MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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February 10, 2015

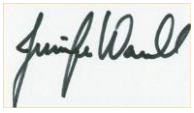
Sound World Solutions
960 N. Northwest Hwy.
Park Ridge, IL 60068

Dear Mike Kilhefner,

Enclosed is the EMC Wireless test report for compliance testing of the Sound World Solutions, HD100, CS100 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B and ICES-003, Issue 4 February 2004 for a Class B Digital Device, and FCC Part 15 Subpart C and RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.



Jennifer Warnell
Documentation Department

Reference: (\Sound World Solutions\EMC84072A-FCC247 Rev. 1)

Electromagnetic Compatibility Criteria
Test Report

for the

Sound World Solutions
HD100, CS100

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC84072A-FCC247 Rev. 1

February 10, 2015

Prepared For:

Sound World Solutions
960 N. Northwest Hwy.
Park Ridge, IL 60068

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

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Djed Mouada, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 12, 2015	Initial Issue.
1	February 10, 2015	Editorial corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Sound World Solutions HD100, CS100, with the requirements of Part 15, §15.247. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the HD100, CS100. Sound World Solutions should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the HD100, CS100, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with Sound World Solutions, purchase order number 1085. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issues 3: 2010	Description	Compliance
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class B Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-Gen(4.6)	20 dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Average Time of Occupancy (Dwell Time)	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Number of RF Channels	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	RF Channel Separation	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	Spurious Conducted Emissions	Compliant
Title 47 of the CFR, Part 15 §15.247(g) & (h)	RSS-210(A8.1)	Declaration Statements for FHSS	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-GEN (5.6)	Maximum Permissible Exposure (MPE)	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Sound World Solutions to perform testing on the HD100, CS100, under Sound World Solutions' purchase order number 1085.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Sound World Solutions, HD100, CS100.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	HD100, CS100	
Model(s) Covered:	HD100, CS100	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: YW6HD100 IC: 10330A-HD100	
	Type of Modulations:	FHSS (GFSK,QPSK,8DPSK)
	Equipment Code:	DSS
	Peak RF Output Power:	3.30 dBm
	EUT Frequency Ranges:	2402MHz-2480MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Djed Mouada	
Report Date(s):	February 10, 2015	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Sound World Solutions HD100, Equipment Under Test (EUT), is a hearing aid with Bluetooth and Bluetooth LE functionality. It sits behind a person's ear on the left or the right side and has a receiver (speaker) that is inserted into the ear. The HD100 can be paired with a phone or other HFP/HSP/A2DP capable Bluetooth device to receive calls and stream music. Apps are available on the Android, iPhone, PC and Mac platforms that allow a person to customize the HD100. On the iPhone platform, Bluetooth LE is used for customization. On the other platforms, the customization is done with classic Bluetooth RFCOMM.

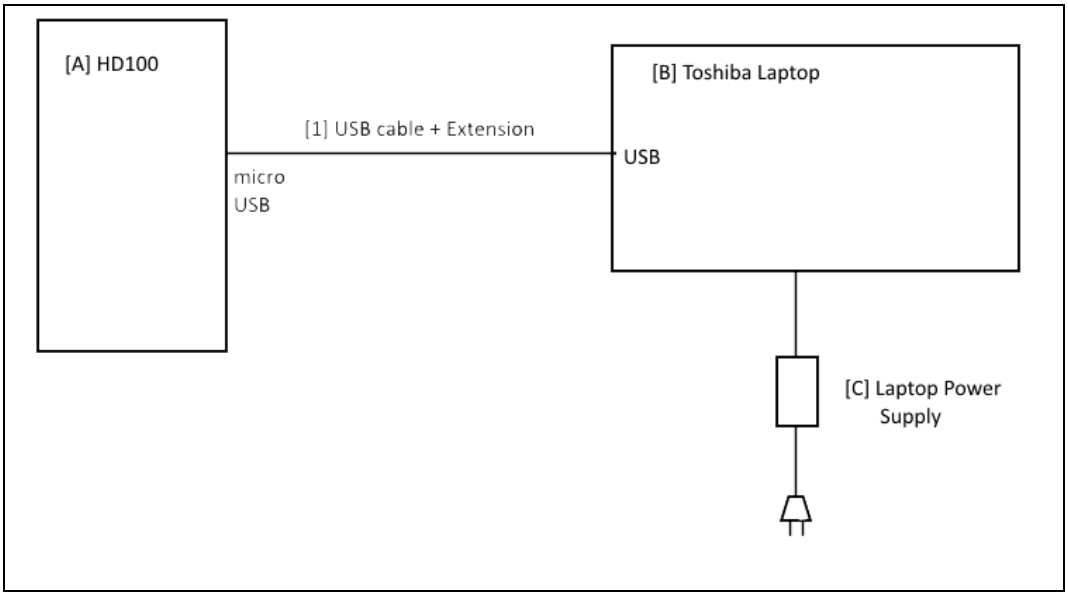


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
A	HD100 EUT	HD100	--	--	2.0

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
B	Laptop with BlueTest3	Toshiba	Satellite
C	Laptop Power Supply	--	--

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	Data	Micro USB cable with 10m extension	1	10.5	Yes	--

Table 6. Ports and Cabling Information

H. Mode of Operation

The EUT can be set up using the HD100Tester software included on the laptop. Once the EUT is set into the desired mode, it can be disconnected from the laptop and will continue to run in that mode until reset by plugging in a live USB cable.

- Simulation Mode with frequency hopping in GFSK. Multiple data packet types could be selected.
- Simulation Mode with frequency hopping in DQPSK. Multiple data packet types could be selected.
- Simulation Mode with frequency hopping in 8DPSK. Multiple data packet types could be selected.
- Channel Mode with lower, middle, or highest channel selected. Multiple data packet types could be selected.

In any modes, the output power can be selected from -32dBm to +4dBm.

I. Method of Monitoring EUT Operation

When the EUT is set up correctly, the HD100Tester software "Start" button changes to "Update" to allow you to change the parameters. When it is plugged in to the USB connector, the LED will be orange if charging and green if fully charged. If the EUT is in either simulation or channel test mode, the LED will remain lit after disconnecting. If the EUT is not in a test mode, the LED will shut off after disconnecting the USB.

J. Modifications

a) Modifications to EUT
No modifications were made to the EUT.

b) Modifications to Test Standard
No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Sound World Solutions upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency range (MHz)	Class A Conducted Limits (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

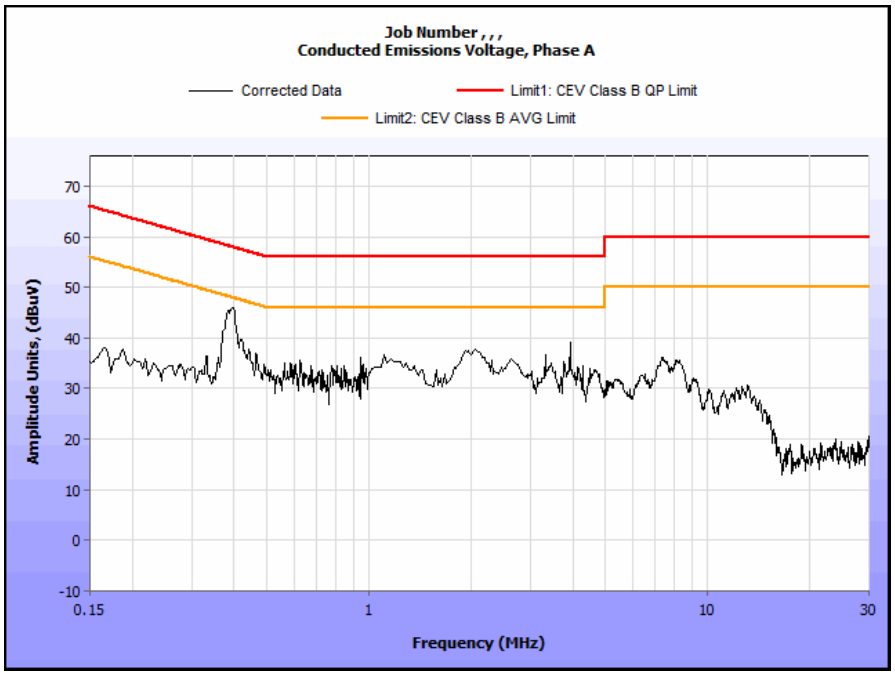
Test Engineer(s): Djed Mouada

Test Date(s): 11/24/14

Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.173	41.52	0	41.52	64.82	-23.3	25.79	0	25.79	54.82	-29.03
0.3883	45.14	0	45.14	58.1	-12.96	26.39	0	26.39	48.1	-21.71
0.7047	32.05	0	32.05	56	-23.95	16.75	0	16.75	46	-29.25
1.968	39.69	0	39.69	56	-16.31	19.2	0	19.2	46	-26.8
12.12	31.66	0	31.66	60	-28.34	10.92	0	10.92	50	-39.08
24.01	21.27	0	21.27	60	-38.73	11.68	0	11.68	50	-38.32

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

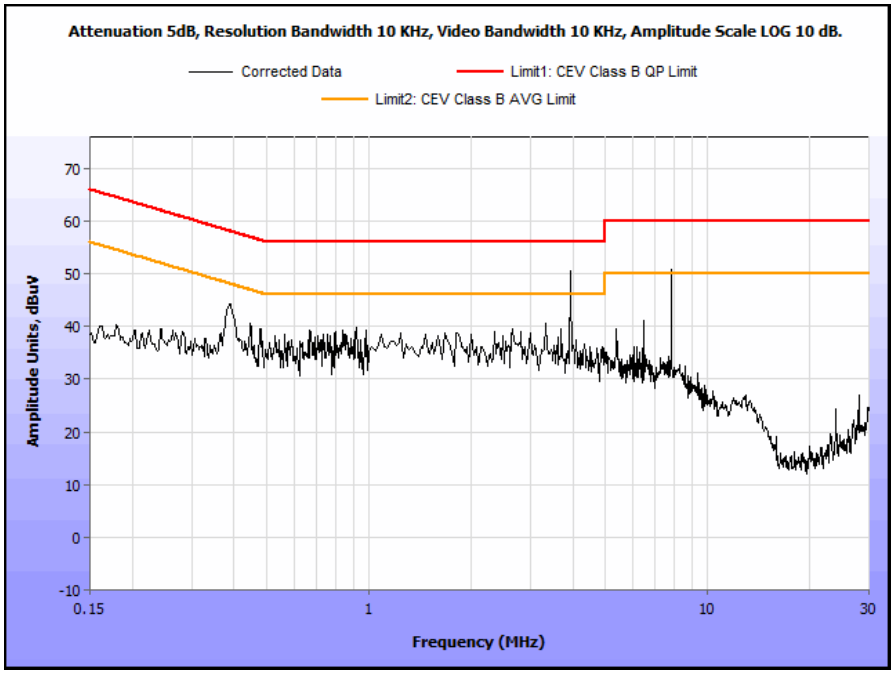


Plot 1. Conducted Emissions, Phase Line

Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.2662	27.91	0	27.91	61.24	-33.33	13.28	0	13.28	51.24	-37.96
0.3908	35.53	0	35.53	58.05	-22.52	20.05	0	20.05	48.05	-28
0.6432	26.75	0	26.75	56	-29.25	11.83	0	11.83	46	-34.17
3.925	53.24	0	53.24	56	-2.76	17.11	0	17.11	46	-28.89
12.13	29.17	0	29.17	60	-30.83	9.27	0	9.27	50	-40.73
29.77	25.75	0	25.75	60	-34.25	7.303	0	7.303	50	-42.697

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)



Plot 2. Conducted Emissions, Neutral Line

Conducted Emissions Limits Test Setup

Photograph 1. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 10.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 10.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 10. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

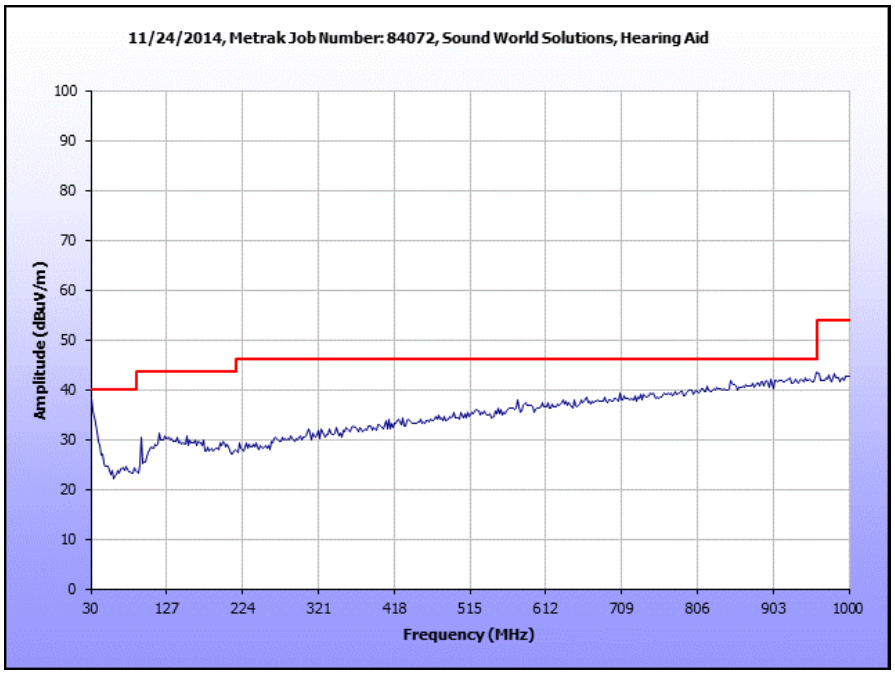
Test Engineer(s): Djed Mouada

Test Date(s): 11/24/14

Radiated Emissions Limits Test Results, Class B

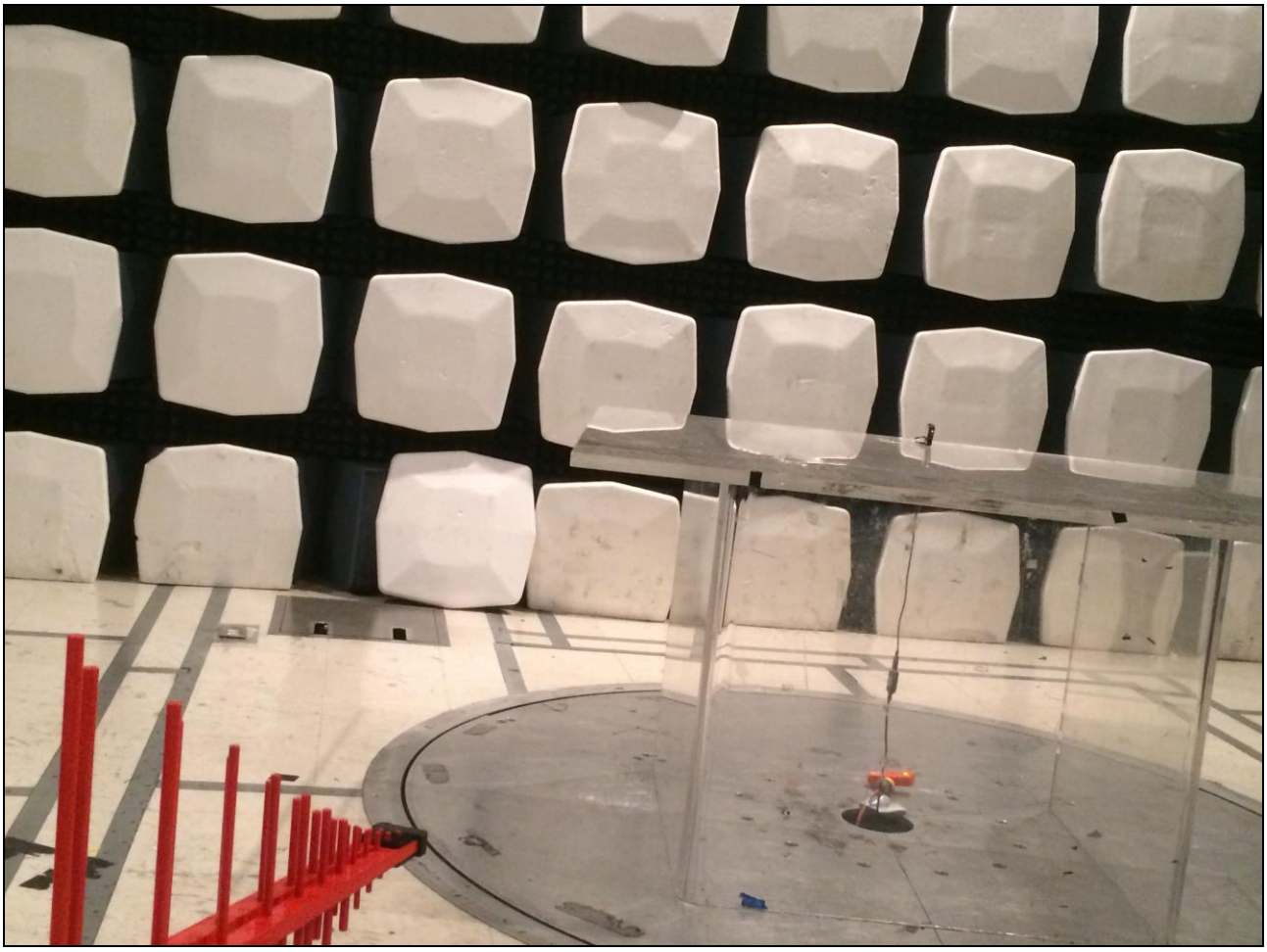
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBµV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
48.489203	281	H	1.82	10.93	9.46	-20.53	0.00	-0.14	40.00	-40.14
48.489203	303	V	2.20	11.06	9.46	-20.53	0.00	-0.01	40.00	-40.01
123.5	34	H	1.55	11.22	14.25	-20.24	0.00	5.23	43.50	-38.27
123.5	162	V	1.57	11.25	14.25	-20.24	0.00	5.26	43.50	-38.24
215.03006	344	H	1.77	8.05	11.40	-19.88	0.00	-0.43	43.50	-43.93
215.03006	235	V	1.70	8.04	11.40	-19.88	0.00	-0.44	43.50	-43.94
370.94188	63	H	1.90	7.53	15.62	-19.34	0.00	3.81	46.00	-42.19
370.94188	68	V	2.02	7.65	15.62	-19.34	0.00	3.93	46.00	-42.07
682.36473	208	H	2.21	9.93	20.80	-19.99	0.00	10.74	46.00	-35.26
682.36473	358	V	2.15	9.94	20.80	-19.99	0.00	10.75	46.00	-35.25
888.17635	250	H	2.01	11.03	22.86	-19.57	0.00	14.32	46.00	-31.68
888.17635	203	V	1.81	11.05	22.86	-19.57	0.00	14.34	46.00	-31.66

Table 11. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz



Plot 3. Radiated Emissions, Pre-Scan, 30 MHz – 1 GHz

Radiated Emissions Limits Test Setup



Photograph 2. Radiated Emissions, Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203. The EUT has an integral antenna.

Test Engineer(s): Djed Mouada

Test Date(s): 11/17/14

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 12. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were below applicable limits.

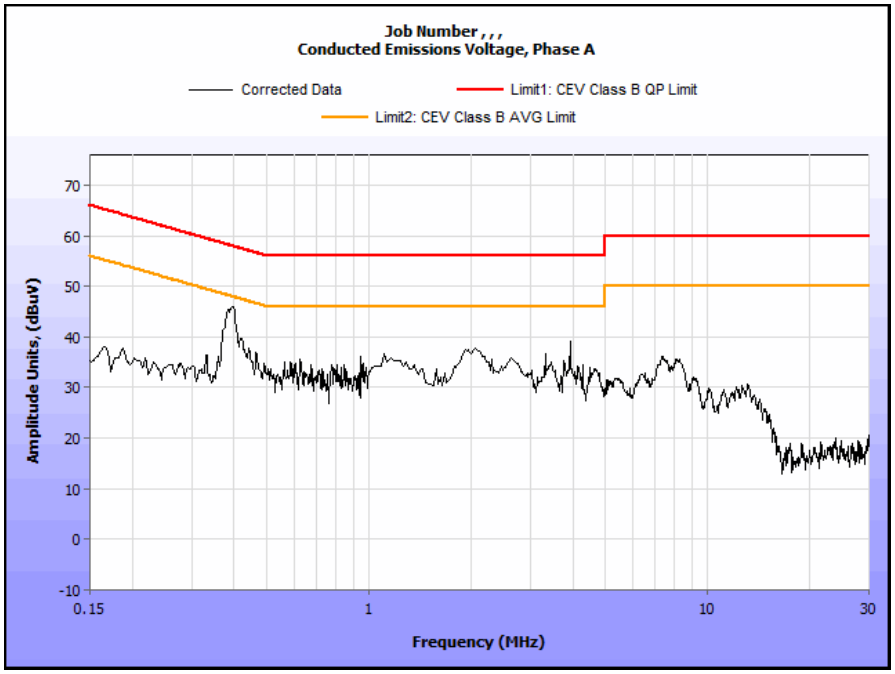
Test Engineer(s): Djed Mouada

Test Date(s): 11/24/14

15.207(a) Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.173	41.52	0	41.52	64.82	-23.3	25.79	0	25.79	54.82	-29.03
0.3883	45.14	0	45.14	58.1	-12.96	26.39	0	26.39	48.1	-21.71
0.7047	32.05	0	32.05	56	-23.95	16.75	0	16.75	46	-29.25
1.968	39.69	0	39.69	56	-16.31	19.2	0	19.2	46	-26.8
12.12	31.66	0	31.66	60	-28.34	10.92	0	10.92	50	-39.08
24.01	21.27	0	21.27	60	-38.73	11.68	0	11.68	50	-38.32

Table 13. Conducted Emissions, 15.207(a), Phase Line, Test Results

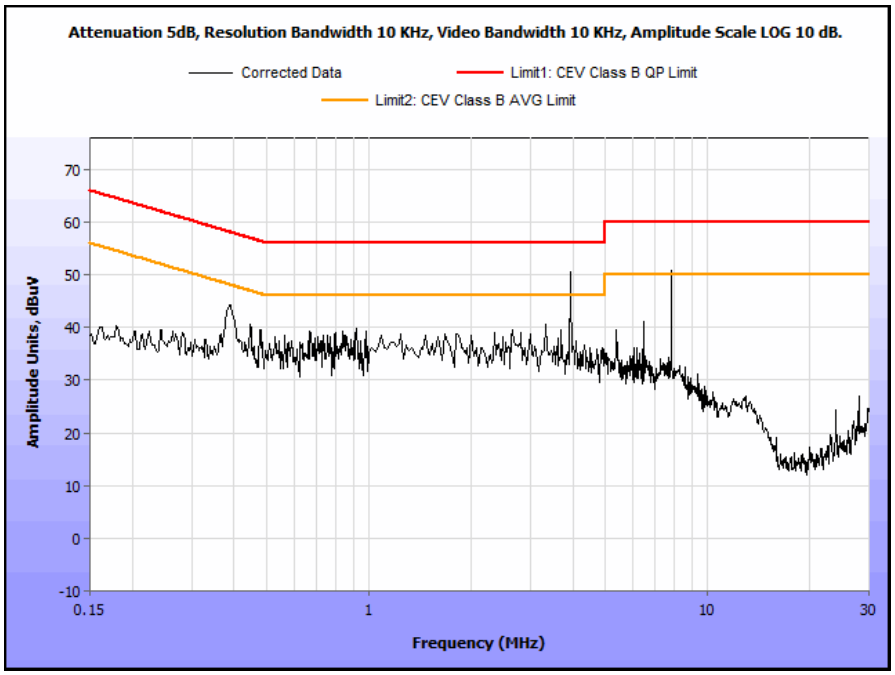


Plot 4. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.2662	27.91	0	27.91	61.24	-33.33	13.28	0	13.28	51.24	-37.96
0.3908	35.53	0	35.53	58.05	-22.52	20.05	0	20.05	48.05	-28
0.6432	26.75	0	26.75	56	-29.25	11.83	0	11.83	46	-34.17
3.925	53.24	0	53.24	56	-2.76	17.11	0	17.11	46	-28.89
12.13	29.17	0	29.17	60	-30.83	9.27	0	9.27	50	-40.73
29.77	25.75	0	25.75	60	-34.25	7.303	0	7.303	50	-42.697

Table 14. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Plot 5. Conducted Emissions, 15.207(a), Neutral Line

15.207(a) Conducted Emissions Test Setup

Photograph 3. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(1) 20 dB Occupied Bandwidth

Test Requirements: **§15.247(a):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

§15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure: The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth. The 20 dB bandwidth was measured and recorded.

Test Results The EUT was compliant with § 15.247 (a)(1).

Test Engineer(s): Djed Mouada

Test Date(s): 11/18/14

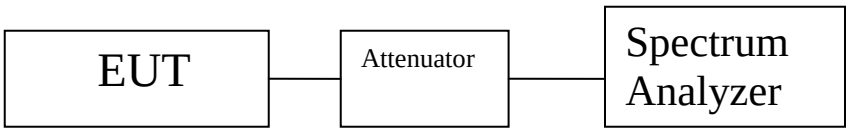
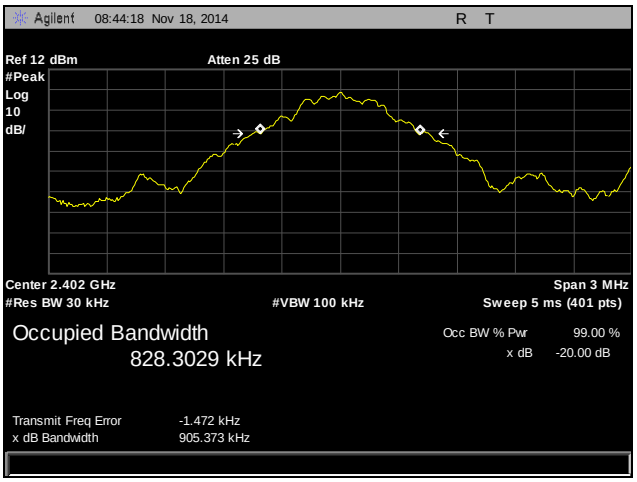
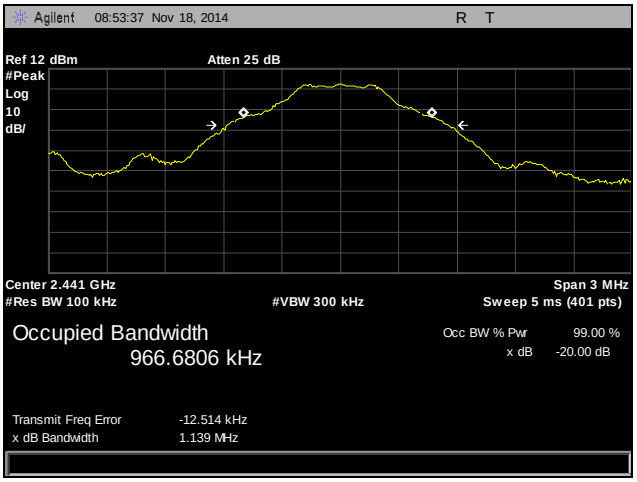


Figure 2. Block Diagram, Occupied Bandwidth Test Setup

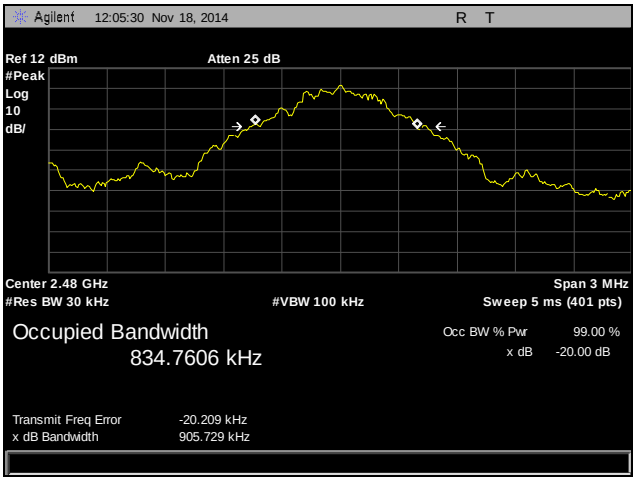
20 dB Occupied Bandwidth, GFSK



Plot 6. 20 dB Occupied Bandwidth, Low Channel, GFSK

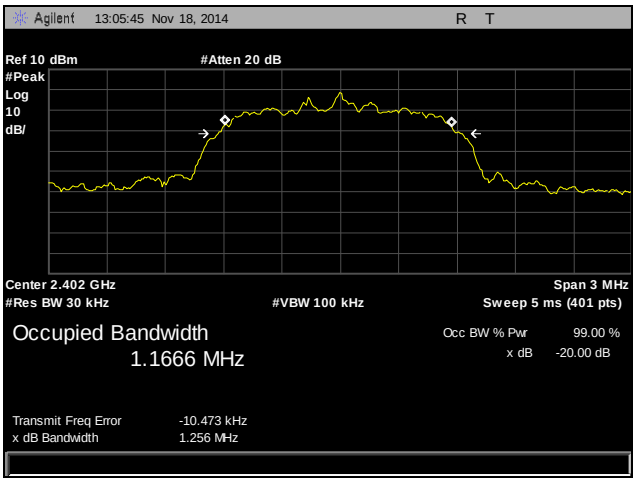


Plot 7. 20 dB Occupied Bandwidth, Mid Channel, GFSK

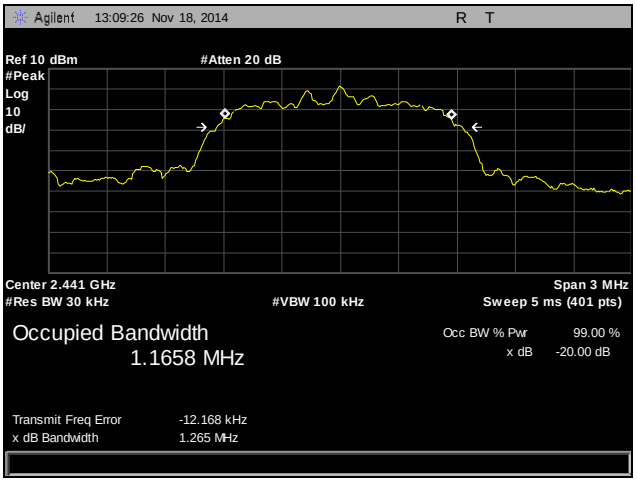


Plot 8. 20 dB Occupied Bandwidth, High Channel, GFSK

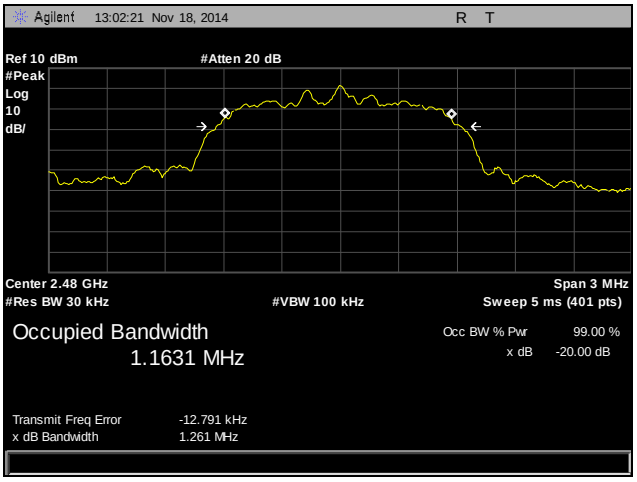
20 dB Occupied Bandwidth, DQPSK



Plot 9. 20 dB Occupied Bandwidth, Low Channel, DQPSK

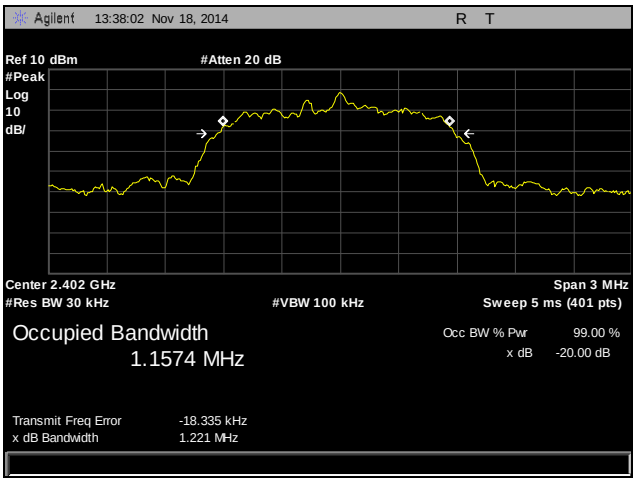


Plot 10. 20 dB Occupied Bandwidth, Mid Channel, DQPSK

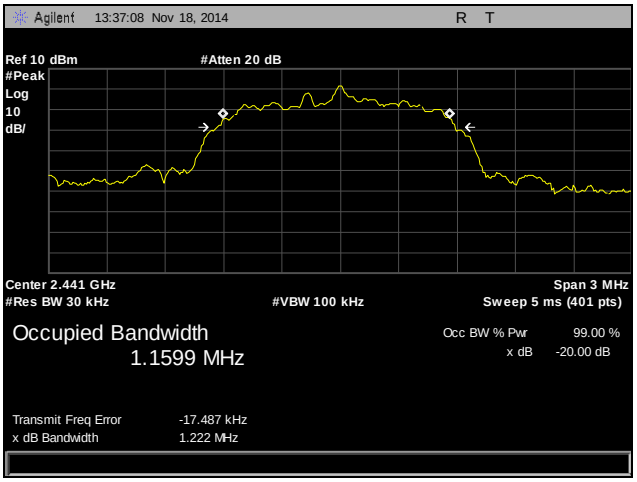


Plot 11. 20 dB Occupied Bandwidth, High Channel, DQPSK

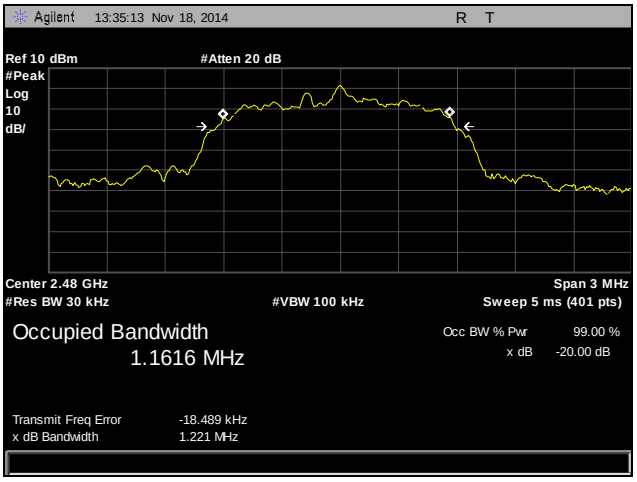
20 dB Occupied Bandwidth, 8DPSK



Plot 12. 20 dB Occupied Bandwidth, Low Channel, 8DPSK

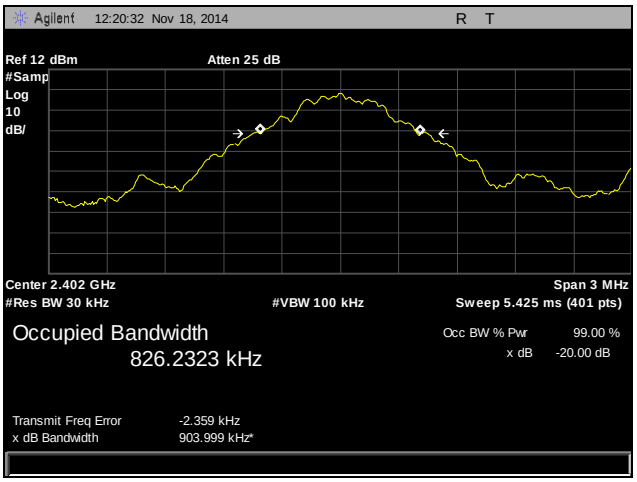


Plot 13. 20 dB Occupied Bandwidth, Mid Channel, 8DPSK

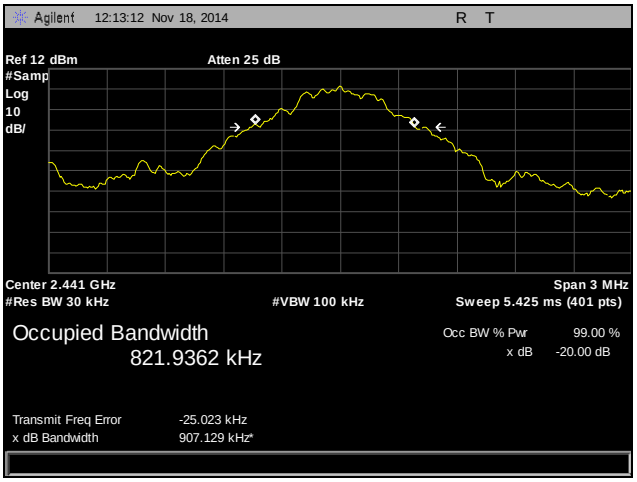


Plot 14. 20 dB Occupied Bandwidth, High Channel, 8DPSK

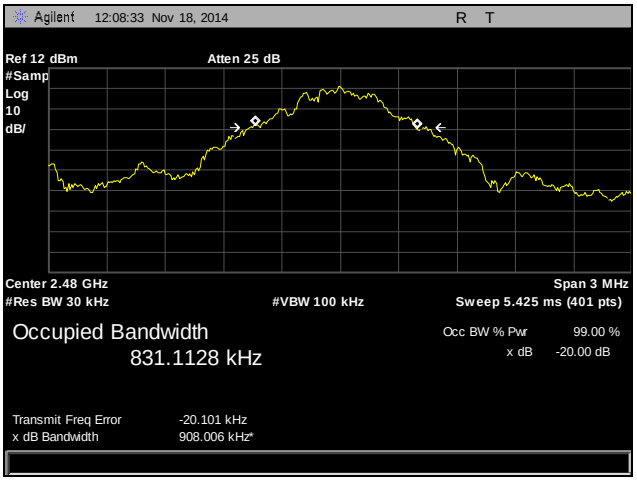
99% Occupied Bandwidth, GFSK



Plot 15. 99% Occupied Bandwidth, Low Channel, GFSK

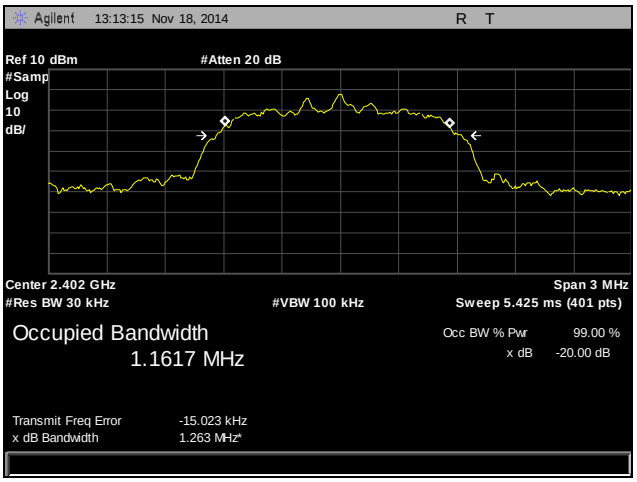


Plot 16. 99% Occupied Bandwidth, Mid Channel, GFSK

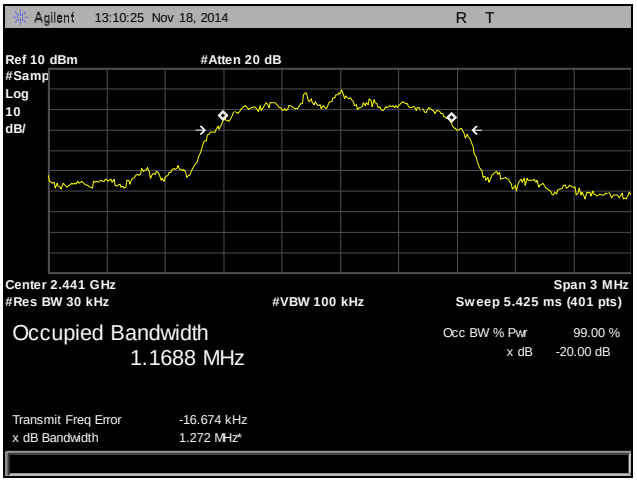


Plot 17. 99% Occupied Bandwidth, High Channel, GFSK

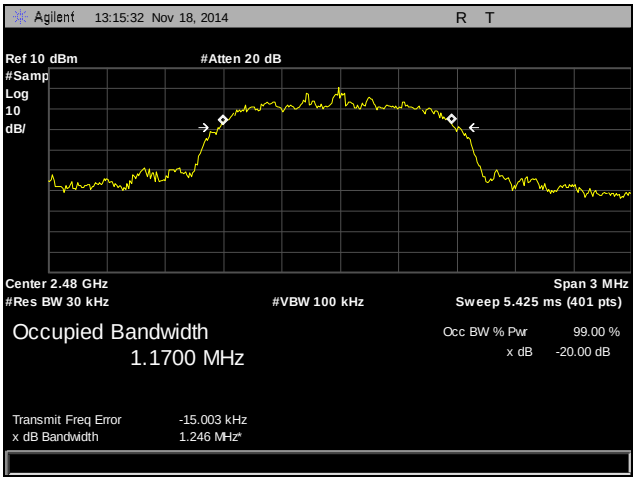
99% Occupied Bandwidth, DQPSK



Plot 18. 99% Occupied Bandwidth, Low Channel, DQPSK

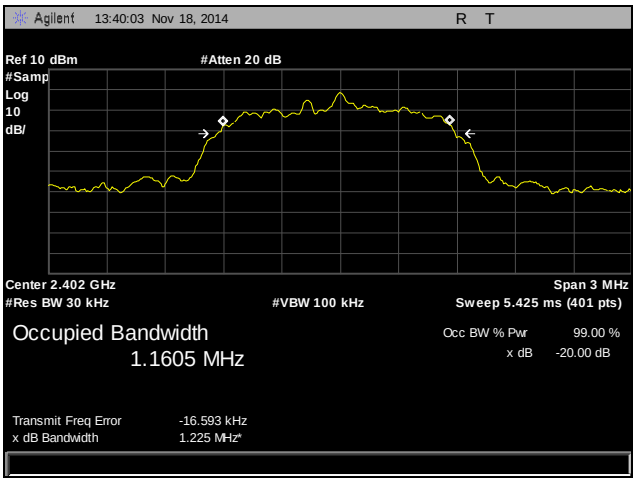


Plot 19. 99% Occupied Bandwidth, Mid Channel, DQPSK

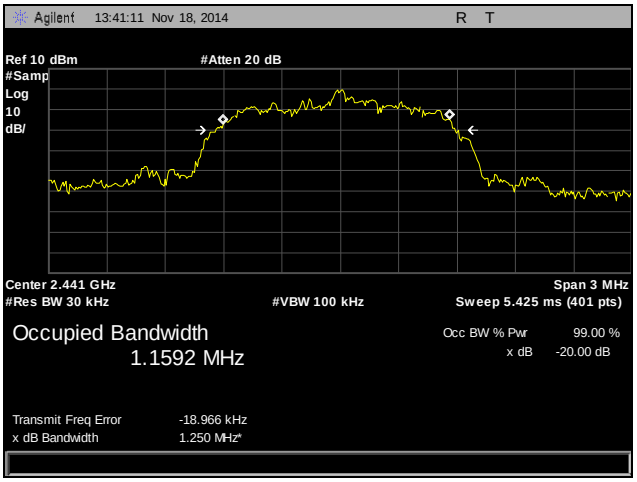


Plot 20. 99% Occupied Bandwidth, High Channel, DQPSK

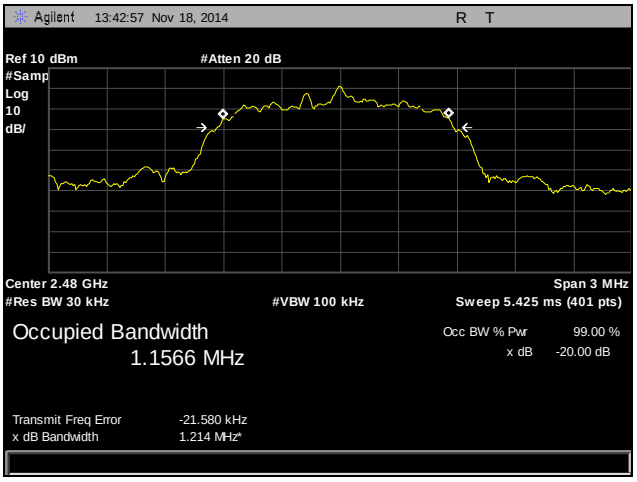
99% Occupied Bandwidth, 8DPSK



Plot 21. 99% Occupied Bandwidth, Low Channel, 8DPSK



Plot 22. 99% Occupied Bandwidth, Mid Channel, 8DPSK



Plot 23. 99% Occupied Bandwidth, High Channel, 8DPSK

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(1)(iii) No. of channels and Average Time of Occupancy (Dwell Time)

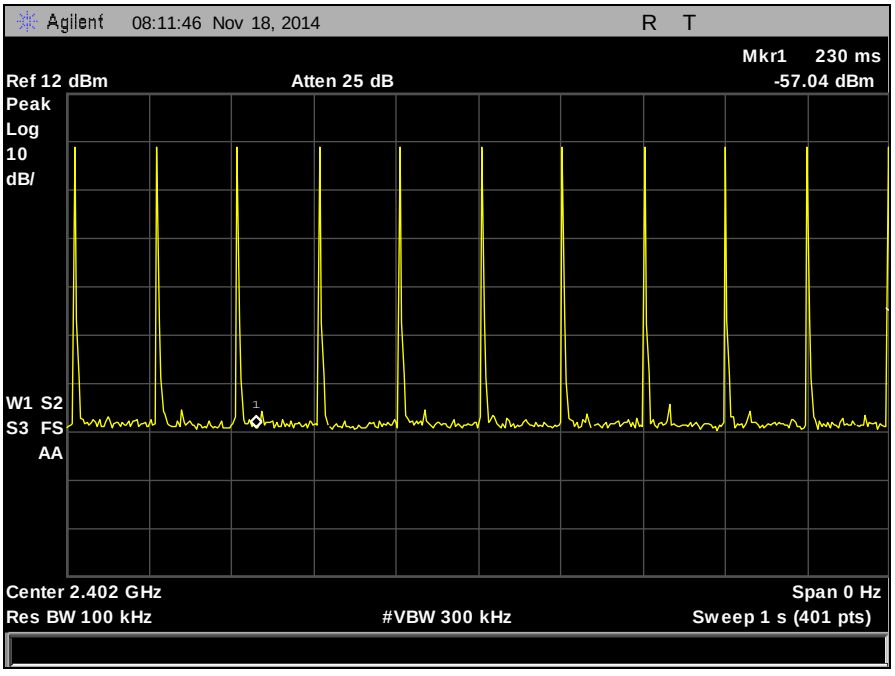
Remarks: Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Total number of hopping channels is 79. The EUT meets the specifications of Section 15.247(a) (1) (iii) for Number of Hopping Channels (plots 30-32).

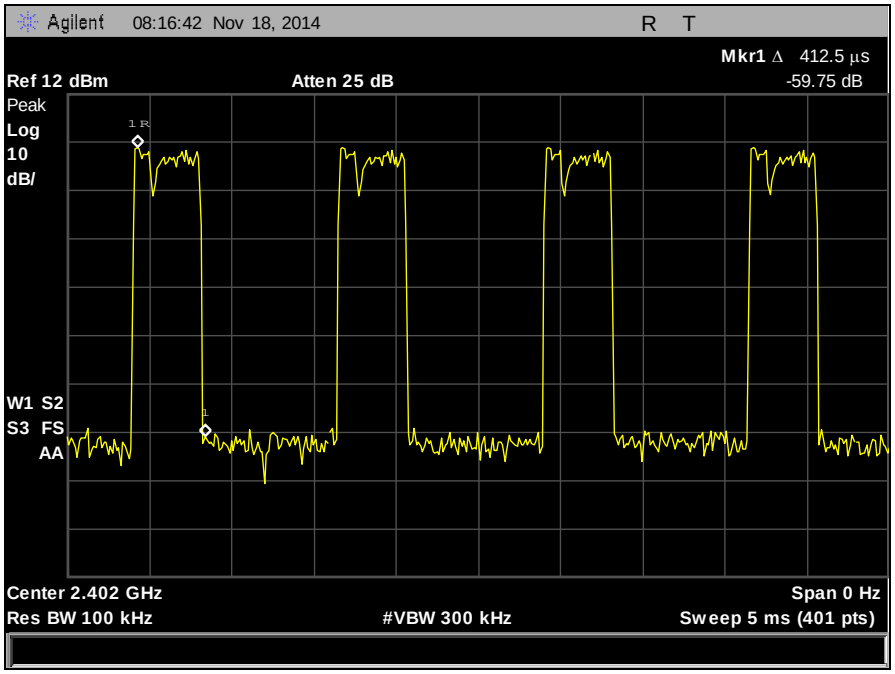
Dwell Time:

Modulation	On Time (ms)	No. of times channel appears in 31.6 sec window	Dwell Time (sec)	Limit (sec)
GFSK	0.4125	348	0.14	0.4
DQPSK	3.037	95	0.29	0.4
8DPSK	3.038	95	0.29	0.4

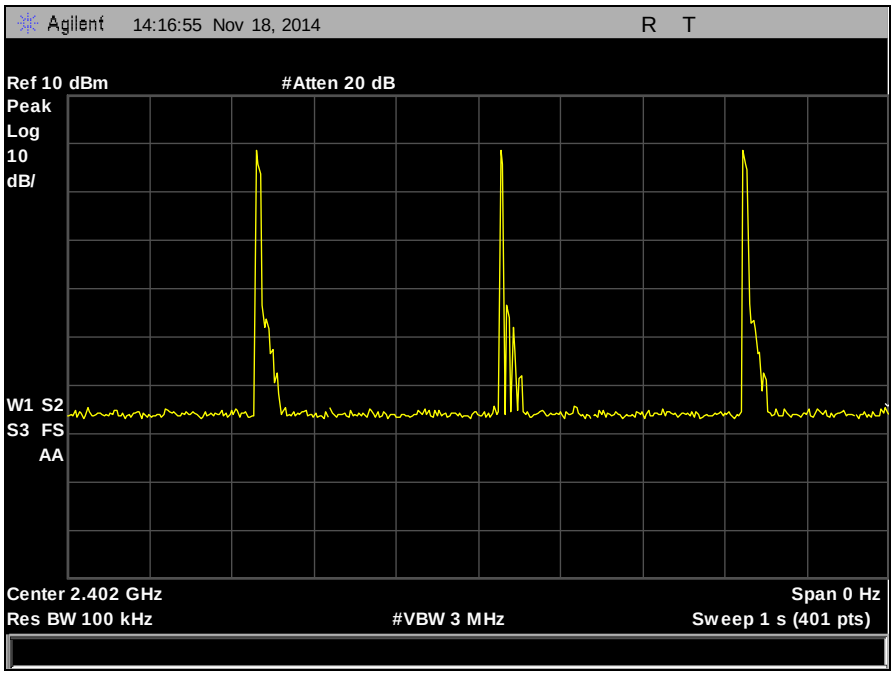
Table 15. Number of Channels and Dwell Time, Test Results



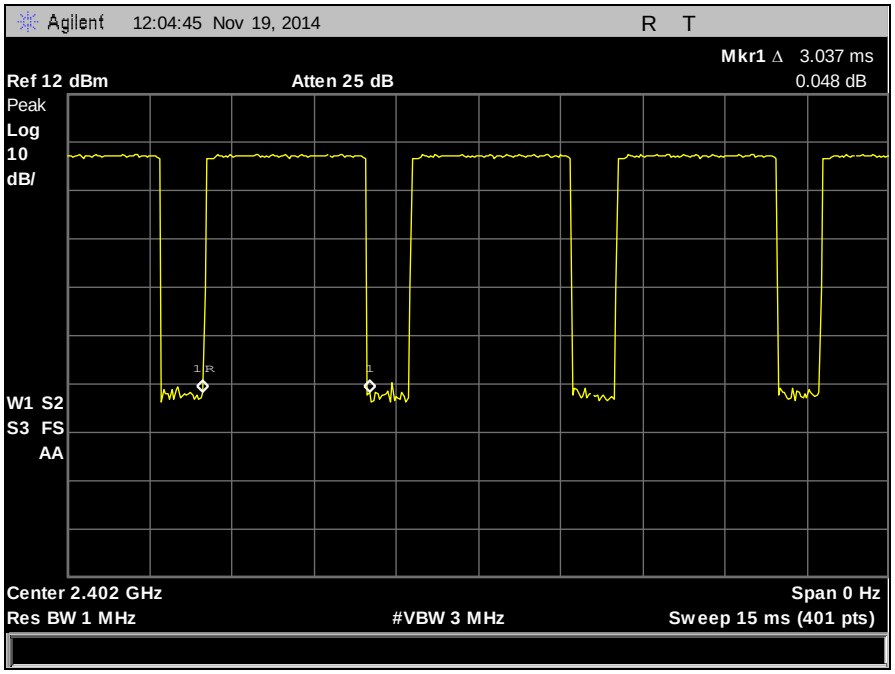
Plot 24. Dwell Time, GFSK, 1s Sweep



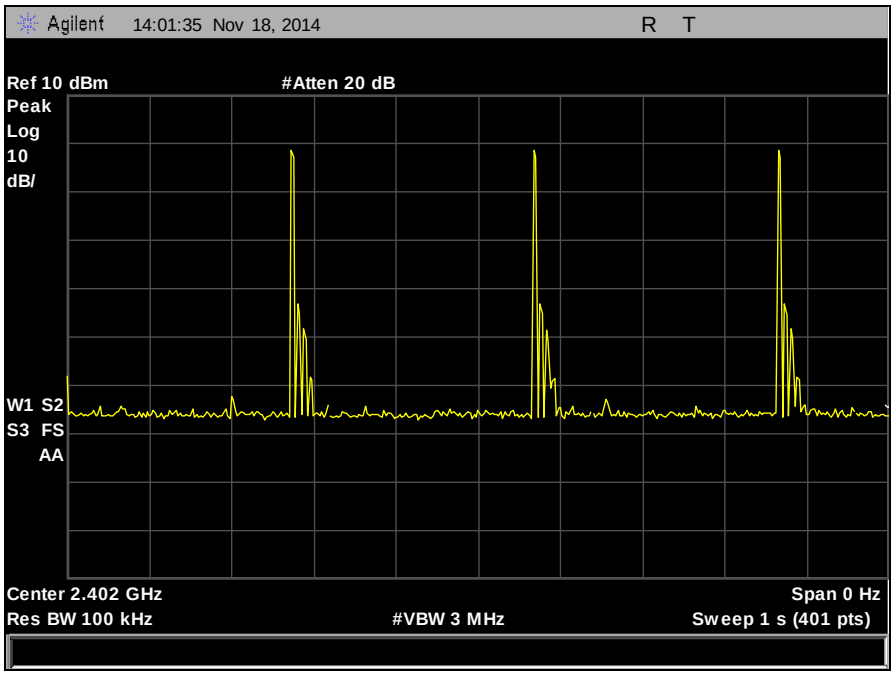
Plot 25. Dwell Time, GFSK, On Time



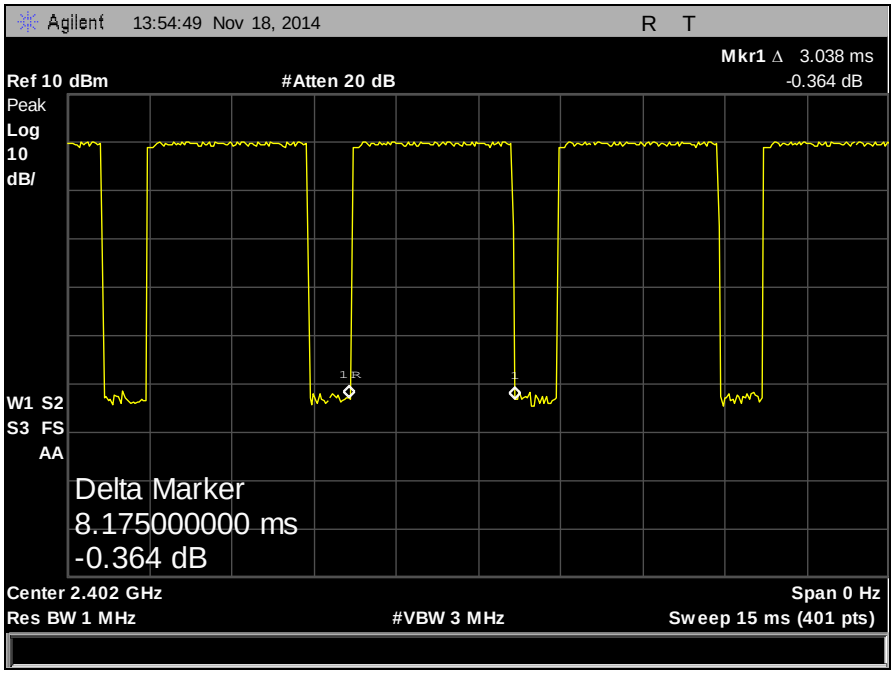
Plot 26. Dwell Time, DQPSK, 1s Sweep



Plot 27. Dwell Time, DQPSK, On Time



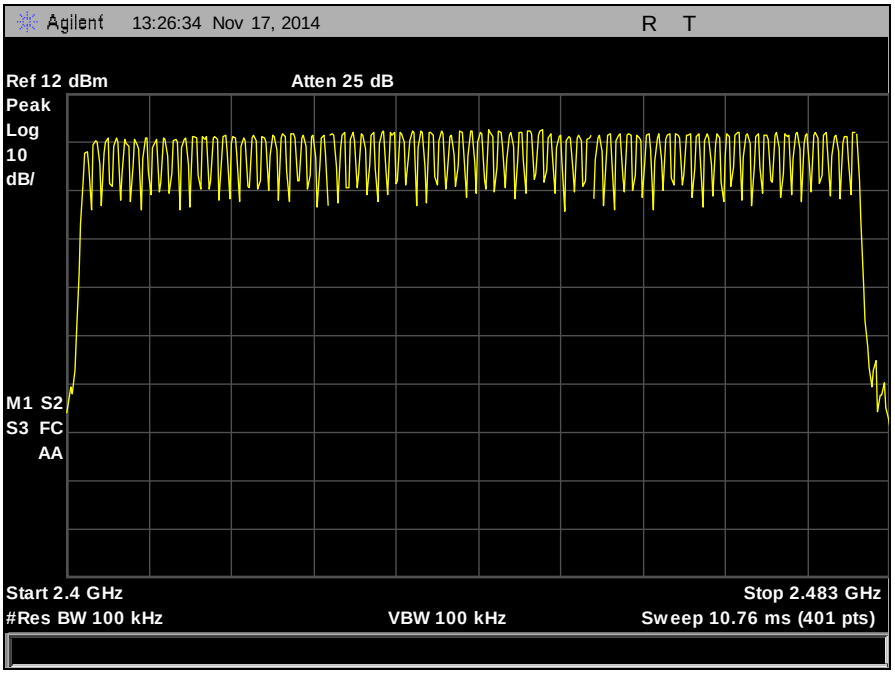
Plot 28. Dwell Time, 8DPSK, 1s Sweep



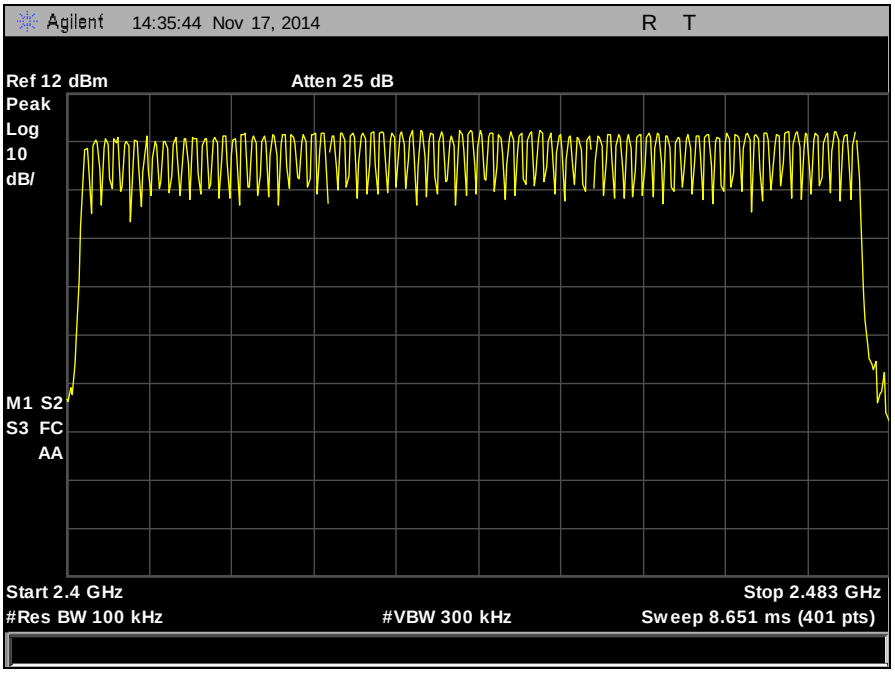
Plot 29. Dwell Time, 8DPSK, On Time

Electromagnetic Compatibility Criteria for Intentional Radiators

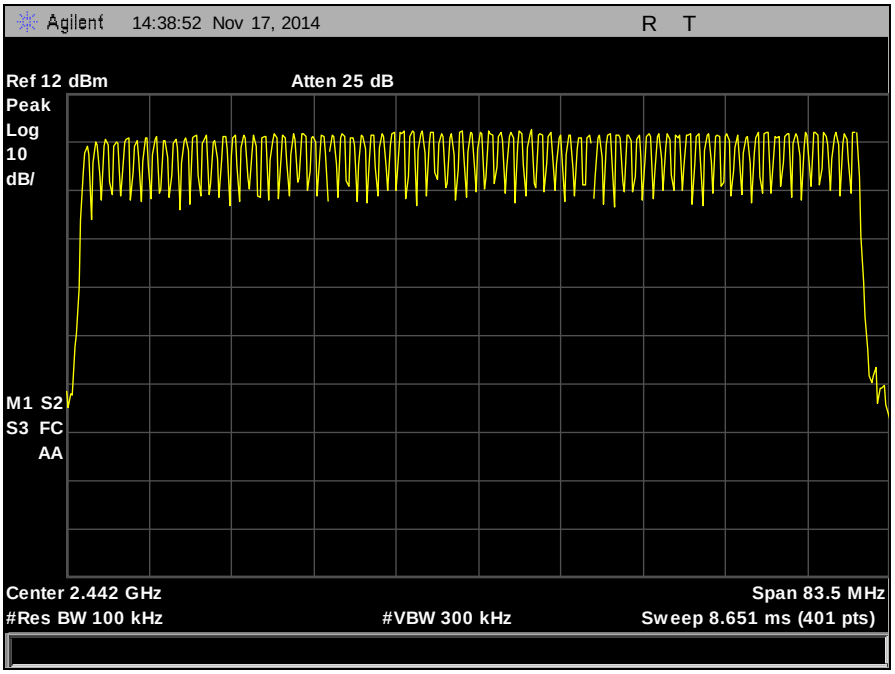
§ 15.247(a)(1) Number of RF Channels



Plot 30. Number of Channels, GFSK



Plot 31. Number of Channels, DQPSK



Plot 32. Number of Channels, 8DPSK

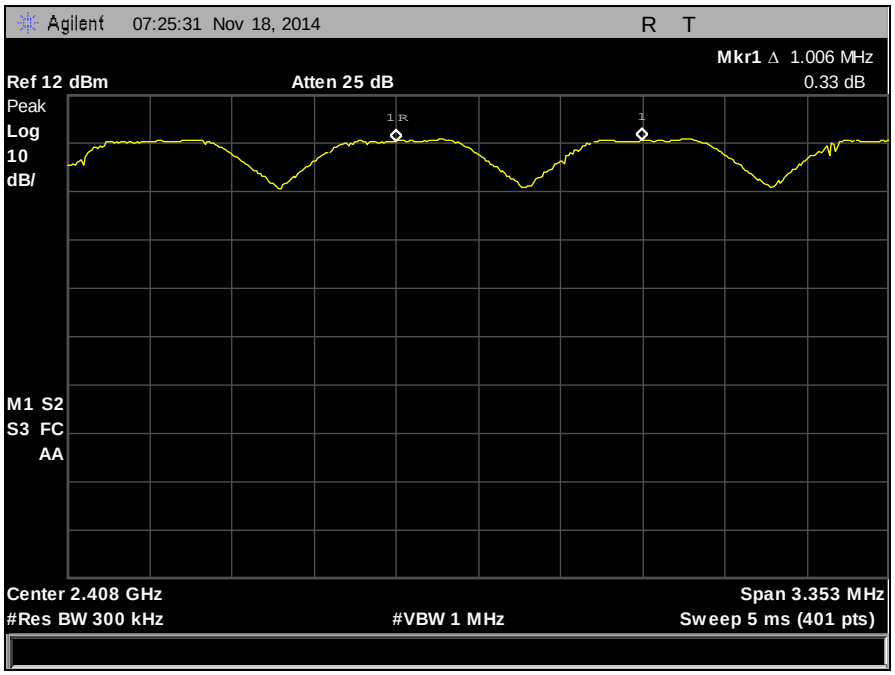
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(1) RF Channel Separation

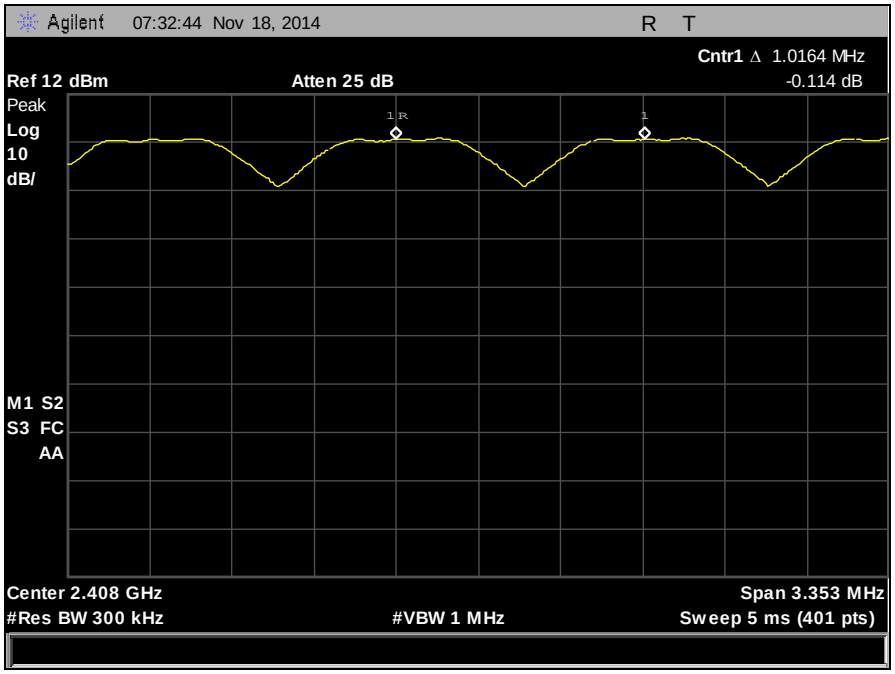
Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Remarks: EUT operates below 125mW (20dBm). Channels are separated by more than two thirds of the -20dB Bandwidth.

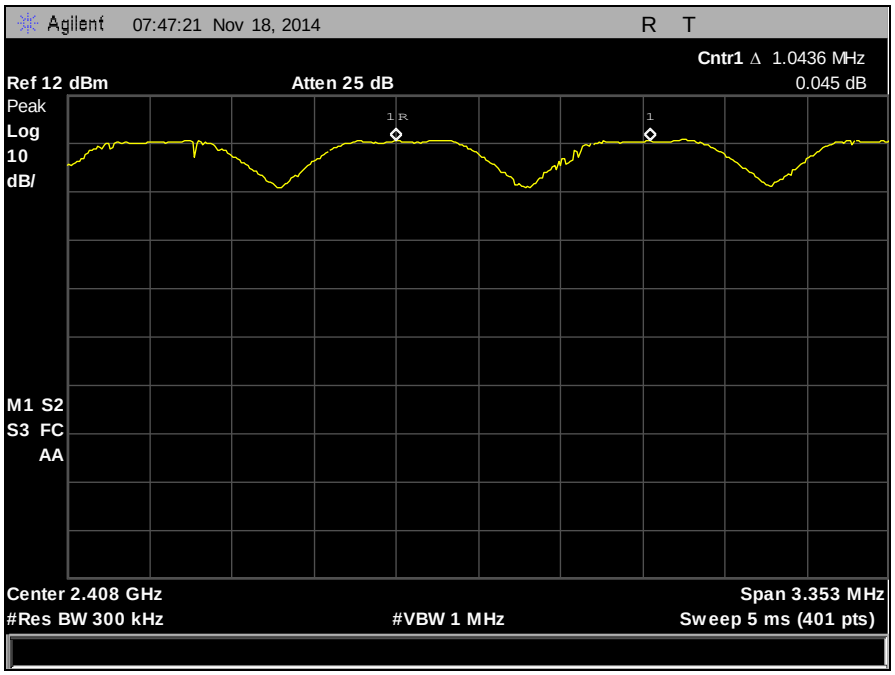
EDR – 2/3 *1.296 MHz (20dB Bandwidth) = 864 kHz Minimum Separation Distance



Plot 33. Channel Separation, GFSK



Plot 34. Channel Separation, DQPSK



Plot 35. Channel Separation, 8DPSK

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

Test Requirements: **§15.247(b)(1):** 1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

Test Procedure: The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band.

Test Results: The EUT was compliant with the Peak Power Output limits of **§15.247(b)**.

Test Engineer(s): Djed Mouada

Test Date(s): 11/19/14

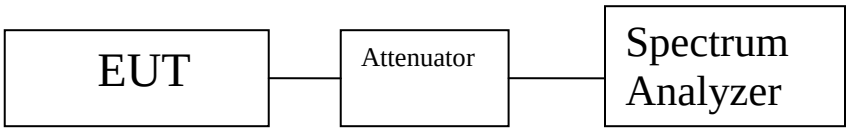
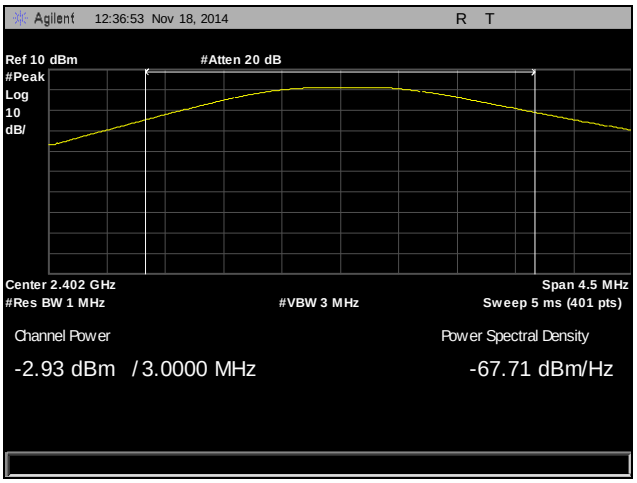
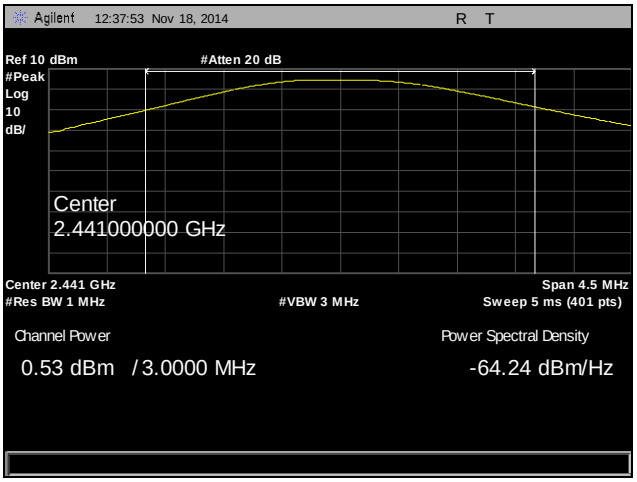


Figure 3. Peak Power Output Test Setup

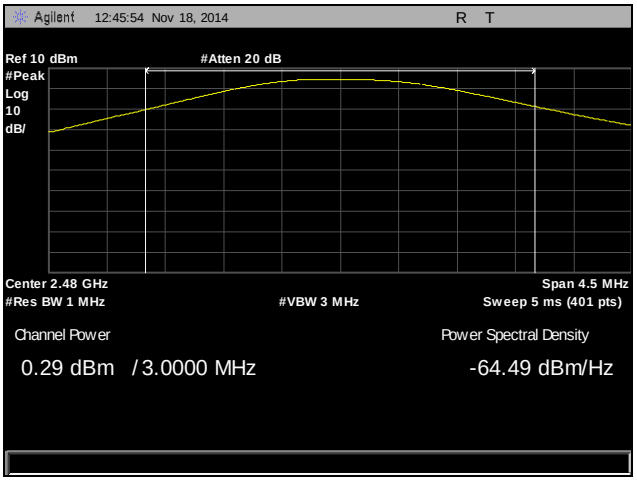
Peak Power Output Test Results, GFSK



Plot 36. Peak Power Output, Low Channel, GFSK

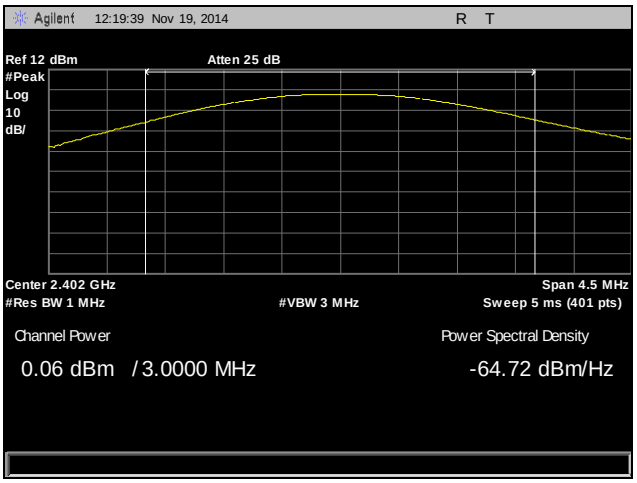


Plot 37. Peak Power Output, Mid Channel, GFSK

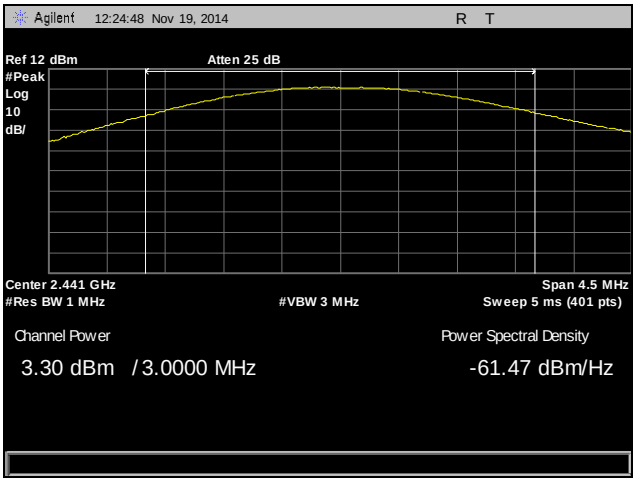


Plot 38. Peak Power Output, High Channel, GFSK

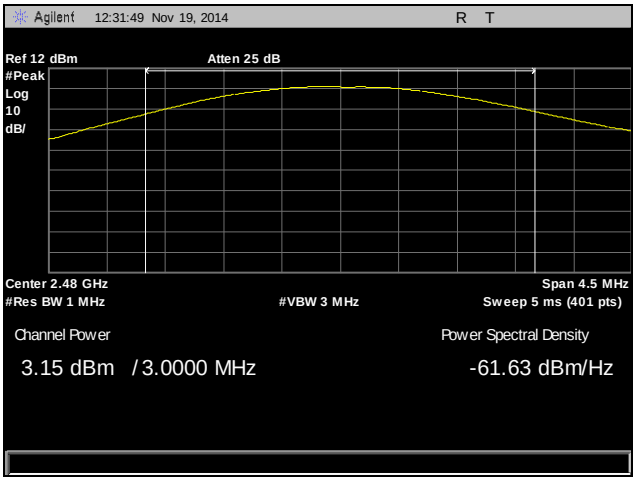
Peak Power Output Test Results, DQPSK



Plot 39. Peak Power Output, Low Channel, DQPSK

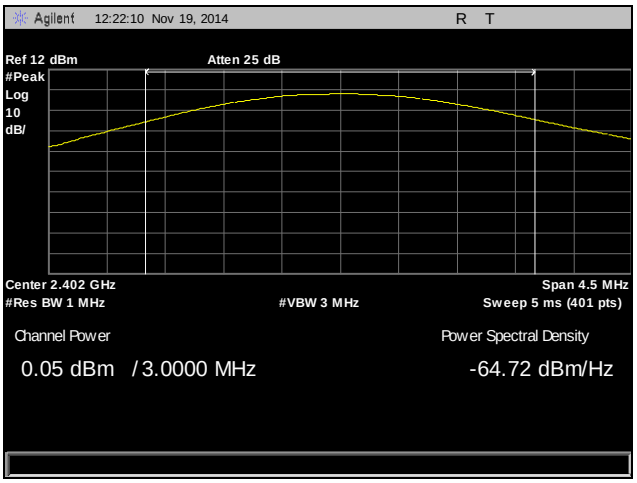


Plot 40. Peak Power Output, Mid Channel, DQPSK

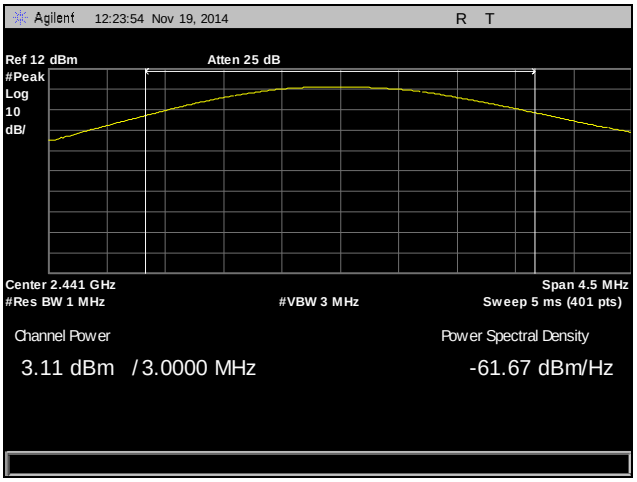


Plot 41. Peak Power Output, High Channel, DQPSK

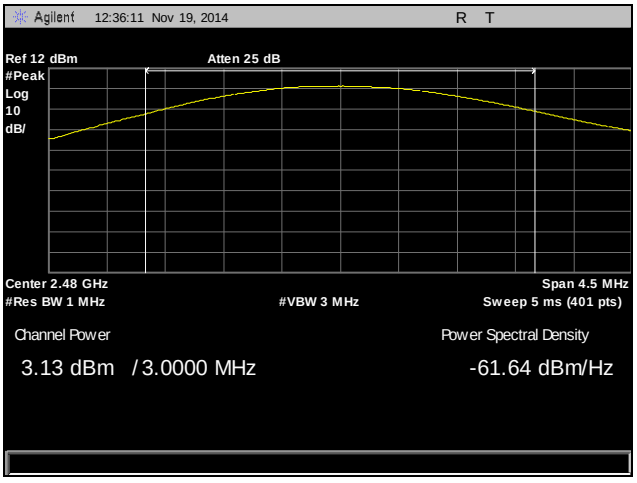
Peak Power Output Test Results, 8DPSK



Plot 42. Peak Power Output, Low Channel, 8DPSK



Plot 43. Peak Power Output, Mid Channel, 8DPSK



Plot 44. Peak Power Output, High Channel, 8DPSK

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: **§15.247(d); §15.205:** Emissions outside the frequency band.

§15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505----------	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905----------	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128----------	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775----------	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775----------	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218----------	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825----------	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225----------	123–138	2200–2300	14.47–14.5
8.291–8.294----------	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366----------	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675----------	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475----------	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293----------	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025----------	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725----------	322–335.4	3600–4400	([2])

Table 16. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 17.

Frequency (MHz)	§ 15.209(a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 17. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedure: The transmitter was set to the mid channel at the highest output power and placed on a 0.8 m high wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. Measurement were repeated the measurement at the low and highest channels.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

In accordance with §15.35(b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

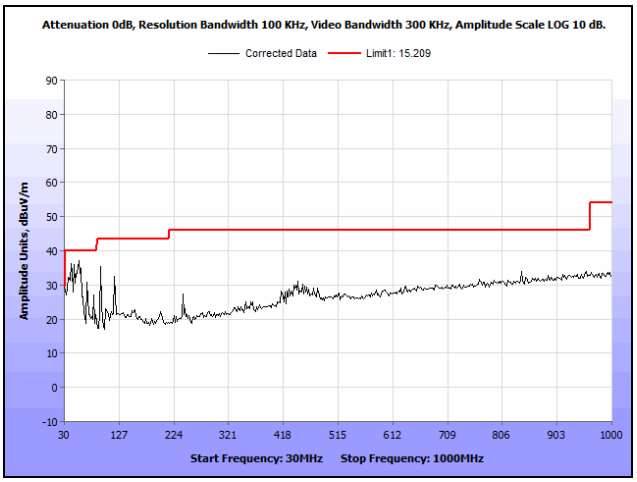
EUT Field Strength Final Amplitude = Raw Amplitude – Preamp gain + Antenna Factor + Cable Loss – Distance Correction Factor

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of **§15.247(d)**.

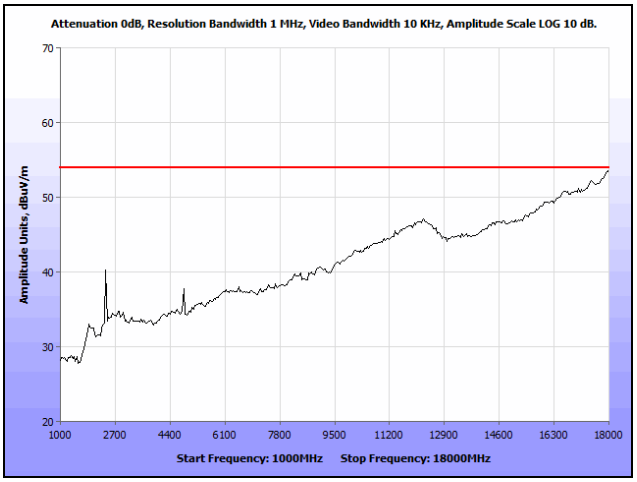
Test Engineer(s): Djed Mouada

Test Date(s): 11/24/14

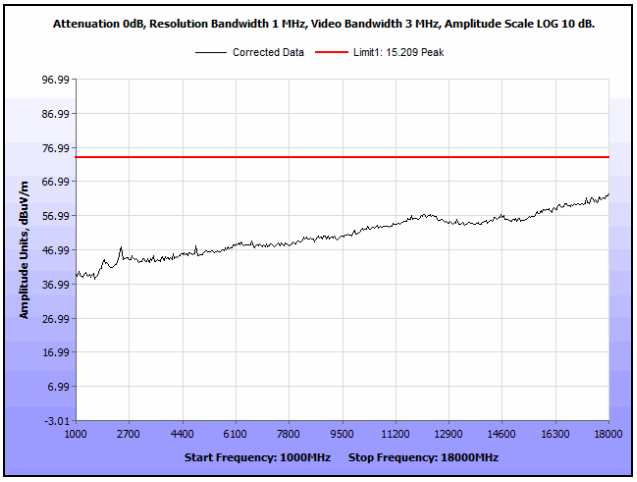
Radiated Spurious Emissions, GFSK



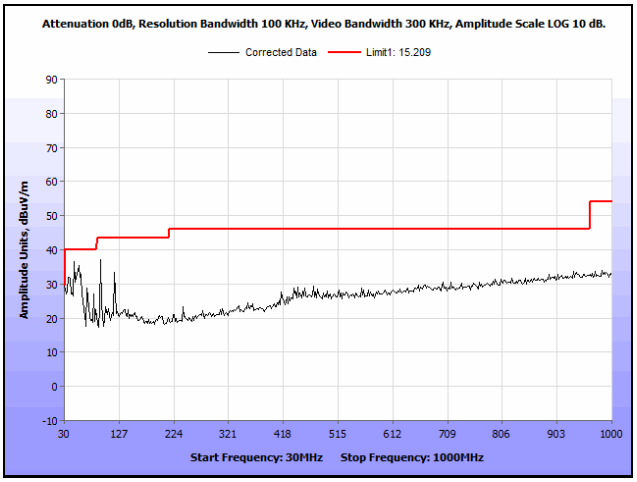
Plot 45. Radiated Spurious Emissions, Low Channel, GFSK, 30 MHz – 1 GHz



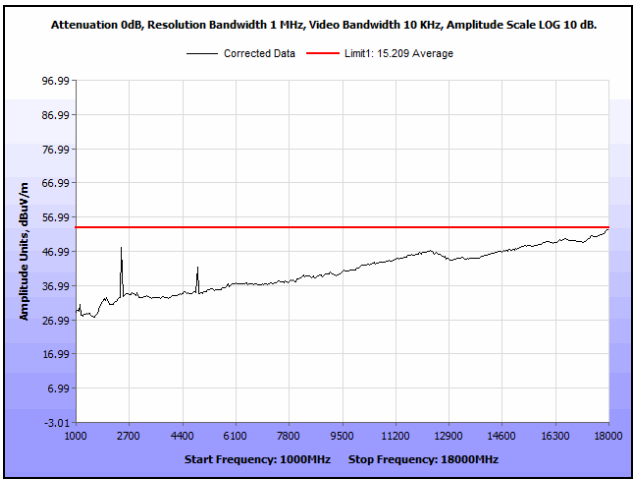
Plot 46. Radiated Spurious Emissions, Low Channel, GFSK, 1 GHz – 18 GHz, Average



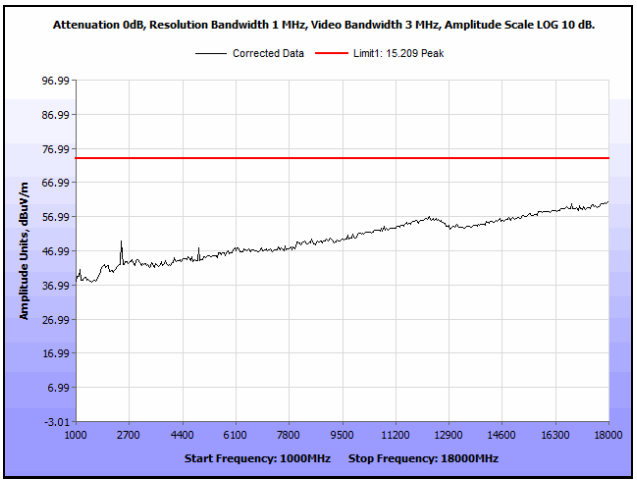
Plot 47. Radiated Spurious Emissions, Low Channel, GFSK, 1 GHz – 18 GHz, Peak



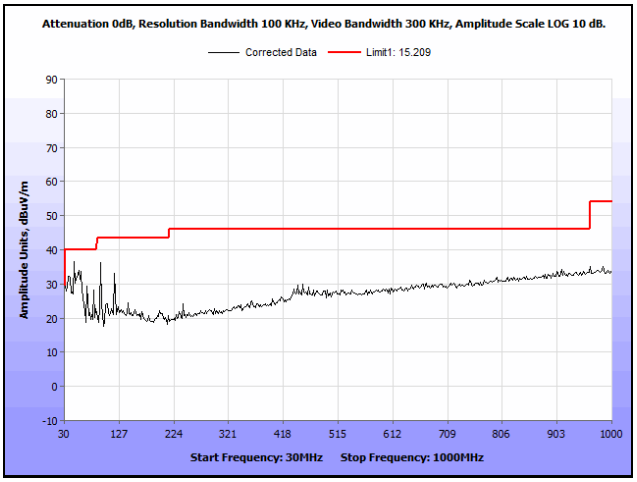
Plot 48. Radiated Spurious Emissions, Mid Channel, GFSK, 30 MHz – 1 GHz



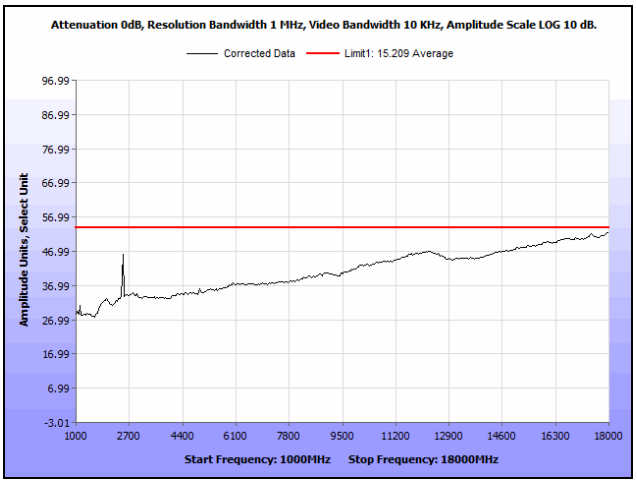
Plot 49. Radiated Spurious Emissions, Mid Channel, GFSK, 1 GHz – 18 GHz, Average



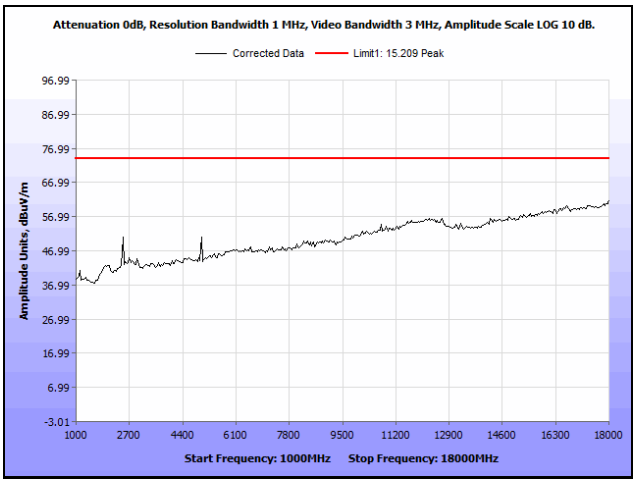
Plot 50. Radiated Spurious Emissions, Mid Channel, GFSK, 1 GHz – 18 GHz, Peak



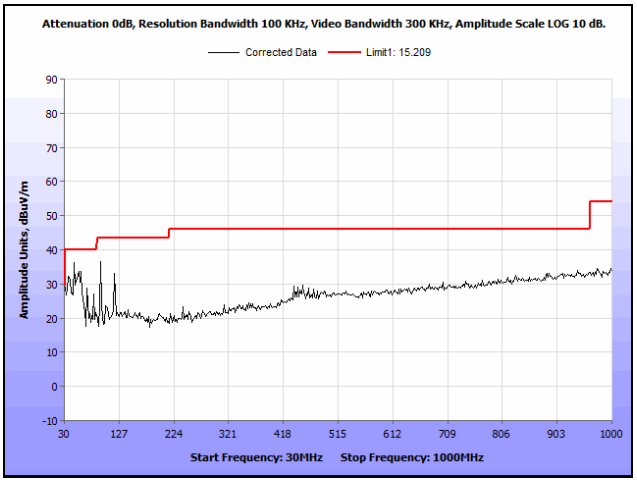
Plot 51. Radiated Spurious Emissions, High Channel, GFSK, 30 MHz – 1 GHz



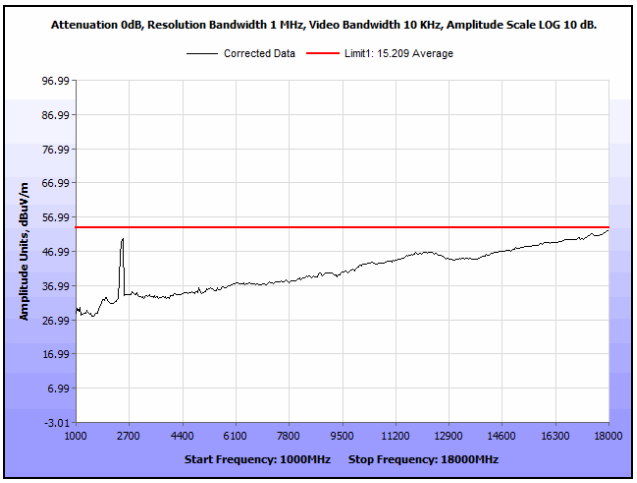
Plot 52. Radiated Spurious Emissions, High Channel, GFSK, 1 GHz – 18 GHz, Average



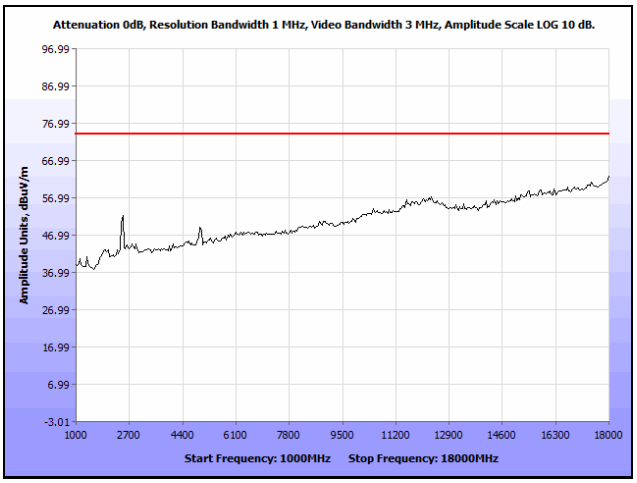
Plot 53. Radiated Spurious Emissions, High Channel, GFSK, 1 GHz – 18 GHz, Peak



Plot 54. Radiated Spurious Emissions, Hopping, GFSK, 30 MHz – 1 GHz

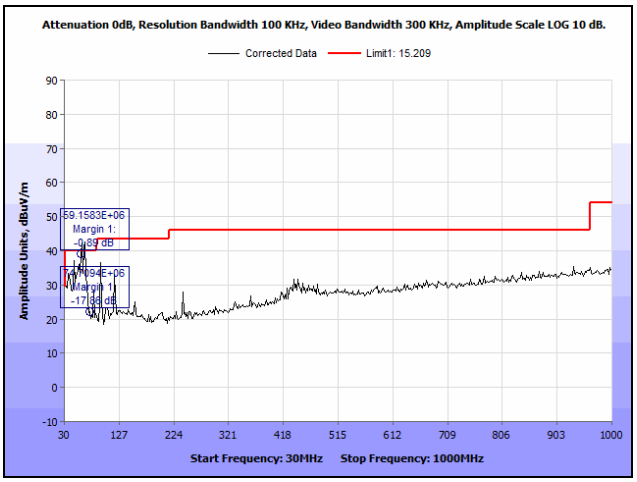


Plot 55. Radiated Spurious Emissions, Hopping, GFSK, 1 GHz – 18 GHz, Average

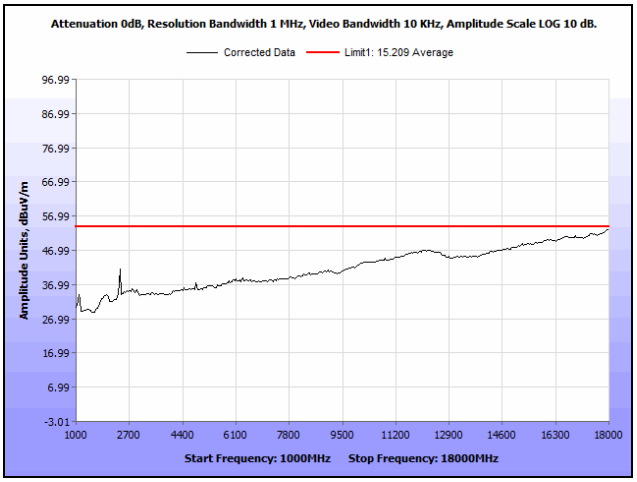


Plot 56. Radiated Spurious Emissions, Hopping, GFSK, 1 GHz – 18 GHz, Peak

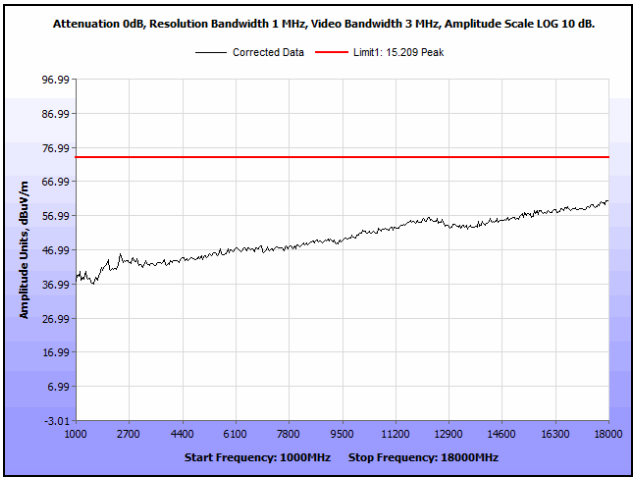
Radiated Spurious Emissions, DQPSK



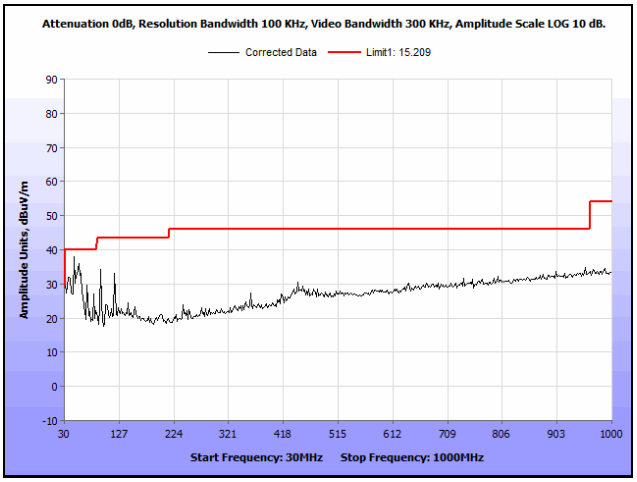
Plot 57. Radiated Spurious Emissions, Low Channel, DQPSK, 30 MHz – 1 GHz



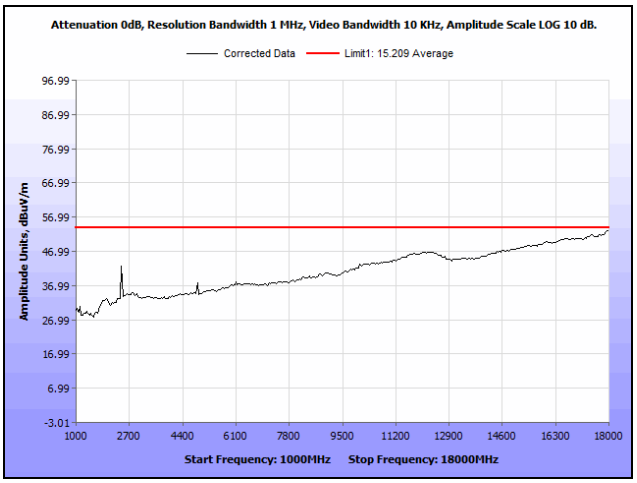
Plot 58. Radiated Spurious Emissions, Low Channel, DQPSK, 1 GHz – 18 GHz, Average



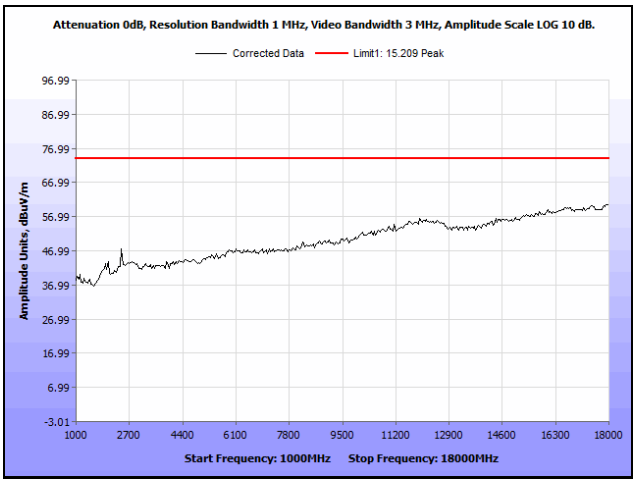
Plot 59. Radiated Spurious Emissions, Low Channel, DQPSK, 1 GHz – 18 GHz, Peak



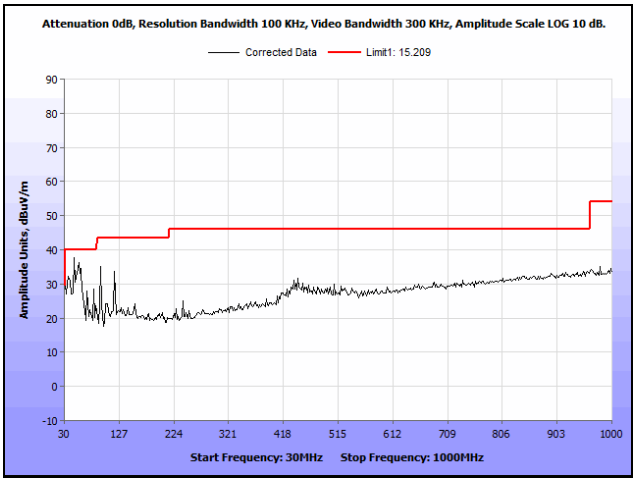
Plot 60. Radiated Spurious Emissions, Mid Channel, DQPSK, 30 MHz – 1 GHz



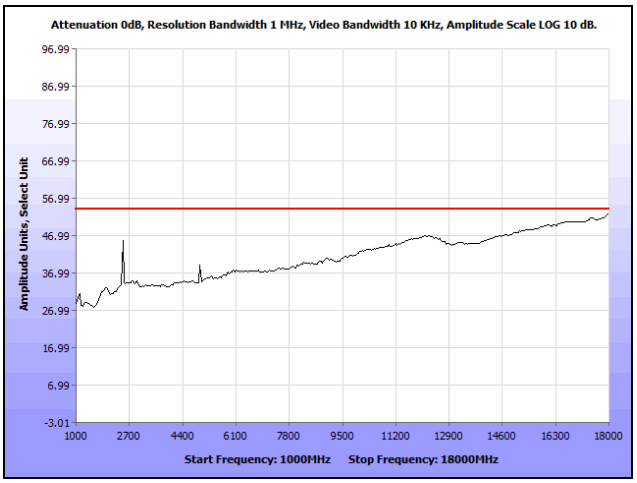
Plot 61. Radiated Spurious Emissions, Mid Channel, DQPSK, 1 GHz – 18 GHz, Average



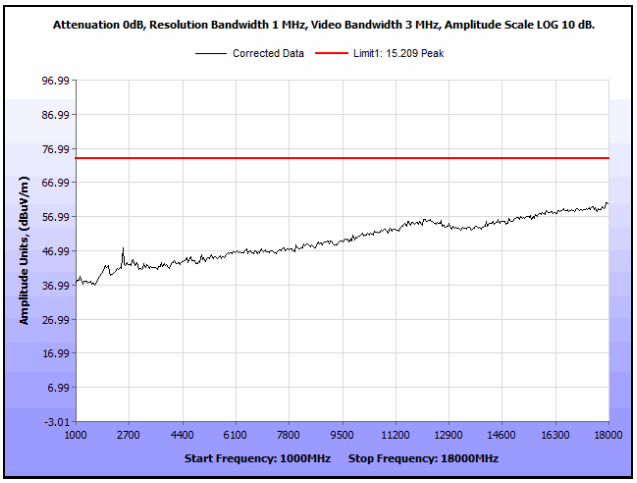
Plot 62. Radiated Spurious Emissions, Mid Channel, DQPSK, 1 GHz – 18 GHz, Peak



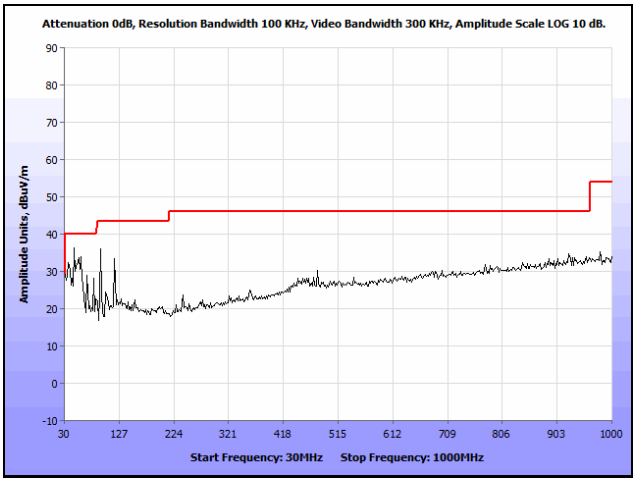
Plot 63. Radiated Spurious Emissions, High Channel, DQPSK, 30 MHz – 1 GHz



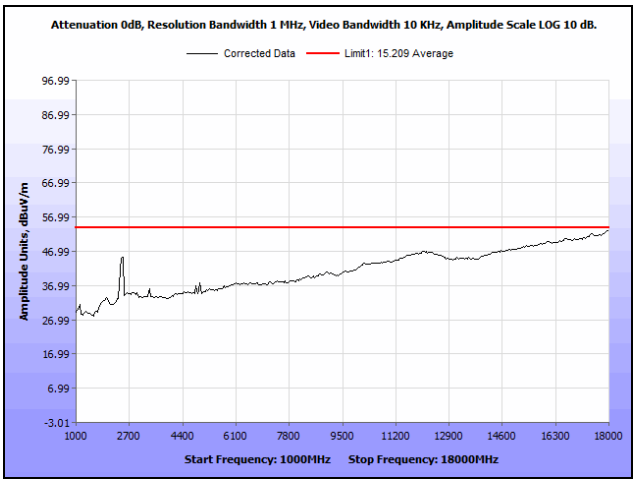
Plot 64. Radiated Spurious Emissions, High Channel, DQPSK, 1 GHz – 18 GHz, Average



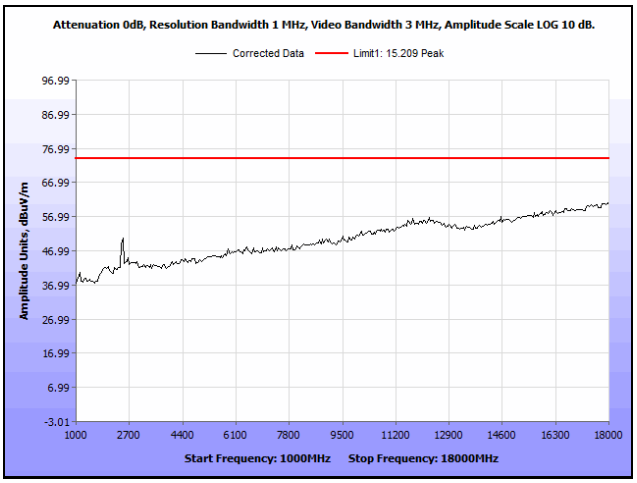
Plot 65. Radiated Spurious Emissions, High Channel, DQPSK, 1 GHz – 18 GHz, Peak



Plot 66. Radiated Spurious Emissions, Hopping, DQPSK, 30 MHz – 1 GHz

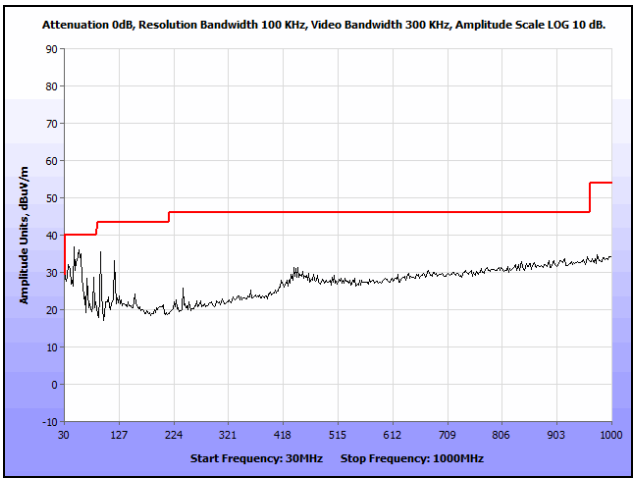


Plot 67. Radiated Spurious Emissions, Hopping, DQPSK, 1 GHz – 18 GHz, Average

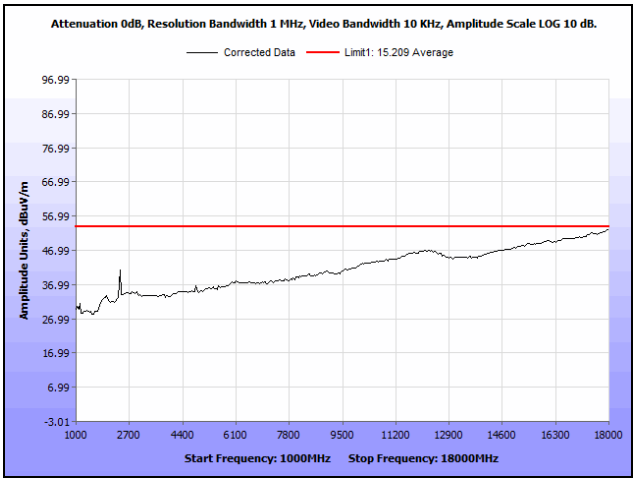


Plot 68. Radiated Spurious Emissions, Hopping, DQPSK, 1 GHz – 18 GHz, Peak

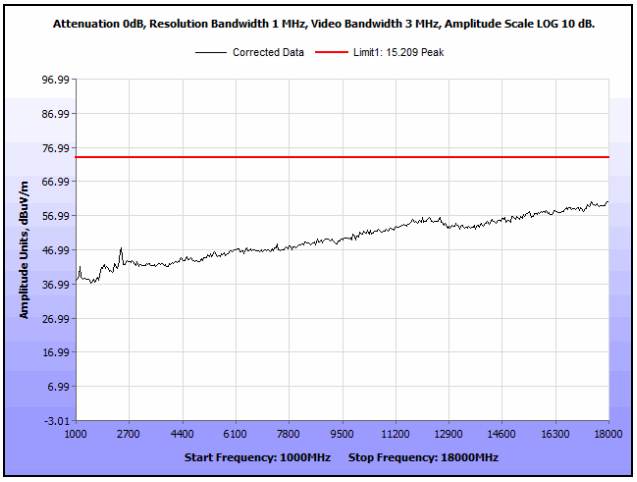
Radiated Spurious Emissions, 8DPSK



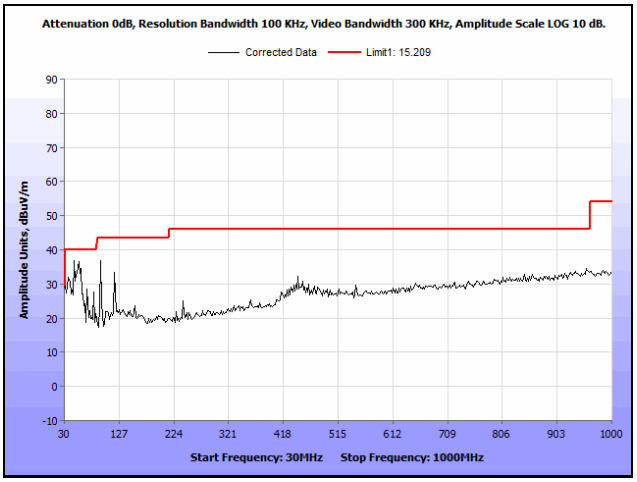
Plot 69. Radiated Spurious Emissions, Low Channel, 8DPSK, 30 MHz – 1 GHz



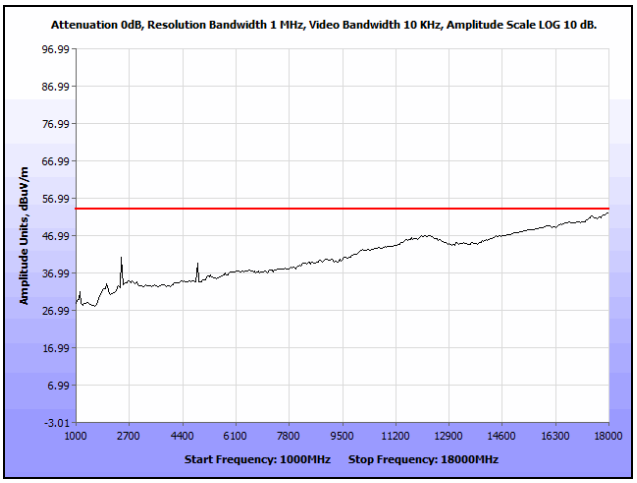
Plot 70. Radiated Spurious Emissions, Low Channel, 8DPSK, 1 GHz – 18 GHz, Average



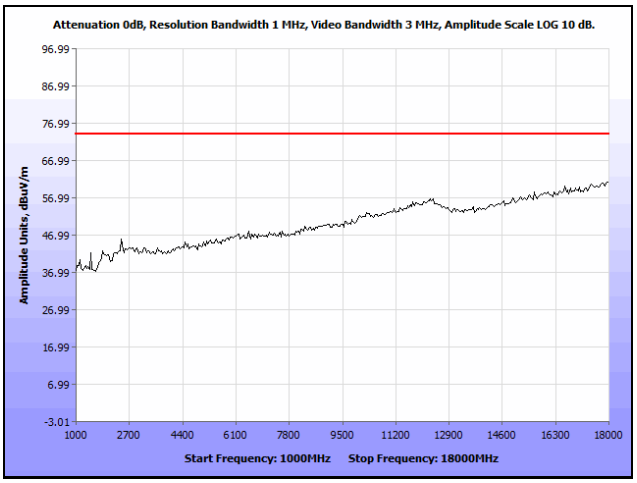
Plot 71. Radiated Spurious Emissions, Low Channel, 8DPSK, 1 GHz – 18 GHz, Peak



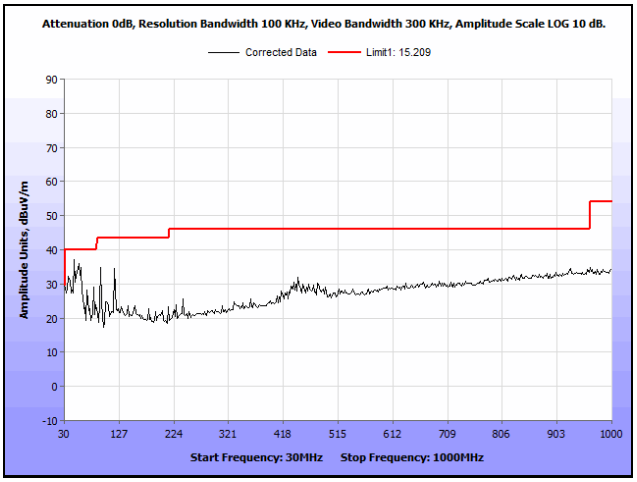
Plot 72. Radiated Spurious Emissions, Mid Channel, 8DPSK, 30 MHz – 1 GHz



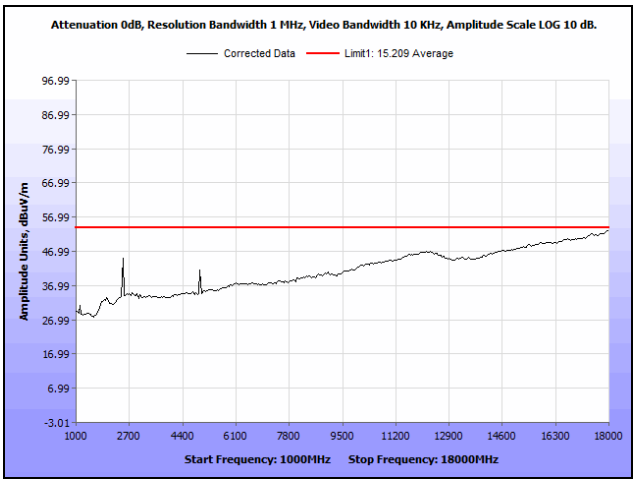
Plot 73. Radiated Spurious Emissions, Mid Channel, 8DPSK, 1 GHz – 18 GHz, Average



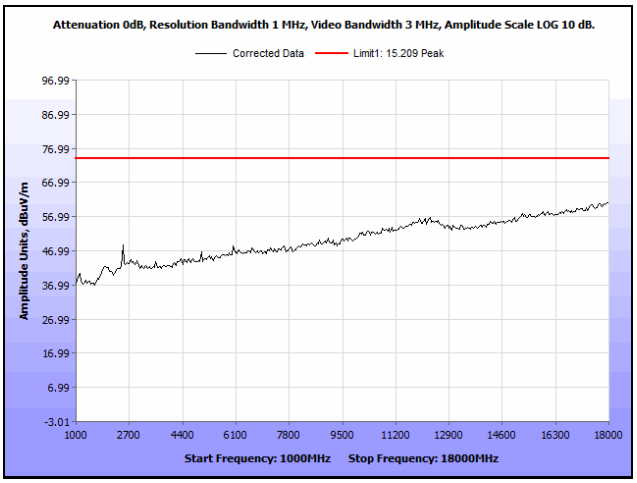
Plot 74. Radiated Spurious Emissions, Mid Channel, 8DPSK, 1 GHz – 18 GHz, Peak



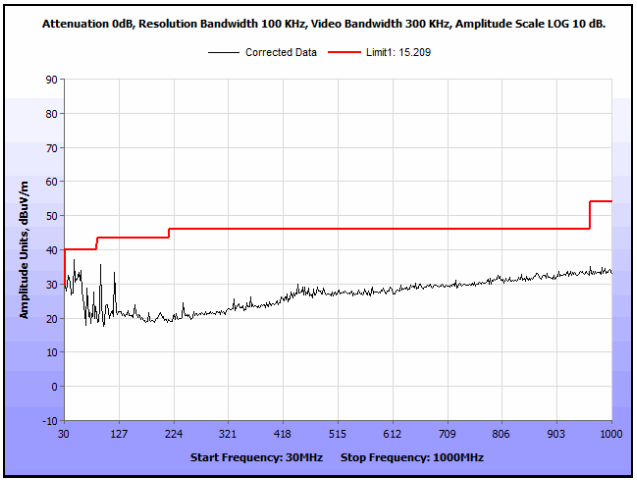
Plot 75. Radiated Spurious Emissions, High Channel, 8DPSK, 30 MHz – 1 GHz



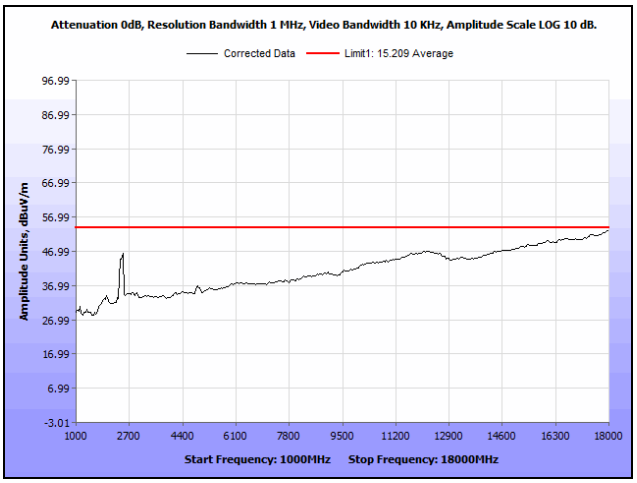
Plot 76. Radiated Spurious Emissions, High Channel, 8DPSK, 1 GHz – 18 GHz, Average



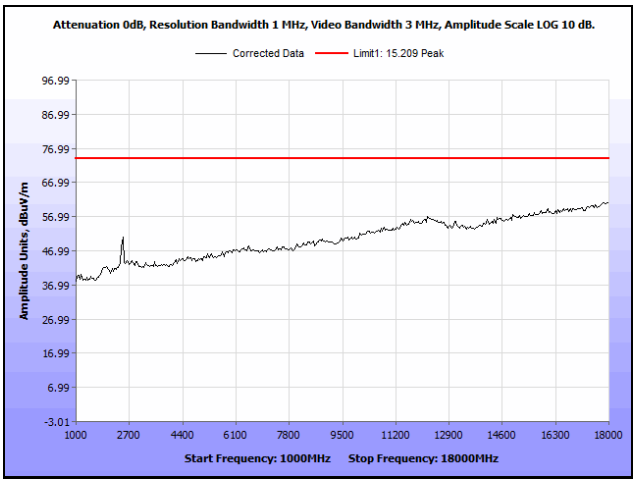
Plot 77. Radiated Spurious Emissions, High Channel, 8DPSK, 1 GHz – 18 GHz, Peak



Plot 78. Radiated Spurious Emissions, Hopping, 8DPSK, 30 MHz – 1 GHz



Plot 79. Radiated Spurious Emissions, Hopping, 8DPSK, 1 GHz – 18 GHz, Average

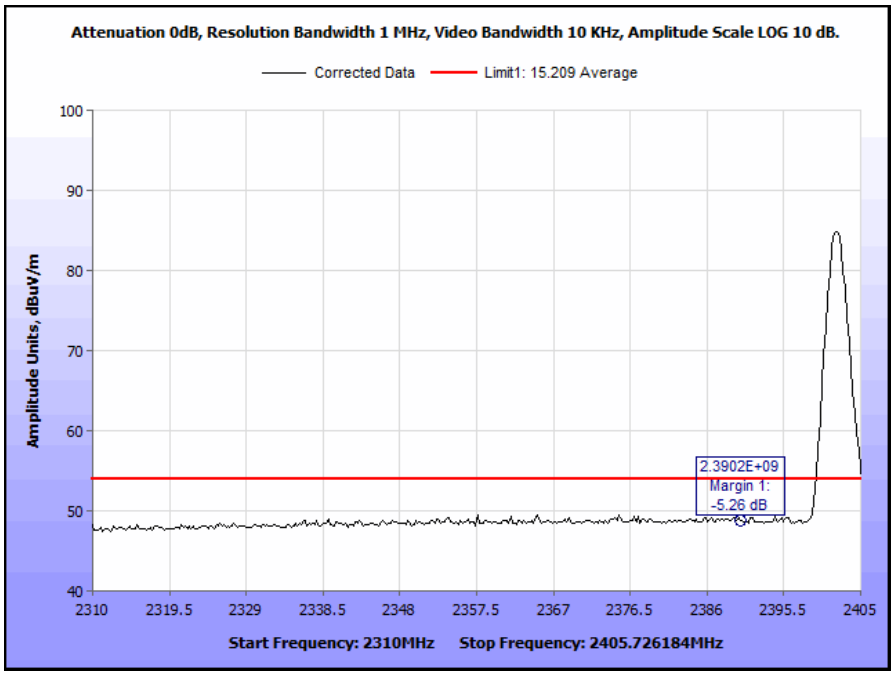


Plot 80. Radiated Spurious Emissions, Hopping, 8DPSK, 1 GHz – 18 GHz, Peak

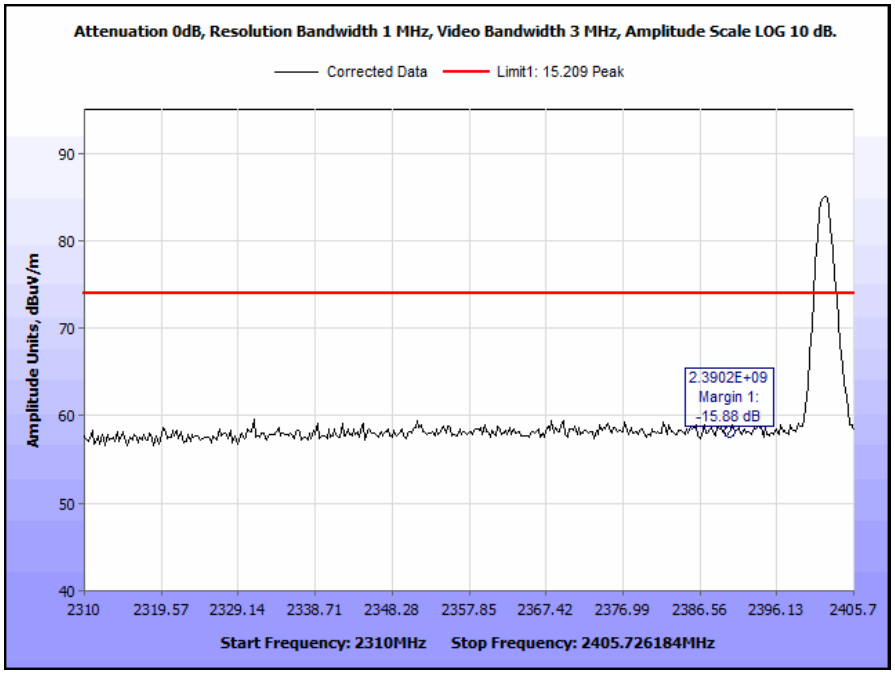
Radiated Band Edge Measurements

Test Procedures: The transmitter was turned. Measurements were performed of the low and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance.

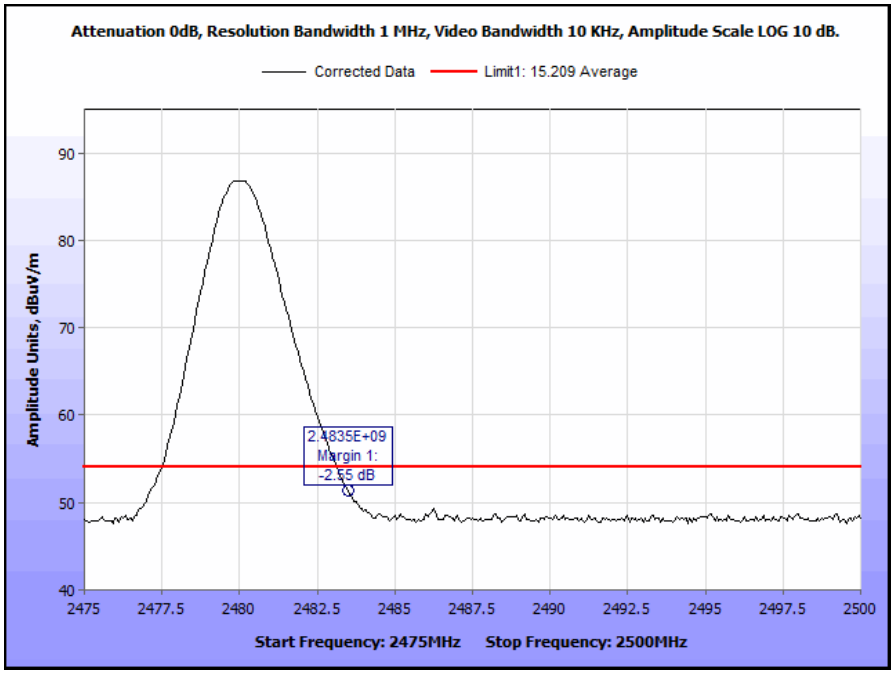
Radiated Band Edge Measurements, GFSK



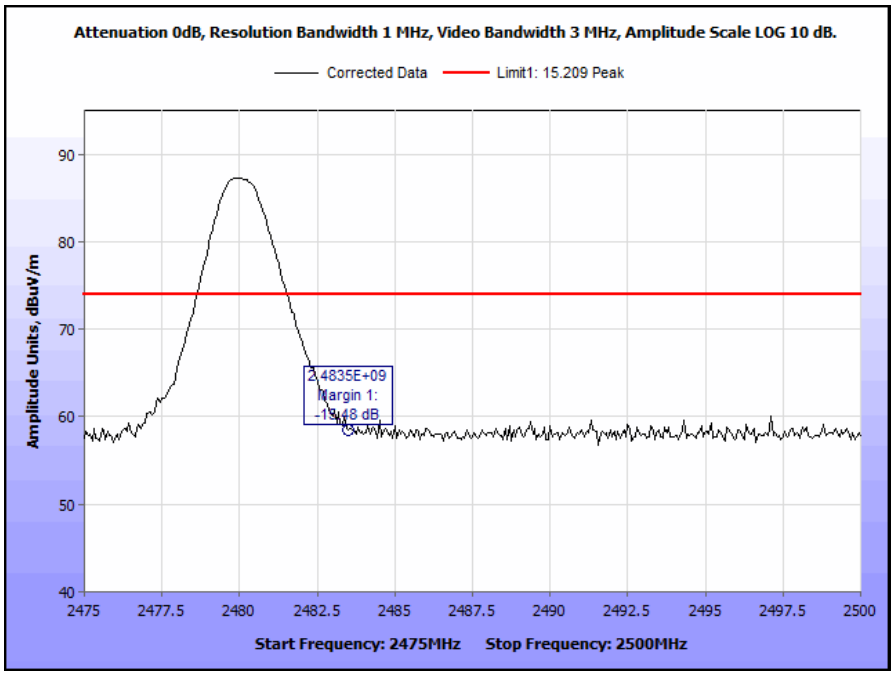
Plot 81. Radiated Restricted Band Edge, Low Channel, GFSK, Average



Plot 82. Radiated Restricted Band Edge, Low Channel, GFSK, Peak

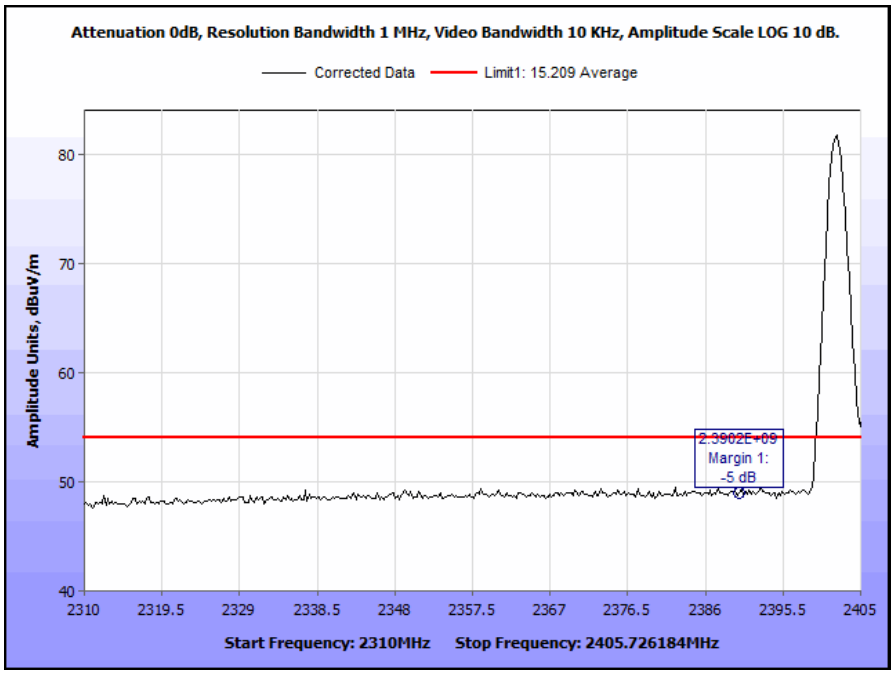


Plot 83. Radiated Restricted Band Edge, High Channel, GFSK, Average

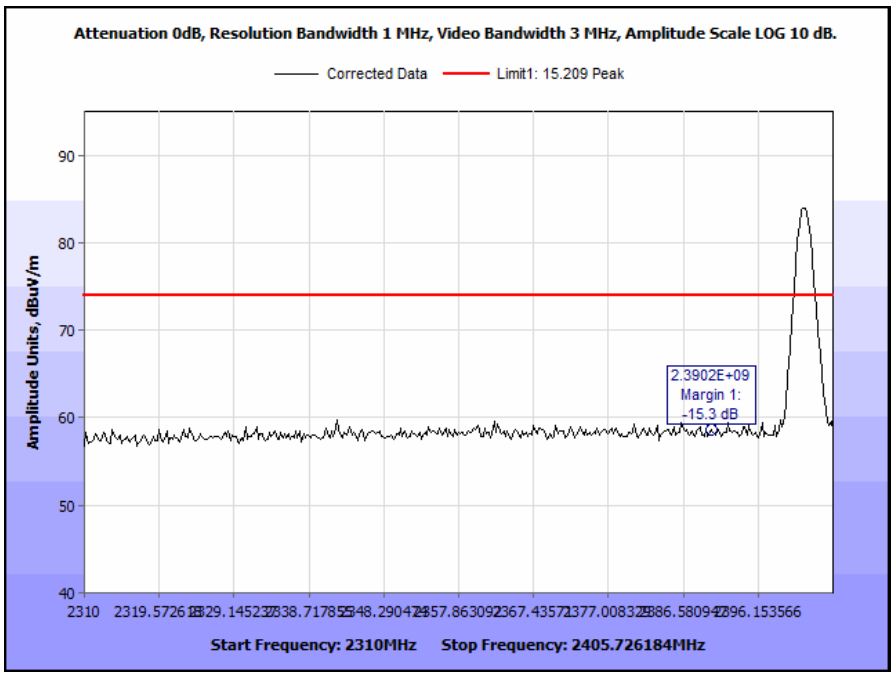


Plot 84. Radiated Restricted Band Edge, High Channel, GFSK, Peak

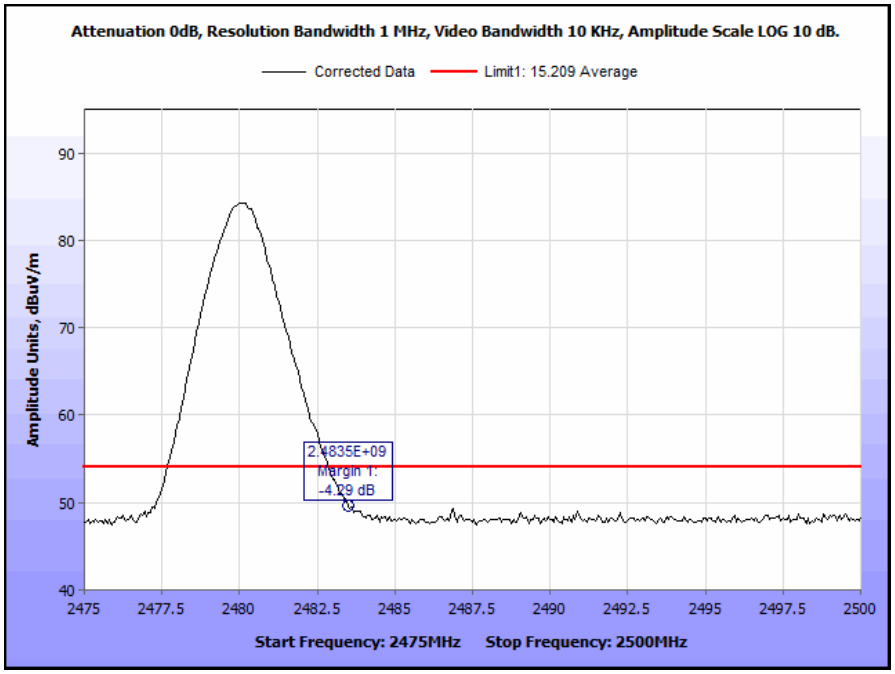
Radiated Band Edge Measurements, DQPSK



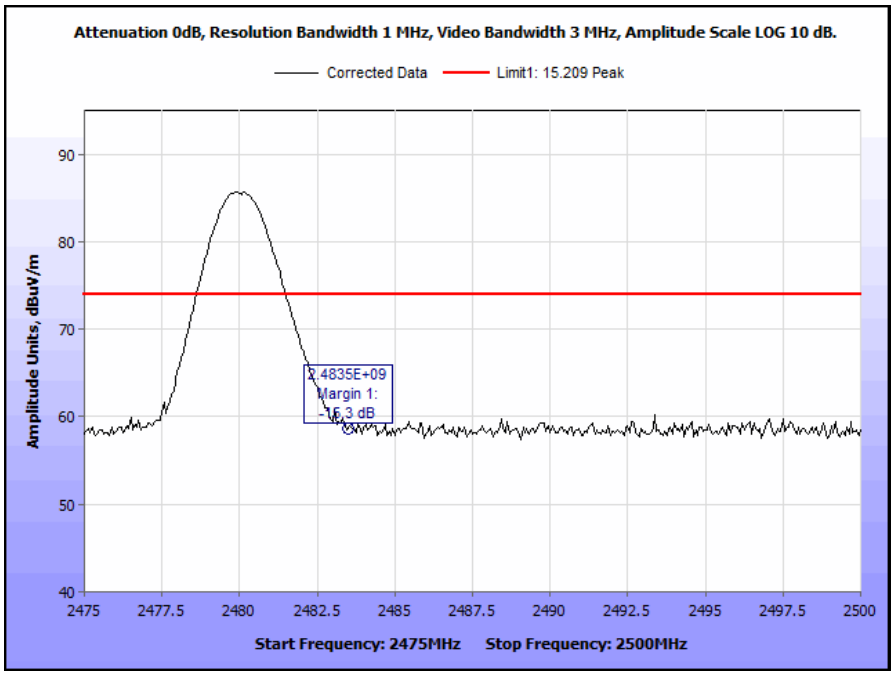
Plot 85. Radiated Restricted Band Edge, Low Channel, DQPSK, Average



Plot 86. Radiated Restricted Band Edge, Low Channel, DQPSK, Peak

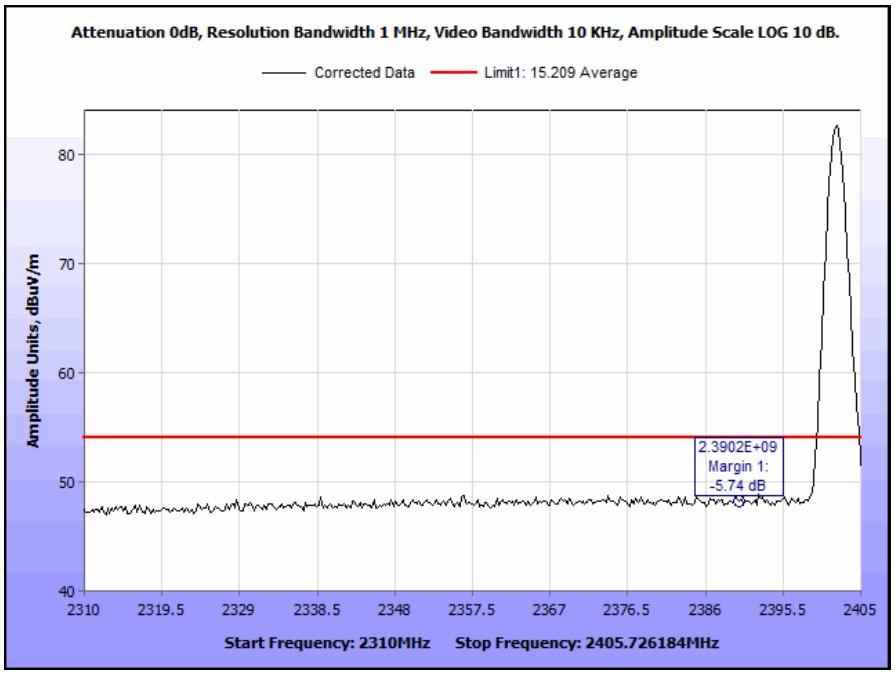


Plot 87. Radiated Restricted Band Edge, High Channel, DQPSK, Average

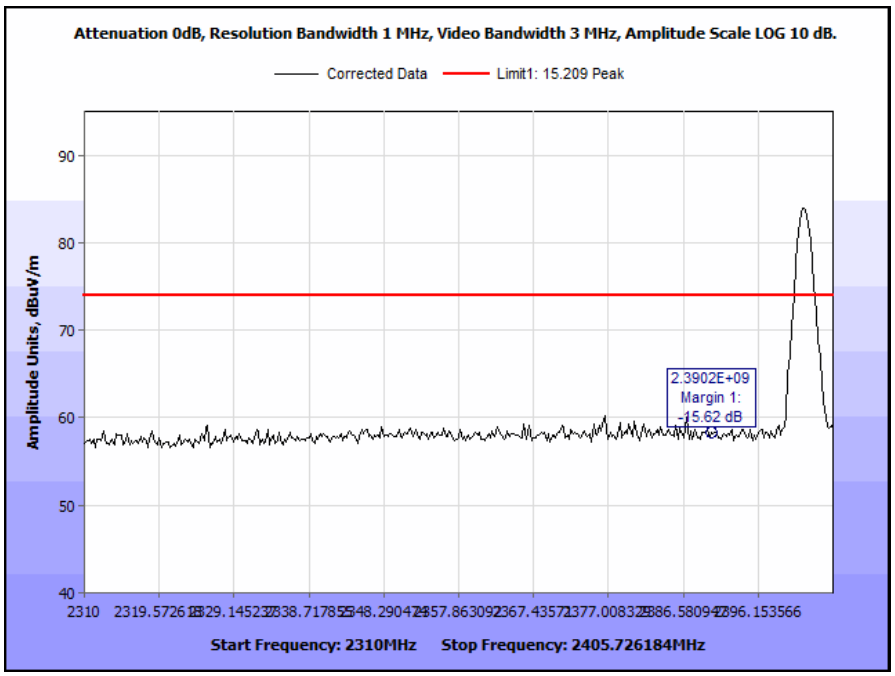


Plot 88. Radiated Restricted Band Edge, High Channel, DQPSK, Peak

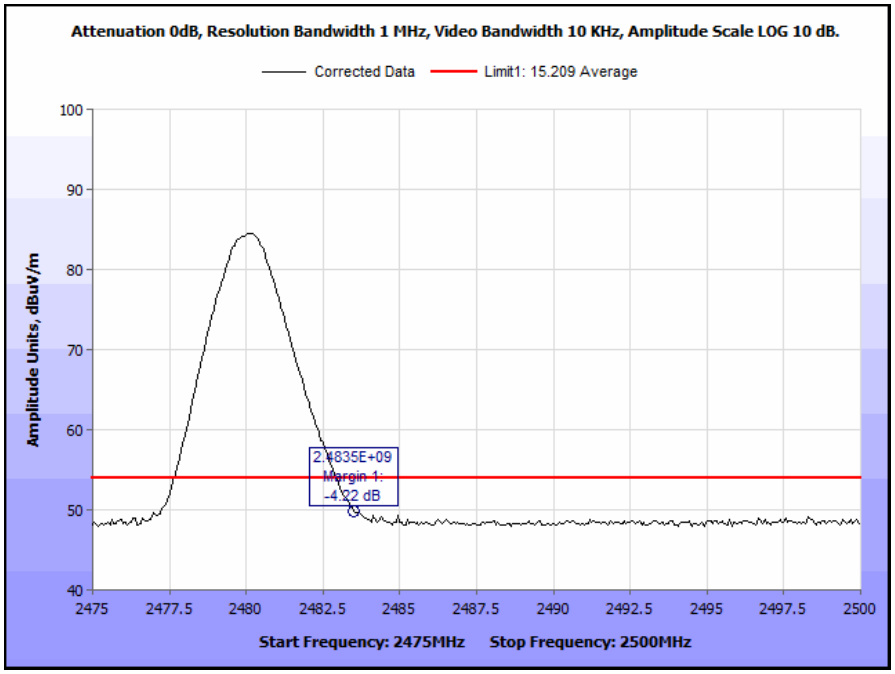
Radiated Band Edge Measurements, 8DPSK



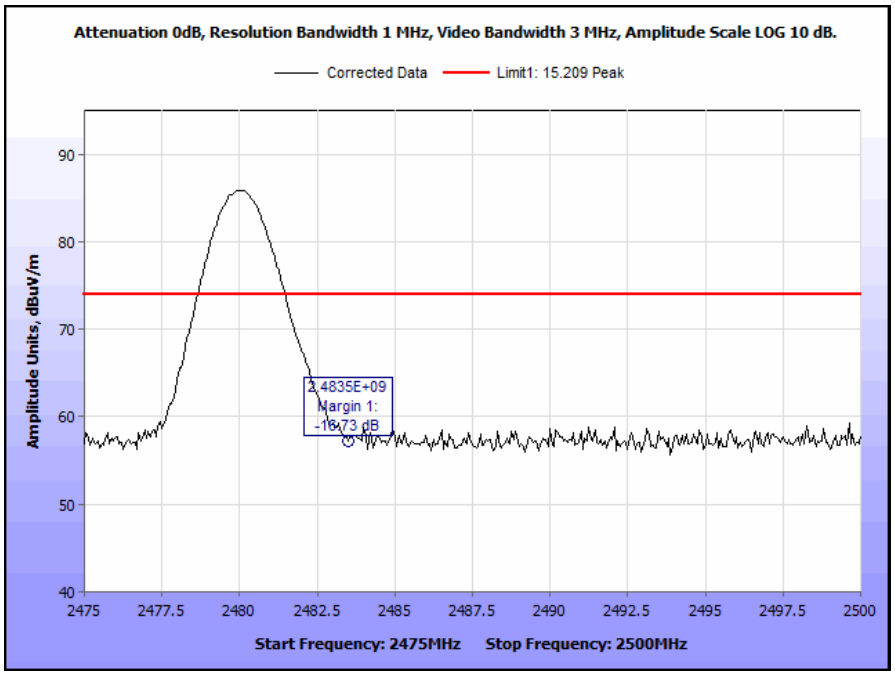
Plot 89. Radiated Restricted Band Edge, Low Channel, 8DPSK, Average



Plot 90. Radiated Restricted Band Edge, Low Channel, 8DPSK, Peak



Plot 91. Radiated Restricted Band Edge, High Channel, 8DPSK, Average

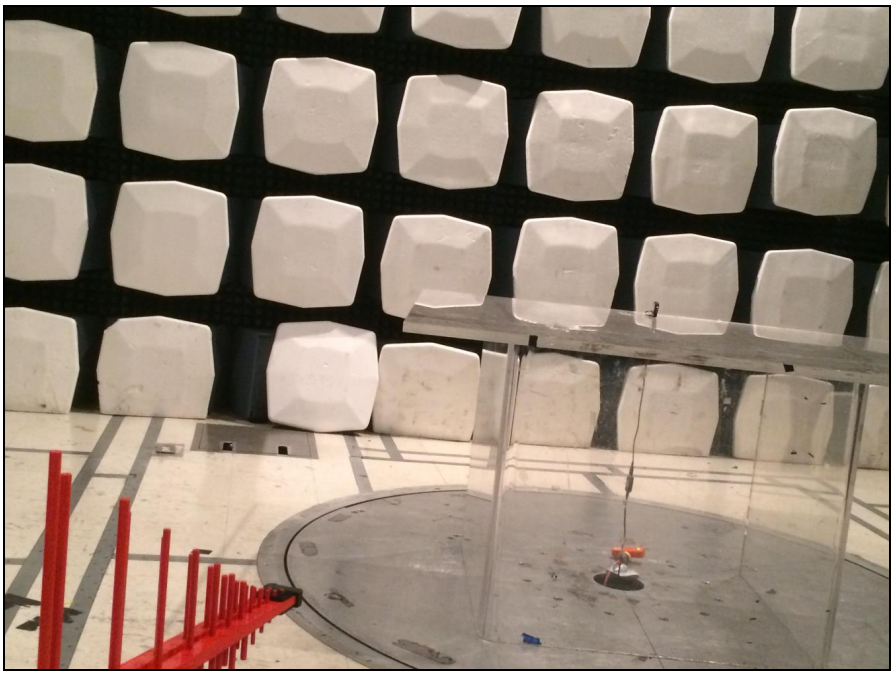


Plot 92. Radiated Restricted Band Edge, High Channel, 8DPSK, Peak

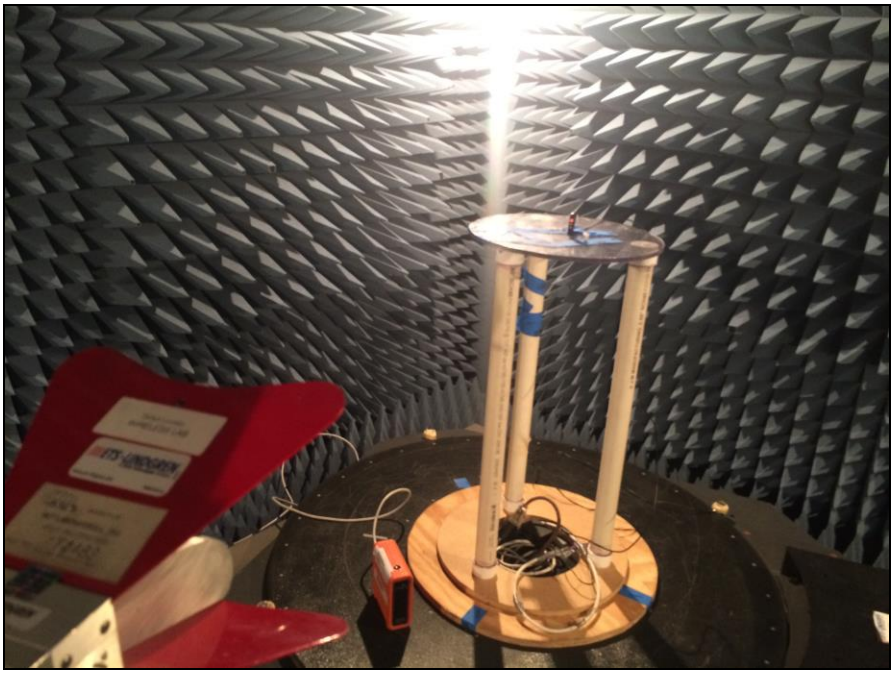
Test Procedures for Radiated Band Edge for High Channel 2480 MHz:

1. The field strength of the fundamental emission was measured using a 1MHz RBW and a 3MHz VBW for the peak value and a 1MHz RBW and a 10Hz VBW for the average value.
2. The spectrum analyzer was spanned to encompass both the peak of the fundamental emission and the band edge emission under investigation. The RBW was set to 1% of the span and the VBW to 3x the RBW. The delta between the peak levels of the fundamental emission at the relevant band edge emission was measured and recorded.
3. The resulting delta value was used to determine compliance.

Radiated Spurious Emissions Test Setup



Photograph 4. Radiated Spurious Emissions, Test Setup below 1 GHz



Photograph 5. Radiated Spurious Emissions, Test Setup above 1 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

See following pages for detailed test results with RF Conducted Spurious Emissions.

Test Results: The EUT was compliant with the Conducted Spurious Emission limits of **§15.247(d)**.

Test Engineer(s): Djed Mouada

Test Date(s): 11/20/14

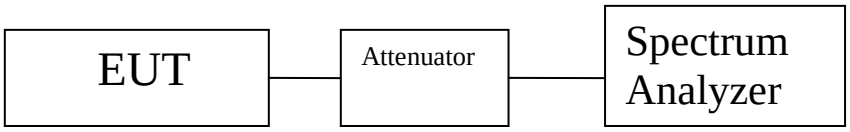
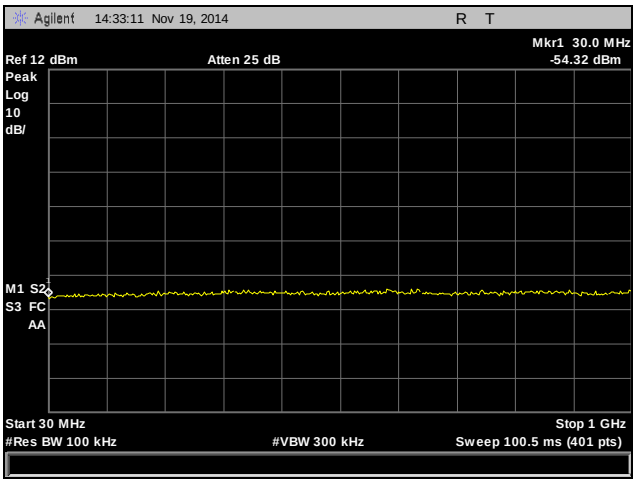
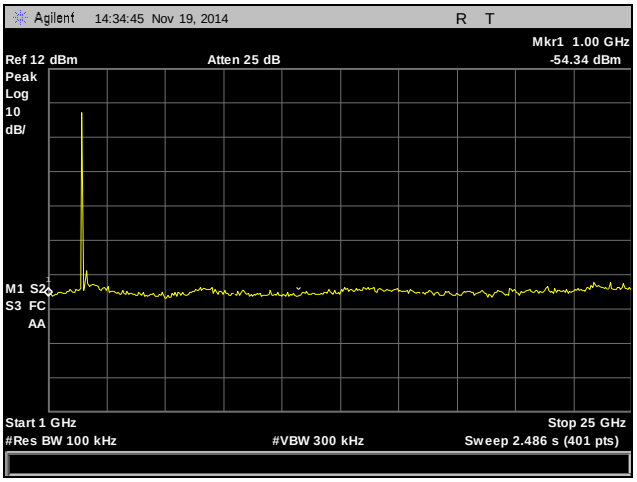


Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

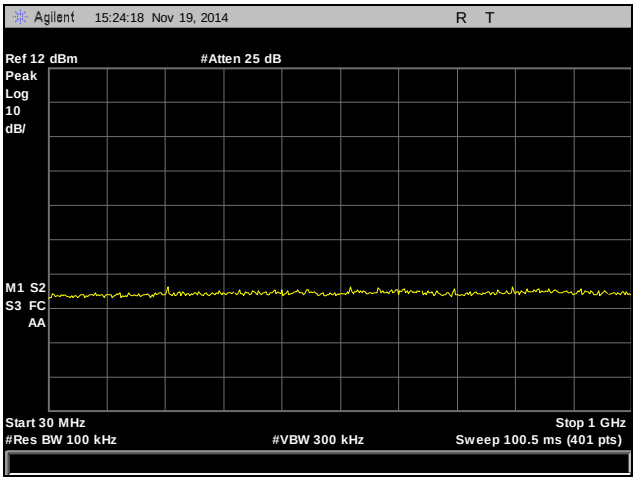
Conducted Spurious Emissions, GFSK



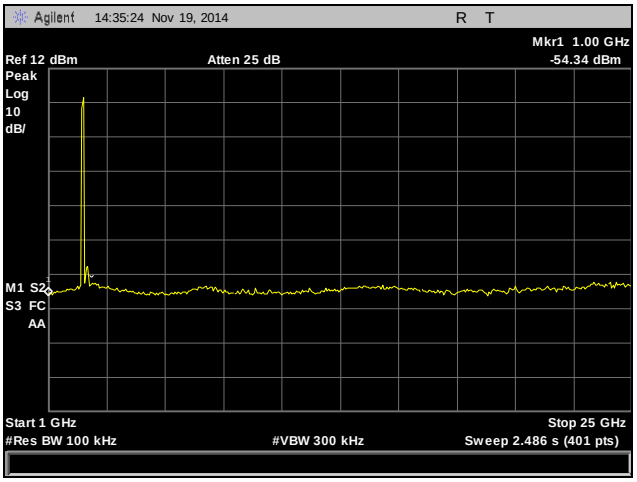
Plot 93. Conducted Spurious Emissions, Low Channel, GFSK, 30 MHz – 1 GHz



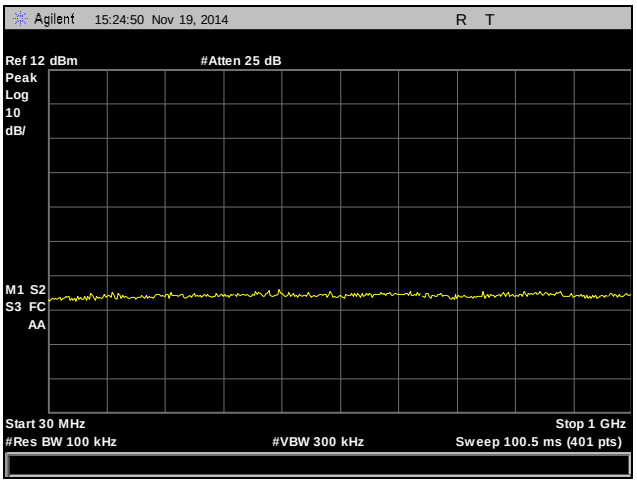
Plot 94. Conducted Spurious Emissions, Low Channel, GFSK, 1 GHz – 25 GHz



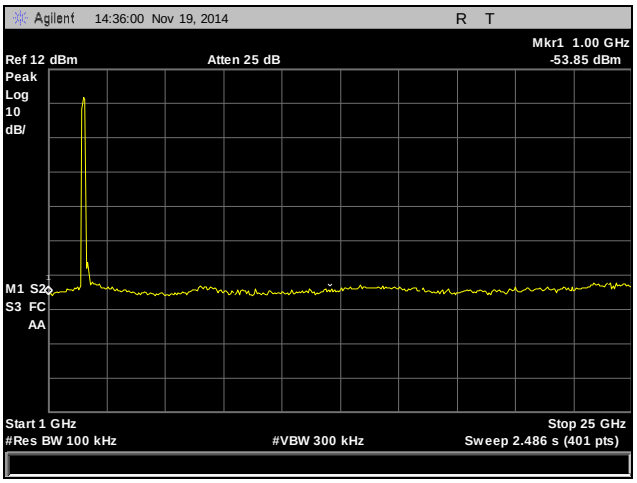
Plot 95. Conducted Spurious Emissions, Mid Channel, GFSK, 30 MHz – 1 GHz



Plot 96. Conducted Spurious Emissions, Mid Channel, GFSK, 1 GHz – 25 GHz

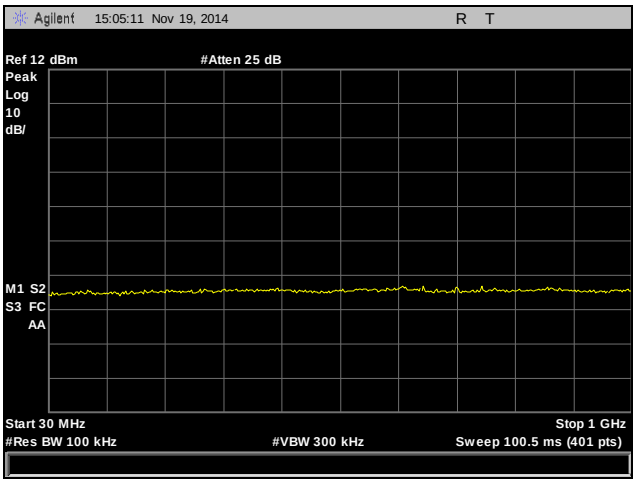


Plot 97. Conducted Spurious Emissions, High Channel, GFSK, 30 MHz – 1 GHz

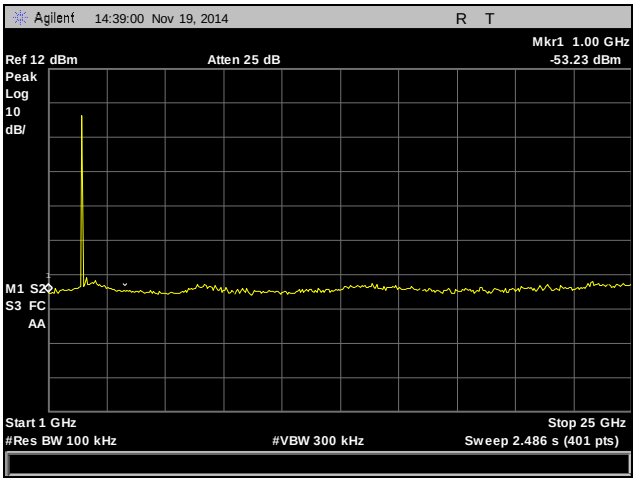


Plot 98. Conducted Spurious Emissions, High Channel, GFSK, 1 GHz – 25 GHz

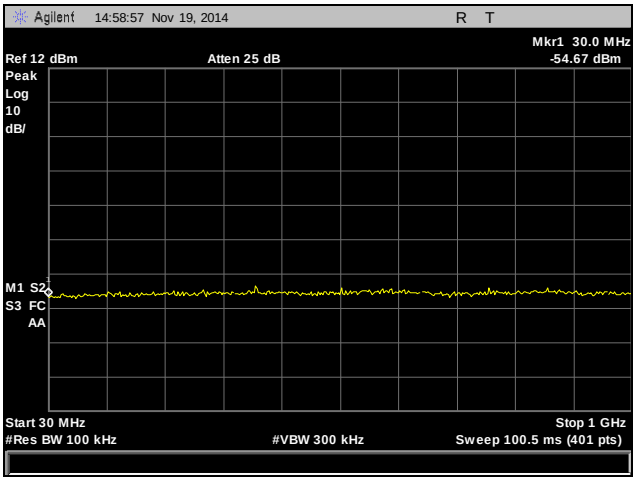
Conducted Spurious Emissions, DPQSK



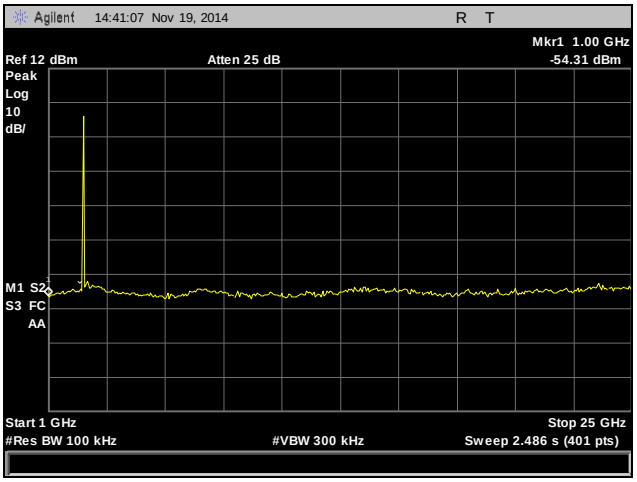
Plot 99. Conducted Spurious Emissions, Low Channel, DPQSK, 30 MHz – 1 GHz



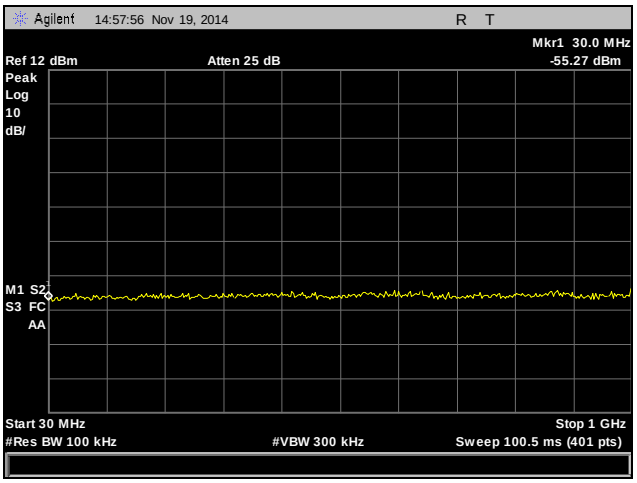
Plot 100. Conducted Spurious Emissions, Low Channel, DPQSK, 1 GHz – 25 GHz



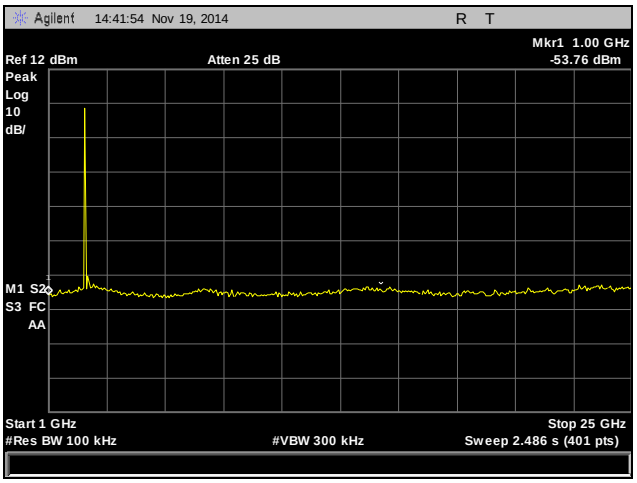
Plot 101. Conducted Spurious Emissions, Mid Channel, DPQSK, 30 MHz – 1 GHz



Plot 102. Conducted Spurious Emissions, Mid Channel, DPQSK, 1 GHz – 25 GHz

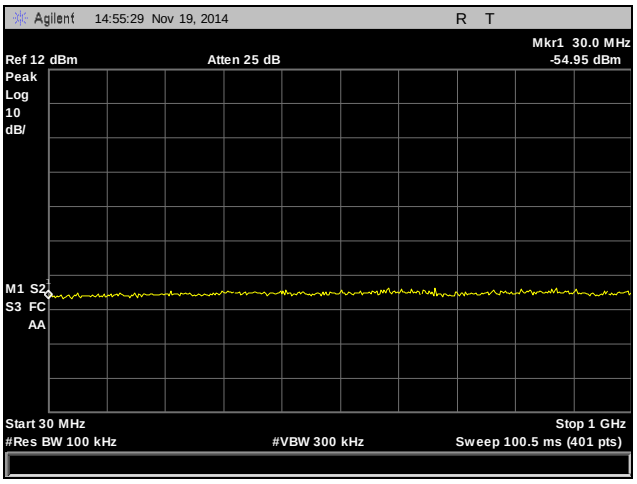


Plot 103. Conducted Spurious Emissions, High Channel, DPQSK, 30 MHz – 1 GHz

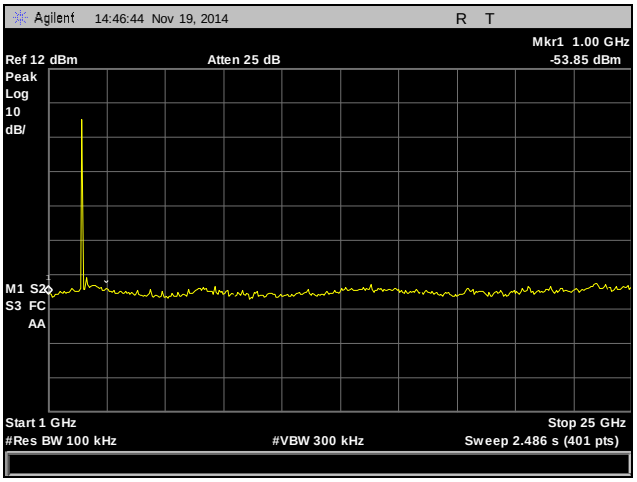


Plot 104. Conducted Spurious Emissions, High Channel, DPQSK, 1 GHz – 25 GHz

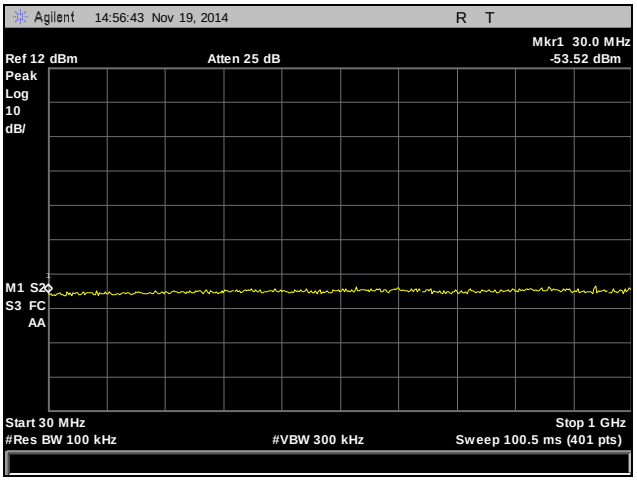
Conducted Spurious Emissions, 8DPSK



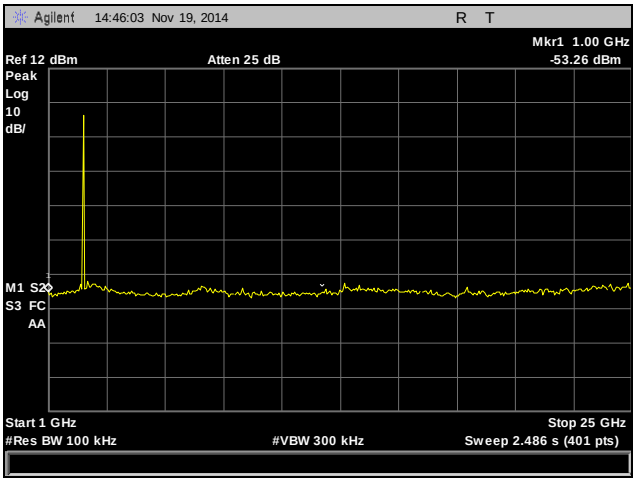
Plot 105. Conducted Spurious Emissions, Low Channel, 8DPSK, 30 MHz – 1 GHz



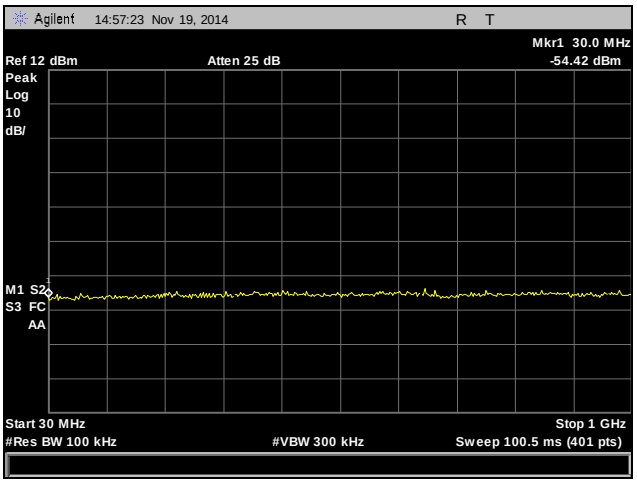
Plot 106. Conducted Spurious Emissions, Low Channel, 8DPSK, 1 GHz – 25 GHz



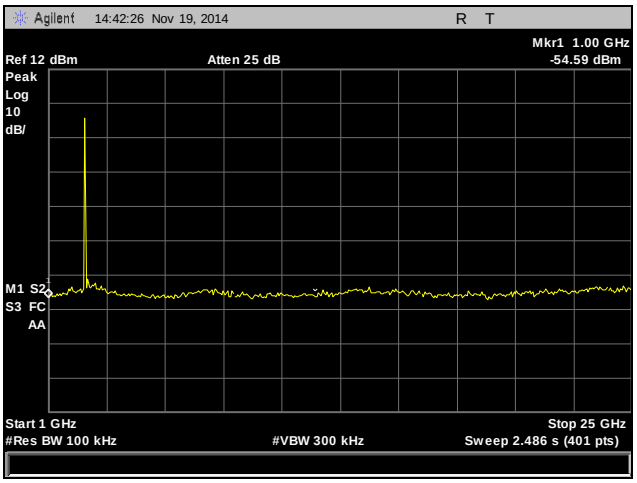
Plot 107. Conducted Spurious Emissions, Mid Channel, 8DPSK, 30 MHz – 1 GHz



Plot 108. Conducted Spurious Emissions, Mid Channel, 8DPSK, 1 GHz – 25 GHz

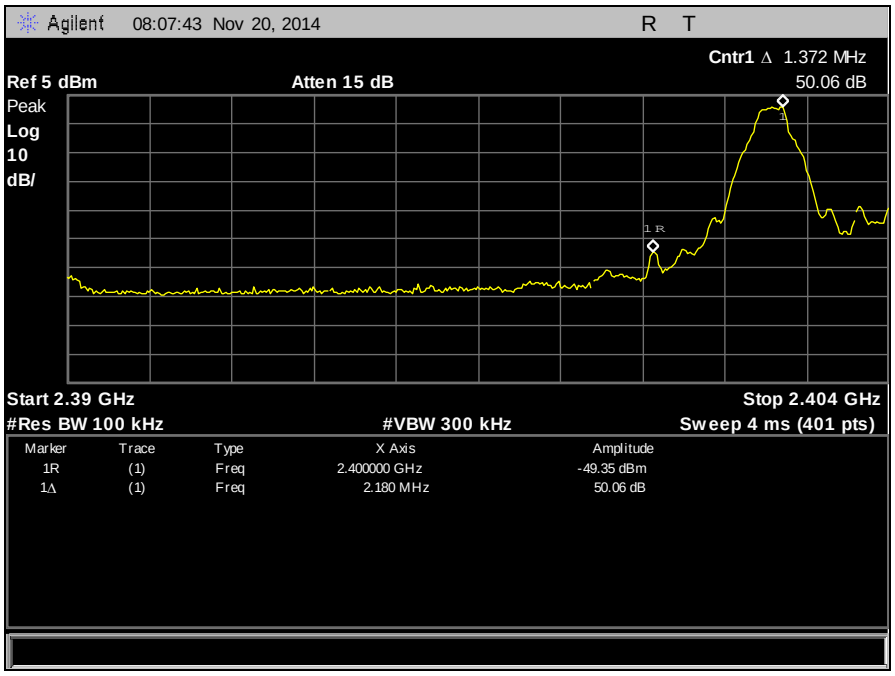


Plot 109. Conducted Spurious Emissions, High Channel, 8DPSK, 30 MHz – 1 GHz

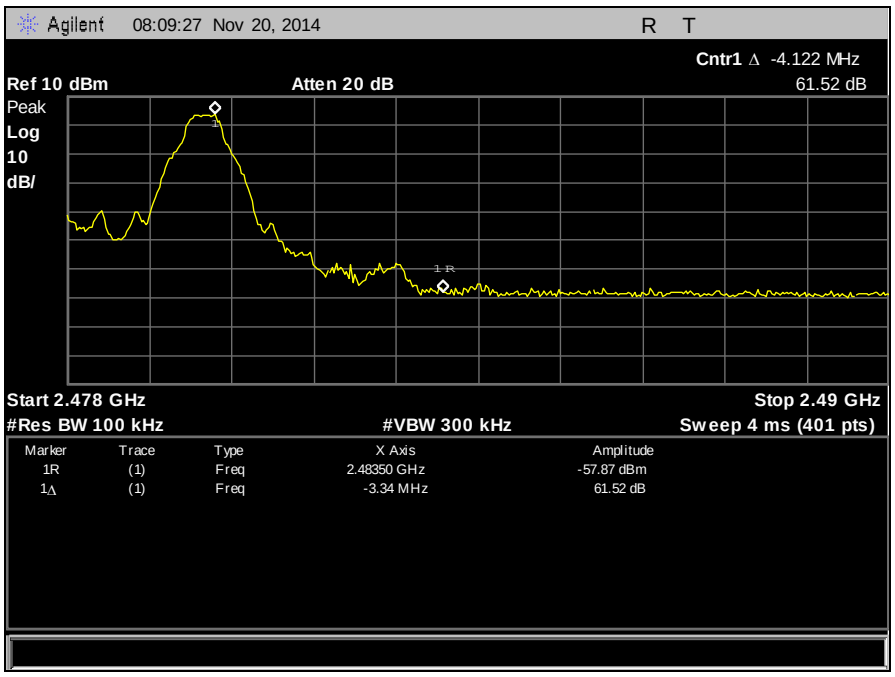


Plot 110. Conducted Spurious Emissions, High Channel, 8DPSK, 1 GHz – 25 GHz

Conducted Band Edge, GFSK

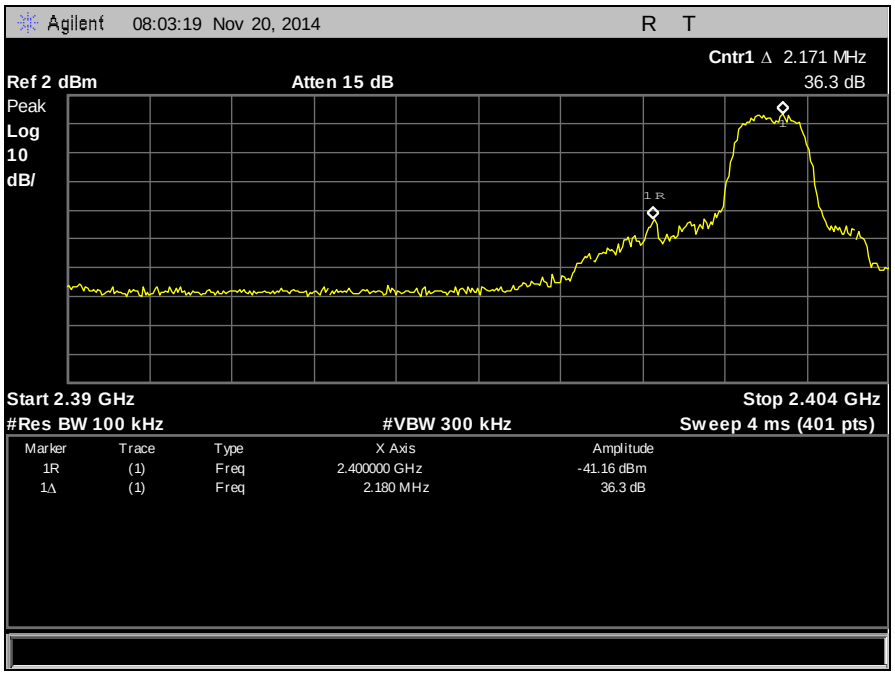


Plot 111. Conducted Band Edge, Low Channel, GFSK

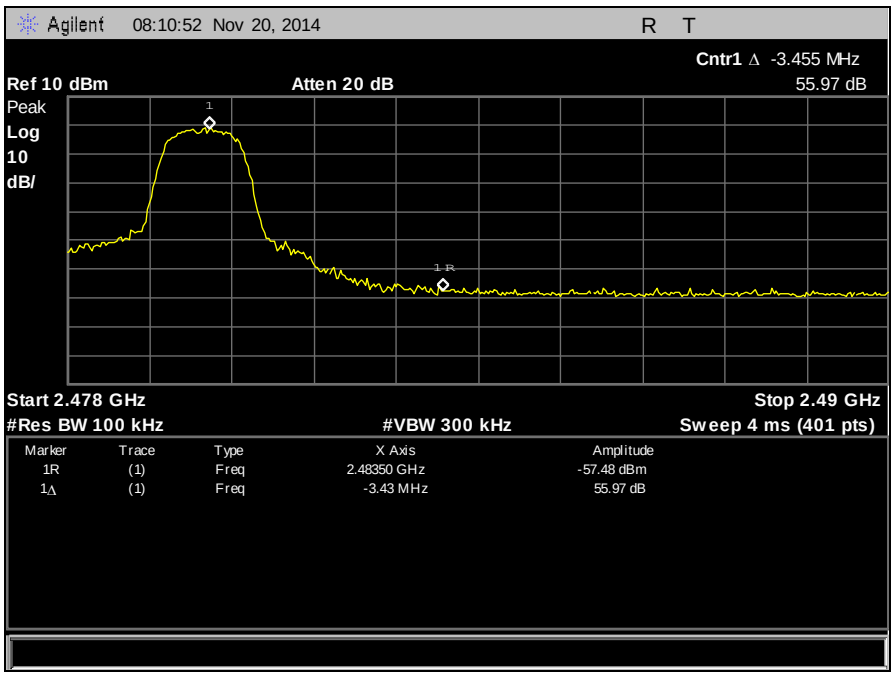


Plot 112. Conducted Band Edge, High Channel, GFSK

Conducted Band Edge, DQPSK

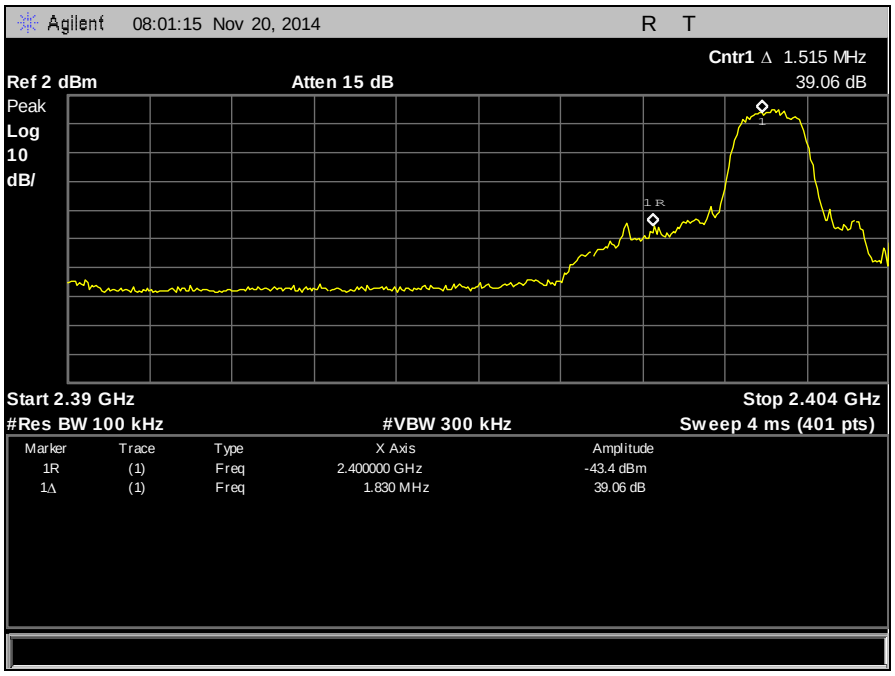


Plot 113. Conducted Band Edge, Low Channel, DQPSK

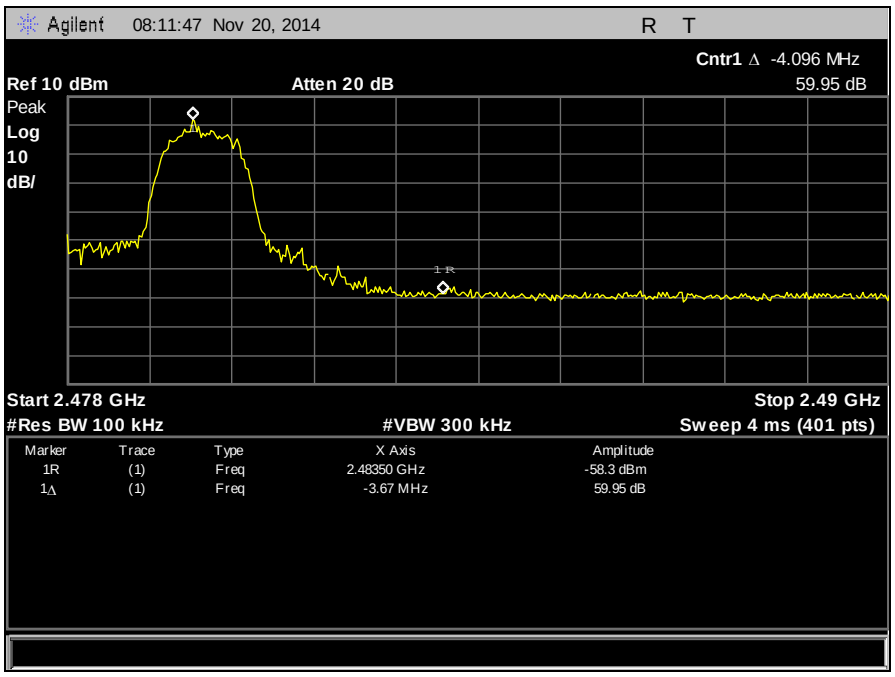


Plot 114. Conducted Band Edge, High Channel, DQPSK

Conducted Band Edge, 8DPSK



Plot 115. Conducted Band Edge, Low Channel, 8DPSK



Plot 116. Conducted Band Edge, High Channel, 8DPSK

V. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4497	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4432B	10/6/2014	4/6/2016
1T4744	ANTENNA, HORN	ETS-LINDGREN	3116	9/9/2014	9/9/2015
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	11/25/2014	11/25/2015
1T4745	ANTENNA, HORN	ETS-LINDGREN	3116	11/14/2013	5/14/2015
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	1/5/2014	1/5/2015
1T4377	TRUE RMS MULTIMETER	FLUKE	189	7/25/2013	1/25/2015
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	7/25/2014	7/25/2015
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	2/28/2014	8/28/2015
1T2665	ANTENNA; HORN	EMCO	3115	4/3/2014	10/3/2015
1T4565	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	6/26/2014	12/26/2015

Table 18. Test Equipment List

VI. Certification & User's Manual Information

Certification & User's Manual Information

L. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

1. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

> "At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

[2] Insert either A or B but not both as appropriate for the equipment requirements.

End of Report

