EMC TEST REPORT	
TEST REPORT NUMBER	BQD 1647INF386
TEST REPORT DATE	5 December 2016
TEST REPORT VERSION	1.0
MANUFACTURER	APC by Schneider Electric
PRODUCT NAME	LEO
PRODUCT MODEL	SRT1000XLA , SRT1000RMXLA, SRT1000RMXLA-NC, SRT1500XLA, SRT1500RMXLA, SRT1500RMXLA-NC and Battery pack-SRT48RMBP, SRT48BP
CONDITION OF EUT WHEN RECEIVED	Good
ISSUED TO	Schneider Electric IT Business Bearys Global Research Triangle Sy.No 63/3B,Gorvigere Village, Bidarahalli Hobli, Bangalore East Taluk, Whitefield Ashram Road, Bangalore-560067
ISSUED BY	**TARANG Lab** Wipro Technologies, SJP2, Survey#70,77,78/8A, Dodda Kanelli, Sarjapur road, Bangalore. Karnataka. India - 560 035 Tel: +91-80-30292929 Fax: +91-80-30298200 Email: tarang.planet@wipro.com Web: www.wipro.com

AMENDMENT HISTORY

Amendment Number	Amendment Date	Author of Amendment	Previous Report Version	Previous Report Date
Amendment Details				

TABLE OF CONTENTS

1 TEST REPORT SUMMARY 6

2 GENERAL INFORMATION 7

2.1 ACCREDITATION DETAILS 7
2.2 MEASUREMENT UNCERTAINTY 7

3 INSTRUMENTATION AND CALIBRATION 8

3.1 TEST AND MEASURING EQUIPMENT 8
3.2 EQUIPMENT USED 8

4 PRODUCT INFORMATION 9

4.1 DESCRIPTION OF THE PRODUCT 9
4.2 SOFTWARE AND FIRMWARE DETAILS 10

5 TEST DETAILS 11

5.1 PRODUCT AND TEST SETUP 11
5.1.1 PRODUCT CONFIGURATION 11
5.1.2 TEST SETUP DETAILS 11
5.1.3 ACCESSORIES 12
5.2 APPLICABLE TEST 12
5.3 TEST RESULT 13
5.3.1 RADIATED EMISSIONS TEST 13
5.3.2 CONDUCTED EMISSIONS TEST 20

ANNEXURE I: TEST SETUP PHOTOGRAPHS 29

ANNEXURE II: ACRONYMS 41

LIST OF FIGURES

FIGURE 1: BLOCK DIAGRAM OF THE EUT SETUP 11
FIGURE 2: SAMPLE RE TEST SETUP FOR TABLE TOP EQUIPMENT AT 10 METER DISTANCE FROM 30 MHZ TO 1 GHZ 14
FIGURE 3: RE GRAPH USING PEAK DETECTOR ON HORIZONTAL POLARIZATION FROM 30 MHZ TO 1 GHZ_ ONLINE MODE 15
FIGURE 4: RE GRAPH USING PEAK DETECTOR ON VERTICAL POLARIZATION FROM 30 MHZ TO 1 GHZ_ ONLINE MODE 15
FIGURE 5: RE GRAPH USING PEAK DETECTOR ON HORIZONTAL POLARIZATION FROM 30 MHZ TO 1 GHZ_ GREEN/ECO MODE 16
FIGURE 6: RE GRAPH USING PEAK DETECTOR ON VERTICAL POLARIZATION FROM 30 MHZ TO 1 GHZ_ GREEN/ECO MODE 17
FIGURE 7: RE GRAPH USING PEAK DETECTOR ON HORIZONTAL POLARIZATION FROM 30 MHZ TO 1 GHZ _ BATTERY/INVERTER MODE 18
FIGURE 8: RE GRAPH USING PEAK DETECTOR ON VERTICAL POLARIZATION FROM 30 MHZ TO 1 GHZ _ BATTERY/INVERTER MODE 18
FIGURE 9: SAMPLE CE TEST SETUP FOR TABLE TOP EQUIPMENT FROM 150 KHZ TO 30 MHZ 21
FIGURE 10: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ _ONLINE MODE- LINE 22
FIGURE 11: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ _ONLINE MODE – NEUTRAL 22
FIGURE 12: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ _ONLINE MODE – LINE 23
FIGURE 13: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ _ONLINE MODE – NEUTRAL 23
FIGURE 14: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – LINE 24
FIGURE 15: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – NEUTRAL 24
FIGURE 16: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – LINE 25
FIGURE 17: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – NEUTRAL 25
FIGURE 18: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ _BATTERY/INVERTER MODE- LINE 26
FIGURE 19: CE GRAPH USING PEAK DETECTOR FROM 150 KHZ TO 30 MHZ _BATTERY/INVERTER MODE – NEUTRAL 26
FIGURE 20: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ _BATTERY/INVERTER MODE – LINE 27
FIGURE 21: CE GRAPH USING AVERAGE DETECTOR FROM 150 KHZ TO 30 MHZ_ BATTERY/INVERTER MODE – NEUTRAL 27
FIGURE 22: PHOTOGRAPH OF EUT 29
FIGURE 23: PHOTOGRAPH OF EUT REAR VIEW 29
FIGURE 24: PHOTOGRAPH OF MODEL NUMBER ON EUT 30
FIGURE 25: PHOTOGRAPH OF SERIAL NUMBER ON THE EUT 31
FIGURE 26: PHOTOGRAPH OF MODEL NUMBER AND SERIAL NUMBER ON THE BATTERY PACK 31
FIGURE 27: PHOTOGRAPH OF NETWORK SWITCH 32
FIGURE 28: PHOTOGRAPH OF ISOLATION TRANSFORMER 32
FIGURE 29: PHOTOGRAPH OF PC 33
FIGURE 30: PHOTOGRAPH OF PARAMETER MONITORED ON PC 33
FIGURE 31: PHOTOGRAPH OF RESISTIVE LOAD 34
FIGURE 32: PHOTOGRAPH OF BULB LOAD 34
FIGURE 33: PHOTOGRAPH OF ETHERNET CABLE RJ 45 (LCE) 35
FIGURE 34: PHOTOGRAPH OF NMC ETHERNET CABLE 35
FIGURE 35: PHOTOGRAPH OF USB CABLE 36
FIGURE 36: PHOTOGRAPH OF SERIAL CABLE 36
FIGURE 37: PHOTOGRAPH OF UNIVERSAL I/O PORT CABLE 1 37
FIGURE 38: PHOTOGRAPH OF UNIVERSAL I/O PORT CABLE 2 37
FIGURE 39: PHOTOGRAPH OF AC MAINS CABLE 38
FIGURE 40: PHOTOGRAPH OF AC OUTPUT CABLE 38
FIGURE 41: PHOTOGRAPH OF EPO CABLE 39
FIGURE 42: PHOTOGRAPH OF RE TEST SETUP FROM 30MHZ TO 1GHZ-HORIZONTAL POLARIZATION 39
FIGURE 43: PHOTOGRAPH OF RE TEST SETUP FROM 30MHZ TO 1GHZ-VERTICAL POLARIZATION 40
FIGURE 44: PHOTOGRAPH OF CE TEST SETUP 40

LIST OF TABLES

TABLE 1:LIST OF EQUIPMENT USED FOR RE TEST 8
TABLE 2:LIST OF EQUIPMENT USED FOR CE TEST 8
TABLE 3: PRODUCT DETAILS 9
TABLE 4: LIST OF CABLES CONNECTED TO EUT 9
TABLE 5: LIST OF ACCESSORIES USED FOR TESTING 12
TABLE 6: RE QUASI-PEAK MEASUREMENT TABLE FROM 30MHZ TO 1GHZ_ONLINE MODE 16
TABLE 7: RE QUASI-PEAK MEASUREMENT TABLE FROM 30MHZ TO 1GHZ_ GREEN/ECO MODE 17
TABLE 8: RE QUASI-PEAK MEASUREMENT TABLE FROM 30MHZ TO 1GHZ _ BATTERY/INVERTER MODE 19
TABLE 9: CE QUASI-PEAK MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ _ONLINE MODE – LINE AND NEUTRAL 22
TABLE 10: CE AVERAGE MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ _ONLINE MODE – LINE AND NEUTRAL 23
TABLE 11: CE QUASI-PEAK MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – LINE AND NEUTRAL 24
TABLE 12: CE AVERAGE MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ_ GREEN/ECO MODE – LINE AND NEUTRAL 25
TABLE 13: CE QUASI-PEAK MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ _BATTERY/INVERTER MODE – LINE AND NEUTRAL 26
TABLE 14: CE AVERAGE MEASUREMENT TABLE FROM 150 KHZ TO 30 MHZ_ BATTERY/INVERTER MODE – LINE AND NEUTRAL 27

1 TEST REPORT SUMMARY

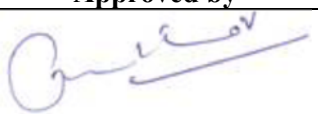
Applicant	Schneider Electric IT Business
Manufacturer	APC by Schneider Electric
Product Name	LEO
Product Model	SRT1000XLA , SRT1000RMXLA, SRT1000RMXLA-NC, SRT1500XLA, SRT1500RMXLA, SRT1500RMXLA-NC and Battery pack-SRT48RMBP, SRT48BP
Product Serial Number	UPS - AS1632190444 Battery pack - 7S1615L00386
Date of receipt of test item	17 November 2016
Date of Test	17 November 2016 to 28 November 2016
Venue of Test	Tarang Lab

Applicable Standard	**Description**	**Criteria / Class**	**Results**
47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B	Radiated emissions test	Class A	PASS
47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B	Conducted emissions test	Class A	PASS

LEO was tested by Tarang Lab as per the standards that are listed in the table above. Based on the observations during the test and interpretations by Tarang lab, results have been indicated. The test results produced in this report shall apply only to the above sample that has been tested under the specific conditions and modes of testing as described in the report. Other similar equipment may not necessarily reproduce same result due to production tolerances and measurement uncertainties. Any measurement uncertainties listed in this report are for information purpose only.

The results shall stand invalid, in case there are any modifications / additions / removals to the hardware or software or end use atmosphere to the product tested. This report shall not be modified or in any way revised unless it is expressly permitted and endorsed by Tarang lab, through a duly authorized representative. Particulars on Manufacturer / Supplier / Product configuration / performance criteria, given in this report, are based on the information given by the customer, along with test request. Tarang does not assume any responsibility for the correctness of such information for the above mentioned equipment under test.

Customer acknowledges that this is a test report and not a certificate to gain market access for the product. To gain market access, Customer needs appropriate clearance from the Government or authorized agency for the target market. For markets that allow self-declaration, customer needs to follow the procedure defined by the target market.

Prepared by	**Reviewed by**	**Approved by**
		
Daniel. E	Albin A	Preetha Velayudhan
Lead EMI/EMC Test Engineer	Principal EMI/EMC Test Engineer	Functional Head

2 GENERAL INFORMATION

2.1 ACCREDITATION DETAILS

Following are the accreditation and listing details for Tarang.

Accreditation / Listing body	Registration / Company / Certificate Number
NABL, India	Certificate No: T-1533, T-1534 http://www.nabl-india.org/
FCC (Federal Communications Commission)	Registration Number: 799247 http://www.fcc.gov/
IC (Industry Canada)	Company Number: 9023A-1 http://www.ic.gc.ca

2.2 MEASUREMENT UNCERTAINTY.

The following measurement uncertainties are applicable to the relevant tests that are mentioned below:

Name of the test	Measurement Uncertainty
Conducted Emission from 150 kHz to 30 MHz	± 1.6795 dB
Radiated Emission from 30MHz to 1GHz_10m	± 4.6387 dB

3 INSTRUMENTATION AND CALIBRATION

3.1 TEST AND MEASURING EQUIPMENT

The list of following measuring equipment used for this testing conforms to the applicable standards. Performance of all test and measuring equipment including any accessories are checked periodically to ensure accuracy.

3.2 EQUIPMENT USED

Name of Equipment	Manufacturer	Model No.	Serial No.	Calibration Due
EMI test Receiver	R&S	ESU 40	100510	20th Sep 2017
Hybrid Log periodic Antenna	TDK	HLP-3003C	130334	20th Jan 2017
Preamplifier	R&S	SCU-01	100626	27th Sep 2017
Clamp meter	Fluke	362	30150129WS	31st Dec 2016

Table 1:List of equipment used for RE test

Name of Equipment	Manufacturer	Model No.	Serial No.	Calibration Due
EMI test Receiver	R&S	ESU8	100324	09th Mar 2017/ 14th Jun 2017
Pulse Limiter	R&S	ESH3-Z2	101260	03rd Mar 2017
V-LISN	SME	NNLK 8129	8129-260	20th Oct 2017
Clamp meter	Fluke	362	30150129WS	31st Dec 2016

Table 2:List of equipment used for CE test

4 PRODUCT INFORMATION

4.1 DESCRIPTION OF THE PRODUCT

The EUT is a UPS which provides reliable power to connected load and when there is power failure. It draws power from battery and supplies load. The EUT has three modes of operation.

1. Online mode – Provides regulated output to the connected load and charges battery.
2. Green/ ECO mode – when the input voltage is good (within range) bypasses power to the load and changes battery.
3. Battery/ Inverter mode – When the input power has failed / out of range, the UPS power up the connected load by converting power by battery.

Product	LEO
Model Number	SRT1000XLA , SRT1000RMXLA, SRT1000RMXLA-NC, SRT1500XLA, SRT1500RMXLA, SRT1500RMXLA-NC and Battery pack-SRT48RMBP, SRT48BP
Serial Number	UPS - AS1632190444 Battery pack - 7S1615L00386
Product Category / Type of Equipment	ITE / Table top
EUT Operating Voltage range	120 V AC & 48 V DC
EUT Operating frequency range	60 & NA
EUT Power Rating	1500 VA / 1350 W
EUT Operating Current (Max)	12 A (AC) & 35 A (DC-Battery mode)

Note: The EUT with model number SRT1500RMXLA was used for testing

Table 3: Product details

No	Cable /Name	No of Ports	Cable Color	Cable Length	Power / Interconnection cable	Shielded / Unshielded	Cable photos
1	Ethernet Cable RJ45 (LCE)	01	Grey	15 m	Interconnection	Unshielded	Figure 33
2	NMC Ethernet Cable	01	Grey	15 m	Interconnection	Unshielded	Figure 34
3	USB Cable	01	Black	5 m	Interconnection	Shielded	Figure 35
4	Serial cable	01	Black	5 m	Interconnection	Unshielded	Figure 36
5	Universal I/O port cable 1	01	Black	4 m	Interconnection	Unshielded	Figure 37
6	Universal I/O port cable 2	01	Black	4 m	Interconnection	Unshielded	Figure 38
7	Mains Cable	01	Black	1.82 m	Power	Unshielded	Figure 39
8	Output Cable	04	Black & red	2 m	Power	Unshielded	Figure 40
9	EPO Cable	01	Black & red	5 m	Interconnection	Unshielded	Figure 41

Table 4: List of cables connected to EUT

4.2 SOFTWARE AND FIRMWARE DETAILS

Microlink Simulator-Version: UL Sim 4.0.0.6

5 TEST DETAILS

5.1 PRODUCT AND TEST SETUP

5.1.1 PRODUCT CONFIGURATION

The EUT was intended to operate in three modes:

- Online mode:
  - EUT was powered with 120V/60Hz supply.
- Green mode:
  - EUT was powered with 120V/60Hz supply
- Battery mode:
  - EUT was powered with 48V DC battery.

The resistive load and bulb load was used for 100% resistive load of 1350W. The communication ports NMC, LCE, USB and micro link were energized during the test where NMC and LCE ports are used to remotely monitor the parameters of the EUT on the PC. The temperature/Humidity measurements ports were enabled. The pinging was done through Microlink Software only for battery mode.

Note: The EUT with model number SRT1500RMXLA was used for testing

5.1.2 TEST SETUP DETAILS

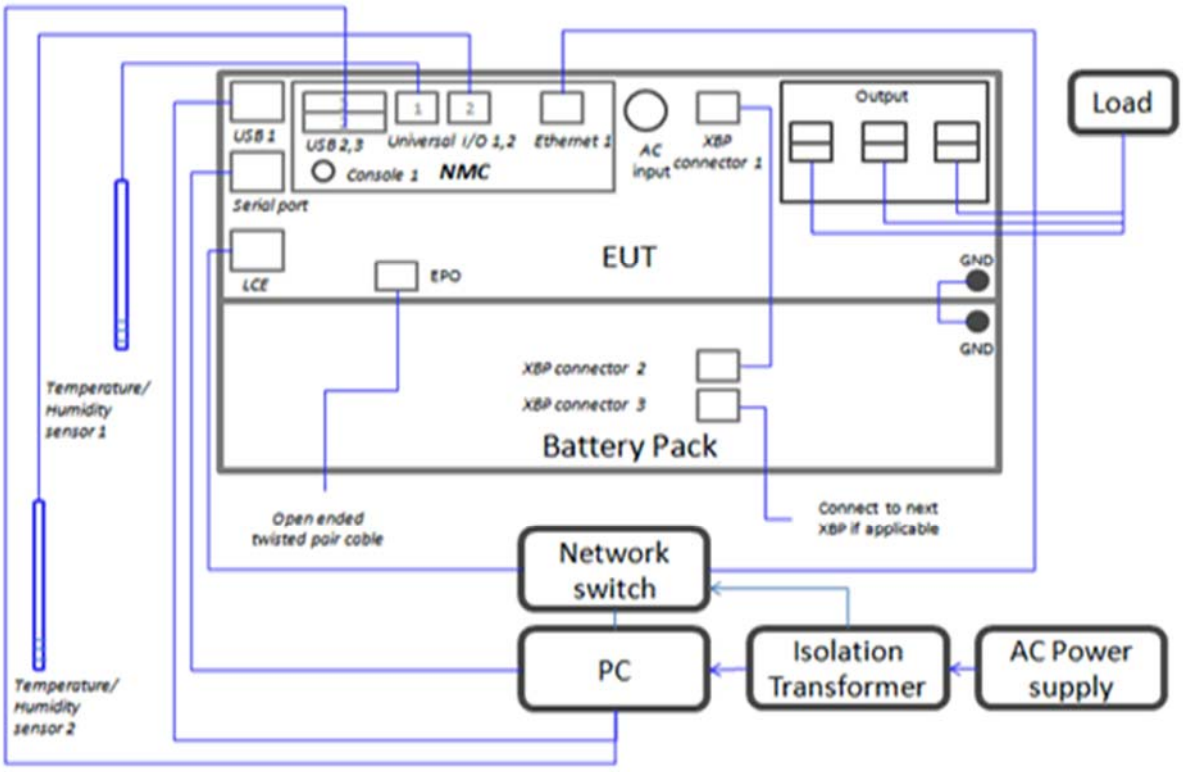


Figure 1: Block diagram of the EUT setup

5.1.3 ACCESSORIES

S.No	Name of Accessories	Make	Model No	Serial No
1	Desktop (CPU)	DELL	DCNE1F	8PKD6BS
2	Monitor	DELL	Rev A00	CN-0WJ59T-64180-976-05JS
3	Network switch	D-Link	DES1008A	NA
4	Resistive load	Avtron	K490	590
5	Bulb load	NA	NA	NA
6	Isolation Transformer	Sabtron	STSD-4	0676810

Table 5: List of Accessories used for testing

5.2 APPLICABLE TEST

Applicable Standard:Version, Ed.x.x	Description	Test level / Test Voltage	Applicability
47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B	Radiated emissions test	30 MHz to 1 GHz/ Class A	Enclosure
47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B	Conducted emissions test	150 kHz to 30 MHz / Class A	Power lines

5.3 TEST RESULT

5.3.1 RADIATED EMISSIONS TEST

5.3.1.1 TEST SPECIFICATION

Test Standard	47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B
Test Procedure	ANSI C63.4-2014
Product / Generic Standard	NA
Class / Group	Class A
Frequency Range	30 MHz to 1 GHz
Resolution Bandwidth	120 kHz
Video Bandwidth	300 kHz
Step size	40 kHz
Pre Scan Measurement Time	20 ms
Final Measurement Time	1 second
Attenuation	10 dB
Test Distance	10 meter
Polarization	Horizontal and Vertical
Detector	Quasi-peak
EUT Type	Table top
Input Voltage	120 V AC
Input Frequency	60 Hz
Temperature	22 ºC
Relative Humidity	58 %
Tested By	Suresh.G.N
Test Date	28 November 2016

5.3.1.2 DEVIATION FROM THE STANDARD

During battery mode condition the test was performed with antenna at 1m fixed height for vertical polarization and 4 m fixed height for horizontal polarization. The turn table was rotated from 0 º to 360º with 45º step for prescan measurement and the graph was captured This is done as per customer requirement due to the limitation in the battery bank back up time.

5.3.1.3 LIMITS

Maximum permissible level of Radiated Emissions at 10 meter distance as per 47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B is as shown below:

Frequency (MHz)	**Quasi-peak limit Class A (dBµV/m)**
30-88	39.08
88-216	43.52
216-960	46.44
960-1000	49.54

5.3.1.4 TEST SETUP

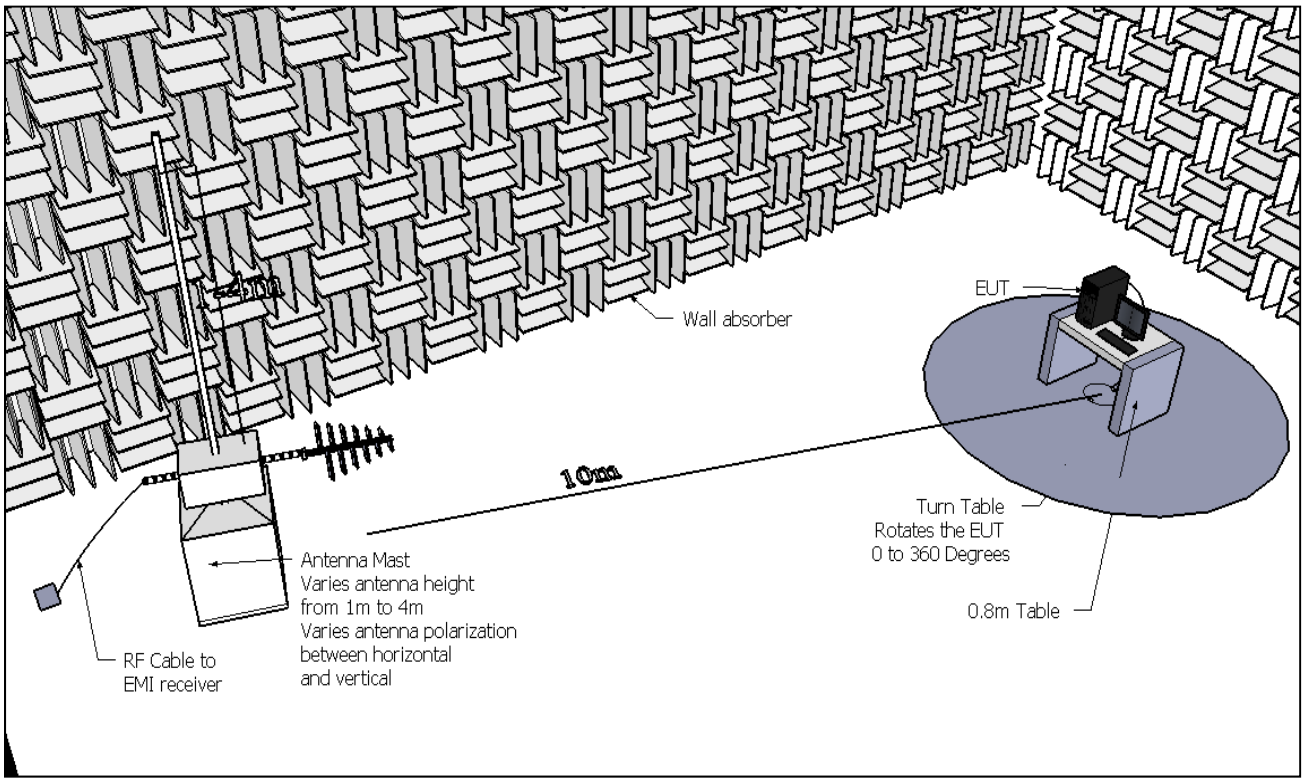


Figure 2: Sample RE test setup for table top equipment at 10 meter distance from 30 MHz to 1 GHz

5.3.1.5 TEST PROCEDURE

The test procedure was in accordance with ANSI C63.4-2014.

The table top equipment was tested in a Semi-Anechoic chamber. The EUT was placed on non-conductive table of 0.8m height which was in turn placed on a turn table to enable 0º to 360º rotation as per standard. The distance between the edge of the EUT and receiving antenna was 10m. The receiving antenna was mounted on antenna mast to enable height variation from 1 to 4m above the ground plane.

Pre-scan (Peak) was measured by varying the azimuth angle in 22.5º steps for online mode, green mode (for battery mode refer deviation Section 5.3.1.2) and antenna height varied from 1m to 4m in 1m steps, in both horizontal and vertical polarization of the antenna. The measurement was carried out in max-hold mode and maximum amplitude of radiated emissions from the EUT was plotted in the graph. The dominant peaks at various frequencies, closer to and above the limit line were identified using peak search option and listed. Quasi-peak measurement was carried out for the listed frequencies and compared with the limit specified in the standard.

5.3.1.6 MEASUREMENT DATA

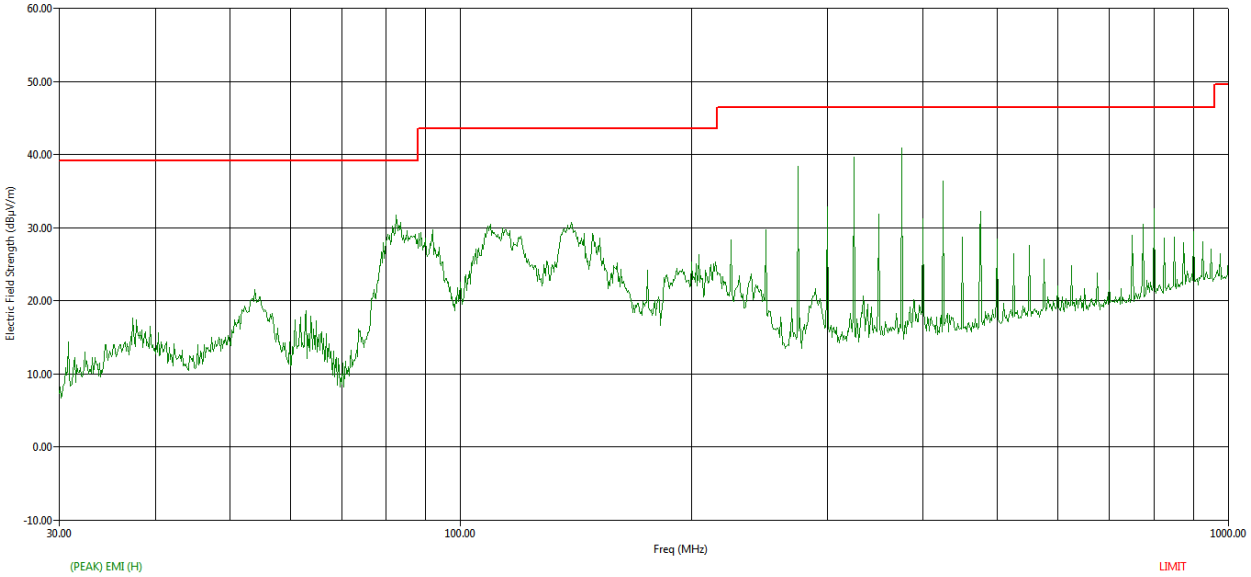


Figure 3: RE graph using peak detector on Horizontal polarization from 30 MHz to 1 GHz_ Online mode

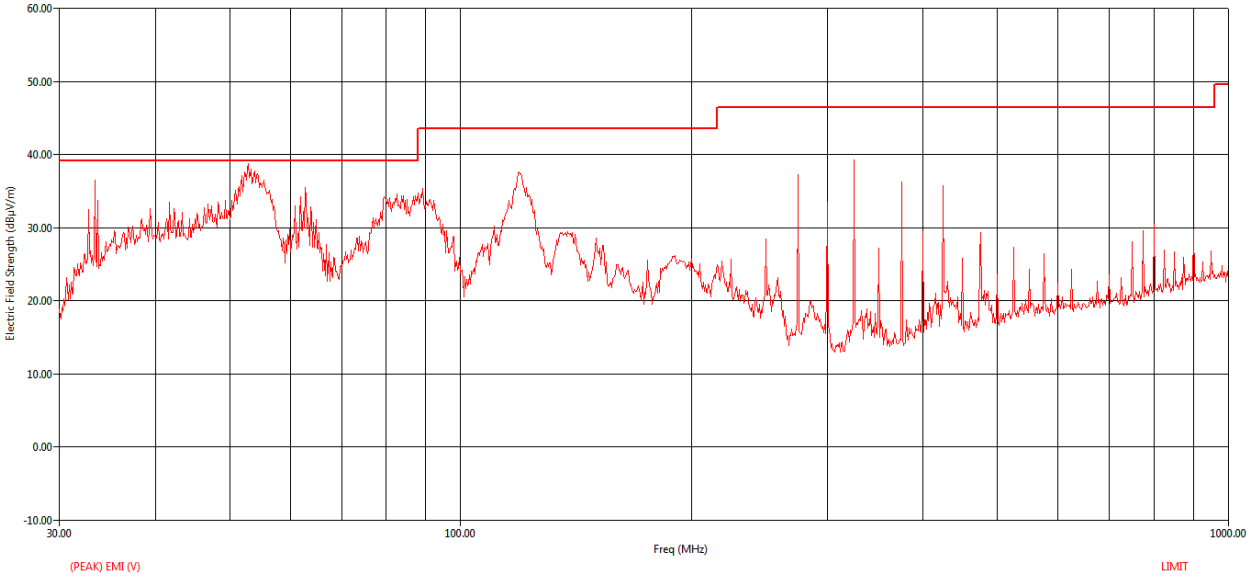


Figure 4: RE graph using peak detector on Vertical polarization from 30 MHz to 1 GHz_ Online mode

Freq (MHz)	Freq (Max) (MHz)	Pol	Twr Ht (cm)	EUT Ttbl Agl (deg)	(QP) Trace (dBµV)	Cable (dB)	Transducer (dB)	Preamp (dB)	(QP) EMI (dBµV/m)	Limit (dBµV/m)	(QP) Margin (dB)
33.40	33.50	V	132.00	202.10	53.55	1.25	10.22	42.80	22.21	39.08	-16.87
52.88	52.98	V	178.00	349.80	66.64	1.59	9.88	42.84	35.27	39.08	-3.81
62.80	62.90	V	299.00	162.10	65.95	1.71	8.90	42.86	33.71	39.08	-5.37
119.24	119.24	V	100.00	336.80	63.59	2.32	10.46	42.93	33.44	43.52	-10.08
275.00	275.00	H	283.00	69.00	65.51	3.49	11.26	43.28	36.98	46.44	-9.46
325.00	325.10	H	294.00	162.70	64.18	3.78	13.69	43.30	38.35	46.44	-8.09
325.00	325.20	V	100.00	161.90	59.72	3.78	13.69	43.30	33.90	46.44	-12.54
375.00	375.00	H	246.00	43.20	64.28	4.07	15.23	43.18	40.40	46.44	-6.04
425.00	425.00	H	201.00	127.70	58.90	4.34	16.43	43.04	36.63	46.44	-9.81

Table 6: RE quasi-peak measurement table from 30MHz to 1GHz_Online mode

QP EMI (dBµV/m) = QP Trace (dBµV) + Cable (dB) + Transducer (dB) – Preamp (dB)
QP Margin (dB) = QP EMI (dBµV/m) – QP Limit (dBµV/m)

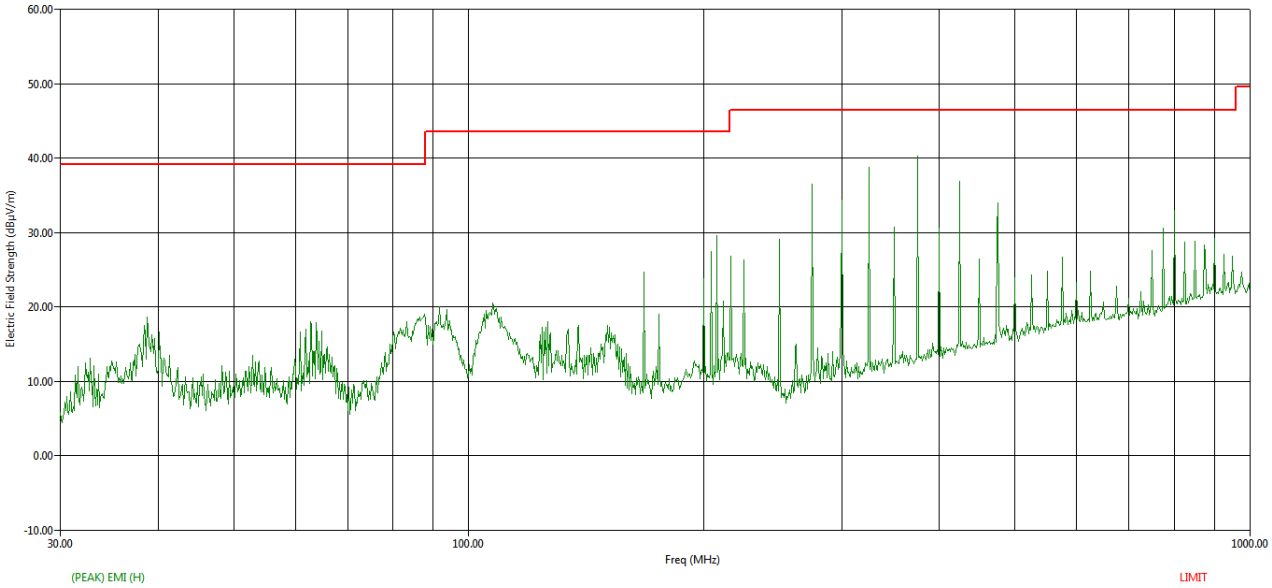


Figure 5: RE graph using peak detector on Horizontal polarization from 30 MHz to 1 GHz_ Green/Eco mode

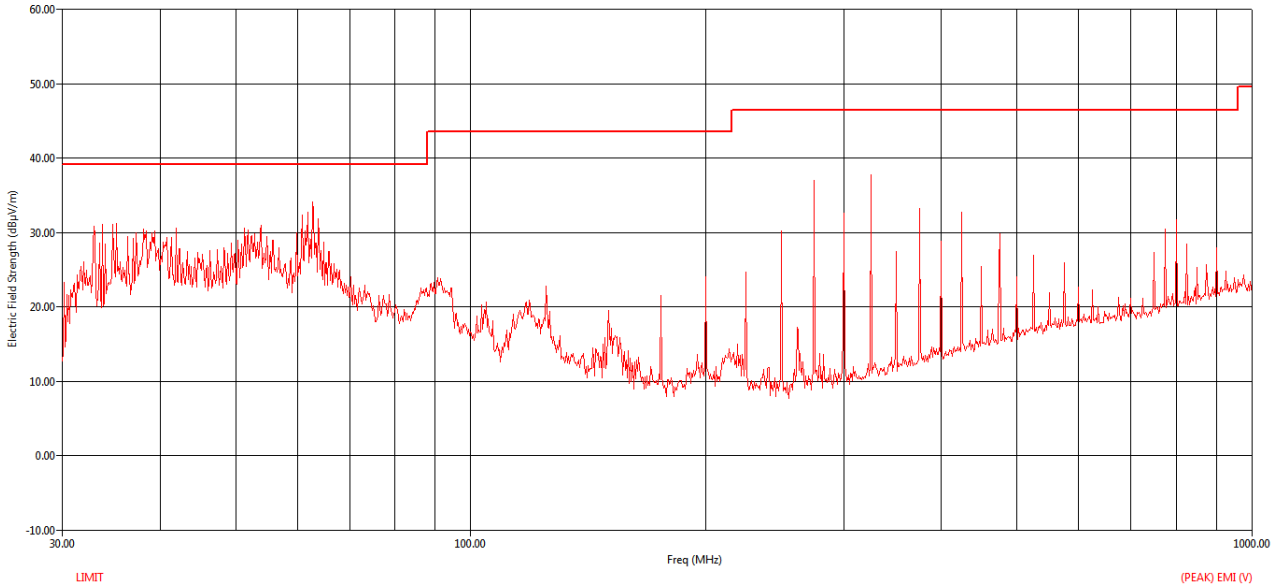


Figure 6: RE graph using peak detector on Vertical polarization from 30 MHz to 1 GHz_ Green/Eco mode

Freq (MHz)	Freq (Max) (MHz)	Pol	Twr Ht (cm)	EUT Ttbl Agl (deg)	(QP) Trace (dBµV)	Cable (dB)	Transducer (dB)	Preamp (dB)	(QP) EMI (dBµV/m)	Limit (dBµV/m)	(QP) Margin (dB)
35.19	35.20	V	225.00	242.00	52.91	1.29	9.82	42.81	21.21	39.08	-17.87
62.80	62.80	V	289.00	161.90	61.85	1.71	8.90	42.86	29.62	39.08	-9.46
275.00	275.20	H	281.00	80.90	66.44	3.49	11.26	43.28	37.91	46.44	-8.53
275.00	274.90	V	100.00	22.00	64.11	3.49	11.26	43.28	35.58	46.44	-10.86
300.00	300.00	H	295.00	51.10	57.28	3.64	12.82	43.36	30.38	46.44	-16.06
325.00	324.90	H	282.00	162.00	62.96	3.78	13.69	43.30	37.13	46.44	-9.31
375.00	375.50	H	245.00	50.60	64.19	4.07	15.23	43.18	40.32	46.44	-6.12
425.00	425.20	H	218.00	127.10	57.93	4.34	16.43	43.04	35.66	46.44	-10.78
800.00	800.00	H	100.00	162.10	44.44	5.97	20.94	42.94	28.41	46.44	-18.03

Table 7: RE quasi-peak measurement table from 30MHz to 1GHz_ Green/Eco mode

QP EMI (dBµV/m) = QP Trace (dBµV) + Cable (dB) + Transducer (dB) – Preamp (dB)
QP Margin (dB) = QP EMI (dBµV/m) – QP Limit (dBµV/m)

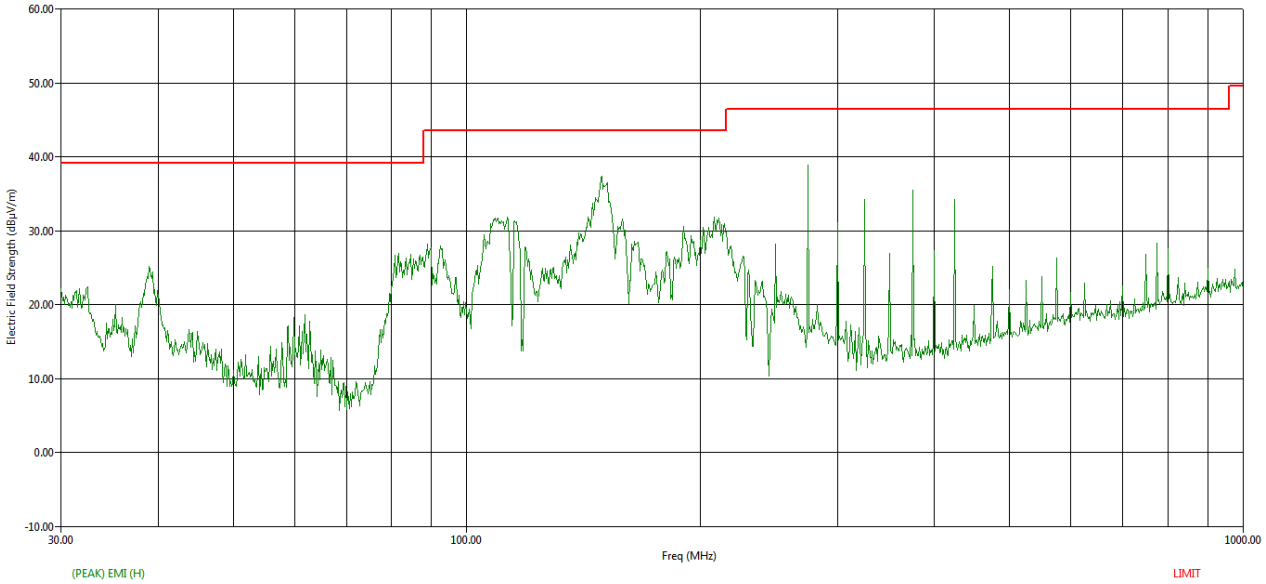


Figure 7: RE graph using peak detector on Horizontal polarization from 30 MHz to 1 GHz _ Battery/Inverter mode

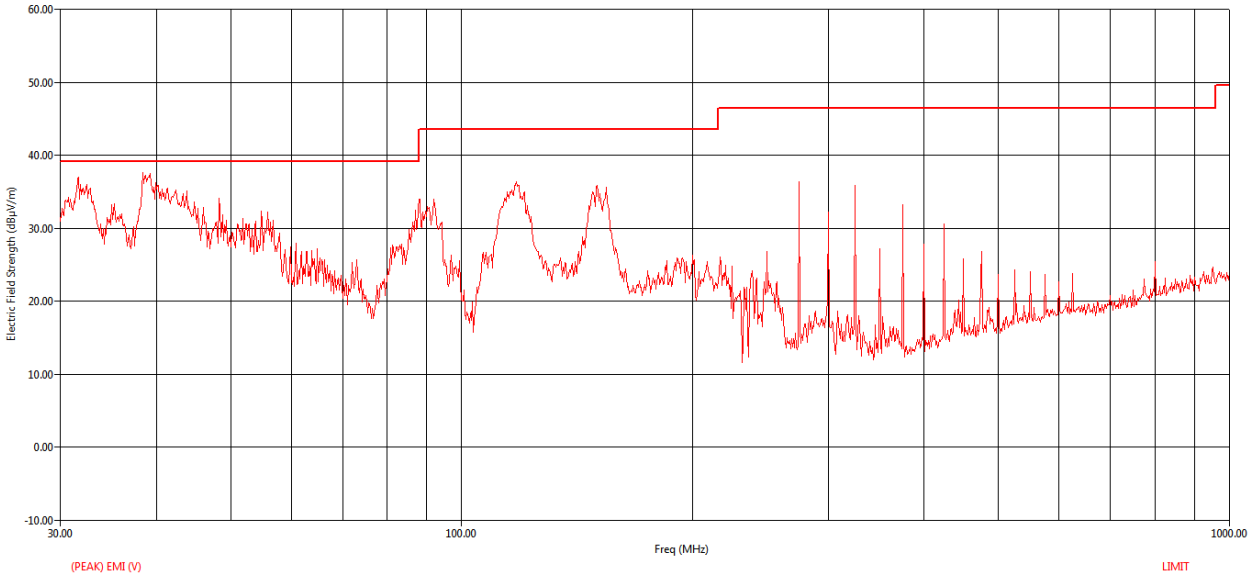


Figure 8: RE graph using peak detector on Vertical polarization from 30 MHz to 1 GHz _ Battery/Inverter mode

Freq (MHz)	Freq (Max) (MHz)	Pol	Twr Ht (cm)	EUT Ttbl Agl (deg)	(QP) Trace (dBµV)	Cable (dB)	Transducer (dB)	Preamp (dB)	(QP) EMI (dBµV/m)	Limit (dBµV/m)	(QP) Margin (dB)
31.68	31.70	V	375.00	12.40	61.63	1.21	10.68	42.80	30.72	39.08	-8.36
38.40	38.50	V	295.00	119.20	62.59	1.35	10.03	42.81	31.16	39.08	-7.92
117.86	117.81	V	110.00	162.10	50.42	2.30	10.27	42.93	20.07	43.52	-23.45
149.49	150.00	H	347.00	223.80	64.43	2.59	10.72	42.96	34.78	43.52	-8.74

Table 8: RE quasi-peak measurement table from 30MHz to 1GHz _ Battery/Inverter mode

QP EMI (dBµV/m) = QP Trace (dBµV) + Cable (dB) + Transducer (dB) – Preamp (dB)
QP Margin (dB) = QP EMI (dBµV/m) – QP Limit (dBµV/m)

5.3.1.7 RESULT

Radiated Emissions from the EUT as per Class A limit: PASS.

5.3.2 CONDUCTED EMISSIONS TEST

5.3.2.1 TEST SPECIFICATION

Test Standard	47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B
Test Procedure	ANSI C63.4-2014
Product / Generic Standard	NA
Class / Group	Class A
Type of cable (Shielded/Unshielded)	Unshielded
Frequency Range	150 kHz to 30 MHz
Resolution Bandwidth	9 kHz
Video Bandwidth	30 kHz
Step size	4 kHz
Pre scan Measurement Time	20 ms
Final Measurement Time	1 second
Attenuation	10 dB
Detector	Quasi-peak and Average
EUT Type	Table top
Input Voltage	120 V AC
Input Frequency	60 Hz
Temperature	23 ° C
Relative Humidity	52 %
Tested By	Daniel.E
Test Date	17 November 2016

5.3.2.2 DEVIATION FROM THE STANDARD

NA

5.3.2.3 LIMITS

Maximum permissible conducted emission (disturbance) at the mains port as per 47 CFR Ch. I (10–1–15 Ed), Part 15, Subpart B is as shown below:

Frequency (MHz)	**Voltage limits Class A (dBµV)**	
	Quasi-peak	**Average**
0.15 to 0.50	79	66
0.5 to 30	73	60

5.3.2.4 TEST SETUP

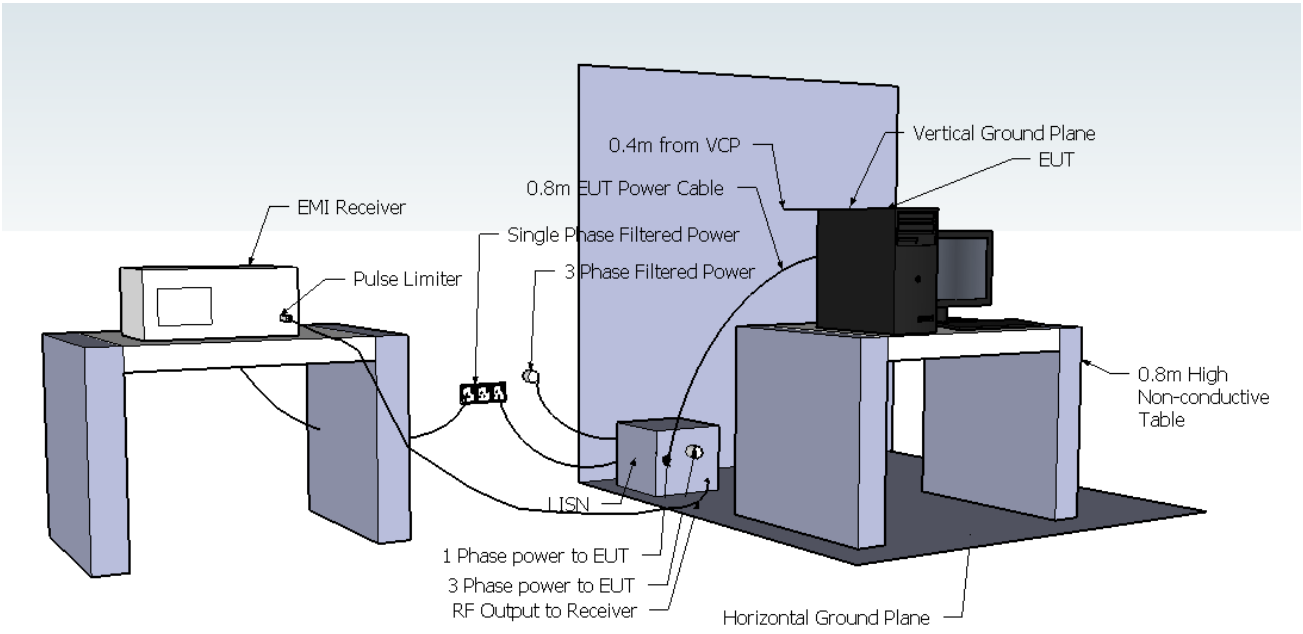


Figure 9: Sample CE test setup for table top equipment from 150 kHz to 30 MHz

5.3.2.5 TEST PROCEDURE

The test procedure was in accordance with ANSI C63.4-2014.

This Table top equipment was tested at the conducted emissions test site with a horizontal ground reference plane and a vertical ground reference plane bonded together. The EUT was placed on non-conductive table of 0.8m height as per standard. The power supply to the EUT and auxiliary equipment was feed through LISN.

LISN (Voltage Method):

The conducted emissions (disturbance) was measured through the 50 Ω RF port of the LISN using an EMI receiver. Pre-scan (Peak and Average) was carried out in max hold mode and conducted emission from the EUT coupled through the Power (mains) port was plotted in the graph. The dominant peaks at various frequencies, closer to and above the limit line were identified using peak search option and listed. Quasi-peak and Average measurement was carried out for the listed frequencies and compared with the limit specified in the standard.

5.3.2.6 MEASUREMENT DATA

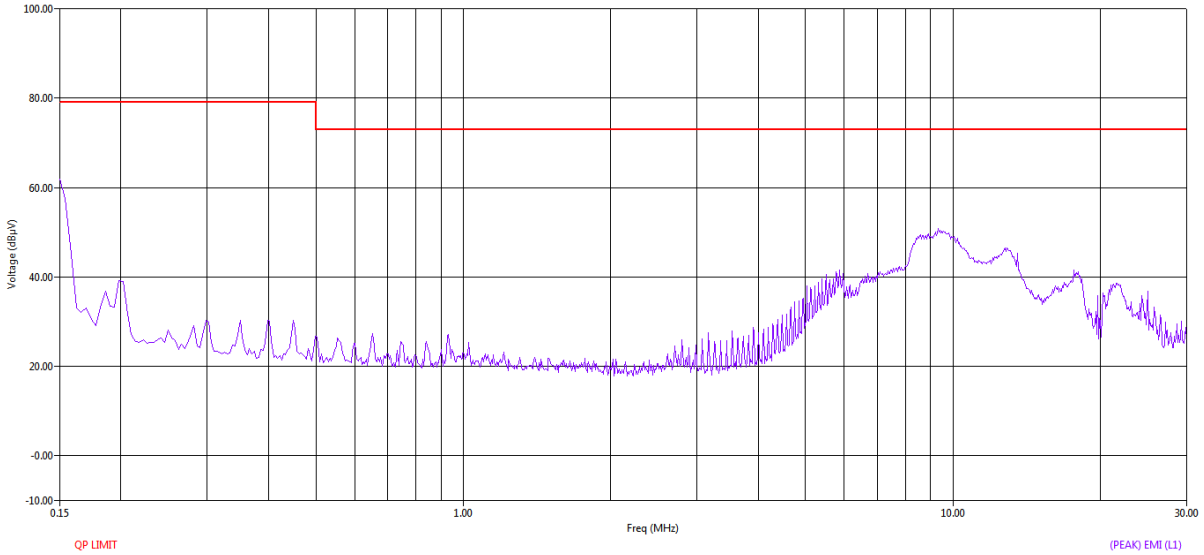


Figure 10: CE graph using peak detector from 150 kHz to 30 MHz _Online mode- Line

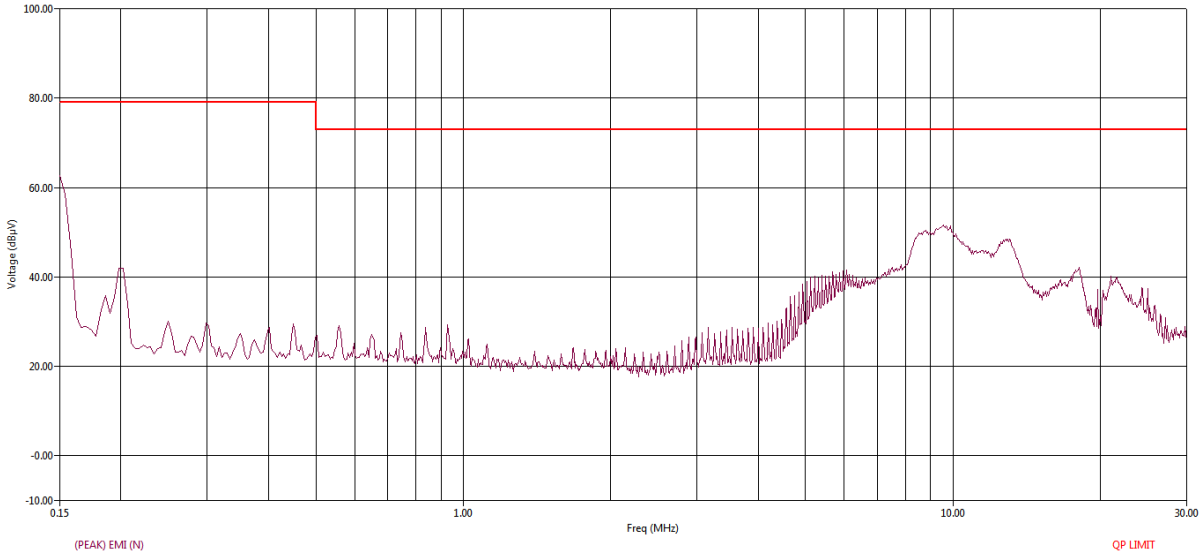


Figure 11: CE graph using peak detector from 150 kHz to 30 MHz _Online mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(QP) EMI (dBµV)	(QP) Limit (dBµV)	(QP) Margin (dB)
13.02	13.02	N	34.50	9.97	0.41	0.00	44.88	73.00	-28.12
13.56	13.56	L1	29.66	9.97	0.00	0.40	40.03	73.00	-32.97
17.65	17.65	L1	26.56	9.90	0.00	0.53	36.99	73.00	-36.01
17.80	17.80	N	27.45	9.89	0.50	0.00	37.84	73.00	-35.16
17.85	17.85	L1	27.25	9.89	0.00	0.54	37.68	73.00	-35.32
17.95	17.95	N	27.94	9.89	0.50	0.00	38.33	73.00	-34.67
18.00	18.00	N	28.20	9.89	0.50	0.00	38.59	73.00	-34.41
18.00	18.00	L1	27.40	9.89	0.00	0.54	37.83	73.00	-35.17

Table 9: CE quasi-peak measurement table from 150 kHz to 30 MHz _Online mode – Line and Neutral

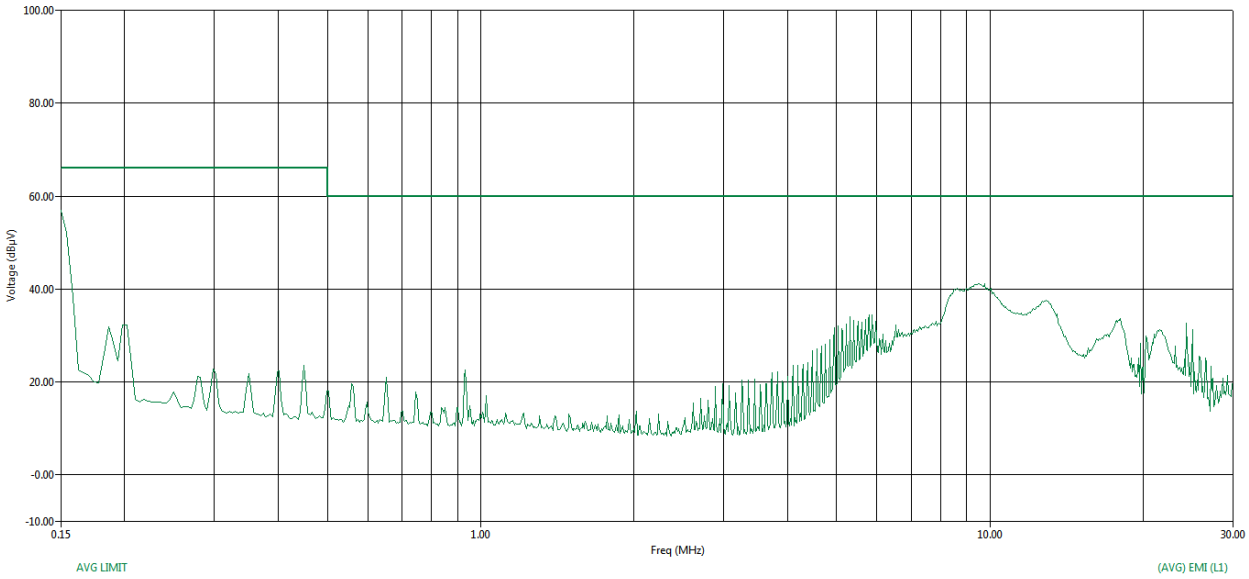


Figure 12: CE graph using average detector from 150 kHz to 30 MHz _Online mode – Line

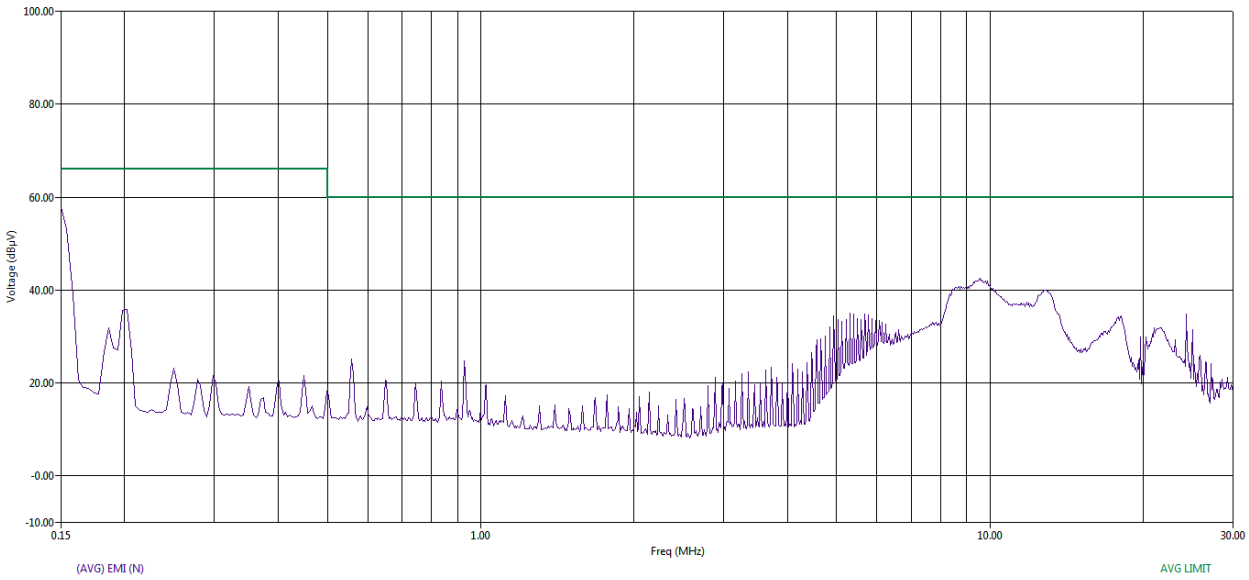


Figure 13: CE graph using average detector from 150 kHz to 30 MHz _Online mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(AVG) EMI (dBµV)	(AVG) Limit (dBµV)	(AVG) Margin (dB)
13.02	13.02	N	28.86	9.97	0.41	0.00	39.24	60.00	-20.76
13.56	13.56	L1	23.50	9.97	0.00	0.40	33.87	60.00	-26.13
17.65	17.65	L1	21.76	9.90	0.00	0.53	32.19	60.00	-27.81
17.80	17.80	N	22.55	9.89	0.50	0.00	32.94	60.00	-27.06
17.85	17.85	L1	22.23	9.89	0.00	0.54	32.66	60.00	-27.34
17.95	17.95	N	23.01	9.89	0.50	0.00	33.40	60.00	-26.60
18.00	18.00	N	23.25	9.89	0.50	0.00	33.64	60.00	-26.36
18.00	18.00	L1	22.45	9.89	0.00	0.54	32.89	60.00	-27.11

Table 10: CE average measurement table from 150 kHz to 30 MHz _Online mode – Line and Neutral

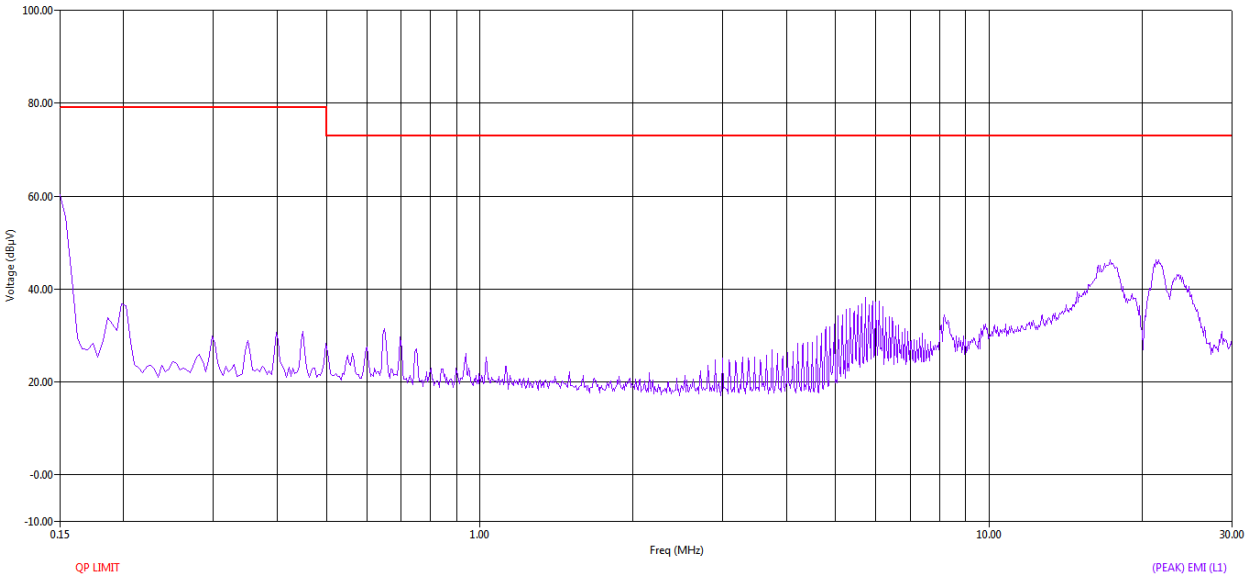


Figure 14: CE graph using peak detector from 150 kHz to 30 MHz_ Green/Eco mode – Line

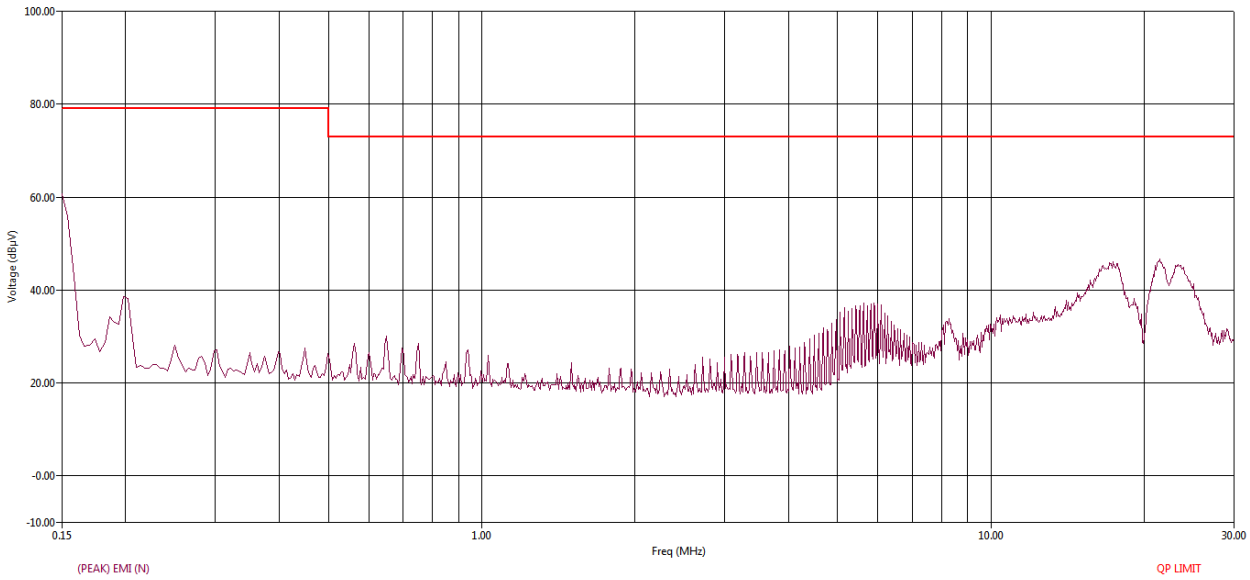


Figure 15: CE graph using peak detector from 150 kHz to 30 MHz_ Green/Eco mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(QP) EMI (dBµV)	(QP) Limit (dBµV)	(QP) Margin (dB)
0.15	0.15	L1	48.35	9.82	0.00	1.39	59.56	79.00	-19.44
5.71	5.72	L1	25.43	9.92	0.00	0.35	35.70	73.00	-37.30
5.71	5.72	N	25.50	9.92	0.35	0.00	35.77	73.00	-37.23
6.09	6.10	L1	25.74	9.92	0.00	0.36	36.02	73.00	-36.98
6.09	6.10	N	25.73	9.92	0.36	0.00	36.01	73.00	-36.99
12.78	12.77	L1	11.28	9.97	0.00	0.39	21.65	73.00	-51.35
13.02	13.03	N	15.46	9.97	0.41	0.00	25.84	73.00	-47.16
13.56	13.55	L1	21.17	9.97	0.00	0.40	31.54	73.00	-41.46

Table 11: CE quasi-peak measurement table from 150 kHz to 30 MHz_ Green/Eco mode – Line and Neutral

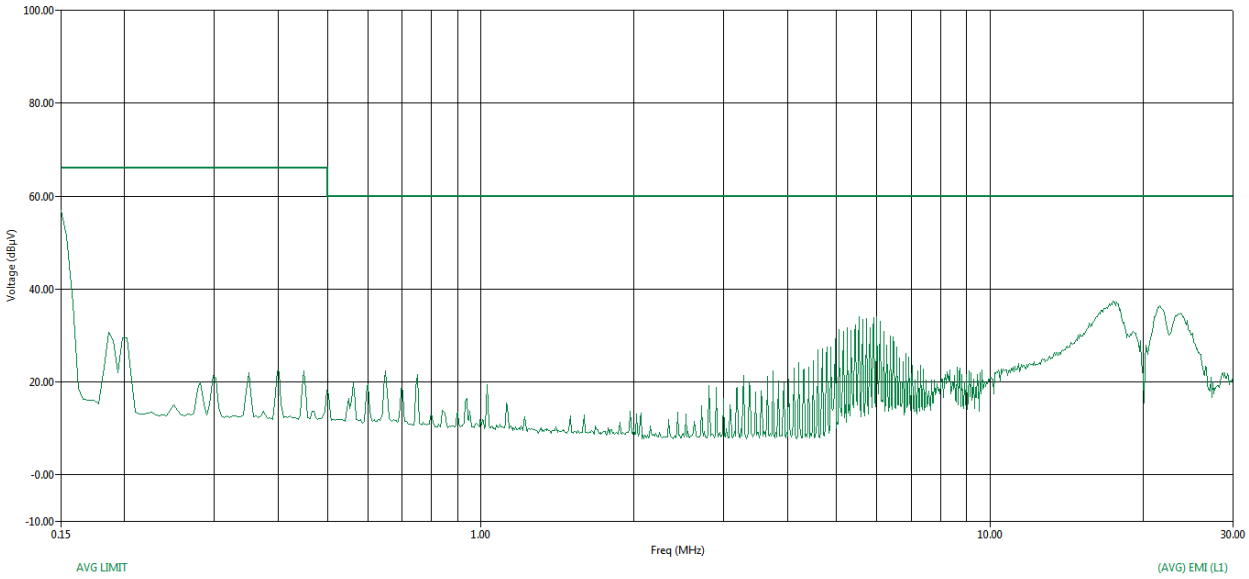


Figure 16: CE graph using average detector from 150 kHz to 30 MHz_ Green/Eco mode – Line

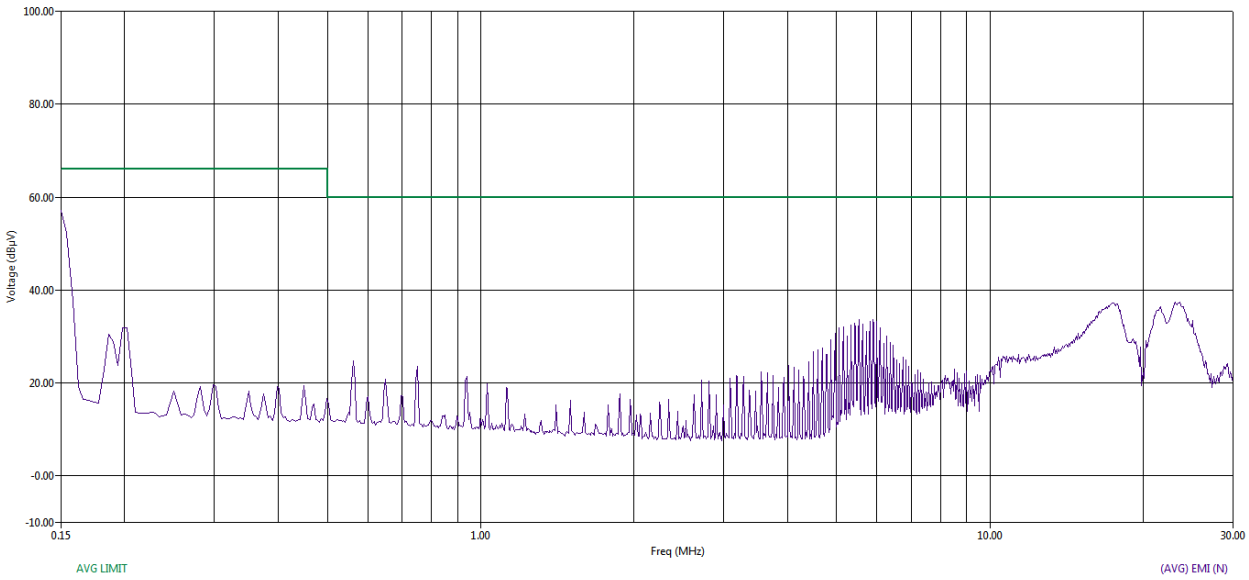


Figure 17: CE graph using average detector from 150 kHz to 30 MHz_ Green/Eco mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(AVG) EMI (dBµV)	(AVG) Limit (dBµV)	(AVG) Margin (dB)
0.15	0.15	L1	45.26	9.82	0.00	1.39	56.46	66.00	-9.54
5.71	5.72	L1	23.14	9.92	0.00	0.35	33.42	60.00	-26.58
5.71	5.72	N	22.72	9.92	0.35	0.00	33.00	60.00	-27.00
6.09	6.10	L1	23.40	9.92	0.00	0.36	33.68	60.00	-26.32
6.09	6.10	N	23.16	9.92	0.36	0.00	33.44	60.00	-26.56
12.78	12.77	L1	4.46	9.97	0.00	0.39	14.82	60.00	-45.18
13.02	13.03	N	9.61	9.97	0.41	0.00	19.99	60.00	-40.01
13.56	13.55	L1	15.21	9.97	0.00	0.40	25.58	60.00	-34.42

Table 12: CE average measurement table from 150 kHz to 30 MHz_ Green/Eco mode – Line and Neutral

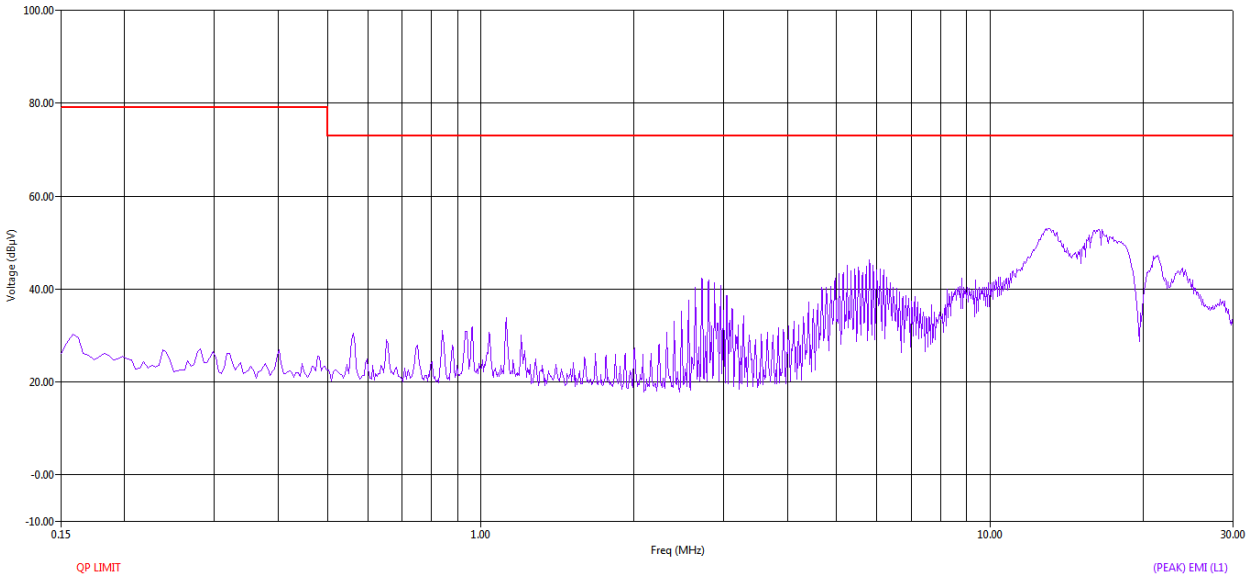


Figure 18: CE graph using peak detector from 150 kHz to 30 MHz _Battery/Inverter mode- Line

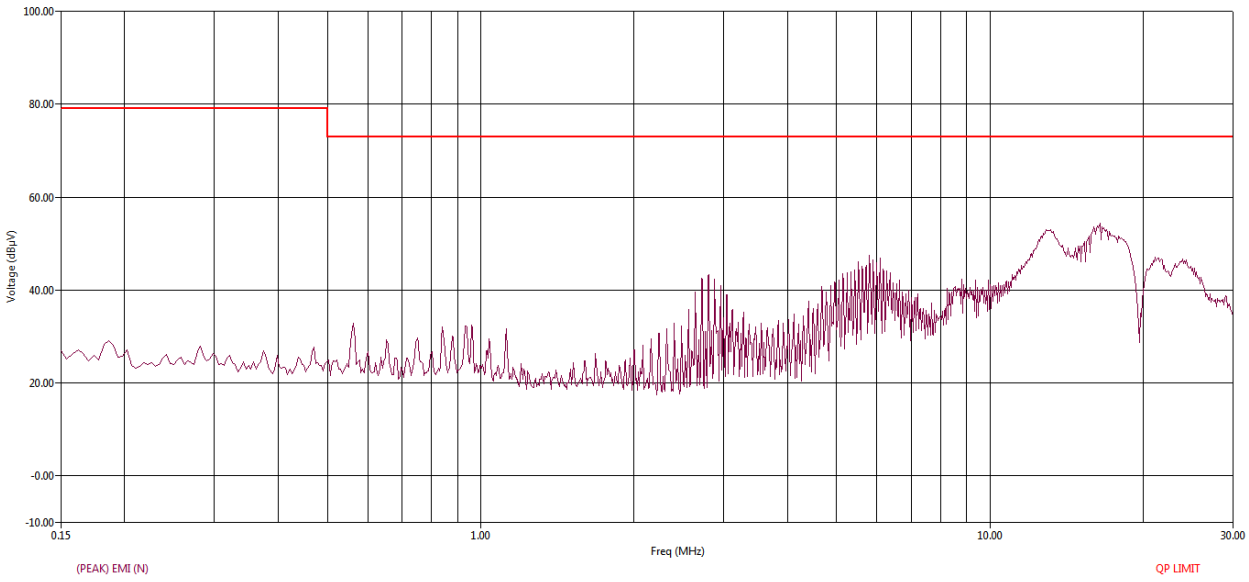


Figure 19: CE graph using peak detector from 150 kHz to 30 MHz _Battery/Inverter mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(QP) EMI (dBµV)	(QP) Limit (dBµV)	(QP) Margin (dB)
16.24	16.24	L1	40.58	9.93	0.00	0.47	50.98	73.00	-22.02
16.32	16.32	N	41.04	9.93	0.46	0.00	51.43	73.00	-21.57
16.32	16.32	L1	40.62	9.93	0.00	0.47	51.02	73.00	-21.98
16.40	16.40	N	41.31	9.93	0.46	0.00	51.70	73.00	-21.30
16.40	16.40	L1	40.70	9.93	0.00	0.48	51.10	73.00	-21.90
16.48	16.48	N	40.96	9.92	0.47	0.00	51.35	73.00	-21.65
16.48	16.48	L1	40.71	9.92	0.00	0.48	51.11	73.00	-21.89
16.56	16.56	N	41.16	9.92	0.47	0.00	51.54	73.00	-21.46

Table 13: CE quasi-peak measurement table from 150 kHz to 30 MHz _Battery/Inverter mode – Line and Neutral

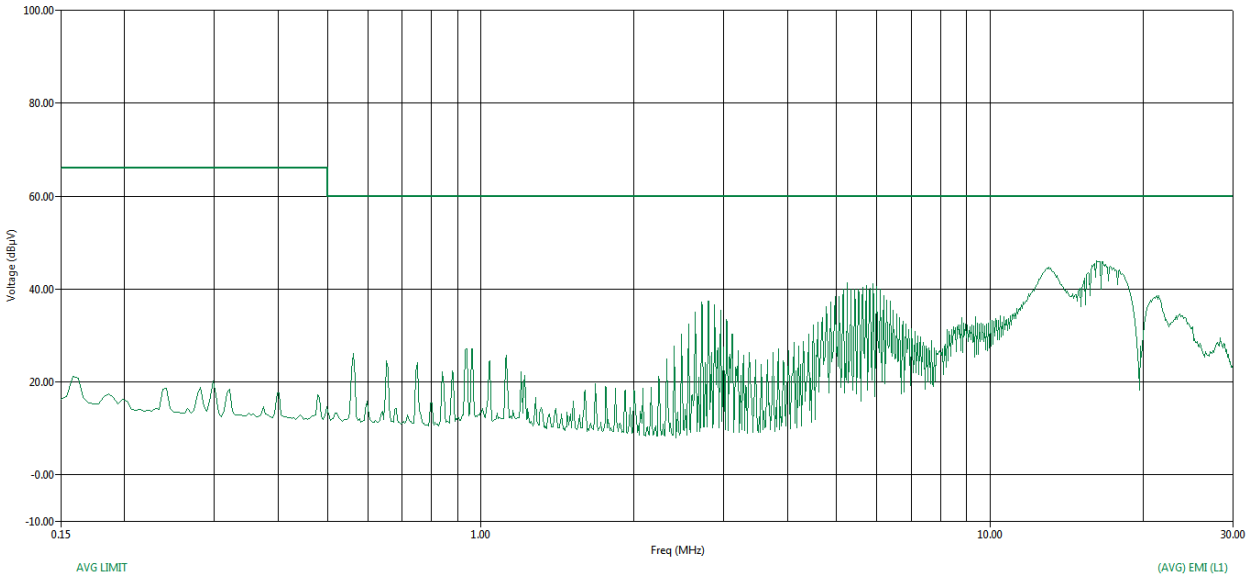


Figure 20: CE graph using average detector from 150 kHz to 30 MHz _Battery/Inverter mode – Line

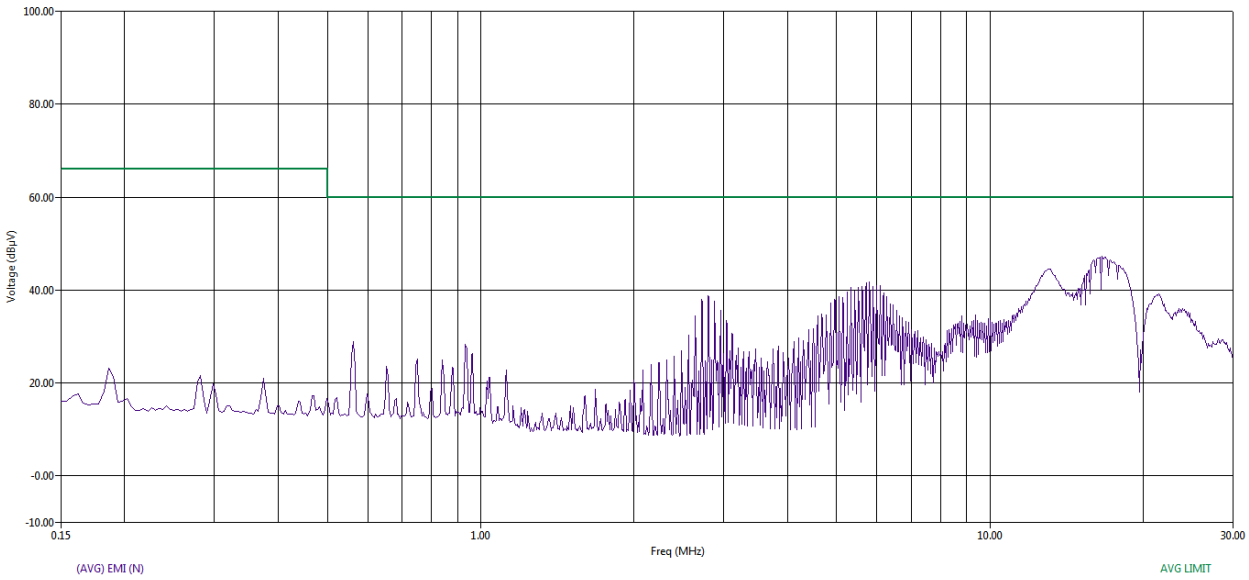


Figure 21: CE graph using average detector from 150 kHz to 30 MHz_ Battery/Inverter mode – Neutral

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dBµV)	Cable+Pulse Limiter (dB)	Transducer N (dB)	Transducer L (dB)	(AVG) EMI (dBµV)	(AVG) Limit (dBµV)	(AVG) Margin (dB)
16.24	16.24	L1	35.76	9.93	0.00	0.47	46.16	60.00	-13.84
16.32	16.32	N	36.19	9.93	0.46	0.00	46.57	60.00	-13.43
16.32	16.32	L1	35.81	9.93	0.00	0.47	46.21	60.00	-13.79
16.40	16.40	N	36.58	9.93	0.46	0.00	46.97	60.00	-13.03
16.40	16.40	L1	36.02	9.93	0.00	0.48	46.42	60.00	-13.58
16.48	16.48	N	36.43	9.92	0.47	0.00	46.82	60.00	-13.18
16.48	16.48	L1	35.86	9.92	0.00	0.48	46.27	60.00	-13.73
16.56	16.56	N	36.62	9.92	0.47	0.00	47.01	60.00	-12.99

Table 14: CE average measurement table from 150 kHz to 30 MHz_ Battery/Inverter mode – Line and Neutral

(QP) EMI (dBµV) = (QP) Trace (dBµV) + Transducer (dB) + {Cable + Pulse limiter} (dB)
QP Margin QPL (dB) = (QP) EMI (dBµV) – (QP) Limit (dBµV)

(AVG) EMI (dBµV) = (AVG) Trace (dBµV) + Transducer (dB) + {Cable + Pulse limiter} (dB)
AVG Margin AVL (dB) = (AVG) EMI (dBµV) – (AVG) Limit (dBµV)

5.3.2.7 RESULT

Conducted Emissions from the EUT as per Class A limit: PASS.

ANNEXURE I: TEST SETUP PHOTOGRAPHS

Figure 22: Photograph of EUT

Figure 23: Photograph of EUT rear view

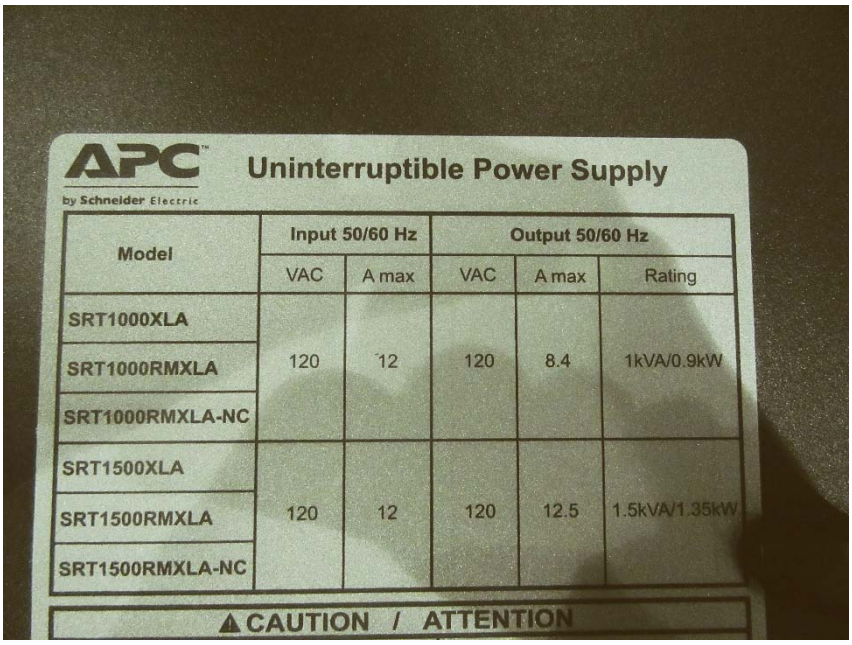


Figure 24: Photograph of model number on EUT

Figure 25: Photograph of serial number on the EUT

Figure 26: Photograph of model number and serial number on the battery pack

Figure 27: Photograph of Network switch

Figure 28: Photograph of isolation transformer

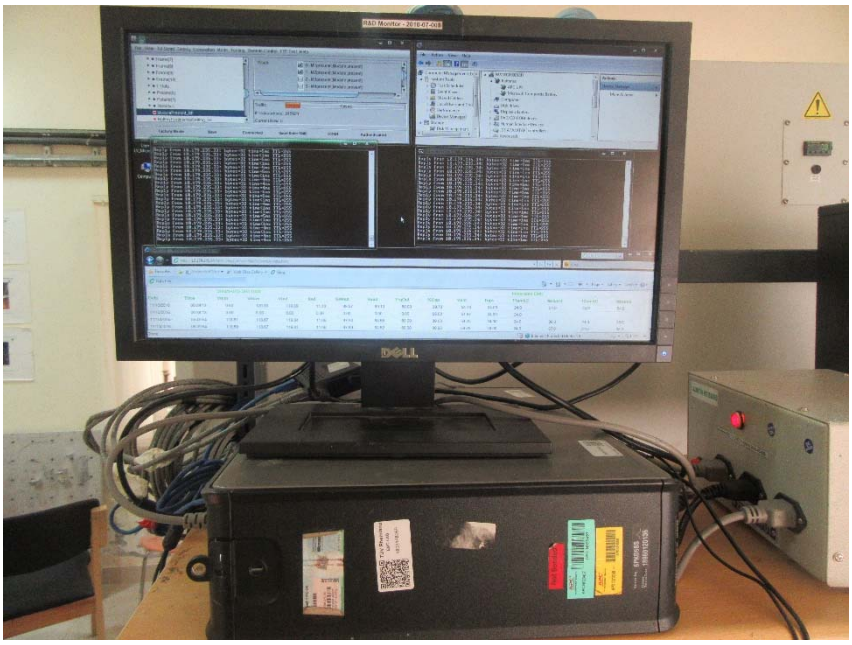


Figure 29: Photograph of PC

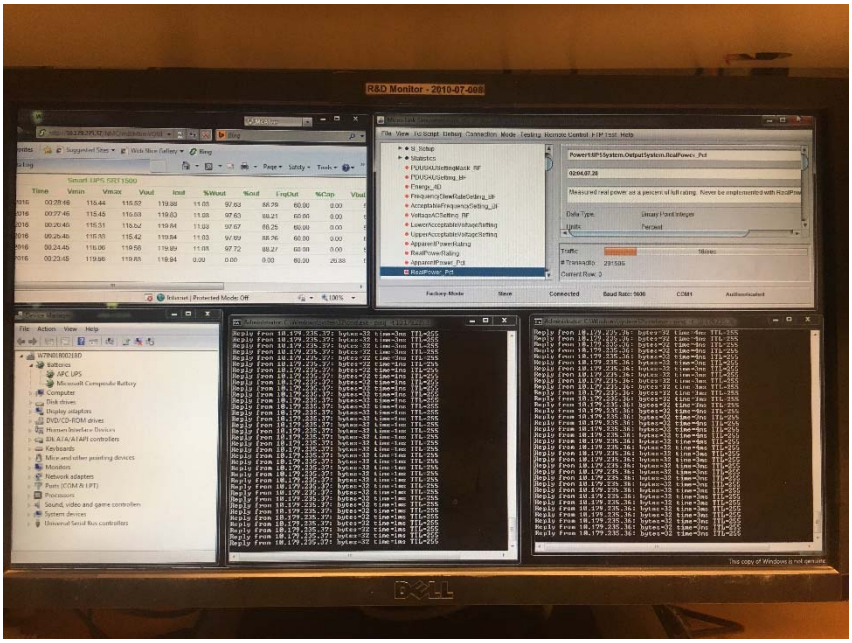


Figure 30: Photograph of parameter monitored on PC

Figure 31: Photograph of resistive load

Figure 32: Photograph of bulb load

Figure 33: Photograph of Ethernet cable RJ 45 (LCE)

Figure 34: Photograph of NMC Ethernet cable

Figure 35: Photograph of USB cable

Figure 36: Photograph of serial cable

Figure 37: Photograph of Universal I/O port cable 1

Figure 38: Photograph of Universal I/O port cable 2

Figure 39: Photograph of AC mains cable

Figure 40: Photograph of AC output cable

Figure 41: Photograph of EPO cable

Figure 42: Photograph of RE test setup from 30MHz to 1GHz-Horizontal polarization

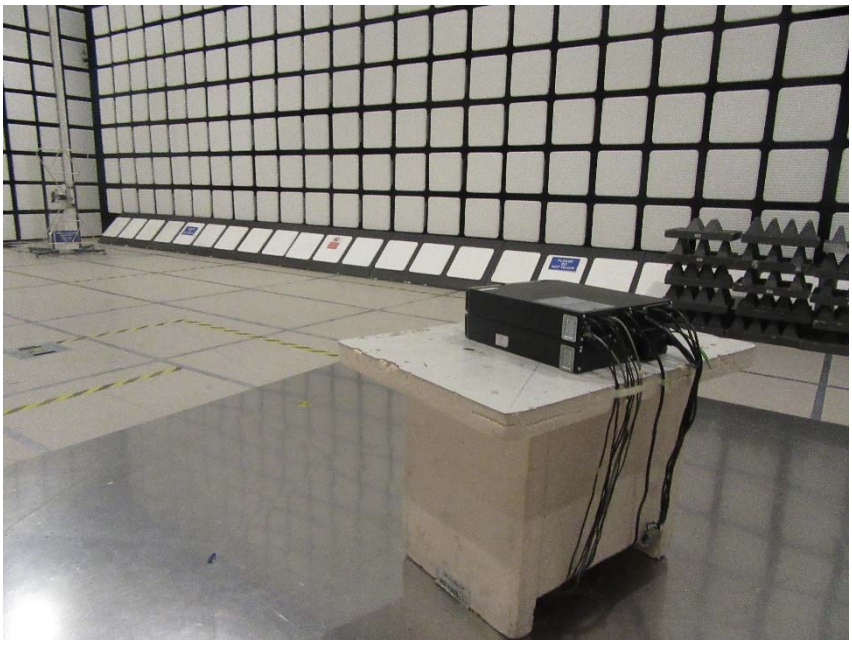


Figure 43: Photograph of RE test setup from 30MHz to 1GHz-Vertical polarization

Figure 44: Photograph of CE test setup

ANNEXURE II: ACRONYMS

AC	Alternating Current
CE	Conducted Emissions
dB	decibel
DC	Direct Current
EUT	Equipment Under Test
GRP	Ground Reference Plane
NA	Not Applicable
RE	Radiated Emissions

END OF REPORT