Certification Test Report

FCC ID: AZ489FT4910
IC: 109U-89FT4910

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 12-2018.W06.1A

Manufacturer: Motorola Solutions SDNBHD
Model: H51SDH9PW7AN

Test Begin Date: **February 13, 2012**
Test End Date: **February 17, 2012**

Report Issue Date: March 5, 2012

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ACLASS, ANSI, or any agency of the Federal Government.

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This report contains 58 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Manufacturer Information

Motorola Solutions SDNBHD
Plot 2 Bayan Lepas
Technoplex Industrial Park
MK 12 SWD
11900 Pulau Pinang

1.3 Product description

The APX4000 model H51SDH9PW7AN is a two way portable UHF radio capable of TDMA as well as digital and analog FM transmission. The unit includes a Bluetooth 2.0 +EDR radio.

Table1.3-1: Bluetooth Radio Properties

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
GFSK	2402 - 2480	79	1000	1000
π/4-DQPSK	2402 - 2480	79	1000	2000
8DPSK	2402 - 2480	79	1000	3000

Model Number: H51SDH9PW7AN

Table 1.3-2 Model Variants

Variant	Description	Tested
H51SDH9PW7AN	APX4000 Full Keypad Model (MUE4080)	Yes
H51SDF9PW6AN	APX4000 Limited Keypad Model (MUE3772)	----

Per the customer, the model tested is considered the worst case and the remaining models are declared compliant based on similarity.

Test Sample Serial Number(s): 426TNB0591, 426TNB0593

Test Sample Condition: Good

1.4 Test Methodology and Considerations

The H51SDH9PW7AN Bluetooth radio was evaluated for radiated and power line conducted emissions as well as RF conducted measurements at the antenna port.

For the radiated emissions evaluation, the unit was pre-scanned in three orthogonal positions. The final measurements were performed for the EUT orientation leading to the highest emissions. The EUT was also evaluated for inter-modulation products from the collocated Bluetooth and the UHF radio. All inter-modulation products were attenuated below the limits of 15.209.

The RF conducted evaluation was performed on the EUT modified with a temporary SMA connector at the antenna port.

The power line conducted emissions evaluations were performed for the EUT set to the hopping mode for the three available modes of operation. The results are reported for the configuration leading to the highest emissions.

Table 1.4-1: Bluetooth Radio Test configuration

Mode of Operations	Frequency (MHz)	Data Rate (kbps)
GFSK	2402	1000
	2441	1000
	2480	1000
π/4 DQPSK	2402	2000
	2441	2000
	2480	2000
8 DPSK	2402	3000
	2441	3000
	2480	3000

The unit was also evaluated for unintentional emissions when operating as a computer peripheral device. The results are documented separately in a Declaration of Conformity/Verification test report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 587595
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

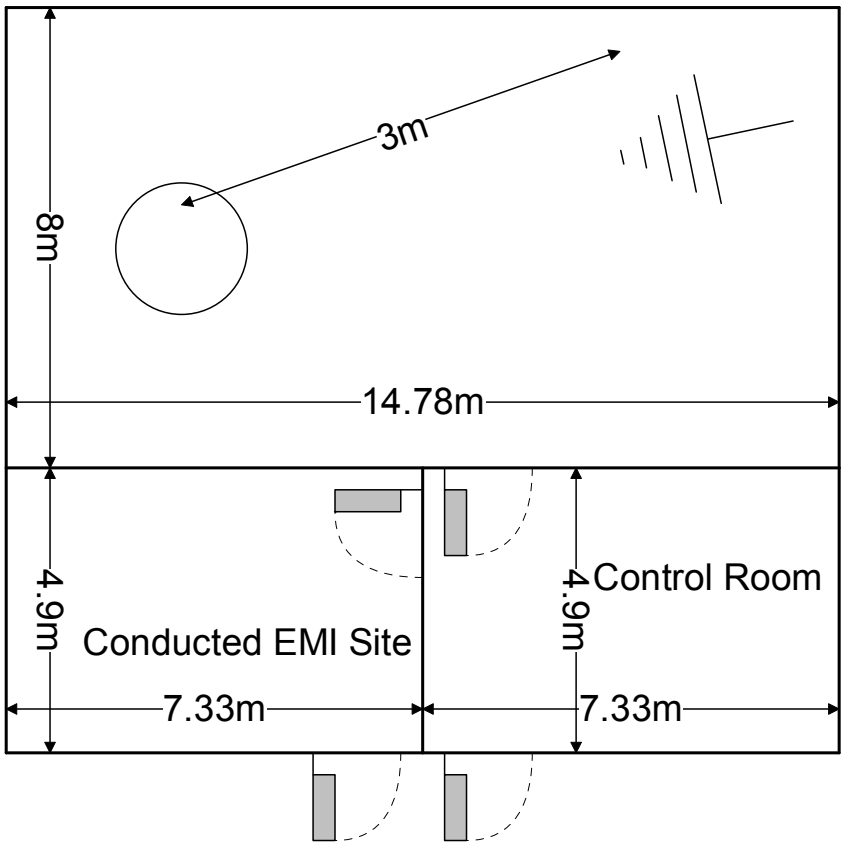


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

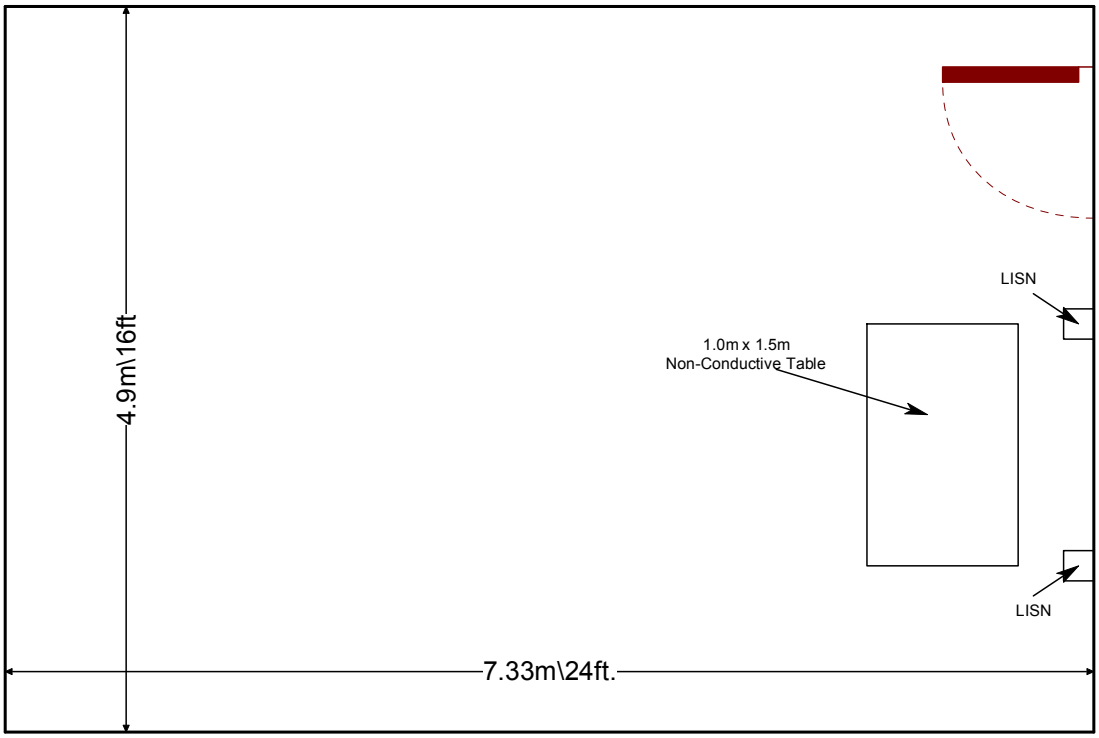


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2012
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2012
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/5/2011	1/5/2013
524	Chase	CBL6111	Antennas	1138	1/7/2011	1/7/2013
2006	EMCO	3115	Antennas	2573	3/2/2011	3/2/2013
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	1/2/2012	1/2/2013
2022	EMCO	LISN3825/2R	LISN	1095	8/19/2011	8/19/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/2/2012	1/2/2013
2044	QMI	N/A	Cables	2044	1/2/2012	1/2/2013
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/2/2012	1/2/2013
2064	CIR Q-TEL	FHT/22-10K-13/50-3A/3A	Filter	9	12/30/2011	12/30/2012
2070	Mini Circuits	VHF-8400+	Filter	2070	1/19/2012	1/19/2013
2072	Mini Circuits	VHF-3100+	Filter	30737	1/19/2012	1/19/2013
2075	Hewlett Packard	8495B	Attenuators	2626A11012	1/2/2012	1/2/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	1/2/2012	1/2/2013
2082	Teledyne Storm Products	90-010-048	Cables	2082	6/6/2011	6/6/2012
2091	Agilent Technologies, Inc.	8573A	Spectrum Analyzers	2407A03233	12/12/2011	12/12/2013
RE586	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00168	9/23/2011	9/23/2012

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment (Stand-alone)

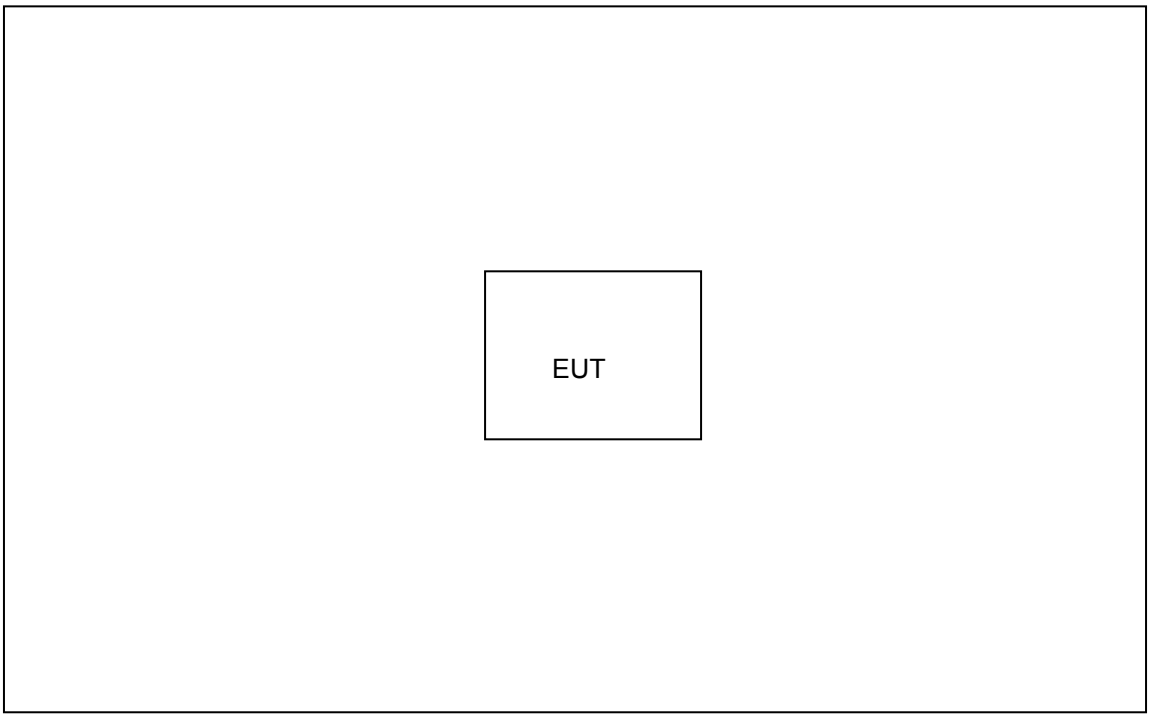
Item	Equipment Type	Manufacturer	Model Number	Serial Number
No Support Equipment				

Table 5-2: Support Equipment (With charger)

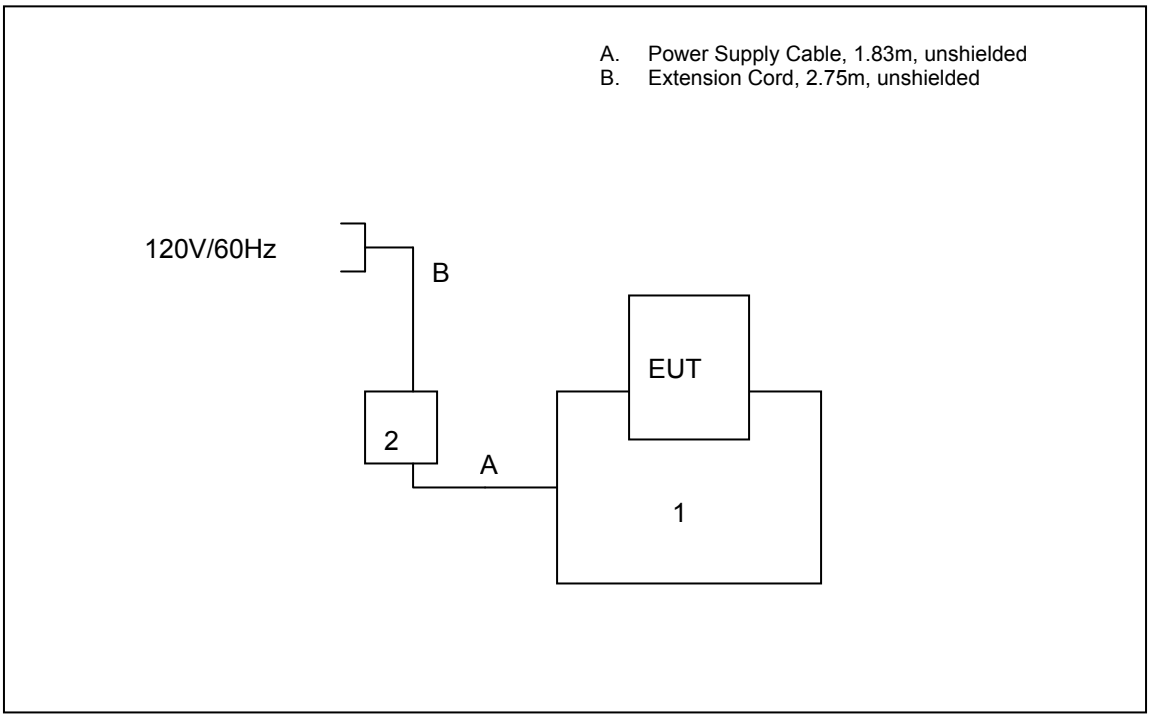
Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	**Adaptive Charger**	**Impres**	**WPLN4226A**	**0071MTT01**
2	**18 VDC Power supply**	**Motorola**	**481809OO3NT**	**1015**

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

Configuration 1 – Radiated Emissions (EUT Stand-alone)



Configuration 2 – Power Line Conducted Emissions (With charger)



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The unit uses an internal antenna for the Bluetooth radio which is not accessible to the end-user, thus meeting the requirements of 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test corresponding to the EUT configuration leading to the worse case emissions are shown below in Table 7.2.2-1 and Figure 7.2.2-1 to Figure 7.2.2-2.

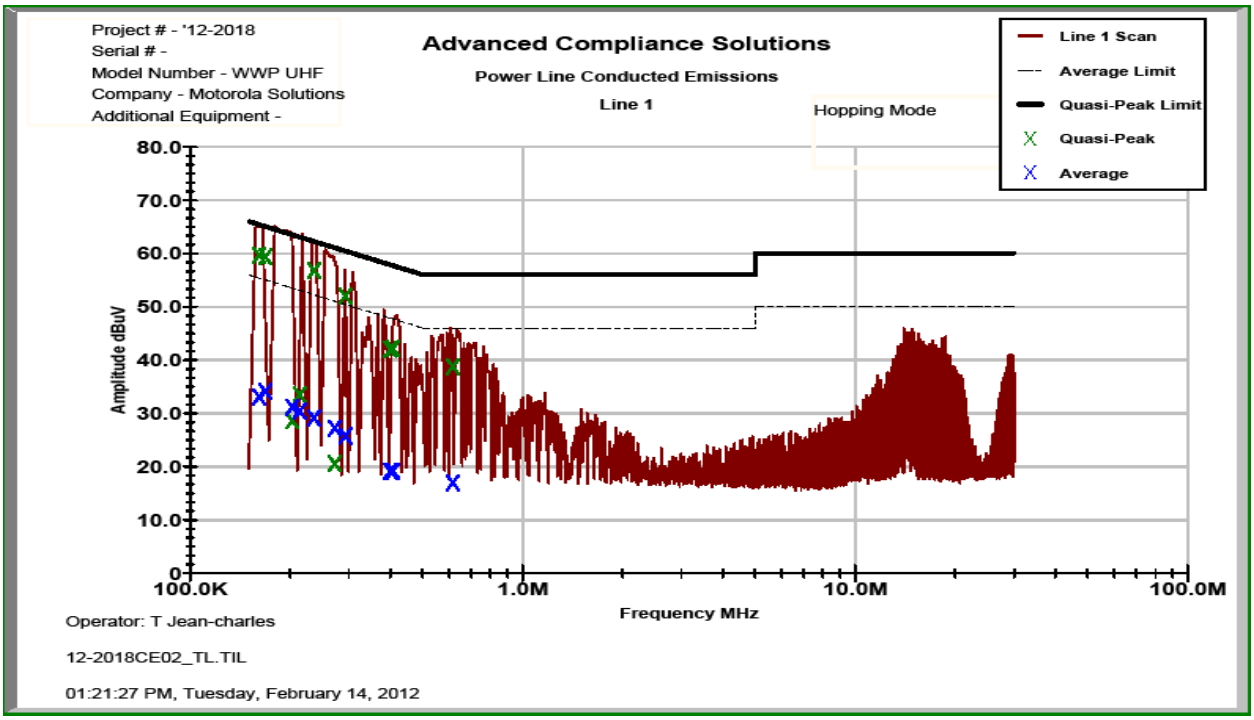


Figure 7.2.2-1: Conducted Emissions Results – Line 1

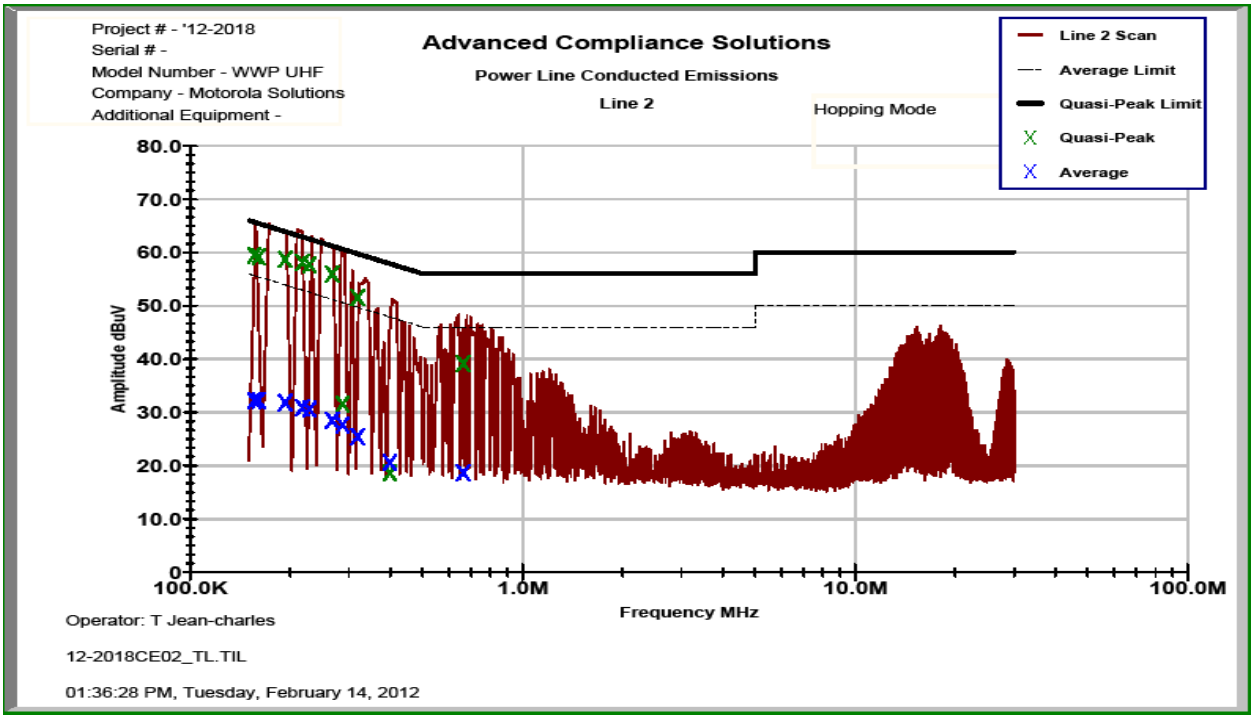


Figure 7.2.2-2: Conducted Emissions Results – Line 2

Table 7.2.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3
☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Plot Number: 12-2018CE02
Power Supply Description: 18 VDC

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.161125	59.252	32.646	1.50	60.75	34.15	65.41	55.41	4.7	21.3
0.168399	58.927	33.662	1.48	60.41	35.15	65.04	55.04	4.6	19.9
0.202763	28.175	30.766	1.11	29.28	31.88	63.50	53.50	34.2	21.6
0.213137	33.09	30.003	1.10	34.19	31.10	63.08	53.08	28.9	22.0
0.235575	56.406	28.737	1.07	57.47	29.80	62.25	52.25	4.8	22.4
0.272087	20.182	26.822	0.88	21.07	27.71	61.05	51.05	40.0	23.3
0.292613	51.62	25.356	0.87	52.49	26.22	60.45	50.45	8.0	24.2
0.399838	41.689	18.818	0.67	42.36	19.49	57.86	47.86	15.5	28.4
0.40715	41.802	18.832	0.60	42.40	19.43	57.71	47.71	15.3	28.3
0.616213	38.44	16.646	0.50	38.94	17.15	56.00	46.00	17.1	28.9
Line 2									
0.155756	59.015	31.767	1.52	60.54	33.29	65.69	55.69	5.2	22.4
0.160388	58.724	31.814	1.51	60.24	33.33	65.44	55.44	5.2	22.1
0.193	58.28	31.414	1.29	59.57	32.71	63.91	53.91	4.3	21.2
0.217388	57.705	30.453	1.08	58.79	31.53	62.92	52.92	4.1	21.4
0.228362	57.348	30.147	1.07	58.42	31.21	62.51	52.51	4.1	21.3
0.267124	55.573	28.099	0.87	56.44	28.97	61.21	51.21	4.8	22.2
0.287312	31.176	27.278	0.85	32.03	28.13	60.60	50.60	28.6	22.5
0.318662	51.137	25.066	0.73	51.87	25.79	59.74	49.74	7.9	23.9
0.398124	18.267	20.205	0.65	18.92	20.85	57.89	47.89	39.0	27.0
0.662076	38.79	18.335	0.49	39.28	18.82	56.00	46.00	16.7	27.2

* Note: Results are reported for the EUT configuration leading to the worst case emissions.

7.3 Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-210 A8.4(2)

7.3.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation.

7.3.2 Measurement Results

Results are shown below in Table 7.3.2-1 to Table 7.3.2-3 and Figure 7.3.2-1 to Figure 7.3.2-9 below:

Table 7.3.2-1: RF Output Power (GFSK)

Frequency (MHz)	Power (dBm)
2402.00	7.697
2441.00	7.554
2480.00	7.602

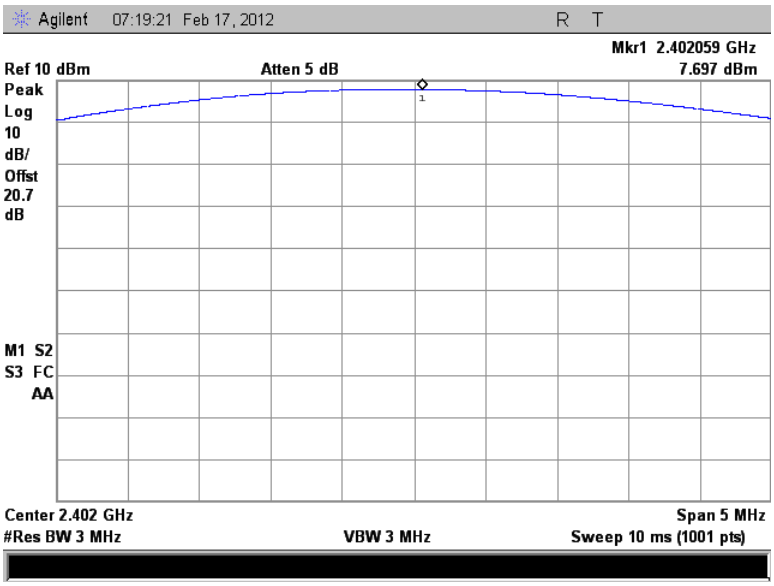


Figure 7.3.2-1: RF Output Power (GFSK) - Low Channel

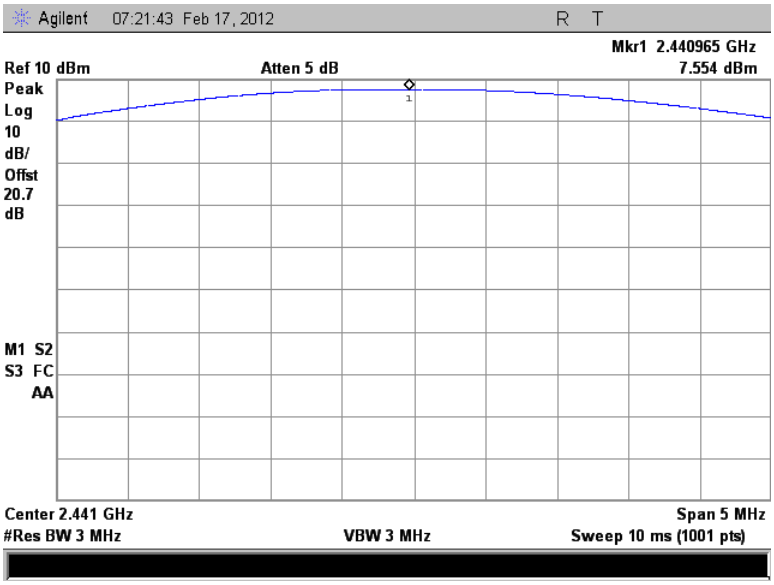


Figure 7.3.2-2: RF Output Power (GFSK) - Middle Channel

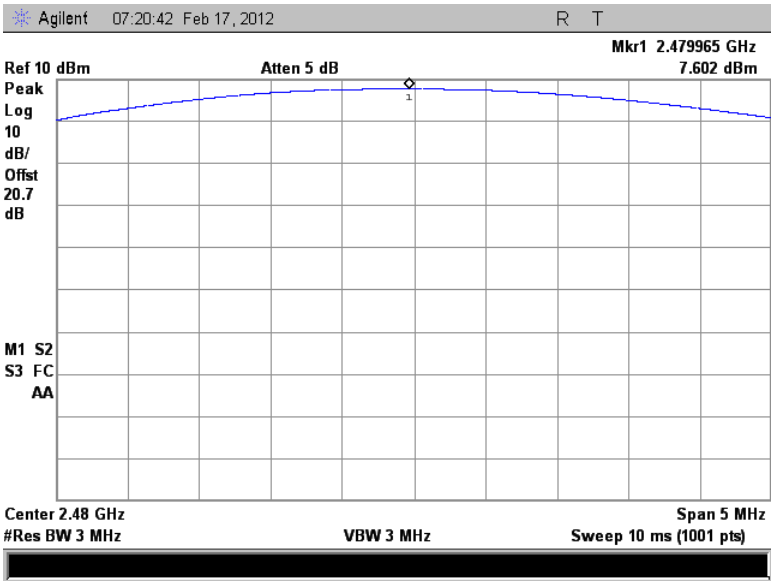


Figure 7.3.2-3: RF Output Power (GFSK) - High Channel

Table 7.3.2-2: RF Output Power (π/4 DQPSK)

Frequency (MHz)	Power (dBm)
2402.00	7.353
2441.00	7.35
2480.00	7.393

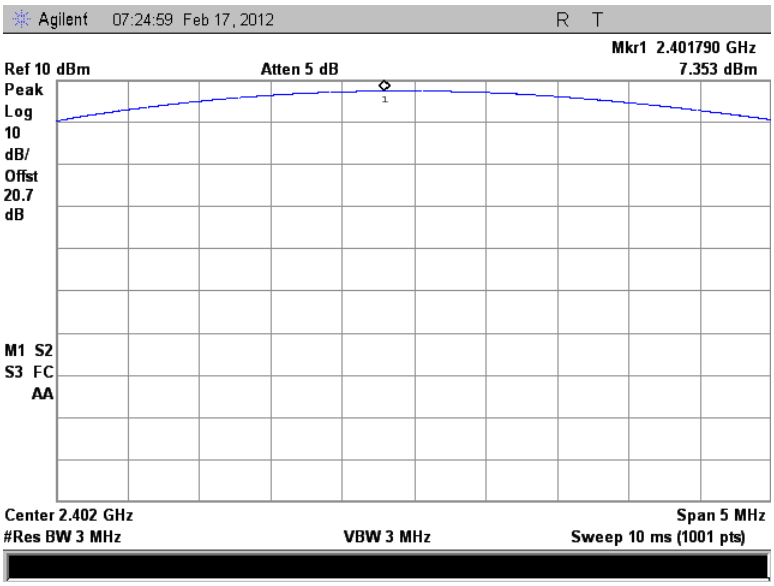


Figure 7.3.2-4: RF Output Power (π/4 DQPSK) - Low Channel

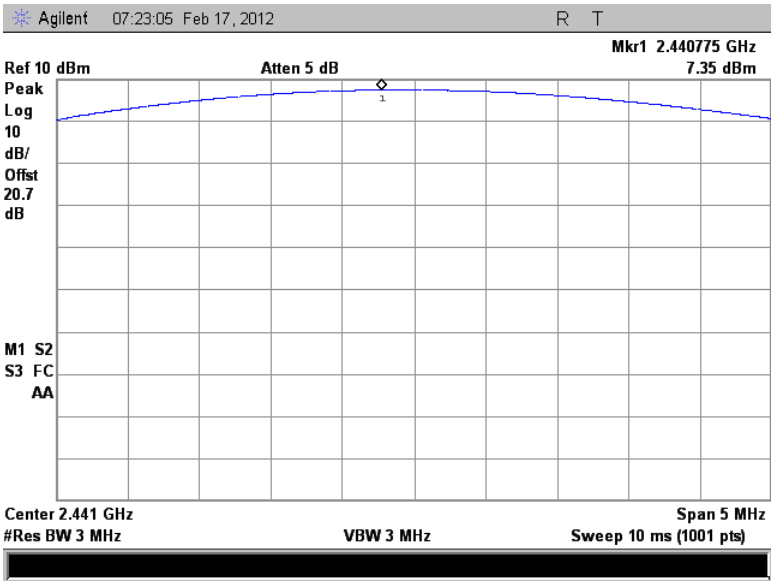


Figure 7.3.2-5: RF Output Power (π/4 DQPSK) - Middle Channel

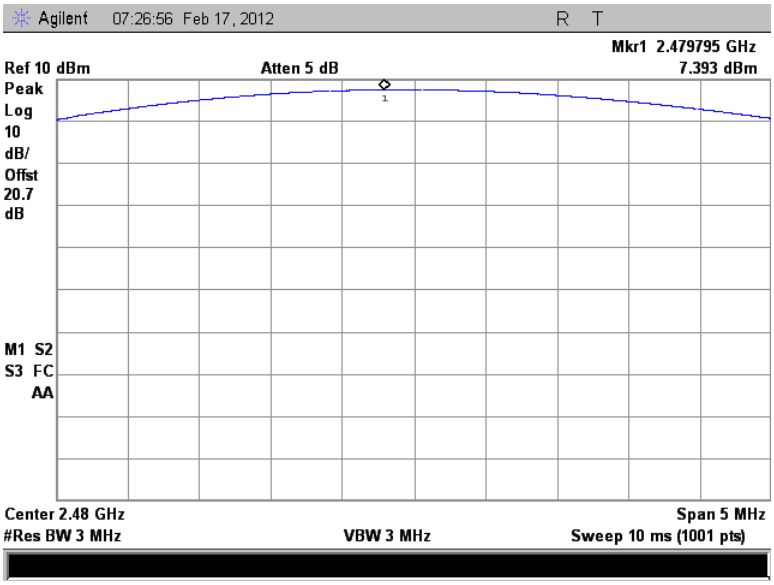


Figure 7.3.2-6: RF Output Power (π/4 DQPSK) - High Channel

Table 7.3.2-3 RF Output Power (8DPSK)

Frequency (MHz)	Power (dBm)
2402.00	7.798
2441.00	7.788
2480.00	7.836

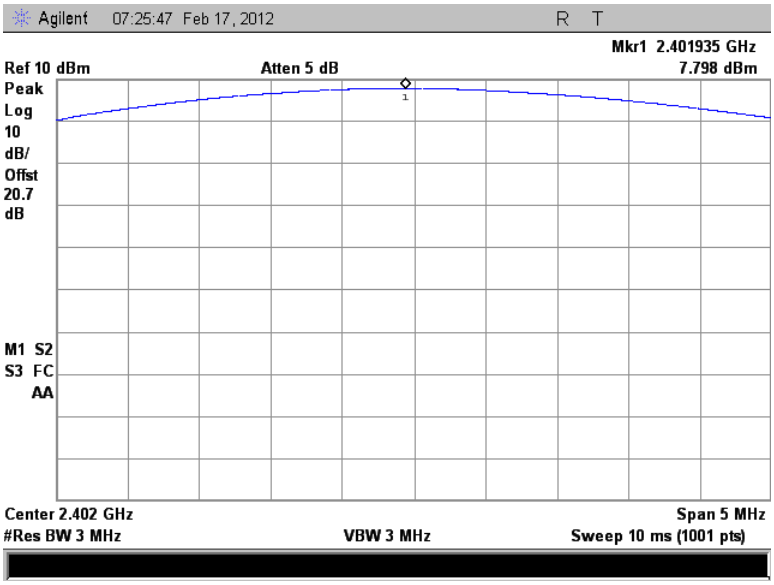


Figure 7.3.2-7: RF Output Power (8DPSK) - Low Channel

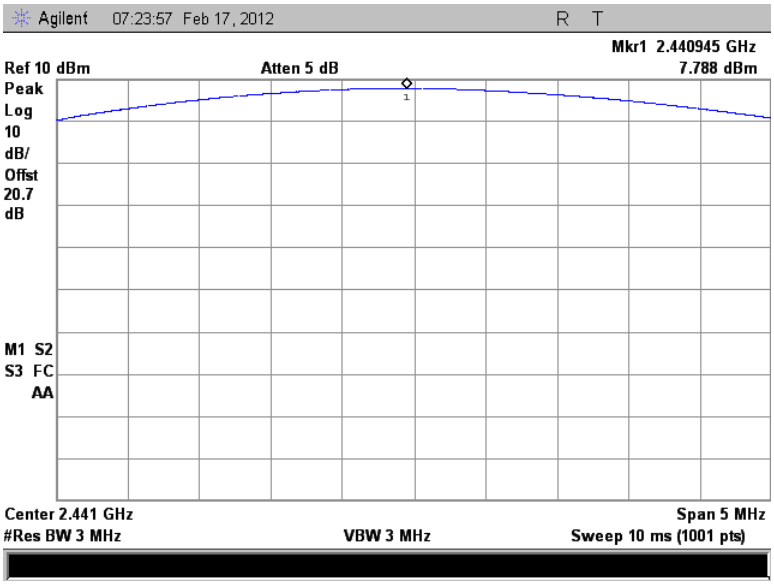


Figure 7.3.2-8: RF Output Power (8DPSK) - Middle Channel

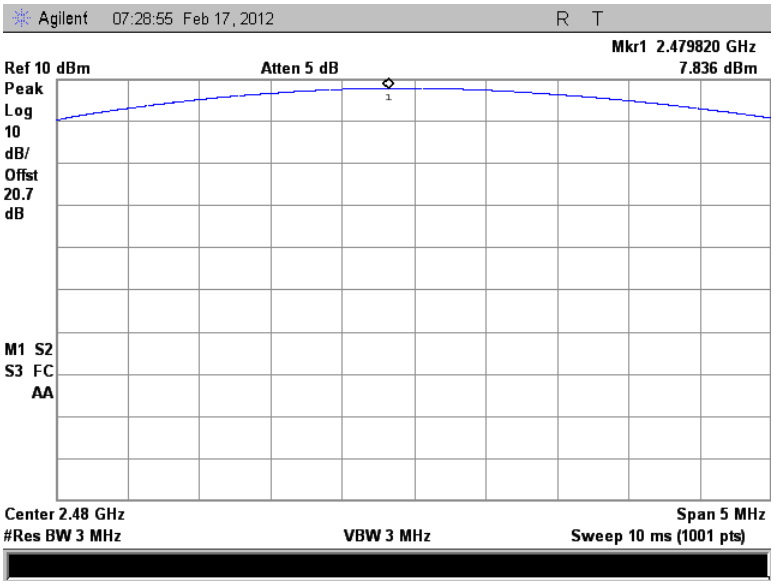


Figure 7.3.2-9: RF Output Power (8DPSK) - High Channel

7.4 Channel Usage Requirements

7.4.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

7.4.1.2 Measurement Results

Results are shown below in Figure 7.4.1.2-1.

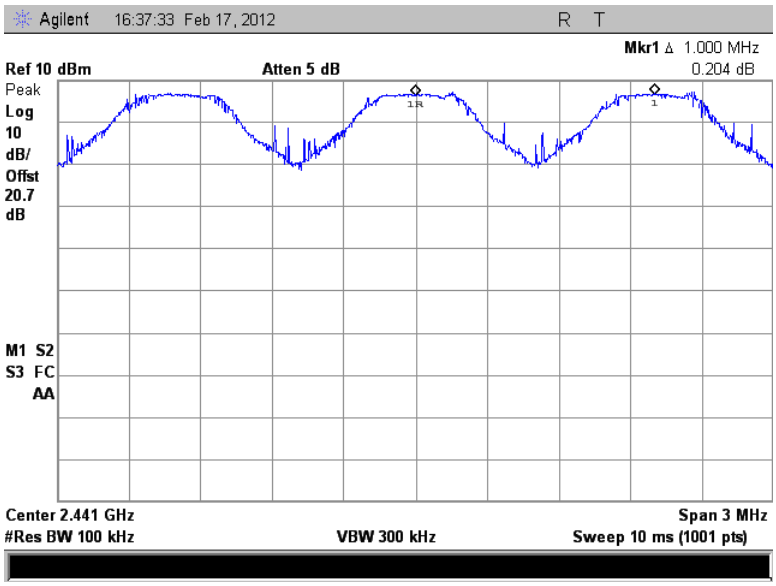


Figure 7.4.1.2-1: Carrier Frequency Separation

7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.2.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer through suitable attenuation. The span of the spectrum analyzer was set wide enough to capture the number of hopping channels. The peak detector max hold function was enabled for the measurements.

7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-3.

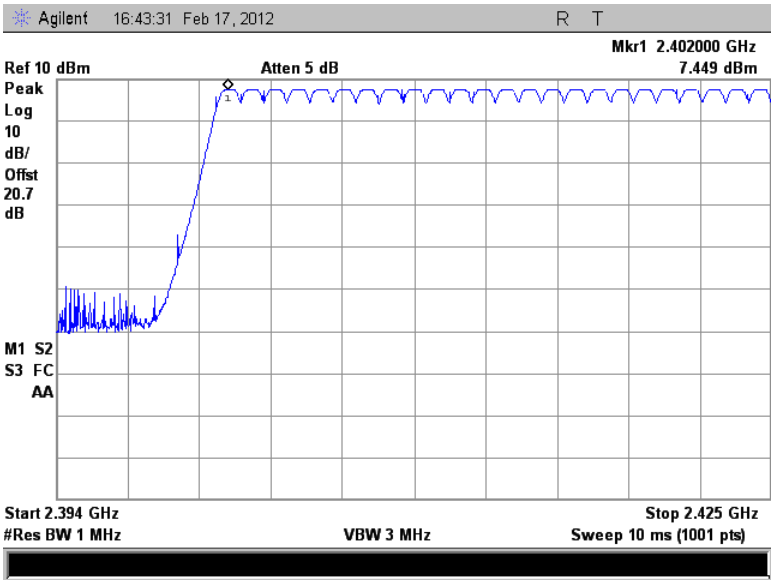


Figure 7.4.2.2-1: Number of Hopping Channels (1 – 24)

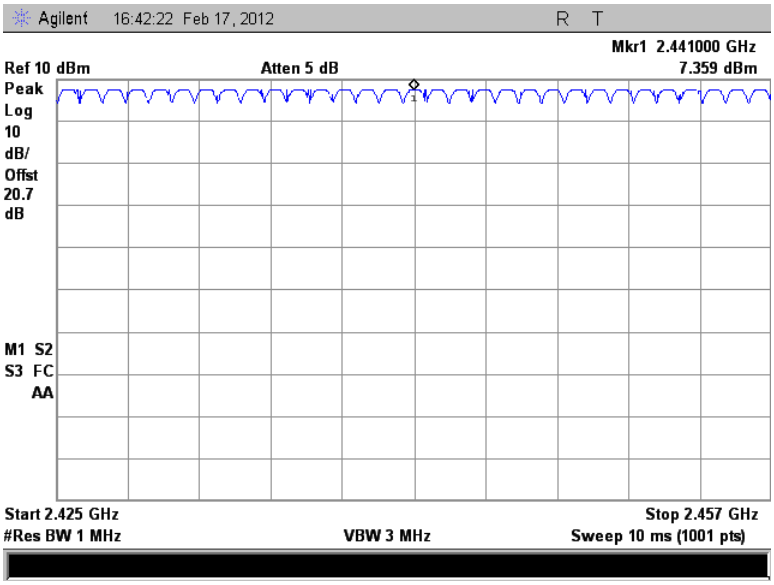


Figure 7.4.2.2-2: Number of Hopping Channels (25 – 55)

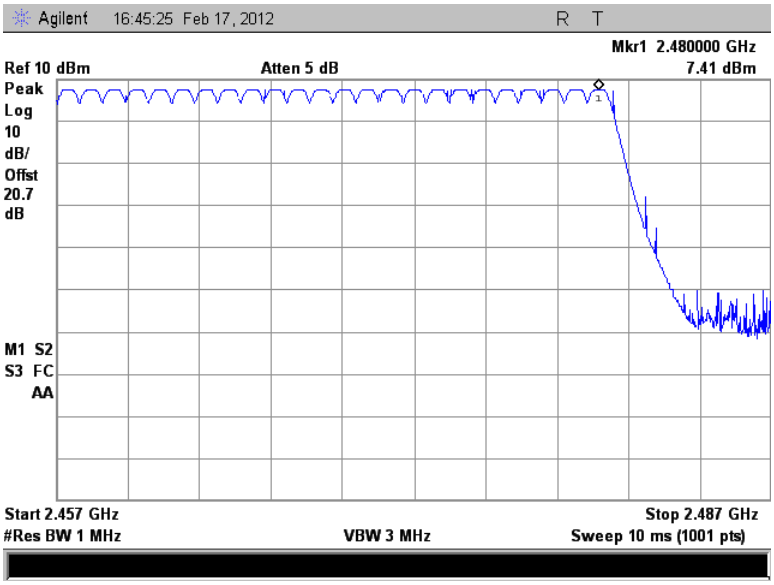


Figure 7.4.2.2-3: Number of Hopping Channels (56 – 79)

7.4.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set 0 Hz centered on a hopping channel. The RBW was set to 1 MHz and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

7.4.3.2 Measurement Results

Results are shown below in Table 7.4.3.2-1 and Figure 7.4.3.2-1 to Figure 7.4.3.2-3

Table 7.4.3.2-1 Dwell Time on a 31.6 Second Cycle

Packet Format	Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 31.6 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 31.6 s Cycle	Limit (ms)	Status
DH1	800	10.13	320	0.398	127.36	400	PASS
DH3	400	5.06	160	1.655	264.80	400	PASS
DH5	266.67	3.38	106.67	2.91	310.41	400	PASS

*Notes:

NHPS = (1600 /sec)/ (NT+NR) (where NT and NR are the number of transmit and receive packets, respectively)
NHPCPS = NHPS/79
NHPC = NHPCPS * 31.6s
Dwell Time per Cycle = NHPC* Measured Dwell Time

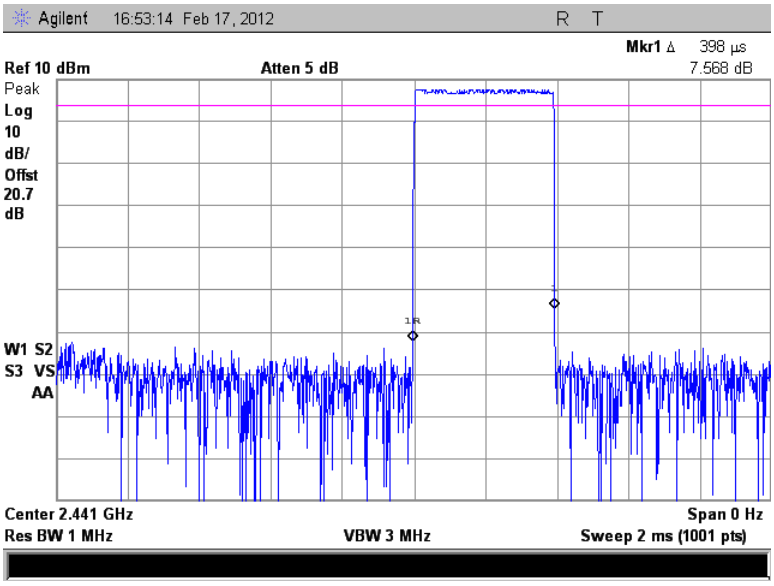


Figure 7.4.3.2-1: Channel Dwell Time – DH1

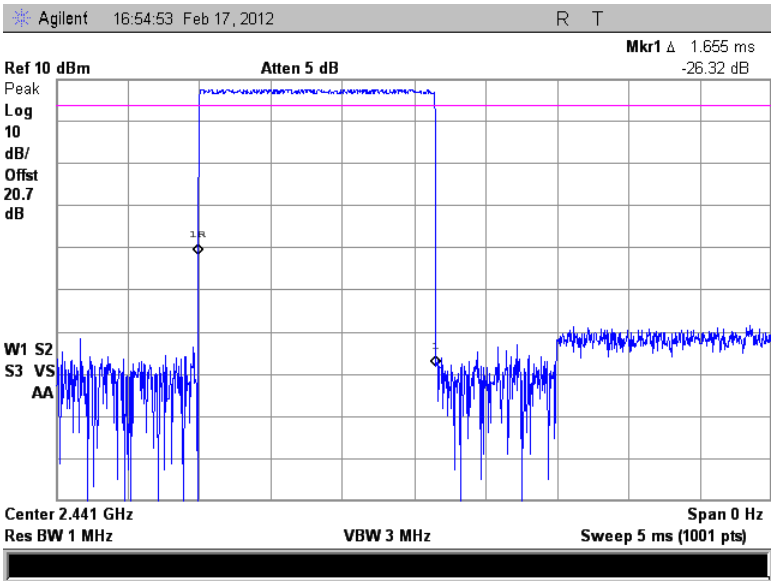


Figure 7.4.3.2-2: Channel Dwell Time – DH3

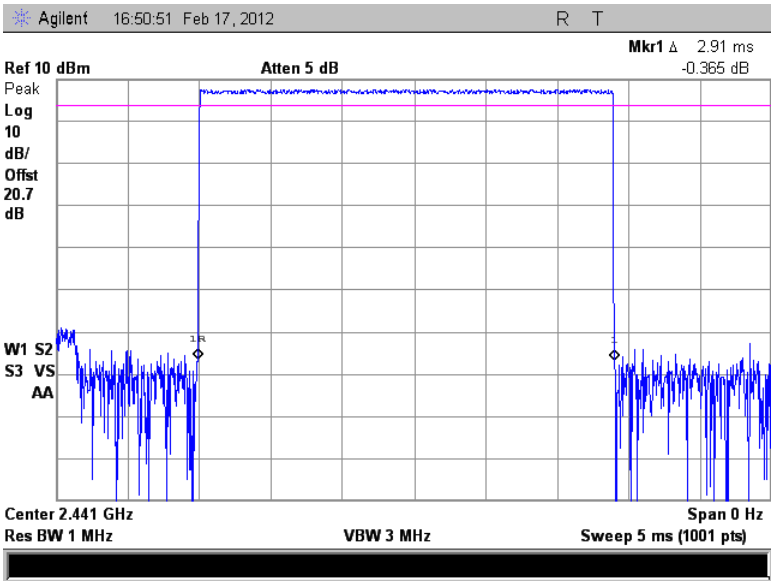


Figure 7.4.3.2-3: Channel Dwell Time – DH5

7.4.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(a)

7.4.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% of the span. . The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.4.4.2 Measurement Results

Results are shown below in Table 7.4.4.2-1 to Table 7.4.4.2-3 and Figures 7.4.4.2-1 to 7.4.4.2-18.

Table 7.4.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	956	879
2442	959	867
2480	956	864

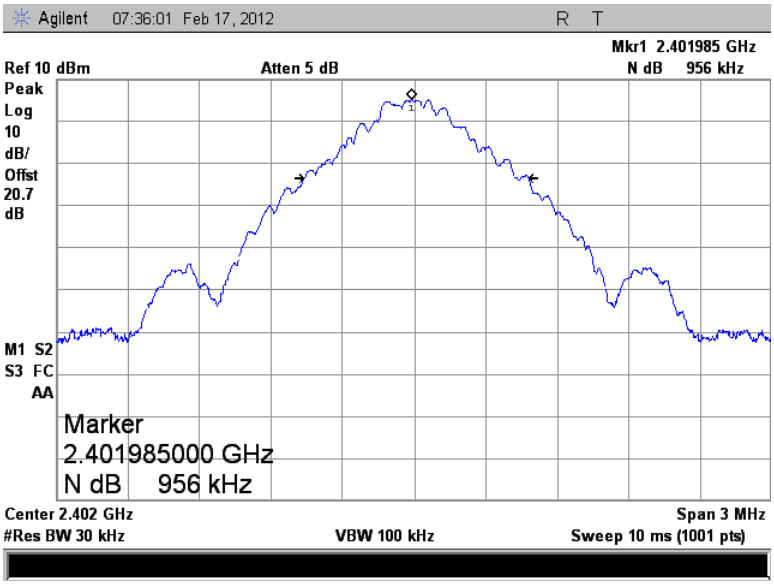


Figure 7.4.4.2-1: 20dB BW Low Channel (GFSK)

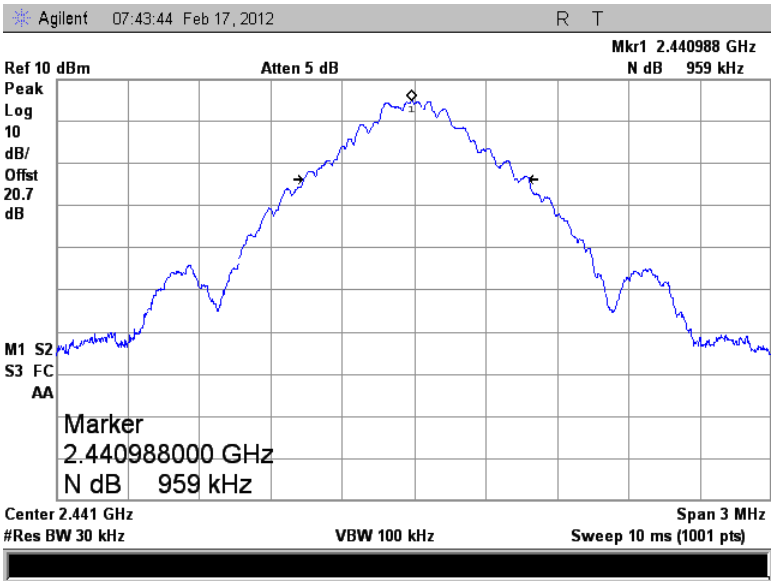


Figure 7.4.4.2-2: 20dB BW Middle Channel (GFSK)

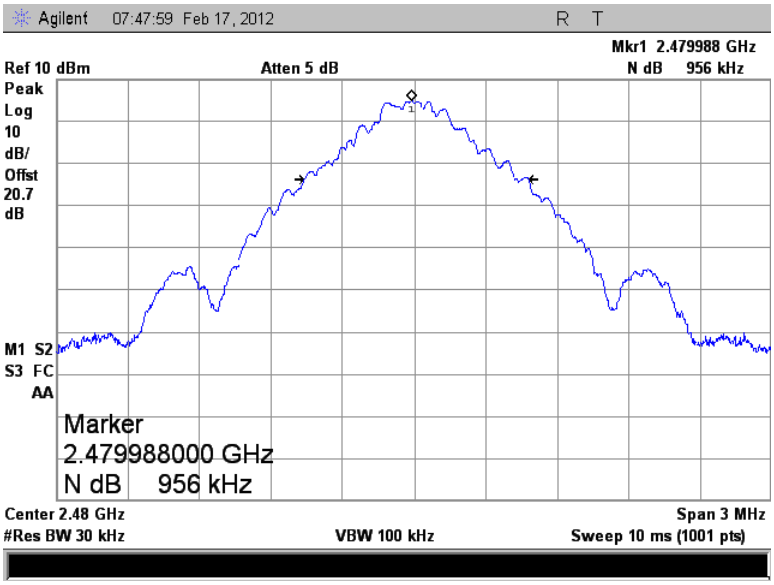


Figure 7.4.4.2-3: 20dB BW High Channel (GFSK)

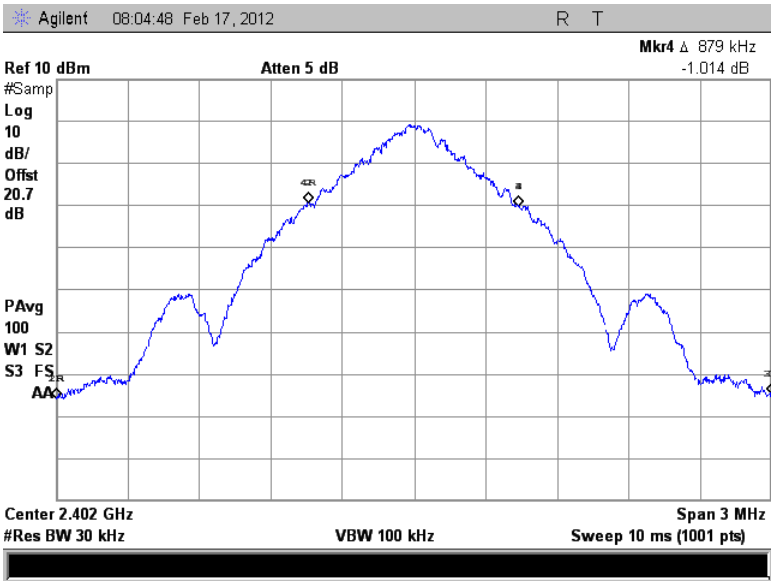


Figure 7.4.4.2-4: 99% OBW Low Channel (GFSK)

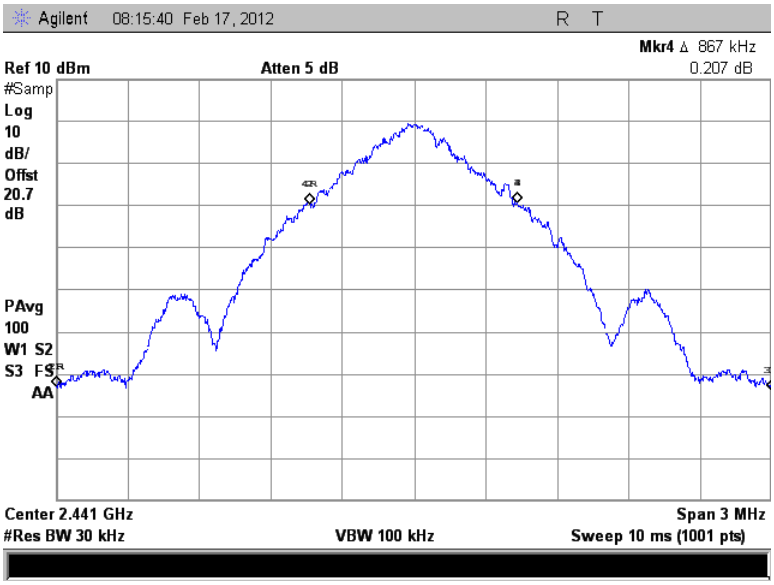


Figure 7.4.4.2-5: 99% OBW Middle Channel (GFSK)

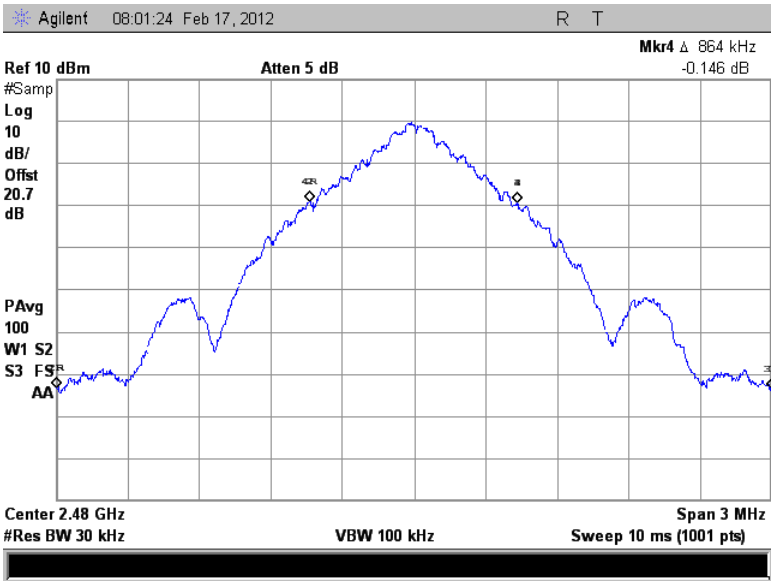


Figure 7.4.4.2-6: 99% OBW High Channel (GFSK)

Table 7.4.4.2-2: 20dB / 99% Bandwidth (π/4 DQPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1400	1242
2441	1397	1239
2480	1394	1242

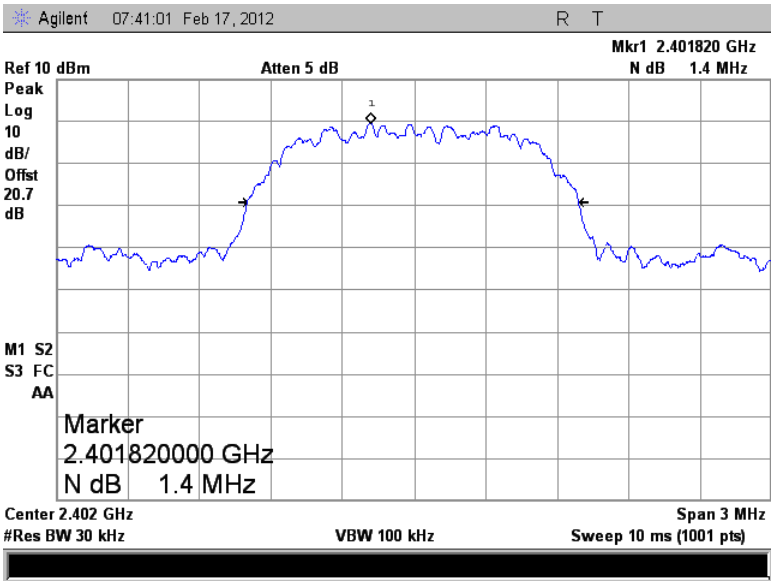


Figure 7.4.4.2-7: 20dB BW Low Channel (π/4 DQPSK)

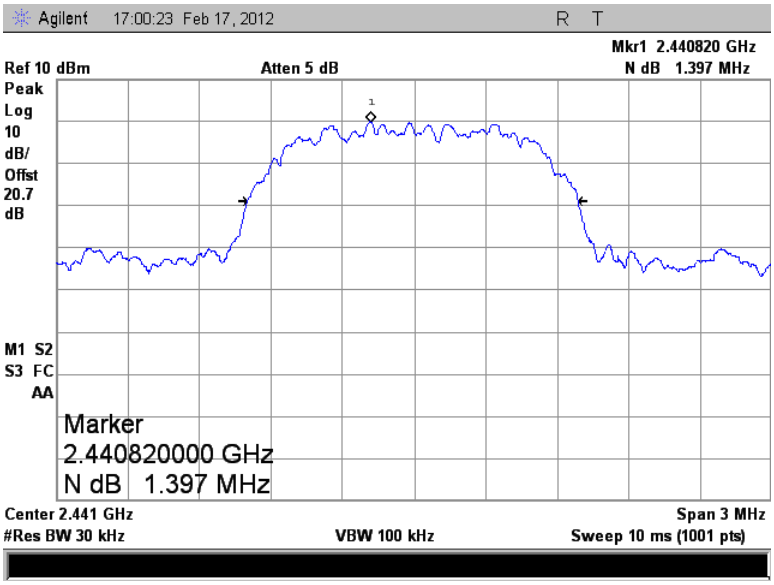


Figure 7.4.4.2-8: 20dB BW Middle Channel (π/4 DQPSK)

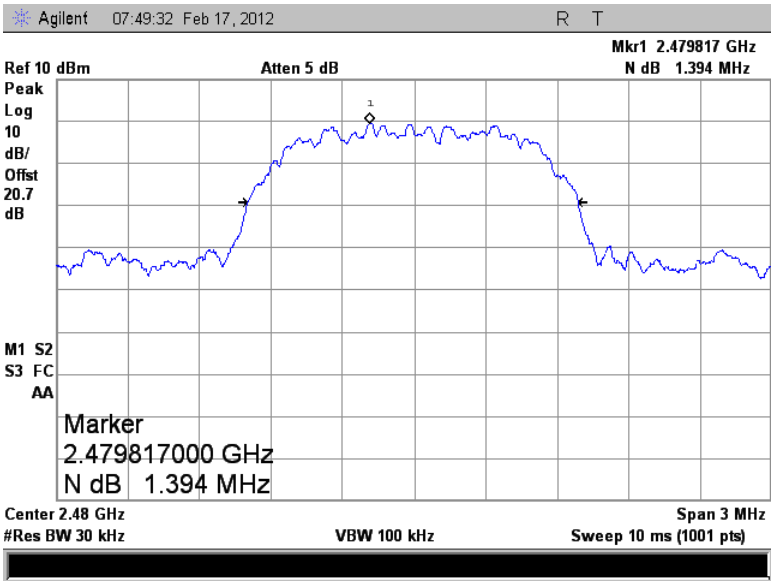


Figure 7.4.4.2-9: 20dB BW High Channel (π/4 DQPSK)

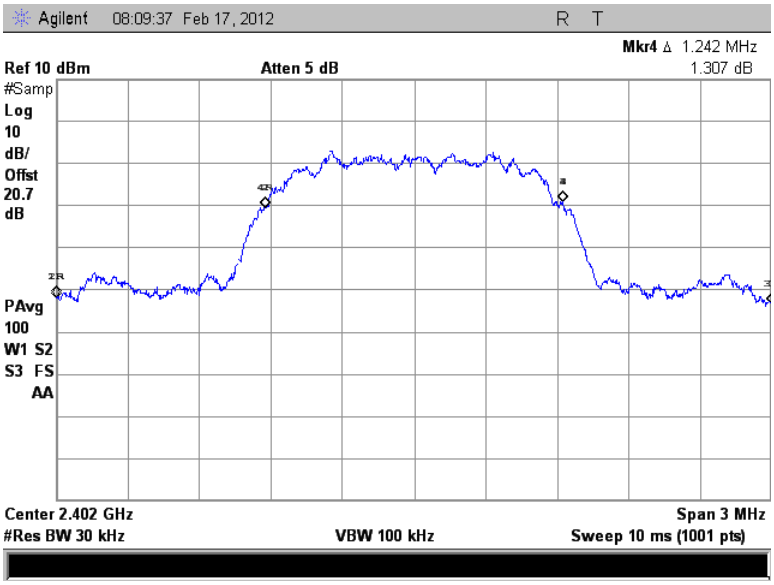


Figure 7.4.4.2-10: 99% OBW Low Channel (π/4 DQPSK)

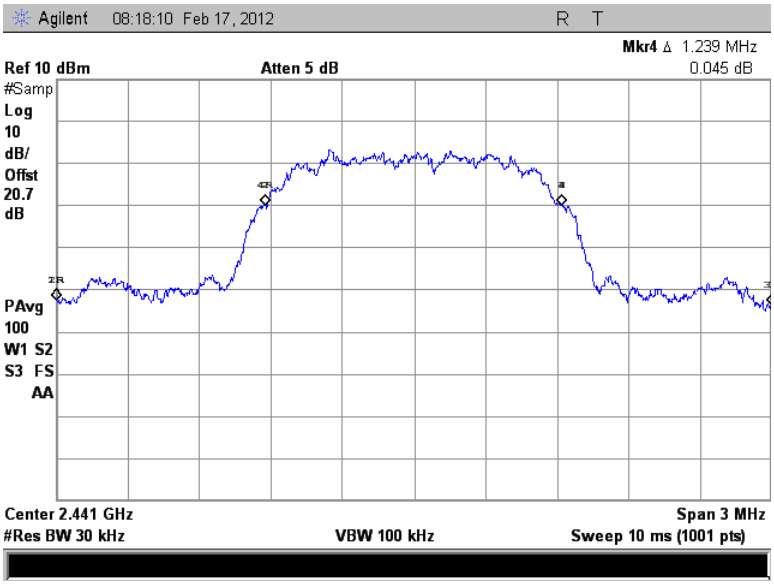


Figure 7.4.4.2-11: 99% OBW Middle Channel (π/4 DQPSK)

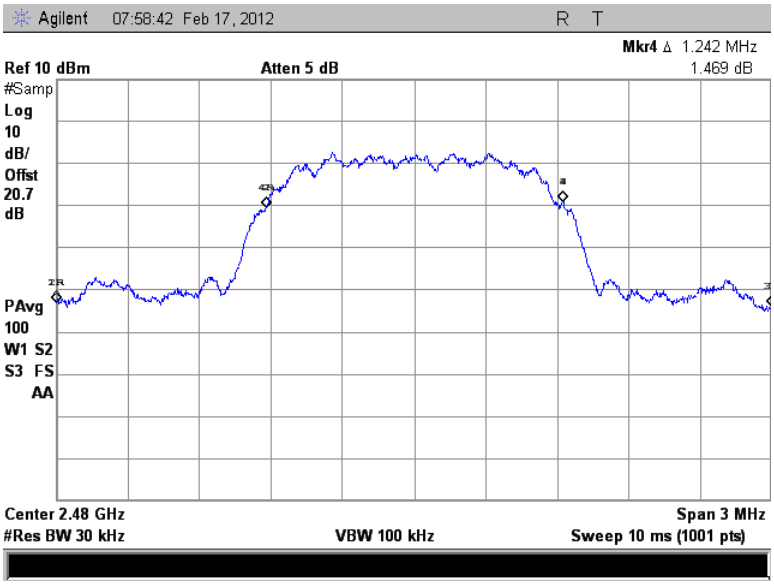


Figure 7.4.4.2-12: 99% OBW High Channel (π/4 DQPSK)

Table 7.4.4.2-3: 20dB / 99% Bandwidth (8DPSK)

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1400	1245
2441	1394	1242
2480	1391	1242

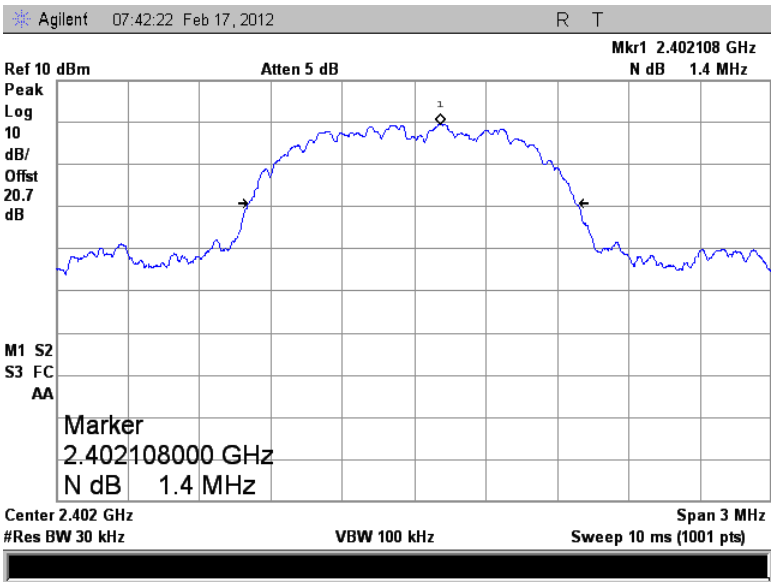


Figure 7.4.4.2-13: 20dB BW Low Channel (8DPSK)

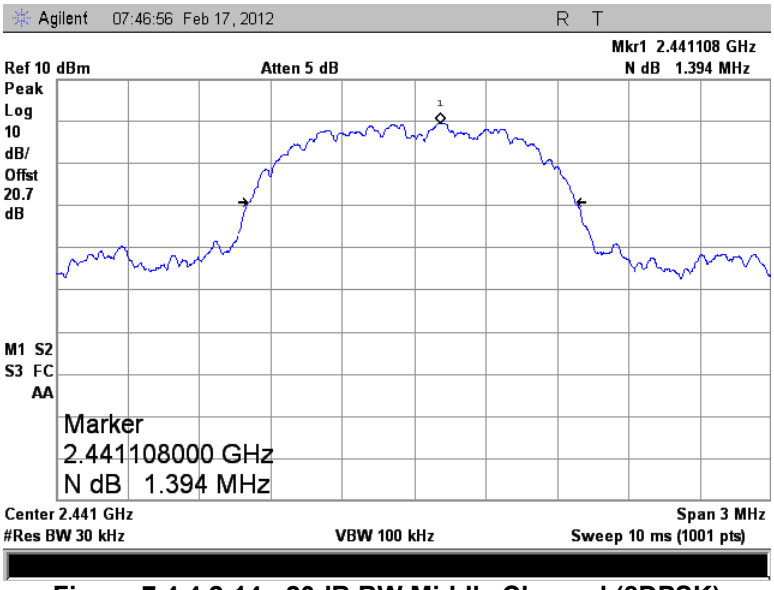


Figure 7.4.4.2-14: 20dB BW Middle Channel (8DPSK)

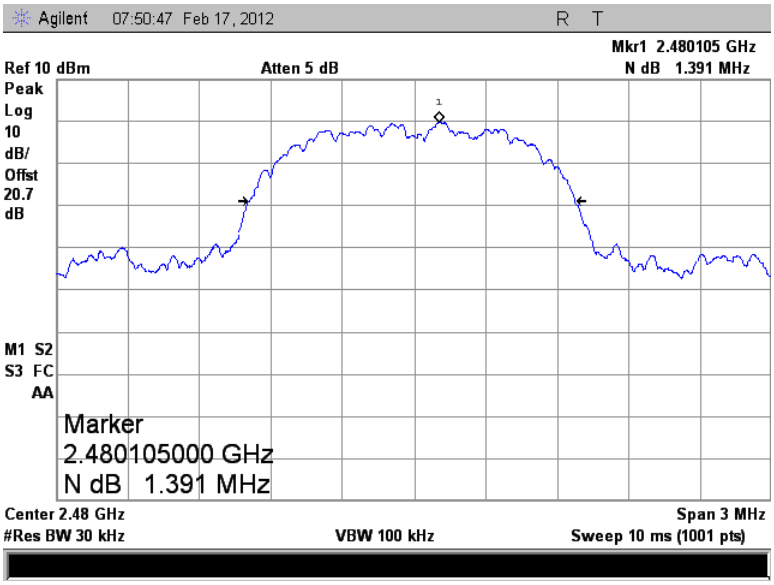


Figure 7.4.4.2-15: 20dB BW High Channel (8DPSK)

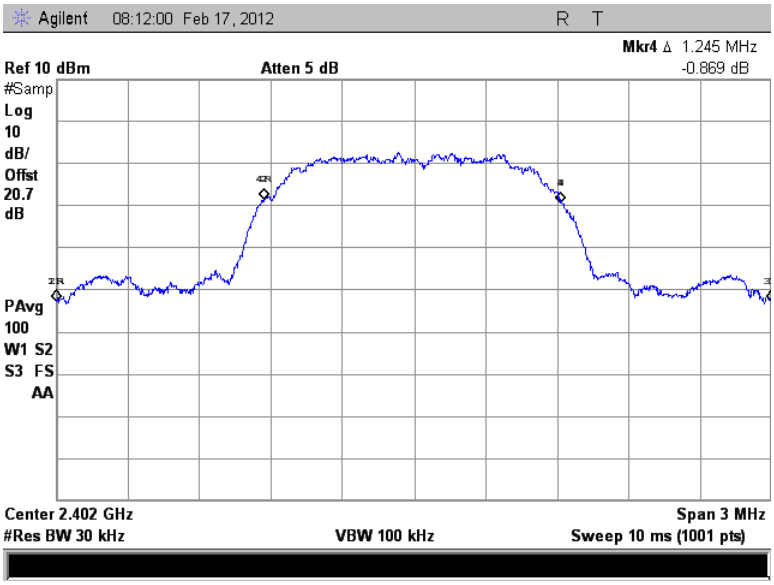


Figure 7.4.4.2-16: 99% OBW Low Channel (8DPSK)

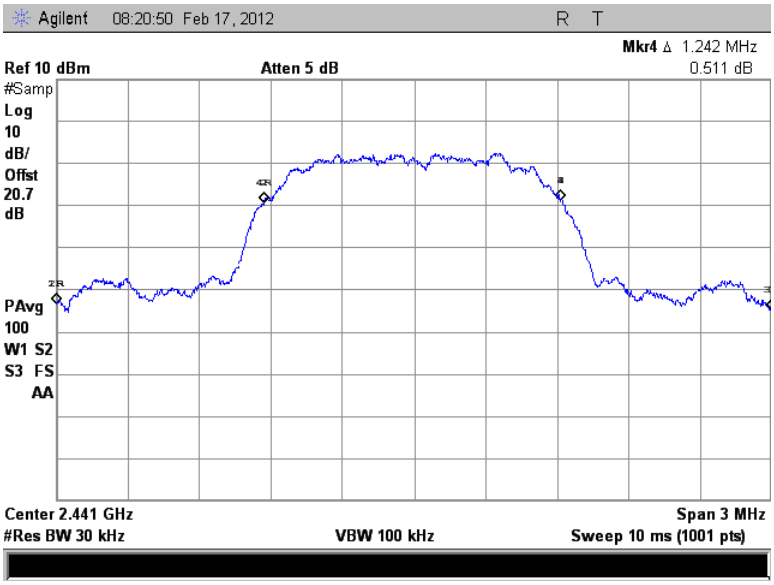


Figure 7.4.4.2-17: 99% OBW Middle Channel (8DPSK)

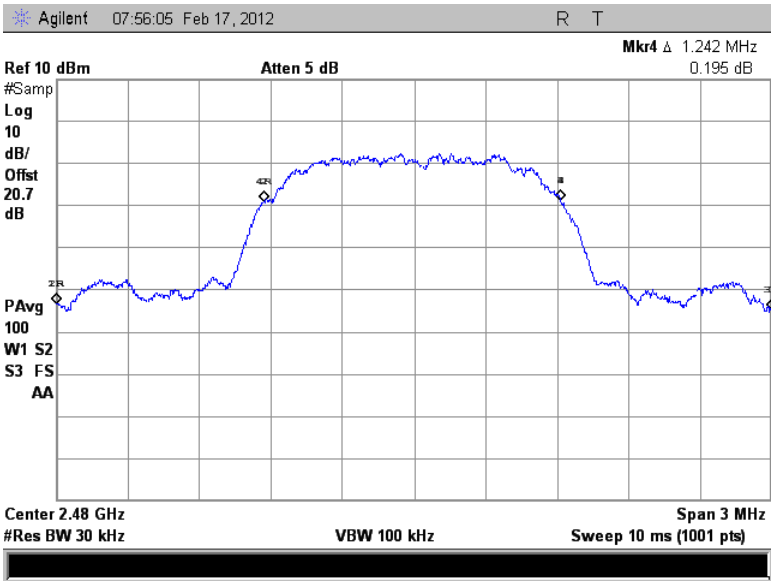


Figure 7.4.4.2-18: 99% OBW High Channel (8DPSK)

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC:RSS-210 A8.5

7.5.1 Band-Edge Compliance of RF Conducted Emissions

7.5.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, which is ≥ 1% of the span, and the VBW was set to 300 kHz.

7.5.1.2 Measurement Results

Results are shown in Figure 7.5.1.2-1 to Figure 7.5.1.2-12 below.

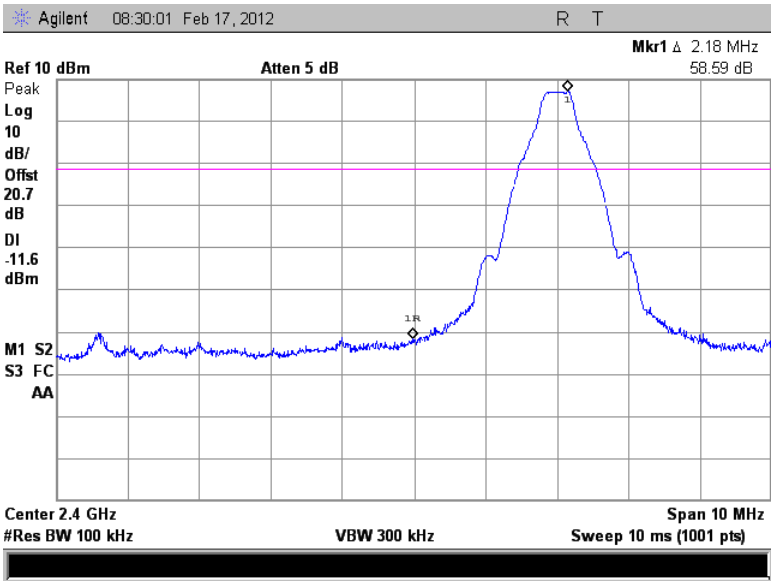


Figure 7.5.1.2-1: Lower Band-edge – Continuous Mode (GFSK)

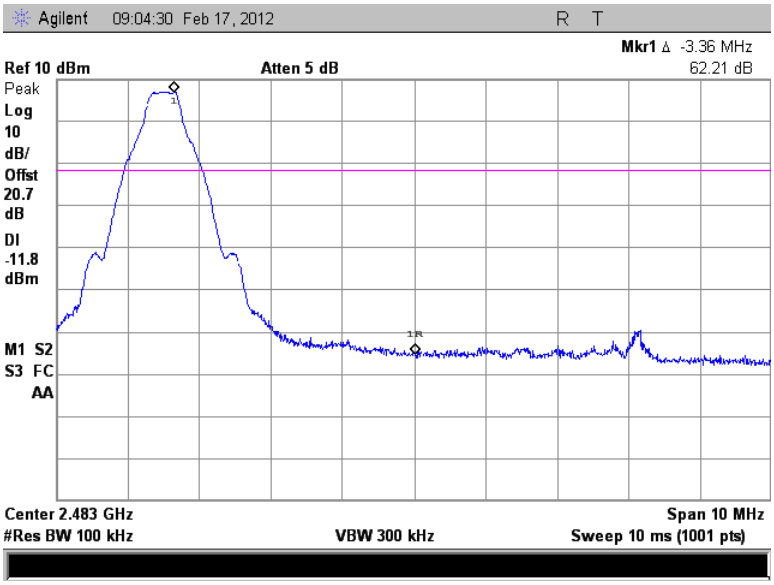


Figure 7.5.1.2-2: Upper Band-edge – Continuous Mode (GFSK)

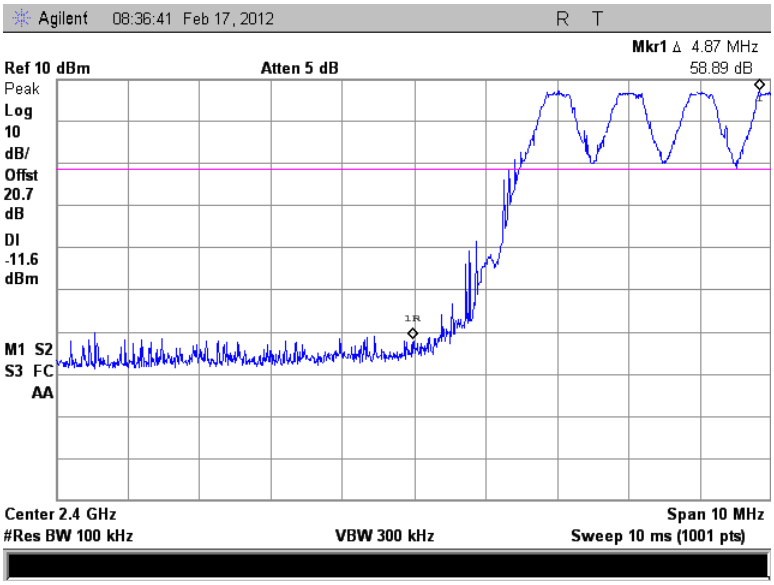


Figure 7.5.1.2-3: Lower Band-edge – Hopping Mode (GFSK)

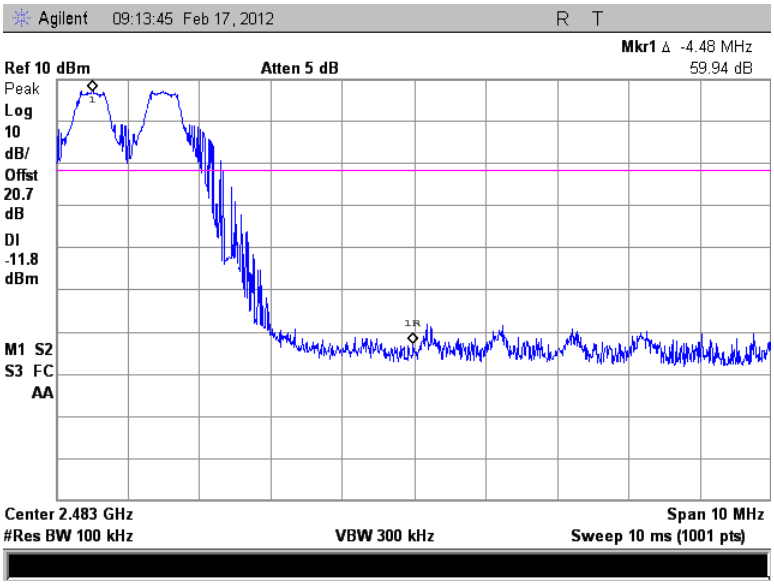


Figure 7.5.1.2-4: Upper Band-edge – Hopping Mode (GFSK)

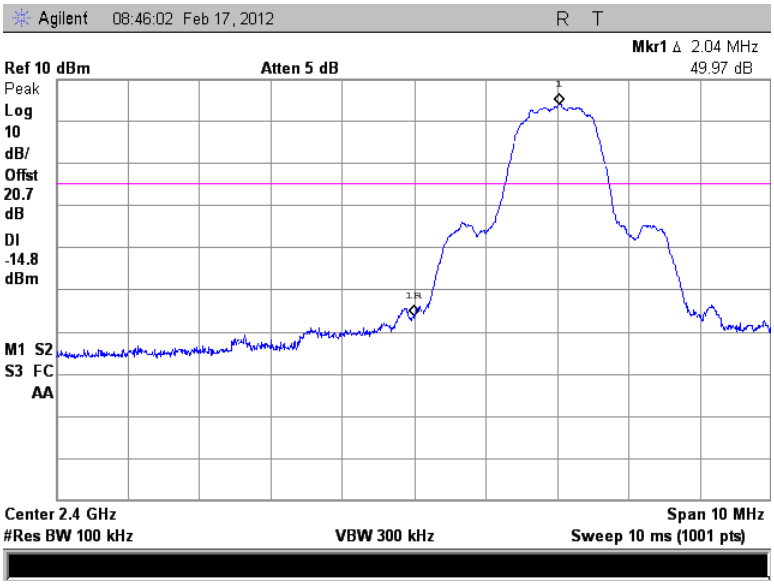


Figure 7.5.1.2-5: Lower Band-edge – Continuous Mode (π/4 DQPSK)

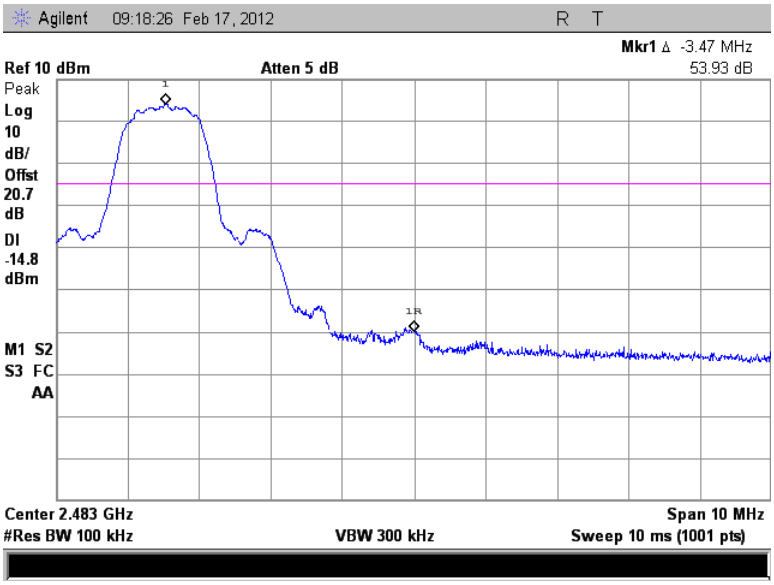


Figure 7.5.1.2-6: Upper Band-edge – Continuous Mode (π/4 DQPSK)

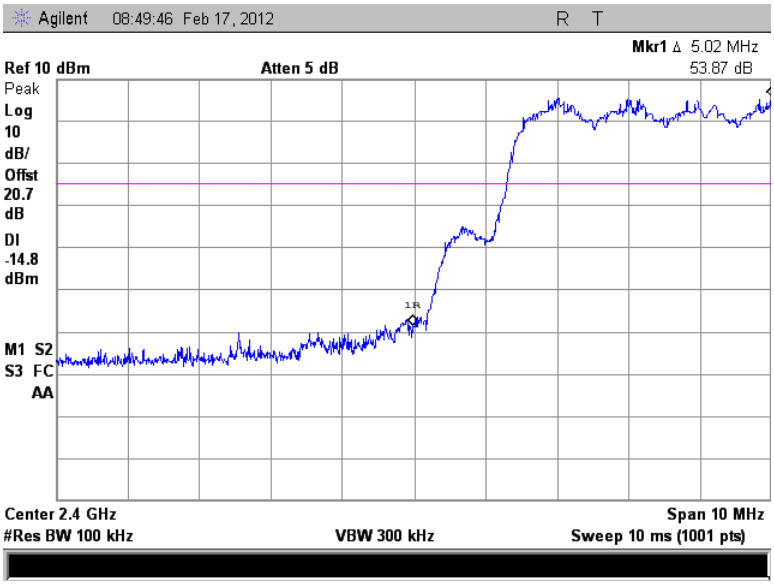


Figure 7.5.1.2-7: Lower Band-edge – Hopping Mode (π/4 DQPSK)

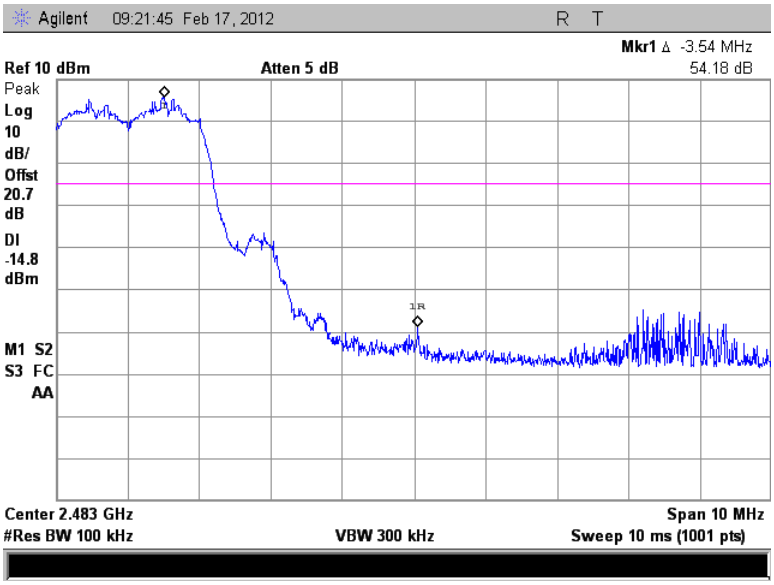


Figure 7.5.1.2-8: Upper Band-edge – Hopping Mode (π/4 DQPSK)

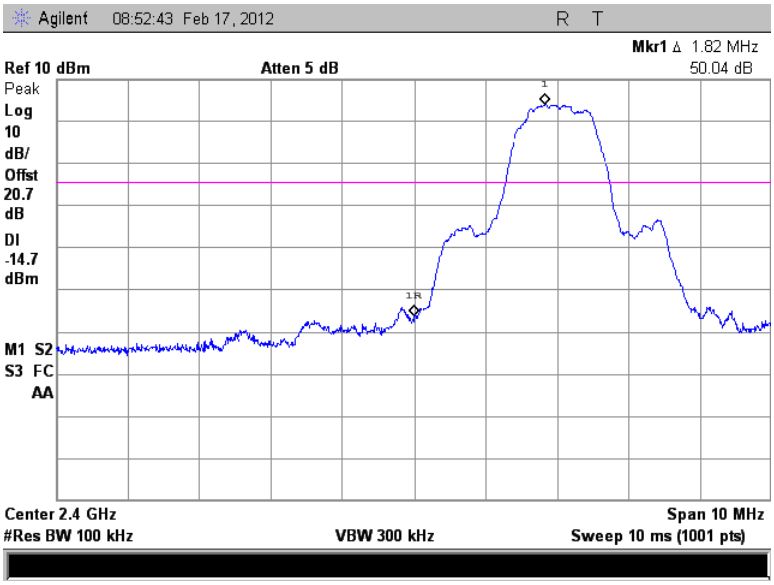


Figure 7.5.1.2-9: Lower Band-edge – Continuous Mode (8DPSK)

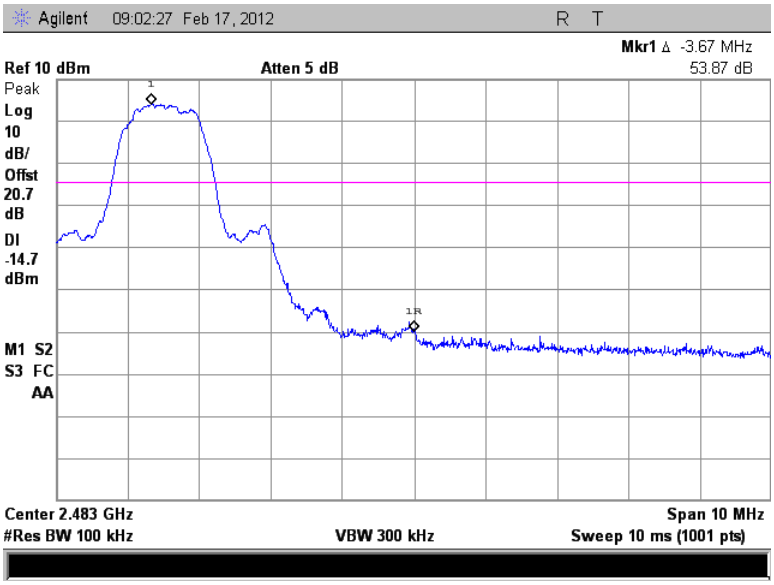


Figure 7.5.1.2-10: Upper Band-edge – Continuous Mode (8DPSK)

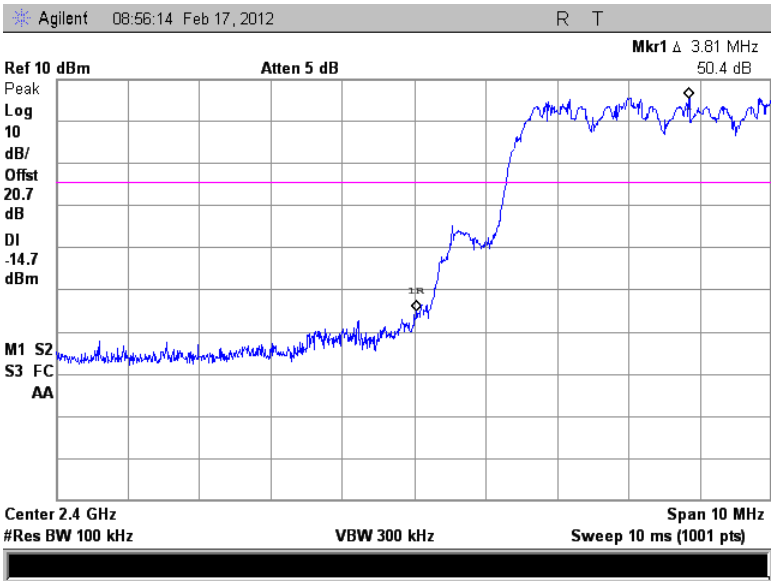


Figure 7.5.1.2-11: Lower Band-edge – Hopping Mode (8DPSK)

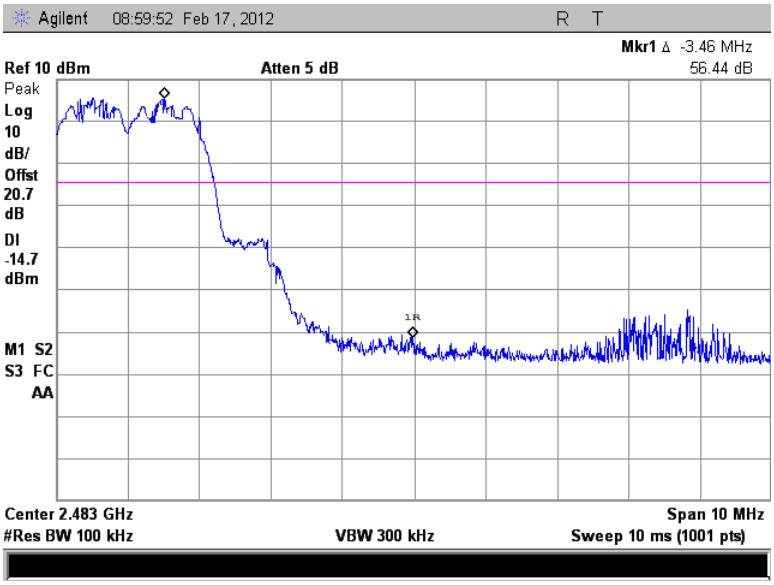


Figure 7.5.1.2-12: Upper Band-edge – Hopping Mode (8DPSK)

7.5.2 Band-Edge Compliance of Radiated Spurious Emissions

7.5.2.1 Measurement Procedure

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emission

7.5.2.2 Measurement Results

Band-edge compliance is displayed in Table 7.5.2.2-1 to Table 7.5.2.2-3 and Figure 7.5.2.2-1 to Figure 7.5.2.2-6.

Table 7.5.2.2-1: Upper Band-edge – GFSK

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Margin to Limits (dB)	
										74	54
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
2480	116.90	116.60	H	-9.92	106.98	106.68	59.28	47.70	47.40	26.30	6.60
2480	108.90	108.50	V	-9.92	98.98	98.58	54.51	44.47	44.07	29.53	9.93

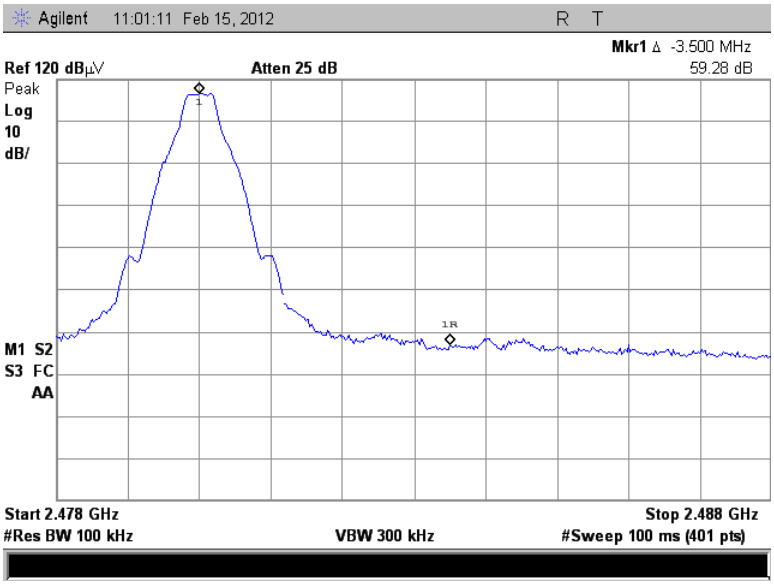


Figure 7.5.2.2-1: Upper Band-edge (GFSK - Horizontal)

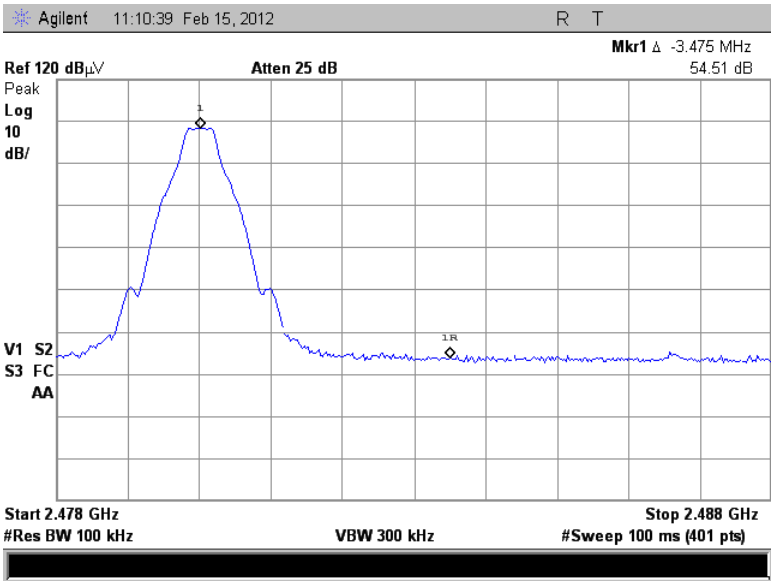


Figure 7.5.2.2-2: Upper Band-edge (GFSK - Vertical)

Table 7.5.2.2-2: Upper Band-edge – π/4 DQPSK

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Margin to Limits (dB)	
										74	54
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
2480	115.50	112.50	H	-9.92	105.58	102.58	53.41	52.17	49.17	21.83	4.83
2480	107.70	104.60	V	-9.92	97.78	94.68	50.32	47.46	44.36	26.54	9.64

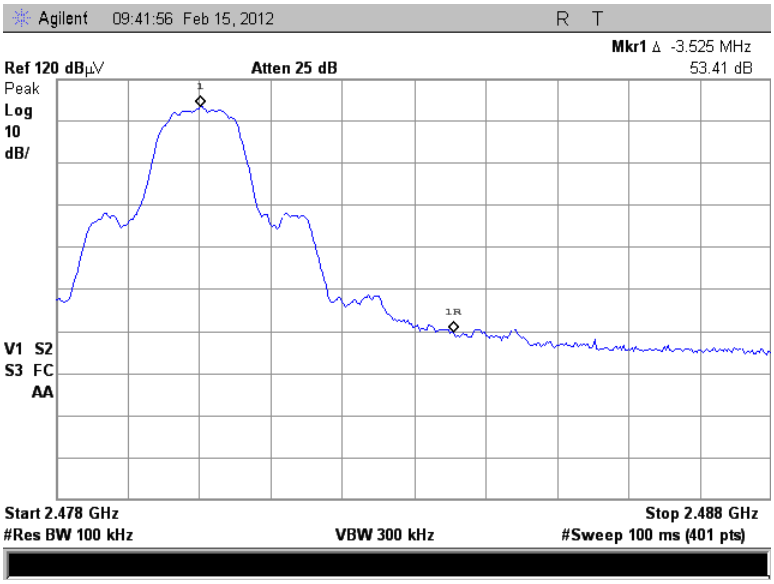


Figure 7.5.2.2-3: Upper Band-edge (π/4 DQPSK - Horizontal)

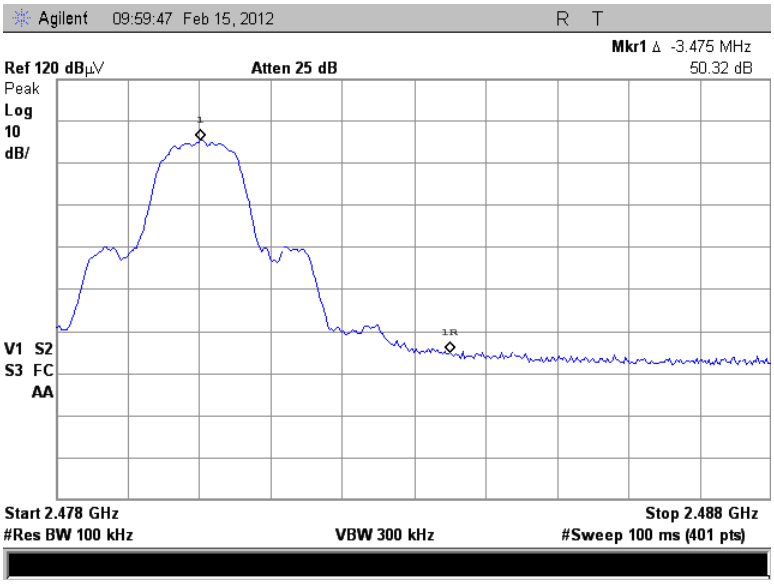


Figure 7.5.2.2-4: Upper Band-edge (π/4 DQPSK - Vertical)

Table 7.5.2.2-3: Upper Band-edge – 8DPSK

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Margin to Limits (dB)	
										74	54
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
2480	116.00	112.60	H	-9.92	106.08	102.68	51.32	54.76	51.36	19.24	2.64
2480	107.70	104.50	V	-9.92	97.78	94.58	49.43	48.35	45.15	25.65	8.85

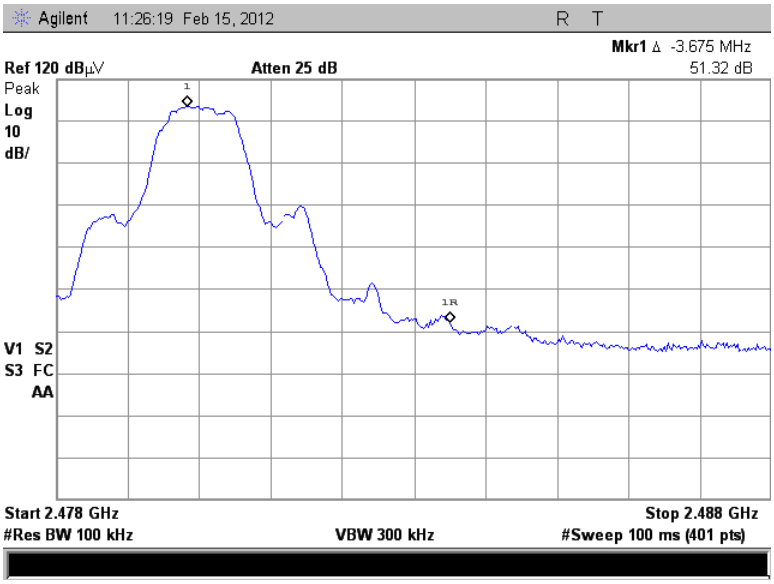


Figure 7.5.2.2-5: Upper Band-edge (8DPSK- Horizontal)

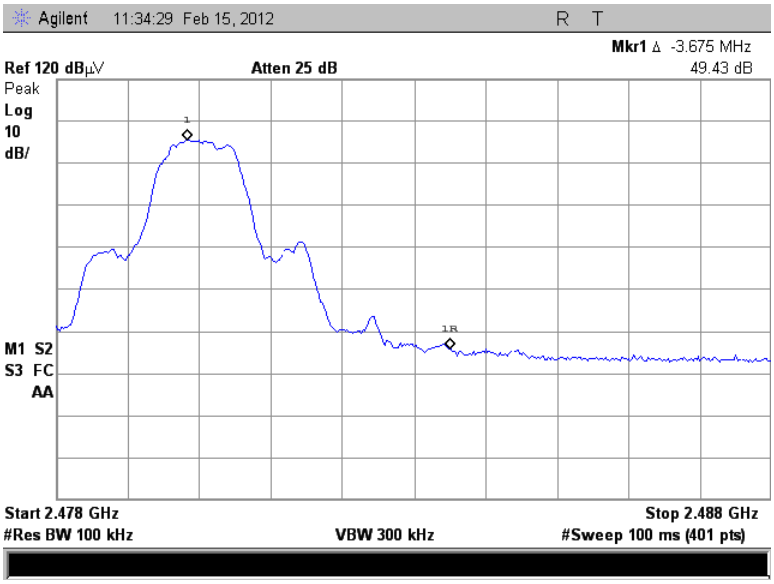


Figure 7.5.2.2-6: Upper Band-edge (8DPSK - Vertical)

7.5.3 RF Conducted Spurious Emissions

7.5.3.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer through 20 dB of external attenuation. The EUT was investigated for conducted spurious emissions from 30MHz to 26 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz. A peak detector function was used with the trace set to max hold.

7.5.3.2 Measurement Results

Results are shown below in Figure 7.5.3.2-1 to Figure 7.5.3.2-18:

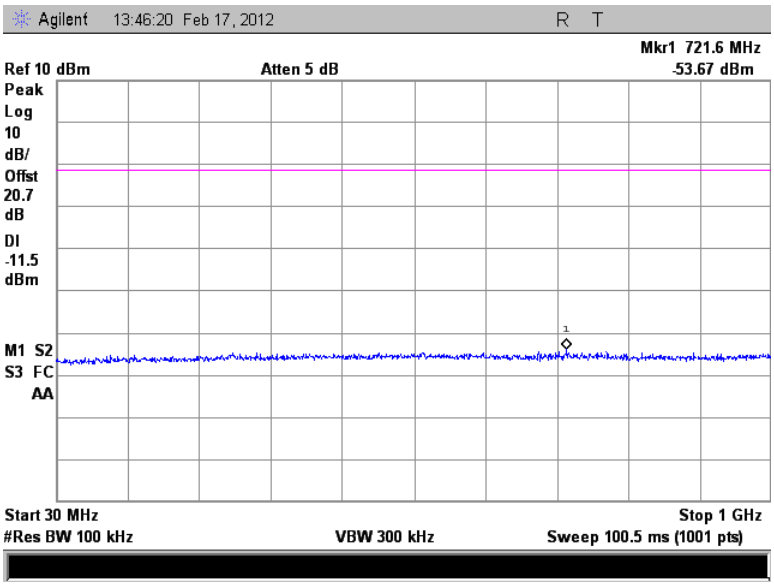


Figure 7.5.3.2-1: 30 MHz – 1 GHz – Low Channel (GFSK)

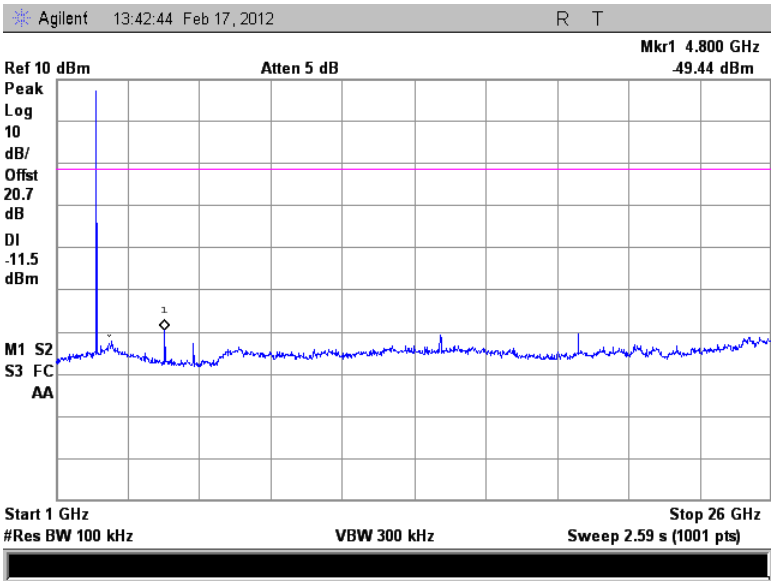


Figure 7.5.3.2-2: 1 GHz –26 GHz – Low Channel (GFSK)

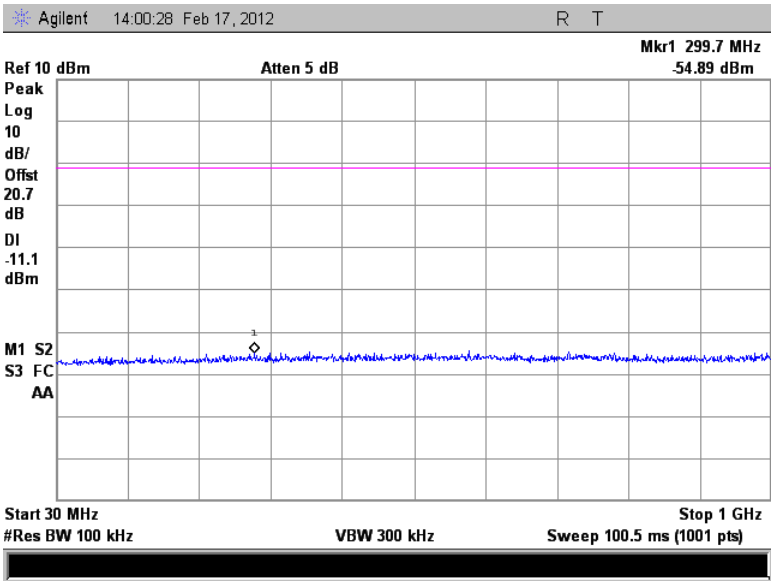


Figure 7.5.3.2-3: 30 MHz – 1 GHz – Middle Channel (GFSK)

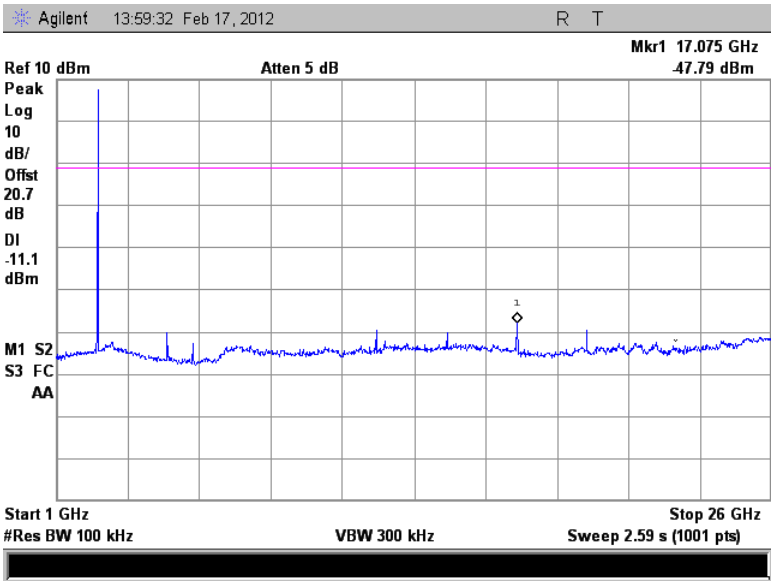


Figure 7.5.3.2-4: 1 GHz –26 GHz – Middle Channel (GFSK)

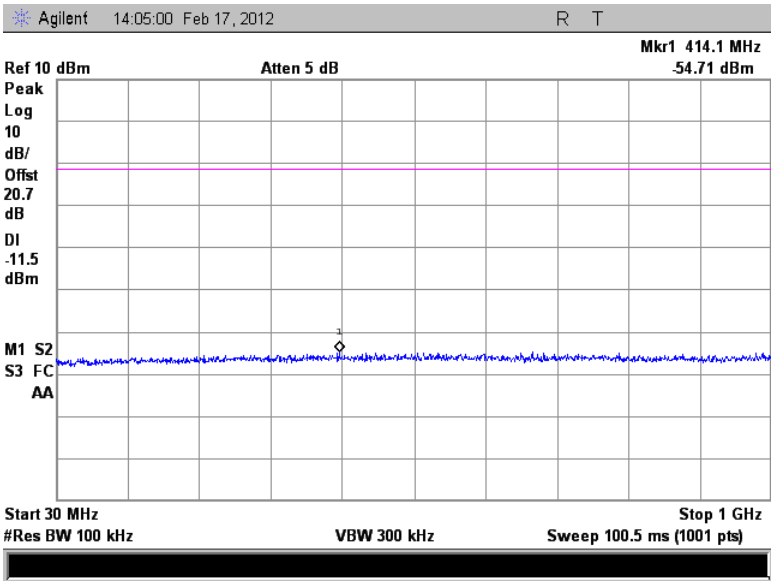


Figure 7.5.3.2-5: 30 MHz – 1 GHz – High Channel (GFSK)

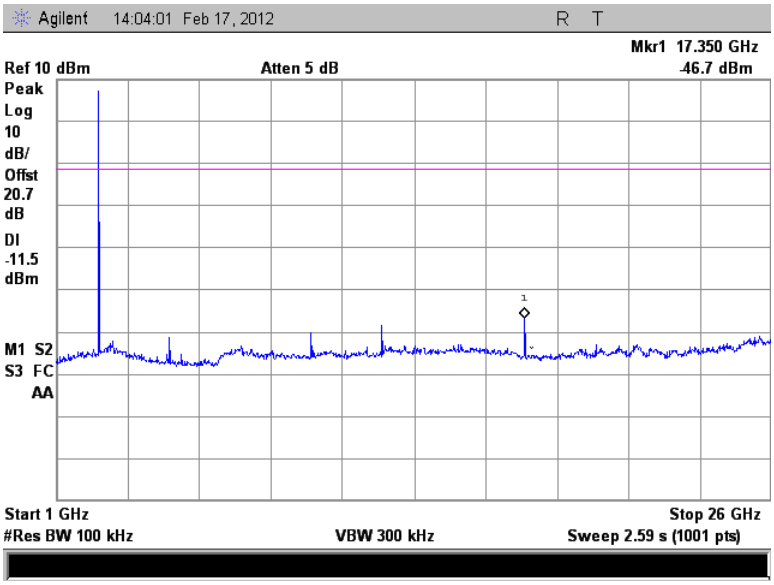


Figure 7.5.3.2-6: 1 GHz –26 GHz – High Channel (GFSK)

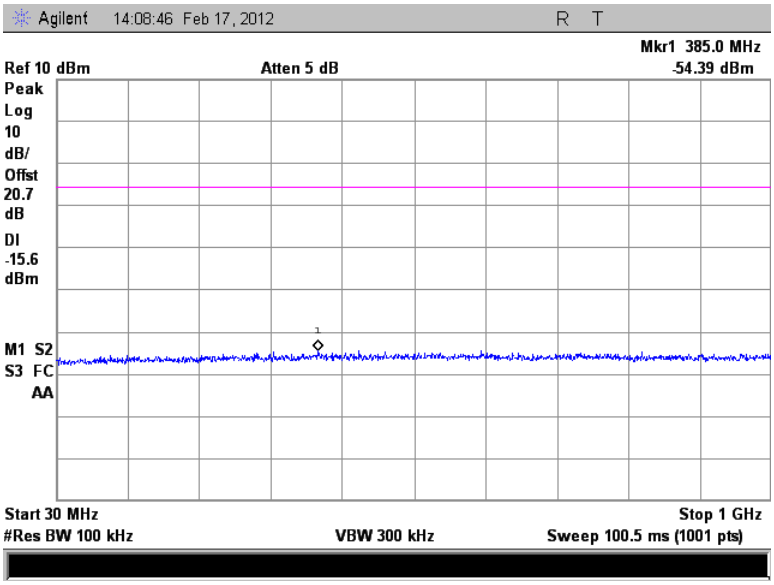


Figure 7.5.3.2-7: 30 MHz – 1 GHz – Low Channel (π/4 DQPSK)

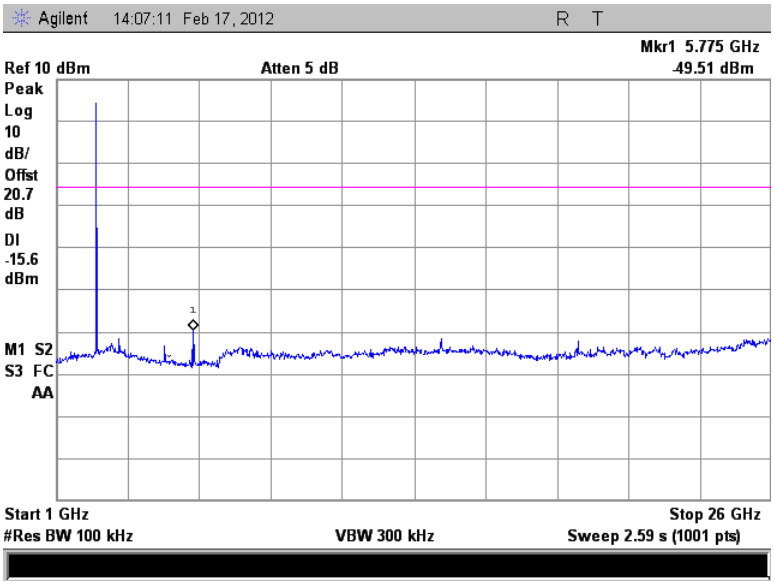


Figure 7.5.3.2-8: 1 GHz –26 GHz – Low Channel (π/4 DQPSK)

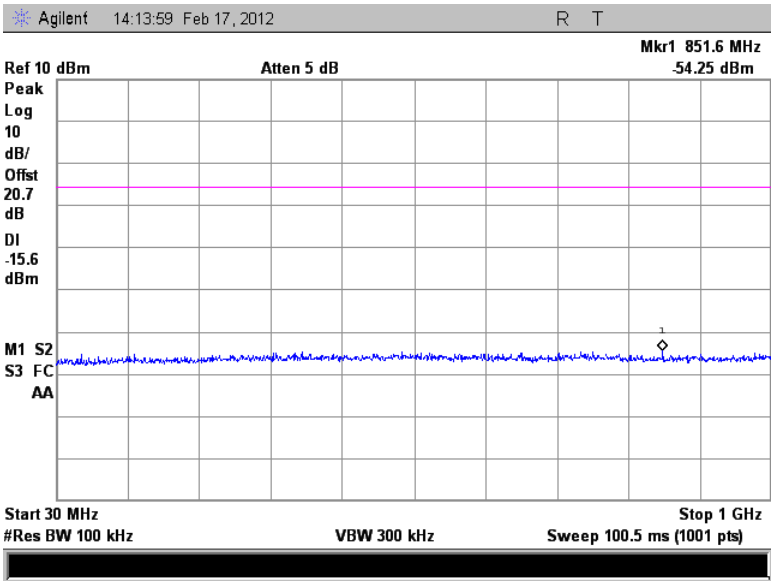


Figure 7.5.3.2-9: 30 MHz – 1 GHz – Middle Channel (π/4 DQPSK)

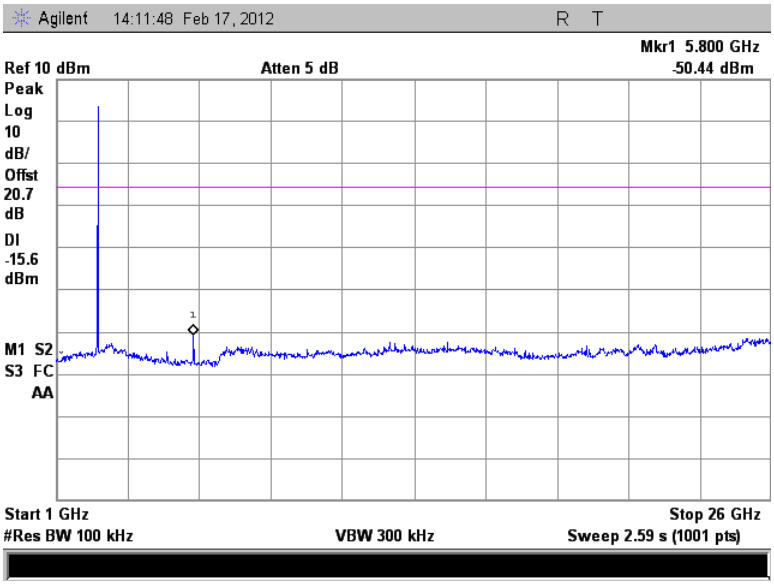


Figure 7.5.3.2-10: 1 GHz –26 GHz – Middle Channel (π/4 DQPSK)

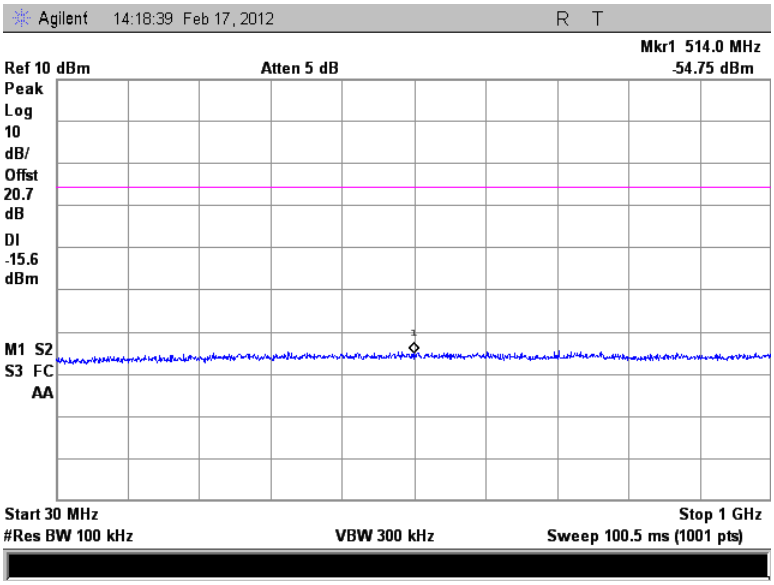


Figure 7.5.3.2-11: 30 MHz – 1 GHz – High Channel (π/4 DQPSK)

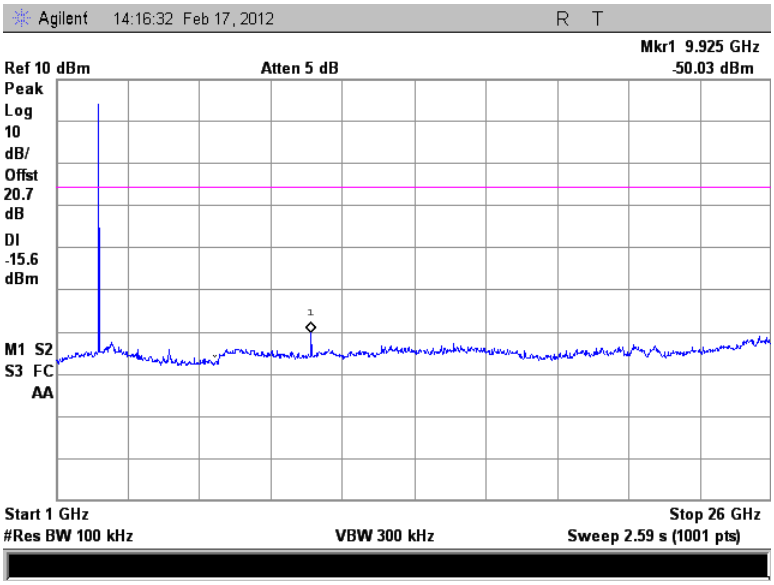


Figure 7.5.3.2-12: 1 GHz –26 GHz – High Channel (π/4 DQPSK)

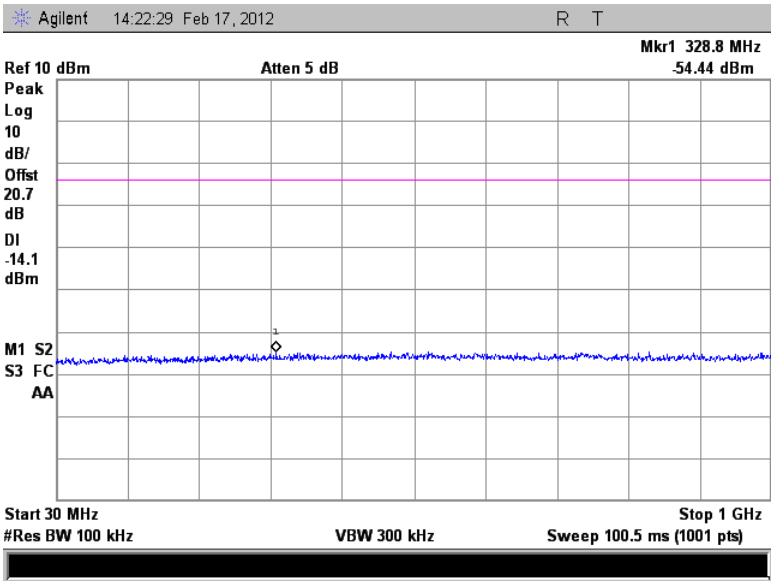


Figure 7.5.3.2-13: 30 MHz – 1 GHz – Low Channel (8DPSK)

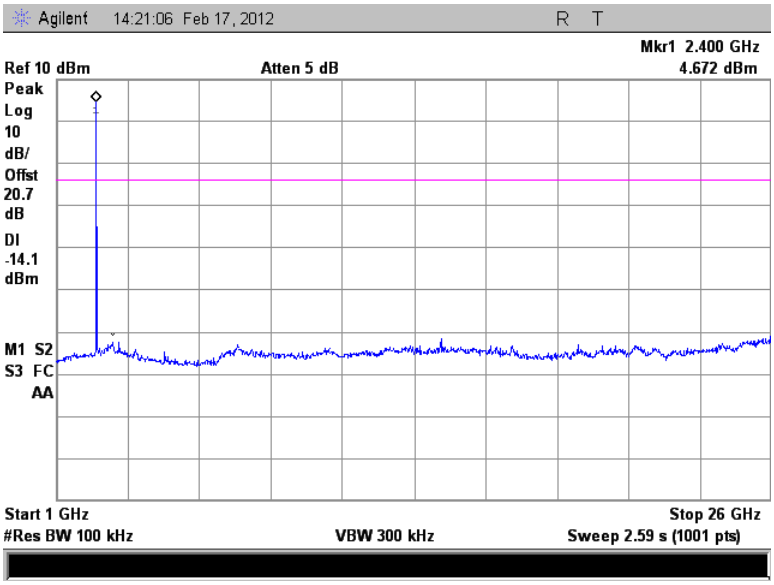


Figure 7.5.3.2-14: 1 GHz –26 GHz – Low Channel (8DPSK)

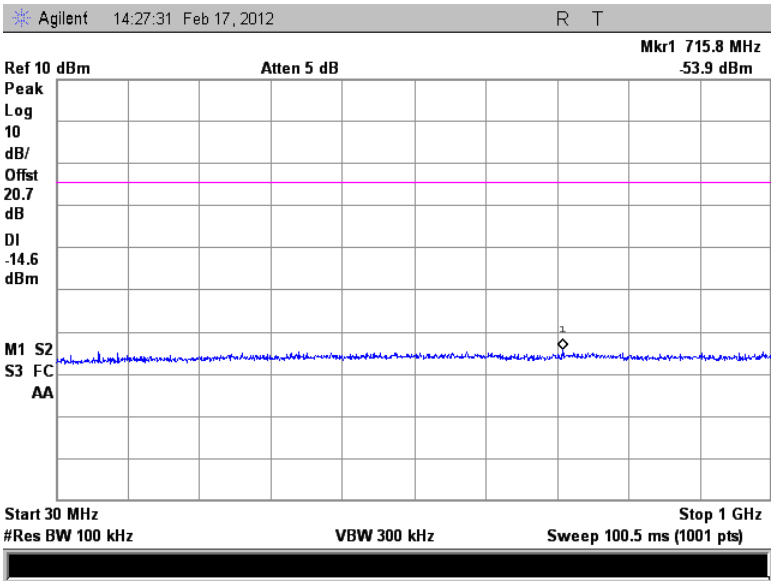


Figure 7.5.3.2-15: 30 MHz – 1 GHz – Middle Channel (8DPSK)

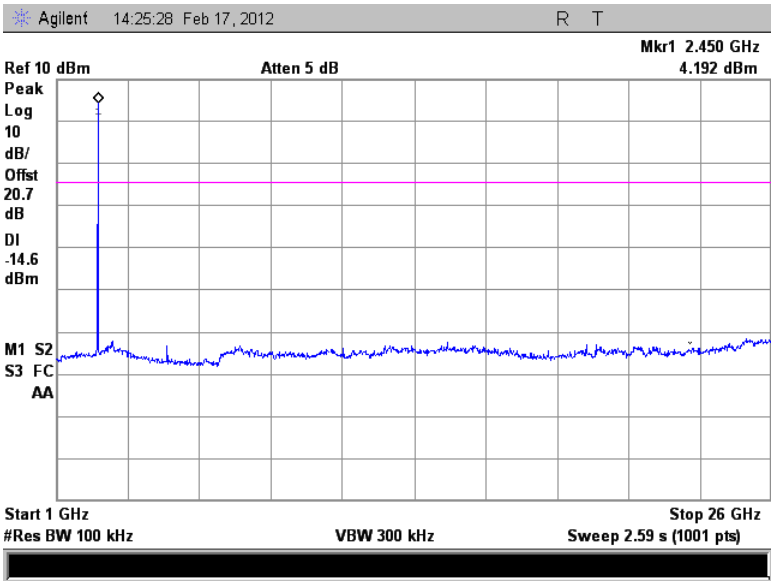


Figure 7.5.3.2-16: 1 GHz –26 GHz – Middle Channel (8DPSK)

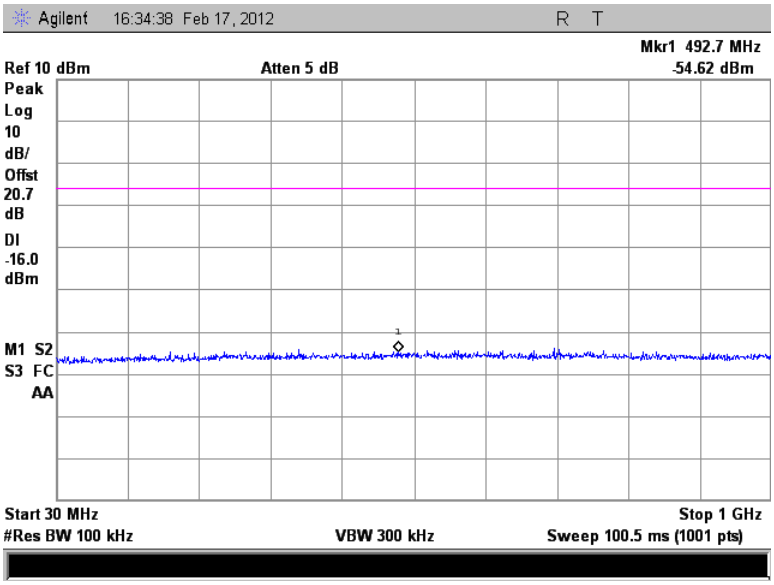


Figure 7.5.3.2-17: 30 MHz – 1 GHz – High Channel (8DPSK)

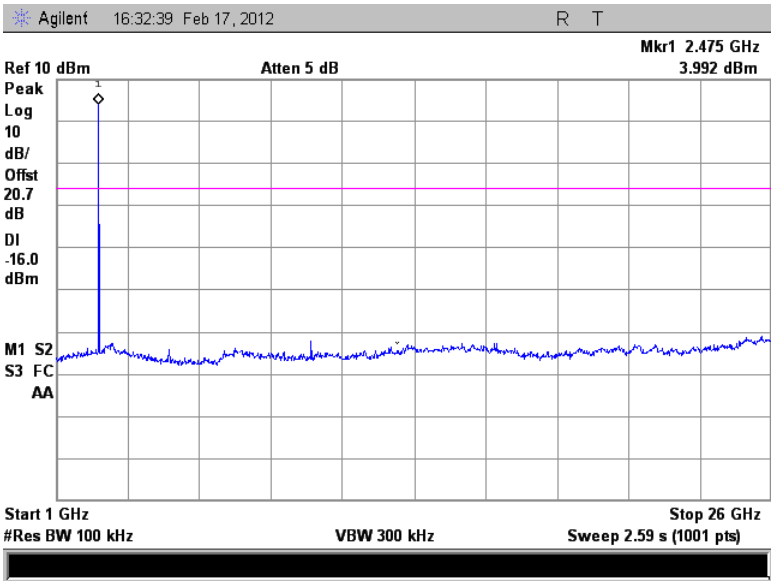


Figure 7.5.3.2-18: 1 GHz –26 GHz – High Channel (8DPSK)

7.5.4 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-Gen 7.2.5

7.5.4.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 26GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.5.4.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 26 GHz are reported in the Tables 7.5.4.2-1 to 7.5.4.2-3 below.

Table 7.5.4.2-1: Radiated Spurious Emissions Tabulated Data - GFSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2402 MHz										
4804	51.95	44.61	H	-2.85	49.10	41.76	74.0	54.0	24.90	12.20
4804	58.40	52.63	V	-2.85	55.55	49.78	74.0	54.0	18.40	4.20
Middle Channel 2441 MHz										
4882	49.59	40.59	H	-2.64	46.95	37.95	74.0	54.0	27.00	16.00
4882	53.67	45.89	V	-2.64	51.03	43.25	74.0	54.0	23.00	10.70
High Channel 2480 MHz										
4960	52.11	43.56	H	-2.43	49.68	41.13	74.0	54.0	24.30	12.90
4960	56.76	49.94	V	-2.43	54.33	47.51	74.0	54.0	19.70	6.50
12400	48.90	38.46	H	9.78	58.68	48.24	83.5	63.5	24.80	15.30
19840	48.30	37.13	H	7.73	56.03	44.86	83.5	63.5	27.50	18.60
19840	47.63	35.35	V	7.73	55.36	43.08	83.5	63.5	28.10	20.40

* Notes:
All emissions above 19840 MHz were attenuated below the permissible limit.
For the emissions above 10 GHz, the limits are corrected for 1m measurements using the distance factor 20*log(3) dB.

Table 7.5.4.2-2: Radiated Spurious Emissions Tabulated Data – (π/4) DQPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2402 MHz										
4804	52.61	41.26	V	-2.85	49.76	38.41	74.0	54.0	24.20	15.60
Middle Channel 2441 MHz										
4882	50.29	38.45	V	-2.64	47.65	35.81	74.0	54.0	26.30	18.20
High Channel 2480 MHz										
4960	51.77	42.01	V	-2.43	49.34	39.58	74.0	54.0	24.70	14.40

* Notes:
All emissions above 4960 MHz were attenuated below the permissible limit.

Table 7.5.4.2-3: Radiated Spurious Emissions Tabulated Data – 8DPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2402 MHz										
4804	52.13	42.25	V	-2.85	49.28	39.40	74.0	54.0	24.70	14.60
Middle Channel 2441 MHz										
4882	49.96	38.54	V	-2.64	47.32	35.90	74.0	54.0	26.70	18.10
High Channel 2480 MHz										
4960	48.88	35.87	H	-2.43	46.45	33.44	74.0	54.0	27.50	20.60
4960	51.05	41.94	V	-2.43	48.62	39.51	74.0	54.0	25.40	14.50

* Notes:
All emissions above 4960 MHz were attenuated below the permissible limit.

7.5.4.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 58.4+ (-2.85) = 55.55dBuV/m
Margin: 74 dBuV/m – 55.55dBuV/m = 18.4dB

Example Calculation: Average
Corrected Level: 52.63 + (-2.85) - 0= 49.78dBuV/m
Margin: 54 dBuV/m – 49.78dBuV/m = 4.2dB

8 CONCLUSION

In the opinion of ACS, Inc. the H51SDH9PW7AN, manufactured by Motorola Solutions, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT