RADIO TEST REPORT
FCC ID: 2BRKV-1018

Product: Stem2

Trade Mark: N/A

Model No.: 1018

Family Model: N/A

Report No.: S24101501301001

Issue Date: Oct. 31, 2025

Prepared for

AshDust UK Limited

Unit 12.1 - 12.2, 11-29 Fashion Street, LONDON, E1 6PX, United Kingdom

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

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Tel. 0755-2320 0050 Website: http://www.ntek.org.cn

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1 TEST RESULT CERTIFICATION

Applicant's name ..... :	AshDust UK Limited
Address..... :	Unit 12.1 - 12.2, 11-29 Fashion Street, LONDON, E1 6PX, United Kingdom
Manufacturer's Name ..... :	AshDust UK Limited
Address..... :	Unit 12.1 - 12.2, 11-29 Fashion Street, LONDON, E1 6PX, United Kingdom
Product description	
Product name ..... :	Stem2
Trade Mark..... :	N/A
Model name ..... :	1018
Family Model ..... :	N/A
Test Sample Number ..... :	S241015013001
Date of Test..... :	Oct. 24, 2024 ~ Oct. 31, 2025

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD/ TEST PROCEDURE	TEST RESULT
FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C ANSI C63.10-2020 KDB 558074 D01 15.247 Meas Guidance v05r02	Complied

This device described above has been tested by Shenzhen NTEK Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
This report shall not be reproduced except in full, without the written approval of Shenzhen NTEK Testing Technology Co., Ltd., this document may be altered or revised by Shenzhen NTEK Testing Technology Co., Ltd., personnel only, and shall be noted in the revision of the document.
The test results of this report relate only to the tested sample identified in this report.

Prepared By : Gavan Zhang
Gavan Zhang
(Project Engineer)

Reviewed By : Aaron Cheng
Aaron Cheng
(Supervisor)

Approved By : Alex Li
Alex Li
(Manager)

2 SUMMARY OF TEST RESULTS

FCC Part15 (15.247), Subpart C			
Standard Section	**Test Item**	**Verdict**	**Remark**
15.207	Conducted Emission	PASS	
15.209 (a) 15.205 (a)	Radiated Spurious Emission	PASS	
15.247(a)(1)	Hopping Channel Separation	PASS	
15.247(b)(1)	Peak Output Power	PASS	
15.247(a)(iii)	Number of Hopping Frequency	PASS	
15.247(a)(iii)	Dwell Time	PASS	
15.247(a)(1)	Bandwidth	PASS	
15.247 (d)	Band Edge Emission	PASS	
15.247 (d)	Spurious RF Conducted Emission	PASS	
15.203	Antenna Requirement	PASS	

Remark:
1. “N/A” denotes test is not applicable in this Test Report.
2. All test items were verified and recorded according to the standards and without any deviation during the test.

3 FACILITIES AND ACCREDITATIONS

3.1 FACILITIES

All measurement facilities used to collect the measurement data are located at
No. 24 Xinfa East Road, Xiangshan Community, Xinqiao Street, Baoan District, Shenzhen, Guangdong, People's Republic of China.

3.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

CNAS-Lab.	:	The Certificate Registration Number is L5516.
IC-Registration		The Certificate Registration Number is 9270A. CAB identifier:CN0074
FCC- Accredited		Test Firm Registration Number: 463705. Designation Number: CN1184
A2LA-Lab.		The Certificate Registration Number is 4298.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

3.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	±3.70dB
2	RF power, conducted	±0.9dB
3	Spurious emissions, conducted	±2.2dB
4	Occupied bandwidth	±1.15%
5	All emissions, radiated(<1G)	±4.9dB
6	All emissions, radiated(>1G)	±5.1dB
7	Temperature	±0.5°C
8	Humidity	±2%
9	Time	±0.01%

4 GENERAL DESCRIPTION OF EUT

Product Feature and Specification	
Equipment	Stem2
Trade Mark	N/A
FCC ID	2BRKV-1018
Model No.	1018
Family Model	N/A
Model Difference	N/A
Operating Frequency	2402MHz~2480MHz
Modulation	GFSK, π/4-DQPSK, 8-DPSK
Number of Channels	79 Channels
Antenna Type	PIFA Antenna
Antenna Gain	0.7 dBi
Adapter	N/A
Battery	DC 7.3V, 6600mAh
Power supply	DC 7.3V from battery or DC 5V from Type-C port
HW Version	N/A
FW Version	N/A
SW Version	N/A

Note 1: Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.

Note 2: The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

Revision History

Report No.	Version	Description	Issued Date
S24101501301001	Rev.01	Initial issue of report	Oct. 31, 2025

5 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for GFSK modulation; 2Mbps for π/4-DQPSK modulation; 3Mbps for 8-DPSK modulation) were used for all test.
The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

Carrier Frequency and Channel list:

Channel	Frequency(MHz)
0	2402
1	2403
…	…
39	2441
40	2442
…	…
77	2479
78	2480

Note: fc=2402MHz+k×1MHz k=0 to 78
The following summary table is showing all test modes to demonstrate in compliance with the standard.

For AC Conducted Emission	
Final Test Mode	Description
Mode 1	normal link mode

Note: AC power line Conducted Emission was tested under maximum output power.

For Radiated Test Cases	
Final Test Mode	Description
Mode 1	normal link mode
Mode 2	CH00(2402MHz)
Mode 3	CH39(2441MHz)
Mode 4	CH78(2480MHz)

Note: For radiated test cases, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and no other significantly frequencies found in conducted spurious emission.

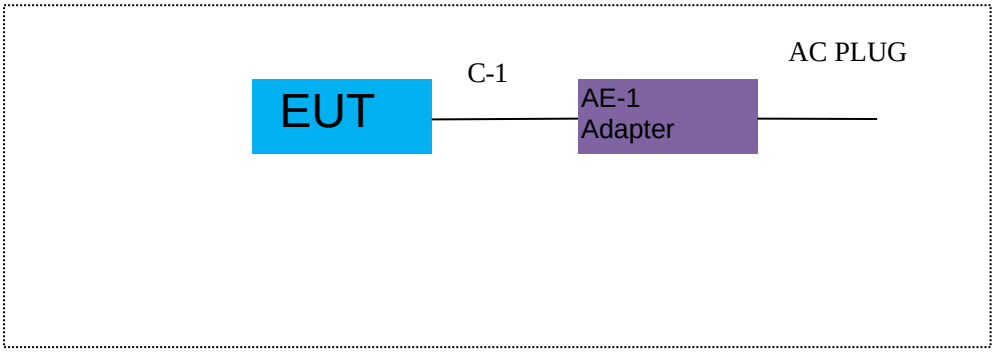
For Conducted Test Cases	
Final Test Mode	Description
Mode 2	CH00(2402MHz)
Mode 3	CH39(2441MHz)
Mode 4	CH78(2480MHz)
Mode 5	Hopping mode

Note: The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

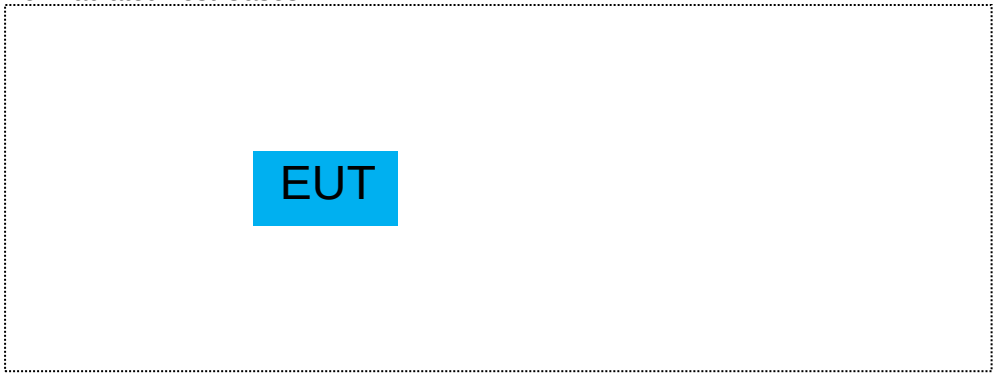
6 SETUP OF EQUIPMENT UNDER TEST

6.1 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM

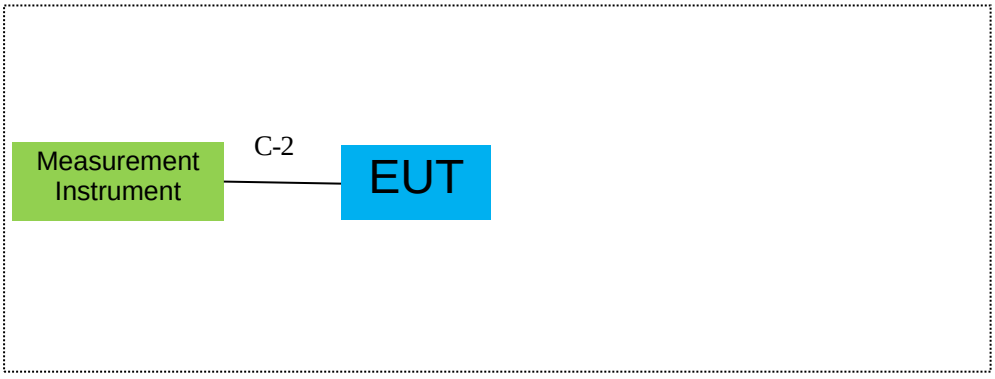
For AC Conducted Emission Mode



For Radiated Test Cases



For Conducted Test Cases



Note: 1. The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

2. EUT built-in battery-powered, the battery is fully-charged.

6.2 SUPPORT EQUIPMENT

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Model/Type No.	Series No.	Note
AE-1	Adapter	N/A	N/A	Peripherals

Item	Cable Type	Shielded Type	Ferrite Core	Length
C-1	USB Cable	YES	NO	1.0m
C-2	RF Cable	YES	NO	0.1m

Notes:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.
(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

6.3 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation& Conducted Test equipment

	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4440A	MY41000130	2024.04.26 2025.04.24	2025.04.25 2026.04.23	1 year
2	Spectrum Analyzer	Keysight	N9020A	MY53280244	2024.04.26 2025.04.16	2025.04.25 2026.04.15	1 year
3	Spectrum Analyzer	R&S	FSV40	101417	2024.04.26 2025.04.17	2025.04.25 2026.04.16	1 year
4	Test Receiver	R&S	ESPI3	101417	2024.07.25 2025.07.23	2025.07.24 2026.07.22	1 year
5	Log-Periodic Antenna	SCHWARZBECK	VULB 9162	675	2024.05.01 2025.04.29	2025.04.30 2026.04.28	1 year
6	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2024.04.26	2027.04.25	3 year
7	Broadband Horn Antenna	SCHWARZBECK	BBHA 9120 D	2817	2024.05.12	2027.05.11	3 year
8	Broadband Horn Antenna	SCHWARZBECK	BBHA 9120 D	2816	2024.05.18	2027.05.17	3 year
9	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	803	2024.05.12	2027.05.11	3 year
10	Low Noise Amplifier	Agilent	8449B	30008A01520	2024.04.26 2025.04.16	2025.04.25 2026.04.15	1 year
11	Low Noise Amplifier	EMC	EMC051835SE	980246	2024.04.26 2025.04.17	2025.04.25 2026.04.16	1 year
12	Low Noise Amplifier	B&Z	BZ-P540-550850-452727	16476-11729	2024.04.26 2025.04.17	2025.04.25 2026.04.16	1 year
13	Active Loop Antenna	SCHWARZBECK	FMZB 1519 B	055	2024.05.17	2027.05.16	3 year
14	Power Meter	DARE	RPR3006W	15I00041SNO84	2024.04.26 2025.04.17	2025.04.25 2026.04.16	1 year
15	Test Cable	Talent Microwave	A40-2/92M2/92M-2M	22084903	2024.04.25	2027.04.24	3 year
16	Test Cable	Talent Microwave	A81-SMAMSMAM-2M	22084900	2024.04.26	2027.04.25	3 year
17	Test Cable	Talent Microwave	A81-SMAMSMAM-8.5M	22084899	2024.04.26	2027.04.25	3 year
18	Filter	TRILTHIC	2400MHz	29	2024.04.26	2027.04.25	3 year
19	temporary antenna connector (Note)	NTS	R001	N/A	N/A	N/A	N/A
20	Spectrum Analyzer	Keysight	N9020B	MY60112710	2024.01.04 2025.01.02	2025.01.03 2026.01.01	1 year

Note:
We will use the temporary antenna connector (soldered on the PCB board) When conducted test
And this temporary antenna connector is listed within the instrument list

AC Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2024.04.26 2025.04.17	2025.04.25 2026.04.16	1 year
2	LISN	R&S	ENV216	101313	2024.04.26 2025.04.16	2025.04.25 2026.04.15	1 year
3	LISN	R&S	ENV216	101490	2024.04.26 2025.04.16	2025.04.25 2026.04.15	1 year
4	50Ω Coaxial Switch	ANRITSU CORP	MP59B	6200983704	2024.04.26	2027.04.25	3 year
5	Test Cable	N/A	R-03	N/A	2024.04.25	2027.04.24	3 year

Note: Each piece of equipment is scheduled for calibration once a year except the Aux Equipment & Test Cable which is scheduled for calibration every 2 or 3 years.

Measurement Software

Item	Manufacturer	Software Name	Software Version	Description
1	WCS Technology	WCS-WCN	25.06.2801	RF Conducted Test
2	Farad	EZ-EMC_RE	AIT-03A	RadiatedTest
3	Farad	EZ-EMC_CE	AIT-03A	AC Conducted Test

7 TEST REQUIREMENTS

7.1 CONDUCTED EMISSIONS TEST

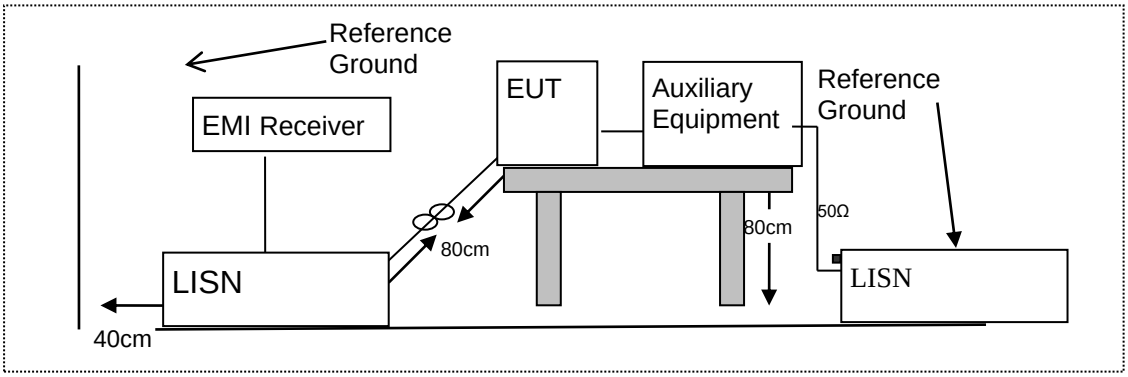
7.1.1 Applicable Standard

According to FCC Part 15.207(a)

7.1.2 Conformance Limit

Frequency(MHz)	Conducted Emission Limit	
	Quasi-peak	Average
0.15-0.5	66-56*	56-46*
0.5-5.0	56	46
5.0-30.0	60	50
Note: 1. *Decreases with the logarithm of the frequency 2. The lower limit shall apply at the transition frequencies 3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.		

7.1.3 Test Configuration



7.1.4 Test Procedure

According to the requirements in Section 6.2 of ANSI C63.10-2020 Conducted emissions the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room.
2. The EUT was placed on a table which is 0.8m above ground plane.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40cm long.
5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
6. LISN at least 80 cm from nearest part of EUT chassis.
7. The frequency range from 150KHz to 30MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth(IF bandwidth=9KHz) with Maximum Hold Mode
9. For the actual test configuration, please refer to the related Item –EUT Test Photos.

7.1.5 Test Results

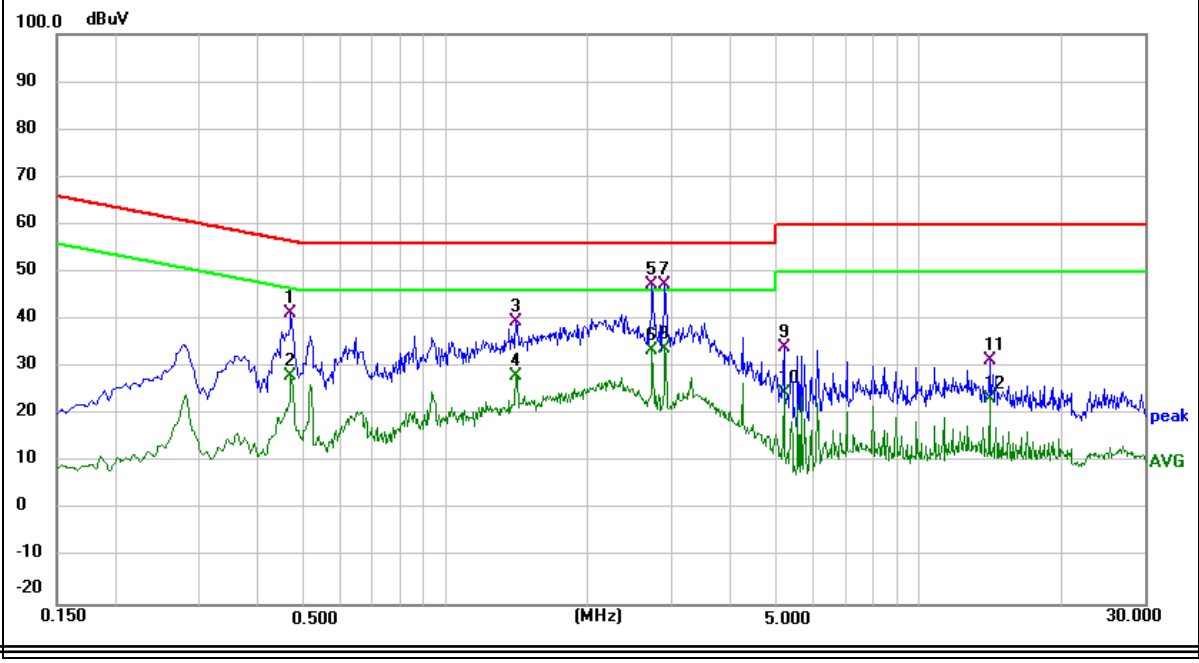
Pass

7.1.6 Test Results

EUT：	Stem2	Model Name ：	1018
Temperature：	22℃	Relative Humidity：	57%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5V from Adapter AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.4700	30.61	10.63	41.24	56.51	-15.27	QP
0.4700	17.65	10.63	28.28	46.51	-18.23	AVG
1.4100	26.95	12.58	39.53	56.00	-16.47	QP
1.4100	15.70	12.58	28.28	46.00	-17.72	AVG
2.7340	37.49	9.86	47.35	56.00	-8.65	QP
2.7340	23.64	9.86	33.50	46.00	-12.50	AVG
2.9140	37.49	9.87	47.36	56.00	-8.64	QP
2.9140	24.08	9.87	33.95	46.00	-12.05	AVG
5.1740	24.00	10.12	34.12	60.00	-25.88	QP
5.1740	14.50	10.12	24.62	50.00	-25.38	AVG
14.1100	19.70	11.67	31.37	60.00	-28.63	QP
14.1100	11.60	11.67	23.27	50.00	-26.73	AVG

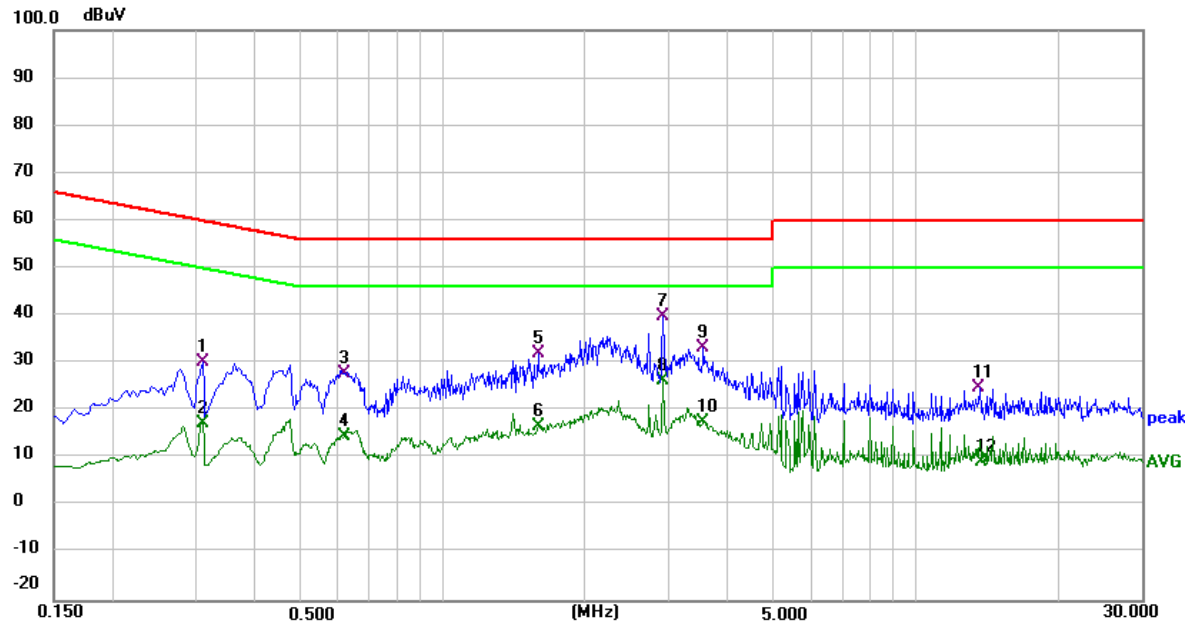
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Stem2	Model Name ：	1018
Temperature：	25℃	Relative Humidity：	62%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5V from Adapter AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.3100	20.68	9.72	30.40	59.97	-29.57	QP
0.3100	7.72	9.72	17.44	49.97	-32.53	AVG
0.6180	17.55	10.22	27.77	56.00	-28.23	QP
0.6180	4.50	10.22	14.72	46.00	-31.28	AVG
1.5900	19.90	12.22	32.12	56.00	-23.88	QP
1.5900	4.55	12.22	16.77	46.00	-29.23	AVG
2.9260	30.65	9.13	39.78	56.00	-16.22	QP
2.9260	17.33	9.13	26.46	46.00	-19.54	AVG
3.5580	24.02	9.19	33.21	56.00	-22.79	QP
3.5580	8.34	9.19	17.53	46.00	-28.47	AVG
13.6379	14.03	10.78	24.81	60.00	-35.19	QP
13.7939	-1.44	10.81	9.37	50.00	-40.63	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



7.2 RADIATED SPURIOUS EMISSION

7.2.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209

7.2.2 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009~0.490	2400/F(KHz)	20 log (uV/m)	300
0.490~1.705	24000/F(KHz)	20 log (uV/m)	30
1.705~30.0	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Limits of Radiated Emission Measurement(Above 1000MHz)

Frequency(MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

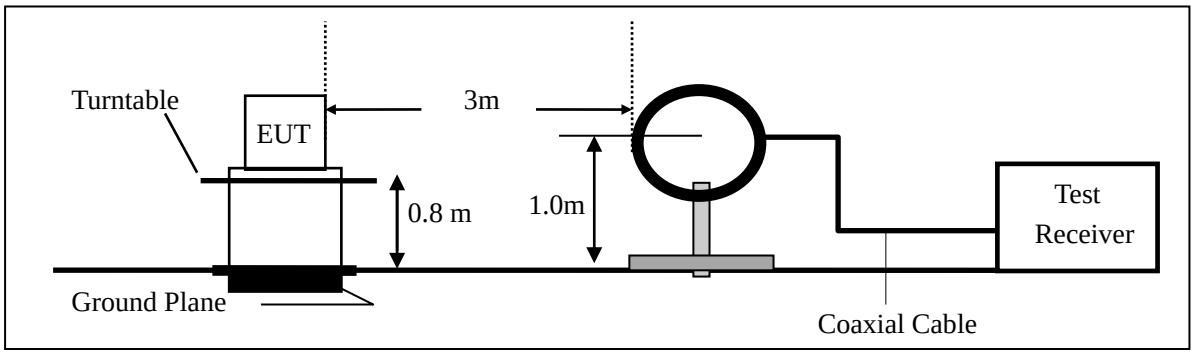
Remark :1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. For Frequency 9kHz~30MHz:
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.
For Frequency above 30MHz:
Distance extrapolation factor =20log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

7.2.3 Measuring Instruments

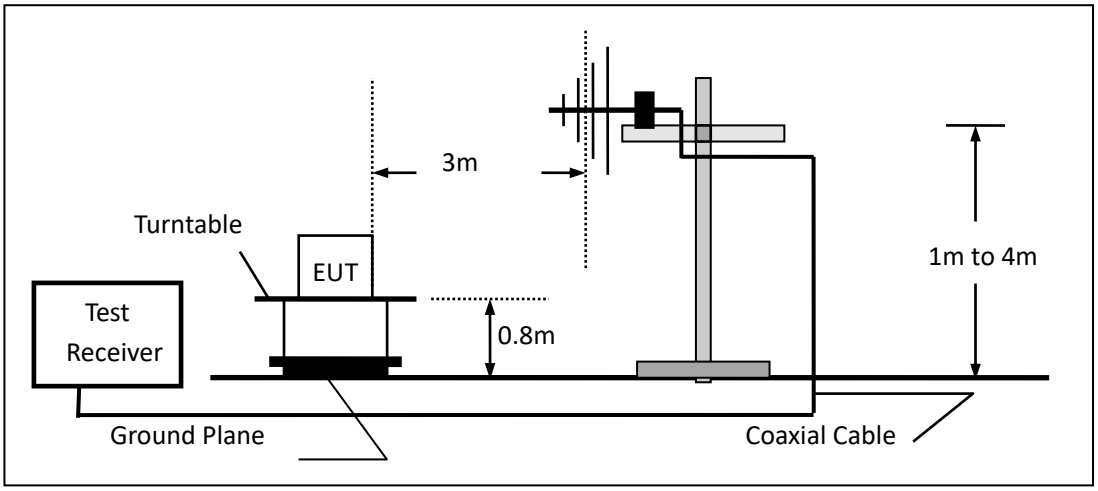
The Measuring equipment is listed in the section 6.3 of this test report.

7.2.4 Test Configuration

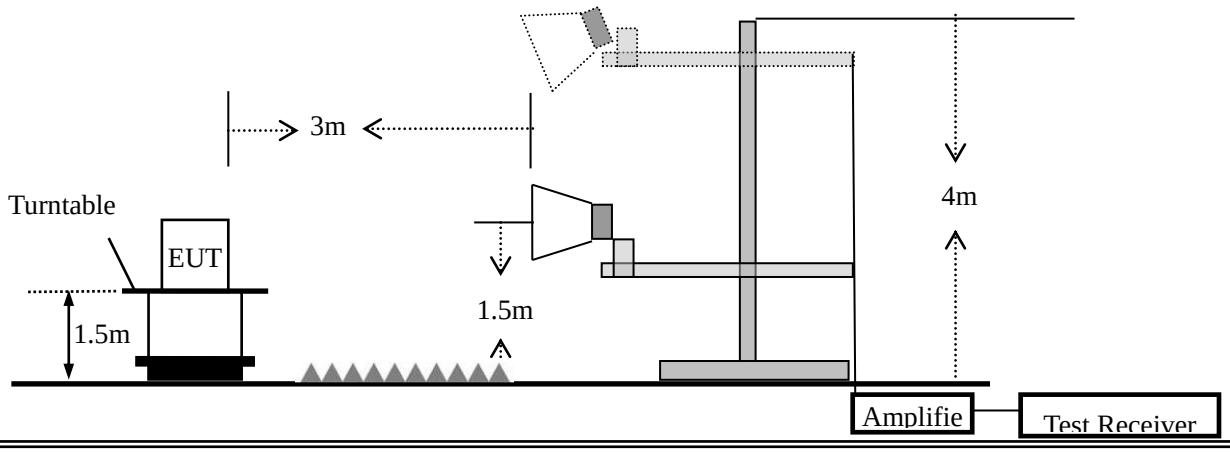
(a) For radiated emissions below 30MHz



(b) For radiated emissions from 30MHz to 1000MHz



(c) For radiated emissions above 1000MHz



7.2.5 Test Procedure

According to the requirements in Section 6.3, 6.5, 6.6 and 6.10.5 of ANSI C63.10-2020

From 30 MHz to 1GHz test procedure as below:
1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3-meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

Above 1GHz test procedure as below:
1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter.
2) Test the EUT in the lowest channel, middle channel, the highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and test the worst-case axis positioning.
4) Repeat above procedures until all frequencies measured was complete.

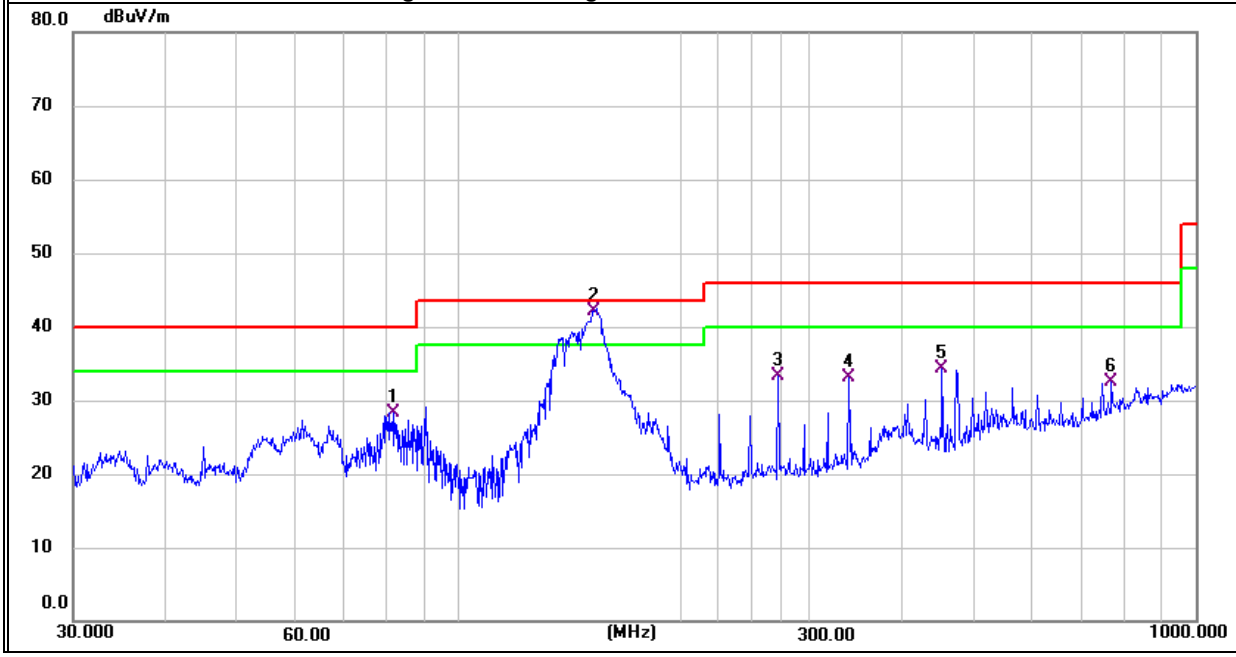
7.2.6 Test Results

■ Spurious Emission below 1GHz (30MHz to 1GHz)
All the modulation modes have been tested, and the worst result was report as below:

EUT：	Stem2	Model Name ：	1018
Temperature：	25℃	Relative Humidity：	55%
Pressure：	1010hPa	Test Mode：	Mode 4
Test Voltage ：	DC 7.3V		

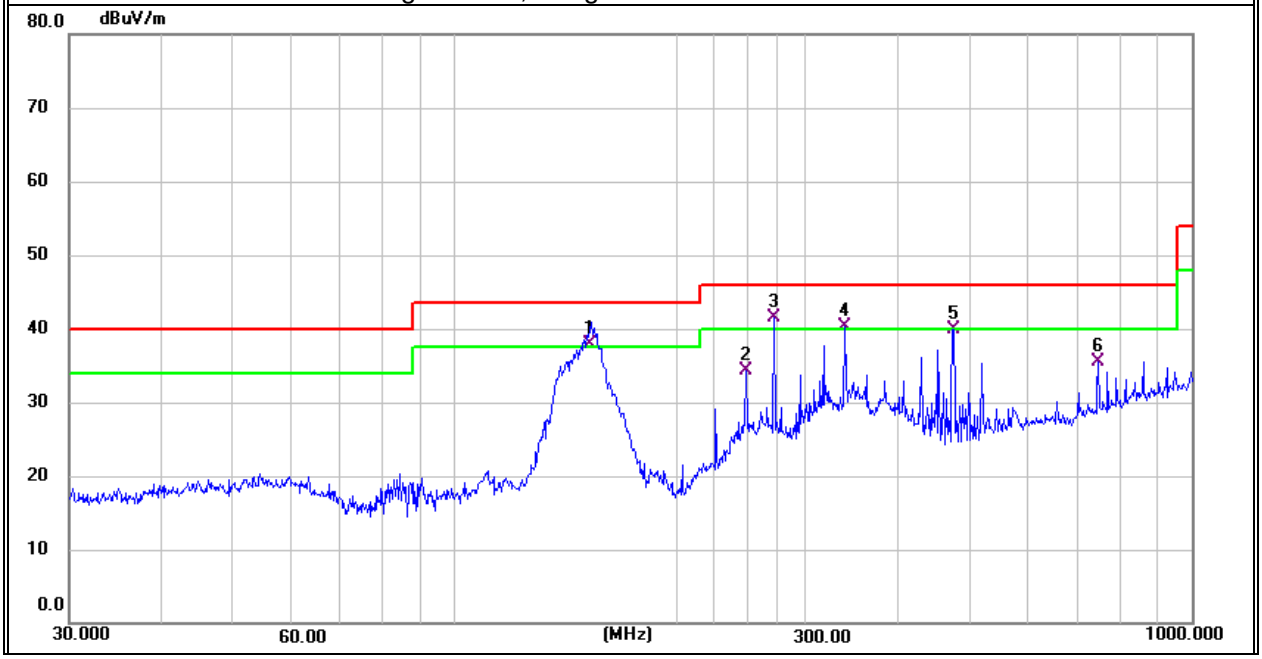
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
V	81.4970	14.21	14.13	28.34	40.00	-11.66	QP
V	153.0450	27.41	14.61	42.02	43.50	-1.48	QP
V	271.3250	14.26	19.07	33.33	46.00	-12.67	QP
V	338.4000	12.19	20.92	33.11	46.00	-12.89	QP
V	452.7200	11.16	23.19	34.35	46.00	-11.65	QP
V	768.7480	4.00	28.59	32.59	46.00	-13.41	QP

Remark:
Emission Level= Meter Reading+ Factor, Margin= Emission Level - Limit



Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
H	153.0800	23.26	14.60	37.86	43.50	-5.64	QP
H	248.5520	15.30	19.00	34.30	46.00	-11.70	QP
H	271.3250	22.40	19.07	41.47	46.00	-4.53	QP
H	338.4000	19.43	20.92	40.35	46.00	-5.65	QP
H	475.4990	15.78	24.20	39.98	46.00	-6.02	QP
H	747.4830	7.43	28.05	35.48	46.00	-10.52	QP

Remark:
Emission Level= Meter Reading+ Factor, Margin= Emission Level - Limit



■ Spurious Emission Above 1GHz

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relati ve Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Harry Huang

All the modulation modes have been tested, and the worst result was report as below:

Frequency	Read Level	Cable loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Remark	Comment
(MHz)	(dBμV)	(dB)	dB/m	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
Low Channel (2402 MHz)(8-DPSK)--Above 1G									
4804	68.83	5.21	35.59	44.30	65.33	74.00	-8.67	Pk	Vertical
4804	50.39	5.21	35.59	44.30	46.89	54.00	-7.11	AV	Vertical
7206	68.38	6.48	36.27	44.60	66.53	74.00	-7.47	Pk	Vertical
7206	49.82	6.48	36.27	44.60	47.97	54.00	-6.03	AV	Vertical
4804	69.77	5.21	35.55	44.30	66.23	74.00	-7.77	Pk	Horizontal
4804	47.8	5.21	35.55	44.30	44.26	54.00	-9.74	AV	Horizontal
7206	70.16	6.48	36.27	44.52	68.39	74.00	-5.61	Pk	Horizontal
7206	48.66	6.48	36.27	44.52	46.89	54.00	-7.11	AV	Horizontal
Mid Channel (2441 MHz)(8-DPSK)--Above 1G									
4882	69.57	5.21	35.66	44.20	66.24	74.00	-7.76	Pk	Vertical
4882	49.13	5.21	35.66	44.20	45.80	54.00	-8.20	AV	Vertical
7323	69.87	7.10	36.50	44.43	69.04	74.00	-4.96	Pk	Vertical
7323	46.65	7.10	36.50	44.43	45.82	54.00	-8.18	AV	Vertical
4882	68.56	5.21	35.66	44.20	65.23	74.00	-8.77	Pk	Horizontal
4882	50.73	5.21	35.66	44.20	47.40	54.00	-6.60	AV	Horizontal
7323	70.28	7.10	36.50	44.43	69.45	74.00	-4.55	Pk	Horizontal
7323	47.89	7.10	36.50	44.43	47.06	54.00	-6.94	AV	Horizontal
High Channel (2480 MHz)(8-DPSK)-- Above 1G									
4960	70.06	5.21	35.52	44.21	66.58	74.00	-7.42	Pk	Vertical
4960	45.73	5.21	35.52	44.21	42.25	54.00	-11.75	AV	Vertical
7440	70.03	7.10	36.53	44.60	69.06	74.00	-4.94	Pk	Vertical
7440	46	7.10	36.53	44.60	45.03	54.00	-8.97	AV	Vertical
4960	70.08	5.21	35.52	44.21	66.60	74.00	-7.40	Pk	Horizontal
4960	49.16	5.21	35.52	44.21	45.68	54.00	-8.32	AV	Horizontal
7440	70.21	7.10	36.53	44.60	69.24	74.00	-4.76	Pk	Horizontal
7440	50.76	7.10	36.53	44.60	49.79	54.00	-4.21	AV	Horizontal

Note:

(1) Emission Level= Antenna Factor + Cable Loss + Read Level - Preamp Factor

(2)All other emissions more than 20dB below the limit.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/ Mode4	Test By:	Harry Huang

All the modulation modes have been tested, and the worst result was report as below:

Frequency	Meter Reading	Cable Loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	dB/m	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
3Mbps(8-DPSK)-Non-hopping									
2310.00	68.17	2.97	27.80	43.80	55.14	74	-18.86	Pk	Horizontal
2310.00	49.65	2.97	27.80	43.80	36.62	54	-17.38	AV	Horizontal
2310.00	69.29	2.97	27.80	43.80	56.26	74	-17.74	Pk	Vertical
2310.00	45.79	2.97	27.80	43.80	32.76	54	-21.24	AV	Vertical
2390.00	69.49	3.14	27.21	43.80	56.04	74	-17.96	Pk	Vertical
2390.00	45.20	3.14	27.21	43.80	31.75	54	-22.25	AV	Vertical
2390.00	69.97	3.14	27.21	43.80	56.52	74	-17.48	Pk	Horizontal
2390.00	50.46	3.14	27.21	43.80	37.01	54	-16.99	AV	Horizontal
2483.50	68.72	3.58	27.70	44.00	56.00	74	-18.00	Pk	Vertical
2483.50	50.14	3.58	27.70	44.00	37.42	54	-16.58	AV	Vertical
2483.50	68.18	3.58	27.70	44.00	55.46	74	-18.54	Pk	Horizontal
2483.50	46.33	3.58	27.70	44.00	33.61	54	-20.39	AV	Horizontal
3Mbps(8-DPSK)-hopping									
2310.00	69.83	2.97	27.80	43.80	56.80	74	-17.20	Pk	Horizontal
2310.00	47.75	2.97	27.80	43.80	34.72	54	-19.28	AV	Horizontal
2310.00	70.70	2.97	27.80	43.80	57.67	74	-16.33	Pk	Vertical
2310.00	48.32	2.97	27.80	43.80	35.29	54	-18.71	AV	Vertical
2390.00	69.20	3.14	27.21	43.80	55.75	74	-18.25	Pk	Vertical
2390.00	47.76	3.14	27.21	43.80	34.31	54	-19.69	AV	Vertical
2390.00	70.37	3.14	27.21	43.80	56.92	74	-17.08	Pk	Horizontal
2390.00	47.76	3.14	27.21	43.80	34.31	54	-19.69	AV	Horizontal
2483.50	68.94	3.58	27.70	44.00	56.22	74	-17.78	Pk	Vertical
2483.50	48.77	3.58	27.70	44.00	36.05	54	-17.95	AV	Vertical
2483.50	69.29	3.58	27.70	44.00	56.57	74	-17.43	Pk	Horizontal
2483.50	46.33	3.58	27.70	44.00	33.61	54	-20.39	AV	Horizontal

Note: (1) All other emissions more than 20dB below the limit.

7.3 NUMBER OF HOPPING CHANNEL

7.3.1 Applicable Standard

According to FCC Part 15.247(a)(1) (iii) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.3.2 Conformance Limit

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

7.3.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.3.4 Test Setup

Please refer to Section 6.1 of this test report.

7.3.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 7.8.3
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT must have its hopping function enabled.
Use the following spectrum analyzer settings:
Span: The frequency band of operation. Depending on the number of channels the device supports, it could be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
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 = No faster than coupled (auto) time.
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

7.3.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode 5	Test By:	Leo Wang

Test data reference attachment.

7.4 HOPPING CHANNEL SEPARATION MEASUREMENT

7.4.1 Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.4.2 Conformance Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

7.4.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.4.4 Test Setup

Please refer to Section 6.1 of this test report.

7.4.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 7.8.2
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span: Wide enough to capture the peaks of two adjacent channels.
RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW ≥ RBW
Sweep = No faster than coupled (auto) time.
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

7.4.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode5	Test By:	Leo Wang

Test data reference attachment.

7.5 AVERAGE TIME OF OCCUPANCY (DWELL TIME)

7.5.1 Applicable Standard

According to FCC Part 15.247(a)(1)(iii) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.5.2 Conformance Limit

The average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

7.5.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.5.4 Test Setup

Please refer to Section 6.1 of this test report.

7.5.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 7.8.4
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT must have its hopping function enabled.
Use the following spectrum analyzer settings:
Span: Zero span, centered on a hopping channel.
RBW shall be $\leqslant$ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected transmission time per hop.
Sweep time: Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured. Setting the sweep time to be slightly longer than the hopping period per channel (hopping period = 1/hopping rate) should achieve this.
Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed. The trigger level might need adjustment to reduce the chance of triggering when the system hops on an adjacent channel.
Detector function = peak
Trace = Clear-write, single sweep.
Measure the maximum time duration of one single pulse.
Set the EUT for DH5, DH3 and DH1 packet transmitting.
Measure the maximum time duration of one single pulse.

7.5.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode5	Test By:	Leo Wang

Test data reference attachment.

Note:

A Period Time = (channel number)*0.4

DH1 Dwell time: Reading * (1600/2)*31.6/(channel number)

DH3 Dwell time: Reading * (1600/4)*31.6/(channel number)

DH5 Dwell time: Reading * (1600/6)*31.6/(channel number)

For Example:

1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

2. In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.

3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

7.6 DUTY CYCLE

7.6.1 Applicable Standard

According to KDB 558074 D01 15.247 Meas Guidance v05r02 Section 6&9

7.6.2 Conformance Limit

No limit requirement.

7.6.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.6.4 Test Setup

Please refer to Section 6.1 of this test report.

7.6.5 Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Set the center frequency of the instrument to the center frequency of the transmission.
Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
Set VBW ≥ RBW. Set detector = peak or average.
The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if T ≤ 16.7 μs.)

7.6.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Leo Wang

Test data reference attachment.

7.7 20DB BANDWIDTH

7.7.1 Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.7.2 Conformance Limit

No limit requirement.

7.7.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.7.4 Test Setup

Please refer to Section 6.1 of this test report.

7.7.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 6.9.2
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = 2 to 5 times the OBW
RBW = 1% to 5% of the OBW
VBW ≥ 3*RBW
Sweep = auto
Detector function = peak
Trace = max hold

7.7.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Leo Wang

Test data reference attachment.

7.8 99% OCCUPIED BANDWIDTH

7.8.1 Applicable Standard

According to FCC Part 2.1049 and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.8.2 Conformance Limit

No limit requirement.

7.8.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.8.4 Test Setup

Please refer to Section 6.1 of this test report.

7.8.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 6.9.3
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = 1.5 to 5 times the OBW
Set RBW = 1% to 5% of the OBW
Set VBW ≥ 3*RBW
Set Detector = Peak.
Set Trace mode = max hold.
Set Sweep = auto couple

7.8.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Leo Wang

Test data reference attachment.

7.9 PEAK OUTPUT POWER

7.9.1 Applicable Standard

According to FCC Part 15.247(b)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.9.2 Conformance Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

7.9.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.9.4 Test Setup

Please refer to Section 6.1 of this test report.

7.9.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 7.8.5.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
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 = No faster than coupled (auto) time.
Detector function = peak
Trace = max hold
Allow trace to stabilize.

7.9.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2/Mode3/Mode4	Test By:	Leo Wang

Test data reference attachment.

7.10 CONDUCTED BAND EDGE MEASUREMENT

7.10.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.10.2 Conformance 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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.10.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.10.4 Test Setup

Please refer to Section 6.1 of this test report.

7.10.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 6.10.4 & 7.8.7
a) Compliance with a relative limit at the band-edges shall be made on the lowest and on the highest channels with frequency hopping disabled and repeated with frequency hopping enabled. For the latter test the hopping sequence shall include the lowest and highest channels.
b) For measurements with the hopping disabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of the allocated band-edge.
c) For measurements with the hopping enabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of both of the allocated band-edges. This could require separate spectral plots for each band-edge.
d) Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step g).
e) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
f) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation”.
g) Perform the test as follows:
Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products that fall outside of the authorized band of operation.
Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
Attenuation: Auto.
Sweep time: No faster than coupled (auto) time.
Resolution bandwidth: 100 kHz
Video bandwidth: 300 kHz.
Detector: Peak.
Trace: Max-hold.
h) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes

to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.
i) Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
j) Repeat step f) through step g) for every applicable modulation.
k) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c).

7.10.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2 /Mode4/ Mode 5	Test By:	Leo Wang

Test data reference attachment.

7.11 SPURIOUS RF CONDUCTED EMISSION

7.11.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 Section 9

7.11.2 Conformance 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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.11.3 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

7.11.4 Test Setup

Please refer to Section 6.1 of this test report.

7.11.5 Test Procedure

The testing follows ANSI C63.10-2020 clause 7.8.7
Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The frequency range of testing shall span 30 MHz to 10 times the operating frequency and this may be done in a single sweep or, to aid resolution, across a number of sweeps. The resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector.
The limit is based on the highest in-band level across all channels measured using the same instrument settings (resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector). To help clearly demonstrate compliance a display line may be set at the required offset below the highest in-band level. Where the highest in-band level is not clearly identified in the out-of-band measurements a separate spectral plot showing the in-band level shall be provided.

7.11.6 Test Results

EUT:	Stem2	Model No.:	1018
Temperature:	20 ℃	Relative Humidity:	48%
Test Mode:	Mode2 /Mode3/ Mode4	Test By:	Leo Wang

Remark: The measurement frequency range is from 30MHzHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions measurement data.

Test data reference attachment.

7.12 ANTENNA APPLICATION

7.12.1 Antenna Requirement

15.203 requirement: For intentional device, according to 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.

7.12.2 Result

The EUT antenna is permanent attached PIFA antenna (Gain: 0.7dBi). It comply with the standard requirement.

7.13 FREQUENCY HOPPING SYSTEM (FHSS) EQUIPMENT REQUIREMENTS

7.11.1 Standard Applicable

According to FCC Part 15.247(a)(1), 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 hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals. (g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section. (h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

7.11.2 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule. This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock. Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.
This device was tested with an bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for FCC Part 15.247 rule.

7.11.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below: Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

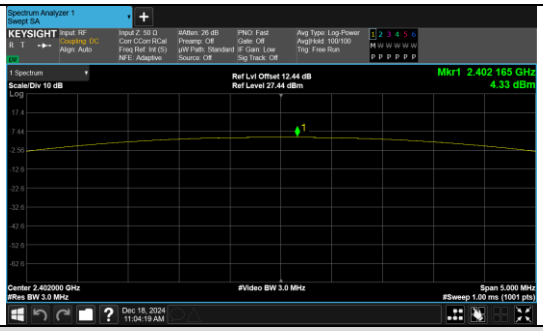
8 TEST RESULTS

8.1 CONDUCTED OUTPUT POWER

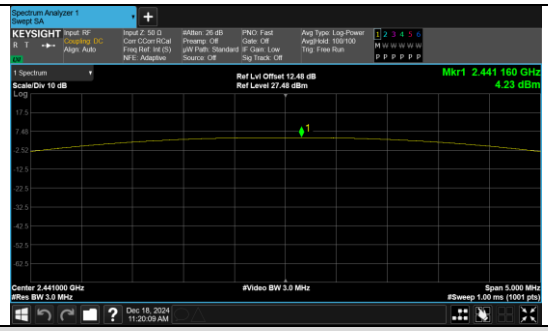
Test Result

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	4.33	2.71	≤30	PASS
		39	4.23	2.65		PASS
		78	4.29	2.68		PASS
π/4DQPSK	2-DH5	0	6.41	4.38	≤20.97	PASS
		39	6.31	4.27		PASS
		78	6.59	4.56		PASS
8DPSK	3-DH5	0	6.64	4.61		PASS
		39	6.58	4.55		PASS
		78	6.82	4.80		PASS

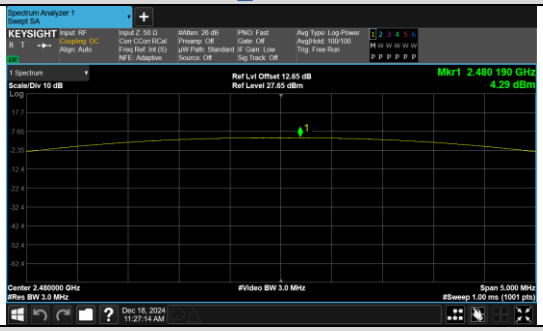
Test Graphs



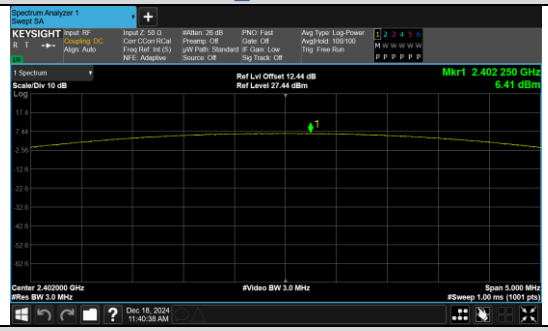
Peak Output Power
GFSK_Channel 0



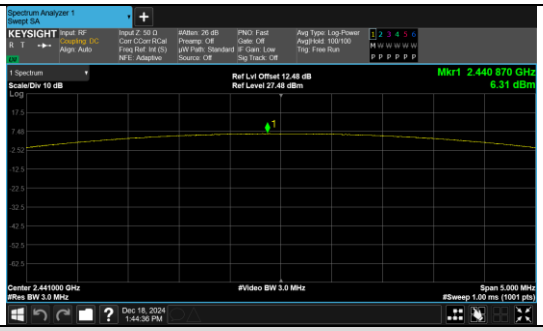
Peak Output Power
GFSK_Channel 39



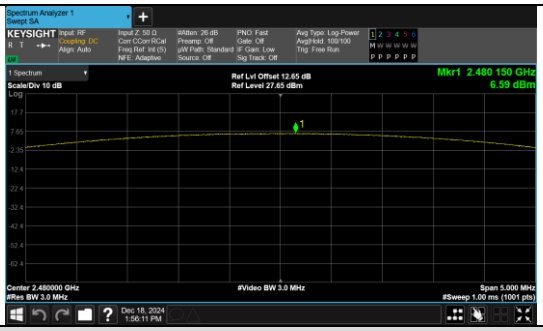
Peak Output Power
GFSK_Channel 78



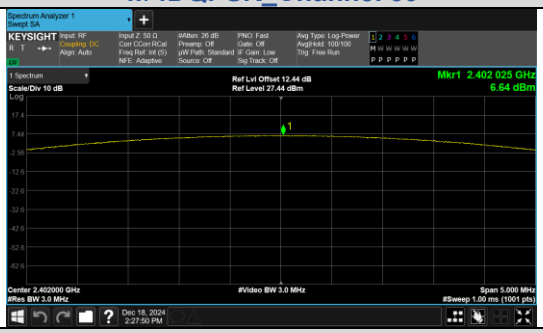
Peak Output Power
π/4DQPSK_Channel 0



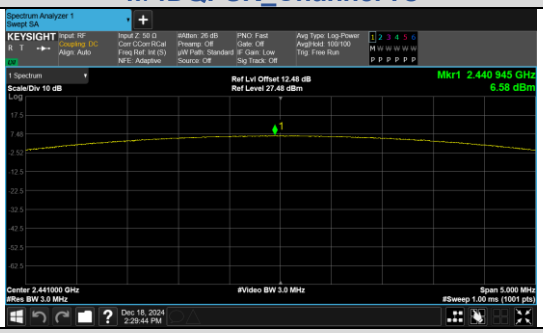
Peak Output Power
π/4DQPSK_Channel 39



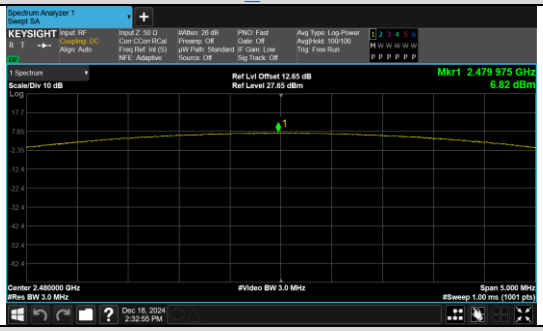
Peak Output Power
π/4DQPSK_Channel 78



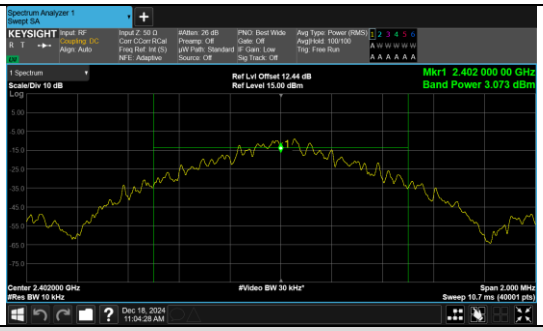
Peak Output Power
8DPSK_Channel 0



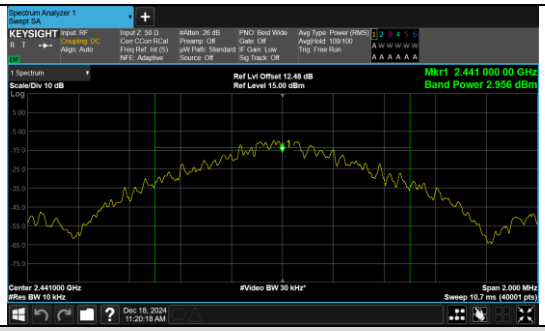
Peak Output Power
8DPSK_Channel 39



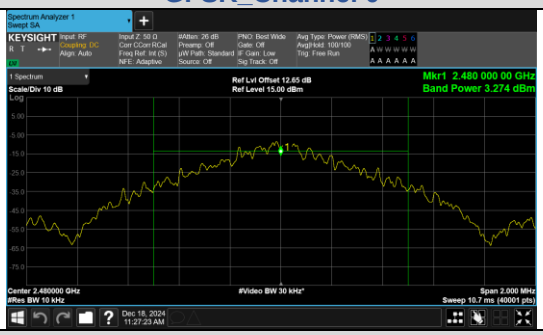
Peak Output Power
8DPSK_Channel 78



Average Output Power
GFSK_Channel 0

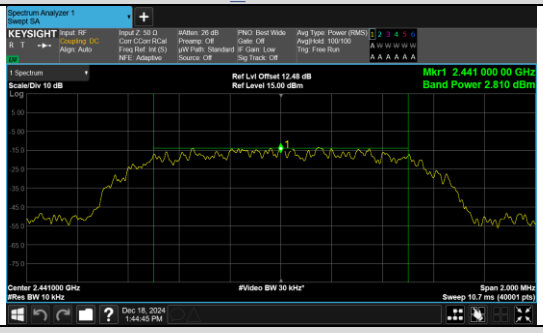


Average Output Power
GFSK_Channel 39

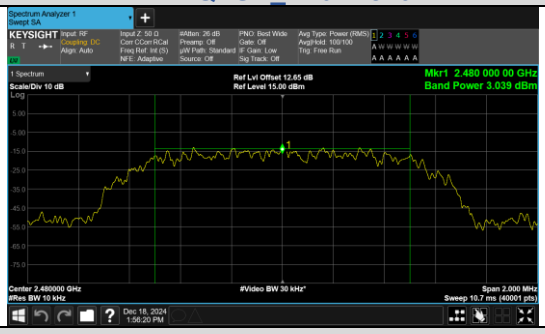


Average Output Power
GFSK_Channel 78

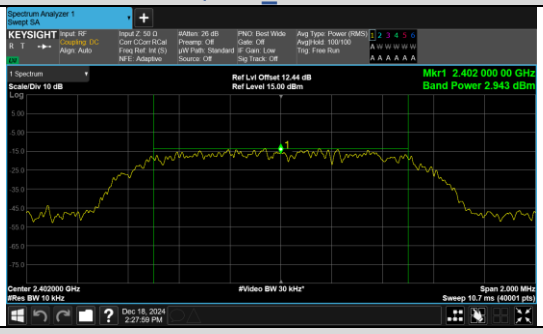
Average Output Power
π/4DQPSK_Channel 0



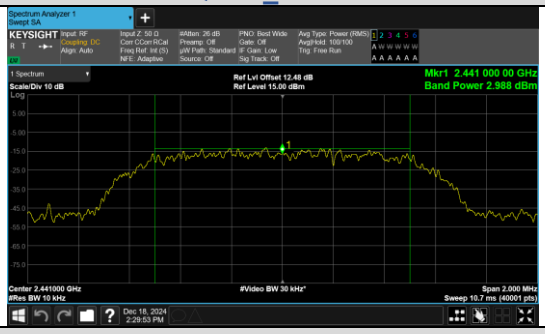
Average Output Power
π/4DQPSK_Channel 39



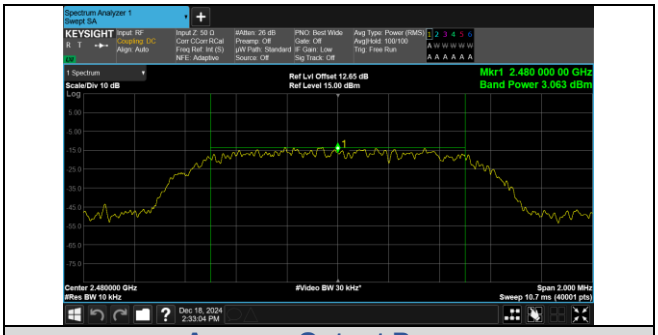
Average Output Power
π/4DQPSK_Channel 78



Average Output Power
8DPSK_Channel 0



Average Output Power
8DPSK_Channel 39



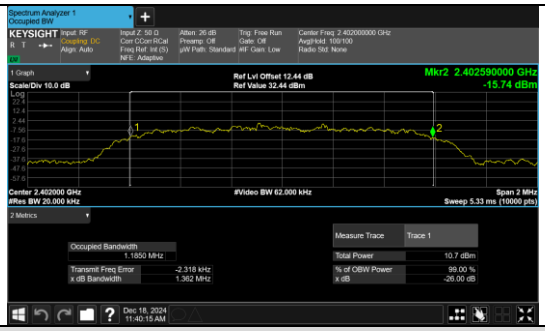
Average Output Power
8DPSK_Channel 78

8.2 99% BANDWIDTH
Test Result

Modulation	Channel	Center Frequency (MHz)	99% BW (MHz)
GFSK	0	2402	0.85879
	39	2441	0.86780
	78	2480	0.85801
π/4DQPSK	0	2402	1.1850
	39	2441	1.1858
	78	2480	1.1833
8DPSK	0	2402	1.1943
	39	2441	1.1924
	78	2480	1.1946

Test Graphs

GFSK_DH5_Channel 0



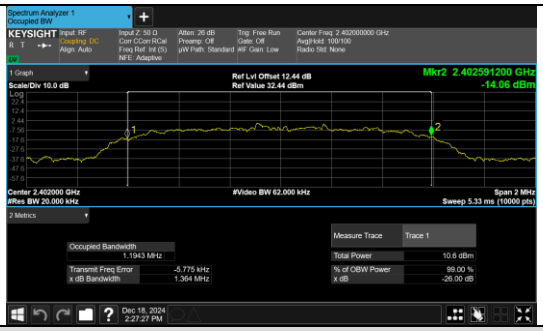
π/4DQPSK_2-DH5_Channel 0

GFSK_DH5_Channel 39

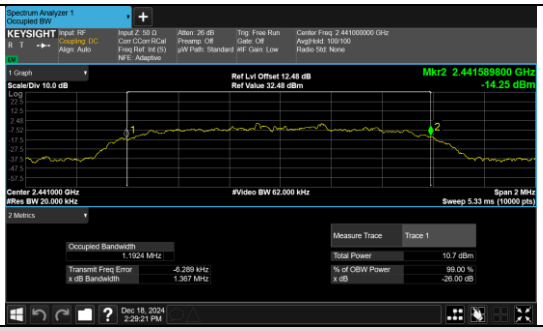
π/4DQPSK_2-DH5_Channel 39

GFSK_DH5_Channel 78

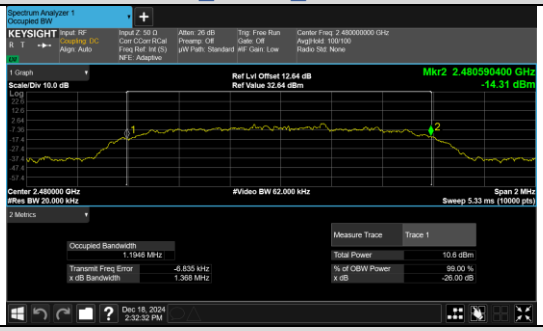
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



8DPSK_3-DH5_Channel 78

8.3 20dB Bandwidth
Test Result

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	0.9491
	39	2441 MHz	0.9540
	78	2480 MHz	0.9529
π/4DQPSK	0	2402 MHz	1.310
	39	2441 MHz	1.314
	78	2480 MHz	1.311
8DPSK	0	2402 MHz	1.296
	39	2441 MHz	1.296
	78	2480 MHz	1.295

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

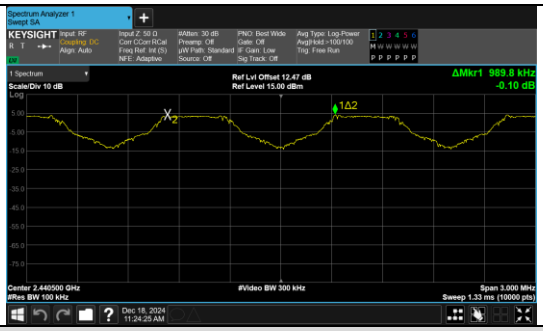
8DPSK_3-DH5_Channel 39

8DPSK_3-DH5_Channel 78

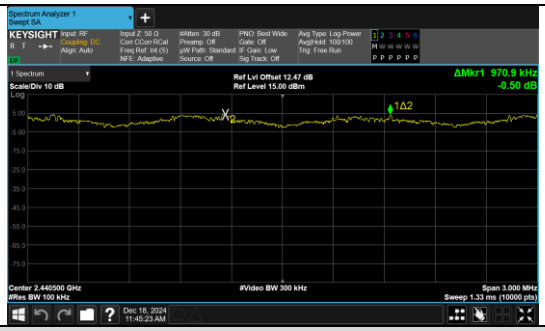
8.4 CARRIER FREQUENCIES SEPARATION
Test Result

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.8314	2440.8212	0.9898	0.636	PASS
π/4DQPSK	2-DH5	2440.1656	2441.1365	0.9709	0.873	PASS
8DPSK	3-DH5	2440.1647	2441.1611	0.9964	0.864	PASS

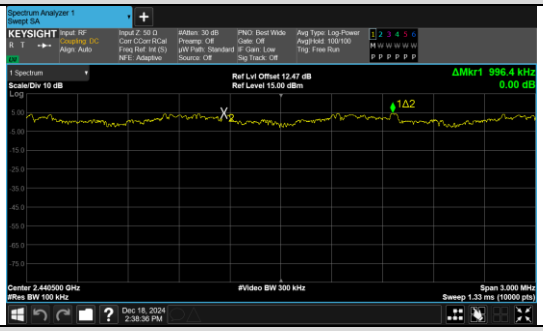
Test Graphs



GFSK



π/4DQPSK



8DPSK

N/A

8.5 CONDUCTED OUT OF BAND EMISSION

Test Result

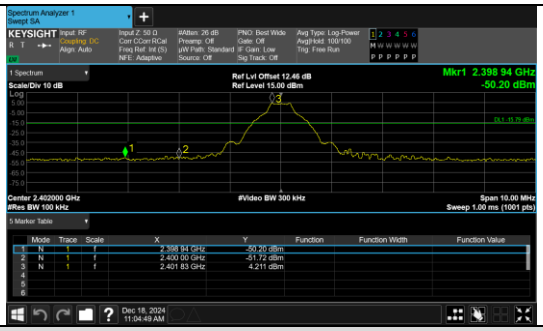
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2398.94	-50.201	-15.79	-34.411	PASS
			2400.00	-51.720	-15.79	-35.930	PASS
			23996.2	-61.171	-15.79	-45.381	PASS
		39	24836.5	-60.774	-15.93	-44.844	PASS
		78	2483.50	-50.988	-15.85	-35.138	PASS
			23961.9	-61.515	-15.85	-45.665	PASS
π/4DQPSK	2-DH5	0	2397.78	-58.272	-15.53	-42.742	PASS
			2400.00	-45.187	-15.53	-29.657	PASS
		39	22876.3	-61.410	-15.68	-45.730	PASS
		78	2483.50	-51.172	-15.53	-35.642	PASS
			23864.5	-61.687	-15.53	-46.157	PASS
8DPSK	3-DH5	0	2397.78	-56.633	-15.39	-41.243	PASS
			2400.00	-42.846	-15.39	-27.456	PASS
		39	24896.4	-61.581	-15.49	-46.091	PASS
		78	2483.50	-46.839	-15.31	-31.529	PASS
			24242.2	-61.227	-15.31	-45.917	PASS

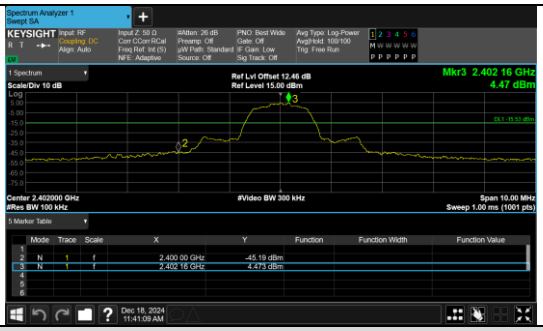
Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2397.35	-49.391	-15.79	-33.601	PASS
			2400.00	-51.363	-15.79	-35.573	PASS
			2483.50	-50.373	-15.92	-34.453	PASS
			2398.08	-48.632	-15.71	-32.922	PASS
			2400.00	-51.232	-15.71	-35.522	PASS
			2483.50	-50.985	-15.95	-35.035	PASS
π/4DQPSK	2-DH5		2400.00	-32.709	-4.82	-27.889	PASS
			2483.50	-50.994	-16.1	-34.894	PASS
			2400.00	-45.681	-15.53	-30.151	PASS
			2483.50	-50.422	-15.49	-34.932	PASS
8DPSK	3-DH5		2398.67	-44.028	-15.34	-28.688	PASS
			2400.00	-45.487	-15.34	-30.147	PASS
			2483.50	-47.327	-15.37	-31.957	PASS
			2400.00	-42.905	-15.31	-27.595	PASS
			2483.50	-48.355	-15.33	-33.025	PASS

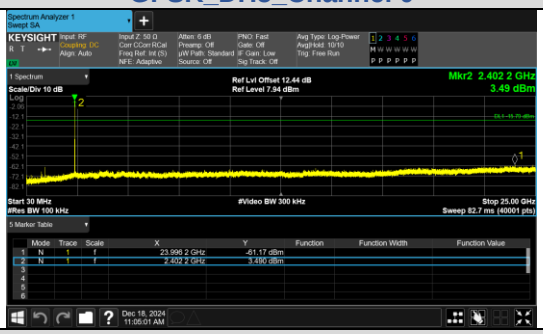
Test Graphs



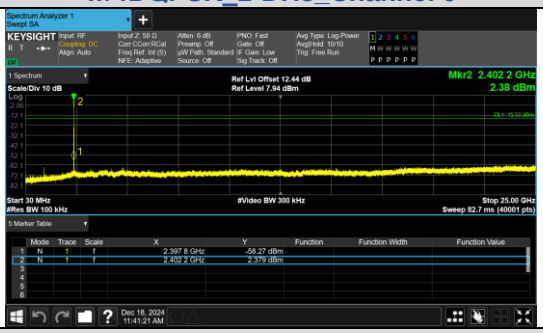
Out Of Band Emission
GFSK_DH5_Channel 0



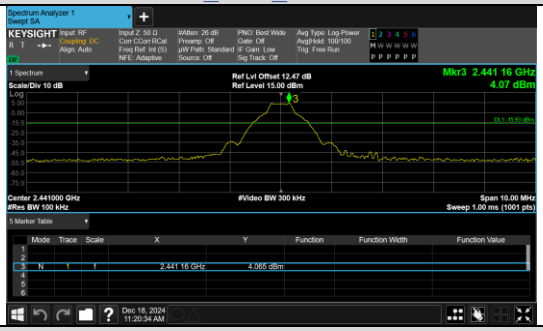
Out Of Band Emission
π/4DQPSK_2-DH5_Channel 0



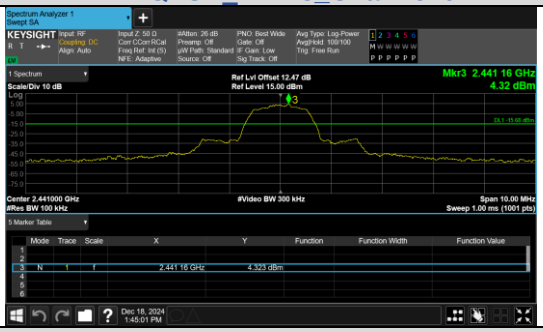
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 0



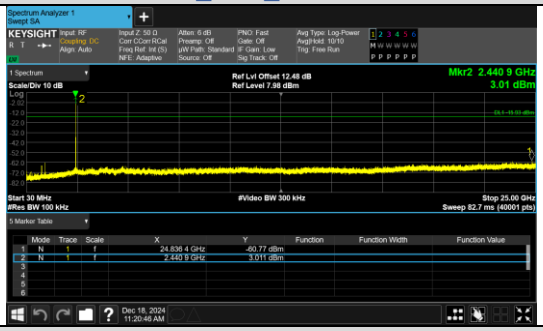
30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 0



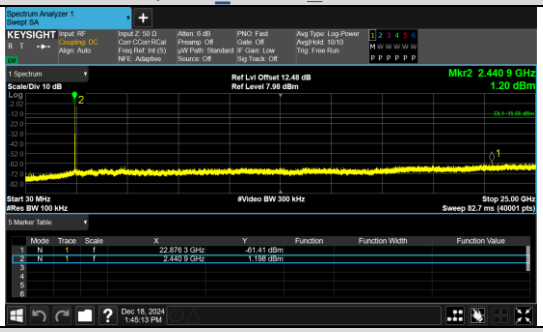
Out Of Band Emission
GFSK_DH5_Channel 39



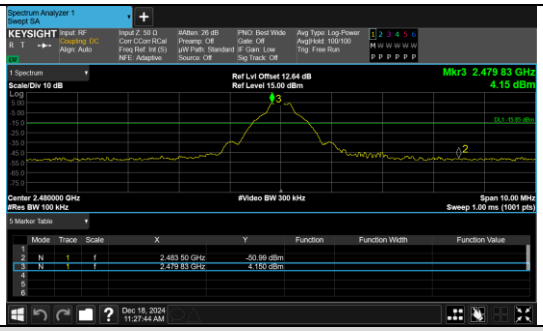
Out Of Band Emission
π/4DQPSK_2-DH5_Channel 39



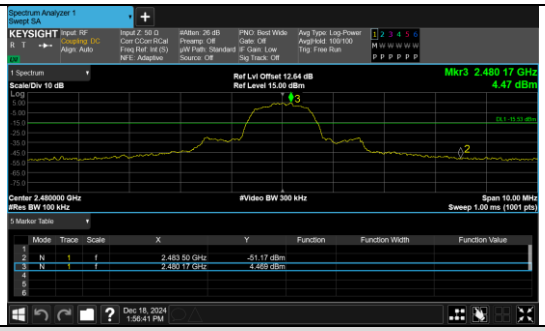
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 39



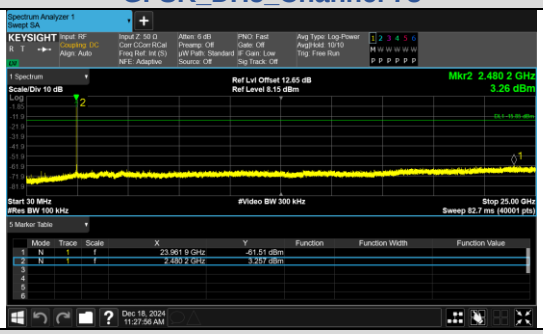
30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 39



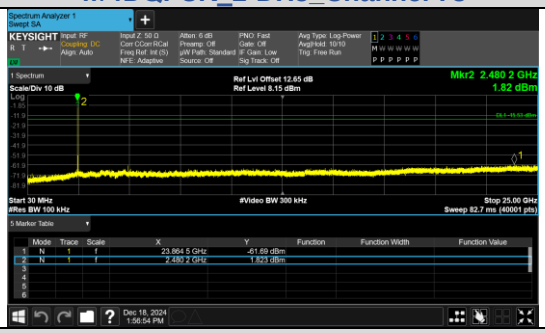
Out Of Band Emission
GFSK_DH5_Channel 78



Out Of Band Emission
π/4DQPSK_2-DH5_Channel 78

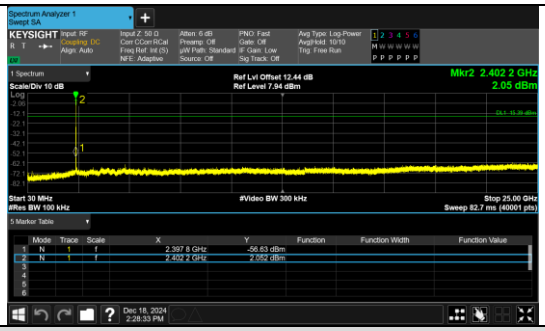


30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 78

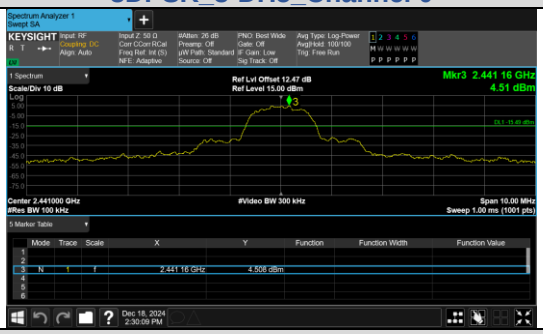


30.0 MHz - 25000.0 MHz
π/4DQPSK_2-DH5_Channel 78

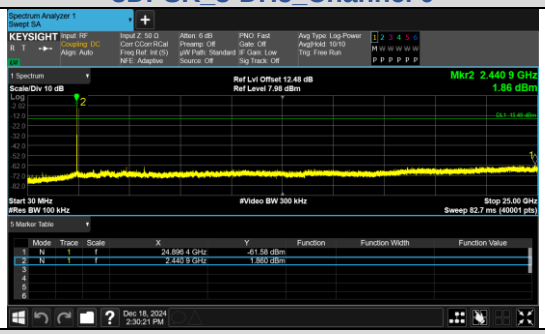
Out Of Band Emission
8DPSK_3-DH5_Channel 0



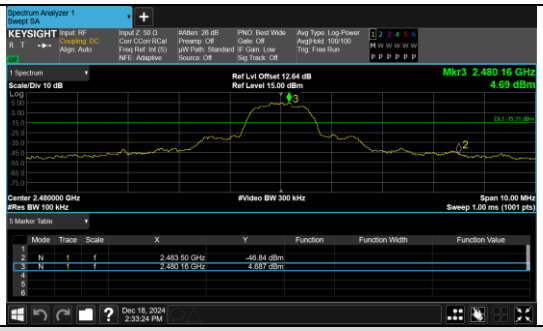
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 0



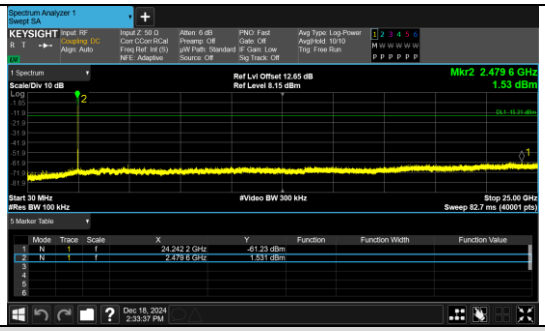
Out Of Band Emission
8DPSK_3-DH5_Channel 39



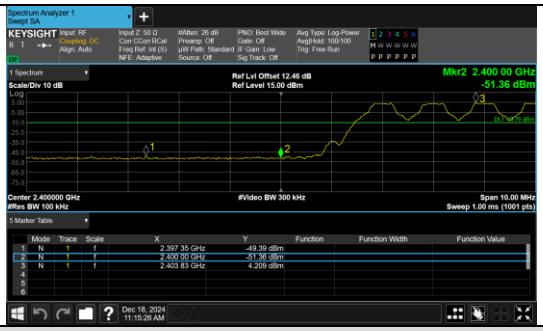
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 39



Out Of Band Emission
8DPSK_3-DH5_Channel 78



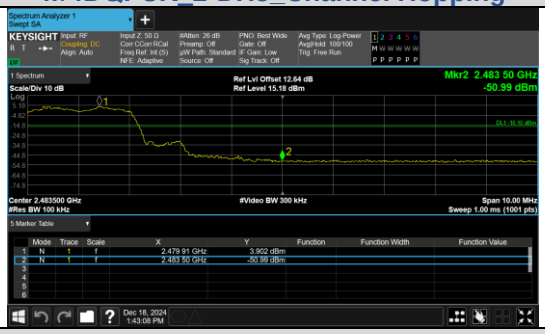
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 78



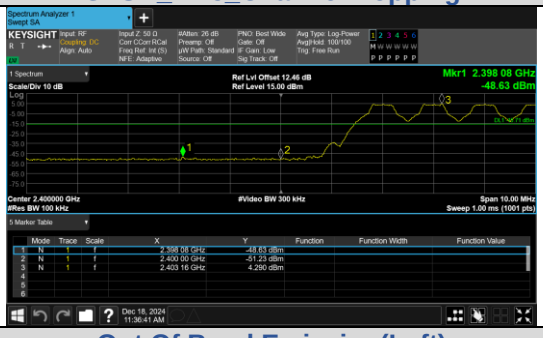
Out Of Band Emission(Left)
GFSK_DH5_Channel Hopping

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

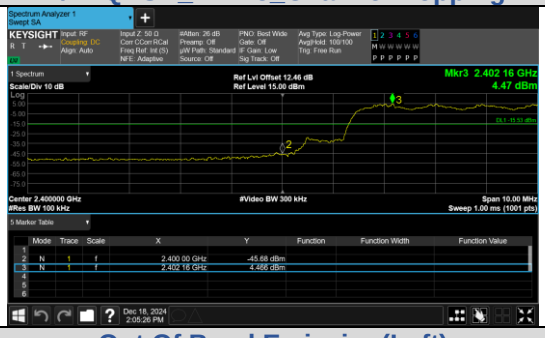
Out Of Band Emission(Right)
GFSK_DH5_Channel Hopping



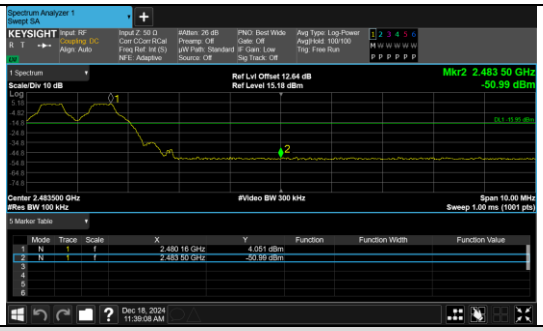
Out Of Band Emission(Right)
π/4DQPSK_2-DH5_Channel Hopping



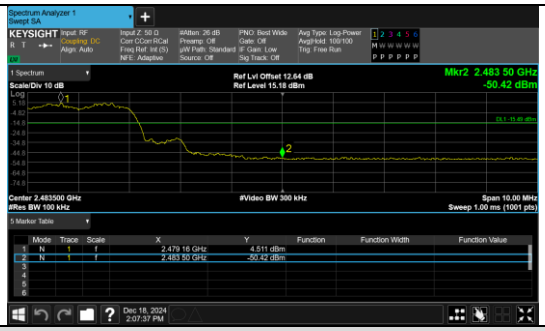
Out Of Band Emission(Left)
GFSK_DH5_Channel Hopping



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



Out Of Band Emission(Right)
GFSK_DH5_Channel Hopping

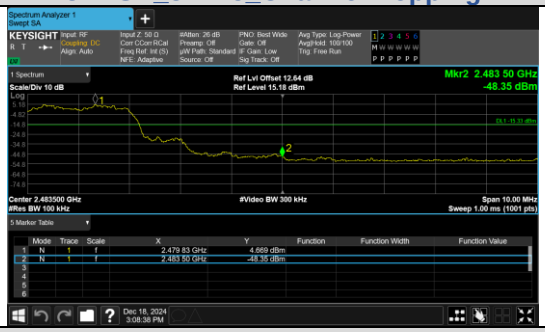


Out Of Band Emission(Right)
π/4DQPSK_2-DH5_Channel Hopping

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

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

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

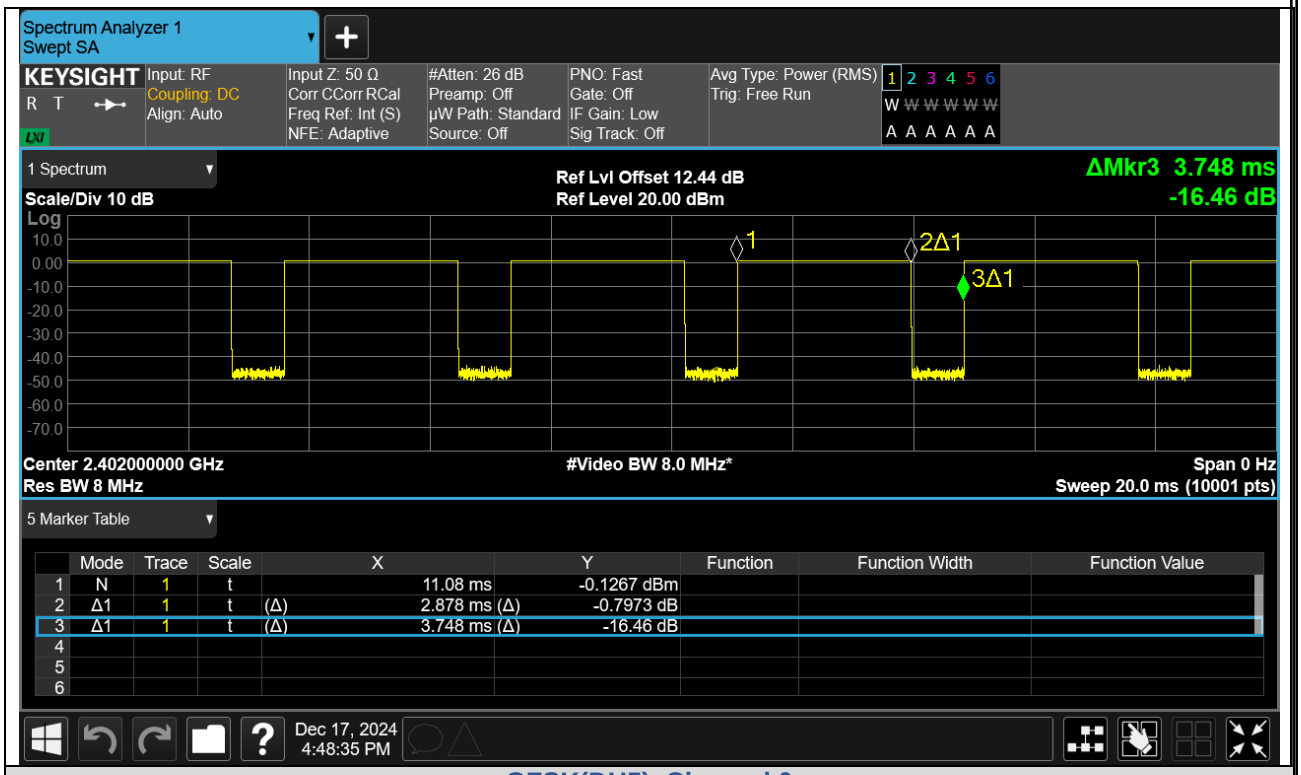


Out Of Band Emission(Right)
8DPSK_3-DH5_Channel Hopping

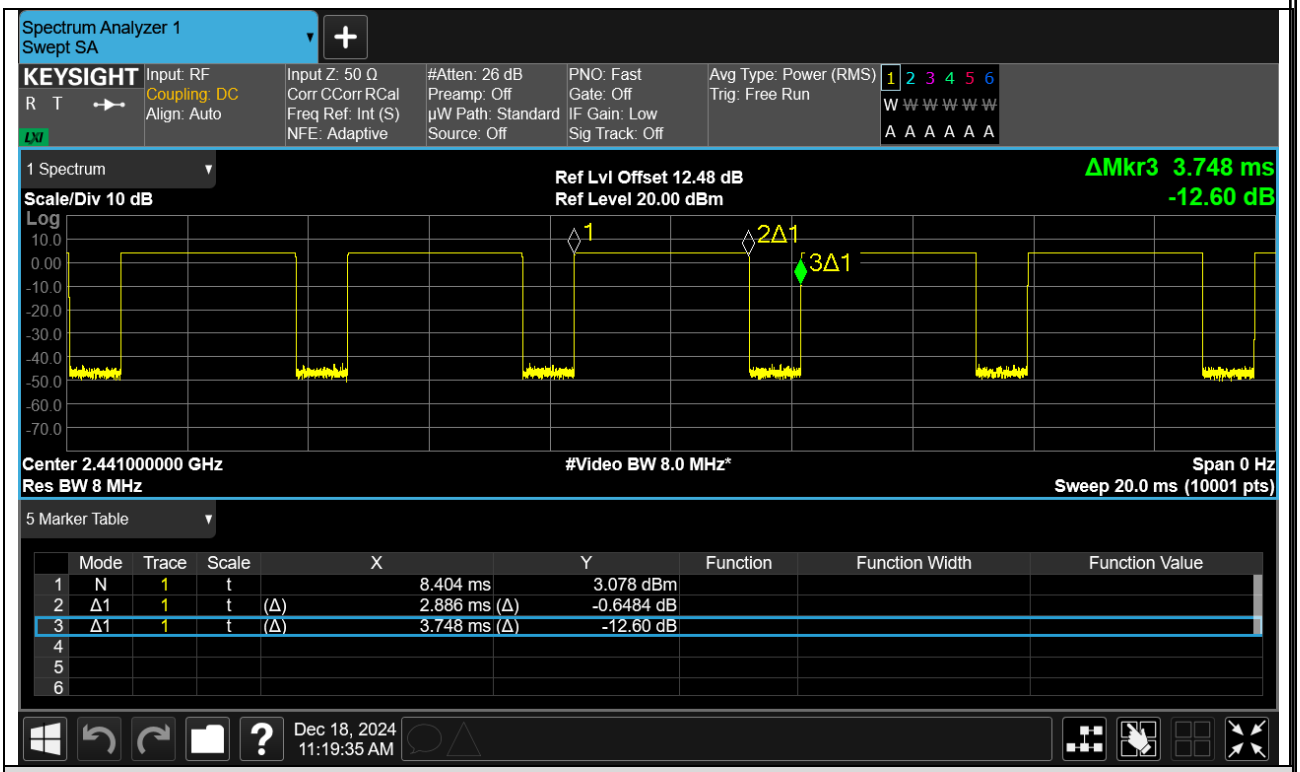
8.6 DUTY CYCLE
Test Result

Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)	1/T
GFSK	DH5	0	2.878	3.748	76.79	0.7679	1.147	0.3475
		39	2.886	3.748	77.00	0.7700	1.1351	0.3465
		78	2.888	3.748	77.05	0.7705	1.1323	0.3463
π/4DQPSK	2-DH5	0	2.884	3.748	76.95	0.7695	1.1379	0.3467
		39	2.886	3.748	77.00	0.7700	1.1351	0.3465
		78	2.884	3.748	76.95	0.7695	1.1379	0.3467
8DPSK	3-DH5	0	2.884	3.748	76.95	0.7695	1.1379	0.3467
		39	2.884	3.748	76.95	0.7695	1.1379	0.3467
		78	2.884	3.748	76.95	0.7695	1.1379	0.3467

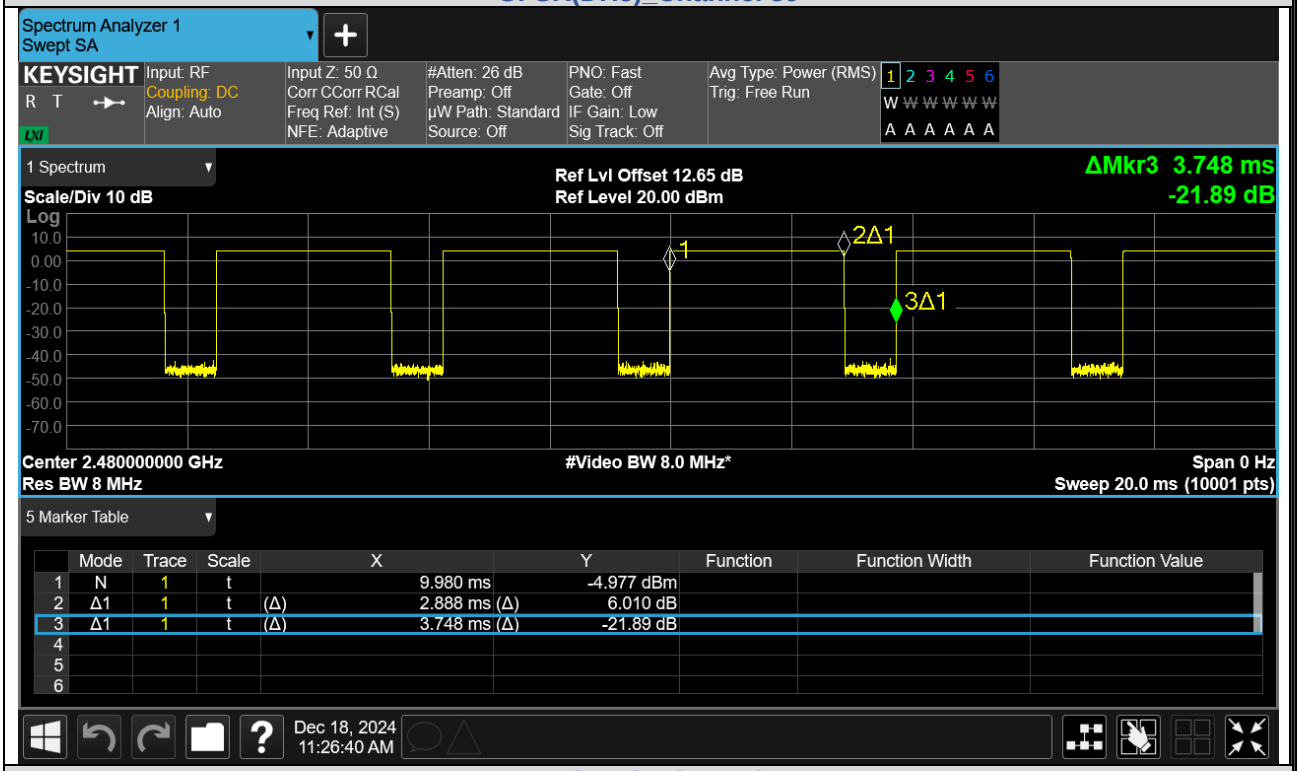
Test Graphs



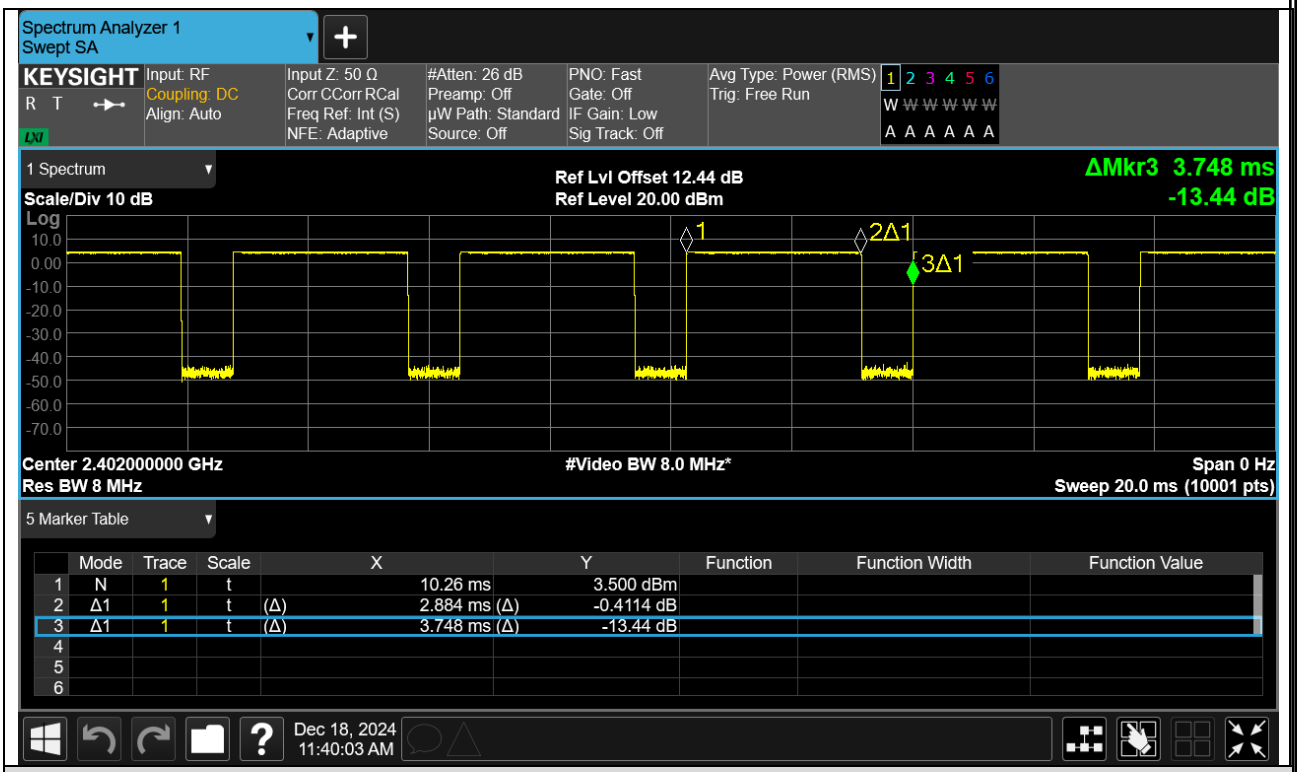
GFSK(DH5)_Channel 0



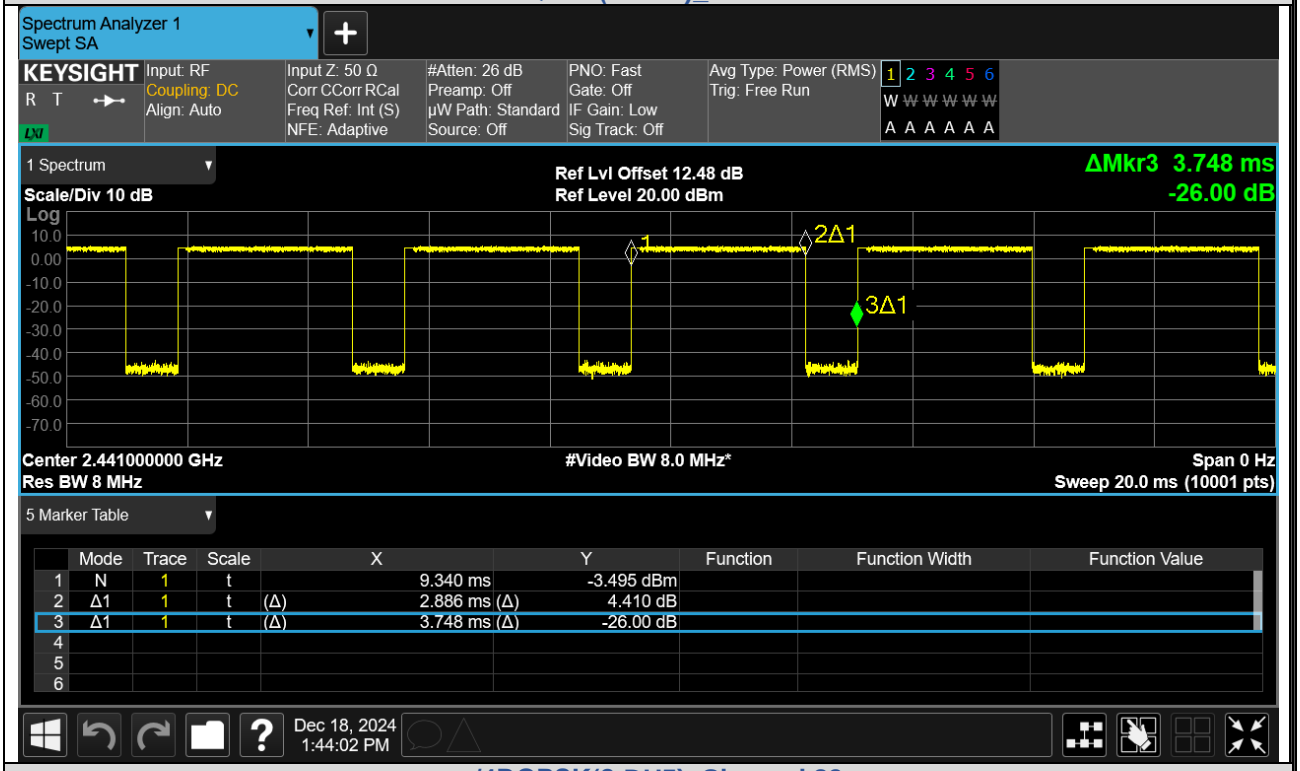
GFSK(DH5)_Channel 39



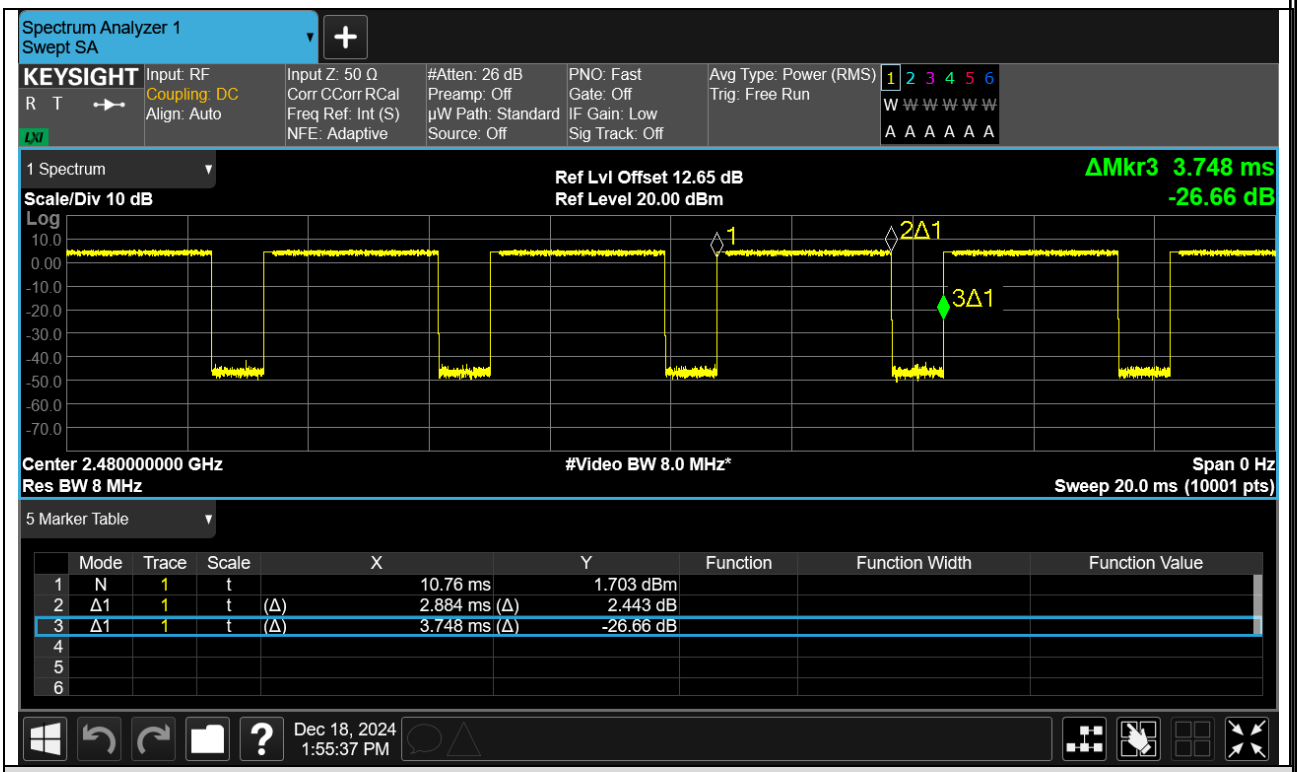
GFSK(DH5)_Channel 78



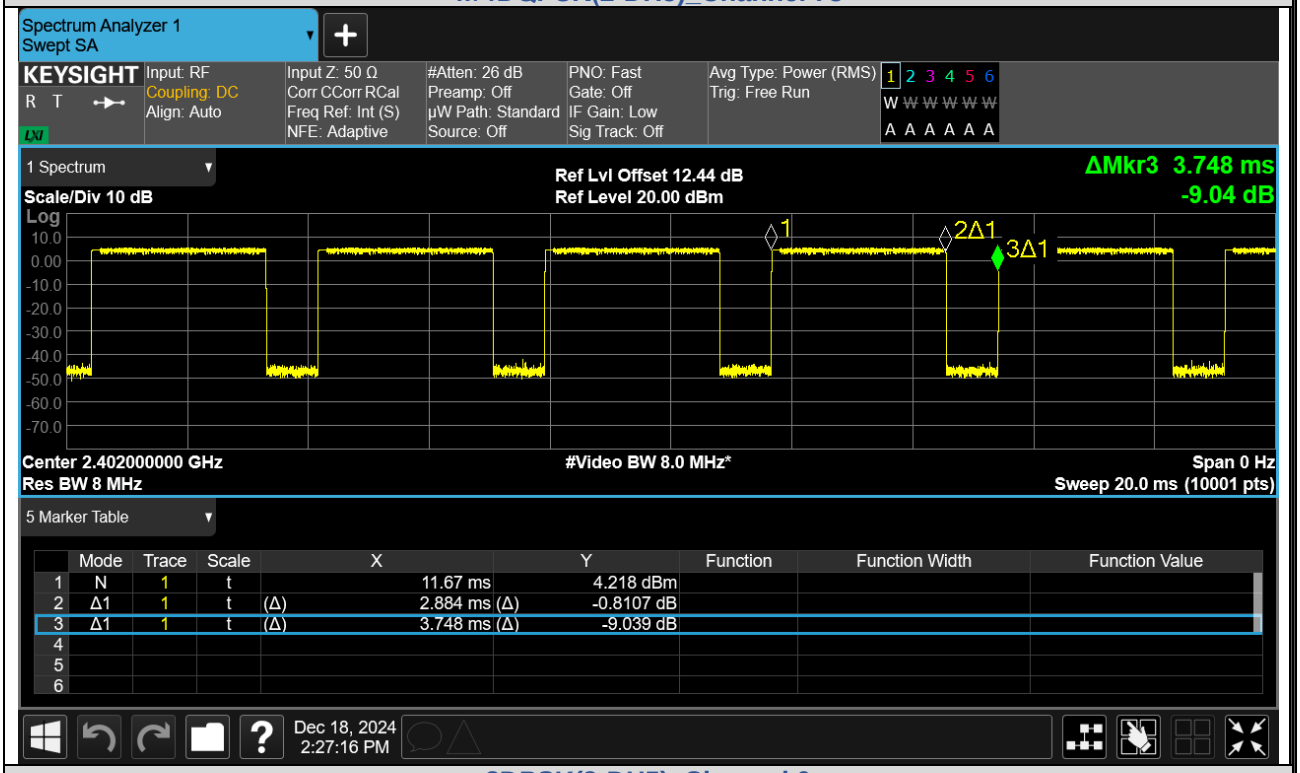
π/4DQPSK(2-DH5)_Channel 0



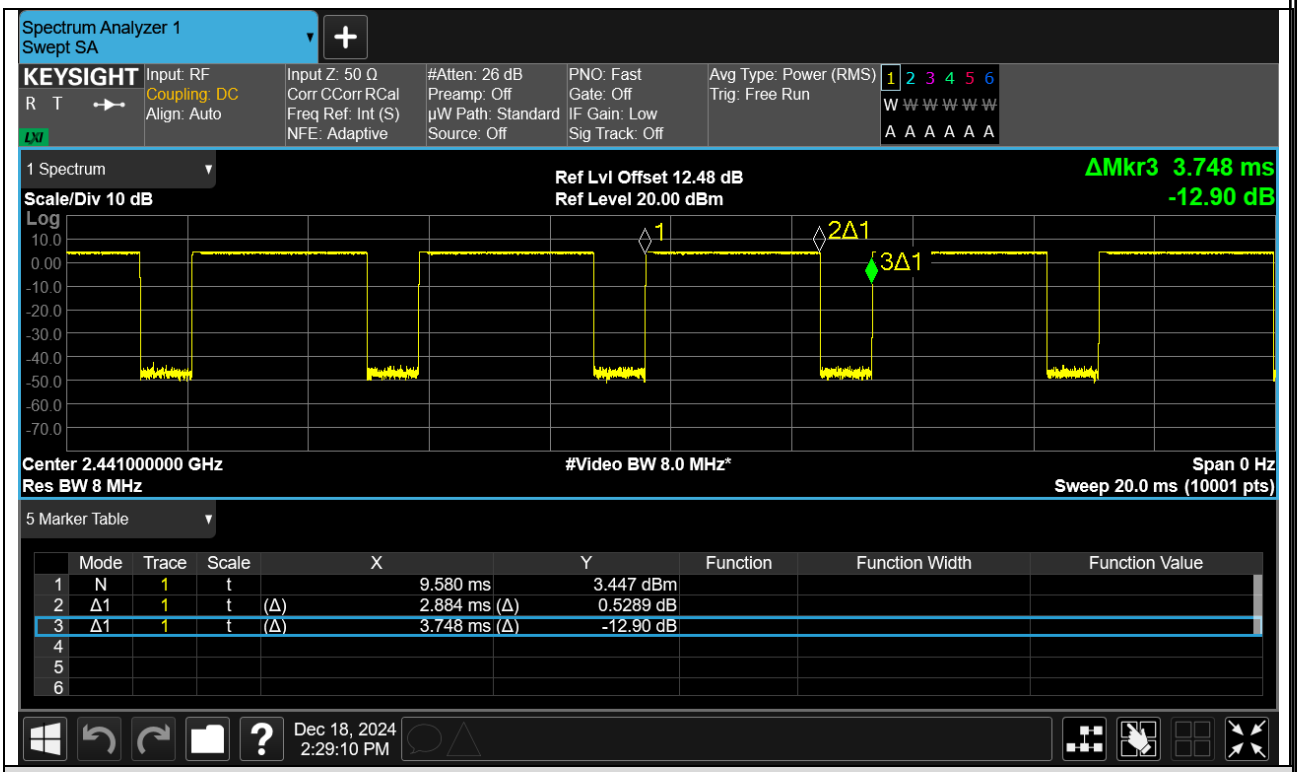
π/4DQPSK(2-DH5)_Channel 39



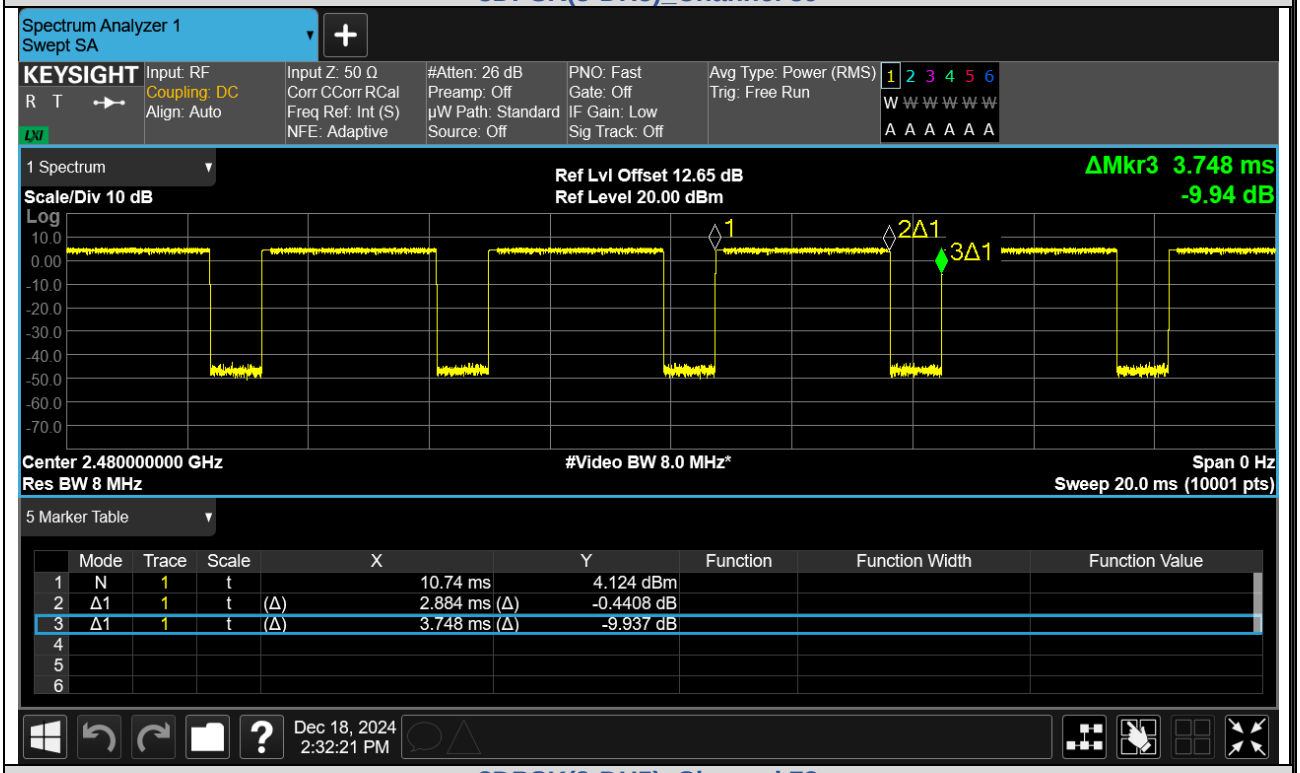
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39

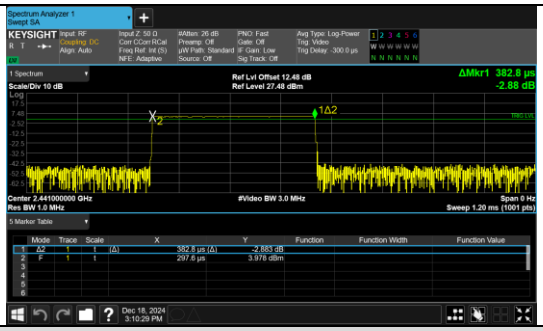


8DPSK(3-DH5)_Channel 78

8.7 DWELL TIME
Test Result

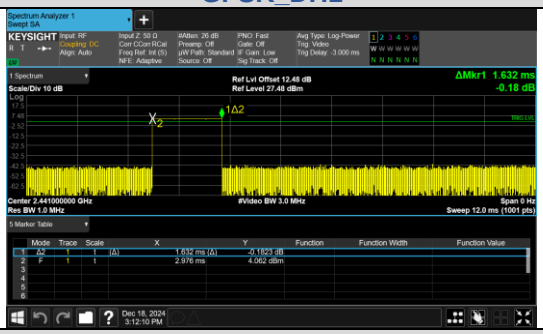
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH1	CH39 (2441MHz)	0.3828	313	119.82	< 400	PASS
	DH3		1.632	157	256.22		PASS
	DH5		2.896	108	312.77		PASS
π/4DQPSK	2-DH1		0.3840	311	119.42		PASS
	2-DH3		1.632	157	256.22		PASS
	2-DH5		2.880	111	319.68		PASS
8DPSK	3-DH1		0.3840	314	120.58		PASS
	3-DH3		1.632	156	254.59		PASS
	3-DH5		2.880	99	285.12		PASS

Test Graphs

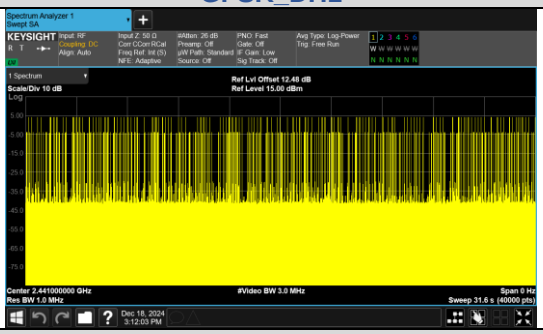


Pulse Width
GFSK_DH1

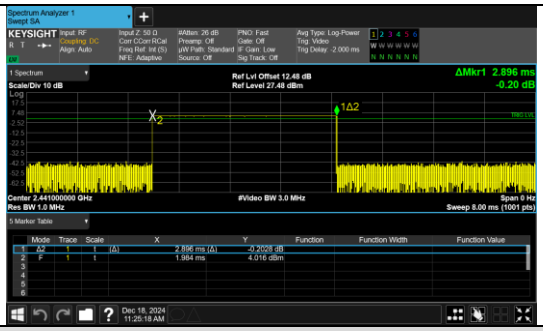
Number of Pulses in 31.6 seconds
GFSK_DH1



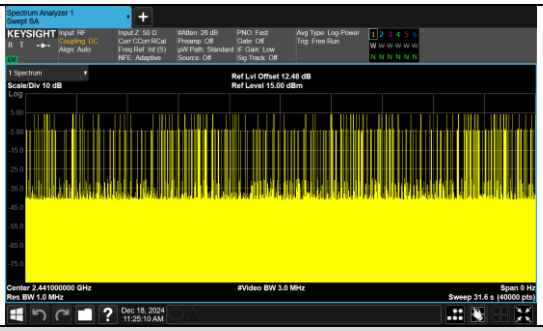
Pulse Width
GFSK_DH3



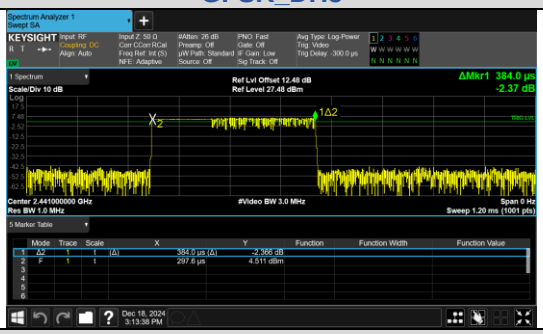
Number of Pulses in 31.6 seconds
GFSK_DH3



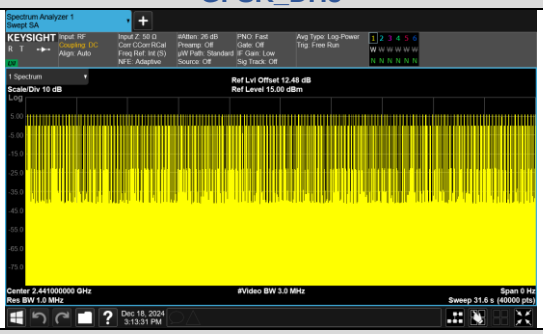
Pulse Width
GFSK_DH5



Number of Pulses in 31.6 seconds
GFSK_DH5

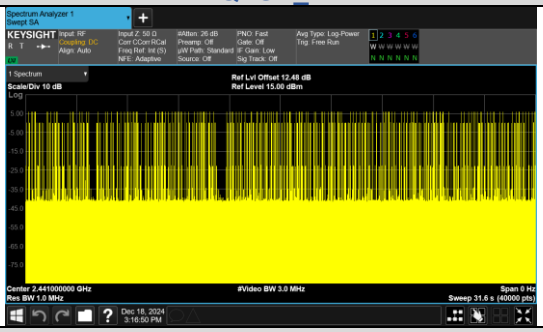


Pulse Width
π/4DQPSK_2-DH1



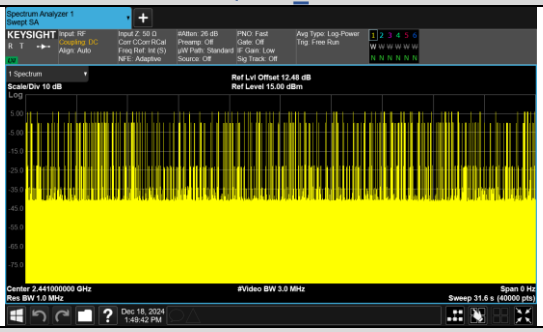
Number of Pulses in 31.6 seconds
π/4DQPSK_2-DH1

Pulse Width
π/4DQPSK_2-DH3



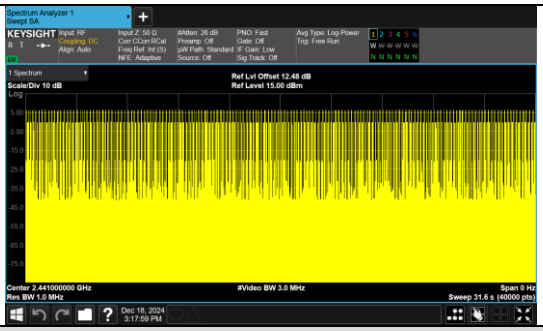
Number of Pulses in 31.6 seconds
π/4DQPSK_2-DH3

Pulse Width
π/4DQPSK_2-DH5



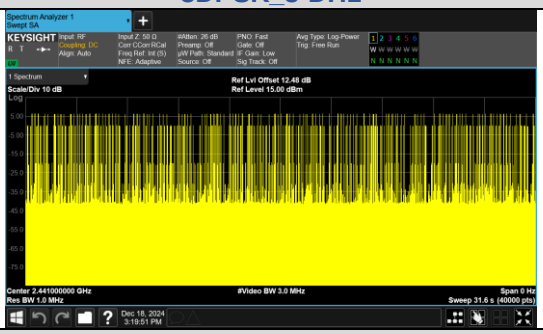
Number of Pulses in 31.6 seconds
π/4DQPSK_2-DH5

Pulse Width
8DPSK_3-DH1



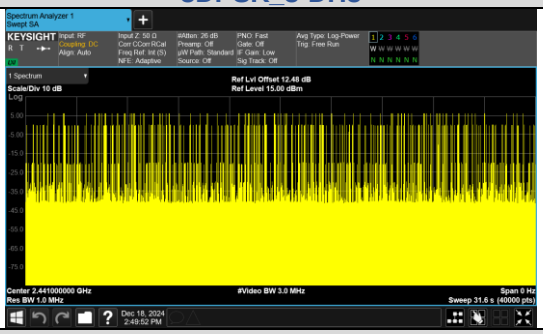
Number of Pulses in 31.6 seconds
8DPSK_3-DH1

Pulse Width
8DPSK_3-DH3



Number of Pulses in 31.6 seconds
8DPSK_3-DH3

Pulse Width
8DPSK_3-DH5



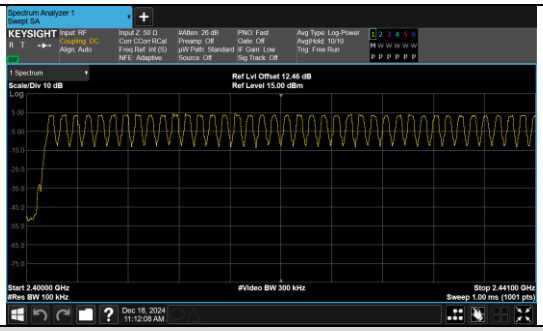
Number of Pulses in 31.6 seconds
8DPSK_3-DH5

8.8 NUMBER OF HOPPING CHANNEL

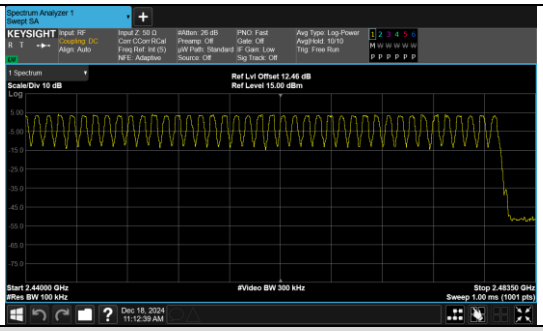
Test Result

Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

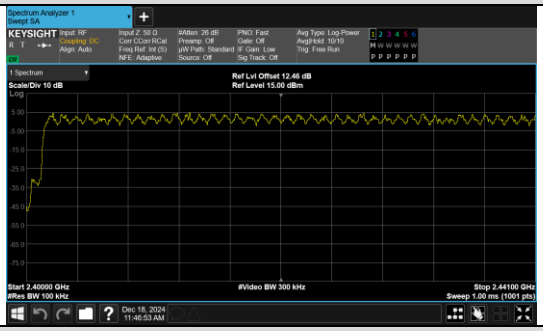
Test Graphs



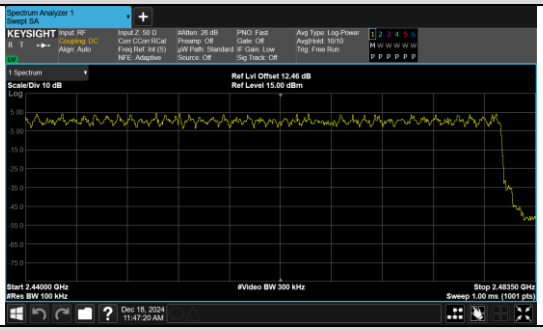
Low End Spectrum Channel Hopping Plot GFSK



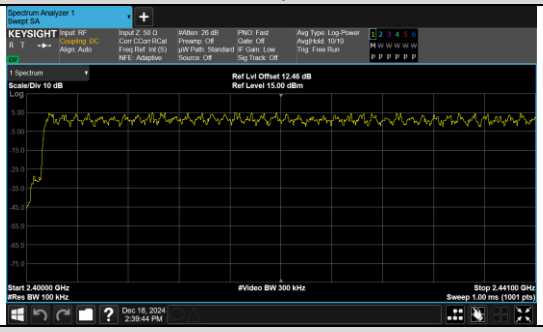
High End Spectrum Channel Hopping Plot GFSK



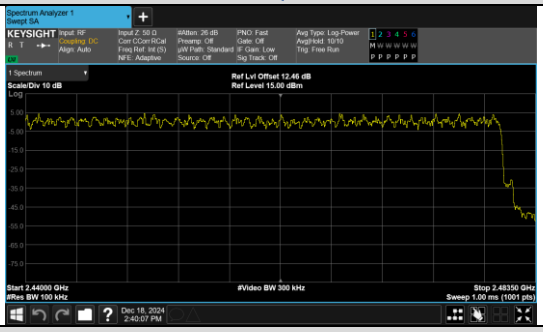
Low End Spectrum Channel Hopping Plot π/4DQPSK



High End Spectrum Channel Hopping Plot π/4DQPSK



Low End Spectrum Channel Hopping Plot 8DPSK



High End Spectrum Channel Hopping Plot 8DPSK

END OF REPORT