Electromagnetic Compatibility Test Report

Tests Performed on a Trilithic

WiFi Module for Business Certification Meter, Model 2072290000

Radiometrics Document RP-7625

ACCREDITED
TESTING CERT #1495.01

Product Detail:
FCC ID: P4V-RP1103N
IC: 7020A-RP1103N
Equipment type: 2412-2462 MHz and 5745-5825 MHz DTS Transmitter for 15.247

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2012
Industry Canada RSS-210, Issue 8: 2010 as required for Category I Equipment

This report concerns: Original Grant for Certification
FCC Part 15.247

Tests Performed For:	*Test Facility:*
Trilithic 9710 Park Davis Dr. Indianpolis, IN 46235	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 (815) 293-0772

Test Date(s): (Month-Day-Year)
July 3, 2013 to May 28, 2014

Document RP-7625 Revisions:

Rev.	Issue Date	Affected Sections	Revised By
0	June 10, 2014		
1	November 4, 2014	Cover, 1, 2, 3.1, 10.1, 10.8, 10.9	Joseph Strzelecki

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Trilithic, WiFi Module for Business Certification Meter Model: 2072290000 Serial Number: 360122095 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) June 25, 2013	*Test Date(s): (Month-Day-Year)* July 3, 2013 to May 28, 2014
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by personnel from Trilithic
Radiometrics' Personnel Responsible for Test: Joseph Strzelecki 11/04/14 Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By* Chris W. Carlson 6/10/14 Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a WiFi Module for Business Certification Meter, Model 2072290000, manufactured by Trilithic. The detailed test results are presented in a separate section. The following is a summary of the test results.

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS- Section	Test Result
RF AC Mains Conducted Emissions	0.15 - 30 MHz	15.207	GEN; 7.2.2	Pass
RF Radiated Emissions	30-25,000 MHz	15.209	GEN; 7.2.5	Pass
6 dB Bandwidth Test	2400 to 2483 MHz	15.247 a	210; A8.1 (4)	Pass
Peak Output Power	2400 to 2483 MHz	15.247 b	210; A8.1 (1)	Pass
Band-edge Compliance of RF Conducted Emissions	2400 to 2483 MHz	15.247 d	210; A8.4 (2)	Pass
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 d	210; A8.5	Pass
Power Spectral Density	2400 to 2483 MHz	15.247 e	210; A8.2 (1)	Pass

Note: The RSS-210 specification is not currently covered in Radiometrics' Scope of Accreditation. This is technically very similar to FCC, CFR 47 Part 15 which is on Radiometrics scope.

2.1 RF Exposure Compliance Requirements

Since the Average power output is 11.1 mW, the EUT meets the FCC requirement for RF exposure and is exempt from RSS-102. There are no power level adjustments and the antenna is attached internally. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a WiFi Module for Business Certification Meter, Model 2072290000, manufactured by Trilithic. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is internal to the unit and the port cannot be accessed by the end user. Therefore, it meets the 15.203 Requirements. The antenna is a Pulse part number W3525B100, 2.4GHz PCB Antenna.

3.2 Related Submittals

Trilithic is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	WiFi Module for Business Certification Meter	E	Trilithic	2072290000	281195
2	Router	P	Dynex	DX-GB8PRT	10K22B16124

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of System Cables

QTY	Length (m)	Cable Description	Shielded?
1	1.8	AC Cord to external power supply	No
1	1.5	DC Cord to external power supply	No
1	10	Ethernet cable	No
1	1.8	USB Cable	Yes
1	1.0	75 Ohm coaxial Cable	No

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2012	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2009	2009	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2009	2009	American National Standard for Testing Unlicensed Wireless Devices
IC RSS-210 Issue 8	2010	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 3	2010	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

The test procedures used are in accordance with the Industry Canada RSS-GEN and ANSI document C63.10. Radiated testing was performed at an antenna to EUT distance of 3 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC8727A-1.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	06/25/13
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	01/15/13 01/17/14
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	01/15/13 01/15/14
AMP-29	HP / Agilent	Amplifier	11975A	2304A00158	2-8 GHz	12 Mo.	11/06/12 12/20/13
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	12/05/12
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/14/11 12/10/13
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26.5 GHz	24 Mo.	08/08/13
ANT-61	RMC	Std Gain Horn	HW2030	1001	26-40 GHz	12 Mo.	04/05/13 12/27/13
MXR-02	HP / Agilent	Harmonic Mixer	11970K	2332A00489	18-26.5GHz	12 Mo.	11/06/12 12/20/13
MXR-03	HP / Agilent	Harmonic Mixer	11971A	2332A00390	26.5-40GHz	12 Mo.	11/06/12 12/20/13
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	24 Mo.	11/21/12
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	04/08/13
REC-10	HP / Agilent	EMI Receiver	8546A	3842A00521 3704A00484	30Hz-6GHz	24 Mo.	01/09/12 01/13/14
REC-11	HP / Agilent	Spectrum Analyzer	E7405A	US39110103	9Hz-26.5GHz	12 Mo.	06/13/13
REC-12	Agilent	Spectrum Analyzer	AT/N9030A-550;C	MY53310115	3Hz-50 GHz	12 Mo.	03/25/14
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	24 Mo.	06/27/13

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 7.2.2.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

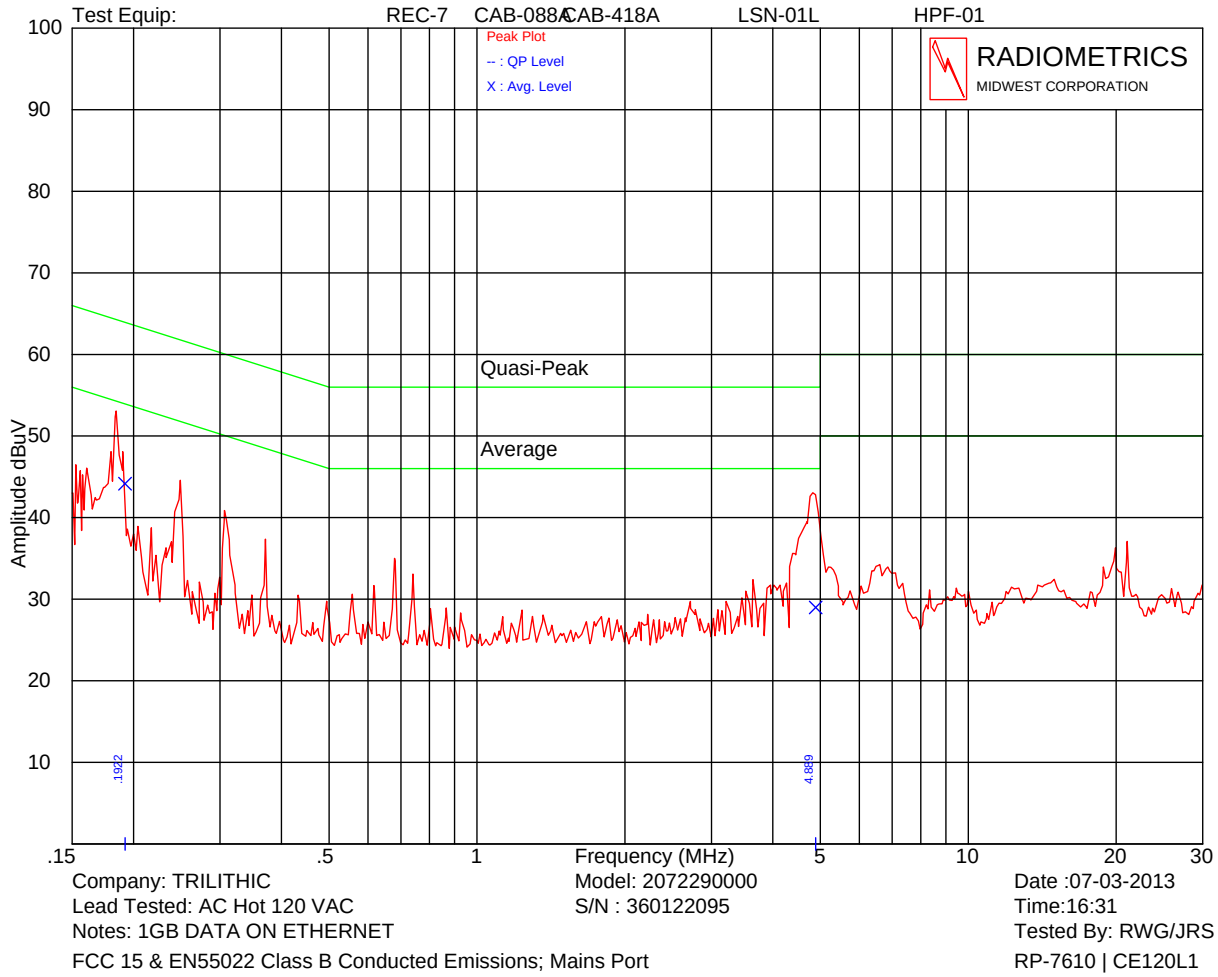
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation.

Test Date : July 3, 2013
The Amplitude is the final corrected value with cable and LISN Loss.

Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.192	49.5P	63.9	45.5	53.9
AC Neutral	0.254	43.7P	61.6	36.6	51.6
AC Neutral	0.687	41.0P	56.0	37.5	46.0
AC Neutral	20.486	39.2P	60.0	36.1	50.0
AC Neutral	0.748	42.2P	56.0	40.0	46.0
AC Neutral	4.449	31.2Q	56.0	28.4	46.0
AC Hot	0.192	52.4P	63.9	44.2	53.9
AC Hot	4.890	42.8P	56.0	29.0	46.0
AC Hot	0.192	50.7P	63.9	41.5	53.9
AC Hot	4.517	36.9P	56.0	32.5	46.0

The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by at least 6 dB



Company: TRILITHIC
Lead Tested: AC Hot 120 VAC
Notes: 1GB DATA ON ETHERNET
FCC 15 & EN55022 Class B Conducted Emissions; Mains Port

Model: 2072290000
S/N : 360122095

Date :07-03-2013
Time:16:31
Tested By: RWG/JRS
RP-7610 | CE120L1

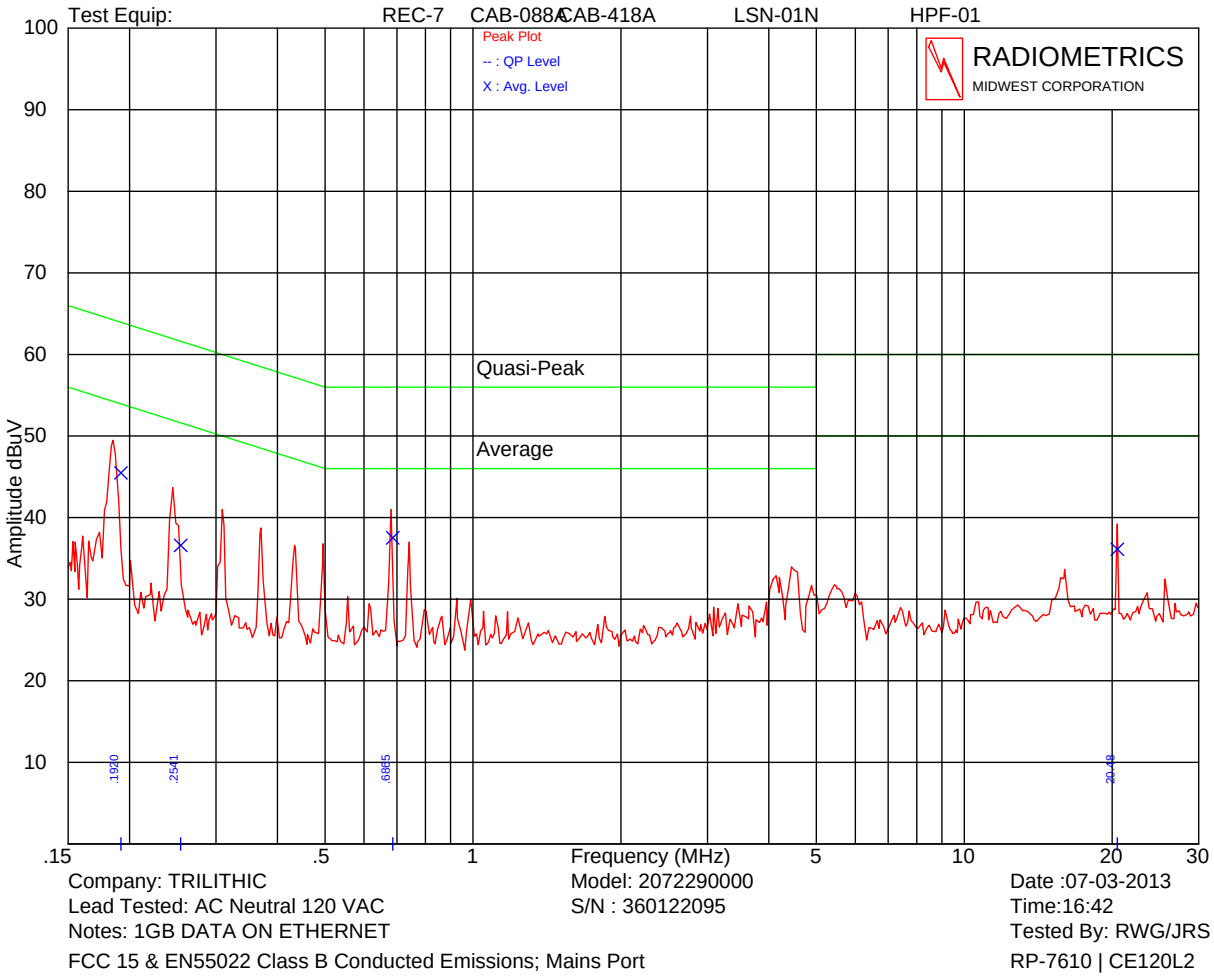
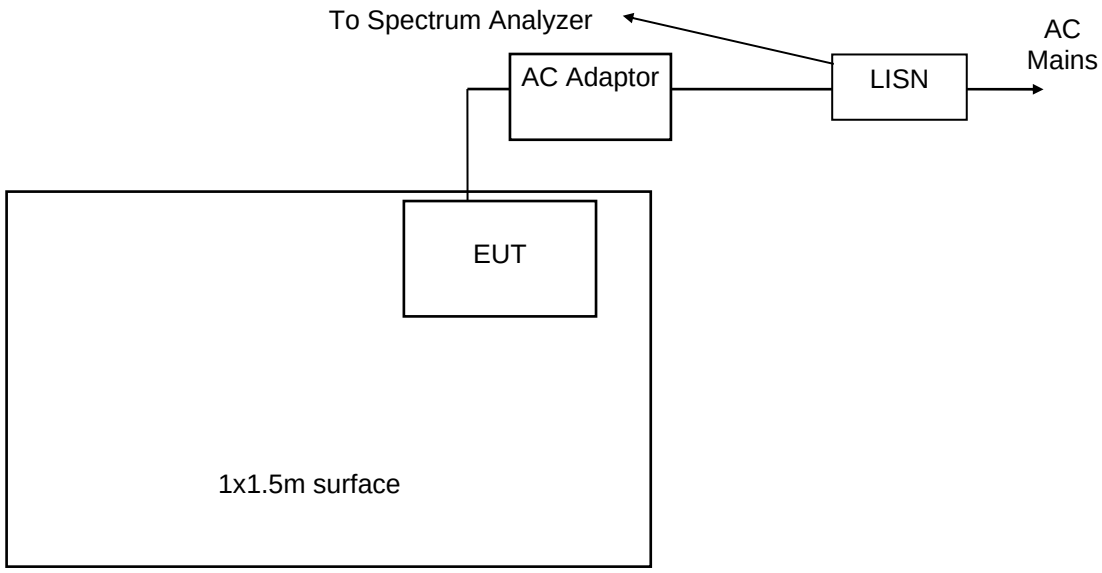

Test Equip:
REC-7
CAB-088A
CAB-418A
LSN-01N
HPF-01
Peak Plot
-- : QP Level
X : Avg. Level
RADIOMETRICS
MIDWEST CORPORATION
Quasi-Peak
Average
Amplitude dBuV
100
90
80
70
60
50
40
30
20
10
.15
.5
1
5
10
20
30
Frequency (MHz)
.1920
.2541
.6865
20.48
Company: TRILITHIC
Lead Tested: AC Neutral 120 VAC
Notes: 1GB DATA ON ETHERNET
Model: 2072290000
S/N : 360122095
Date :07-03-2013
Time:16:42
Tested By: RWG/JRS
FCC 15 & EN55022 Class B Conducted Emissions; Mains Port
RP-7610 | CE120L2

Figure 1. Conducted Emissions Test Setup



Notes:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

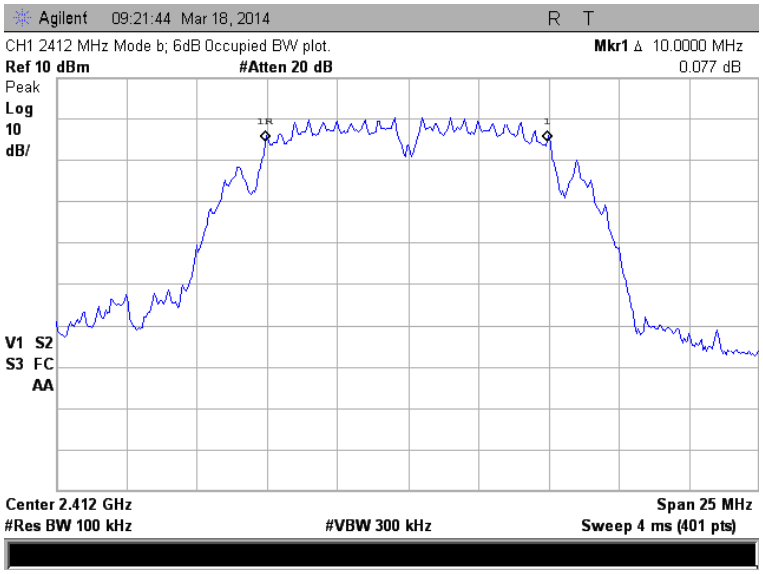
10.2 Occupied Bandwidth

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 or 20 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the bandwidth of the emission.

Occupied Bandwidth			802		BW		BW		BW	
Type	Channels Tested	Mbps	Mode	MHz	MHz	MHz	MHz	MHz	MHz	RBW
6 dB	1, 6, 11	1	b	2412	10.00	2437	10.00	2462	10.13	100 kHz
6 dB	1, 6, 11	6	g	2412	16.63	2437	16.50	2462	16.50	100 kHz
6 dB	1, 6, 11	6.5	N	2412	17.75	2437	17.75	2462	17.75	100 kHz
20 dB	1, 6, 11	1	b	2412	13.50	2437	13.50	2462	13.50	300 kHz
20 dB	1, 6, 11	6	g	2412	19.13	2437	19.00	2462	18.88	300 kHz
20 dB	1, 6, 11	6.5	N	2412	19.43	2437	19.38	2462	19.31	300 kHz
6 dB	149, 157, 165	6	a	5745	16.56	5765	16.44	5825	16.50	100 kHz
6 dB	149, 157, 165	6.5	N	5745	17.75	5765	17.69	5825	17.69	100 kHz
20 dB	149, 157, 165	6	a	5745	19.06	5765	19.00	5825	19.00	300 kHz
20 dB	149, 157, 165	6.5	N	5745	19.56	5765	19.38	5825	19.50	300 kHz

The highlighted cells are the bandwidths in MHz.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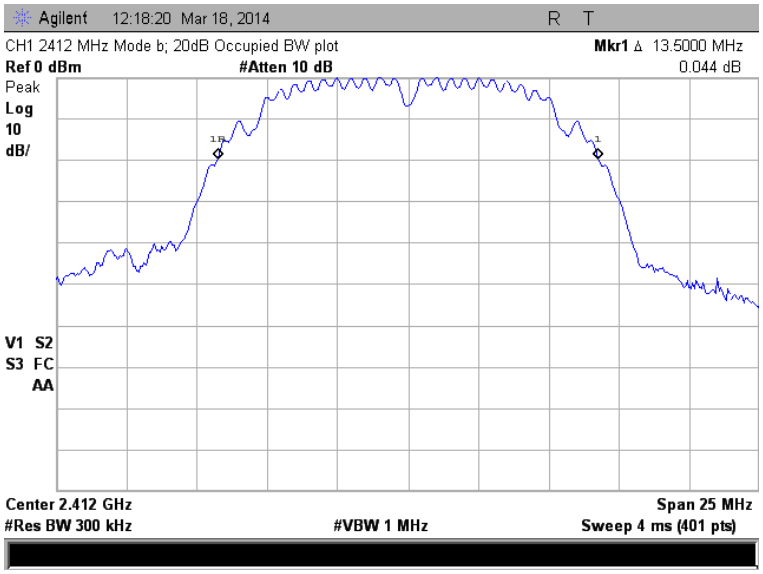
Mkr1 Δ 10.0000 MHz
Ref 10 dBm
#Atten 20 dB
0.077 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)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Mkr1 Δ 13.5000 MHz
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0.044 dB
Peak
Log
10
dB/
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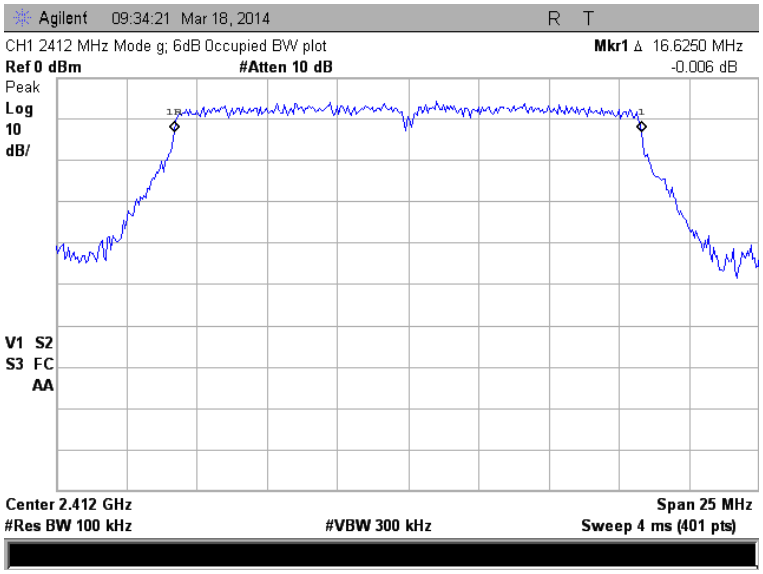
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)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Mkr1 Δ 16.6250 MHz
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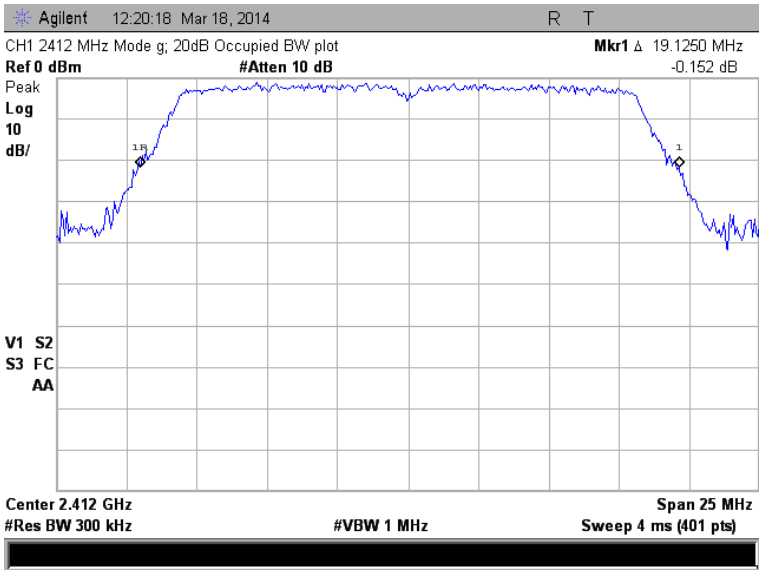
-0.006 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)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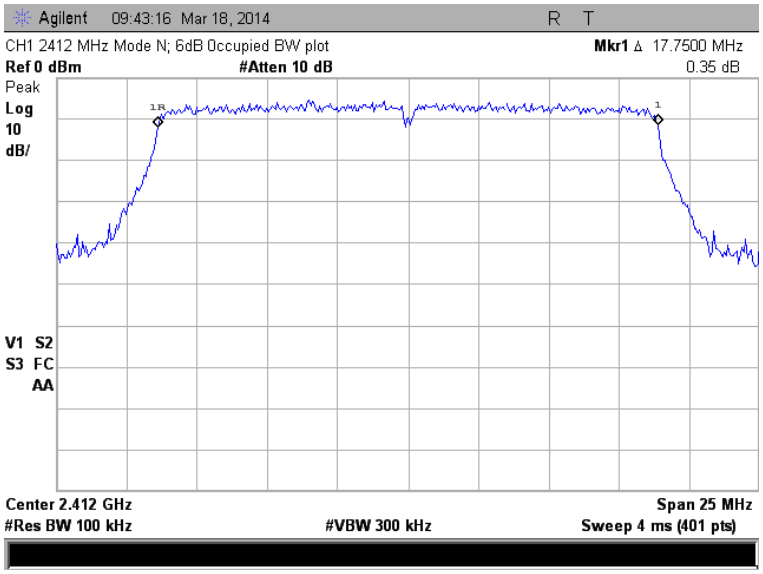
-0.152 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)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Mkr1 Δ 17.7500 MHz
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0.35 dB
Peak
Log
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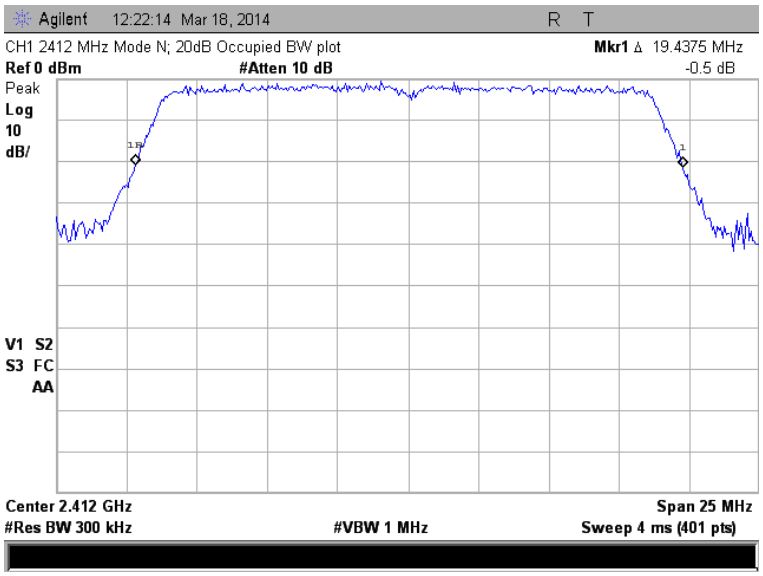
dB/
V1 S2
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)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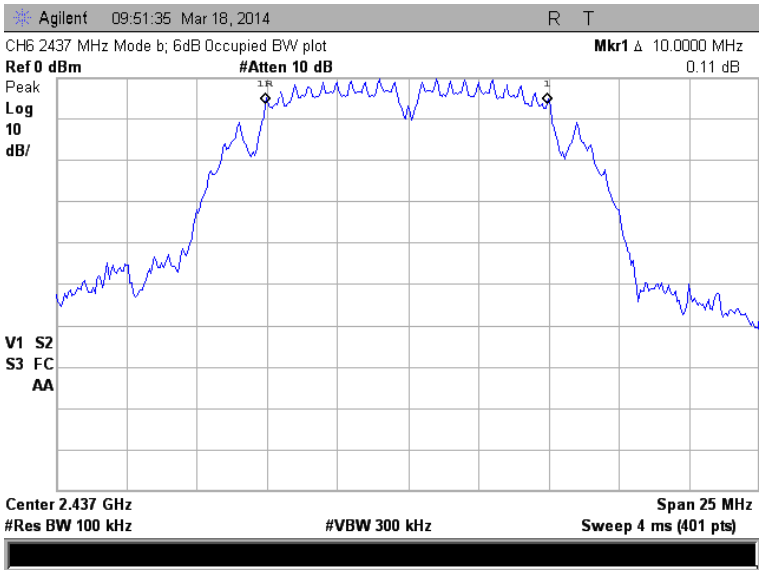
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.412 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)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Peak
Log
10
dB/
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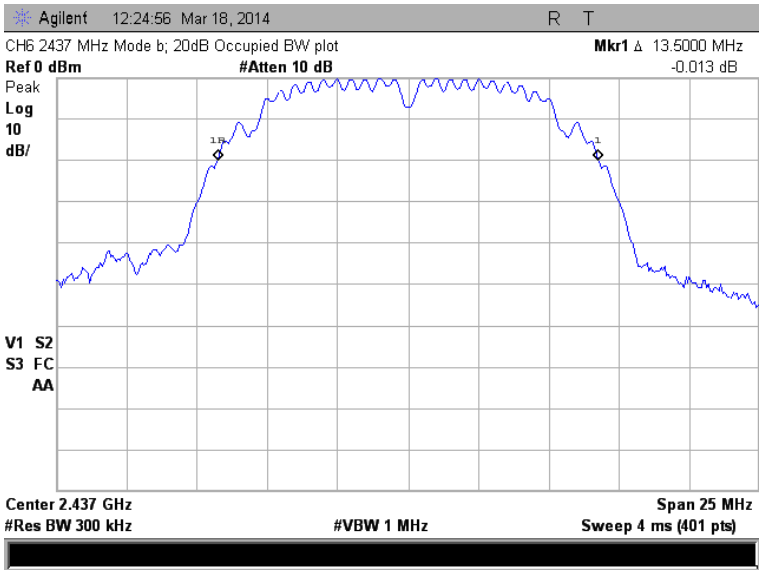
S3 FC
AA
Center 2.437 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)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dB/
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S3 FC
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Center 2.437 GHz
Span 25 MHz
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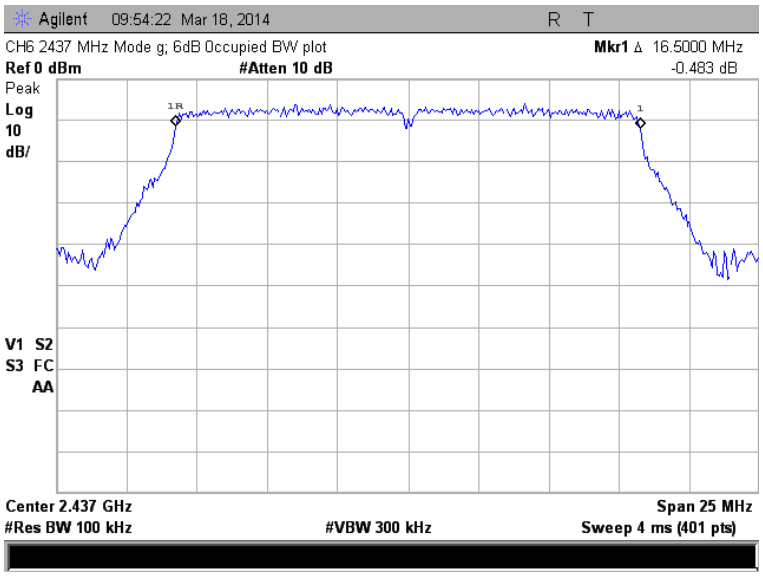
Sweep 4 ms (401 pts)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Peak
Log
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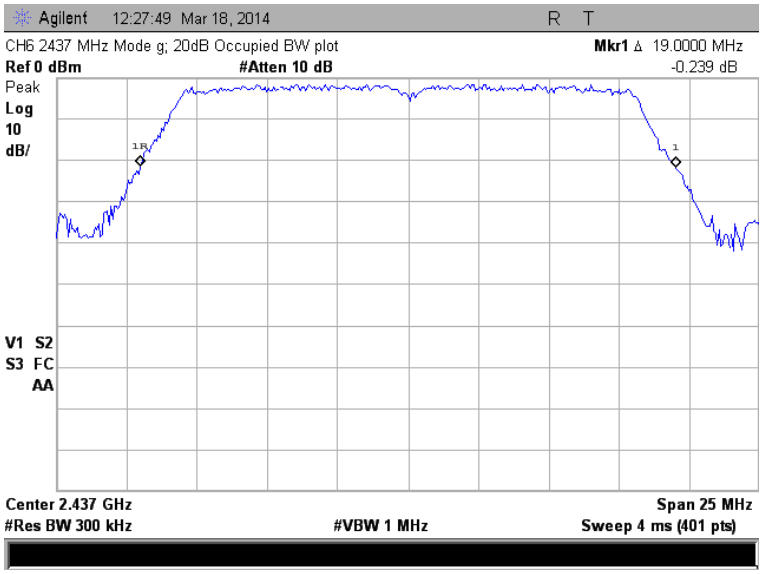
dB/
V1 S2
S3 FC
AA
Center 2.437 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)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-0.239 dB
Peak
Log
10
dB/
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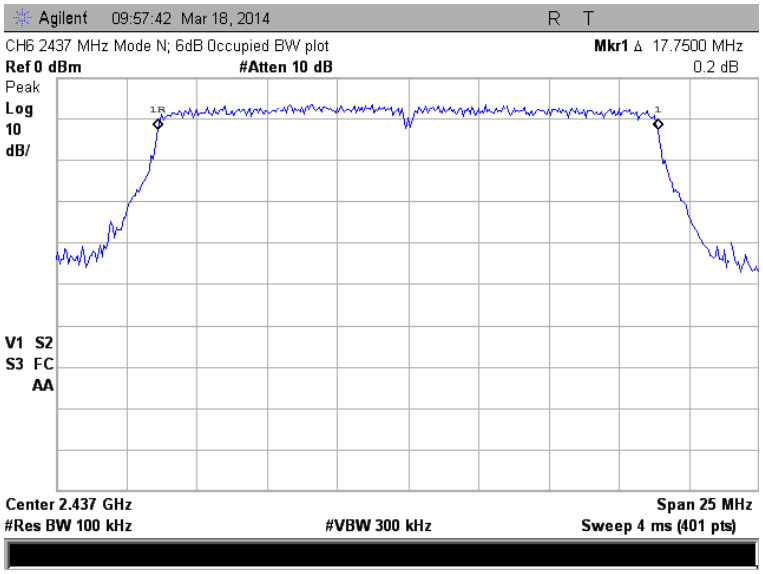
S3 FC
AA
Center 2.437 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)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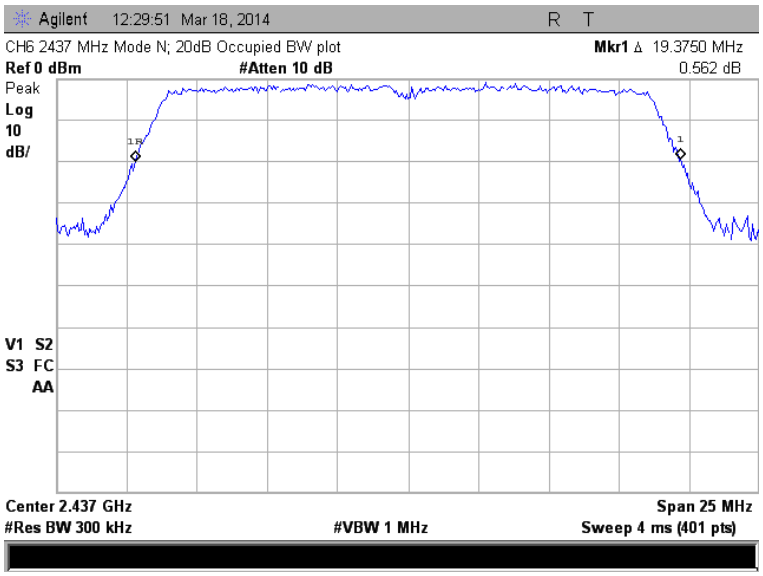
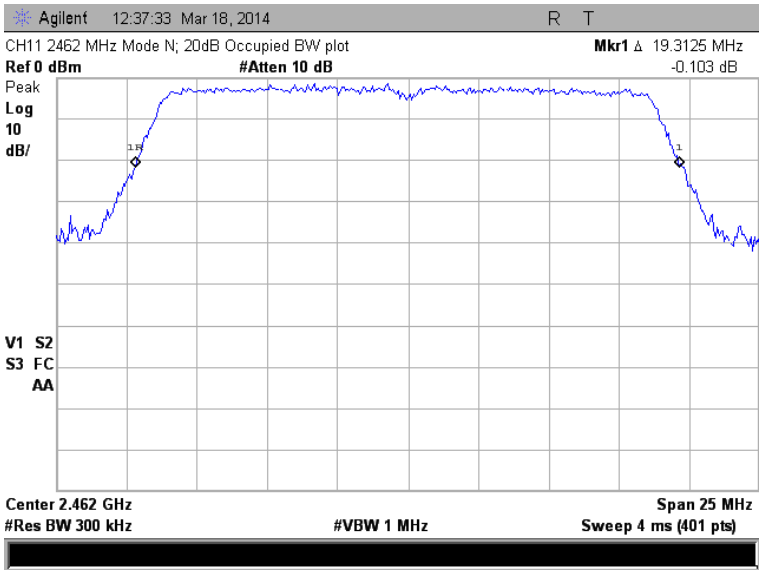
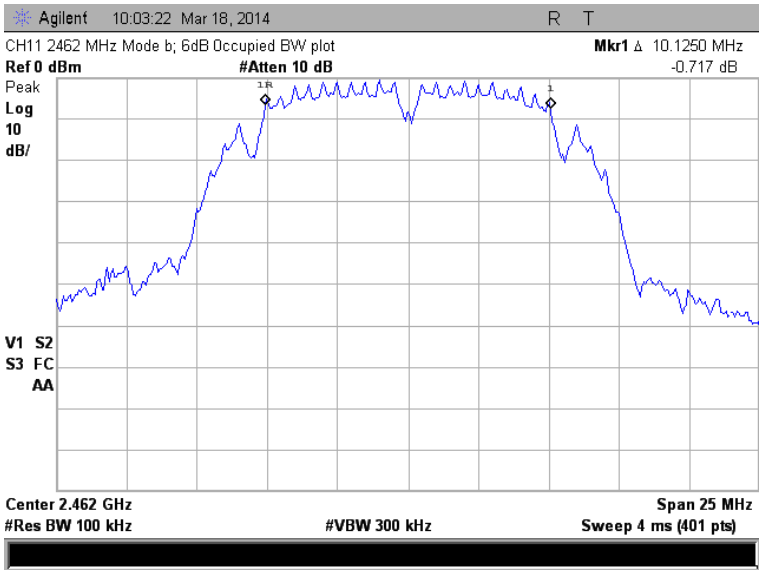
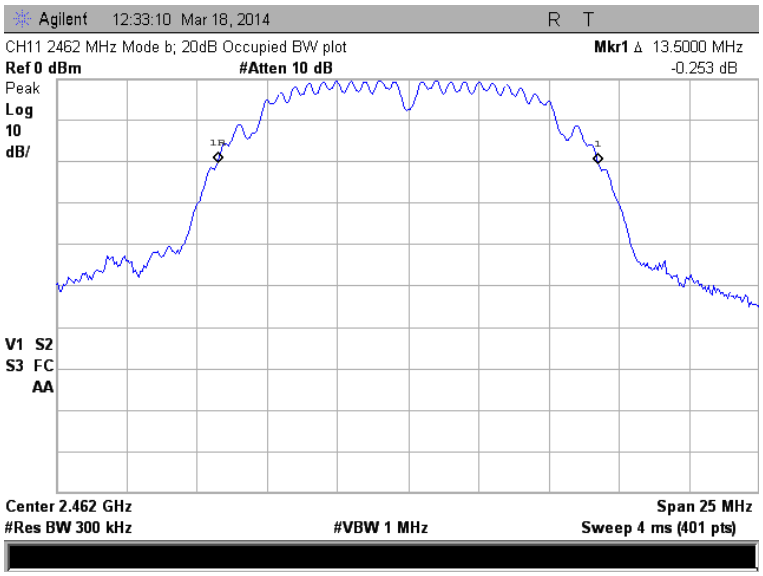
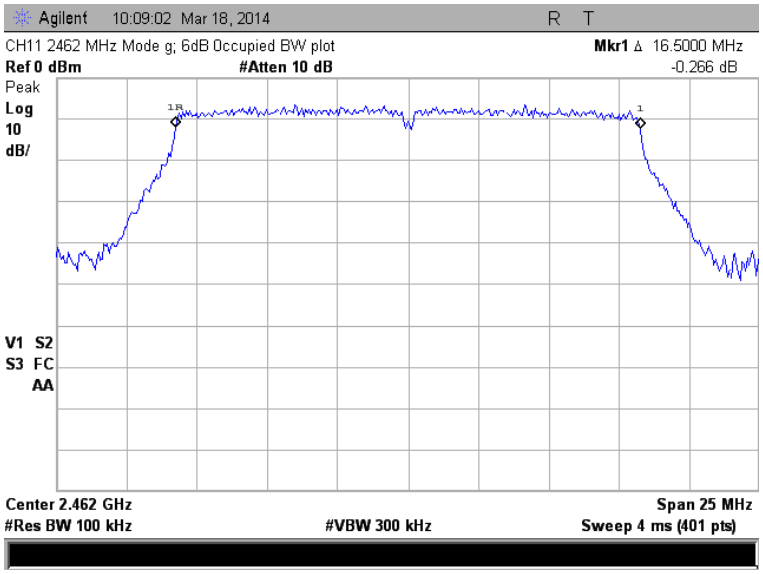
Ref 0 dBm
#Atten 10 dB
0.2 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.437 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

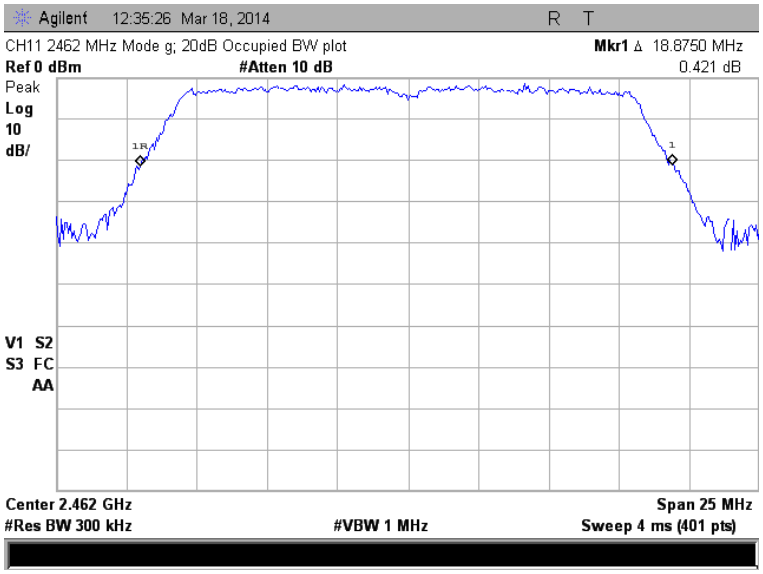

Agilent 12:29:51 Mar 18, 2014
R T
CH6 2437 MHz Mode N; 20dB Occupied BW plot
Mkr1 Δ 19.3750 MHz
Ref 0 dBm
#Atten 10 dB
0.562 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.437 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

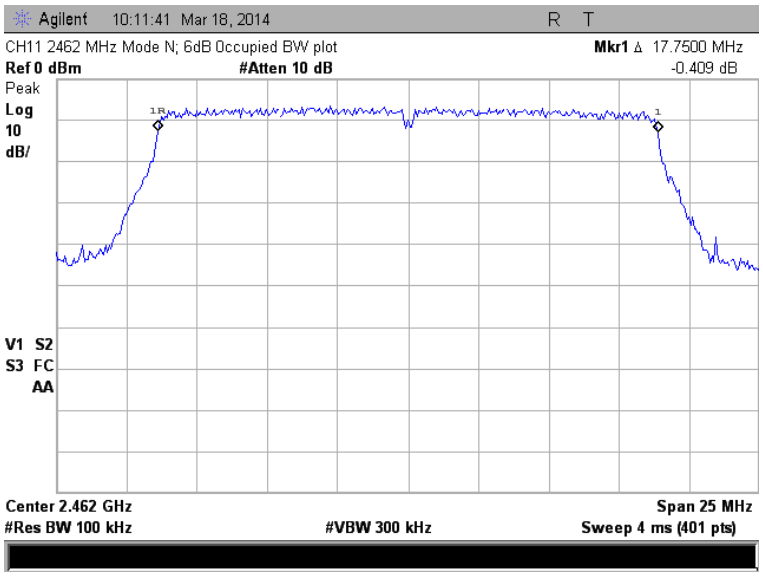

Agilent 12:37:33 Mar 18, 2014
R T
CH11 2462 MHz Mode N; 20dB Occupied BW plot
Mkr1 Δ 19.3125 MHz
Ref 0 dBm
#Atten 10 dB
-0.103 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

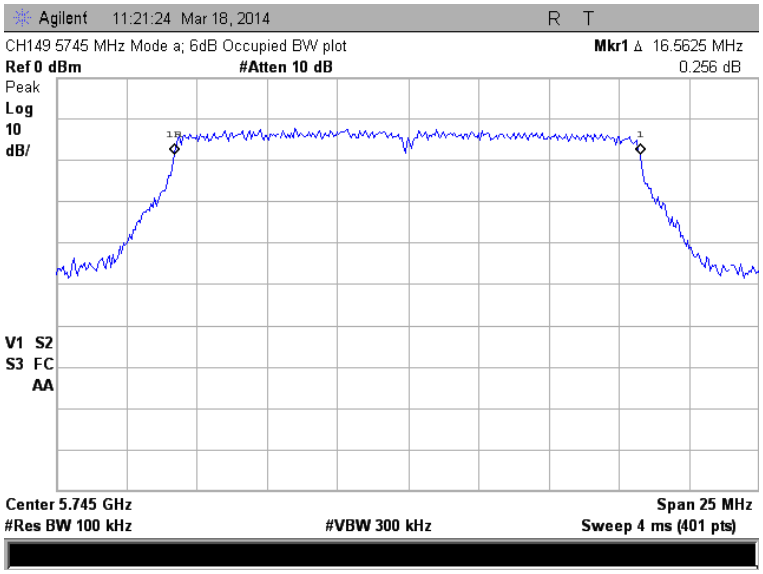

Agilent 10:03:22 Mar 18, 2014
R T
CH11 2462 MHz Mode b; 6dB Occupied BW plot
Mkr1 Δ 10.1250 MHz
Ref 0 dBm
#Atten 10 dB
-0.717 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

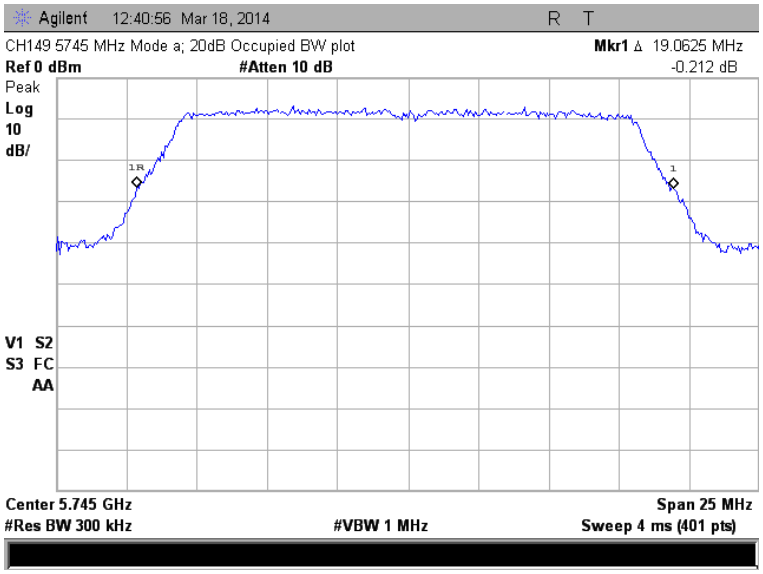

Agilent 12:33:10 Mar 18, 2014
R T
CH11 2462 MHz Mode b; 20dB Occupied BW plot
Mkr1 Δ 13.5000 MHz
Ref 0 dBm
#Atten 10 dB
-0.253 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

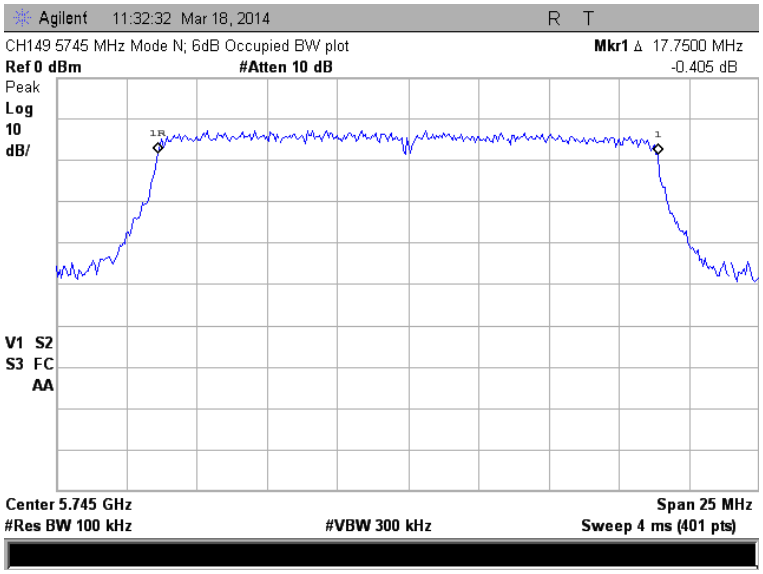

Agilent 10:09:02 Mar 18, 2014
R T
CH11 2462 MHz Mode g; 6dB Occupied BW plot
Mkr1 Δ 16.5000 MHz
Ref 0 dBm
#Atten 10 dB
-0.266 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

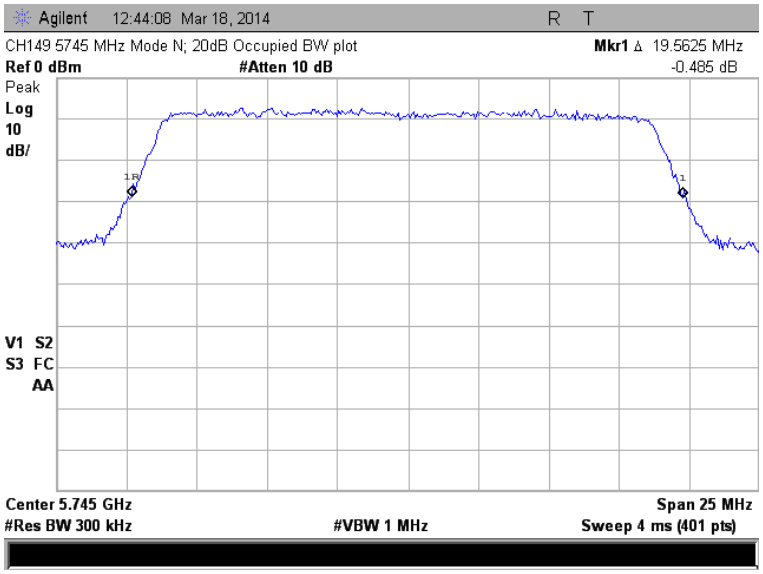

Agilent 12:35:26 Mar 18, 2014
R T
CH11 2462 MHz Mode g; 20dB Occupied BW plot
Mkr1 Δ 18.8750 MHz
Ref 0 dBm
#Atten 10 dB
0.421 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

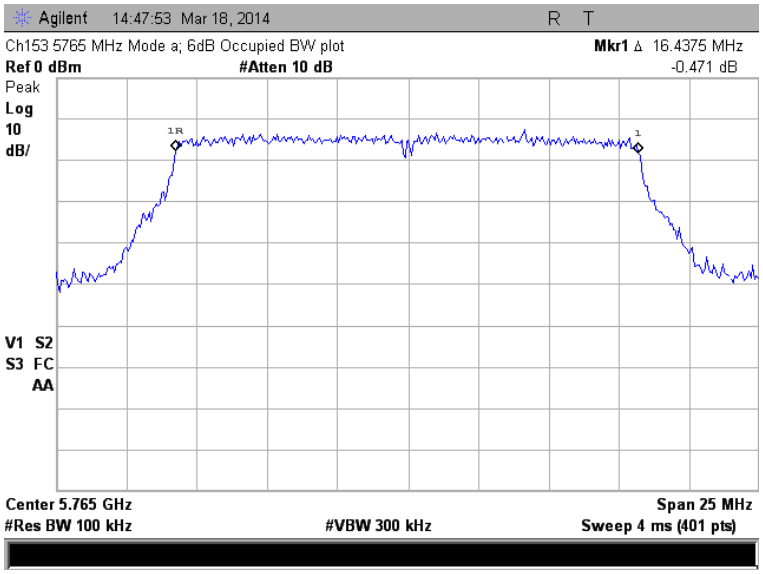

Agilent 10:11:41 Mar 18, 2014
R T
CH11 2462 MHz Mode N; 6dB Occupied BW plot
Mkr1 Δ 17.7500 MHz
Ref 0 dBm
#Atten 10 dB
-0.409 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 2.462 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

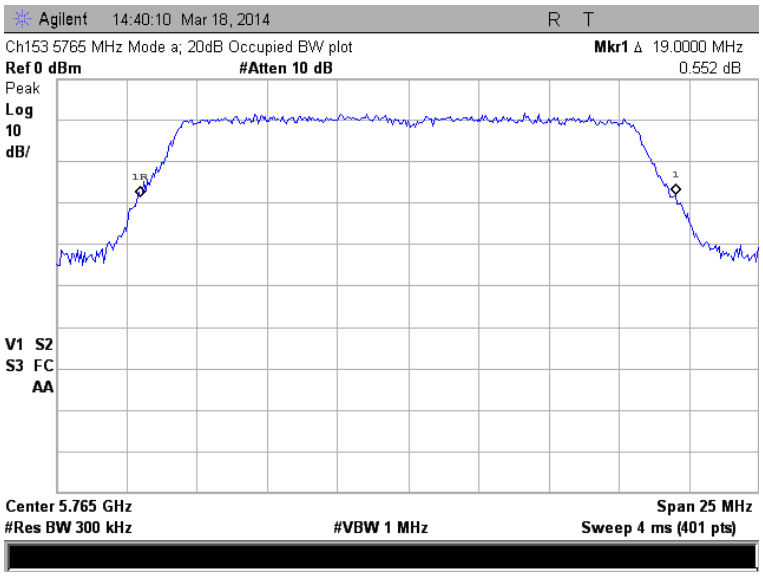

Agilent 11:21:24 Mar 18, 2014
R T
CH149 5745 MHz Mode a; 6dB Occupied BW plot
Mkr1 Δ 16.5625 MHz
Ref 0 dBm
#Atten 10 dB
0.256 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.745 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

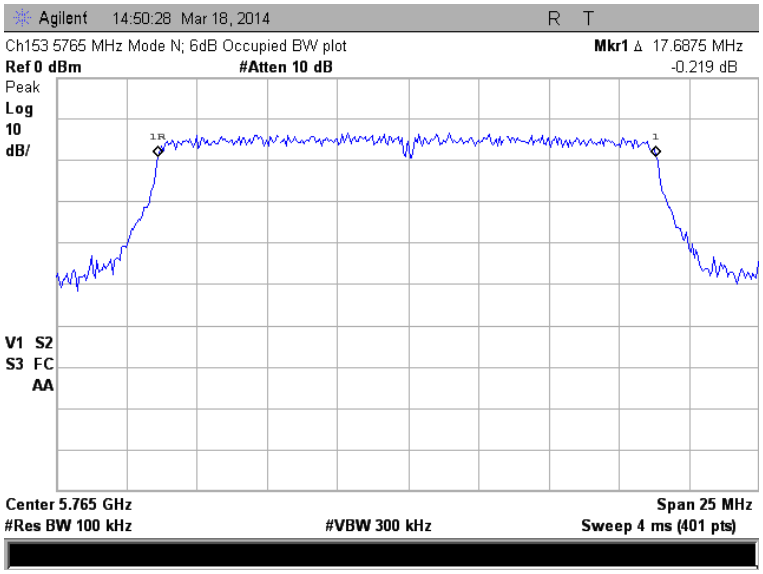

Agilent 12:40:56 Mar 18, 2014
R T
CH149 5745 MHz Mode a; 20dB Occupied BW plot
Mkr1 Δ 19.0625 MHz
Ref 0 dBm
#Atten 10 dB
-0.212 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.745 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

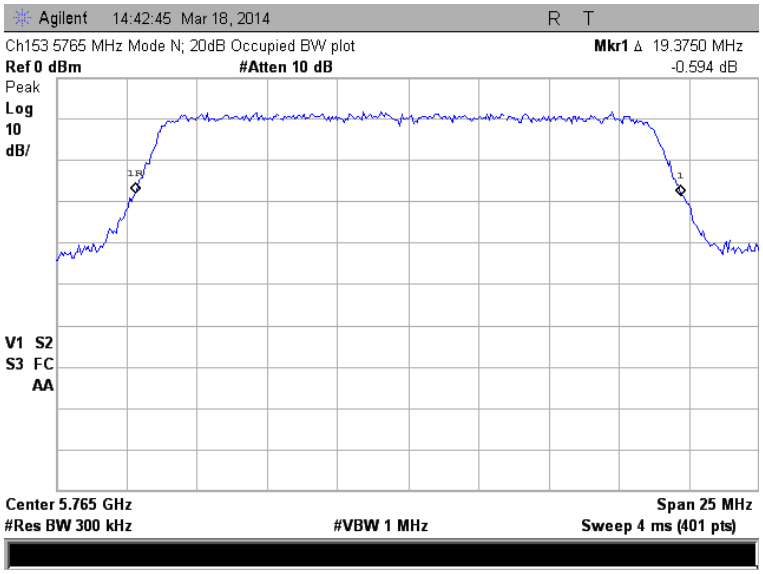

Agilent 11:32:32 Mar 18, 2014
R T
CH149 5745 MHz Mode N; 6dB Occupied BW plot
Mkr1 Δ 17.7500 MHz
Ref 0 dBm
#Atten 10 dB
-0.405 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.745 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

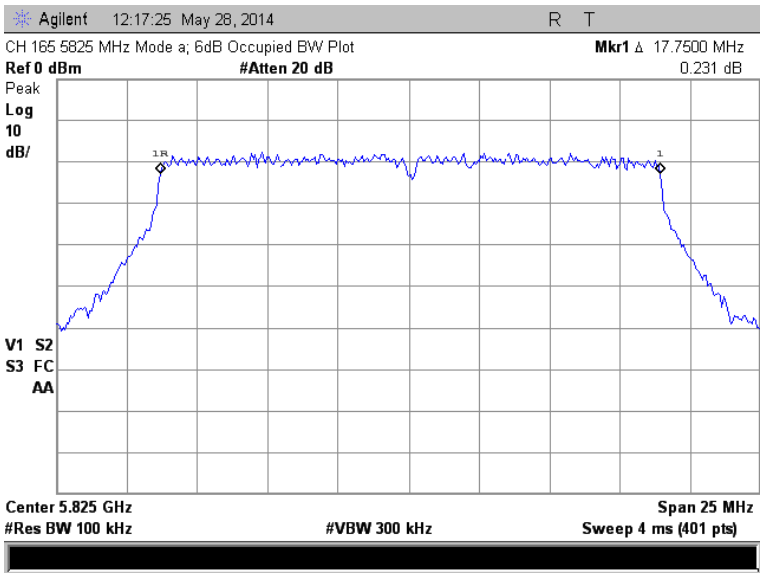

Agilent 12:44:08 Mar 18, 2014
R T
CH149 5745 MHz Mode N; 20dB Occupied BW plot
Mkr1 Δ 19.5625 MHz
Ref 0 dBm
#Atten 10 dB
-0.485 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.745 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

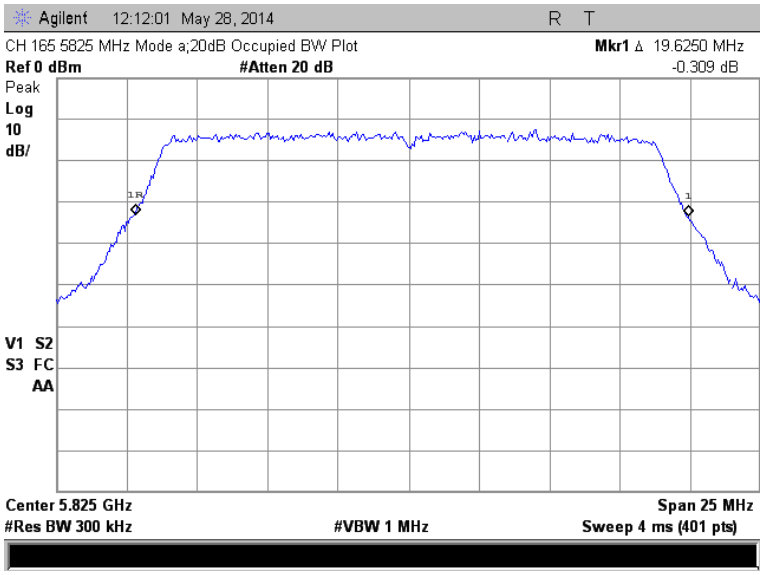

Agilent 14:47:53 Mar 18, 2014
R T
Ch153 5765 MHz Mode a; 6dB Occupied BW plot
Mkr1 Δ 16.4375 MHz
Ref 0 dBm
#Atten 10 dB
-0.471 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.765 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)

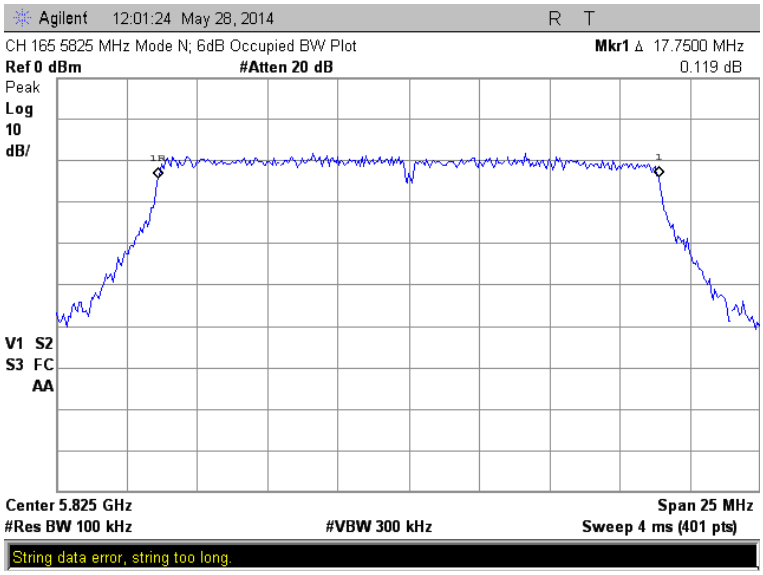

Agilent 14:40:10 Mar 18, 2014
R T
Ch153 5765 MHz Mode a; 20dB Occupied BW plot
Mkr1 Δ 19.0000 MHz
Ref 0 dBm
#Atten 10 dB
0.552 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.765 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

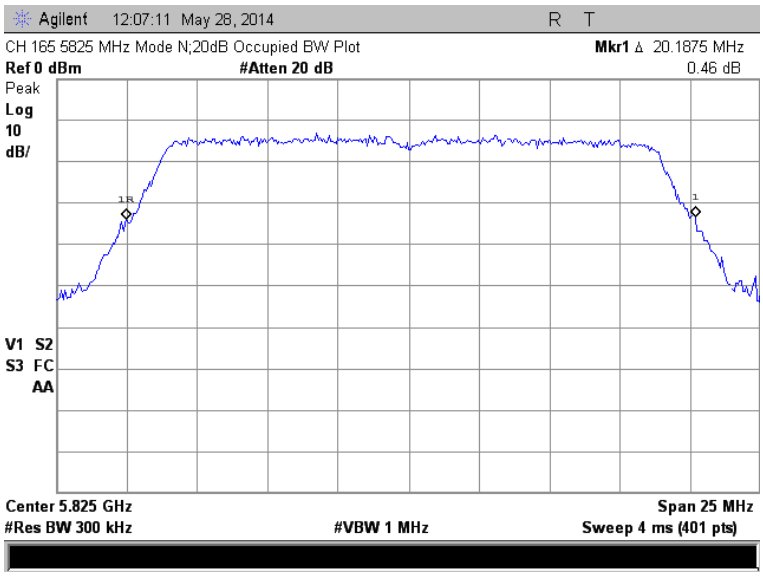

Agilent 14:50:28 Mar 18, 2014
R T
Ch153 5765 MHz Mode N; 6dB Occupied BW plot
Mkr1 Δ 17.6875 MHz
Ref 0 dBm
#Atten 10 dB
-0.219 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.765 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)


Agilent 14:42:45 Mar 18, 2014
R T
Ch153 5765 MHz Mode N; 20dB Occupied BW plot
Mkr1 Δ 19.3750 MHz
Ref 0 dBm
#Atten 10 dB
-0.594 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.765 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)


Agilent 12:17:25 May 28, 2014
R T
CH 165 5825 MHz Mode a; 6dB Occupied BW Plot
Mkr1 Δ 17.7500 MHz
Ref 0 dBm
#Atten 20 dB
0.231 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.825 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)


Agilent 12:12:01 May 28, 2014
R T
CH 165 5825 MHz Mode a;20dB Occupied BW Plot
Mkr1 Δ 19.6250 MHz
Ref 0 dBm
#Atten 20 dB
-0.309 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.825 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)


Agilent 12:01:24 May 28, 2014
R T
CH 165 5825 MHz Mode N; 6dB Occupied BW Plot
Mkr1 Δ 17.7500 MHz
Ref 0 dBm
#Atten 20 dB
0.119 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.825 GHz
Span 25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4 ms (401 pts)
String data error, string too long.


Agilent 12:07:11 May 28, 2014
R T
CH 165 5825 MHz Mode N;20dB Occupied BW Plot
Mkr1 Δ 20.1875 MHz
Ref 0 dBm
#Atten 20 dB
0.46 dB
Peak
Log
10
dB/
V1 S2
S3 FC
AA
Center 5.825 GHz
Span 25 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 4 ms (401 pts)

10.3 Peak Output Power

The EUT antenna port was connected to the spectrum analyzer via a low loss coaxial cable.

The power output test method from ANSI C63.10 section 6.10.2.1 c) was used for this test. The spectrum analyzer was set to the following settings:

Span = 20 MHz; RBW = 8 MHz; VBW = 8 MHz; Detector function = peak; Trace = max hold; REC-12
The BW correction factor = 10*LOG[(6 dB BW of emission)/(Analyzer RBW)]
Test Date: 05/29/2014; Test Personnel: Richard L. Tichgelaar

The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. The indicated level is the peak output power. Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6 dB, the limit is not reduced.

Chan	Freq. MHz	Mode	Mbps	Spec An dBm	Cable Loss	BW corr. dB	Atten. dB	BW of signal (MHz)	Pk pwr	Limit dBm	Margin
1	2412	802.11b	1	11.0	0.6	1.0	5.1	10.00	13.6	30.0	16.4
1	2412	802.11g	6	10.1	0.6	3.2	5.1	16.63	14.9	30.0	15.1
1	2412	802.11N	MSC0	10.1	0.6	3.5	5.1	17.75	15.1	30.0	14.9
6	2437	802.11b	1	10.6	0.6	1.0	5.1	10.00	13.2	30.0	16.8
6	2437	802.11g	6	10.2	0.6	3.1	5.1	16.50	14.9	30.0	15.1
6	2437	802.11N	MSC0	9.4	0.6	3.5	5.1	17.75	14.4	30.0	15.6
11	2462	802.11b	1	10.2	0.6	1.0	5.1	10.13	12.8	30.0	17.2
11	2462	802.11g	6	8.5	0.6	3.1	5.1	16.50	13.2	30.0	16.8
11	2462	802.11N	MSC0	10.9	0.6	3.5	5.1	17.75	15.9	30.0	14.1
149	5745	802.11a	6	5.9	0.9	3.2	5.0	16.56	11.0	30.0	19.0
149	5745	802.11N	MSC0	5.0	0.9	3.5	5.0	17.75	10.4	30.0	19.6
157	5785	802.11a	6	4.8	0.9	3.1	5.0	16.44	9.9	30.0	20.1
157	5785	802.11N	MSC0	4.6	0.9	3.4	5.0	17.69	10.0	30.0	20.0
165	5825	802.11a	6	0.0	0.9	3.1	5.0	16.50	5.2	30.0	24.8
165	5825	802.11N	MSC0	1.5	0.9	3.4	5.0	17.69	6.9	30.0	23.1

Judgement: Pass by 14.9 dBm.

10.4 Power Spectral Density

The PSD test method from ANSI C63.10 section 6.11.2.3 was used for this test. The spectrum analyzer was set to the following settings:

Test Date: 3/18/2014; Test Personnel: Richard L. Tichgelaar
Span = 20 MHz; RBW = 3 kHz; VBW = 10 kHz
Detector function = Peak

Chan	Mbps	Mode	MHz	dBm	Loss	Pk pwr	Limit	Margin
1	1	802.11b	2412	-8.3	1.1	-7.1	8.0	15.1
1	6	802.11g	2412	-17.0	1.1	-15.8	8.0	23.8
1	MSC0	802.11N	2412	-16.0	1.1	-14.8	8.0	22.8
6	1	802.11b	2437	-8.5	1.1	-7.3	8.0	15.3
6	6	802.11g	2437	-18.3	1.1	-17.1	8.0	25.1
6	MSC0	802.11N	2437	-17.3	1.1	-16.1	8.0	24.1

11	1	802.11b	2462	-9.0	1.1	-7.8	8.0	15.8
11	6	802.11g	2462	-18.5	1.1	-17.4	8.0	25.4
11	MSC0	802.11N	2462	-17.9	1.1	-16.7	8.0	24.7
149	6	802.11a	5745	-18.9	1.7	-17.2	8.0	25.2
149	MSC0	802.11N	5745	-18.8	1.7	-17.1	8.0	25.1
153	6	802.11a	5765	-20.5	1.7	-18.8	8.0	26.8
153	MSC0	802.11N	5765	-19.6	1.7	-17.9	8.0	25.9
157	6	802.11a	5785	-19.8	1.7	-18.1	8.0	26.1
157	MSC0	802.11N	5785	-20.4	1.7	-18.7	8.0	26.7
165	6	802.11a	5825	-19.3	1.7	-17.6	8.0	25.6
165	MSC0	802.11N	5825	-19.5	1.7	-17.8	8.0	25.8

Judgement: Pass by 15.1 dBm.

10.5 Average power

The purpose of this is for RF Exposure Compliance requirements. This is a direct reading from the Antenna port on the EUT.

The power output test method from ANSI C63.10 section 6.10.2.1 c) was used for this test with the exception of a 100 Hz VBW used. The spectrum analyzer was set to the following settings:

Span = 20 MHz; RBW = 8 MHz; VBW = 100 Hz; Linear Scale; Trace = max hold; REC-12
The BW correction factor = 10*LOG[(6 dB BW of emission)/(Analyzer RBW)]
Test Date: 05/29/2014; Test Personnel: Richard L. Tichgelaar

Chan	Freq. MHz	Mode	Mbps	Average Spec An dBm	Cable Loss	BW corr. dB	Atten. dB	BW of signal (MHz)	Pk pwr	Limit dBm	Margin
1	2412	802.11b	1	3.8	0.6	5.1	1.0	10.00	10.4	13.0	2.6
1	2412	802.11g	6	0.4	0.6	5.1	3.2	16.63	9.2	13.0	3.8
1	2412	802.11N	MSC0	0.4	0.6	5.1	3.5	17.75	9.5	13.0	3.5
6	2437	802.11b	1	3.3	0.6	5.1	1.0	10.00	9.9	13.0	3.1
6	2437	802.11g	6	0.0	0.6	5.1	3.1	16.50	8.8	13.0	4.2
6	2437	802.11N	MSC0	0.1	0.6	5.1	3.5	17.75	9.2	13.0	3.8
11	2462	802.11b	1	2.8	0.6	5.1	1.0	10.13	9.5	13.0	3.5
11	2462	802.11g	6	-0.5	0.6	5.1	3.1	16.50	8.3	13.0	4.7
11	2462	802.11N	MSC0	-0.6	0.6	5.1	3.5	17.75	8.5	13.0	4.5
149	5745	802.11a	6	-4.8	1.0	5.0	3.2	16.56	4.3	13.0	8.7
149	5745	802.11N	MSC0	-4.9	1.0	5.0	3.5	17.75	4.6	13.0	8.4
157	5785	802.11a	6	-6.1	1.0	5.0	3.1	16.44	3.0	13.0	10.0
157	5785	802.11N	MSC0	-6.2	1.0	5.0	3.4	17.69	3.3	13.0	9.7
165	5825	802.11a	6	-12.4	1.0	5.0	3.1	16.50	-3.3	13.0	16.3
165	5825	802.11N	MSC0	-12.5	1.0	5.0	3.4	17.69	-3.1	13.0	16.1

Since the average power output is 11.0 mW, The EUT meets the requirement for RF exposure.

10.6 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.
Span = 20 MHz; RBW = 1 MHz; VBW = 3 MHz; Trace = max hold; REC-12

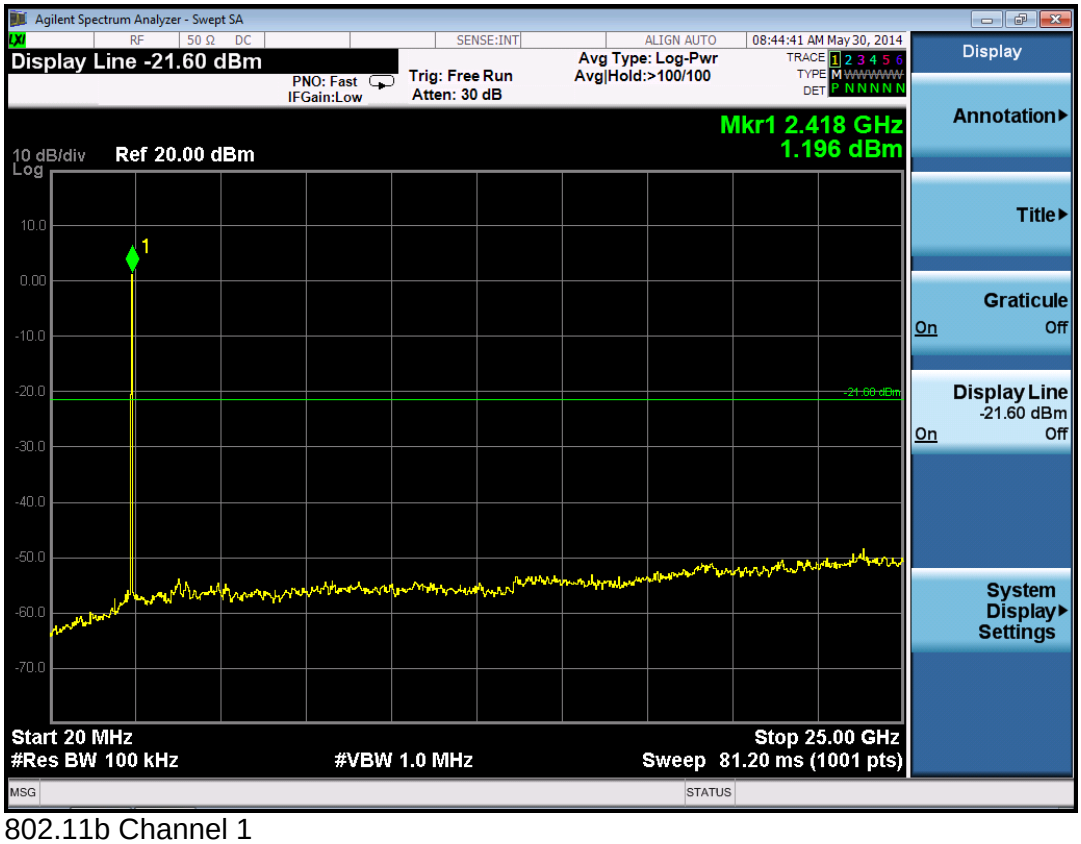
Test Date: 05/29/2014; Test Personnel: Richard L. Tichgelaar

Chan	Frequency	**Mode**	**Mbps**	Delta dB	Limit dB	Margin dB	Band edge Freq MHz
1	2412	802.11b	1	45.5	20.0	25.5	2400.0
1	2412	802.11g	6	31.4	20.0	11.4	2400.0
1	2412	802.11N	MSC0	30.4	20.0	10.4	2400.0
11	2462	802.11b	1	53.0	20.0	33.0	2483.5
11	2462	802.11g	6	46.3	20.0	26.3	2483.5
11	2462	802.11N	MSC0	41.8	20.0	21.8	2483.5
149	5745	802.11a	6	42.5	20.0	22.5	5725.0
149	5745	802.11N	MSC0	38.1	20.0	18.1	5725.0
165	5825	802.11a	6	46.2	20.0	26.2	5875.0
165	5825	802.11N	MSC0	45.7	20.0	25.7	5875.0

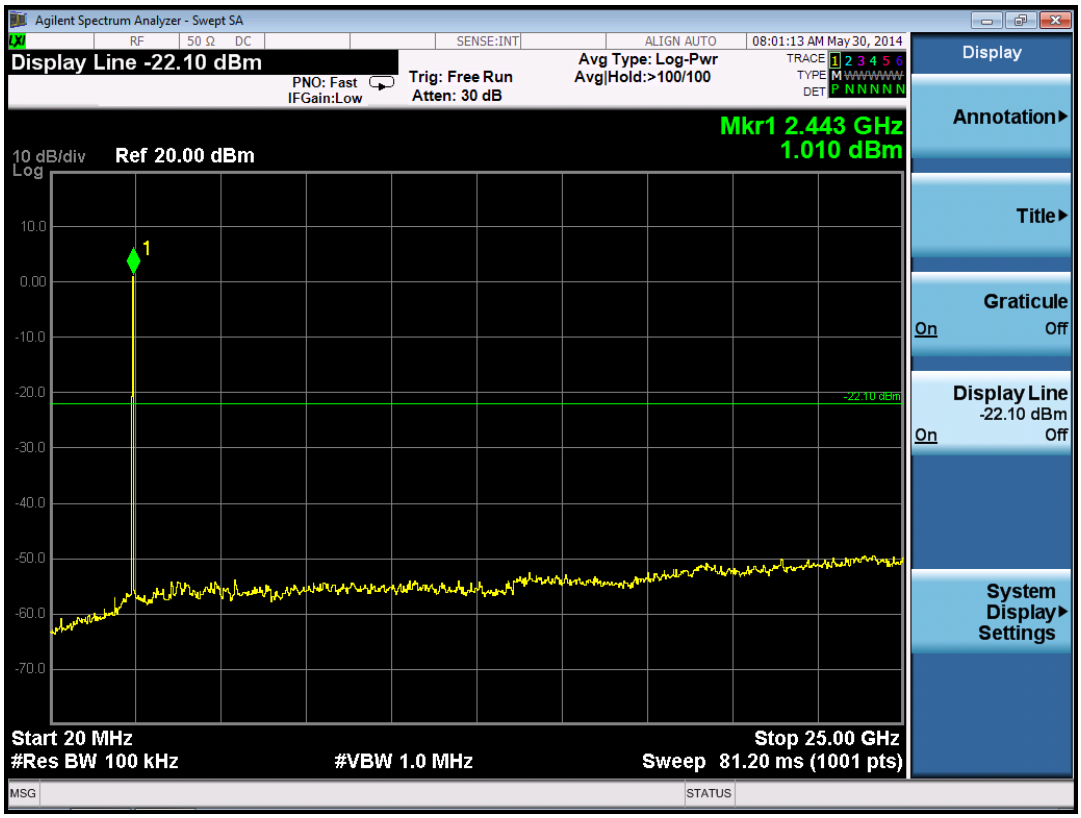
Judgement: Pass by 10.4 dB

10.7 Spurious RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic or 40 GHz. The trace was allowed to stabilize.

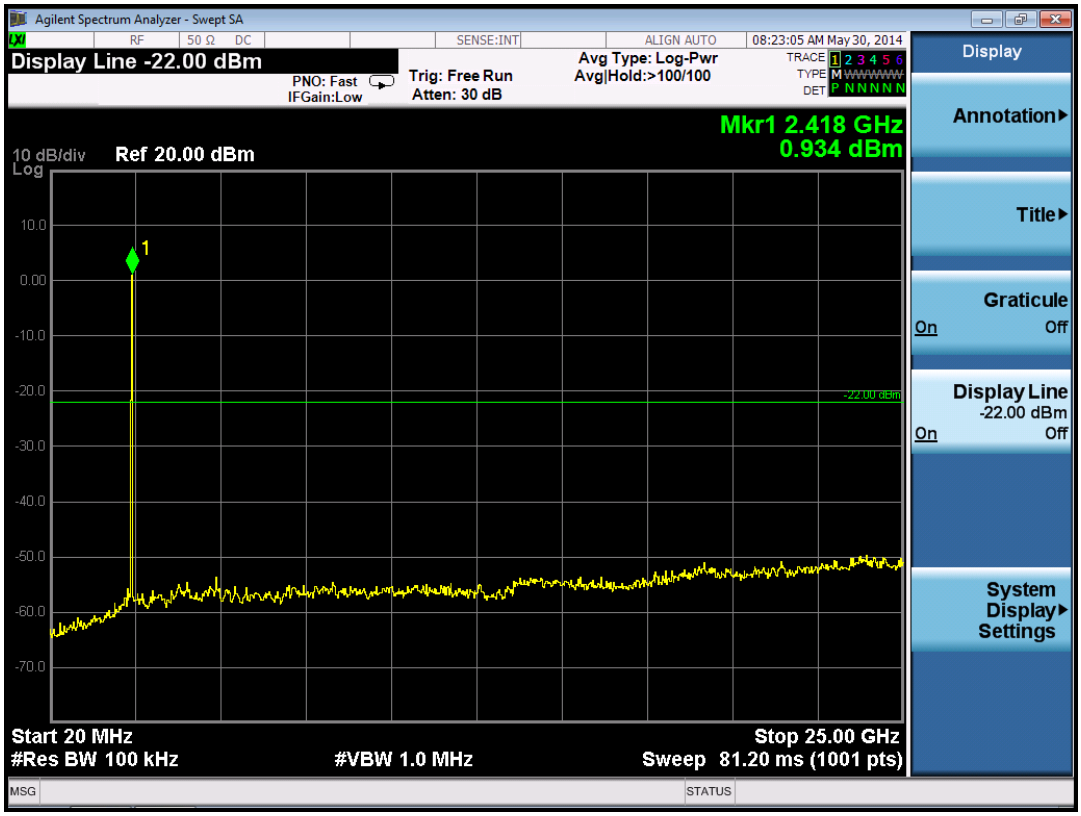


802.11b Channel 1

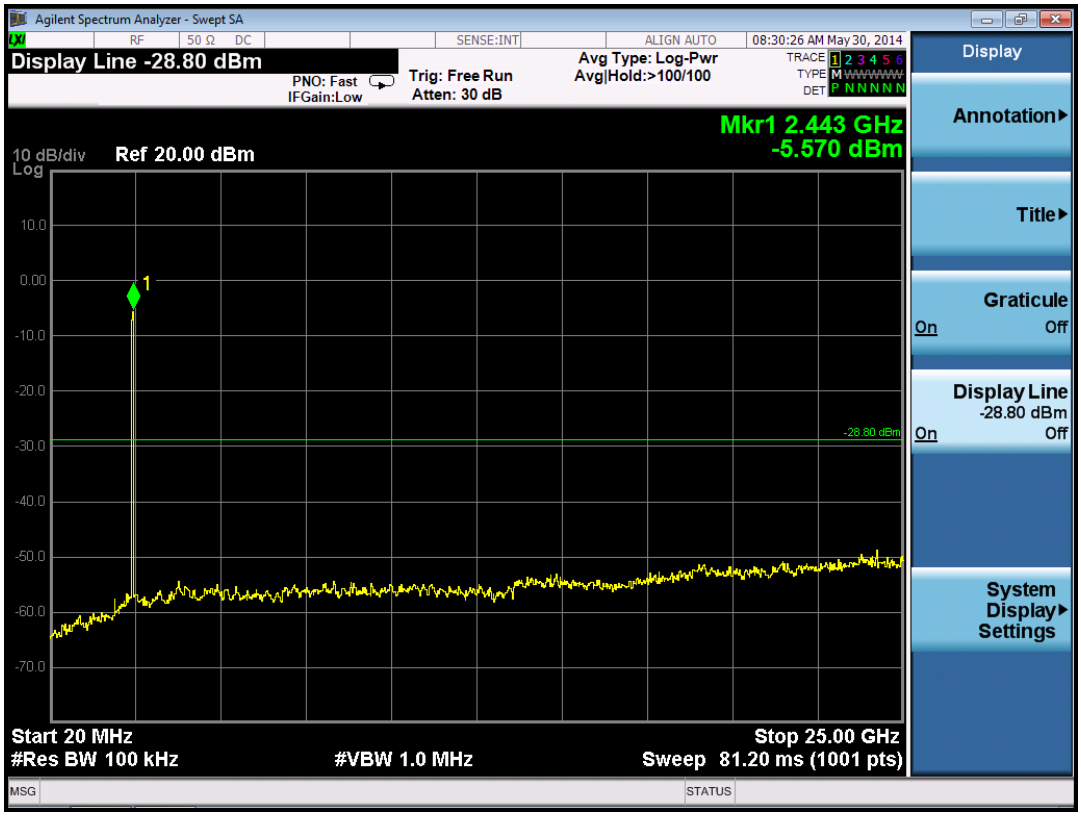


802.11b Channel 6

802.11b Channel 11



802.11g Channel 1

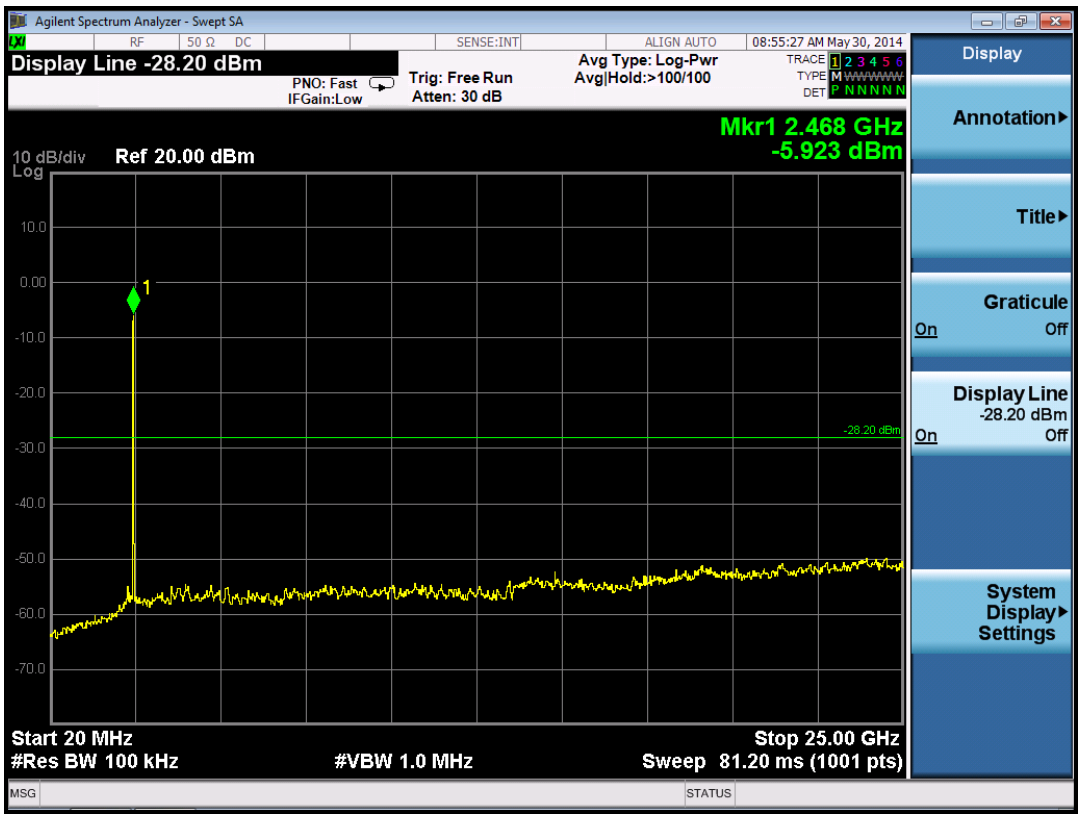


802.11g Channel 6

802.11g Channel 11

802.11N Channel 1

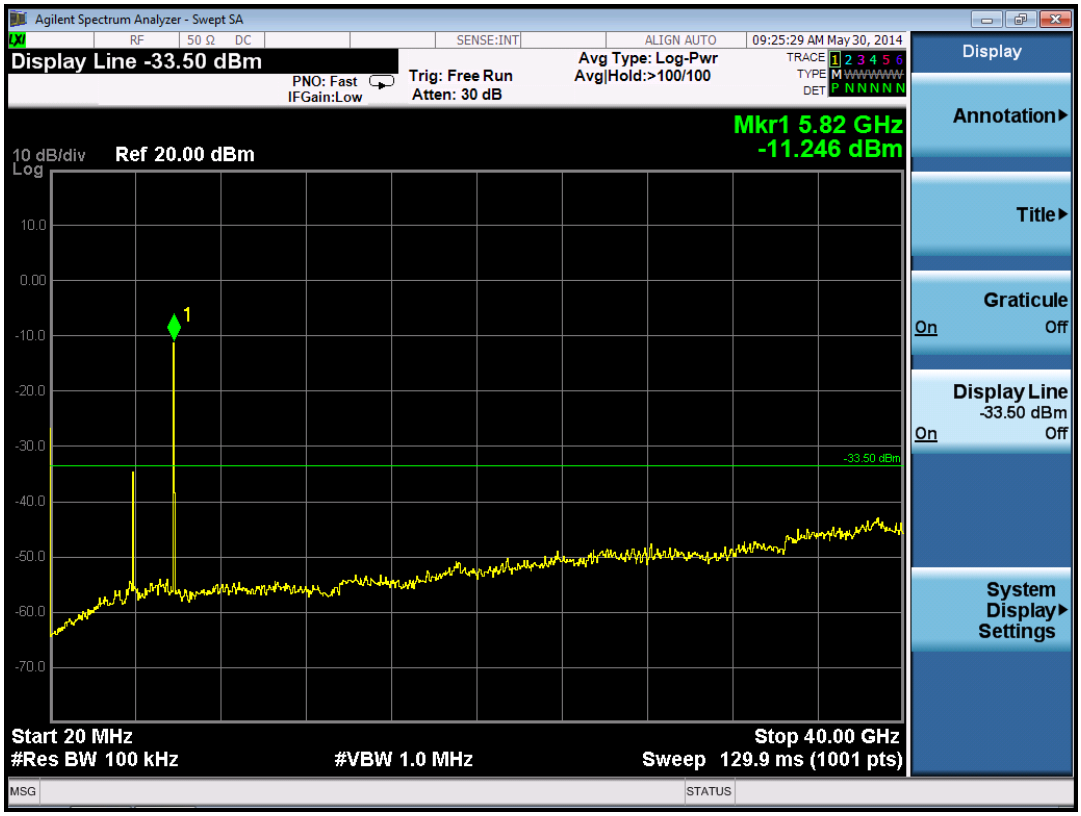
802.11N Channel 6



802.11N Channel 11

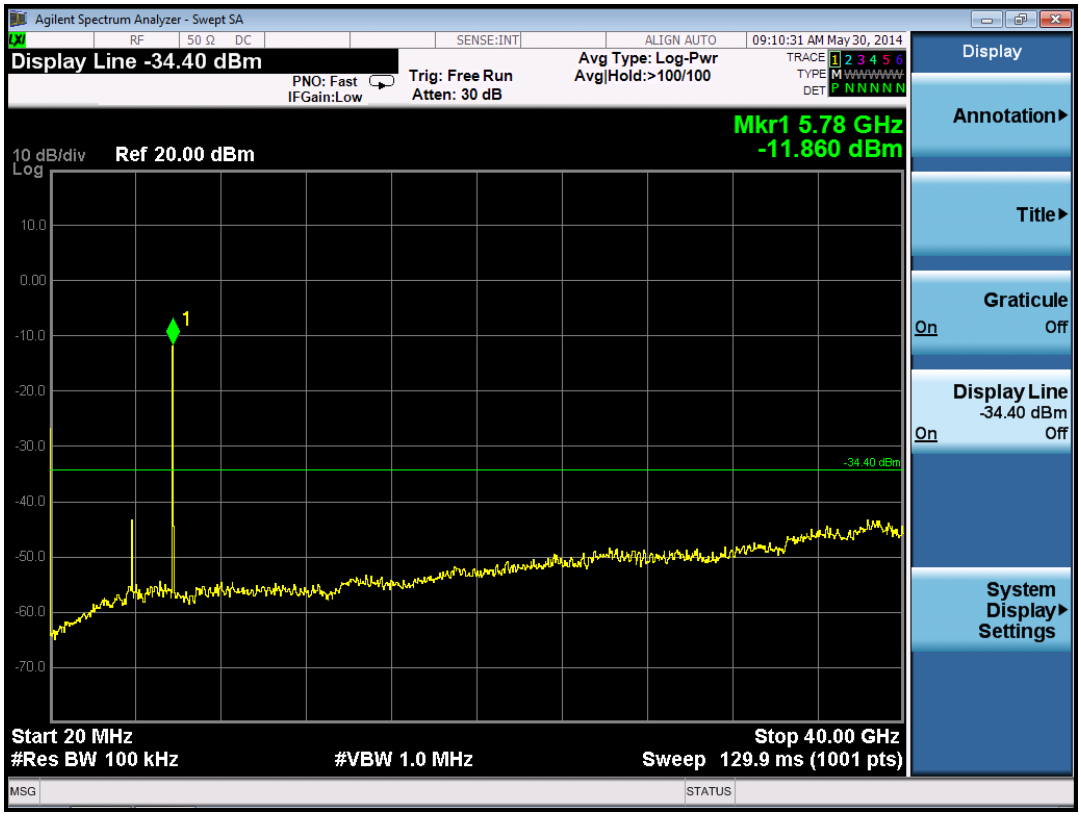
802.11A Channel 149

802.11A Channel 157



802.11A Channel 165

802.11N Channel 149



802.11N Channel 157

802.11N Channel 165

10.8 Spurious Radiated Emissions (Restricted Band)

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu spectrum analyzer was used. For tests from 1 to 25 GHz, an HP 8566 spectrum analyzer was used. For tests from 1 to 10 GHz, a high pass filter was used to reduce the fundamental emission. A harmonic mixer was used from 18 to 25 GHz. Figure 4 herein lists the details of the test equipment used during radiated emissions tests. In addition, a high pass filter was used to reduce the fundamental emission.

The was device was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the radiated tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 25,000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

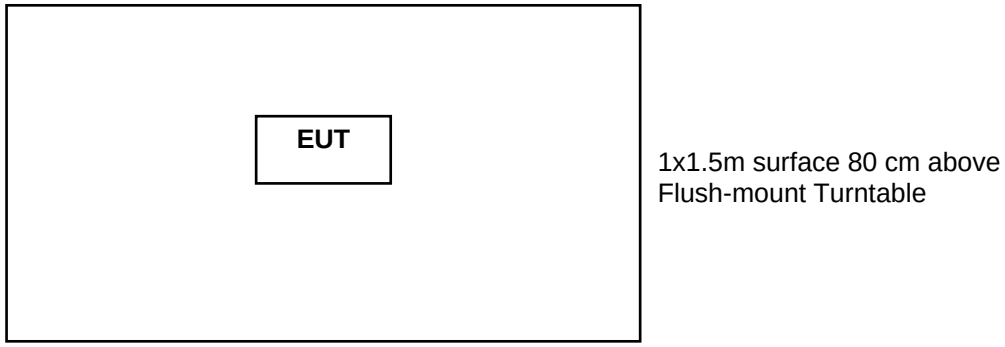
10.8.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

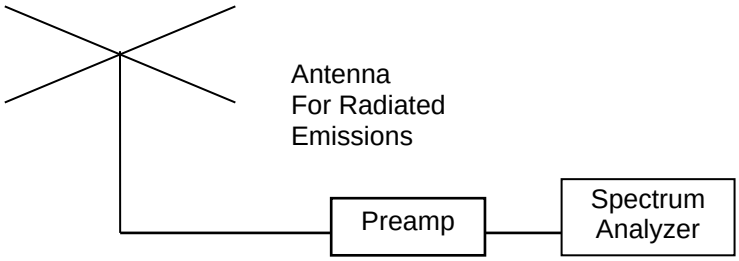
FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss

Figure 2. Drawing of Radiated Emissions Setup



Notes:
- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale



10.8.2 Radiated Emissions Test Results

The following spectrum analyzer settings were used.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold
A Video Bandwidth of 10 Hz was used for Average measurements above 1 GHz.

Manufacturer	Trilithic	Specification	FCC Part 15 Subpart C & RSS-210
Model	2072290000	Test Date	July 10-30, 2013 & 5-16-2014
Serial Number	360122095	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain – Duty Cycle Factor + HP Filter Loss		

Non Harmonic, Restricted band Emissions

Freq. MHz	Meter Reading dBuV	Dect. Type	Antenna Pol.	Antenna ID#	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
3856.7	42.3	P	H	13.0	10.6	52.9	74.0	21.1
3856.7	38.9	A	H	13.0	10.6	49.5	54.0	4.5
3856.7	41.8	P	V	13.0	10.6	52.4	74.0	21.6
3856.7	37.8	A	V	13.0	10.6	48.4	54.0	5.6
3830.1	43.5	P	H	13.0	10.5	54.0	74.0	20.0
3830.0	40.7	A	H	13.0	10.5	51.2	54.0	2.8
3830.1	43.2	P	V	13.0	10.5	53.7	74.0	20.3
3830.0	41.3	A	V	13.0	10.5	51.8	54.0	2.2
3870.1	42.9	P	V	13.0	10.6	53.5	74.0	20.5
3870.1	39.2	A	V	13.0	10.6	49.8	54.0	4.2
3869.9	39.5	P	H	13.0	10.6	50.1	74.0	23.9
3870.1	34.6	A	H	13.0	10.6	45.2	54.0	8.8

Judgement: Pass by 2.2 dB

802.11b Radiated emissions (2.4 GHz)

		Spectrum Analyzer Readings									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization					Freq					
#	Freq	X	Y	Z	Max	X	Y	Z	Max	Fact.	MHz	dBuV/m		dBuV/m		Limit
1	2412	98.3	93.5	105.5	101.5	95.9	99.5	94.1	97.0	2.1	2412	107.6	103.6	125	115	11.4
BE	2412	46.1	41.3	53.3	49.3	43.7	47.3	41.9	44.8	2.1	2390	55.4	51.4	74	54	2.6
2	2412	35.5	36.2	36.0	33.1	35.9	39.8	33.5	36.7	10.5	4824	50.3	47.2	74	54	6.8
3	2412	36.0	36.0	36.0	32.9	36.0	36.0	36.0	32.9	11.3	7236	47.3	44.2	74	54	9.8
1	2437	96.8	94.1	104.6	101.5	95.9	105.1	99.9	102.0	2.2	2437	107.3	104.2	125	115	10.8
2	2437	39.1	37.6	40.0	36.9	35.6	40.7	36.3	37.6	10.6	4874	51.3	48.2	74	54	5.8
3	2437	36.0	36.0	36.0	32.9	36.0	36.0	36.0	32.9	11.1	7311	47.1	44.0	74	54	10.0
1	2462	93.9	96.5	104.5	101.4	95.8	103.1	97.5	100.0	2.3	2462	106.8	103.7	125	115	11.3
BE	2462	38.9	41.5	49.5	46.4	40.8	48.1	42.5	45.0	2.3	2483.5	51.8	48.7	74	54	5.3
2	2462	38.7	39.7	41.9	38.8	39.0	41.8	38.7	38.7	10.0	4924	51.9	48.8	74	54	5.2
3	2462	36.0	36.0	36.0	32.9	36.0	36.0	36.0	32.9	11.5	7386	47.5	44.4	74	54	9.6
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Judgment: Passed by 2.6 dB
No other emissions were detected from 8 to 25 GHz.

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Highest Average Reading
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Highest Average Reading
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

802.11g Radiated emissions (2.4 GHz)

		Spectrum Analyzer Readings									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization					Freq					
#	Freq	X	Y	Z	Max	X	Y	Z	Max	Fact.	MHz	dBuV/m		dBuV/m		Limit
1	2412	96.4	101.2	106.4	94.9	98.3	103.6	99.6	93.2	2.1	2412	108.5	97.0	125	115	16.5
BE	2412	63.5	65.8	70.2	50.4	63.2	68.9	64.5	49.6	2.1	2390	72.3	52.5	74	54	1.5
2	2412	36.6	39.7	42.8	36.8	35.9	43.1	36.8	37.1	10.5	4824	53.6	47.6	74	54	6.4
3	2412	36.0	36.0	36.0	30.0	36.0	36.0	36.0	30.0	11.3	7236	47.3	41.3	74	54	12.7
1	2437	99.8	101.2	106.9	100.9	99.3	105.6	102.8	93.5	2.2	2437	109.1	103.1	125	115	11.9
2	2437	37.8	38.9	41.2	35.2	35.9	42.0	39.0	36.0	10.6	4874	52.6	46.6	74	54	7.4
3	2437	36.0	36.0	36.0	30.0	37.0	39.7	37.0	33.7	11.1	7311	50.8	44.8	74	54	9.2
1	2462	99.5	101.7	105.9	93.9	99.4	105.6	101.6	95.0	2.3	2462	108.2	97.3	125	115	16.8
BE	2462	63.8	65.3	69.5	49.5	65.2	70.0	66.1	50.3	2.3	2483.5	72.3	52.6	74	54	1.4
2	2462	36.8	38.9	41.3	35.3	36.4	40.7	37.9	34.7	10.0	4924	51.3	45.3	74	54	8.7
3	2462	36.0	36.0	36.0	30.0	36.0	36.0	36.0	30.0	11.5	7386	47.5	41.5	74	54	12.5
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Judgment: Passed by 1.4 dB
No other emissions were detected from 8 to 25 GHz.

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Highest Average Reading
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Highest Average Reading
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

802.11N Radiated emissions (2.4 GHz)

		Spectrum Analyzer Readings									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization					Freq					
#	Freq	X	Y	Z	Max	X	Y	Z	Max	Fact.	MHz	dBuV/m		dBuV/m		Limit
1	2412	92.2	102.6	93.9	94.6	97.7	91.7	100.3	92.3	3.1	2412.0	105.7	97.7	125	115	17.3
BE	2412	61.1	68.6	60.8	47.9	66.5	62.1	68.7	47.0	3.1	2390.0	71.8	51.0	74	54	2.2
2	2412	38.4	39.5	39.0	31.5	38.8	39.4	40.6	11.6	11.6	4824.0	52.2	43.1	74	54	10.9
3	2412	38.6	39.1	37.6	31.1	37.4	36.9	38.1	30.1	12.5	7236.0	51.6	43.6	74	54	10.4
1	2437	93.5	101.2	94.5	93.2	98.7	95.3	101.0	93.0	3.2	2437.0	104.4	96.4	125	115	18.6
2	2437	39.0	39.1	38.7	31.1	37.6	38.6	39.5	31.5	11.2	4874.0	50.7	42.7	74	54	11.3
3	2437	38.4	38.5	38.1	30.5	38.0	37.8	39.6	31.6	12.5	7311.0	52.1	44.1	74	54	9.9
1	2462	88.2	99.9	91.5	92.0	96.4	91.2	98.9	90.9	3.3	2462.0	103.2	95.3	125	115	19.7
BE	2462	51.9	64.7	52.2	46.0	61.2	58.4	63.4	46.9	3.3	2483.5	68.0	50.2	74	54	3.8
2	2462	39.9	40.3	38.7	32.3	38.5	39.6	38.4	31.6	11.5	4924.0	51.8	43.8	74	54	10.2
3	2462	37.8	36.8	37.2	29.8	37.9	37.6	37.1	29.9	12.4	7386.0	50.3	42.3	74	54	11.7
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Judgment: Passed by 2.2 dB
No other emissions were detected from 8 to 25 GHz.

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Highest Average Reading
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Highest Average Reading
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

802.11A; FCC 15.247 Radiated emissions (Fundamental, Band edge and Harmonics)

5745, 5785 and 5825 MHz

		Spectrum Analyzer Readings									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization					Freq					
#	Freq	X	Y	Z	Max	X	Y	Z	Max	Fact.	MHz	dBuV/m		dBuV/m		Limit
1	5745	78.3	84.7	73.5	76.0	85.6	74.1	82.7	76.9	12.5	5745.0	98.1	89.4	125	115	25.6
2	5745	36.8	37.9	38.0	29.3	37.2	37.0	36.8	11.6	17.7	11490.0	55.7	47.0	74	54	7.0
1	5785	76.9	83.0	75.2	74.3	84.3	73.4	82.4	75.6	12.4	5785.0	96.7	88.0	125	115	27.0
2	5785	36.5	36.8	34.9	28.1	34.9	36.0	35.0	27.3	17.8	11570.0	54.6	45.9	74	54	8.1
1	5825	79.5	83.9	76.5	75.2	84.9	74.8	81.6	76.2	12.4	5825.0	97.3	88.6	125	115	26.4
2	5825	36.4	36.1	36.5	27.8	35.7	36.4	36.2	27.7	17.6	11650.0	54.1	45.4	74	54	8.6
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Judgment: Passed by 7.0 dB
No other emissions were detected from 12 to 40 GHz.

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Highest Average Reading
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Highest Average Reading
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

802.11N; FCC 15.247 Radiated emissions (Fundamental, Band edge and Harmonics)

5745, 5785 and 5825 MHz

		Spectrum Analyzer Readings									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization					Freq					
#	Freq	X	Y	Z	Max	X	Y	Z	Max	Fact.	MHz	dBuV/m		dBuV/m		Limit
1	5745	77.8	84.0	75.4	75.3	84.9	75.0	83.0	76.2	12.5	5745.0	97.4	88.7	125	115	26.3
2	5745	36.2	37.5	36.4	28.8	37.6	38.6	38.7	11.6	17.7	11490.0	56.4	46.5	74	54	7.5
1	5785	78.4	83.7	72.7	75.0	84.9	75.7	82.1	76.2	12.4	5785.0	97.3	88.6	125	115	26.4
2	5785	37.8	36.8	36.5	29.1	36.8	37.1	38.3	29.6	17.8	11570.0	56.1	47.4	74	54	6.6
1	5825	79.6	82.8	75.9	74.1	83.6	77.0	83.2	74.9	12.4	5825.0	96.0	87.3	125	115	27.7
2	5825	36.8	37.9	38.5	29.8	37.2	37.3	36.6	28.6	17.6	11650.0	56.1	47.4	74	54	6.6
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Judgment: Passed by 6.6 dB
No other emissions were detected from 12 to 40 GHz.

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Highest Average Reading
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Highest Average Reading
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

10.9 Unintentional Emissions (Receive Mode)

Manufacturer	Trilithic	Specification	FCC Part 15.247 & RSS-210
Model	2072290000	Test Date	7/10/2013
Serial Number	360122095	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain		
Configuration	Receive mode emissions		

Freq. MHz	Meter Reading dBuV	Dect. Type	Antenna Factor dB	Antenna Pol/ ID#	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
30.7	42.5	Q	16.4	H/44	-27.9	31.0	40.0	9.0
47.2	45.4	P	14.6	H/44	-28.2	31.8	40.0	8.2
61.5	52.2	Q	10.1	H/44	-28.0	34.3	40.0	5.7
116.8	38.7	P	13.7	H/44	-26.7	25.7	43.5	17.8
124.8	43.0	P	14.6	H/44	-27.3	30.3	43.5	13.2
172.7	56.4	Q	9.3	H/44	-26.7	39.0	43.5	4.5
199.6	48.0	P	9.8	H/44	-26.0	31.8	43.5	11.7
215.2	53.2	P	11.1	H/44	-26.3	38.0	43.5	5.5
224.8	45.3	P	11.7	H/44	-26.2	30.8	46.0	15.2
225.1	44.8	Q	11.7	H/44	-25.9	30.7	46.0	15.3
233.4	52.0	P	11.6	H/44	-26.2	37.4	46.0	8.6
268.1	57.7	P	12.8	H/44	-27.5	43.0	46.0	3.0
335.3	41.8	P	13.9	H/44	-25.2	30.6	46.0	15.4
376.8	46.3	P	15.4	H/44	-25.0	36.7	46.0	9.3
424.9	35.8	P	16.4	H/44	-24.8	27.5	46.0	18.5
444.5	38.6	P	17.1	H/44	-24.5	31.1	46.0	14.9
469.2	38.6	P	17.3	H/44	-24.3	31.6	46.0	14.4
474.8	32.3	P	17.5	H/44	-24.3	25.5	46.0	20.5
491.0	43.4	P	17.2	H/44	-24.3	36.3	46.0	9.7
521.0	42.4	P	17.9	H/44	-24.2	36.1	46.0	9.9
575.0	42.8	P	19.6	H/44	-26.6	35.8	46.0	10.2
622.0	34.2	P	19.6	H/44	-23.3	30.5	46.0	15.5
675.0	46.4	P	20.0	H/44	-26.4	40.0	46.0	6.0
725.0	47.9	P	20.4	H/44	-26.1	42.2	46.0	3.8
737.0	29.6	P	20.2	H/44	-22.7	27.1	46.0	18.9
775.0	47.7	P	20.7	H/44	-26.0	42.4	46.0	3.6
825.0	43.8	P	21.1	H/44	-25.6	39.3	46.0	6.7
826.0	27.3	P	21.1	H/44	-21.6	26.8	46.0	19.2
846.0	33.9	P	21.5	H/44	-21.5	33.9	46.0	12.1
960.0	26.8	P	21.9	H/44	-20.3	28.4	46.0	17.6
34.0	48.8	P	16.3	V/44	-28.4	36.7	40.0	3.3
95.0	56.8	Q	8.6	V/44	-27.6	37.8	43.5	5.7
97.6	57.2	P	9.0	V/44	-27.6	38.6	43.5	4.9
233.4	54.4	P	11.6	V/44	-26.2	39.8	46.0	6.2
250.2	57.1	P	12.7	V/44	-27.5	42.3	46.0	3.7
267.7	52.9	P	12.8	V/44	-27.5	38.2	46.0	7.8
268.1	57.8	P	12.8	V/44	-27.5	43.1	46.0	2.9
437.2	43.1	P	17.1	V/44	-27.3	32.9	46.0	13.1
525.0	44.2	P	18.0	V/44	-26.8	35.4	46.0	10.6
575.0	44.8	P	19.6	V/44	-26.6	37.8	46.0	8.2
625.0	42.9	P	19.8	V/44	-26.6	36.1	46.0	9.9
675.0	42.0	P	20.0	V/44	-26.4	35.6	46.0	10.4

Freq. MHz	Meter Reading dBuV	Dect. Type	Antenna Factor dB	Antenna Pol/ ID#	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
725.0	43.0	P	20.4	V/44	-26.1	37.3	46.0	8.7
775.0	42.3	P	20.7	V/44	-26.0	37.0	46.0	9.0
825.0	41.0	P	21.1	V/44	-25.6	36.5	46.0	9.5
925.0	36.5	P	21.8	V/44	-25.2	33.1	46.0	12.9
1054.0	32.8	P	24.6	H/13	-26.6	30.8	54.0	23.2
1126.0	37.0	P	25.1	H/13	-26.3	35.8	54.0	18.2
1176.0	34.0	P	25.3	H/13	-26.2	33.1	54.0	20.9
1251.0	33.5	P	25.3	H/13	-26.2	32.7	54.0	21.3
1375.0	43.4	P	25.4	H/13	-26.1	42.6	54.0	11.4
1475.0	33.6	P	25.5	H/13	-26.2	32.9	54.0	21.1
1626.0	37.0	P	25.8	H/13	-26.0	36.8	54.0	17.2
1875.0	37.6	P	27.3	H/13	-25.4	39.5	54.0	14.5
1921.0	37.4	P	27.4	H/13	-25.6	39.2	54.0	14.8
1126.0	35.6	P	25.1	V/13	-26.3	34.3	54.0	19.7
1144.0	37.5	P	25.2	V/13	-26.3	36.4	54.0	17.6
1375.0	40.9	P	25.4	V/13	-26.1	40.2	54.0	13.8
1394.0	46.4	P	25.3	V/13	-26.1	45.6	54.0	8.4
1492.0	38.6	P	25.5	V/13	-26.2	37.8	54.0	16.2
1501.0	34.9	P	25.5	V/13	-26.1	34.3	54.0	19.7
1527.0	36.2	P	25.6	V/13	-26.0	35.8	54.0	18.2
1626.0	43.6	P	25.8	V/13	-26.0	43.4	54.0	10.6
1875.0	44.7	P	27.3	V/13	-25.4	46.6	54.0	7.4
1921.0	32.8	P	27.4	V/13	-25.6	34.6	54.0	19.4

Judgement: Pass by 3.0 dB