RF Test Report

As per

RSS-210 Issue 10:2019 + A1:2020
&
FCC Part 15 Subpart 15.209 & 15.249

Low Power License Exempt Radio Communication Devices Intentional Radiators

on the

Saffire EVO LZ-M

Issued by:

TÜV SÜD Canada Inc.
1280 Teron Rd
Ottawa, Canada

Testing produced for
dormakaba
See Appendix A for full client & EUT details.

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Testing Laboratory
Certificate #2955.19

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Report Scope

This report addresses the EMC verification testing and test results of the **Saffire EVO LZ-M**, herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-210 Issue 10:2019 + A1:2020

FCC Part 15 Subpart C 15.209 & 15.249:2022

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

Summary

The results contained in this report relate only to the item(s) tested.

EUT	**Saffire EVO LZ-M**
FCC Certification #, FCC ID:	Q8SSAFFIREEVOM
Industry Canada Certification #, IC:	4652A-SAFFIREEVOM
EUT passed all tests performed	Yes
Tests conducted by	Scott Drysdale

Note:

Contains FCC ID: 2AU49-DA16200MC
Contains IC: 25650-DA16200MC

For testing dates, see "Testing Environmental Conditions and Dates".

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.209 RSS-GEN (Table 4)	Transmitter Spurious Radiated Emissions	Quasi-Peak	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	Quasi-Peak, Average	N/A, See Justification
FCC 15.215 (c) C63.10 Section 6.9	Occupied Bandwidth	20dB OBW	Pass
RSS-GEN Section 6.6	Occupied Bandwidth	99% OBW	Pass
Overall Result			**Pass**

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a ‘PASS’ grade. If not ‘FAIL’ grade will be issued. Note that ‘PASS’ / ‘FAIL’ grade is independent of any measurement uncertainties. A ‘PASS’ / ‘FAIL’ grade within measurement uncertainty is marked with a ‘*’.

Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

For the antenna requirement specified in FCC 15.203, for RFID the EUT uses a custom loop antenna which is also not meant to be replaceable by the user. For Bluetooth™ the EUT uses a PCB chip antenna, which is not meant to be replaceable by the user.

The device also incorporates a certified Wi Fi module IC: 25650-DA16200MC / FCC ID: 2AU49-DA16200MC. Integration testing was performed separately. All testing in this test report had the module in the on state and performing as per normal operation.

For the Restricted Bands of operation, the EUT is designed to operate only at 13.56 MHz and 2.4 GHz to 2.4835 GHz.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the Z-axis. Worst case results are presented.

Power line conducted emissions was not applicable since the EUT is a battery operated device with no provision for charging or connection to AC mains.

All the tests were performed with new batteries installed.

The EUT does not have an antenna port and all measurements were performed using the radiated method. Antenna gain is not specified as the device has been tested to comply with the applicable radiated emissions limits via radiated emissions measurements and antenna port conducted emissions do not apply.

Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)
Margin = 50.5dBµV/m – (50dBµV + 10dB/m + 2.5dB – 20dB)
Margin = 8.0 dB (pass)

Applicable Standards, Specifications and Methods

ANSI C63.4:2017	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2020	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2022	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
RSS-GEN Issue 5 2018	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 10:2019 + A1:2020	Licence-Exempt Radio Apparatus: Category I Equipment
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories

Document Revision Status

Revision 000 - Sept 18, 2023

Revision 001 – Sept 20, 2023 – Corrected FCC ID

Revision 002 – Oct 3, 2023 – Minor Corrections as per TCB request, kept on file.

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

BW – Bandwidth. Unless otherwise stated, this is refers to the 20 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Ottawa, Ontario. The testing lab has calibrated 10m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 3m and a height of up to 3m. The chambers are equipped with a turntable that is capable of testing devices up to 5000lb in weight and are equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. This facility is capable of testing products that are rated for single phase or 3-phase AC input and DC capability is also available. Radiated emission measurements are performed using Loop antenna, Biconical antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the vertical ground plane if applicable.

Calibrations and Accreditations

The 10m semi-anechoic chamber is registered with Federal Communications Commission, Innovation, Science and Economic Development Canada and Voluntary Control Council for Interference (Japan). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, where applicable, a 16-point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. All measuring equipment is calibrated on an annual or biennial basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
July 2nd, 2023 Sept 5th, 2023	Radiated Emissions	SD	20-23	50.0	98-106.5
Aug 15, 2023	Bandwidth measurements	SD	22.5	45.0	98-106.5

Detailed Test Results Section

Radiated Emission Field Strength (RFID -15.209)

Purpose

The purpose of this test is to ensure that the RF energy emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect other devices which may be using the same spectrum allocations for similar or other purposes and also ensures the transmit range of the device is within the pre-determined suitable range. This also ensures public safety by not exceeding a level which has been deemed safe for human exposure.

Limits and Method

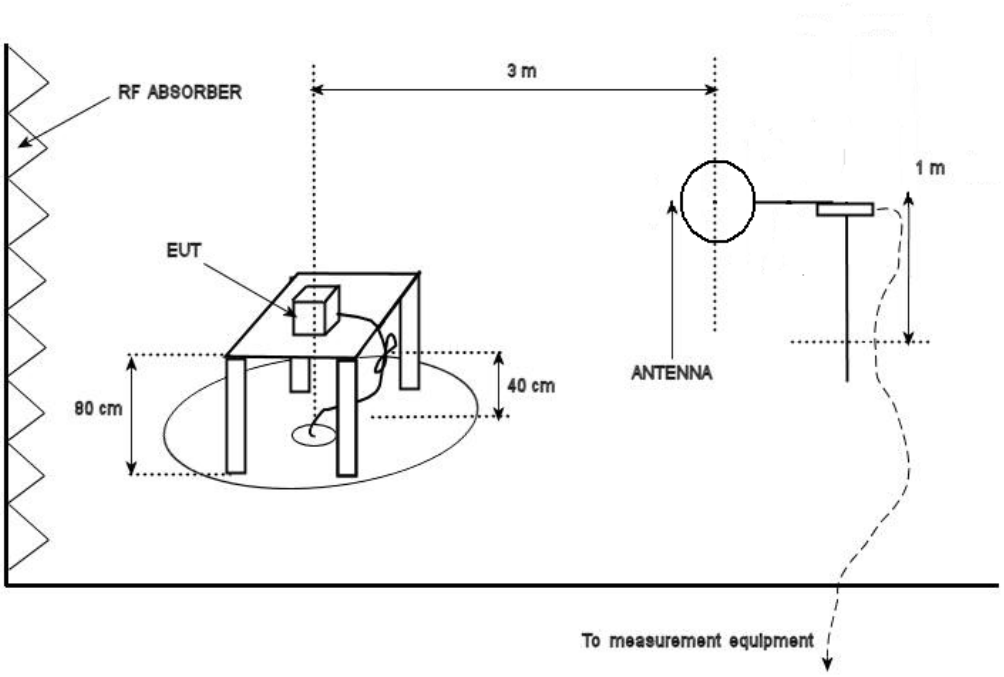
The limits are defined in FCC Part 15.209(a).
Method is using a loop antenna and converting to voltage based on the impedance of free space.

Fundamental Frequency (kHz)	Field Strength Limit (uV/m) at 300m	Limit (dBuV/m)[1] at 3m
13.6 MHz	2400/F (kHz)	69.5

[1]Limit is with a Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1
Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

In accordance with FCC Part 15, section 15.31(f)(2), testing was performed at a 3 meter test distance and an extrapolation factor of 40 dB/decade was applied. For example, an extrapolation of 300m to 3m is 20Log(uV/m) + 40Log(300m/3m).

Typical Radiated Emissions Setup



Measurement Uncertainty

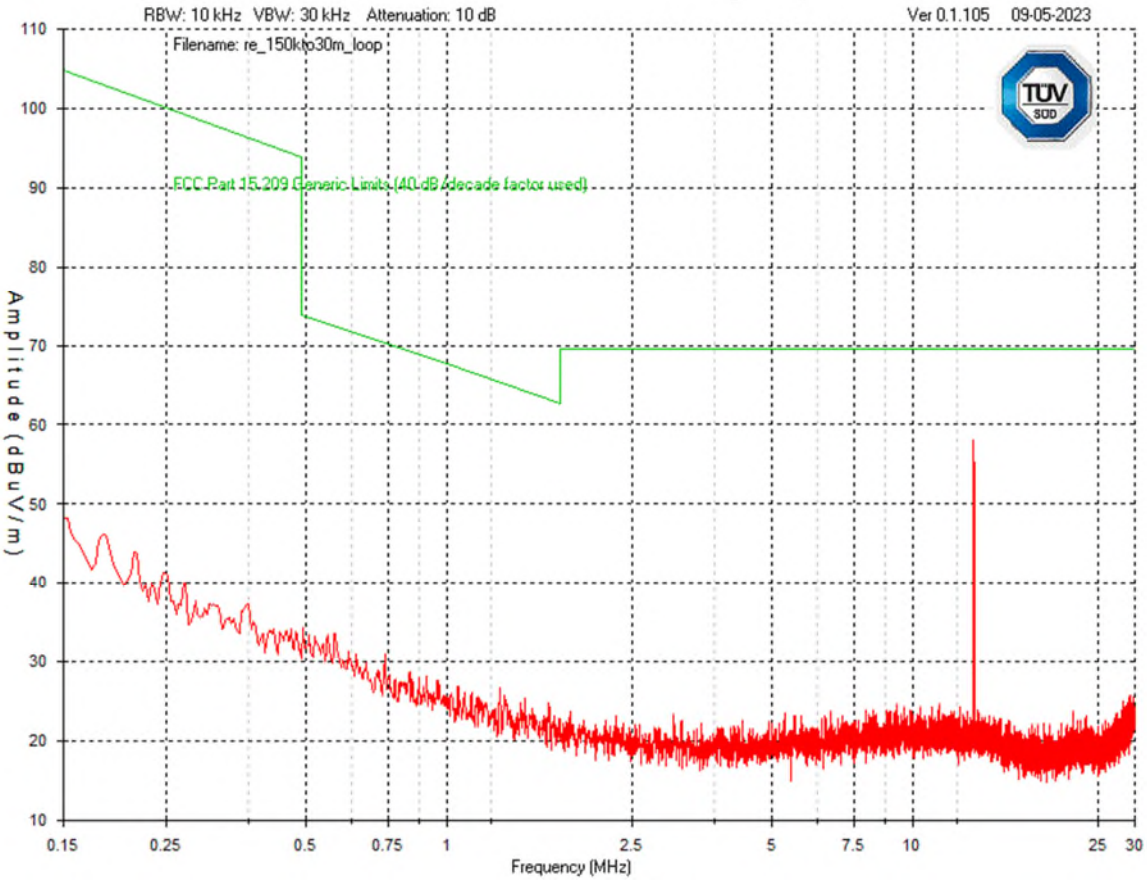
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

The graphs shown below are maximized peak measurement graphs over a full 0-360°. The loop was orientated at 0 degrees and 90 degrees and a maximized reading is shown. The marker shows the raw value. See the Final Measurements section below for corrected values.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

Peak Emission at Carrier Frequency



Final Measurements

Freq.	Detector Peak/QP	EUT Axis	Received Signal (dBµV)	Pre Amp	dBuA/ dBuV Conv. factor	Antenna Factor, Cable (dB/m)	Level (dBµV/m)	Emission Limit dB(µV/m)	Margin dB	Result
13.56	Peak	Z	52.1	-31.6	51.5	-13.9	58.1	69.5	11.4	Pass

Emissions Table

Note:

Peak = Peak measurement
QP = Quasi-Peak measurement

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up and EUT axis.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan 14, 2022	Jan 14, 2024	SSG013672
Pre-Amp	LNA-1450	RF Bay	Sept 16, 2022	Sept 15, 2024	SSG013864
Loop Antenna	EM 6879	Electro-Metrics	Oct 19, 2021	Oct 19, 2023	LAVE4040
RF Cable	Huber & Suhner	104PEA	Jan 24, 2022	Jan 24, 2024	SSG012041

Radiated Emissions Field Strength (Bluetooth™ - 15.249)

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The method is as defined in Section 12.2 of FCC KDB 558074 and ANSI C63.10.

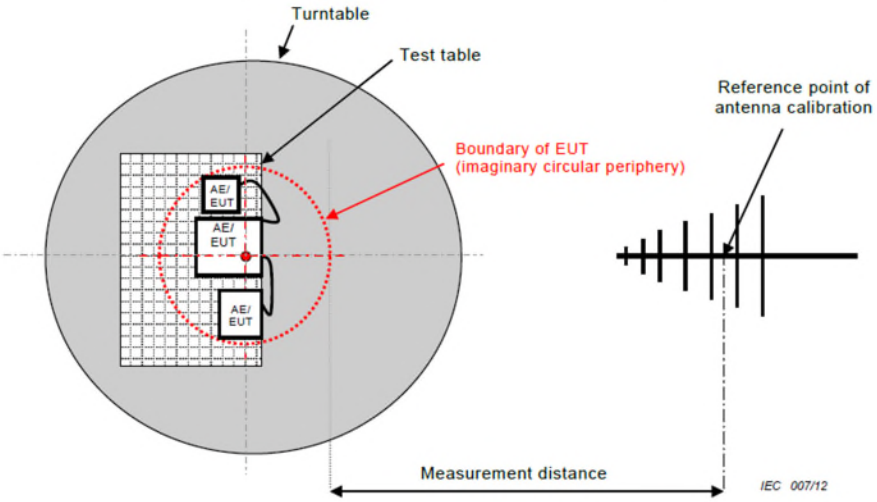
The limits, as defined in 15.249(a) for intentional radiated emissions are:

Fundamental frequency	Field strength of fundamental (millivolts/meter)[1]	Field strength of harmonics (microvolts/meter)
2400-2483.5 MHz	50.0 (94.0 dBuV/m) at 3m	500 (54 dBuV/m) at 3m

[1]Limit is specified with 1 MHz measurement bandwidth and using an Average detector, however a peak limit of 20 dB higher than the average limit applies.

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the average limits, where defined, then the EUT is deemed to have passed the requirements

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

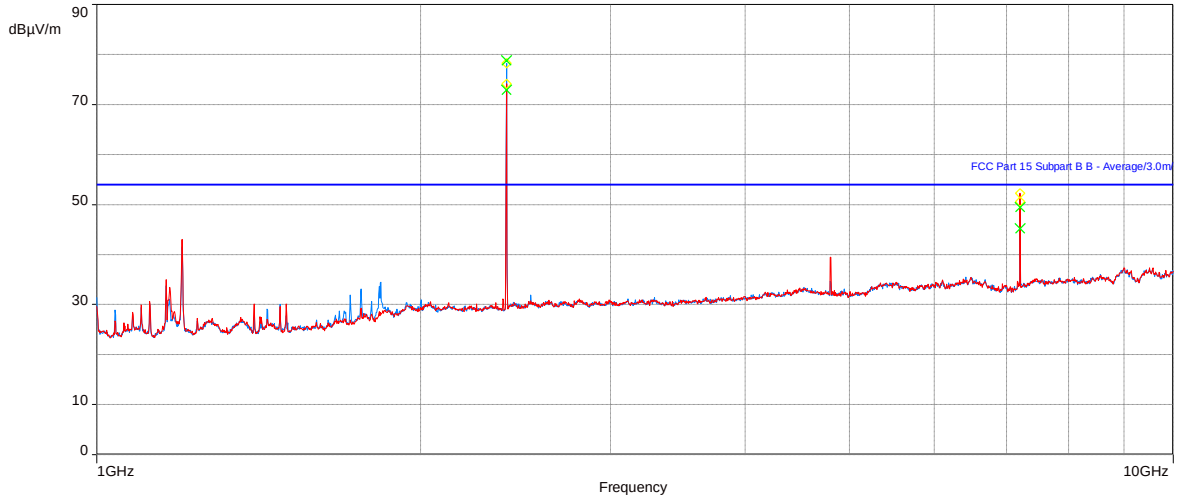
Preliminary Graphs

The graphs shown below are obtained at a 3m test distance and are maximized measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This maximization process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the Z-axis.

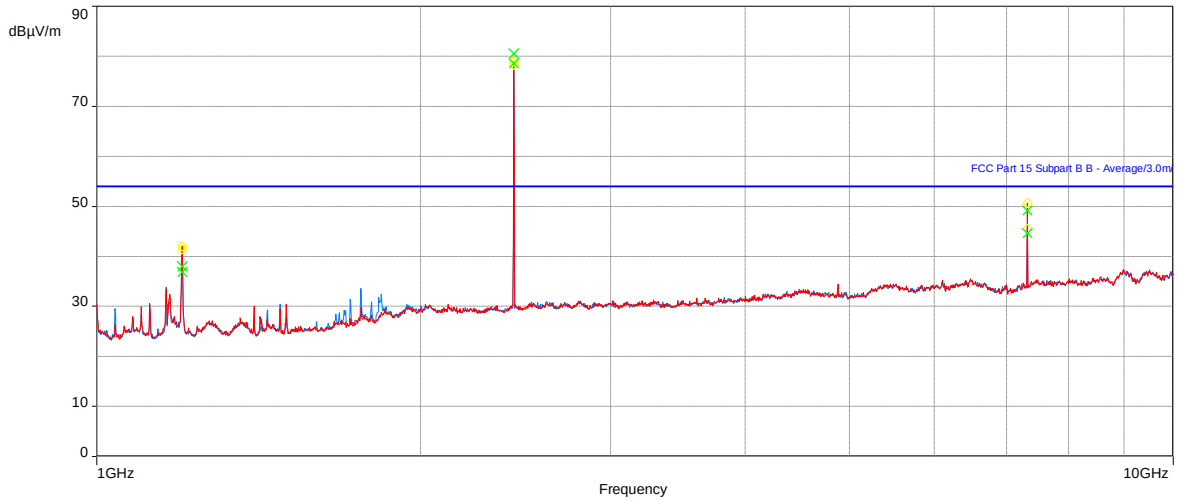
Final Measurements

Low channel



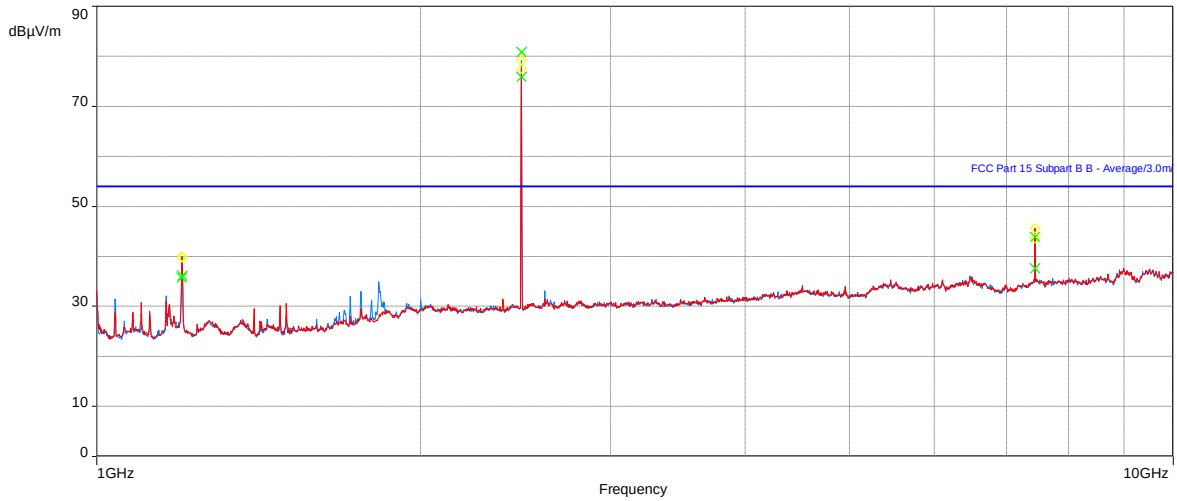
Frequency (MHz)	Det.	Height (m)	Azimuth (°)	Pol	Correction (dB+dB/m)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
2402.0	AV	1.00	0.00	V	-4.95	72.91	94	21.09	Pass
2402.0	AV	1.98	55.25	H	-4.95	78.71	94	15.29	Pass
2402.0	PK	1.00	0.00	V	-4.95	74.0	114	40	Pass
2402.0	PK	1.98	55.25	H	-4.95	79.7	114	34.3	Pass

Middle Channel



Frequency (MHz)	Det.	Height (m)	Azimuth (°)	Pol	Correction (dB+dB/m)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
2440	AVG	1.04	326.50	V	-4.77	78.5	94.0	15.5	Pass
2440	AVG	1.93	33.50	H	-4.77	80.5	94.0	13.5	Pass
2440	PK	1.04	326.50	V	-4.77	79.6	114.0	34.4	Pass
2440	PK	1.93	33.50	H	-4.77	81.5	114.0	32.5	Pass

High Channel



Frequency (MHz)	Det.	Height (m)	Azimuth (°)	Pol	Correction (dB+dB/m)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
2480.0	AVG	1.00	360.00	V	4.73	75.9	94.0	18.1	Pass
2480.0	AVG	1.00	40.75	H	4.73	80.9	94.0	13.1	Pass
2480.0	PK	1.00	360.00	V	4.73	76.9	114.0	37.1	Pass
2480.0	PK	1.00	40.75	H	4.73	81.9	114.0	32.1	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan 14, 2022	Jan 14, 2024	SSG013672
Pre-Amplifier (1-18GHz) (A7)	BNR	LNA	May 16, 2022	May 16, 2024	SSG012594
Coaxial Cable (1-18 GHz)	Micro-Coax	UFA 210B-1-1500-504504	Jan 27, 2022	Jan 24, 2025	SSG012376
Horn Antenna 3MCH 00003	ETS-Lindgren	3117	May 11, 2022	May 11, 2024	LAVE04211

Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The limits are as defined in FCC Part 15 Section 15.209(a). The method is as defined in ANSI C63.10.

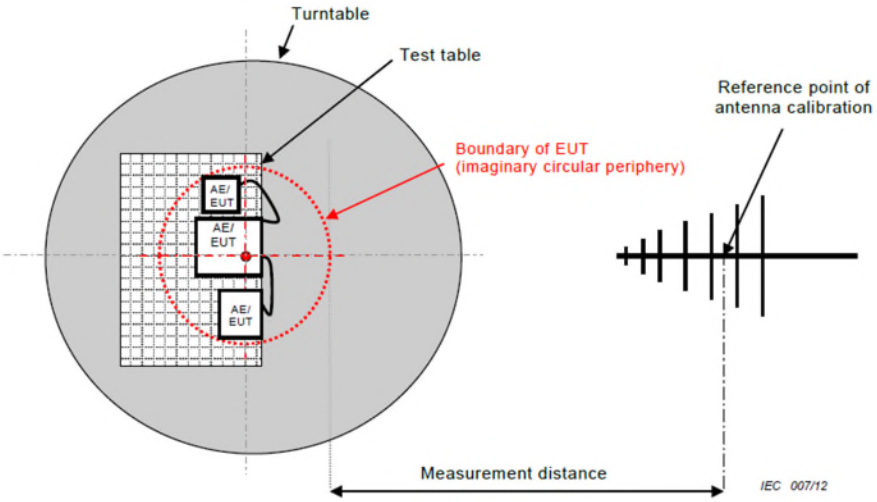
The limits apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8[1]
0.490 MHz – 1.705 MHz	73.8 to 63[1]
1.705 MHz – 30 MHz	69.5[1]
30 MHz – 88 MHz	40.0[1]
88 MHz – 216 MHz	43.5[1]
216 MHz – 960 MHz	46.0[1]
Above 960 MHz	54.0[1]
Above 1000 MHz	54.0[2]
Above 1000 MHz	74.0[3]

[1]Limit is with Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

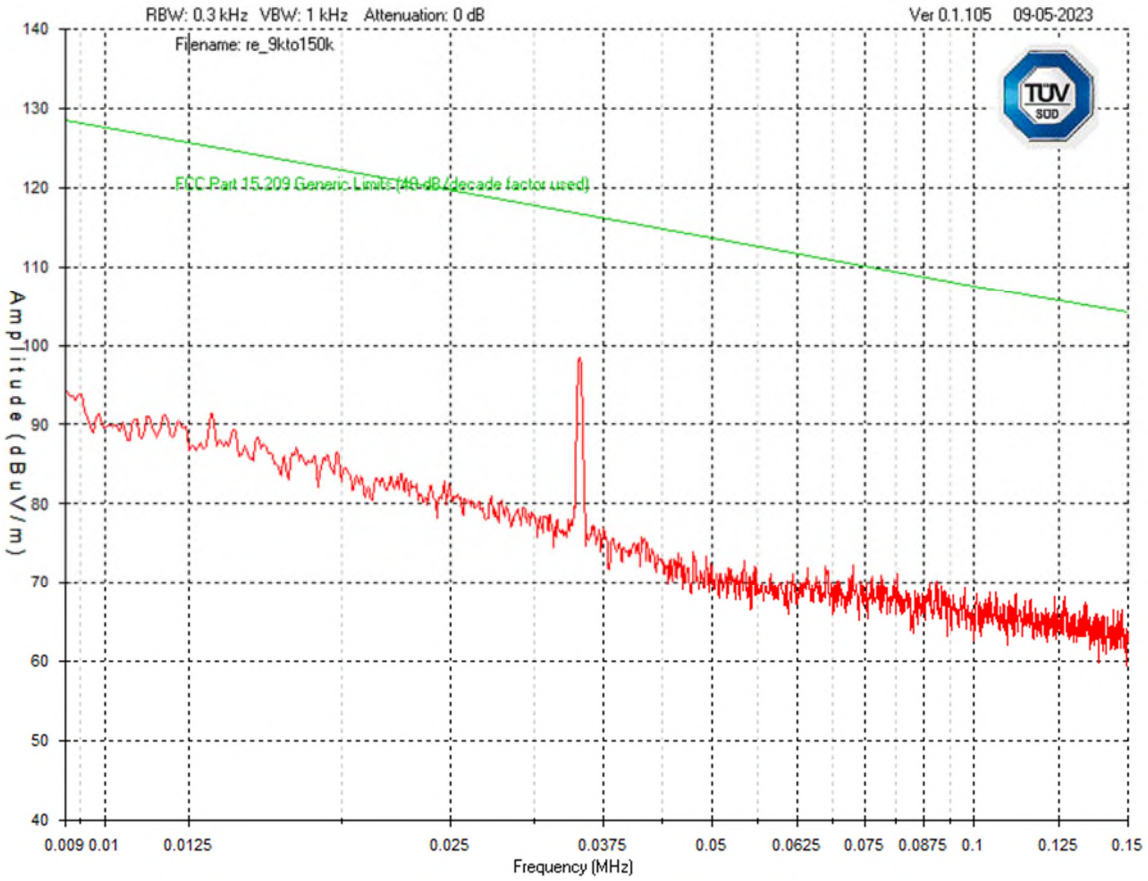
The graphs shown below are obtained at a 3m test distance and are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

In accordance with FCC Part 15, Subpart A, Section 15.33(a), the device is scanned to at least the 10^{th} harmonic (A minimum of 1.25MHz).

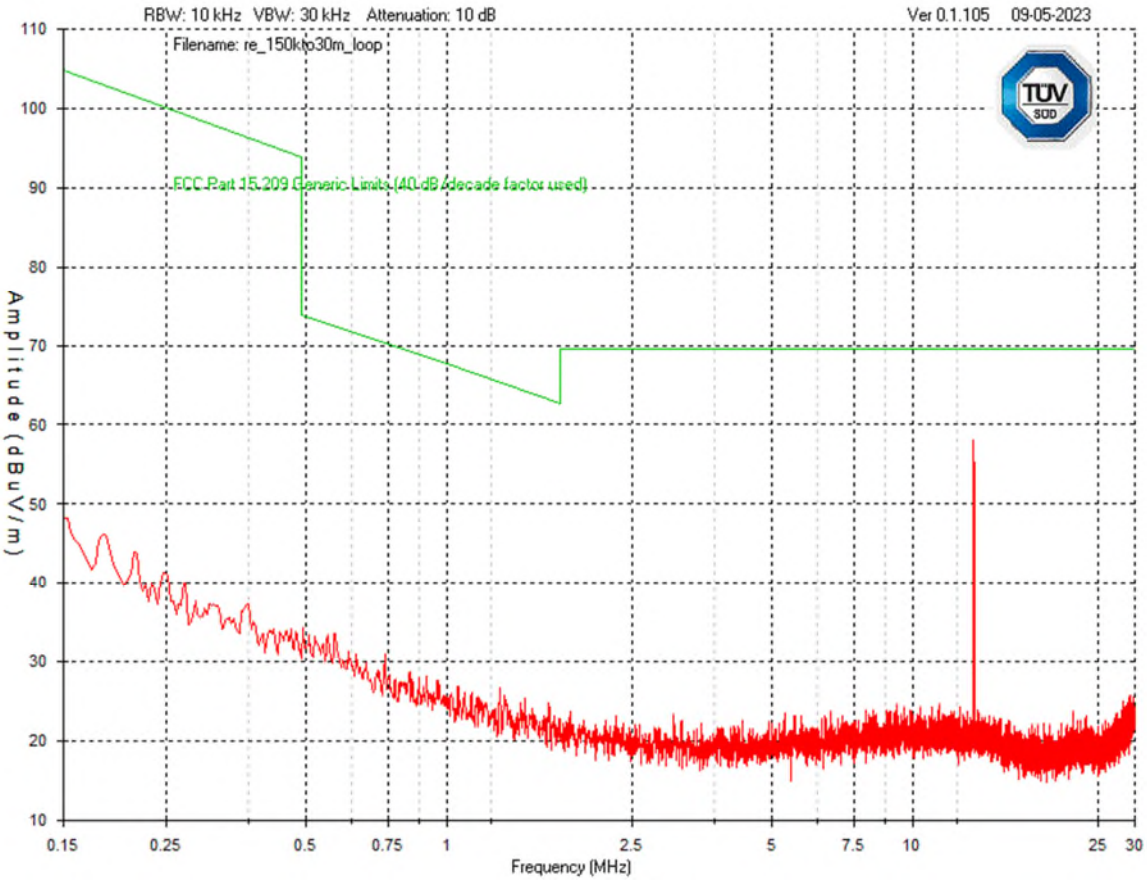
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31(f), an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example, an extrapolation of 30m to 3m for frequencies below 30MHz is 20Log(uV/m) + 40Log(30m/3m).

The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the Z-axis.

9 kHz – 150 kHz

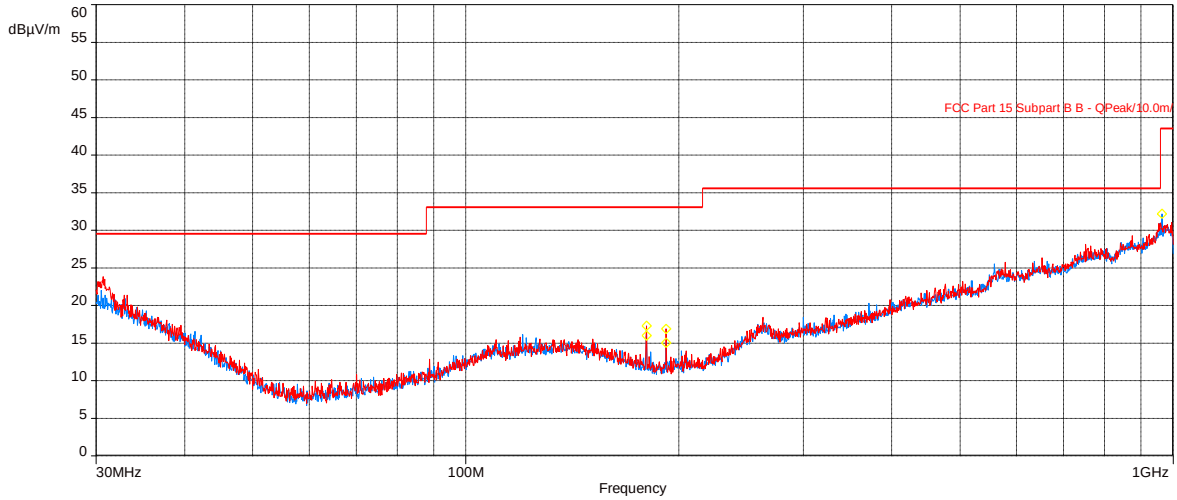


150 kHz – 30 MHz

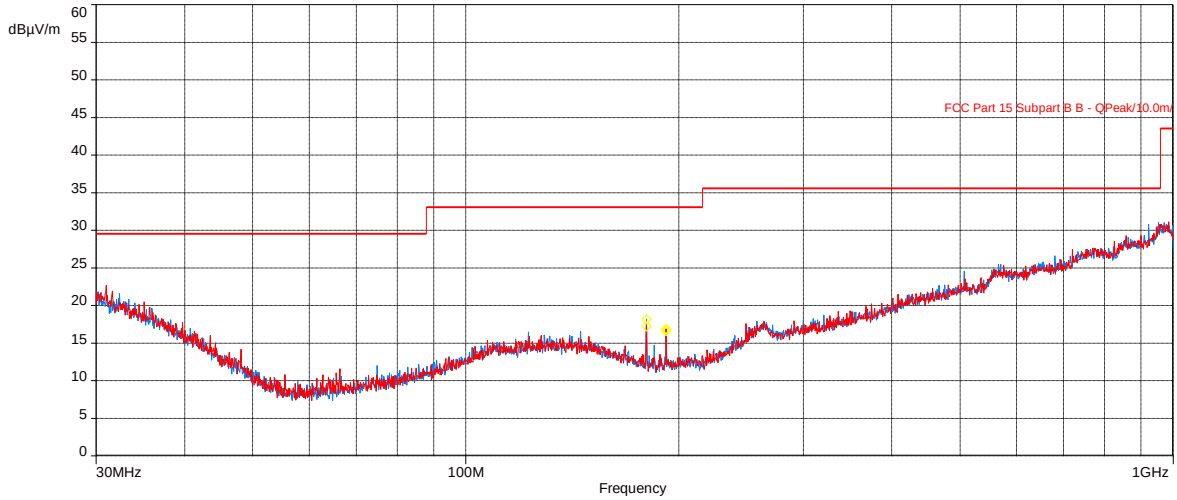


Note: Spike shown at 13.56 MHz is intentional RFID signal.

30 MHz to 1 GHz RFID On

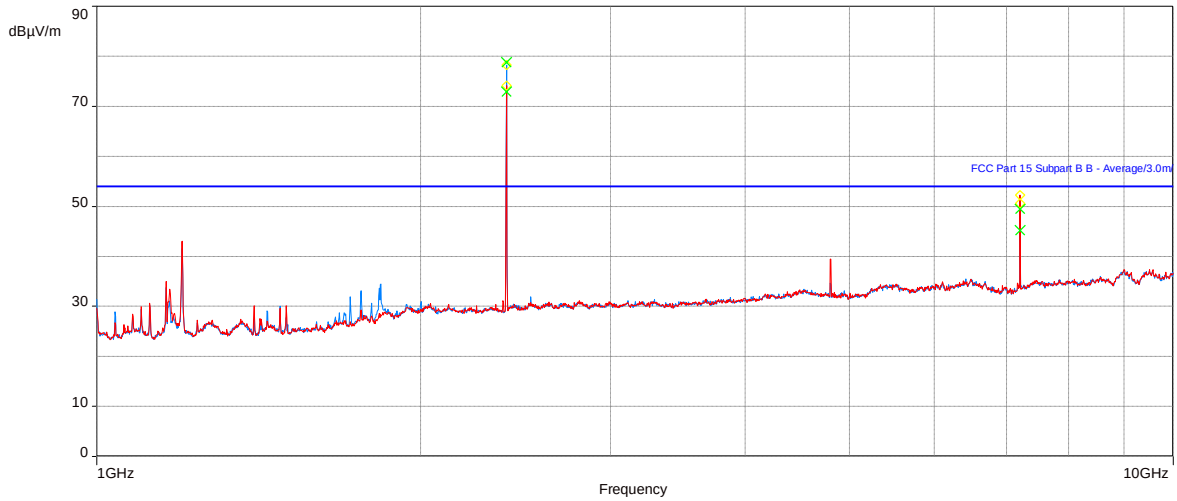


30 MHz to 1 GHz – Bluetooth on



Note: Low channel 'on' presented as representative.

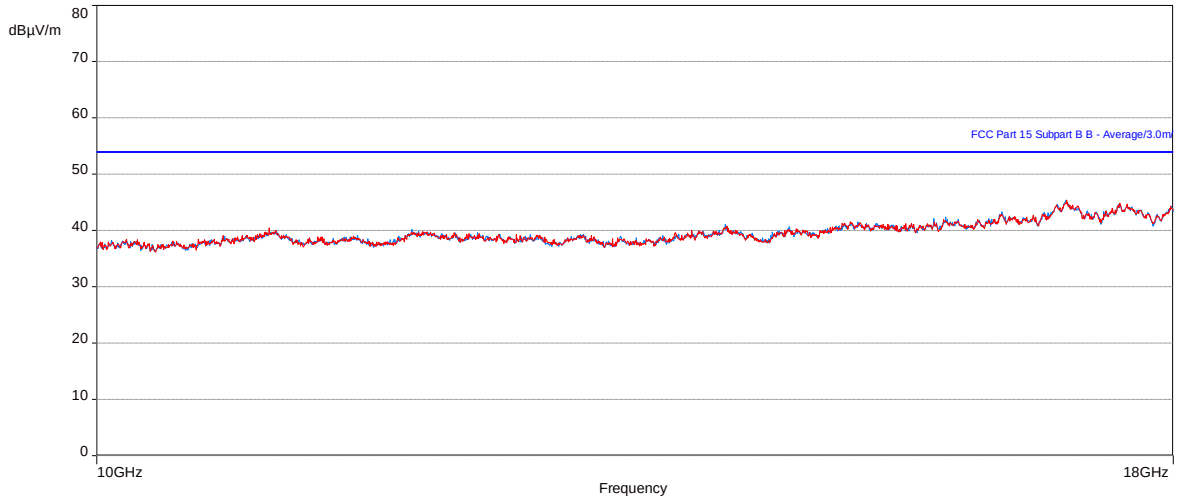
Low Channel (Worst case / representative)



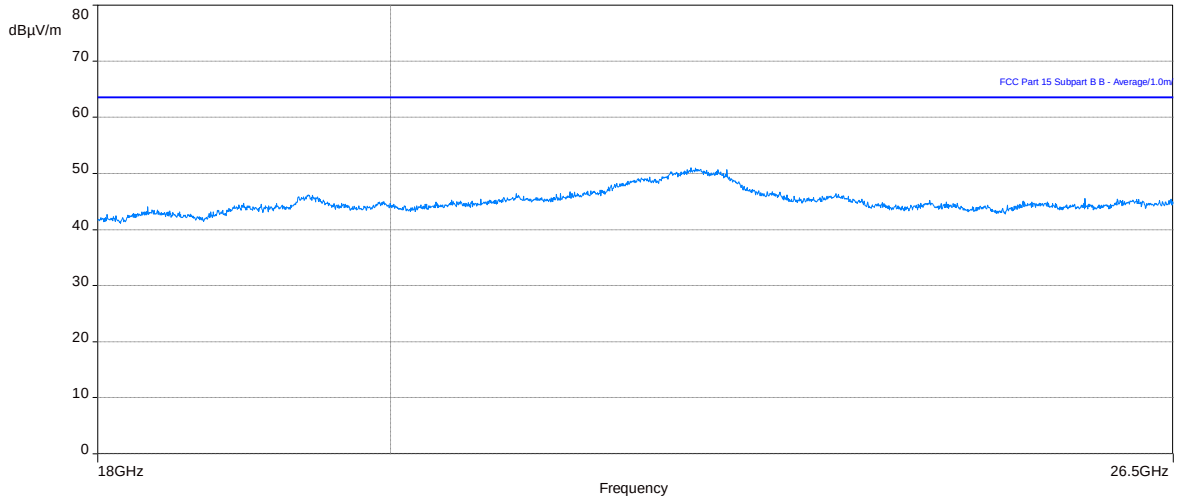
Note: Emission at 2.4 GHz is intentional BT signal.

Frequency (MHz)	Det.	Height (m)	Azimuth (°)	Pol	Correction (dB+dB/m)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
7206.7	AV	1.00	341.00	V	2.49	49.4	54.0	4.6	Pass
7206.7	AV	1.00	26.50	H	2.49	45.2	54.0	8.8	Pass

10 GHz to 18 GHz – Bluetooth™ on.



18 GHz to 26 GHz – Bluetooth™ on.



Note: testing was performed to 40 GHz, no emissions above 26.5 GHz were detected and the reading were below the applicable limit(s).

Final Measurements

The EUT passed. No quasi-peak or average measurement is required as all peak emissions are more than 10dB below the limit, other then as noted in the tables above.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan 14, 2022	Jan 14, 2024	SSG013672
Pre-Amp	LNA-1450	RF Bay	Sept 16, 2022	Sept 15, 2024	SSG013864
Loop Antenna	EM 6879	Electro-Metrics	Oct 19, 2021	Oct 19, 2023	LAVE4040
Bilog Antenna	Teseq	59119	Jan 24, 2022	Jan 24, 2024	SSG013965
RF Amplifier (30-1000MHz)	Hewlett Packard	8447D	May 5, 2022	May 5, 2024	SSG013045
RF Cable	Huber & Suhner	104PEA	Jan 24, 2022	Jan 24, 2024	SSG012041
Pre-Amplifier (1-18GHz) (A7)	BNR	LNA	May 16, 2022	May 16, 2024	SSG012594
Coaxial Cable (1-18 GHz)	Micro-Coax	UFA 210B-1-1500-504504	Jan 27, 2022	Jan 24, 2024	SSG012376
Horn Antenna 3MCH 00003	ETS-Lindgren	3117	May 11, 2022	May 11, 2024	LAVE04211

99% Occupied Bandwidth

Purpose

The purpose of this test is to verify that intentional radiators operating under the alternative provisions to the general emission limits are designed to ensure the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. This helps ensure the utilization of the frequency allocation and prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits and Method

The limit is as specified in FCC Part 15.215(c) and RSS-GEN Section 6.6 and the method is given in ANSI C63.10.

Results

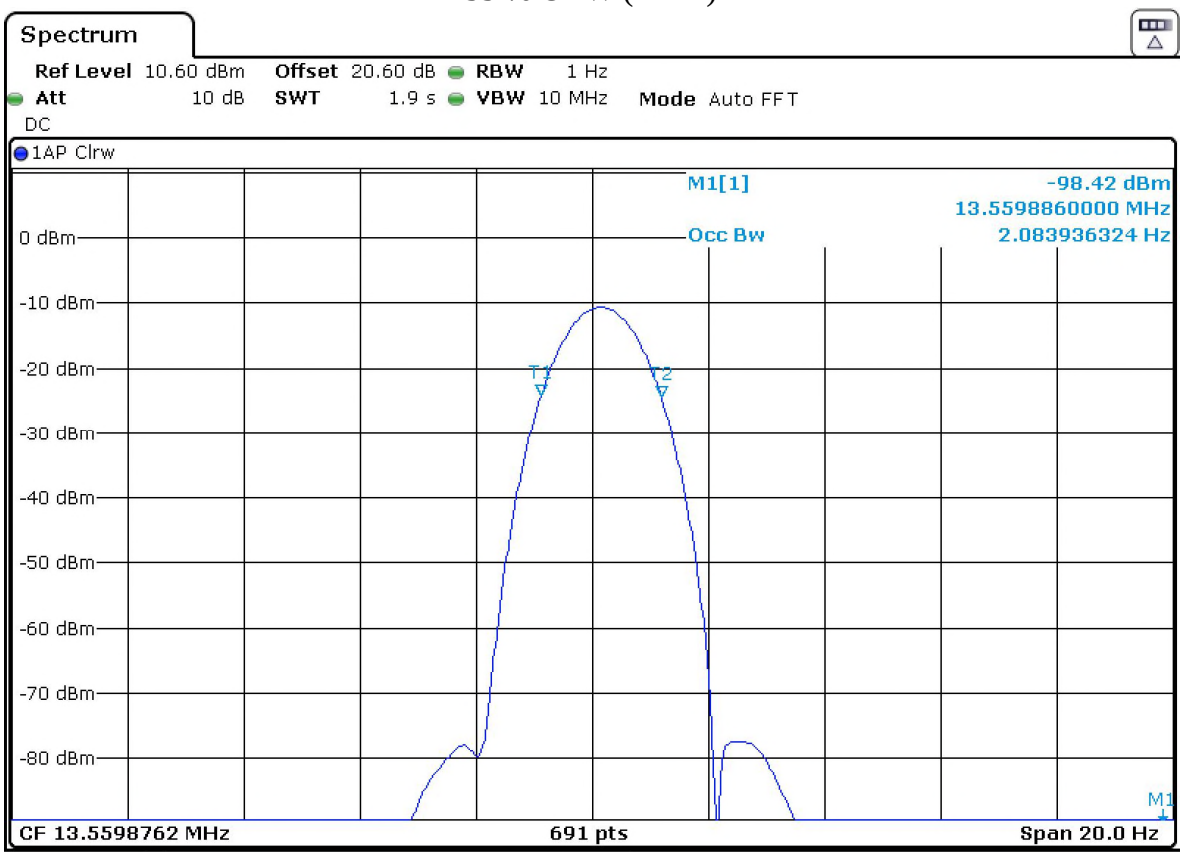
The 99% BW was measured using the 99% BW function of the spectrum analyzer.

Frequency	99% Bandwidth
13.56MHz (RFID)	2 Hz
2.402 GHz (BLE low)	1.06 MHz
2.44 GHz (BLE mid)	1.06 MHz
2.48 GHz (BLE high)	1.06 MHz

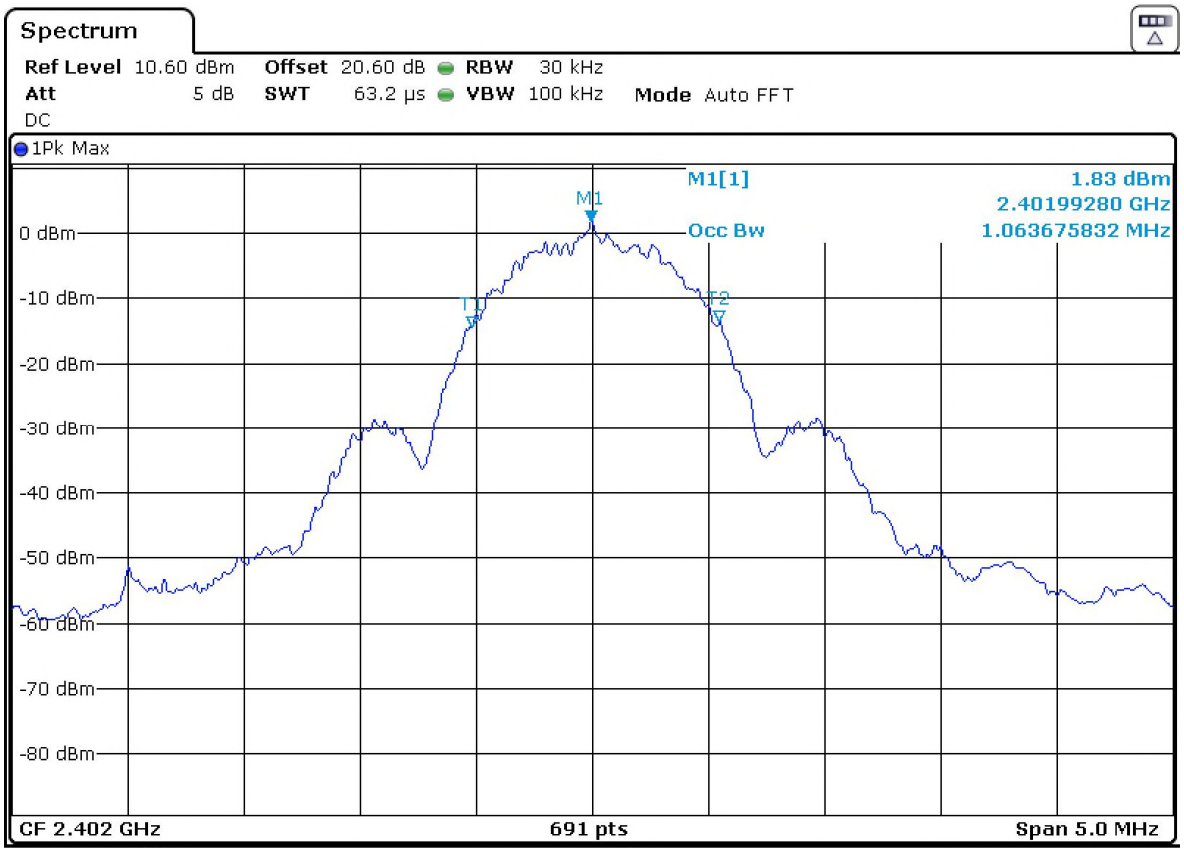
Graphs

The graphs showed below shows the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.

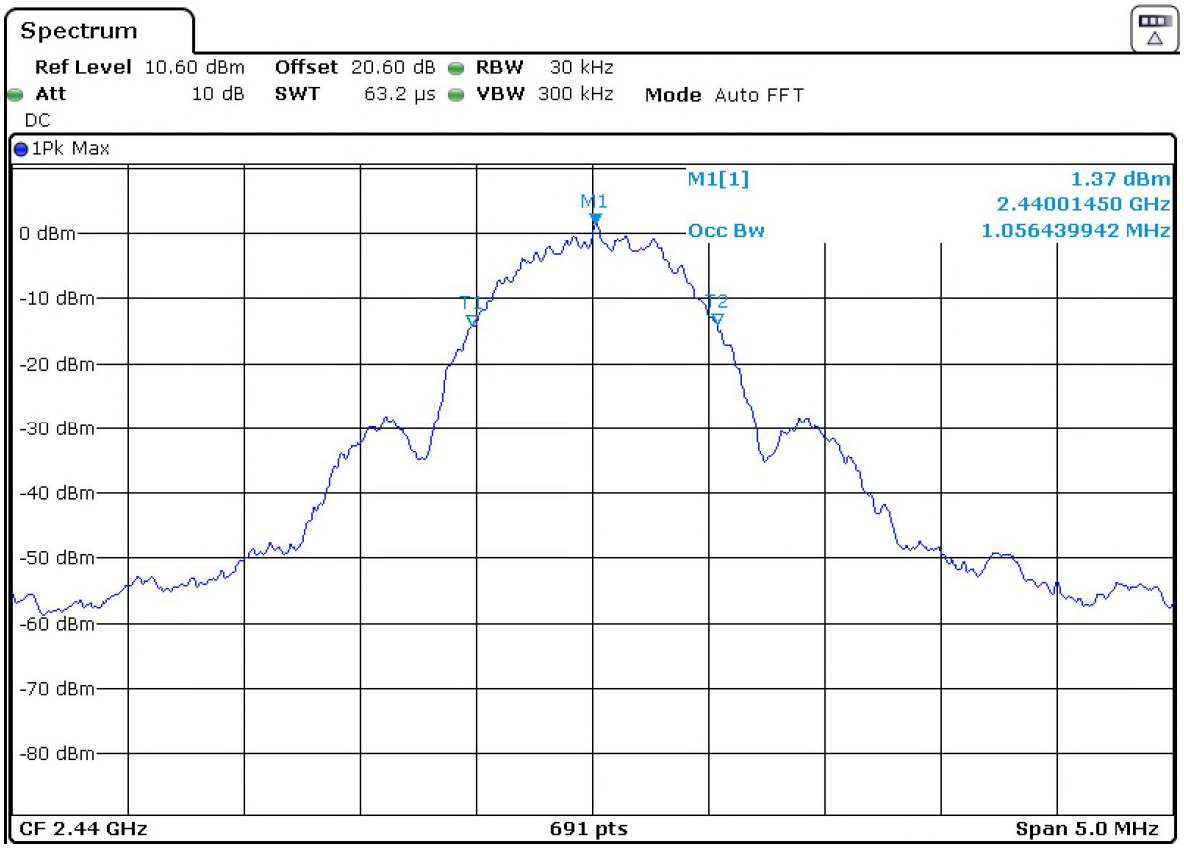
99 % OBW (RFID)



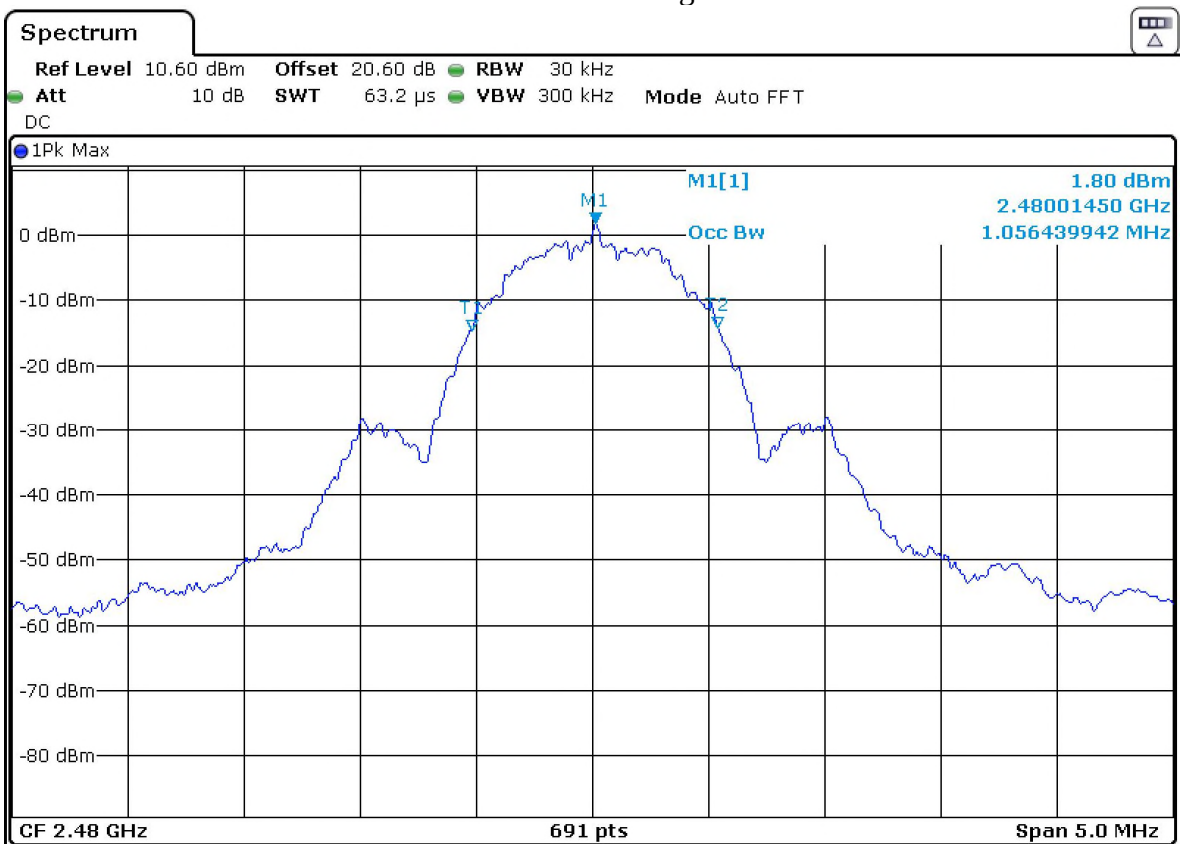
OBW – BLE Low



OBW – BLE Mid



OBW – BLE High



Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan 14, 2022	Jan 14, 2024	SSG013672

Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

Client	
Organization / Address	Dormakaba Canada Inc 7301 Decarie Blvd H4P 2G7, Montreal, Canada
EUT Details	
EUT Name	**Saffire EVO LZ-M**
EUT Model	SAFFIRE EVO LZ
Equipment Category	RFID and Bluetooth™
Basic EUT Functionality	The Saffire EVO LZ-M reads information on the user's RFID keycard data or communicates with the user's Bluetooth phone to determine if access can be granted or not
Input Voltage	4.5V (Battery powered internal – no provisions for external DC source)
Connectors available on EUT	None
Peripherals Required for Test	13.6MHz RFID tag
Release type	Final
Intentional Radiator Frequency	13.6MHz for RFID applications and Bluetooth™
EUT Configuration	Wireless configured to continuously transmit either RFID or Bluetooth™

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT and Test Setup Photos'.

Appendix B – EUT and Test Setup Photos

See the Test Setup exhibit which is separate from this test report for the EUT and Test Setup photos.