



Canada

RF Test Report

As per

FCC Part 15 Subpart 15.247: 2015 & RSS 247 Issue 1: 2015

Unlicensed Intentional Radiators

on the

Smart Cap V2

Issued by:

TÜV SÜD Canada Inc.
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Min Xie,
EMC Project Engineer

Testing produced for



See Appendix A for full client &
EUT details.



LAB REGISTRATION
#6844A-3



Testing Laboratory
Certificate
#2955.02



FCC
REGISTRATION
#CA6844



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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Table of Contents

Table of Contents	2
Report Scope	3
Summary	4
Test Results Summary	5
Justifications, Descriptions, or Deviations.....	6
Applicable Standards, Specifications and Methods.....	7
Sample calculation(s).....	8
Document Revision Status	8
Definitions and Acronyms	9
Testing Facility	10
Calibrations and Accreditations	10
Testing Environmental Conditions and Dates	11
Detailed Test Results Section	12
6dB Bandwidth of Digitally Modulated Systems	13
Maximum Peak Envelope Conducted Power - DTS.....	17
Antenna Spurious Conducted Emissions (-20 dBc Requirement) – 15.247	22
Radiated Emissions	25
Power Spectral Density.....	51
Appendix A – EUT Summary.....	62

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Report Scope

This report addresses the EMC verification testing and test results of MMB Research Inc's **Smart Cap V2**, herein referred to as EUT (Equipment Under Test) performed at TUV SUD Canada.

The EUT was tested for compliance against the following standards:

RSS 247 Issue 1:2015
FCC Part 15 Subpart C 15.247:2015

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 A2LA or any other accreditation agency, any government, or TUV SUD Canada.

Opinions/interpretations expressed in this report, if any, are outside the scope of TUV SUD Canada accreditation. Any opinions expressed do not necessarily reflect the opinions of TUV SUD Canada, unless otherwise stated.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Summary

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

EUT FCC Certification #, FCC ID:	XFFSMRTCPV2
EUT Industry Canada Certification #, IC:	8365A-SMRTCPV2
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Min Xie

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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 (1)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-247 5.4 (4)	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS-247 5.4 (4)	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 (2)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) RSS-102	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
Overall Result			PASS

All tests were performed by Min Xie.

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 '*'.

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Justifications, Descriptions, or Deviations

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

For maximum permissible exposure, this device operates at less than 1 Watt at 2400 – 2483.5 MHz and is designed to operate less than 20 cm from any personnel during normal operation. The device is categorized as a Portable device

SAR and RF Exposure assessment is applicable to the EUT. The separation distance between radiating structure of the EUT and human body is 35 mm.

For the Antenna requirement specified in FCC 15.203, the unit uses a permanently connected SMD antenna (0 dBi peak gain – Johanson Technology’s 2.4 GHz SMD Antenna) which is less than 6 dBi gain.

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. However the 15.247 (d) requirement of power density were met and are detailed later in this test report.

For the scope of this test report the EUT was mounted in three orthogonal axes to maximize emissions. Worst case results are presented.

The EUT contains a rechargeable battery. All RF tests were performed with the battery fully charged.

The EUT have a USB powered docking station that contains not electronic. The USB connection is only used as a power source; the data lines were not used. The docking station provides two contact points to charge the EUT. Power line conducted emissions were performed on a laptop with the dock plugged into a USB port and the EUT in charge mode.

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Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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 15C:2015
Code of Federal Regulations – Radio Frequency Devices

CISPR 22:2008 Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement

ICES-003:2012 Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard

ISO 17025:2005 General Requirements for the competence of testing and calibration laboratories

RSS-GEN Issue 4:2014
General Requirements and Information for the Certification of Radio Apparatus

RSS-247 Issue 1: 2015

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS 102 Issue 5: 2015
Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Sample calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)

Margin = 50.5dB μ V/m – (50dB μ V + 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 = 73.0dB μ V – (50dB μ V + 10dB + 2.5dB + 0.5dB)

Margin = 10.0 dB (pass)

Document Revision Status

Revision 0 - July 23, 2016

Initial release

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Definitions and Acronyms

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

AE – Auxillary Equipment.

DTS BW – This is refers to the 6 dB bandwidth.

OBW – 99% power Occupied Bandwidth

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Testing Facility

Testing for EMC on the EUT was carried out at TUV SUD Canada near Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 6844A-3) and VCCI (R-4023, G-506, T-1246, and C-4498). This semi-anechoic chamber complies with the requirements of EN55016-2-3:2006, section 7.5 and the site attenuation requirements of EN55016-1-4. This chamber was additionally 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 TUV SUD 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 TUV SUD Canada. TUV SUD Canada is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratories 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.

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Testing Environmental Conditions and Dates

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

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
2016/4/28	Radiated emission	MX	20-24°C	39 - 50%	96 -102kPa
2016/5/2	Antenna conducted	MX	20-24°C	39 - 50%	96 -102kPa
2016/6/30	Power Line Conducted Emission	MX	20-24°C	39 - 50%	96 -102kPa

Client	MMB Research Inc	 Canada
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Detailed Test Results Section

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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 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 and Section 6.9.3 Occupied bandwidth test.

Results

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

Additionally, the 99% bandwidth were measured for information purpose. There is no requirement on 99% bandwidth.

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

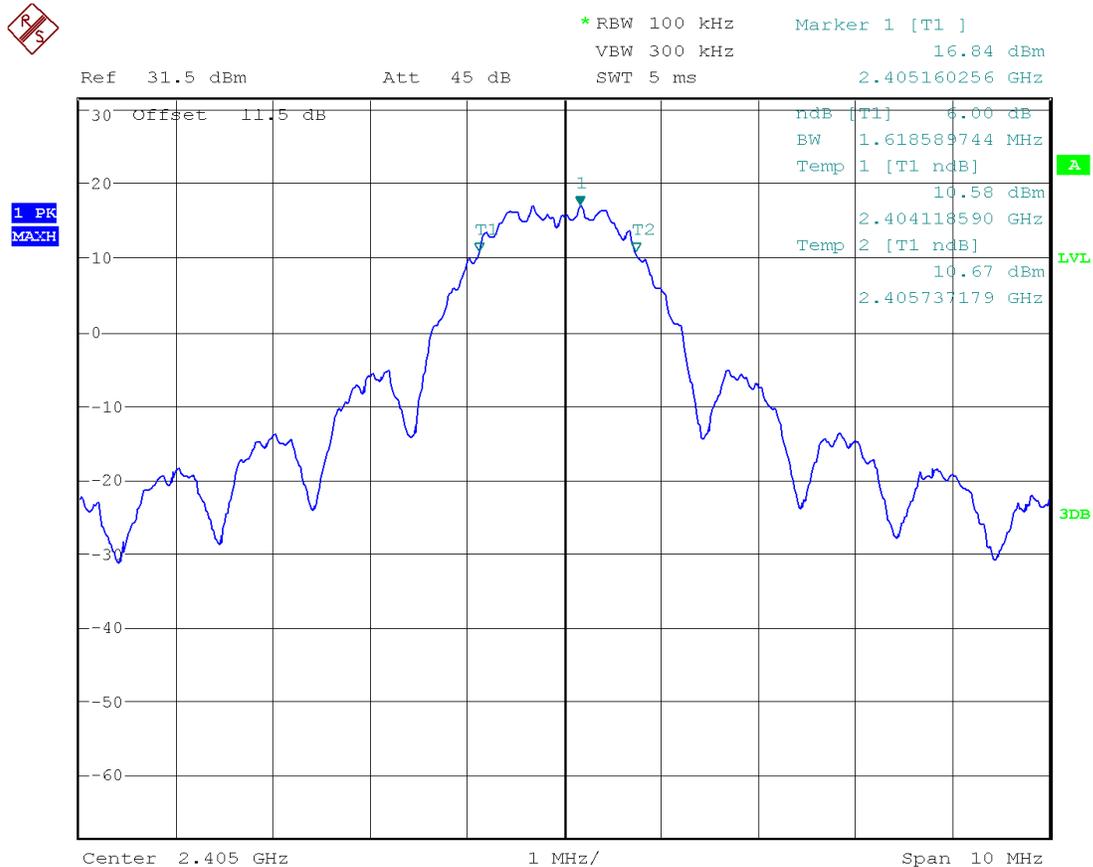
Bandwidth - B-Mode					
Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	6 dB BW Limit (MHz)	Pass/Fail
0x0B	2405	1.62	2.47	0.5	Pass
0x13	2445	1.60	2.47	0.5	Pass
0x19	2475	1.60	2.47	0.5	Pass
0x1A	2480	1.58	2.45	0.5	Pass

Client	MMB Research Inc	 Canada
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Graph(s)

The graphs shown below show the DTS BW and OBW during the operation of the device. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

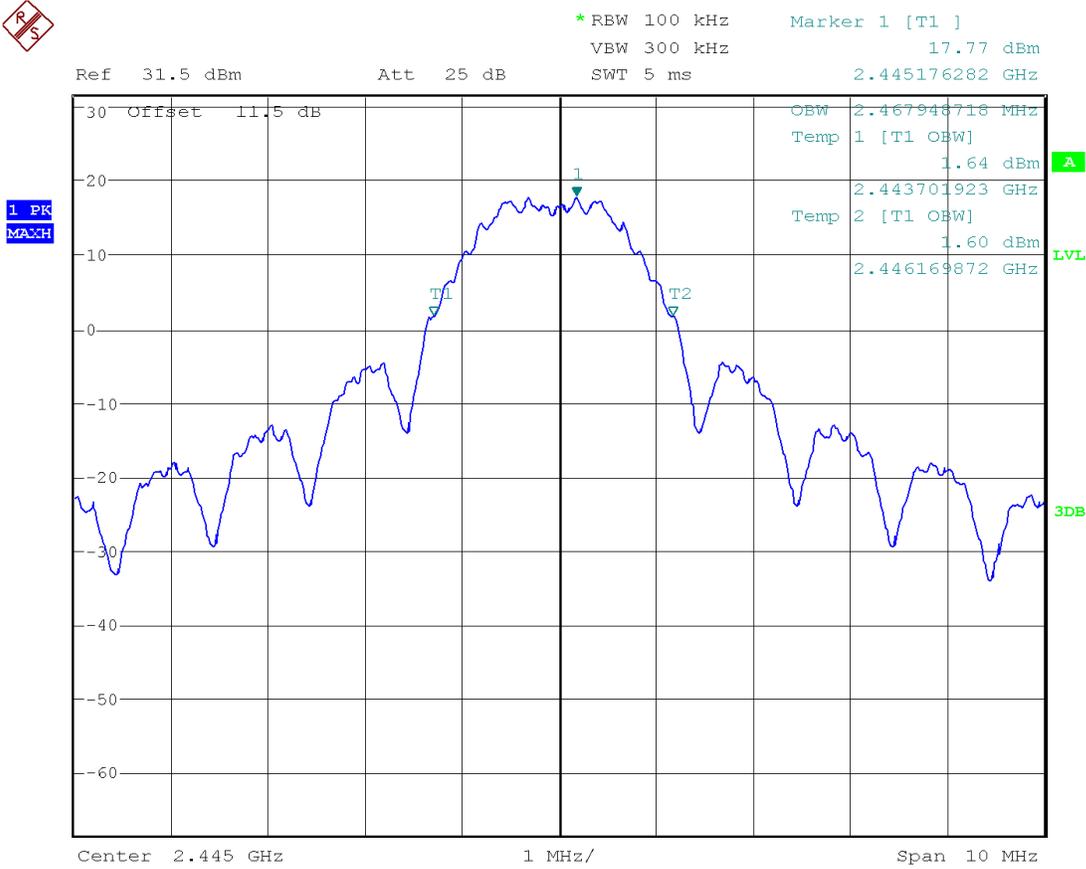
6 dB Bandwidth Channel 0xB



Date: 2.MAY.2016 13:37:00

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

99% Bandwidth
Channel 0x13



Date: 2.MAY.2016 13:39:37

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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

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

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Maximum Peak Envelope Conducted Power - DTS

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 11.9.1.1 $RBW \geq DTS$ bandwidth method.

Results

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

Peak Power					
Channel	Frequency (MHz)	Power (dBm)	Power (mW)	Limit (mW)	Pass/Fail
0x0B	2405	20.59	114.55	1000	Pass
0x13	2445	21.47	140.28	1000	Pass
0x19	2475	22.34	171.40	1000	Pass
0x1A	2480	-2.38	0.58	1000	Pass

Readings

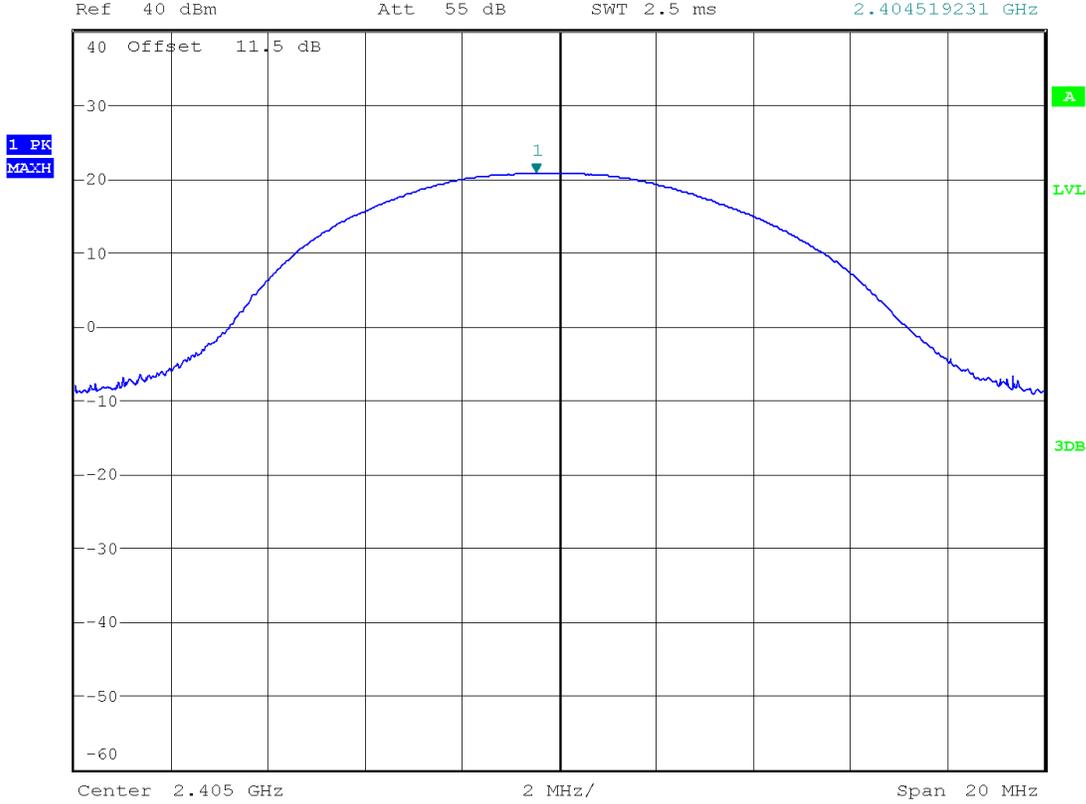
The graphs shown below show the peak power output of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 5 MHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power
Channel 0xB



* RBW 5 MHz Marker 1 [T1]
 VBW 10 MHz 20.59 dBm
 SWT 2.5 ms 2.404519231 GHz



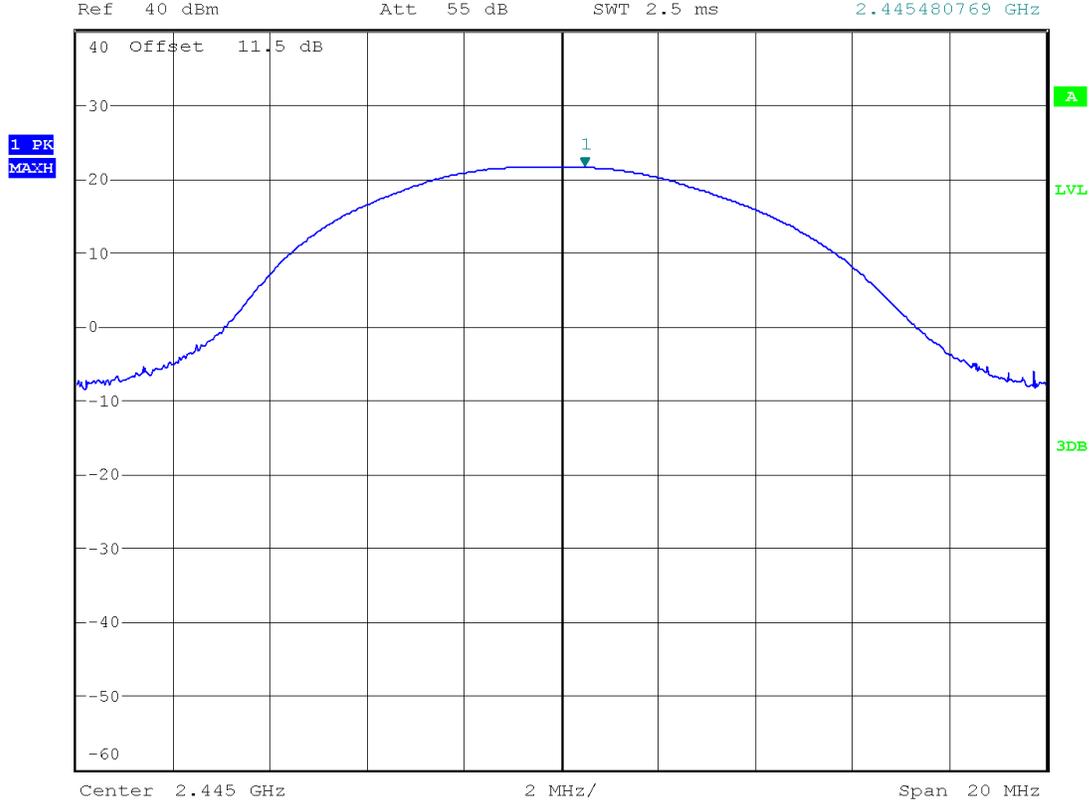
Date: 2.MAY.2016 13:50:30

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power Channel 0x13



* RBW 5 MHz Marker 1 [T1]
VBW 10 MHz 21.47 dBm
SWT 2.5 ms 2.445480769 GHz



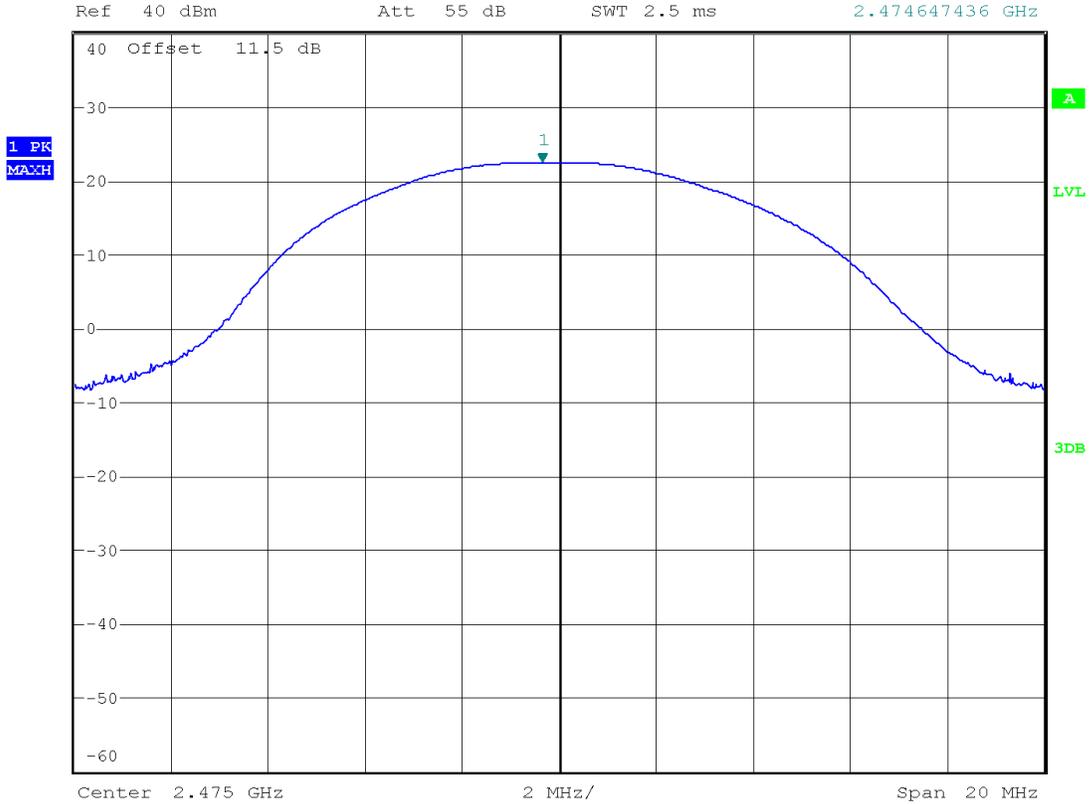
Date: 2.MAY.2016 13:49:56

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power
Channel 0x19



* RBW 5 MHz Marker 1 [T1]
VBW 10 MHz 22.34 dBm
SWT 2.5 ms 2.474647436 GHz



Date: 2.MAY.2016 13:48:32

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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

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

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Antenna Spurious Conducted Emissions (-20 dBc Requirement) – 15.247

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 Section 11.11 Emission in non-restricted frequency bands.

Results

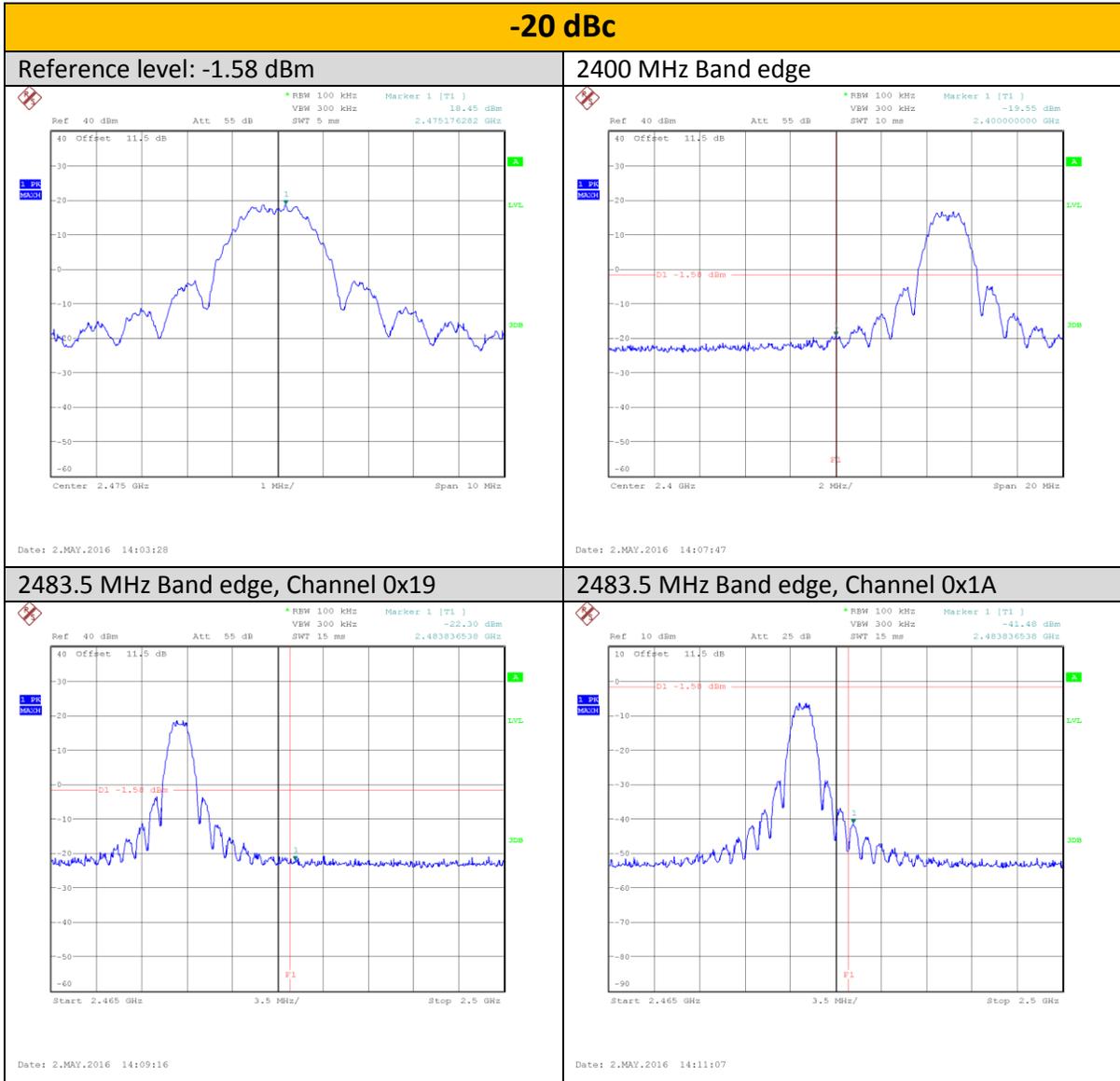
The EUT passed.

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.

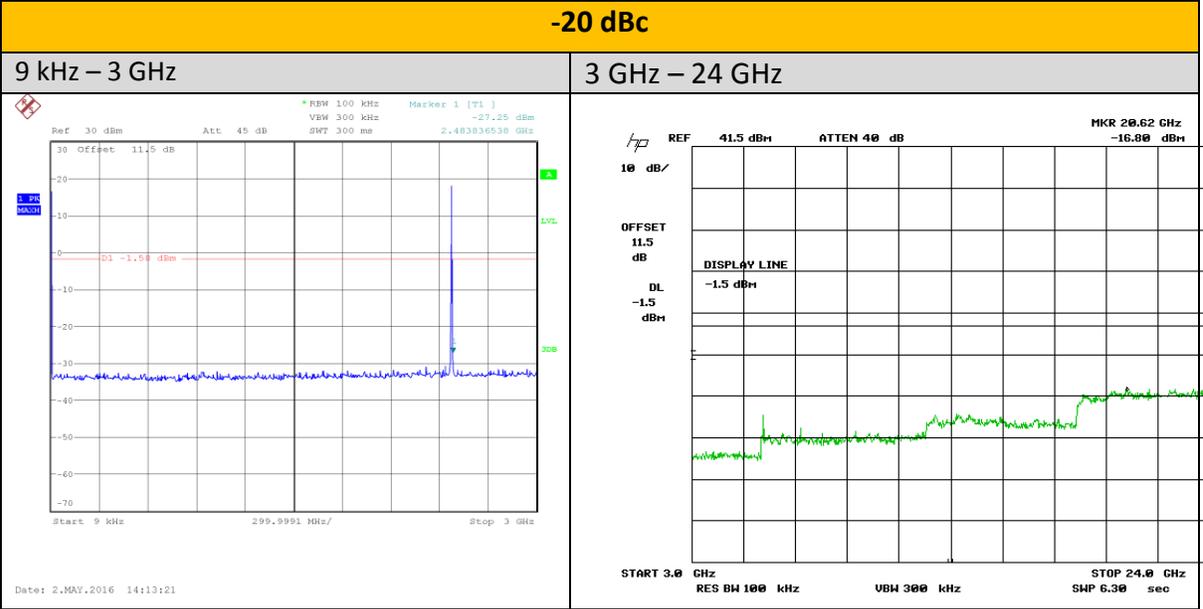
Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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.



Client	MMB Research Inc	 Canada
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Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	



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 #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

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

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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.

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 m¹

0.490 MHz – 1.705 MHz, 24000/F (kHz) uV/m at 30 m¹

1.705 MHz – 30 MHz, 30 uV/m at 30 m¹

30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m

88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m

216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m¹) at 3 m

Above 960 MHz, 500 uV/m (54.0 dBuV/m¹) at 3 m

Above 1000 MHz, 500 uV/m (54 dBuV/m²) at 3m

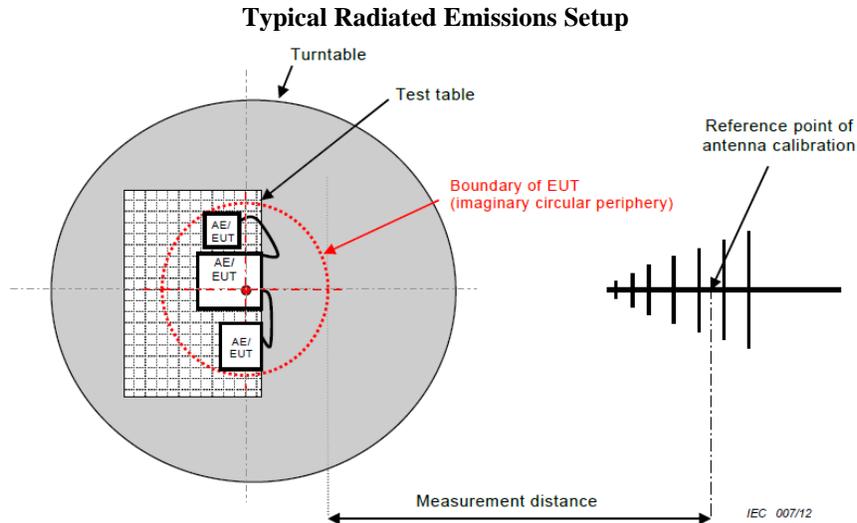
Above 1000 MHz, 500 uV/m (74 dBuV/m³) at 3m

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

²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Client	MMB Research Inc	
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Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB 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.

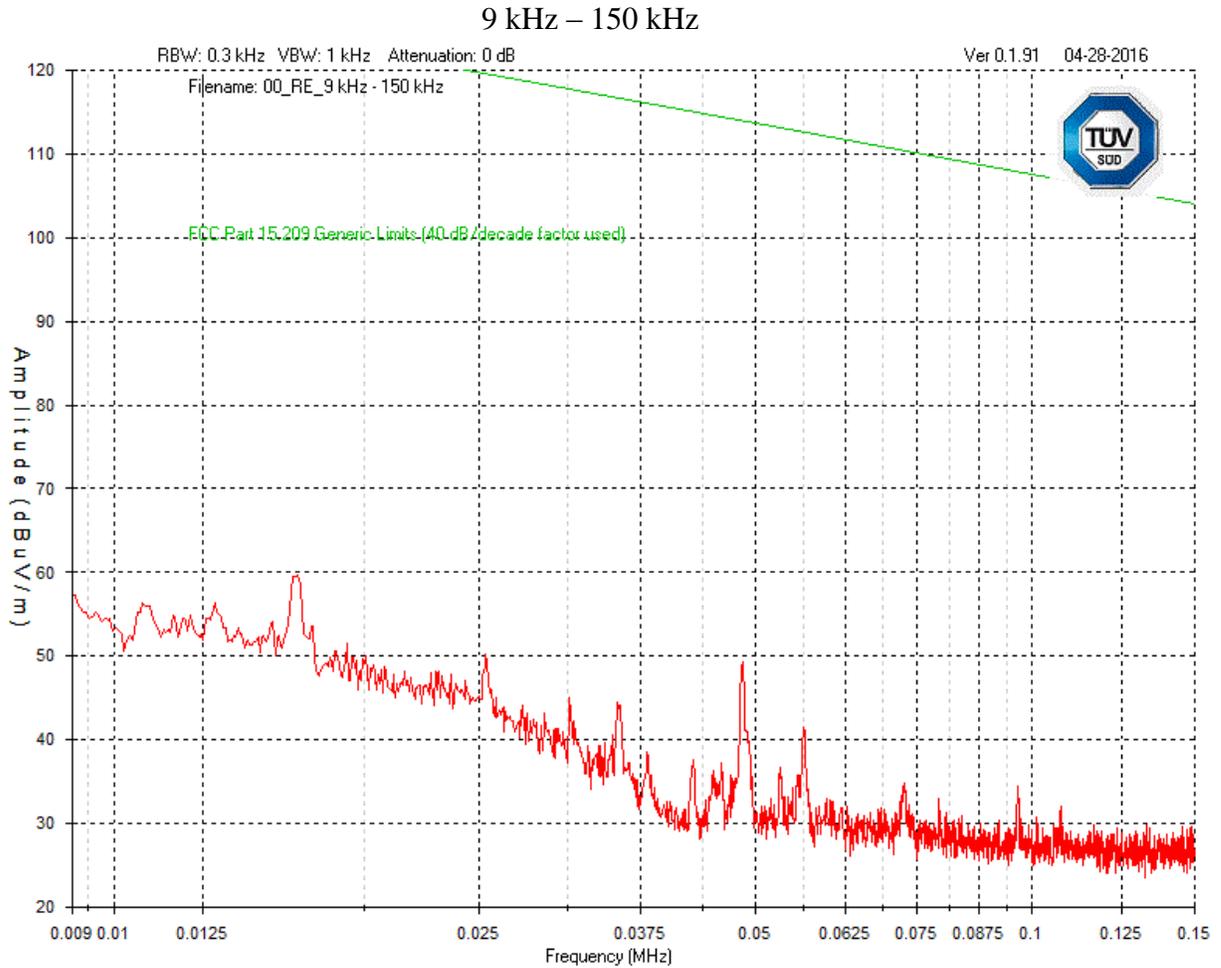
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of a 24.835 GHz).

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.

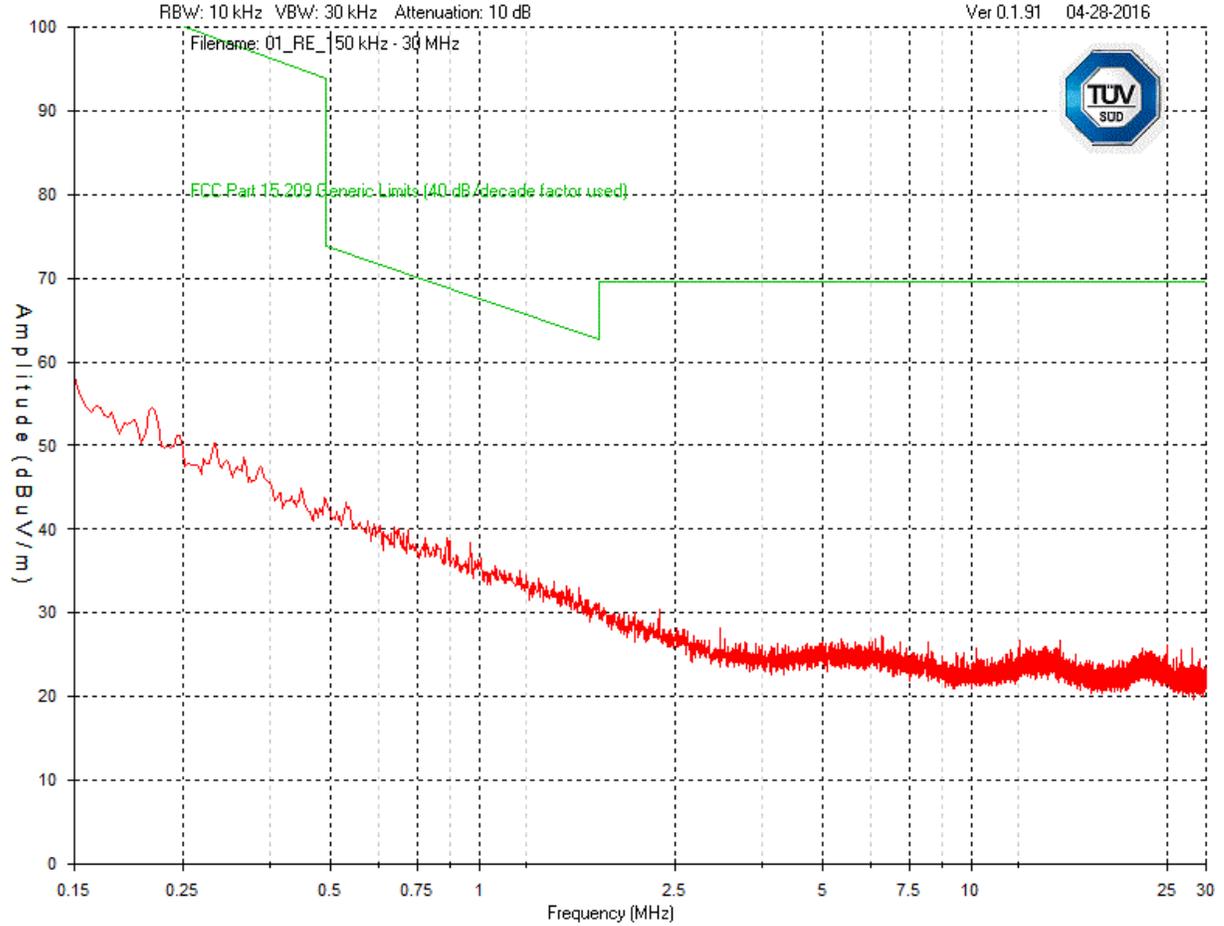
Client	MMB Research Inc	
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Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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



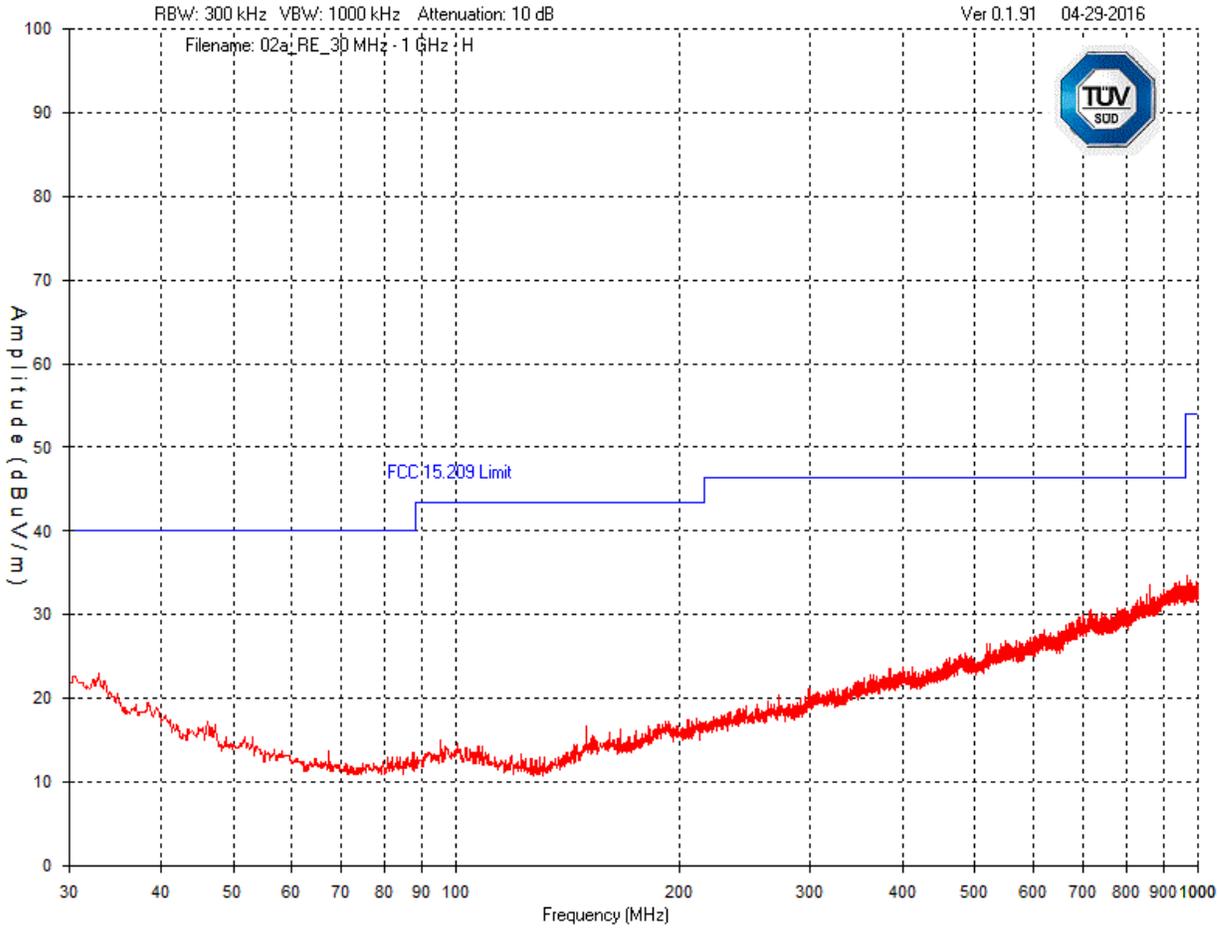
Client	MMB Research Inc	 Canada
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150 kHz – 30 MHz



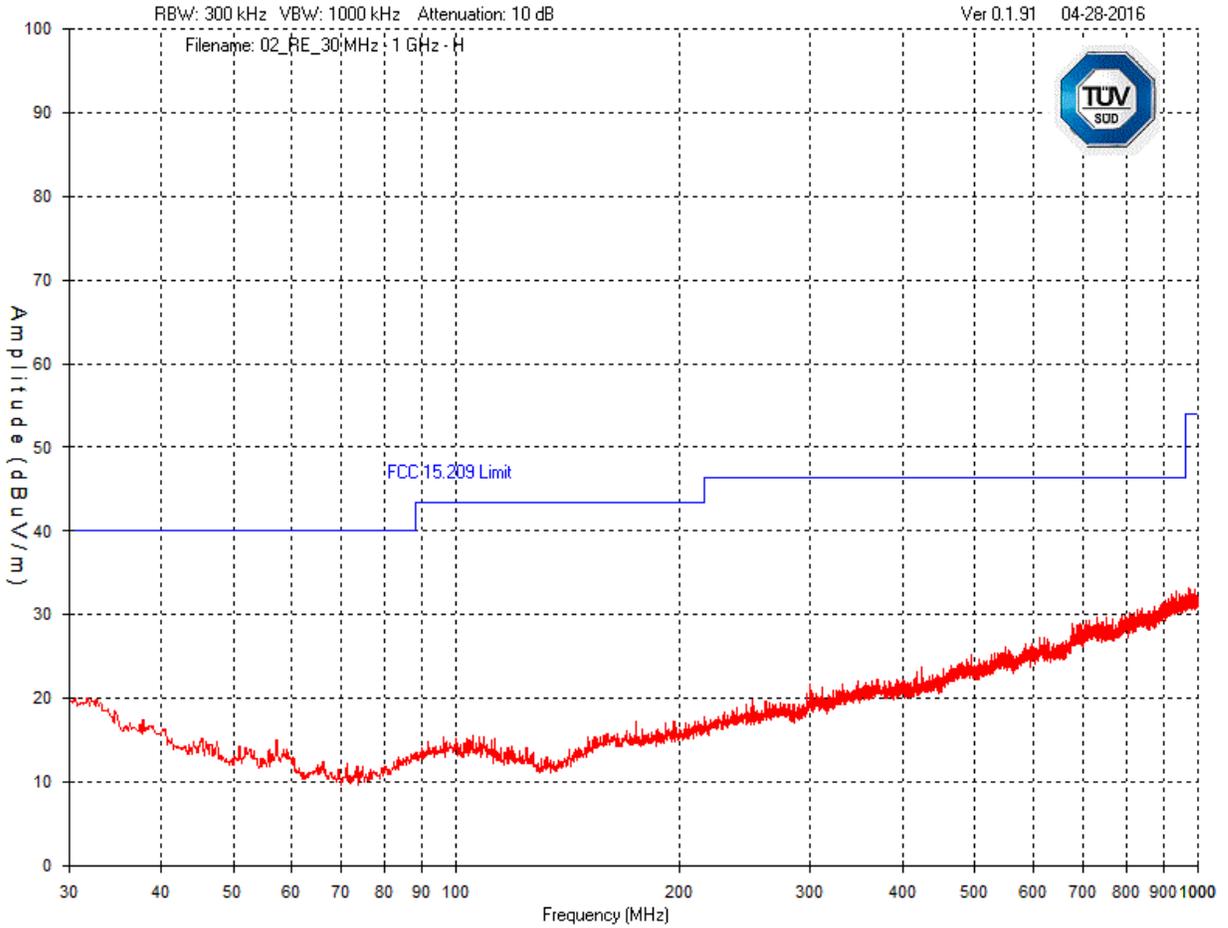
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Mid Channel - 30 MHz – 1 GHz
 Vertical – Peak Emission Graph



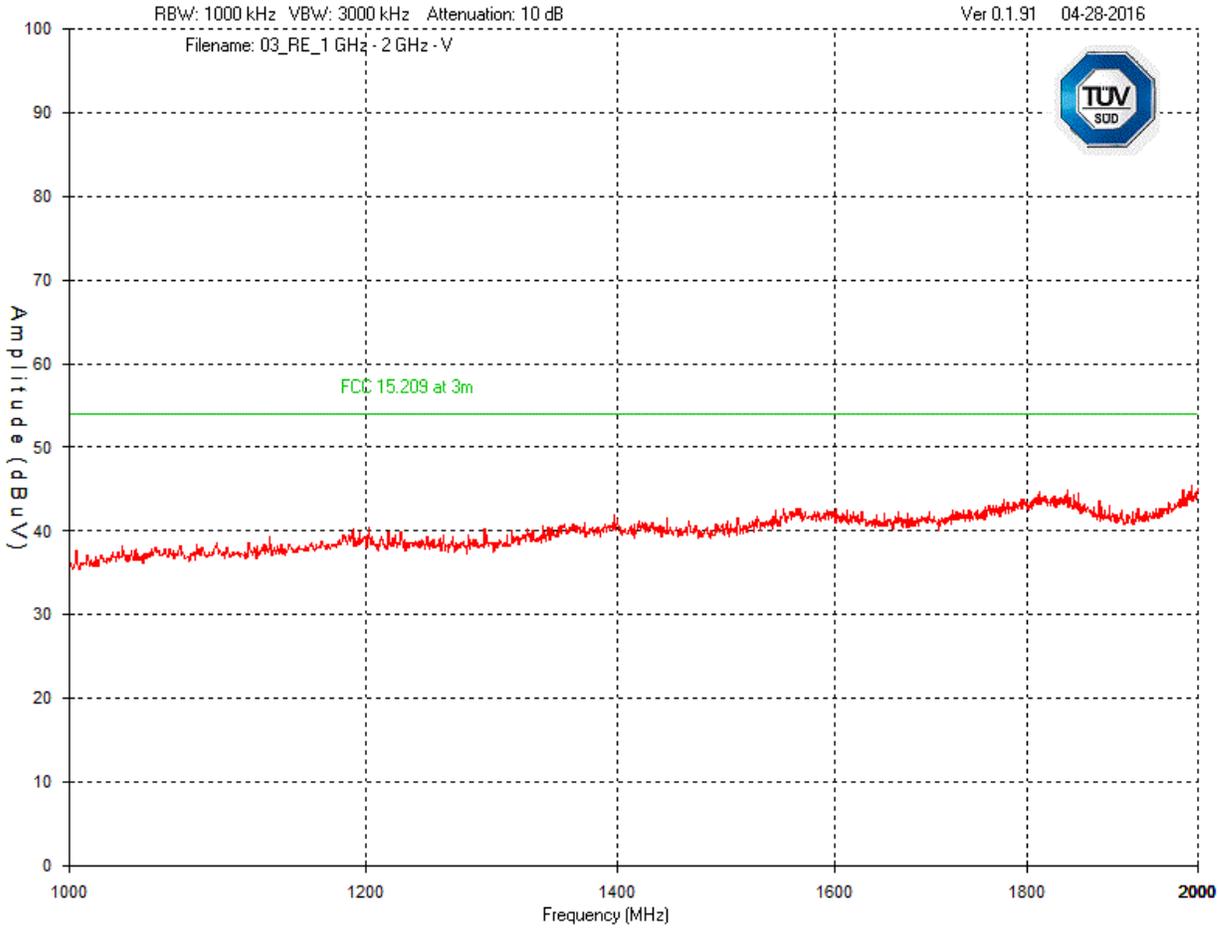
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**Mid Channel – 30 MHz – 1 GHz
Horizontal - Peak Emission Graph**



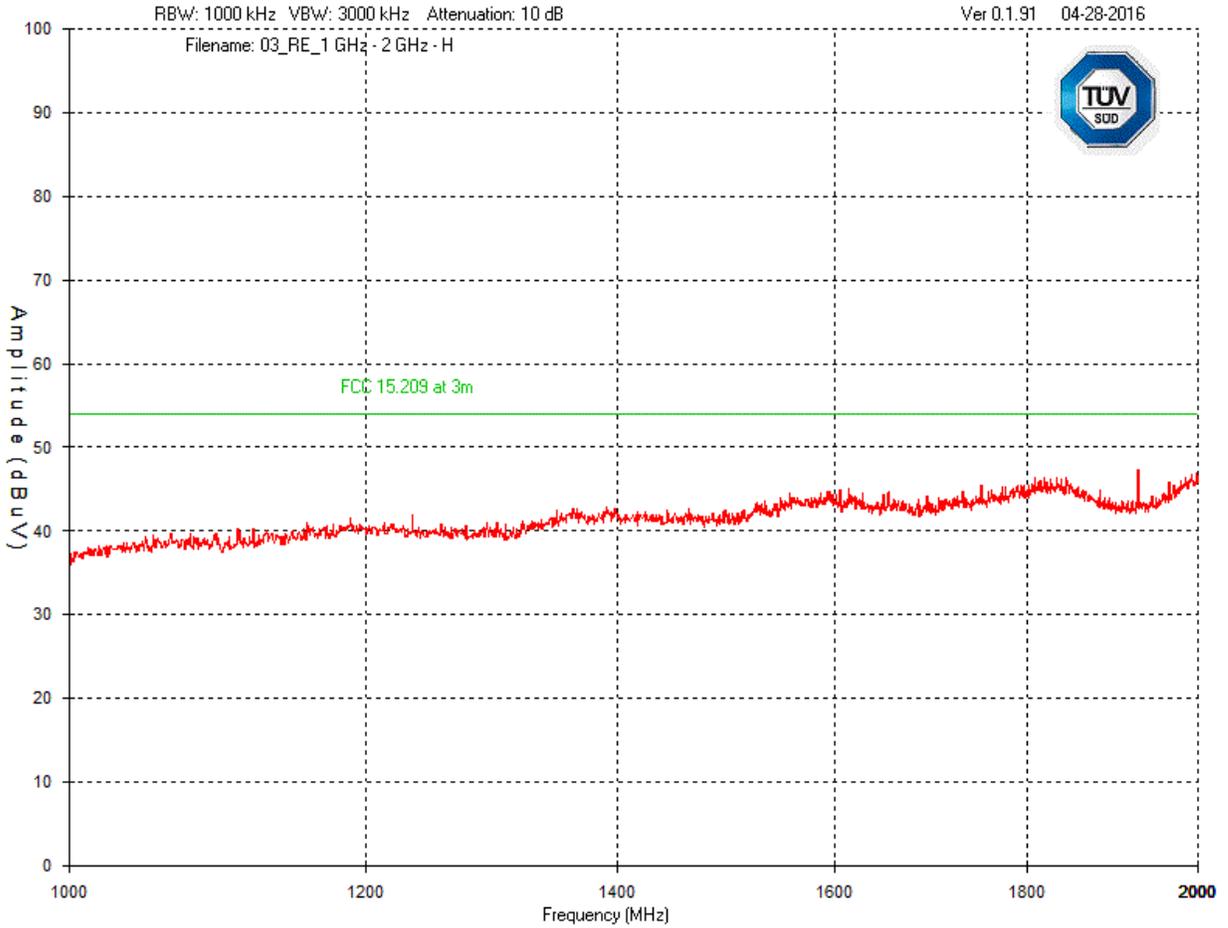
Client	MMB Research Inc	 Canada
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Mid Channel – 1 GHz – 2 GHz
 Vertical - Peak Emission Graph



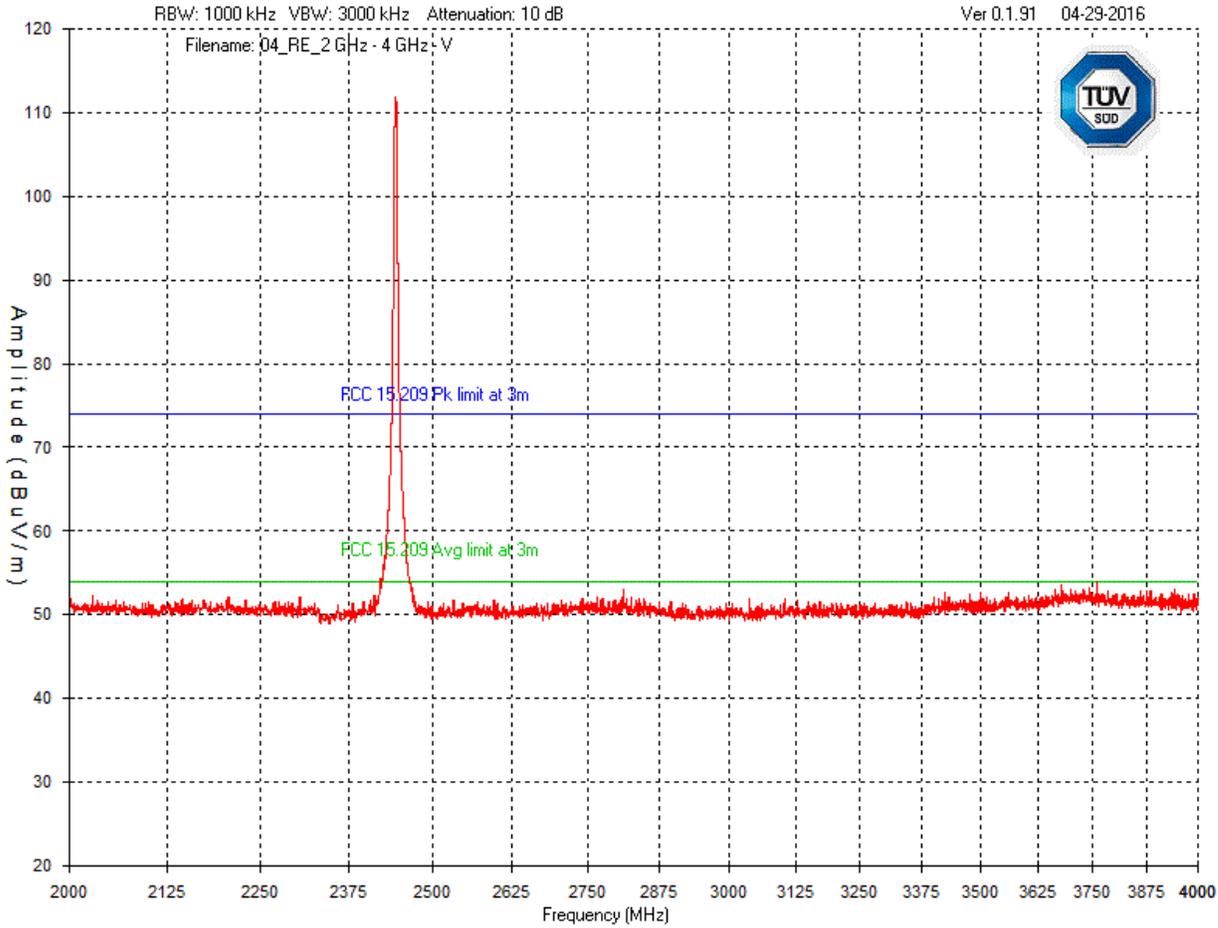
Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Mid Channel – 1 GHz – 2 GHz
Horizontal - Peak Emission Graph



Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

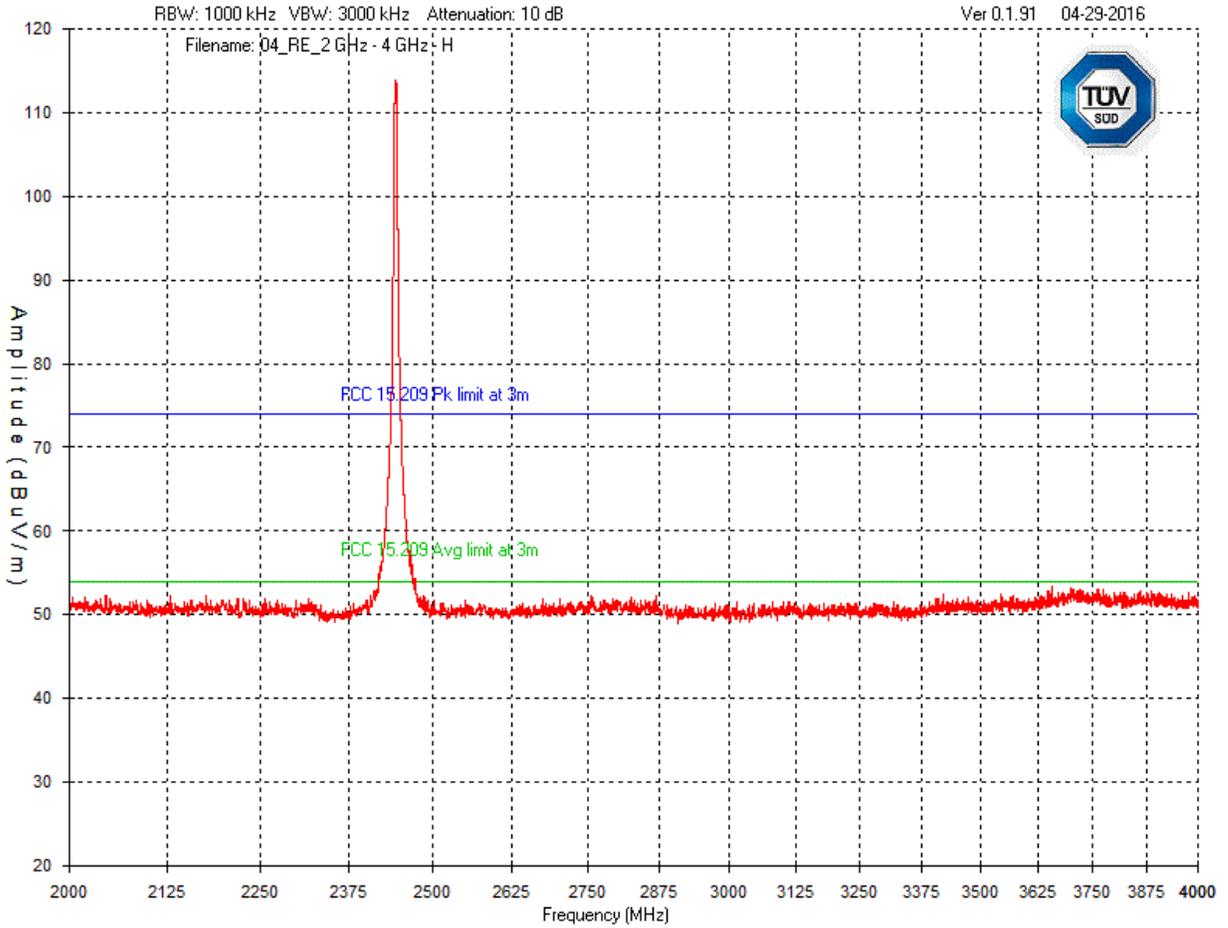
**Mid Channel – 2 GHz – 4 GHz
Vertical - Peak Emission Graph**



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

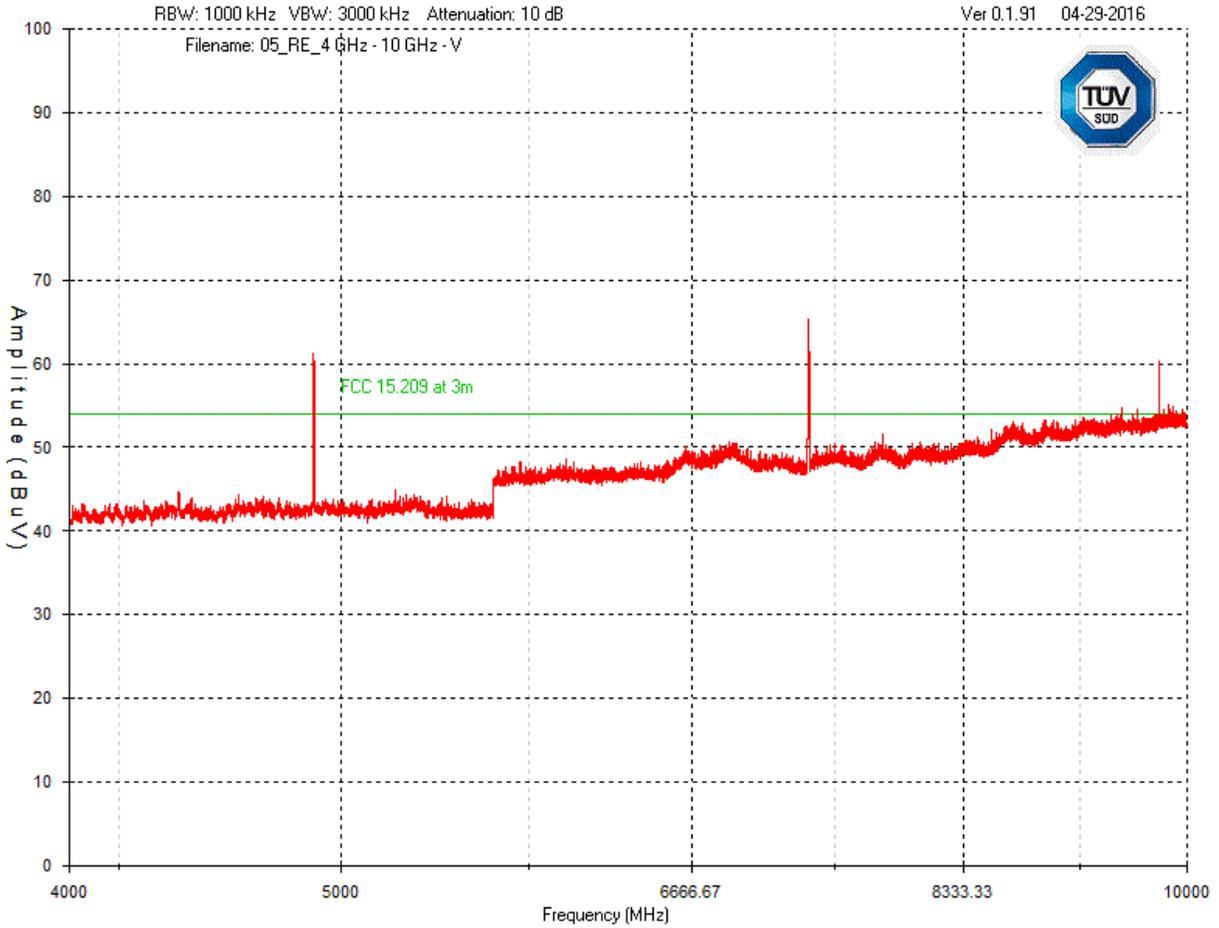
**Mid Channel – 2 GHz – 4 GHz
Horizontal - Peak Emission Graph**



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

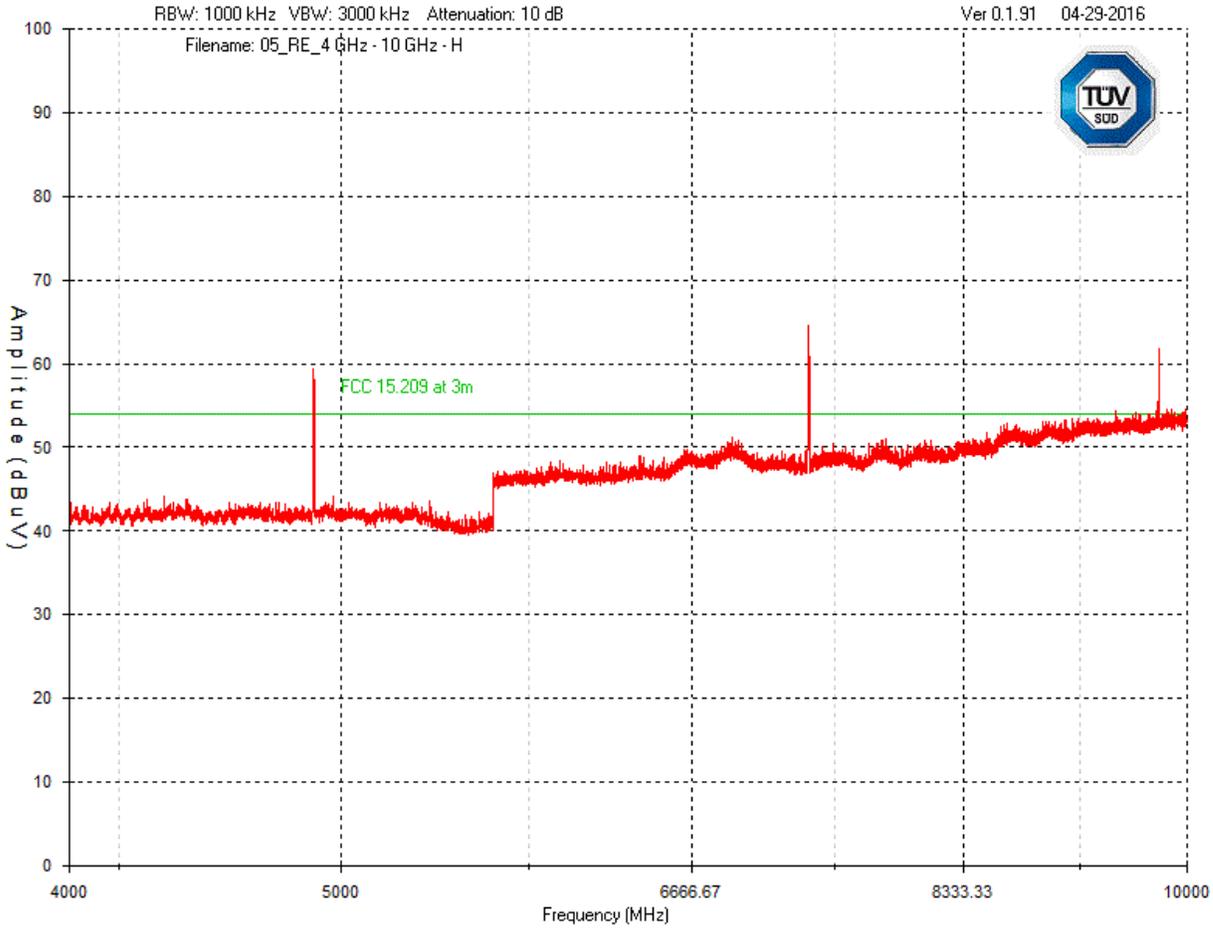
Mid Channel – 4 GHz – 10GHz
 Vertical - Peak Emission Graph



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

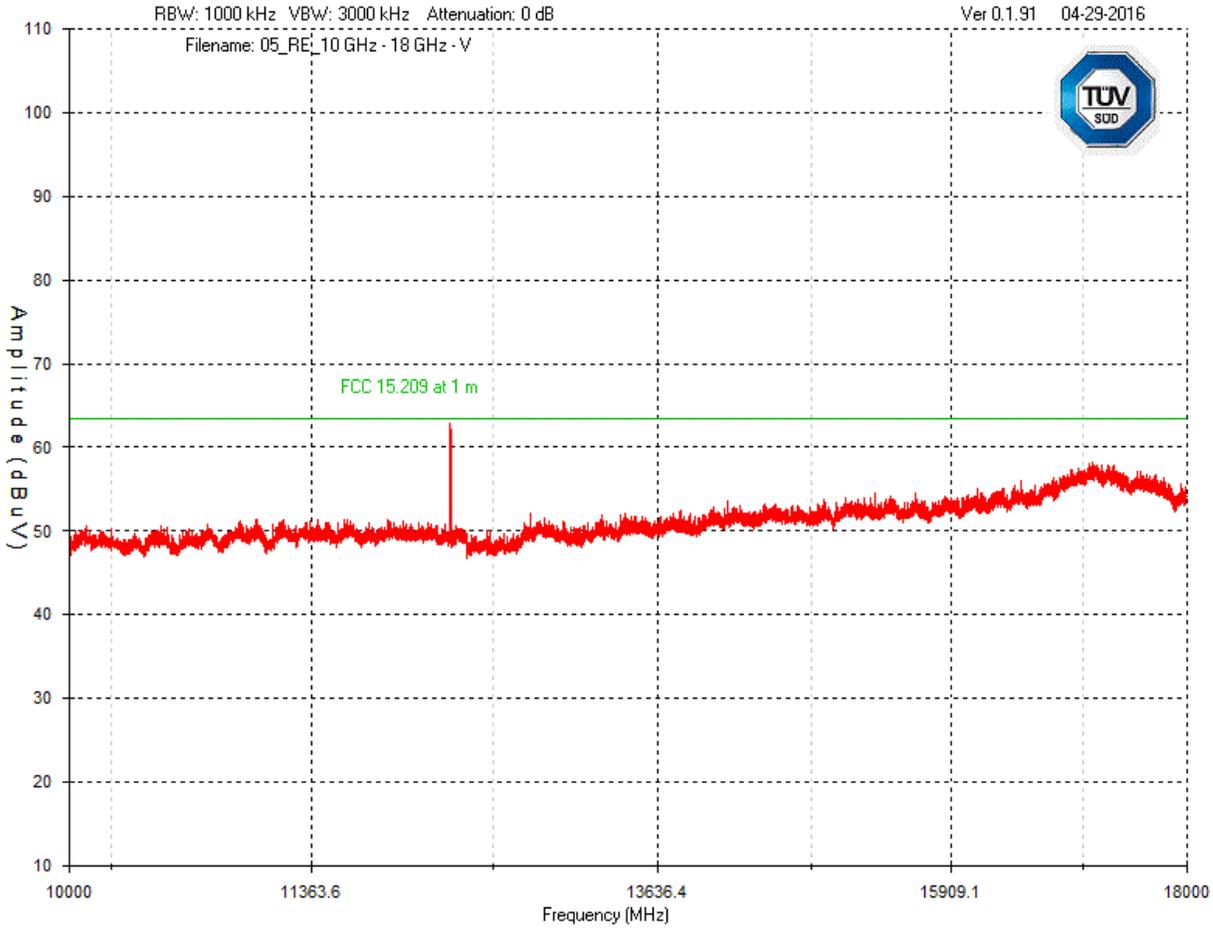
**Mid Channel – 6 GHz – 10 GHz
Vertical - Peak Emission Graph**



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

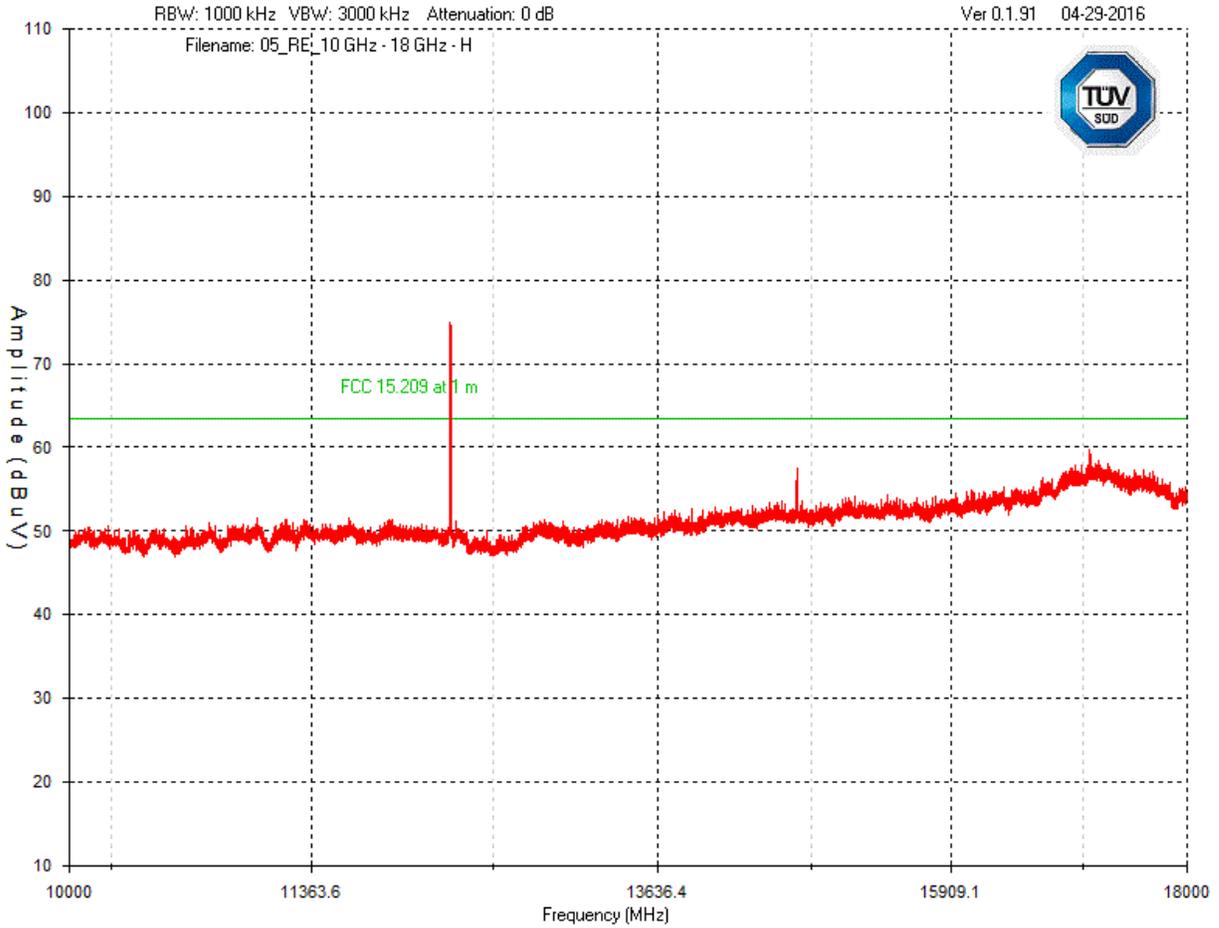
**Mid Channel – 10 GHz – 18 GHz
Vertical - Peak Emission Graph**



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

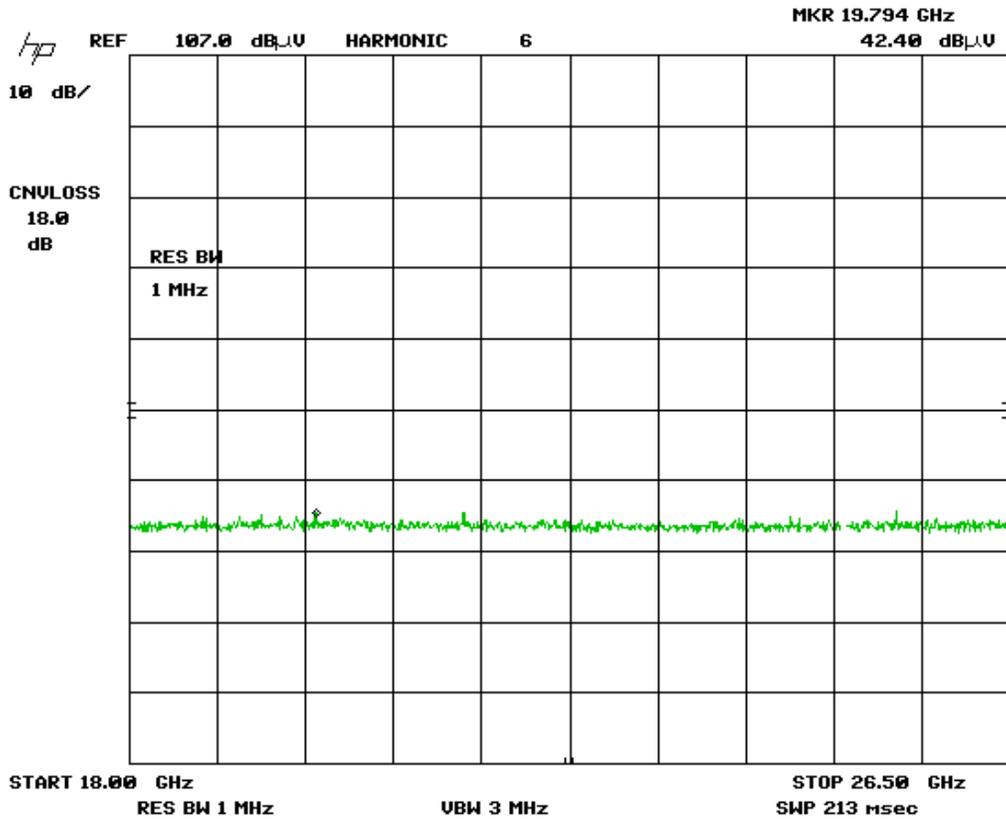
**Mid Channel – 10 GHz – 18 GHz
Horizontal - Peak Emission Graph**



Note: See Final Measurements and Results section starting on page 47 for measurements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

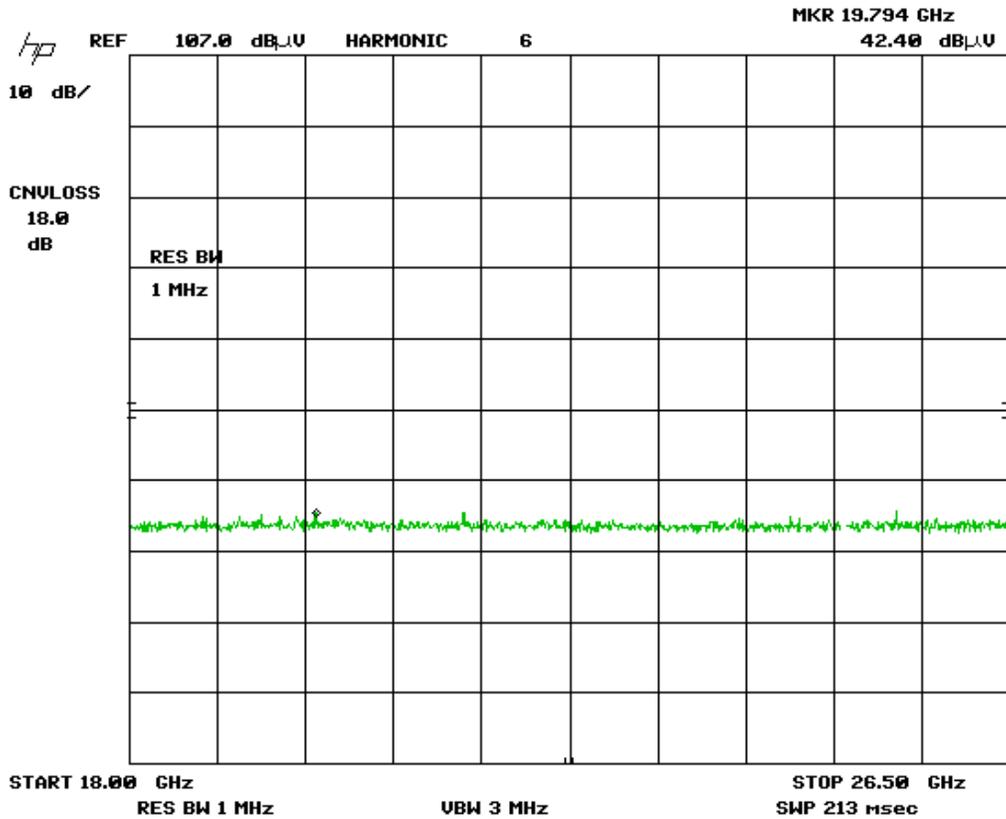
Mid Channel – 18 GHz – 26 GHz
Horizontal - Peak Emission Graph



Plot was taken at 1 meter distances. All emissions shown were instrument noise floor of measurement instrument. No emissions were found in this frequency range.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Mid Channel – 18 GHz – 26 GHz
Vertical - Peak Emission Graph

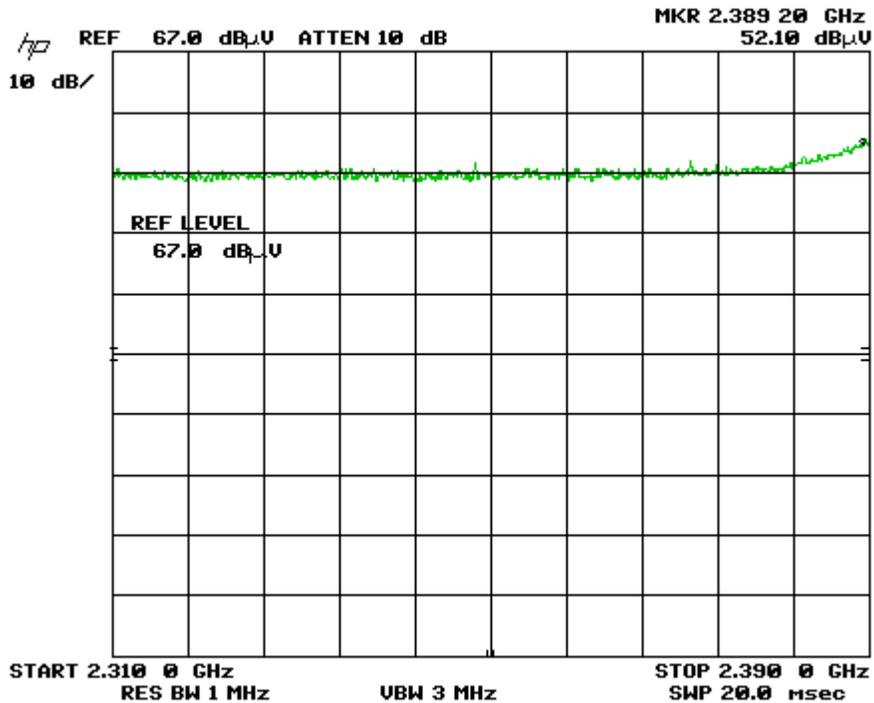


Plot was taken at 1 meter distances. All emissions shown were instrument noise floor of measurement instrument. No emissions were found in this frequency range.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Band edge measurements

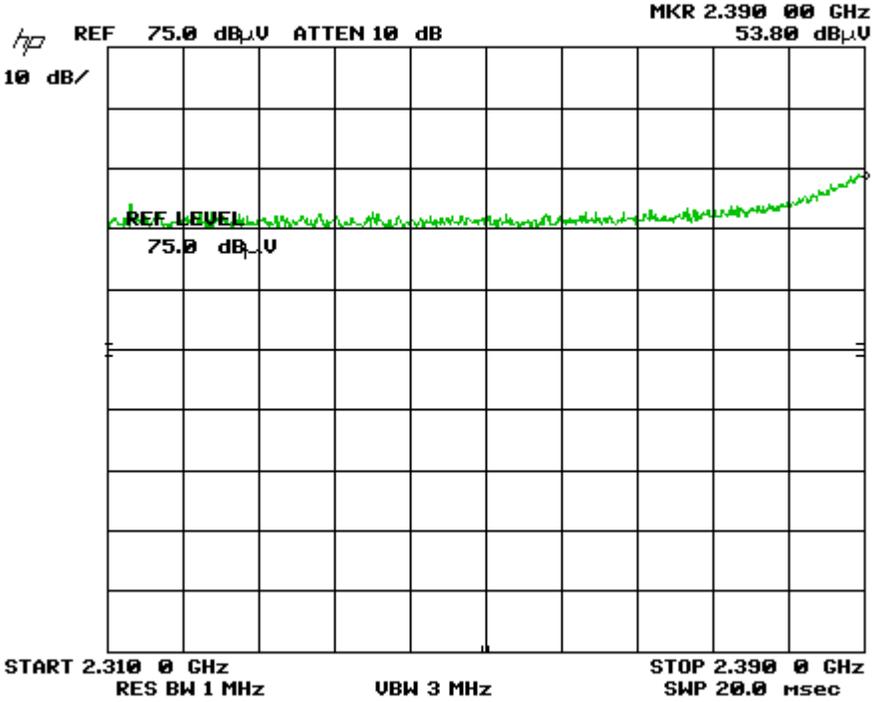
Band Edge – Low Channel
Vertical - Peak Emission



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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

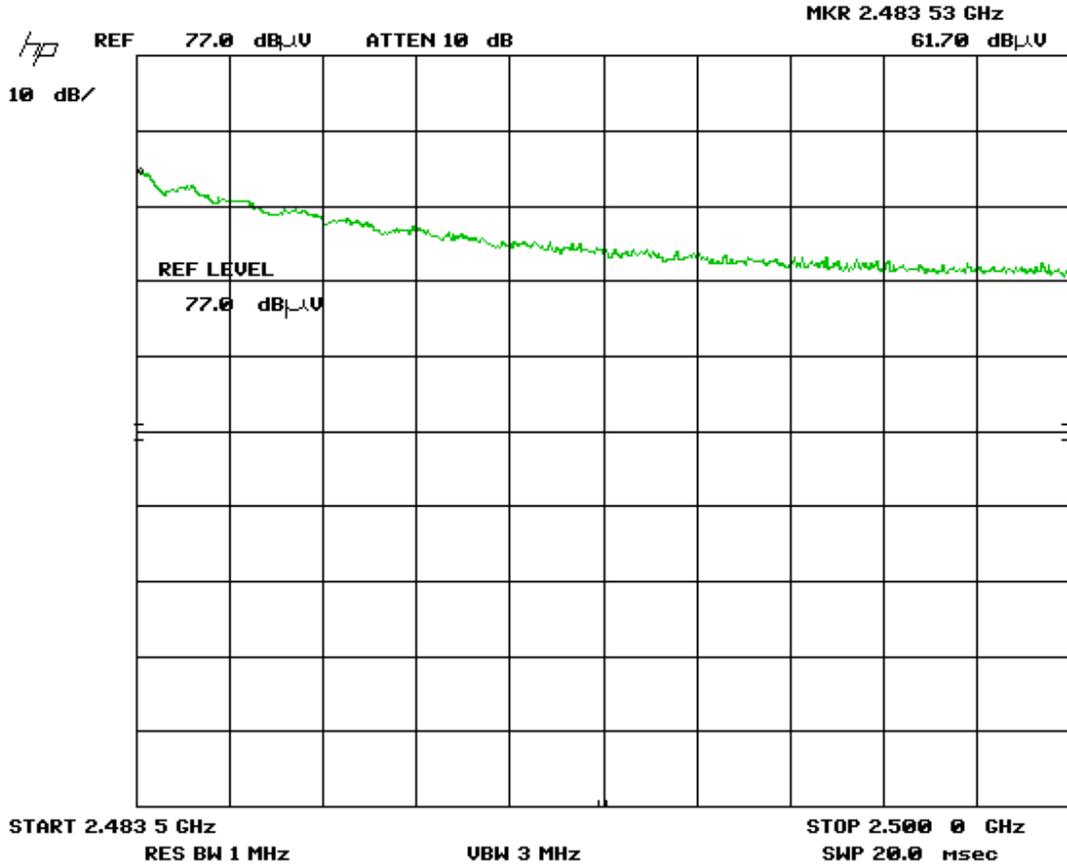
Band Edge – Low Channel
Horizontal - Peak Emission



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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

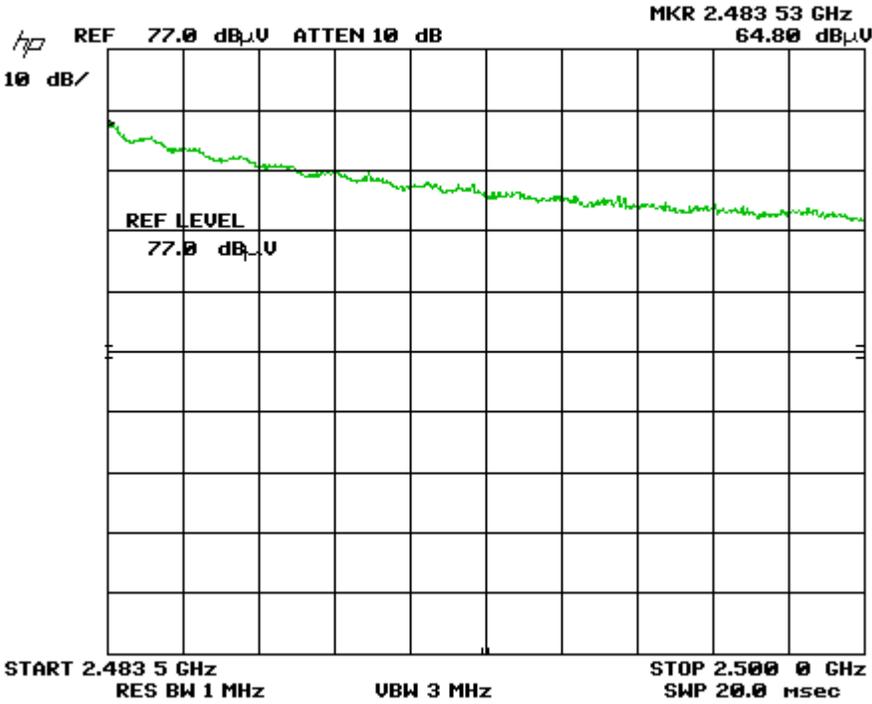
Band Edge – Hi Channel 0x19
Vertical - Peak Emission



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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

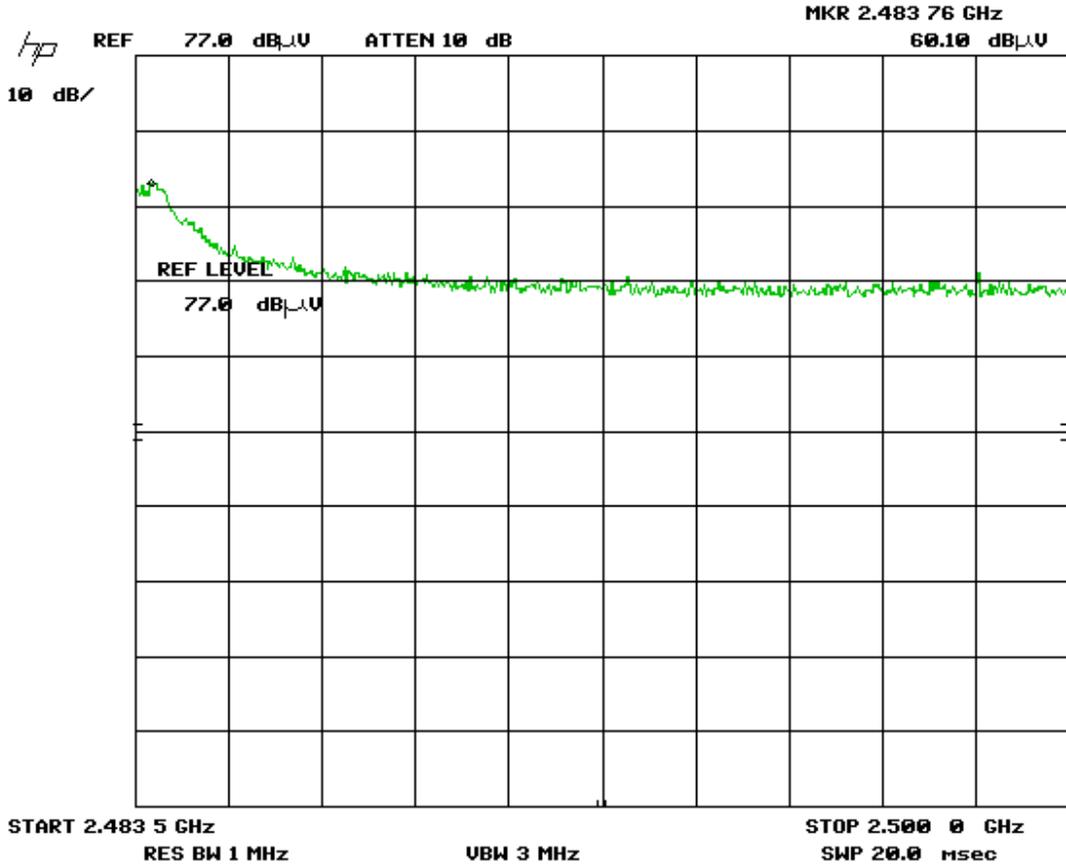
Band Edge – Hi Channel 0x19
 Horizontal - Peak Emission



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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

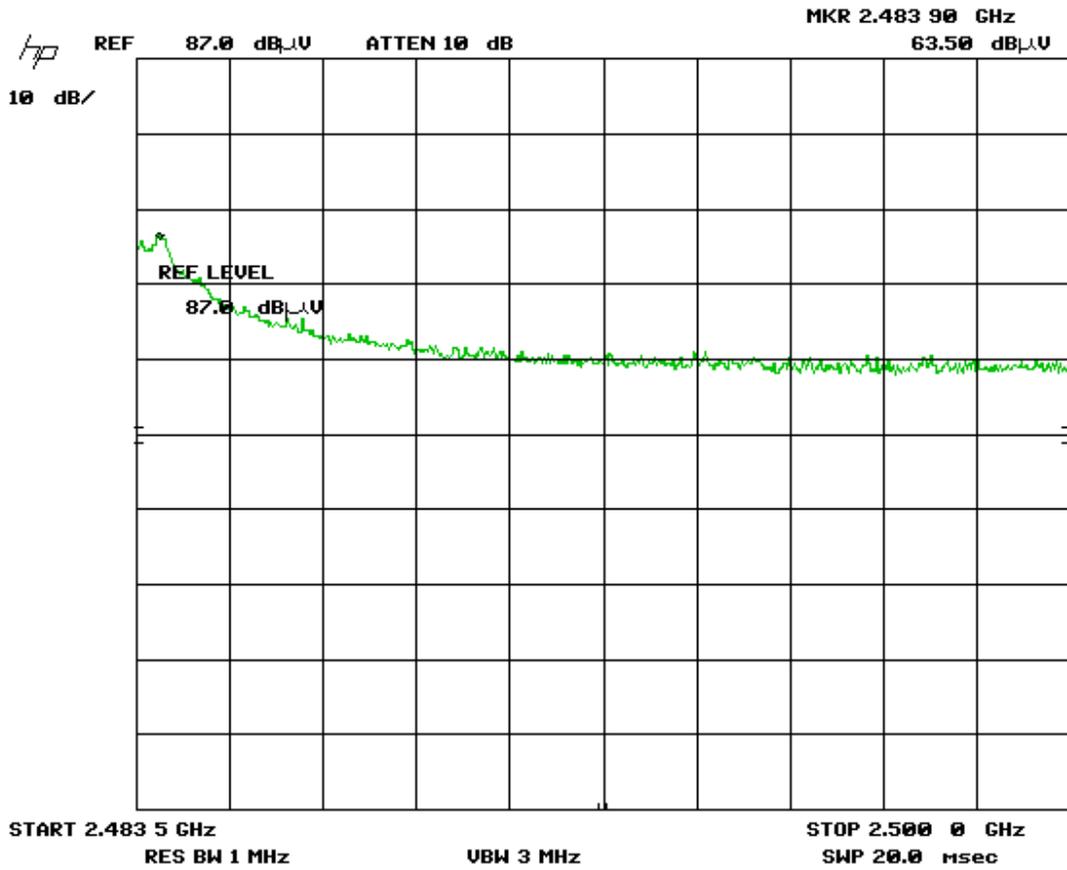
Band Edge – Hi Channel 0x1A
Vertical - Peak Emission



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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Band Edge – Hi Channel 0x1A
Horizontal - Peak 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 47 for corrected values.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

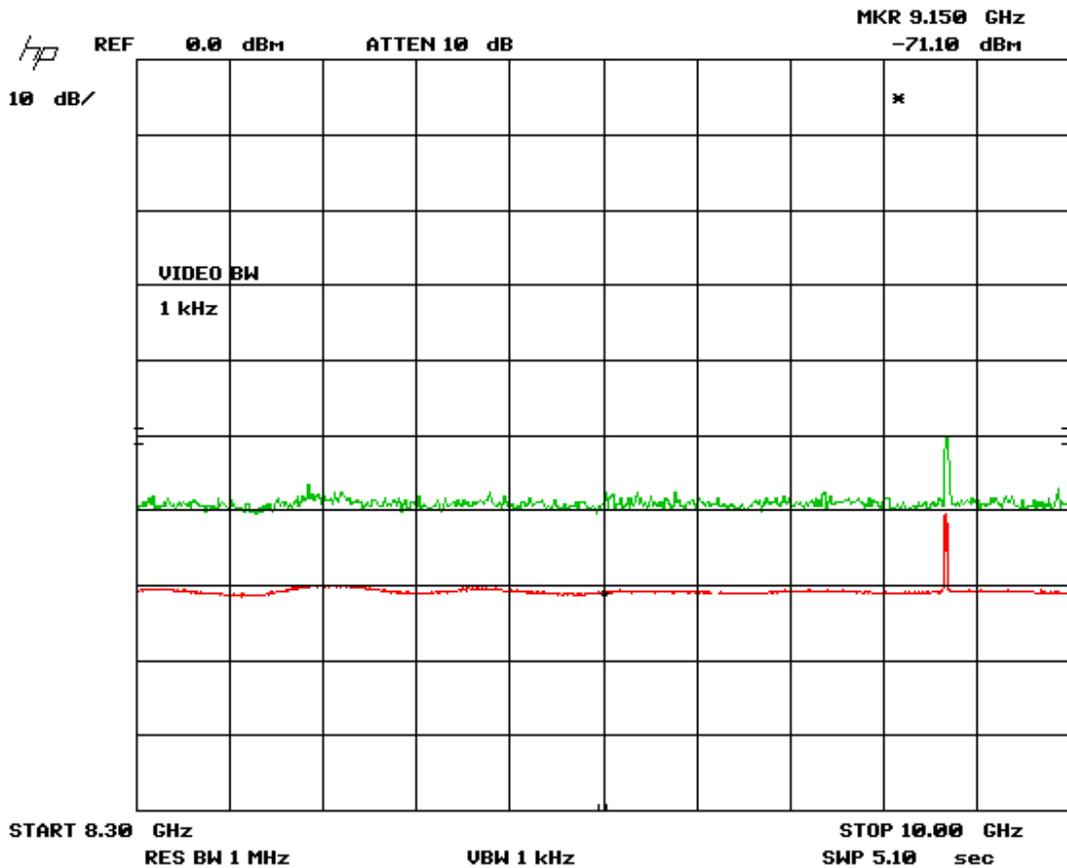
Final Measurements and Results

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.

The noise floor of the measurement instruments touches the Average limit between 8 GHz to 10 GHz. The plot below shows the difference between peak and average. The average is at least 10 dB below the peak.



Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB	Result
Low Channel (11) -Y axis (Vertical) setpower 0											
2405	Peak	Horz	109.3	26.1	4.2	10.0	35.8	113.8			PASS
2405	Avg	Horz	107.4	26.1	4.2	10.0	35.8	111.9			PASS
2405	Peak	Vert	106.0	26.1	4.2	10.0	35.8	110.5			PASS
2405	Avg	Vert	103.8	26.1	4.2	10.0	35.8	108.3			PASS
2390	Peak	Horz	53.8	26.1	4.2	10.0	35.8	58.3	74.0	15.7	PASS
2390	Avg	Horz	35.1	26.1	4.2	10.0	35.8	39.6	54.0	14.4	PASS
2390	Peak	Vert	51.9	26.1	4.2	10.0	35.8	56.4	74.0	17.6	PASS
2390	Avg	Vert	33.2	26.1	4.2	10.0	35.8	37.7	54.0	16.3	PASS
Mid Channel (0x13) - Y axis (Vertical) Setpower 0											
2445	Peak	Horz	111.7	26.1	4.2	10.0	35.8	116.2			PASS
2445	Avg	Horz	109.6	26.1	4.2	10.0	35.8	114.1			PASS
2445	Peak	Vert	107.7	26.1	4.2	10.0	35.8	112.2			PASS
2445	Avg	Vert	105.6	26.1	4.2	10.0	35.8	110.1			PASS
4890	Peak	Horz	61.5	27.6	5.9	0.0	35.2	59.8	74.0	14.2	PASS
4890	Avg	Horz	42.8	27.6	5.9	0.0	35.2	41.1	54.0	12.9	PASS
4890	Peak	Vert	66.3	27.6	5.9	0.0	35.2	64.6	74.0	9.4	PASS
4890	Avg	Vert	47.6	27.6	5.9	0.0	35.2	45.9	54.0	8.1	PASS
7335	Peak	Vert	70.5	28.9	7.3	0.0	35.6	71.1	74.0	2.9	PASS
7335	Avg	Vert	51.8	28.9	7.3	0.0	35.6	52.4	54.0	1.6	PASS
7335	Peak	Horz	68.9	28.9	7.3	0.0	35.6	69.5	74.0	4.5	PASS
7335	Avg	Horz	50.2	28.9	7.3	0.0	35.6	50.8	54.0	3.2	PASS
9780	Peak	Horz	57.5	31.3	9.3	0.0	36.1	62.0	74.0	12.0	PASS
9780	Avg	Horz	38.8	31.3	9.3	0.0	36.1	43.3	54.0	10.7	PASS
9780	Peak	Vert	57.8	31.3	9.3	0.0	36.1	62.3	74.0	11.7	PASS
9780	Avg	Vert	39.1	31.3	9.3	0.0	36.1	43.6	54.0	10.4	PASS
12225	Peak	Horz	68.7	31.7	9.5	0.0	35.1	74.8	83.5	8.7	PASS
12225	Avg	Horz	50.0	31.7	9.5	0.0	35.1	56.1	63.5	7.4	PASS
12225	Peak	Vert	58.0	31.7	9.5	0.0	35.1	64.1	83.5	19.4	PASS
12225	Avg	Vert	39.3	31.7	9.5	0.0	35.1	45.4	63.5	18.1	PASS
Mid Channel (0x13) - Z axis (Flat) setpower 3											
2445	Peak	Horz	109.4	26.1	4.2	10.0	35.8	113.9			PASS
2445	Avg	Horz	107.4	26.1	4.2	10.0	35.8	111.9			PASS
2445	Peak	Vert	108.0	26.1	4.2	10.0	35.8	112.5			PASS
2445	Avg	Vert	106.4	26.1	4.2	10.0	35.8	110.9			PASS
Mid Channel (0x13) X - Side											
2445	Peak	Horz	111.5	26.1	4.2	10.0	35.8	116.0			PASS
2445	Avg	Horz	109.2	26.1	4.2	10.0	35.8	113.7			PASS
2445	Peak	Vert	109.4	26.1	4.2	10.0	35.8	113.9			PASS
2445	Avg	Vert	107.9	26.1	4.2	10.0	35.8	112.4			PASS

Note 1: A duty cycle correction factor of -18.7 dB was used to derive average emissions from peak emissions

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB	Result
High Channel (0x19) - set power 3											
2475	Peak	Horz	109.8	26.1	4.2	10.0	35.8	114.3			PASS
2475	Avg	Horz	107.9	26.1	4.2	10.0	35.8	112.4			PASS
2475	Peak	Vert	107.7	26.1	4.2	10.0	35.8	112.2			PASS
2475	Avg	Vert	105.8	26.1	4.2	10.0	35.8	110.3			PASS
2483.5	Peak	Horz	64.8	26.1	4.2	10.0	35.8	69.3	74.0	4.7	PASS
2483.5	Avg	Horz	46.1	26.1	4.2	10.0	35.8	50.6	54.0	3.4	PASS
2483.5	Peak	Vert	61.7	26.1	4.2	10.0	35.8	66.2	74.0	7.8	PASS
2483.5	Avg	Vert	43.0	26.1	4.2	10.0	35.8	47.5	54.0	6.5	PASS
High Channel (0x1A) -Z Axis (Flat) Set Power -21											
2480	Peak	Horz	88.7	26.1	4.2	10.0	35.8	93.2			PASS
2480	Avg	Horz	86.8	26.1	4.2	10.0	35.8	91.3			PASS
2480	Peak	Vert	84.9	26.1	4.2	10.0	35.8	89.4			PASS
2480	Avg	Vert	82.5	26.1	4.2	10.0	35.8	87.0			PASS
2483.5	Peak	Horz	63.5	26.1	4.2	10.0	35.8	68.0	74.0	6.0	PASS
2483.5	Avg	Horz	44.8	26.1	4.2	10.0	35.8	49.3	54.0	4.7	PASS
2483.5	Peak	Vert	60.1	26.1	4.2	10.0	35.8	64.6	74.0	9.4	PASS
2483.5	Avg	Vert	41.4	26.1	4.2	10.0	35.8	45.9	54.0	8.1	PASS

Note 1: A duty cycle correction factor of -18.7 dB was used to derive average emissions from peak emissions

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 5, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 5, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Sept 8, 2014	Sept 8, 2016	GEMC 137
Attenuator 10 dB	8493B	Agilent	Feb 11, 2016	Feb 11, 2017	GEMC 133
4GHZ-12GHz High Pass filter	11SH10-4000/T12000-0/0	K & L Microwave	Apr 9, 2015	Apr 9, 2016	GEMC 119
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept 9, 2014	Sept 9, 2016	GEMC 6403
Q-Par Horn Antenna (2 to 18 GHz)	WBH218HN	Q-par	Feb 12, 2016	Feb 12, 2018	GEMC 6375
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Sept 9, 2014	Sept 9, 2016	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	Feb 8, 2016	Feb 8, 2018	GEMC 158
1-26G pre-amp	HP 8449B	HP	Sept 9, 2014	Sept 9, 2016	GEMC 6351
2.0-8.0 GHz Amplifier	11975A	HP	Feb 8, 2016	Feb 8, 2018	GEMC157
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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. External attenuator and cable loss were accounted for as reference offset in the spectrum analyzer. The following table show the peak power spectral density:

PSD: B-Mode				
Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Pass/Fail
0x0B	2405	4.61	8	Pass
0x13	2445	6.00	8	Pass
0x19	2475	6.55	8	Pass
0x1A	2480	-17.62	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.

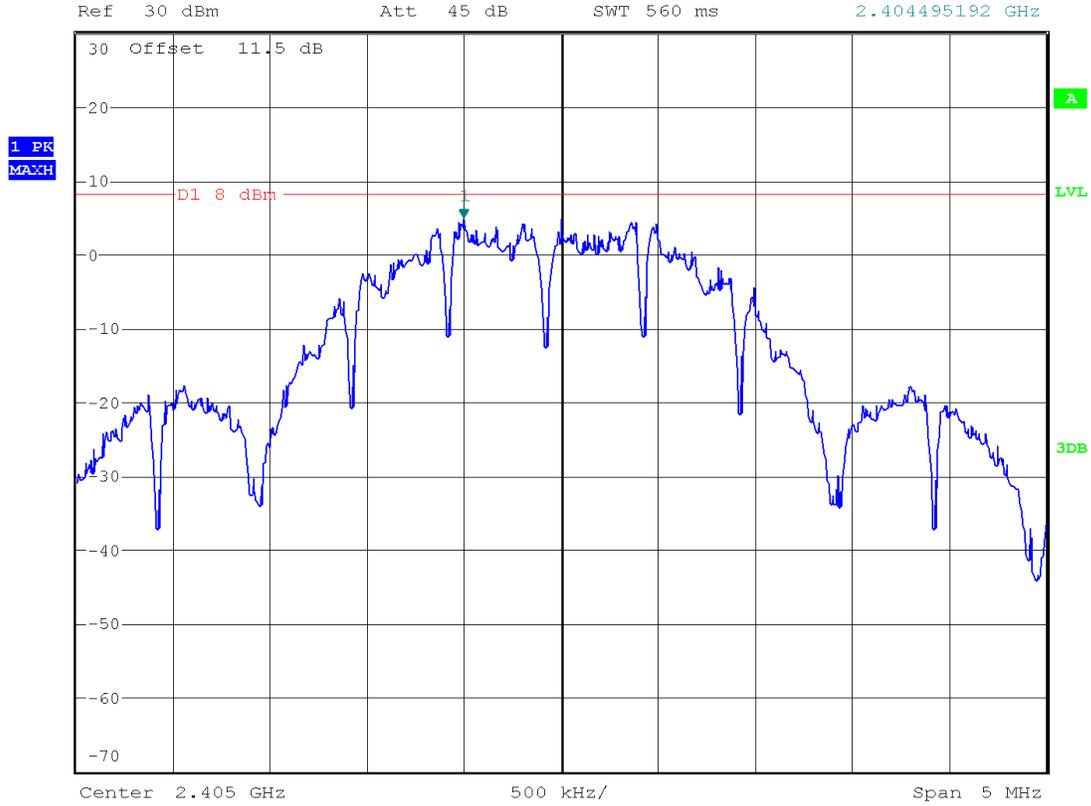
Low, middle, and high channel was investigated in each mode, with the worst case being presented.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power Spectral Density
Channel 0xB



* RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz 4.61 dBm
 SWT 560 ms 2.404495192 GHz



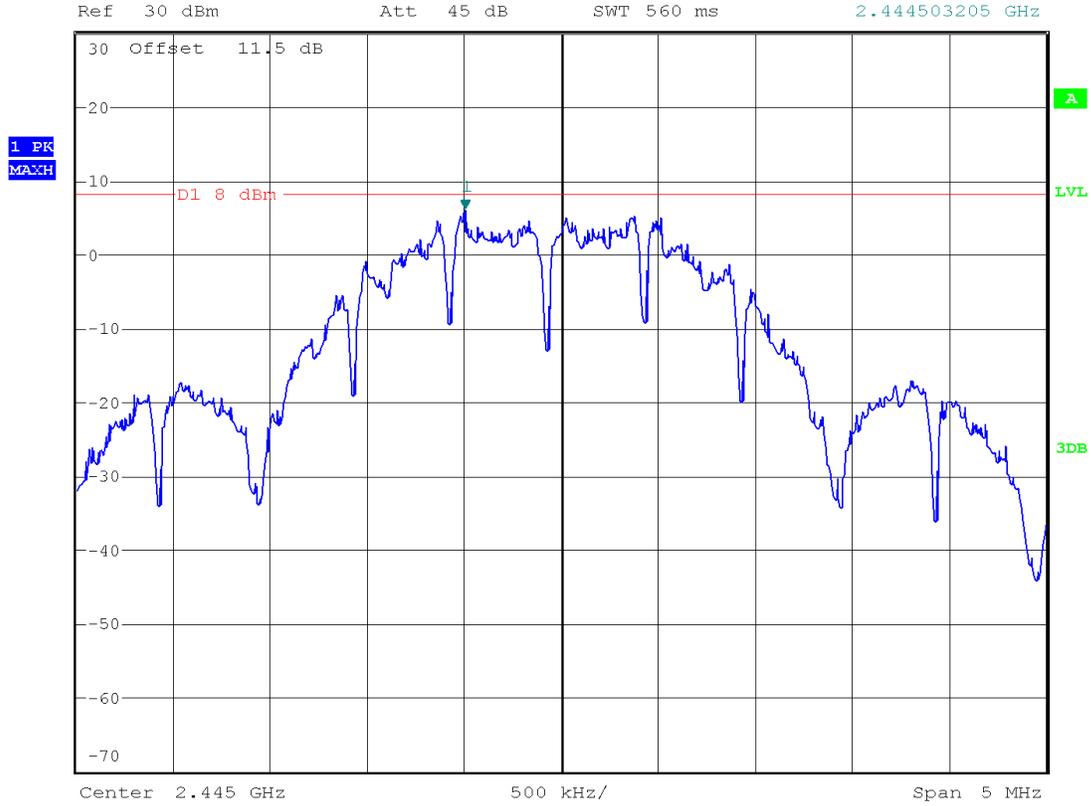
Date: 2.MAY.2016 14:18:50

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power Spectral Density
Channel 0x13



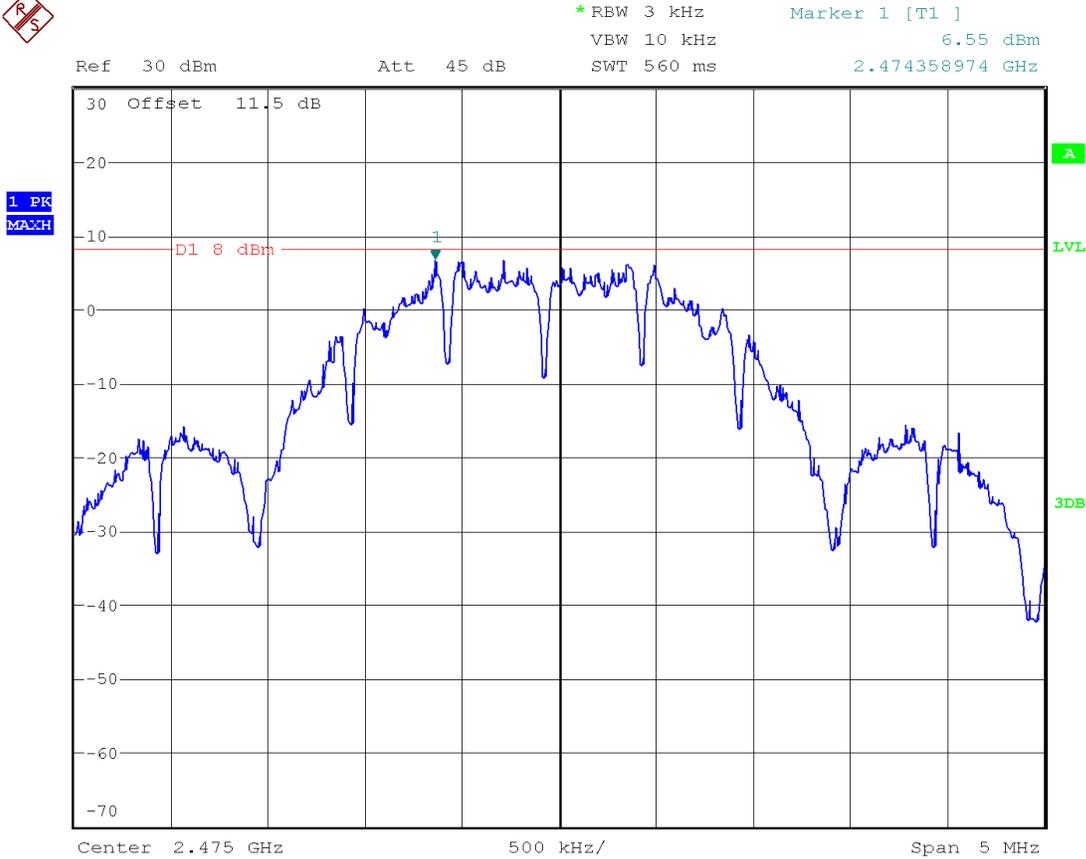
* RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz 6.00 dBm
 SWT 560 ms 2.444503205 GHz



Date: 2.MAY.2016 14:17:21

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Peak Power Spectral Density
Channel 0x19



Date: 2.MAY.2016 14:14:43

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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

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

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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 and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The limits and method are as defined in Part 15 Section 15.207, and RSS-GEN Issue 4 Section 8.8.

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

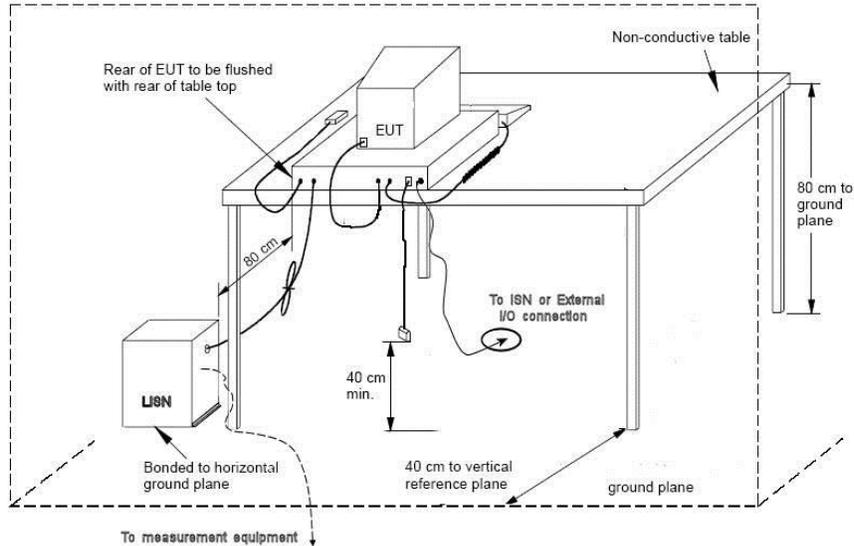
* Decreases linearly with the logarithm of the frequency

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 C63.10 Section 4.1.4.2.1, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Typical Setup Diagram



Measurement Uncertainty

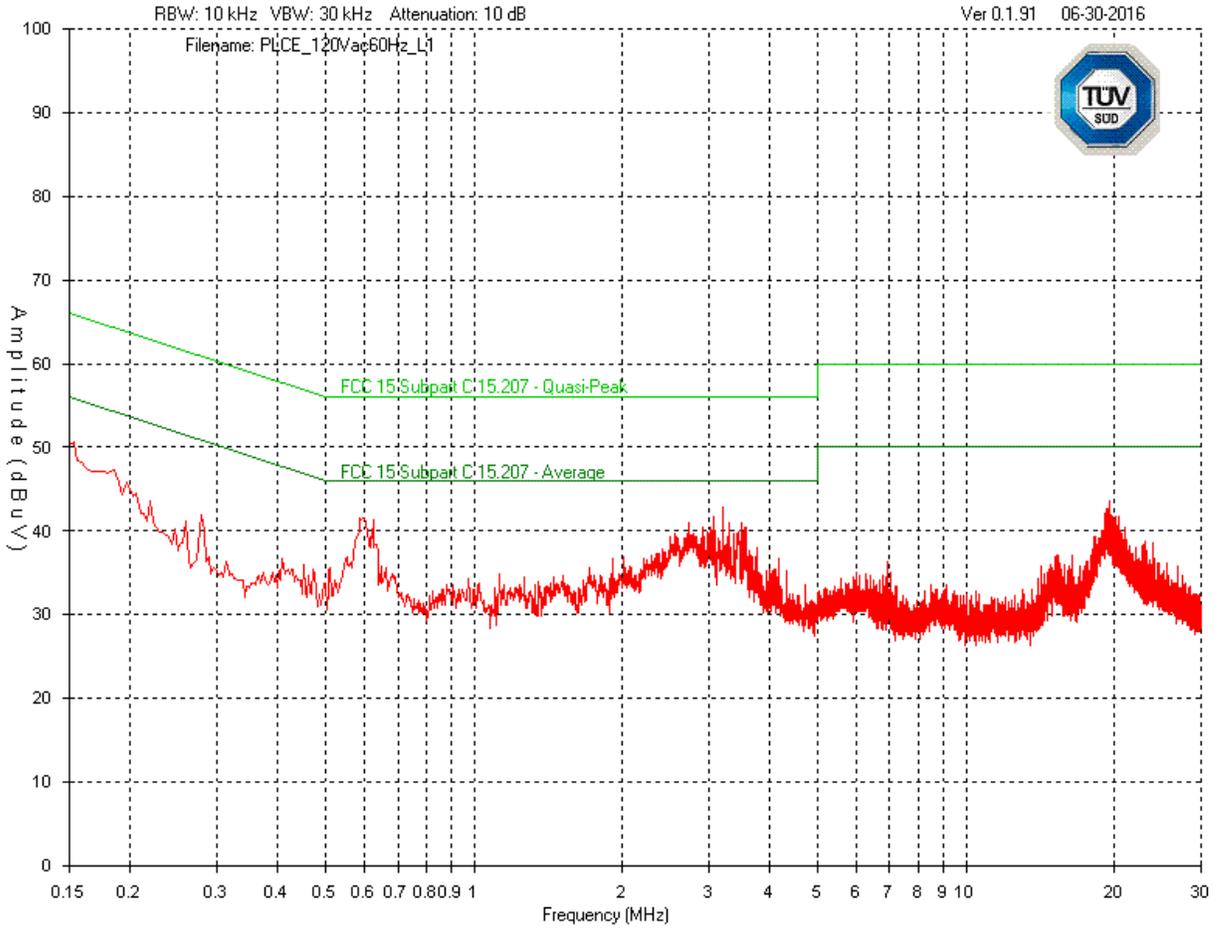
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 2.91\text{dB}$ with a 'k=2' coverage factor and a 95% confidence level.

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.

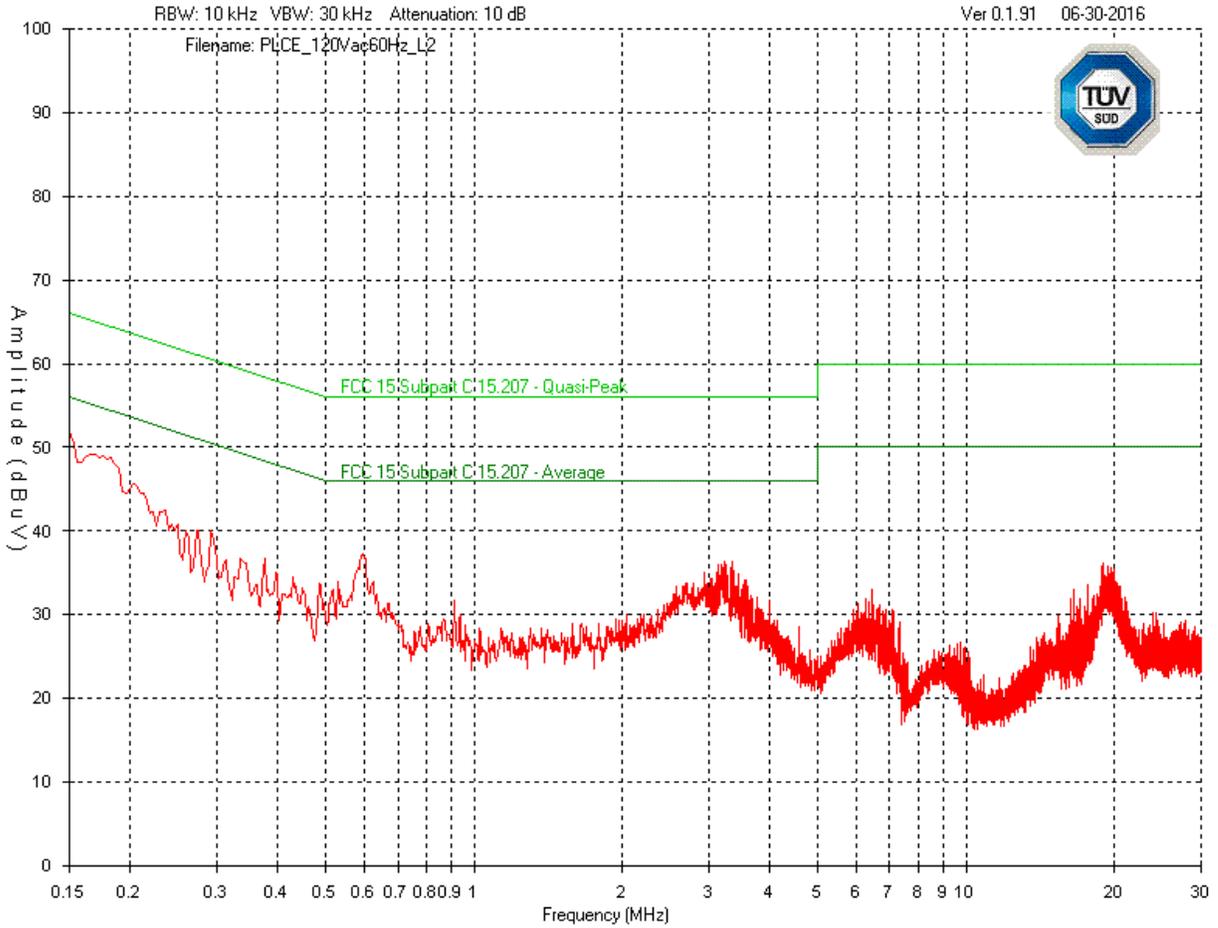
Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Line (L1) – 120Vac 60Hz



Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Neutral (L2) – 120Vac 60Hz



Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Final Measurements

Product	Smart Cap V2 / Lenovo T430 (PSU Model 45N0121)						
Supply	120 Vac 60 Hz						
Line Emission Table							
Frequency (MHz)	Detector	Raw (dBuV)	Factors (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
3.2113	PEAK	32.8	10.1	42.9	46.0	3.1	Pass
3.0786	PEAK	31.5	10.1	41.6	46.0	4.4	Pass
0.5978	PEAK	31.5	10.1	41.6	46.0	4.4	Pass
3.5098	PEAK	30.9	10.1	41.0	46.0	5.0	Pass
3.3075	PEAK	30.8	10.1	40.9	46.0	5.1	Pass
0.1533	PEAK	40.5	10.0	50.5	55.8	5.3	Pass
Neutral Emission Table							
0.1533	PEAK	40.3	10.0	50.3	55.8	5.5	Pass
0.5944	PEAK	27.2	10.1	37.3	46.0	8.7	Pass
3.3506	PEAK	26.3	10.1	36.4	46.0	9.6	Pass
3.2279	PEAK	26.3	10.1	36.4	46.0	9.6	Pass
0.2926	PEAK	30.0	10.1	40.1	50.5	10.4	Pass
3.5861	PEAK	24.0	10.1	34.1	46.0	11.9	Pass

Note:

Peak = Peak measurement

AVG = Average measurement

QP = Quasi-Peak measurement

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

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Jan. 15, 2015	Jan. 15, 2017	GEMC 65
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 29
10dB Attenuator	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

This report module is based on report template 'C22_EN22_FCC_ICES_CE_Rev1'

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

Appendix A – EUT Summary

Client	MMB Research Inc	
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

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

General EUT Description

Client	
Organization	MMB Research Inc.
Contact	Mark Borins
Phone	416.636.3145
Email	mark.borins@mmbresearch.com
EUT Details	
EUT Model number	Smart Cap V2
Equipment Category	Wireless
Basic EUT Functionality	<p>The Smart Cap V2 is a ZigBee radio transceiver with integrated microcontroller operating in the 2.4GHz ISM band. The radio operates according to the IEEE 802.15.4 standard and employs DSSS and O-QPSK modulation. The antenna is a 50 ohm ceramic chip tuned to match the RF circuit of the radio transceiver.</p> <p>The EUT is a cap for sports bottles. It measures liquid volumes.</p>
Input Voltage and Frequency	3.3 Vdc
Connectors available on EUT	None.
Peripherals Required for Test	None.
Release type	Final
Intentional Radiator Frequency	2405 – 2480.0 MHz for Zigbee applications as described above.

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 & Test Setup Photographs’.

Client	MMB Research Inc	 Canada
Product	Smart Cap V2	
Standard(s)	RSS 247:2015 / FCC Part 15 Subpart 15.247 15:2015	

EUT Configuration

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

- Wireless were configured to transmit at 100% duty cycle
- The power output for channel 0xB to 0x19 were set using settxpower 0 and channel 0x1A were set using settxpower -0x15;
- All tests were performed with the EUT running Node test with command txstream to put the EUT in constant transmission.

Operational Setup

No additional device were required to be attached to the EUT for its normal operation. However, the EUT was modified with a header for serial communication.