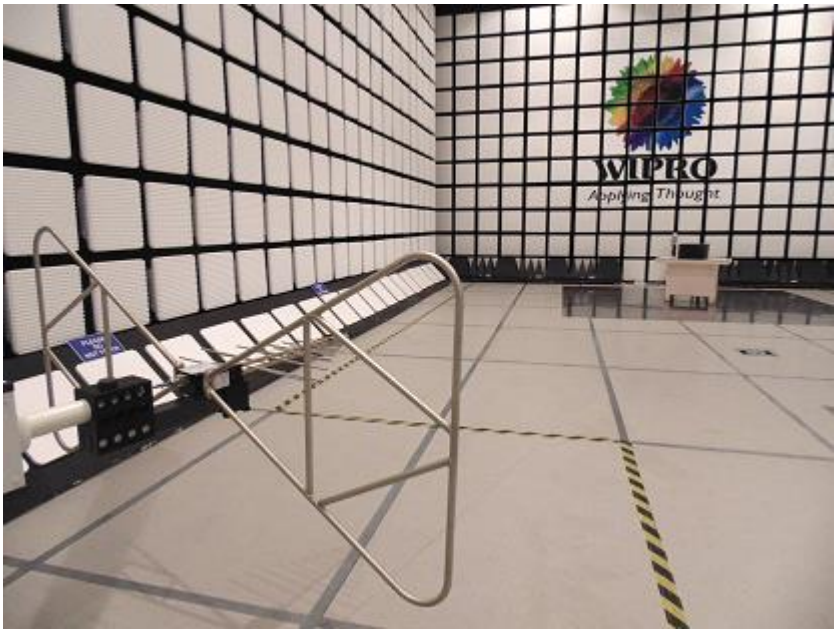
Figure 7: Photo of Radiated emission test setup



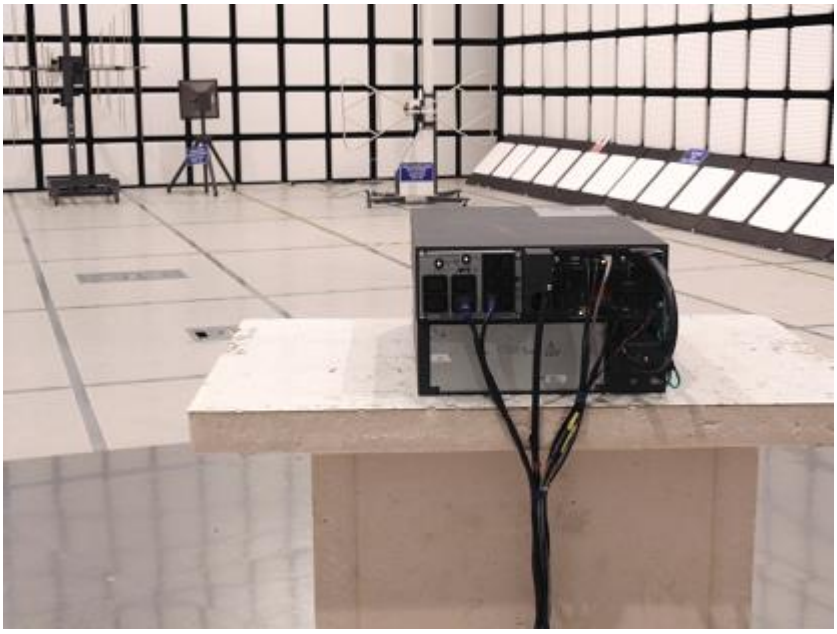


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Table 9: Test data for Radiated emission (on line mode)

Test Frequency (MHz)	Polarity (V/H)	Azimuth (Deg.)	Antenna Height (cm)	Meter Reading (dBµV) (a)	Cable Loss (dB) (b)	Antenna Factor (dB/m) (c)	Preamp (dB) (d)	QP Level dBµV/m (e)	Limit dBµV/m (f)	Margin (dB) (g)
30.62	V	162.0	164	50.14	1.07	11.2	32.04	30.38	40.00	-9.62
42.07	V	10.6	156	44.57	1.25	11.81	32.08	25.55	40.00	-14.45
50.42	V	225.0	241	42.36	1.36	10.56	32.1	22.19	40.00	-17.81
105.60	H	296.1	400	48.25	1.98	9.61	32.09	27.75	40.00	-12.25
275.00	H	22.4	279	49.34	3.17	12.03	32.00	32.54	47.00	-14.46
275.00	V	14.6	100	47.72	3.17	12.03	32.00	30.93	47.00	-16.07
300.00	H	310.5	262	45.17	3.35	13.38	32.00	29.9	47.00	-17.10
374.99	H	308.7	226	42.05	3.72	14.99	32.00	28.75	47.00	-18.25
874.95	H	175.6	104	30.29	5.71	21.9	31.44	26.46	47.00	-20.54
896.82	V	186.4	366	22.26	5.76	22.14	31.32	18.84	47.00	-28.16

Supplementary information:
Margin (g) = QP Level (e) – Limit (f)
QP Level (e) = [Meter reading (a) + cable loss (b) + Antenna Factor (c) – Preamp (d)]

Table 10: Test data for Radiated emission (on battery mode)

Test Frequency (MHz)	Polarity (V/H)	Azimuth (Deg.)	Antenna Height (cm)	Meter Reading (dBµV) (a)	Cable Loss (dB) (b)	Antenna Factor (dB/m) (c)	Preamp (dB) (d)	QP Level dBµV/m (e)	Limit dBµV/m (f)	Margin (dB) (g)
32.41	V	203.3	165	45.29	1.1	11.13	32.05	25.48	40	-14.52
224.99	V	162	100	41.59	2.88	11.75	32	24.21	40	-15.79
43.81	V	165.2	215	45	1.28	11.49	32.08	25.69	40	-14.31
95.76	V	161.9	288	41.22	1.91	8.66	32.1	19.69	40	-20.31
374.98	H	300.9	210	41.24	3.72	14.99	32	27.94	47	-19.06

Supplementary information:
Margin (g) = QP Level (e) – Limit (f)
QP Level (e) = [Meter reading (a) + cable loss (b) + Antenna Factor (c) – Preamp (d)]

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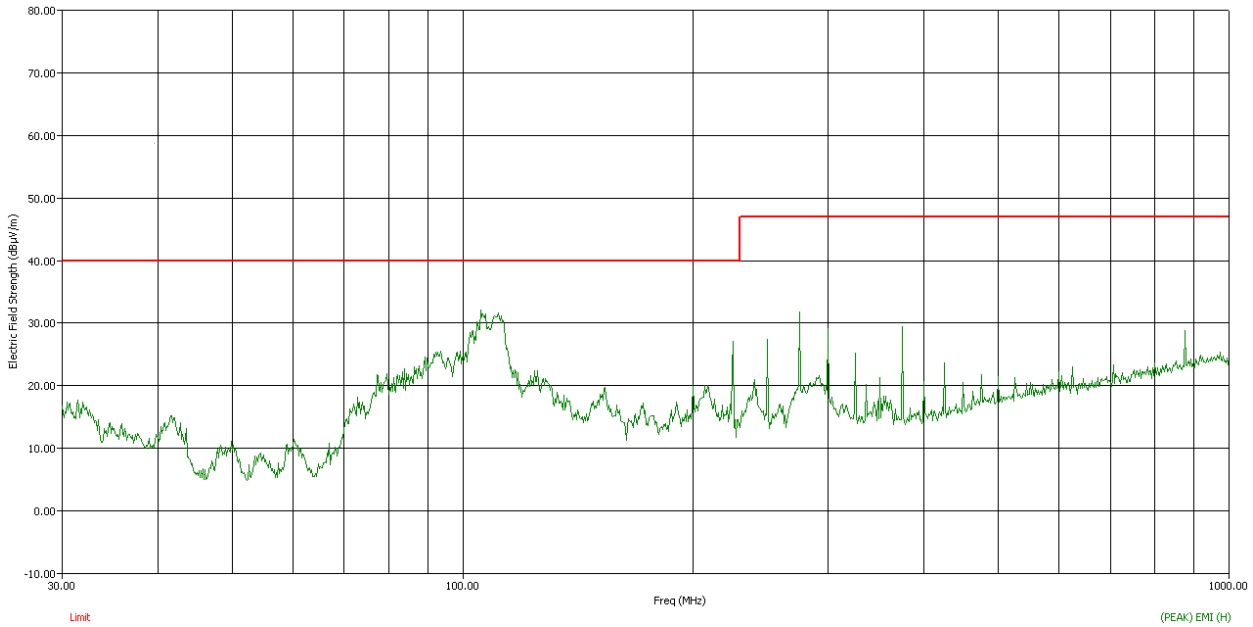
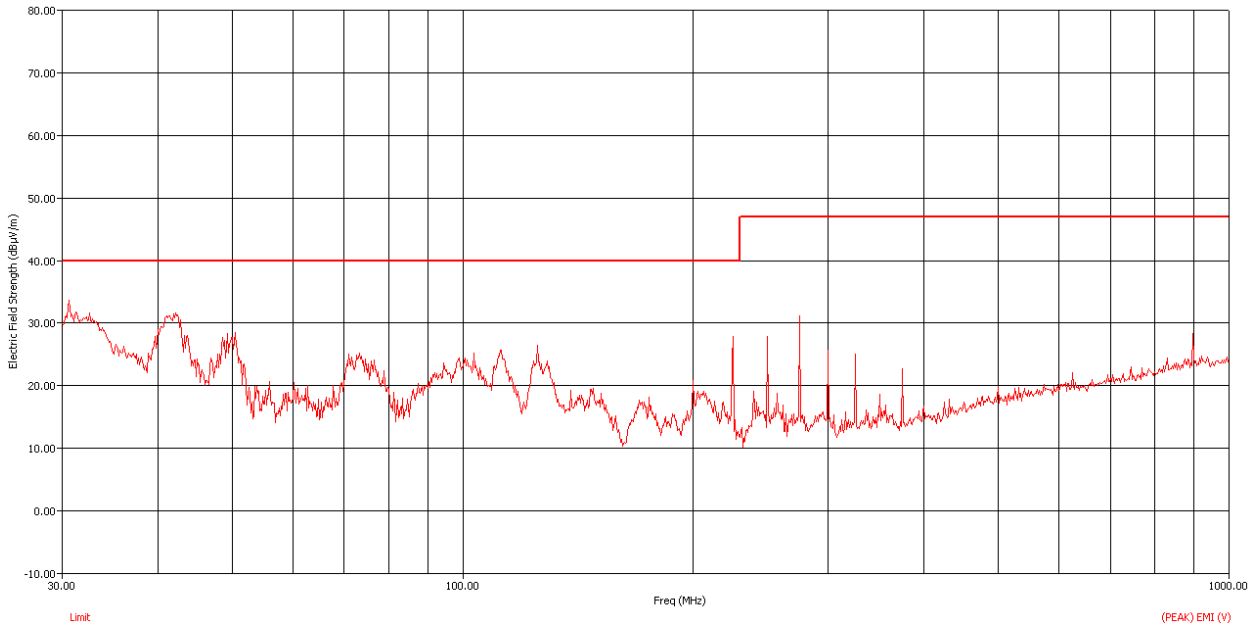
Figure 8: Graphical representation of Radiated emission (on line mode)



Horizontal Polarization



Vertical Polarization

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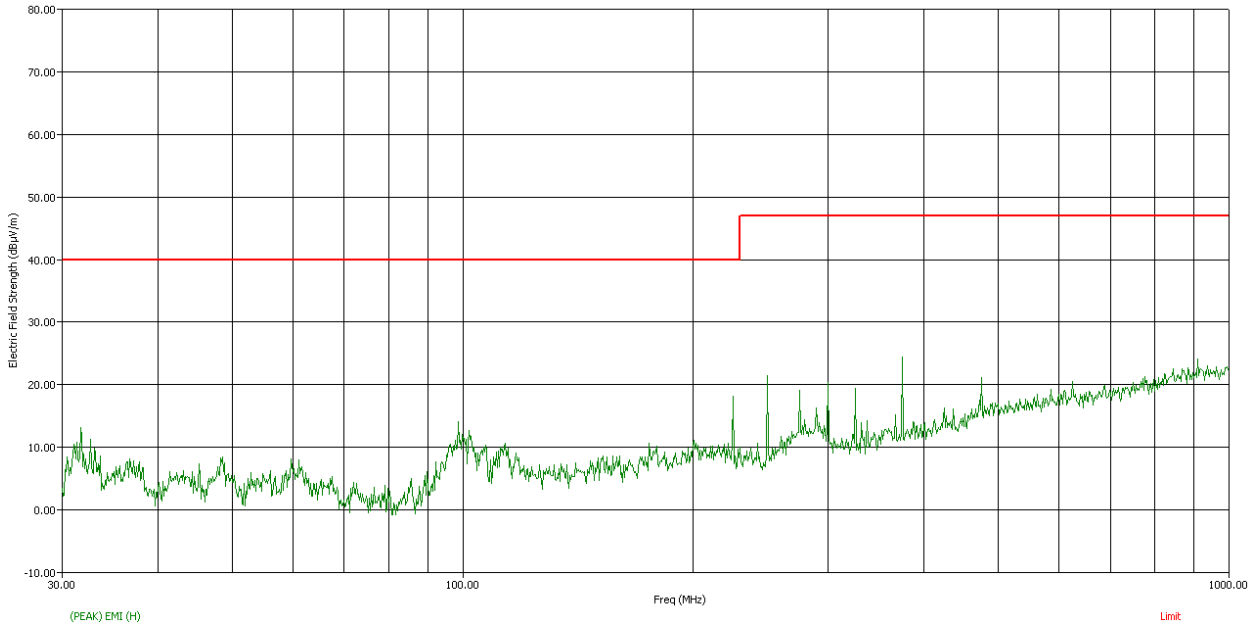
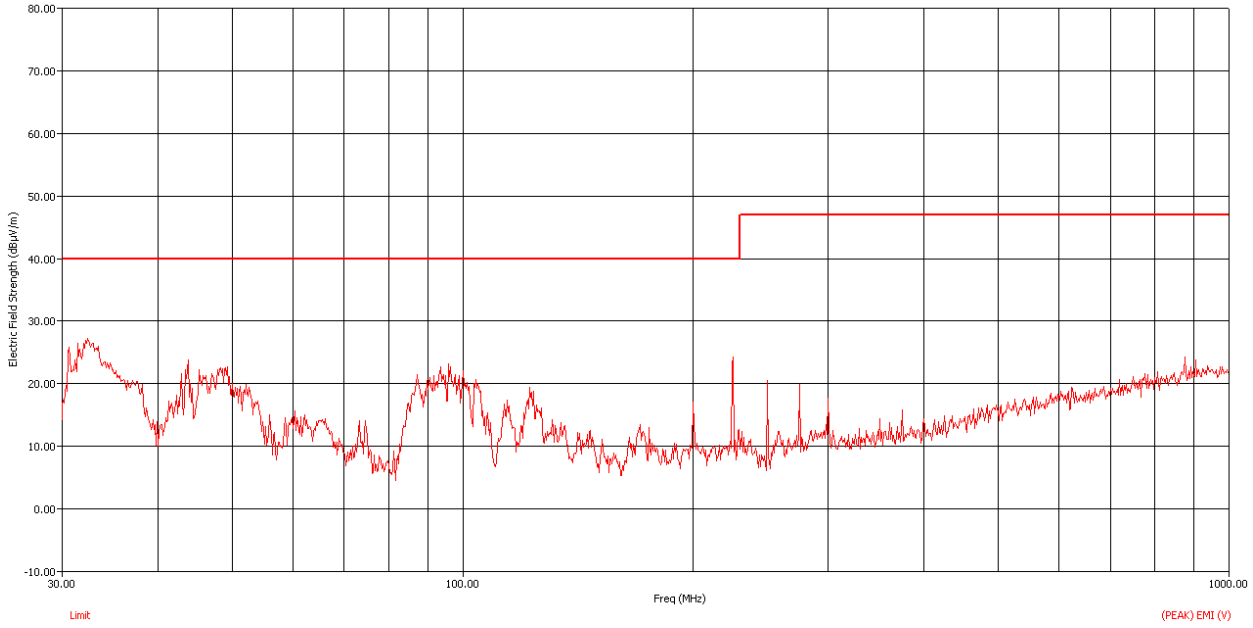
Figure 9: Graphical representation of Radiated emission (on battery mode)



Horizontal Polarization



Vertical Polarization

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6.4 HARMONIC CURRENT EMISSION

Test	Limits of harmonics of current		
Method	This test consists on the measurement of harmonics components of the input current which may be produced by equipment having an input current > 16 A and less than equal to 75A phase, and intended to be connected to public low-voltage distribution systems. The equipment is tested under specified conditions of operation.		
TEST ENVIRONMENT			
Parameters recorded during the test	Laboratory Ambient Temperature		22.0 °C
	Relative Humidity		58.0 %
	Atmospheric pressure		920 mbar
Basic Standard	IEC 61000-3-12:2011		
Equipment class	Class A	Results	Pass

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 10: Photo of Harmonics current emission test setup

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Table 11: Harmonic current Emission Test data

Average harmonic current results

Hn	Ieff [A]	Ieff [%]	Limit [%]	Result
1	20.985	100.000		
2	53.367E-3	0.254	8.00	PASS
3	187.705E-3	0.894	27.00	PASS
4	23.602E-3	0.112	4.00	PASS
5	217.988E-3	1.039	15.00	PASS
6	13.591E-3	0.065	2.67	PASS
7	155.580E-3	0.741	10.00	PASS
8	14.264E-3	0.068	2.00	PASS
9	161.648E-3	0.770	6.00	PASS
10	12.519E-3	0.060	1.60	PASS
11	162.423E-3	0.774	5.00	PASS
12	9.308E-3	0.044	1.33	PASS
13	157.557E-3	0.751	4.00	PASS
14	6.637E-3	0.032		PASS
15	146.319E-3	0.697		PASS
16	7.783E-3	0.037		PASS
17	134.680E-3	0.642		PASS
18	11.774E-3	0.056		PASS
19	125.642E-3	0.599		PASS
20	14.232E-3	0.068		PASS
21	120.996E-3	0.577		PASS
22	13.728E-3	0.065		PASS
23	114.781E-3	0.547		PASS
24	11.713E-3	0.056		PASS
25	103.313E-3	0.492		PASS
26	10.314E-3	0.049		PASS
27	86.051E-3	0.410		PASS
28	11.350E-3	0.054		PASS
29	66.234E-3	0.316		PASS
30	13.193E-3	0.063		PASS
31	44.631E-3	0.213		PASS
32	13.063E-3	0.062		PASS
33	27.759E-3	0.132		PASS
34	11.262E-3	0.054		PASS
35	15.200E-3	0.072		PASS
36	9.316E-3	0.044		PASS
37	8.484E-3	0.040		PASS
38	6.413E-3	0.031		PASS
39	4.829E-3	0.023		PASS
40	4.645E-3	0.022		PASS

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6.5 ELECTROSTATIC DISCHARGES (ESD)

TEST	Electrostatic Discharge		
Method	Measurements were made on a ground plane. Air discharges were applied to non-metallic parts of the system. Contact discharges were applied to all accessible metallic parts. Discharges were also applied to the Horizontal and Vertical Coupling Planes, where applicable. Each discharge was applied at a rate of one (1) discharge per second.		
Parameters required prior to the test	Laboratory Ambient Temperature	15 to 35 °C	
	Relative Humidity	30 to 60 %	
	Air pressure	860 to 1060 mbar	
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C	
	Relative Humidity	54 %	
	Air pressure	1014 mbar	
Basic Standard	IEC 61000-4-2:2008		
Measurement Port	Product Enclosure		
Required Performance criteria	B		

Test Levels

Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)
	Positive	Negative	
Air – Direct	2, 4, 8	2, 4, 8	10
Contact – Direct	2, 4	2, 4	10
Contact – Indirect	2, 4	2, 4	10

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 11: Photo of ESD test setup and test points

Contact Discharge – Indirect

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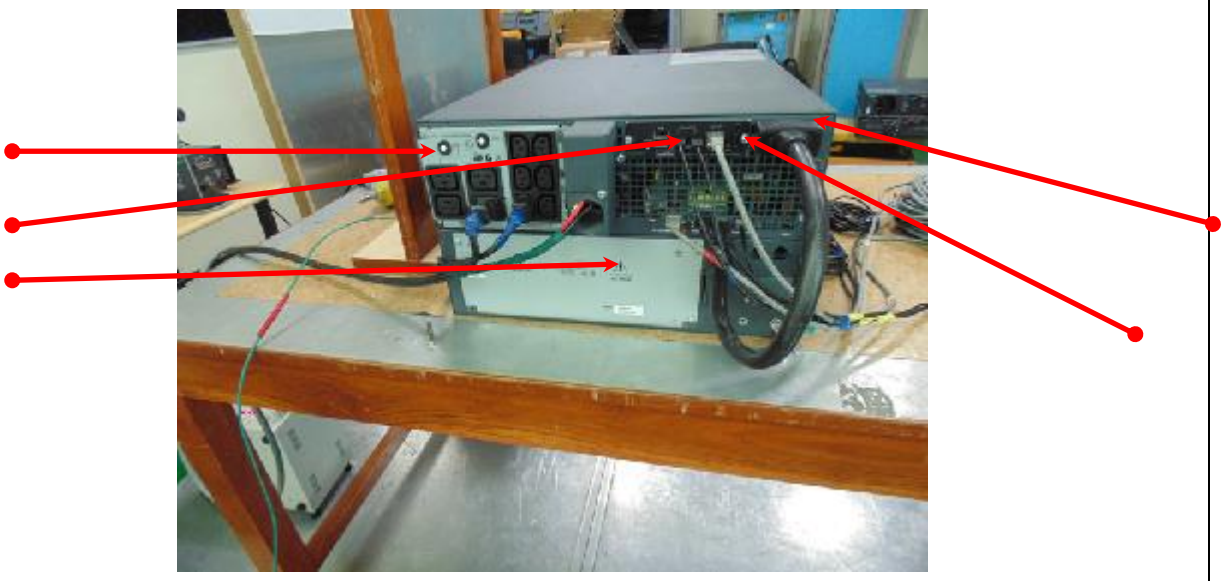

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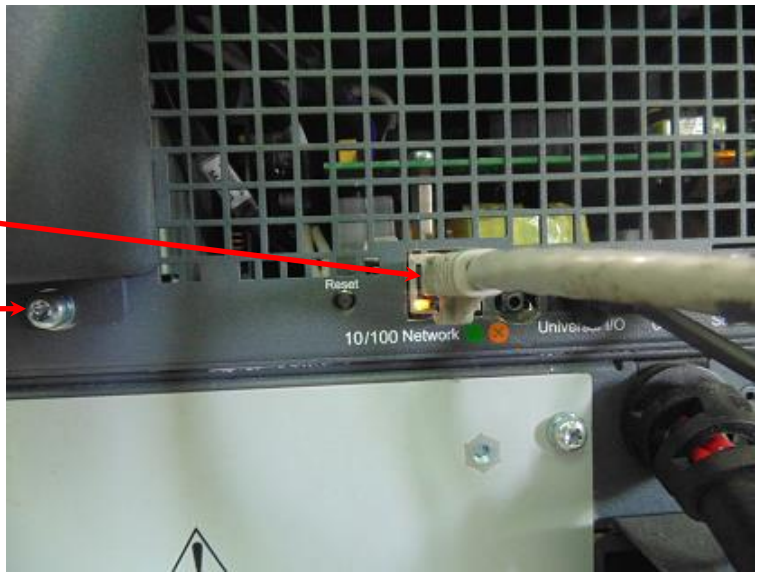

Contact Discharge – Direct

Discharge points

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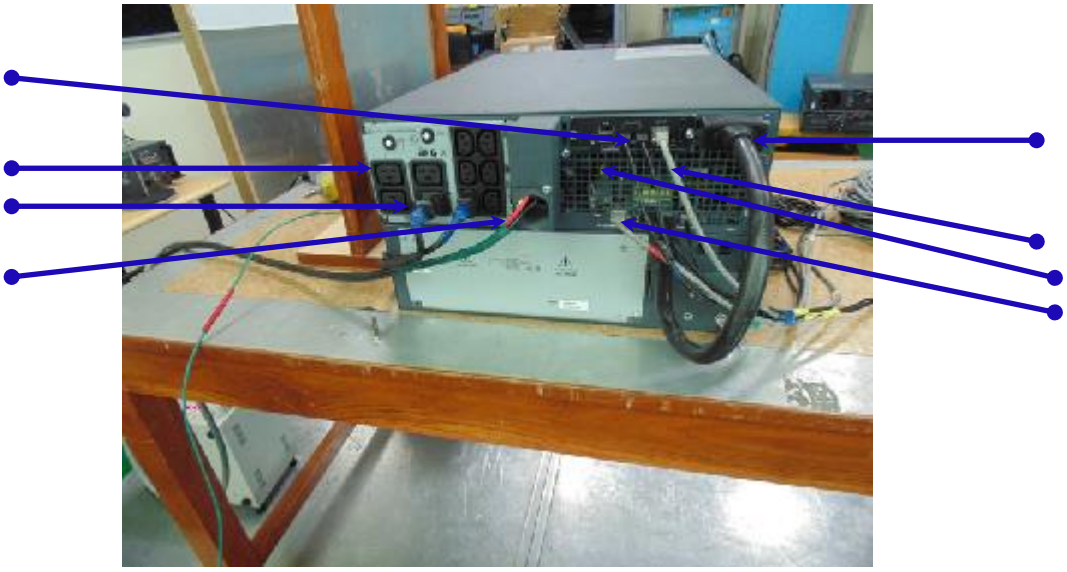

Air Discharge
Discharge points

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Table 12: Results for Electrostatic Discharges – Indirect Contact Discharges

TEST POINT (HCP & VCP)	Positive Polarity		Negative Polarity	
	2 kV	4 kV	2 kV	4 kV
Front side	A	A	A	A
Left side	A	A	A	A
Right side	A	A	A	A
Back side	A	A	A	A

Results Descriptions:

A –During and after the test, the EUT continue to operate as intended without any degradation of Performance or loss of function and product specific performance requirement. No observed response from EUT
B –During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 13: Results for Electrostatic Discharges – Direct Contact Discharges

TEST POINT	Positive Polarity		Negative Polarity	
	2 kV	4 kV	2 kV	4 kV
Metal Enclosure	A	A	A	A
Metal Screws	A	A	A	A
USB Connector on NMC	A	A	A	A
USB Connector on Mini-rohdes	A	A	A	A
Ethernet Connector on NMC	A	A	A	A
Ethernet Connector on Mini-rohdes	A	A	A	A

Results Descriptions:

A –During and after the test, the EUT continue to operate as intended without any degradation of Performance or loss of function and product specific performance requirement. No observed response from EUT
B –During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 14: Results for Electrostatic Discharges – Air Discharges

TEST POINT (HCP & VCP)	Positive Polarity			Negative Polarity		
	2 kV	4 kV	8 kV	2 kV	4 kV	8 kV
PDU Output connectors	A	A	A	A	A	A
PDU Output open ports	A	A	A	A	A	A
Input Cable	A	A	A	A	A	A
Universal I/O 1 on NMC	A	A	A	A	A	A
Universal I/O 2 on NMC	A	A	A	A	A	A
Ethernet Port on NMC	A	A	**B***	A	A	**B***
Ethernet Port on Mini-rohdes	A	A	**B***	A	A	**B***
XBP Connector & Cable	A	A	A	A	A	A
Universal I/O on Mini-rohdes	A	A	A	A	A	A
USB Connectors	A	A	A	A	A	A
Micro link Connectors	A	A	A	A	A	A
Display	A	A	**B****	A	A	A
Air gaps	A	A	A	A	A	A
Backside Ventilators	A	A	**B***	A	A	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT ➢ *** Ethernet LED blinking stopped which recovered without manual intervention after the test.** ➢ **** Display changed to blank when ESD applied to up-down arrows which recovered within 1 minute without manual intervention after the test.**
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.6 RADIATED RF DISTUBANCE (Radiated Susceptibility)

TEST	Radio-frequency electromagnetic field. Amplitude modulated	
Method	Measurements were made in a shielded semi-anechoic chamber and the indicated field strength was pre-calibrated prior to placement of the system under test. Tests were performed in both the horizontal and vertical polarities, where applicable. The antenna was placed 3 meters from the product under test. All sides of the EUT were investigated for abnormalities.	
TEST ENVIRONMENT		
Parameters recorded during the test	Laboratory Ambient Temperature	22.0 °C
	Relative Humidity	58.0 %
	Air pressure	925 mbar
Basic Standard	IEC 61000-4-3:2010	
Measurement Port	Product Enclosure	
Frequency range	80 MHz – 6000 MHz	
Required Performance criteria	A	

Applied Field Strength

Frequency (MHz)	(V/m)	Modulation
80 – 1000	10	AM, 1 kHz, 80%
1000 – 4200	10	AM, 1 kHz, 80%
4200 - 6000	10	AM, 1 kHz, 80%

Supplementary information: Dwell time: 3 sec., Frequency step: 1%

Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

Note: Test frequency selected as per customer request.

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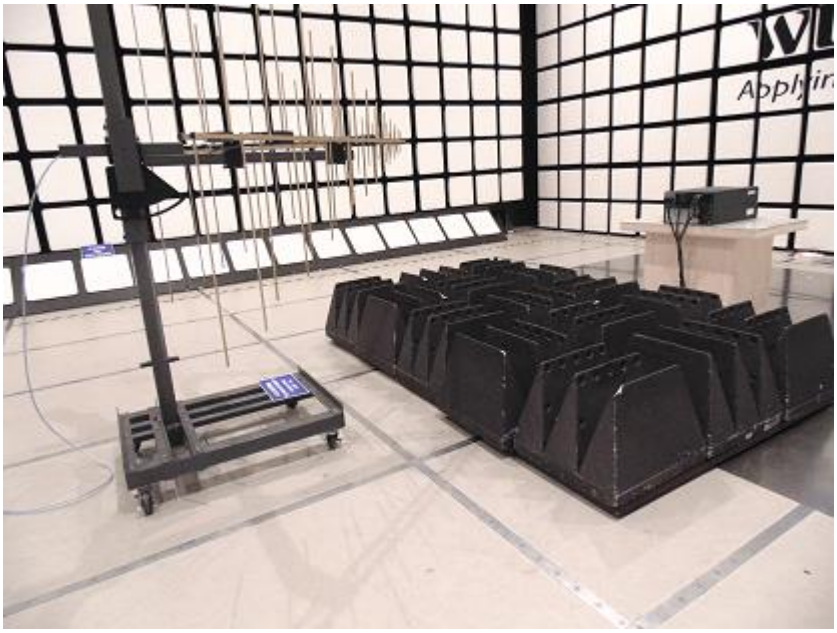
Figure 12: Photo of Radiated Susceptibility test setup



Frequency : 80 – 1000 MHz

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Frequency : 1000 – 4200 MHz

Frequency : 4200 – 6000 MHz

Table 15: Description of Product Performance at the level of 10 V/m

EUT SIDE	POLARITY	Observations	EUT SIDE	POLARITY	Observations
Front	Horizontal	A	Front	Vertical	A
Left	Horizontal	A	Left	Vertical	A
Right	Horizontal	A	Right	Vertical	A
Rear	Horizontal	A	Rear	Vertical	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.7 ELECTRICAL FAST TRANSIENTS (EFT) / BURST

TEST	Electrical Fast Transients	
Method	Measurements were made on a ground plane. Mains power tests were conducted with the product connected to a Coupling/Decoupling Network (CDN). I/O lines were tested in a Capacitive Coupling Clamp. One of each unique interface was tested for a period of one (1) minute per polarity.	
TEST ENVIRONMENT		
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C
	Relative Humidity	58 %
	Air pressure	1010 mbar
Basic Standard	IEC 61000-4-4:2012	
Measurement Port	Input & output AC Power Ports and Signal Lines	
Required Performance criteria	B	

Applied Level		
Application Point	Level (kV)	Repetition Frequency (kHz)
Input AC Power Lines	±0.5, ±1 , ± 2	5
Output AC Power Lines	±0.5, ±1 , ± 2	5
Universal I/O on Mini-rohdes	±0.5, ±1 , ± 2	5
Universal I/O 1 on NMC	±0.5, ±1 , ± 2	5
Universal I/O 2 on NMC	±0.5, ±1 , ± 2	5
Ethernet on Mini-rohdes	±0.5, ±1 , ± 2	5
Ethernet on NMC	±0.5, ±1 , ± 2	5
Micro link serial communication	±0.5, ±1 , ± 2	5
USB	±0.5, ±1 , ± 2	5
EPO	±0.5, ±1 , ± 2	5

Supplementary Information: Test was conducted at Location (A) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 13: Photo of EFT test setup

EFT on AC input power lines

EFT on AC output power lines

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EFT on Universal I/O on Mini-rohdes

EFT on Universal I/O 1 on NMC

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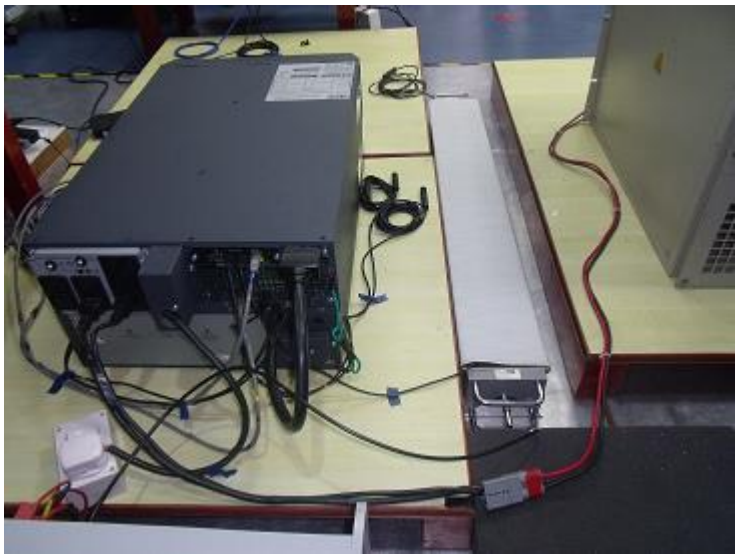

EFT on Universal I/O 2 on NMC

EFT on Ethernet on Mini-rohdes

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EFT on Ethernet on NMC

EFT on Micro link serial communication

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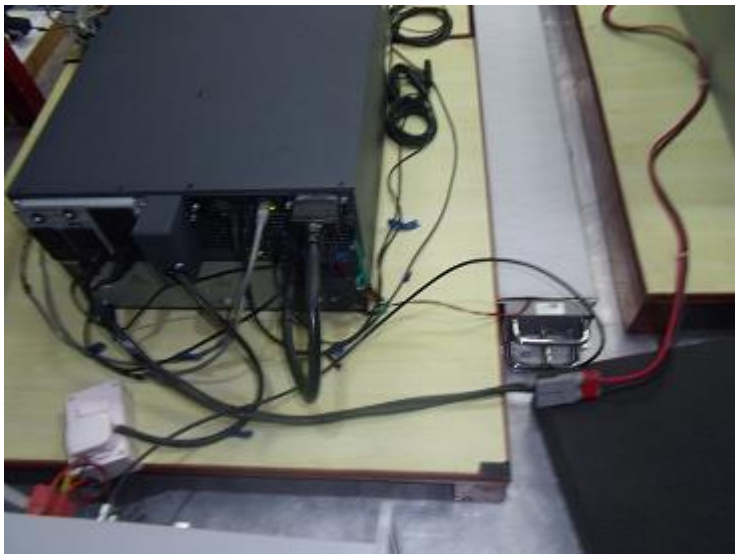
EFT on USB



EFT on EPO

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Table 16: Results for Electrical Fast Transients on input power lines

Point of Application	Level	Polarity	Observations
Input AC Power Lines (L+N+GND)	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 17: Results for Electrical Fast Transients on output power lines

Point of Application	Level	Polarity	Observations
Output AC Power Lines (L+N+GND)	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 18: Results for Electrical Fast Transients on Universal I/O Mini-rohdes

Point of Application	Level	Polarity	Observations
Universal I/O on Mini-rohdes	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 19: Results for Electrical Fast Transients on Universal I/O 1 on NMC

Point of Application	Level	Polarity	Observations
Universal I/O 1 on NMC	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	**B***
		Negative	**B***

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT ➢ ***Communication card got reset, with display blackout which recovered without manual intervention after the test.**
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 20: Results for Electrical Fast Transients on Universal I/O 2 on NMC

Point of Application	Level	Polarity	Observations
Universal I/O 2 on NMC	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	**B***
		Negative	**B***

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT ➢ ***Communication card got reset, with display blackout which recovered without manual intervention after the test.**
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 21: Results for Electrical Fast Transients on Ethernet on Mini-rohdes

Point of Application	Level	Polarity	Observations
Ethernet on Mini-rohdes	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 22: Results for Electrical Fast Transients on Ethernet on NMC

Point of Application	Level	Polarity	Observations
Ethernet on NMC	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 23: Results for Electrical Fast Transients on Micro link serial communication

Point of Application	Level	Polarity	Observations
Micro link serial communication	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 24: Results for Electrical Fast Transients on USB

Point of Application	Level	Polarity	Observations
USB	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 25: Results for Electrical Fast Transients on EPO

Point of Application	Level	Polarity	Observations
EPO	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT.
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.8 SURGES

TEST	Surges	
Method	Mains power tests were conducted with the product connected to a Coupling/Decoupling Network (CDN). The test voltage was increased from the lowest indicated level up to the maximum level. Five (5) positive surges and five (5) negative surges were applied at each of phases of the a.c. waveform: 0°, 90°, 180° and 270°. Each surge was applied 60 seconds after the previous surge. Communication lines were conducted with the product connected to Coupling/Decoupling network (CDN) with 42 ohms impedance. The test voltage was increased from the lowest indicated level up to the maximum level. Five (5) positive surges and five (5) negative surges were applied at each line. Each surge was applied 60 seconds after the previous surge.	
TEST ENVIRONMENT		
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	55 %
	Air pressure	1016 mbar
Basic Standard – Mains	IEC 61000-4-5: 2005	
Measurement Port	Input AC Power Ports and Signal Lines	
Required Performance criteria	B	

Applied Level		
Application Point	(KV)	Required Surge Waveform
Input AC Power Lines Output AC Power Lines Signals Lines (RJ-45)	±1.0 (Line to Line)	Combination Wave (1.2µS x 50µS Voltage, 8µS x 20µS Current)
	±2.0 (Line to Earth)	Combination Wave (1.2µS x 50µS Voltage, 8µS x 20µS Current)

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 14: Photo of Surge test setup

Surge on AC input power lines

Surge on AC output power lines

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Surge on Ethernet on Mini-rohdes

Surge on Ethernet on NMC

Reviewed by signature:

Table 26: Results for Surges (Input & Output power lines)

Mode of Application –Input & Output AC Mains	Level	Polarity	Observations
L-N (Differential mode)	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
L-PE (Differential mode)	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
	2.0kV	Positive	A
		Negative	A
N-PE (Differential mode)	0.5kV	Positive	A
		Negative	A
	1.0kV	Positive	A
		Negative	A
		Negative	A
	2.0kV	Positive	A
		Negative	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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Table 27: Results for surges (RJ -45)

Mode of Application – Telecommunication ports (RJ-45)	Level	Polarity	Observations
Ethernet on Mini-rohdes	0.5kV	Positive	**B***
		Negative	**B***
	1.0kV	Positive	**B***
		Negative	**B***
Ethernet on NMC	0.5kV	Positive	**B***
		Negative	**B***
	1.0kV	Positive	**B***
		Negative	**B***

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT. ***Communication checked before and after the test, since CDN data speed was less than the Ethernet speed.**
C – During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.9 CONTINUOUS CONDUCTED DISTURBANCES

TEST	Continuous Conducted Radio-Frequency		
Method	Measurements were made on a ground plane. The EUT was located 10cm above the reference ground plane and any associated I/O cables attached to the EUT were located between 30mm and 50mm above the ground plane. The indicated field was pre-calibrated prior to placement of the system under test.		
TEST ENVIRONMENT			
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C	
	Relative Humidity	55 %	
	Air pressure	1013 mbar	
Basic Standard	IEC 61000-4-6: 2008		
Measurement Port	Input & output AC Power Ports and Signal Lines		
Frequency range	150kHz to 80MHz		
Required Performance criteria	A		
Applied Level			
Application Point	**Frequency (MHz)**	**(Vrms)**	**Modulation**
Input AC Power Lines	0.150 – 80	10	80%, AM (1 kHz)
Output AC Power Lines	0.150 – 80	10	80%, AM (1 kHz)
Universal I/O on Mini-rohdes	0.150 – 80	10	80%, AM (1 kHz)
Universal I/O 1 on NMC	0.150 – 80	10	80%, AM (1 kHz)
Universal I/O 2 on NMC	0.150 – 80	10	80%, AM (1 kHz)
Ethernet on Mini-rohdes	0.150 – 80	10	80%, AM (1 kHz)
Ethernet on NMC	0.150 – 80	10	80%, AM (1 kHz)
Micro link serial communication	0.150 – 80	10	80%, AM (1 kHz)
USB	0.150 – 80	10	80%, AM (1 kHz)
EPO	0.150 – 80	10	80%, AM (1 kHz)

Supplementary information: Dwell time: 3 sec., Frequency step: 1%

Test was conducted at Location (A) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 15: Photo of Continuous Conducted Radio-Frequency test setup

Continuous Conducted Radio-Frequency on AC input power lines

Continuous Conducted Radio-Frequency on AC output power lines

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Continuous Conducted Radio-Frequency on Universal I/O on Mini-rohdes

Continuous Conducted Radio-Frequency on Universal I/O 1 on NMC

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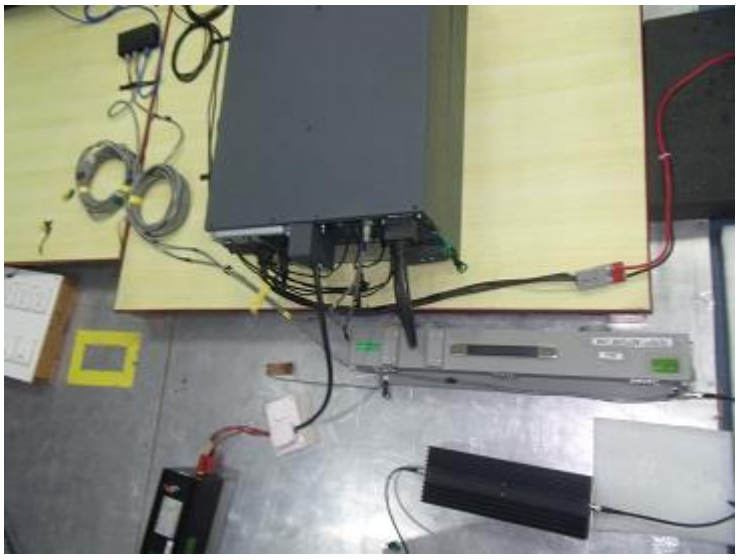
Continuous Conducted Radio-Frequency on Universal I/O 2 on NMC



Continuous Conducted Radio-Frequency on Ethernet on Mini-rohdes

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Continuous Conducted Radio-Frequency on Ethernet on NMC

Continuous Conducted Radio-Frequency on Micro link serial communication

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Continuous Conducted Radio-Frequency on USB

Continuous Conducted Radio-Frequency on EPO

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Table 28: Results for Continuous Conducted Disturbances

Point of application	Observations
Input AC Power Lines	A
Output AC Power Lines	A
Universal I/O on Mini-rohdes	A
Universal I/O 1 on NMC	A
Universal I/O 2 on NMC	A
Ethernet on Mini-rohdes	A
Ethernet on NMC	A
Micro link serial communication	A
USB	A
EPO	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.10 POWER-FREQUENCY MAGNETIC FIELDS

TEST	Power-frequency magnetic field		
Method	Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. The indicated field was pre-calibrated prior to placement of the system under test.		
Parameters required prior to the test		Laboratory Ambient Temperature	10 to 40 °C
		Relative Humidity	10 to 90 %
Parameters recorded during the test		Laboratory Ambient Temperature	22°C
		Relative Humidity	58%
		Frequency	Application Point
Fully configured sample tested at the power line frequency		50 Hz	Enclosure
Basic Standard		IEC 61000-4-8: 2009	
Required Performance criteria		A	
Test Level			
Frequency (Hz)		A/m	
50		30	

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

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Figure 16: Photo of Power frequency magnetic field test setup

X-Axis

Y-Axis

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Z-Axis

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Table 29: Description of Product Performance

Power Frequency (50 Hz):

Point of application	Observations
X-Axis	A
Y-Axis	A
Z-Axis	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.11 VOLTAGE DIPS AND INTERRUPTIONS

TEST	Voltage Dips and Interruptions	
Method	The product was subjected to voltage dips and interruptions. Testing was performed with the product connected directly to a generator capable of simulating the voltage drops and interrupts as described at each of phases of AC waveforms: 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°.	
TEST ENVIRONMENT		
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	58 %
	Air pressure	920 mbar
Basic Standard	IEC 61000-4-11: 2004	
Measurement Port	Input AC Power Port	

Applied Levels		
Voltage Reduction	Period (Cycles)	Required Performance criteria
>95%	0.5	A
>95%	1	A
30%	25	A
>95%	250	A

Supplementary Information: Test was conducted at Location (B) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

Note: Test standard and performance criteria were decided as per customer specification.

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Figure 17: Photo of Voltage Dips and Interruptions test setup

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Table 30: Results for voltage dips and interruptions

Point of application	Voltage Reduction	Duration (ms)	Observations
230V, 50Hz L, L+N	>95%	10	A*
	>95%	20	A*
	30%	500	A*
	>95%	5000	A*

Results Descriptions:

A –During and after the test, the EUT continue to operate as intended without any degradation of Performance or loss of function and product specific performance requirement. No observed response from EUT *** Observations: UPS changed to battery mode.**
B –During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

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6.12 IMMUNITY TO LOW FREQUENCY

TEST	Continuous Conducted Radio-Frequency		
Method	Mains power tests were conducted with the product connected to a Coupling Network (CN). The test voltage was applied on the power lines individually.		
TEST ENVIRONMENT			
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C	
	Relative Humidity	55 %	
	Air pressure	1009 mbar	
Basic Standard	IEC 61000-2-2		
Measurement Port	Input AC Power Port		
Frequency range	140Hz to 360Hz		
Required Performance criteria	A		
Applied Level			
Application Point	**Frequency (Hz)**	**(Vrms)**	
Input AC Power Lines	140 – 360	10	

Supplementary information: Dwell time: 3 sec., Frequency step: 1%

Test was conducted at Location (C) with below configuration

- EUT Power Interface Mode : 1
- EUT Operation Mode : 1

Location (C) : Robert Bosch Engineering and Business Solution Ltd.

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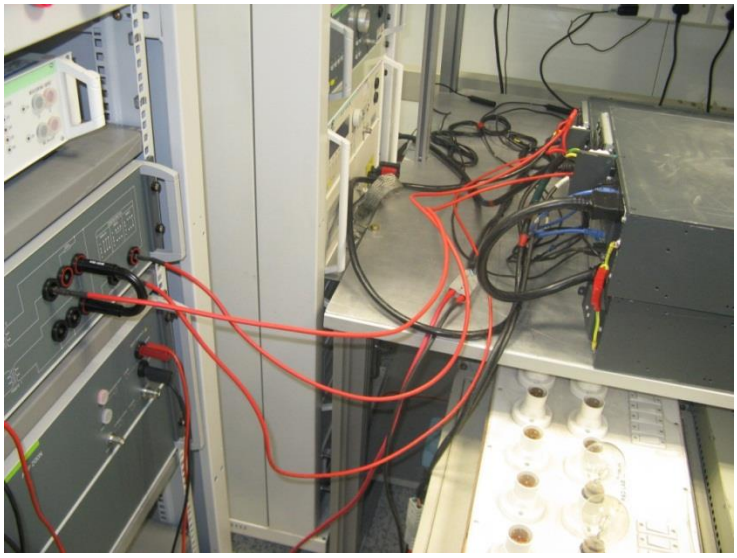
Figure 18: Photo of Immunity to Low Frequency test setup

Immunity to Low Frequency on Line



Immunity to Low Frequency on Neutral

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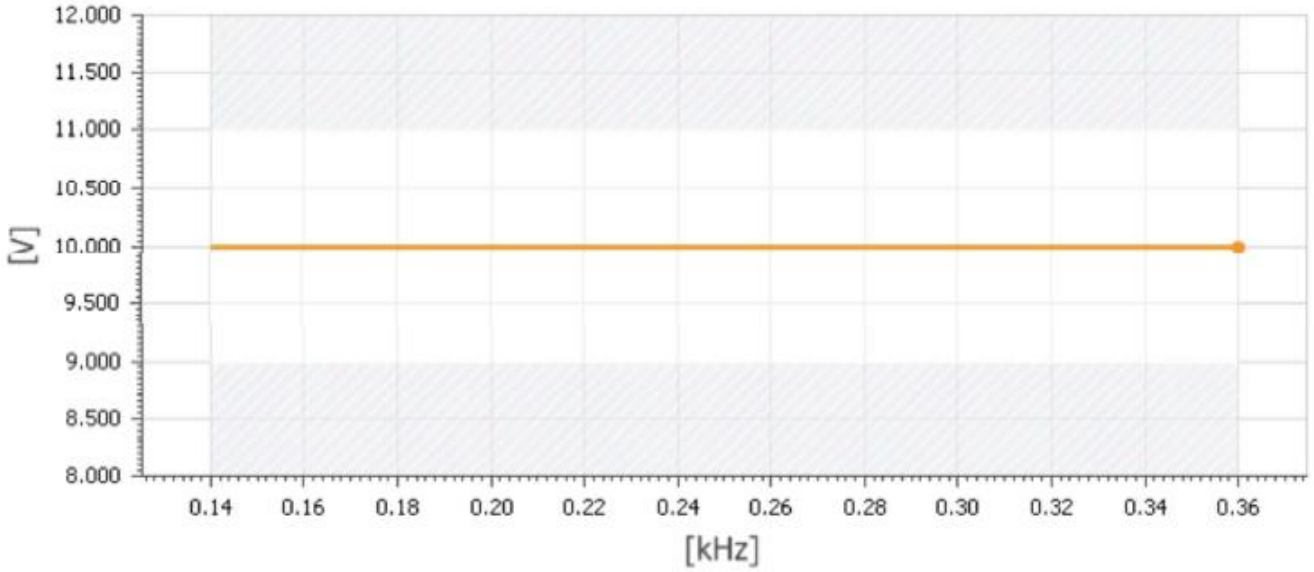
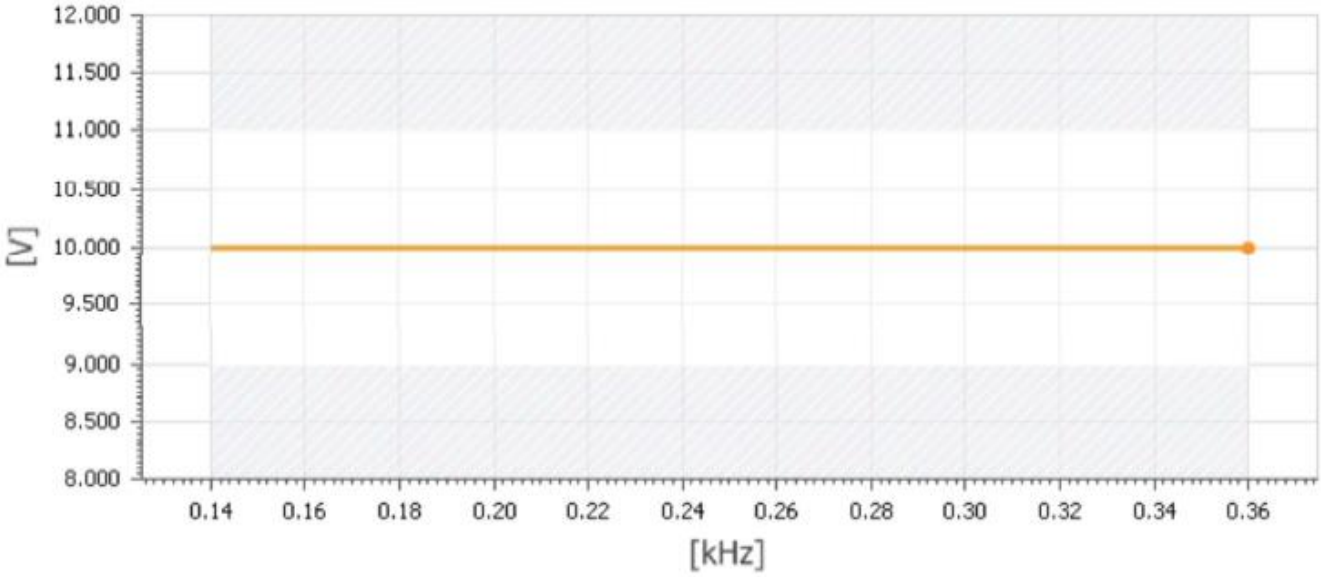
Figure 19: Graphical representation of Immunity to Low Frequency



Test Level on Line



Test Level on Neutral

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Table 31: Results for Immunity to Low Frequency

Point of application (Input AC power ports)	Observations
Line	A
Neutral	A

Results Descriptions:

A – During and after the test, the EUT continue to operate as intended without any degradation of performance or loss of function and product specific performance requirement. No observed response from EUT
B – During the test, some degradation of performance or loss of function observed. But, after the test, the EUT continues to operate as intended. Some observed response from EUT
C - During the test, some degradation of performance or loss of function observed; the correction of which requires operator intervention

******End of Report******

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