

TÜV SÜD Canada Inc.

EMC & RF Test Report

As per
RSS-247 Issue 1:2015
&
FCC Part 15 Subpart 15.247:2016
Unlicensed Intentional Radiators
on the
Nymi Band



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Testing produced for



nymi™

See Appendix A for full client & EUT details.



Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Report Scope

This report addresses the EMC verification testing and test results of the **Nymi Band Model: 151100**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 1:2015

FCC Part 15 Subpart C 15:2015

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	Nymi™	
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Summary

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

EUT FCC Certification #, FCC ID:	2ADLK151100
EUT Industry Canada Certification #, IC:	12505A-151100
EUT passed all tests performed	Yes
Tests conducted by	Amir Emami

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

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Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 6)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-GEN (Table 4)	Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-247 5.2(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)	Power Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) RSS-102	RF Exposure	≤ 20 cm Separation.	Pass See justification and calculations
Overall Result			Pass

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

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Notes, Justifications, or Deviations

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

For the Antenna requirement specified in FCC 15.203 (RSS-247 section 5.5), the unit uses a custom monopole designed trace antenna with less than 6dBi gain.

The nominal antenna gain was not provided by the client. Highest antenna gain was used from test results; it was calculated from in band EIRP and peak conducted power. The highest antenna gain calculated was 4.79dB. The highest in band field strength at 3 m is 94.6 in the high channel and the conducted power in the same channel is -4.56 dBm.

EIRP @ 3m = 94.6 - 95.2 = -0.6 dBm. However this value was measured with a RBW of 1 MHz. It is corrected to the peak EIRP by

$$\text{EIRP}_{\text{peak}} = \text{EIRP}_{\text{RBW}=1\text{MHz}} + 20\log(99\% \text{ BW} / \text{Meas BW})$$

$$\text{EIRP}_{\text{peak}} = -0.6 + 20\log(1.1/1)$$

$$\text{EIRP}_{\text{peak}} = 0.4$$

The antenna gain is calculate by using:

$$\text{EIRP} = P_{\text{cond}} + G$$

$$G = \text{EIRP} - P_{\text{cond}}$$

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

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

For the scope of this test report, the EUT was mounted in three orthogonal axis to determine the worst case radiated emissions. Worst case results are presented.

The EUT is not sold with any AC/DC power adaptor and is charged via a custom USB adapter charger cable. Conducted emissions was evaluated on a laptop to which the EUT was connected and charging from.

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 personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

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Sample Calculation(s)

Radiated Emission Test

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

Margin = 50.5dBμV/m – (50dBμV + 10dB + 2.5dB – 20dB)

Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

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

Margin = 73.0dBμV – (50dBμV + 10dB + 2.5dB + 0.5dB)

Margin = 10.0 dB (pass)

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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 15.247	Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
FCC KDB 558074: 2016	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
FCC KDB 447498: 2015	RF exposure procedures and equipment authorization policies for mobile and portable devices
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 1:2015	Issue 1: 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)
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

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Document Revision Status

Revision 0 - June 14, 2016
Initial Release

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Standard(s)	RSS 247 Issue 1:2015 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 an 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)
May 16-17, 2016	Radiated Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
May 16 – June 9, 2016	Antenna Conducted Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
May 17, 2016	Power Line Conducted Emissions	AE	20 – 24	40 – 51	98.0 – 102.0

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Detailed Test Results Section

Client	Nymi™	
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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 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

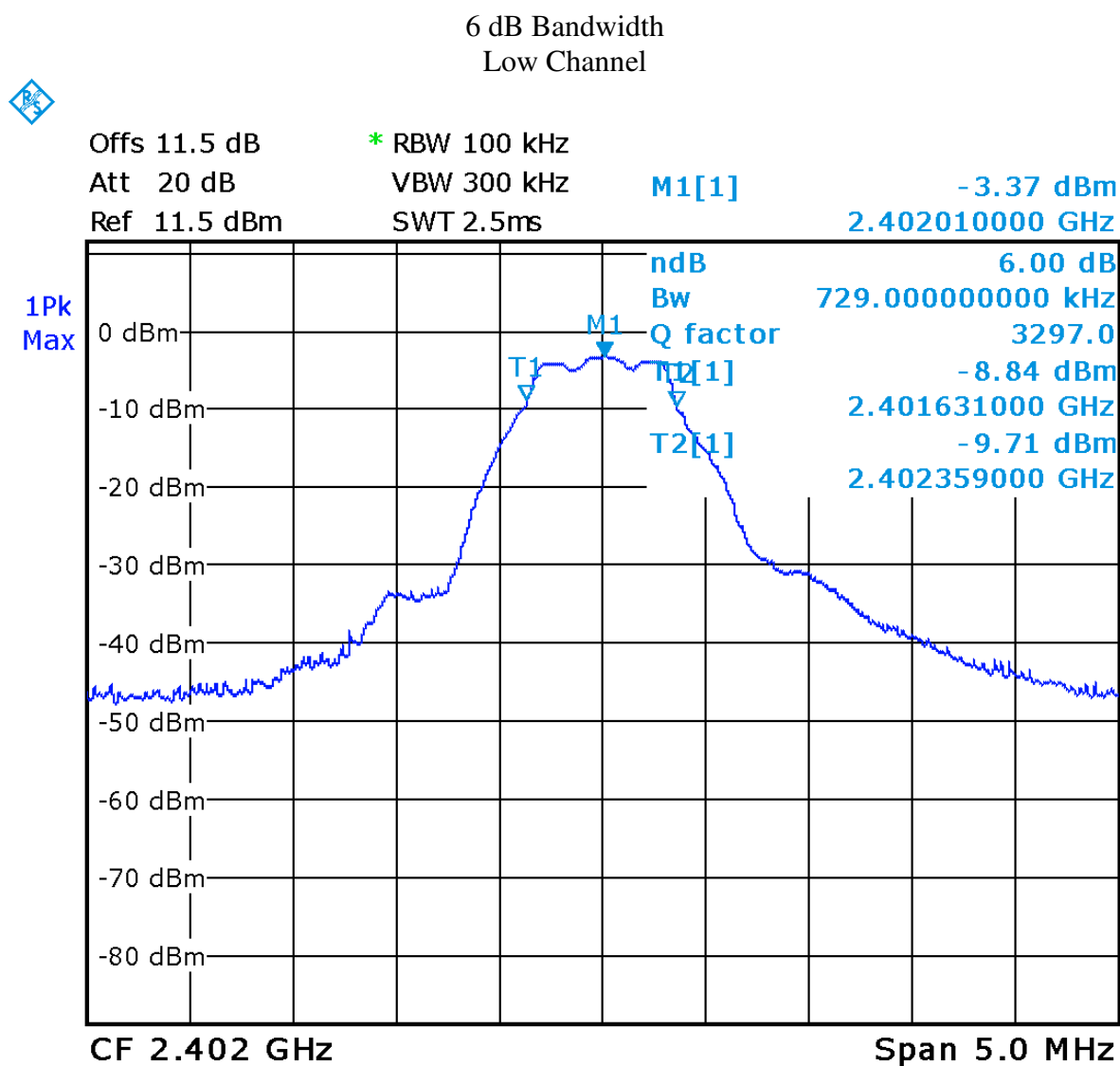
The EUT passed. The minimum 6 dB BW measured was 689 kHz and the maximum 99% BW at full power setting was 1108 kHz.

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Lo Channel	2402	729	1108
Mid Channel	2440	689	1068
Hi Channel	2480	699	1078

Client	Nymi™	
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Graphs

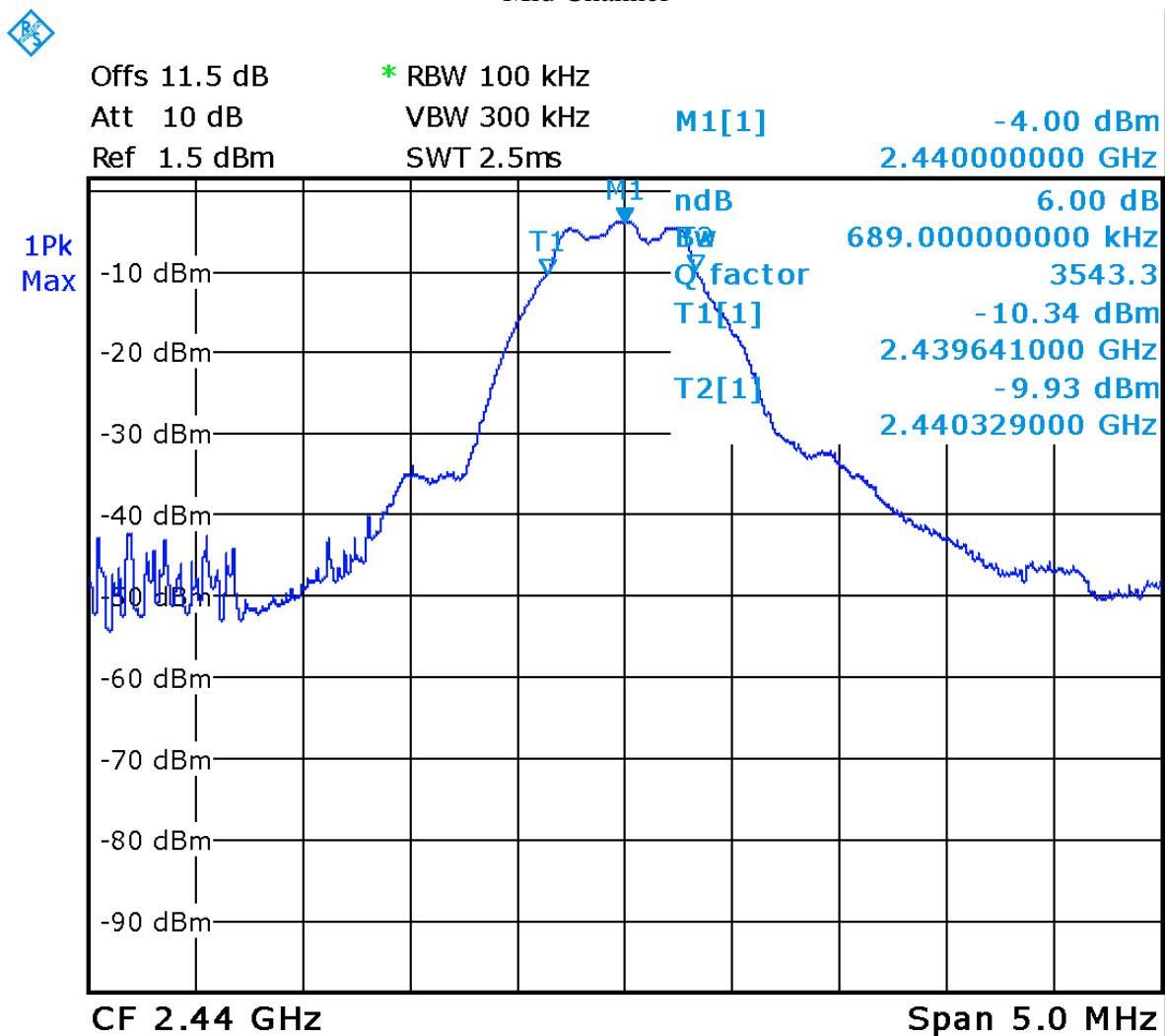
The graphs showed below shows the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration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



Date: 20.MAY.2016 14:35:10

Client	Nymi™	
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Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

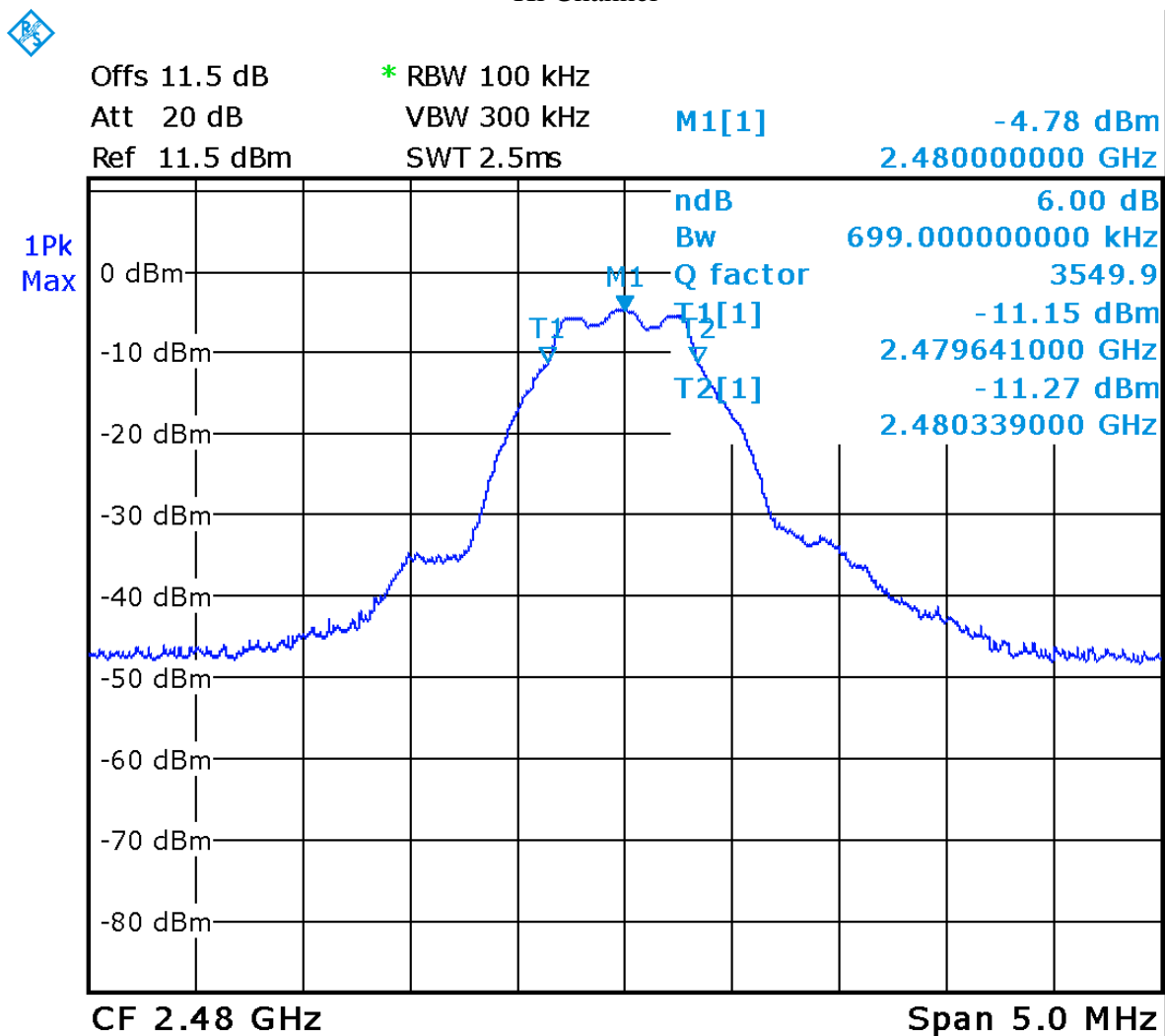
6 dB Bandwidth
Mid Channel



Date: 20.MAY.2016 15:23:15

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

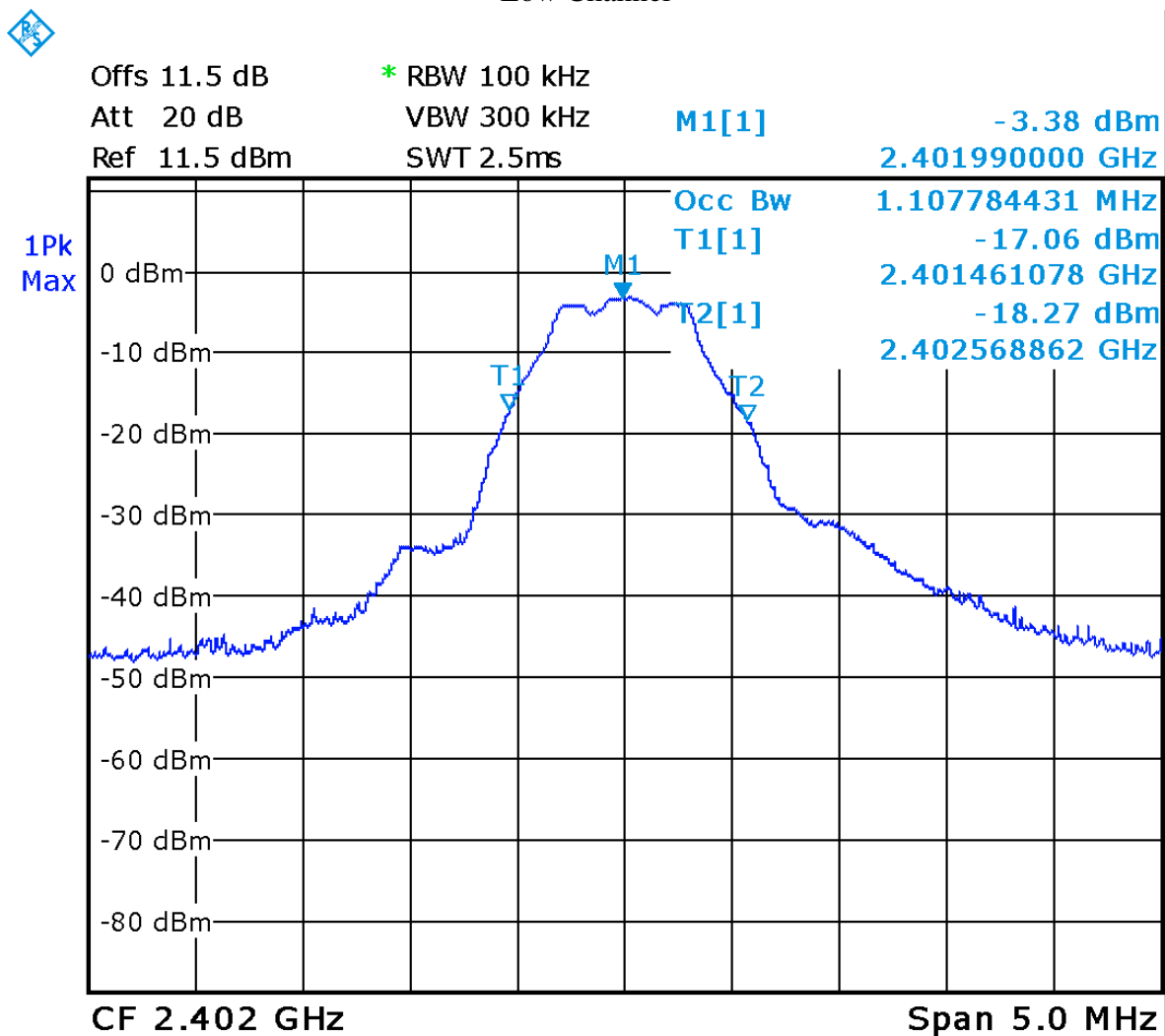
6 dB Bandwidth
Hi Channel



Date: 20.MAY.2016 15:46:24

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

99% Bandwidth
Low Channel



Date: 20.MAY.2016 14:37:28

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

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Standard(s)	RSS 247 Issue 1:2015 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	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223

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

Client	Nymi™	
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Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Maximum Peak Envelope Conducted Power

Purpose

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

Limits and Method

The limits are defined in FCC Part 15.247(b) and RSS-247.

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt (30 dBm).

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

Results

The EUT passed. The EUT was set to transmit at maximum power (PWR=7). Three channels were measured. The following table show the peak power:

Channel	Frequency (MHz)	Peak Power dBm	Peak Power (mW)
Lo Channel	2402	-3.22	0.476
Mid Channel	2440	-3.67	0.430
Hi Channel	2480	-4.56	0.350

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 power output of the device during the antenna conducted measurements during transmit operation of the EUT. The measurement RBW is $\geq$ than the DTS bandwidth.

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Peak Power, Low Channel



Offs 11.5 dB

* RBW 1 MHz

Att 20 dB

VBW 3 MHz

M1[1]

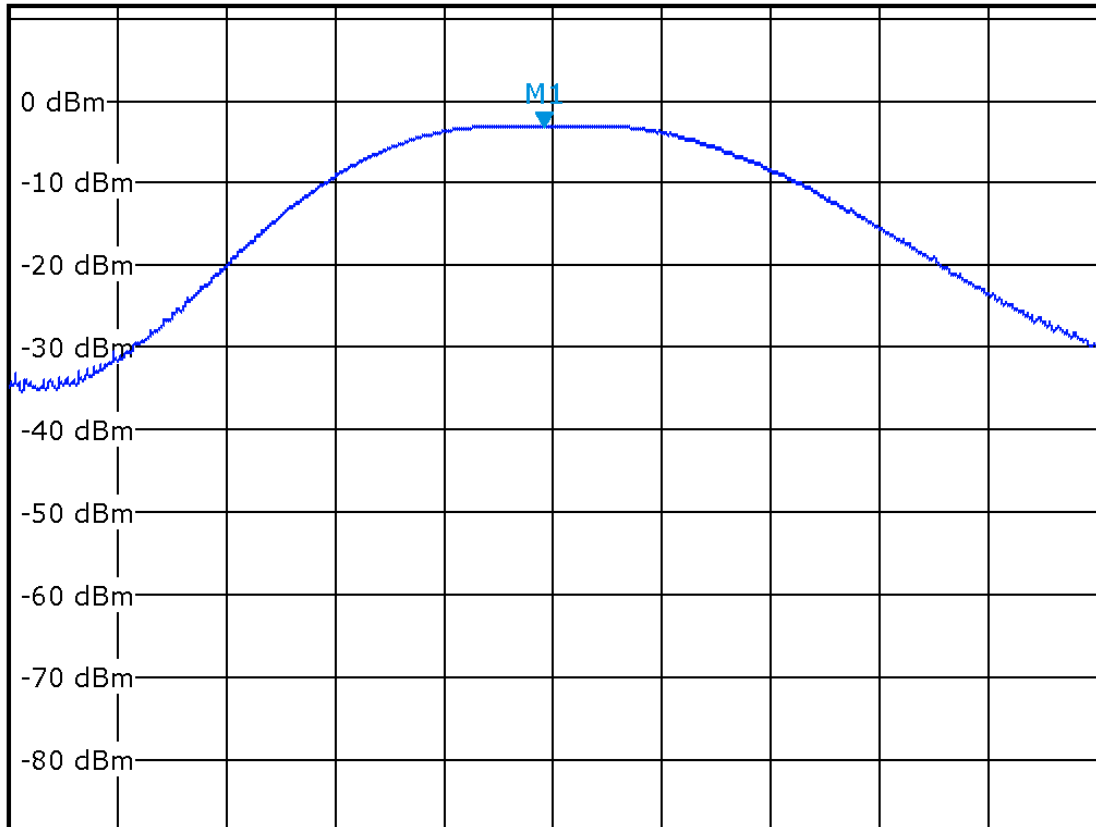
-3.22 dBm

Ref 11.5 dBm

SWT 2.5ms

2.401960000 GHz

1Pk
Max



CF 2.402 GHz

Span 5.0 MHz

Date: 20.MAY.2016 16:03:20

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Peak Power, Mid Channel



Offs 11.5 dB

* RBW 1 MHz

Att 20 dB

VBW 3 MHz

M1[1]

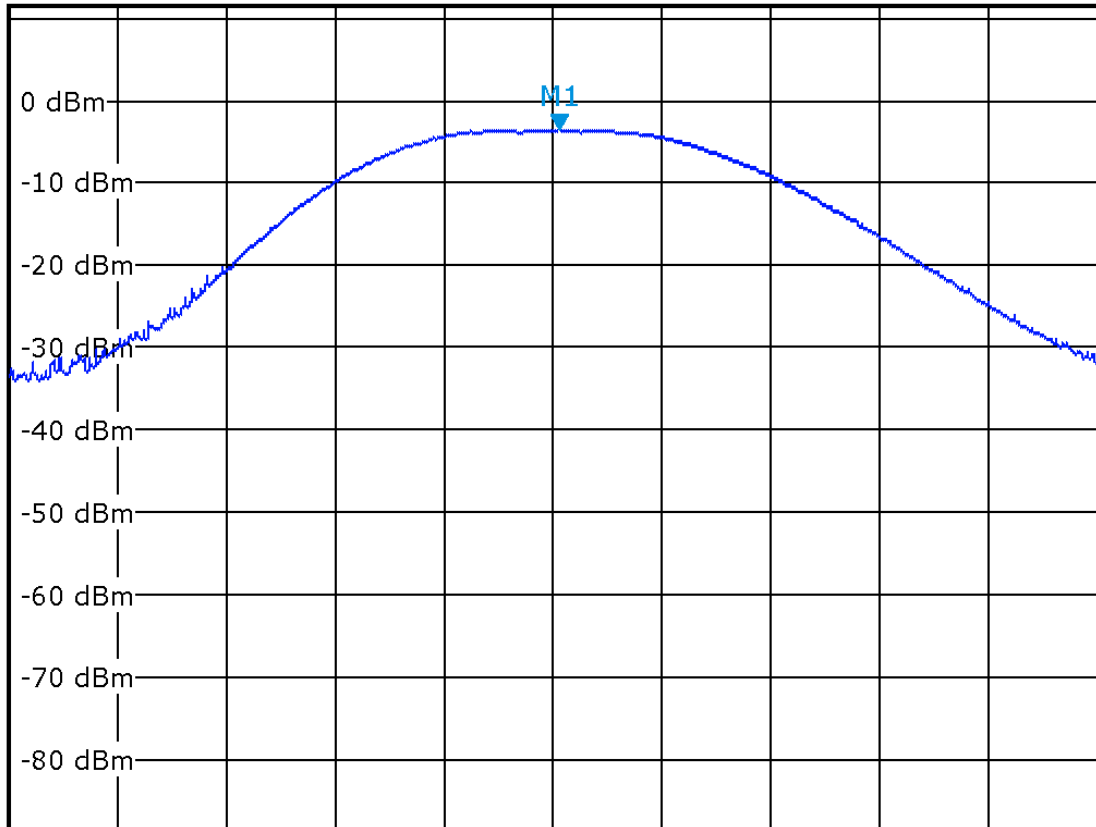
-3.67 dBm

Ref 11.5 dBm

SWT 2.5ms

2.440030000 GHz

1Pk
Max

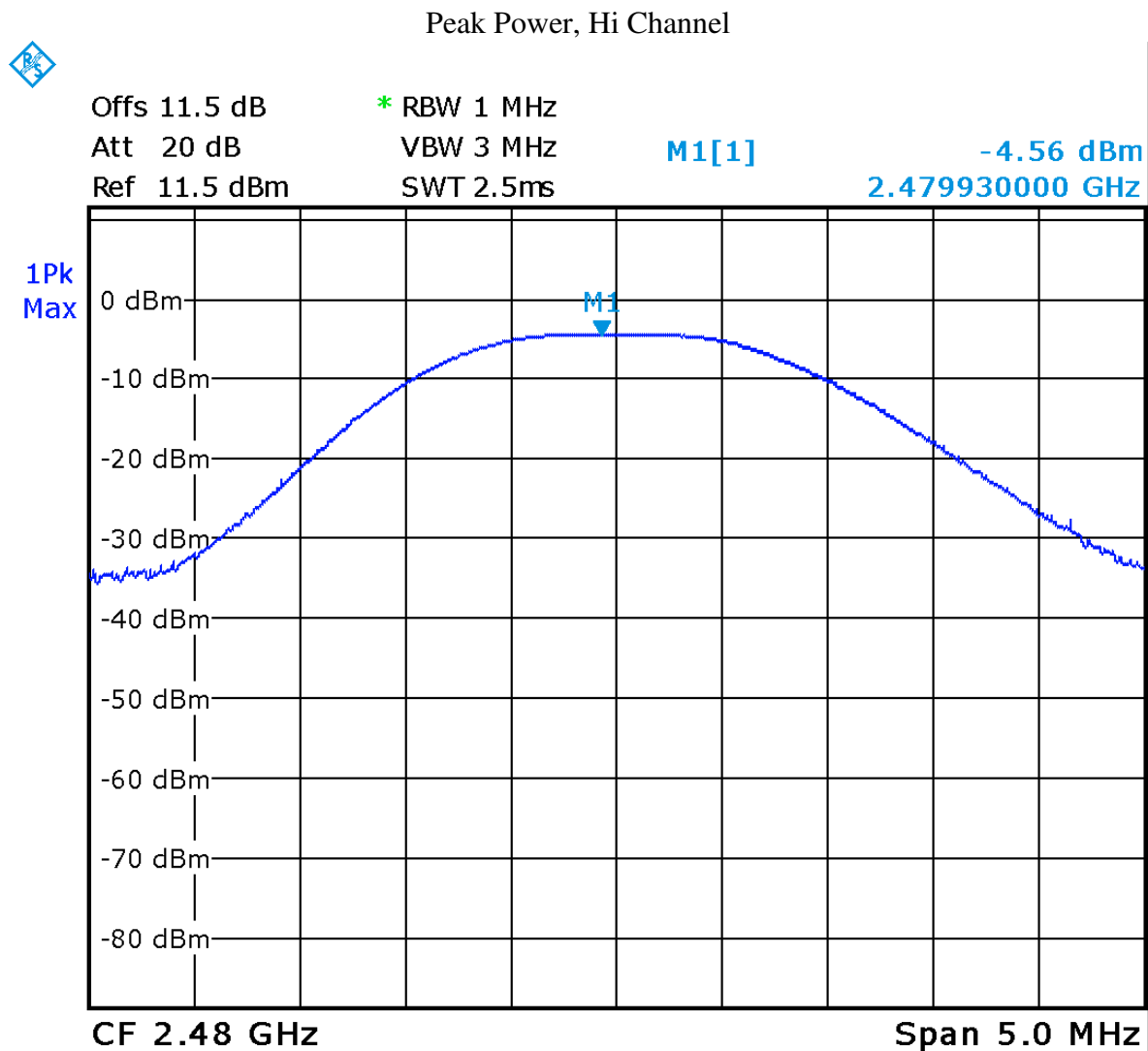


CF 2.44 GHz

Span 5.0 MHz

Date: 20.MAY.2016 15:32:38

Client	Nymi™	
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Date: 20.MAY.2016 15:51:28

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

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Standard(s)	RSS 247 Issue 1:2015 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	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223

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

Client	Nymi™	
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Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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

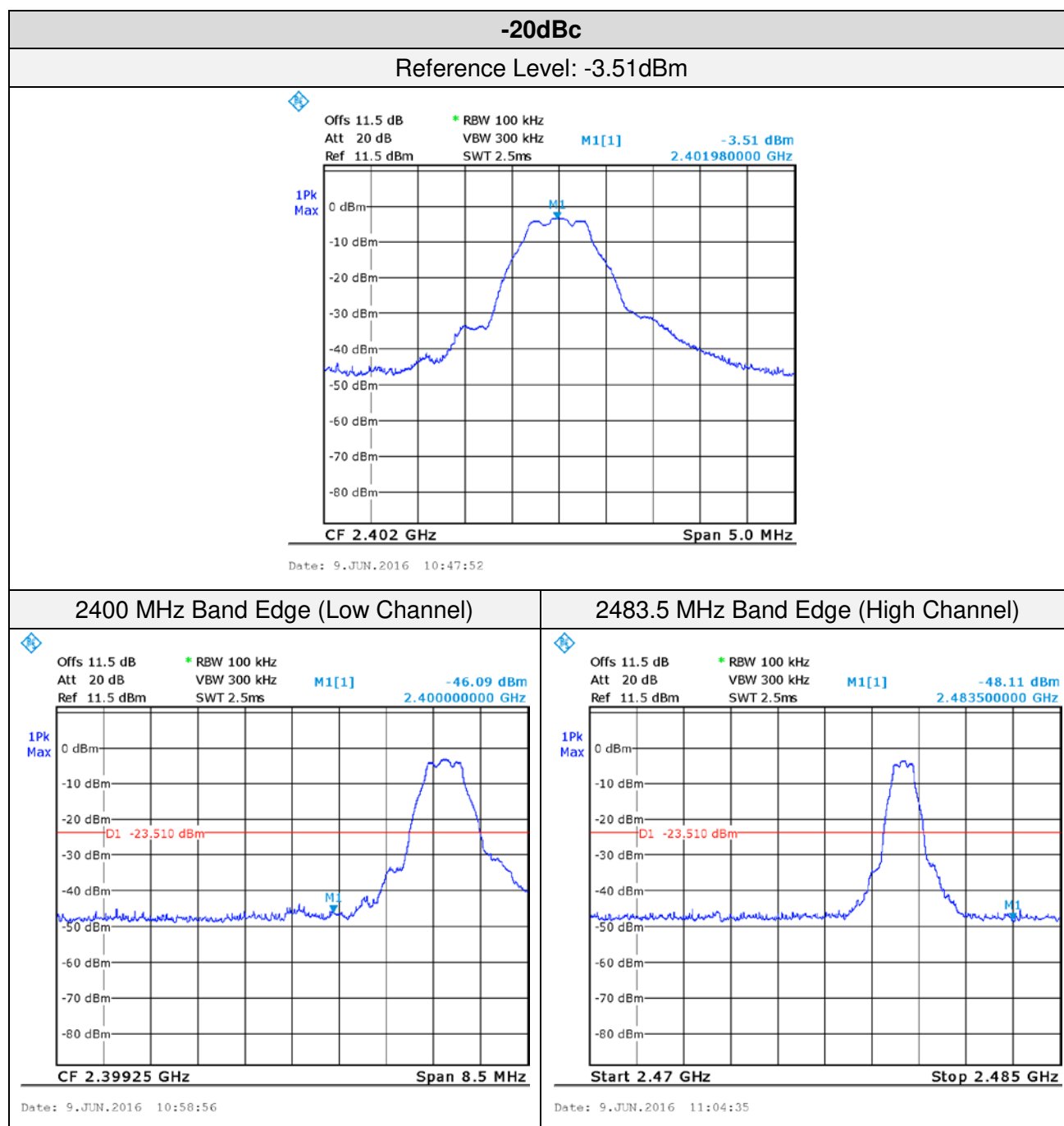
Results

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. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

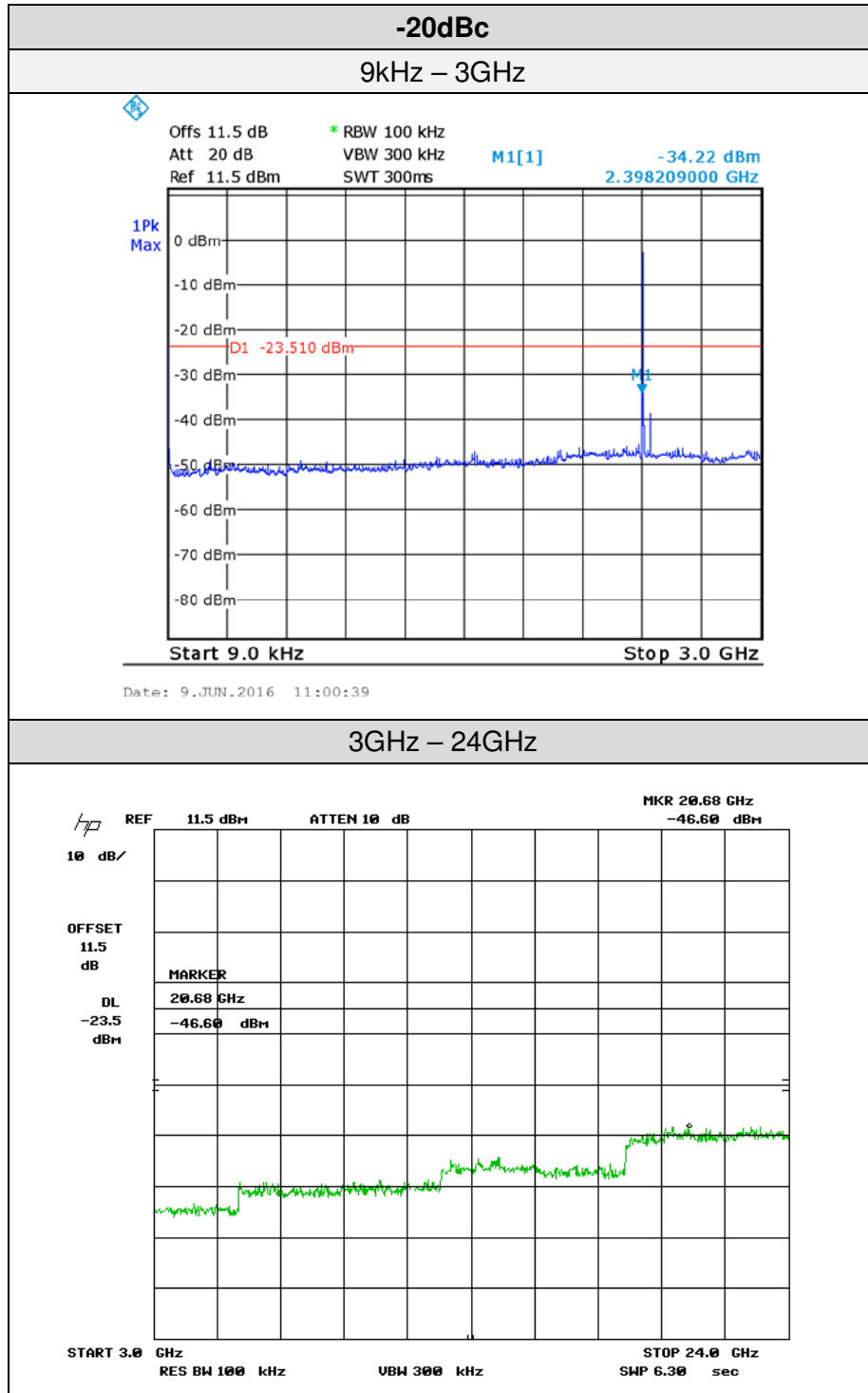
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Graphs

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



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
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
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223

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

Client	Nymi™	
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Standard(s)	RSS 247 Issue 1:2015 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 are as defined in FCC Part 15, Section 15.209:

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

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

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

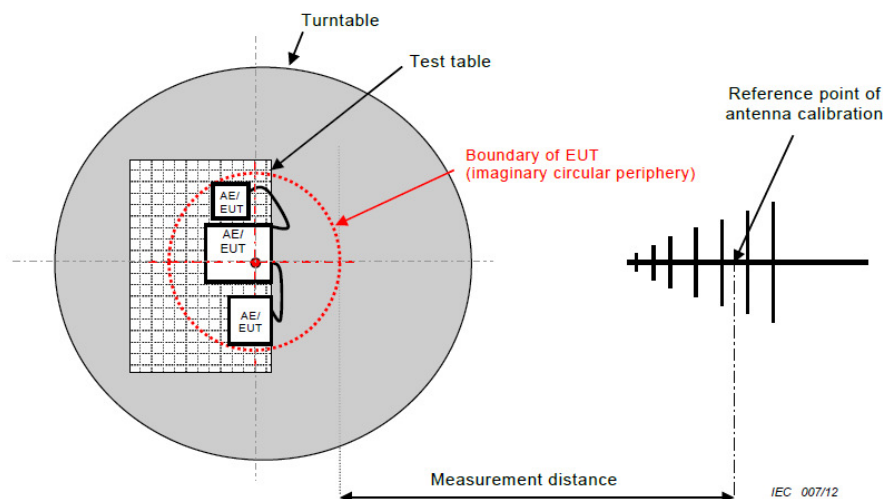
¹Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

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

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

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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.

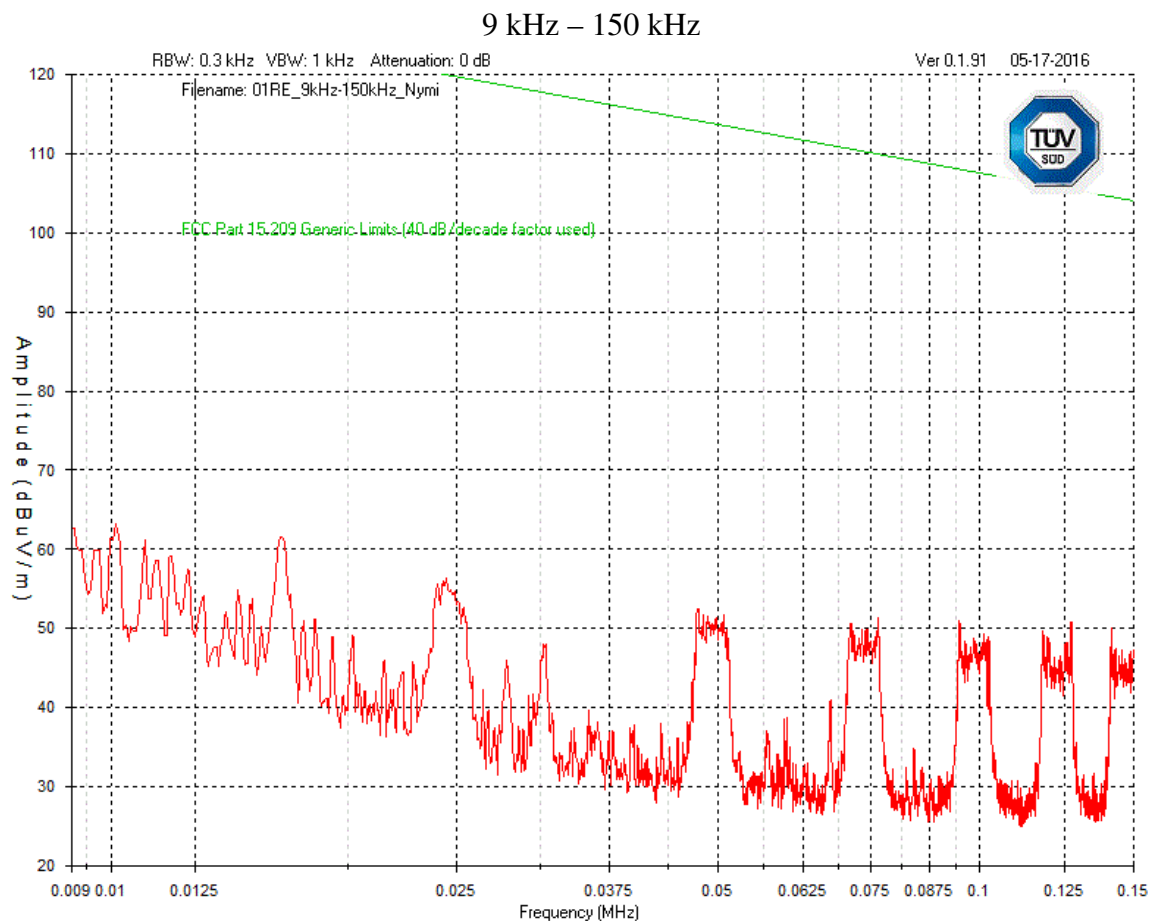
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of a 24.835 GHz).

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.

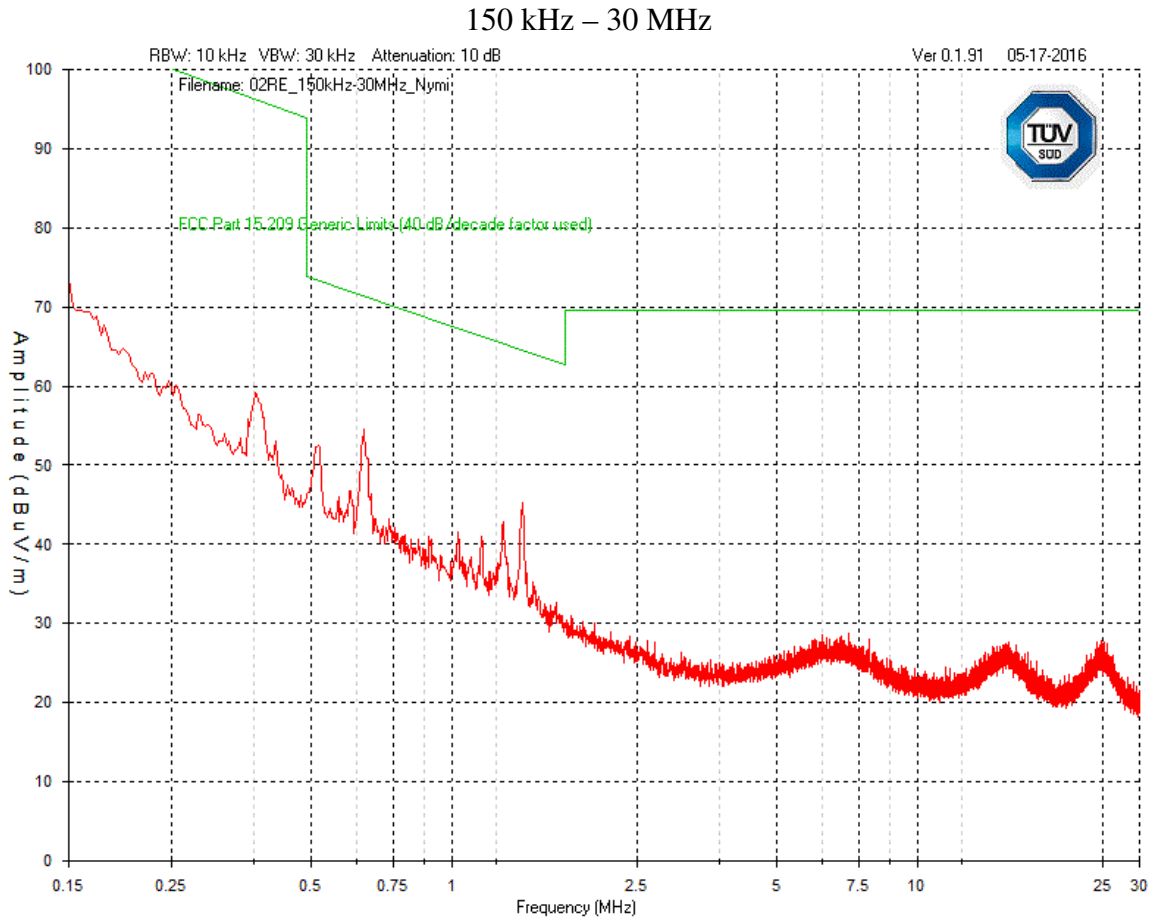
Low, middle and high channels, each in three orthogonal axes were checked. However, the worst case graphs are presented and they are from the X-Axis.

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Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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

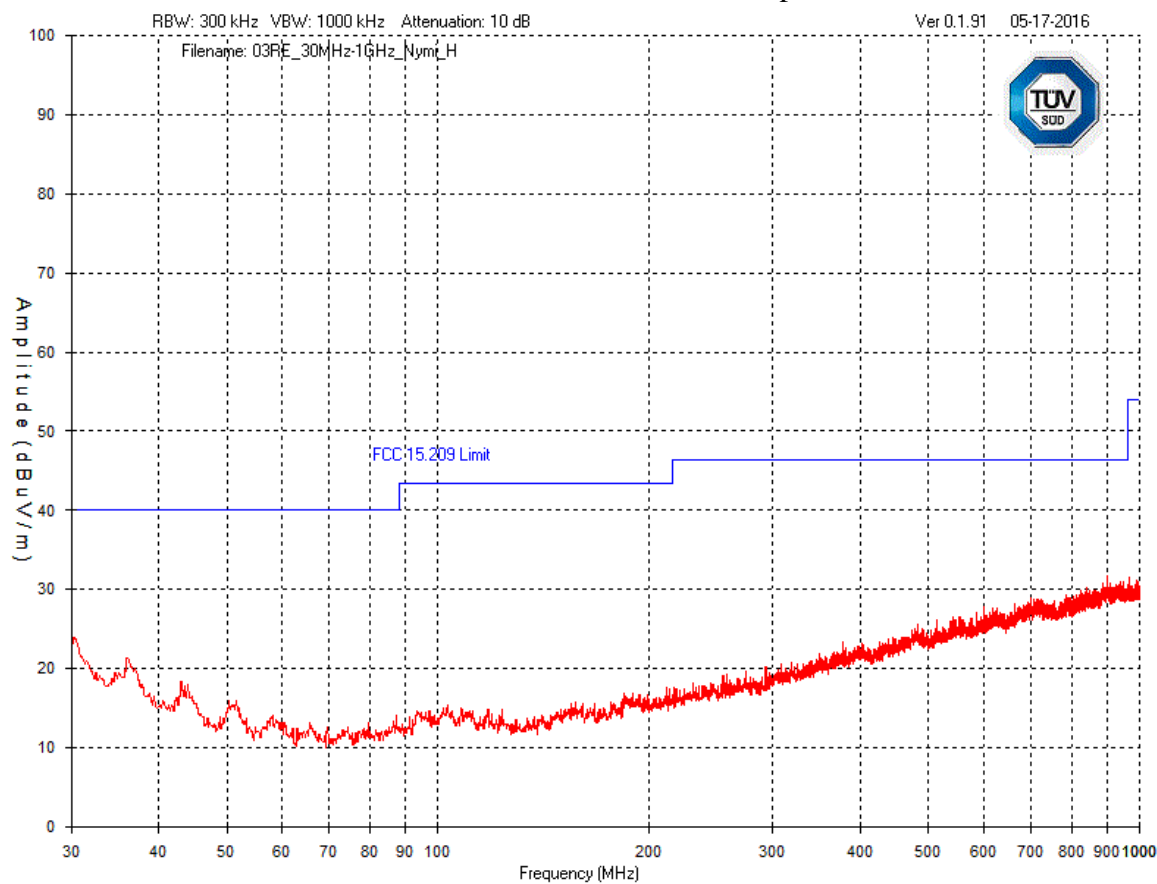


Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	



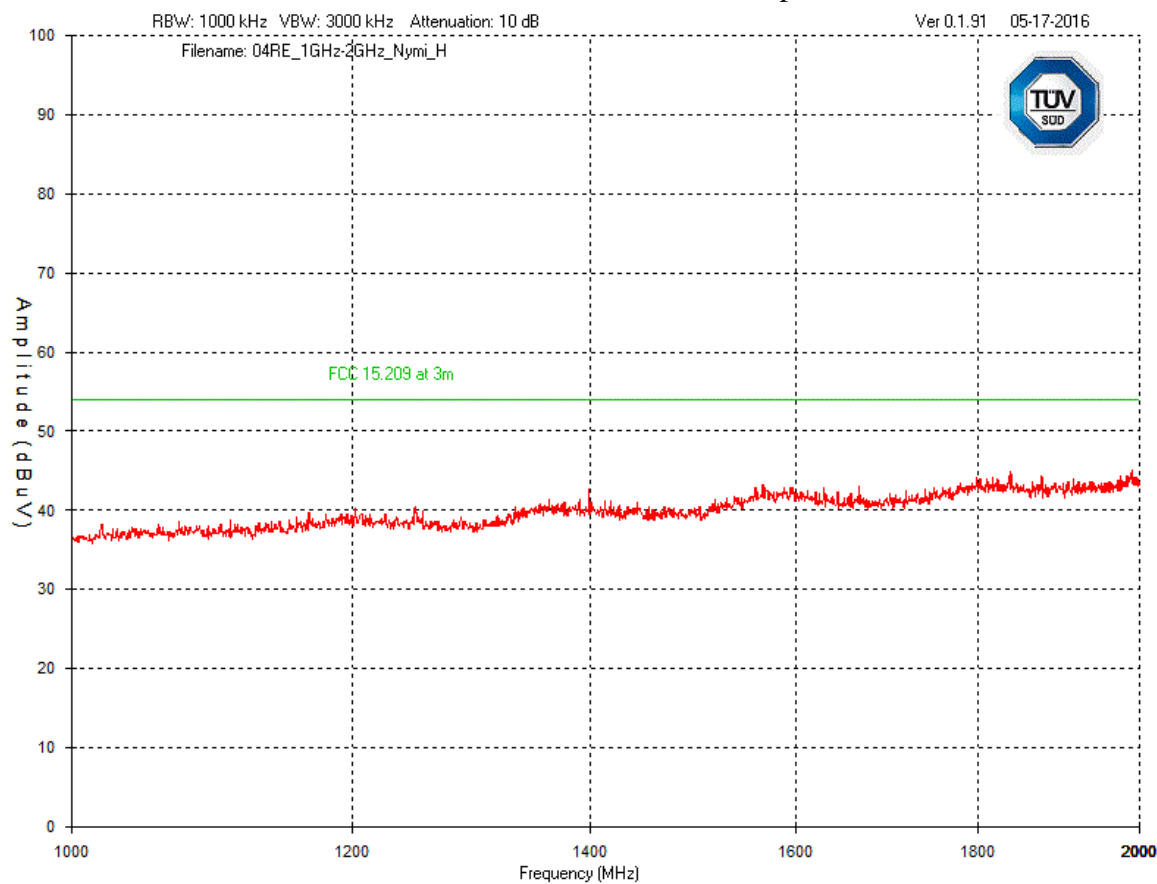
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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



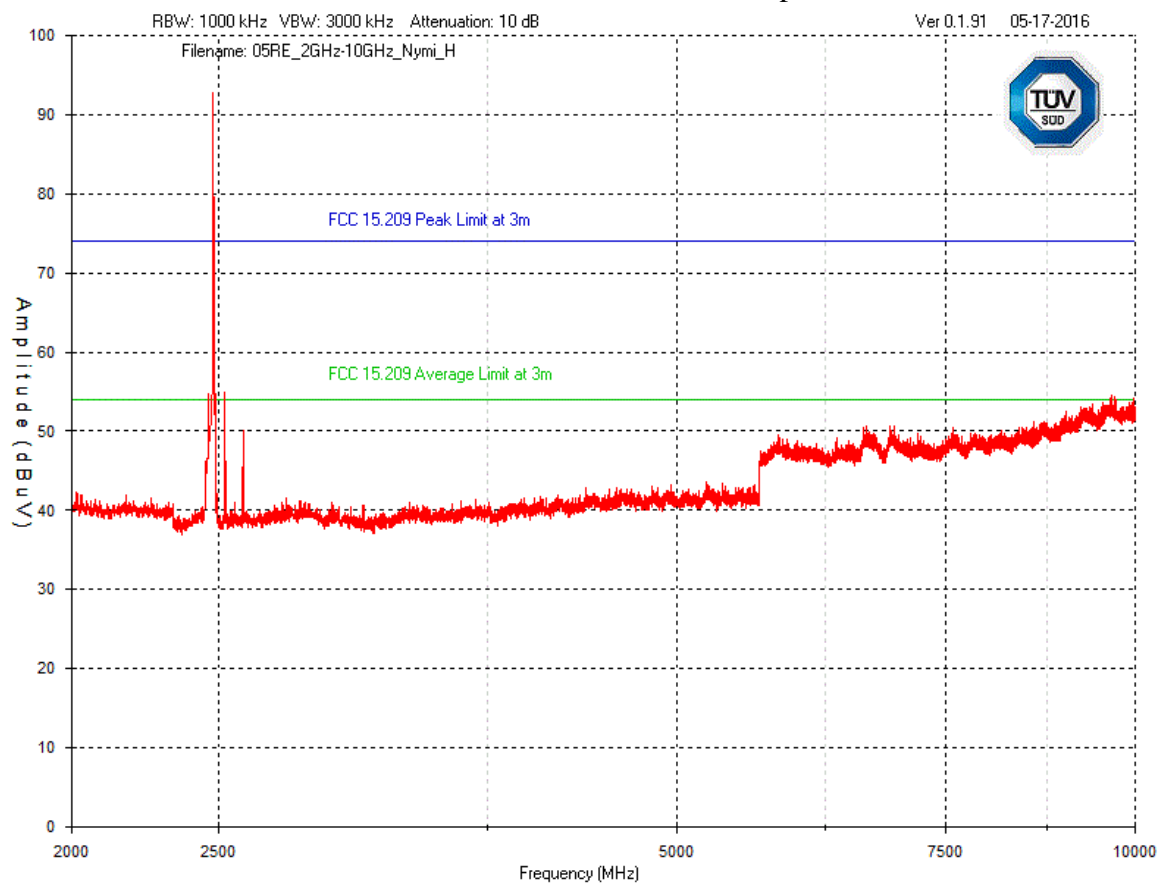
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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



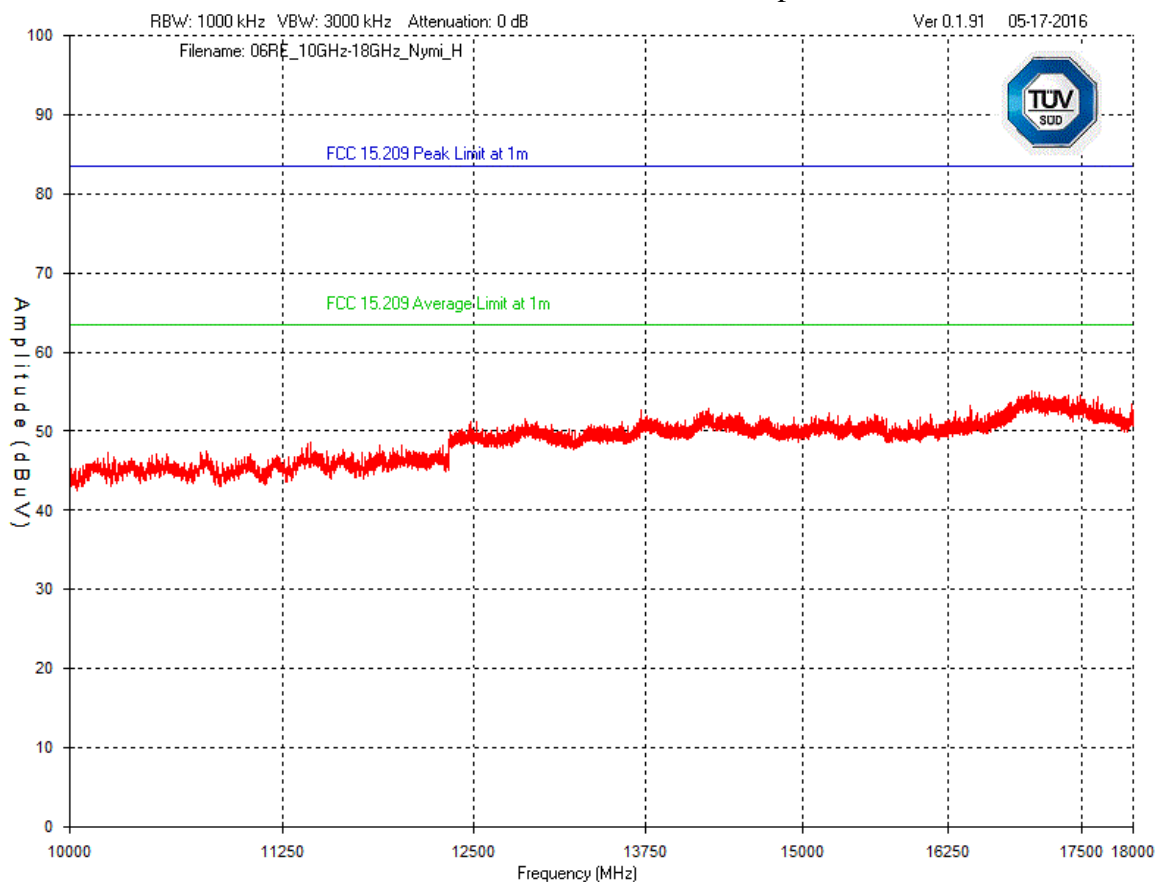
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Hi Channel – 2 GHz – 10 GHz Horizontal - Peak Emission Graph



Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

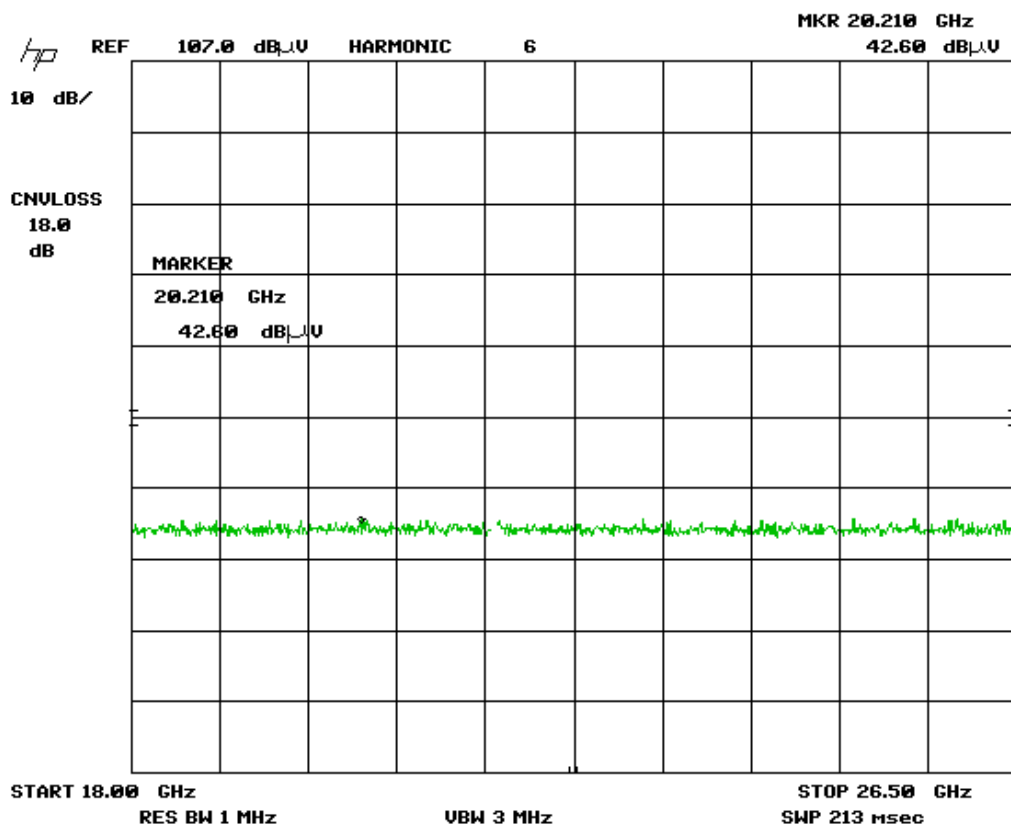
Hi Channel – 10 GHz – 18 GHz Horizontal - Peak Emission Graph



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

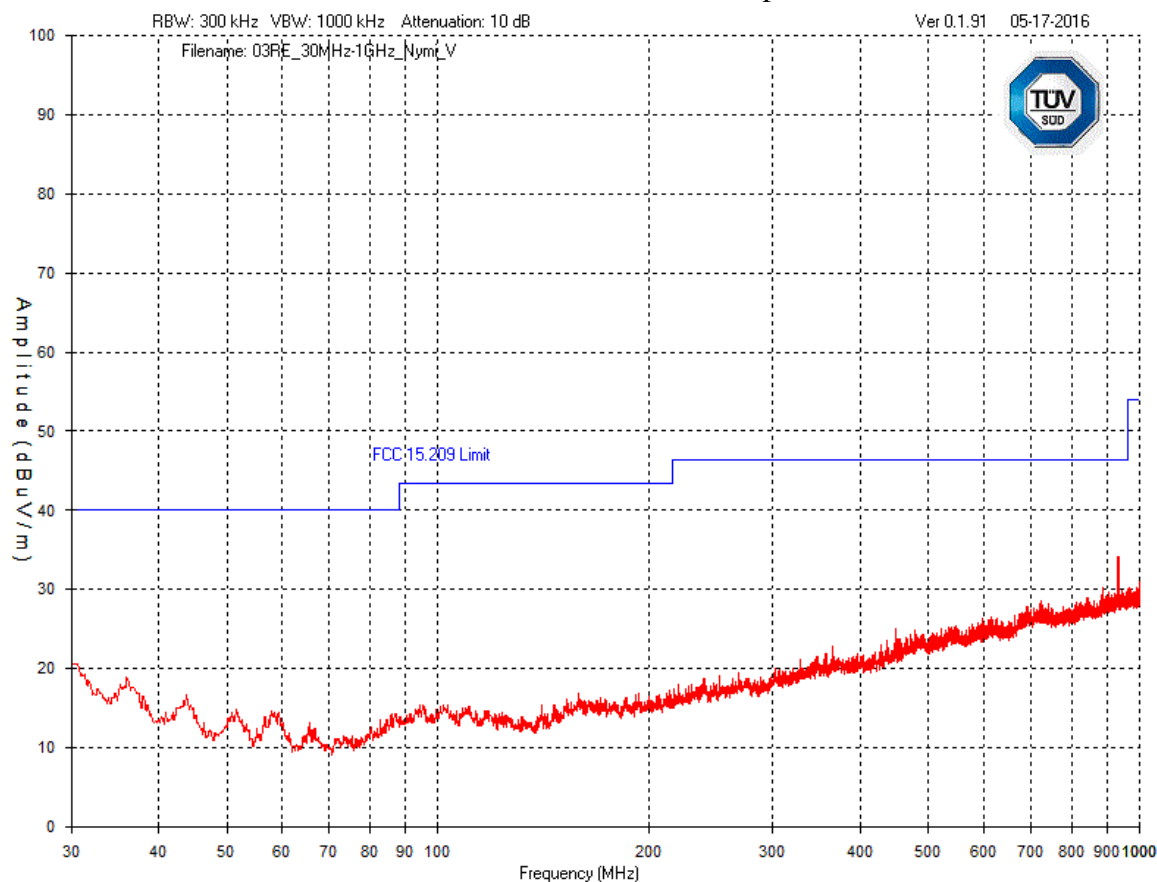
Hi Channel – 18 GHz – 26.5 GHz
Horizontal - Peak Emission Graph



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

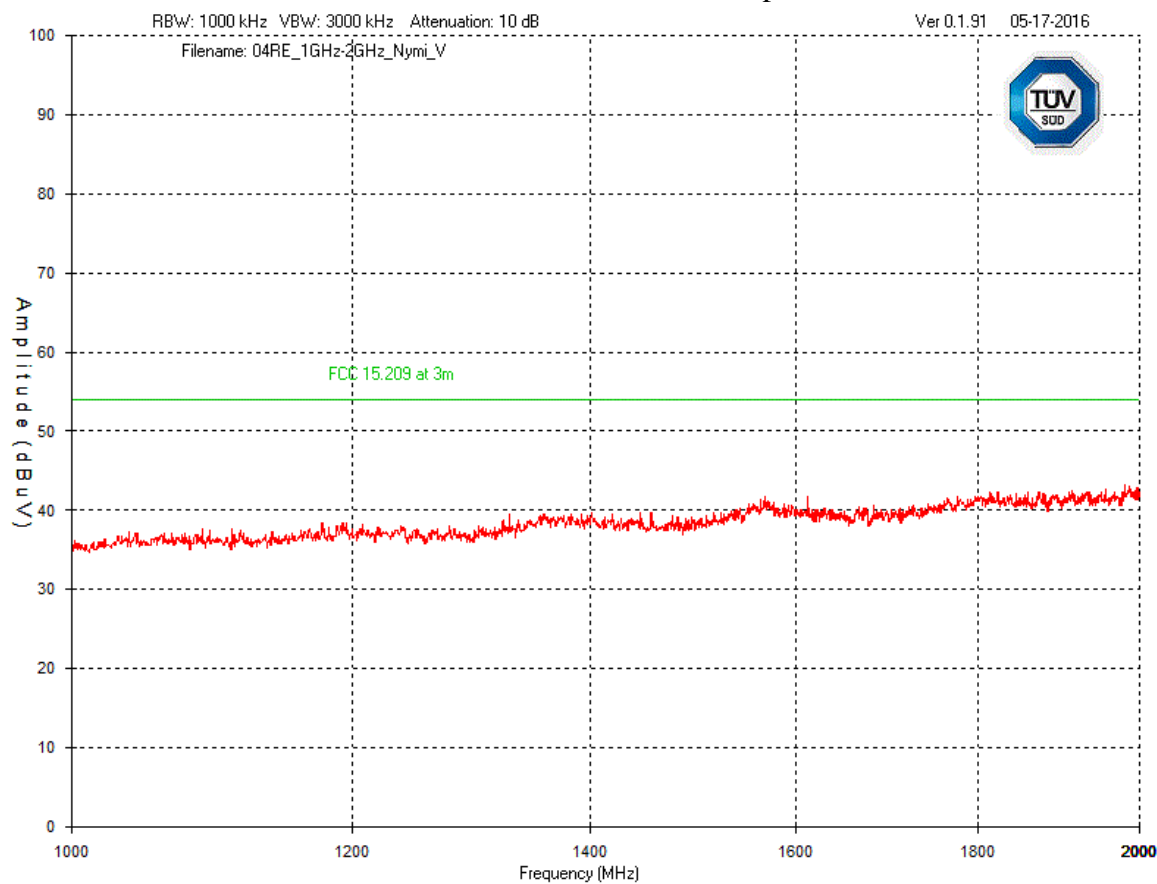
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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



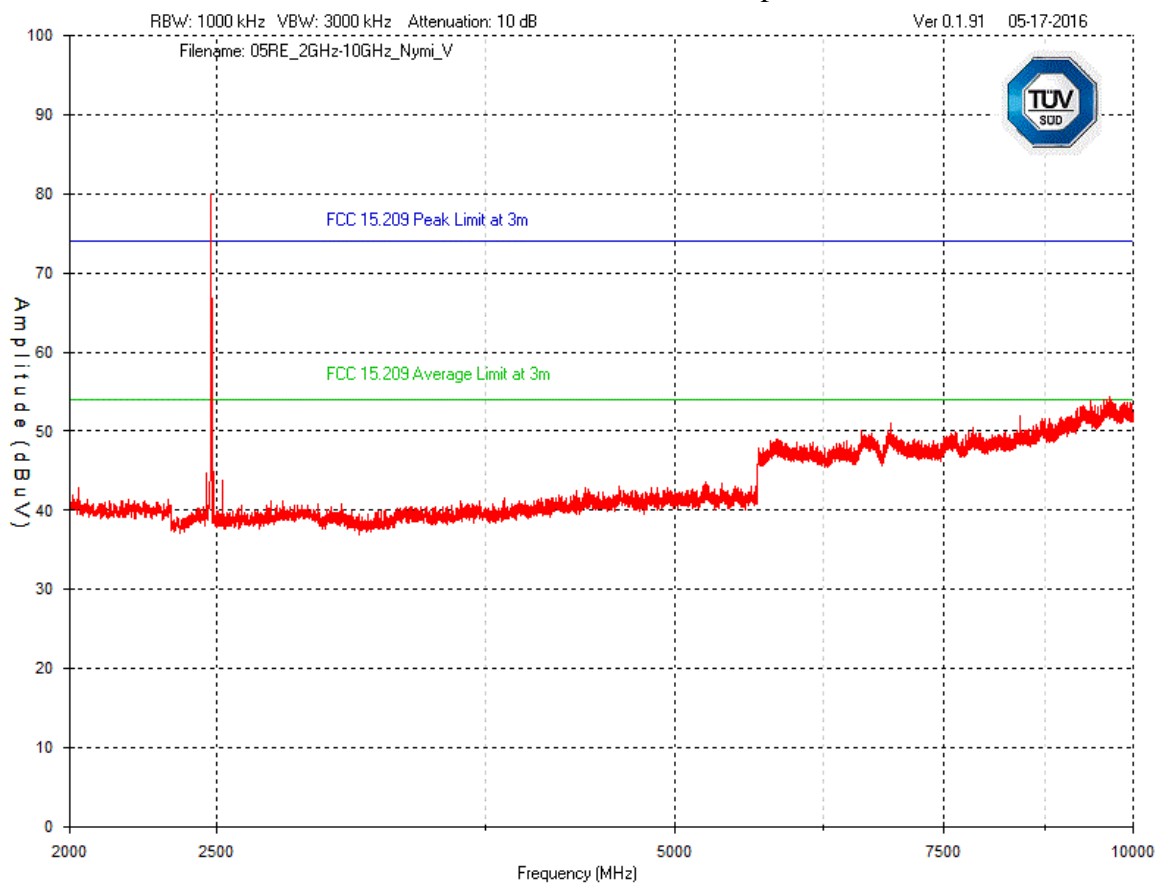
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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



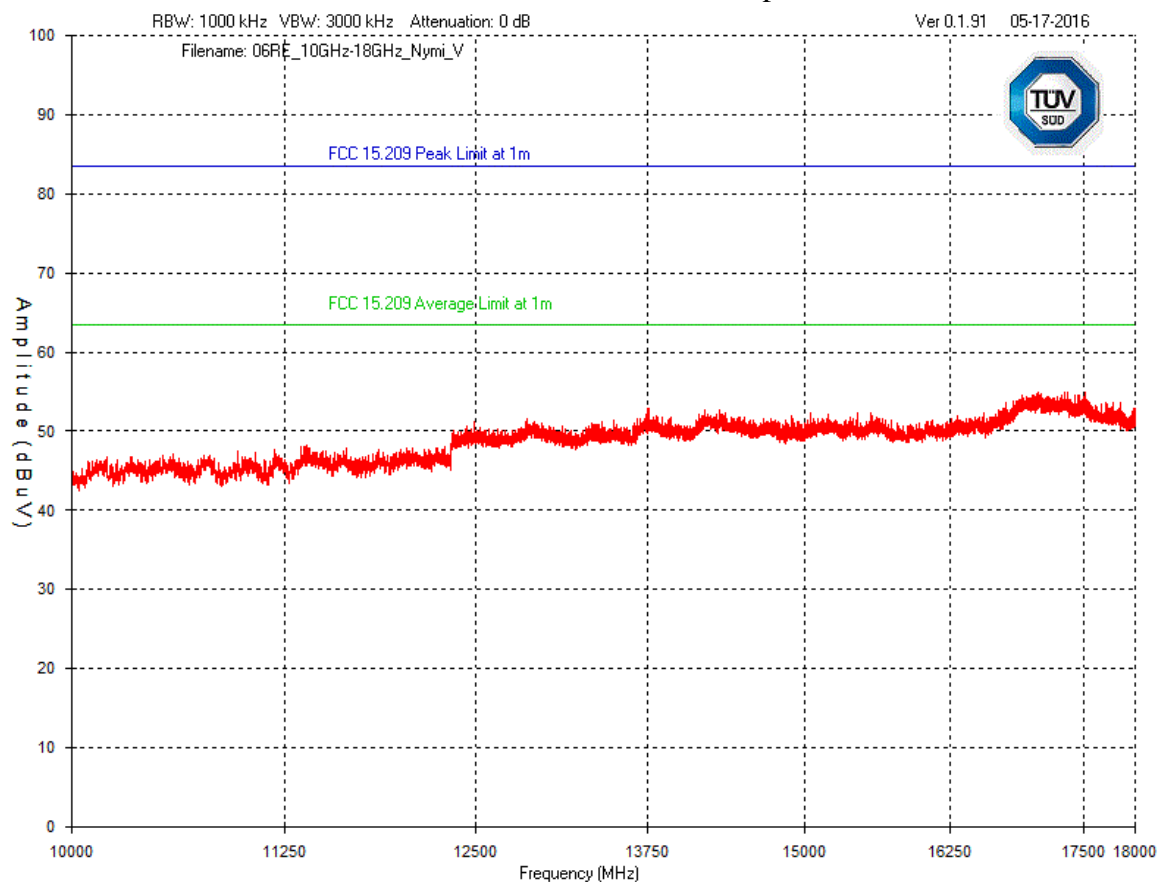
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Hi Channel – 2 GHz – 10 GHz Vertical - Peak Emission Graph



Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

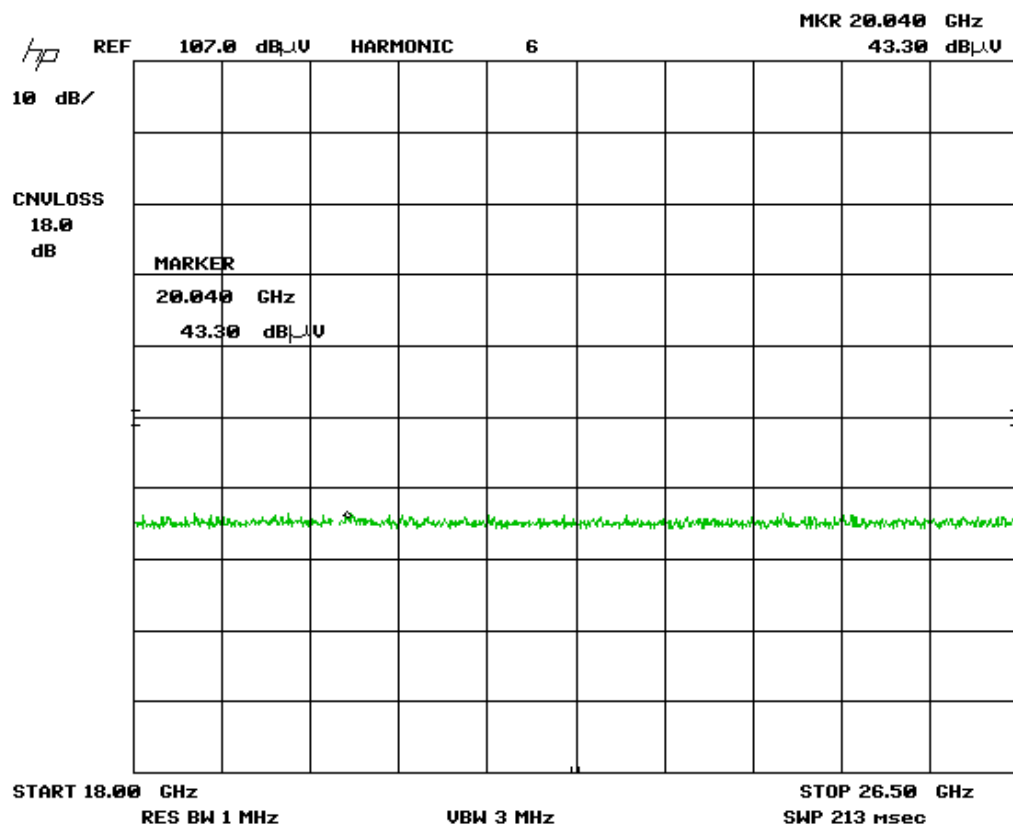
Hi Channel – 10 GHz – 18 GHz Vertical - Peak Emission Graph



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

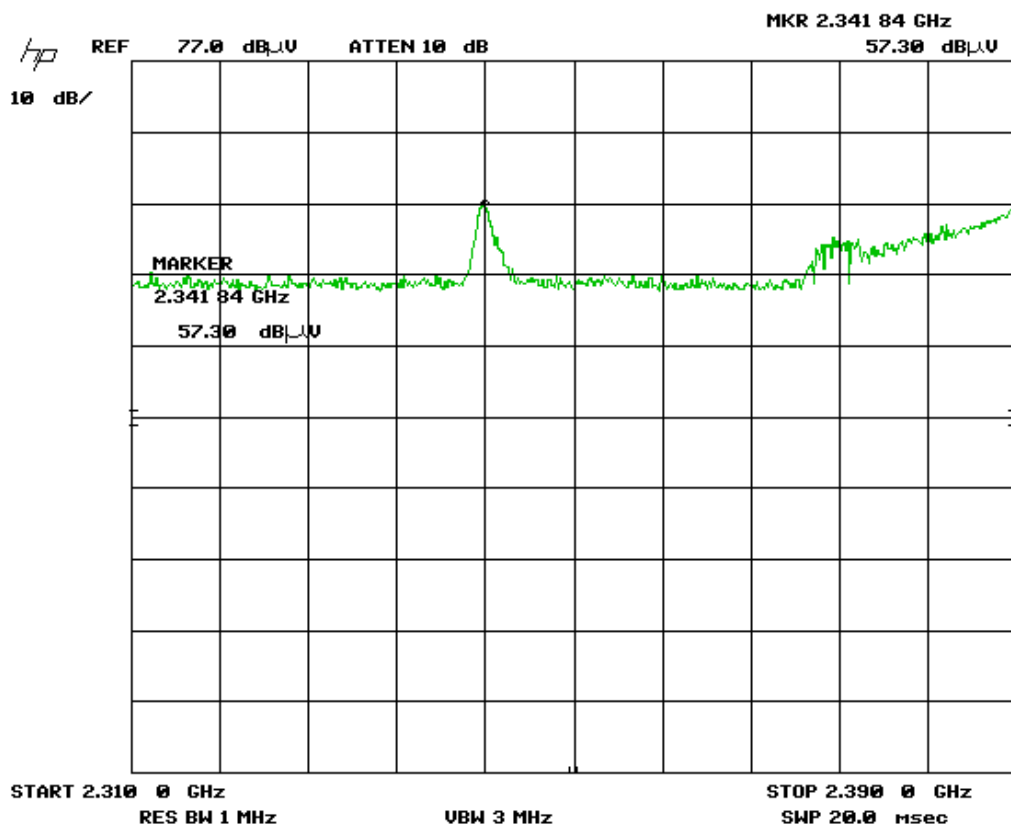
Hi Channel – 18 GHz – 26.5 GHz
Vertical - Peak Emission Graph



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

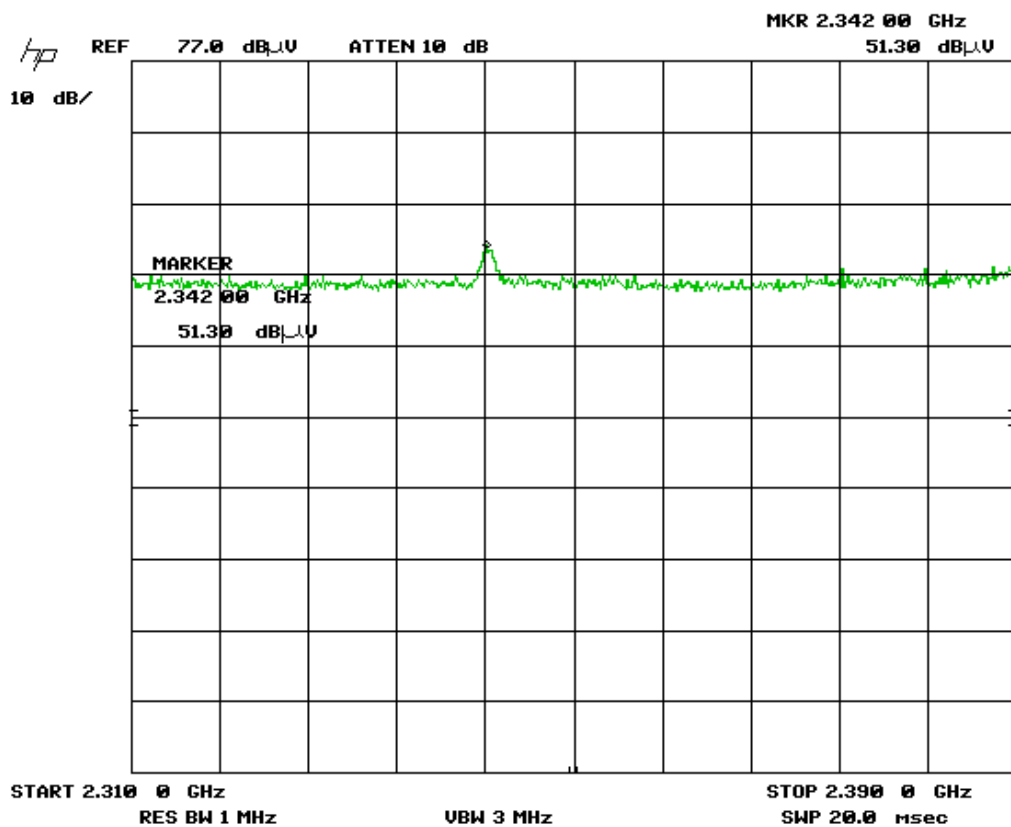
Band Edge – Low Channel
Horizontal - Peak Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

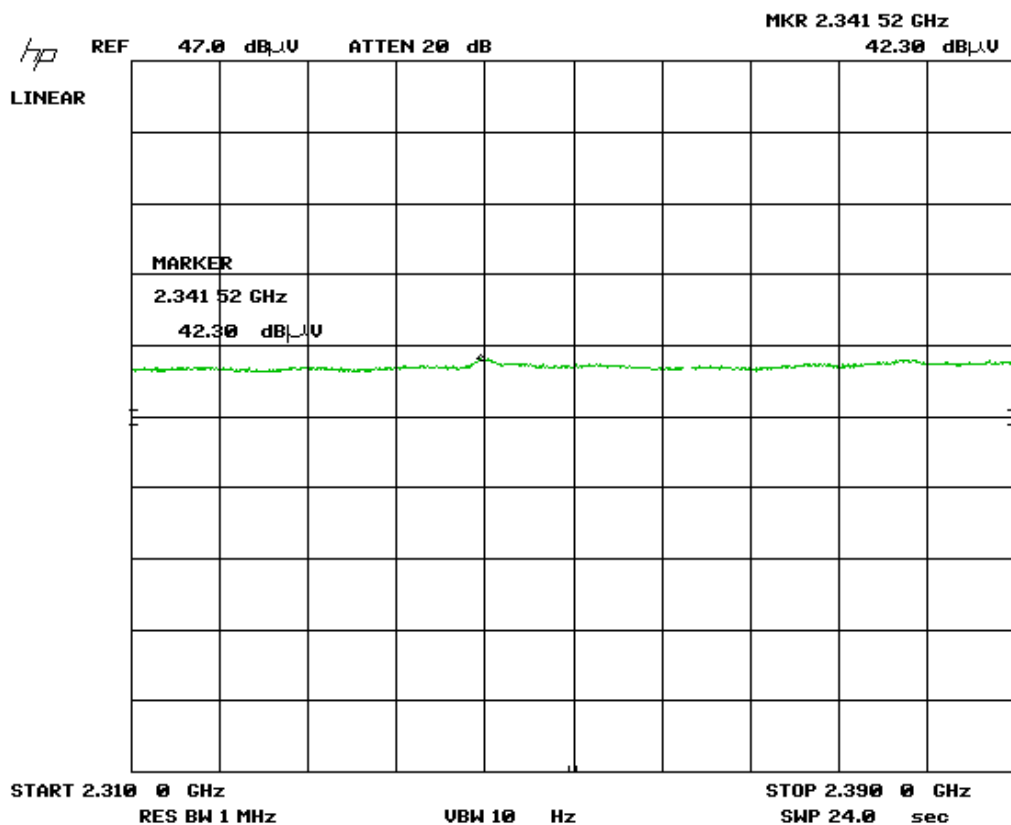
Band Edge – Low Channel
Vertical - Peak Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

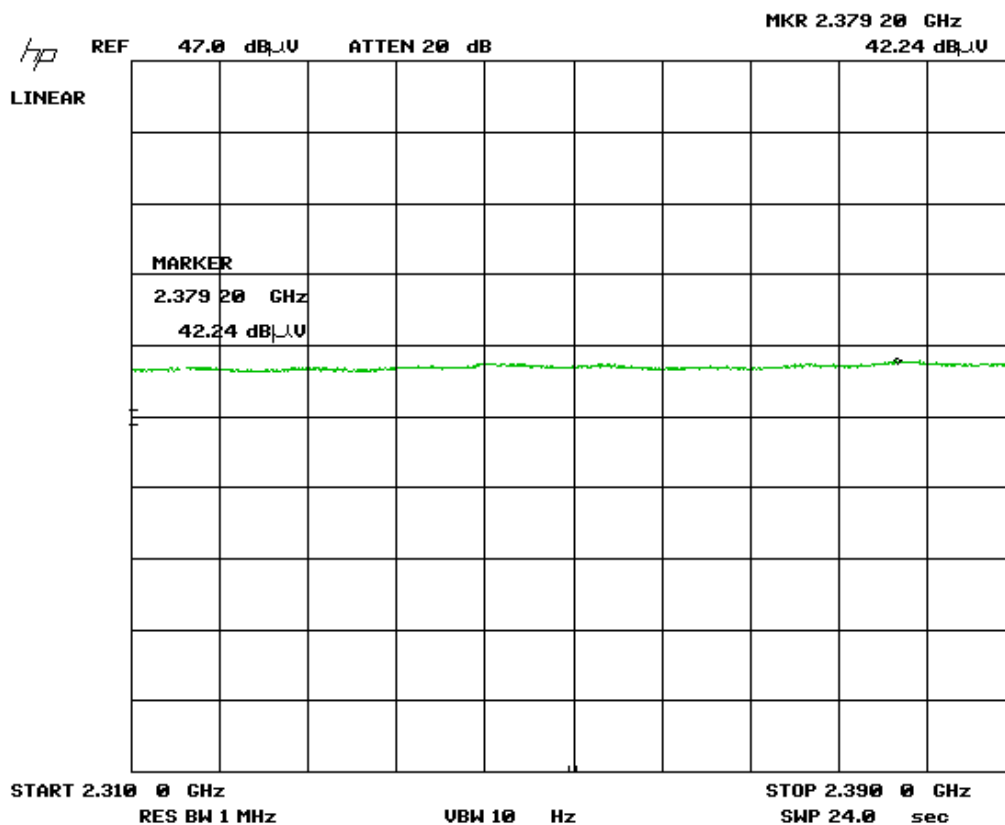
Band Edge – Low Channel
Horizontal - Average Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

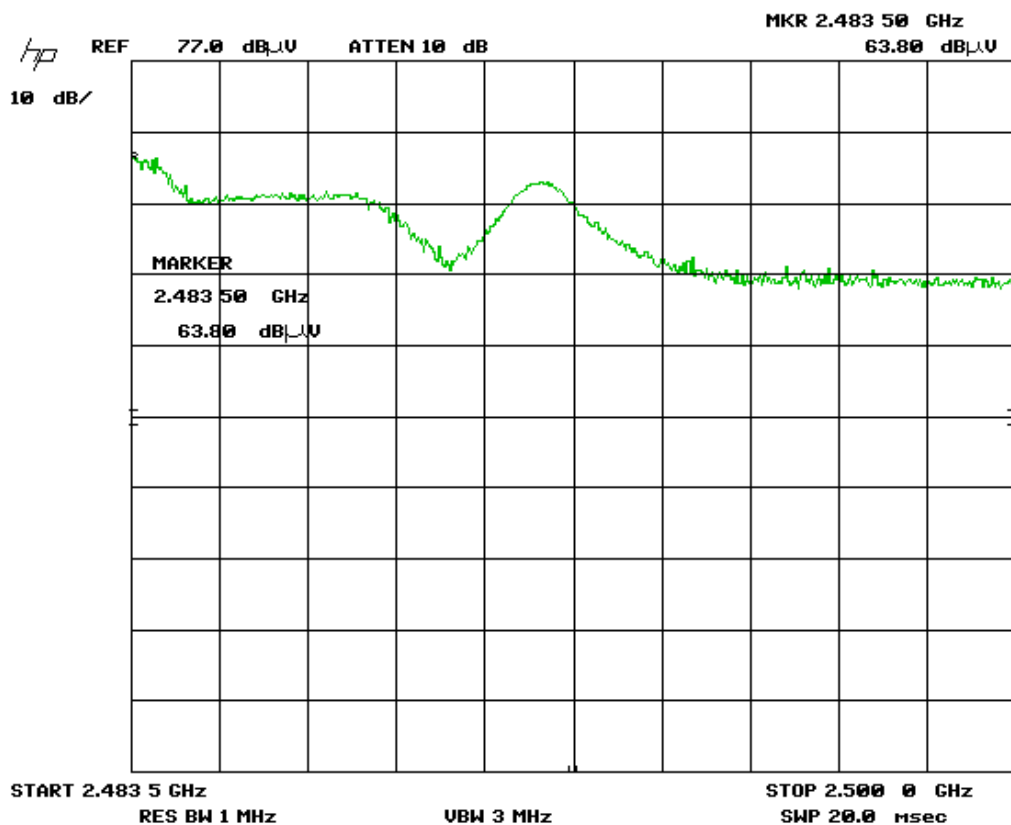
Band Edge – Low Channel
Vertical – Average Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

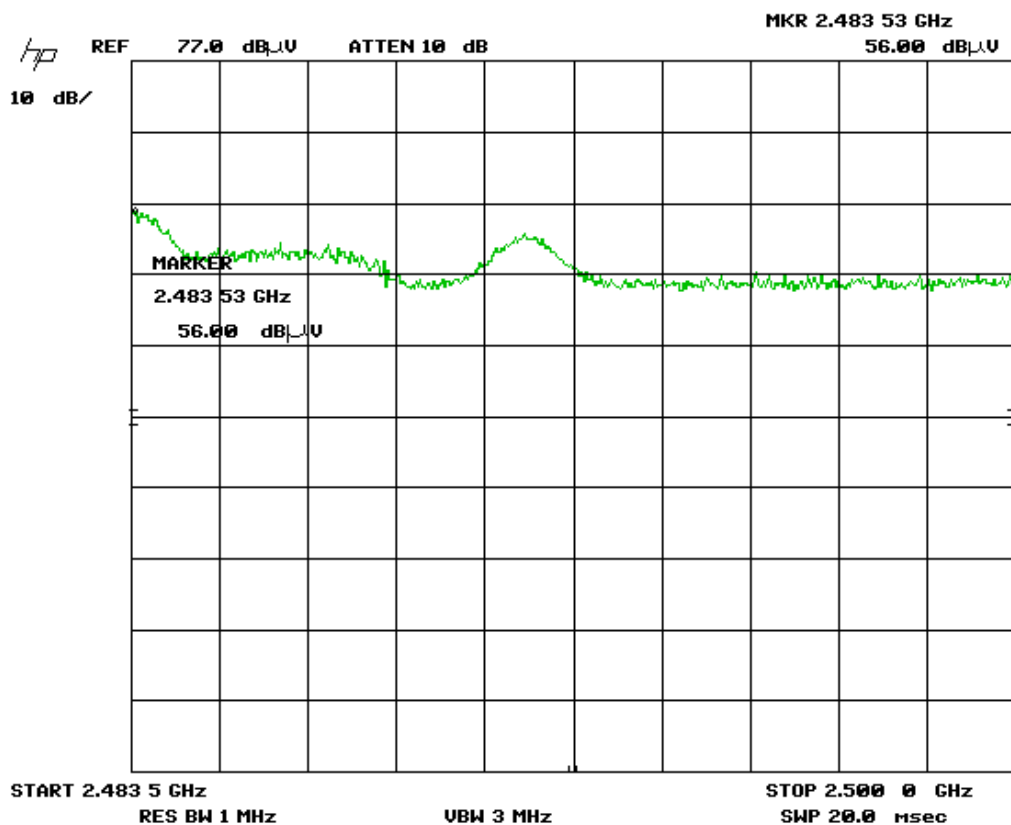
Band Edge – Hi Channel
Horizontal - Peak Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

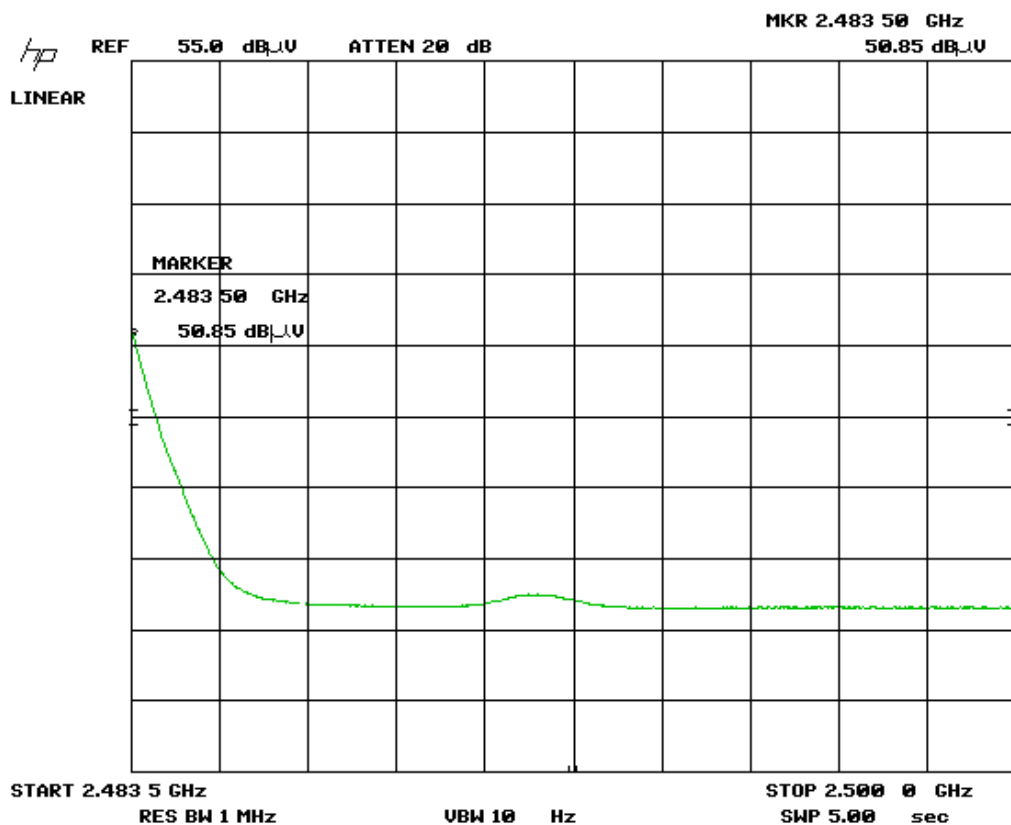
Band Edge – Hi Channel
Vertical - Peak Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

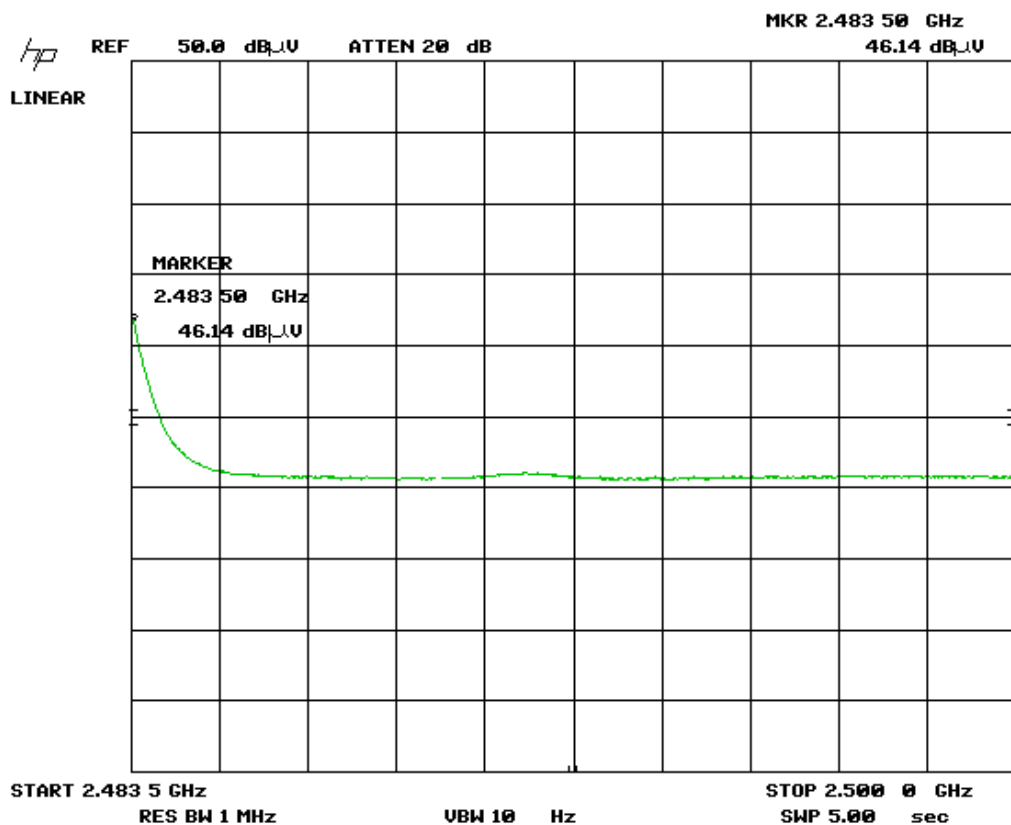
Band Edge – Hi Channel
Horizontal - Average Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Hi Channel
Vertical – Average Emission



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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Final Measurements and Results

The EUT passed. Low, middle, and high bands were measured in three orthogonal axis.

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.

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(μV)	Result
Mid Channel - Z axis											
2440	Peak	Horz	87.9	26.4	4.2	0.0	33.1	85.4			PASS
2440	Avg	Horz	71.9	26.4	4.2	0.0	33.1	69.4			PASS
2440	Peak	Vert	97.3	26.4	4.2	0.0	33.1	94.8			PASS
2440	Avg	Vert	78.8	26.4	4.2	0.0	33.1	76.3			PASS
Mid Channel - X axis											
2440	Peak	Horz	96.3	26.4	4.2	0.0	33.1	93.8			PASS
2440	Avg	Horz	78.3	26.4	4.2	0.0	33.1	75.8			PASS
2440	Peak	Vert	86.3	26.4	4.2	0.0	33.1	83.8			PASS
2440	Avg	Vert	70.6	26.4	4.2	0.0	33.1	68.1			PASS
Mid Channel - Y axis											
2440	Peak	Horz	95.3	26.4	4.2	0.0	33.1	92.8			PASS
2440	Avg	Horz	77.5	26.4	4.2	0.0	33.1	75.0			PASS
2440	Peak	Vert	91.2	26.4	4.2	0.0	33.1	88.7			PASS
2440	Avg	Vert	74.4	26.4	4.2	0.0	33.1	71.9			PASS

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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(μV)	Result
Low Channel - Z axis											
2402	Peak	Horz	87.1	26.4	4.2	0.0	33.5	84.2			PASS
2402	Avg	Horz	71.0	26.4	4.2	0.0	33.5	68.1			PASS
2402	Peak	Vert	95.3	26.4	4.2	0.0	33.5	92.4			PASS
2402	Avg	Vert	77.3	26.4	4.2	0.0	33.5	74.4			PASS
2342.16	Peak	Horz	51.4	26.4	4.2	0.0	33.5	48.5	74.0	25.5	PASS
2342.3	Avg	Horz	42.2	26.4	4.2	0.0	33.5	39.3	54.0	14.7	PASS
2342.3	Peak	Vert	56.6	26.4	4.2	0.0	33.5	53.7	74.0	20.3	PASS
2342.16	Avg	Vert	42.3	26.4	4.2	0.0	33.5	39.4	54.0	14.6	PASS
Low Channel - X axis											
2402	Peak	Horz	95.6	26.4	4.2	0.0	33.5	92.7			PASS
2402	Avg	Horz	77.4	26.4	4.2	0.0	33.5	74.5			PASS
2402	Peak	Vert	84.7	26.4	4.2	0.0	33.5	81.8			PASS
2402	Avg	Vert	69.3	26.4	4.2	0.0	33.5	66.4			PASS
2341.8	Peak	Horz	57.3	26.4	4.2	0.0	33.5	54.4	74.0	19.6	PASS
2341.5	Avg	Horz	42.3	26.4	4.2	0.0	33.5	39.4	54.0	14.6	PASS
2342	Peak	Vert	51.3	26.4	4.2	0.0	33.5	48.4	74.0	25.6	PASS
2379.2	Avg	Vert	42.2	26.4	4.2	0.0	33.5	39.3	54.0	14.7	PASS
Low Channel - Y axis											
2402	Peak	Horz	93.7	26.4	4.2	0.0	33.5	90.8			PASS
2402	Avg	Horz	76.1	26.4	4.2	0.0	33.5	73.2			PASS
2402	Peak	Vert	90.9	26.4	4.2	0.0	33.5	88.0			PASS
2402	Avg	Vert	74.0	26.4	4.2	0.0	33.5	71.1			PASS
2342.16	Peak	Horz	56.1	26.4	4.2	0.0	33.5	53.2	74.0	20.8	PASS
2342.16	Avg	Horz	42.3	26.4	4.2	0.0	33.5	39.4	54.0	14.6	PASS
2342	Peak	Vert	52.1	26.4	4.2	0.0	33.5	49.2	74.0	24.8	PASS
2342.2	Avg	Vert	42.2	26.4	4.2	0.0	33.5	39.3	54.0	14.7	PASS

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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(μV)	Result
High Channel - Z axis											
2480	Peak	Horz	90.4	26.4	4.3	0.0	33.8	87.3			PASS
2480	Avg	Horz	73.8	26.4	4.3	0.0	33.8	70.7			PASS
2480	Peak	Vert	95.4	26.4	4.3	0.0	33.8	92.3			PASS
2480	Avg	Vert	77.7	26.4	4.3	0.0	33.8	74.6			PASS
2483.5	Peak	Horz	59.6	26.4	4.3	0.0	33.8	56.5	74.0	17.5	PASS
2483.5	Avg	Horz	47.0	26.4	4.3	0.0	33.8	43.9	54.0	10.1	PASS
2483.5	Peak	Vert	62.3	26.4	4.3	0.0	33.8	59.2	74.0	14.8	PASS
2483.5	Avg	Vert	50.7	26.4	4.3	0.0	33.8	47.6	54.0	6.4	PASS
High Channel - X axis											
2480	Peak	Horz	97.2	26.4	4.3	0.0	33.3	94.6			PASS
2480	Avg	Horz	79.0	26.4	4.3	0.0	33.3	76.4			PASS
2480	Peak	Vert	86.2	26.4	4.3	0.0	33.3	83.6			PASS
2480	Avg	Vert	70.6	26.4	4.3	0.0	33.3	68.0			PASS
2483.5	Peak	Horz	63.8	26.4	4.3	0.0	33.3	61.2	74.0	12.8	PASS
2483.5	Avg	Horz	50.9	26.4	4.3	0.0	33.3	48.3	54.0	5.8	PASS
2483.5	Peak	Vert	56.0	26.4	4.3	0.0	33.3	53.4	74.0	20.6	PASS
2483.5	Avg	Vert	46.1	26.4	4.3	0.0	33.3	43.5	54.0	10.5	PASS
4960	Peak	Horz	51.0	28.1	5.9	0.0	32.1	52.9	74.0	21.1	PASS
4960	Avg	Horz	39.4	28.1	5.9	0.0	32.1	41.3	54.0	12.7	PASS
4960	Peak	Vert	51.2	28.1	5.9	0.0	32.1	53.1	74.0	20.9	PASS
4960	Avg	Vert	39.3	28.1	5.9	0.0	32.1	41.2	54.0	12.8	PASS
7440	Peak	Horz	58.0	29.2	7.3	0.0	32.3	62.2	74.0	11.8	PASS
7440	Avg	Horz	46.2	29.2	7.3	0.0	32.3	50.4	54.0	3.6	PASS
7440	Peak	Vert	58.9	29.2	7.3	0.0	32.3	63.1	74.0	10.9	PASS
7440	Avg	Vert	46.2	29.2	7.3	0.0	32.3	50.4	54.0	3.6	PASS
High Channel - Y axis											
2480	Peak	Horz	94.6	26.4	4.3	0.0	33.3	92.0			PASS
2480	Avg	Horz	77.0	26.4	4.3	0.0	33.3	74.4			PASS
2480	Peak	Vert	92.7	26.4	4.3	0.0	33.3	90.1			PASS
2480	Avg	Vert	75.6	26.4	4.3	0.0	33.3	73.0			PASS
2483.5	Peak	Horz	62.0	26.4	4.3	0.0	33.3	59.4	74.0	14.6	PASS
2483.5	Avg	Horz	50.4	26.4	4.3	0.0	33.3	47.8	54.0	6.2	PASS
2483.5	Peak	Vert	59.8	26.4	4.3	0.0	33.3	57.2	74.0	16.8	PASS
2483.5	Avg	Vert	47.0	26.4	4.3	0.0	33.3	44.4	54.0	9.6	PASS

Frequency (MHz)	Detector Peak/AVG	Received Signal (dBμV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	AVG Limit (dBμV/m)	AVG Margin (dB)	Pass / Fail
Horizontal Antenna Polarization									
2524.61	AVG	31.4	26.2	4.2	-33.8	28.0	54.0	26.0	Pass
9639.00	AVG	35.8	31.3	9.3	-34.5	41.9	54.0	12.1	Pass
2596.00	AVG	31.0	26.5	4.2	-33.8	27.9	54.0	26.1	Pass
Vertical Antenna Polarization									
9656.33	AVG	35.8	31.3	9.3	-34.5	41.9	54.0	12.1	Pass
9600.00	AVG	35.9	31.3	9.2	-34.5	41.9	54.0	12.1	Pass

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi-Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb 12, 2016	Feb 12, 2018	GEMC 6375
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 189
Horn Antenna 18 - 26.5 GHz	SAS-572	A.H. Systems	Sept 09, 2014	Sept 09, 2016	GEMC 6371
Harmonic Mixer 18 - 26.5 GHz	11970K	HP	Feb 8, 2016	Feb 8, 2018	GEMC 158
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Sept 8, 2014	Sept 8, 2016	GEMC 8
4GHZ-12GHz High Pass Filter	11SH10-4000/T12000-0/0	K & L Microwave	Apr 9, 2016	Apr 9, 2017	GEMC 119
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-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"

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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

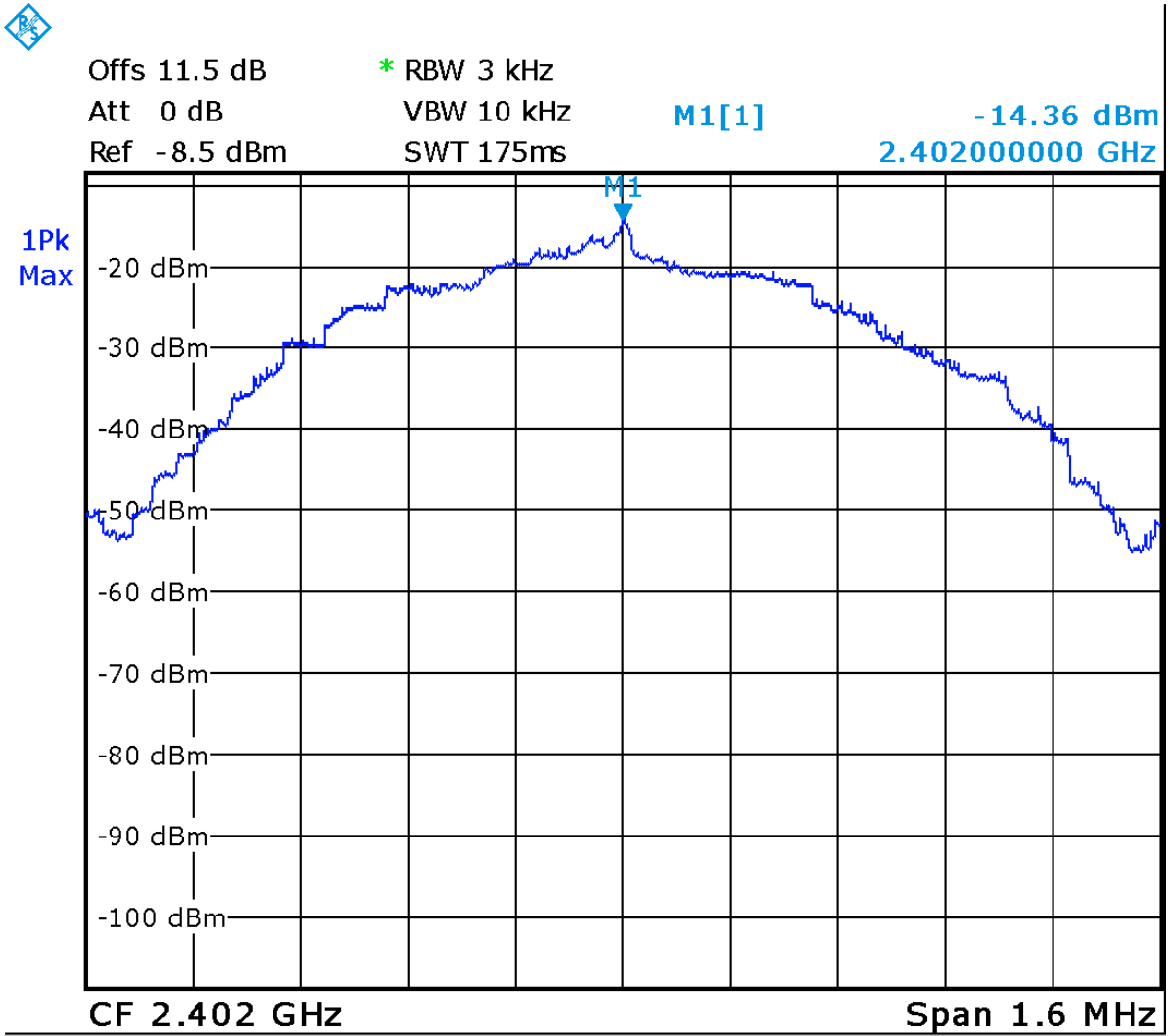
The EUT passed. Low, medium, and high bands were tested. The worst case value is -14.36 dBm as measured with a 3 kHz resolution bandwidth (peak power).

Graphs

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

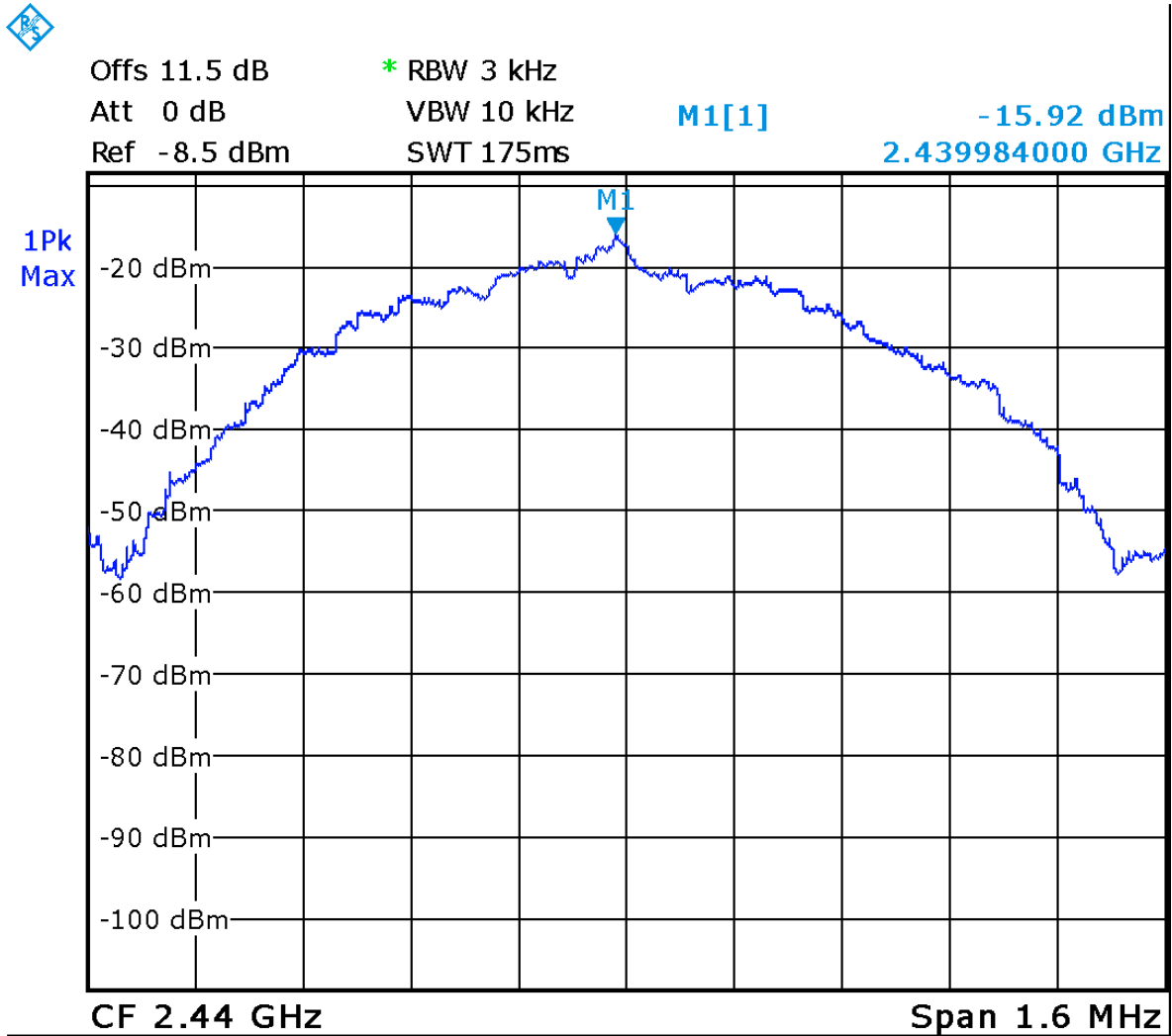
PSD - Low Channel



Date: 20.MAY.2016 15:01:53

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

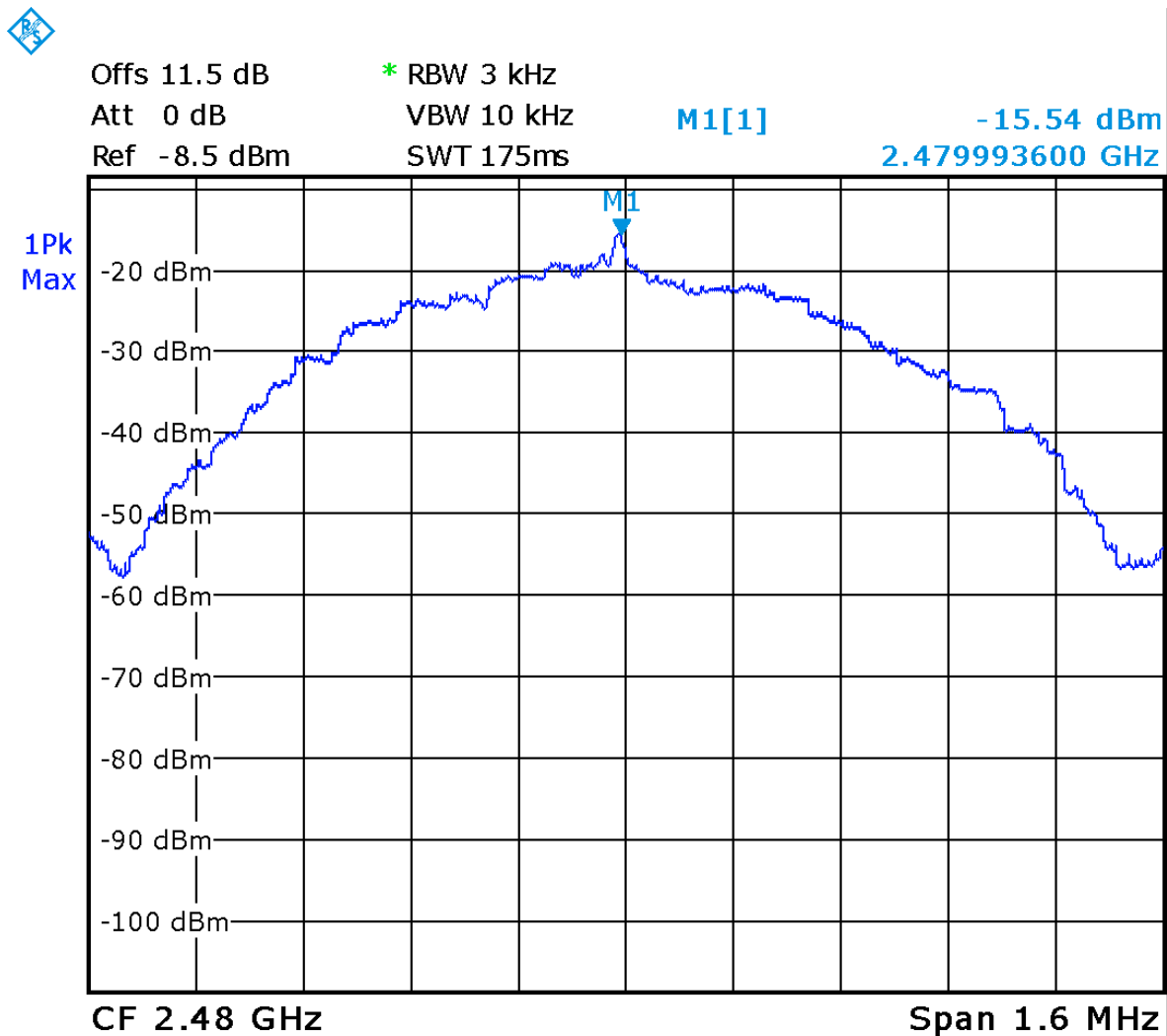
PSD - Mid Channel



Date: 20.MAY.2016 15:34:32

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

PSD - Hi Channel



Date: 20.MAY.2016 15:44:23

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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 C63.4:2014

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

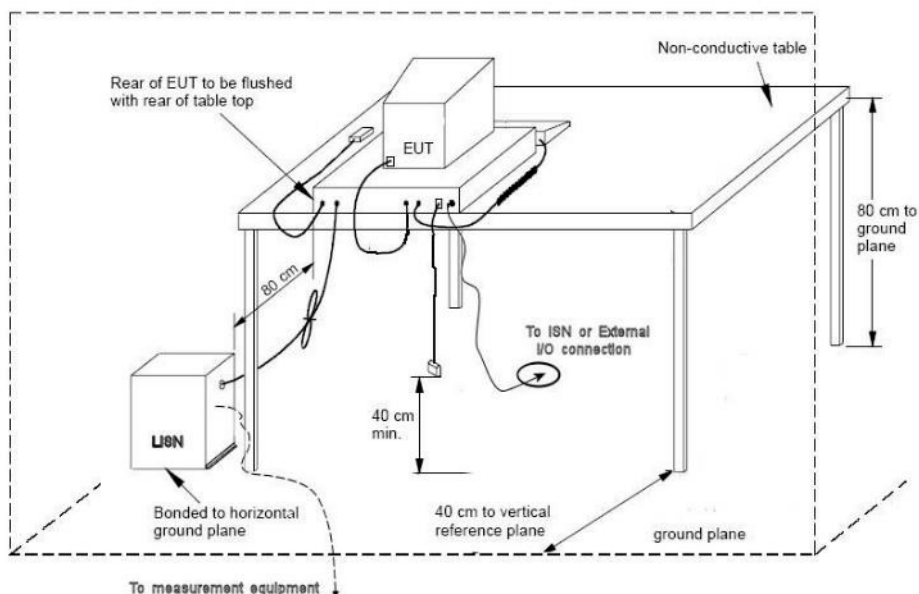
* Decreases linearly with the logarithm of the frequency

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

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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.

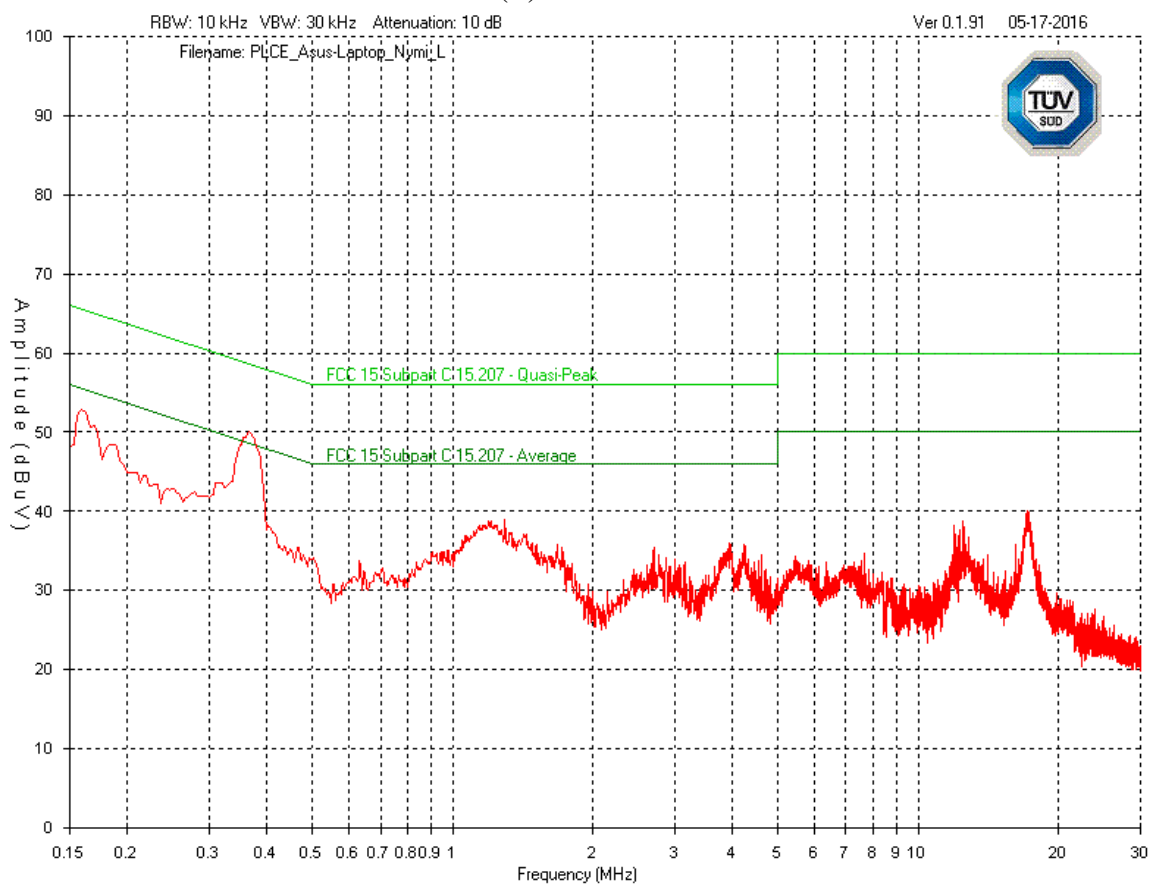
Preliminary Graphs

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.

Note: The graphs are obtained by having the EUT charging via a laptop.

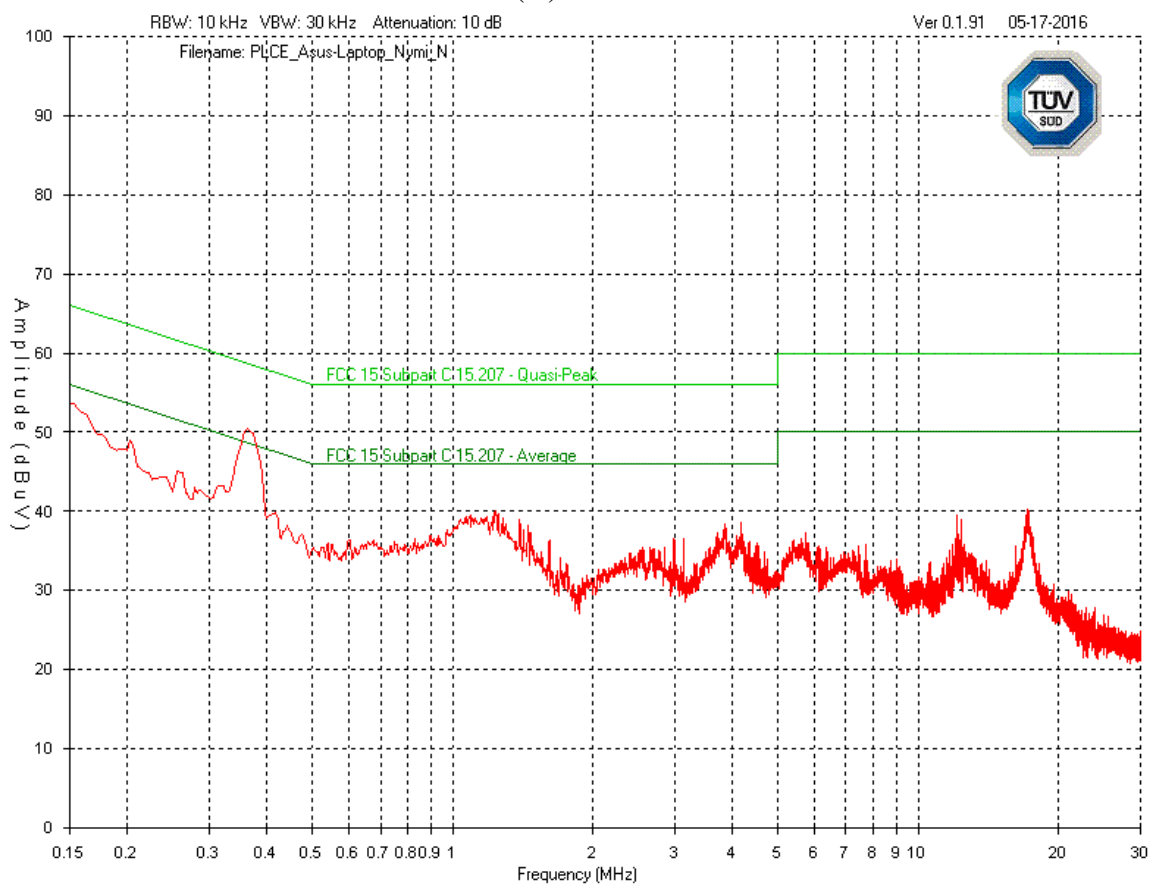
Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Line (L) – 120Vac 60Hz



Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Neutral (N) – 120Vac 60Hz



Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Final Measurements

Product Category			Class B								
Supply			Laptop powered at 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											
0.357	AVG	28.3	10	0.1	0.0	38.4	--	48.6	--	10.2	Pass
0.158	AVG	25.4	10	0.1	0.0	35.5	--	55.5	--	20.0	Pass
0.366	PEAK	39.9	10	0.1	0.0	50.0	59	--	8.6	--	Pass
0.160	PEAK	42.8	10	0.1	0.0	52.9	66	--	12.6	--	Pass
1.293	PEAK	28.9	10	0.1	0.0	39.0	56	46	17.0	7.0	Pass
3.939	PEAK	25.9	10	0.1	0.0	36.0	56	46	20.0	10.0	Pass
17.175	PEAK	29.8	10	0.2	0.1	40.1	60	50	19.9	9.9	Pass
2.706	PEAK	25.2	10	0.1	0.0	35.3	56	46	20.7	10.7	Pass
Neutral											
0.371	AVG	28.7	10	0.1	0.0	38.8	--	48.7	--	10.0	Pass
0.153	AVG	26.0	10	0.1	0.0	36.1	--	55.8	--	19.7	Pass
0.363	PEAK	40.4	10	0.1	0.0	50.5	59	--	8.2	--	Pass
0.153	PEAK	43.5	10	0.1	0.0	53.6	66	--	12.2	--	Pass
1.240	PEAK	29.9	10	0.1	0.0	40.0	56	46	16.0	6.0	Pass
4.168	PEAK	28.5	10	0.1	0.0	38.6	56	46	17.4	7.4	Pass
2.991	PEAK	26.5	10	0.1	0.0	36.6	56	46	19.4	9.4	Pass
3.134	PEAK	26.4	10	0.1	0.0	36.5	56	46	19.5	9.5	Pass

Average and Quasi-Peak Emissions Table

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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 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	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	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 1m	LMR-400-1M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 29
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

This report module is based on GEMC report template 'FCC_ICES003_CE_Rev1'

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

RF Exposure

The device is intended for use on extremities (wrists) and the minimum separation distance from the radiating structure to any part of the body or extremity of a user is 7mm as stated by the manufacturer during normal operation.

General SAR test exclusion guidance – RSS 102:

As per RSS 102 Section 2.5.1, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1 below:

Table 1 - SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

The maximum conducted output power was -3.22dBm or 0.48mW. The maximum isotropically radiated power (e.i.r.p.) was recorded to be 0.4dBm or 1.1mW.

Since the device operates below the applicable output power level for the specified separation distance, the SAR Exclusion Threshold condition is met.

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

General SAR test exclusion guidance – FCC KDB 447498:

As per FCC KDB 447498 Section 4.3.1 1), the 10-g extremity SAR Test Exclusion Threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm is determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] [\sqrt{f_{(\text{GHz})}}] \leq 7.5$$

Where:

$f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz = 2.480GHz

(max. power of channel, including tune-up tolerance, mW) = 0.476 mW

(min. test separation distance, mm) = 7 mm

Peak conducted power was measured to be 0.476mW. Therefore,

$$[0.476 \text{ mW} / 7 \text{ mm}] * [\sqrt{2.480 \text{ GHz}}] = 0.11 \leq 7.5$$

SAR Exclusion Threshold condition is met with peak conducted power.

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Radiofrequency Radiation Exposure Evaluation: Portable Devices – FCC §1.1310

Portable devices shall be evaluated for RF radiation exposure according to the provisions of FCC §2.1093 and the MPE guidelines identified in FCC §1.1310.

As per FCC §1.1310 Table 1(B), the limit for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields in the frequency range of 1.5GHz to 100GHz for General Population/Uncontrolled Exposure is 1.0 mW/cm².

The power density formula is given by:

$$P_d = \text{EIRP} / (4 * \pi * R^2)$$

Where,

EIRP = Equivalent Isotropic Radiated Power in mW

Pi = 3.1416

R = Separation distance in cm = 0.7cm

EIRP = Highest received peak signal measured under the Radiated Emission results (94.8dB(uV/m)) – Free Space Impedance at 3m, 95.2.

Since the 99% bandwidth is greater than the measurement bandwidth, an adjustment factor of 20log(99% BW/Measurement BW) was used.

$$\text{EIRP} = 94.8 - 95.2 + 20\log(1.1/1) = 0.4\text{dBm or } 1.096\text{mW}.$$

$$P_d = (1.096\text{mW}) / (4 * 3.1416 * (0.7\text{cm})^2)$$

$$P_d = 1.096\text{mW} / 6.158 \text{ cm}^2$$

$$P_d = 0.178 \text{ mW/cm}^2$$

The device passes the requirement. The calculated power density is 0.178mW/cm² and this is below the 1.0 mW/cm² limit.

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Appendix A – EUT Summary

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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

General EUT Description

Client	
Organization / Address	Nymi Inc. 82 Peter Street, Suite 500, Toronto, ON, M5V2G5
Phone	416-977-3042
EUT Details	
EUT Name	Nymi Band
EUT Model	151100
Equipment Category	Consumer Wearable
Basic EUT Functionality	Wearable device for biometric user identification
EUT is powered using	Internal Rechargeable Battery
Input Voltage Range	2.5 – 4.2
Rated Input Current	150mA pk, 1mA avg
Connectors available on EUT	Custom 5-pin pogo pin interface on top enclosure for USB charger adaptor
Peripherals Required for Test	Windows compatible (7 and up) PC with Bluetooth dongle (Bluegiga BLE112) and BLE wireless serial tool
Intentional Radiator Frequency	2400 – 2483.5 MHz for BLE applications as described above.
EUT Configuration	BLE Direct Test Mode with the following settings: Mode: 2 (Tx) Power: 7 (max) Channel: 0 = Low Channel or 19 = Mid Channel or 39 = High Channel Packet Length: 37 (max) Packet Type: 0 (PRBS9)
Dimensions of product	L 40.75 mm W 21.75mm H 10.85 mm

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	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Appendix B – EUT and Test Setup Photos

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

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

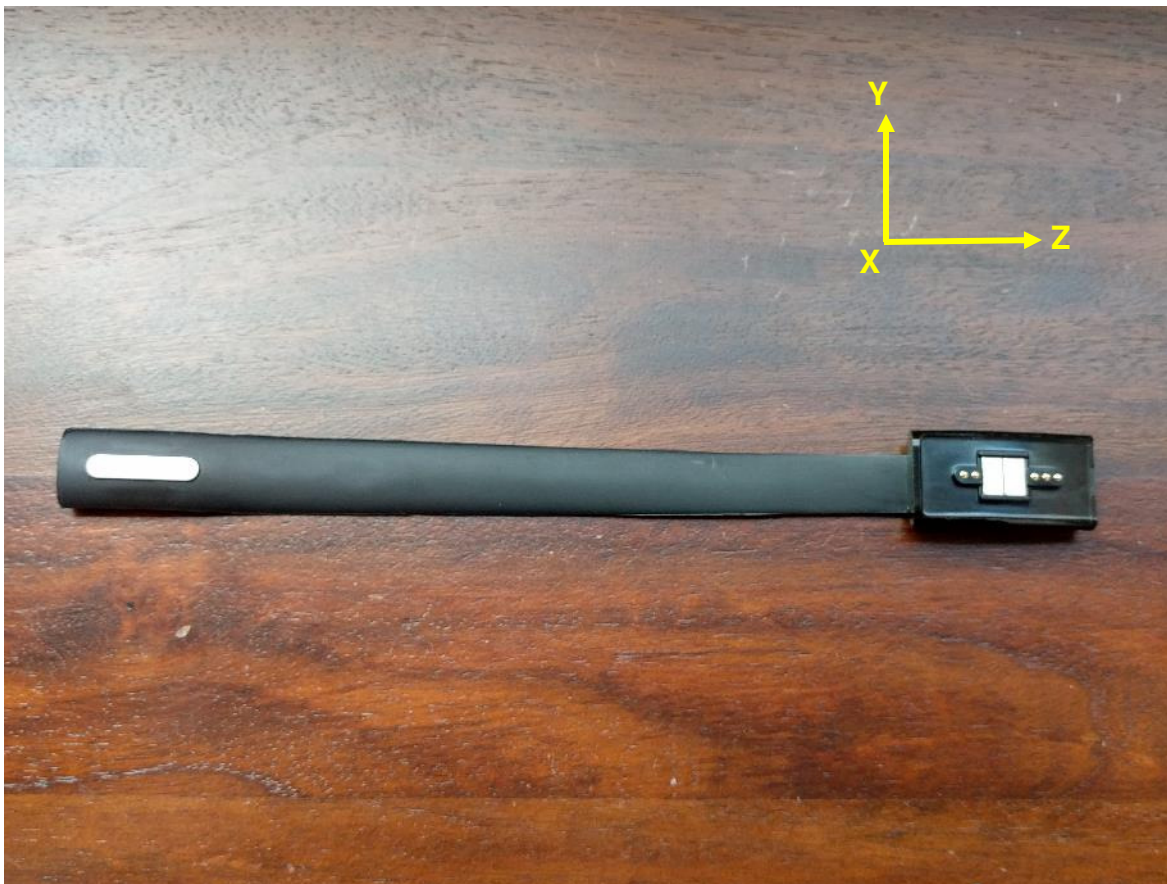


Figure 1 – EUT Close Up

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	



Figure 2 – Radiated Emissions Setup – Photo 1

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	



Figure 3 – Radiated Emissions Setup – Photo 2

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

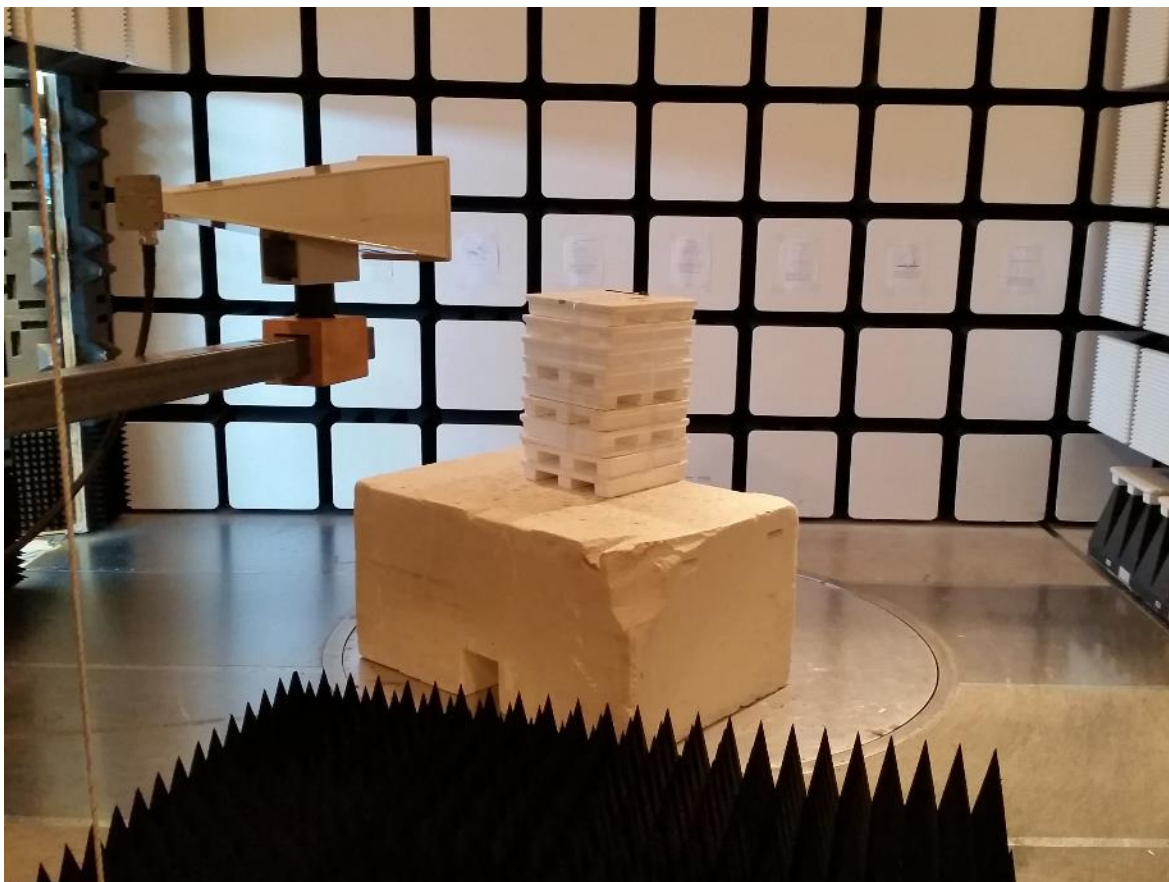


Figure 4 – Radiated Emissions Setup – Photo 3

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

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

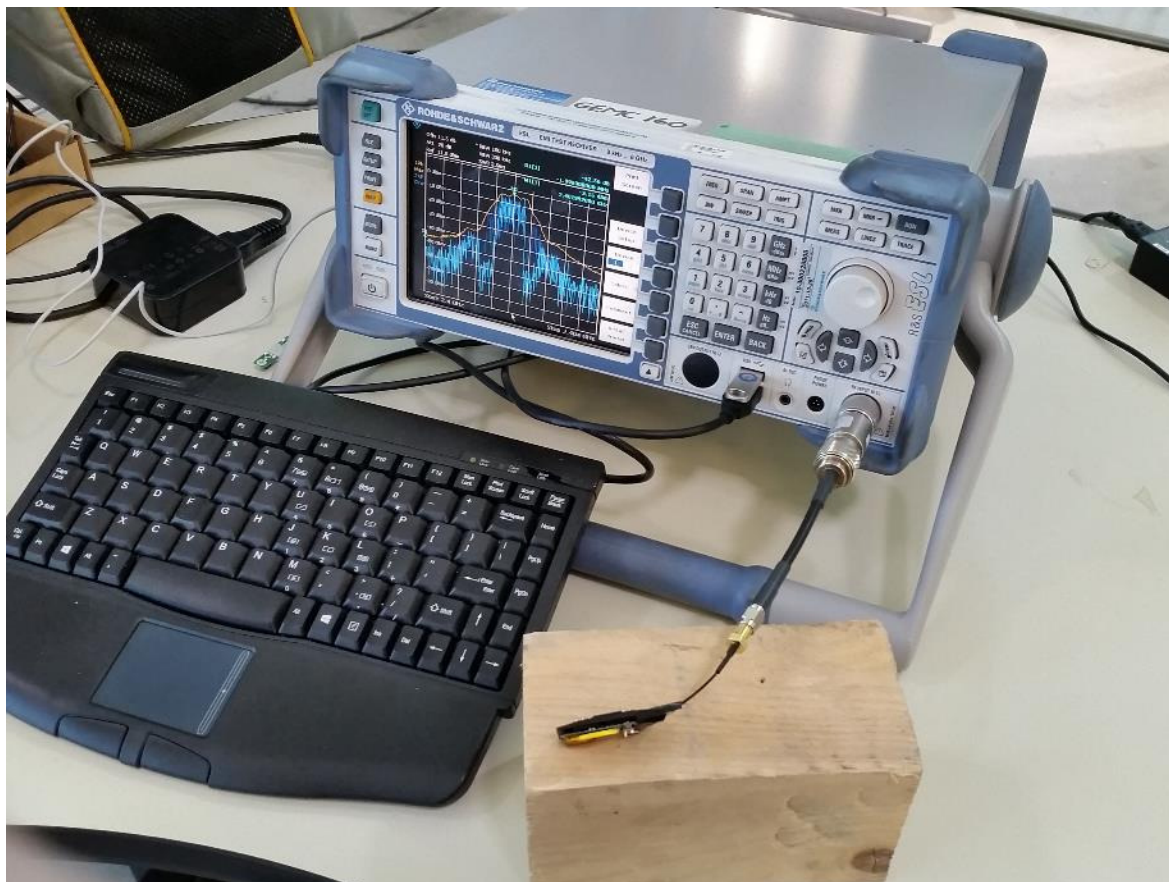


Figure 5 – Antenna Port Conducted Emissions Setup

Client	Nymi™	
Product	Nymi Band, Model: 151100	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

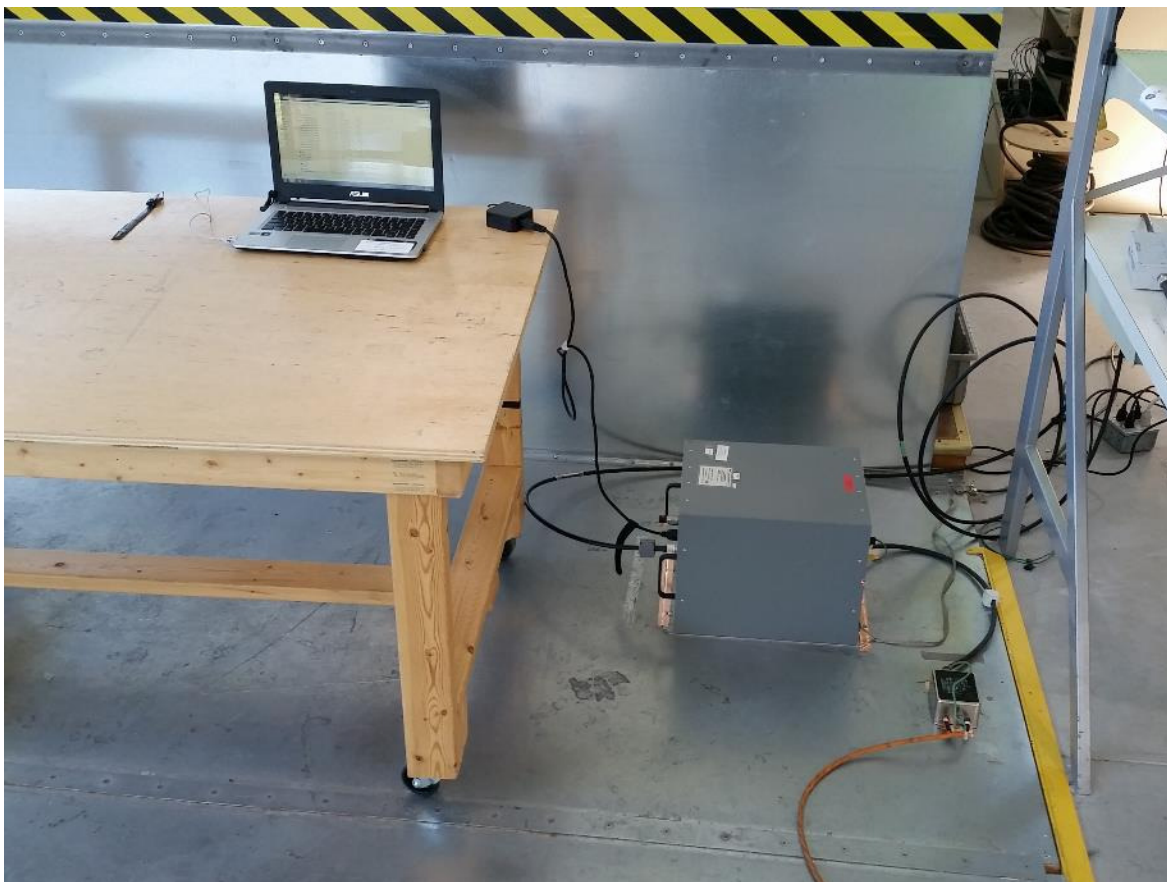


Figure 6 – Power Line Conducted Emissions Setup