MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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September 6, 2017

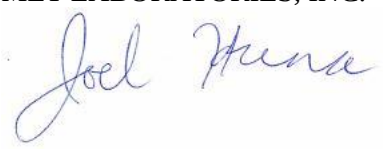
Xytronix Research & Design
1681 West 2960 South
Nibley, Utah 84321

Dear David Witbeck,

Enclosed is the EMC Wireless test report for compliance testing of the Xytronix Research & Design, XW-210-I as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15 Subpart C 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.



Joel Huna
Documentation Department

Reference: (\Xytronix Research & Design\EMCS95120-FCC247 Rev. 1)

A2LA ACCREDITED
TESTING CERT #0591.02

Electromagnetic Compatibility Criteria
Test Report

for the

Xytronix Research & Design
XW-210-I

Tested under
the FCC Certification Rules
contained in
15.247 Subpart C for Intentional Radiators

MET Report: EMCS95120-FCC247 Rev. 1

September 6, 2017

Prepared For:

Xytronix Research & Design
1681 West 2960 South
Nibley, Utah 84321

Prepared By:
MET Laboratories, Inc.
3162 Belick St.,
Santa Clara, CA 95054

Electromagnetic Compatibility Criteria
Test Report

for the

Xytronix Research & Design
XW-210-I

Tested under
the FCC Certification Rules
contained in
15.247 Subpart C for Intentional Radiators

Jun Qi, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
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 Part 15.247 under normal use and maintenance.

John Mason,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 9, 2017	Initial Issue.
1	September 6, 2017	Engineer corrections.

Table of Contents

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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 Xytronix Research & Design XW-210-I, 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 XW-210-I. Xytronix Research & Design should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the XW-210-I, 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 Xytronix Research & Design, purchase order number PO-0000022454. All tests were conducted using measurement procedure ANSI C63.4-2014.

FCC Reference 47 CFR Part 15.247:2005	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	6dB Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	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 Xytronix Research & Design to perform testing on the XW-210-I, under Xytronix Research & Design's purchase order number PO-0000022454.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Xytronix Research & Design, XW-210-I.

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

Model(s) Tested:	XW-210-I	
Model(s) Covered:	XW-210-I	
EUT Specifications:	Primary Power: 9 - 28VDC	
	FCC ID: 2AE4Z-XWD002	
	Type of Modulations:	DSS, OFDM
	Equipment Code:	DTS
	Peak RF Output Power:	15.18 dBm @ 2437MHz g mode.
	EUT Frequency Ranges:	Channel 1: 2412 MHz, Channel 11: 2462MHz
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:	Jun Qi	
Report Date(s):	September 6, 2017	

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
ANSI C63.4:2014	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 C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., Santa Clara, CA 95054. 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 5 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.

MET Laboratories is a ISO/IEC 17025 accredited site by A2LA. #0591.02.

D. Description of Test Sample

The Xytronix Research & Design XW-210-I, Equipment Under Test (EUT), is a Wi-Fi enabled relay, temperature monitor and status alerting device. The XW-210 has a built-in relay for controlling lights, motors and other relatively high current loads, a digital input which can be used to monitor and report the status of switch closure sensors and a "1-wire" port for connecting up to four digital temperature or other Xytronix 1-wire sensors. The XW-210 is used for applications where devices must be controlled or where temperature or events must be monitored and Ethernet wiring is not accessible or practical to install. The module is powered by an external wall transformer (9-28 VDC) or other DC power source.

The XW-210 works as a standalone device that can be controlled using a web browser. It can be configured using simple menus and drop-down lists. It includes features such as logging, input state monitoring, and the ability to control other relays on other devices.

The XW-210 can be a self-contained wireless access point that requires no additional servers or ControlByWeb devices. In this mode the XW-210 provides live, real-time temperatures or relay status directly to a single user through web browsers or the CBW Mobile app.

After being commissioned the XW-210 can recognize and attach to your Wi-Fi access point. The XW-210 offers the ability to control it's relay, monitor temperature or input status and send out email alerts (which can be converted to text message alerts) whenever an alarm condition occurs.

Plug-in terminal strips provide connections for the DC power, relay contacts, optically isolated input and up to 4-temperature or other Xytronix 1-wire sensors. No other cables, interfaces, or PC utility programs are needed.

Two push-button switches aid in provisioning the module. Press the "Access Point" button anytime to active the access point mode. With a WiFi enabled PC or smart phone you then connect to and access the internal web server at the default IP address, port and password. Using the web server, you configure the access port, name, and other setup parameters. Alternatively, add the XW-210 to an existing network by pressing the "WPS" (Wi-Fi Protected Setup) button on both your access point (i.e., router) and the XW-210.

Photograph 1. Xytronix Research & Design XW-210-I

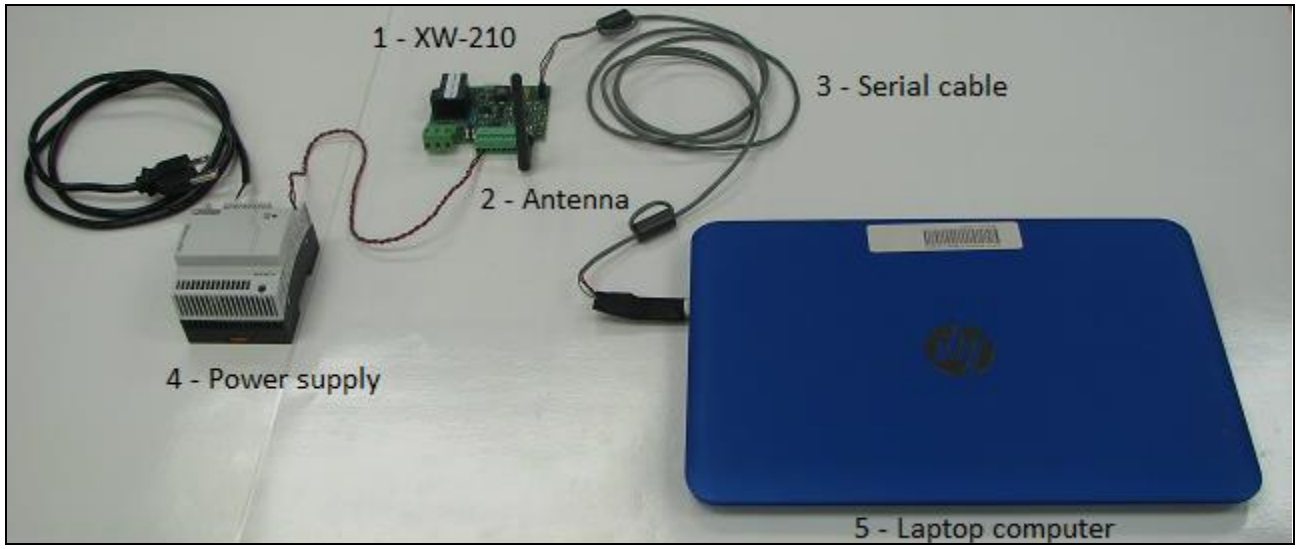


Figure 1. Block Diagram of Test Configuration

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	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
EUT 1		WiFi WebRelay with production firmware	XW-210-I		none	A
EUT 2		WiFi WebRelay with production firmware	XW-210-I		none	A
EUT 3		WiFi WebRelay with radio tool firmware	XW-210-I		none	A
EUT 4		WiFi WebRelay with radio tool firmware	XW-210-I		none	A

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	*Customer Supplied Calibration Data
1	Device Under Test	Xytronix	XW-210-I	NA
2	Antenna	Pulse	W1030	see data sheet
3	USB serial cable	Xytronix	custom for test	NA
4	Power supply	Phoenix	STEP-PS/1AC/24DC/2.5	NA
5	Laptop Computer	HP	unknown	NA
The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.				

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded ? (Y/N)	Termination Box ID & Port Name
1	3-pin terminal block	Relay contacts	1	not used	not used	NA	no connection
1	5-pin terminal block	Power connections	1	1-meter	NA	no	power supply
1	Antenna	50-Ohm, reverse SMA	1	direct connection	direct connection	yes	antenna
1	J4	Serial test port	1	1-meter	USB Cable	no	laptop USB port

Table 6. Ports and Cabling Information

H. Mode of Operation

As a WiFi device, the XW-210 normally communicates with a WiFi access point. The device responds to beacons and HTML file requests. Transmissions are initiated and sequenced thru the access point.

For EMC testing where continuous operation is needed, the Radio Tool firmware is used to force carrier wave or packetized data transmissions. The "Continuous" transmission option results in a continuous stream of back to back packet transmissions.

In order to use the Radio Tool to control the emissions, you must use a XW-210 module having the label "Radio Tool Firmware" as opposed to "Production Firmware".

Radio Tool Packetized: Each packet is sent one at a time from the application MCU to the network processor. There is a large delay between packets in this mode. Generally used for RF evaluation.

Radio Tool Continuous: This is a test mode where the network processor sends out packets back to back in an internal loop, without the intervention of host MCU. The delay between packets is typically very small and hence useful for FCC/ETSI certification purposes where high duty cycle is required. Only used for emission certification.

Radio Tool CW: In this mode the device transmits an un-modulated RF tone. The frequencies can be selected in steps of 312.5Khz. Note that the power output with tone 0 is very low. In case higher RF power is desired use tone numbers other than 0.

I. Method of Monitoring EUT Operation

Consistent with the Mode of Operation section above, there needs to be a means of continuously monitoring the operation of the EUT.

(#1) Production Firmware: The XW210 has no display. Proper operation can be monitored by successful connection to a WiFi access point and access to the internal web server from a web browser. Continuous monitoring can be made by refreshing the web browser display. The LINK Led will be illuminated when the XW-210 has successfully connected to a WiFi access point.

(#1) Radio Tool Firmware: There will be indication through the program console of proper operation. The Radio Tool is not capable of monitoring the emissions. With the Radio Tool firmware the LINK Led is off.

(#2) Production Firmware: If the XW-210 is not performing its functions, the access point will not receive the SSID or the internal web server will not be accessible. The LINK Led will be off.

(#2) Radio Tool Firmware: The XW21The Radio Tool will display an error if it cannot communicate with the EUT. The Radio Tool is not capable of monitoring the emissions.

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 Xytronix Research & Design upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.247 Duty Cycle Check

Test Requirements: **558074 D01 DTS Meas Guidance v04:** All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

Test Procedure: The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T, where T is defined in section II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

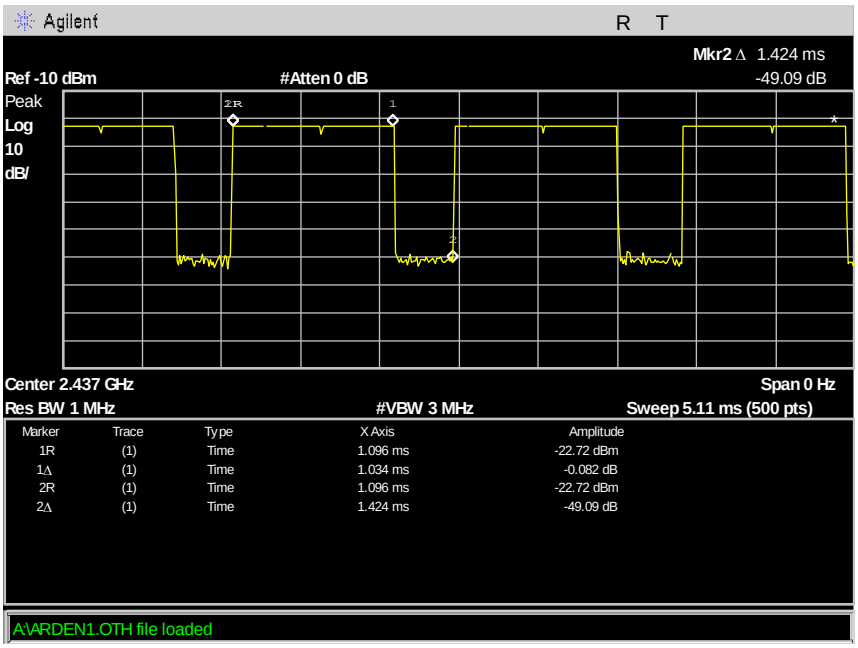
Test Results: The duty cycle of EUT is 96%

Test Engineer(s): Jun Qi

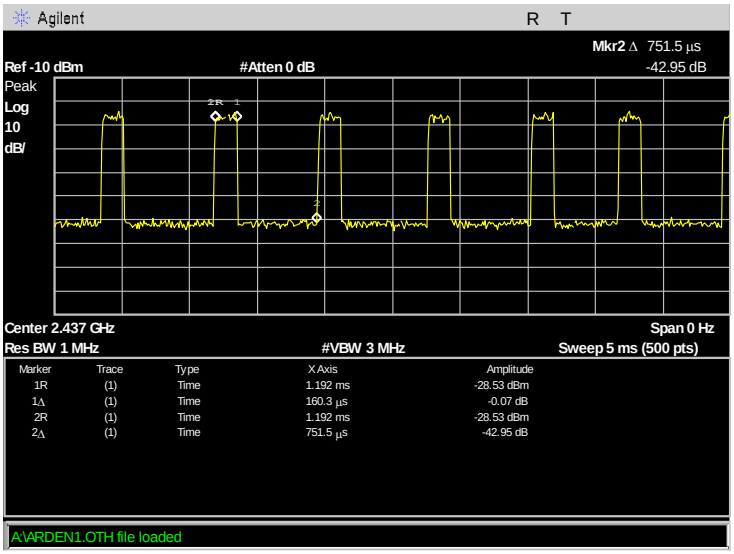
Test Date(s): 7/18/2017

DCF = 10*log(1/Duty cycle)

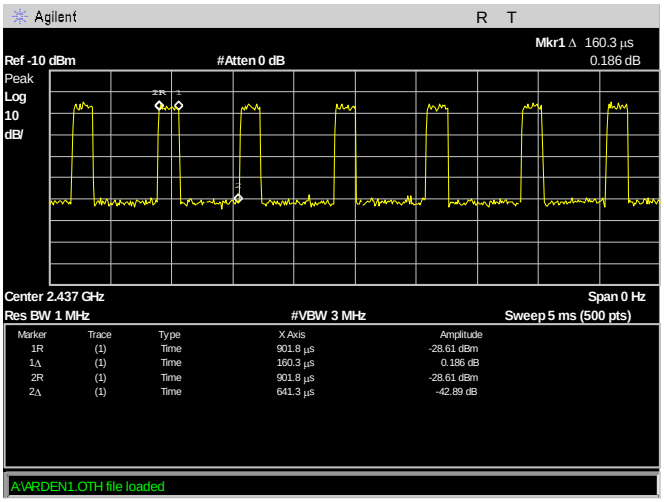
Center Frequency	Bandwidth	Mode	Duty Cycle	Duty Cycle Factor(dB)
Ch 2437M	BW 20M	b mode	0.726	1.39
Ch 2437M	BW 20M	g mode	0.213	6.71
Ch 2437M	BW 20M	n mode	0.250	6.02



Plot 1. 11b Duty Cycle



Plot 2. 11g Duty Cycle



Plot 3. 11n Duty Cycle

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 C of §15.203.

Test Engineer(s): Jun Qi

Test Date(s): July 18, 2017

Gain	Type	Model	Manufacturer
2 dBi	Dipole	W1030	Pulse Electronics

Table 7. Antenna List

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 8. 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 C63.4-2014 "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.

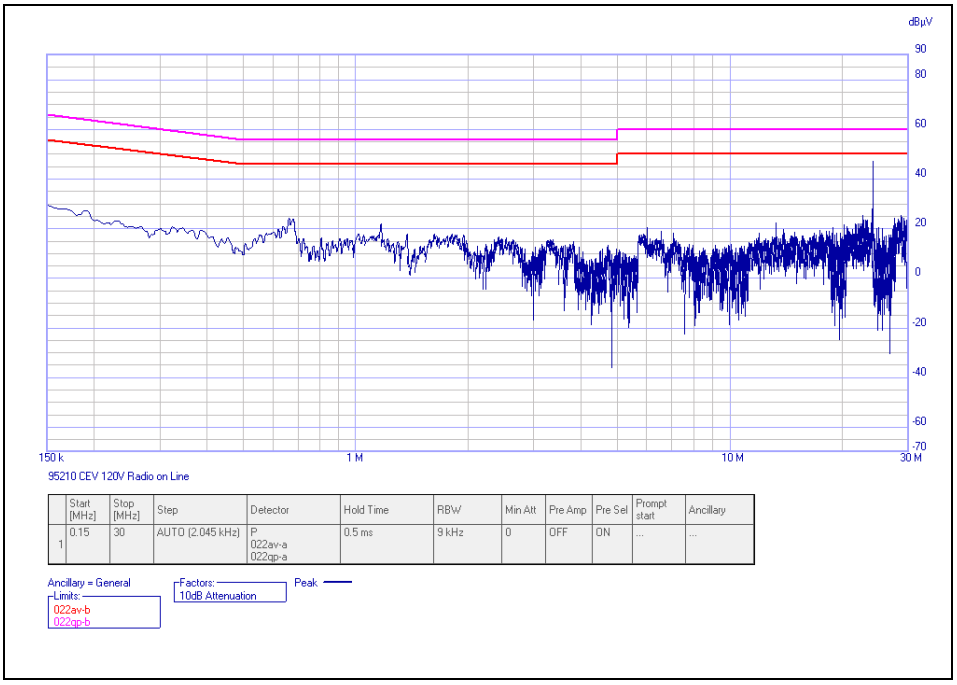
Test Engineer(s): Jun Qi

Test Date(s): July 19, 2017

15.207(a) Conducted Emissions Test Results

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	0.15	29.46	66	-36.54	Pass	21.15	56	-34.85	Pass
Line	0.15409	28.98	65.777	-36.797	Pass	20.78	55.777	-34.997	Pass
Line	0.663295	23.14	56	-32.86	Pass	17.41	46	-28.59	Pass
Line	22.55706	21.06	60	-38.94	Pass	13.95	50	-36.05	Pass
Line	23.98243	41.11	60	-18.89	Pass	32.73	50	-17.27	Pass
Line	28.426	22.73	60	-37.27	Pass	16.49	50	-33.51	Pass

Table 9. Conducted Emissions, 15.207(a), Phase Line, Test Results

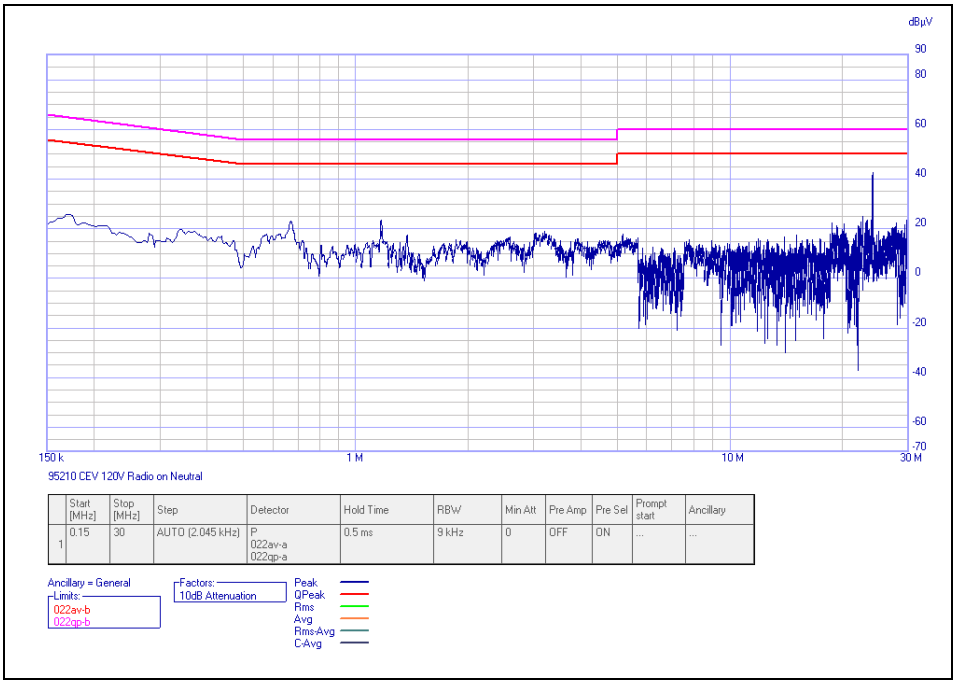


Plot 4. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

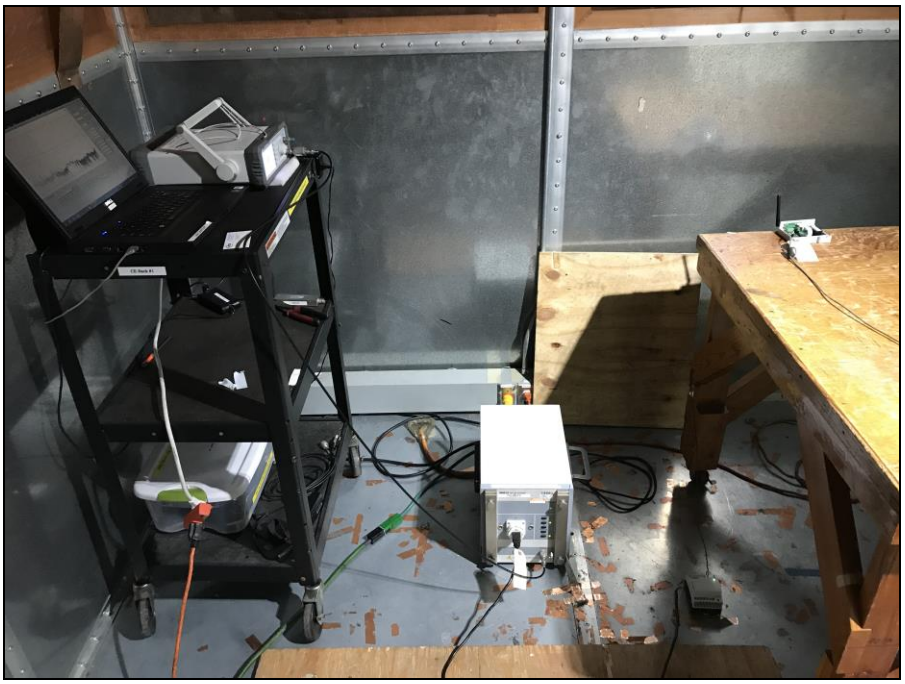
Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Neutral	0.17045	30.25	64.941	-34.691	Pass	20.15	54.941	-34.791	Pass
Neutral	1.170455	26.76	56	-29.24	Pass	23.7	46	-22.3	Pass
Neutral	22.57547	25.62	60	-34.38	Pass	21.9	50	-28.1	Pass
Neutral	23.23396	23.12	60	-36.88	Pass	19.3	50	-30.7	Pass
Neutral	24.00084	46.24	60	-13.76	Pass	42.71	50	-7.29	Pass
Neutral	29.59	24.79	60	-35.21	Pass	21.05	50	-28.95	Pass

Table 10. 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 Photo



Photograph 2. Conducted Emissions, 15.207(a), Test Setup

Photograph 3. Conducted Emissions, 15.207(a), Milliohm

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB Bandwidth

Test Requirements: **§ 15.247(a)(2):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

Test Results The EUT was compliant with § 15.247 (a)(2).

The 6 dB Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Jun Qi

Test Date(s): July 18, 2017

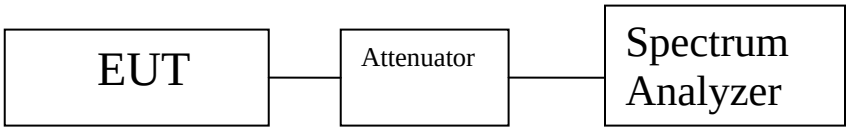


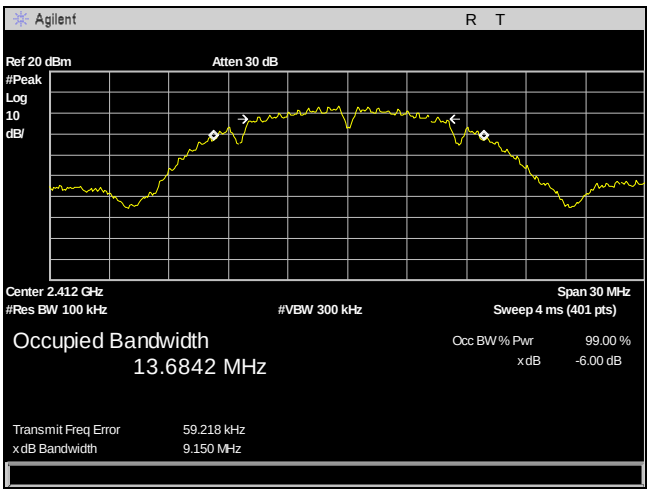
Figure 2. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

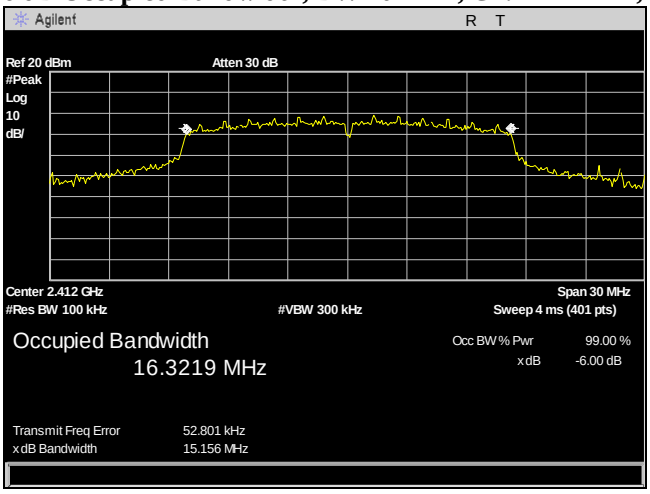
Center Frequency	Bandwidth	Mode	6dB Bandwidth(MHz)
Ch 2412M	BW 20M	b mode	9.15
Ch 2412M	BW 20M	g mode	15.156
Ch 2412M	BW 20M	n mode	15.209
Ch 2437M	BW 20M	b mode	9.16
Ch 2437M	BW 20M	g mode	15.201
Ch 2437M	BW 20M	n mode	15.184
Ch 2462M	BW 20M	b mode	9.173
Ch 2462M	BW 20M	g mode	15.191
Ch 2462M	BW 20M	n mode	15.198

Table 11. 6 dB Occupied Bandwidth, Test Results

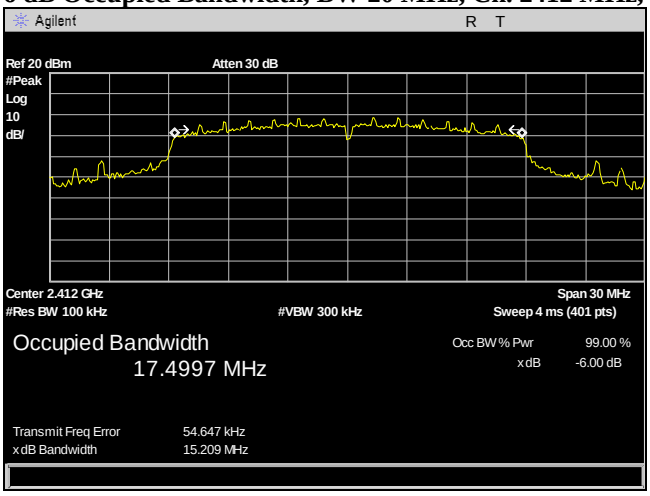
6 dB Occupied Bandwidth Test Results



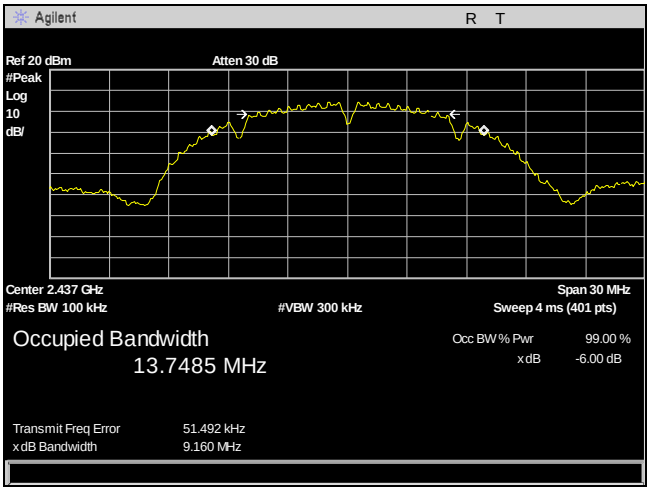
Plot 6. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2412 MHz, b mode



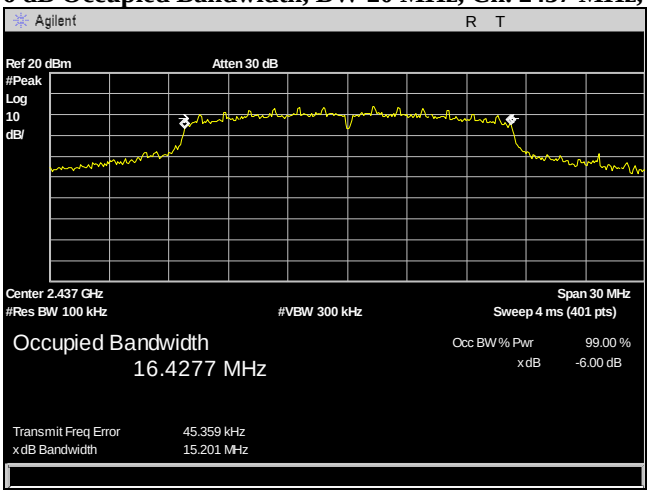
Plot 7. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2412 MHz, g mode



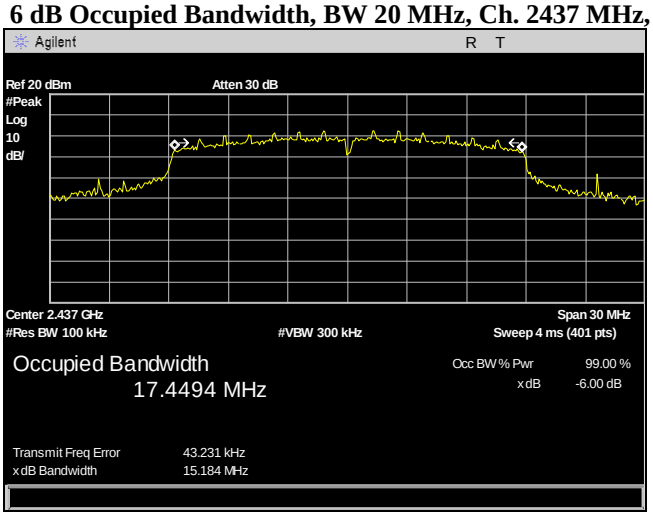
Plot 8. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2412 MHz, n mode



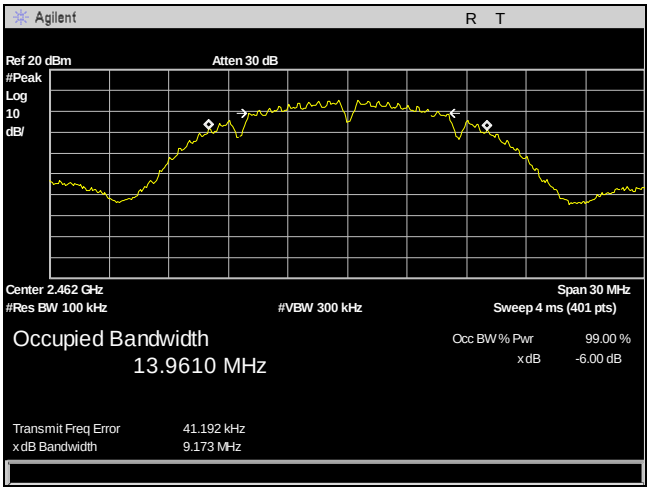
Plot 9. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2437 MHz, b mode



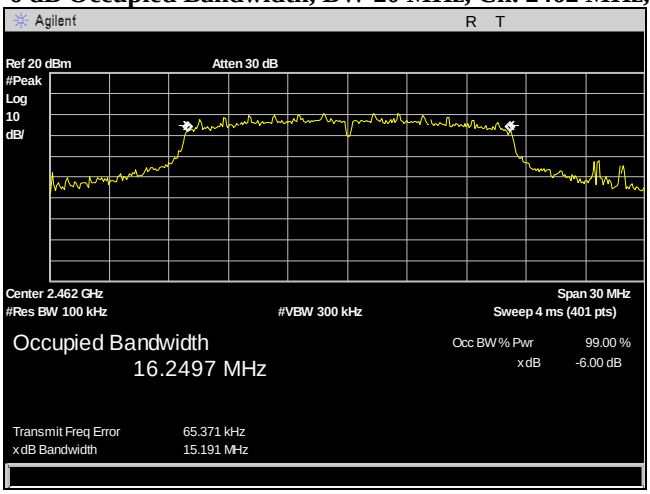
Plot 10. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2437 MHz, g mode



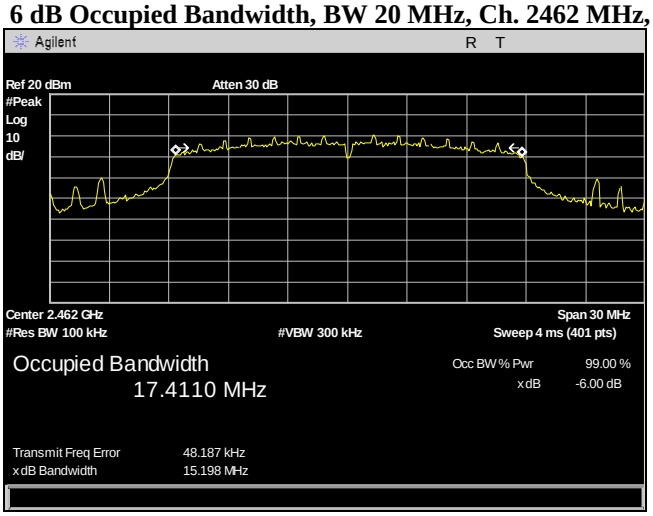
Plot 11. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2437 MHz, n mode



Plot 12. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2462 MHz, b mode



Plot 13. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2462 MHz, g mode



Plot 14. 6 dB Occupied Bandwidth, BW 20 MHz, Ch. 2462 MHz, n mode

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

Test Requirements: **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400–2483.5	1.000
5725– 5850	1.000

Table 12. Output Power Requirements from §15.247(b)

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 12, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

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 at the maximum power level.

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

Test Engineer(s): Jun Qi

Test Date(s): July 18, 2017

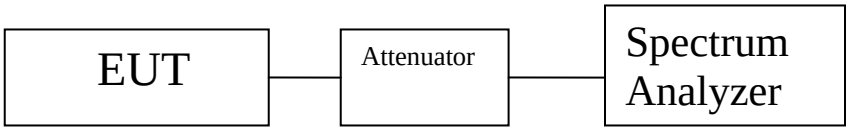


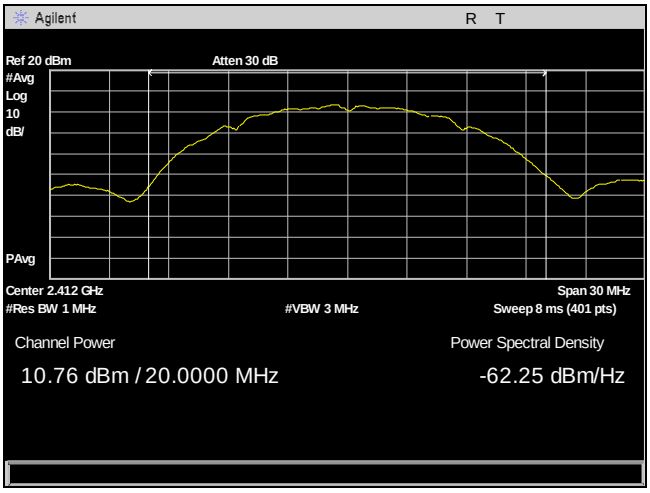
Figure 3. Peak Power Output Test Setup

Peak Power Output Test Results

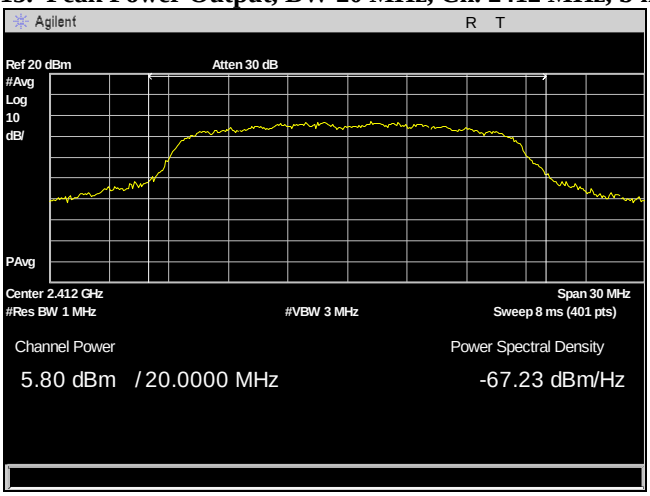
Center Frequency	Bandwidth	Mode	Measured Data dBm	Duty Cycle Factor	Final Data dBm	Antenna Gain dBi	Limit dBm	Margin dB
Ch 2412M	BW 20M	b mode	10.76	1.39	12.15	2	30	17.85
Ch 2412M	BW 20M	g mode	5.8	6.71	12.51	2	30	17.49
Ch 2412M	BW 20M	n mode	4.83	6.02	10.85	2	30	19.15
Ch 2437M	BW 20M	b mode	12.1	1.39	13.49	2	30	16.51
Ch 2437M	BW 20M	g mode	8.47	6.71	15.18	2	30	14.82
Ch 2437M	BW 20M	n mode	7.49	6.02	13.51	2	30	16.49
Ch 2462M	BW 20M	b mode	12.33	1.39	13.72	2	30	16.28
Ch 2462M	BW 20M	g mode	5.48	6.71	12.19	2	30	17.81
Ch 2462M	BW 20M	n mode	4.22	6.02	10.24	2	30	19.76

Table 13. Peak Power Output, Test Results

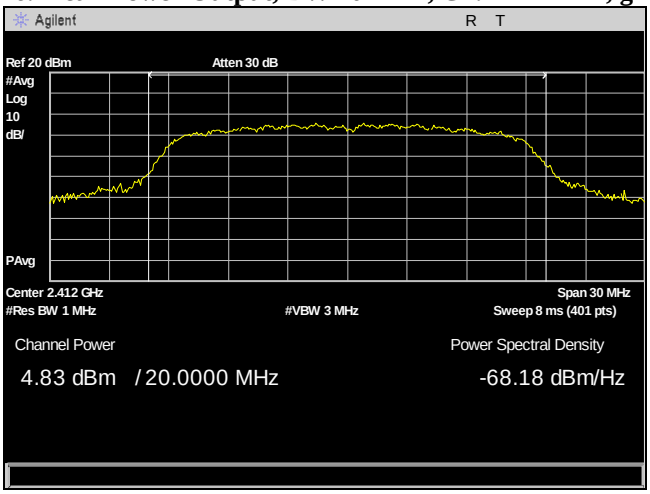
Peak Power Output Test Results



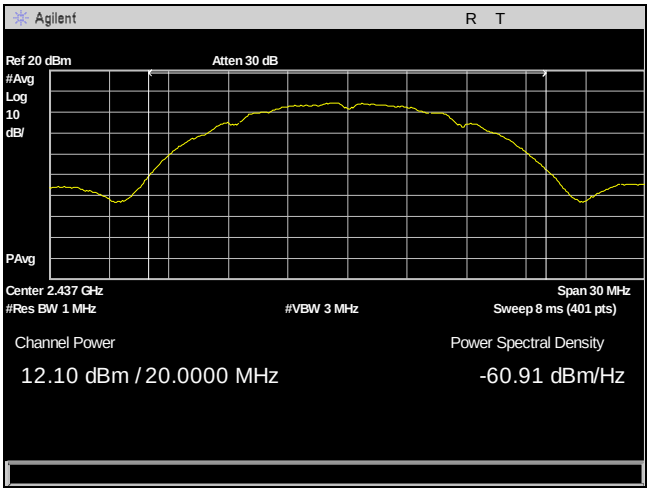
Plot 15. Peak Power Output, BW 20 MHz, Ch. 2412 MHz, b mode



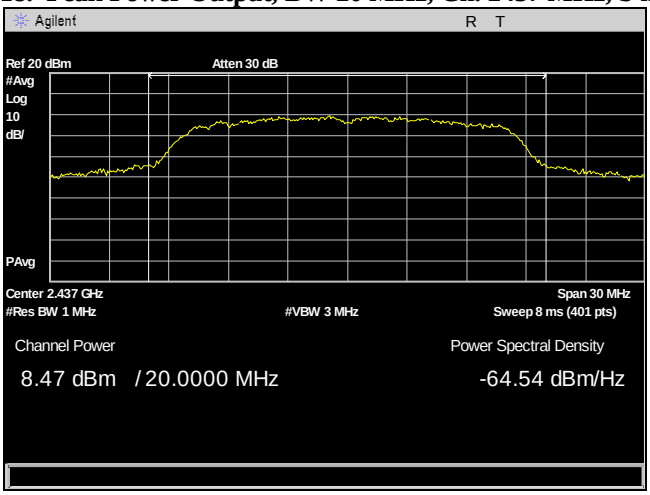
Plot 16. Peak Power Output, BW 20 MHz, Ch. 2412 MHz, g mode



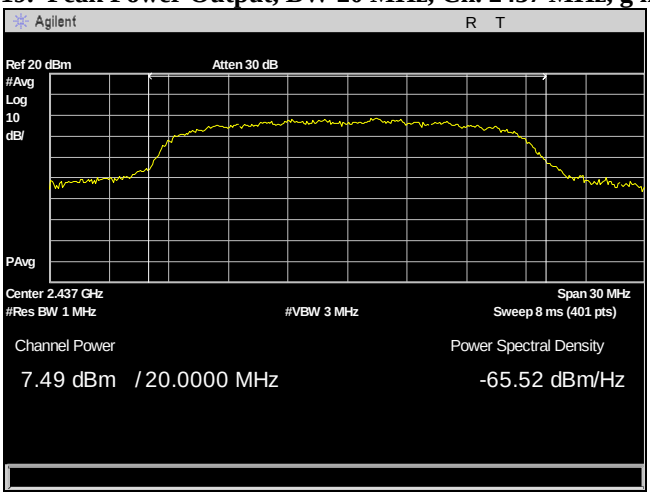
Plot 17. Peak Power Output, BW 20 MHz, Ch. 2412 MHz, n mode



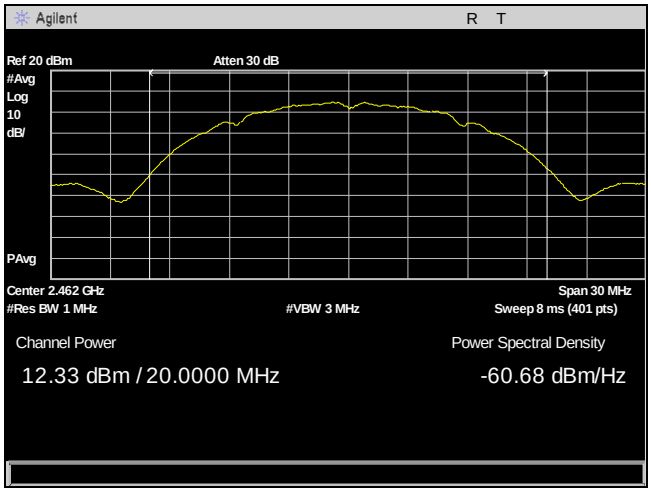
Plot 18. Peak Power Output, BW 20 MHz, Ch. 2437 MHz, b mode



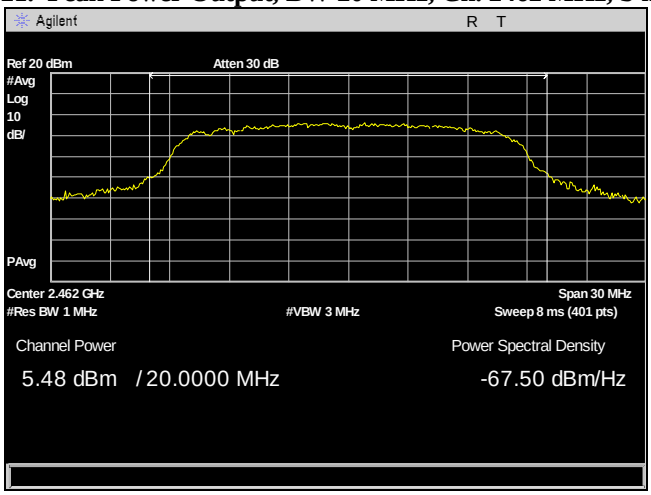
Plot 19. Peak Power Output, BW 20 MHz, Ch. 2437 MHz, g mode



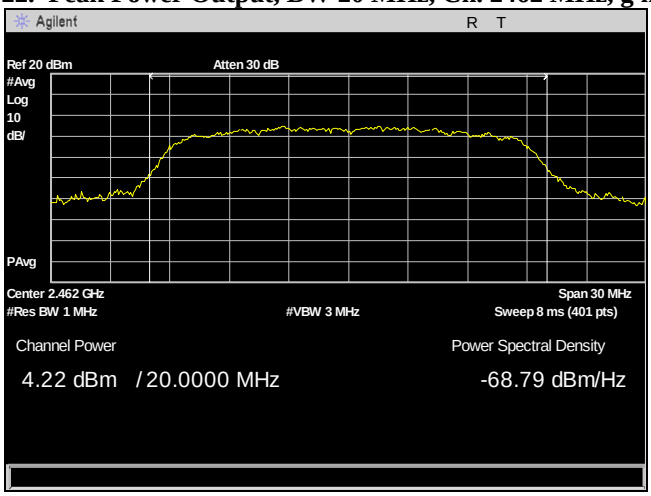
Plot 20. Peak Power Output, BW 20 MHz, Ch. 2437 MHz, n mode



Plot 21. Peak Power Output, BW 20 MHz, Ch. 2462 MHz, b mode



Plot 22. Peak Power Output, BW 20 MHz, Ch. 2462 MHz, g mode



Plot 23. Peak Power Output, BW 20 MHz, Ch. 2462 MHz, n mode

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 14. 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 15.

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

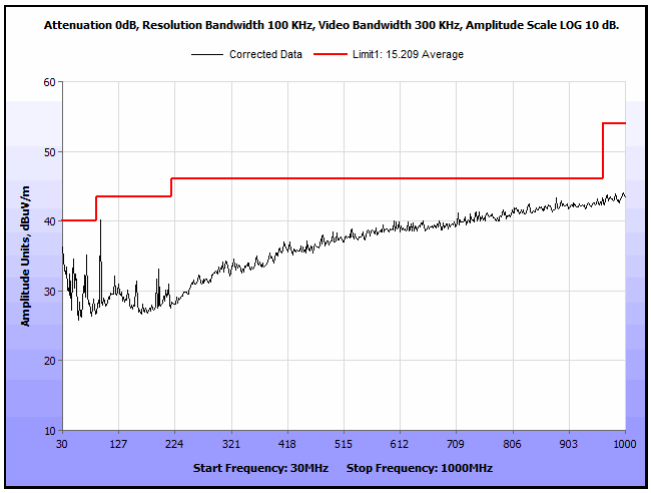
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

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

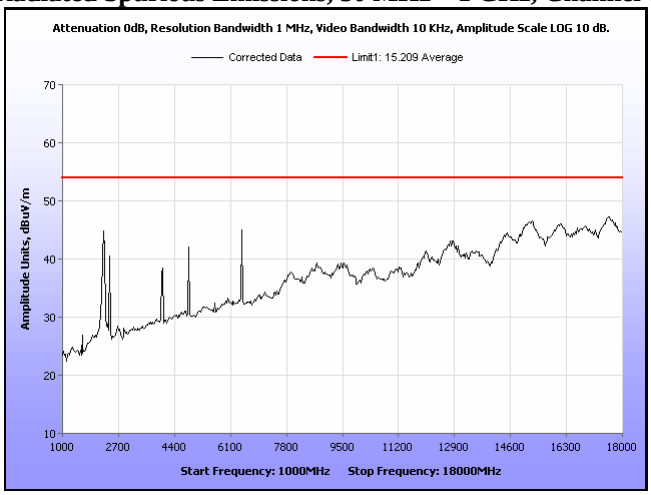
Test Engineer(s): Jun Qi

Test Date(s): July 20, 2017

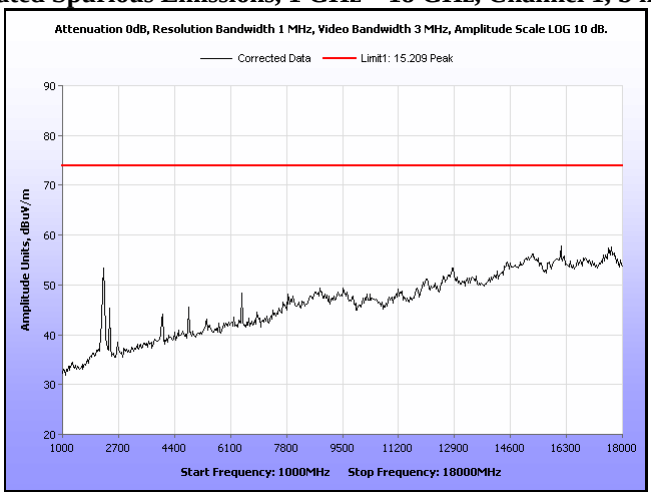
Radiated Spurious Emissions Test Results



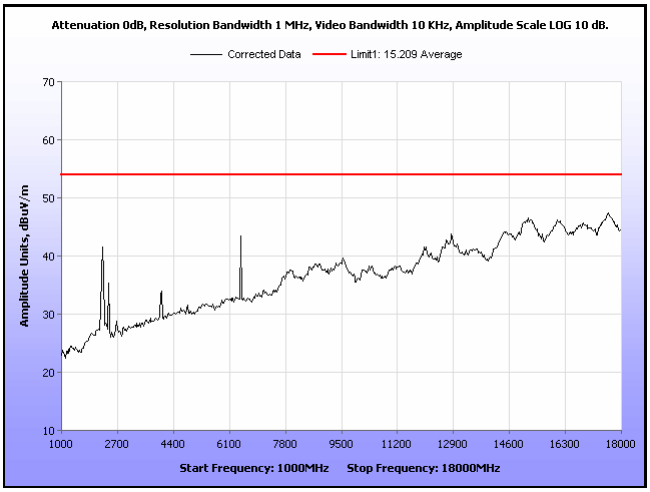
Plot 24. Radiated Spurious Emissions, 30 MHz – 1 GHz, Channel 6, b mode



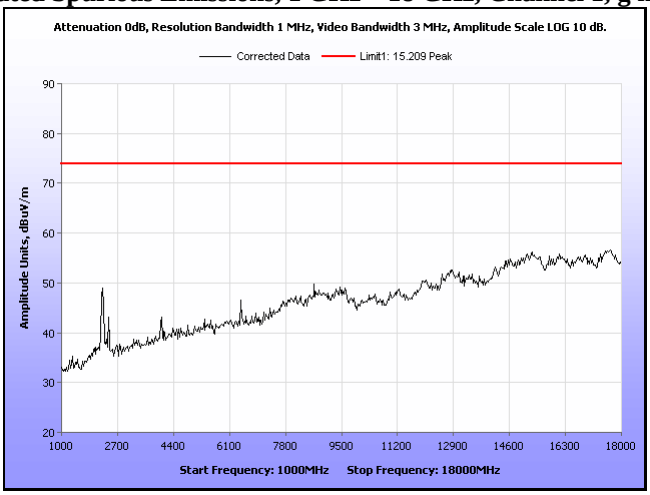
Plot 25. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, b mode, Average



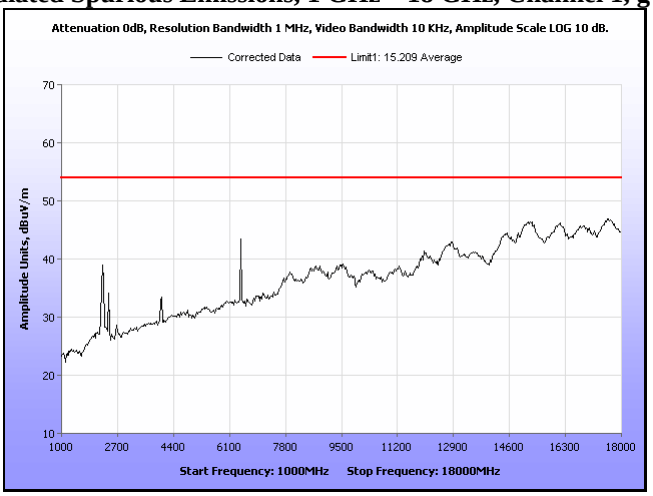
Plot 26. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, b mode, Peak



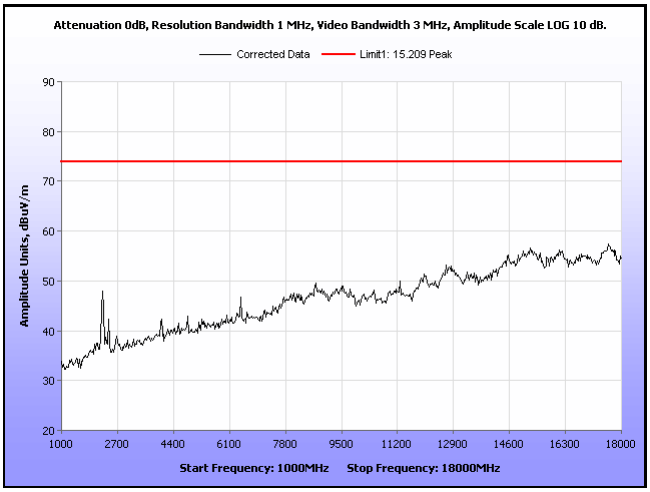
Plot 27. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, g mode, Average



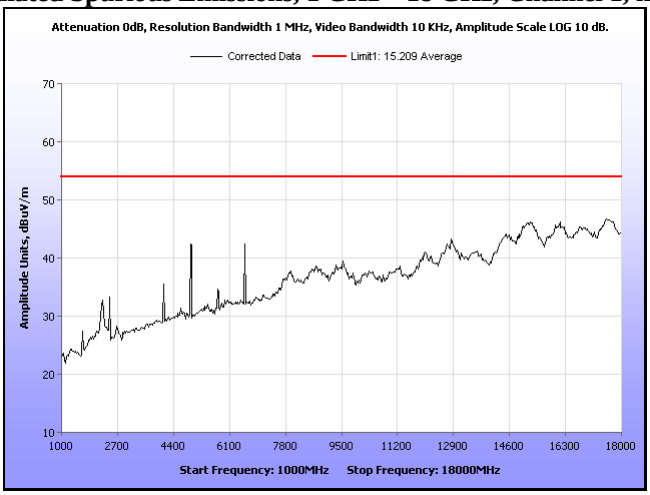
Plot 28. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, g mode, Peak



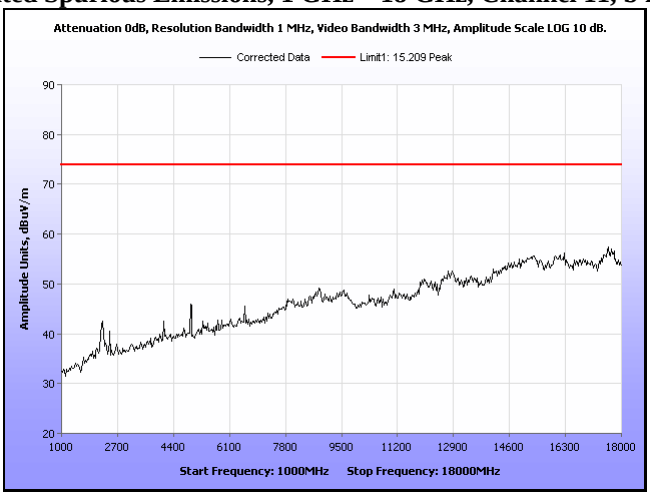
Plot 29. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, n mode, Average



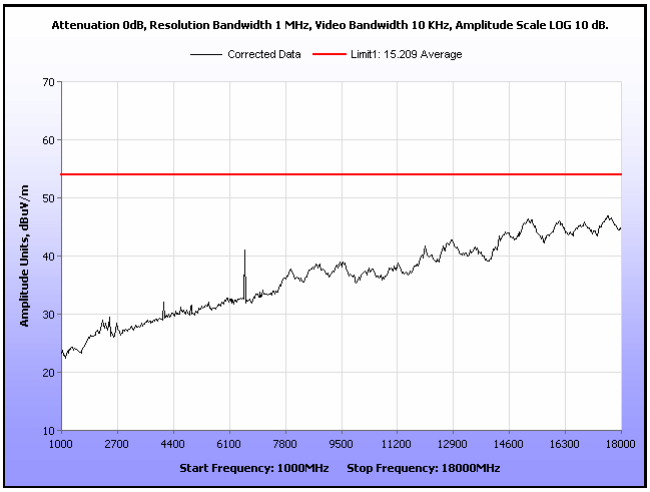
Plot 30. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1, n mode, Peak



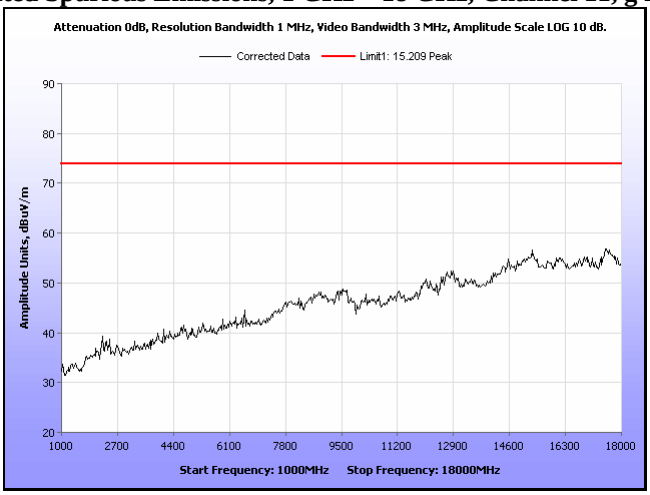
Plot 31. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, b mode, Average



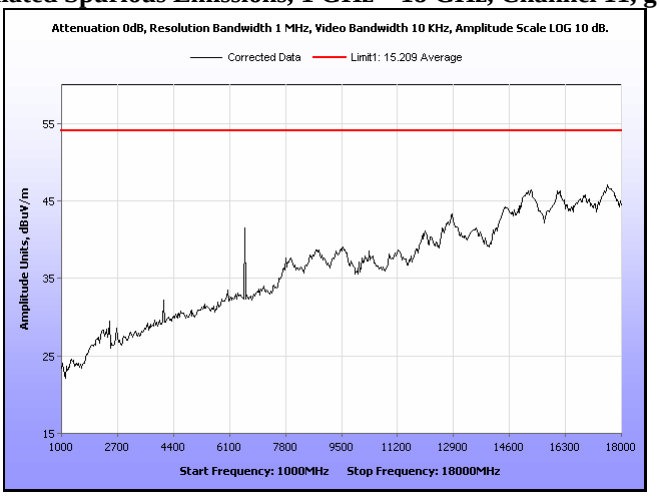
Plot 32. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, b mode, Peak



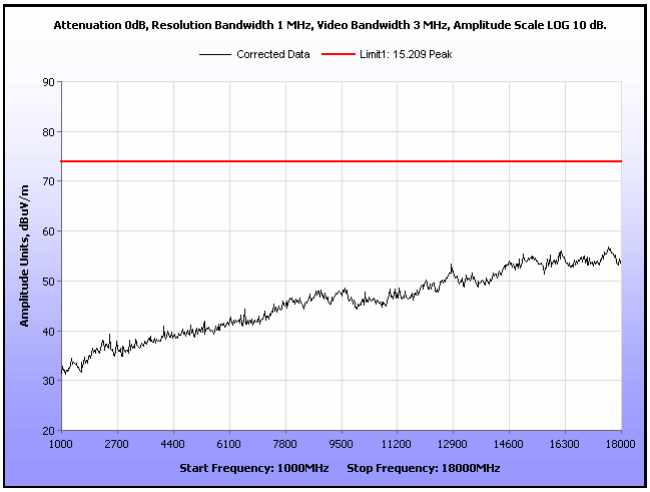
Plot 33. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, g mode, Average



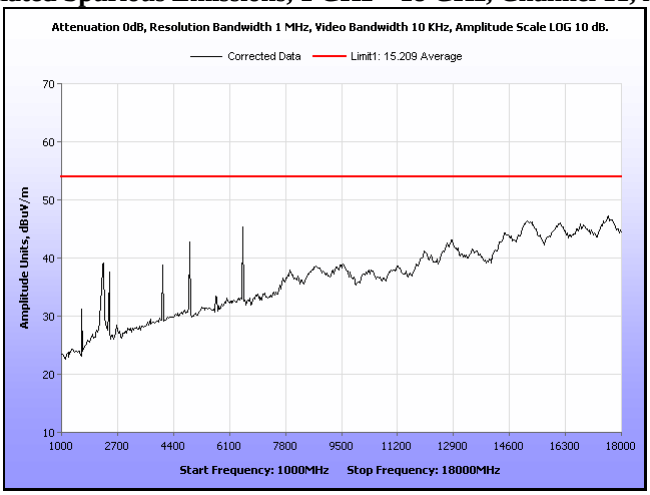
Plot 34. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, g mode, Peak



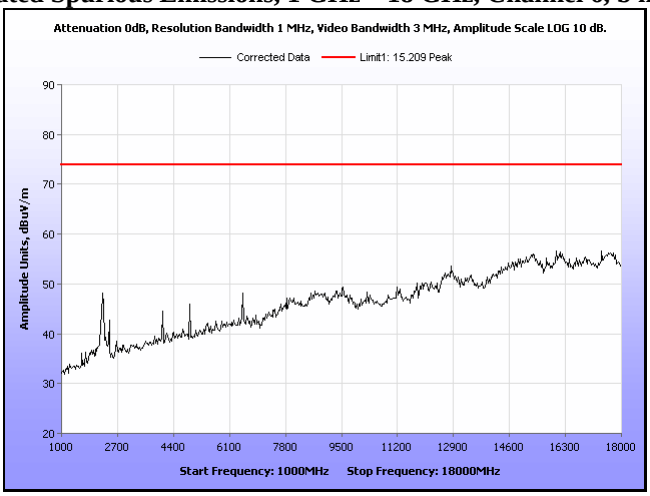
Plot 35. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, n mode, Average



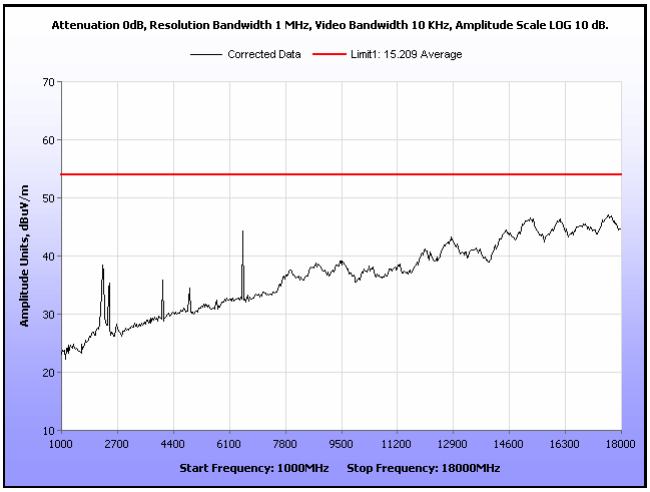
Plot 36. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11, n mode, Peak



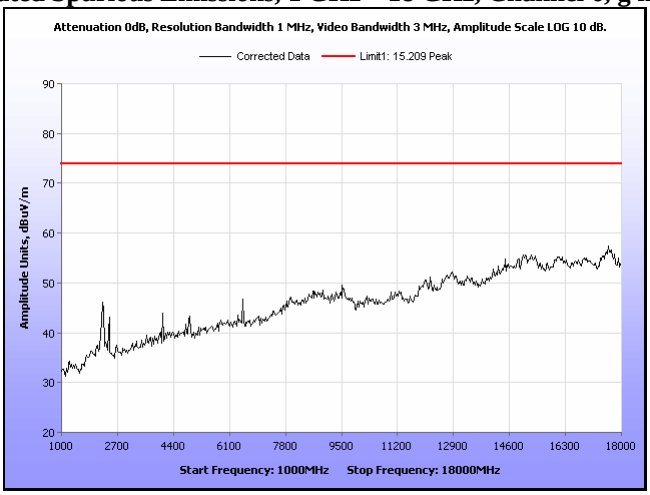
Plot 37. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, b mode, Average



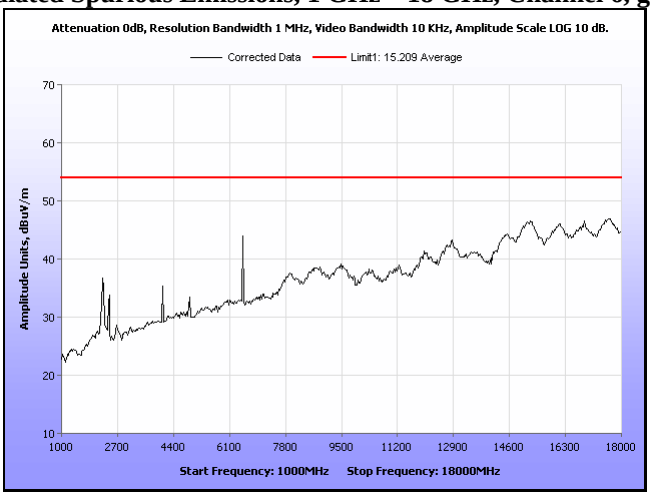
Plot 38. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, b mode, Peak



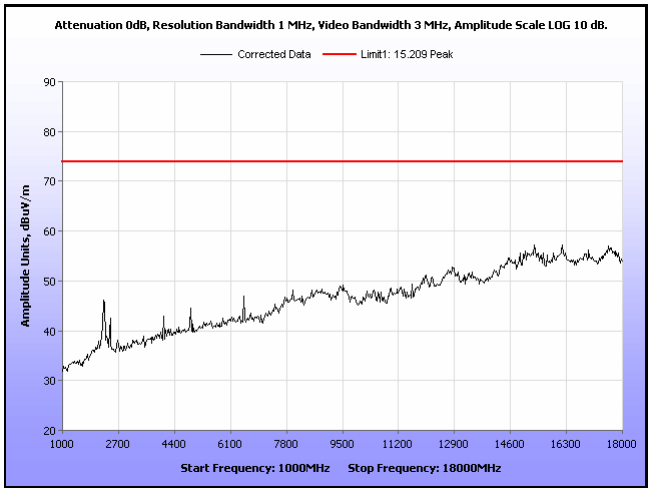
Plot 39. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, g mode, Average



Plot 40. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, g mode, Peak



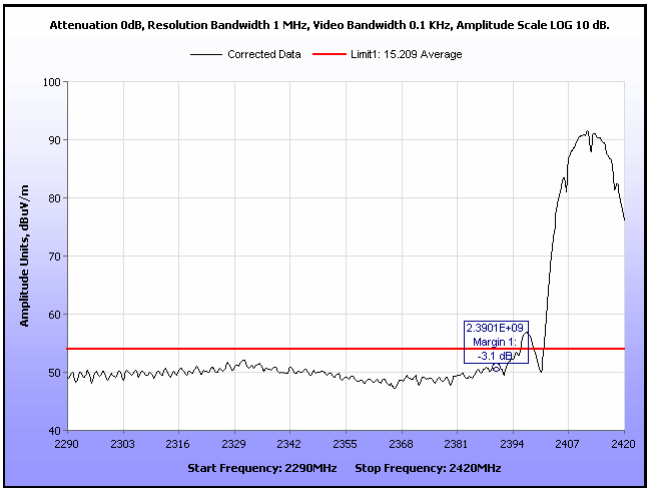
Plot 41. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, n mode, Average



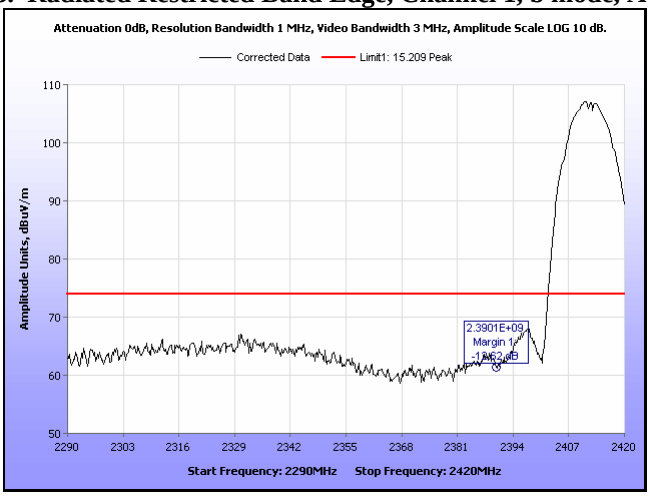
Plot 42. Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 6, n mode, Peak

Radiated Band Edge Measurements

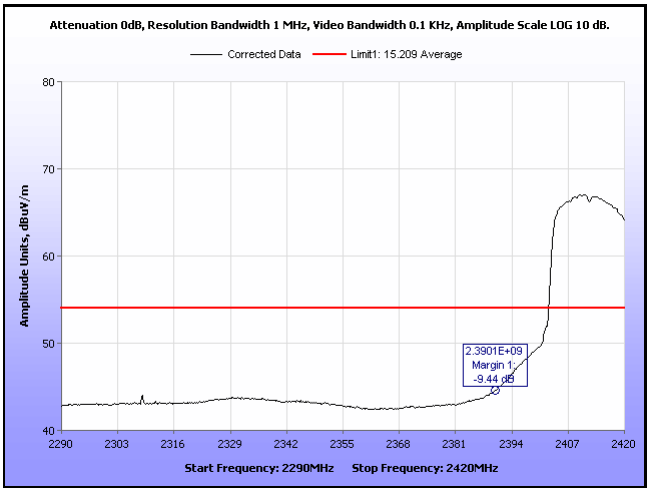
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.



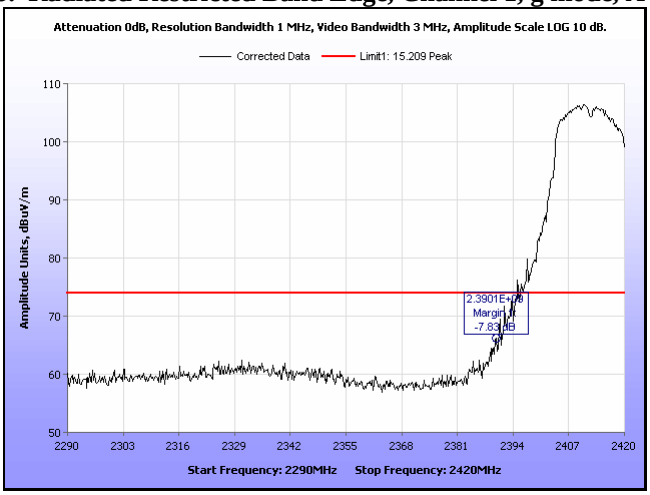
Plot 43. Radiated Restricted Band Edge, Channel 1, b mode, Average



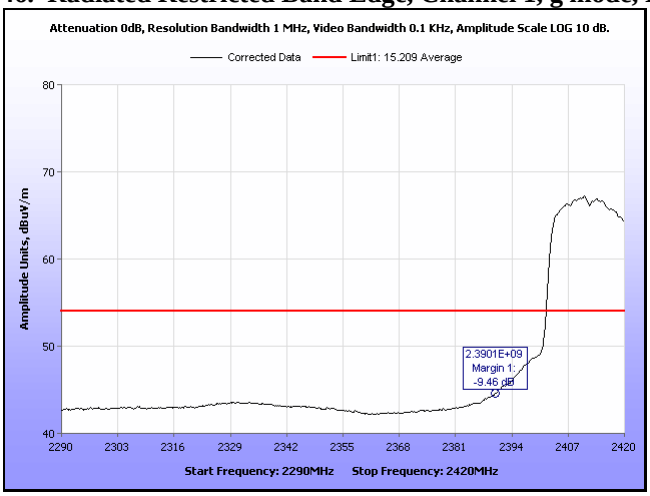
Plot 44. Radiated Restricted Band Edge, Channel 1, b mode, Peak



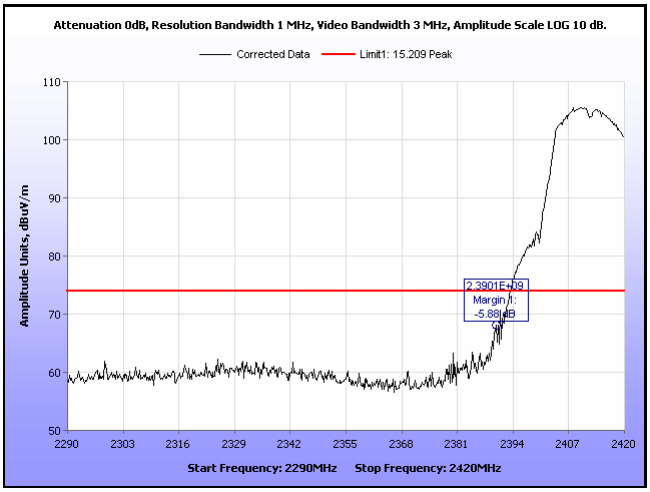
Plot 45. Radiated Restricted Band Edge, Channel 1, g mode, Average



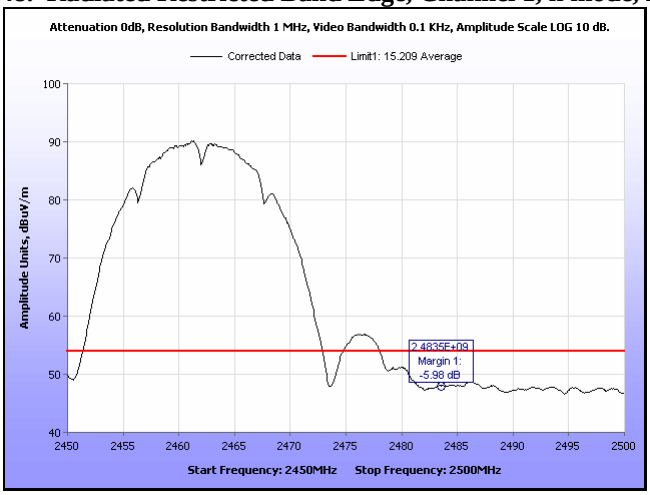
Plot 46. Radiated Restricted Band Edge, Channel 1, g mode, Peak



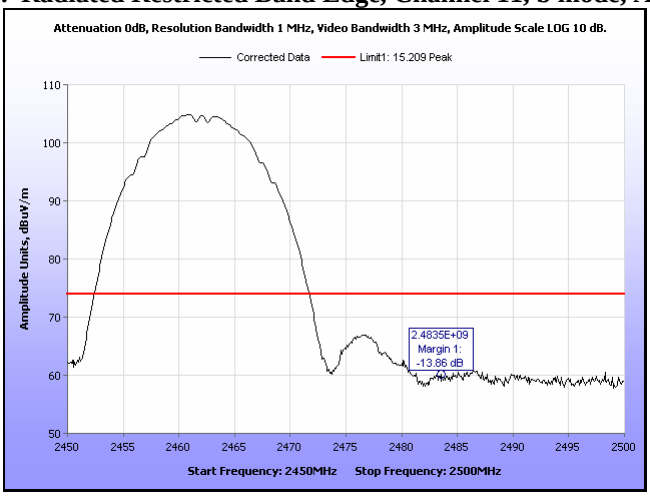
Plot 47. Radiated Restricted Band Edge, Channel 1, n mode, Average



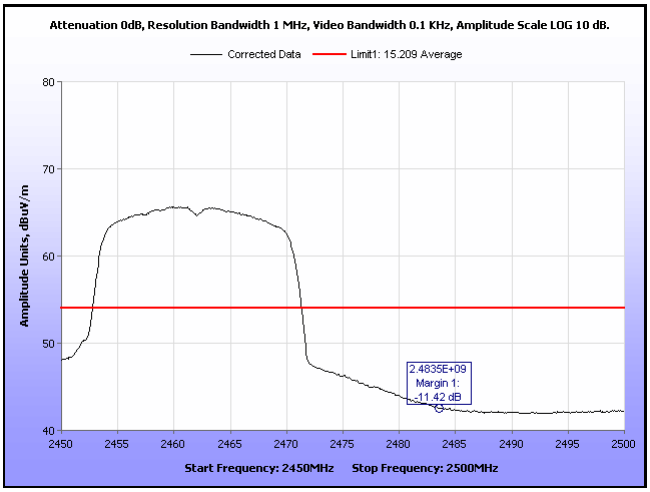
Plot 48. Radiated Restricted Band Edge, Channel 1, n mode, Peak



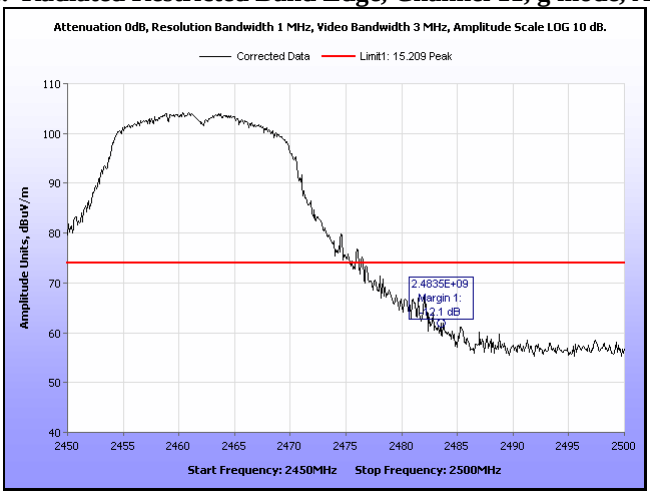
Plot 49. Radiated Restricted Band Edge, Channel 11, b mode, Average



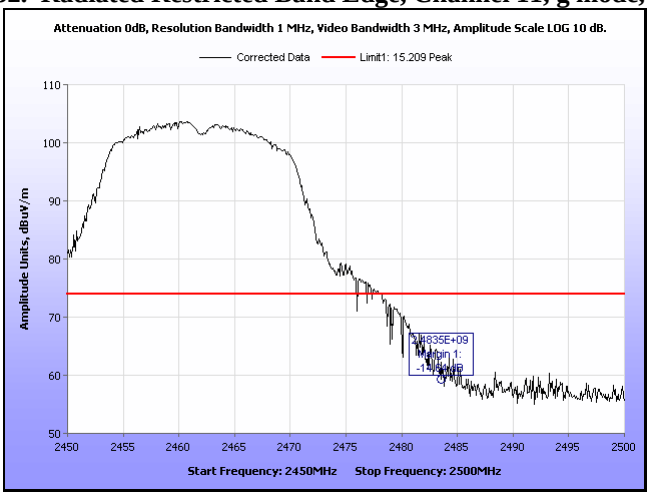
Plot 50. Radiated Restricted Band Edge, Channel 11, b mode, Peak



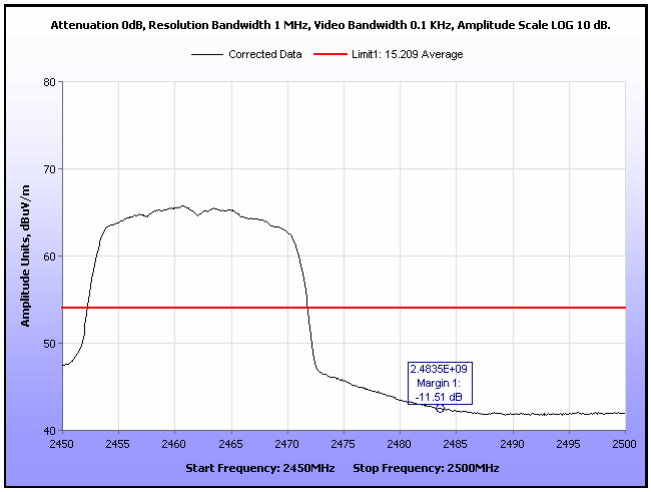
Plot 51. Radiated Restricted Band Edge, Channel 11, g mode, Average



Plot 52. Radiated Restricted Band Edge, Channel 11, g mode, Peak

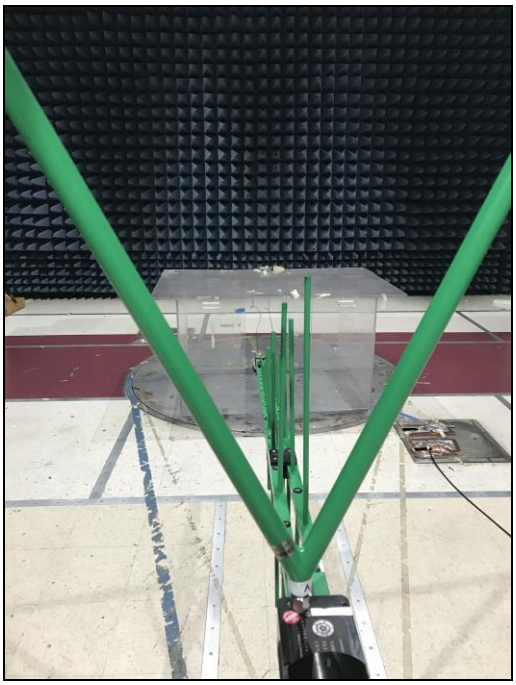


Plot 53. Radiated Restricted Band Edge, Channel 11, n mode, Average

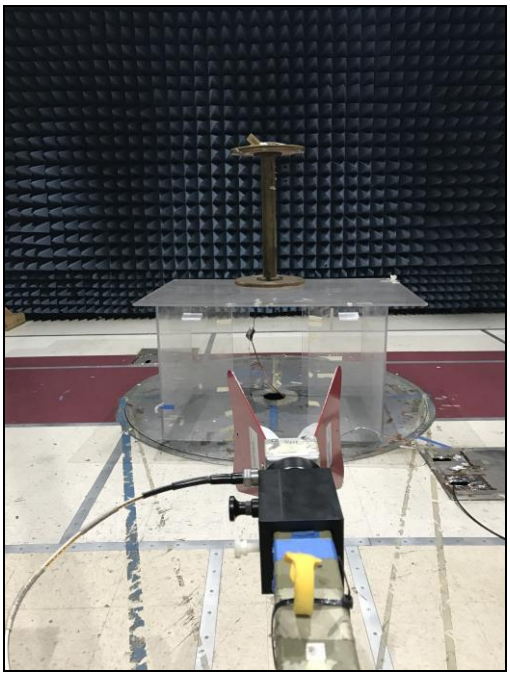


Plot 54. Radiated Restricted Band Edge, Channel 11, n mode, Peak

Radiated Spurious Emissions Test Setup



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



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

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): Jun Qi

Test Date(s): July 18, 2017

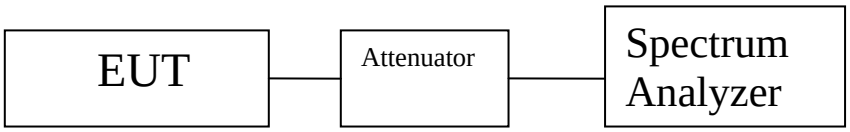
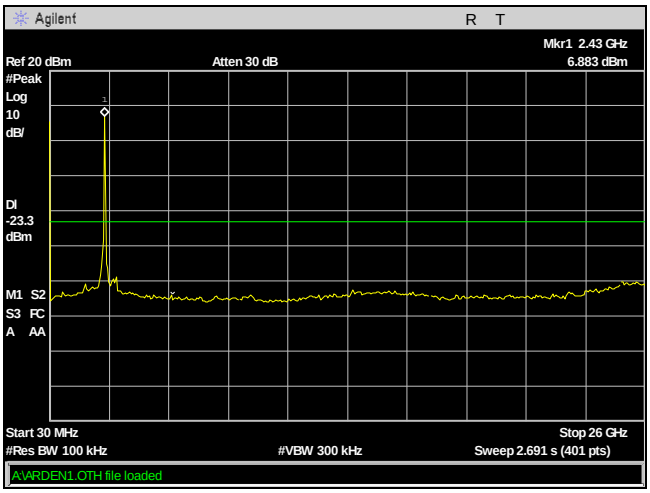
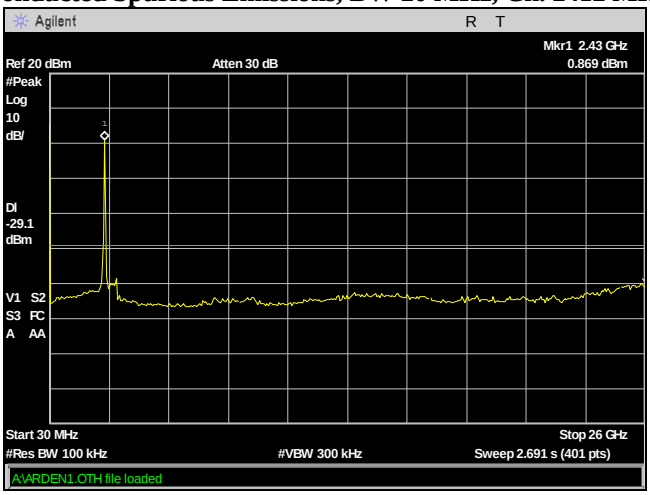


Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

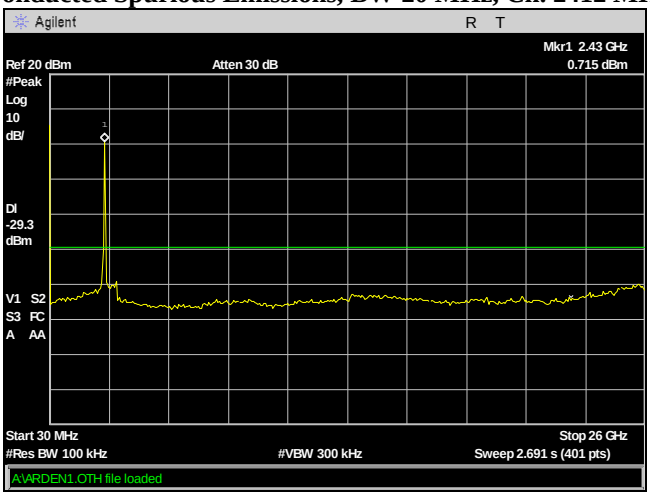
Conducted Spurious Emissions Test Results



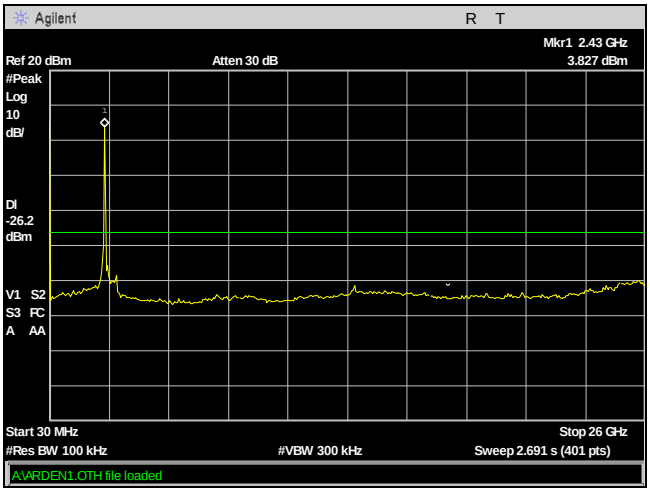
Plot 55. Conducted Spurious Emissions, BW 20 MHz, Ch. 2412 MHz, b mode



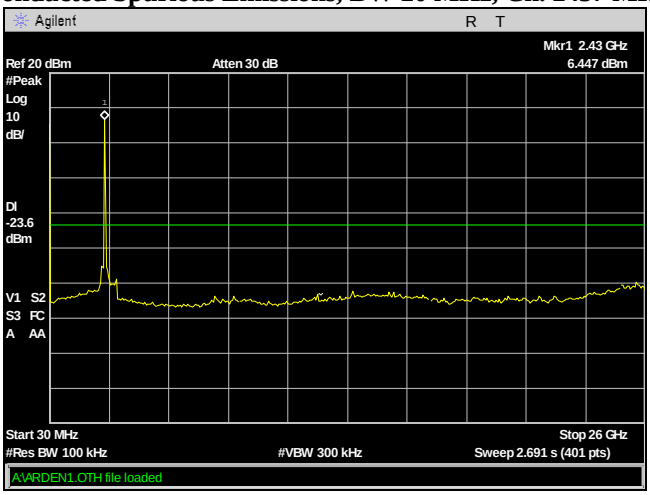
Plot 56. Conducted Spurious Emissions, BW 20 MHz, Ch. 2412 MHz, g mode



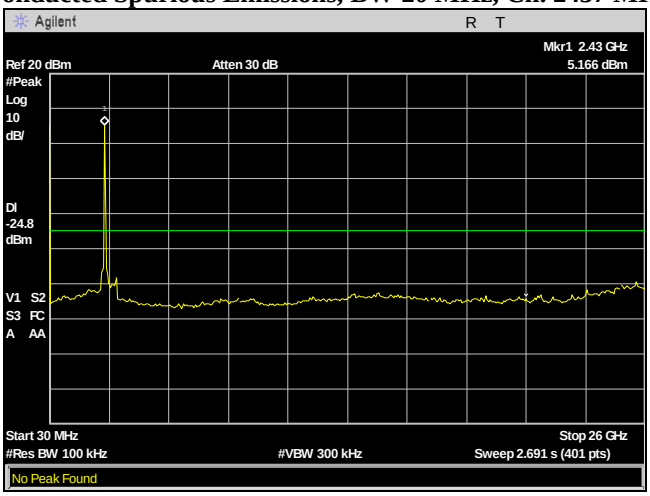
Plot 57. Conducted Spurious Emissions, BW 20 MHz, Ch. 2412 MHz, n mode



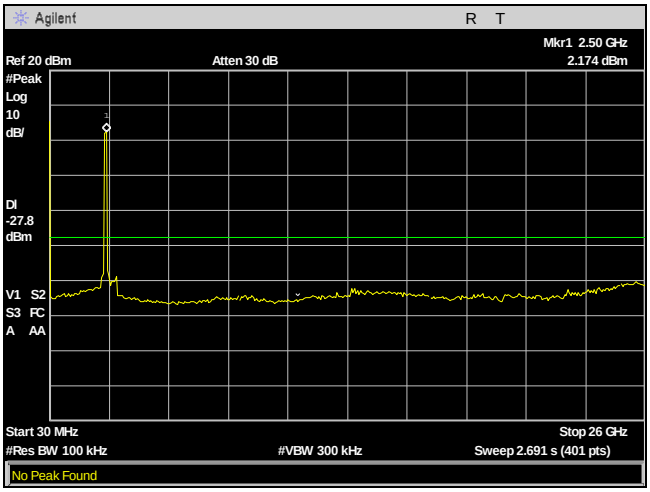
Plot 58. Conducted Spurious Emissions, BW 20 MHz, Ch. 2437 MHz, b mode



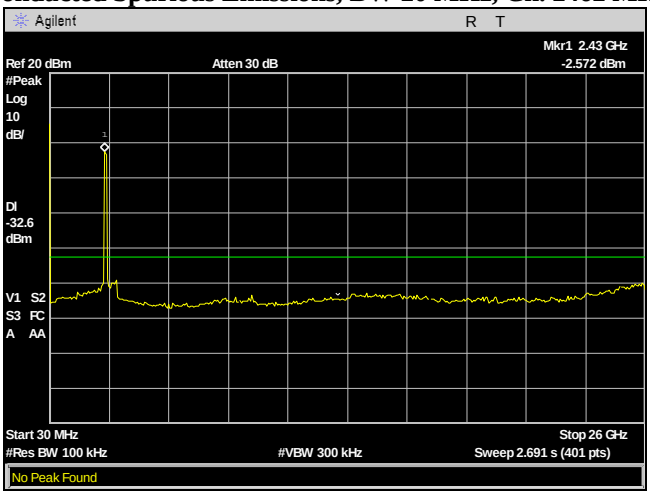
Plot 59. Conducted Spurious Emissions, BW 20 MHz, Ch. 2437 MHz, g mode



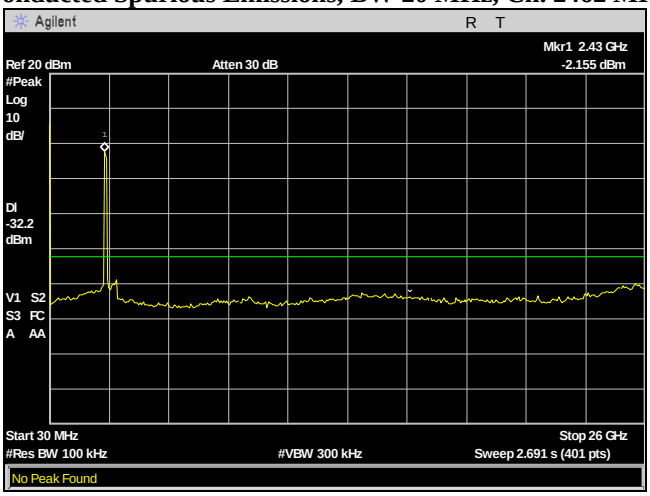
Plot 60. Conducted Spurious Emissions, BW 20 MHz, Ch. 2437 MHz, n mode



Plot 61. Conducted Spurious Emissions, BW 20 MHz, Ch. 2462 MHz, b mode

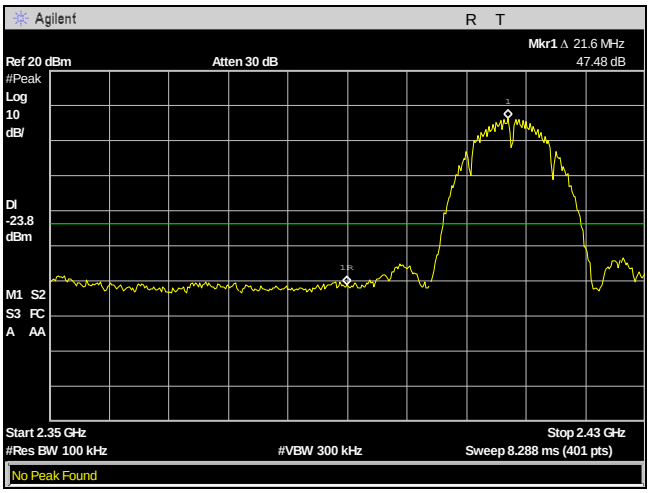


Plot 62. Conducted Spurious Emissions, BW 20 MHz, Ch. 2462 MHz, g mode

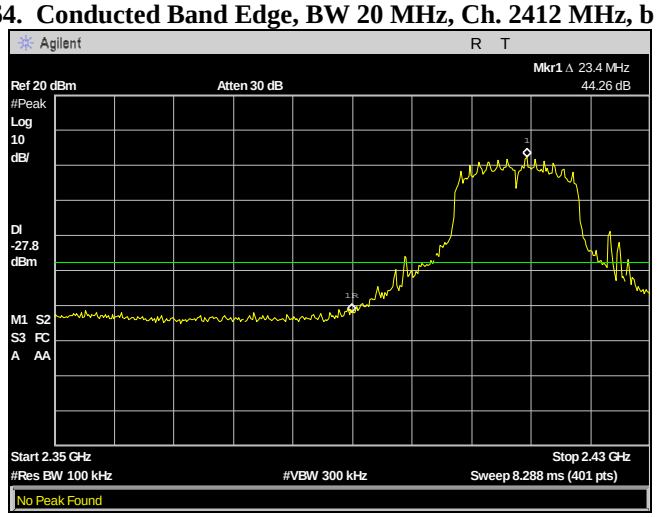


Plot 63. Conducted Spurious Emissions, BW 20 MHz, Ch. 2462 MHz, n mode

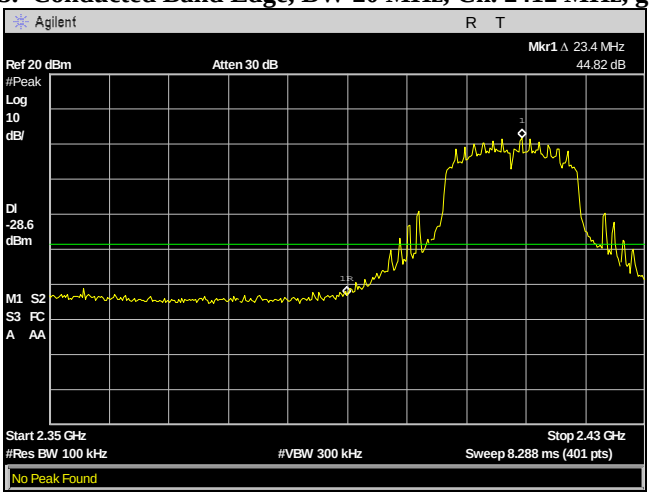
Conducted Band Edge Test Results



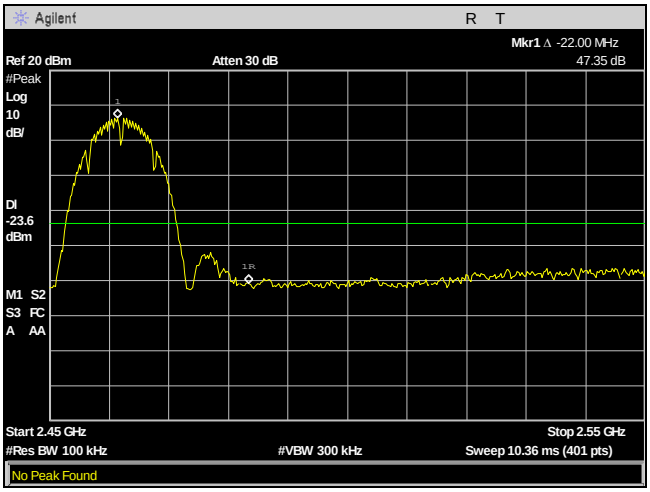
Plot 64. Conducted Band Edge, BW 20 MHz, Ch. 2412 MHz, b mode



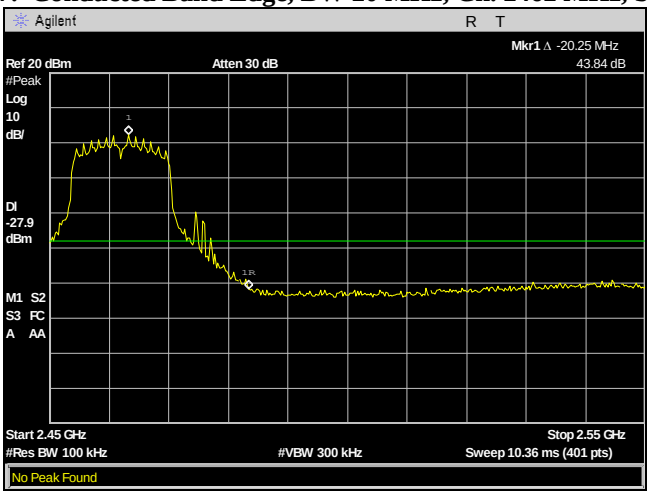
Plot 65. Conducted Band Edge, BW 20 MHz, Ch. 2412 MHz, g mode



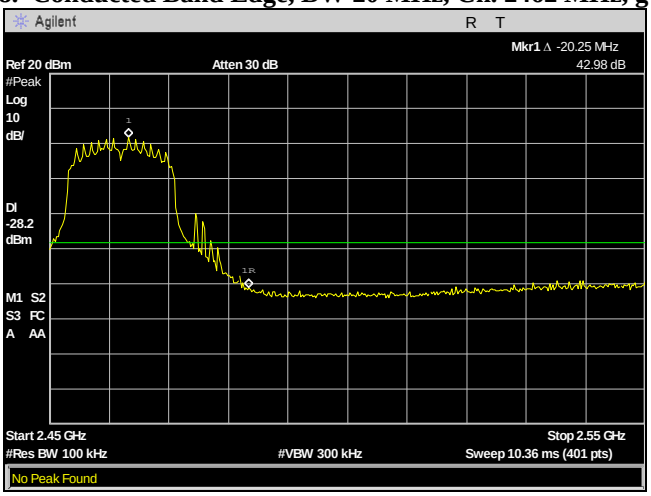
Plot 66. Conducted Band Edge, BW 20 MHz, Ch. 2412 MHz, n mode



Plot 67. Conducted Band Edge, BW 20 MHz, Ch. 2462 MHz, b mode



Plot 68. Conducted Band Edge, BW 20 MHz, Ch. 2462 MHz, g mode



Plot 69. Conducted Band Edge, BW 20 MHz, Ch. 2462 MHz, n mode

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level throughout each of the 100 sweeps of power averaging. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Jun Qi

Test Date: July 18, 2017

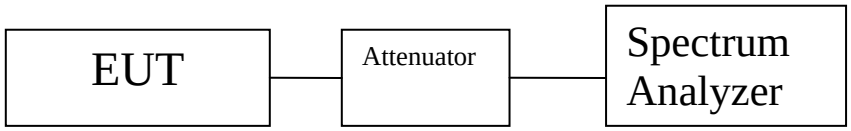


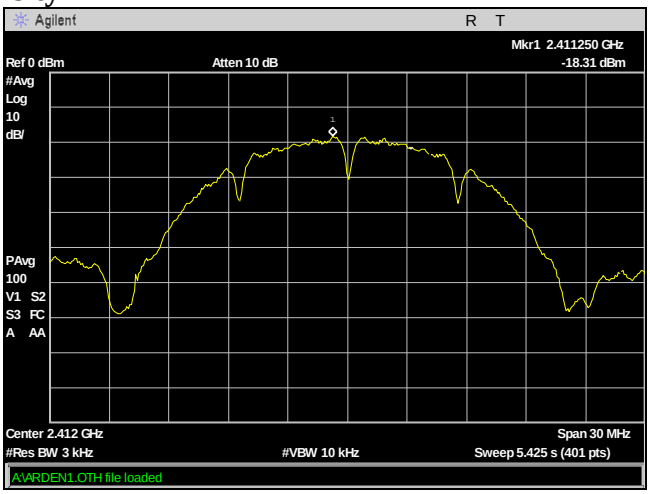
Figure 5. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

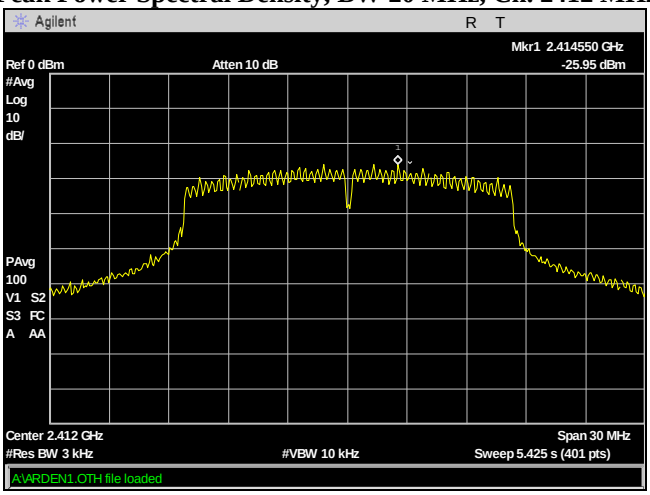
Center Frequency	Bandwidth	Mode	Measured Data dBm	Duty Cycle Factor	Final data dBm	Antenna Gain dBi	Limit dBm	Margin dB
Ch 2412M	BW 20M	b mode	-18.31	1.39	-16.92	2	8	24.92
Ch 2412M	BW 20M	g mode	-25.95	6.71	-19.24	2	8	27.24
Ch 2412M	BW 20M	n mode	-25.86	6.02	-19.84	2	8	27.84
Ch 2437M	BW 20M	b mode	-18.96	1.39	-17.57	2	8	25.57
Ch 2437M	BW 20M	g mode	-23.35	6.71	-16.64	2	8	24.64
Ch 2437M	BW 20M	n mode	-23.53	6.02	-17.51	2	8	25.51
Ch 2462M	BW 20M	b mode	-20.85	1.39	-19.46	2	8	27.46
Ch 2462M	BW 20M	g mode	-26.61	6.71	-19.9	2	8	27.9
Ch 2462M	BW 20M	n mode	-25.91	6.02	-19.89	2	8	27.89

Table 16. Peak Power Spectral Density, Test Results

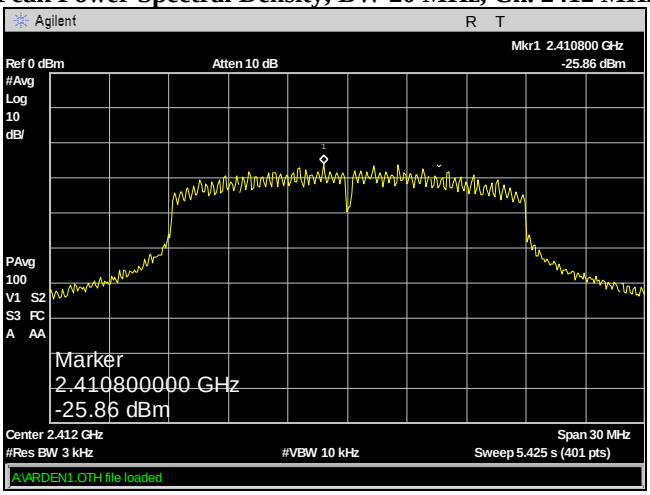
Peak Power Spectral Density



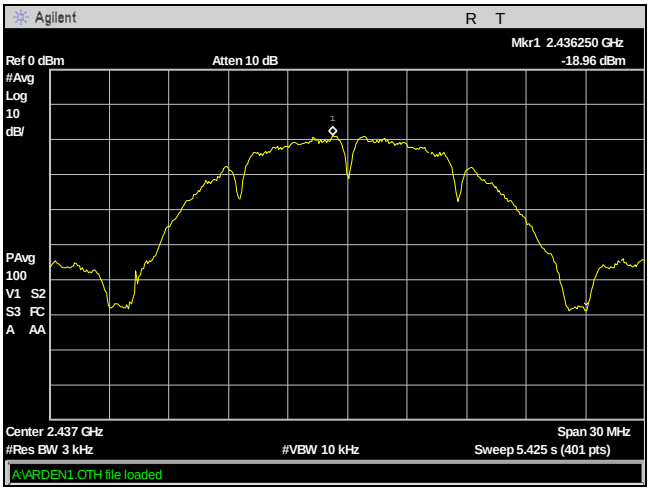
Plot 70. Peak Power Spectral Density, BW 20 MHz, Ch. 2412 MHz, b mode



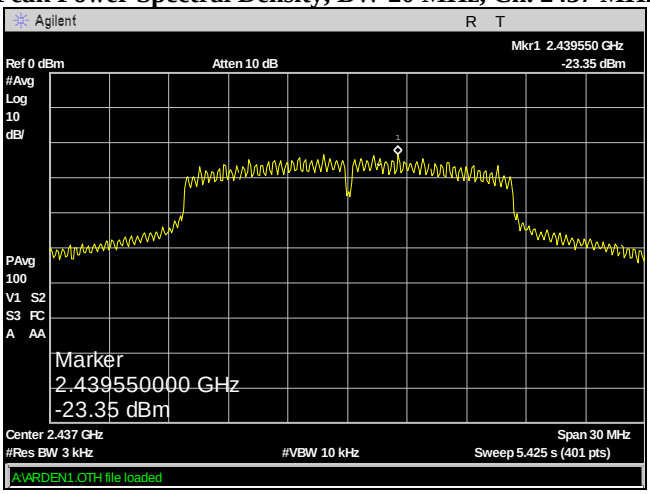
Plot 71. Peak Power Spectral Density, BW 20 MHz, Ch. 2412 MHz, g mode



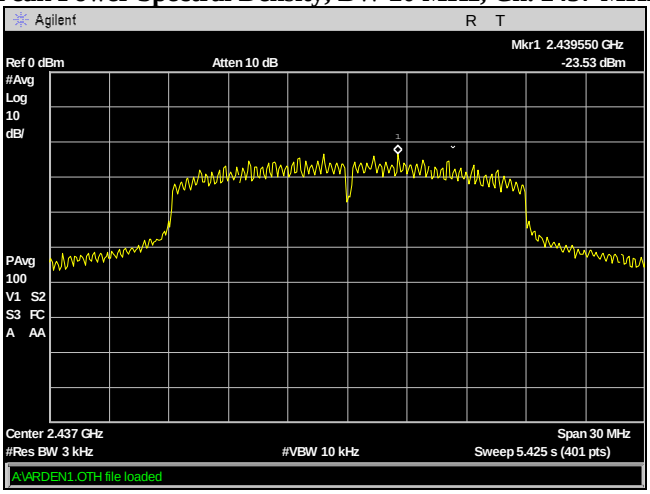
Plot 72. Peak Power Spectral Density, BW 20 MHz, Ch. 2412 MHz, n mode



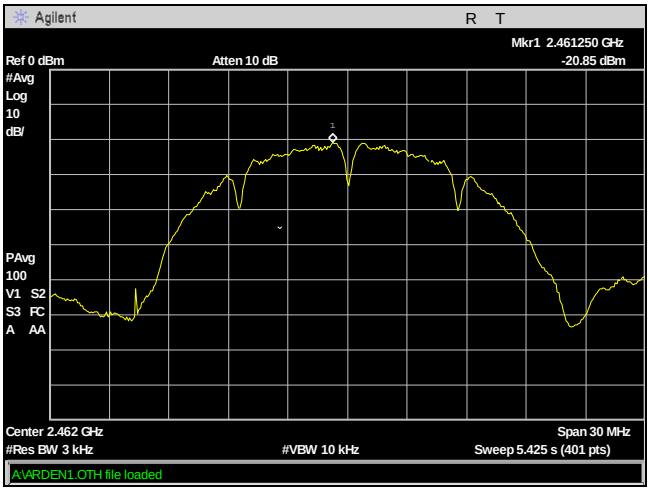
Plot 73. Peak Power Spectral Density, BW 20 MHz, Ch. 2437 MHz, b mode



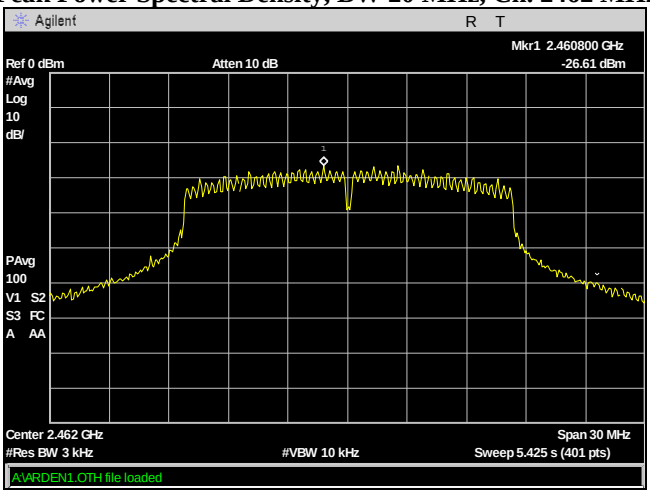
Plot 74. Peak Power Spectral Density, BW 20 MHz, Ch. 2437 MHz, g mode



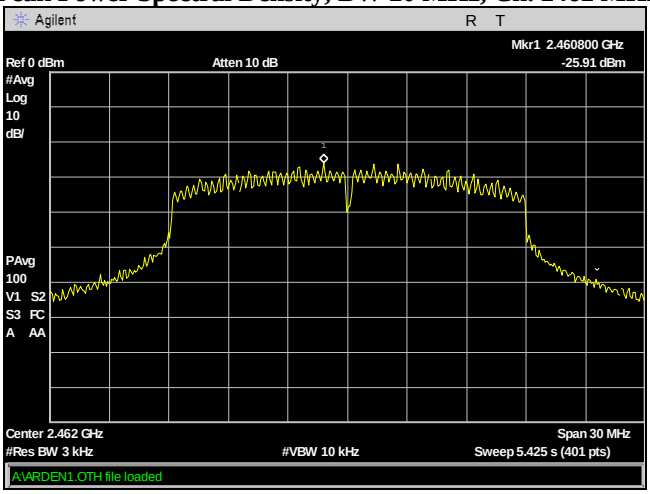
Plot 75. Peak Power Spectral Density, BW 20 MHz, Ch. 2437 MHz, n mode



Plot 76. Peak Power Spectral Density, BW 20 MHz, Ch. 2462 MHz, b mode



Plot 77. Peak Power Spectral Density, BW 20 MHz, Ch. 2462 MHz, g mode



Plot 78. Peak Power Spectral Density, BW 20 MHz, Ch. 2462 MHz, n mode

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(i) Maximum Permissible Exposure

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit: EUT's operating frequencies @ 2400-2483.5 MHz; **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm^2)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

Test Results:

FCC									
Frequency (MHz)	**Con. Pwr. (dBm)**	**Con. Pwr. (mW)**	**Ant. Gain (dBi)**	**Ant. Gain numeric**	**Pwr. Density (mW/cm^2)**	**Limit (mW/cm^2)**	**Margin**	**Distance (cm)**	**Result**
2437	15.18	32.961	2	1.585	0.01039	1	0.98961	20	Pass

The safe distance where Power Density is less than the MPE Limit listed above was found to be 20 cm.

IV. 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
1S3809	EMI RECEIVER	NARDA SAFETY TEST SOLUTIONS	PMM 9010F	2/20/2017	2/20/2018
1S2488	SCREEN ROOM	UNIVERSAL	CUSTOM MADE	NOT REQUIRED	
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	11/28/2016	11/28/2018
1S2482	5 METER CHAMBER (NSA)	PANASHIELD	5 METER SEMI-ANECHOIC CHAMBER	SEE NOTE	
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINDGREN	3117	8/9/2016	8/9/2018
1S2583	SPECTRUM ANALYZER	AGILENT/HEWLETT PACKARD	E4447A	10/31/2016	10/31/2017
1U0258	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	2/3/2017	2/3/2018
1S2677	LISN, DUAL-LINE V-NETWORK	TESEQ	NNB 51	6/27/2017	7/27/2017

Table 17. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

V. Certification & User's Manual Information

Certification & User's Manual Information

A. 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 user's 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.

End of Report

