EMC & RF Test Report

As per

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

Unlicensed Intentional Radiators

on the

WMODHP

Issued by: **TÜV SÜD Canada Inc.**
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Testing produced for

See Appendix A for full client & EUT details.

Innovation, Science and Economic Development Canada
Registration # 6844A-3

Testing Laboratory Certificate #2955.02

R-4023, G-506
C-4498, T-1246

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Report Scope

This report addresses the EMC verification testing and test results of the **Innovere Medical Inc. Model: WMODHP**, 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 15.247:2018

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

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

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.

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Summary

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

EUT:	WMODHP
FCC Certification #, FCC ID:	2ATDA-WMODHPA
Industry Canada Certification #, IC:	25063-WMODHPA
EUT passed all tests performed	Yes
Tests conducted by	Min Xie

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

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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
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 ‘*’.

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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 5.5), the unit uses the following antennas:

1. Taoglas WPC.25A 0.5 dBi Ceramic Patch Antenna;
2. Taoglas FXP70 1.1 dBi Patch Antenna
3. PCB – inverted F-Antenna 3.3 dBi

Note: Antenna gains were declared by the manufacturer based on the latest data sheet.

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

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it.

The EUT is a FHSS transmitter. However, it meets all the requirement of DTS and is therefore tested as a DTS transmitter.

The EUT was mounted in three orthogonal axis for spurious radiated emissions.

SAR assessment is applicable to the EUT. Please see RF Exposure exhibits for details.

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)

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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:2018	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
CISPR 32:2012	Electromagnetic Compatibility of Multimedia Equipment – Emission Requirements
FCC KDB 558074: 2017	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
FCC KDB 447498: 2015	RF exposure procedures and equipment authorization policies for mobile and portable devices
ICES-003 Issue 6 2017	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 5 2018	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 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

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Document Revision Status

Revision	Date	Description
000	March 20, 2020	Initial Release
001	May 12, 2020	Rev 001 Updated radiated emission with host data. The revision replace the previous revision by its entirety.

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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

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Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Toronto, Ontario. The testing lab has calibrated 3m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The testing lab also has a calibrated 10m Open Area Test Site (OATS). 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 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, CA6844), Innovation, Science and Economic Development Canada (ISED, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). 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 biennial basis as listed for each respective test.

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Testing Environmental Conditions and Dates

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

Rev 000

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
2019/07/09 - 11 2019/07/20	Radiated Emissions	MX	24.7 - 25.7	39.4 - 57.4	100.9 - 102.0
2019/07/26	Antenna Conducted Emissions	MX	23.9 - 24.6	48.2 - 53.1	100.4 - 100.8

Rev 001

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
2020/04/13 - 22	Radiated Emissions	MX	22.2 – 23.1	15.1 - 34.1	99.1 - 102.1

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Detailed Test Results Section

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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 Methods

The Limit is as specified in FCC Part 15.247 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 ANSI C63.10 Clause 11.8 DTS bandwidth.

Results

The EUT passed. The minimum measured 6 dB BW was of all modulations were greater than 500 kHz.

Additional 99% bandwidth were measured for information purpose. There is no requirement on 99% bandwidth.

Three Channels were measured. The following table show the 6 dB and 99% bandwidth: The external attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

Bandwidth					
Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	6 dB BW Limit (MHz)	Pass/Fail
Low	2406	2.14	3.86	0.50	Pass
Mid	2438	2.16	3.87	0.50	Pass
High	2470	2.03	3.82	0.50	Pass

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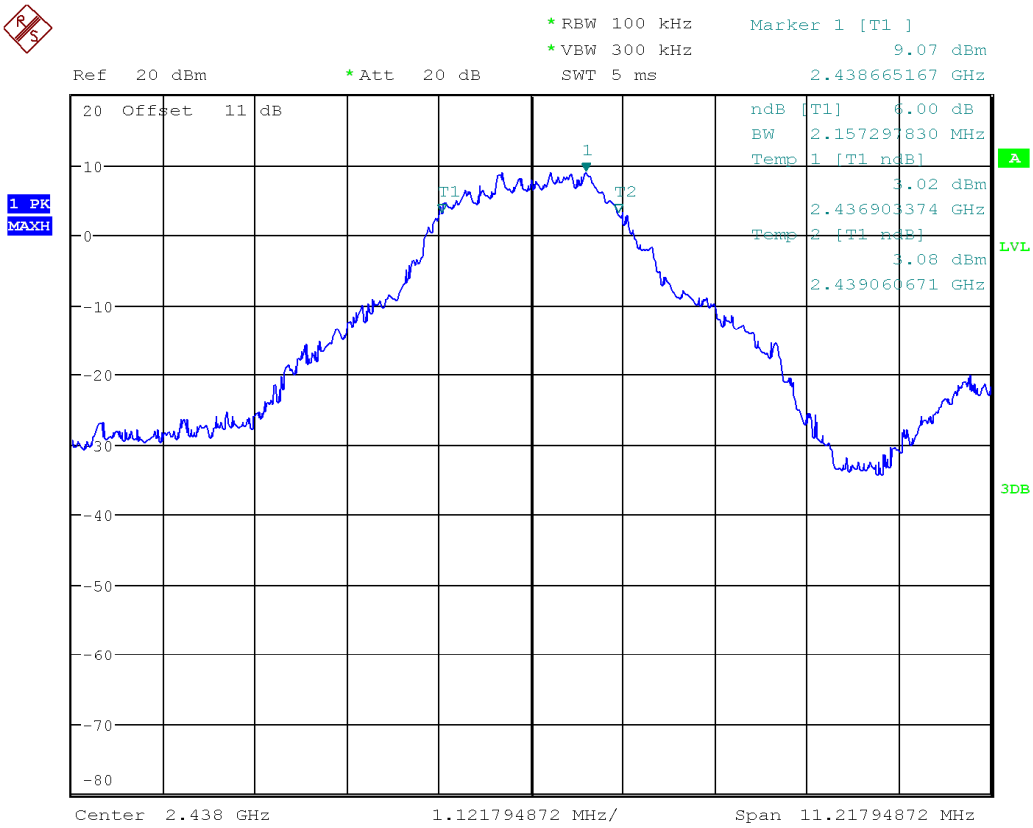
Graph(s)

The graphs shown 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. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

6 dB Bandwidth
Mid Channel



Date: 26.JUL.2019 17:38:16

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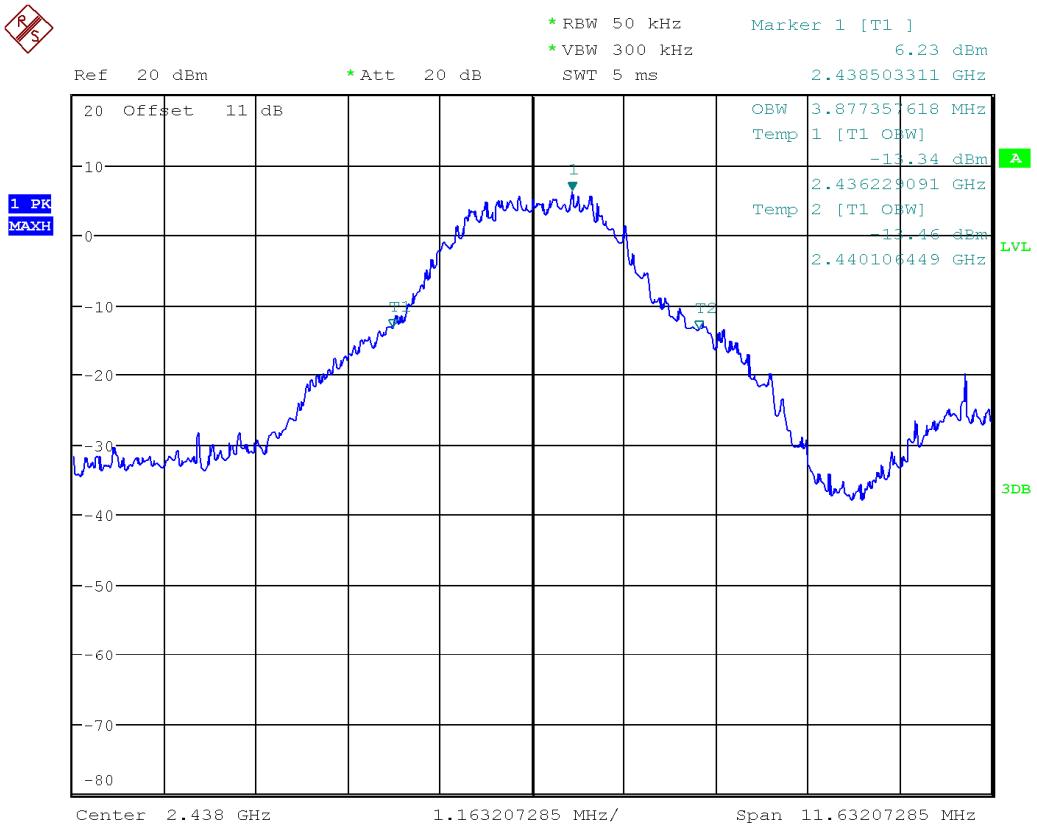
99%Bandwidth
Mid Channel



Date: 26.JUL.2019 17:40:17

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

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Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
26.5GHz Spectrum Analyzer	FSQ26	Rohde & Schwarz	Mar-1,2019	Mar-1,2021	GEMC 234
Attenuator 10 dB	3M-10	Weinshel	NCR	NCR	GEMC 279

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

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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, that the maximum power does not exceed an amount which may create an excessive power level.

Limits and Methods

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.

The method is given in ANSI C63.10 Clause 11.9.1.2 Integrated band power method.

Results

The EUT passed. The EUT was set to transmit at maximum power. Three Channels were measured. The following table shows the peak power: The external attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

Power					
Channel	Frequency (MHz)	Power (dBm)	Power (mW)	Limit (mW)	Pass/Fail
Low	2406	13.49	22.33	1000	Pass
Mid	2438	12.59	18.15	1000	Pass
High	2470	11.60	14.47	1000	Pass

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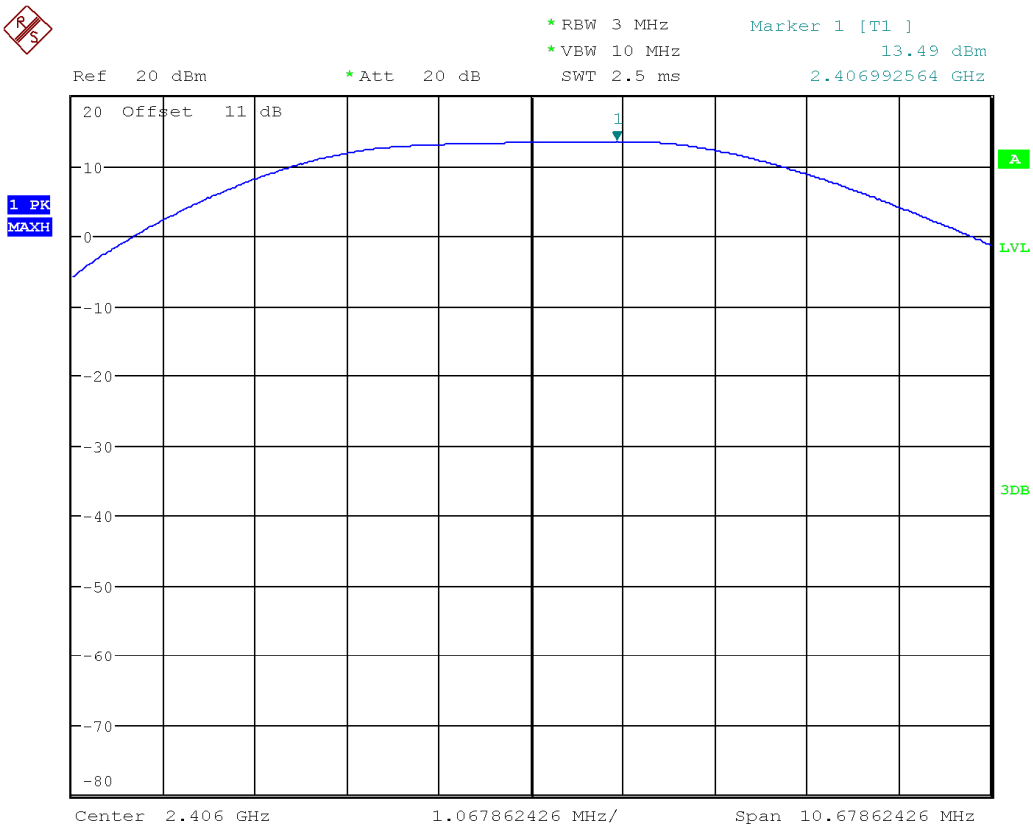
Readings

The graphs shown below show the peak power output of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 3MHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Peak Power
Low Channel



Date: 26.JUL.2019 17:36:16

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

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Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
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Attenuator 10 dB	3M-10	Weinshel	NCR	NCR	GEMC 279

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

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Antenna Spurious Conducted Emissions (-20 dBc Requirement)

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

Limits and Methods

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10th harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

The method is given in ANSI C63.10 Clause 11.11 Emissions in nonrestricted frequency bands

Results

The EUT passed.

The EUT was set to transmit at maximum power. Three Channels were measured.

Low, middle and high channels were measured. The worst case was presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

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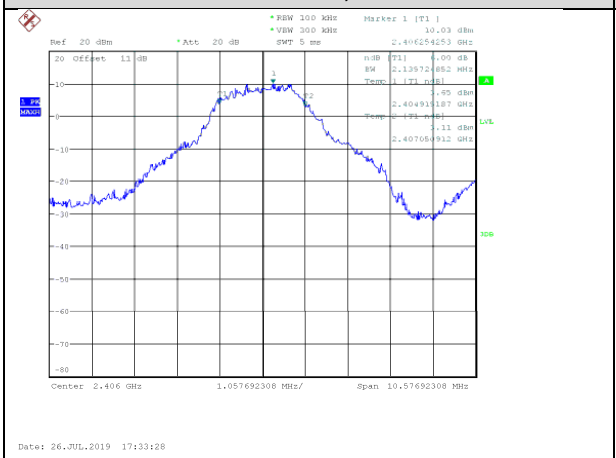
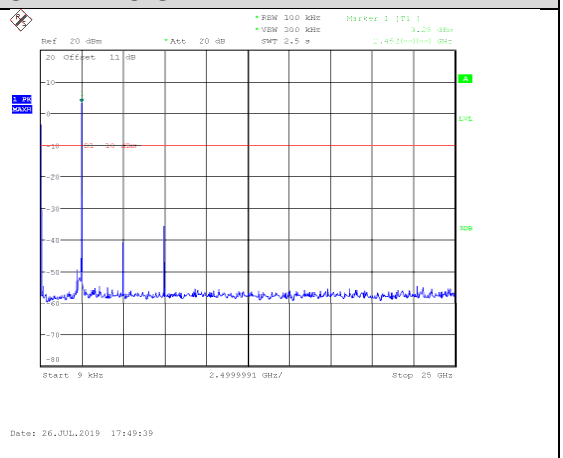
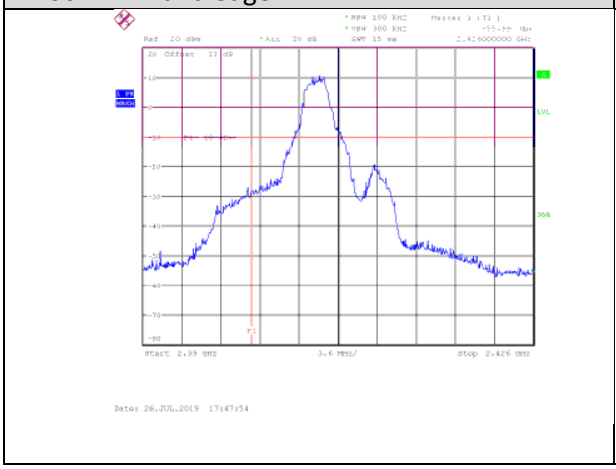
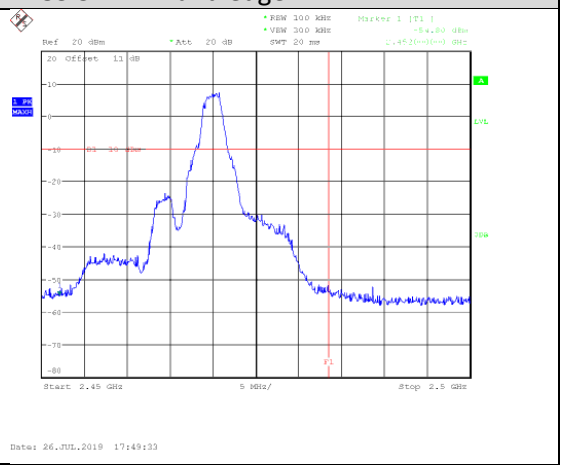
Graph(s)

The graphs shown below shows the peak power spectral density of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 100 kHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

-20 dBc	
Reference level: 10.03 dBm, limit: -9.97 dBm	9 kHz – 25 GHz
	
2400 MHz Band edge	2483.5 MHz Band edge
	

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Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
26.5GHz Spectrum Analyzer	FSQ26	Rohde & Schwarz	Mar-1,2019	Mar-1,2021	GEMC 234
Attenuator 10 dB	3M-10	Weinshel	NCR	NCR	GEMC 279

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

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Radiated Emissions in Restricted Band

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.

Limit and Method

The method is given in ANSI C 63.10
The limits are as defined in FCC Part 15, Section 15.209 and RSS GEN:

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 'Spurious Conducted Emissions' for further details.

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

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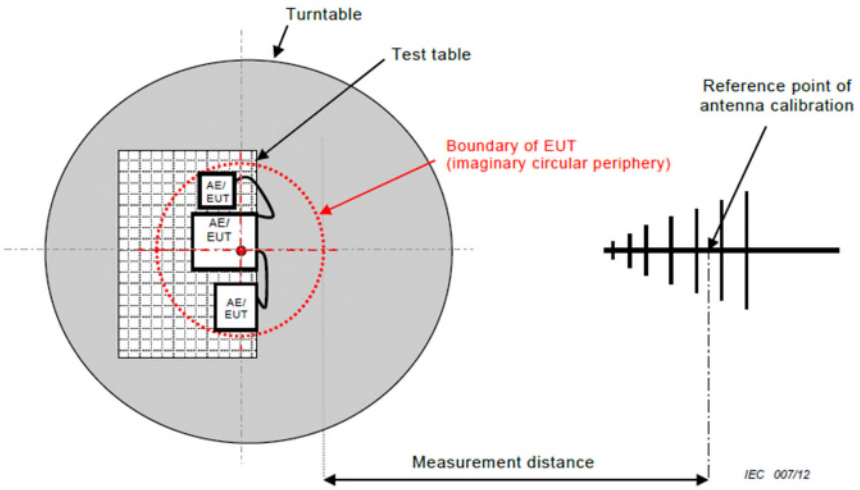
Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±5.67dB for 30MHz – 1GHz and ±4.58dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

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

The EUT was set to transmit at maximum power. Low, middle and high channels in each mode were measured; however the worst case graphs are presented.

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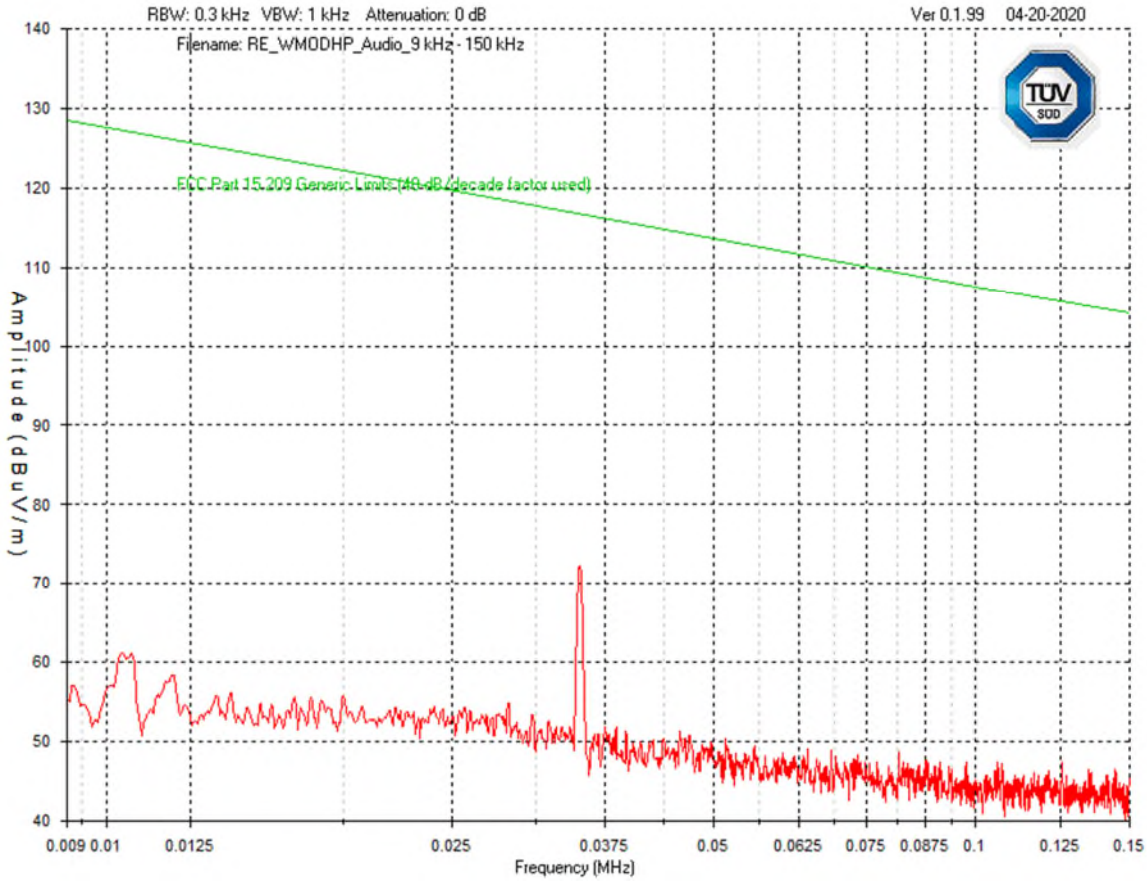
Band edge measure graphs were shown for illustrations purpose. See final measurement section for all measurements.

The EUT was mounted in three orthogonal axis. Band edge graphs were shown for one axis. Final measurement section have data for all three axis.

9 kHz – 150 kHz



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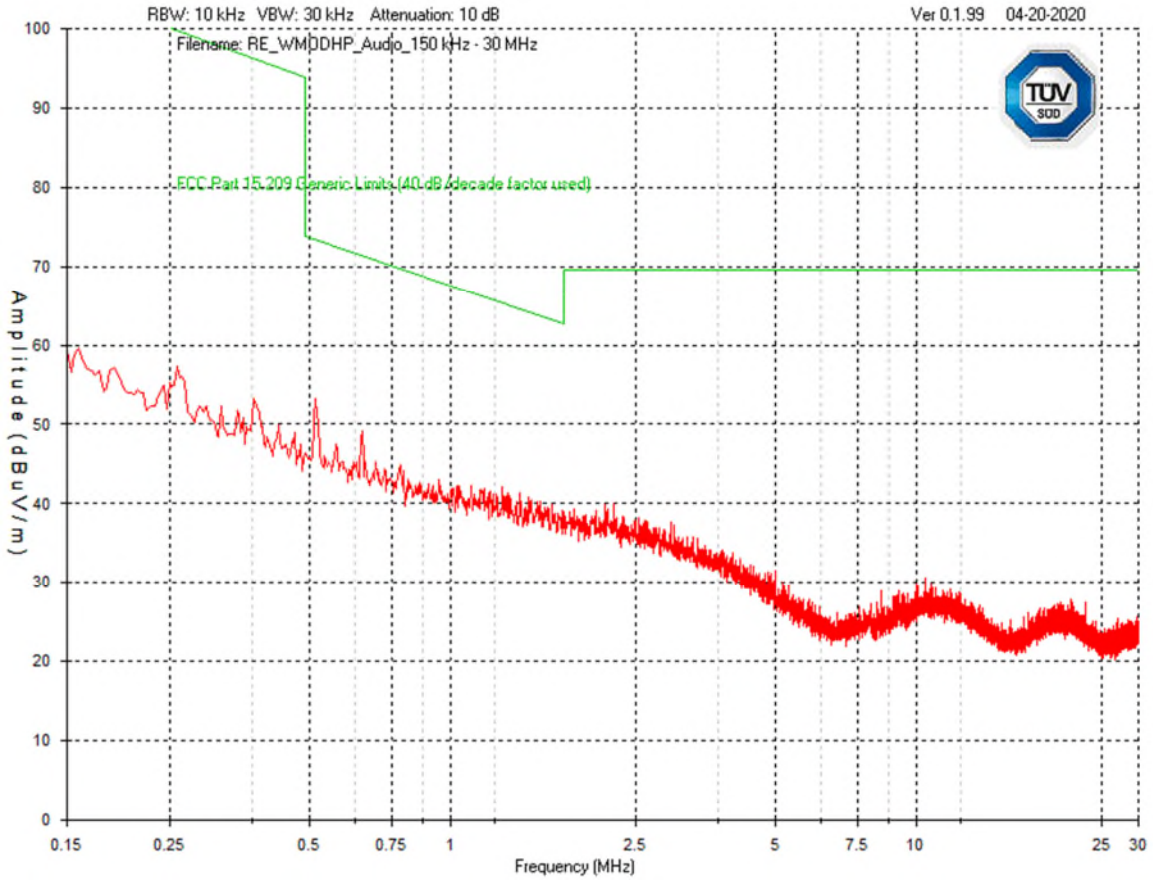
150 kHz – 30 MHz



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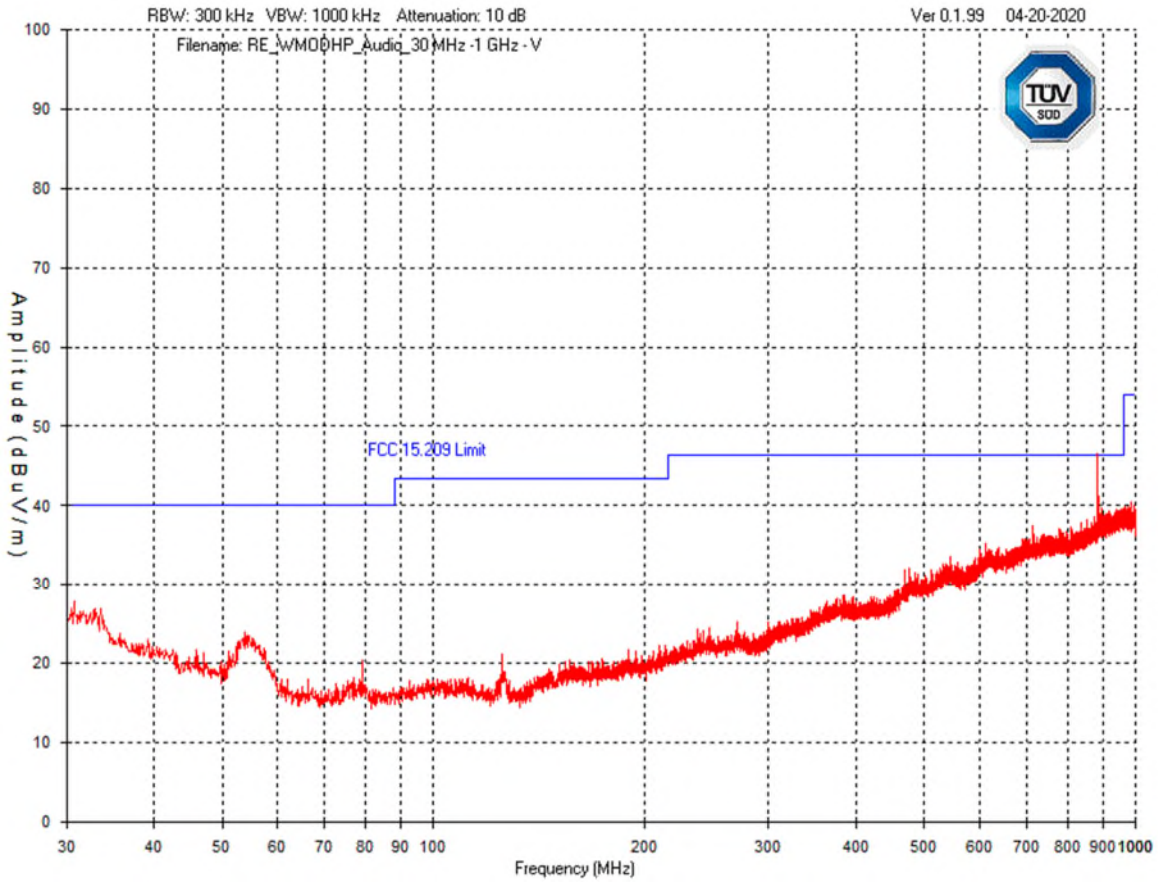
Mid Channel - 30 MHz – 1 GHz
Vertical – Peak Emission Graph



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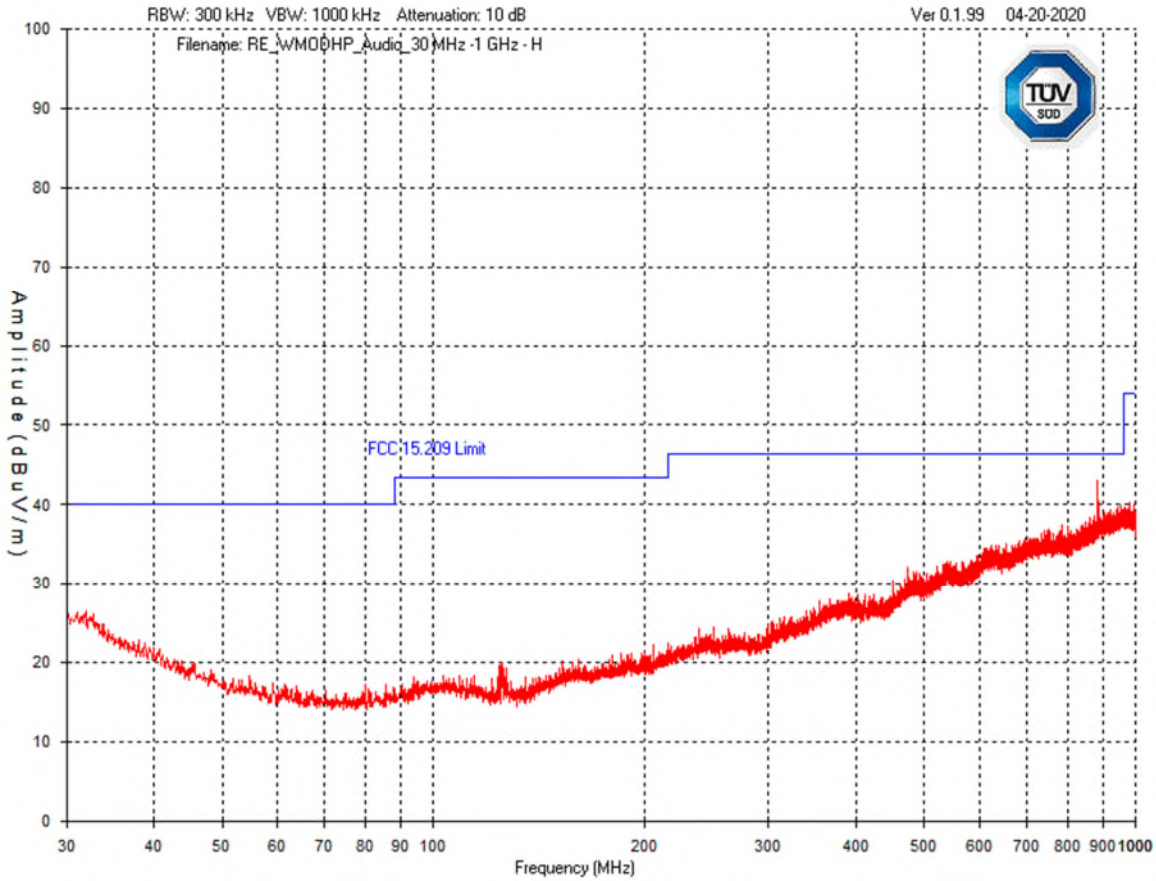
Mid Channel – 30 MHz – 1 GHz
Horizontal - Peak Emission Graph



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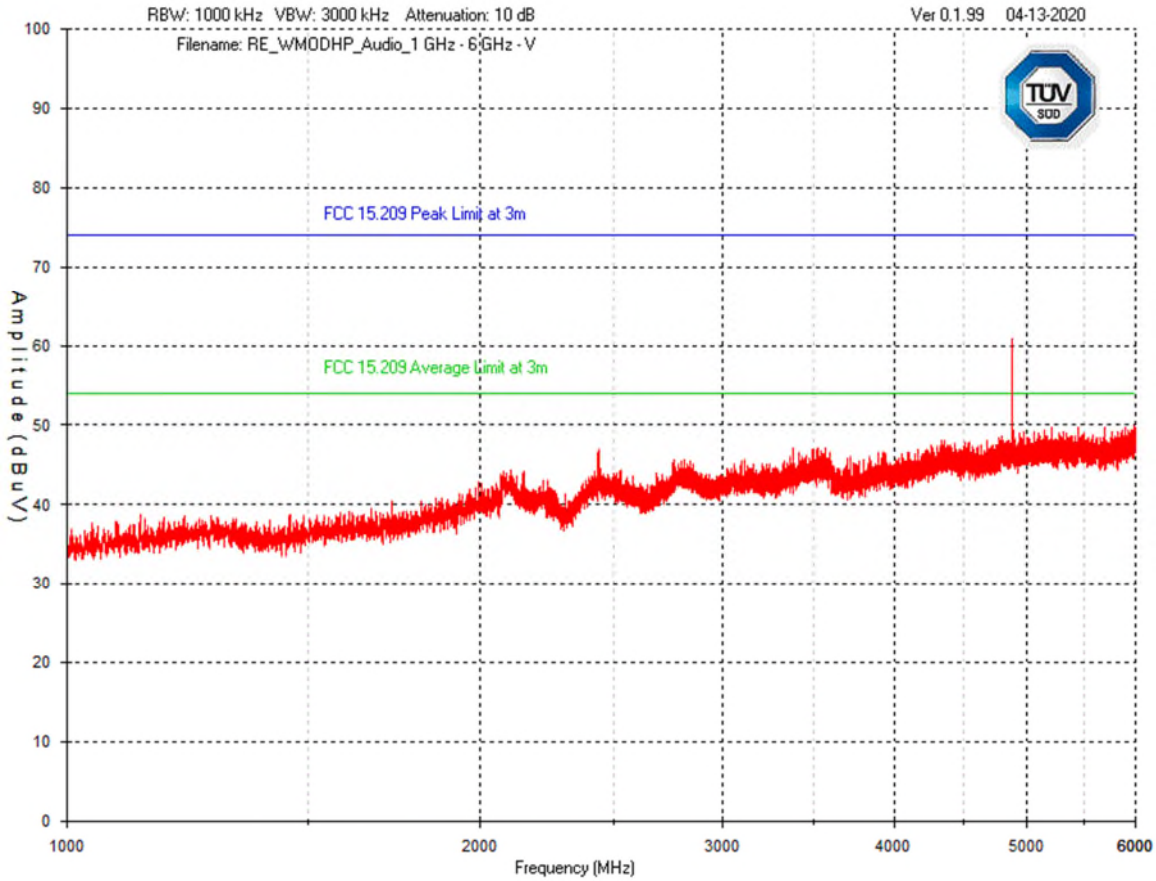
Mid Channel – 1 GHz – 6 GHz
Vertical - Peak Emission Graph



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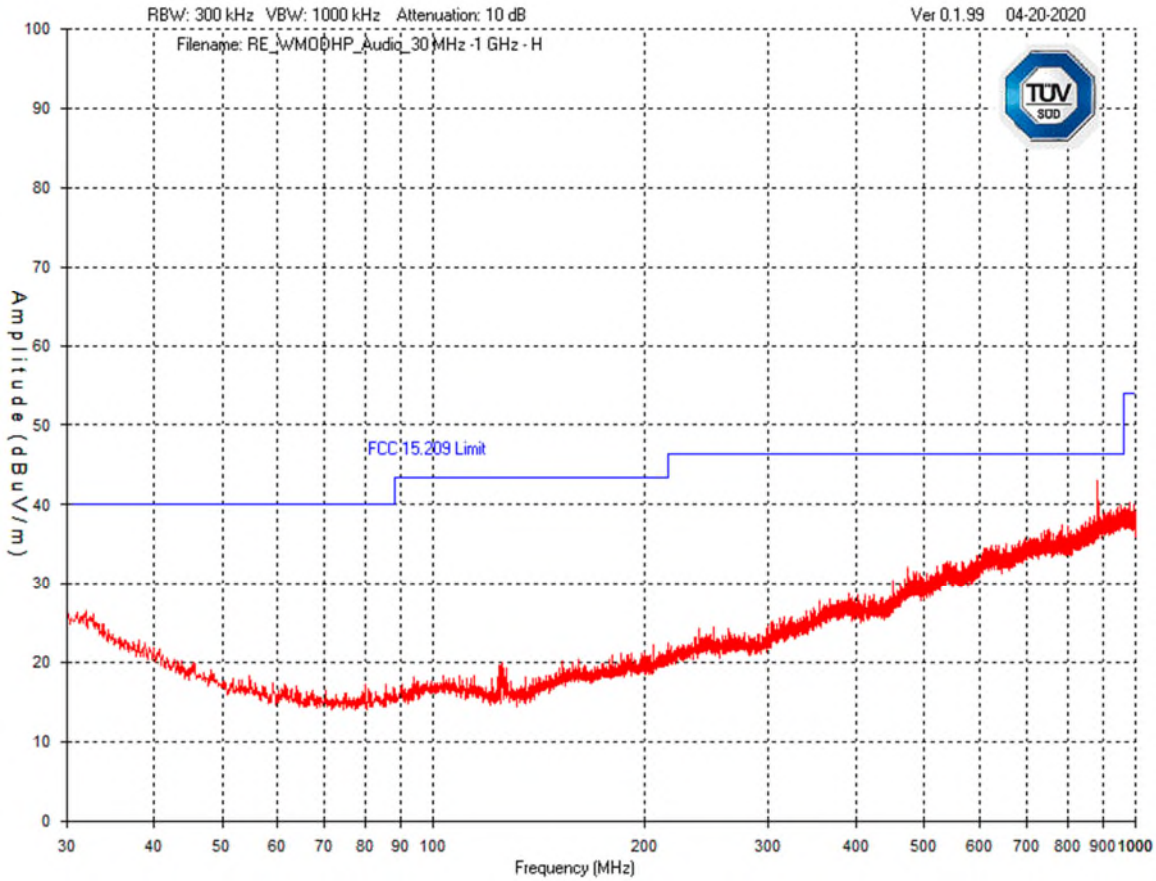
Mid Channel – 1 GHz – 6 GHz
Horizontal - Peak Emission Graph



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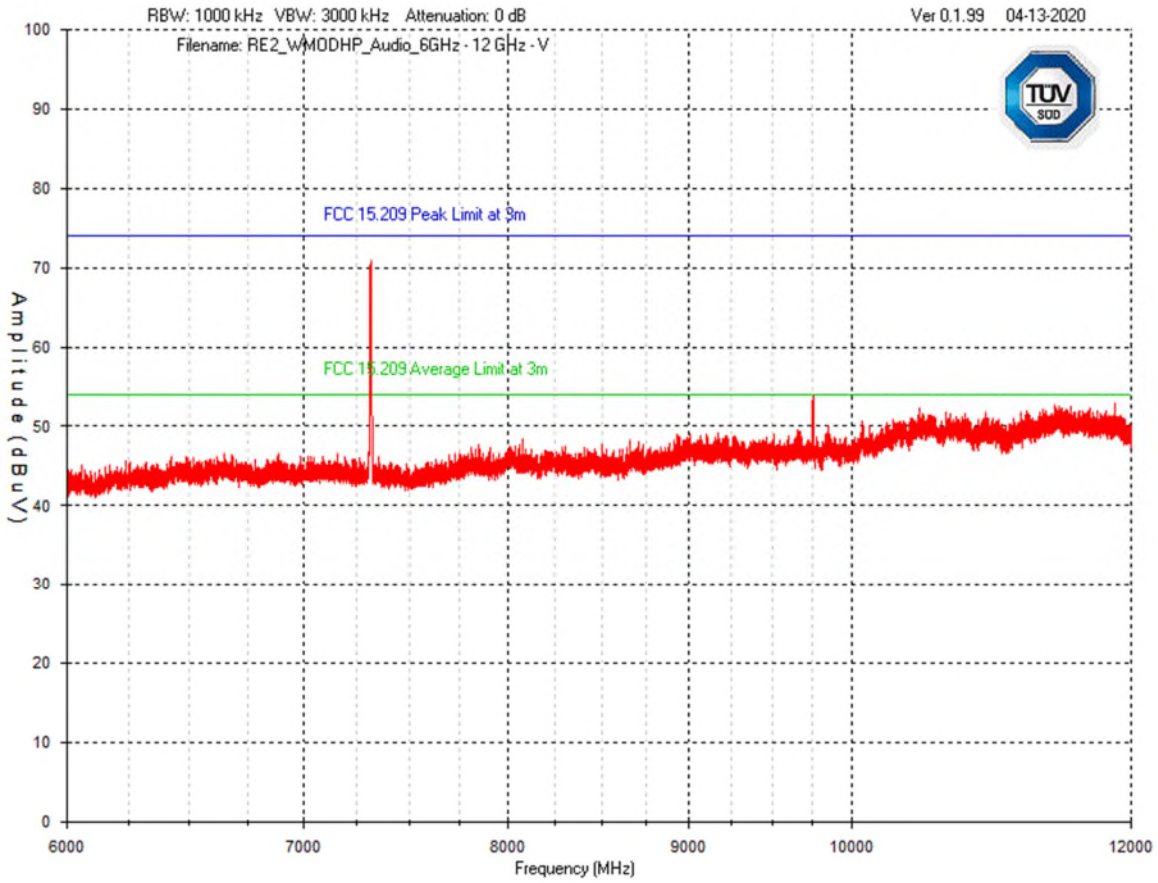
Mid Channel – 6 GHz – 12 GHz
Vertical - Peak Emission Graph



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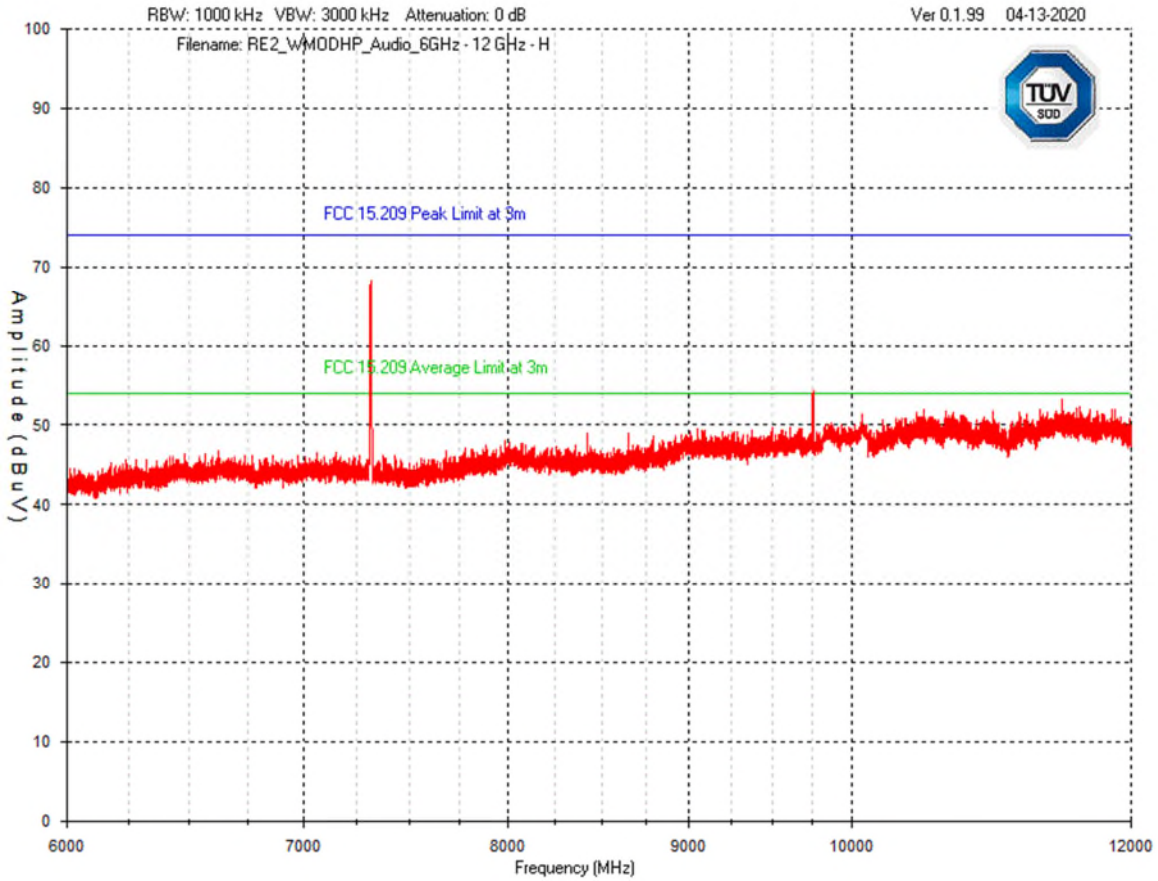
Mid Channel – 6 GHz – 12 GHz
Horizontal - Peak Emission Graph



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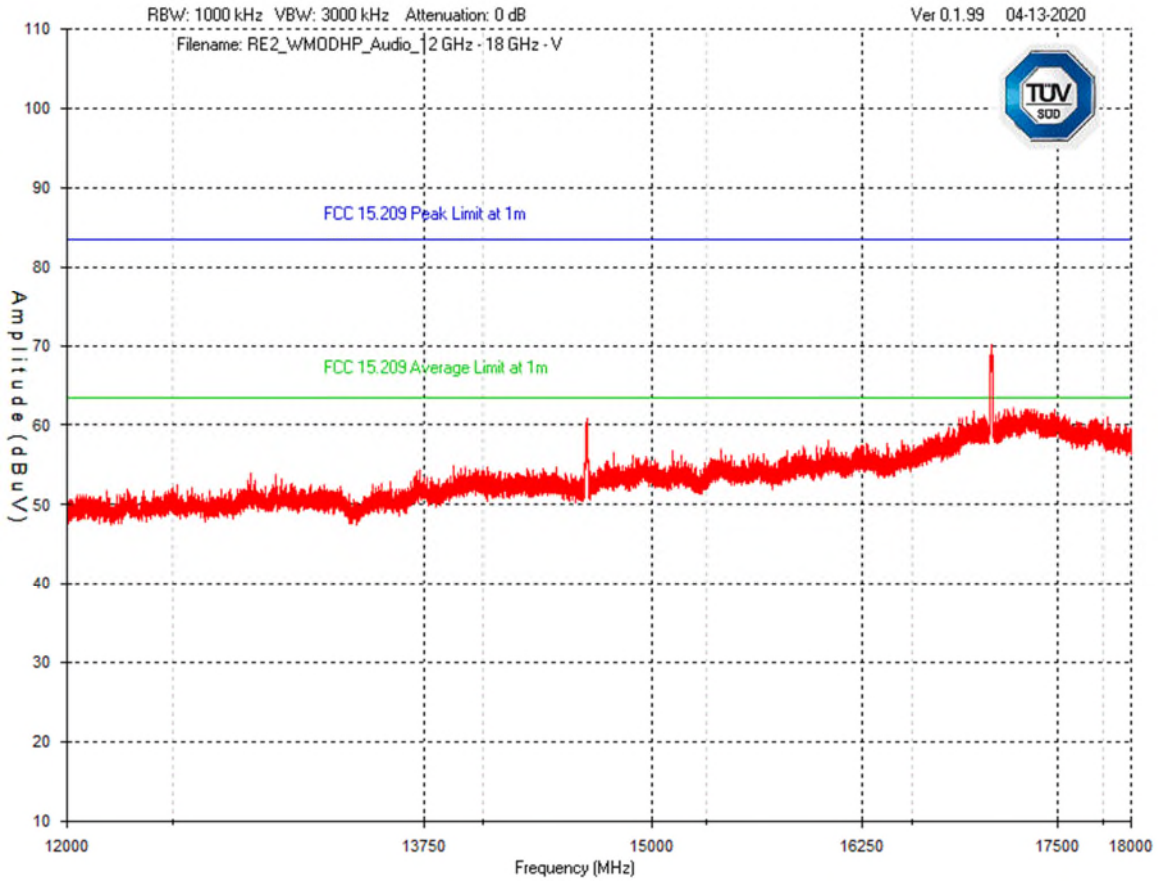
Mid Channel – 12 GHz – 18 GHz
Vertical - Peak Emission Graph



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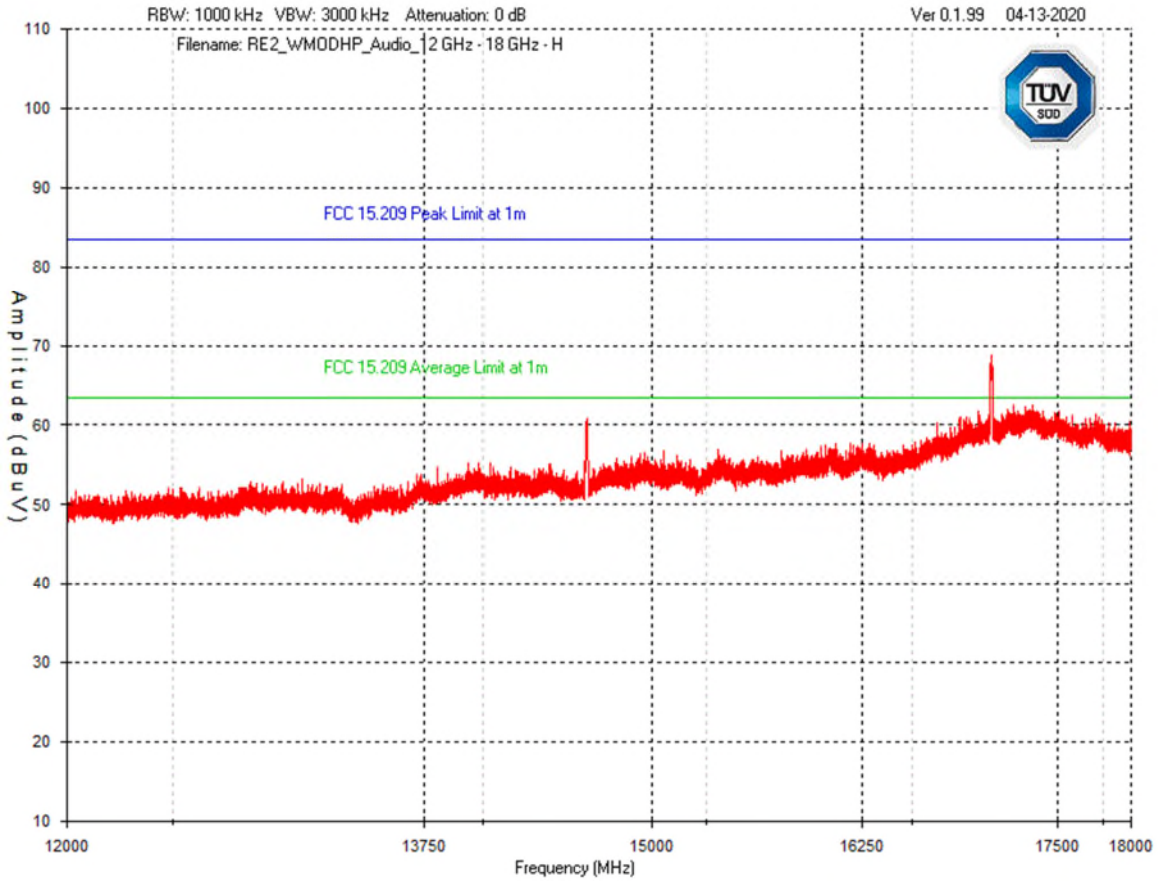
Mid Channel – 12 GHz – 18 GHz
Horizontal - Peak Emission Graph



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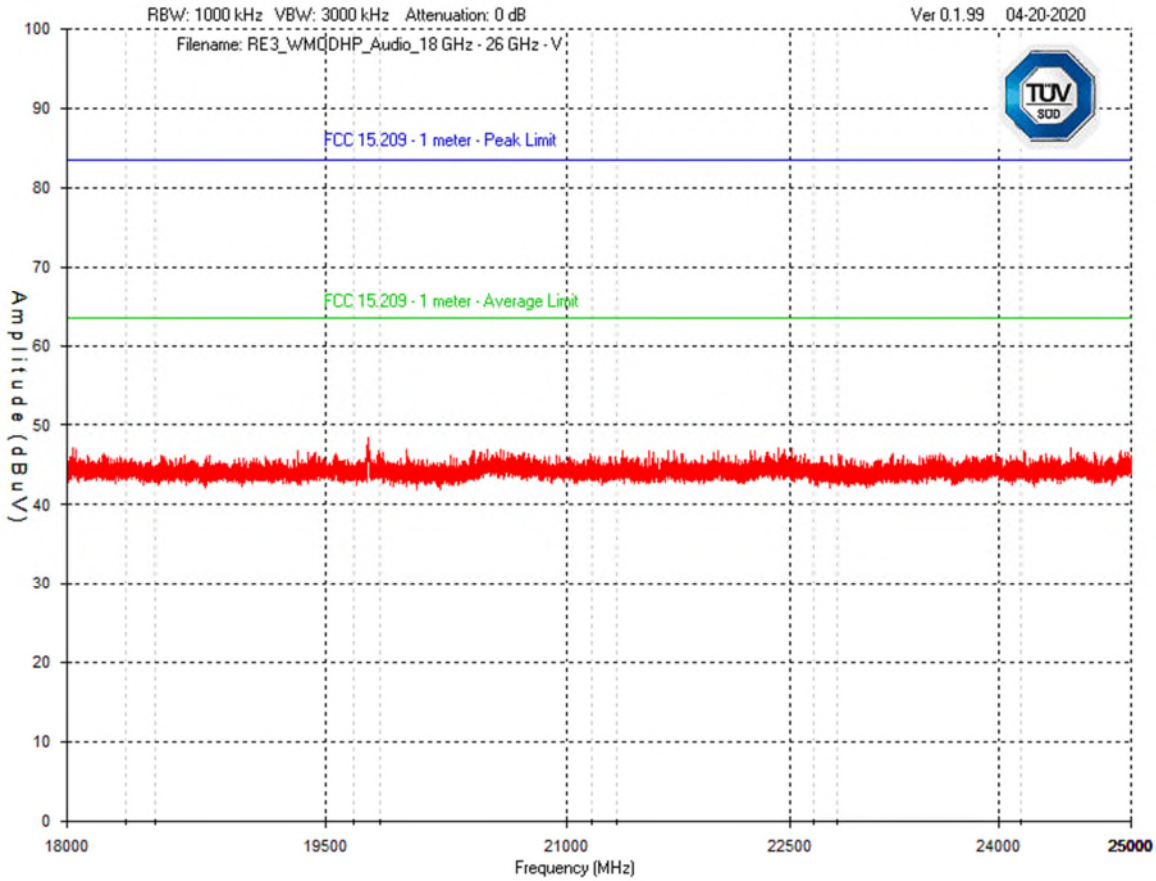
Mid Channel – 18 GHz – 25 GHz
Vertical - Peak Emission Graph



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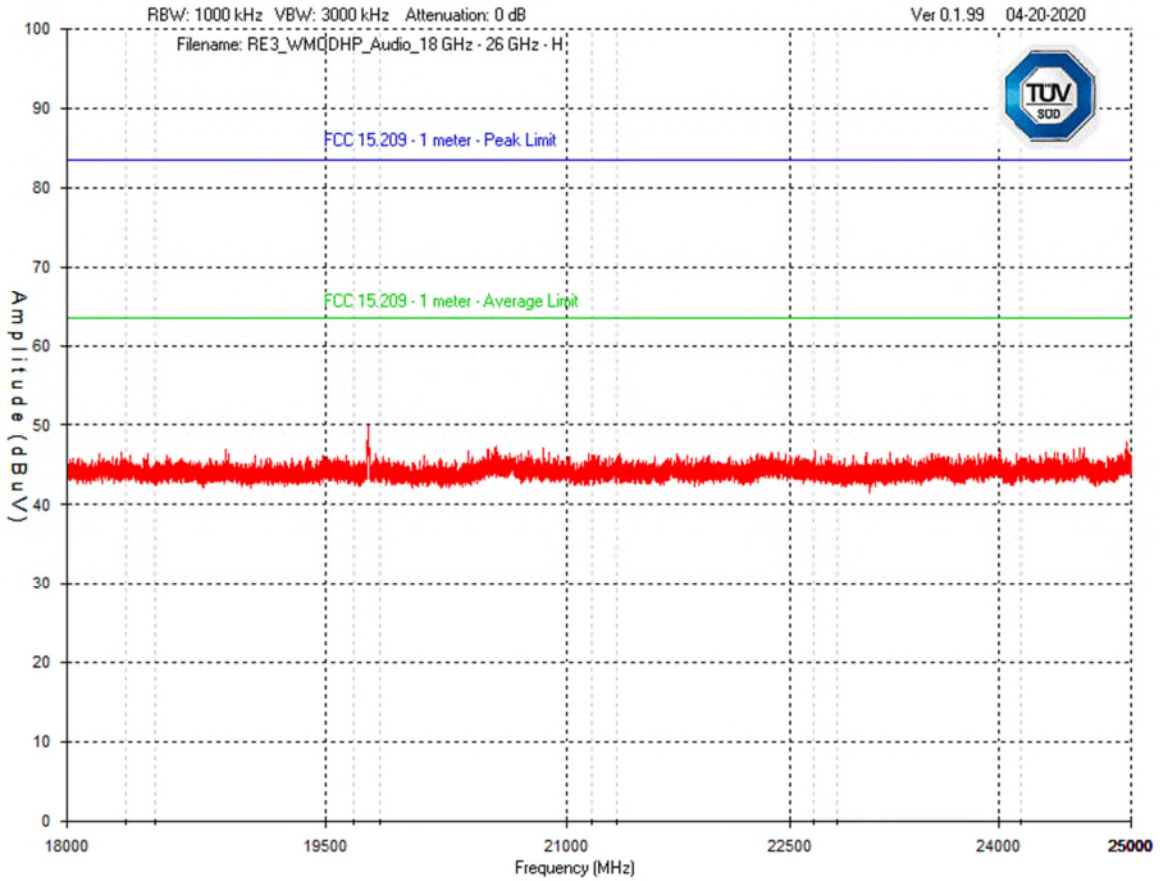
Mid Channel – 18 GHz – 25 GHz
Horizontal - Peak Emission Graph



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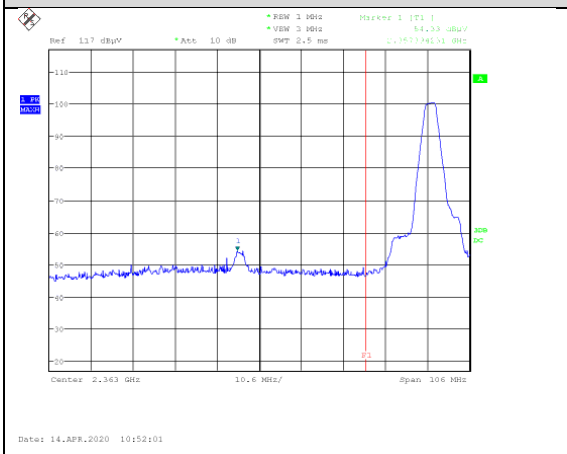
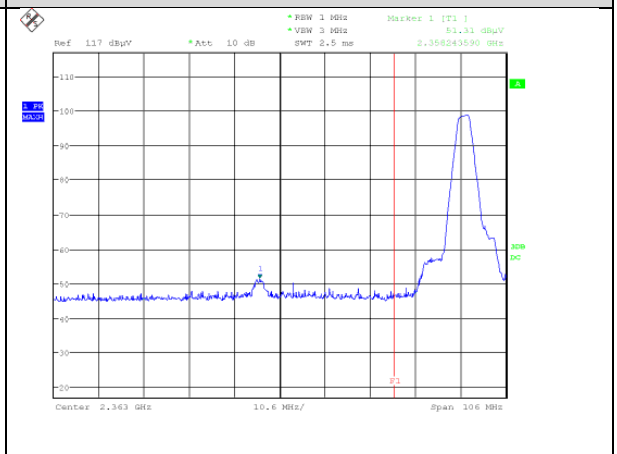
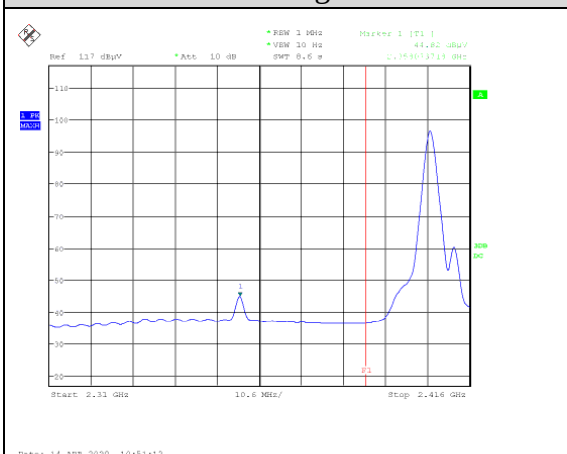
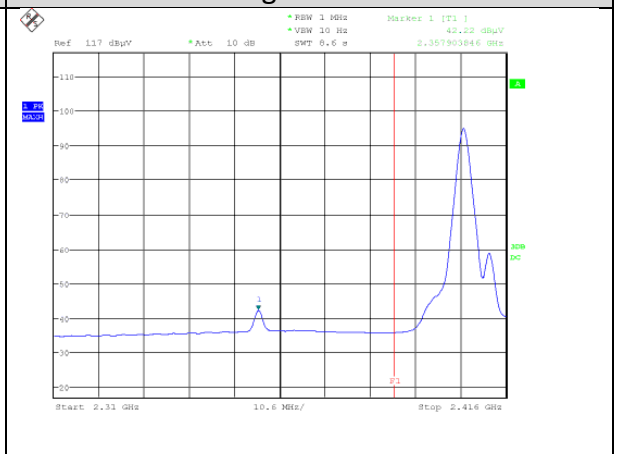
Band edge measurements

PCB Inverted –F Antenna Band Edge – Low Channel	
Vertical – Peak Emission	Horizontal – Peak Emission
	
Vertical – Average Emission	Horizontal – Average Emission
	

Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43 for corrected values.

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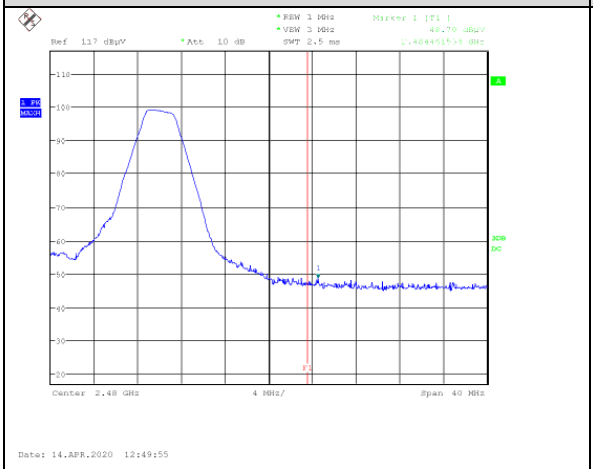
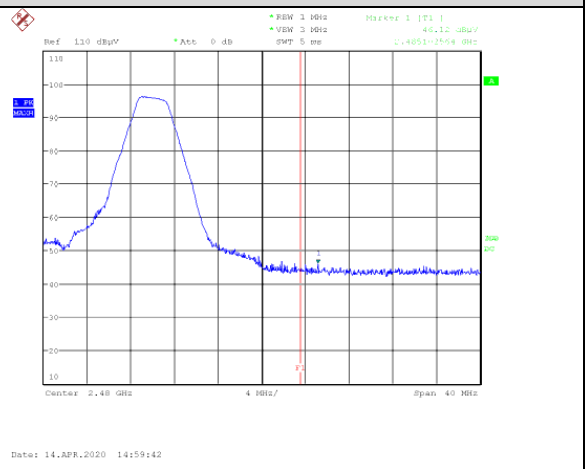
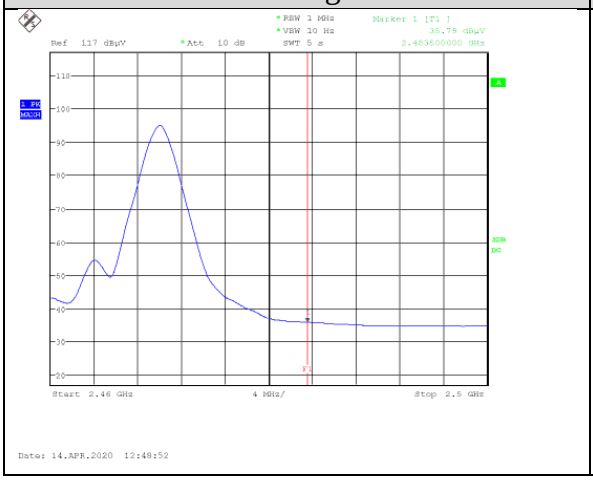
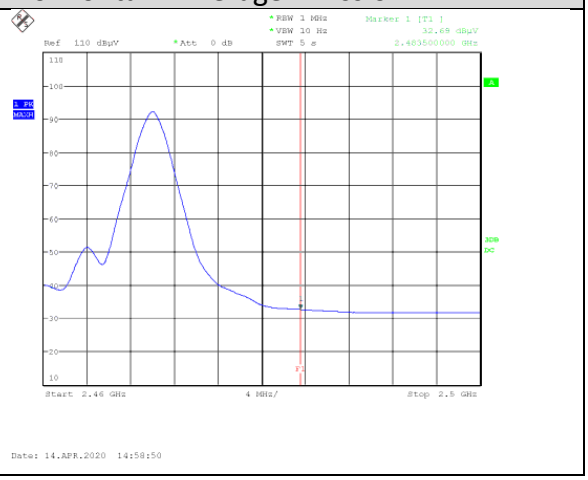
PCB Inverted –F Antenna
Band Edge – High Channel

Vertical – Peak Emission	Horizontal – Peak Emission
	
Vertical – Average Emission	**Horizontal – Average Emission**
	

Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43for corrected values.

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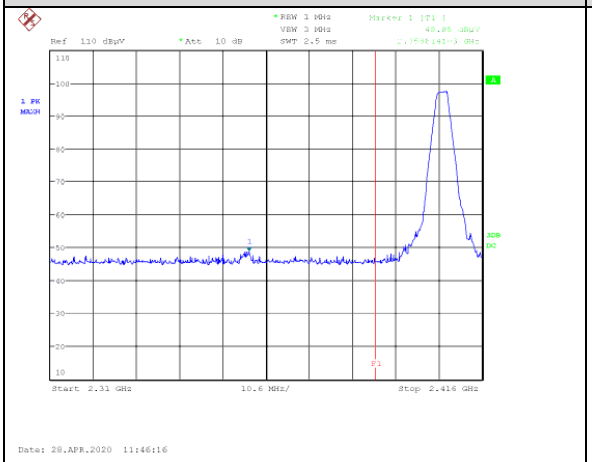
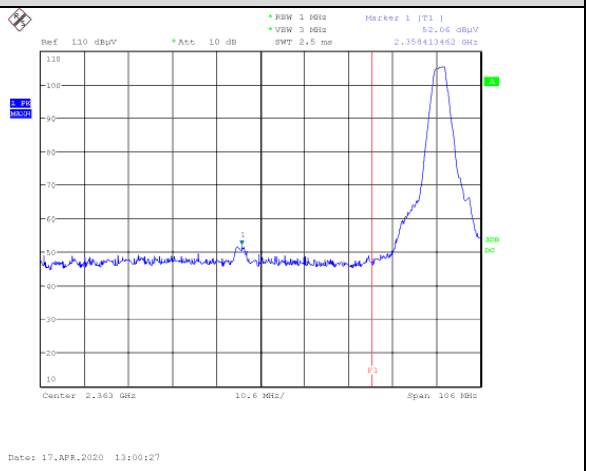
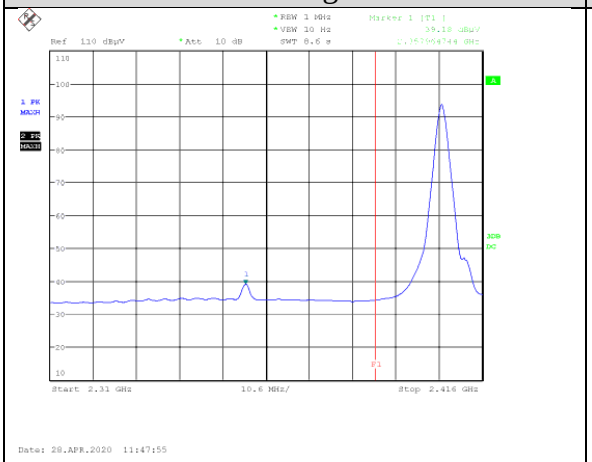
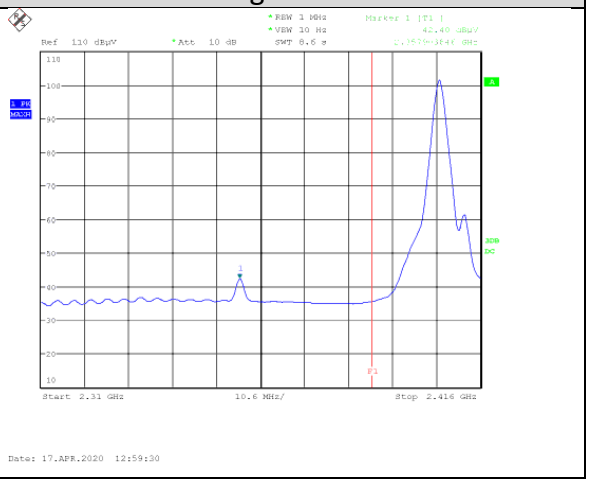
Taoglas FXP70 Antenna
Band Edge – Low Channel

Vertical – Peak Emission	Horizontal – Peak Emission
	
Vertical – Average Emission	Horizontal – Average Emission
	

Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43 for corrected values.

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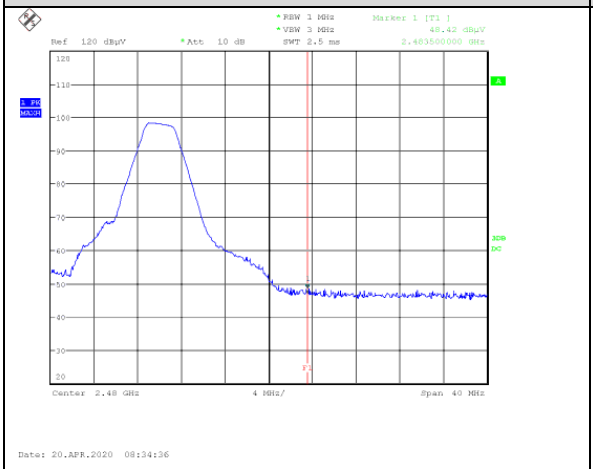
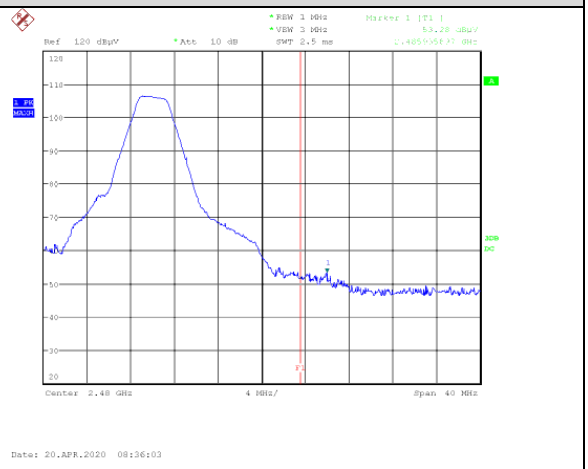
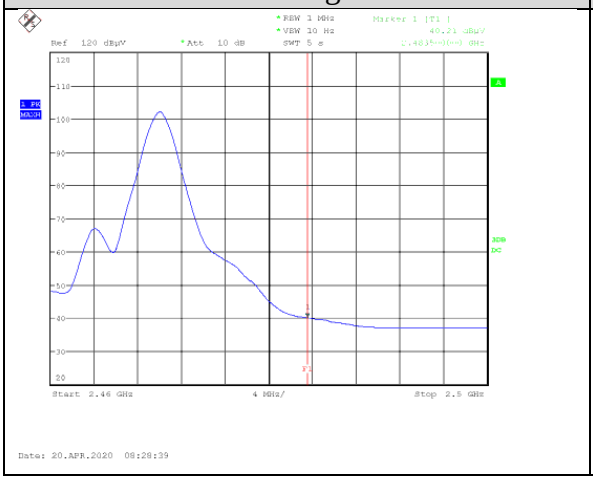
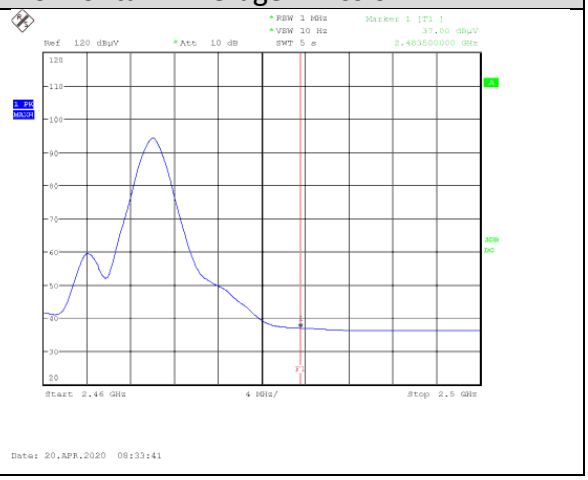
Taoglas FXP70 Antenna Band Edge – High Channel	
Vertical – Peak Emission	Horizontal – Peak Emission
	
Vertical – Average Emission	Horizontal – Average Emission
	

Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43 for corrected values.

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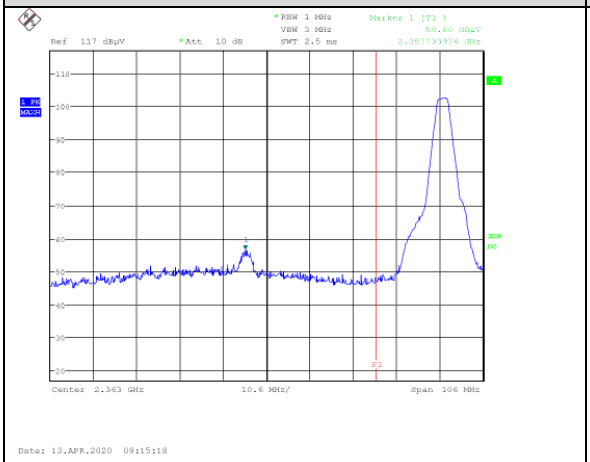
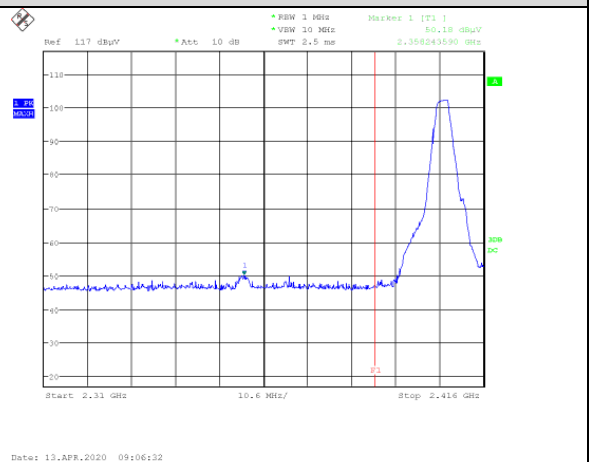
Taoglas WPC25A Antenna
Band Edge – Low Channel

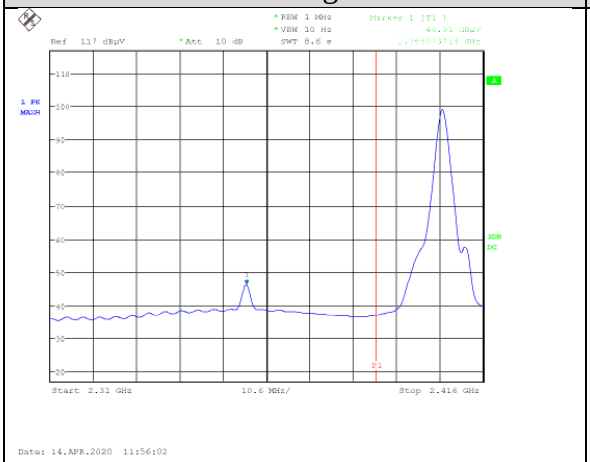
Vertical – Peak Emission



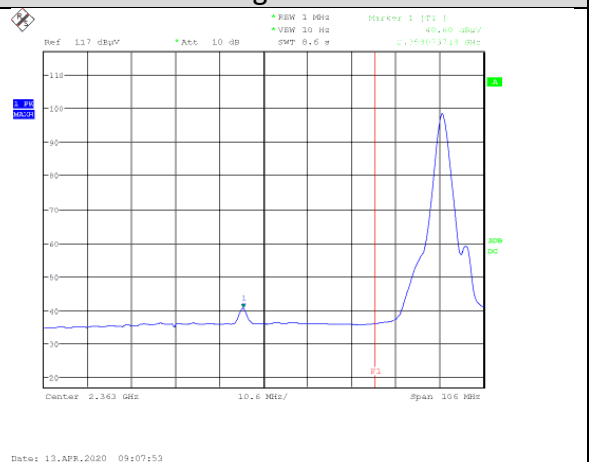
Horizontal – Peak Emission



Vertical – Average Emission



Horizontal – Average Emission



Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43 for corrected values.

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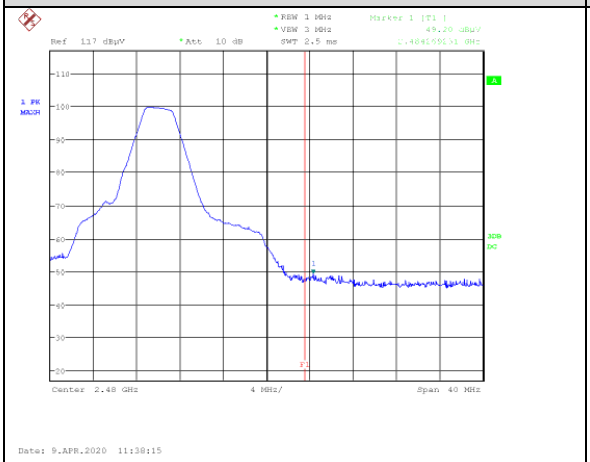
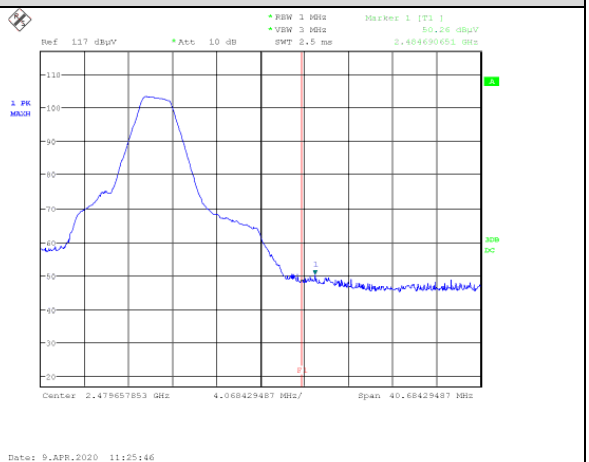
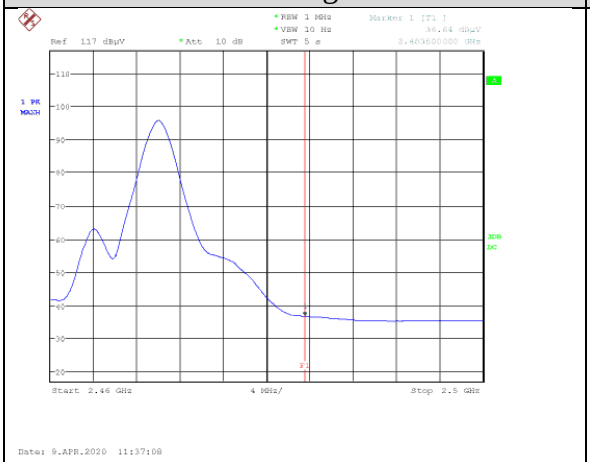
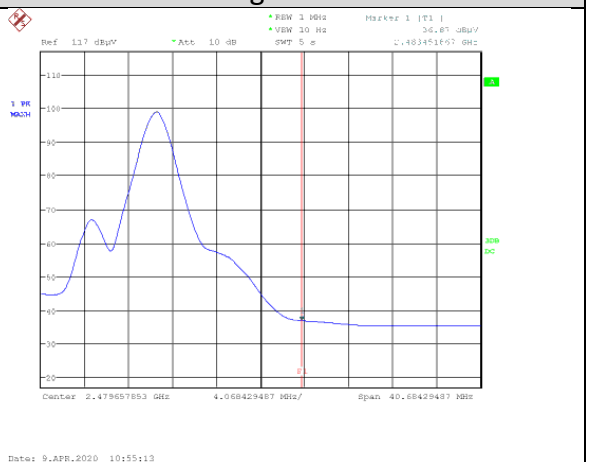
Taoglas WPC25A Antenna Band Edge – High Channel	
Vertical – Peak Emission	Horizontal – Peak Emission
	
Vertical – Average Emission	Horizontal – Average Emission
	

Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 43 for corrected values.

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Final Measurements and Results

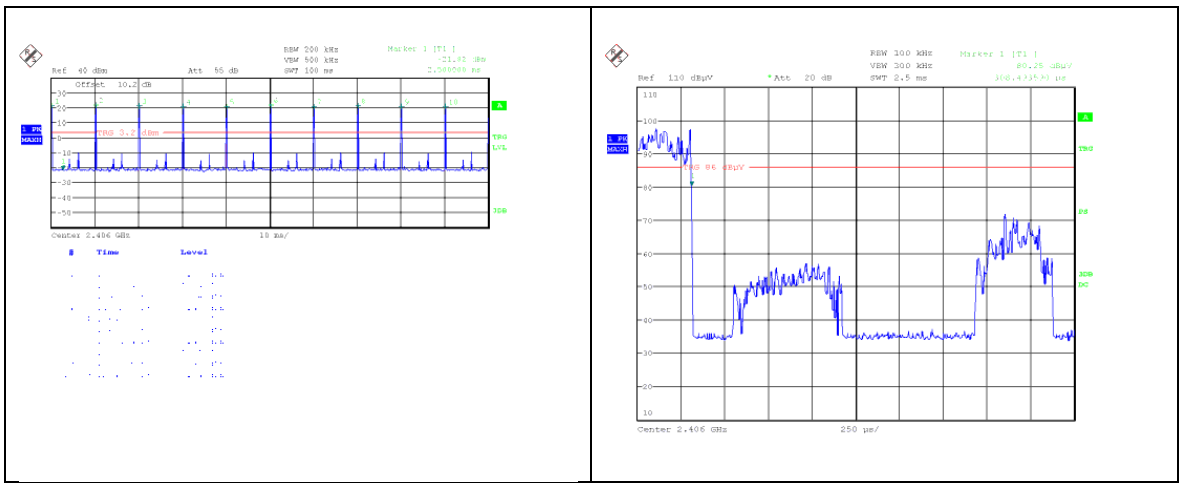
The EUT passed the limits. Low, middle and high bands were measured.

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. Emission outside the restricted bands were measured for information purpose.

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.

All emissions above 18 GHz were instrument noise floor of measurement instrument. No emissions were found in this frequency range.

The EUT have a duty cycle of 3.08% (10 pulse in 100 ms where each pulse is 0.308 ms). A Duty Cycle Correction factor of -30.2 dB was applied to peak harmonic to get the average emission.



Note: See Operation Description for more details on the spectrum access technique of the transmitter.

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PCB Inverted-F Antenna

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Mid Channel - Z axis											
2438	Peak	Horz	98.4	28.6	4.7	10.0	-35.8	105.8			PASS
2438	Avg	Horz	94.6	28.6	4.7	10.0	-35.8	102.0			PASS
2438	Peak	Vert	94.9	28.6	4.7	10.0	-35.8	102.3			PASS
2438	Avg	Vert	91.3	28.6	4.7	10.0	-35.8	98.7			PASS
Mid Channel - X axis											
2438	Peak	Horz	98.6	28.6	4.7	10.0	-35.8	106.0			PASS
2438	Avg	Horz	94.8	28.6	4.7	10.0	-35.8	102.2			PASS
2438	Peak	Vert	101.2	28.6	4.7	10.0	-35.8	108.6			PASS
2438	Avg	Vert	97.2	28.6	4.7	10.0	-35.8	104.6			PASS
2388	Peak	Horz	53.4	28.3	4.7	10.0	-35.9	60.5	74.0	13.5	PASS
2388	Avg	Horz	44.1	28.3	4.7	10.0	-35.9	51.2	54.0	2.8	PASS
2388	Peak	Vert	54.4	28.3	4.7	10.0	-35.9	61.5	74.0	12.5	PASS
2388	Avg	Vert	45.0	28.3	4.7	10.0	-35.9	52.1	54.0	1.9	PASS
4876	Peak	Horz	53.2	33.4	7.0	1.0	-34.0	60.5	74.0	13.5	PASS
4876	Avg	Horz	22.9	33.4	7.0	1.0	-34.0	30.3	54.0	23.7	PASS
4876	Peak	Vert	50.3	33.4	7.0	1.0	-34.0	57.6	74.0	16.4	PASS
4876	Avg	Vert	20.0	33.4	7.0	1.0	-34.0	27.4	54.0	26.6	PASS
7314	Peak	Horz	59.6	29.1	8.8	1.0	-33.7	64.7	74.0	9.3	PASS
7314	Avg	Horz	29.4	29.1	8.8	1.0	-33.7	34.5	54.0	19.5	PASS
7314	Peak	Vert	61.6	29.1	8.8	1.0	-33.7	66.7	74.0	7.3	PASS
7314	Avg	Vert	31.4	29.1	8.8	1.0	-33.7	36.5	54.0	17.5	PASS
9752	Peak	Horz	50.3	31.3	9.9	1.0	-33.9	58.6	74.0	15.4	PASS
9752	Avg	Horz	20.1	31.3	9.9	1.0	-33.9	28.4	54.0	25.6	PASS
9752	Peak	Vert	55.0	31.3	9.9	1.0	-33.9	63.3	74.0	10.7	PASS
9752	Avg	Vert	24.8	31.3	9.9	1.0	-33.9	33.1	54.0	20.9	PASS
12190	Peak	Horz	42.2	31.8	11.3	1.0	-32.0	54.3	83.5	29.2	PASS
12190	Avg	Horz	12.0	31.8	11.3	1.0	-32.0	24.1	63.5	39.4	PASS
12190	Peak	Vert	42.7	31.8	11.3	1.0	-32.0	54.7	83.5	28.8	PASS
12190	Avg	Vert	12.4	31.8	11.3	1.0	-32.0	24.5	63.5	39.0	PASS
14628	Peak	Horz	42.6	32.5	12.7	1.0	-30.0	58.9	83.5	24.6	PASS
14628	Avg	Horz	12.4	32.5	12.7	1.0	-30.0	28.6	63.5	34.9	PASS
14628	Peak	Vert	43.0	32.5	12.7	1.0	-30.0	59.3	83.5	24.2	PASS
14628	Avg	Vert	12.8	32.5	12.7	1.0	-30.0	29.0	63.5	34.5	PASS
17066	Peak	Horz	44.9	36.6	13.4	1.0	-28.7	67.2	83.5	16.3	PASS
17066	Avg	Horz	14.7	36.6	13.4	1.0	-28.7	37.0	63.5	26.5	PASS
17066	Peak	Vert	46.1	36.6	13.4	1.0	-28.7	68.4	83.5	15.1	PASS
17066	Avg	Vert	15.9	36.6	13.4	1.0	-28.7	38.2	63.5	25.3	PASS
Mid Channel - Y axis											
2438	Peak	Horz	100.5	28.6	4.7	10.0	-35.8	107.9			PASS
2438	Avg	Horz	96.6	28.6	4.7	10.0	-35.8	104.0			PASS
2438	Peak	Vert	98.1	28.6	4.7	10.0	-35.8	105.5			PASS
2438	Avg	Vert	94.1	28.6	4.7	10.0	-35.8	101.5			PASS

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Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Low Channel - X axis											
2406	Peak	Horz	98.9	28.4	4.7	10.0	-35.9	106.1			PASS
2406	Avg	Horz	95.2	28.4	4.7	10.0	-35.9	102.3			PASS
2406	Peak	Vert	100.6	28.4	4.7	10.0	-35.9	107.7			PASS
2406	Avg	Vert	96.7	28.4	4.7	10.0	-35.9	103.9			PASS
2357	Peak	Horz	51.3	28.2	4.7	10.0	-35.9	58.3	74.0	15.7	PASS
2357	Avg	Horz	42.2	28.2	4.7	10.0	-35.9	49.2	54.0	4.8	PASS
2357	Peak	Vert	54.3	28.2	4.7	10.0	-35.9	61.3	74.0	12.7	PASS
2357	Avg	Vert	44.8	28.2	4.7	10.0	-35.9	51.8	54.0	2.2	PASS
High Channel - X axis											
2470	Peak	Horz	97.6	28.7	4.7	10.0	-35.8	105.1			PASS
2470	Avg	Horz	93.4	28.7	4.7	10.0	-35.8	101.0			PASS
2470	Peak	Vert	99.2	28.7	4.7	10.0	-35.8	106.7			PASS
2470	Avg	Vert	95.2	28.7	4.7	10.0	-35.8	102.7			PASS
2483.5	Peak	Horz	16.1	28.8	4.7	10.0	-35.8	23.7	74.0	50.3	PASS
2483.5	Avg	Horz	32.6	28.8	4.7	10.0	-35.8	40.2	54.0	13.8	PASS
2483.5	Peak	Vert	48.7	28.8	4.7	10.0	-35.8	56.3	74.0	17.7	PASS
2483.5	Avg	Vert	35.8	28.8	4.7	10.0	-35.8	43.4	54.0	10.6	PASS

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Taoglas FCP70 Antenna

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Mid Channel - Z axis											
2438	Peak	Horz	105.4	28.6	4.7	10.0	-35.8	112.8			PASS
2438	Avg	Horz	101.5	28.6	4.7	10.0	-35.8	108.9			PASS
2438	Peak	Vert	99.5	28.6	4.7	10.0	-35.8	106.9			PASS
2438	Avg	Vert	95.4	28.6	4.7	10.0	-35.8	102.8			PASS
Mid Channel - X axis											
2438	Peak	Horz	107.7	28.6	4.7	10.0	-35.8	115.1			PASS
2438	Avg	Horz	103.7	28.6	4.7	10.0	-35.8	111.1			PASS
2438	Peak	Vert	98.6	28.6	4.7	10.0	-35.8	106.0			PASS
2438	Avg	Vert	94.7	28.6	4.7	10.0	-35.8	102.1			PASS
2388	Peak	Horz	53.5	28.3	4.7	10.0	-35.9	60.6	74.0	13.4	PASS
2388	Avg	Horz	44.4	28.3	4.7	10.0	-35.9	51.5	54.0	2.5	PASS
2388	Peak	Vert	47.8	28.3	4.7	10.0	-35.9	54.9	74.0	19.1	PASS
2388	Avg	Vert	37.1	28.3	4.7	10.0	-35.9	44.1	54.0	9.9	PASS
4876	Peak	Horz	61.6	33.4	7.0	1.0	-34.0	69.0	74.0	5.0	PASS
4876	Avg	Horz	31.4	33.4	7.0	1.0	-34.0	38.8	54.0	15.2	PASS
4876	Peak	Vert	58.7	33.4	7.0	1.0	-34.0	66.0	74.0	8.0	PASS
4876	Avg	Vert	28.4	33.4	7.0	1.0	-34.0	35.8	54.0	18.2	PASS
7314	Peak	Horz	61.2	29.1	8.8	1.0	-33.7	66.3	74.0	7.7	PASS
7314	Avg	Horz	30.9	29.1	8.8	1.0	-33.7	36.1	54.0	17.9	PASS
7314	Peak	Vert	65.3	29.1	8.8	1.0	-33.7	70.4	74.0	3.6	PASS
7314	Avg	Vert	35.0	29.1	8.8	1.0	-33.7	40.1	54.0	13.9	PASS
9752	Peak	Horz	60.5	31.3	9.9	1.0	-33.9	68.8	74.0	5.2	PASS
9752	Avg	Horz	30.3	31.3	9.9	1.0	-33.9	38.6	54.0	15.4	PASS
9752	Peak	Vert	61.1	31.3	9.9	1.0	-33.9	69.4	74.0	4.6	PASS
9752	Avg	Vert	30.9	31.3	9.9	1.0	-33.9	39.2	54.0	14.8	PASS
12190	Peak	Horz	47.1	31.8	11.3	1.0	-32.0	59.2	83.5	24.3	PASS
12190	Avg	Horz	16.9	31.8	11.3	1.0	-32.0	29.0	63.5	34.5	PASS
12190	Peak	Vert	48.0	31.8	11.3	1.0	-32.0	60.1	83.5	23.4	PASS
12190	Avg	Vert	17.8	31.8	11.3	1.0	-32.0	29.9	63.5	33.6	PASS
14628	Peak	Horz	44.3	32.5	12.7	1.0	-30.0	60.5	83.5	23.0	PASS
14628	Avg	Horz	14.1	32.5	12.7	1.0	-30.0	30.3	63.5	33.2	PASS
14628	Peak	Vert	44.5	32.5	12.7	1.0	-30.0	60.8	83.5	22.7	PASS
14628	Avg	Vert	14.3	32.5	12.7	1.0	-30.0	30.5	63.5	33.0	PASS
17066	Peak	Horz	49.7	36.6	13.4	1.0	-28.7	72.0	83.5	11.5	PASS
17066	Avg	Horz	19.5	36.6	13.4	1.0	-28.7	41.8	63.5	21.7	PASS
17066	Peak	Vert	52.6	36.6	13.4	1.0	-28.7	74.9	83.5	8.6	PASS
17066	Avg	Vert	22.4	36.6	13.4	1.0	-28.7	44.7	63.5	18.8	PASS
Mid Channel - Y axis											
2438	Peak	Horz	91.8	28.6	4.7	10.0	-35.8	99.2			PASS
2438	Avg	Horz	87.9	28.6	4.7	10.0	-35.8	95.3			PASS
2438	Peak	Vert	106.4	28.6	4.7	10.0	-35.8	113.8			PASS
2438	Avg	Vert	102.5	28.6	4.7	10.0	-35.8	109.9			PASS

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Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Low Channel - X axis											
2406	Peak	Horz	105.3	28.4	4.7	10.0	-35.9	112.5			PASS
2406	Avg	Horz	101.5	28.4	4.7	10.0	-35.9	108.6			PASS
2406	Peak	Vert	96.8	28.4	4.7	10.0	-35.9	104.0			PASS
2406	Avg	Vert	93.0	28.4	4.7	10.0	-35.9	100.2			PASS
2357	Peak	Horz	52.1	28.2	4.7	10.0	-35.9	59.0	74.0	15.0	PASS
2357	Avg	Horz	42.4	28.2	4.7	10.0	-35.9	49.4	54.0	4.6	PASS
2357	Peak	Vert	48.9	28.2	4.7	10.0	-35.9	55.8	74.0	18.2	PASS
2357	Avg	Vert	39.2	28.2	4.7	10.0	-35.9	46.2	54.0	7.8	PASS
High Channel - X axis											
2470	Peak	Horz	106.2	28.7	4.7	10.0	-35.8	113.8			PASS
2470	Avg	Horz	102.2	28.7	4.7	10.0	-35.8	109.8			PASS
2470	Peak	Vert	98.3	28.7	4.7	10.0	-35.8	105.8			PASS
2470	Avg	Vert	94.4	28.7	4.7	10.0	-35.8	101.9			PASS
2483.5	Peak	Horz	53.3	28.8	4.7	10.0	-35.8	60.9	74.0	13.1	PASS
2483.5	Avg	Horz	40.2	28.8	4.7	10.0	-35.8	47.8	54.0	6.2	PASS
2483.5	Peak	Vert	48.4	28.8	4.7	10.0	-35.8	56.0	74.0	18.0	PASS
2483.5	Avg	Vert	37.0	28.8	4.7	10.0	-35.8	44.6	54.0	9.4	PASS

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Taoglas WPC25A Antenna

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Mid Channel - Z axis											
2438	Peak	Horz	102.1	28.6	4.7	10.0	-35.8	109.5			PASS
2438	Avg	Horz	98.1	28.6	4.7	10.0	-35.8	105.5			PASS
2438	Peak	Vert	103.8	28.6	4.7	10.0	-35.8	111.3			PASS
2438	Avg	Vert	99.9	28.6	4.7	10.0	-35.8	107.4			PASS
Mid Channel - X axis											
2438	Peak	Horz	104.6	28.6	4.7	10.0	-35.8	112.0			PASS
2438	Avg	Horz	100.7	28.6	4.7	10.0	-35.8	108.1			PASS
2438	Peak	Vert	102.4	28.6	4.7	10.0	-35.8	109.8			PASS
2438	Avg	Vert	98.6	28.6	4.7	10.0	-35.8	106.1			PASS
2388	Peak	Horz	51.9	28.3	4.7	10.0	-35.9	59.0	74.0	15.0	PASS
2388	Avg	Horz	42.5	28.3	4.7	10.0	-35.9	49.6	54.0	4.4	PASS
2388	Peak	Vert	53.0	28.3	4.7	10.0	-35.9	60.1	74.0	13.9	PASS
2388	Avg	Vert	43.7	28.3	4.7	10.0	-35.9	50.8	54.0	3.2	PASS
4876	Peak	Horz	60.6	33.4	7.0	1.0	-34.0	68.0	74.0	6.0	PASS
4876	Avg	Horz	30.4	33.4	7.0	1.0	-34.0	37.8	54.0	16.2	PASS
4876	Peak	Vert	60.7	33.4	7.0	1.0	-34.0	68.1	74.0	5.9	PASS
4876	Avg	Vert	30.5	33.4	7.0	1.0	-34.0	37.9	54.0	16.1	PASS
7314	Peak	Horz	64.2	29.1	8.8	1.0	-33.7	69.3	74.0	4.7	PASS
7314	Avg	Horz	33.9	29.1	8.8	1.0	-33.7	39.0	54.0	15.0	PASS
7314	Peak	Vert	65.6	29.1	8.8	1.0	-33.7	70.7	74.0	3.3	PASS
7314	Avg	Vert	35.4	29.1	8.8	1.0	-33.7	40.5	54.0	13.5	PASS
9752	Peak	Horz	45.7	31.3	9.9	1.0	-33.9	54.0	74.0	20.0	PASS
9752	Avg	Horz	15.5	31.3	9.9	1.0	-33.9	23.8	54.0	30.2	PASS
9752	Peak	Vert	45.9	31.3	9.9	1.0	-33.9	54.2	74.0	19.8	PASS
9752	Avg	Vert	15.6	31.3	9.9	1.0	-33.9	24.0	54.0	30.0	PASS
12190	Peak	Horz	42.5	31.8	11.3	1.0	-32.0	54.6	83.5	28.9	PASS
12190	Avg	Horz	12.3	31.8	11.3	1.0	-32.0	24.3	63.5	39.2	PASS
12190	Peak	Vert	41.0	31.8	11.3	1.0	-32.0	53.0	83.5	30.5	PASS
12190	Avg	Vert	10.7	31.8	11.3	1.0	-32.0	22.8	63.5	40.7	PASS
14628	Peak	Horz	47.0	32.5	12.7	1.0	-30.0	63.2	83.5	20.3	PASS
14628	Avg	Horz	16.7	32.5	12.7	1.0	-30.0	33.0	63.5	30.5	PASS
14628	Peak	Vert	46.9	32.5	12.7	1.0	-30.0	63.1	83.5	20.4	PASS
14628	Avg	Vert	16.7	32.5	12.7	1.0	-30.0	32.9	63.5	30.6	PASS
17066	Peak	Horz	49.4	36.6	13.4	1.0	-28.7	71.7	83.5	11.8	PASS
17066	Avg	Horz	19.2	36.6	13.4	1.0	-28.7	41.5	63.5	22.0	PASS
17066	Peak	Vert	48.4	36.6	13.4	1.0	-28.7	70.7	83.5	12.8	PASS
17066	Avg	Vert	18.2	36.6	13.4	1.0	-28.7	40.5	63.5	23.0	PASS
Mid Channel - Y axis											
2438	Peak	Horz	102.2	28.6	4.7	10.0	-35.8	109.6			PASS
2438	Avg	Horz	98.3	28.6	4.7	10.0	-35.8	105.7			PASS
2438	Peak	Vert	101.0	28.6	4.7	10.0	-35.8	108.4			PASS
2438	Avg	Vert	97.2	28.6	4.7	10.0	-35.8	104.6			PASS

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Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Low Channel - X axis											
2406	Peak	Horz	102.6	28.4	4.7	10.0	-35.9	109.8			PASS
2406	Avg	Horz	98.6	28.4	4.7	10.0	-35.9	105.8			PASS
2406	Peak	Vert	102.6	28.4	4.7	10.0	-35.9	109.8			PASS
2406	Avg	Vert	98.8	28.4	4.7	10.0	-35.9	106.0			PASS
2357	Peak	Horz	50.2	28.2	4.7	10.0	-35.9	57.2	74.0	16.8	PASS
2357	Avg	Horz	40.6	28.2	4.7	10.0	-35.9	47.6	54.0	6.4	PASS
2357	Peak	Vert	56.6	28.2	4.7	10.0	-35.9	63.6	74.0	10.4	PASS
2357	Avg	Vert	46.3	28.2	4.7	10.0	-35.9	53.3	54.0	0.7	PASS
High Channel - X axis											
2470	Peak	Horz	103.4	28.7	4.7	10.0	-35.8	110.9			PASS
2470	Avg	Horz	99.1	28.7	4.7	10.0	-35.8	106.7			PASS
2470	Peak	Vert	99.9	28.7	4.7	10.0	-35.8	107.5			PASS
2470	Avg	Vert	96.0	28.7	4.7	10.0	-35.8	103.5			PASS
2483.5	Peak	Horz	50.3	28.8	4.7	10.0	-35.8	57.9	74.0	16.1	PASS
2483.5	Avg	Horz	36.9	28.8	4.7	10.0	-35.8	44.5	54.0	9.5	PASS
2483.5	Peak	Vert	49.2	28.8	4.7	10.0	-35.8	56.8	74.0	17.2	PASS
2483.5	Avg	Vert	36.5	28.8	4.7	10.0	-35.8	44.1	54.0	9.9	PASS

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Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 15, 2020	Jan. 15, 2022	GEMC 233
Loop Antenna	EM 6871	Electro-Metrics	Feb 15, 2019	Feb 15, 2021	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 15, 2019	Feb 15, 2021	GEMC 71
BiLog Antenna	3142-C	ETS	Oct 18, 2018	Oct 18, 2020	GEMC 8
Horn Antenna 1 – 18 GHz	AH-118	Com-Power Corporation	Aug. 5, 2019	Aug. 5, 2021	GEMC 214
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Apr. 1, 2020	Apr. 1, 2022	GEMC 6375
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Oct 23, 2018	Oct 23, 2020	GEMC 6371
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Feb. 25, 2019	Feb. 25, 2021	GEMC 168
2.4GHz-2.5GHz Notch Filter	BRM50702	Micro-Tronics	NCR	NCR	GEMC 230
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Dec. 20, 2019	Dec. 20, 2021	GEMC 189
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	NCR	NCR	GEMC 224
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 274
RF Cable HF	HP305S	Semflex Inc.	NCR	NCR	GEMC 330
RF Cable 2m	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
Emissions Software	0.1.98	TUV SUD Canada, Inc.	NCR	NCR	GEMC 58

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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 Methods

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 ANSI 63.10 11.10.2 Method PKPSD.

Results

The EUT passed. The EUT was set to transmit at maximum power. Three Channels were measured. The following tables show the peak power spectral density: External attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

PSD				
Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Pass/Fail
1	2406	-3.45	8	Pass
6	2438	-4.68	8	Pass
11	2470	-6.71	8	Pass

Graph(s)

The graphs shown below show the power spectral density of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 3 kHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Low, middle, and high channel for each mode was investigated in each mode, with the worst case being presented.

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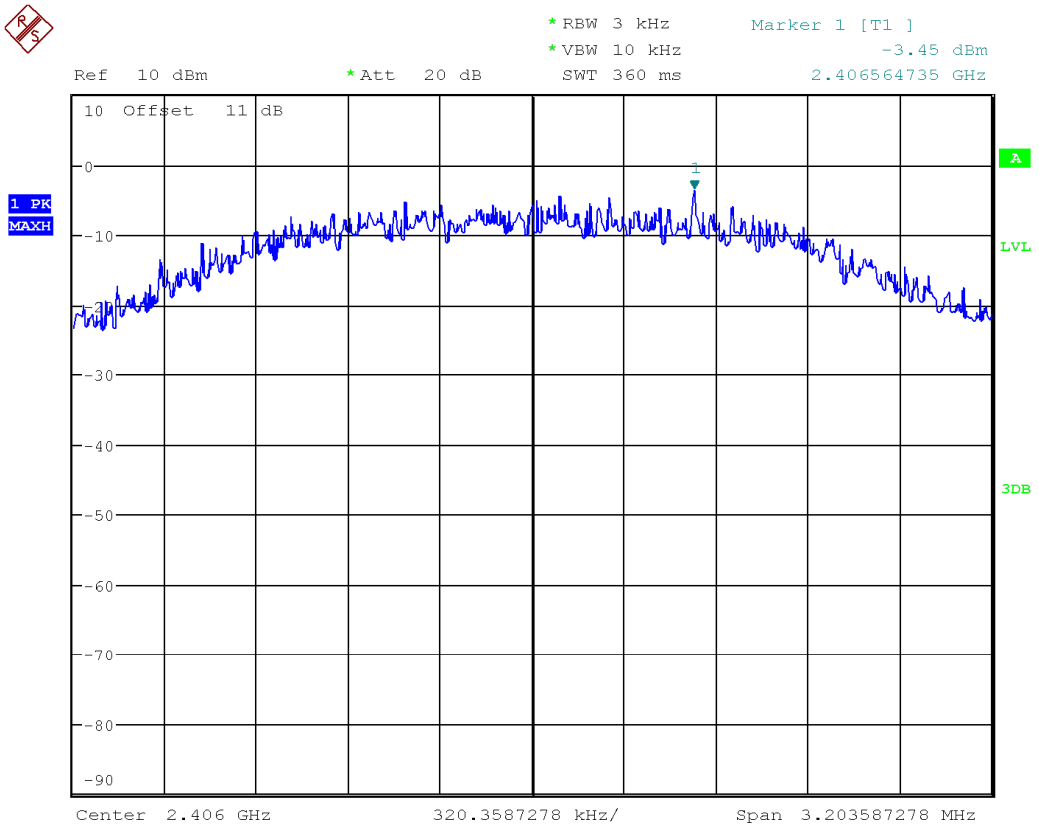
Peak Power Spectral Density
Low Channel



Date: 26.JUL.2019 17:36:32

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

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Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
26.5GHz Spectrum Analyzer	FSQ26	Rohde & Schwarz	Mar-1,2019	Mar-1,2021	GEMC 234
Attenuator 10 dB	3M-10	Weinshel	NCR	NCR	GEMC 279

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

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Appendix A – EUT Summary

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

General EUT Description

Client	
Organization / Address	Innovere Medical Inc. 250 Shields Court Unit 6 Markham ON L3R 9W7 Canada
Contact	Kevan Anderson
Phone	1-888-262-0408
Email	kevan.anderson@innoveremedical.com
EUT Details	
EUT Name	EMODHP
FCC ID	2ATDA-WMODHPA
Industry Canada #	25063-WMODHPA
Equipment Category	Low power wireless transceiver
Basic EUT Functionality	EUT is a 2.4 GHz wireless module
Peripherals Required for Test	Debug board
Release type	Final
Intentional Radiator Frequency	2400 – 2483.5 MHz FHSS
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’.

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EUT Configuration

Please see Appendix B for a picture of the unit running in normal conditions.

- Wireless were configured to transmit at maximum possible duty cycle
- Hoping was disable for all test. The EUT is tested as a DTS transmitter.
- A power setting of 0 dBm.

Operational Setup

These devices are required to be attached to the EUT for its normal operation.

- A debug board was connected to the EUT to issue test commands and to power it.

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Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report

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