



REPORT No.: SZ18010062E01

# TEST REPORT

**MANUFACTURER** : Shenzhen Chainway Information Technology Co.,Ltd.

**PRODUCT NAME** : Mobile Data Terminal

**MODEL NAME** : C72


**BRAND NAME** : CHAINWAY

**STANDARD(S)** : Draft ETSI EN 301 489-1 V2.2.0 (2017-03)  
Final draft ETSI EN 301 489-3 V2.1.1 (2017-03)  
Draft ETSI EN 301 489-17 V3.2.0 (2017-03)  
Draft ETSI EN 301 489-19 V2.1.0 (2017-03)  
Draft ETSI EN 301 489-52 V1.1.0 (2016-11)

**TEST DATE** : 2018-01-20 to 2017-01-24

**ISSUE DATE** : 2018-03-30

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Approved by:

  
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Change History		
Issue	Date	Reason for change
1.0	2018-03-30	First edition



# 1. Technical Information

**Note:** Provide by manufacturer.

## 1.1. Manufacturer and Factory Information

<b>Manufacturer:</b>	Shenzhen Chainway Information Technology Co.,Ltd.
<b>Manufacturer Address:</b>	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen
<b>Factory:</b>	Shenzhen Chainway Information Technology Co.,Ltd.
<b>Factory Address:</b>	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen

## 1.2. Equipment Under Test (EUT) Description

<b>EUT Type:</b>	Mobile Data Terminal
<b>Serial No:</b>	(N/A, marked #1 by test site)
<b>Hardware Version:</b>	C70SE_MB_V11
<b>Software Version:</b>	C72E_MT6735_V1.1_EU_GITfcd74c4_20180115
<b>SIM Cards Description:</b>	SIM 1 and SIM 2 is a chipset unit and tested as a single chipset. The SIM 1 is chosen for test
<b>Tx Frequency:</b>	GSM900: 880 MHz ~ 915 MHz GSM1800: 1710 MHz ~ 1785 MHz WCDMA Band I: 1920 MHz ~ 1980 MHz WCDMA Band VIII: 880 MHz ~ 915 MHz LTE Band 1: 1920 MHz ~ 1980 MHz LTE Band 3: 1710 MHz ~ 1785 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 8: 880 MHz ~ 915 MHz LTE Band 20: 832 MHz ~ 862 MHz LTE Band 40: 2300 MHz ~ 2400 MHz Bluetooth: 2402 MHz ~ 2480 MHz 802.11b/g/n: 2412 MHz ~ 2472 MHz; 802.11a/n: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz; 5725 MHz ~ 5875 MHz; NFC: 13.56 MHz RFID: 865 MHz ~ 868 MHz
<b>Rx Frequency:</b>	GSM900: 925 MHz ~ 960 MHz GSM1800: 1805 MHz ~ 1880 MHz WCDMA Band I: 2110 MHz ~ 2170 MHz



	WCDMA Band VIII: 925 MHz ~ 960 MHz LTE Band 1: 2110 MHz ~ 2170 MHz LTE Band 3: 1805 MHz ~ 1880 MHz LTE Band 7: 2620 MHz ~ 2690 MHz LTE Band 8: 925 MHz ~ 960 MHz LTE Band 20: 791 MHz ~ 821 MHz LTE Band 40: 2300 MHz ~ 2400 MHz Bluetooth: 2402 MHz ~ 2480 MHz 802.11b/g/n: 2412 MHz ~ 2472 MHz; 802.11a/n: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz; 5725 MHz ~ 5875 MHz; GPS: 1575.42 MHz NFC: 13.56 MHz RFID: 865 MHz ~ 868 MHz	
<b>Antenna Type:</b>	WIFI : PIFA Antenna Bluetooth : PIFA Internal Antenna 2G/3G/4G : PIFA Antenna	
<b>Type of Modulation:</b>	GSM: GMSK EDGE: 8PSK WCDMA: QPSK(Uplink) LTE: QPSK / 16QAM (Uplink) 802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11a: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth 4.0 BDR (1Mbps) : GFSK Bluetooth 2.1 EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth 2.1 EDR (3Mbps) : 8-DPSK Bluetooth 4.0 - LE (1Mbps): GFSK GPS : BPSK NFC: ASK	
<b>Ancillary Equipment:</b>	<b>AC Adapter</b>	
	Brand Name:	GME
	Model No.:	GME10D-050200FGu
	Serial No.:	(N/A, marked #1 by test site)
	Rated Input:	~ 100-240V, 50/60Hz, 0.28A
	Rated Output:	5.0V=2A
	<b>Battery</b>	
	Brand Name:	N/A
	Model No.:	646069
	Serial No.:	(N/A, marked #1 by test site)



	Capacity:	8000mAh
	Rated Voltage:	3.8V
	Charge Limit:	4.35V

**Note:**

1. The Mobile Data Terminal supports GSM900MHz, 1800MHz, GPRS, EDGE, WCDMA Band I , BandⅧ, HSDPA,HSUPA,HSPA+,LTE Band 1/3/7/8/20/40,GPS,NFC,RFID,SRD 5.8GHz,ISM 2.4GHz Bluetooth band and WIFI (802.11a/b/g/n) band.
2. The EUT is equipped with a T-Flash card slot, two SIM card slots and a Micro USB port which can be connected to ancillary equipments. It supports FM function.
3. For a more detailed description, please refer to specification or user's manual supplied by the applicant and/or manufacturer.

## 2. Test Results

### 2.1. Applied Reference Documents

The objective of the report is to perform testing according to following standards for CE marking:

No.	Identity	Document Title
1	Draft ETSI EN 301 489-1 V2.2.0 (2017-03)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
2	Final draft ETSI EN 301 489-3 V2.1.1 (2017-03)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
3	Draft ETSI EN 301 489-17 V3.2.0 (2017-03)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
4	Draft ETSI EN 301 489-19 V2.1.0 (2017-03)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
5	Draft ETSI EN 301 489-52 V1.1.0 (2016-11)	Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
6	EN 61000-3-3:2013	Electromagnetic compatibility (EMC) -- Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $\leq 16$ A per phase and not subject to conditional connection
7	EN 61000-3-2:2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase)



Test detailed items required and results are listed as below (the latest versions of basic standards are applied):

No.	Base Standard	Test Type	Test Engineer	Result
<b>Emission (EN 301 489-1 Clause 7.1)</b>				
1	EN 55032	Radiated Emission	Peng Shiqing	PASS
2	EN 55032	Conducted Emission, DC Ports	N/A	N/A
3	EN 55032	Conducted Emission, AC Ports	Peng Shiqing	PASS
4	EN 55032	Conducted Emission, Telecom Ports	N/A	N/A
5	EN 61000-3-2	Harmonic Current Emissions	N/A	PASS <sup>Note1</sup>
6	EN 61000-3-3	Voltage Fluctuations & Flicker	Peng Shiqing	PASS
<b>Immunity (EN 301 489-1 Clause 7.2)</b>				
7	EN 61000-4-2	Electrostatic Discharge Immunity	Peng Shiqing	PASS
8	EN 61000-4-3	Radiated RF Electromagnetic Field Immunity	Peng Shiqing	PASS
9	EN 61000-4-4	Electrical Fast Transient/Burst Immunity	Peng Shiqing	PASS
10	ISO 7637-1, -2	Transients and Surges, DC Ports	N/A	N/A
11	EN 61000-4-5	Surge Immunity, AC Ports, Telecom Ports	Peng Shiqing	PASS
12	EN 61000-4-6	Immunity to Conducted Disturbances Induced by RF Fields	Peng Shiqing	PASS
13	EN 61000-4-11	Voltage Dips and Short Interruptions Immunity	Peng Shiqing	PASS
<b>Note 1:</b> There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2: 2014. For further details, please refer to Clause 7 of EN 61000-3-2: 2014, which states: “For the following categories of equipment, limits are not specified in this edition of the standard: - equipment with a rated power of 75W or less, other than lighting equipment.”				



## 2.2. EUT Setup and Operating Conditions

Frequency range was investigated: Conducted emission test: from 150 KHz to 30 MHz; Radiated emission test: from 30 MHz to 6000 MHz; Radio frequency electromagnetic field immunity test: 80 MHz to 6000 MHz. Conducted frequency, common mode: from 150 KHz to 80 MHz.

Note: All of the following test modes are tested in all the test items.

Test Mode	
Mode 1	<b>GSM900 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable (Charging from Adapter) + Adapter + SIM Card</b>
Mode 2	GSM900 Link + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 3	GSM1800 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 4	GSM1800 Link + Bluetooth Link + WLAN Link + Battery + Base + USB Cable (Charging from Adapter) + Adapter + SIM Card
Mode 5	WCDMA Band I Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 6	WCDMA Band I Link + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 7	WCDMA Band VIII Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 8	WCDMA Band VIII Link + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 9	LTE Band 1 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 10	LTE Band 1 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 11	LTE Band 3 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 12	LTE Band 3 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 13	LTE Band 7 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 14	LTE Band 7 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 15	LTE Band 8 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 16	LTE Band 8 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB





	Cable(Charging from Adapter) + Adapter + SIM Card
Mode 17	LTE Band 20 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 18	LTE Band 20 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 19	LTE Band 40 Link + Bluetooth Idle + WLAN Idle + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 20	LTE Band 40 Link Idle + Bluetooth Link + WLAN Link + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 21 :	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + GPS Rx + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 22 :	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + Camera + Battery + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 23 :	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + MP4 + Battery + Base + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 24	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + NFC + Earphone + Battery + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 25	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + RFID + Earphone + Battery + USB Cable(Charging from Adapter) + Adapter + SIM Card
Mode 26	GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + 5.8GHz + Earphone + Battery + USB Cable(Charging from Adapter) + Adapter + SIM Card
<b>Mode 27 :</b>	<b>GSM/WCDMA/LTE Band Idle + Bluetooth Idle + WLAN Idle + PC + T-Flash Card + Battery + Base + USB Cable + SIM Card</b>
<b>Remark:</b> The above test modes in boldface were the worst cases of conducted emission, radiated emission, flicker, ESD, RS, DIP, SURGE, EFT and CS tests; only the test data of these modes was reported.	

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 - 60
Atmospheric Pressure (kPa):	86 - 106

## 3. Emission Tests

### 3.1. Mains Terminal Disturbance Voltage

#### 3.1.1. Limits of Mains Terminal Disturbance Voltage

Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5 – 30	60	50

**Note:** The lower limit shall apply at the band edges.

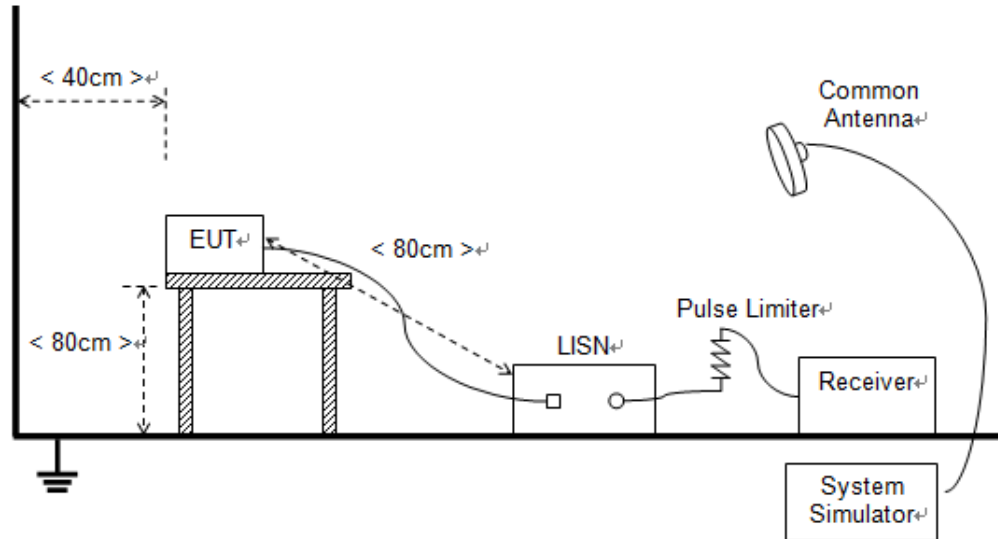
The limit decreases linearly with the logarithm of the frequency in the range 0.15 – 0.50MHz.

#### 3.1.2. Test Procedure

1. The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50 $\Omega$ /50 $\mu$ H of coupling impedance for the measuring instrument.
2. The test frequency range is from 150kHz to 30MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors.
3. Tests for both Line and Neutral lines of the power mains connected to the EUT are performed.

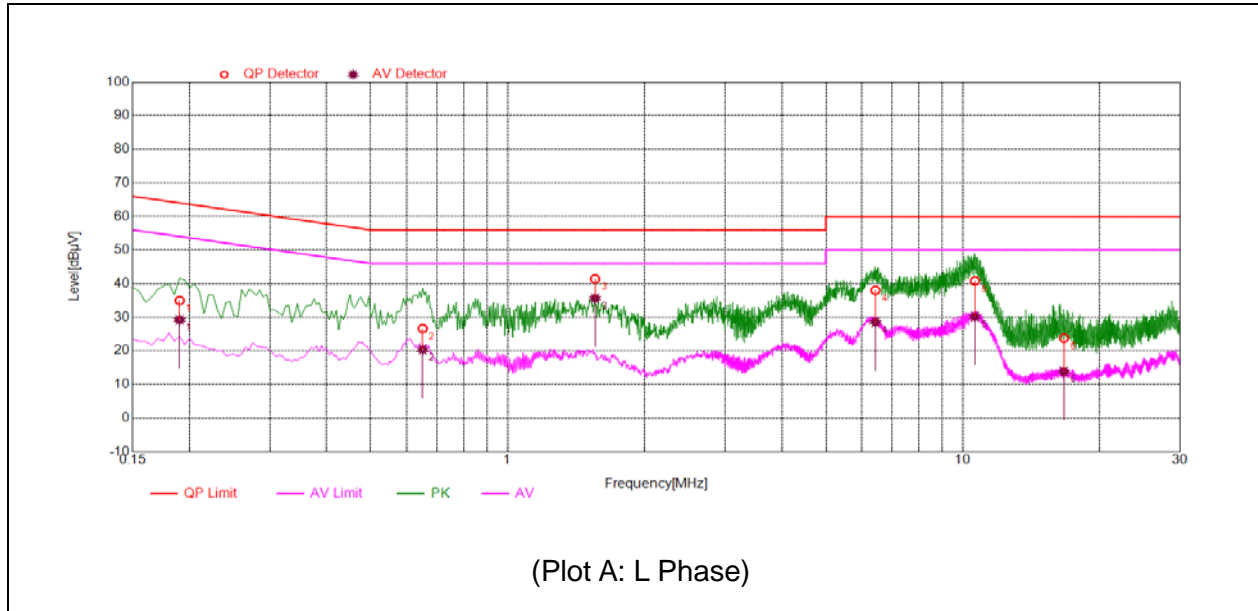
### 3.1.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.

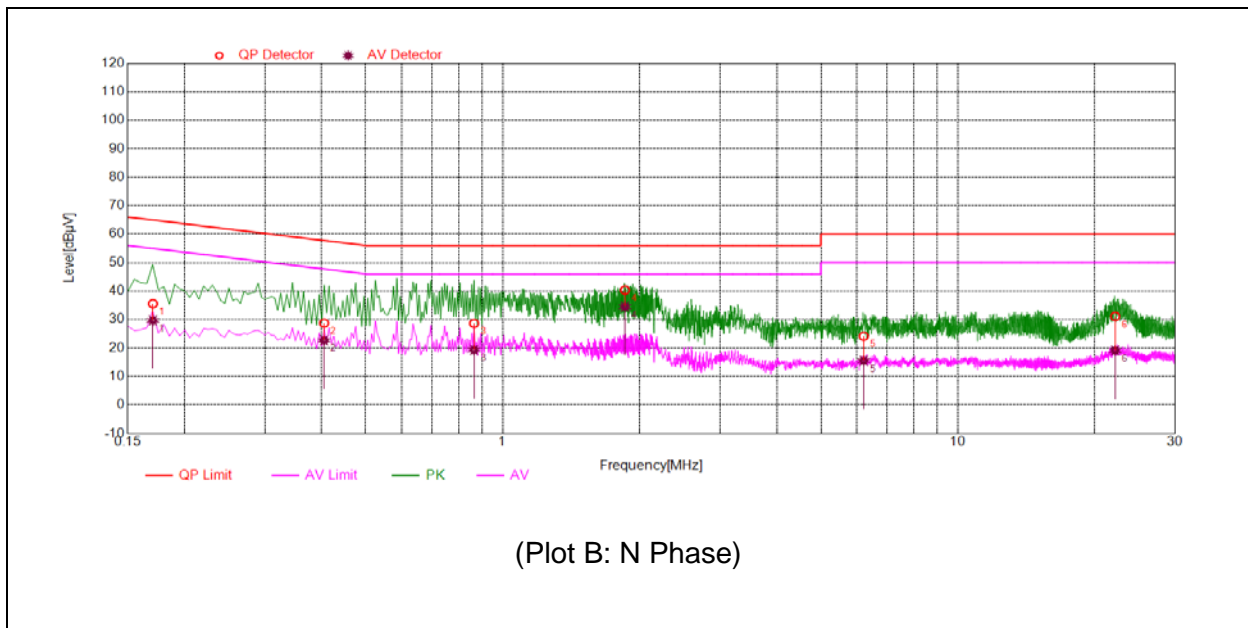


### 3.1.4. Test Result

#### Mode 1

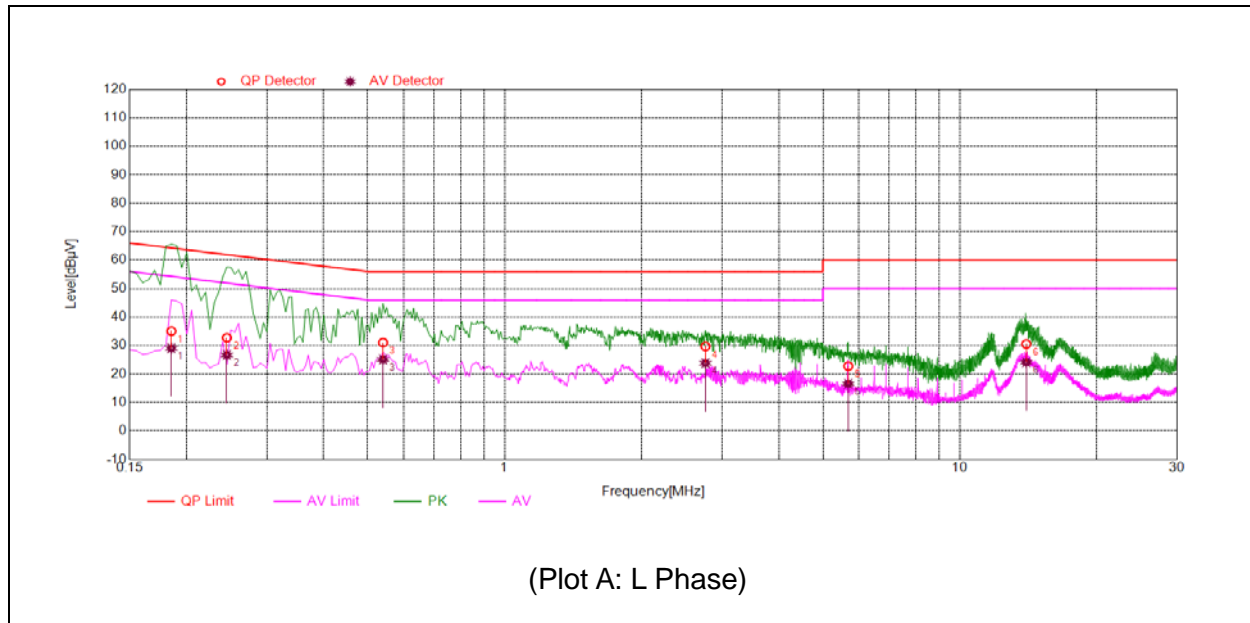


NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1899	34.96	29.24	64.04	54.04	Line	PASS
2	0.6499	26.61	20.37	56.00	46.00		PASS
3	1.5549	41.41	35.64	56.00	46.00		PASS
4	6.4246	38.04	28.50	60.00	50.00		PASS
5	10.630	40.82	30.18	60.00	50.00		PASS
6	16.680	23.81	13.82	60.00	50.00		PASS

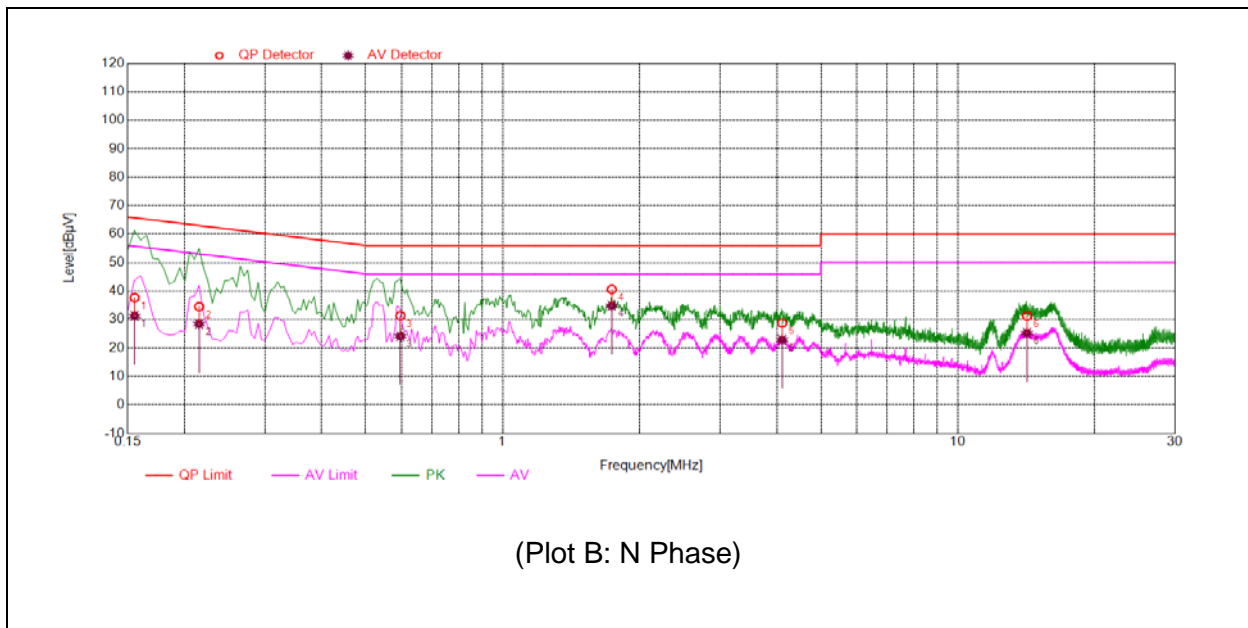


NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1702	35.54	29.70	64.95	54.95	Neutral	PASS
2	0.4047	28.75	22.71	57.76	47.76		PASS
3	0.8647	28.66	19.36	56.00	46.00		PASS
4	1.8554	40.34	34.50	56.00	46.00		PASS
5	6.2101	24.13	15.57	60.00	50.00		PASS
6	22.164	31.10	19.15	60.00	50.00		PASS

# Mode 27



NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1850	35.08	29.08	64.26	54.26	Line	PASS
2	0.2449	32.75	26.69	61.93	51.93		PASS
3	0.5400	31.04	25.12	56.00	46.00		PASS
4	2.7600	29.73	23.81	56.00	46.00		PASS
5	5.6849	22.79	16.61	60.00	50.00		PASS
6	13.994	30.53	24.11	60.00	50.00		PASS



NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1551	37.67	31.26	65.72	55.72	Neutral	PASS
2	0.2150	34.54	28.45	63.01	53.01		PASS
3	0.5954	31.36	24.13	56.00	46.00		PASS
4	1.7352	40.59	34.87	56.00	46.00		PASS
5	4.1104	28.78	22.87	56.00	46.00		PASS
6	14.189	31.24	25.24	60.00	50.00		PASS

## 3.2. Radiated Disturbance

### 3.2.1. Limits of Radiated Disturbance

Frequency range (MHz)	Quasi-Peak Limit (dB $\mu$ V/m)	--
30 – 230	40	--
230 – 1000	47	--
Frequency range (MHz)	Peak Limit (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)
1000-3000	70	50
3000-6000	74	54

**Note:** The limit is applicable to 3m measurement distance.

The lower limit shall apply at the transition frequency.

Additional provisions may be required for cases where interference occurs.

### 3.2.2. Test Procedure

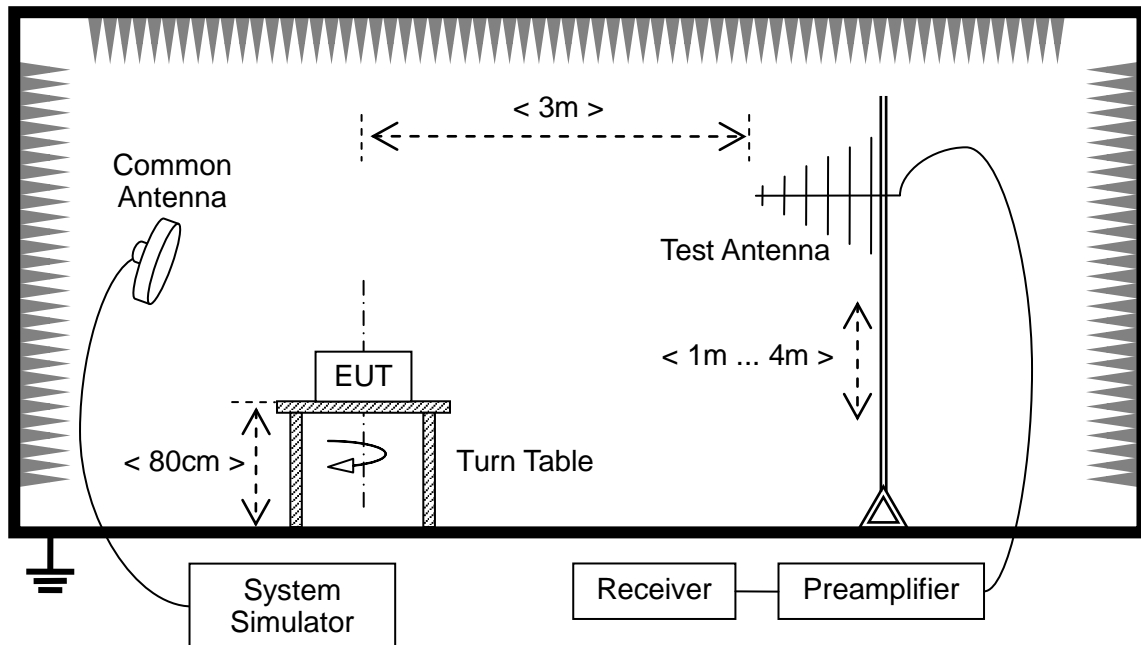
1. The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.
2. For each suspected emission, the EUT is arranged to its worst case and then the Test Antenna is tuned to the heights from 1 to 4m and the Turn Table is tuned from 0 to 360 degrees to find the maximum reading.
3. The Test Antenna is a bi-log one, and its height is varied from 1 to 4m above the ground to determine the maximum value of the field strength. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests.
4. The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with QP and AV detectors.

### 3.2.3. Test Setup

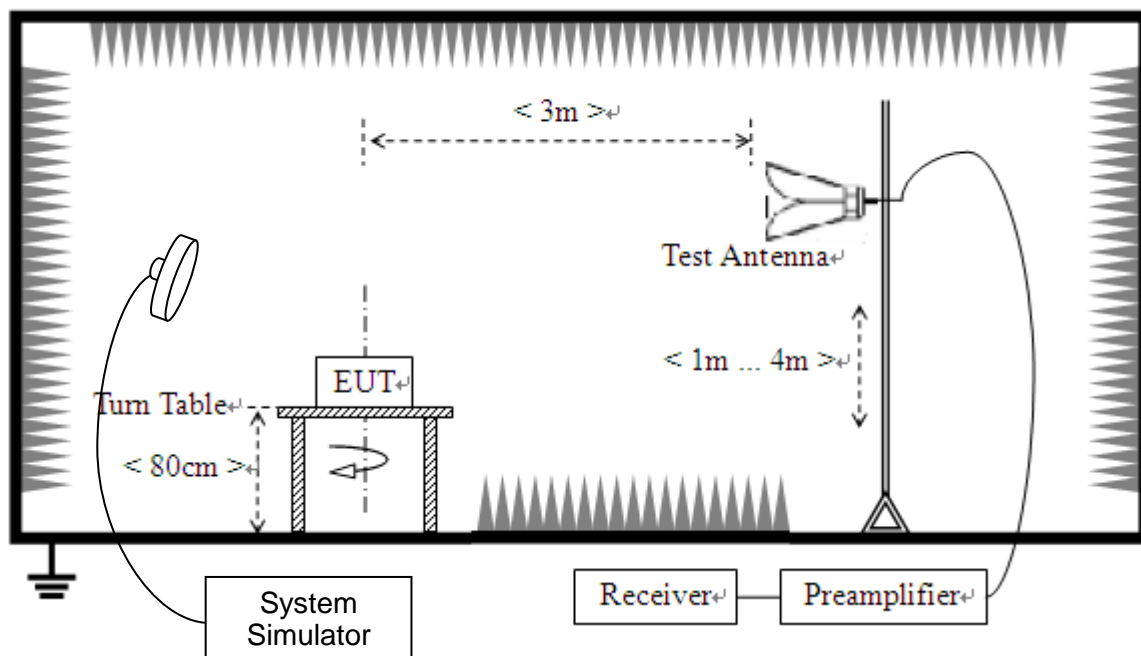
Please refer to Annex A for the photographs of the Test Configuration.



1) For radiated emissions from 30MHz to1GHz



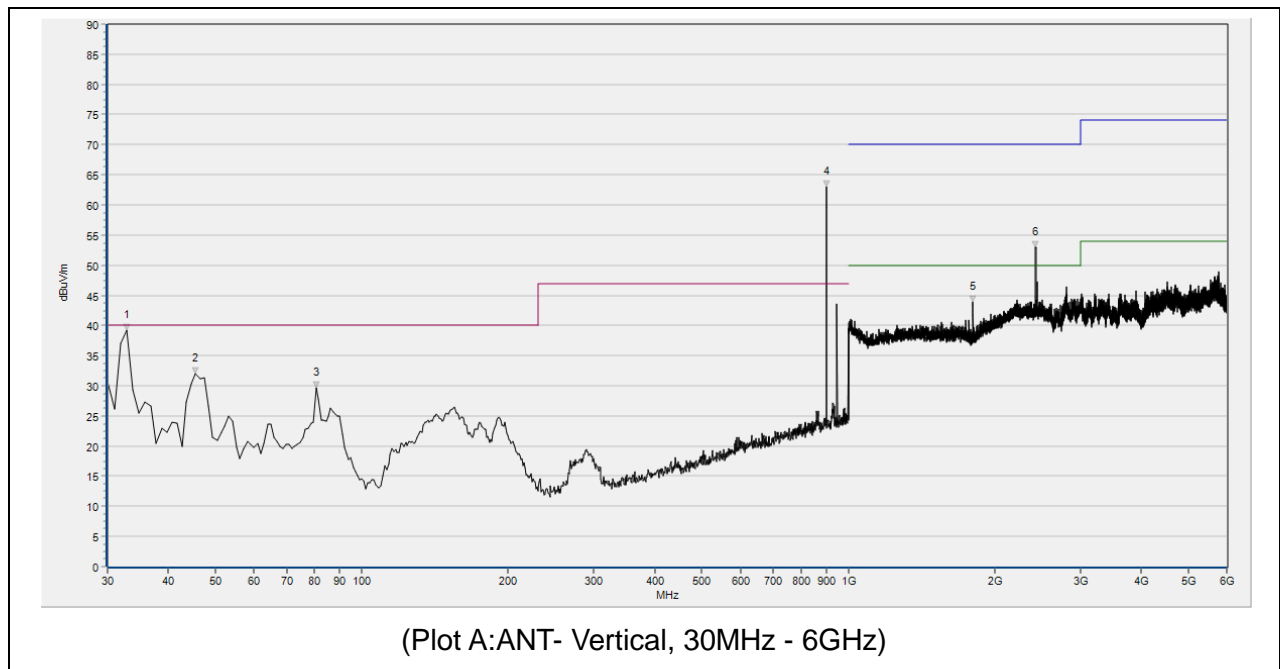
2) For radiated emissions above 1GHz



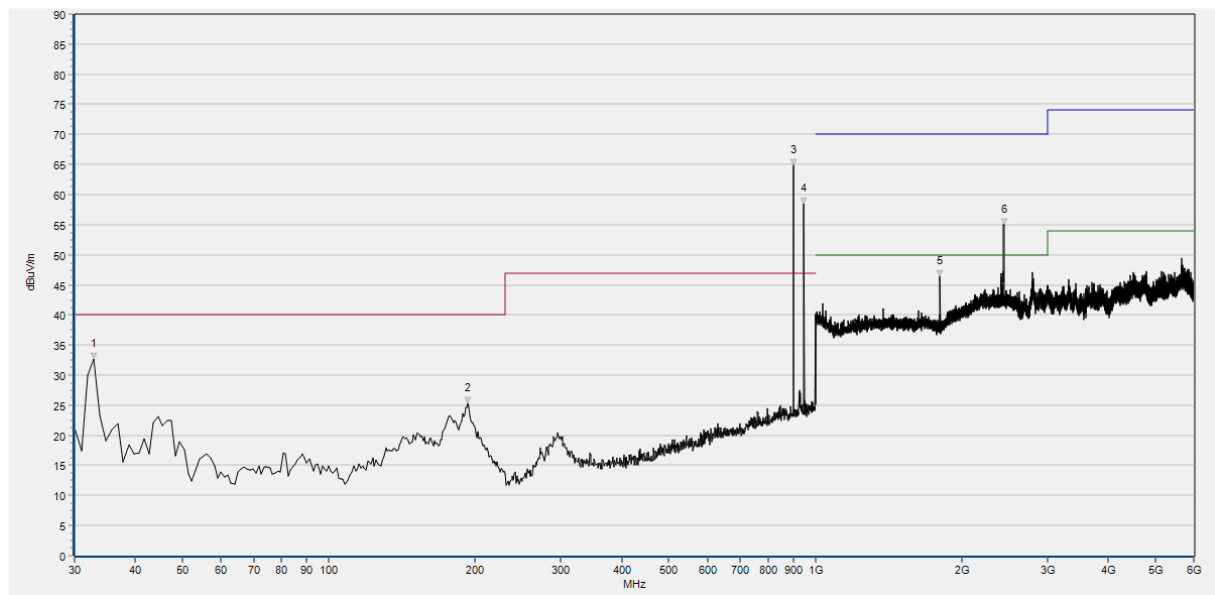
### 3.2.4. Test Result

#### Mode 1

Note: Following is the plots for emission measurement; please note that marked spikes near 900MHz and harmonics should be ignored because they are MS and SS carrier frequency and harmonics frequency, please note that marked spikes near 2400MHz and harmonics should be ignored because they are Bluetooth and WIFI carrier frequency and harmonics frequency.



No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	32.910	39.25	33.84	N.A.	N.A.	40.00	N.A.	V	PASS
2	45.520	32.02	N.A.	N.A.	N.A.	40.00	N.A.	V	PASS
3	80.440	29.68	N.A.	N.A.	N.A.	40.00	N.A.	V	PASS
4	902.030	63.00	N.A.	N.A.	N.A.	47.00	N.A.	V	N.A.
5	1805.333	43.95	N.A.	N.A.	70.00	N.A.	50.00	V	N.A.
6	2423.467	53.52	N.A.	N.A.	70.00	N.A.	50.00	V	N.A.

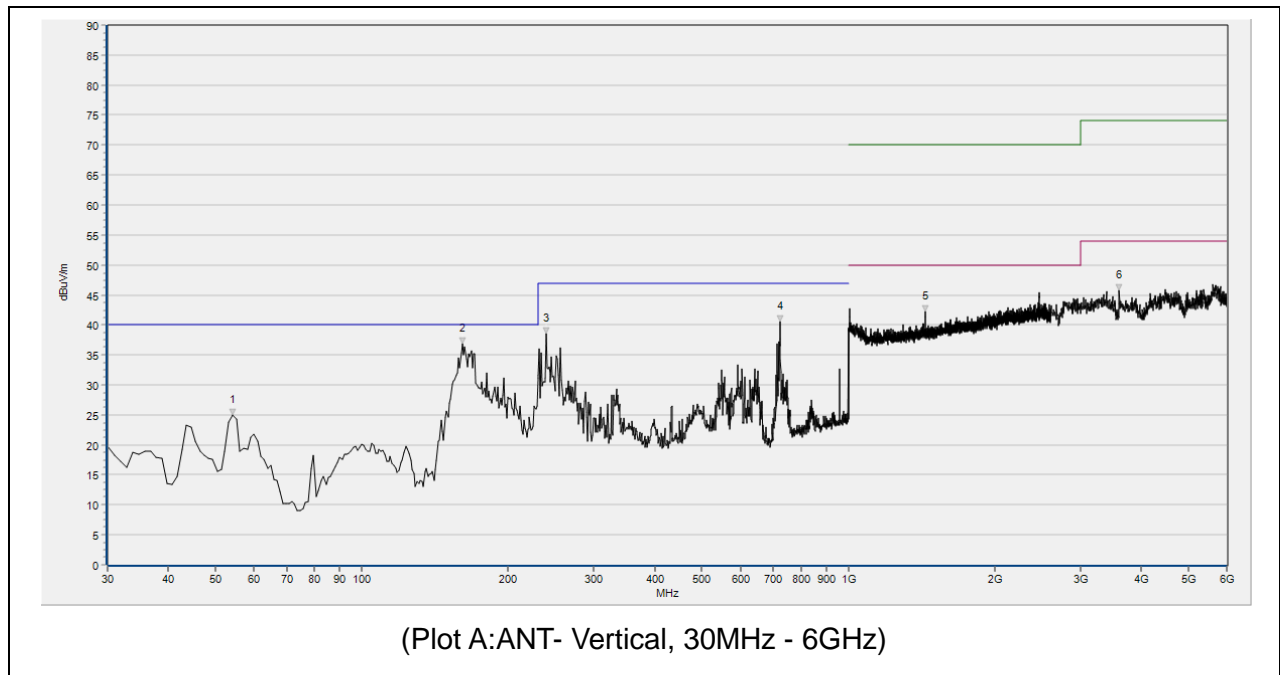


(Plot B:ANT- Horizontal, 30MHz - 6GHz)

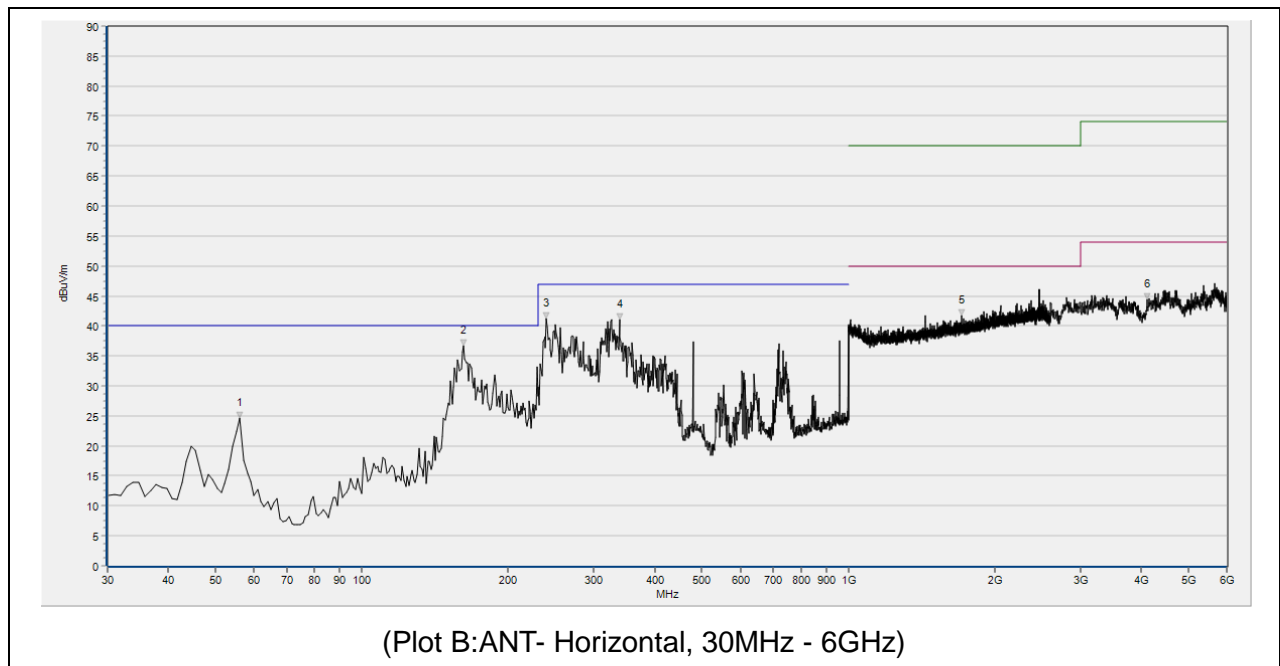
No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	32.910	32.75	N.A.	N.A.	N.A.	40.00	N.A.	H	PASS
2	192.960	25.31	N.A.	N.A.	N.A.	40.00	N.A.	H	PASS
3	902.030	64.79	N.A.	N.A.	N.A.	47.00	N.A.	H	N.A.
4	947.620	58.47	N.A.	N.A.	N.A.	47.00	N.A.	H	N.A.
5	1805.333	46.45	N.A.	N.A.	70.00	N.A.	50.00	H	N.A.
6	2440.533	55.13	N.A.	N.A.	70.00	N.A.	50.00	H	N.A.



Mode 27



No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	54.250	24.97	N/A	N/A	N/A	40.00	N/A	V	PASS
2	160.950	36.95	26.39	N/A	N/A	40.00	N/A	V	PASS
3	239.520	38.48	N/A	N/A	N/A	47.00	N/A	V	PASS
4	723.550	40.59	N/A	N/A	N/A	47.00	N/A	V	PASS
5	1440.000	42.31	N/A	N/A	70.00	N/A	50.00	V	PASS
6	3608.000	45.72	N/A	N/A	74.00	N/A	54.00	V	PASS



No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	56.190	24.67	N/A	N/A	N/A	40.00	N/A	H	PASS
2	161.920	36.70	28.56	N/A	N/A	40.00	N/A	H	PASS
3	239.520	41.20	N/A	N/A	N/A	47.00	N/A	H	PASS
4	338.460	40.99	N/A	N/A	N/A	47.00	N/A	H	PASS
5	1712.000	41.72	N/A	N/A	70.00	N/A	50.00	H	PASS
6	4118.720	44.41	N/A	N/A	74.00	N/A	54.00	H	PASS

### 3.3. Voltage Fluctuations and Flicker Measurement

#### 3.3.1. Limits of Voltage Fluctuations and Flicker

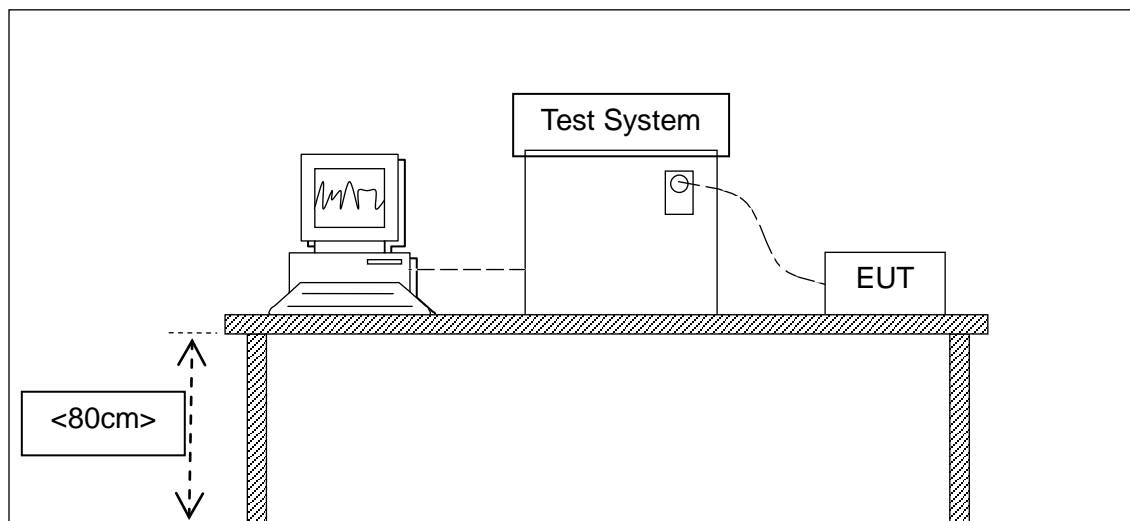
Test Item	Limit	Note
$P_{st}$	1.0	Short-term flicker indicator
$P_{lt}$	0.65	Long-term flicker indicator
$T_{dt}$	0.5	Maximum time that dt exceeds 3%
$d_{max}$ (%)	4%	Maximum relative voltage change
$d_c$ (%)	3.3%	Relative steady-state voltage change

#### 3.3.2. Test Procedure

1. The EUT is placed on the top of a wooden table 0.8m above the ground and operated to produce the most unfavorable sequence of voltage changes under normal conditions.
2. During the Flicker measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

#### 3.3.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.





### 3.3.4. Test Result

#### A. Test Specification:

No.	Specification	Value
1	Test Frequency	50Hz
2	Test Voltage	230VAC
3	Waveform	Sine
4	Test Time	10 minutes for $P_{st}$ ; 2 hours for $P_{lt}$

#### B. Test Verdict:

Test Mode	Test Parameter	Limit	Measurement Value	Verdict
See section 2.2	$P_{st}$	1.0	0.19	PASS
	$P_{lt}$	0.65	0.00	PASS
	$T_{dt}$	0.5	0.00	PASS
	$d_{max}$ (%)	4%	0.34%	PASS
	$d_c$ (%)	3.3%	0.0%	PASS

## 4. Immunity Tests

### 4.1. EUT Operation and Performance Criteria

#### 4.1.1. Performance Criteria

##### A. General Performance Criteria:

Type	Description
Criterion A	The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion B	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

##### B. Performance Criteria for CT and CR:

Refer to EN 301 489-52 subclasses 6.1 and 6.2 for the performance criteria for Continuous phenomena applied to Transmitter (CT) and Receiver (CR).

A call is established at the start of the test, and maintained during the test. During the test, the RXQUAL of the downlink shall not exceed 3, measured during each individual exposure in the test sequence. Both the uplink speech output level and the downlink speech output level shall be at least 35dB less than the previously recorded reference levels, when measured through an audio band Pass filter of width 200Hz, centered on 1kHz (audio breakthrough check). 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.

##### UTRA

In the data transfer mode, the performance criteria can be one of the following:

- if the BER (as referred in ETSI TS 134 109 [4]) is used, it shall not exceed 0,001 during the test sequence;
- if the BLER (as referred in ETSI TS 134 109 [4]) is used, it shall not exceed 0,01 during the test sequence.

The BLER calculation shall be based on evaluating the CRC on each transport block.

##### E-UTRA





In the data transfer mode, the performance criteria shall be that the throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channel as specified in annex C in ETSI TS 136 101 [9] with parameters specified in tables 7.3.1-1 and 7.3.1-2 in ETSI TS 136 101 [9] during the test sequence.

### **C. Performance Criteria for TT and TR:**

Refer to EN 301 489-52 subclasses 6.1 and 6.2 for the performance criteria for Transient phenomena applied to Transmitter (TT) and Receiver (TR).

#### Traffic operating mode

A call is established at the start of the test. 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.

## 4.2. Electrostatic Discharge Immunity

### 4.2.1. Test Specification

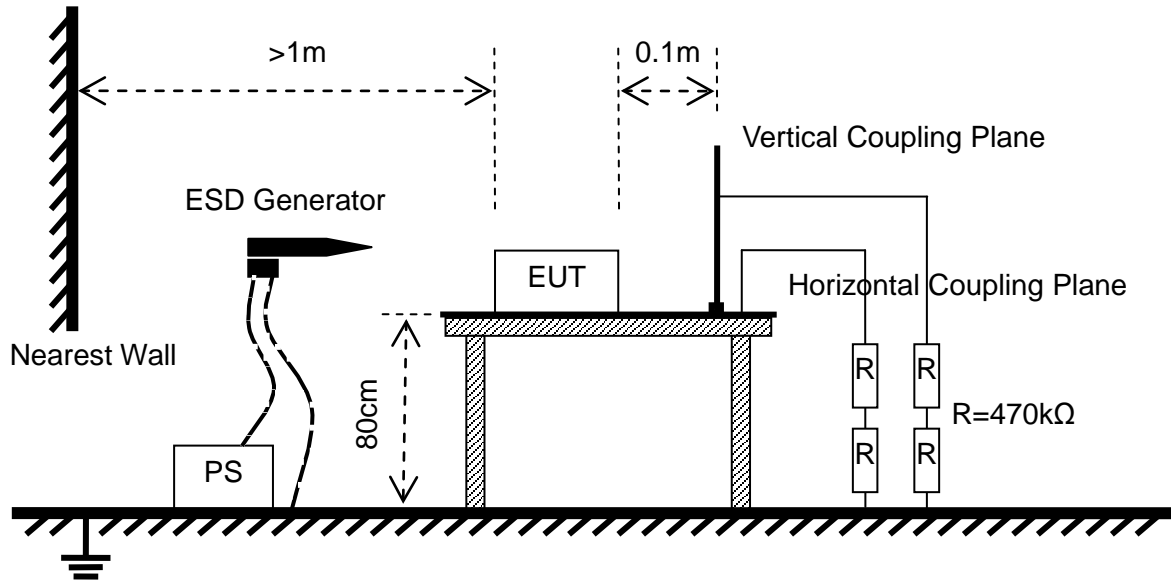
Specification	Value
Basic Standard	EN 61000-4-2:2009
Discharge Impedance	330Ohm / 150pF
Discharge Voltage	Air Discharge: 8kV; Contact Discharge: 4kV
Polarity	Positive / Negative
Number of Discharge	Minimum 20 times at each test point
Discharge Mode	Single discharge
Discharge Period	1 second minimum

### 4.2.2. Test Procedure

1. Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
2. The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
3. The time interval between two successive single discharges is at least 1 second.
4. The ESD generator is held perpendicularly to the surface to which the discharge is applied and the return cable is at least 0.2 meters from the EUT.
5. Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
6. Air discharges are 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 is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges were completed.
7. At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
8. At least ten single discharges ( in the most sensitive polarity) are applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m\*0.5m) is placed vertically to and 0.1 meters from the EUT.

#### 4.2.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



#### 4.2.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for TT/TR or Criterion B. All test modes have the same test results, only one result is recorded in this report.

Test Points	Discharge Level (kV)	Discharge Mode	Number of Discharge	Test Mode	Observation	Verdict
HCP	±4	Contact	20	See section 2.2	A	PASS
VCP	±4	Contact	20		A	PASS
Please refer to the blue arrow	±4	Contact	20		A	PASS
Please refer to the red arrow	±2,±4,±8	Air	20		A	PASS

Note: The performance criteria in TT and TR is only applicable to the mode 1 test of the EUT, performances of the mode 27 test comply with the performance criteria in Criterion B.

#### 4.2.5. The ESD test points









**Represent air discharge**



**Represents contact discharge**



## 4.3. Radiated, Radio Frequency Electromagnetic Field Immunity Test

### 4.3.1. Test Specification

<b>Basic Standard:</b>	EN 61000-4-3:2006+A1:2008+A2:2010
<b>Frequency Range:</b>	80 MHz – 6000MHz
<b>Field Strength:</b>	3V/m
<b>Modulation:</b>	1 kHz sine wave, 80%, AM modulation
<b>Frequency Step:</b>	1% of fundamental
<b>Polarity of Antenna</b>	Horizontal and Vertical
<b>Test Distance:</b>	3m
<b>Antenna Height:</b>	1.5m
<b>Dwell Time:</b>	3 seconds

### Audio calibration factor

Audio direction	Audio calibration factor (dB)
Uplink (CH B)	100
Downlink (CH A)	96.25

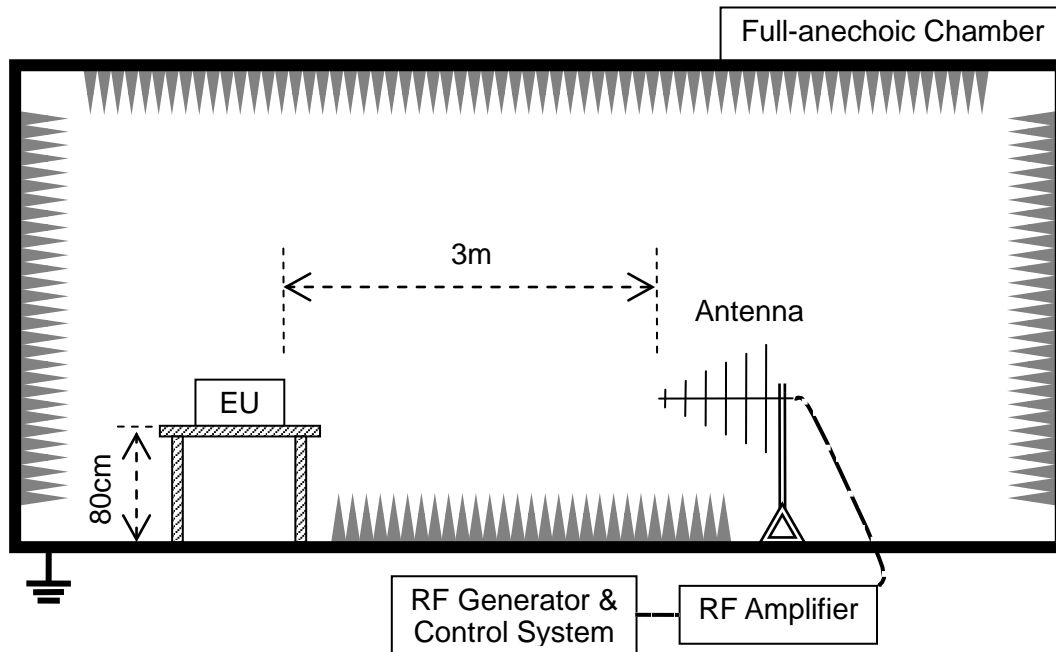
### 4.3.2. Test Procedure

The test procedure was in accordance with EN 61000-4-3:2006+A1:2008+A2:2010.

1. The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
2. The test signal was 80% amplitude modulated with a 1 kHz sine wave.
3. The frequency range was swept from 80 MHz to 6000MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers. 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.
4. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
5. The field strength level was 3V/m.
6. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

7. A spot frequency test shall additionally be performed at: • 80 MHz; • 104 MHz; • 136 MHz; • 165 MHz; • 200 MHz; • 260 MHz; • 330 MHz; • 430 MHz; • 560 MHz; • 715 MHz  $\pm$  1 MHz; • a spot frequency test shall be performed at 920 MHz  $\pm$  1 MHz using a test level of 3 V/m (measured unmodulated) 100 % modulated by 200 Hz pulses of equal mark to space ratio.

#### 4.3.3. Test Setup



For the actual test configuration refer to Annex A for the photographs of the Test Configuration.

#### 4.3.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for CT/CR or Criterion A. All test modes have the same test results, only one result is recorded in this report.

Operating Mode	Field Strength	Frequency (MHz)	Modulation	EUT Face	Observation	Verdict
See Section 2.2	3 V/m	80-6000	1KHz, 80% Amp. Mod, 1% increment	Front	A	Pass
				Rear	A	Pass
				Left	A	Pass
				Right	A	Pass

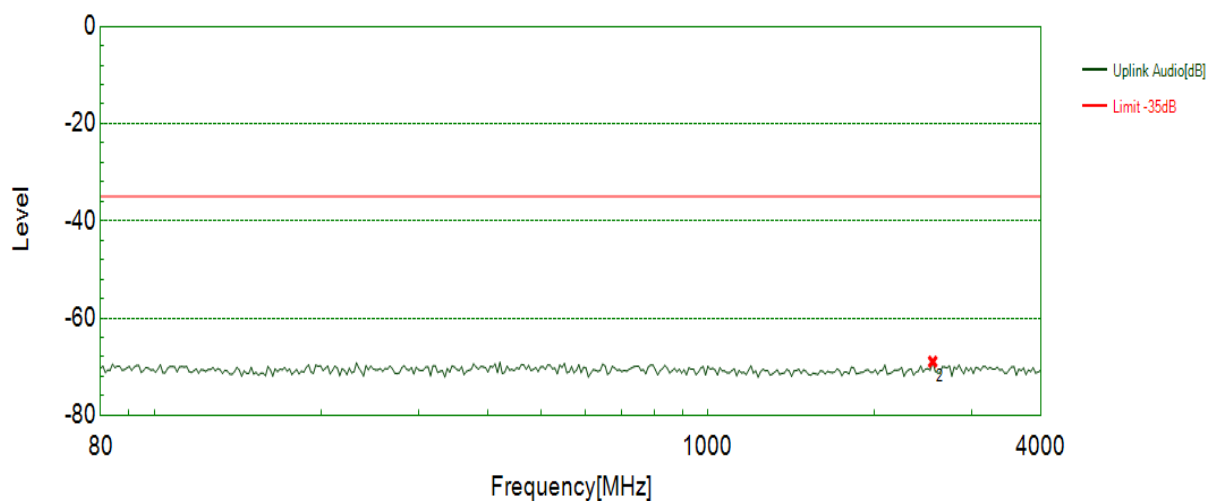
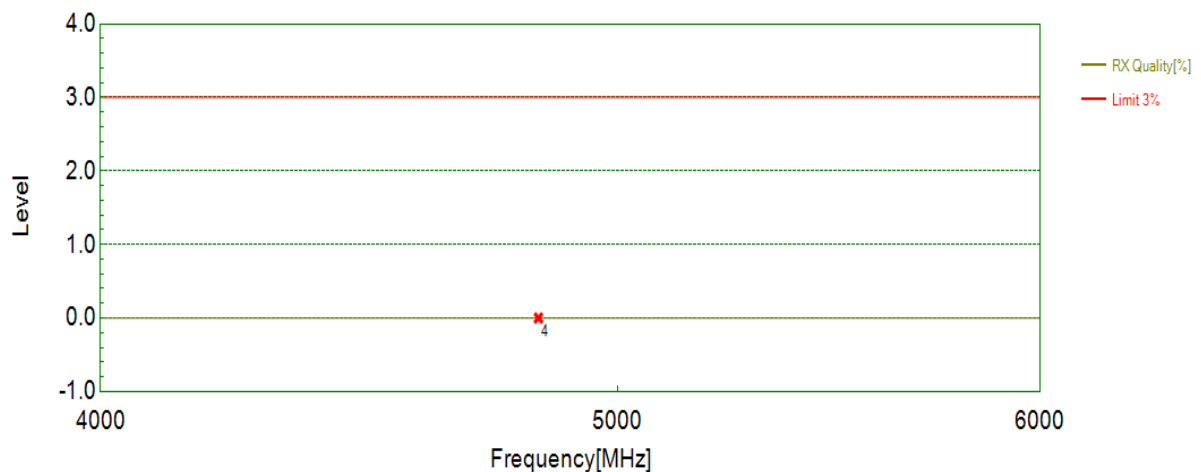
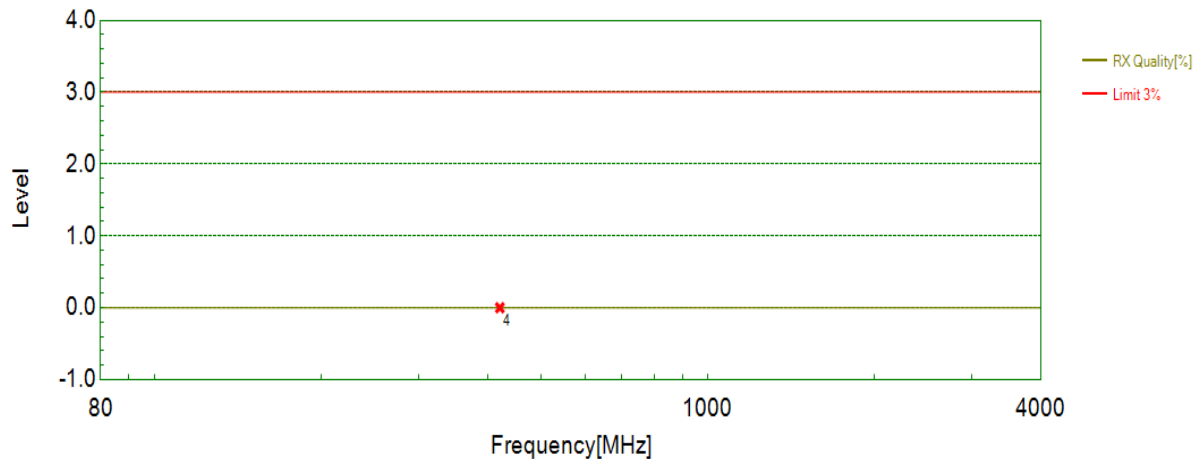
Note: The mode 1 test performances comply with the performance criteria for CT and CR, and the

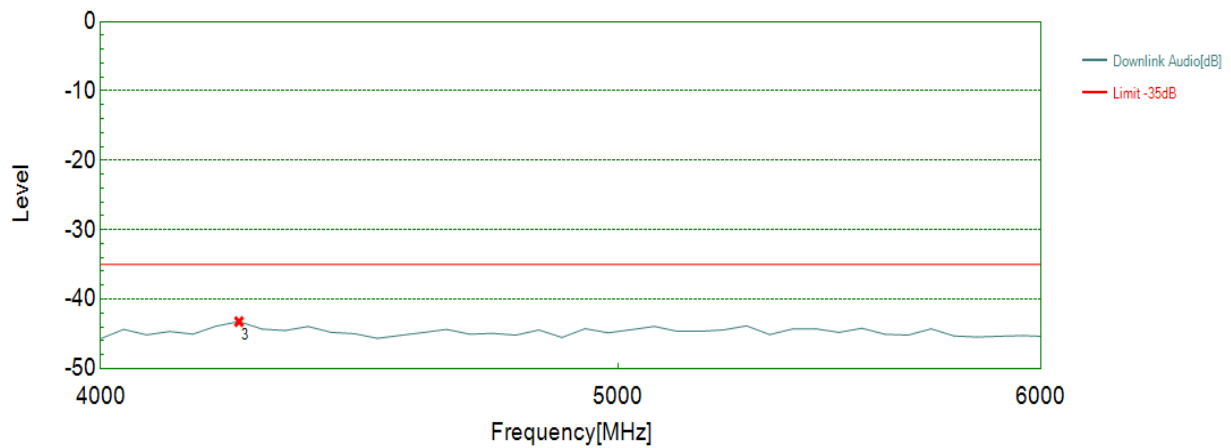
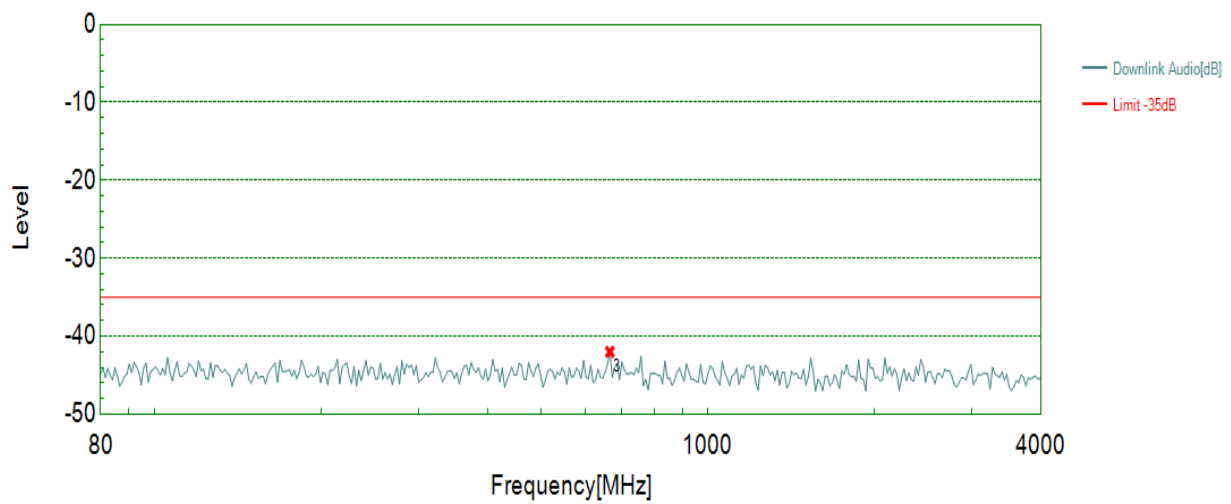
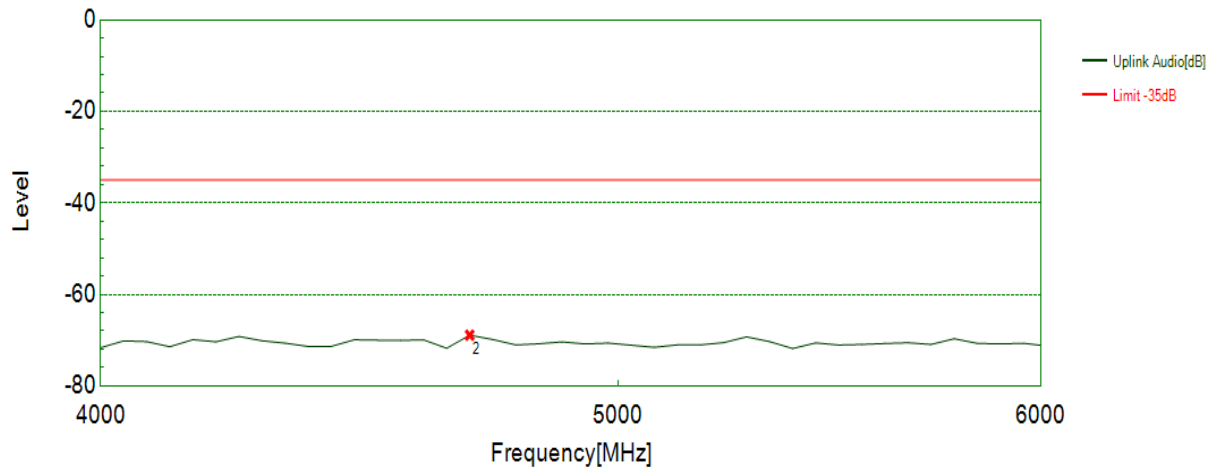




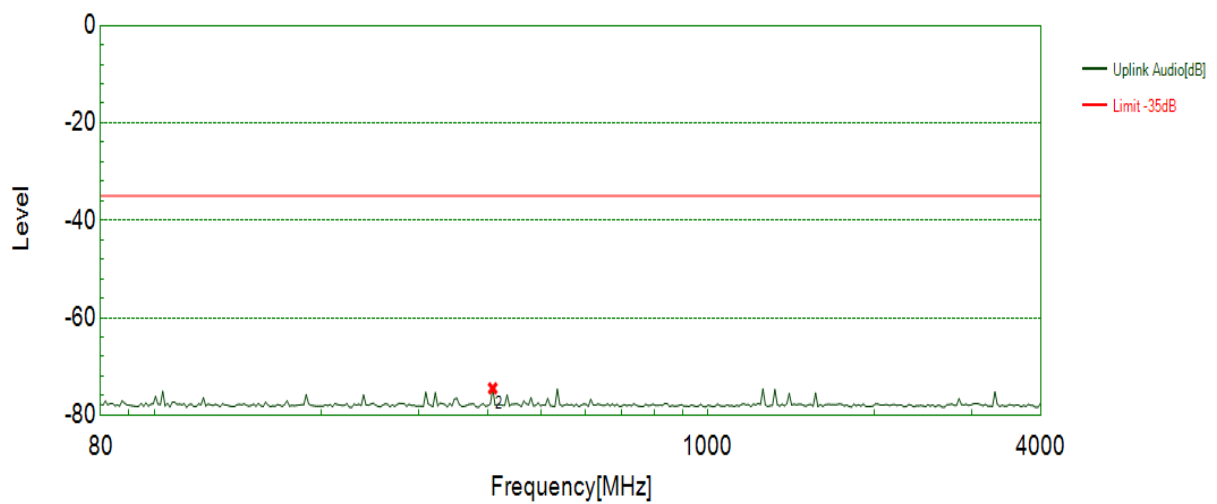
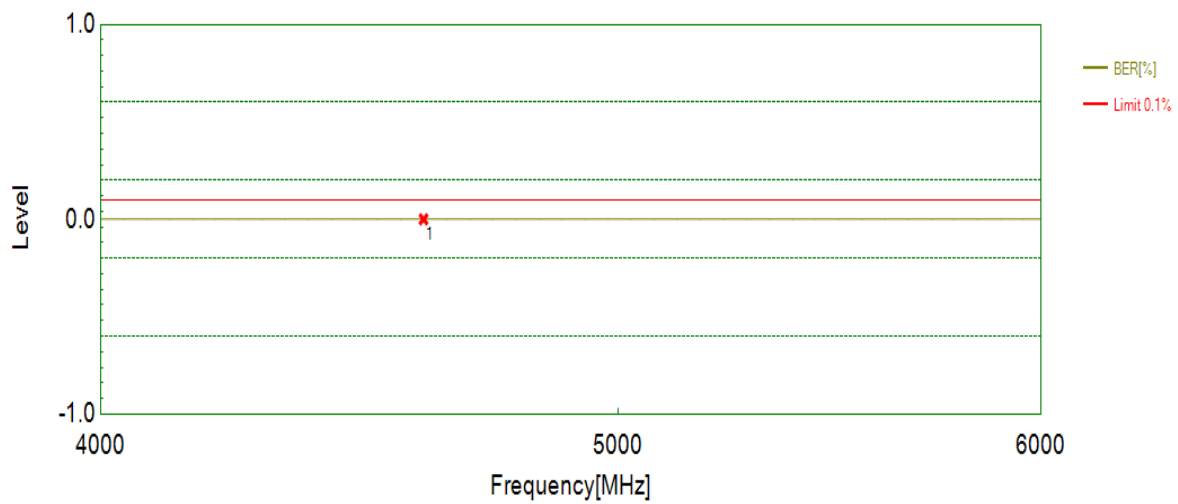
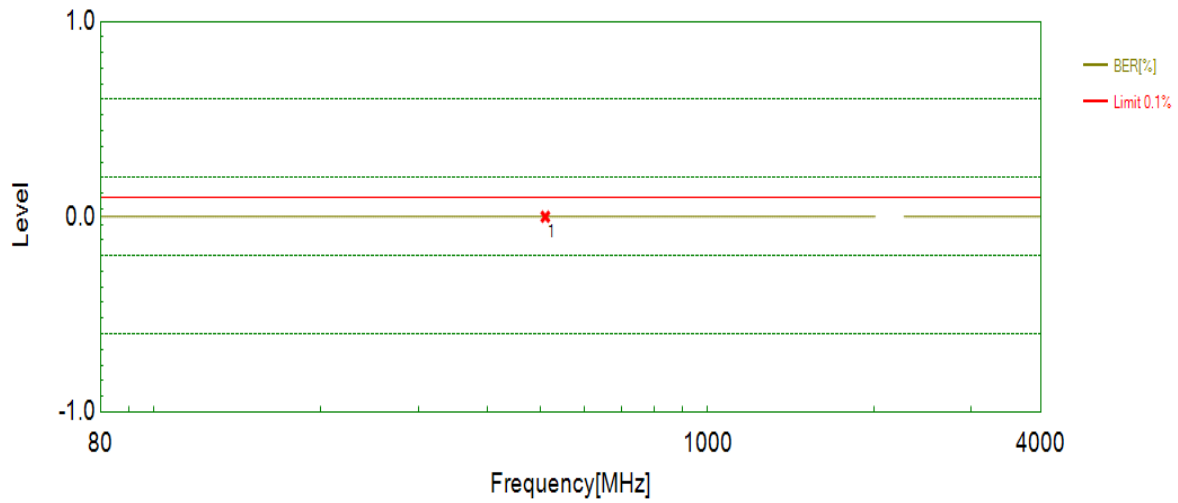
mode 27 test performances comply with the performance criteria for Criterion A.

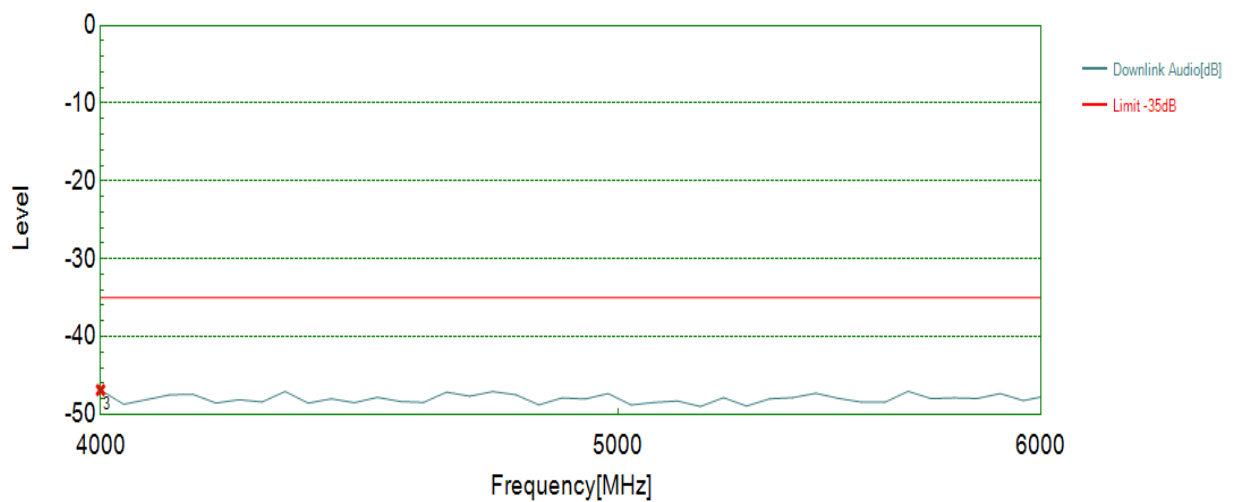
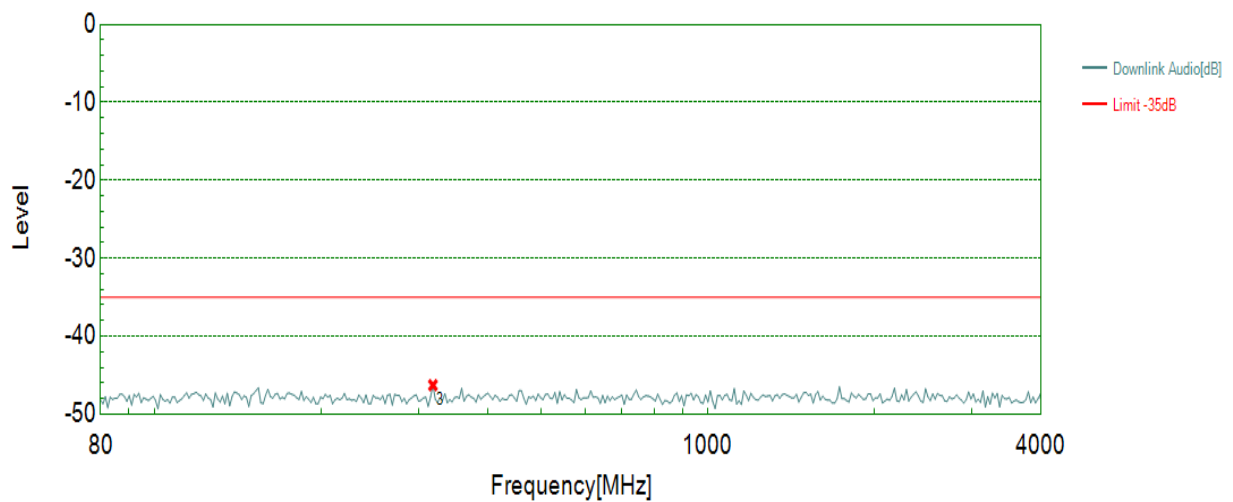
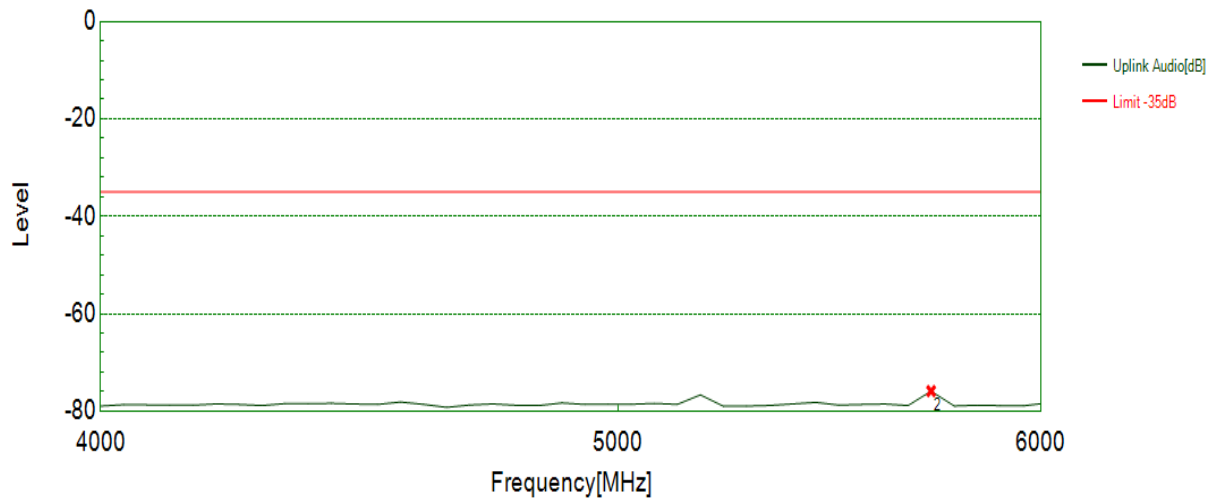
Note: All test modes are performed, only the worst cases(ANT-Horizontal, GSM900, WCDMA Band I , LTE Band 1) are recorded in this report.



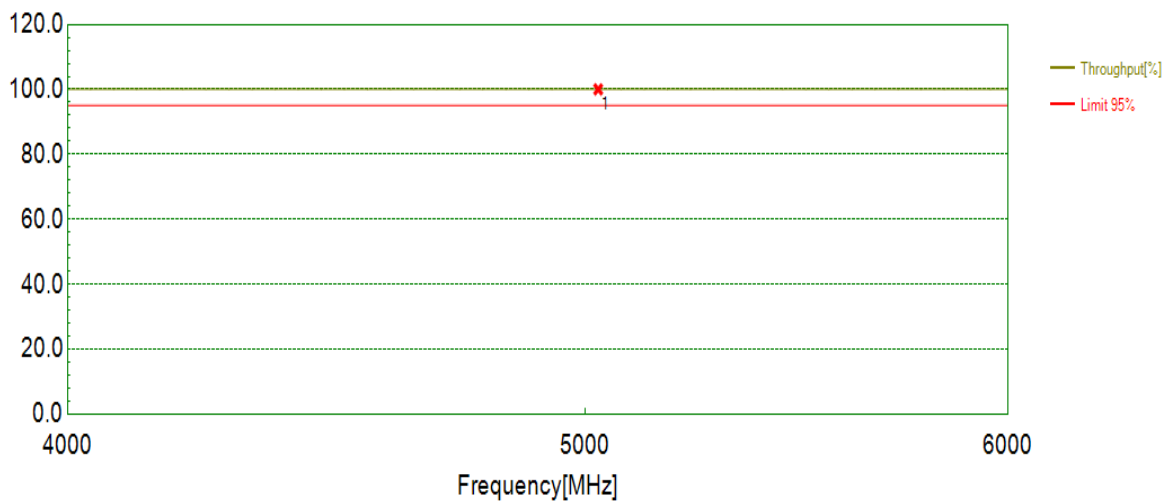
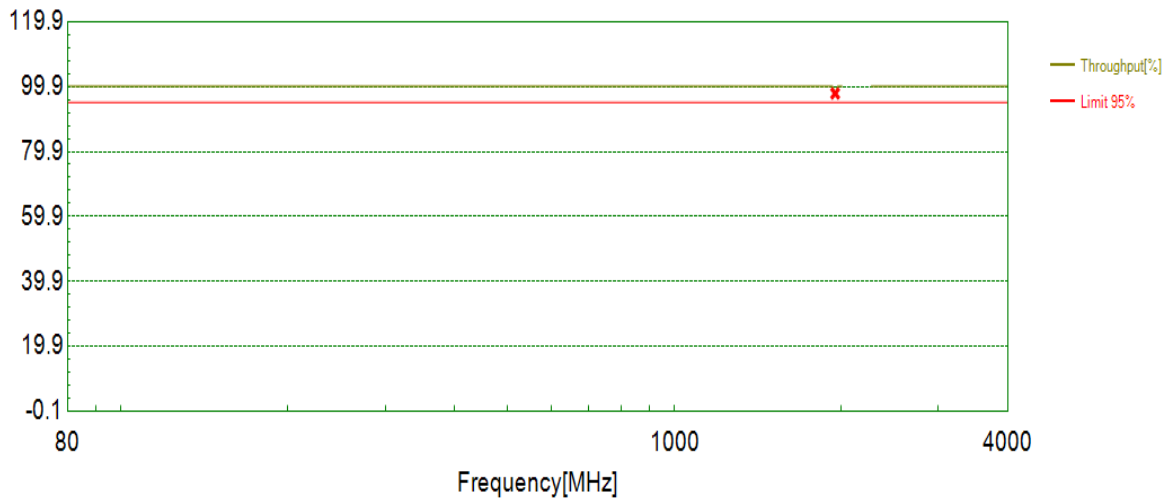


GSM900, ANT-H, Frequency: 80MHz-6GHz





WCDMA Band I , ANT-H, Frequency: 80MHz-6GHz



LTE Band1, ANT-H, Frequency: 80MHz-6GHz

## 4.4. Immunity to Conducted Disturbance Induced by RF Fields

### 4.4.1. Test Specification

Specification	Value
Basic Standard	EN 61000-4-6:2009
Frequency Range	0.15MHz - 80MHz
Field Strength	3Vrms
Modulation	1kHz sine wave, 80% AM
Frequency Step	1% of fundamental
Coupled Cable	AC Power Line
Coupling Device	CDN-M2

### Audio calibration factor

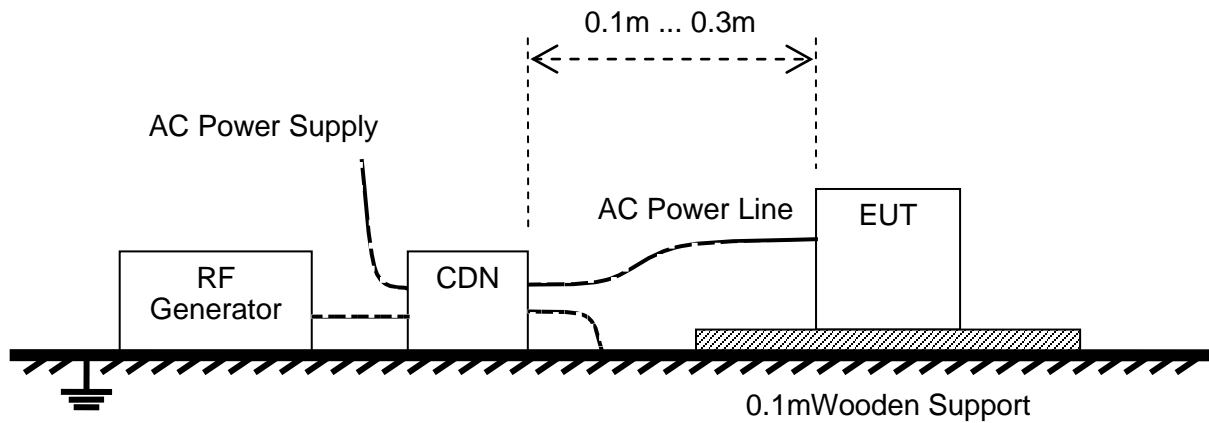
Audio direction	Audio calibration factor (dB)
Uplink (CH B)	95
Downlink (CH A)	102

### 4.4.2. Test Procedure

1. The EUT shall be tested within its intended operating and climatic conditions.
2. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50Ohm load resistor.
3. The test signal is 80% amplitude modulated with a 1kHz sine wave.
4. The frequency range is swept from 150kHz to 80MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The sweep rate shall not exceed  $1.5 \times 10^{-3}$  decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.
5. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.
6. Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

#### 4.4.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



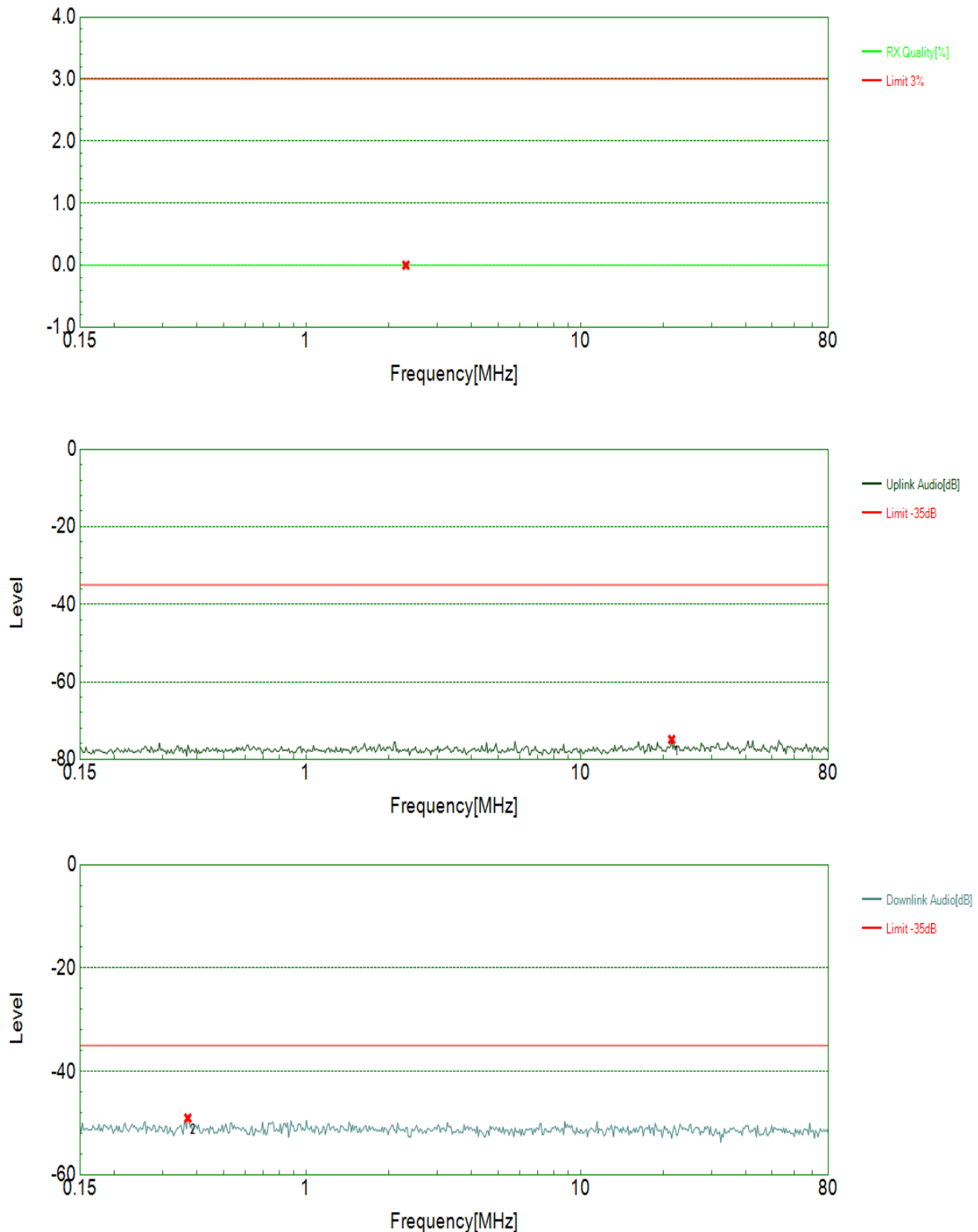
#### 4.4.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for CT/CR or Criterion A. All test modes have the same test results, only one result is recorded in this report.

EUT Operating Mode	Test Point	Frequency (MHz)	Voltage level (V)	Observation	Verdict
See section 2.2	AC Port	0.15 - 80	3	A	PASS

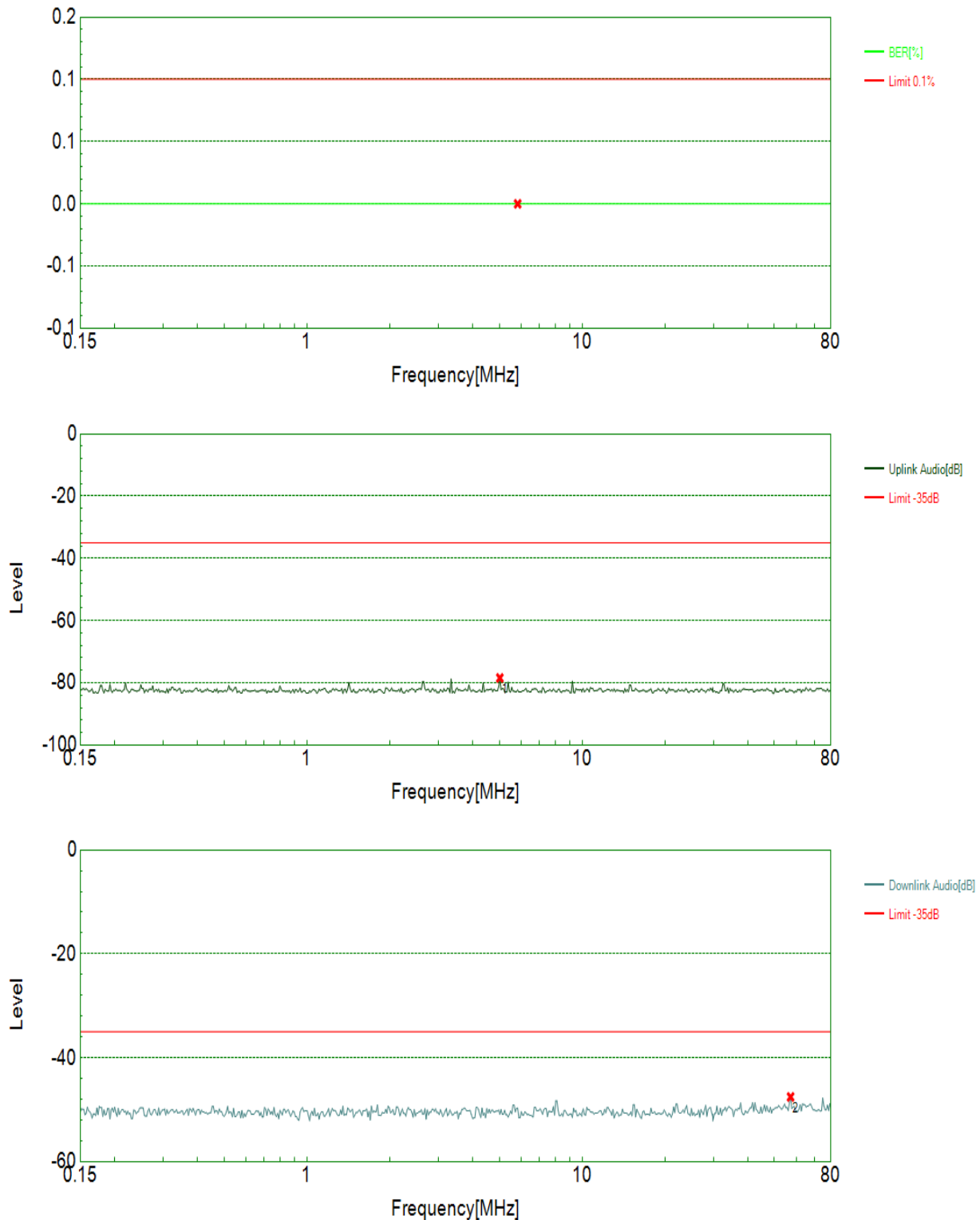
Note: The mode 1 test performances comply with the performance criteria for CT and CR, and the mode 27 test performances comply with the performance criteria for Criterion A.

Note: All test modes are performed, only the worst case(GSM900, WCDMA Band I ,LTE Band 1) are recorded in this report.

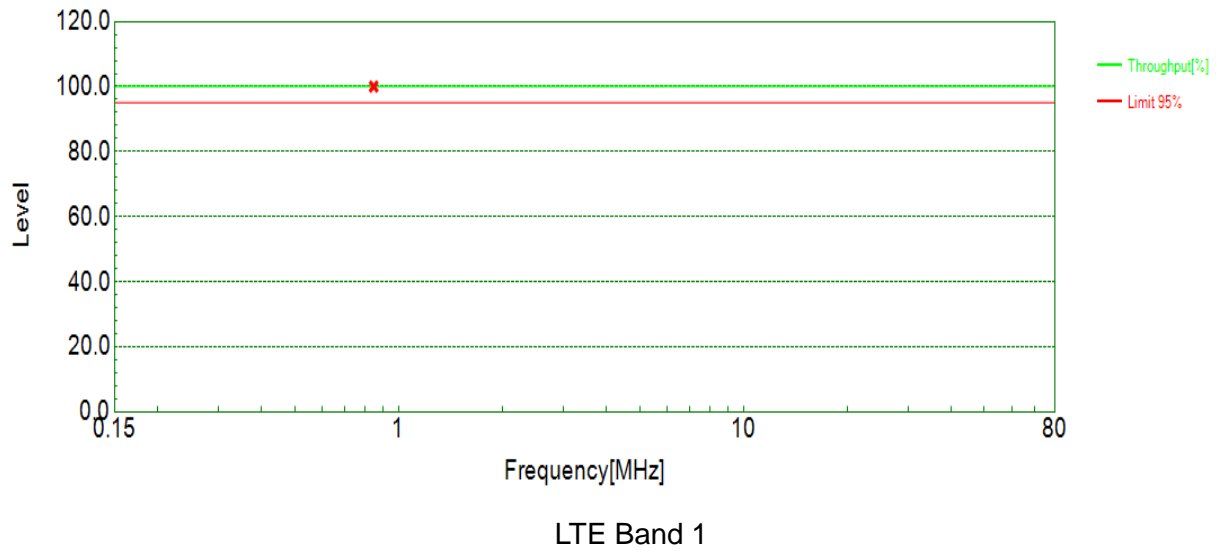


GSM900





### WCDMA Band I



## 4.5. Electrical Fast Transient / Burst Immunity

### 4.5.1. Test Specification

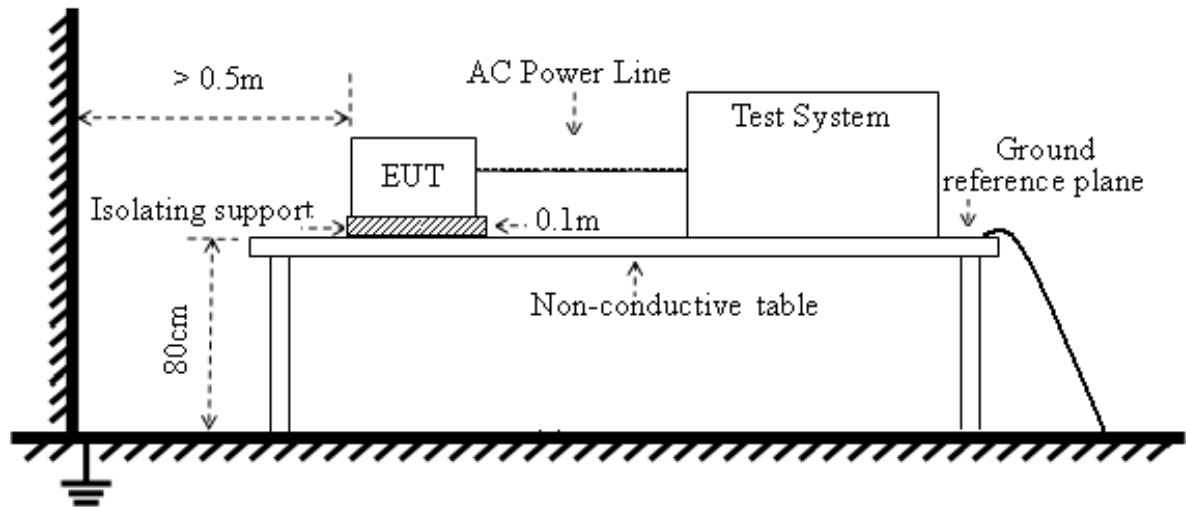
Specification	Value
Basic Standard	EN 61000-4-4:2012
Test Voltage	AC Power Port: 1kV
Polarity	Positive / Negative
Impulse Frequency	5kHz
Impulse Wave Shape	5/50ns
Burst Duration	15ms
Burst Period	300ms
Test Duration	≥ 2min

### 4.5.2. Test Procedure

1. The EUT is tested with 1000V discharges to the AC power input leads.
2. Both positive and negative polarity discharges are applied.
3. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1m.
4. The duration time of each test sequential is 2min.
5. The transient / burst waveform is in accordance with EN 61000-4-4:2012, 5/50ns.

### 4.5.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



#### 4.5.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for TT/TR or Criterion B. All test modes have the same test results, only one result is recorded in this report.

EUT Operating Mode	Test Point	Polarity	Test Level (kV)	Observation	Verdict
See section 2.2	AC Port, L	+ / -	1	A	PASS
	AC Port, N	+ / -	1	A	PASS
	AC Port, L-N	+ / -	1	A	PASS

**Note:** The performance criteria in TT and TR is only applicable to the mode 1 test of the EUT, performances of the mode 27 test comply with the performance criteria in Criterion B.

## 4.6. Surge Immunity

### 4.6.1. Test Specification

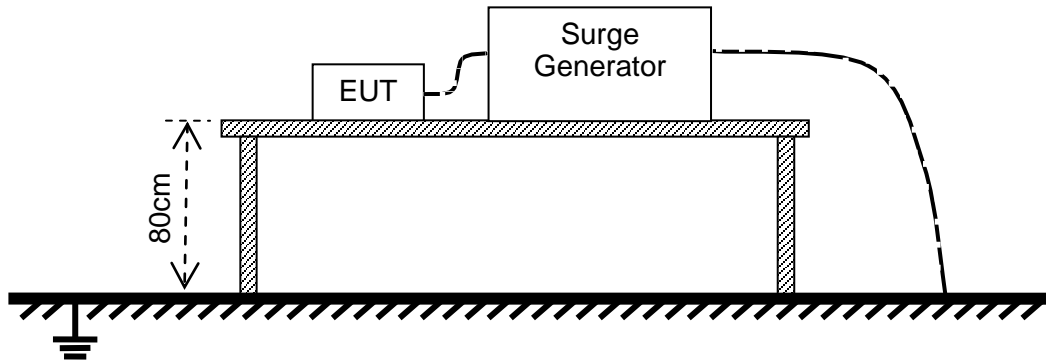
Specification	Value
Basic Standard	EN 61000-4-5:2006
Waveform	Voltage: 1.2/50 $\mu$ s; Current: 8/20 $\mu$ s
Test Voltage	AC Power Port: line to ground 2kV, line to line 1kV
Polarity	Positive / Negative
Phase Angle	0°, 90°, 180°, 270°
Repetition Rate	60 seconds
Times	5 times per condition

### 4.6.2. Test Procedure

1. The EUT and the auxiliary equipment are placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m\*1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT is less than 2 meters (provided by the manufacturer).
2. The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise is applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
3. The surges are applied line to line and line(s) to earth. When testing line to earth the test voltage is applied successively between each of the lines and earth. Steps up to the test level specified increased the test voltage. All lower levels including the selected test level are tested. The polarity of each surge level included positive and negative test pulses.

### 4.6.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



#### 4.6.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for TT/TR or Criterion B. All test modes have the same test results, only one result is recorded in this report.

EUT Operating Mode	Coupling Line	Polarity	Voltage (kV)	Observation	Verdict
See section 2.2	AC Port, L-N	+ / -	0.5	A	PASS
			1	A	PASS

**Note:** The performance criteria in TT and TR is only applicable to the mode 1 test of the EUT, performances of the mode 27 test comply with the performance criteria in Criterion B.

## 4.7. Voltage Dips and Short Interruptions Immunity

### 4.7.1. Test Specification

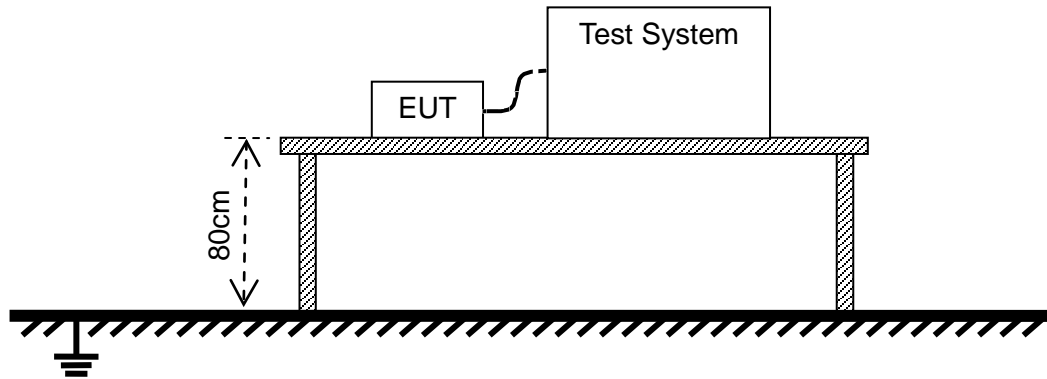
Specification	Value
Basic Standard	EN 61000-4-11:2004
Voltage Dips	100% reduction: 10ms; 100% reduction: 20ms; 30% reduction: 500ms
Voltage Interruptions	100% reduction: 5000ms
Voltage Phase Angle	0°&180°

### 4.7.2. Test Procedure

1. The power cord is used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.
2. The EUT is tested for a) 100% voltage dip of supplied voltage with duration of 10ms; b) 100% voltage dip of supplied voltage with duration of 20ms; c) 30% voltage dip of supplied voltage and duration 500ms. Both of the dip tests are carried out for a sequence of three voltage dips with intervals of 10 seconds.
3. 100% voltage interruption of supplied voltage with duration of 5000ms is followed, which is a sequence of three voltage interruptions with intervals of 10 seconds.
4. Voltage reductions occur at 0 degrees crossover point of the voltage waveform. The performance of the EUT is checked after the voltage dip or interruption.

### 4.7.3. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



#### 4.7.4. Test Result

Performances of all test modes of the EUT should comply with the performance criteria for TT/TR or Criterion B. All test modes have the same test results, only one result is recorded in this report.

EUT Operating Mode	Test Mode	Voltage Reduction	Duration (ms)	Times	Interval (sec)	Observation	Verdict
See section 2.2	Voltage Dips	30%	500	3	10	A	PASS
		100%	20	3	10	A	PASS
		100%	10	3	10	A	PASS
	Voltage Interruptions	100%	5000	3	10	A	PASS

**Note:** The performance criteria in TT and TR is only applicable to the mode 1 test of the EUT, performances of the mode 27 test comply with the performance criteria in Criterion B.



## Annex A Photographs of Test Setup

### 1. Mains Terminal Disturbance Voltage Measurement





## 2. Radiated Field Strength Measurement(30MHz-1GHz)





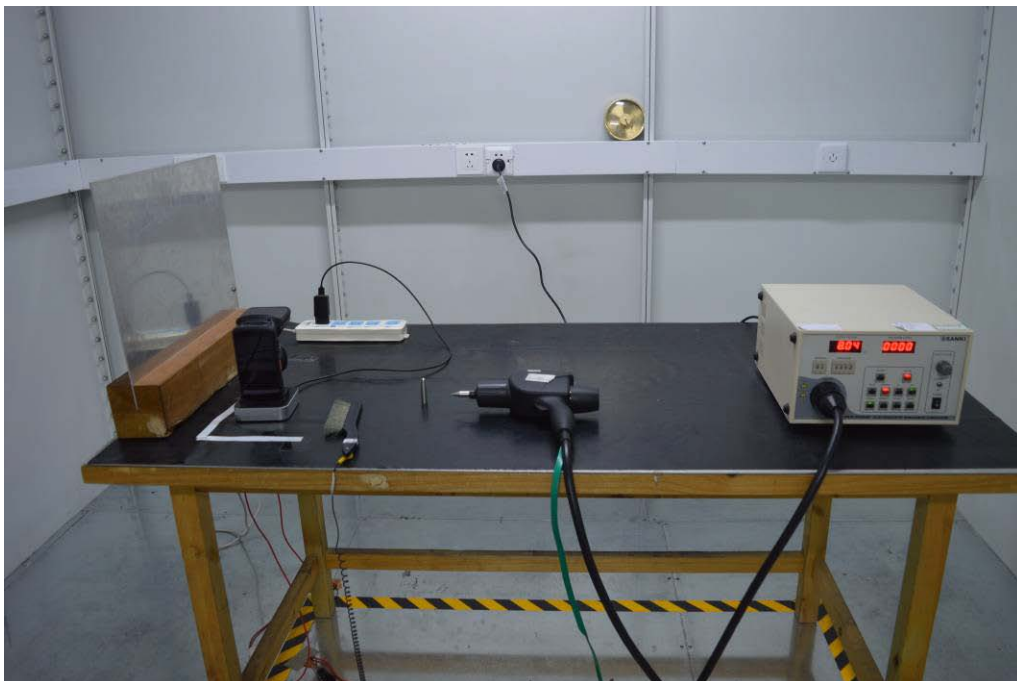
## 3. Radiated Field Strength Measurement(above 1GHz)



## 4. Voltage Fluctuations &amp; Flicker



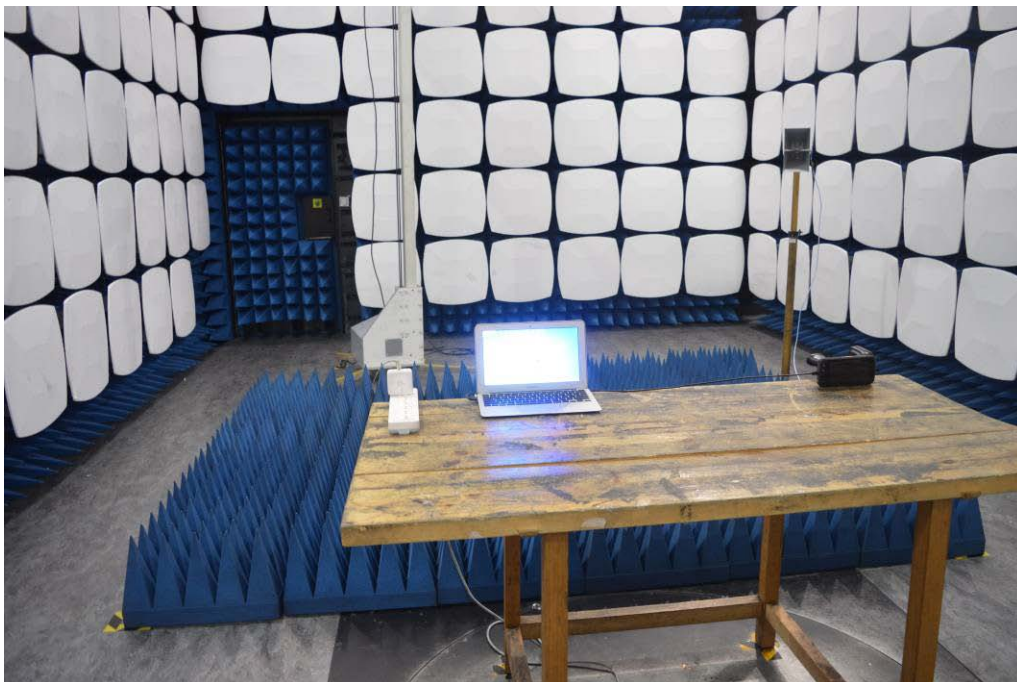
## 5. Electrostatic Discharge Immunity Test



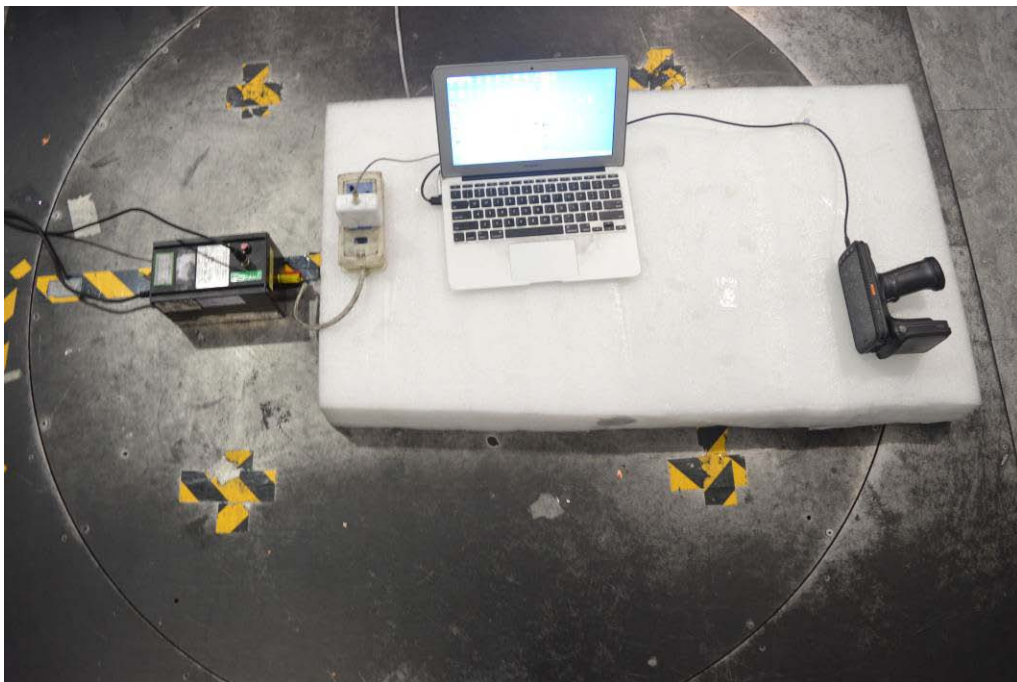
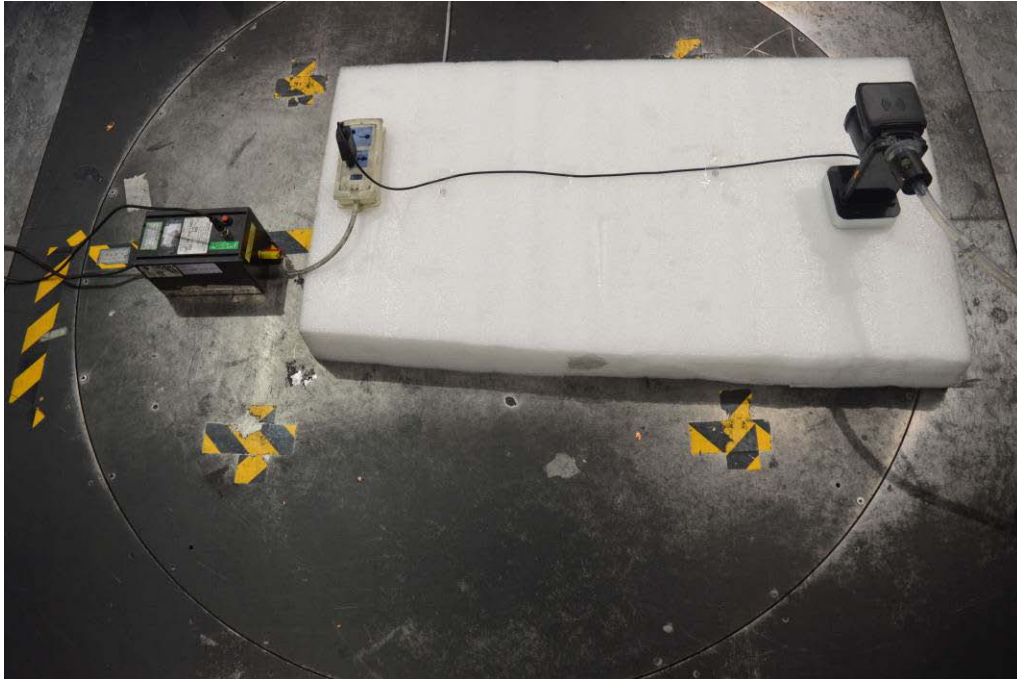
## 6. Radiated, Radio Frequency Electromagnetic Field Immunity Test







## 7. Immunity to Conducted Disturbance Induced by RF Fields





## 8. Voltage Dips and Short Interruptions Immunity, Surge Immunity Test



## 9. Electrical Fast Transient/Burst Immunity Test



## Annex B Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

### Uncertainty of Conducted Emission Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	9kHz-150kHz	±4.1 dB
	150kHz-30MHz	±3.7dB

### Uncertainty of Radiated Emission Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	30MHz-200MHz	±5.06dB
	200MHz-1000MHz	±5.24dB
	1GHz-6GHz	±5.18dB
	6GHz-18GHz	±5.48dB

### Uncertainty of voltage fluctuations and flicker Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	±0.702%
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### Uncertainty of Radiated Susceptibility Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	80MHz-6GHz	±1.78dB
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### Uncertainty of Conducted Susceptibility Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	150kHz-80MHz	±1.96dB
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### Uncertainty of Electrostatic Discharge Measurement

	Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))
Electrostatic Discharge – Rise Time	11.0%
Electrostatic Discharge – Peak Current	8.0%
Electrostatic Discharge – 30ns Current	8.0%
Electrostatic Discharge – 60ns Current	8.0%



## Uncertainty of SURGE Measurement

	Measuring Uncertainty for a Level of Confidence of 95%( $U=2U_c(y)$ )
Open-circuit Peak Voltage	10.0%
Short-circuit Peak Current	8.0%
Front Time	8.3%
Duration	4.0%

## Uncertainty of EFT/B Measurement

	Measuring Uncertainty for a Level of Confidence of 95%( $U=2U_c(y)$ )
Peak Voltage	4.0%
Repetition frequency	0.0%
Burst Duration	2.6%
Burst period	0.0%
Rise Time	22%
Pulse Width	23%

## Uncertainty of DIP Measurement

	Measuring Uncertainty for a Level of Confidence of 95%( $U=2U_c(y)$ )
Voltage Variations	0.9%
Voltage Rising/ Fall Time	0.0%
Phase	5.7%



## Annex C Testing Laboratory Information

### 1. Identification of the Responsible Testing Laboratory

<b>Company Name:</b>	Shenzhen Morlab Communications Technology Co., Ltd.
<b>Department:</b>	Morlab Laboratory
<b>Address:</b>	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China
<b>Responsible Test Lab Manager:</b>	Mr. Su Feng
<b>Telephone:</b>	+86 755 36698555
<b>Facsimile:</b>	+86 755 36698525

### 2. Identification of the Responsible Testing Location

<b>Name:</b>	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
<b>Address:</b>	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China

### 3. Test Software Utilized

Model	Version Number	Producer
MORLAB EMCR V1.2	Version 1.0	MORLAB
TS+ -[ JS32-CE]	Version2.5.0.0	Tonscend
JS35-CS	Version 2.0.1.2	Tonscend
JS35-RS	Version 2.0.1.6	Tonscend
Tti HA1600 Power &HARMONICS ANALYSER HA-PC Link Plus	Version 2.02 2nd October 2010	ThurlbyThandar Instruments

**4. Test Equipments Utilized**

Description	Manufacturer	Model	Serial No.	Cal. Date	Due. Date
MXE EMI Receiver	Agilent	N9038A	MY54130016	2017.05.17	2018.05.16
Receiver	KEYSIGHT	N9038A	MY56400093	2017.07.13	2018.07.12
LISN	Schwarzbeck	NSLK 8127	812744	2017.05.17	2018.05.16
Pulse Limiter (20dB)	VTSD	9561D	9537	2017.05.17	2018.05.16
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-519	2017.05.14	2018.05.13
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	1774	2017.09.13	2018.09.12
Semi-Anechoic Chamber	CRT	9m*6m*6m	N/A	2017.11.19	2020.11.18
ESD Test System	SANKI	SKS-0220S E	020312009E 327	2017.09.08	2018.09.07
EFT/Surge/DIP Testing System	HTEC	HCOMPAC T7	106701	2017.08.01	2018.07.31
Signal Generator	Agilent	N5181A	MY50141911	2017.05.27	2018.05.23
Power Amplifier	rflight	NTWPAS-00810200	17033067	2017.05.17	2018.05.16
Power Amplifier	rflight	NTWPAS-2560100	17043104	2017.05.17	2018.05.16
Power Amplifier	Prana	AP32 DR180	908-961	2017.05.17	2018.05.16
Power Amplifier	rflight	NTWPAS-1 025100	17033064	2017.05.24	2018.05.23
Power Meter	Agilent	E4419B	MY45104496	2017.07.13	2018.07.12
Mouth Simulation	Brüel & Kjær	4227	A0304216	2017.07.13	2018.07.12
Ear Simulation and supply	Brüel & Kjær	BK4190-L-0 01	2996490	2017.07.13	2018.07.12
CDN	LuthiElektronik-Feinmechanik AG	CDNL-801 M2/M3	2573	2017.05.17	2018.05.16
Acoustical Calibrators	Brüel & Kjær	BK4231	3018296	2017.07.13	2018.07.12
Flicker and Harmonic test	LAPLACE	AC2000A	377949	2018.02.09	2019.02.08



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system					
PC	Apple	A1370	C02FQ2PYDDQ W	N/A	N/A
System Simulator	R&S	CMU200	117801	2017.11.30	2018.11.29
System Simulator	R&S	CMW500	152038	2017.11.30	2018.11.29
Audio Analyzer	R&S	UPV	101766	2017.05.25	2018.05.24

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