



Canada

EMC & RF Test Report

As per

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

Unlicensed Intentional Radiators

on the

MiCare Beacon NC-211

Issued by:

TÜV SÜD Canada Inc.
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Canada
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Amir Emami,
Project Engineer

Testing produced for



See Appendix A for full client &
EUT details.





Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Report Scope

This report addresses the EMC verification testing and test results of the **MiCare Beacon**, Model: **NC-211**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:


RSS-247 Issue 2:2017

FCC Part 15 Subpart C 15.247:2016

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

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

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


Client	Mircom Technologies Limited	
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Summary

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

EUT:	MiCare Beacon, Model: NC-211
FCC Certification #, FCC ID:	2ABFD-NC-211
ISED Certification #, IC:	1156A-NC211
EUT passed all tests performed	Yes
Tests conducted by	Amir Emami


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

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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)3 RSS-247 5.4(d)	Max Peak 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)	Power 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 5.4(d)), the unit uses a standalone antenna mounted inside the enclosure through a UFL-type coaxial connector and with less than 6 dBi gain (2.9 dBi gain dipole antenna – Molex 47950-2001).

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

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

The EUT has a fixed (source based) duty cycle of 2% (2ms on time/100ms) which cannot be changed or modified by either the device or the end user. As per KDB 558074 section 12.2.5.2, for the average radiated emission measurements of the band edges and of the spurious emissions in the restricted bands, a duty cycle correction factor of 2% [$20\log(2\%) = -33.98$] was applied to the peak measurement to obtain the average measurement.

Channel 26, centered at 2480MHz, is locked in firmware and not used under normal operation. Therefore, channel 25 at 2475MHz is used for high channel measurements.

Sample Calculation(s)

Radiated Emission Test

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

Margin = $50.5\text{dB}\mu\text{V/m} - (50\text{dB}\mu\text{V} + 10\text{dB} + 2.5\text{dB} - 20\text{dB})$


Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)


Margin = $73.0\text{dB}\mu\text{V} - (50\text{dB}\mu\text{V} + 10\text{dB} + 2.5\text{dB} + 0.5\text{dB})$

Margin = 10.0 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:2016	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
CISPR 22:2008	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
FCC KDB 558074: v04, 2017	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
ICES-003 Issue 6 2016	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 4 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 2:2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

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Document Revision Status

Revision 1 - February 14, 2018
Initial Release

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Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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 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 labs near Toronto, Ontario. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable.

Calibrations and Accreditations


The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 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 #2555.01. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

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Testing Environmental Conditions and Dates

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

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
January 19, 2018	Radiated Emissions	AE	22.0	14.6	101.1
January 19, 2018	Antenna Conducted Emissions	AE	22.0	14.6	101.1
January 23, 2018	Power Line Conducted Emissions	AE	21.9	13.2	100.6

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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 Method

The limit is as specified in FCC Part 15.247(a)2 and RSS-247.


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

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

Results

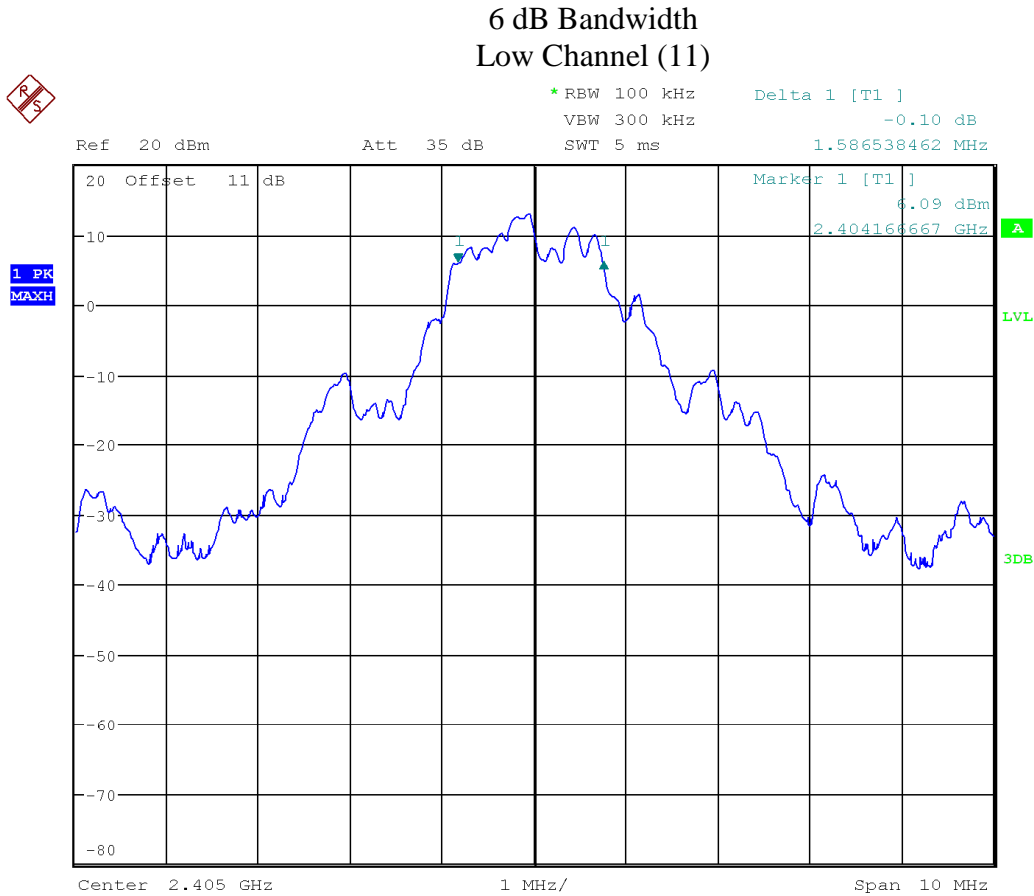
The EUT passed. The minimum 6 dB BW measured was 1510 kHz and the maximum 99% BW at full power setting was 2560 kHz.

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low (11)	2405	1.59	2.55
Mid (18)	2440	1.52	2.56
High (25)	2475	1.51	2.55


Client	Mircom Technologies Limited	
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Graphs

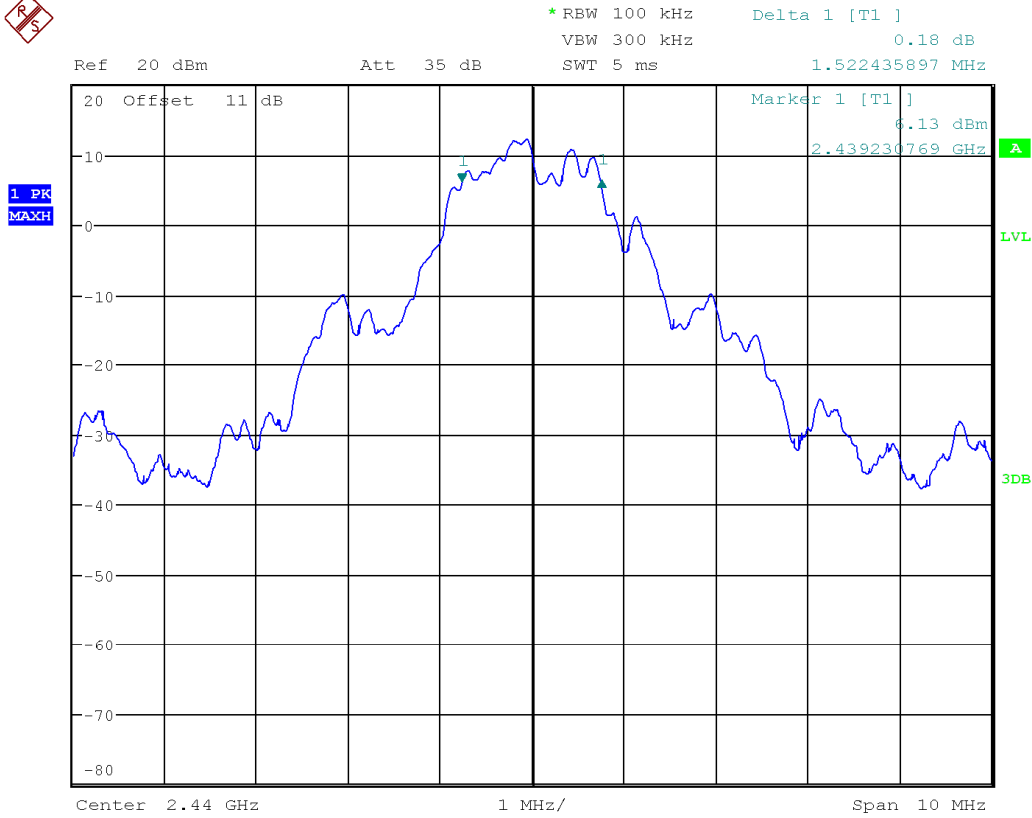
The graphs showed below show the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of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




Date: 19.JAN.2018 17:37:28

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

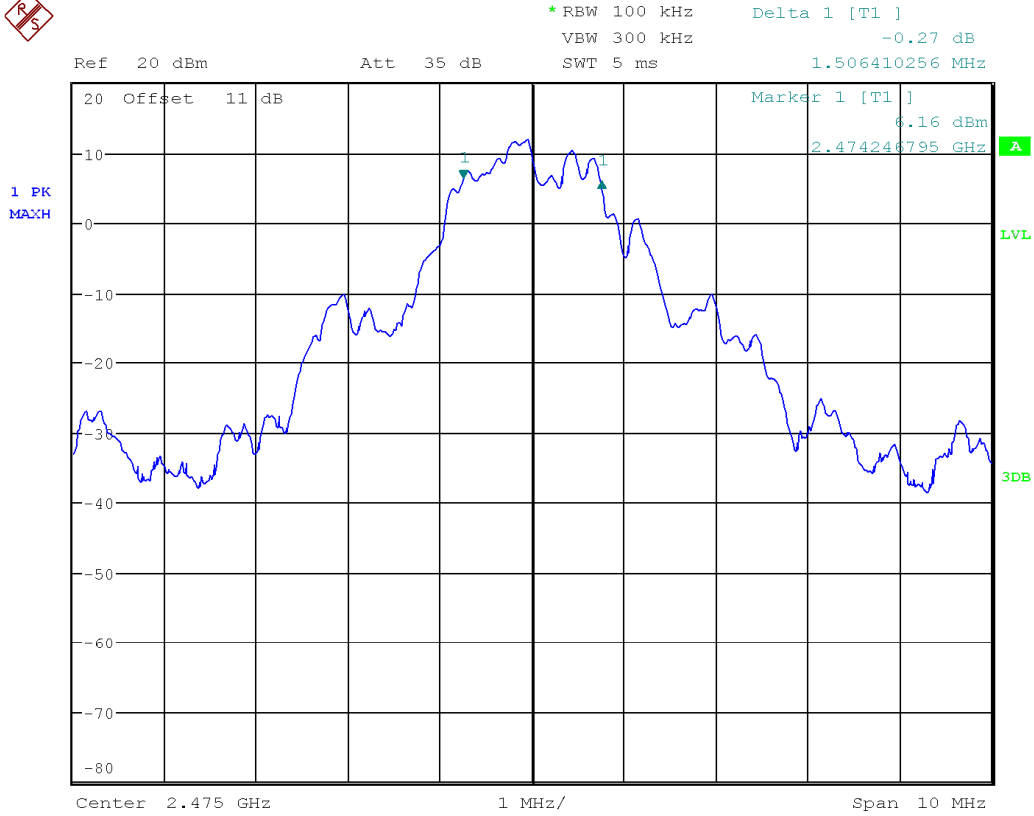
6 dB Bandwidth Mid Channel (18)




Date: 19.JAN.2018 17:29:38

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

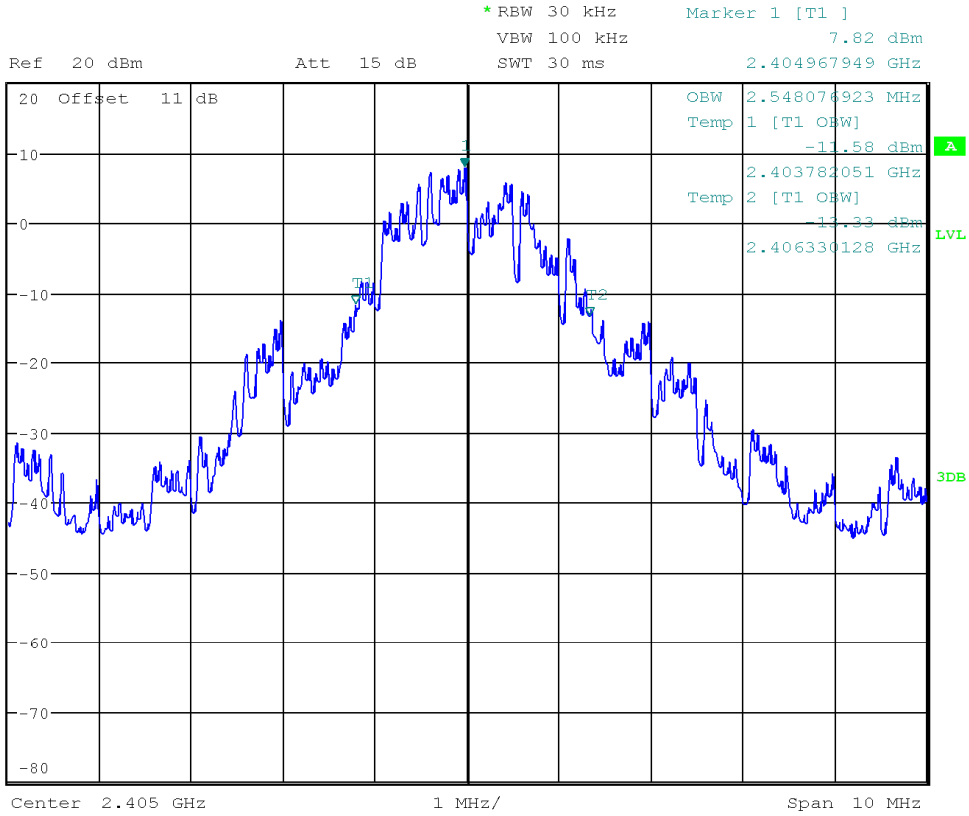
6 dB Bandwidth High Channel (25)




Date: 19.JAN.2018 16:28:35

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

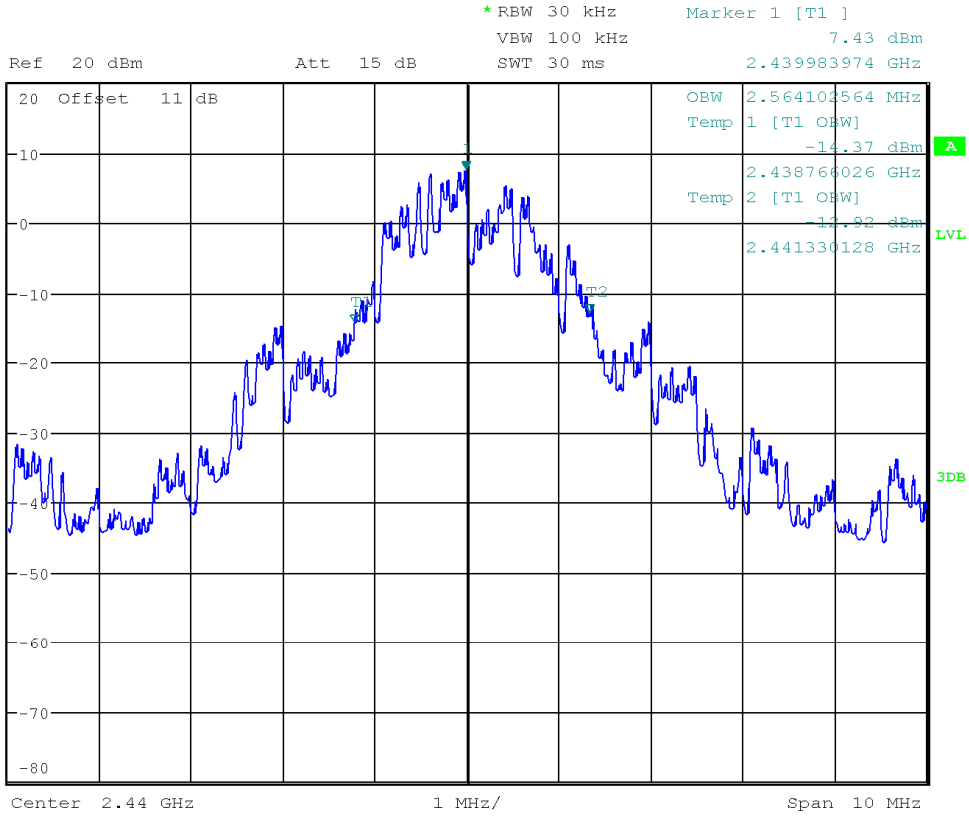
99% Bandwidth Low Channel (11)




Date: 19.JAN.2018 17:39:02

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

99% Bandwidth Mid Channel (18)



Date: 19.JAN.2018 17:30:45


Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

99% Bandwidth
High Channel (25)




Date: 19.JAN.2018 16:31:12

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

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Product	NC-211	
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Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSQ 26	Rohde & Schwarz	Feb 28, 2017	Feb 28, 2019	GEMC 232
Attenuator 10 dB	8493B	Agilent	Feb 20, 2017	Feb 20, 2018	GEMC 133

Client	Mircom Technologies Limited	
Product	NC-211	
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Maximum Peak Conducted Output Power

Purpose

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

Limits and Method

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

The method is given in Section 9.1.1 of FCC KDB 558074 and ANSI C63.10.

Results


The EUT passed. The EUT was set to transmit at maximum power (PWR=18). Three channels were measured. The following table show the peak conducted power:

Channel	Frequency (MHz)	Peak Power dBm	Peak Power (mW)
Low (11)	2405	17.01	50.23
Mid (18)	2440	16.76	47.42
High (25)	2475	16.42	43.85

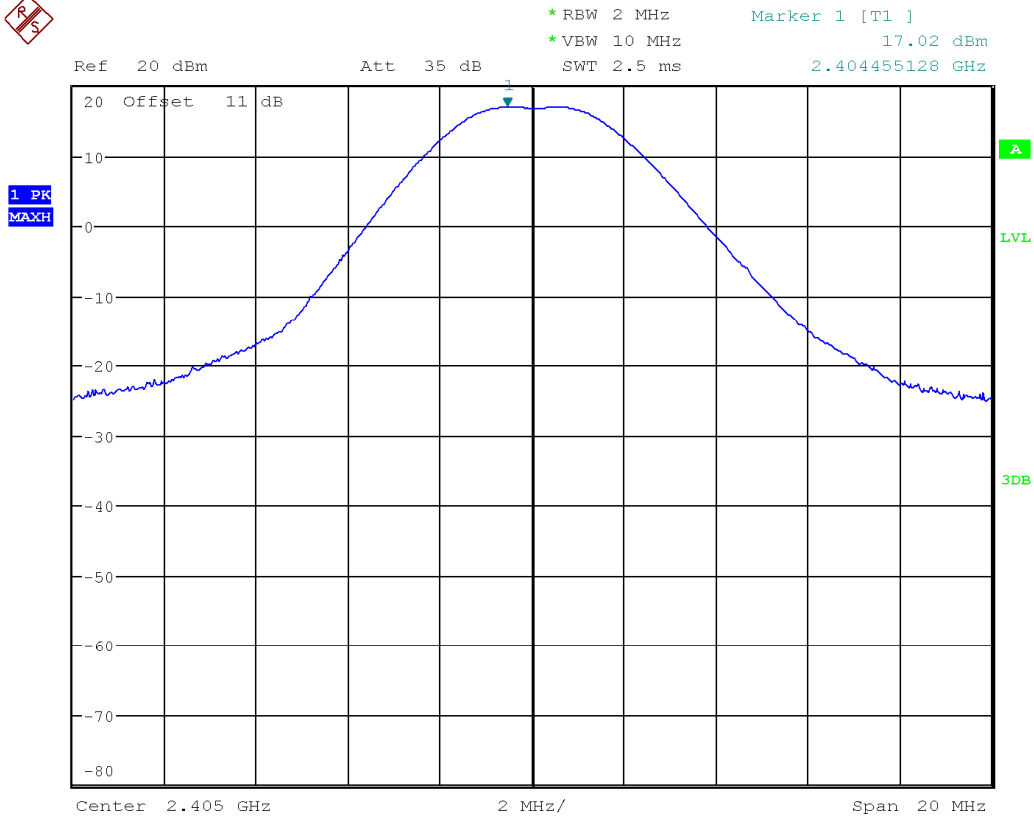
Note: The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer

Graphs


The plots shown below show the peak output power of the device during the antenna conducted measurements.

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

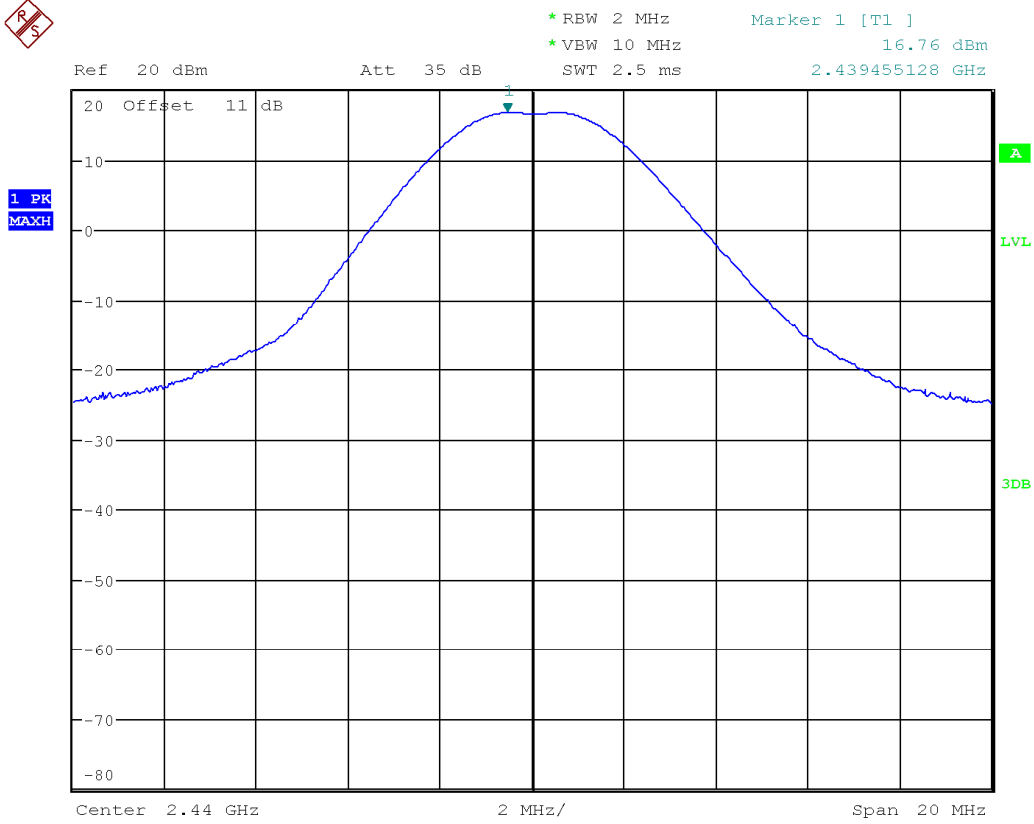
Peak Power, Low Channel (11)




Date: 19.JAN.2018 15:18:22

Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

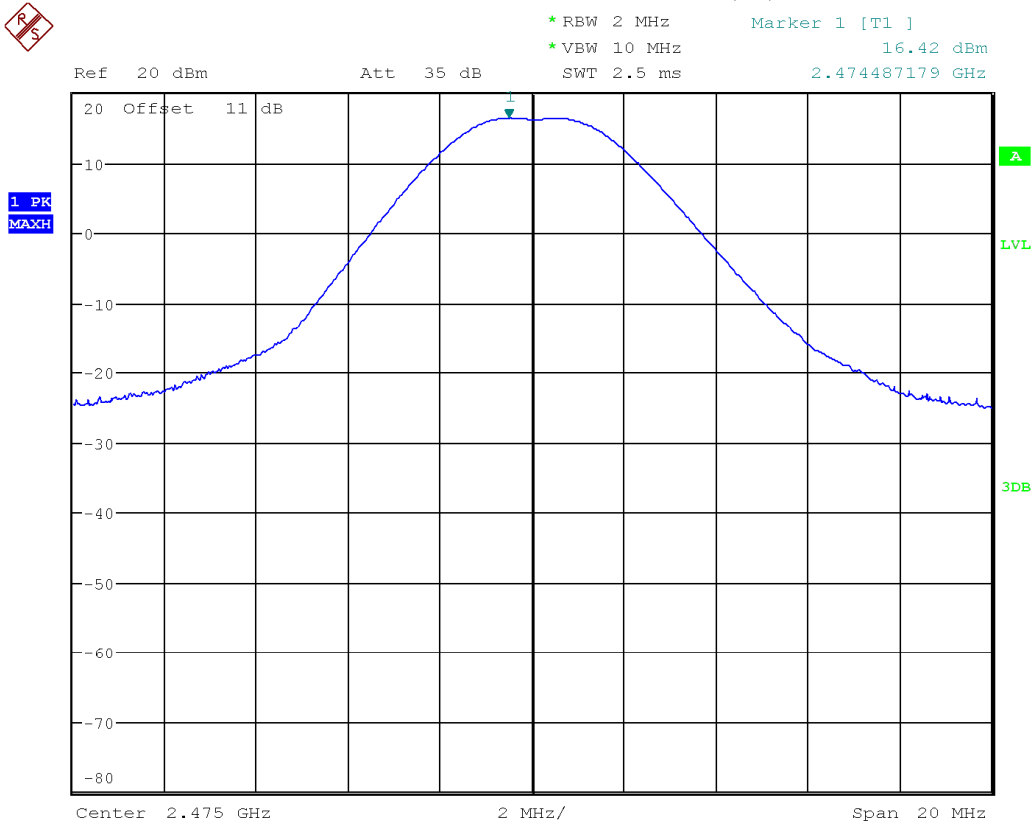
Peak Power, Mid Channel (18)



Date: 19.JAN.2018 17:25:24

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Peak Power, Hi Channel (25)




Date: 19.JAN.2018 16:17:57

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSQ 26	Rohde & Schwarz	Feb 28, 2017	Feb 28, 2019	GEMC 232
Attenuator 10 dB	8493B	Agilent	Feb 20, 2017	Feb 20, 2018	GEMC 133

Client	Mircom Technologies Limited	
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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 Method

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 Section 11 of FCC KDB 558074 and ANSI C63.10

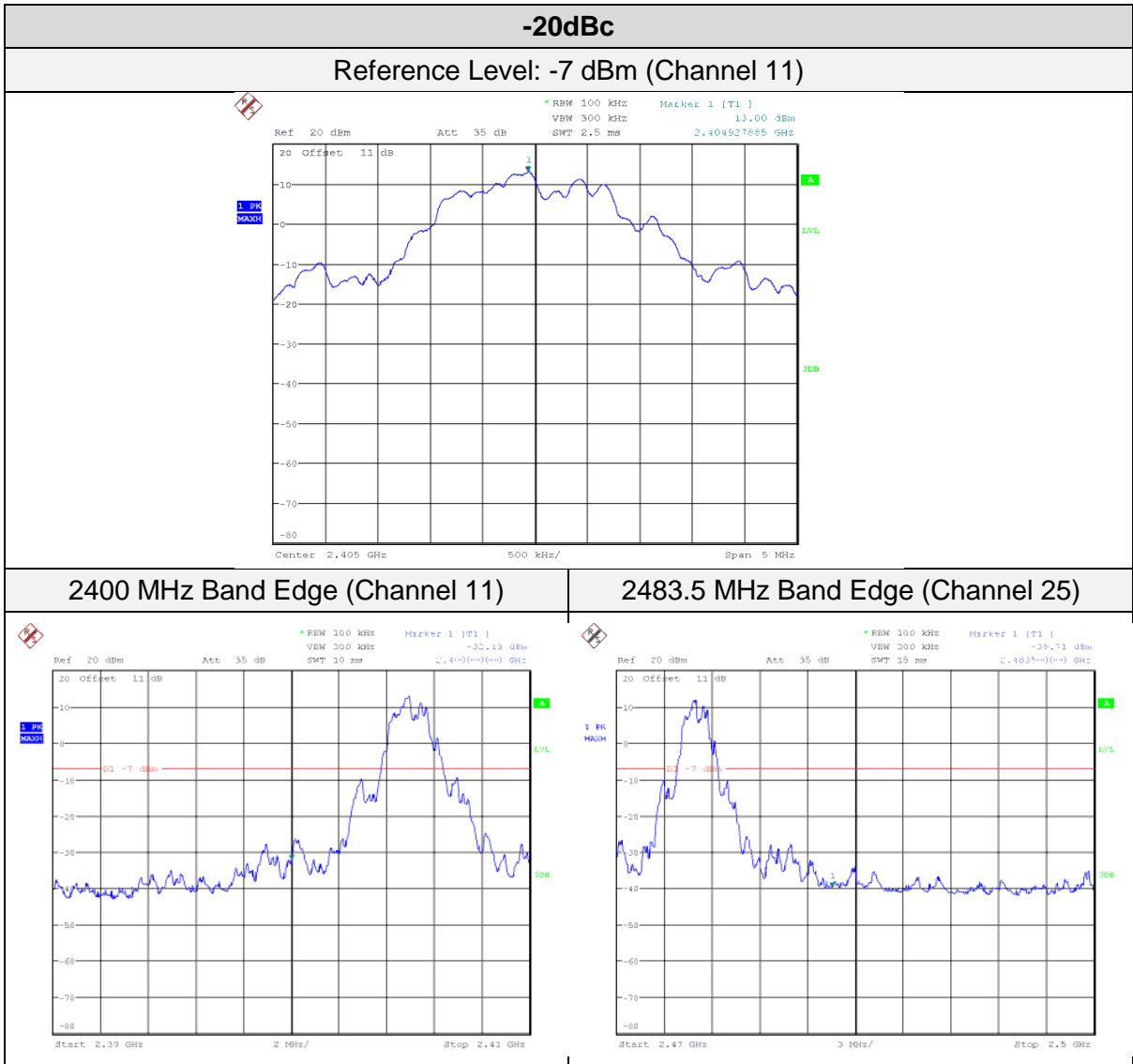
Results


The EUT passed. Low, middle and high bands were measured. The worst case is 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 and also for the higher band edge at 2.4835 GHz in the high band.

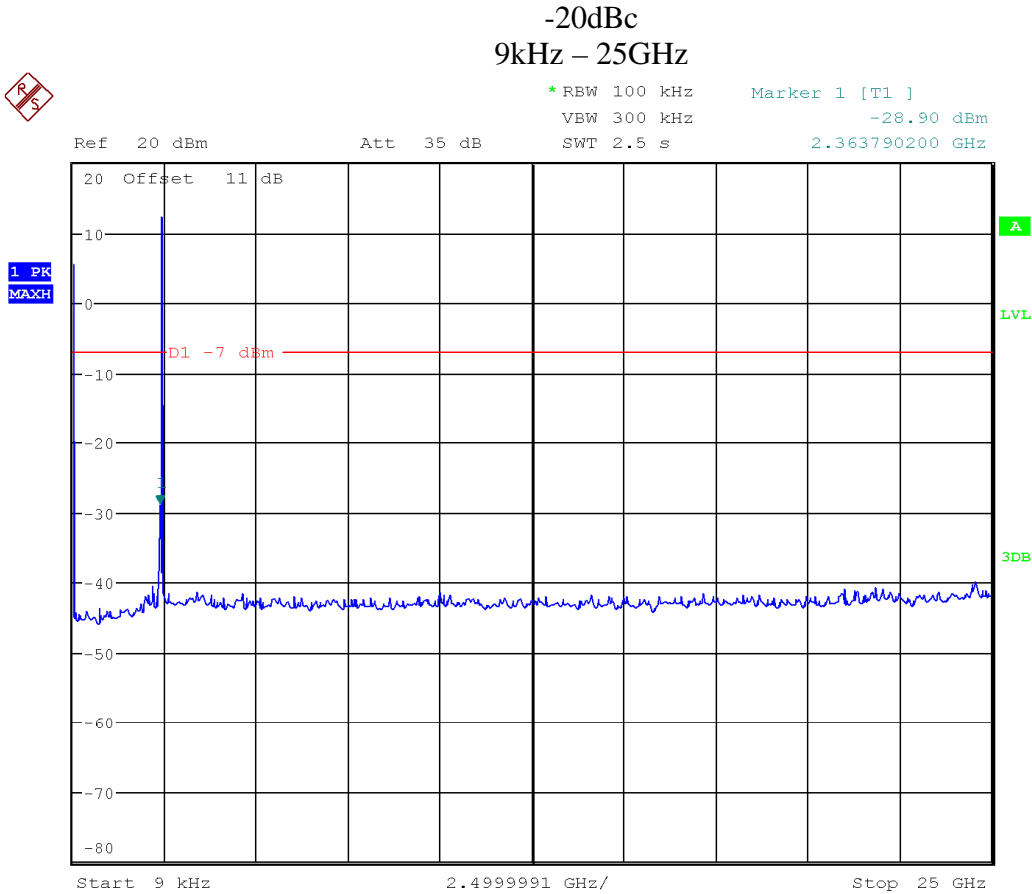
Client	Mircom Technologies Limited	
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Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Graphs

The graphs shown below show the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.



Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	




Date: 19.JAN.2018 17:44:28

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSQ 26	Rohde & Schwarz	Feb 28, 2017	Feb 28, 2019	GEMC 232
Attenuator 10 dB	8493B	Agilent	Feb 20, 2017	Feb 20, 2018	GEMC 133

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Transmitter Spurious Radiated Emissions

Purpose

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

Limits and Method

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

The limits, as defined in 15.247(d) for unintentional radiated emissions, apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

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


Frequency	Limit
0.009 MHz – 0.490 MHz	2400/F(kHz) uV/m at 300m ¹
0.490 MHz – 1.705 MHz	24000/F(kHz) uV/m at 30m ¹
1.705 MHz – 30 MHz	30 uV/m at 30m ¹
30 MHz – 88 MHz	100 uV/m (40.0 dBuV/m ¹) at 3m
88 MHz – 216 MHz	150 uV/m (43.5 dBuV/m ¹) at 3m
216 MHz – 960 MHz	200 uV/m (46.0 dBuV/m ¹) at 3m
Above 960 MHz	500 uV/m (54.0 dBuV/m ¹) at 3m
Above 1000 MHz	500 uV/m (54.0 dBuV/m ²) at 3m
Above 1000 MHz	5000 uV/m (74.0 dBuV/m ³) at 3m

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

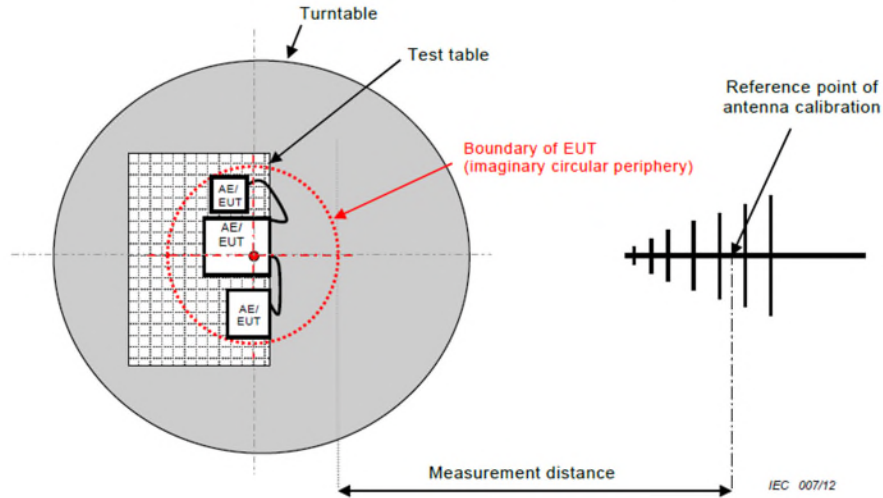
²Limit is with 1 MHz measurement bandwidth and using an Average detector

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

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

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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 $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

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

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

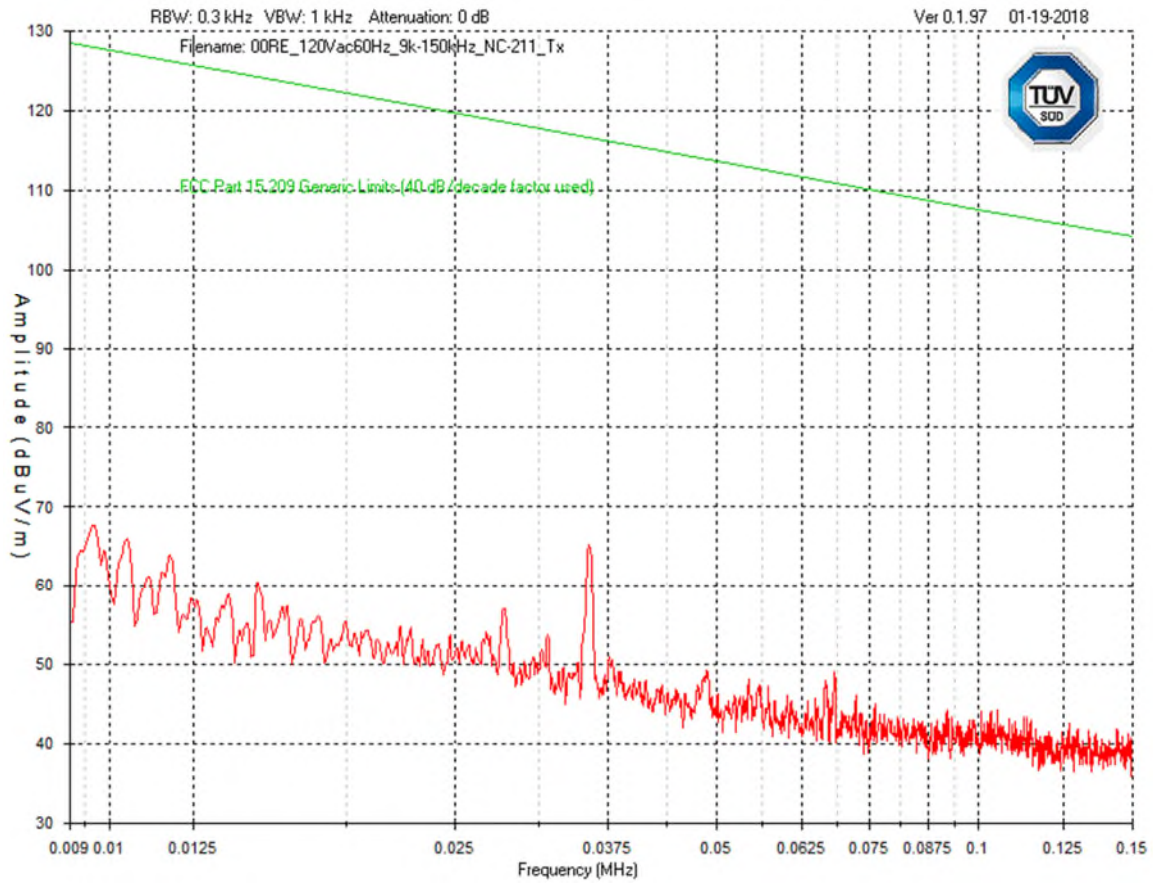
Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m /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


Low, middle and high channels were checked. However, the worst case graphs are presented.

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Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

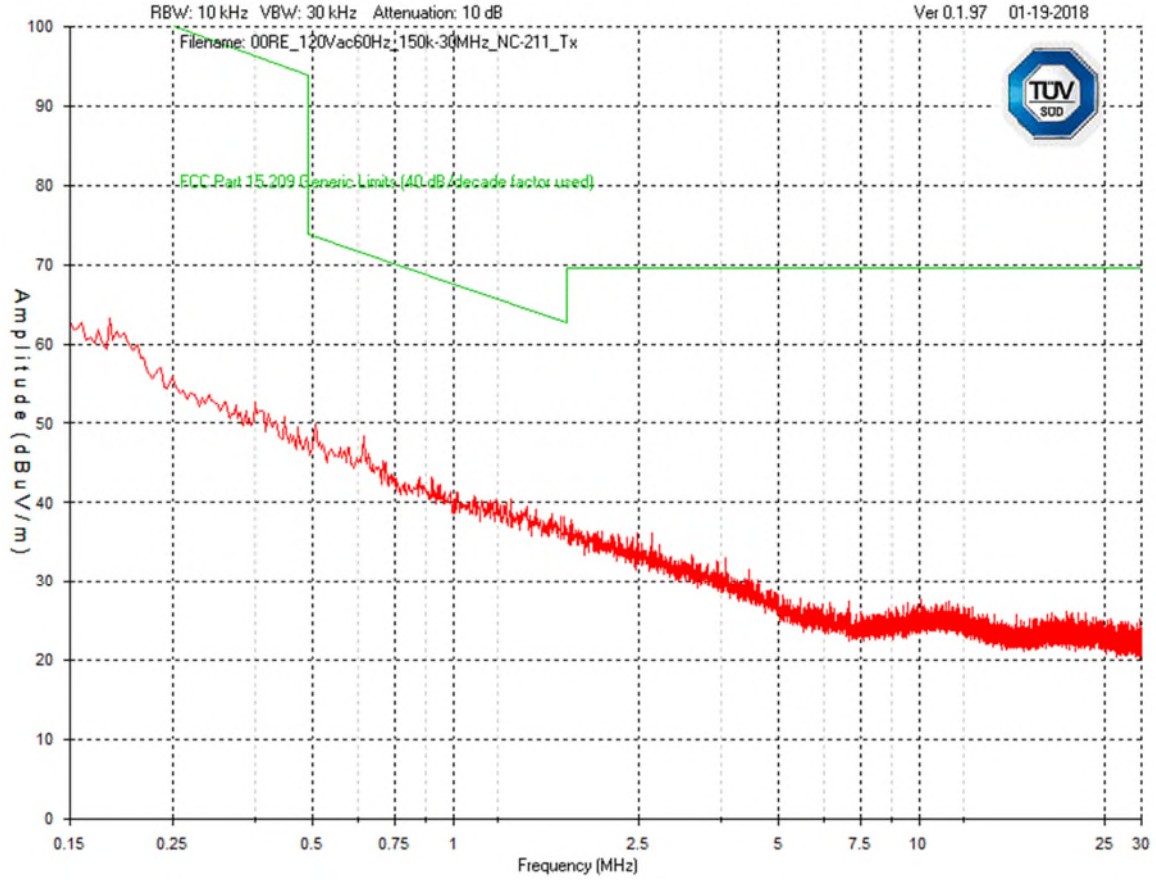
Band-edge measurement graphs are shown for illustration purposes. See final measurement section for all measurements.


Low Channel
9 kHz – 150 kHz
Peak Emission Graph



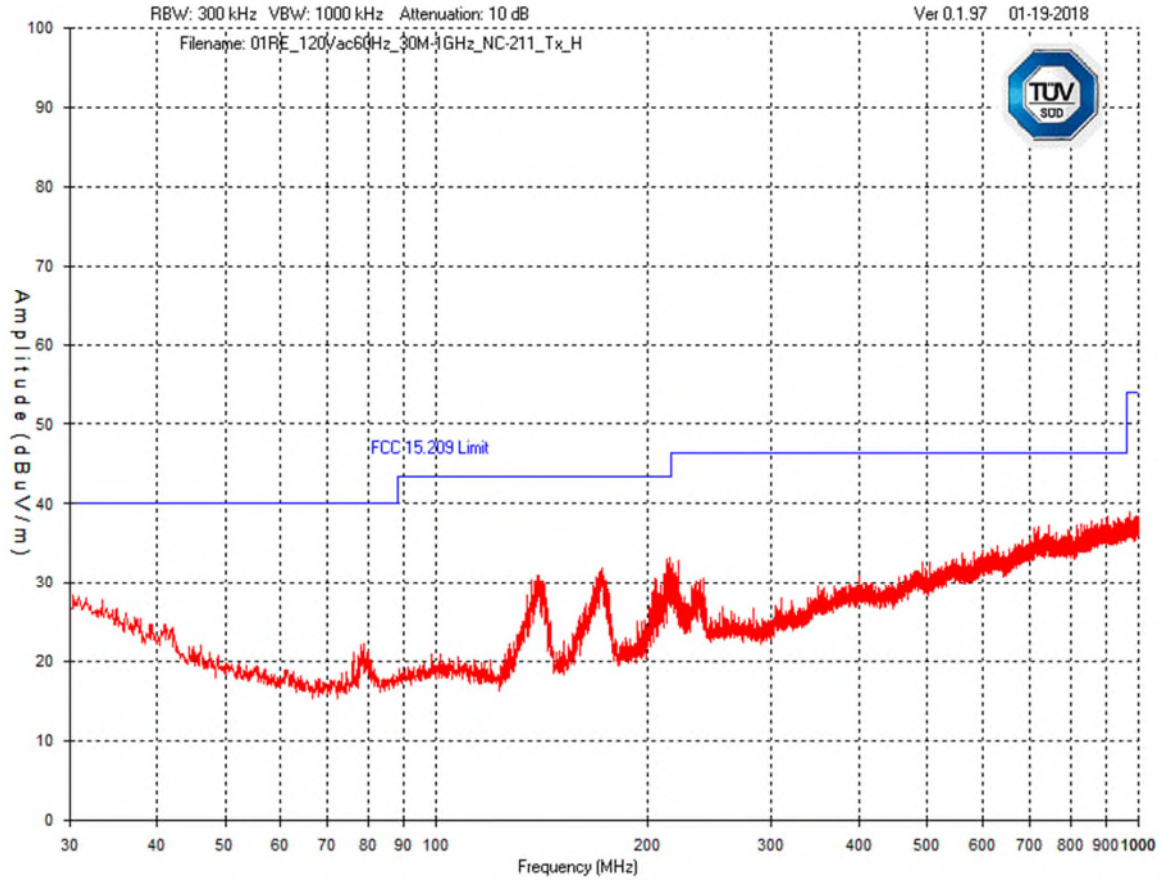
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


Low Channel
150 kHz – 30 MHz
Peak Emission Graph



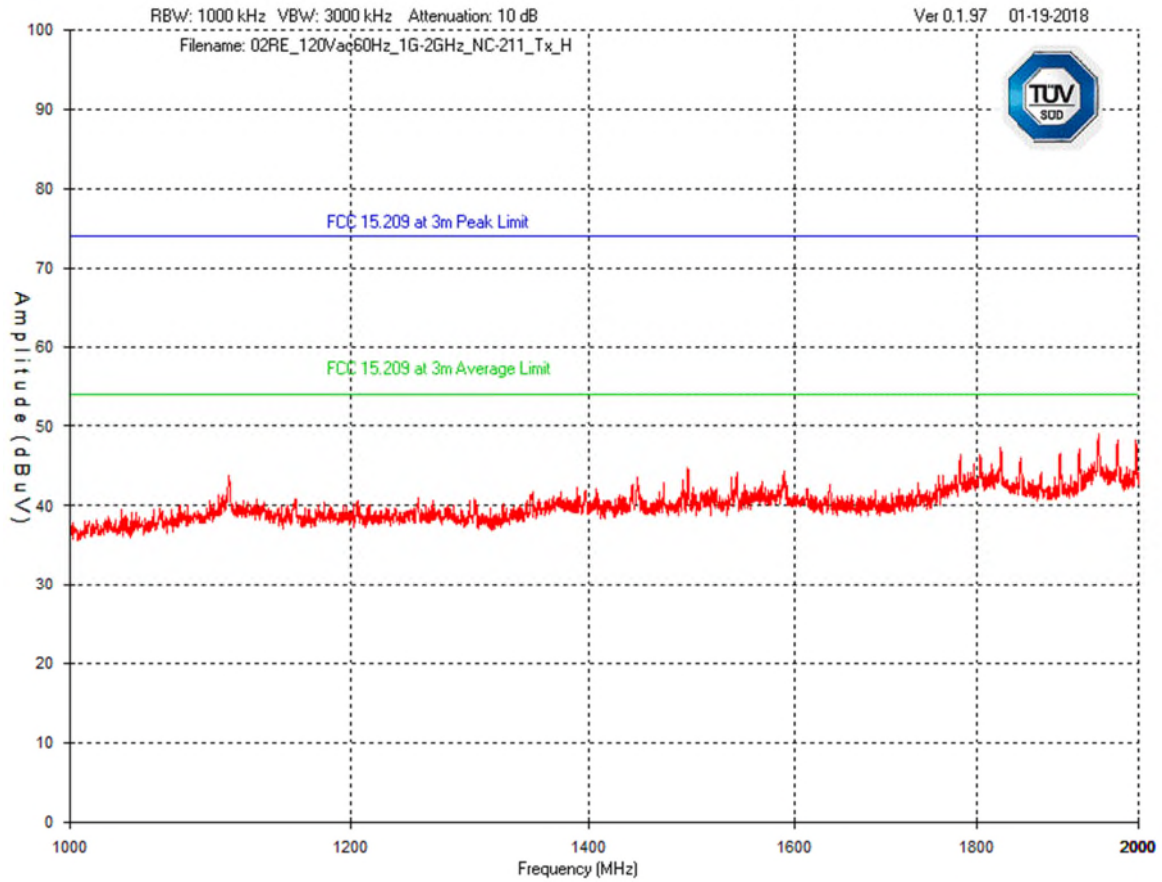
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


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



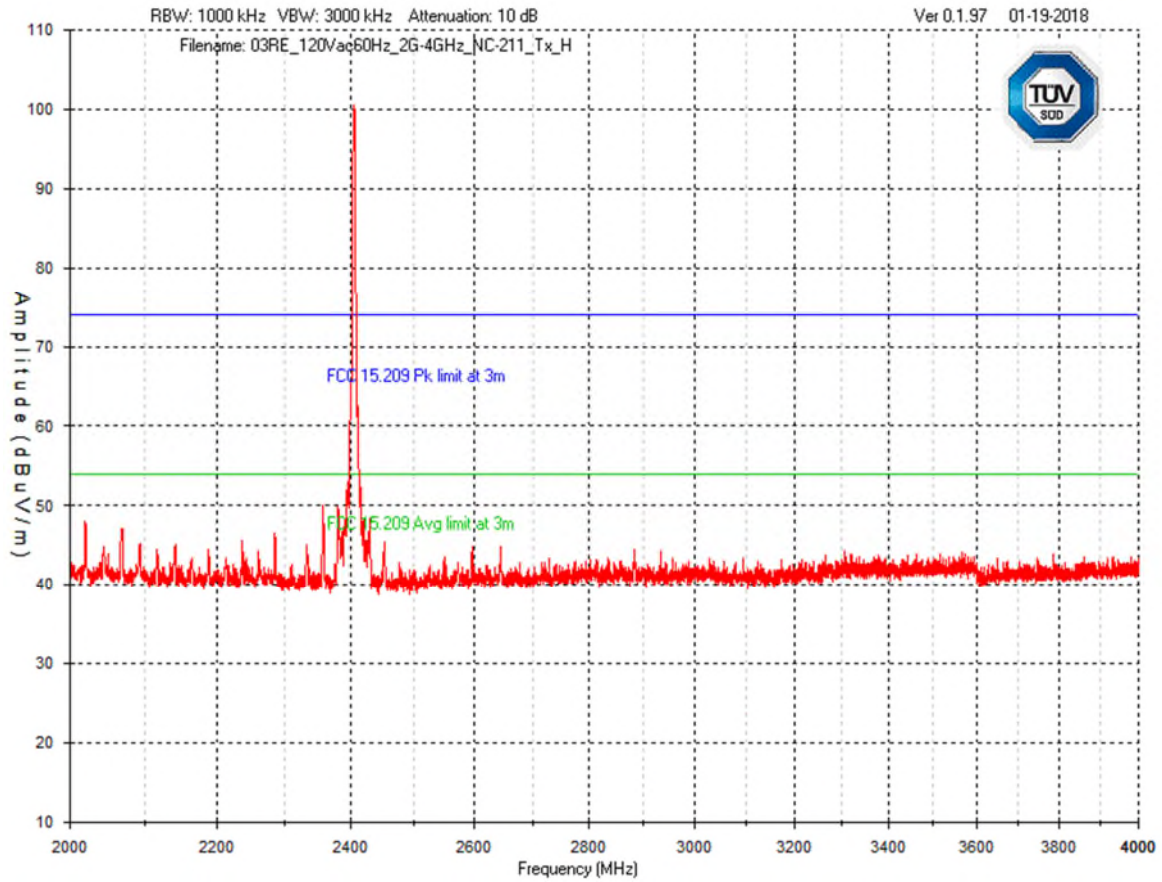
Client	Mircom Technologies Limited	
Product	NC-211	
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**Low Channel – 1 GHz – 2 GHz
Horizontal - Peak Emission Graph**



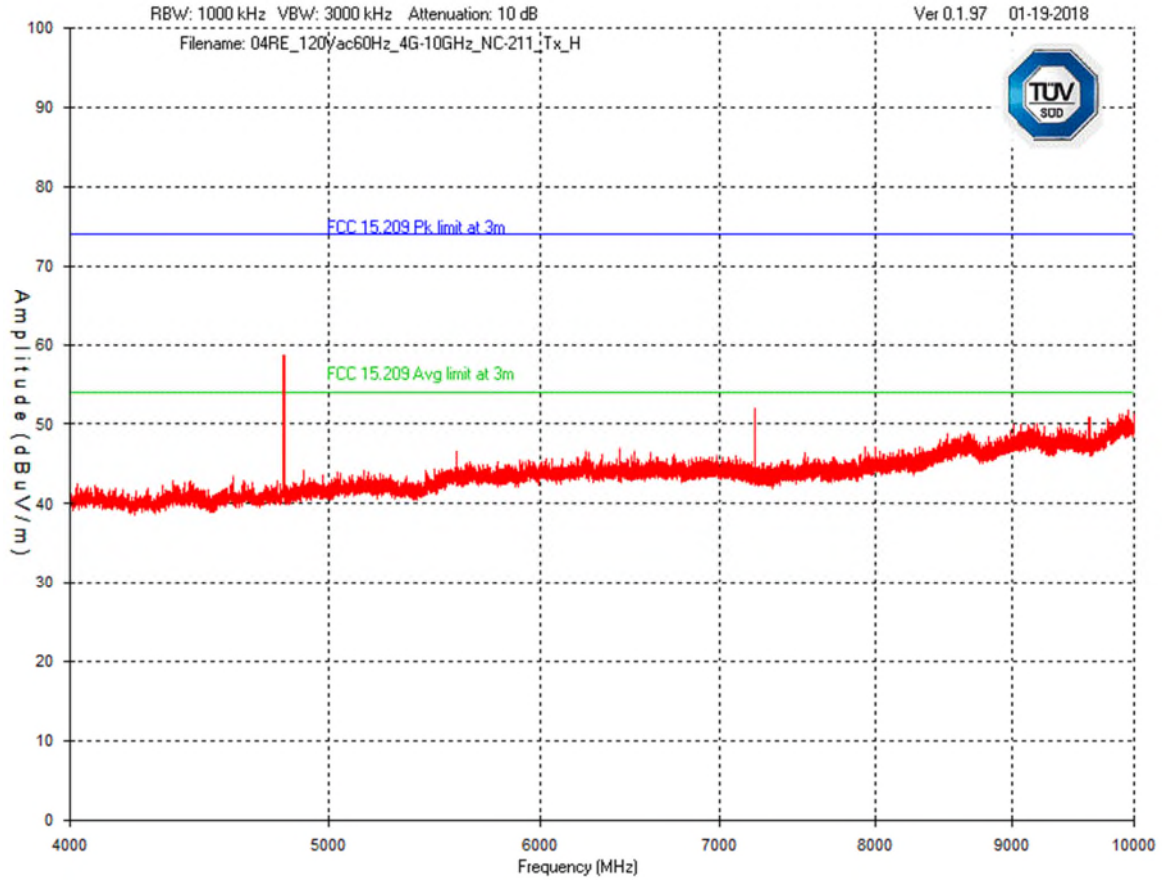
Client	Mircom Technologies Limited	
Product	NC-211	
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Low Channel – 2 GHz – 4 GHz
Horizontal - Peak Emission Graph



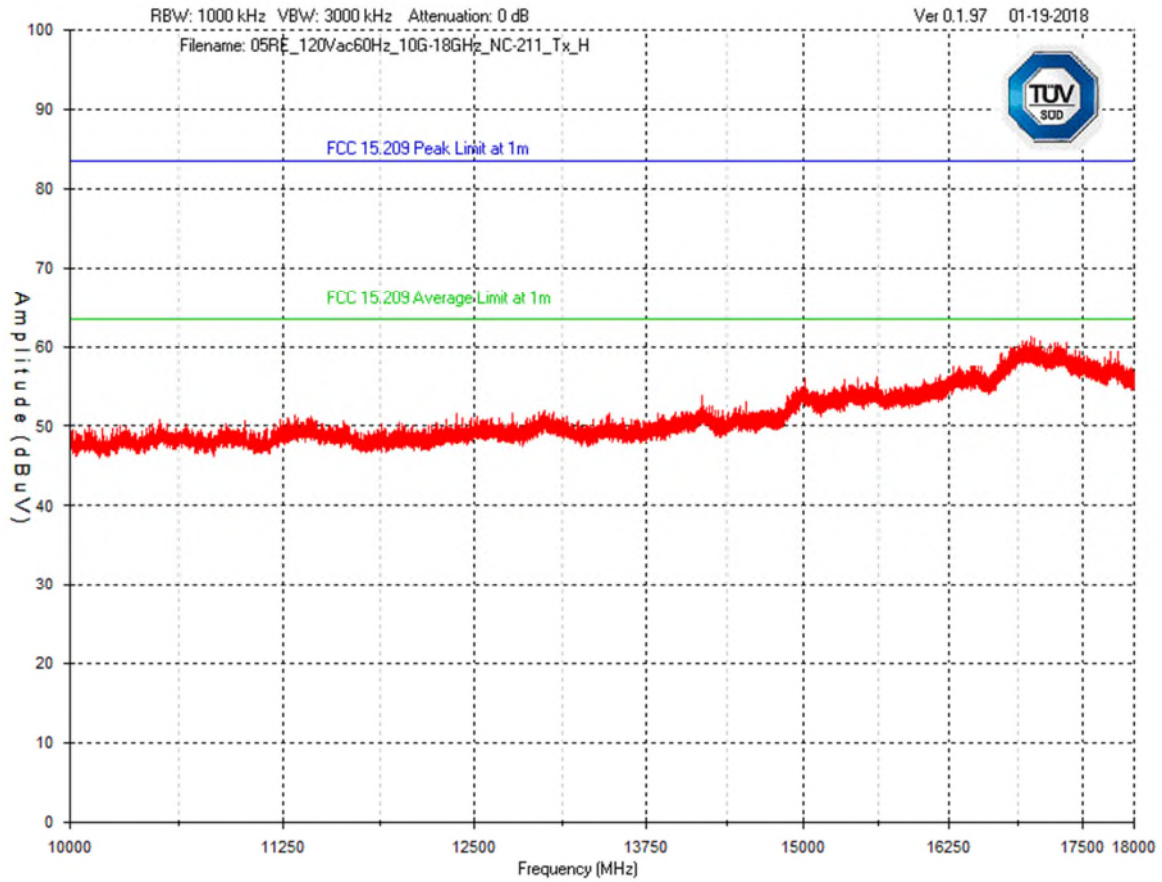
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Low Channel – 4 GHz – 10 GHz
Horizontal - Peak Emission Graph




Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

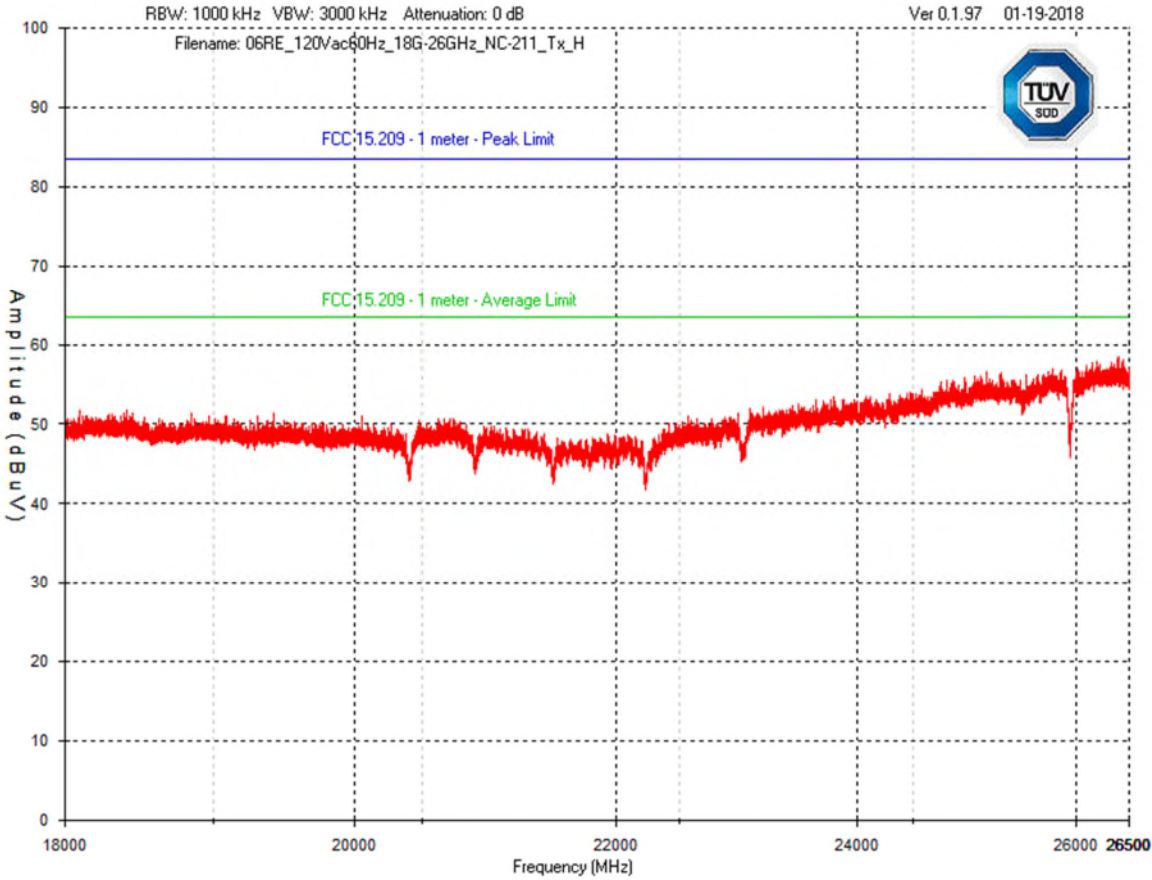
Low Channel – 10 GHz – 18 GHz
Horizontal - Peak Emission Graph




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

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

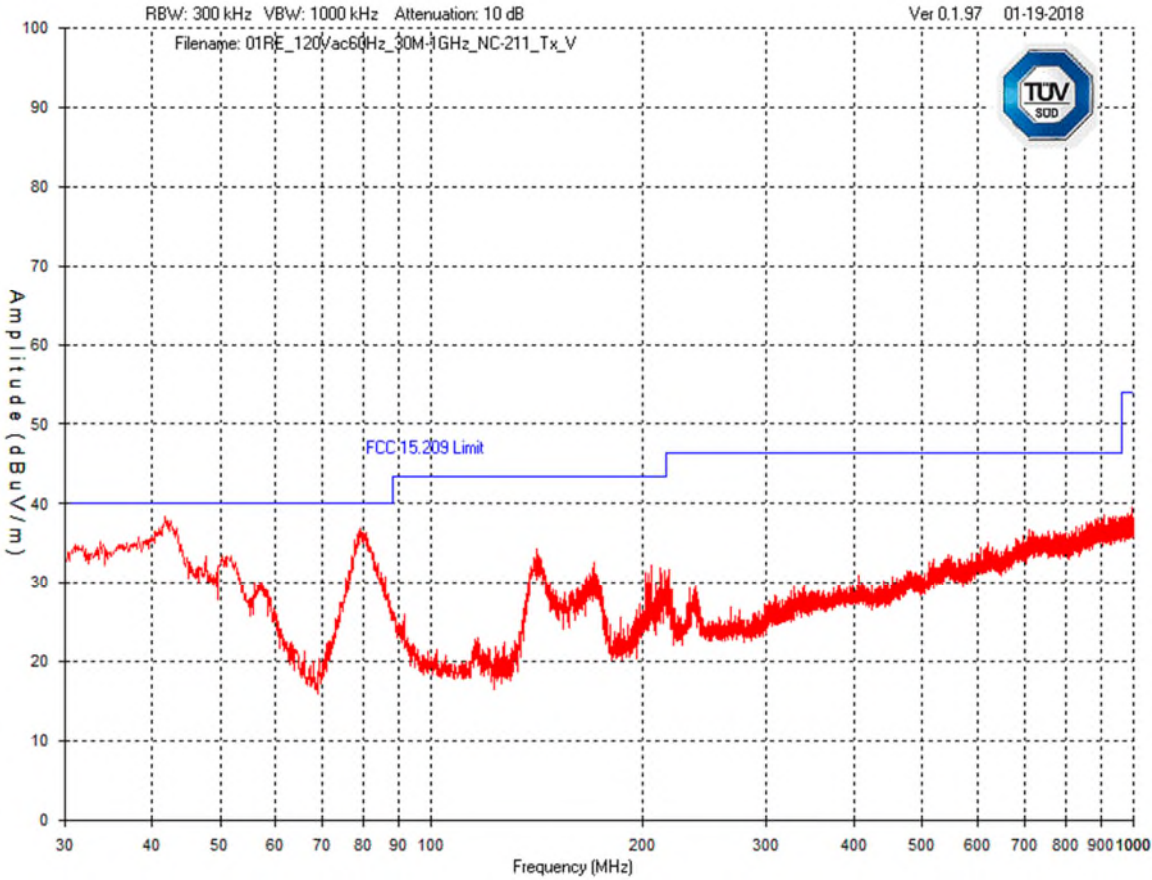
**Low Channel – 18 GHz – 26.5 GHz
Horizontal - Peak Emission Graph**




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

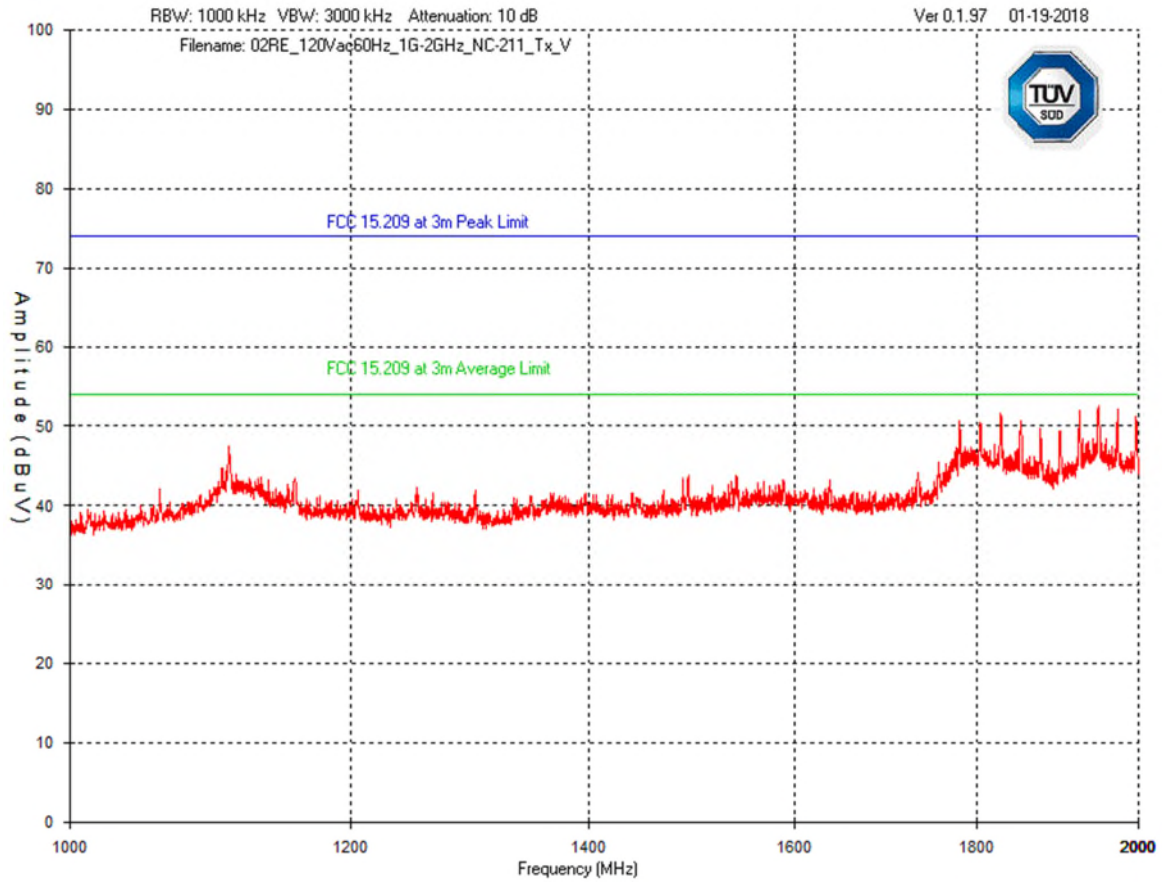
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


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



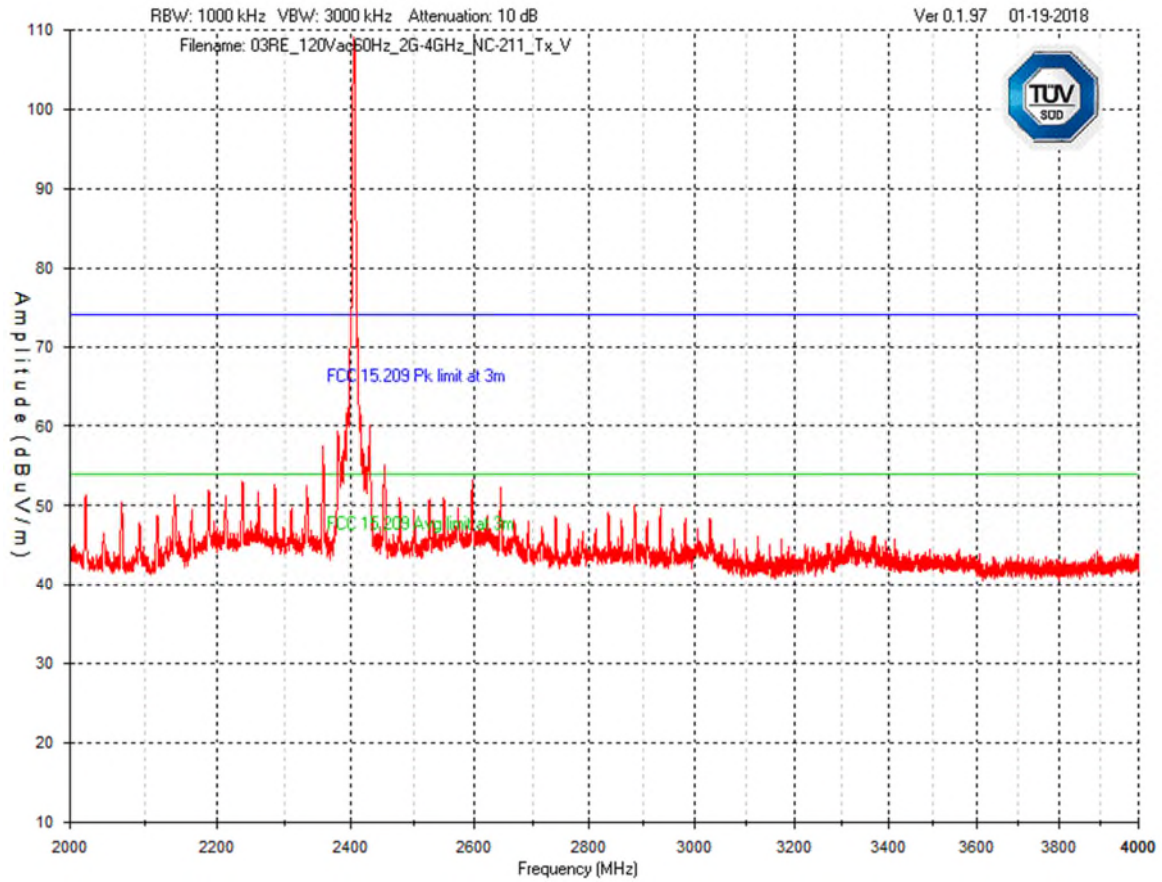
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


Low Channel – 1 GHz – 2 GHz
Vertical - Peak Emission Graph



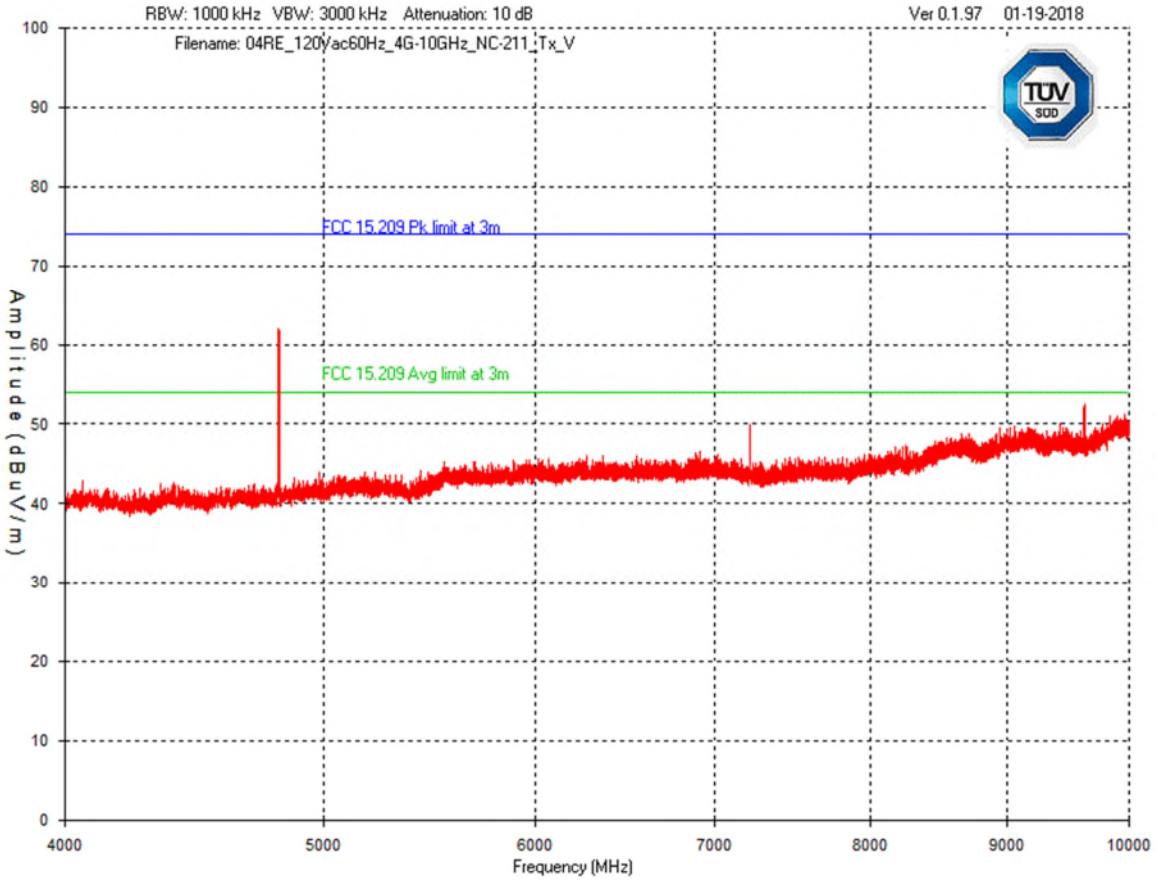
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


Low Channel – 2 GHz – 4 GHz
Vertical - Peak Emission Graph



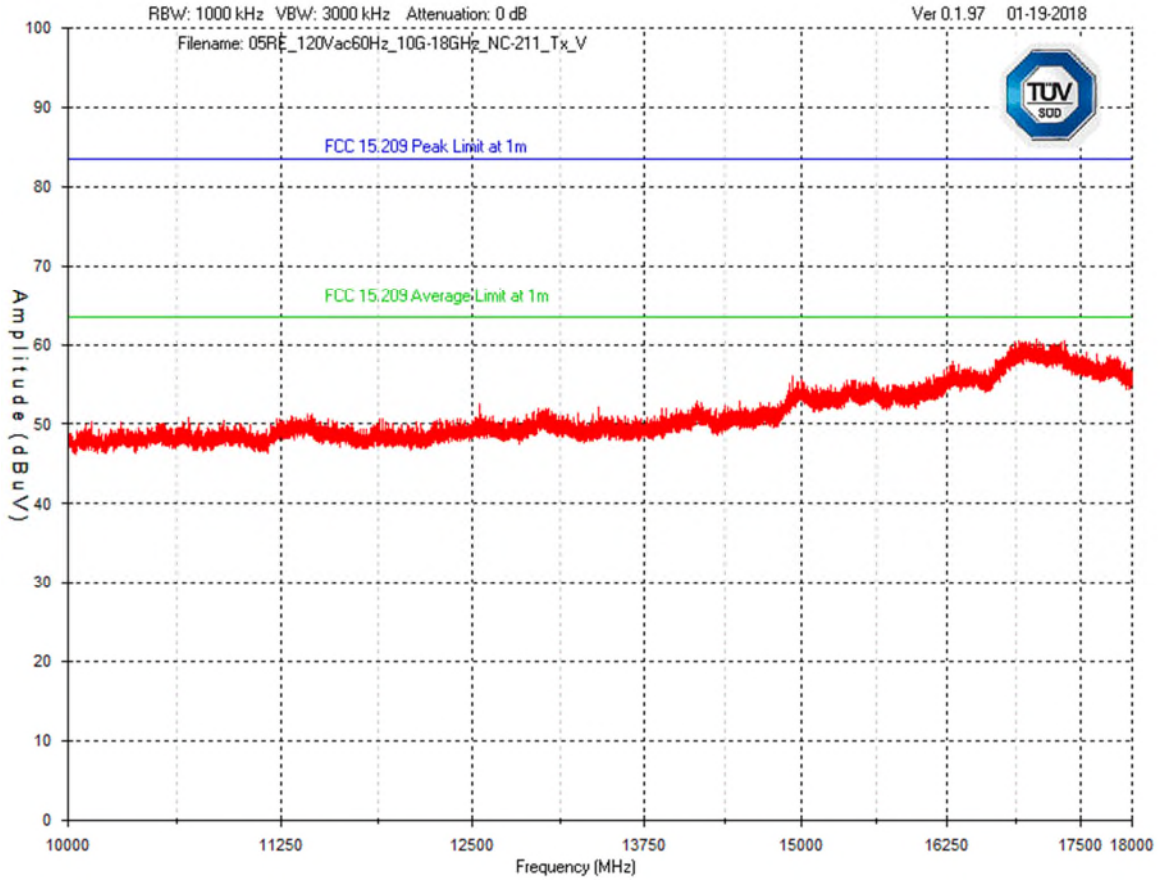
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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




Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

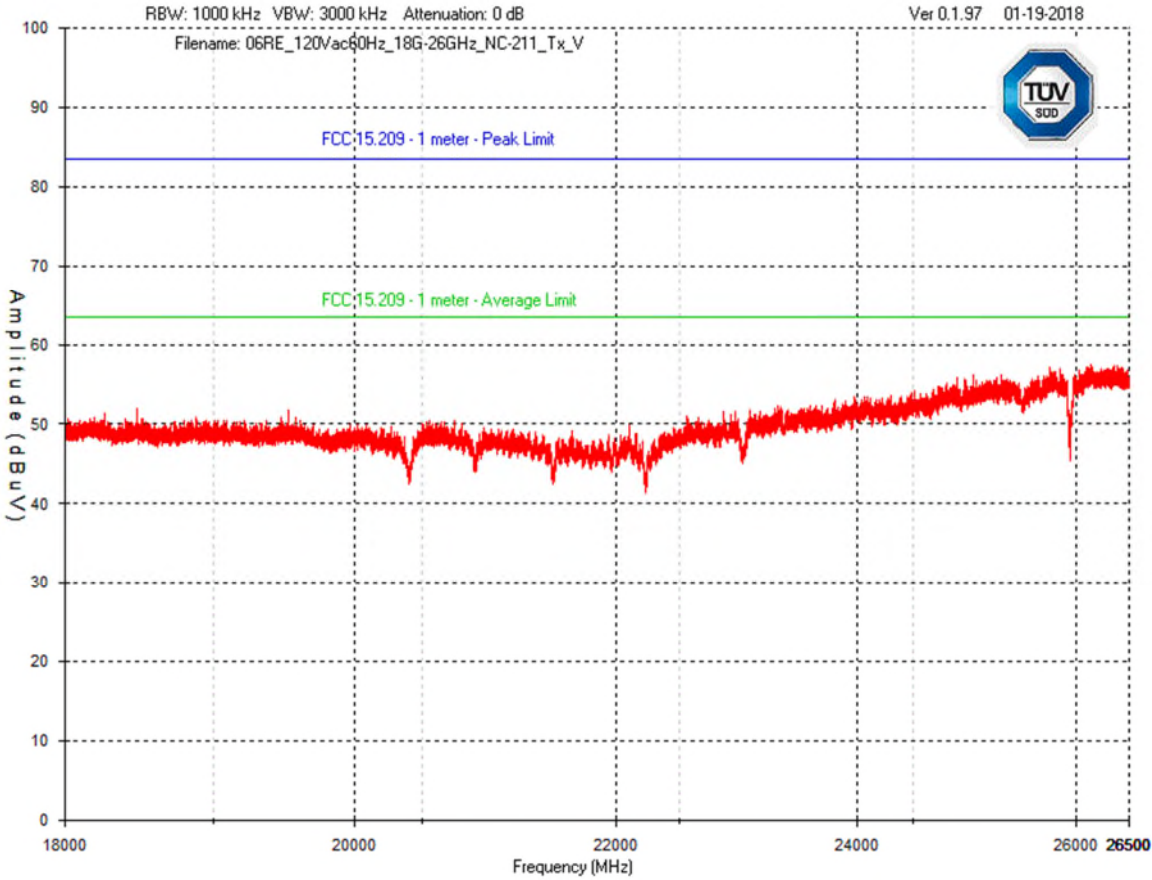
Low Channel – 10 GHz – 18 GHz
Vertical - Peak Emission Graph




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

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

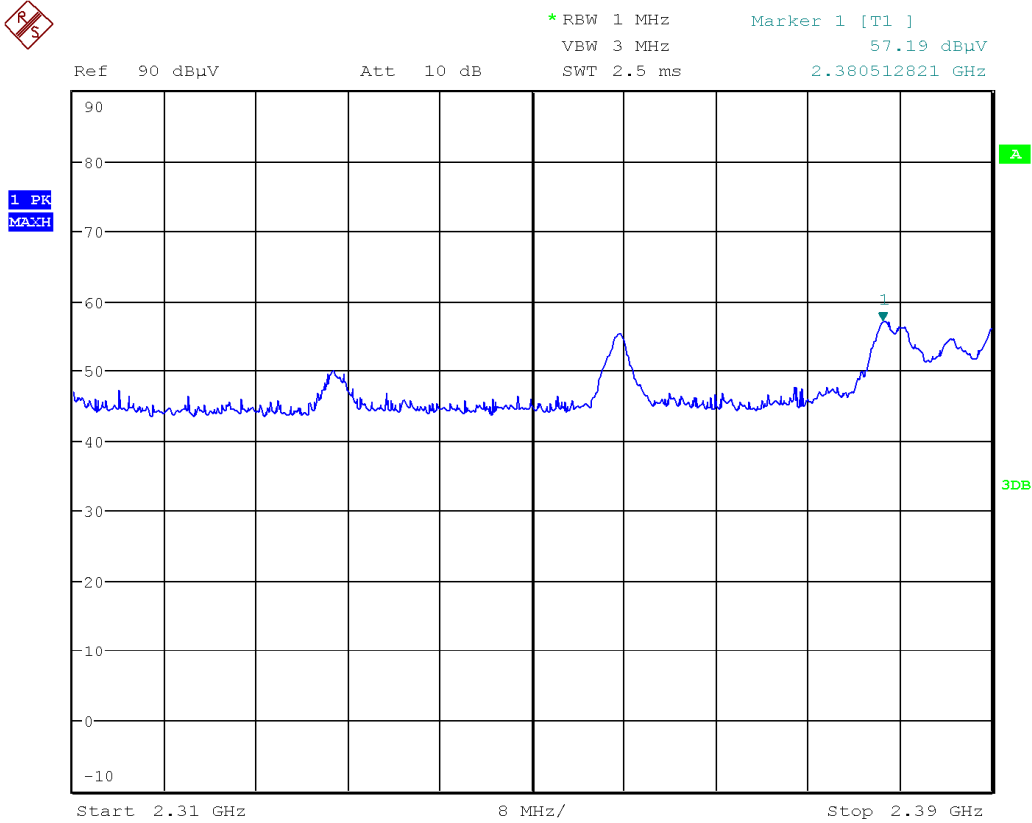
Low Channel – 18 GHz – 26.5 GHz
Vertical - Peak Emission Graph



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


Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Low Channel (11)
Band Edge – 2310MHz – 2390MHz
Horizontal - Peak Emission

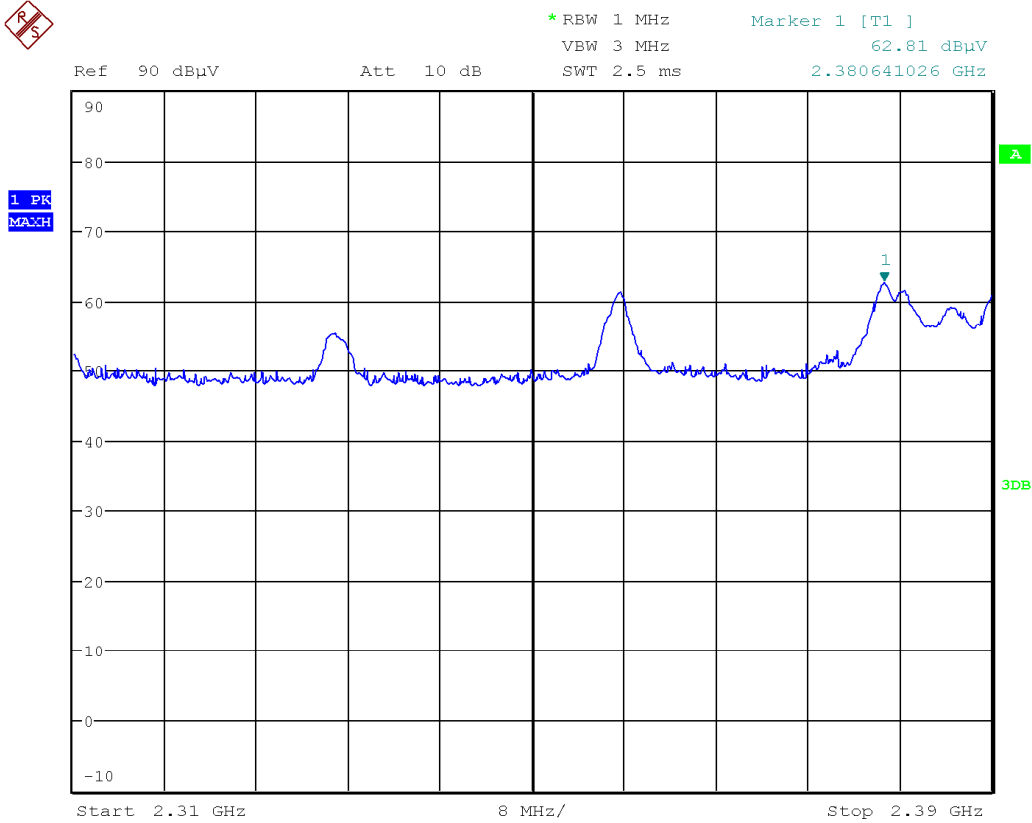


Date: 19.JAN.2018 09:39:46

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


Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Low Channel (11)
 Band Edge – 2310MHz – 2390MHz
 Vertical - Peak Emission

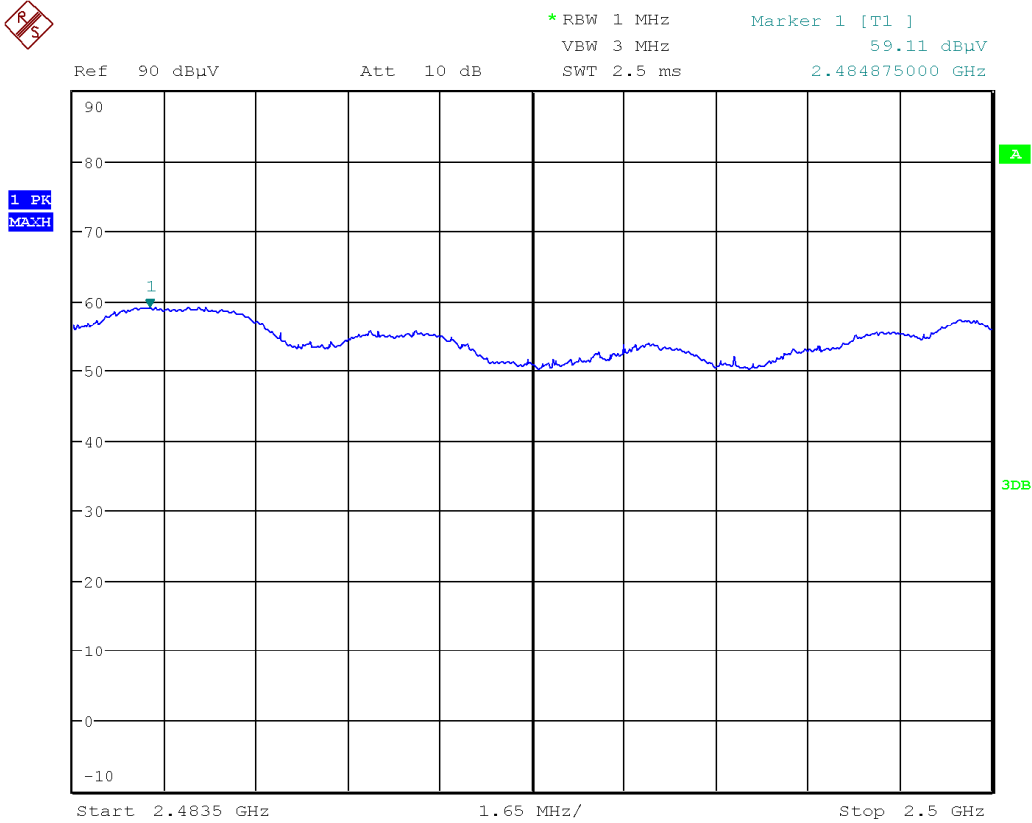


Date: 19.JAN.2018 09:28:14

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


Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Hi Channel (25)
Band Edge – 2483.5MHz – 2500MHz
Horizontal - Peak Emission



Date: 19.JAN.2018 10:08:25

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

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


Final Measurements and Results

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

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

Product Category			Class B							
Supply			120Vac 60Hz							
Frequency (MHz)	Detector Peak/AVG/QP	Received Signal (dBµV)	Antenna Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass / Fail
Horizontal Antenna Polarization										
215.07	PEAK	44.1	10.7	6	1.0	-28.5	33.3	43.5	10.2	Pass
1948.95	PEAK	49.6	29.0	0	3.1	-32.7	49.0	54.0	5.0	Pass
1996.25	PEAK	47.8	29.9	0	3.2	-32.7	48.2	54.0	5.8	Pass
1972.72	PEAK	48.6	29.2	0	3.2	-32.7	48.3	54.0	5.7	Pass
2357.00	AVG	41.6	26.2	0	3.5	-32.7	38.6	54.0	15.4	Pass
Vertical Antenna Polarization										
42.70	QP	36.3	11.0	6	0.5	-28.5	25.3	40.0	14.7	Pass
79.45	QP	37.3	5.8	6	0.7	-28.5	21.3	40.0	18.7	Pass
1948.70	AVG	46.0	29.0	0	3.1	-32.7	45.4	54.0	8.6	Pass
1973.00	AVG	43.1	29.1	0	3.2	-32.7	42.7	54.0	11.3	Pass
1925.00	AVG	43.6	28.6	0	3.1	-32.7	42.6	54.0	11.4	Pass
1829.00	AVG	43.7	29.5	0	2.9	-32.7	43.4	54.0	10.6	Pass
1997.00	AVG	40.3	29.9	0	3.2	-32.7	40.7	54.0	13.3	Pass
2357.50	AVG	53.3	26.2	0	3.5	-32.7	50.3	54.0	3.7	Pass
2596.99	AVG	49.6	26.5	0	3.7	-32.9	46.9	54.0	7.1	Pass
2236.90	AVG	50.3	26.4	0	3.4	-32.7	47.4	54.0	6.6	Pass
2285.02	AVG	50.4	26.1	0	3.4	-32.7	47.2	54.0	6.8	Pass
2332.90	AVG	49.9	26.2	0	3.5	-32.7	46.9	54.0	7.2	Pass
2644.95	AVG	47.6	26.5	0	3.7	-32.8	45.0	54.0	9.0	Pass
2189.00	AVG	47.3	26.6	0	3.4	-32.6	44.7	54.0	9.3	Pass
2260.90	AVG	45.4	26.3	0	3.4	-32.7	42.4	54.0	11.6	Pass
2140.95	AVG	45.2	26.4	0	3.3	-32.7	42.2	54.0	11.8	Pass
2020.97	AVG	36.5	27.0	0	3.2	-32.7	34.0	54.0	20.0	Pass


Spurious Emission Measurements

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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
Channel 11 - Modulated											
2405	Peak	Horz	107.3	26.4	3.6	0.0	-32.7	104.6			PASS
2405	Avg	Horz	104.7	26.4	3.6	0.0	-32.7	102.0			PASS
2405	Peak	Vert	112.2	26.4	3.6	0.0	-32.7	109.5			PASS
2405	Avg	Vert	109.5	26.4	3.6	0.0	-32.7	106.7			PASS
2380.5	Peak	Horz	57.2	26.3	3.6	0.0	-32.7	54.4	74.0	19.6	PASS
2380.5	Avg	Horz	23.2	26.3	3.6	0.0	-32.7	20.4	54.0	33.6	PASS
2380.6	Peak	Vert	62.8	26.3	3.6	0.0	-32.7	60.0	74.0	14.0	PASS
2380.6	Avg	Vert	28.8	26.3	3.6	0.0	-32.7	26.0	54.0	28.0	PASS
4810	Peak	Horz	58.2	27.7	5.7	1.1	-32.8	59.9	74.0	14.1	PASS
4810	Avg	Horz	24.2	27.7	5.7	1.1	-32.8	25.9	54.0	28.1	PASS
4810	Peak	Vert	61.6	27.7	5.7	1.1	-32.8	63.3	74.0	10.7	PASS
4810	Avg	Vert	27.6	27.7	5.7	1.1	-32.8	29.3	54.0	24.7	PASS
7215	Peak	Horz	49.2	29.0	7.6	1.1	-33.0	53.9	74.0	20.1	PASS
7215	Avg	Horz	15.2	29.0	7.6	1.1	-33.0	19.9	54.0	34.1	PASS
7215	Peak	Vert	47.5	29.0	7.6	1.1	-33.0	52.1	74.0	21.9	PASS
7215	Avg	Vert	13.5	29.0	7.6	1.1	-33.0	18.2	54.0	35.8	PASS
Channel 18 - Modulated											
2440	Peak	Horz	103.5	26.3	3.6	0.0	-32.7	100.7			PASS
2440	Avg	Horz	101.0	26.3	3.6	0.0	-32.7	98.2			PASS
2440	Peak	Vert	111.4	26.3	3.6	0.0	-32.7	108.6			PASS
2440	Avg	Vert	108.5	26.3	3.6	0.0	-32.7	105.7			PASS
Channel 25 - Modulated											
2475	Peak	Horz	106.2	26.2	3.6	0.0	-32.8	103.3			PASS
2475	Avg	Horz	103.5	26.2	3.6	0.0	-32.8	100.6			PASS
2475	Peak	Vert	109.1	26.2	3.6	0.0	-32.8	106.1			PASS
2475	Avg	Vert	106.5	26.2	3.6	0.0	-32.8	103.5			PASS
2484.8	Peak	Horz	59.1	26.2	3.6	0.0	-32.8	56.1	74.0	17.9	PASS
2484.8	Avg	Horz	25.1	26.2	3.6	0.0	-32.8	22.2	54.0	31.8	PASS
2485.1	Peak	Vert	62.2	26.2	3.6	0.0	-32.8	59.2	74.0	14.8	PASS
2485.1	Avg	Vert	28.2	26.2	3.6	0.0	-32.8	25.2	54.0	28.8	PASS

Peak Radiated Power and Band Edge Measurements


Note: The EUT has a fixed (source based) duty cycle of 2% (2ms on time/100ms) which cannot be changed or modified by either the device or the end user. For the average radiated emission measurements of the band edges and of the spurious emissions in the restricted bands, a duty cycle correction factor of 2% [$20\log(2\%) = -33.98$] was applied to the peak measurement to obtain the average measurement.

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 12, 2018	Jan. 12, 2020	GEMC 233
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Feb. 2, 2017	Feb. 2, 2019	GEMC 168
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Oct. 27, 2017	Oct. 27, 2019	GEMC 279
Attenuator 6 dB	612-6-1	Meca Electronics, Inc	Feb 20, 2017	Feb 20, 2018	GEMC 286
Loop Antenna	EM 6871	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 13, 2017	Feb 13, 2019	GEMC 71
BiLog Antenna	3142-C	ETS	Oct 5, 2016	Oct 5, 2018	GEMC 8
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb. 12, 2016	Feb. 12, 2018	GEMC 6375
Horn Antenna 18 – 26.5 GHz	SAS-572	A.H. Systems	Oct 11, 2016	Oct 11, 2018	GEMC 6371
2.4GHz-2.5GHz Notch Filter	BRM50702	Micro-Tronics	Feb 20, 2017	Feb 20, 2018	GEMC 230
RF Cable 10m	LMR-400- 10M-50Ω-MN- MN	LexTec	Feb 20, 2017	Feb 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb 20, 2017	Feb 20, 2018	GEMC 271
Emissions Software	0.1.97	Global EMC	NCR	NCR	GEMC 58

FCC - 15.209 -Radiated Emissions_Rev1

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Power Spectral Density

Purpose

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

Limits and Method

The limits are defined in 15.247(e).

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

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


Results

The EUT passed. Low, medium, and high bands were tested. The worst case value is 6.51 dBm as measured with a 3 kHz resolution bandwidth (peak power).

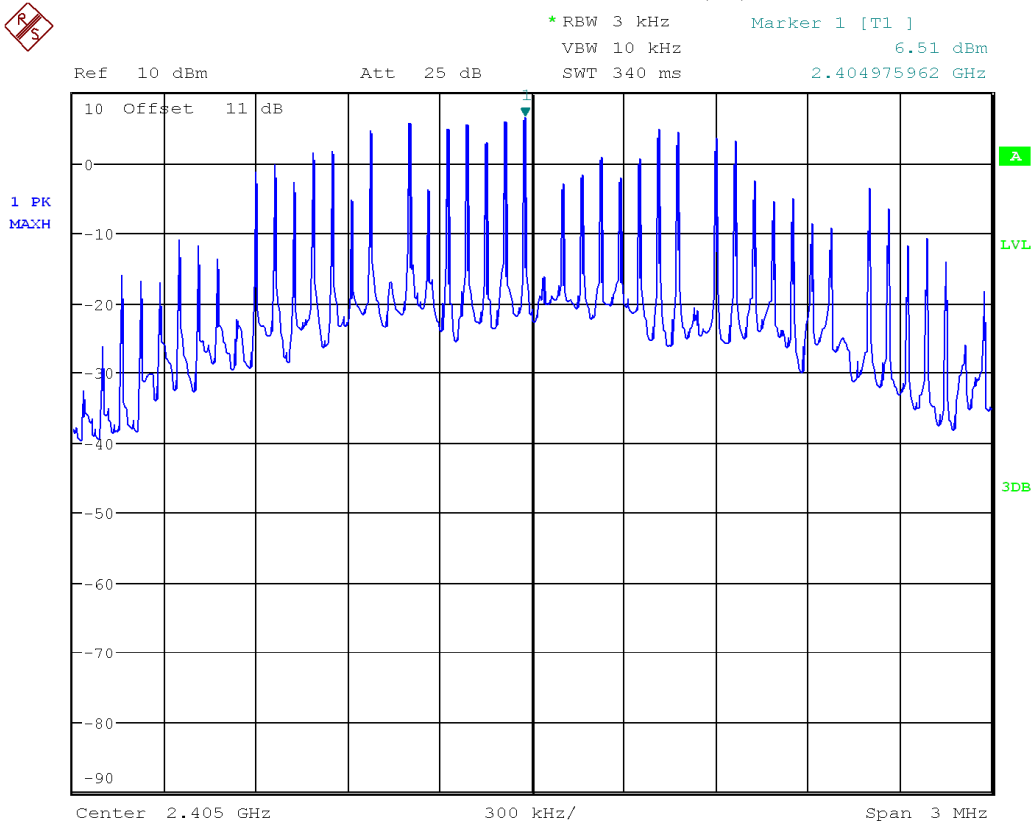
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Result
Low (11)	2405	6.51	8	Pass
Mid (18)	2440	6.37	8	Pass
High (25)	2475	6.06	8	Pass

Graphs

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated in each mode, with the worst case being presented. The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer.

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

PSD - Low Channel (11)




Date: 19.JAN.2018 15:48:06

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSQ 26	Rohde & Schwarz	Feb 28, 2017	Feb 28, 2019	GEMC 232
Attenuator 10 dB	8493B	Agilent	Feb 20, 2017	Feb 20, 2018	GEMC 133

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Power Line Conducted Emissions

Purpose

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

Limits and Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207


Method is as defined in ANSI C63.4

Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* 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

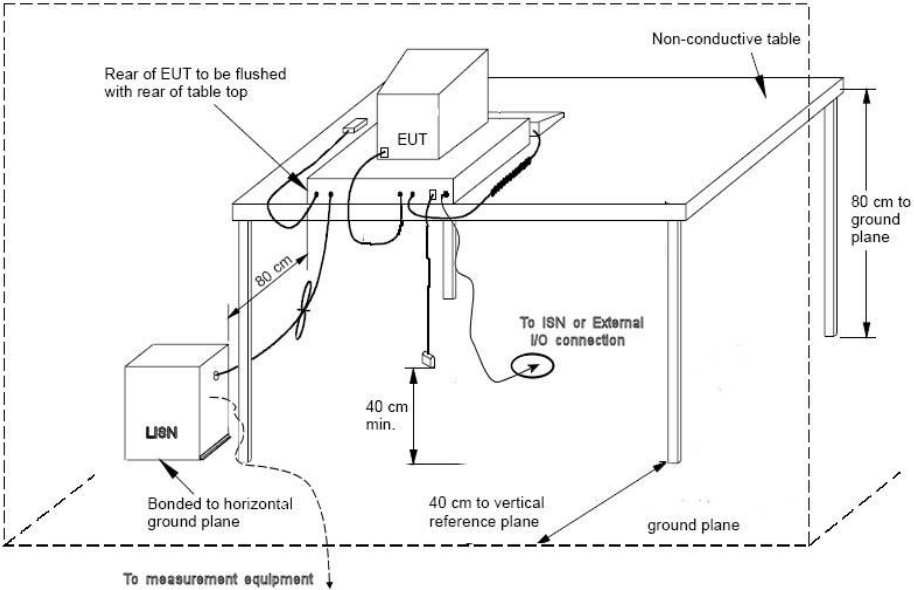
* Decreases linearly with the logarithm of the frequency

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

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Typical Setup Diagram




Measurement Uncertainty

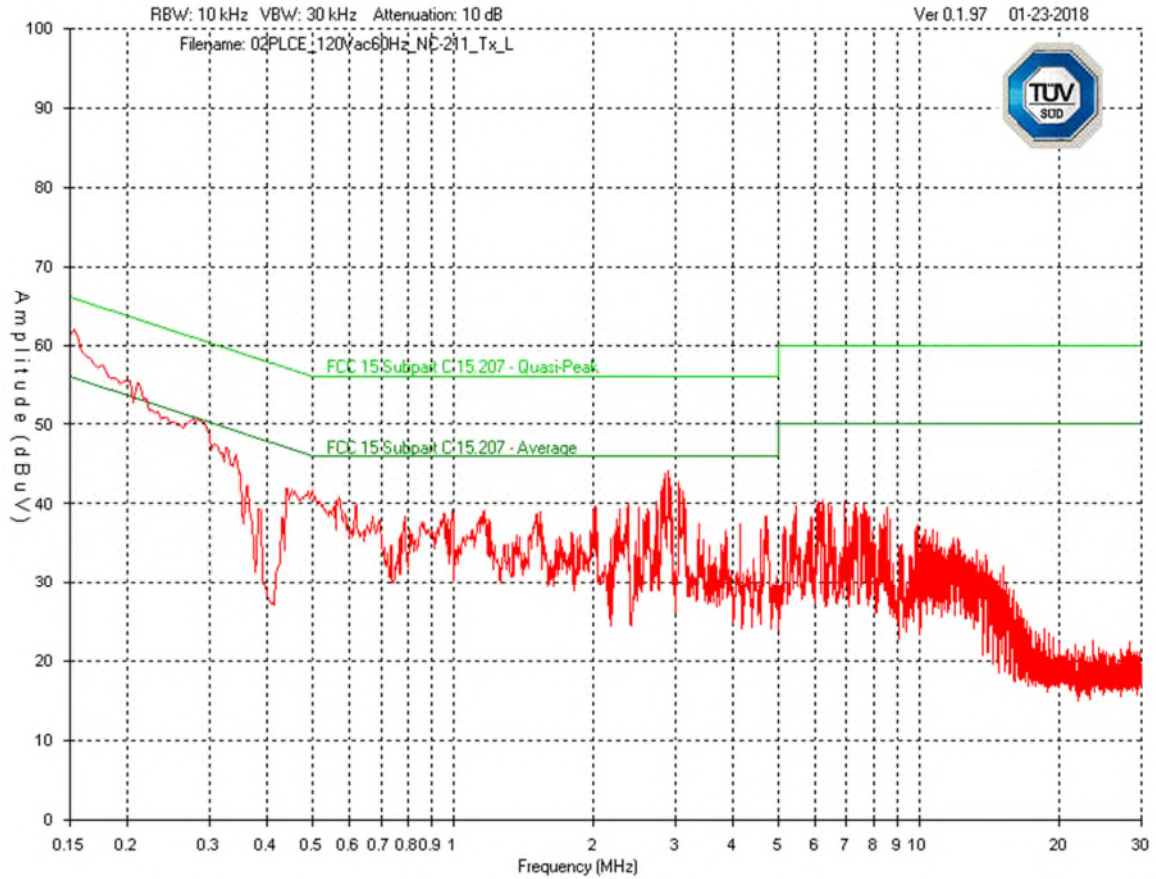
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 2.91\text{dB}$ with a 'k=2' coverage factor and a 95% confidence level.


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.

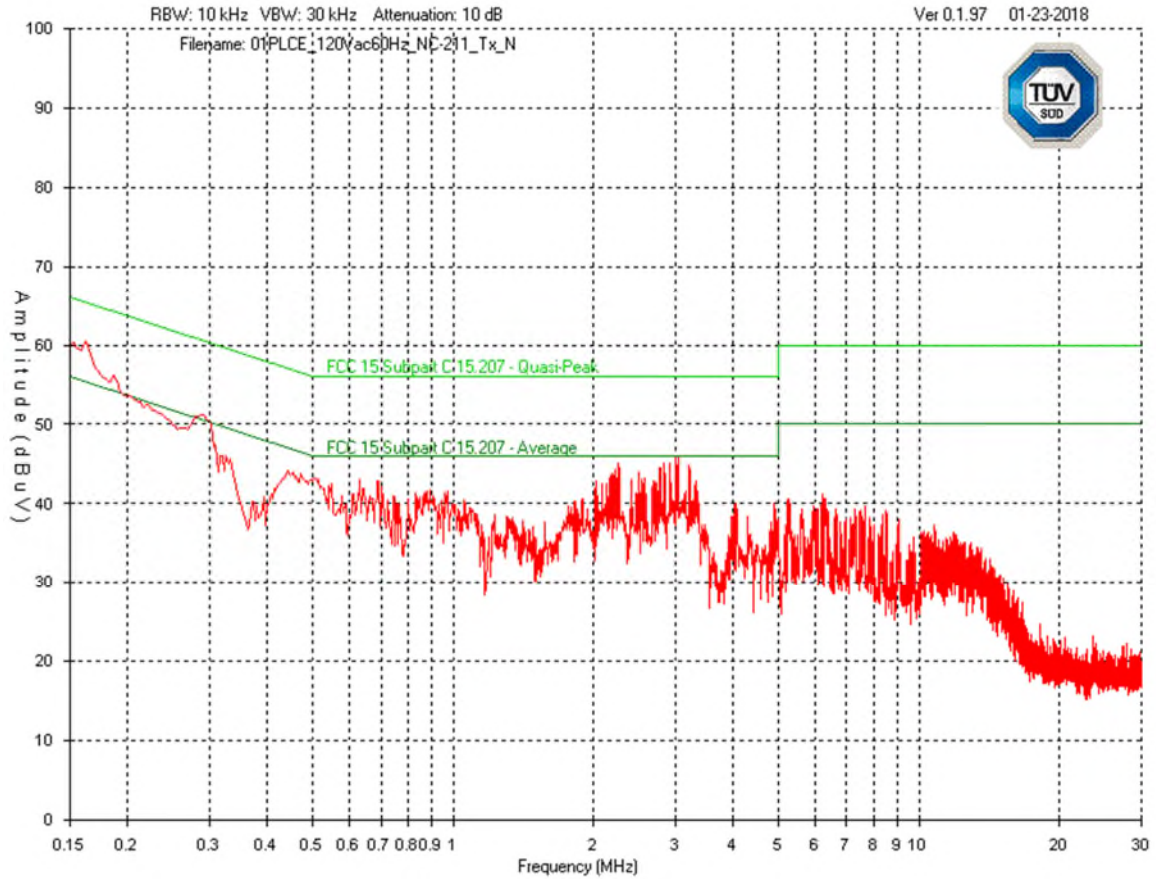
Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	


Line (L) – 120Vac 60Hz



Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Neutral (N) – 120Vac 60Hz




Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Final Measurements

Product Category			Class B								
Supply			120Vac 60Hz								
Frequency (MHz)	Detector Peak/AVG/QP	Received Signal (dBμV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBμV)	QP Limit (dBμV)	AVG Limit (dBμV)	QP Margin (dB)	AVG Margin (dB)	Pass/Fail
Line											
0.153	AVG	13.4	10	0.0	0.2	23.6	--	55.8	--	32.2	Pass
0.280	AVG	17.6	10	0.0	0.2	27.8	--	50.8	--	23.0	Pass
2.895	AVG	8.4	10	0.1	0.1	18.6	--	46.0	--	27.4	Pass
3.051	AVG	9.9	10	0.1	0.1	20.1	--	46.0	--	25.9	Pass
0.443	AVG	9.9	10	0.1	0.1	20.1	--	47.0	--	27.0	Pass
2.742	AVG	8.0	10	0.1	0.1	18.2	--	46.0	--	27.8	Pass
0.153	QP	43.4	10	0.0	0.2	53.6	65.8	--	12.2	--	Pass
0.280	PEAK	40.1	10	0.0	0.2	50.3	60.8	--	10.5	--	Pass
2.895	PEAK	33.9	10	0.1	0.1	44.1	56.0	--	11.9	--	Pass
3.051	PEAK	32.6	10	0.1	0.1	42.8	56.0	--	13.2	--	Pass
0.443	PEAK	31.7	10	0.1	0.1	41.9	57.0	--	15.1	--	Pass
2.742	PEAK	30.0	10	0.1	0.1	40.2	56.0	--	15.8	--	Pass
Neutral											
0.163	AVG	13.5	10	0.0	0.2	23.7	--	55.3	--	31.6	Pass
0.279	AVG	19.2	10	0.0	0.2	29.4	--	50.9	--	21.5	Pass
0.515	AVG	12.1	10	0.0	0.2	22.3	--	46.0	--	23.7	Pass
3.008	AVG	14.7	10	0.1	0.1	24.9	--	46.0	--	21.1	Pass
2.829	AVG	13.2	10	0.1	0.1	23.4	--	46.0	--	22.7	Pass
2.257	AVG	11.8	10	0.1	0.1	22.0	--	46.0	--	24.0	Pass
3.217	AVG	14.6	10	0.1	0.1	24.8	--	46.0	--	21.2	Pass
0.163	QP	43.6	10	0.0	0.2	53.8	65.3	--	11.5	--	Pass
0.279	PEAK	40.7	10	0.0	0.2	50.9	60.9	--	10.0	--	Pass
0.515	PEAK	32.8	10	0.0	0.2	43.0	56.0	--	13.0	--	Pass
3.008	PEAK	35.7	10	0.1	0.1	45.9	56.0	--	10.1	--	Pass
2.829	PEAK	35.0	10	0.1	0.1	45.2	56.0	--	10.8	--	Pass
2.257	PEAK	34.9	10	0.1	0.1	45.1	56.0	--	10.9	--	Pass

Average and Quasi-Peak Emissions Table

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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


Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Dec. 27, 2017	Dec. 27, 2019	GEMC 160
LISN	FCC-LISN-50-100-1-02-MS461F	FCC	Feb. 5, 2016	Feb. 5, 2018	GEMC 121, GEMC 122
RF Cable 3m	LMR-400-3M-50Ω-MN-MN	LexTec	Feb 20, 2017	Feb 20, 2018	GEMC 276
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 20, 2017	Feb 20, 2018	GEMC 223
Emissions Software	0.1.97	Global EMC	NCR	NCR	GEMC 58

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Client	Mircom Technologies Limited	 Canada
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Appendix A – EUT Summary


Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

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

General EUT Description

Client	
Organization / Address	Mircom Technologies Ltd. 25 Interchange Way Vaughan, Ontario, L4K 5W3 Canada
Contact	Michael Sugarman
Phone	905-660-4655 #7250
Email	msugarman@mircom.com
EUT Details	
EUT Name	MiCare Beacon
EUT Model	NC-211
Equipment Category	ITE
Basic EUT Functionality	Standalone ZigBee repeater
Input Voltage and Frequency	120Vac 60Hz
Rated Input Current	70mA
Connectors available on EUT	Mini USB (Service only, not user accessible)
Peripherals Required for Test	None
Release type	Final
Intentional Radiator Frequency	2405 – 2475 MHz for ZigBee applications
EUT Configuration	ZigBee configured to transmit continuously at 100% duty cycle during testing. Channel 26 is not used and therefore Channel 25 is taken as the highest channel

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’.

Client	Mircom Technologies Limited	
Product	NC-211	
Standard(s)	RSS 247 Issue 2:2017 FCC Part 15 Subpart 15.247:2016	

Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report.