Certification Test Report

FCC ID: AZ489FT4918
IC: 109U-89FT4918

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

ACS Report Number: 13-2135.W06.1B

Manufacturer: Motorola Solutions SDNBHD
Model: AAH81TCN9NA2AN

Test Begin Date: **August 25, 2011**
Test End Date: **October 12, 2013**

Report Issue Date: November 6, 2013

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.

Project Manager:

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Director, Wireless Certifications
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This report contains 57 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 Malaysia Sdn Bhd
Plot 2, Bayan Lepas,
Technoplex Industrial Park,
Mukim 12, SWD (CSC)
11900 Bayan Lepas, Penang Malaysia

1.3 Product Description

The Motorola Solutions MotoTRBO SL7550 (Malta UHF2), model AAH81TCN9NA2AN is a 2W two way portable radio capable of digital transmission. The device operates in the UHF2 band ranging from 450 MHz to 512 MHz. The device also includes a Bluetooth 2.0+ EDR transceiver.

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: AAH81TCN9NA2AN (Radiated and power line conducted emissions)
AAH81QCN9NAZAN (RF Conducted)

Test Sample Serial Number(s): 682TPT0180 (Radiated and power line conducted emissions)
DFLTMN03VD (RF Conducted)

Test Sample Condition: The samples were in good conditions with no observable physical damages.

1.4 Test Methodology and Considerations

The EUT was tested for RF conducted emissions at the antenna port as well as for radiated and power line conducted emissions for the Bluetooth radio for all available modulations.

The RF conducted data included in this report was collected on model AAH81QCN9NAZAN (FCC ID: ABZ99FT4090 / IC: 109AB-99FT4090). The Bluetooth transceiver in model AAH81QCN9NAZAN (FCC ID: ABZ99FT4090 / IC: 109AB-99FT4090) is identical to the hardware and software of the model identified in this report. Preliminary measurements were made to confirm the data provided in this report is representative of the model presented for testing. The RF conducted test data was originally provided in test report 11-2072.W06.1B. Where applicable, data is provided for the modulation corresponding to the worst case.

The radiated emissions evaluations were conducted up to the 10th harmonic for all available modulations. Preliminary measurements were collected for the EUT set in three orthogonal orientations. The measurements reported herein correspond to the orientation leading to the highest emissions relative to the limits. The EUT was also evaluated for inter-modulation products for the co-located Bluetooth and UHF2 radios transmitting at the same time. All inter-modulation products were found compliant to the limits of FCC Section 15.209 and Industry Canada RSS-GEN.

Power line conducted emissions measurements were performed for the Bluetooth in the hopping mode for all available modulations. The results are provided for the worst case configuration.

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 EUT 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 #: 475089
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:

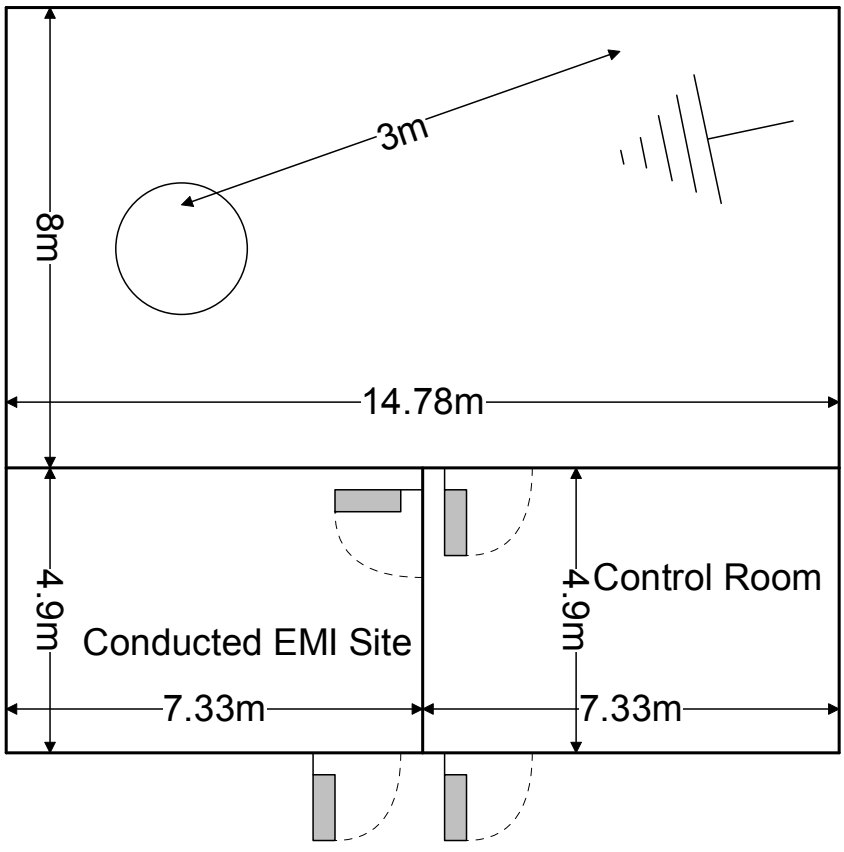


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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:

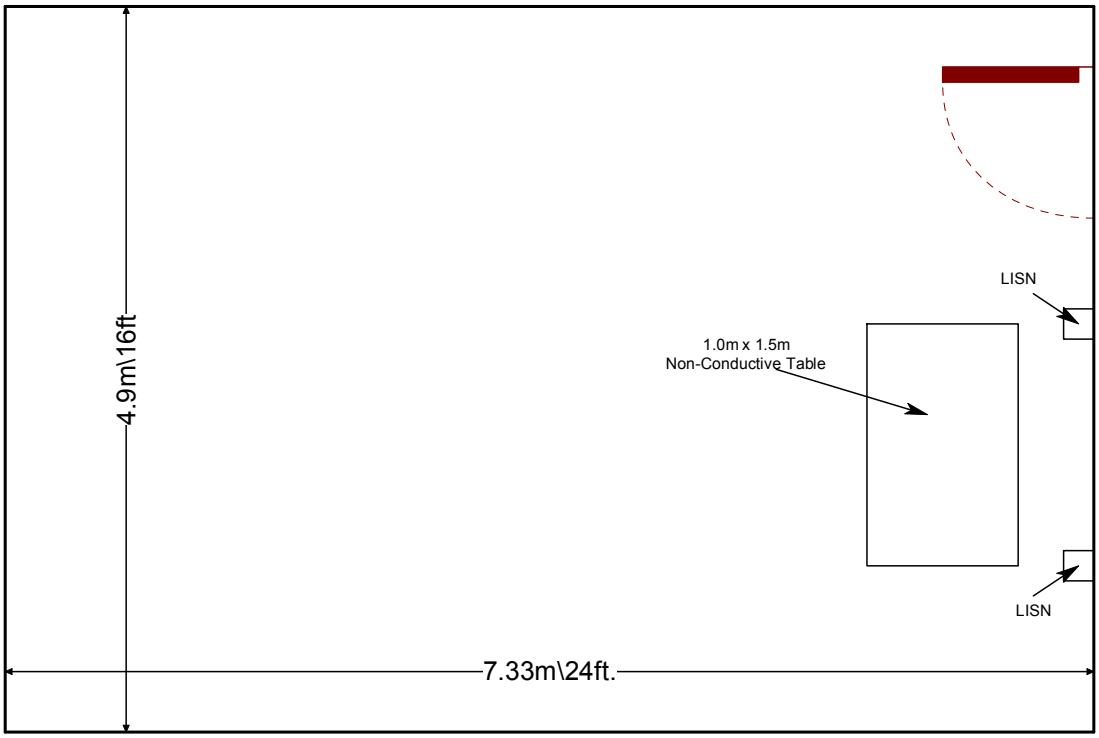


Figure 2.3.2-1: AC Mains Conducted EMI Site

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
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2013
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2013
- 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: Radiated and Power Line Conducted Emissions

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
524	Chase	CBL6111	Antennas	1138	1/7/2013	1/7/2015
2006	EMCO	3115	Antennas	2573	4/24/2013	4/24/2015
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2012	12/31/2013
2022	EMCO	LISN3825/2R	LISN	1095	9/9/2013	9/9/2015
2044	QMI	N/A	Cables	2044	12/31/2012	12/31/2013
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	12/31/2012	12/31/2013
2064	CIR Q-TEL	FHT/22-10K-13/50-3A/3A	Filter	9	12/31/2012	12/31/2013
2070	Mini Circuits	VHF-8400+	Filter	2070	12/31/2012	12/31/2013
2072	Mini Circuits	VHF-3100+	Filter	30737	12/31/2012	12/31/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	12/29/2012	12/29/2013
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/29/2012	12/29/2013
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/20/2012	12/20/2013
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
RE361	Agilent	AT/E7405A	Analyzers	MY42000089	5/28/2013	5/28/2014

Notes: NCR=No Calibration Required
The testing was performed from October 4, 2013 through October 12, 2013 on the Model AAH81TCN9NA2AN (FCC ID: AZ489FT4918 / IC: 109U-89FT4918) per Section 1.4

Table 4-2: Test Equipment: RF Conducted Measurements

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/5/2011	1/5/2013
2082	Teledyne Storm Products	90-010-048	Cables	2082	6/6/2011	6/6/2012

Note: The testing was performed from August 25, 2011 through August 31, 2011 on the model AAH81QCN9NAZAN (FCC ID: ABZ99FT4090 / IC: 109AB-99FT4090) per Section 1.4

5 SUPPORT EQUIPMENT

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

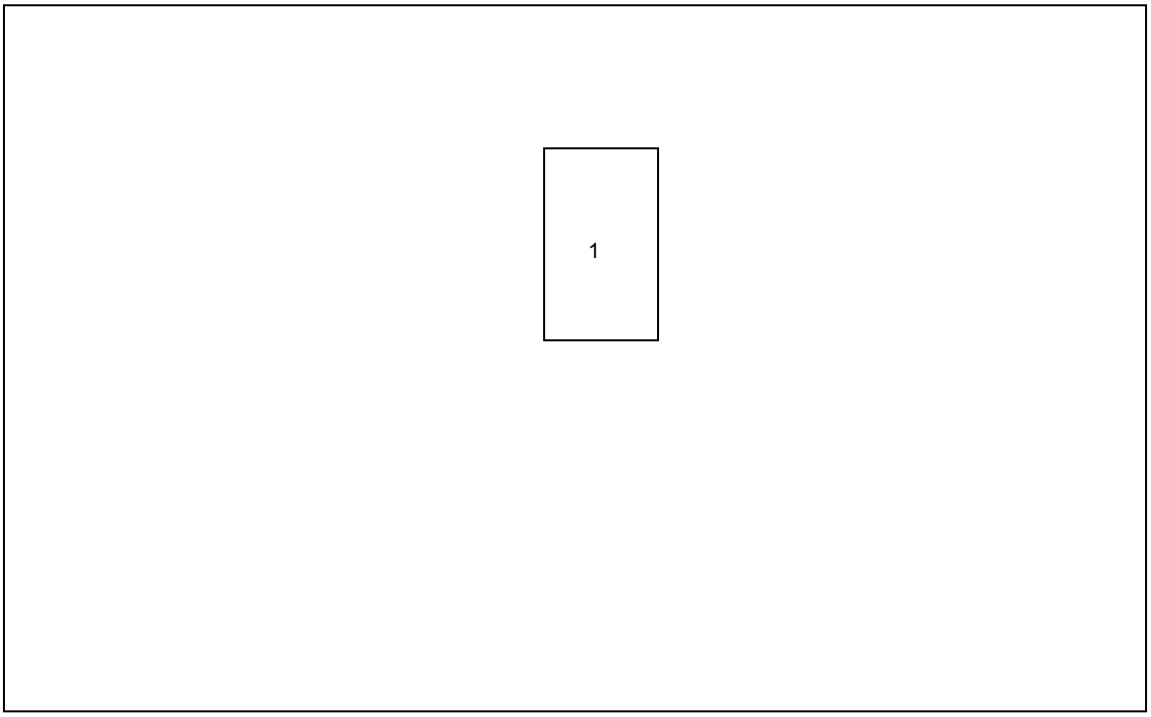
Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	AAH81TCN9NA2AN	682TPT0180
			AAH81QCN9NAZAN	DFLTMN03VD

Table 5-2: EUT and Support Equipment (With charger)

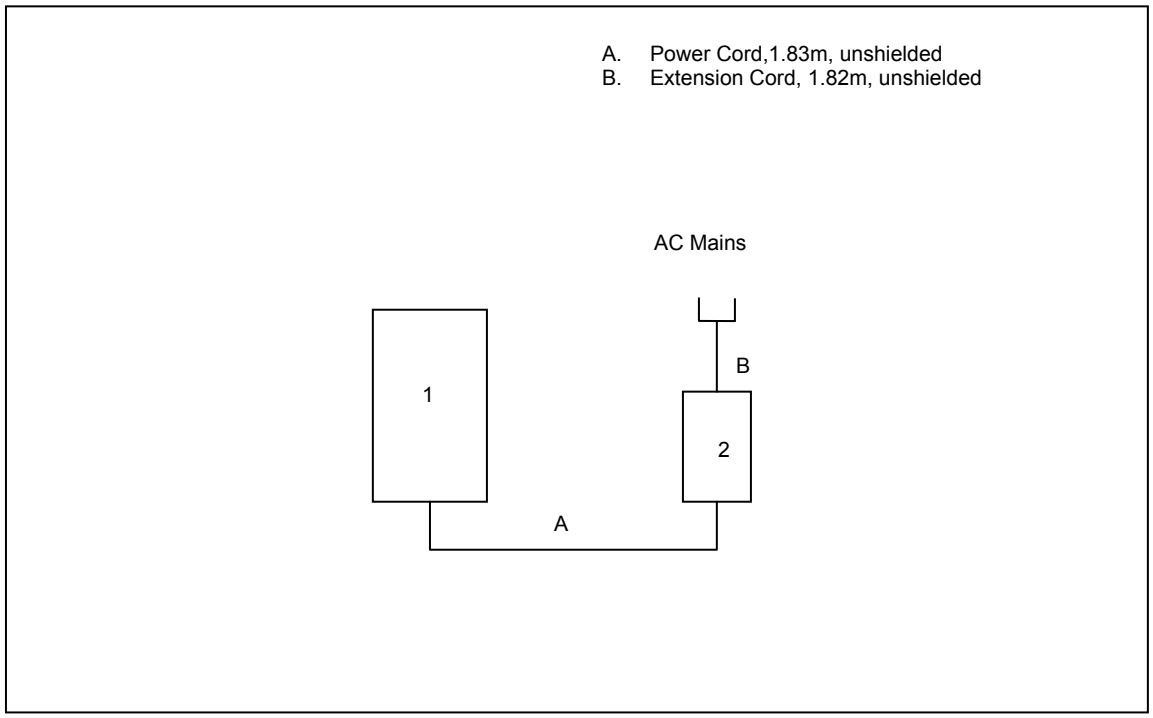
Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	AAH81TCN9NA2AN	682TPT0180
2	5 VDC Power Supply	Motorola Solutions	DCH4-050MV-0301	17MAY12-C6-0821306-4006T

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

Configuration 1 – Radiated Emissions and RF Conducted Measurements (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 EUT uses an internal antenna for the Bluetooth radio. The antenna is not detachable, thus meeting the requirements of FCC 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.

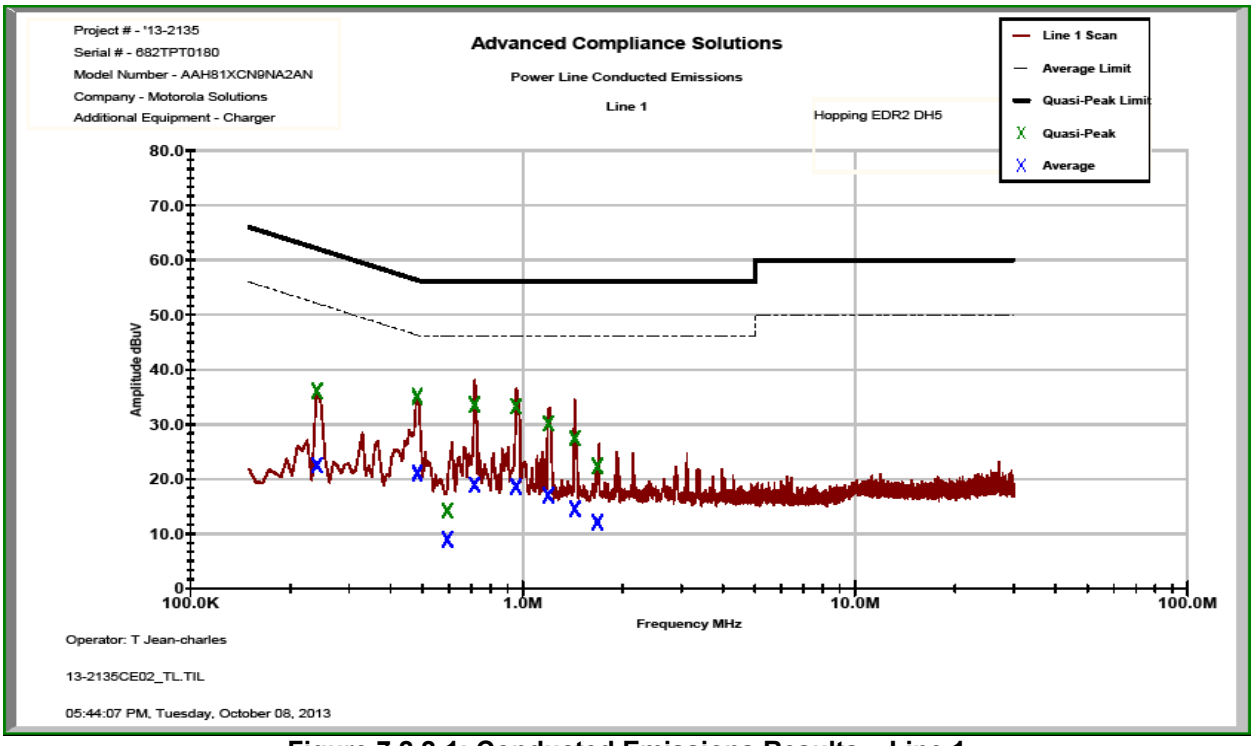


Figure 7.2.2-1: Conducted Emissions Results – Line 1

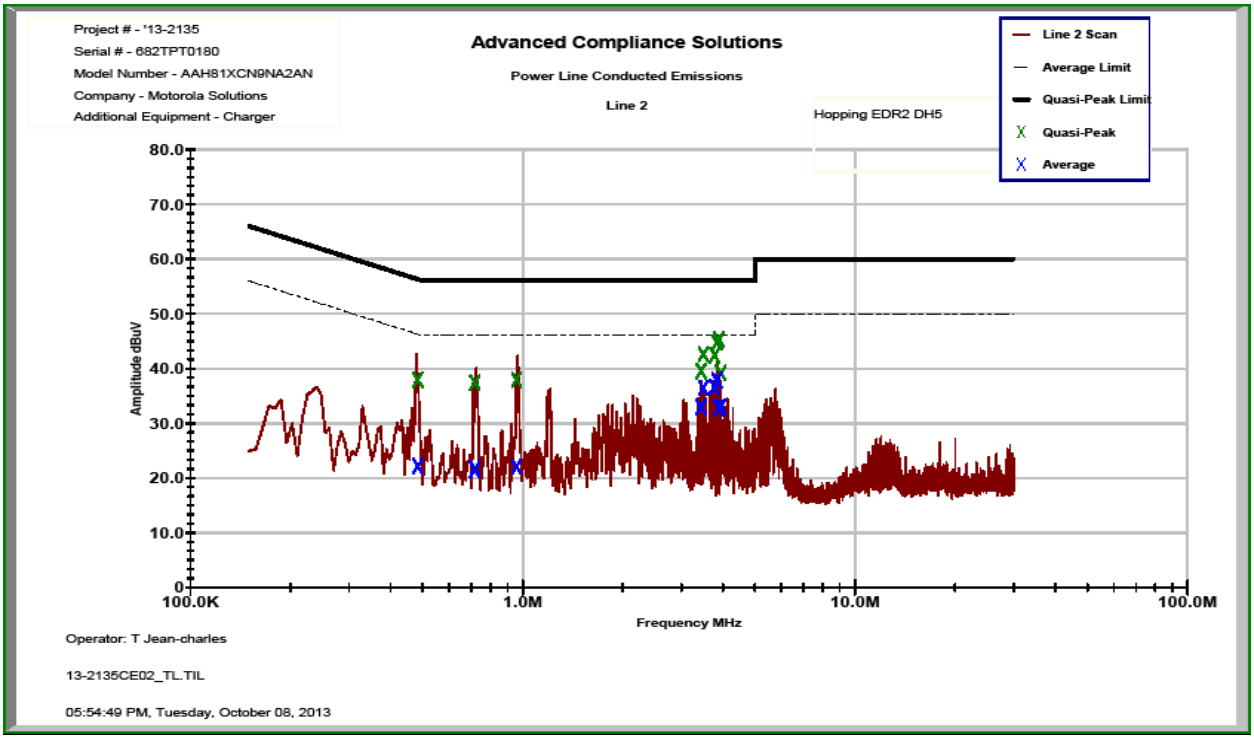


Figure 7.2.2-2: Conducted Emissions Results – Line 2

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: 13-2135CE02
Power Supply Description: 5 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									
0.24005	35.783	22.183	0.33	36.11	22.51	62.09	52.09	26.0	29.6
0.480962	34.785	20.891	0.25	35.04	21.14	56.32	46.32	21.3	25.2
0.4811	34.918	20.692	0.25	35.17	20.94	56.32	46.32	21.2	25.4
0.592674	13.984	8.705	0.24	14.23	8.95	56.00	46.00	41.8	37.1
0.71555	33.329	18.683	0.25	33.58	18.93	56.00	46.00	22.4	27.1
0.9535	33.061	18.365	0.24	33.30	18.60	56.00	46.00	22.7	27.4
1.19291	29.9	16.767	0.23	30.13	17.00	56.00	46.00	25.9	29.0
1.43385	27.173	14.29	0.23	27.40	14.52	56.00	46.00	28.6	31.5
1.67474	22.041	11.794	0.23	22.27	12.02	56.00	46.00	33.7	34.0
Line 2									
0.48295	37.658	21.865	0.28	37.94	22.14	56.29	46.29	18.4	24.1
0.717488	37.086	21.19	0.27	37.36	21.46	56.00	46.00	18.6	24.5
0.717962	37.151	21.438	0.27	37.42	21.71	56.00	46.00	18.6	24.3
0.956312	37.714	21.804	0.26	37.98	22.07	56.00	46.00	18.0	23.9
3.44011	39.154	32.591	0.37	39.53	32.96	56.00	46.00	16.5	13.0
3.49465	42.219	36.052	0.37	42.59	36.42	56.00	46.00	13.4	9.6
3.77374	42.049	36.181	0.37	42.42	36.55	56.00	46.00	13.6	9.4
3.83552	44.349	37.455	0.37	44.72	37.83	56.00	46.00	11.3	8.2
3.88976	44.881	32.349	0.37	45.25	32.72	56.00	46.00	10.7	13.3
3.94466	38.755	32.666	0.37	39.13	33.04	56.00	46.00	16.9	13.0

* 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.

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)	Reading (dBm)	Insertion Loss (dB)	Power (dBm)
2402.00	4.216	0.555	4.771
2441.00	3.760	0.555	4.315
2480.00	2.984	0.555	3.539

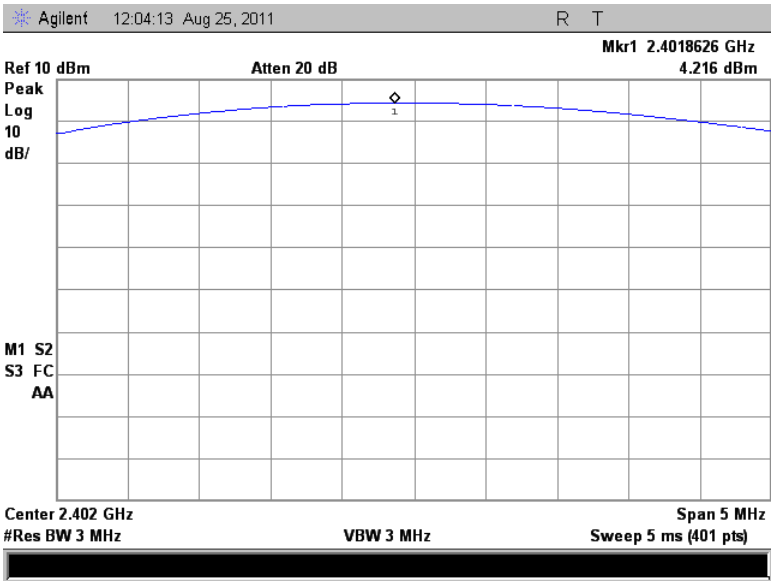


Figure 7.3.2-1: RF Output Power (GFSK) - Low Channel

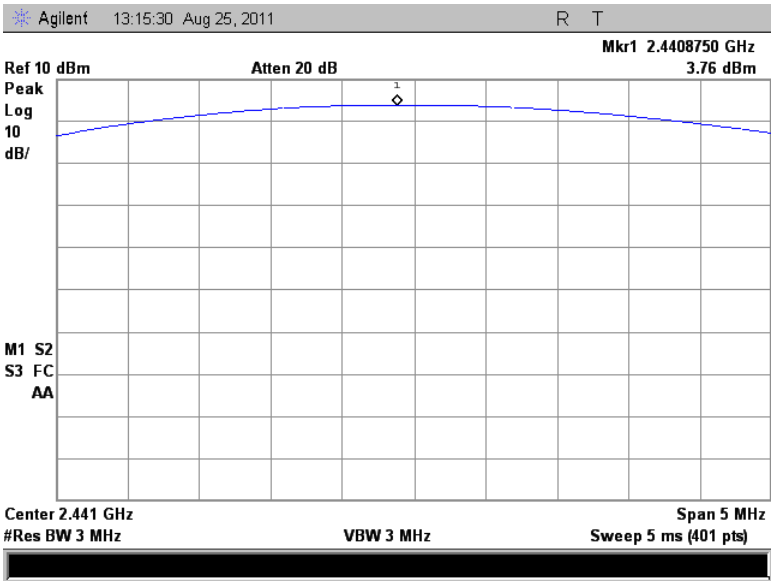


Figure 7.3.2-2: RF Output Power (GFSK) - Middle Channel

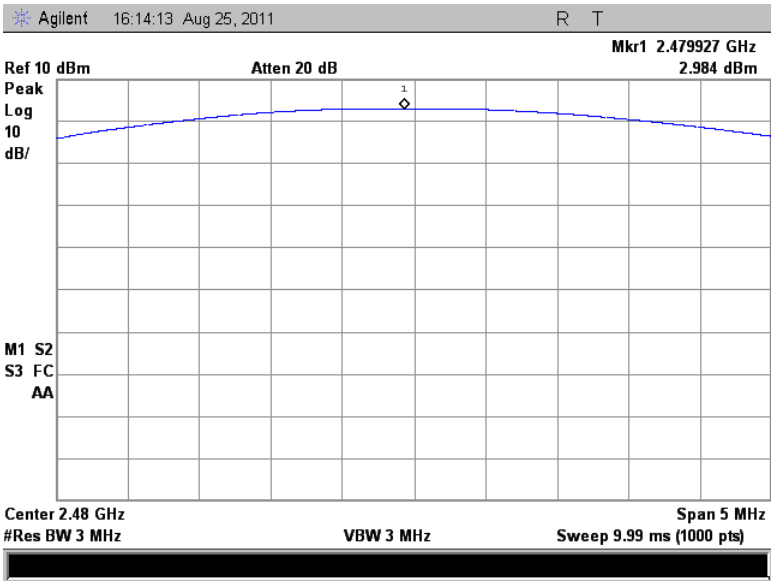


Figure 7.3.2-3: RF Output Power (GFSK) - High Channel

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

Frequency (MHz)	Reading (dBm)	Insertion Loss (dB)	Power (dBm)
2402.00	6.166	0.555	6.721
2441.00	5.995	0.555	6.55
2480.00	5.294	0.555	5.849

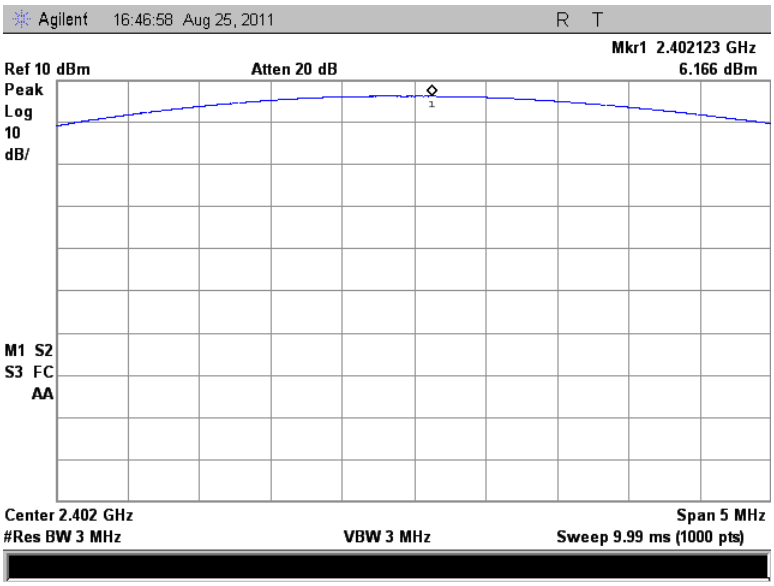


Figure 7.3.2-4: RF Output Power (π/4 DQPSK) - Low Channel

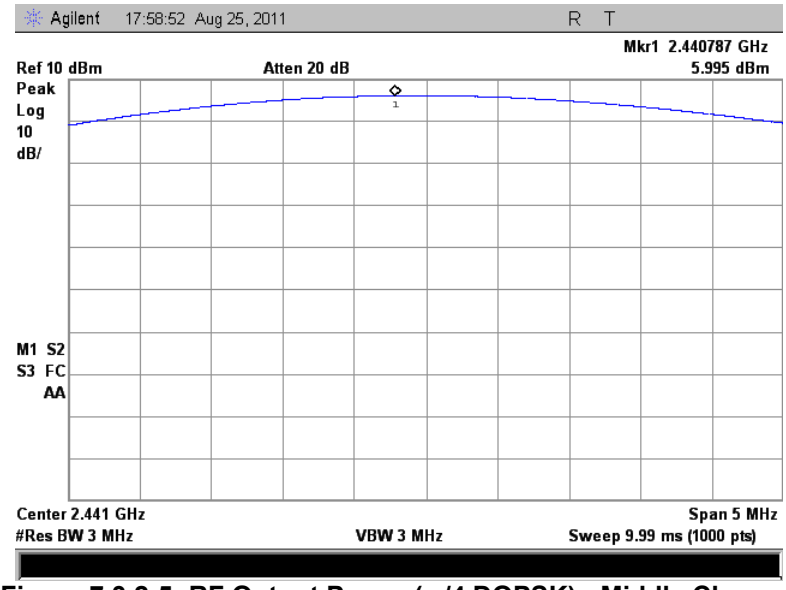


Figure 7.3.2-5: RF Output Power (π/4 DQPSK) - Middle Channel

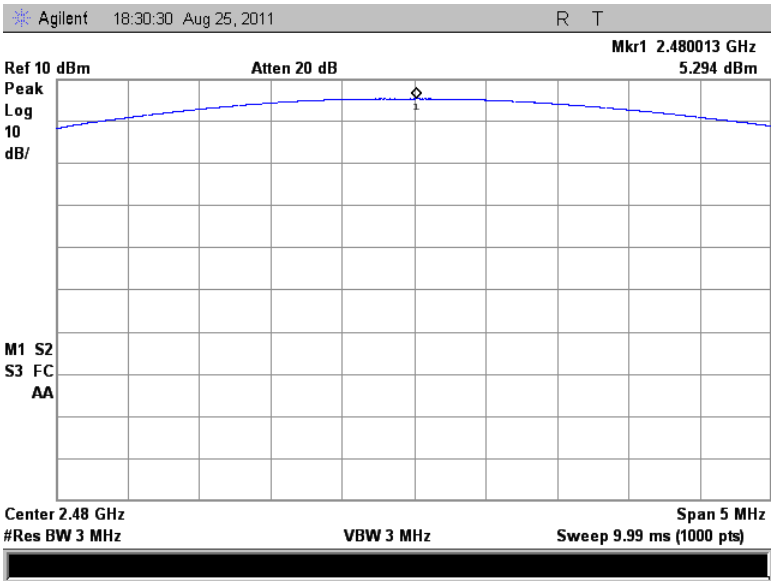


Figure 7.3.2-6: RF Output Power (π/4 DQPSK) - High Channel

Table 7.3.2-3 RF Output Power (8DPSK)

Frequency (MHz)	Reading (dBm)	Insertion Loss (dB)	Power (dBm)
2402.00	6.828	0.555	7.383
2441.00	6.688	0.555	7.243
2480.00	5.948	0.555	6.503

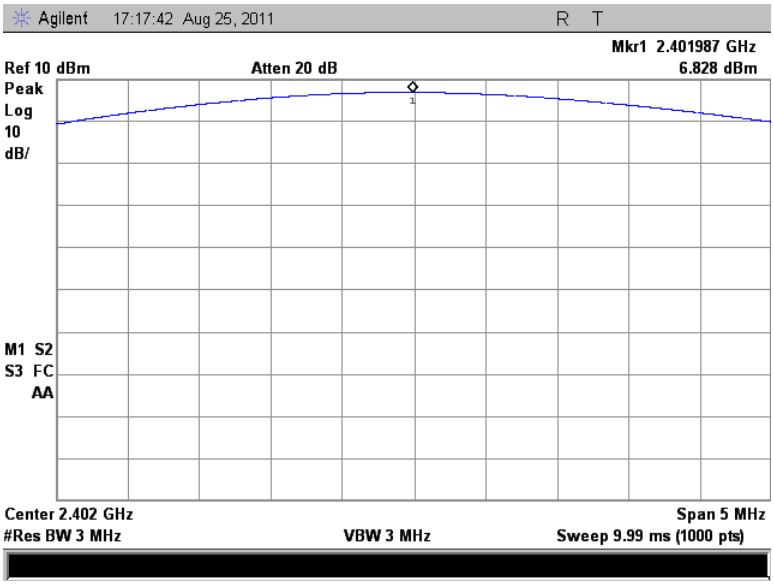


Figure 7.3.2-7: RF Output Power (8DPSK) - Low Channel

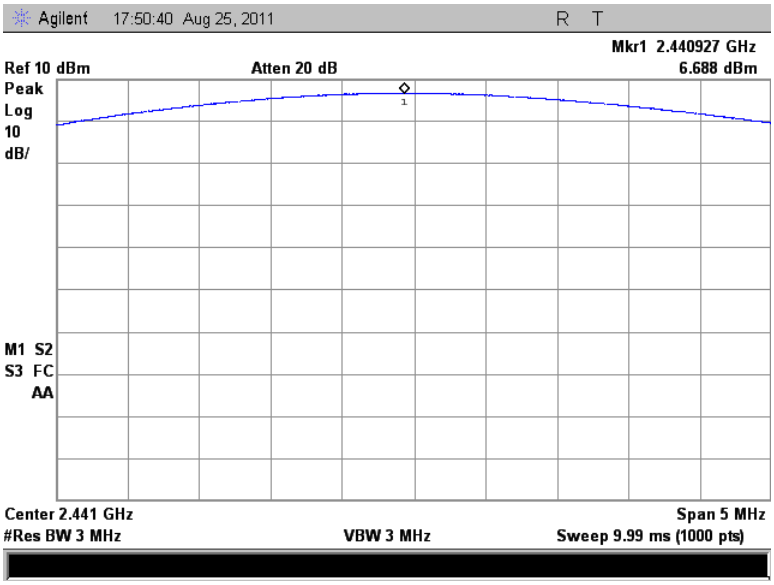


Figure 7.3.2-8: RF Output Power (8DPSK) - Middle Channel

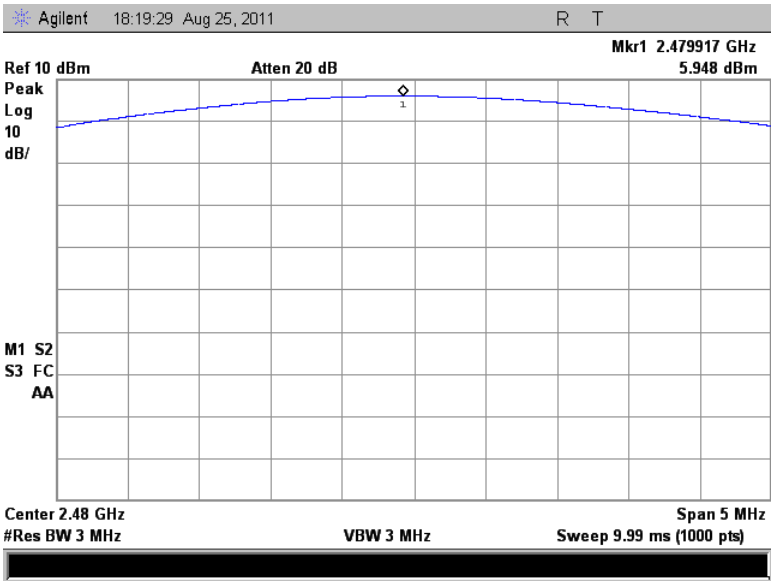


Figure 7.3.2-9: RF Output Power (8DPSK) - High Channel

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.

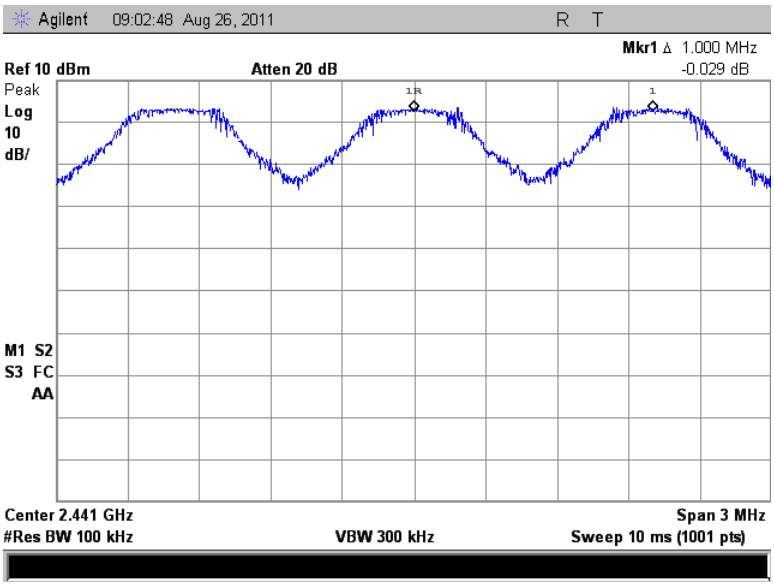


Figure 7.4.1.2-1: Carrier Frequency Separation

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 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.

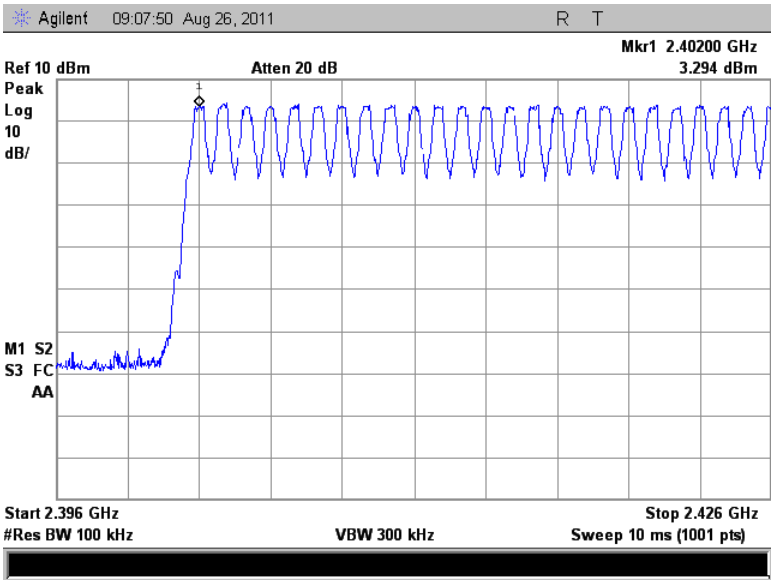


Figure 7.4.2.2-1: Number of Hopping Channels (1 – 25)

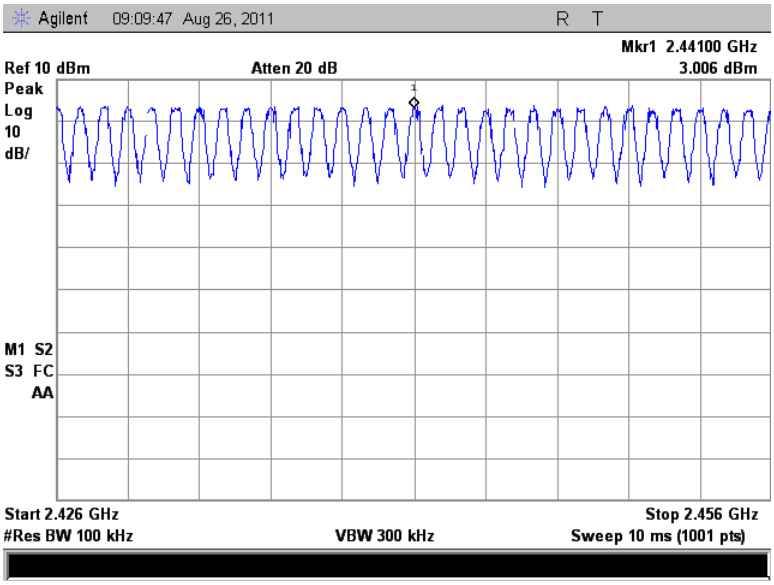


Figure 7.4.2.2-2: Number of Hopping Channels (25 – 55)

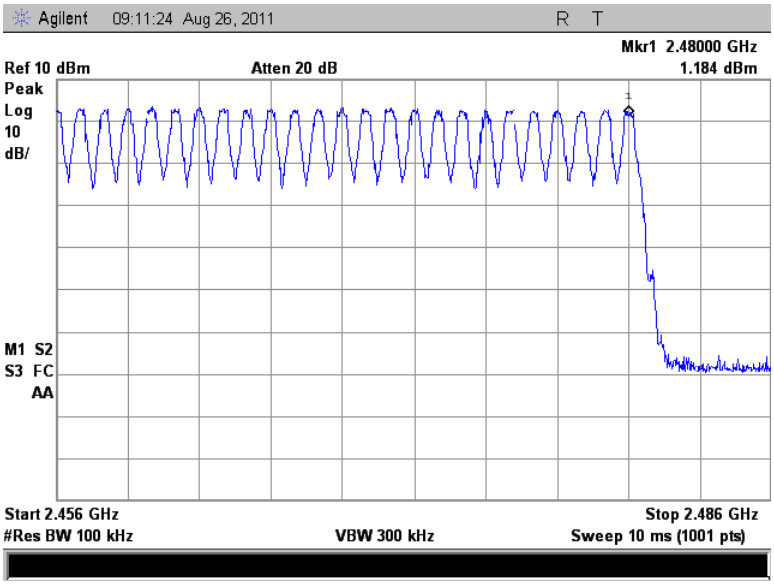


Figure 7.4.2.2-3: Number of Hopping Channels (55 – 79)

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	800.00	10.13	320.00	0.42	134.40	400.00	PASS
DH3	400.00	5.06	160.00	1.69	270.40	400.00	PASS
DH5	266.67	3.38	106.67	2.98	317.88	400.00	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

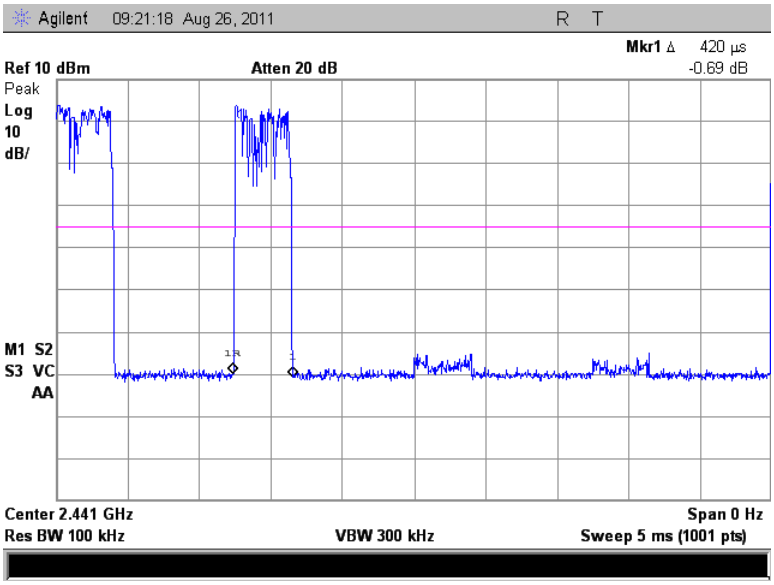


Figure 7.4.3.2-1: Channel Dwell Time – DH1

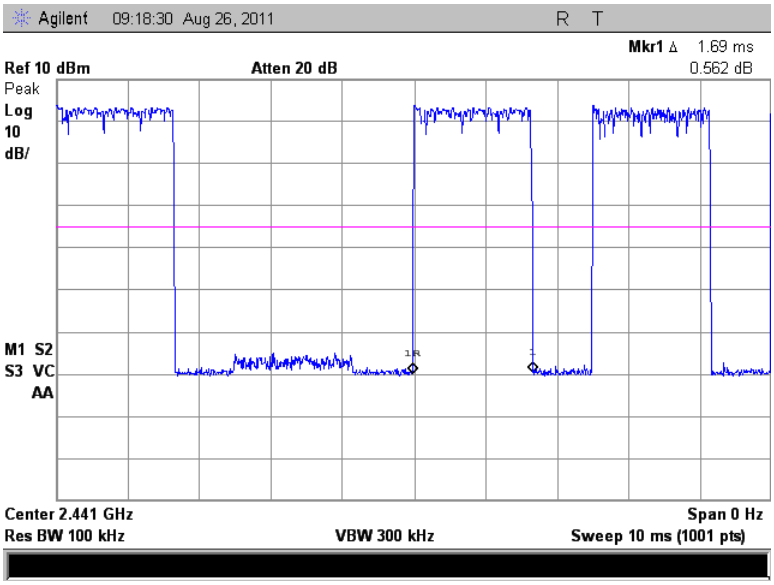


Figure 7.4.3.2-2: Channel Dwell Time – DH3

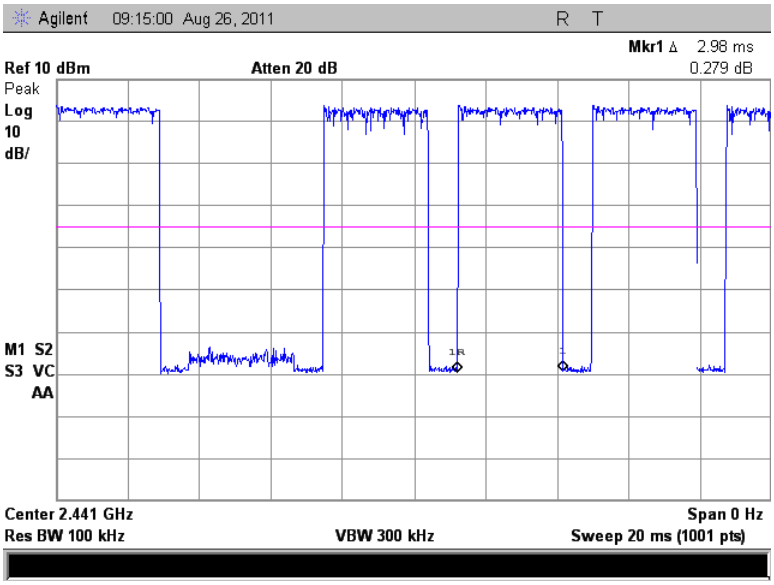


Figure 7.4.3.2-3: Channel Dwell Time – DH5

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	960	1153
2442	960	1171
2480	958	1153

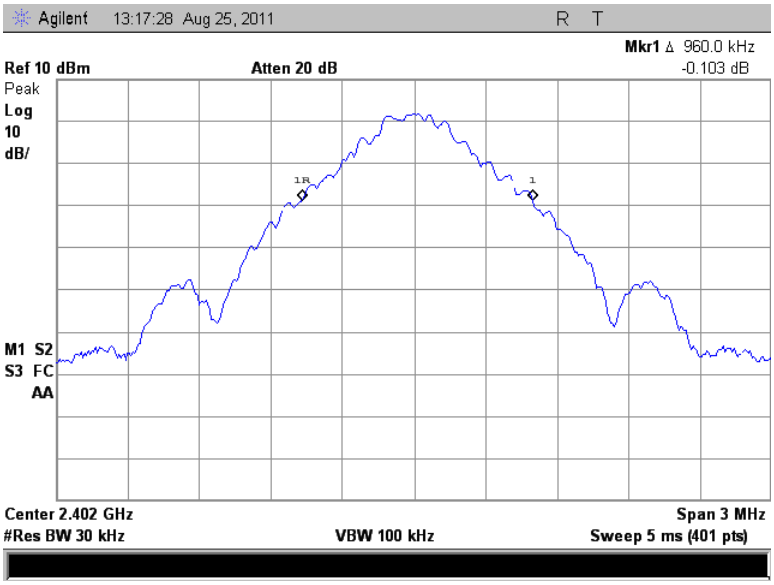


Figure 7.4.4.2-1: 20dB BW Low Channel (GFSK)

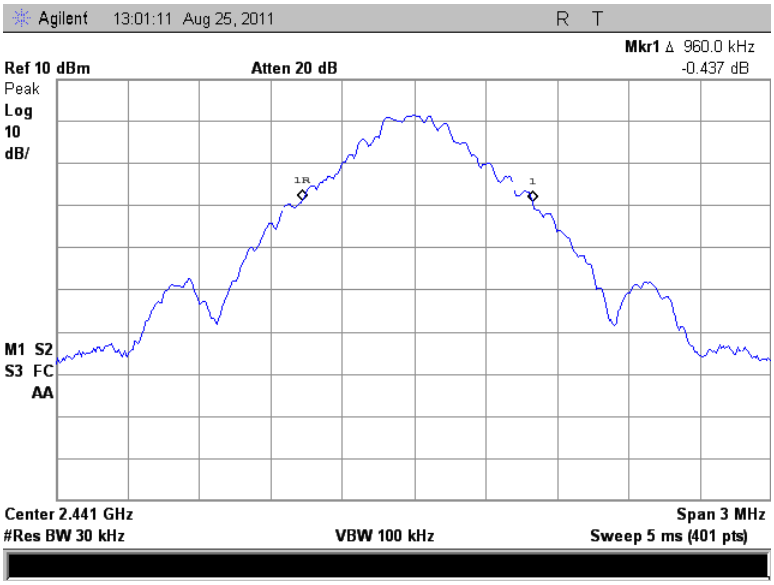


Figure 7.4.4.2-2: 20dB BW Middle Channel (GFSK)

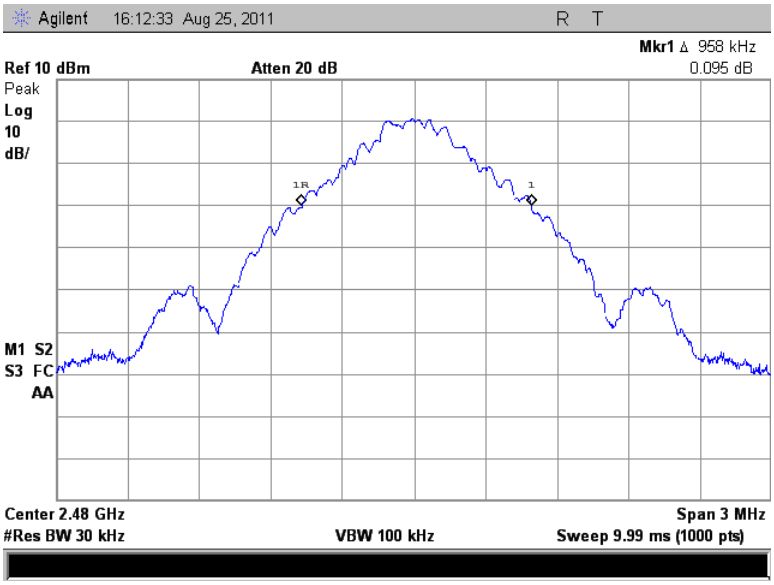


Figure 7.4.4.2-3: 20dB BW High Channel (GFSK)

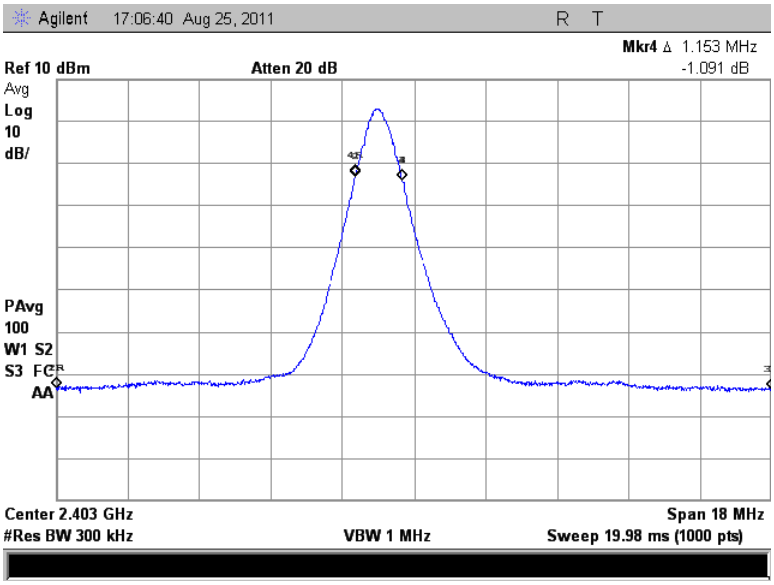


Figure 7.4.4.2-4: 99% OBW Low Channel (GFSK)

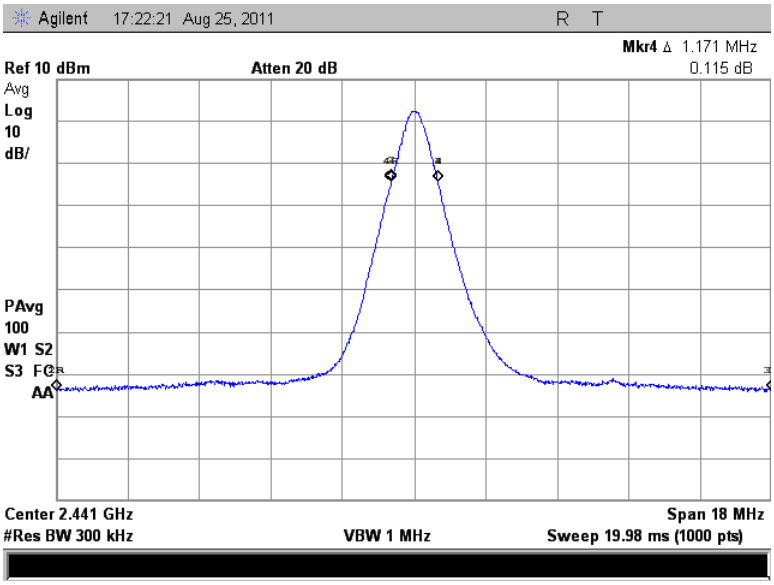


Figure 7.4.4.2-5: 99% OBW Middle Channel (GFSK)

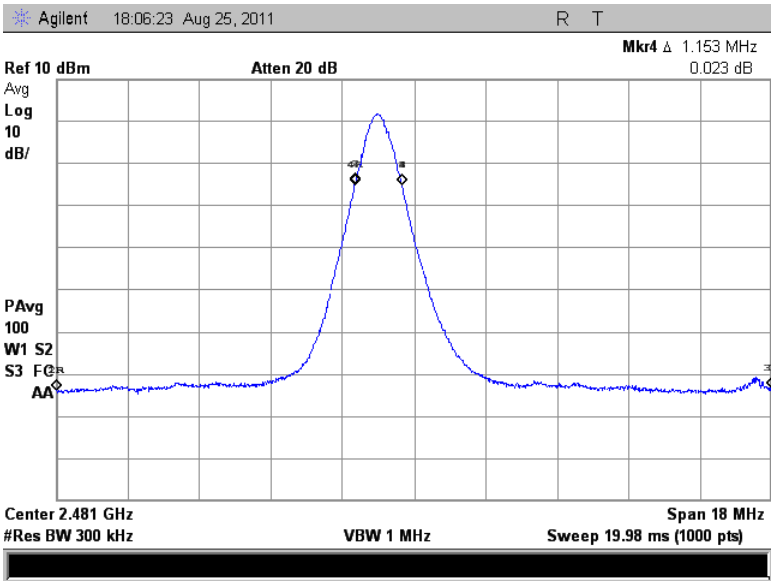


Figure 7.4.4.2-6: 99% OBW High Channel (GFSK)

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

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1387	1604
2441	1381	1568
2480	1387	1568

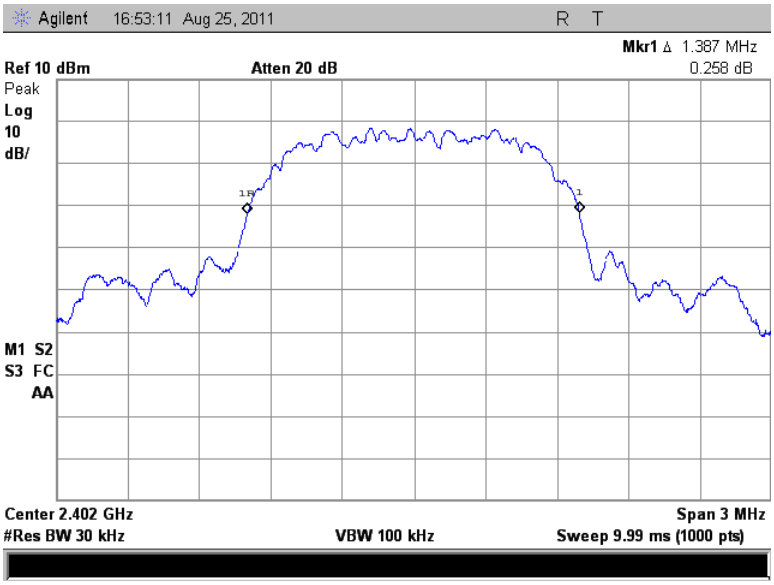


Figure 7.4.4.2-7: 20dB BW Low Channel (π/4 DQPSK)

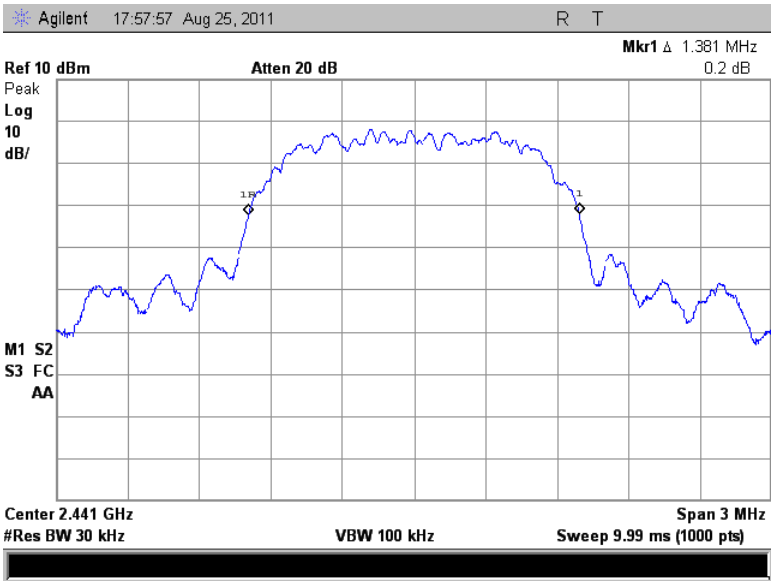


Figure 7.4.4.2-8: 20dB BW Middle Channel (π/4 DQPSK)

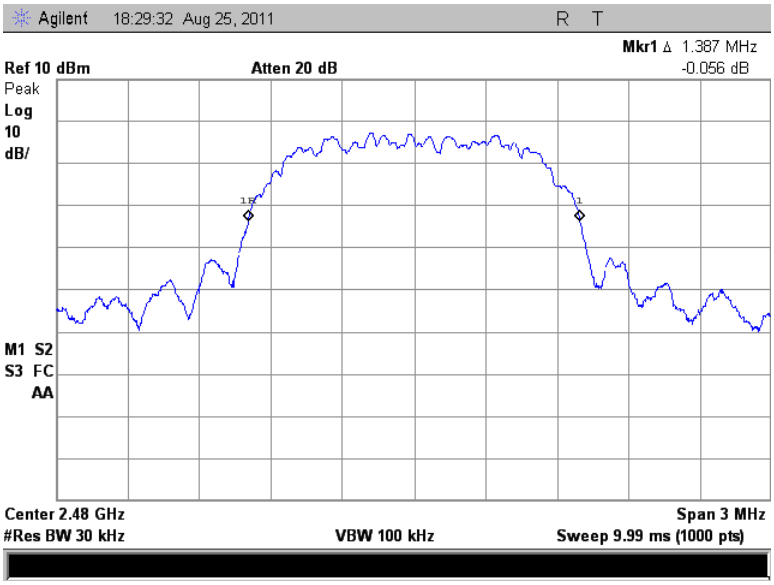


Figure 7.4.4.2-9: 20dB BW High Channel (π/4 DQPSK)

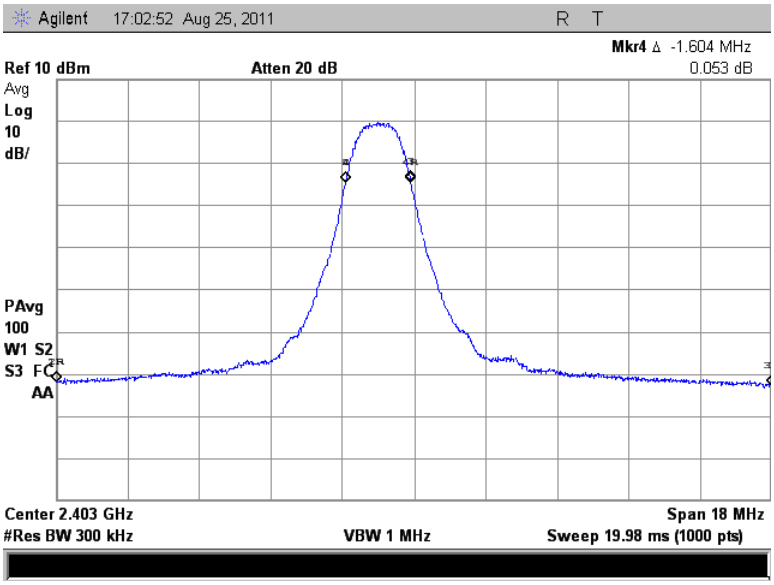


Figure 7.4.4.2-10: 99% OBW Low Channel (π/4 DQPSK)

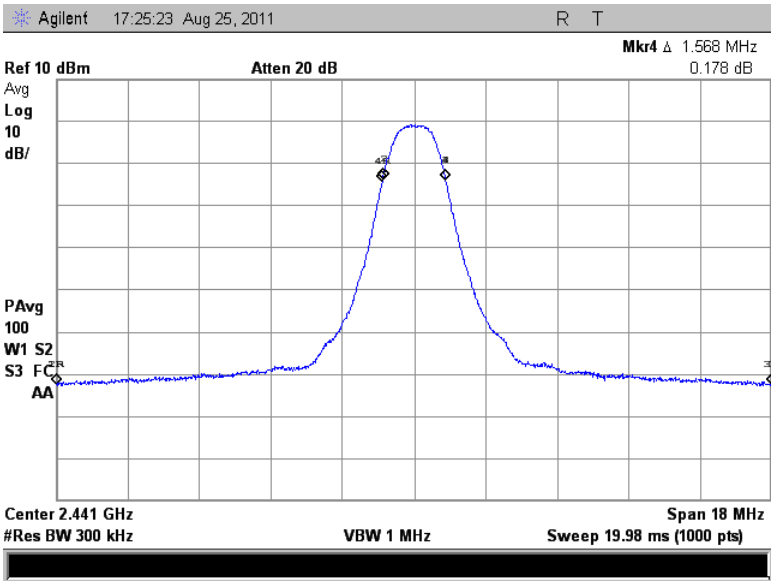


Figure 7.4.4.2-11: 99% OBW Middle Channel (π/4 DQPSK)

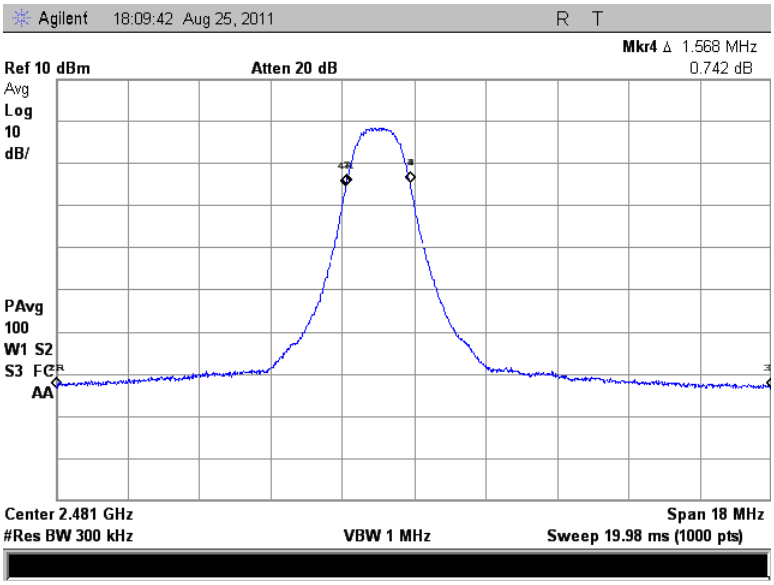


Figure 7.4.4.2-12: 99% OBW High Channel (π/4 DQPSK)

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

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2402	1372	1586
2441	1372	1568
2480	1366	1568

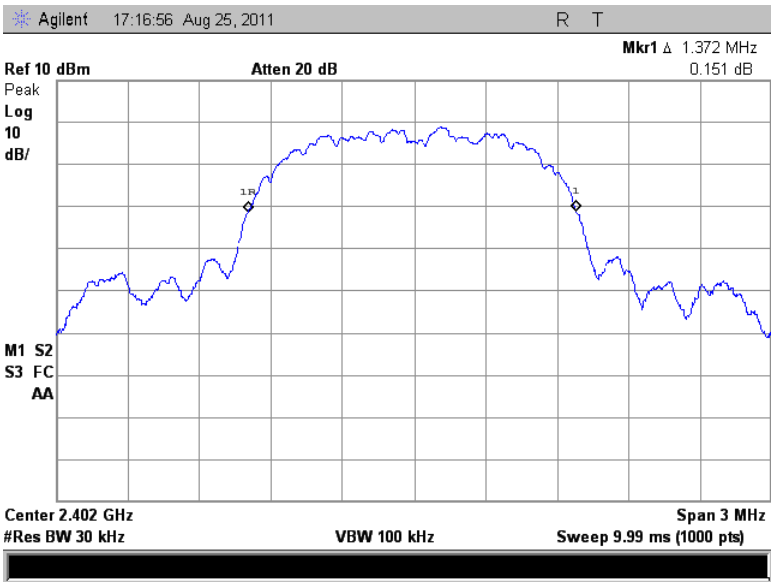


Figure 7.4.4.2-13: 20dB BW Low Channel (8DPSK)

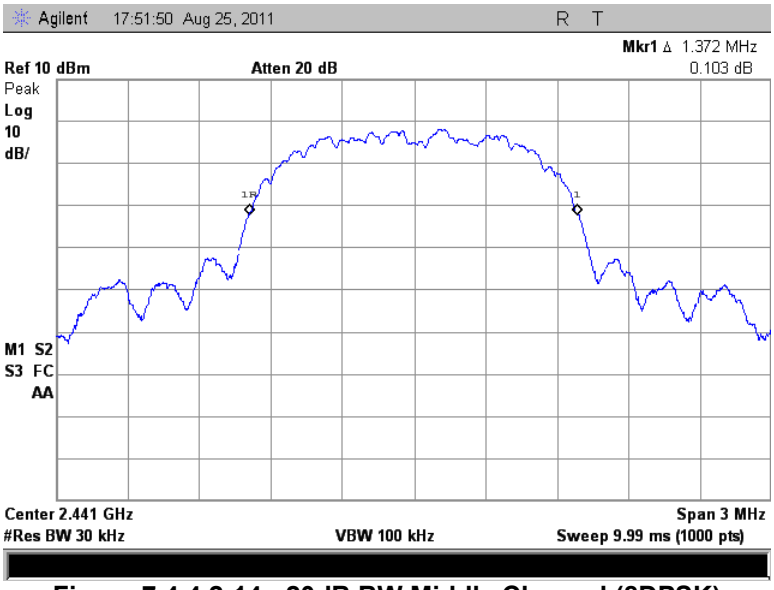


Figure 7.4.4.2-14: 20dB BW Middle Channel (8DPSK)

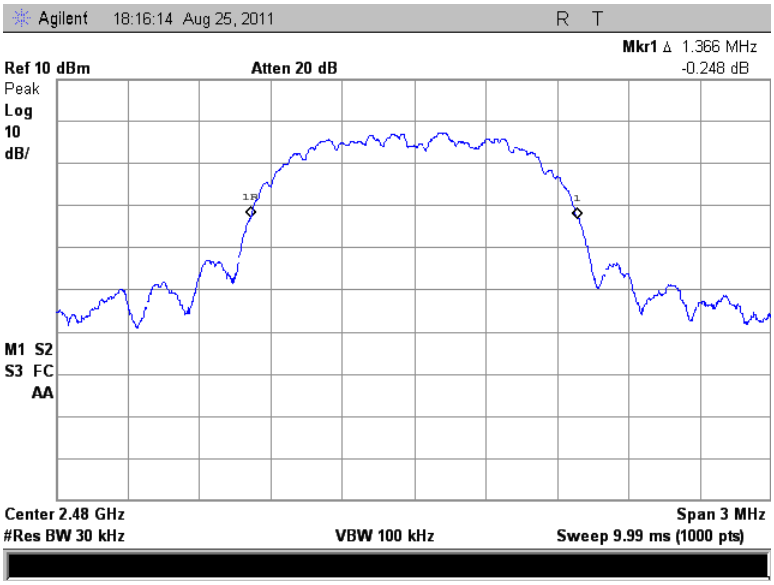


Figure 7.4.4.2-15: 20dB BW High Channel (8DPSK)

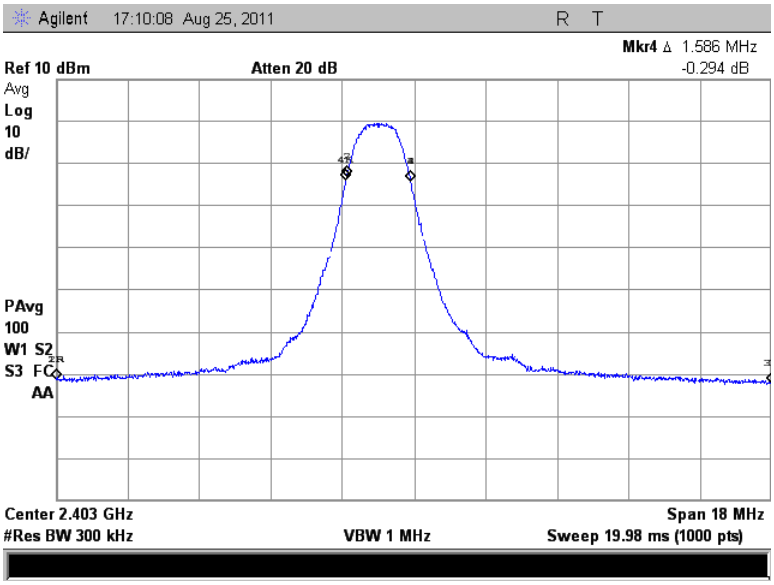


Figure 7.4.4.2-16: 99% OBW Low Channel (8DPSK)

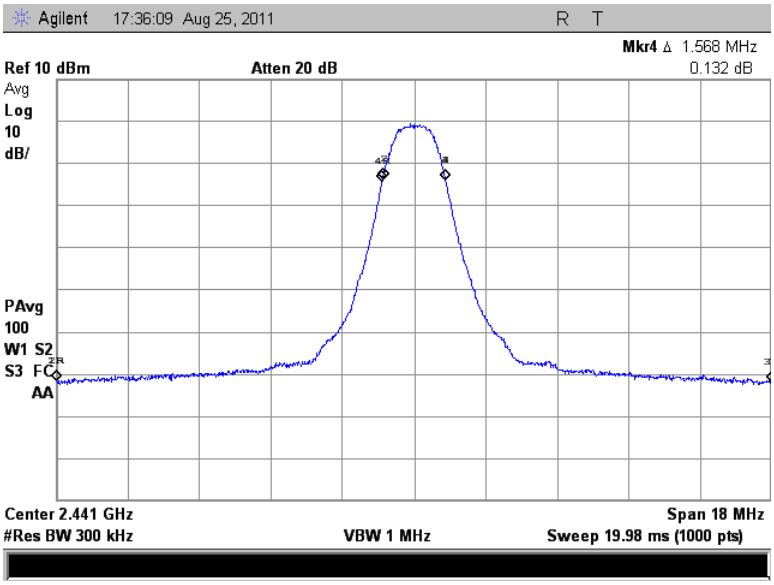


Figure 7.4.4.2-17: 99% OBW Middle Channel (8DPSK)

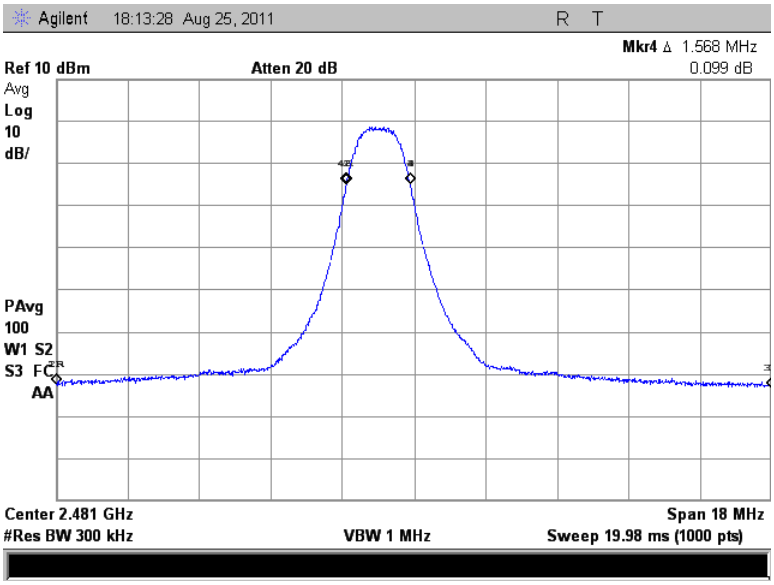


Figure 7.4.4.2-18: 99% OBW High Channel (8DPSK)

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 connected to the input of the spectrum analyzer through suitable attenuation. 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

Table 7.5.1.2-1: Conducted Band Edge - GFSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	58.73	60.64	> 20 dB	Passed	Passed
Upper Band-Edge	56.65	58.21	>20dB	Passed	Passed

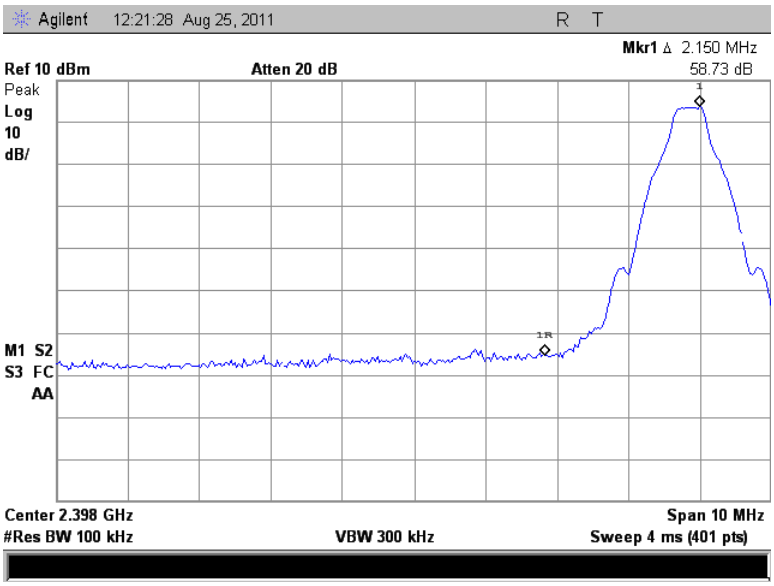


Figure 7.5.1.2-1: Lower Band-edge (GFSK)

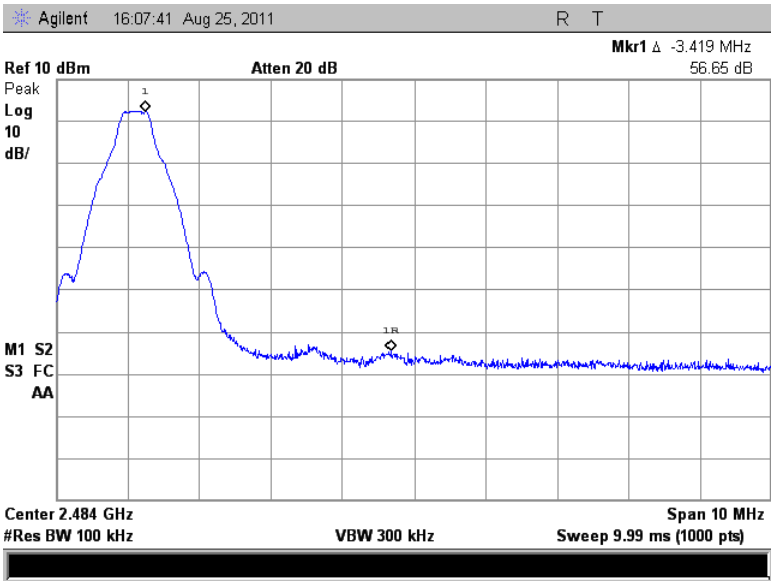


Figure 7.5.1.2-2: Upper Band-edge (GFSK)

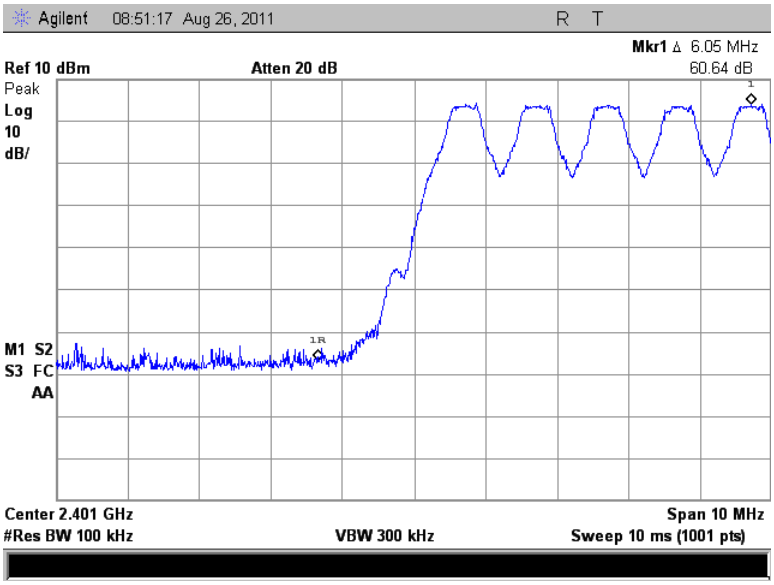


Figure 7.5.1.2-3: Lower Band-edge – Hopping Mode (GFSK)

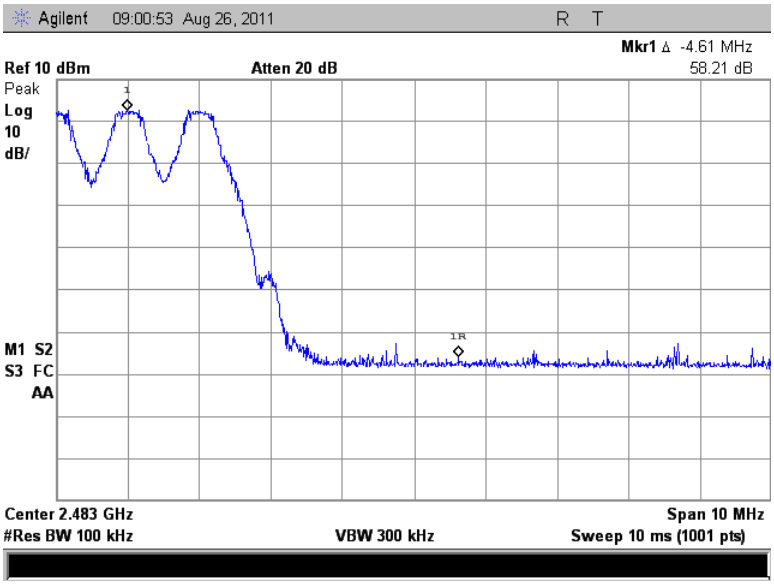


Figure 7.5.1.2-4: Upper Band-edge – Hopping Mode (GFSK)

Table 7.5.1.2-2: Conducted Band Edge - π/4 DQPSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	47.80	53.47	> 20 dB	Passed	Passed
Upper Band-Edge	56.06	57.09	> 20 dB	Passed	Passed

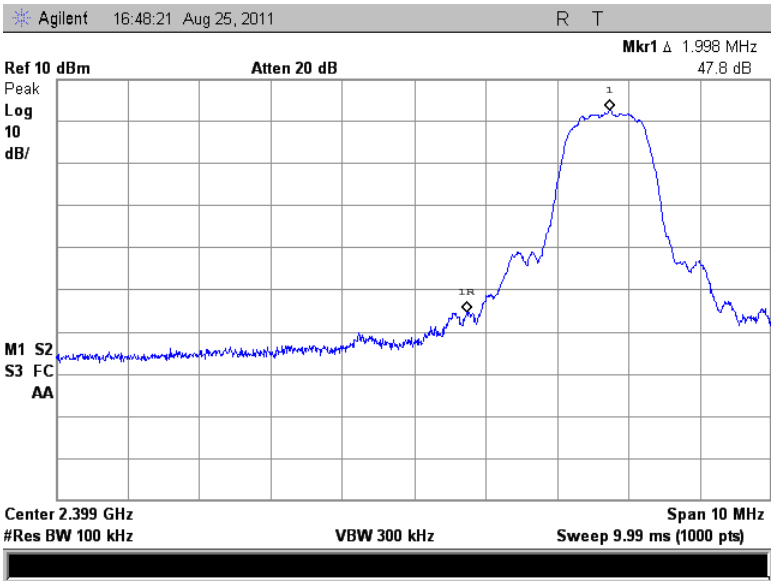


Figure 7.5.1.2-5: Lower Band-edge (π/4 DQPSK)

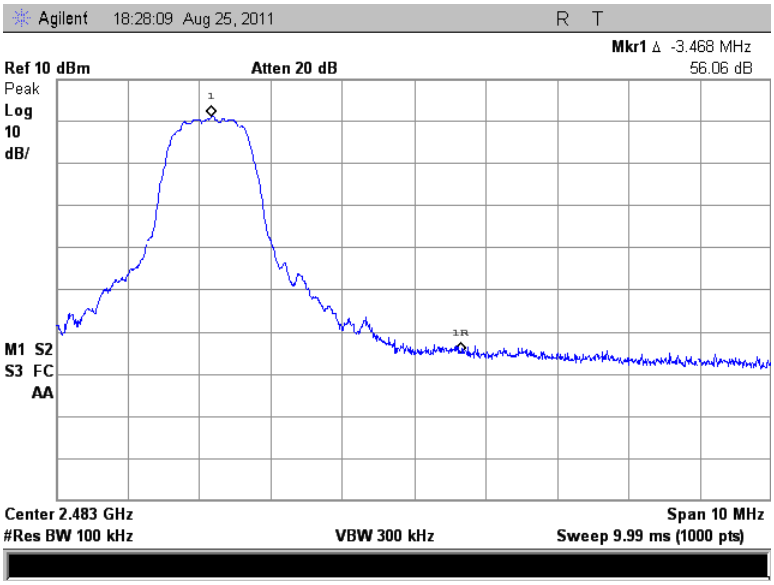


Figure 7.5.1.2-6: Upper Band-edge (π/4 DQPSK)

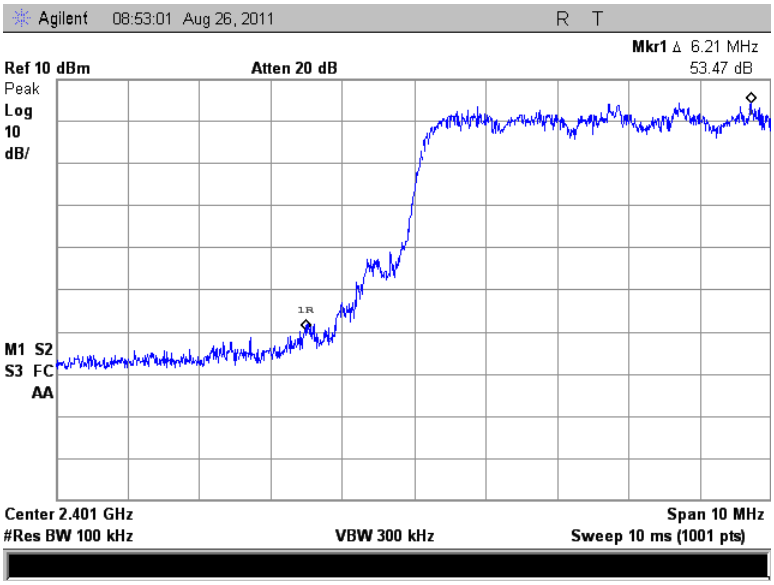


Figure 7.5.1.2-7: Lower Band-edge – Hopping Mode (π/4 DQPSK)

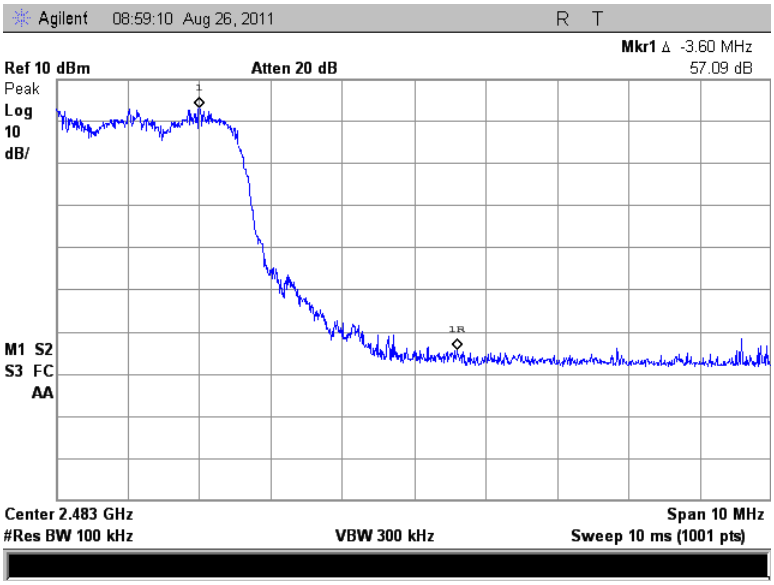


Figure 7.5.1.2-8: Upper Band-edge – Hopping Mode (π/4 DQPSK)

Table 7.5.1.2-3: Conducted Band Edge – 8DPSK

	Measured Delta (dB)		Requirements	Band Edge	
	Single TX	Hopping Mode		Single TX	Hopping Mode
Lower Band-Edge	48.53	50.05	> 20 dB	Passed	Passed
Upper Band-Edge	53.63	54.20	> 20 dB	Passed	Passed

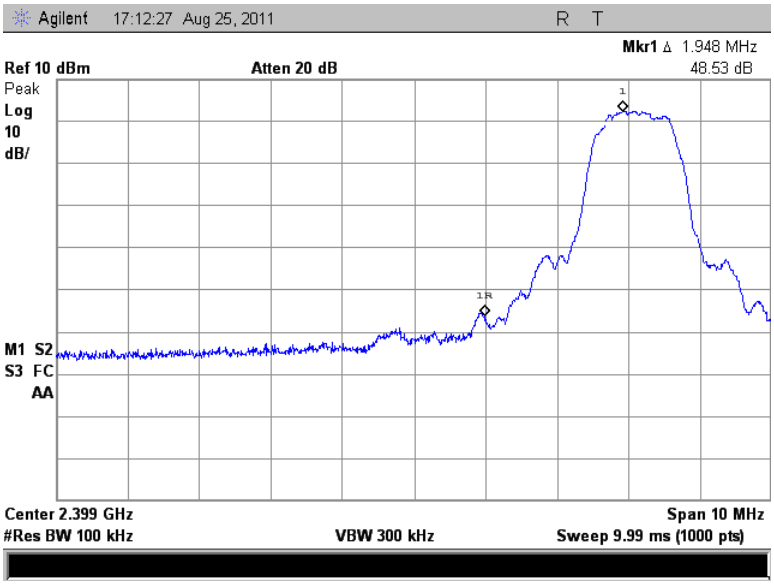


Figure 7.5.1.2-9: Lower Band-edge (8DPSK)

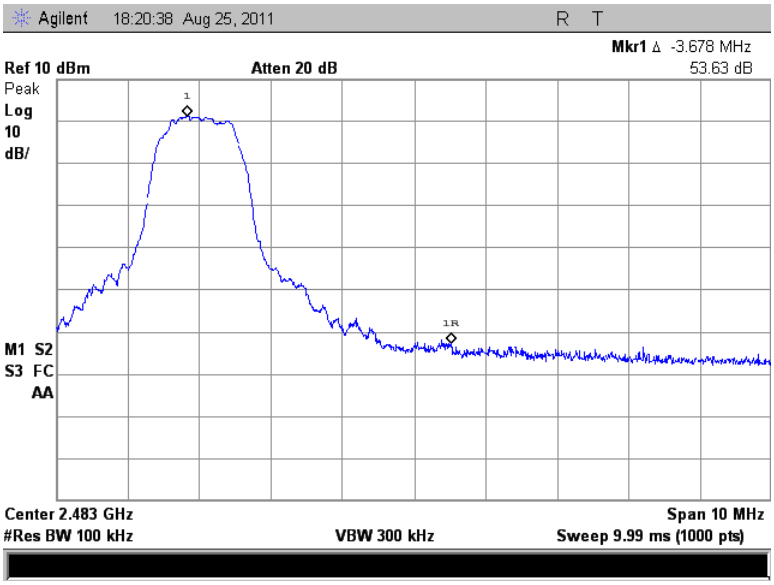


Figure 7.5.1.2-10: Upper Band-edge (8DPSK)

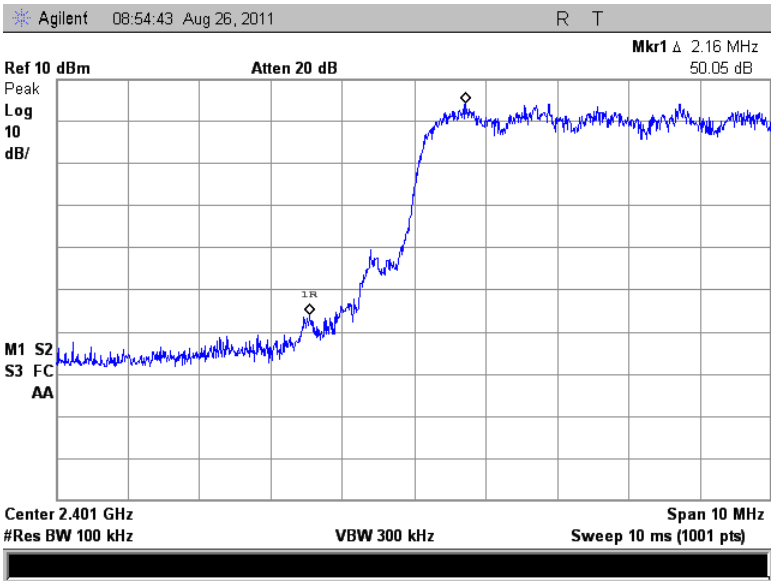


Figure 7.5.1.2-11: Lower Band-edge – Hopping Mode (8DPSK)

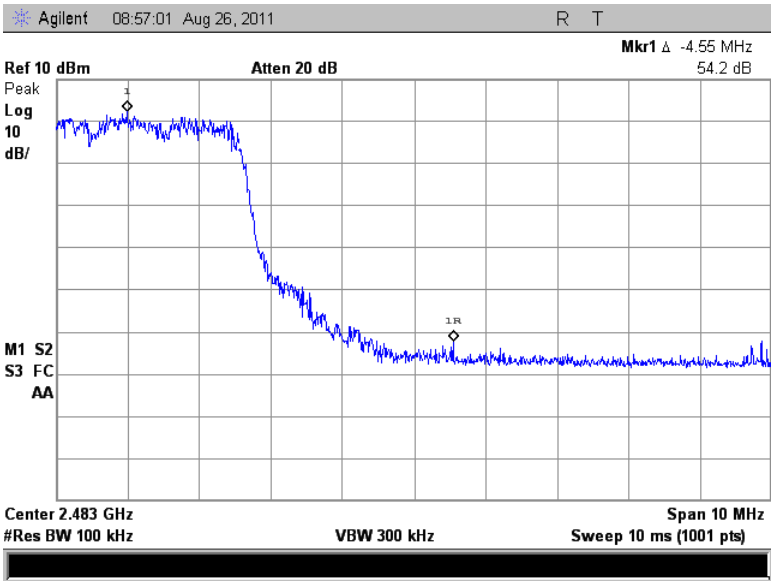


Figure 7.5.1.2-12: Upper Band-edge – Hopping Mode (8DPSK)

7.5.2 RF Conducted Spurious Emissions

7.5.2.1 Measurement Procedure

The RF output port of the EUT was connected to the spectrum analyzer. 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. The levels were corrected for cable and attenuator losses.

7.5.2.2 Measurement Results

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

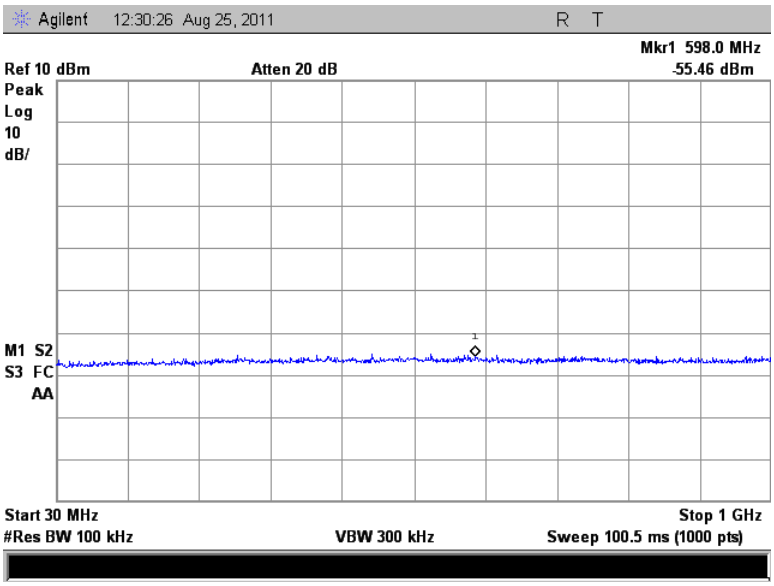


Figure 7.5.3.2-1: 30 MHz – 1 GHz – Low Channel (GFSK)

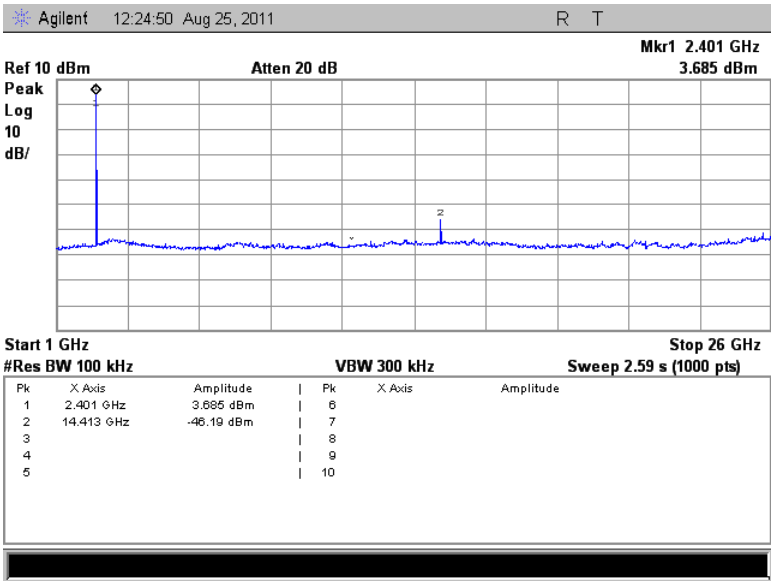


Figure 7.5.3.2-2: 1 GHz –26 GHz – Low Channel (GFSK)

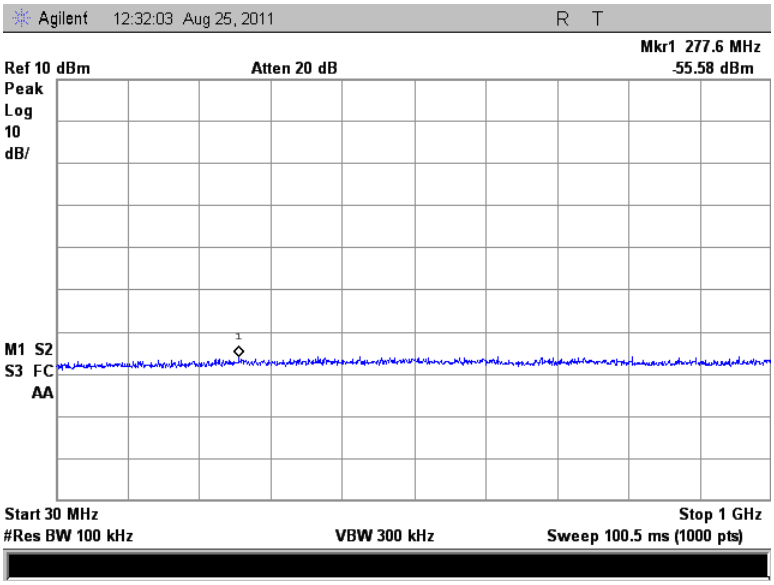


Figure 7.5.3.2-3: 30 MHz – 1 GHz –Middle Channel (GFSK)

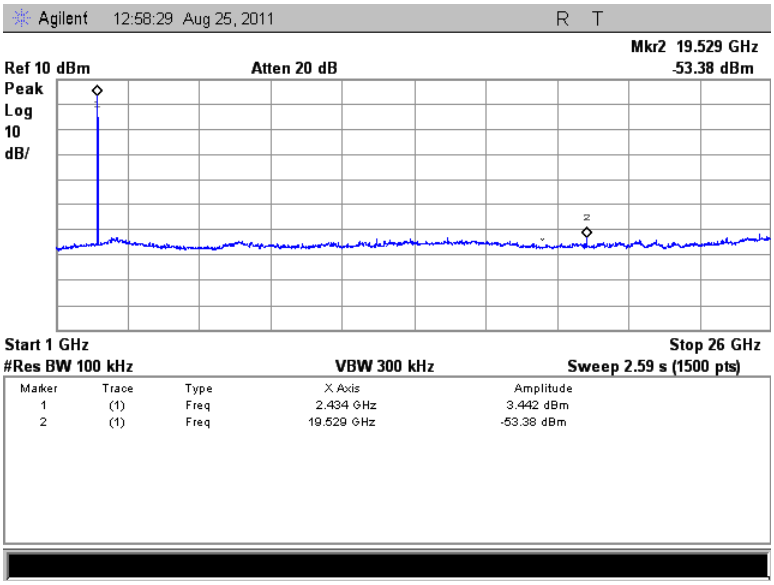


Figure 7.5.3.2-4: 1 GHz –26 GHz – Middle Channel (GFSK)

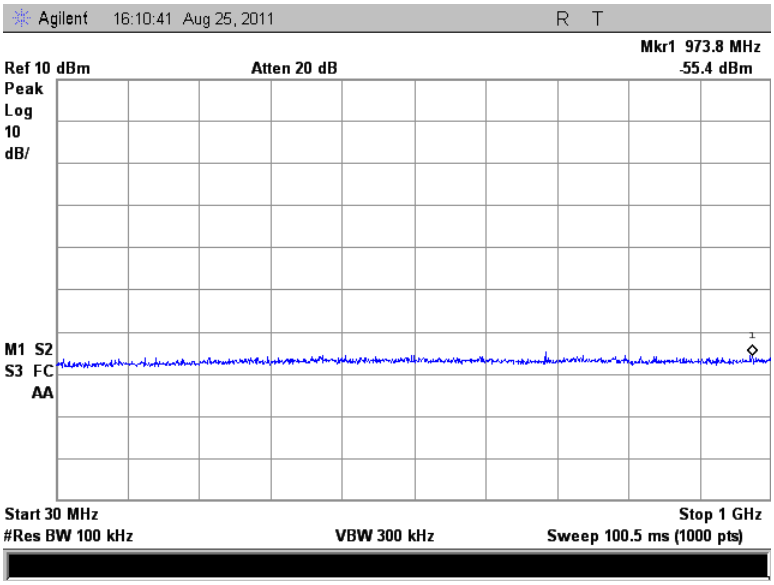


Figure 7.5.3.2-5: 30 MHz – 1 GHz – High Channel (GFSK)

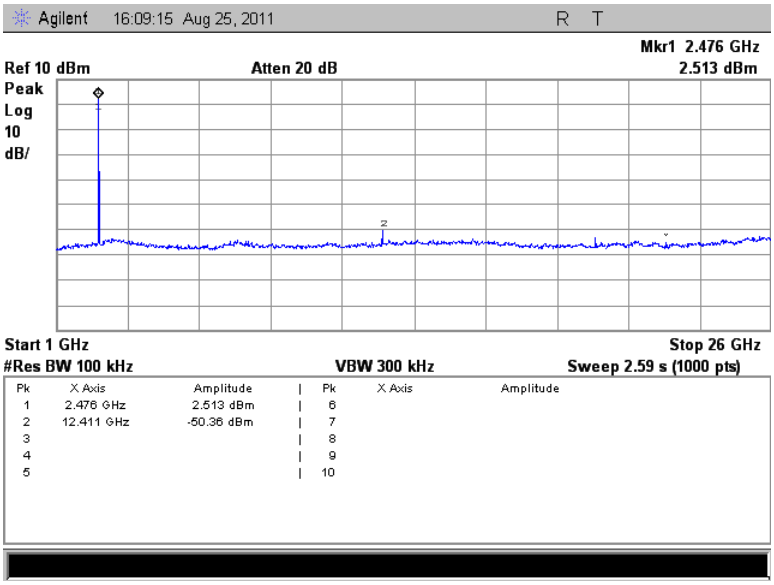


Figure 7.5.3.2-6: 1 GHz –26 GHz –High Channel (GFSK)

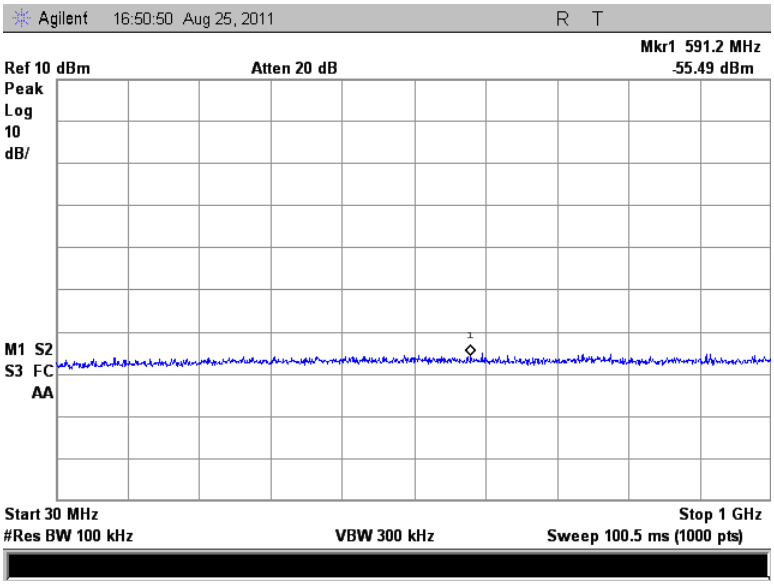


Figure 7.5.3.2-7: 30 MHz – 1 GHz – Low Channel (π/4 DQPSK)

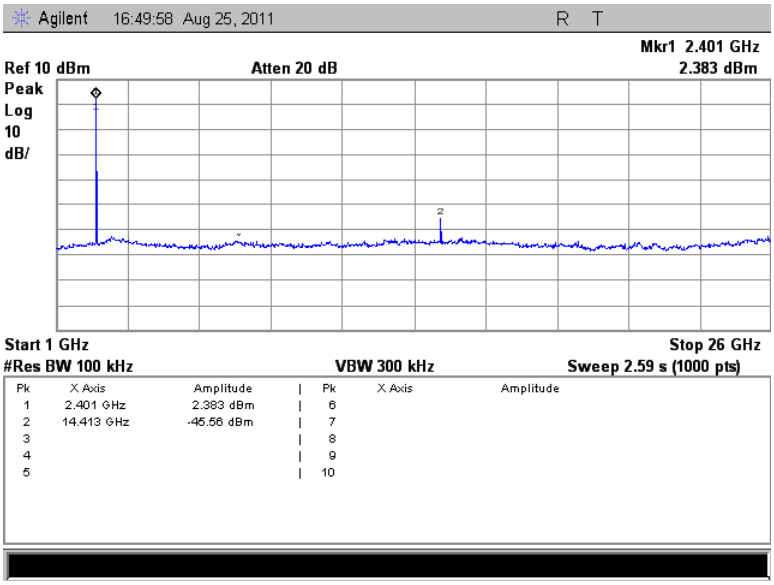


Figure 7.5.3.2-8: 1 GHz –26 GHz – Low Channel (π/4 DQPSK)

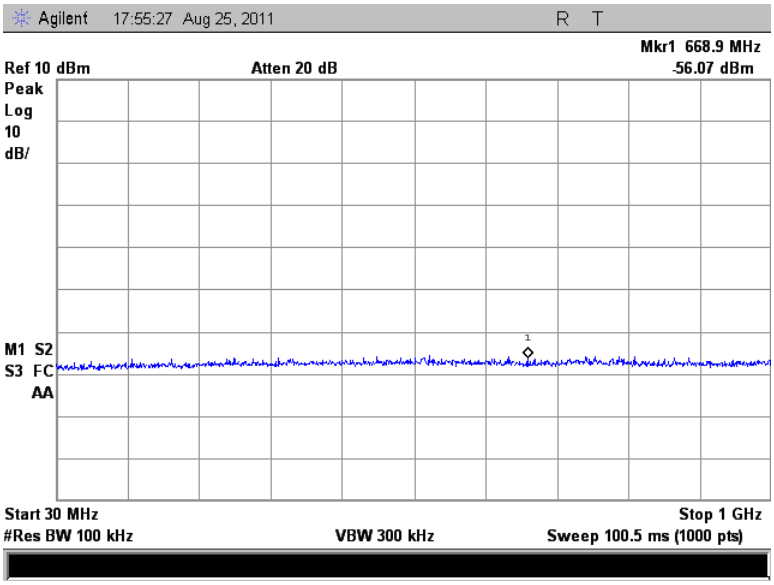


Figure 7.5.3.2-9: 30 MHz – 1 GHz –Middle Channel (π/4 DQPSK)

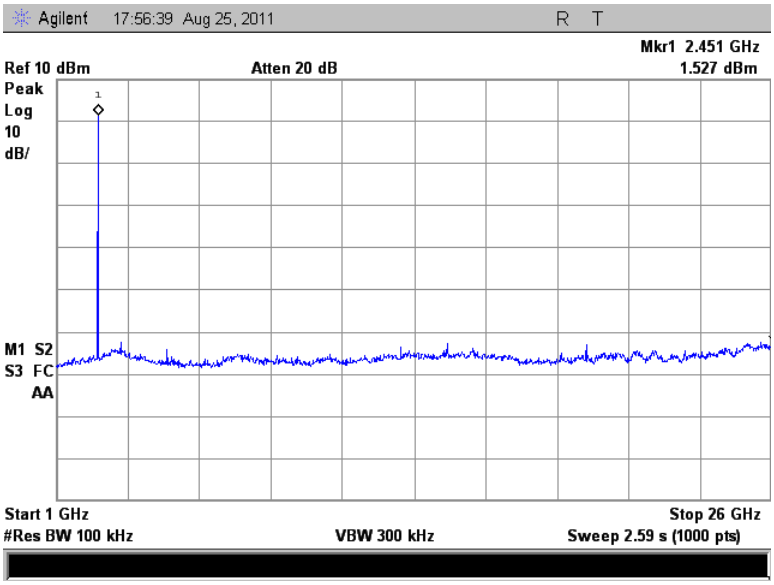


Figure 7.5.3.2-10: 1 GHz –26 GHz – Middle Channel (π/4 DQPSK)

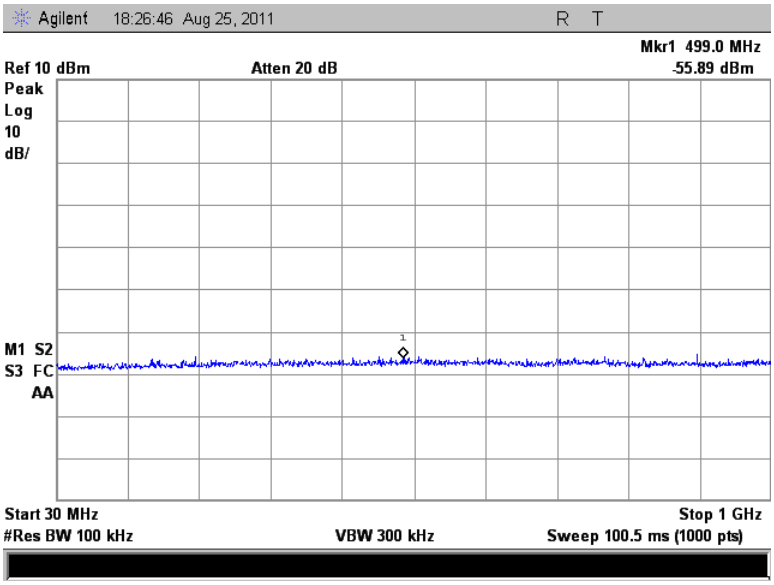


Figure 7.5.3.2-11: 30 MHz – 1 GHz – High Channel (π/4 DQPSK)

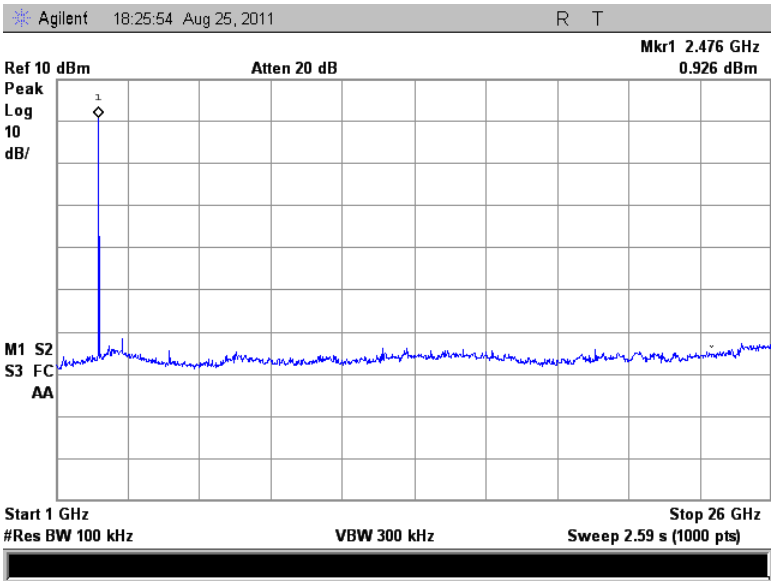


Figure 7.5.3.2-12: 1 GHz –26 GHz –High Channel (π/4 DQPSK)

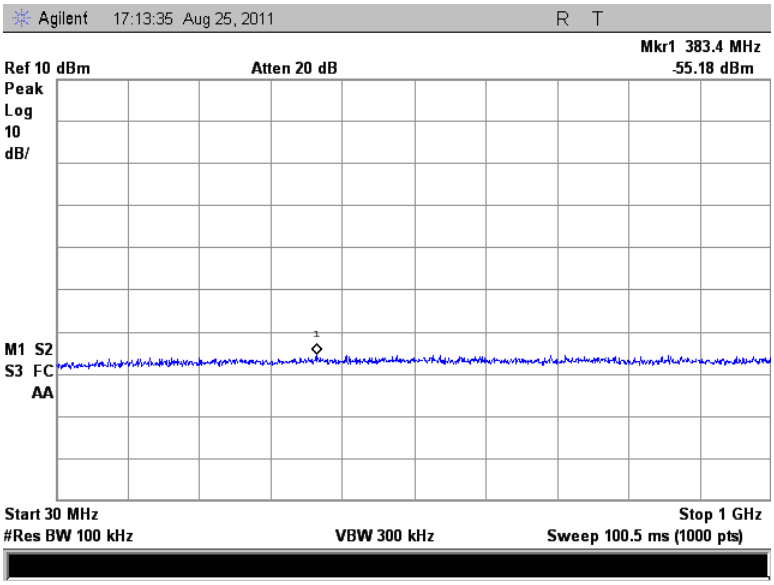


Figure 7.5.3.2-13: 30 MHz – 1 GHz – Low Channel (8DPSK)

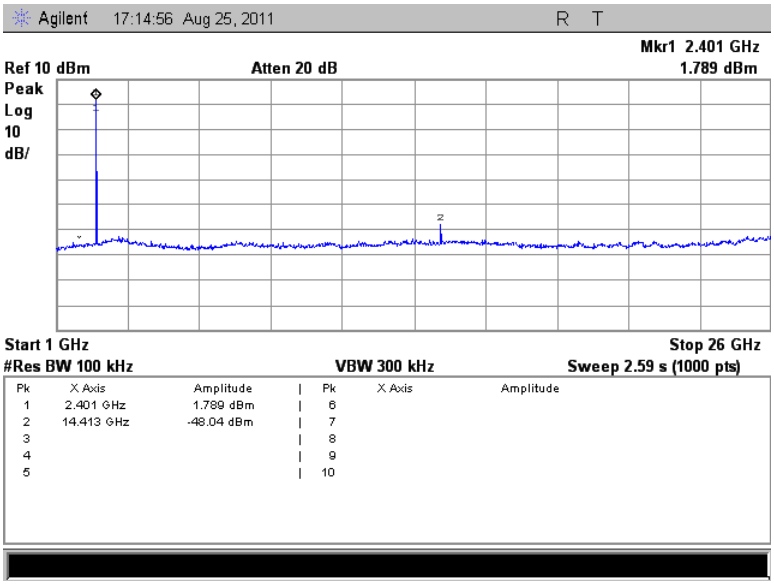


Figure 7.5.3.2-14: 1 GHz –26 GHz – Low Channel (8DPSK)

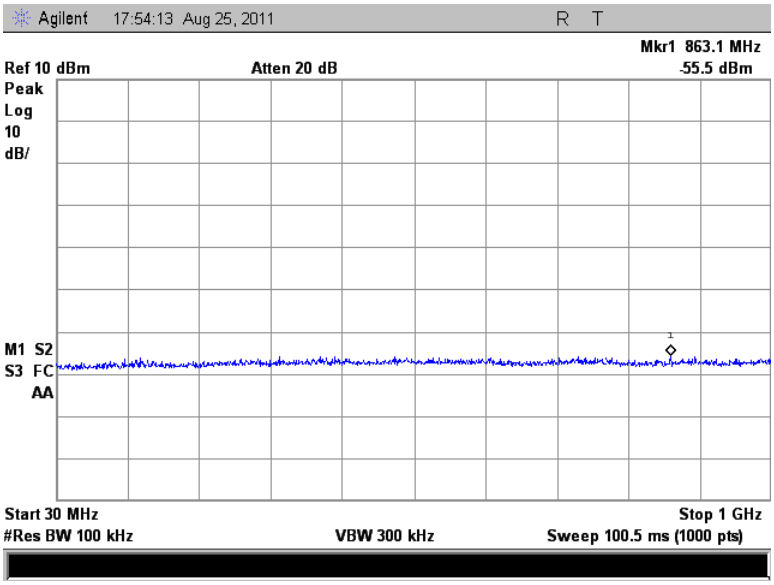


Figure 7.5.3.2-15: 30 MHz – 1 GHz –Middle Channel (8DPSK)

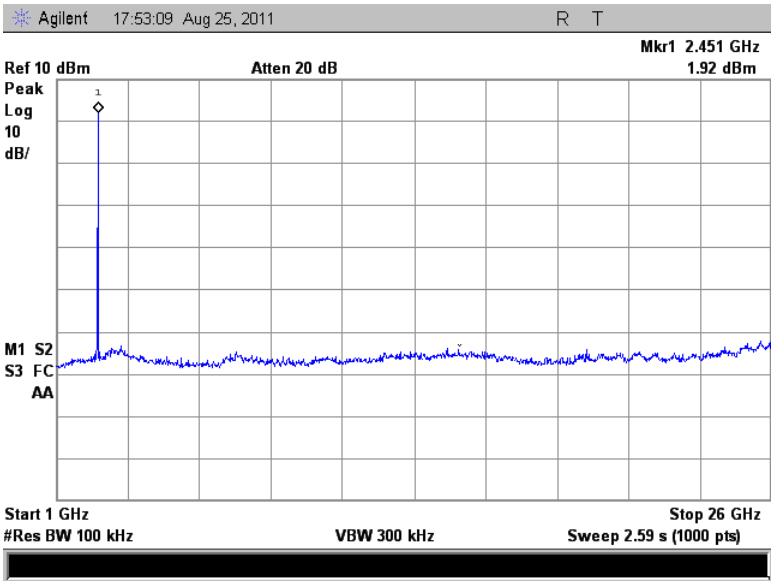


Figure 7.5.3.2-16: 1 GHz –26 GHz – Middle Channel (8DPSK)

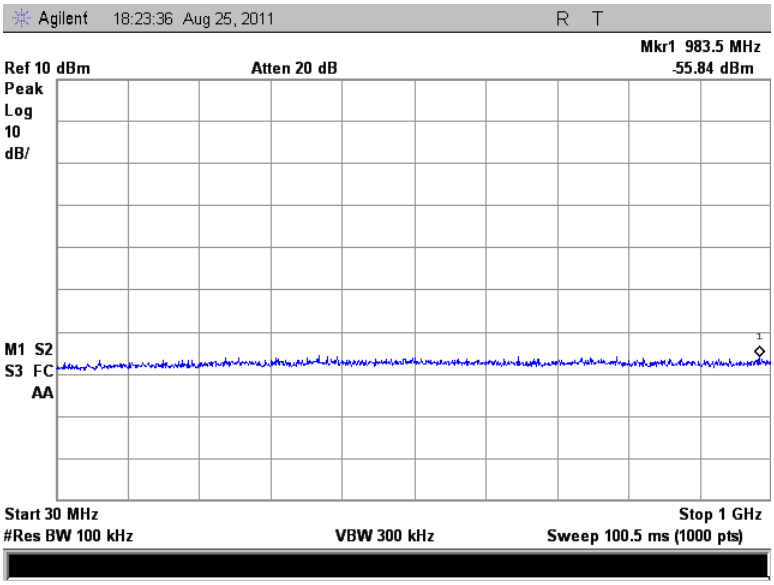


Figure 7.5.3.2-17: 30 MHz – 1 GHz – High Channel (8DPSK)

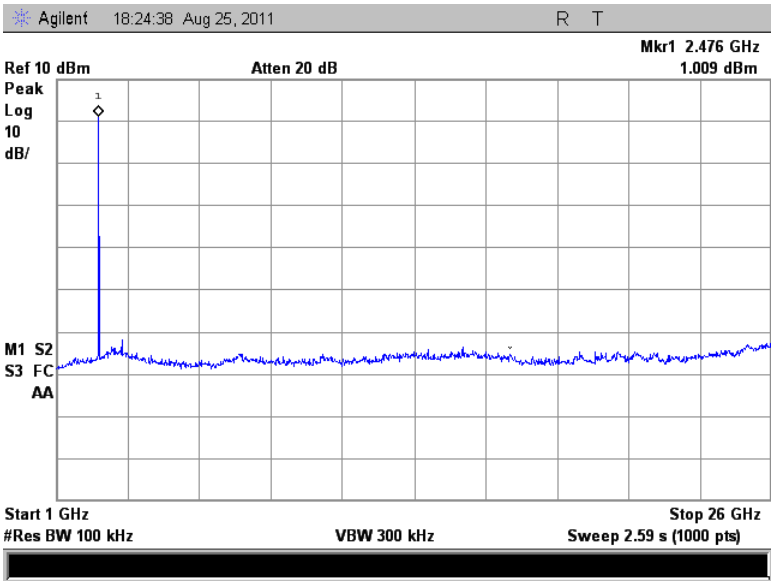


Figure 7.5.3.2-18: 1 GHz –26 GHz –High Channel (8DPSK)

7.5.3 Radiated Spurious Emissions - FCC Section 15.205, 15.209; IC: RSS-Gen 7.2.2, 7.2.5

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 26 GHz, 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 1000 MHz, peak measurements made with RBW and VBW of 1 MHz and 3 MHz respectively. Average measurements were collected in the linear amplitude scale with VBW of 30 Hz.

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

7.5.3.2 Measurement Results

Band-edge and radiated spurious emissions found in the band of 30MHz to 26 GHz are reported in the tables 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	53.46	48.52	H	-0.89	52.57	47.63	74.0	54.0	21.4	6.4
4804	51.70	45.39	V	-0.89	50.81	44.50	74.0	54.0	23.2	9.5
12010	49.00	38.99	H	11.35	60.35	50.34	83.5	63.5	23.2	13.2
12010	46.90	36.13	V	11.35	58.25	47.48	83.5	63.5	25.3	16.0
19216	42.02	29.67	V	9.23	51.25	38.90	83.5	63.5	32.2	24.6
Middle Channel = 2441 MHz										
4882	55.81	51.16	H	-0.66	55.15	50.50	74.0	54.0	18.8	3.5
4882	53.13	48.07	V	-0.66	52.47	47.41	74.0	54.0	21.5	6.6
7323	47.13	33.82	H	4.00	51.13	37.82	74.0	54.0	22.9	16.2
7323	46.76	33.80	V	4.00	50.76	37.80	74.0	54.0	23.2	16.2
12205	48.68	38.81	H	11.22	59.90	50.03	83.5	63.5	23.6	13.5
12205	46.33	35.21	V	11.22	57.55	46.43	83.5	63.5	25.9	17.1
19528	40.50	27.80	V	9.55	50.05	37.35	83.5	63.5	33.5	26.2
High Channel = 2480 MHz										
2483.5	62.46	56.32	H	-8.26	54.20	48.06	74.0	54.0	19.8	5.9
2483.5	59.92	51.96	V	-8.26	51.66	43.70	74.0	54.0	22.3	10.3
4960	53.38	48.22	H	-0.43	52.95	47.79	74.0	54.0	21.0	6.2
4960	50.94	44.71	V	-0.43	50.51	44.28	74.0	54.0	23.5	9.7
7440	46.66	33.90	H	4.31	50.97	38.21	74.0	54.0	23.0	15.8
7440	46.98	34.13	V	4.31	51.29	38.44	74.0	54.0	22.7	15.6
12400	45.67	34.39	H	11.10	56.77	45.49	83.5	63.5	26.7	18.0
12400	44.13	32.40	V	11.10	55.23	43.50	83.5	63.5	28.3	20.0
19840	43.27	29.71	H	10.92	54.19	40.63	83.5	63.5	29.3	22.9
19840	42.28	30.09	V	10.92	53.20	41.01	83.5	63.5	30.3	22.5
22320	41.18	28.24	V	12.04	53.22	40.28	83.5	63.5	30.3	23.2

Notes:

- **All emissions above 22.32 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **All emissions above 10 GHz were measured at a distance of 1m from the EUT. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB ≈ 9.54 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	59.28	52.60	H	-0.89	58.39	51.71	74.0	54.0	15.6	2.3
4804	56.18	49.45	V	-0.89	55.29	48.56	74.0	54.0	18.7	5.4
12010	48.05	35.58	H	11.35	59.40	46.93	83.5	63.5	24.1	16.6
12010	45.59	33.60	V	11.35	56.94	44.95	83.5	63.5	26.6	18.6
19216	41.64	29.22	H	9.23	50.87	38.45	83.5	63.5	32.6	25.0
19216	42.43	29.82	V	9.23	51.66	39.05	83.5	63.5	31.8	24.4
Middle Channel = 2441 MHz										
4882	54.86	47.73	H	-0.66	54.20	47.07	74.0	54.0	19.8	6.9
4882	52.54	44.60	V	-0.66	51.88	43.94	74.0	54.0	22.1	10.1
7323	47.29	33.91	H	4.00	51.29	37.91	74.0	54.0	22.7	16.1
7323	47.06	34.00	V	4.00	51.06	38.00	74.0	54.0	22.9	16.0
12205	46.69	34.45	H	11.22	57.91	45.67	83.5	63.5	25.6	17.8
12205	45.59	32.47	V	11.22	56.81	43.69	83.5	63.5	26.7	19.8
19528	42.31	29.18	H	9.55	51.86	38.73	83.5	63.5	31.6	24.8
19528	42.54	29.47	V	9.55	52.09	39.02	83.5	63.5	31.4	24.5
High Channel = 2480 MHz										
2483.5	66.98	58.11	H	-8.26	58.72	49.85	74.0	54.0	15.3	4.2
2483.5	63.48	53.80	V	-8.26	55.22	45.54	74.0	54.0	18.8	8.5
4960	50.98	39.86	H	-0.43	50.55	39.43	74.0	54.0	23.4	14.6
4960	49.05	37.14	V	-0.43	48.62	36.71	74.0	54.0	25.4	17.3
7440	46.64	33.79	H	4.31	50.95	38.10	74.0	54.0	23.0	15.9
7440	46.71	33.96	V	4.31	51.02	38.27	74.0	54.0	23.0	15.7
12400	44.29	30.79	H	11.10	55.39	41.89	83.5	63.5	28.1	21.6
12400	43.06	30.42	V	11.10	54.16	41.52	83.5	63.5	29.3	22.0
19840	43.16	30.24	H	10.92	54.08	41.16	83.5	63.5	29.4	22.3
19840	44.03	31.64	V	10.92	54.95	42.56	83.5	63.5	28.6	20.9

Notes:

- **All emissions above 19.84 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **All emissions above 10 GHz were measured at a distance of 1m from the EUT. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB ≈ 9.54 dB**

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	59.69	52.51	H	-0.89	58.80	51.62	74.0	54.0	15.2	2.4
4804	56.77	49.26	V	-0.89	55.88	48.37	74.0	54.0	18.1	5.6
12010	47.17	35.33	H	11.35	58.52	46.68	83.5	63.5	25.0	16.8
12010	45.70	33.30	V	11.35	57.05	44.65	83.5	63.5	26.5	18.9
19216	42.49	29.69	V	9.23	51.72	38.92	83.5	63.5	31.8	24.6
Middle Channel = 2441 MHz										
4882	54.99	47.34	H	-0.66	54.33	46.68	74.0	54.0	19.7	7.3
4882	52.17	43.82	V	-0.66	51.51	43.16	74.0	54.0	22.5	10.8
7323	46.81	33.89	H	4.00	50.81	37.89	74.0	54.0	23.2	16.1
7323	46.25	33.90	V	4.00	50.25	37.90	74.0	54.0	23.7	16.1
12205	46.22	33.67	H	11.22	57.44	44.89	83.5	63.5	26.1	18.6
12205	45.24	32.02	V	11.22	56.46	43.24	83.5	63.5	27.0	20.3
19528	41.37	28.87	H	9.55	50.92	38.42	83.5	63.5	32.6	25.1
19528	42.43	29.37	V	9.55	51.98	38.92	83.5	63.5	31.5	24.6
High Channel = 2480 MHz										
2483.5	69.37	57.97	H	-8.26	61.11	49.71	74.0	54.0	12.9	4.3
2483.5	65.05	53.69	V	-8.26	56.79	45.43	74.0	54.0	17.2	8.6
4960	51.48	39.68	H	-0.43	51.05	39.25	74.0	54.0	22.9	14.7
4960	48.75	36.98	V	-0.43	48.32	36.55	74.0	54.0	25.7	17.4
7440	46.41	33.93	H	4.31	50.72	38.24	74.0	54.0	23.3	15.8
7440	47.02	33.90	V	4.31	51.33	38.21	74.0	54.0	22.7	15.8
12400	43.20	30.71	H	11.10	54.30	41.81	83.5	63.5	29.2	21.7
19840	42.79	30.16	H	10.92	53.71	41.08	83.5	63.5	29.8	22.4
19840	43.14	31.21	V	10.92	54.06	42.13	83.5	63.5	29.4	21.4

Notes:

- **All emissions above 19.84 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **All emissions above 10 GHz were measured at a distance of 1m from the EUT. The limits are corrected accordingly using a distance factor of 20*log(3/1) dB ≈ 9.54 dB**

7.5.3.3 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: 53.46+ (-0.89) = 52.57dBµV/m
Margin: 74 dBµV/m – 52.57dBµV/m = 21.4dB

Example Calculation: Average
Corrected Level: 48.52 + (-0.89) = 47.63dBµV/m
Margin: 54 dBµV/m – 47.63 dBµV/m = 6.4dB

8 CONCLUSION

In the opinion of ACS, Inc., the AAH81TCN9NA2AN manufactured by Motorola Solutions SDNBHD meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT