

TEST REPORT


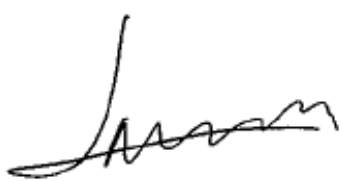
Applicant	Particle Industries, Inc
Address	126 Post St, 4th floor, San Francisco, CA 94108 USA

Manufacturer	Particle Industries, Inc	
Address	126 Post St, 4th floor, San Francisco, CA 94108 USA	
Product	Tracker One LTE CAT1/3G/2G	
Brand Name	Particle	
Model	ONE523M	
Additional Models & Model Difference	ONE524M, ONE523M-NB, ONE524M-NB, see section 2.1 note	
Date of tests	Aug. 18, 2020 ~ Oct. 28, 2020	

The submitted sample of the above equipment has been tested according to the requirements of the following standards:

- ☒ EN 55032:2015+A11:2020 CLASS B
- ☒ EN 55035:2017
- ☒ EN 301 489-1 V2.2.3 (2019-11)
- ☒ EN 301 489-3 V2.1.1 (2019-03)
- ☒ EN 301 489-17 V3.2.4 (2020-09)

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Breeze Jiang Senior Project Engineer / EMC Department	Approved by Madison Luo Assistant Manager / EMC Department
	

Date: Dec. 21, 2020

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RELEASE CONTROL RECORD

Issue No.	Description	Date Issued
CE2008WDG0083	Original release	Dec. 21, 2020



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

EMISSION			
Standard	Test Item	Result	Remarks
EN 55032:2015 + A11:2020, CLASS B	Conducted emission from the AC mains power port	PASS	Minimum passing Class B margin is -17.45dB at 0.55518MHz
	Radiated emission 30MHz-1000MHz	PASS	Minimum passing Class B margin is -9.59dB at 33.8317MHz
	Radiated emission 1GHz -6GHz	PASS	Minimum passing Class B margin is -13.60dB at 2451.00MHz.

IMMUNITY (EN 55035:2017)			
Standard	Test Type	Result	Remark
IEC 61000-4-2:2008 ED. 2.0	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A
IEC 61000-4-3:2010 ED. 3.2	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Meets the requirements

IMMUNITY (EN 301 489-1 V2.2.3, EN 301 489-3 V2.1.1, EN 301489-17 V3.2.4)			
Standard	Test Type	Result	Remarks
EN 61000-4-2:2009	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A
EN 61000-4-3:2006 A1:2008 + A2:2010	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-6000 MHz, 3V/m, 80% AM (1kHz), Performance Criterion A



1.1 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
Mains Terminal Disturbance Voltage Test	0.15MHz ~ 30MHz	+/-2.70 dB
Radiated Disturbance Test	30MHz ~ 1000MHz	+/-3.99 dB
	1GHz ~ 6GHz	+/-4.62 dB



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Tracker One LTE CAT1/3G/2G
BRAND	Particle
TEST MODEL	ONE523M
ADDITIONAL MODELS	ONE524M, ONE523M-NB, ONE524M-NB
POWER SUPPLY	LI+ pin: DC+3.6v--4.2V or Vusb PIN: DC+4.5V--5.5V or Vin PIN: DC 6V--30V
OPERATING FREQUENCY	2412MHz -2472MHz for WIFI, 2402MHz -2480MHz for BT, 13.56MHz for NFC receiving only
CABLE SUPPLIED	N/A

Note:

1. For the test results, the EUT had been tested with all conditions. But only the worst case was showed in test report.
2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
3. Please refer to the EUT photo document (Reference No.: 2008WDG0083) for detailed product photo.
4. Additional models ONE524M, ONE523M-NB, ONE524M-NB are identical with the test model ONE523M except the model number for marketing purpose.
5. The EUT has two version: V1.0 and V1.1, the V1.1 version sample based on V1.0 version sample added GPIO isolation and LDO, the difference has been considered during this test, full test V1.0 version sample, and partial test V1.1 version sample, test radiated emission and ESD.



2.2 DESCRIPTION OF TEST MODES

The EUT were tested under the following modes, the final worst mode was marked in boldface and recorded in this report.

◆ MAINS TERMINAL DISTURBANCE VOLTAGE TEST

Test Mode	Test Voltage	Test Sample
NFC Normal Working	DC 5V from Adapter Input AC230V 50Hz, DC 12V from Adapter Input AC230V 50Hz, DC 3.7V from Battery	V1.0 version
BT Link Normal Working		
WIFI Link Normal Working		

◆ FOR RADIATED EMISSIONS TEST(Below 1GHz):

Test Mode	Test Voltage	Test Sample
NFC Normal Working	DC 5V from Adapter Input AC230V 50Hz, DC 12V from Adapter Input AC230V 50Hz, DC 3.7V from Battery	V1.0 version, V1.1 version
BT Link Normal Working		
WIFI Link Normal Working		

◆ FOR RADIATED EMISSIONS TEST(Above 1GHz):

Test Mode	Test Voltage	Test Sample
BT Link Normal Working	DC 5V from Adapter Input AC230V 50Hz	V1.0 version
WIFI Link Normal Working		

◆ FOR ESD IMMUNITY TEST

Test Mode	Test Voltage	Test Sample
NFC Normal Working	DC 5V from Adapter Input AC230V 50Hz, DC 12V from Adapter Input AC230V 50Hz, DC 3.7V from Battery	V1.0 version, V1.1 version
BT Link Normal Working		
WIFI Link Normal Working		

◆ FOR RS IMMUNITY TEST

Test Mode	Test Voltage	Test Sample
NFC Normal Working	DC 5V from Adapter Input AC230V 50Hz, DC 12V from Adapter Input AC230V 50Hz, DC 3.7V from Battery	V1.0 version
BT Link Normal Working		
WIFI Link Normal Working		

2.3 TEST PROGRAM USED AND OPERATION DESCRIPTIONS

- a. Turned on the power of all equipment.
- b. EUT was operated according to the type described in manufacturer's specifications or the user's manual.

2.4 MISCELLANEOUS

➤ Affix CE marking

The marking must be placed visibly and legibly on the product or, if not possible due to the nature of the product, be affixed to the packaging and the accompanying document. The CE marking shall consist of the initials 'CE' taking the following form:



The various components of the CE marking must have the same vertical dimension, and may not be smaller than 5 mm. If the CE marking is reduced or enlarged, the proportions given in the graduated drawing above must be respected.

When the product is subject to other Directives covering other aspects and which also provide for the 'CE' marking, the accompanying documents must indicate that the product also conforms to those other Directives.

However, when one or more of those Directives allow the manufacturer, during a transitional period, to choose which arrangements to apply, the 'CE' marking has to indicate conformity only with the Directives applied by the manufacturer. In this case, the particularities of the Directives applied, as published in the Official Journal of the European Union, must be given in the documents, notices or instructions required by the Directives and accompanying such products.



2.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturers, the EUT must comply with the requirements of the following standards:

EN 55032:2015+A11:2020, CLASS B

EN 55035:2017

IEC 61000-4-2:2008 ED. 2.0

IEC 61000-4-3:2010 ED. 3.2

EN 301 489-1 V2.2.3 (2019-11)

EN 301 489-3 V2.1.1 (2019-03)

EN 301 489-17 V3.2.4 (2020-09)

EN 61000-4-2:2009

EN 61000-4-3:2006 + A1:2008 + A2:2010

All applicable tests have been performed and recorded as per the above standards.

The EUT is without AC input function and therefore the test items Harmonic, Flicker, EFT, Surge, CS and Dip were not tested.

The EUT haven't any components susceptible to magnetic fields, so don't test power-frequency magnetic field item.

2.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Adapter	N/A	DC 5V 2A	N/A	N/A
2	Mobile Phone	MI	HM 1W	9THYNBYL7H9THQU8	N/A
3	Iphone 4	APPLE	A1332	CP7P0NTT79X9TN1	N/A
4	iPhone 6s	Apple	ML7F2CH/A	C6KQKXLAGRY8	N/A
5	Notebook	DELL	Alienware 13 R2	GRWVL72	N/A
6	Adapter	PHICOMM	YH-AD-120A200-C H	N/A	N/A

NO.	DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	USB-C Line: Unshielded detachable 2.0m.
2~4	N/A
5	AC Line: Unshielded, Detachable 0.8m, DC Line: Unshielded, Non-detachable 1.5m.
6	DC Line: Unshielded detachable 2.0m.



3 CONDUCTED EMISSION FROM THE AC MAINS POWER PORT

3.1 LIMITS

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.

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

3.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Mar. 17,21
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 17,21
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Mar. 17,21
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Sep. 23,21
Test software	ADT	ADT_Conc_V7.3.7	N/A	N/A

NOTES: 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.

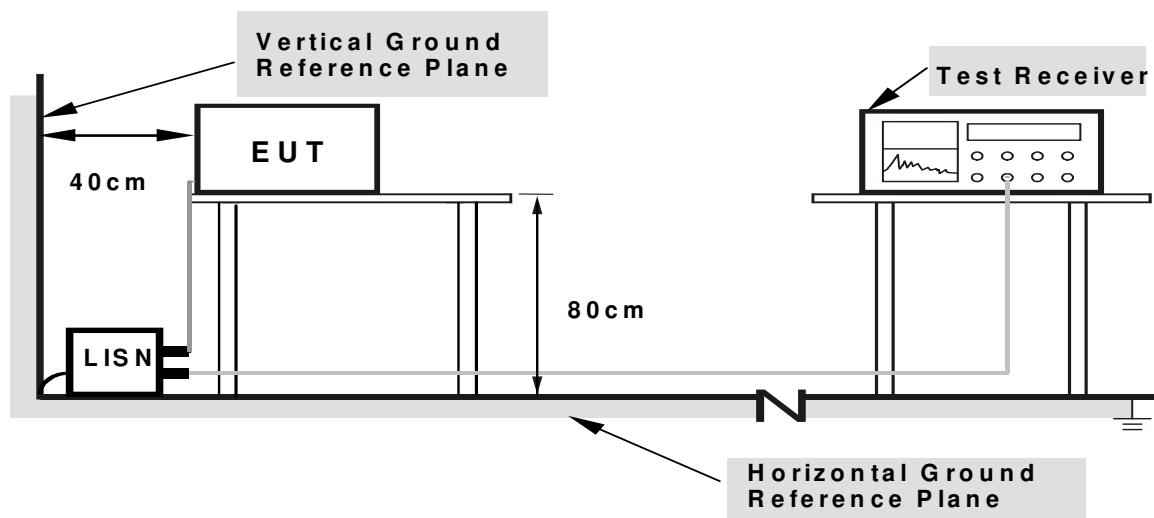
2. The test was performed at Shielded Room 553.

3.3 TEST ARRANGEMENT

- 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.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

3.4 TEST SETUP



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

3.5 SUPPLEMENTARY INFORMATION

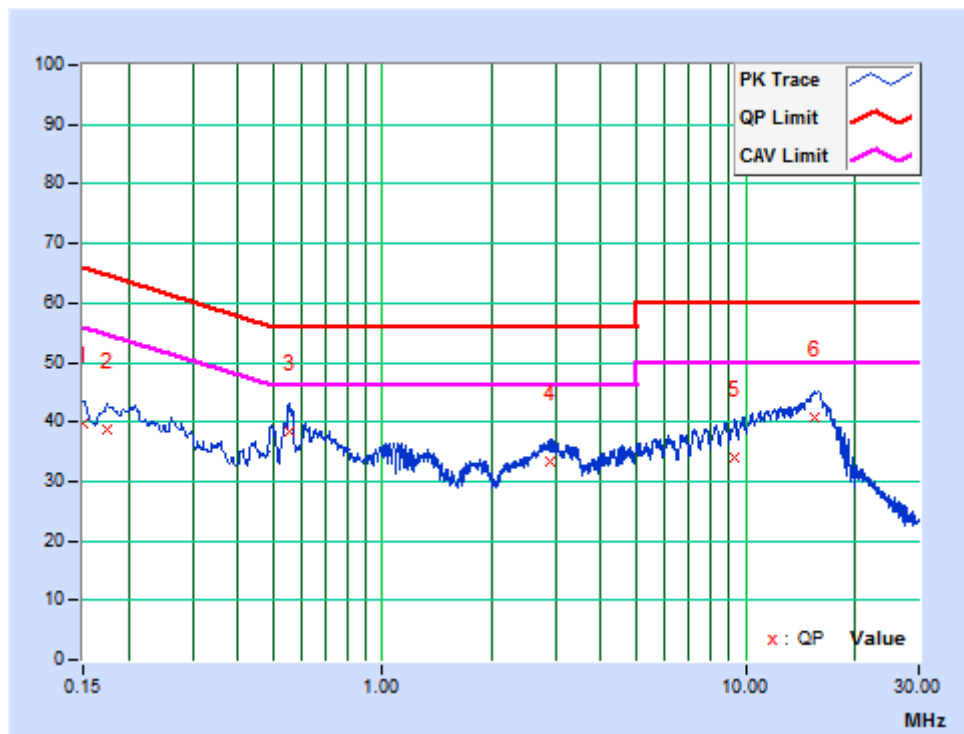
N/A



3.6 TEST RESULTS

TEST MODE			See section 2.2							
TEST VOLTAGE			See section 2.2			6dB BANDWIDTH		9 kHz		
ENVIRONMENTAL CONDITIONS			25 deg. C, 50% RH			TESTED BY: Ming Bai				
PHASE OF POWER: LINE (L)										
No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB(uV)]		[dB(uV)]		[dB(uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.77	29.96	15.14	39.73	24.91	66.00	56.00	-26.27	-31.09
2	0.17466	9.77	29.04	15.13	38.81	24.90	64.74	54.74	-25.93	-29.84
3	0.55518	9.85	28.70	18.01	38.55	27.86	56.00	46.00	-17.45	-18.14
4	2.90175	9.86	23.31	17.30	33.17	27.16	56.00	46.00	-22.83	-18.84
5	9.32550	10.01	23.92	12.56	33.93	22.57	60.00	50.00	-26.07	-27.43
6	15.48150	10.13	30.65	19.98	40.78	30.11	60.00	50.00	-19.22	-19.89

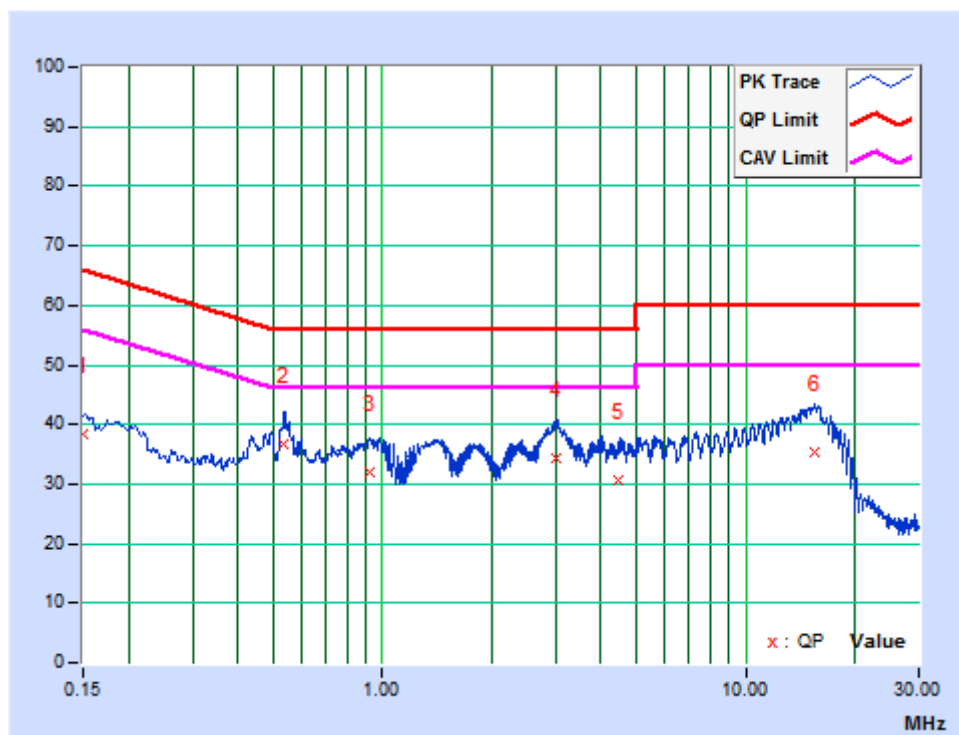
REMARK: The emission levels of other frequencies were very low against the limit.





TEST MODE			See section 2.2							
TEST VOLTAGE			See section 2.2				6dB BANDWIDTH		9 kHz	
ENVIRONMENTAL CONDITIONS			25 deg. C, 50% RH				TESTED BY: Ming Bai			
PHASE OF POWER: NEUTRAL (N)										
No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB(uV)]		[dB(uV)]		[dB(uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.70	28.59	14.57	38.29	24.27	66.00	56.00	-27.71	-31.73
2	0.53700	9.80	26.91	13.77	36.71	23.57	56.00	46.00	-19.29	-22.43
3	0.92171	9.77	22.16	12.51	31.93	22.28	56.00	46.00	-24.07	-23.72
4	2.99850	9.80	24.58	14.55	34.38	24.35	56.00	46.00	-21.62	-21.65
5	4.48184	9.82	20.81	12.71	30.63	22.53	56.00	46.00	-25.37	-23.47
6	15.50175	10.13	25.15	12.26	35.28	22.39	60.00	50.00	-24.72	-27.61

REMARK: The emission levels of other frequencies were very low against the limit.





4 RADIATED EMISSION MEASUREMENT

4.1 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 FM receivers

Distance (m)	Source	Frequency Range (MHz)	Limits dB (uV/m)	
			Quasi-peak	
10	Local oscillator	≤1000	Fundamental	50
		30 to 300	Harmonics	42
		300 to 1000	Harmonics	46
	Other	30 to 230		30
		230 to 1000		37
3	Local oscillator	≤1000	Fundamental	60
		30 to 300	Harmonics	52
		300 to 1000	Harmonics	56
	Other	30 to 230		40
		230 to 1000		47



FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	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

FOR FREQUENCY ABOVE 1000 MHz

FREQUENCY (GHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
1 to 3	76	56	70	50
3 to 6	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 emanation 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.



4.2 TEST INSTRUMENTS

FREQUENCY RANGE BELOW 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU26	100005	May 19, 21
EMI Test Receiver	Rohde&Schwarz	ESR7	101564	Mar. 17,21
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-555	Nov. 23, 20
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-554	Nov. 30, 20
Preamplifier	EMCI	EMC1135	980378	Mar. 14,21
Preamplifier	EMCI	EMC1135	980423	Mar. 14,21
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8.8m	NSEMC006	Oct. 18,21
Test Software	ADT	ADT_Radiated_V8.7.07	N/A	N/A

NOTES: 1. The test was performed in 10m Chamber.

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.

FREQUENCY RANGE ABOVE 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Horn Antenna	ETS-Lindgren	3117	00085519	Nov. 23, 20
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170147	Jun. 22,21
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101003	Mar. 17,21
Broadband Preamplifier (1~18GHz)	SCHWARZBECK	BBV9718	266	Apr. 20,21
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Mar. 03,21
Test Software	ADT	ADT_Radiated_V8.7.07	N/A	N/A

NOTES: 1. The test was performed in 10m Chamber.

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.



4.3 TEST PROCEDURE

<Frequency Range below 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 10 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>

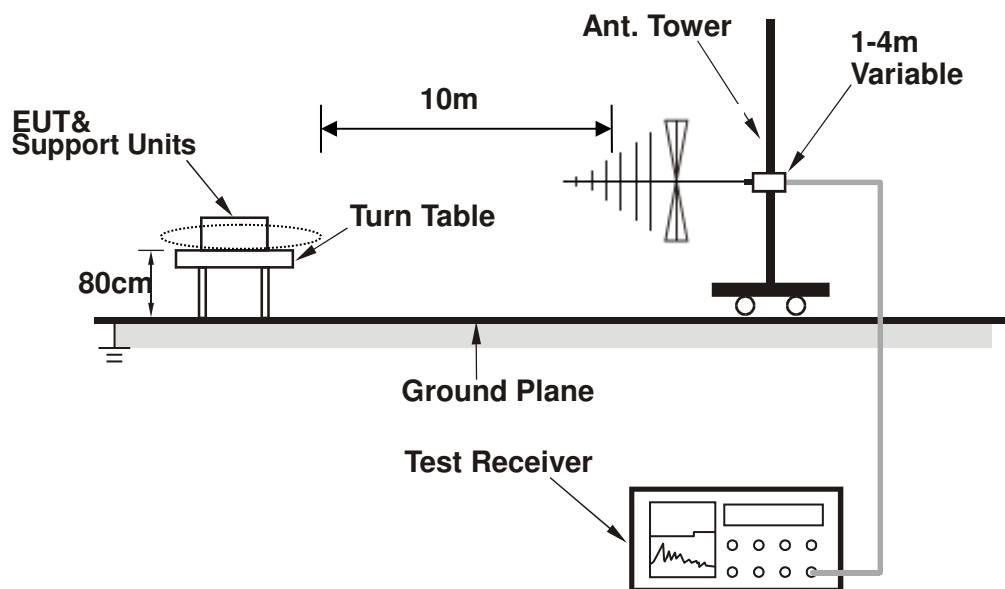
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna can be varied from one meter-to four 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.
- 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 1 GHz.

NOTE:

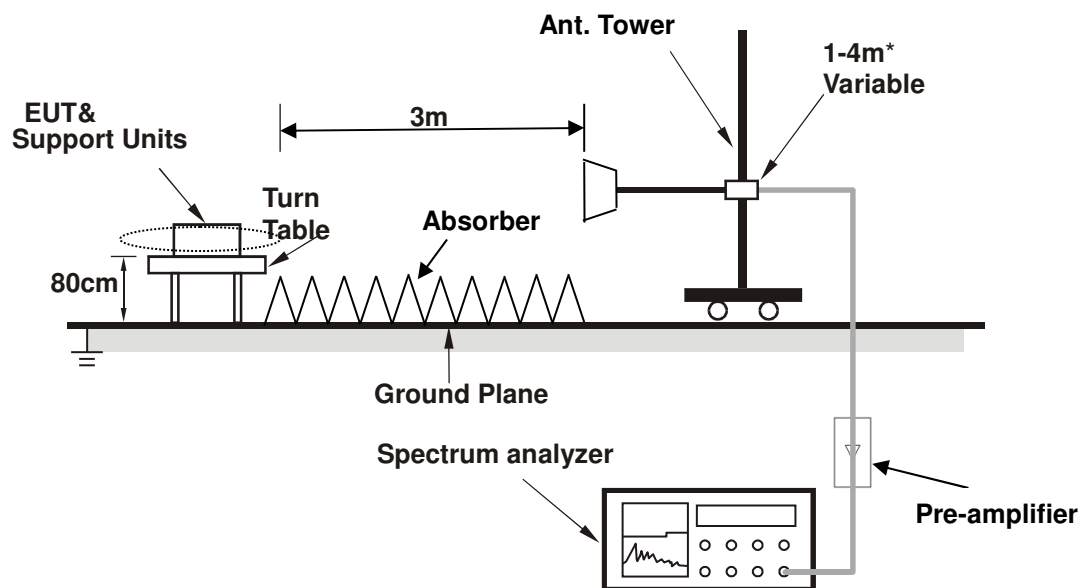
1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
2. For measurement of frequency above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

4.4 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.5 SUPPLEMENTARY INFORMATION

The more stringent measurement method of paragraph 8.3.2 in ANSI C63.4:2014 was applied for the test.

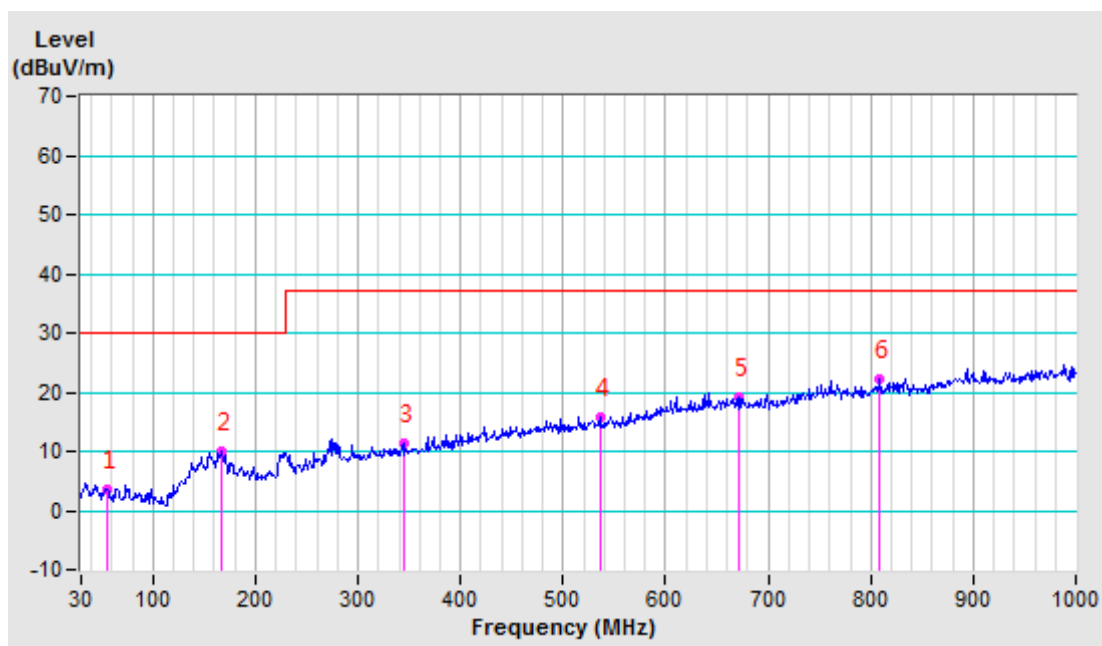


4.6 TEST RESULTS (BELOW 1GHz)

TEST MODE	See section 2.2	FREQUENCY RANGE	30-1000MHz
TEST VOLTAGE	See section 2.2	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	25.0deg. C, 59.0% RH	TESTED BY: Jelly	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 10 M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	56.19000	-26.57	30.28	3.71	30.00	-26.29	400	6
2	166.4062	-21.70	31.82	10.12	30.00	-19.88	400	227
3	344.6438	-19.06	30.42	11.36	37.00	-25.64	200	80
4	535.9763	-14.22	29.96	15.74	37.00	-21.26	200	252
5	670.5638	-10.71	29.78	19.07	37.00	-17.93	200	32
6	808.0612	-8.00	30.25	22.25	37.00	-14.75	400	208

REMARK: The emission levels of other frequencies were very low against the limit.



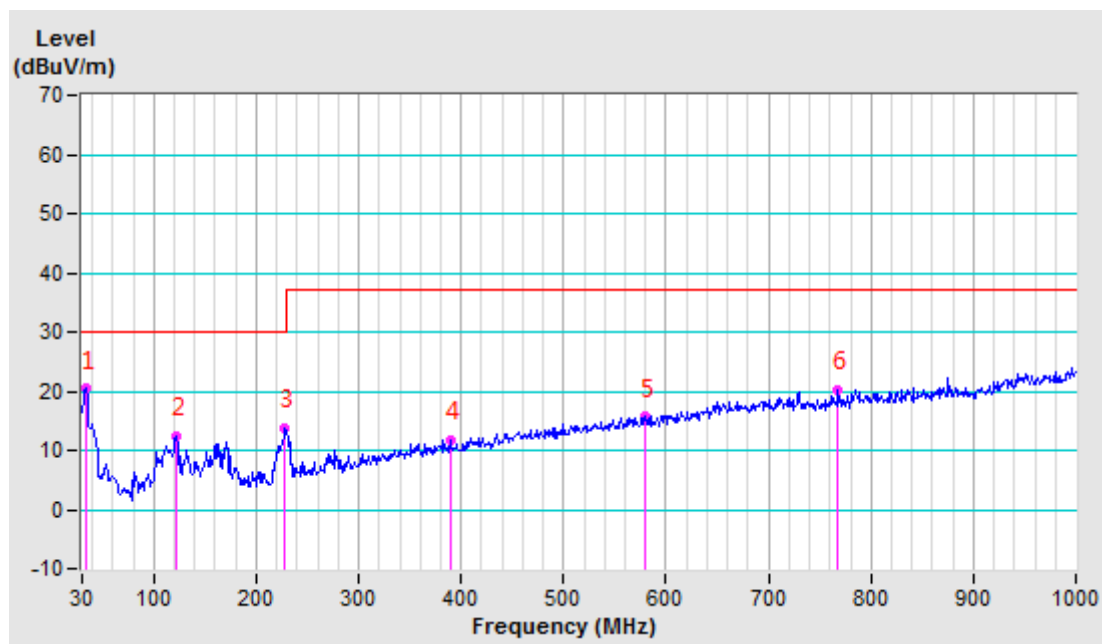


TEST MODE	See section 2.2	FREQUENCY RANGE	30-1000MHz
TEST VOLTAGE	See section 2.2	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	25.0deg. C, 59.0% RH	TESTED BY: Jelly	

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 10 M

No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	33.8317	-23.46	43.87	20.41	30.00	-9.59	100	177
2	122.2516	-23.74	36.19	12.45	30.00	-17.55	100	83
3	228.2779	-23.19	36.91	13.72	30.00	-16.28	100	252
4	389.2575	-17.68	29.44	11.76	37.00	-25.24	100	116
5	579.484	-12.98	28.60	15.62	37.00	-21.38	300	170
6	768.0129	-9.47	29.60	20.13	37.00	-16.87	100	230

REMARK: The emission levels of other frequencies were very low against the limit.



**4.7 TEST RESULTS (ABOVE 1GHz)**

TEST MODE	See section 2.2		
TEST VOLTAGE	See section 2.2	FREQUENCY RANGE	1-6 GHz
ENVIRONMENTAL CONDITIONS	25.0deg. C, 59.0% RH	TESTED BY: Jelly	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	1856.00PK	3.92	40.18	44.10	70.00	-25.90	200	341
2	1856.00AV	3.92	32.28	36.20	50.00	-13.80	200	341
3	3642.00PK	6.20	39.90	46.10	74.00	-27.90	300	262
4	3642.00AV	6.20	30.40	36.60	54.00	-17.40	300	262
5	5364.00PK	9.21	37.39	46.60	74.00	-27.40	300	257
6	5364.00AV	9.21	25.59	34.80	54.00	-19.20	300	257
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	2451.00PK	5.65	39.55	45.20	70.00	-24.80	100	147
2	2451.00AV	5.65	30.75	36.40	50.00	-13.60	100	147
3	4162.00PK	7.03	40.17	47.20	74.00	-26.80	100	265
4	4162.00AV	7.03	26.77	33.80	54.00	-20.20	100	265
5	5385.00PK	9.25	35.35	44.60	74.00	-29.40	200	221
6	5385.00AV	9.25	26.45	35.70	54.00	-18.30	200	221

- REMARK:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 6GHz.
 4. Only emissions significantly above equipment noise floor are reported.



5 IMMUNITY TEST

5.1 GENERAL DESCRIPTION

5.1.1 GENERAL DESCRIPTION OF EN 55035

Product Standard	EN 55035:2017	
Basic Standard, specification requirement, and Performance Criteria:	IEC 61000-4-2	Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion B
	IEC 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-1000 MHz, 3V/m, 80% AM (1kHz), 1800 MHz,3V/m, 80% AM (1kHz), 2600 MHz,3V/m, 80% AM (1kHz), 3500 MHz,3V/m, 80% AM (1kHz), 5000 MHz,3V/m, 80% AM (1kHz)

Product Standard	EN 301 489-1 V2.2.3 (2019-11) EN 301 489-3 V2.1.1 (2019-03) EN 301 489-17 V3.2.4 (2020-09)	
Basic Standard, Specification, and Performance Criterion required	EN 61000-4-2	Electrostatic Discharge – ESD: 8 kV air discharge, 4 kV contact discharge, Performance Criterion B
	EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~ 6000 MHz, 3 V/m, 80% AM (1 kHz), Performance Criterion A



5.1.2 PERFORMANCE CRITERIA

According to Clause 8.2, 8.3, 8.4 of EN55035:2017 standard, the following describes the general performance criteria.

CRITERION A	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
	For audio output device: The measured acoustic interference ratio and/or the measured electrical interference during the test shall be -20dB or better(see note1)
CRITERION B	<p>During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.</p> <p>After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.</p> <p>If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.</p>
CRITERION C	<p>Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.</p> <p>Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</p>

Note 1: This performance criterion only using for Continuous induced RF disturbances and Continuous RF electromagnetic field disturbances item.



Modified test levels for performance criterion A for the broadcast reception function:

Performance criteria	Test Item	Group 1	Group 2
A	RS	The disturbance level is reduced to 1V/m for in-band frequencies	No test requirements apply
A	CS	The disturbance level is reduced to 1V/m for in-band frequencies	

Note: 1. In-band is defined as the entire tuneable operating range of the selected broadcast reception function.

2. The tuned channel $\pm 0,5$ MHz (lower edge frequency – 0,5 MHz up to the upper edge frequency + 0,5 MHz of the tuned channel) is excluded from testing.

3. Group 1: Equipment in which the desired RF broadcast signal enters the equipment through a coaxial broadcast receiver tuner port. These coaxial ports are intended to be connected via a coaxial cable to an antenna or a cable distribution system.

4. Group 2: Broadcast reception equipment which is not included in Group 1.

For EN 301 489-3

The phenomena allowed during and after test in each criterion are clearly stated in the following table.

Performance criteria		
Criteria	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 Loss of function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions

**For EN 301 489-17**

The performance criteria		
Performance criteria A for immunity tests with phenomena of a continuous nature	continuous phenomena	1. Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test. 2. Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test
Performance criteria B for immunity tests with phenomena of a transient nature	Transient phenomena	1. Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test 2. Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test
Performance criteria C for immunity tests with power interruptions exceeding a certain time	Transient phenomena	Voltage dips greater than or equal to 100 ms and voltage interruptions of 5000 ms duration, for which performance criteria C shall apply

The phenomena allowed during and after test in each criterion are clearly stated in the following table.

Performance criteria		
Criteria	During test	After test
A	Shall operate as intended. (see note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of stored data.
B	May show loss of function	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.
NOTE: Operate as intended during the test allows a level of degradation in accordance with a and b. (a) For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %. (b) For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.		

5.1.3 EUT OPERATING CONDITION

Same as item 2.3



5.2 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD) (EN 55035, EN 301489)

5.2.1 TEST SPECIFICATION

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

5.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
ESD Generator	TESEQ	NSG 437	279	Mar. 05,21
Test Software	TESEQ	V03.03	N/A	N/A
ESD Generator	EM TEST	Dito	V1211112265	Nov. 29,20
Test Software	EM TEST	V 2.31	N/A	N/A

- NOTES:** 1. The test was performed in ESD 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.



5.2.3 TEST PROCEDURE

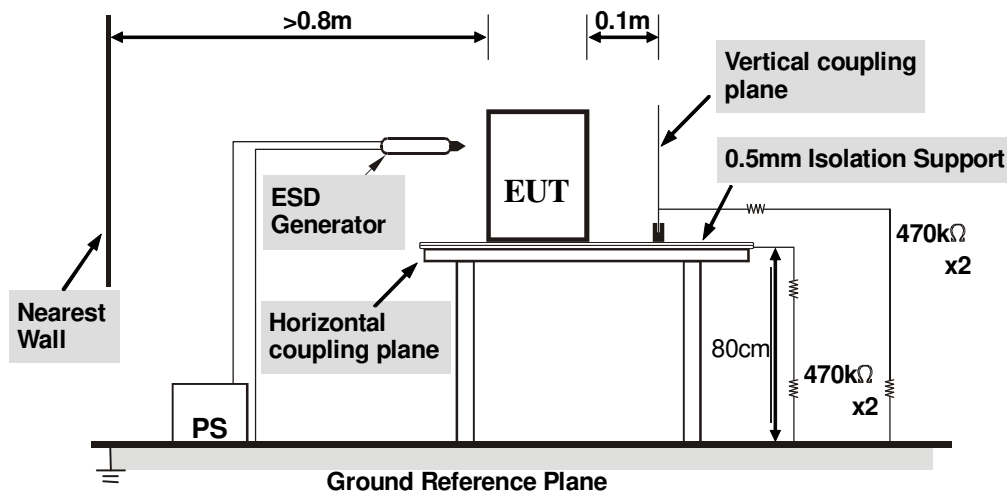
The basic test procedure was in accordance with IEC 61000-4-2:

- 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 discharge return cable of the generator shall be kept at a distance of at least 0.2 m from the EUT whilst the discharge is being applied and should not be held by the operator.
- 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 Horizontal Coupling Plane 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 Vertical Coupling Plane 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.

5.2.4 DEVIATION FROM TEST STANDARD

No deviation.

5.2.5 TEST SETUP



NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **Horizontal Coupling Plane** (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 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 0.8-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

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

**5.2.6 TEST RESULTS**

TEST VOLTAGE	See section 2.2	ENVIRONMENTAL CONDITIONS	25.3deg. C, 49.7% RH, 100.2kPa
TESTED BY	Stalker		

Direct Discharge Application				
Test Level (kV)	Polarity	Test Point	Test Result of Contact Discharge	Test Result of Air Discharge
4	+ /-	All metal part	A	N/A
8	+ /-	Other non-metal Part	N/A	A

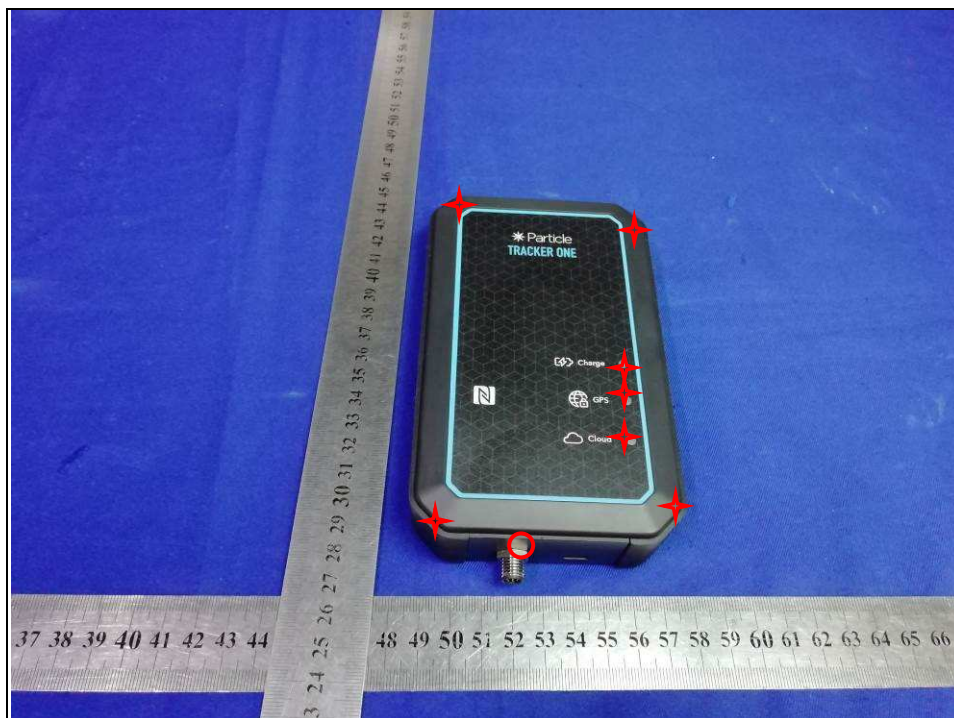
Indirect Discharge Application				
Discharge Level (kV)	Polarity	Test Point	Test Result of HCP	Test Result of VCP
4	+ /-	HCP	A	N/A
4	+ /-	VCP	N/A	A

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



ESD TEST POINT

(○ - Direct Contact Discharge; ✦ - Air Discharge)





5.3 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS) (EN55035)

5.3.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-3
Frequency Range:	80-1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	at least 3 seconds

5.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Signal Generator	Agilent	N5181A	MY50142530	Sep. 04,21
Antenna Log-Periodic	AR	ATR80M6G	0337307	N/A
Antenna Log-Periodic	AR	ATS700M11G	0336821	N/A
Switch Controller	AR	SC1000	0337343	N/A
RF Power Meter	Boonton	4242	13984	Sep. 04,21
Power Sensor	Boonton	51011EMC	35716	Sep. 04,21
Power Sensor	Boonton	51011EMC	35715	Sep. 04,21
E-Field probe	Narda	NBM-520	2403/01B	Dec. 23,20
Power Amplifier	TESEQ	CBA 1G-150	T44029	N/A
Power Amplifier	TESEQ	CBA 3G-100	T44030	N/A
Power Amplifier	TESEQ	CBA 6G-050	1041204	N/A
Dual Directional Coupler	TESEQ	C5982	95208	Sep. 04,21
Dual Directional Coupler	TESEQ	C6187	95175	Sep. 04,21
Dual Directional Coupler	TESEQ	CPH-274F	M251304-01	Sep. 04,21
Audio analyzer	Rohde&Schwarz	UPV	101397	Sep. 04,21
Conditioning Amplifier	B&K	2690A0S2	2437856	Oct. 17,21
EAR SIMULATOR	B&K	4192	2764719	May 09,21
Test Software	Tonscend	TS+	2.0.1.8	N/A
Test Software	ADT	BVADT_RS_V7.6.4-DG	N/A	N/A

- NOTES:**
1. The test was performed in RS chamber.
 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

The test procedure was in accordance with IEC 61000-4-3

- a. The testing was performed in a fully-anechoic chamber.
- b. The frequency range is swept from 80 MHz to 1000 MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz, with the signal 80% amplitude modulated with a 1kHz 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 levels were 3V/m.
- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

For Broadcast reception function:

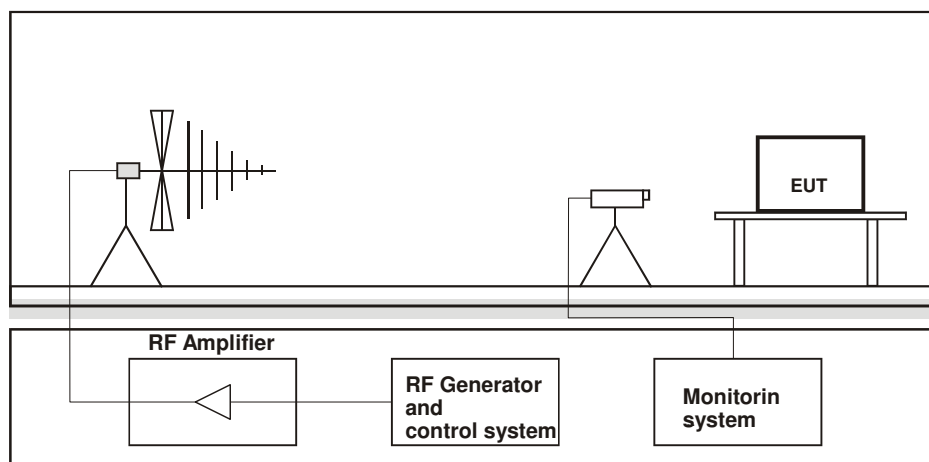
- f. **Group1:** Equipment in which the desired RF broadcast signal enters the equipment through a coaxial broadcast receiver tuner port. These coaxial ports are intended to be connected via a coaxial cable to an antenna or a cable distribution system.
- g. **Group 2:** Broadcast reception equipment which is not included in Group 1.
- h. AM/FM/DAB equipment with a coaxial broadcast receiver tuner port is classified as Group 2 equipment if the manufacturer declares that the equipment is not intended to be connected to a CATV or other cable distribution network.
- i. The broadcast reception function shall be tested in each reception mode for which the receiver is designed, for example analogue reception, DVB-T, DVB-T2, DVB-C, DVB-C2, DVB-S, DVB-S2. The receiver shall be tuned to one channel and provided with an appropriate wanted signal on that channel or other input typical of normal use.

5.3.4 DEVIATION FROM TEST STANDARD

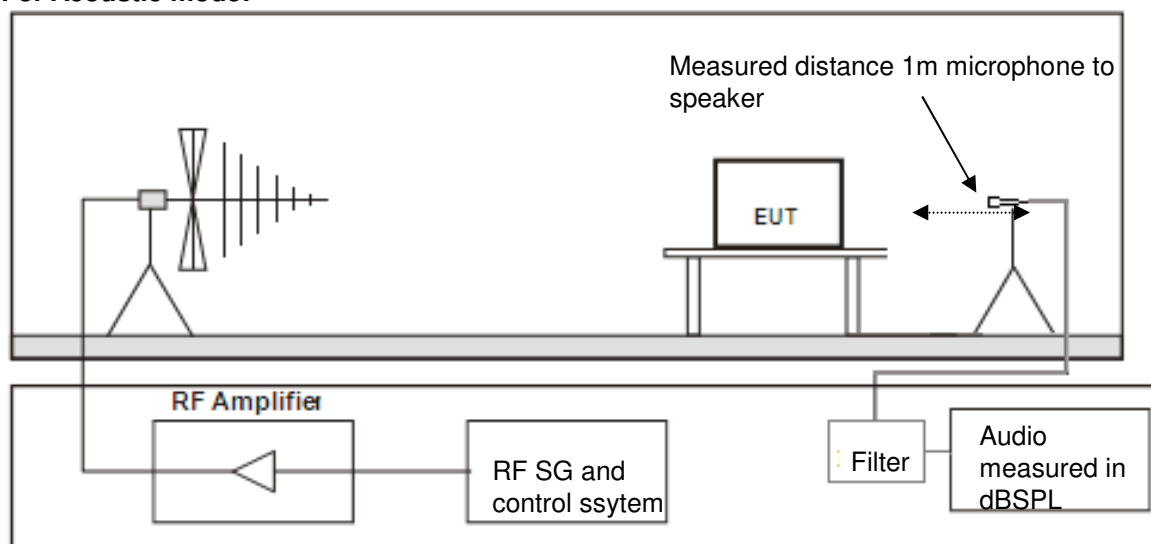
No deviation.

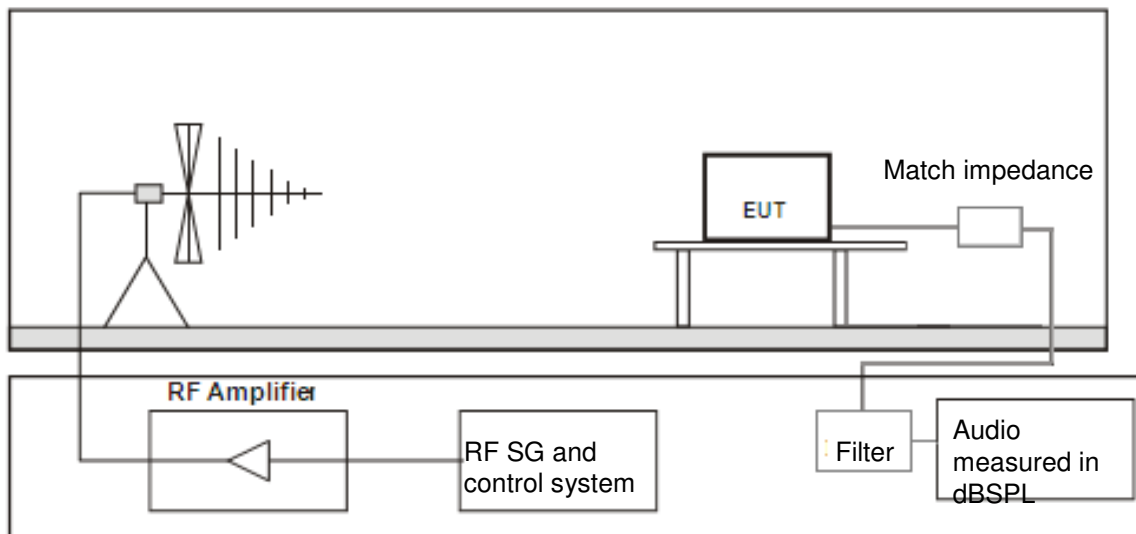
5.3.5 TEST SETUP

For Picture monitoring:



For Acoustic mode:



For Electrical mode:**NOTE:**

1. The EUT installed in a representative system as described in section 7 of IEC 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.
2. Filter: 1kHz 3dB band pass filter.
3. The measurement distance: EUT to interference antenna was 3m.

**5.3.6 TEST RESULTS**

TEST MODE	See section 2.2	TEST VOLTAGE	See section 2.2
ENVIRONMENTAL CONDITIONS	27.1deg.C, 68.2% RH	TESTED BY: Dragon	

Field Strength (V/m)	Test Frequency (MHz)	Polarization of antenna (Horizontal / Vertical)	Test Distance (m)	Test Result	Remark
3	80-1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz	H&V	3	A	Pass

NOTE: A: There was no change compared with initial operation during the test



5.4 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS) (EN301489)

5.4.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz ~ 6000 MHz
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.	Next Cal.
Signal Generator	Agilent	N5181A	MY50142530	Sep. 04,21
Antenna Log-Periodic	AR	ATR80M6G	0337307	N/A
Antenna Log-Periodic	AR	ATS700M11G	0336821	N/A
Switch Controller	AR	SC1000	0337343	N/A
RF Power Meter	Boonton	4242	13984	Sep. 04,21
Power Sensor	Boonton	51011EMC	35716	Sep. 04,21
Power Sensor	Boonton	51011EMC	35715	Sep. 04,21
E-Field probe	Narda	NBM-520	2403/01B	Dec. 23,20
Power Amplifier	TESEQ	CBA 1G-150	T44029	N/A
Power Amplifier	TESEQ	CBA 3G-100	T44030	N/A
Power Amplifier	TESEQ	CBA 6G-050	1041204	N/A
Dual Directional Coupler	TESEQ	C5982	95208	Sep. 04,21
Dual Directional Coupler	TESEQ	C6187	95175	Sep. 04,21
Dual Directional Coupler	TESEQ	CPH-274F	M251304-01	Sep. 04,21
Audio analyzer	Rohde&Schwarz	UPV	101397	Sep. 04,21
Conditioning Amplifier	B&K	2690A0S2	2437856	Oct. 17,21
EAR SIMULATOR	B&K	4192	2764719	May 09,21
Test Software	Tonscend	TS+	2.0.1.8	N/A
Test Software	ADT	BVADT_RS_V7.6.4-DG	N/A	N/A

- NOTES:**
1. The test was performed in RS chamber.
 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

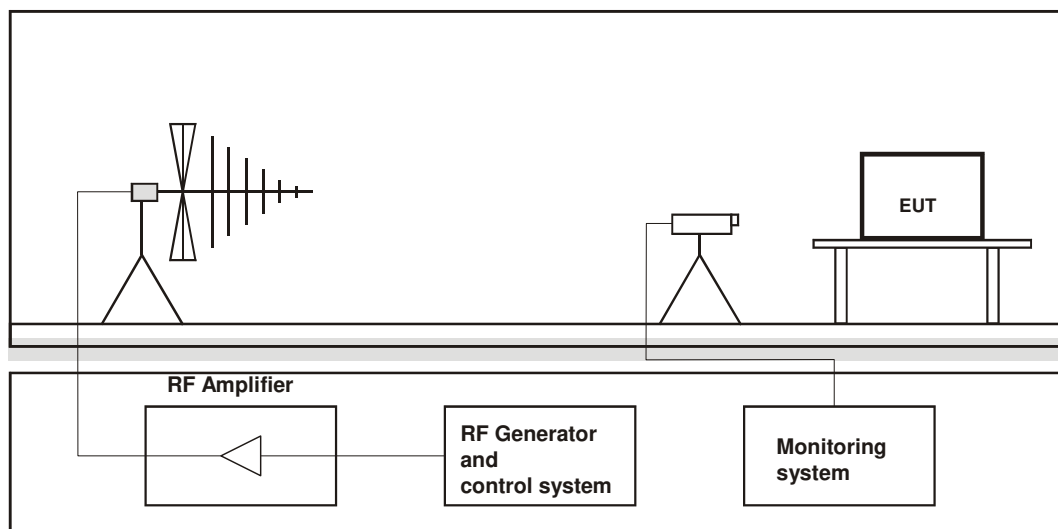
The test procedure was in accordance with EN 61000-4-3.

- The testing was performed in a fully-anechoic chamber.
- The frequency range is swept from 80 MHz to 6000 MHz with the signal 80% amplitude modulated with a 1 kHz sine wave.
- 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.
- The field strength level was 3 V/m.
- 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 MODE	See section 2.2	TEST VOLTAGE	See section 2.2
ENVIRONMENTAL CONDITIONS	27.1deg.C, 68.2% RH	TESTED BY: Dragon	

Field Strength (V/m)	Test Frequency Note ^{#1} (MHz)	Polarization of antenna (Horizontal / Vertical)	Test Distance (m)	Test Result	Remark
3	80 - 6000	H / V	3	A	Note 1

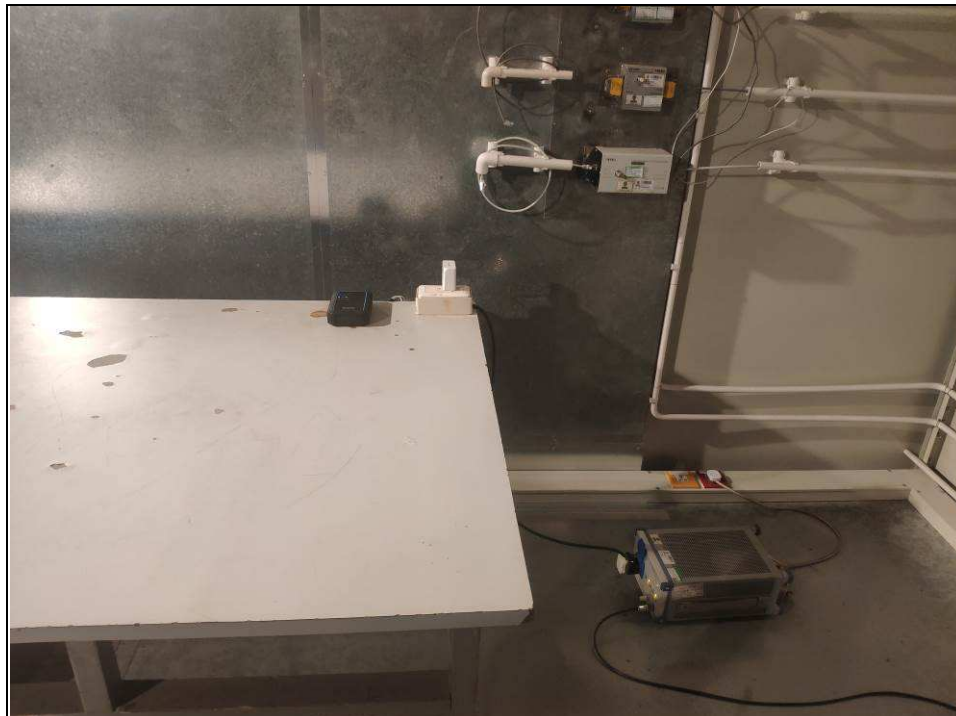
Note^{#1}: Tested Israel SII Frequencies 89,100,107,144,163,196,244,315,434,460,600,825,845,880 MHz

Note 1: A: There was no change compared with initial operation during the test.



6 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST





BUREAU
VERITAS

Test Report No.: CE2008WDG0083

RADIATED EMISSION TEST (30MHz-1GHz)





RADIATED EMISSION TEST (Above 1GHz)

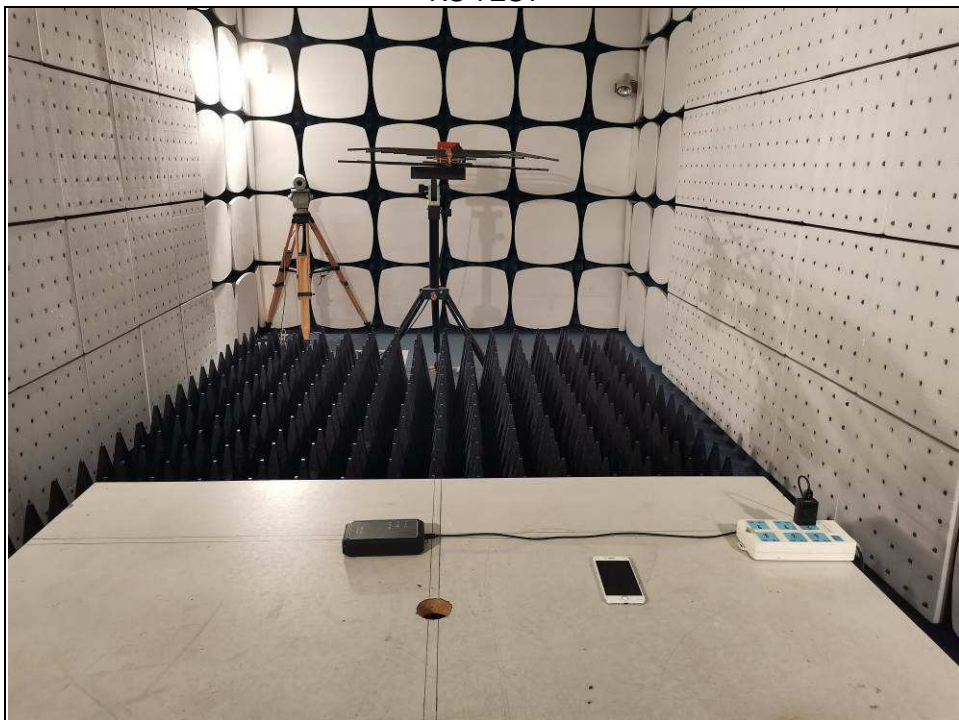




ESD TEST



RS 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.

---END---