



Test Report No.: FCC2022-0078-RF2/R2

TEST REPORT

FCC ID	:	2A9GO-XS1-32DISPLAY
Applicant	:	Jiangsu TSD Electronics Technology Co., Ltd
Product Name	:	XS1 32 inches Display
Mode No.	:	IDS320

CVC Testing Technology Co., Ltd.




Applicant		Name: Jiangsu TSD Electronics Technology Co., Ltd Address: No.198, East ChenFeng Road, Yushan Town	
Manufacturer		Name: Jiangsu TSD Electronics Technology Co., Ltd Address: No.198, East ChenFeng Road, Yushan Town	
Equipment Under Test		Product Name : XS1 32 inches Display Model No. : IDS320 Trade mark : TSD Serial no. : — Sampling : 1-1	
Date of Receipt.	2022.12.28	Date of Testing	2023.3.8
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 Issue Date: 2023.5.31	
Approved by:  Chen Huawen		Reviewed by:  Xu Zhenfei	Tested by:  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: After the release of this report, it replaces the report numbered FCC2022-0078-RF2/R1.			

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1. General Product Information

1.1 General information

Product Name	XS1 32 inches Display
Model No.	IDS320
Additional model	N/A
Power Supply	AC 100-240V,50/60Hz
Serial Number(SN)	TM23C002814
HVIN	IDS320
firmware	XMA311D.B-2
software	20220620
specific power settings	DH5: Default 2DH5: Default 3DH5: Default
Antenna Type	External Antenna
Antenna Connector	A detachable antenna
Antenna Gain	2.0 dBi (provided by client)
Beamforming gain	Unsupported (provided by client)
Frequency Range	2402MHz~2480MHz
Bluetooth Version:	4.2
Channel Number	79
Type of Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Hopping Channel Type:	Adaptive Frequency Hopping systems
Max. Conducted Power	DH5: 6.82 dBm 2DH5: 6.76 dBm 3DH5: 7.39 dBm
Operate Temp.Range	0~40°C
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.

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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
DH1/DH3/DH5 2DH1/2DH3/2DH5 3DH1/3DH3/3DH5	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	3DH5	0
Radiated Emissions	3DH5	0
Peak Power Output -Conducted	DH5/2DH5/3DH5	0,39,78
20dB Emission Bandwidth	DH5/2DH5/3DH5	0,39,78
Occupied Channel Bandwidth	DH5/2DH5/3DH5	0,39,78
Frequency Separation	DH5/2DH5/3DH5	hop
Time of Occupancy (Dwell Time)	DH1/DH3/DH5/ 2DH1/2DH3/2DH5/ 3DH1/3DH3/3DH5	hop
Band Edge Compliance	DH5/2DH5/3DH5	0,78
Number of Hopping Frequency	DH5/2DH5/3DH5	hop
Spurious RF Conducted Emissions	DH5/2DH5/3DH5	0,39,78

3.2 Duty cycle

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
DH5	Ant1	2402	2.88	3.78	76.19	---	---
	Ant1	2441	2.89	3.79	76.25	---	---
	Ant1	2480	2.88	3.78	76.19	---	---
2DH5	Ant1	2402	2.88	3.78	76.19	---	---
	Ant1	2441	2.89	3.79	76.25	---	---
	Ant1	2480	2.89	3.79	76.25	---	---
3DH5	Ant1	2402	2.89	3.79	76.25	---	---
	Ant1	2441	2.89	3.79	76.25	---	---
	Ant1	2480	2.90	3.80	76.32	---	---

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	/
20dB Emission Bandwidth	15.247(a)(1)	PASS	/
Occupied Channel Bandwidth	15.247(a)(1)	PASS	/
Frequency Separation	15.247(a)(1)	PASS	/
Time of Occupancy (Dwell Time)	15.247(a)(1)(iii)	PASS	/
Band Edge Compliance	15.247(d)	PASS	/
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS	/
Spurious RF Conducted Emissions	15.247(d)	PASS	/
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.

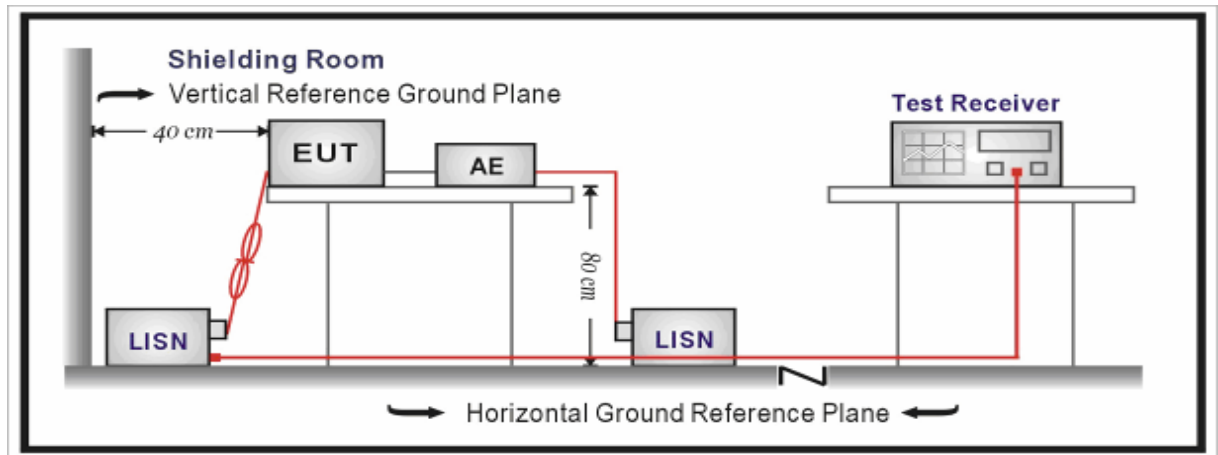
Limits:

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:

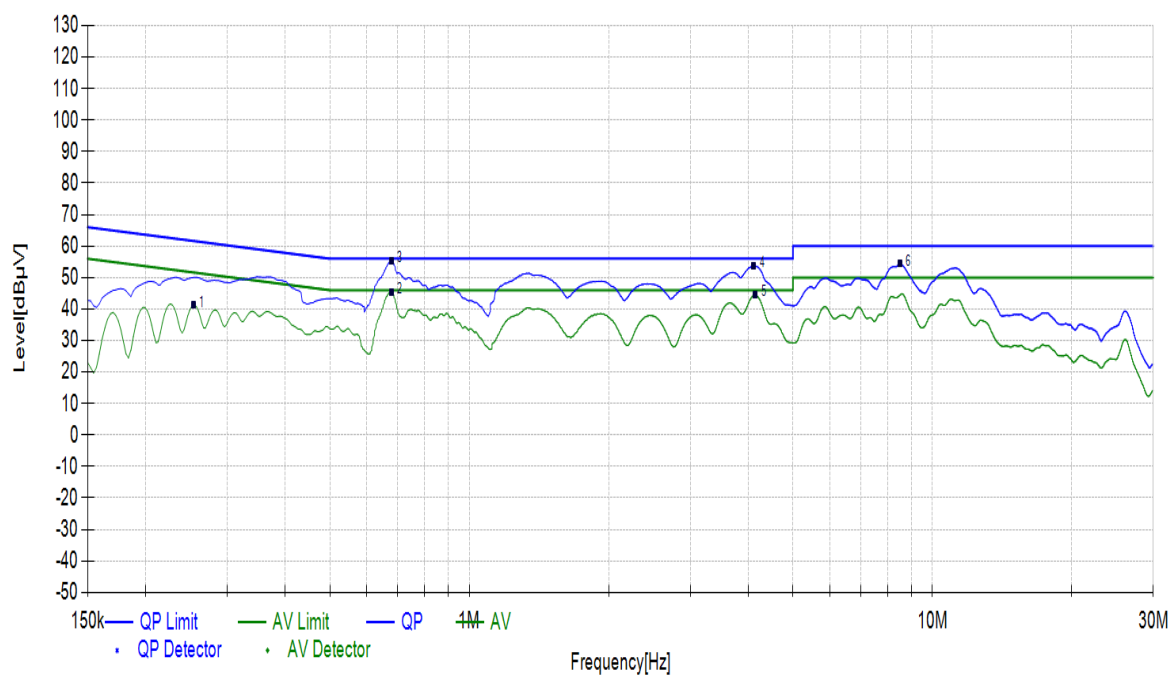
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$. $U = 3.12$ dB.

Test Results:

During the test, the Conducted Emission from 150KHz to 30MHz was performed in all modes with all channels, and all antennas. BT 8DPSK Channel 0, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

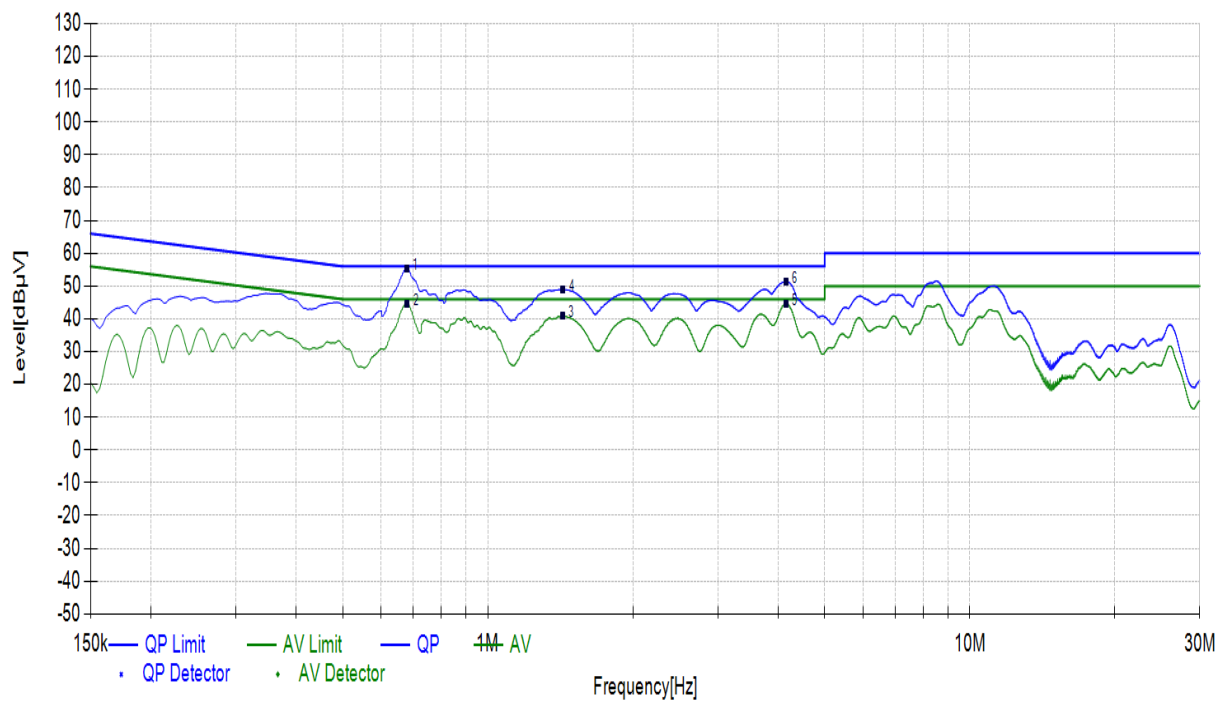
Power Line	L
Test channel	Worst-Case

Suspected List								
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
6	8.5043	10.53	43.84	54.37	60.00	5.63	QP	PASS
4	4.1100	10.40	43.43	53.83	56.00	2.17	QP	PASS
3	0.6788	10.31	44.85	55.16	56.00	0.84	QP	PASS
2	0.6788	10.31	34.96	45.27	46.00	0.73	AV	PASS
5	4.1483	10.40	34.11	44.51	46.00	1.49	AV	PASS
1	0.2535	10.29	30.86	41.15	51.64	10.49	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
6	4.1550	10.41	41.07	51.48	56.00	8.52	QP	PASS
4	1.4325	10.34	38.68	49.02	56.00	6.98	QP	PASS
1	0.6788	10.31	44.83	55.14	56.00	0.86	QP	PASS
2	0.6810	10.31	34.28	44.59	46.00	1.41	AV	PASS
5	4.1528	10.41	34.26	44.67	46.00	1.33	AV	PASS
3	1.4303	10.34	30.57	40.91	46.00	10.73	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 ($\mu\text{V/m}$)	Limit ($\text{dB}\mu\text{V/m}$ @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

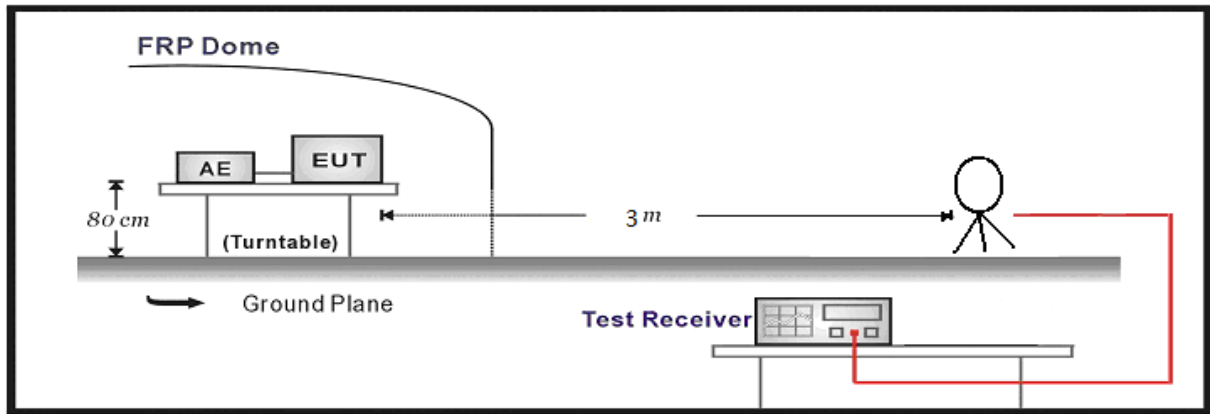
	5000@3m	74.0	Peak Level
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Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

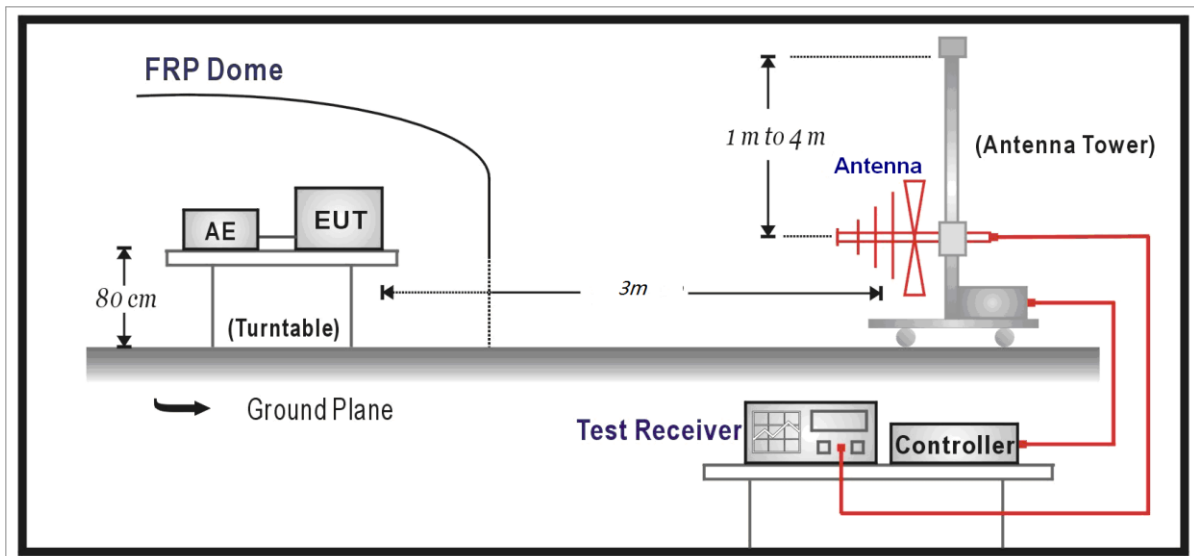
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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:

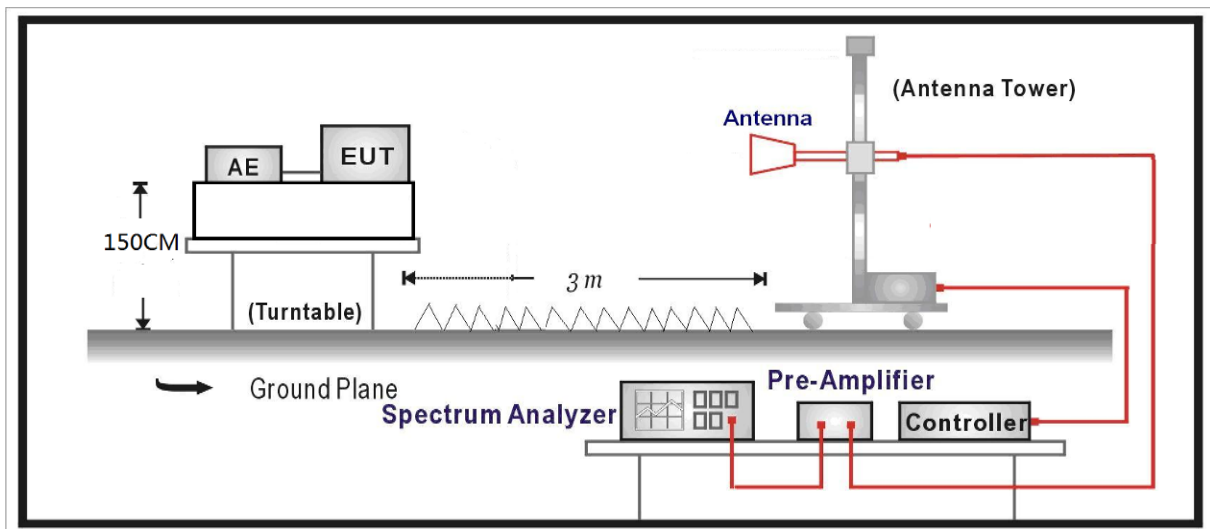
Below 30MHz Test Setup:



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

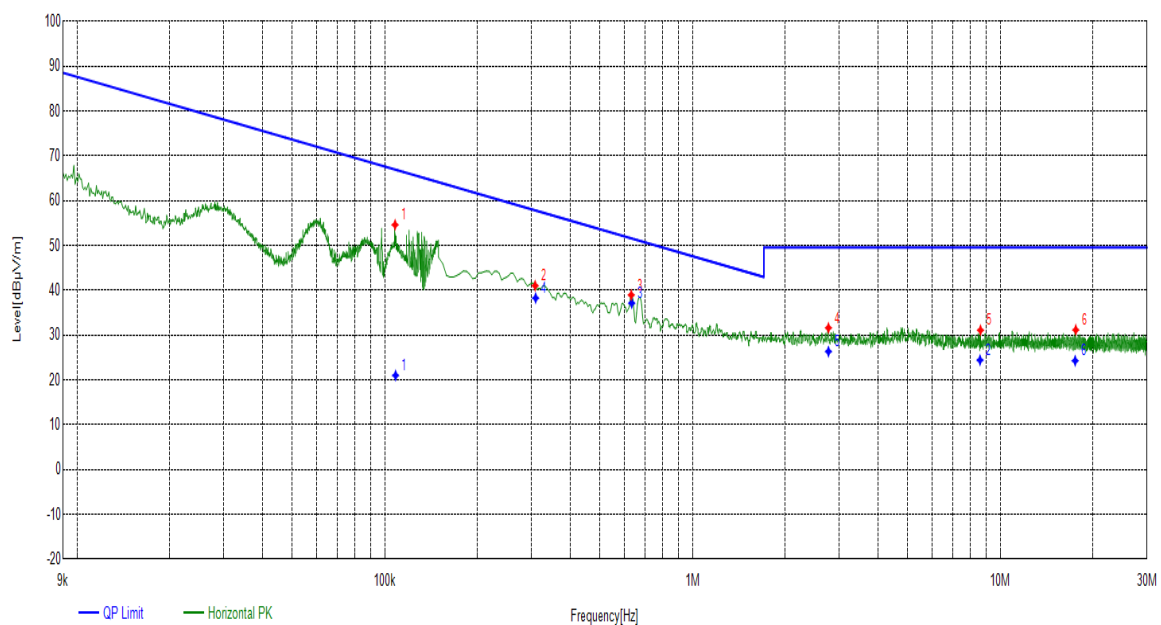
Test Results:

During the test, the Radiates Emission from 9KHz to 40GHz was performed in all modes with all channels, and all antennas, BT 8DPSK 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:

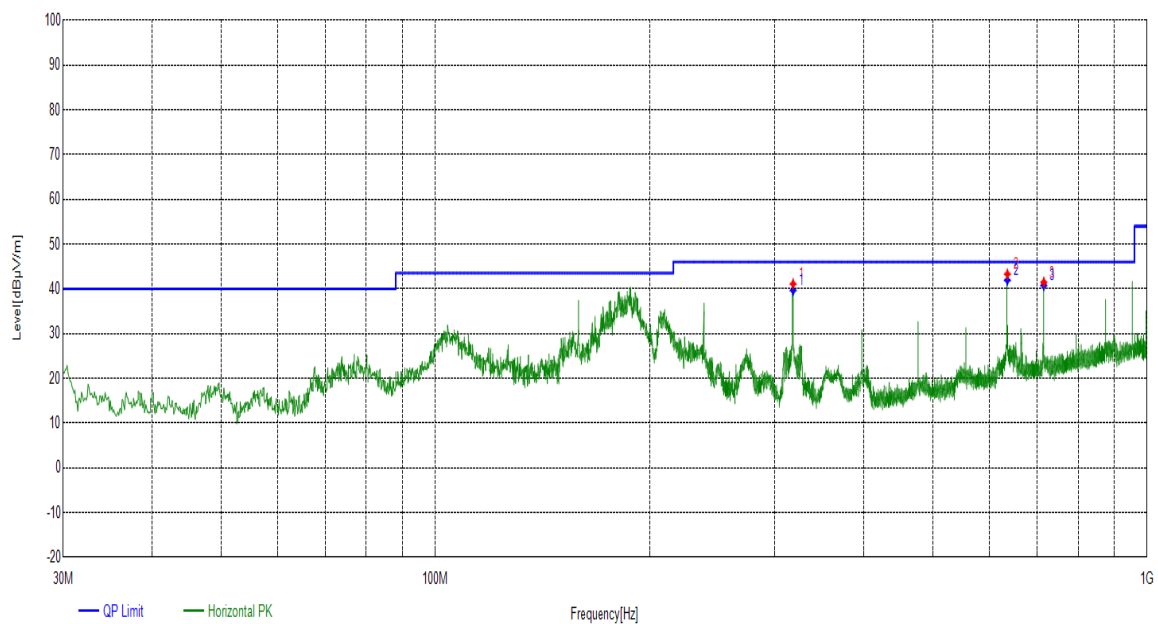
Radiated Emission	9KHz-30MHz
Polarity	X axis
Test channel	Worst-Case

Final Data List								
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail
0.1083	X axis	19.72	21.00	66.92	45.92	100	124	PASS
0.3089	X axis	19.53	38.27	57.81	19.54	100	119	PASS
0.6340	X axis	19.67	37.14	51.56	14.42	100	118	PASS
2.7645	X axis	19.87	26.34	49.54	23.20	100	88	PASS
8.5946	X axis	19.78	24.42	49.54	25.12	100	131	PASS
17.5132	X axis	20.21	24.28	49.54	25.26	100	23	PASS



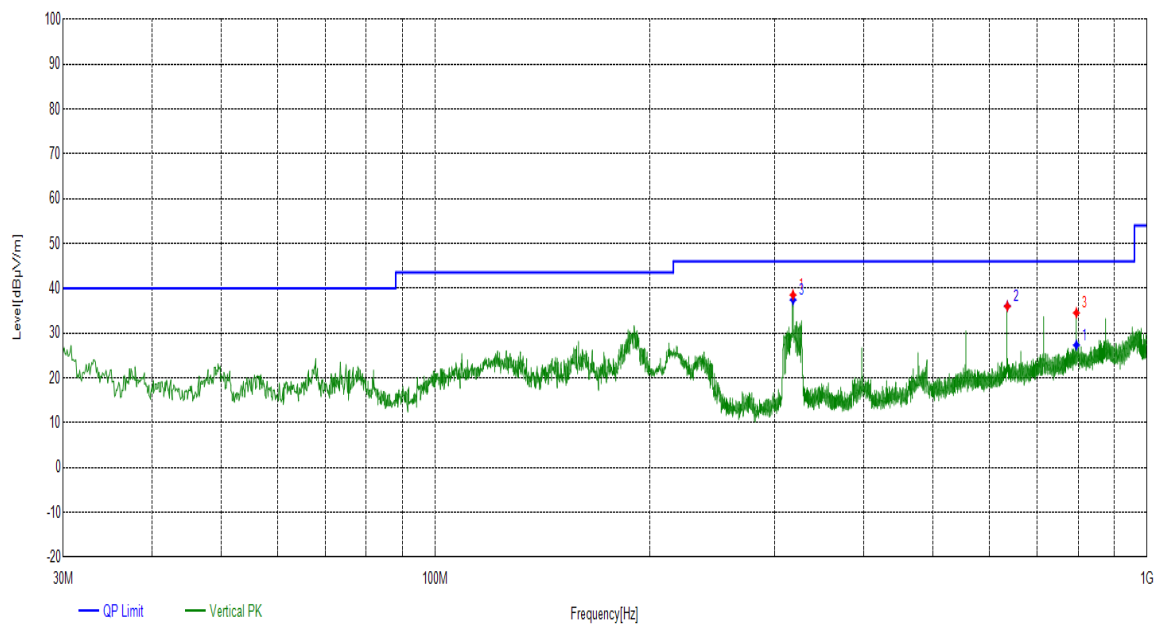
Radiates Emission			30M~1G							
Test channel			Worst-Case							
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
318.2158	Horizontal	15.53	25.57	41.10	46.00	4.90	PK	100	10	PASS
636.5047	Horizontal	23.06	20.22	43.28	46.00	2.72	PK	100	90	PASS
716.0526	Horizontal	24.88	16.61	41.49	46.00	4.51	PK	100	280	PASS

Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
318.2526	Horizontal	15.54	39.64	46.00	6.36	170	10	PASS	
636.4126	Horizontal	23.06	41.92	46.00	4.08	180	90	PASS	
715.9803	Horizontal	24.87	40.76	46.00	5.24	260	280	PASS	

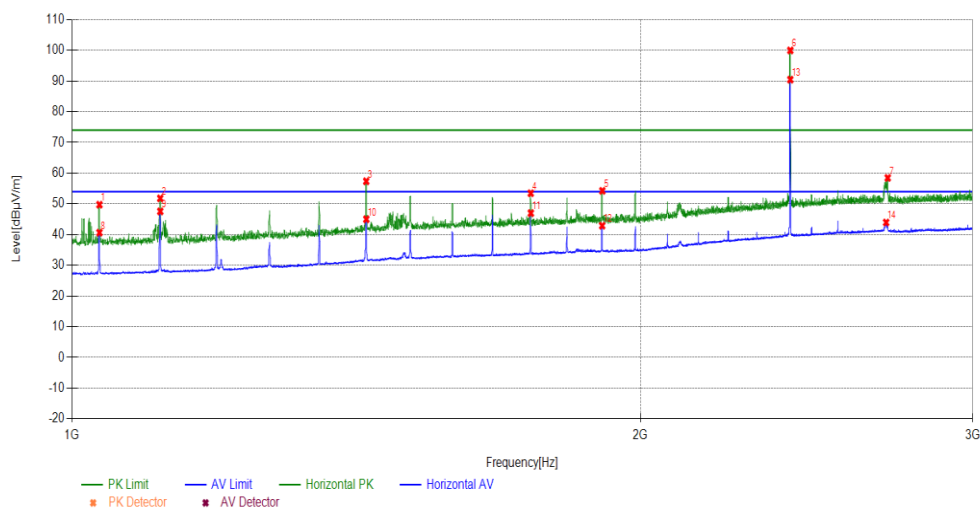


Radiates Emission			30M~1G							
Test channel			Worst-Case							
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
318.1188	Vertical	15.53	22.99	38.52	46.00	7.48	PK	100	330	PASS
636.4076	Vertical	23.06	12.92	35.98	46.00	10.02	PK	100	290	PASS
795.6006	Vertical	26.68	7.84	34.52	46.00	11.48	PK	100	190	PASS

Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
795.6356	Vertical	26.68	27.32	46.00	18.68	130	190	PASS	
636.4353	Vertical	23.06	36.04	46.00	9.96	260	290	PASS	
318.2155	Vertical	15.53	37.41	46.00	8.59	110	330	PASS	

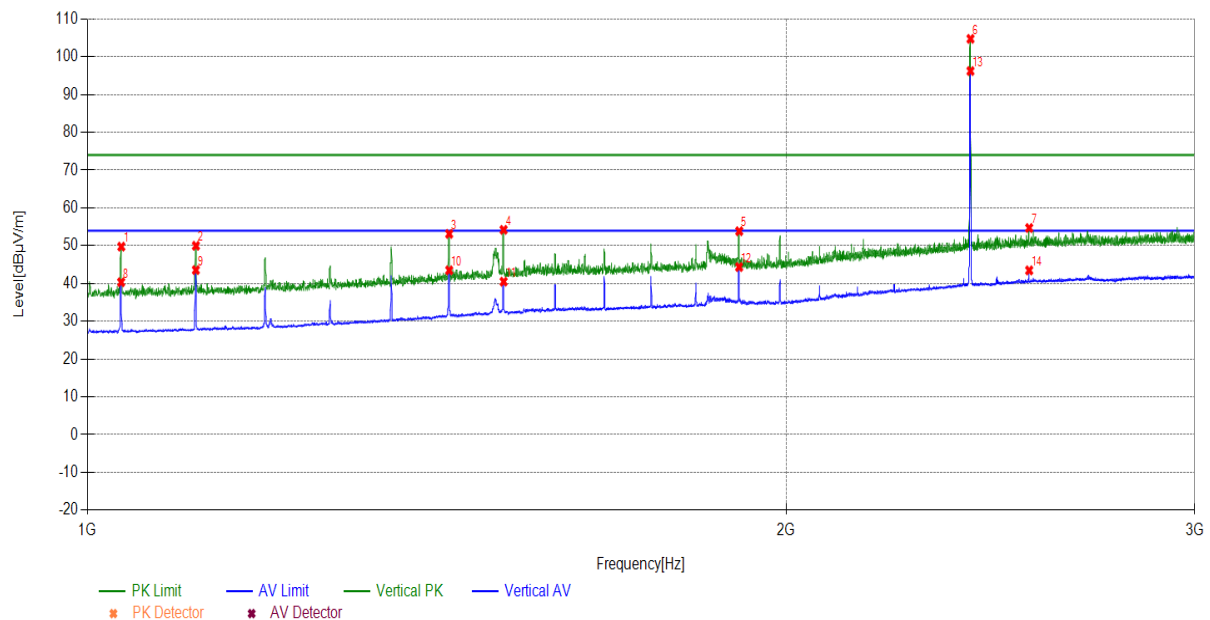


Radiates Emission		1G~3G							
Test channel		Worst-Case							
polarization		Horizontal							
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
1034.0034	26.26	23.49	49.75	74.00	24.25	PK	150	192	PASS
1113.6114	26.88	24.93	51.81	74.00	22.19	PK	150	192	PASS
1431.6432	30.06	27.30	57.36	74.00	16.64	PK	150	235	PASS
1749.875	32.22	21.25	53.47	74.00	20.53	PK	150	235	PASS
1909.4909	32.75	21.49	54.24	74.00	19.76	PK	150	92	PASS
2401.7402	37.17	62.79	99.96	74.00	-25.96	PK	150	121	---
2704.7705	38.32	20.15	58.47	74.00	15.53	PK	150	135	PASS
1034.0034	26.26	14.36	40.62	54.00	13.38	AV	150	192	PASS
1113.6114	26.88	20.67	47.55	54.00	6.45	AV	150	192	PASS
1431.8432	30.07	14.94	45.01	54.00	8.99	AV	150	235	PASS
1750.075	32.22	14.76	46.98	54.00	7.02	AV	150	235	PASS
1909.0909	32.75	10.16	42.91	54.00	11.09	AV	150	92	PASS
2401.7402	37.17	53.28	90.45	54.00	-36.45	AV	150	135	---
2699.3699	38.30	5.64	43.94	54.00	10.06	AV	150	135	PASS



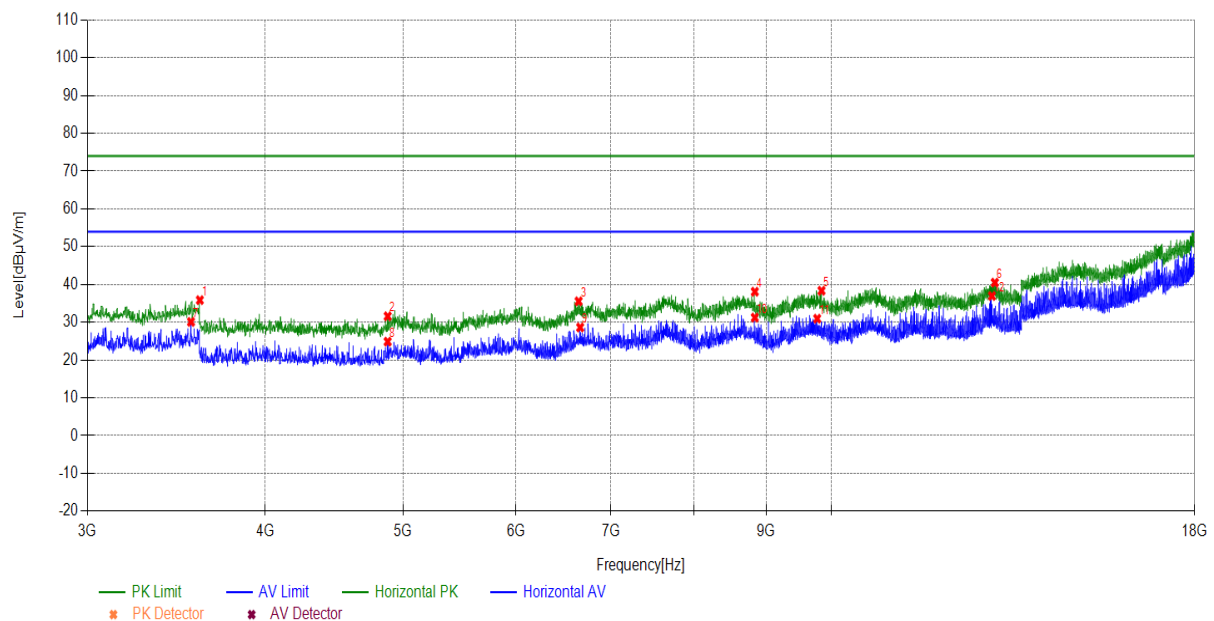
Note: The signal beyond the limit is carrier

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]	Detect or	Height [cm]	Angle deg	Pass/ Fail
1034.2034	26.26	23.51	49.77	74.00	24.23	PK	150	191	PASS
1113.6114	26.88	23.11	49.99	74.00	24.01	PK	150	176	PASS
1431.8432	30.07	23.06	53.13	74.00	20.87	PK	150	219	PASS
1511.2511	30.89	23.32	54.21	74.00	19.79	PK	150	219	PASS
1909.2909	32.75	21.10	53.85	74.00	20.15	PK	150	176	PASS
2401.7402	37.17	67.58	104.75	74.00	-30.75	PK	150	176	---
2545.7546	37.79	16.90	54.69	74.00	19.31	PK	150	162	PASS
1034.0034	26.26	14.07	40.33	54.00	13.67	AV	150	191	PASS
1113.6114	26.88	16.67	43.55	54.00	10.45	AV	150	191	PASS
1431.8432	30.07	13.43	43.50	54.00	10.50	AV	150	205	PASS
1511.2511	30.89	9.61	40.50	54.00	13.50	AV	150	205	PASS
1909.0909	32.75	11.61	44.36	54.00	9.64	AV	150	162	PASS
2401.7402	37.17	59.05	96.22	54.00	-42.22	AV	150	148	---
2545.7546	37.79	5.69	43.48	54.00	10.52	AV	150	134	PASS

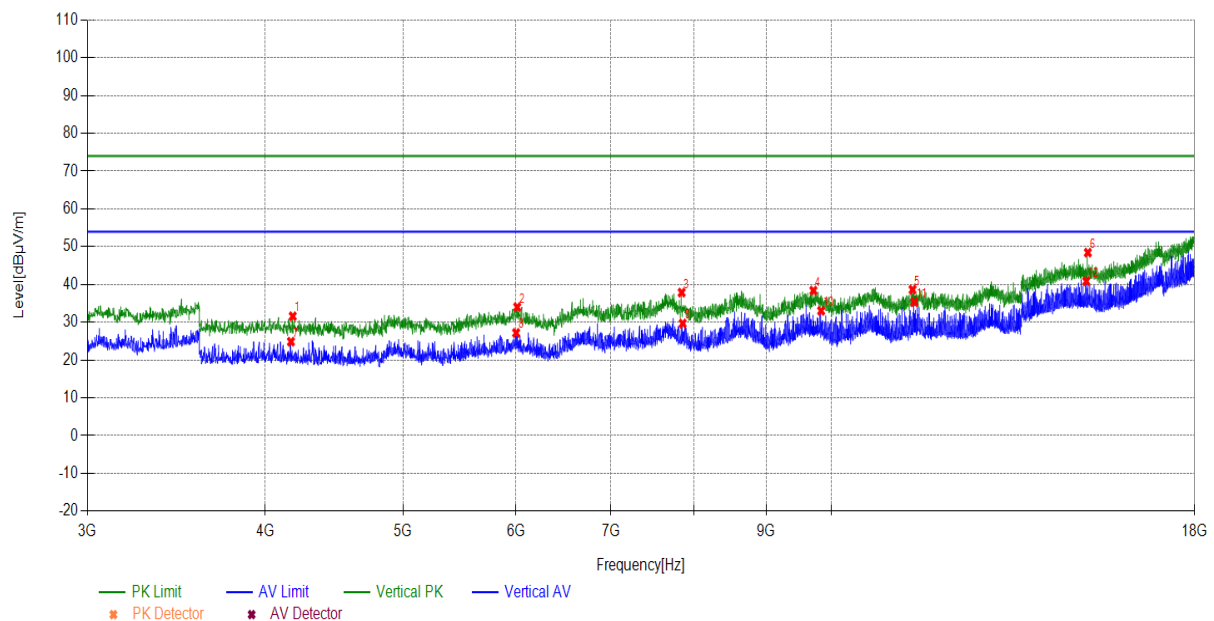


Note: The signal beyond the limit is carrier

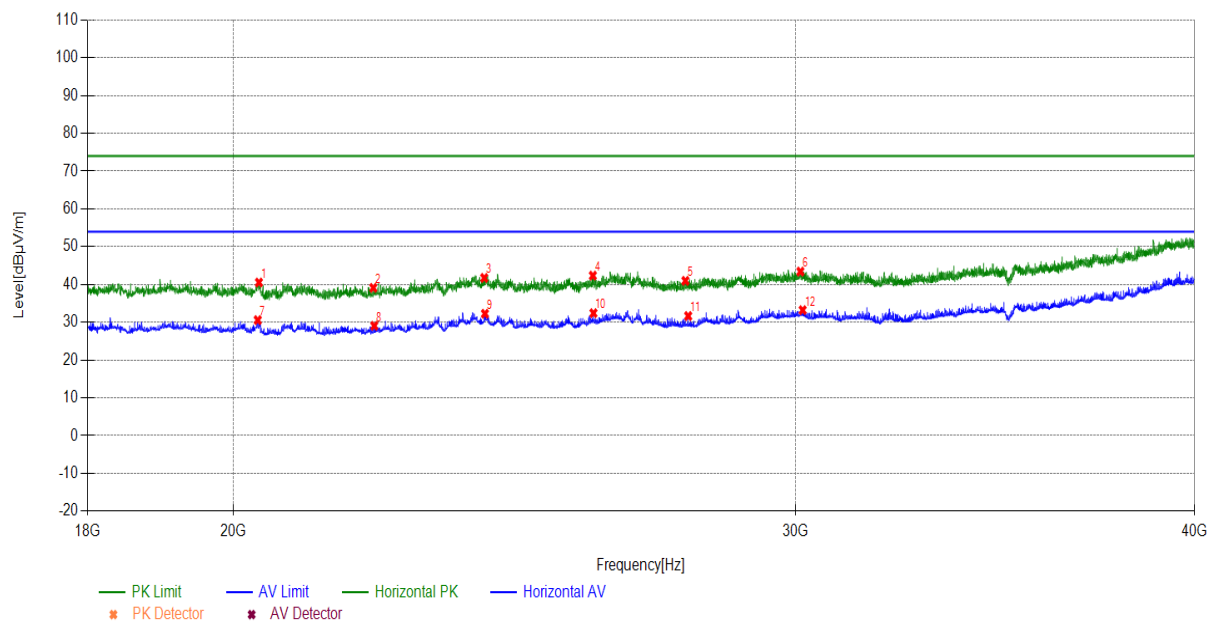
Radiates Emission		3G~18G							
Test channel		Worst-Case							
polarization		Horizontal							
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
3598.5599	-0.84	36.71	35.87	74.00	38.13	PK	150	130	PASS
4876.6877	0.93	30.67	31.60	74.00	42.40	PK	150	70	PASS
6642.3642	6.21	29.35	35.56	74.00	38.44	PK	150	90	PASS
8834.0834	9.41	28.69	38.10	74.00	35.90	PK	150	20	PASS
9840.6841	11.55	26.80	38.35	74.00	35.65	PK	150	190	PASS
13027.0027	13.29	27.21	40.50	74.00	33.50	PK	150	310	PASS
3547.5548	-0.95	31.06	30.11	54.00	23.89	AV	150	10	PASS
4876.6877	0.93	23.95	24.88	54.00	29.12	AV	150	10	PASS
6658.8659	6.29	22.36	28.65	54.00	25.35	AV	150	10	PASS
8834.0834	9.41	21.84	31.25	54.00	22.75	AV	150	10	PASS
9771.6772	11.57	19.39	30.96	54.00	23.04	AV	150	10	PASS
12965.4966	13.21	23.76	36.97	54.00	17.03	AV	150	10	PASS



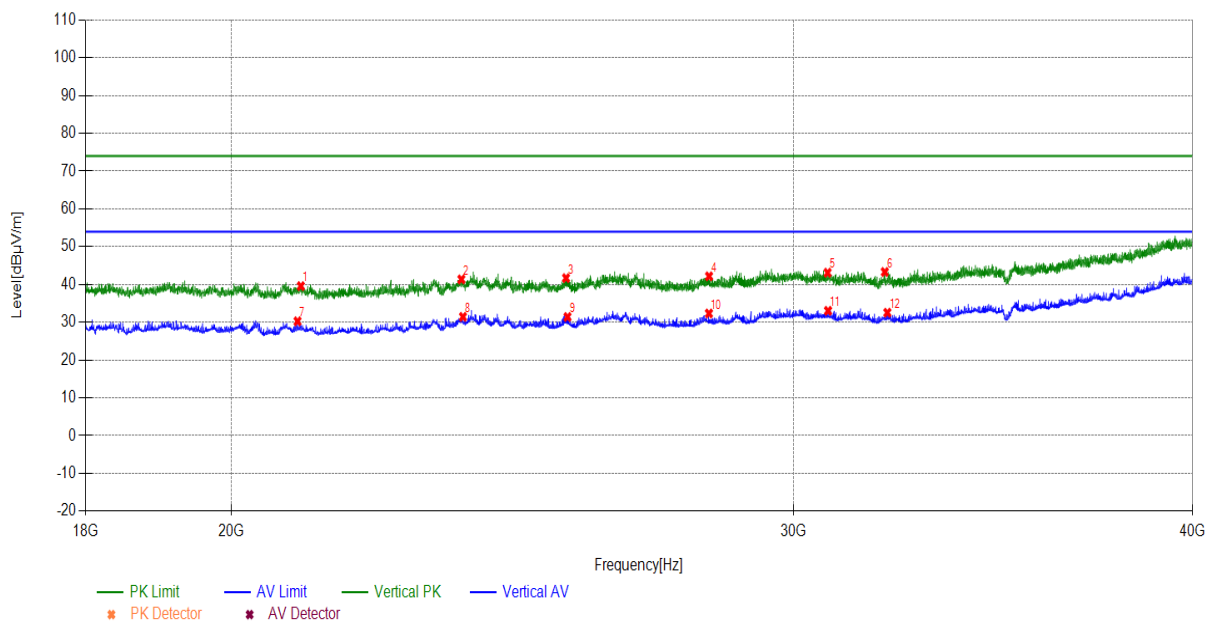
Radiates Emission		3G~18G							
Test channel		Worst-Case							
polarization		Vertical							
Suspected List									
Frequency[MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4182.1182	-0.34	31.94	31.60	74.00	42.40	PK	150	110	PASS
6013.8014	4.97	29.06	34.03	74.00	39.97	PK	150	310	PASS
7846.9847	8.43	29.43	37.86	74.00	36.14	PK	150	90	PASS
9711.6712	11.58	26.79	38.37	74.00	35.63	PK	150	90	PASS
11402.3402	11.32	27.32	38.64	74.00	35.36	PK	150	90	PASS
15142.2142	16.10	32.34	48.44	74.00	25.56	PK	150	40	PASS
4170.117	-0.32	25.18	24.86	54.00	29.14	AV	150	10	PASS
6003.3003	4.96	22.23	27.19	54.00	26.81	AV	150	10	PASS
7860.486	8.44	21.25	29.69	54.00	24.31	AV	150	10	PASS
9834.6835	11.56	21.48	33.04	54.00	20.96	AV	150	10	PASS
11435.3435	11.27	24.09	35.36	54.00	18.64	AV	150	10	PASS
15103.2103	16.22	24.66	40.88	54.00	13.12	AV	150	10	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]	Detect or	Height [cm]	Angle deg	Pass/ Fail
20369.637	1.43	39.11	40.54	74.00	33.46	PK	150	160	PASS
22121.0121	2.02	37.10	39.12	74.00	34.88	PK	150	170	PASS
23962.5963	3.67	38.07	41.74	74.00	32.26	PK	150	140	PASS
25916.3916	4.47	37.88	42.35	74.00	31.65	PK	150	230	PASS
27705.1705	5.25	35.72	40.97	74.00	33.03	PK	150	330	PASS
30101.2101	6.65	36.77	43.42	74.00	30.58	PK	150	200	PASS
20352.0352	1.42	29.16	30.58	54.00	23.42	AV	150	10	PASS
22136.4136	2.04	27.02	29.06	54.00	24.94	AV	150	10	PASS
23975.7976	3.68	28.59	32.27	54.00	21.73	AV	150	10	PASS
25927.3927	4.47	27.95	32.42	54.00	21.58	AV	150	10	PASS
27760.176	5.28	26.38	31.66	54.00	22.34	AV	150	10	PASS
30149.615	6.63	26.58	33.21	54.00	20.79	AV	150	10	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]	Detect or	Height [cm]	Angle deg	Pass/ Fail
21025.3025	1.66	37.92	39.58	74.00	34.42	PK	150	110	PASS
23606.1606	3.38	37.98	41.36	74.00	32.64	PK	150	70	PASS
25456.5457	4.28	37.43	41.71	74.00	32.29	PK	150	80	PASS
28222.2222	5.53	36.64	42.17	74.00	31.83	PK	150	210	PASS
30741.4741	6.37	36.75	43.12	74.00	30.88	PK	150	180	PASS
32035.2035	5.91	37.41	43.32	74.00	30.68	PK	150	350	PASS
20974.6975	1.64	28.63	30.27	54.00	23.73	AV	150	10	PASS
23632.5633	3.41	28.04	31.45	54.00	22.55	AV	150	10	PASS
25482.9483	4.29	27.12	31.41	54.00	22.59	AV	150	10	PASS
28220.022	5.53	26.80	32.33	54.00	21.67	AV	150	10	PASS
30750.275	6.36	26.69	33.05	54.00	20.95	AV	150	10	PASS
32094.6095	5.94	26.61	32.55	54.00	21.45	AV	150	10	PASS

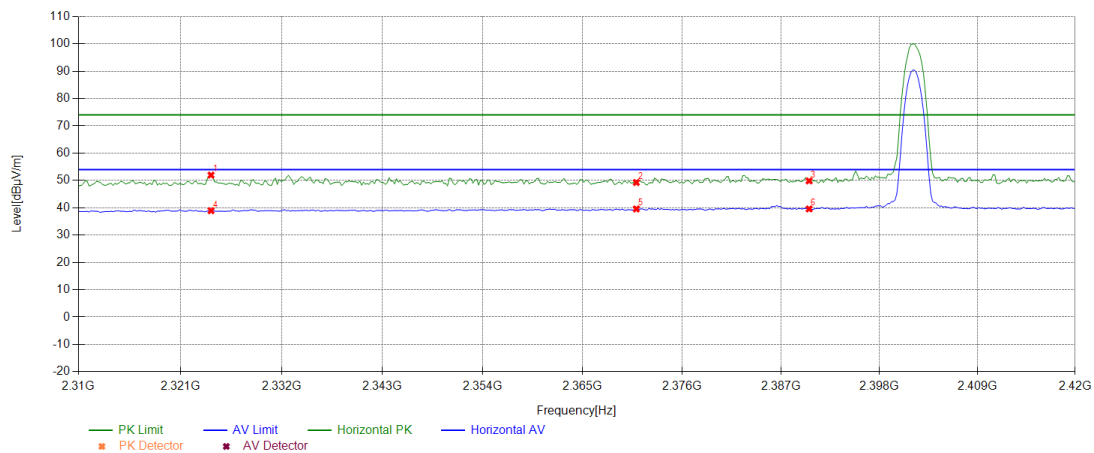


Band Edge:

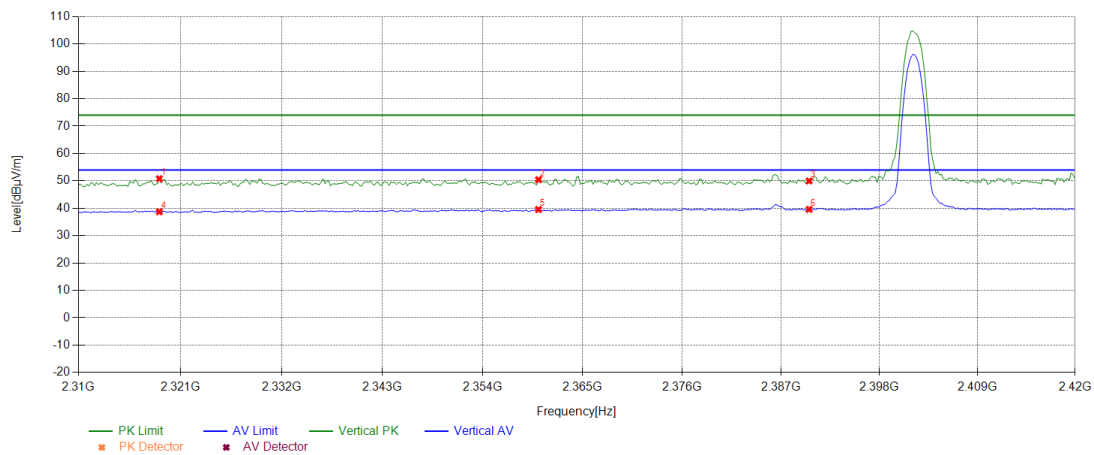
During the test, the Band Edge was performed in BLE all modes with all channels and all antennas.

BT 8DPSK, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

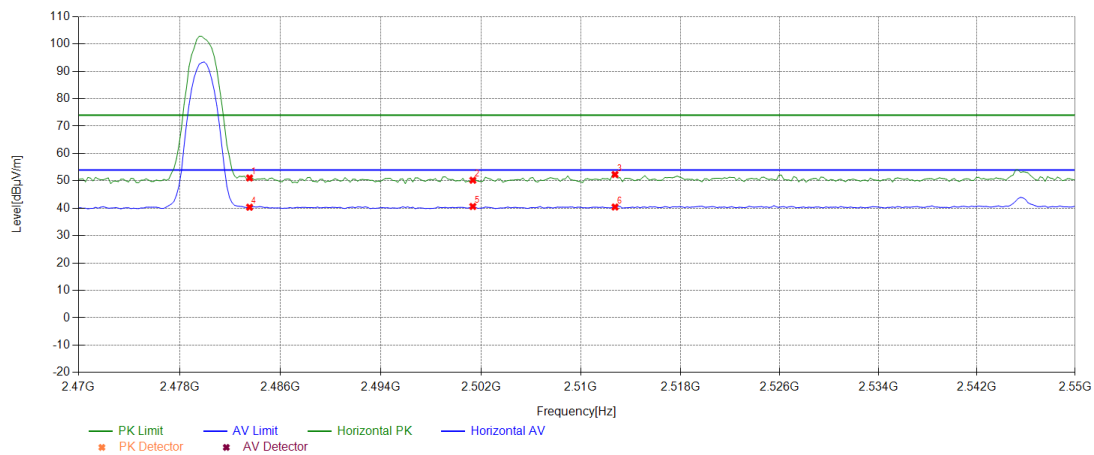
Test mode			8DPSK						
Test channel			Lowest channel						
polarization			Horizontal						
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2324.3324	36.47	15.51	51.98	74.00	22.02	PK	150	235	PASS
2370.9371	36.90	12.35	49.25	74.00	24.75	PK	150	36	PASS
2390.139	37.07	12.78	49.85	74.00	24.15	PK	150	121	PASS
2324.3324	36.47	2.47	38.94	54.00	15.06	AV	150	249	PASS
2370.9371	36.90	2.67	39.57	54.00	14.43	AV	150	1	PASS
2390.139	37.07	2.53	39.60	54.00	14.40	AV	150	206	PASS



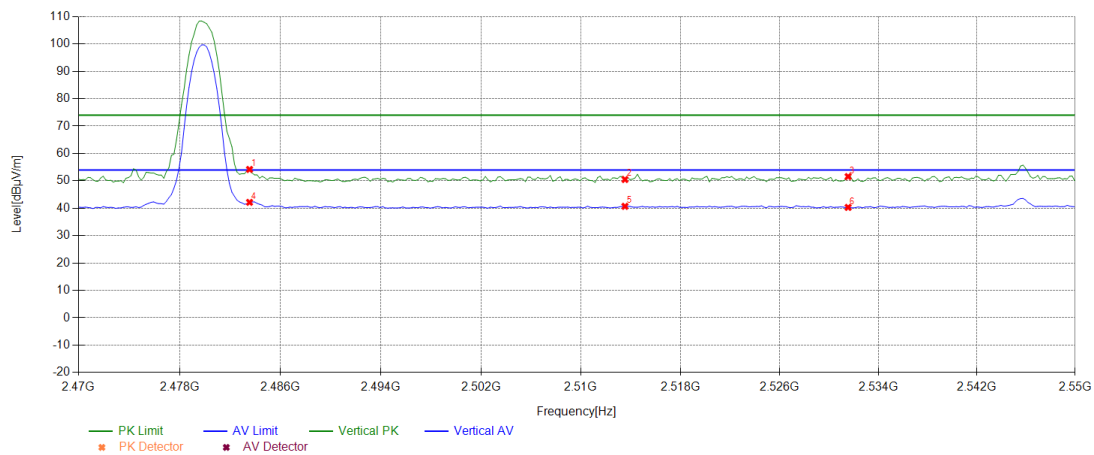
Test mode			8DPSK						
Test channel			Lowest channel						
polarization			Vertical						
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/ Fail
2318.7319	36.42	14.38	50.80	74.00	23.20	PK	150	106	PASS
2360.136	36.80	13.64	50.44	74.00	23.56	PK	150	332	PASS
2390.139	37.07	12.90	49.97	74.00	24.03	PK	150	0	PASS
2318.7319	36.42	2.29	38.71	54.00	15.29	AV	150	219	PASS
2360.136	36.80	2.74	39.54	54.00	14.46	AV	150	78	PASS
2390.139	37.07	2.53	39.60	54.00	14.40	AV	150	148	PASS



Test mode			8DPSK						
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	37.54	13.53	51.07	74.00	22.93	PK	150	176	PASS
2501.3501	37.62	12.63	50.25	74.00	23.75	PK	150	77	PASS
2512.7513	37.66	14.66	52.32	74.00	21.68	PK	150	190	PASS
2483.5484	37.54	2.85	40.39	54.00	13.61	AV	150	77	PASS
2501.3501	37.62	3.04	40.66	54.00	13.34	AV	150	133	PASS
2512.7513	37.66	2.81	40.47	54.00	13.53	AV	150	289	PASS



Test mode			8DPSK						
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	37.54	16.64	54.18	74.00	19.82	PK	150	153	PASS
2513.5514	37.67	12.86	50.53	74.00	23.47	PK	150	196	PASS
2531.5532	37.74	13.83	51.57	74.00	22.43	PK	150	2	PASS
2483.5484	37.54	4.63	42.17	54.00	11.83	AV	150	182	PASS
2513.5514	37.67	3.04	40.71	54.00	13.29	AV	150	210	PASS
2531.5532	37.74	2.57	40.31	54.00	13.69	AV	150	98	PASS



5.3 Peak Power Output -Conducted

Ambient condition:

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

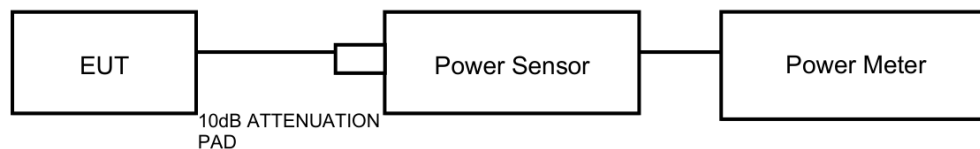
Method of Measurement:

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."

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
DH5	Ant1	2402	4.95	≤ 30.00	PASS
	Ant1	2441	5.65	≤ 30.00	PASS
	Ant1	2480	6.82	≤ 30.00	PASS
2DH5	Ant1	2402	5.34	≤ 20.97	PASS
	Ant1	2441	5.7	≤ 20.97	PASS
	Ant1	2480	6.76	≤ 20.97	PASS
3DH5	Ant1	2402	5.86	≤ 20.97	PASS
	Ant1	2441	6.22	≤ 20.97	PASS
	Ant1	2480	7.39	≤ 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
DH5	Ant1	2402	0.95	2401.523	2402.477	---	---
	Ant1	2441	0.96	2440.523	2441.48	---	---
	Ant1	2480	0.96	2479.52	2480.48	---	---
2DH5	Ant1	2402	1.23	2401.367	2402.6	---	---
	Ant1	2441	1.23	2440.367	2441.6	---	---
	Ant1	2480	1.23	2479.367	2480.6	---	---
3DH5	Ant1	2402	1.25	2401.355	2402.606	---	---
	Ant1	2441	1.25	2440.355	2441.606	---	---
	Ant1	2480	1.25	2479.355	2480.606	---	---

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
DH5	Ant1	2402	0.869	2401.553	2402.423	---	---
	Ant1	2441	0.866	2440.553	2441.420	---	---
	Ant1	2480	0.866	2479.553	2480.420	---	---
2DH5	Ant1	2402	1.139	2401.419	2402.557	---	---
	Ant1	2441	1.145	2440.416	2441.560	---	---
	Ant1	2480	1.139	2479.419	2480.557	---	---
3DH5	Ant1	2402	1.145	2401.422	2402.566	---	---
	Ant1	2441	1.148	2440.419	2441.566	---	---
	Ant1	2480	1.148	2479.419	2480.566	---	---

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
DH5	Ant1	Hop	1.328	≥ 0.960	PASS
2DH5	Ant1	Hop	1.333	≥ 1.230	PASS
3DH5	Ant1	Hop	1.333	≥ 1.250	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 is $1600/6=266.67(\text{ch*hop/s})$

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	$\leq 400\text{ms}$
------------	---------------------

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
DH1	Ant1	Hop	0.38	320	0.122	≤0.4	PASS
DH3	Ant1	Hop	1.63	160	0.261	≤0.4	PASS
DH5	Ant1	Hop	2.87	106.67	0.306	≤0.4	PASS
2DH1	Ant1	Hop	0.39	320	0.125	≤0.4	PASS
2DH3	Ant1	Hop	1.63	160	0.261	≤0.4	PASS
2DH5	Ant1	Hop	2.87	106.67	0.306	≤0.4	PASS
3DH1	Ant1	Hop	0.39	320	0.125	≤0.4	PASS
3DH3	Ant1	Hop	1.63	160	0.261	≤0.4	PASS
3DH5	Ant1	Hop	2.87	106.67	0.306	≤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 $k = 1.96$, $U = 936 \text{ Hz}$, $2 \text{ GHz}-3 \text{ GHz} = 1.407 \text{ dB}$.

Test Result:

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	4.63	-47.81	≤-15.37	PASS
		High	2480	6.14	-47.06	≤-13.86	PASS
		Low	Hop_2402	5.08	-49.16	≤-14.92	PASS
		High	Hop_2480	6.73	-47.27	≤-13.27	PASS
2DH5	Ant1	Low	2402	4.84	-48.26	≤-15.16	PASS
		High	2480	6.33	-47.25	≤-13.67	PASS
		Low	Hop_2402	0.69	-49.38	≤-19.31	PASS
		High	Hop_2480	6.34	-47.25	≤-13.66	PASS
3DH5	Ant1	Low	2402	4.82	-47.94	≤-15.18	PASS
		High	2480	6.24	-47.42	≤-13.76	PASS
		Low	Hop_2402	2.93	-49.31	≤-17.07	PASS
		High	Hop_2480	7.36	-47.57	≤-12.64	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 $k = 2$, $U = 0.75\text{dB}$.

Test Results:

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	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 to 100kHz and VBW to 300 kHz, Sweep is set to AUTO. The test is in transmitting mode.

Limits:

Rule Part 15.247(d) specifies 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
DH5	Ant1	2402	Reference	4.71	4.71	---	PASS
			30~1000	4.71	-59.47	≤ -15.29	PASS
			1000~26500	4.71	-49.21	≤ -15.29	PASS
		2441	Reference	5.03	5.03	---	PASS
			30~1000	5.03	-59.38	≤ -14.97	PASS
			1000~26500	5.03	-48.6	≤ -14.97	PASS
		2480	Reference	6.15	6.15	---	PASS
			30~1000	6.15	-58.41	≤ -13.85	PASS
			1000~26500	6.15	-48.85	≤ -13.85	PASS
2DH5	Ant1	2402	Reference	4.89	4.89	---	PASS
			30~1000	4.89	-59.7	≤ -15.11	PASS
			1000~26500	4.89	-48.12	≤ -15.11	PASS
		2441	Reference	5.26	5.26	---	PASS
			30~1000	5.26	-59.14	≤ -14.74	PASS
			1000~26500	5.26	-47.98	≤ -14.74	PASS
		2480	Reference	6.29	6.29	---	PASS
			30~1000	6.29	-59.72	≤ -13.71	PASS
			1000~26500	6.29	-48.81	≤ -13.71	PASS
3DH5	Ant1	2402	Reference	4.87	4.87	---	PASS
			30~1000	4.87	-56.66	≤ -15.13	PASS
			1000~26500	4.87	-48.27	≤ -15.13	PASS
		2441	Reference	5.18	5.18	---	PASS
			30~1000	5.18	-60.01	≤ -14.82	PASS
			1000~26500	5.18	-48.68	≤ -14.82	PASS
		2480	Reference	6.20	6.20	---	PASS
			30~1000	6.20	-59.37	≤ -13.8	PASS
			1000~26500	6.20	-48.36	≤ -13.8	PASS

6. Appendix A

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
Spectrum Analyzer	FSV40	101580	DZ-000238-3	R&S	2023/06/05
Comprehensive Test Instrument	CMW270	100304	DZ-000240-1	R&S	2023/12/06
Analog Signal Generator	SMB100A	181858	DZ-000238-2	R&S	2023/06/05
Vector Signal Generator	SGT100A	111661	DZ-000238-1	R&S	2023/06/05
RF Radio Frequency Switch	JS0806-2	19H9080187	DZ-000241	Tonscend	2023/06/06
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	2023/06/06
Broadband Antenna	VULB 9163	9163-676	EM-000382	SCHWARZBECK	2023/07/01
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWARZBECK	2023/06/25
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	2023/06/05
EMI Test Receiver (#1)	ESW44	103123	EM-000698	R&S	2023/06/18
LISN	NSLK 8128	8128-316	VGDY-0149	SCHWARZBECK	2023/09/04
Plus Limiter (#1)	VTSD 9561 F-N	00515	VGDY-0808	SCHWARZBECK	2024/03/04
Shielding Room(#1)	GP1A	001	WKNF-0001	LEINING	2024/08/08

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.

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