FCC Part 15C Test Report
FCC ID:2A2NL-T20

Applicant:	Shenzhen futianda Electronic Technology Group Co.,Ltd
Address:	2th floor, NO.2 building chenqiu industrial park NO.88 Hudipai village Guanlan District, Shenzhen City
Manufacturer:	Shenzhen futianda Electronic Technology Group Co.,Ltd
Address:	2th floor, NO.2 building chenqiu industrial park NO.88 Hudipai village Guanlan District, Shenzhen City
EUT:	Wireless Bluetooth Earbuds
Trade Mark:	N/A
Model Number:	T20, T18
Date of Receipt:	Jul. 03, 2021
Test Date:	Jul. 03, 2021 - Jul. 16, 2021
Date of Report:	Jul. 16, 2021
Prepared By:	Shenzhen DL Testing Technology Co., Ltd.
Address:	101-201, Building C, Shuanghuan, No.8, Baoqing Road, Baolong Industrial Zone, Baolong Street, Longgang District, Shenzhen, Guangdong, China
Applicable Standards:	FCC PART 15 C 15.249 ANSI C63.10:2013
Test Result:	Pass
Report Number:	DL-20210716021E

Prepared (Test Engineer):	Pxing Huang
Reviewer (Supervisor):	Jack Bu
Approved (Manager):	Jade Yang

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Shenzhen DL Testing Technology Co., Ltd.

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.249) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.249(c)	Fundamental &Radiated Spurious Emission Measurement	PASS	
15.205	Band Edge Emission	PASS	
15.215	20dB Bandwidth	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

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

1.1 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** %.

No.	Item	Uncertainty
1	Conducted Emission Test	±2.56dB
2	RF power,conducted	±0.42dB
3	Spurious emissions,conducted	±2.76dB
4	All emissions,radiated(<1G)	±3.65dB
5	All emissions,radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name:	Wireless Bluetooth Earbuds
Trademark	N/A
Model No.:	T20, T18
Model Difference	All samples are the same except the model name, so we prepare " T20" for test only.
Operation Frequency:	2402~2480MHz
Channel numbers:	79 Channels
Channel separation:	1/2/3M
Modulation technology:	GFSK , PI/4 DQPSK, 8DPSK
Antenna Type:	Internal Antenna
Antenna gain:	2.67dBi
Power supply:	DC 3.7V from battery DC 5V from charger

Note:
1.For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2.The EUT's all information provided by client.

3.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

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	CH00	GFSK,PI/4 DQPSK,8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Link Mode	

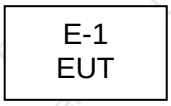
For Conducted & Radiated Emission		
Final Test Mode	Description	
Mode 1	CH00	GFSK,PI/4 DQPSK,8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Link Mode	

Note:

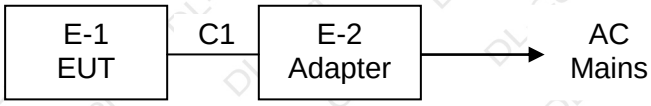
(1) The measurements are performed at the highest, middle, lowest available channels.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Spurious Emission Test



2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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	Model/Type No.	Series No.	Note
E-1	Wireless Bluetooth Earbuds	T20	N/A	EUT
E-2	Adapter	HW-0501000E	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C1	No	No	0.5m	Mini USB Line

Note:

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

2.5 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the end product.

Test software Version	Test program: AXDN-0002.0		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Setting of Softwave	10	10	10

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation test, Band-edge test and 20db bandwidth test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4408B	MY50140780	Dec. 07, 2020	Dec. 06, 2021
2	Test Receiver (9kHz-7GHz)	R&S	ESRP7	101393	Dec. 07, 2020	Dec. 06, 2021
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB9162	00306	Dec. 07, 2020	Dec. 06, 2021
4	Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA9120D	02139	Dec. 07, 2020	Dec. 06, 2021
5	Horn Antenna (18GHz-40GHz)	A.H. Systems	SAS-574	588	Dec. 07, 2020	Dec. 06, 2021
6	Amplifier (9KHz-6GHz)	Schwarzbeck	BBV9743B	00153	Dec. 07, 2020	Dec. 06, 2021
7	Amplifier (1GHz-18GHz)	EMEC	EM01G8GA	00270	Dec. 07, 2020	Dec. 06, 2021
8	Amplifier (18GHz-40GHz)	Quanjuda	DLE-161	97	Dec. 07, 2020	Dec. 06, 2021
9	Loop Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1519B	00014	Dec. 07, 2020	Dec. 06, 2021
10	RF cables1 (9kHz-1GHz)	ChengYu	966	004	Dec. 07, 2020	Dec. 06, 2021
11	RF cables2 (1GHz-40GHz)	ChengYu	966	003	Dec. 07, 2020	Dec. 06, 2021
12	Antenna connector	Florida RF Labs	N/A	RF 01#	Dec. 07, 2020	Dec. 06, 2021
13	Power probe	KEYSIGHT	U2021XA	MY55210018	Dec. 07, 2020	Dec. 06, 2021
14	Signal Analyzer 9kHz-26.5GHz	Agilent	N9020A	MY55370280	Dec. 07, 2020	Dec. 06, 2021
15	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	Dec. 07, 2020	Dec. 06, 2021
16	D.C. Power Supply	LongWei	PS-305D	010964729	Dec. 07, 2020	Dec. 06, 2021

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	843 Shielded Room	ChengYu	843 Room	843	Nov. 25, 2019	Nov. 24, 2022
2	EMI Receiver	R&S	ESR	101421	Dec. 07, 2020	Dec. 06, 2021
3	LISN	R&S	ENV216	102417	Dec. 07, 2020	Dec. 06, 2021
4	843 Cable 1#	ChengYu	CE Cable	001	Dec. 07, 2020	Dec. 06, 2021

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	FALA	EZ_EMC	EMC-CON 3A1.1
2	EMC radiation test system	FALA	EZ_EMC	FA-03A2
3	RF test system	MAIWEI	MTS8310	2.0.0.0
4	RF communication test system	MAIWEI	MTS8200	2.0.0.0

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

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

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

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.

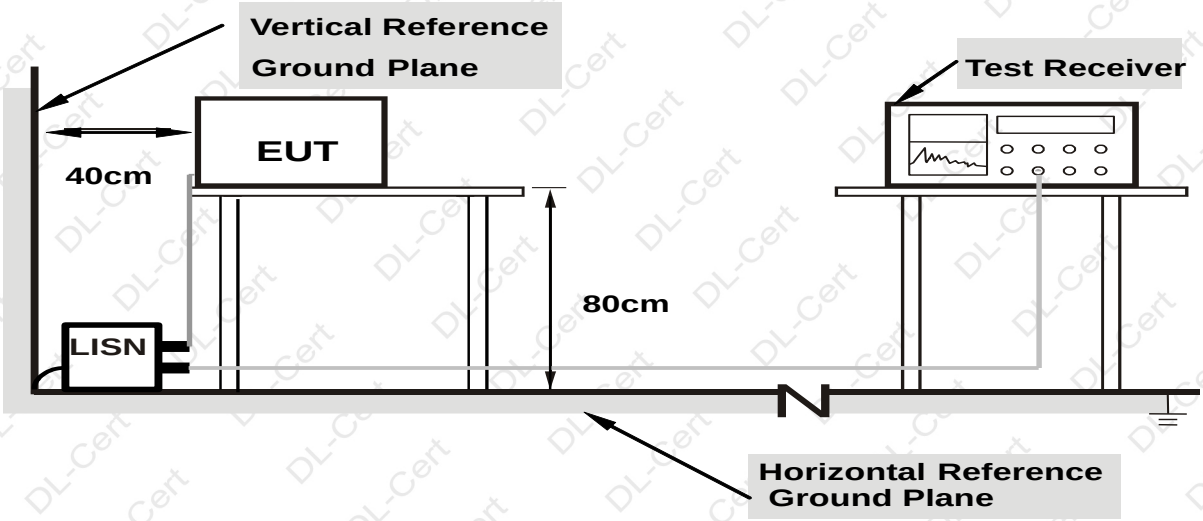
d. LISN at least 80 cm from nearest part of EUT chassis.

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

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 TEST SETUP



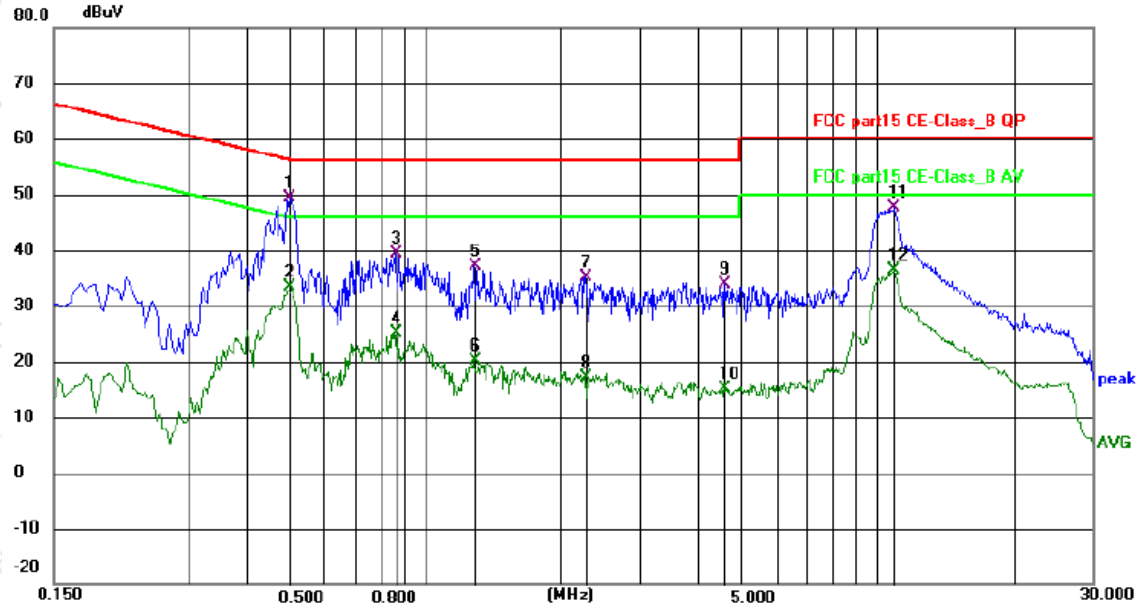
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.
We pretest AC 120V and AC 230V, the worst voltage was AC 120V and the data recording in the report.

3.1.6 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	L
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 4

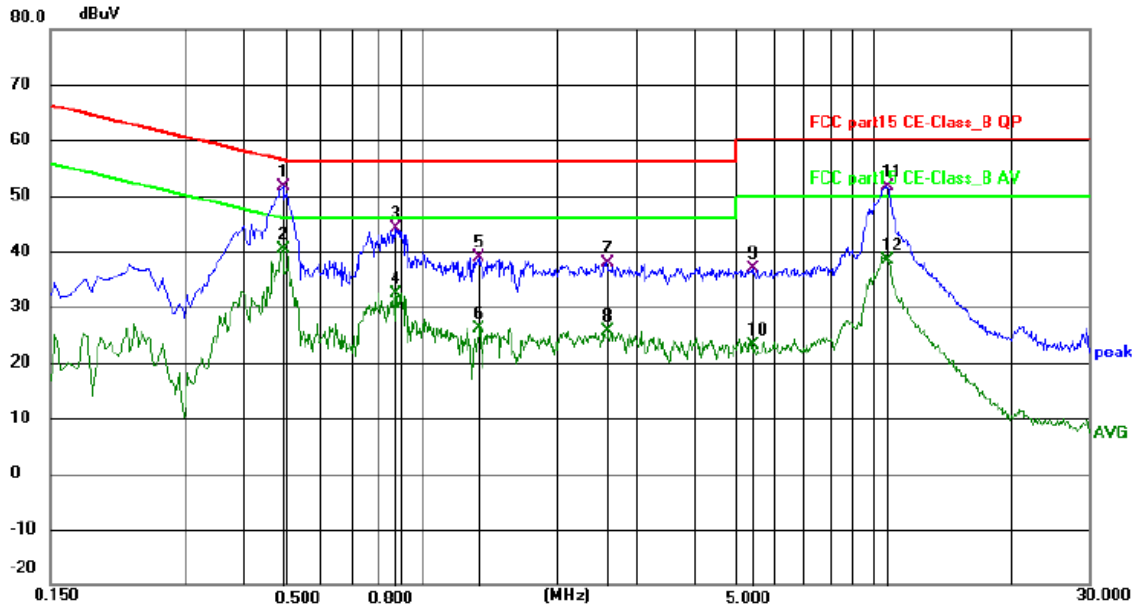


Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.5010	40.05	9.35	49.40	56.00	6.60	QP	P	
2	0.5010	24.05	9.35	33.40	46.00	12.60	AVG	P	
3	0.8609	29.78	9.50	39.28	56.00	16.72	QP	P	
4	0.8609	15.52	9.50	25.02	46.00	20.98	AVG	P	
5	1.2884	27.42	9.61	37.03	56.00	18.97	QP	P	
6	1.2884	10.46	9.61	20.07	46.00	25.93	AVG	P	
7	2.2514	25.54	9.69	35.23	56.00	20.77	QP	P	
8	2.2514	7.35	9.69	17.04	46.00	28.96	AVG	P	
9	4.6185	24.18	9.78	33.96	56.00	22.04	QP	P	
10	4.6185	5.39	9.78	15.17	46.00	30.83	AVG	P	
11	10.9230	37.71	10.04	47.75	60.00	12.25	QP	P	
12	10.9230	26.34	10.04	36.38	50.00	13.62	AVG	P	

Temperature:	25 ℃	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 4



Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.4920	42.18	9.54	51.72	56.13	4.41	QP	P	
2	0.4920	30.90	9.54	40.44	46.13	5.69	AVG	P	
3	0.8744	34.69	9.48	44.17	56.00	11.83	QP	P	
4	0.8744	22.86	9.48	32.34	46.00	13.66	AVG	P	
5	1.3334	29.15	9.71	38.86	56.00	17.14	QP	P	
6	1.3334	16.45	9.71	26.16	46.00	19.84	AVG	P	
7	2.5620	27.96	9.98	37.94	56.00	18.06	QP	P	
8	2.5620	15.54	9.98	25.52	46.00	20.48	AVG	P	
9	5.3925	26.98	9.94	36.92	60.00	23.08	QP	P	
10	5.3925	13.07	9.94	23.01	50.00	26.99	AVG	P	
11	10.7295	41.43	10.21	51.64	60.00	8.36	QP	P	
12	10.7295	28.27	10.21	38.48	50.00	11.52	AVG	P	

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 - 928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

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

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

Receiver setup:

Frequency	Detector	RBW	VBW	Value
9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

3.2.2 TEST PROCEDURE

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. 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 antenna height 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) 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 Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. (Above 18GHz the distance is 3 meter and table is 1.5 metre).
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

Note:

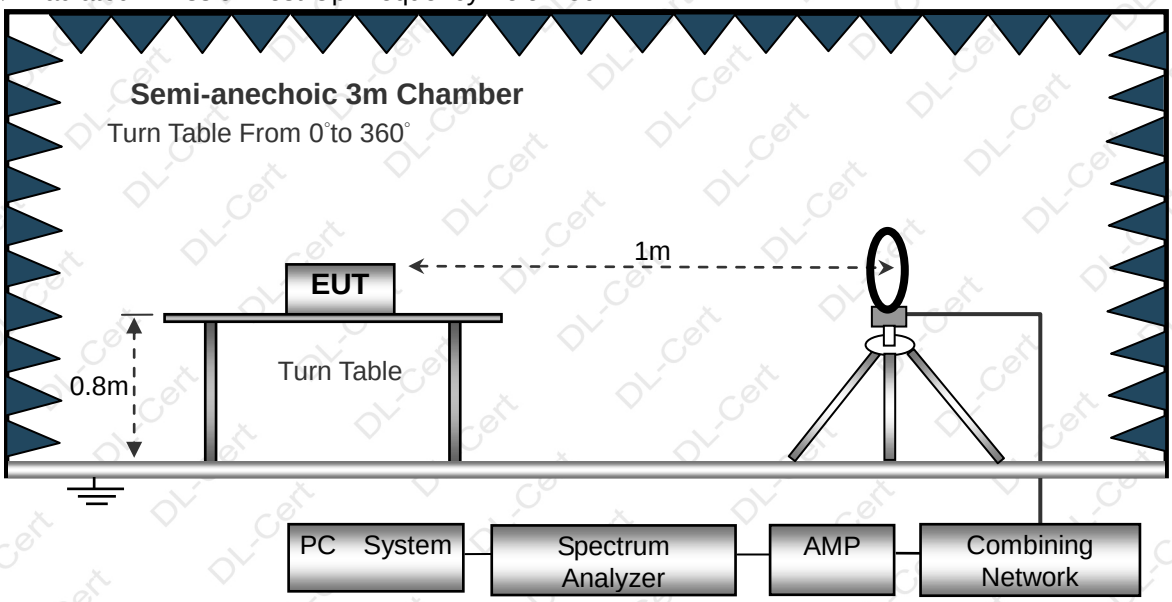
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

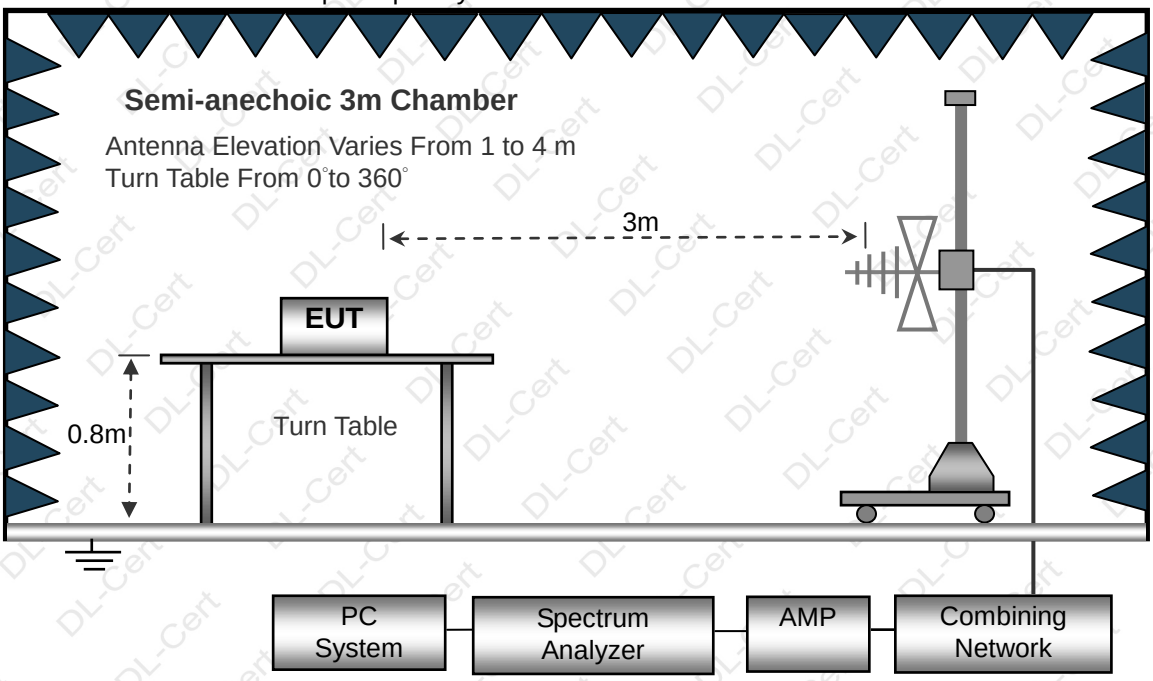
No deviation

3.2.4 TEST SETUP

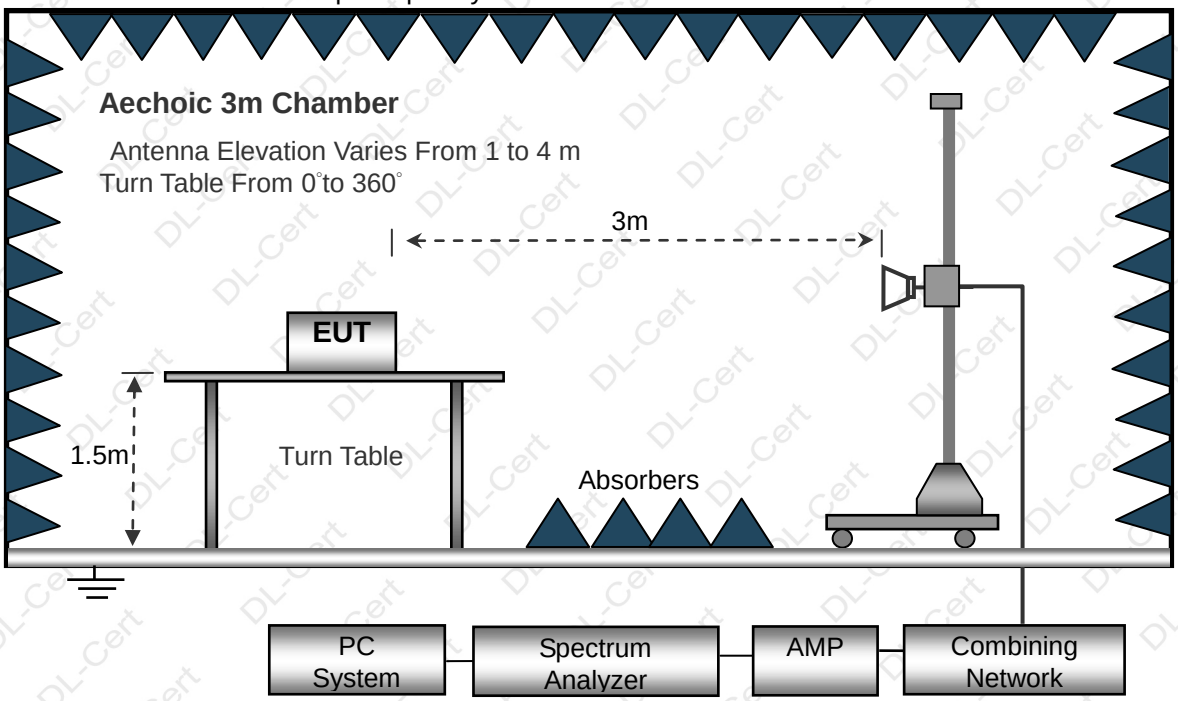
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 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.

3.2.6 TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)

Temperature:	20℃	Relative Humidtity:	48%
Pressure:	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 4	Polarization :	--

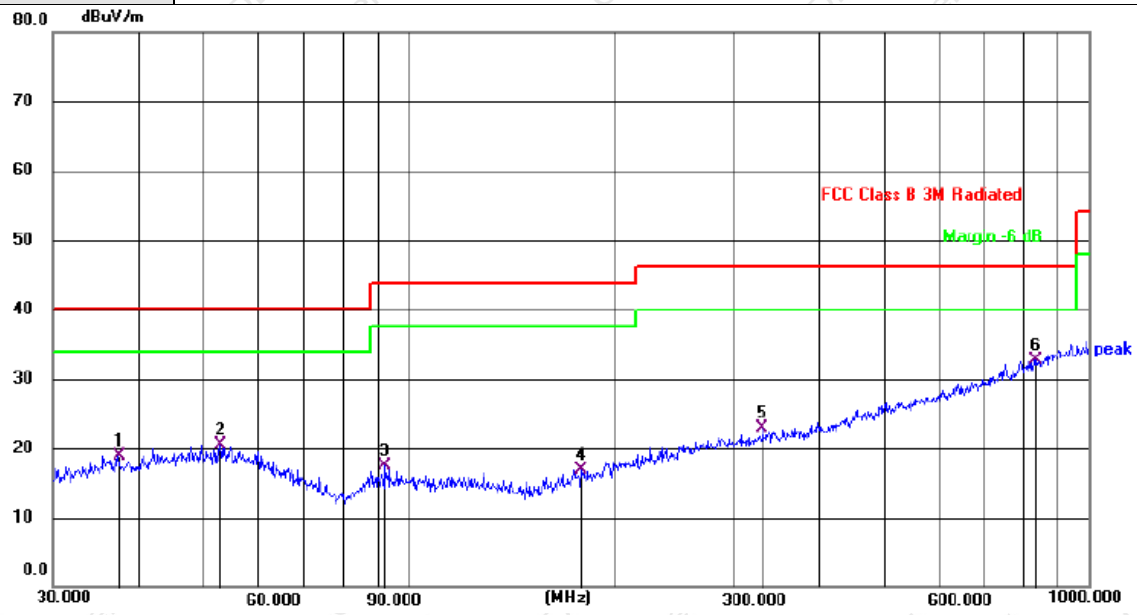
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (BETWEEN 30MHZ – 1GHZ)

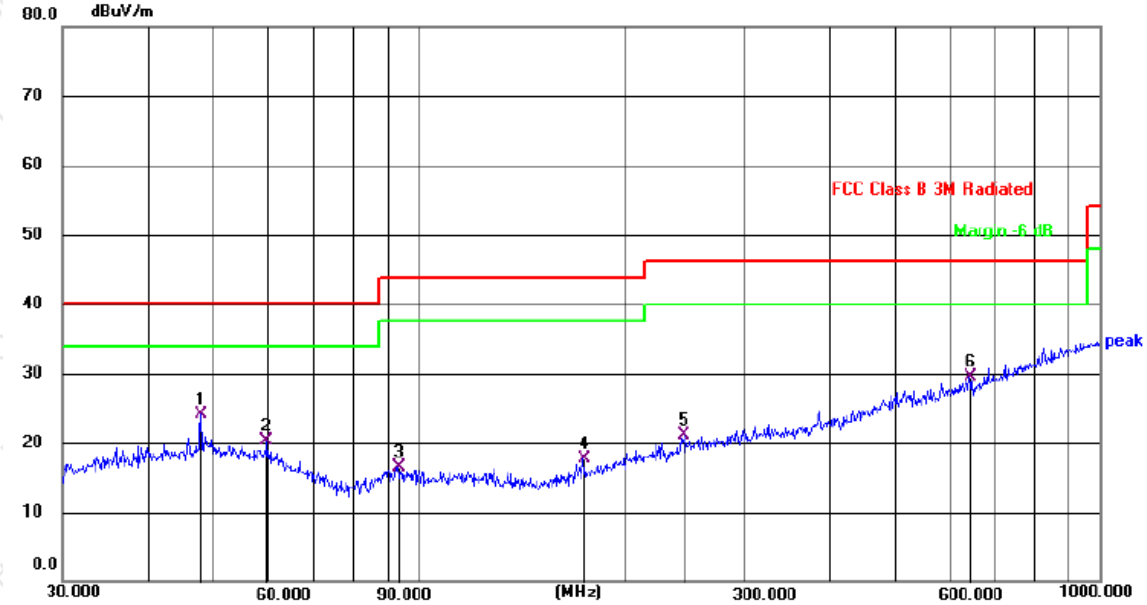
Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Horizontal
Test Voltage :	DC 3.7V		
Test Mode :	Mode 4		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		37.4165	33.71	-14.74	18.97	40.00	21.03	QP
2		52.9453	34.06	-13.57	20.49	40.00	19.51	QP
3		92.4624	34.90	-17.31	17.59	43.50	25.91	QP
4		179.3863	34.36	-17.36	17.00	43.50	26.50	QP
5		331.3546	34.86	-12.00	22.86	46.00	23.14	QP
6	*	830.4002	35.27	-2.53	32.74	46.00	13.26	QP

Remark:
Correct Factor = Cable loss + Antenna factor – Preamplifier;
Level = Reading Level + Correct Factor; Margin = Limit – Level;

Temperature:	26℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Vertical
Test Voltage :	DC 3.7V		
Test Mode :	Mode 4		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	47.9940	37.66	-13.50	24.16	40.00	15.84	QP
2		59.8588	34.46	-14.17	20.29	40.00	19.71	QP
3		93.1132	33.82	-17.34	16.48	43.50	27.02	QP
4		174.4241	35.34	-17.66	17.68	43.50	25.82	QP
5		245.0900	35.17	-14.11	21.06	46.00	24.94	QP
6		642.8613	35.29	-5.77	29.52	46.00	16.48	QP

Remark:

Correct Factor = Cable loss + Antenna factor – Preamplifier;

Level = Reading Level + Correct Factor; Margin = Limit – Level;

3.2.8 TEST RESULTS (1GHZ~25GHZ)

GFSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	113.24	52.16	2.78	27.41	91.27	114	-22.73	PK
V	2402.00	106.27	52.16	2.78	27.41	84.3	94	-9.7	AV
V	4804.00	77.75	51.74	3.08	31.25	60.34	74	-13.66	PK
V	4804.00	65.24	51.74	3.08	31.25	47.83	54	-6.17	AV
V	16132.00	58.87	51.56	7.36	41.57	56.24	74	-17.76	PK
H	2402.00	112.86	52.16	2.78	27.41	90.89	114	-23.11	PK
H	2402.00	105.53	52.16	2.78	27.41	83.56	94	-10.44	AV
H	4804.00	76.84	51.74	3.08	31.25	59.43	74	-14.57	PK
H	4804.00	65.43	51.74	3.08	31.25	48.02	54	-5.98	AV
H	16132.00	58.83	51.56	7.36	41.57	56.2	74	-17.8	PK
operation frequency:2441									
V	2441.00	112.4	52.11	2.82	27.47	90.58	114	-23.42	PK
V	2441.00	105.95	52.11	2.82	27.47	84.13	94	-9.87	AV
V	4882.00	77.56	51.77	3.03	31.34	60.16	74	-13.84	PK
V	4882.00	65.14	51.77	3.03	31.34	47.74	54	-6.26	AV
V	16132.00	58.7	51.56	7.36	41.57	56.07	74	-17.93	PK
H	2441.00	112.54	52.11	2.82	27.47	90.72	114	-23.28	PK
H	2441.00	104.93	52.11	2.82	27.47	83.11	94	-10.89	AV
H	4882.00	76.65	51.77	3.03	31.34	59.25	74	-14.75	PK
H	4882.00	65.27	51.77	3.03	31.34	47.87	54	-6.13	AV
H	16132.00	58.72	51.56	7.36	41.57	56.09	74	-17.91	PK
operation frequency:2480									
V	2480.00	113.4	52.23	2.86	27.44	91.47	114	-22.53	PK
V	2480.00	106.53	52.23	2.86	27.44	84.6	94	-9.4	AV
V	4960.00	78.03	51.69	3.05	31.39	60.78	74	-13.22	PK
V	4960.00	65.54	51.69	3.05	31.39	48.29	54	-5.71	AV
V	16132.00	59.15	51.56	7.36	41.57	56.52	74	-17.48	PK
H	2480.00	113.35	52.23	2.86	27.44	91.42	114	-22.58	PK
H	2480.00	105.55	52.23	2.86	27.44	83.62	94	-10.38	AV
H	4960.00	77.07	51.69	3.05	31.39	59.82	74	-14.18	PK
H	4960.00	65.55	51.69	3.05	31.39	48.3	54	-5.7	AV
H	16132.00	59.16	51.56	7.36	41.57	56.53	74	-17.47	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

PI/4 DQPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	113.84	52.16	2.78	27.41	91.87	114	-22.13	PK
V	2402.00	107.32	52.16	2.78	27.41	85.35	94	-8.65	AV
V	4804.00	77.44	51.74	3.08	31.25	60.03	74	-13.97	PK
V	4804.00	65.54	51.74	3.08	31.25	48.13	54	-5.87	AV
V	16132.00	59.46	51.56	7.36	41.57	56.83	74	-17.17	PK
H	2402.00	113.21	52.16	2.78	27.41	91.24	114	-22.76	PK
H	2402.00	106.27	52.16	2.78	27.41	84.3	94	-9.7	AV
H	4804.00	79.54	51.74	3.08	31.25	62.13	74	-11.87	PK
H	4804.00	66.37	51.74	3.08	31.25	48.96	54	-5.04	AV
H	16132.00	57.75	51.56	7.36	41.57	55.12	74	-18.88	PK
operation frequency:2441									
V	2441.00	112.46	52.11	2.82	27.47	90.64	114	-23.36	PK
V	2441.00	105.34	52.11	2.82	27.47	83.52	94	-10.48	AV
V	4882.00	77.15	51.77	3.03	31.34	59.75	74	-14.25	PK
V	4882.00	65.37	51.77	3.03	31.34	47.97	54	-6.03	AV
V	16132.00	58.55	51.56	7.36	41.57	55.92	74	-18.08	PK
H	2441.00	112.84	52.11	2.82	27.47	91.02	114	-22.98	PK
H	2441.00	105.31	52.11	2.82	27.47	83.49	94	-10.51	AV
H	4882.00	76.65	51.77	3.03	31.34	59.25	74	-14.75	PK
H	4882.00	65.74	51.77	3.03	31.34	48.34	54	-5.66	AV
H	16132.00	58.37	51.56	7.36	41.57	55.74	74	-18.26	PK
operation frequency:2480									
V	2480.00	113.15	52.23	2.86	27.44	91.22	114	-22.78	PK
V	2480.00	105.26	52.23	2.86	27.44	83.33	94	-10.67	AV
V	4960.00	77.54	51.69	3.05	31.39	60.29	74	-13.71	PK
V	4960.00	65.17	51.69	3.05	31.39	47.92	54	-6.08	AV
V	16132.00	56.74	51.56	7.36	41.57	54.11	74	-19.89	PK
H	2480.00	113.13	52.23	2.86	27.44	91.2	114	-22.8	PK
H	2480.00	104.22	52.23	2.86	27.44	82.29	94	-11.71	AV
H	4960.00	76.44	51.69	3.05	31.39	59.19	74	-14.81	PK
H	4960.00	64.22	51.69	3.05	31.39	46.97	54	-7.03	AV
H	16132.00	57.94	51.56	7.36	41.57	55.31	74	-18.69	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

8DPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	112.45	52.16	2.78	27.41	90.48	114	-23.52	PK
V	2402.00	105.71	52.16	2.78	27.41	83.74	94	-10.26	AV
V	4804.00	76.87	51.74	3.08	31.25	59.46	74	-14.54	PK
V	4804.00	65.75	51.74	3.08	31.25	48.34	54	-5.66	AV
V	16132.00	56.66	51.56	7.36	41.57	54.03	74	-19.97	PK
H	2402.00	112.24	52.16	2.78	27.41	90.27	114	-23.73	PK
H	2402.00	105.07	52.16	2.78	27.41	83.1	94	-10.9	AV
H	4804.00	76.66	51.74	3.08	31.25	59.25	74	-14.75	PK
H	4804.00	65.64	51.74	3.08	31.25	48.23	54	-5.77	AV
H	16132.00	57.41	51.56	7.36	41.57	54.78	74	-19.22	PK
operation frequency:2441									
V	2441.00	112.25	52.11	2.82	27.47	90.43	114	-23.57	PK
V	2441.00	104.87	52.11	2.82	27.47	83.05	94	-10.95	AV
V	4882.00	76.75	51.77	3.03	31.34	59.35	74	-14.65	PK
V	4882.00	64.93	51.77	3.03	31.34	47.53	54	-6.47	AV
V	16132.00	57.84	51.56	7.36	41.57	55.21	74	-18.79	PK
H	2441.00	112.23	52.11	2.82	27.47	90.41	114	-23.59	PK
H	2441.00	103.52	52.11	2.82	27.47	81.7	94	-12.3	AV
H	4882.00	75.37	51.77	3.03	31.34	57.97	74	-16.03	PK
H	4882.00	63.65	51.77	3.03	31.34	46.25	54	-7.75	AV
H	16132.00	56.38	51.56	7.36	41.57	53.75	74	-20.25	PK
operation frequency:2480									
V	2480.00	112.41	52.23	2.86	27.44	90.48	114	-23.52	PK
V	2480.00	103.57	52.23	2.86	27.44	81.64	94	-12.36	AV
V	4960.00	77.64	51.69	3.05	31.39	60.39	74	-13.61	PK
V	4960.00	64.38	51.69	3.05	31.39	47.13	54	-6.87	AV
V	16132.00	58.63	51.56	7.36	41.57	56	74	-18	PK
H	2480.00	112.44	52.23	2.86	27.44	90.51	114	-23.49	PK
H	2480.00	103.77	52.23	2.86	27.44	81.84	94	-12.16	AV
H	4960.00	77.45	51.69	3.05	31.39	60.2	74	-13.8	PK
H	4960.00	64.78	51.69	3.05	31.39	47.53	54	-6.47	AV
H	16132.00	57.53	51.56	7.36	41.57	54.9	74	-19.1	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.3 RADIATED BAND EMISSION MEASUREMENT

3.3.1 TEST REQUIREMENT:

FCC Part15 C Section 15.209 and 15.205

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

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

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

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

3.3.2 TEST PROCEDURE

Above 1GHz test procedure as below:

a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. 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 antenna height 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel,the Highest channel

Note:

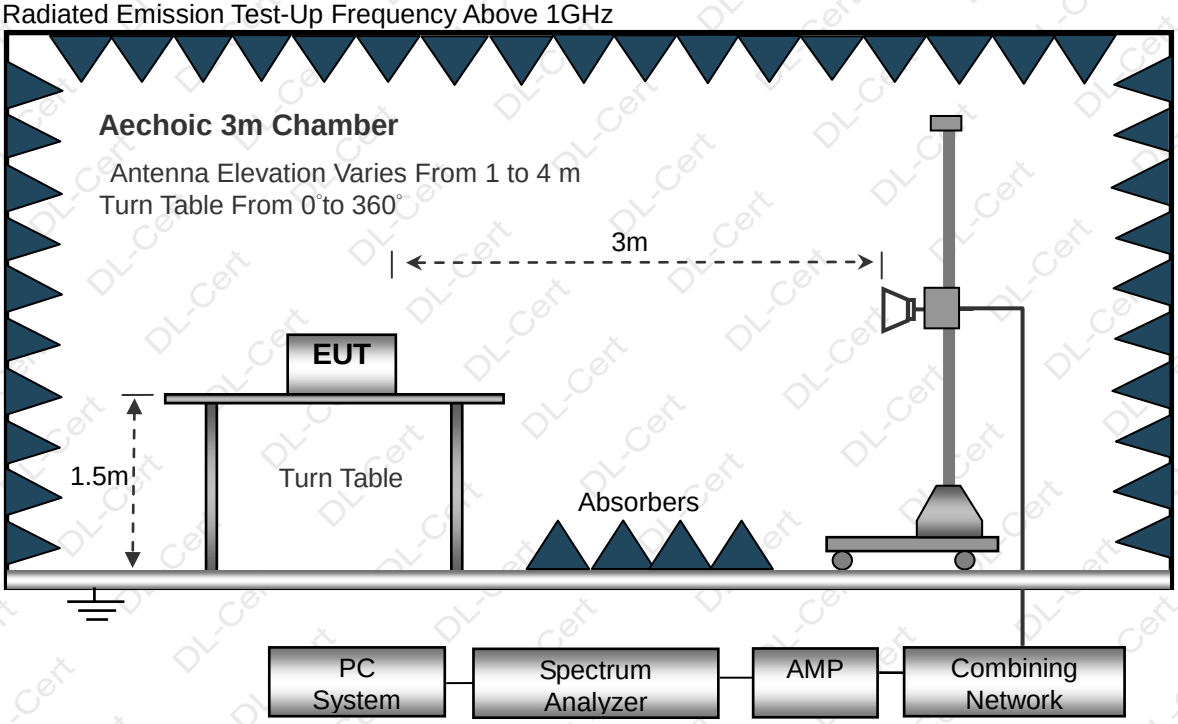
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



3.3.5 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.

3.3.6 TEST RESULT

GFSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	76.24	52.12	2.73	27.38	54.23	74	-19.77	PK
V	2390.00	65.17	52.12	2.73	27.38	43.16	54	-10.84	AV
V	2400.00	76.15	52.16	2.78	27.41	54.18	74	-19.82	PK
V	2400.00	64.74	52.16	2.78	27.41	42.77	54	-11.23	AV
H	2390.00	76.76	52.12	2.73	27.38	54.75	74	-19.25	PK
H	2390.00	65.25	52.12	2.73	27.38	43.24	54	-10.76	AV
H	2400.00	76.32	52.16	2.78	27.41	54.35	74	-19.65	PK
H	2400.00	65.14	52.16	2.78	27.41	43.17	54	-10.83	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	76.61	52.23	2.86	27.44	54.68	74	-19.32	PK
V	2483.50	65.45	52.23	2.86	27.44	43.52	54	-10.48	AV
V	2500.00	76.57	52.26	2.88	27.49	54.68	74	-19.32	PK
V	2500.00	64.86	52.26	2.88	27.49	42.97	54	-11.03	AV
H	2483.50	76.78	52.23	2.86	27.44	54.85	74	-19.15	PK
H	2483.50	65.45	52.23	2.86	27.44	43.52	54	-10.48	AV
H	2500.00	76.34	52.26	2.88	27.49	54.45	74	-19.55	PK
H	2500.00	65.63	52.26	2.88	27.49	43.74	54	-10.26	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

PI/4 DQPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	76.16	52.12	2.73	27.38	54.15	74	-19.85	PK
V	2390.00	65.35	52.12	2.73	27.38	43.34	54	-10.66	AV
V	2400.00	76.51	52.16	2.78	27.41	54.54	74	-19.46	PK
V	2400.00	64.94	52.16	2.78	27.41	42.97	54	-11.03	AV
H	2390.00	76.86	52.12	2.73	27.38	54.85	74	-19.15	PK
H	2390.00	65.37	52.12	2.73	27.38	43.36	54	-10.64	AV
H	2400.00	76.73	52.16	2.78	27.41	54.76	74	-19.24	PK
H	2400.00	65.24	52.16	2.78	27.41	43.27	54	-10.73	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	76.61	52.23	2.86	27.44	54.68	74	-19.32	PK
V	2483.50	65.54	52.23	2.86	27.44	43.61	54	-10.39	AV
V	2500.00	76.71	52.26	2.88	27.49	54.82	74	-19.18	PK
V	2500.00	65.05	52.26	2.88	27.49	43.16	54	-10.84	AV
H	2483.50	76.96	52.23	2.86	27.44	55.03	74	-18.97	PK
H	2483.50	65.63	52.23	2.86	27.44	43.7	54	-10.3	AV
H	2500.00	76.45	52.26	2.88	27.49	54.56	74	-19.44	PK
H	2500.00	65.86	52.26	2.88	27.49	43.97	54	-10.03	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

8DPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	76.77	52.12	2.73	27.38	54.76	74	-19.24	PK
V	2390.00	65.44	52.12	2.73	27.38	43.43	54	-10.57	AV
V	2400.00	77.63	52.16	2.78	27.41	55.66	74	-18.34	PK
V	2400.00	65.04	52.16	2.78	27.41	43.07	54	-10.93	AV
H	2390.00	77.05	52.12	2.73	27.38	55.04	74	-18.96	PK
H	2390.00	65.56	52.12	2.73	27.38	43.55	54	-10.45	AV
H	2400.00	76.97	52.16	2.78	27.41	55	74	-19	PK
H	2400.00	65.49	52.16	2.78	27.41	43.52	54	-10.48	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	77.52	52.23	2.86	27.44	55.59	74	-18.41	PK
V	2483.50	65.74	52.23	2.86	27.44	43.81	54	-10.19	AV
V	2500.00	76.95	52.26	2.88	27.49	55.06	74	-18.94	PK
V	2500.00	65.26	52.26	2.88	27.49	43.37	54	-10.63	AV
H	2483.50	77.16	52.23	2.86	27.44	55.23	74	-18.77	PK
H	2483.50	65.74	52.23	2.86	27.44	43.81	54	-10.19	AV
H	2500.00	76.72	52.26	2.88	27.49	54.83	74	-19.17	PK
H	2500.00	66.06	52.26	2.88	27.49	44.17	54	-9.83	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

4. BANDWIDTH TEST

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.215) , Subpart C	
Section	Test Item
15.215	Bandwidth

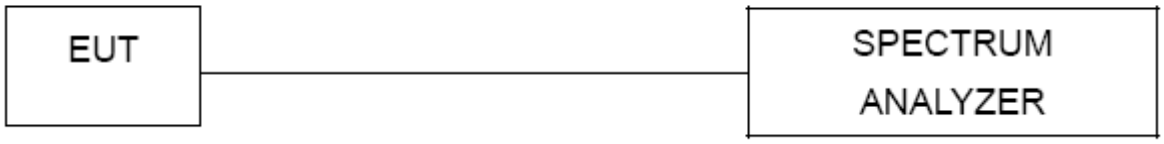
4.1.1 TEST PROCEDURE

1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW) ≥RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



4.1.4 EUT OPERATION CONDITIONS

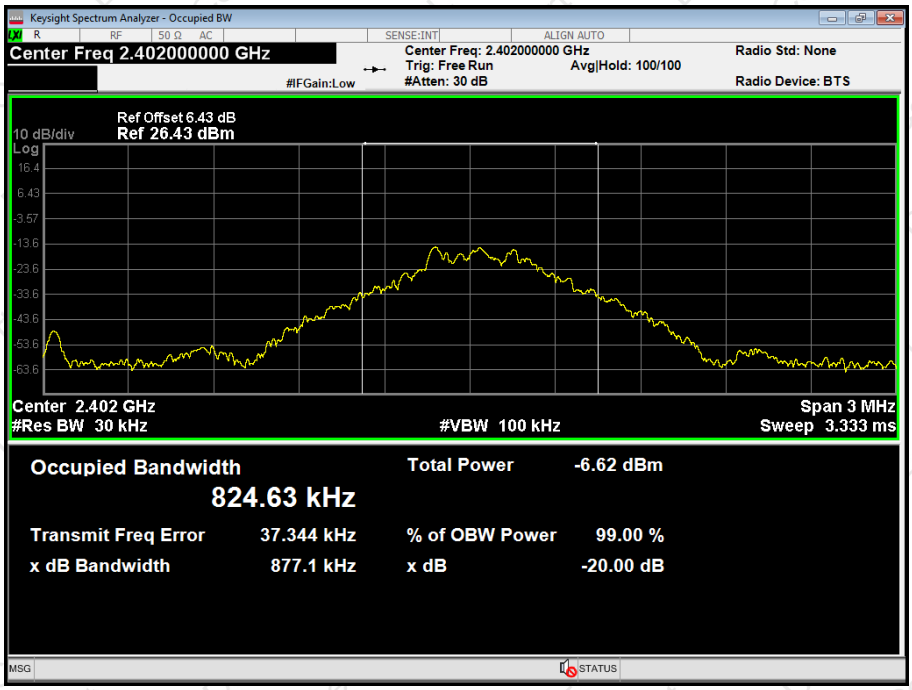
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

4.1.5 TEST RESULTS

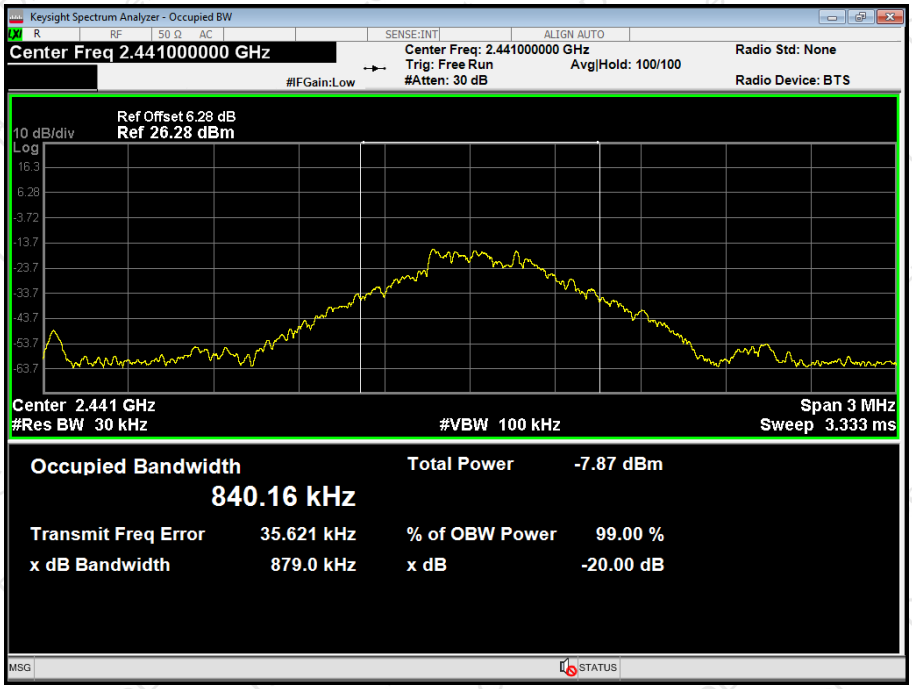
Temperature:	25℃	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage :	DC 3.7V
Test Mode :	TX Mode /CH00, CH39, CH78		

	Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2402	0.877	Pass
	2441	0.879	Pass
	2480	0.878	Pass
PI/4 DQPSK	2402	1.259	Pass
	2441	1.248	Pass
	2480	1.215	Pass
8DPSK	2402	1.243	Pass
	2441	1.210	Pass
	2480	1.217	Pass

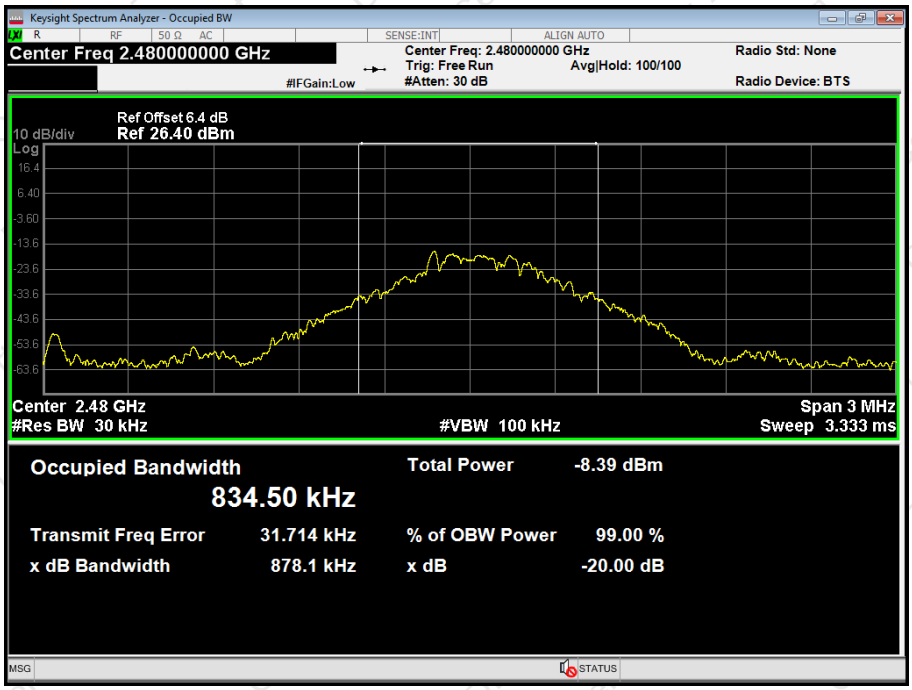
GFSK



2402MHz

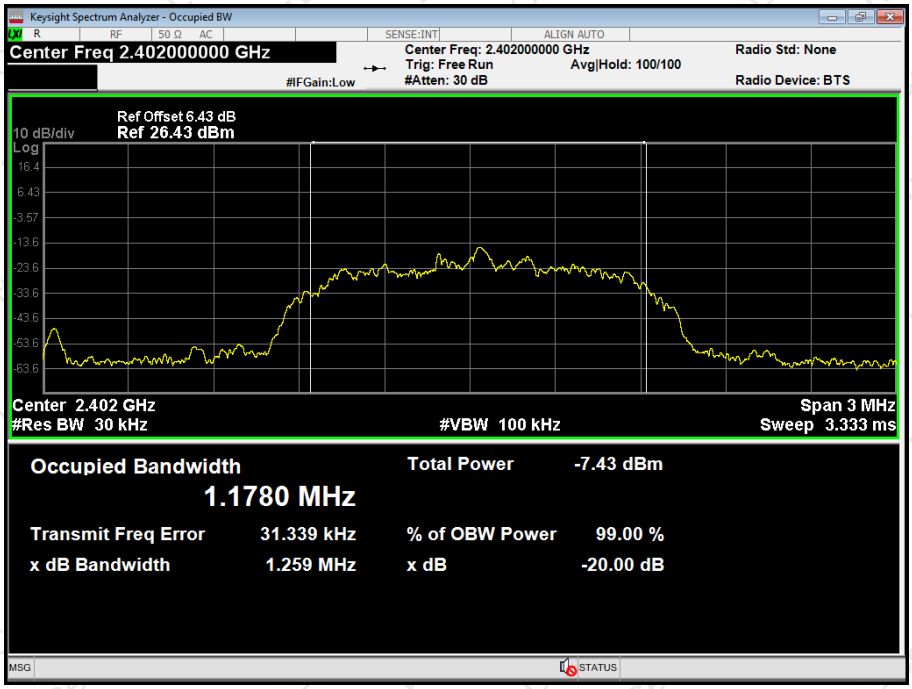


2441MHz

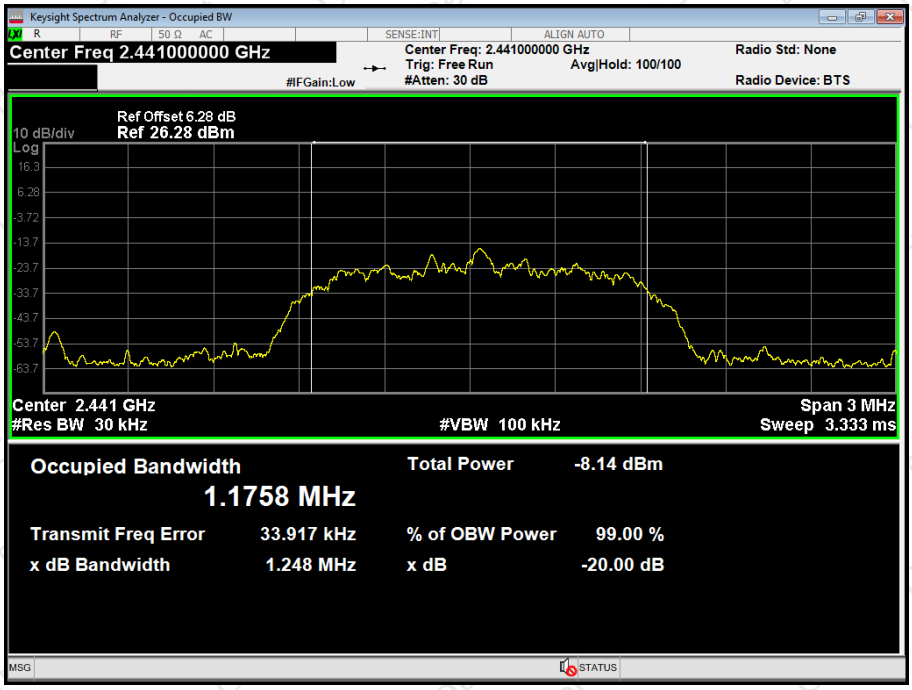

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Ref Offset 6.4 dB
10 dB/div
Ref 26.40 dBm
Log
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.333 ms
Occupied Bandwidth
834.50 kHz
Total Power -8.39 dBm
Transmit Freq Error 31.714 kHz
% of OBW Power 99.00 %
x dB Bandwidth 878.1 kHz
x dB -20.00 dB
MSG
STATUS

2480MHz

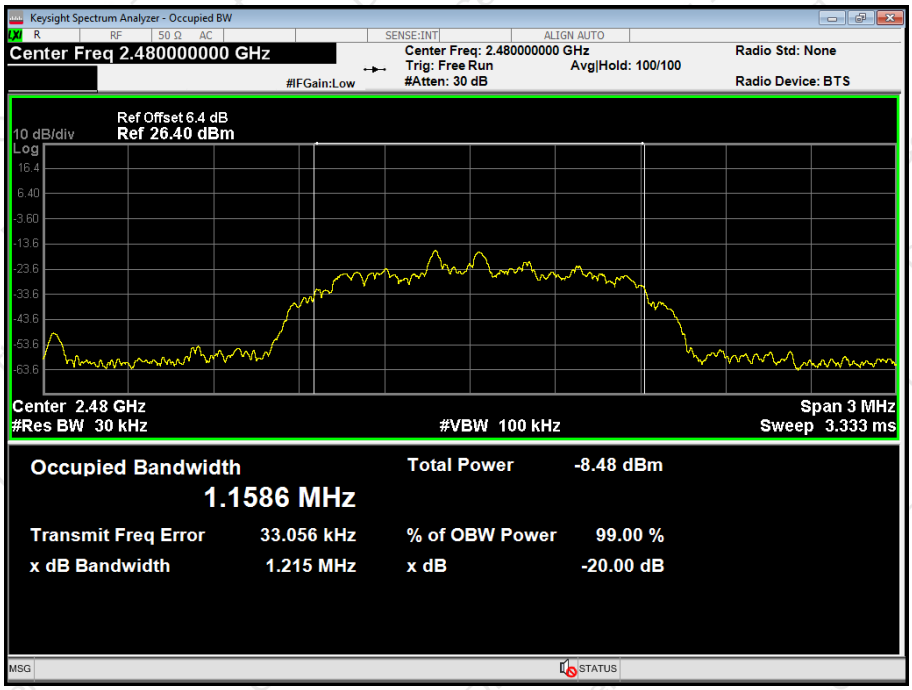
PI/4 DQPSK



2402MHz

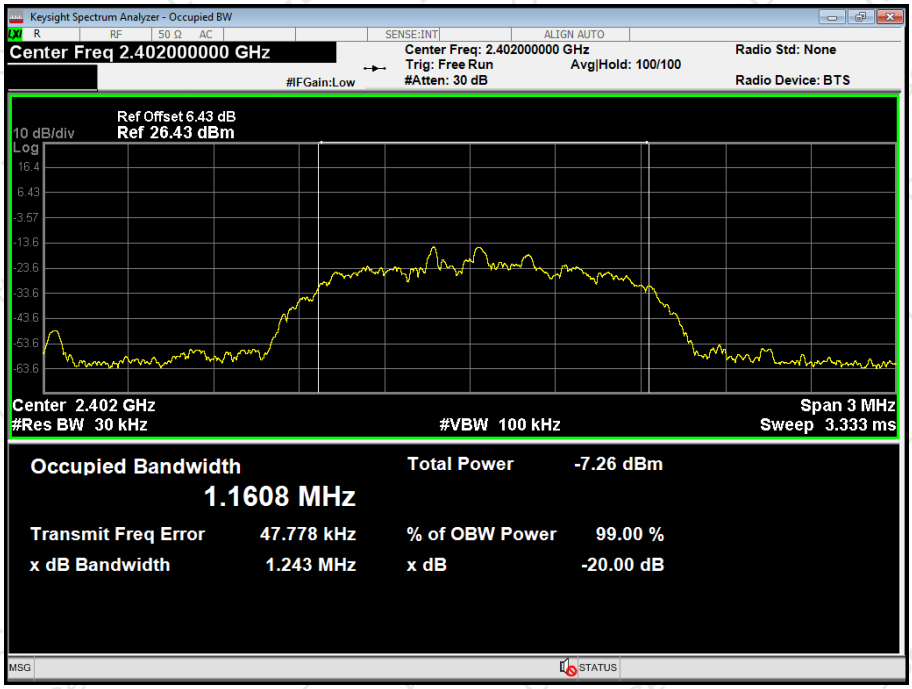


2441MHz

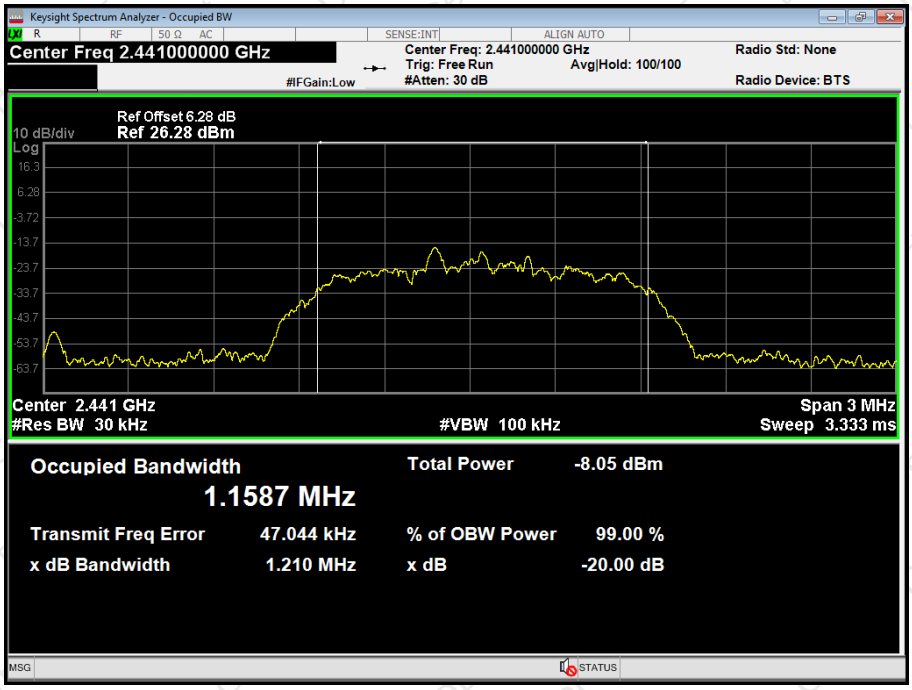

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Ref Offset 6.4 dB
10 dB/div
Ref 26.40 dBm
Log
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.333 ms
Occupied Bandwidth
1.1586 MHz
Total Power -8.48 dBm
Transmit Freq Error 33.056 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.215 MHz
x dB -20.00 dB
MSG
STATUS

2480MHz

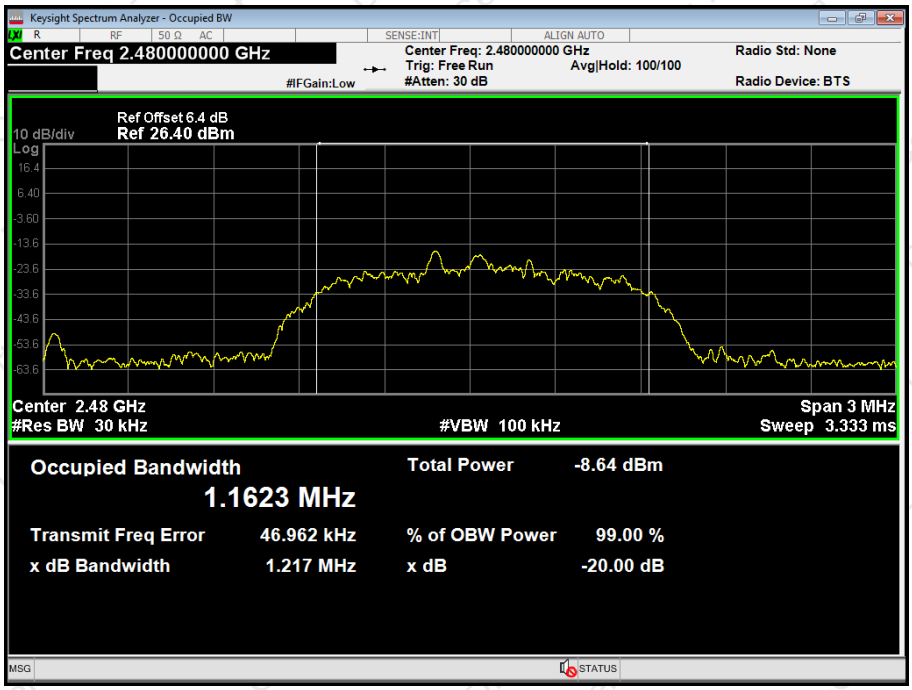
8DPSK



2402MHz



2441MHz



2480MHz

5. ANTENNA REQUIREMENT

5.1 STANDARD REQUIREMENT

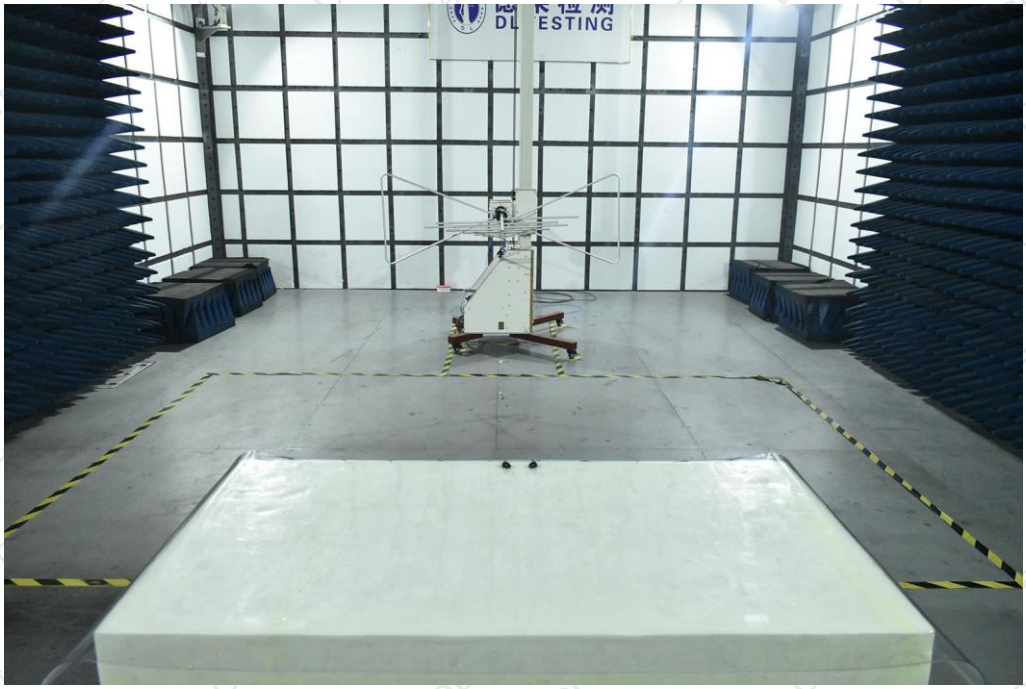
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

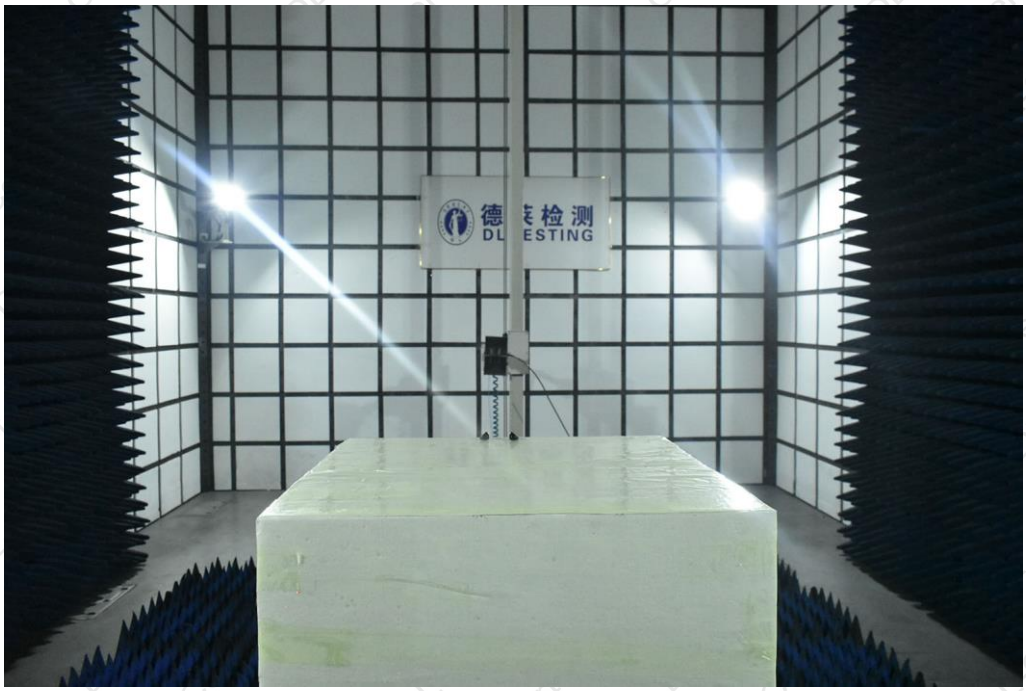
5.2 EUT ANTENNA

The EUT antenna is internal antenna,. It comply with the standard requirement.

6. TEST SEUUP PHOTO

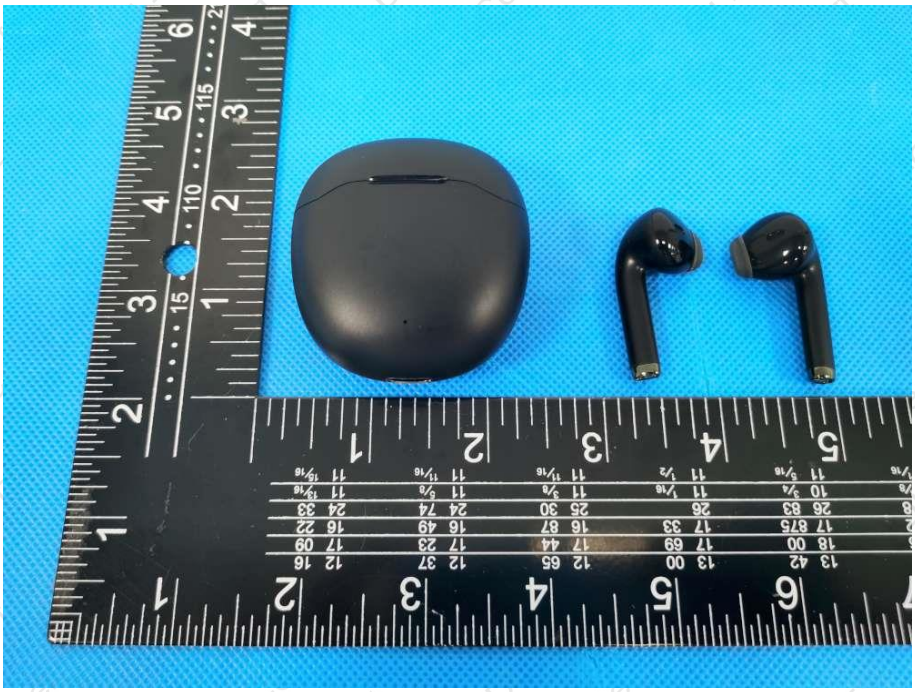
Radiated Measurement Photos

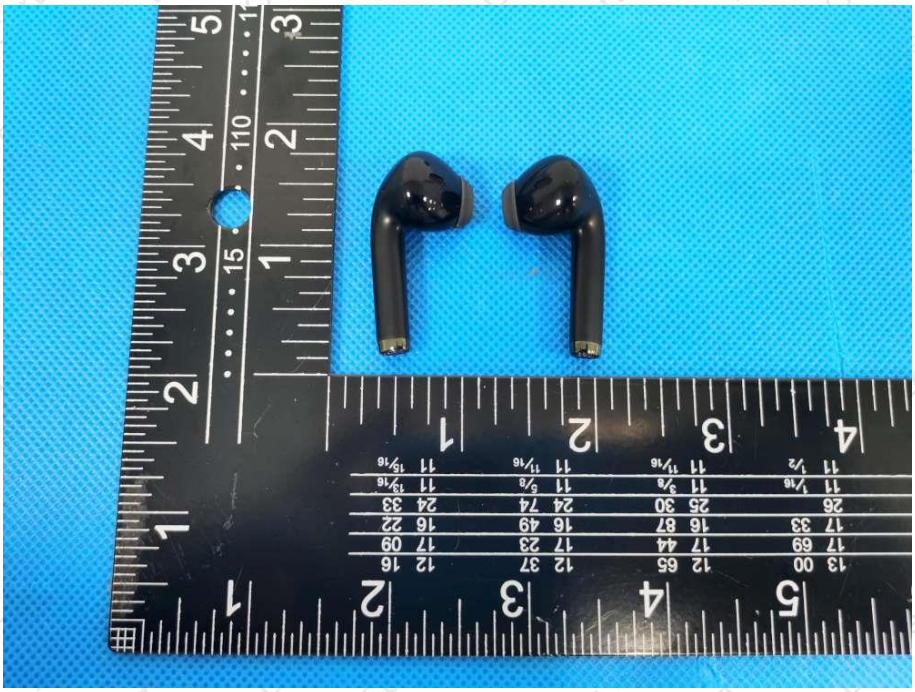


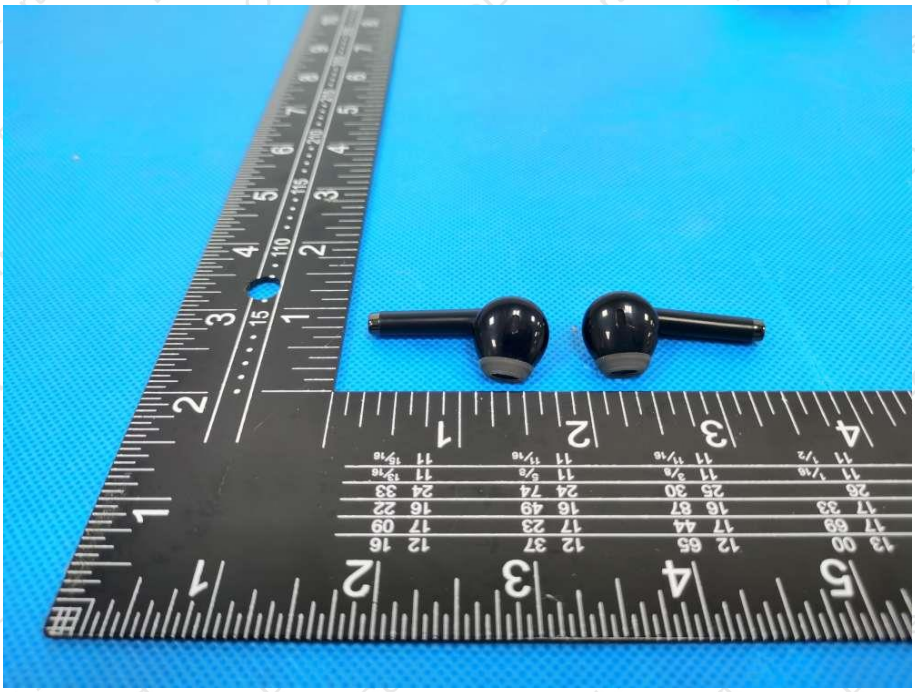


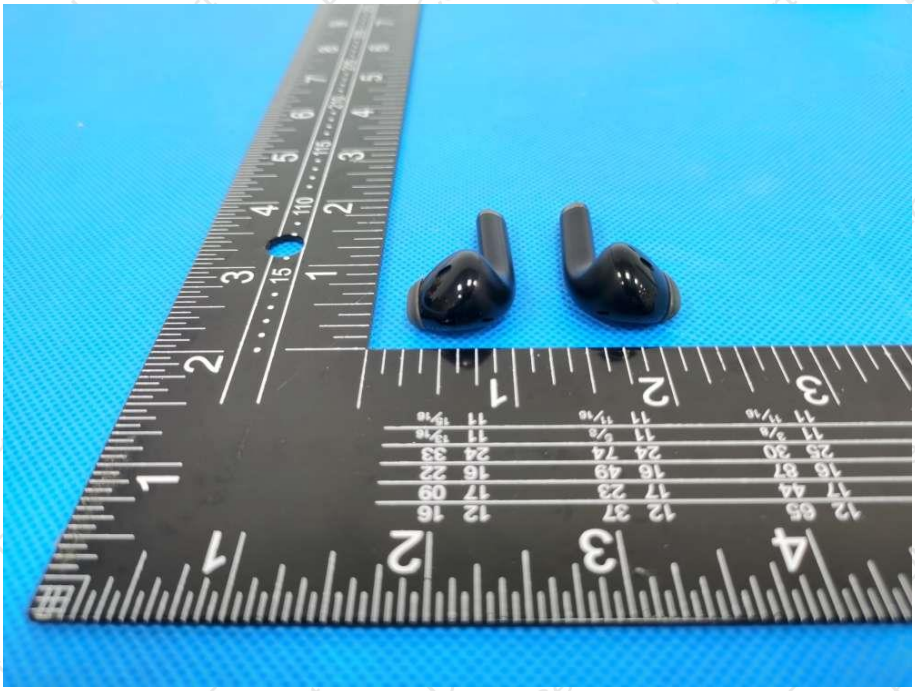
Conducted Measurement Photos

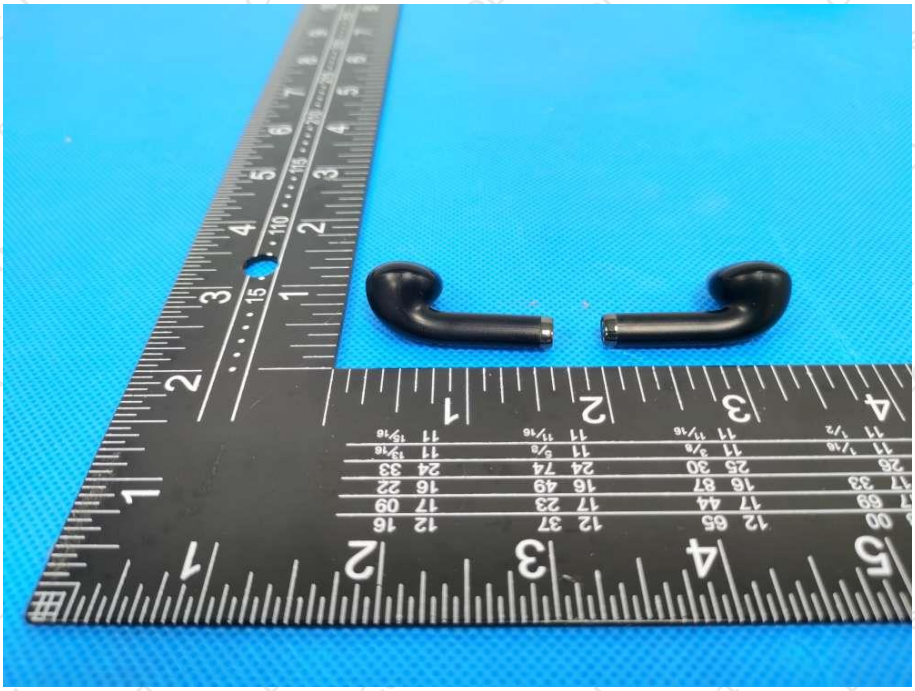
7. EUT PHOTO

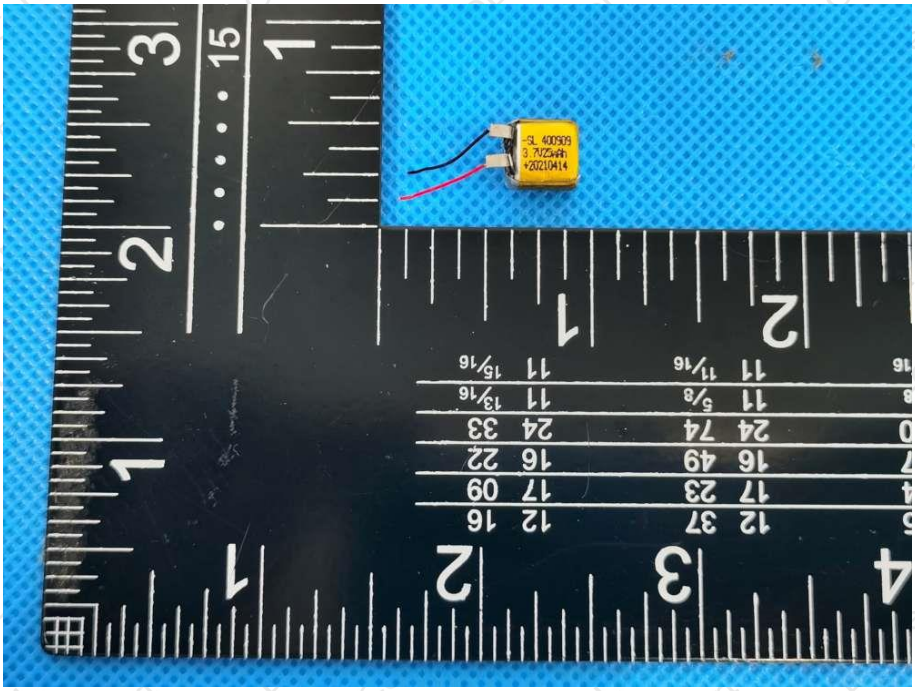


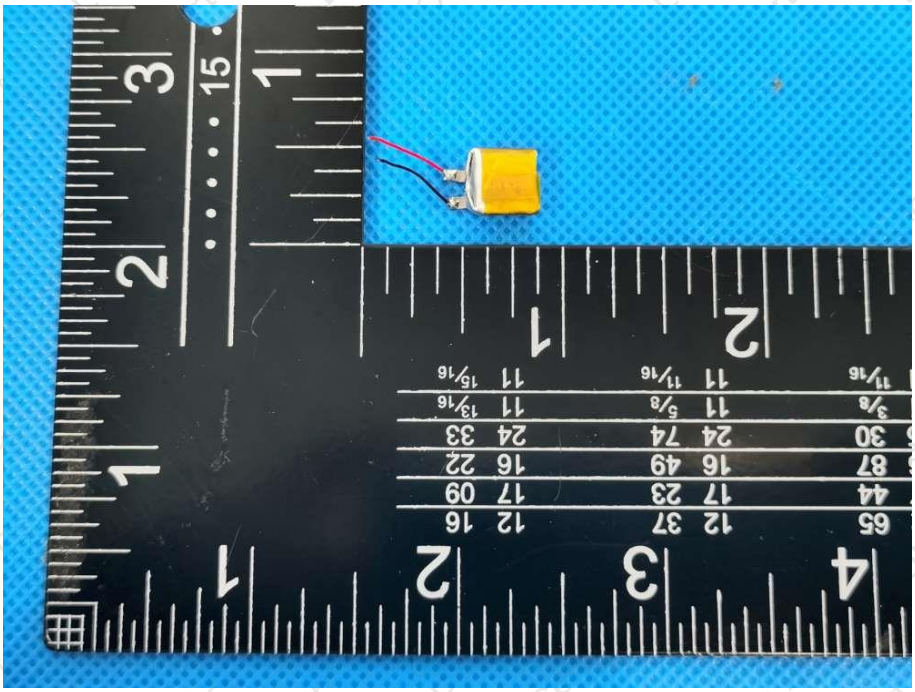


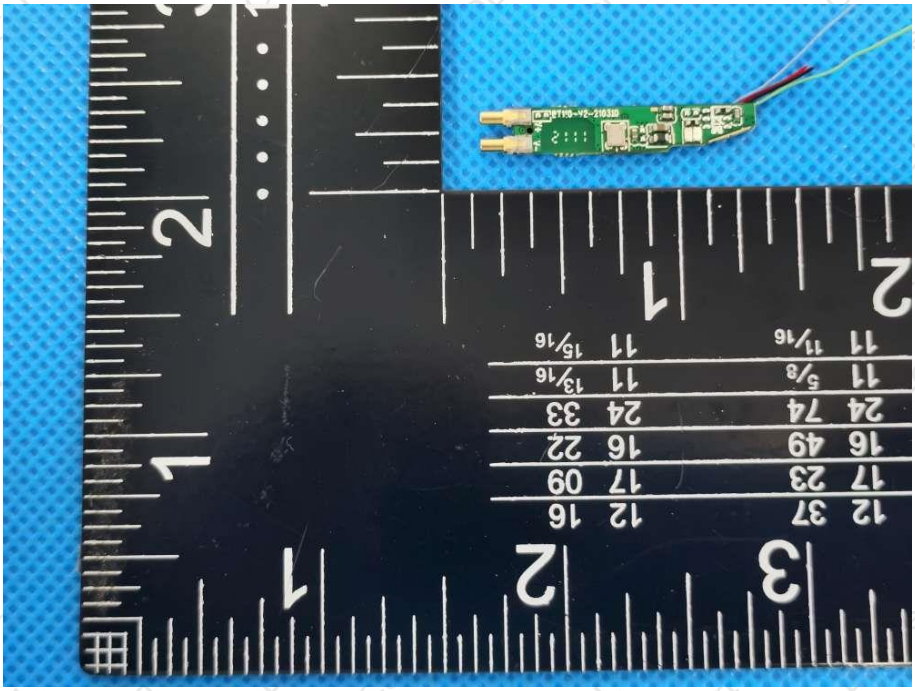


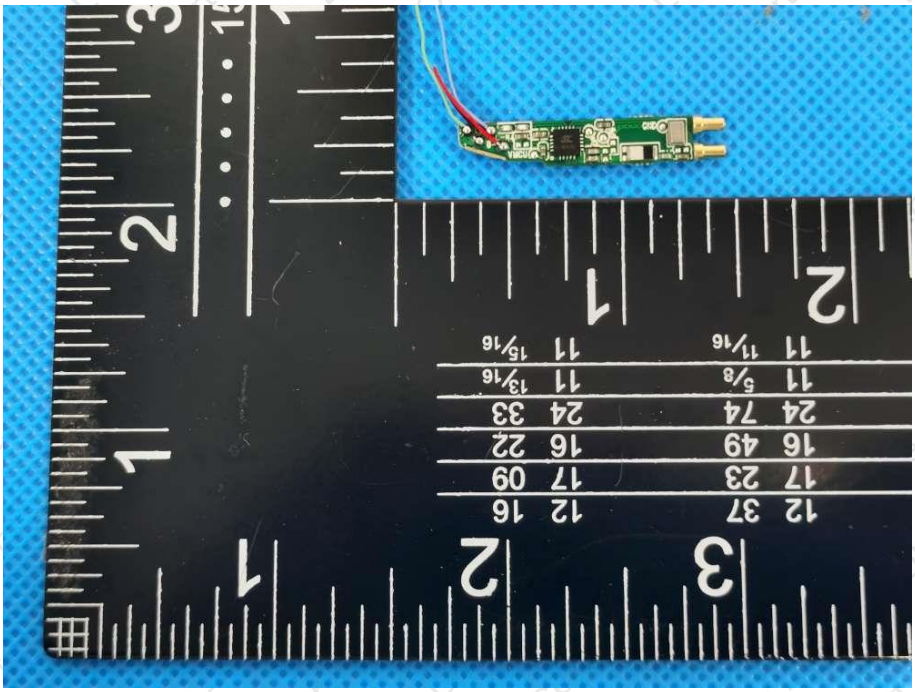


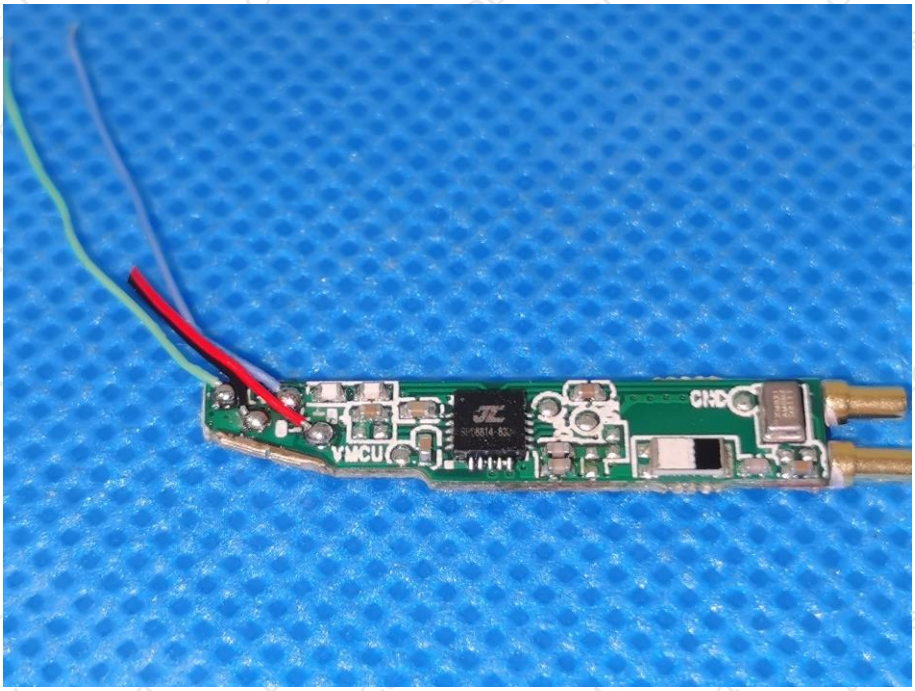












※※※※※ **END OF REPORT** ※※※※※