

# EN 301 489 Test Report

**Project No.** : 1705C214  
**Equipment** : 150Mbps High Gain Wireless USB Adapter  
**Test Model** : U2  
**Applicant** : SHENZHEN TENDA TECHNOLOGY CO.,LTD  
**Address** : 6-8 Floor, Tower E3, No. 1001, Zhongshanyuan Road,  
Nanshan District, Shenzhen, China. 518052

**Date of Receipt** : May 15, 2017  
**Date of Test** : May 15, 2017 ~ Jun. 21, 2017  
**Issued Date** : Jun. 23, 2017  
**Tested by** : BTL Inc.

**Testing Engineer** : Treey Chen  
(Treey Chen)

**Technical Manager** : Bill Zhang  
(Bill Zhang)

**Authorized Signatory** : Steven Lu  
(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.

This report is the confidential property of the client. As a mutual protection to the clients, the public and **BTL-self**, extracts from the test report shall not be reproduced except in full with **BTL's** authorized written approval.

**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.

**Table of Contents****Page**

<b>1 . CERTIFICATION</b>	<b>7</b>
<b>2 . SUMMARY OF TEST RESULTS</b>	<b>8</b>
2.1 TEST FACILITY	10
2.2 MEASUREMENT UNCERTAINTY	10
<b>3 . GENERAL INFORMATION</b>	<b>11</b>
3.1 GENERAL DESCRIPTION OF EUT	11
3.2 DESCRIPTION OF TEST MODES	11
3.3 EUT OPERATING CONDITIONS	12
3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	12
3.5 DESCRIPTION OF SUPPORT UNITS	13
<b>4 . EMC EMISSION TEST</b>	<b>14</b>
4.1 RADIATED EMISSION	14
4.1.1 LIMITS	14
4.1.2 TEST PROCEDURE	16
4.1.3 DEVIATION FROM TEST STANDARD	16
4.1.4 TEST SETUP	17
4.1.5 MEASUREMENT DISTANCE	18
4.1.6 EUT TEST CONDITIONS	18
4.1.7 TEST RESULTS (UP TO 1 GHZ)	18
4.1.8 TEST RESULTS (ABOVE 1 GHZ)	18
4.2 CONDUCTED EMISSIONS AT AC MAINS POWER PORT	19
4.2.1 LIMITS	19
4.2.2 TEST PROCEDURE	19
4.2.3 DEVIATION FROM TEST STANDARD	19
4.2.4 TEST SETUP	20
4.2.5 EUT TEST CONDITIONS	20
4.2.6 TEST RESULTS	20
<b>5 . EMC IMMUNITY TEST</b>	<b>21</b>
5.1 STANDARD COMPLIANCE/SEVERITY LEVEL/CRITERIA	21
5.2 GENERAL PERFORMANCE CRITERIA	23
5.3 GENERAL PERFORMANCE CRITERIA TEST SETUP	24
5.4 ESD TESTING	25
5.4.1 TEST SPECIFICATION	25
5.4.2 TEST PROCEDURE	25
5.4.3 DEVIATION FROM TEST STANDARD	26
5.4.4 TEST SETUP	26
5.4.5 EUT OPERATING CONDITIONS	26
5.4.6 TEST RESULTS	26

<b>Table of Contents</b>	<b>Page</b>
<b>5.5 RS TESTING</b>	<b>27</b>
5.5.1 TEST SPECIFICATION	27
5.5.2 TEST PROCEDURE	27
5.5.3 DEVIATION FROM TEST STANDARD	28
5.5.4 TEST SETUP	28
5.5.5 EUT OPERATING CONDITIONS	28
5.5.6 TEST RESULTS	28
<b>5.6 EFT/BURST TESTING</b>	<b>29</b>
5.6.1 TEST SPECIFICATION	29
5.6.2 TEST PROCEDURE	29
5.6.3 DEVIATION FROM TEST STANDARD	29
5.6.4 TEST SETUP	29
5.6.5 EUT OPERATING CONDITIONS	30
5.6.6 TEST RESULTS	30
<b>5.7 SURGE TESTING</b>	<b>31</b>
5.7.1 TEST SPECIFICATION	31
5.7.2 TEST PROCEDURE	31
5.7.3 DEVIATION FROM TEST STANDARD	32
5.7.4 TEST SETUP	32
5.7.5 EUT OPERATING CONDITIONS	32
5.7.6 TEST RESULTS	32
<b>5.8 INJECTION CURRENT TESTING</b>	<b>33</b>
5.8.1 TEST SPECIFICATION	33
5.8.2 TEST PROCEDURE	33
5.8.3 DEVIATION FROM TEST STANDARD	34
5.8.4 TEST SETUP	34
5.8.5 EUT OPERATING CONDITIONS	35
5.8.6 TEST RESULTS	35
<b>5.9 VOLTAGE INTERRUPTION/DIPS TESTING</b>	<b>36</b>
5.9.1 TEST SPECIFICATION	36
5.9.2 TEST PROCEDURE	36
5.9.3 DEVIATION FROM TEST STANDARD	36
5.9.4 TEST SETUP	36
5.9.5 EUT OPERATING CONDITIONS	36
5.9.6 TEST RESULTS	36
<b>6 . MEASUREMENT INSTRUMENTS LIST</b>	<b>37</b>
<b>7 . EUT TEST PHOTO</b>	<b>40</b>
<b>ATTACHMENT A - RADIATED EMISSION UP TO 1GHZ</b>	<b>46</b>
<b>ATTACHMENT B - RADIATED EMISSION ABOVE 1GHZ</b>	<b>49</b>
<b>ATTACHMENT C - CONDUCTED EMISSION AT AC MAINS POWER PORT</b>	<b>52</b>
<b>ATTACHMENT D - ESD</b>	<b>55</b>

## Table of Contents

Page

ATTACHMENT E - RS	58
ATTACHMENT F - EFT/BURST	60
ATTACHMENT G - SURGE	62
ATTACHMENT H - INJECTION CURRENT	64
ATTACHMENT I - VOLTAGE INTERRUPTION/DIPS	66

### REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-ETSE-1-1705C214	Original Issue.	Jun. 23, 2017

## 1. CERTIFICATION

Equipment : 150Mbps High Gain Wireless USB Adapter  
Brand Name : Tenda  
Test Model : U2  
Applicant : SHENZHEN TENDA TECHNOLOGY CO.,LTD  
Manufacturer : SHENZHEN TENDA TECHNOLOGY CO.,LTD  
Address : 6-8 Floor, Tower E3, No. 1001, Zhongshanyuan Road, Nanshan District,  
Shenzhen, China. 518052  
Date of Test : May 15, 2017 ~ Jun. 21, 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-1-1705C214) 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	Not Applicable	N/A NOTE (1)
8.7	Conducted emission	Wired network port	AAN	EN 55032: 2015	Not Applicable	N/A NOTE (1)
			Current Probe		Not Applicable	N/A NOTE (1)
			CVP		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 108 MHz, so the test will be performed.
- (3) For equipment with a rated power of 75 W or less, limits are not specified.

(4)

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.

- (5) 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, Guangdong, 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  $U_{\text{CISPR}}$  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,(dB)
DG-C02	CISPR	150 kHz ~ 30MHz	2.32

### B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
DG-CB02 (3m)	CISPR	30MHz ~ 200MHz	V	3.83
		30MHz ~ 200MHz	H	3.79
		200MHz ~ 1,000MHz	V	4.04
		200MHz ~ 1,000MHz	H	4.02

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB02 (3m)	CISPR	1 ~ 6 GHz	4.50
		6 ~18 GHz	5.18

### C. Immunity Measurement:

Test Site	Method	Test Item	U
DG-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%
DG-CB05	EN 61000-4-3	80MHz~1GHz	2.175 dB
		1GHz~6GHz	2.175 dB
DG-SR05	EN 61000-4-4	Impulse Voltage	4.0 %
		Impulse Rise Time	4.5 %
		Impulse duration Time	4.0 %
DG-SR05	EN 61000-4-5	Impulse Voltage	4.0 %
		Impulse Rise Time	4.5 %
		Impulse duration Time	4.0 %
DG-CB06	EN 61000-4-6	CDN: 150kHz~230MHz	2.509 dB
		EM Clamp: 150kHz~230MHz	3.094 dB
DG-SR05	EN 61000-4-11	Impulse Amplitude	4 %
		Timing	3 %

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Equipment	150Mbps High Gain Wireless USB Adapter
Brand Name	Tenda
Test Model	U2
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
Mode 1	Operating

For Radiated Test	
Final Test Mode	Description
Mode 1	Operating

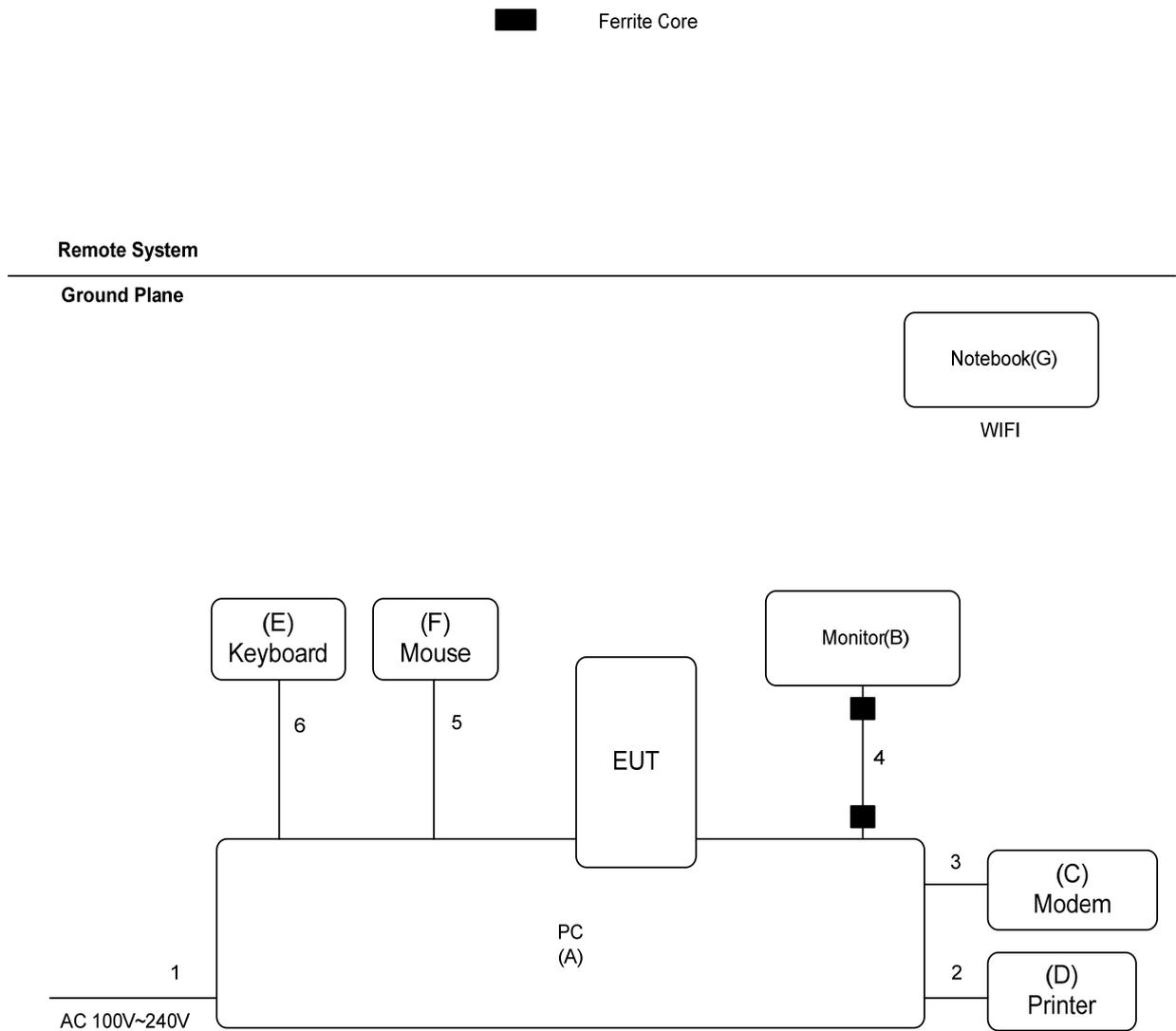
For Conducted Test	
Final Test Mode	Description
Mode 1	Operating

For EMS Test	
Final Test Mode	Description
Mode 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.

**3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED**



### 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	Vostro 470	DOC	24454162837
B	Monitor	DELL	E177FPC	DOC	CN-OFJ79-64180-6AG-1HCS
C	Modem	ACEEX	DM-1414V	DOC	603002131
D	Printer	SII	DPU-414	DOC	3018507 B
E	Keyboard	DELL	L100	DOC	CNORH6596589071T08NE
F	Mouse	DELL	MS111-P	DOC	CN011D3V71581279OLOT
G	Notebook	Lenovo	E445	N/A	MP-05Y56S

Item	Shielded Type	Ferrite Core	Length	Note
1	YES	NO	1.8m	AC Cable
2	YES	NO	1.5m	Parallel Cable
3	YES	NO	1.5m	RS232 Cable
4	YES	YES	1.8m	D-SUB Cable
5	YES	NO	1.8m	USB Cable
6	YES	NO	1.8m	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( $\mu$ V/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	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( $\mu$ V/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	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 (dBuV/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 <sup>th</sup> 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**

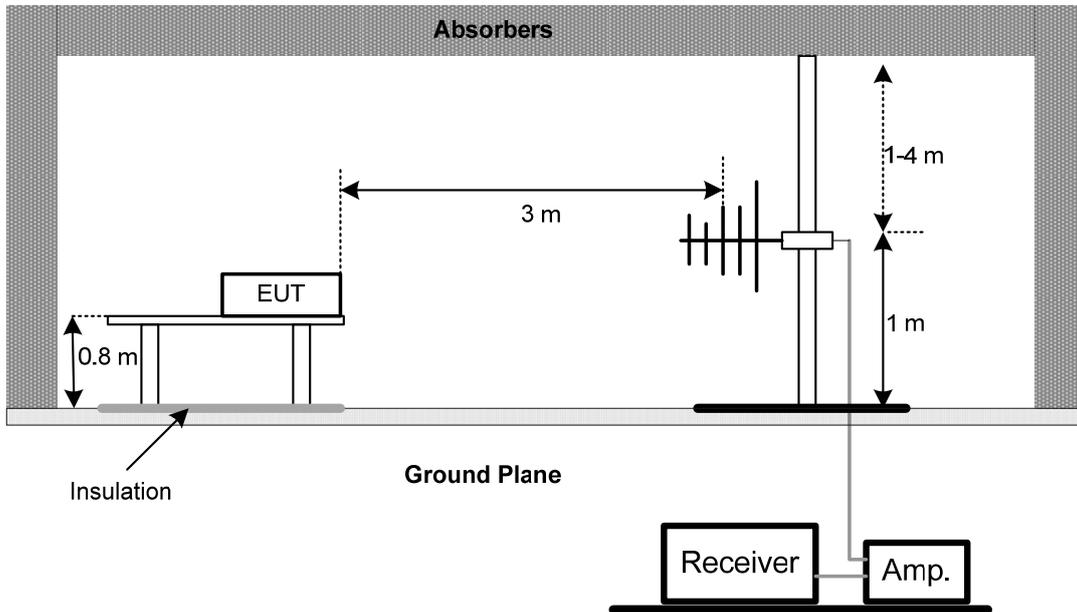
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz).
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- f. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- g. For the actual test configuration, please refer to the related Item - Block Diagram of system tested (please refer to 3.4).

**4.1.3 DEVIATION FROM TEST STANDARD**

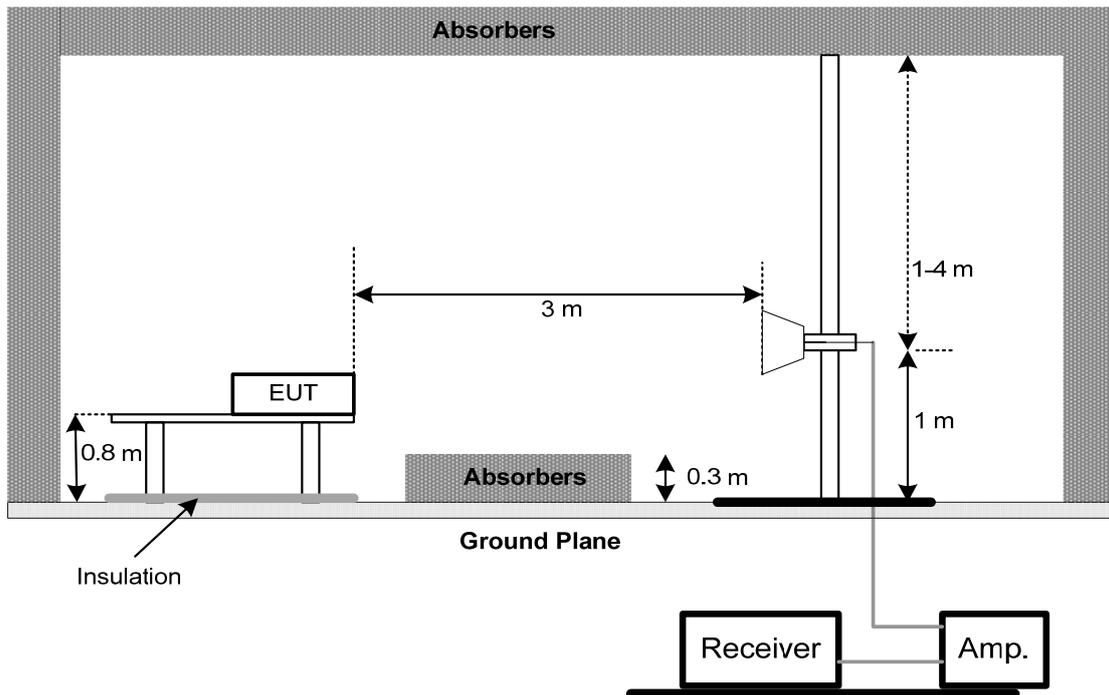
No deviation

**4.1.4 TEST SETUP**

**UP TO 1 GHZ**

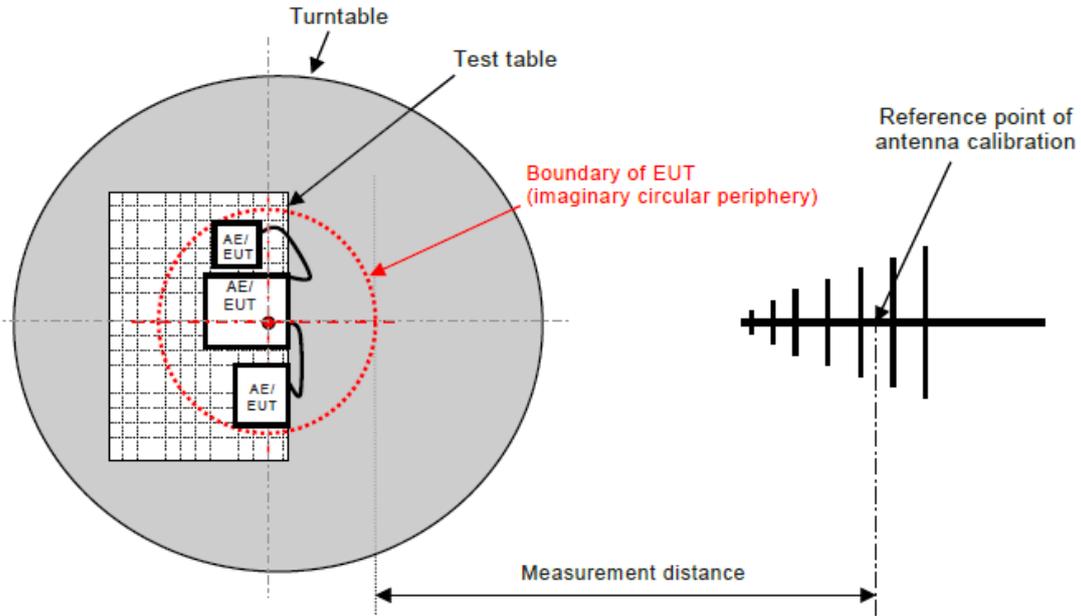


**ABOVE 1 GHZ**

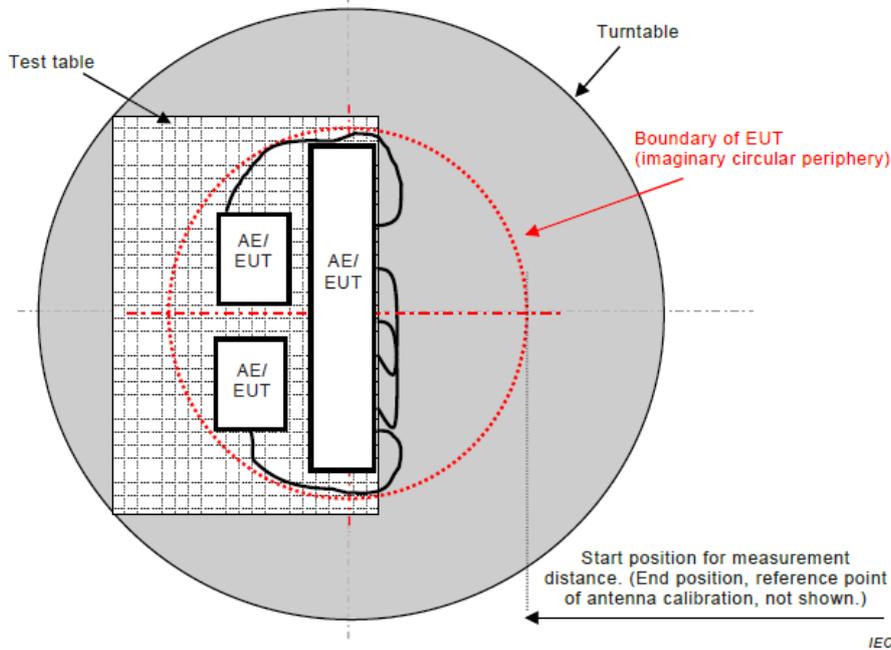


Note: The antenna can be moved between 1 to 4 meters above the ground.

**4.1.5 MEASUREMENT DISTANCE**



**Figure C.1 – Measurement distance**



**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 MAINS 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

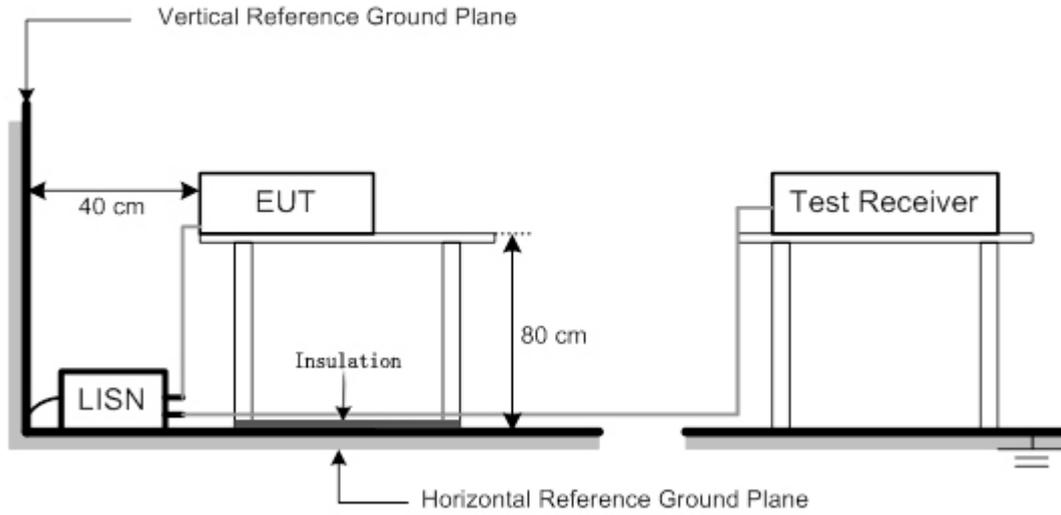
### 4.2.2 TEST PROCEDURE

- 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.
- 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.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- 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 <b>(NOTE 1)</b>	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 <b>(NOTE 2)</b>	B
	± 0.5 kV(peak) 5/50 ns Tr/Th 5 kHz Repetition Frequency	Signal port, Wired network port, Control port <b>(NOTE 2)</b>	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 <b>(line to line)</b>	AC mains power port	B
	± 2 kV(5P/5N) 1.2/50(8/20) Tr/Th us <b>(line to earth or ground)</b>		B
	±1 kV (5P/5N) 10/700 (5/320)Tr/Th us <b>(symmetrically operated line to ground )</b>	wired network ports <b>(NOTE 3)</b>	B
	±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us <b>(non-symmetrically line to line)</b>		
	±1 kV (5P/5N) 1.2/50(8/20) Tr/Th us <b>(non-symmetrically line to ground, or shield to ground)</b>		
±0.5 kV (5P/5N) 1.2/50(8/20) Tr/Th us <b>(line to ground, or shield to ground)</b>	wired network ports <b>(NOTE 4)</b>		

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 <b>(NOTE 1)</b>	AC Power Port	A
	0.15 MHz to 80 MHz 3 V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance <b>(NOTE 1)</b>	DC Power Port <b>(NOTE 2)</b>	A
	0.15 MHz to 80 MHz 3V (unmodulated, r.m.s), 1000 Hz or 400 Hz, 80%, AM Modulated 150Ω source impedance <b>(NOTE 1)</b>	signal ports, wired network ports, control ports <b>(NOTE 2)</b>	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 <b>(NOTE 5)</b>

**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
<b>A</b>	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>B</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.
<b>C</b>	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:	Air Discharge: $\pm 2\text{kV}/\pm 4\text{kV}/\pm 8\text{kV}$ (Direct) 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.

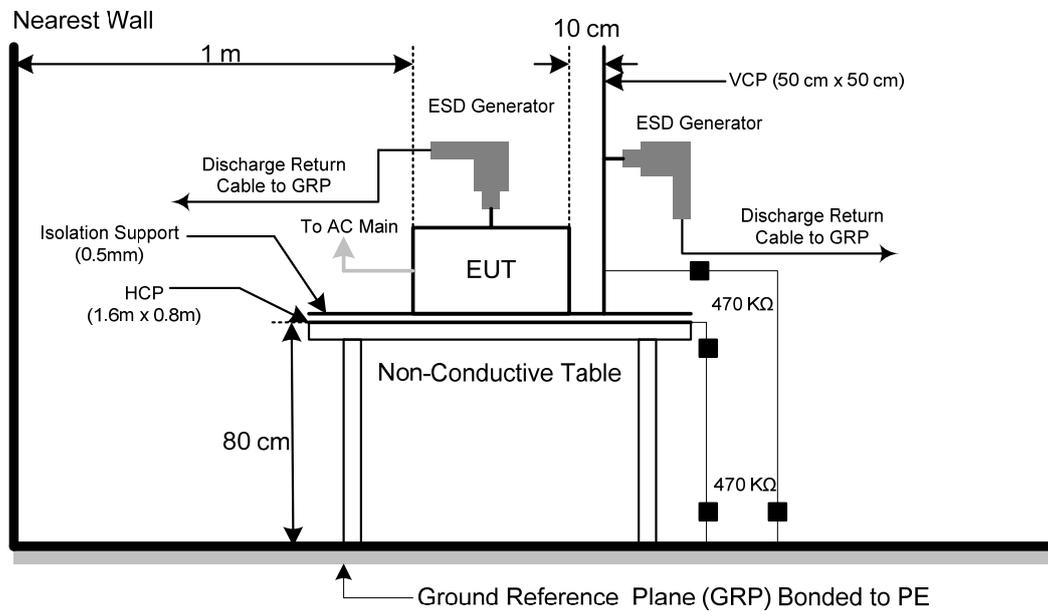
- b. Air discharges at insulation surfaces of the EUT.

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

### 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 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: 20°C Relative Humidity: 52% Test Pressure: 1001 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.

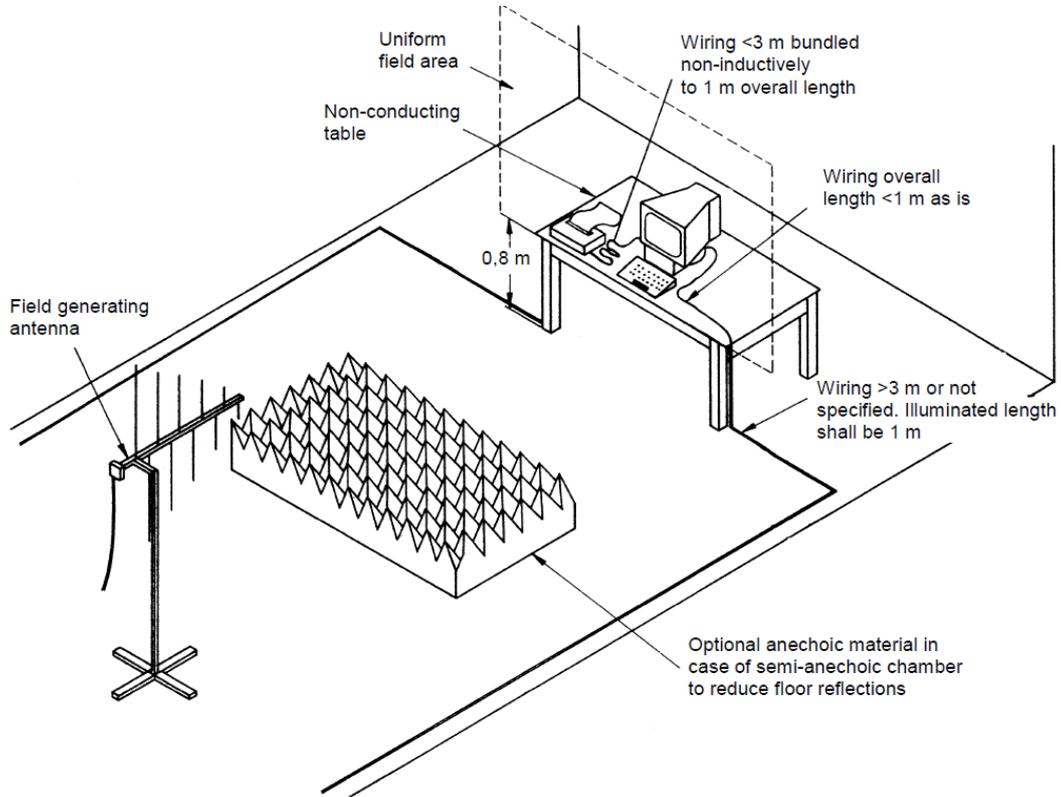
The exclusion band for immunity testing of equipment operating in the 5,8 GHz band shall be:

  - 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-conducting 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-conducting 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: 20°C Relative Humidity: 52%

**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:±1 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.

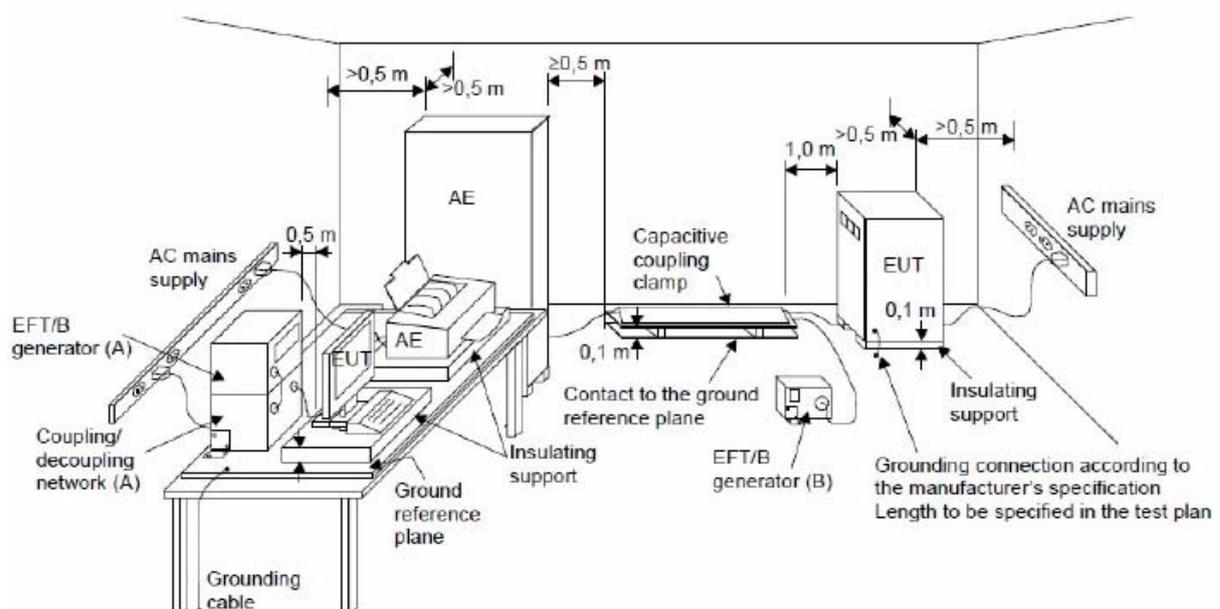
The other condition as following manner:

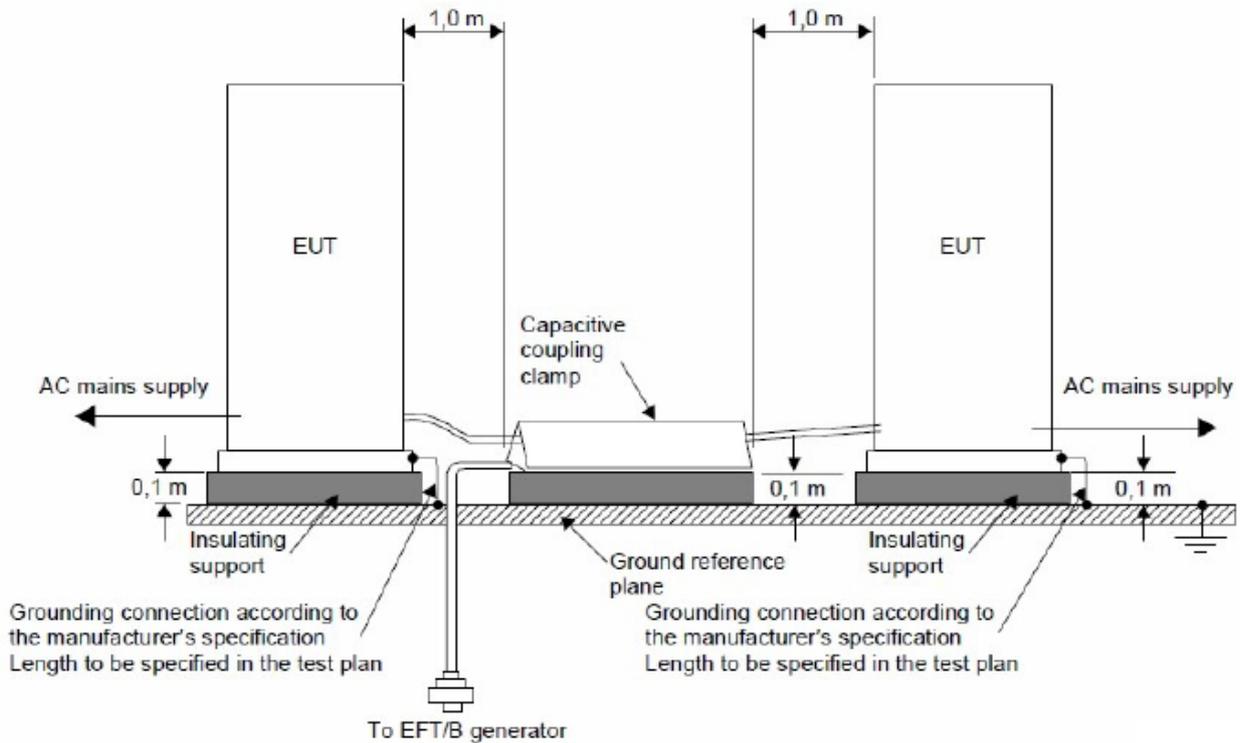
- The length of power cord between the coupling device and the EUT should not exceed 1 meter.
- Both positive and negative polarity discharges were applied.
- The duration time of each test sequential was 1 minute

### 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: 55%

**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: $\pm 0.5$ kV, $\pm 1$ kV, $\pm 1.5$ kV, $\pm 2$ kV
Surge Input/Output:	L-N, L-PE, N-PE
Generator Source	2 ohm between networks
Impedance:	12 ohm between networks or grounds
Polarity:	Positive/Negative
Phase Angle:	AC Power: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 –Block Diagram of system tested (please refer to 3.3).

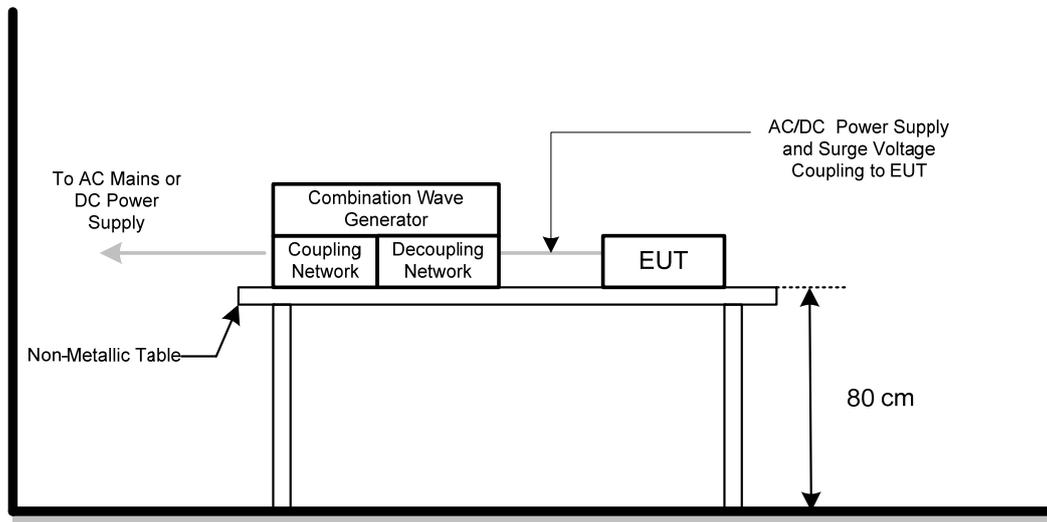
e. Downlink Mode: the audio source was adjusted to achieve a reference level equivalent to a SPL of 0 dBPa at 1 kHz at the input of the acoustic coupler for the downlink, the reading of the audio level meter was recorded as a reference level. During the test, the downlink speech output level was monitored, it was confirmed to be at least 35 dB less than the previously-recorded reference level.

f. Uplink Mode: EUT is used for this calibration, the output of the audio source was adjusted to achieve a reference level equivalent to a SPL of - 5 dBPa at 1kHz at the Mouth Reference Point (MRP), the reading of the audio level meter, which was connected to the output of the communication tester, was recorded as a reference level. During the test, the uplink speech output level was monitored, it was confirmed to be at least 35 dB less than the previously-recorded reference level.

### 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: 55%

### 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.

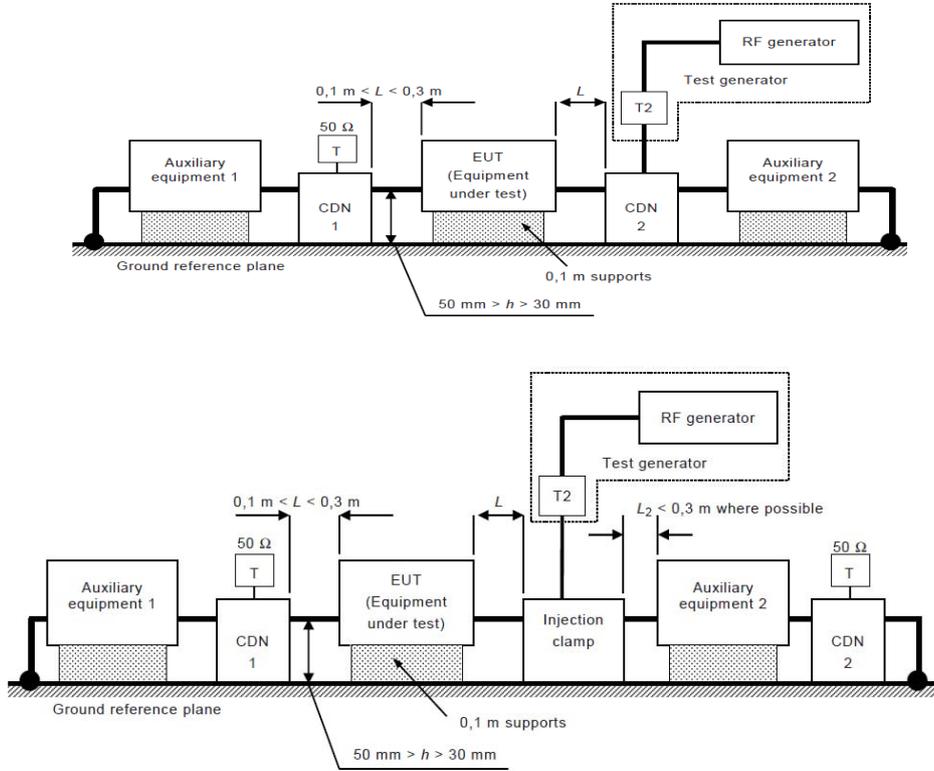
The other condition as following manner:

- 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**

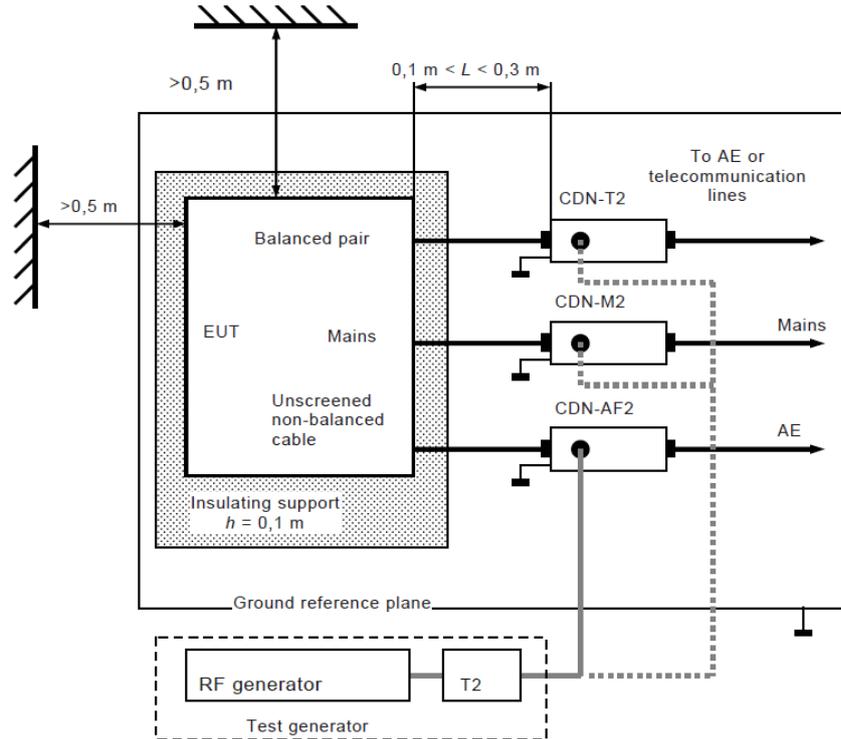
No deviation

**5.8.4 TEST SETUP**



IEC 1583/03

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



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

**5.8.5 EUT OPERATING CONDITIONS**

Temperature: 25°C Relative Humidity: 55%

**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 (0 % residual voltage for 0,5 cycle) B (0 % residual voltage for 1 cycle) B (70 % residual voltage for 25 cycles (at 50 Hz)) C (0 % residual voltage for 250 cycles (at 50 Hz))
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

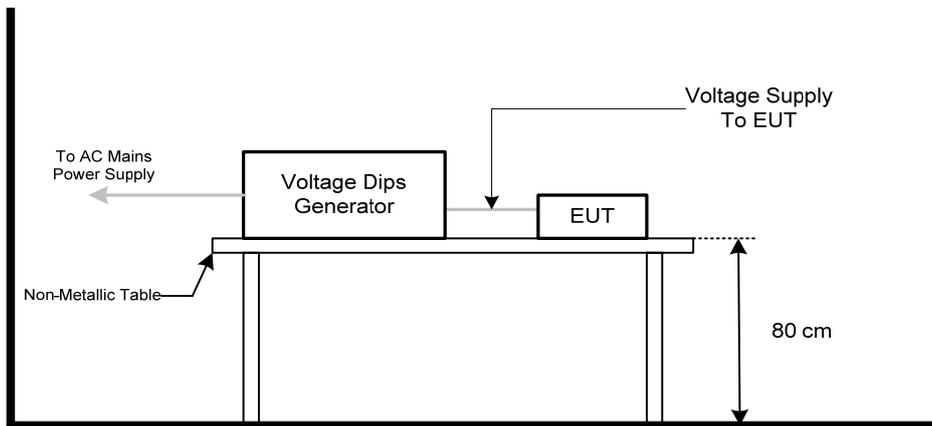
### 5.9.2 TEST PROCEDURE

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



### 5.9.5 EUT OPERATING CONDITIONS

Temperature: 25°C Relative Humidity: 55%

### 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	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 26, 2018
2	Double Ridged Horn Antenna	ARA	DRG-118A	16554	Mar. 26, 2018
3	Amplifier	Agilent	8449B	3008A02274	Feb. 22, 2018
4	Amplifier	HP	8447D	1937A02847	Feb. 22, 2018
5	RF Pre-selector	Agilent	N9039A	MY46520201	Sep. 04, 2017
6	Cable	emci	LMR-400(30MHz-1GHz)(10m+2.5m)	N/A	Jun. 27, 2017
7	Cable	emci	EMC104-SM-SM-10000 (1GHz—26.5GHz)(10m)	N/A	Jun. 30, 2017
8	Controller	CT	SC100	N/A	N/A
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
10	Spectrum Analyzer	Agilent	E4447A	MY48250208	Sep. 04, 2017

Radiated emission above 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Guide Antenna	ETS	3115	75789	Mar. 26, 2018
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Apr. 22, 2018
3	Amplifier	Agilent	8449B	3008A02274	Feb. 22, 2018
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 26, 2018
5	Receiver	Agilent	N9038A	MY52130039	Sep. 04, 2017
6	Antenna	EM	EM-6876-1	230	Jul. 08, 2017
7	Controller	CT	SC100	N/A	N/A
8	Controller	MF	MF-7802	MF780208416	N/A
9	Cable	emci	EMC104-SM-SM-12000(12m)	N/A	Jul. 06, 2017
10	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

### Conducted Emission

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESCI	100382	Mar. 26, 2018
2	LISN	EMCO	3816/2	52765	Mar. 26, 2018
3	50Ω Terminator	SHX	TF2-3G-A	8122901	Mar. 26, 2018
4	TWO-LINE V-NETWORK	R&S	ENV216	101447	Mar. 26, 2018
5	Cable	emci	RG223(9KHz-30 MHz)(5m)	N/A	Mar. 07, 2018
6	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

### ESD

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	ESD Generator	TESEQ AG	NSG 437	450	Nov. 03, 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	System mainframe	Schaffner	NSG 2050	200729-619L U	Sep. 04, 2017
2	THE MODULAR SOLUTION FOR 6 KV APPLICATIONS	Teseq	NSG 3060	1423	Sep. 04, 2017
3	Measurement Software	Teseq	Win 3000 Version 1.2.0	N/A	N/A
4	Measurement Software	Schaffner	Win 2000 Version V7.10	N/A	N/A

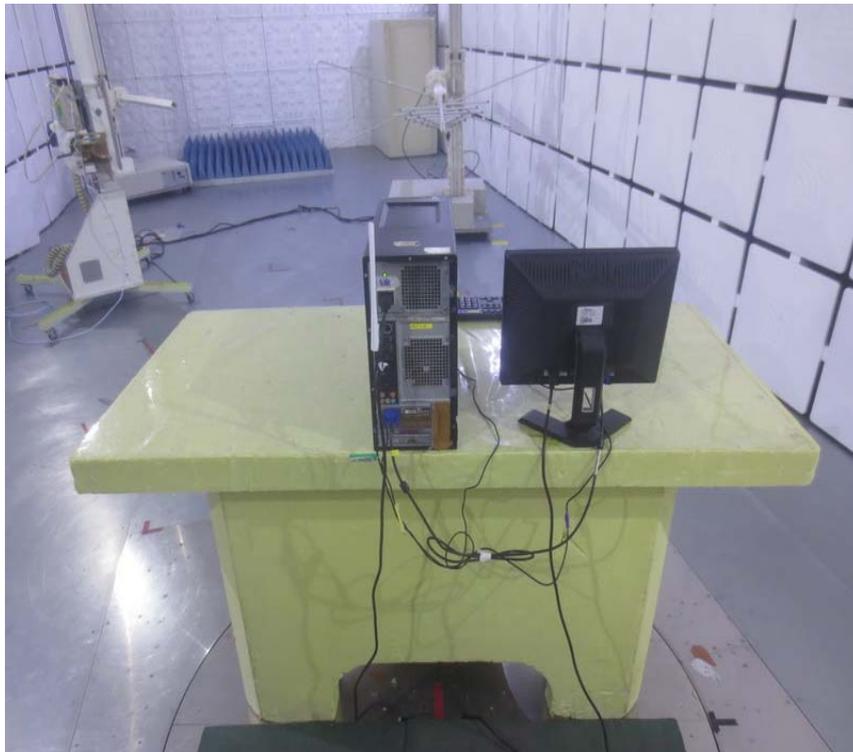
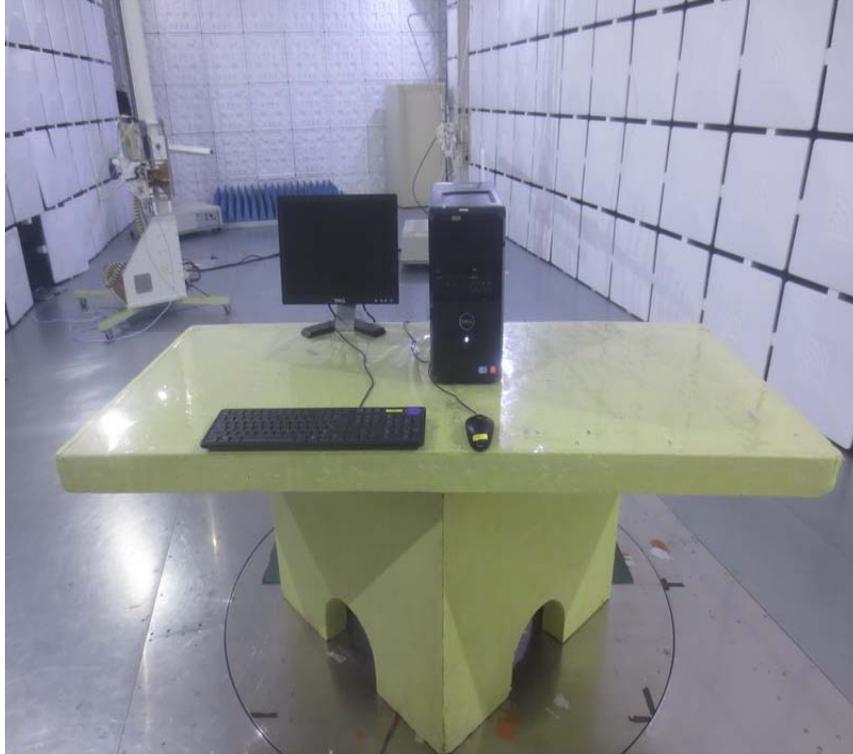
CS					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	HP	8648A	3636A02964	Mar. 26, 2018
2	Power Amplifier	Teseq	CBA230M-080	T43748	Mar. 26, 2018
3	Power CDN	FCC	FCC-801-M2/ M3-16A	100270	Mar. 26, 2018
4	Power CDN	FCC	FCC-801-M2/ M3-16A	100271	Mar. 26, 2018
5	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

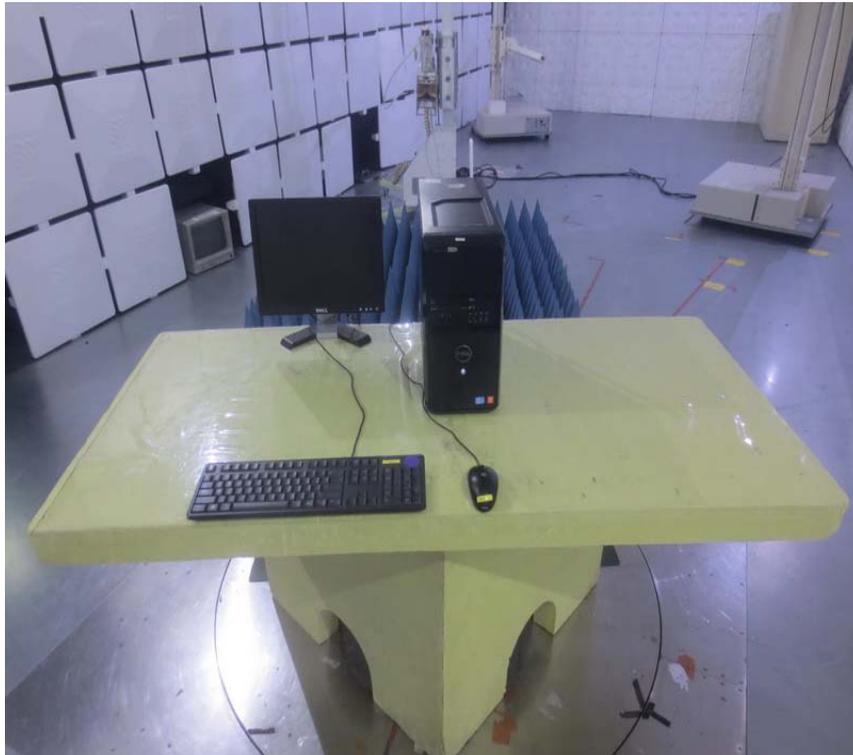
Remark: "N/A" denotes no model name, serial no. or calibration specified.  
All calibration period of equipment list is one year.

## 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**

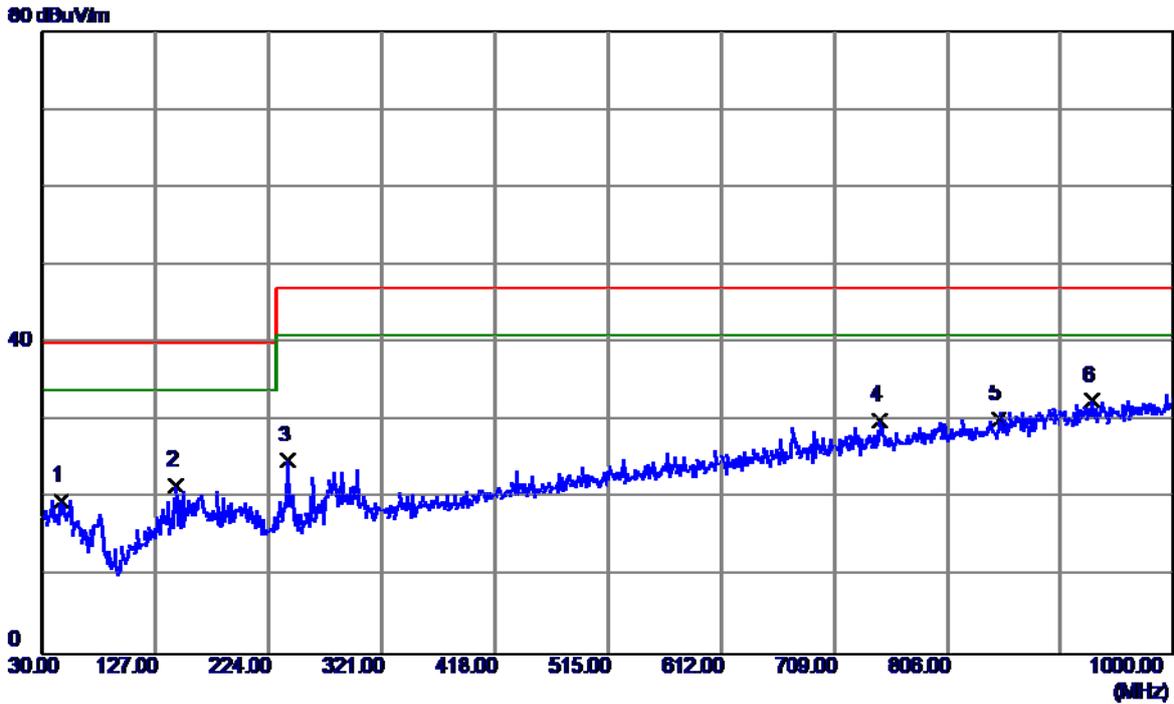


CS



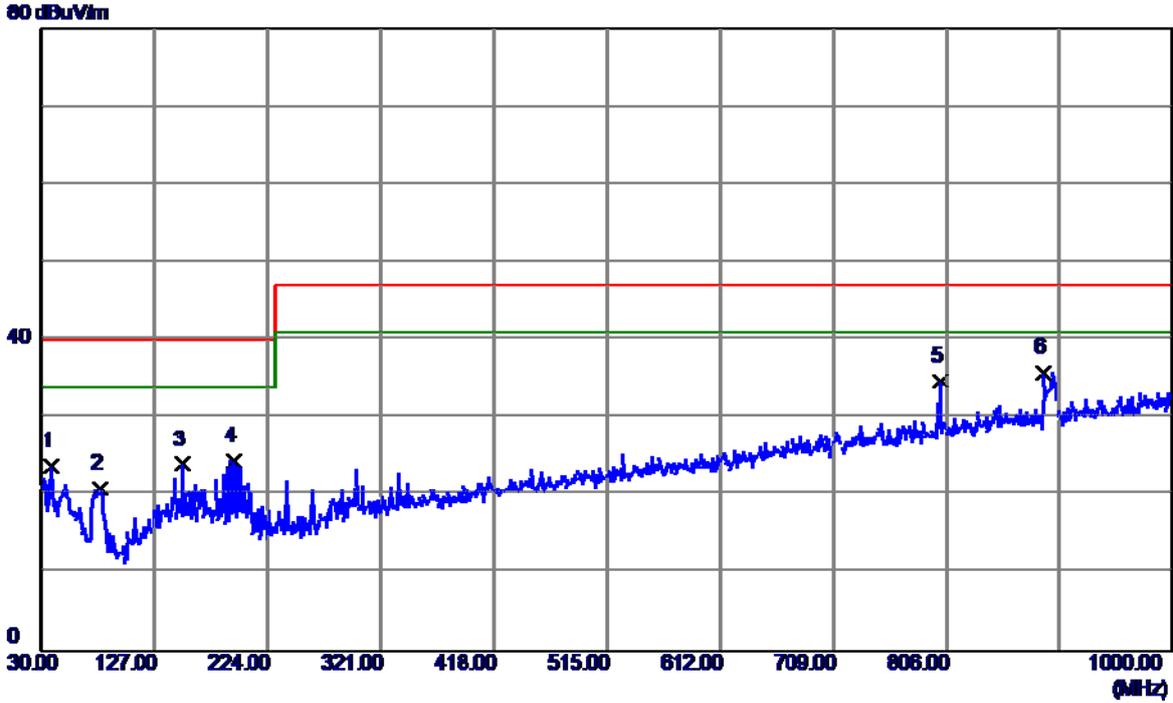
# ATTACHMENT A - RADIATED EMISSION UP TO 1GHZ

EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	60%
Test Voltage	DC 5V	Polarization	Vertical
Test Mode	Operating		
Test Engineer	Treyy Chen		



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector
1	46.4900	31.52	-11.76	19.76	40.00	-20.24	QP
2	144.4600	33.98	-12.25	21.73	40.00	-18.27	QP
3	240.4900	38.32	-13.37	24.95	47.00	-22.05	QP
4	747.8000	30.33	-0.18	30.15	47.00	-16.85	QP
5	849.6500	28.39	1.92	30.31	47.00	-16.69	QP
6 *	930.1600	29.27	3.41	32.68	47.00	-14.32	QP

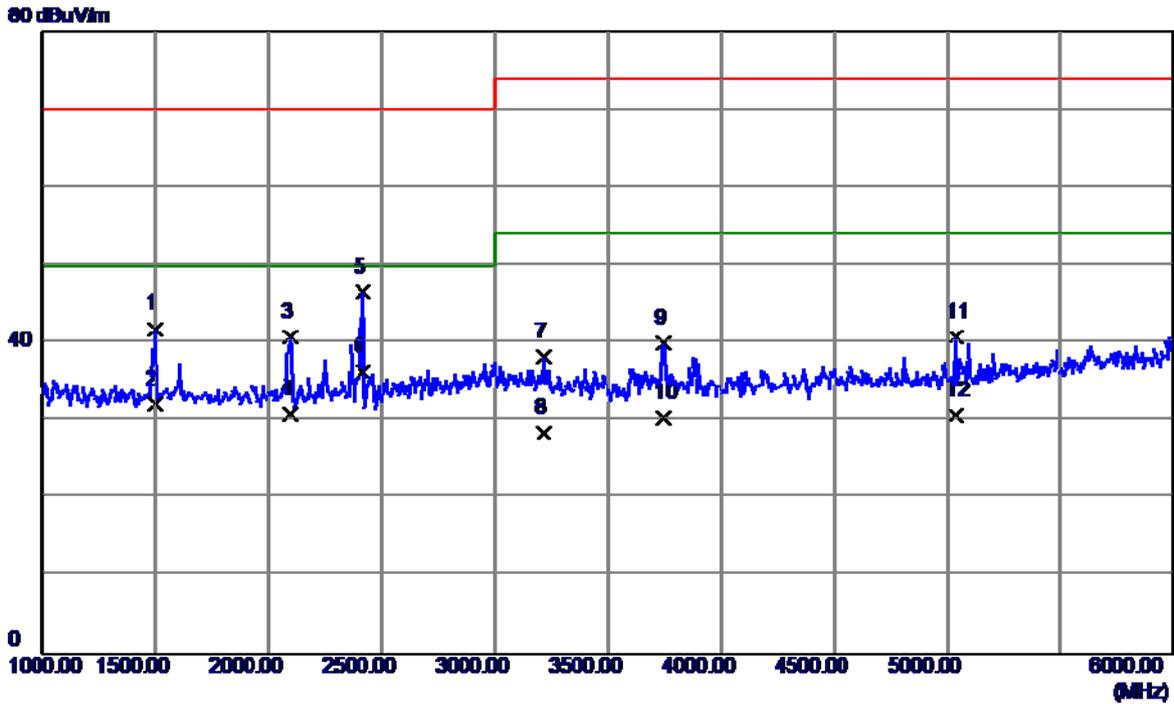
EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	60%
Test Voltage	DC 5V	Polarization	Horizontal
Test Mode	Operating		
Test Engineer	Treey Chen		



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector
1	38.7300	36.58	-12.77	23.81	40.00	-16.19	QP
2	80.4400	37.67	-16.75	20.92	40.00	-19.08	QP
3	150.2800	36.06	-11.98	24.08	40.00	-15.92	QP
4	194.9000	36.24	-11.80	24.44	40.00	-15.56	QP
5	800.1800	33.87	0.79	34.66	47.00	-12.34	QP
6 *	889.4200	33.24	2.67	35.91	47.00	-11.09	QP

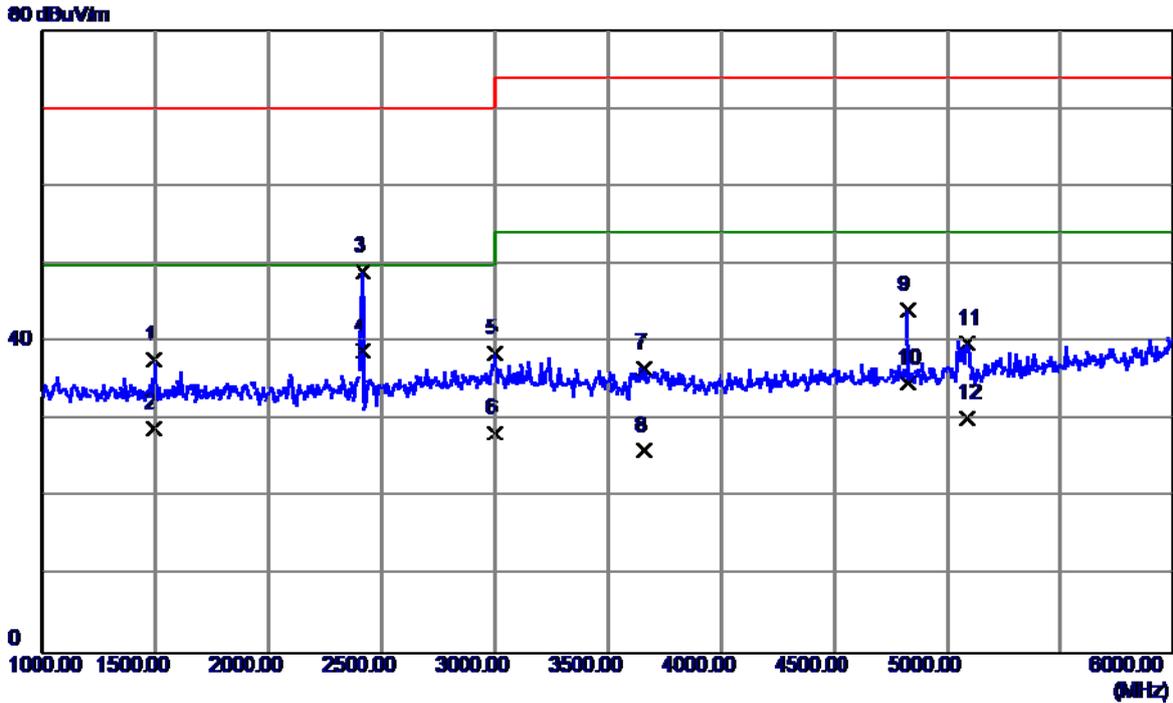
## ATTACHMENT B - RADIATED EMISSION ABOVE 1GHZ

EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	60%
Test Voltage	DC 5V	Polarization	Vertical
Test Mode	Operating		
Test Engineer	Treyy Chen		



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure ment dBuV/m	Limit dBuV/m	Margin dB	Detector
1	1500.0000	45.43	-3.59	41.84	70.00	-28.16	Peak
2	1500.0000	35.70	-3.59	32.11	50.00	-17.89	AVG
3	2095.0000	42.07	-1.26	40.81	70.00	-29.19	Peak
4	2095.0000	32.14	-1.26	30.88	50.00	-19.12	AVG
5	2415.0000	46.13	0.43	46.56	70.00	-23.44	Peak
6 *	2415.0000	35.87	0.43	36.30	50.00	-13.70	AVG
7	3215.0000	34.13	4.11	38.24	74.00	-35.76	Peak
8	3215.0000	24.33	4.11	28.44	54.00	-25.56	AVG
9	3745.0000	35.09	4.88	39.97	74.00	-34.03	Peak
10	3745.0000	25.47	4.88	30.35	54.00	-23.65	AVG
11	5040.0000	33.69	7.18	40.87	74.00	-33.13	Peak
12	5040.0000	23.51	7.18	30.69	54.00	-23.31	AVG

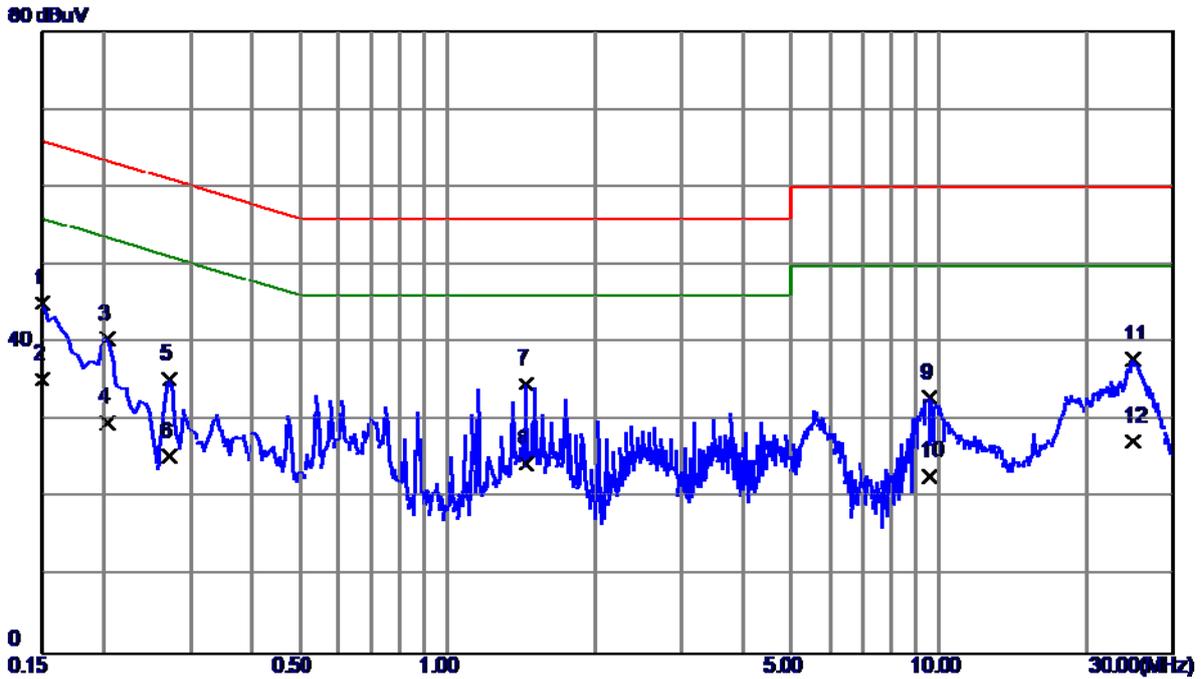
EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	60%
Test Voltage	DC 5V	Polarization	Horizontal
Test Mode	Operating		
Test Engineer	Treey Chen		



No.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Margin dB	Detector
1	1495.0000	41.38	-3.61	37.77	70.00	-32.23	Peak
2	1495.0000	32.56	-3.61	28.95	50.00	-21.05	AVG
3	2415.0000	48.63	0.43	49.06	70.00	-20.94	Peak
4 *	2415.0000	38.45	0.43	38.88	50.00	-11.12	AVG
5	3000.0000	34.83	3.70	38.53	70.00	-31.47	Peak
6	3000.0000	24.55	3.70	28.25	50.00	-21.75	AVG
7	3660.0000	31.87	4.80	36.67	74.00	-37.33	Peak
8	3660.0000	21.26	4.80	26.06	54.00	-27.94	AVG
9	4825.0000	37.39	6.76	44.15	74.00	-29.85	Peak
10	4825.0000	27.96	6.76	34.72	54.00	-19.28	AVG
11	5090.0000	32.49	7.36	39.85	74.00	-34.15	Peak
12	5090.0000	22.85	7.36	30.21	54.00	-23.79	AVG

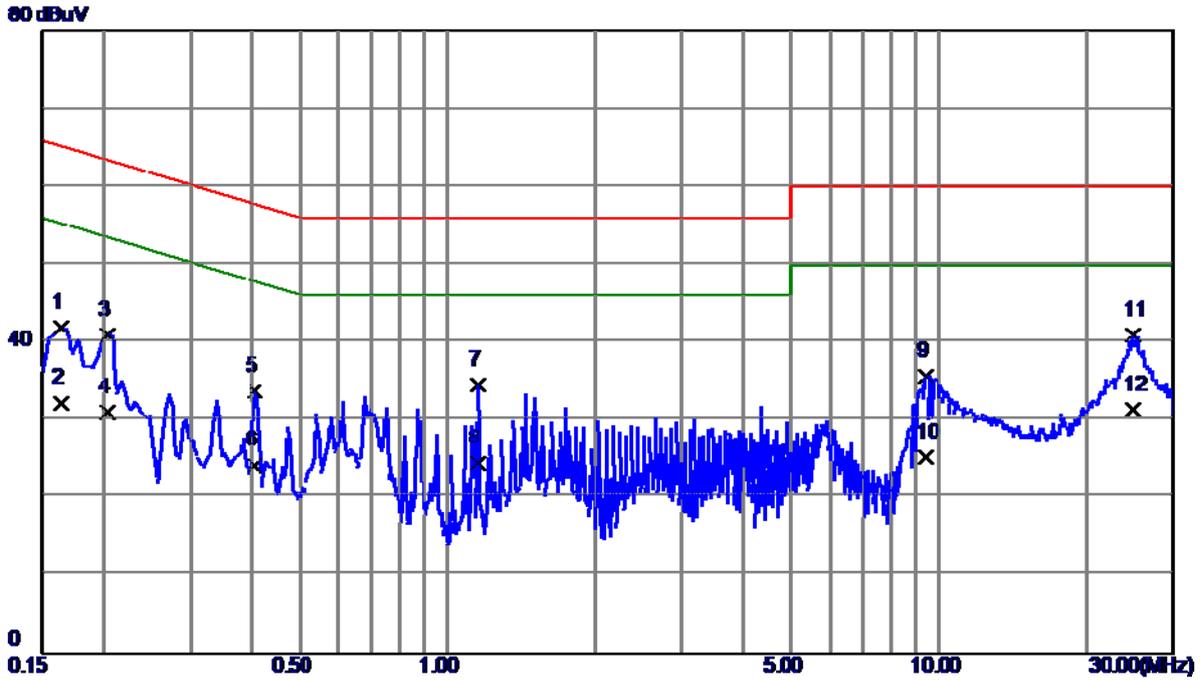
**ATTACHMENT C - CONDUCTED EMISSION AT AC MAINS  
POWER PORT**

EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	53%
Test Voltage	DC 5V	Phase	Line
Test Mode	Operating		
Test Engineer	Treyy Chen		



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Margin dB	Detector
1	0.1500	35.30	9.75	45.05	66.00	-20.95	QP
2 *	0.1500	25.60	9.75	35.35	56.00	-20.65	AVG
3	0.2040	30.73	9.72	40.45	63.45	-23.00	QP
4	0.2040	20.10	9.72	29.82	53.45	-23.63	AVG
5	0.2714	25.65	9.72	35.37	61.07	-25.70	QP
6	0.2714	15.71	9.72	25.43	51.07	-25.64	AVG
7	1.4460	24.94	9.81	34.75	56.00	-21.25	QP
8	1.4460	14.60	9.81	24.41	46.00	-21.59	AVG
9	9.5595	22.98	10.03	33.01	60.00	-26.99	QP
10	9.5595	12.79	10.03	22.82	50.00	-27.18	AVG
11	24.8145	27.53	10.35	37.88	60.00	-22.12	QP
12	24.8145	17.00	10.35	27.35	50.00	-22.65	AVG

EUT	150Mbps High Gain Wireless USB Adapter	Model Name	U2
Temperature	25°C	Relative Humidity	53%
Test Voltage	DC 5V	Phase	Neutral
Test Mode	Operating		
Test Engineer	Treey Chen		



No.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Margin dB	Detector
1	0.1635	32.23	9.64	41.87	65.28	-23.41	QP
2	0.1635	22.60	9.64	32.24	55.28	-23.04	AVG
3	0.2040	31.36	9.65	41.01	63.45	-22.44	QP
4	0.2040	21.40	9.65	31.05	53.45	-22.40	AVG
5	0.4065	24.10	9.65	33.75	57.72	-23.97	QP
6	0.4065	14.59	9.65	24.24	47.72	-23.48	AVG
7	1.1580	24.81	9.68	34.49	56.00	-21.51	QP
8	1.1580	14.79	9.68	24.47	46.00	-21.53	AVG
9	9.4290	25.73	9.97	35.70	60.00	-24.30	QP
10	9.4290	15.29	9.97	25.26	50.00	-24.74	AVG
11	24.8280	30.50	10.50	41.00	60.00	-19.00	QP
12 *	24.8280	20.81	10.50	31.31	50.00	-18.69	AVG

# ATTACHMENT D - ESD

Test Voltage:	DC 5V
Test Mode:	Operating

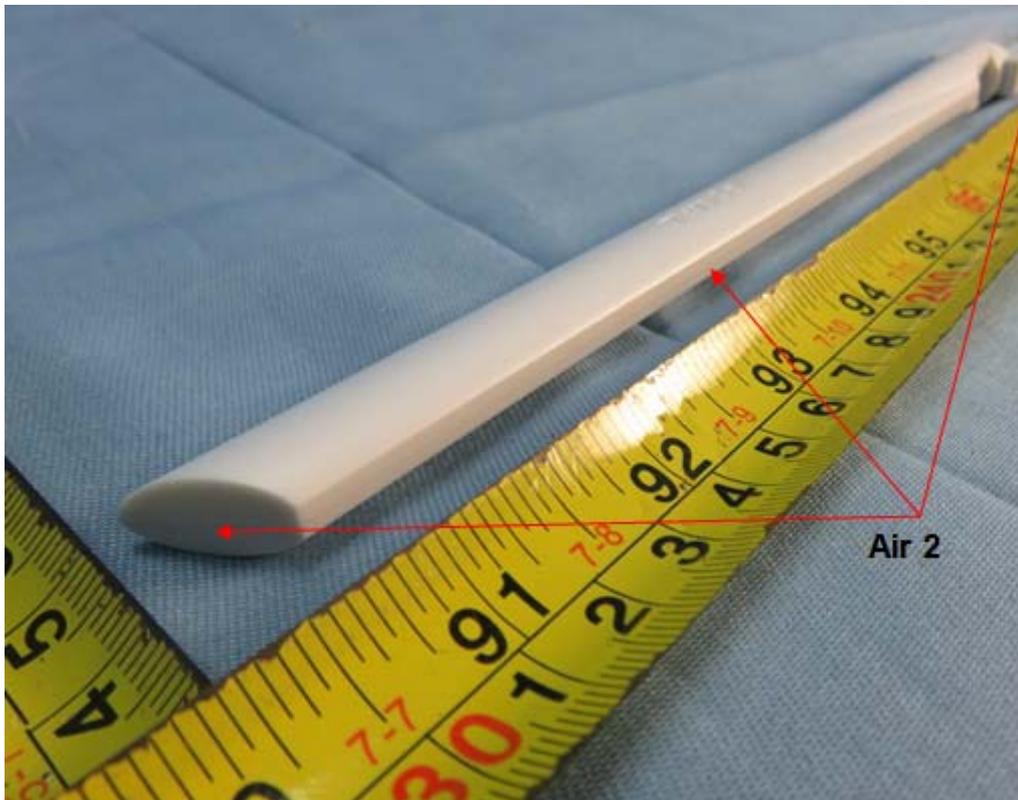
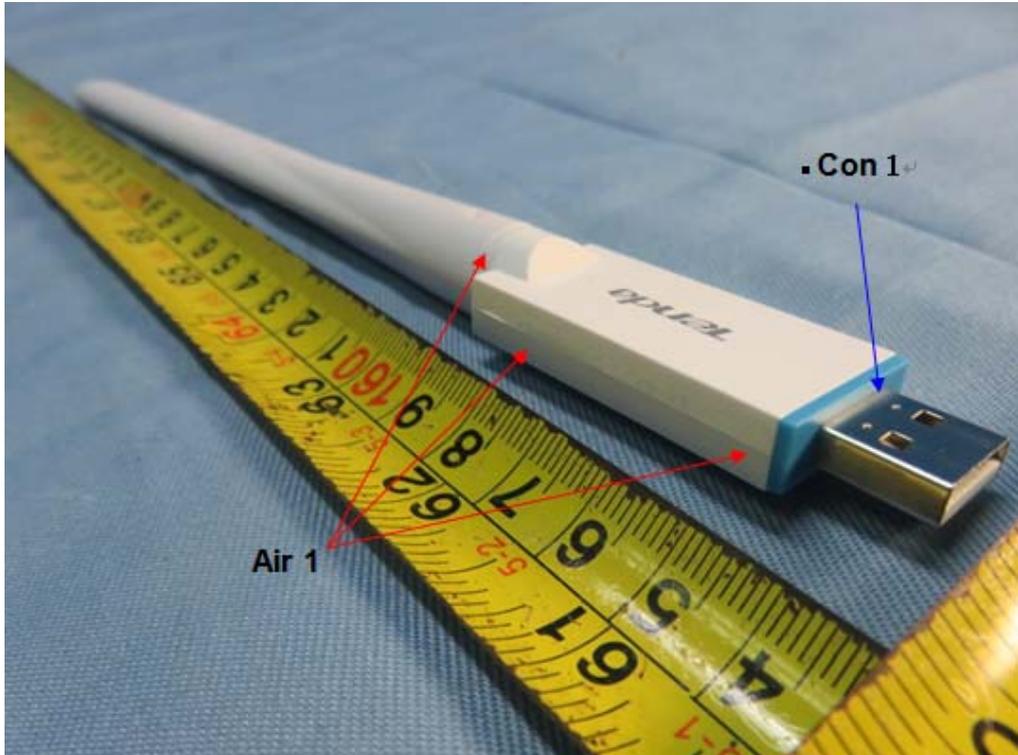
Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		- kV		2kV		4kV		- kV		- kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	A	A	A	A	-	-	A	A	A	A	-	-	-	-
2	A	A	A	A	A	A	-	-	-	-	-	-	-	-	-	-
Criteria	<b>B</b>								<b>B</b>							
Result	<b>A</b>								<b>A</b>							
Judgme	<b>PASS</b>								<b>PASS</b>							

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</b>								<b>B</b>							
Result	<b>A</b>								<b>A</b>							
Judgment	<b>PASS</b>								<b>PASS</b>							

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) Test condition: Direct / Indirect (HCP/VCP) discharges: Minimum 20 times (Positive/Negative) at each point. Air discharges: Minimum 20 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) Performance Criteria please refer to clause 5.2.

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



# ATTACHMENT E - RS

Test Voltage:	DC 5V
Test Mode:	Operating

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Criteria	Results	Judgment
80 - 1000	V/H	3 V/m	0	A	A	PASS
		(unmodulated, r.m.s)	90			
		AM Modulated	180			
		1000 Hz, 80%	270			
1000 - 3000	V/H	3 V/m	0	A	A	PASS
		(unmodulated, r.m.s)	90			
		AM Modulated	180			
		1000 Hz, 80%	270			
3000 - 6000	V/H	3 V/m	0	A	A	PASS
		(unmodulated, r.m.s)	90			
		AM Modulated	180			
		1000 Hz, 80%	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:	DC 5V
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>		<b>B</b>		<b>B</b>	
Result	<b>A</b>		<b>N/A</b>		<b>N/A</b>	
Judgment	<b>PASS</b>		<b>N/A</b>		<b>N/A</b>	

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable to this device
- 3) Performance Criteria please refer to clause 5.2.

## ATTACHMENT G - SURGE

Test Voltage:	DC 5V
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	1.5kV	2kV			
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) Polarity and Numbers of Impulses:5 Pst / Ngt at each tested mode
- 2) N/A - denotes test is not applicable to this device
- 3) Performance Criteria please refer to clause 5.2.

## ATTACHMENT H - INJECTION CURRENT

Test Voltage:	DC 5V
Test Mode:	Operating

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

Note:

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

# ATTACHMENT I - VOLTAGE INTERRUPTION/DIPS

Test Voltage:	DC 5V
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

AC 240V/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

AC 100V/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 applicable to this device.
- 2) Performance Criteria please refer to clause 5.2.