



CERTIFICATE OF COMPLIANCE

This is to certify that the equipment listed below was (were) tested in the BTL Laboratory and shown compliance with the applicable technical standard(s) according to the Radio Equipment Directive (RED) 2014/53/EU.

Equipment PHOTON

Model Name PHOTONH

Brand Name Particle

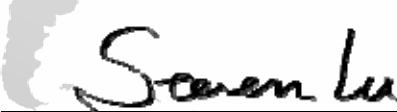
Applicant Particle Industries, Inc

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

Standard(s) EN 301 489-1 V2.2.0 (2017-03) Draft
EN 301 489-17 V3.2.0 (2017-03) Draft
EN 300 328 V2.1.1 (2016-11)
EN 62311: 2008

Report(s) BTL-ETSE-1-1504C213C
BTL-ETSP-1-1504C213C
BTL-ETSP-2-1504C213C

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.



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EN 301 489 Test Report

Project No. : 1504C213C
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, Jul. 03, 2017
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Jul. 03, 2017 ~ Jul. 18, 2017
Issued Date : Jul. 20, 2017
Tested by : BTL Inc.

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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> <p>(a) Replace the USB connection Encapsulation.</p> <p>(b) The model of the power controlling IC U2 changes from RT8008-3V3 to RT8059.</p> <p>(c) Add two 0201 resistances R9 and R10.</p> <p>(d) Add one 0201 capacitance C18.</p> <p>(e) change the resistor R4's encapsulation from 0402 to 0201.</p> <p>2. Layout changes</p> <p>All test results has been re-evaluated and recorded in the test report.</p>	Nov. 08, 2016
BTL-ETSE-1-1504C213C	<p>Compared with the previous report (BTL-ETSE-1-1504C213B), the standards are updated to the latest, only the EMI and RS have been re-evaluated and recorded in the test report.</p> <p>This test report only in valid when be combined with previous test report(s).</p>	Jul. 20, 2017

1. CERTIFICATION

Equipment : PHOTON
Brand Name : Particle
Model Name : PHOTONH
Applicant : Particle Industries, Inc
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Jul. 03, 2017 ~ Jul. 18, 2017
Test Sample : Engineering Sample
Standard(s) : EN 301 489-1 V2.2.0 (2017-03) Draft
EN 301 489-17 V3.2.0 (2017-03) Draft 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+AC :2015
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-1-1504C213C) 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 up to 1 GHz	Enclosure of ancillary equipment	EN 55032: 2015	Class B	PASS
	Radiated emission above 1 GHz			Class B	PASS NOTE (2)
8.3	Conducted emission	DC power input/output port	EN 55032: 2015	Not Applicable	N/A NOTE (1)
8.4		AC mains input/output port		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	Wired network port	AAN Current Probe CVP	Not Applicable	N/A NOTE (1)
				Not Applicable	N/A NOTE (1)
				Not Applicable	N/A NOTE (1)

NOTE:

- (1) "N/A" denotes test is not applicable to this device.
- (2) The EUT's max operating frequency is 2.4GHz which exceeds 108MHz, so the test will be performed.

(3)	Cable Type	Number of pairs	Measurement type	Procedures
	Balanced Unscreened	1 (2 wire), 2 (4 wire), 3 (6 wire), 4 (8 wire)	Voltage	AAN
	Balanced Unscreened	See a)	Voltage and Current	CP+CVP
	Screened or Coaxial	n/a	Voltage	AAN
	Screened or Coaxial	n/a	Voltage or Current	CP or CVP
	Unbalanced cables	n/a	Voltage and Current	CP+CVP

Ports connected to cables with more than 4 balanced pairs or where the port is unable to function correctly when connected through an AAN.

- (4) The requirement followed by the client's specification.

EN 301 489-1 / EN 301 489-17, Immunity					
Clause	Phenomenon	Application	Basic Standard or Test Method	Limit	Judgment
9.2	Radio frequency electromagnetic field (80 MHz to 6000 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	Radio frequency, common mode 0.15 MHz to 80 MHz	Signal, telecommunication and control ports, DC and AC power ports	EN 61000-4-6: 2014+AC: 2015	A (CT,CR)	PASS
9.6	Transients and surges in the vehicular environment	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 (2)
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) 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
- (3) For the performance criteria for Transient phenomena applied to Transmitter (TT) and Receiver (TR)
- (4) For the performance criteria for Continuous phenomena applied to Transmitter (CT) and Receiver (CR).
- (5) The requirement followed by the client's specification.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, China.

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	$U,(\text{dB})$
DG-C01	CISPR	150 kHz ~ 30MHz	3.16

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	Ant. H / V	$U,(\text{dB})$
DG-CB08 (10m)	CISPR	30MHz ~ 200MHz	V	4.66
		30MHz ~ 200MHz	H	4.64
		200MHz ~ 1,000MHz	V	4.88
		200MHz ~ 1,000MHz	H	4.86

Test Site	Method	Measurement Frequency Range	$U,(\text{dB})$
DG-CB08 (3m)	CISPR	1 ~ 6 GHz	4.26
		6 ~ 18 GHz	5.30

C. Harmonic/ Flicker Measurement:

Test Site	Method	Test Item	$U,(\%)$
C01	EN 61000-3-2 EN 61000-3-3	Voltage	0.774
		Current	0.782

D. 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

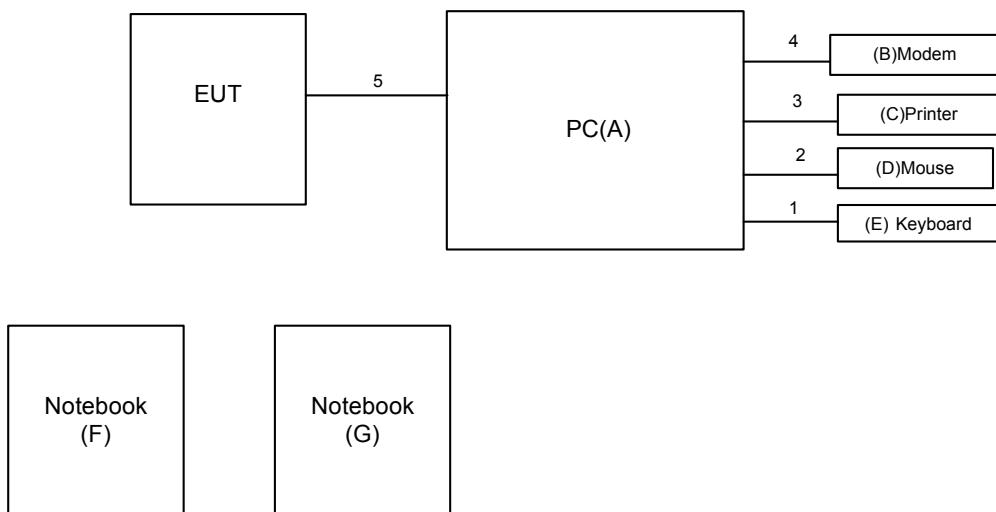
For EMS Test	
Final Test Mode	Description
1	OPERATING

3.3 EUT OPERATING CONDITIONS

The EUT exercise program used during radiated and/or conducted emission measurement was designed to exercise the various system components in a manner similar to a typical use. The standard test signals and output signal as following:

1. EUT Connected to PC via USB cable.
2. PC Connected to Modem via RS232 cable.
3. PC Connected to Printer via Parallel cable.
4. PC Connected to Mouse& Keyboard via USB cable.
5. EUT Connected to Notebook via WIFI function.

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF RADIATION EMISSION TEST



3.5 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

4. EMC EMISSION TEST

4.1 RADIATED EMISSION

4.1.1 LIMITS

Class A equipment up to 1000MHz

Table clause	Frequency range MHz	Measurement			Class A limits dB(µV/m)	
		Facility see Table A.1)	Distance m	Detector type/ bandwidth		
A2.1	30-230	OATS/SAC	10	Quasi peak / 120 kHz	40	
	230-1000				47	
A2.2	30-230	OATS/SAC	3		50	
	230-1000				57	
A2.3	30-230	FA	10	Quasi peak / 120 kHz	42 to 35	
	230-1000				42	
A2.4	30-230	FAR	3		52 to 45	
	230-1000				52	

Apply only A2.1 or A2.2 or A2.3 or A2.4 across the entire frequency range.

Class A equipment above 1000MHz

Table clause	Frequency range MHz	Measurement			Class A limits dB(µV/m)
		Facility (see Table A.1)	Distance m	Detector type/bandwidth	
A3.1	1000-3000	FSOATS	3	Average / 1 MHz	56
	3000-6000				60
A3.2	1000-3000			Peak / 1 MHz	76
	3000-6000				80

Apply A3.1 and A3.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1.

Class B equipment up to 1000MHz

Table clause	Frequency range MHz	Measurement			Class B limits dB(μV/m)	
		Facility (see Table A.1)	Distance m	Detector type/ bandwidth		
A4.1	30-230	OATS/SAC	10	Quasi peak / 120 kHz	30	
	230-1000				37	
A4.2	30-230	OATS/SAC	3		40	
	230-1000				47	
A4.3	30-230	FAR	10	Quasi peak / 120 kHz	32 to 25	
	230-1000				32	
A4.4	30-230	FAR	3		42 to 35	
	230-1000				42	

Apply only table clause A4.1 or A4.2 or A4.3 or A4.4 across the entire frequency range.
These requirements are not applicable to the local oscillator and harmonics frequencies of equipment covered by Table A.6.

Class B equipment above 1000MHz

Table clause	Frequency range MHz	Measurement			Class B limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type/bandwidth	
A5.1	1000-3000	FSOATS	3	Average / 1 MHz	50
	3000-6000				54
A5.2	1000-3000			Peak / 1 MHz	70
	3000-6000				74

Apply A5.1 and A5.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1.

Notes:

(1) The limit for radiated test was performed according to as following: EN 55032
 (2) The tighter limit applies at the band edges.

(3) Emission level (dB_{UV}/m)=20log Emission level (uV/m).

(4) The test result calculated as following:

Measurement Value = Reading Level + Correct Factor

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)

Margin Level = Measurement Value - Limit Value

Required highest frequency for radiated measurement

Highest internal frequency (F_x) MHz	Highest measured frequency MHz
$F_x \leq 108$	1000
$108 < F_x \leq 500$	2000
$500 < F_x \leq 1000$	5000
$F_x > 1000$	5 th up to a maximum 6 GHz,

Note for FM and TV broadcast receiver, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

4.1.2 TEST PROCEDURE

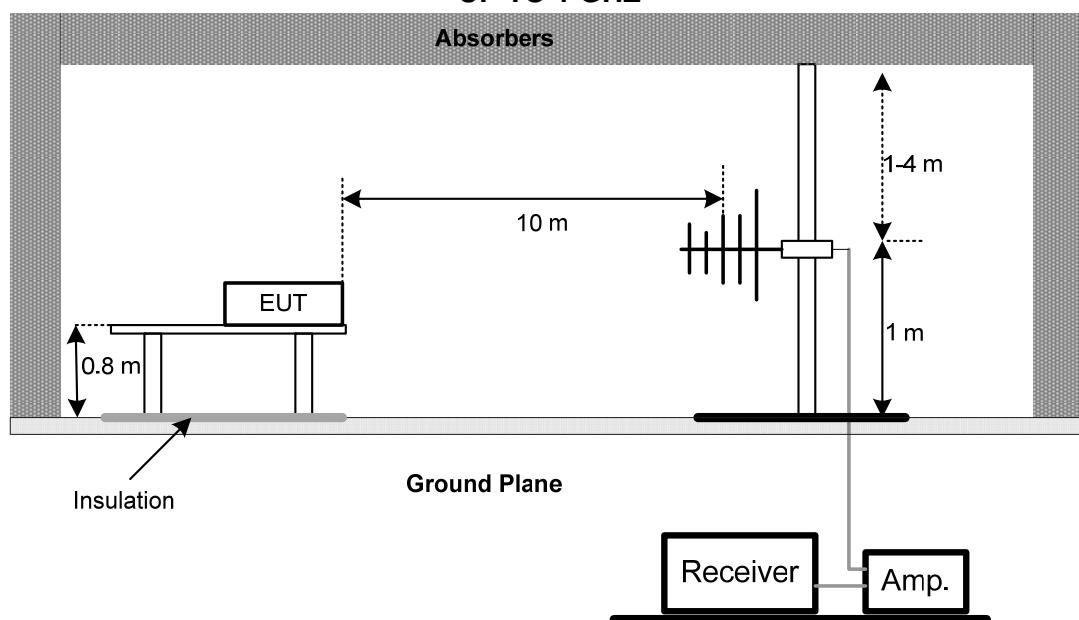
- The measuring distance of 10 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz).
- The measuring distance 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)
- 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.
- 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.
- 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)
- 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)
- For the actual test configuration, please refer to the related Item - Block Diagram of system tested (please refer to 3.4).

4.1.3 DEVIATION FROM TEST STANDARD

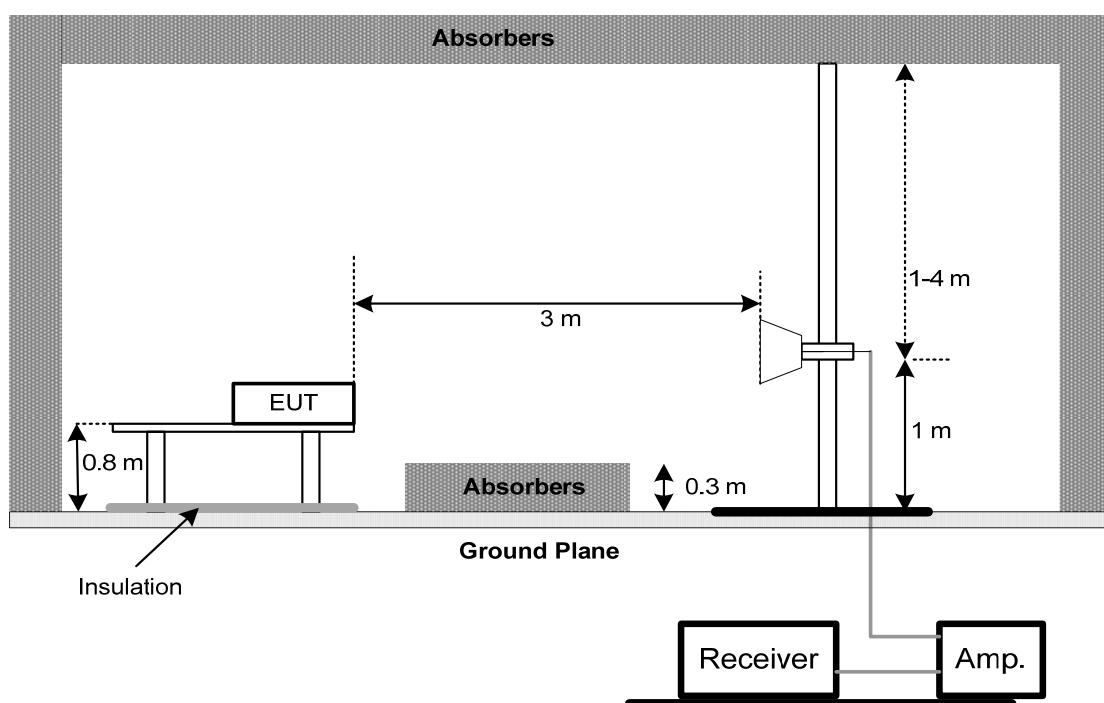
No deviation

4.1.4 TEST SETUP

UP TO 1 GHZ

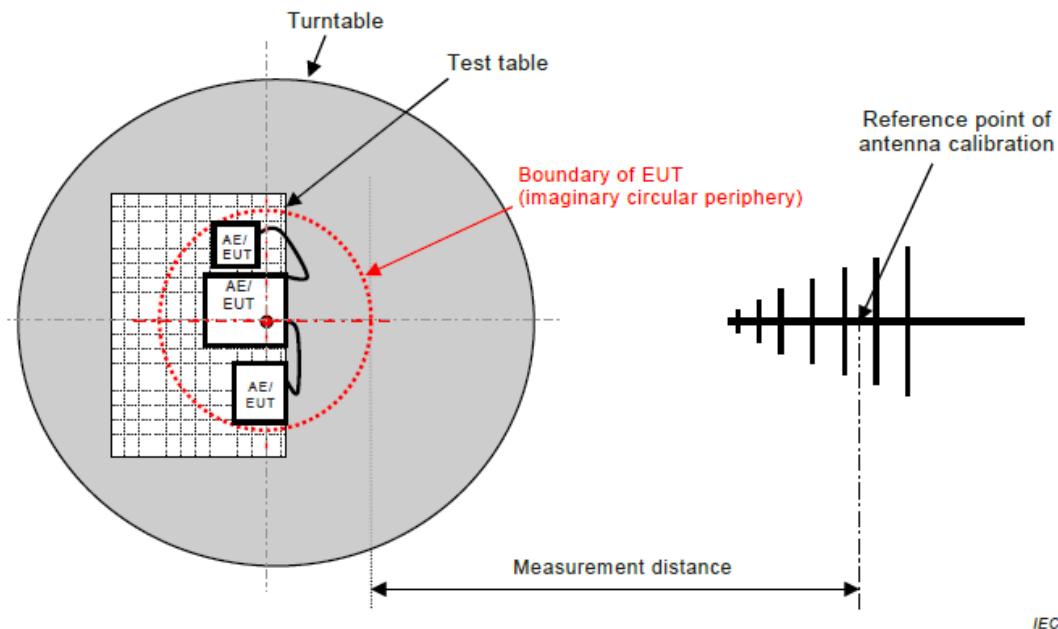


ABOVE 1 GHZ



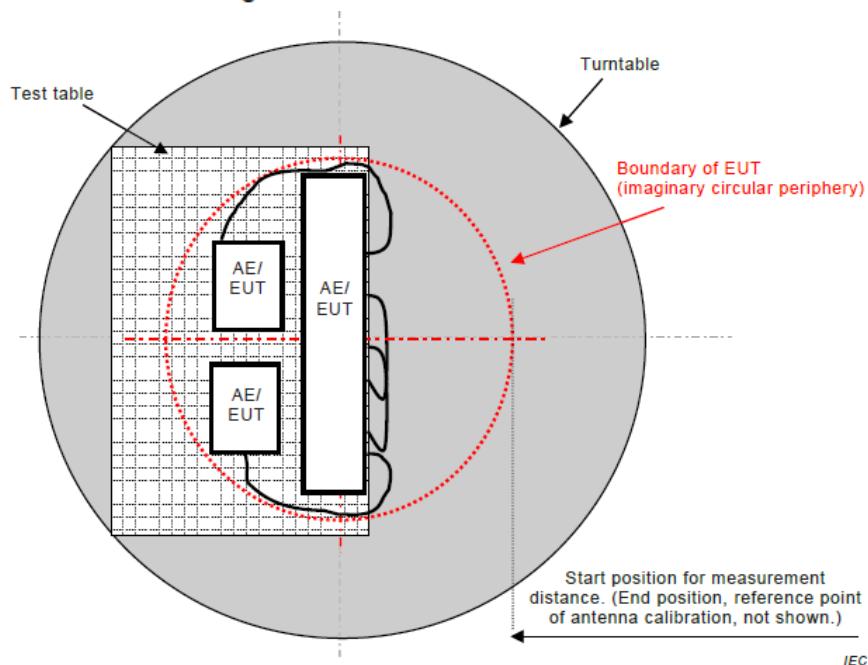
Note: The antenna can be moved between 1 to 4 meters above the ground.

4.1.5 MEASUREMENT DISTANCE



IEC

Figure C.1 – Measurement distance



IEC

Figure C.2 – Boundary of EUT, Local AE and associated cabling

4.1.6 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 53%

4.1.7 TEST RESULTS (UP TO 1 GHZ)

Please refer to the Attachment A.

4.1.8 TEST RESULTS (ABOVE 1 GHZ)

Please refer to the Attachment B.

4.2 CONDUCTED EMISSIONS AT AC MANIS POWER PORT

4.2.1 LIMITS

Requirements for conducted emissions from AC mains power ports of Class A equipment

Table clause	Frequency Range MHz	Coupling Device	Detector Type / bandwidth	Class A Limits (dB(μV))
A9.1	0.15 - 0.5	AMN	Quasi Peak / 9 kHz	79
	0.5 - 30			73
A9.2	0.15 - 0.5	AMN	Average / 9 kHz	66
	0.5 - 30			60

Apply A9.1 and A9.2 across the entire frequency range.

Requirements for conducted emissions from AC mains power ports of Class B equipment

Table clause	Frequency Range MHz	Coupling Device	Detector Type / bandwidth	Class B Limits (dB(μV))
A10.1	0.15 - 0.5	AMN	Quasi Peak / 9 kHz	66-56
	0.5 - 5			56
	5 - 30			60
A10.2	0.15 - 0.5	AMN	Average / 9 kHz	56-46
	0.5 - 5			46
	5 - 30			50

Apply A10.1 and A10.2 across the entire frequency range.

NOTE:

- (1) 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

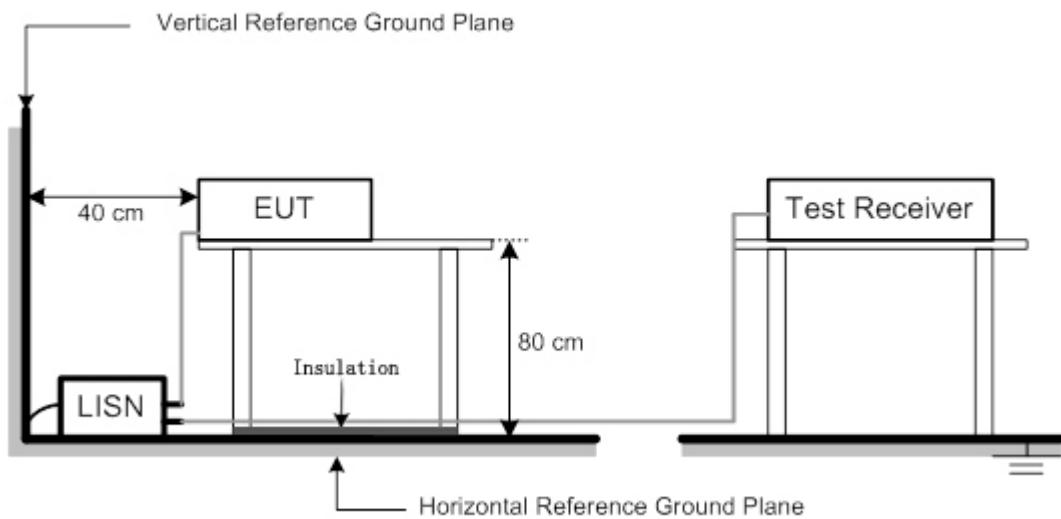
4.2.2 TEST PROCEDURE

- 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 equipment 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 - Block Diagram of system tested (please refer to 3.4).

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

4.2.4 TEST SETUP



4.2.5 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 60%

4.2.6 TEST RESULTS

Please refer to the Attachment C.

5. EMC IMMUNITY TEST

5.1 STANDARD COMPLIANCE/SEVERITY LEVEL/CRITERIA

Test Standard No.	Test Specification Level	Test Mode Test Port	Performance Criteria
Electrostatic discharge Clause 9.3 EN 61000-4-2 (ESD)	± 8 kV air discharge ± 4 kV contact discharge	Direct Mode	B
	± 4 kV HCP discharge ± 4 kV VCP discharge	Indirect Mode	B
Radio frequency electromagnetic Field Clause 9.2 EN 61000-4-3 (RS)	80 MHz to 6000 MHz 3 V/m (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM modulated (NOTE 1)	Enclosure	A
Fast transients, common mode Clause 9.4 EN 61000-4-4 (EFT)	± 1 kV(peak) 5/50 ns Tr/Th 5 kHz Repetition Frequency	AC mains power port	B
	±0.5 kV(peak) 5/50ns Tr/Th 5 kHz Repetition Frequency	DC power port (NOTE 2)	B
	± 0.5 kV(peak) 5/50 ns Tr/Th 5 kHz Repetition Frequency	Signal port, Wired network port, Control port (NOTE 2)	B
Surges, line to line and line to Ground Clause 9.8 EN 61000-4-5 (Surges)	±1 kV(5P/5N) 1.2/50(8/20) Tr/Th us (line to line)	AC mains power port	B
	± 2 kV(5P/5N) 1.2/50(8/20) Tr/Th us (line to earth or ground)		B
	±1 kV (5P/5N) 10/700 (5/320)Tr/Th us (symmetrically operated line to ground)	wired network ports (NOTE 3)	B
	±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us (non-symmetrically line to line)		
	±1 kV (5P/5N) 1.2/50(8/20) Tr/Th us (non-symmetrically line to ground, or shield to ground)		
	±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us (line to ground, or shield to ground)	wired network ports (NOTE 4)	

	0.15 MHz to 80 MHz 3 V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	AC Power Port	A
Radio frequency, common mode EN 61000-4-6 Clause 9.5 (CS)	0.15 MHz to 80 MHz 3 V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	DC Power Port (NOTE 2)	A
	0.15 MHz to 80 MHz 3V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	signal ports, wired network ports, control ports (NOTE 2)	A
Voltage dips and interruptions EN 61000-4-11 Clause 9.7 (Dips)	Voltage dip 0% Voltage dip 0% Voltage dip 70% Voltage Interruption 0%	AC Power Port	B B B B/C (NOTE 5)

NOTE:

- (1) If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used.
- (2) If the cables may be longer than 3 m.
- (3) Only for directly connected to outdoor cables.
- (4) Only for connected to indoor cables (longer than 30 m).
- (5) With battery back-up: Criteria B (TT,TR), without battery back-up: Criteria C.

5.2 GENERAL 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. (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 3). 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 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). 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 3).

NOTE 1: Operate as intended during the test allows a level of degradation 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: 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 3: 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

Clause:	9.3
Test Method:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	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.

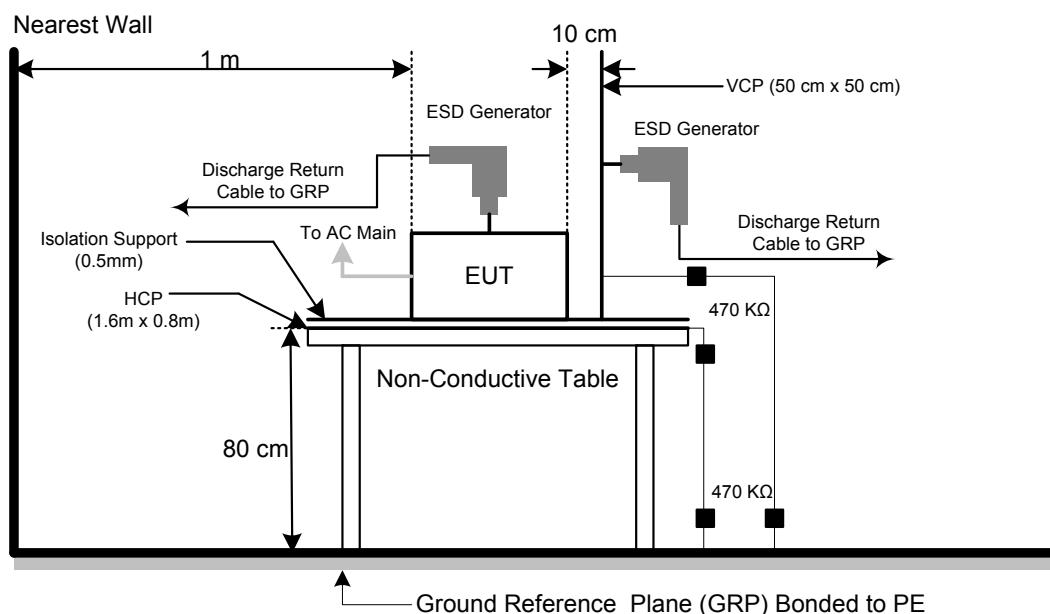
It was at least ten single discharges with positive and negative at the same selected point.

- 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

Clause:	9.2
Test Method:	EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 6000 MHz
Field Strength:	3 V/m (unmodulated, r.m.s)
Modulation:	1000 Hz Sine Wave, 80%, AM Modulation If the wanted signal is modulated at 1000 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:

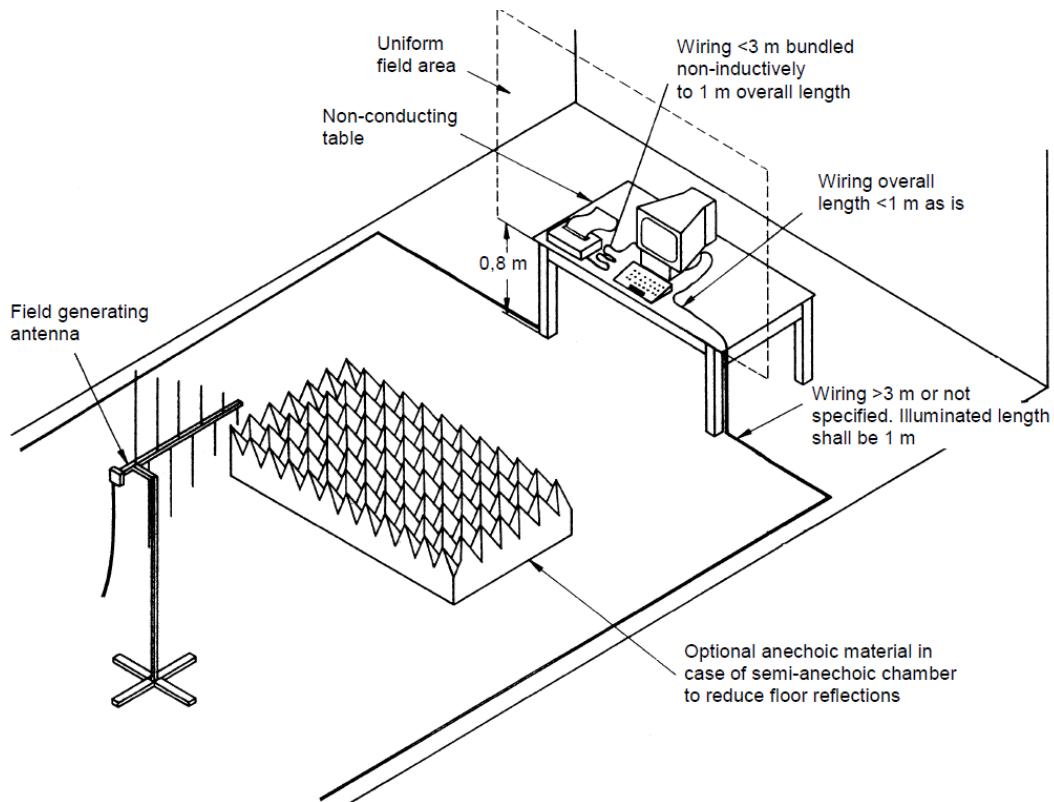
- a. The field strength level was 3 V/m (unmodulated, r.m.s).
- b. The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz. If the wanted signal is modulated at 1000 Hz, then an audio signal of 400 Hz shall be used,
The test shall be performed over the frequency range 80 MHz to 6000 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 exclusion band for immunity testing of equipment operating in the 2,4 GHz band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -120 MHz, i.e. 2280MHz;
 - Upper limit of exclusion band = highest allocated band edge frequency +120 MHz, i.e. 2603.5 MHz.
 The exclusion band for immunity testing of equipment operating in the 5 GHz Wi-Fi band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4880MHz;
 - Upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5995MHz.
 The exclusion band for immunity testing of equipment operating in the 5,8 GHz band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 5455 MHz;
 - As the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band Would be greater than this for the 5,8 GHz band. The above frequency shall also be regarded as the upper end of the test range.
- d. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

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

Clause:	9.4
Test Method:	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.

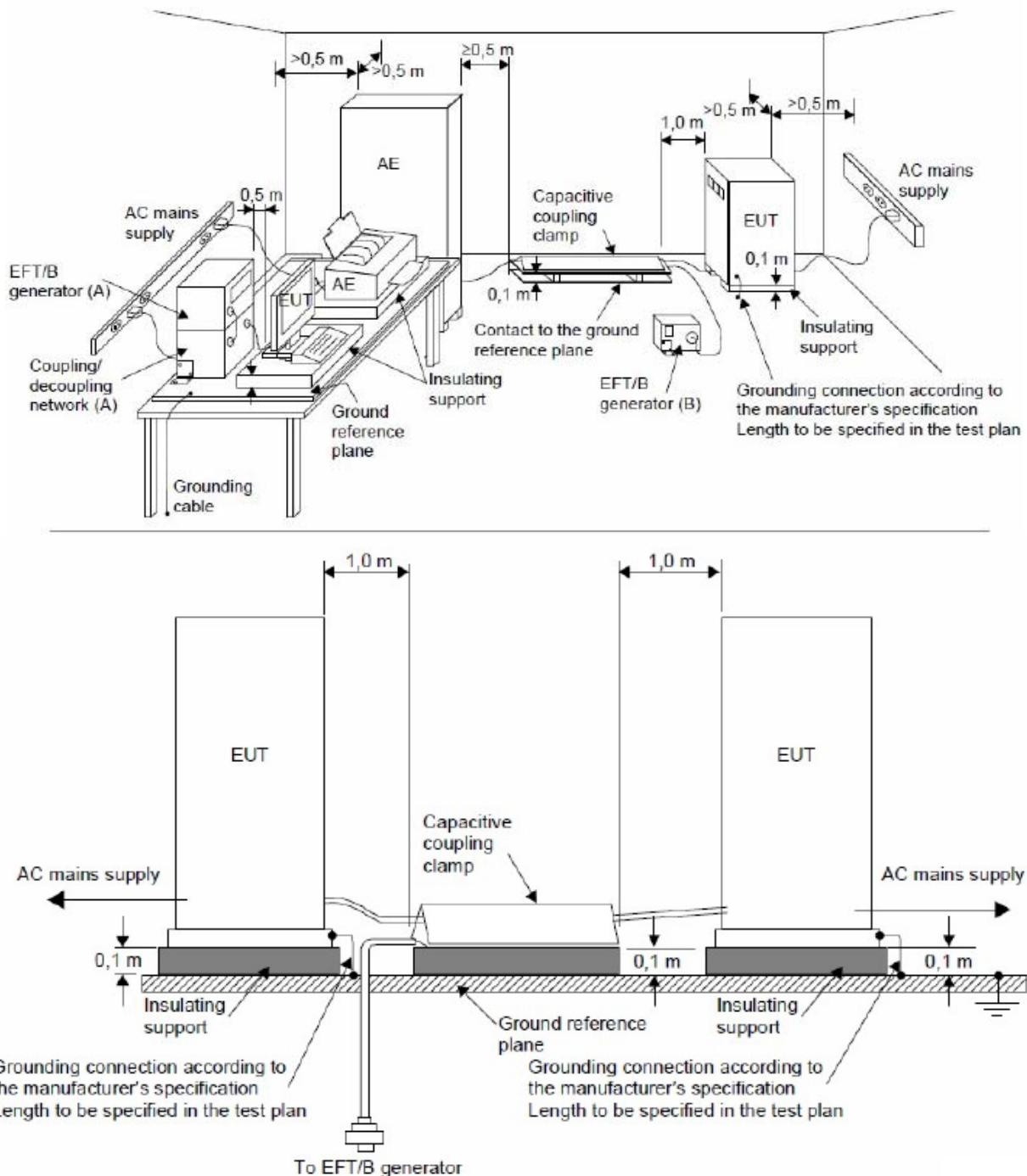
The other condition as following manner:

- 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

Clause:	9.8
Test Method:	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:

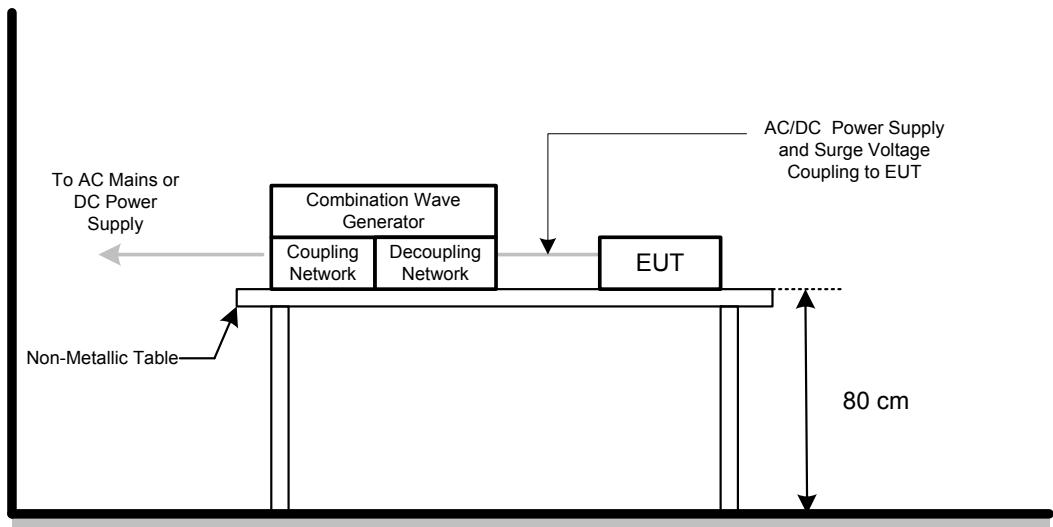
The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

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

Clause:	9.5
Test Method:	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 150 KHz 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;

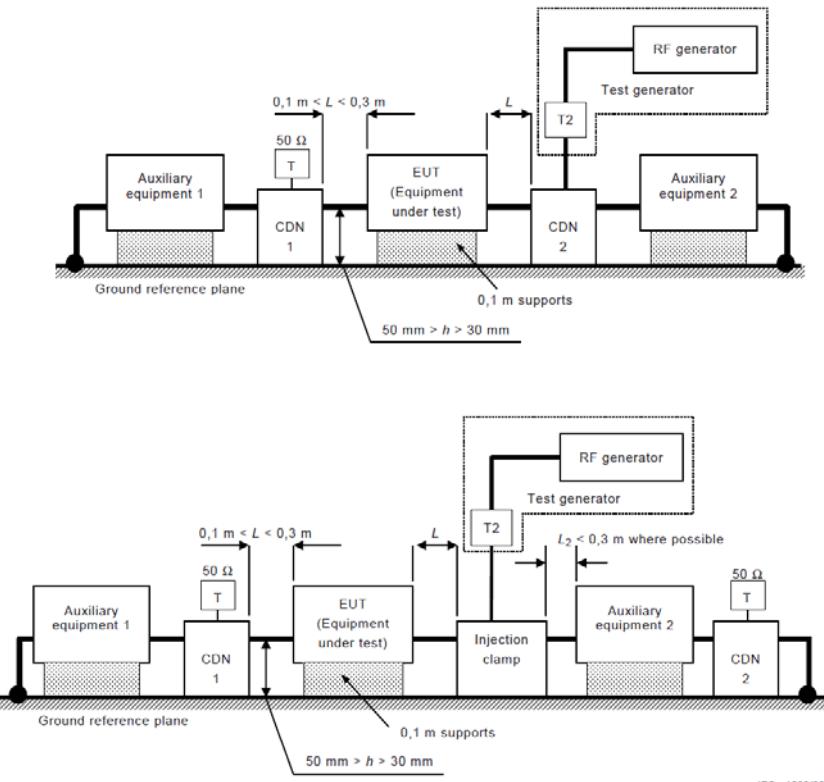
The test shall be performed over the frequency range 150 kHz to 80 MHz with the exception of an exclusion band for transmitters, and for receivers and duplex transceivers, (see clause 4); For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary 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.

5.8.3 DEVIATION FROM TEST STANDARD

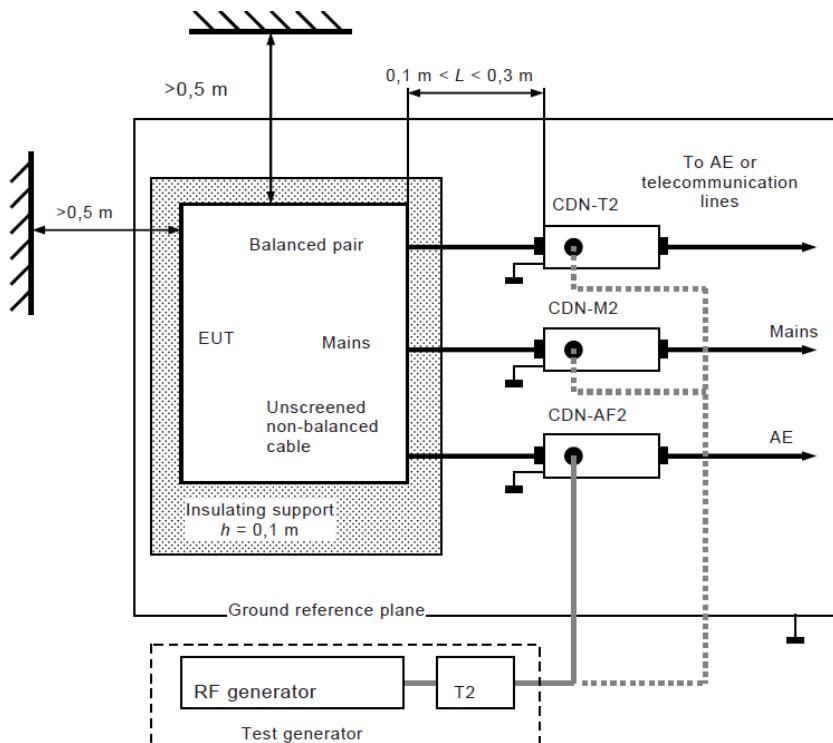
No deviation

5.8.4 TEST SETUP



IEC 1583/03

T : Termination 50Ω
 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

Clause:	9.7
Test Method:	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

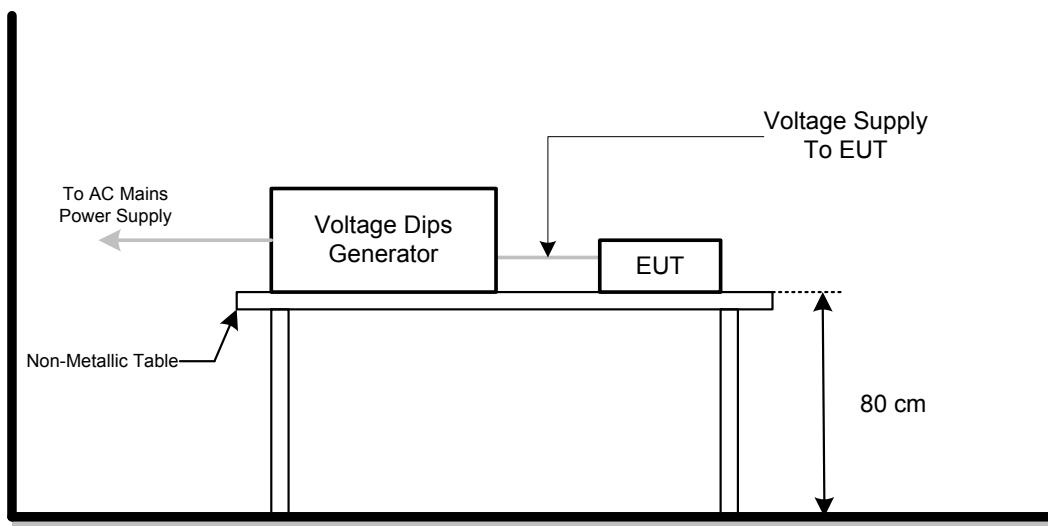
5.9.2 TEST PROCEDURE

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

Radiated emission up to 1GHz

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Attenuator	N/A	SA18N-06	6dB	Apr. 14, 2018
2	Receiver	Keysight	N9038A	MY54450004	Sep. 04, 2017
3	Pre-Amplifier	Mini-Circuits	EMC 9135	980284	Mar. 26, 2018
4	Pre-Amplifier	Mini-Circuits	EMC 9135	980283	Mar. 26, 2018
5	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	586	Mar. 26, 2018
6	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	587	Mar. 26, 2018
7	Cable	emci	LMR-400(5m+11m+15m)	N/A	Dec. 27, 2017
8	Cable	emci	LMR-400(5m+8m+15m)	N/A	Dec. 27, 2017
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

Radiated emission above 1GHz

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Horn Antenna	EMCO	3115	9605-4803	Mar. 26, 2018
2	Amplifier	Agilent	8449B	3008A02584	Sep. 04, 2017
3	Measurement Software	Farad	EZ-EMC Ver.BTL-2ANT-1	N/A	N/A
4	Cable	emci	SUCOFLEX_15m_5m(0.01GHz—26.5GHz)	N/A	Dec. 27, 2017
5	Multi-Device Controller	ETS-Lindgren	2090	N/A	N/A
6	Controller	MF	MF-7802	MF780208159	N/A

Conducted Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
2	50Ω Terminator	SHX	TF2-3G-A	08122901	Mar. 26, 2018
3	TWO-LINE V-NETWORK	R&S	ENV216	100526	Mar. 26, 2018
4	EMI Test Receiver	R&S	ESR3	101862	Sep. 04, 2017
5	Artificial-Mains Network	SCHWARZBECK	NSLK 8127	8127685	Sep. 04, 2017
6	Cable	N/A	RG400 12m	N/A	Mar. 07, 2018

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	Digital Signal Generator	HP	ESG-D3000A	US36260188	Mar. 26, 2018
2	Antenna	ETS	3142C	00047662	Mar. 26, 2018
3	Antenna	TESEQ	STLP 9149	9149-277	Mar. 27, 2019
4	Power amplifier	MILMEGA	AS1860-50	1064834	Nov. 02, 2017
5	Power amplifier	MILMEGA	80RF1000-250	N/A	Nov. 02, 2017
6	Amplifier	AR	50S1G4A	326720	Mar. 26, 2018
7	Measurement Software	TOYO	IM5/R Ver 3.8.050	N/A	N/A

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

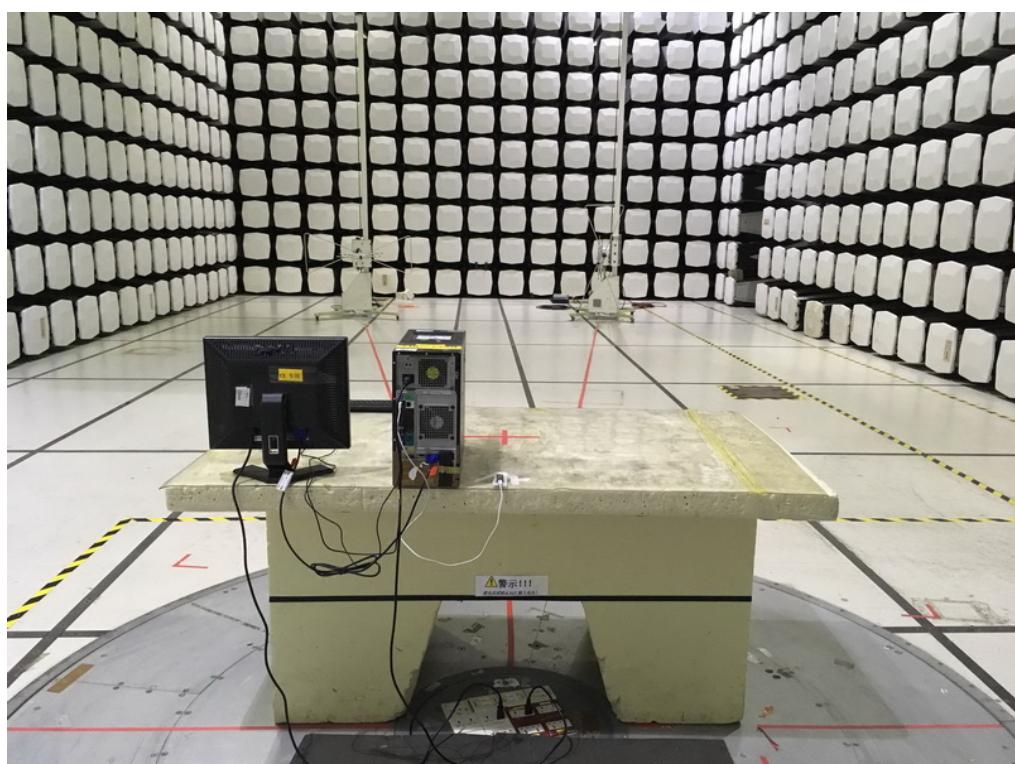
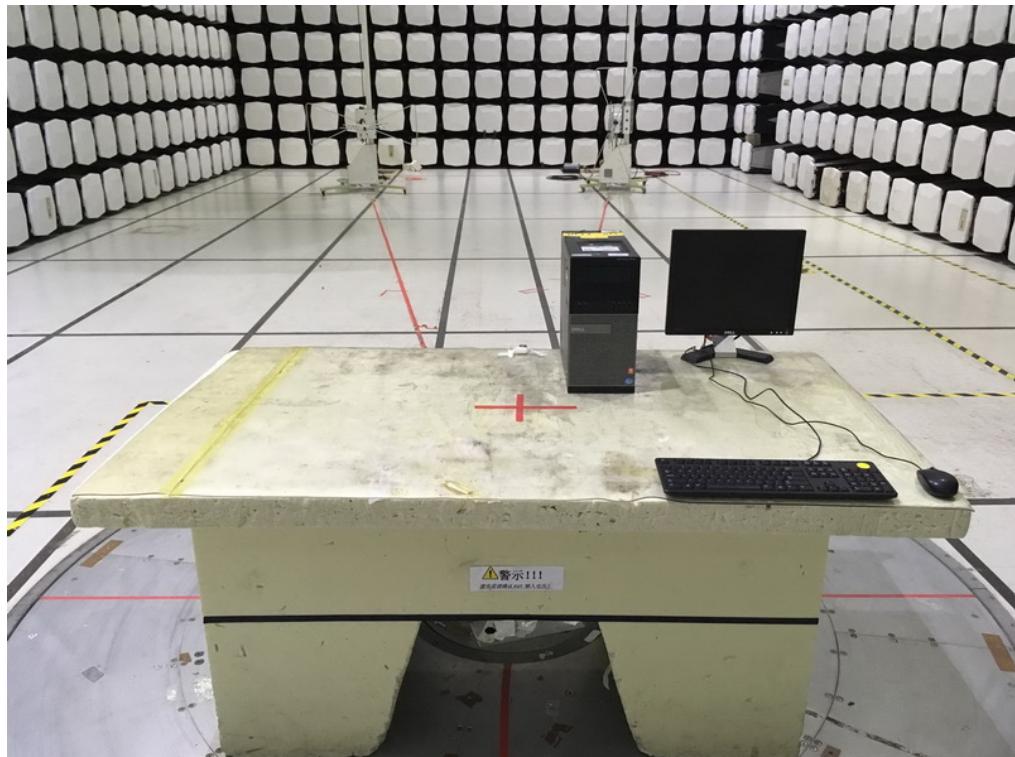
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
2	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A

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

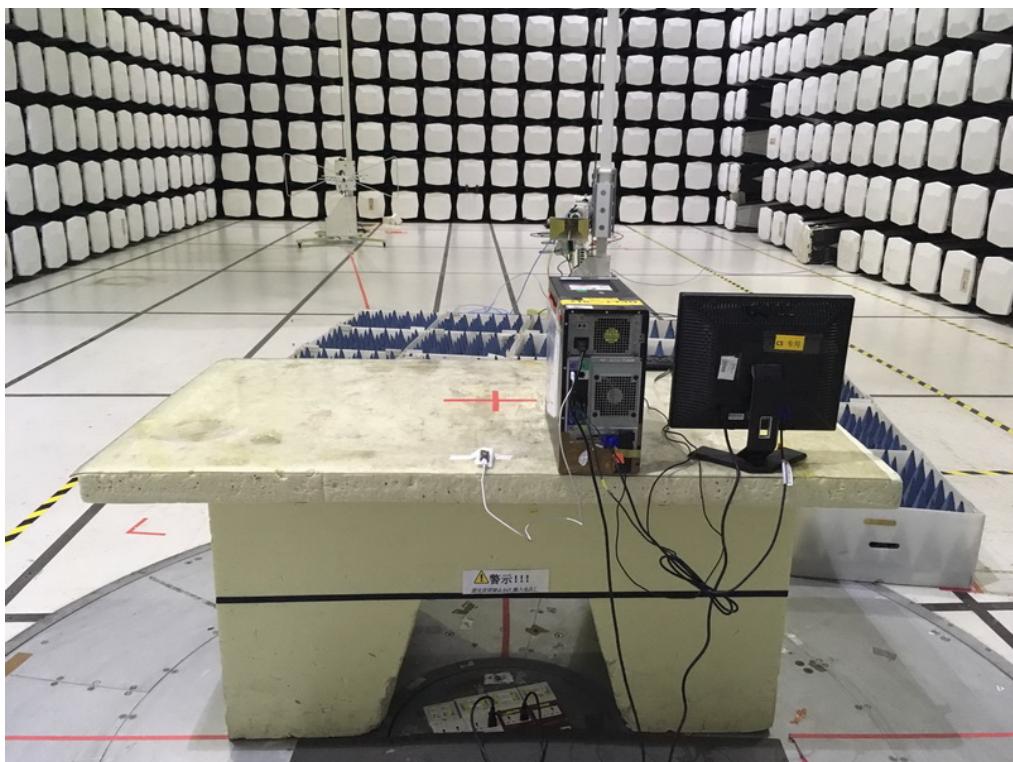
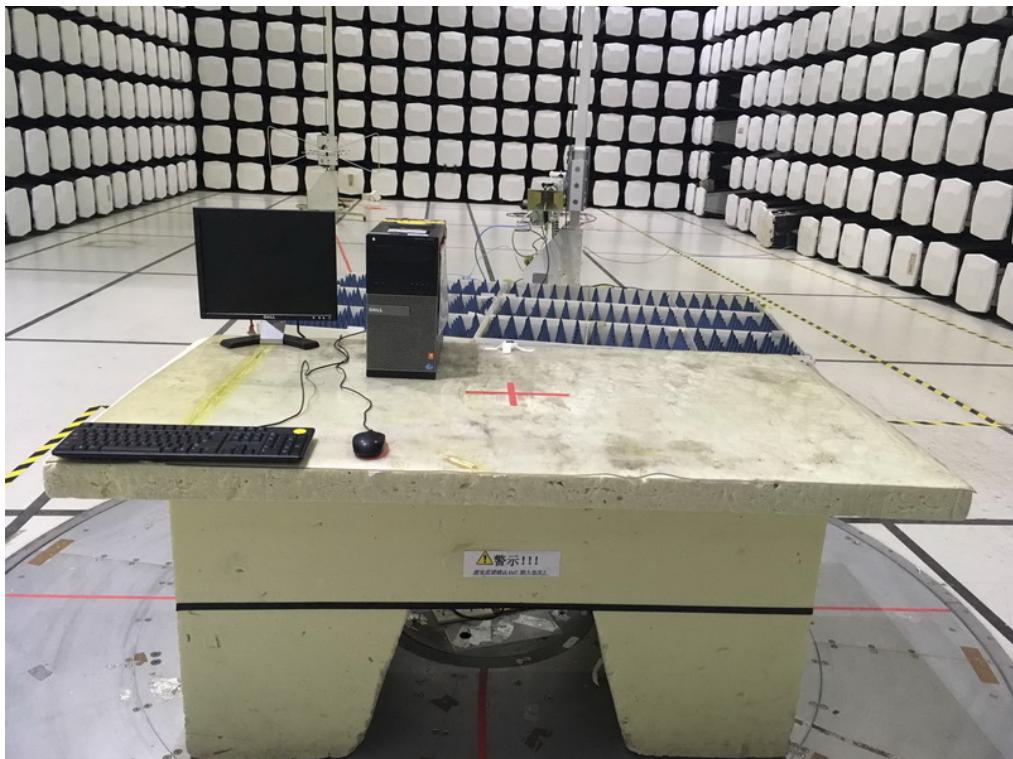
All calibration period of equipment list is one year.

7. EUT TEST PHOTO

Radiated emissions up to 1 GHz



Radiated emissions above 1 GHz



Conducted emissions AC mains power port

EMS Measurement Photos**ESD****RS - Below 1GHz**

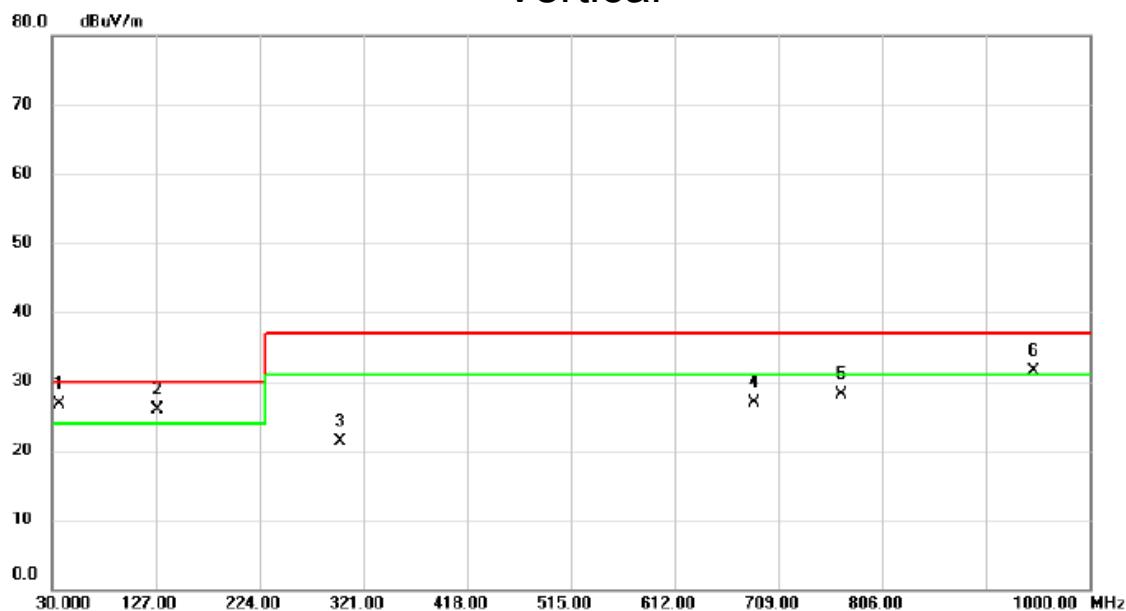
RS - Above 1GHz**EFT / Surge / Dip**

CS

ATTACHMENT A - RADIATED EMISSION UP TO 1GHZ

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

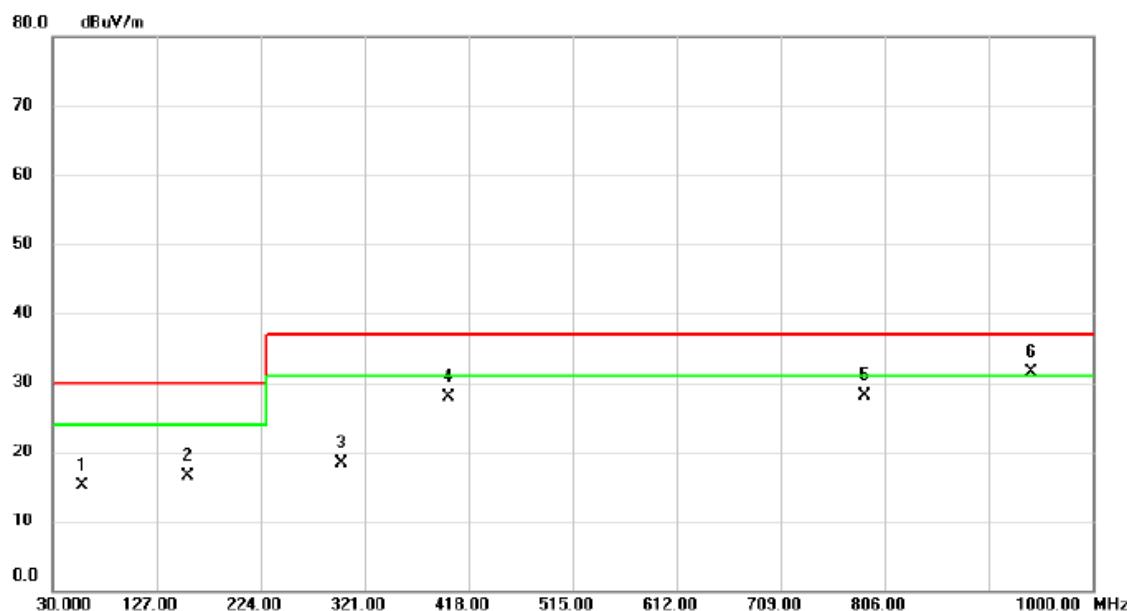
Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment Limit dBuV/m	Margin dB	Detector	Comment
1	*	36.7900	44.46	-17.78	26.68	30.00	-3.32	QP
2	!	128.9400	42.92	-17.07	25.85	30.00	-4.15	QP
3		299.6600	35.24	-13.98	21.26	37.00	-15.74	QP
4		685.7200	32.32	-5.45	26.87	37.00	-10.13	QP
5		767.6850	32.13	-3.94	28.19	37.00	-8.81	QP
6	!	947.6200	32.66	-1.23	31.43	37.00	-5.57	QP

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

Horizontal

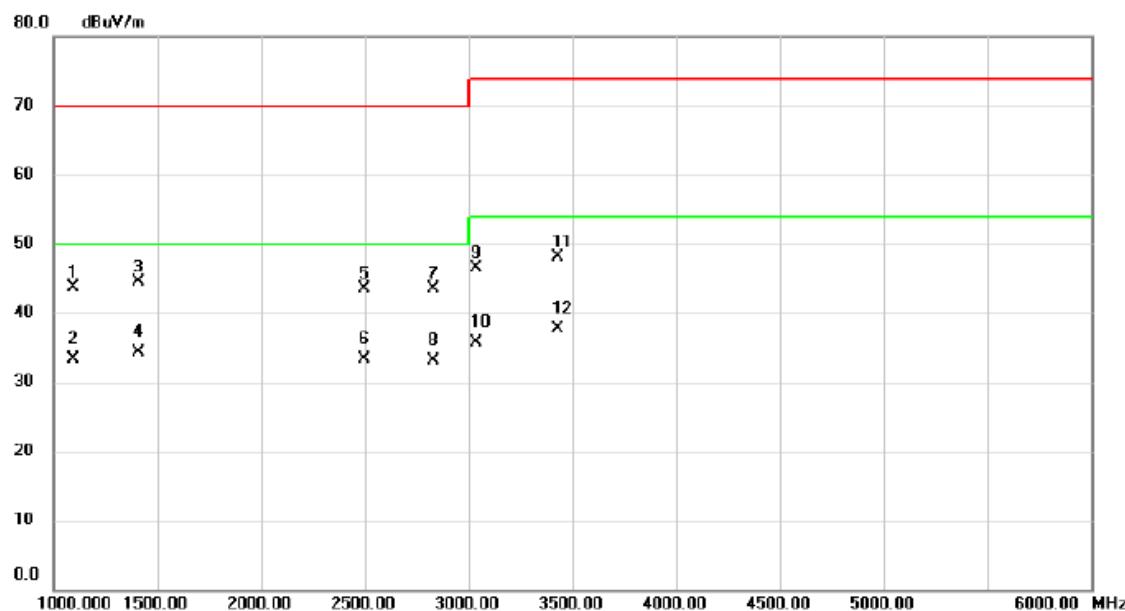


No.	Mk.	Freq. MHz	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level dBuV	Factor dB	mV/m				
1		57.1600	31.60	-16.44	15.16	30.00	-14.84	QP	
2		156.1000	31.55	-15.07	16.48	30.00	-13.52	QP	
3		299.6600	31.99	-13.63	18.36	37.00	-18.64	QP	
4		399.5700	38.89	-10.96	27.93	37.00	-9.07	QP	
5		787.5700	31.26	-3.11	28.15	37.00	-8.85	QP	
6	*	942.7700	32.06	-0.62	31.44	37.00	-5.56	QP	

ATTACHMENT B - RADIATED EMISSION ABOVE 1GHZ

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

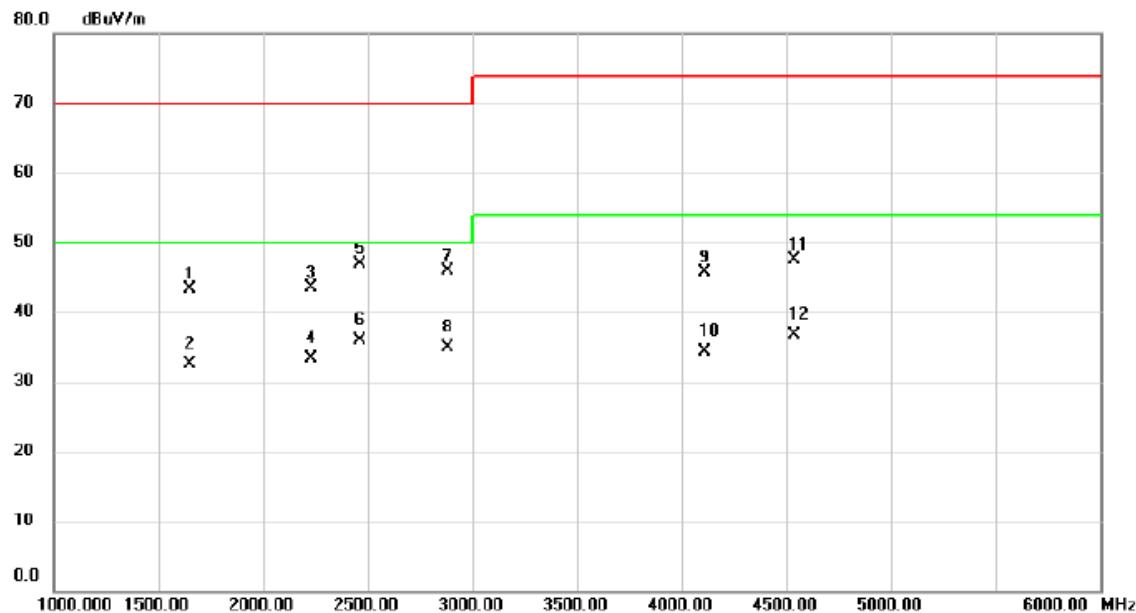
Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB	Margin	
							Detector	Comment
1		1095.000	48.33	-4.54	43.79	70.00	-26.21	peak
2		1095.000	37.79	-4.54	33.25	50.00	-16.75	AVG
3		1412.500	47.91	-3.50	44.41	70.00	-25.59	peak
4	*	1412.500	37.71	-3.50	34.21	50.00	-15.79	AVG
5		2497.500	43.27	0.25	43.52	70.00	-26.48	peak
6		2497.500	33.00	0.25	33.25	50.00	-16.75	AVG
7		2832.500	41.45	2.06	43.51	70.00	-26.49	peak
8		2832.500	30.96	2.06	33.02	50.00	-16.98	AVG
9		3037.500	43.56	3.00	46.56	74.00	-27.44	peak
10		3037.500	32.78	3.00	35.78	54.00	-18.22	AVG
11		3432.500	44.79	3.36	48.15	74.00	-25.85	peak
12		3432.500	34.28	3.36	37.64	54.00	-16.36	AVG

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

Horizontal

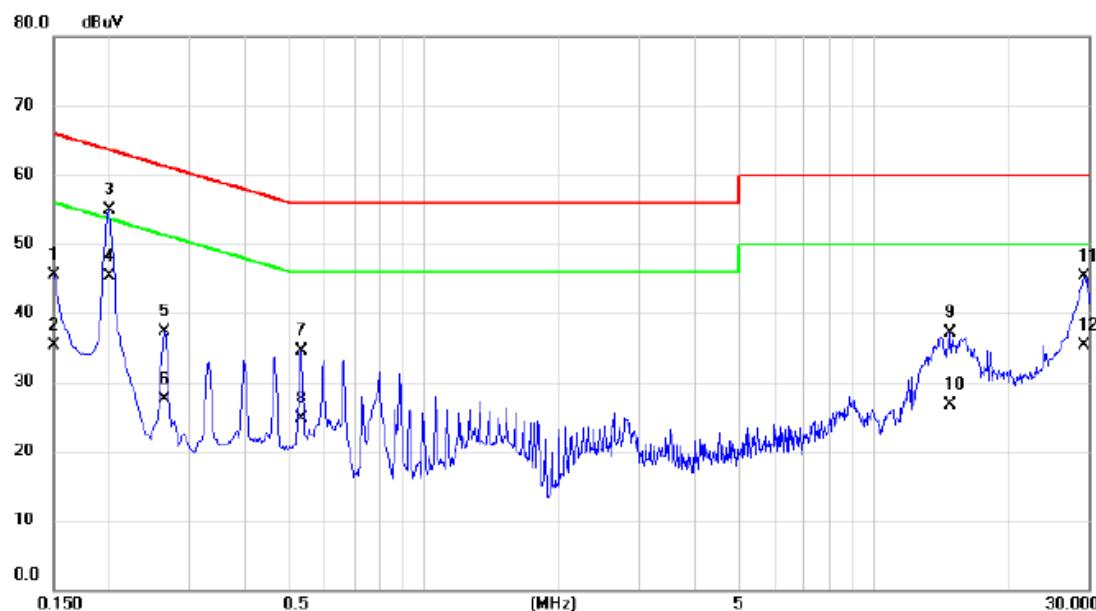


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1		1650.000	46.50	-3.26	43.24	70.00	-26.76	peak
2		1650.000	35.80	-3.26	32.54	50.00	-17.46	AVG
3		2227.500	45.30	-1.74	43.56	70.00	-26.44	peak
4		2227.500	34.98	-1.74	33.24	50.00	-16.76	AVG
5		2460.000	46.95	-0.02	46.93	70.00	-23.07	peak
6	*	2460.000	35.89	-0.02	35.87	50.00	-14.13	AVG
7		2882.500	43.55	2.33	45.88	70.00	-24.12	peak
8		2882.500	32.54	2.33	34.87	50.00	-15.13	AVG
9		4112.500	40.46	5.28	45.74	74.00	-28.26	peak
10		4112.500	29.07	5.28	34.35	54.00	-19.65	AVG
11		4537.500	42.38	5.17	47.55	74.00	-26.45	peak
12		4537.500	31.62	5.17	36.79	54.00	-17.21	AVG

ATTACHMENT C - CONDUCTED EMISSION

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

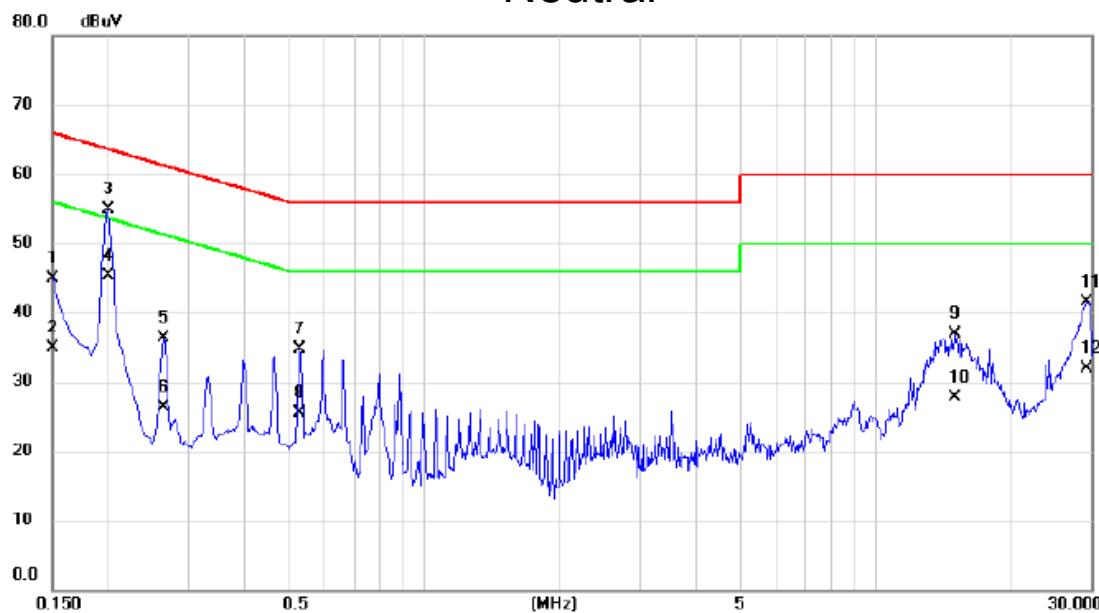
Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dB	Margin	Detector	Comment
1		0.1500	35.90	9.67	45.57	66.00	-20.43	QP	
2		0.1500	25.60	9.67	35.27	56.00	-20.73	AVG	
3		0.1995	45.25	9.69	54.94	63.63	-8.69	QP	
4	*	0.1995	35.70	9.69	45.39	53.63	-8.24	AVG	
5		0.2647	27.68	9.69	37.37	61.28	-23.91	QP	
6		0.2647	17.80	9.69	27.49	51.28	-23.79	AVG	
7		0.5325	24.80	9.74	34.54	56.00	-21.46	QP	
8		0.5325	14.90	9.74	24.64	46.00	-21.36	AVG	
9		14.7908	26.64	10.46	37.10	60.00	-22.90	QP	
10		14.7908	16.20	10.46	26.66	50.00	-23.34	AVG	
11		29.1840	34.27	11.05	45.32	60.00	-14.68	QP	
12		29.1840	24.30	11.05	35.35	50.00	-14.65	AVG	

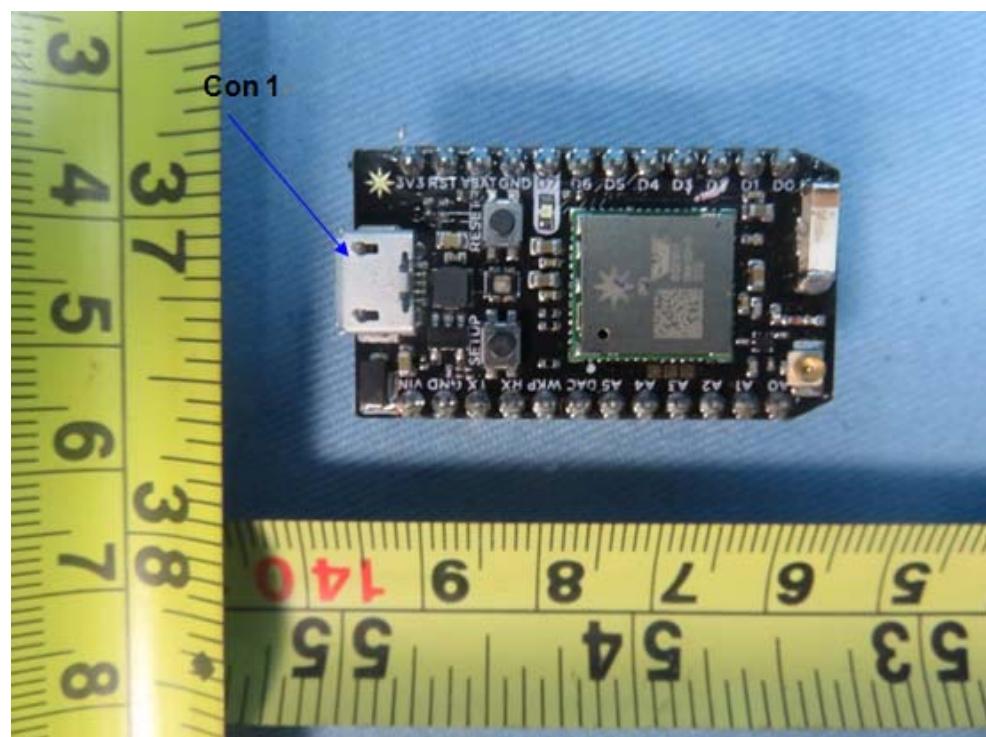
Test Voltage:	AC 230V/50Hz
Test Mode:	OPERATING

Neutral



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1500	35.22	9.66	44.88	66.00	-21.12	QP	
2		0.1500	25.30	9.66	34.96	56.00	-21.04	AVG	
3		0.1995	45.28	9.69	54.97	63.63	-8.66	QP	
4	*	0.1995	35.60	9.69	45.29	53.63	-8.34	AVG	
5		0.2647	26.68	9.68	36.36	61.28	-24.92	QP	
6		0.2647	16.70	9.68	26.38	51.28	-24.90	AVG	
7		0.5302	25.01	9.72	34.73	56.00	-21.27	QP	
8		0.5302	15.80	9.72	25.52	46.00	-20.48	AVG	
9		14.9865	26.26	10.56	36.82	60.00	-23.18	QP	
10		14.9865	17.20	10.56	27.76	50.00	-22.24	AVG	
11		29.2470	30.29	11.31	41.60	60.00	-18.40	QP	
12		29.2470	20.50	11.31	31.81	50.00	-18.19	AVG	

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 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			
1000 - 3000	V/H	3 V/m (unmodulated, r.m.s) AM Modulated 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			
3000 - 6000	V/H	3 V/m (unmodulated, r.m.s) AM Modulated 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			

Note:

- 1) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

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) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

ATTACHMENT G - SURGE

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

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us					Criteria	Results	Judgment		
	Polarity	Phase	Voltage							
			0.5kV	1kV	1.5 kV	2 kV				
L - N	+	0°	A	A	-	-	B	A	PASS	
	-		A	A	-	-				
	+	90°	A	A	-	-				
	-		A	A	-	-				
	+	180°	A	A	-	-				
	-		A	A	-	-				
	+	270°	A	A	-	-				
	-		A	A	-	-				
L - PE	+	0°	A	A	A	A	B	A	PASS	
	-		A	A	A	A				
	+	90°	A	A	A	A				
	-		A	A	A	A				
	+	180°	A	A	A	A				
	-		A	A	A	A				
	+	270°	A	A	A	A				
	-		A	A	A	A				
N - PE	+	0°	A	A	A	A	B	A	PASS	
	-		A	A	A	A				
	+	90°	A	A	A	A				
	-		A	A	A	A				
	+	180°	A	A	A	A				
	-		A	A	A	A				
	+	270°	A	A	A	A				
	-		A	A	A	A				
Signal Line (N/A)	+	N/A	-	-	-	-	B	N/A	N/A	
	-		-	-	-	-				

Note:

- 1) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

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		A	A	PASS
Input/ Output DC. Power Port	0.15 --- 80	3V(unmodulated, r.m.s.) AM Modulated 1000Hz, 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) Performance Criteria please refer to clause 5.2.

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) Performance Criteria please refer to clause 5.2.



CERTIFICATE OF COMPLIANCE

This is to certify that the equipment listed below was (were) tested in the BTL Laboratory and shown compliance with the applicable technical standard(s) according to the Radio Equipment Directive (RED) 2014/53/EU.

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 V2.2.0 (2017-03) Draft
EN 301 489-17 V3.2.0 (2017-03) Draft
EN 300 328 V2.1.1 (2016-11)
EN 62311: 2008

Report(s) BTL-ETSE-1-1504C213C
BTL-ETSP-1-1504C213C
BTL-ETSP-2-1504C213C

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

Authorized Signatory

BTL INC.

No. 3, Jinshagang 1st Road, Shixia, Dalang Town,
Dongguan, Guangdong, China.
TEL:+86-769-8318-3000
FAX:+86-769-8319-6000



EN 301 489 Test Report

Project No. : 1504C213C
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, Jul. 03, 2017
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Jul. 03, 2017 ~ Jul. 18, 2017
Issued Date : Jul. 20, 2017
Tested by : BTL Inc.

Testing Engineer : _____
(Jason Yang)

Technical Manager : _____
(Bill Zhang)

Authorized Signatory : _____
(Steven Lu)

B T L I N C .

No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan,
Guangdong, China.

TEL: +86-769-8318-3000 FAX: +86-769-8319-6000



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).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

BTL's report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

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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> <p>(a) Replace the USB connection Encapsulation.</p> <p>(b) The model of the power controlling IC U2 changes from RT8008-3V3 to RT8059.</p> <p>(c) Add two 0201 resistances R9 and R10.</p> <p>(d) Add one 0201 capacitance C18.</p> <p>(e) change the resistor R4's encapsulation from 0402 to 0201.</p> <p>2. Layout changes</p> <p>All test results has been re-evaluated and recorded in the test report.</p>	Nov. 08, 2016
BTL-ETSE-1-1504C213C	<p>Compared with the previous report (BTL-ETSE-1-1504C213B), the standards are updated to the latest, only the EMI and RS have been re-evaluated and recorded in the test report.</p> <p>This test report only in valid when be combined with previous test report(s).</p>	Jul. 20, 2017

1. CERTIFICATION

Equipment : PHOTON
Brand Name : Particle
Model Name : PHOTONH
Applicant : Particle Industries, Inc
Date of Test : Aug. 29, 2016 ~ Oct. 31, 2016
Jul. 03, 2017 ~ Jul. 18, 2017
Test Sample : Engineering Sample
Standard(s) : EN 301 489-1 V2.2.0 (2017-03) Draft
EN 301 489-17 V3.2.0 (2017-03) Draft 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+AC :2015
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-1-1504C213C) 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 up to 1 GHz	Enclosure of ancillary equipment	EN 55032: 2015	Class B	PASS
	Radiated emission above 1 GHz			Class B	PASS NOTE (2)
8.3	Conducted emission	DC power input/output port	EN 55032: 2015	Not Applicable	N/A NOTE (1)
8.4		AC mains input/output port		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	Wired network port	AAN Current Probe CVP	Not Applicable	N/A NOTE (1)
				Not Applicable	N/A NOTE (1)
				Not Applicable	N/A NOTE (1)

NOTE:

- (1) "N/A" denotes test is not applicable to this device.
- (2) The EUT's max operating frequency is 2.4GHz which exceeds 108MHz, so the test will be performed.

(3)	Cable Type	Number of pairs	Measurement type	Procedures
	Balanced Unscreened	1 (2 wire), 2 (4 wire), 3 (6 wire), 4 (8 wire)	Voltage	AAN
	Balanced Unscreened	See a)	Voltage and Current	CP+CVP
	Screened or Coaxial	n/a	Voltage	AAN
	Screened or Coaxial	n/a	Voltage or Current	CP or CVP
	Unbalanced cables	n/a	Voltage and Current	CP+CVP

Ports connected to cables with more than 4 balanced pairs or where the port is unable to function correctly when connected through an AAN.

- (4) The requirement followed by the client's specification.

EN 301 489-1 / EN 301 489-17, Immunity					
Clause	Phenomenon	Application	Basic Standard or Test Method	Limit	Judgment
9.2	Radio frequency electromagnetic field (80 MHz to 6000 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	Radio frequency, common mode 0.15 MHz to 80 MHz	Signal, telecommunication and control ports, DC and AC power ports	EN 61000-4-6: 2014+AC: 2015	A (CT,CR)	PASS
9.6	Transients and surges in the vehicular environment	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 (2)
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) 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
- (3) For the performance criteria for Transient phenomena applied to Transmitter (TT) and Receiver (TR)
- (4) For the performance criteria for Continuous phenomena applied to Transmitter (CT) and Receiver (CR).
- (5) The requirement followed by the client's specification.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, China.

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	$U,(\text{dB})$
DG-C01	CISPR	150 kHz ~ 30MHz	3.16

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	Ant. H / V	$U,(\text{dB})$
DG-CB08 (10m)	CISPR	30MHz ~ 200MHz	V	4.66
		30MHz ~ 200MHz	H	4.64
		200MHz ~ 1,000MHz	V	4.88
		200MHz ~ 1,000MHz	H	4.86

Test Site	Method	Measurement Frequency Range	$U,(\text{dB})$
DG-CB08 (3m)	CISPR	1 ~ 6 GHz	4.26
		6 ~ 18 GHz	5.30

C. Harmonic/ Flicker Measurement:

Test Site	Method	Test Item	$U,(\%)$
C01	EN 61000-3-2 EN 61000-3-3	Voltage	0.774
		Current	0.782

D. 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

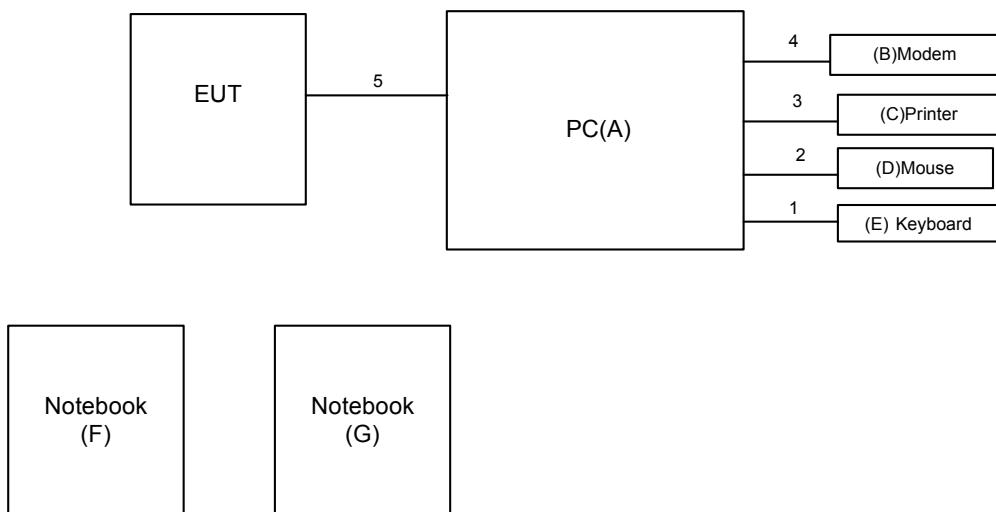
For EMS Test	
Final Test Mode	Description
1	OPERATING

3.3 EUT OPERATING CONDITIONS

The EUT exercise program used during radiated and/or conducted emission measurement was designed to exercise the various system components in a manner similar to a typical use. The standard test signals and output signal as following:

1. EUT Connected to PC via USB cable.
2. PC Connected to Modem via RS232 cable.
3. PC Connected to Printer via Parallel cable.
4. PC Connected to Mouse& Keyboard via USB cable.
5. EUT Connected to Notebook via WIFI function.

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF RADIATION EMISSION TEST



3.5 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

4. EMC EMISSION TEST

4.1 RADIATED EMISSION

4.1.1 LIMITS

Class A equipment up to 1000MHz

Table clause	Frequency range MHz	Measurement			Class A limits dB(µV/m)	
		Facility see Table A.1)	Distance m	Detector type/ bandwidth		
A2.1	30-230	OATS/SAC	10	Quasi peak / 120 kHz	40	
	230-1000				47	
A2.2	30-230	OATS/SAC	3		50	
	230-1000				57	
A2.3	30-230	FA	10	Quasi peak / 120 kHz	42 to 35	
	230-1000				42	
A2.4	30-230	FAR	3		52 to 45	
	230-1000				52	

Apply only A2.1 or A2.2 or A2.3 or A2.4 across the entire frequency range.

Class A equipment above 1000MHz

Table clause	Frequency range MHz	Measurement			Class A limits dB(µV/m)
		Facility (see Table A.1)	Distance m	Detector type/bandwidth	
A3.1	1000-3000	FSOATS	3	Average / 1 MHz	56
	3000-6000				60
A3.2	1000-3000			Peak / 1 MHz	76
	3000-6000				80

Apply A3.1 and A3.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1.

Class B equipment up to 1000MHz

Table clause	Frequency range MHz	Measurement			Class B limits dB(μV/m)	
		Facility (see Table A.1)	Distance m	Detector type/ bandwidth		
A4.1	30-230	OATS/SAC	10	Quasi peak / 120 kHz	30	
	230-1000				37	
A4.2	30-230	OATS/SAC	3		40	
	230-1000				47	
A4.3	30-230	FAR	10	Quasi peak / 120 kHz	32 to 25	
	230-1000				32	
A4.4	30-230	FAR	3		42 to 35	
	230-1000				42	

Apply only table clause A4.1 or A4.2 or A4.3 or A4.4 across the entire frequency range.
These requirements are not applicable to the local oscillator and harmonics frequencies of equipment covered by Table A.6.

Class B equipment above 1000MHz

Table clause	Frequency range MHz	Measurement			Class B limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type/bandwidth	
A5.1	1000-3000	FSOATS	3	Average / 1 MHz	50
	3000-6000				54
A5.2	1000-3000			Peak / 1 MHz	70
	3000-6000				74

Apply A5.1 and A5.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1.

Notes:

- (1) The limit for radiated test was performed according to as following: EN 55032
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dB_BV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
 Margin Level = Measurement Value - Limit Value

Required highest frequency for radiated measurement

Highest internal frequency (F_x) MHz	Highest measured frequency MHz
$F_x \leq 108$	1000
$108 < F_x \leq 500$	2000
$500 < F_x \leq 1000$	5000
$F_x > 1000$	5 th up to a maximum 6 GHz,

Note for FM and TV broadcast receiver, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

4.1.2 TEST PROCEDURE

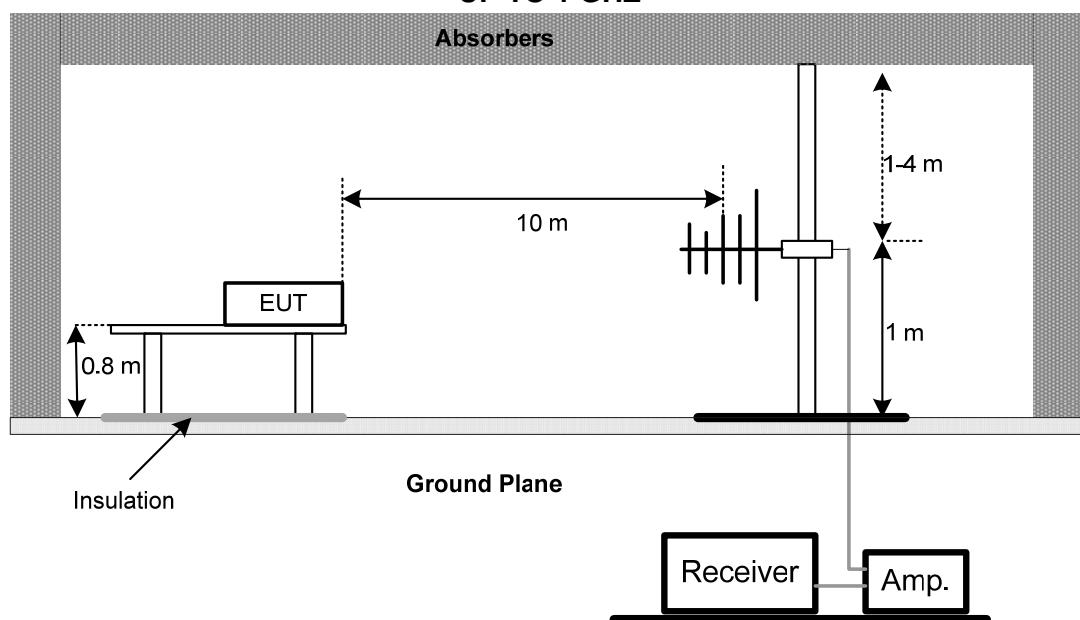
- The measuring distance of 10 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz).
- The measuring distance 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)
- 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.
- 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.
- 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)
- 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)
- For the actual test configuration, please refer to the related Item - Block Diagram of system tested (please refer to 3.4).

4.1.3 DEVIATION FROM TEST STANDARD

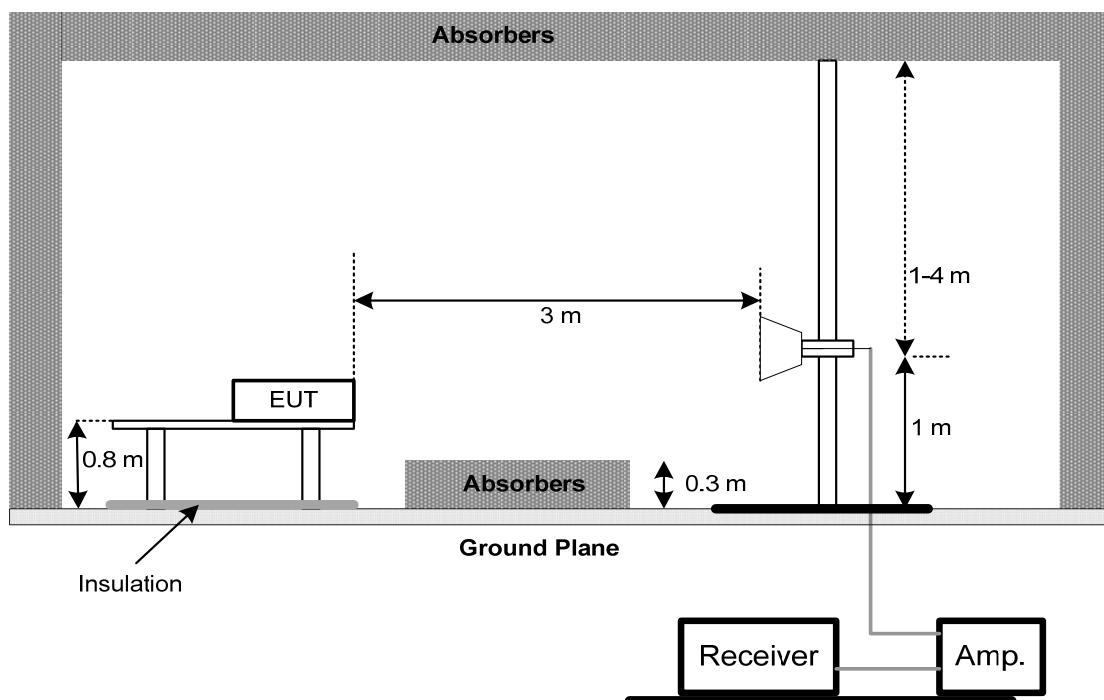
No deviation

4.1.4 TEST SETUP

UP TO 1 GHZ

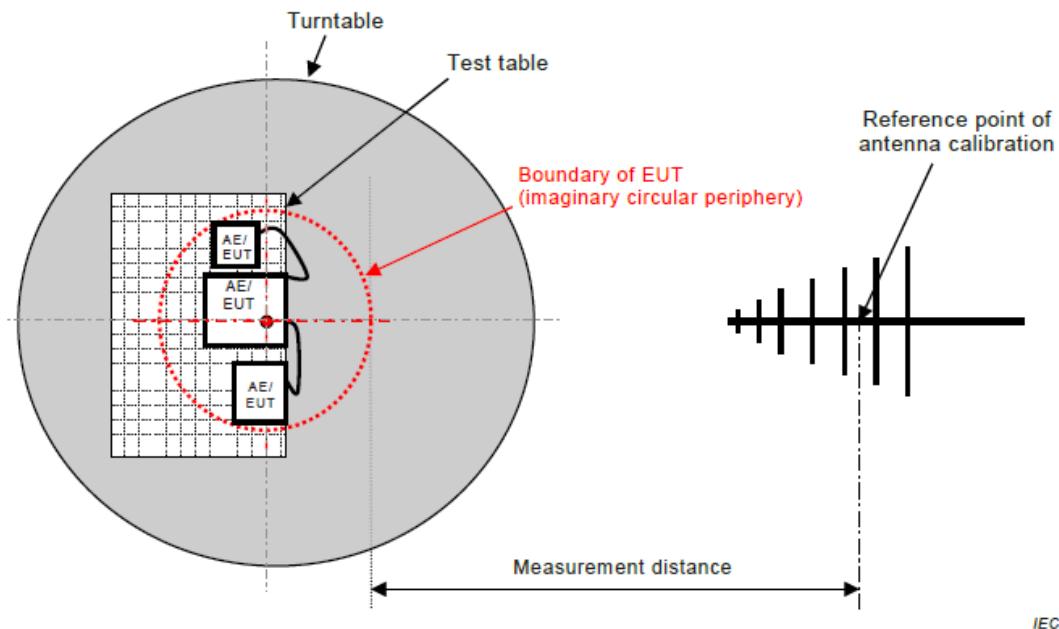


ABOVE 1 GHZ



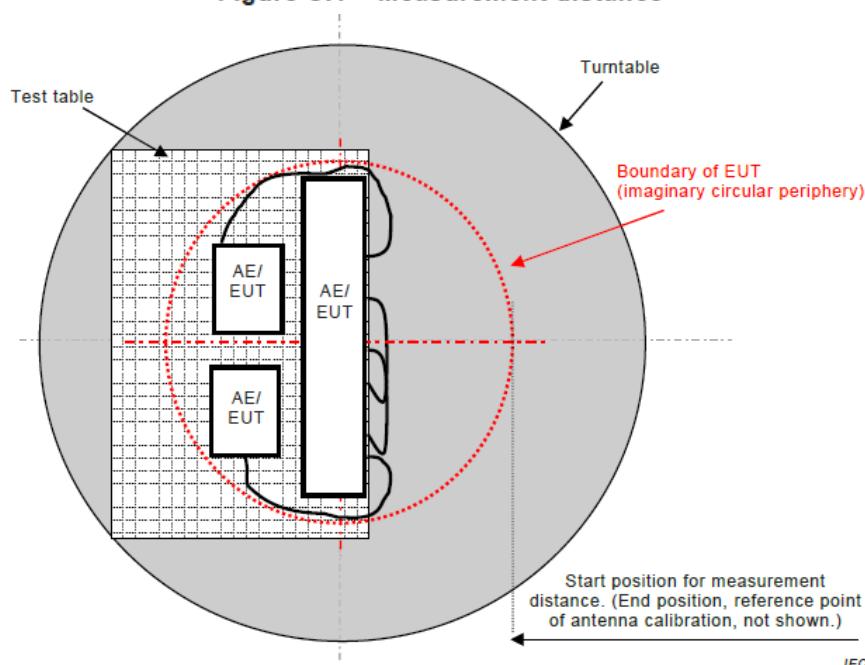
Note: The antenna can be moved between 1 to 4 meters above the ground.

4.1.5 MEASUREMENT DISTANCE



IEC

Figure C.1 – Measurement distance



IEC

Figure C.2 – Boundary of EUT, Local AE and associated cabling

4.1.6 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 53%

4.1.7 TEST RESULTS (UP TO 1 GHZ)

Please refer to the Attachment A.

4.1.8 TEST RESULTS (ABOVE 1 GHZ)

Please refer to the Attachment B.

4.2 CONDUCTED EMISSIONS AT AC MANIS POWER PORT

4.2.1 LIMITS

Requirements for conducted emissions from AC mains power ports of Class A equipment

Table clause	Frequency Range MHz	Coupling Device	Detector Type / bandwidth	Class A Limits (dB(μV))
A9.1	0.15 - 0.5	AMN	Quasi Peak / 9 kHz	79
	0.5 - 30			73
A9.2	0.15 - 0.5	AMN	Average / 9 kHz	66
	0.5 - 30			60

Apply A9.1 and A9.2 across the entire frequency range.

Requirements for conducted emissions from AC mains power ports of Class B equipment

Table clause	Frequency Range MHz	Coupling Device	Detector Type / bandwidth	Class B Limits (dB(μV))
A10.1	0.15 - 0.5	AMN	Quasi Peak / 9 kHz	66-56
	0.5 - 5			56
	5 - 30			60
A10.2	0.15 - 0.5	AMN	Average / 9 kHz	56-46
	0.5 - 5			46
	5 - 30			50

Apply A10.1 and A10.2 across the entire frequency range.

NOTE:

- (1) 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

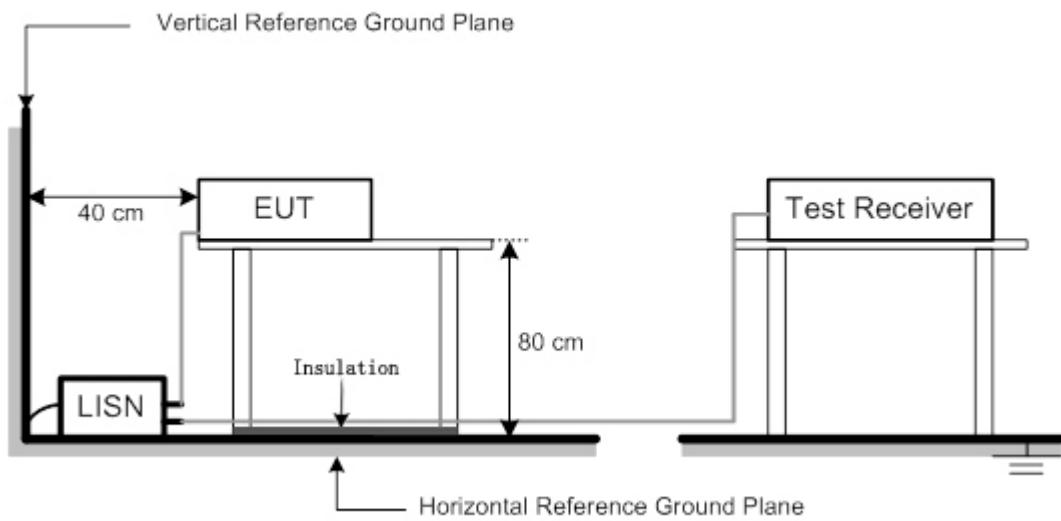
4.2.2 TEST PROCEDURE

- 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 equipment 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 - Block Diagram of system tested (please refer to 3.4).

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

4.2.4 TEST SETUP



4.2.5 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 60%

4.2.6 TEST RESULTS

Please refer to the Attachment C.

5. EMC IMMUNITY TEST

5.1 STANDARD COMPLIANCE/SEVERITY LEVEL/CRITERIA

Test Standard No.	Test Specification Level	Test Mode Test Port	Performance Criteria
Electrostatic discharge Clause 9.3 EN 61000-4-2 (ESD)	± 8 kV air discharge ± 4 kV contact discharge	Direct Mode	B
	± 4 kV HCP discharge ± 4 kV VCP discharge	Indirect Mode	B
Radio frequency electromagnetic Field Clause 9.2 EN 61000-4-3 (RS)	80 MHz to 6000 MHz 3 V/m (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM modulated (NOTE 1)	Enclosure	A
Fast transients, common mode Clause 9.4 EN 61000-4-4 (EFT)	± 1 kV(peak) 5/50 ns Tr/Th 5 kHz Repetition Frequency	AC mains power port	B
	±0.5 kV(peak) 5/50ns Tr/Th 5 kHz Repetition Frequency	DC power port (NOTE 2)	B
	± 0.5 kV(peak) 5/50 ns Tr/Th 5 kHz Repetition Frequency	Signal port, Wired network port, Control port (NOTE 2)	B
Surges, line to line and line to Ground Clause 9.8 EN 61000-4-5 (Surges)	±1 kV(5P/5N) 1.2/50(8/20) Tr/Th us (line to line)	AC mains power port	B
	± 2 kV(5P/5N) 1.2/50(8/20) Tr/Th us (line to earth or ground)		B
	±1 kV (5P/5N) 10/700 (5/320)Tr/Th us (symmetrically operated line to ground)	wired network ports (NOTE 3)	B
	±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us (non-symmetrically line to line)		
	±1 kV (5P/5N) 1.2/50(8/20) Tr/Th us (non-symmetrically line to ground, or shield to ground)		
	±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us (line to ground, or shield to ground)	wired network ports (NOTE 4)	

	0.15 MHz to 80 MHz 3 V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	AC Power Port	A
Radio frequency, common mode EN 61000-4-6 Clause 9.5 (CS)	0.15 MHz to 80 MHz 3 V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	DC Power Port (NOTE 2)	A
	0.15 MHz to 80 MHz 3V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance (NOTE 1)	signal ports, wired network ports, control ports (NOTE 2)	A
Voltage dips and interruptions EN 61000-4-11 Clause 9.7 (Dips)	Voltage dip 0% Voltage dip 0% Voltage dip 70% Voltage Interruption 0%	AC Power Port	B B B B/C (NOTE 5)

NOTE:

- (1) If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used.
- (2) If the cables may be longer than 3 m.
- (3) Only for directly connected to outdoor cables.
- (4) Only for connected to indoor cables (longer than 30 m).
- (5) With battery back-up: Criteria B (TT,TR), without battery back-up: Criteria C.

5.2 GENERAL 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. (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 3). 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 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). 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 3).

NOTE 1: Operate as intended during the test allows a level of degradation 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: 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 3: 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

Clause:	9.3
Test Method:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	Contact Discharge: $\pm 2\text{kV}/\pm 4\text{kV}$ (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.

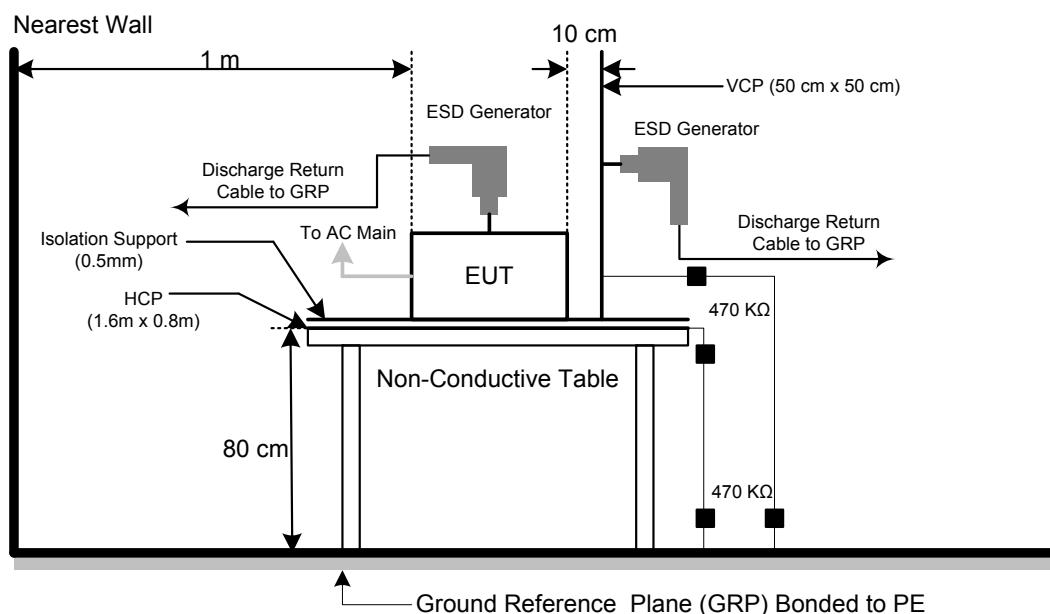
It was at least ten single discharges with positive and negative at the same selected point.

- 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

Clause:	9.2
Test Method:	EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 6000 MHz
Field Strength:	3 V/m (unmodulated, r.m.s)
Modulation:	1000 Hz Sine Wave, 80%, AM Modulation If the wanted signal is modulated at 1000 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:

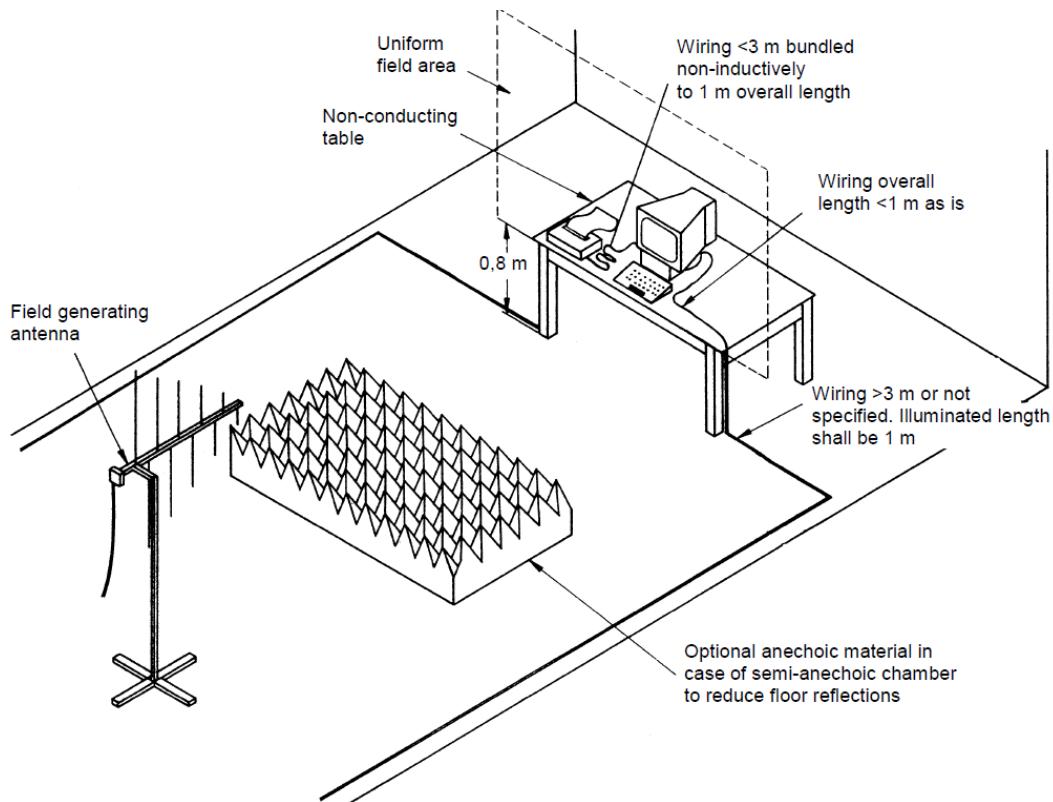
- a. The field strength level was 3 V/m (unmodulated, r.m.s).
- b. The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz. If the wanted signal is modulated at 1000 Hz, then an audio signal of 400 Hz shall be used,
The test shall be performed over the frequency range 80 MHz to 6000 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 exclusion band for immunity testing of equipment operating in the 2,4 GHz band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -120 MHz, i.e. 2280MHz;
 - Upper limit of exclusion band = highest allocated band edge frequency +120 MHz, i.e. 2603.5 MHz.
 The exclusion band for immunity testing of equipment operating in the 5 GHz Wi-Fi band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4880MHz;
 - Upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5995MHz.
 The exclusion band for immunity testing of equipment operating in the 5,8 GHz band shall be:
 - Lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 5455 MHz;
 - As the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band Would be greater than this for the 5,8 GHz band. The above frequency shall also be regarded as the upper end of the test range.
- d. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

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

Clause:	9.4
Test Method:	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.

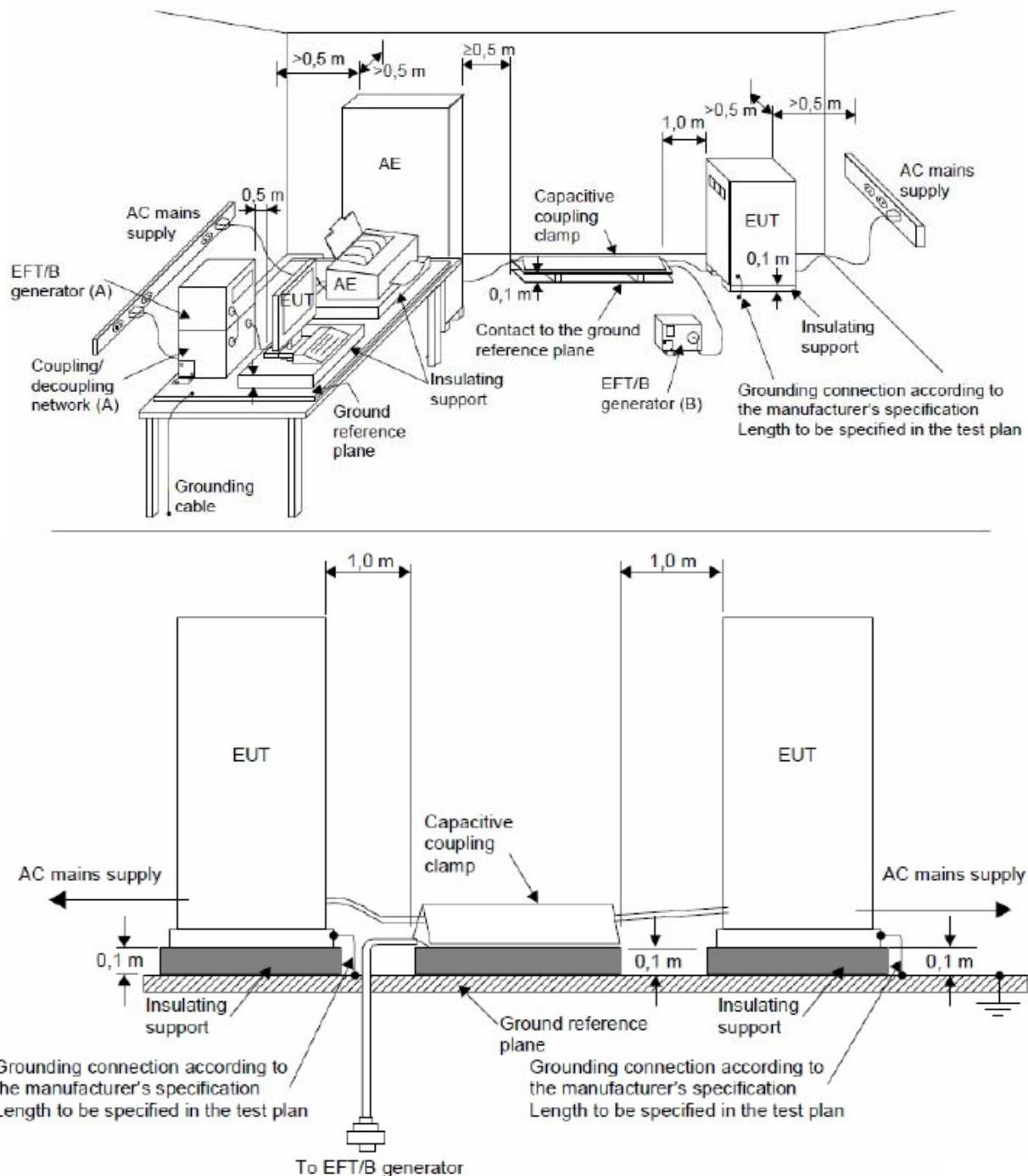
The other condition as following manner:

- 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

Clause:	9.8
Test Method:	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:

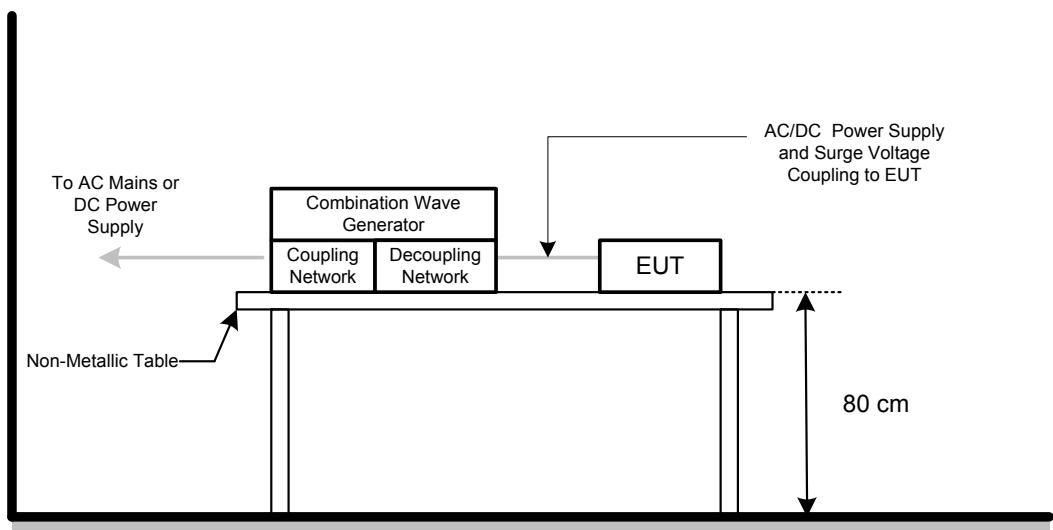
The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

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

Clause:	9.5
Test Method:	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 150 KHz 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;

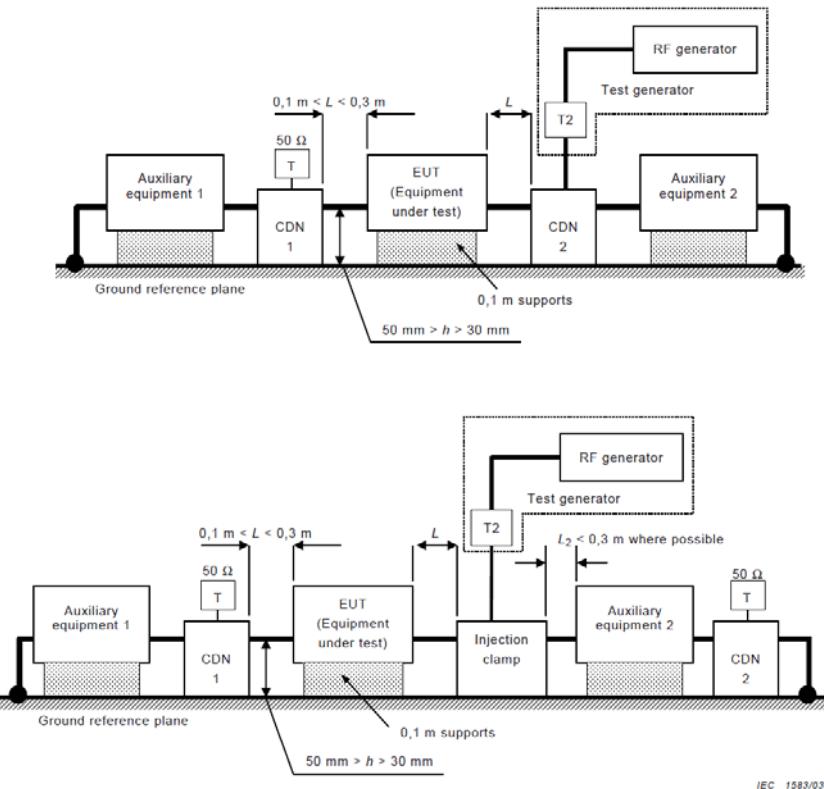
The test shall be performed over the frequency range 150 kHz to 80 MHz with the exception of an exclusion band for transmitters, and for receivers and duplex transceivers, (see clause 4); For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary 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.

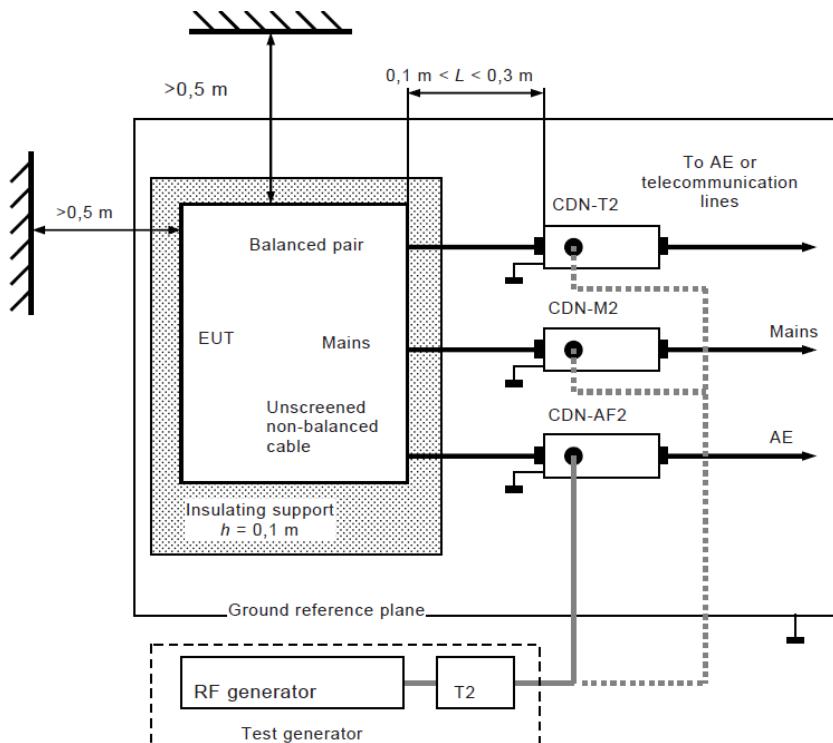
5.8.3 DEVIATION FROM TEST STANDARD

No deviation

5.8.4 TEST SETUP



T : Termination 50Ω
 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

Clause:	9.7
Test Method:	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

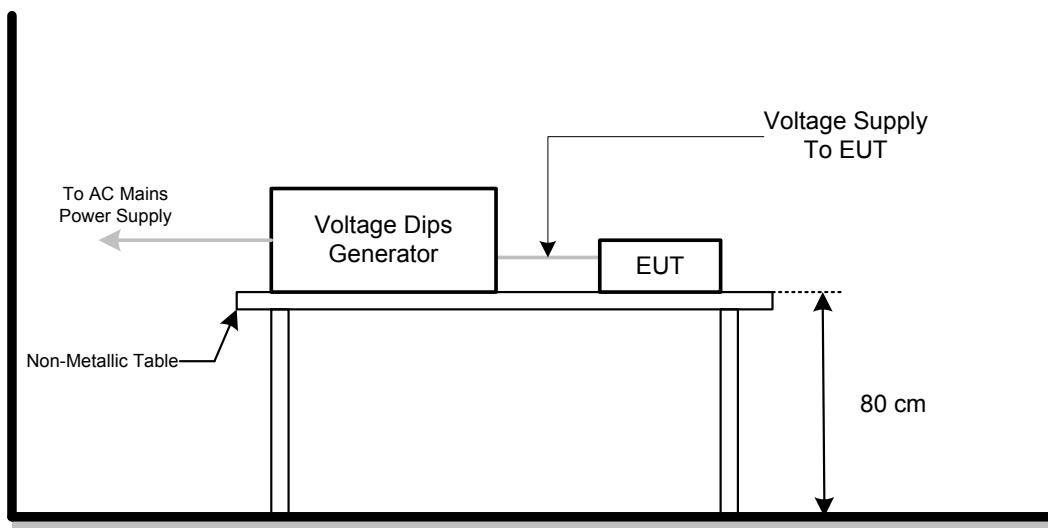
5.9.2 TEST PROCEDURE

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

Radiated emission up to 1GHz

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Attenuator	N/A	SA18N-06	6dB	Apr. 14, 2018
2	Receiver	Keysight	N9038A	MY54450004	Sep. 04, 2017
3	Pre-Amplifier	Mini-Circuits	EMC 9135	980284	Mar. 26, 2018
4	Pre-Amplifier	Mini-Circuits	EMC 9135	980283	Mar. 26, 2018
5	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	586	Mar. 26, 2018
6	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	587	Mar. 26, 2018
7	Cable	emci	LMR-400(5m+11m+15m)	N/A	Dec. 27, 2017
8	Cable	emci	LMR-400(5m+8m+15m)	N/A	Dec. 27, 2017
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

Radiated emission above 1GHz

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Horn Antenna	EMCO	3115	9605-4803	Mar. 26, 2018
2	Amplifier	Agilent	8449B	3008A02584	Sep. 04, 2017
3	Measurement Software	Farad	EZ-EMC Ver.BTL-2ANT-1	N/A	N/A
4	Cable	emci	SUCOFLEX_15m_5m(0.01GHz—26.5GHz)	N/A	Dec. 27, 2017
5	Multi-Device Controller	ETS-Lindgren	2090	N/A	N/A
6	Controller	MF	MF-7802	MF780208159	N/A

Conducted Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
2	50Ω Terminator	SHX	TF2-3G-A	08122901	Mar. 26, 2018
3	TWO-LINE V-NETWORK	R&S	ENV216	100526	Mar. 26, 2018
4	EMI Test Receiver	R&S	ESR3	101862	Sep. 04, 2017
5	Artificial-Mains Network	SCHWARZBECK	NSLK 8127	8127685	Sep. 04, 2017
6	Cable	N/A	RG400 12m	N/A	Mar. 07, 2018

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	Digital Signal Generator	HP	ESG-D3000A	US36260188	Mar. 26, 2018
2	Antenna	ETS	3142C	00047662	Mar. 26, 2018
3	Antenna	TESEQ	STLP 9149	9149-277	Mar. 27, 2019
4	Power amplifier	MILMEGA	AS1860-50	1064834	Nov. 02, 2017
5	Power amplifier	MILMEGA	80RF1000-250	N/A	Nov. 02, 2017
6	Amplifier	AR	50S1G4A	326720	Mar. 26, 2018
7	Measurement Software	TOYO	IM5/R Ver 3.8.050	N/A	N/A

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

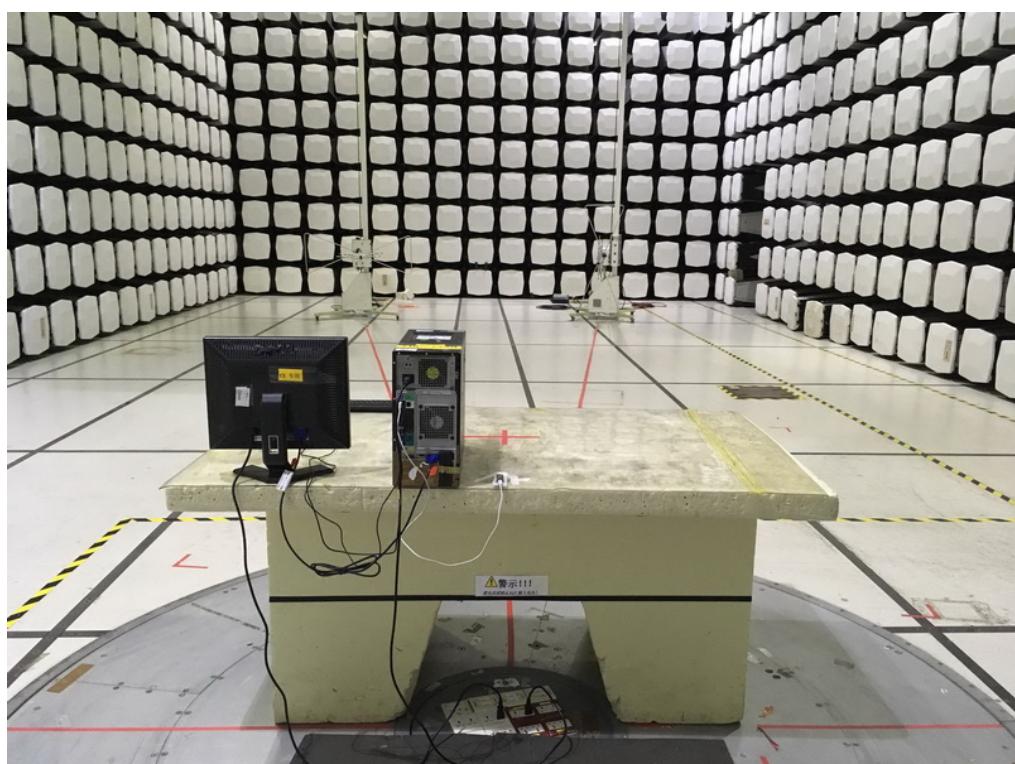
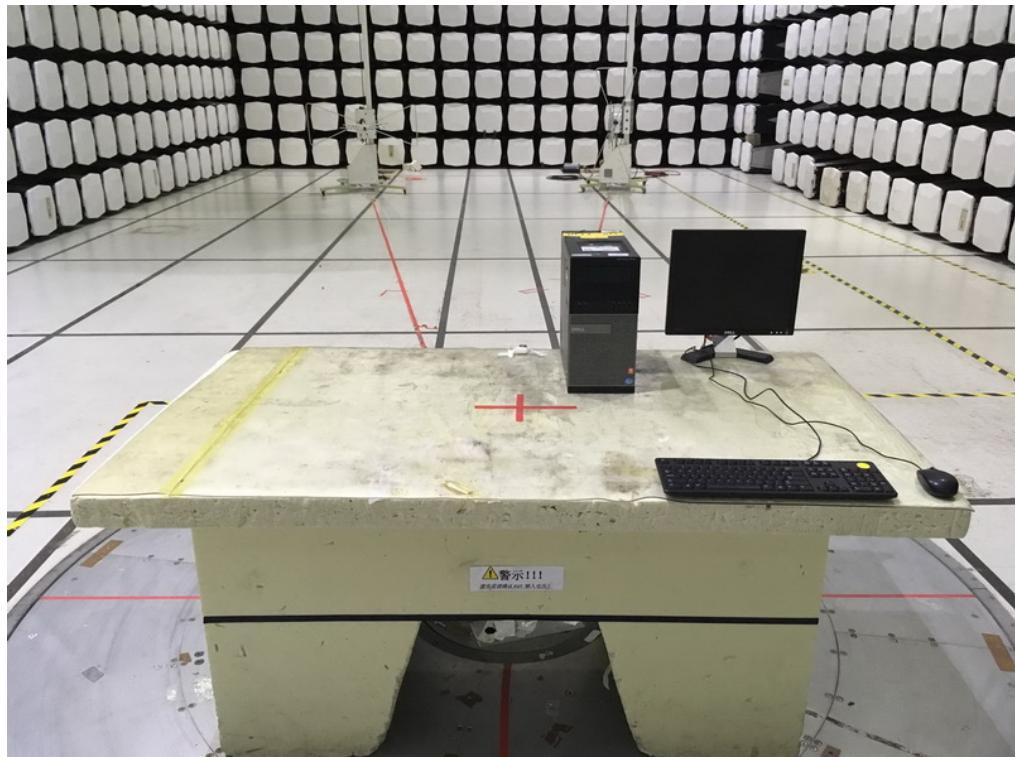
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
2	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A

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

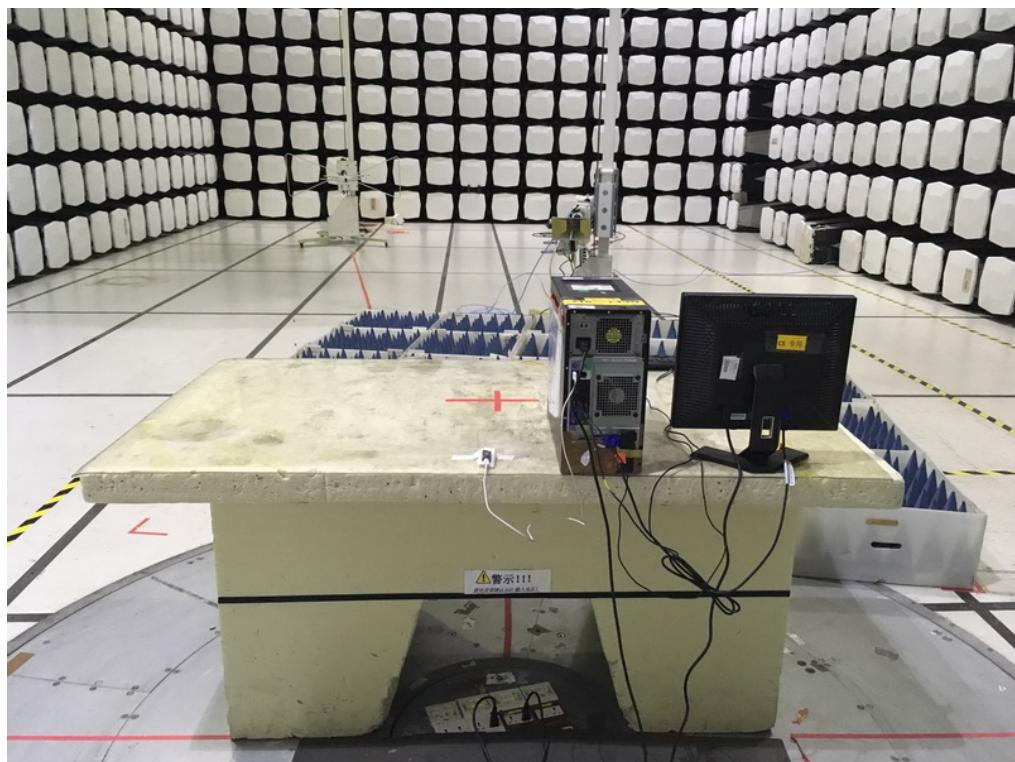
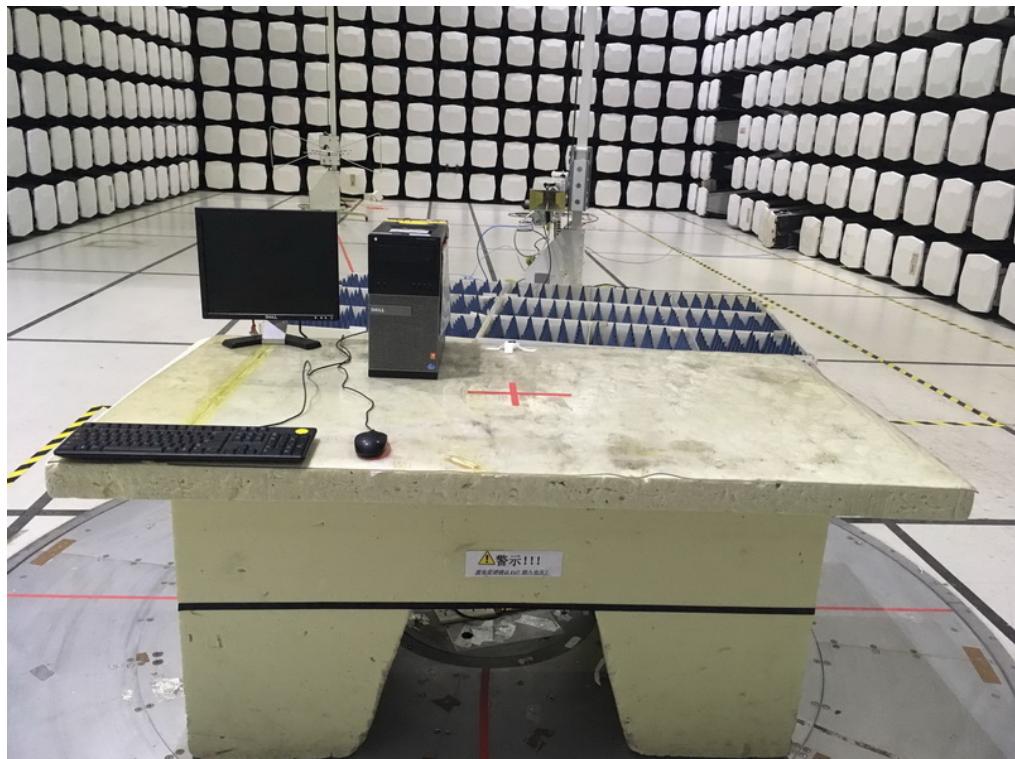
All calibration period of equipment list is one year.

7. EUT TEST PHOTO

Radiated emissions up to 1 GHz



Radiated emissions above 1 GHz



Conducted emissions AC mains power port

EMS Measurement Photos**ESD****RS - Below 1GHz**

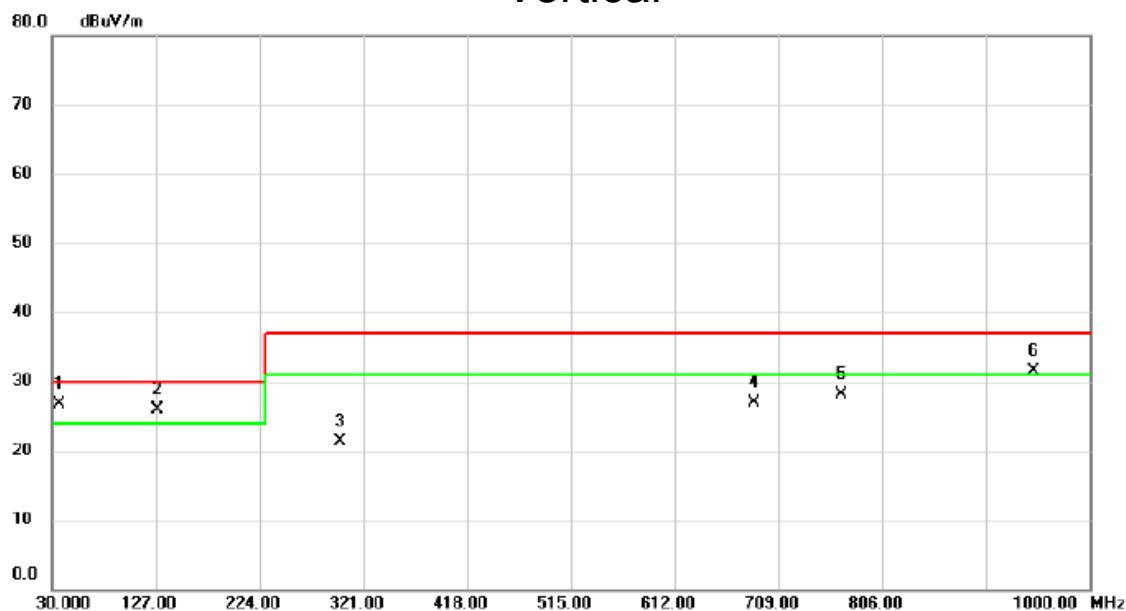
RS - Above 1GHz**EFT / Surge / Dip**

CS

ATTACHMENT A - RADIATED EMISSION UP TO 1GHZ

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

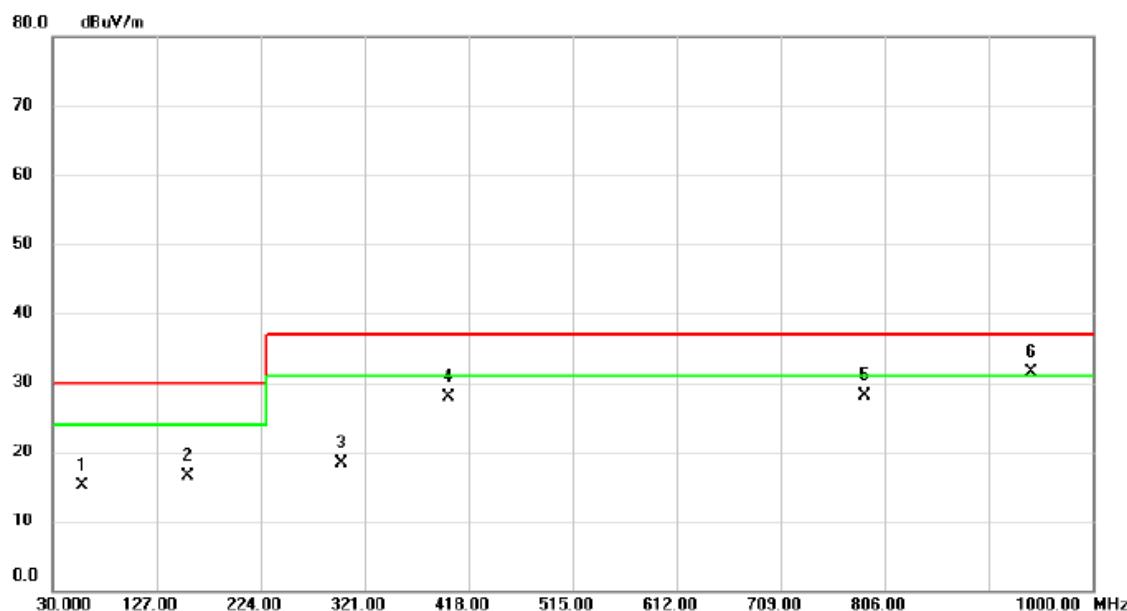
Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment Limit dBuV/m	Margin dB	Detector	Comment
1	*	36.7900	44.46	-17.78	26.68	30.00	-3.32	QP
2	!	128.9400	42.92	-17.07	25.85	30.00	-4.15	QP
3		299.6600	35.24	-13.98	21.26	37.00	-15.74	QP
4		685.7200	32.32	-5.45	26.87	37.00	-10.13	QP
5		767.6850	32.13	-3.94	28.19	37.00	-8.81	QP
6	!	947.6200	32.66	-1.23	31.43	37.00	-5.57	QP

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

Horizontal

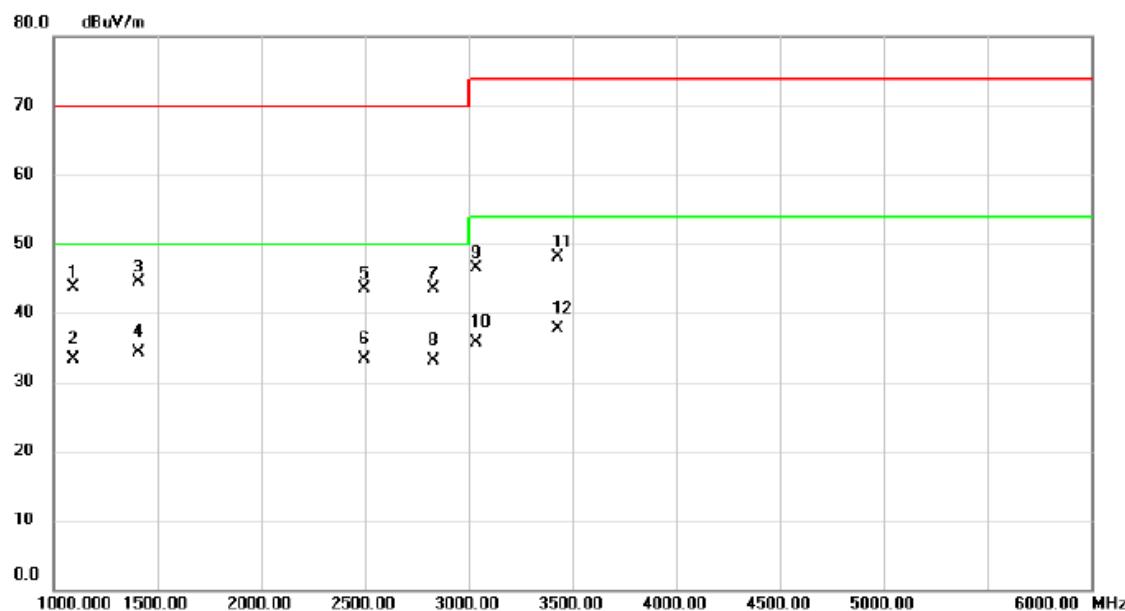


No.	Mk.	Freq. MHz	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level dBuV	Factor dB	m				
1		57.1600	31.60	-16.44	15.16	30.00	-14.84	QP	
2		156.1000	31.55	-15.07	16.48	30.00	-13.52	QP	
3		299.6600	31.99	-13.63	18.36	37.00	-18.64	QP	
4		399.5700	38.89	-10.96	27.93	37.00	-9.07	QP	
5		787.5700	31.26	-3.11	28.15	37.00	-8.85	QP	
6	*	942.7700	32.06	-0.62	31.44	37.00	-5.56	QP	

ATTACHMENT B - RADIATED EMISSION ABOVE 1GHZ

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

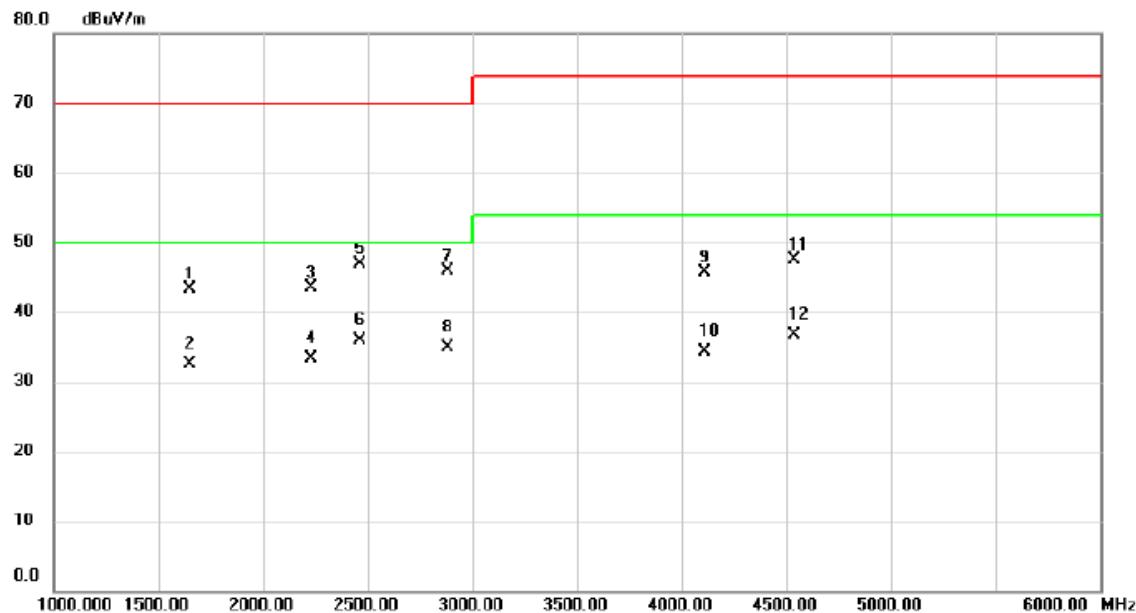
Vertical



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV/m	dB			
1		1095.000	48.33	-4.54	43.79	70.00	-26.21	peak	
2		1095.000	37.79	-4.54	33.25	50.00	-16.75	AVG	
3		1412.500	47.91	-3.50	44.41	70.00	-25.59	peak	
4	*	1412.500	37.71	-3.50	34.21	50.00	-15.79	AVG	
5		2497.500	43.27	0.25	43.52	70.00	-26.48	peak	
6		2497.500	33.00	0.25	33.25	50.00	-16.75	AVG	
7		2832.500	41.45	2.06	43.51	70.00	-26.49	peak	
8		2832.500	30.96	2.06	33.02	50.00	-16.98	AVG	
9		3037.500	43.56	3.00	46.56	74.00	-27.44	peak	
10		3037.500	32.78	3.00	35.78	54.00	-18.22	AVG	
11		3432.500	44.79	3.36	48.15	74.00	-25.85	peak	
12		3432.500	34.28	3.36	37.64	54.00	-16.36	AVG	

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

Horizontal

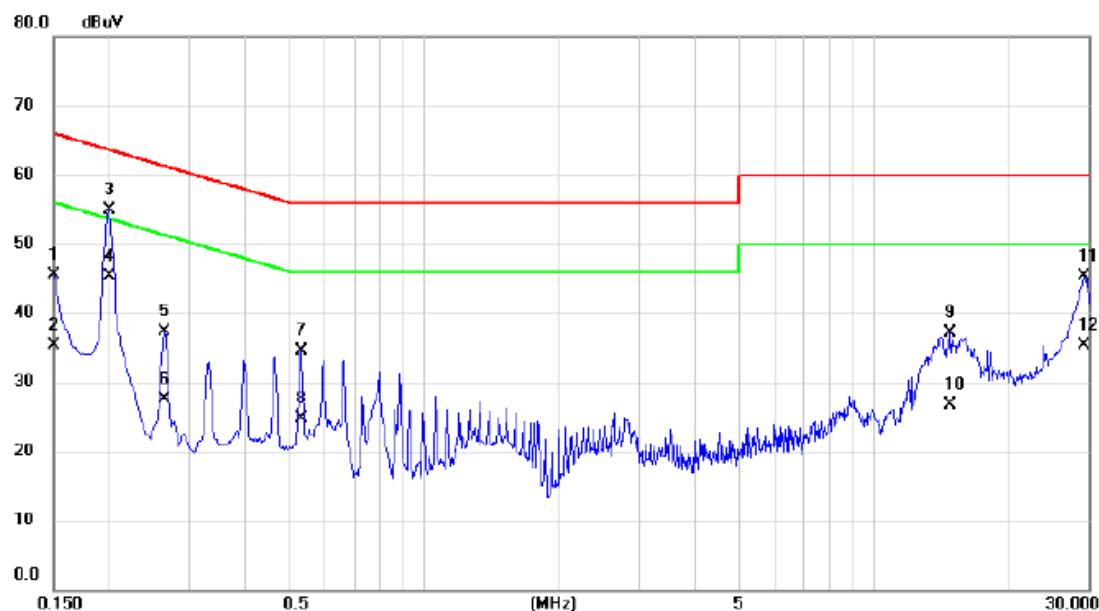


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector Comment
1		1650.000	46.50	-3.26	43.24	70.00	-26.76	peak
2		1650.000	35.80	-3.26	32.54	50.00	-17.46	AVG
3		2227.500	45.30	-1.74	43.56	70.00	-26.44	peak
4		2227.500	34.98	-1.74	33.24	50.00	-16.76	AVG
5		2460.000	46.95	-0.02	46.93	70.00	-23.07	peak
6	*	2460.000	35.89	-0.02	35.87	50.00	-14.13	AVG
7		2882.500	43.55	2.33	45.88	70.00	-24.12	peak
8		2882.500	32.54	2.33	34.87	50.00	-15.13	AVG
9		4112.500	40.46	5.28	45.74	74.00	-28.26	peak
10		4112.500	29.07	5.28	34.35	54.00	-19.65	AVG
11		4537.500	42.38	5.17	47.55	74.00	-26.45	peak
12		4537.500	31.62	5.17	36.79	54.00	-17.21	AVG

ATTACHMENT C - CONDUCTED EMISSION

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

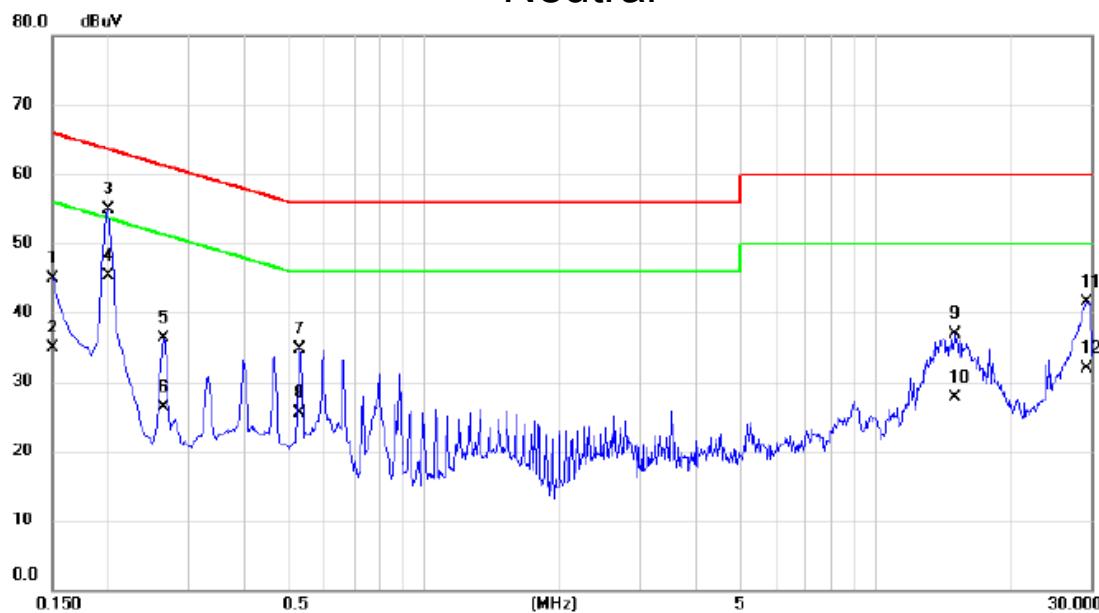
Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dB	Margin Detector	Comment
1		0.1500	35.90	9.67	45.57	66.00	-20.43	QP
2		0.1500	25.60	9.67	35.27	56.00	-20.73	AVG
3		0.1995	45.25	9.69	54.94	63.63	-8.69	QP
4	*	0.1995	35.70	9.69	45.39	53.63	-8.24	AVG
5		0.2647	27.68	9.69	37.37	61.28	-23.91	QP
6		0.2647	17.80	9.69	27.49	51.28	-23.79	AVG
7		0.5325	24.80	9.74	34.54	56.00	-21.46	QP
8		0.5325	14.90	9.74	24.64	46.00	-21.36	AVG
9		14.7908	26.64	10.46	37.10	60.00	-22.90	QP
10		14.7908	16.20	10.46	26.66	50.00	-23.34	AVG
11		29.1840	34.27	11.05	45.32	60.00	-14.68	QP
12		29.1840	24.30	11.05	35.35	50.00	-14.65	AVG

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		0.1500	35.22	9.66	44.88	66.00	-21.12	QP	
2		0.1500	25.30	9.66	34.96	56.00	-21.04	AVG	
3		0.1995	45.28	9.69	54.97	63.63	-8.66	QP	
4	*	0.1995	35.60	9.69	45.29	53.63	-8.34	AVG	
5		0.2647	26.68	9.68	36.36	61.28	-24.92	QP	
6		0.2647	16.70	9.68	26.38	51.28	-24.90	AVG	
7		0.5302	25.01	9.72	34.73	56.00	-21.27	QP	
8		0.5302	15.80	9.72	25.52	46.00	-20.48	AVG	
9		14.9865	26.26	10.56	36.82	60.00	-23.18	QP	
10		14.9865	17.20	10.56	27.76	50.00	-22.24	AVG	
11		29.2470	30.29	11.31	41.60	60.00	-18.40	QP	
12		29.2470	20.50	11.31	31.81	50.00	-18.19	AVG	

ATTACHMENT D - ESD

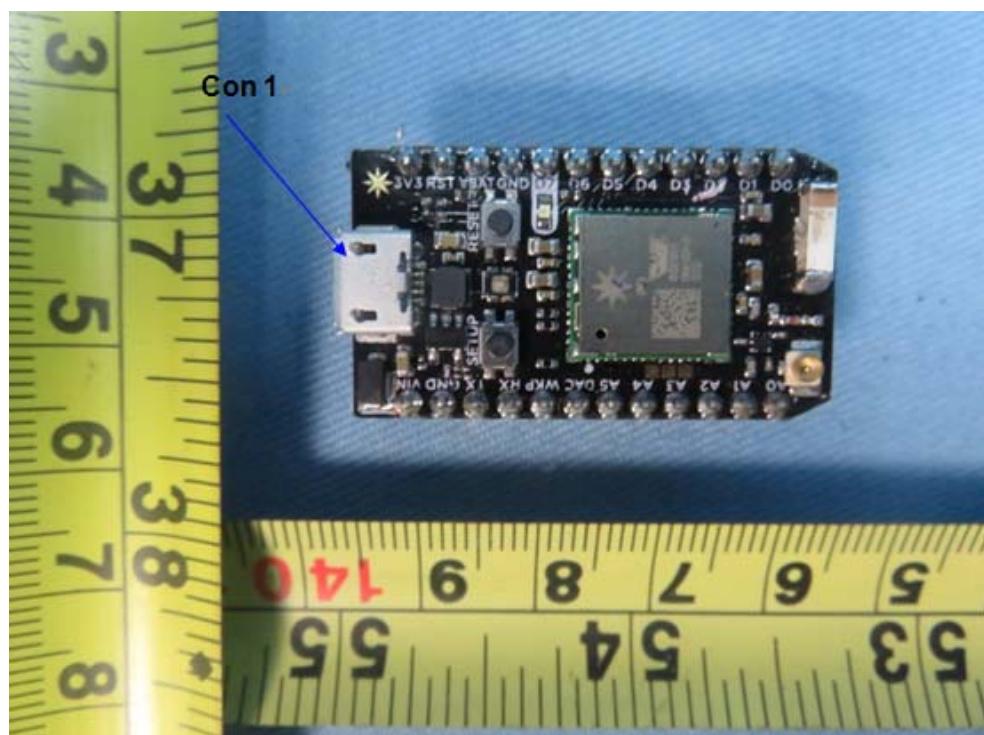
Test Power :	AC 230V/50Hz											
Test Mode :	OPERATING											

Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		- kV		2kV		4kV		- kV		- kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	-	-	-	-	-	-	-	-	A	A	A	A	-	-	-	-
Criteria	B				-				B				-			
Result	N/A				-				A				-			
Judgment	N/A				-				PASS				-			

Mode	HCP Discharge								VCP Discharge							
	2kV		4kV		- kV		- kV		2kV		4kV		- kV		- kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
2	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
3	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
4	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
Criteria	B				-				B				-			
Result	A				-				A				-			
Judgment	PASS				-				PASS				-			

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) Test condition: Direct / Indirect (HCP/VCP) discharges: Minimum 50 times (Positive/Negative) at each point. Air discharges: Minimum 10 times (Positive/Negative) at each point.
- 3) Test location(s) in which discharge (Air and contact discharge) to be applied illustrated by photos shown in next page(s)
- 4) The Indirect (HCP/VCP) discharges description of test point as following:
 1.left side 2.right side 3.front side 4.rear side
- 5) N/A - denotes test is not applicable to this device
- 6) Criterion A: No observation of any performance degradation.
- 7) Criterion B: Some degradation of performance is observed but the equipment continues to operate as intended.
- 8) Criterion C: Loss of functionality, but self-recoverable by user, without loss of information or settings.

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 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			
1000 - 3000	V/H	3 V/m (unmodulated, r.m.s) AM Modulated 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			
3000 - 6000	V/H	3 V/m (unmodulated, r.m.s) AM Modulated 1000 Hz, 80%	0	A	A	PASS
			90			
			180			
			270			

Note:

- 1) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

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) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

ATTACHMENT G - SURGE

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

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us					Criteria	Results	Judgment		
	Polarity	Phase	Voltage							
			0.5kV	1kV	1.5 kV	2 kV				
L - N	+	0°	A	A	-	-	B	A	PASS	
	-		A	A	-	-				
	+	90°	A	A	-	-				
	-		A	A	-	-				
	+	180°	A	A	-	-				
	-		A	A	-	-				
	+	270°	A	A	-	-				
	-		A	A	-	-				
L - PE	+	0°	A	A	A	A	B	A	PASS	
	-		A	A	A	A				
	+	90°	A	A	A	A				
	-		A	A	A	A				
	+	180°	A	A	A	A				
	-		A	A	A	A				
	+	270°	A	A	A	A				
	-		A	A	A	A				
N - PE	+	0°	A	A	A	A	B	A	PASS	
	-		A	A	A	A				
	+	90°	A	A	A	A				
	-		A	A	A	A				
	+	180°	A	A	A	A				
	-		A	A	A	A				
	+	270°	A	A	A	A				
	-		A	A	A	A				
Signal Line (N/A)	+	N/A	-	-	-	-	B	N/A	N/A	
	-		-	-	-	-				

Note:

- 1) N/A - denotes test is not applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.

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		A	A	PASS
Input/ Output DC. Power Port	0.15 --- 80	3V(unmodulated, r.m.s.) AM Modulated 1000Hz, 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) Performance Criteria please refer to clause 5.2.

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) Performance Criteria please refer to clause 5.2.