TEST REPORT

Applicant:	Shenzhen ELECQ Technology Co. Ltd
Address:	7th Floor, Building 9, Changyuan Xincai, Gaoxin Middle 1st Road, Nanshan, Shenzhen, Guangdong, China
Equipment Type:	Elecq Home UL50 J1772
Model Name:	AU105 (refer to section 2.3)
Brand Name:	ELECQ
FCC ID:	2BKKM-EHAU101
ISED Number:	32968-EHAU101
Test Standard:	47 CFR Part 15 Subpart C RSS-Gen Issue 5 RSS-247 Issue 3 (refer to section 3.1)
Sample Arrival Date:	Sep. 20, 2024
Test Date:	Oct. 08, 2024 - Oct. 17, 2024
Date of Issue:	Oct. 29, 2024

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Julie Zhu **Checked by:** Ye Hongji **Approved by:** Sunny Zou (Technical Director)

Revision History

Version	Issue Date	Revisions
Rev. 01	Oct. 29, 2024	Initial Issue

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☑ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☐ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Shenzhen ELECQ Technology Co. Ltd
Address	7th Floor, Building 9, Changyuan Xincai, Gaoxin Middle 1st Road, Nanshan, Shenzhen, Guangdong, China

2.2 Manufacturer Information

Manufacturer	Shenzhen ELECQ Technology Co. Ltd
Address	7th Floor, Building 9, Changyuan Xincai, Gaoxin Middle 1st Road, Nanshan, Shenzhen, Guangdong, China

2.3 General Description for Equipment under Test (EUT)

EUT Name	Elecq Home UL50 J1772
Model Name Under Test	AU105
Series Model Name	AU101, AU102, AU106
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ as below:

Product Name	Model	Max Current	Max Power	Plug	Output Charging Cable
Elecq Home UL40 NEMA14-50 J1772	AU101	40A	9.6kW	NEMA14 -50 plug	Type1 7.5m
Elecq Home UL40 NEMA14-50 NACS	AU102				NACS 7.5m
Elecq Home UL50 J1772	AU105	50A	12kW	Not support	Type1 7.5m
Elecq Home UL50 NACS	AU106				NACS 7.5m

(this information provided by the applicant)

Serial Number	AU101A8G000189
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac and 802.11ax Wi-SUN, NFC

The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology	FHSS
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK
Product Type	☒ Mobile ☐ Portable ☐ Fix Location
Transfer Rate	DH5: 1 Mbps 2DH5: 2 Mbps 3DH5: 3 Mbps
Frequency Range	The frequency range used is 2400 MHz to 2483.5 MHz.
Number of Channel	79 (at intervals of 1 MHz)
Tested Channel	0 (2402 MHz), 39 (2441 MHz), 78 (2480 MHz)
Antenna Type	Shrapnel Antenna
Antenna Gain	4.5 dBi
Antenna Impedance	50Ω
Antenna System (MIMO Smart Antenna)	N/A

All channel was listed on the following table:

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
0	**2402**	21	2423	42	2444	63	2465
1	2403	22	2424	43	2445	64	2466
2	2404	23	2425	44	2446	65	2467
3	2405	24	2426	45	2447	66	2468
4	2406	25	2427	46	2448	67	2469
5	2407	26	2428	47	2449	68	2470
6	2408	27	2429	48	2450	69	2471
7	2409	28	2430	49	2451	70	2472
8	2410	29	2431	50	2452	71	2473
9	2411	30	2432	51	2453	72	2474
10	2412	31	2433	52	2454	73	2475
11	2413	32	2434	53	2455	74	2476
12	2414	33	2435	54	2456	75	2477
13	2415	34	2436	55	2457	76	2478
14	2416	35	2437	56	2458	77	2479
15	2417	36	2438	57	2459	**78**	**2480**
16	2418	37	2439	58	2460	-	-
17	2419	38	2440	59	2461	-	-
18	2420	**39**	**2441**	60	2462	-	-
19	2421	40	2442	61	2463	-	-
20	2422	41	2443	62	2464	-	-

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Intentional radiators of radio frequency equipment
2	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
3	RSS-247 Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems(FHSs) and Licence-Exemp Local Area Network (LE-LAN) Devices
4	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
5	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

3.2 Test Verdict

No.	Description	FCC Part No.	ISED Part No.	Channel	Test Result	Verdict	Remark
1	Antenna Requirement	15.203	RSS-247, 5.4 (f)	N/A	--	Pass	Note [1]
2	Number of Hopping Frequencies	15.247(a)	RSS-247, 5.1 (d)	Hopping Mode	ANNEX A.1	Pass	Note [2]
3	Peak Output Power and E.I.R.P	15.247(b)	RSS-247, 5.4 (b)	Low/Middle/ High	ANNEX A.2	Pass	--
4	Occupied Bandwidth	15.247(a)	RSS-247, 5.1 (a)	Low/Middle/ High	ANNEX A.3	Pass	--
5	Carrier Frequency Separation	15.247(a)	RSS-247, 5.1 (b)	Hopping Mode	ANNEX A.4	Pass	Note [2]
6	Time of Occupancy (Dwell time)	15.247(a)	RSS-247, 5.1 (d)	Hopping Mode	ANNEX A.5	Pass	Note [2]
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	RSS-247, 5.5	Hopping Mode; Low/Middle/ High	ANNEX A.6	Pass	Note [2]
8	Conducted Emission	15.207	RSS-GEN, 8.8	Low/Middle/ High	ANNEX A.7	Pass	Note [2]
9	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 5.5	Low/Middle/ High	ANNEX A.8	Pass	Note [2]
10	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	RSS-247, 5.5	Low/High	ANNEX A.9	Pass	Note [2]
11	Receiver Spurious Emissions	--	RSS-Gen, 7.3	--	--	N/A	Note [3]

Note [1]: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

Note [2]: π/4-DQPSK is the EDR 2M rate mode, 8-DPSK is the EDR 3M rate mode. The consistency of test results in π/4-DQPSK and 8-DPSK is very high. So we chose 8-DPSK as a typical representative to appear on the report. Another we will show all the modes on the RF output power test item.

Note [3]: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz, as well as scanner receivers, are subject to Industry Canada requirements, so this test is not applicable.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	45% to 56%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+23.8℃ to +26.4℃
Working Voltage of the EUT	NV (Normal Voltage)	240 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	KEYSIGHT	N9020A	MY46471071	2024.07.04	2025.07.03
Signaling Unit	ROHDE&SCHWARZ	CMW500	171150	2024.05.22	2025.05.21
Spectrum Analyzer	KEYSIGHT	N9020A	MY50531259	2024.08.01	2025.07.31
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	02460	2024.05.16	2027.05.15
Test Antenna-Horn	A-INFO	LB-180400KF	J211060273	2024.06.15	2027.06.14
Anechoic Chamber	RAINFORD	9m*6m*6m	140	2024.07.28	2027.07.27
Amplifier	COM-MV	LSCX_LNA1-12G-01	7210214	2024.08.01	2025.07.31
Amplifier	COM-MV	XKu_LNA7-18G-01	7210209	2024.08.01	2025.07.31
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2024.08.01	2025.07.31
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-624	2024.07.06	2027.07.05
Test Antenna-Loop	SCHWARZBECK	FMZB 1519	1519-037	2024.01.23	2025.01.22
Amplifier	COM-MV	ZT30-1000M	B2017119082	2023.12.05	2024.12.04
Anechoic Chamber	RAINFORD	9m*6m*6m	101	2023.03.04	2026.03.03
EMI Receiver	KEYSIGHT	N9010B	MY57110309	2024.08.01	2025.07.31
LISN	SCHWARZBECK	NSLK 8127	8127-687	2024.05.09	2025.05.08
Shielded Enclosure	YiHeng Electronic Co., Ltd	3.5m*3.1m*2.8 m	112	2022.02.19	2025.02.18

4.3 Test Software List

Description	Manufacturer	Software Version	Serial No.	Applicable test Setup
BL410R	BALUN	V2.1.1.488	N/A	The section 4.5.1
BL410E	BALUN	V22.930	N/A	The section 4.5.2&4.5.3&4.5.4&4.5.5

4.4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

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

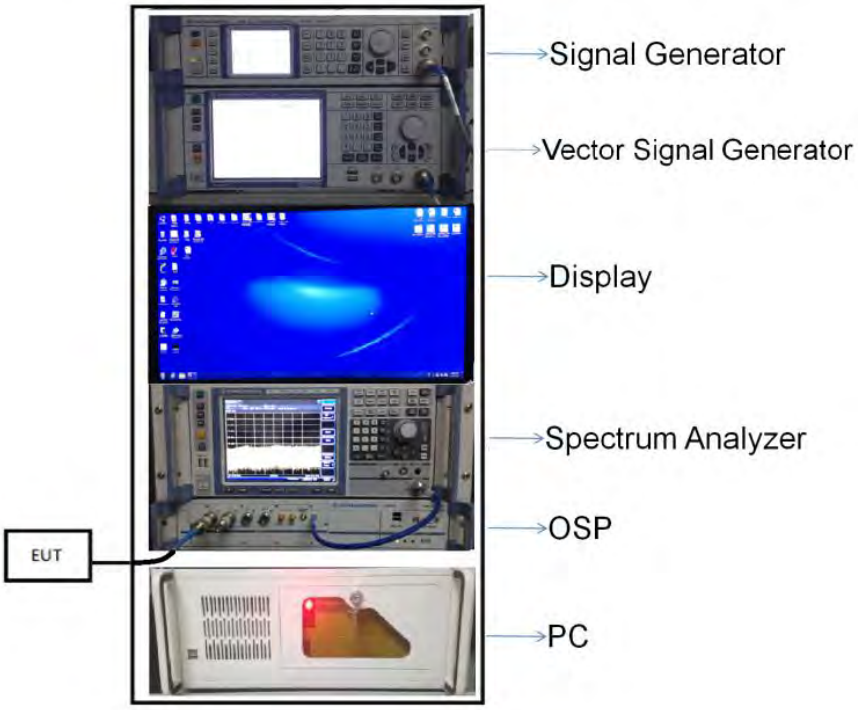
Parameters	Uncertainty
Occupied Channel Bandwidth	2.8%
RF output power, conducted	1.28 dB
Power Spectral Density, conducted	1.30 dB
Unwanted Emissions, conducted	1.84 dB
All emissions, radiated	5.36 dB
Temperature	0.8℃
Humidity	4%

4.5 Description of Test Setup

4.5.1 For Antenna Port Test

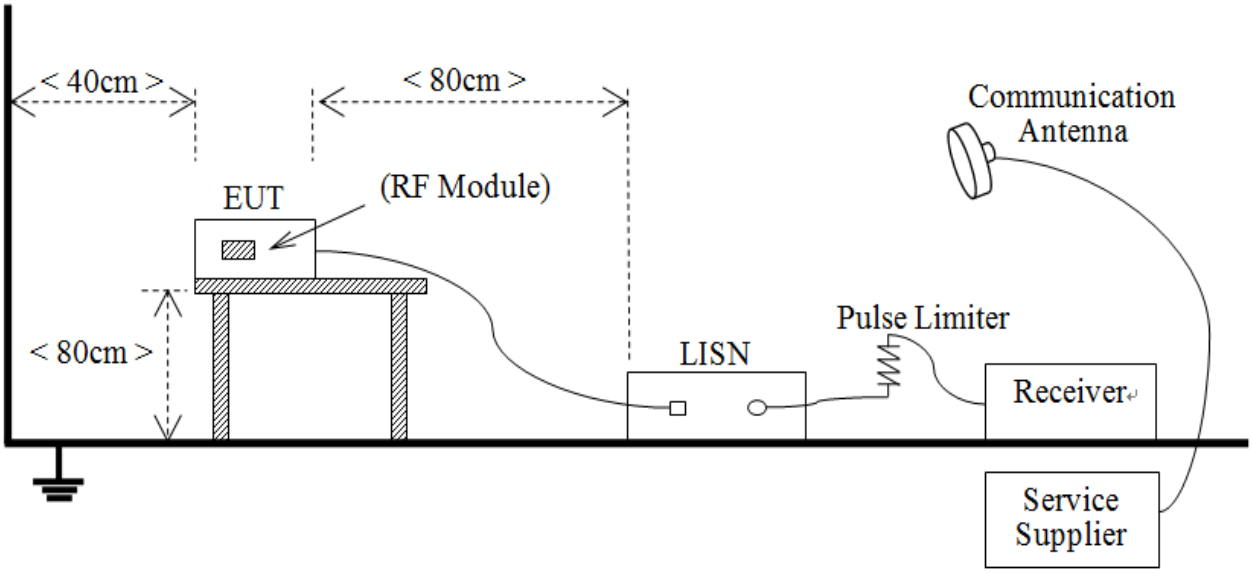
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:
Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



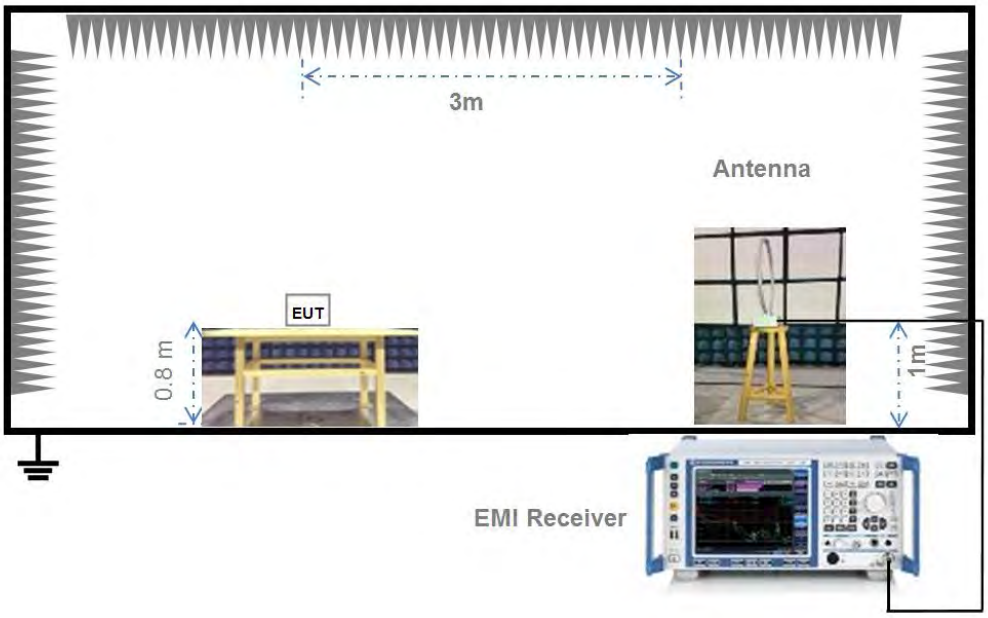
(Diagram 1)

4.5.2 For AC Power Supply Port Test



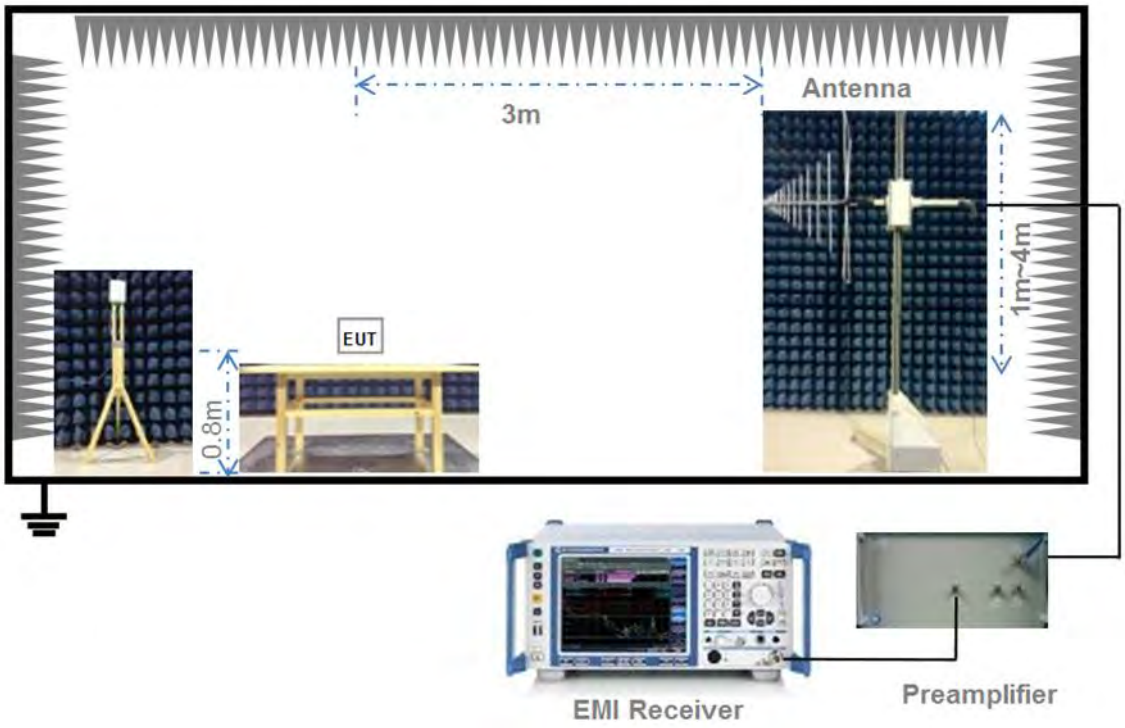
(Diagram 2)

4.5.3 For Radiated Test (Below 30 MHz)



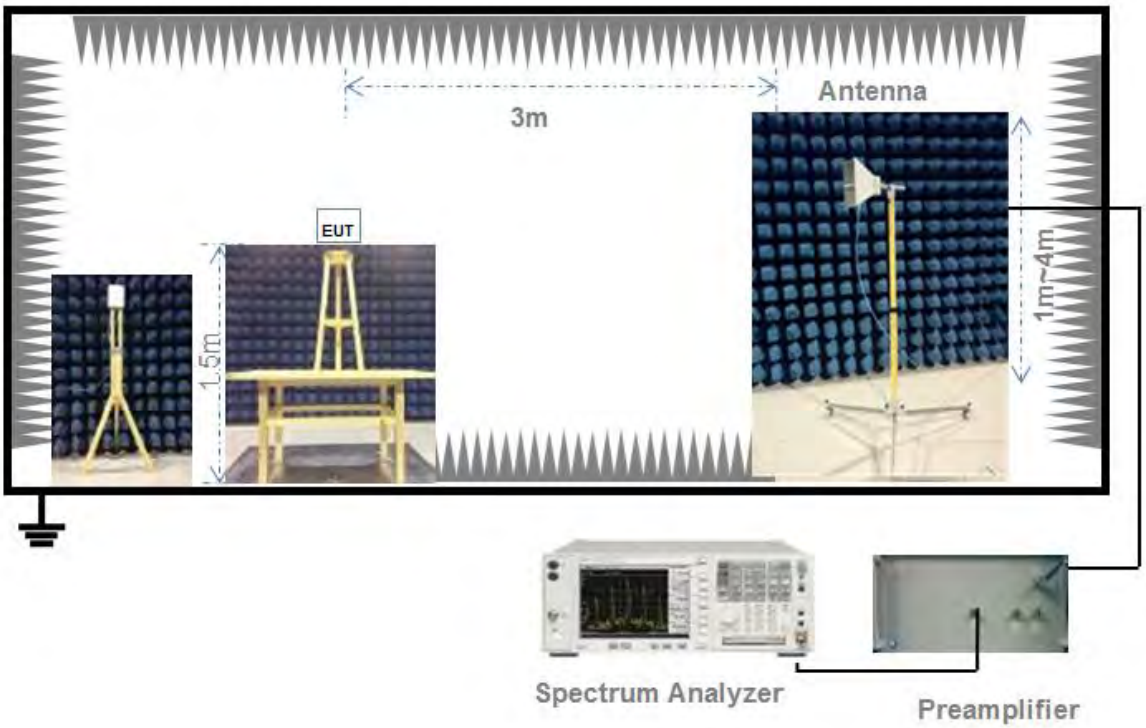
(Diagram 3)

4.5.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.5.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.6 Measurement Results Explanation Example

4.6.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247, 5.4 (f)
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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	An embedded-in antenna design is used.

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Frequency Hopping Systems

5.2.1 Relevant Standards

FCC §15.247(a) (1) (i) (ii) (iii) (iv); FCC §15.247(g); FCC §15.247(h)

Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, to demonstrate that the sequence meets the requirement specified in the definition of an FHSS system. Per the definition in Section 2.1(c), the hop set shall appear as random in the near term, shall appear as evenly distributed in the long term, and sequential hops shall be randomly distributed in both direction and magnitude of change.

Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event).

Describe how the associated receiver(s) complies with the requirement that the input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.

Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals.

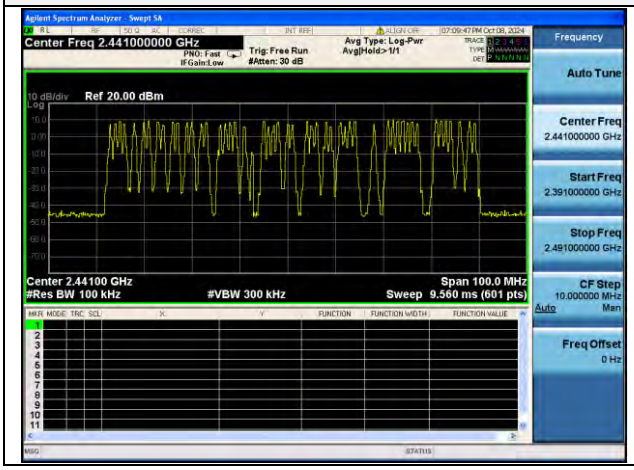
For short burst systems, describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system. Specifically, the device shall comply with the equal frequency use and pseudorandom hopping sequence requirement when transmitting in short bursts, and shall be designed to comply when presented with continuous data (or information) stream.

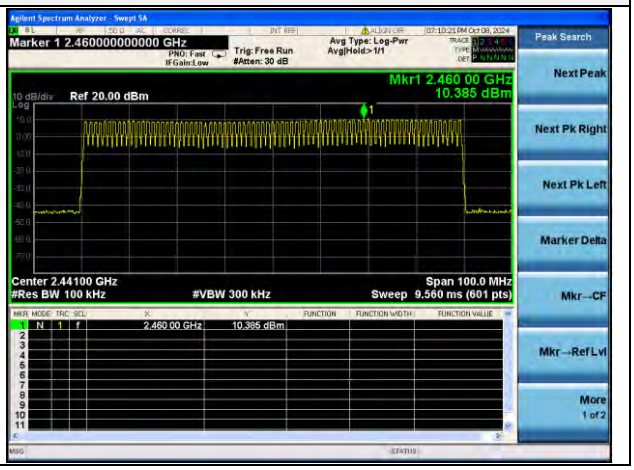
Describe how the EUT complies with the requirement that it not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

5.2.2 Description of the systems

1. According to the preset procedure of the whole network, all the stations in the automatic control network synchronously change the frequency multiple times within one second, and temporarily stay on each frequency hopping channel. Periodic synchronization signaling is sent from the primary station, instructing all slaves to simultaneously change the operating frequency, then the hopping sequence is generated.
2. The hop set shall appear as random in the near term, shall appear as evenly distributed in the long term, and sequential hops shall be randomly distributed in both direction and magnitude of change.

Reference Documents





3. Channels are classified into two categories, used and unused, where used channels are part of the hopping sequence and unused channels are replaced in the hopping sequence by used channels in a pseudo-random way. Make each individual EUT meets the requirement that each of its hopping channels is used equally on average.
4. The input bandwith and transmitted bandwith are both 1MHz, the associated receiver(s) complies with the requirement that the input bandwidth matches the bandwidth of the transmitted signal.
5. Connected devices communicate on the same physical channel by synchronizing with a common clock and hopping sequence.
6. EUT isn't short burst systems.
7. EUT can't have the ability to be coordinated with other FHSS systems in an effort.

5.3 Number of Hopping Frequencies

5.3.1 Limit

FCC §15.247(a) (1) (iii); RSS-247, 5.1 (d)

Frequency hopping systems operating in the 2400 MHz to 2483.5 MHz bands shall use at least 15 hopping frequencies.

5.3.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = The frequency band of operation

RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

5.3.4 Test Result

Please refer to ANNEX A.1.

5.4 Peak Output Power and E.I.R.P

5.4.1 Test Limit

FCC § 15.247(b)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247, 5.4 (b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels (see Section 5.4(5) for exceptions).

5.4.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

The Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

5.4.4 Test Result

Please refer to ANNEX A.2.

5.5 Occupied Bandwidth

5.5.1 Limit

FCC §15.247(a); RSS-247, 5.1 (a)

Measurement of the 20dB bandwidth of the modulated signal.

5.5.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel

RBW = in the range of 1% to 5% of the OBW

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.5.4 Test Result

Please refer to ANNEX A.3.

5.6 Carrier Frequency Separation

5.6.1 Limit

FCC §15.247(a); RSS-247, 5.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 2/3 of the 20 dB bandwidth of the hopping channel, whichever is greater.

5.6.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

5.6.4 Test Result

Please refer to ANNEX A.4.

5.7 Time of Occupancy (Dwell time)

5.7.1 Limit

FCC §15.247(a); RSS-247, 5.1 (d)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz band shall use at least 15 non-overlapping 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

5.7.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
Span: Zero span, centered on a hopping channel
RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel
Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel
Detector function: Peak
Trace: Max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

The average time of occupancy on any channel within the Period can be calculated with formulas:
For GFSK and 8-DPSK:
For DH1 package type
{Total of Dwell} = {Pulse Time} * (1600 / 2) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4 s * {Number of Hopping Frequency}
For DH3 package type
{Total of Dwell} = {Pulse Time} * (1600 / 4) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4 s * {Number of Hopping Frequency}
For DH5 package type
{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4 s * {Number of Hopping Frequency}
For AFH Mode:
For DH1 package type
{Total of Dwell} = {Pulse Time} * (800 / 2) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}
For DH3 package type
{Total of Dwell} = {Pulse Time} * (800 / 4) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4 s * {Number of Hopping Frequency}
For DH5 package type
{Total of Dwell} = {Pulse Time} * (800 / 6) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4 s * {Number of Hopping Frequency}

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

5.7.4 Test Result

Please refer to ANNEX A.5.

5.8 Conducted Spurious Emission & Authorized-band band-edge

5.8.1 Limit

FCC §15.247(d); RSS-247, 5.5

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.

5.8.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW = 300 kHz
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

5.8.4 Test Result

Please refer to ANNEX A.6.

5.9 Conducted Emission

5.9.1 Limit

FCC §15.207; RSS-GEN, 8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.9.2 Test Setup

See section 4.5.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.
Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.9.4 Test Result

Please refer to ANNEX A.7.

5.10 Radiated Spurious Emission

5.10.1 Limit

FCC §15.209&15.247(d); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.10.2 Test Setup

See section 4.5.3 to 4.5.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.10.4 Test Result

Please refer to ANNEX A.8.

5.11 Band Edge (Restricted-band band-edge)

5.11.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

5.11.2 Test Setup

See section 4.5.3 to 4.5.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.11.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.11.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

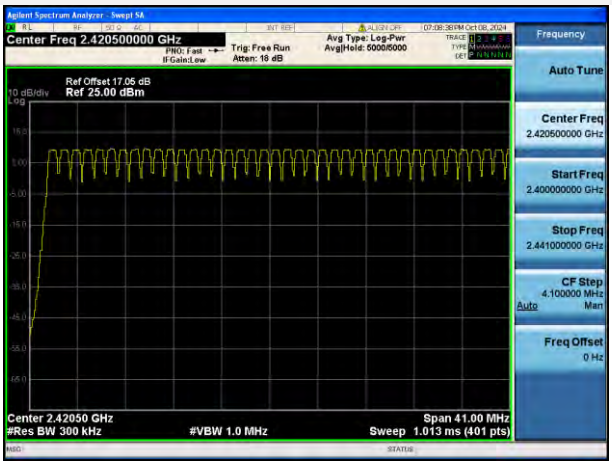
A.1 Number of Hopping Frequency

Test Data

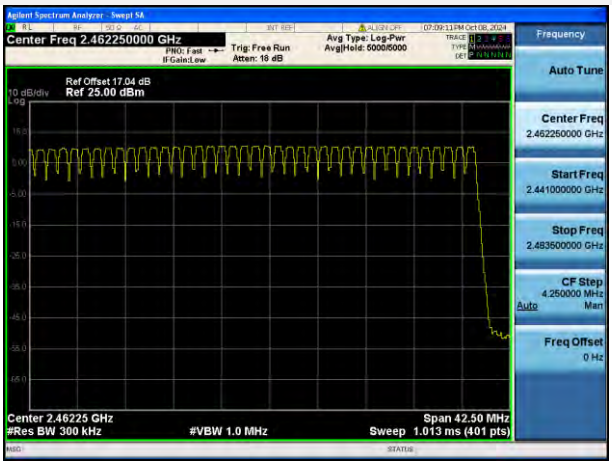
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	Pass
8-DPSK	2400 - 2483.5	79	15	Pass

Test Plots

GFSK 2.4 GHz ~ 2.4415 GHz

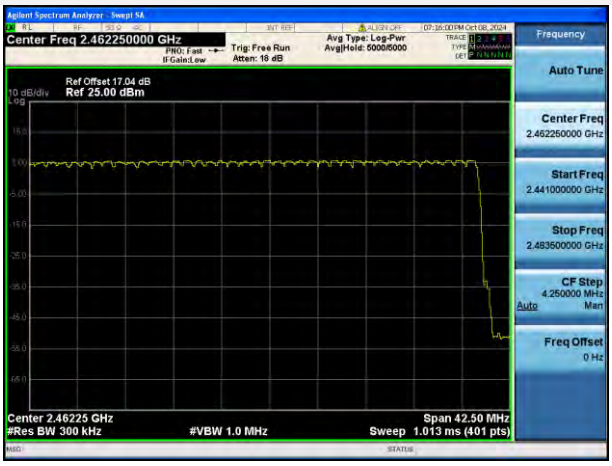


GFSK 2.4415 GHz ~ 2.4835 GHz



8-DPSK 2.4 GHz ~ 2.4415 GHz

8-DPSK 2.4415 GHz ~ 2.4835 GHz



A.2 Peak Output Power and E.I.R.P

Peak Power Test Data

Channel	Measured Output Peak Power						Limit		Verdict
	GFSK		π/4-DQPSK		8-DPSK		dBm	mW	
	dBm	mW	dBm	mW	dBm	mW			
Low	9.53	8.97	7.76	5.97	8.08	6.43	21	125	Pass
Middle	9.49	8.89	7.60	5.75	8.21	6.62			Pass
High	10.19	10.45	8.32	6.79	8.80	7.59			Pass

E.I.R.P Test Data (For ISED)

Channel	E.I.R.P						Limit		Verdict
	GFSK		π/4-DQPSK		8-DPSK		dBm	mW	
	dBm	mW	dBm	mW	dBm	mW			
Low	14.03	25.29	12.26	16.83	12.58	18.11	36	4000	Pass
Middle	13.99	25.06	12.10	16.22	12.71	18.66			Pass
High	14.69	29.44	12.82	19.14	13.30	21.38			Pass

Test Plots

GFSK LOW CHANNEL

GFSK MIDDLE CHANNEL

GFSK HIGH CHANNEL

π/4-DQPSK LOW CHANNEL

π/4-DQPSK MIDDLE CHANNEL

π/4-DQPSK HIGH CHANNEL

8-DPSK LOW CHANNEL

8-DPSK MIDDLE CHANNEL

8-DPSK HIGH CHANNEL

A.3 20 dB and 99% bandwidth

Test Data

GFSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.012700	0.896250
Middle	1.020000	0.897650
High	1.012500	0.898710
π/4-DQPSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.365200	1.198900
Middle	1.365000	1.198000
High	1.365000	1.198200
8-DPSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.350100	1.201400
Middle	1.349900	1.200500
High	1.342500	1.202200

Test Plots

20 dB Bandwidth

GFSK LOW CHANNEL

GFSK MIDDLE CHANNEL

GFSK HIGH CHANNEL

π/4-DQPSK LOW CHANNEL

π/4-DQPSK MIDDLE CHANNEL

π/4-DQPSK HIGH CHANNEL

8-DPSK LOW CHANNEL

8-DPSK MIDDLE CHANNEL

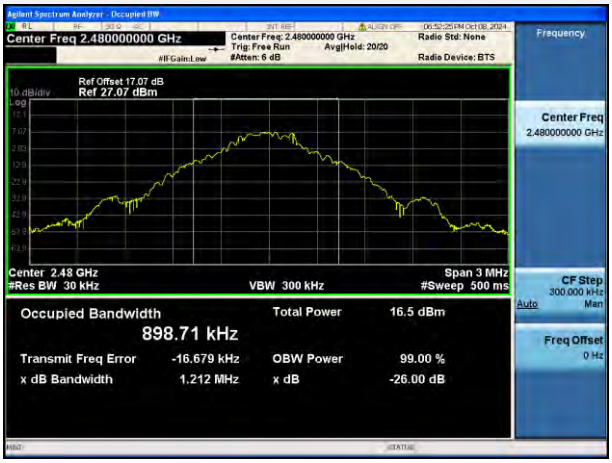
8-DPSK HIGH CHANNEL

99% Bandwidth

GFSK LOW CHANNEL

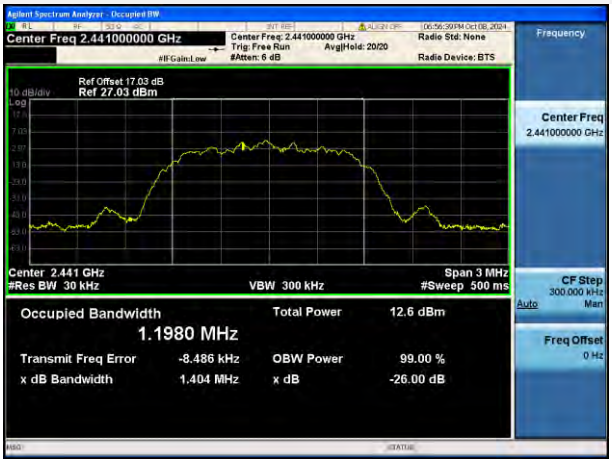
GFSK MIDDLE CHANNEL

GFSK HIGH CHANNEL



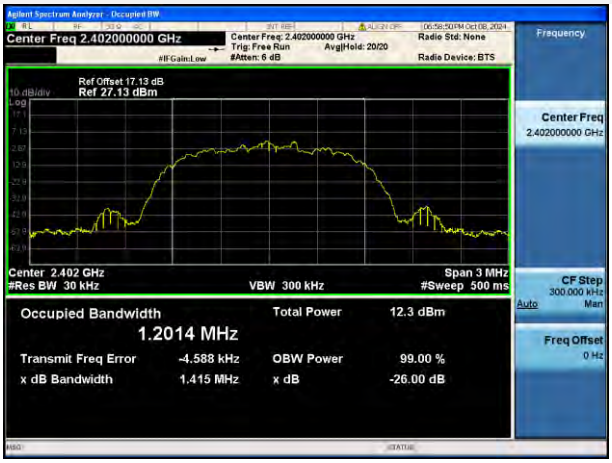
π/4-DQPSK LOW CHANNEL

π/4-DQPSK MIDDLE CHANNEL

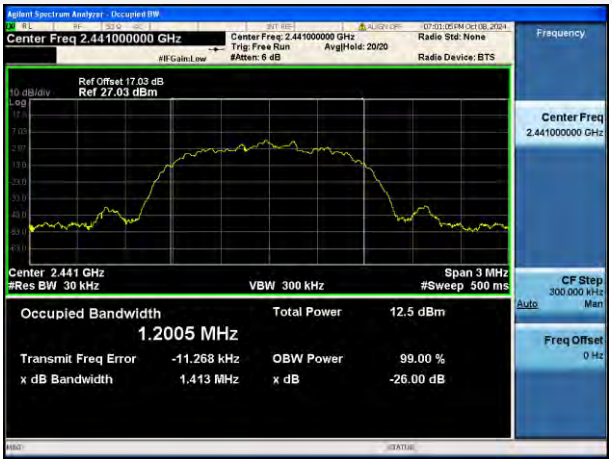


π/4-DQPSK HIGH CHANNEL

8-DPSK LOW CHANNEL



8-DPSK MIDDLE CHANNEL



8-DPSK HIGH CHANNEL

A.4 Hopping Frequency Separation

Test Data

Mode	Frequency separation (MHz)	2/3 of the 20 dB Bandwidth (MHz)	Verdict
GFSK	1.000	0.680	Pass
8-DPSK	1.000	0.900	Pass

Test Plots

GFSK

8-DPSK

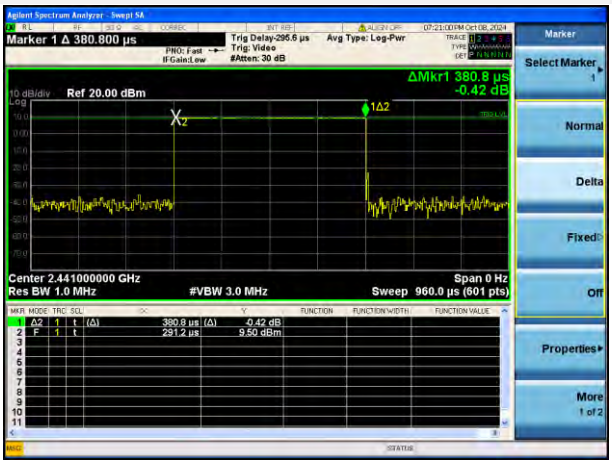
A.5 Average Time of Occupancy

Test Data

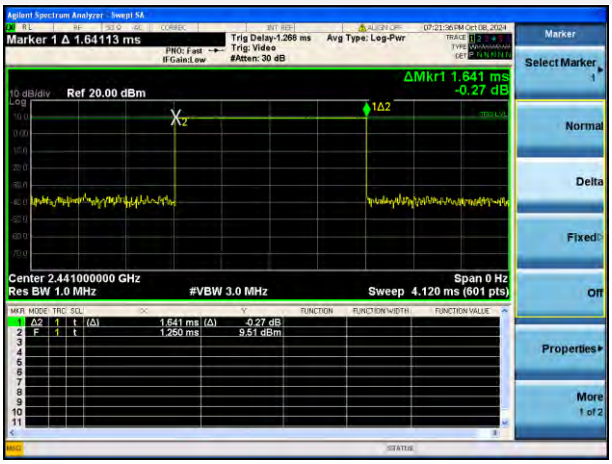
GFSK				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.38080	121.856	0.4	Pass
DH 3	1.64100	262.560	0.4	Pass
DH 5	2.88800	308.053	0.4	Pass
8-DPSK				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
3DH 1	0.38720	123.904	0.4	Pass
3DH 3	1.64100	262.560	0.4	Pass
3DH 5	2.88800	308.053	0.4	Pass
AFH Mode				
DH Packet	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
DH 1	0.38080	60.928	0.4	Pass
DH 3	1.63400	130.720	0.4	Pass
DH 5	2.87600	153.387	0.4	Pass

Test Plots

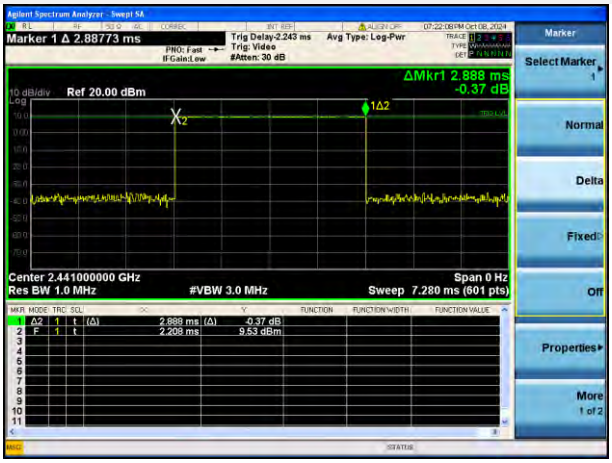
GFSK DH1



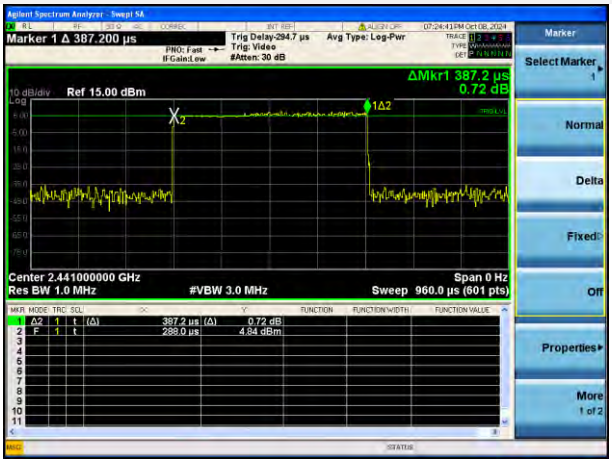
GFSK DH3



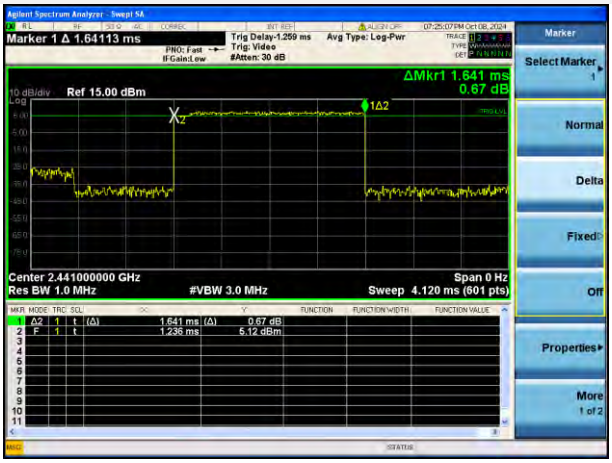
GFSK DH5



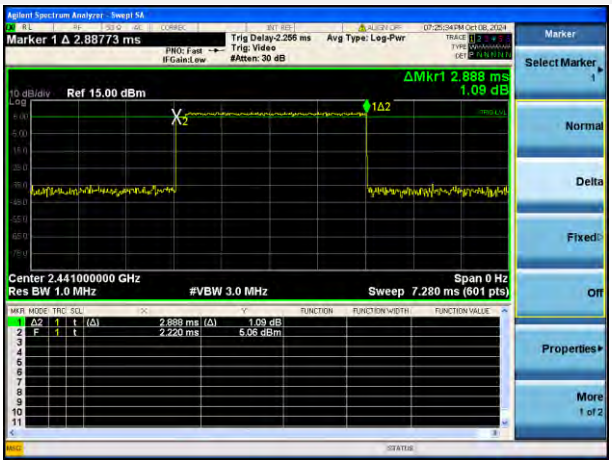
8-DPSK 3DH1



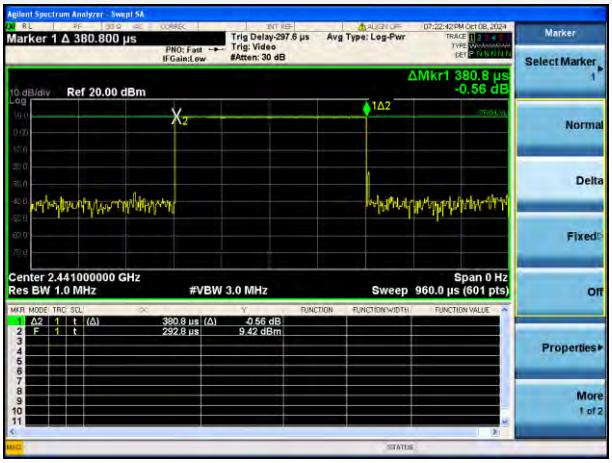
8-DPSK 3DH3



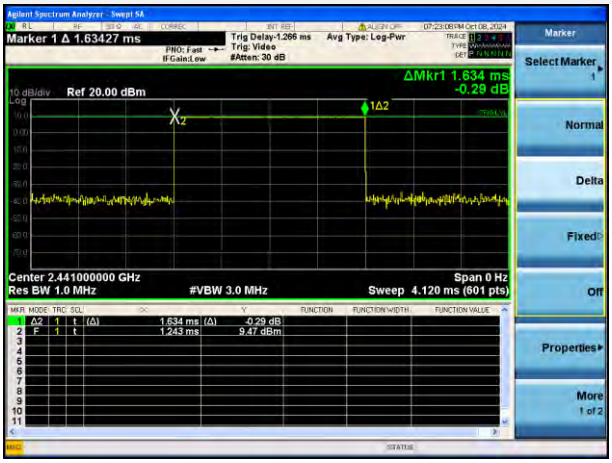
8-DPSK 3DH5



AFH Mode DH1



AFH Mode DH3



AFH Mode DH5

A.6 Conducted Spurious Emissions & Authorized-band band-edge

Test Data

GFSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-28.94	9.16	-10.84	Pass
Middle	-29.41	9.08	-10.92	Pass
High	-28.63	9.78	-10.22	Pass
8-DPSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-37.83	4.66	-15.34	Pass
Middle	-29.59	4.89	-15.11	Pass
High	-27.96	5.68	-14.32	Pass

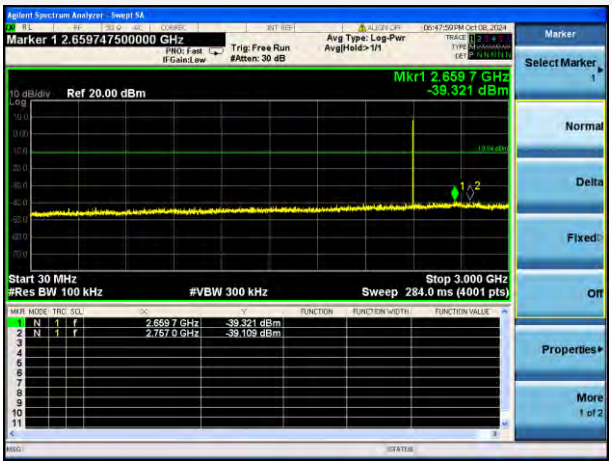
Hopping Mode				
Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
GFSK	-29.60	10.38	-9.62	Pass
8-DPSK	-29.83	4.47	-15.53	Pass

Test Plots

GFSK LOW CHANNEL, CARRIER LEVEL

GFSK LOW CHANNEL, BAND EDGE

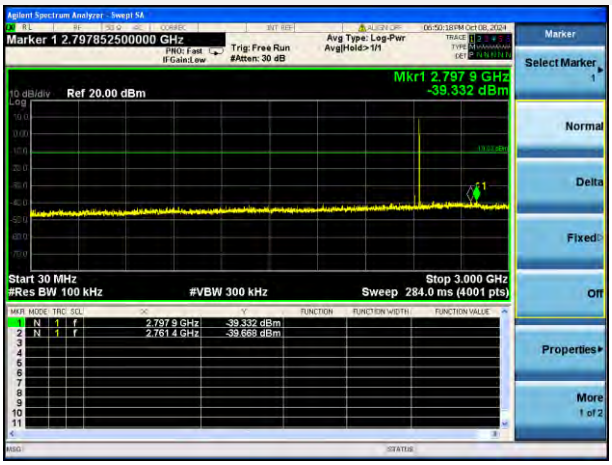
GFSK LOW CHANNEL, SPURIOUS
30 MHz ~ 3 GHz



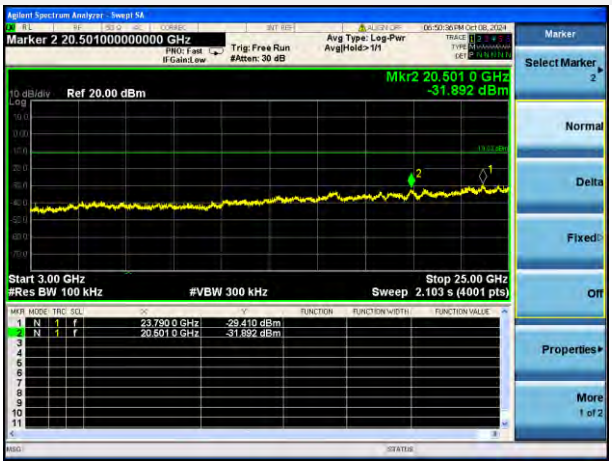
GFSK LOW CHANNEL, SPURIOUS
3 GHz ~ 25 GHz

GFSK MIDDLE CHANNEL, CARRIER LEVEL

GFSK MIDDLE CHANNEL, SPURIOUS
30 MHz ~ 3 GHz

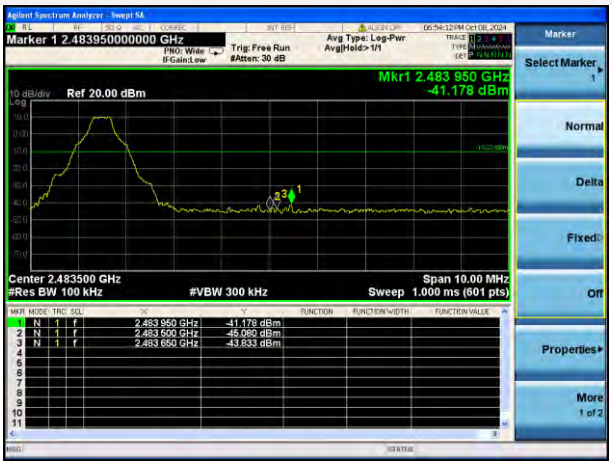


GFSK MIDDLE CHANNEL, SPURIOUS
3 GHz ~ 25 GHz

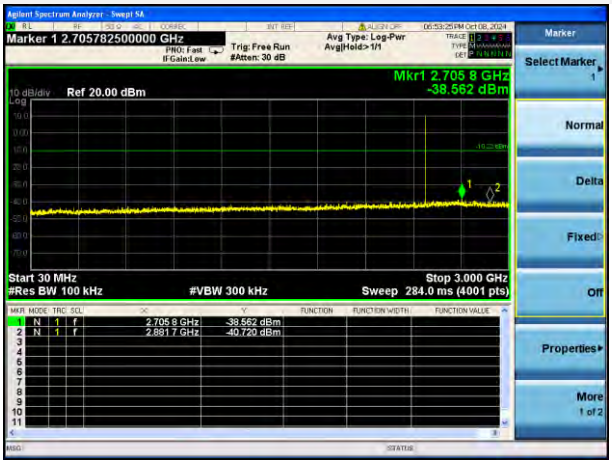


GFSK HIGH CHANNEL, CARRIER LEVEL

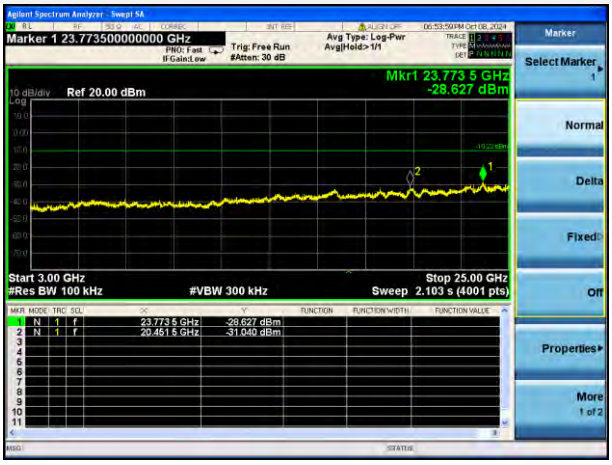
GFSK HIGH CHANNEL, BAND EDGE



GFSK HIGH CHANNEL, SPURIOUS
30 MHz ~ 3 GHz

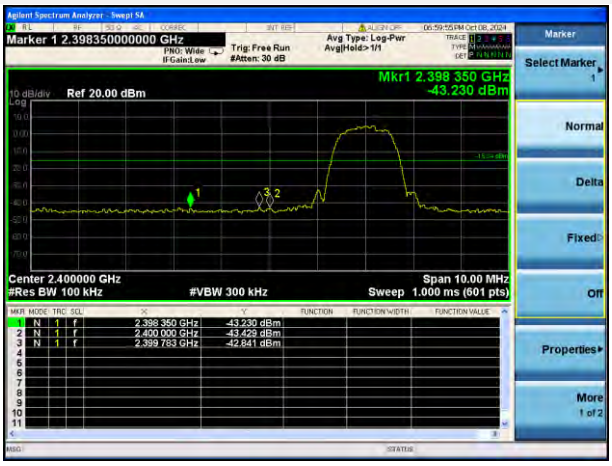


GFSK HIGH CHANNEL, SPURIOUS
3 GHz ~ 25 GHz

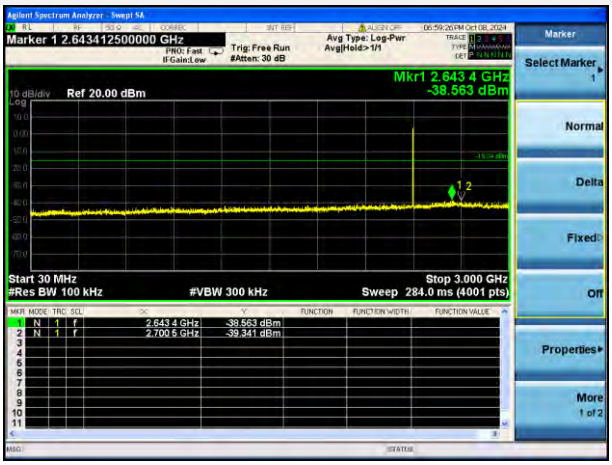


8-DPSK LOW CHANNEL, CARRIER LEVEL

8-DPSK LOW CHANNEL, BAND EDGE



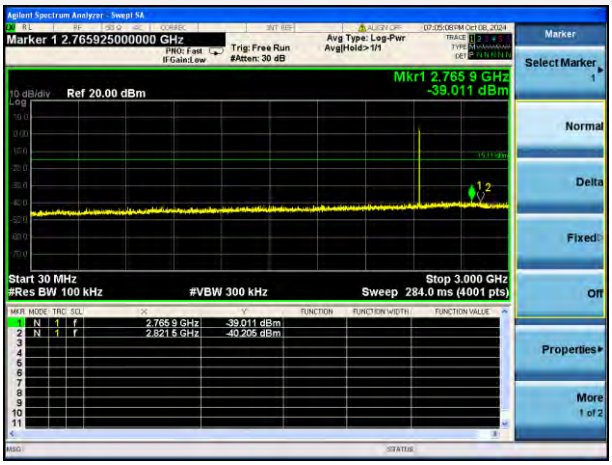
8-DPSK LOW CHANNEL, SPURIOUS
30 MHz ~ 3 GHz



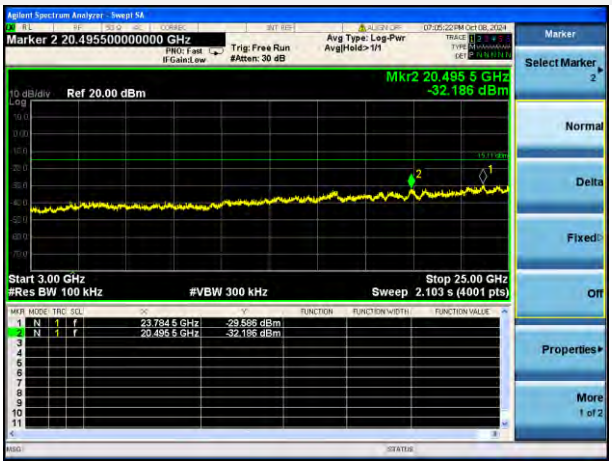
8-DPSK LOW CHANNEL, SPURIOUS
3 GHz ~ 25 GHz

8-DPSK MIDDLE CHANNEL, CARRIER LEVEL

8-DPSK MIDDLE CHANNEL, SPURIOUS
30 MHz ~ 3 GHz



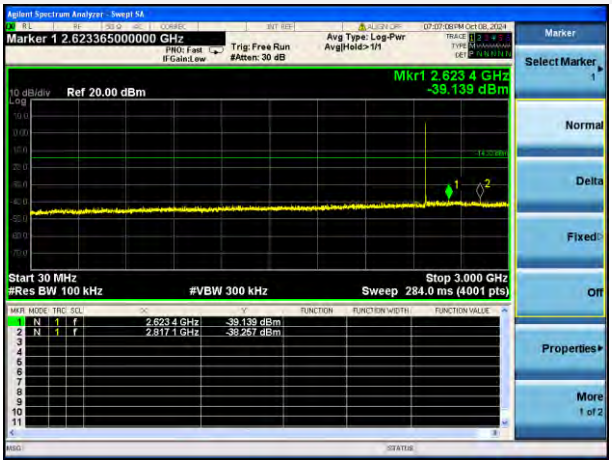
8-DPSK MIDDLE CHANNEL, SPURIOUS
3 GHz ~ 25 GHz



8-DPSK HIGH CHANNEL, CARRIER LEVEL

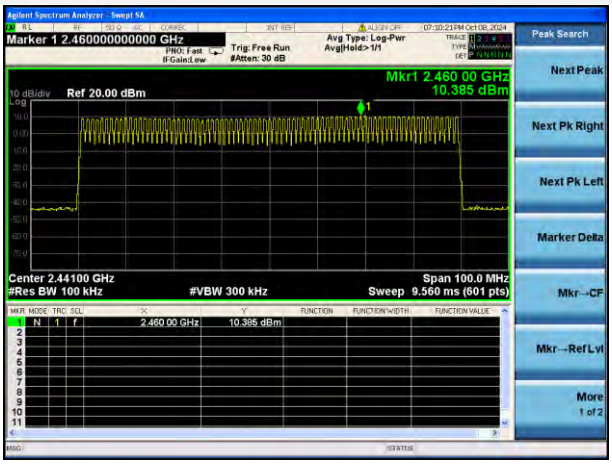
8-DPSK HIGH CHANNEL, BAND EDGE

8-DPSK HIGH CHANNEL, SPURIOUS
30 MHz ~ 3 GHz



8-DPSK HIGH CHANNEL, SPURIOUS
3 GHz ~ 25 GHz

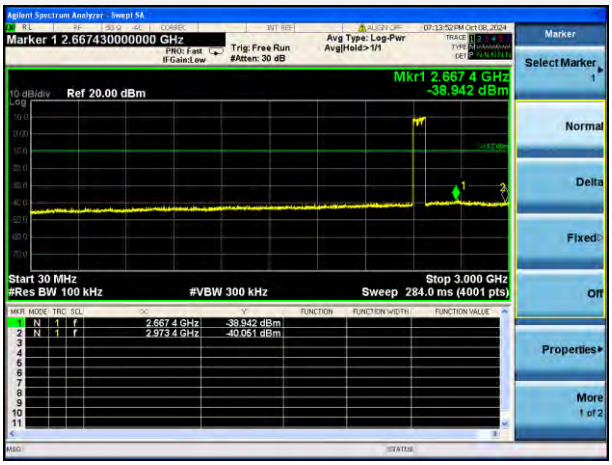
GFSK HOPPING, CARRIER LEVEL



GFSK HOPPING BAND EDGE (LOW)

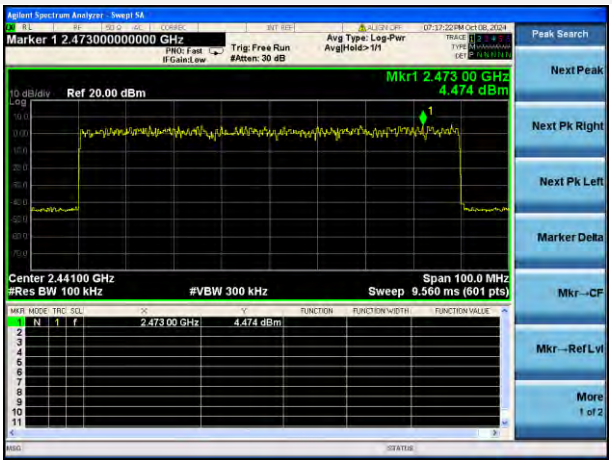
GFSK HOPPING BAND EDGE (HIGH)

GFSK Hopping Mode, SPURIOUS
30 MHz ~ 3 GHz



GFSK Hopping Mode, SPURIOUS
3GHz ~ 25 GHz

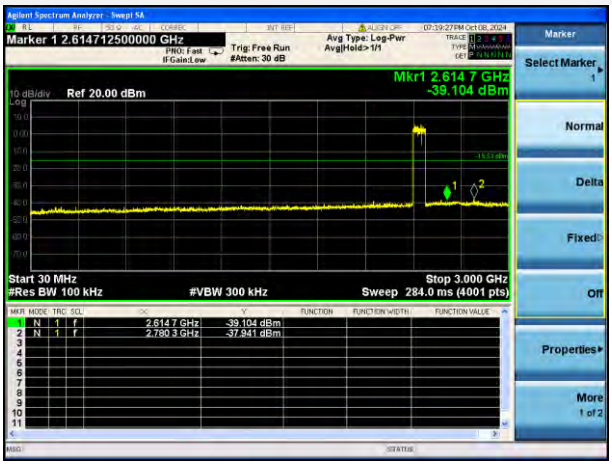
8-DPSK HOPPING, CARRIER LEVEL



8-DPSK Hopping BAND EDGE (LOW)

8-DPSK Hopping BAND EDGE (HIGH)

8-DPSK Hopping Mode, SPURIOUS
30 MHz ~ 3 GHz



8-DPSK Hopping Mode, SPURIOUS
3GHz ~ 25 GHz

A.7 Conducted Emissions

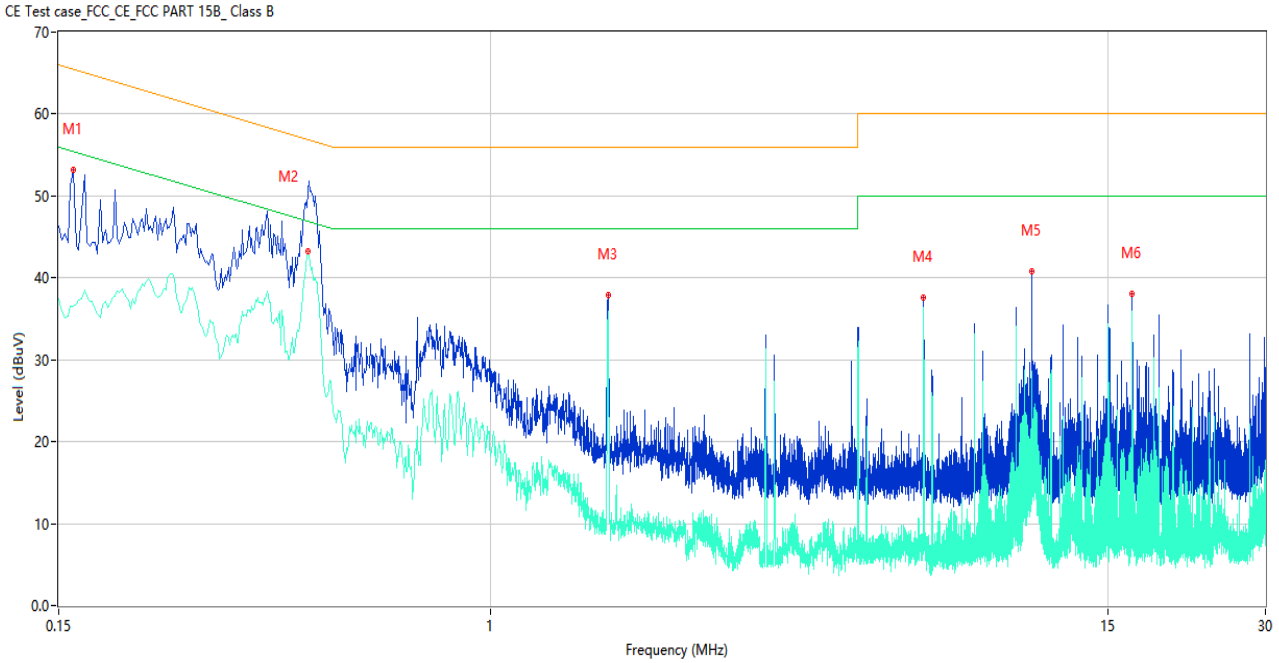
Note [1]: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

Note [2]: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Note [3]: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

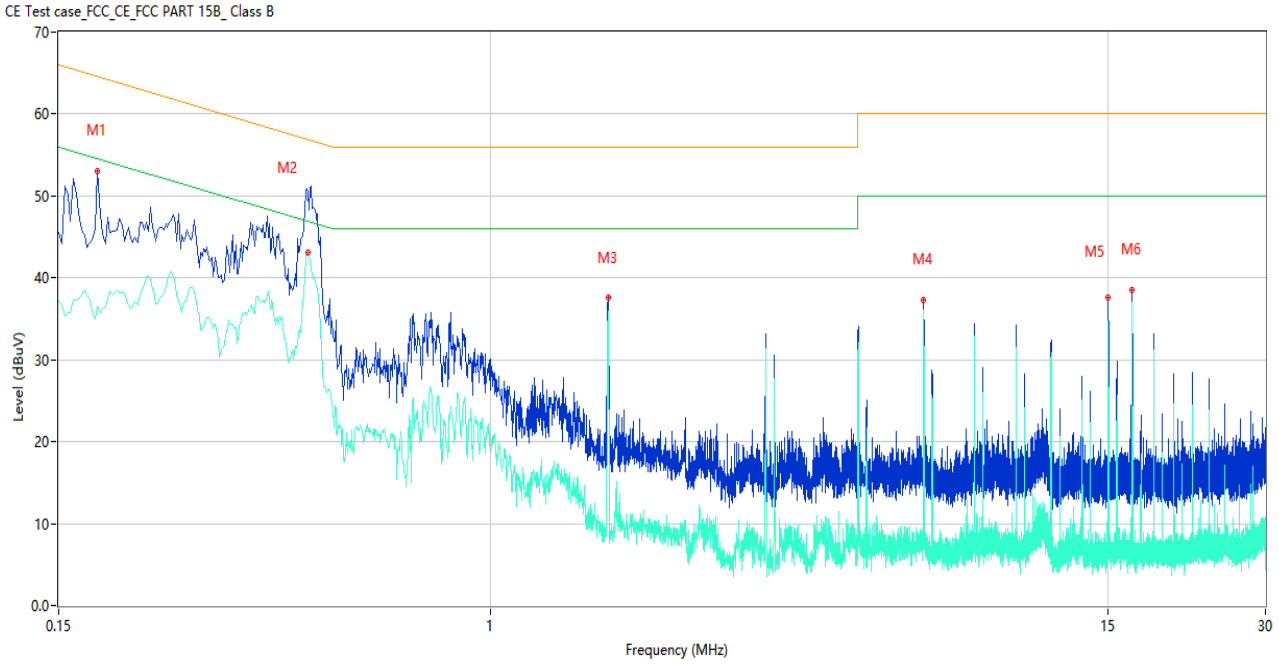
Test Data and Plots

PHASE L1



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.160	53.11	9.98	65.46	12.35	Peak	L1	Pass
1**	0.160	36.48	9.98	55.46	18.98	AV	L1	Pass
2	0.448	50.53	9.99	56.91	6.38	Peak	L1	Pass
2**	0.448	43.23	9.99	46.91	3.68	AV	L1	Pass
3	1.672	37.93	10.05	56.00	18.07	Peak	L1	Pass
3**	1.672	35.93	10.05	46.00	10.07	AV	L1	Pass
4	6.690	37.61	9.97	60.00	22.39	Peak	L1	Pass
4**	6.690	36.37	9.97	50.00	13.63	AV	L1	Pass
5	10.768	40.84	9.95	60.00	19.16	Peak	L1	Pass
5**	10.768	28.61	9.95	50.00	21.39	AV	L1	Pass
6	16.724	38.02	10.20	60.00	21.98	Peak	L1	Pass
6**	16.724	35.24	10.20	50.00	14.76	AV	L1	Pass

PHASE L2



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.178	53.01	9.92	64.58	11.57	Peak	L2	Pass
1**	0.178	36.57	9.92	54.58	18.01	AV	L2	Pass
2	0.448	50.36	9.99	56.91	6.55	Peak	L2	Pass
2**	0.448	43.05	9.99	46.91	3.86	AV	L2	Pass
3	1.672	37.55	10.05	56.00	18.45	Peak	L2	Pass
3**	1.672	35.84	10.05	46.00	10.16	AV	L2	Pass
4	6.692	37.22	9.98	60.00	22.78	Peak	L2	Pass
4**	6.692	36.10	9.98	50.00	13.90	AV	L2	Pass
5	15.056	37.57	10.18	60.00	22.43	Peak	L2	Pass
5**	15.056	33.89	10.18	50.00	16.11	AV	L2	Pass
6	16.726	38.48	10.20	60.00	21.52	Peak	L2	Pass
6**	16.726	36.92	10.20	50.00	13.08	AV	L2	Pass

A.8 Radiated Spurious Emission

Note [1]: The symbol of "--" in the table which means not application.

Note [2]: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

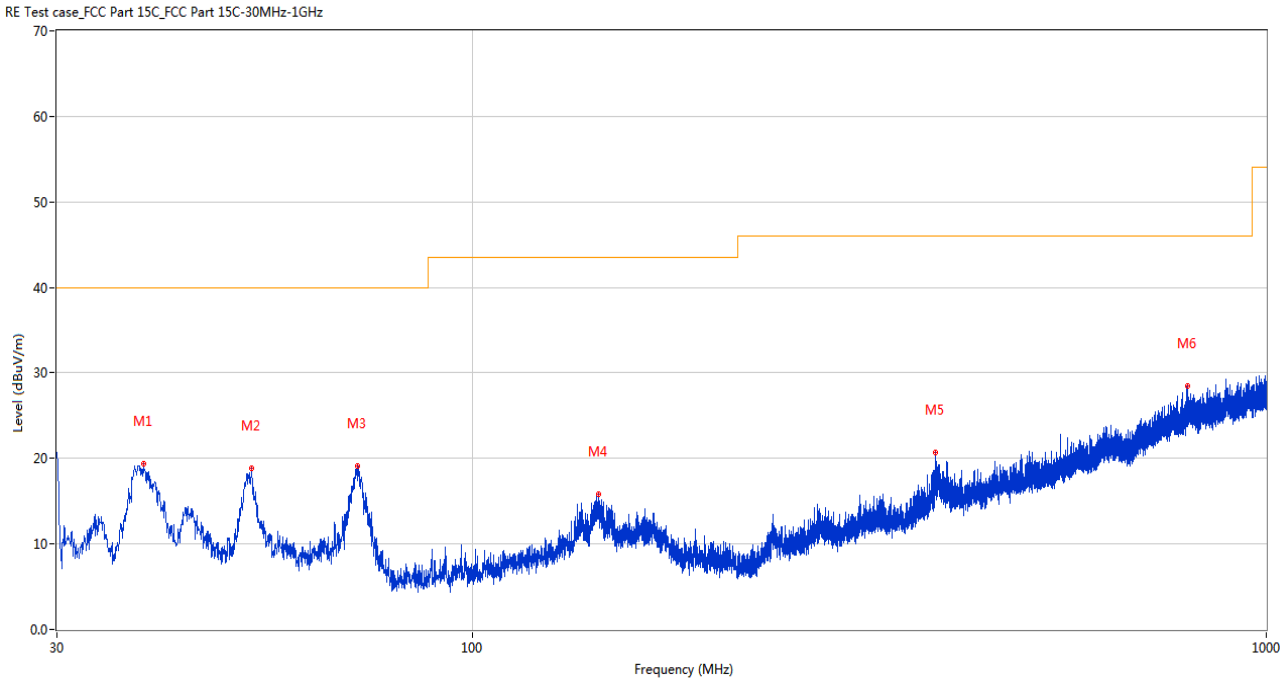
Note [3]: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and DH5-Hopping mode is the worst.

Note [4]: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

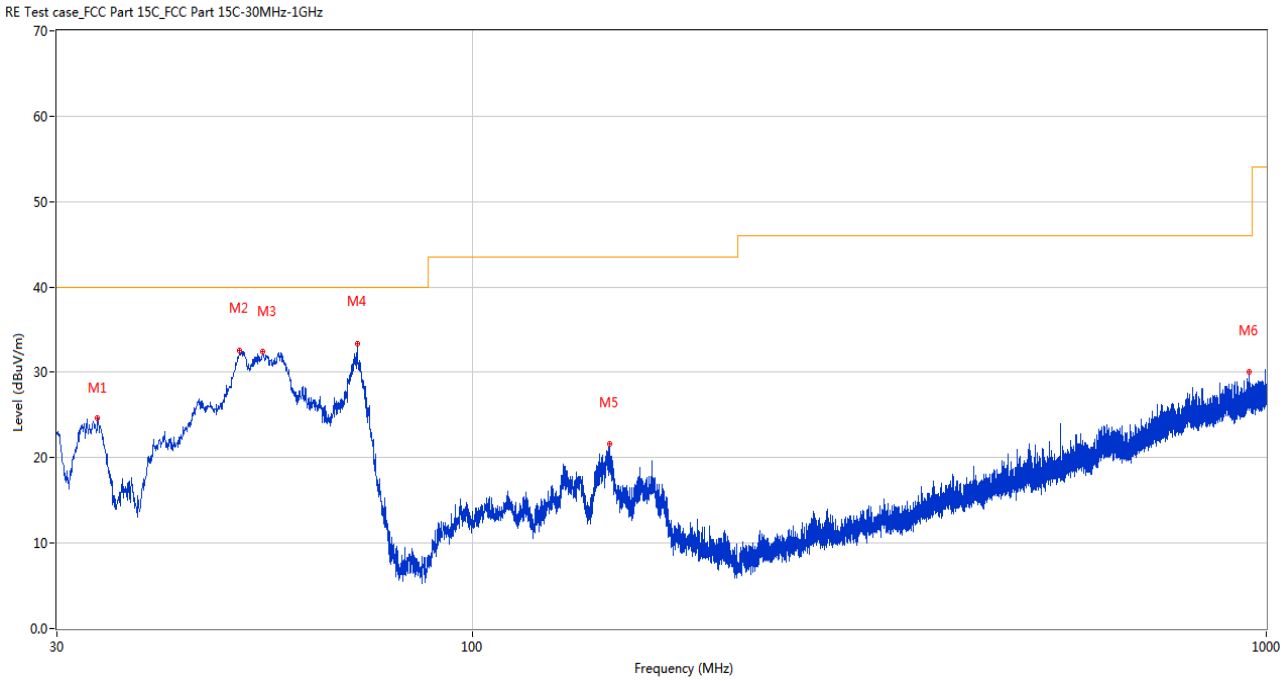
Test Data and Plots

30 MHz to 1 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	38.536	19.33	-26.80	40.0	20.67	Peak	118.00	200	Horizontal	Pass
2	52.795	18.85	-26.67	40.0	21.15	Peak	218.00	200	Horizontal	Pass
3	71.661	19.17	-29.02	40.0	20.83	Peak	201.00	200	Horizontal	Pass
4	144.169	15.83	-26.25	43.5	27.67	Peak	219.00	100	Horizontal	Pass
5	383.468	20.75	-21.87	46.0	25.25	Peak	254.00	100	Horizontal	Pass
6	796.737	28.45	-11.84	46.0	17.55	Peak	209.00	100	Horizontal	Pass

30 MHz to 1 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	33.734	24.71	-27.62	40.0	15.29	Peak	172.00	100	Vertical	Pass
2	50.952	32.54	-26.21	40.0	7.46	Peak	310.00	100	Vertical	Pass
3	54.541	32.47	-26.89	40.0	7.53	Peak	234.00	100	Vertical	Pass
4	71.613	33.31	-28.99	40.0	6.69	Peak	218.00	100	Vertical	Pass
5	149.019	21.56	-25.59	43.5	21.94	Peak	45.00	100	Vertical	Pass
6	950.482	30.00	-9.79	46.0	16.00	Peak	0.00	100	Vertical	Pass

Note [1]: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note [2]: The spurious from 18GHz-25GHz is noise only, do not show on the report.

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1339.383	40.04	74.0	33.96	Peak	83.00	300	Horizontal	Pass
1**	1339.383	29.29	54.0	24.71	AV	83.00	300	Horizontal	Pass
2	2973.868	51.37	74.0	22.63	Peak	137.00	100	Horizontal	Pass
2**	2973.868	42.37	54.0	11.63	AV	137.00	100	Horizontal	Pass
3	4918.594	48.79	74.0	25.21	Peak	121.00	200	Horizontal	Pass
3**	4918.594	37.90	54.0	16.10	AV	121.00	200	Horizontal	Pass
4	7627.586	52.42	74.0	21.58	Peak	336.00	200	Horizontal	Pass
4**	7627.586	45.96	54.0	8.04	AV	336.00	200	Horizontal	Pass
5	12472.631	52.11	74.0	21.89	Peak	234.00	100	Horizontal	Pass
5**	12472.631	47.40	54.0	6.60	AV	234.00	100	Horizontal	Pass
6	16858.296	53.90	74.0	20.10	Peak	253.00	400	Horizontal	Pass
6**	16858.296	45.43	54.0	8.57	AV	253.00	400	Horizontal	Pass

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1466.497	39.63	74.0	34.37	Peak	86.00	300	Vertical	Pass
1**	1466.497	34.82	54.0	19.18	AV	86.00	300	Vertical	Pass
2	2990.304	48.44	74.0	25.56	Peak	117.00	200	Vertical	Pass
2**	2990.304	41.60	54.0	12.40	AV	117.00	200	Vertical	Pass
3	4823.442	52.22	74.0	21.78	Peak	157.00	200	Vertical	Pass
3**	4823.442	38.67	54.0	15.33	AV	157.00	200	Vertical	Pass
4	7970.533	50.61	74.0	23.39	Peak	212.00	400	Vertical	Pass
4**	7970.533	41.63	54.0	12.37	AV	212.00	400	Vertical	Pass
5	12443.404	55.64	74.0	18.36	Peak	135.00	200	Vertical	Pass
5**	12443.404	45.34	54.0	8.66	AV	135.00	200	Vertical	Pass
6	17457.163	56.04	74.0	17.96	Peak	241.00	200	Vertical	Pass
6**	17457.163	47.91	54.0	6.09	AV	241.00	200	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1333.636	44.95	74.0	29.05	Peak	347.00	100	Horizontal	Pass
1**	1333.636	29.10	54.0	24.90	AV	347.00	100	Horizontal	Pass
2	2976.131	51.27	74.0	22.73	Peak	77.00	400	Horizontal	Pass
2**	2976.131	41.39	54.0	12.61	AV	77.00	400	Horizontal	Pass
3	4912.191	49.71	74.0	24.29	Peak	134.00	200	Horizontal	Pass
3**	4912.191	41.56	54.0	12.44	AV	134.00	200	Horizontal	Pass
4	7629.607	52.77	74.0	21.23	Peak	264.00	200	Horizontal	Pass
4**	7629.607	45.27	54.0	8.73	AV	264.00	200	Horizontal	Pass
5	12476.242	52.27	74.0	21.73	Peak	132.00	400	Horizontal	Pass
5**	12476.242	46.56	54.0	7.44	AV	132.00	400	Horizontal	Pass
6	16859.332	57.01	74.0	16.99	Peak	241.00	400	Horizontal	Pass
6**	16859.332	48.01	54.0	5.99	AV	241.00	400	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1460.371	40.05	74.0	33.95	Peak	136.00	300	Vertical	Pass
1**	1460.371	30.44	54.0	23.56	AV	136.00	300	Vertical	Pass
2	2988.596	49.45	74.0	24.55	Peak	252.00	200	Vertical	Pass
2**	2988.596	42.79	54.0	11.21	AV	252.00	200	Vertical	Pass
3	4823.732	47.05	74.0	26.95	Peak	330.00	200	Vertical	Pass
3**	4823.732	40.88	54.0	13.12	AV	330.00	200	Vertical	Pass
4	7967.446	52.44	74.0	21.56	Peak	79.00	400	Vertical	Pass
4**	7967.446	44.84	54.0	9.16	AV	79.00	400	Vertical	Pass
5	12441.842	51.60	74.0	22.40	Peak	45.00	100	Vertical	Pass
5**	12441.842	43.92	54.0	10.08	AV	45.00	100	Vertical	Pass
6	17453.337	57.87	74.0	16.13	Peak	54.00	200	Vertical	Pass
6**	17453.337	44.12	54.0	9.88	AV	54.00	200	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1335.371	41.04	74.0	32.96	Peak	33.00	400	Horizontal	Pass
1**	1335.371	30.76	54.0	23.24	AV	33.00	400	Horizontal	Pass
2	2976.292	52.95	74.0	21.05	Peak	1.00	200	Horizontal	Pass
2**	2976.292	39.32	54.0	14.68	AV	1.00	200	Horizontal	Pass
3	4915.432	47.53	74.0	26.47	Peak	242.00	200	Horizontal	Pass
3**	4915.432	40.10	54.0	13.90	AV	242.00	200	Horizontal	Pass
4	7624.979	53.05	74.0	20.95	Peak	241.00	100	Horizontal	Pass
4**	7624.979	43.30	54.0	10.70	AV	241.00	100	Horizontal	Pass
5	12473.646	51.59	74.0	22.41	Peak	350.00	100	Horizontal	Pass
5**	12473.646	42.23	54.0	11.77	AV	350.00	100	Horizontal	Pass
6	16863.007	53.36	74.0	20.64	Peak	207.00	300	Horizontal	Pass
6**	16863.007	48.43	54.0	5.57	AV	207.00	300	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1466.782	43.42	74.0	30.58	Peak	228.00	300	Vertical	Pass
1**	1466.782	33.80	54.0	20.20	AV	228.00	300	Vertical	Pass
2	2994.529	50.96	74.0	23.04	Peak	145.00	200	Vertical	Pass
2**	2994.529	39.99	54.0	14.01	AV	145.00	200	Vertical	Pass
3	4822.092	47.23	74.0	26.77	Peak	170.00	200	Vertical	Pass
3**	4822.092	36.88	54.0	17.12	AV	170.00	200	Vertical	Pass
4	7968.058	52.45	74.0	21.55	Peak	229.00	200	Vertical	Pass
4**	7968.058	43.16	54.0	10.84	AV	229.00	200	Vertical	Pass
5	12445.475	55.31	74.0	18.69	Peak	285.00	200	Vertical	Pass
5**	12445.475	47.41	54.0	6.59	AV	285.00	200	Vertical	Pass
6	17458.666	52.17	74.0	21.83	Peak	335.00	400	Vertical	Pass
6**	17458.666	45.50	54.0	8.50	AV	335.00	400	Vertical	Pass

8-DPSK LOW CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1289.025	40.94	74.0	33.06	Peak	139.00	200	Horizontal	Pass
1**	1289.025	32.36	54.0	21.64	AV	139.00	200	Horizontal	Pass
2	2769.098	52.55	74.0	21.45	Peak	76.00	100	Horizontal	Pass
2**	2769.098	44.31	54.0	9.69	AV	76.00	100	Horizontal	Pass
3	5163.489	51.97	74.0	22.03	Peak	344.00	200	Horizontal	Pass
3**	5163.489	40.81	54.0	13.19	AV	344.00	200	Horizontal	Pass
4	6808.605	56.01	74.0	17.99	Peak	305.00	200	Horizontal	Pass
4**	6808.605	46.86	54.0	7.14	AV	305.00	200	Horizontal	Pass
5	13468.234	52.49	74.0	21.51	Peak	35.00	400	Horizontal	Pass
5**	13468.234	45.47	54.0	8.53	AV	35.00	400	Horizontal	Pass
6	17463.650	55.76	74.0	18.24	Peak	225.00	400	Horizontal	Pass
6**	17463.650	44.92	54.0	9.08	AV	225.00	400	Horizontal	Pass

8-DPSK LOW CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1279.622	45.42	74.0	28.58	Peak	308.00	400	Vertical	Pass
1**	1279.622	34.23	54.0	19.77	AV	308.00	400	Vertical	Pass
2	2768.297	51.06	74.0	22.94	Peak	11.00	300	Vertical	Pass
2**	2768.297	42.82	54.0	11.18	AV	11.00	300	Vertical	Pass
3	5164.312	52.48	74.0	21.52	Peak	175.00	200	Vertical	Pass
3**	5164.312	44.73	54.0	9.27	AV	175.00	200	Vertical	Pass
4	6805.694	55.19	74.0	18.81	Peak	145.00	400	Vertical	Pass
4**	6805.694	43.78	54.0	10.22	AV	145.00	400	Vertical	Pass
5	13468.126	52.08	74.0	21.92	Peak	5.00	200	Vertical	Pass
5**	13468.126	42.21	54.0	11.79	AV	5.00	200	Vertical	Pass
6	17465.950	58.71	74.0	15.29	Peak	291.00	400	Vertical	Pass
6**	17465.950	48.91	54.0	5.09	AV	291.00	400	Vertical	Pass

8-DPSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1285.750	43.40	74.0	30.60	Peak	200.00	100	Horizontal	Pass
1**	1285.750	30.49	54.0	23.51	AV	200.00	100	Horizontal	Pass
2	2768.327	52.47	74.0	21.53	Peak	138.00	400	Horizontal	Pass
2**	2768.327	40.09	54.0	13.91	AV	138.00	400	Horizontal	Pass
3	5165.740	53.55	74.0	20.45	Peak	177.00	200	Horizontal	Pass
3**	5165.740	45.42	54.0	8.58	AV	177.00	200	Horizontal	Pass
4	6805.639	57.52	74.0	16.48	Peak	342.00	400	Horizontal	Pass
4**	6805.639	45.20	54.0	8.80	AV	342.00	400	Horizontal	Pass
5	13468.484	54.79	74.0	19.21	Peak	289.00	400	Horizontal	Pass
5**	13468.484	46.42	54.0	7.58	AV	289.00	400	Horizontal	Pass
6	17469.051	53.63	74.0	20.37	Peak	292.00	200	Horizontal	Pass
6**	17469.051	46.63	54.0	7.37	AV	292.00	200	Horizontal	Pass

8-DPSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1285.092	42.91	74.0	31.09	Peak	236.00	400	Vertical	Pass
1**	1285.092	35.92	54.0	18.08	AV	236.00	400	Vertical	Pass
2	2768.685	56.32	74.0	17.68	Peak	7.00	100	Vertical	Pass
2**	2768.685	47.93	54.0	6.07	AV	7.00	100	Vertical	Pass
3	5168.144	54.76	74.0	19.24	Peak	54.00	200	Vertical	Pass
3**	5168.144	43.50	54.0	10.50	AV	54.00	200	Vertical	Pass
4	6805.343	51.93	74.0	22.07	Peak	54.00	200	Vertical	Pass
4**	6805.343	45.87	54.0	8.13	AV	54.00	200	Vertical	Pass
5	13469.625	51.95	74.0	22.05	Peak	40.00	400	Vertical	Pass
5**	13469.625	43.76	54.0	10.24	AV	40.00	400	Vertical	Pass
6	17462.323	58.79	74.0	15.21	Peak	130.00	100	Vertical	Pass
6**	17462.323	48.05	54.0	5.95	AV	130.00	100	Vertical	Pass

8-DPSK HIGH CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1284.491	39.80	74.0	34.20	Peak	166.00	200	Horizontal	Pass
1**	1284.491	33.59	54.0	20.41	AV	166.00	200	Horizontal	Pass
2	2773.700	53.45	74.0	20.55	Peak	12.00	300	Horizontal	Pass
2**	2773.700	42.81	54.0	11.19	AV	12.00	300	Horizontal	Pass
3	5164.173	52.69	74.0	21.31	Peak	340.00	200	Horizontal	Pass
3**	5164.173	45.62	54.0	8.38	AV	340.00	200	Horizontal	Pass
4	6810.030	52.31	74.0	21.69	Peak	232.00	300	Horizontal	Pass
4**	6810.030	46.93	54.0	7.07	AV	232.00	300	Horizontal	Pass
5	13464.960	58.19	74.0	15.81	Peak	236.00	300	Horizontal	Pass
5**	13464.960	42.98	54.0	11.02	AV	236.00	300	Horizontal	Pass
6	17466.794	53.12	74.0	20.88	Peak	30.00	400	Horizontal	Pass
6**	17466.794	44.67	54.0	9.33	AV	30.00	400	Horizontal	Pass

8-DPSK HIGH CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1284.872	45.53	74.0	28.47	Peak	117.00	200	Vertical	Pass
1**	1284.872	32.89	54.0	21.11	AV	117.00	200	Vertical	Pass
2	2767.275	55.25	74.0	18.75	Peak	299.00	200	Vertical	Pass
2**	2767.275	44.16	54.0	9.84	AV	299.00	200	Vertical	Pass
3	5164.191	57.20	74.0	16.80	Peak	320.00	200	Vertical	Pass
3**	5164.191	45.44	54.0	8.56	AV	320.00	200	Vertical	Pass
4	6806.970	54.78	74.0	19.22	Peak	313.00	100	Vertical	Pass
4**	6806.970	45.95	54.0	8.05	AV	313.00	100	Vertical	Pass
5	13466.561	54.31	74.0	19.69	Peak	206.00	100	Vertical	Pass
5**	13466.561	41.74	54.0	12.26	AV	206.00	100	Vertical	Pass
6	17467.125	59.87	74.0	14.13	Peak	121.00	100	Vertical	Pass
6**	17467.125	50.18	54.0	3.82	AV	121.00	100	Vertical	Pass

A.9 Band Edge (Restricted-band band-edge)

Note [1]: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Note [2]: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note [3]: According the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note [4]: The Level (dBuV/m) has been corrected by factor.

Test Data

GFSK LOW CHANNEL

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2362.281	56.1	74.0	17.90	Peak	297.00	300	Horizontal	Pass
1**	2362.281	47.45	54.0	6.55	AV	297.00	300	Horizontal	Pass
2	2390.000	54.92	74.0	19.08	Peak	160.00	100	Horizontal	Pass
2**	2390.000	47.36	54.0	6.64	AV	160.00	100	Horizontal	Pass

GFSK HIGH CHANNEL

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	55.39	74.0	18.61	Peak	275.00	300	Horizontal	Pass
1**	2483.500	48.15	54.0	5.85	AV	275.00	300	Horizontal	Pass
2	2485.502	59.67	74.0	14.33	Peak	2.00	200	Horizontal	Pass
2**	2485.502	47.03	54.0	6.97	AV	2.00	200	Horizontal	Pass

8-DPSK LOW CHANNEL

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2363.444	58.54	74.0	15.46	Peak	46.00	100	Horizontal	Pass
1**	2363.444	44.13	54.0	9.87	AV	46.00	100	Horizontal	Pass
2	2390.000	55.32	74.0	18.68	Peak	238.00	200	Horizontal	Pass
2**	2390.000	46.43	54.0	7.57	AV	238.00	200	Horizontal	Pass

8-DPSK HIGH CHANNEL

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	57.11	74.0	16.89	Peak	171.00	300	Horizontal	Pass
1**	2483.500	45.65	54.0	8.35	AV	171.00	300	Horizontal	Pass
2	2485.525	59.29	74.0	14.71	Peak	158.00	300	Horizontal	Pass
2**	2485.525	45.99	54.0	8.01	AV	158.00	300	Horizontal	Pass

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2481098-AR.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2481098-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2481098-AI.PDF”.

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