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Prüfbericht - Nr.: *Test Report No.:*	**19660144 001**		**Seite 1 von 46** *Page 1 of 46*
Auftraggeber: *Client:*	**Redpine Signals Inc** **2107 N.First Street, Suite 680,** **San Jose, CA 95131-2019** **United States**		
Gegenstand der Prüfung: *Test item:*	**Dual Band Combo Module**		
Bezeichnung: *Identification:*	**RS9113DB**	**Serien-Nr.:** *Serial No.*	**Engineering Sample**
Wareneingangs-Nr.: *Receipt No.:*	**1803055286**	**Eingangsdatum:** *Date of receipt:*	**11.11.2014**
Prüfort: *Testing location:*	**Refer Page 4 of 46 for test facilities**		
Prüfgrundlage: *Test specification:*	**FCC Part 15: Subpart C Section 15.247** **ANSI C63.4-2009**		
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test items passed the test specification(s).*		
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland (India) Pvt. Ltd.** 82/A, 3rd Main, West Wing, Electronic City Phase 1 Hosur Road, Bangalore – 560 100. India **FCC Registration No.: 176555**		

geprüft / *tested by:*			**kontrolliert** / *reviewed by:*		
17.12.2014	Vinay N Sr. Engineer	Vinay. N	18.12.2014	Raghavendra Kulkarni Sr. Manager	Kulkarni
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges /*Other Aspects:* **FCC ID: XF6-RS9113DB**

Abkürzungen:	***P(ass)***	=	***entspricht Prüfgrundlage***	***Abbreviations:***	***P(ass)***	=	***passed***
	F(ail)	=	***entspricht nicht Prüfgrundlage***		***F(ail)***	=	***failed***
	N/A	=	***nicht anwendbar***		***N/A***	=	***not applicable***
	N/T	=	***nicht getestet***		***N/T***	=	***not tested***

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.

This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.

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Test Result Summary

Clause	Test Item	Result
Section 15.247 (b) (1)	Conducted Peak RF Output Power Test	Pass
Section 15.247 (a)(1)	Bandwidth Occupancy	Pass
Section 15.247 (a)(1)(III)	Number of Hopping Channels	Pass
Section 15.247 (a)(1)	Carrier Frequency Separation	Pass
Section 15.247 (a)(1)(III)	Time of Occupancy	Pass
Section 15.247 (d)	Band-edge compliance	Pass
Section 15.209 &15.205	Spurious Radiated Emissions and Restricted bands of operation	Pass

Note: Conducted measurements are done according to the procedure given in KDB No. **DA 00-705** March 2000

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Bandwidth Occupancy — Section 15.247 (a) (1) 15
Number of Hopping Channels — Section (a) (1) (iii) 26
Carrier Frequency Separation — Section 15.247 (a) (1) 28
Time of Occupancy (Dwell Time) — Section 15.247 (a)(1)(III) 29
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Appendix 1: Test Setup Photo

Appendix 2: EUT External Photo

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Appendix 5: Block Diagram

Appendix 6: Specification of EUT

Appendix 7: Schematic Diagrams

Appendix 8: Bill of Material

Appendix 9: User Manual

Appendix 10: Maximum Permissible Exposure Calculation

List of Test and Measurement Instruments

Equipment	Manufacturer	Model Name	Calibration Due Date
EMI Test Receiver	Rohde & Schwarz	ESU 40	04.10.2015
Broadband Antenna	Frankonia	ALX-4000	10.10.2015
Broadband Horn Antenna	Frankonia	HAX-18	10.10.2015
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	116794	01.09.2015
Active Loop Antenna	Frankonia	LAX-10	11.04.2015
Spectrum Analyser	Agilent Technologies	E4407B	23.03.2015

Testing Facilities:

1) TUV Rheinland (India) Private Limited
No. 108, West Wing
Electronic city Phase I
Bangalore – 560100

General Product Information

Product Function and Intended Use

The RS9113 module integrates a multi-threaded MAC processor with integrated analog peripherals and support for digital peripherals, baseband digital signal processor, analog front-end, crystal oscillator, calibration OTP memory, Dual band RF transceiver, Dual-band high-power amplifiers, baluns, diplexers, diversity switch and Quad-SPI Flash thus providing a fully-integrated solution for embedded wireless applications. The RS9113 based chips and modules leverage and improve upon Redpine's proven low power innovations from Lite-FTM products (RS9110) and provide WLAN 802.11n, BT4.0 and ZigBee convergence solution for integration into mobile and M2M communication devices. It can connect to a host processor through SDIO, USB, SPI or UART interfaces.

Ratings and System Details

Operating Frequency	2400 – 2483.5MHz	
No. of channel	79	
Channel Spacing	1MHz	
Transmitted Power	17.15dBm (Conducted peak power)	
Modulation	1Mbps	GFSK
	2Mbps	π/4-DQPSK
	3Mbps	8DPSK
Antenna Type	PCB Trace Antenna,	
Number of antenna	One	
Antenna Gain	0.5dBi	
Supply Voltage to Module	3.1V – 3.6V DC from Host device	
Environmental	Operational Temperature: -40ºC to 85º C	

Test Conditions:

Supply Voltage: 5V DC from USB

Environmental conditions:

Temperature: +24 º C RH: 62%

Test Set-up and Operation Mode

Principle of Configuration Selection
Transmission was enabled with 100% duty cycle duty on low, mid and high channel.

Test Operation and Test Software
Test software was used to enable the transmission with 100% duty cycle, changing channels (low/mid/high) and data rates on the EUT for the tests in this report.

Special Accessories and Auxiliary Equipment
- None

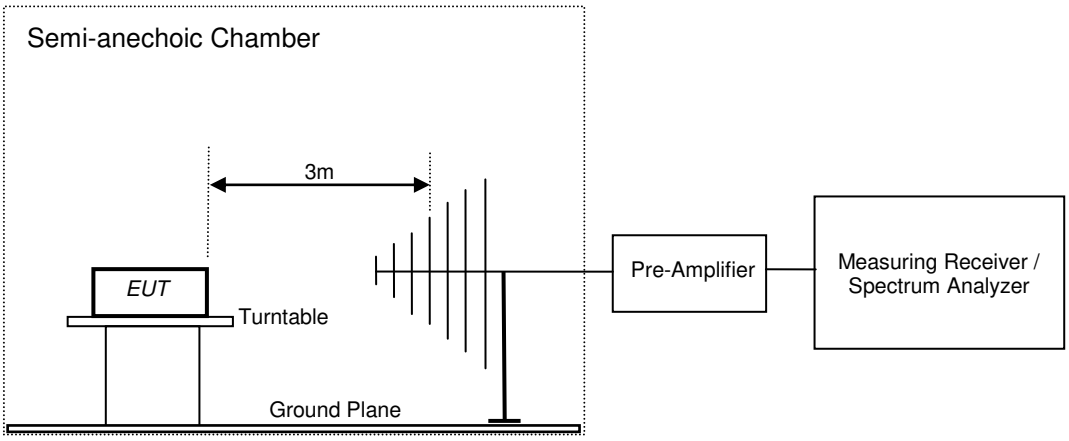
Countermeasures to achieve EMC Compliance
- None

Test Modes – Data Rates and Modulations
For Radiated spurious emissions, the tests were performed for all data rates and only worst case results are reported in this report.

Test Methodology

Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.4-2009. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000MHz was performed by horn antenna. The measurement below 30MHz was performed by loop antenna.

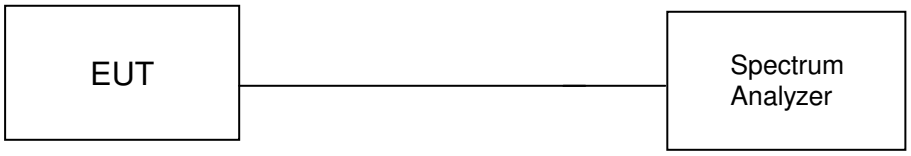


Test Results

Conducted Peak Output Power **Section 15.247 (b) (1)**
Result **Pass**

Test Specification	FCC Part 15C
Measurement Bandwidth (RBW)	3MHz
Detector	Peak
Requirement	<125 mW

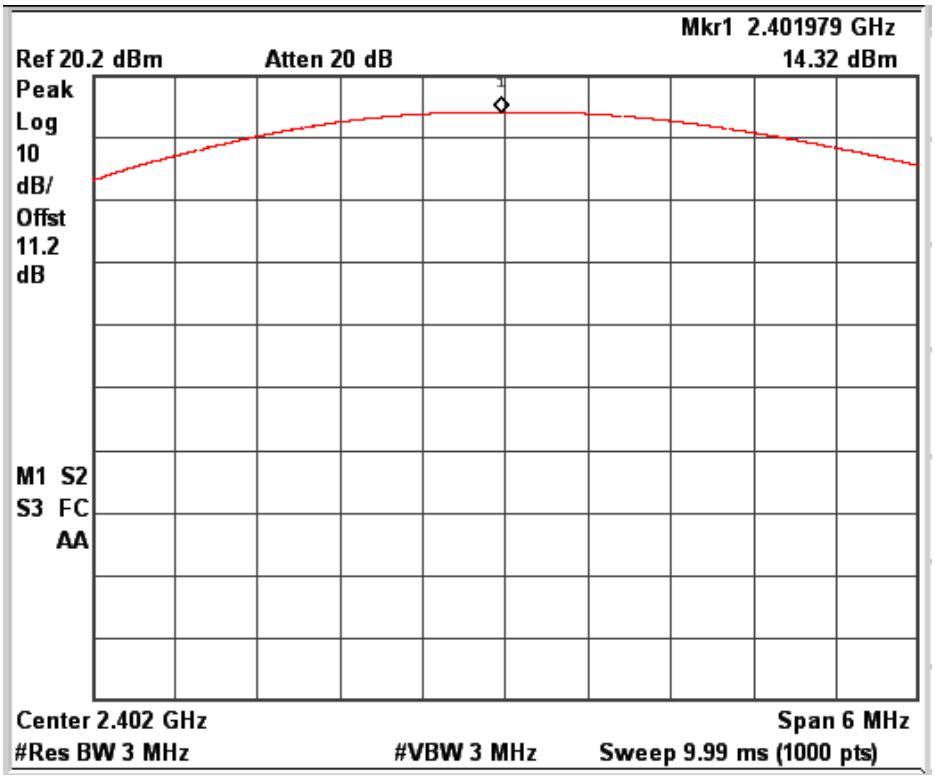
Test Method:



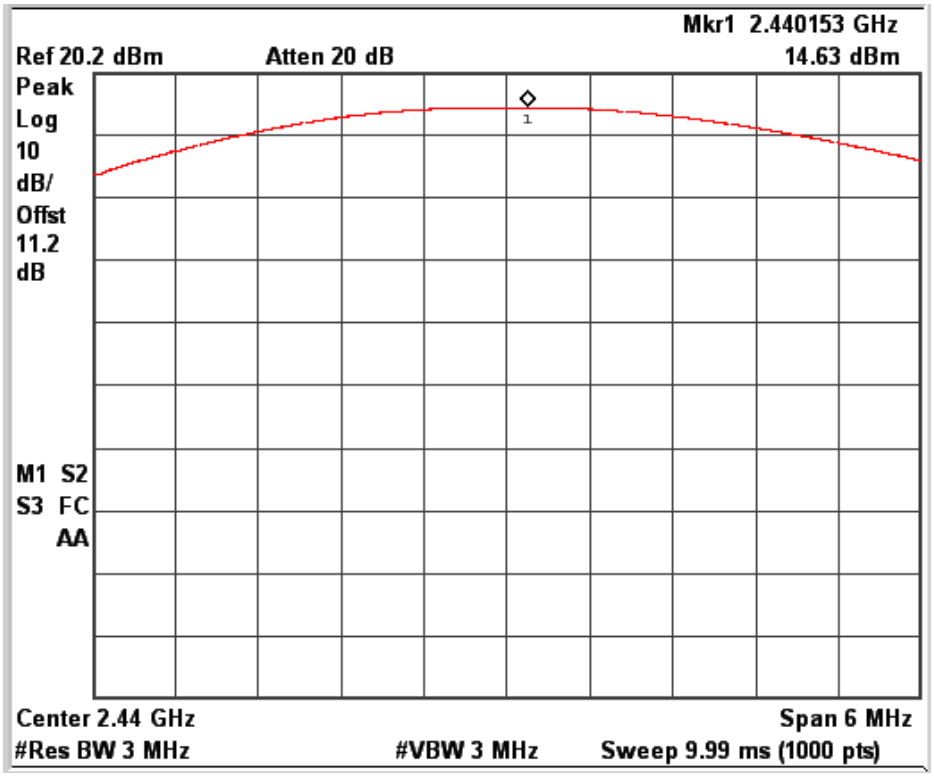
Test Result:

Modulation Type: GFSK

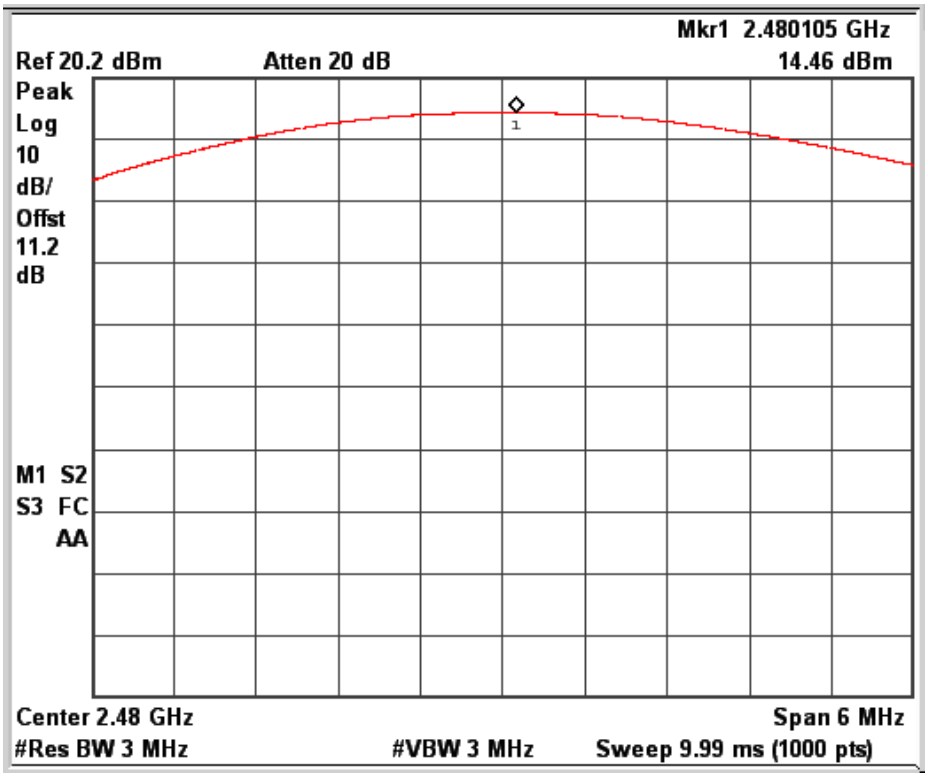
Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
Low	2402	14.32	20.96
Mid	2440	14.63	20.96
High	2480	14.46	20.96



Channel Frequency: 2402 MHz



Channel Frequency: 2440 MHz

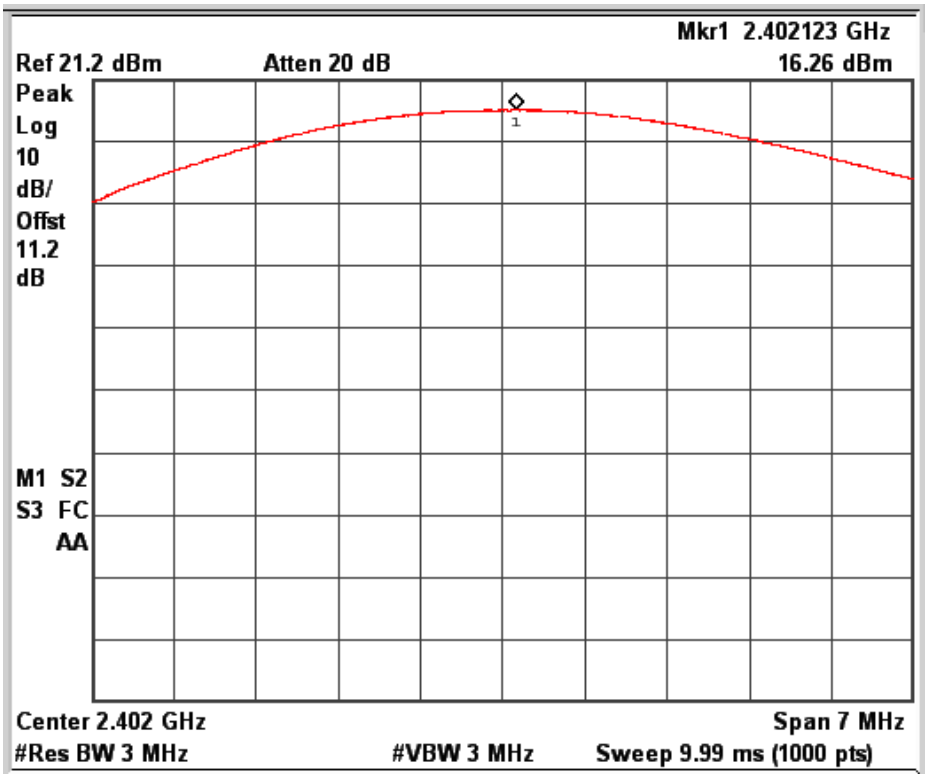


Channel Frequency: 2480 MHz

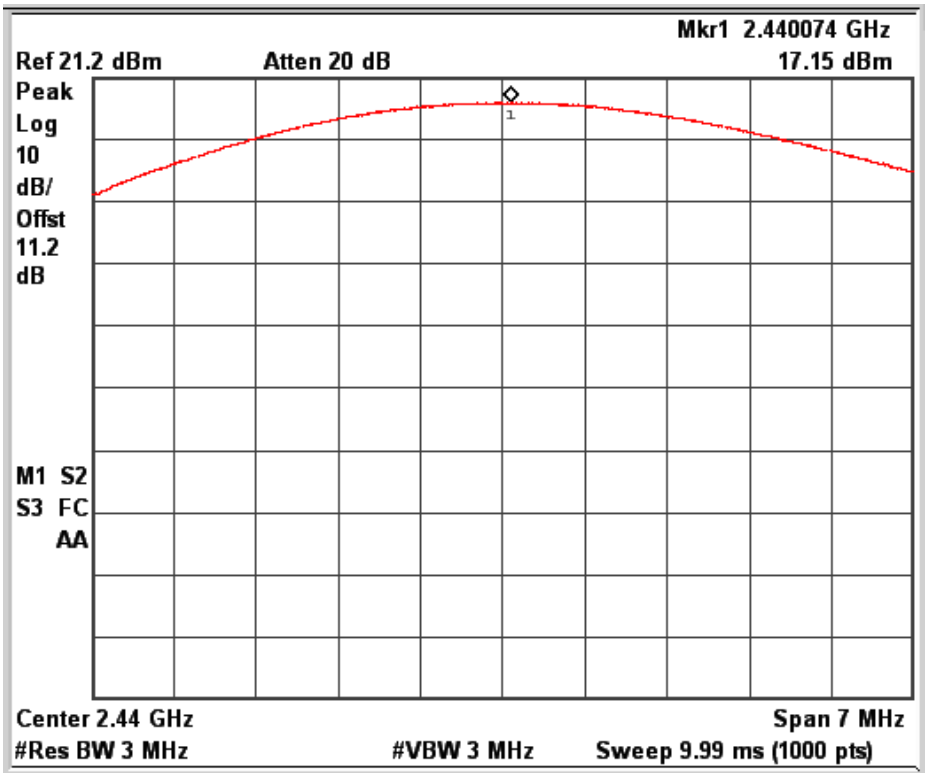
Modulation Type: P/4 DQPSK

Test Results:

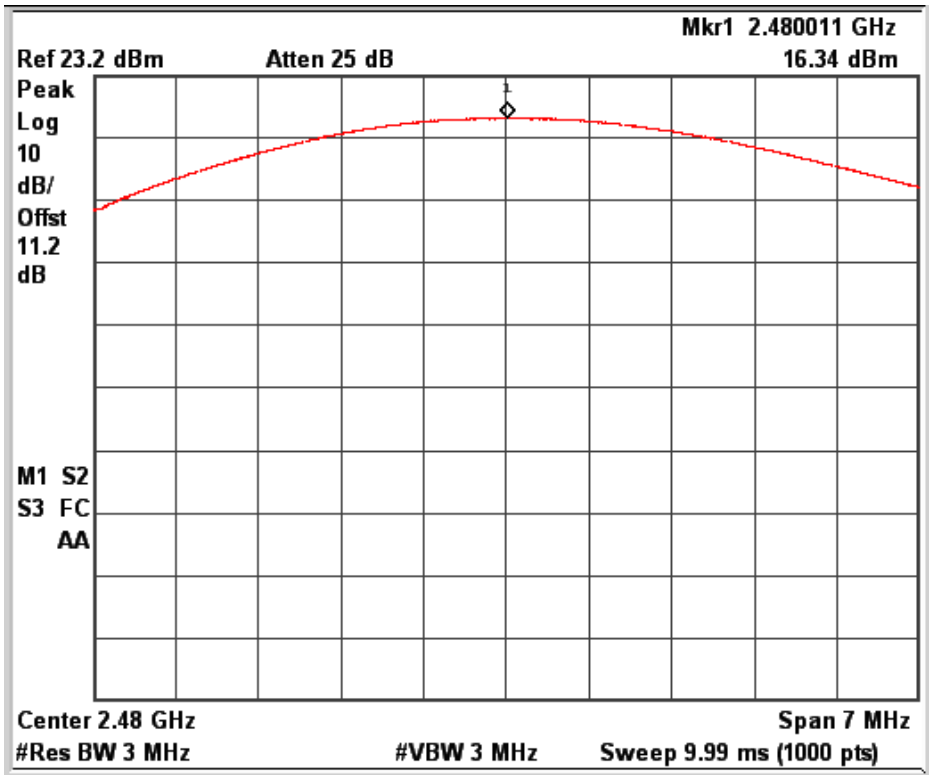
Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
Low	2402	16.26	20.96
Mid	2440	17.15	20.96
High	2480	16.34	20.96



Channel Frequency: 2402 MHz



Channel Frequency: 2440 MHz

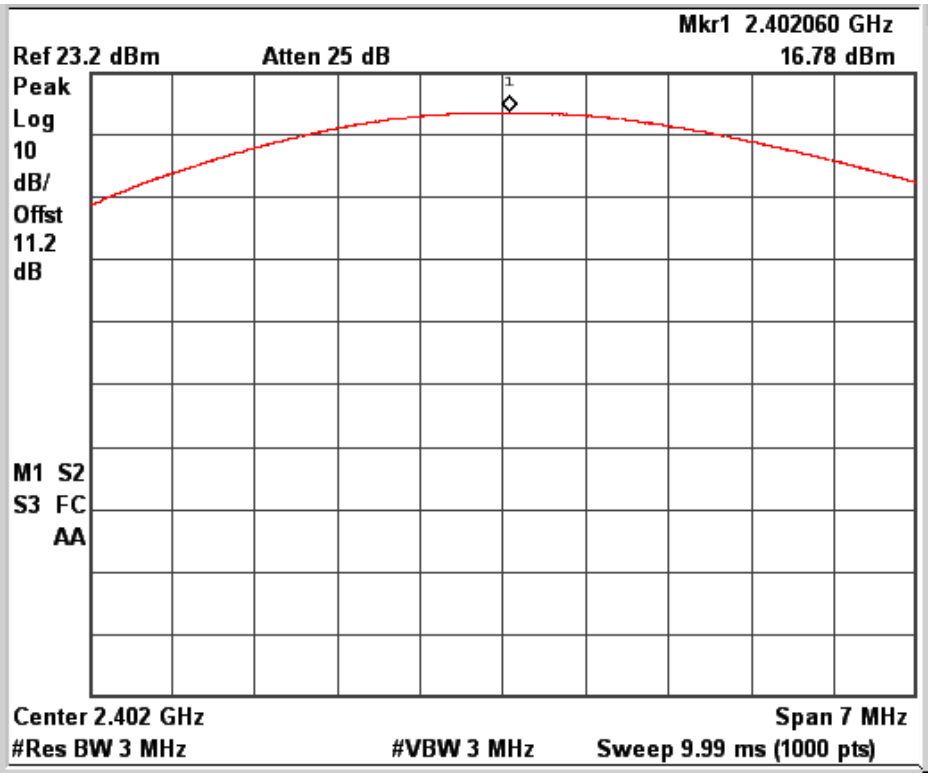


Channel Frequency: 2480 MHz

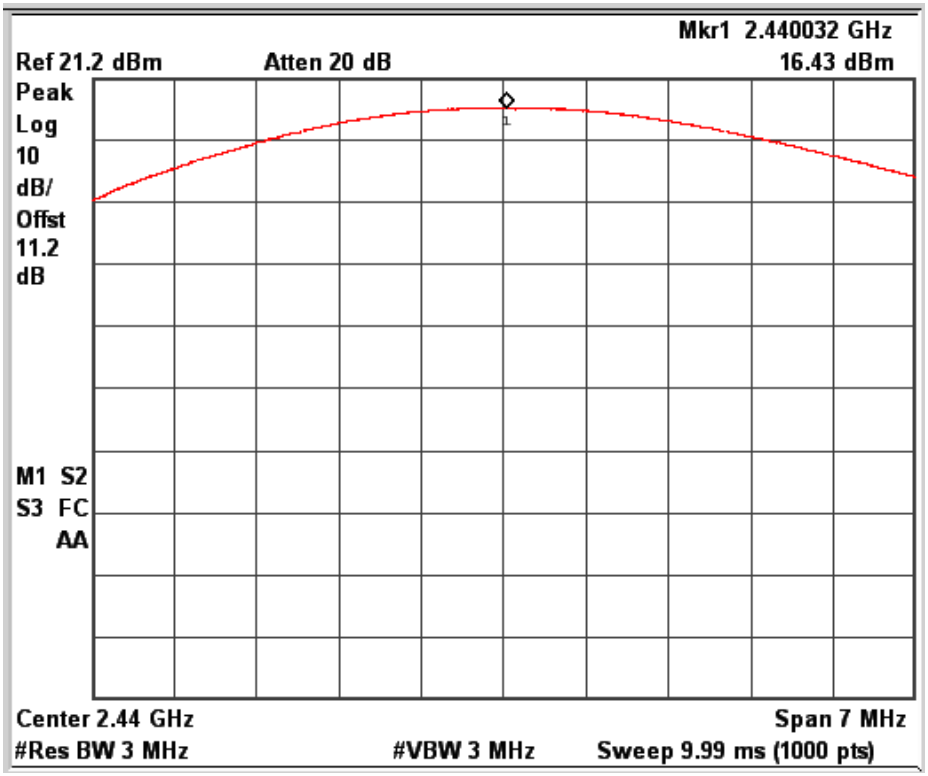
Modulation Type: 8 DQPSK

Test Results:

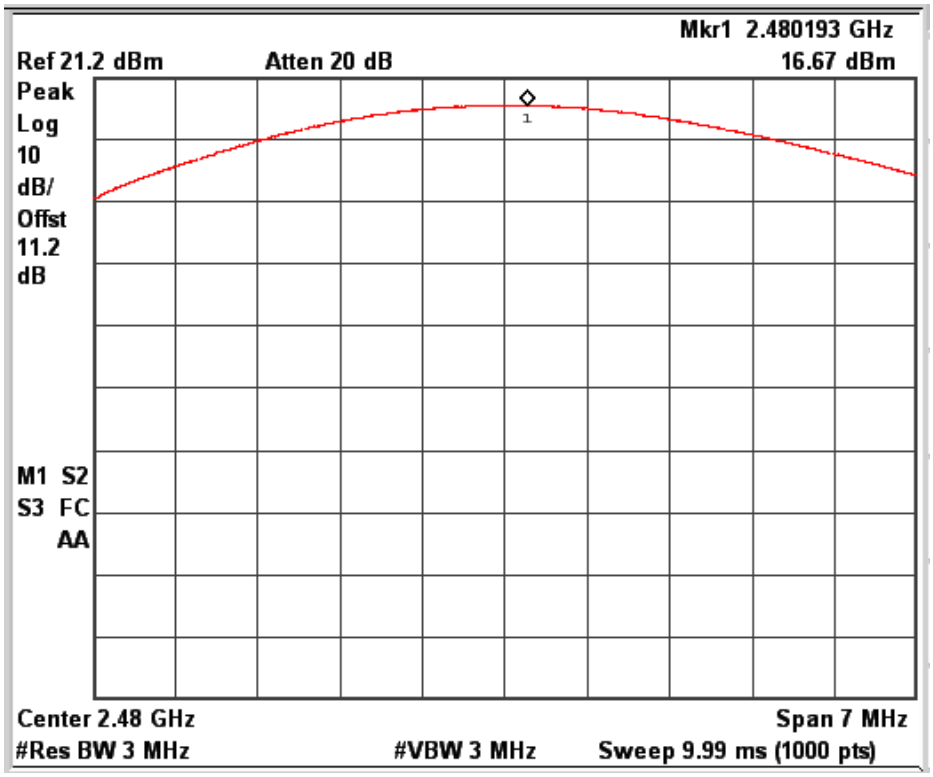
Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
Low	2402	16.78	20.96
Mid	2440	16.43	20.96
High	2480	16.67	20.96



Channel Frequency: 2402 MHz



Channel Frequency: 2440 MHz



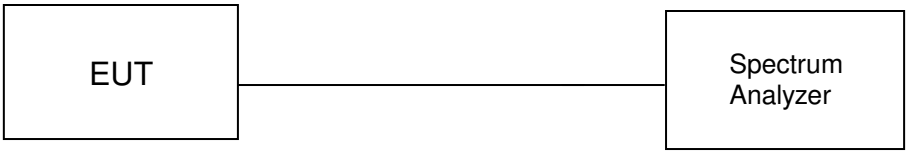
Channel Frequency: 2480 MHz

Bandwidth Occupancy **Section 15.247 (a) (1)**

Result **Pass**

Test Specification	FCC Part 15C
Detector Function	Peak
Port of testing	Antenna port
Requirement	The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset while the long-term distribution appears evenly distributed.

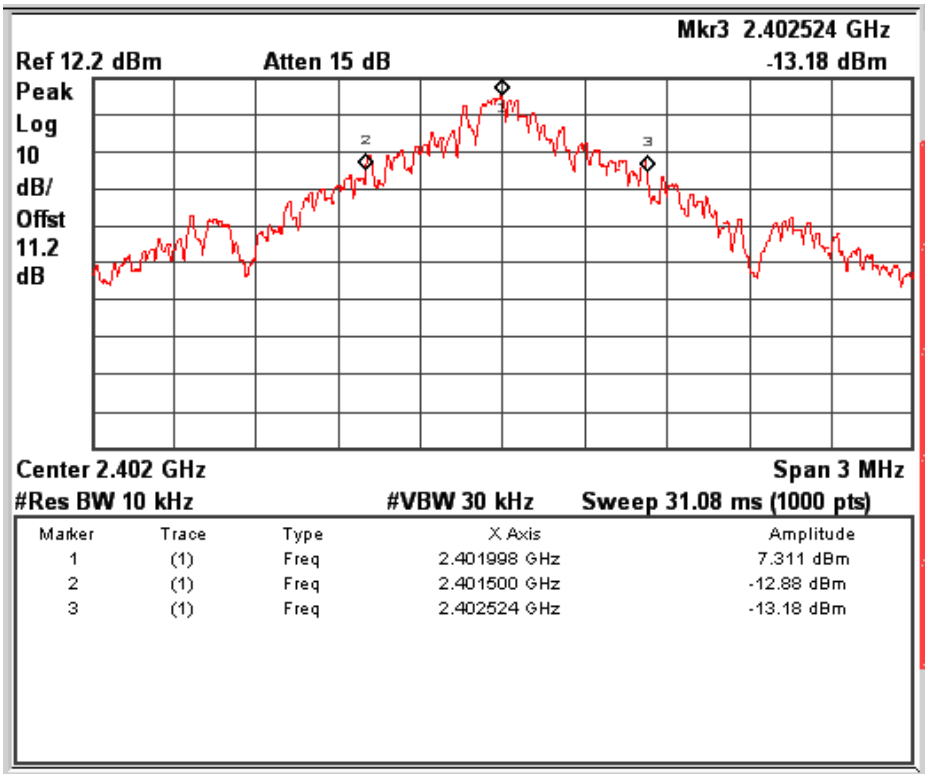
Test Method:



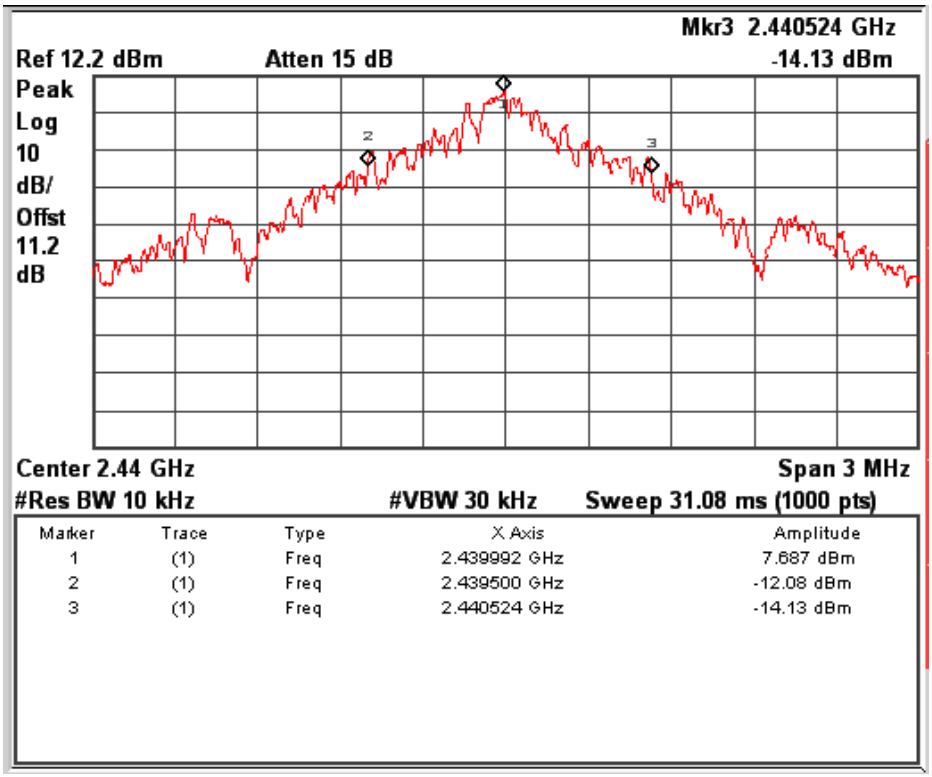
Test Result:

Modulation Type: GFSK

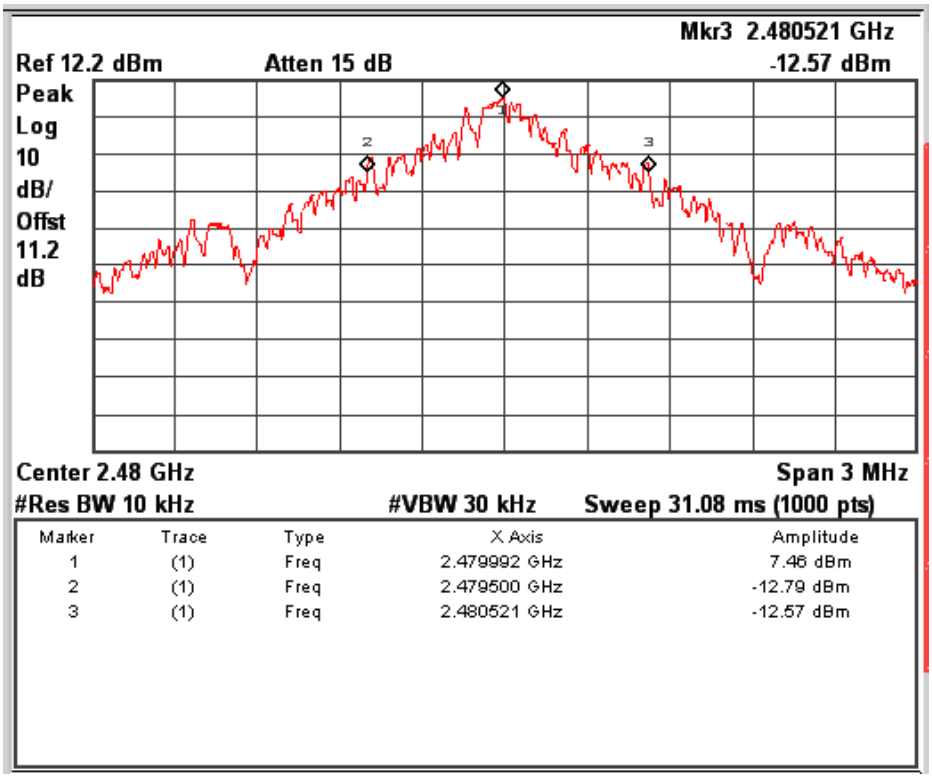
Channel	Channel Frequency (MHz)	Lower 20dB Frequency (MHz)	Higher 20dB Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
Low	2402	2401.500	2402.524	1.024	1.1148
Mid	2440	2439.500	2440.524	1.024	1.1150
High	2480	2479.500	2480.521	1.021	1.1129



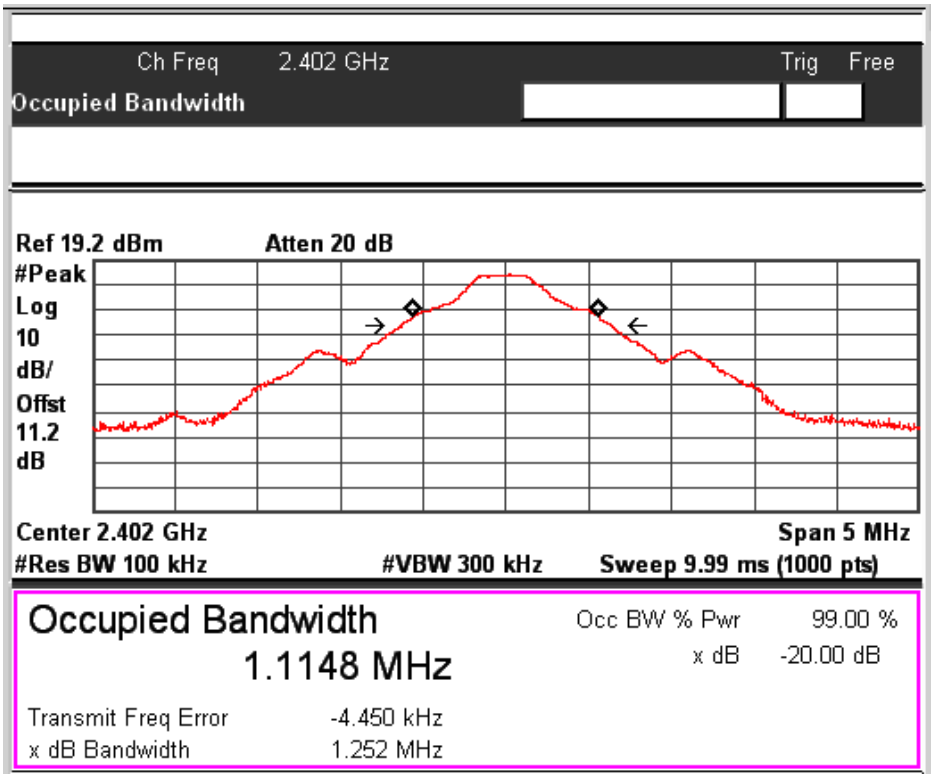
Channel Low: 20dB Bandwidth Measurement



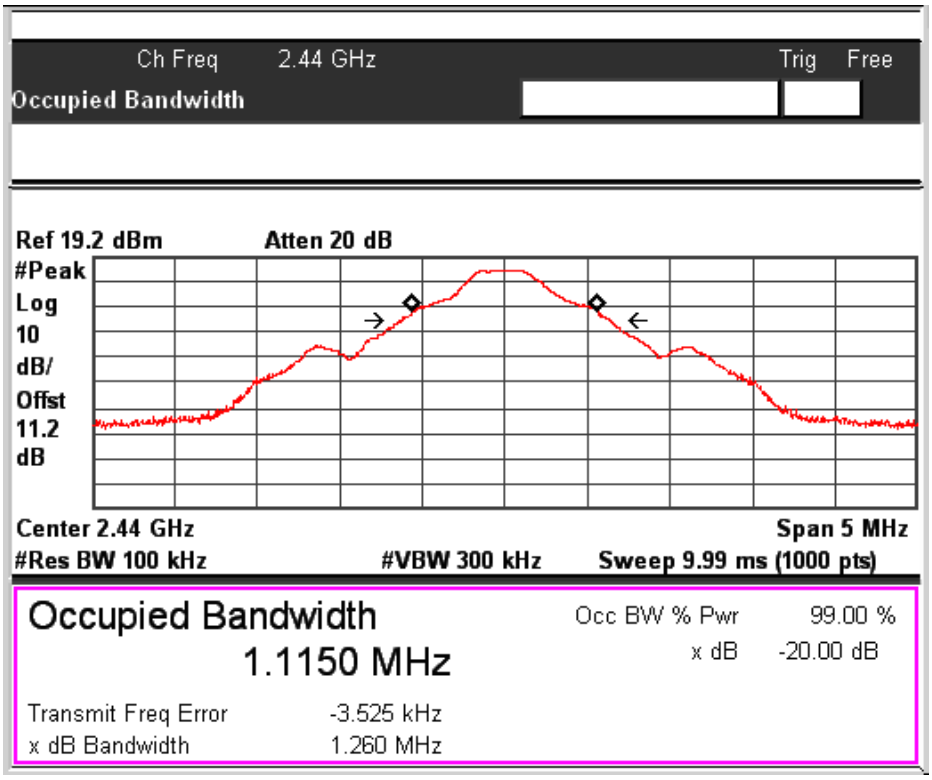
Channel Mid: 20dB Bandwidth Measurement



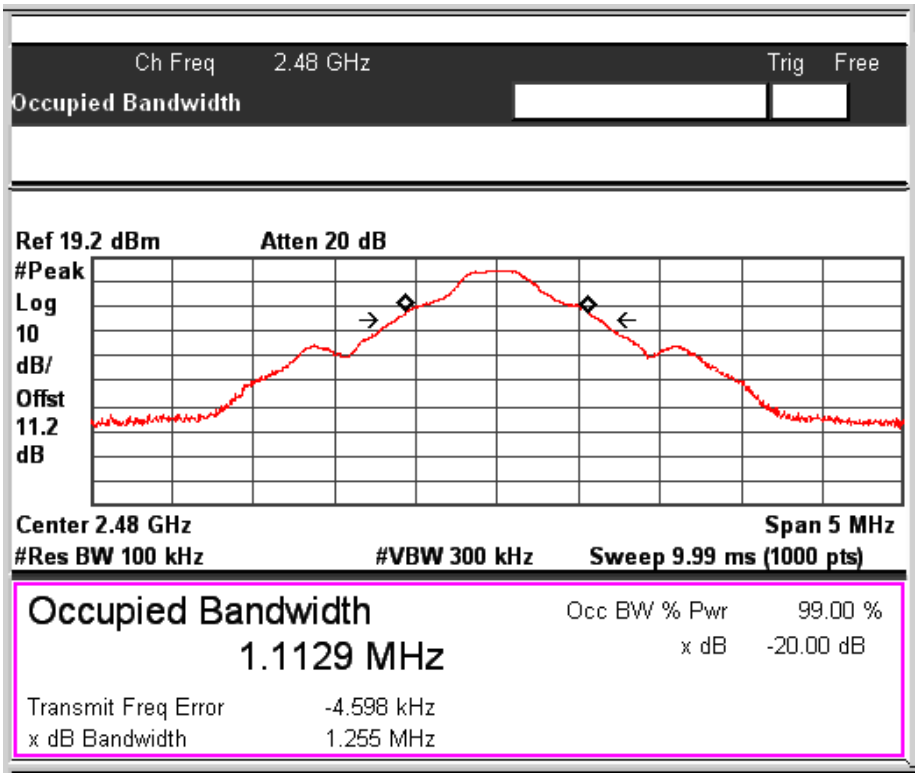
Channel High: 20dB Bandwidth Measurement



99% Occupied Bandwidth: Channel Low



99% Occupied Bandwidth: Channel Mid

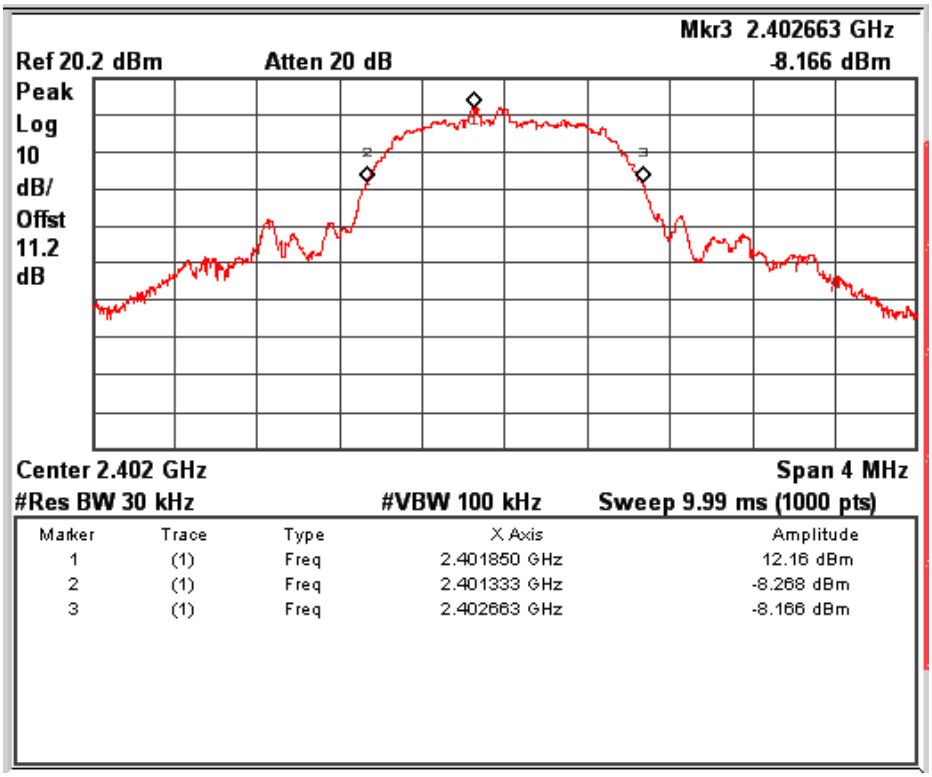


99% Occupied Bandwidth: Channel High

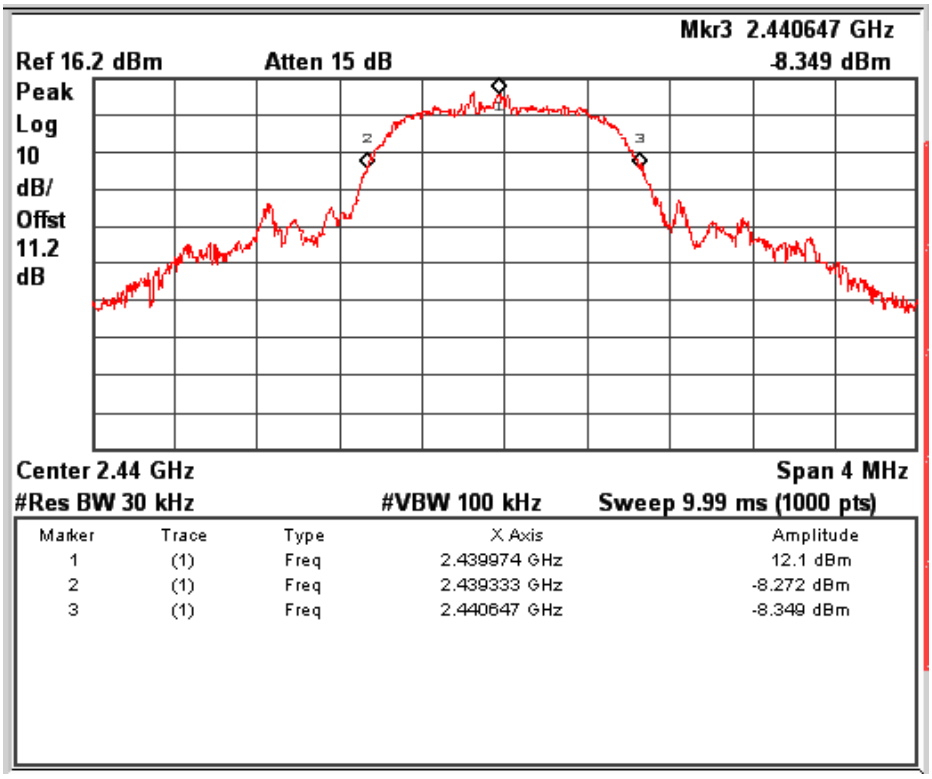
Modulation Type: P/4 DQPSK

Test Results:

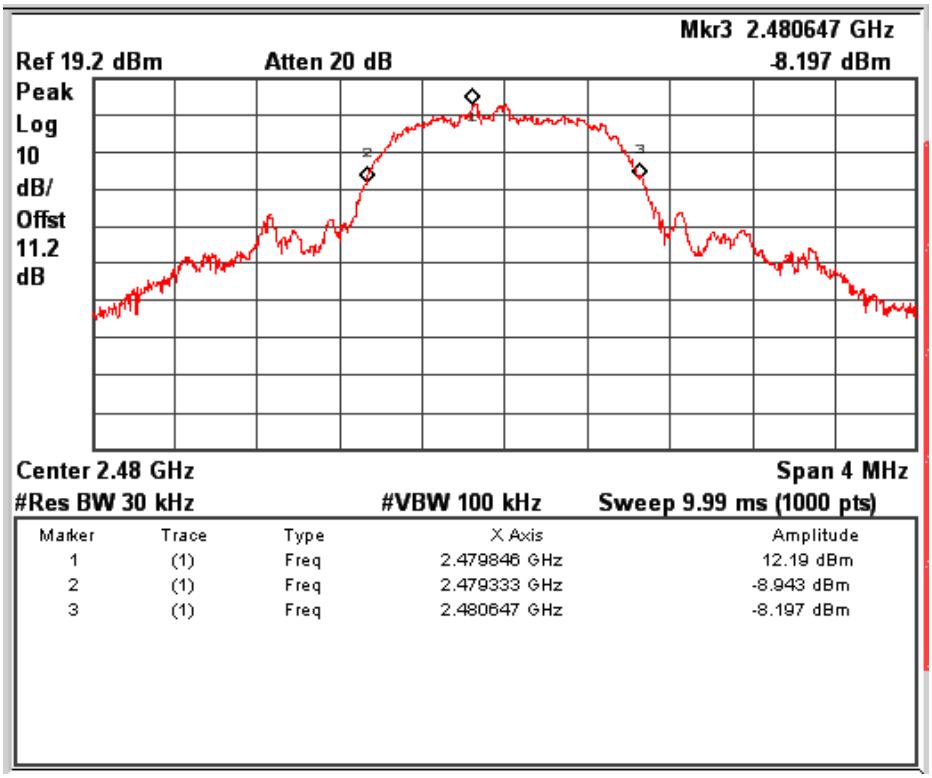
Channel	Channel Frequency (MHz)	Lower 20dB Frequency (MHz)	Higher 20dB Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
Low	2402	2401.333	2402.663	1.330	1.2448
Mid	2440	2439.333	2440.647	1.314	1.2399
High	2480	2479.333	2480.647	1.314	1.2464



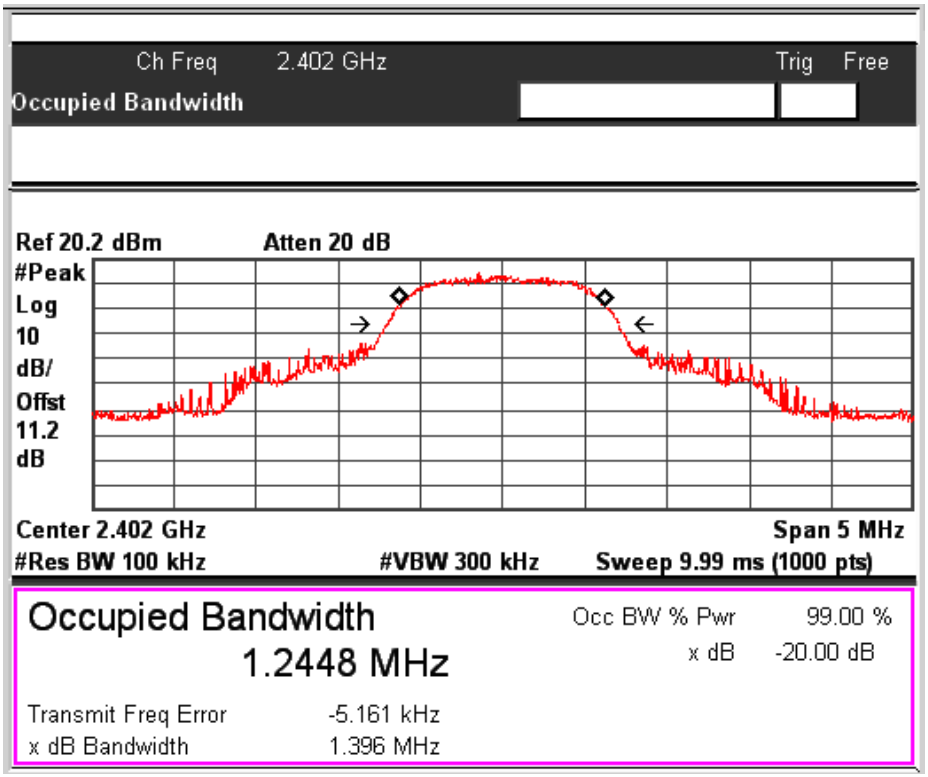
Channel Low: 20dB Bandwidth Measurement



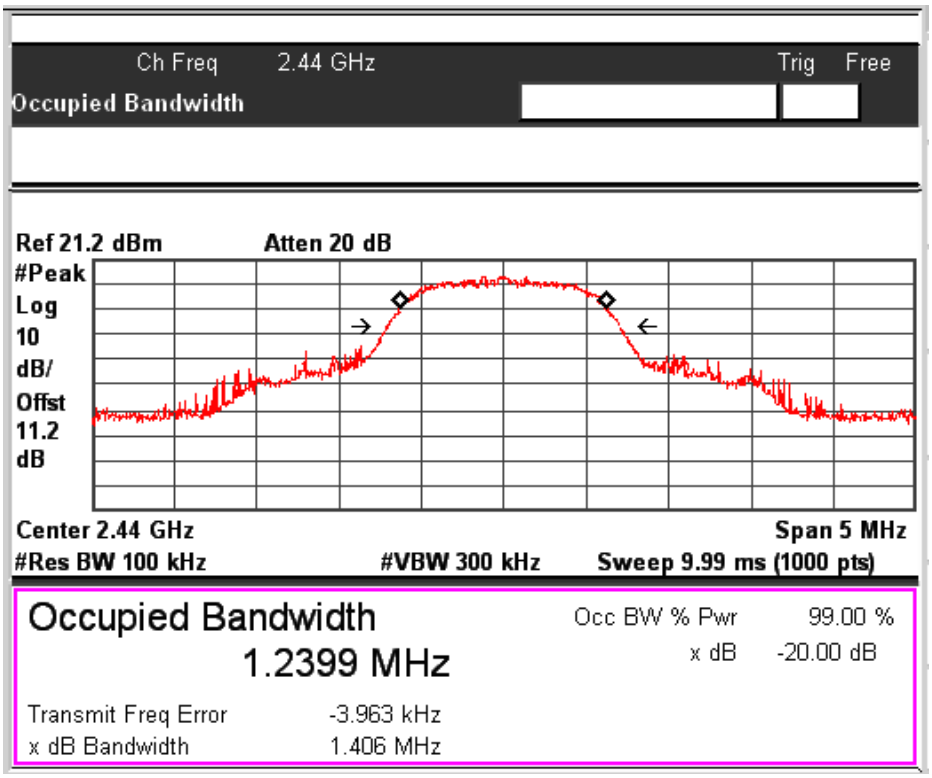
Channel Mid: 20dB Bandwidth Measurement



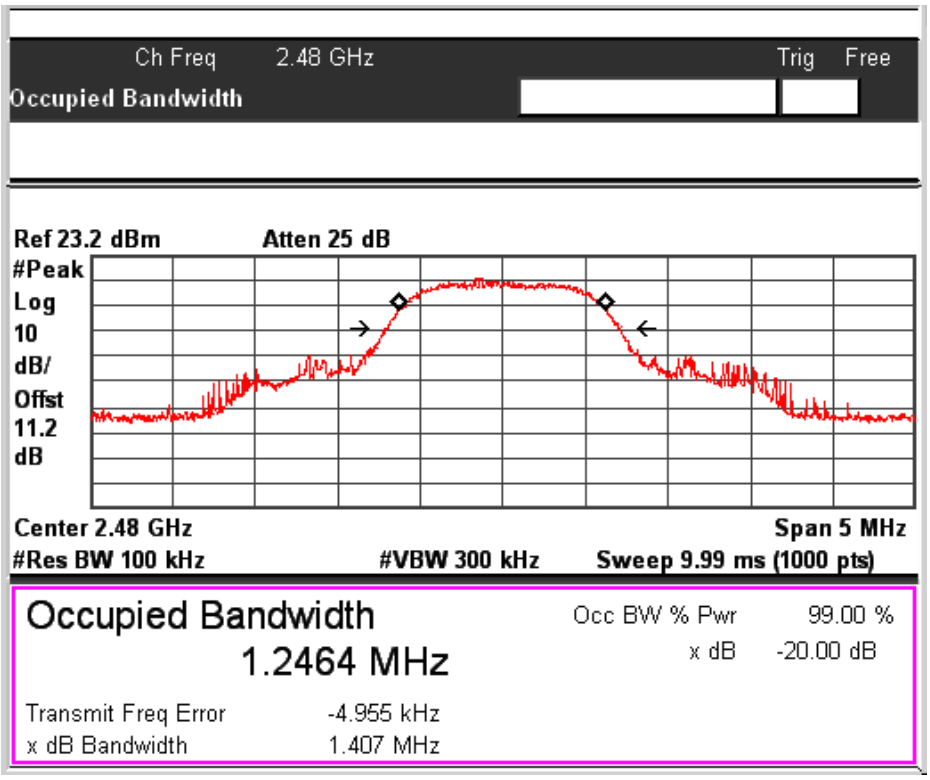
Channel High: 20dB Bandwidth Measurement



99% Occupied Bandwidth: Channel Low



99% Occupied Bandwidth: Channel Mid

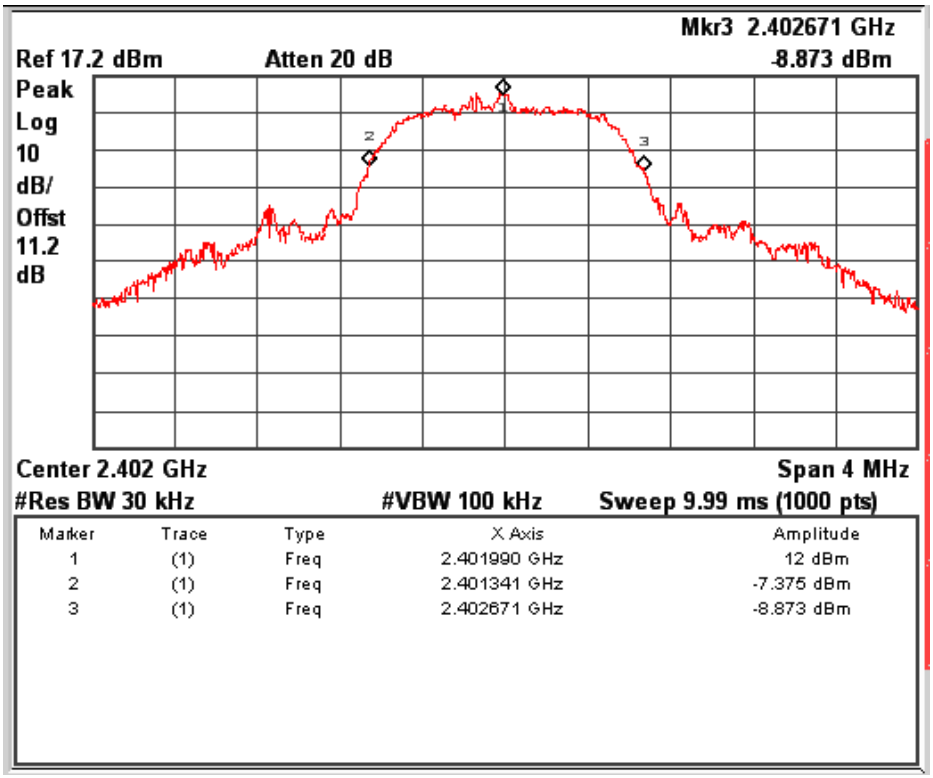


99% Occupied Bandwidth: Channel High

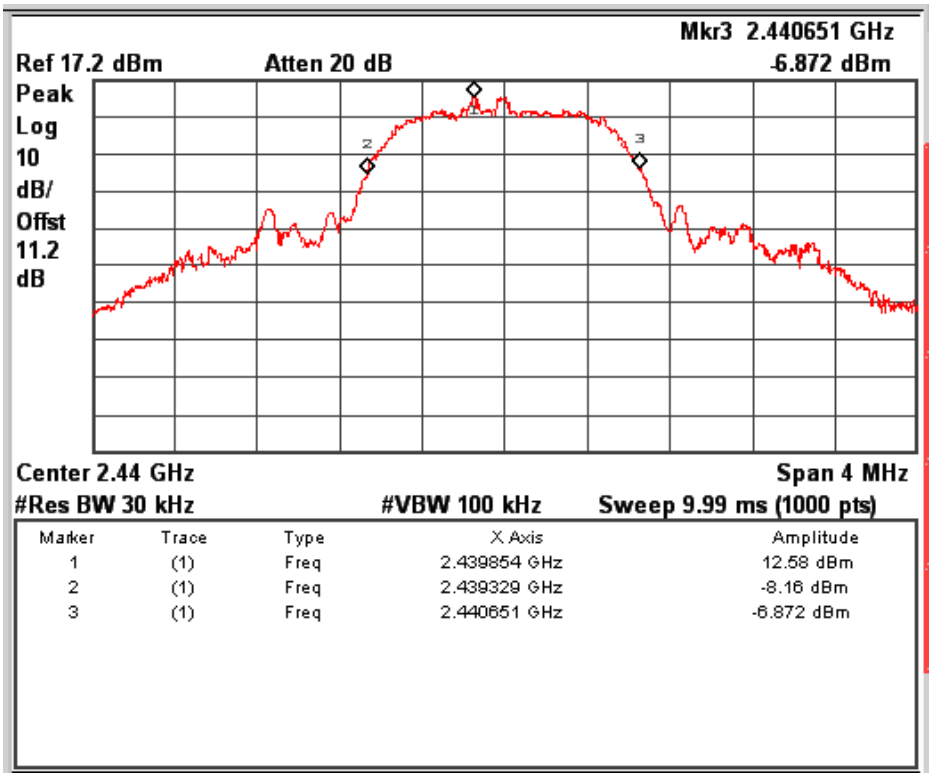
Modulation Type: 8 DQPSK

Test Results:

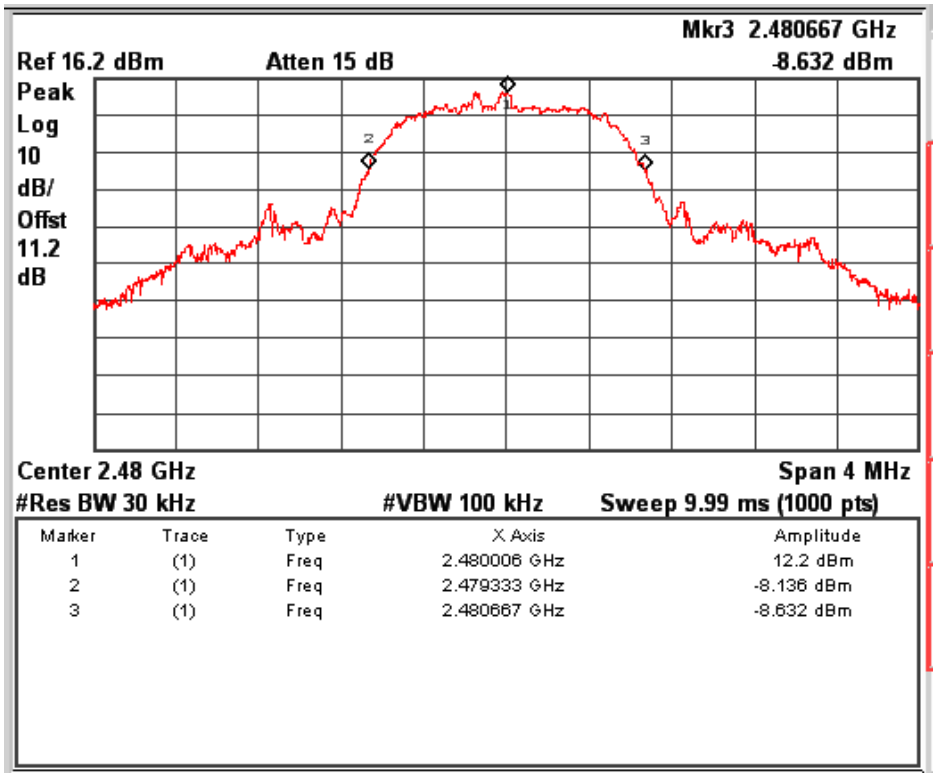
Channel	Channel Frequency (MHz)	Lower 20dB Frequency (MHz)	Higher 20dB Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
Low	2402	2401.341	2402.671	1.330	1.2453
Mid	2440	2439.329	2440.651	1.322	1.2498
High	2480	2479.333	2480.667	1.334	1.2487



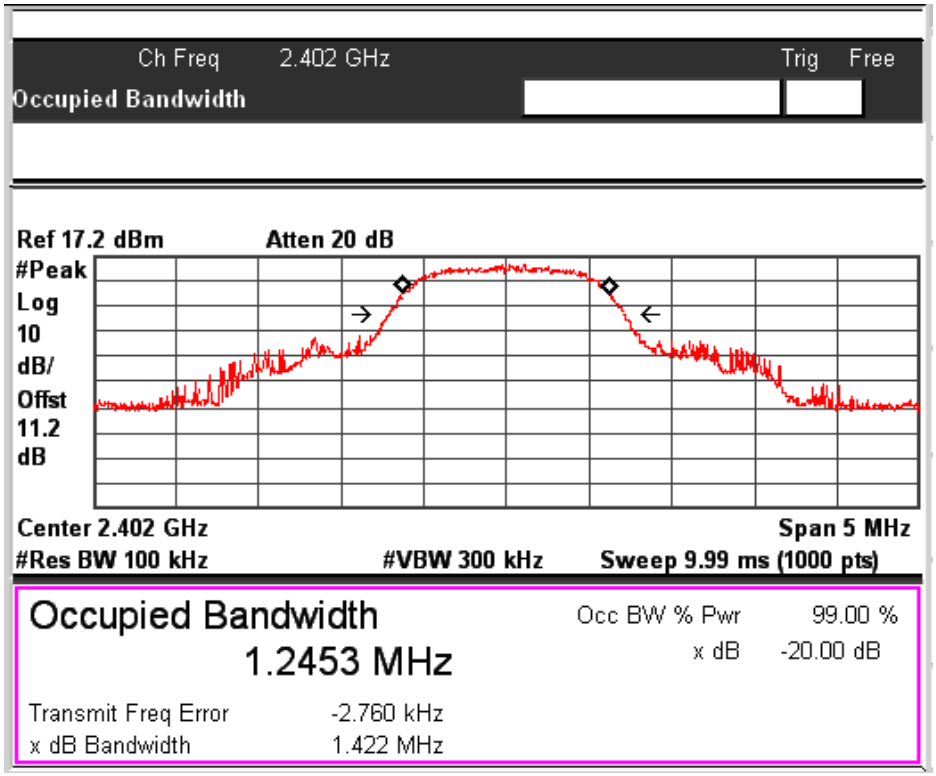
Channel Low: 20dB Bandwidth Measurement



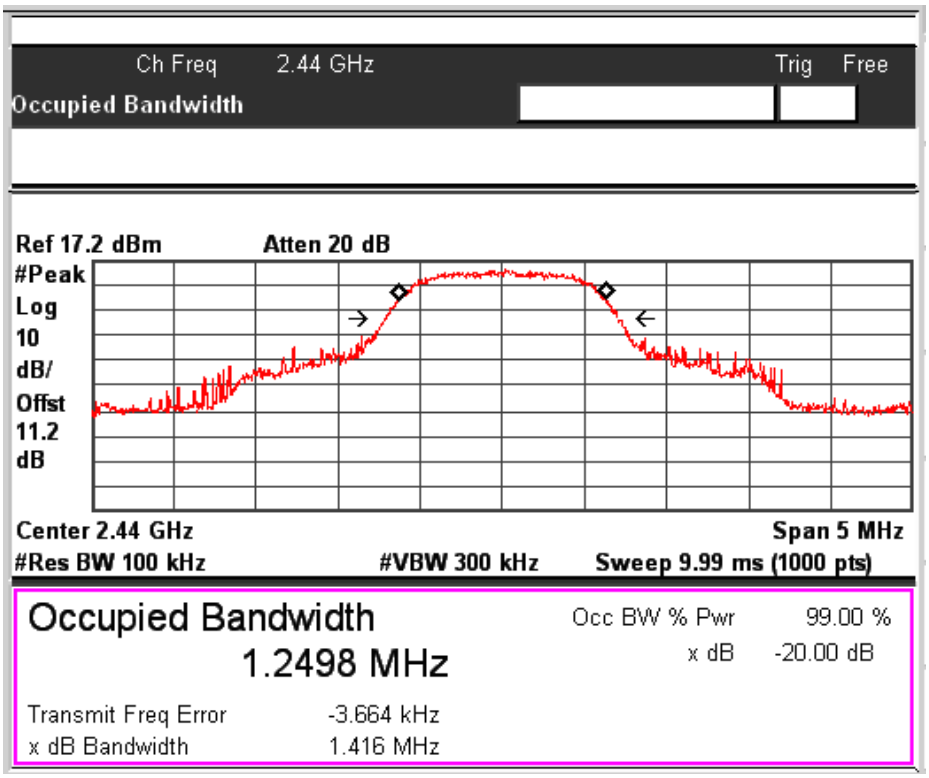
Channel Mid: 20dB Bandwidth Measurement



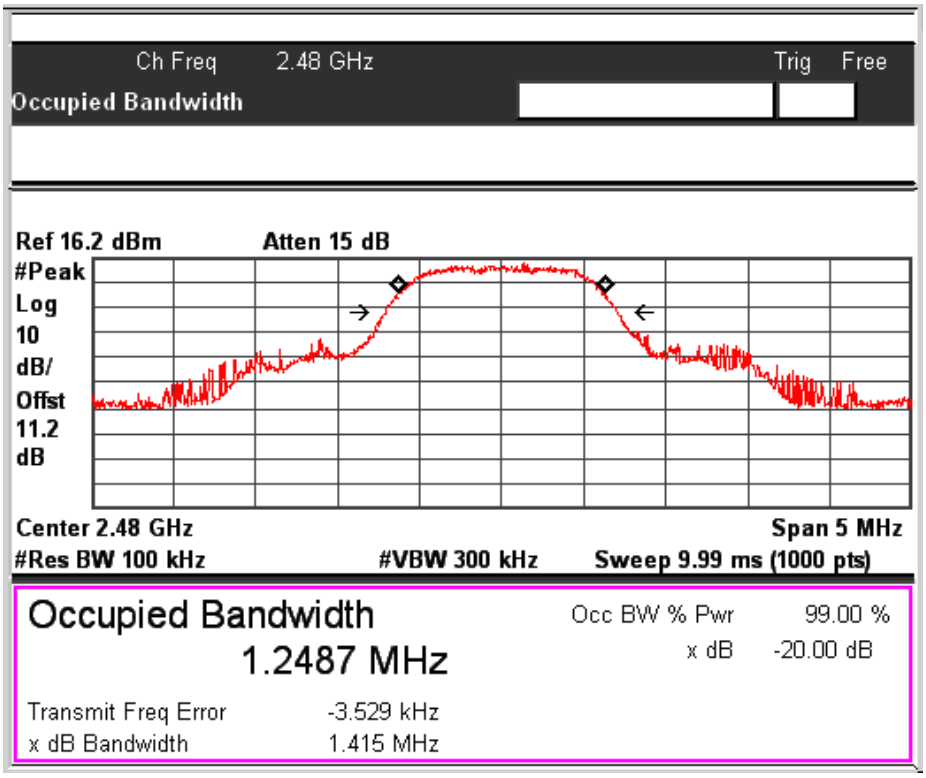
Channel High: 20dB Bandwidth Measurement



99% Occupied Bandwidth: Channel Low



99% Occupied Bandwidth: Channel Mid



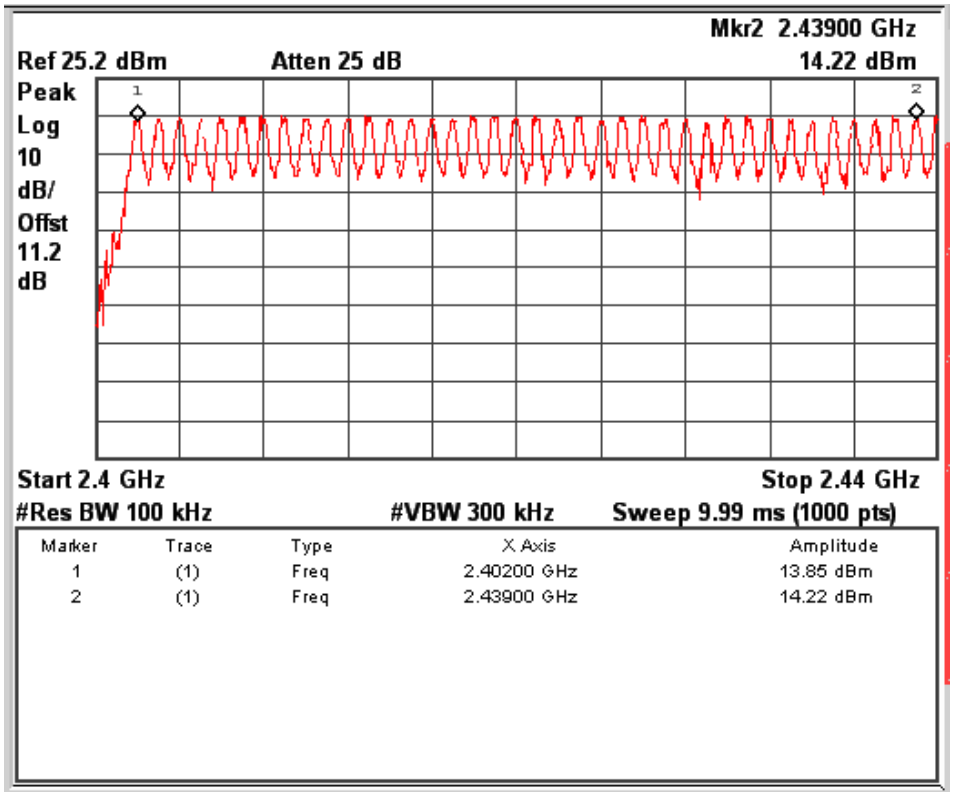
99% Occupied Bandwidth: Channel High

Number of Hopping Channels **Section (a) (1) (iii)**
Result **Pass**

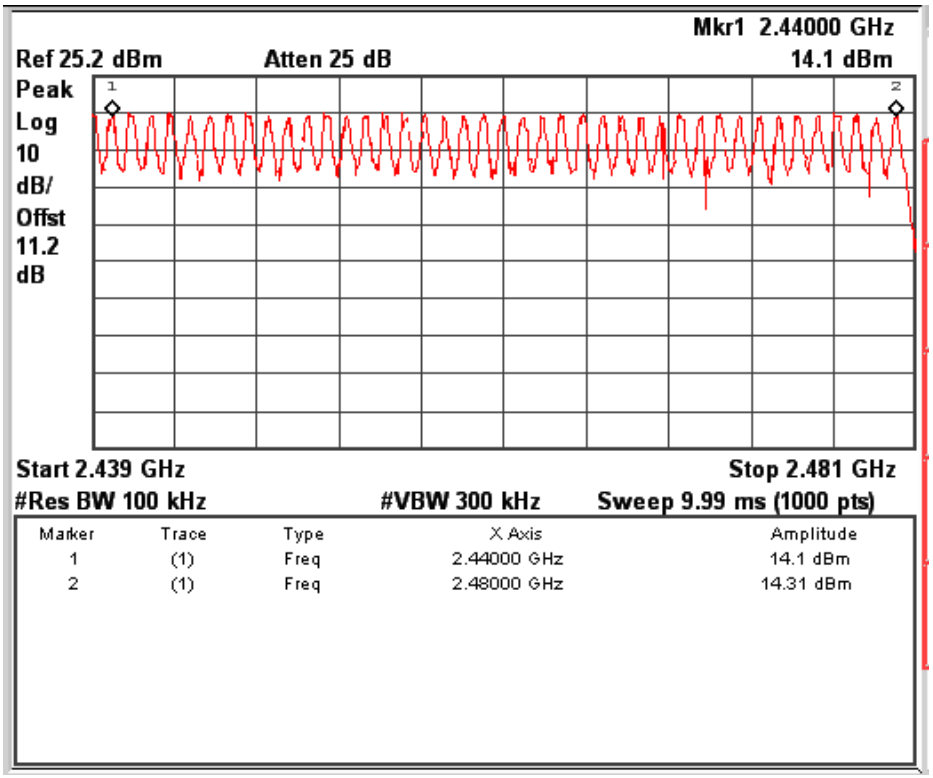
Test Specification	FCC part 15C
Detector Function	Peak
Port of testing	Antenna port
Requirement	Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels

Test Method:

Test Result:



Number of Hopping Channels: 38



Number of Hopping Channels: 41

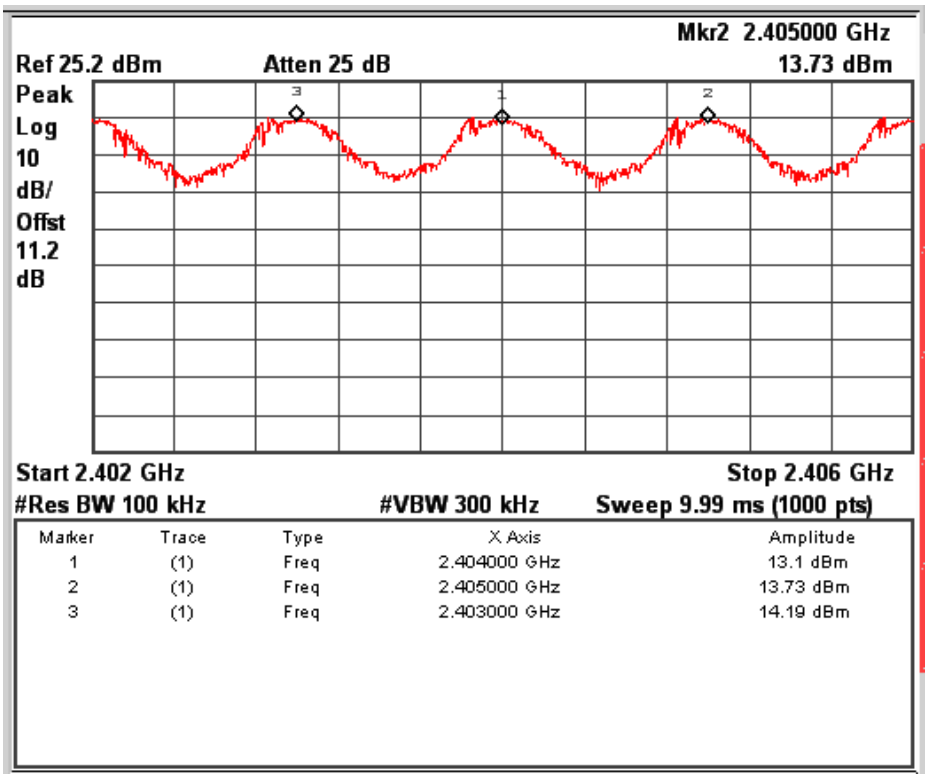
Total Number of hopping channels = 79 (38+41)

Carrier Frequency Separation **Section 15.247 (a) (1)**
Result **Pass**

Test Specification	FCC Part 15C
Detector Function	Peak
Port of testing	Antenna port
Requirement	Frequency hopping systems shall have hopping channel carrier frequency separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater

Test Method:

Test Result:

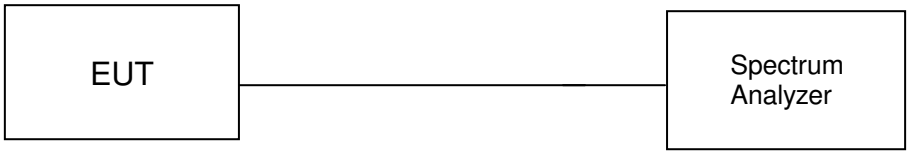


Channel Separation

Time of Occupancy (Dwell Time) **Section 15.247 (a)(1)(III)**
Result **Pass**

Test Specification	RSS-210 Issue 7, A8.1 (c)
Detector Function	Peak
Port of testing	Antenna port
Requirement	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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Method:



Test Result:

Time slot		Time Slot (ms)
DH	**Measurement Value (sec)**	
DH1	0.00034	0.1088
DH3	0.00068	0.1088
DH5	0.00230	0.2453

Measurement Method

Period Time = 0.4(sec)*79 (hopping channel) = 31.6 s

DH1 Time slot = Measurement value (Sec)*(1600/ (2*79))*Period time

DH3 Time slot = Measurement value (Sec)*(1600/ (4*79))*Period time

DH5 Time slot = Measurement value (Sec)*(1600/ (6*79))*Period time

Band-edge Compliance **Section 15.247 (d)**
Result
Pass

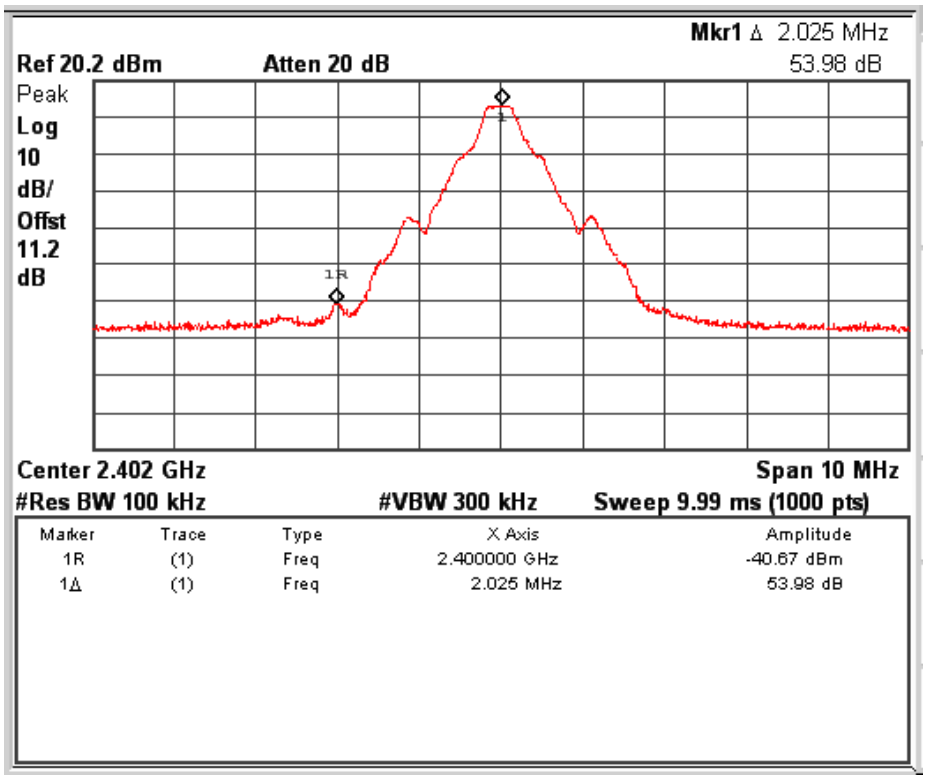
Test Specification	FCC Part 15C
Detector Function	Peak
Port of testing	Antenna port
Requirement	In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method:

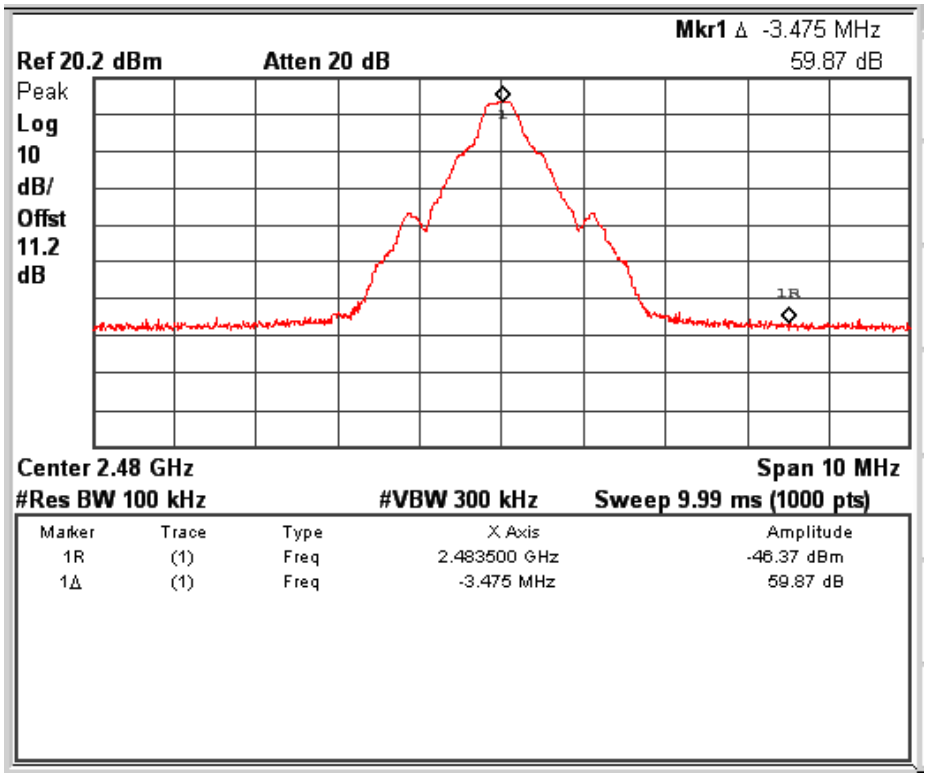
Modulation Type: GFSK

Test Result:

Channel	Fundamental Frequency (MHz)	Value at Band Edge		Limit (dBc)
		Frequency (MHz)	Value (dBc)	
Low	2402.00	2400.0	-53.98	-20
High	2480.00	2483.5	-59.87	-20



Channel Low

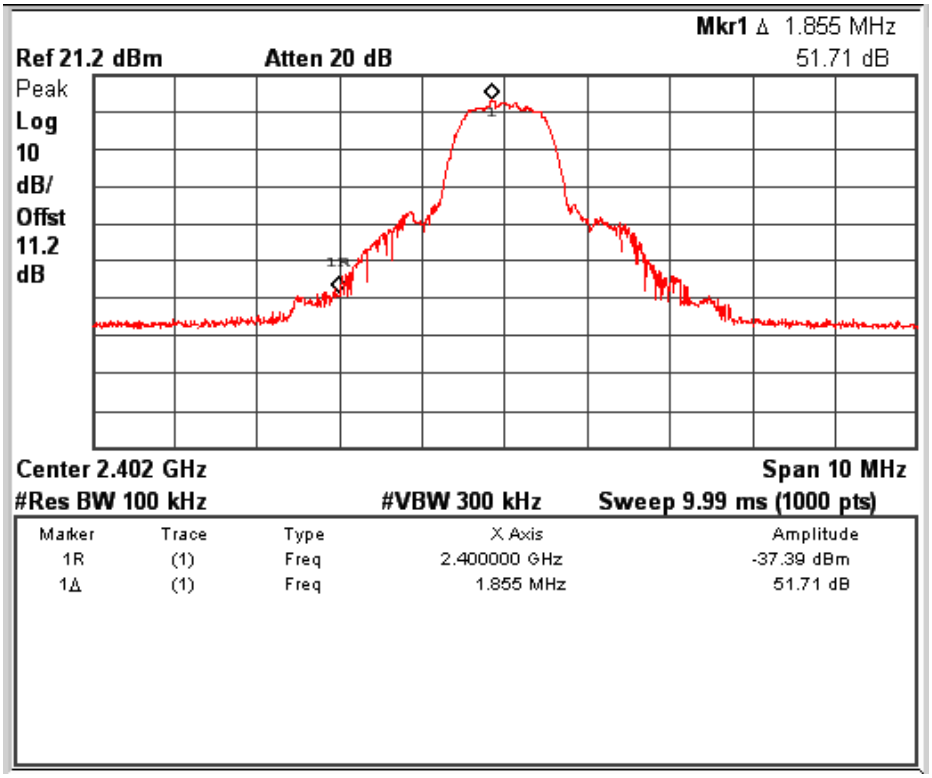


Channel High

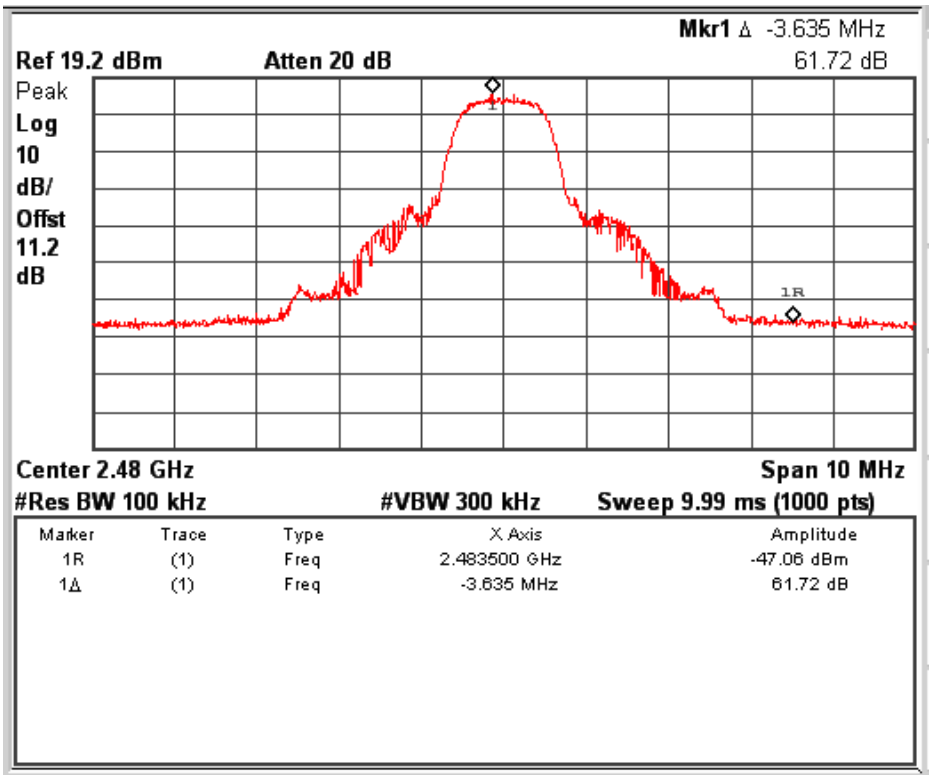
Modulation Type: Pi/4 DQPSK

Test Results:

Channel	Fundamental Frequency (MHz)	Value at Band Edge		Limit (dBc)
		Frequency (MHz)	Value (dBc)	
Low	2402.00	2400.0	-51.71	-20
High	2480.00	2483.5	-61.72	-20



Channel Low

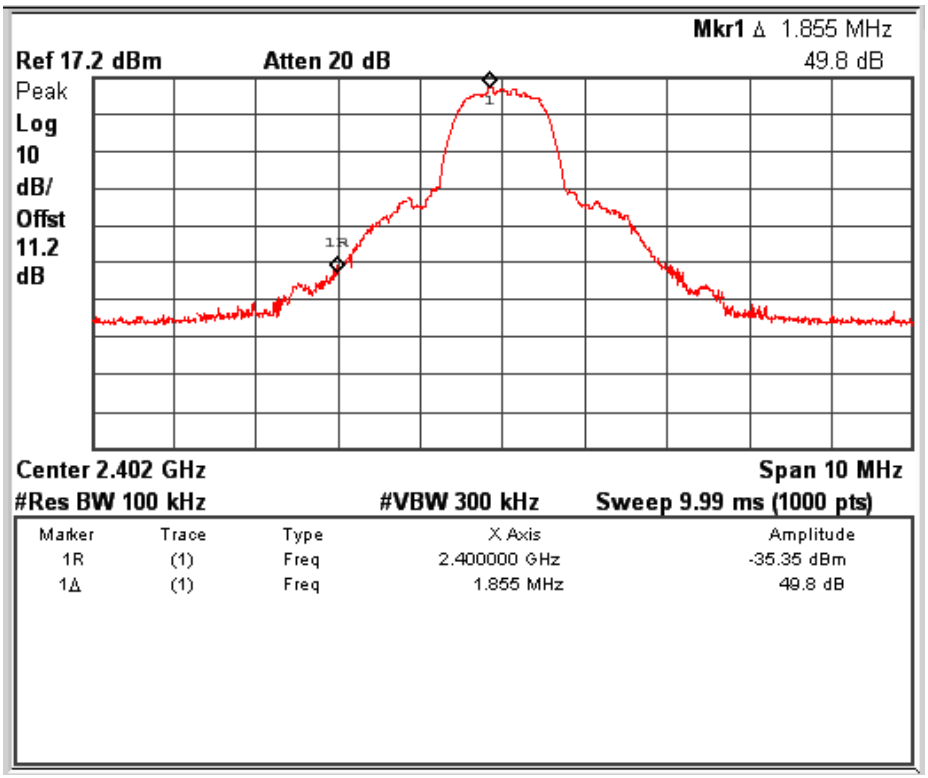


Channel High

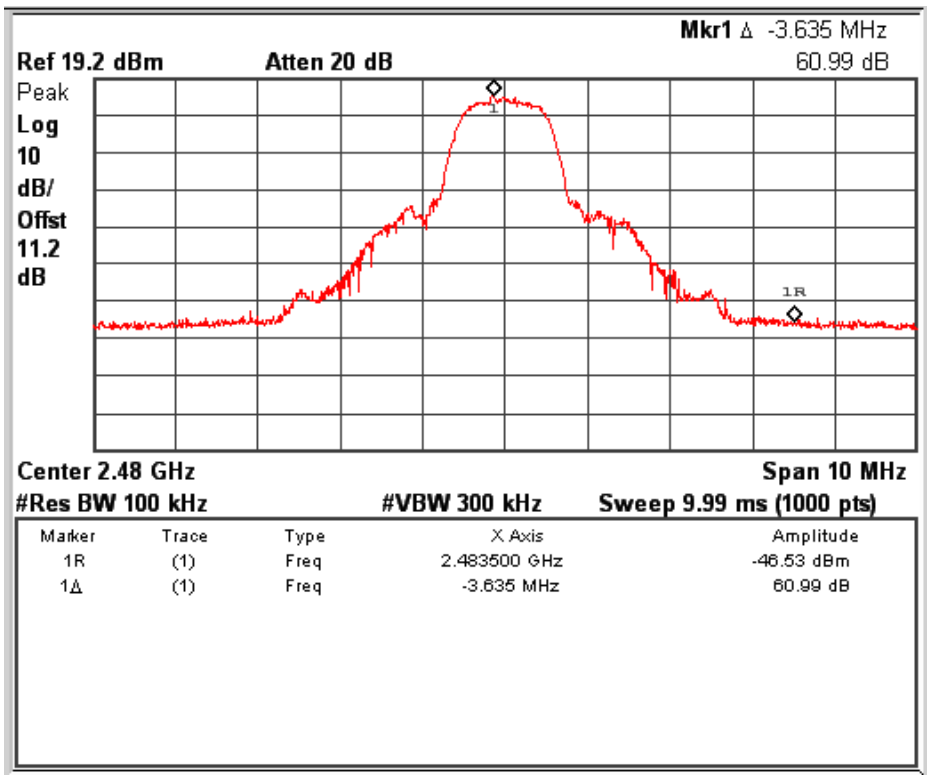
Modulation Type: 8 DQPSK

Test Results:

Channel	Fundamental Frequency (MHz)	Value at Band Edge		Limit (dBc)
		Frequency (MHz)	Value (dBc)	
Low	2402.00	2400.0	-49.80	-20
High	2480.00	2483.5	-60.99	-20

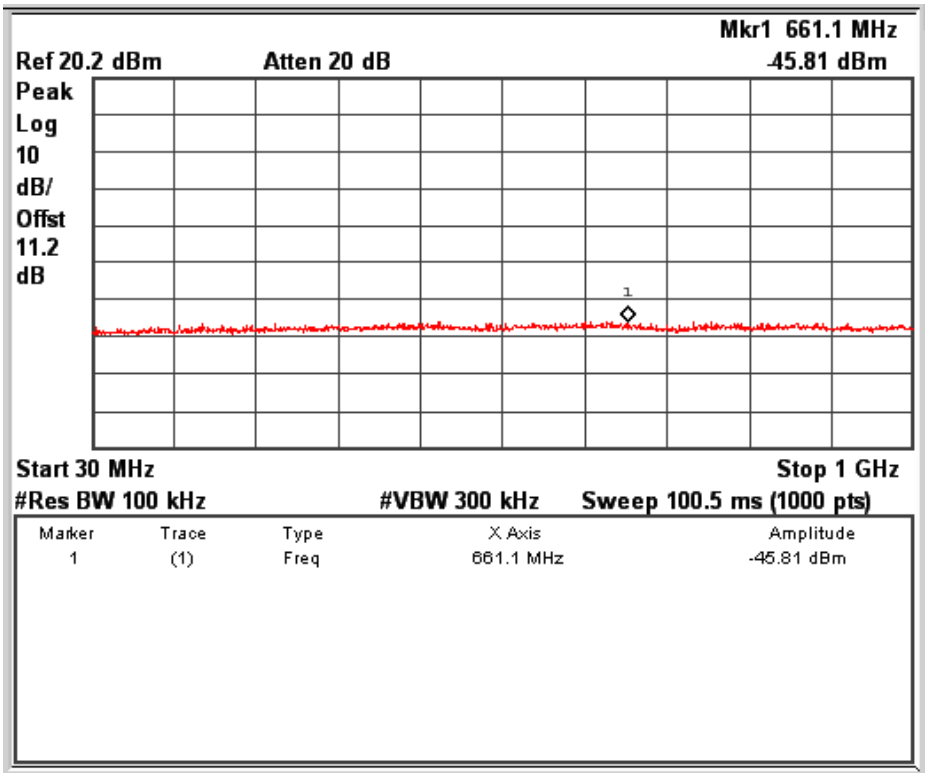


Channel Low

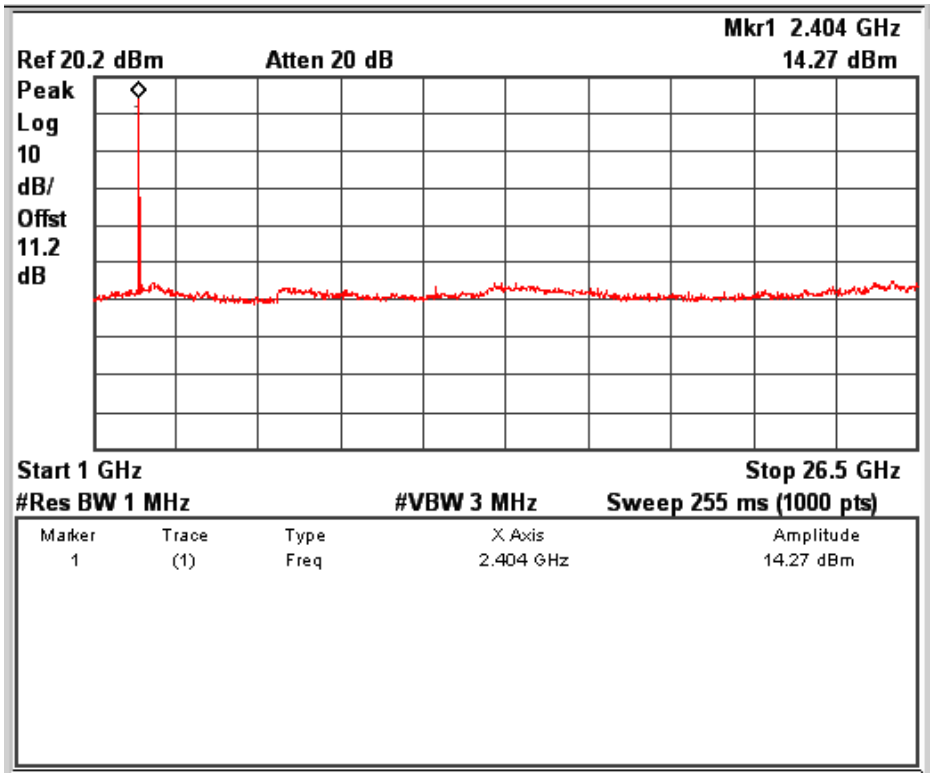


Channel High

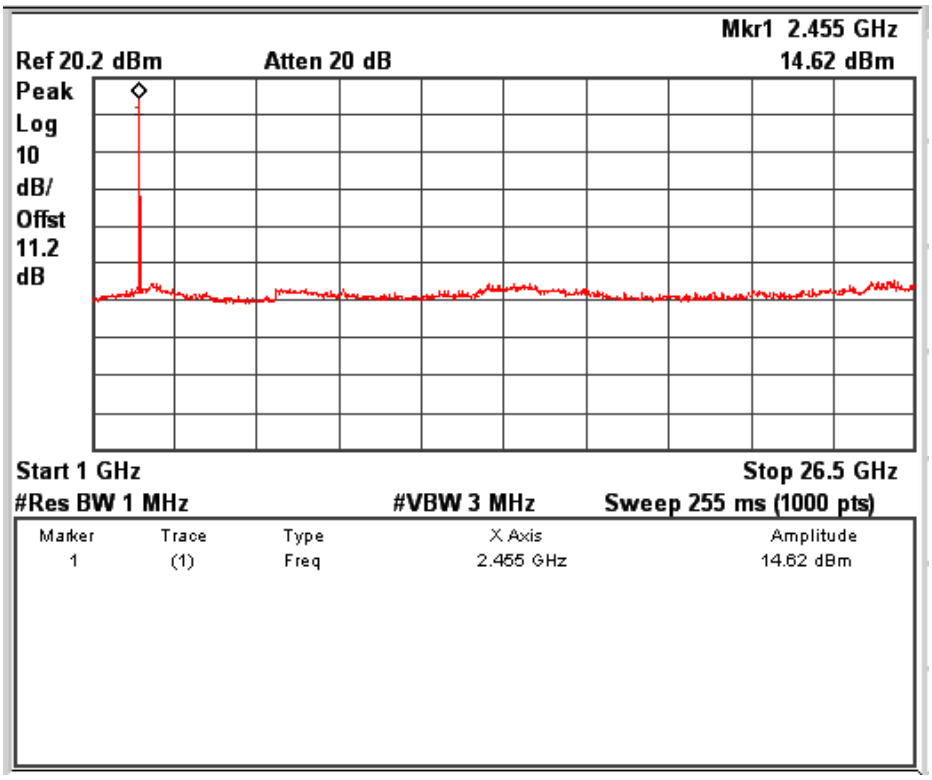
Conducted Spurious Emissions



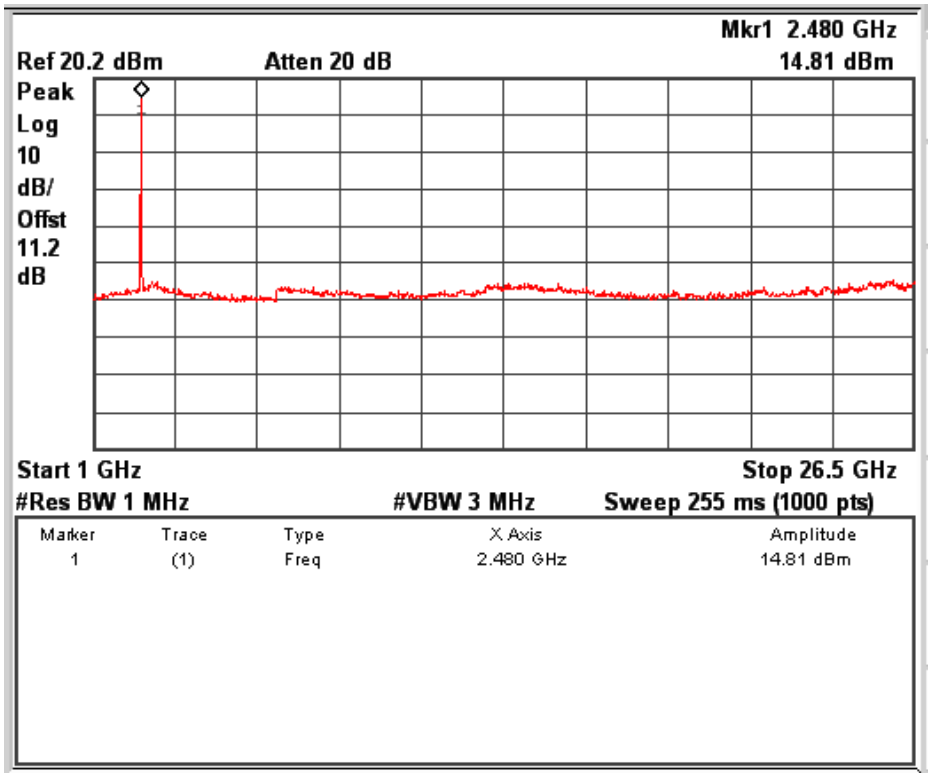
30MHz to 1GHz Spurious Emissions



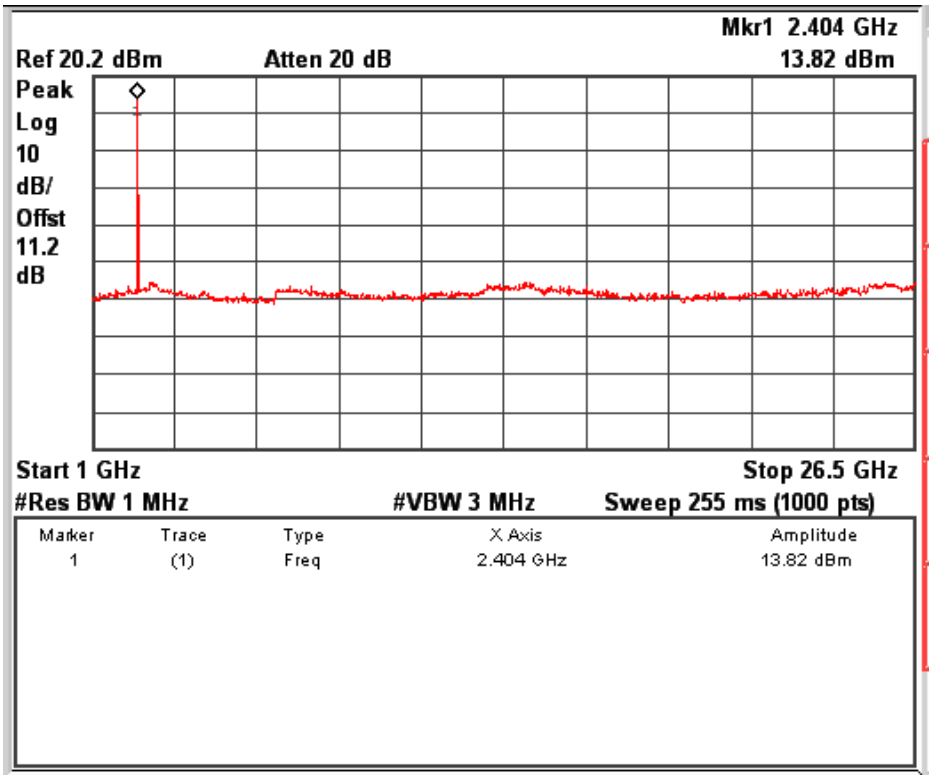
Channel: Low **Modulation: GFSK**



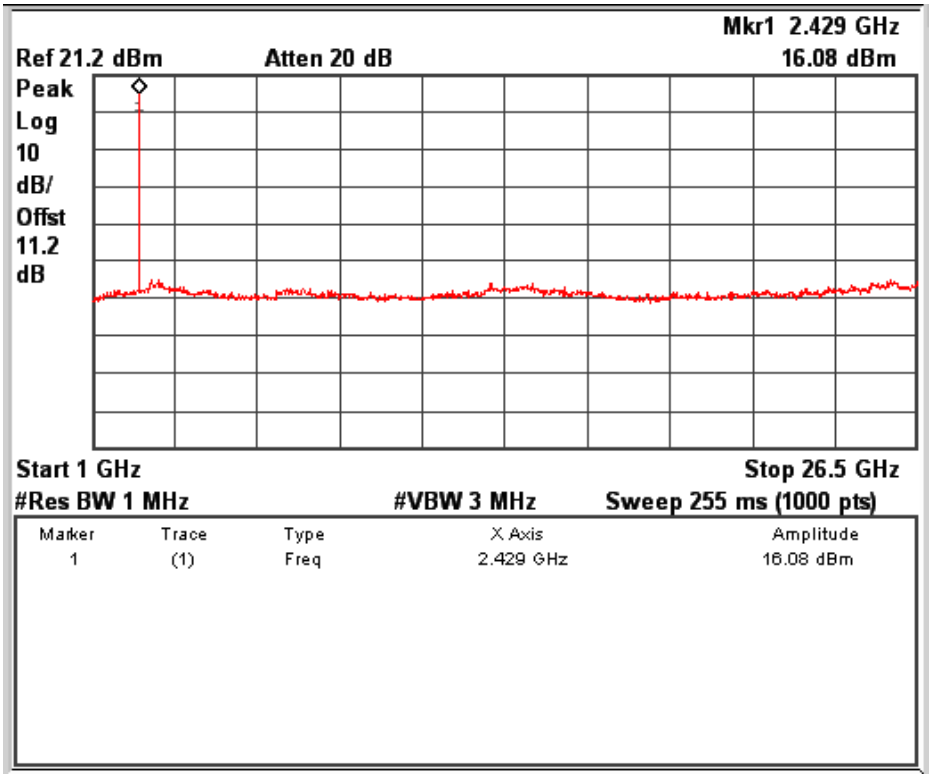
Channel: Mid **Modulation: GFSK**



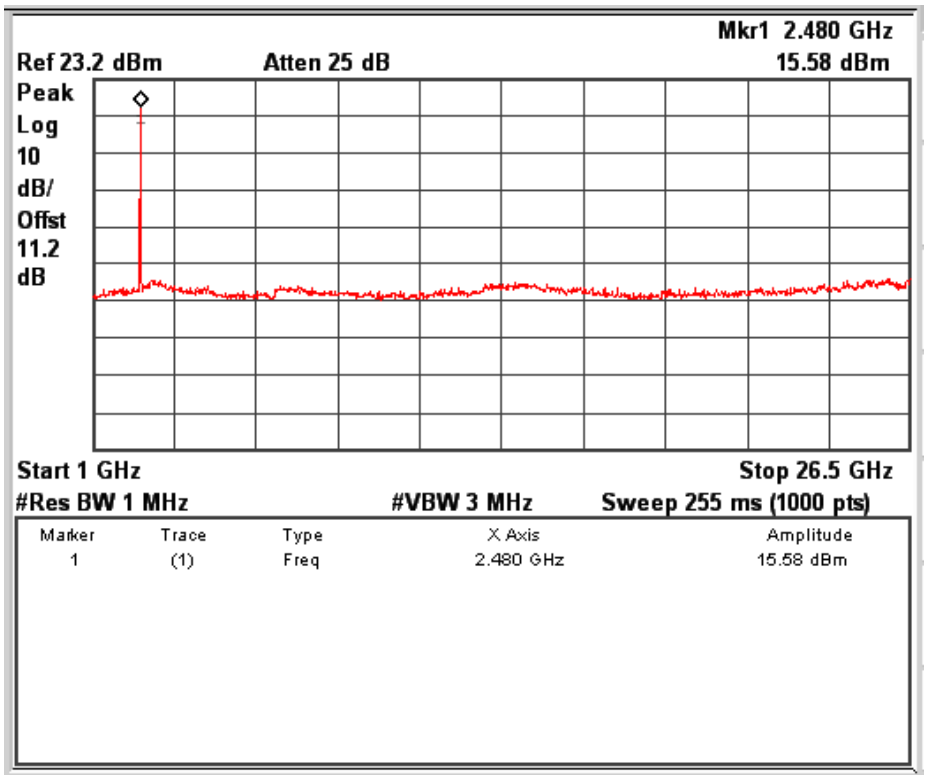
Channel: High **Modulation: GFSK**



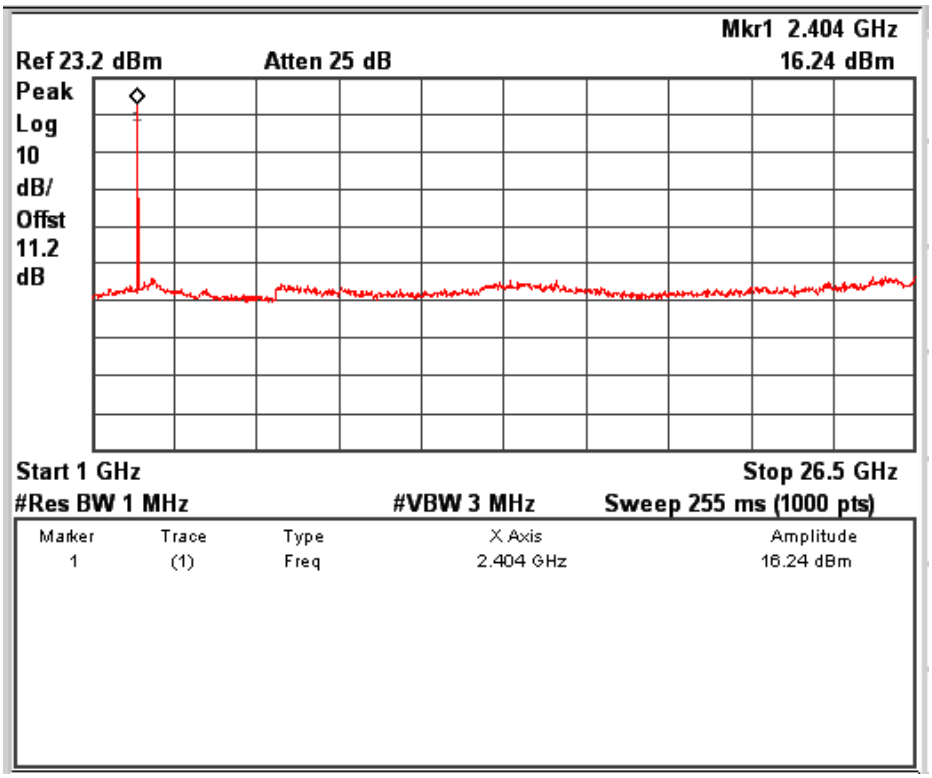
Channel: Low **Modulation: P/4 DQPSK**



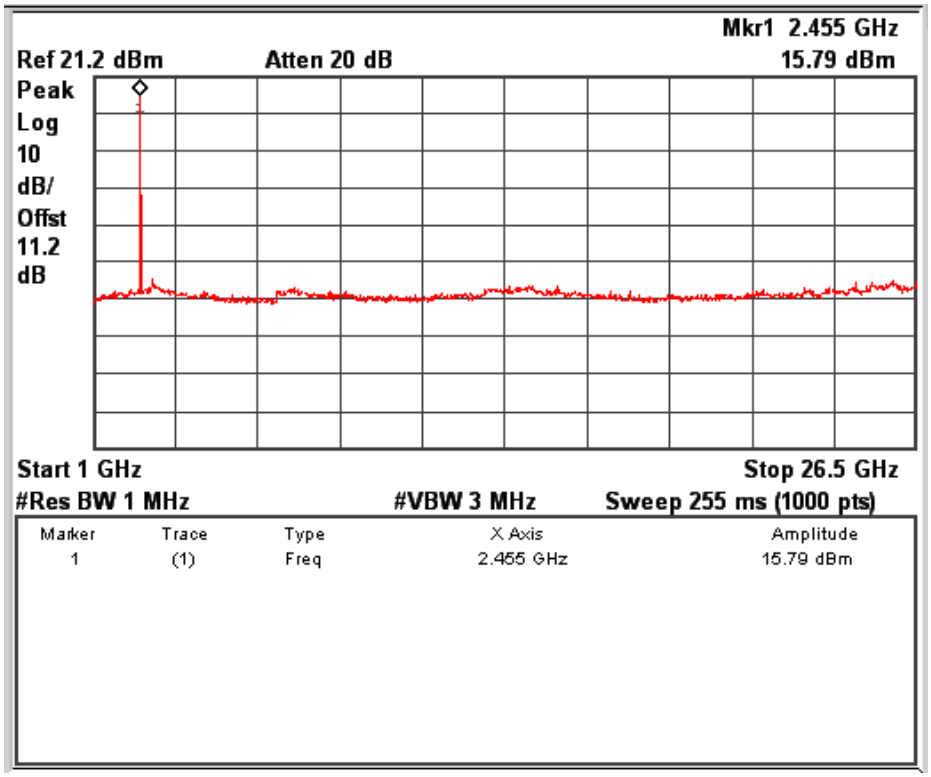
Channel: Mid **Modulation: P/4 DQPSK**



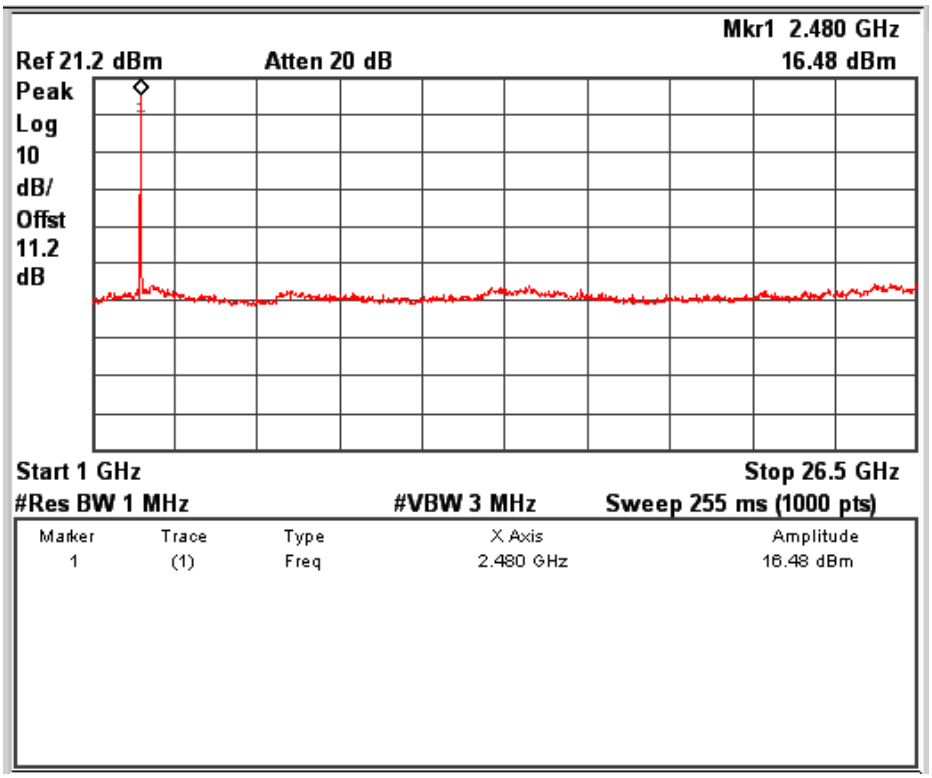
Channel: High **Modulation: P/4 DQPSK**



Channel: Low **Modulation: 8 DQPSK**



Channel: Mid **Modulation: 8 DQPSK**



Channel: High **Modulation: 8 DQPSK**

Spurious Radiated Emissions & Restricted Bands of Operation
Section 15.209 & 15.205
Result **Pass**

Test Specification	FCC Part 15C
Test Method	ANSI C63.4-2009
Measurement Location	Semi Anechoic Chamber
Measuring Frequency Range	9kHz to 40GHz (Up to 10th harmonic of the highest fundamental frequency)
Measuring Distance	3m
Detection	QP for frequency below 1GHz,Peak, Average for frequency above 1GHz
Requirement	As per the limits mentioned in the bellow table

Limit for Radiated Emission of Section 15.209:

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * the limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 88, 50 – 53.80, 53.80 – 43.00 and 49.5dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

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Test results:

No emissions were found in the range 9 kHz to 1GHz.

Test results for frequencies in the range 1 GHz 26.5 GHz

Modulation type: GFSK

Channel	Polarization	Frequency (MHz)	Measured Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	V	2390 (Pk)	44.23	74.00	-29.77
		2390 (Av)	31.24	54.00	-22.76
		2402 (Pk)	99.23	-	*
		2402 (Av)	97.88	-	*
		4804 (Pk)	53.87	74.00	-20.13
		4804 (Av)	47.74	54.00	-6.26
		7206 (Pk)	60.64	74.00	-13.36
		7206 (Av)	51.91	54.00	-2.09
	H	2390 (Pk)	48.99	74.00	-25.01
		2390 (Av)	37.89	54.00	-16.11
		2402 (Pk)	106.98	-	*
		2402 (Av)	105.76	-	*
		4804 (Pk)	54.86	74.00	-19.14
		4804 (Av)	49.43	54.00	-4.57
		7206 (Pk)	59.54	74.00	-14.46
		7206 (Av)	47.95	54.00	-6.05
Mid	V	4880 (Pk)	53.58	74.00	-20.42
		4880 (Av)	45.15	54.00	-8.85
		7320 (Pk)	60.81	74.00	-13.19
		7320 (Av)	51.27	54.00	-2.73
	H	4880 (Pk)	54.33	74.00	-19.67
		4880 (Av)	47.46	54.00	-6.54
		7320 (Pk)	59.34	74.00	-14.66
		7320 (Av)	47.72	54.00	-6.28
High	V	2480 (Pk)	99.98	-	*
		2480 (Av)	99.02	-	*
		2483.5 (Pk)	51.58	74.00	-22.42
		2483.5 (Av)	38.34	54.00	-15.66
		4960 (Pk)	53.36	74.00	-20.64
		4960 (Av)	45.27	54.00	-8.73

		7440 (Pk)	61.13	74.00	-12.87
		7440 (Av)	51.05	54.00	-2.95
	H	2480 (Pk)	107.21	-	*
		2480 (Av)	106.87	-	*
		2483.5 (Pk)	53.12	74.00	-20.88
		2483.5 (Av)	41.35	54.00	-12.65
		4960 (Pk)	54.56	74.00	-19.44
		4960 (Av)	48.16	54.00	-5.84
		7440 (Pk)	60.19	74.00	-13.81
		7440 (Av)	47.35	54.00	-6.65

* * -> Fundamental Frequency
Pk - > Peak Detector
Av->Average Detector

Modulation type: P/4 DQPSK

Channel	Polarization	Frequency (MHz)	Measured Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	V	2390 (Pk)	44.01	74.00	-29.99
		2390 (Av)	30.28	54.00	-23.72
		2402 (Pk)	101.78	-	*
		2402 (Av)	99.01	-	*
		4804 (Pk)	53.86	74.00	-20.14
		4804 (Av)	45.32	54.00	-8.68
		7206 (Pk)	60.84	74.00	-13.16
		7206 (Av)	50.88	54.00	-3.12
	H	2390 (Pk)	48.95	74.00	-25.05
		2390 (Av)	37.12	54.00	-16.88
		2402 (Pk)	107.12	-	*
		2402 (Av)	105.56	-	*
		4804 (Pk)	54.59	74.00	-19.41
		4804 (Av)	46.43	54.00	-7.57
		7206 (Pk)	59.26	74.00	-14.74
		7206 (Av)	47.67	54.00	-6.33
Mid	V	4880 (Pk)	52.32	74.00	-21.68
		4880 (Av)	42.31	54.00	-11.69
		7320 (Pk)	58.76	74.00	-15.24
		7320 (Av)	45.13	54.00	-8.87
	H	4880 (Pk)	54.87	74.00	-19.13
		4880 (Av)	43.98	54.00	-10.02
		7320 (Pk)	58.76	74.00	-15.24

		7320 (Av)	46.21	54.00	-7.79
High	V	2480 (Pk)	100.01	-	*
		2480 (Av)	96.34	-	*
		2483.5 (Pk)	54.21	74.00	-19.79
		2483.5 (Av)	36.23	54.00	-17.77
		4960 (Pk)	52.89	74.00	-21.11
		4960 (Av)	44.23	54.00	-9.77
		7440 (Pk)	58.24	74.00	-15.76
		7440 (Av)	46.12	54.00	-7.88
	H	2480 (Pk)	107.26	-	*
		2480 (Av)	105.76	-	*
		2483.5 (Pk)	54.24	74.00	-19.76
		2483.5 (Av)	42.12	54.00	-11.88
		4960 (Pk)	56.68	74.00	-17.32
		4960 (Av)	45.37	54.00	-8.63
		7440 (Pk)	62.32	74.00	-11.68
		7440 (Av)	52.13	54.00	-1.87

* * -> Fundamental Frequency
Pk - > Peak Detector
Av->Average Detector

Modulation Type: 8 DQPSK

Channel	Polarization	Frequency (MHz)	Measured Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	V	2390 (Pk)	43.34	74.00	-30.66
		2390 (Av)	30.54	54.00	-23.46
		2402 (Pk)	103.76	-	*
		2402 (Av)	99.89	-	*
		4804 (Pk)	52.01	74.00	-21.99
		4804 (Av)	41.08	54.00	-12.92
		7206 (Pk)	58.23	74.00	-15.77
		7206 (Av)	46.43	54.00	-7.57
	H	2390 (Pk)	48.79	74.00	-25.21
		2390 (Av)	38.65	54.00	-15.35
		2402 (Pk)	107.03	-	*
		2402 (Av)	104.78	-	*
		4804 (Pk)	56.45	74.00	-17.55
		4804 (Av)	45.32	54.00	-8.68
		7206 (Pk)	61.24	74.00	-12.76
		7206 (Av)	50.32	54.00	-3.68

Mid	V	4880 (Pk)	54.23	74.00	-19.77
		4880 (Av)	43.21	54.00	-10.79
		7320 (Pk)	58.05	74.00	-15.95
		7320 (Av)	45.62	54.00	-8.38
	H	4880 (Pk)	54.52	74.00	-19.48
		4880 (Av)	45.02	54.00	-8.98
		7320 (Pk)	58.78	74.00	-15.22
		7320 (Av)	45.66	54.00	-8.34
High	V	2480 (Pk)	101.98	-	*
		2480 (Av)	97.67	-	*
		2483.5 (Pk)	53.67	74.00	-20.33
		2483.5 (Av)	34.89	54.00	-19.11
		4960 (Pk)	52.98	74.00	-21.02
		4960 (Av)	42.34	54.00	-11.66
		7440 (Pk)	57.89	74.00	-16.11
		7440 (Av)	45.87	54.00	-8.13
	H	2480 (Pk)	107.44	-	*
		2480 (Av)	105.67	-	*
		2483.5 (Pk)	55.36	74.00	-18.64
		2483.5 (Av)	42.31	54.00	-11.69
		4960 (Pk)	55.48	74.00	-18.52
		4960 (Av)	46.89	54.00	-7.11
		7440 (Pk)	56.87	74.00	-17.13
		7440 (Av)	49.34	54.00	-4.66

* * -> Fundamental Frequency
Pk - > Peak Detector
Av->Average Detector

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Power level Settings used during testing:

		Channels		
Mode	**Data Rate (Mbps)**	**Low**	**Mid**	**High**
802.11 b	1	18	20	18
	11	19	20	19
802.11 g	6	13	20	12
	24	13	20	12
	54	13	20	12
802.11 n	MCS0	11	20	10
	MCS4	11	20	10
	MCS7	11	20	10
Bluetooth	1	15	15	15
	2	15	15	15
	3	15	15	15
	LE	15	15	15
Zigbee	250kbps	16	16	16