



**ETSI EN 301 489-1  
ETSI EN 301 489-52**

**TEST REPORT**

*For*

**Electron 2G/3G Global**

**MODEL NUMBER: E310D, ELC314**

**REPORT NUMBER: 4789723883.1-1**

**ISSUE DATE: December 25, 2020**

*Prepared for*

**Particle Industries, Inc.  
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*Prepared by*

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V0	12/25/2020	Initial Issue	

Note: This is a copy report base on 4788749548.1-1 which is issued by UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch on January 24, 2019. The customer need to add a new series model ELC314 which is all the same with the original model E310D except for the manufacturer of the embedded SIM card. We update the test report directly without any test. For more informaton, please refer to the original report.



**TEST REPORT CERTIFICATION**

**Applicant's Name**.....: Particle Industries, Inc.

Address .....: 26 Post St, 4th floor, San Francisco, CA 94108, USA

**Manufacturer's Name** .....: Particle Industries, Inc.

Address .....: 26 Post St, 4th floor, San Francisco, CA 94108, USA

**Product Description** .....

Product Name .....: Electron 2G/3G Global

Brand Name .....: Particle

Model Name .....: E310D

Series Model .....: ELC314

Model Difference .....: Please refer to clause 2.1 GENERAL DESCRIPTION OF THE EUT

**Standards**.....: Draft ETSI EN 301 489-1 V2.2.0 (2017-03)  
Draft ETSI EN 301 489-52 V1.1.0 (2016-11)


This device described above has been tested by STS, and the test results show that the equipment under test (EUT) is in compliance with the 2014/53/EU RE Directive Art 3.1b requirements. And it is applicable only to the tested sample identified in the report.


**Date of Test**.....:


Date (s) of Performance of Tests .....: 19 Nov. 2018 ~ 23 Nov. 2018

Date of Issue.....: 24 Jan. 2019

Test Result .....: **Pass**

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## 1. TEST SUMMARY

Test procedures according to the technical standards:

Draft ETSI EN 301 489-1 V2.2.0 (2017-03)

Draft ETSI EN 301 489-52 V1.1.0 (2016-11)

EMC Emission				
Standard	Test Item	Limit	Judgment	Remark
EN 55032:2015	Conducted Emission On AC And Telecom Port 150kHz to 30MHz	Class B	PASS	
	Radiated Emission 30MHz to 1000MHz	Class B	PASS	
	Radiated Emission 1GHz to 6GHz	Class B	PASS	NOTE (1)
EN 61000-3-2:2014	Harmonic Current Emission	-----	N/A	NOTE (2)
EN 61000-3-3:2013	Voltage Fluctuations & Flicker	-----	PASS	
EMC Immunity				
Section	Test Item	Performance Criteria	Judgment	Remark
EN 61000-4-2:2009	Electrostatic Discharge	B	PASS	
EN 61000-4-3:2006+A1:2008+A2:2010	RF Electromagnetic Field	A	PASS	
EN 61000-4-4:2012	Fast Transients	B	PASS	
EN 61000-4-5:2006	Surges	B	PASS	
EN 61000-4-6:2009	Injected Current	A	PASS	
EN 61000-4-11:2004	Volt. Interruptions Volt. Dips	B / C / C / C	PASS	NOTE (3)

Note:

(1) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz.

If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.

If the highest frequency of the internal sources of the EUT is between 500 MHz and 1GHz, the measurement shall only be made up to 5 GHz.

If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times of the highest frequency or 6 GHz, whichever is less.

(2) The power consumption of EUT is less than 75W and no Limits apply.

(3) Voltage Dip: 100% reduction – Performance Criteria B

Voltage Dip: 30% reduction – Performance Criteria C

Voltage Dip: 40% reduction – Performance Criteria C



Voltage Interruption: 100% Interruption – Performance Criteria C

For GSM mode add special conditions for EMC immunity tests

(4) For client's request and manual description, the test will not be executed.

(5) "N/A" denotes test is not applicable in this Test Report

## 1.1 TEST FACTORY

Company Name:	Shenzhen STS Test Services Co. Ltd.
Address:	1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	+86-755 3688 6288
Fax:	+86-755 3688 6277
Registration No.:	FCC Registration No.: 625569
	IC Registration No.: 12108A; A2LA Certificate No.: 4338.01;

## 1.2 MEASUREMENT UNCERTAINTY

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)	NOTE
STSC01	ANSI	9KHz-150KHz	3.18	
		150 KHz ~ 30MHz	2.70	

### B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	U · (dB)	NOTE
STSC02	ANSI	30MHz ~ 200MHz	3.43	
		200MHz ~ 1000MHz	3.57	
		1GHz ~ 6 GHz	4.13	

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Electron 2G/3G Global	
Brand Name	Particle	
Model Name	E310D	
Series Model	ELC314	
Model Difference	The schematic and PCB of the ELC314 is completely the same with E310D, and these two models of HW&SW is the same. Because changing the MVNO's E-SIM card (embedded SIM card) provider from Kore to Twilio. The differences are as follows: E310D uses eSIM of Kore. ELC314 uses eSIM of Twilio.	
Test Sample Number	181119020	
Frequency Bands	GSM	900: 880.2 MHz to 914.8 MHz 1800: 1710.2 MHz to 1784.8 MHz
	WCDMA	Band I: 1922.4 MHz to 1977.6 MHz Band VIII: 882.4 MHz to 912.6 MHz
Modulation Mode	GSM	GMSK for GPRS; GMSK and 8PSK for EDGE
	WCDMA	QPSK; HSDPA:QPSK/16QAM; HSUPA:BPSK
SIM Card	Only single SIM card is supported	
Power Rating	Input: DC 5V 500mA Output:DC3.6V to 5.5V	
Battery	Battery(rating): Rated Voltage: 3.7V Capacity :1800mAh	
Hardware Version Number	N/A	
Software Version Number	N/A	



## 2.2 DESCRIPTION OF THE 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	WCDMA Band I
Mode 2	WCDMA Band VIII
Mode 3	GPRS 900 Mode
Mode 4	GSM 900 Mode
Mode 5	EDGE 900 Mode
Mode 6	GSM 1800 Mode
Mode 7	GPRS 1800 Mode
Mode 8	EDGE 1800 Mode
Mode 9	Charging Mode

For Conducted Test	
Final Test Mode	Description
Mode 1	WCDMA Band I+Charging Mode

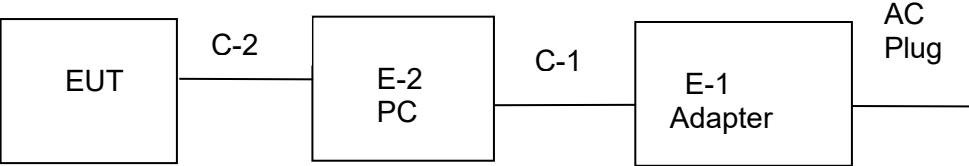
For Radiated Test	
Final Test Mode	Description
Mode 4	GSM 900 Mode+Charging Mode

For EMS Test	
Final Test Mode	Description
Mode 1	WCDMA Band I
Mode 2	WCDMA Band VIII
Mode 3	GSM 900 Mode
Mode 4	GPRS 900 Mode
Mode 5	EDGE 900 Mode
Mode 6	GSM 1800 Mode
Mode 7	GPRS 1800 Mode
Mode 8	EDGE 1800 Mode
Mode 9	Charging Mode

Note: The test modes were carried out for all operation modes(include link and idle).

The worst test mode for the final conducted data of EUT is Mode 1 and the worst test mode for radiation data is Mode 4, test data display.

**2.3 DESCRIPTION OF THE TEST SETUP**



## 2.4 DESCRIPTION OF THE 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.

### Accessories equipment

Item	Equipment	Mfr/Brand	Model/Type No.
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

### Auxiliary equipment

Item	Equipment	Mfr/Brand	Model/Type No.
E-1	PC	HP	S7RIX8250H
E-2	Adapter	HP	AC-09

### Cable

Item	Type	Shielded Type	Ferrite Core	Length
C-1	N/A	Unshielded	NO	80cm
C-2	USB Micro-B Plug Cable	Unshielded	NO	80cm

#### Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” means “shielded” “with core”; “NO” means “unshielded” “without core”.

## 2.5 MEASUREMENT INSTRUMENTS LIST

### 2.5.1 CONDUCTED TEST SITE

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
EMI Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
LISN	R&S	ENV216	101242	2018.10.11	2019.10.10
LISN	ETS	3810/2NM	00023625	2018.10.11	2019.10.10
Absorbing Clamp	R&S	MDS-21	100668	2018.10.17	2019.10.16
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
CE Cable	N/A	C01	N/A	2018.10.13	2019.10.12
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

### 2.5.2 RADIATED TEST SITE

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
EMI Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
Bilog Antenna	TESEQ	CBL6111D	45873	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1343	2018.10.19	2021.10.18
Pre-mpifier(1G-18G)	SKET	LNPA-01018G-45	SK2018080901	2018.10.13	2019.10.12
Pre-mpifier(0.1M-3GHz)	EM	EM330	060665	2018.07.10	2019.07.09
Spectrum Analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
RE Cable (9K-1G)	N/A	R01	N/A	2018.10.13	2019.10.12
RE Cable (1G-18G)	N/A	R02	N/A	2018.10.13	2019.10.12
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

### 2.5.3 HARMONICS AND FLICKER

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Harmonic Voltage & Flicker	LAPLACE	AC 2000A	311217	2018.10.13	2019.10.12
AC Power Source	MTONI	PHF-5010	631169	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

## 2.5.4 ESD

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Electrostatic Discharge Simulator	KZKUSUI	KES4021	LB003568	2018.06.29	2019.06.28
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
Temperature & Humidity	N/A	WS1066	N/A	2018.04.08	2019.04.07

## 2.5.5 SURGE, EFT/BURST, VOLTAGE INTERRUPTION/DIPS

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Surger Generator	HTEC	HCWG 10	152101	2018.10.13	2019.10.12
Surger Generator	HTEC	TC0MB4	152104	2018.10.13	2019.10.12
VOLTAGE DIPS & INTERRUPTIONS Generator	HTEC	HPFS 161P	143803	2018.10.13	2019.10.12
EFT/B Generator	HTEC	HEFT 51	143801	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

## 2.5.6 RS

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Power Meter	Agilent	E4419B	QB4331226	2018.10.13	2019.10.12
Power Sensor	Hp	E9300A	US39210170	2018.10.13	2019.10.12
Power Sensor	Hp	E9300A	US39210476	2018.10.13	2019.10.12
Signal Generator	Agilent	N5181A	MY46240556	2018.11.10	2019.11.09
Power Amplifier	MICOTOP	MPA-80-1000-250	MPA1711489	2018.10.27	2019.10.26
Power Amplifier	MICOTOP	MPA-1000-3000-75	MPA1711488	2018.10.13	2019.10.12
Power Amplifier	MICOTOP	MPA-3000-6000-50	MPA1711490	2018.10.13	2019.10.12
Bilog Antenna	TESEQ	CBL6111D	45873	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1343	2018.10.19	2021.10.18
Universal Radio Communication Tester	R&S	CMU200	111764	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
Audio Analyzer	R&S	UPL	100689	2018.03.08	2019.03.07

Audio Breakthrough Shielding Box	SKET	SB_ABT/C35	N/A	2018.10.13	2019.10.12
Ear Simulator	SKET	AE_ABT/C35	N/A	2018.10.13	2019.10.12
Mouth Simulator	SKET	AM_ABT/C35	N/A	2018.10.13	2019.10.12
1KHz Standard Source	SKET	MSC_ABT/C35	N/A	2018.10.13	2019.10.12
Field Probe	Narda	EP601	611WX80261	2018.10.23	2019.10.22
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

### 2.5.7 INJECTION CURRENT

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
CS	SCHLODER	CDG-6000-25	126A1280/2014	2018.10.13	2019.10.12
CDN	SCHLODER	CDN-M2+3	A2210275/2014	2018.10.13	2019.10.12
EM Clamp	SCHLODER	EMCL-20	132A1283	2018.10.13	2019.10.12
Attenuator	Nemtest	ATT-6DB-100	A100W224	2018.10.13	2019.10.12
Audio Analyzer	R&S	UPL	100419	2018.03.08	2019.03.07
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMU200	111764	2018.10.13	2019.10.12
Audio Analyzer	R&S	UPL	100689	2018.10.13	2019.10.12
Audio Breakthrough Shielding Box	SKET	SB_ABT/C35	N/A	2018.10.13	2019.10.12
Ear Simulator	SKET	AE_ABT/C35	N/A	2018.10.13	2019.10.12
Mouth Simulator	SKET	AM_ABT/C35	N/A	2018.10.13	2019.10.12
1KHz Standard Source	SKET	MSC_ABT/C35	N/A	2018.10.13	2019.10.12
Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10

### 2.5.8 PFMF

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
MF Generator	HTEC	HMFG-COMB	143903	2018.10.13	2019.10.12
Magnetic Field Coil	HTEC	HCOIL 100	143808	2018.10.13	2019.10.12
Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12

### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 POWER LINE CONDUCTED EMISSION

(Frequency Range 150KHz-30MHz)

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

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

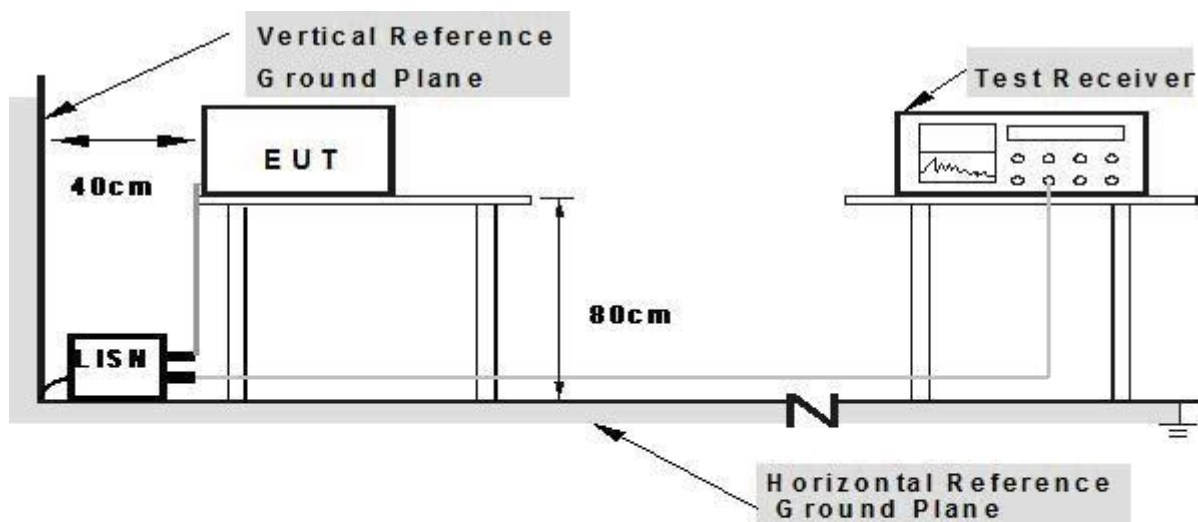
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

### 3.1.2 TEST PROCEDURE

- a. The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 TEST SETUP



- Note: 1. Support units were connected to second LISN.**  
**2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes**

### 3.1.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the following during the testing.



### 3.1.5 TEST RESULTS

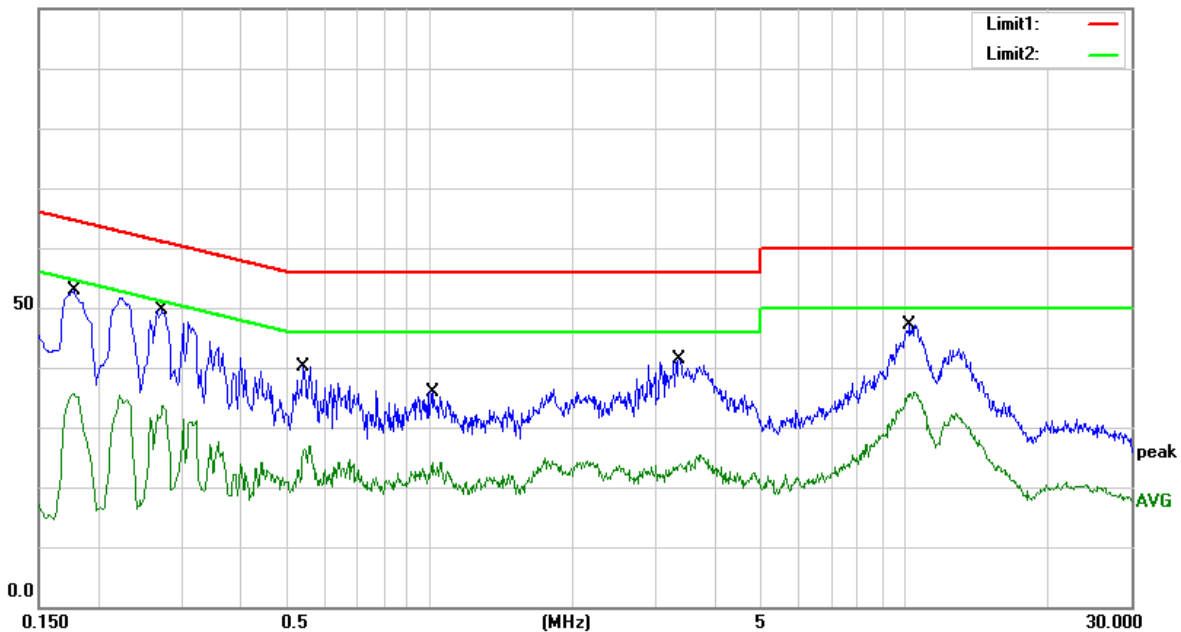
Temperature:	24.5°C	Relative Humidity:	59%
Phase:	L	Test Mode:	Mode 1
Test Voltage:	DC 5V From PC	Model:	E310D

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1780	32.61	20.23	52.84	64.58	-11.74	QP
2	0.1780	15.51	20.23	35.74	54.58	-18.84	AVG
3	0.2741	28.62	20.59	49.21	60.99	-11.78	QP
4	0.2741	12.98	20.59	33.57	50.99	-17.42	AVG
5	0.5420	19.74	20.43	40.17	56.00	-15.83	QP
6	0.5420	6.44	20.43	26.87	46.00	-19.13	AVG
7	1.0180	15.77	20.16	35.93	56.00	-20.07	QP
8	1.0180	4.06	20.16	24.22	46.00	-21.78	AVG
9	3.3540	21.41	19.97	41.38	56.00	-14.62	QP
10	3.3540	5.39	19.97	25.36	46.00	-20.64	AVG
11	10.2460	27.01	20.12	47.13	60.00	-12.87	QP
12	10.2460	15.66	20.12	35.78	50.00	-14.22	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = Cable Loss + Antenna Factor - Amplifier Gain

100.0 dBuV



Temperature:	24.5°C	Relative Humidity:	59%
--------------	--------	--------------------	-----

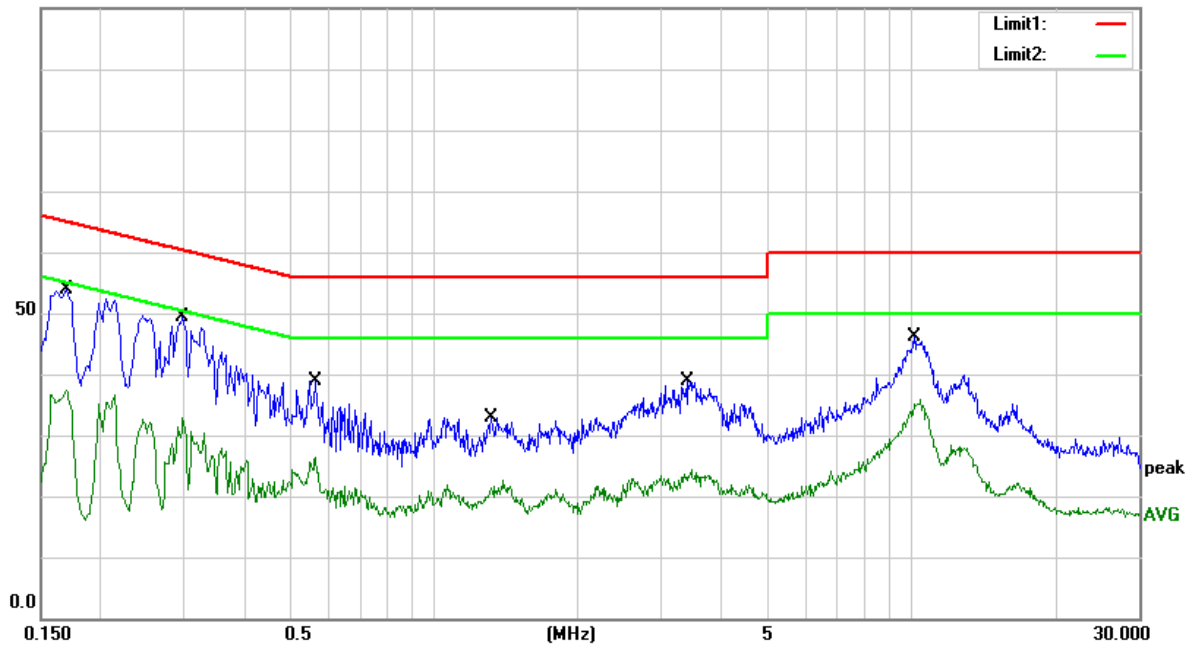
Phase:	N	Test Mode:	Mode 1
Test Voltage:	DC 5V From PC	Model:	E310D

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1700	33.57	20.23	53.80	64.96	-11.16	QP
2	0.1700	17.14	20.23	37.37	54.96	-17.59	AVG
3	0.2980	28.66	20.71	49.37	60.30	-10.93	QP
4	0.2980	12.13	20.71	32.84	50.30	-17.46	AVG
5	0.5660	18.56	20.41	38.97	56.00	-17.03	QP
6	0.5660	6.05	20.41	26.46	46.00	-19.54	AVG
7	1.3220	12.75	20.12	32.87	56.00	-23.13	QP
8	1.3220	2.48	20.12	22.60	46.00	-23.40	AVG
9	3.4060	18.81	19.97	38.78	56.00	-17.22	QP
10	3.4060	4.47	19.97	24.44	46.00	-21.56	AVG
11	10.1620	25.99	20.13	46.12	60.00	-13.88	QP
12	10.1620	15.78	20.13	35.91	50.00	-14.09	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = Cable Loss + Antenna Factor - Amplifier Gain

100.0 dBuV



## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 LIMITS OF THE RADIATED EMISSION MEASUREMENT (Below 1000MHz)

FREQUENCY (MHz)	Class A		Class B	
	At 10m	At 3m	At 10m	At 3m
	dBuV/m	dBuV/m	dBuV/m	dBuV/m
30 – 230	40	50	30	40
230 – 1000	47	57	37	47

### 3.2.2 LIMITS OF THE RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class A (at 3m) dBuV/m		Class B (at 3m) dBuV/m	
	Peak	AVG	Peak	AVG
1000-3000	76	56	70	50
3000-6000	80	60	74	54

Notes:

- (1) The limit for radiated test was performed in the following: CISPR 32.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

### 3.2.3 TEST PROCEDURE

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.2.4 TEST SETUP

#### (A) Radiated Emission Test Setup Frequency Below 1 GHz

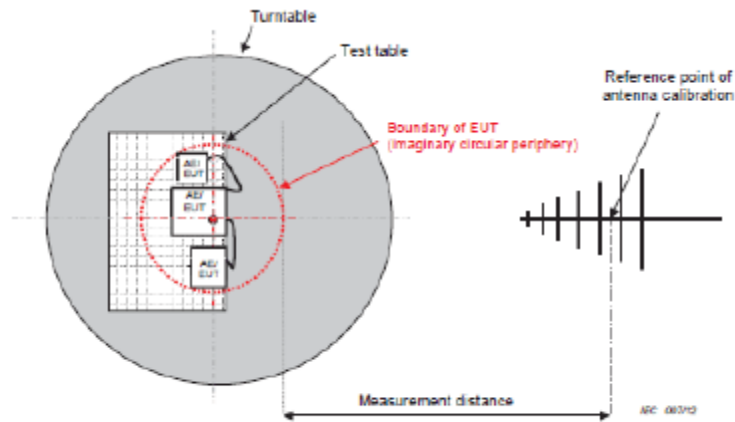


Figure C.1 - Measurement distance

#### (B) Radiated Emission Test Setup Frequency Above 1GHz

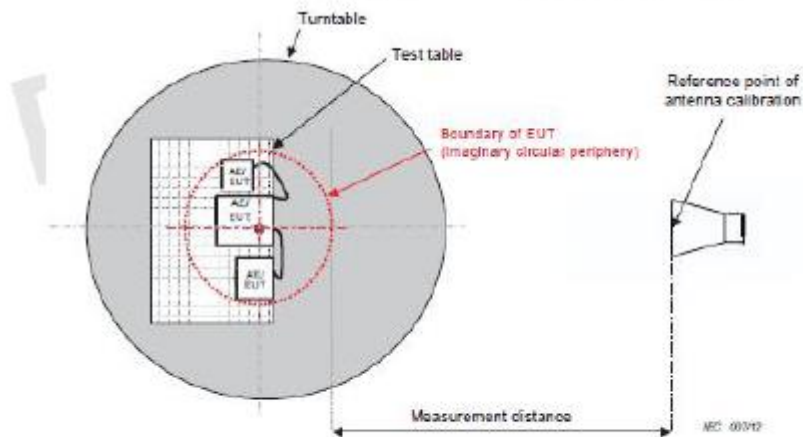


Figure C.1 - Measurement distance

### 3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the following during the testing.

### 3.2.6 TEST RESULTS(30 - 1000 MHz)

Temperature:	26.1°C	Relative Humidity:	53%
Phase:	Horizontal	Test Mode:	Mode 4
Test Voltage:	DC 5V From PC	Model:	E310D

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	47.8260	41.15	-20.36	20.79	40.00	-19.21	QP
2	135.9822	43.06	-17.52	25.54	40.00	-14.46	QP
3	220.6171	55.42	-19.08	36.34	40.00	-3.66	QP
4	293.0842	42.88	-15.24	27.64	47.00	-19.36	QP
5	465.5994	37.77	-10.39	27.38	47.00	-19.62	QP
6	955.4381	28.42	-0.26	28.16	47.00	-18.84	QP

**Remark:**

1. All readings are Quasi-Peak.
2. Margin = Result (Result =Reading + Factor )–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain



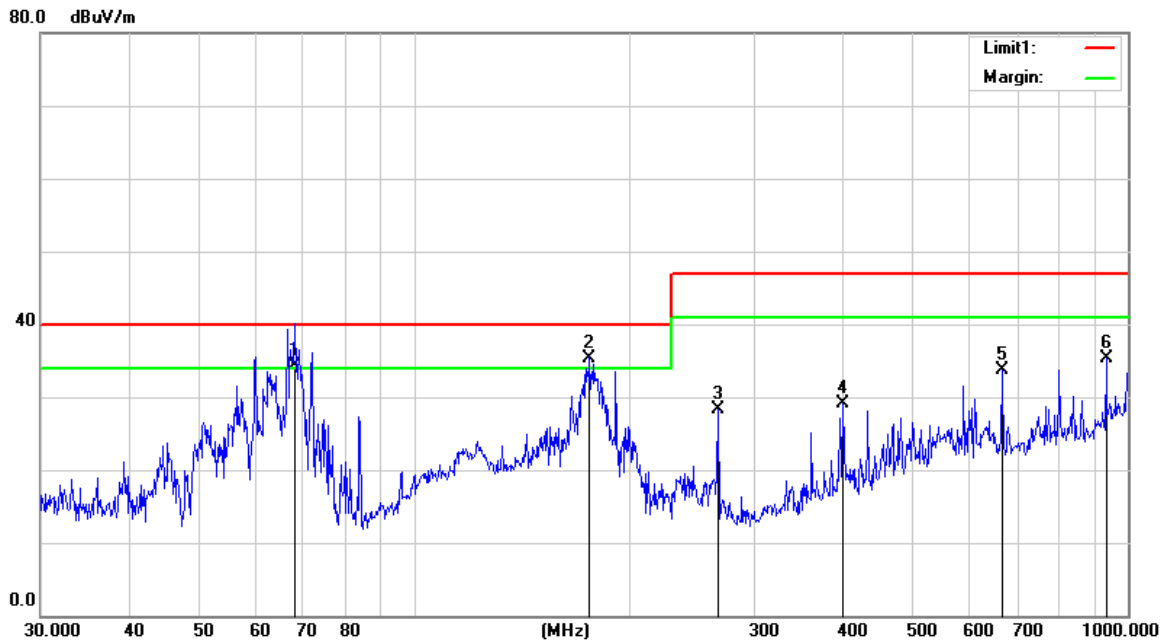
Temperature:	26.1°C	Relative Humidity:	53%
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Phase:	Vertical	Test Mode:	Mode 4
Test Voltage:	DC 5V From PC	Model:	E310D

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	68.1514	58.53	-24.15	34.38	40.00	-5.62	QP
2	176.2686	54.81	-19.41	35.40	40.00	-4.60	QP
3	266.6090	43.65	-15.33	28.32	47.00	-18.68	QP
4	399.0302	40.47	-11.28	29.19	47.00	-17.81	QP
5	665.8035	39.78	-6.11	33.67	47.00	-13.33	QP
6	932.2715	36.42	-1.05	35.37	47.00	-11.63	QP

Remark:

1. All readings are Quasi-Peak.
2. Margin = Result (Result = Reading + Factor )–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain



### 3.2.7 TEST RESULT (1000 - 6000MHz)

Temperature:	26.1°C	Relative Humidity:	53%
Phase:	Horizontal	Test Mode:	Mode 4

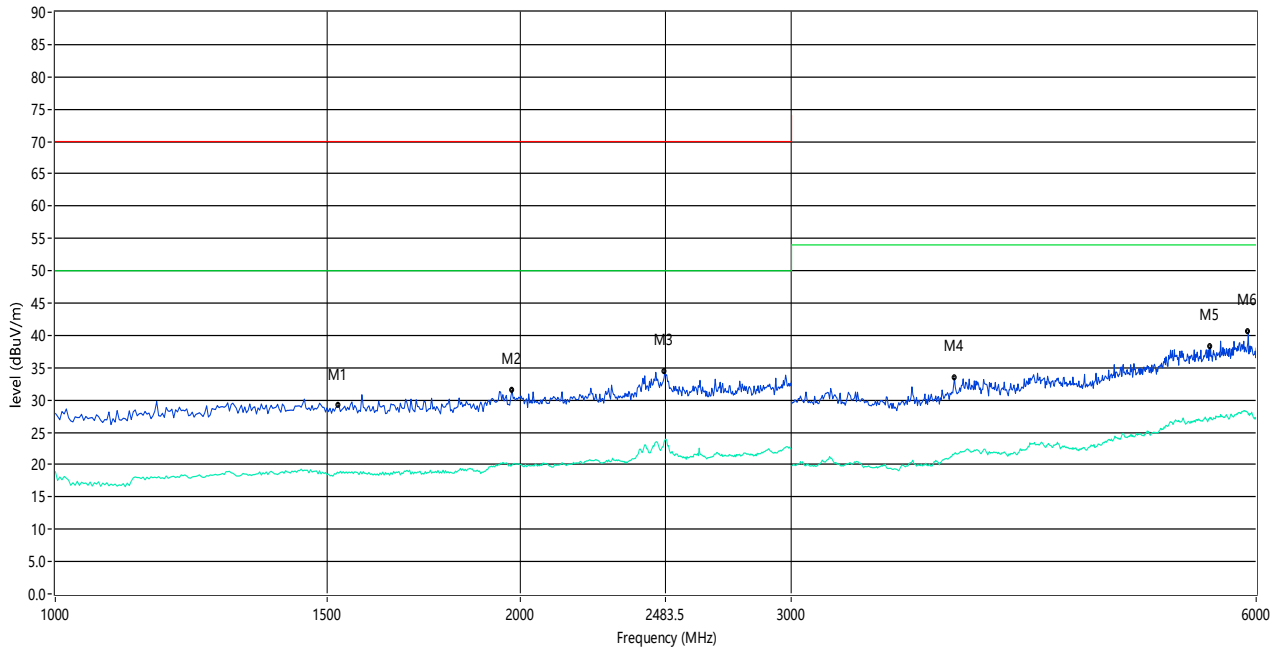
Test Voltage:	DC 5V From PC	Model:	E310D
---------------	---------------	--------	-------

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector
1**	1526.667	18.68	-19.12	50.0	-31.32	AV
1	1526.667	29.14	-19.12	70.0	-40.86	Peak
2**	1976.667	19.93	-17.44	50.0	-30.07	AV
2	1976.667	31.48	-17.44	70.0	-38.52	Peak
3**	2483.333	23.82	-13.56	50.0	-26.18	AV
3	2483.333	34.39	-13.56	70.0	-35.61	Peak
4**	3825.000	21.70	-0.11	54.0	-32.30	AV
4	3825.000	33.38	-0.11	74.0	-40.62	Peak
5**	5605.000	27.10	3.82	54.0	-26.90	AV
5	5605.000	38.17	3.82	74.0	-35.83	Peak
6**	5930.000	27.74	4.13	54.0	-26.26	AV
6	5930.000	40.53	4.13	74.0	-33.47	Peak

Remark:

1. All readings are Peak and Average values.
2. Margin = Result (Result =Reading + Factor )–Limit
3. Factor= Cable Loss +Antenna Factor–Amplifier Gain

RE\_EN Test Case\_EN 301489 B 1G-6GHz



Temperature:	26.1°C	Relative Humidity:	53%
Phase:	Vertical	Test Mode:	Mode 4

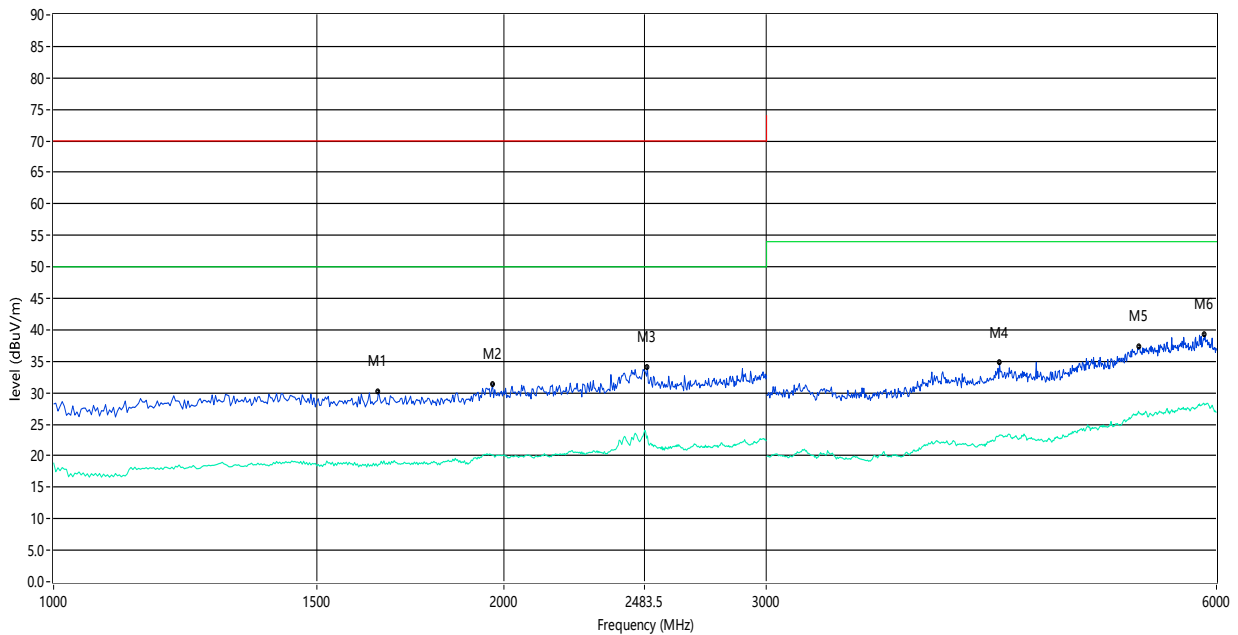
Test Voltage:	DC 5V From PC	Model:	E310D
---------------	---------------	--------	-------

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector
1**	1650.000	18.66	-19.09	50.0	-31.34	AV
1	1650.000	30.22	-19.09	70.0	-39.78	Peak
2**	1966.667	20.06	-17.51	50.0	-29.94	AV
2	1966.667	31.28	-17.51	70.0	-38.72	Peak
3**	2496.667	23.15	-13.95	50.0	-26.85	AV
3	2496.667	34.06	-13.95	70.0	-35.94	Peak
4**	4295.000	23.28	1.30	54.0	-30.72	AV
4	4295.000	34.70	1.30	74.0	-39.30	Peak
5**	5330.000	26.78	3.06	54.0	-27.22	AV
5	5330.000	37.27	3.06	74.0	-36.73	Peak
6**	5895.000	28.22	4.32	54.0	-25.78	AV
6	5895.000	39.16	4.32	74.0	-34.84	Peak

Remark:

1. All readings are Peak and Average values
2. Margin = Result (Result =Reading + Factor )–Limit
3. Factor= Cable Loss +Antenna Factor–Amplifier Gain

RE\_EN Test Case\_EN 301489 B 1G-6GHz





### 3.3 HARMONICS CURRENT

#### 3.3.1 LIMITS OF THE HARMONICS CURRENT

IEC 555-2					
Table - I			Table - II		
Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in Amperes)	Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in Amperes)
Non Portable Tools or TV Receivers	Odd Harmonics		TV Receivers	Odd Harmonics	
	3	2.30		3	0.80
	5	1.14		5	0.60
	7	0.77		7	0.45
	9	0.40		9	0.30
	11	0.33		11	0.17
	13	0.21		13	0.12
	15 ≤ n ≤ 39	0.15 · 15/n		15 ≤ n ≤ 39	0.10 · 15/n
	Even Harmonics			Even Harmonics	
	2	1.08		2	0.30
4	0.43	4	0.15		
8	0.30				
8 ≤ n ≤ 40	0.23 · 8/n	DC	0.05		

EN 61000-3-2/IEC 61000-3-2					
Equipment Category	Max. Permissible Harmonic Current (in Amperes)	Equipment Category	Harmonic Order n	Max. Permissible Harmonic Current (in A)	Max. Permissible Harmonic Current (mA/w)
Class A	Same as Limits Specified in 4-2.1, Table - I, but only odd harmonics required	Class D	3	2.30	3.4
			5	1.14	1.9
			7	0.77	1.0
			9	0.40	0.5
			11	0.33	0.35
			13 ≤ n ≤ 39	see Table I	3.85/n



### 3.3.2 TEST PROCEDURE

a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions.

b. The classification of EUT is according to section 5 of EN 61000-3-2. The EUT is classified as follows:

Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

Class B: Portable tools. Portable tools.; Arc welding equipment which is not professional equipment.

Class C: Lighting equipment.

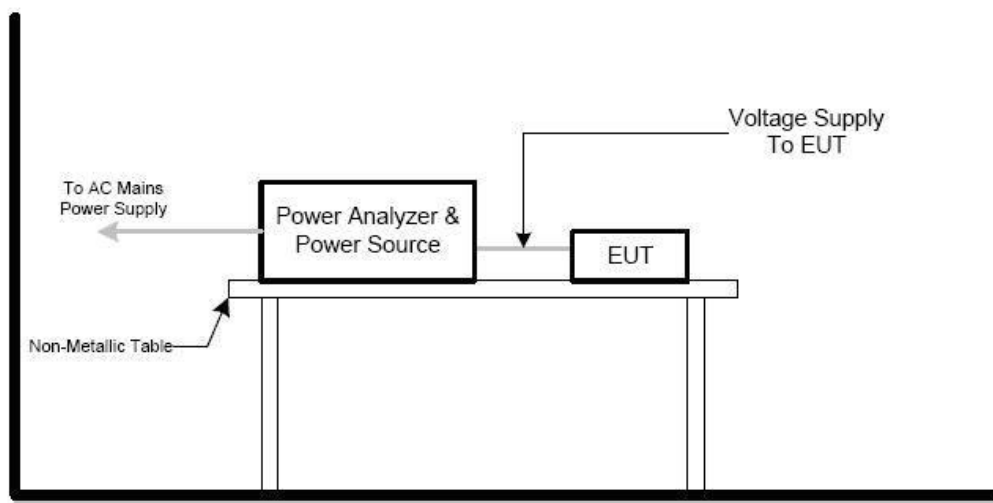
Class D: Equipment having a specified power less than or equal to 600W of the following types: Personal computers and personal computer monitors and television receivers.

c. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

### 3.3.3 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the following during the testing.

### 3.3.4 TEST SETUP



### 3.3.5 TEST RESULTS

Temperature:	26°C	Relative Humidity:	45%
Test Voltage:	N/A		

*Note: The above limits for all equipment except for lighting equipment having an active input power >75 W and no limits apply for equipment with an active input power up to and including 75W.*

### 3.4 VOLTAGE FLUCTUATION AND FLICKERS

#### 3.4.1 LIMITS OF THE VOLTAGE FLUCTUATION AND FLICKERS

Tests	Measurement Value	Limit	Descriptions
	IEC555-3	IEC/EN 61000-3-3	
P <sub>st</sub>	≤ 1.0, T <sub>p</sub> = 10 min.	≤ 1.0, T <sub>p</sub> = 10 min.	Short Term Flicker Indicator
P <sub>lt</sub>	N/A	≤0.65, T <sub>p</sub> =2 hr.	Long Term Flicker Indicator
T <sub>dt(s)</sub>	≤ 3%	≤ 3.3%	Relative Steady-State V-Chang
d <sub>max</sub> (%)	≤ 4%	≤ 4%	Maximum Relative V-Chang
d <sub>c</sub> (%)	N/A	≤ 3.3% for > 500 ms	Relative V-change Characteristic

#### 3.4.2 TEST PROCEDURE

a. Fluctuation and Flickers Test:

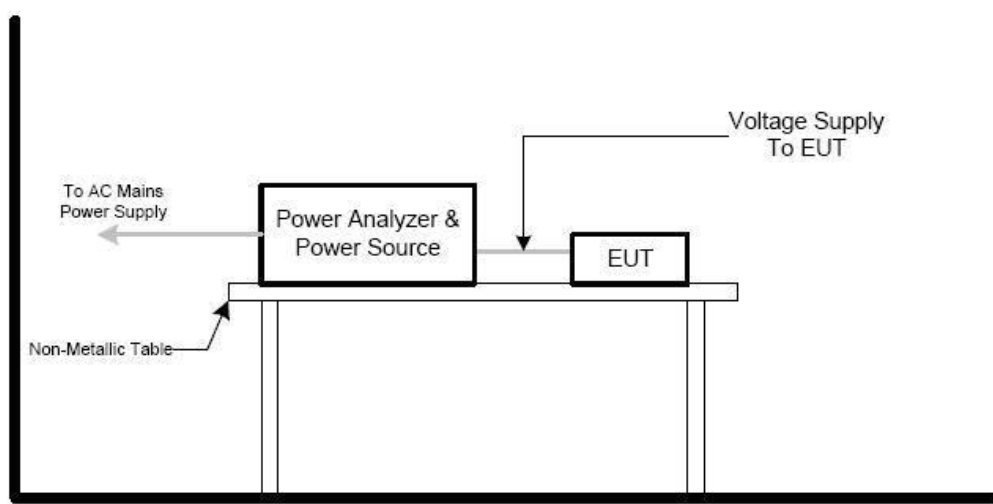
Tests was performed according to the Test Conditions/Assessment of Voltage Fluctuations specified in Clause 5.0/6.0 of IEC555-3 and/or Clause 6.0/4.0 of IEC/EN 61000-3-3 depend on which standard adopted for compliance measurement.

b. All types of voltage fluctuation in this report are assessed by direct measurement using flicker-meter.

#### 3.4.3 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the following during the testing.

#### 3.4.4 TEST SETUP



### 3.4.5 TEST RESULTS

Temperature:	25.5°C	Relative Humidity:	46%
Test Voltage:	DC 5V From PC	Model:	E310D

Test Parameter	Measurement Value	Limit	Remarks
P <sub>st</sub>	0.00	1.0	Pass
P <sub>lt</sub>	--	0.65	--
T <sub>dt(s)</sub>	0.00	0.5	Pass
d <sub>max</sub> (%)	0.00%	4%	Pass
d <sub>c</sub> (%)	0.00%	3.3%	Pass

## 4. EMC IMMUNITY TEST

### 4.1 GENERAL PERFORMANCE CRITERIA

#### 4.1.1 PERFORMANCE CRITERIA (GSM)

According to **Draft ETSI EN 301 489-52** standard, the general performance criteria as following:

##### **Performance criteria for Continuous phenomena applied to Transmitters (CT)**

A communication link shall be established at the start of the test, and maintained during the test, see clauses 4.2.3 and 4.2.4.

NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

##### **Performance criteria for Transient phenomena applied to Transmitters (TT)**

A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.4.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

##### **Performance criteria for Continuous phenomena applied to Receivers (CR)**

A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.6.

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.

During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

NOTE: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.

**Performance criteria for Transient phenomena applied to Receivers (TR)**

A communications link shall be established at the start of the test, see appropriate clauses 4.2. to 4.2.6.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

**Performance criteria for ancillary equipment tested on a stand alone basis**

The provision of Draft ETSI EN 301 489-1 [1], clause 6.4 shall apply.

**4.1.2 GENERAL PERFORMANCE CRITERIA TEST SETUP**

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the following during the testing.



## 4.2 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD)

### 4.2.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance:	B
Discharge Voltage:	Air Discharge: 2KV/4KV/8KV (Direct) 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

### 4.2.2 TEST PROCEDURE

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

- a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation  
The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

The time interval between two successive single discharges was at least 1 second.

The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

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):

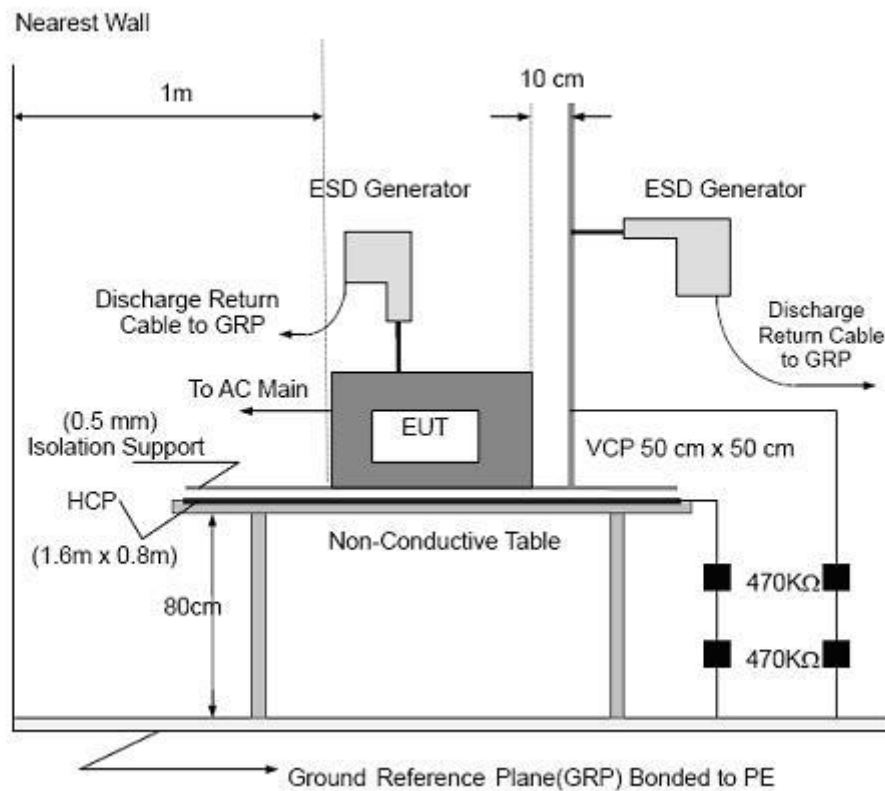
The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

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.

### 4.2.3 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. 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 940kΩ 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 0.8-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 IEC/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 was consisted of a sheet of aluminum that is at least 0.25mm thick, and extended at least 0.5 meters from the EUT on all sides.

#### 4.2.4 TEST RESULT

Temperature:	23.5°C	Relative Humidity:	46%
Pressure:	1000hPa	Test Voltage:	DC 5V From PC
Test Mode:	Mode1/2/3/4/5/6/7/8/9		

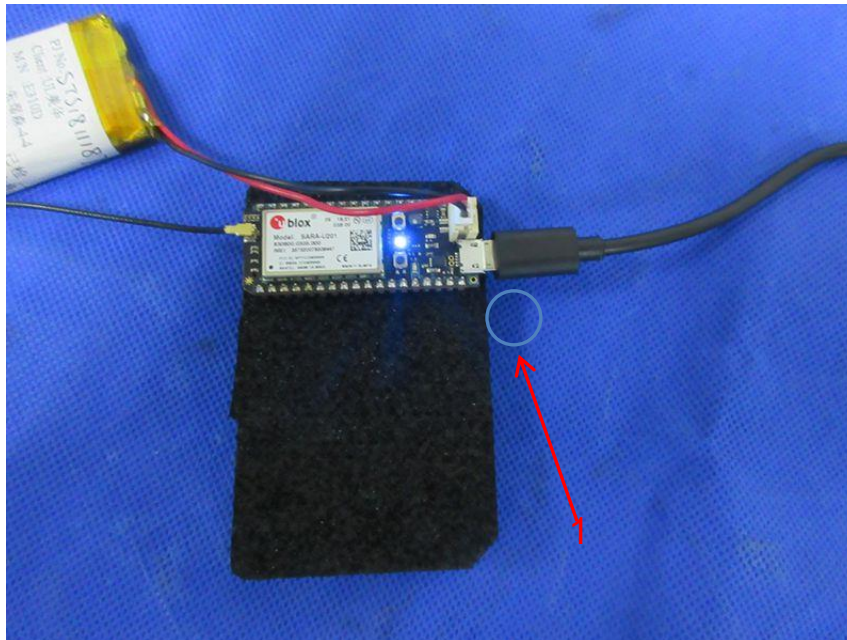
#### GSM/GPRS/EDGE TEST RESULT

Discharge Level	Polarity	Test Points	Contact Discharge	Air Discharge	Criterion	Test Result
2,4	+/-	HCP/VCP	Note1	NA	A	PASS
2,4	+/-	1	Note1	NA	A	PASS

#### WCDMA/LTE/HSDPA/HSUPA TEST RESULT

Discharge Level	Polarity	Test Points	Contact Discharge	Air Discharge	Criterion	Test Result
4	+/-	VCP/HCP	NOTE	N/A	A	PASS
2,4,8	+/-	1-8	N/A	NOTE	A	PASS

#### The Photo for Discharge Points of EUT



Note: The EUT function was correct during the test.  
 Red Dot —Air Discharged  
 Blue Dot —Contact Discharged

## 4.3 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS)

### 4.3.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-3
Required Performance:	A
Frequency Range:	80 MHz - 6000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Polarity of Antenna:	Horizontal and Vertical
Test Distance:	3 m
Antenna Height:	1.5 m
Dwell Time:	$1.5 \times 10^{-3}$ decade/s

### 4.3.2 TEST PROCEDURE

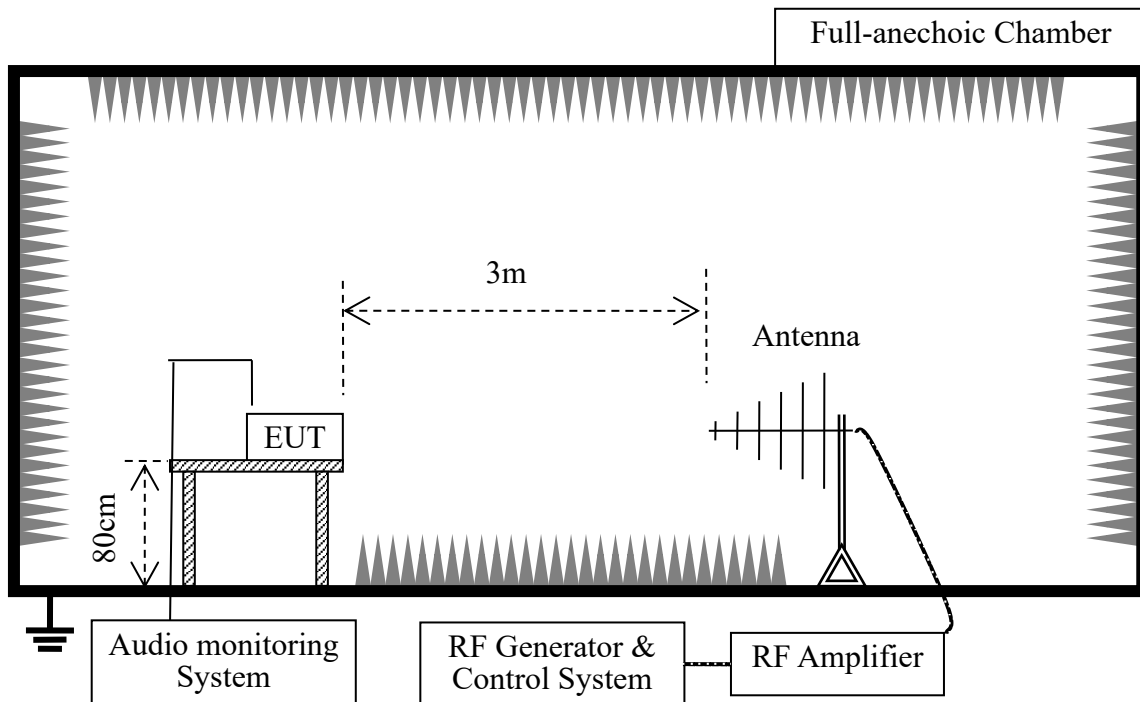
The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber.

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

The other condition need as following manners:

- a. The frequency range is swept from 80 MHz to 6000 MHz with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- b. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- c. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

### 4.3.3 TEST SETUP



Note:

#### TABLE-TOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/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 IEC/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.

#### 4.3.4 TEST RESULTS

Temperature:	24.6°C	Relative Humidity:	49%
Test Voltage:	DC 5V From PC	Test Mode:	Mode1/2/3/4/5/6/7/8/9

#### GSM/WCDMA Uplink/Downlink

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Observation	Perform. Criteria	Results	Judgment
80-6000	H / V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	<b>CT,CR</b>	<b>A</b>	<b>A</b>	<b>PASS</b>
			Rear				
			Left				
			Right				

Note: During the test, the Maximum Bit Error Ratio was less than  $1 \times 10^{-3}$ , the Uplink/Downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

The RXQUAL of the downlink is not exceeding the value of three, measured during each individual exposure in the test sequence. Or During and after the test, the apparatus continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

#### GPRS/EDGE Uplink/Downlink

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Observation	Perform. Criteria	Results	Judgment
80-6000	H / V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	<b>CT,CR</b>	<b>A</b>	<b>A</b>	<b>PASS</b>
			Rear				
			Left				
			Right				

Note: During the test, the Maximum Bit Error Ratio was less than  $1 \times 10^{-3}$

### HSDPA/HSUPA Uplink/Downlink

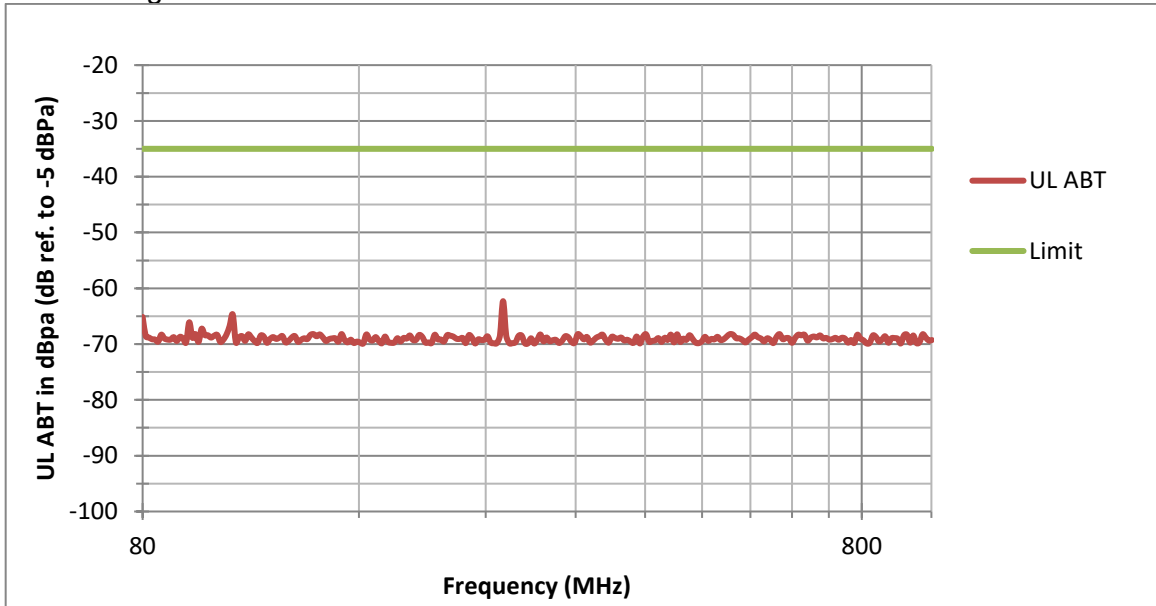
Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Observation	Perform. Criteria	Results	Judgment
80-6000	H / V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	<b>CT,CR</b>	<b>A</b>	<b>A</b>	<b>PASS</b>
			Rear				
			Left				
			Right				

During the test, the Maximum Block Error Ratio was less than  $1 \times 10^{-2}$

Note:

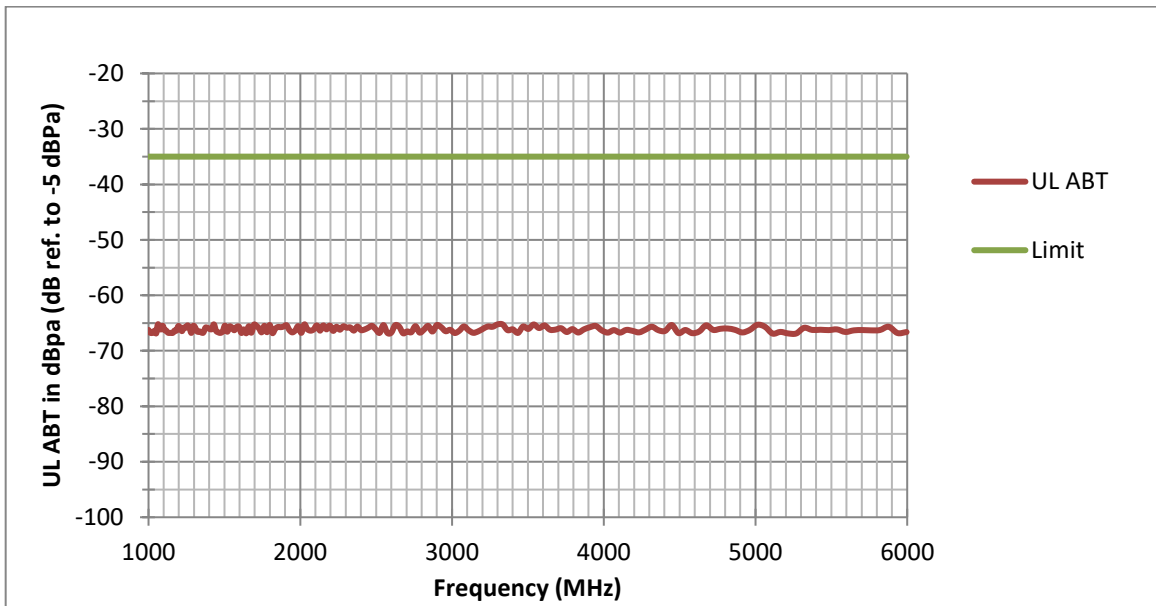
- 1) N/A - denotes test is not applicable in this test report.
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.

### Audio Breakthrough Measurement Result



Uplink Audio Berak-through Test PASS

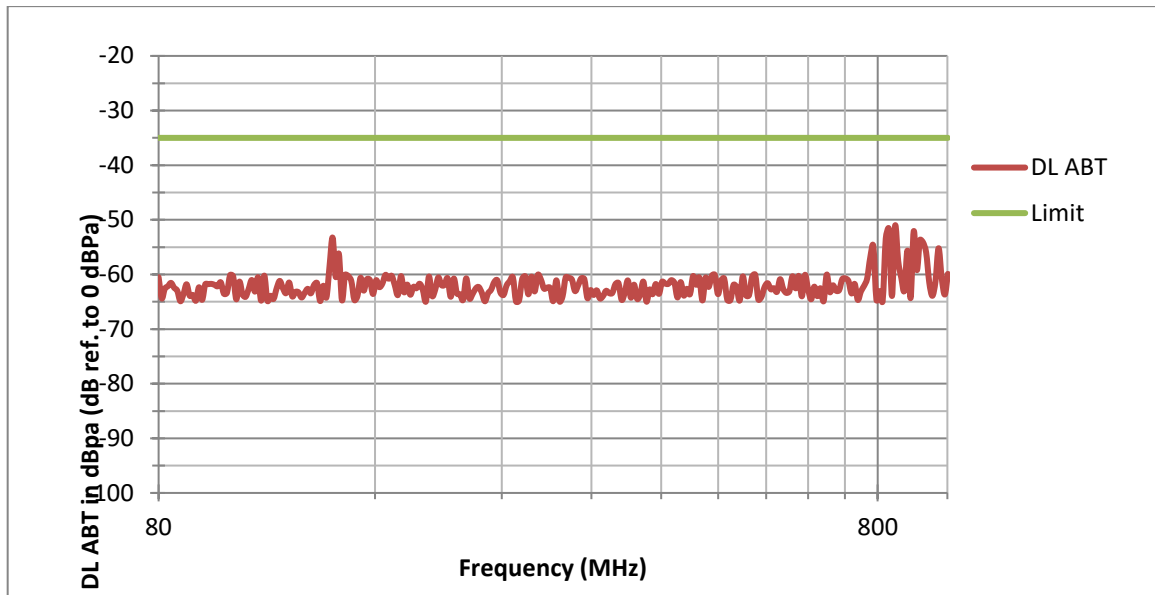
Worst. Value is -62.38 Audio level (dB ref. to -5 dBPa) at 251.74M Hz (Margin 27.38 Audio level (dB ref. to -5 dBPa))



Uplink Audio Berak-through Test PASS

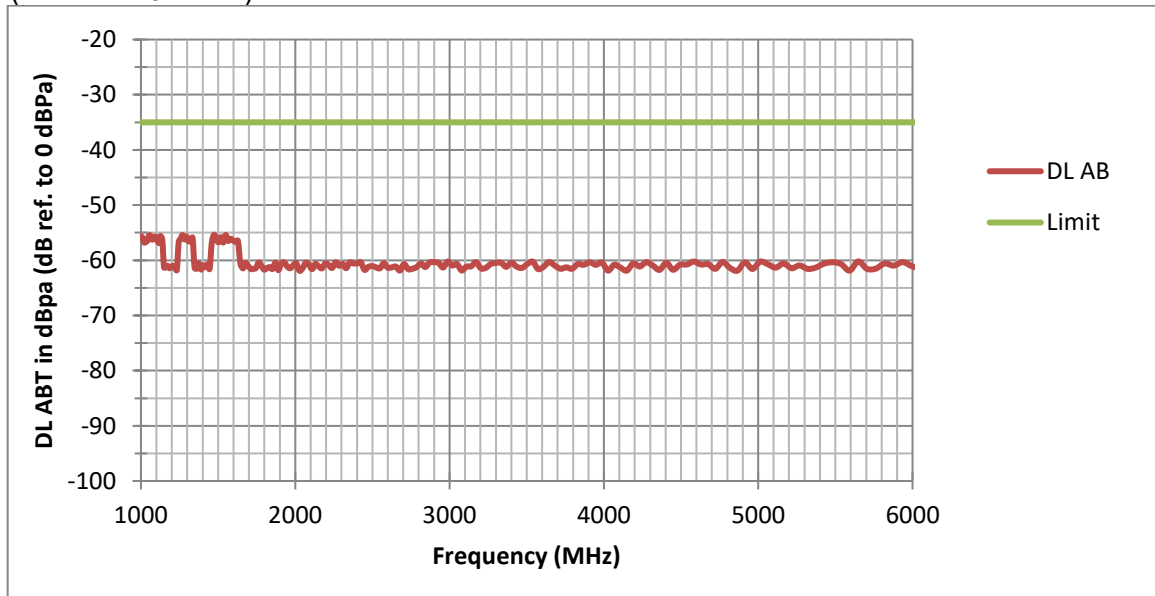
Worst. Value is -65.26 Audio level (dB ref. to -5 dBPa) at 4423.45M Hz (Margin 30.26 Audio level (dB ref. to -5 dBPa))





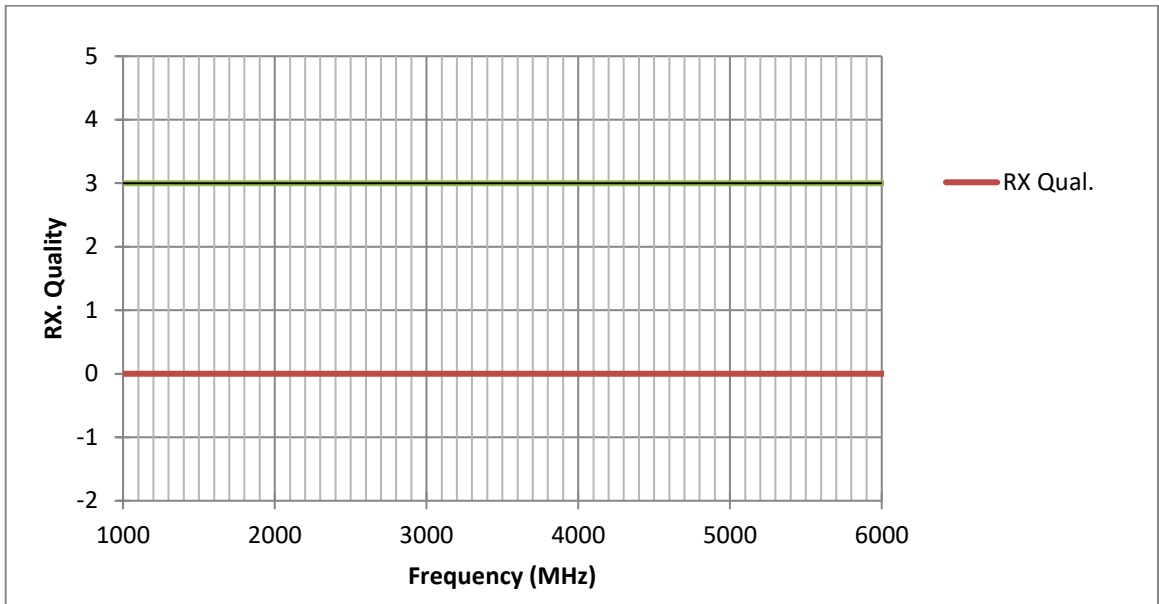
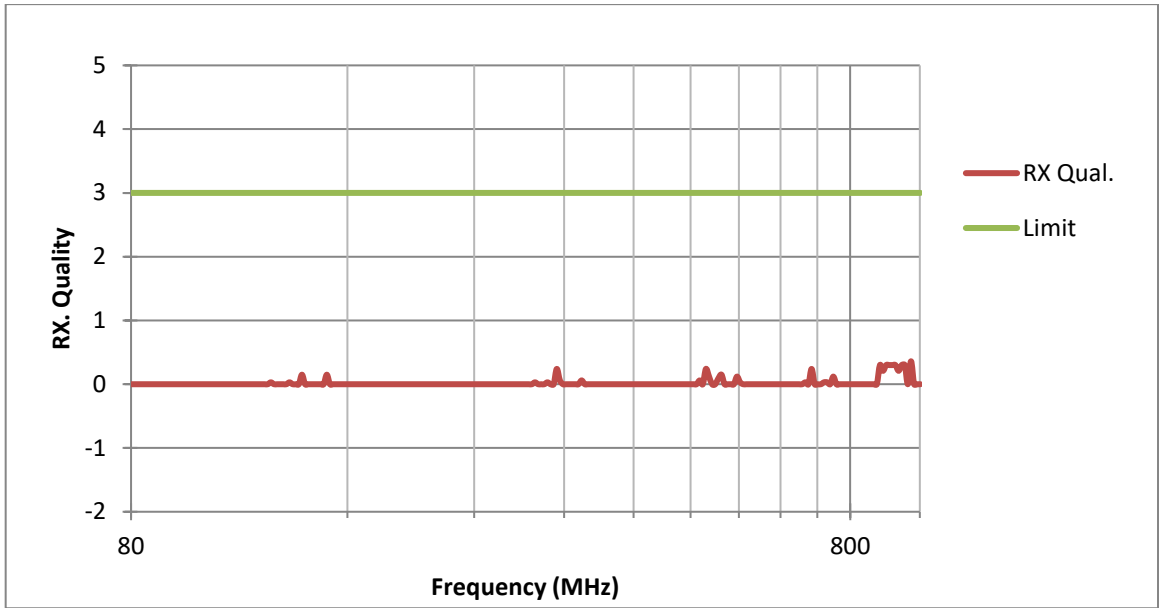
Downlink Audio Berak-through Test PASS

Worst. Value is -50.89 Audio level (dB ref. to 0 dBPa) at 843.11M Hz (Margin 15.89 Audio level (dB ref. to 0 dBPa))



Downlink Audio Berak-through Test PASS

Worst. Value is -55.79 Audio level (dB ref. to 0 dBPa) at 1456.47M Hz (Margin 20.79 Audio level (dB ref. to 0 dBPa))



## 4.4 ELECTRICAL FAST TRANSIENT (EFT)

### 4.4.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-4
Required Performance:	B
Test Voltage:	Power Line: 1 KV Signal/Control Line: 0.5 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 2 min.

### 4.4.2 TEST PROCEDURE

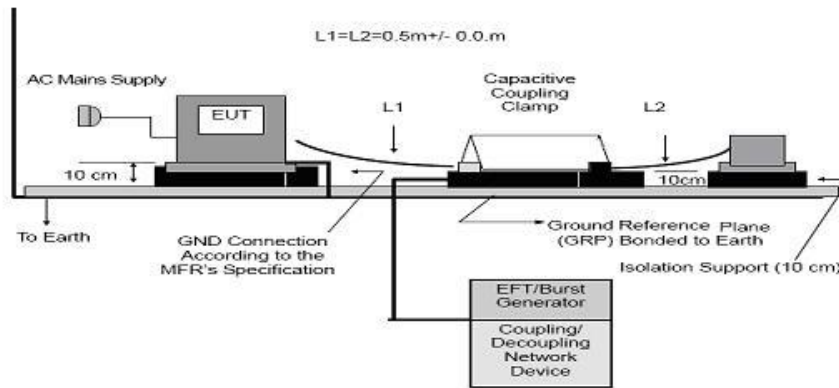
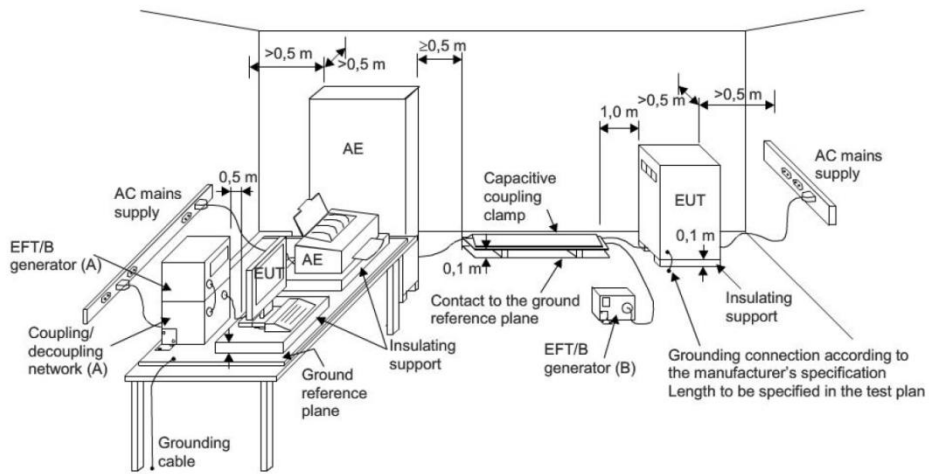
The EUT and support equipment, are placed on a table that is 0.8 meter&0.1 meter above a metal ground plane measured 1m\*1m min .

The ground reference plane shall be a metallic sheet (copper or aluminium) of 0.25 mm minimum thickness; other metallic materials may be used , but they shall have at least 0.65 mm minimum thickness.

The other condition need as following manners:

- 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 2 minute

### 4.4.3 TEST SETUP



Note:

#### TABLE-TOP EQUIPMENT

Table-top equipment and equipment normally mounted on ceilings or walls as well as built-in equipment shall be tested with the EUT located ( $0.1 \pm 0.01$ ) m above the ground reference plane.

Testing of large table-top equipment or multiple systems can be performed on the floor; maintaining the same distances as for the test setup of table-top equipment.

The test generator and the coupling/decoupling network shall be bonded to the ground reference plane.

The ground reference plane shall be a metallic sheet (copper or aluminium) of 0.25 mm minimum thickness; other metallic materials may be used, but they shall have at least 0.65 mm minimum thickness.

The minimum size of the ground reference plane is 0.8 m x 1 m. The actual size depends on the dimensions of the EUT.

The ground reference plane shall project beyond the EUT by at least 0.1 m on all sides.

The ground reference plane shall be connected to protective earth (PE) for safety reasons.

The EUT shall be arranged and connected to satisfy its functional requirements, according to the equipment installation specifications.

The minimum distance between the EUT and all other conductive structures (including the generator, AE and the walls of a shielded room), except the ground reference plane, shall be more than 0.5 m.

All cables to the EUT shall be placed on the insulation support 0.1 m above the ground reference plane. Cables not subject to electrical fast transients shall be routed as far as possible from the cable under test to minimize the coupling between the cables.

The EUT shall be connected to the earthing system in accordance with the manufacturer's installation specifications; no additional earthing connections are allowed.

The connection impedance of the coupling/decoupling network earth cables to the ground reference plane and all bondings shall provide a low inductance.

Either a direct coupling network or a capacitive clamp shall be used for the application of the test voltages. The test voltages shall be coupled to all of the EUT ports in turn, including those between two units of equipment involved in the test, unless the length of the interconnecting cable makes it impossible to test.

#### FLOOR-STANDING EQUIPMENT

When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces (including the generator), except the ground reference plane beneath the coupling clamp and beneath the EUT, shall be at least 0.5 m.

The distance between any coupling devices and the EUT shall be ( $0.5 - 0/+0.1$ ) m for tabletop equipment testing, and ( $1.0 \pm 0.1$ ) m for floor standing equipment, unless otherwise specified in product standards. When it is not physically possible to apply the distances mentioned above, other distances can be used and shall be recorded in the test report.

The cable between the EUT and the coupling device, if detachable, shall be as short as possible to comply with the requirements of this clause. If the manufacturer provides a cable exceeding the distance between the coupling device and the point of entry of the EUT, the excess length of this cable shall be bundled and situated at a distance of 0.1 m above the ground reference plane. When a capacitive clamp is used as a coupling device, the excess cable length shall be bundled at the AE side.

Parts of the EUT with interconnecting cables of a length less than 3 m, which are not tested, shall be placed on the insulating support. The parts of the EUT shall have a distance of 0.5 m between them. Excess cable length shall be bundled.

#### 4.4.4 TEST RESULTS

Temperature:	24.2°C	Relative Humidity:	48%
Test Voltage:	DC 5V From PC	Test Mode:	Mode1/2/3/4/5/6/7/8/9

#### WCDMA/HSDPA/HSUPA/LTE TEST RESULT

Coupling Line		Test level (KV)								Observation	Criterion	Result
		0.5		1		2		4				
		+	-	+	-	+	-	+	-			
AC line	L	A	A	A	A					TT,TR	A	PASS
	N	A	A	A	A							PASS
	PE	A	A	A	A							PASS
	L+N	A	A	A	A							PASS
	L+PE	A	A	A	A							PASS
	N+PE	A	A	A	A							PASS
	L+N+PE	A	A	A	A							PASS
DC Line												

#### GSM/GPRS/EDGE TEST RESULT

Coupling Line		Test level (KV)								Observation	Criterion	Result
		0.5		1		2		4				
		+	-	+	-	+	-	+	-			
AC line	L	A	A	A	A					TT,TR	A	PASS
	N	A	A	A	A							PASS
	PE	A	A	A	A							PASS
	L+N	A	A	A	A							PASS
	L+PE	A	A	A	A							PASS
	N+PE	A	A	A	A							PASS
	L+N+PE	A	A	A	A							PASS
DC Line												
Signal Line												

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable in this test report
- 3) There was not any unintentional transmission in standby mode

## 4.5 SURGE TESTING

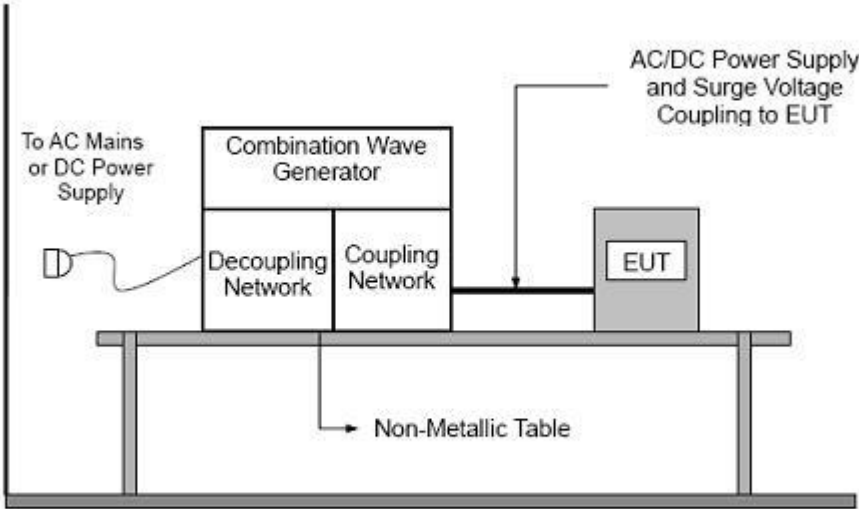
### 4.5.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-5
Required Performance:	B
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage
Test Voltage:	Power line ~ line to line: 1 KV line to ground: 2KV Telecommunication line: 1 KV
Surge Input/Output:	L-N, L-PE, N-PE
Generator Source:	(L-N)2 ohm between networks
Impedance:	(L-PE, N-PE)12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0 /90/180/270°
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

### 4.5.2 TEST PROCEDURE

- a. For EUT power supply:
- b. 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).
- c. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:
- d. 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).

4.5.3 TEST SETUP





#### 4.5.4 TEST RESULTS

Temperature:	24.2°C	Relative Humidity:	48%
Test Voltage:	DC 5V From PC	Test Mode:	Mode1/2/3/4/5/6/7/8/9

#### WCDMA/HSDPA/HSUPA/LTE TEST RESULT

Coupling Line			Test level								Observation	Criterion	Result
			0.5 KV		1 KV		2 KV		4 KV				
			+	-	+	-	+	-	+	-			
AC line	L-N	0°	A	A	A	A					TT,TR	A	PASS
		90°	A	A	A	A							
		180°	A	A	A	A							
		270°	A	A	A	A							
	L-PE	0°	A	A	A	A	A	A					PASS
		90°	A	A	A	A	A	A					
		180°	A	A	A	A	A	A					
		270°	A	A	A	A	A	A					
	N-PE	0°	A	A	A	A	A	A					PASS
		90°	A	A	A	A	A	A					
		180°	A	A	A	A	A	A					
		270°	A	A	A	A	A	A					
DC Line													
Signal Line													

**GSM/GPRS/EDGE TEST RESULT**

Coupling Line			Test level								Observation	Criterion	Result
			0.5 KV		1 KV		2 KV		4 KV				
			+	-	+	-	+	-	+	-			
AC line	L-N	0°	A	A	A	A					TT,TR	A	PASS
		90°	A	A	A	A							
		180°	A	A	A	A							
		270°	A	A	A	A							
	L-PE	0°	A	A	A	A	A	A					PASS
		90°	A	A	A	A	A	A					
		180°	A	A	A	A	A	A					
		270°	A	A	A	A	A	A					
	N-PE	0°	A	A	A	A	A	A					PASS
		90°	A	A	A	A	A	A					
		180°	A	A	A	A	A	A					
		270°	A	A	A	A	A	A					
DC Line													
Signal Line													

Note:

- 1) Polarity and Numbers of Impulses : 5 Pst / Ngst at each tested mode
- 2) N/A - denotes test is not applicable in this Test Report
- 3) There was not any unintentional transmission in standby mode

## 4.6 CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

### 4.6.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-6
Required Performance:	A
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	3 Vr.m.s.
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Dwell Time:	1.5x 10 <sup>-3</sup> decade/s

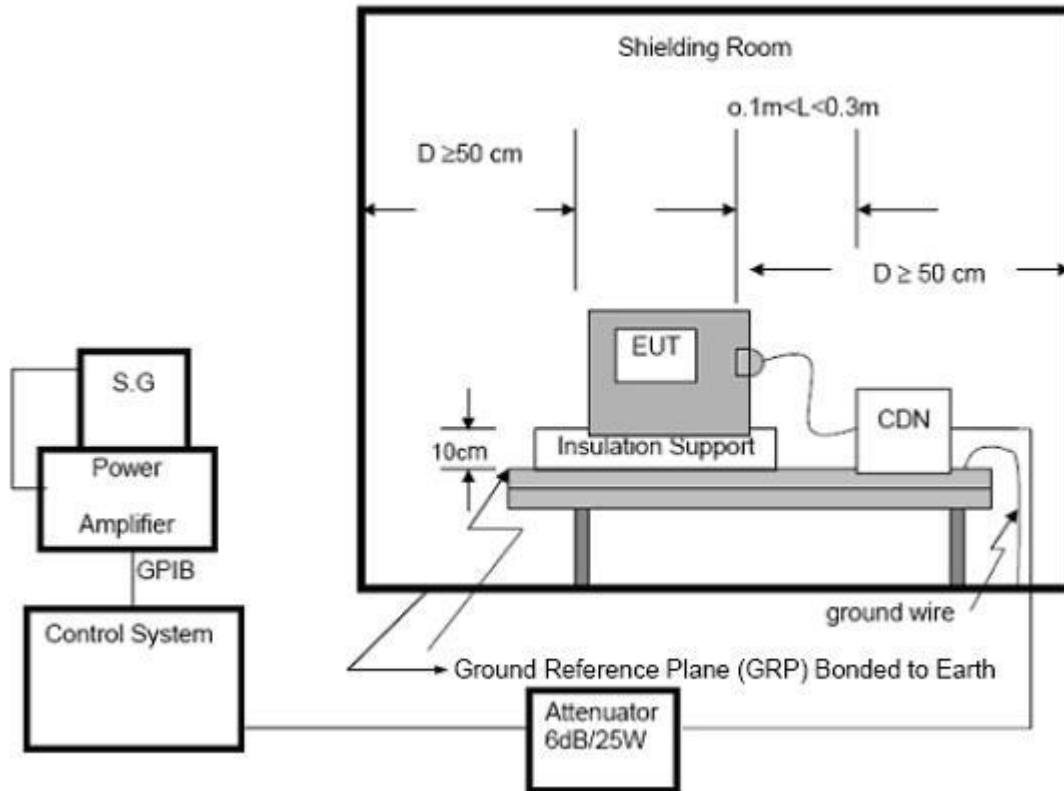
### 4.6.2 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter&0.1 meter above a metal ground plane measured 1m\*1m min.

The other condition need as following manners:

- a. The EUT shall be tested within its intended operating and climatic conditions.
- b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.
- c. One of the CDNs not used for injection was terminated with 50Ω, providing only one return path. All other CDNs were coupled as decoupling networks.
- d. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1% of the preceding frequency value.
- e. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s. The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately.
- f. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

### 4.6.3 TEST SETUP



NOTE:

#### FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

#### 4.6.4 TEST RESULTS

Temperature:	23.5°C	Relative Humidity:	46%
Test Voltage:	DC 5V From PC	Test Mode:	Mode1/2/3/4/5/6/7/8/9

#### GSM/WCDMA Uplink/Downlink

Test Ports (Mode)	Freq. Range MHz)	Field Strength	Observation	Perform. Criteria	Results	Judgment
Input/ Output AC. Power Port	0.15 ---80	3V(rms)	<b>CT, CR</b>	<b>A</b>	<b>A</b>	<b>PASS</b>
Input/ Output DC. Power Port	0.15 --- 80	AM Modulated	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Signal Line	0.15 --- 80	1000Hz, 80%	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

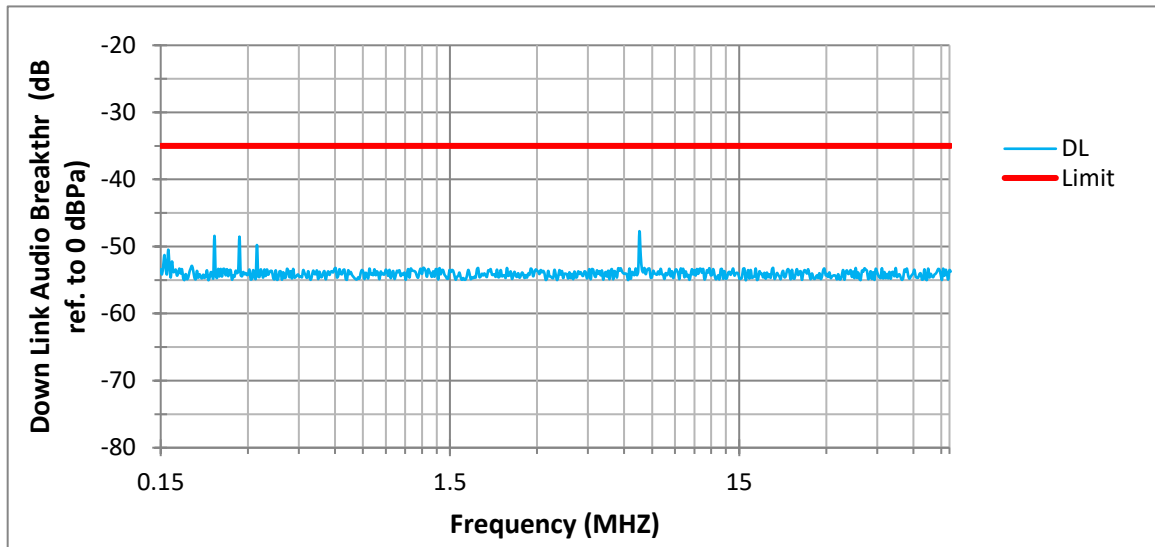
Note: During the test, the Maximum Bit Error Ratio was less than  $1 \times 10^{-3}$ . "A" stand for, the uplink/downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check). The RXQUAL of the downlink is not exceeding the value of three, measured during each individual exposure in the test sequence. Or During and after the test, the apparatus continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level.

#### GPRS/EDGE/HSDPA/HSUPA Uplink/Downlink

Test Ports (Mode)	Freq. Range MHz)	Field Strength	Observation	Perform. Criteria	Results	Judgment
Input/ Output AC. Power Port	0.15 ---80	3V(rms)	<b>CT, CR</b>	<b>A</b>	<b>A</b>	<b>PASS</b>
Input/ Output DC. Power Port	0.15 --- 80	AM Modulated	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Signal Line	0.15 --- 80	1000Hz, 80%	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

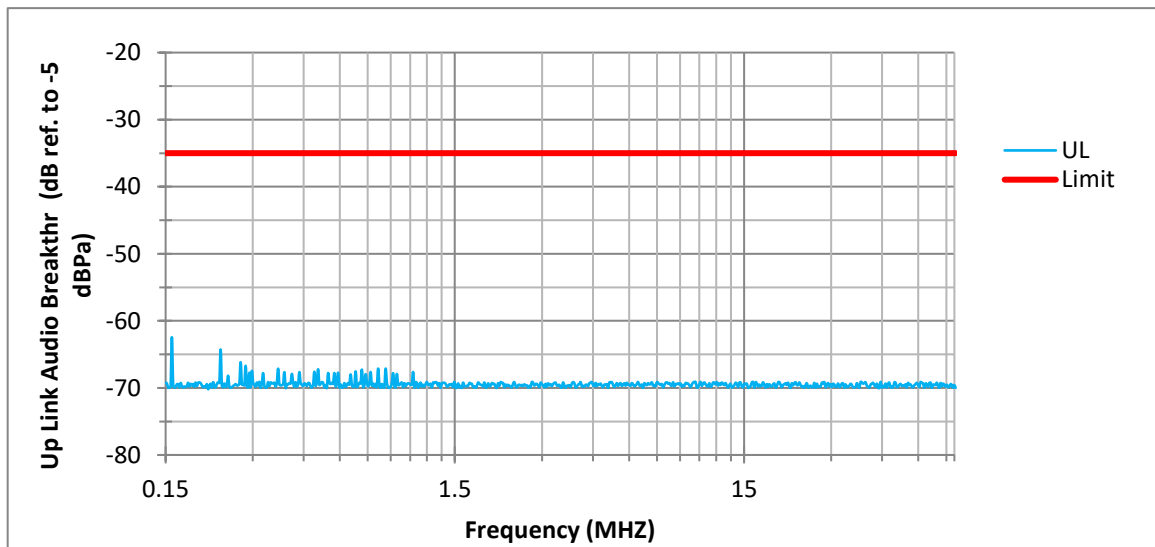
Note: During the test, the Maximum Bit Error Ratio was less than  $1 \times 10^{-3}$

## Audio Breakthrough Measurement Result



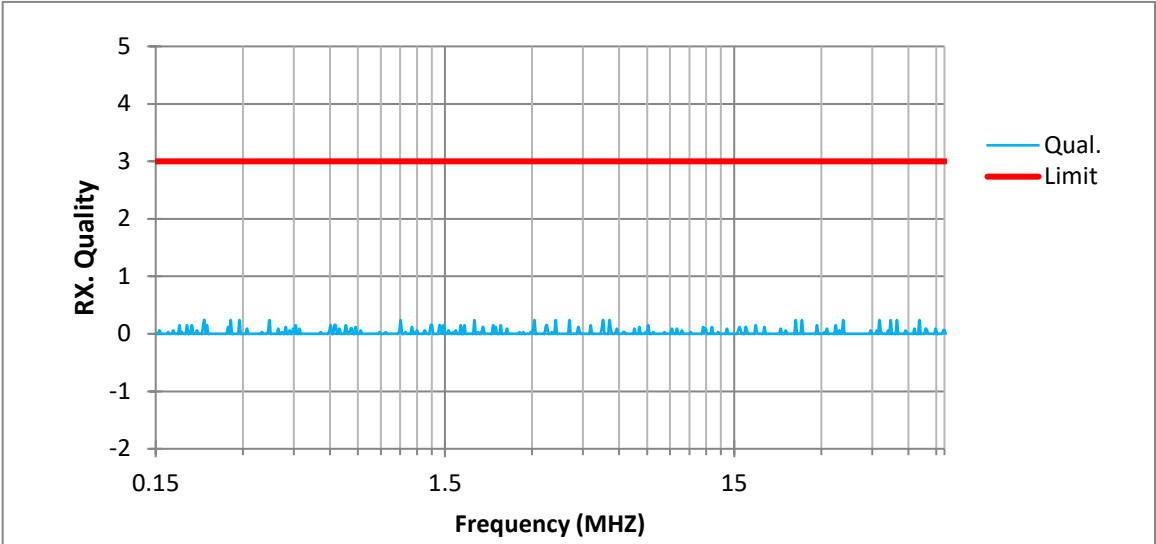
Downlink Audio Berak-through Test PASS

Worst. Value is -50.76 Audio level (dB ref. to 0 dBPa) at 6.59M Hz (Margin 15.76 Audio level (dB ref. to 0 dBPa))



Uplink Audio Berak-through Test PASS

Worst. Value is -62.03 Audio level (dB ref. to -5 dBPa) at 0.149M Hz (Margin 27.03 Audio level (dB ref. to -5 dBPa))



## 4.7 VOLTAGE INTERRUPTION/DIPS TESTING (DIPS)

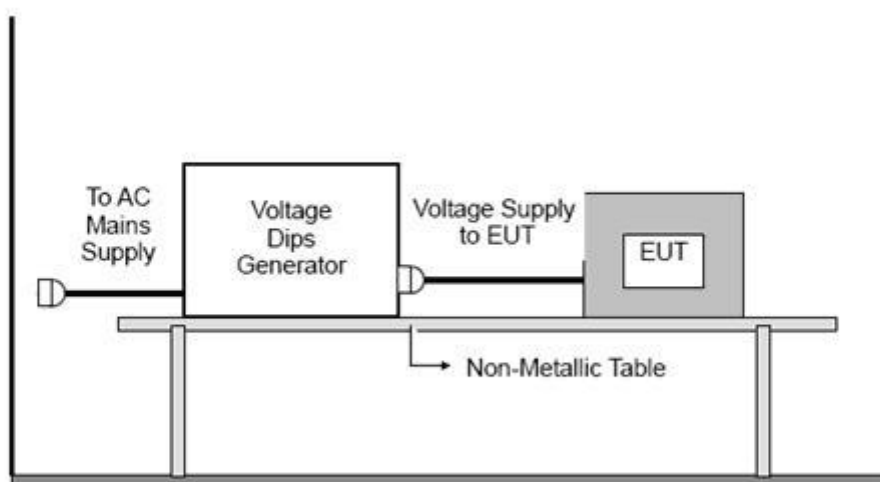
### 4.7.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-11
Required Performance:	B (For 100% Voltage Dips, 0.5 Cycle) B (For 100% Voltage Dips, 1 Cycle) C (For 30% Voltage Dips, 25 Cycles) C (For 100% Voltage Interruptions, 250 Cycles) B(For 30% Voltage Dips, 10ms)
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

### 4.7.2 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.

### 4.7.3 TEST SETUP





#### 4.7.4 TEST RESULTS

Temperature:	24.2°C	Relative Humidity:	48%
Test Voltage:	DC 5V From PC	Test Mode:	Mode1/2/3/4/5/6/7/8/9

#### WCDMA/HSDPA/HSUPA/LTE TEST RESULT

Voltage Reduction	Duration (ms)	Observation	Perform Criteria	Results	Judgment
Voltage dip 0%	10	TT, TR	B	A	PASS
Voltage dip 0%	20	TT, TR	B	A	PASS
Voltage dip 70%	500	TT, TR	C	A	PASS
Voltage interruptions	5000	TT, TR	C	B	PASS
Voltage dip 30%	10	TT, TR	B	A	PASS

#### GSM/GPRS/EDGE TEST RESULT

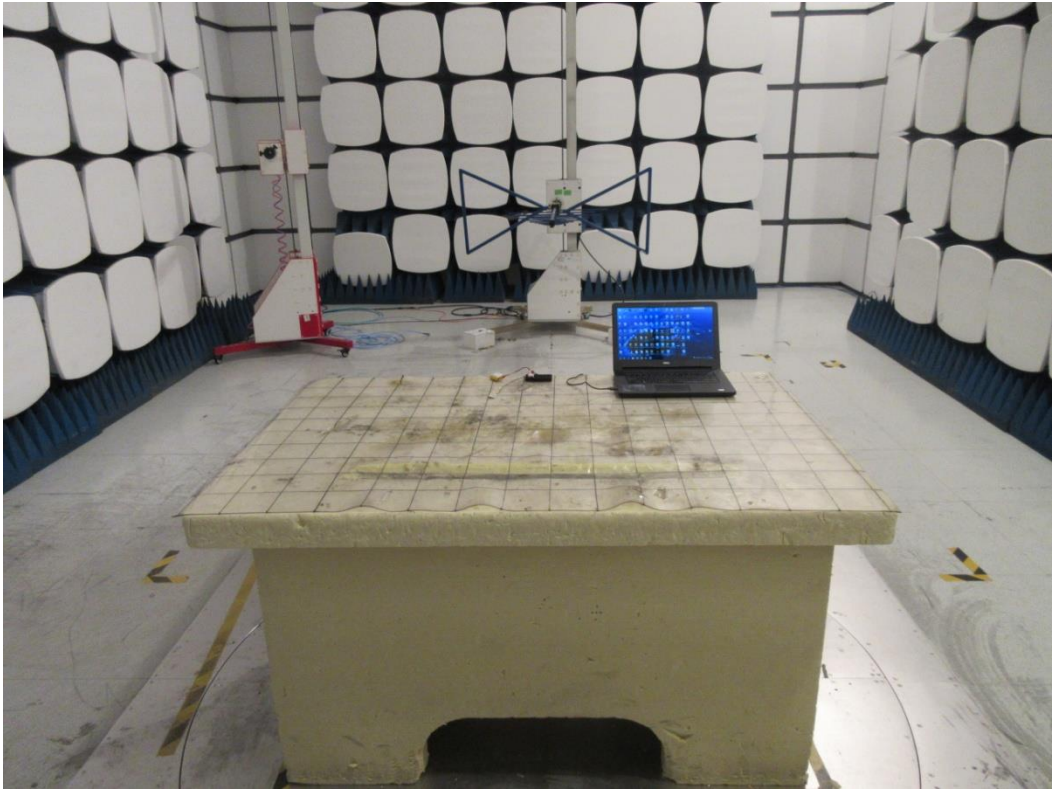
Voltage Reduction	Duration (ms)	Observation	Perform Criteria	Results	Judgment
Voltage dip 0%	10	TT, TR	B	A	PASS
Voltage dip 0%	20	TT, TR	B	A	PASS
Voltage dip 70%	500	TT, TR	C	A	PASS
Voltage interruptions	5000	TT, TR	C	B	PASS
Voltage dip 30%	10	TT, TR	B	A	PASS

Note:

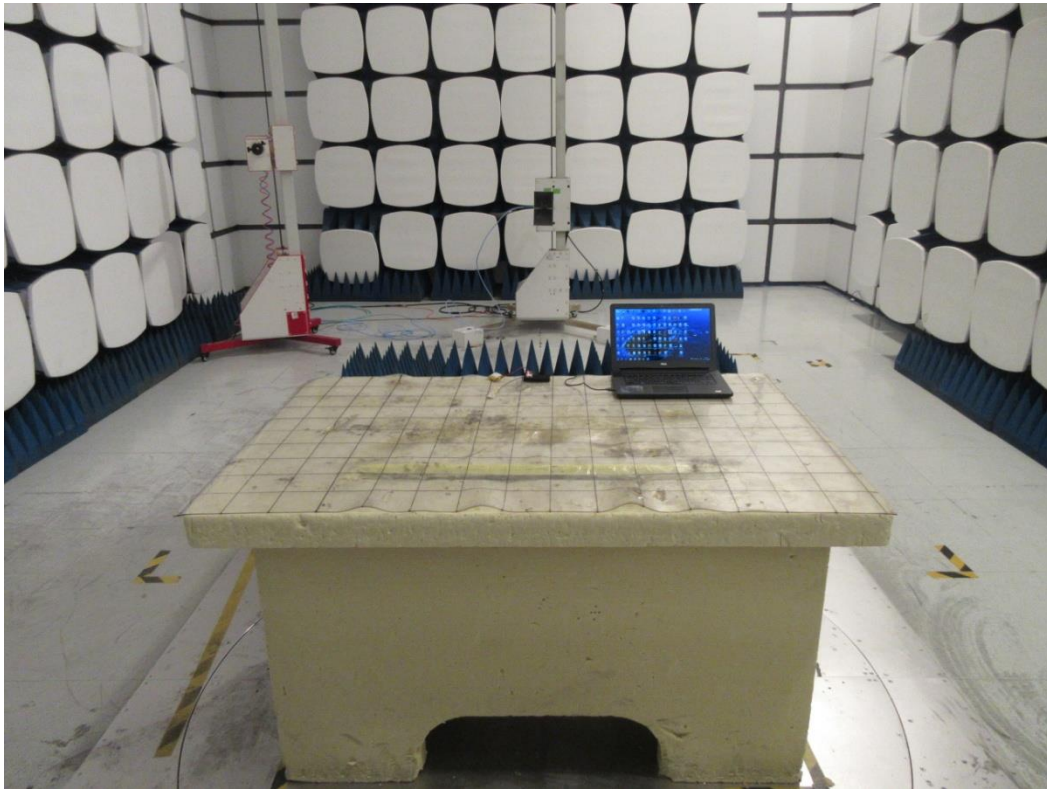
- 1) There was not any unintentional transmission in standby mode

# APPENDIX I- TEST SETUP

RE (30 - 1000 MHz )



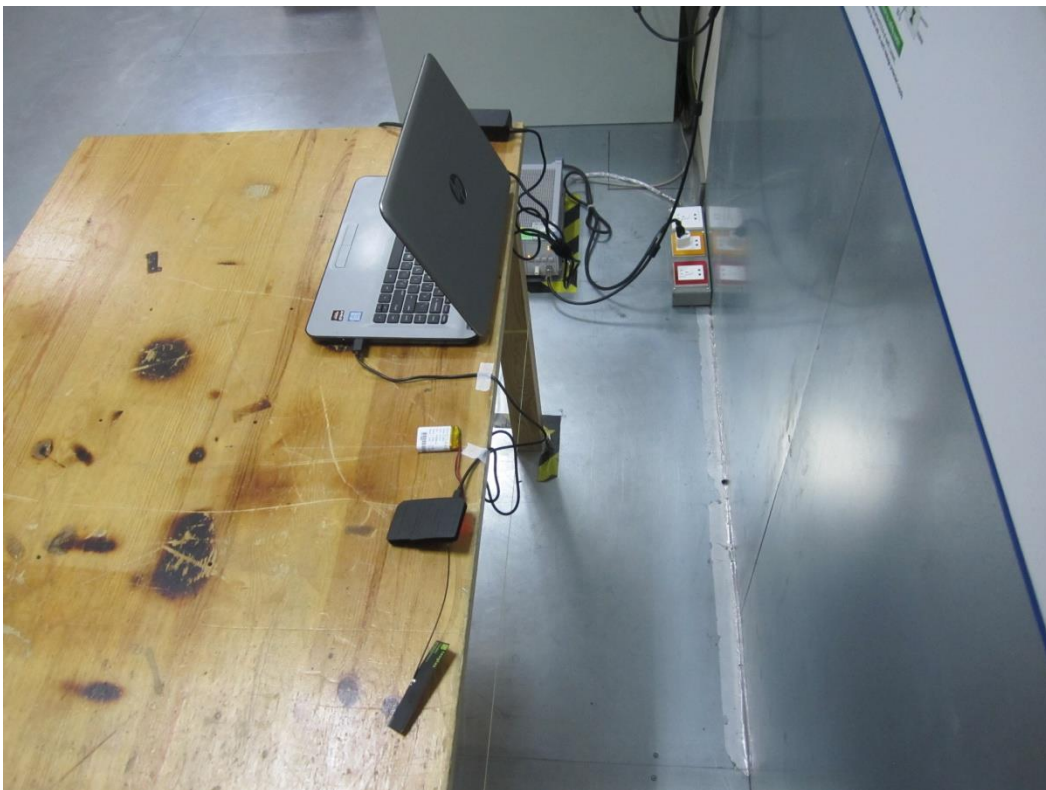
RE (1000 - 6000 MHz )



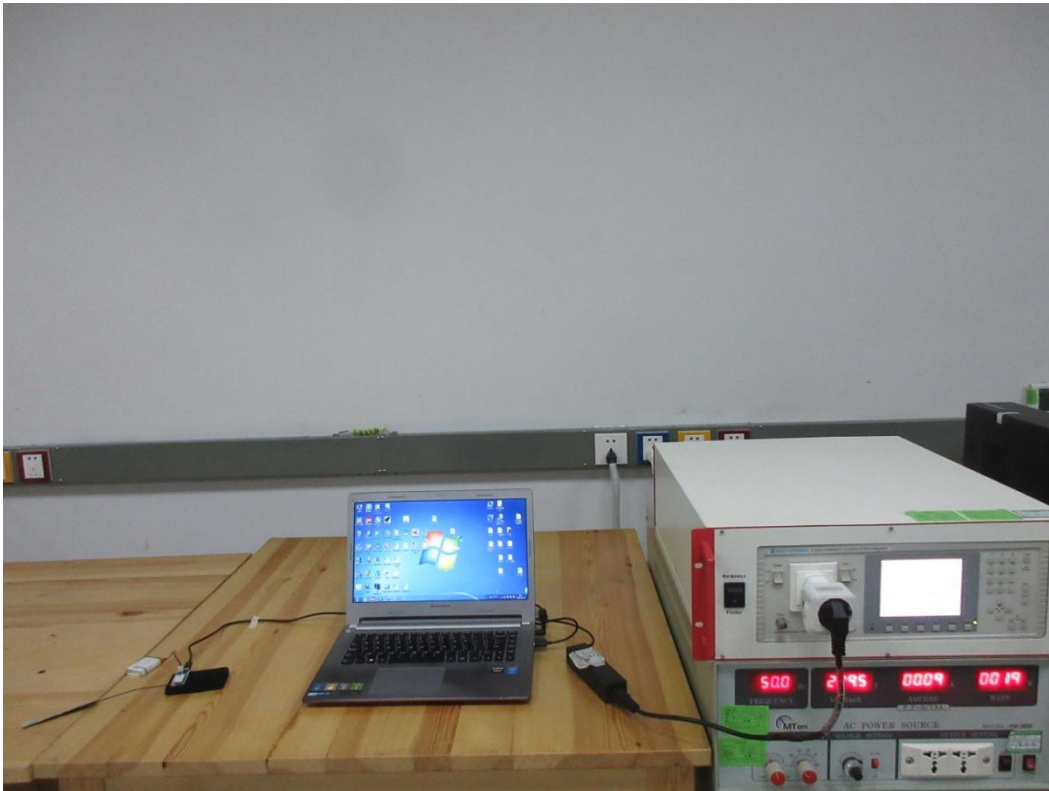
**CE**



**CE**



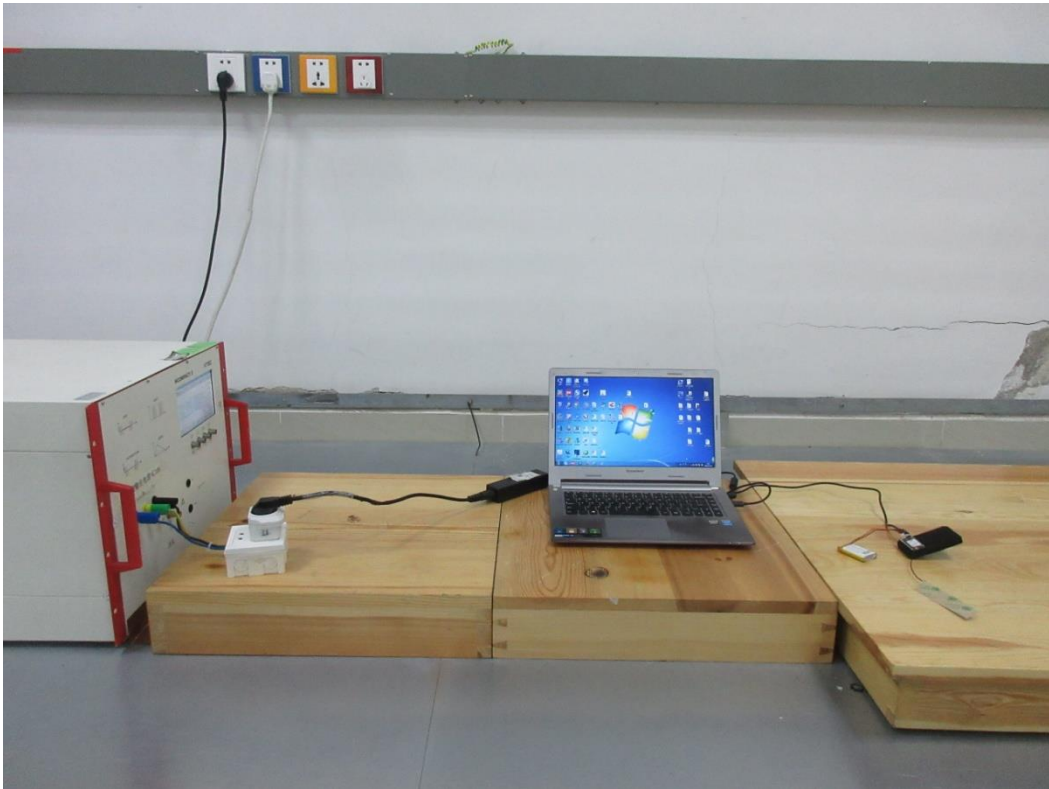
## FLICKER



## SURGE



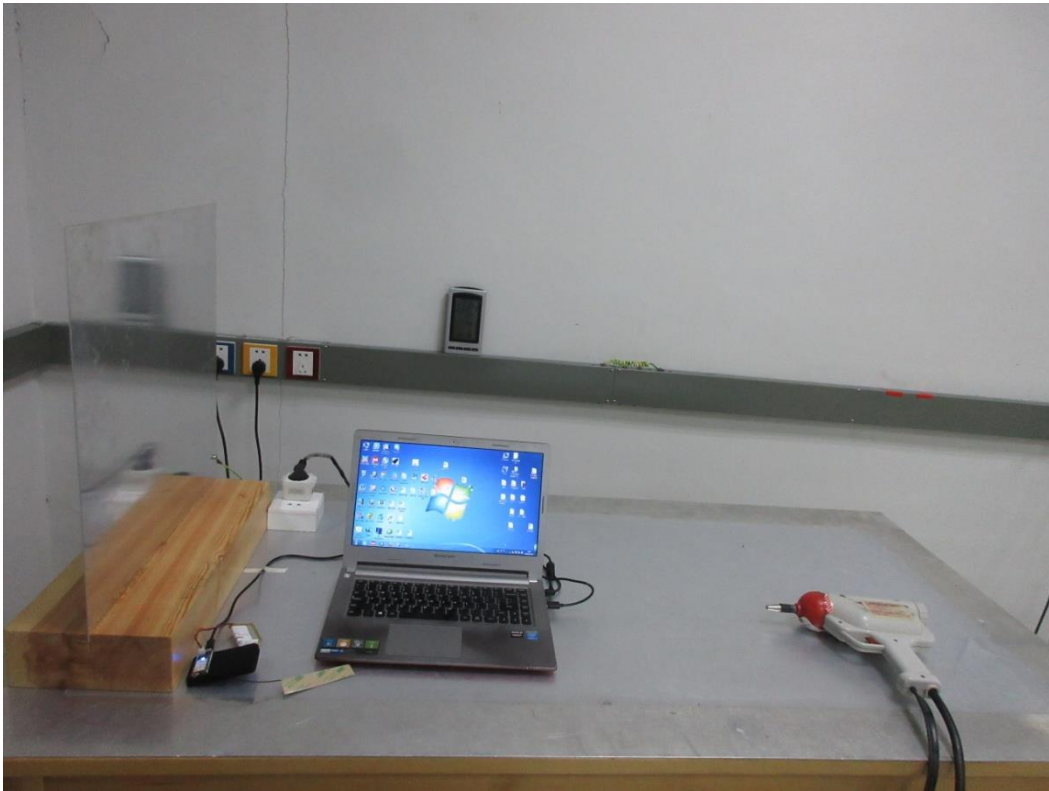
## EFT



## DIPS



**ESD**



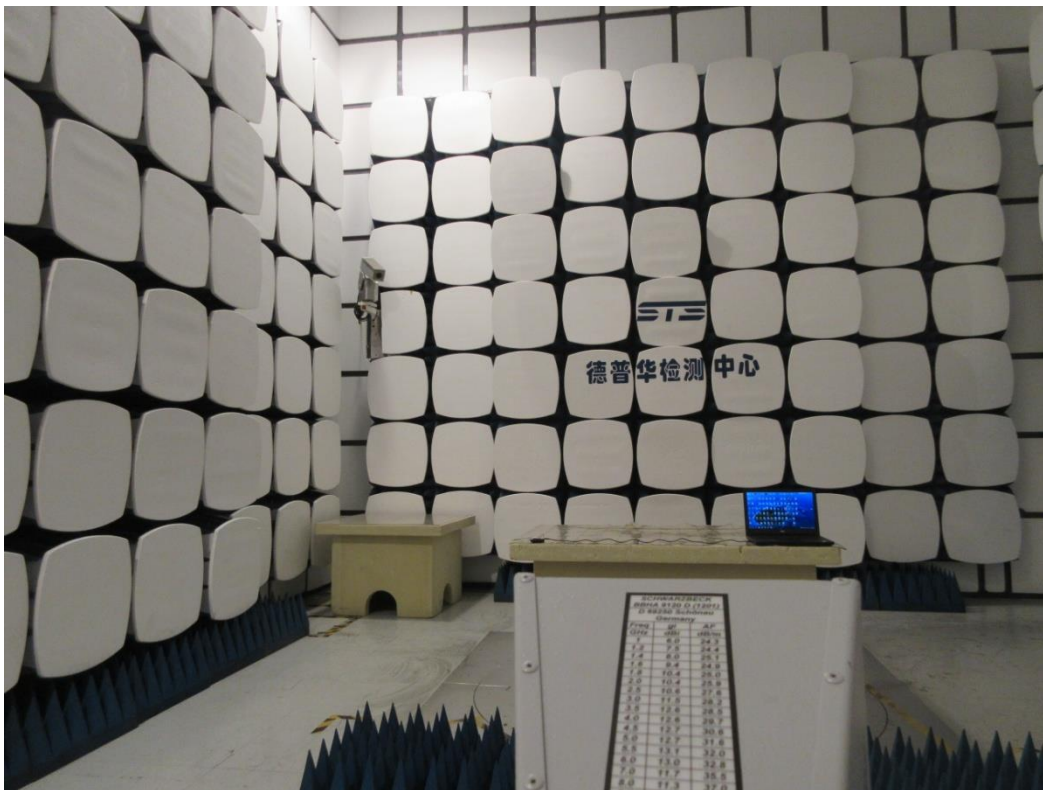
**CS**



**RS (80 - 1000 MHz)**



**RS (1000 - 6000 MHz)**



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