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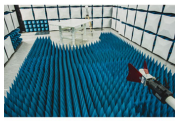

MEASUREMENT REPORT
FCC PART 15.247 Bluetooth (Low Energy)

Applicant Name:
Sirius XM Radio Inc.
1500 Eckington Place, NE
Washington, DC 20002
United States
Attn: Beejay Jolayemi

Date of Testing:
11/04/19 - 01/10/20
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1911040180-03.RS2

FCC ID:	**RS2LBEE5HY1MW**
APPLICANT:	**Sirius XM Radio Inc.**

Application Type:	Class II Permissive Change
Model:	LBEE5HY1MW
EUT Type:	BT/WiFi Module
Max. RF Output Power:	3.733mW (5.72dBm) Peak Conducted
Frequency Range:	2402 – 2480MHz
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01 v05r02
Class II Permissive Change:	Please see FCC change document
Original Grant Date:	12/23/2019

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Sirius XM BT/WiFi Module FCC ID: RS2LBEE5HY1MW**. The data found in this test report was taken with the EUT operating in Bluetooth low energy mode.

The EUT is integrated into a host device certified under FCC ID: RS2SXWB1.

Test Device Serial No.: 89337

2.2 Device Capabilities

This device contains the following capabilities:

2.4GHz WiFi, 5GHz UNII, Bluetooth, Bluetooth LE

Ch.	Frequency (MHz)
0	2402
:	:
19	2440
:	:
39	2480

Table 2-1. Frequency / Channel Operations

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups and 3.3 for radiated emissions test setups.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50□/50□H Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.5. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

3.4 Environmental Conditions

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna(s) of the EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Keysight	N9030A	PXA Signal Analyzer (26.5GHz)	9/13/2019	Annual	9/13/2020	MY54490576
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107
Agilent	N9038A	MXE EMI Receiver	7/17/2019	Annual	7/17/2020	MY51210133
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	6/18/2018	Biennial	6/18/2020	114451

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Sirius XM Radio Inc.

FCC ID: RS2LBEE5HY1MW

FCC Classification: Digital Transmission System (DTS)

Number of Channels: 40

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(b)(3)	Transmitter Output Power	< 1 Watt	CONDUCTED	PASS	Sections 7.2
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	RADIATED	PASS	Sections 7.3, 7.4
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.5

Table 7-1. Summary of Test Results

Notes:

1. All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4. For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Bluetooth LE Automation," Version 3.6.
5. For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.3.1.

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7.2 Output Power Measurement – Bluetooth (LE)

§15.247(b.3)

Test Overview and Limits

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.1
KDB 558074 D01 v05r02 – Section 8.3.1.1

Test Settings

1. RBW = 3MHz
2. VBW = 50MHz
3. Span ≥ 3 x RBW
4. Sweep = auto couple
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

The conducted powers were measured for the purpose of ensuring that the powers are equivalent to the powers of the original certified module (FCC ID: VPYLBEE5HY1MW).

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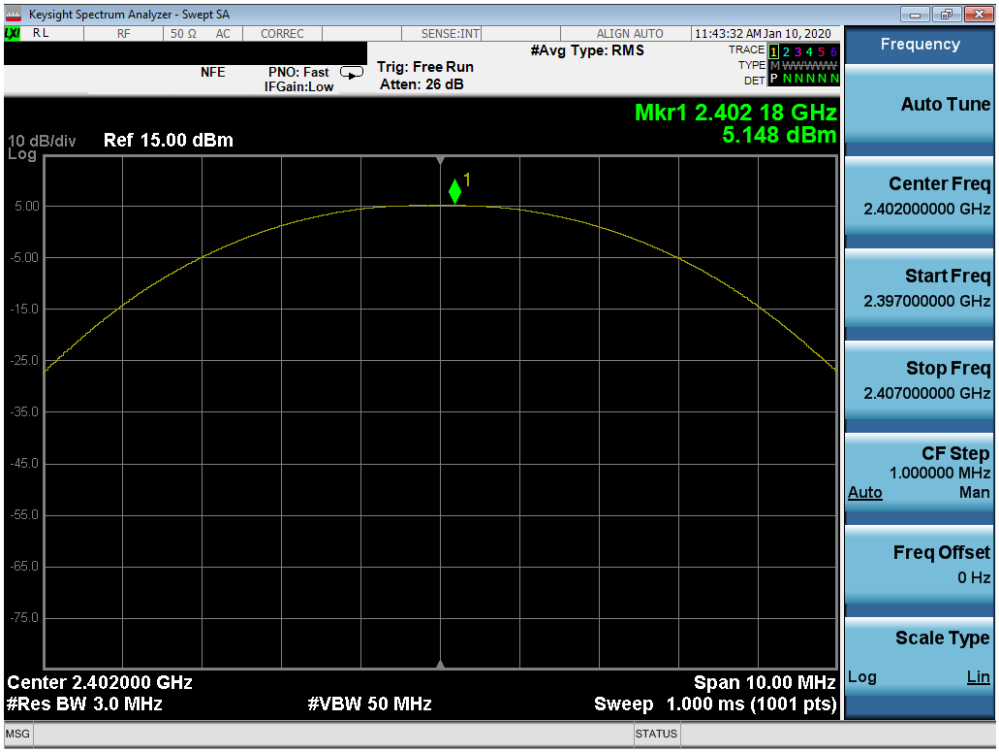
Frequency [MHz]	Data Rate [Mbps]	Mod.	Channel No.	Bluetooth Mode	Peak Conducted Power	
					[dBm]	[mW]
2402	1 Mbps	GFSK	0	LE	5.15	3.272
2440	1 Mbps	GFSK	19	LE	5.72	3.733
2480	1 Mbps	GFSK	39	LE	5.37	3.441

Table 7-2. Conducted Output Power Measurements (Bluetooth (LE))



Plot 7-1. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 0)

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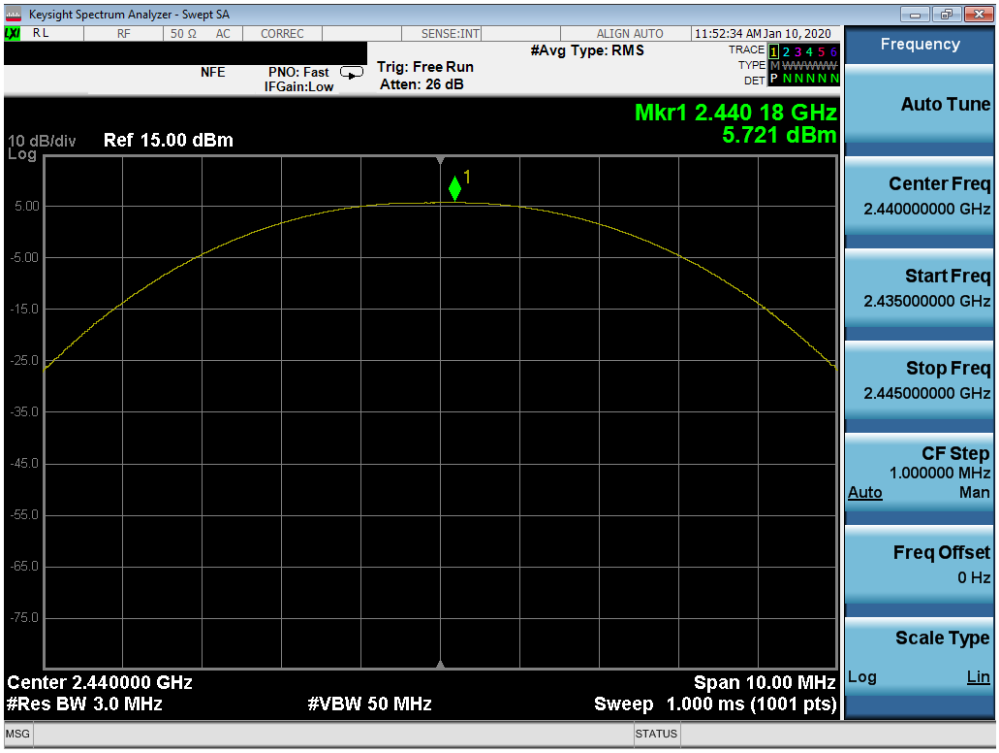
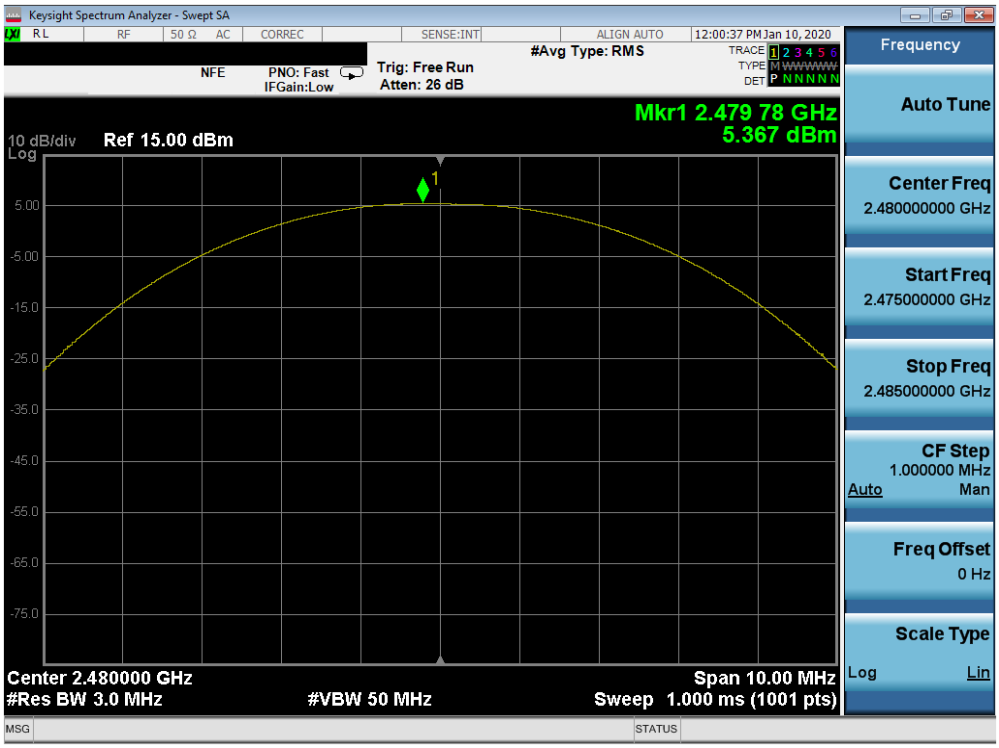


Plot 7-2. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 19)



Plot 7-3. Peak Power Plot (Bluetooth (LE), 1Mbps – Ch. 39)

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7.3 Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247(d)

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-3 per Section 15.209.

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-3. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3

KDB 558074 D01 v05r02 – Section 8.6, 8.7

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3kHz > 1/T
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to run for at least 50 times (1/duty cycle) traces

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Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in Table 7-4 below
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Frequency	RBW
9 – 150kHz	200 – 300Hz
0.15 – 30MHz	9 – 10kHz
30 – 1000MHz	100 – 120kHz
> 1000MHz	1MHz

Table 7-4. RBW as a Function of Frequency

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

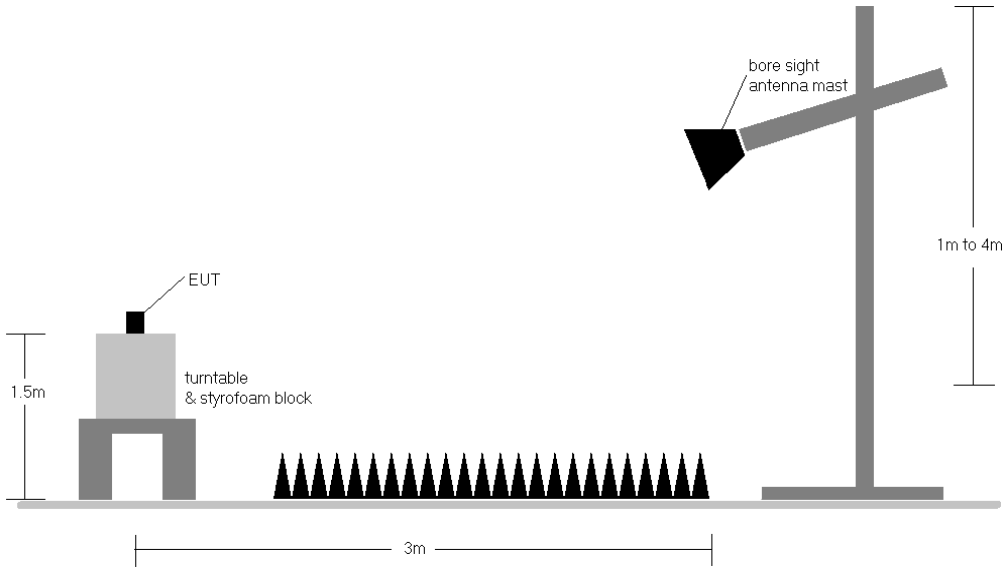

Figure 7-2. Radiated Test Setup >1GHz

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Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05r02 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-3.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested while powered by a 12V DC power source (battery).
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
6. Average measurements were recorded using a VBW of 3kHz, per Section 4.1.4.2.3 of ANSI C63.10-2013, since 1/T is equal to just under 3kHz. This method was used because the EUT could not be configured to operate with a duty cycle > 98%. Both average and peak measurements were made using a peak detector
7. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
8. No significant radiated band edge emissions were found in the 2310 – 2390MHz restricted band.
9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\square V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\square V/m]}$ – Limit $_{[dB\square V/m]}$

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Radiated Spurious Emission Measurements
§15.205 §15.209 §15.247(d)

Bluetooth Mode: LE
Distance of Measurements: 3 Meters
Operating Frequency: 2402MHz
Channel: 0

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4804.00	Avg	V	-	-	-78.73	2.97	31.24	53.98	-22.74
4804.00	Peak	V	-	-	-66.48	2.97	43.49	73.98	-30.49
12010.00	Avg	V	-	-	-81.46	14.09	39.63	53.98	-14.35
12010.00	Peak	V	-	-	-69.17	14.09	51.92	73.98	-22.06

Table 7-5. Radiated Measurements @ 3 meters

Bluetooth Mode: LE
Distance of Measurements: 3 Meters
Operating Frequency: 2442MHz
Channel: 20

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4884.00	Avg	V	121	170	-77.93	3.90	-22.50	10.47	53.98	-43.51
4884.00	Peak	V	121	170	-65.62	3.90	0.00	45.28	73.98	-28.70
7326.00	Avg	V	131	173	-80.53	7.93	-22.50	11.90	53.98	-42.08
7326.00	Peak	V	131	173	-68.32	7.93	0.00	46.61	73.98	-27.37
12210.00	Avg	V	-	-	-82.04	13.91	0.00	38.87	53.98	-15.11
12210.00	Peak	V	-	-	-69.76	13.91	0.00	51.15	73.98	-22.83

Table 7-6. Radiated Measurements @ 3 meters

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Radiated Spurious Emission Measurements
§15.205 §15.209 §15.247(d)

Bluetooth Mode: LE
Distance of Measurements: 3 Meters
Operating Frequency: 2480MHz
Channel: 39

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4960.00	Avg	V	115	174	-78.56	3.61	32.05	53.98	-21.93
4960.00	Peak	V	115	174	-67.32	3.61	43.29	73.98	-30.69
7440.00	Avg	V	-	-	-80.07	8.30	35.23	53.98	-18.75
7440.00	Peak	V	-	-	-68.01	8.30	47.29	73.98	-26.69
12400.00	Avg	V	-	-	-81.84	14.09	39.25	53.98	-14.73
12400.00	Peak	V	-	-	-69.78	14.09	51.31	73.98	-22.67

Table 7-7. Radiated Measurements @ 3 meters

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7.4 Radiated Spurious Emissions Measurements – Below 1GHz §15.209

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-8 per Section 15.209.

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-8. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.

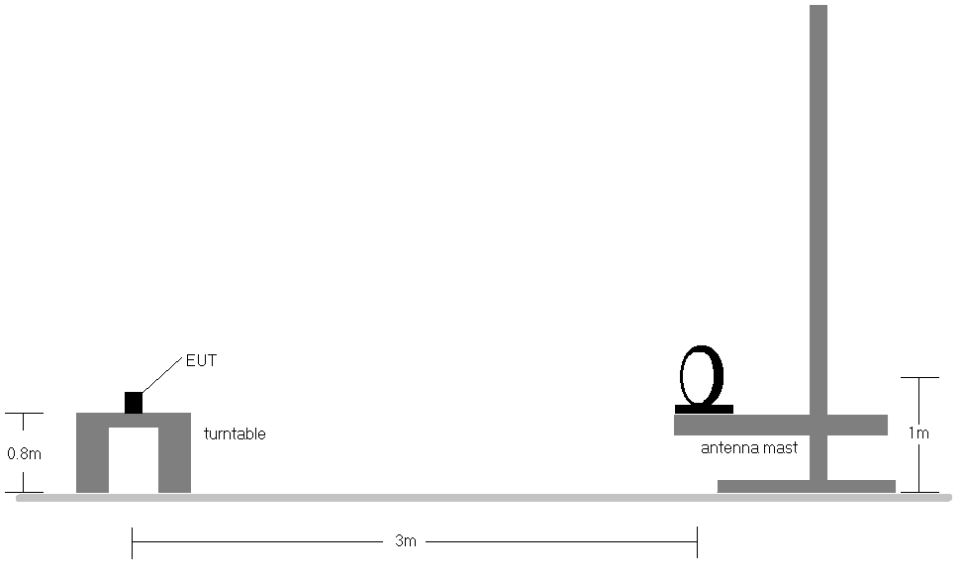

Figure 7-3. Radiated Test Setup < 30Mhz

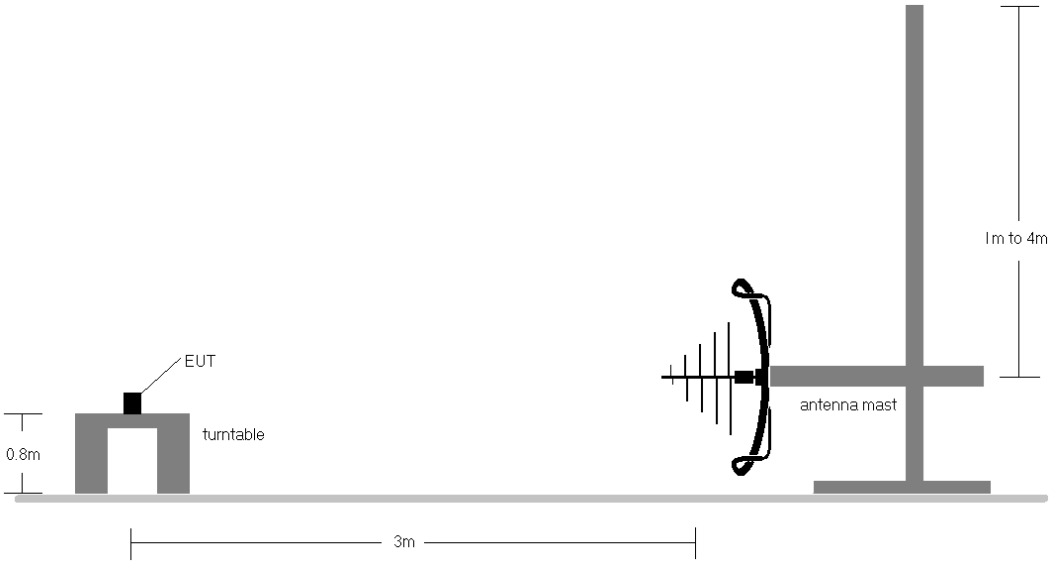

Figure 7-4. Radiated Test Setup < 1GHz

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Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-8.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested while powered by a 12V DC power source (battery).
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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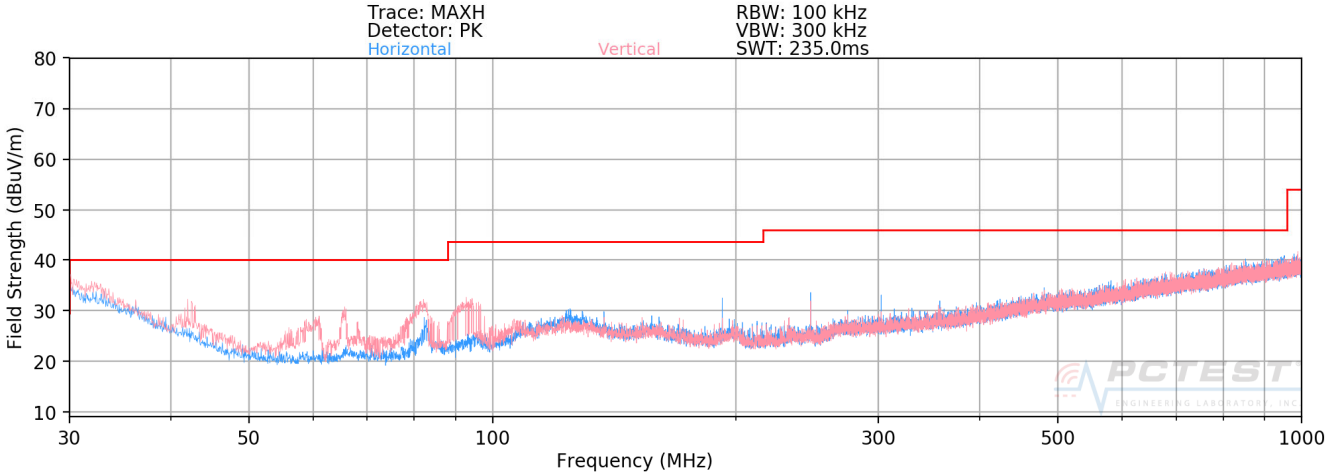
Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-4. Radiated Spurious Plot below 1GHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
66.31	Quasi-Peak	V	-92.76	15.11	29.35	40.00	-10.65
73.18	Quasi-Peak	V	-96.06	18.78	29.72	40.00	-10.28
93.25	Quasi-Peak	V	-94.28	17.88	30.60	43.52	-12.92
247.25	Quasi-Peak	H	-92.38	18.94	33.56	46.02	-12.46
302.20	Quasi-Peak	H	-95.4	21.23	32.83	46.02	-13.19
357.10	Quasi-Peak	H	-96.88	22.29	32.41	46.02	-13.61

Table 7-9. Radiated Spurious Emissions below 1GHz

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7.5 Line-Conducted Test Data

§15.207

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207.

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-10. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

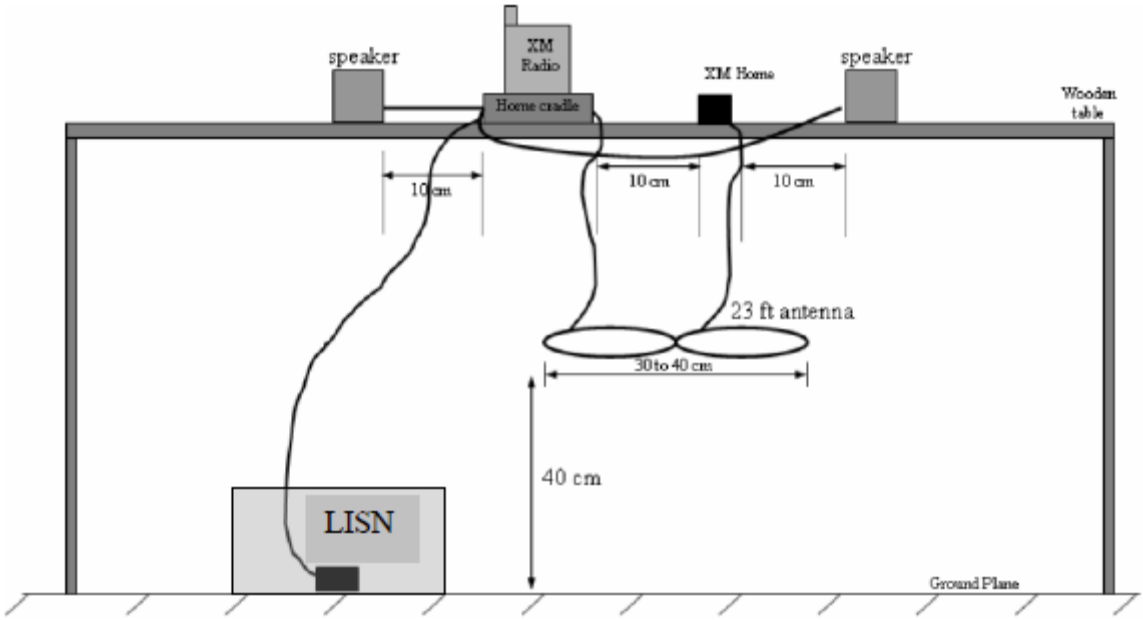

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207.
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dB□V) = QP/AV Analyzer/Receiver Level (dB□V) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dB□V) - QP/AV Level (dB□V)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

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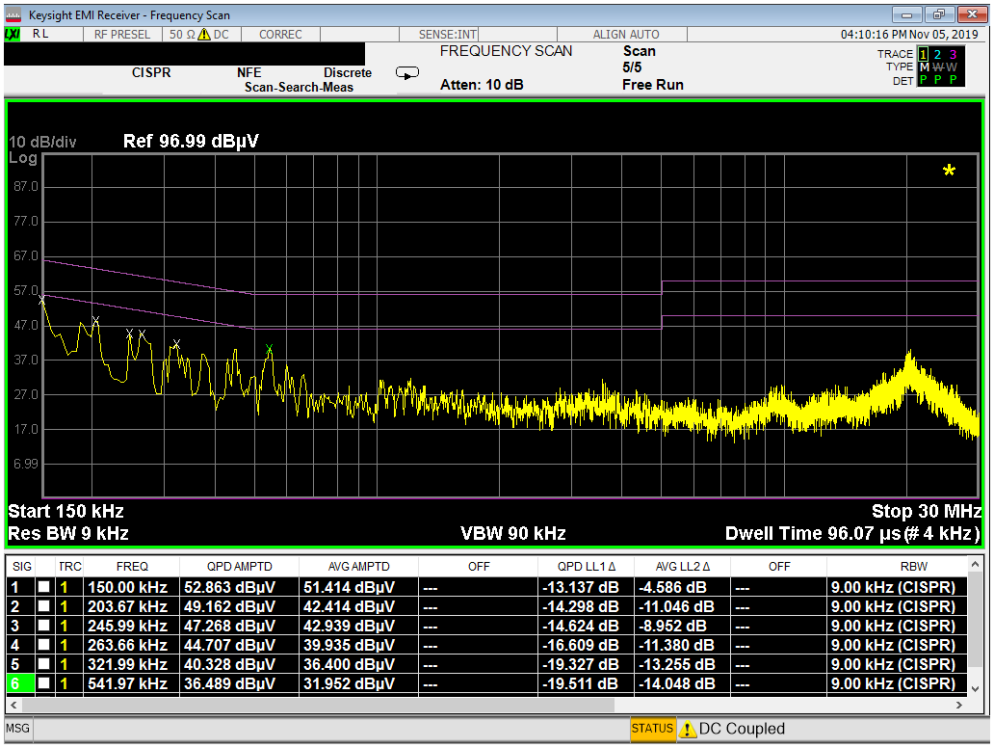
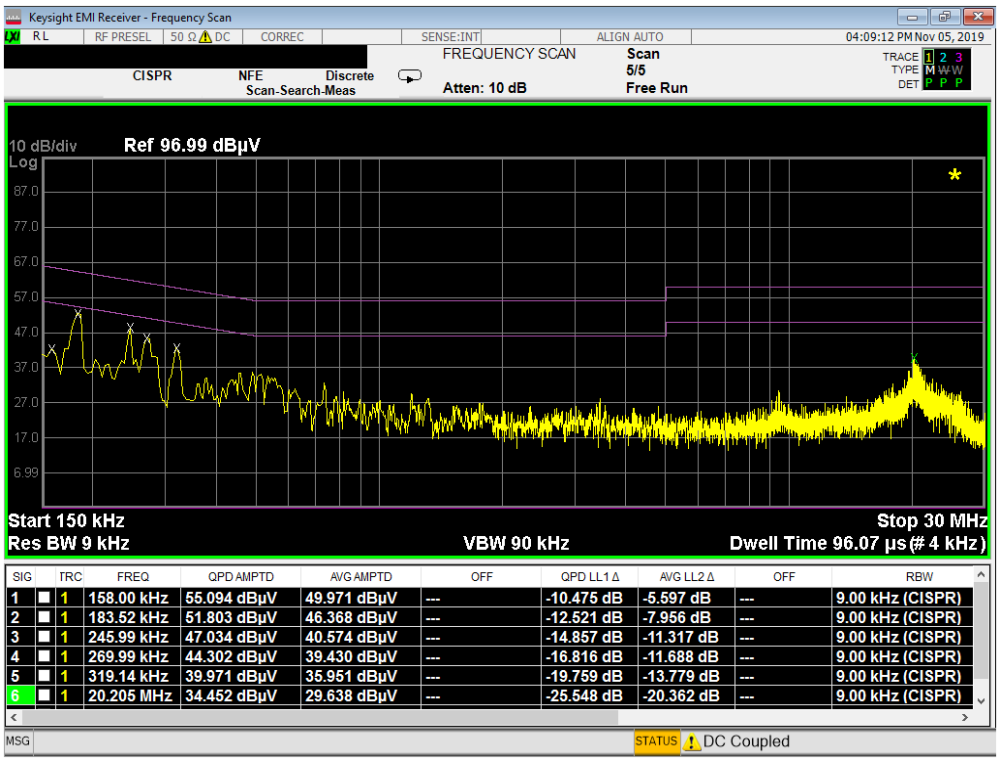


SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	150.00 kHz	52.863 dBµV	51.414 dBµV	---	-13.137 dB	-4.586 dB	---	9.00 kHz (CISPR)
2	1	203.67 kHz	49.162 dBµV	42.414 dBµV	---	-14.298 dB	-11.046 dB	---	9.00 kHz (CISPR)
3	1	245.99 kHz	47.268 dBµV	42.939 dBµV	---	-14.624 dB	-8.952 dB	---	9.00 kHz (CISPR)
4	1	263.66 kHz	44.707 dBµV	39.935 dBµV	---	-16.609 dB	-11.380 dB	---	9.00 kHz (CISPR)
5	1	321.99 kHz	40.328 dBµV	36.400 dBµV	---	-19.327 dB	-13.255 dB	---	9.00 kHz (CISPR)
6	1	541.97 kHz	36.489 dBµV	31.952 dBµV	---	-19.511 dB	-14.048 dB	---	9.00 kHz (CISPR)

Plot 7-5. Line Conducted Plot with Bluetooth LE (L1)



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	158.00 kHz	55.094 dBµV	49.971 dBµV	---	-10.475 dB	-5.597 dB	---	9.00 kHz (CISPR)
2	1	183.52 kHz	51.803 dBµV	46.368 dBµV	---	-12.521 dB	-7.956 dB	---	9.00 kHz (CISPR)
3	1	245.99 kHz	47.034 dBµV	40.574 dBµV	---	-14.857 dB	-11.317 dB	---	9.00 kHz (CISPR)
4	1	269.99 kHz	44.302 dBµV	39.430 dBµV	---	-16.816 dB	-11.688 dB	---	9.00 kHz (CISPR)
5	1	319.14 kHz	39.971 dBµV	35.951 dBµV	---	-19.759 dB	-13.779 dB	---	9.00 kHz (CISPR)
6	1	20.205 MHz	34.452 dBµV	29.638 dBµV	---	-25.548 dB	-20.362 dB	---	9.00 kHz (CISPR)

Plot 7-6. Line Conducted Plot with Bluetooth LE (N)

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Sirius XM BT/WiFi Module FCC ID: RS2LBEE5HY1MW** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules.

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