FCC EMC Test Report

Subject to

Supplier's Declaration of Conformity

Procedure

Product : BT Model

Trade Mark : B&T,

Model Number : PB-02, PB-01

Prepared for

Shenzhen Ai-Thinker Technology Co., Ltd.

410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Bao'an District, Shenzhen China

Prepared by

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Tel.: 400-800-6106, 0755-3699 5508 Website: http://www.ntek.org.cn

TEST RESULT CERTIFICATION

Applicant's Name	Shenzhen Ai-Thinker Technology Co., Ltd.
Address.....	410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Bao'an District, Shenzhen China
Manufacturer's Name.....	Shenzhen Ai-Thinker Technology Co., Ltd.
Address.....	410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Bao'an District, Shenzhen China

Product description

Product name.....	BT Model
Model and/or type reference ..:	PB-02, PB-01
Standards.....	47 CFR FCC part15 subpart B, 10-1-2020 ANSI C63.4:2014

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with Part 15 of FCC Rules. And it is applicable only to the tested sample identified in the report.

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Date of Test	
Date (s) of performance of tests	27 Sep. 2020 ~ 15 Oct. 2020
Date of Issue	15 Oct. 2020
Test Result	**Pass**

Testing Engineer : Allen Huang
(Allen Huang)

Technical Manager : Sky Zhang
(Sky Zhang)

Authorized Signatory : Alex
(Alex)

Shenzhen NTEK Testing Technology Co., Ltd. NTEK Report Seal

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1. TEST SUMMARY

Test procedures according to the technical standards:

EMC Emission				
Standard	Test Item	Limit	Judgment	Remark
FCC part15 subpart B, 10-1-2020 ANSI C63.4: 2014	Conducted Emission	Class B	PASS	
	Radiated Emission	Class B	PASS	

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report

(2) For client's request and manual description, the test will not be executed.

1.1 TEST FACILITY

Shenzhen NTEK Testing Technology Co., Ltd.

Add. : 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street Bao'an District, Shenzhen 518126 P.R. China

CNAS-Lab. : The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2018 (identical to ISO/IEC 17025:2017)
The Certificate Registration Number is L5516

IC-Registration : The Certificate Registration Number is CN0074

FCC- Accredited : Test Firm Registration Number: 463705
Designation Number: CN1184

A2LA-Lab. : The Certificate Registration Number is 4298.01
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ± **U**, where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

Test Item	Measurement Frequency Range	K	U(dB)
AC Mains Conducted Emission	0.009kHz ~ 0.15MHz	2	2.66
AC Mains Conducted Emission	0.15MHz ~ 30MHz	2	2.80
Telecom Conducted Emission (Cat 3)	0.15MHz ~ 30MHz	2	2.40
Telecom Conducted Emission (Cat 5)	0.15MHz ~ 30MHz	2	2.58
Radiated Emission	30MHz ~ 1000MHz	2	2.64
Radiated Emission	1000MHz ~ 6000MHz	2	5.10
Radiated Emission	6000MHz ~ 18000MHz	2	2.52
Power Clamp	30MHz ~ 300MHz	2	2.20

Revision History

Report No.	Version	Description	Issued Date
S20092702204001	Rev.01	Initial issue of report	Oct. 15, 2020

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Equipment</td><td>BT Model</td></tr>
<tr><td>Model Name</td><td>PB-02</td></tr>
<tr><td>Additional Model Number(s)</td><td>PB-01</td></tr>
<tr><td>Model Difference</td><td>All models are identical except PB-02 comes with PCB antenna, PB-01 has no antenna.</td></tr>
<tr><td>Product Description</td><td>The EUT is a BT Model.
<table><tr><td>Operating frequency:</td><td>2483.5 MHz (Declaration by factory)</td></tr><tr><td>Connecting I/O port:</td><td>N/A</td></tr></table>
Based on the application, features, or specification exhibited in User's Manual. More details of EUT technical specification, please refer to the User's Manual.</td></tr>
<tr><td>Power Source</td><td>DC Voltage</td></tr>
<tr><td>Power Rating</td><td>DC 3.3V</td></tr>
</table>

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

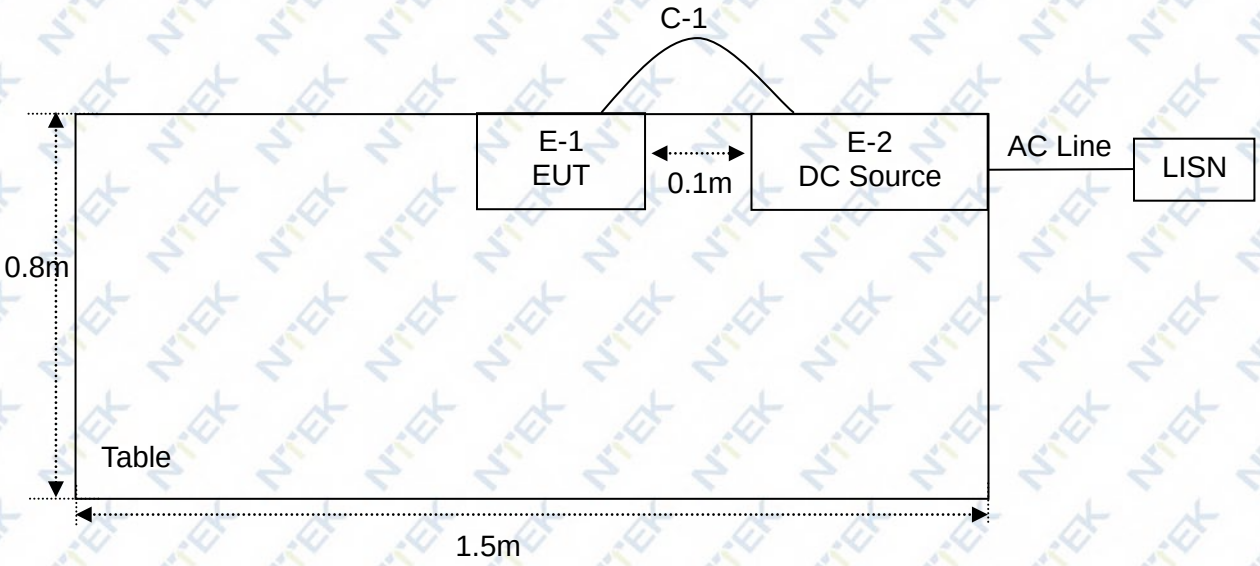
Pretest Mode	Description
Mode 1	Working

For Conducted Test	
Final Test Mode	Description
Mode 1	Working

For Radiated Test	
Final Test Mode	Description
Mode 1	Working

2.3 DESCRIPTION OF TEST SETUP

Mode CE: Working



2.4 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL

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.

Item	Equipment	Brand	Model/Type No.	Series No.	Note
E-1	BT Model	B&T,	PB-02	N/A	EUT
E-2	DC Source	N/A	PS-6005D	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	80cm	

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

(3) "YES" means "shielded" "with core"; "NO" means "unshielded" "without core".

2.5 MEASUREMENT INSTRUMENTS LIST

2.5.1 CONDUCTED TEST SITE

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Low frequency cable	N/A	C-01	N/A	May 11, 2020	May 10, 2023	3 years
2	50Ω Switch	Anritsu	MP59B	6200983704	May 11, 2020	May 10, 2023	3 years
3	EMI Test Receiver	R&S	ESCI	101160	May 11, 2020	May 10, 2021	1 year
4	LISN	R&S	ENV216	101490	Jul. 13, 2020	Jul. 12, 2021	1 year
5	LISN	R&S	ENV216	101313	May 11, 2020	May 10, 2021	1 year
6	LISN	SCHWARZBECK	NNLK 8129	8129245	May 11, 2020	May 10, 2021	1 year

2.5.2 RADIATED TEST SITE

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Antenna Mast	SKET	N/A	N/A	N/A	N/A	N/A
2	Antenna Mast	EM	SC100	N/A	N/A	N/A	N/A
3	50Ω Switch	Anritsu	MP59B	6200983705	May 11, 2020	May 10, 2023	3 years
4	Test Cable	N/A	R-03	N/A	Jun. 28, 2019	Jun. 27, 2022	3 years
5	Test Cable	N/A	R-01	N/A	Aug. 06, 2019	Aug. 05, 2022	3 years
6	Pre-Amplifier	EMC	EMC051835SE	980246	Jul. 13, 2020	Jul. 12, 2021	1 year
7	EMI Test Receiver	R&S	ESCI	101160	May 11, 2020	May 10, 2021	1 year
8	Spectrum Analyzer	Agilent	E4440A	MY41000130	May 11, 2020	May 10, 2021	1 year
9	Bilog Antenna	TESEQ	CBL6111D	31216	Apr. 11, 2020	Apr. 10, 2021	1 year
10	Broadband Horn Antenna	EM	EM-AH-10180	2011071402	Apr. 08, 2018	Apr. 07, 2021	3 years

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION (Frequency Range 150kHz-30MHz)

FREQUENCY (MHz)	☐Class A (dBμV)		☒Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 - 5.0	73.00	60.00	56.00	46.00
5.0 - 30.0	73.00	60.00	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

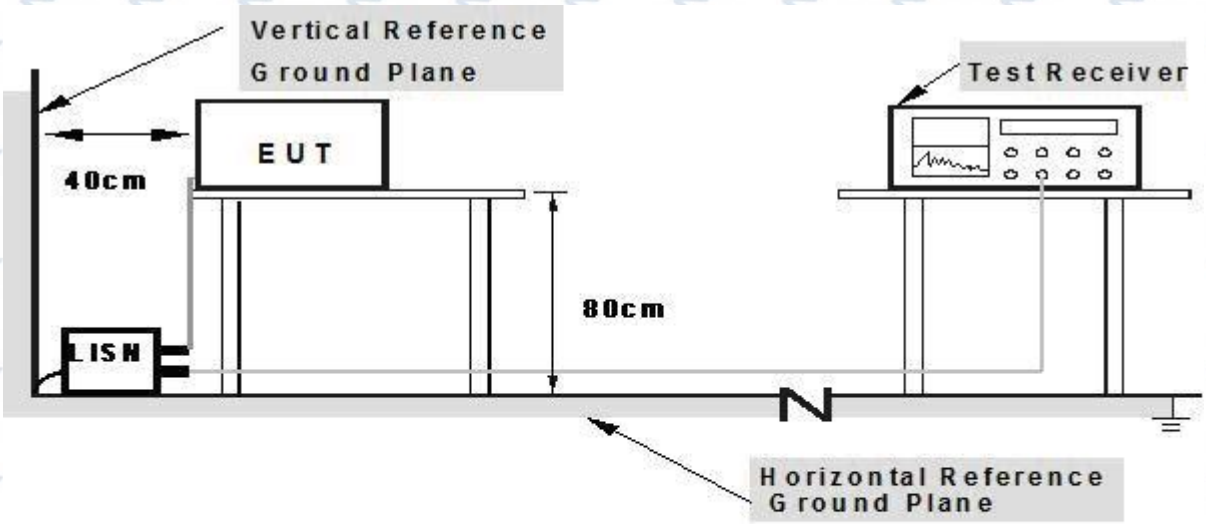
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of The cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



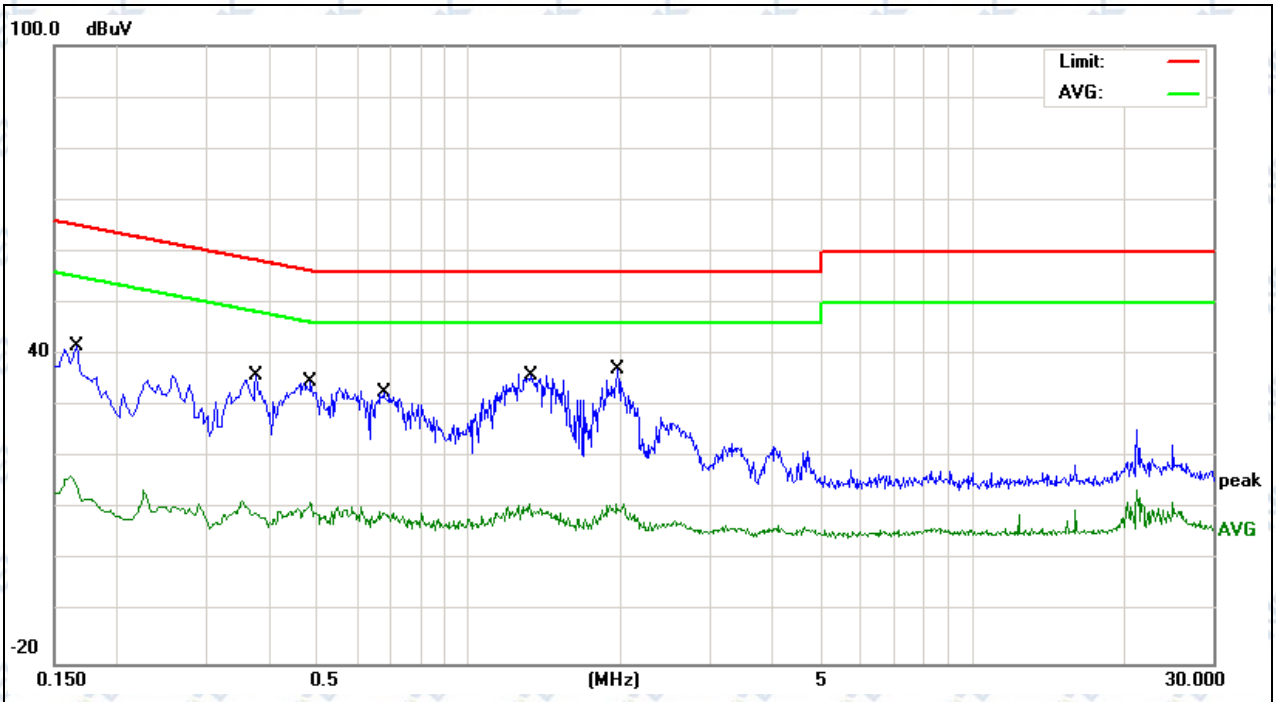
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

3.1.5 TEST RESULTS

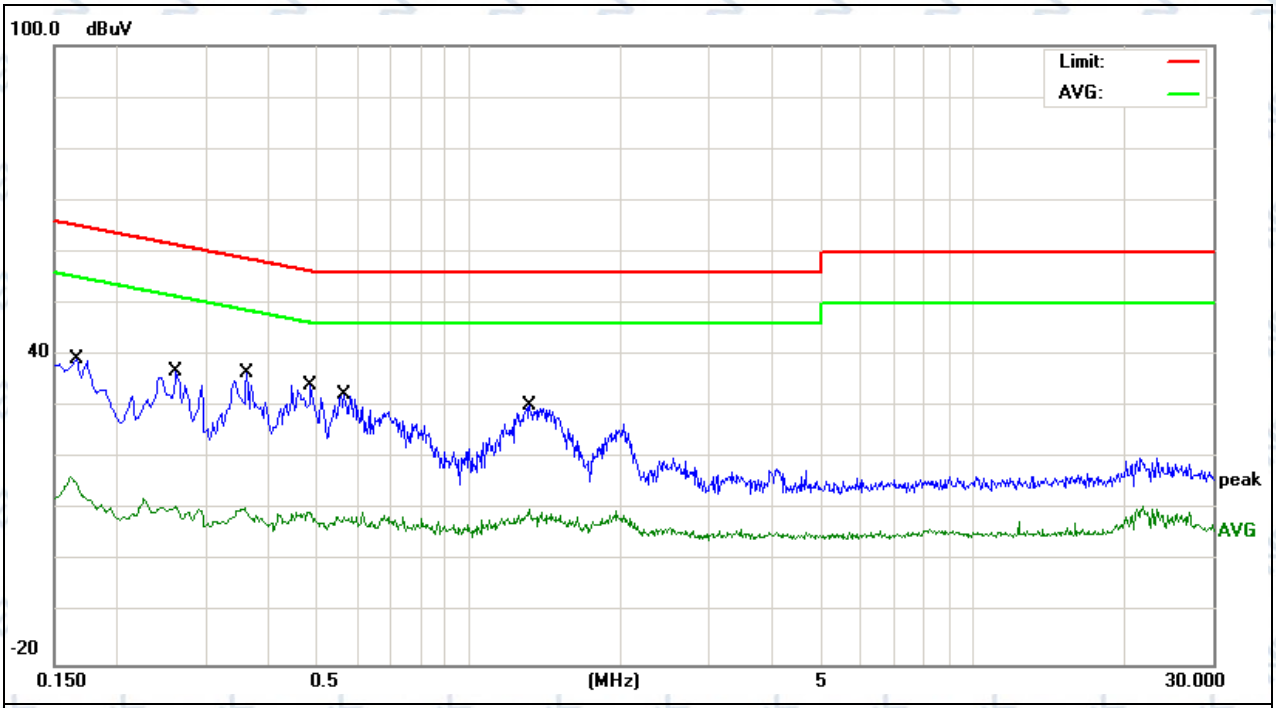
EUT:	BT Model	Model Name:	PB-02
Temperature:	22℃	Relative Humidity:	54%
Pressure:	1010hPa	Test Date:	2020-10-13
Test Mode:	Working	Phase:	L
Test Voltage:	DC 3.3V powered by DC Source AC 120V/60Hz		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1660	31.94	9.56	41.50	65.15	-23.65	QP	
2		0.1660	6.82	9.56	16.38	55.15	-38.77	AVG	
3		0.3780	26.28	9.55	35.83	58.32	-22.49	QP	
4		0.3780	2.22	9.55	11.77	48.32	-36.55	AVG	
5		0.4858	25.28	9.55	34.83	56.24	-21.41	QP	
6		0.4858	1.76	9.55	11.31	46.24	-34.93	AVG	
7		0.6780	23.25	9.55	32.80	56.00	-23.20	QP	
8		0.6780	-0.04	9.55	9.51	46.00	-36.49	AVG	
9		1.3260	26.26	9.56	35.82	56.00	-20.18	QP	
10		1.3260	1.50	9.56	11.06	46.00	-34.94	AVG	
11	*	1.9778	27.68	9.58	37.26	56.00	-18.74	QP	
12		1.9778	1.44	9.58	11.02	46.00	-34.98	AVG	

Remark:
Correct Factor = Insertion Loss + Cable Loss
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

EUT:	BT Model	Model Name:	PB-02
Temperature:	22℃	Relative Humidity:	54%
Pressure:	1010hPa	Test Date:	2020-10-13
Test Mode:	Working	Phase:	N
Test Voltage:	DC 3.3V powered by DC Source AC 120V/60Hz		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1660	29.80	9.55	39.35	65.15	-25.80	QP	
2		0.1660	6.76	9.55	16.31	55.15	-38.84	AVG	
3		0.2620	27.17	9.53	36.70	61.36	-24.66	QP	
4		0.2620	1.14	9.53	10.67	51.36	-40.69	AVG	
5		0.3619	27.02	9.54	36.56	58.68	-22.12	QP	
6		0.3619	0.91	9.54	10.45	48.68	-38.23	AVG	
7	*	0.4859	24.60	9.54	34.14	56.24	-22.10	QP	
8		0.4859	0.15	9.54	9.69	46.24	-36.55	AVG	
9		0.5658	22.71	9.54	32.25	56.00	-23.75	QP	
10		0.5658	0.11	9.54	9.65	46.00	-36.35	AVG	
11		1.3220	20.55	9.55	30.10	56.00	-25.90	QP	
12		1.3220	0.68	9.55	10.23	46.00	-35.77	AVG	

Remark:
Correct Factor = Insertion Loss + Cable Loss
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

FREQUENCY (MHz)	☐Class A (at 3m)	☒Class B (at 3m)
	dBμV/m	dBμV/m
30 ~ 88	49.5	40.0
88 ~ 216	53.9	43.5
216 ~ 960	56.9	46.0
Above 960	60.0	54.0

Notes:

(1) The limit for radiated test was performed according to as following: FCC PART 15B.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBμV/m)=20log Emission level (uV/m).

3.2.2 TEST PROCEDURE

a. The measuring distance of at 3m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.

b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

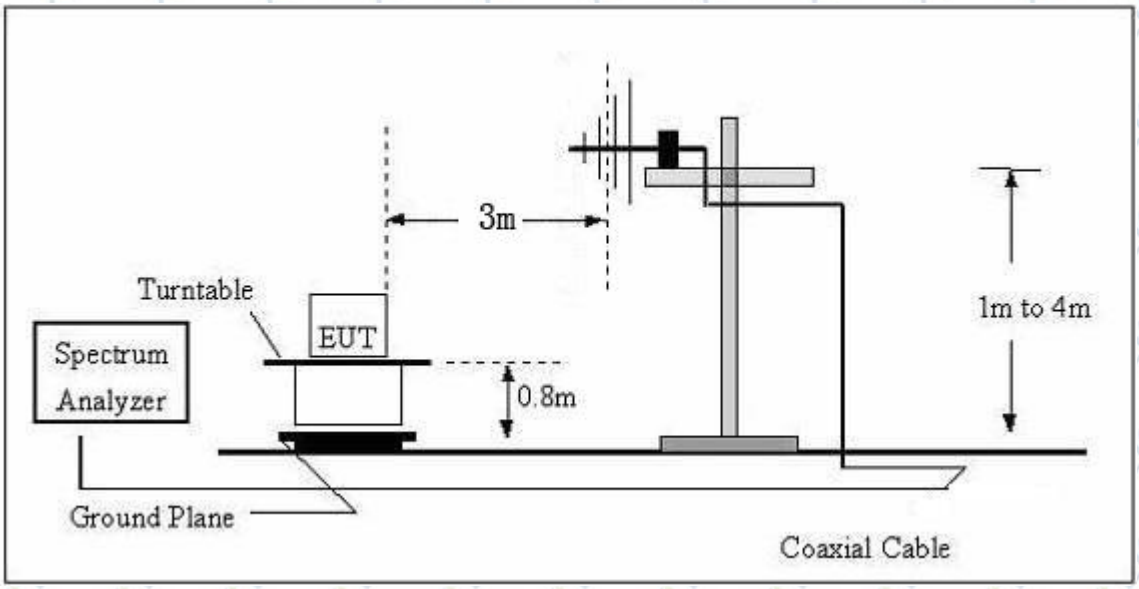
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked And then Quasi Peak detector mode re-measured, above 1G Average detector mode will be instead.

e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP(AV) Limits and then no additional QP Mode measurement performed.

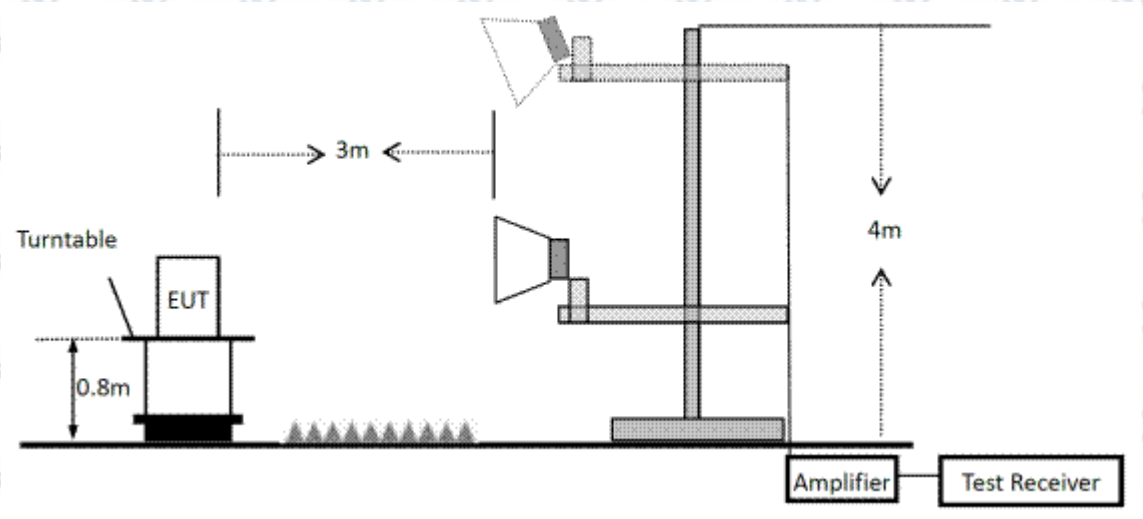
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.2.3 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1GHz

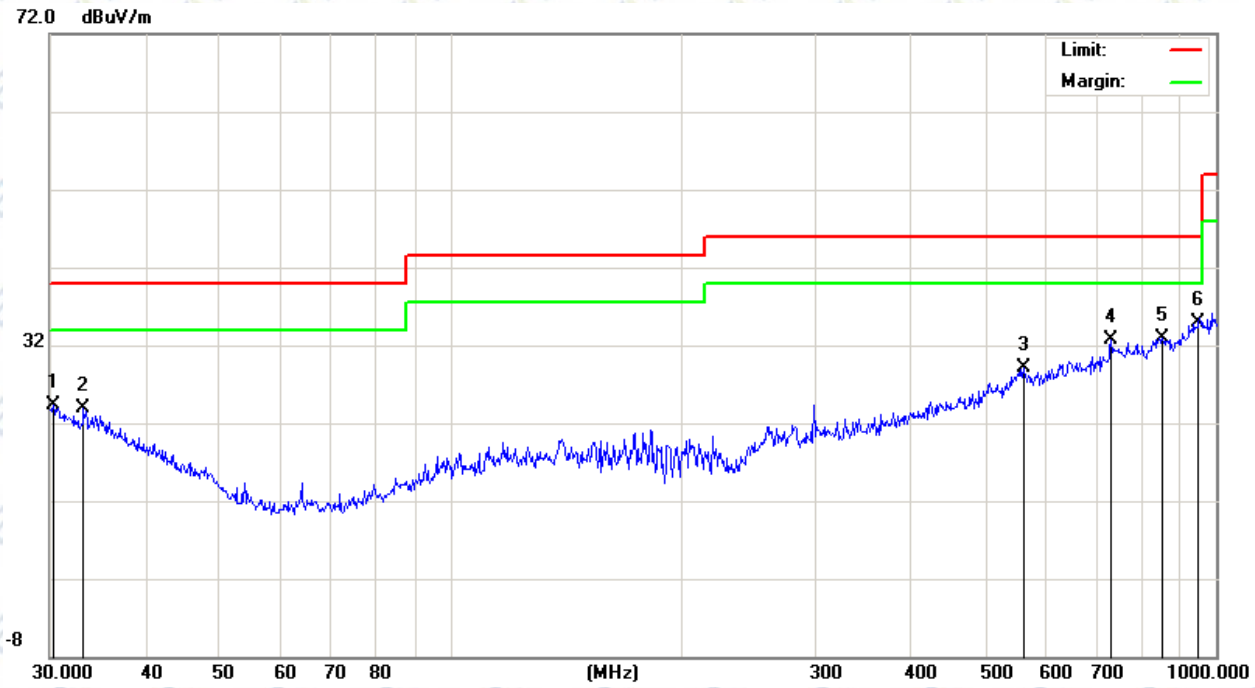


3.2.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.5 TEST RESULTS(30-1000MHz)

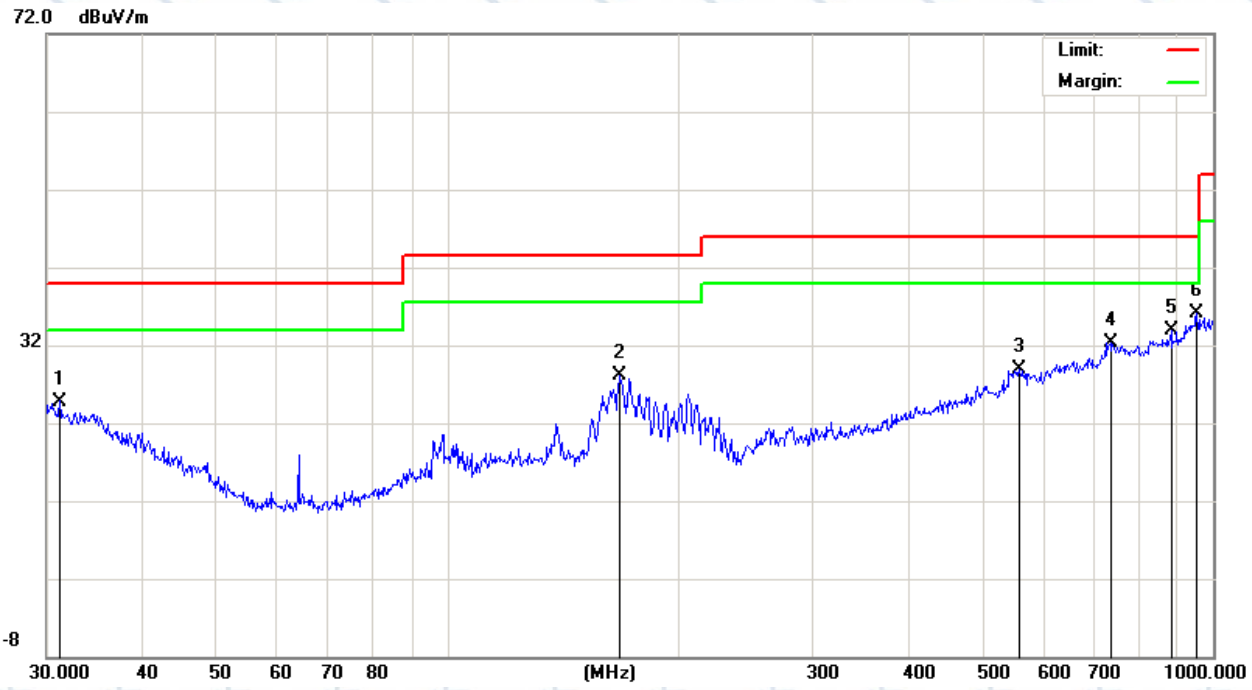
EUT:	BT Model	Model Name:	PB-02
Temperature:	25℃	Relative Humidity:	55%
Pressure:	1010hPa	Test Date:	2020-10-14
Test Mode:	Working	Polarization:	Horizontal
Test Power:	DC 3.3V powered by DC Source AC 120V/60Hz		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.3170	5.68	18.68	24.36	40.00	-15.64	QP			
2		33.2111	6.43	17.50	23.93	40.00	-16.07	QP			
3		560.6928	6.79	22.32	29.11	46.00	-16.89	QP			
4		729.3582	7.59	25.10	32.69	46.00	-13.31	QP			
5		851.0353	6.77	26.22	32.99	46.00	-13.01	QP			
6	*	948.7608	6.53	28.35	34.88	46.00	-11.12	QP			

Remark:
Correct Factor = Antenna Factor + Cable Loss – Pre-Amplifier gain
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

EUT:	BT Model	Model Name:	PB-02
Temperature:	25℃	Relative Humidity:	55%
Pressure:	1010hPa	Test Date:	2020-10-14
Test Mode:	Working	Polarization:	Vertical
Test Power:	DC 3.3V powered by DC Source AC 120V/60Hz		

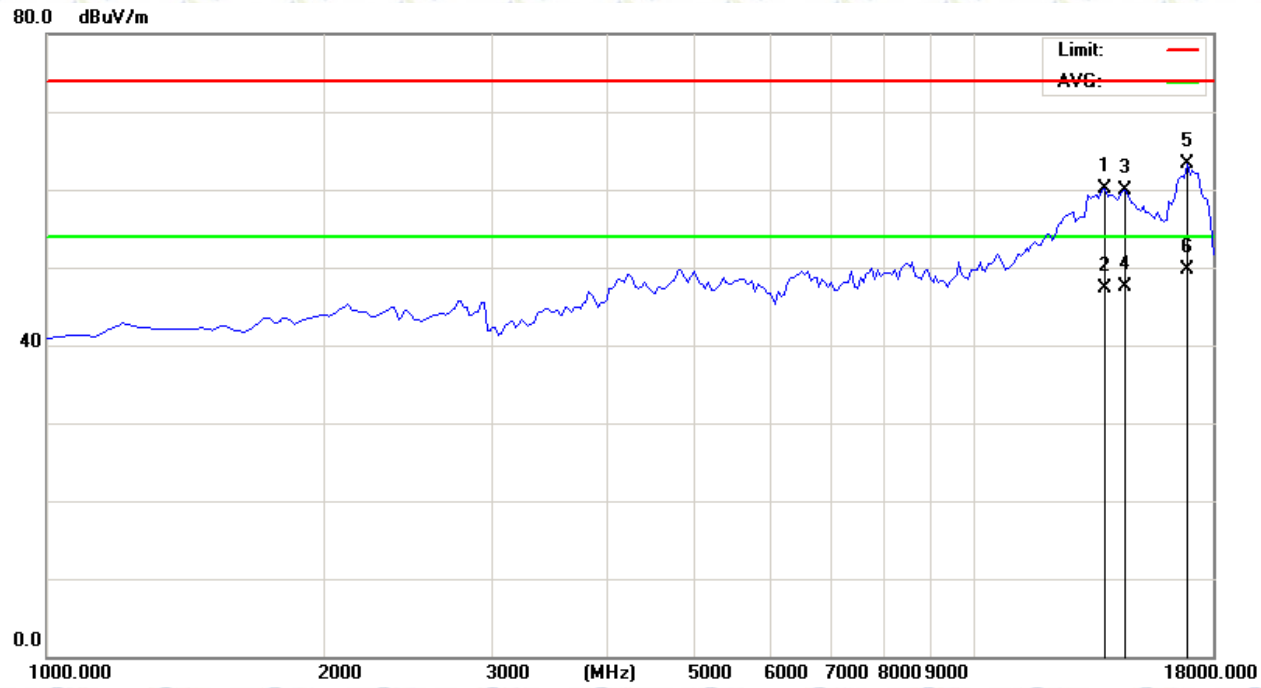


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		31.1798	6.59	18.21	24.80	40.00	-15.20	QP			
2		167.8240	17.31	10.72	28.03	43.50	-15.47	QP			
3		558.7300	6.53	22.38	28.91	46.00	-17.09	QP			
4		734.4913	7.23	25.15	32.38	46.00	-13.62	QP			
5		881.4067	8.27	25.70	33.97	46.00	-12.03	QP			
6	*	952.0937	7.61	28.40	36.01	46.00	-9.99	QP			

Remark:
Correct Factor = Antenna Factor + Cable Loss – Pre-Amplifier gain
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

3.2.6 TEST RESULTS(Above 1000MHz)

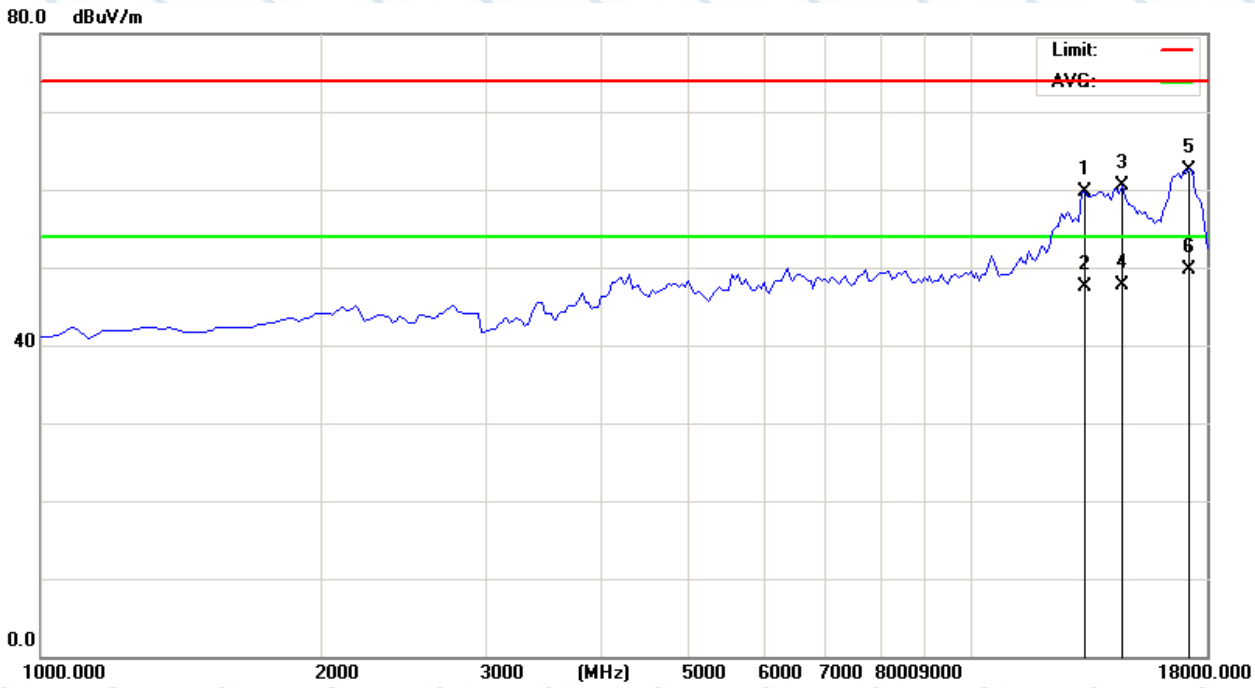
EUT:	BT Model	Model Name:	PB-02
Temperature:	25℃	Relative Humidity:	55%
Pressure:	1010hPa	Test Date:	2020-10-14
Test Mode:	Working	Polarization:	Horizontal
Test Power:	DC 3.3V powered by DC Source AC 120V/60Hz		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		13835.00	35.73	24.38	60.11	74.00	-13.89	peak			
2		13835.00	23.02	24.38	47.40	54.00	-6.60	AVG			
3		14557.50	35.49	24.46	59.95	74.00	-14.05	peak			
4		14557.50	23.14	24.46	47.60	54.00	-6.40	AVG			
5		16980.00	35.43	27.79	63.22	74.00	-10.78	peak			
6	*	16980.00	22.01	27.79	49.80	54.00	-4.20	AVG			

Remark:
Correct Factor = Antenna Factor + Cable Loss – Pre-Amplifier gain
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

EUT:	BT Model	Model Name:	PB-02
Temperature:	25℃	Relative Humidity:	55%
Pressure:	1010hPa	Test Date:	2020-10-14
Test Mode:	Working	Polarization:	Vertical
Test Power:	DC 3.3V powered by DC Source AC 120V/60Hz		

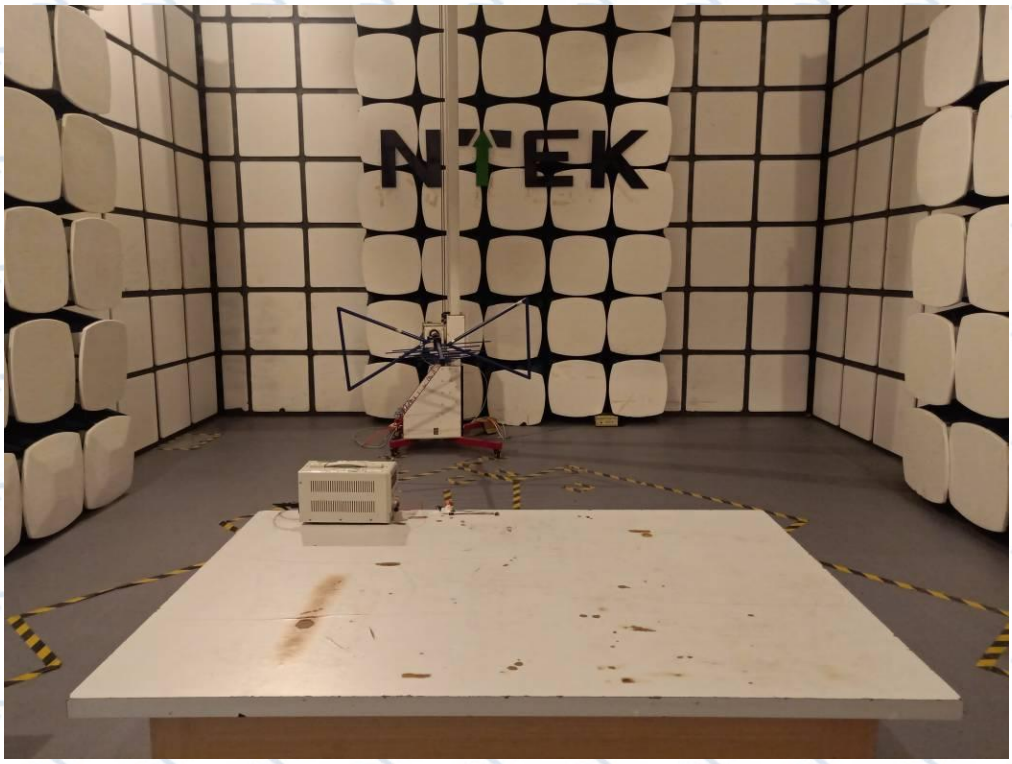


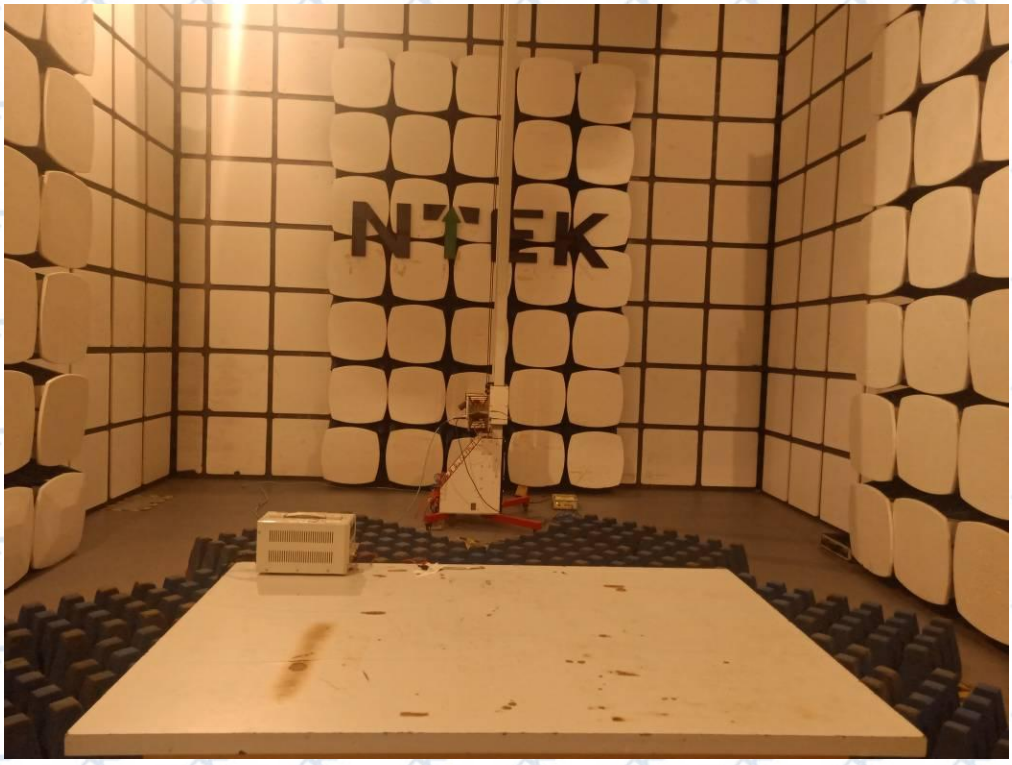
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		13367.50	35.67	24.10	59.77	74.00	-14.23	peak			
2		13367.50	23.40	24.10	47.50	54.00	-6.50	AVG			
3		14600.00	36.10	24.50	60.60	74.00	-13.40	peak			
4		14600.00	23.20	24.50	47.70	54.00	-6.30	AVG			
5		17277.50	34.05	28.55	62.60	74.00	-11.40	peak			
6	*	17277.50	21.15	28.55	49.70	54.00	-4.30	AVG			

Remark:
Correct Factor = Antenna Factor + Cable Loss – Pre-Amplifier gain
Measurement Level = Reading Level + Correct Factor
Over Level = Measurement Level - Limit

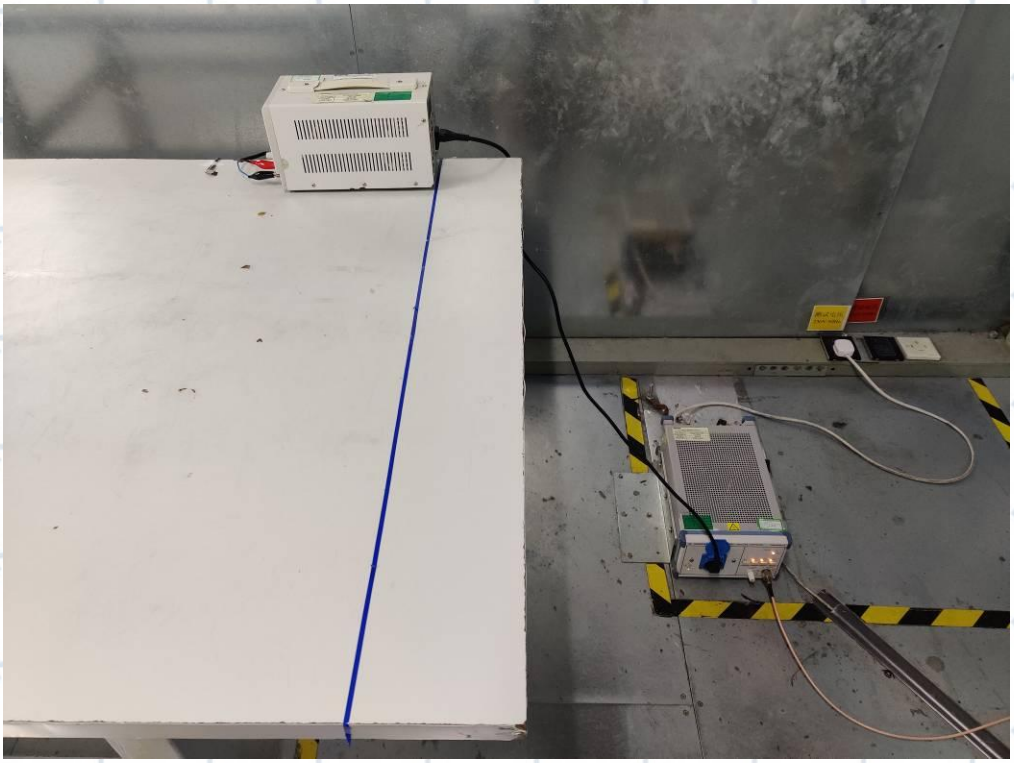
4. EUT TEST PHOTO

Radiated Measurement Photo





Conducted Measurement Photo



ATTACHMENT PHOTOGRAPHS OF EUT

Photo 1

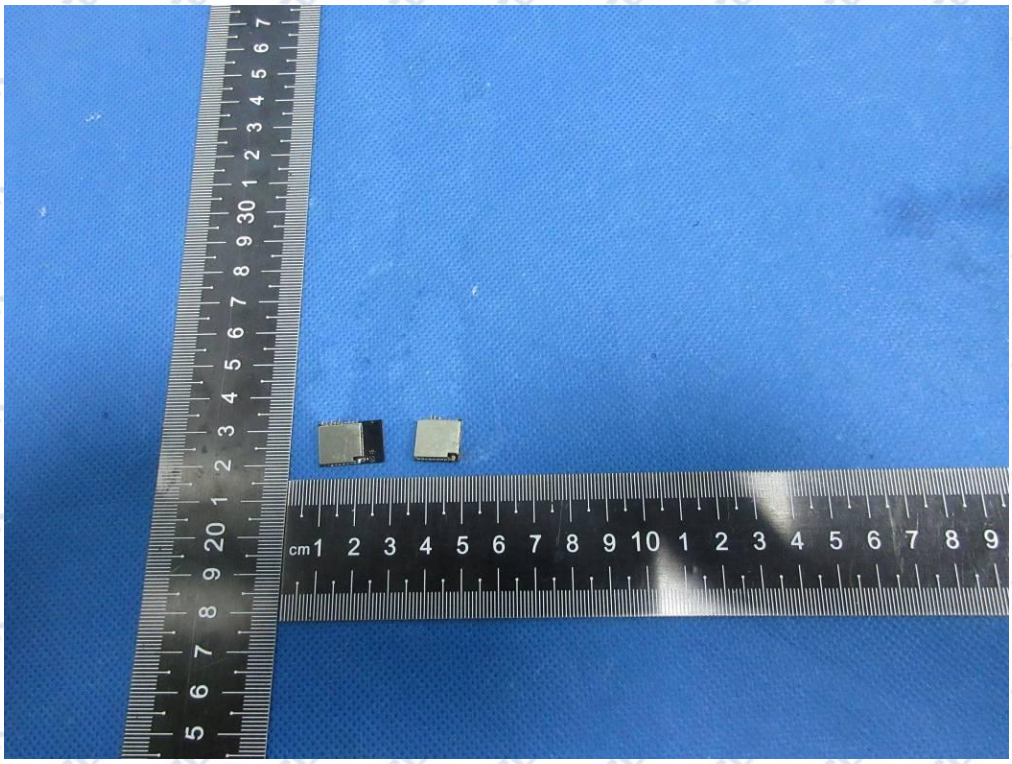


Photo 2

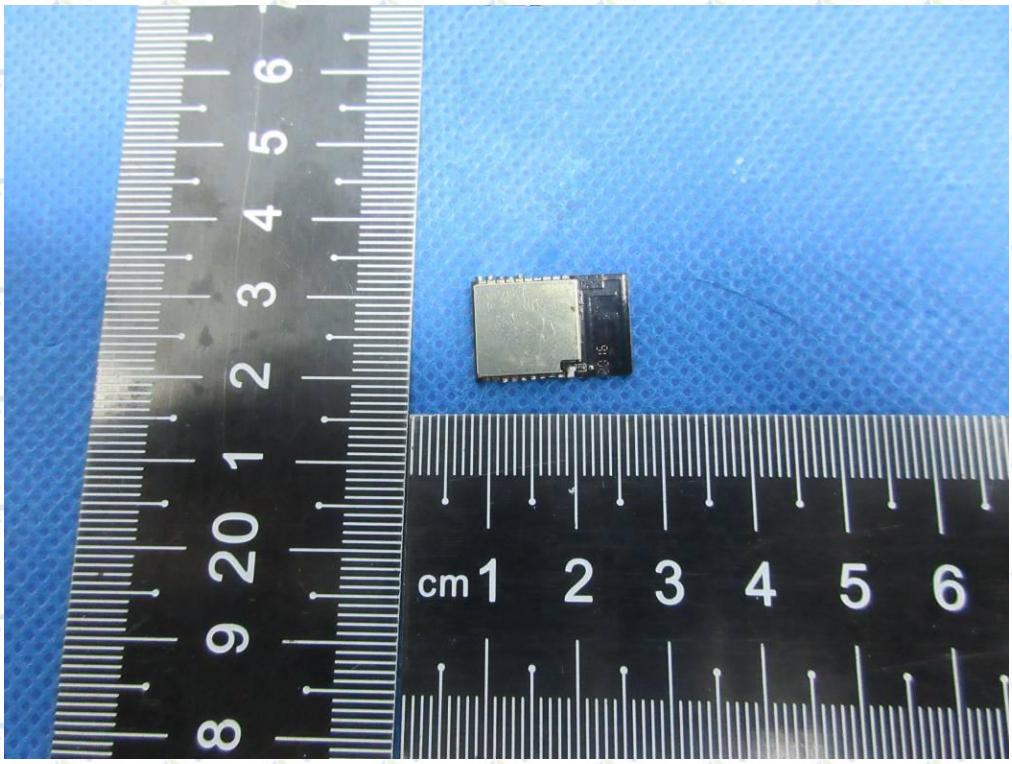
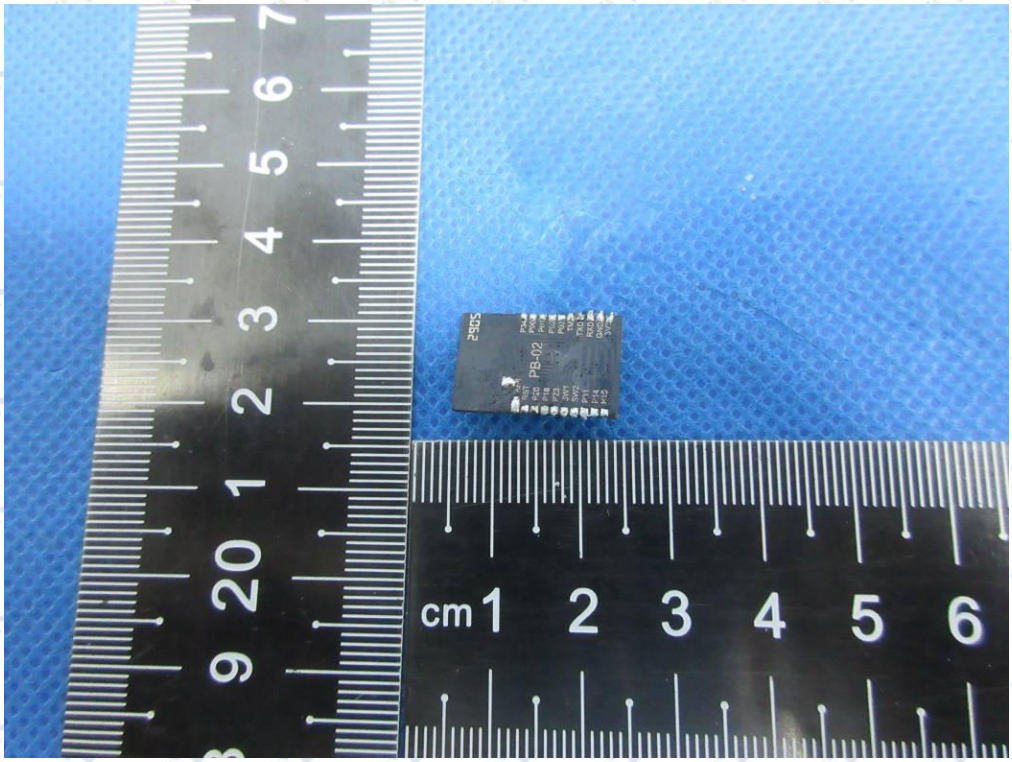


Photo 3



------ End of Report ------