FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**MAX25030155P01-R01**
FCC ID..... :	**2BPVZ-HT-A001**
Compiled by (position+printed name+signature)..:	Engineer/ Cindy Zheng Cindy zheng
Supervised by (position+printed name+signature)..:	Manager/Haley Wen Haley wen
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Date of issue.....:	June 4, 2025
Testing Laboratory Name.....:	**MAXLAB Testing Co.,Ltd.**
Address..... :	1/F, Building B, Xinshidai GR Park,Shiyan Street, Bao'an District, Shenzhen,Guangdong, 518052, People's Republic of China
Applicant's name.....:	**Happy Tik USA LLC**
Address..... :	1429 Vivginia Ave Baldwin Park,CA 91706 USA
Test specification.....:	
Standard.....:	**FCC Part 15.247:** **ANSI C63.10-2020** **KDB558074 D01 V05r02: April 2, 2019**

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Test item description.....:	Automatic pet washing machine
Trade Mark.....:	Happy Tik
Manufacturer.....:	Happy Tik USA LLC
Model/Type reference.....:	HT-A001
Listed Models .....:	N/A
Modulation .....:	GFSK, π/4DQPSK, 8-DPSK
Frequency.....	From 2402MHz to 2480MHz
Ratings.....:	AC 120V
Result.....:	**PASS**

TEST REPORT

Equipment under Test	:	**Automatic pet washing machine**
Model /Type	:	HT-A001
Listed Models	:	N/A
Model Declaration	:	N/A
Applicant	:	**Happy Tik USA LLC**
Address	:	1429 Vivginia Ave Baldwin Park,CA 91706 USA
Manufacturer	:	**Happy Tik USA LLC**
Address	:	1429 Vivginia Ave Baldwin Park,CA 91706 USA

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2020: American National Standard for Testing Unlicensed Wireless Devices
KDB558074 D01 V05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	April 3, 2025
Testing commenced on	:	April 3, 2025
Testing concluded on	:	May 30, 2025

2.2 Product Description

Product Name:	Automatic pet washing machine
Model/Type reference:	HT-A001
Power supply:	AC 120V
Hardware version:	/
Software version:	/
Testing sample ID：	MAX25030155P01-R01-1# (Engineer sample) MAX25030155P01-R01-2# (Normal sample)
Bluetooth :	
Supported Type:	Bluetooth BR/EDR
Modulation:	GFSK, π/4DQPSK, 8-DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Internal antenna
Antenna gain:	0 dBi

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	●	120V / 60Hz
		○	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

2.4 Short description of the Equipment under Test (EUT)

This is a Automatic pet washing machine.
For more details, refer to the user's manual of the EUT.

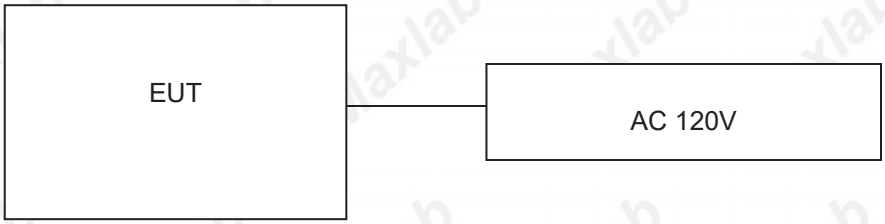
2.5 EUT operation mode

The Applicant provides communication tools software(Engineer mode) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

Operation Frequency：

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
38	2440
39	2441
40	2442
⋮	⋮
77	2479
78	2480

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

MAXLAB Testing Co.,Ltd.
1/F, Building B, Xinshidai GR Park,Shiyan Street, Bao'an District, Shenzhen,Guangdong, 518052, People's Republic of China

3.2 Test Facility

FCC-Registration No.: 562200 Designation Number: CN1338
MAX Testing Co.,Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

Industry Canada Registration Number. Is: 11093A CAB identifier: CN0019
The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

A2LA-Lab Cert. No.: 4707.01
MAX Testing Co.,Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

AC Power Conducted Emission:

Temperature:	25 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	25 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Test result
§15.247(a)(1)	Carrier Frequency separation	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Number of Hopping channels	GFSK Π/4DQPSK 8DPSK	☒ Full	GFSK	☒ Full	Compliant
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Spectrumbandwidth of aFHSS system20dB bandwidth	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(b)(1)	Maximum output peak power	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	Band edgecompliance conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.205	Band edgecompliance radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.247(d)	TX spuriousemissions conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	TX spuriousemissions radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.209(a)	TX spurious Emissions radiated Below 1GHz	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Middle	Compliant
§15.107(a) §15.207	Conducted Emissions 9KHz-30 MHz	Charging	/	Charging	/	Compliant

Remark:
1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the MAXLAB Testing Co.,Ltd.quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for MAXLAB Testing Co.,Ltd.:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.82 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Transmitter power conducted	1~40GHz	0.57 dB	(1)
Conducted spurious emission	1~40GHz	1.60 dB	(1)
OBW	1~40GHz	25 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6 Equipments Used during the Test

Conducted Emission					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	MAX252	2024-10-28	2025-10-27
EMI Test Receiver	R&S	ESCI 7	MAX552	2024-10-28	2025-10-27
Coaxial Switch	ANRITSU CORP	MP59B	MAX225	2024-10-28	2025-10-27
ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	MAX226	2024-10-28	2025-10-27
Coaxial Cable	MAX	N/A	MAX227	N/A	N/A
EMI Test Software	AUDIX	E3	N/A	N/A	N/A
Thermo meter	KTJ	TA328	MAX233	2024-10-28	2025-10-27
Absorbing clamp	Elektronik-Feinmechanik	MDS21	MAX229	2024-10-28	2025-10-27
LISN	R&S	ENV216	308	2024-10-28	2025-10-27
LISN	R&S	ENV216	314	2024-10-28	2025-10-27

Radiation Test equipment					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	MAX250	2024-10-28	2025-10-27
Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	MAX251	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESU26	MAX203	2024-10-28	2025-10-27
BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	MAX214	2024-10-28	2025-10-27
Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	MAX208	2024-10-28	2025-10-27
Horn Antenna	ETS-LINDGREN	3160	MAX217	2024-10-28	2025-10-27
EMI Test Software	AUDIX	E3	N/A	N/A	N/A
Coaxial Cable	MAX	N/A	MAX213	2024-10-28	2025-10-27
Coaxial Cable	MAX	N/A	MAX211	2024-10-28	2025-10-27
Coaxial cable	MAX	N/A	MAX210	2024-10-28	2025-10-27
Coaxial Cable	MAX	N/A	MAX212	2024-10-28	2025-10-27
Amplifier(100kHz-3GHz)	HP	8347A	MAX204	2024-10-28	2025-10-27
Amplifier(2GHz-20GHz)	HP	84722A	MAX206	2024-10-28	2025-10-27
Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	MAX218	2024-10-28	2025-10-27
Band filter	Amindeon	82346	MAX219	2024-10-28	2025-10-27
Power Meter	Anritsu	ML2495A	MAX540	2024-10-28	2025-10-27
Power Sensor	Anritsu	MA2411B	MAX541	2024-10-28	2025-10-27
Wideband Radio Communication	Rohde & Schwarz	CMW500	MAX575	2024-10-28	2025-10-27

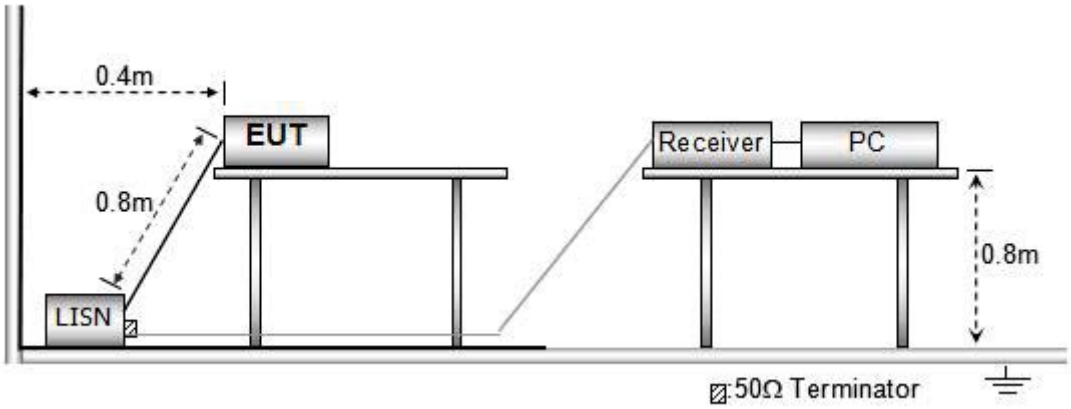
Tester					
Splitter	Agilent	11636B	MAX237	2024-10-28	2025-10-27
Loop Antenna	ZHINAN	ZN30900A	MAX534	2024-10-28	2025-10-27
Breitband hornantenne	SCHWARZBECK	BBHA 9170	MAX579	2024-10-28	2025-10-27
Amplifier	TDK	PA-02-02	MAX574	2024-10-28	2025-10-27
Amplifier	TDK	PA-02-03	MAX576	2024-10-28	2025-10-27
PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	MAX578	2024-10-28	2025-10-27

RF Conducted Test:					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
MXA Signal Analyzer	Agilent	N9020A	MAX566	2024-10-28	2025-10-27
EMI Test Receiver	R&S	ESCI 7	MAX552	2024-10-28	2025-10-27
Spectrum Analyzer	Agilent	E4440A	MAX533	2024-10-28	2025-10-27
MXG vector Signal Generator	Agilent	N5182A	MAX567	2024-10-28	2025-10-27
ESG Analog Signal Generator	Agilent	E4428C	MAX568	2024-10-28	2025-10-27
USB RF Power Sensor	DARE	RPR3006W	MAX569	2024-10-28	2025-10-27
RF Switch Box	Shongyi	RFSW3003328	MAX571	2024-10-28	2025-10-27
Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	MAX572	2024-10-28	2025-10-27

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2020
2 Support equipment, if needed, was placed as per ANSI C63.10-2020
All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2020
The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded 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 EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected 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.
8 During the above scans, the emissions were maximized by cable manipulation.

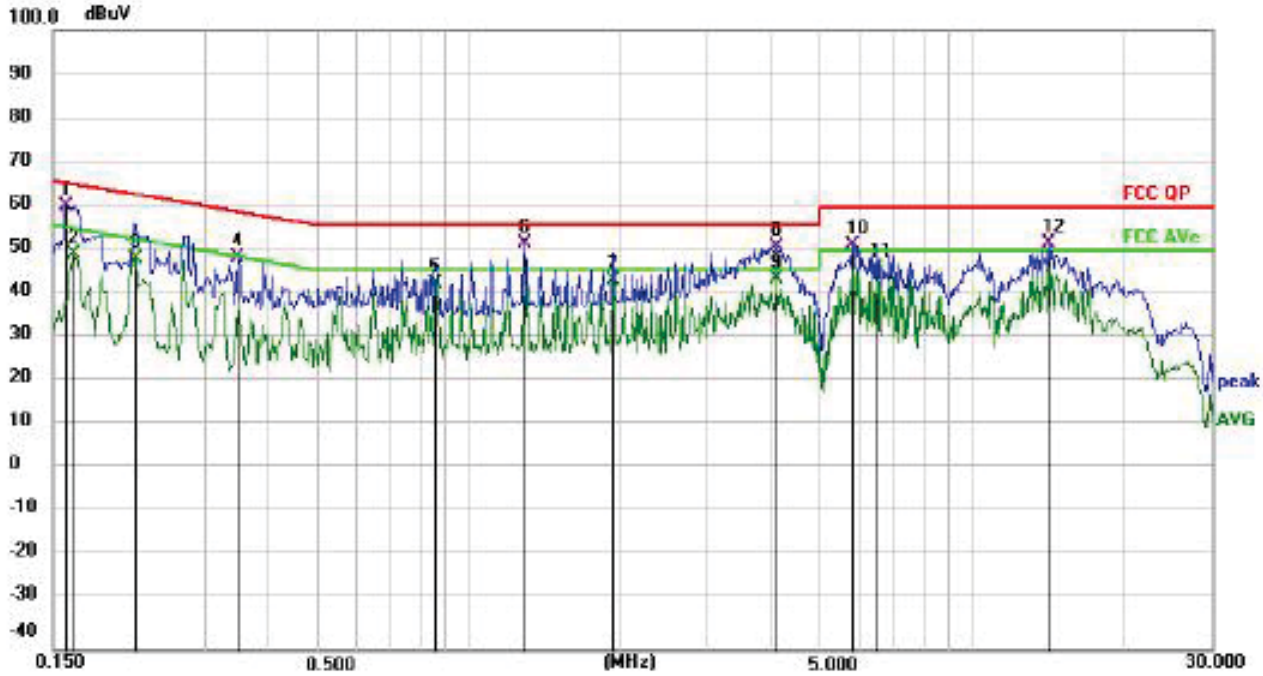
AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

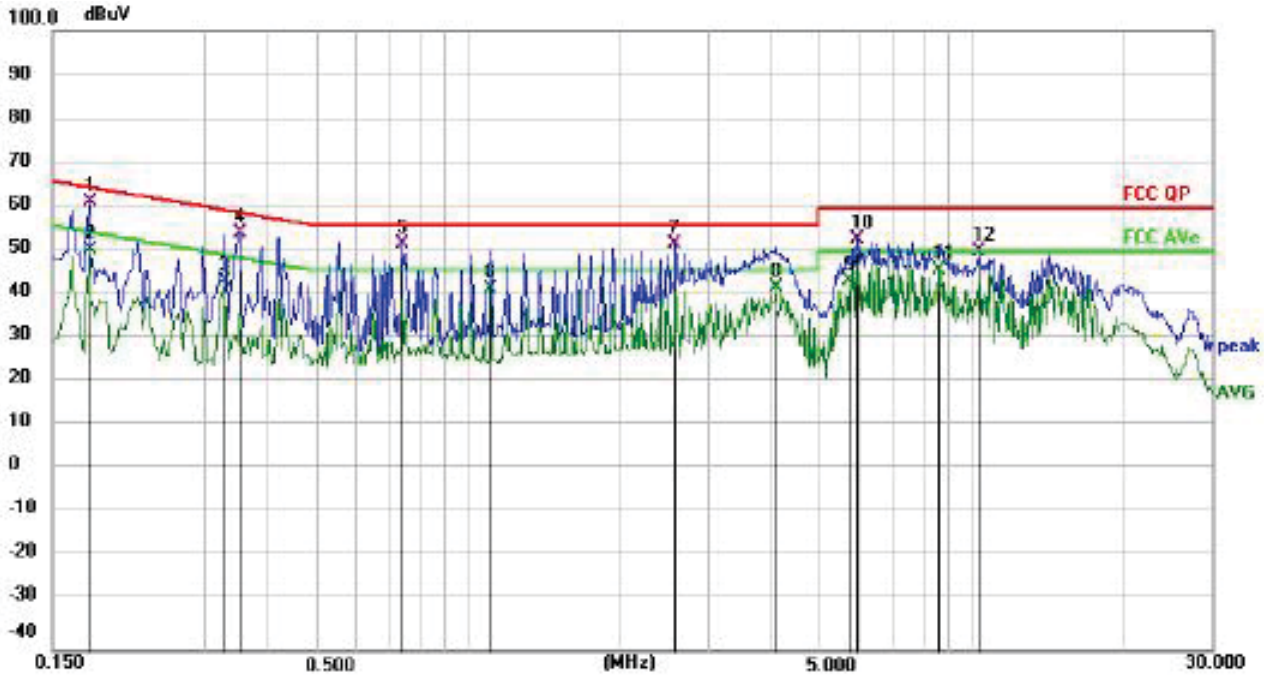
Power supply:	AC 120V/60Hz	Polarization	L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1590	43.69	16.65	60.34	65.52	-5.18	QP	P
2	0.1650	32.65	16.69	49.34	55.21	-5.87	AVG	P
3	0.2174	31.75	16.72	48.47	52.92	-4.45	AVG	P
4	0.3478	32.04	16.70	48.74	59.01	-10.27	QP	P
5	0.8655	25.98	16.64	42.62	46.00	-3.38	AVG	P
6	1.2975	35.20	16.58	51.78	56.00	-4.22	QP	P
7	1.9455	27.06	16.49	43.55	46.00	-2.45	AVG	P
8	4.1055	35.10	16.21	51.31	56.00	-4.69	QP	P
9 *	4.1055	27.49	16.21	43.70	46.00	-2.30	AVG	P
10	5.8334	35.65	15.94	51.59	60.00	-8.41	QP	P
11	6.4813	30.53	15.81	46.34	50.00	-3.66	AVG	P
12	14.2620	37.44	14.57	52.01	60.00	-7.99	QP	P

Note:1).Level (dBμV)= Reading (dBμV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). Margin(dB) = Limit (dBμV) - Level (dBμV)

Power supply:	AC 120V/60Hz	Polarization	N



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1 *	0.1768	43.86	17.53	61.39	64.63	-3.24	QP	P
2	0.1768	32.86	17.53	50.39	54.63	-4.24	AVG	P
3	0.3300	25.89	17.52	43.41	49.45	-6.04	AVG	P
4	0.3519	36.89	17.52	54.41	58.92	-4.51	QP	P
5	0.7439	34.46	17.51	51.97	56.00	-4.03	QP	P
6	1.1129	24.18	17.50	41.68	46.00	-4.32	AVG	P
7	2.5935	34.46	17.45	51.91	56.00	-4.09	QP	P
8	4.1055	24.59	17.42	42.01	46.00	-3.99	AVG	P
9	5.7255	26.19	17.27	43.46	50.00	-6.54	AVG	P
10	5.9413	35.75	17.23	52.98	60.00	-7.02	QP	P
11	8.6415	29.19	16.74	45.93	50.00	-4.07	AVG	P
12	10.3695	33.65	16.42	50.07	60.00	-9.93	QP	P

Note:1).Level (dBμV)= Reading (dBμV)+ Factor (dB)

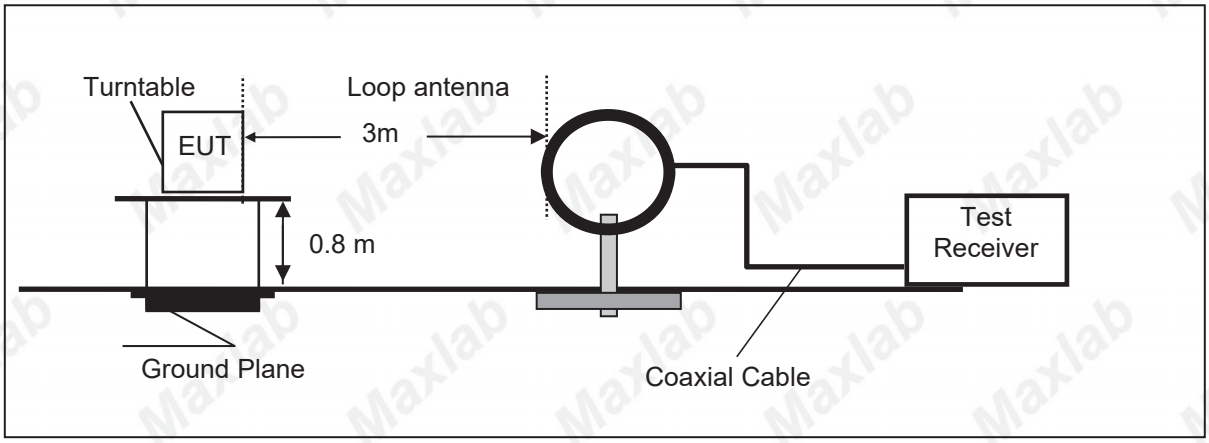
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBμV) - Level (dBμV)

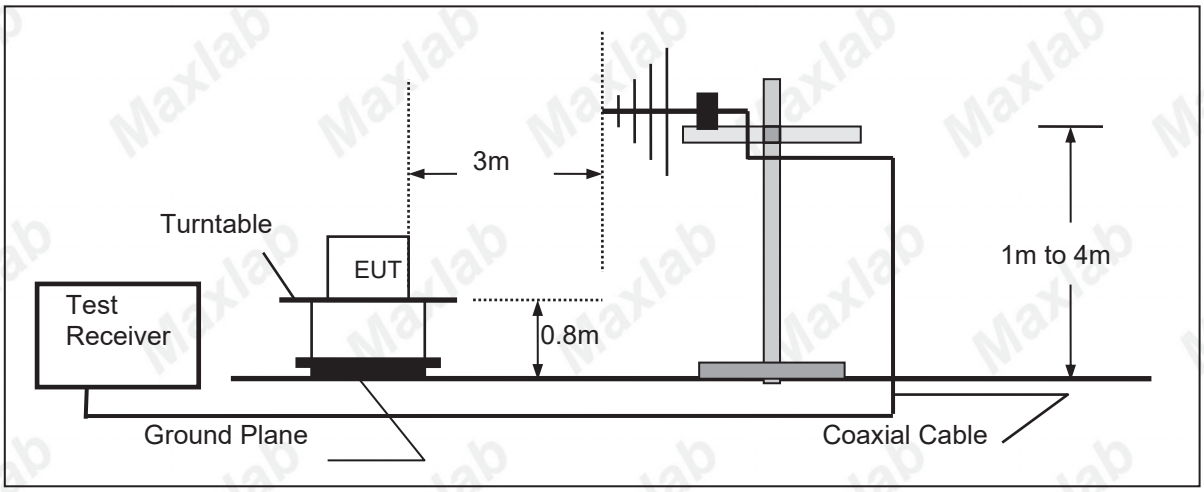
4.2 Radiated Emission

TEST CONFIGURATION

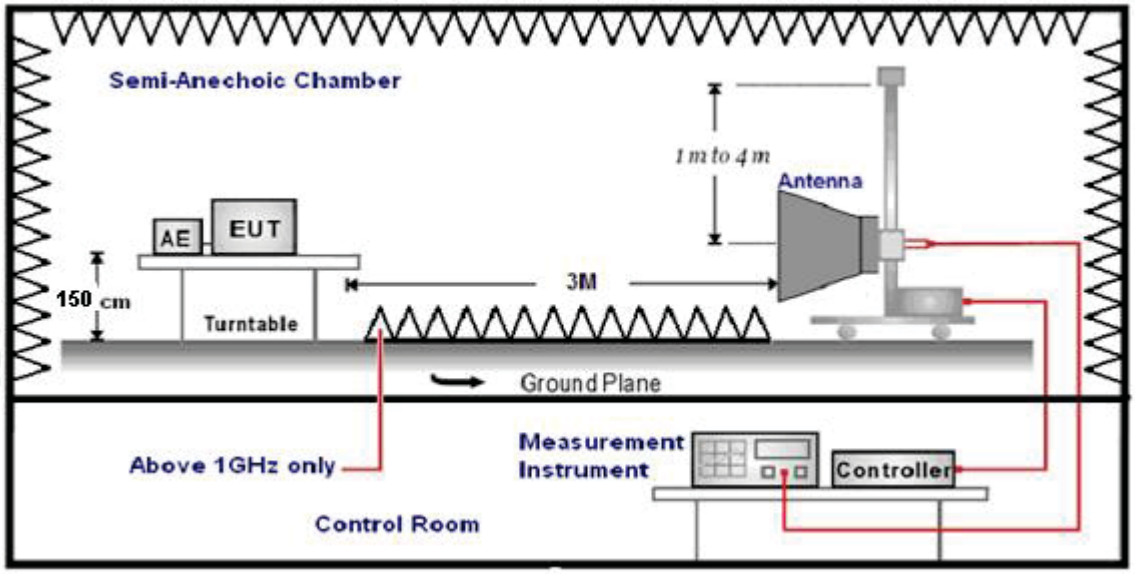
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. We measured Radiated Emission at GFSK, π/*4 DQPSK and 8-DPSK* mode from 9 KHz to 25GHz and recorded worst case at GFSK DH5 mode.
3. For below 1GHz testing recorded worst at GFSK DH5 middle channel.
4. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal

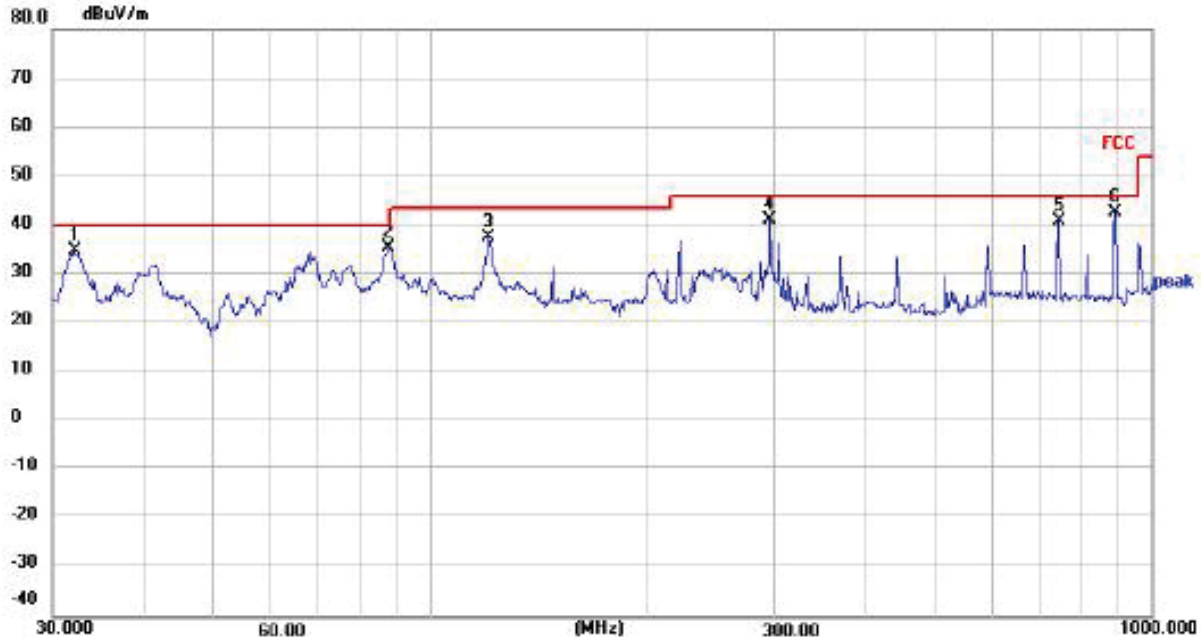
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
1	32.0667	47.29	-17.10	30.19	40.00	-9.81	peak	100	0	P
2	120.6991	55.67	-17.86	37.81	43.50	-5.69	peak	100	0	P
3 *	222.1697	60.12	-19.17	40.95	46.00	-5.05	peak	100	0	P
4	296.1836	54.23	-15.69	38.54	46.00	-7.46	peak	100	0	P
5	519.0649	43.72	-10.15	33.57	46.00	-12.43	peak	100	0	P
6	742.2587	45.52	-5.49	40.03	46.00	-5.97	peak	100	0	P

Note:1).Level (dBμV/m)= Reading (dBμV/m)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
1	32.1794	51.84	-17.11	34.73	40.00	-5.27	peak	100	360	P
2	87.7246	55.99	-20.65	35.34	40.00	-4.66	peak	100	360	P
3	120.6991	55.56	-17.86	37.70	43.50	-5.80	peak	100	360	P
4	296.1836	56.84	-15.69	41.15	46.00	-4.85	peak	100	360	P
5	742.2587	46.35	-5.49	40.86	46.00	-5.14	peak	100	360	P
6 *	890.7277	46.49	-3.86	42.63	46.00	-3.37	peak	100	360	P

Note:1).Level (dBμV/m)= Reading (dBμV/m)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

For 1GHz to 25GHz

Note: GFSK, π/4 DQPSK and 8-DPSK all have been tested, only worse case GFSK is reported.

GFSK (above 1GHz)

Frequency(MHz):			2402		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	55.89	PK	74	18.11	60.25	32.40	5.11	41.87	-4.36
4804.00	46.12	AV	54	7.88	50.48	32.40	5.11	41.87	-4.36
7206.00	54.85	PK	74	19.15	55.48	36.58	6.43	43.64	-0.63
7206.00	44.71	AV	54	9.29	45.34	36.58	6.43	43.64	-0.63

Frequency(MHz):			2402		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	56.20	PK	74	17.80	60.56	32.40	5.11	41.87	-4.36
4804.00	46.06	AV	54	7.94	50.42	32.40	5.11	41.87	-4.36
7206.00	54.71	PK	74	19.29	55.34	36.58	6.43	43.64	-0.63
7206.00	44.66	AV	54	9.34	45.29	36.58	6.43	43.64	-0.63

Frequency(MHz):			2441		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	56.30	PK	74	17.70	60.25	32.56	5.34	41.85	-3.95
4882.00	46.47	AV	54	7.53	50.42	32.56	5.34	41.85	-3.95
7323.00	54.98	PK	74	19.02	55.34	36.54	6.81	43.71	-0.36
7323.00	44.90	AV	54	9.10	45.26	36.54	6.81	43.71	-0.36

Frequency(MHz):			2441		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	56.57	PK	74	17.43	60.52	32.56	5.34	41.85	-3.95
4882.00	46.31	AV	54	7.69	50.26	32.56	5.34	41.85	-3.95
7323.00	55.05	PK	74	18.95	55.41	36.54	6.81	43.71	-0.36
7323.00	44.90	AV	54	9.10	45.26	36.54	6.81	43.71	-0.36

Frequency(MHz):			2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	56.79	PK	74	17.21	60.25	32.73	5.64	41.83	-3.46
4960.00	46.96	AV	54	7.04	50.42	32.73	5.64	41.83	-3.46
7440.00	55.20	PK	74	18.80	55.26	36.50	7.23	43.79	-0.06
7440.00	45.23	AV	54	8.77	45.29	36.50	7.23	43.79	-0.06

Frequency(MHz):			2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	57.39	PK	74	16.61	60.85	32.73	5.64	41.83	-3.46
4960.00	47.28	AV	54	6.72	50.74	32.73	5.64	41.83	-3.46
7440.00	55.40	PK	74	18.60	55.46	36.50	7.23	43.79	-0.06
7440.00	45.83	AV	54	8.17	45.89	36.50	7.23	43.79	-0.06

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

Note: GFSK, Pi/4 DQPSK and 8-DPSK all have been tested, only worse case GFSK is reported.

GFSK

Test Frequency(MHz):			Lowest channel		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2310.00	50.54	PK	74	23.46	60.96	27.42	4.31	42.15	-10.42
2310.00	40.32	AV	54	13.68	50.74	27.42	4.31	42.15	-10.42
2390.00	48.17	PK	74	25.83	58.46	27.55	4.35	42.19	-10.29
2390.00	37.97	AV	54	16.03	48.26	27.55	4.35	42.19	-10.29
2400.00	45.43	PK	74	28.57	55.62	27.70	4.39	42.28	-10.19
2400.00	35.39	AV	54	18.61	45.58	27.70	4.39	42.28	-10.19

Test Frequency(MHz):			Lowest channel		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2310.00	45.32	PK	74	28.68	55.74	27.42	4.31	42.15	-10.42
2310.00	35.21	AV	54	18.79	45.63	27.42	4.31	42.15	-10.42
2390.00	42.96	PK	74	31.04	53.25	27.55	4.35	42.19	-10.29
2390.00	32.97	AV	54	21.03	43.26	27.55	4.35	42.19	-10.29
2400.00	41.05	PK	74	32.95	51.24	27.70	4.39	42.28	-10.19
2400.00	30.07	AV	54	23.93	40.26	27.70	4.39	42.28	-10.19

Test Frequency(MHz):			Highest channel		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	45.11	PK	74	28.89	55.74	27.55	4.38	42.56	-10.63
2483.50	35.00	AV	54	19.00	45.63	27.55	4.38	42.56	-10.63
2500.00	42.75	PK	74	31.25	53.48	27.69	4.46	42.88	-10.73
2500.00	32.23	AV	54	21.77	42.96	27.69	4.46	42.88	-10.73

Test Frequency(MHz):			Highest channel		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	42.62	PK	74	31.38	53.25	27.55	4.38	42.56	-10.63
2483.50	32.85	AV	54	21.15	43.48	27.55	4.38	42.56	-10.63
2500.00	40.90	PK	74	33.10	51.63	27.69	4.46	42.88	-10.73
2500.00	31.23	AV	54	22.77	41.96	27.69	4.46	42.88	-10.73

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 30dBm(for GFSK)/20.97dBm(for EDR)

Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz Sweep=auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

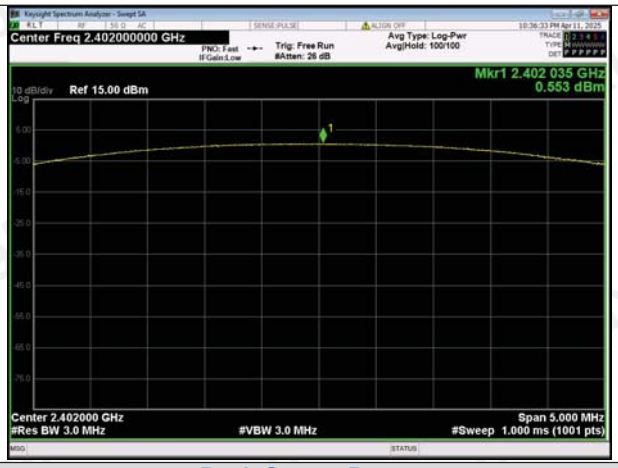
Test Configuration

Test Results

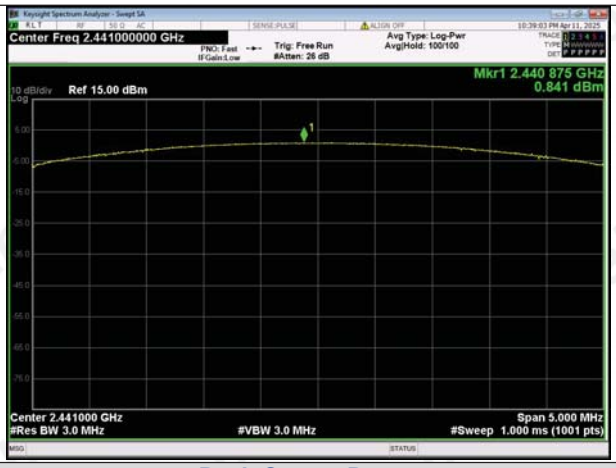
Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	0.553	30.00	Pass
	39	0.841		
	78	0.364		
π/4DQPSK	00	0.546	20.97	Pass
	39	0.916		
	78	0.419		
8-DPSK	00	0.540	20.97	Pass
	39	0.827		
	78	0.351		

Note: 1.The test results including the cable lose.

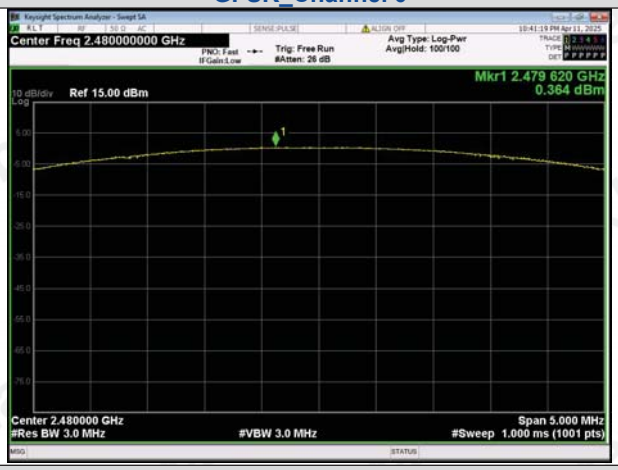
Test plots



Peak Output Power
GFSK_Channel 0



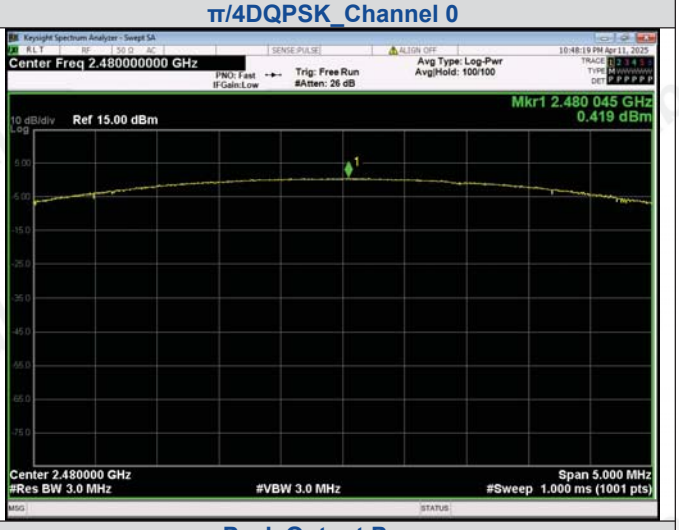
Peak Output Power
GFSK_Channel 39



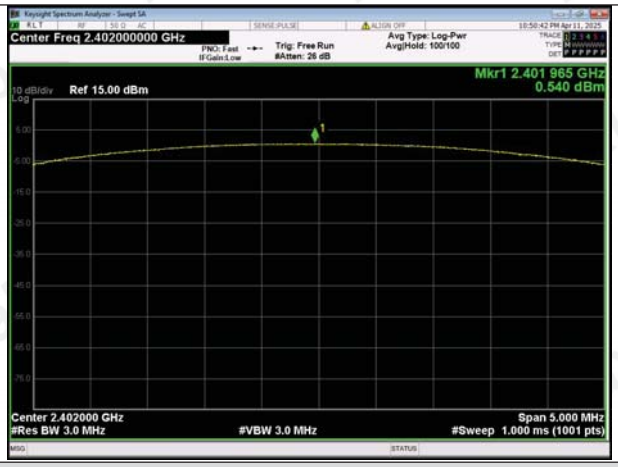
Peak Output Power
GFSK_Channel 78

Peak Output Power
π/4DQPSK_Channel 0

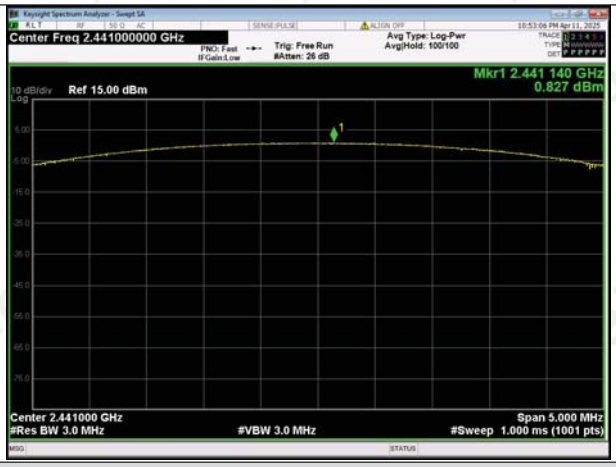
Peak Output Power
π/4DQPSK_Channel 39



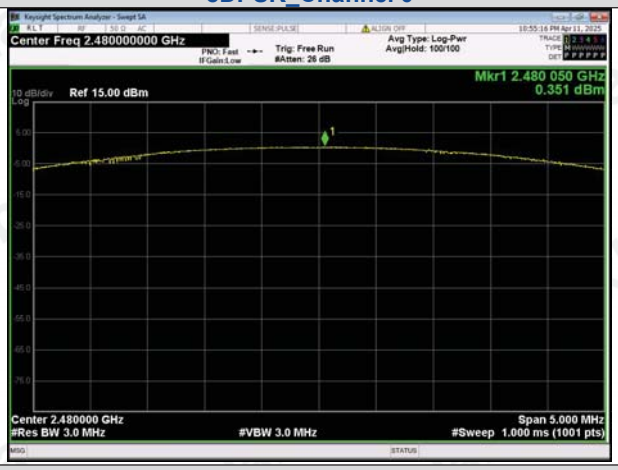
Peak Output Power
π/4DQPSK_Channel 78



Peak Output Power
8DPSK_Channel 0



Peak Output Power
8DPSK_Channel 39



Peak Output Power
8DPSK_Channel 78

4.4 20dB Bandwidth

Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 91 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration

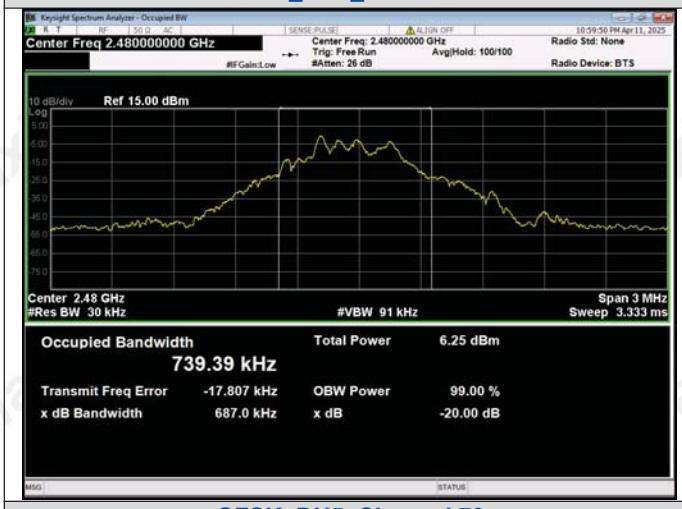
Test Results

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	CH00	0.6853	Pass
	CH39	0.6853	
	CH78	0.6870	
π/4DQPSK	CH00	1.122	
	CH39	1.118	
	CH78	1.125	
8-DPSK	CH00	1.117	
	CH39	1.127	
	CH78	1.131	

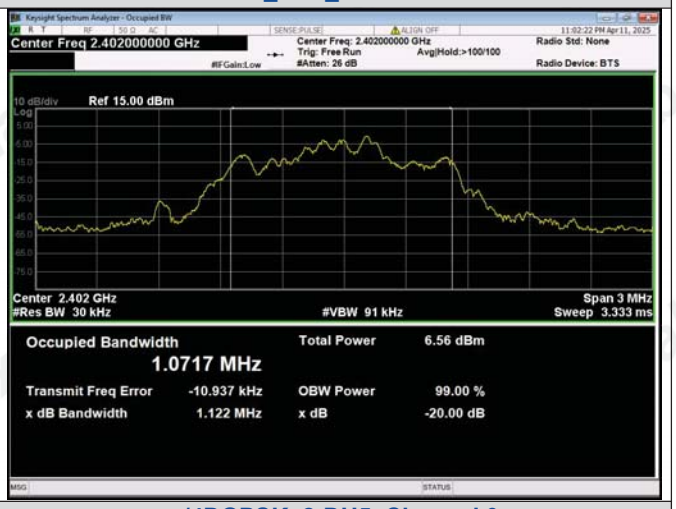
Test Graphs

GFSK_DH5_Channel 0

GFSK_DH5_Channel 39

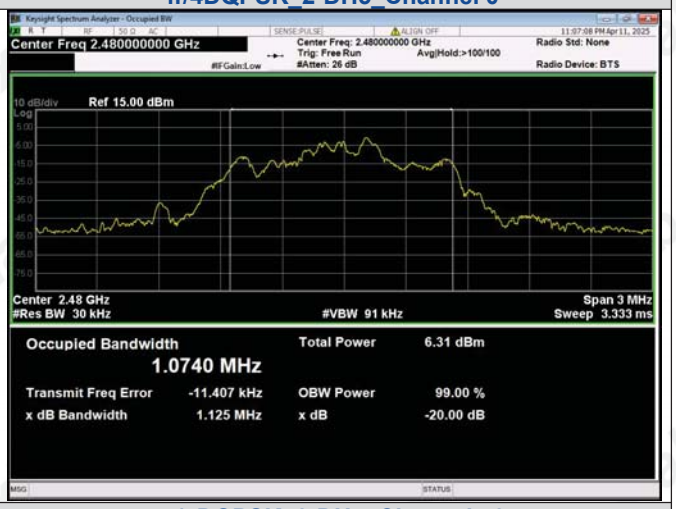


GFSK_DH5_Channel 78



π/4DQPSK_2-DH5_Channel 0

π/4DQPSK_2-DH5_Channel 39



π/4DQPSK_2-DH5_Channel 78

8DPSK_3-DH5_Channel 0

8DPSK_3-DH5_Channel 39

8DPSK_3-DH5_Channel 78

4.5 Frequency Separation

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW.

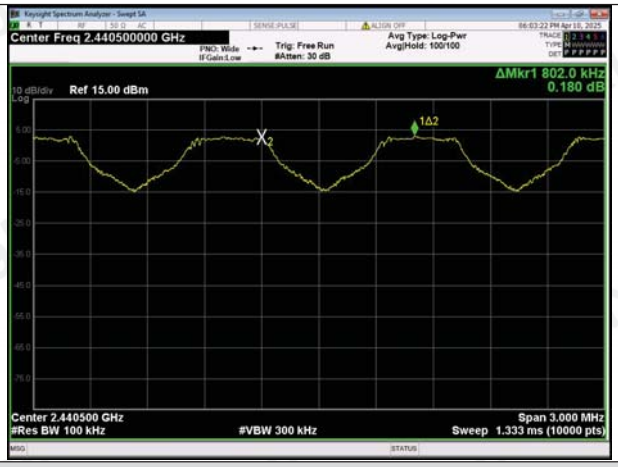
TEST CONFIGURATION

TEST RESULTS

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.1998	2441.0018	0.8020	0.639	PASS
π/4DQPSK	2-DH5	2439.8638	2440.8704	1.0066	0.856	PASS
8DPSK	3-DH5	2439.8785	2441.0063	1.1278	0.869	PASS

Note:We have tested all mode at high, middle and low channel, and recorded worst case at middle

Test Graphs



GFSK

π/4DQPSK

8DPSK

4.6 Number of Hopping Channel

Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Procedure

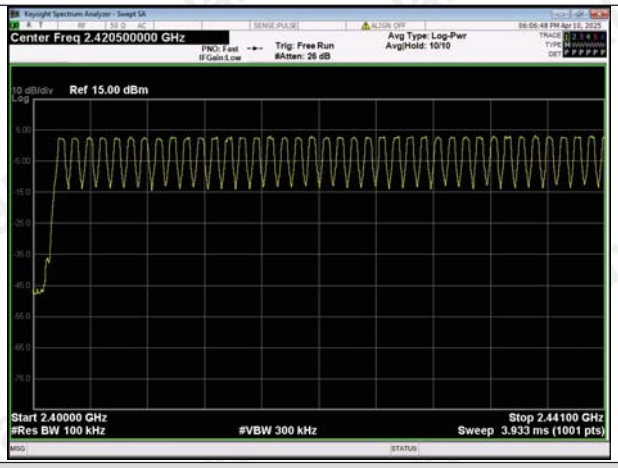
The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

Test Configuration

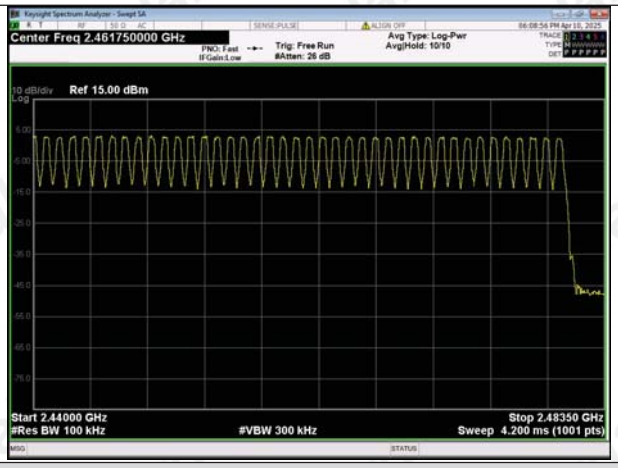
Test Results

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π/4DQPSK	79		
8-DPSK	79		

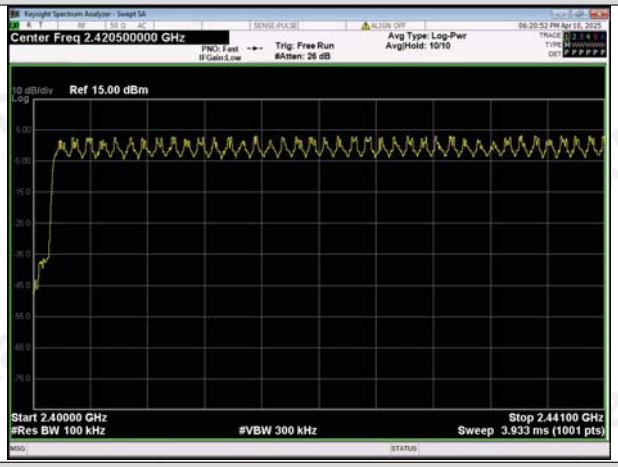
Test Graphs



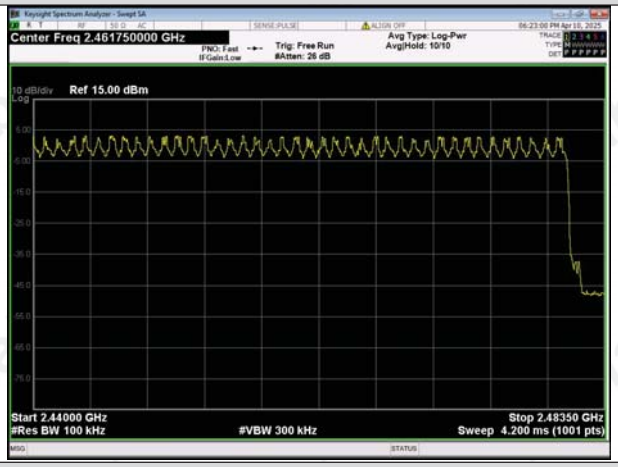
Low End Spectrum Channel Hopping Plot
GFSK



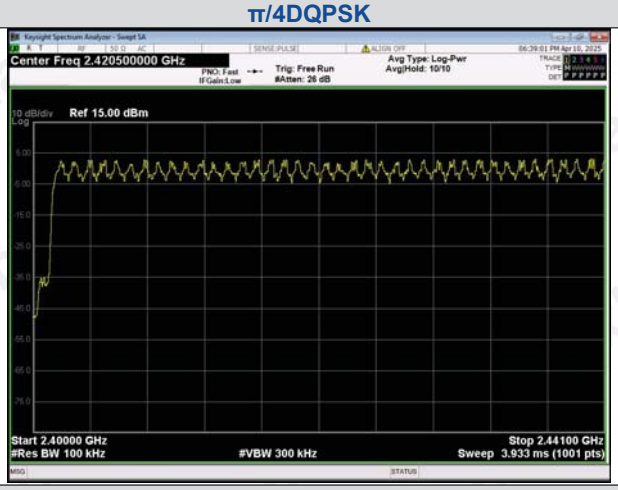
High End Spectrum Channel Hopping Plot
GFSK



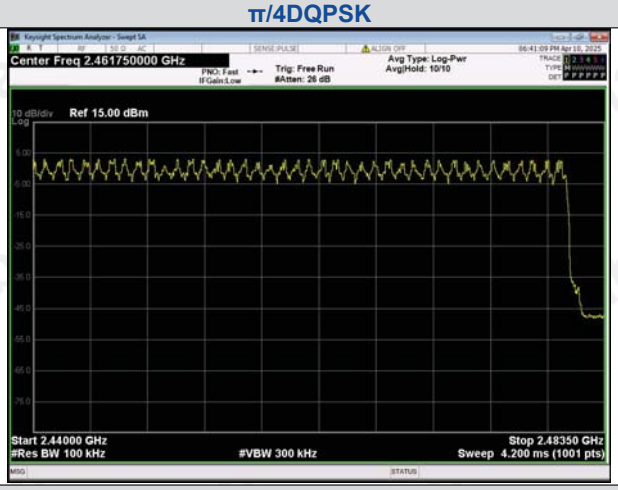
Low End Spectrum Channel Hopping Plot
π/4DQPSK



High End Spectrum Channel Hopping Plot
π/4DQPSK



Low End Spectrum Channel Hopping Plot
8DPSK



High End Spectrum Channel Hopping Plot
8DPSK

4.7 Time of Occupancy (Dwell Time)

Limit

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.

Test Procedure

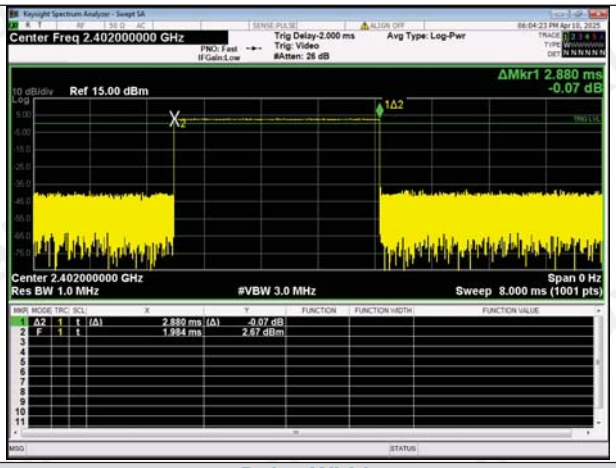
The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 3MHz VBW, Span 0Hz.

Test Configuration

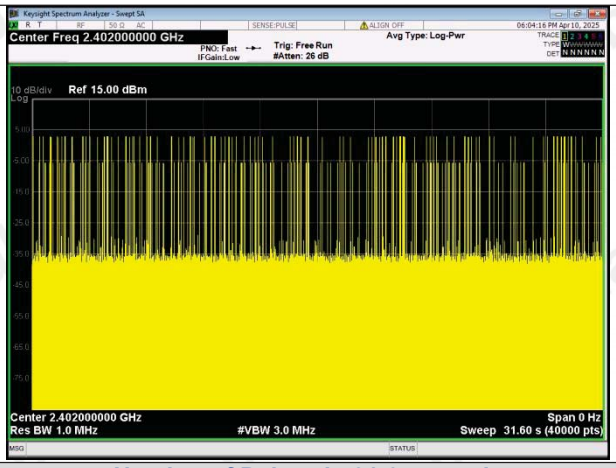
Test Results

Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.880	113	325.44	< 400	PASS
π/4DQPSK	2-DH5		2.880	107	308.16		PASS
8DPSK	3-DH5		2.896	118	341.73		PASS

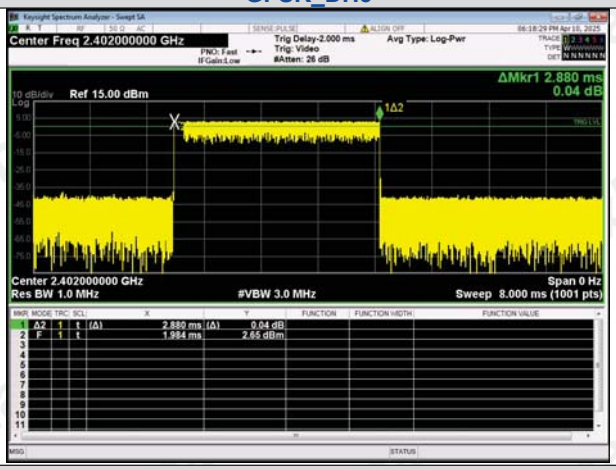
Test Graphs



Pulse Width
GFSK_DH5

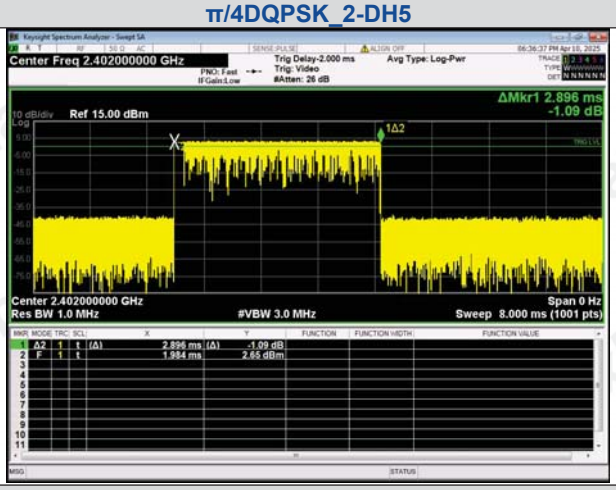


Number of Pulses in 31.6 seconds
GFSK_DH5

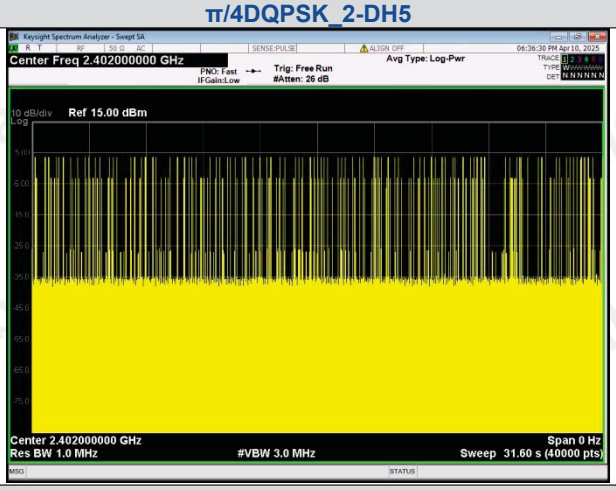


Pulse Width
π/4DQPSK_2-DH5

Number of Pulses in 31.6 seconds
π/4DQPSK_2-DH5



Pulse Width
8DPSK_3-DH5



Number of Pulses in 31.6 seconds
8DPSK_3-DH5

4.8 Out-of-band Emissions

Limit

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 con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

Test Configuration

Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.
We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

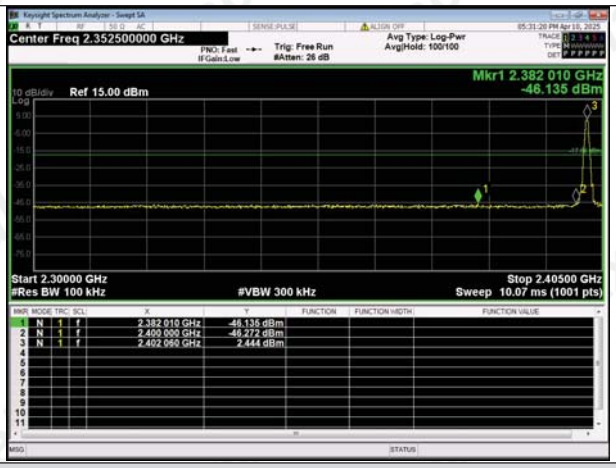
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2382.01	-46.135	-17.56	-28.575	PASS
			2400.00	-46.272	-17.56	-28.712	PASS
			9607.90	-36.079	-17.56	-18.519	PASS
		39	9763.93	-36.348	-17.01	-19.338	PASS
		78	2483.50	-48.313	-17.6	-30.713	PASS
			9919.99	-37.715	-17.6	-20.115	PASS
π/4DQPSK	2-DH5	0	2400.00	-46.306	-17.34	-28.966	PASS
			9607.87	-36.252	-17.34	-18.912	PASS
		39	9763.93	-36.044	-17.12	-18.924	PASS
		78	2483.50	-48.774	-17.49	-31.284	PASS
			9919.99	-37.759	-17.49	-20.269	PASS
8DPSK	3-DH5	0	2400.00	-45.566	-17.7	-27.866	PASS
			9607.87	-36.034	-17.7	-18.334	PASS
		39	2518.26	-31.819	-17.01	-14.809	PASS
		78	2483.50	-48.678	-17.75	-30.928	PASS
			9919.99	-37.529	-17.75	-19.779	PASS

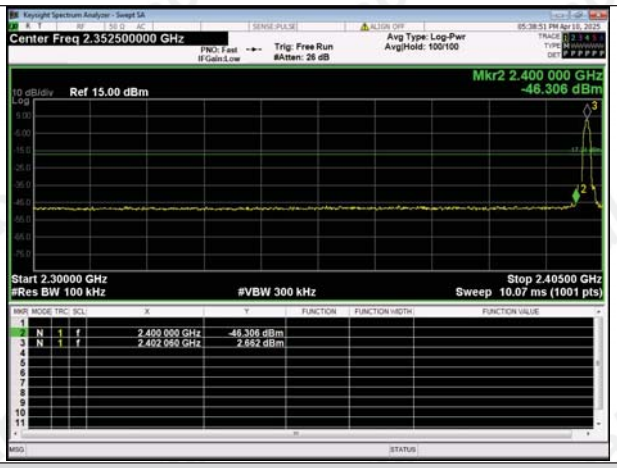
Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2377.07	-46.941	-17.56	-29.381	PASS
			2400.00	-47.214	-17.56	-29.654	PASS
			2483.50	-47.835	-17.26	-30.575	PASS
π/4DQPSK	2-DH5		2379.38	-46.470	-17.5	-28.970	PASS
			2400.00	-47.408	-17.5	-29.908	PASS
			2483.50	-47.696	-17.28	-30.416	PASS
8DPSK	3-DH5		2400.00	-45.001	-17.24	-27.761	PASS
			2483.50	-47.368	-17.23	-30.138	PASS

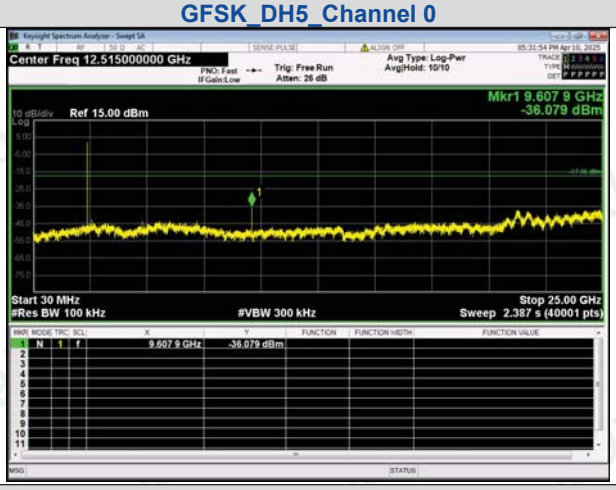
Test Graphs



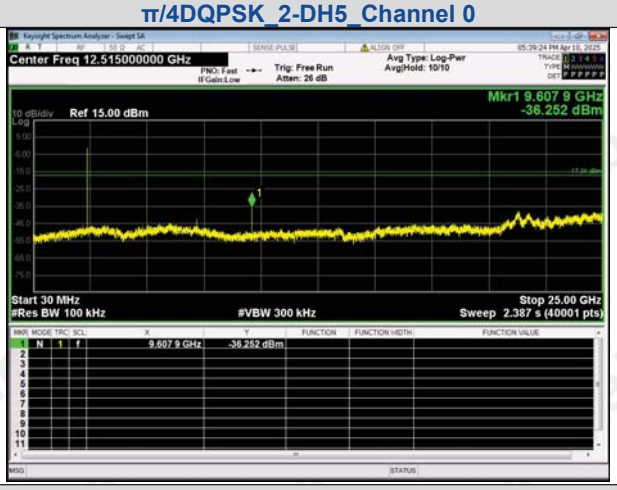
Out Of Band Emission
GFSK_DH5_Channel 0



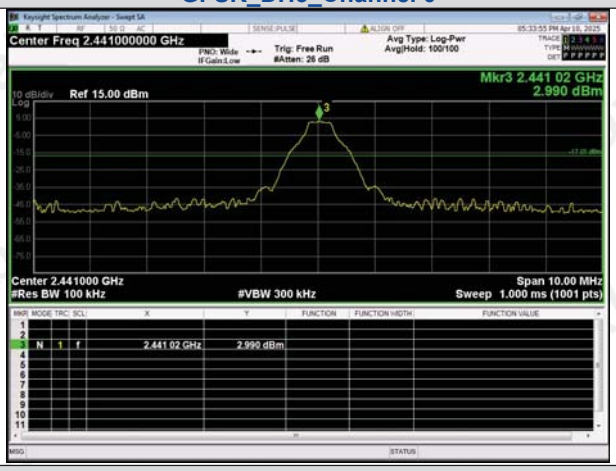
Out Of Band Emission
π/4DQPSK_2-DH5_Channel 0



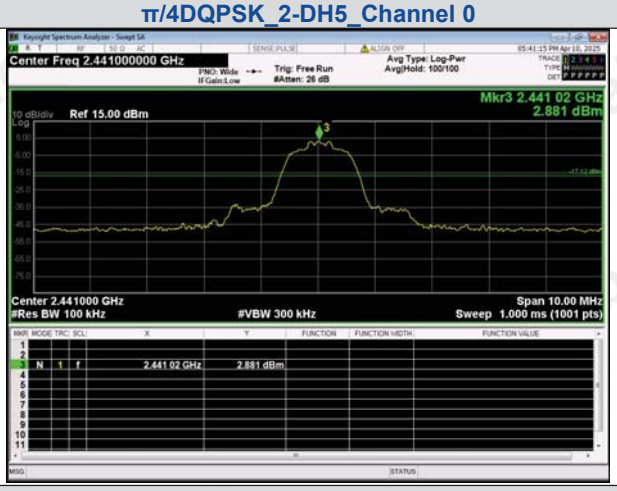
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 0



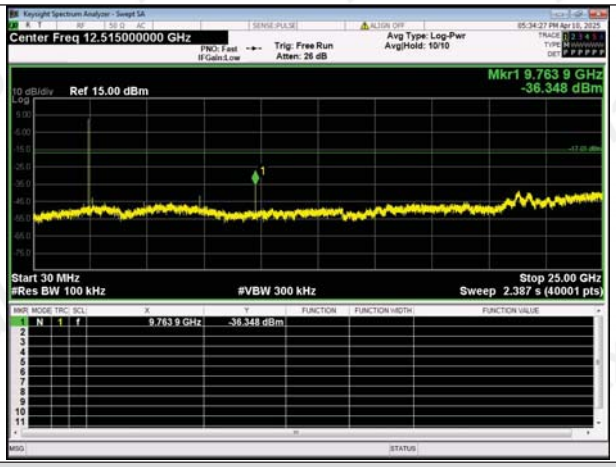
30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 0



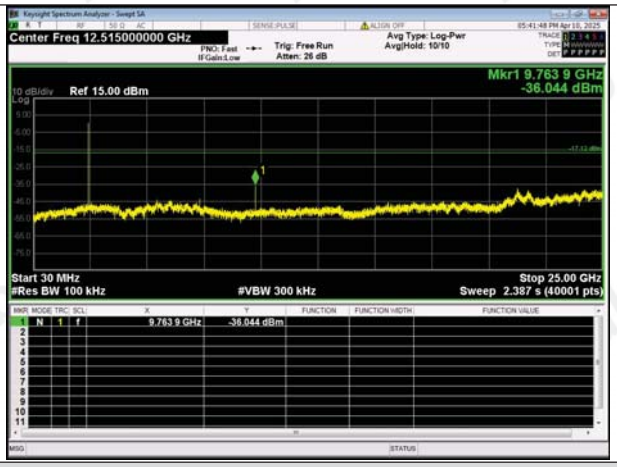
Out Of Band Emission
GFSK_DH5_Channel 39



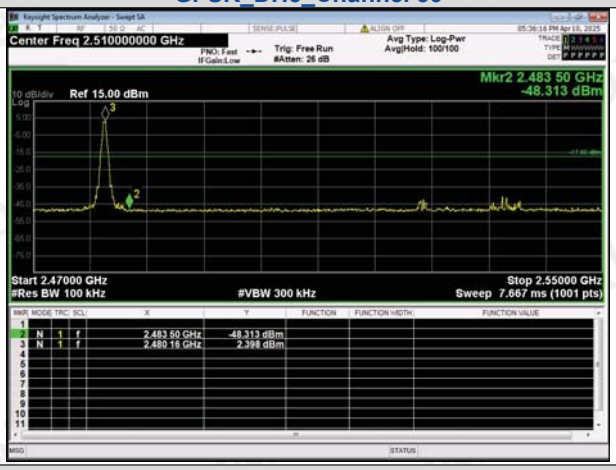
Out Of Band Emission
π/4DQPSK_2-DH5_Channel 39



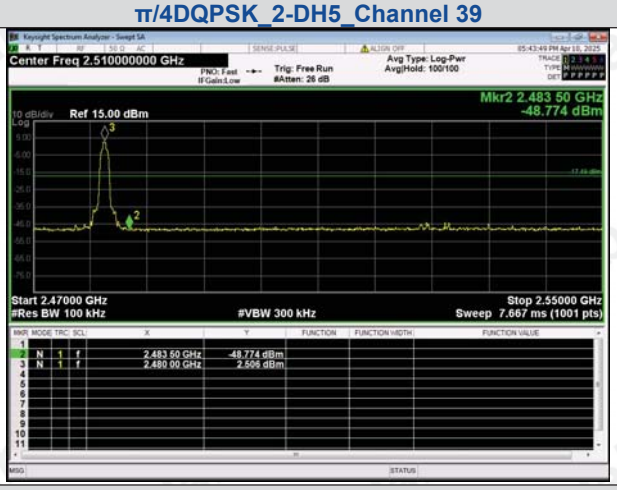
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 39



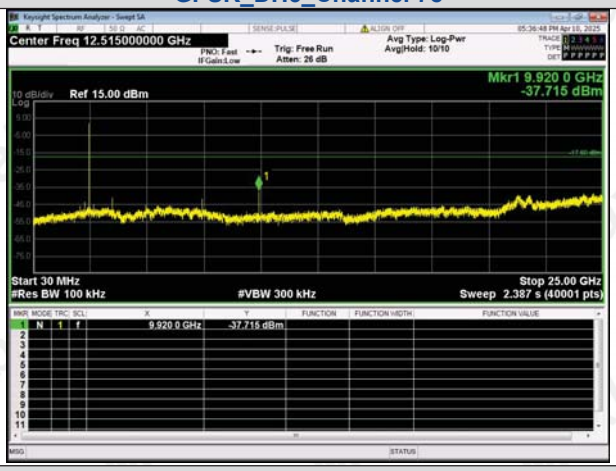
30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 39



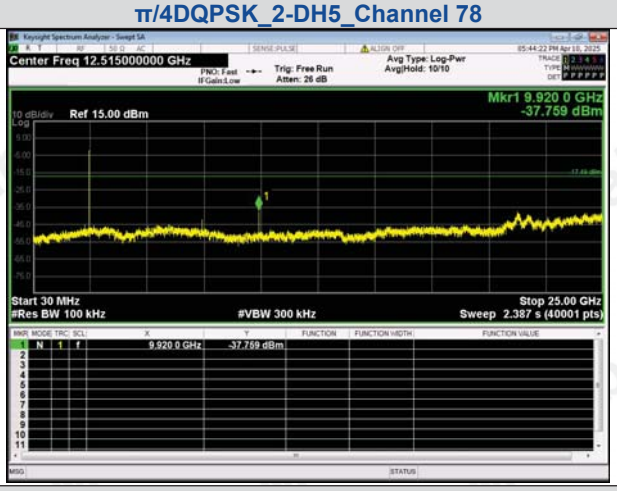
Out Of Band Emission
GFSK_DH5_Channel 78



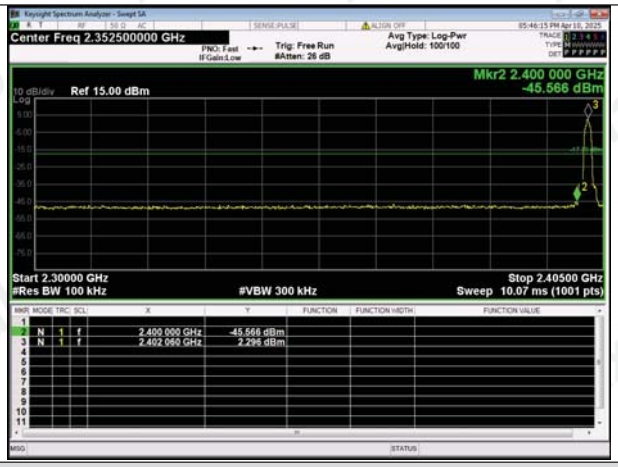
Out Of Band Emission
π/4DQPSK_2-DH5_Channel 78



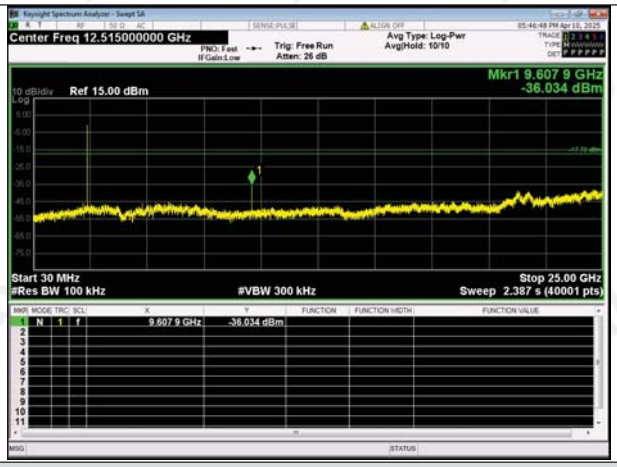
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 78



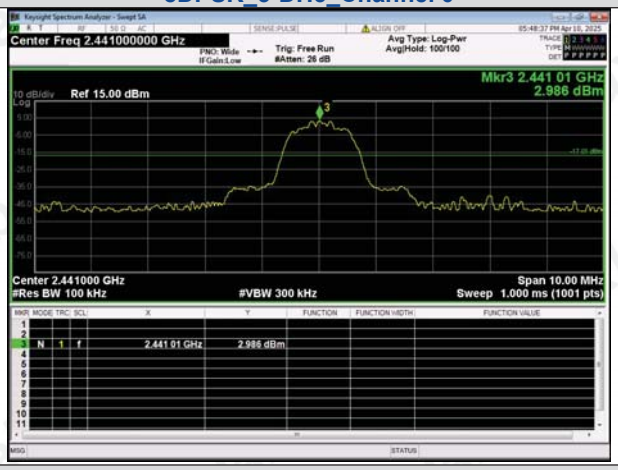
30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 78



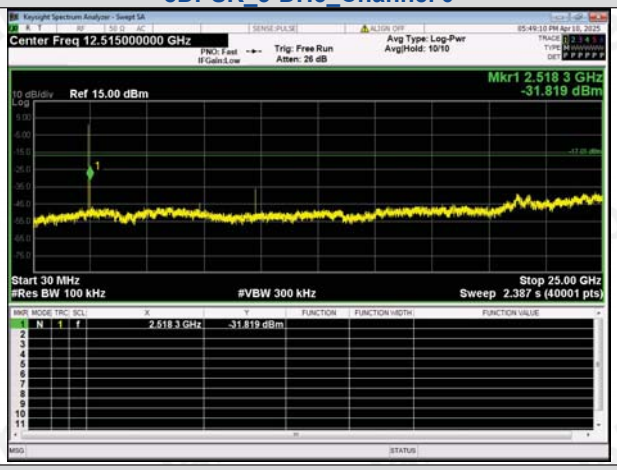
Out Of Band Emission
8DPSK_3-DH5_Channel 0



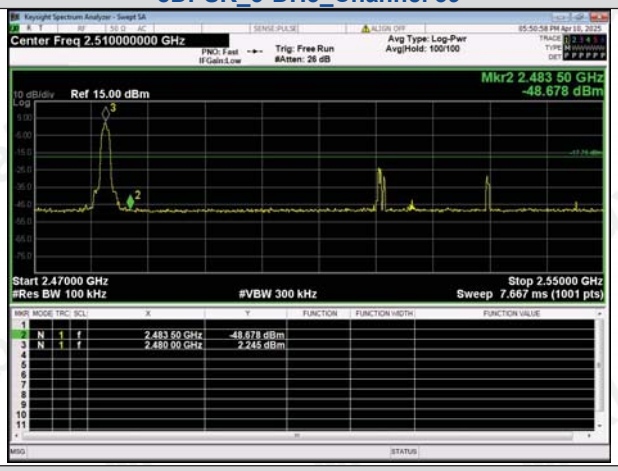
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 0



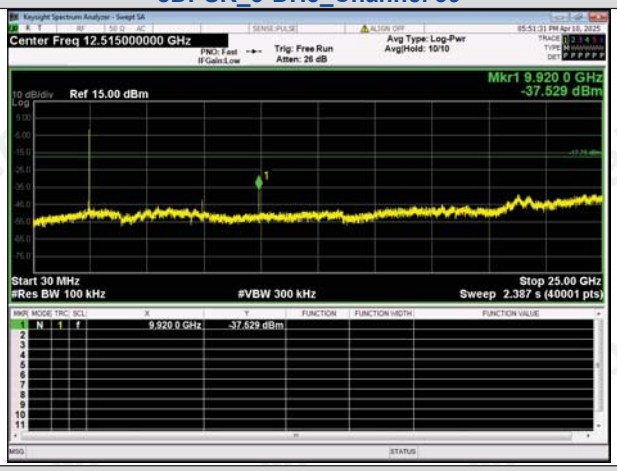
Out Of Band Emission
8DPSK_3-DH5_Channel 39



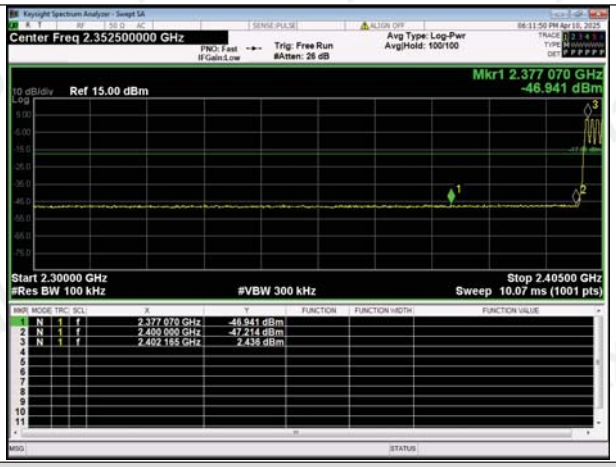
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 39



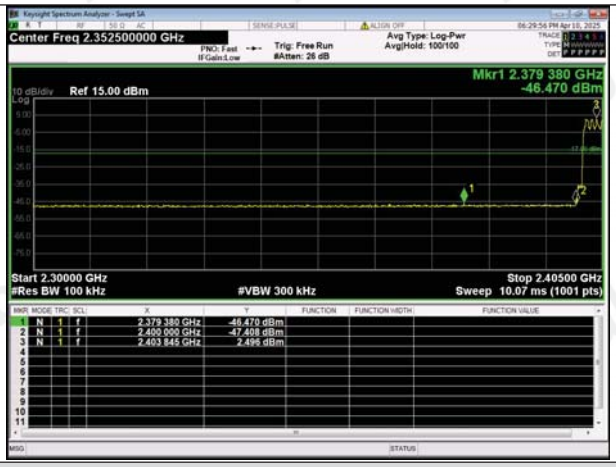
Out Of Band Emission
8DPSK_3-DH5_Channel 78



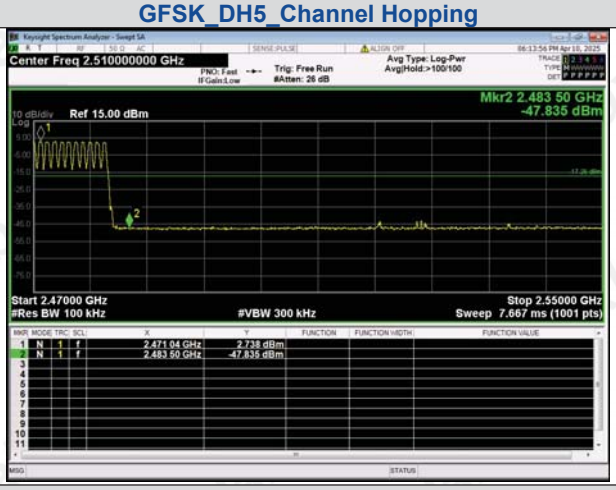
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 78



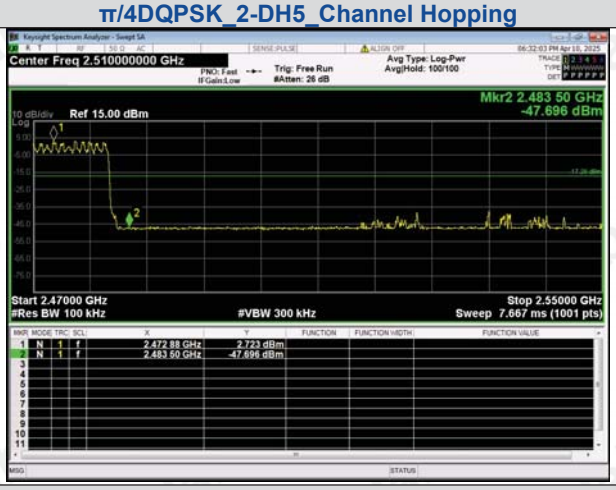
Out Of Band Emission(Left)
GFSK_DH5_Channel Hopping



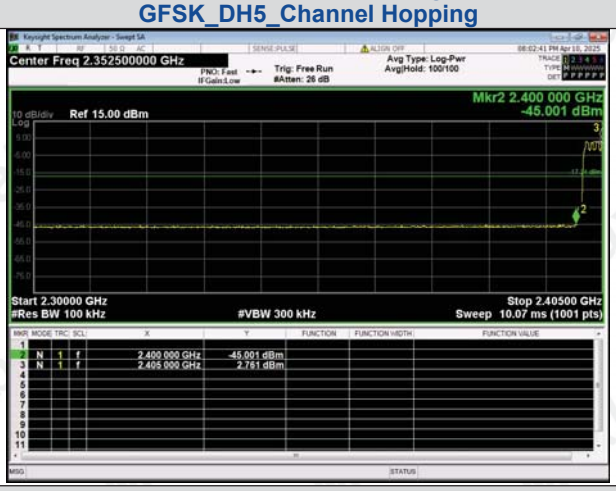
Out Of Band Emission(Left)
π/4DQPSK_2-DH5_Channel Hopping



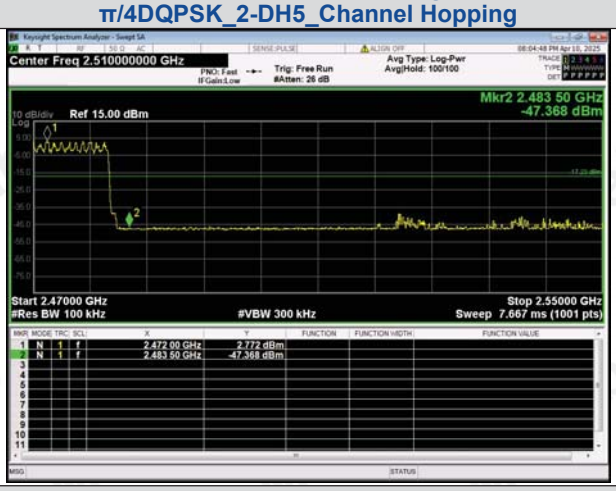
Out Of Band Emission(Right)
GFSK_DH5_Channel Hopping



Out Of Band Emission(Right)
π/4DQPSK_2-DH5_Channel Hopping



Out Of Band Emission(Left)
8DPSK_3-DH5_Channel Hopping



Out Of Band Emission(Right)
8DPSK_3-DH5_Channel Hopping

4.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

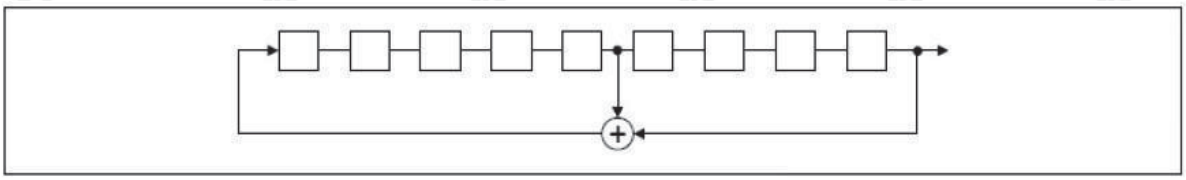
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

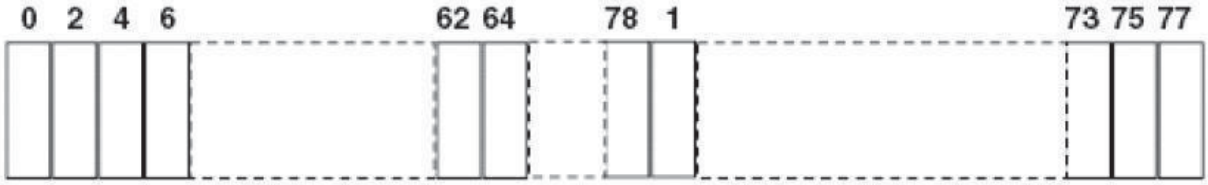
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.10 Antenna Requirement

Standard Applicable

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

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

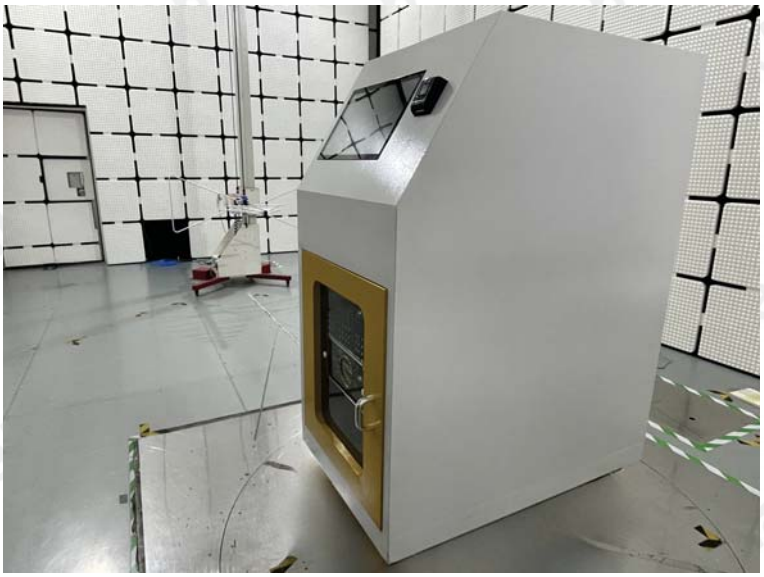
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

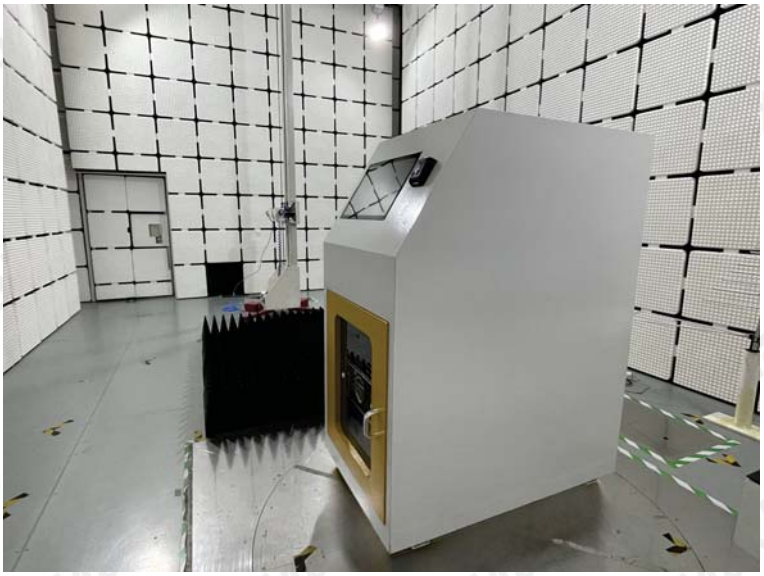
Antenna Connected Construction

The maximum gain of antenna is 0dBi.

Remark:The antenna gain is provided by the customer, if the data provided by the customer is not accurate, MAXLAB Testing Co.,Ltd. does not assume any responsibility.

5 Test Setup Photos of the EUT





6 Photos of the EUT

Reference to the report ANNEX A of external photos and ANNEX B of internal photos.

**********End of Report**********