



CERTIFICATE OF COMPLIANCE

This is to certify that the product listed in follows was (were) tested in the BTL EMC Laboratory to comply with the required criteria levels of the follow-mentioned ETSI harmonized standard according to the essential conformity requirements of the R&TTE Directive of 1999/5/EC and related directives .

Equipment PHOTON

Model Name PHOTONH

Brand Name Particle

Applicant Particle Industries, Inc

Address 1475 Folsom Street, Suite 200, San Francisco, CA 94103

Standard(s)
EN 301 489-1 V1.9.2 (2011-09)
EN 301 489-17 V2.2.1 (2012-09)
EN 300 328 V1.8.1 (2012-06)
EN 62311:2008

Report(s)
BTL-ETSE-1-1504C213B
BTL-ETSP-1-1504C213B
BTL-ETSP-2-1504C213B

The test data, data evaluation, and equipment configuration contained in our test report(s) above was(were) obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s). The test data contained in the referenced test report relate only to the EUT sample and item(s) tested.

Steven Lu
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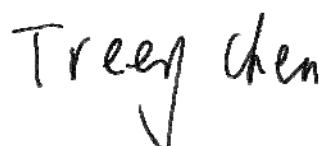


EN 301 489 Test Report

Project No. : 1504C213B
Equipment : PHOTON
Model Name : PHOTONH
Applicant : Particle Industries, Inc
Address : 1475 Folsom Street, Suite 200, San Francisco, CA 94103

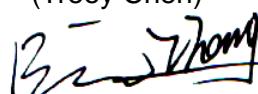
Date of Receipt : Aug. 29, 2016
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Issued Date : Nov. 08, 2016
Tested by : BTL Inc.

Testing Engineer :



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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

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BTL's laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-ETSE-1-1504C213	Original report.	May 22, 2015
BTL-ETSE-1-1504C213B	<p>Compared with the previous report (BTL-ETSE-1-1504C213),</p> <p>1. The changes of components</p> <ul style="list-style-type: none">(a) Replace the USB connection Encapsulation.(b) The model of the power controlling IC U2 changes from RT8008-3V3 to RT8059.(c) Add two 0201 resistances R9 and R10.(d) Add one 0201 capacitance C18.(e) change the resistor R4's encapsulation from 0402 to 0201. <p>2. Layout changes</p> <p>All test results has been re-evaluated and recorded in the test report.</p>	Nov. 08, 2016

1. CERTIFICATION

Equipment : PHOTON
Brand Name : Particle
Model Name : PHOTONH
Applicant : Particle Industries, Inc
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Test Sample : Engineering Sample
Standard(s) : EN 301 489-1 V1.9.2 (2011-09)
EN 301 489-17 V2.2.1 (2012-09)
EN 61000-4-2: 2009
EN 61000-4-3: 2006+A1: 2008+A2: 2010
EN 61000-4-4: 2012
EN 61000-4-5: 2014
EN 61000-4-6: 2014
EN 61000-4-11: 2004

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-ETSE-1-1504C213B) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

2. SUMMARY OF TEST RESULTS

EN 301 489-1 / EN 301 489-17, EMC emission					
Clause	Phenomenon	Application	Basic Standard or Test Method	Limit	Judgment
8.2	Radiated emission below 1 GHz	Enclosure of ancillary equipment	EN 55022:2010 +AC:2011	Class B	PASS
	Radiated emission above 1 GHz			Class B	PASS NOTE (2)
8.3	Conducted emission	DC power input/output port (fixed use)	EN 55022:2010 +AC:2011	Not Applicable	N/A NOTE (1)
		DC power input/output port (vehicular use)	CISPR 25: 2008	Not Applicable	N/A NOTE (1)
8.4	Conducted emission	AC mains input/output port	EN 55022:2010 +AC:2011	Class B	PASS
8.5	Harmonic current emissions	AC mains input port	EN 61000-3-2: 2014	Not Applicable	N/A NOTE (1)
8.6	Voltage fluctuations and flicker	AC mains input port	EN 61000-3-3: 2013	-----	N/A NOTE (1)
8.7	Conducted emission	Telecommunication port	EN 55022:2010 +AC:2011	Not Applicable	N/A NOTE (1)

EN 301 489-1 / EN 301 489-17, Immunity

Clause	Phenomenon	Application	Basic Standard or Test Method	Limit	Judgment
9.2	RF electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)	Enclosure	EN 61000-4-3: 2006 +A1:2008 +A2:2010	A (CT,CR)	PASS
9.3	Electrostatic discharge	Enclosure	EN 61000-4-2: 2009	B (TT,TR)	PASS
9.4	Fast transients common mode	Signal, telecommunication and control ports, DC and AC power ports	EN 61000-4-4: 2012	B (TT,TR)	PASS
9.5	RF common mode 0,15 MHz to 80 MHz	Signal, telecommunication and control ports, DC and AC power ports	EN 61000-4-6: 2014	A (CT,CR)	PASS
9.6	Transients and surges	DC power input ports (vehicular use)	ISO 7637-2: 2011	Not Applicable	N/A NOTE (1)
9.7	Voltage dips and interruptions	AC mains power input ports	EN 61000-4-11: 2004	B (TT,TR)/C	PASS NOTE (4)
9.8	Surges, line to line and line to ground	AC mains power input ports, telecommunication ports	EN 61000-4-5: 2014	B (TT,TR)	PASS

NOTE:

- (1) "N/A" denotes test is not applicable to this device.
- (2) The EUT's max operating frequency is 2.4GHz which exceeds 108 MHz, so the test will be performed.
- (3) For equipment with a rated power of 75 W or less, limits are not specified.
- (4) Voltage dip: 0% residual voltage for 0, 5 cycle - Criteria B (TT,TR)
Voltage dip: 0% residual voltage for 1 cycle - Criteria B (TT,TR)
Voltage dip: 70% residual voltage for 25 cycle (at 50Hz) - Criteria B (TT,TR)
Voltage Interruption: 0% residual voltage for 250 cycle (at 50Hz) - with battery back-up: Criteria B (TT,TR), without battery back-up: Criteria C
- (5) For the performance criteria for Transient phenomena applied to Transmitter (TT) and Receiver (TR)
- (6) For the performance criteria for Continuous phenomena applied to Transmitter (CT) and Receiver (CR).

E. Immunity Measurement:

Test Site	Method	Test Item	U
SR02	EN 61000-4-2	Voltage (2kV/4kV/6kV/8kV/15kV/25kV/30kV)	1.0%
		Peak Current	6.0%
		30/60ns Current	6.0%
		Rise time	6.4%
CB05	EN 61000-4-3	80MHz~1GHz	2.175 dB
		1GHz~6GHz	2.175 dB
SR05	EN 61000-4-4	Impulse Voltage	4.0 %
		Impulse Rise Time	4.5 %
		Impulse duration Time	4.0 %
SR05	EN 61000-4-5	Impulse Voltage	4.0 %
		Impulse Rise Time	4.5 %
		Impulse duration Time	4.0 %
CB06	EN 61000-4-6	CDN: 150kHz~230MHz	2.509 dB
		EM Clamp: 150kHz~230MHz	3.094 dB
SR05	EN 61000-4-11	Impulse Amplitude	4 %
		Timing	3 %

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	PHOTON
Brand Name	Particle
Model Name	PHOTONH
OEM Brand/Model Name	N/A
Model Difference	N/A
Power Source	Supplied from PC USB port.
Power Rating	DC 5V

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
1	OPERATING

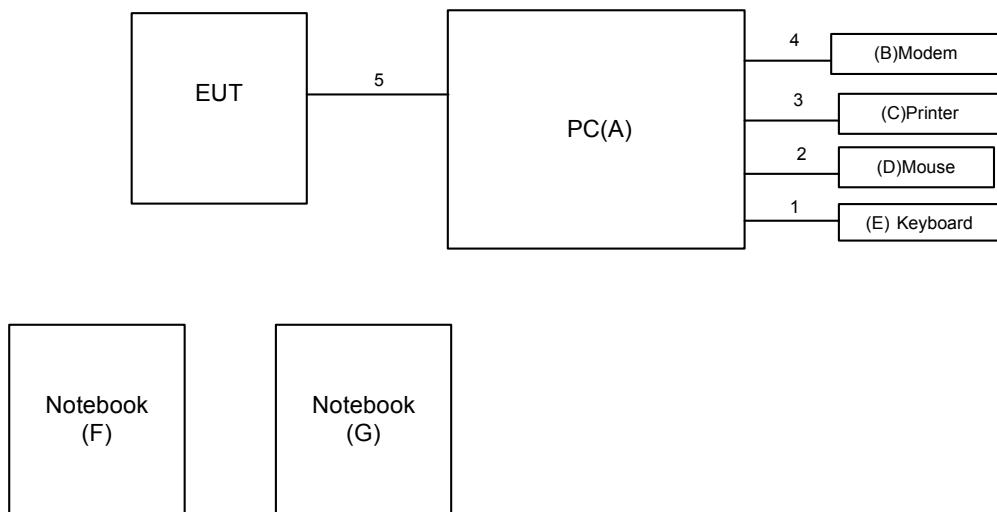
The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

For Conducted Test	
Final Test Mode	Description
1	OPERATING

For Radiated Test	
Final Test Mode	Description
1	OPERATING

For EMS Test	
Final Test Mode	Description
1	OPERATING

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF RADIATION EMISSION TEST



3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
A	PC	DELL	7010MT	DOC	16553832481
B	Modem	ACEEX	DM-1414V	IFAXDM1414	0603002131
C	Printer	SII	DPU-414	DOC	3018507 B
D	USB Mouse	DELL	MS111-P	DOC	CN011D3V71581 279OLOT
E	USB Keyboard	DELL	KB212-B	DOC	CN0HTXH97158 125004DXA01
F	Notebook	Lenovo	E46L	DOC	EB21809870
G	Notebook	Lenovo	E46L	DOC	EB22953770

Item	Shielded Type	Ferrite Core	Length	Note
1	YES	NO	1.8m	USB Cable
2	YES	NO	1.8m	USB Cable
3	YES	NO	1.5m	Parallel Cable
4	YES	NO	1.5m	RS232 Cable
5	YES	NO	0.5m	USB Cable

Note:

- (1) For detachable type I/O cable should be specified the length in m in 『Length』 column.

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION (FREQUENCY RANGE 150KHZ-30MHZ)

FREQUENCY (MHz)	Class A (dB μ V)		Class B (dB μ V)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The limit for conducted test was performed according to as following: EN 55022
- (2) The tighter limit applies at the band edges.
- (3) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
Margin Level = Measurement Value – Limit Value

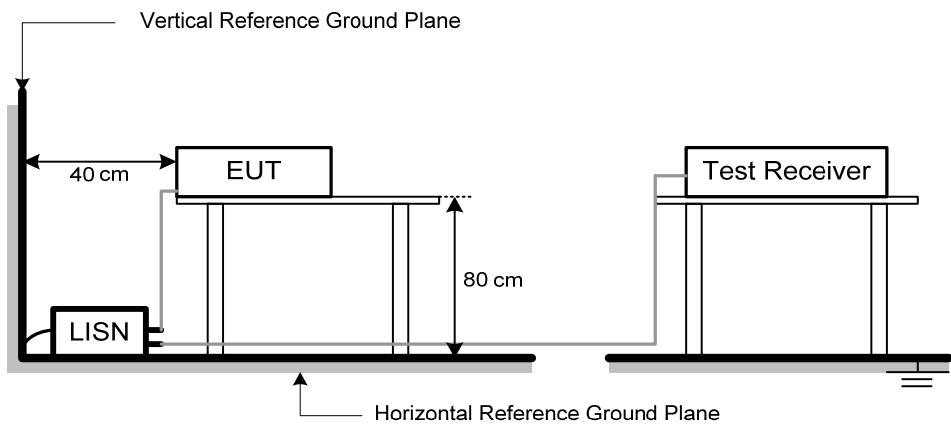
4.1.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 TEST SETUP



4.1.5 EUT OPERATING CONDITIONS

The EUT will be configured to operate in a typical fashion as normally used.
Temperature: 21°C Relative Humidity: 51%

4.1.6 TEST RESULTS

Please refer to the Attachment A.

4.2.2 TEST PROCEDURE

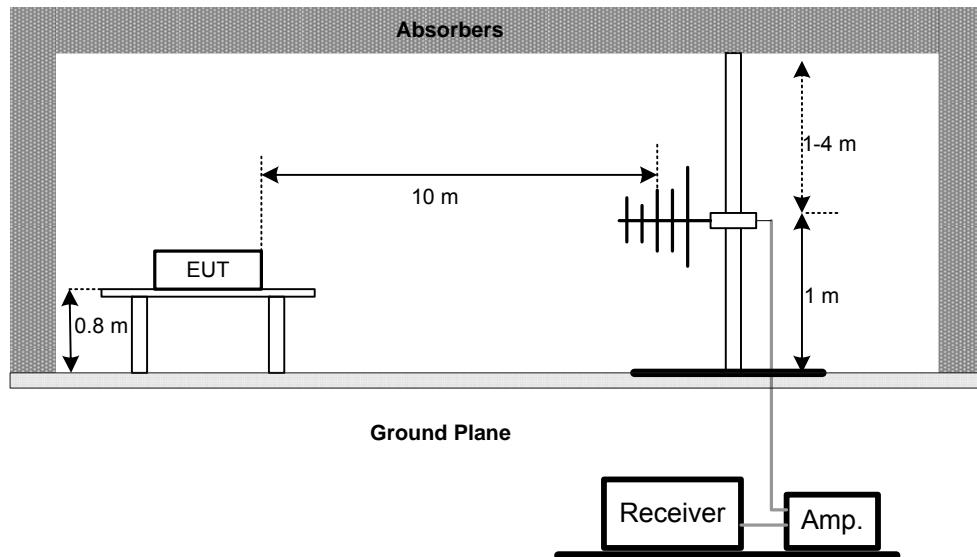
- a. The measuring distance of 10 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- f. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- g. For the actual test configuration, please refer to the related Item - EUT Test Photos.

4.2.3 DEVIATION FROM TEST STANDARD

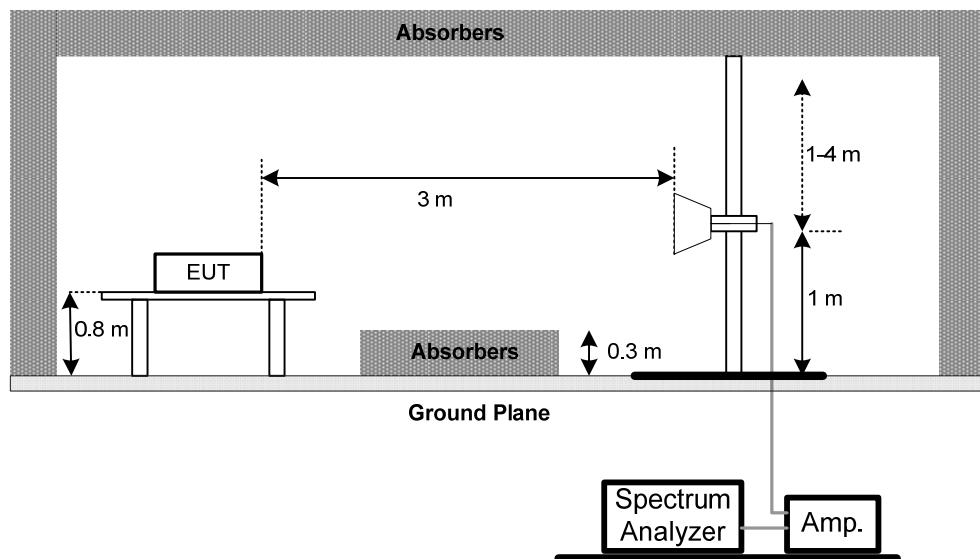
No deviation

4.2.4 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



Note: The antenna can be moved between 1 to 4 meters above the ground.

4.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the related operation mode otherwise a special operating condition is specified in the follows during the testing.

Temperature: 30°C Relative Humidity: 52%

4.2.6 TEST RESULTS: 30MHz - 1000MHz

Please refer to the Attachment B.

4.2.7 TEST RESULTS: ABOVE 1000MHz

Please refer to the Attachment C.

5. EMC IMMUNITY TEST

5.1 STANDARD COMPLIANCE/SERVRITY LEVEL/CRITERIA

Test Standard No.	Test Specification Level	Test Mode Test Port	Criteria
Electrostatic discharge immunity EN 61000-4-2 (ESD)	± 8kV air discharge ± 4kV contact discharge	Direct Mode	B
	± 4kV HCP discharge ± 4kV VCP discharge	Indirect Mode	B
Radiated, radio-frequency, electromagnetic field immunity EN 61000-4-3 (RS)	80 MHz to 1000 MHz & 1400 MHz to 2700MHz 3V/m(unmodulated, r.m.s), 1KHz, 80%,AM modulated	Enclosure	A
Electrical fast transient/burst immunity EN 61000-4-4 (EFT/Burst)	±1.0kV(peak) 5/50ns Tr/Th 5KHz Repetition Freq.	Power Supply Port	B
	±0.5 kV(peak) 5/50ns Tr/Th 5KHz Repetition Freq.	CTL/Signal Data Line Port	B
Surge immunity EN 61000-4-5 (Surges)	±1 kV(5P/5N) 1.2/50(8/20) Tr/Th us	L-N	B
	± 2 kV(5P/5N) 1.2/50(8/20) Tr/Th us	L-PE N-PE	B
	±0.5 kV(RJ45) ± 1 kV(DSL)(5P/5P) 1.2/50(8/20) Tr/Th us	CTL/Signal Data Line Port	B
Immunity to conducted disturbances, induced by radio-frequency fields EN 61000-4-6 (Injected Current)	0.15 MHz to 80 MHz 3V(unmodulated, r.m.s), 1KHz 80%, AM Modulated 150Ω source impedance	CTL/Signal Port	A
	0.15 MHz to 80 MHz 3V(unmodulated, r.m.s), 1KHz 80%, AM Modulated 150Ω source impedance	AC Power Port	A
Voltage dips, short interruptions and voltage variations immunity EN 61000-4-11 (Voltage Interruption/Dips)	Voltage dip 0% Voltage dip 0% Voltage dip 70% Voltage Interruption 0%	AC Power Port	B B C C

5.2 The Requirement of Performance Criteria

- | |
|---|
| 1. Performance criteria for continuous phenomena applied to transmitters (CT) |
| 2. Performance criteria for transient phenomena applied to transmitters (TT) |
| 3. Performance criteria for continuous phenomena applied to receivers (CR) |
| 4. Performance criteria for transient phenomena applied to receivers (TR) |

According to **ETSI EN 301 489-17** standard, the general performance criteria as following:

Criteria	During Test	After Test
A	Shall operate as intended May show degradation of performance (see note 1) Shall be no loss of function Shall be no unintentional transmissions	Shall operate as intended Shall be no degradation of performance (see note 2) Shall be no loss of function Shall be no loss of stored data or user programmable functions
B	May show loss of function (one or more) May show degradation of performance (see note 1) No unintentional transmissions	Functions shall be self-recoverable Shall operate as intended after recovering Shall be no degradation of performance (see note 2) Shall be no loss of stored data or user programmable functions
C	May be loss of function (one or more)	Functions shall be recoverable by the operator Shall operate as intended after recovering Shall be no degradation of performance (see note 2)

NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

Performance Criteria for CT and CR:

Refer to **EN 301 489-17** subclasses 6.3 and 6.5 for the performance criteria for Continuous phenomena applied to Transmitter (CT) and Receiver (CR).

Performance Criteria for TT and TR:

Refer to EN 301 489-17 subclasses 6.4 and 6.6 for the performance criteria for Transient phenomena applied to Transmitter (TT) and Receiver (TR).

5.3 GENERAL PERFORMANCE CRITERIA TEST SETUP

The EUT tested system was configured as the related operation mode otherwise a special operating condition is specified in the follows during the testing.

5.4 ESD TESTING

5.4.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	Air Discharge: N/A Contact Discharge: ±2kV/± 4kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 20 times at each test point Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

5.4.2 TEST PROCEDURE

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

- a. Contact discharge was applied to conductive surfaces and coupling planes of the EUT. During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

- b. Air discharges at insulation surfaces of the EUT.

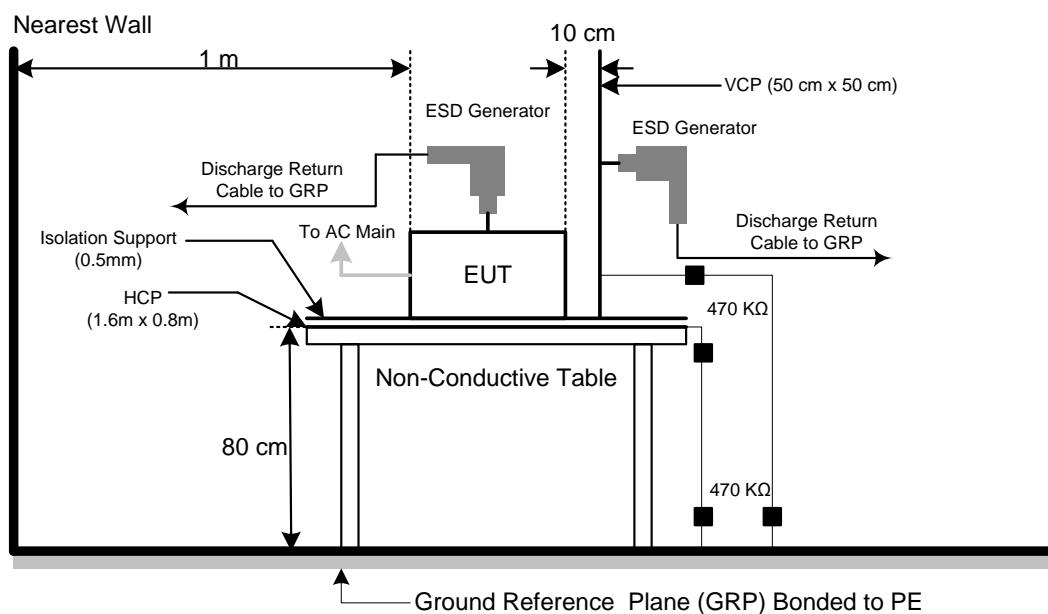
It was at least ten single discharges with positive and negative at the same selected point.

- c. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.4.3 DEVIATION FROM TEST STANDARD

No deviation

5.4.4 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC /EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

5.4.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 44% Test Pressure: 1002 hPa

5.4.6 TEST RESULTS

Please refer to the Attachment D.

5.5 RS TESTING

5.5.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 1000 MHz & 1400MHz - 2700MHz
Field Strength:	3 V/m, unmodulated, r.m.s
Modulation:	1kHz Sine Wave, 80%, AM Modulation If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used.
Frequency Step:	1% of fundamental
Polarity of Antenna:	Horizontal and Vertical
Test Distance:	3 m
Antenna Height:	1.5 m
Dwell Time:	at least 3 seconds

5.5.2 TEST PROCEDURE

The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber.

The testing distance from antenna to the EUT was 3 meters.

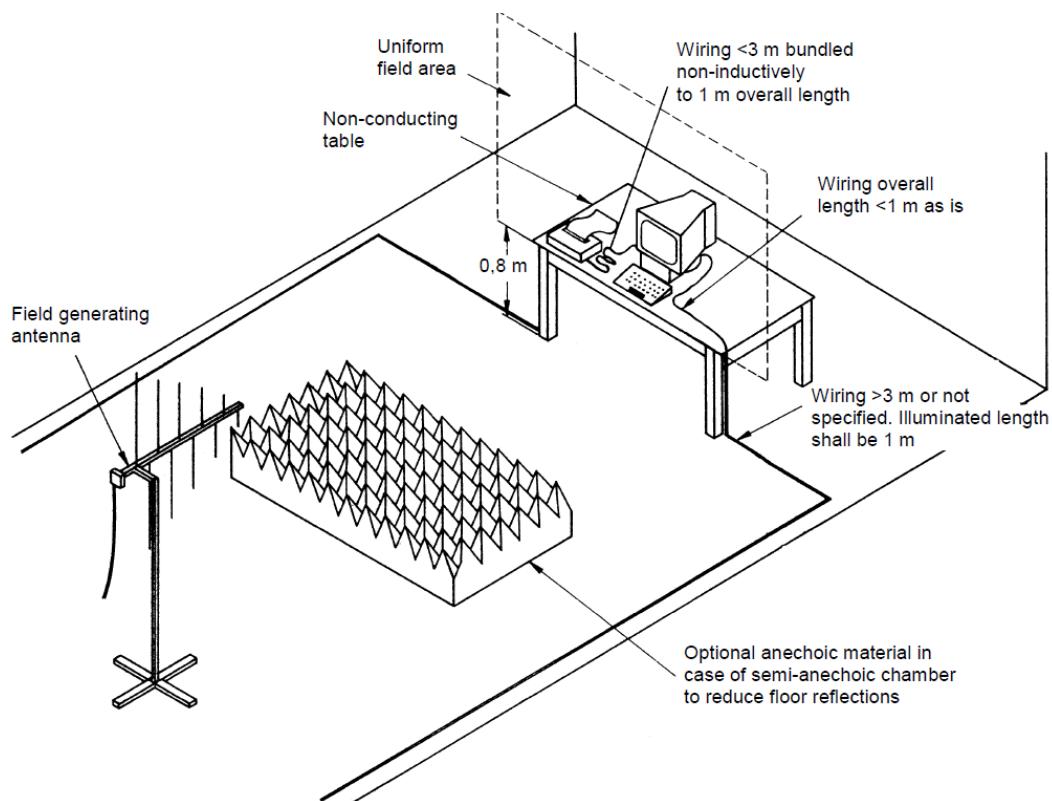
The other condition as following manner:

- a. The field strength level was 3V/m, unmodulated, r.m.s.
- b. The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used;
The test shall be performed over the frequency range 80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers (see clause 4), as appropriate;
For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency, unless specified otherwise in the part of EN 301 489 series [i.13] dealing with the relevant type of radio equipment.
- c. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.5.3 DEVIATION FROM TEST STANDARD

No deviation

5.5.4 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

5.5.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 56%

5.5.6 TEST RESULTS

Please refer to the Attachment E.

5.6 EFT/BURST TESTING

5.6.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-4
Required Performance	B
Test Voltage :	Power Line: $\pm 1\text{ kV}$
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	Not less than 1 min.

5.6.2 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

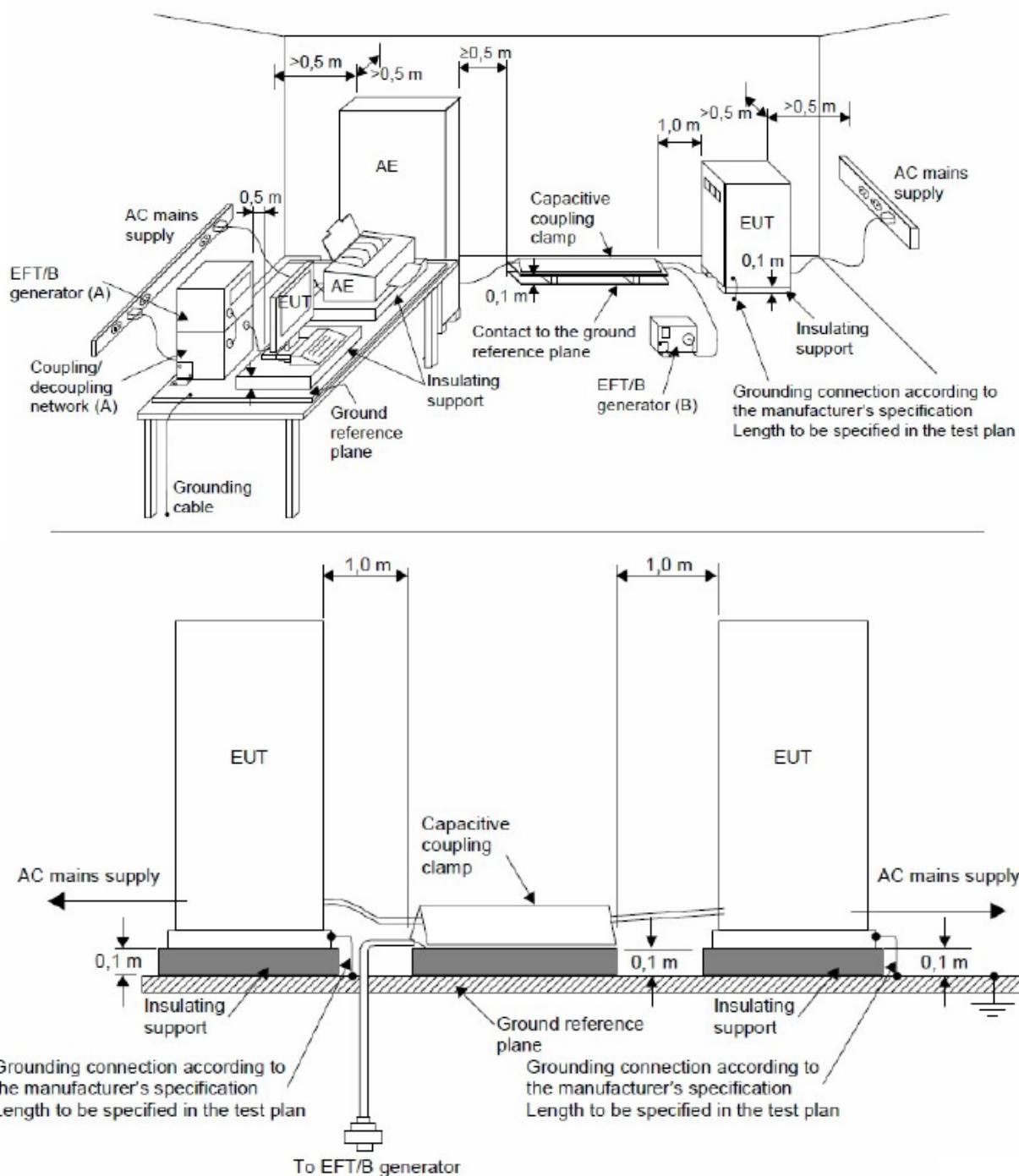
The other condition as following manner:

- a. The length of power cord between the coupling device and the EUT should not exceed 1 meter.
- b. Both positive and negative polarity discharges were applied.
- c. The duration time of each test sequential was 1 minute
- d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.6.3 DEVIATION FROM TEST STANDARD

No deviation

5.6.4 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane and should be located 0.1 m+/- 0.01m above the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

5.6.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 56%

5.6.6 TEST RESULTS

Please refer to the Attachment F.

5.7 SURGE TESTING

5.7.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-5
Required Performance	B
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage :	Power Line: ± 0.5 kV, ± 1 kV, ± 2 kV
Surge Input/Output:	L1-L2, L1-PE, L2-PE
Generator Source	2 ohm between networks
Impedance:	12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	AC Port: 0° /90°/180°/270°
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

5.7.2 TEST PROCEDURE

a. For EUT power supply:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2meters in length (or shorter).

b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:

The surge is applied to the lines via the capacitive coupling. The coupling /decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

c. For test applied to unshielded symmetrically operated interconnection /telecommunication lines of EUT:

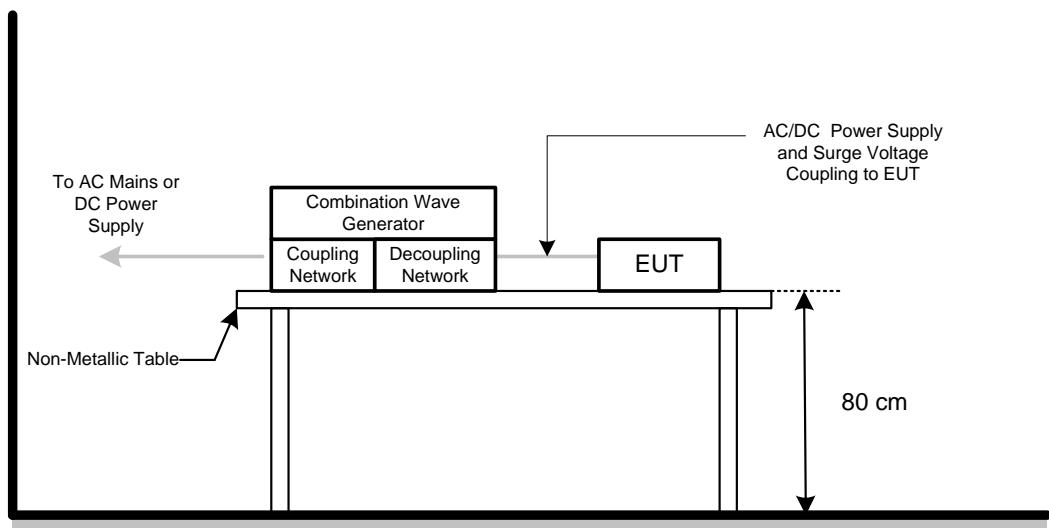
The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.7.3 DEVIATION FROM TEST STANDARD

No deviation

5.7.4 TEST SETUP



5.7.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 56%

5.7.6 TEST RESULTS

Please refer to the Attachment G.

5.8 INJECTION CURRENT TESTING

5.8.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-6
Required Performance	A
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	3 V, unmodulated, r.m.s.
Modulation:	1kHz Sine Wave, 80%, AM Modulation If the wanted signal is modulated at 1 000 Hz, then the test signal of 400 Hz shall be used.
Frequency Step:	1% of fundamental
Dwell Time:	at least 3 seconds

5.8.2 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

The other condition as following manner:

- a. The field strength level was 3V, unmodulated, r.m.s..
- b. The frequency range is swept from 150KHz to 80 MHz,

The test level shall be severity level 2 as given in EN 61000-4-6 [6] corresponding to 3 V rms unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then the test signal of 400 Hz shall be used;

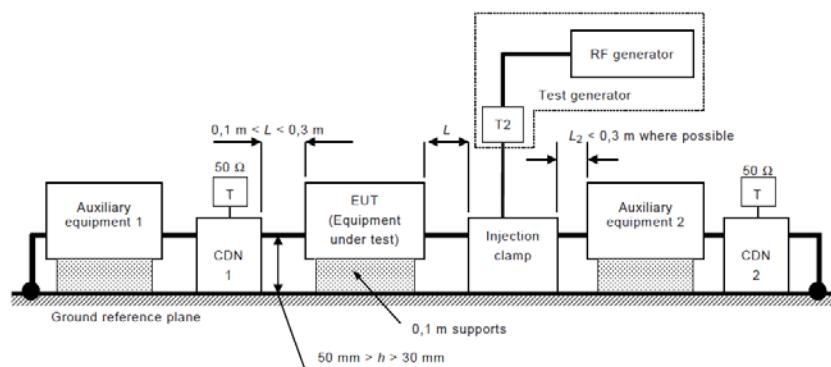
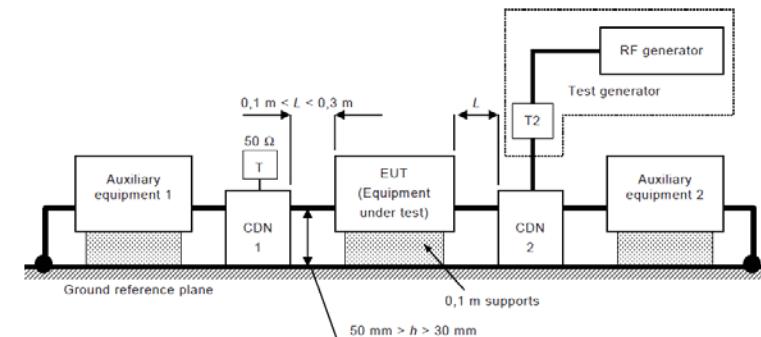
The test shall be performed over the frequency range 150 kHz to 80 MHz with the exception of an exclusion band for transmitters, and for receivers and duplex transceivers, (see clause 4); For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary frequency in the frequency range 150 kHz to 80 MHz, unless specified otherwise in the part of EN 301 489 series [i.13] dealing with the particular type of radio equipment.

- c. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.8.3 DEVIATION FROM TEST STANDARD

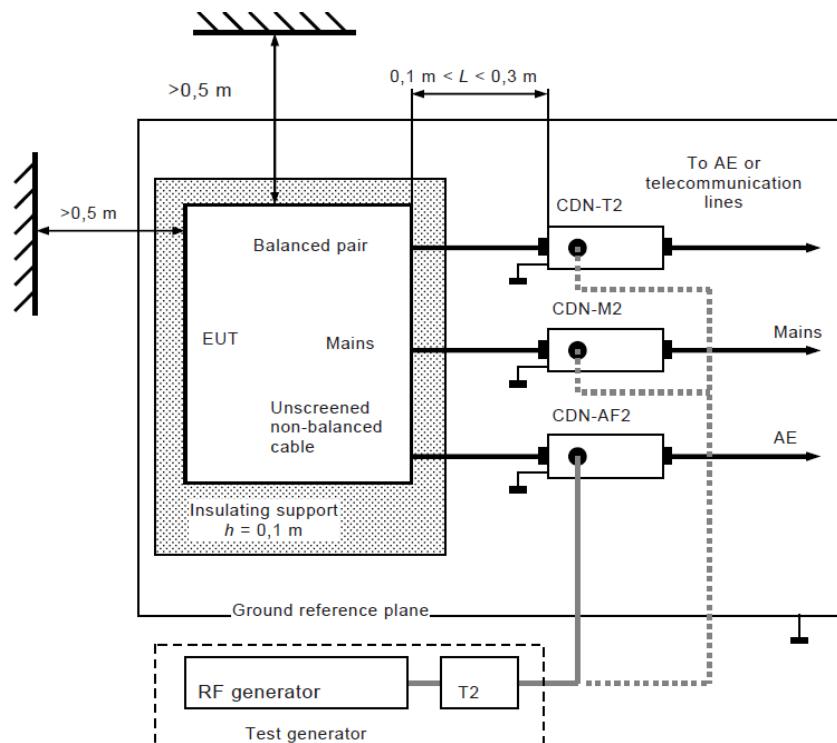
No deviation

5.8.4 TEST SETUP



IEC 1503/03

T : Termination 50 Ω
 T2: Power attenuator (6 dB)
 CDN: Coupling and decoupling network
 Injection clamp: current clamp or EM clamp



The EUT clearance from any metallic objects shall be at least 0.5 m.

5.8.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 56%

5.8.6 TEST RESULTS

Please refer to the Attachment H.

5.9 VOLTAGE INTERRUPTION/DIPS TESTING

5.9.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-11
Required Performance	B (For 0% Voltage Dips) B (For 0% Voltage Dips) B (For 70% Voltage Dips) C (For 0% Voltage Interruptions)
Test Duration Time:	Minimum three test events in sequence
Interval between Event:	Minimum ten seconds
Phase Angle:	0°/45°/90°/135°/180°/225°/270°/315°/360°
Test Cycle:	3 times

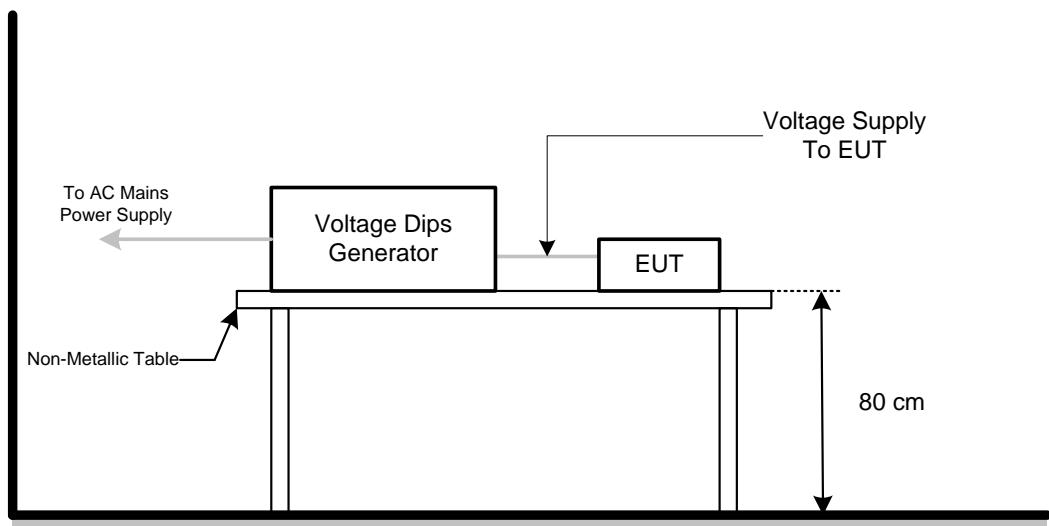
5.9.2 TEST PROCEDURE

The EUT shall be tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

5.9.3 DEVIATION FROM TEST STANDARD

No deviation

5.9.4 TEST SETUP



For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.9.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 56%

5.9.6 TEST RESULTS

Please refer to the Attachment I.

6. MEASUREMENT INSTRUMENTS LIST

Conducted Emission

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	50Ω Terminator	SHX	TF2-3G-A	8122901	Mar. 27, 2017
2	TWO-LINE V-NETWORK	R&S	ENV216	100526	Mar. 27, 2017
3	EMI Test Receiver	R&S	ESR3	101862	Nov. 20, 2016
4	Artificial-Mains Network	SCHWARZBEC K	NSLK 8127	8127685	Nov. 20, 2016
5	Cable	N/A	RG400 12m	N/A	Mar. 10, 2017
6	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emission

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Receiver	Keysight	N9038A	MY54450004	Nov. 20, 2016
2	MXE EMI Receiver	Agilent	N9038A	MY53220133	Jun. 23, 2017
3	Pre-Amplifier	Mini-Circuits	EMC 9135	980284	Mar. 27, 2017
4	Pre-Amplifier	Mini-Circuits	EMC 9135	980283	Mar. 27, 2017
5	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	586	Feb. 04, 2017
6	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	587	Jan. 26, 2017
7	Cable	emci	LMR-400(5m+11 m+15m)	N/A	Dec. 31, 2016
8	Cable	emci	LMR-400(5m+8 m+15m)	N/A	Dec. 31, 2016
9	Measurement Software	Farad	EZ-EMC Ver.BTL-2ANT-1	N/A	N/A
10	Multi-Device Controller	ETS-Lindgren	2090	N/A	N/A
11	Horn Antenna	EMCO	3115	9605-4803	Mar. 27, 2017
12	Cable	emci	SUCOFLEX_15 m_5m(0.01GHz – 26.5GHz)	N/A	Dec. 31, 2016
13	Multi-Device Controller	ETS-Lindgren	2090	N/A	N/A
14	Controller	MF	MF-7802	MF780208159	N/A
15	Cable	emci	SUCOFLEX 102_8m(0.01GHz – 40GHz)	N/A	Mar. 27, 2017

ESD

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	ESD Generator	TESEQ AG	NSG 437	450	Oct. 27, 2017

RS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	ETS	3142C	47662	Mar. 27, 2017
2	Digital Signal Generator	HP	ESG-D3000A	US36260188	Mar. 27, 2017
3	Amplifier	AR	50S1G4A	326720	Mar. 28, 2018
4	Measurement Software	TOYO	IM5/R Ver 3.8.050	N/A	N/A
5	Power amplifier	MILMEGA	AS1860-50	1064834	Nov. 02, 2017
6	Microwave Log.-Per. Antenna	TESEQ	STLP 9149	9149-277	Mar. 27, 2019
7	Power amplifier	MILMEGA	80RF1000-250	1064833	Nov. 02, 2017

EFT

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
2	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A

Surge

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
2	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A

CS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	HP	8648A	3636A02964	Mar. 27, 2017
2	Power Amplifier	Teseq	CBA230M-080	T43748	Mar. 27, 2017
3	Measurement Software	Farad	EZ-CS?(V2.0.1 .2)	N/A	N/A

DIPS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
2	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A

Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

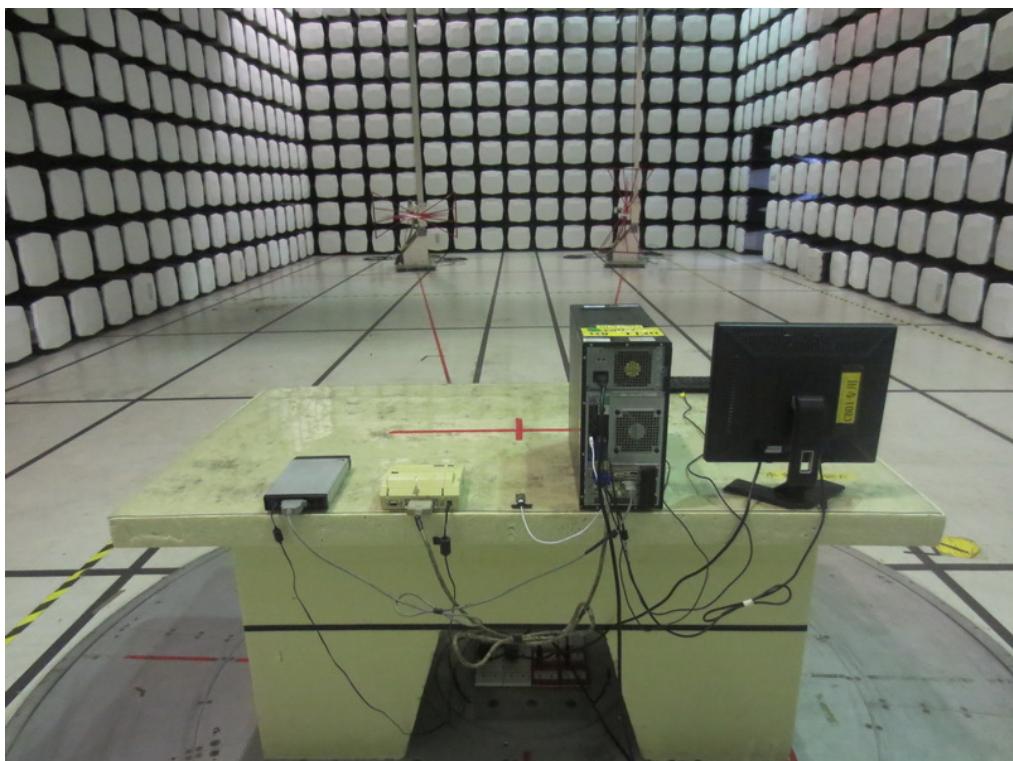
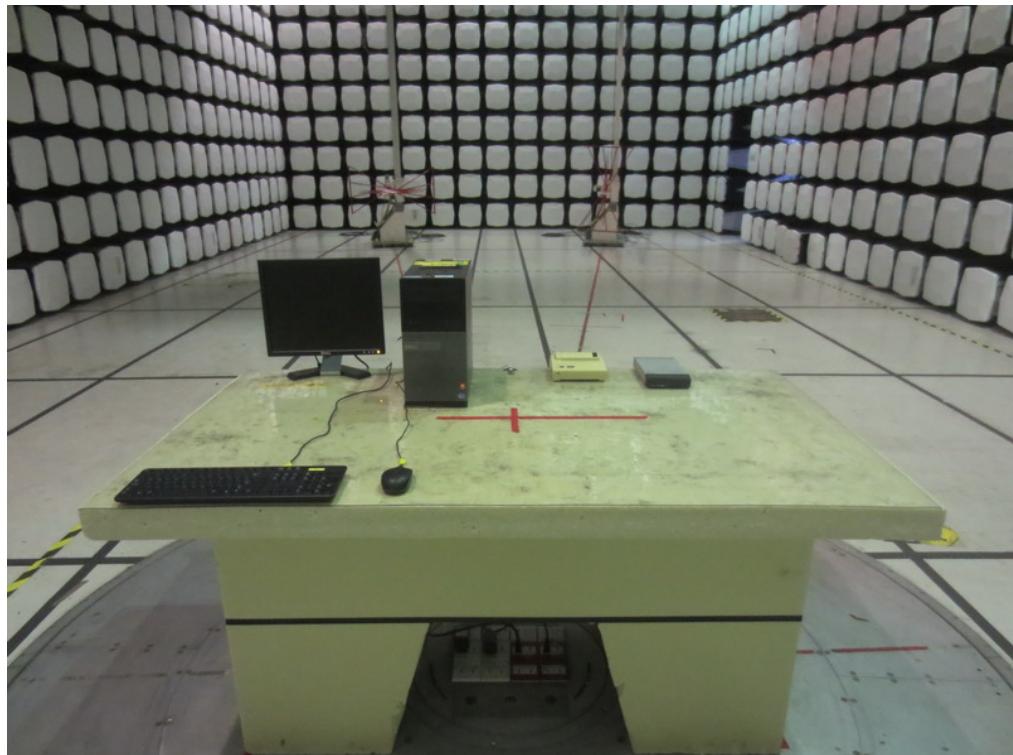
7. EUT TEST PHOTO

Conducted Measurement Photos



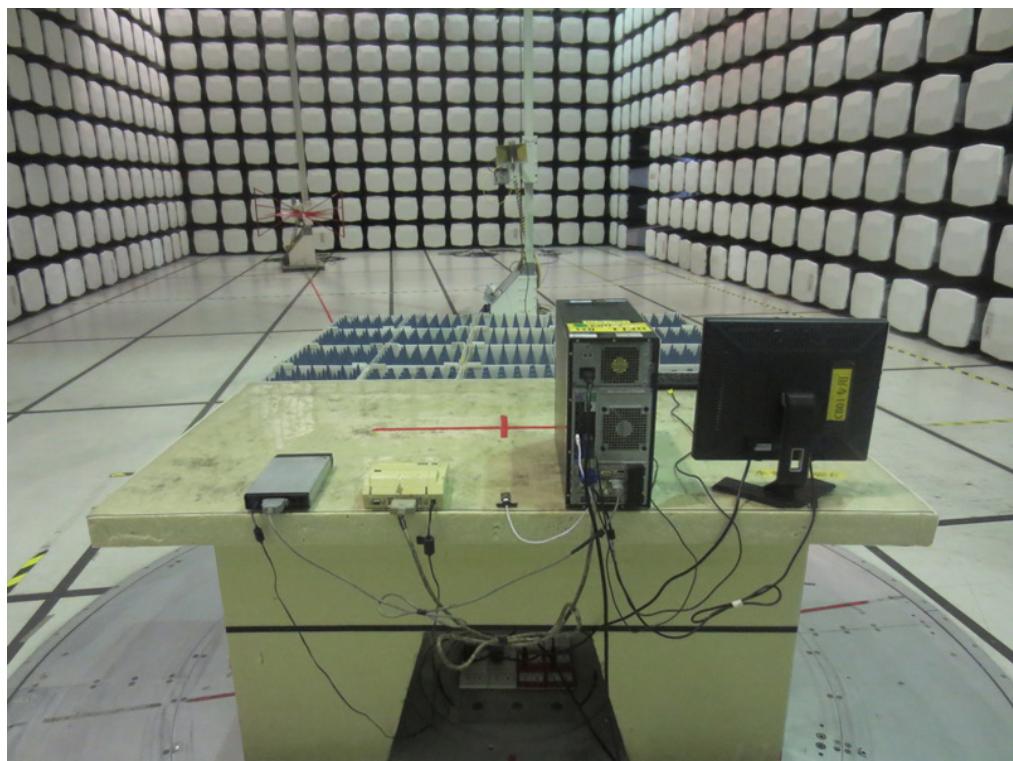
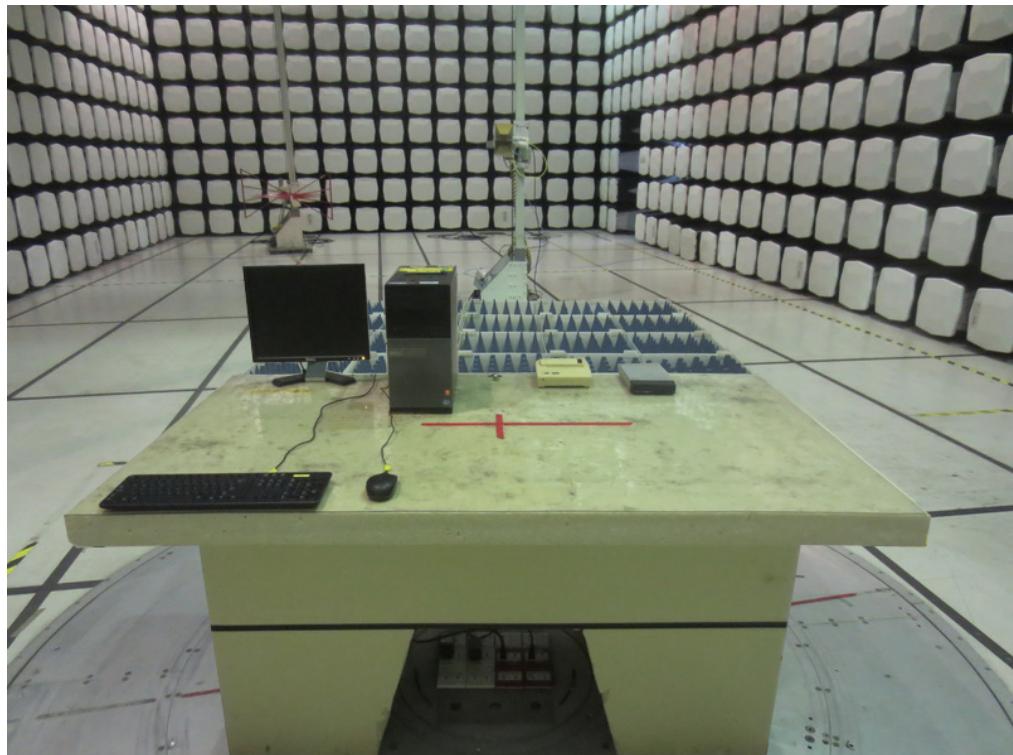
Radiated Measurement Photos

Below 1GHz



Radiated Measurement Photos

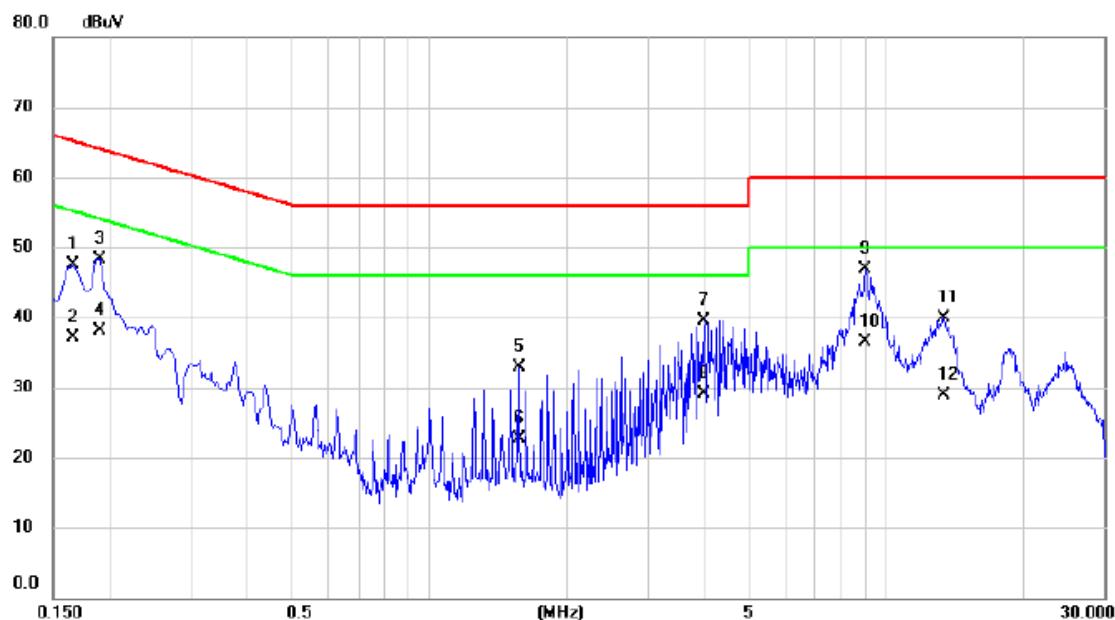
Above 1GHz



ATTACHMENT A - CONDUCTED EMISSION

Test Voltage:	AC 230V/50Hz
Test Mode:	OPERATING

Neutral

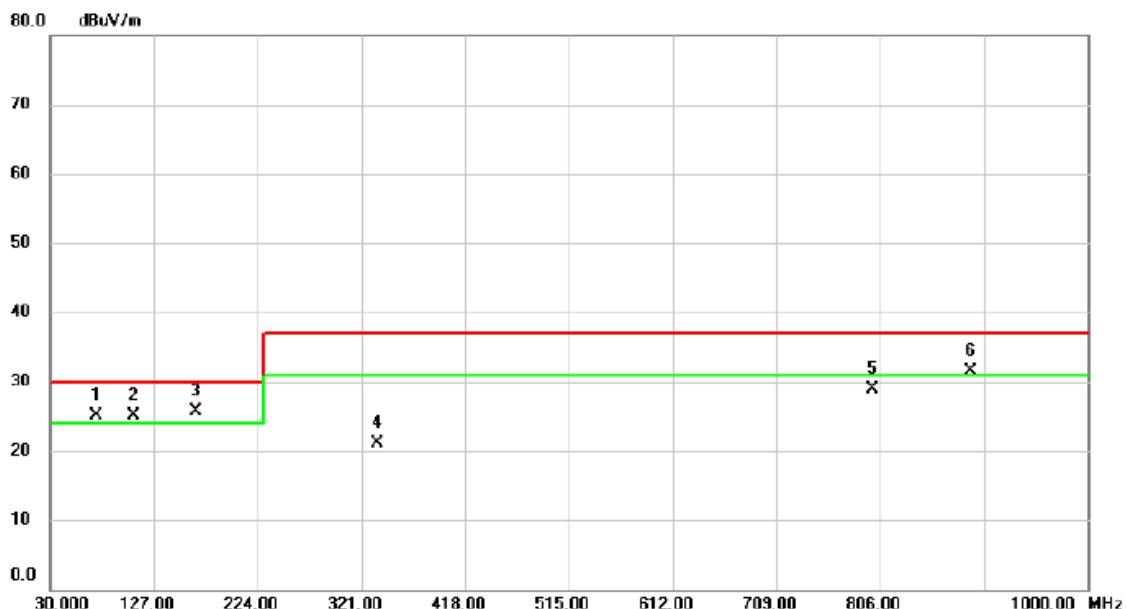


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1660	37.98	9.44	47.42	65.16	-17.74	QP	
2		0.1660	27.60	9.44	37.04	55.16	-18.12	AVG	
3		0.1900	38.86	9.50	48.36	64.04	-15.68	QP	
4		0.1900	28.60	9.50	38.10	54.04	-15.94	AVG	
5		1.5660	23.21	9.68	32.89	56.00	-23.11	QP	
6		1.5660	13.00	9.68	22.68	46.00	-23.32	AVG	
7		4.0060	29.71	9.89	39.60	56.00	-16.40	QP	
8		4.0060	19.20	9.89	29.09	46.00	-16.91	AVG	
9	*	9.0060	36.65	10.20	46.85	60.00	-13.15	QP	
10		9.0060	26.30	10.20	36.50	50.00	-13.50	AVG	
11		13.4060	29.57	10.34	39.91	60.00	-20.09	QP	
12		13.4060	18.60	10.34	28.94	50.00	-21.06	AVG	

ATTACHMENT B - RADIATED EMISSION (30MHZ-1000MHZ)

Test Voltage:	AC 230V/50Hz
Test Mode:	OPERATING

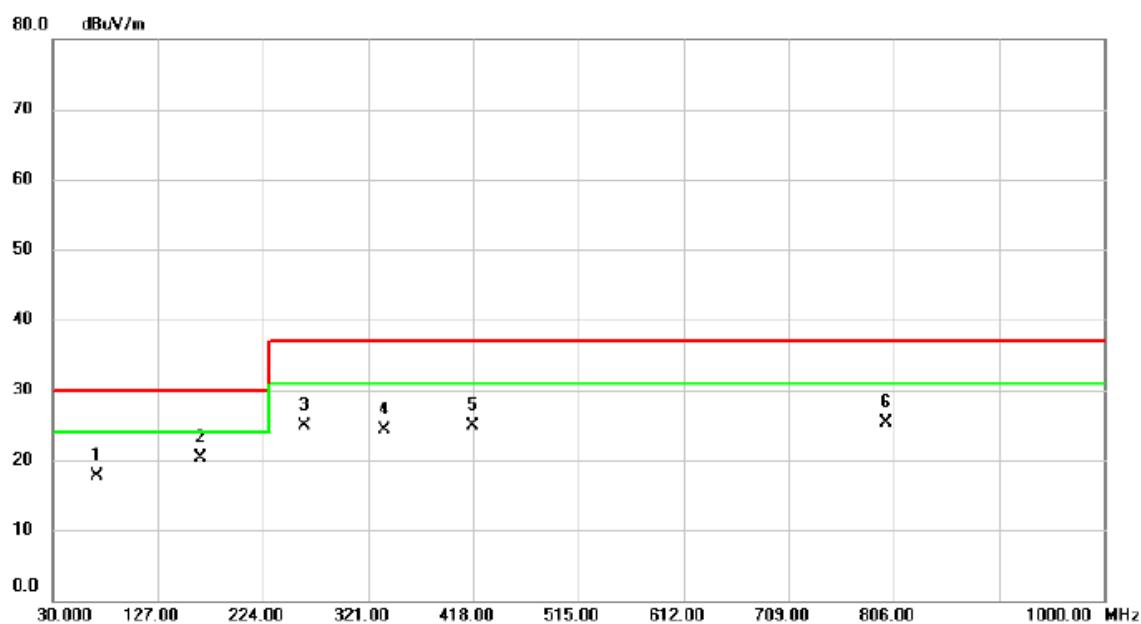
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB	Detector	Comment
1	!	72.6800	45.48	-20.45	25.03	30.00	-4.97	QP
2	!	108.5275	43.83	-18.74	25.09	30.00	-4.91	QP
3	*	166.7700	41.95	-16.31	25.64	30.00	-4.36	QP
4		336.0350	30.81	-9.69	21.12	37.00	-15.88	QP
5		798.2400	29.91	-1.08	28.83	37.00	-8.17	QP
6	!	890.2775	30.87	0.66	31.53	37.00	-5.47	QP

Test Voltage:	AC 230V/50Hz
Test Mode:	OPERATING

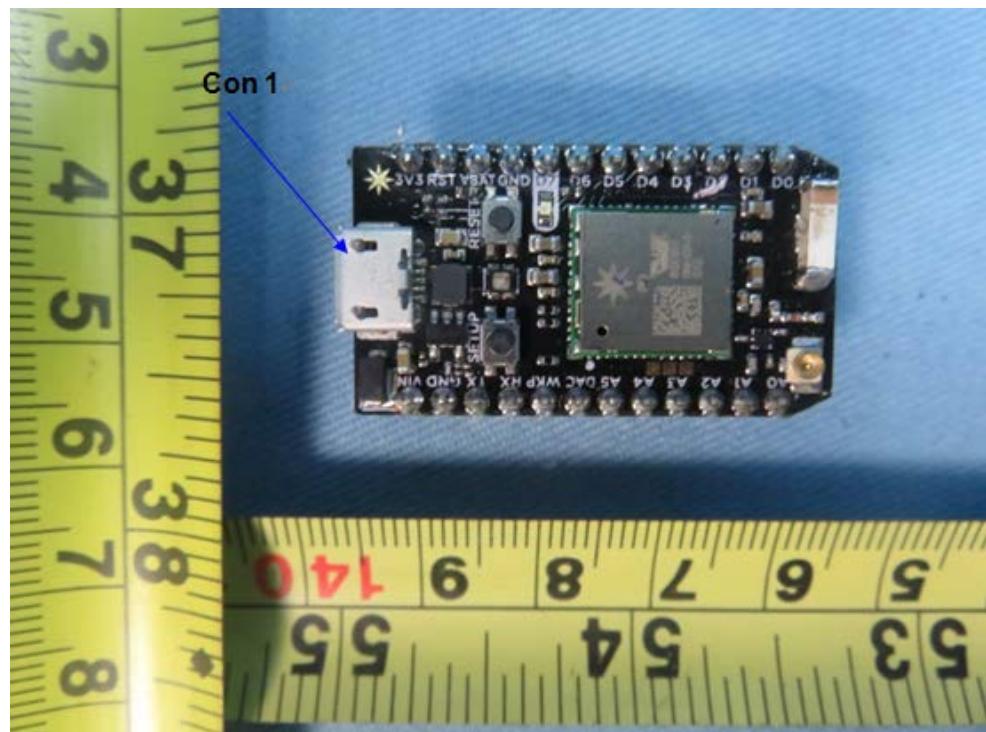
Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB	Margin Detector	Comment
1		71.2250	38.02	-20.40	17.62	30.00	-12.38	QP
2	*	166.2850	36.59	-16.31	20.28	30.00	-9.72	QP
3		262.3150	37.12	-12.26	24.86	37.00	-12.14	QP
4		336.0350	34.01	-9.69	24.32	37.00	-12.68	QP
5		417.0300	32.91	-8.04	24.87	37.00	-12.13	QP
6		798.2400	26.39	-1.08	25.31	37.00	-11.69	QP

ATTACHMENT C - RADIATED EMISSION (ABOVE 1000MHZ)

ATTACHMENT D - ESD

PHOTO(S) SHOWN THE LOCATION(S) OF ESD EVALUATED

ATTACHMENT E - RS

Test Voltage :	AC 230V/50Hz
Test Mode :	OPERATING

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Criteria	Results	Judgment
80 - 1000	V/H	3 V/m (unmodulated, r.m.s.) AM Modulated 1000Hz, 80%	0°	A	A	PASS
			90°			
			180°			
			270°			
1400 - 2700	V/H	3 V/m (unmodulated, r.m.s.) AM Modulated 1000Hz, 80%	0°	A	A	PASS
			90°			
			180°			
			270°			

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable to this device.
- 3) Criterion A: No observation of any performance degradation.
- 4) Criterion B: Some degradation of performance is observed but the equipment continues to operate as intended.
- 5) Criterion C: Loss of functionality, but self-recoverable by user, without loss of information or settings.

ATTACHMENT F - EFT/BURST

Test Voltage :	AC 230V/50Hz		
Test Mode :	OPERATING		

Mode	(V) AC Power Line		() DC Power Line		() Signal/Control Line	
Test Level	1kV		0.5kV		0.5kV	
Port(s)	Polarity	Results	Polarity	Results	Polarity	Results
Line (L)	P	A	P	-	P	-
	N	A	N	-	N	-
Neutral (N)	P	A	P	-	P	-
	N	A	N	-	N	-
Ground (PE)	P	A	P	-	P	-
	N	A	N	-	N	-
Signal/Control Line(N/A)	P	-	P	-	P	-
	N	-	N	-	N	-
Criteria	B		B		B	
Result	A		N/A		N/A	
Judgment	PASS		N/A		N/A	

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable to this device
- 3) Criterion A: No observation of any performance degradation.
- 4) Criterion B: Some degradation of performance is observed but the equipment continues to operate as intended.
- 5) Criterion C: Loss of functionality, but self-recoverable by user, without loss of information or settings.

ATTACHMENT G - SURGE

ATTACHMENT H - INJECTION CURRENT

Test Voltage :	AC 230V/50Hz
Test Mode :	OPERATING

Test Ports (Mode)	Freq. Range MHz)	Field Strength	Criteria	Results	Judgment
Input/ Output AC. Power Port	0.15 ---80	3V(unmodulated, r.m.s.) AM Modulated 1000Hz, 80%	A	A	PASS
Input/ Output DC. Power Port	0.15 --- 80		A	N/A	N/A
Signal Line (N/A)	0.15 --- 80		A	N/A	N/A

Note:

- 1) N/A - denotes test is not applicable to this device.
- 2) Criterion A: No observation of any performance degradation.
- 3) Criterion B: Some degradation of performance is observed but the equipment continues to operate as intended.
- 4) Criterion C: Loss of functionality, but self-recoverable by user, without loss of information or settings.

ATTACHMENT I - VOLTAGE INTERRUPTION/DIPS

Test Voltage :	AC 230V/50Hz
Test Mode :	OPERATING

AC 230V/50Hz				
Voltage Residual	Cycles	Criteria	Results	Judgment
Voltage dip 0%	0.5	B	A	PASS
Voltage dip 0%	1	B	A	PASS
Voltage dip 70%	25	B	A	PASS
Voltage Interruption 0%	250	C	C	PASS

Note:

- 1). N/A - denotes test is not applicable to this device.
- 2) Criterion A: No observation of any performance degradation.
- 3) Criterion B: Some degradation of performance is observed but the equipment continues to operate as intended.
- 4) Criterion C: Loss of functionality, but self-recoverable by user, without loss of information or settings.
- 5) Voltage Interruption: 0% residual voltage for 250 cycle (at 50Hz)

ATTACHMENT

PHOTOGRAPHS OF EUT

