Electromagnetic Compatibility Test Report

Tests Performed on a goTenna, Inc.

goTenna Pro Transceiver, Model 37337

Radiometrics Document RP-8728C

Product Detail:
FCC ID: 2ABVK37337 IC: 21842-37337 Equipment type: DXX Low power transmitter FCC 15.249
Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2018 Canada ISED; RSS-210, Issue 9: 2016 as required for Category I Equipment This report concerns: Original Grant for Certification

Tests Performed For:	*Test Facility:*
goTenna, Inc. 1013 Elroy Dr. Middlebury, IN 46540	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446-1349 (815) 293-0772

Test Date(s): (Month-Day-Year)
September 20 thru November 18, 2017

Document RP-8728C Revisions:

Rev.	Issue Date	Affected Sections	Revised By
0	January 26, 2018		

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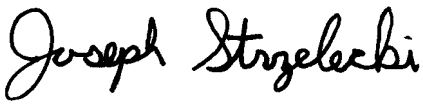
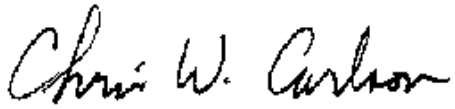
1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
A goTenna, Inc., goTenna Pro Model: 37337 Serial Number: none This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year)	*Test Date(s): (Month-Day-Year)*
September 19, 2017	September 20 thru November 18, 2017
Test Report Written By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by goTenna, Inc.
Radiometrics' Personnel Responsible for Test:	*Test Report Approved By*
 01/26/2018 Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	 Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a goTenna Pro, Model 37337, manufactured by goTenna, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-25,000 MHz	FCC Part 15.249 RSS-210 & RSS-GEN	Pass
Occupied Bandwidth Test	Fundamental Freq.	FCC Part 15 RSS-210 & RSS-GEN	Pass

No AC conducted emissions were performed, since the EUT is for installations in vehicles and will not be connected to AC mains.

Note: The RSS-210 specification is on Radiometrics' Scope of Accreditation. This is technically very similar to FCC, CFR 47 Part 15 which is on Radiometrics scope. RSS-GEN references ANSI C63.10 test procedures which is on Radiometrics scope.

2.1 RF Exposure Compliance Requirements

Since the power output is less than 10 mW, the EUT meets the FCC requirement for RF exposure and it is exempt from RSS-102 SAR and RF exposure evaluations. There are no power level adjustments available to the end user. The antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a goTenna Pro, Model 37337, manufactured by goTenna, Inc. 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 permanently attached to the printed circuit board. Therefore, it meets the 15.203 requirements.

4.0 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 or 150 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.

Since the EUT is wall mounted or table mounted, it was placed in an upright and table-mounted configuration during the tests. Power was supplied with a new battery.

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	goTenna Pro	E	goTenna, Inc.	37337	none

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

List of System Cables

QTY	Length (m)	Cable Description	Shielded?
1	1.0	DC Cord to battery	No
1	1.8	Ethernet cable to router or termination	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.

5.0 TEST SPECIFICATIONS

Document	Date	Title
FCC CFR Title 47	2017	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-210 Issue 9	2016	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 4	2014	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices

7.0 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 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. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

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 IC 3124A-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).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 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.

10.0 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.	01/09/17
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	04/11/17
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	01/09/17
AMP-59	Amplitech	Pre-amplifier	APTMP44	AMP-59	18-26 GHz	12 Mo.	01/04/17
ANT-04	Tensor	Biconical Antenna	4104	2246	20-250MHz	24 Mo.	05/16/16
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 Mo.	11/25/15
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	12/28/16
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	24 Mo.	12/15/15
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	12 Mo.	02/15/17
CAB-106A	Teledyne	Coaxial Cable	N/A	106A	DC-2 GHz	24 Mo.	04/21/16
CAB-1090	Teledyne	Coaxial Cable	N/A	1090	DC-18 GHz	24 Mo.	04/19/16
CAB-160B	Teledyne	Coaxial Cable	N/A	160B	DC-18 GHz	24 Mo.	04/21/16
CAB-090A	Teledyne	Coaxial Cable	N/A	090A	DC-26 GHz	24 Mo.	01/04/17
CAB-295A	Teledyne	Coaxial Cable	N/A	295A	DC-26 GHz	24 Mo.	01/04/17
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	06/30/17
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/15/16
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	07/13/16
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	12/22/15
THM-03	Fluke	Temp/Humid Meter	971	95850465	N/A	12 Mo.	02/20/17

Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	REREC11D	02.28.17	RF Radiated Emissions (FCC Part 15 & EN 55011/22)
Agilent	PSA/ESA-E/L/EMC	2.4.0.42	Bandwidth and screen shots

11.0 TEST SECTIONS

11.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 8.8.

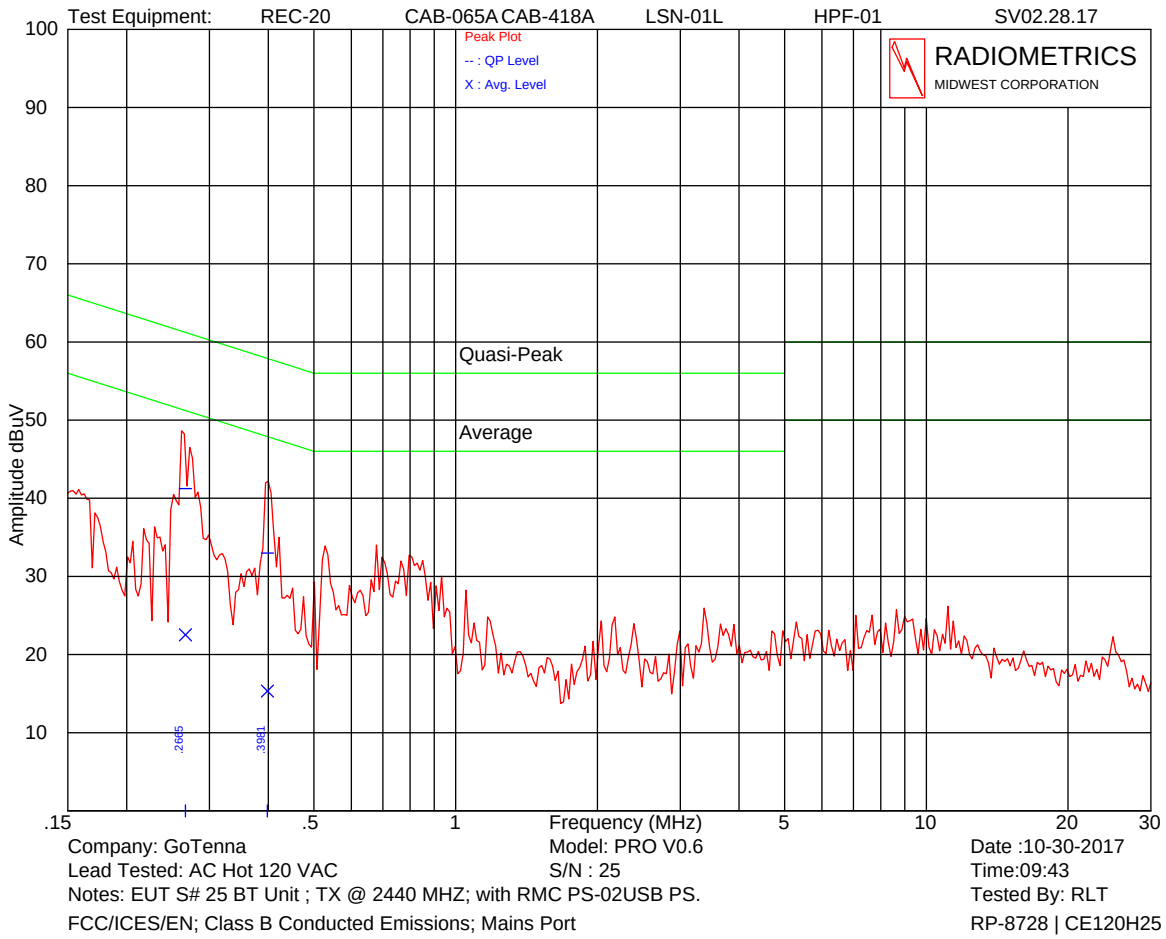
A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on a semi-log graph generated by the computer. 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.

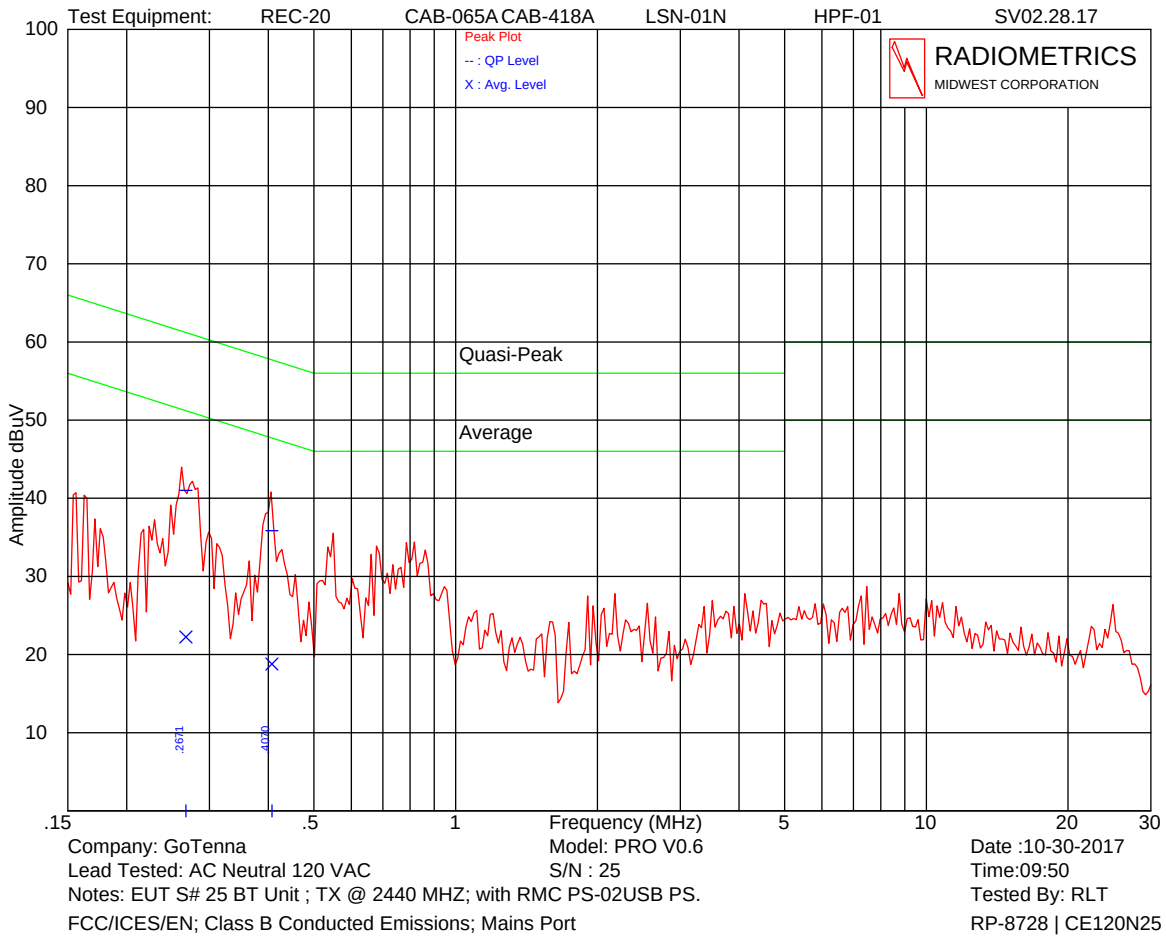
FCC Limits of Conducted Emissions at the AC Mains Ports

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 USB power supply with the EUT connected, after testing all modes of operation.

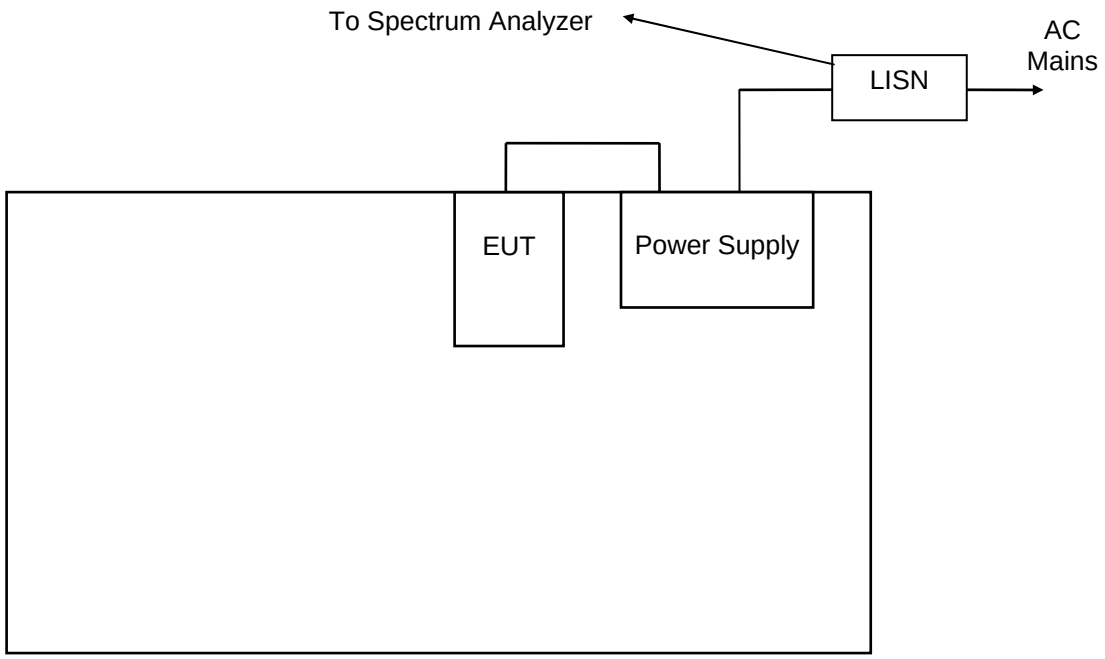


Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.267	41.3	61.2	22.5	51.2	20.0
0.398	33.0	57.9	15.3	47.9	24.9



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.265	50.5	61.3	36.1	51.3	10.8
0.397	42.7	57.9	27.6	47.9	15.3
0.405	43.7	57.8	34.9	47.8	12.9

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

11.2 Radiated RF Emissions

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. 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. High pass filters were not needed above 10 GHz, since the preamplifiers attenuated the fundamental emission.

The EUT was rotated through three orthogonal axis as per 5.10.1 of ANSI C63.10 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.

11.2.1 Field Strength 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 + HPF + PKA

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss
PKA = Peak to Average Factor (This is only used for average measurements above 1 GHz)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission.

Note: The actual FCC limits are in uV/m. The data in the results table coverted the limits to dBuV/m.
100 uV/m = 40.0 dBuV/m
150 uV/m = 43.5 dBuV/m
200 uV/m = 46.0 dBuV/m
500 uV/m = 54.0 dBuV/m

11.2.2 Duty Cycle

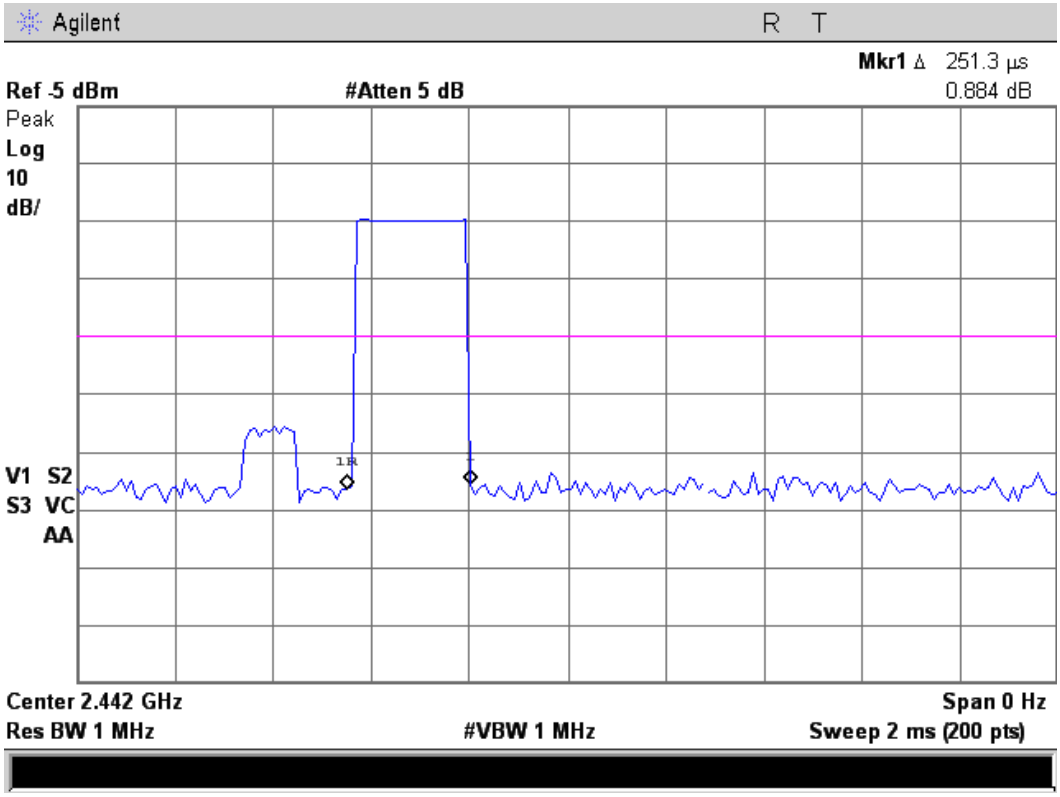
In accordance to 7.5 of ANSI C63.10 the following procedures were used.

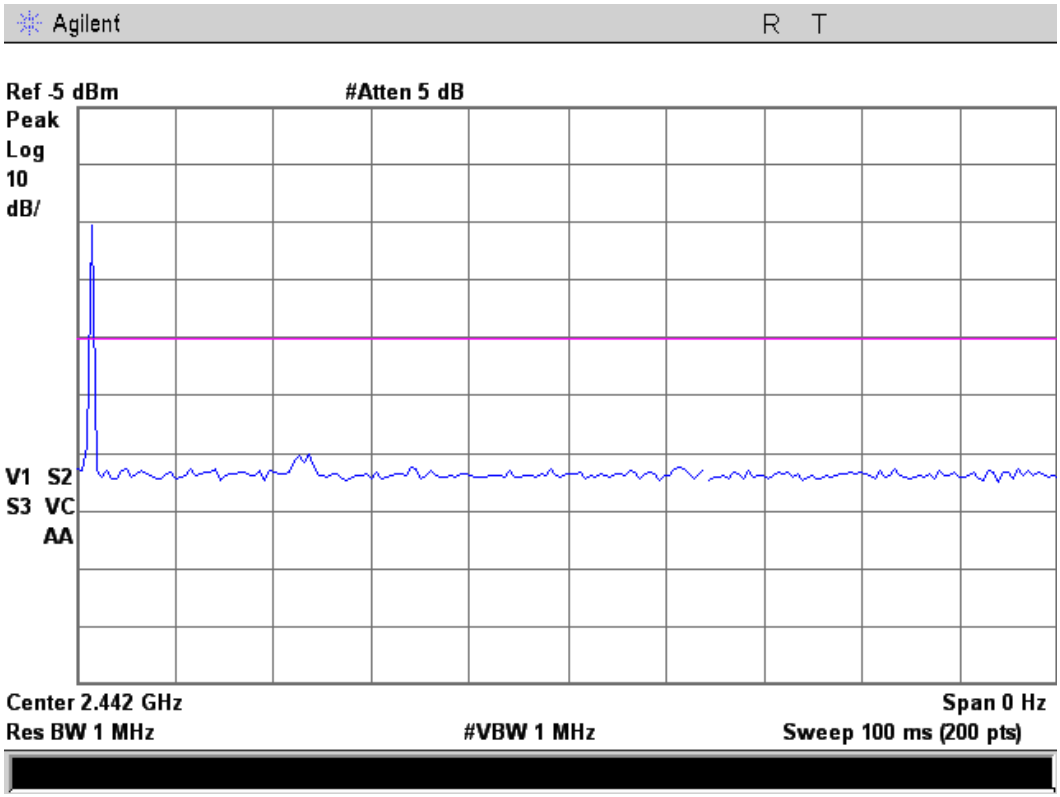
a) The EUT was set to the “worst-case” pulse ON time.
b) The RF output was Coupled to the input of a spectrum analyzer by a “near-field” coupling method. The signal received shall be of sufficient level to trigger adequately the spectrum analyzer sweep display.
c) The center frequency of the spectrum analyzer was set to the center of the RF signal.
d) The spectrum analyzer was set for ZERO SPAN.
e) The sweep time was of the analyzer was set to 100 ms and other times to show the duty cycle.
f) Since the pulse train has a period that exceeds 100 ms, then:
1) The trigger on the spectrum analyzer was set to capture the greatest amount of pulse “ON time” over 100 ms.
2) The 100 ms period that contains the maximum “on time” was found.
3) The duty cycle was determined by dividing the total maximum “ON time” by 100 ms (tON/100 ms).
h) The duty cycle correction factor was used applying Equation (10) of ANSI C63.10 to the duty cycle determined in the preceding steps.

The width of each pulse is 251.3 uSec. There are, at most, 1 pulses per 100mS. This yields an effective duty cycle of 0.251%.

The Peak to average factor is calculated by the highest duty cycle in percent over any 100mS transmission. The transmitter operates for a maximum duration of 0.251 ms in any 100 ms interval. 20 Log*(.251mSec/100mSec) = -52 dB Peak to Average correction factor.

Since the difference between the peak and the average limits are 20 dB, there is no need to use a correction factor more than 20 dB. Therefore, a 20 dB factor was used.





11.2.3 Radiated Emissions Test Results

Test Date	10-27-2017
Test Distance	3 Meters
Tested by	Richard Tichgelaar
Specification	FCC Part 15 Subpart C & RSS-210 Section B.10
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP

All emissions except Fundamental and harmonics; Emissions in the bluetooth Transmit and Receive Mode

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
30.0	7.1	P	H	11.1	0.5	0.0	18.7	40.0	21.3	
32.2	13.5	P	H	11.3	0.5	0.0	25.3	40.0	14.7	
33.0	15.4	P	H	11.3	0.5	0.0	27.2	40.0	12.8	
34.7	16.8	P	H	11.5	0.5	0.0	28.8	40.0	11.2	
36.0	13.2	P	H	11.6	0.5	0.0	25.3	40.0	14.7	
48.9	11.4	P	H	11.5	0.6	0.0	23.5	40.0	16.5	
134.1	9.7	P	H	11.6	1.0	0.0	22.3	43.5	21.2	
191.3	8.8	P	H	17.0	1.1	0.0	26.9	43.5	16.6	
200.0	8.1	P	H	11.0	1.2	0.0	20.2	43.5	23.3	
202.0	8.6	P	H	16.2	1.2	0.0	26.0	43.5	17.5	
328.4	8.8	P	H	13.7	1.5	0.0	24.0	46.0	22.0	
432.5	9.3	P	H	15.6	1.8	0.0	26.6	46.0	19.4	
500.0	7.1	P	H	17.8	1.9	0.0	26.8	46.0	19.2	
502.0	9.3	P	H	17.8	1.9	0.0	29.0	46.0	17.0	
656.3	8.4	P	H	20.2	2.2	0.0	30.8	46.0	15.2	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
805.0	9.1	P	H	20.5	2.6	0.0	32.2	46.0	13.8	
907.5	8.4	P	H	22.1	2.6	0.0	33.1	46.0	12.9	
1690.0	40.7	P	H	25.9	-32.3	0.0	34.2	74.0	39.8	1
1832.5	40.6	P	H	26.8	-31.9	0.0	35.5	74.0	38.5	1
1977.5	40.1	P	H	27.2	-31.7	0.0	35.6	74.0	38.4	1
2270.0	39.4	P	H	27.8	-31.6	0.0	35.6	74.0	38.4	1
2420.0	39.0	P	H	28.4	-30.9	0.0	36.5	74.0	37.5	1
2467.5	37.2	P	H	28.4	-30.9	0.0	34.8	74.0	39.2	1
2732.5	40.2	P	H	28.9	-31.0	0.0	38.1	74.0	35.9	1
2770.0	40.1	P	H	28.9	-30.9	0.0	38.1	74.0	35.9	1
2982.5	39.5	P	H	30.0	-30.1	0.0	39.4	74.0	34.6	1
3135.0	39.5	P	H	30.8	-29.7	0.0	40.6	74.0	33.4	1
3645.0	35.7	P	H	31.7	-28.8	0.0	38.6	74.0	35.4	1
3802.5	39.0	P	H	32.8	-29.0	0.0	42.8	74.0	31.2	1
3990.0	36.1	P	H	32.8	-28.9	0.0	40.0	74.0	34.0	1
4117.5	36.1	P	H	32.5	-28.2	0.0	40.4	74.0	33.6	1
4497.5	36.1	P	H	33.0	-28.0	0.0	41.1	74.0	32.9	1
4820.0	37.1	P	H	33.4	-26.7	0.0	43.8	74.0	30.2	1
30.0	7.7	P	V	11.1	0.5	0.0	19.3	40.0	20.7	
42.0	16.7	P	V	12.0	0.5	0.0	29.2	40.0	10.8	
64.4	10.7	P	V	8.0	0.7	0.0	19.3	40.0	20.7	
113.4	8.2	P	V	12.5	0.9	0.0	21.6	43.5	21.9	
130.2	9.0	P	V	11.8	1.0	0.0	21.8	43.5	21.7	
182.2	9.3	P	V	17.0	1.1	0.0	27.4	43.5	16.1	
202.0	8.7	P	V	16.2	1.2	0.0	26.1	43.5	17.4	
208.3	12.6	P	V	10.4	1.2	0.0	24.2	43.5	19.3	
246.8	12.5	P	V	10.9	1.3	0.0	24.7	46.0	21.3	
353.3	8.2	P	V	14.1	1.6	0.0	23.9	46.0	22.1	
410.6	9.9	P	V	15.0	1.7	0.0	26.6	46.0	19.4	
457.5	12.0	P	V	16.0	1.8	0.0	29.8	46.0	16.2	
501.3	7.4	P	V	17.8	1.9	0.0	27.1	46.0	18.9	
502.0	10.5	P	V	17.8	1.9	0.0	30.2	46.0	15.8	
612.5	8.1	P	V	18.6	2.1	0.0	28.9	46.0	17.1	
772.5	9.5	P	V	21.7	2.4	0.0	33.6	46.0	12.4	
883.8	8.7	P	V	21.7	2.6	0.0	33.0	46.0	13.0	
992.5	9.0	P	V	23.3	2.8	0.0	35.1	54.0	18.9	
1440.0	42.2	P	V	25.0	-32.5	0.0	34.7	74.0	39.3	1
1832.5	41.7	P	V	26.8	-31.9	0.0	36.6	74.0	37.4	1
1957.5	42.3	P	V	27.2	-31.7	0.0	37.9	74.0	36.1	1
2400.0	40.6	P	V	28.4	-31.1	0.0	37.9	74.0	36.1	1
2687.5	42.2	P	V	28.8	-31.1	0.0	39.9	74.0	34.1	1
3000.0	43.2	P	V	30.1	-30.0	0.0	43.3	74.0	30.7	1
3465.0	41.0	P	V	31.2	-29.6	0.0	42.6	74.0	31.4	1
3932.5	40.1	P	V	32.8	-29.1	0.0	43.8	74.0	30.2	1
4102.5	36.5	P	V	32.5	-28.3	0.0	40.7	74.0	33.3	1
4592.5	36.8	P	V	33.2	-28.0	0.0	42.0	74.0	32.0	1
4885.0	35.8	P	V	33.3	-26.5	0.0	42.6	74.0	31.4	1

Note 1: Peak Reading under the Average limit, therefore no Average reading is required.
Judgment: Passed by at least 10 dB

Fundammental and Harmonic Emissions FCC 15.249; Three axis tested

		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	2402	76.9	79.9	85.8	65.8	81.2	77.8	88.0	68.0	-2.7	2402.0	85.3	65.3	114	94	28.7
BE	2402	31.1	34.1	40.0	20.0	35.4	32.0	42.2	22.2	0.0	2390.0	42.2	22.2	74	54	31.8
2	2402	41.4	40.8	41.5	21.5	40.7	41.4	41.2	21.4	6.6	4804.0	48.1	28.1	74	54	25.9
3	2402	41.4	41.8	41.6	21.8	41.4	42.3	41.6	22.3	11.7	7206.0	54.0	34.0	74	54	20.0
1	2440	82.2	78.8	86.4	66.4	82.0	84.3	88.5	68.5	-2.4	2440.0	86.1	66.1	114	94	27.9
2	2440	41.2	41.9	41.0	21.9	41.2	41.3	42.3	22.3	6.6	4880.0	48.9	28.9	74	54	25.1
3	2440	41.2	41.3	41.4	21.4	41.3	41.1	41.7	21.7	12.6	7320.0	54.3	34.3	74	54	19.7
1	2480	82.0	88.3	81.4	68.3	82.8	80.5	85.6	65.6	-2.5	2480.0	85.8	65.8	114	94	28.2
BE	2480	36.1	42.4	35.5	22.4	36.9	34.6	39.7	19.7	0.0	2483.5	42.4	22.4	74	54	31.6
2	2480	41.4	41.3	41.5	21.5	41.5	41.5	41.7	21.7	6.5	4960.0	48.2	28.2	74	54	25.8
3	2480	41.6	41.1	41.7	21.7	41.1	41.2	42.5	22.5	12.5	7440.0	55.0	35.0	74	54	19.0
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

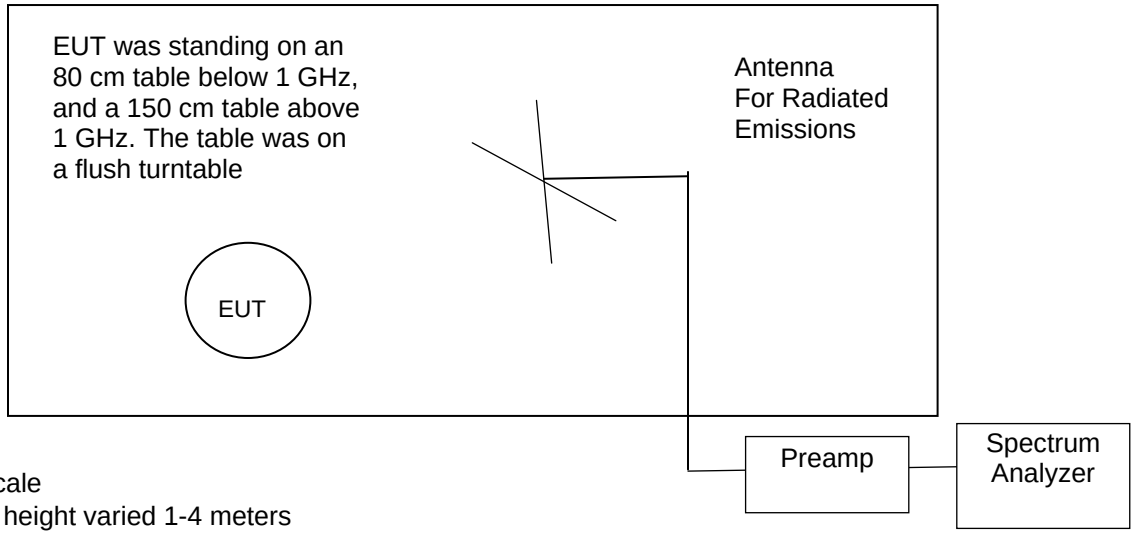
Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Average Reading based on peak reading reduced by the Duty cycle correction
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. Average Reading based on peak reading reduced by the Duty cycle correction
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. (Fundamental limit is 15.249, Harmonics are 15.209)
Column #16. Average Limit. (Fundamental limit is 15.249, Harmonics are 15.209)
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

Overall Judgment: Passed by at least 15 dB

No other Emissions were detected from 30 to 25,000 MHz within 10 dB of the limits.

Figure 2. Drawing of Radiated Emissions Setup

Chamber E, anechoic



Notes:
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer	High Pass Filter
30 to 200 MHz	ANT-04	AMP-22	REC-21	None
200 to 1000 MHz	ANT-06	AMP-22	REC-21	None
1 to 10 GHz	ANT-66	AMP-05	REC-21	None
10 to 18 GHz	ANT-66	AMP-20	REC-21	None
18 to 26 GHz	ANT-48	AMP-59	REC-21	None

A high pass filter was not needed since the EIRP is less than 0.5 mW.

11.3 Occupied Bandwidth Data

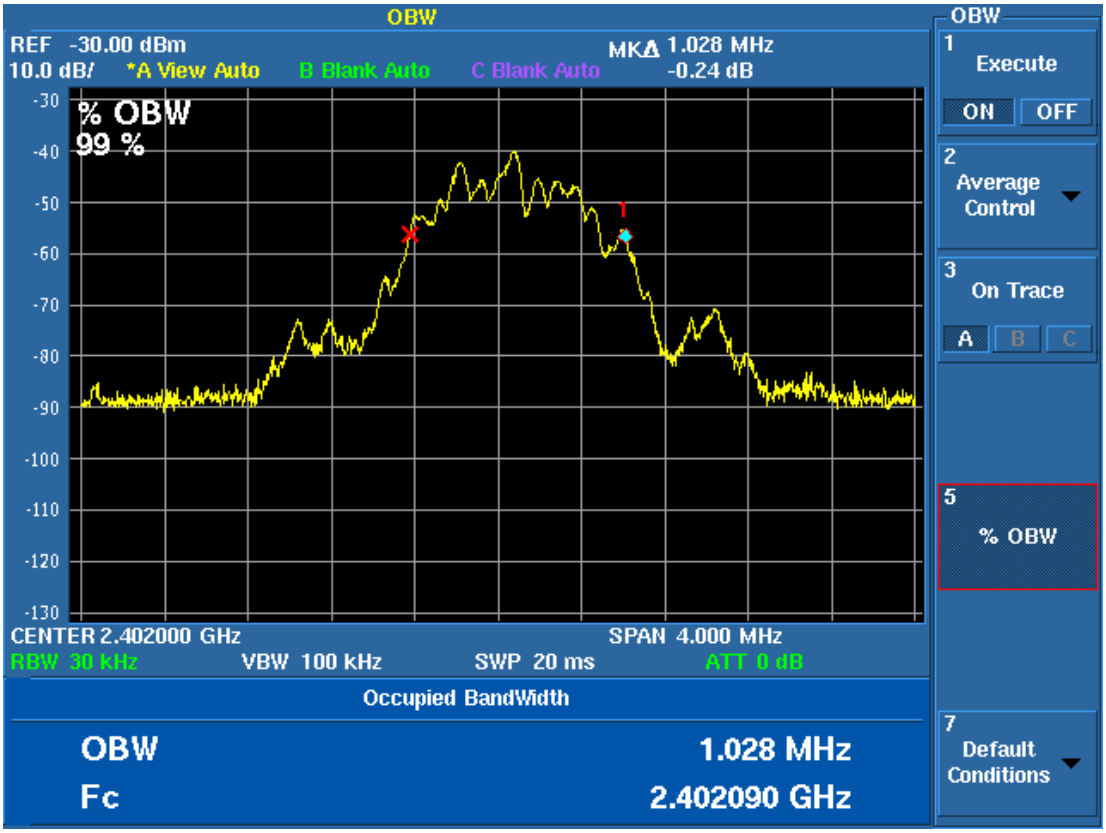
The occupied bandwidth of the RF output was measured using a spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth.

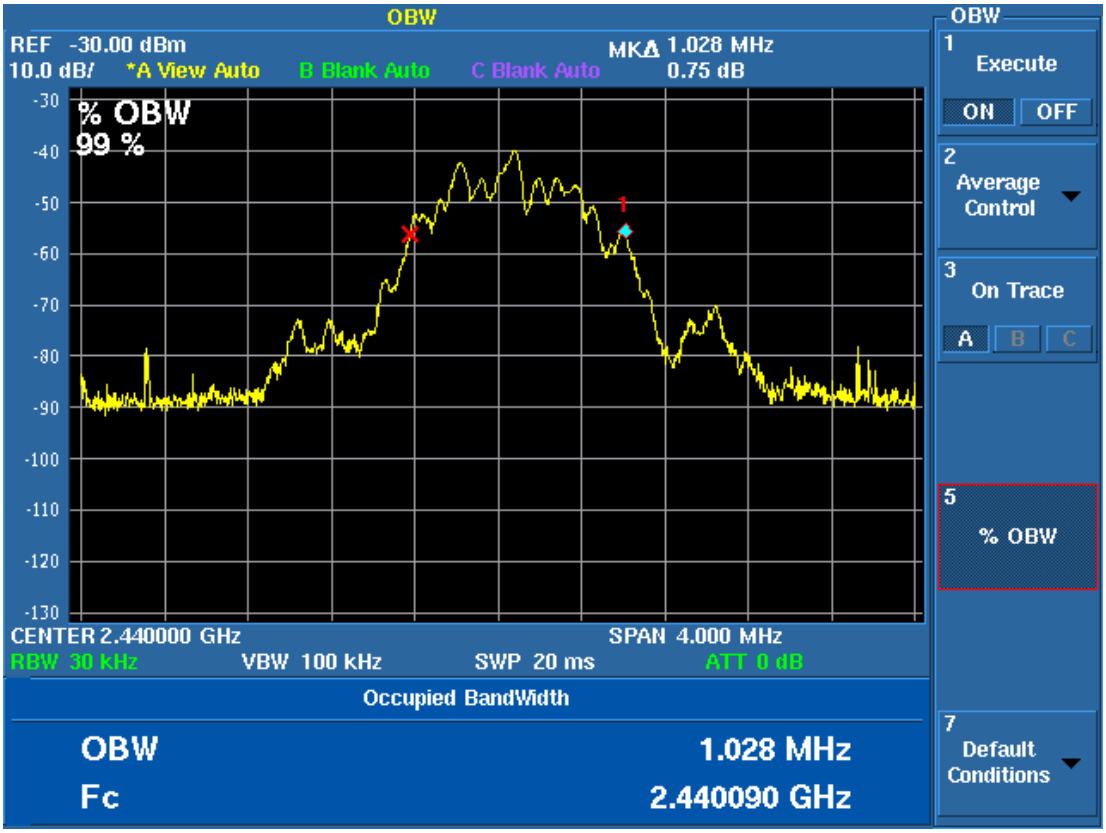
A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. A limit was drawn on the plots based on the level of the modulated carrier. The plots of the occupied bandwidth for the EUT are supplied on the following page.

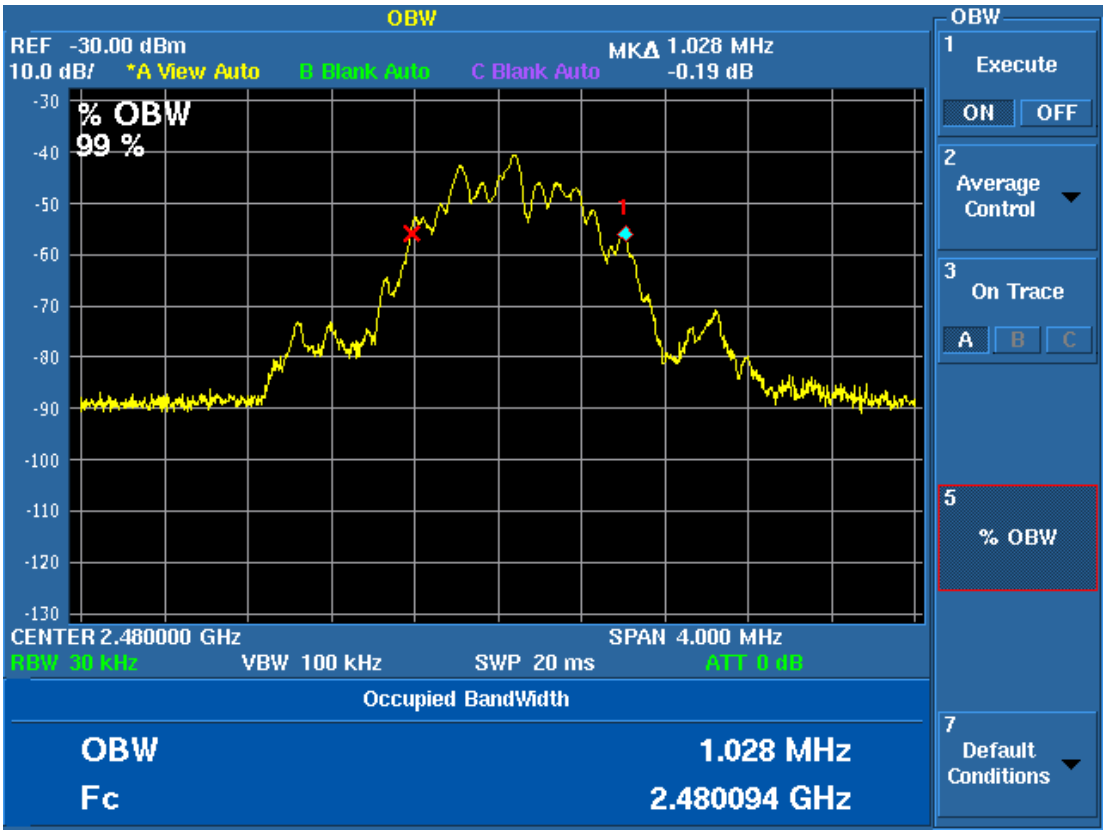
Channel MHz	99% EBW MHz
2402	1.028
2440	1.028
2480	1.028

Judgement: Pass

Figure 3. Occupied Bandwidth Plot







11.3.1 Measurement Instrumentation Uncertainty

Measurement	Uncertainty
Conducted LISN method (150kHz to 30 MHz)	2.7 dB
Radiated Emissions, H-field, 3 meters, 150kHz to 30 MHz	2.7 dB
Radiated Emissions, E-field, 3 meters, 30 to 1000 MHz	5.3 dB
Radiated Emissions, E-field, 3 meters, 1 to 6 GHz	5.5 dB
Radiated Emissions, E-field, 3 meters, 6 to 26 GHz	5.9 dB
99% Occupied Bandwidth using REC-43	1% of frequency span
Temperature THM-02	0.6 Deg C

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.