EMC TEST REPORT

Product:	Head Mounted Tablet
Model Name:	T1100G
Applicant:	RealWear, Inc.
Address:	1851 McCarthy Boulevard, Suite 120, Milpitas, CA 95035
Manufacturer:	Shanghai Sunrise Simcom Limited
Address:	No.888,Shengli Road,Qingpu Industrial Park, Shanghai, P.R.China
Prepared by:	BV 7Layers Communications Technology (Shenzhen) Co. Ltd
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Report No.:	RM161205W004
Received Date:	Dec. 06, 2016
Test Date:	Dec. 07, 2016 ~ Mar. 03, 2017
Issued Date:	Mar. 07, 2017

This report should not be used by the client to claim product certification, approval, or endorsement by A2LA or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RM161205W004	Original release	Mar. 07, 2017

1 CERTIFICATION

PRODUCT: Head Mounted Tablet

BRAND NAME: realwear

MODEL NAME: T1100G

APPLICANT: RealWear, Inc.

TEST DATE: Dec. 07, 2016 ~ Mar. 03, 2017

TEST SAMPLE: Identical Prototype

STANDARDS: **EN 301 489-1 V2.1.1 (2017-02)**
Final draft EN 301 489-3 V2.1.1 (2017-03)
EN 301 489-17 V3.1.1 (2017-02)
EN 55032:2012+AC:2013, Class B
EN 61000-3-2:2014, Class A
EN 61000-3-3:2013
EN 61000-4-2:2009
EN 61000-4-3:2006 +A1:2008 +A2:2010
EN 61000-4-4:2012
EN 61000-4-5:2014
EN 61000-4-6:2013
EN 61000-4-11:2004

The above equipment has been tested by **BV 7Layers Communications Technology (Shenzhen) Co. Ltd** and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : _____ , **DATE:** Mar. 07, 2017
(Eric Shi/ Engineer)

APPROVED BY : _____ , **DATE:** Mar. 07, 2017
(Bill Yao / Manager)

2 SUMMARY OF TEST RESULTS

EN 301 489-1 V2.1.1 (2017-02) / Final draft EN 301 489-3 V2.1.1 (2017-03) / EN 301 489-17 V3.1.1 (2017-02), Emission					
Clause	Basic Standard	Phenomenon	Application	Result/Remarks	Verdict
8.2	EN 55032:2012 + AC:2013	Radiated emission 30-1000 MHz	Enclosure of ancillary equipment measured on a stand alone basis	Minimum passing Class B margin is -3.16dB at 165.8MHz	Pass
		Radiated emission 1-6 GHz		Minimum passing Class B margin is -11.76dB at 2370MHz	Pass
8.3	EN 55032:2012 +AC:2013	Conducted emission 150 kHz- 30 MHz	DC power input/output ports (fixed)	Test not applicable because port does not exists	N/A
		Conducted emission 150 kHz- 30 MHz	DC power input ports(vehicular)	Test not applicable because the port does not exist.	N/A
8.4	EN 55032:2012 +AC:2013	Conducted emission 150 kHz- 30 MHz	AC mains input/ output ports	Minimum passing Class B margin is -7.12dB at 15.308000 MHz	Pass
8.5	EN 61000-3-2:2014	Harmonic current emissions	AC mains input port	Class A The limits are not specified for equipment with a rated power of 75W or less. The EUT meets the condition, so it conforms to EN61000-3-2.	Pass
8.6	EN 61000-3-3:2013	Voltage fluctuations and flicker	AC mains input ports	As the section 6.1 of EN61000-3-3, “Devices and Equipment that do (with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested.”	Pass
8.7	EN 55032:2012 +AC:2013	Conducted disturbance 150 kHz - 30 MHz	Telecommunication ports	Without telecom port of the EUT	N/A

EN 301 489-1 V2.1.1 (2017-02) / Final draft EN 301 489-3 V2.1.1 (2017-03) / EN 301 489-17 V3.1.1 (2017-02), Immunity					
Clause	Basic Standard	Phenomenon	Application	Result/Remarks	Verdict
9.2	EN 61000-4-3:2006 +A1:2008 +A2:2010	RF Electromagnetic Field (80 MHz to 6000) (RS)	Enclosure	Performance Criterion CT/CR	Pass
9.3	EN 61000-4-2:2009	Electrostatic Discharges (ESD)	Enclosure	Performance Criterion TT/TR	Pass
9.4	EN 61000-4-4:2012	Fast Transients Common Mode (EFT)	Signal, telecommunication and control ports, DC and AC power ports	Performance Criterion TT/TR	Pass
9.8	EN 61000-4-5:2014	Surge immunity test	AC power ports	Performance Criterion TT/TR	Pass
9.5	EN 61000-4-6:2013	RF Common Mode 150 kHz to 80 MHz (CS)	Signal, telecommunication and control ports, DC and AC power ports	Performance Criterion CT/CR	Pass
9.6	ISO 7637-2:2004	Transients and Surges	DC power input ports (Vehicular)	Test not applicable because not intend for vehicular use.	N/A
9.7	EN 61000-4-11:2004	Voltage Dips and Interruptions	AC mains power input ports	Voltage Dips: 0 % residual – 0.5 cycle Performance Criterion TT/TR 0 % residual – 1 cycle Performance Criterion TT/TR 70 % residual – 25 cycles Performance Criterion TT/TR Voltage Interruptions: 0 % residual – 250 cycles Performance Criterion TT/TR is required for EUT with battery back-up EN301489-3 special: Voltage Dips: 30 % reduction – 10 ms Performance Criterion TT/TR 60 % reduction – 100 ms Performance Criterion TT/TR Voltage Interruptions: >95 % reduction – 5000 ms Performance Criterion TT/TR EN301489-52 special: Voltage Dips: 30 % reduction – 10 ms Performance Criterion TT/TR	Pass

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:
The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Uncertainty
Conducted emission	150kHz ~ 30MHz	+ /-2.66dB
Radiated emissions	30MHz ~1000MHz	+/- 3.26dB
	1GHz ~ 6GHz	+/- 4.48dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Head Mounted Tablet	
BRAND NAME	realwear	
MODEL NAME	T1100G	
NOMINAL VOLTAGE	5.0Vdc (adapter or host equipment) 3.8Vdc (Li-ion, battery)	
BATTERY	Brand Name: realwear Model Name: B1200G Power Rating: DC 3.7V, 3250mAh, Li-ion	
MODULATION TYPE	**WLAN**	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
	BT_LE	BT-LE(GFSK) for DTS
	Bluetooth	GFSK, π/4-DQPSK, 8DPSK
	GPS/Glonass	C/A code
OPERATING FREQUENCY	**WLAN**	2412 ~ 2472MHz for 11b/g/n(HT20) 2422 ~ 2462MHz for 11n(HT40) 5180 ~ 5240MHz, 5260 ~ 5320MHz 5500 ~ 5700MHz, 5745 ~ 5850MHz for 11a/ n(HT20)/ n(HT40)/ac(VHT80)
	Bluetooth/BT_LE	2402MHz ~ 2480MHz
	GPS	1575.42MHz
	Glonass	1602MHz
I/O PORTS	Refer to user's manual	
HW VERSION	A	
SW VERSION	HMT-1.G.0-6.0.1-03.00-T	
CABLE SUPPLIED	USB cable: non-shielded, detachable, 2.0meter	

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. The EUT matched the following USB cable:

USB CABLE	
BRAND:	KELI
MODEL:	KLC-2551
SIGNAL LINE:	2.0 METER

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3.2 DESCRIPTION OF TEST MODES

For Radiated Emission evaluation, 230Vac/50Hz & 110/60Hz had been covered during the pre-test. The worst data was found at **230Vac/50Hz** and recorded in the applied test report.
For Conducted Emission evaluation, 230Vac/50Hz & 110/60Hz had been covered during the pre-test. The worst data was found at **230Vac/50Hz** and recorded in the applied test report.

Test Mode	Test Condition
Radiated emission test	
1	WIFI Link(2.4G)+ Adapter+ Type-C Cable+ USB cable+ USB Link +Earphone+ GPS Rx+ Camera on+ BT Link+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable+ OTG cable+ Mouse+ Earphone+ Glonass Rx+ Coulor Bar+ BT Link+ SD Card
Conducted emission test	
1	WIFI Link(2.4G)+ Adapter+ Type-C Cable+ USB cable+ USB Link +Earphone+ GPS Rx+ Camera on+ BT Link+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable+ OTG cable+ Mouse+ Earphone+ Glonass Rx+ Coulor Bar+ BT Link+ SD Card

NOTE:
1. For conducted emission test, test mode 2 was the worst case and only this mode was presented in this report.
2. For radiated emission test, test mode 1 was the worst case and only this mode was presented in this report.

Test Mode	Test Condition
ESD test	
1	WIFI Link(2.4G)+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable + MPEG4+ SD Card
3	BT Link+ Adapter+ Type-C Cable +Camera on+ SD Card+ USB Cable+ USB Link
4	Glonass Rx+ Adapter+ Type-C Cable+ SD Card
5	GPS Rx+ Adapter+ Type-C Cable+ SD Card
RS test	
1	WIFI Link(2.4G)+ Adapter+ Type-C Cable +Camera on+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable + MPEG4+ SD Card+ USB Cable+ USB Link
3	BT Link+ Adapter+ Type-C Cable+ SD Card
4	Glonass Rx+ Adapter+ Type-C Cable+ SD Card
5	GPS Rx+ Adapter+ Type-C Cable+ SD Card
CS test	
1	WIFI Link(2.4G)+ Adapter+ Type-C Cable +Camera on+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable + MPEG4+ SD Card+ USB Cable+ USB Link

3	BT Link+ Adapter+ Type-C Cable+ SD Card
4	Glonass Rx+ Adapter+ Type-C Cable+ SD Card
5	GPS Rx+ Adapter+ Type-C Cable+ SD Card
EFT, Surge, Dip tests	
1	WIFI Link(2.4G)+ Adapter+ Type-C Cable +Camera on+ SD Card
2	WIFI Link(5G)+ Adapter+ Type-C Cable + MPEG4+ SD Card+ USB Cable+ USB Link
3	BT Link+ Adapter+ Type-C Cable+ SD Card
4	Glonass Rx+ Adapter+ Type-C Cable+ SD Card
5	GPS Rx+ Adapter+ Type-C Cable+ SD Card

Remark: GPS function run a GPS test program (provided by manufacturer) make the products have been Link state.

3.3 TEST PROGRAM USED AND OPERATION DESCRIPTION

<Emission Tests>

a. The EUT linked with Bluetooth earphone.
b. The EUT sent audio signal to the earphone.
c. The EUT played camera with recording video.
d. The EUT communicated data with the CMW500 / Wireless AP/ GPS simulator, which acted as communication partners.

<Immunity Tests>

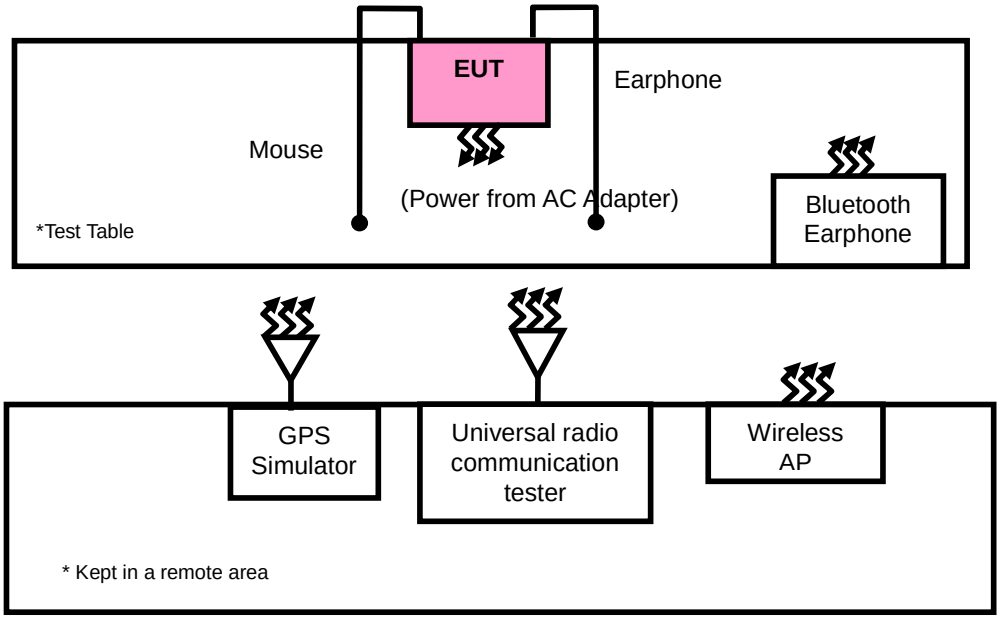
a. The EUT was charged from the adapter or PC/NB when the mode was tested.
b. The EUT linked with Bluetooth earphone.
c. The EUT sent audio signal to the earphone.
d. The EUT played MPEG4 / Camera.
e. The EUT linked with notebook via USB cable for RS only.
f. The EUT linked with PC via USB cable for ESD only.
g. Notebook / PC ran test program to enable all functions.
h. Notebook linked with Wireless AP via RJ45 cable.
i. The Spectrum Analyzer was applied for monitoring purpose when the mode was tested.
j. The EUT communicated data with the Universal Radio Communication Tester / Wireless AP / Notebook / CMW500/ GPS simulator, which acted as communication partners.

3.4 PRIMARY CLOCK FREQUENCIES OF INTERNAL SOURCE

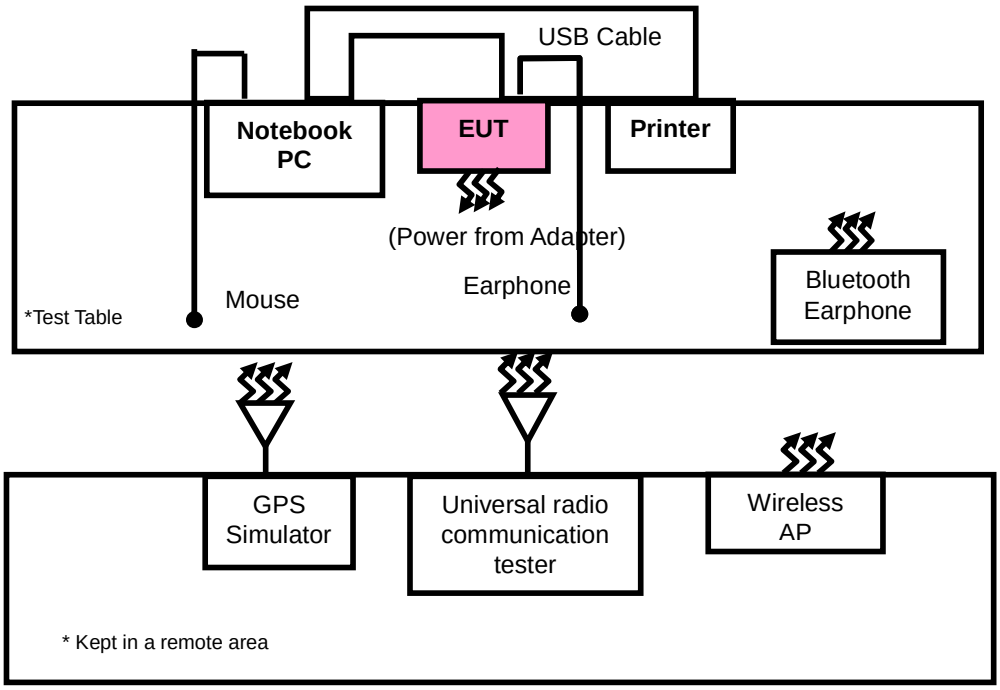
The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 5000 MHz, provided by the manufacturer, for detailed internal source, please refer to the manufacturer's specifications.

3.5 CONFIGURATION OF SYSTEM UNDER TEST

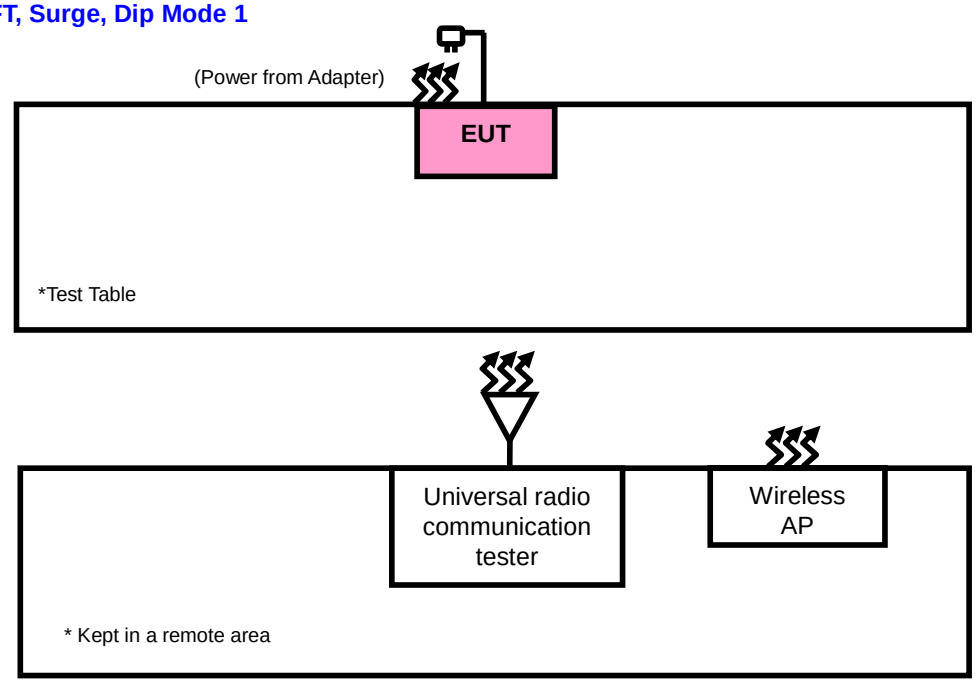
FOR EMISSION TESTS
Radiation Mode 2
Conduction Mode 2



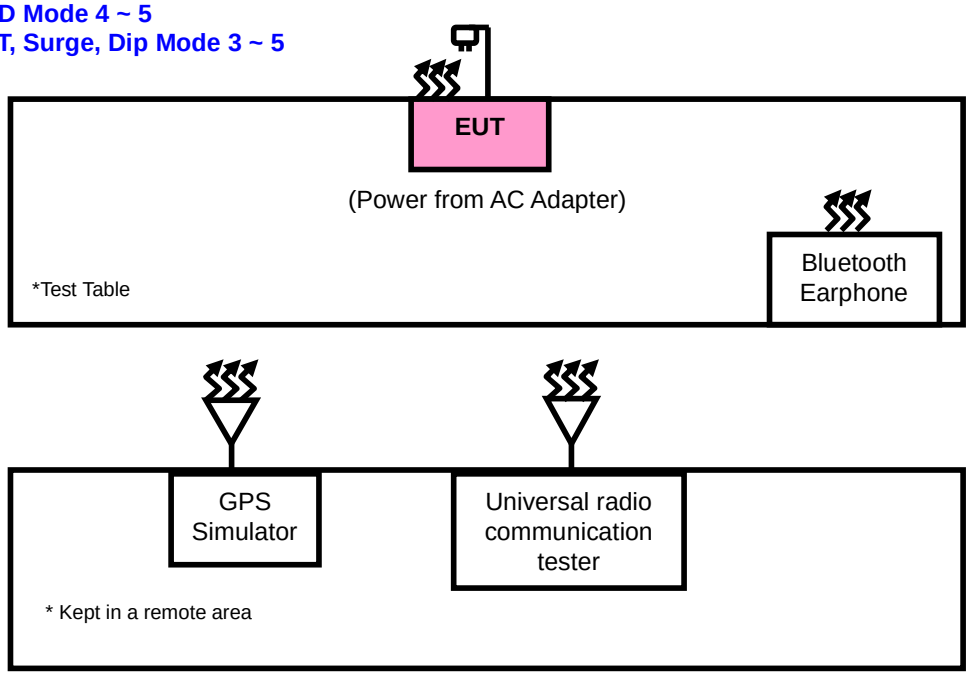
Conduction Mode 1
Radiation Mode 1



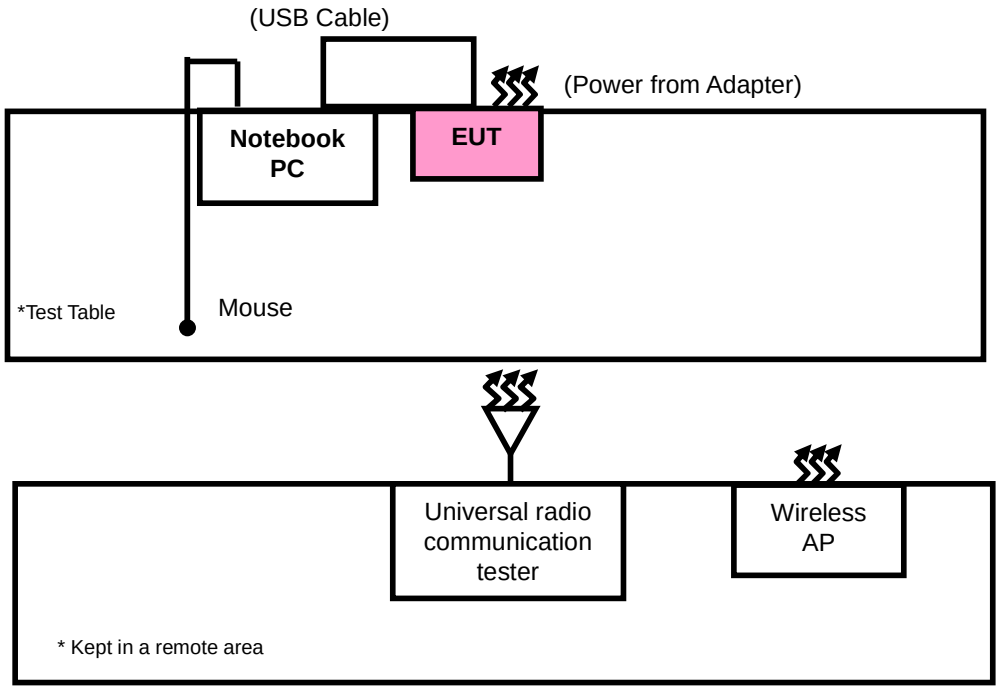
FOR IMMUNITY TESTS
RS, CS Mode 1
ESD Mode 2
EFT, Surge, Dip Mode 1



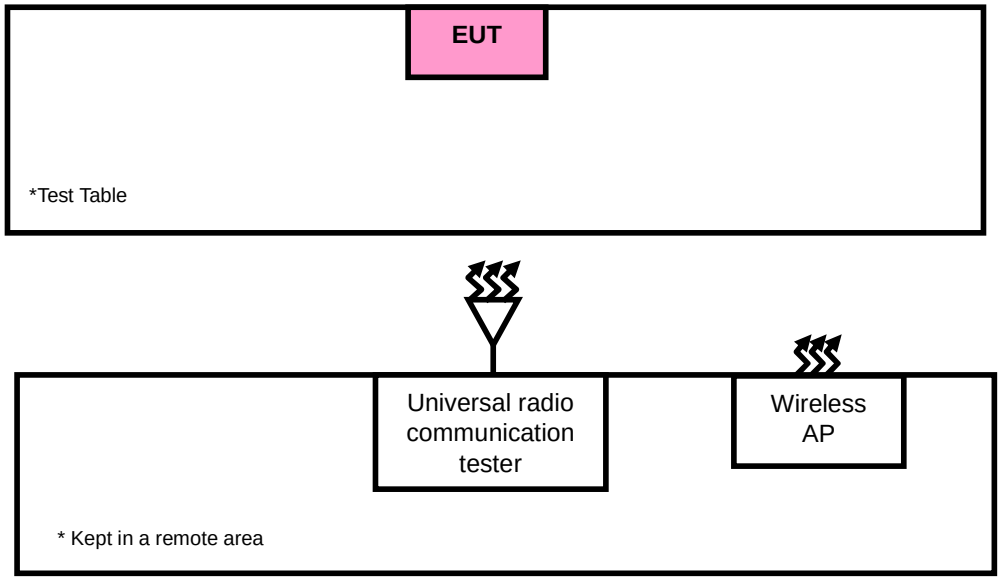
RS, CS Mode 3 ~ 5
ESD Mode 4 ~ 5
EFT, Surge, Dip Mode 3 ~ 5



RS, CS Mode 2
ESD Mode 3
EFT, Surge, Dip Mode 2



ESD Mode 1



3.6 DESCRIPTION OF SUPPORT UNIT

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.

FOR EMISSION TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Wireless AP	ABOCOM	WR224GR	060500749P	D43064
2	Bluetooth Earphone	FAP00	H6080	12098	N/A
3	Desktop	Lenovo	M73 SFF	PC04GRQT	N/A
4	Laptop	Lenovo	Thnikpad L440	R90FTFKP	N/A
5	Printer	HP	hp LaserJet 1300	CNSJF75989	N/A
6	Earphone	N/A	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	N/A
3	AC Line: Unshielded, Detachable 1.5m
4	AC Line: Unshielded, Detachable 1.5m
5	USB Line: Shielded, Detachable 1.5m;
6	Earphone Line: Unshielded, Non-detachable 1.5m

NOTE:
1. All power cords of the above support units are non-shielded (1.8m).
2. Items 2 acted as communication partners to transfer data.

FOR IMMUNITY TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	GPS Simulator +Antenna	TOJOIN	GNSS-5000A	E1-010-010119	N/A
2	Bluetooth Earphone	FAP00	H6080	12098	N/A
3	Desktop	Lenovo	M73 SFF	PC04GRQT	N/A
4	Wireless AP	ABOCOM	WR224GR	060500749P	D43064

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	N/A
3	AC Line: Unshielded, Detachable 1.5m
4	N/A

NOTE:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item 2 acted as communication partners to transfer data.

4 EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT AT MAINS PORTS

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15-0.5	79	66	66-56	56-46
0.5-5	73	60	56	46
5-30	73	60	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	June. 29, 16	June. 28, 17
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Sep. 21, 16	Sep. 20, 17

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in Shielded Room 553.

4.1.3 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

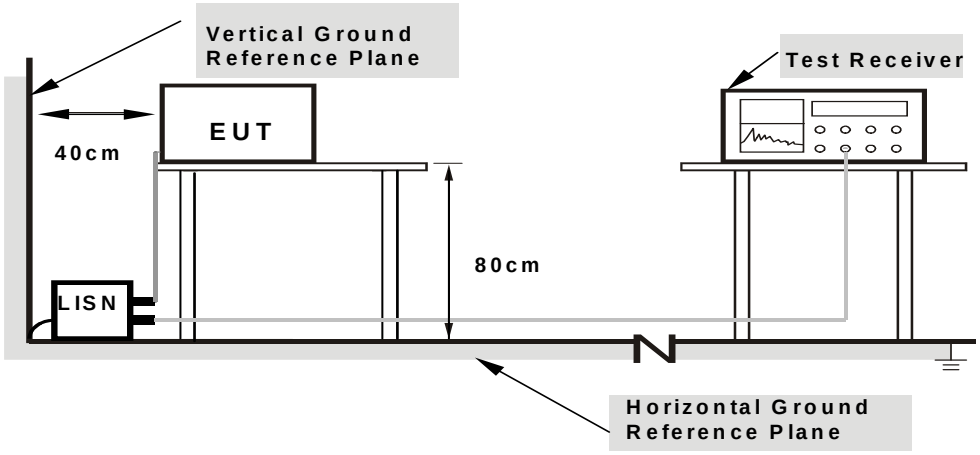
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under Limit - 20dB was not recorded.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 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

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.1.6 EUT OPERATING CONDITIONS

Same as clause 3.3

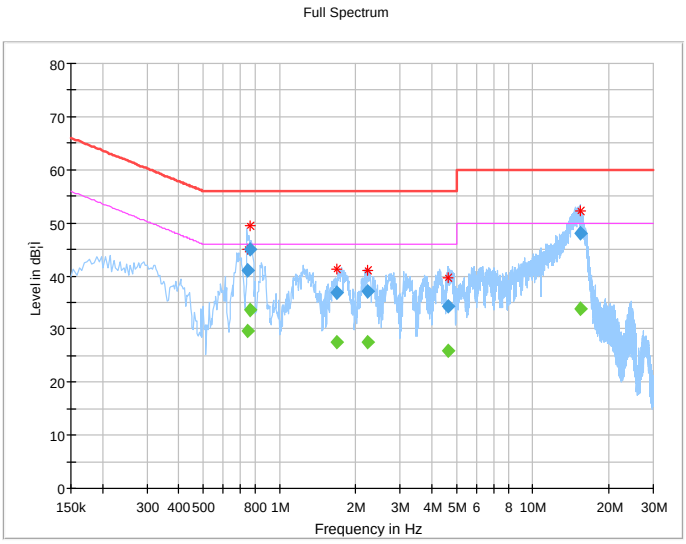
4.1.7 TEST RESULTS

CONDUCTED WORST-CASE DATA:

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Quasi-Peak(QP)/ Average(AV), 9 KHz
ENVIRONMENTAL CONDITIONS	21deg. C, 51% RH	**TESTED BY**	Alex Chen

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.746000	---	29.52	46.00	-16.48	L	ON	9.7
0.746000	40.94	---	56.00	-15.06	L	ON	9.7
0.768000	---	33.57	46.00	-12.43	L	ON	9.7
0.768000	44.91	---	56.00	-11.09	L	ON	9.7
1.692000	---	27.42	46.00	-18.58	L	ON	9.7
1.692000	36.89	---	56.00	-19.11	L	ON	9.7
2.224000	---	27.59	46.00	-18.41	L	ON	9.7
2.224000	37.03	---	56.00	-18.97	L	ON	9.7
4.632000	---	25.90	46.00	-20.10	L	ON	9.7
4.632000	34.28	---	56.00	-21.72	L	ON	9.7
15.420000	---	33.87	50.00	-16.13	L	ON	9.9
15.420000	48.06	---	60.00	-11.94	L	ON	9.9

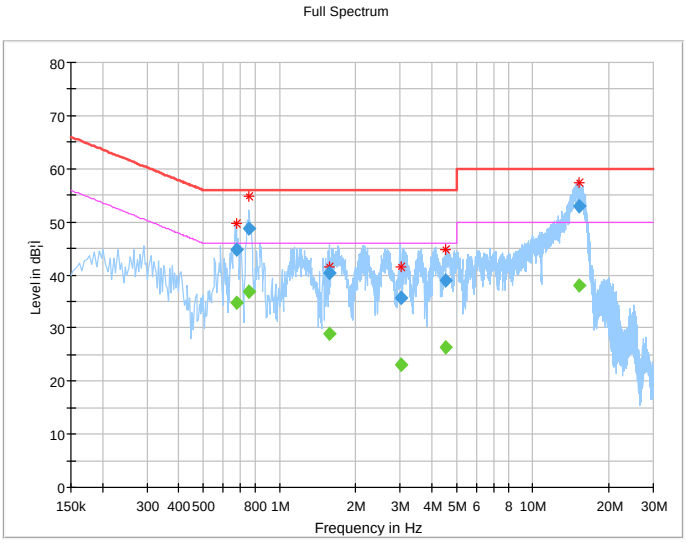
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak(QP)/ Average(AV), 9 KHz
ENVIRONMENTAL CONDITIONS	21deg. C, 51% RH	TESTED BY	Alex Chen

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.676000	---	34.70	46.00	-11.30	N	ON	10.0
0.676000	44.83	---	56.00	-11.17	N	ON	10.0
0.760000	---	36.74	46.00	-9.26	N	ON	10.0
0.760000	48.63	---	56.00	-7.37	N	ON	10.0
1.582000	---	29.03	46.00	-16.97	N	ON	9.9
1.582000	40.31	---	56.00	-15.69	N	ON	9.9
3.036000	---	23.11	46.00	-22.89	N	ON	9.8
3.036000	35.58	---	56.00	-20.42	N	ON	9.8
4.520000	---	26.47	46.00	-19.53	N	ON	9.8
4.520000	38.87	---	56.00	-17.13	N	ON	9.8
15.308000	---	38.12	50.00	-11.88	N	ON	9.9
15.308000	**52.88**	**---**	**60.00**	**-7.12**	**N**	**ON**	**9.9**

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.2 RADIATED DISTURBANCE MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

FOR FREQUENCY BELOW 1000 MHz

Frequency (MHz)	Class A (at 10m)	Class B (at 10m)
	Quasi-peak (dBuV/m)	Quasi-peak (dBuV/m)
30-230	40	30
230-1000	47	37
Frequency (MHz)	**Class A (at 3m)**	**Class B (at 3m)**
	Quasi-peak (dBuV/m)	**Quasi-peak (dBuV/m)**
30-230	50	40
230-1000	57	47

FOR FREQUENCY ABOVE 1000 MHz

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

NOTE: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

FREQUENCY RANGE OF RADIATED MEASUREMENT

Highest frequency generated or used within the EUT or on which the EUT operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 108	1000
108-500	2000
500-1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

4.2.2 TEST INSTRUMENTS

Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May 14,16	May 13,17
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Nov. 26,16	Nov. 25,18
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 18,16	Mar. 17,17
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jul. 27, 16	Jul. 26, 17

Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	ETS-LINDGREN	3117	00168728	Nov. 26,16	Nov. 25,18
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 18,16	Mar. 17,17
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jul. 27, 16	Jul. 26, 17

NOTE: 1. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Chamber.

4.2.3 TEST PROCEDURE

Frequency range 30MHz~1GHz

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.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain (dB) (if the raw value contains the amplifier).
5. Margin value = Emission level – Limit value.

Frequency range above 1GHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter Fully-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 can be varied from 1 meter to 4 meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test receiver/spectrum was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.

NOTE:

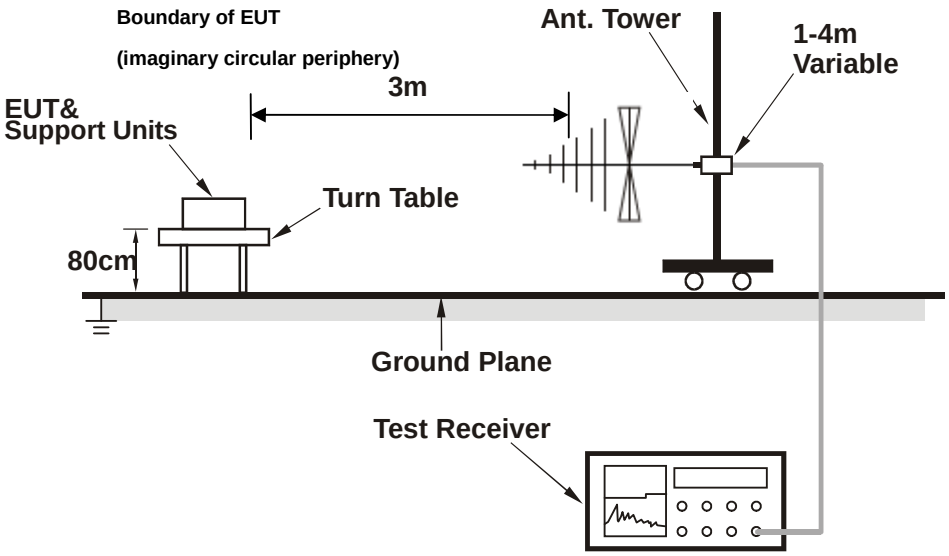
1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
2. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
3. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
5. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
6. Margin value = Emission level – Limit value.

4.2.4 DEVIATION FROM TEST STANDARD

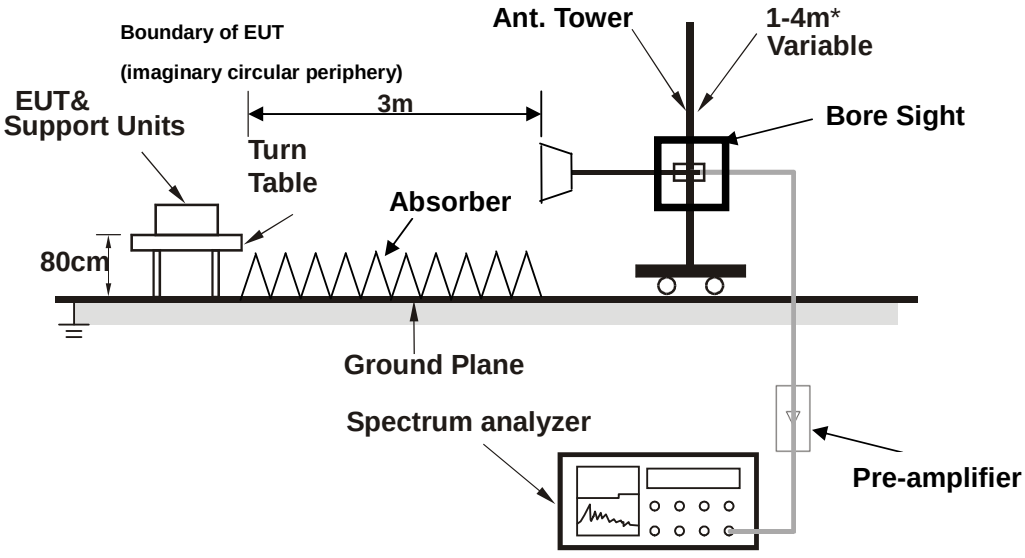
No deviation.

4.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



***** depends on the EUT height and the antenna 3dB beam width both, refer to section 7.3 of CISPR 16-2-3.

4.2.6 EUT OPERATING CONDITIONS

Same as clause 3.3

4.2.7 TEST RESULTS

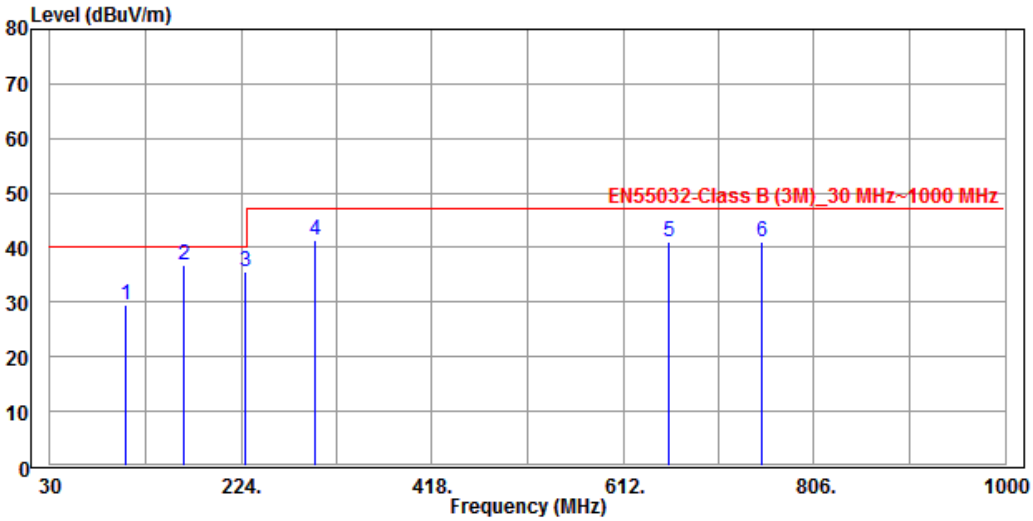
Below 1GHz worst case data

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**FREQUENCY RANGE**	30-1000 MHz
ENVIRONMENTAL CONDITIONS	22deg. C, 57% RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Quasi-Peak , 120 kHz
TESTED BY	Tony Zou		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA FACTOR (dB /m)**	**CABLE LOSS (dB)**	**PREAMP FACTOR (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**REMARK**
106.63	29.57	57.18	40.00	-10.43	7.77	1.59	36.97	200	36	QP
165.8	**36.84**	**61.49**	**40.00**	**-3.16**	**10.11**	**1.97**	**36.73**	**200**	**120**	QP
228.85	35.54	58.31	40.00	-4.46	11.43	2.33	36.53	200	150	QP
299.66	41.23	62.01	47.00	-5.77	13.00	2.72	36.50	200	36	QP
658.56	40.98	52.18	47.00	-6.02	21.94	4.17	37.31	200	15	QP
752.36	41.02	50.98	47.00	-5.98	23.05	4.49	37.50	200	248	QP

REMARKS: 1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)

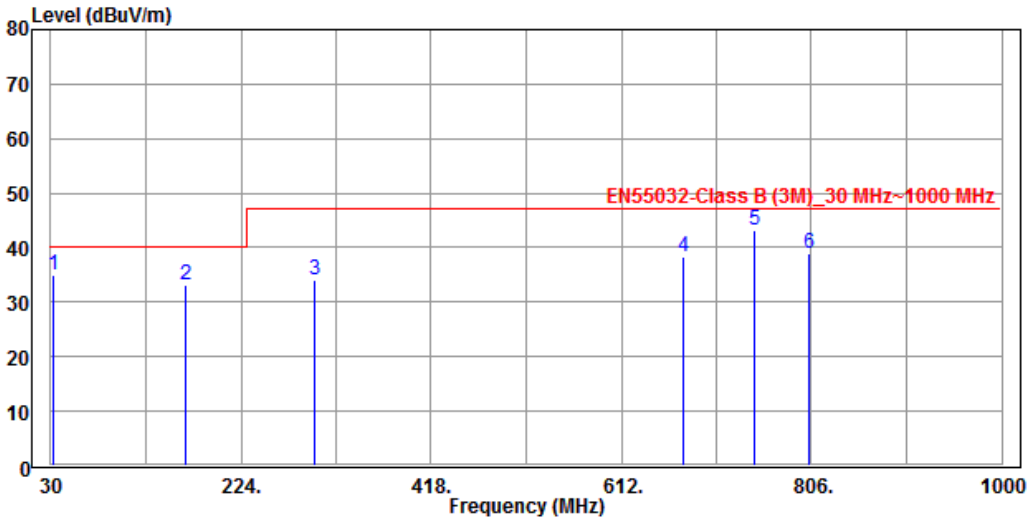
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	22deg. C, 57% RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak , 120 kHz
TESTED BY	Tony Zou		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
32.91	34.93	56.54	40.00	-5.07	15.09	0.84	37.54	100	48	QP
166.77	33.04	57.69	40.00	-6.96	10.10	1.97	36.72	100	147	QP
298.69	33.98	54.79	47.00	-13.02	12.98	2.71	36.50	100	256	QP
675.05	38.22	48.94	47.00	-8.78	22.40	4.21	37.33	100	63	QP
747.8	43.30	53.26	47.00	-3.70	23.05	4.47	37.48	100	128	QP
804.06	38.92	48.85	47.00	-8.08	23.00	4.69	37.62	100	97	QP

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



Above 1GHz worst case data

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**FREQUENCY RANGE**	1-6 GHz
ENVIRONMENTAL CONDITIONS	22deg. C, 57% RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Peak/Average, 1 MHz
TESTED BY	Tony Zou		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA FACTOR (dB /m)**	**CABLE LOSS (dB)**	**PREAMP FACTOR (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**REMARK**
1325	32.36	45.93	50.00	-17.64	28.88	5.91	48.36	100	36	Average
1325	45.05	58.62	70.00	-24.95	28.88	5.91	48.36	100	36	Peak
1600	36.98	49.45	50.00	-13.02	29.34	6.55	48.36	100	48	Average
1600	46.87	59.34	70.00	-23.13	29.34	6.55	48.36	100	48	Peak
2025	36.74	45.68	50.00	-13.26	31.92	7.49	48.35	100	98	Average
2025	46.02	54.96	70.00	-23.98	31.92	7.49	48.35	100	98	Peak
2575	37.24	44.58	50.00	-12.76	32.48	8.48	48.30	100	93	Average
2575	46.38	53.72	70.00	-23.62	32.48	8.48	48.30	100	93	Peak
3245	38.42	44.27	54.00	-15.58	32.95	9.57	48.37	100	245	Average
3245	47.87	53.72	74.00	-26.13	32.95	9.57	48.37	100	245	Peak
3475	39.24	44.75	54.00	-14.76	32.99	9.91	48.41	100	175	Average
3475	49.63	55.14	74.00	-24.37	32.99	9.91	48.41	100	175	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA FACTOR (dB /m)**	**CABLE LOSS (dB)**	**PREAMP FACTOR (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**REMARK**
1200	34.56	48.30	50.00	-15.44	29.00	5.62	48.36	100	40	Average
1200	45.21	58.95	70.00	-24.79	29.00	5.62	48.36	100	40	Peak
1600	35.58	48.05	50.00	-14.42	29.34	6.55	48.36	100	56	Average
1600	47.69	60.16	70.00	-22.31	29.34	6.55	48.36	100	56	Peak
2045	36.98	45.86	50.00	-13.02	31.94	7.53	48.35	100	248	Average
2045	46.78	55.66	70.00	-23.22	31.94	7.53	48.35	100	248	Peak
2370	**38.24**	**46.16**	**50.00**	**-11.76**	**32.27**	**8.12**	**48.31**	**100**	**115**	Average
2370	48.36	56.28	70.00	-21.64	32.27	8.12	48.31	100	115	Peak
2985	38.12	44.38	50.00	-11.88	32.89	9.18	48.33	100	280	Average
2985	48.86	55.12	70.00	-21.14	32.89	9.18	48.33	100	280	Peak
3360	40.54	46.22	54.00	-13.46	32.97	9.74	48.39	100	156	Average
3360	51.12	56.80	74.00	-22.88	32.97	9.74	48.39	100	156	Peak

REMARKS: 1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

4.3 HARMONICS CURRENT MEASUREMENT

4.3.1 LIMITS OF HARMONICS CURRENT MEASUREMENT

TEST STANDARD: EN 61000-3-2

Limits for Class A equipment	
Harmonics Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15<=n<=39	0.15x15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8<=n<=40	0.23x8/n

Limits for Class D equipment		
Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonics only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13	0.30	0.21
15<=n<=39	3.85/n	0.15x15/n

NOTE: 1. Class A and Class D are classified according to item section 5 of EN 61000-3-2.

2. According to section 7 of EN 61000-3-2, 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 75 W.

4.3.2 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 for each successive harmonic component in turn.

The classification of EUT is according to section 5 of EN 61000-3-2.

The EUT is classified as follows:

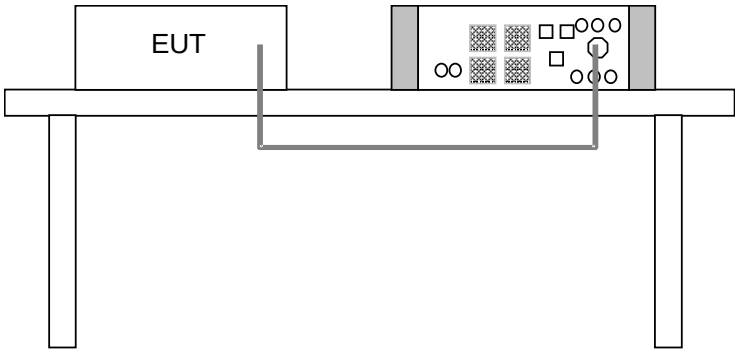
Class A	Class B	Class C	Class D
Balanced three-phase equipment; Household appliances excluding equipment as Class D; Tools excluding portable tools; Dimmers for incandescent lamps; Audio equipment; Equipment not specified in one of the three other classes.	Portable tools; Arc welding equipment which is not professional equipment.	Lighting equipment.	Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors; Television receivers; Refrigerators and freezers having one or more variable-speed drives to

b. 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.

4.3.3 DEVIATION FROM TEST STANDARD

No deviation.

4.3.4 TEST SETUP



4.3.5 TEST RESULTS

As specified on section 7 and above figure of EN 61000-3-2, the limit is not specified for equipment with a rated power of 75W or less.
The EUT meets the above condition, so it conforms to EN 61000-3-2.

4.4 VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

4.4.1 LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

TEST STANDARD: EN 61000-3-3

Test Item	Limit	Note
P_{st}	1.0	P_{st} means short-term flicker indicator.
P_{lt}	0.65	P_{lt} means long-term flicker indicator.
T_{dt} (ms)	500	T_{dt} means maximum time that dt exceeds 3.3 %.
d_{max} (%)	4%	d_{max} means maximum relative voltage change.
dc (%)	3.3%	dc means relative steady-state voltage change

4.4.2 TEST PROCEDURE

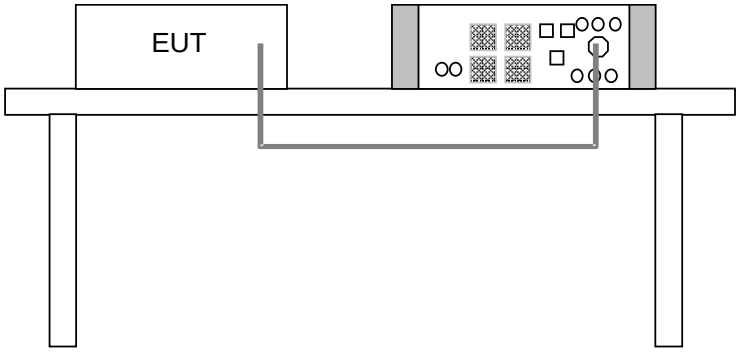
a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

b. During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

4.4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4.4 TEST SETUP



4.4.5 TEST RESULTS

As the section 6.1 of EN 61000-3-3, “Devices and Equipment that do (with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested.

5 IMMUNITY TEST

5.1 GENERAL DESCRIPTION

EN 301 489-1 V2.1.1 (2017-02) / Final draft EN 301 489-3 V2.1.1 (2017-03)/ EN 301 489-17 V3.1.1 (2017-02), Immunity requirements			
Clause	**Reference standard**	**Test specification**	**Performance Criterion**
9.3	EN 61000-4-2 ESD	Enclosure port: ±8 kV Air discharge, ±4 kV Contact discharge	TT/TR
9.2	EN 61000-4-3 RS	Enclosure port: 80-6000 MHz, 3 V/m, 80 % AM (1 kHz)	CT/CR
9.4	EN 61000-4-4 EFT	Signal ports, telecommunication ports and control ports: ±0.5 kV, 5/50 T_r/T_h ns, 5 kHz Input DC power ports: ±0.5 kV, 5/50 T_r/T_h ns, 5 kHz Input AC Power ports: ±1 kV, 5/50 T_r/T_h ns, 5 kHz	TT/TR
9.8	EN 61000-4-5 Surge	Wired network ports(directly connected to outdoor cables): Symmetrically operated : ±1 kV, 10/700 Tr/Th μs Non-symmetrically operated : line to line: ±0.5 kV, 1.2/50 Tr/Th μs line to ground: ±1 kV, 1.2/50 Tr/Th μs Wired network ports(indoor cables, longer than 30 m): ±0.5 kV, 1.2/50 Tr/Th μs	TT/TR
		Input AC Power ports: Telecom centres: line to line: ±0.5 kV, 1.2/50 Tr/Th μs line to ground: ±1 kV, 1.2/50 Tr/Th μs Others: line to line: ±1 kV, 1.2/50 Tr/Th μs line to ground: ±2 kV, 1.2/50 Tr/Th μs	TT/TR
9.5	EN 61000-4-6 CS	Signal ports, telecommunication ports, control ports and DC power ports (if cables length > 3 m): 0.15-80 MHz, 3 V, 80 % AM (1 kHz) AC Power ports: 0.15-80 MHz, 3 V, 80 % AM (1 kHz)	CT/CR
9.7	EN 61000-4-11 Dips & Interruptions	AC Power ports: Voltage Dips: 0 % residual, 0.5 cycle 0 % residual, 1 cycle 70 % residual, 25 cycles (at 50 Hz) Voltage Interruptions: 0 % residual, 250 cycles (at 50 Hz) EUT with battery back-up EUT without battery back-up	TT/TR TT/TR TT/TR C Recoverable by user or better

5.2 PERFORMANCE CRITERIA

General Performance Criteria

- Performance criteria for continuous phenomena applied to transmitters and receivers (CT/CR)

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

- Performance criteria for transient phenomena applied to transmitters and receivers (TT/TR)

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

- Performance criteria for equipment which does not provide a continuous communication link

For radio equipment which does not provide a continuous communication link, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

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

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

Product Specific Performance Criteria

The particular performance criteria which are specified in the relevant part of EN 301 489 series dealing with the particular type of radio equipment, take precedence over the corresponding parts of the general performance criteria.

Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

EN 301 489-3, SRD

TYPE of Device

Device Type	Risk assessment of communication link performance
1	Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person)
2	Medium reliable SRD communication media; e.g. causing inconvenience to persons, which cannot simply be overcome by other means
3	Standard reliable SRD communication media; e.g. inconvenience to persons, which can simply be overcome by other means (e.g. manual)

The performance criteria are:

- Performance criterion A applies for immunity tests with phenomena of a continuous nature;
- Performance criterion B applies for immunity tests with phenomena of a transient nature.

Table 2: Performance Requirements

Criterion	During test	After test
A	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
B	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions

EN 301 489-17, Broadband Data Transmission Systems

Special conditions for Draft EN 301489-17		
Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).
Note 1: Degradation of performance during the test is understood as degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended. Note 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.		

Note:

1. The WLAN linking mode is activated and monitoring communication status via notebook by ping command during and after tests.
2. The BT linking mode is activated and the communication status is monitored via the earphone during and after tests.

5.3 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD)

5.3.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: 2, 4, 8 kV (Direct) Contact Discharge: 2, 4 kV Indirect Discharge: 2, 4kV
Polarity:	Positive & Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

5.3.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
ESD GUN	TESEQ	NSG 438	1399	May 14,16	May 13,17
ESD GUN-POWER	TESEQ	NSG 438-ACC	NA	NA	NA

NOTE: 1. The test was performed in EMS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

5.3.3 TEST PROCEDURE

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

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

d. 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.

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

f. 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.

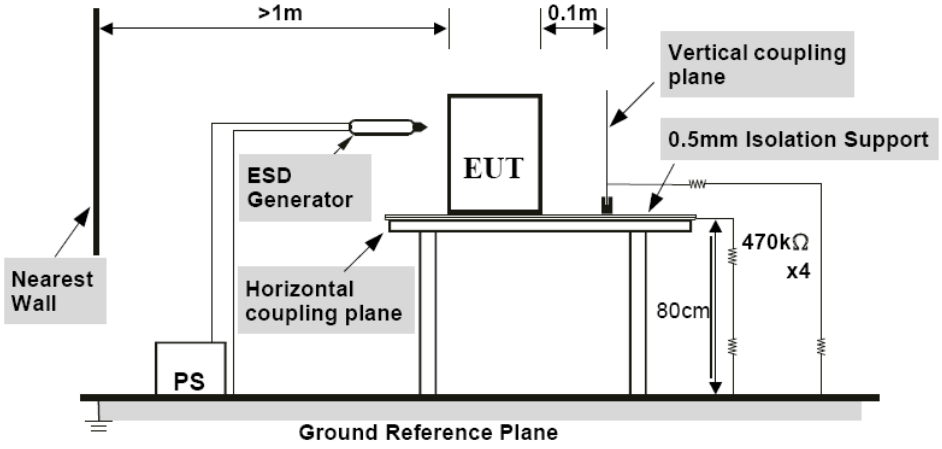
g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned horizontally at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

5.3.4 DEVIATION FROM TEST STANDARD

No deviation.

5.3.5 TEST SETUP



NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum or copper at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (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 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

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

5.3.6 TEST RESULTS

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**ENVIRONMENTAL CONDITIONS**	21.4deg. C, 45.3% RH, 101.5kpa
TEST MODE	See section 3.2	**TESTED BY**	Eric Shi

Mode 1

Discharge Level	Polarity	Test Points	Contact Discharge	Air Discharge	Performance Criterion	Test Result
2,4,8	+/-	2,4,6,7,9,12,13	NA	NOTE	TT/TR	PASS
2,4	+/-	1,3,5,8,10	NA	NA	TT/TR	PASS

Mode 2,4,5

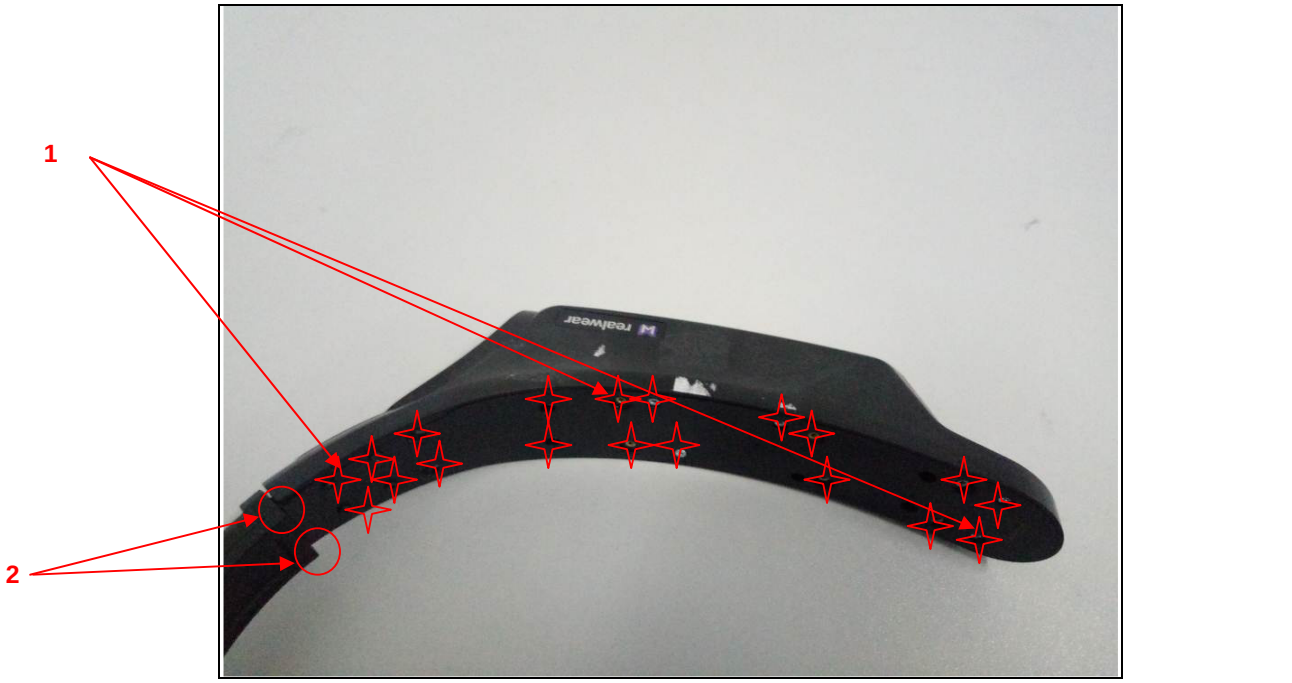
Discharge Level	Polarity	Test Points	Contact Discharge	Air Discharge	Performance Criterion	Test Result
2,4,8	+/-	2,4,6,7,9,11,12,15	NA	NOTE	TT/TR	PASS
2,4	+/-	1,3,5,8,10	NOTE	NA	TT/TR	PASS

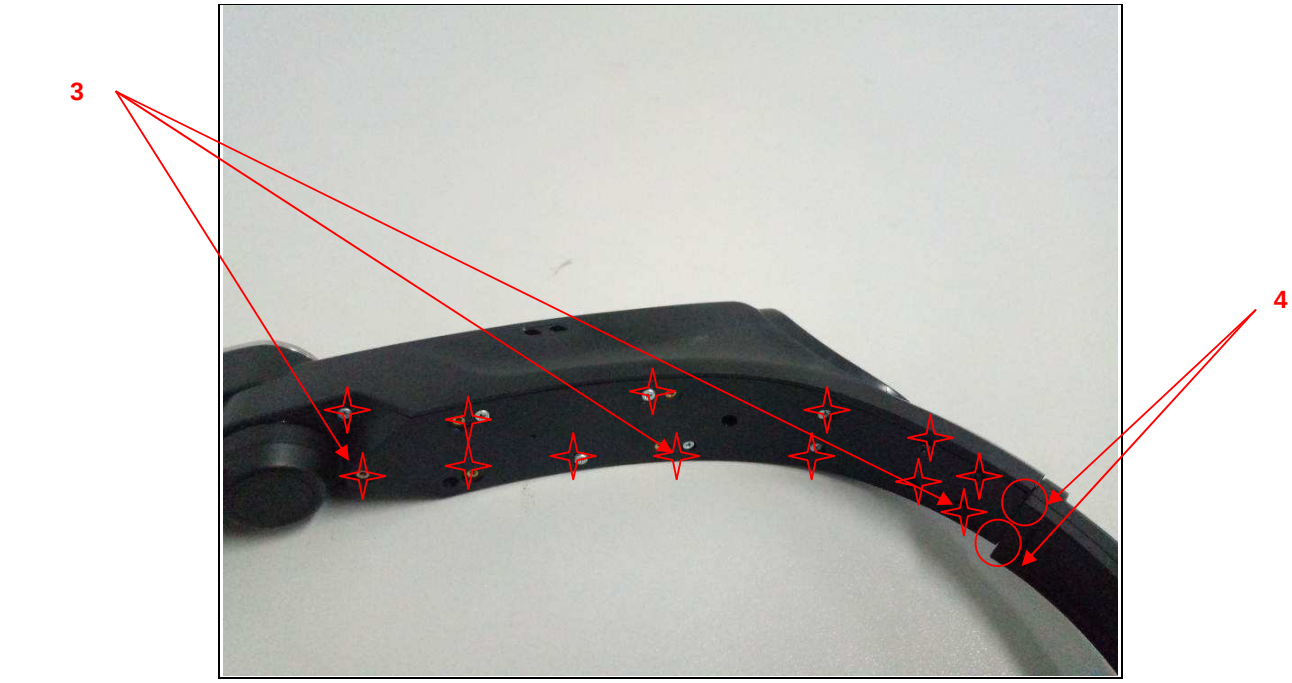
Mode 3

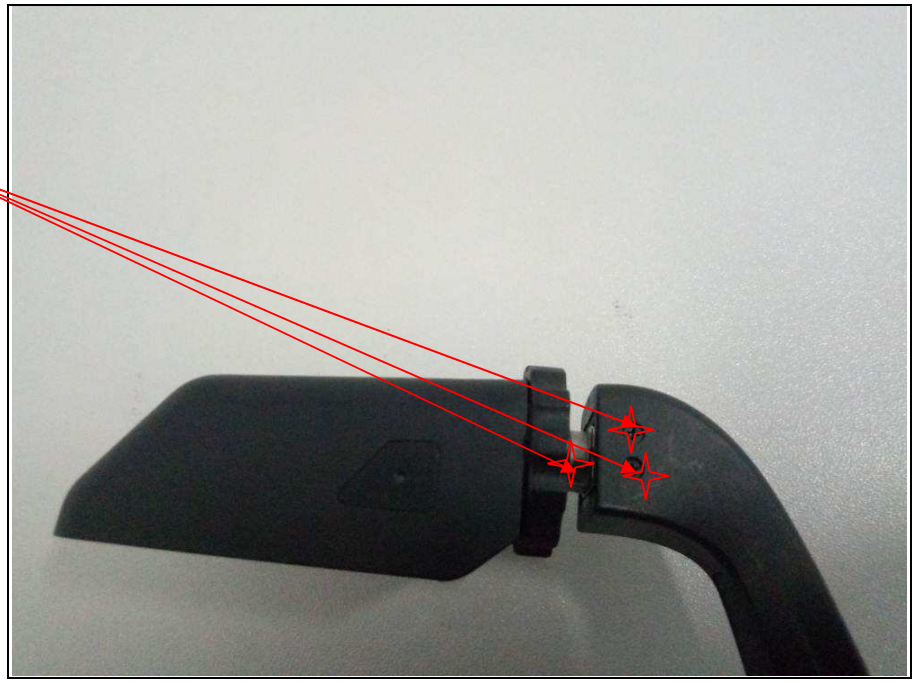
Discharge Level	Polarity	Test Points	Contact Discharge	Air Discharge	Performance Criterion	Test Result
2,4,8	+/-	2,4,6,7,9,11,12,14,15	NA	NOTE	TT/TR	PASS
2,4	+/-	1,3,5,8	NOTE	NA	TT/TR	PASS

NOTE: The EUT function was correct during the test.

ESD TEST POINTS



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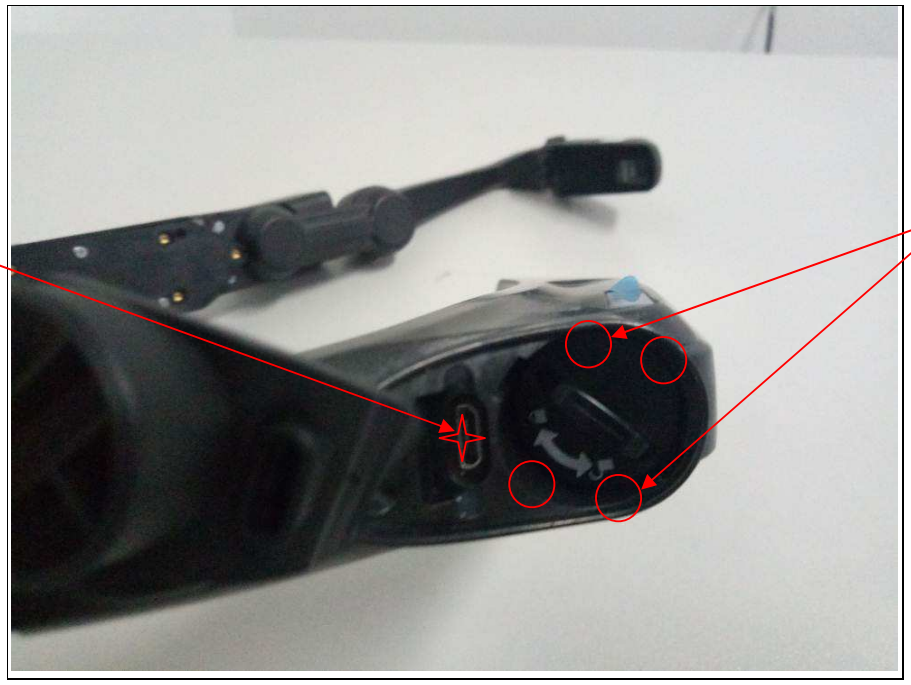
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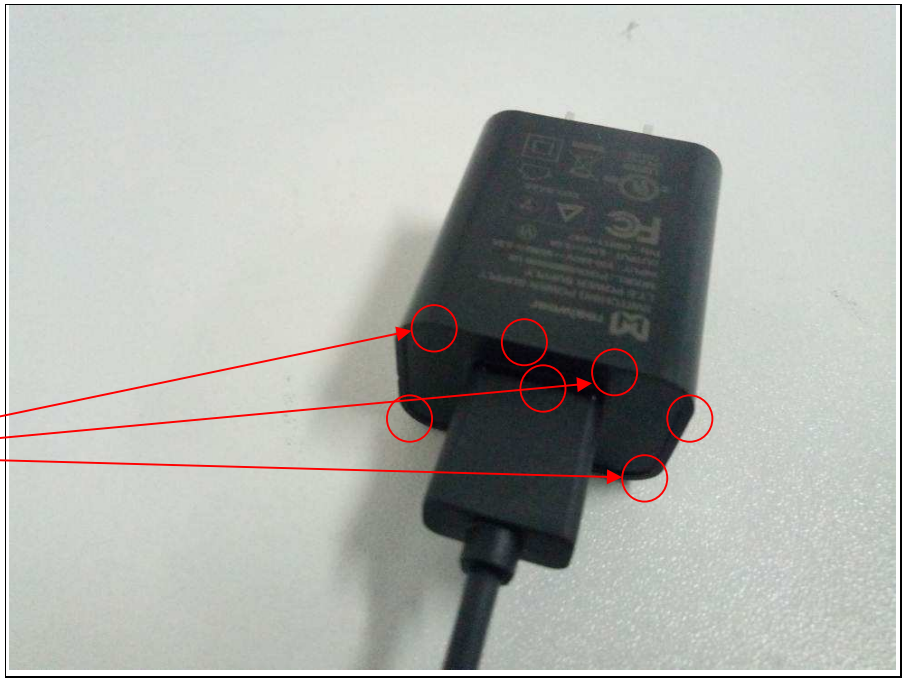


5.4 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS)

5.4.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz ~ 6000 MHz & 80MHz-2700MHz
Field Strength:	3 V/m
Modulation:	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5 m
Dwell Time:	3 seconds

5.4.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Base station R&S CMW500	Rohde&Schwarz	CMW500	153084	May 14,16	May 13,17
Audio Analyzer	Rohde&Schwarz	UPV	104035	May 14,16	May 13,17
RS Test System TS9982	Rohde&Schwarz	SMB100A + SMB-B106	109279	May 14,16	May 13,17
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
POWER AMPLIFIER_RS	Rohde&Schwarz	BBA100-B250	101805	June 14,16	June 13,17
POWER AMPLIFIER_RS	Rohde&Schwarz	BBA100-D110	101823	June 14,16	June 13,17
RS Antenna_LF	Rohde&Schwarz	R&S® HL046E	HL064E	June. 28,16	June. 27,17
RS Antenna_HF	Rohde&Schwarz	STLP 9149	9149-329	June. 28,16	June. 27,17
3m Fully-anechoic Chamber	ETS-LINDGREN	10m*10m*5m	Euroshieldpn-CT0001143-1217	June 14,16	June 13,17
Ear Simulator	Rohde&Schwarz	4182	2959480	May 14,16	May 13,17
Mouth Simulator	Rohde&Schwarz	4227	2981654	May 14,16	May 13,17
conditionaling Amplifier	Rohde&Schwarz	Type 5935	2997236	May 14,16	May 13,17
power sensor	Rohde&Schwarz	NRP-Z91	102958	Sep. 25,16	Sep. 24,17
power sensor	Rohde&Schwarz	NRP-Z91	102969	Sep. 25,16	Sep. 24,17

NOTE: 1. The test was performed in RS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

5.4.3 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-3.

a. The testing was performed in a fully-anechoic chamber.

b. The frequency range is swept from 80 MHz to 6000 MHz with the signal 80% amplitude modulated with a 1 kHz sine wave.

c. The dwell time 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 0.5s.

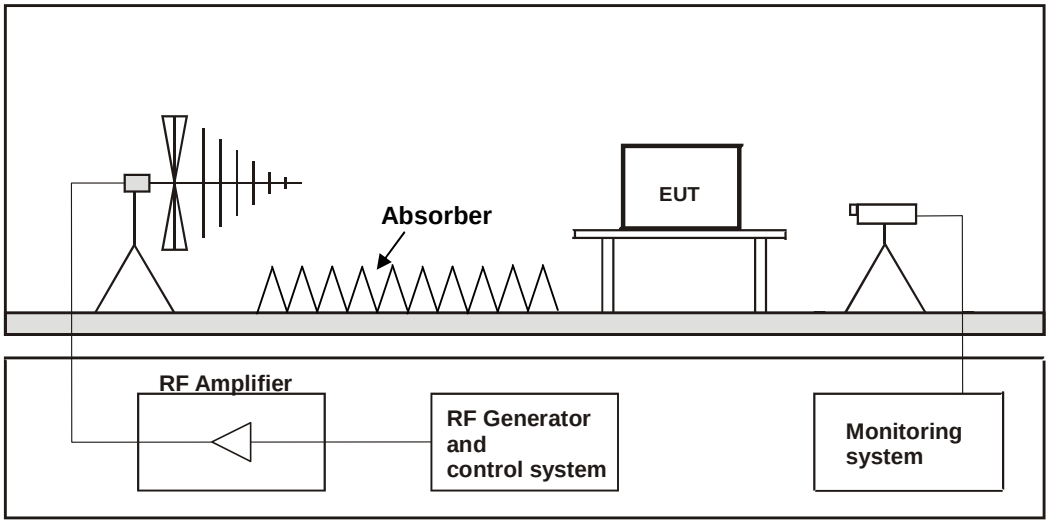
d. The field strength level was 3 V/m.

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

5.4.4 DEVIATION FROM TEST STANDARD

No deviation.

5.4.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT

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

5.4.6 TEST RESULTS

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**ENVIRONMENTAL CONDITIONS**	21.5deg. C, 50.6% RH
TEST MODE	1 ~ 3	**TESTED BY**	Gravin Ou

Field Strength (V/m)	Test Frequency Note#1 (MHz)	Polarization of antenna (Horizontal / Vertical)	Azimuth (0)	Test Distance (m)	Test Result	Performance Criterion
3	80 - 6000	H&V	0/90/180/270	3	PASS	CT/CR

* The exclusion band for the transmitter and / or receiver part of the 2.4 GHz band equipment under test shall extend from 2280 MHz to 2603.5 MHz. The WLAN connection of EUT goes offline during the test.

NOTE:

1. There was no change compared with initial operation during and after the test.

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**ENVIRONMENTAL CONDITIONS**	21.5deg. C, 50.6% RH
TEST MODE	4 ~ 5	**TESTED BY**	Gravin Ou

Field Strength (V/m)	Test Frequency Note#1 (MHz)	Polarization of antenna (Horizontal / Vertical)	Azimuth (0)	Test Distance (m)	Test Result	Performance Criterion
3	80 - 2700	H&V	0/90/180/270	3	PASS	CT/CR

NOTE:

1. There was no change compared with initial operation during and after the test.

5.5 ELECTRICAL FAST TRANSIENT (EFT)

5.5.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-4
Test Voltage:	Input AC Power ports: ±1 kV
EFT Input/Output:	L,N,L+N
Polarity:	Positive & Negative
Impulse Repetition Frequency:	others: 5 kHz
Impulse Waveshape:	T_r/T_h 5/50 ns
Burst Duration:	15 ms for 5 kHz Repetition Frequency 0.75 ms for 100 kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min

5.5.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Surge Pulse for power port	TESEQ	CWM 3650	NA	Sep. 25,16	Sep. 24,17
Surge Pulse for RJ45/RJ11 port	TESEQ	TSM 3751	1086	Sep. 25,16	Sep. 24,17
EFT/Burst Module for power port	TESEQ	FTM 3425-60	3298	Sep. 25,16	Sep. 24,17
EFT CDN Clamp for DATA LINE	TESEQ	CDN 3425	1985	Sep. 25,16	Sep. 24,17
DIP KIT	TESEQ	VAR-3005-S16	890	Sep. 25,16	Sep. 24,17
EFT check voltage	TESEQ	CAS 3025	40446	Sep. 25,16	Sep. 24,17
surge check voltage	TESEQ	MD 200A	152841	Sep. 25,16	Sep. 24,17

NOTE: 1. The test was performed in EMS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

5.5.3 TEST PROCEDURE

a. Both positive and negative polarity discharges were applied.

b. The distance between any coupling devices and the EUT should be (0.5 − 0/+0.1) m for table-top equipment testing, and (1.0 ± 0.1) m for floor standing equipment.

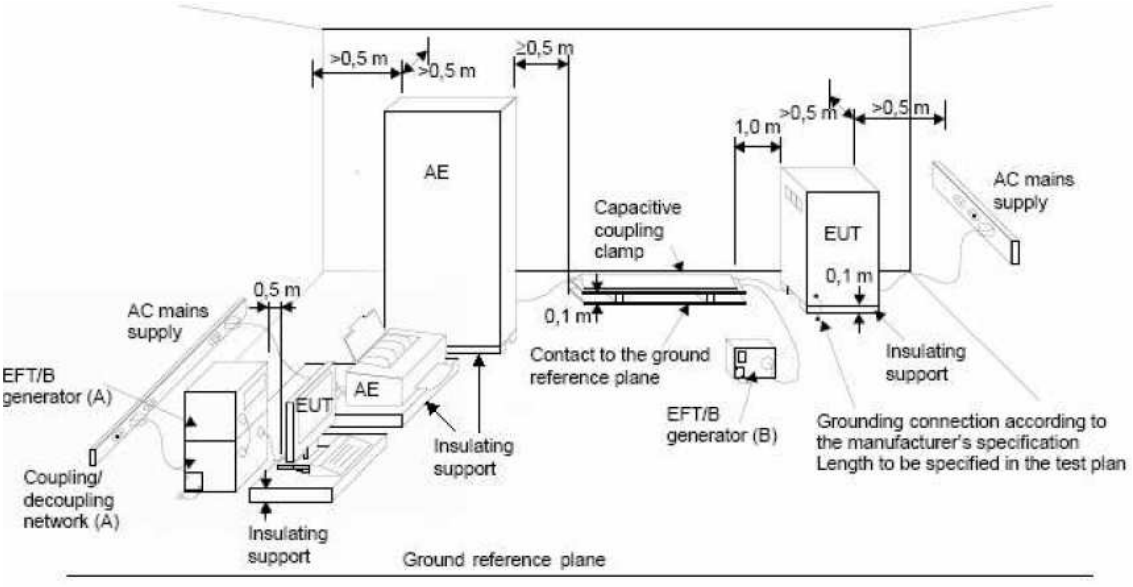
c. The duration time of each test sequential was 1 minute.

d. The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.

5.5.4 DEVIATION FROM TEST STANDARD

No deviation.

5.5.5 TEST SETUP



(A) location for supply line coupling
(B) location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

5.5.6 TEST RESULTS

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	ENVIRONMENTAL CONDITIONS	23.4deg. C, 55% RH
TEST MODE	See section 3.2	TESTED BY	Eric Shi

Test Point	Polarity	Test Level (kV)	Observation	Performance Criterion	Test Result
L	+/-	1	NOTE	TT/TR	PASS
N	+/-	1	NOTE	TT/TR	PASS
L+N	+/-	1	NOTE	TT/TR	PASS

NOTE: There was no change compared with initial operation during and after the test.

5.6 SURGE IMMUNITY

5.6.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-5
Wave-Shape:	Input AC power port: 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
Test Voltage:	Input AC power ports: Line to line: ±1 kV
Surge Input/Output:	L-N
Generator Source Impedance:	2 ohm between networks
Polarity:	Positive/Negative
Phase Angle:	0°/90°/180°/270°
Pulse Repetition Rate:	1 time / 60 sec.
Number of Tests:	5 positive and 5 negative at selected points

5.6.2 TEST INSTRUMENT

Refer to section 5.5.2 to get information of above instrument.

5.6.3 TEST PROCEDURE

a. For EUT power supply:

The surge is 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 was shorter than 2 meters in length.

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and telecommunication ports,

- Unshielded unsymmetrical interconnection lines:

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.

- Unshielded symmetrical interconnections communication lines:

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

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

  - Direct application,

  The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

  Rules for application of the surge to shielded lines:

  a) Shields grounded at both ends

  > The surge injection on the shield.

b) Shields grounded at one end

> If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

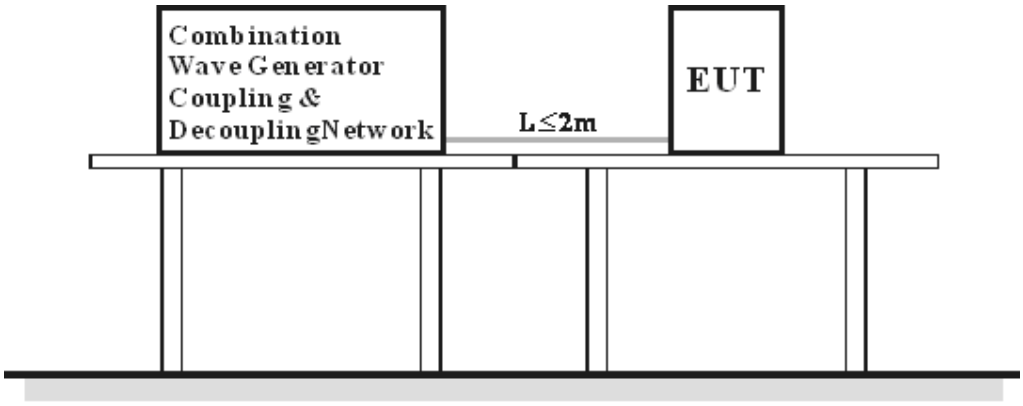
- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.

5.6.4 DEVIATION FROM TEST STANDARD

No deviation.

5.6.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

5.6.6 TEST RESULTS

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**ENVIRONMENTAL CONDITIONS**	23.4deg. C, 55% RH
TEST MODE	See section 3.2	**TESTED BY**	Eric Shi

AC Power port：

\Phase angle \ Test result \Voltage (kV) \ Test point\ Polarity			0°	90°	180°	270°	DC Power Port	Performance Criterion
1	L-N	+	PASS	PASS	PASS	PASS	N/A	TT/TR
		—	PASS	PASS	PASS	PASS	N/A	TT/TR

NOTE: There was no change compared with initial operation during and after the test.

5.7 CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

5.7.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz ~ 80 MHz
Field Strength:	3 Vrms
Modulation:	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Coupled cable:	Power Mains, Unshielded
Coupling device:	CDN-M2

5.7.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Current Injection	Rohde&Schwarz	F-120-9A	160178	May. 14, 16	May. 13, 17
Current Probe	Rohde&Schwarz	F-52	160179	May. 14, 16	May. 13, 17
Base station R&S CMU200	Rohde&Schwarz	CMU200	N/A	May. 14, 16	May. 13, 17
Audio Analyzer	Rohde&Schwarz	UPV	104033	May. 14, 16	May. 13, 17
CS Test System TS9982	Rohde&Schwarz	SMC100A + SMC-B101	109278	May. 14, 16	May. 13, 17
POWER AMPLIFIER_CS	Rohde&Schwarz	BBA100-A125	101804	May. 14, 16	May. 13, 17
CDN	Rohde&Schwarz	FCC-801-M2/M3-16A	160181	May. 14, 16	May. 13, 17
BCI Impedance	Rohde&Schwarz	FCC-801-150-50-BCI	160185	May. 14, 16	May. 13, 17
CDN	Rohde&Schwarz	FCC-801-150-50-CDN-ED4	160182	May. 14, 16	May. 13, 17
calibration Fixture	Rohde&Schwarz	FCC-BCICF-6-150	160184	May. 14, 16	May. 13, 17
Proble Kit	Rohde&Schwarz	FCC-MPCF-3-F-52	160180	May. 14, 16	May. 13, 17
Line Impedance network-T8	TESEQ	ISN T8	39161	May. 14, 16	May. 13, 17
coupling-decoupling network-T400	TESEQ	CDN T400A	25868	May. 14, 16	May. 13, 17
Ear Simulator	Rohde&Schwarz	4182	2981654	May. 14, 16	May. 13, 17
Mouth Simulator	Rohde&Schwarz	4227	2981654	May. 14, 16	May. 13, 17
conditionaling Amplifier	Rohde&Schwarz	Type 5935	2997235	May. 14, 16	May. 13, 17
power sensor	Rohde&Schwarz	NRP-Z91	102957	Sep. 25,16	Sep. 24,17
power sensor	Rohde&Schwarz	NRP-Z91	102960	Sep. 25,16	Sep. 24,17

NOTE: 1. The test was performed in CS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

5.7.3 TEST PROCEDURE

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.

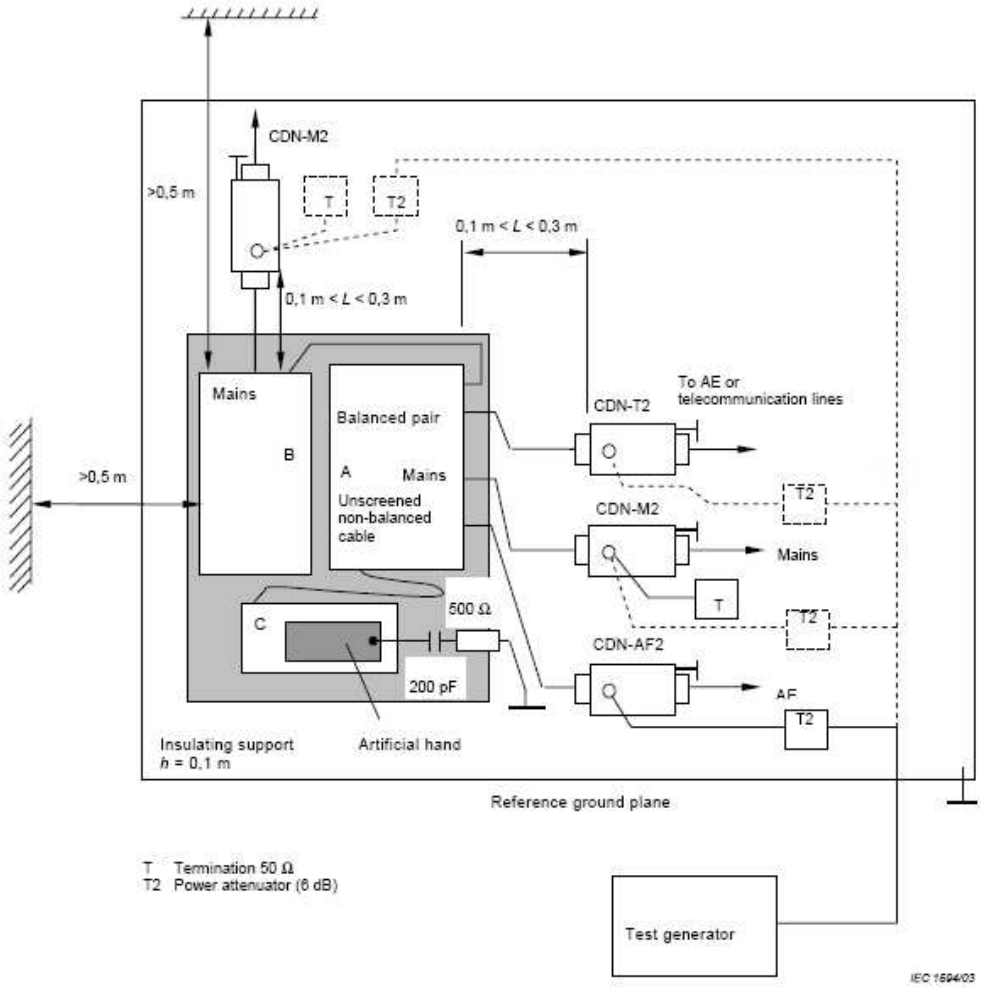
e. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s. The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately.

f. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

5.7.4 DEVIATION FROM TEST STANDARD

No deviation.

5.7.5 TEST SETUP



Note: 1.The EUT clearance from any metallic obstacles shall be at least 0.5 m.

2. Interconnecting cables (≦1 m) belonging to the EUT shall remain on the insulating support.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

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.

5.7.6 TEST RESULTS

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	ENVIRONMENTAL CONDITIONS	22.4deg. C, 50.2% RH
TEST MODE	1 ~ 5	TESTED BY	Alex Chen

Voltage (V)	Test Frequency Note#1 (MHz)	Tested Line	Injection Method.	Test Result	Performance Criterion
3	0.15 – 80	AC line	CDN-M2	PASS	CT/CR

NOTE: 1. There was no change compared with the initial operation during and after the test.

5.8 VOLTAGE DIP/SHORT INTERRUPTIONS/VOLTAGE VARIATIONS (DIP) IMMUNITY TEST

5.8.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-11
Test Levels:	Voltage Dips: 0% residual voltage for 0.5 cycle 0% residual voltage for 1 cycle 70% residual voltage for 25 cycles Voltage Interruptions: 0% residual voltage for 250 cycles
Special conditions for EN301489-52:	Voltage Dips: 30 % reduction for 10 ms
Interval between Event:	10 seconds
Phase Angle:	0°/180°
Test cycle:	3 times

5.8.2 TEST INSTRUMENT

Refer to section 5.5.2 to get information of above instrument.

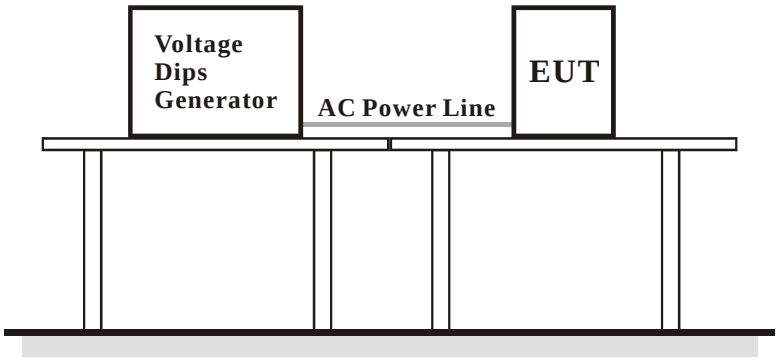
5.8.3 TEST PROCEDURE

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

5.8.4 DEVIATION FROM TEST STANDARD

No deviation.

5.8.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

5.8.6 TEST RESULTS

EN 301489-1/-3/-17(BT&WiFi)

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	ENVIRONMENTAL CONDITIONS	23.4deg. C, 55% RH
TEST MODE	1 ~ 5	TESTED BY	Eric Shi

Ut : 230 Vac 50 Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Test result
voltage residual (%)	(period)	(ms)				
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS

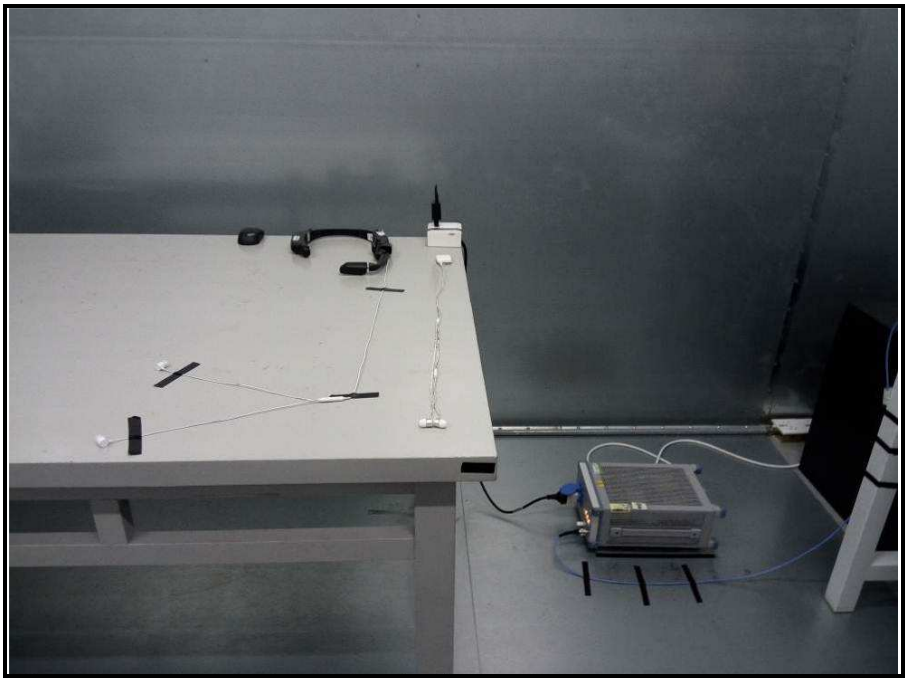
Ut : 100 Vac 60 Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Test result
voltage residual (%)	(period)	(ms)				
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS

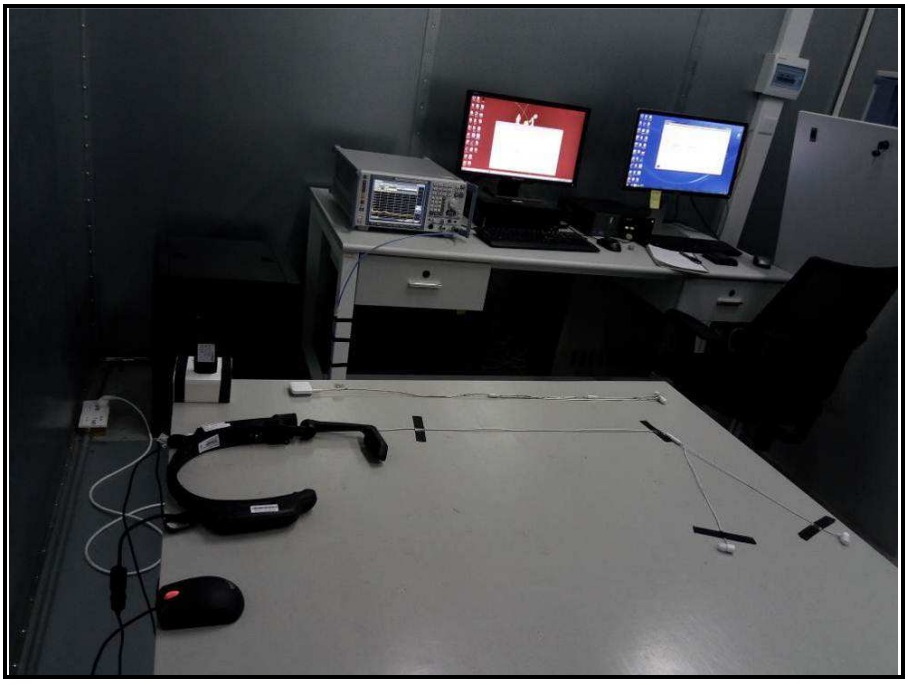
Ut : 240 Vac 50 Hz	Durations		Event interval (sec)	Total events (time)	Performance Criterion	Test result
voltage residual (%)	(period)	(ms)				
0	1	20	10	3	TT/TR	PASS
0	0.5	10	10	3	TT/TR	PASS
70	25	500	10	3	TT/TR	PASS
0	250	5000	10	3	TT/TR	PASS

NOTE: There was no change compared with the initial operation during and after the test.

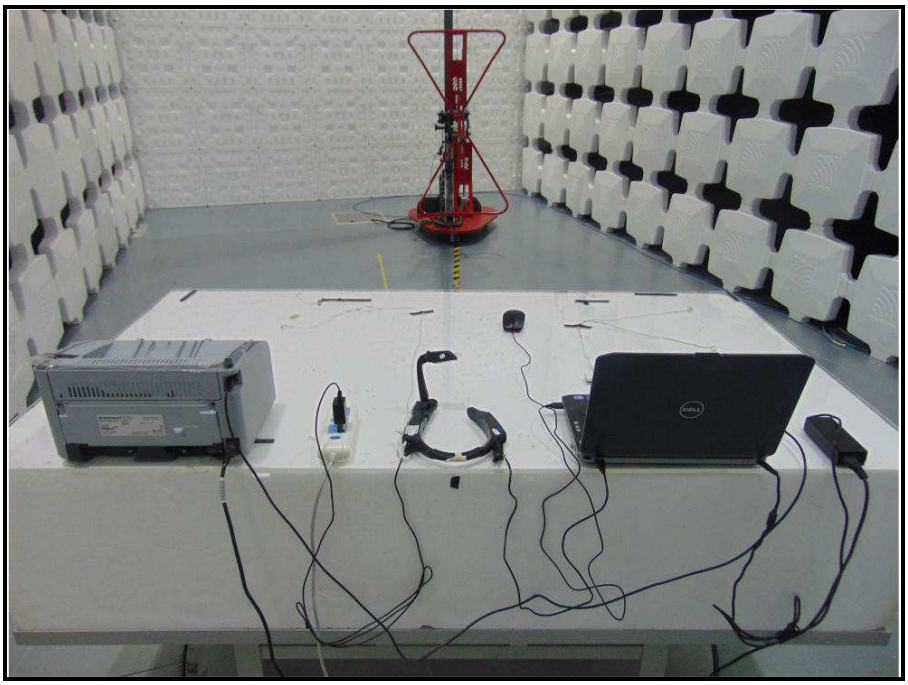
6 PHOTOGRAPHS OF THE TEST CONFIGURATION

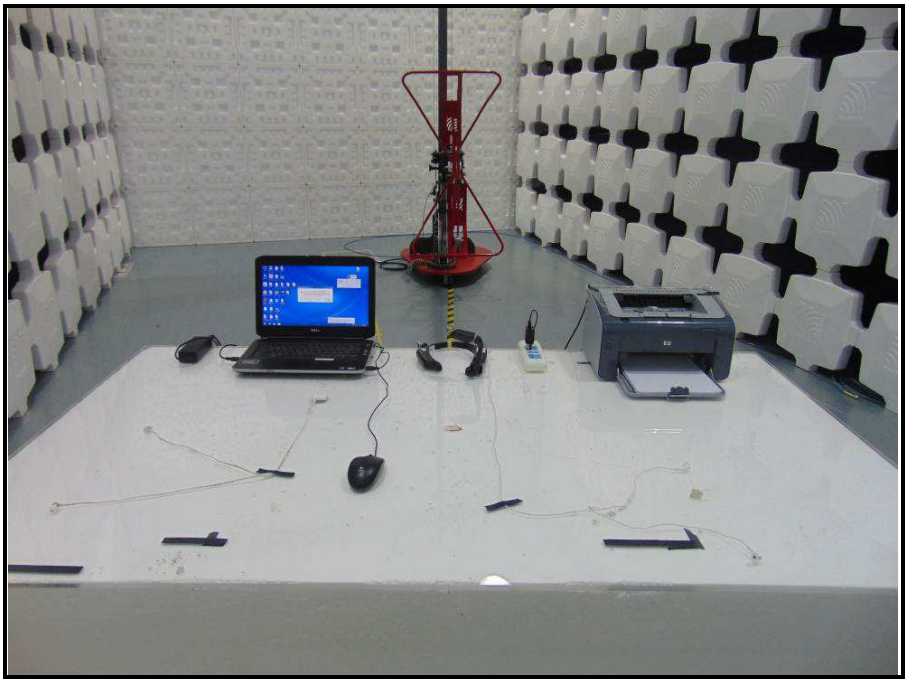
Conducted Emission Test at Mains Port



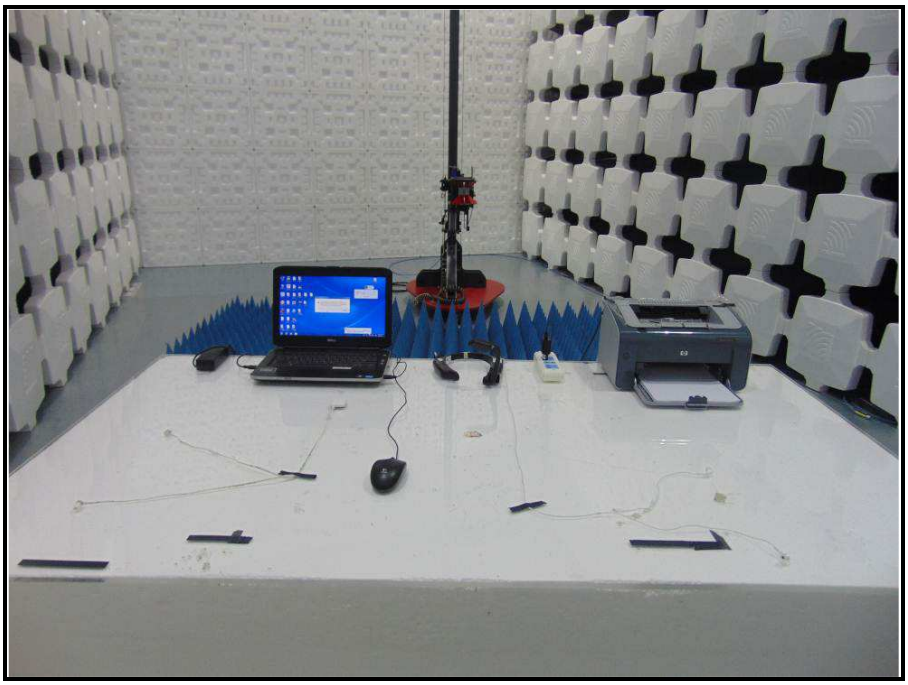


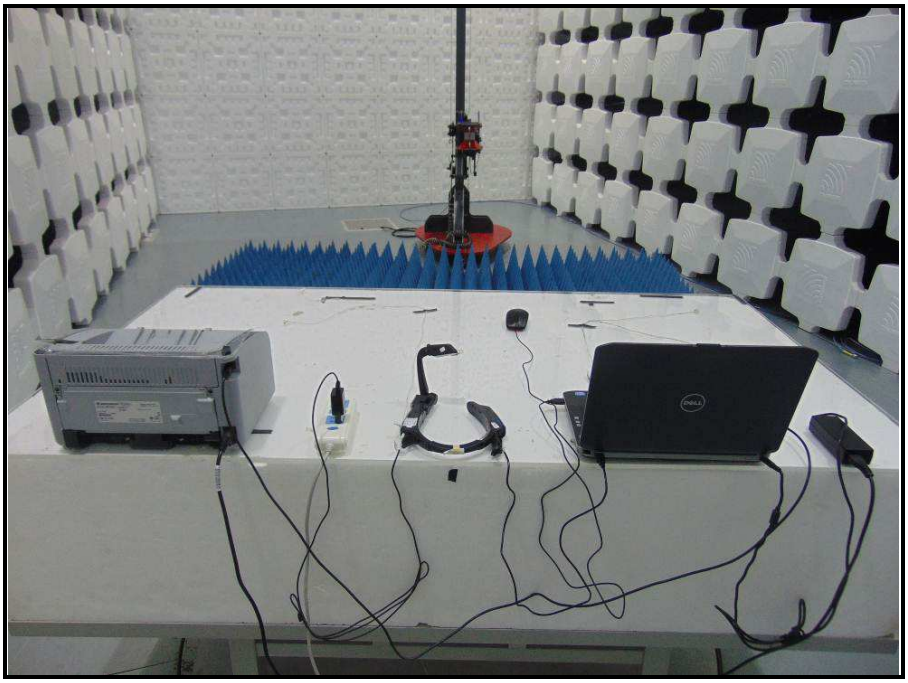
Radiated Emission Test (Frequency range 30MHz ~1GHz)



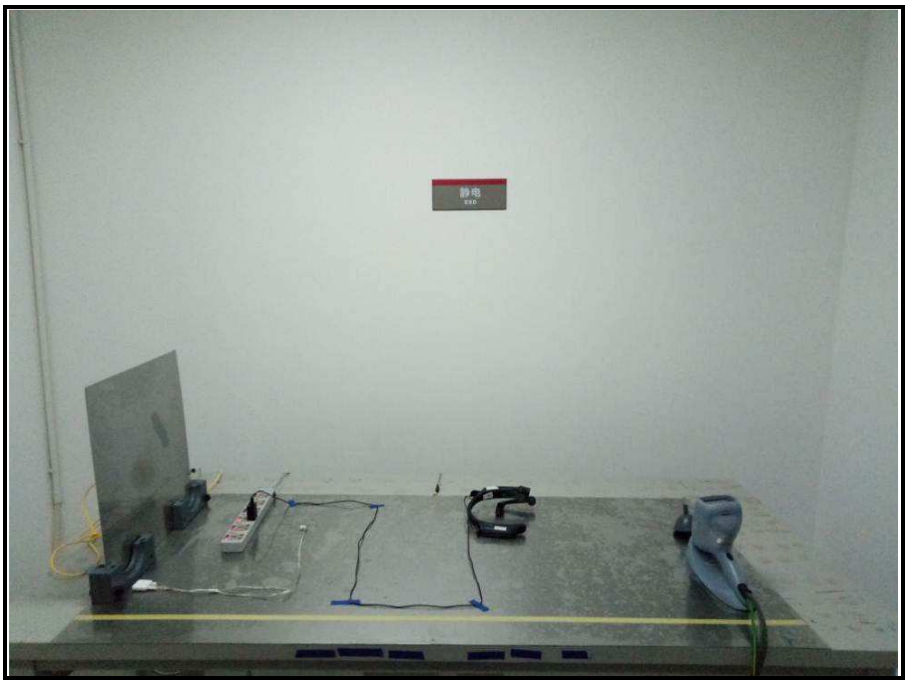


Radiated Emission Test (Frequency range above 1GHz)

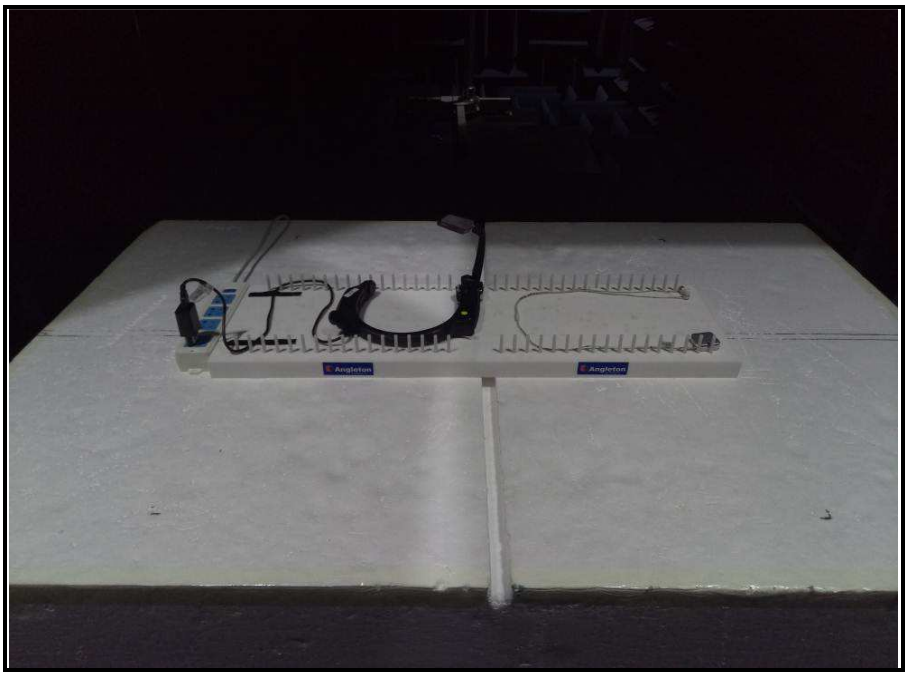




ESD Test



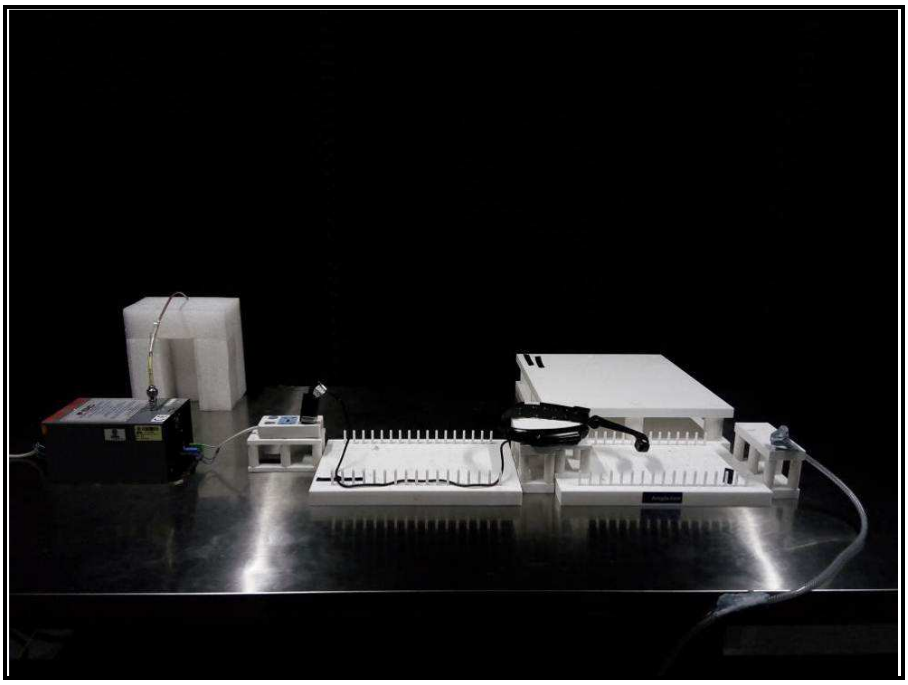
RS Test



EFT Test

Surge Test

CS Test



Voltage Dip and Interruption Test

7 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

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