3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

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

GFSK

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390	59.42	PK	74	14.58	64.83	27.49	3.32	36.22	-5.41
2390	38.86	AV	54	15.14	44.27	27.49	3.32	36.22	-5.41
Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390	58.5	PK	74	15.5	63.91	27.49	3.32	36.22	-5.41
2390	39.18	AV	54	14.82	44.59	27.49	3.32	36.22	-5.41
Frequency(MHz):			**2480**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.5	58.95	PK	74	15.05	64.46	27.45	3.38	36.34	-5.51
2483.5	41.57	AV	54	12.43	47.08	27.45	3.38	36.34	-5.51
Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.5	59.31	PK	74	14.69	64.82	27.45	3.38	36.34	-5.51
2483.5	39.77	AV	54	14.23	45.28	27.45	3.38	36.34	-5.51

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.

5.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 125mW (20.97).

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the powersensor.

Test Configuration

Test Results

See Appendix I

5.4 20dB Bandwidth

Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

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

Test Configuration

Test Results

See Appendix III

5.5 Frequency Separation

LIMIT

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

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100 KHz RBW and 300 KHz VBW.

TEST CONFIGURATION

TEST RESULTS

See Appendix IV

5.6 Number of hopping frequency

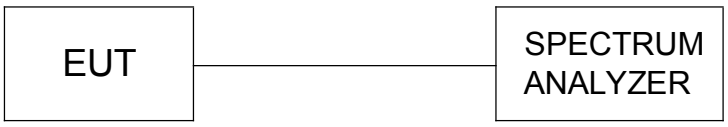
Limit

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

Test Procedure

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

Test Configuration



Test Results

See Appendix VIII

5.7 Time of Occupancy (Dwell Time)

Limit

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

Test Procedure

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

Test Configuration

Test Results

See Appendix VII

5.8 Spurious RF Conducted Emission

TEST CONFIGURATION

TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and mwasure frequeny range from 9KHz to 25GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

Test Results

See Appendix V

5.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

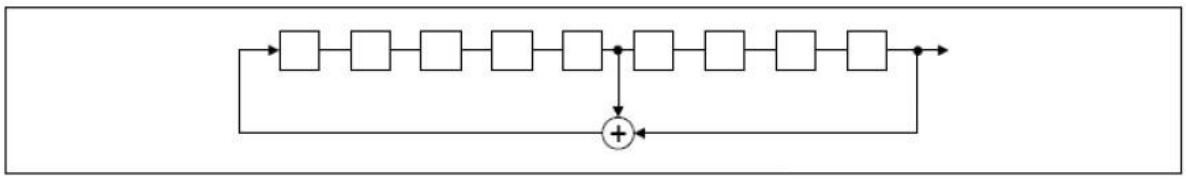
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

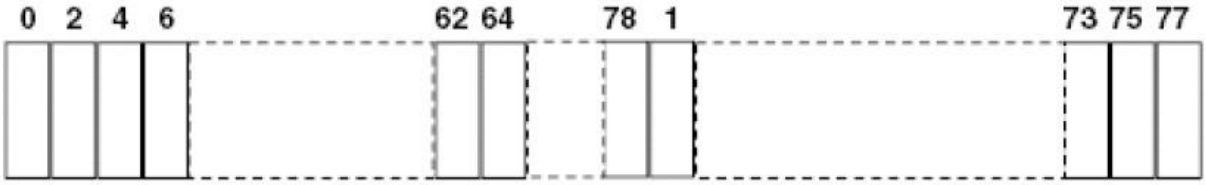
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

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



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

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

5.10 Antenna Requirement

Standard Applicable

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

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

Refer to statement below for compliance

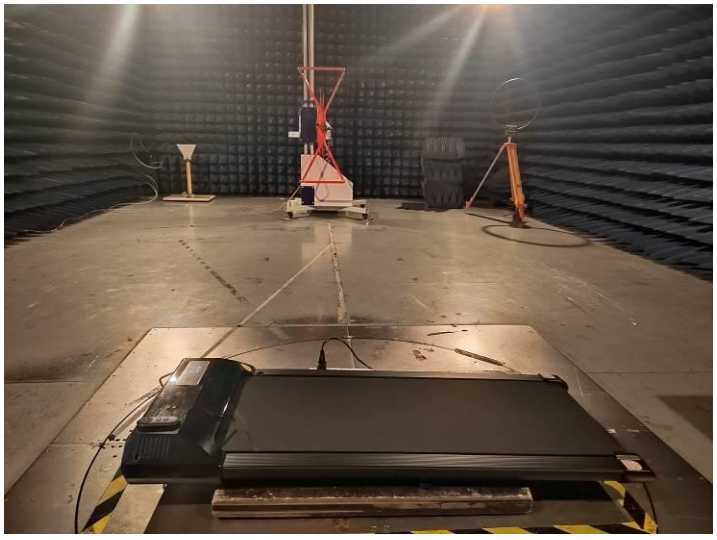
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

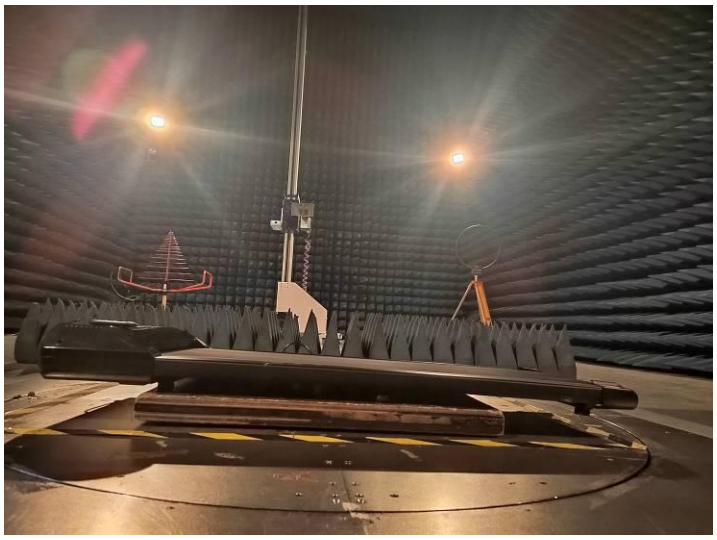
Antenna Connected Construction

The directional gains of antenna used for transmitting is 0dBi, and the antenna is an PCB antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

Results: Compliance.

6 Test Setup Photos of the EUT





7 Photos of the EUT

See related photo report.

APPENDIX I.Conducted Peak Output Power

Test Result

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Max. Avg. Power (dBm)	Limit (dBm)	Result
GFSK	DH5	0	-1.085	0.779	None	30	PASS
		39	-0.267	0.940	None		PASS
		78	-0.609	0.869	None		PASS
π/4DQPSK	2-DH5	0	0.637	1.158	None	20.97	PASS
		39	1.478	1.405	None		PASS
		78	1.208	1.321	None		PASS
8DPSK	3-DH5	0	0.696	1.174	None		PASS
		39	1.574	1.437	None		PASS
		78	1.200	1.318	None		PASS

APPENDIX II.99% Bandwidth

Test Result

Modulation	Channel	99% BW (MHz)
GFSK	0	0.99995
	39	0.99499
	78	0.99488
π/4DQPSK	0	1.0672
	39	1.0603
	78	1.0361
8DPSK	0	1.1115
	39	1.1146
	78	1.1166

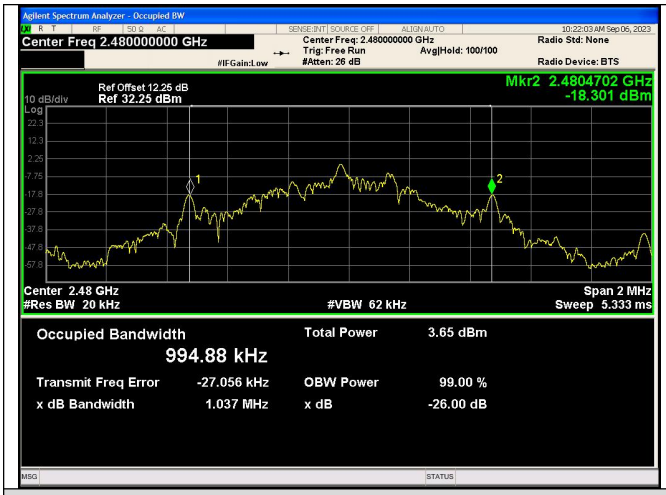
Test Graphs

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

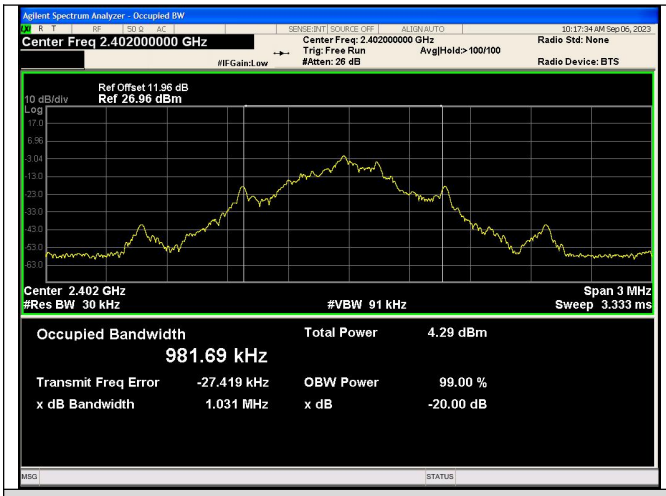
Void

APPENDIX III.20dB Bandwidth

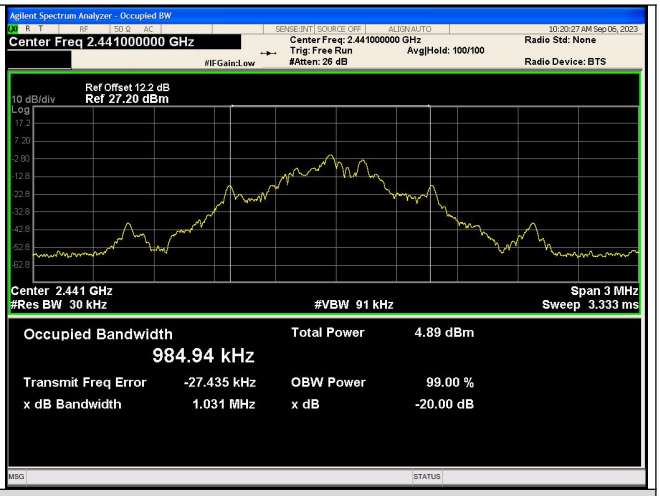
Test Result

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	1.031
	39	2441 MHz	1.031
	78	2480 MHz	1.031
π/4DQPSK	0	2402 MHz	1.137
	39	2441 MHz	1.141
	78	2480 MHz	1.146
8DPSK	0	2402 MHz	1.200
	39	2441 MHz	1.197
	78	2480 MHz	1.188

Test Graphs



GFSK_DH5_Channel 0

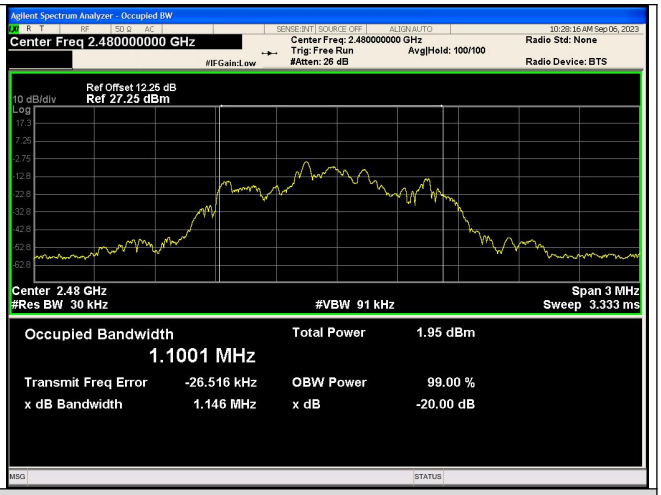


GFSK_DH5_Channel 39

GFSK_DH5_Channel 78

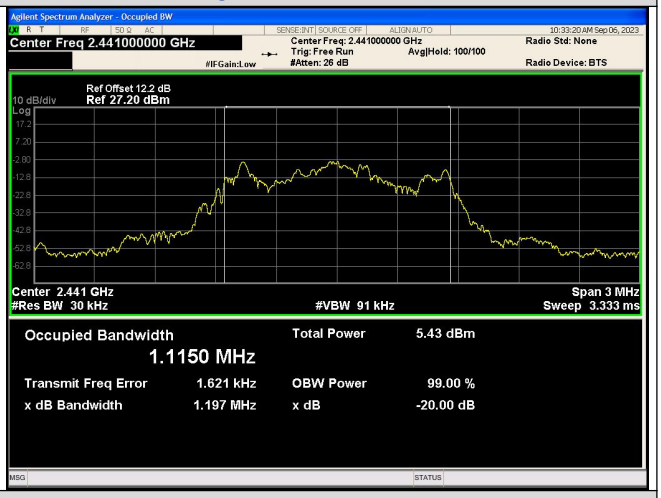
π/4DQPSK_2-DH5_Channel 0

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

Void

APPENDIX IV.Carrier Frequencies Separation

Test Result

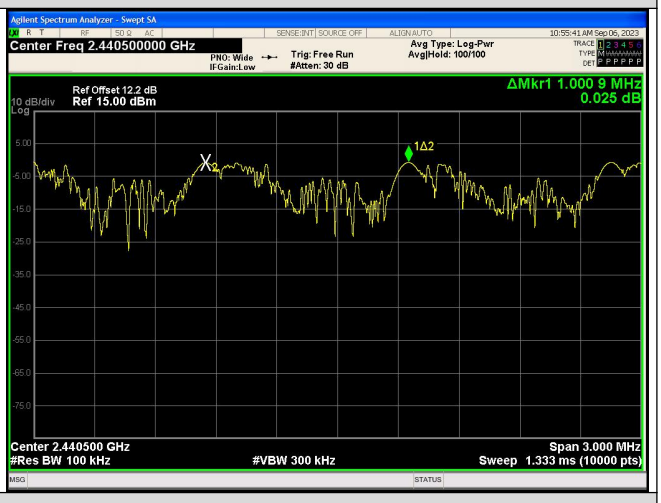
Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.9748	2440.9745	0.9997	0.687	PASS
GFSK	DH5	2439.9715	2440.9736	1.0021	0.687	PASS
GFSK	DH5	2439.9895	2440.9733	0.9838	0.687	PASS
π/4DQPSK	2-DH5	2439.8488	2440.8497	1.0009	0.758	PASS
π/4DQPSK	2-DH5	2439.8497	2440.8503	1.0006	0.761	PASS
π/4DQPSK	2-DH5	2439.985	2440.9703	0.9853	0.764	PASS
8DPSK	3-DH5	2439.973	2440.9739	1.0009	0.8	PASS
8DPSK	3-DH5	2440.1242	2441.1065	0.9823	0.798	PASS
8DPSK	3-DH5	2439.9889	2441.135	1.1461	0.792	PASS

Test Graphs

GFSK

GFSK

GFSK



π/4DQPSK

π/4DQPSK

π/4DQPSK

8DPSK

8DPSK

8DPSK

Void

APPENDIX V.Conducted Out Of Band Emission

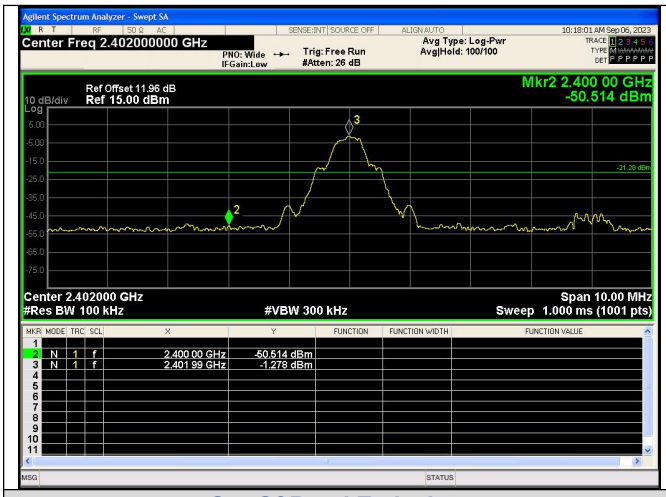
Test Result

Non-Hopping

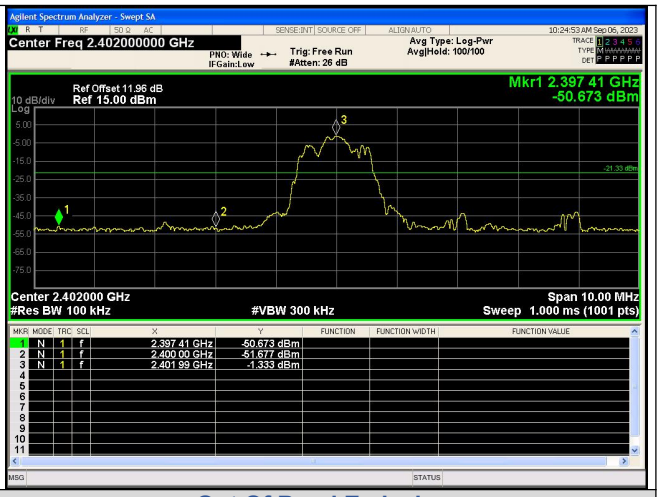
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2400.00	-50.514	-21.28	-29.236	PASS
			4803.76	-59.026	-21.28	-37.746	PASS
			7205.93	-63.835	-21.28	-42.555	PASS
			9608.11	-62.834	-21.28	-41.554	PASS
			24967.5	-46.652	-21.28	-25.372	PASS
		39	4881.79	-59.031	-20.5	-38.531	PASS
			7323.30	-63.705	-20.5	-43.205	PASS
			9764.17	-62.559	-20.5	-42.059	PASS
			24983.8	-46.343	-20.5	-25.843	PASS
		78	2483.50	-51.782	-20.86	-31.410	PASS
			4959.83	-60.147	-20.86	-39.287	PASS
			7440.03	-62.966	-20.86	-42.106	PASS
			9919.62	-63.677	-20.86	-42.817	PASS
			24948.8	-45.633	-20.86	-24.773	PASS
π/4DQPSK	2-DH5	0	2400.00	-51.677	-21.33	-30.347	PASS
			2397.41	-50.673	-21.33	-29.343	PASS
			4803.80	-59.102	-21.33	-37.772	PASS
			7205.30	-62.880	-21.33	-41.550	PASS
			9608.70	-63.670	-21.33	-42.340	PASS
			24983.8	-45.359	-21.33	-24.029	PASS
		39	4881.79	-59.641	-20.48	-39.161	PASS
			7322.05	-64.102	-20.48	-43.621	PASS
			9763.55	-63.335	-20.48	-42.855	PASS
			24917.6	-46.134	-20.48	-25.654	PASS
		78	2483.50	-51.452	-24.28	-27.253	PASS
			4959.83	-62.161	-24.28	-37.881	PASS
			7440.03	-63.065	-24.28	-38.785	PASS
			9920.24	-63.040	-24.28	-38.760	PASS
			24918.8	-44.311	-24.28	-20.031	PASS
8DPSK	3-DH5	0	2400.00	-52.190	-21.41	-30.780	PASS
			2397.14	-49.998	-21.41	-28.588	PASS
			4804.40	-60.154	-21.41	-38.744	PASS
			7205.30	-63.814	-21.41	-42.404	PASS
			9607.50	-64.338	-21.41	-42.928	PASS
			24882.0	-46.295	-21.41	-24.885	PASS

		39	4881.79	-60.031	-20.47	-39.561	PASS
			7323.30	-62.317	-20.47	-41.847	PASS
			9764.80	-62.272	-20.47	-41.802	PASS
			24892.0	-45.758	-20.47	-25.288	PASS
		78	2483.50	-51.506	-21.16	-30.360	PASS
			4959.83	-60.172	-21.16	-39.012	PASS
			7440.66	-63.331	-21.16	-42.171	PASS
			9920.24	-62.501	-21.16	-41.341	PASS
			24875.8	-45.987	-21.16	-24.827	PASS

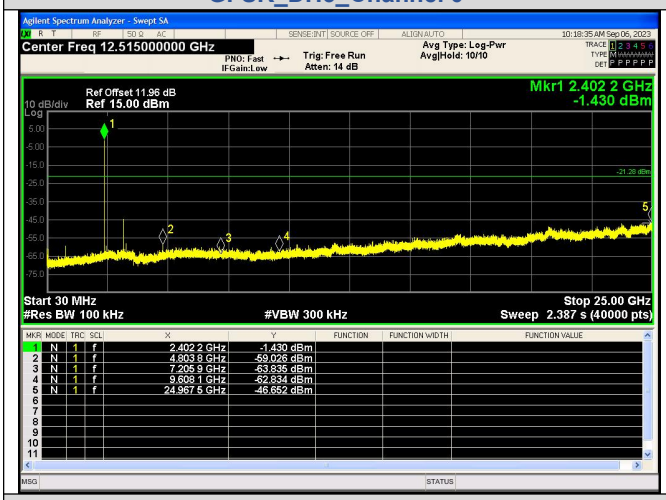
Test Graphs



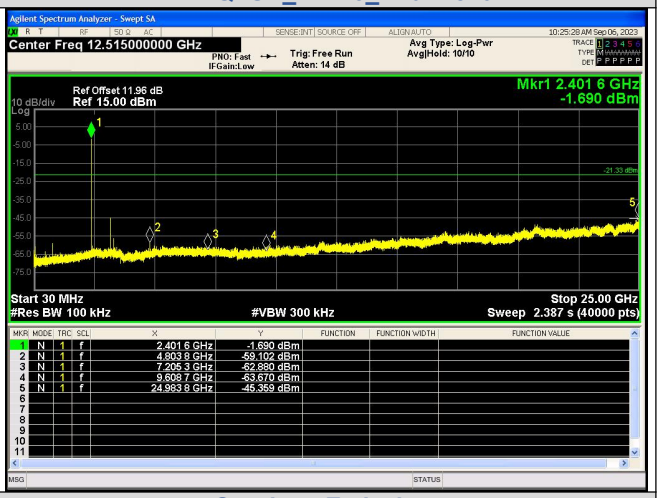
Out Of Band Emission
GFSK_DH5_Channel 0



Out Of Band Emission
π/4DQPSK_2-DH5_Channel 0



Spurious Emission
GFSK_DH5_Channel 0



Spurious Emission
π/4DQPSK_2-DH5_Channel 0