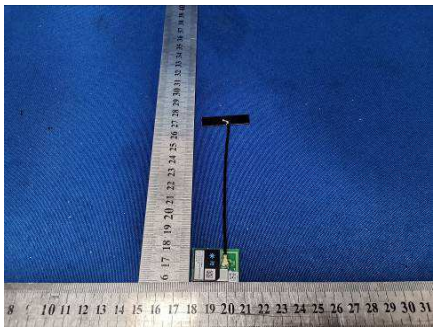
TEST REPORT

Applicant	Particle Industries,Inc
Address	325 9th Street, San Francisco, CA 94103 United States

Manufacturer or Supplier	Particle Industries,Inc
Address	325 9th Street, San Francisco, CA 94103 United States
Product	Wi-Fi Module
Brand Name	Particle
Model	P2
Additional Model & Model Difference	N/A
Date of tests	Apr. 14, 2022 ~ Apr. 19, 2022



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

☒ **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 Lucas Chen Project Engineer / EMC Department	Approved by Madison Luo Assistant Manager / EMC Department
	Date: May 18, 2022

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RM2202WDG0092	Original release	May 18, 2022

1 SUMMARY OF TEST RESULTS

After estimating all the combination of every test mode, the result shown as below is the worst case.

The EUT has been tested according to the following specifications.

EMISSION			
Standard	**Test Type**	**Result**	**Remark**
EN 55032:2015, Class B	Conducted test	PASS	Minimum passing margin is -10.10 dB at 0.4286MHz
	Radiated test (30MHz~1GHz)	PASS	Meets limits minimum passing margin is -3.64dB at 118.129MHz
	Radiated Test (1GHz~6GHz)	PASS	Meets limits minimum passing margin is -12.70 dB at 2355.00MHz

IMMUNITY			
Standard	**Test Type**	**Result**	**Remark**
EN 61000-4-2:2009	Electrostatic discharge immunity test	PASS	Meets the requirements of Performance Criterion A
EN IEC 61000-4-3: 2020	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Meets the requirements of 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:

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

Measurement	Frequency	Uncertainty
Conducted emission	150kHz ~ 30MHz	+/- 3.05 dB
Radiated emissions	30MHz~1GHz	+ /- 4.79 dB
	1GHz ~ 6GHz	+ /- 5.14 dB

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Wi-Fi Module
TEST MODEL	P2
ADDITIONAL MODEL	N/A
NOMINAL VOLTAGE	DC 3.3V
MODULATION TECHNOLOGY	DTS, DSSS, OFDM
MODULATION TYPE	BT-LE GFSK(1, 2 Mbps); 2.4GHz WIFI: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 5GHz WIFI: 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
OPERATING FREQUENCY	2402MHz-2480MHz for BT-LE; 2412-2472MHz for 2.4GHz WIFI; 5180MHz ~ 5240MHz, 5260MHz ~ 5320MHz, 5500MHz ~ 5700MHz, 5745MHz ~ 5825MHz for 5 GHz WIFI
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions, but only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 2202WDG0092) for detailed product photo.

2.2 DESCRIPTION OF TEST MODE

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

◆ **FOR CONDUCTED EMISSION TEST**

Test Mode	Test Voltage
BT Link	**DC 3.3V from Base Support**
2.4GHz WIFI Link	
5GHz WIFI Link	

◆ **FOR RADIATED EMISSIONS TEST(Below 1GHz)**

Test Mode	Test Voltage
BT Link	**DC 3.3V from Base Support**
2.4GHz WIFI Link	
5GHz WIFI Link	

◆ **FOR RADIATED EMISSIONS TEST(Above 1GHz)**

Test Mode	Test Voltage
BT Link	**DC 3.3V from Base Support**
2.4GHz WIFI Link	
5GHz WIFI Link	

◆ **FOR ESD, RS IMMUNITY TESTS**

Test Mode	Test Voltage
BT Link	**DC 3.3V from Base Support**
2.4GHz WIFI Link	
5GHz WIFI Link	

2.3 GENERAL DESCRIPTION OF APPLIED STANDARD

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

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 55032:2015, Class B
EN 61000-4-2:2009
EN IEC 61000-4-3:2020

Note: The above EN basic standards are applied with latest version if customer has no special requirement.

2.4 DESCRIPTION OF SUPPORT UNIT

The EUT has been tested as an dependent 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	S8	Samsung	G9500	N/A	N/A
2	PCB Base Support	N/A	N/A	N/A	N/A
3	Wireless Router	TP-LINK	TL-WDR3310	1240431130	N/A
4	Notebook	ALIENWARE	ALIENWARE 13 R2	2015AP3711	N/A
5	Notebook	DELL	Latitude 5280	CZFTNH2	N/A
6	Printer	Lenovo	LJ2200L	LP02857415 48001408	N/A

NO.	DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	USB Cable: Shielded, Detachable, 0.5m
3	DC Line: Unshielded, Detachable 1.5m
4	AC Line: Unshielded, Detachable 0.8m;DC Line: Unshielded, Non-detachable 1.8m
5	AC Line: Unshielded, Detachable 0.8m;DC Line: Unshielded, Non-detachable 1.8m
6	AC Line: Unshielded, Detachable 1.5m; USB Line: Shielded, Detachable 1.5m

3 EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: EN 55032

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.

3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Jan. 18,23
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Jan. 23,23
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Jan. 18,23
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Aug. 05,22
Coaxial RF Cable	/	CE CABLE	C2310066DG	Jul. 27,22
Test software	ADT	ADT_Cond_V7.3 .7	N/A	N/A

NOTE: 1. The test was performed at Shielded Room 553. (Chen Wu)
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.

3.1.3 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.

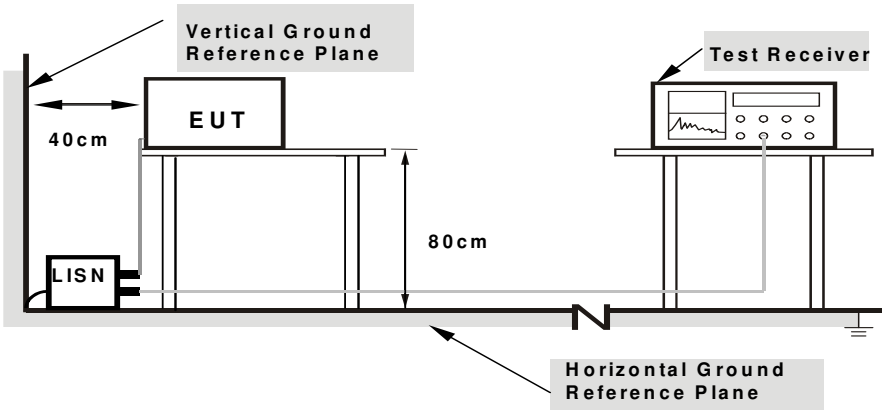
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

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

3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

3.1.5 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

3.1.6 EUT OPERATING CONDITIONS

a. Turned on the power of all equipment.

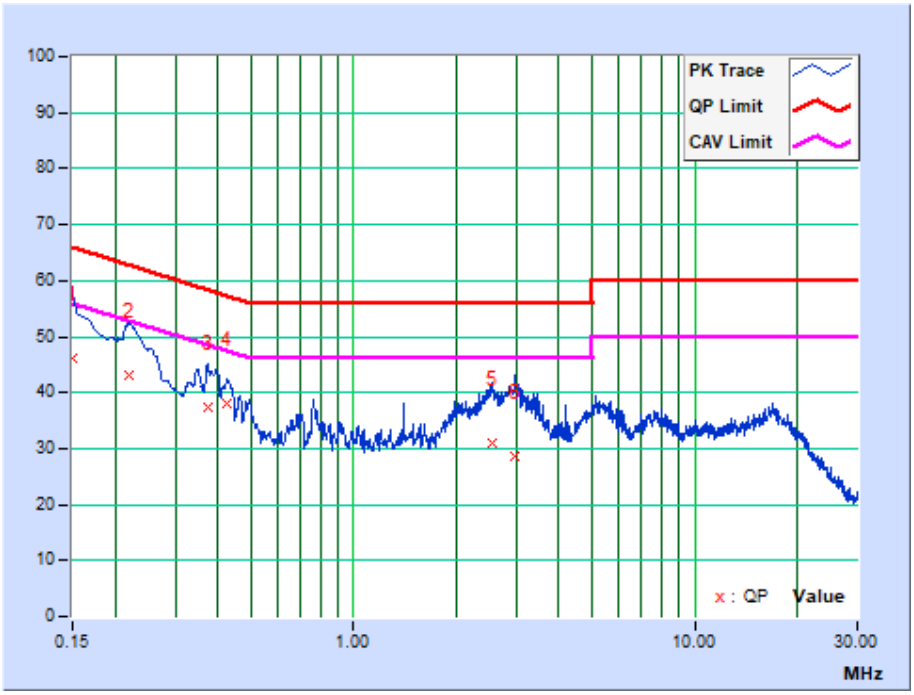
b. EUT was operated according to the type described in manufacturer's specifications or the user's manual.

3.1.7 TEST RESULTS

TEST MODE	See section 2.2	**6DB BANDWIDTH**	9 kHz
TEST VOLTAGE	See section 2.2	**PHASE**	Line (L)
ENVIRONMENTAL CONDITIONS	25deg. C, 58% RH	**TESTED BY**	Summer

No.	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.90	36.34	17.55	46.24	27.45	66.00	56.00	-19.76	-28.55
2	0.21976	9.93	33.24	18.42	43.17	28.35	62.83	52.83	-19.66	-24.48
3	0.37263	9.94	27.27	11.50	37.21	21.44	58.44	48.44	-21.23	-27.00
4	0.42635	9.96	28.07	9.02	38.03	18.98	57.32	47.32	-19.30	-28.35
5	2.53725	10.11	20.86	13.81	30.97	23.92	56.00	46.00	-25.03	-22.08
6	2.96025	10.13	18.39	10.75	28.52	20.88	56.00	46.00	-27.48	-25.12

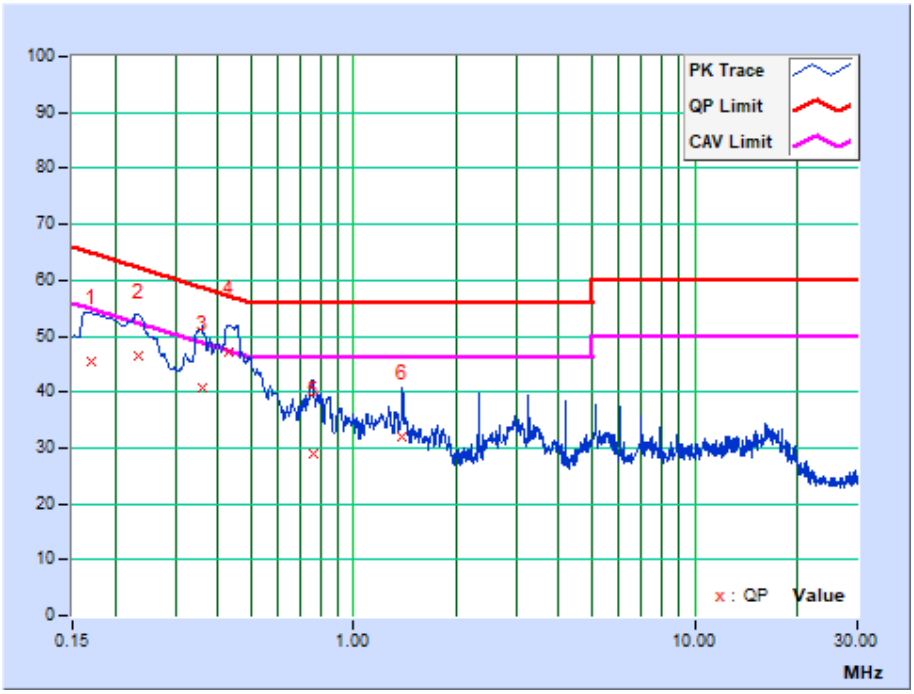
REMARK: The emission levels of other frequencies were very low against the limit.



TEST MODE	See section 2.2	6DB BANDWIDTH	9 kHz
TEST VOLTAGE	See section 2.2	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25deg. C, 58% RH	TESTED BY	Summer

No.	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17025	9.84	35.47	12.37	45.31	22.21	64.95	54.95	-19.63	-32.73
2	0.23290	9.85	36.64	15.69	46.49	25.54	62.35	52.35	-15.85	-26.80
3	0.35911	9.85	30.81	22.10	40.66	31.95	58.75	48.75	-18.09	-16.80
4	**0.42860**	**9.85**	**37.33**	**26.50**	**47.18**	**36.35**	**57.28**	**47.28**	**-10.10**	**-10.93**
5	0.76200	9.87	19.03	11.77	28.90	21.64	56.00	46.00	-27.10	-24.36
6	1.39200	9.90	22.11	8.70	32.01	18.60	56.00	46.00	-23.99	-27.40

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



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: EN 55032
FOR FREQUENCY BELOW 1000 MHz

FREQUENCY (MHz)	Class A (at 10m) Quasi-Peak dBuV/m	Class B (at 10m) Quasi-Peak dBuV/m
30 – 230	40	30
230 – 1000	47	37

FREQUENCY (MHz)	Class A (at 3m) Quasi-Peak dBuV/m	Class B (at 3m) 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.

3.2.2 TEST INSTRUMENTS

FREQUENCY RANGE BELOW 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU26	100005	Apr. 16, 22
EMI Test Receiver	Rohde&Schwarz	ESR7	101564	Jan. 18,23
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-555	Jan. 09, 23
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-554	Jan. 09, 23
Preamplifier	EMCI	EMC1135	980378	Mar. 09,23
Preamplifier	EMCI	EMC1135	980423	Mar. 09,23
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8.8m	NSEMC006	Oct. 15,22
Coaxial RF Cable	/	10m Below 1GHz	C2310084	Aug. 03,22
Coaxial RF Cable	/	10m Below 1GHz	C2310085	Aug. 03,22
Test Software	ADT	ADT_Radiated_V8.7.07	N/A	N/A

NOTES: 1. The test was performed in 10m Chamber. (Chen Wu)
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. 06, 22
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170147	May 14, 22
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101003	Jan. 16.23
Broadband Preamplifier (1~18GHz)	SCHWARZBECK	BBV 9718C	00136	Aug. 06,23
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Jan. 26,23
Coaxial RF Cable	/	10m Above 1GHz	C2310041DG	Jan. 10,23
Test Software	ADT	ADT_Radiated_V8.7.07	N/A	N/A

NOTES: 1. The test was performed in 10m Chamber. (Chen Wu)
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.

3.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground In 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 one meter to four 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 turn 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 1 GHz.

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 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 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. 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 system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

NOTE:

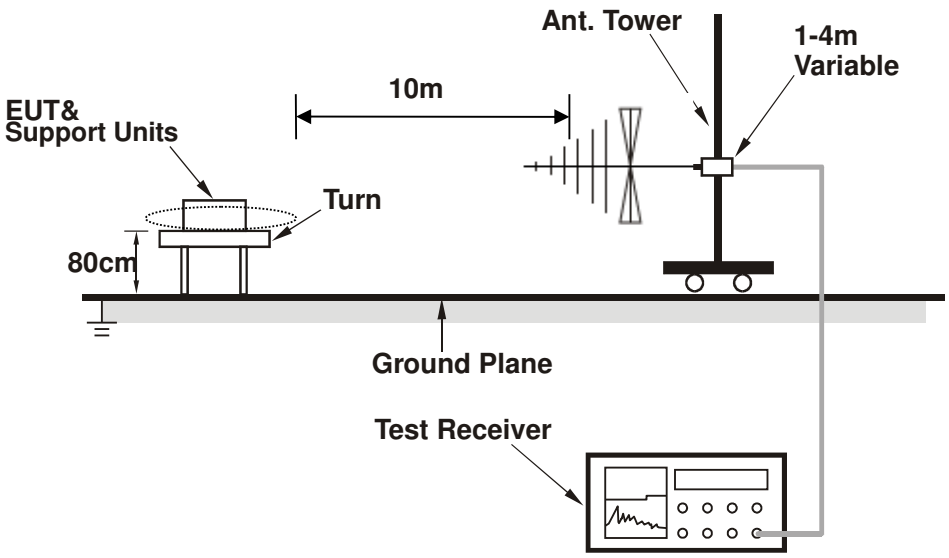
1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
2. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
3. 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.

3.2.4 DEVIATION FROM TEST STANDARD

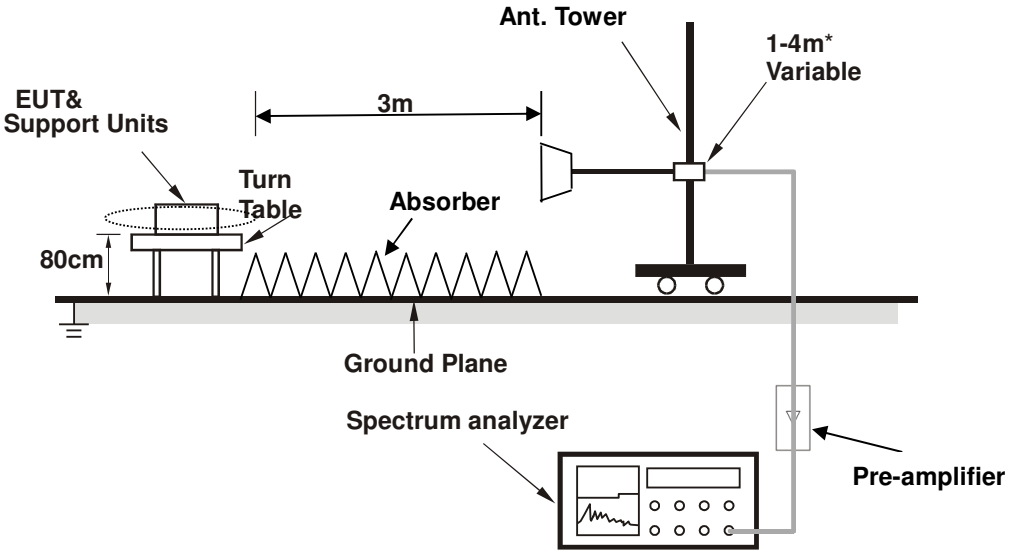
No deviation.

3.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



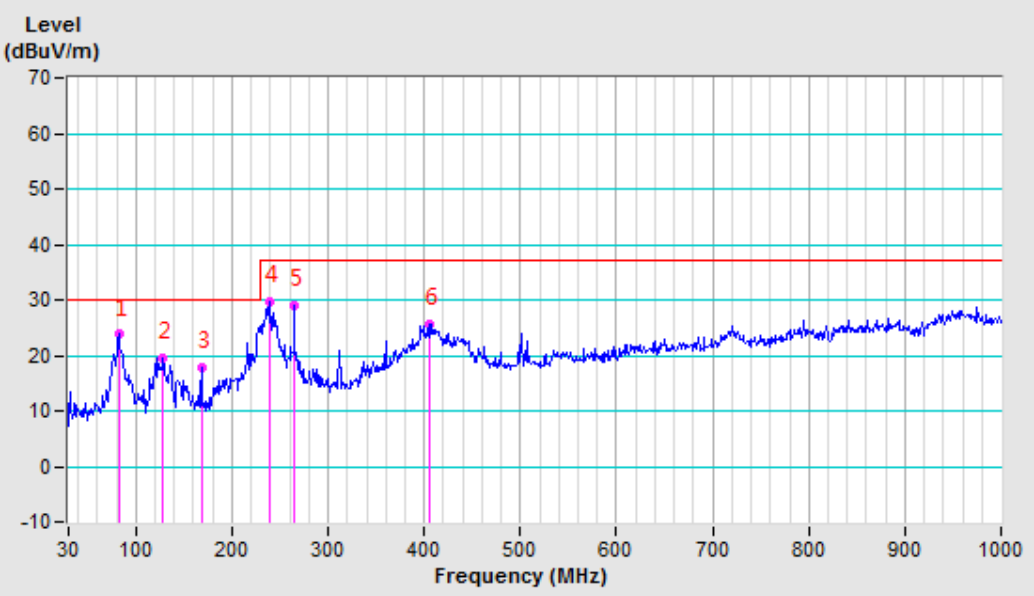
* : depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

3.2.6 TEST RESULTS (BELOW 1GHz)

TEST MODE	See section 2.2	**FREQUENCY RANGE**	30-1000 MHz
TEST VOLTAGE	See section 2.2	**DETECTOR FUNCTION & BANDWIDTH**	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 54% RH	**TESTED BY**: Alex	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 10M								
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	82.623	-25.42	49.21	23.79	30.00	-6.21	200	43
2	128.576	-21.33	40.93	19.60	30.00	-10.40	200	43
3	167.983	-20.71	38.57	17.86	30.00	-12.14	400	170
4	239.763	-21.01	50.69	29.68	37.00	-7.32	400	174
5	264.013	-20.07	48.97	28.90	37.00	-8.10	200	43
6	405.269	-15.78	41.48	25.70	37.00	-11.30	200	207

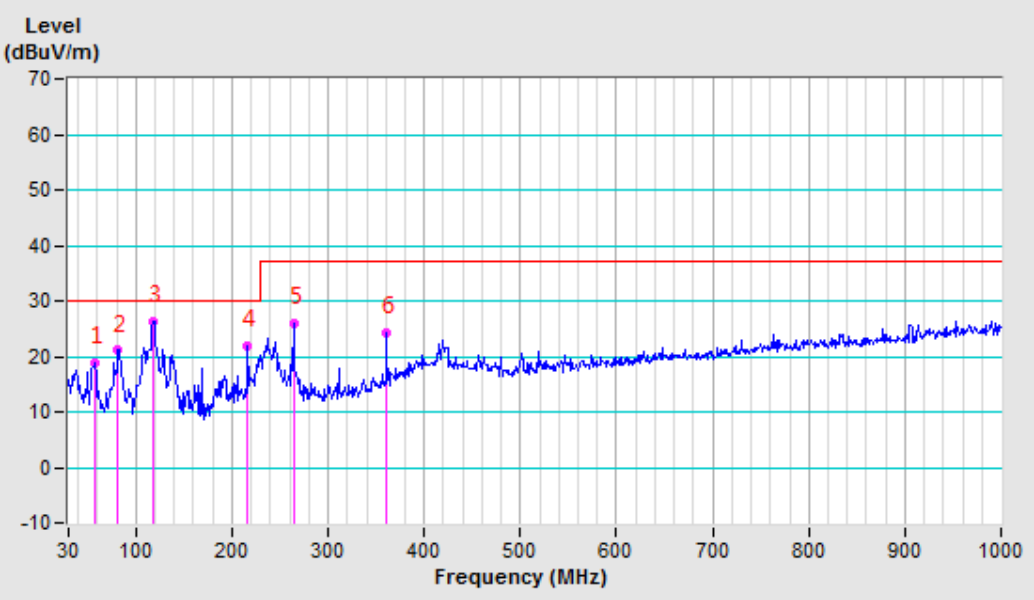
REMARK: 1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
2. Negative sign (-) in the margin column signify levels below the limit.
3. Frequency range scanned: 30MHz to 1000MHz.
4. Only emissions significantly above equipment noise floor are reported.



TEST MODE	See section 2.2	**FREQUENCY RANGE**	30-1000 MHz
TEST VOLTAGE	See section 2.2	**DETECTOR FUNCTION & BANDWIDTH**	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 54% RH	**TESTED BY**: Alex	

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 10M								
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	57.258	-21.97	40.93	18.96	30.00	-11.04	100	316
2	81.607	-25.33	46.39	21.06	30.00	-8.94	100	35
3	**118.129**	**-22.51**	**48.87**	**26.36**	**30.00**	**-3.64**	**300**	**358**
4	215.958	-22.09	44.03	21.94	30.00	-8.06	100	332
5	263.976	-20.07	46.06	25.99	37.00	-11.01	100	338
6	360.011	-17.1	41.35	24.25	37.00	-12.75	100	318

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: 30MHz to 1000MHz.
4. Only emissions significantly above equipment noise floor are reported.



3.2.7 TEST RESULTS (ABOVE 1GHz)

TEST MODE	See section 2.2		
TEST VOLTAGE	See section 2.2	**FREQUENCY RANGE**	1-6 GHz
ENVIRONMENTAL CONDITIONS	24deg. C, 54% RH	**TESTED BY**: Alex	

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	1147.00AV	-1.66	57.76	56.10	70.00	-13.90	100	314
2	1147.00PK	-1.66	36.36	34.70	50.00	-15.30	100	314
3	1695.00AV	0.73	53.97	54.70	70.00	-15.30	100	55
4	1695.00AV	0.73	35.17	35.90	50.00	-14.10	100	55
5	2355.00AV	2.83	48.97	51.80	70.00	-18.20	100	101
6	**2355.00AV**	**2.83**	**34.47**	**37.30**	**50.00**	**-12.70**	**100**	**101**
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	1254.00AV	-1.14	54.54	53.40	70.00	-16.60	100	134
2	1254.00AV	-1.14	36.94	35.80	50.00	-14.20	100	134
3	1884.00PK	1.39	52.21	53.60	70.00	-16.40	100	22
4	1884.00AV	1.39	31.71	33.10	50.00	-16.90	100	22
5	2144.00AV	2.23	50.37	52.60	70.00	-17.40	100	110
6	2144.00AV	2.23	30.27	32.50	50.00	-17.50	100	110

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.

4 IMMUNITY TEST

4.1 GENERAL DESCRIPTION

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 IEC 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80~6000 MHz, 3 V/m, 80% AM (1 kHz), Performance Criterion A

4.1.1 GENERAL PERFORMANCE CRITERIA DESCRIPTION

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 301489-17

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

For EN 301489-17

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.		

4.2 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD)

4.2.1 TEST SPECIFICATION

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

4.2.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
ESD Generator	TESEQ	NSG 437	279	Mar. 06,23
Test Software	TESEQ	V03.03	N/A	N/A
ESD Generator	EM TEST	Dito	V1211112265	Nov. 29, 22
Test Software	EM TEST	V 2.31	N/A	N/A

NOTE: 1. The test was performed in ESD Room. (Chen Wu)
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.

4.2.3 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 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.

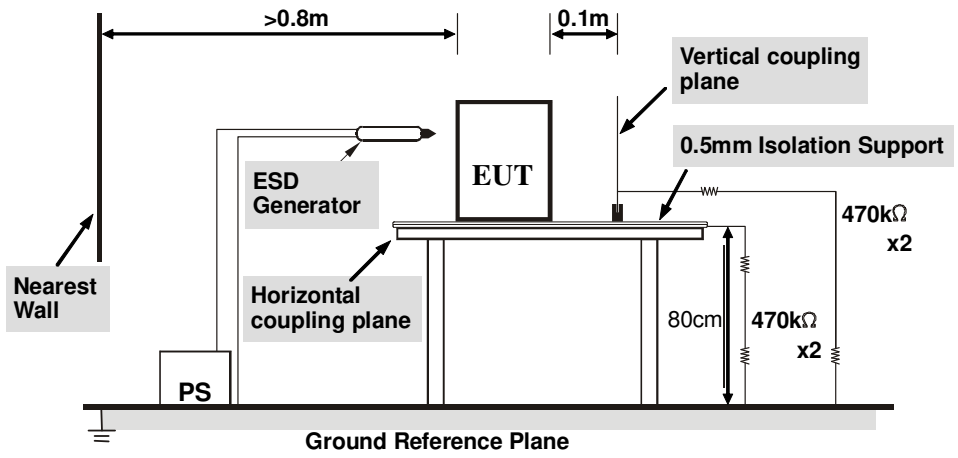
g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned horizontally at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

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.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 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 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 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.

4.2.6 TEST RESULTS

TEST VOLTAGE	See section 2.2	**ENVIRONMENTAL CONDITIONS**	24.3deg. C, 46.4% RH, 101.3kPa
TESTED BY	Hu		

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.

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

4.3.1 TEST SPECIFICATION

Basic Standard:	EN IEC 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

4.3.2 TEST INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Signal Generator	Agilent	N5181A	MY50142530	Aug. 19,22
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. 14,22
Power Sensor	Keysight	U2021XA	MY55060016	Feb. 23, 23
Power Sensor	Boonton	51011EMC	35715	Aug. 19, 22
E-Field probe	Narda	EP601	8112X01099	Jul. 13, 22
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	Aug. 19, 22
Dual Directional Coupler	TESEQ	C6187	95175	Aug. 19, 22
Dual Directional Coupler	TESEQ	CPH-274F	M251304-01	Aug. 19, 22
Audio analyzer	Rohde&Schwarz	UPV	101397	Aug. 19, 22
Conditioning Amplifier	B&K	2690-W-013	3241205	Jan. 25, 23
Ear Simulator	B&K	4192	2764719	May 18, 22
Test Software	Tonscend	TS+	2.0.1.8	N/A
Test Software	ADT	BVADT_RS_V7.6.4-DG	N/A	N/A

NOTE: 1. The test was performed in RS chamber. (Chen Wu)
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.

4.3.3 TEST PROCEDURE

The test procedure was in accordance with EN IEC 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.

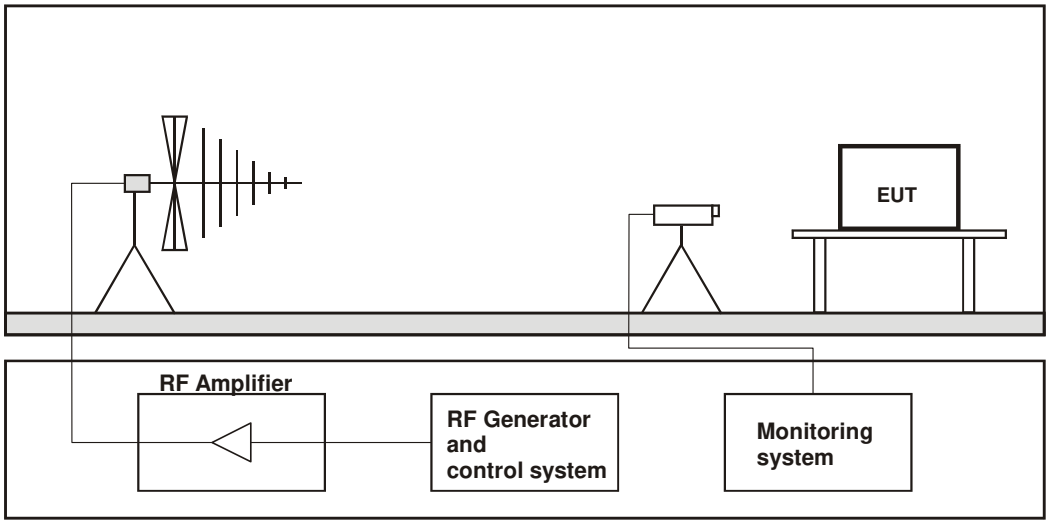
d. The field strength level was 3 V/m.

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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

4.3.5 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 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.

4.3.6 TEST RESULTS

TEST VOLTAGE	See section 2.2	ENVIRONMENTAL CONDITIONS	27.3deg., 65.7% RH
TESTED BY	Andy		

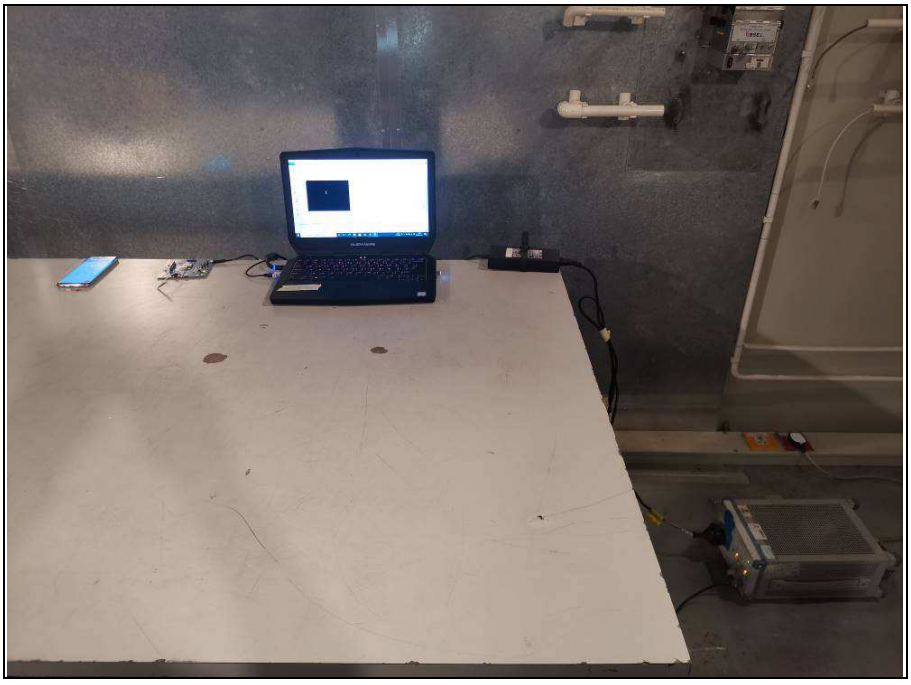
Field Strength (V/m)	Test Frequency Note#1 (MHz)	Polarization of antenna (Horizontal / Vertical)	Test Distance (m)	Test Result	Remark
3	80-6000	H/ V	3	A	N/A

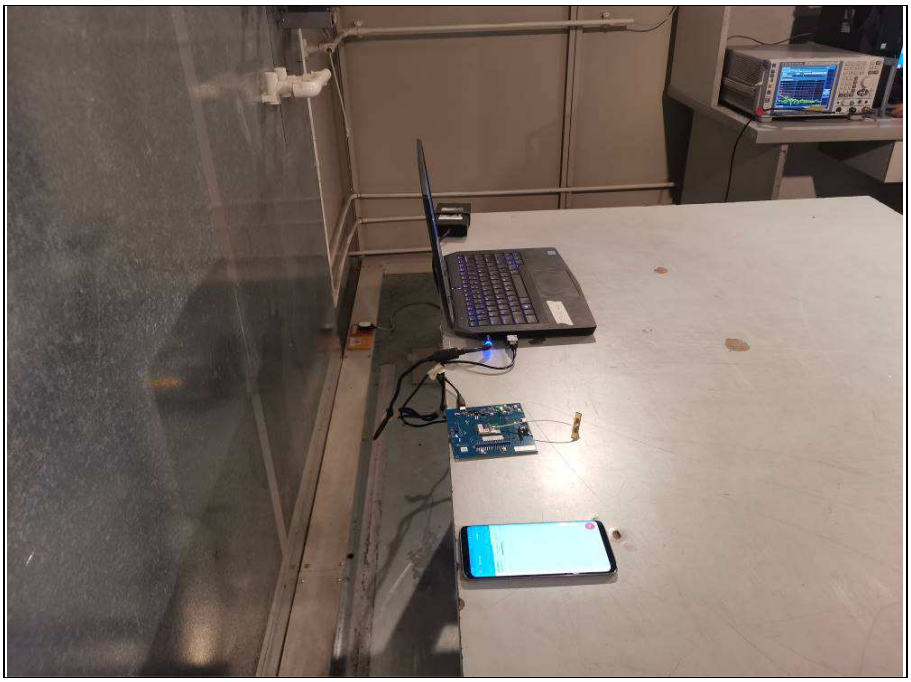
Note#1:Tested Israel SII Frequencies 89,100,107,144,163,196,244,315,434,460,600,825,845,880 MHz

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

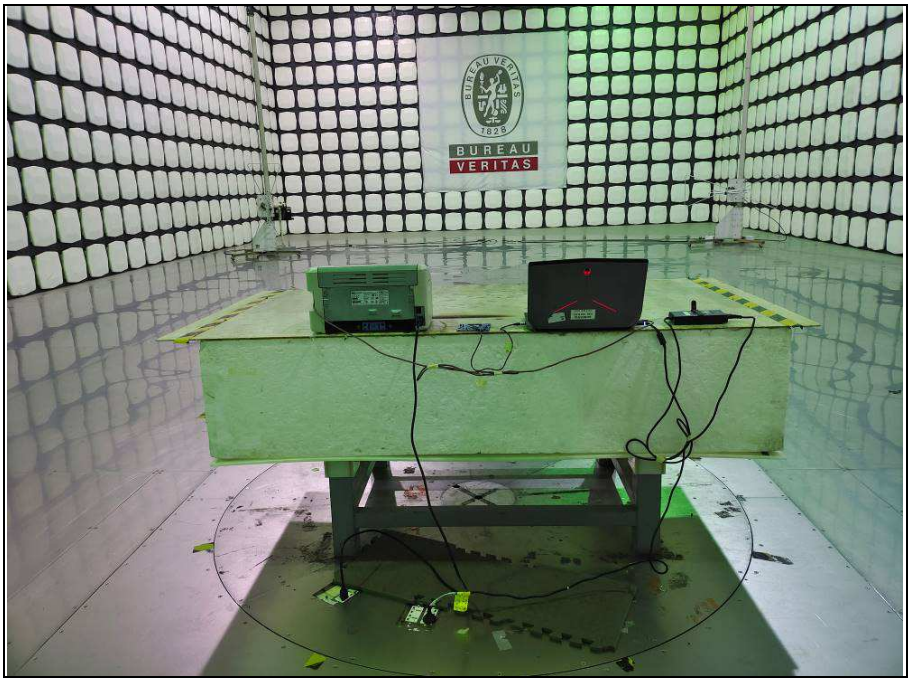
5 PHOTOGRAPHS OF THE TEST CONFIGURATION

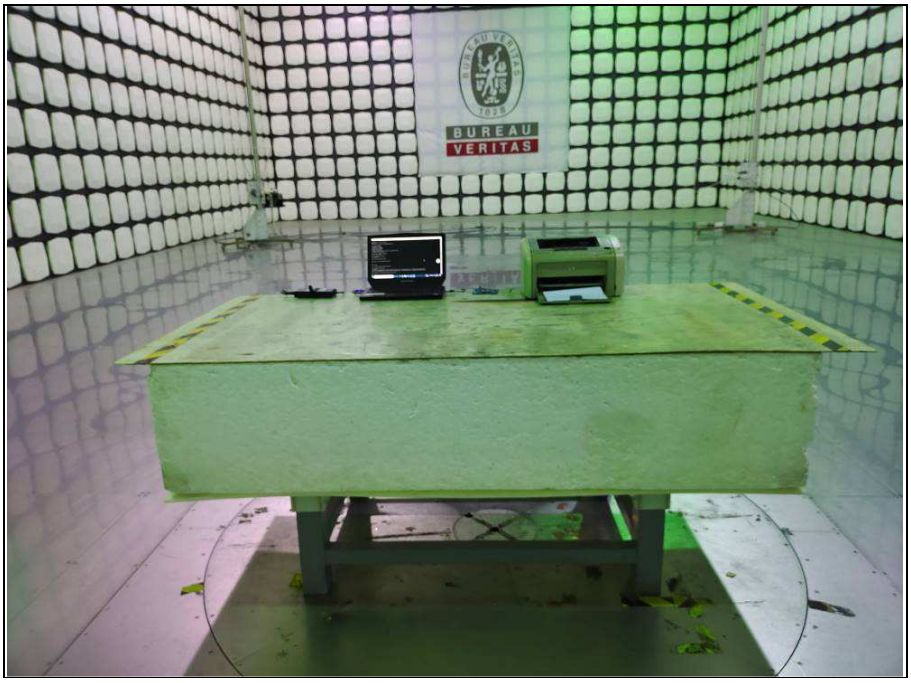
CONDUCTED EMISSION TEST



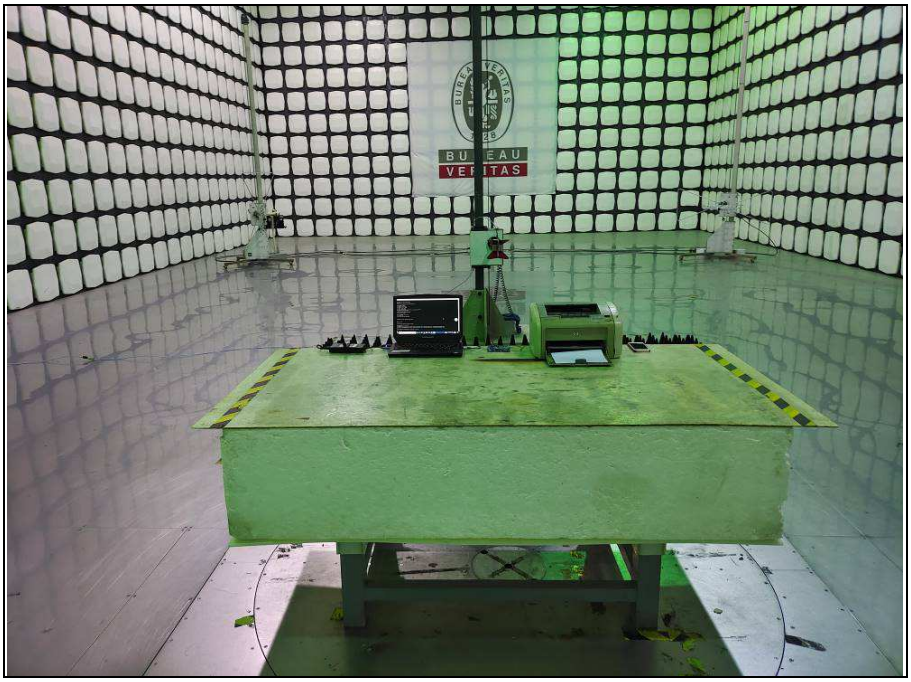


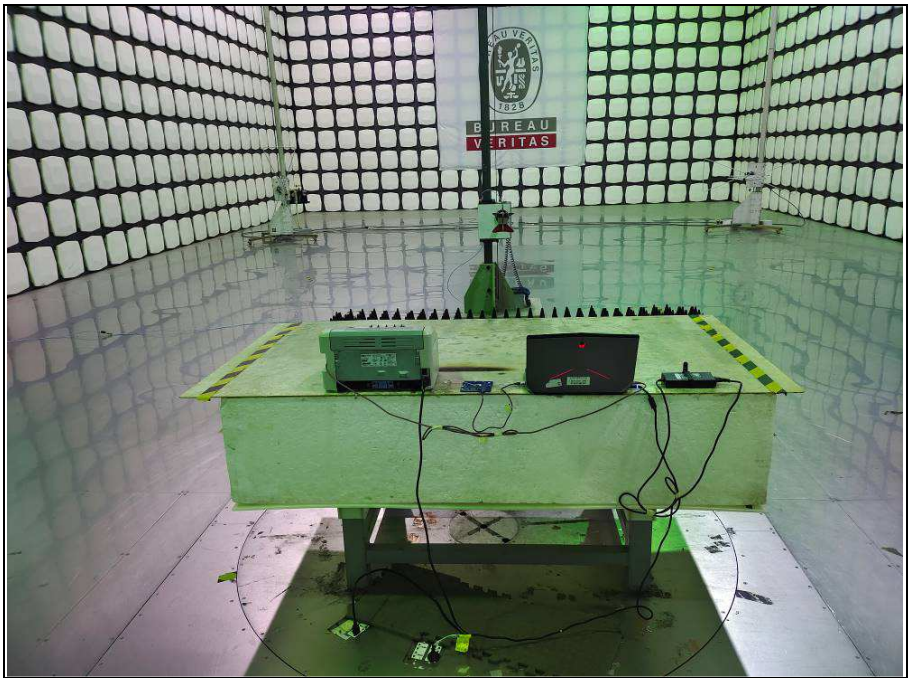
RADIATED EMISSION TEST <30MHz~1GHz>



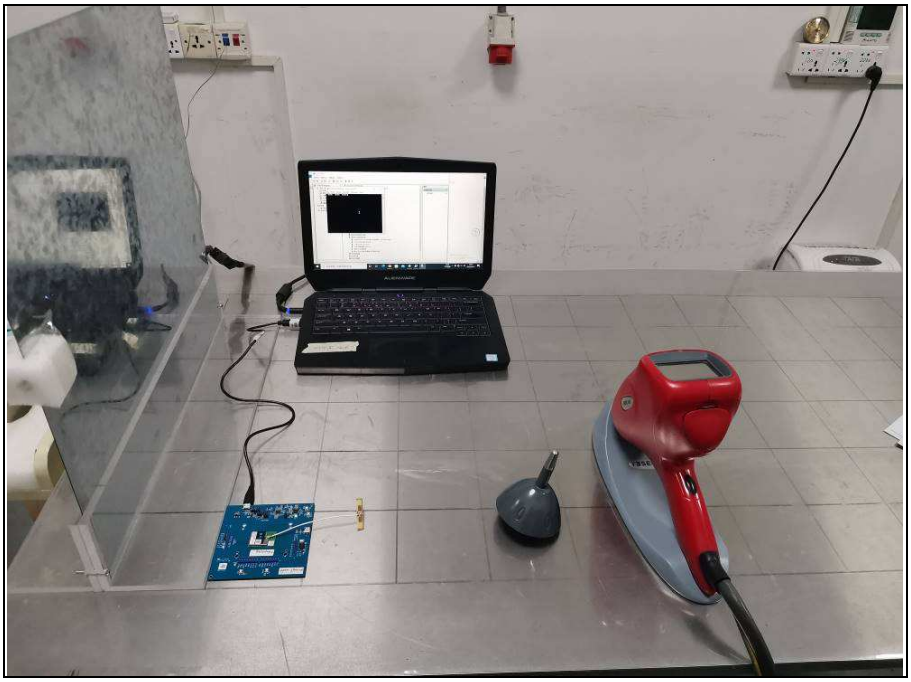


RADIATED EMISSION TEST <Above 1GHz>

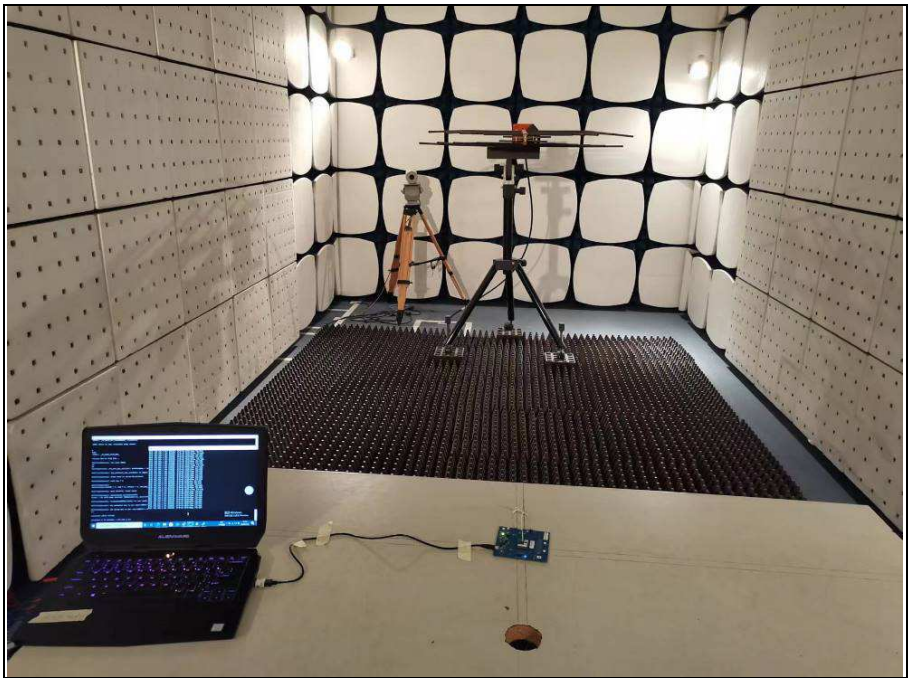




ESD TEST



R/S TEST



6 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---