TEST REPORT

Product Name:	TWS Earphone
Trademark:	
Model Number:	
Prepared For:	
Address:	
Manufacturer:	
Address:	
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China
Sample Received Date:	Aug. 30, 2019
Sample tested Date:	Aug. 30, 2019 to Sep. 2, 2019
Issue Date:	Sep. 2, 2019
Report No.:	CTB190902036REX
Test Standards	Draft ETSI EN 301 489-1 V2.2.1 (2019-03) Draft ETSI EN 301 489-17 V3.2.0 (2017-03)
Test Results	PASS
Remark:	This is RED EMC test report.

Compiled by:	Reviewed by:	Approved by:
Victory	Rita Xiao	Sherwin Qian/ Director

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

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(NOTE: N/A MEANS NOT APPLICABLE)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB190902036REX	Sep. 2, 2019	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

EMISSION		
Standard	**Test Item**	**Test result**
EN 55032	Conducted emissions from the AC mains power ports	Pass
EN 55032	Asymmetric mode conducted emissions	N/A[1]
EN 55032	Conducted differential voltage emissions	N/A[2]
EN 55032	Radiated emissions	Pass
EN 61000-3-2	Harmonic current emission(H)	N/A[3]
EN 61000-3-3	Voltage fluctuations & flicker(F)	Pass

IMMUNITY		
Standard	**Test Item**	**Test result**
IEC 61000-4-2	Electrostatic discharge (ESD)	Pass
IEC 61000-4-3	Continuous RF electromagnetic field disturbances(RS)	Pass[#]
IEC 61000-4-4	Electrical fast transients/burst (EFT)	Pass
IEC 61000-4-5	Surges	Pass
IEC 61000-4-6	Radio frequency, common mode	Pass[#]
IEC 61000-4-11	Voltage dips and interruptions (DIPS)	Pass

Remark:
"#"indicates the testing item(s) was (were) fulfilled by subcontracted lab.
1. Applicable to ports listed above and intended to connect to cables longer than 3 m.
2. The Product has no antenna port.
3. The Product belongs to Class A, and its power is less than 75W, so it deems to fulfil this standard without testing.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Value (dB)
Conducted Emission (150KHz-30MHz)	3.2
Radiated Emission(30MHz ~ 1000MHz)	4.7
Radiated Emission(1GHz ~6GHz)	5.0

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):

Model Description: N/A

Bluetooth Version: Bluetooth 5.0

Hardware Version: V1.0

Software Version: V1.0

Operation Frequency: Bluetooth: 2402-2480MHz

Max. RF output power: Bluetooth: 6.09dBm

Type of Modulation: Bluetooth: GFSK, π/4 DQPSK, 8DPSK

Antenna installation: Bluetooth: Internal antenna

Antenna Gain: Bluetooth: 1dBi

Ratings: Battery DC 3.7V 35mAh
DC 5V, 0.5A, charging from adapter

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1	Laptop	DELL	Inspiron5570	JR4G1A00DPC	AE
2	AC Adaptor	DELL	HA45NM140	CN-00285K-CH200-88V-	AE
3	Adapter	Green cheung	LX05A	Input:100-240V, 50/60Hz, 1.5A Output: 5V 0.5A	AE

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

Test item	Test Mode	Test Voltage
Conducted emissions from the AC mains power ports (150KHz-30MHz) Class B	Charging	AC 230V/50Hz[1]
Radiated emissions(30MHz-6GHz) Class B	Charging	AC 230V/50Hz[1]
	BT	Battery DC 3.7V
Harmonic current emission(H) Class A	Charging	AC 230V/50Hz[1]
Voltage fluctuations & flicker(F)	Charging	AC 230V/50Hz[1]
Electrostatic discharge (ESD) ☒Air Discharge: ±2,4,8kV ☒Contact Discharge: ±2,4kV ☒HCP & VCP: ±2,4kV	Charging	AC 230V/50Hz
	BT	Battery DC 3.7V
	/	/
Continuous RF electromagnetic field disturbances(RS) ☒80MHz-6000MHz , 3V/m,80%	Charging	AC 230V/50Hz
	BT	Battery DC 3.7V
	/	/
Electrical fast transients/burst (EFT) ☒1kV AC(Input) ☐0.5kV DC(Input) ☐0.5kV signal,Telec,control	Charging	AC 230V/50Hz
Surges ☒1kV Line-Line, ☐2kV Line-PE, N-PE ☐0.5kVDC(Input) ☐1KV,☐4KV signal,Telec, control Line-Line:90°+1kV,270°-1kV Line-PE:90°+2kV,270°-2kV N-PE:90°-2kV,270°+2kV	Charging	AC 230V/50Hz
Continuous induced RF disturbances (CS) 0.15MHz to 10MHz 3V,10MHz-30MHz 3 to 1V,30MHz-80MHz 1V ☒ AC(Input) ☐ DC(Input) ☐ signal,control	Charging	AC 230V/50Hz
Voltage dips and interruptions (DIPS) ☒Less 5% 0.5P ☒70% 500ms Voltage Interruptions ☒less5% 5000ms	Charging	AC230V/50Hz
All test mode were tested and passed, only Conducted Emissions, Radiated Emissions Harmonic Current Emissions and Voltage Fluctuations and Flicker shows ([1])s the worst case mode which were recorded in this report.		

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Conducted emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	Nov. 02, 2018	Nov. 01, 2019
Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	Nov. 02, 2018	Nov. 01, 2019
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	Nov. 02, 2018	Nov. 01, 2019
Coaxial cable	ZDECL	Z302S	18091904	Nov. 02, 2018	Nov. 01, 2019
AAN	TESEQ	T8-Cat6	38888	Nov. 02, 2018	Nov. 01, 2019

Radiated emissions Test (966 chamber)					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	1911	Nov. 03, 2018	Nov. 02, 2019
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	Nov. 03, 2018	Nov. 02, 2019
Amplifier	Agilent	8449B	3008A01838	Nov. 02, 2018	Nov. 01, 2019
Amplifier	HP	8447E	2945A02747	Nov. 02, 2018	Nov. 01, 2019
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	Nov. 02, 2018	Nov. 01, 2019
Coaxial cable	ZDECL	ZT26	18091906	Nov. 02, 2018	Nov. 01, 2019
Coaxial cable	ZDECL	ZT26	18097604	Nov. 02, 2018	Nov. 01, 2019
Coaxial cable	ZDECL	ZT26	18091908	Nov. 02, 2018	Nov. 01, 2019
Coaxial cable	ZDECL	ZT26	18091907	Nov. 02, 2018	Nov. 01, 2019

Harmonic / Flicker Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Analyzer	California	PACS-1	72345	Nov. 02, 2018	Nov. 01, 2019
Power Source	California	3001iX	56310	Nov. 02, 2018	Nov. 01, 2019

Electrostatic discharge Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
ESD Simulator	TESTQ	NSG437	329	Nov. 06, 2018	Nov. 05, 2019

Continuous RF electromagnetic field disturbances Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Signal Generator	Agilent	N5181A	MY50142530	Nov. 02, 2018	Nov. 01, 2019
Bilog Antenna	Teseq	CBL 6111D	27089	Nov. 02, 2018	Nov. 01, 2019
Antenna Log-Periodic	AR	ATR80M6G	0337307	Nov. 02, 2018	Nov. 01, 2019
Antenna Log-Periodic	AR	ATS700M11G	0336821	Nov. 02, 2018	Nov. 01, 2019
Switch Controller	AR	SC1000	0337343	Nov. 02, 2018	Nov. 01, 2019
RF Power Meter	ESE	4242	13984	Nov. 02, 2018	Nov. 01, 2019
Power Sensor	ESE	51011EMC	35716	Nov. 02, 2018	Nov. 01, 2019
Power Sensor	ESE	51011EMC	35715	Nov. 02, 2018	Nov. 01, 2019
E-Field probe	Narda	NBM-520	2403/01B	Nov. 02, 2018	Nov. 01, 2019
Power Amplifier	TESEQ	CBA 1G-150	T44029	Nov. 02, 2018	Nov. 01, 2019
Power Amplifier	TESEQ	CBA 3G-100	T44030	Nov. 02, 2018	Nov. 01, 2019
Power Amplifier	TESEQ	CBA 6G-050	1041204	Nov. 02, 2018	Nov. 01, 2019
Dual Directional	TESEQ	C5982	95208	Nov. 02, 2018	Nov. 01, 2019
Dual Directional	TESEQ	C6187	95175	Nov. 02, 2018	Nov. 01, 2019
Dual Directional	TESEQ	CPH-274F	M25 134-01	Nov. 02, 2018	Nov. 01, 2019
Test Sofiware	ADT	BVADT_RS_V7.6.4-DG	N/A	Nov. 02, 2018	Nov. 01, 2019

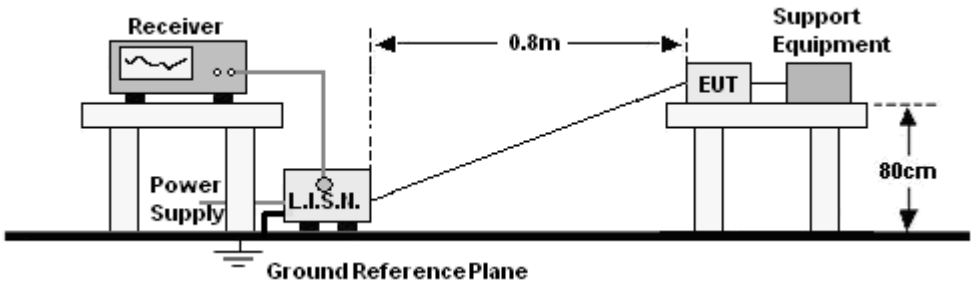
EFT and Surge and Voltage dips and interruptions Test

Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
Surge& Burst Generator	Lioncel	LSG-545CB	180602	Nov. 02, 2018	Nov. 01, 2019
Capacitive coupling clamp	Lioncel	EFTC	18071801	Nov. 02, 2018	Nov. 01, 2019
Voltage dip simulator	Lioncel	VDS-1102	180902	Nov. 02, 2018	Nov. 01, 2019

Continuous induced RF disturbances Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Signal Generator	R&S	SME06	829498/006	Nov. 02, 2018	Nov. 01, 2019
CDN	Luthi	L-801M2/M3	2015	Nov. 02, 2018	Nov. 01, 2019
CDN(AUX)	TESEQ	CDN M016	27452	Nov. 02, 2018	Nov. 01, 2019
CDN	TESEQ	T200A	26944	Nov. 02, 2018	Nov. 01, 2019
CDN	TESEQ	T400A	26536	Nov. 02, 2018	Nov. 01, 2019
CDN	TESEQ	ST08A	32256	Nov. 02, 2018	Nov. 01, 2019
6dB 5Watt Attenuator	HUBER+SUHNER	5906.17.0005	303688	Nov. 02, 2018	Nov. 01, 2019
Power Amplifler	PRANA	DR 220	1512-1788	Nov. 02, 2018	Nov. 01, 2019
ELECTRO MAGNETIC Injection Clamp	Luthi	EM 101	35640	Nov. 02, 2018	Nov. 01, 2019
C/S Test System	HAEFELY	WinPAMP	NSEMC002	Nov. 02, 2018	Nov. 01, 2019
Test Software	ADT	BVADT_CS_V7.6.2	N/A	Nov. 02, 2018	Nov. 01, 2019
Audio analyzer	R&S	UPV	101397	Nov. 02, 2018	Nov. 01, 2019
EAR SIMULATOR	B&K	4192	2764719	Nov. 02, 2018	Nov. 01, 2019
Sound Calibrator	B&K	Type 4231	2463874	Nov. 02, 2018	Nov. 01, 2019
Mouth Simulator	B&K	Type 2716C	2411656	Nov. 02, 2018	Nov. 01, 2019
Conditioning Amplifier	R&S	2690A0S2	2437856	Nov. 02, 2018	Nov. 01, 2019

6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



6.2 Limit

Limits for Conducted emissions at the mains ports of Class B MME

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56*	56 to 46*
0,50 to 5	56	46
5 to 30	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

6.3 Test procedure

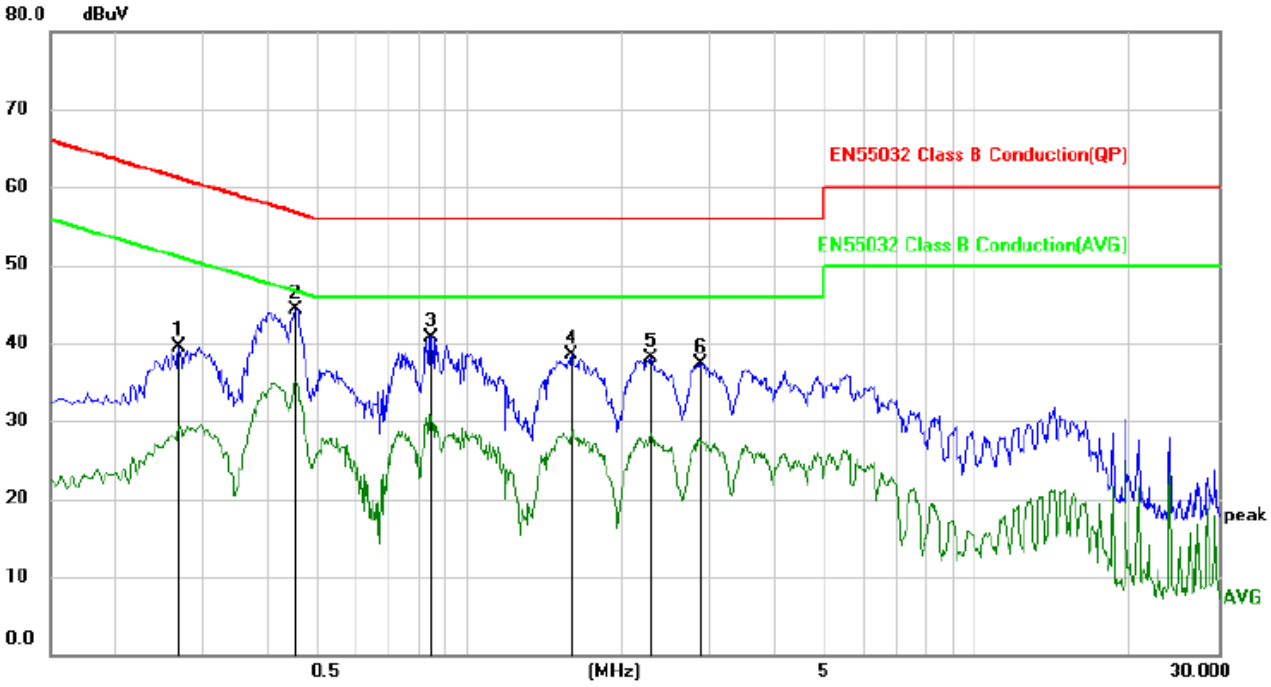
a. The Product was placed on a nonconductive table 0.8m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).

b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.

c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 Test Result

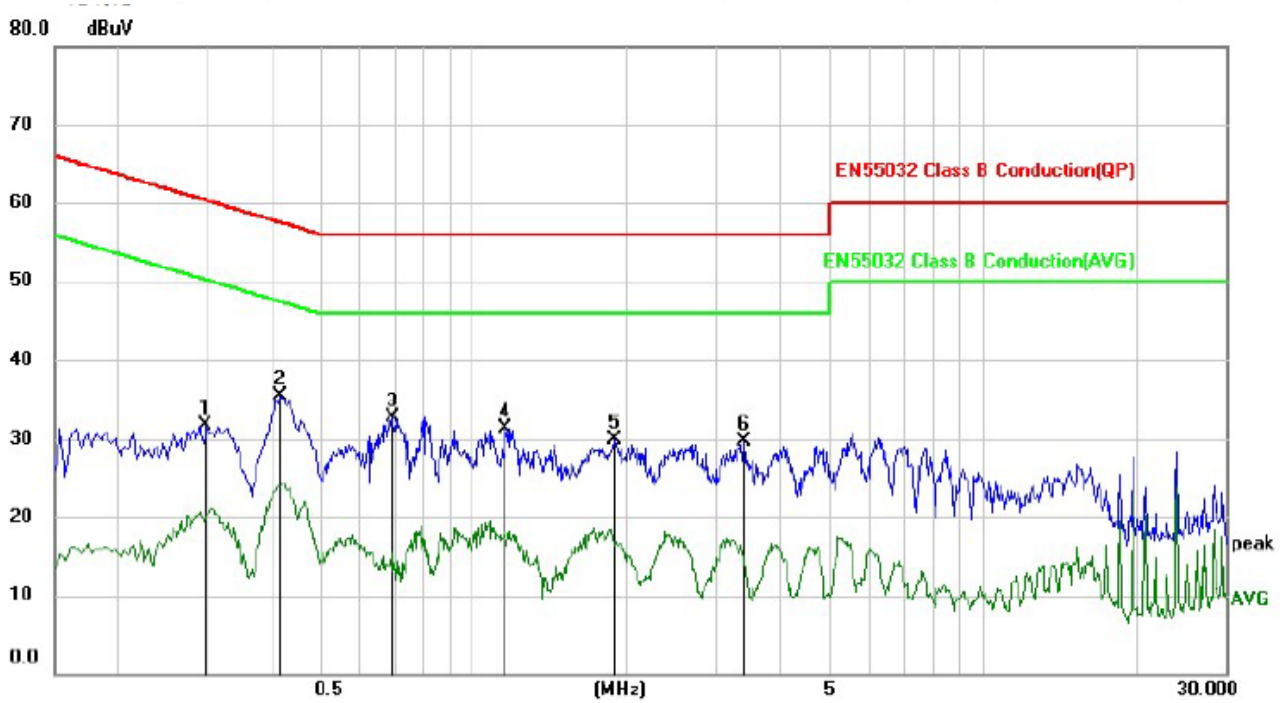
Temperature:	25.6℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Phase :	L
Test Mode	1(the worst data)	Remark:	N/A



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2980	21.88	9.89	31.77	60.30	-28.53	QP	
2	*	0.4180	25.62	9.82	35.44	57.49	-22.05	QP	
3		0.6900	22.81	9.89	32.70	56.00	-23.30	QP	
4		1.1580	21.33	10.06	31.39	56.00	-24.61	QP	
5		1.8940	19.88	10.12	30.00	56.00	-26.00	QP	
6		3.4100	19.38	10.25	29.63	56.00	-26.37	QP	

Remark: Result=Reading +Factor
Over Limit=Result -Limit

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Phase :	N
Test Mode	1(the worst data)	Remark:	N/A



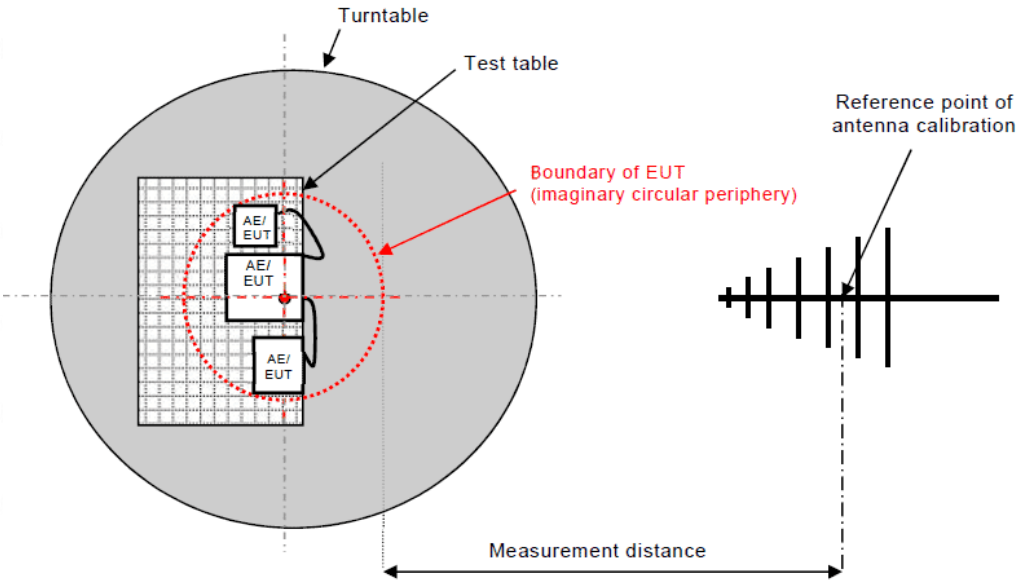
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1955	44.64	9.89	54.53	63.80	-9.27	QP	
2		0.5540	29.12	10.01	39.13	56.00	-16.87	QP	
3		0.6980	25.25	10.04	35.29	56.00	-20.71	QP	
4		1.7060	23.39	10.05	33.44	56.00	-22.56	QP	
5		4.8739	22.03	10.43	32.46	56.00	-23.54	QP	
6		16.4819	24.36	10.69	35.05	60.00	-24.95	QP	

Remark: Result=Reading +Factor
Over Limit=Result -Limit

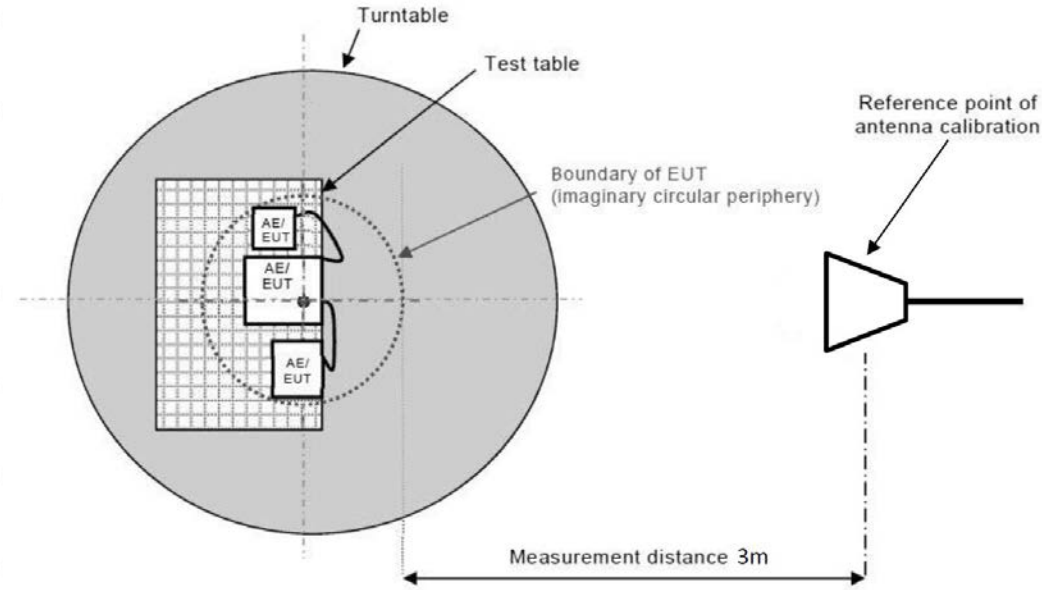
7. RADIATED EMISSIONS TEST

7.1 Block Diagram Of Test Setup

30MHz ~ 1GHz:



Above 1GHz:



7.2 Limits

Limits for radiated disturbance of Class B MME

Frequency (MHz)	Quasi-peak limits at 3m dB(μV/m)
30-230	40
230-1000	47

Frequency (GHz)	limit above 1G at 3m dB(μV/m)	
	Average	peak
1-3	50	70
3-6	54	74

Note: The lower limit shall apply at the transition frequencies.

7.3 Test Procedure

30MHz ~ 1GHz:

a. The Product was placed on the nonconductive turntable 0.8m above the ground in a semi anechoic chamber.

b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.

c. For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Above 1GHz:

a. The Product was placed on the non-conductive turntable 0.8m above the ground in a full anechoic chamber..

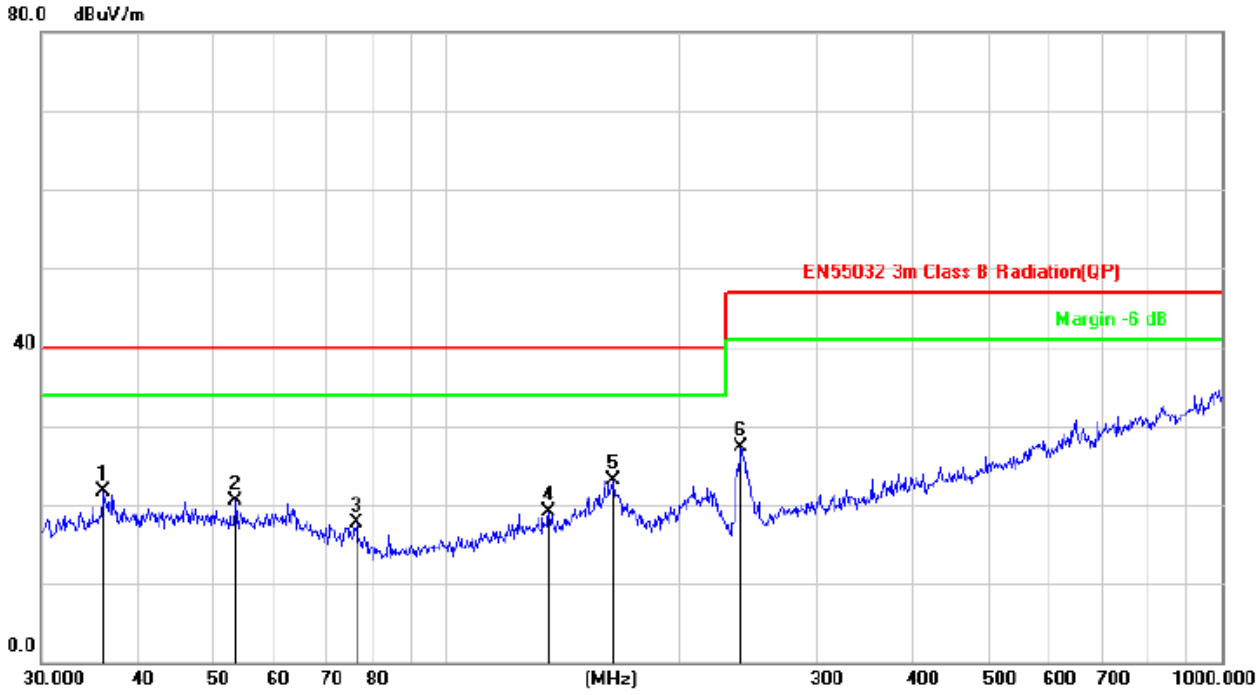
b. Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.

c. For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

7.4 Test Results

Below 1GHz

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Polarization :	Horizontal
Test Mode	1(the worst data)	Remark:	N/A



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		36.1272	28.74	-7.02	21.72	40.00	-18.28	peak			
2		53.5052	27.29	-6.82	20.47	40.00	-19.53	peak			
3		76.5121	27.87	-10.21	17.66	40.00	-22.34	peak			
4		135.5062	26.19	-7.15	19.04	40.00	-20.96	peak			
5	*	164.3301	29.24	-6.08	23.16	40.00	-16.84	peak			
6		239.9874	35.43	-8.16	27.27	47.00	-19.73	peak			

Remark: Result=Reading +Factor
Over Limit=Result -Limit

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Polarization :	Vertical
Test Mode	1(the worst data)	Remark:	N/A

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		31.8427	36.15	-7.54	28.61	40.00	-11.39	peak			
2	*	36.1272	43.56	-7.02	36.54	40.00	-3.46	peak			
3		46.0164	35.91	-6.64	29.27	40.00	-10.73	peak			
4		67.9129	37.53	-8.51	29.02	40.00	-10.98	peak			
5		74.3955	41.61	-9.77	31.84	40.00	-8.16	peak			
6		240.8304	30.56	-8.13	22.43	47.00	-24.57	peak			

Remark: Result=Reading +Factor
Over Limit=Result -Limit

Above 1GHz

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Polarization :	Horizontal
Test Mode	1(the worst data)	Remark:	N/A

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1965.06	45.48	1.51	46.99	70.00	-23.01	peak
2	1965.10	27.62	1.51	29.14	50.00	-20.86	AVG
3	3772.39	43.08	5.78	48.85	74.00	-25.15	peak
4	3772.42	25.50	5.78	31.28	54.00	-22.72	AVG
5	4839.22	42.34	9.56	51.90	74.00	-22.10	peak
6	4839.22	24.49	9.56	34.06	54.00	-19.94	AVG

Remark: Result=Reading +Factor
Over Limit=Result -Limit

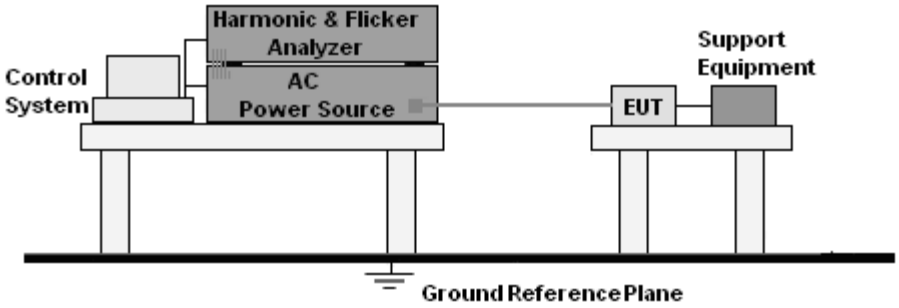
Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Polarization :	Vertical
Test Mode	1(the worst data)	Remark:	N/A

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1993.40	46.72	1.52	48.25	70.00	-21.75	peak
2	1993.44	28.82	1.52	30.35	50.00	-19.65	AVG
3	3806.38	45.92	5.87	51.79	74.00	-22.21	peak
4	3806.29	28.08	5.87	33.95	54.00	-20.05	AVG
5	4770.40	44.30	9.38	53.67	74.00	-20.33	peak
6	4770.41	26.13	9.38	35.51	54.00	-18.49	AVG

Remark: Result=Reading +Factor
Over Limit=Result -Limit

8. HARMONIC CURRENT EMISSION(H)

8.1 Block Diagram of Test Setup



8.2 Limit

EN 61000-3-2:2014 Clause 7.

8.3 Test Procedure

a. The Product was placed on the top of a non-conductive table above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

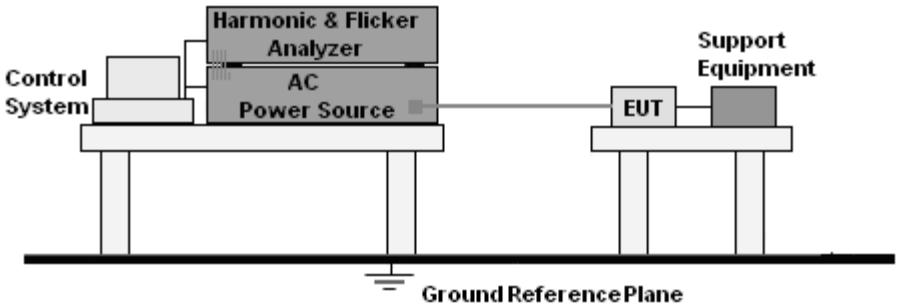
b. The correspondent test program of test instrument to measure the current harmonics emanated from Product was chosen. The measure time shall be not less than the time necessary for the Product to be exercised.8.4 Test Results

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Test Mode	1(the worst data)
Remark:	N/A	Test results	N/A

Remark: No limits apply for equipment with an active input power up to and including 75W.

9. VOLTAGE FLUCTUATIONS & FLICKER(F)

9.1 Block Diagram of Test Setup



9.2 Limit

EN 61000-3-3:2013 Clause 5.

9.3 Test Procedure

a. The Product was placed on the top of a non-conductive table above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

b. During the flick test, the measure time shall include that part of whole operation cycle in which the Product 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.

9.4 Test Results

Temperature:	25.6 ℃	Relative Humidity:	57.8%
Pressure:	101.6kPa	Test Mode	1(the worst data)
Remark:	N/A	Test results	PASS

Remark: Due to the maximum r.m.s input current (including inrush current) does not exceed 20A, and the supply current after inrush in within a variation band of 1.5A, it's not applicable to test the manual switching.
Since the EUT is working in steady state with very low supply current, it will not cause any fluctuations and flicker on the supply system. Considering this, no flicker and voltage fluctuation test had been performed on the EUT, and the EUT can be deemed to comply with the standard accordingly without testing.

10. IMMUNITY TEST OF GENERAL THE PERFORMANCE CRITERIA

Product Standard	ETSI EN 301 489-1
The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests. For the purpose of the present document two categories of performance criteria apply: • Performance criteria for continuous phenomena. • Performance criteria for transient phenomena. NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment.	
Performance criteria for continuous phenomena	During the test, the equipment shall: • continue to operate as intended; • not unintentionally transmit; • not unintentionally change its operating state; • not unintentionally change critical stored data.
Performance criteria for transient phenomena	For all ports and transient phenomena with the exception described below, the following applies: • The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data. • After application of the transient phenomena, the equipment shall operate as intended. For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies: • For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. • For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

According To EN 301489 -17standard, The General Performance Criteria As Following:

Criteria	During the test	After the 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 a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: no degradation of performance after the test is understood as any degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

PERFORMANCE FOR TT

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

PERFORMANCE FOR TR

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

PERFORMANCE FOR CT

The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an Acknowledgement (ACK) or Not Acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

PERFORMANCE FOR CR

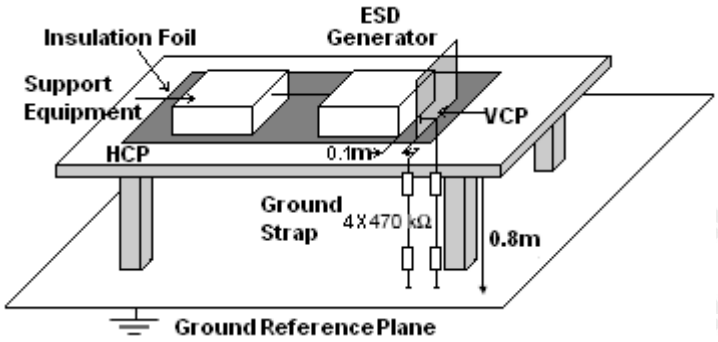
The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

11. ELECTROSTATIC DISCHARGE (ESD)

11.1 Test Specification

Test Port	:	Enclosure port
Discharge Impedance	:	330 ohm / 150 pF
Discharge Mode	:	Single Discharge
Discharge Period	:	one second between each discharge

11.2 Block Diagram of Test Setup



11.3 Test Procedure

a. Electrostatic discharges were applied only to those points and surfaces of the Product 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 Product.

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 Product as fast as possible (without causing mechanical damage) to touch the Product. After each discharge, the ESD generator was removed from the Product 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 Horizontal Coupling Plane at points on each side of the Product. The ESD generator was positioned vertically at a distance of 0.1 meters from the Product 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 Vertical Coupling Plane in sufficiently different positions that the four faces of the Product were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the Product.

.

11.4 Test Results

Temperature：	25 ℃	Relative Humidity：	45%
Pressure：	101.6kPa	Test Mode：	Mode1

Discharge Method	Discharge Position	Voltage (±kV)	Min. No. of Discharge per polarity (Each Point)	Performance Criterion
Contact Discharge	Conductive Surfaces	4	10	A
	Indirect Discharge HCP	4	10	A
	Indirect Discharge VCP	4	10	A
Air Discharge	Slots, Apertures, and Insulating Surfaces	8	10	A

Note: A: No performance degradation during test.
B: During the test, the EUT shut down, after the test, it reset by itself.
C: During the test, the EUT shut down, after the test, it reset by user.

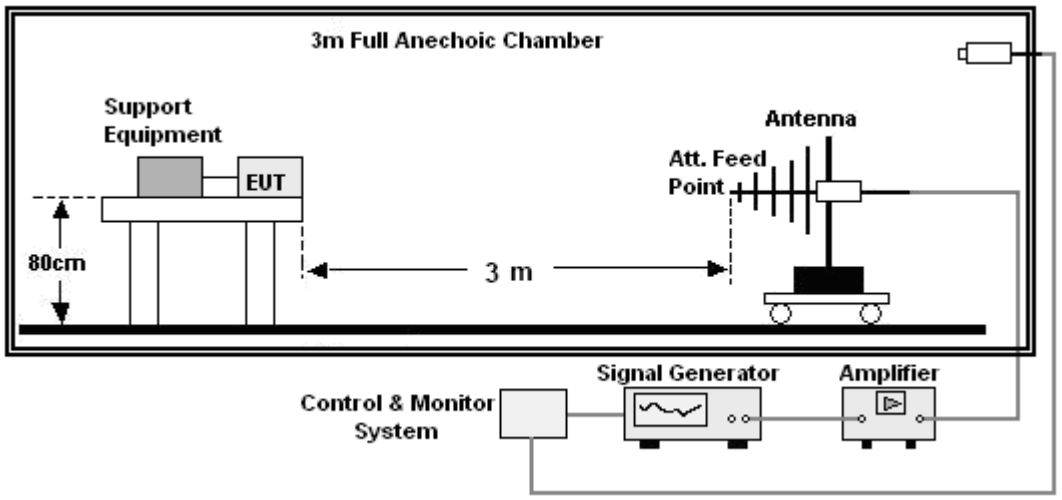
12. CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES(RS)

12.1 Test Specification

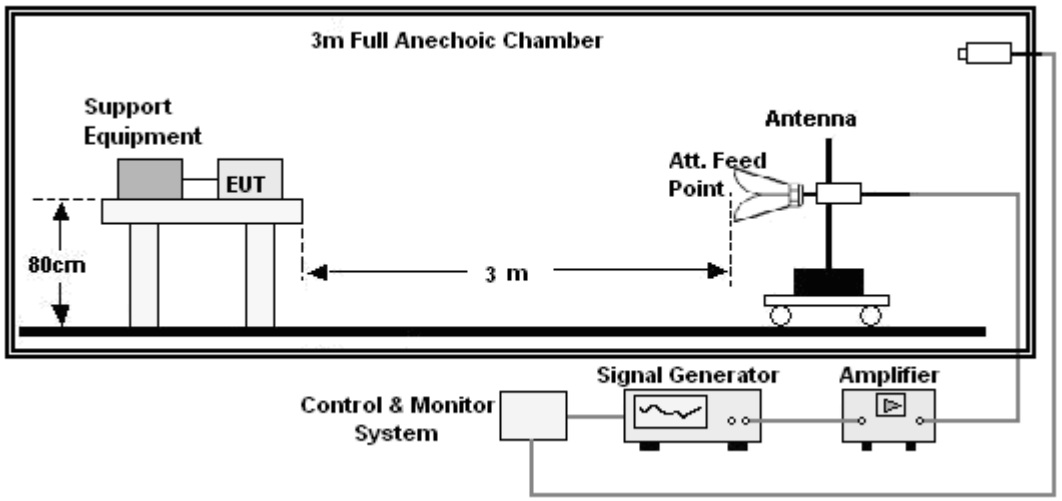
Test Port	:	Enclosure port
Step Size	:	1%
Modulation	:	1kHz, 80% AM
Dwell Time	:	1 second
Polarization	:	Horizontal & Vertical

12.2 Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:



12.3 Test Procedure

a. The testing was performed in a fully-anechoic chamber. The transmit antenna was located at a distance of 3 meters from the Product.

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

c. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond, but should not exceed 5 s at each of the frequencies during the scan.

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

e. For Broadcast reception function:Group 2 not apply in this test.

12.4 Test Results

Temperature：	25 ℃	Relative Humidity：	55%
Pressure：	101.6kPa	Test Mode：	Mode1

Frequency	Position	Field Strength (V/m)	Performance Criterion
80 - 6000MHz	Front, Right, Back, Left	3	A
Note: A: No performance degradation during test.			

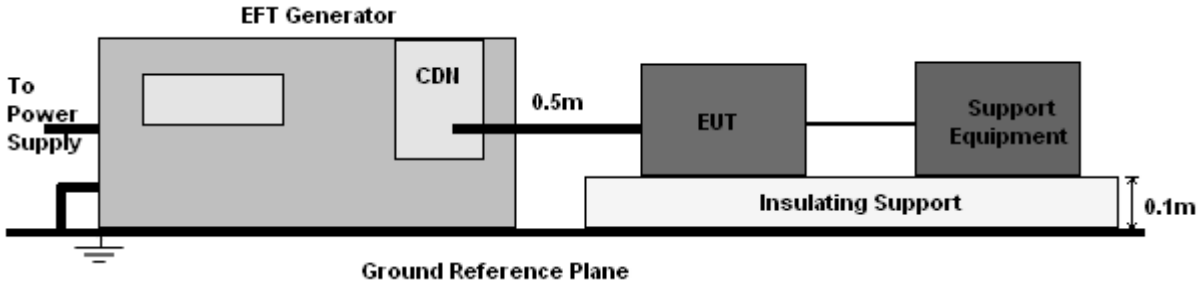
13. ELECTRICAL FAST TRANSIENTS/BURST (EFT)

13.1 Test Specification

Test Port	:	input a.c. power port
Impulse Frequency	:	5 kHz
Impulse Wave-shape	:	5/50 ns
Burst Duration	:	15 ms
Burst Period	:	300 ms
Test Duration	:	2 minutes per polarity

13.2 Block Diagram of EUT Test Setup

For input a.c. power port:



13.3 Test Procedure

a. The Product and support units were located on a non-conductive table above ground reference plane.

b. A 0.5m-long power cord was attached to Product during the test.

13.4 Test Results

Temperature：	25 ℃	Relative Humidity：	45%
Pressure：	101.6kPa	Test Mode：	Mode1

Coupling	Voltage (kV)	Polarity	Performance Criterion
AC MainsL-N	1.0	±	A
Signal Line	0.5	±	N/A
Telec Ports	0.5	±	N/A
DC Ports	0.5	±	N/A

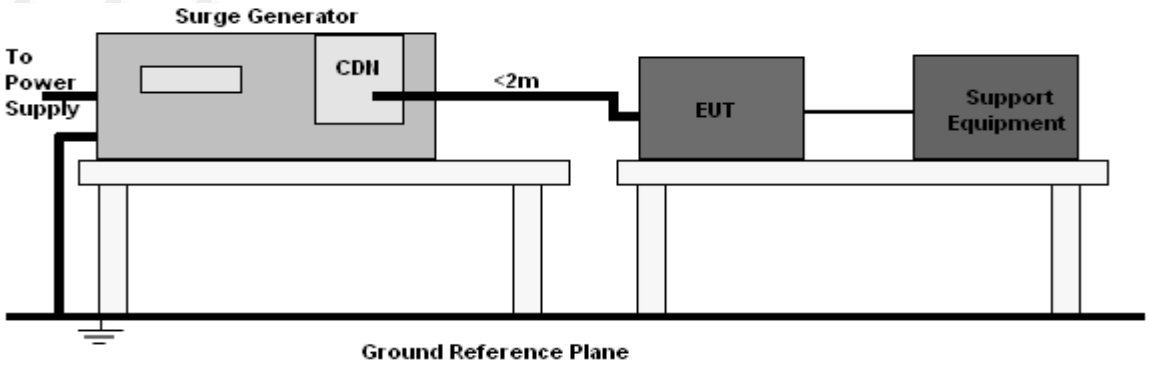
Note: A: No performance degradation during test.
B: During the test, the EUT shut down, after the test, it reset by itself.
C: During the test, the EUT shut down, after the test, it reset by user.

14. SURGES IMMUNITY TEST

14.1 Test Specification

Test Port	:	input a.c. power port
Wave-Shape	:	Open Circuit Voltage - 1.2 / 50 us Short Circuit Current - 8 / 20 us
Pulse Repetition Rate	:	1 pulse / min.
Phase Angle	:	0° / 90° / 180° / 270°
Test Events	:	5 pulses (positive & negative) for each polarity

14.2 Block Diagram of EUT Test Setup



14.3 Test Procedure

a. The surge is to be applied to the Product 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.

b. The power cord between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter). Interconnection line between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter).

14.4 Test Result

Temperature：	25 ℃	Relative Humidity：	45%
Pressure：	101.6kPa	Test Mode：	Mode1

Coupling Line	Voltage (kV)	Polarity	Performance Criterion
L - N	1	±	A
L - PE	2	±	A
N - PE	2	±	A
LAN Ports	±1	/	N/A

Note: A: No performance degradation during test.
B: During the test, the EUT shut down, after the test, it reset by itself.
C: During the test, the EUT shut down, after the test, it reset by user.

Remark: No test shall be required where normal functioning cannot be achieved because of the impact of the CDN on the Product.

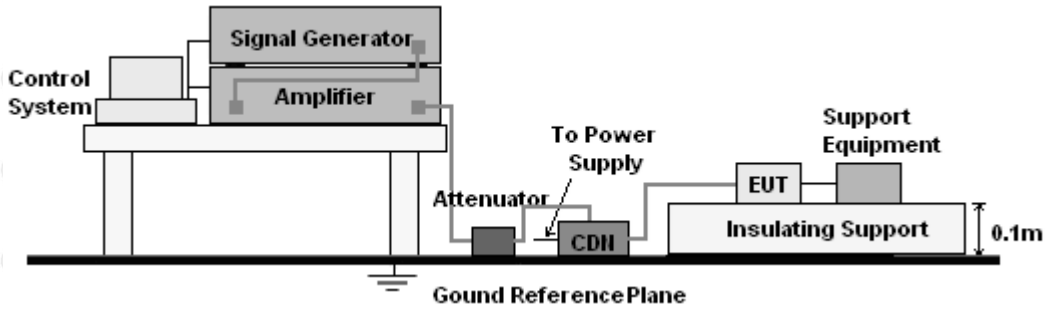
15. CONTINUOUS INDUCED RF DISTURBANCES (CS)

15.1 Test Specification

Test Port	:	input a.c. power port
Step Size	:	1%
Modulation	:	1kHz, 80% AM
Dwell Time	:	1 second

15.2 Block Diagram of EUT Test Setup

For input a.c. power port:



15.3 Test Procedure

For input a.c. power port:

a. The Product and support units were located at a ground reference plane with the interposition of a 0.1 m thickness insulating support and the CDN was located on GRP directly.

b. The frequency range is swept from 150 kHz to 10MHz, 10MHz to 30MHz, 30MHz to 80MHz with the signal 80% amplitude modulated with a 1 kHz sine wave, and the step size was 1% of fundamental.

c. The dwell time at each frequency shall be not less than the time necessary for the Product to be able to respond.

15.4 Test Result

Temperature：	25 ℃	Relative Humidity：	45%
Pressure：	101.6kPa	Test Mode：	Mode1

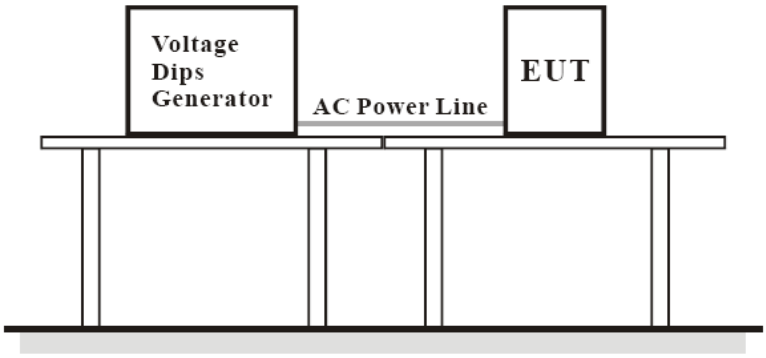
Inject Line	Frequency (MHz)	Voltage Level (V r.m.s.)	Performance Criterion
a.c. port	0.15 - 80	3	A
Signal Line	0.15 - 80	3	N/A
Telec Ports	0.15 - 80	3	N/A
DC Ports	0.15 - 80	3	N/A
Note: A: No performance degradation during test.			

16. VOLTAGE DIPS AND INTERRUPTIONS (DIPS)

16.1 Test Specification

Test Port	:	input a.c. power port
Phase Angle	:	0°, 180°
Test cycle	:	3 times

16.2 Block Diagram of EUT Test Setup



16.3 Test Procedure

a. The Product and support units were located on a non-conductive table above ground floor.

b. Set the parameter of tests and then perform the test software of test simulator.

c. Conditions changes to occur at 0 degree crossover point of the voltage waveform.

16.4 Test Result

Temperature：	25 ℃	Relative Humidity：	45%
Pressure：	101.6kPa	Test Mode：	Mode1

Voltage Dips:			
Test Level % U_T	**Voltage dips in % U_T**	**Duration (ms)**	**Performance Criterion**
0	100	10	A
0	100	20	A
70	30	500	A
Voltage Interruptions:			
0	100	5000	C

Note: A: No performance degradation during test.
B: During the test, the EUT shut down, after the test, it reset by itself.
C: During the test, the EUT shut down, after the test, it reset by user.

17. EUT PHOTOGRAPHS

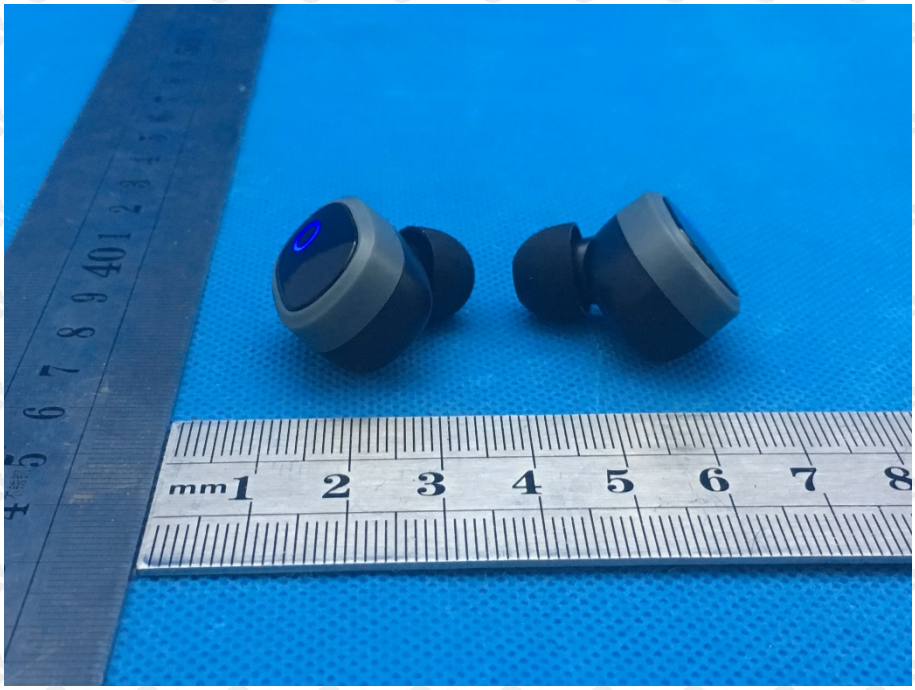
External Photos

EUT Photo 1

EUT Photo 2

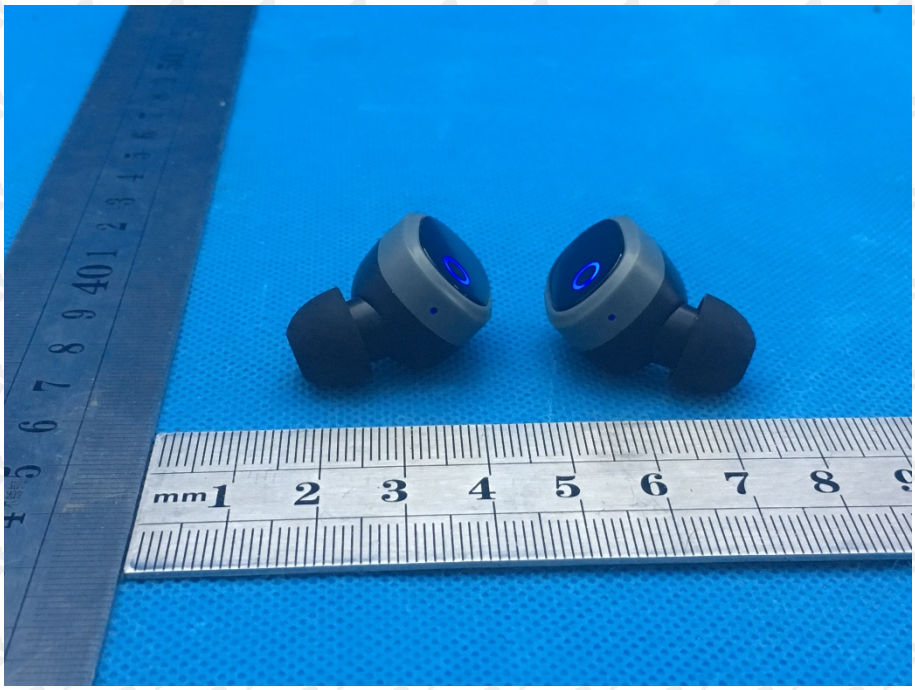
EUT Photo 3

EUT Photo 4



EUT Photo 5

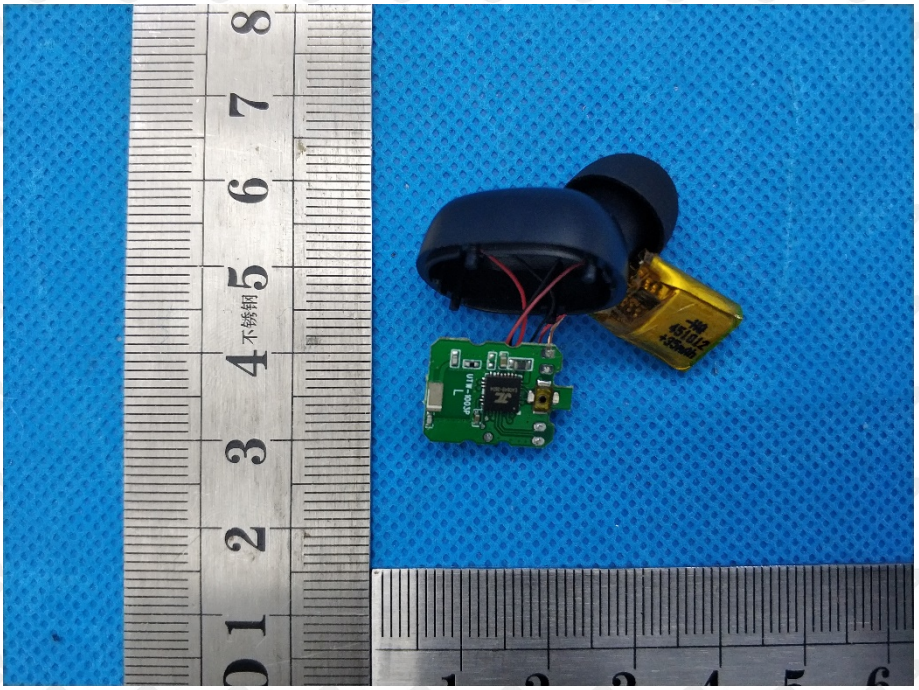
EUT Photo 6



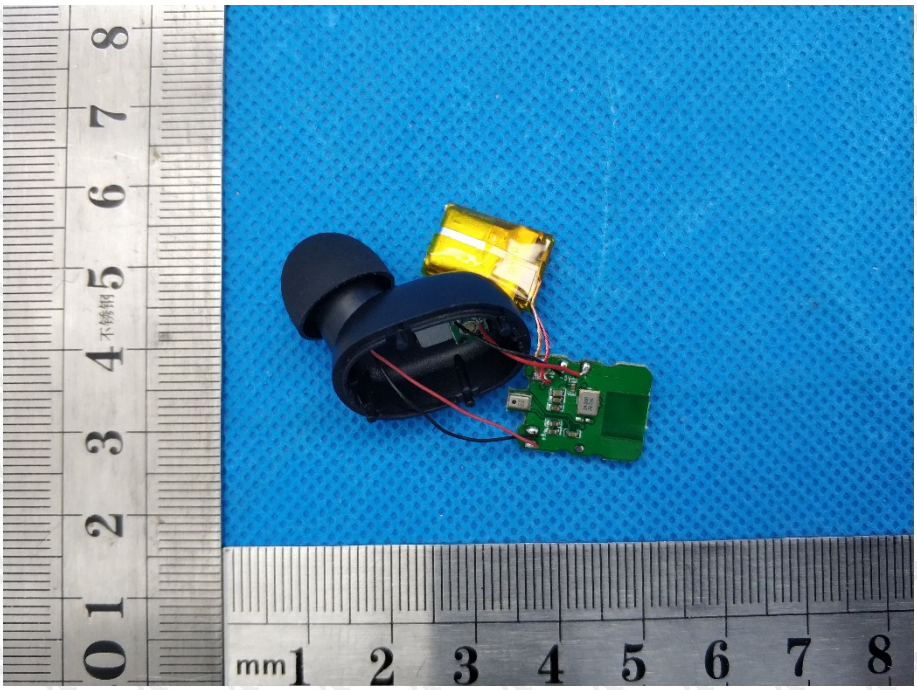
EUT Photo 7

Internal Photos

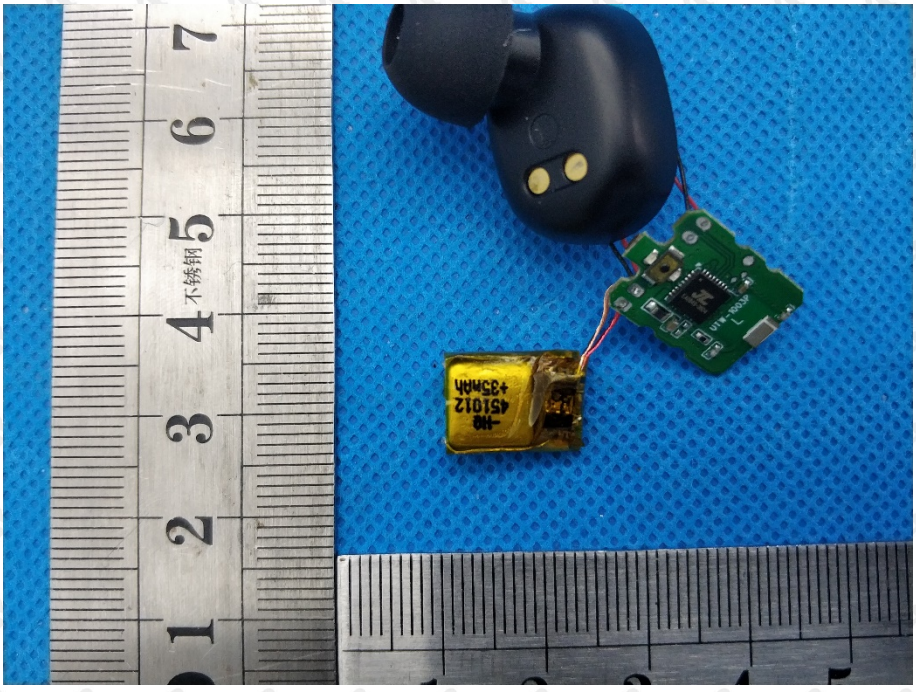
EUT Photo 1 left



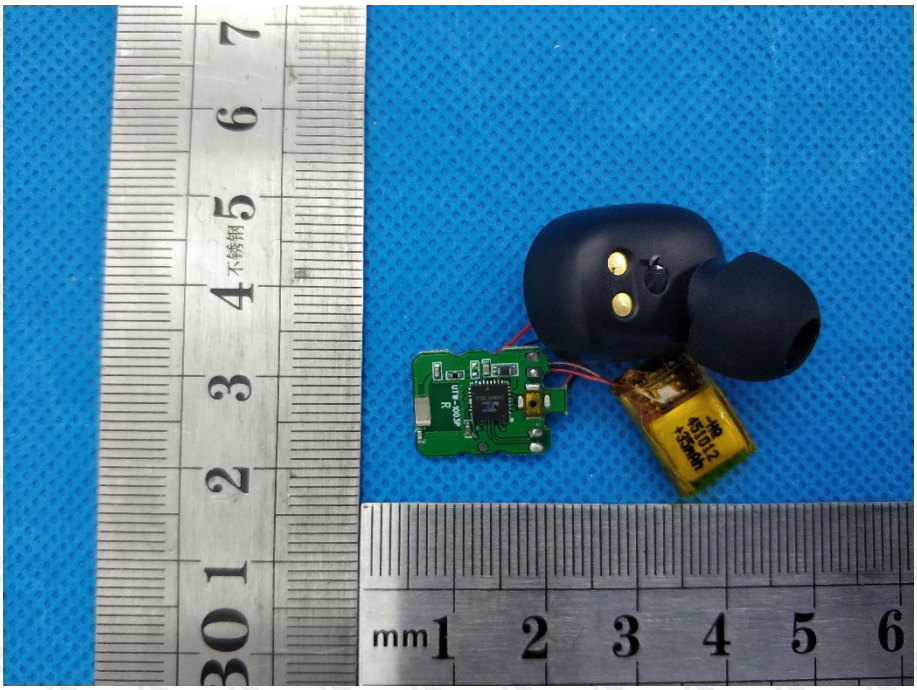
EUT Photo 2



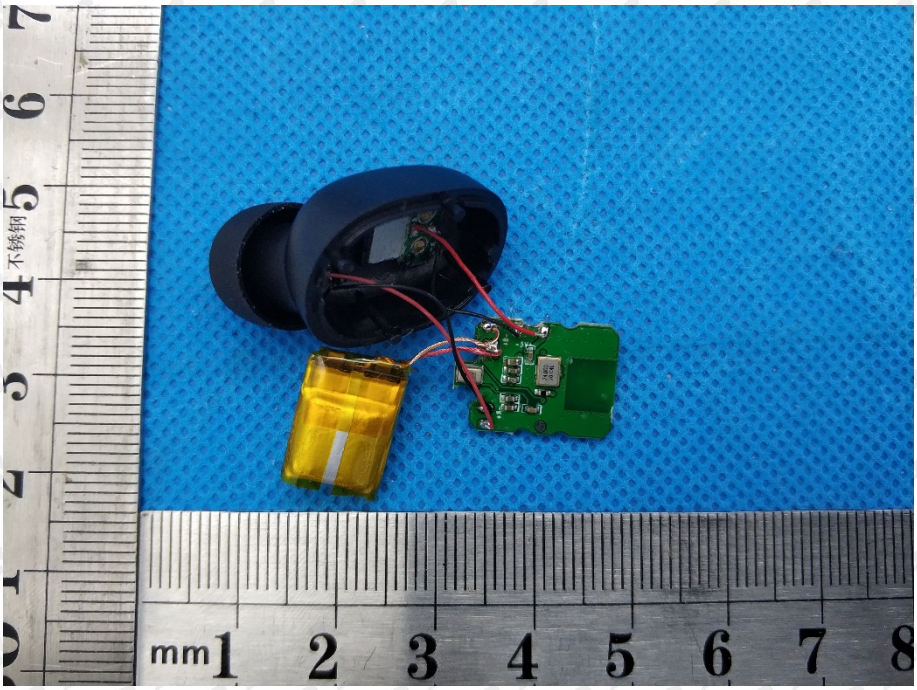
EUT Photo 3



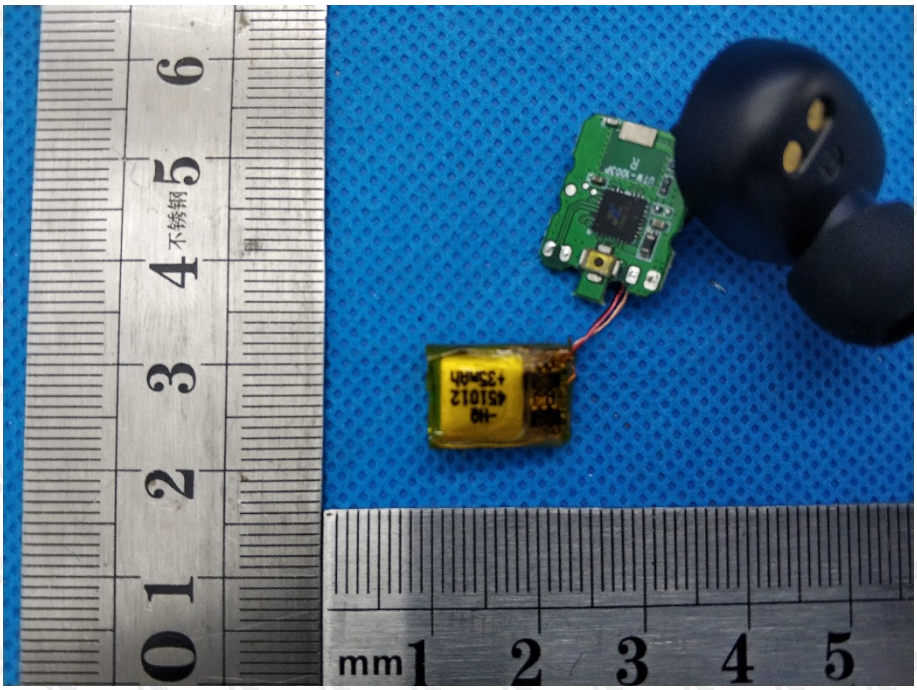
EUT Photo 4 right



EUT Photo 5



EUT Photo 6



18. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions

Radiated emissions below 1G

H/F

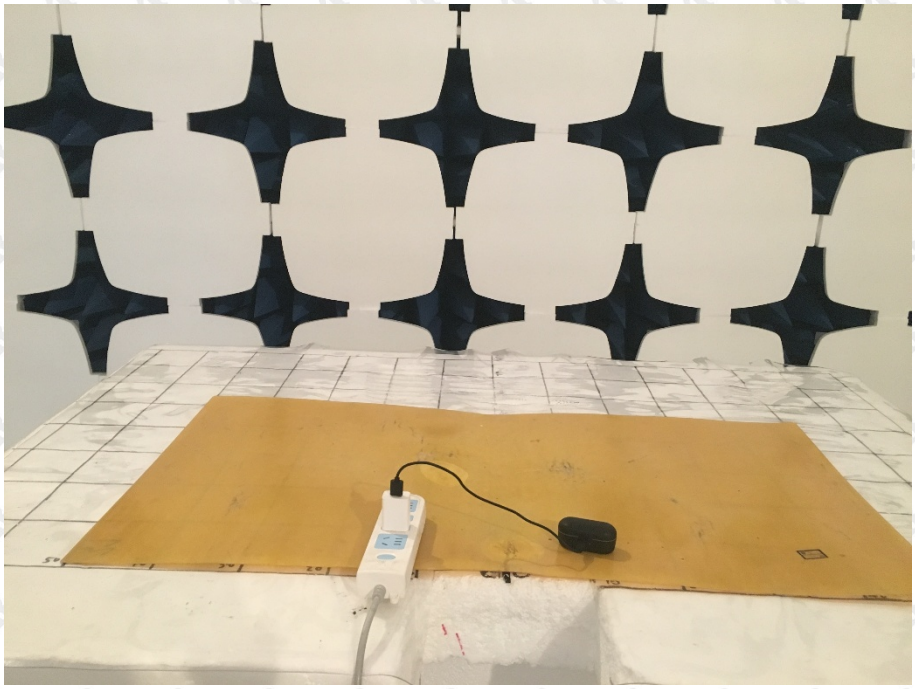
ESD

EFT

Surges

DIPS

RS



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