Certification Test Report

FCC ID: 2AA9WV360
IC: 11665A-V360

FCC Rule Part: 15.407
IC Radio Standards Specification: RSS-210

ACS Report Number: 14-2101.W06.4B

Applicant: VSN Technologies, Inc.
Model(s): V360

Test Begin Date: **September 9, 2014**
Test End Date: **November 19, 2014**

Report Issue Date: November 24, 2014

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

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

Reviewed by:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

This report contains 56 pages

TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

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

1.2 Applicant Information

VSN Technologies Inc.
1975 E. Sunrise Blvd., Suite 400
Ft. Lauderdale, FL 33304

1.3 Product Description

The VSN Technologies model V360 is a high definition (HD) digital camera, with option for USB and HDMI connection. The product offers multiple wireless capabilities such as 2.4/5GHz 802.11b/g/n WLAN, Bluetooth 3.0 and Bluetooth Low Energy (BLE). There are two Bluetooth Low Energy sources on the product. One is located on the main board while the other is located on the daughter board. The BLE transceiver on the daughter board can transmit simultaneously with the transceiver on the main board for the WLAN, BLE and Bluetooth 3.0 modes of operation.

Technical Details

Mode of Operation:	WLAN 802.11n
Frequency Range:	802.11n 20 MHz: 5180 MHz - 5240 MHz, 5745 MHz - 5825 MHz
	802.11n 40 MHz: 5190 MHz - 5230 MHz, 5755 MHz - 5795 MHz
Number of Channels:	5180 MHz - 5240 MHz: 4
	5190 MHz - 5230 MHz: 2
	5745 MHz - 5825 MHz: 5
	5755 MHz - 5795 MHz: 2
Channel Separation:	802.11n 20 MHz: 20 MHz
	802.11n 40 MHz: 40 MHz
Modulations:	OFDM
Antenna Type/Gain:	Monopole with Parasitic Antenna, 2.93 dBi
Input Power:	3.7V (Lithium Ion Battery), 5 VDC USB

Model Number: V360

Test Sample Serial Number(s): ACS#27, ACS#45, ACS#47

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

1.4 Test Methodology and Considerations

The EUT was evaluated for radiated, power line and RF conducted emissions for the 5 GHz WLAN radio located on the main transceiver board.

The RF Conducted measurements were performed for the EUT configured with a temporary SMA connector at the RF port. Where applicable, the data is provided for the worst case data rate configuration.

For the evaluation, the EUT was set in the orientation of typical use. The radiated emissions were investigated up to the 10th harmonic. The data rate configurations leading to the worst case emissions

results were used are documented below. The EUT was also assessed for radiated emissions of intermodulation products for the BLE radio on the daughter board transmitting simultaneously with the 5 GHz WLAN radio on the main transceiver board. All intermodulation products generated by the co-transmission of the co-located radios were found compliant to the limits of FCC Section 15.209.

Table 1.4-1: 802.11n 5 GHz Radio Test Configuration

Mode of Operation	Frequency (MHz)	Channel	Test Software Power Setting	Data Rate Setting)
U-NII-1 (5.15 – 5.25 GHz)				
802.11n 20 MHz	5180	36	14	6.5 Mbps
	5200	40		
	5240	48		
802.11n 40 MHz	5190	38	11	13 Mbps
	5230	46		
U-NII-3 (5.725 – 5.85 GHz)				
802.11n 20 MHz	5745	149	14	6.5 Mbps
	5785	157		
	5825	165		
802.11n 40 MHz	5755	151	11	13 Mbps
	5795	159		

For the power line conducted emissions evaluation, preliminary testing was performed for the EUT powered via the laptop and for the EUT powered via the AC power supply. The input voltage to the AC power supply was set to both 120V/60Hz and 230V/50Hz. The final measurements were performed on the worst case configuration.

2 TEST FACILITIES

2.1 Location

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

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

FCC Test Firm Registration #: 475089
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

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

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

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

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

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

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

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

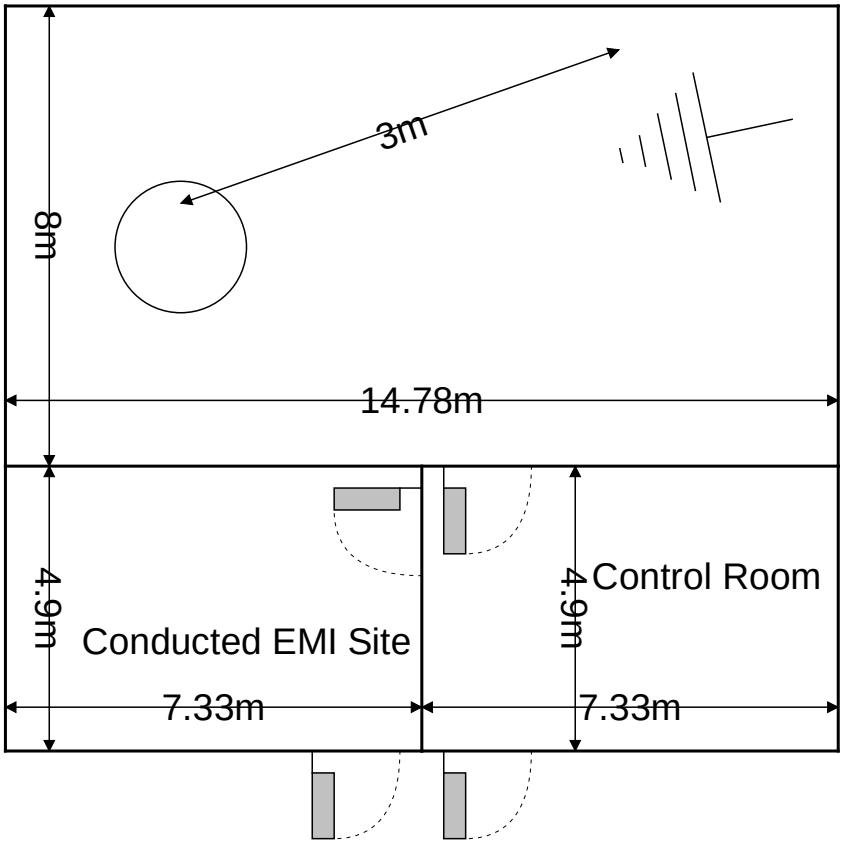


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

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

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

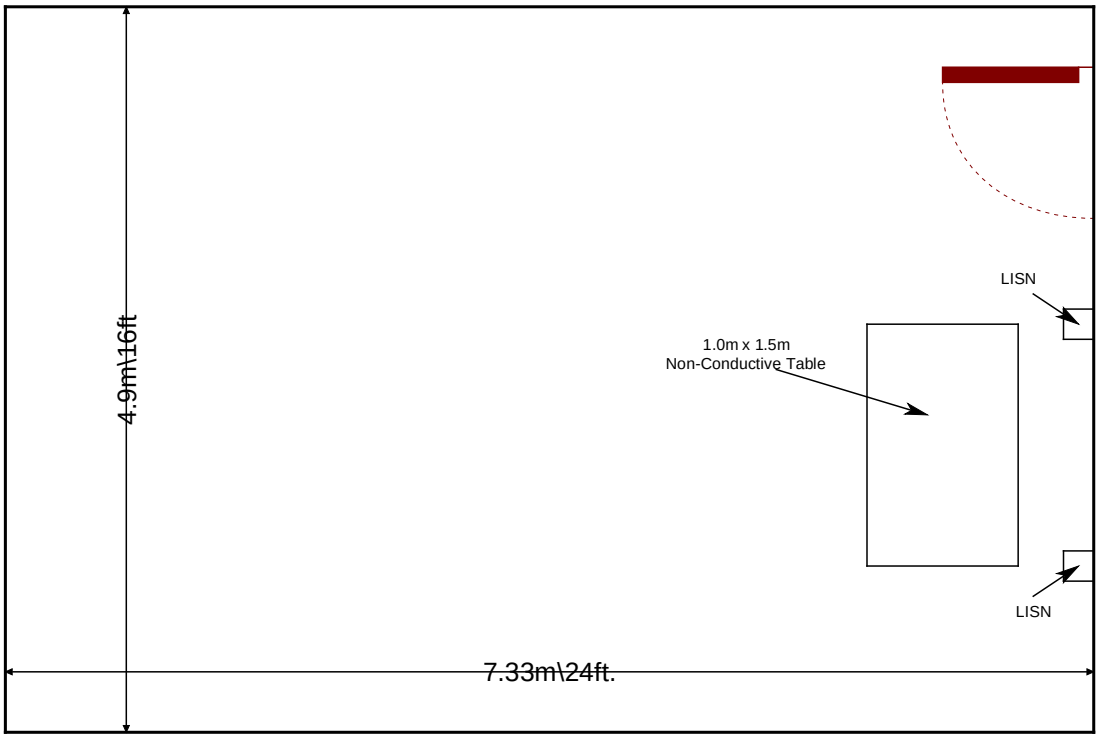


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz.
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2014.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart E: Radio Frequency Devices, Intentional Radiators, 2014
- KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 – Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E, June 6, 2014.
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
2002	EMCO	3108	Antennas	2147	11/22/2013	11/22/2015
2004	EMCO	3146	Antennas	1385	11/22/2013	11/22/2015
2006	EMCO	3115	Antennas	2573	4/24/2013	4/24/2015
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2013	12/31/2014
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	2/27/2014	2/27/2015
2044	QMI	N/A	Cables	2044	12/31/2013	12/31/2014
2070	Mini Circuits	VHF-8400+	Filter	2070	1/1/2014	1/1/2015
2072	Mini Circuits	VHF-3100+	Filter	30737	1/1/2014	1/1/2015
2076	Hewlett Packard	HP5061-5458	Cables	2076	12/31/2013	12/31/2014
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/31/2013	12/31/2014
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/16/2013	12/16/2014
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2022	EMCO	LISN3825/2R	LISN	1095	9/9/2013	9/9/2015
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/1/2014	1/1/2015
3004	Teseq	CFL 9206A	Attenuators	34720	10/21/2013	10/21/2015
2108	Fluke	115	Digital MultiMeter	99211160	3/31/2014	3/31/2015
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/8/2014	5/8/2015
2102	Test Equity	115	Environmental Chambe	150892	3/28/2014	3/28/2015
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	9/18/2013	9/18/2015
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/25/2014	7/25/2015
332	Rohde & Schwarz	TS-PR40	Amplifiers	100021	2/19/2014	2/19/2016
333	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
335	Suhner	SF-102A	Cables	882/2A	7/23/2014	7/23/2015
2099	Agilent Technologies	11970A	Mixer	2332A02313	12/23/2013	12/23/2014
2096	Alpha Wire	9055B	Cables	2096	7/3/2014	7/3/2015

NCR = No Calibration Required

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment – Radiated Emissions

Item #	Type Device	Manufacturer or Responsible Party	Model/Part #	Serial #
1	EUT	VSN Technologies, Inc.	V360	ACS#45
2	Mount	VSN Technologies, Inc.	VN0214F16	ACS#46
3	Monitor	Samsung	S24D300HL	023EHCLF700344
4	Power Supply	Samsung	A2514_DSM	CN07BN4400719ASE38FSLY3RL
5	Laptop	Apple, Inc.	Macbook Pro A1278	C1MN2X3DTY3
6	Power Supply	Apple, Inc.	MagSafe	N/A
7	Mouse	Dell	M-UARDEL7	LZ9440C43W5

Table 5-2: Cable Description – Radiated Emissions

Cable #	Cable Type	Length	Shield	Termination
A	HDMI	1.80 m	Yes	EUT to Monitor
B	USB	1 m	Yes	EUT to Laptop
C	Power	1.50 m	No	Monitor to AC Adaptor
D	Power	1.80 m	No	Laptop to AC Adapter
E	Power	1.85 m	No	Power Supply to AC Mains
F	Power	1.58 m	No	Power Supply to AC Mains
G	USB	1.8m	No	Mouse to Laptop

Table 5-3: EUT and Support Equipment – Power Line Conducted Emissions

Item #	Type Device	Manufacturer or Responsible Party	Model/Part #	Serial #
1	EUT	VSN Technologies, Inc.	V360	ACS#27
2	Mount	VSN Technologies, Inc.	VN0214F16	ACS#46
3	Monitor	Samsung	S24D300HL	023EHCLF700344
4	Power Supply	Samsung	A2514_DSM	CN07BN4400719ASE38FSLY3RL
5	5V Power Supply	Danyang Chenyang Tech-Electron Co., LTD	C-P06	ACS#6

Table 5-4: Cable Description – Power Line Conducted Emissions

Cable #	Cable Type	Length	Shield	Termination
A	HDMI	1.80 m	Yes	EUT to Monitor
B	USB	1 m	Yes	EUT to Power Supply
C	Power	1.50 m	No	Monitor to Power Supply
D	Extension Cord	1.80 m	No	Power Supply to AC Mains
E	Power	1.85 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

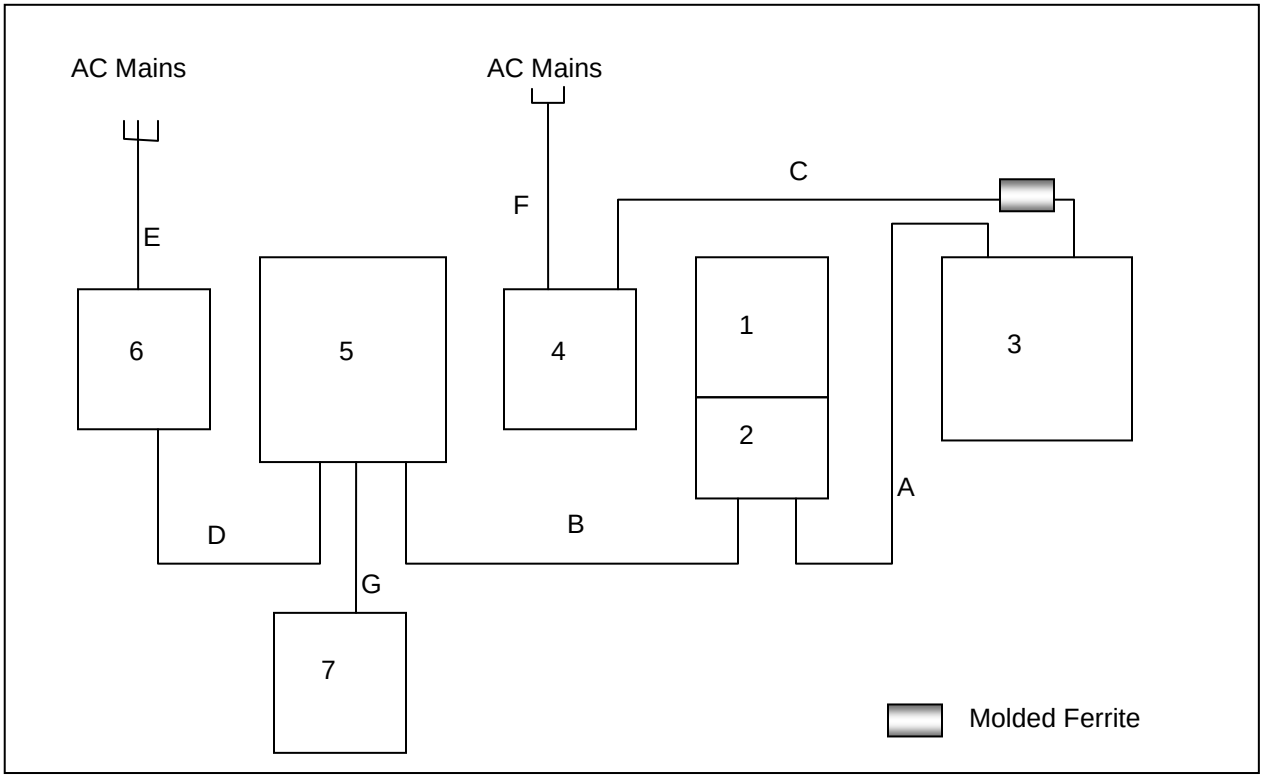


Figure 6-1: Test Setup – Radiated Emissions

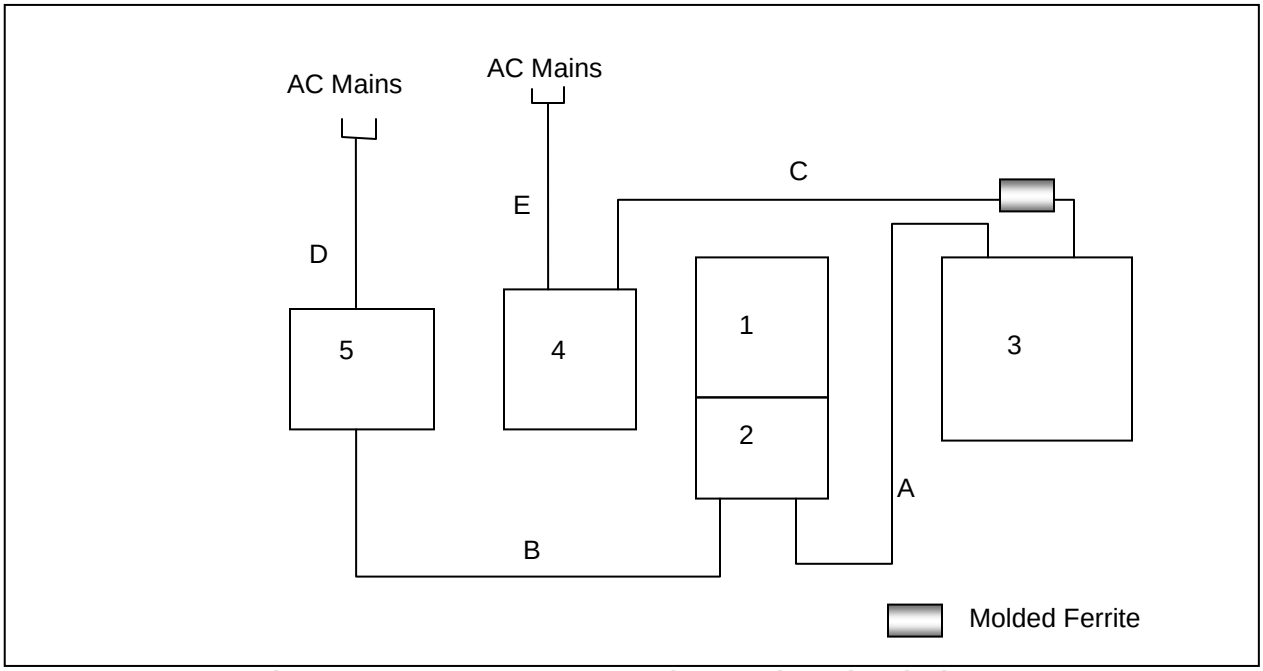


Figure 6-2: Test Setup – Power Line Conducted Emissions

7 SUMMARY OF TESTS

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

7.1 Antenna Requirement – FCC: Section 15.203

The 2.4 GHz radio uses a flexible monopole with parasitic antenna which is connected to the PCB via gold contacts. The antenna is internal to the product and is not easily replaceable, thus fulfilling the requirements of FCC Section 15.203.

7.2 6 dB Bandwidth - FCC: Section 15.407(e) Emission Bandwidth (EBW) 99% Bandwidth IC: RSS-210 A9.2

7.2.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Minimum Emission Bandwidth for the band 5.725-5.85 GHz. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

The 26 dB Emission Bandwidth (EBW) was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Emission Bandwidth (EBW). The RBW was set to approximately 1% of the emission bandwidth. The bandwidth was measured as the maximum width of the emission that is 26 dB down form the maximum of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% of the span. The occupied 99% bandwidth was measured using the occupied bandwidth function of the analyzer.

7.2.2 Measurement Results

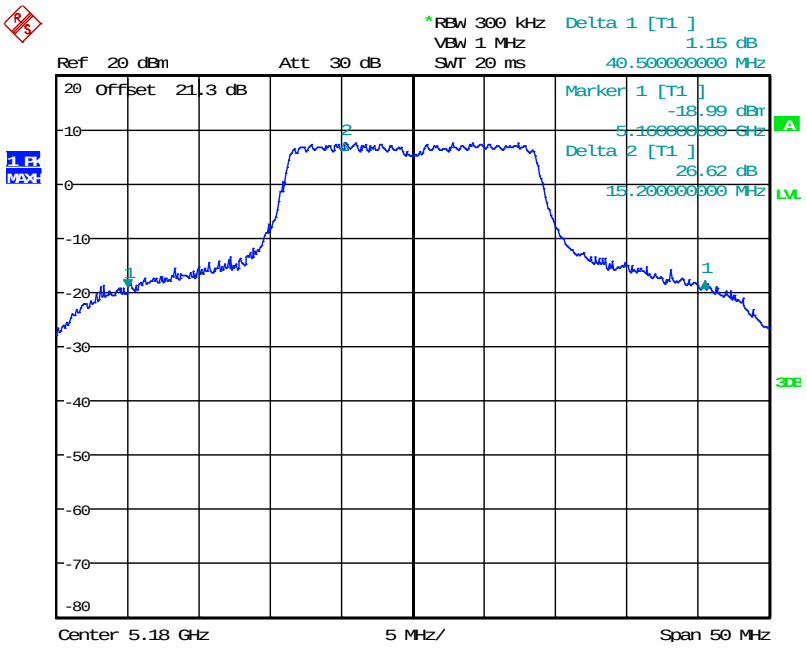
Results are shown below.

Band 5150 – 5250 MHz

802.11n 20 MHz

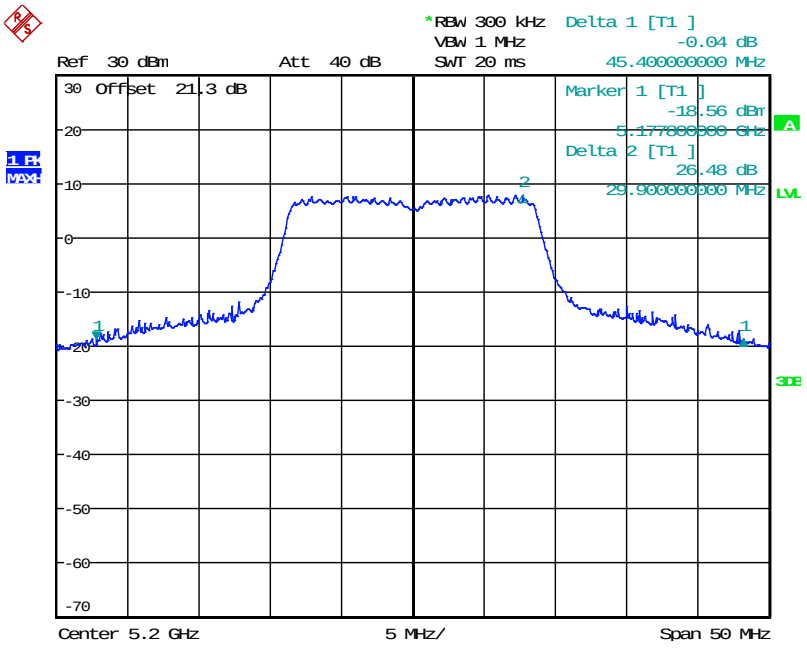
Table 7.2.2-1: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5180	40.5000	20.0000
5200	45.4000	20.4000
5240	46.0000	20.4000



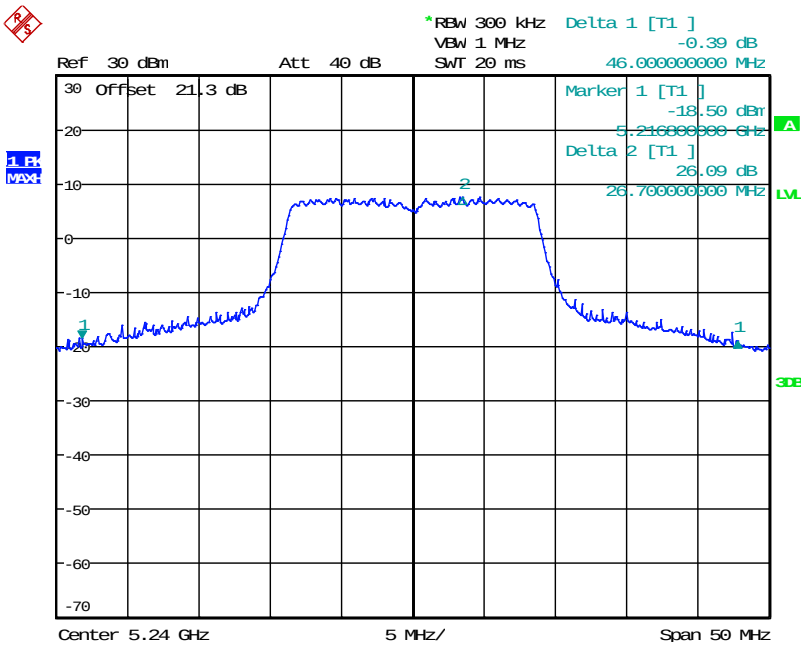
Date: 11.NOV.2014 22:47:34

Figure 7.2.2-1: EBW - Low Channel



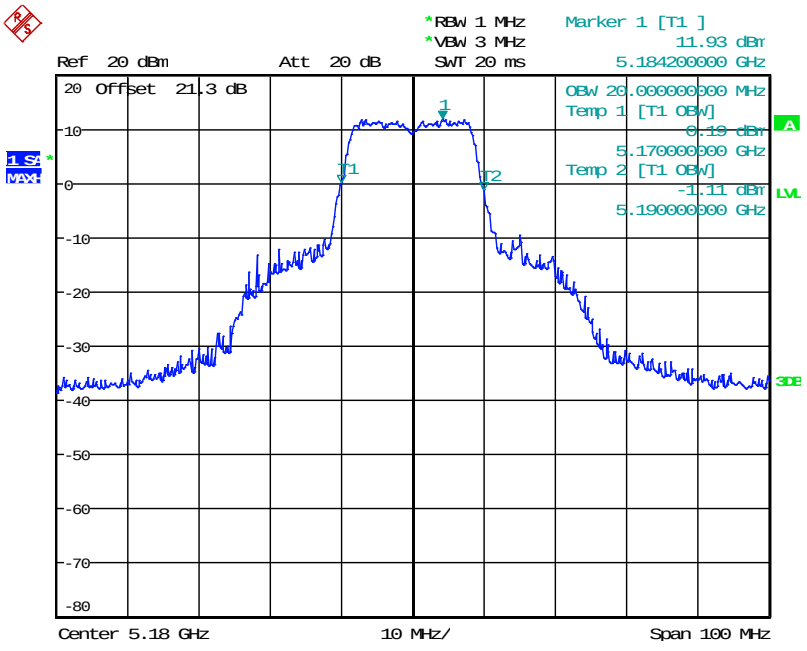
Date: 12.NOV.2014 00:04:29

Figure 7.2.2-2: EBW - Middle Channel



Date: 12.NOV.2014 00:22:15

Figure 7.2.2-3: EBW - High Channel



Date: 11.NOV.2014 23:02:56

Figure 7.2.2-4: 99% OBW - Low Channel

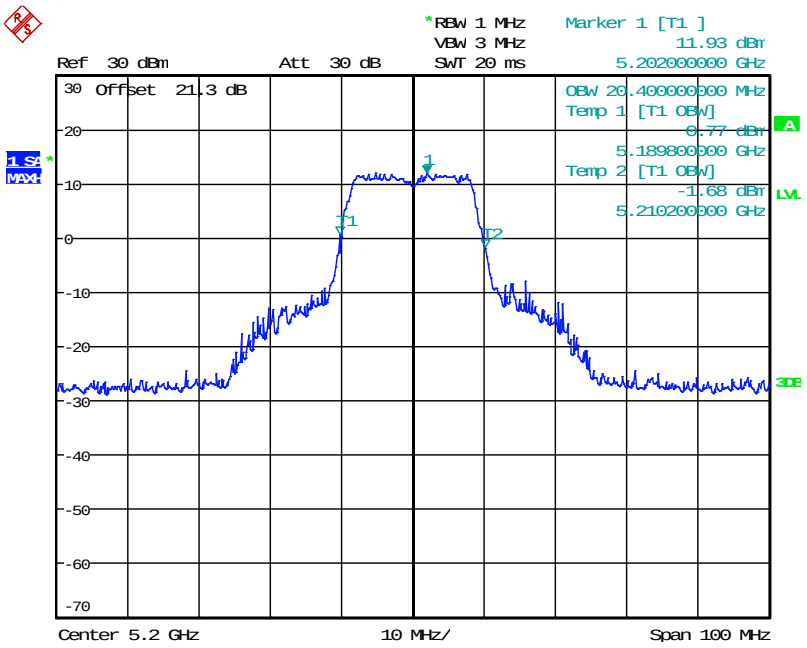


Figure 7.2.2-5: 99% OBW - Middle Channel

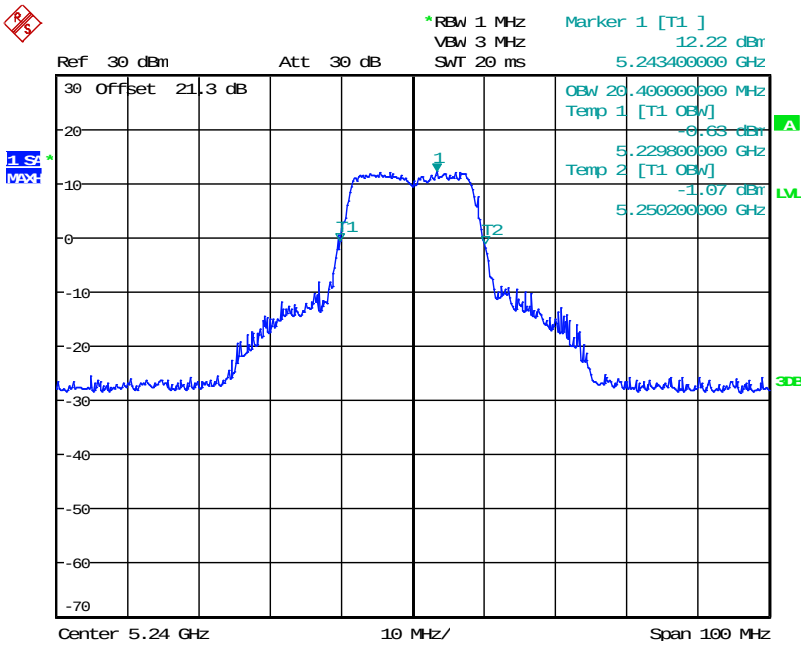


Figure 7.2.2-6: 99% OBW - High Channel

802.11n 40 MHz

Table 7.2.2-2: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5190	43.2000	37.2000
5230	43.8000	36.8000

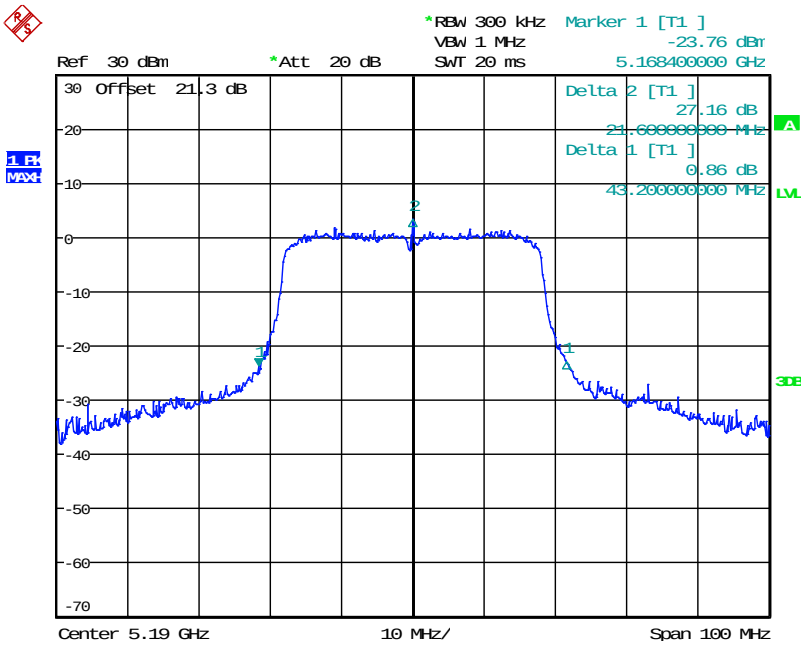
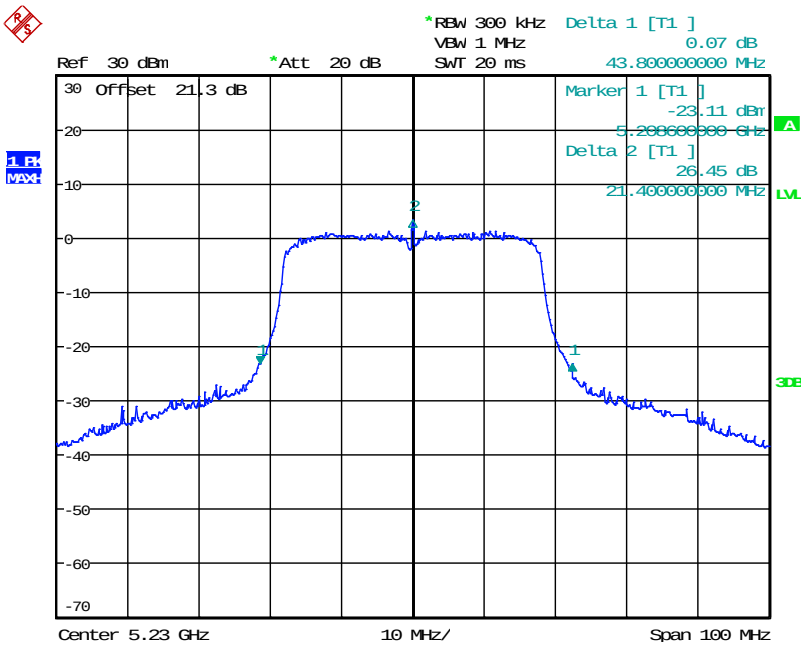
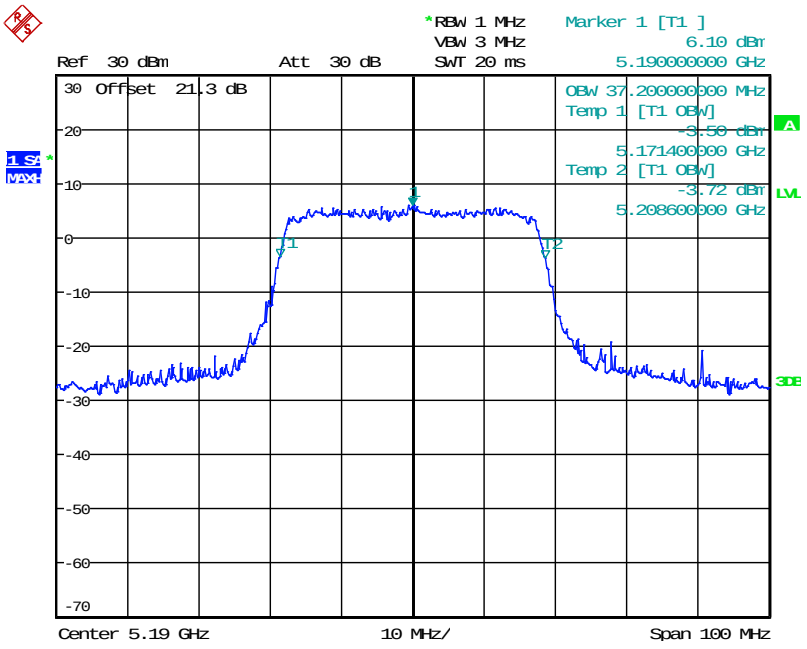


Figure 7.2.2-7: EBW - Low Channel



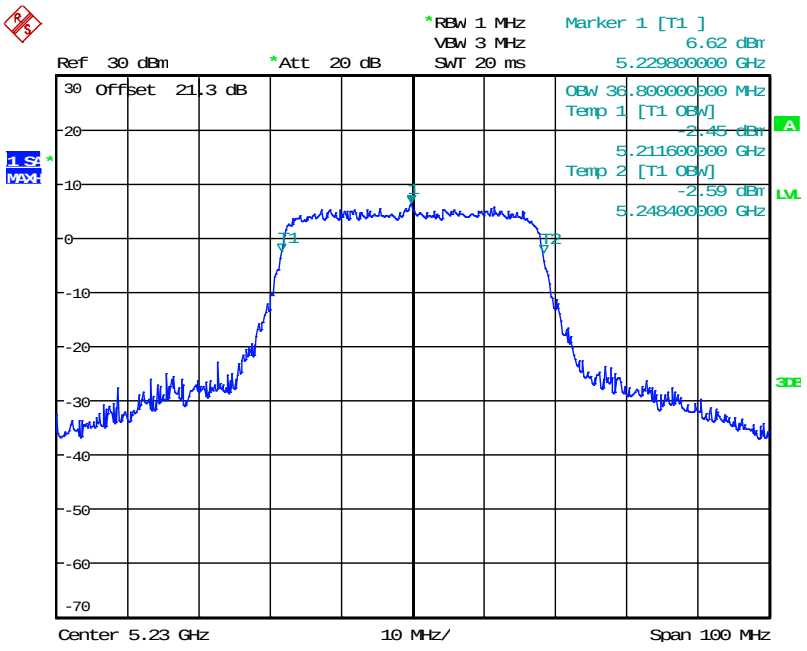
Date: 12.NOV.2014 16:43:19

Figure 7.2.2-8: EBW - High Channel



Date: 12.NOV.2014 00:27:56

Figure 7.2.2-9: 99% OBW - Low Channel



Date: 12.NOV.2014 16:47:37

Figure 7.2.2-10: 99% OBW - High Channel

Band 5725 – 5850 MHz

802.11n 20 MHz

Table 7.2.2-3: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5745	17.8000	35.1000	20.2000
5785	17.8000	37.9000	20.0000
5825	17.7000	38.3000	20.0000

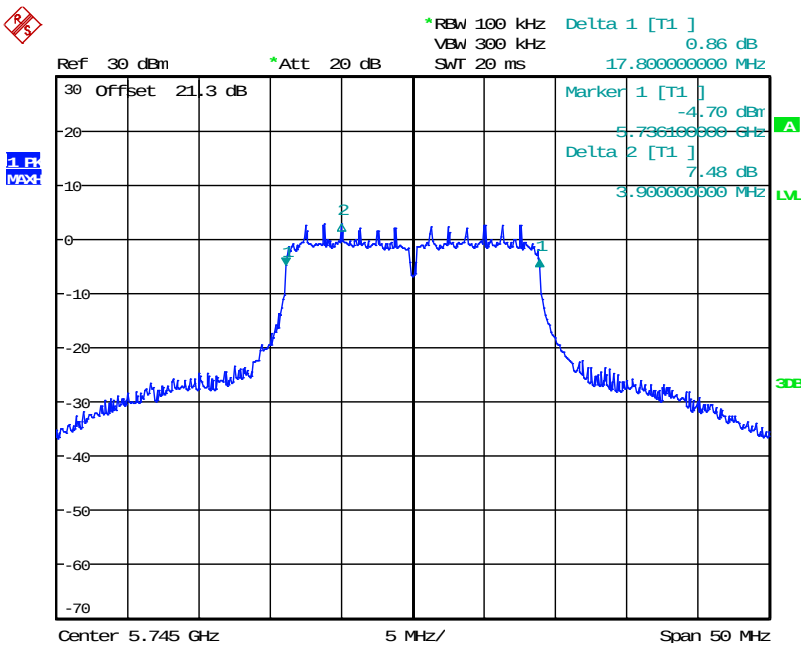
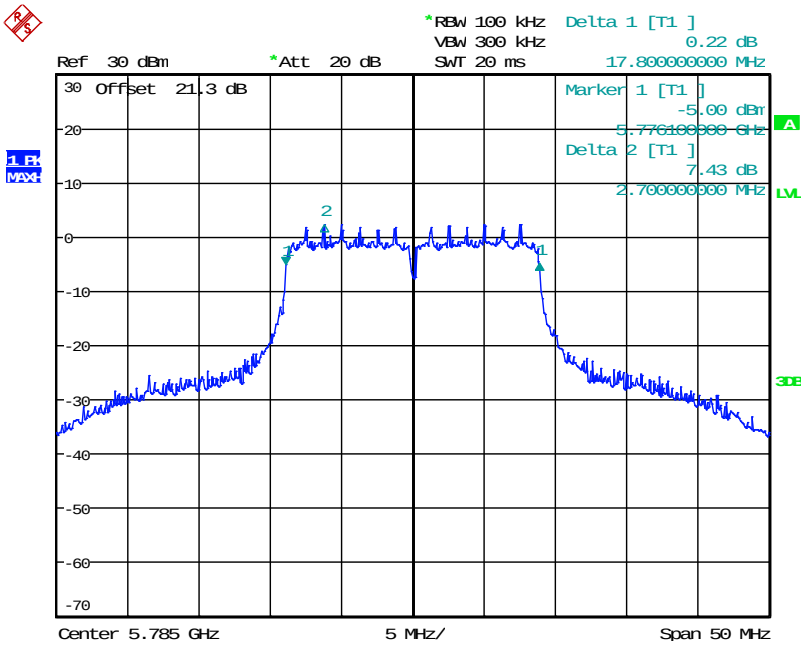
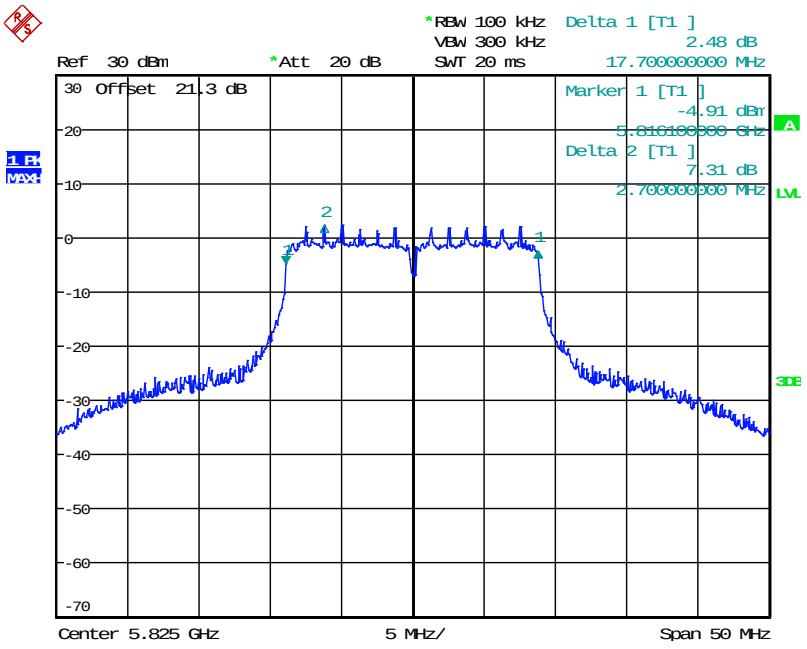


Figure 7.2.2-11: 6dB BW - Low Channel



Date: 12.NOV.2014 20:02:14

Figure 7.2.2-12: 6dB BW - Middle Channel



Date: 12.NOV.2014 20:57:54

Figure 7.2.2-13 6dB BW - High Channel

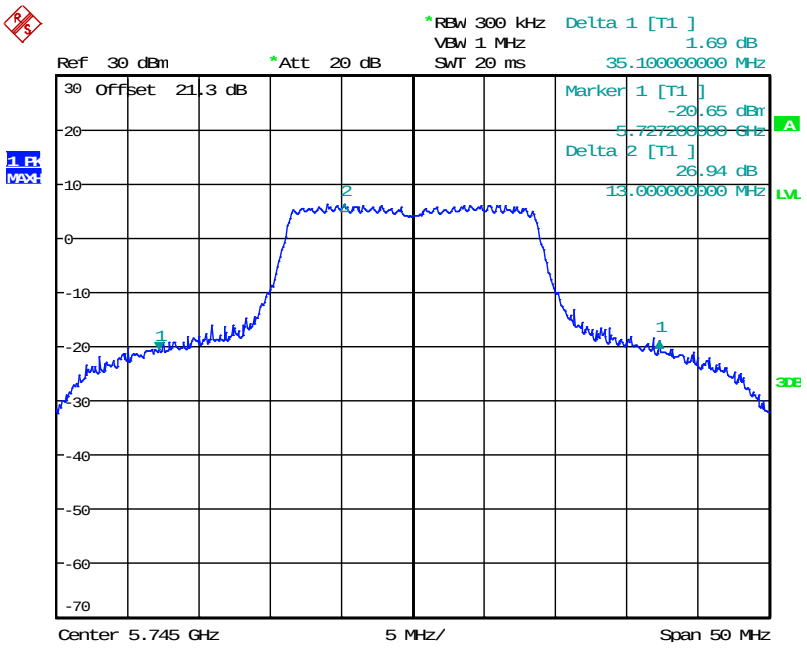


Figure 7.2.2-14: 26dB BW - Low Channel

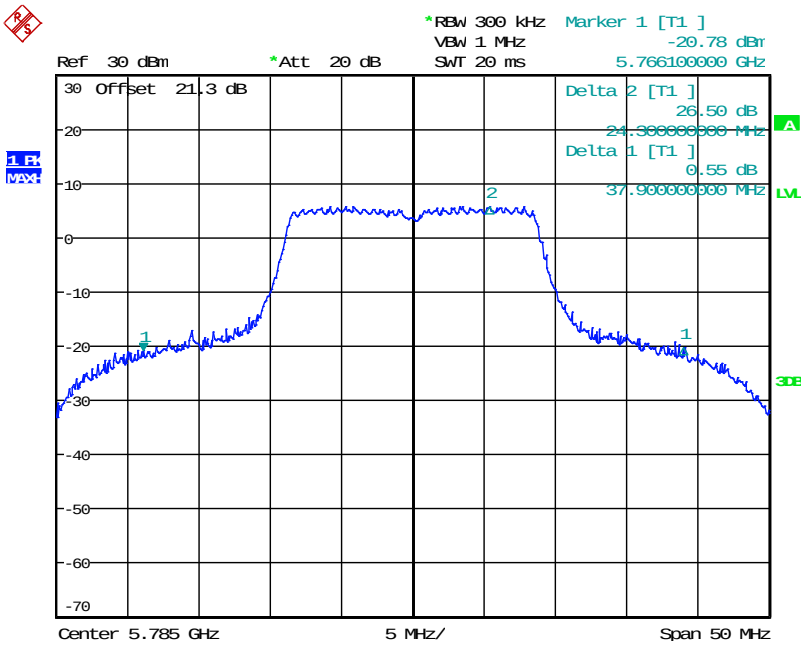
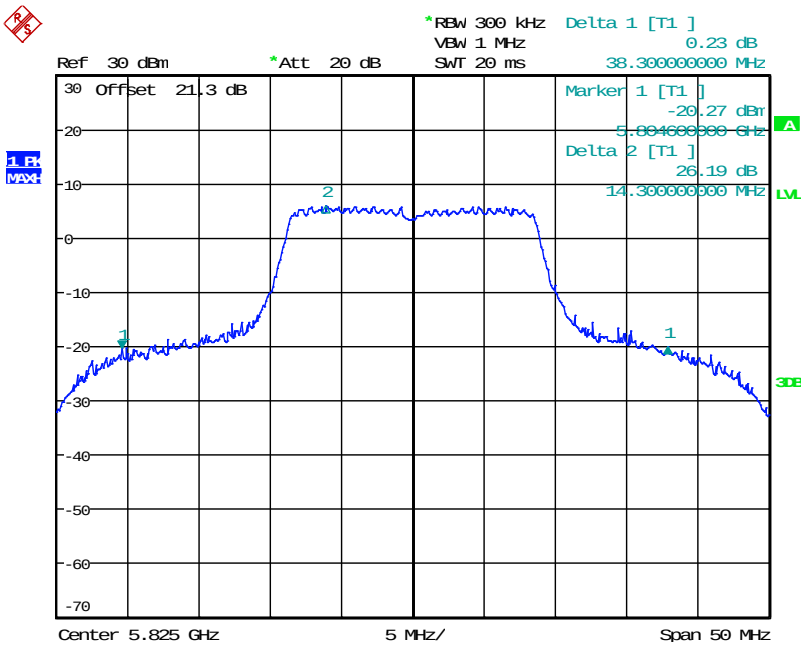
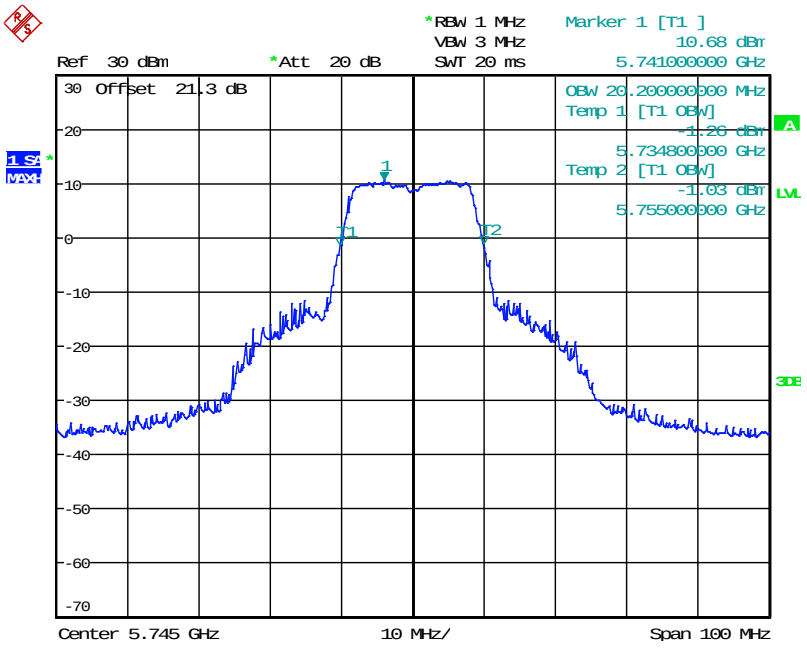


Figure 7.2.2-15: 26dB BW - Middle Channel



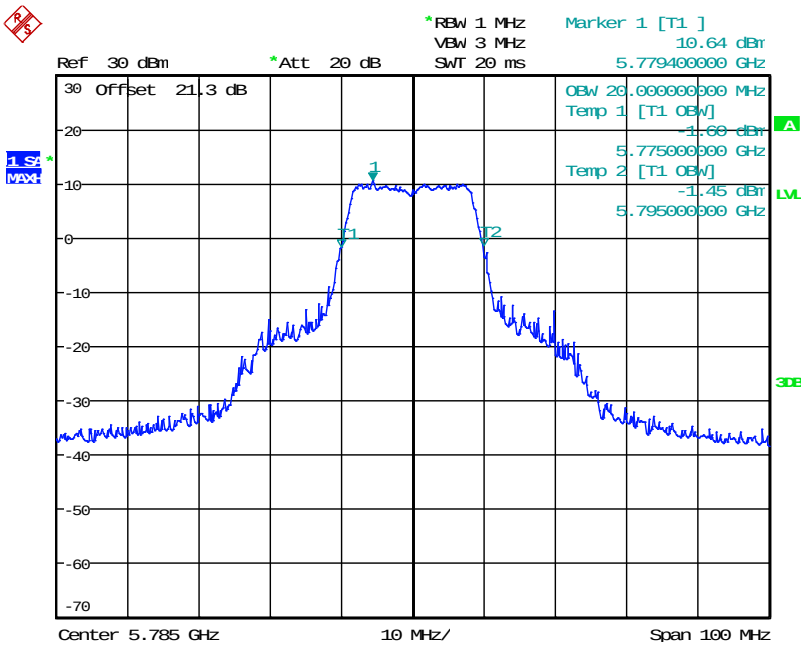
Date: 12.NOV.2014 20:49:06

Figure 7.2.2-16: 26dB BW - High Channel



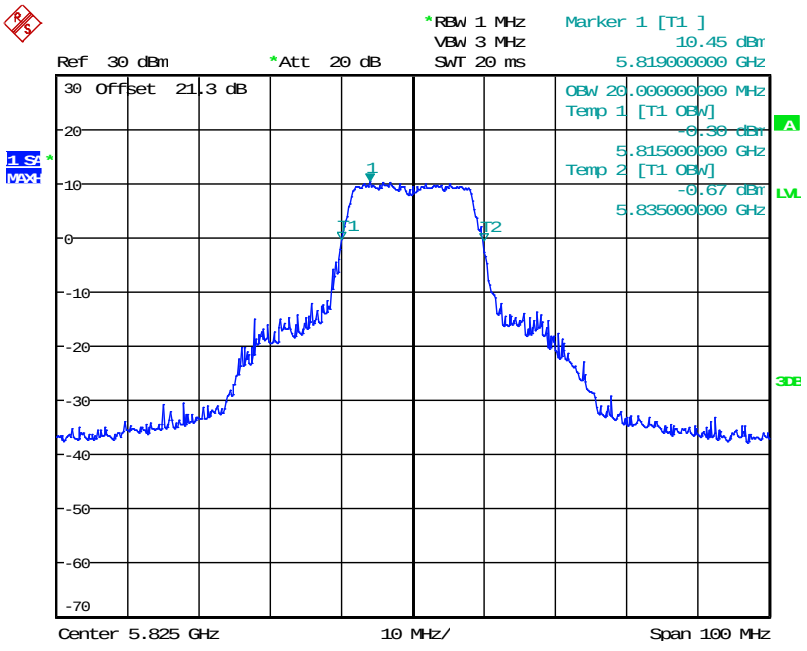
Date: 12.NOV.2014 19:27:40

Figure 7.2.2-17: 99% OBW - Low Channel



Date: 12.NOV.2014 19:45:59

Figure 7.2.2-18: 99% OBW - Middle Channel



Date: 12.NOV.2014 21:08:34

Figure 7.2.2-19: 99% OBW - High Channel

802.11n 40 MHz

Table 7.2.2-4: 6dB / EBW / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5755	35.6000	44.8000	37.2000
5795	35.6000	44.4000	37.0000

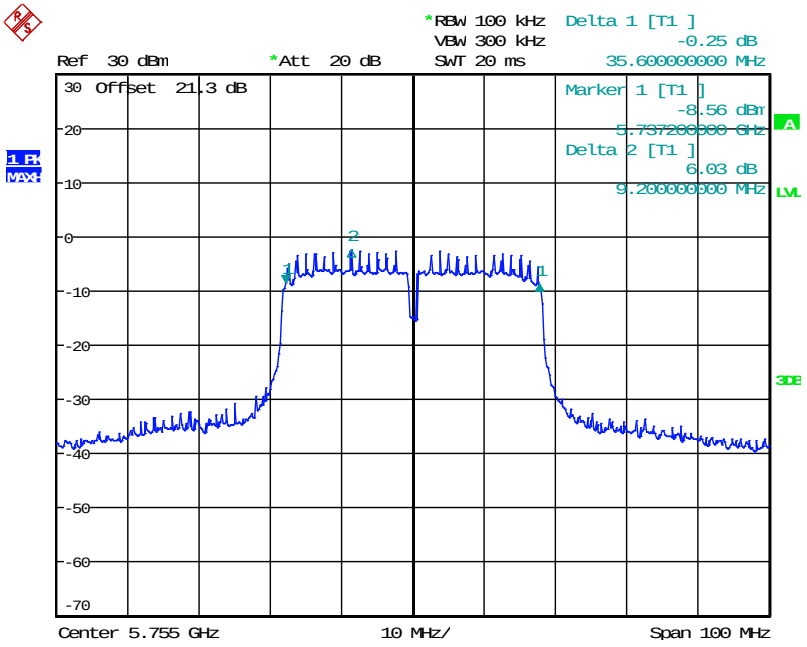
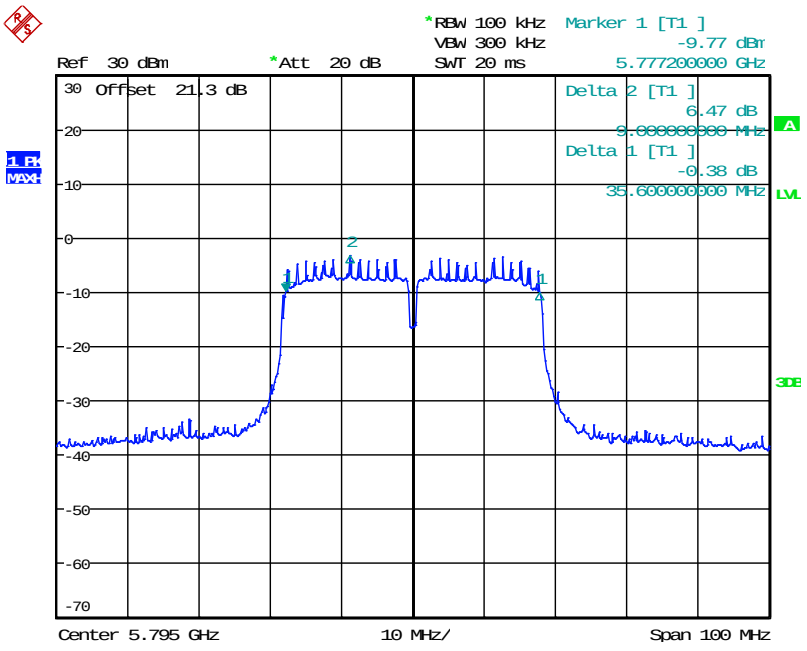
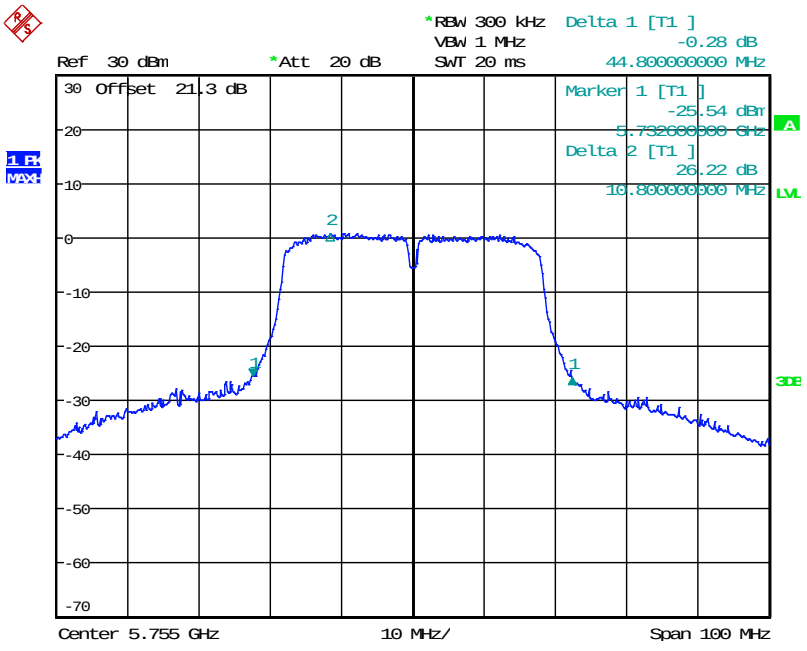


Figure 7.2.2-20: 6dB BW - Low Channel



Date: 12.NOV.2014 23:05:01

Figure 7.2.2-21: 6dB BW - High Channel



Date: 12.NOV.2014 21:47:59

Figure 7.2.2-21: 26dB BW - Low Channel

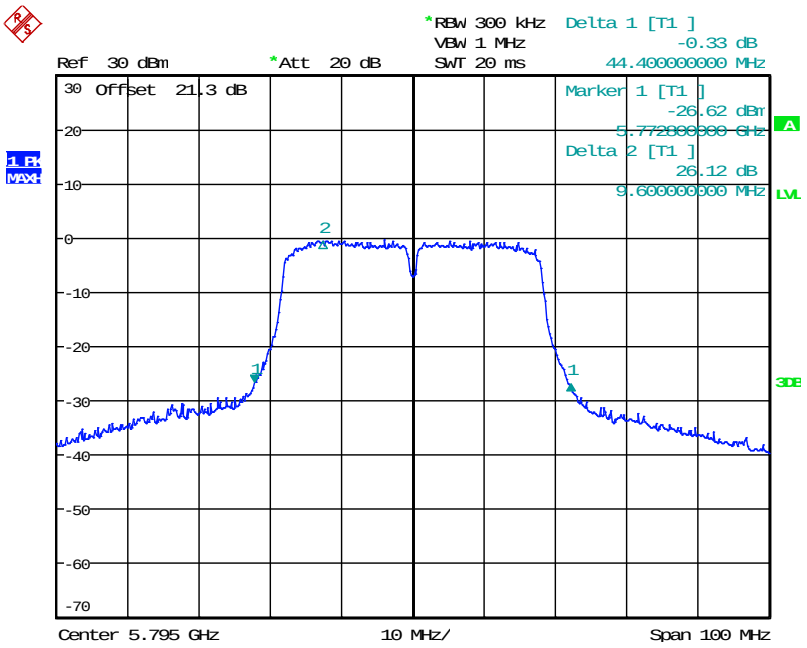


Figure 7.2.2-22: 26dB BW - High Channel

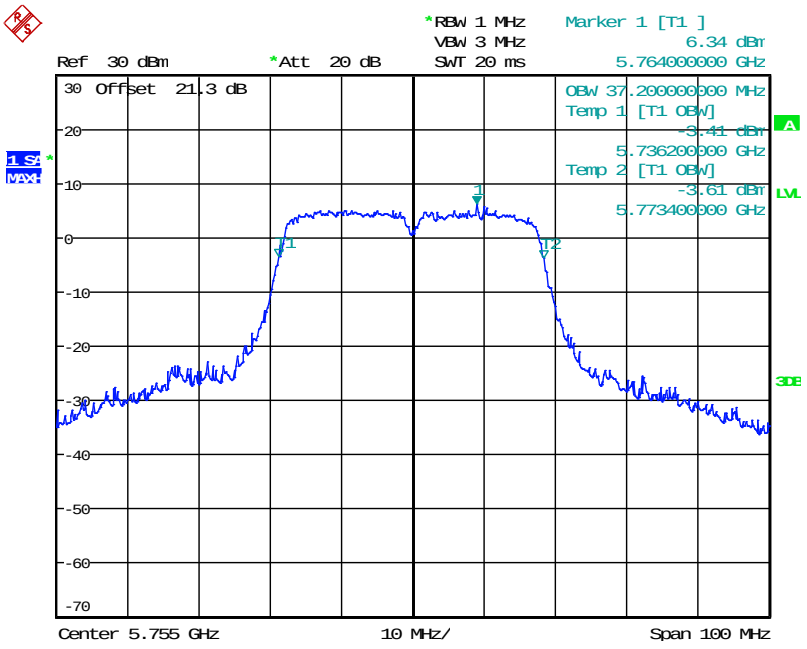
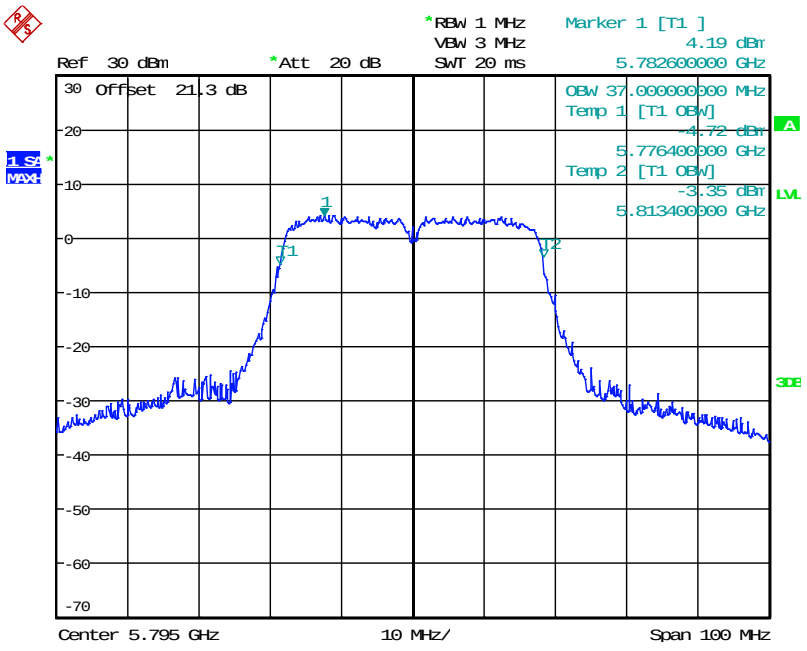


Figure 7.2.2-23: 99% OBW - Low Channel



Date: 12.NOV.2014 22:54:33

Figure 7.2.2-24: 99% OBW - High Channel

7.3 Peak Output Power

7.3.1 Measurement Procedure (Conducted Method)

The Peak Output Power was measured in accordance with the KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Method SA-2. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation. The duty cycle correction was used as a reference offset on the spectrum analyzer.

7.3.2 Measurement Results

Results are shown below.

FCC Section 15.407(a)(1) IC: RSS-210 A9.2(1) Band 5.15 GHz-5.25GHz

802.11n 20 MHz

Table 7.3.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
5180	15.59
5200	15.00
5240	15.84

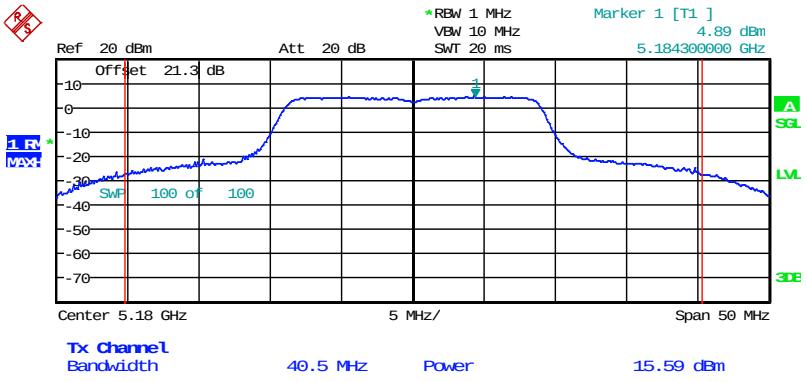
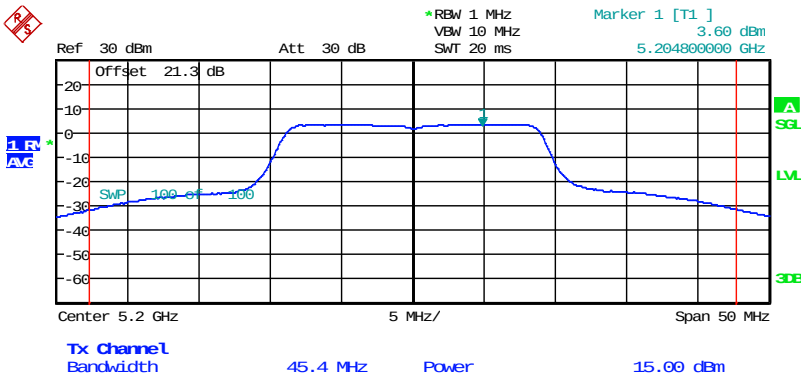
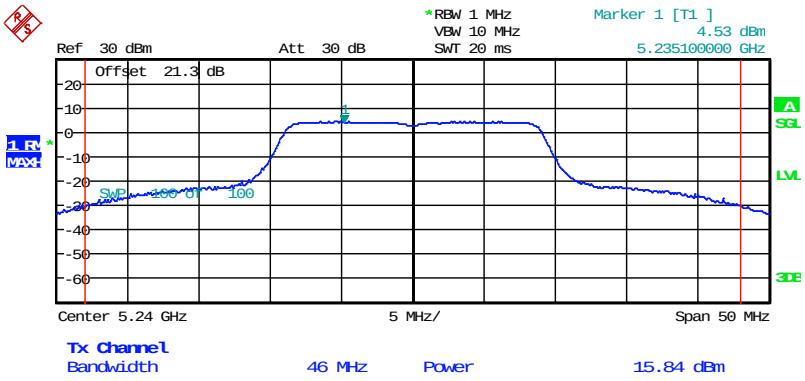


Figure 7.3.2-1: RF Output Power - Low Channel



Date: 12.NOV.2014 00:08:31

Figure 7.3.2-2: RF Output Power - Middle Channel



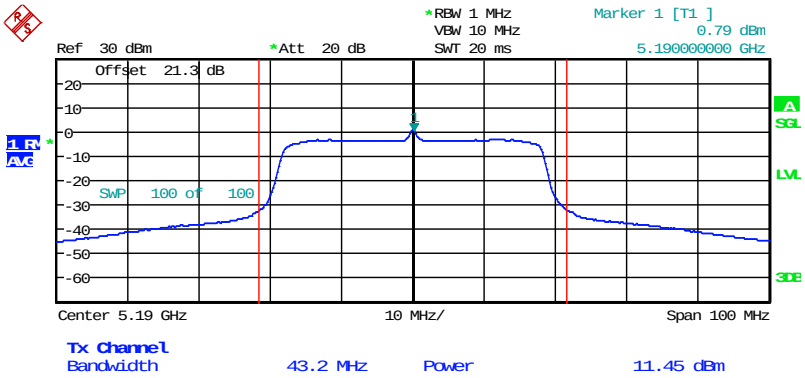
Date: 12.NOV.2014 00:24:10

Figure 7.3.2-3: RF Output Power - High Channel

802.11n 40 MHz

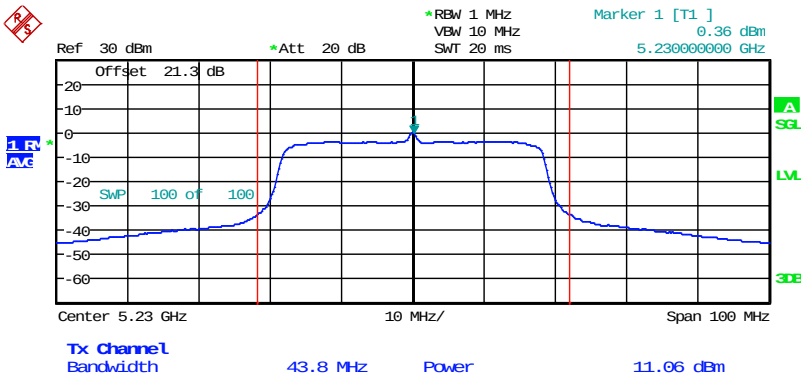
Table 7.3.2-2: RF Output Power

Frequency [MHz]	Level [dBm]
5190	11.45
5230	11.06



Date: 12.NOV.2014 00:40:55

Figure 7.3.2-4: RF Output Power - Low Channel



Date: 12.NOV.2014 16:45:38

Figure 7.3.2-5: RF Output Power - High Channel

FCC Section 15.247(a)(3) IC: RSS-210 A9.2(4) Band 5.725-5.85GHz

802.11n 20 MHz

Table 7.3.2-3: RF Output Power

Frequency [MHz]	Level [dBm]
5745	13.34
5785	13.09
5825	12.96

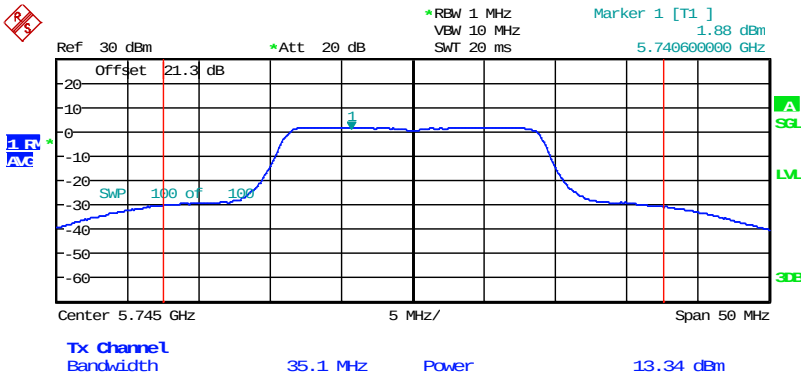
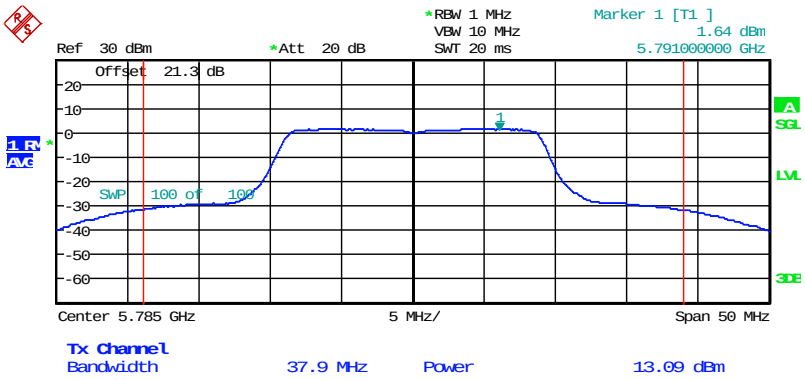
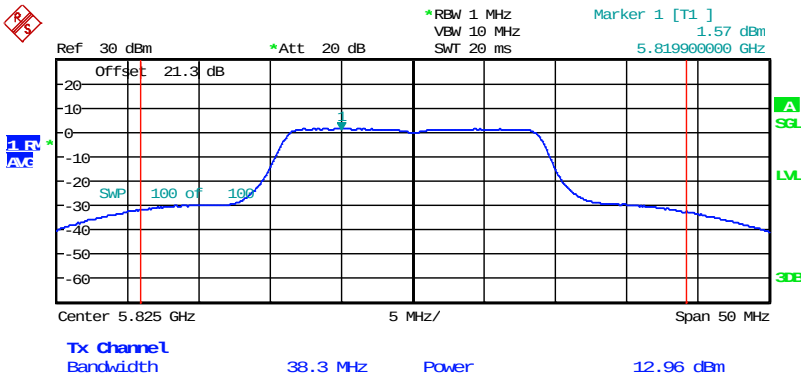


Figure 7.3.2-6: RF Output Power - Low Channel



Date: 12.NOV.2014 20:08:04

Figure 7.3.2-7: RF Output Power - Middle Channel



Date: 12.NOV.2014 21:00:17

Figure 7.3.2-8: RF Output Power - High Channel

802.11n 40 MHz

Table 7.3.2-4: RF Output Power

Frequency [MHz]	Level [dBm]
5755	10.37
5795	9.04

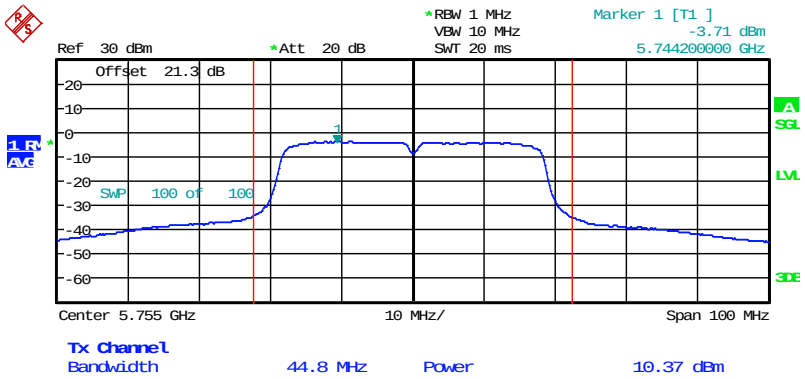
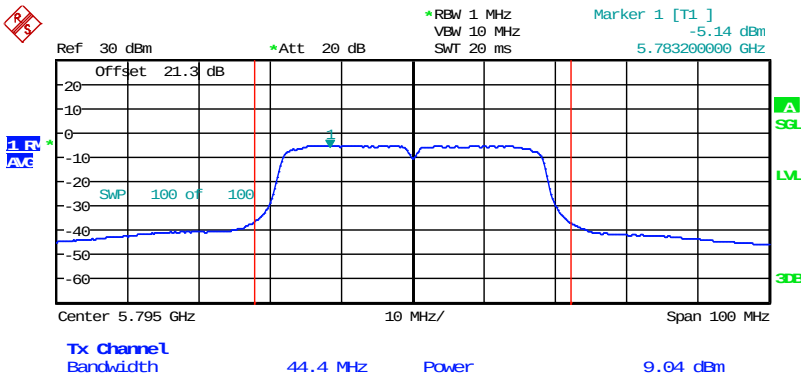


Figure 7.3.2-9: RF Output Power - Low Channel



Date: 12.NOV.2014 23:07:12

Figure 7.3.2-10: RF Output Power - High Channel

7.4 Power Spectral Density

7.4.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Maximum Power Spectral Density (PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable, external attenuation and transmission duty cycle.

For devices operating in the 5.15-5.25 GHz, 5.25-5.35 GHz and 5.47-5.725 GHz bands, the spectrum analyzer RBW was set to 1 MHz and VBW >>3*RBW. The power spectral density was measured from the Maximum Conducted Output Power Measurement.

For devices operating in the band 5.725 – 5.85 GHz, the spectrum analyzer RBW was set to 500 kHz and VBW >>3*RBW. The power spectral density was measured as the maximum level from the average power over 500 kHz reference bandwidth.

7.4.2 Measurement Results

Results are shown below.

FCC Section 15.407(a)(1) IC: RSS-210 A9.2 Band 5.15 – 5.25 GHz

802.11n 20 MHz

Table 7.4.2-1: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5180	4.89	11.0	6.11
5200	3.60	11.0	7.40
5240	4.53	11.0	6.47

Note: Graphical data for the measurement is provided in Section 7.3

802.11n 40 MHz

Table 7.4.2-2: Power Spectral Density

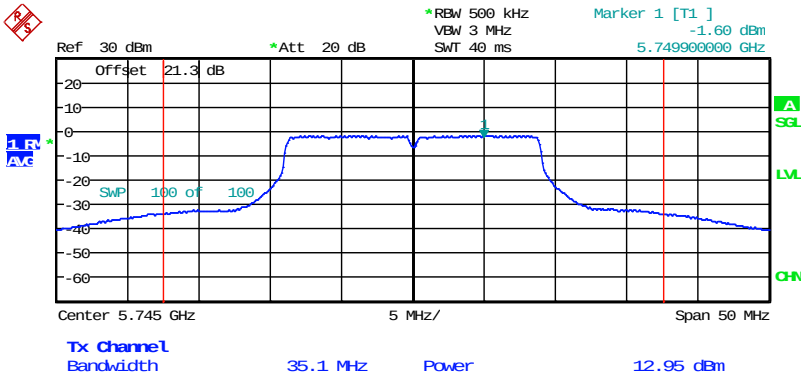
Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5190	0.79	11.0	10.21
5230	0.36	11.0	10.64

Note: Graphical data for the measurement is provided in Section 7.3

FCC Section 15.407(a)(3) IC: RSS-210 A9.2 Band 5.15 – 5.25 GHz

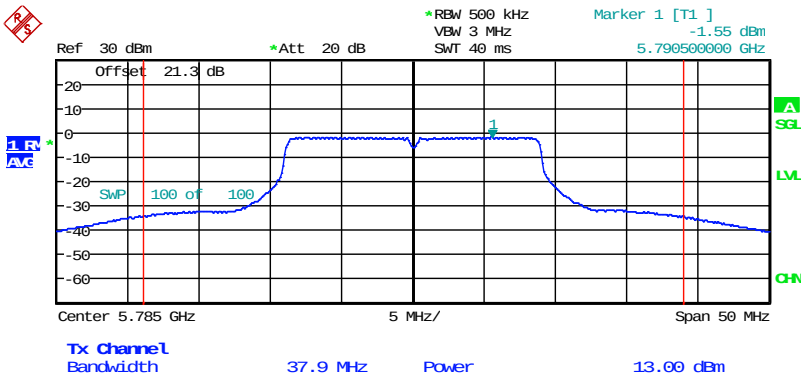
Table 7.4.2-3: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5745	-1.60	30.0	31.60
5785	-1.55	30.0	31.55
5825	-1.76	30.0	31.76



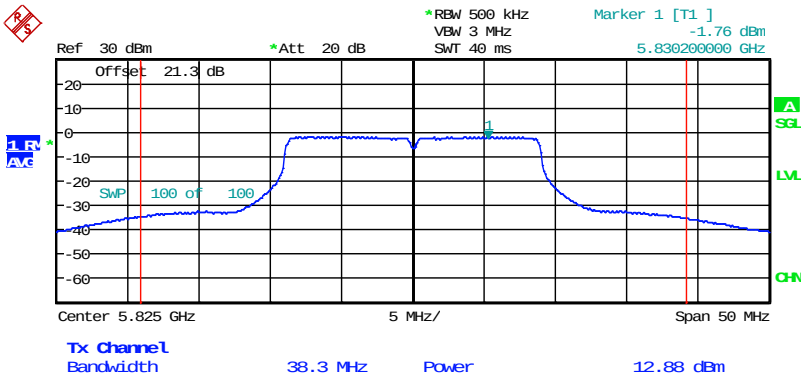
Date: 12.NOV.2014 18:21:12

Figure 7.4.2-1: Power Spectral Density - Low Channel



Date: 12.NOV.2014 20:10:32

Figure 7.4.2-2: Power Spectral Density - Middle Channel



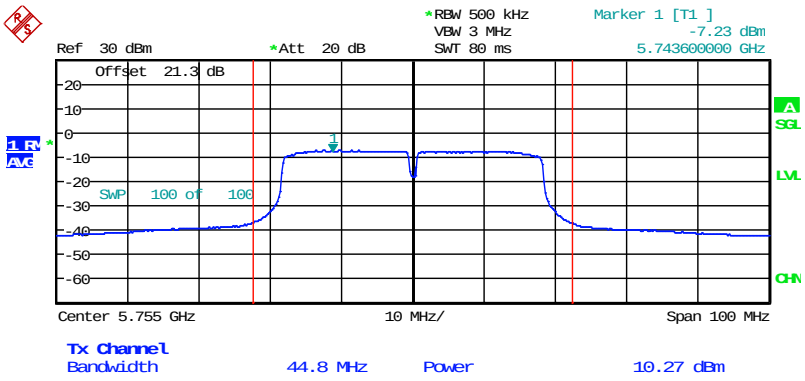
Date: 12.NOV.2014 21:03:23

Figure 7.4.2.3: Power Spectral Density – High Channel

802.11n 40 MHz

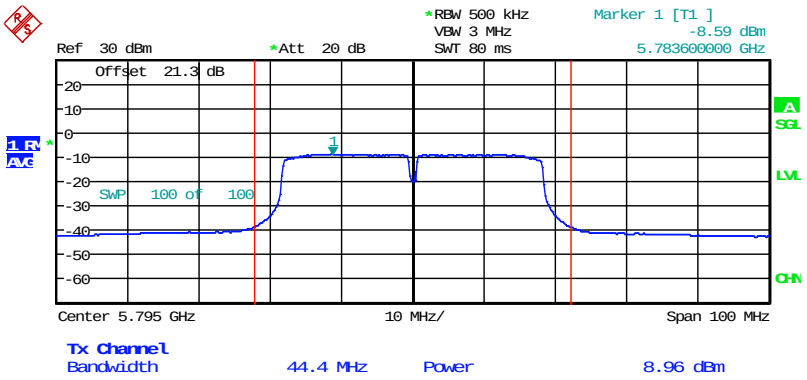
Table 7.5.2-4: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5755	-7.23	30.0	37.23
5795	-8.59	30.0	38.59



Date: 12.NOV.2014 21:57:24

Figure 7.4.2-4: Power Spectral Density - Low Channel



Date: 12.NOV.2014 23:08:37

Figure 7.5.2-5: Power Spectral Density – High Channel

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.407(b) IC: RSS-210 A9.2

7.5.1 Radiated Emissions below 1 GHz

7.5.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 1 GHz. Quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz.

7.5.1.2 Measurement Results

The highest radiated emissions with respect to the limits found in from 30MHz to 1 GHz are reported in the tables below.

Table 7.5.1.2-1: Radiated Emissions Below 1 GHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
81	56.56	54.47	V	-18.46	---------	36.01	--------	40.0	---------	4.0
143.188	58.16	54.27	V	-13.37	---------	40.90	--------	43.5	---------	2.6
189	54.40	51.79	H	-11.69	---------	40.10	--------	43.5	---------	3.4
189	51.30	44.37	V	-11.69	---------	32.68	--------	43.5	---------	10.8
216	58.66	56.60	H	-14.42	---------	42.18	--------	43.5	---------	1.3
243	60.96	58.47	H	-13.63	---------	44.84	--------	46.0	---------	1.2
297	55.05	54.31	H	-10.48	---------	43.83	--------	46.0	---------	2.2
297	53.27	51.24	V	-10.48	---------	40.76	--------	46.0	---------	5.2

7.5.2 Radiated Spurious Emissions into Restricted Frequency Bands - FCC 15.205, 15.209; IC: RSS-210 2.2, RSS-Gen 8.9, 8.10

7.5.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 1 GHz to 40 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz over a 5 second sweep.

7.5.2.2 Measurement Results

Radiated band-edge and spurious emissions found in the restricted frequency bands of 30MHz to 40 GHz are reported in the tables below.

Band 5.15-5.25 GHz

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 5180 MHz										
5150	70.35	48.64	V	0.35	70.70	48.99	74.0	54.0	3.3	5.0
5150	68.48	46.88	H	0.35	68.83	47.23	74.0	54.0	5.2	6.8
Middle Channel = 5200 MHz										
All emissions in the restricted bands were attenuated below the limits and the noise floor										
High Channel = 5240 MHz										
All emissions in the restricted bands were attenuated below the limits and the noise floor										

Note: All emissions in the restricted bands above 5.15 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.2.2-2: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 5190 MHz										
5150	69.55	49.76	H	0.7246	70.2746	50.4846	74	54	3.7	3.5
5150	68.66	50.46	V	0.7246	69.3846	51.1846	74	54	4.6	2.8
High Channel = 5230 MHz										
All emissions in the restricted bands were attenuated below the limits and the noise floor										

Note: All emissions in the restricted bands above 5.15 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Band 5.725-5.85 GHz

Table 7.5.2.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 5745 MHz										
11490	45.20	33.32	H	13.52	58.72	46.84	83.5	63.5	24.8	16.7
11490	44.61	33.04	V	13.52	58.13	46.56	83.5	63.5	25.4	16.9
Middle Channel = 5785 MHz										
11570	43.92	32.74	H	13.44	57.36	46.18	83.5	63.5	26.1	17.3
11570	44.78	32.59	V	13.44	58.22	46.03	83.5	63.5	25.3	17.5
High Channel = 5825 MHz										
11650	45.04	32.53	H	13.31	58.35	45.84	83.5	63.5	25.2	17.7
11650	44.32	32.59	V	13.31	57.63	45.90	83.5	63.5	25.9	17.6

Note: All emissions above 11.65 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.2.2-4: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 5755 MHz										
11510	44.52	34.12	H	12.85	57.37	46.97	83.5	63.5	26.1	16.5
11510	44.63	32.88	V	12.85	57.48	45.73	83.5	63.5	26.0	17.8
High Channel = 5795 MHz										
11590	45.69	33.45	H	12.67	58.36	46.12	83.5	63.5	25.1	17.4
11590	44.60	32.27	V	12.67	57.27	44.94	83.5	63.5	26.2	18.6

Note: All emissions above 11.59 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.2.2-5: Radiated Emissions Independent of TX Channel of Operation

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1039.525	67.69	65.06	H	-16.21	51.48	48.85	74.0	54.0	22.5	5.2
1039.525	67.63	63.82	V	-16.21	51.42	47.61	74.0	54.0	22.6	6.4
2227.5	66.09	57.82	H	-8.68	57.41	49.14	74.0	54.0	16.6	4.9
2227.5	67.86	60.35	V	-8.68	59.18	51.67	74.0	54.0	14.8	2.3
2376	64.18	60.89	H	-8.06	56.12	52.83	74.0	54.0	17.9	1.2
2376	63.39	59.59	V	-8.06	55.33	51.53	74.0	54.0	18.7	2.5

7.5.3 Radiated Spurious Emissions outside of Restricted Frequency Bands - FCC 15.407(b), IC: RSS-210 A9.2

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 1 GHz to 40 GHz, 10 times the highest fundamental frequency. Each emission found to be outside of a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.407(b).

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Average measurements are performed using RBW = 1 MHz with a RMS average detector over 100 sweeps.

The EIRP limits were converted to field strength using a conversion factor of 95.2 dB per FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E"

7.5.3.2 Measurement Results

Radiated band-edge and spurious emissions found in the restricted frequency bands of 1 GHz to 40 GHz are reported in the tables below.

Band 5.15-5.25 GHz

Table 7.5.3.2-1: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Low Channel = 5180 MHz										
10360	-----	38.09	H	9.83	-----	47.92	-----	68.2	-----	20.3
10360	-----	39.52	V	9.83	-----	49.35	-----	68.2	-----	18.8
Middle Channel = 5200 MHz										
10400	-----	38.60	H	9.88	-----	48.48	-----	68.2	-----	19.7
10400	-----	38.74	V	9.88	-----	48.62	-----	68.2	-----	19.6
High Channel = 5240 MHz										
10480	-----	37.36	H	9.98	-----	47.34	-----	68.2	-----	20.9
10480	-----	39.04	V	9.98	-----	49.02	-----	68.2	-----	19.2

Note: All emissions above 10.48 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-2: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Low Channel = 5190 MHz										
10380	-----	38.25	H	9.86	-----	48.11	-----	68.2	-----	20.1
10380	-----	39.14	V	9.86	-----	49.00	-----	68.2	-----	19.2
High Channel = 5230 MHz										
10460	-----	37.88	H	9.03	-----	46.91	-----	68.2	-----	21.3
10460	-----	40.00	V	9.03	-----	49.03	-----	68.2	-----	19.2

Note: All emissions above 10.46 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Band 5.725-5.85 GHz

Table 7.5.3.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Low Channel = 5745 MHz										
5715	-----	46.80	H	2.05	-----	48.85	-----	68.2	-----	19.4
5715	-----	47.96	V	2.05	-----	50.01	-----	68.2	-----	18.2
5725	-----	57.10	H	2.07	-----	59.17	-----	78.2	-----	19.0
5725	-----	59.60	V	2.07	-----	61.67	-----	78.2	-----	16.5
Middle Channel = 5785 MHz										
All emissions outside of the restricted bands were attenuated below the limits and the noise floor										
High Channel = 5825 MHz										
5850	-----	48.71	H	2.29	-----	51.00	-----	78.2	-----	27.2
5850	-----	48.68	V	2.29	-----	50.97	-----	78.2	-----	27.2
5860	-----	44.27	H	2.31	-----	46.58	-----	68.2	-----	21.6
5860	-----	49.56	V	2.31	-----	51.87	-----	68.2	-----	16.3

Note: All emissions outside of the restricted bands beyond 5.86 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-4: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Low Channel = 5755MHz										
5715	-----	48.89	H	1.60	-----	50.49	-----	68.2	-----	17.7
5715	-----	48.09	V	1.60	-----	49.69	-----	68.2	-----	18.5
5725	-----	51.94	H	1.61	-----	53.55	-----	78.2	-----	24.7
5725	-----	49.90	V	1.61	-----	51.51	-----	78.2	-----	26.7
High Channel = 5795 MHz										
5850	-----	43.95	H	1.76	-----	45.71	-----	78.2	-----	32.5
5850	-----	43.99	V	1.76	-----	45.75	-----	78.2	-----	32.5

Note: All emissions outside of the restricted bands beyond 5.85 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.5.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

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

Example Calculation: Peak
Corrected Level: 70.35+ 0.35 = 70.7 dBµV/m
Margin: 74 dBµV/m – 70.7 dBµV/m = 3.3dB

Example Calculation: Average
Corrected Level: 48.64 + 0.35 = 48.99 dBµV/m
Margin: 54 dBµV/m – 48.99 dBµV/m = 5.0 dB

7.6 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 8.8

7.6.1 Measurement Procedure

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

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

7.6.2 Measurement Results

Results are shown below.

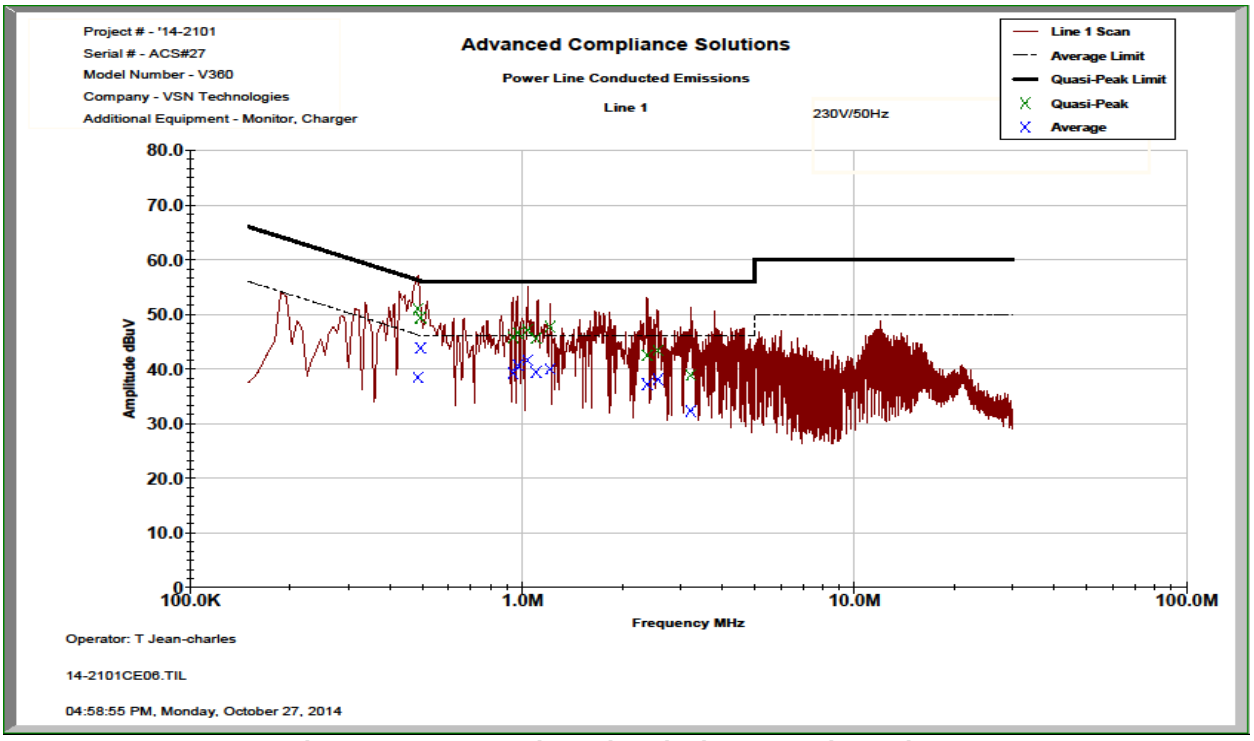


Figure 7.6.2-1: Conducted Emissions Results – Line 1

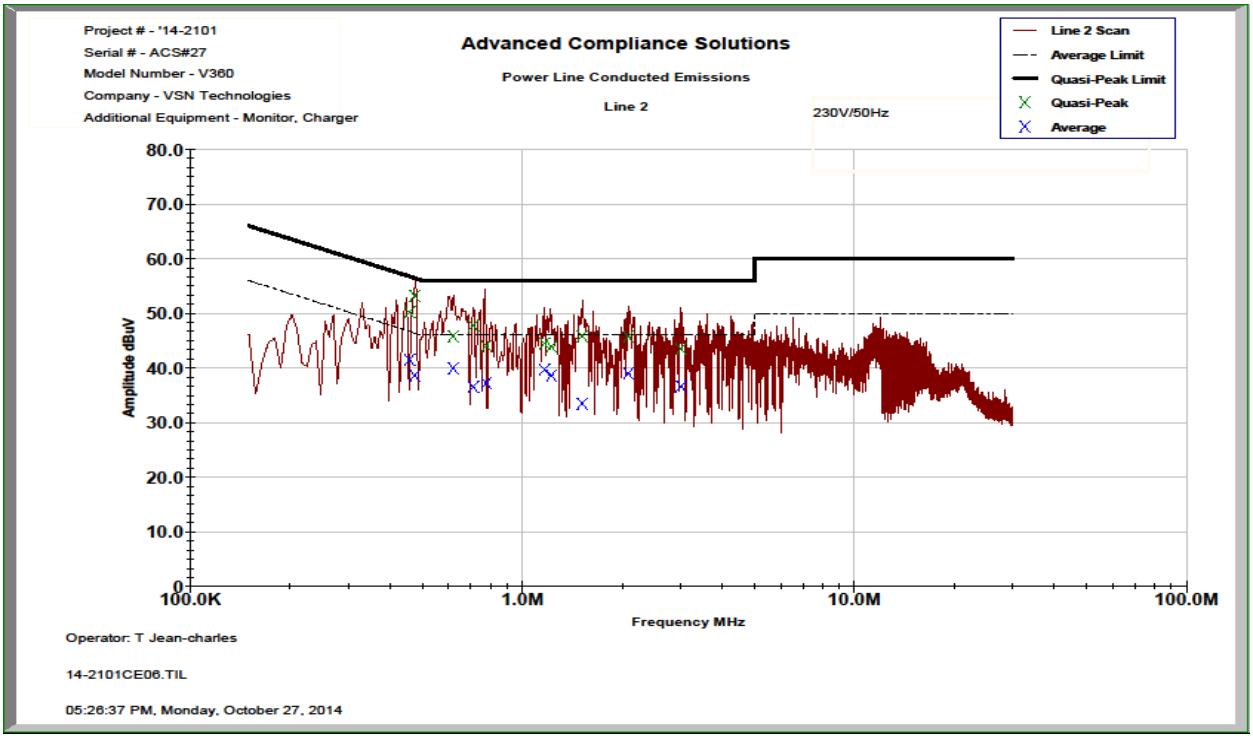


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

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

Plot Number: 14-2101CE06
Power Supply Description: 5V DC

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.4855	40.91	28.36	10.08	50.99	38.44	56.24	46.24	5.3	7.8
0.494499	39.299	33.744	10.08	49.38	43.82	56.09	46.09	6.7	2.3
0.939963	35.709	29.134	10.09	45.80	39.22	56.00	46.00	10.2	6.8
0.972013	36.466	30.564	10.09	46.56	40.66	56.00	46.00	9.4	5.3
1.03984	37.006	31.507	10.11	47.12	41.62	56.00	46.00	8.9	4.4
1.10161	35.477	29.294	10.11	45.59	39.40	56.00	46.00	10.4	6.6
1.21459	37.564	29.875	10.11	47.67	39.98	56.00	46.00	8.3	6.0
2.38097	32.302	26.951	10.18	42.48	37.13	56.00	46.00	13.5	8.9
2.56193	33.169	27.861	10.18	43.35	38.04	56.00	46.00	12.7	8.0
Line 2									
0.4566	42.8	31.43	10.05	52.85	41.48	56.75	46.75	3.9	5.3
0.4753	43.158	28.58	10.05	53.21	38.63	56.42	46.42	3.2	7.8
0.620588	35.749	29.883	10.08	45.82	39.96	56.00	46.00	10.2	6.0
0.712438	37.68	26.45	10.07	47.75	36.52	56.00	46.00	8.2	9.5
0.780588	33.945	27.131	10.07	44.02	37.20	56.00	46.00	12.0	8.8
1.16775	34.442	29.566	10.08	44.52	39.64	56.00	46.00	11.5	6.4
1.22599	33.815	28.525	10.08	43.89	38.60	56.00	46.00	12.1	7.4
1.51599	35.712	23.356	10.08	45.79	33.43	56.00	46.00	10.2	12.6
2.08976	35.54	28.846	10.14	45.68	38.98	56.00	46.00	10.3	7.0
3.00924	33.249	26.397	10.195	43.44	36.59	56.00	46.00	12.6	9.4

7.7 Frequency Stability – FCC Section 15.407(g), IC RSS-Gen 8.11

7.7.1 Measurement Procedure

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the supply voltage was also reduced to the endpoint. The maximum variation of frequency was recorded.

Results of the test are shown below

7.7.2 Measurement Results

Frequency Stability

Frequency (MHz): 5180

Deviation Limit (PPM):

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**5180.056300**	**10.869**	100%	3.70
-20 C	**5180.071400**	**13.784**	100%	3.70
-10 C	**5180.071000**	**13.707**	100%	3.70
0 C	**5180.069000**	**13.320**	100%	3.70
10 C	**5180.049000**	**9.459**	100%	3.70
20 C	**5180.031800**	**6.139**	100%	3.70
30 C	**5180.019000**	**3.668**	100%	3.70
40 C	**5180.020000**	**3.861**	100%	3.70
50 C	**5180.012000**	**2.317**	100%	3.70
20 C	**5180.030000**	**5.792**	end point	3.50

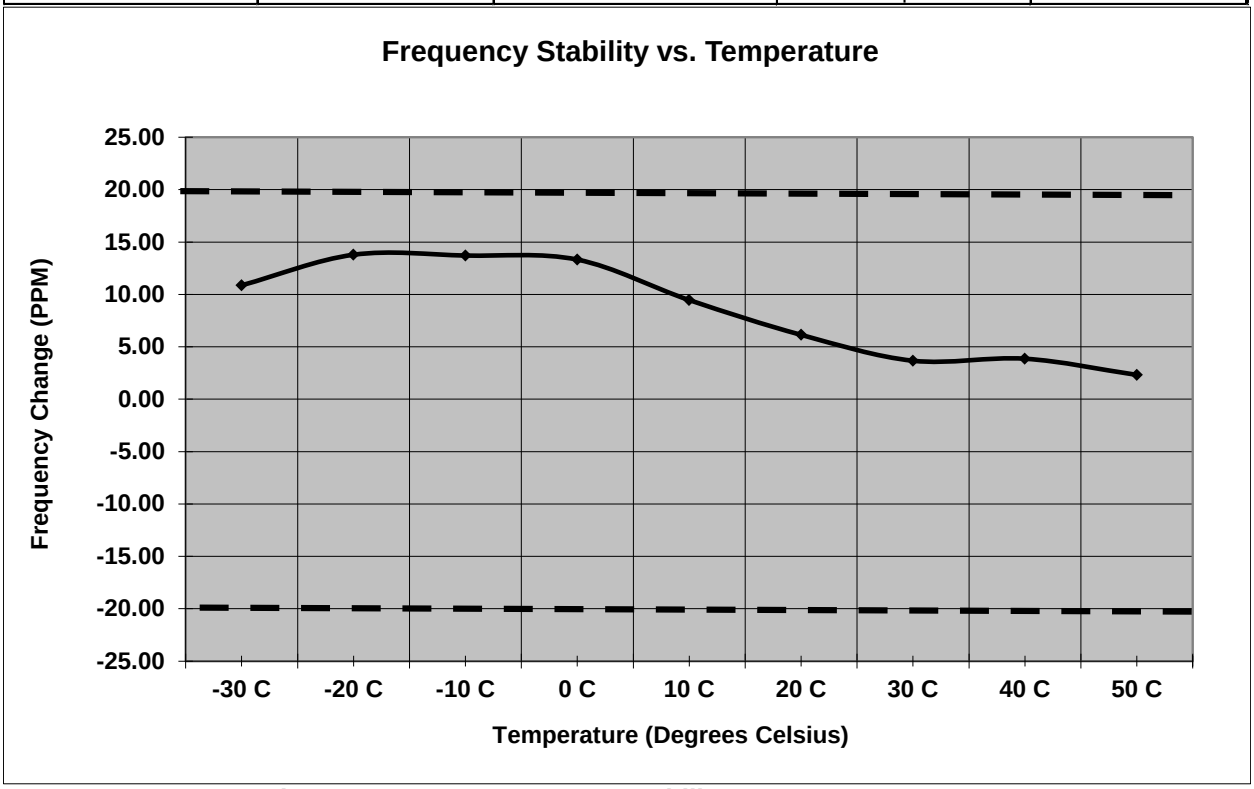


Figure 7.7.2.1-1: Frequency Stability 5.15 GHz – 5.25 GHz

Frequency Stability

Frequency (MHz): 5825

Deviation Limit (PPM):

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**5825.065000**	**11.159**	100%	3.70
-20 C	**5825.078700**	**13.511**	100%	3.70
-10 C	**5825.078000**	**13.391**	100%	3.70
0 C	**5825.077200**	**13.253**	100%	3.70
10 C	**5825.055650**	**9.554**	100%	3.70
20 C	**5825.039000**	**6.695**	100%	3.70
30 C	**5825.024000**	**4.120**	100%	3.70
40 C	**5825.015000**	**2.575**	100%	3.70
50 C	**5825.011000**	**1.888**	100%	3.70
20 C	**5825.038800**	**6.661**	end point	3.50

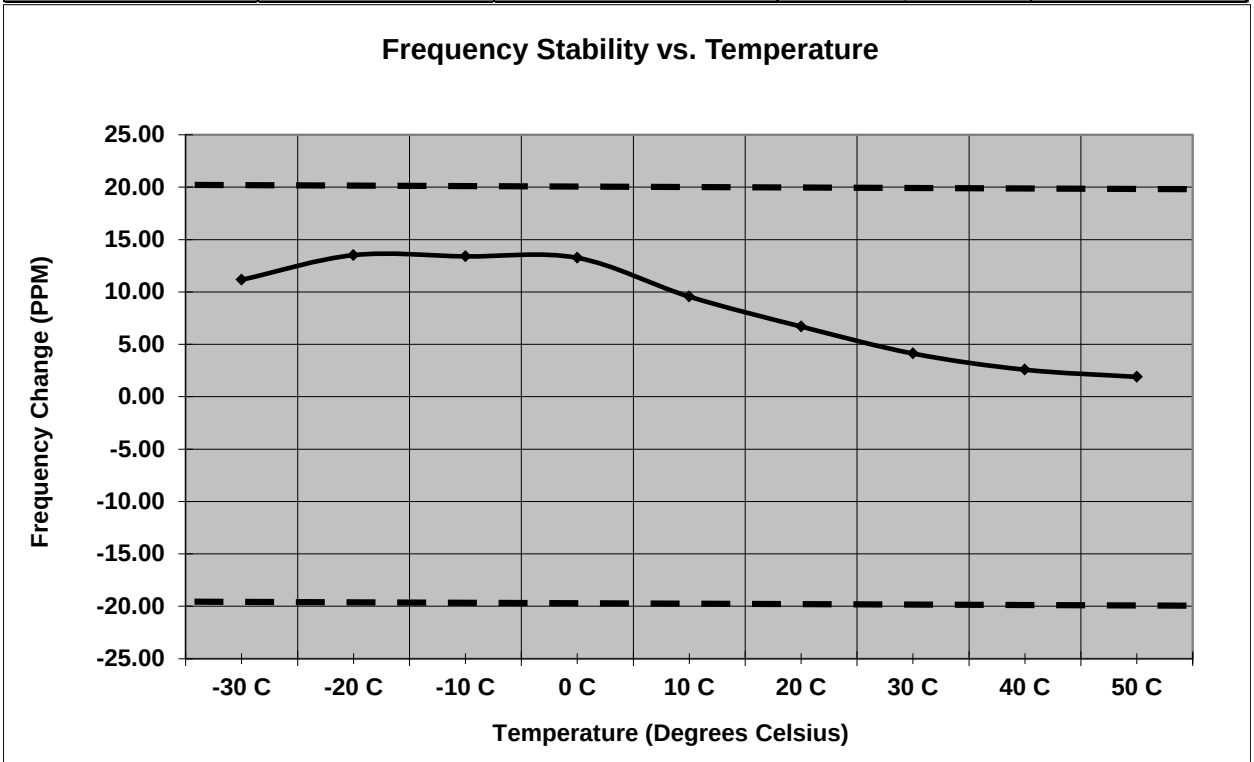


Figure 7.7.2.1-2: Frequency Stability 5.725 GHz – 5.85 GHz

7.8 Duty Cycle

7.8.1 Measurement Procedure

The transmission duty cycle was measured per FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E”. The duty cycle correction factor was added to the RF conducted measurement results as an offset on the spectrum analyzer. The duty cycle is provided below.
.

7.8.2 Measurement Results

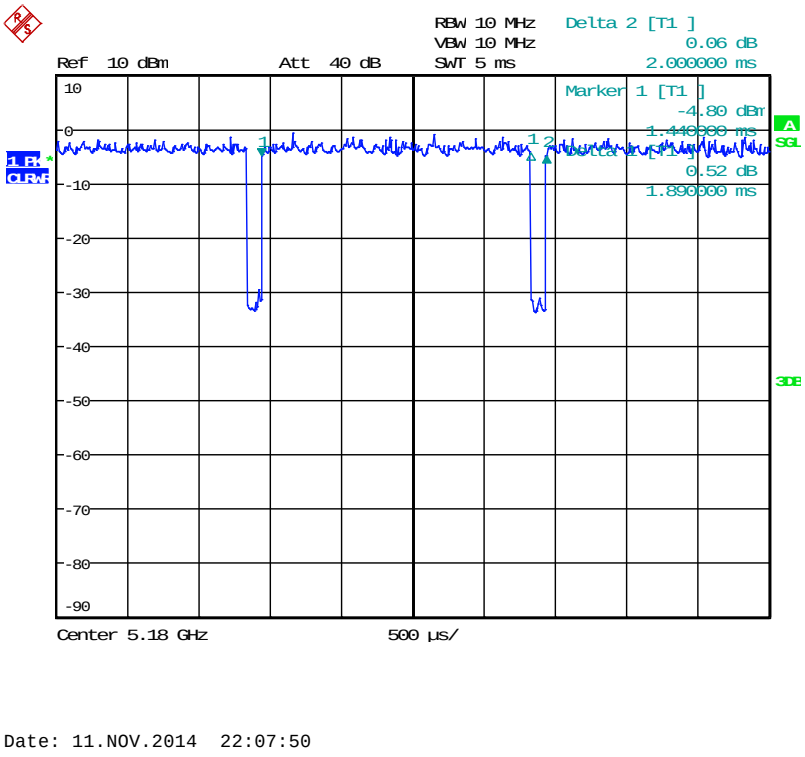


Figure 7.8.2-1: Duty Cycle

Note: The duty cycle correction factor is calculated as 10*log (1/(1.89/2) = 10*log(1/0.945) = 0.246 dB

8 CONCLUSION

In the opinion of ACS, Inc., the model V360 meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210 for the test procedures documented in the test report.

END REPORT