ACCREDITED
CERTIFICATE #5473.01

Test Report No.:
FCC2022-0077-RF2

TEST REPORT

FCC ID	:	2AWMK-BTP-T9
Applicant	:	Guangzhou Pinzhong Electronic Technology Co.,Ltd.
Product Name	:	BEITONG ZEUS 2 ANALOG OPTICAL SWITCHES ELITE GAMEPAD
Mode No.	:	BTP-T9

CVC Testing Technology Co., Ltd.

Applicant	**Name:** Guangzhou Pinzhong Electronic Technology Co.,Ltd. **Address:** Room 611-612, Greenland Center of Financial city, No.662, Huangpu Avenue Middle Road. Tianhe District, Guangzhou City.
Manufacturer	**Name:** Guangzhou Pinzhong Electronic Technology Co.,Ltd. **Address:** Room 611-612, Greenland Center of Financial city, No.662, Huangpu Avenue Middle Road. Tianhe District, Guangzhou City.
Equipment Under Test	**Product Name :** BEITONG ZEUS 2 ANALOG OPTICAL SWITCHES ELITE GAMEPAD **Model No. :** BTP-T9 **Trade mark :** BEITONG **Serial no. :** — **Sampling :** 1-1

Date of Receipt.	2022.12.16	Date of Testing	2023.06.27

Test Specification	**Test Result**
FCC CFR47 Part 15C (2020) Radio Frequency Devices ANSI C63.10 (2013) DA00-705 Filing and Frequency Measurement Guidelines For Frequency Hopping Spread Spectrum System (2000).	PASS
Evaluation of Test Result	The equipment under test was found to comply with the requirements of the standards applied. **Seal of CVC** **Date of issue:** **April 7, 2023,Correction 1: July 4, 2023**

Approved by:	Reviewed by:	Tested by:
Chen HuaWen	**Xu Zhenfei**	**Lu Weiji**

Other Aspects: NONE.

Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested

Note 1: This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of **CVC**.
Note 2: The original Test Report No.FCC2022-0077-RF2 was issued dated on April 7, 2023.
Correction 1 to Report No.FCC2022-0077-RF2 was made dated on July 4, 2023 due tosome editorial mistakes and detailed on P8.

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1. General Product Information

1.1 General information

Product Name	BEITONG ZEUS 2 ANALOG OPTICAL SWITCHES ELITE GAMEPAD	
Model No.	BTP-T9	
Additional model	N/A	
Power Supply	Rated voltage	DC 5.0V
	Battery voltage	DC 3.7V
Serial Number(SN)	K22K25004633	
firmware	V2.52	
software	V1.02	
specific power settings	Bluetooth(2DH1):1.5	
Antenna Type	Internal Antenna	
Antenna Connector	A permanently attached antenna	
Antenna Gain	2.63 dBi (provided by client)	
Beamforming gain	Unsupported (provided by client)	
Frequency Range	2402MHz~2480MHz	
Bluetooth Version:	5.2	
Channel Number	79	
Type of Modulation	π/4DQPSK	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Max. Conducted Power	2DH1: 2.27 dBm	
Operate Temp.Range	-20~40℃	

Note：
1. The information of the EUT is declared by the manufacturer.
2. The laboratory is not responsible for the product technical specification provided by the client.

2. Test Sites

2.1 Test Facilities

The tests and measurements refer to this report were performed by RF testing Lab. of CVC Testing Technology Co., Ltd.

Add.: No.3, Tiantaiyi Road, Kaitai Avenue, Science City, Guangzhou,Guangdong,510663, People's Republic of China

Telephone : +86-20-32293888

Fax : +86-20-32293889

FCC(Test firm designation number：CN1282)

IC(Test firm CAB identifier number：CN0103)

2.2 Description of Non-standard Method and Deviations

The testing and measurement methods used in this report are applied by all standard methods. Not any non-standard method or deviation from the used standards was used.

2.3 List of Test and Measurement Instruments

Refer to **Appendix A**.

3. Test Configuration

3.1 Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Test Mode	Antenna Delivery	Test Channel
2DH1	1TX / 1RX	0,39,78,hop

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate and different channels. Preliminary tests have been done on all the configuration for confirming worst case. Data rate and channel below means worst-case rate of each test item.

Worst-case data rates and channels are shown as following table.

Test Items	Test Modes	Test Channels
Conducted Emissions	2DH1	0
Radiated Emissions	2DH1	0
Peak Power Output -Conducted	2DH1	0,39,78
20dB Emission Bandwidth	2DH1	0,39,78
Occupied Channel Bandwidth	2DH1	0,39,78
Frequency Separation	2DH1	hop
Time of Occupancy (Dwell Time)	2DH1	hop
Band Edge Compliance	2DH1	0,78
Number of Hopping Frequency	2DH1	hop
Spurious RF Conducted Emissions	2DH1	0,39,78

3.2 Duty cycle

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
2DH1	Ant1	2402	0.38	1.25	30.40	---	---
	Ant1	2441	0.38	1.25	30.40	---	---
	Ant1	2480	0.38	1.25	30.40	---	---

4. Summary of measurement results

Summary of measurements of results	Clause in FCC rules	Verdict	Note
Conducted Emissions	15.207	PASS	/
Radiated Emissions	15.247(d),15.205,15.209	PASS	/
Peak Power Output -Conducted	15.247(b)(1)	PASS	Appendix D of FCC-2022-0077-RF2_Test diagram
20dB Emission Bandwidth	15.247(a)(1)	PASS	Appendix B of FCC-2022-0077-RF2_Test diagram
Occupied Channel Bandwidth	15.247(a)(1)	PASS	Appendix C of FCC-2022-0077-RF2_Test diagram
Frequency Separation	15.247(a)(1)	PASS	Appendix E of FCC-2022-0077-RF2_Test diagram
Time of Occupancy (Dwell Time)	15.247(a)(1)(iii)	PASS	Appendix F of FCC-2022-0077-RF2_Test diagram
Band Edge Compliance	15.247(d)	PASS	Appendix H of FCC-2022-0077-RF2_Test diagram
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS	Appendix G of FCC-2022-0077-RF2_Test diagram
Spurious RF Conducted Emissions	15.247(d)	PASS	Appendix I of FCC-2022-0077-RF2_Test diagram
Antenna Requirement	15.203	PASS	See note 1

Note 1: According to 15.203, it is considered sufficient to comply with the provisions of this section.

5. Measurement procedure

5.1 Conducted Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was setup according to ANSI C63.10, 2013 for compliance to FCC 47CFR 15.207 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

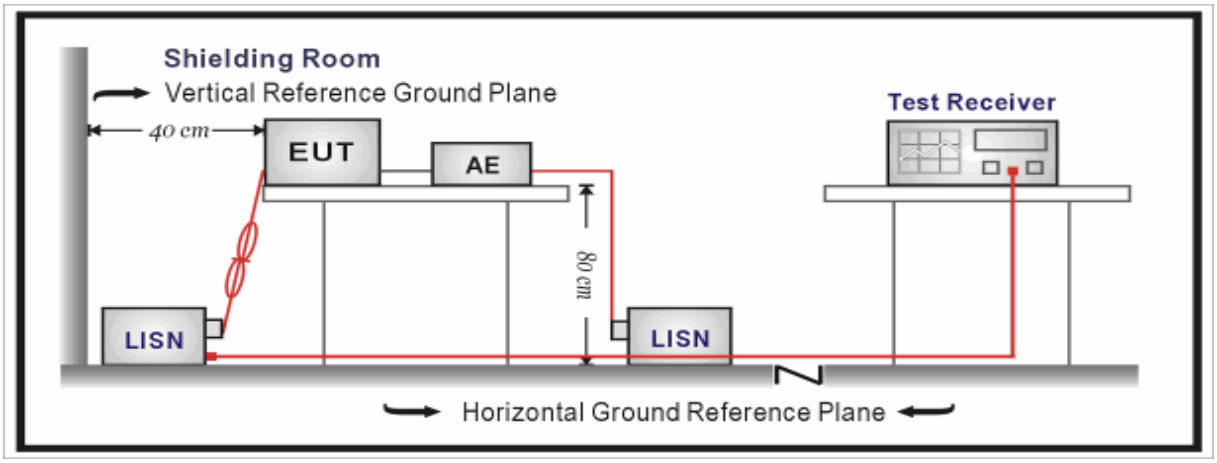
The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

Limits:

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
Note 1: The lower limit shall apply at the transition frequencies. Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.		

Test Setup:



Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Notes:

1. *The following Quasi-Peak and Average measurements were performed on the EUT:*
2. *Final Level =Reading + Factor.*

Measurement Uncertainty：

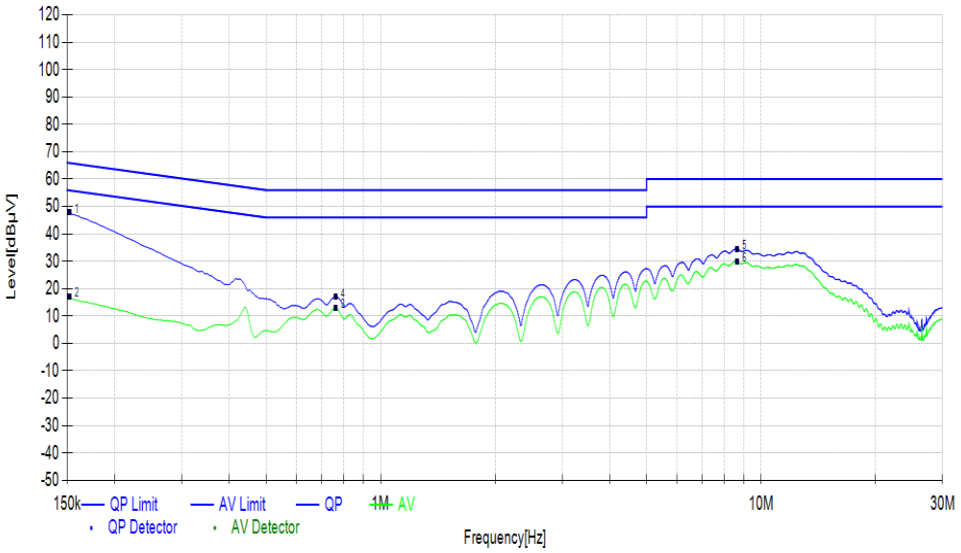
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96. U= 3.12 dB.

Test Results:

During the test, the Conducted Emission from 150kHz to 30MHz was performed in all modes with all channels, and all antennas. BT π/4DQPSK Channel 0, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

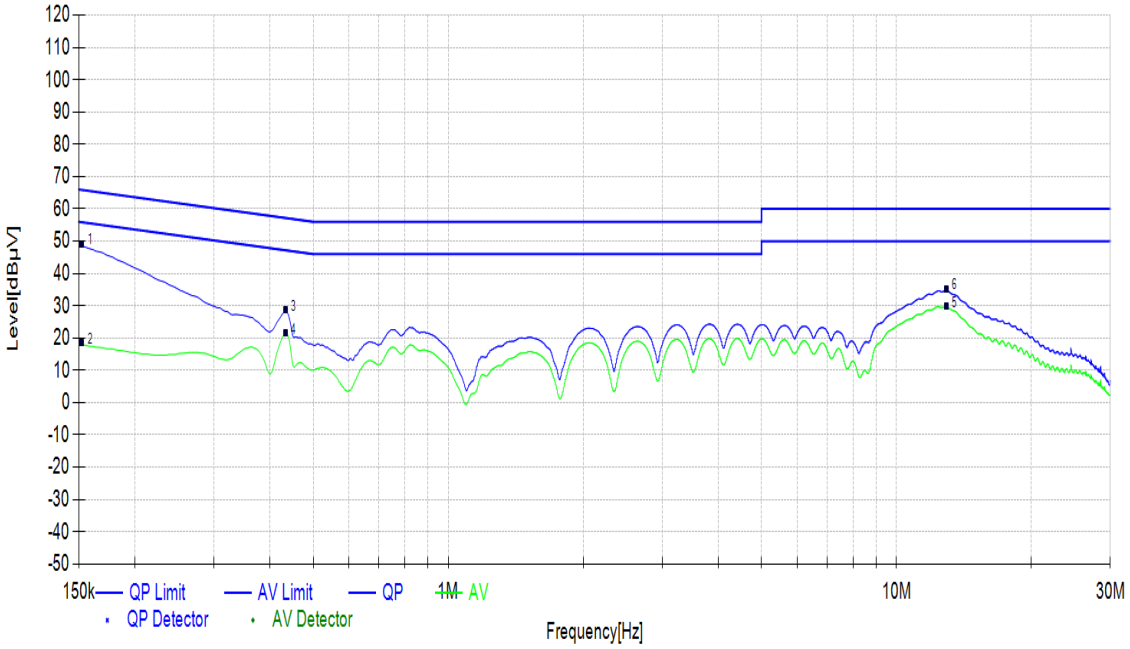
Power Line	L
Test channel	Worst-Case

Suspected List								
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.1523	10.29	37.30	47.59	65.88	18.29	QP	PASS
3	0.7620	10.32	6.73	17.05	56.00	38.95	QP	PASS
5	8.6505	10.53	24.02	34.55	60.00	25.45	QP	PASS
2	0.1523	10.29	6.78	17.07	55.88	38.81	AV	PASS
4	0.7620	10.32	2.66	12.98	46.00	33.02	AV	PASS
6	8.6505	10.53	19.38	29.91	50.00	20.09	AV	PASS



Power Line	N
Test channel	Worst-Case

Suspected List								
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV]	Level [dBµV]	Limit [dBµV]	Margin [dB]	Detector	Pass/Fail
1	0.1523	10.28	38.96	49.24	65.88	16.64	QP	PASS
3	0.4335	10.29	18.37	28.66	57.19	28.53	QP	PASS
5	12.9120	10.63	24.50	35.13	60.00	24.87	QP	PASS
2	0.1523	10.28	8.12	18.40	55.88	37.48	AV	PASS
4	0.4335	10.29	11.21	21.50	47.19	25.69	AV	PASS
6	12.9120	10.63	19.14	29.77	50.00	20.23	AV	PASS



5.2 Radiated Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was setup and tested according to ANSI C63.10, 2013.
The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Antenna to the EUT was 3 meters.
The Antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the Antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.
The frequency range from 30MHz to 10th harmonic is checked.
Note: When doing emission measurement above 1GHz, the horn Antenna will be bended down a little (as horn
Antenna has the narrow beamwidth) in order to keeping the Antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

Limits:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency	Limit (μV/m)	Limit (dBμV/m @3m)	Remark
0.009MHz-0.490MHz	2400/F(kHz)@300m	20lg(240000/F(kHz))	Quasi-peak Level
0.490MHz~1.705MHz	24000/F(kHz)@30m	20lg(240000/F(kHz))	Quasi-peak Level
1.705MHz~30.0MHz	30@30m	49.54	Quasi-peak Level
30MHz-88MHz	100@3m	40.0	Quasi-peak Level
88MHz-216MHz	150@3m	43.5	Quasi-peak Level
216MHz-960MHz	200@3m	46.0	Quasi-peak Level
960MHz-1GHz	500@3m	54.0	Quasi-peak Level
Above 1GHz	500@3m	54.0	Average Level

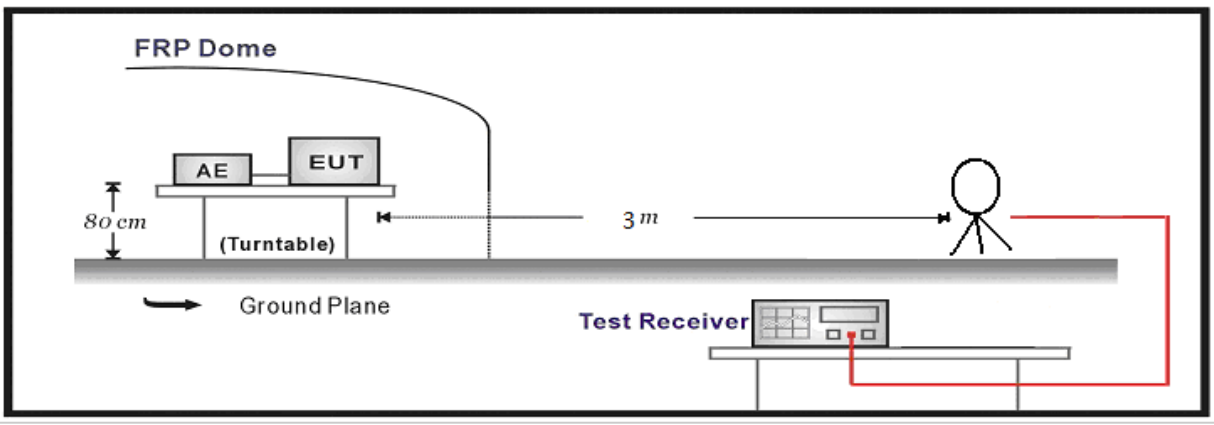
	5000@3m	74.0	Peak Level

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

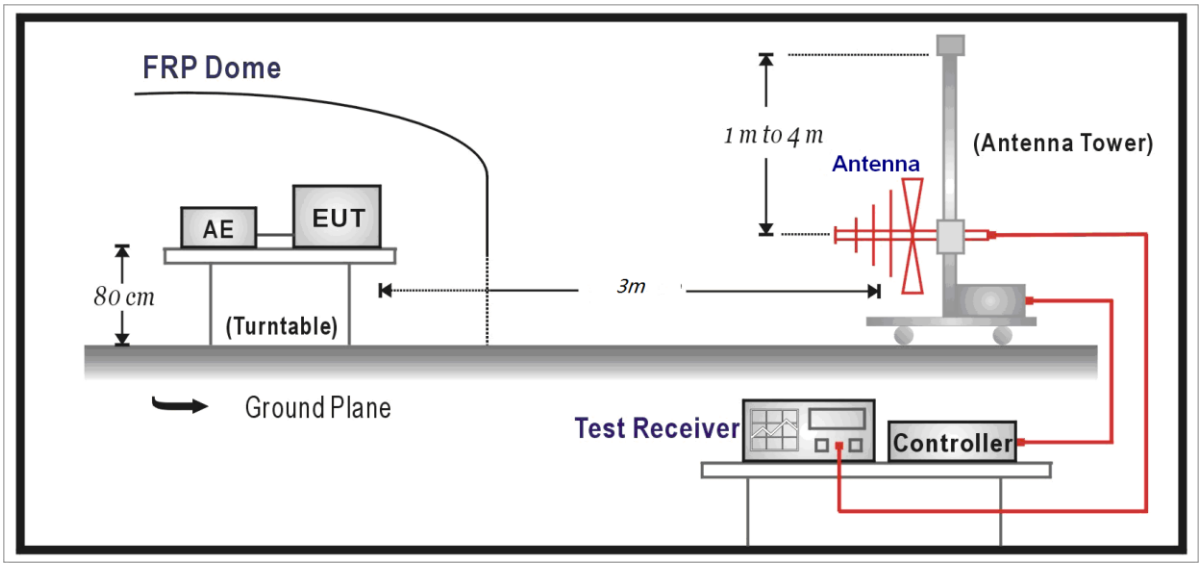
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.
12.57675-12.57725	322-335.4	3600-4400	/
13.36-13.41	/	/	/

Test Setup:

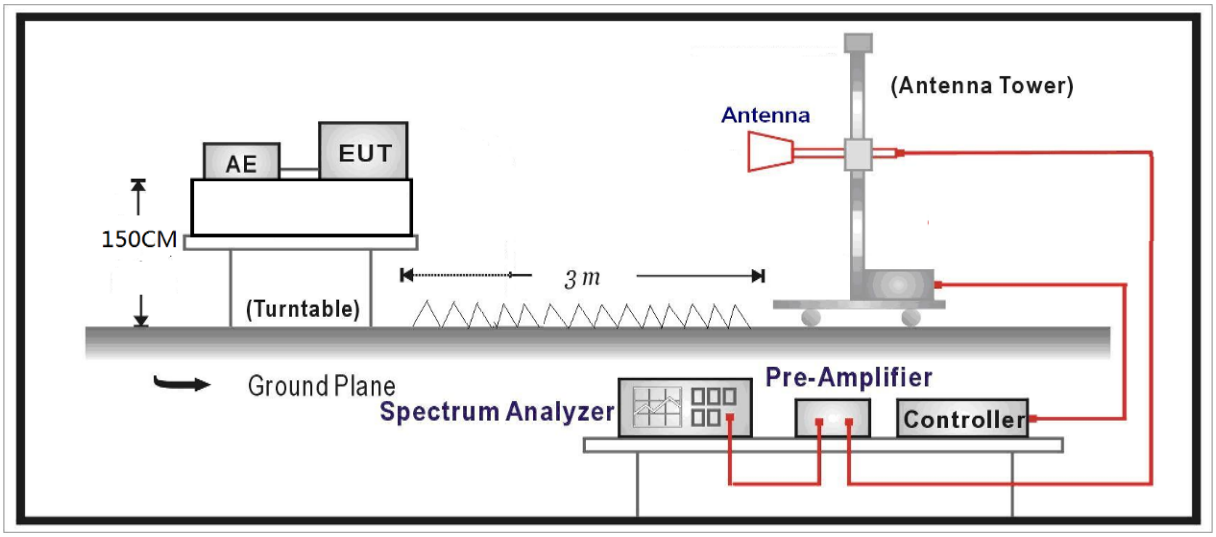
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



Measurement Data：

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Level =Reading - Factor

Factor = Preamplifier Factor – Antenna Factor–Cable Loss

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

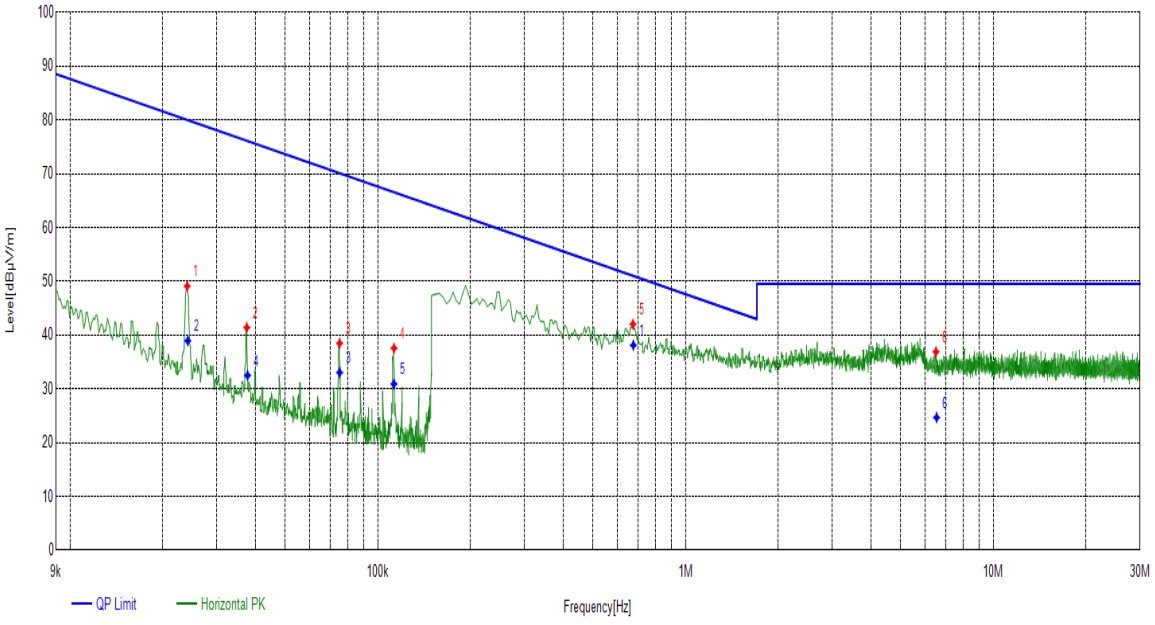
Test Results:

During the test, the Radiates Emission from 9KHz to 40GHz was performed in all modes with all channels, and all antennas. BT π/4DQPSK, Channel 0, antenna 1, X axis are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

SPURIOUS EMISSIONS：

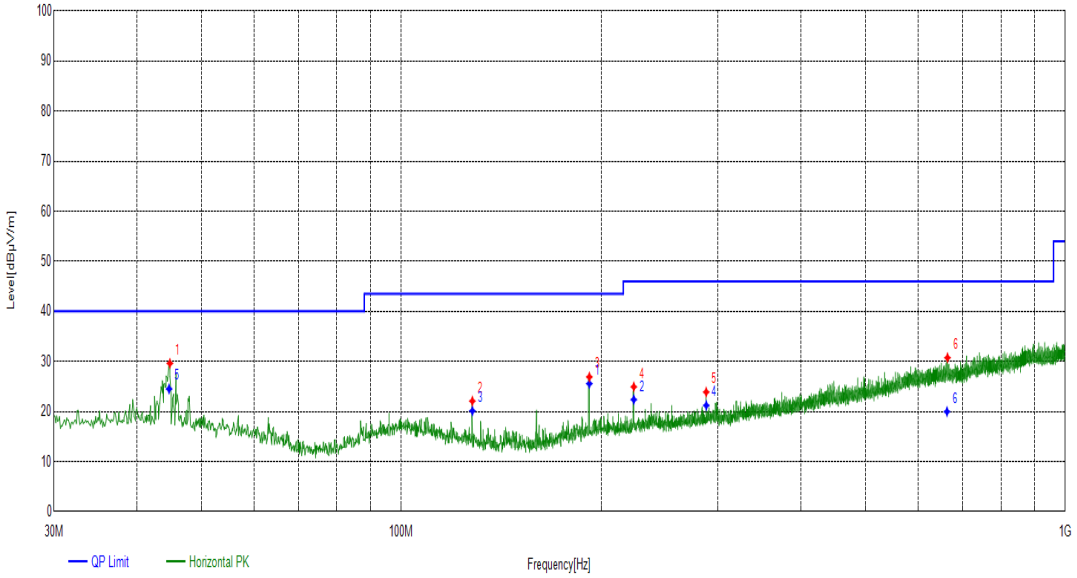
Radiated Emission	9KHz-30MHz
Polarity	X axis
Test channel	Worst-Case

Final Data List								
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
0.6765	X axis	19.68	38.11	51.00	12.89	100	65	PASS
0.0241	X axis	19.62	38.93	79.96	41.03	100	235	PASS
0.0751	X axis	19.68	33.03	70.09	37.06	100	235	PASS
0.0377	X axis	19.63	32.51	76.08	43.57	100	325	PASS
0.1128	X axis	19.70	30.90	66.56	35.66	100	345	PASS
6.5440	X axis	19.70	24.67	49.54	24.87	100	355	PASS



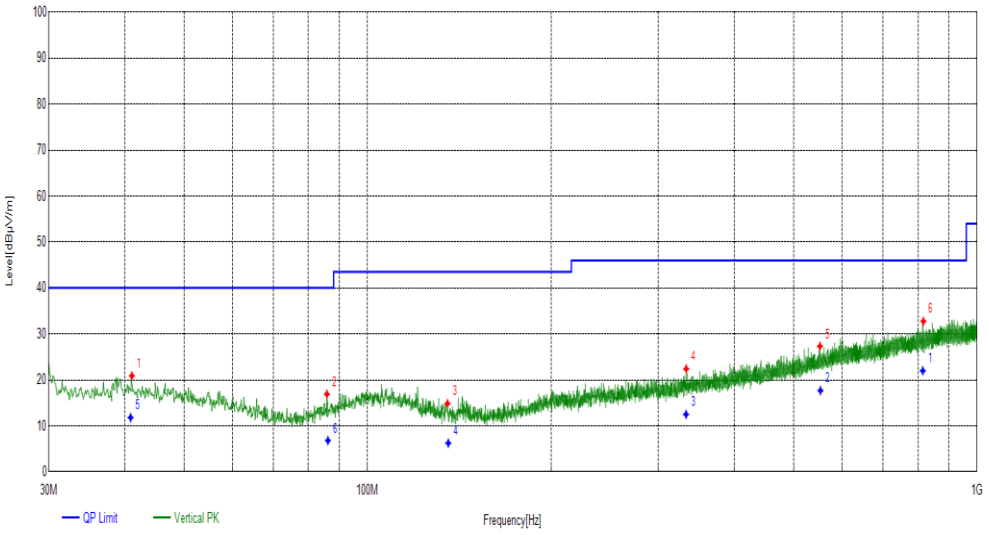
Radiates Emission	30M~1G
Test channel	Worst-Case
Polarity	Horizontal

Final Data List							
Frequency [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
192.0062	18.33	25.57	43.50	17.93	230	217	PASS
224.0162	19.20	22.38	46.00	23.62	180	206	PASS
128.0076	16.91	20.13	43.50	23.37	130	174	PASS
288.0030	21.09	21.21	46.00	24.79	170	42	PASS
44.7140	20.89	24.51	40.00	15.49	200	29	PASS
663.5416	28.86	19.98	46.00	26.02	130	13	PASS



Radiates Emission	30M~1G
Test channel	Worst-Case
Polarity	Vertical

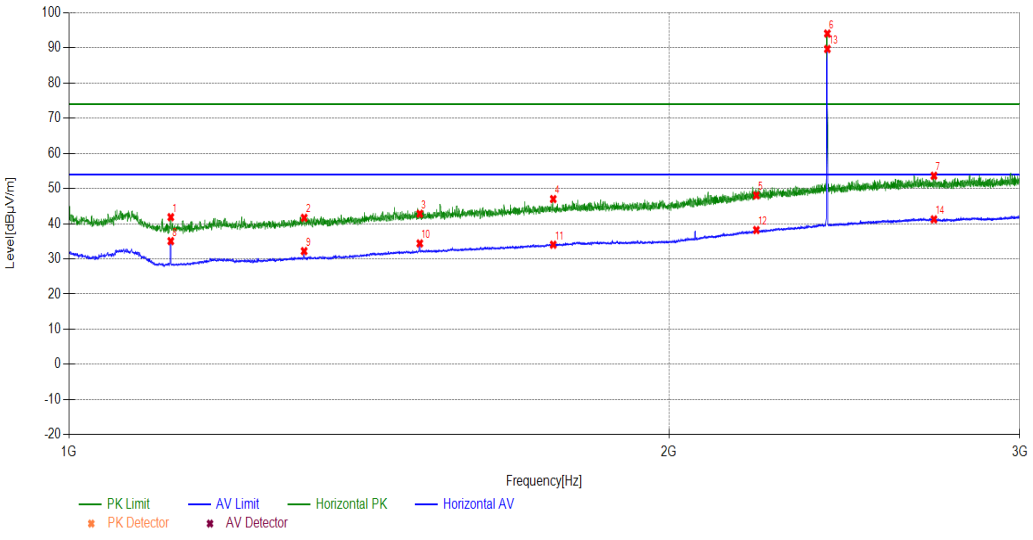
Final Data List							
Frequency [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
814.5083	30.83	21.98	46.00	24.02	160	95	PASS
553.3245	26.93	17.69	46.00	28.31	160	115	PASS
333.0979	22.48	12.50	46.00	33.50	170	175	PASS
135.6646	16.18	6.25	43.50	37.25	140	235	PASS
40.8636	21.10	11.81	40.00	28.19	180	355	PASS
86.1121	17.35	6.81	40.00	33.19	300	355	PASS



Radiates Emission	1G~3G
Test channel	Worst-Case
polarization	Horizontal

Suspected List

Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
1124.8125	27.25	14.62	41.87	74.00	32.13	PK	150	108	PASS
1312.2312	28.98	12.70	41.68	74.00	32.32	PK	150	51	PASS
1499.85	30.95	11.89	42.84	74.00	31.16	PK	150	108	PASS
1749.875	32.64	14.37	47.01	74.00	26.99	PK	150	281	PASS
2212.7213	35.66	12.42	48.08	74.00	25.92	PK	150	281	PASS
2401.9402	37.34	56.72	94.06	74.00	-20.06	PK	150	352	---
2716.7717	38.54	15.09	53.63	74.00	20.37	PK	150	237	PASS
1124.8125	27.25	7.81	35.06	54.00	18.94	AV	150	108	PASS
1312.2312	28.98	3.23	32.21	54.00	21.79	AV	150	36	PASS
1499.85	30.95	3.44	34.39	54.00	19.61	AV	150	94	PASS
1749.875	32.64	1.39	34.03	54.00	19.97	AV	150	209	PASS
2212.7213	35.66	2.56	38.22	54.00	15.78	AV	150	94	PASS
2401.9402	37.34	52.33	89.67	54.00	-35.67	AV	150	352	---
2716.7717	38.54	2.70	41.24	54.00	12.76	AV	150	195	PASS

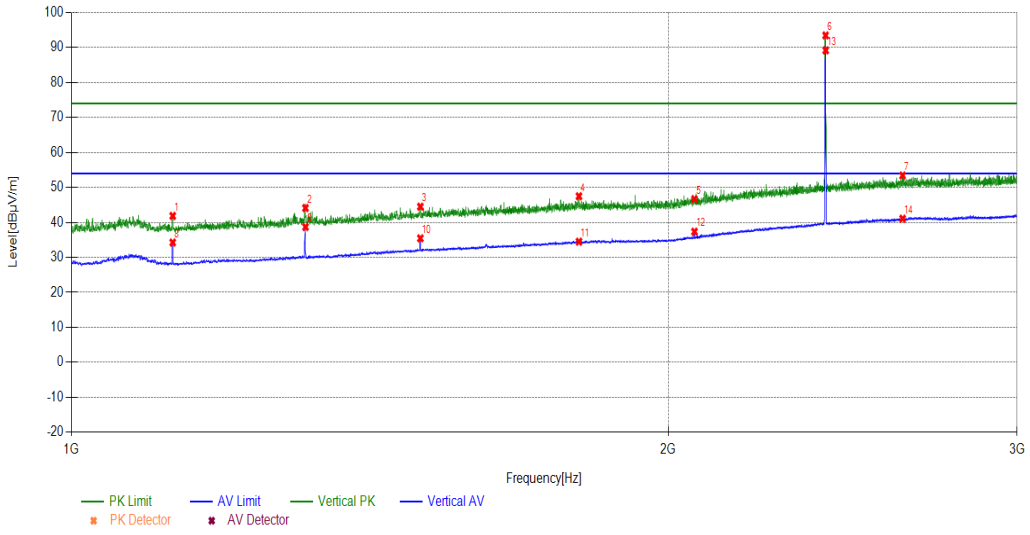


Note: The signal beyond the limit is carrier.

Radiates Emission	1G~3G
Test channel	Worst-Case
polarization	Vertical

Suspected List

Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
1124.8125	27.25	14.61	41.86	74.00	32.14	PK	150	46	PASS
1312.4312	28.98	15.13	44.11	74.00	29.89	PK	150	74	PASS
1499.85	30.95	13.54	44.49	74.00	29.51	PK	150	145	PASS
1803.2803	33.03	14.46	47.49	74.00	26.51	PK	150	88	PASS
2062.3062	33.86	12.81	46.67	74.00	27.33	PK	150	74	PASS
2401.7402	37.34	56.11	93.45	74.00	-19.45	PK	150	74	---
2626.3626	38.27	15.14	53.41	74.00	20.59	PK	150	145	PASS
1124.8125	27.25	7.01	34.26	54.00	19.74	AV	150	46	PASS
1312.4312	28.98	9.72	38.70	54.00	15.30	AV	150	74	PASS
1499.85	30.95	4.51	35.46	54.00	18.54	AV	150	102	PASS
1803.2803	33.03	1.48	34.51	54.00	19.49	AV	150	145	PASS
2062.3062	33.86	3.50	37.36	54.00	16.64	AV	150	102	PASS
2401.9402	37.34	51.83	89.17	54.00	-35.17	AV	150	74	---
2626.3626	38.27	2.80	41.07	54.00	12.93	AV	150	60	PASS

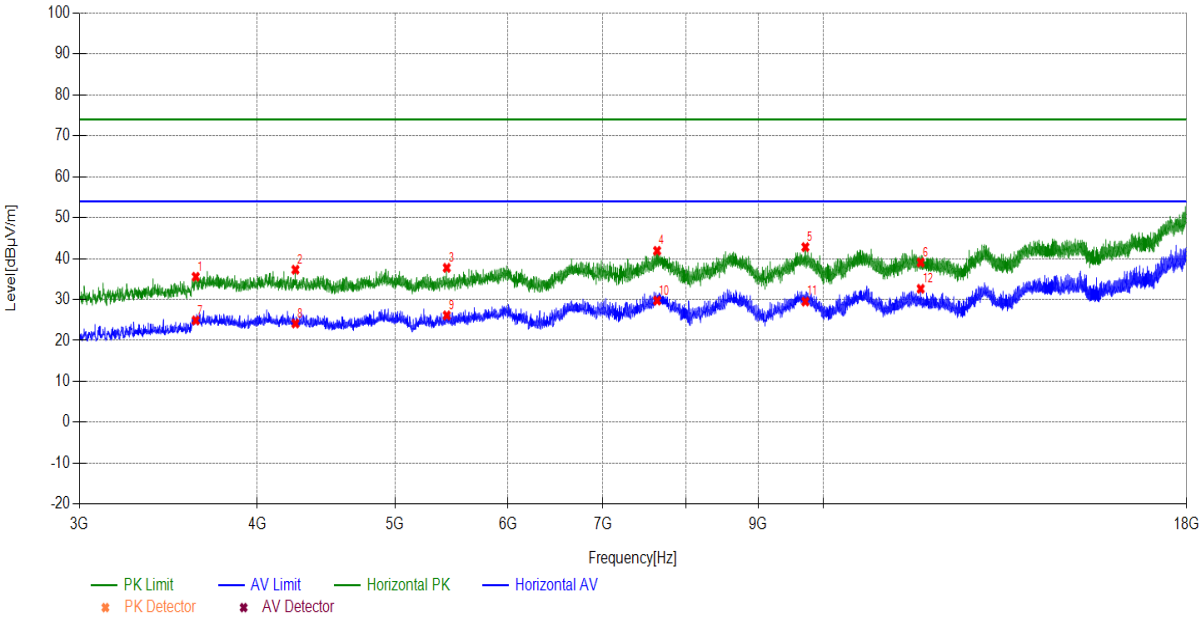


Note: The signal beyond the limit is carrier.

Radiates Emission	3G~18G
Test channel	Worst-Case
polarization	Horizontal

Suspected List

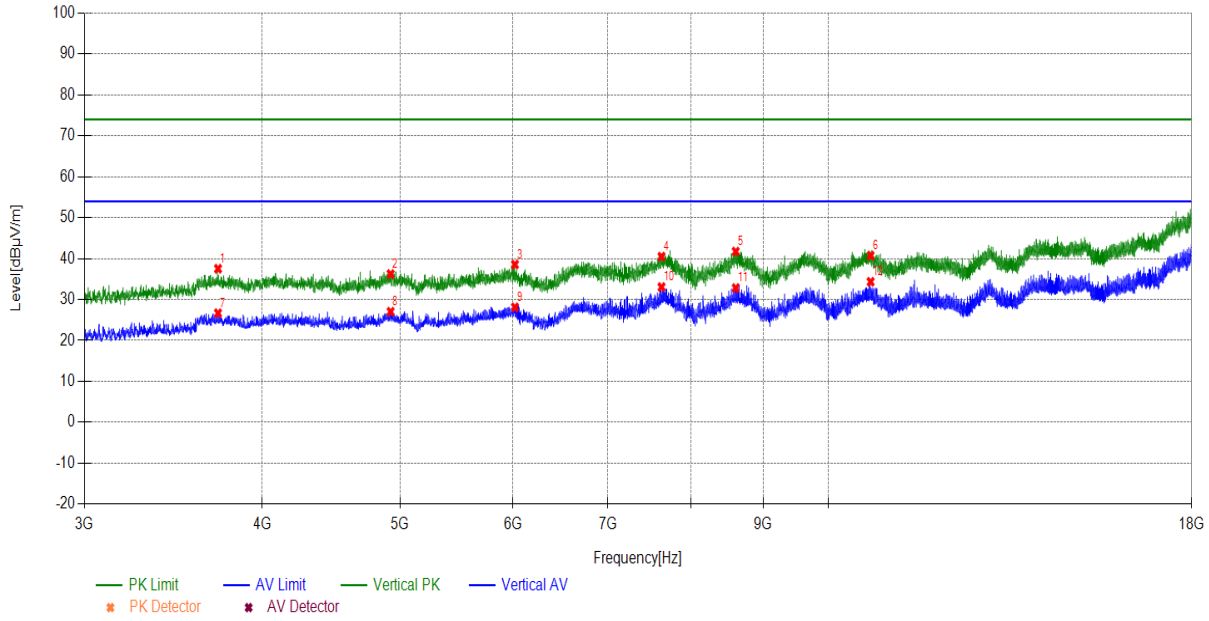
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
3621.0311	-3.07	38.64	35.57	74.00	38.43	PK	150	130	PASS
4254.8127	-2.80	40.09	37.29	74.00	36.71	PK	150	300	PASS
5436.1218	-0.12	37.87	37.75	74.00	36.25	PK	150	110	PASS
7640.482	5.24	36.68	41.92	74.00	32.08	PK	150	60	PASS
9711.3356	7.86	34.95	42.81	74.00	31.19	PK	150	110	PASS
11704.1852	7.06	32.00	39.06	74.00	34.94	PK	150	130	PASS
3621.0311	-3.07	27.98	24.91	54.00	29.09	AV	150	120	PASS
4254.8127	-2.80	26.94	24.14	54.00	29.86	AV	150	290	PASS
5436.1218	-0.12	26.25	26.13	54.00	27.87	AV	150	10	PASS
7640.482	5.24	24.51	29.75	54.00	24.25	AV	150	190	PASS
9711.3356	7.86	21.65	29.51	54.00	24.49	AV	150	280	PASS
11704.1852	7.06	25.58	32.64	54.00	21.36	AV	150	10	PASS



Radiates Emission	3G~18G
Test channel	Worst-Case
polarization	Vertical

Suspected List

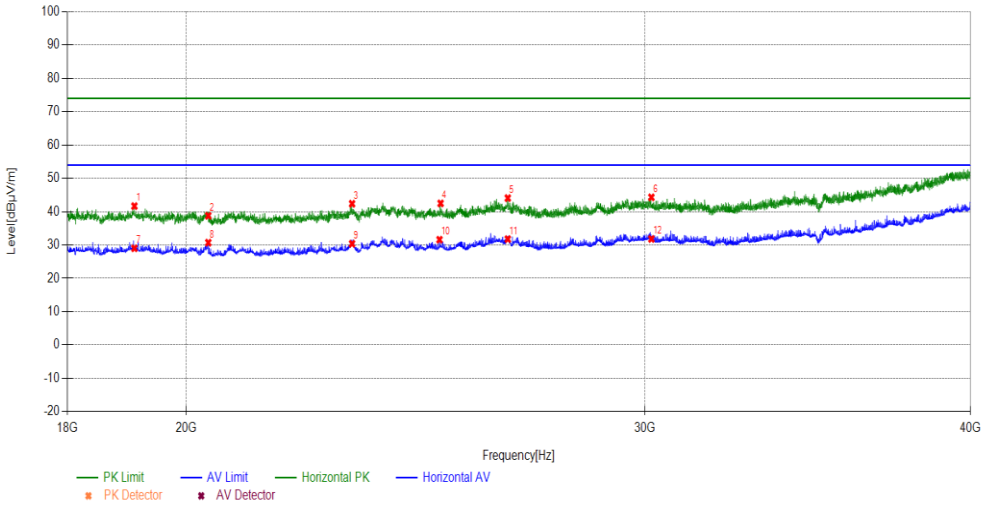
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
3723.7862	-2.97	40.50	37.53	74.00	36.47	PK	150	340	PASS
4923.8462	-1.49	37.72	36.23	74.00	37.77	PK	150	10	PASS
6021.1511	2.24	36.32	38.56	74.00	35.44	PK	150	280	PASS
7632.9816	5.23	35.25	40.48	74.00	33.52	PK	150	10	PASS
8606.5303	5.96	35.77	41.73	74.00	32.27	PK	150	290	PASS
10705.8853	8.03	32.70	40.73	74.00	33.27	PK	150	70	PASS
3723.7862	-2.97	29.64	26.67	54.00	27.33	AV	150	110	PASS
4923.8462	-1.49	28.52	27.03	54.00	26.97	AV	150	10	PASS
6021.1511	2.24	25.87	28.11	54.00	25.89	AV	150	280	PASS
7632.9816	5.23	27.83	33.06	54.00	20.94	AV	150	30	PASS
8606.5303	5.96	26.85	32.81	54.00	21.19	AV	150	50	PASS
10705.8853	8.03	26.32	34.35	54.00	19.65	AV	150	50	PASS



Radiates Emission	18G~40G
Test channel	Worst-Case
polarization	Horizontal

Suspected List

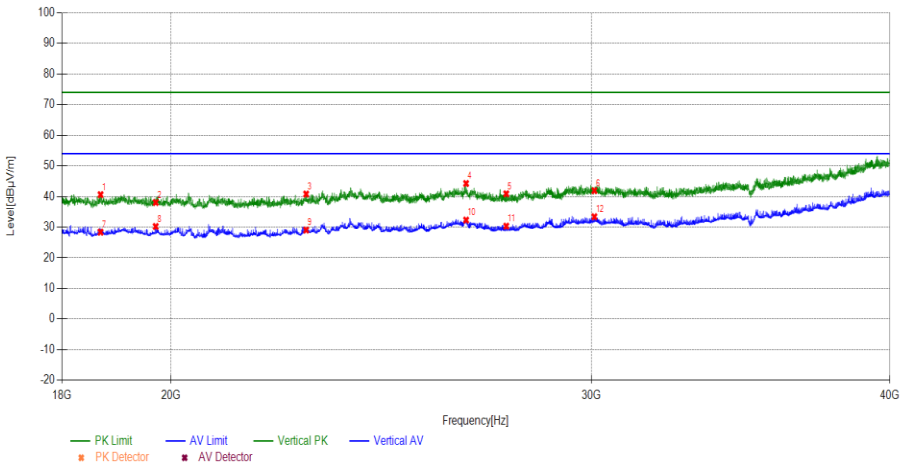
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
19100.11	1.34	40.34	41.68	74.00	32.32	PK	150	210	PASS
20389.4389	1.44	37.32	38.76	74.00	35.24	PK	150	150	PASS
23152.9153	3.02	39.36	42.38	74.00	31.62	PK	150	280	PASS
25038.5038	4.12	38.37	42.49	74.00	31.51	PK	150	140	PASS
26569.857	4.73	39.35	44.08	74.00	29.92	PK	150	290	PASS
30167.2167	6.62	37.67	44.29	74.00	29.71	PK	150	210	PASS
19100.11	1.34	27.68	29.02	54.00	24.98	AV	150	270	PASS
20389.4389	1.44	29.27	30.71	54.00	23.29	AV	150	10	PASS
23152.9153	3.02	27.37	30.39	54.00	23.61	AV	150	300	PASS
25014.3014	4.11	27.48	31.59	54.00	22.41	AV	150	10	PASS
26569.857	4.73	27.04	31.77	54.00	22.23	AV	150	250	PASS
30167.2167	6.62	25.19	31.81	54.00	22.19	AV	150	220	PASS



Radiates Emission	18G~40G
Test channel	Worst-Case
polarization	Vertical

Suspected List

Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
18684.2684	1.27	39.34	40.61	74.00	33.39	PK	150	230	PASS
19705.1705	1.31	36.74	38.05	74.00	35.95	PK	150	150	PASS
22781.0781	2.68	38.14	40.82	74.00	33.18	PK	150	190	PASS
26580.8581	4.73	39.53	44.26	74.00	29.74	PK	150	200	PASS
27630.363	5.22	35.68	40.90	74.00	33.10	PK	150	30	PASS
30081.4081	6.66	35.25	41.91	74.00	32.09	PK	150	270	PASS
18684.2684	1.27	27.10	28.37	54.00	25.63	AV	150	140	PASS
19705.1705	1.31	28.91	30.22	54.00	23.78	AV	150	320	PASS
22781.0781	2.68	26.38	29.06	54.00	24.94	AV	150	200	PASS
26580.8581	4.73	27.58	32.31	54.00	21.69	AV	150	130	PASS
27630.363	5.22	25.10	30.32	54.00	23.68	AV	150	140	PASS
30081.4081	6.66	26.75	33.41	54.00	20.59	AV	150	120	PASS



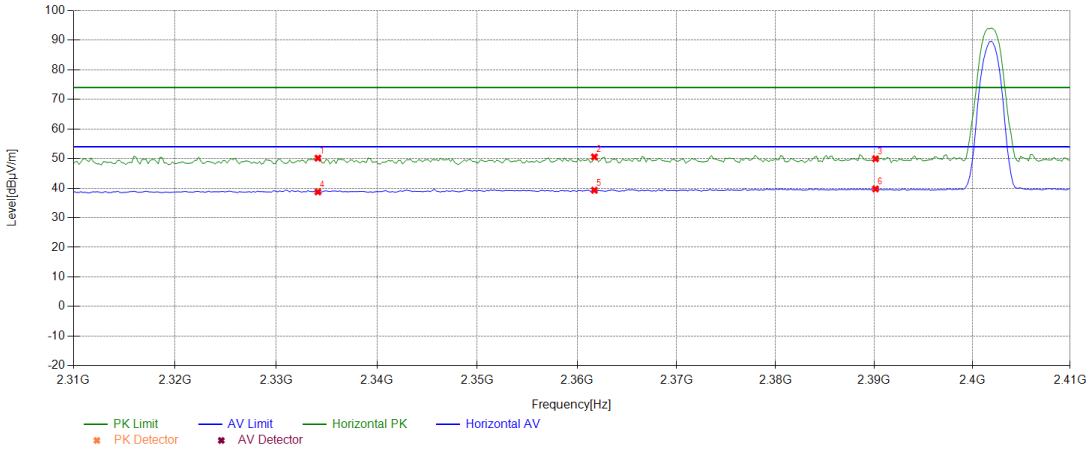
Band Edge：

During the test, the Band Edge was performed in BT π/4DQPSK with all channels and all antennas. BT π/4DQPSK, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Test mode	π/4DQPSK
Test channel	Lowest channel
polarization	Horizontal

Suspected List

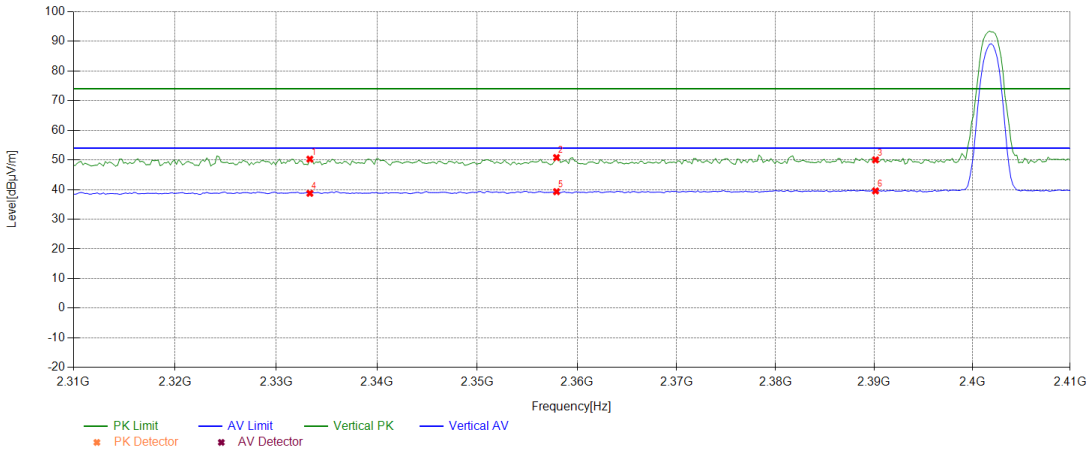
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2334.1334	36.74	13.40	50.14	74.00	23.86	PK	150	352	PASS
2361.7362	36.99	13.57	50.56	74.00	23.44	PK	150	94	PASS
2390.139	37.24	12.66	49.90	74.00	24.10	PK	150	79	PASS
2334.1334	36.74	1.99	38.73	54.00	15.27	AV	150	36	PASS
2361.7362	36.99	2.30	39.29	54.00	14.71	AV	150	151	PASS
2390.139	37.24	2.49	39.73	54.00	14.27	AV	150	309	PASS



Test mode	π/4DQPSK
Test channel	Lowest channel
polarization	Vertical

Suspected List

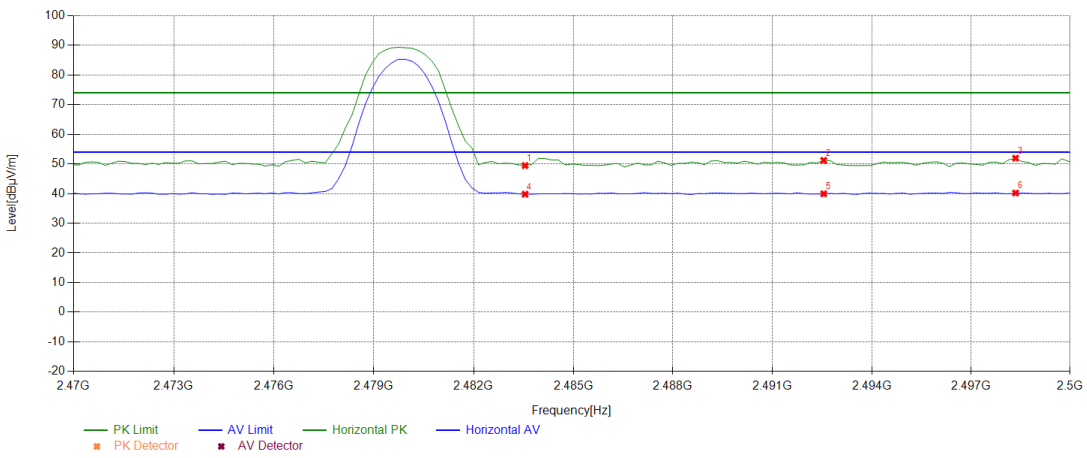
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2333.3333	36.74	13.52	50.26	74.00	23.74	PK	150	174	PASS
2357.9358	36.96	13.83	50.79	74.00	23.21	PK	150	188	PASS
2390.139	37.24	12.78	50.02	74.00	23.98	PK	150	117	PASS
2333.3333	36.74	2.01	38.75	54.00	15.25	AV	150	18	PASS
2357.9358	36.96	2.34	39.30	54.00	14.70	AV	150	74	PASS
2390.139	37.24	2.31	39.55	54.00	14.45	AV	150	330	PASS



Test mode	π/4DQPSK
Test channel	Highest channel
polarization	Horizontal

Suspected List

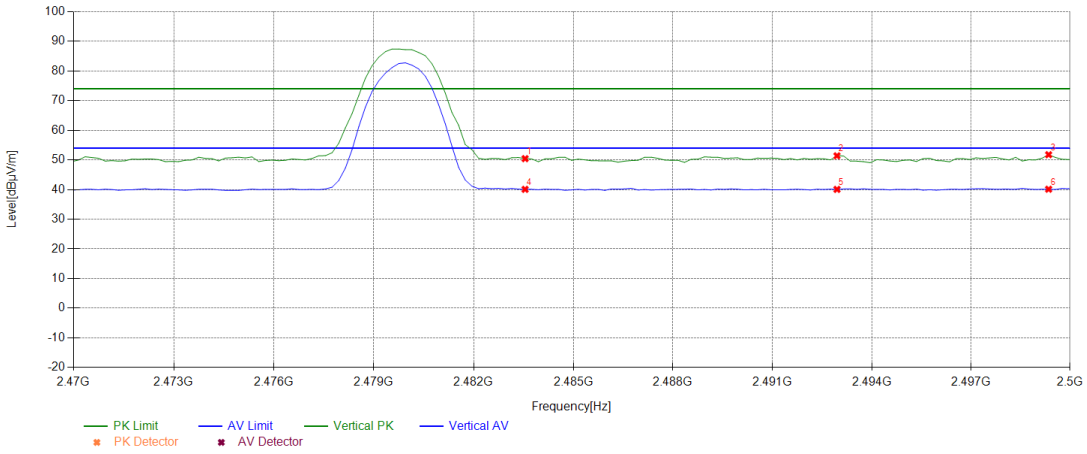
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2483.5484	37.72	11.72	49.44	74.00	24.56	PK	150	356	PASS
2492.5493	37.76	13.44	51.20	74.00	22.80	PK	150	102	PASS
2498.3498	37.79	14.13	51.92	74.00	22.08	PK	150	330	PASS
2483.5484	37.72	2.08	39.80	54.00	14.20	AV	150	102	PASS
2492.5493	37.76	2.17	39.93	54.00	14.07	AV	150	174	PASS
2498.3498	37.79	2.40	40.19	54.00	13.81	AV	150	217	PASS



Test mode	π/4DQPSK
Test channel	Highest channel
polarization	Vertical

Suspected List

Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2483.5484	37.72	12.70	50.42	74.00	23.58	PK	150	360	PASS
2492.9493	37.76	13.63	51.39	74.00	22.61	PK	150	213	PASS
2499.3499	37.79	13.97	51.76	74.00	22.24	PK	150	341	PASS
2483.5484	37.72	2.36	40.08	54.00	13.92	AV	150	127	PASS
2492.9493	37.76	2.31	40.07	54.00	13.93	AV	150	127	PASS
2499.3499	37.79	2.33	40.12	54.00	13.88	AV	150	255	PASS



5.3 Peak Power Output -Conducted

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

During the process of the testing, The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The EUT is controlled by the Bluetooth test set to ensure max power transmission with proper modulation. The peak detector is used.

Limits:

Rule Part 15.247 (b) (1)specifies that " For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts."

Peak Output Power	⩽ 0.125W (20.97dBm)

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

Test Results:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
2DH1	Ant1	2402	1.73	≤20.97	PASS
	Ant1	2441	2.06	≤20.97	PASS
	Ant1	2480	2.27	≤20.97	PASS

5.4 20dB Emission Bandwidth

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 20 kHz; VBW is set to 100 kHz on spectrum analyzer.
Detector=Peak, Trace mode=Max hold.

Limits:

No specific occupied bandwidth requirements in part 15.247(a) (1).

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

Test Results:

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2DH1	Ant1	2402	1.39	2401.298	2402.684	---	---
	Ant1	2441	1.39	2440.298	2441.684	---	---
	Ant1	2480	1.39	2479.295	2480.684	---	---

5.5 Occupied Channel Bandwidth

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 20 kHz; VBW is set to 100 kHz on spectrum analyzer.
Detector=Peak, Trace mode=Max hold.

Limits:

No specific occupied bandwidth requirements in part 15.247(a) (1).

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

Test Results:

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2DH1	Ant1	2402	1.229	2401.365	2402.593	---	---
	Ant1	2441	1.235	2440.362	2441.596	---	---
	Ant1	2480	1.235	2479.362	2480.596	---	---

5.6 Frequency Separation

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer.

Limits:

Rule Part 15.247(a)(1)specifies that “Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. ”

Note: The value of two-thirds of 20 dB bandwidth is always greater than 25 kHz.

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U=936 Hz.

Test Results:

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
2DH1	Ant1	Hop	1	≥0.927	PASS

5.7 Time of Occupancy (Dwell Time)

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 1MHz and VBW is set to 3MHz on spectrum analyzer. The dwell time is calculated by: Dwell time = time slot length * hop rate * 0.4s with:

The selected EUT Packet type uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600(ch*hop/s) for all channels.So the final hopping rate for all channel is1600/6=266.67(ch*hop/s)

Limits:

Rule Part15.247(a) specifies that " Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed."

Dwell time	⩽ 400ms

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2.

Requirements	Uncertainty					
Dwell Time	DH5	U=0.70ms	2DH5	U=0.70ms	3DH5	U=0.70ms

Test Results:

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
2DH1	Ant1	Hop	0.37	320	0.118	≤0.4	PASS

5.8 Band Edge Measurement

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer.

Limits:

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 936 Hz, 2 GHz-3 GHz = 1.407 dB.

Test Result:

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2DH1	Ant1	Low	2402	-2.49	-49.31	≤-22.49	PASS
		High	2480	-1.81	-47.24	≤-21.81	PASS
		Low	Hop_2402	-0.36	-49.47	≤-20.36	PASS
		High	Hop_2480	0.45	-48.23	≤-19.55	PASS

5.9 Number of hopping Frequency

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 100KHz and VBW is set to 300KHz on spectrum analyzer. Set EUT on Hopping on mode.

Limits:

Rule Part 15.247(a) (1) (iii) specifies that" Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels."

Limits	⩾ 15 channels

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.75dB.

Test Results:

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
2DH1	Ant1	Hop	79	≥15	PASS

5.10 Spurious RF Conducted Emissions

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to100kHz and VBW to 300 kHz, Sweep is set to AUTO .The test is in transmitting mode.

Limits:

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Test Setup:

Measurement Uncertainty：

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

Test Results:

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2DH1	Ant1	2402	Reference	-2.52	-2.52	---	PASS
			30~1000	-2.52	-59.9	≤-22.52	PASS
			1000~26500	-2.52	-48.83	≤-22.52	PASS
		2441	Reference	-2.22	-2.22	---	PASS
			30~1000	-2.22	-60.13	≤-22.22	PASS
			1000~26500	-2.22	-49.55	≤-22.22	PASS
		2480	Reference	-2.07	-2.07	---	PASS
			30~1000	-2.07	-59.88	≤-22.07	PASS
			1000~26500	-2.07	-48.96	≤-22.07	PASS

6. Appendix A

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
Spectrum Analyzer	FSV40	101580	DZ-000238-3	R&S	2024/04/22
Comprehensive Test Instrument	CMW270	100304	DZ-000240-1	R&S	2023/12/06
Analog Signal Generator	SMB100A	181858	DZ-000238-2	R&S	2024/05/29
Vector Signal Generator	SGT100A	111661	DZ-000238-1	R&S	2024/05/29
RF Radio Frequency Switch	JS0806-2	19H9080187	DZ-000241	Tonscend	2024/05/29
Programmable DC Power Supply	E3644A	MY58036222	DZ-000178	KEYSIGHT	2024/04/12
3m Semi-Anechoic Chamber	FACT-4	ST08035	WKNA-0024	ETS	2024/12/12
5m Semi-Anechoic Chamber	SAC-5	SAC-5-2.0	EM-000557	COMTEST	2024/11/02
Spectrum Analyzer	N9010B	MY57470323	DZ-000174	KEYSIGHT	2024/02/22
EMI Test Receiver	N9038A-508	MY532290079	EM-000397	Agilent	2024/02/22
EMI Test Receiver	ESR7	102235	VGDY-0956	R&S	2024/02/22
loop antenna	HLA 6121	540046	EM-000546	TESEQ	2024/06/05
Broadband Antenna	VULB 9168	01537	EM-000736-1	SCHWARZBECK	2024/04/24
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWARZBECK	2024/06/10
Waveguide Horn Antenna	HF906	360306/008	EM-000093	R&S	2024/02/24
Waveguide Horn Antenna	BBHA9170	00949	EM-000383	SCHWARZBECK	2023/08/26
Bandstop Filters	SW-BSF-2400-100-7-A1	/	EM-000495	/	2023/08/30
5G Bandstop Filters	WRCJV12-4900-5100-5900-6100-50EE	1	DZ-000186	WI	2023/12/06
Preamplifier	BBV 9721	9721-050	DZ-000209-1	SCHWARZBECK	2024/06/04
EMI Test Receiver	ESR3	102394	VGDY-0705	R&S	2024/04/22
LISN	NSLK 8127	8127644	VGDY-0150	SCHWARZBECK	2023/09/03
Plus Limiter（#2）	VTSD 9561	9561-F017	VGDY-0152	SCHWARZBECK	2024/09/03
Shielding Room(#2)	GP1A	001	WKNF-0006	LEINING	2024/08/07

The End

Important

1. The test report is invalid without the official stamp of CVC;
2. Any part photocopies of the test report are forbidden without the written permission from CVC;
3. The test report is invalid without the signatures of Author and Reviewer;
4. The test report is invalid if altered;
5. Objections to the test report must be submitted to CVC within 15 days;
6. Generally, commission test is responsible for the tested samples only;
7. As for the test result, "—" or " N/A" means "not applicable", " / "means "not testing", "P" means "pass" and "F" means "fail".

The test data and test results given in this test report should only be used for purposes of scientific research, teaching and internal quality control when the CMA symbol is not presented.

Address: No.3,Tiantaiyi Road, Kaitai Avenue, Science City, Guangzhou, China (Test location)
Post Code：510663 Tel：020-32293888
FAX：020 32293889 E-mail：office@cvc.org.cn