FCC RADIO TEST REPORT

FCC ID:2AU88TL897-BT

Product:	TWS earphone
Trade Name:	N/A
Model Name:	TL897
Serial Model:	YN-T01,YN-T02,YN-T05,YN-T10,YN-T11, YN-T13,YN-T15,YN-T16,YN-T17,YN-T18.
Report No.:	UNIA19120917ER-01

Prepared for

Shantou Younor Electronics Co.,Ltd

Cangzhou industrial Zone,Chaoyang District,Shantou City,Guangdong,China

Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

TEST RESULT CERTIFICATION

Applicant's name..... :	Shantou Younor Electronics Co.,Ltd
Address..... :	Cangzhou industrial Zone,Chaoyang District,Shantou City,Guangdong,China
Manufacture's Name..... :	Shantou Younor Electronics Co.,Ltd
Address..... :	Cangzhou industrial Zone,Chaoyang District,Shantou City,Guangdong,China

Product description

Product name..... :	TWS earphone
Trade Mark..... :	N/A
Model and/or type reference . :	TL897,YN-T01,YN-T02,YN-T05,YN-T10,YN-T11, YN-T13,YN-T15,YN-T16,YN-T17,YN-T18.
Standards..... :	FCC Rules and Regulations Part 15 Subpart C Section 15.249 ANSI C63.10: 2013

This device described above has been tested by United, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. 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..... :	Dec. 09, 2019 - Dec. 11, 2019
Date of Issue..... :	Dec. 11, 2019
Test Result..... :	Pass

Prepared by: Kahn Yang

Kahn yang/Editor

Reviewer: Sherwin Qian

Sherwin Qian/Supervisor

Approved & Authorized Signer: liuze

Liuze/Manager

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1. TEST SUMMARY

TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT	STANGARD
CONDUCTED EMISSIONS TEST	COMPLIANT	FCC Part 15.207
RADIATED EMISSION TEST	COMPLIANT	FCC Part15.209/15.249
BAND EDGE	COMPLIANT	FCC Part15.249(d)
OCCUPIED BANDWIDTH MEASUREMENT	COMPLIANT	FCC Part15.215
ANTENNA REQUIREMENT	COMPLIANT	FCC Part15.203

TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address :2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd,Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

A2LA Certificate Number: 4747.01

The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

GENERAL DESCRIPTION OF EUT

Equipment	TWS earphone
Trade Mark	N/A
Model Name	TL897
Serial No.	YN-T01,YN-T02,YN-T05,YN-T10,YN-T11,YN-T13, YN-T15,YN-T16,YN-T17,YN-T18.
Model Difference	Model name and appearance are different inside is the same
FCC ID	2AU88TL897-BT
Antenna Type	PCB Antenna
Antenna Gain	0dBi
Frequency Range	2402-2480MHz
Number of Channels	79CH
Modulation Type	GFSK, π/4 DQPSK, 8DPSK
Battery	DC3.7V
PowerSource	DC3.7V from Battery or DC 5V from adapter with AC 120V/60Hz
Adapter Model	**Laboratory supply** M/N: CH-P002 Input: AC 100-240V, 50/60Hz, 0.2A Output: DC 5V, 1.0A

Note:
1.The EUT consists of a pair of headphones, divided into left and right headphone. The software and electric circuit of the two headphones are the same.
2.This report shows the right headphone.

Table forauxiliary equipment:

Equipment Description	Manufacturer	Model	Calibration Due Date
Adapter	N/A	CH-P002	N/A

Carrier Frequency of Channels

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

Operation of EUT during testing

Operating Mode
The mode is used: Transmitting mode
Low Channel: 2402MHz
Middle Channel: 2441MHz
High Channel: 2480MHz

DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:

Operation of EUT during Radiation testing:

2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
CONDUCTED EMISSIONS TEST					
1	AMN	Schwarzbeck	NNLK8121	8121370	2020.09.06
2	AMN	ETS	3810/2	00020199	2020.09.06
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2020.09.06
4	AAN	TESEQ	T8-Cat6	38888	2020.09.06
RADIATED EMISSION TEST					
1	Horn Antenna	Sunol	DRH-118	A101415	2020.09.06
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2020.09.06
3	PREAMP	HP	8449B	3008A00160	2020.09.06
4	PREAMP	HP	8447D	2944A07999	2020.09.06
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.09.06
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.09.06
7	Signal Generator	Agilent	E4421B	MY4335105	2020.09.06
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.09.06
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2020.09.06
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2020.09.06
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2020.09.06
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2020.09.06
13	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2020.3.14
14	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2020.3.14
15	RF power divider	Anritsu	K241B	992289	2020.09.06
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.09.06
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2020.09.06
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2020.09.06
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2020.09.06
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2020.1.12
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2019.11.02
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2020.03.14
23	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2020.09.06
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2020.05.10
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.05.10
26	Frequency Meter	VICTOR	VC2000	997406086	2020.05.10
27	DC Power Source	HYELEC	HY5020E	055161818	2020.05.10

3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

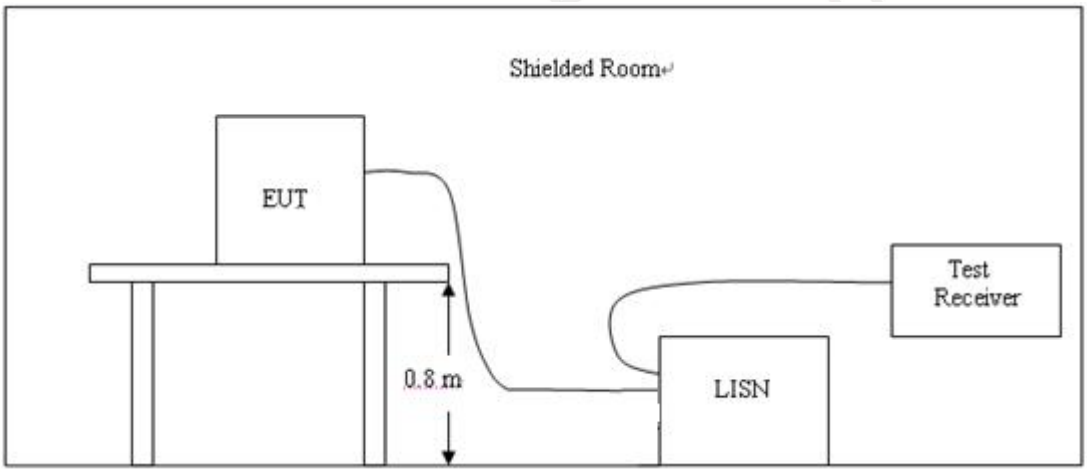
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage(dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 Test Setup



3.3 Test Procedure

1, The equipment was set up as per the test configuration to simulate typical actual usage per the user'smanual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed onthe ground plane as per ANSI C63.10.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4,If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hzpower through a Line Impedance Stabilization Network (LISN) which supplied power source and wasgrounded to the ground plane.
5, All support equipments received AC power from a second LISN, if any.
6, The EUT test program was started. Emissions were measured on each current carrying line of the EUTusing a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has twomonitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

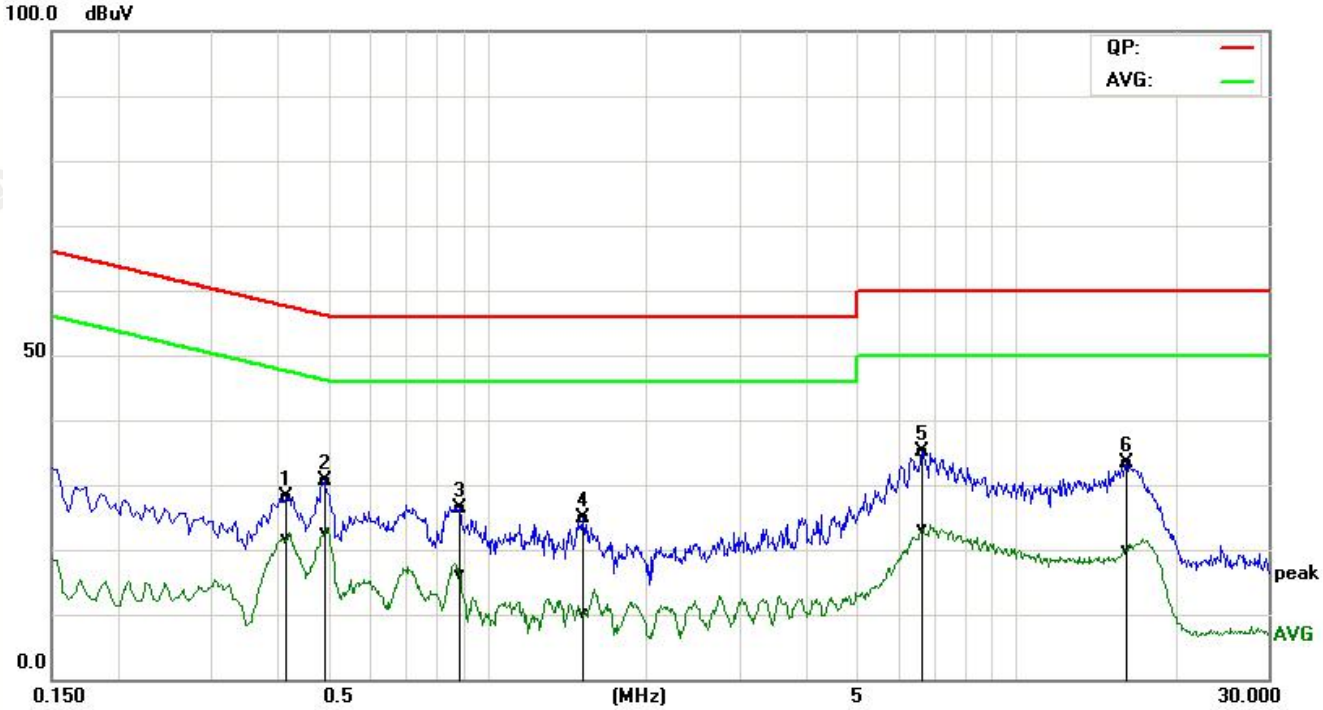
3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below:

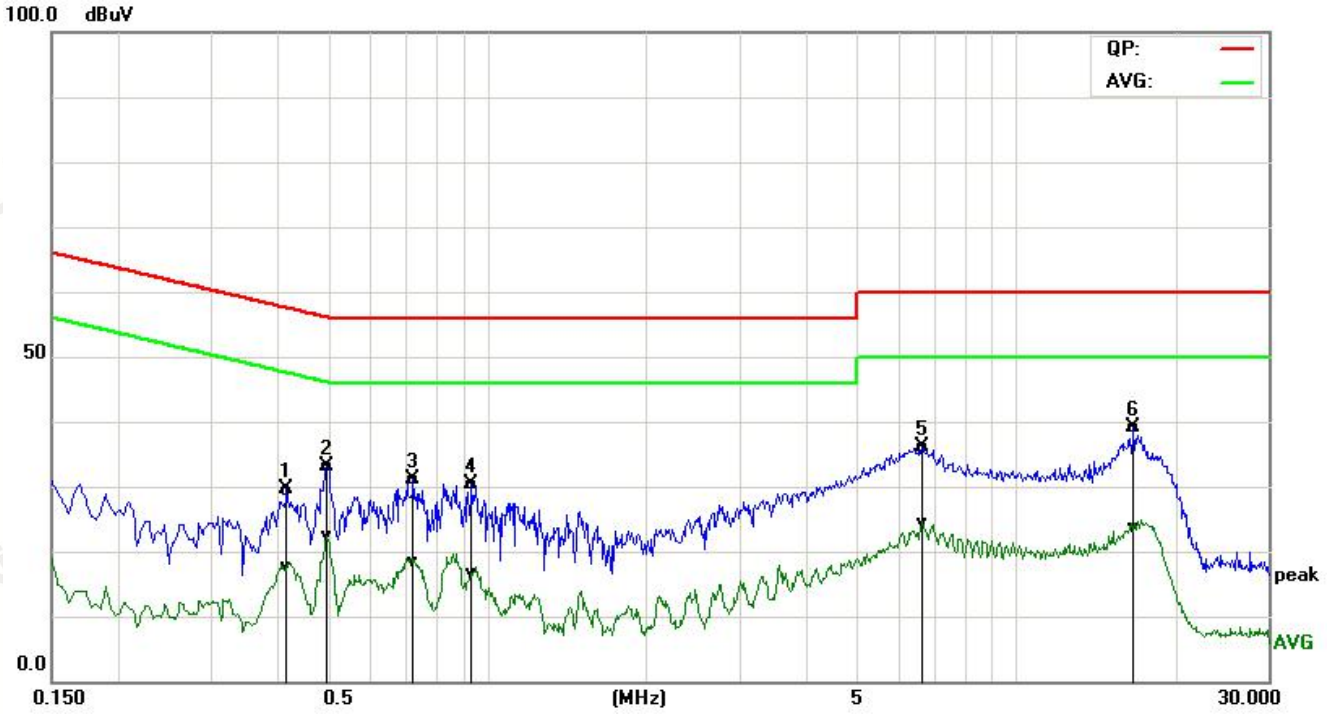
Temperature:	26℃	Relative Humidity:	48%
Test Date:	Dec. 09, 2019	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	BT		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.4180	18.47	11.92	9.70	28.17	21.62	57.49	47.49	-29.32	-25.87	Pass
2*	0.4940	20.89	13.02	9.68	30.57	22.70	56.10	46.10	-25.53	-23.40	Pass
3P	0.8860	16.63	6.49	9.74	26.37	16.23	56.00	46.00	-29.63	-29.77	Pass
4P	1.5180	15.13	0.48	9.76	24.89	10.24	56.00	46.00	-31.11	-35.76	Pass
5P	6.6540	25.22	13.34	9.84	35.06	23.18	60.00	50.00	-24.94	-26.82	Pass
6P	16.1620	32.93	19.48	0.38	33.31	19.86	60.00	50.00	-26.69	-30.14	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result=Reading + Factor, Margin=Result – Limit.

Temperature:	26℃	Relative Humidity:	48%
Test Date:	Dec. 09, 2019	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Neutral
Test Mode:	BT		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.4180	19.80	7.91	9.70	29.50	17.61	57.49	47.49	-27.99	-29.88	Pass
2P	0.4980	23.47	12.62	9.68	33.15	22.30	56.03	46.03	-22.88	-23.73	Pass
3P	0.7260	21.39	8.56	9.72	31.11	18.28	56.00	46.00	-24.89	-27.72	Pass
4P	0.9380	20.70	6.82	9.75	30.45	16.57	56.00	46.00	-25.55	-29.43	Pass
5P	6.6500	26.35	14.66	9.84	36.19	24.50	60.00	50.00	-23.81	-25.50	Pass
6*	16.7139	38.70	23.15	0.40	39.10	23.55	60.00	50.00	-20.90	-26.45	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result=Reading + Factor, Margin=Result – Limit.

4 RADIATED EMISSION TEST

4.1 Radiation Limit

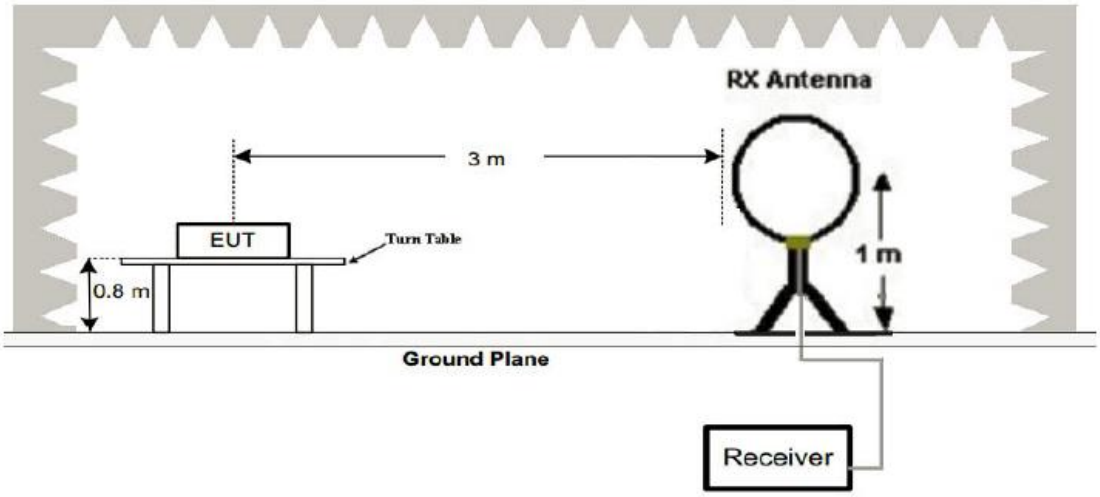
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength ofradiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the followingvalues：

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30-88	3	40	100
88-216	3	43.5	150
216-960	3	46	200
Above 960	3	54	500

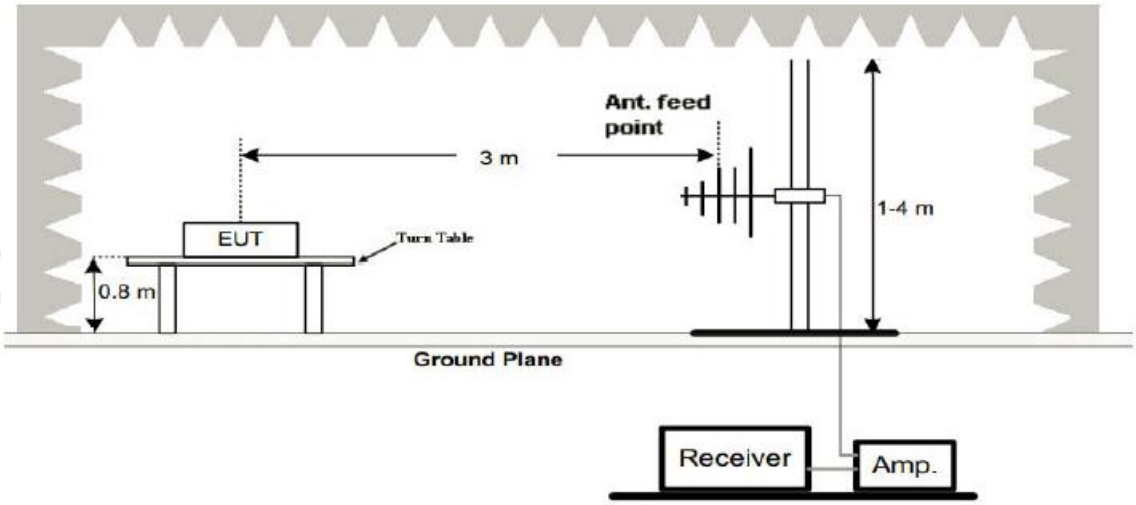
For intentional device, according to § 15.209(a), the general requirement of field strength of radiatedemissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

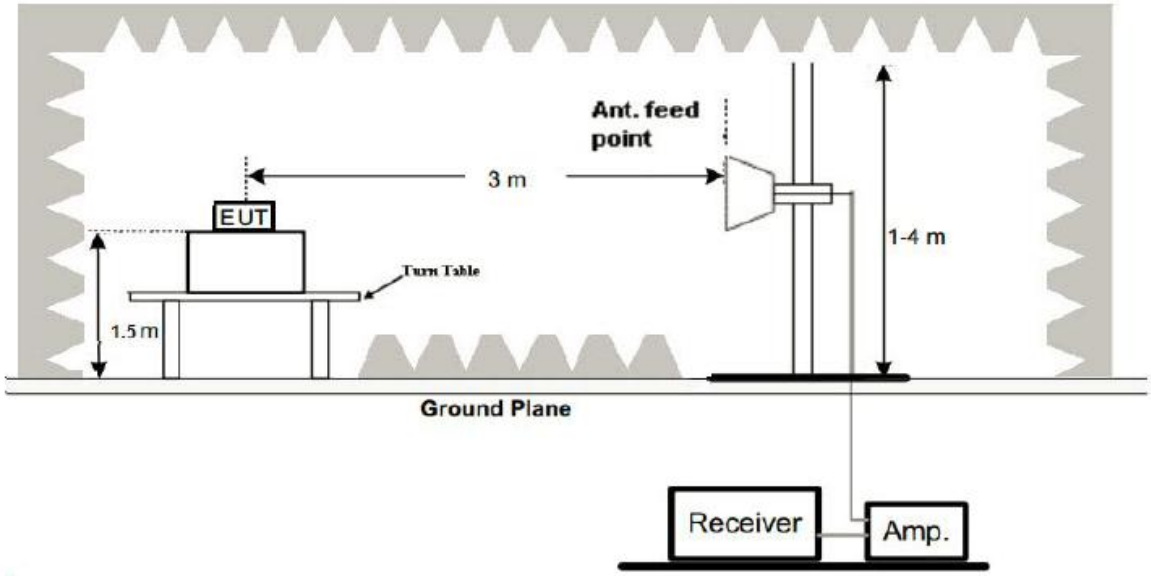
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highestemissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna bothhorizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to25GHz per FCC PART 15.33(a).

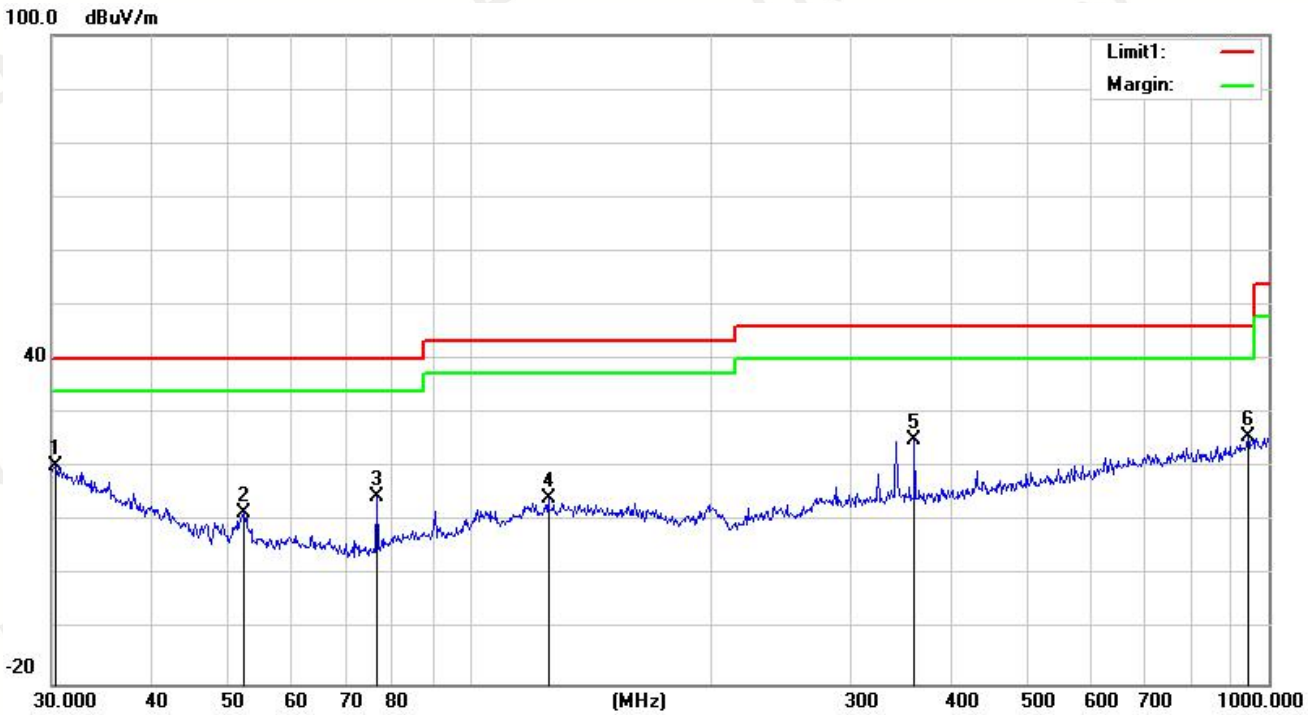
Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

4.4 Test Result

PASS
Remark:
1. All modes of GFSK, π/4 DQPSK, 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK High Channel was reported for below 1GHz test.
2. For BT3.0 above 1GHz test all modes of GFSK, π/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.
3. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
4. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

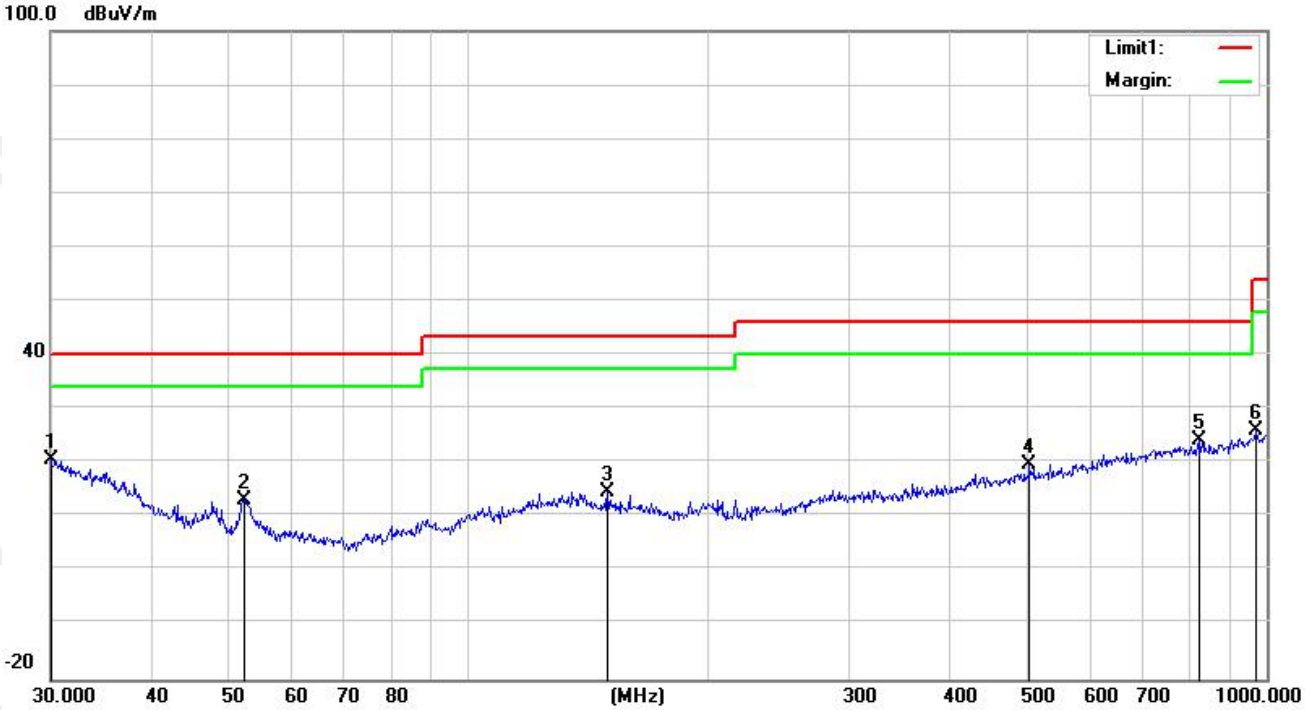
Temperature:	22℃	Relative Humidity:	48%
Test Date:	Dec. 09, 2019	Pressure:	1010hPa
Test Voltage:	DC 3.7V from Battery	Polarization:	Horizontal
Test Mode:	BT		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	30.3173	27.31	-6.95	20.36	40.00	-19.64	134	100	peak
2	52.2079	33.04	-21.45	11.59	40.00	-28.41	163	100	peak
3	76.5121	36.22	-21.59	14.63	40.00	-25.37	196	100	peak
4	125.4457	28.93	-14.55	14.38	43.50	-29.12	122	100	peak
5	360.4477	36.76	-11.75	25.01	46.00	-20.99	187	100	peak
6	942.1305	28.15	-2.47	25.68	46.00	-20.32	209	100	peak

Remark: Absolute Level= Reading Level+ Factor, Margin= Absolute Level – Limit
Factor=Ant. Factor + Cable Loss – Pre-amplifier

Temperature:	22℃	Relative Humidity:	48%
Test Date:	Dec. 09, 2019	Pressure:	1010hPa
Test Voltage:	DC 3.7V from Battery	Polarization:	Vertical
Test Mode:	BT		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	30.0000	27.31	-6.65	20.66	40.00	-19.34	214	100	peak
2	52.3913	34.73	-21.45	13.28	40.00	-26.72	308	100	peak
3	149.4857	29.26	-14.57	14.69	43.50	-28.81	116	100	peak
4	504.7062	29.14	-9.25	19.89	46.00	-26.11	98	100	peak
5	821.7104	28.62	-4.48	24.14	46.00	-21.86	102	100	peak
6	968.9338	28.29	-2.23	26.06	54.00	-27.94	206	100	peak

Remark: Absolute Level= Reading Level+ Factor, Margin= Absolute Level – Limit
Factor=Ant. Factor + Cable Loss – Pre-amplifier

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHzwas verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results (GFSK Mode):
CH Low (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.63	-5.84	102.79	114	-11.21	PK
2402	89.43	-5.84	83.59	94	-10.41	AV
4804	64.82	-3.64	61.18	74	-12.82	PK
4804	45.32	-3.64	41.68	54	-12.32	AV
7206	59.46	-0.95	58.51	74	-15.49	PK
7206	44.37	-0.95	43.42	54	-10.58	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.16	-5.84	102.32	114	-11.68	PK
2402	88.37	-5.84	82.53	94	-11.47	AV
4804	62.33	-3.64	58.69	74	-15.31	PK
4804	43.19	-3.64	39.55	54	-14.45	AV
7206	60.05	-0.95	59.1	74	-14.9	PK
7206	43.86	-0.95	42.91	54	-11.09	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

CH Middle (2441MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	107.42	-5.84	101.58	114	-12.42	PK
2441	87.56	-5.84	81.72	94	-12.28	AV
4882	63.28	-3.64	59.64	74	-14.36	PK
4882	44.92	-3.64	41.28	54	-12.72	AV
7323	62.36	-0.95	61.41	74	-12.59	PK
7323	42.18	-0.95	41.23	54	-12.77	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	107.34	-5.84	101.5	114	-12.5	PK
2441	86.49	-5.84	80.65	94	-13.35	AV
4882	64.52	-3.64	60.88	74	-13.12	PK
4882	45.06	-3.64	41.42	54	-12.58	AV
7323	62.48	-0.95	61.53	74	-12.47	PK
7323	43.17	-0.95	42.22	54	-11.78	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

CH High (2480MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	106.51	-5.65	100.86	114	-13.14	PK
2480	86.32	-5.65	80.67	94	-13.33	AV
4960	65.28	-3.43	61.85	74	-12.15	PK
4960	43.71	-3.43	40.28	54	-13.72	AV
7440	61.52	-0.75	60.77	74	-13.23	PK
7440	41.19	-0.75	40.44	54	-13.56	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	107.06	-5.65	101.41	114	-12.59	PK
2480	87.49	-5.65	81.84	94	-12.16	AV
4960	64.76	-3.43	61.33	74	-12.67	PK
4960	42.93	-3.43	39.5	54	-14.5	AV
7440	61.13	-0.75	60.38	74	-13.62	PK
7440	40.08	-0.75	39.33	54	-14.67	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range ,that the value more than 20dB below limit is not record in the form.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 3MHz for peak measurement with peak detectorat frequency above 1GHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissionsare reported.

π/4 DQPSK 2402

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.26	-5.84	102.42	114	-11.58	PK
2402	81.52	-5.84	75.68	94	-18.32	AV
4804	61.39	-3.64	57.75	74	-16.25	PK
4804	48.62	-3.64	44.98	54	-9.02	AV
7206	56.49	-0.95	55.54	74	-18.46	PK
7206	47.03	-0.95	46.08	54	-7.92	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	106.35	-5.84	100.51	114	-13.49	PK
2402	79.31	-5.84	73.47	94	-20.53	AV
4804	61.25	-3.64	57.61	74	-16.39	PK
4804	47.61	-3.64	43.97	54	-10.03	AV
7206	56.24	-0.95	55.29	74	-18.71	PK
7206	46.81	-0.95	45.86	54	-8.14	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

2441

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	108.62	-5.71	102.91	114	-11.09	PK
2441	81.34	-5.71	75.63	94	-18.37	AV
4882	61.25	-3.51	57.74	74	-16.26	PK
4882	48.36	-3.51	44.85	54	-9.15	AV
7323	56.29	-0.82	55.47	74	-18.53	PK
7323	47.36	-0.82	46.54	54	-7.46	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	109.26	-5.71	103.55	114	-10.45	PK
2441	80.31	-5.71	74.60	94	-19.40	AV
4882	62.06	-3.51	58.55	74	-15.45	PK
4882	50.34	-3.51	46.83	54	-7.17	AV
7323	56.39	-0.82	55.57	74	-18.43	PK
7323	47.61	-0.82	46.79	54	-7.21	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

2480

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	107.43	-5.65	101.78	114	-12.22	PK
2480	80.2	-5.65	74.55	94	-19.45	AV
4960	61.53	-3.43	58.10	74	-15.90	PK
4960	49.31	-3.43	45.88	54	-8.12	AV
7440	57.69	-0.75	56.94	74	-17.06	PK
7440	47.62	-0.75	46.87	54	-7.13	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	107.56	-5.65	101.91	114	-12.09	PK
2480	80.32	-5.65	74.67	94	-19.33	AV
4960	61.25	-3.43	57.82	74	-16.18	PK
4960	48.36	-3.43	44.93	54	-9.07	AV
7440	57.60	-0.75	56.85	74	-17.15	PK
7440	47.25	-0.75	46.50	54	-7.50	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range ,that the value more than 20dB below limit is not record in the form.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 3MHz for peak measurement with peak detectorat frequency above 1GHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissionsare reported.

8DPSK
Horizontal: 2402

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.34	-5.84	102.50	114	-11.50	PK
2402	79.62	-5.84	73.78	94	-20.22	AV
4804	61.53	-3.64	57.89	74	-16.11	PK
4804	49.32	-3.64	45.68	54	-8.32	AV
7206	56.19	-0.95	55.24	74	-18.76	PK
7206	47.62	-0.95	46.67	54	-7.33	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.46	-5.84	102.62	114	-11.38	PK
2402	80.36	-5.84	74.52	94	-19.48	AV
4804	61.25	-3.64	57.61	74	-16.39	PK
4804	49.56	-3.64	45.92	54	-8.08	AV
7206	57.03	-0.95	56.08	74	-17.92	PK
7206	46.51	-0.95	45.56	54	-8.44	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Horizontal: 2441

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	107.62	-5.71	101.91	114	-12.09	PK
2441	81.52	-5.71	75.81	94	-18.19	AV
4882	61.38	-3.51	57.87	74	-16.13	PK
4882	47.69	-3.51	44.18	54	-9.82	AV
7323	56.29	-0.82	55.47	74	-18.53	PK
7323	47.61	-0.82	46.79	54	-7.21	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	109.23	-5.71	103.52	114	-10.48	PK
2441	81.25	-5.71	75.54	94	-18.46	AV
4882	61.49	-3.51	57.98	74	-16.02	PK
4882	49.58	-3.51	46.07	54	-7.93	AV
7323	57.06	-0.82	56.24	74	-17.76	PK
7323	46.61	-0.82	45.79	54	-8.21	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Horizontal: 2480

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	108.67	-5.65	103.02	114	-10.98	PK
2480	80.25	-5.65	74.60	94	-19.40	AV
4960	62.03	-3.43	58.60	74	-15.40	PK
4960	49.18	-3.43	45.75	54	-8.25	AV
7440	57.34	-0.75	56.59	74	-17.41	PK
7440	48.02	-0.75	47.27	54	-6.73	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	107.25	-5.65	101.60	114	-12.40	PK
2480	80.37	-5.65	74.72	94	-19.28	AV
4960	61.52	-3.43	58.09	74	-15.91	PK
4960	47.91	-3.43	44.48	54	-9.52	AV
7440	57.63	-0.75	56.88	74	-17.12	PK
7440	47.82	-0.75	47.07	54	-6.93	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range ,that the value more than 20dB below limit is not record in the form.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 3MHz for peak measurement with peak detectorat frequency above 1GHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissionsare reported.

5 BAND EDGE

5.1 Limits

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics,shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emissionlimits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSIC63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT issituated in three orthogonal planes (if appropriate), adjusting the measurement antenna height andpolarization etc. Set RBW to 100KHz and VBM to 300KHz to measure the peak field strength and setRBW to 1MHz and VBW to 10Hz to measure the average radiated field strength.The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz,to measure the conducted peak band edge.

5.3 Test Result

PASS

Remark: All modes of GFSK, π/4 DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:

GFSK

Horizontal (Worst case): 2402

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	55.47	-5.81	49.66	74	-24.34	PK
2310	46.37	-5.81	40.56	54	-13.44	AV
2390	54.94	-5.84	49.1	74	-24.9	PK
2390	45.92	-5.84	40.08	54	-13.92	AV
2400	55.86	-5.84	50.02	74	-23.98	PK
2400	44.18	-5.84	38.34	54	-15.66	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	56.24	-5.81	50.43	74	-23.57	PK
2310	45.32	-5.81	39.51	54	-14.49	AV
2390	55.18	-5.84	49.34	74	-24.66	PK
2390	44.86	-5.84	39.02	54	-14.98	AV
2400	56.13	-5.84	50.29	74	-23.71	PK
2400	45.76	-5.84	39.92	54	-14.08	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Horizontal (Worst case): 2480

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	55.63	-5.65	49.98	74	-24.02	PK
2483.5	43.52	-5.65	37.87	54	-16.13	AV
2500	54.86	-5.72	49.14	74	-24.86	PK
2500	42.97	-5.72	37.25	54	-16.75	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.38	-5.65	50.73	74	-23.27	PK
2483.5	44.92	-5.65	39.27	54	-14.73	AV
2500	54.84	-5.72	49.12	74	-24.88	PK
2500	43.69	-5.72	37.97	54	-16.03	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

π /4 DQPSK

Horizontal: 2402

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	54.26	-5.81	48.45	74	-25.55	PK
2310	43.79	-5.81	37.98	54	-16.02	AV
2390	55.87	-5.84	50.03	74	-23.97	PK
2390	44.12	-5.84	38.28	54	-15.72	AV
2400	57.61	-5.84	51.77	74	-22.23	PK
2400	47.28	-5.84	41.44	54	-12.56	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	54.37	-5.81	48.56	74	-25.44	PK
2310	43.75	-5.81	37.94	54	-16.06	AV
2390	55.61	-5.84	49.77	74	-24.23	PK
2390	45.94	-5.84	40.1	54	-13.9	AV
2400	57.55	-5.84	51.71	74	-22.29	PK
2400	48.13	-5.84	42.29	54	-11.71	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Horizontal: 2480

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	57.68	-5.65	52.03	74	-21.97	PK
2483.5	46.28	-5.65	40.63	54	-13.37	AV
2500	54.23	-5.72	48.51	74	-25.49	PK
2500	44.52	-5.72	38.8	54	-15.2	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.48	-5.65	50.83	74	-23.17	PK
2483.5	46.39	-5.65	40.74	54	-13.26	AV
2500	55.12	-5.72	49.4	74	-24.6	PK
2500	46.06	-5.72	40.34	54	-13.66	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

8DPSK

Horizontal: 2402

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	55.23	-5.81	49.42	74	-24.58	PK
2310	44.56	-5.81	38.75	54	-15.25	AV
2390	54.39	-5.84	48.55	74	-25.45	PK
2390	43.08	-5.84	37.24	54	-16.76	AV
2400	56.12	-5.84	50.28	74	-23.72	PK
2400	45.82	-5.84	39.98	54	-14.02	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	54.13	-5.81	48.32	74	-25.68	PK
2310	44.13	-5.81	38.32	54	-15.68	AV
2390	55.76	-5.84	49.92	74	-24.08	PK
2390	44.92	-5.84	39.08	54	-14.92	AV
2400	55.37	-5.84	49.53	74	-24.47	PK
2400	45.15	-5.84	39.31	54	-14.69	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

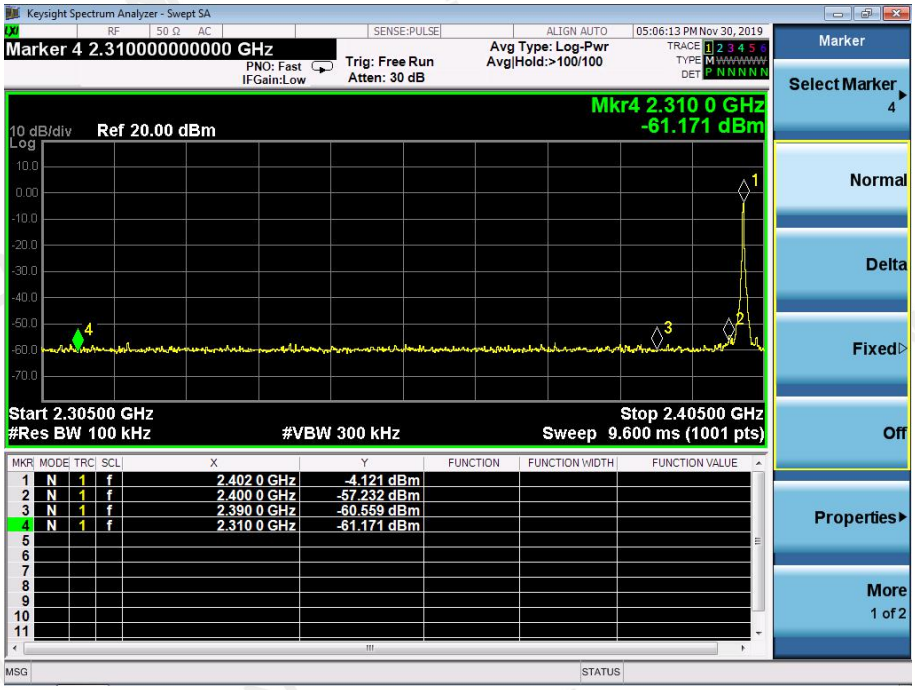
Horizontal: 2480

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.19	-5.65	50.54	74	-23.46	PK
2483.5	45.32	-5.65	39.67	54	-14.33	AV
2500	55.18	-5.72	49.46	74	-24.54	PK
2500	44.84	-5.72	39.12	54	-14.88	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

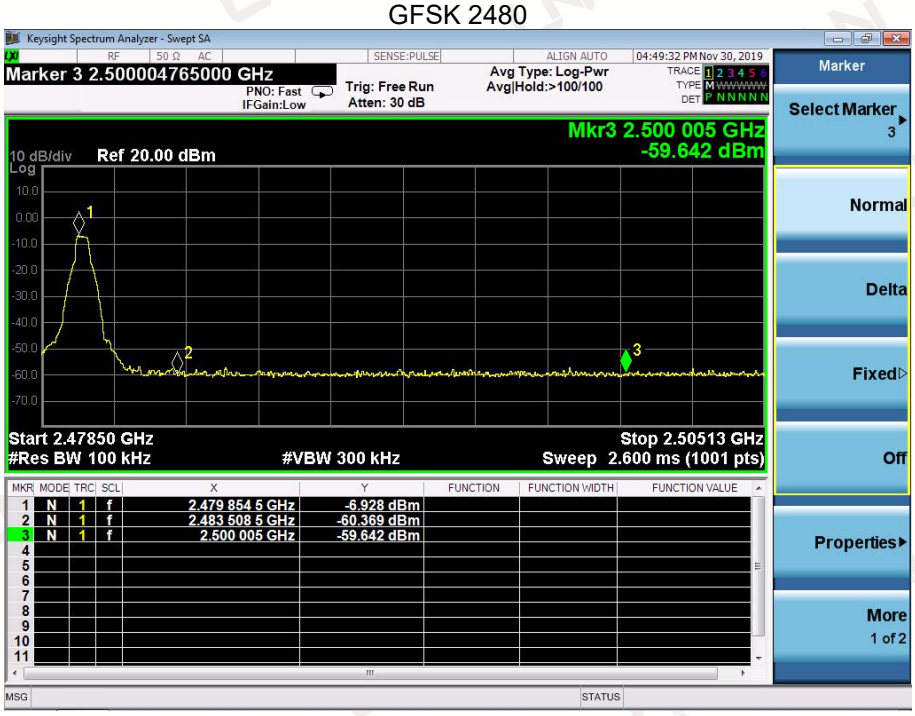
Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.42	-5.65	50.77	74	-23.23	PK
2483.5	45.93	-5.65	40.28	54	-13.72	AV
2500	56.24	-5.72	50.52	74	-23.48	PK
2500	45.81	-5.72	40.09	54	-13.91	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

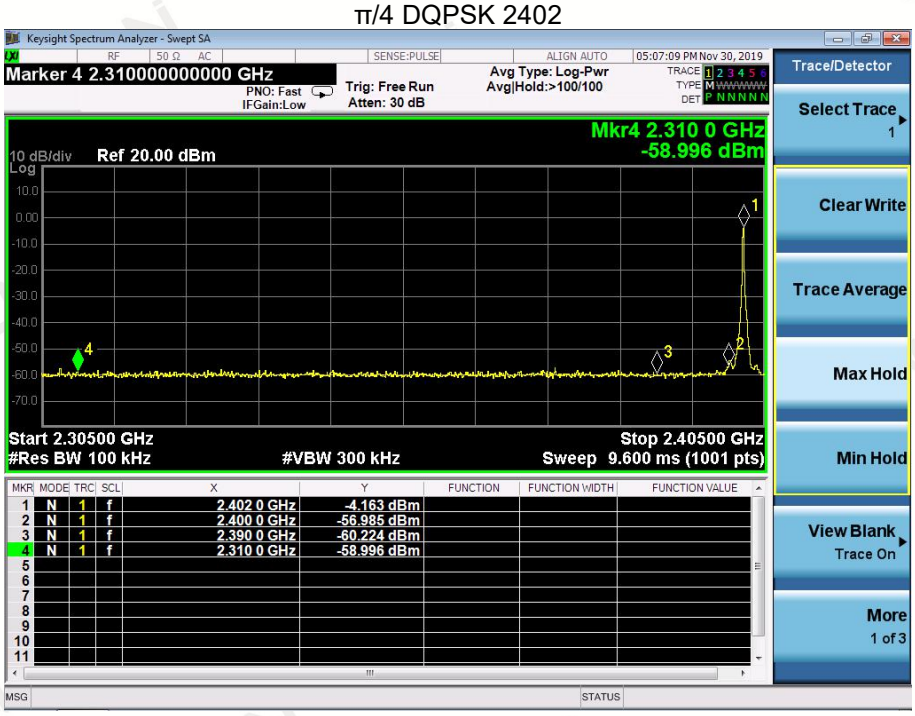
GFSK 2402



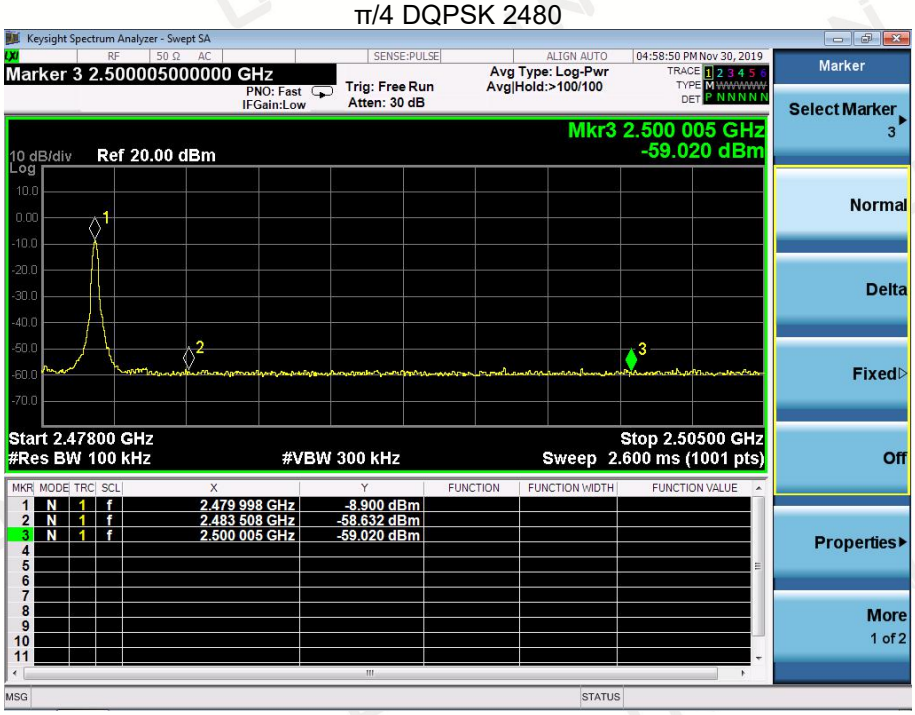
GFSK 2480



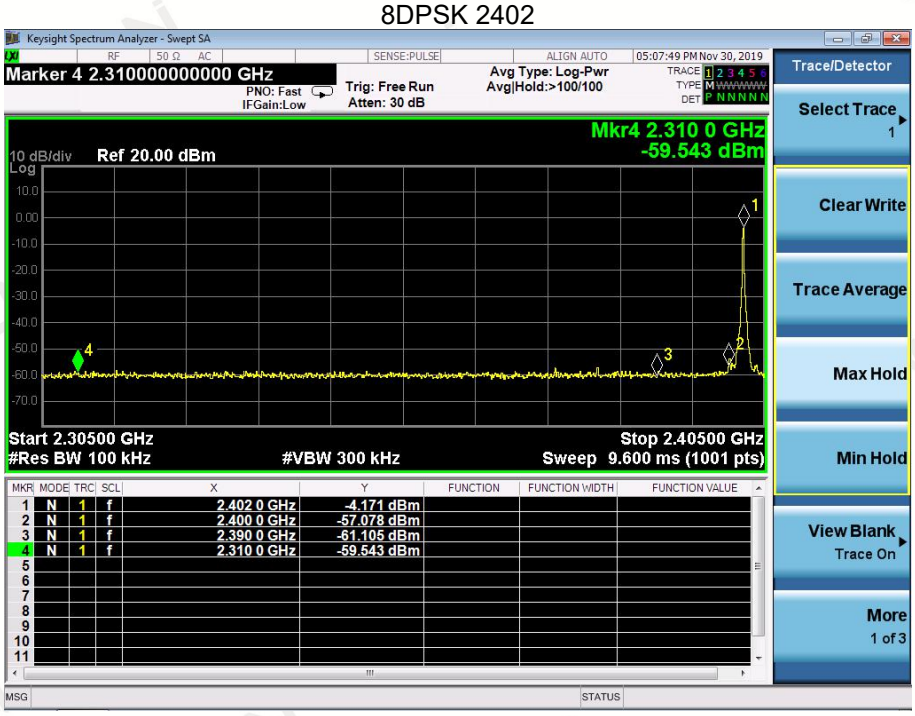
π/4 DQPSK 2402



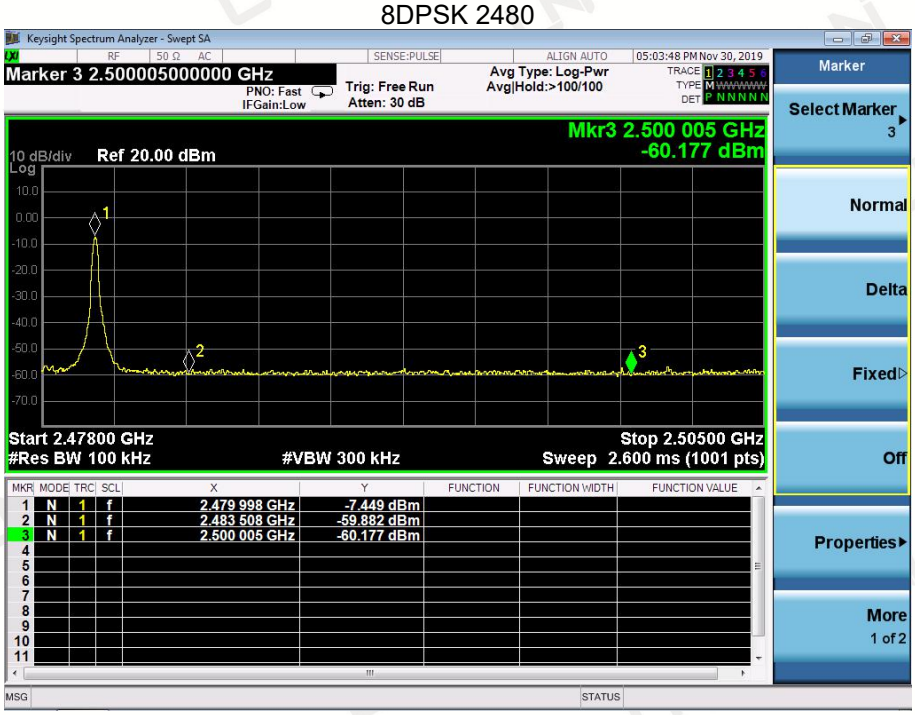
π/4 DQPSK 2480



8DPSK 2402



8DPSK 2480



6 OCCUPIED BANDWIDTH MEASUREMENT

6.1 Test Setup

Same asRadiated Emission Measurement

6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW=30KHz, VBW=100KHz, Span=3MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

6.3 Measurement Equipment Used

Same asRadiated Emission Measurement

6.4 Test Result

PASS

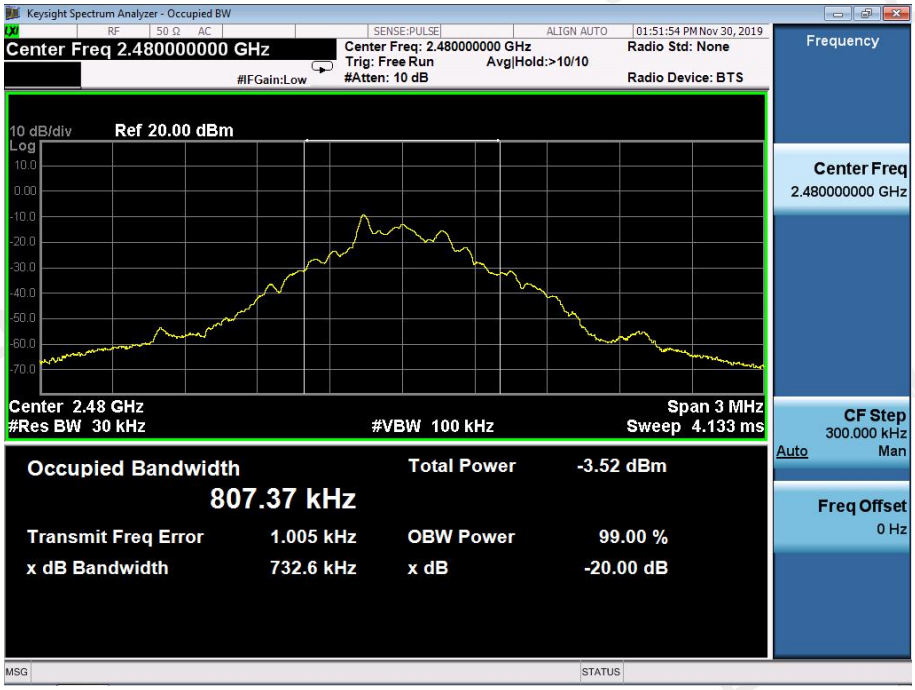
GFSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	0.735	PASS
2441	0.731	PASS
2480	0.733	PASS

CH: 2402MHz

CH: 2441MHz

CH: 2480MHz



π/4 DQPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.109	PASS
2441	1.112	PASS
2480	1.110	PASS

CH: 2402MHz

CH: 2441MHz

CH: 2480MHz

8DPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.150	PASS
2441	1.152	PASS
2480	1.151	PASS

CH: 2402MHz

CH: 2441MHz

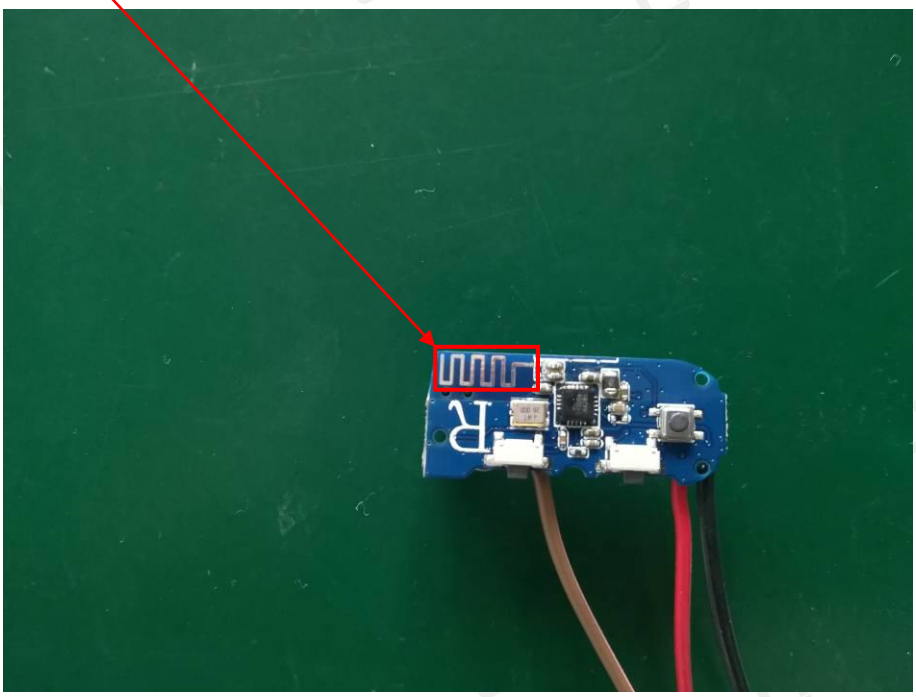
CH: 2480MHz

7 ANTENNA REQUIREMENT

Standard Applicable:
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed toensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Connected Construction
The antenna used in this product is an PCB Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA:



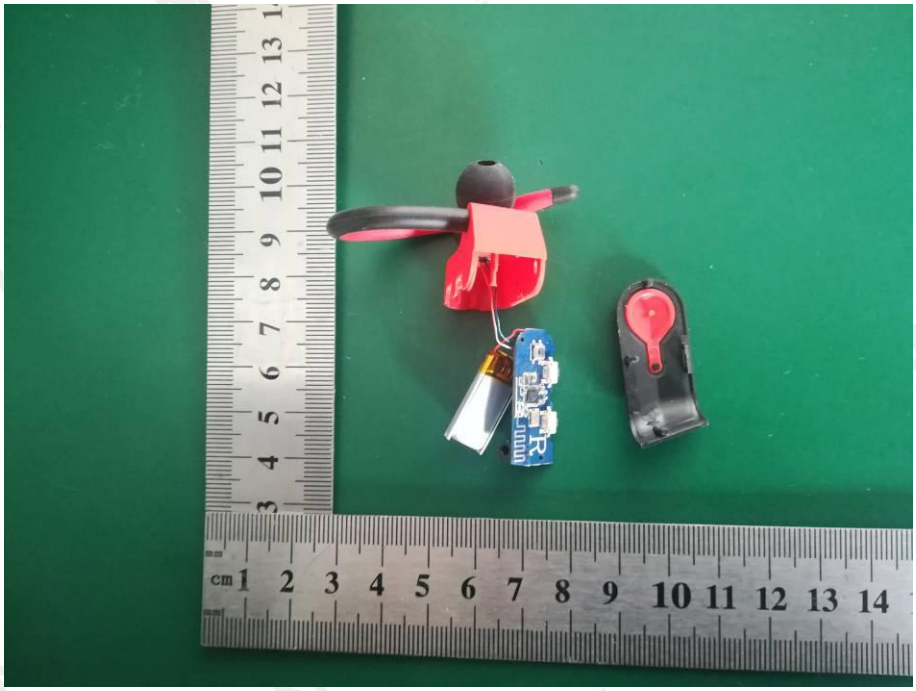
8 PHOTOGRAPH OF TEST

RE

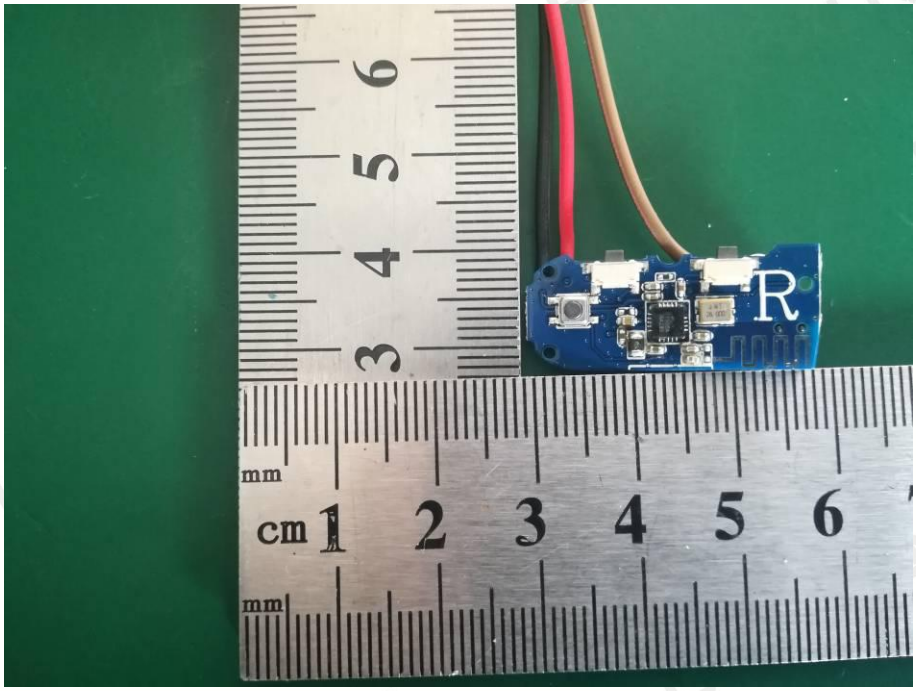
CE

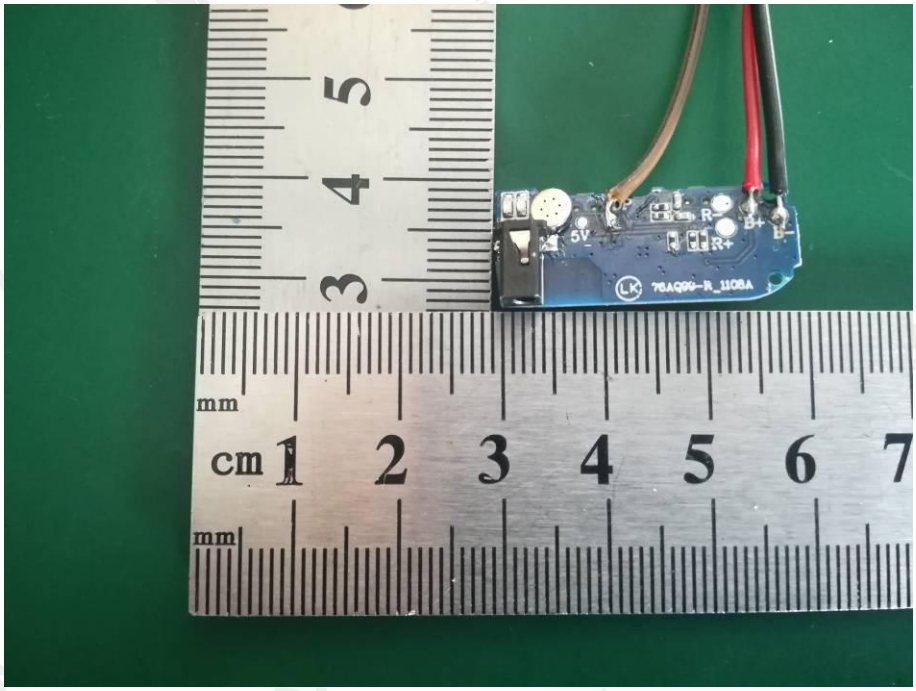
cm 1 2 3 4 5 6 7 8 9 10
mm

cm 1 2 3 4 5 6 7 8 9
mm



cm 1 2 3 4 5 6
mm


R
cm 1 2 3 4 5 6
mm



End of Report