EMC & RF Test Report

As per

RSS-247 Issue 2:2017
&
FCC Part 15 Subpart 15.247:2016

Unlicensed Intentional Radiators

on the

ProLon BLE Converter

Issued by: **TÜV SÜD Canada Inc.**
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Name, Project Engineer

Testing produced for

PROLON

See Appendix A for full client & EUT details.

Industry Canada
Registration # 6844B-1

Testing Laboratory
Certificate #2955.02

Registration # 382292

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the **Prolon BLE Converter**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 2:2017

FCC Part 15 Subpart C 15.247:2016

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:	ProLon BLE Converter
FCC Certification #, FCC ID:	2AK9O-485BT20
Industry Canada Certification #, IC:	22455-485BT20
EUT passed all tests performed	Yes
Tests conducted by	Scott Drysdale

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 15.205 RSS-GEN (Table 6)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass See Justification
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-GEN (Table 4)	Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-247 5.2(a)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-247 5.4(d)	Max Output Power	< 1 Watt	Pass
FCC 15.247(b)4 RSS-247 5.4(d)	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-247 5.5	Antenna Conducted Spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-247 5.2(b)	Spectral Density	< 8 dBm (3 kHz BW)	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 (RSS-247 section 5.4(d)), the unit uses a trace antenna with a gain of less than 6 dBi gain. Based on a theoretical output power of 8 dBm and a received signal of 90 dBuV/m at 3 meters, the calculated antenna gain is approximately -13.2 dBi.

Antenna spurious was not performed as the device employed a trace antenna with no provisions for an external connection.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5 MHz.

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it. However the 15.247 (d) requirement of power density were met and are detailed later in this test report.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the X-axis. Worst case results are presented. See Appendix B for axis details.

The maximum effective isotropic radiated power of the EUT is -5.2 dBm, or 0.3 mW, which is less than the SAR Test Exclusion Power Threshold for 5 mm given in FCC KDB 447498 and also the exclusion criteria at 5 mm in ISED RSS-102. Therefore the device meets the SAR Test Exclusion criteria and no test is required.

Sample Calculation(s)

Radiated Emission Test

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

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)
Margin = 73.0dBµV – (50dBµV + 10dB + 2.5dB + 0.5dB)
Margin = 10.0 dB (pass)

Applicable Standards, Specifications and Methods

ANSI C63.4:2014	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	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2016	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
CISPR 22:2008	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
FCC KDB 558074: 2016	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
ICES-003 Issue 6 2016	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 4 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 2:2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

Document Revision Status

Revision 000 - March 19, 2017
Initial Release

Revision 001 – April 13, 2017
Change of FCC ID as typo error had occurred.

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 6 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 in Montréal, Québec, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is 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. Radiated emission measurements are performed using a BiLog 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 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 382292) and Industry Canada (IC, 6844B-1). 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, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc. is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual 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)
Feb 20-21, 2017	Radiated Emissions	SD	20 – 24	40 – 51	98.0 – 102.0
Feb 20-21, 2017	Antenna Conducted Emissions	SD	20 – 24	40 – 51	98.0 – 102.0
Feb 20-21, 2017	Power Line Conducted Emissions	SD	20 – 24	40 – 51	98.0 – 102.0

Detailed Test Results Section

6dB Bandwidth of Digitally Modulated Systems

Purpose

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps 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 15.247(a)2 and RSS-247.

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. This should be measured with a 100 kHz RBW and a 300 kHz VBW.

The method is given in Section 8.1 of FCC KDB 558074 and ANSI C63.10.

Results

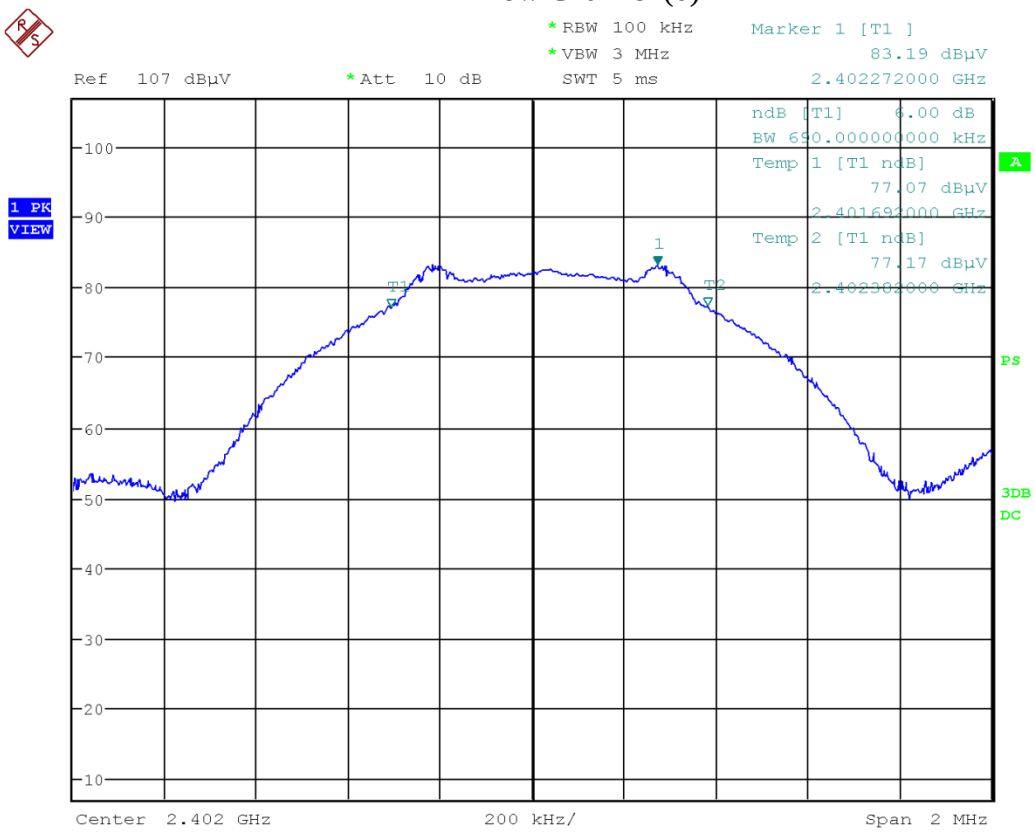
The EUT passed. The minimum 6 dB BW measured was 664 kHz and the maximum 99% BW at full power setting was 1064 kHz.

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low Channel (0)	2402	690	1052
Mid Channel (19)	2440	668	1052
High Channel (39)	2480	664	1064

Graphs

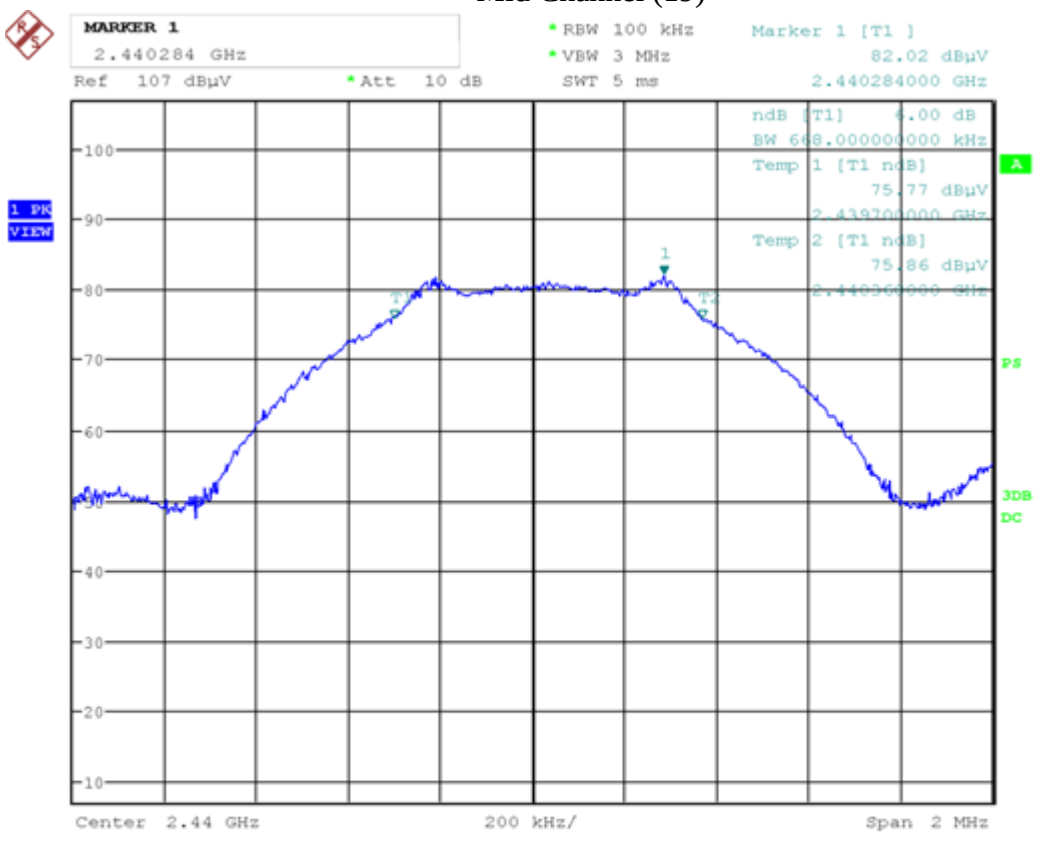
The graphs showed below show the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.

6 dB Bandwidth
Low Channel (0)



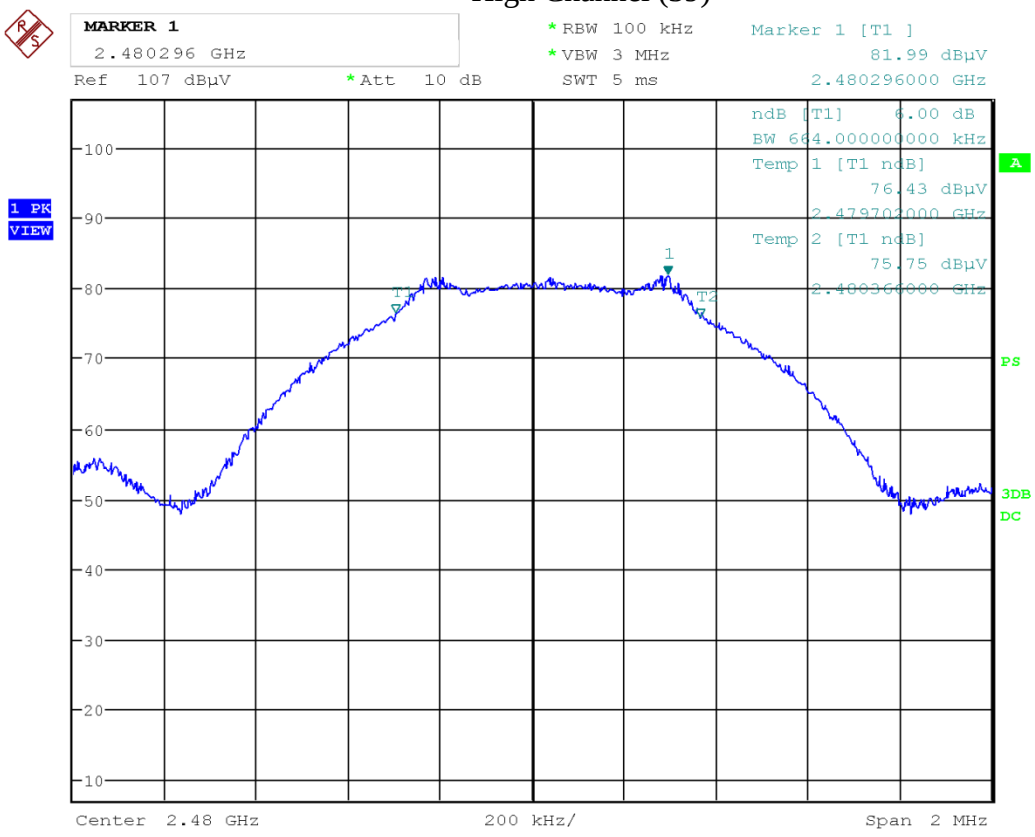
Date: 20.FEB.2017 12:24:34

6 dB Bandwidth
Mid Channel (19)



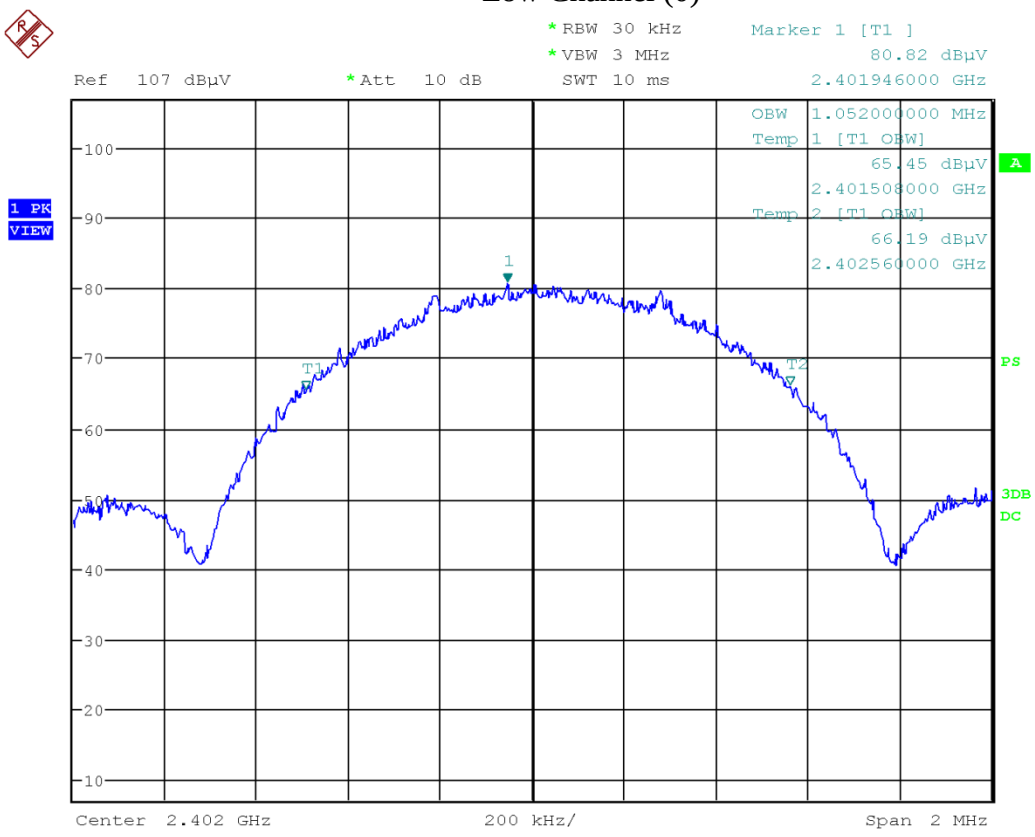
Date: 20.FEB.2017 12:43:31

6 dB Bandwidth
High Channel (39)



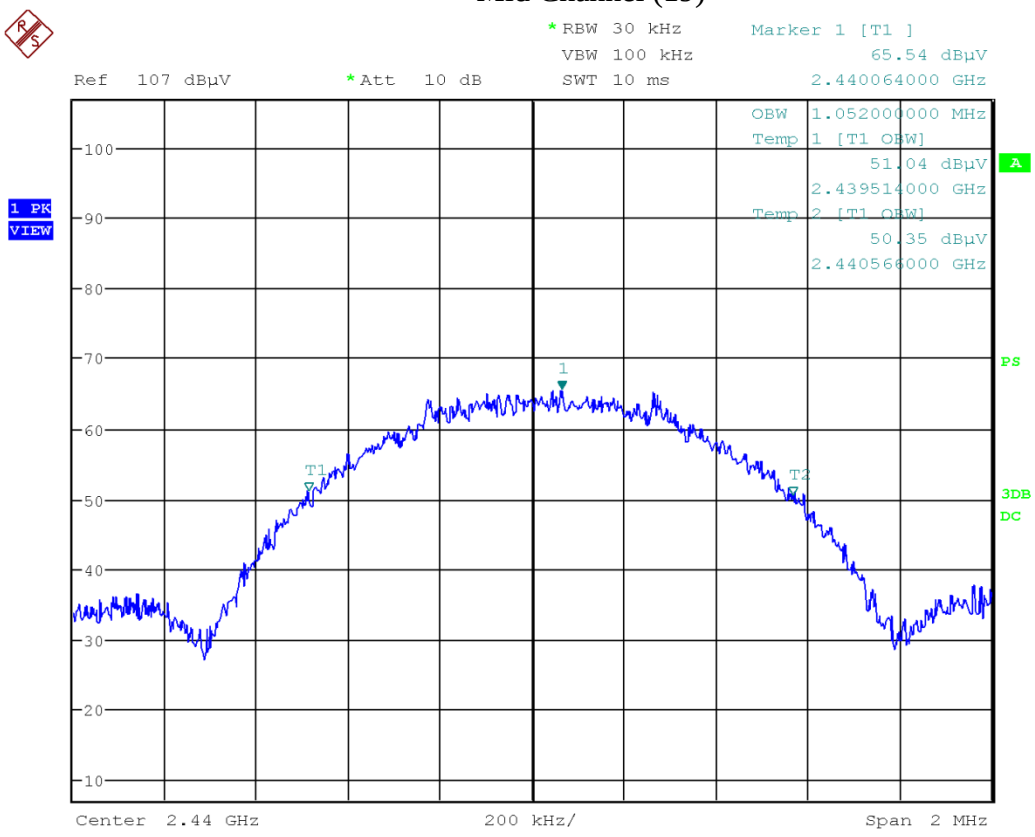
Date: 20.FEB.2017 12:53:29

99% Bandwidth
Low Channel (0)



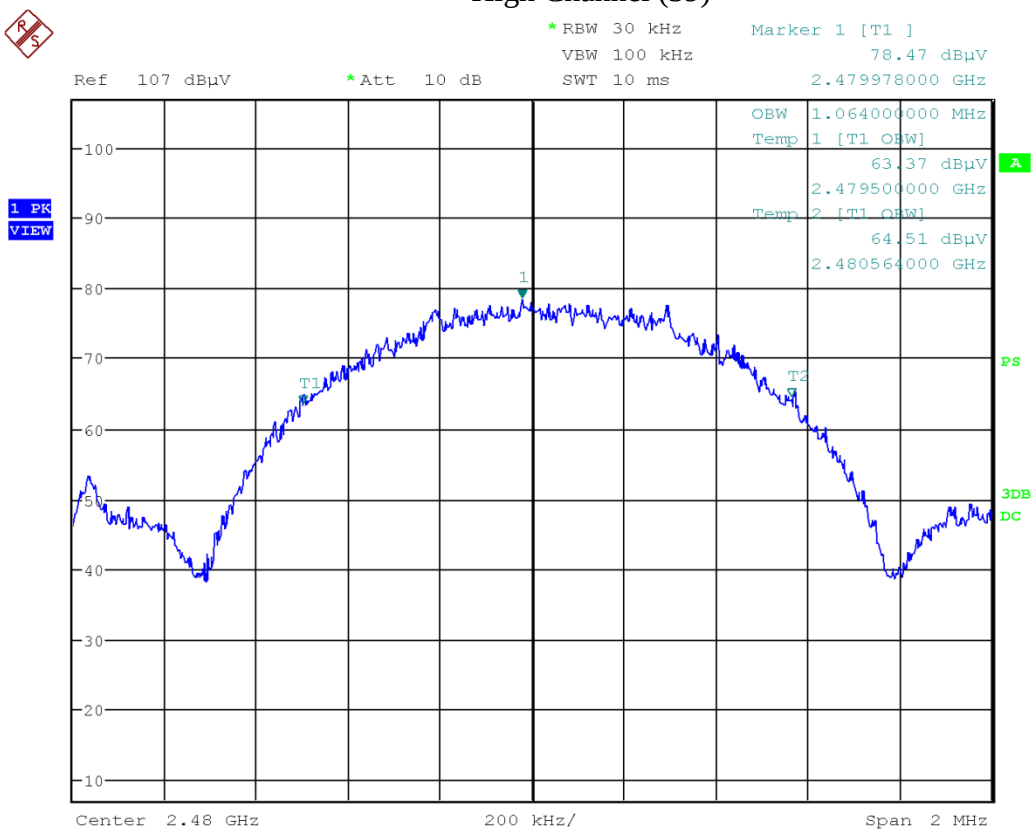
Date: 20.FEB.2017 12:23:37

99% Bandwidth
Mid Channel (19)



Date: 20.FEB.2017 13:04:12

99% Bandwidth
High Channel (39)



Date: 20.FEB.2017 12:54:41

Note: See ‘Appendix B – EUT & Test Setup Photos’ for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	1/28/16	1/28/2018	4092

Maximum Peak Envelope Conducted Power

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.

Limits and Method

The limits are defined in FCC Part 15.247(b) and RSS-247.
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt (30 dBm).

The method is given in Section 9.1.2 of FCC KDB 558074 and ANSI C63.10 Section 11.

Results

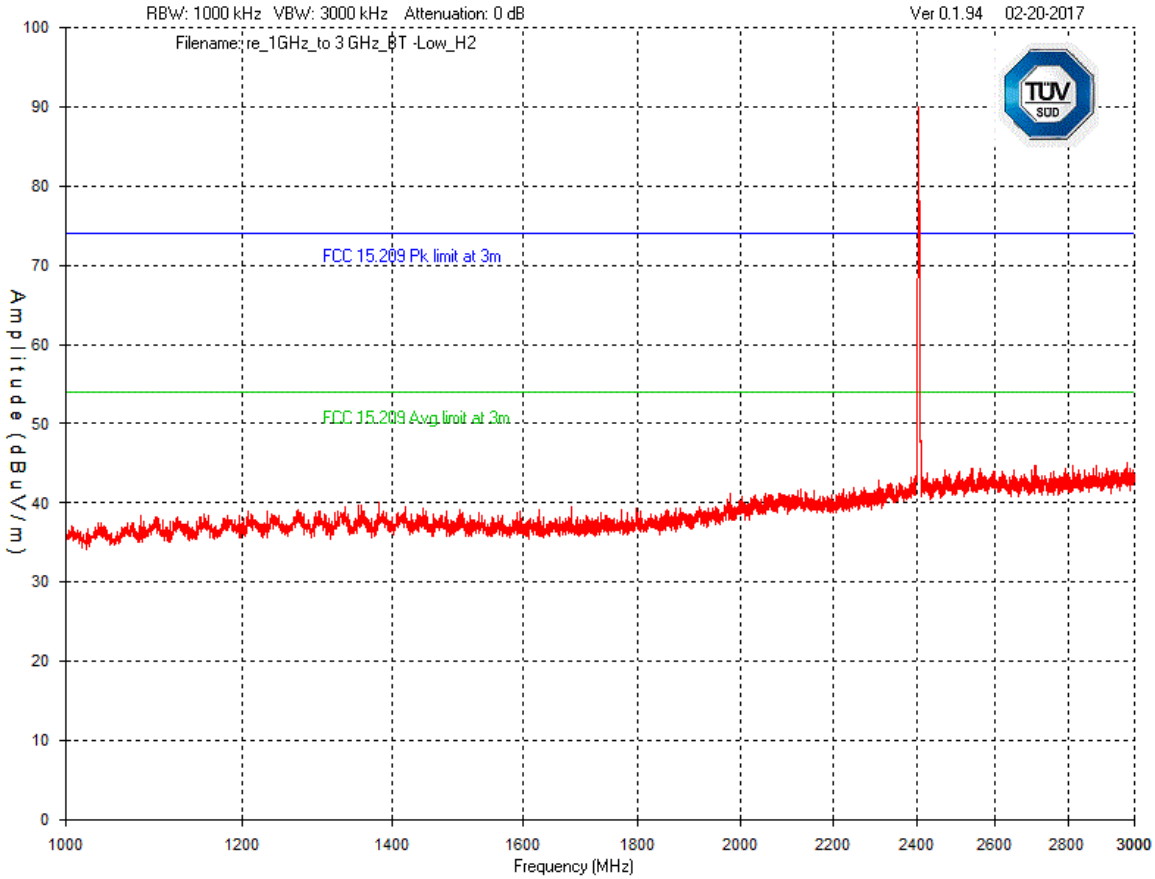
The EUT passed. The EUT was set to transmit at maximum power. Three channels were measured. Radiated measurements were obtained with a RBW greater than the occupied bandwidth and converted to Peak power The following table show the peak power:

Channel	Frequency (MHz)	Peak Power dBm	Peak Power (mW)
Low Channel (0)	2402	-5.2	0.32
Mid Channel (19)	2440	-6.6	0.22
High Channel (39)	2480	-8.2	0.15

Graphs

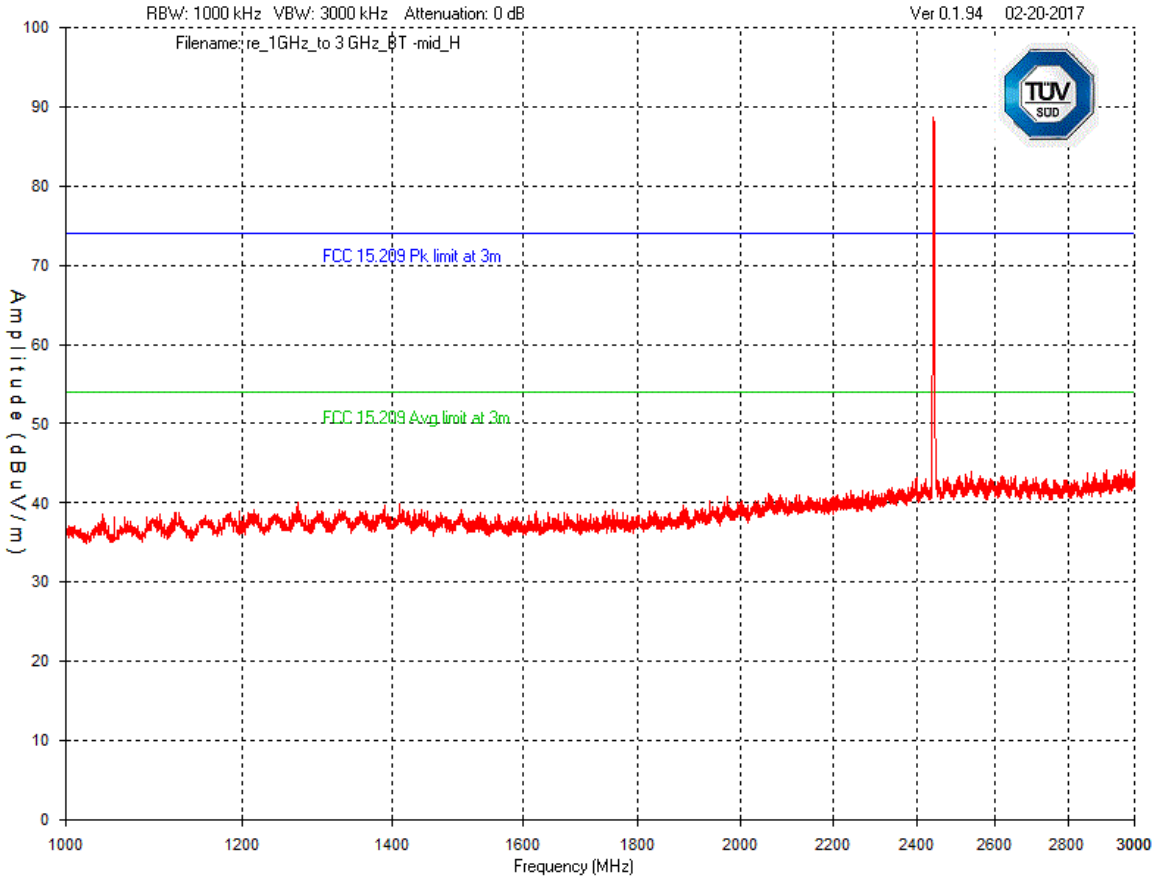
The plots shown below show the peak power output of the device during the antenna radiated measurements during transmit operation of the EUT.

Peak Power, Low Channel (0)



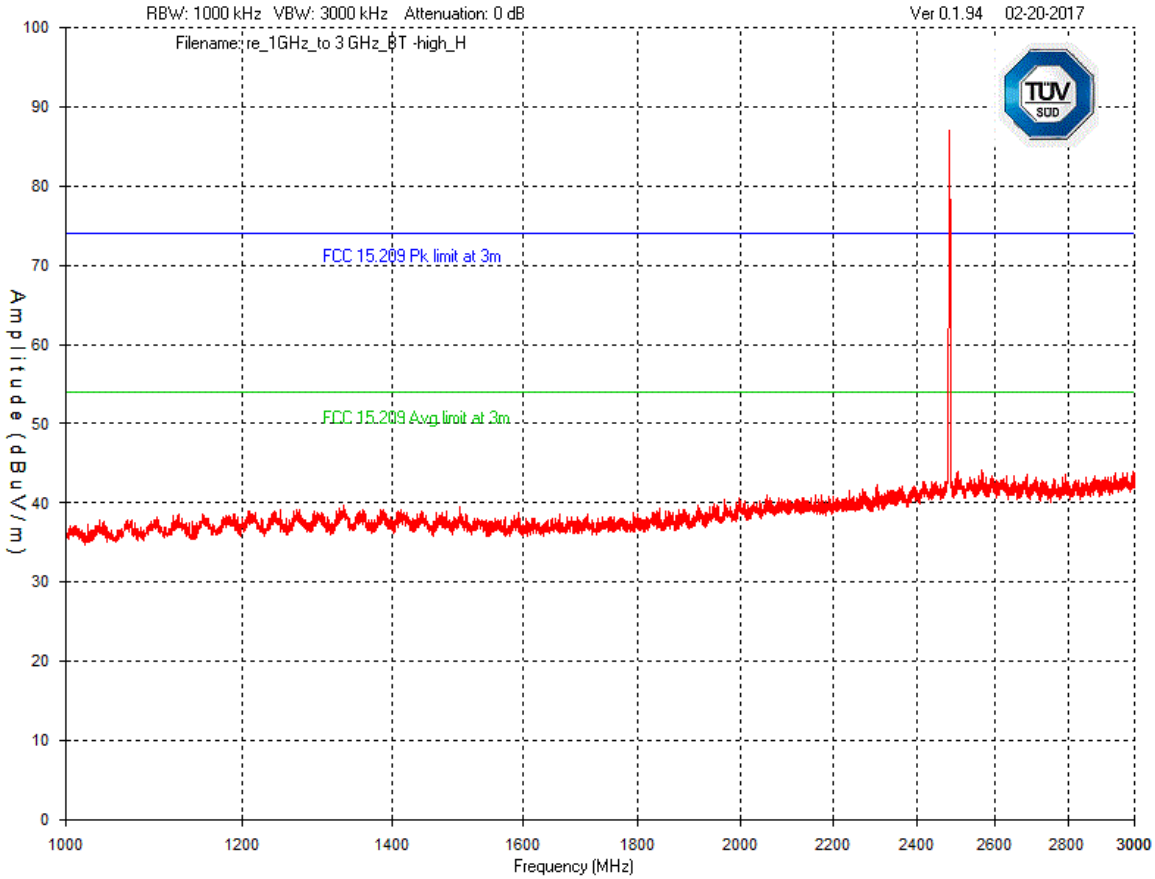
Note: Plot shown with 1 MHz resolution. 99% OBW was 1.06 MHz, however the final reading was obtained with a RBW of 3 MHz.

Peak Power, Mid Channel (19)



Note: Plot shown with 1 MHz resolution. 99% OBW was 1.06 MHz, however the final reading was obtained with a RBW of 3 MHz.

Peak Power, Hi Channel (39)



Note: Plot shown with 1 MHz resolution. 99% OBW was 1.06 MHz, however the final reading was obtained with a RBW of 3 MHz.

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	1/28/16	1/28/2018	4092

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

The limits, as defined in 15.247(d) for unintentional radiated emissions, 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).

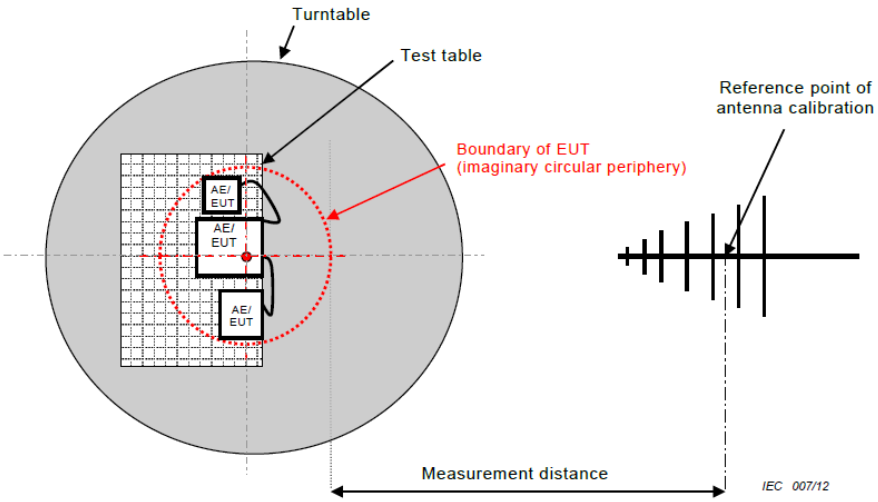
All unintentional emissions must also meet the 'Spurious Conducted Emissions' requirements of -20 dBc or greater. See also 'Antenna Spurious Conducted Emissions (-20dBc)' for further details.

Frequency	Limit
0.009 MHz – 0.490 MHz	2400/F(kHz) uV/m at 300m[1]
0.490 MHz – 1.705 MHz	24000/F(kHz) uV/m at 30m[1]
1.705 MHz – 30 MHz	30 uV/m at 30m[1]
30 MHz – 88 MHz	100 uV/m (40.0 dBuV/m[1]) at 3m
88 MHz – 216 MHz	150 uV/m (43.5 dBuV/m[1]) at 3m
216 MHz – 960 MHz	200 uV/m (46.0 dBuV/m[1]) at 3m
Above 960 MHz	500 uV/m (54.0 dBuV/m[1]) at 3m
Above 1000 MHz	500 uV/m (54 dBuV/m[2]) at 3m
Above 1000 MHz	500 uV/m (74 dBuV/m[3]) at 3m

[1]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1
[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 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.

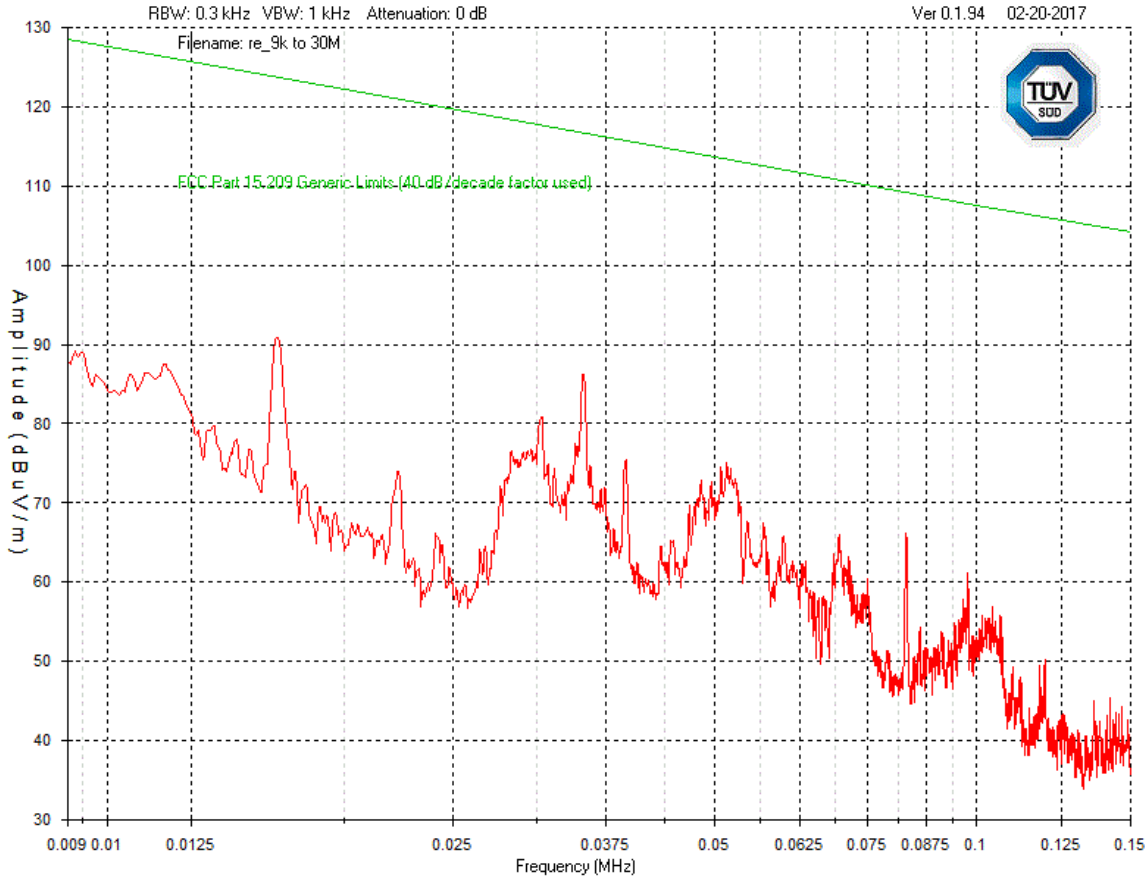
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of 24.835 GHz).

Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

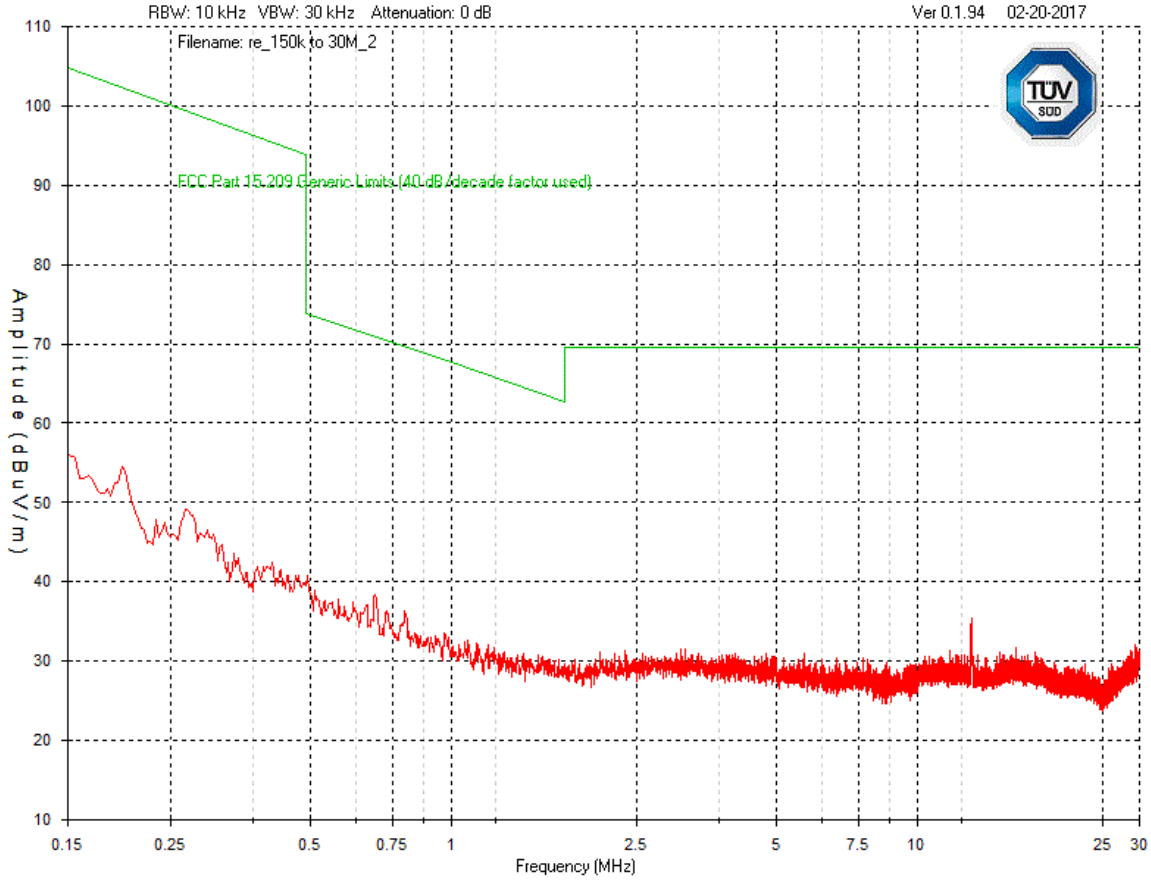
Low, middle and high channels, each in three orthogonal axis were checked. However, the worst case graphs are presented.

Band-edge measurement graphs are shown for illustration purposes. See final measurement section for all measurements.

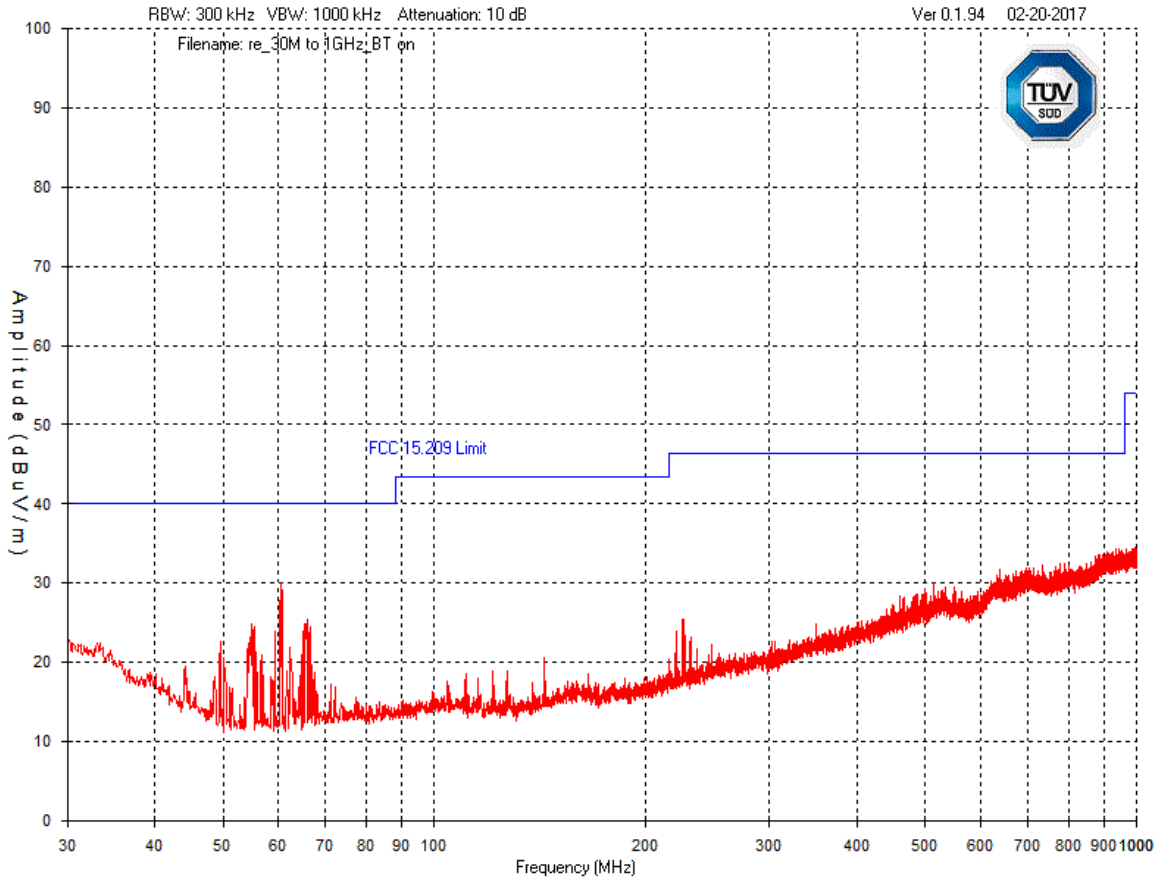
Mid Channel
9 kHz – 150 kHz
Peak Emission Graph



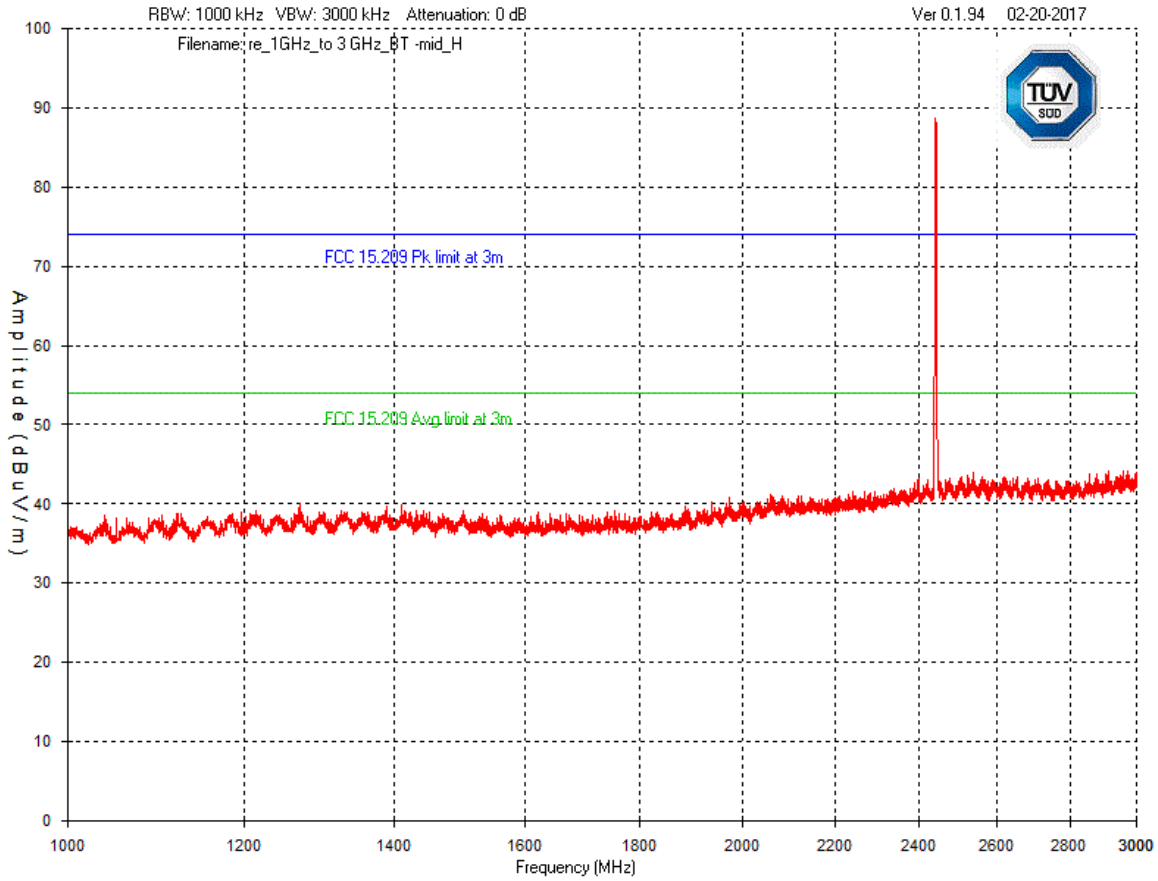
Mid Channel
150 kHz – 30 MHz
Peak Emission Graph



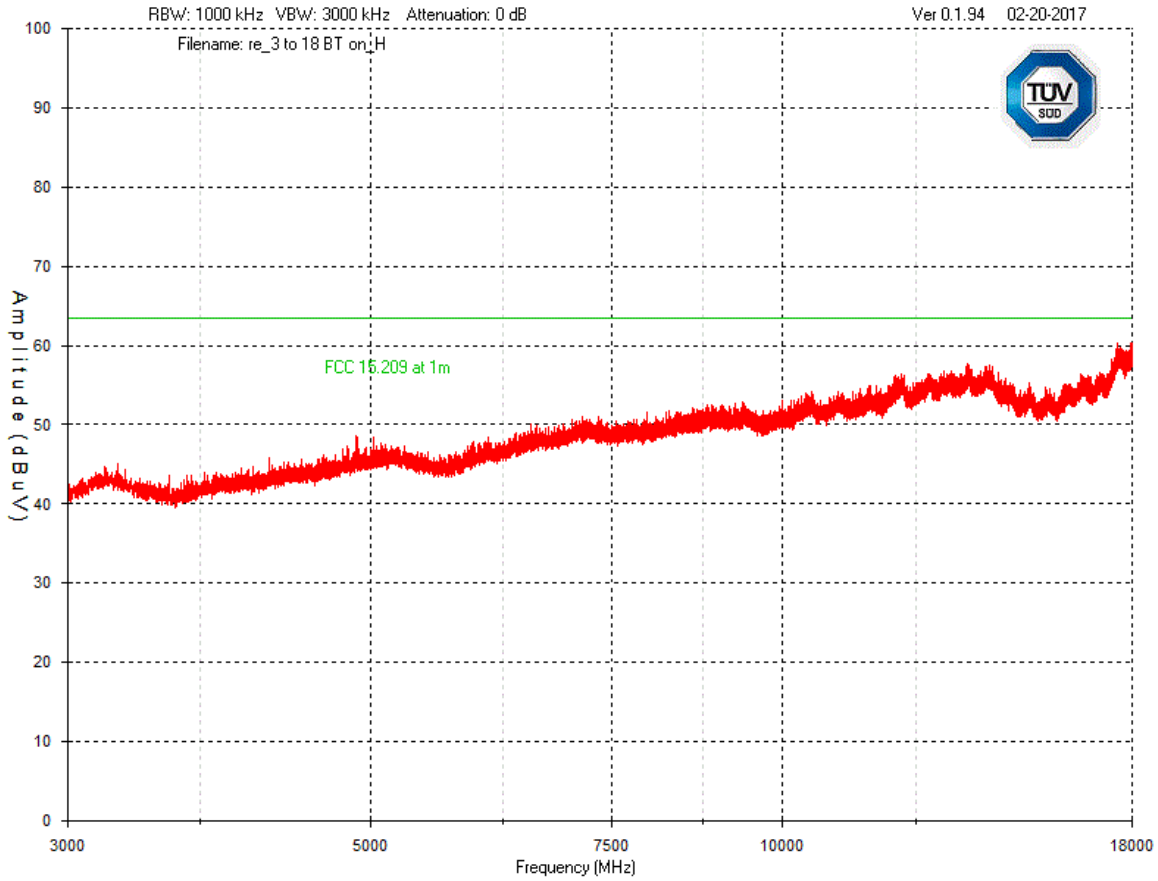
Mid Channel – 30 MHz – 1 GHz
Horizontal - Peak Emission Graph



Mid Channel – 1 GHz – 3 GHz
Horizontal - Peak Emission Graph

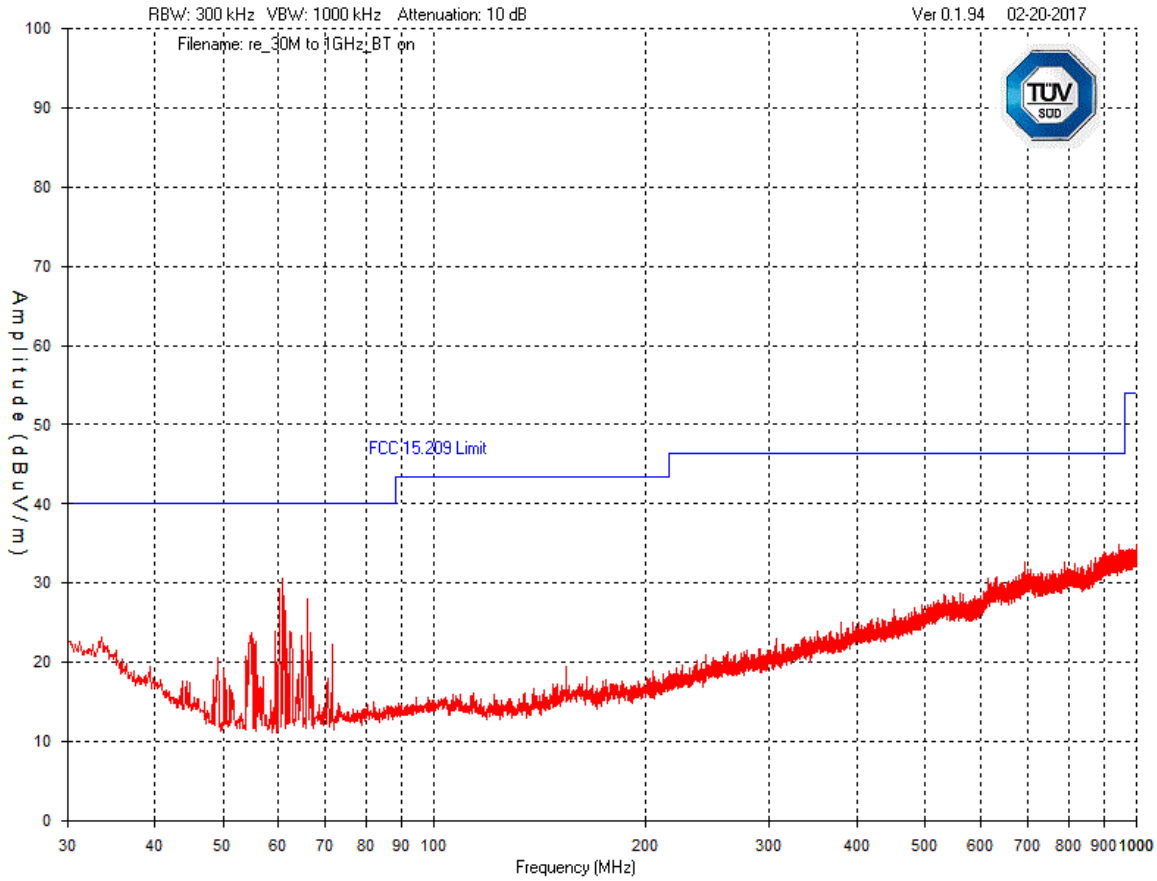


Mid Channel – 3 GHz – 18 GHz
Horizontal - Peak Emission Graph

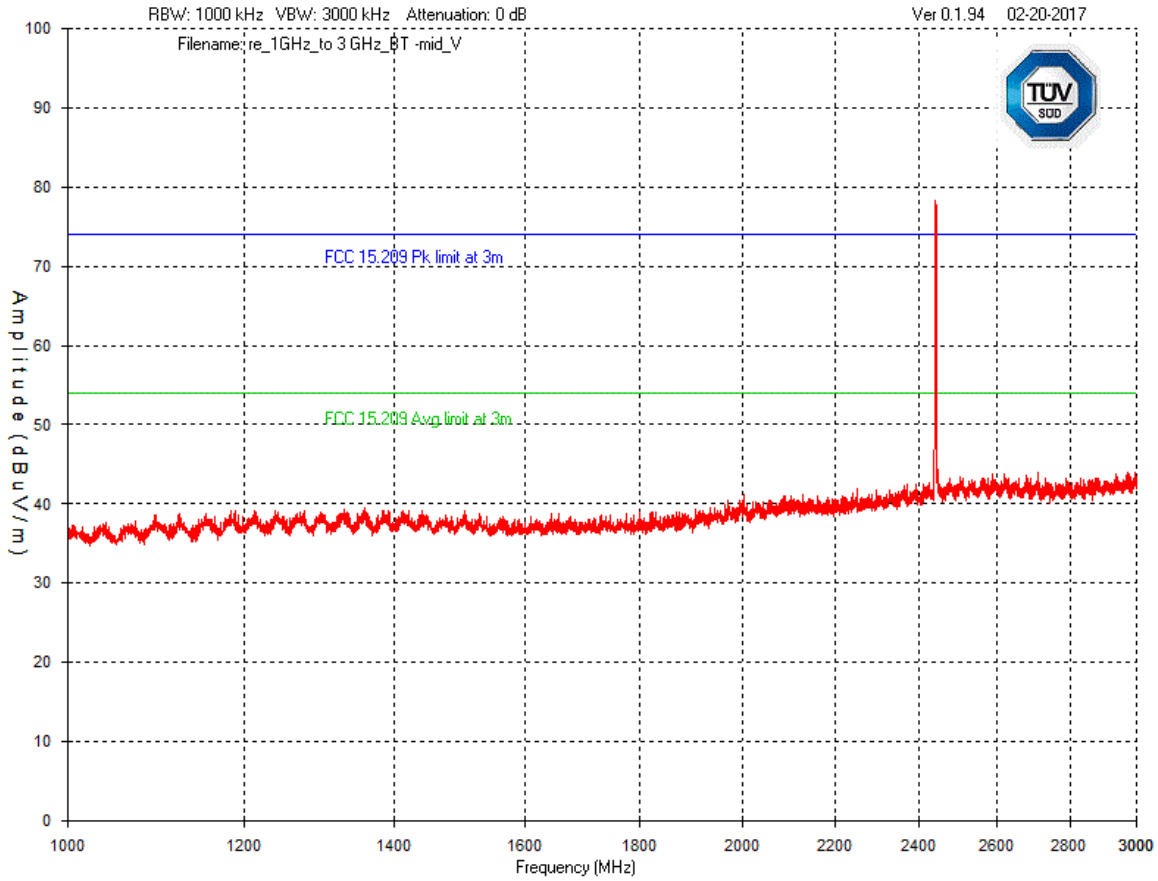


Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range. Emissions were scanned to 25 GHz. No emissions were found above 18 GHz and the noise floor of the measurement was below the applicable limit.

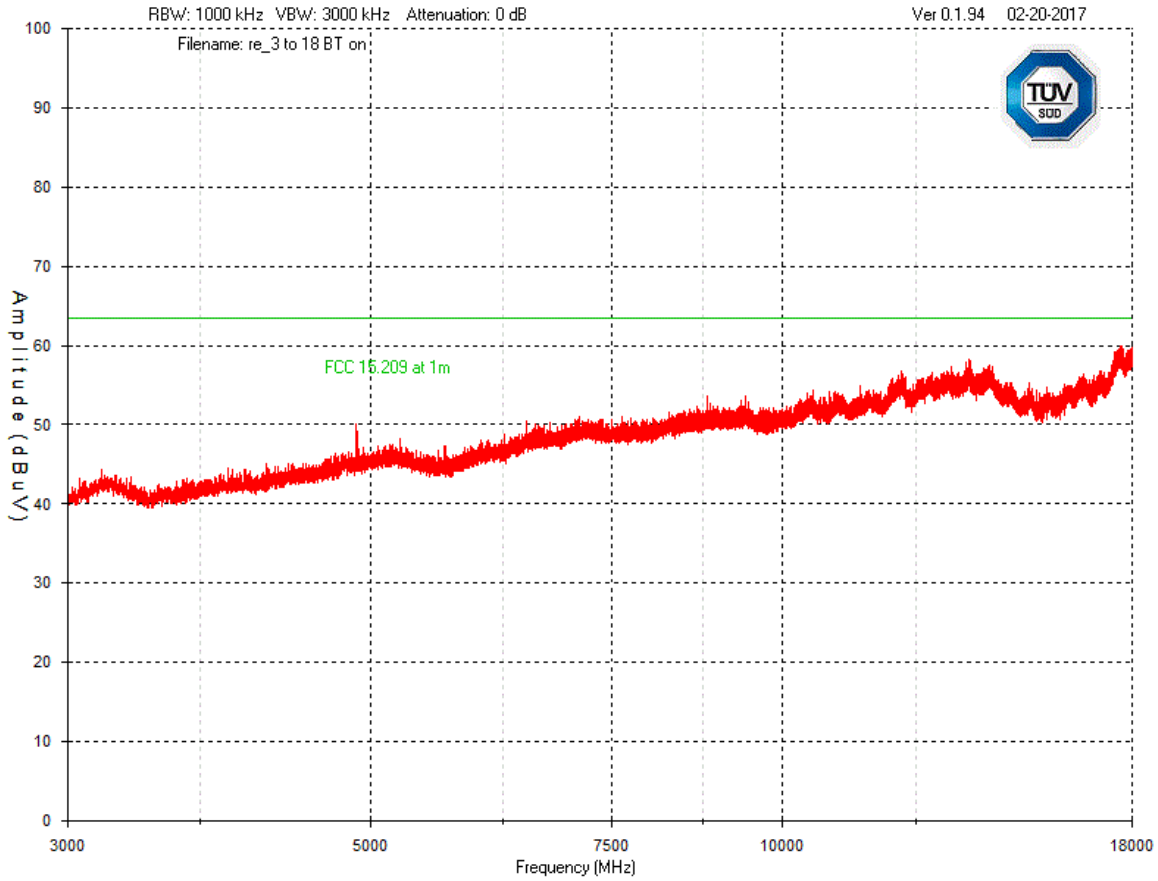
Mid Channel – 30 MHz – 1 GHz
Vertical - Peak Emission Graph



Mid Channel – 1 GHz – 3 GHz
Vertical - Peak Emission Graph

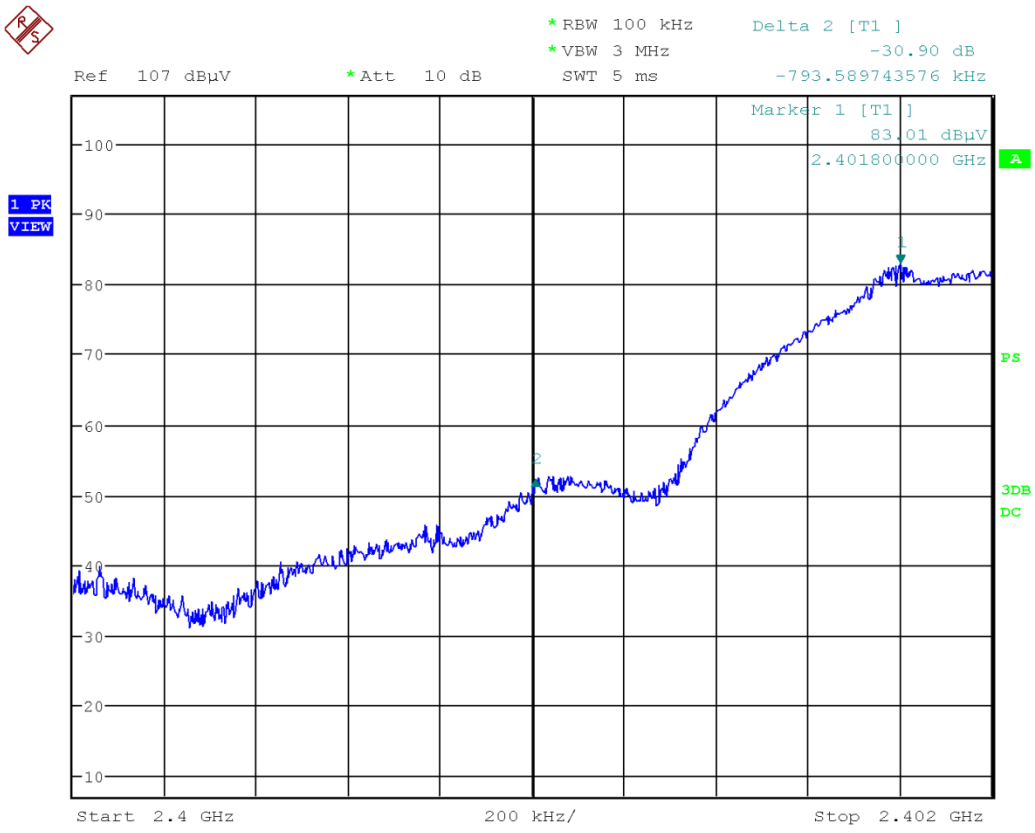


Mid Channel – 3 GHz – 18 GHz
Vertical - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range. Emissions were scanned to 25 GHz. No emissions were found above 18 GHz and the noise floor of the measurement was below the applicable limit.

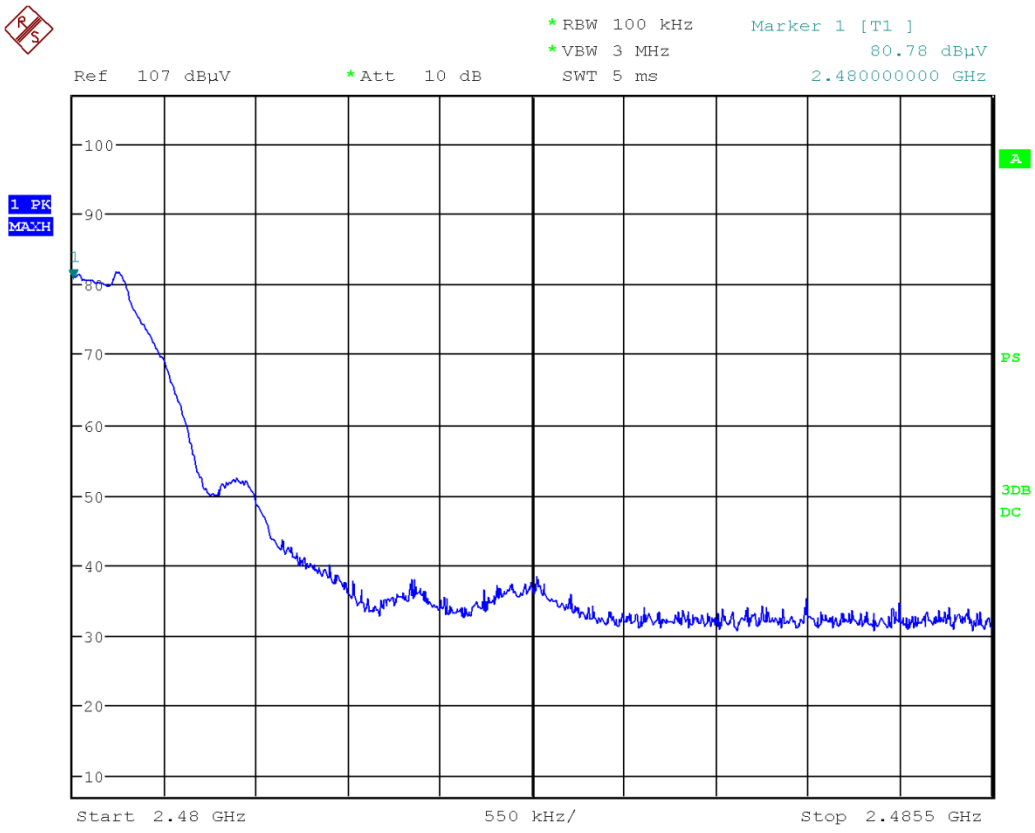
Band Edge – Low Channel (0)
Horizontal - Peak Emission



Date: 20.FEB.2017 12:19:46

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Band Edge – Hi Channel (39)
Horizontal - Peak Emission



Date: 20.FEB.2017 12:52:46

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Final Measurements and Results

The EUT passed. Low, middle, and high bands were measured.

In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205 need to be verified with a final detector. Emissions inside the restricted bands were measured for informational purposes.

The measurements were maximized by rotating the turn table over a full 0-360 rotation and the antenna height was varied from 1 m to 4 m.

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Preselector	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Low Channel											
2402	Peak	Horz	77.0	30.6	5.2	10.0	33.0	89.8			PASS
2402	PEAK 3	Horz	77.2	30.6	5.2	10.0	33.0	90.0			PASS
2402	Peak	Vert	66.3	30.6	5.2	10.0	33.0	79.1			PASS
2402	PEAK 3	Vert	66.6	30.6	5.2	10.0	33.0	79.4			PASS
2400	Peak	Horz	46.2	30.6	5.2	10.0	33.0	59.0	74.0	15.0	PASS
2400	Avg	Horz	39.2	30.6	5.2	10.0	33.0	52.0	54.0	2.0	PASS
2400	Peak	Vert	35.1	30.6	5.2	10.0	33.0	47.9	74.0	26.1	PASS
2400	Avg	Vert	28.7	30.6	5.2	10.0	33.0	41.5	54.0	12.5	PASS
Mid channel											
2445	Peak	Horz	75.4	30.6	5.2	10.0	33.0	88.2			PASS
2445	Peak	Vert	65.1	30.6	5.2	10.0	33.0	77.9			PASS
High channel											
2480	Peak	Horz	74.0	30.6	5.2	10.0	33.0	86.8			PASS
2480	Peak	Vert	63.1	30.6	5.2	10.0	33.0	75.9			PASS
2483.5	Peak	Horz	35.1	30.6	5.2	10.0	33.0	47.9	54.0	6.1	PASS
2483.5	Peak	Vert	30.0	30.6	5.2	10.0	33.0	42.8	54.0	11.2	PASS

Note: Peak 3 is a measurement performed with a 3 MHz RBW for information purposes. Where the peak limit has met the average limit, the product was determined to comply with the requirements.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	1/28/16	1/28/2018	4092
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb 12, 2016	Feb 12, 2018	GEMC 6375
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Oct 12, 2016	Oct 12, 2018	GEMC 6351
Horn Antenna 18 – 26.5 GHz	SAS-572	A.H. Systems	Oct 11, 2016	Oct 11, 2018	GEMC 6371
Loop Antenna	EM 6871	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 71
BiLog Antenna	3142-C	ETS	Oct 5, 2016	Oct 5, 2018	GEMC 8
4GHZ-12GHz High Pass Filter	11SH10-4000/T12000-0/0	K & L Microwave	Apr 9, 2016	Apr 9, 2017	GEMC 119
2.4GHz-2.5GHz Notch Filter	BRM50702	Micro-Tronics	July 11, 2016	July 11, 2017	GEMC 230
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb 1, 2017	Feb 1, 2018	GEMC 4025
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb 1, 2017	Feb 1, 2018	GEMC 4026
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	Feb 1, 2017	Feb 1, 2018	GEMC 4029
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

FCC - 15.209 -Radiated Emissions_Rev1

Power Spectral Density

Purpose

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

Limits and Method

The limits are defined in 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The method is given in Section 10.2 of FCC KDB 558074.

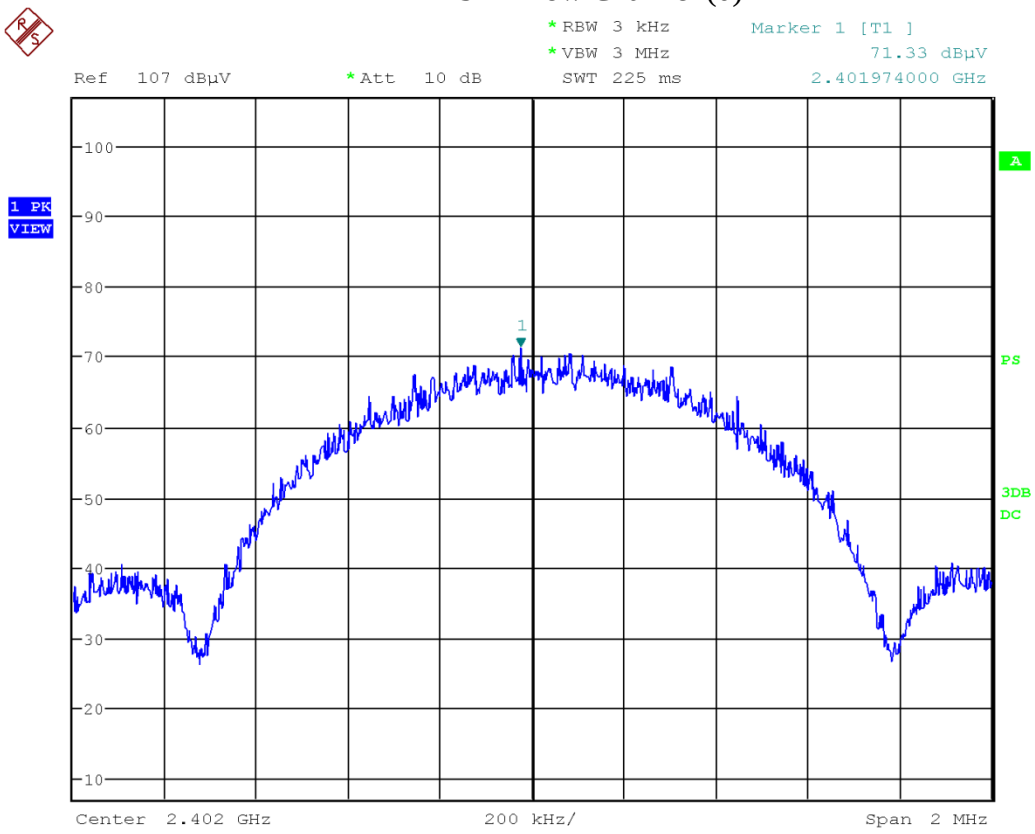
Results

The EUT passed. Low, medium, and high bands were tested. The worst case value is -15.2 dBm as measured with a 3 kHz resolution bandwidth (peak power).

Graphs

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated in each mode, with the worst case being presented. The external attenuator and cable loss are not accounted for as reference offset in the spectrum analyzer, however this is 20.5 dB additional to the reading.

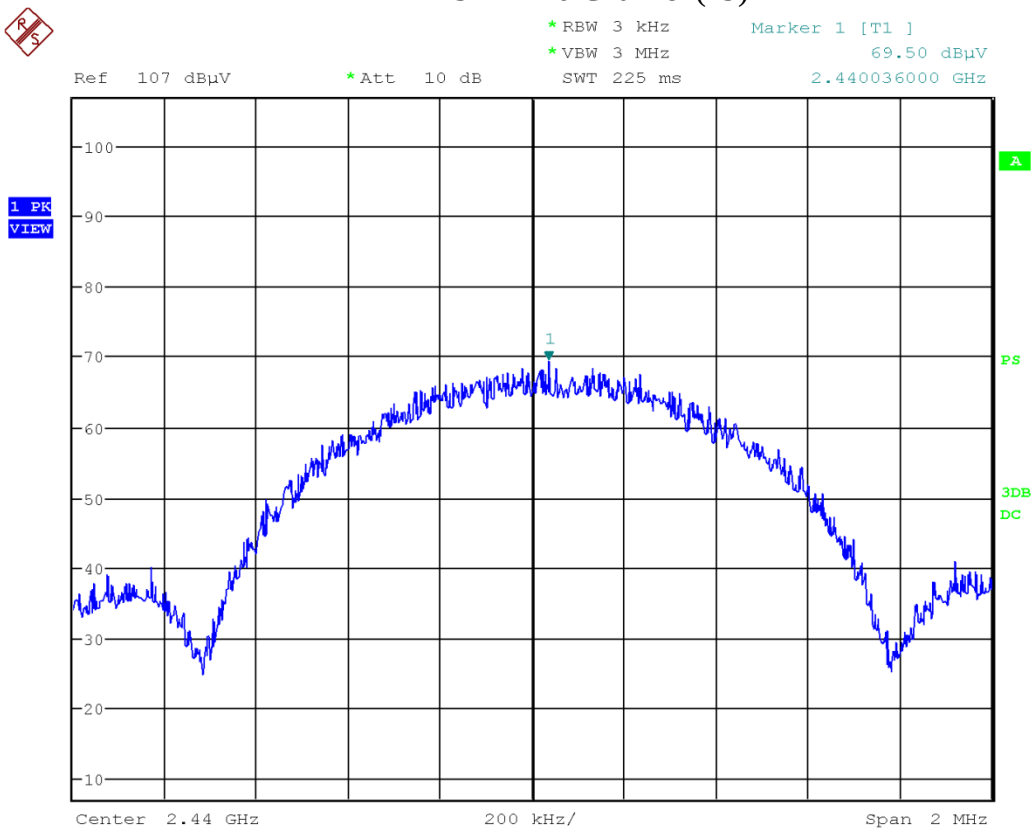
PSD - Low Channel (0)



Date: 20.FEB.2017 12:20:46

Note: 71.3 dBuV – 107 = -35.7 dBm
-35.7 dBm + 20.5 atten = -15.2 dBm

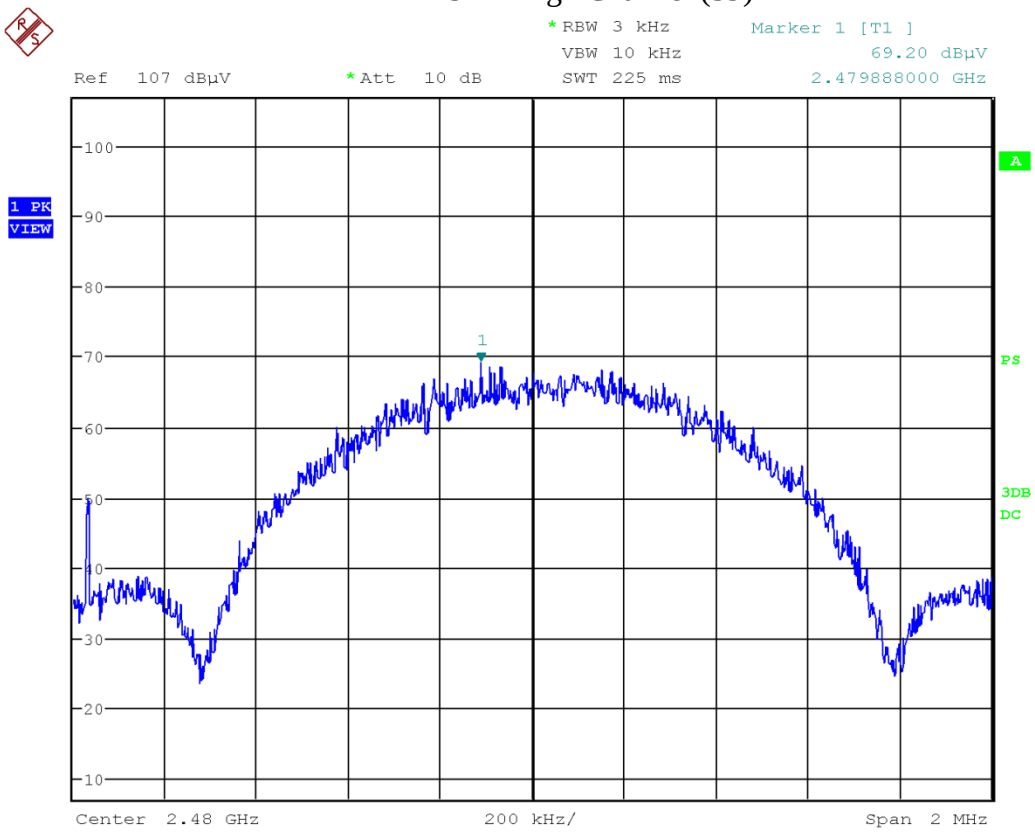
PSD - Mid Channel (19)



Date: 20.FEB.2017 12:44:15

Note: 69.5 dBuV – 107 = -37.5 dBm
-35.7 dBm + 20.5 atten = -15.2 dBm

PSD - High Channel (39)



Date: 20.FEB.2017 12:55:35

Note: 69.2 dBuV – 107 = -37.8 dBm
-37.8 dBm + 20.5 atten = -17.3 dBm

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	1/28/16	1/28/2018	4092

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits and Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207
Method is as defined in ANSI C63.4

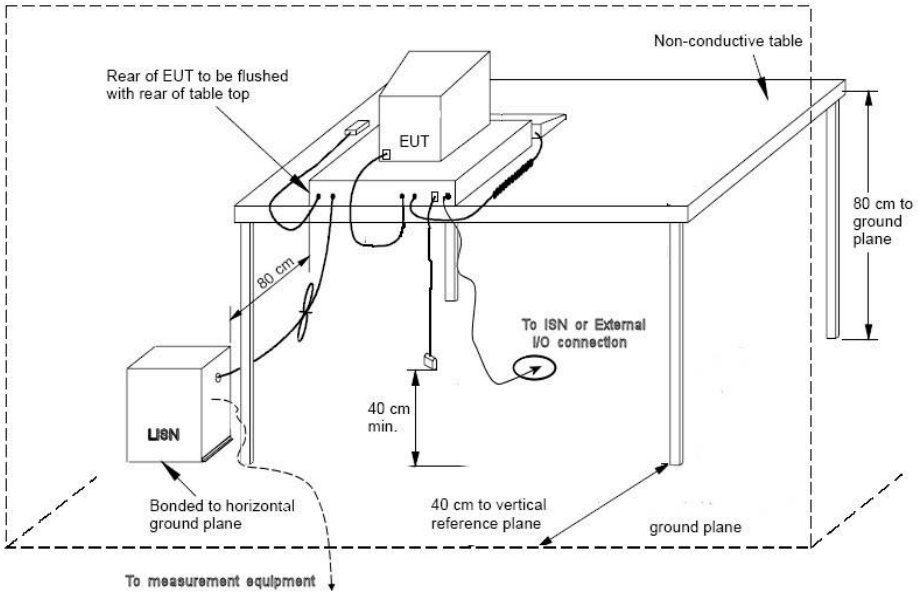
Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* dBµV	150 kHz – 500 kHz	66 to 56* dBµV
500 kHz – 5 MHz	46 dBµV	500 kHz – 5 MHz	56 dBµV
5 MHz – 30 MHz	50 dBµV	5 MHz – 30 MHz	60 dBµV

* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

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

Typical Setup Diagram



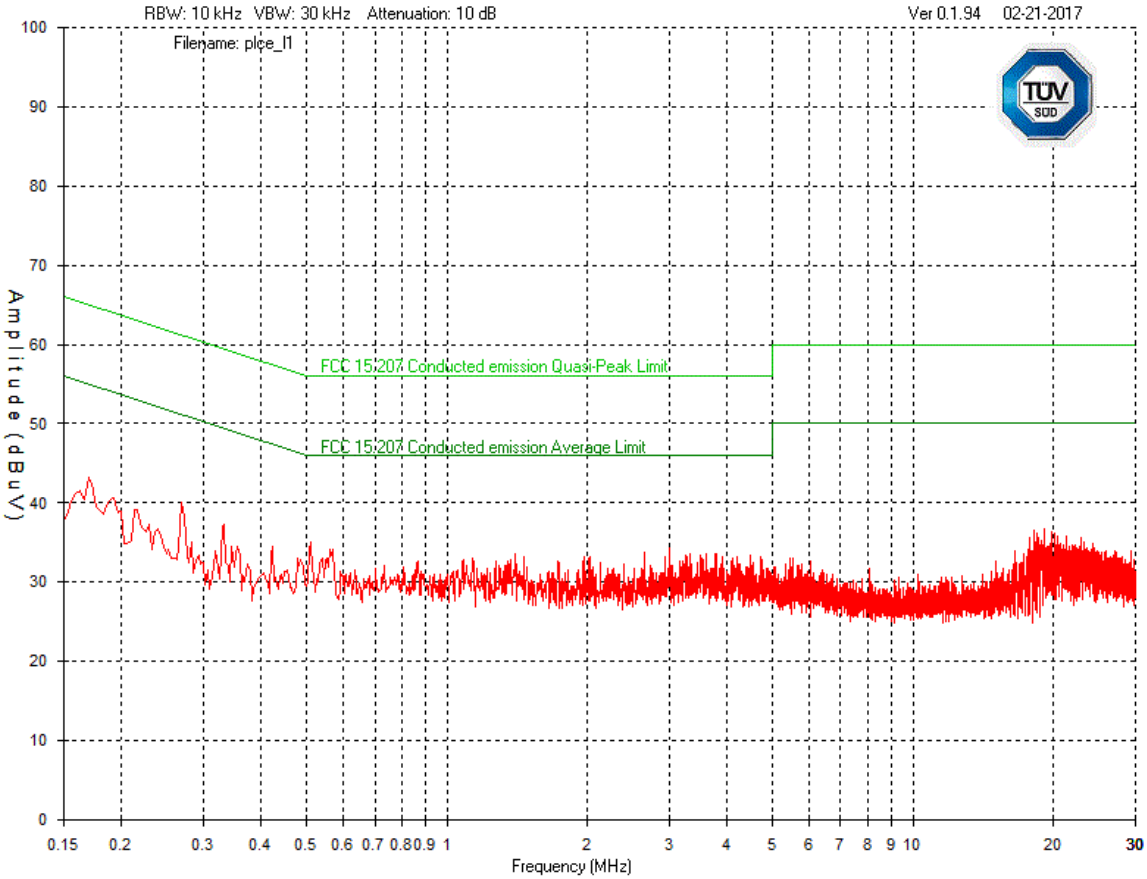
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.91dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

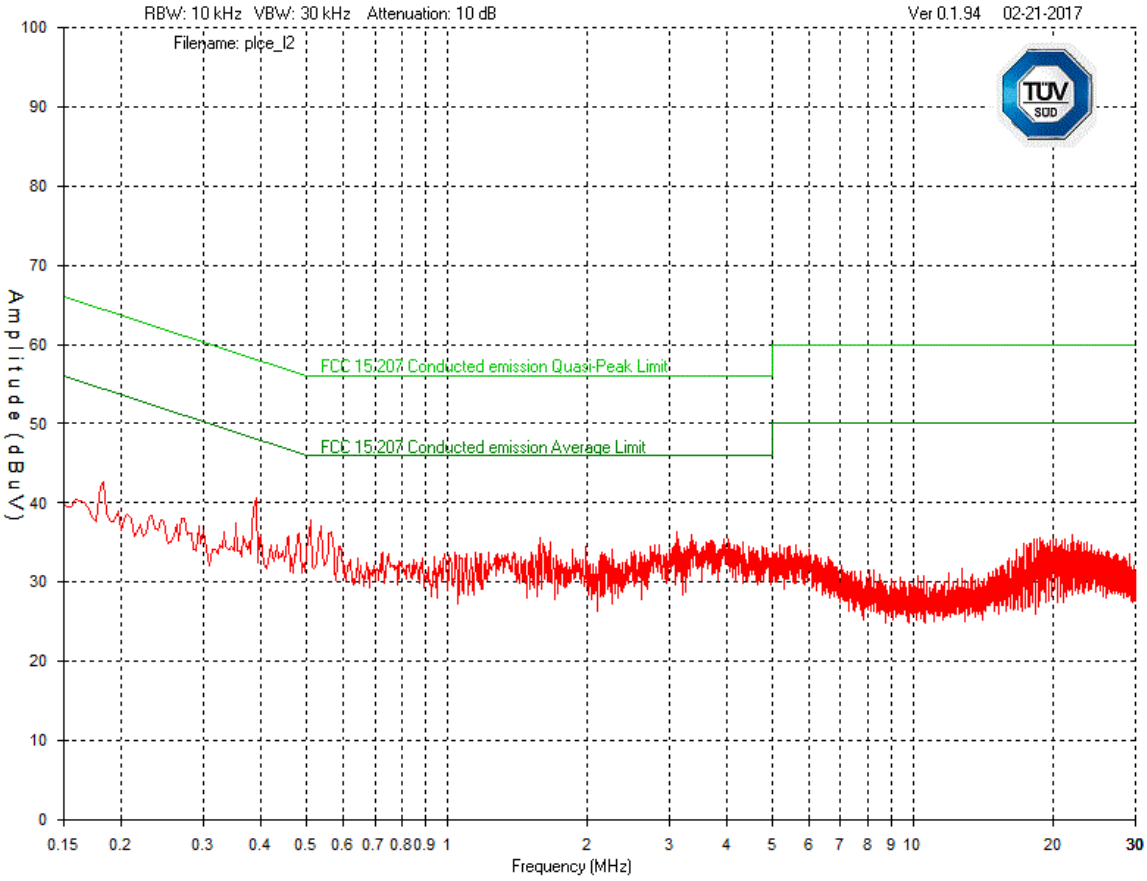
The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements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

Line 1 (L1) – 120Vac 60Hz



Note: No peak emissions exceeded the average limits as shown above.

Line 2 (L2) – 120Vac 60Hz



Note: No peak emissions exceeded the average limits as shown above.

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	1/28/16	1/28/2018	4092
LISN	FCC-LISN-50/250-16-2-01	FCC	Feb. 1, 2017	Feb. 1, 2019	GEMC 65
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb 1, 2017	Feb 1, 2018	GEMC 4025
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb 1, 2017	Feb 1, 2018	GEMC 4026
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

FCC_ICES003_CE_Rev1

Appendix A – EUT Summary

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

General EUT Description

Client	
Organization / Address	ProLonme
Contact	Brian Galardo
Phone	450-973-5100
Email	brian.galardo@prolon.net
EUT Details	
EUT Name	Prolon BLE Converter
FCC ID	2AK9O-485BT20
Industry Canada #	22455-485BT20
Equipment Category	Industrial
Basic EUT Functionality	EUT converts RS485 to Bluetooth
Input Voltage and Frequency	120 Vac, 60 Hz
Rated Input Current	1A
Connectors available on EUT	RJ45, USB
Peripherals Required for Test	N/A
Release type	
Intentional Radiator Frequency	2400 – 2483.5 MHz for BLE applications as described above.
EUT Configuration	Wireless configured to transmit continuously at 100% duty cycle

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

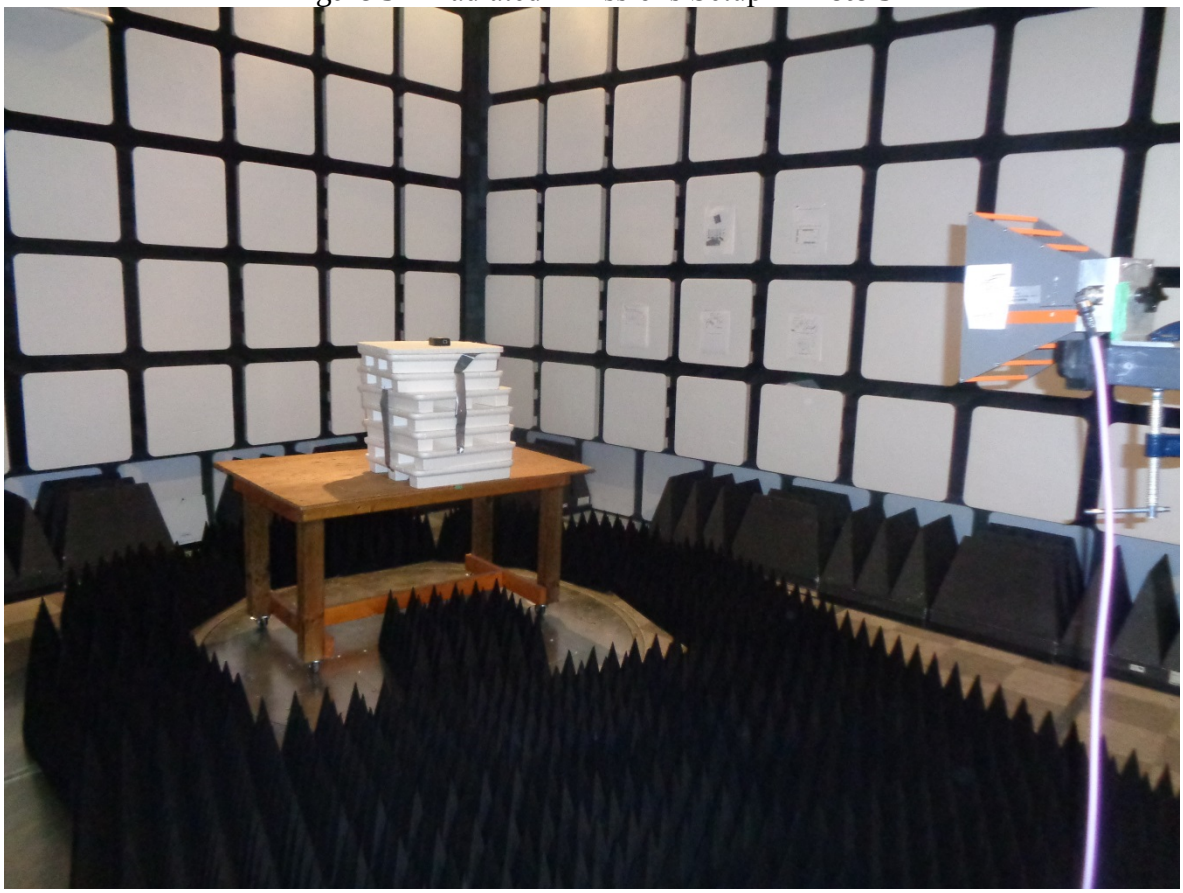
Note: These photos are for informational purposes. Also refer to the PDF files which are separate from this test report.

Figure 1 – Radiated Emissions Setup – Photo 1

Figure 2 – Radiated Emissions Setup – Photo 2

Note: As per ANSI C63.10 Clause 6.3.1, below 1GHz, the height of the EUT was set to 80cm. Above 1GHz, the height was raised to 1.5m.

Figure 3 – Radiated Emissions Setup – Photo 3



Note: As per ANSI C63.10 Clause 6.3.1, above 1GHz, the height of the EUT was set to 1.5m.

Figure 4 – Power Line Conducted Emissions Setup – Photo 1

Figure 5 – Power Line Conducted Emissions Setup – Photo 2