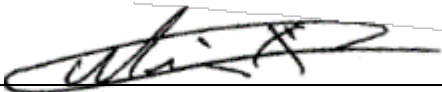


Global EMC Inc. Labs

EMC & RF Test Report

As per
RSS 210 Issue 8:2010
&
FCC Part 15 Subpart C:2014
Unlicensed Intentional Radiators
on the
Myo Armband



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Testing produced for
 **THALMICLABS™**
See Appendix A for full customer & EUT details.



Industry
Canada

LAB REGISTRATION
#6844A-3



Testing Laboratory
Certificate
#2555.01



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



Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

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Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Report Scope

This report addresses the EMC verification testing and test results of Thalmic Labs Inc's Myo Armband, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:


RSS 210 Issue 8:2010
FCC Part 15 Subpart C 15:2014

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

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

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.


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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Summary

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

EUT FCC Certification #, FCC ID:	2ACKV-TL9B
EUT Industry Canada Certification #, IC:	12013A-TL9A
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Min Xie


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	QuasiPeak Average	Pass
FCC 15.207	Power line conducted emissions	QuasiPeak Average	N/A, (See Justifications)
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-210 A8.2(a)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-210 A8.4(4)	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS-210 A8.4(5)	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-210 A8.5	Antenna conducted spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-210 A8.2(b)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
Overall Result			PASS

All tests were performed by Min Xie.

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Justifications, Descriptions, or Deviations

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

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), the unit uses a permanently connected SMD ceramic chip antenna (0.5 dBi peak gain –Johanson Technology 2.45 GHz Antenna, Model: 2450AT18B100).


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

For maximum permissible exposure, this device operates at less than 1 Watt at 2400 – 2483.5 MHz and is designed to operate greater than 5 mm from any personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

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


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

For FCC 15.107 power line conducted emission, the device is battery operated, this requirement does not apply. The batteries are rechargeable batteries and the device turns the transmitter off when charging. The devices charges through a micro USB port and it does not sell with a power supply. Power line conducted emissions test is include for information purpose only and is performed on an Lenovo T410 laptop with AC Adapter (Model: ADLX90NCT2A).

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Applicable Standards, Specifications and Methods

CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ANSI C63.10:2009	- American national standard for testing unlicensed wireless devices
FCC KDB 558074	- FCC KDB 558074 Digital Transmission Systems, measurements and procedures
ICES-003:2012	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS-GEN	General Requirements and Information for the Certification of Radio Apparatus
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power License-Exempt Radiocommunication Devices

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Sample calculation(s)


Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

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

Margin = 8.5 dB

Document Revision Status

Revision 1 - July 8, 2014
Initial release

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Definitions and Acronyms

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

AE – Auxillary Equipment.

BW – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity


EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Testing Facility

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

For ESD testing, the HCP is 1.6m x 0.8m and the VCP is 0.5m x 0.5m. The reference ground plane, when applicable, is 1.6m x 1.6m.

Calibrations and Accreditations


The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 377448), Industry Canada (IC, 6844A-3) and 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 Global EMC. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at Global EMC. Global EMC 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.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Testing Environmental Conditions and Dates

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

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
2014/6/25	Radiated Emissions	MX	21-25°C	38 - 45%	98 -103kPa
2014/7/4	Antenna Conducted Emissions	MX	21-25°C	38 - 45%	98 -103kPa
2014/6/3	Power Line Conducted Emissions	MX	21-25°C	38 - 45%	98 -103kPa

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Detailed Test Results Section

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

6dB Bandwidth of Digitally Modulated Systems

Purpose

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits and Methods


The Limit is as specified in FCC Part 15.247 (a) and RSS 210.

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: April 9, 2013.

Results

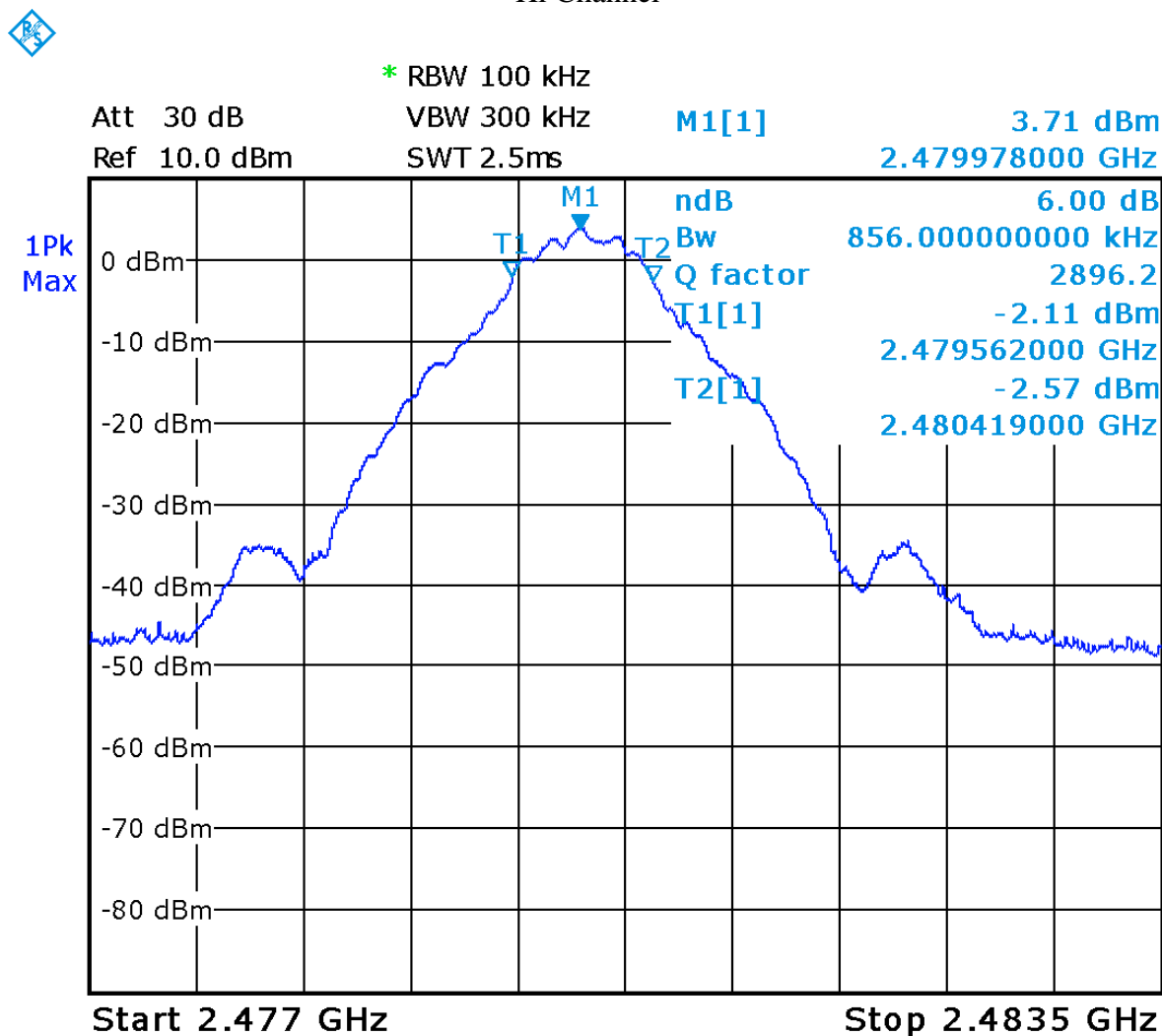
The EUT passed. The minimum 6 dB BW measured was 806.4 kHz.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Graph(s)


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

Hi Channel

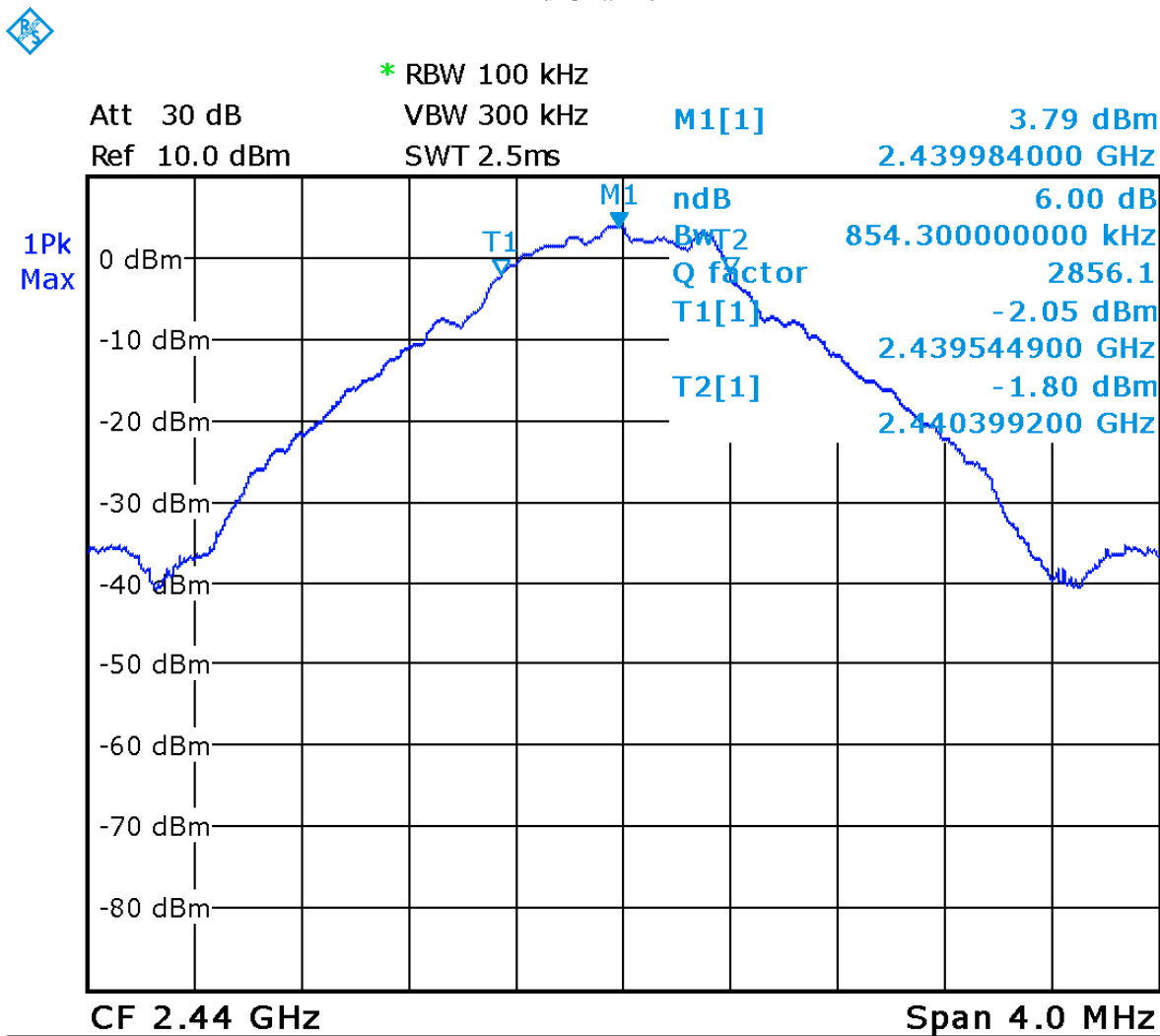


Date: 4.JUL.2014 14:27:10

6 dB BW = 856.0 kHz
20 dB BW = 1985.0 kHz


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Mid Channel

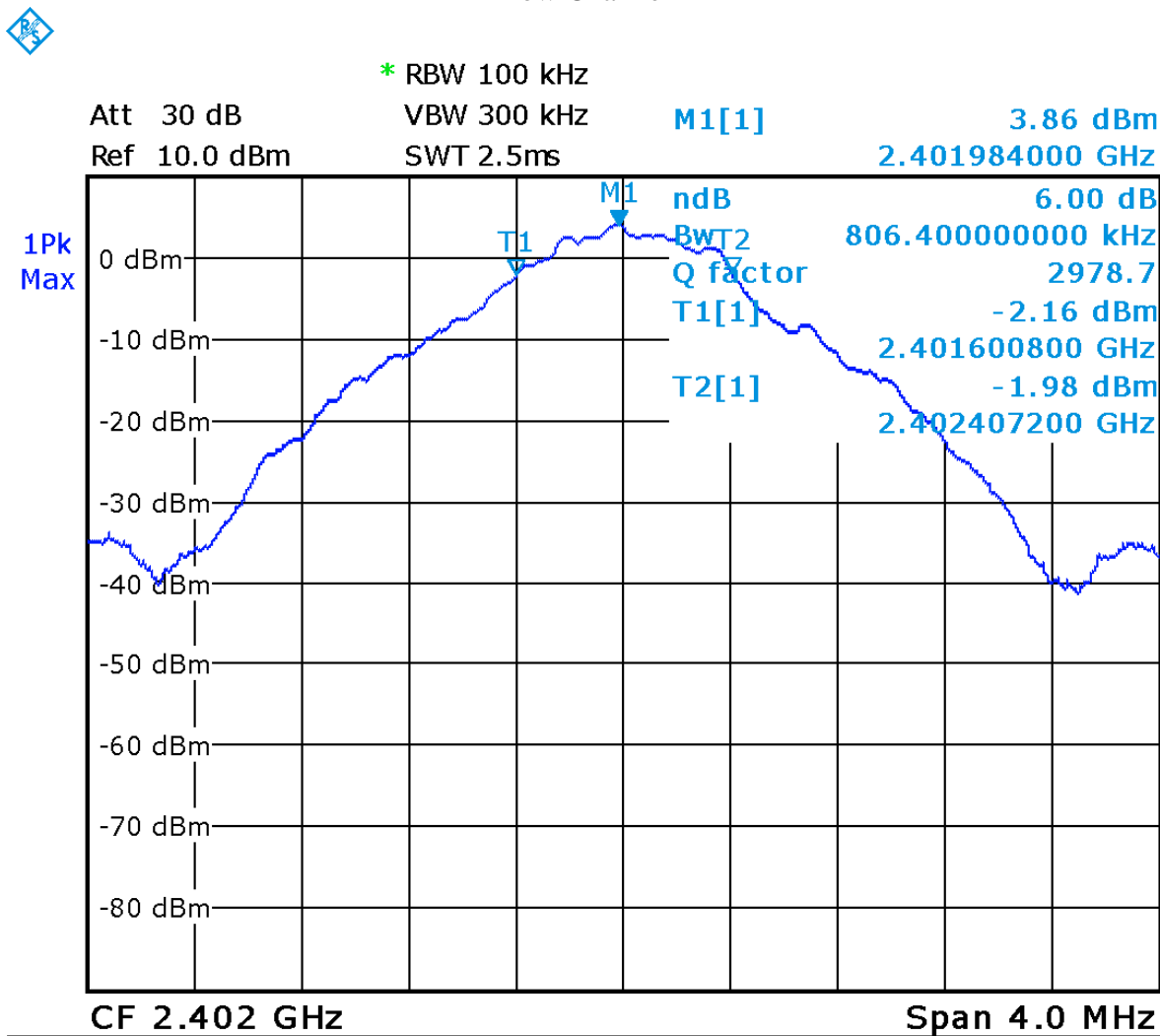


Date: 4.JUL.2014 15:23:48

6 dB BW = 854.3 kHz
20 dB BW = 1964.1 kHz

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Low Channel



Date: 4.JUL.2014 15:44:43

6 dB BW = 806.4 kHz
20 dB BW = 2060.0 kHz


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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GMEC 160
RF Cable 9"	8120-5148-B	HP/Agilent	NCR	NCR	GEMC 6100

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Maximum Peak Envelope Conducted Power

Purpose

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

Limits and Methods

The limits are defined in FCC Part 15.247(b) and RSS 210.


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

The method is given in Section 9.1.3 of FCC KDB 558074: April 9, 2013.

Results

The EUT passed. The power of the EUT was set to transmit at maximum power. Three channels were measured. The following table shows the peak power of each channel:

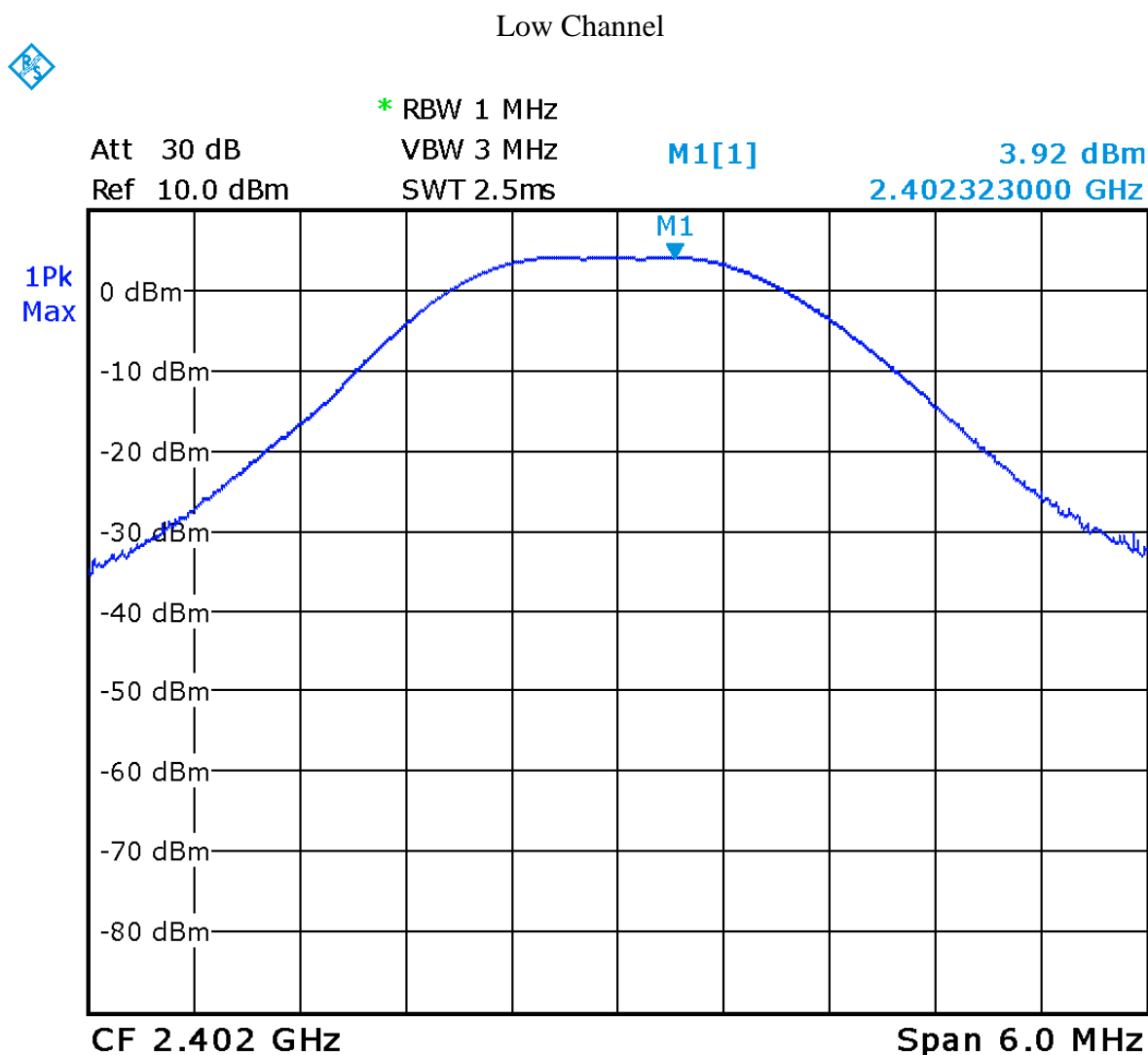
Channel	Frequency (MHz)	Power (dBm)	Power (mW)
Lo Channel	2402	3.92	2.47
Mid Channel	2440	3.84	2.42
Hi Channel	2480	3.72	2.36

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Readings

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

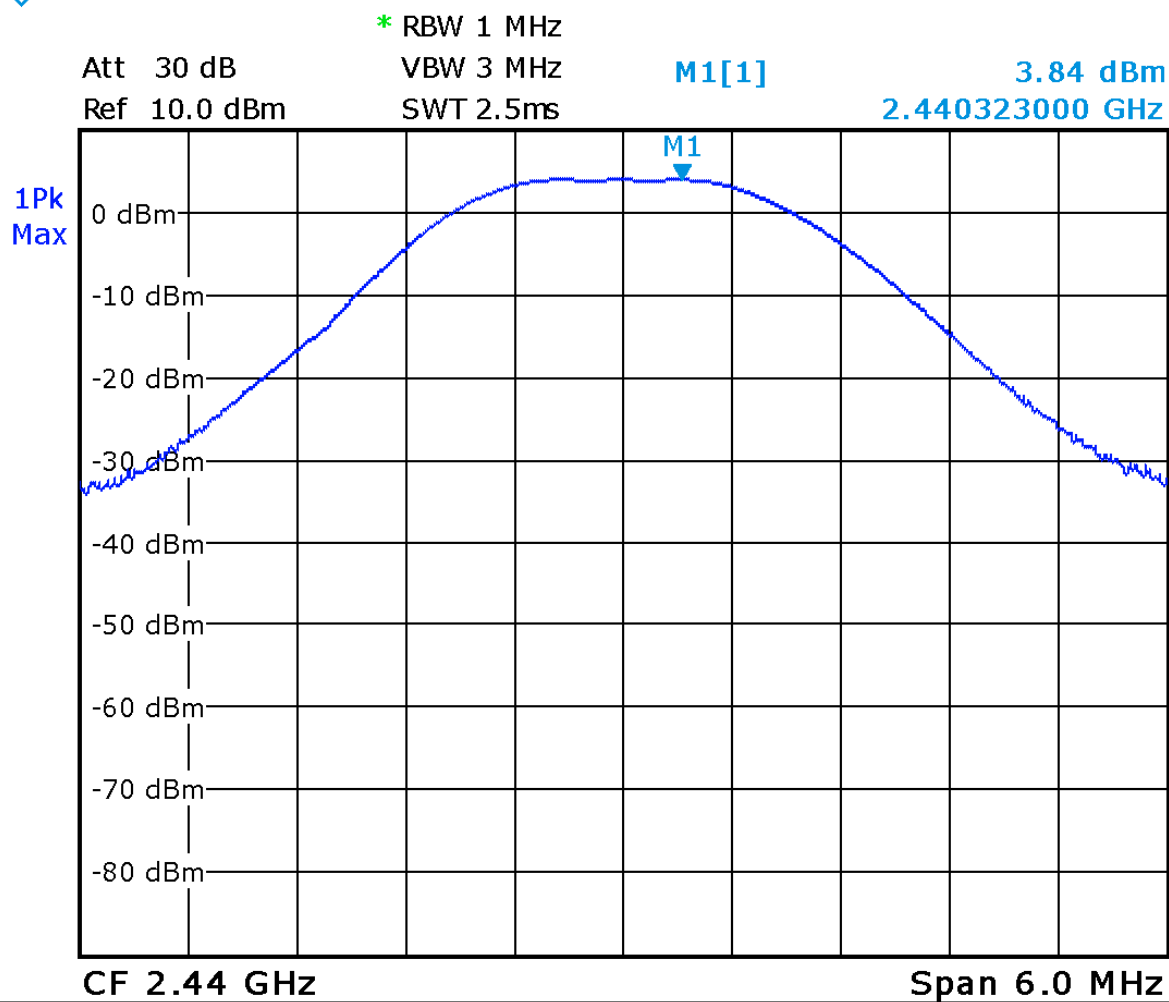
Tests were conducted using a spectrum analyzer.




Date: 4.JUL.2014 15:09:20

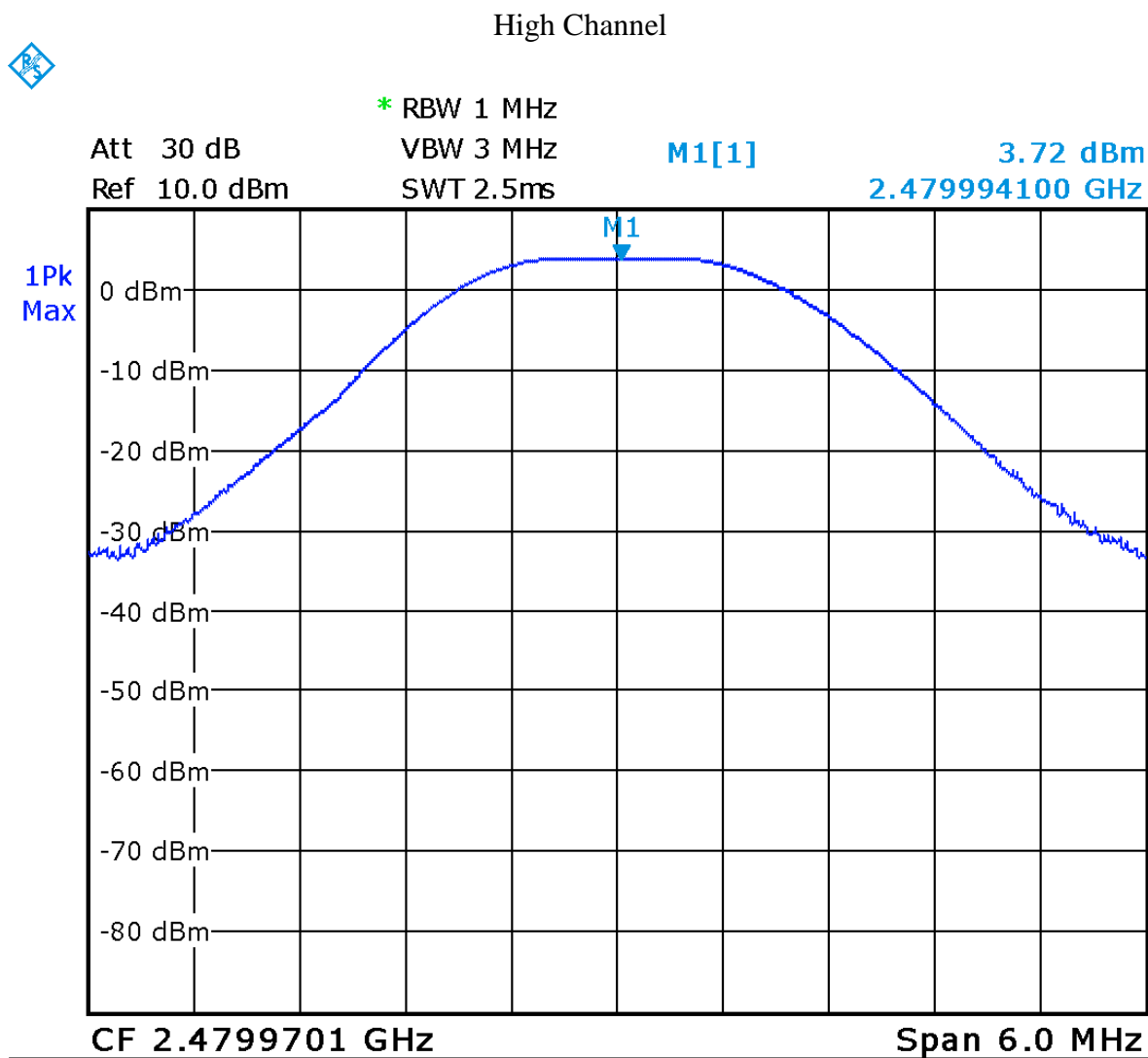
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Mid Channel




Date: 4.JUL.2014 15:20:47

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



Date: 4.JUL.2014 15:32:45


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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GMEC 160
RF Cable 9"	8120-5148-B	HP/Agilent	NCR	NCR	GEMC 6100

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

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

Purpose

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


Limits and Methods

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

The method is given in Section 11 of FCC KDB 558074: April 9, 2013.

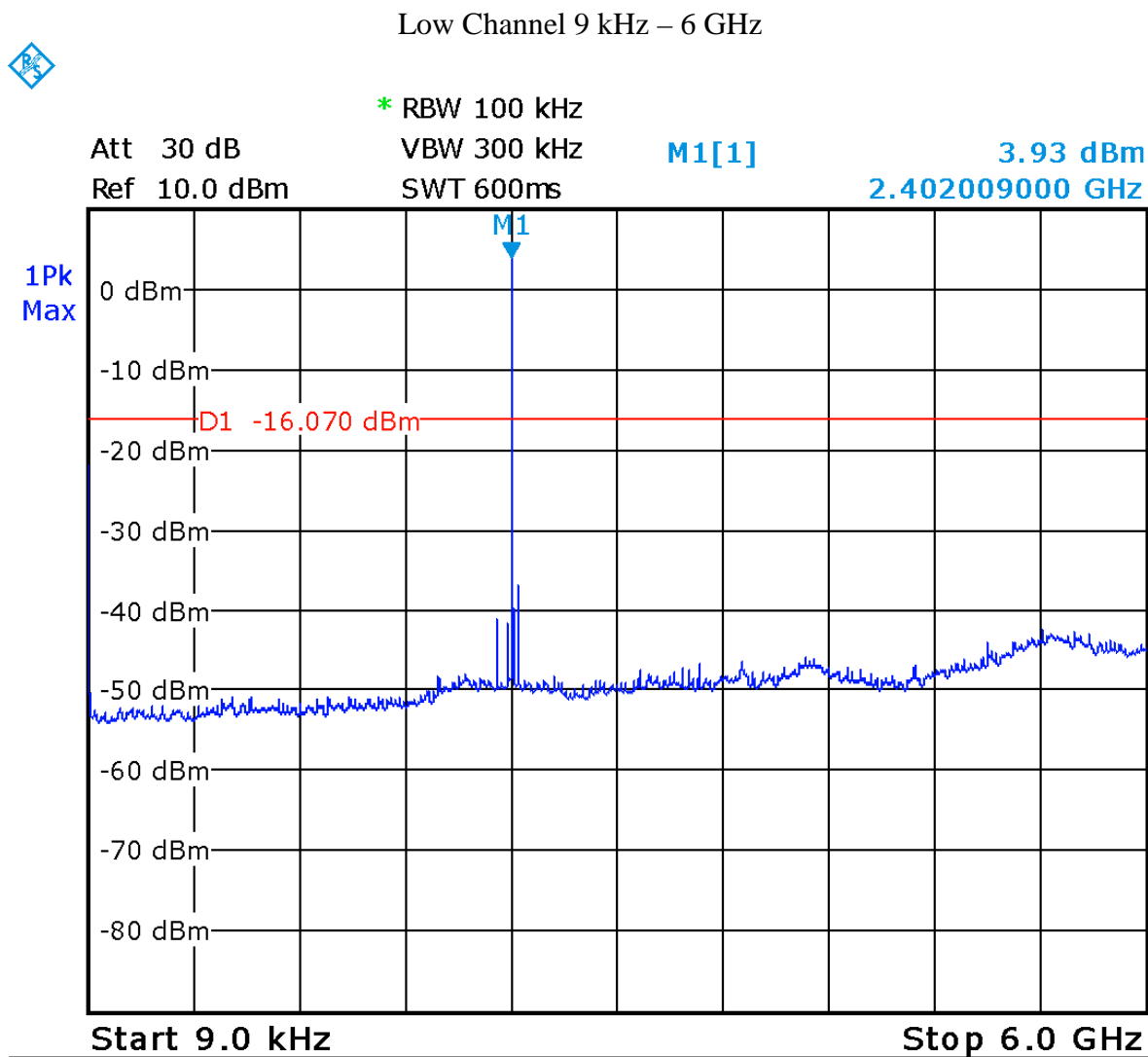
Results

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


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Graph(s)

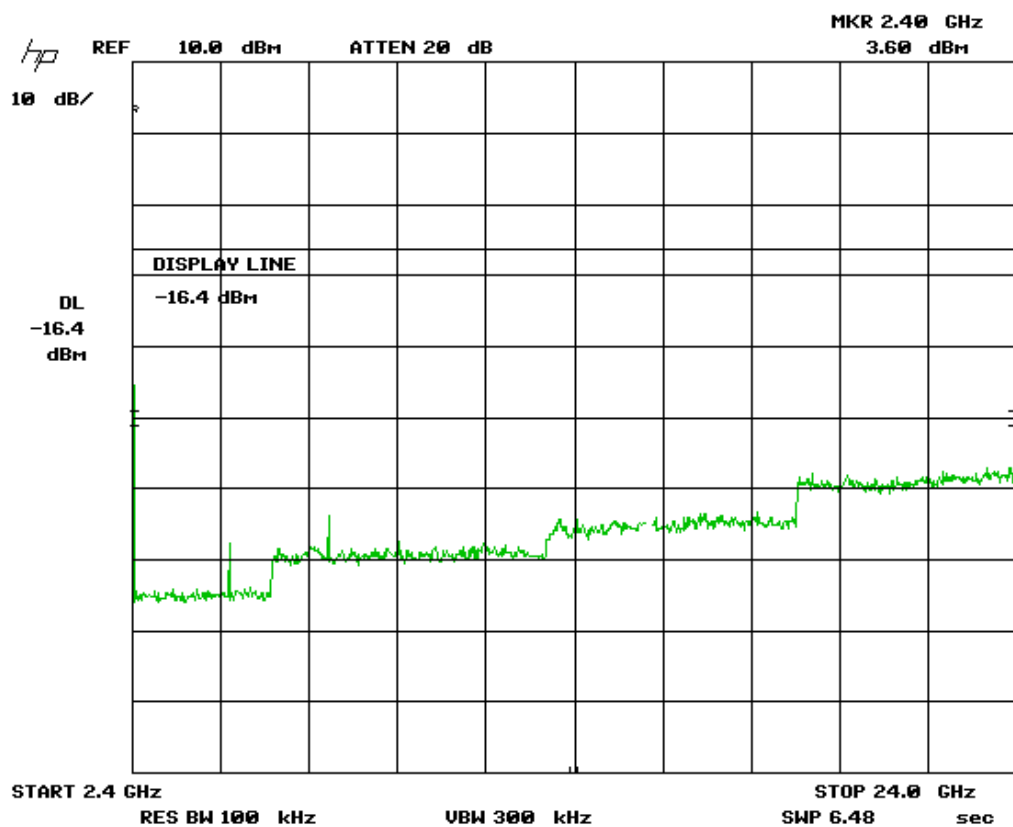
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.




Date: 4.JUL.2014 14:51:57

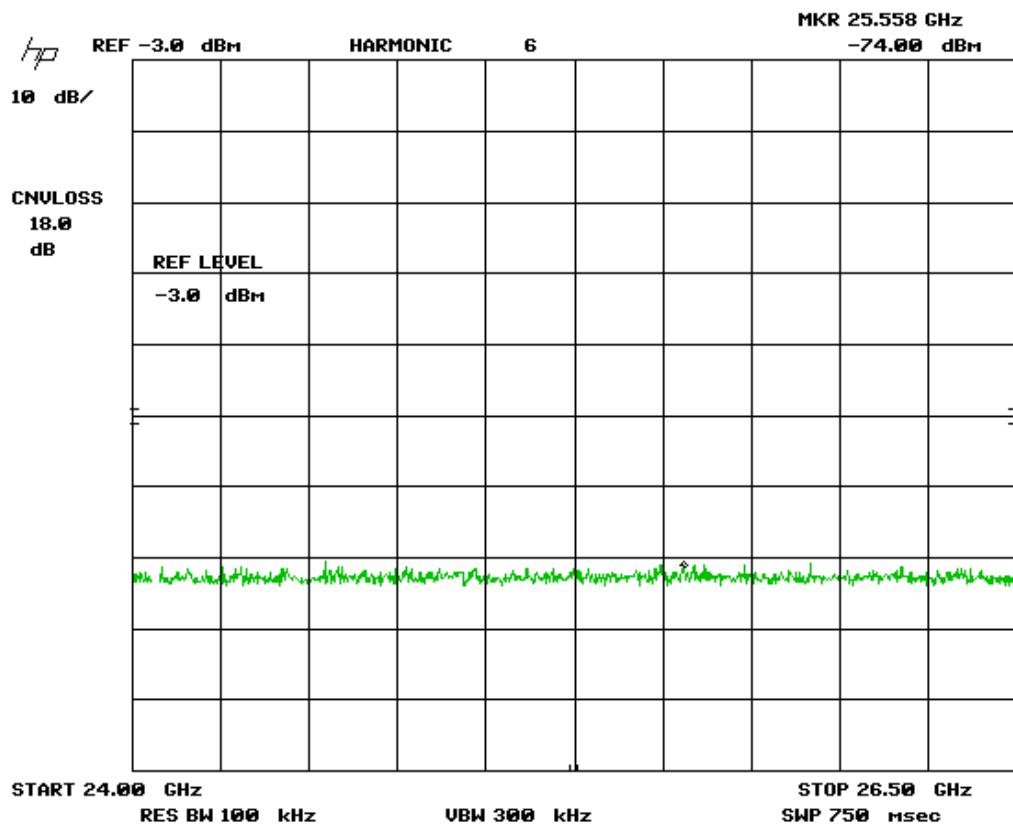
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Low Channel 2.4 GHz – 24 GHz



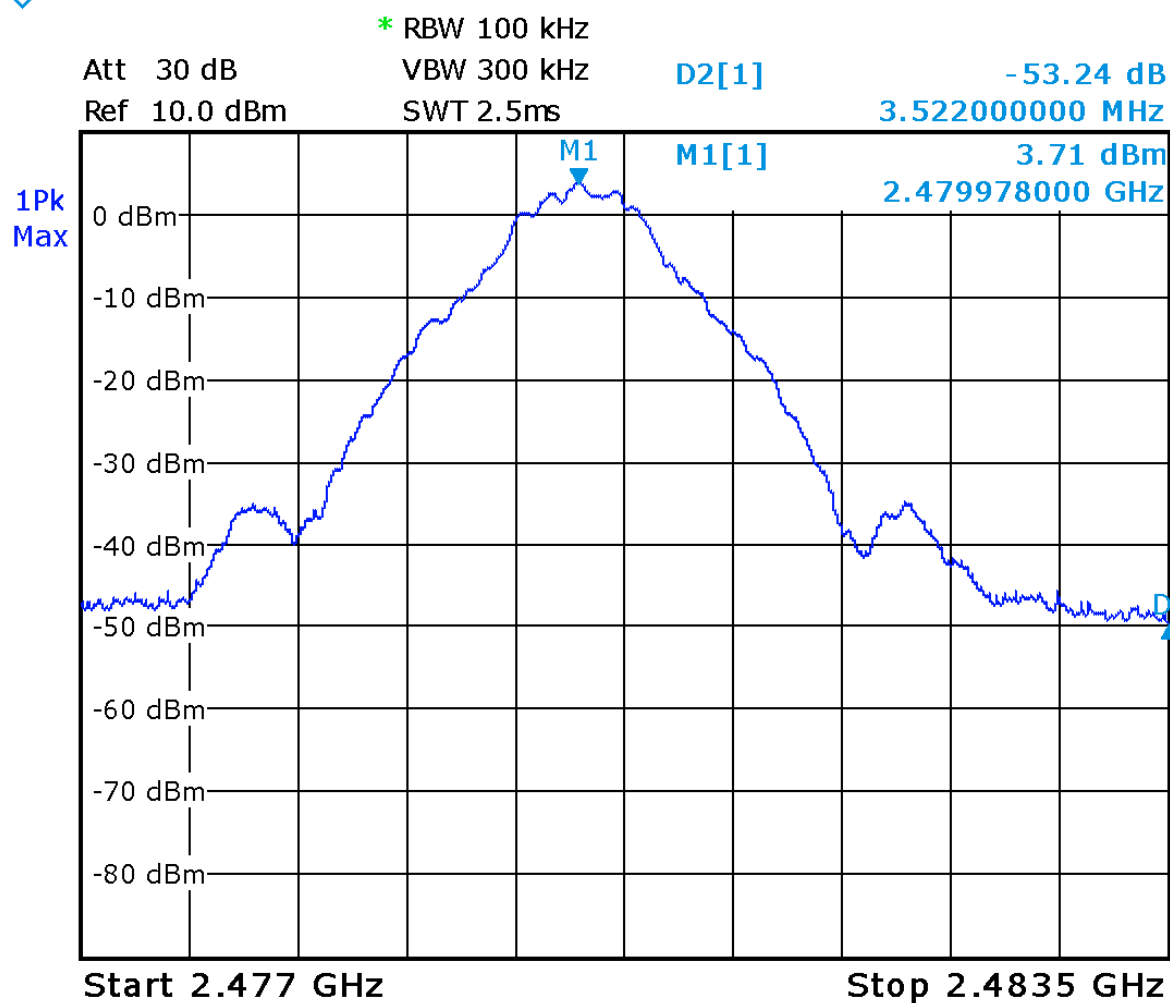
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Low Channel 24 GHz – 26 GHz




Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

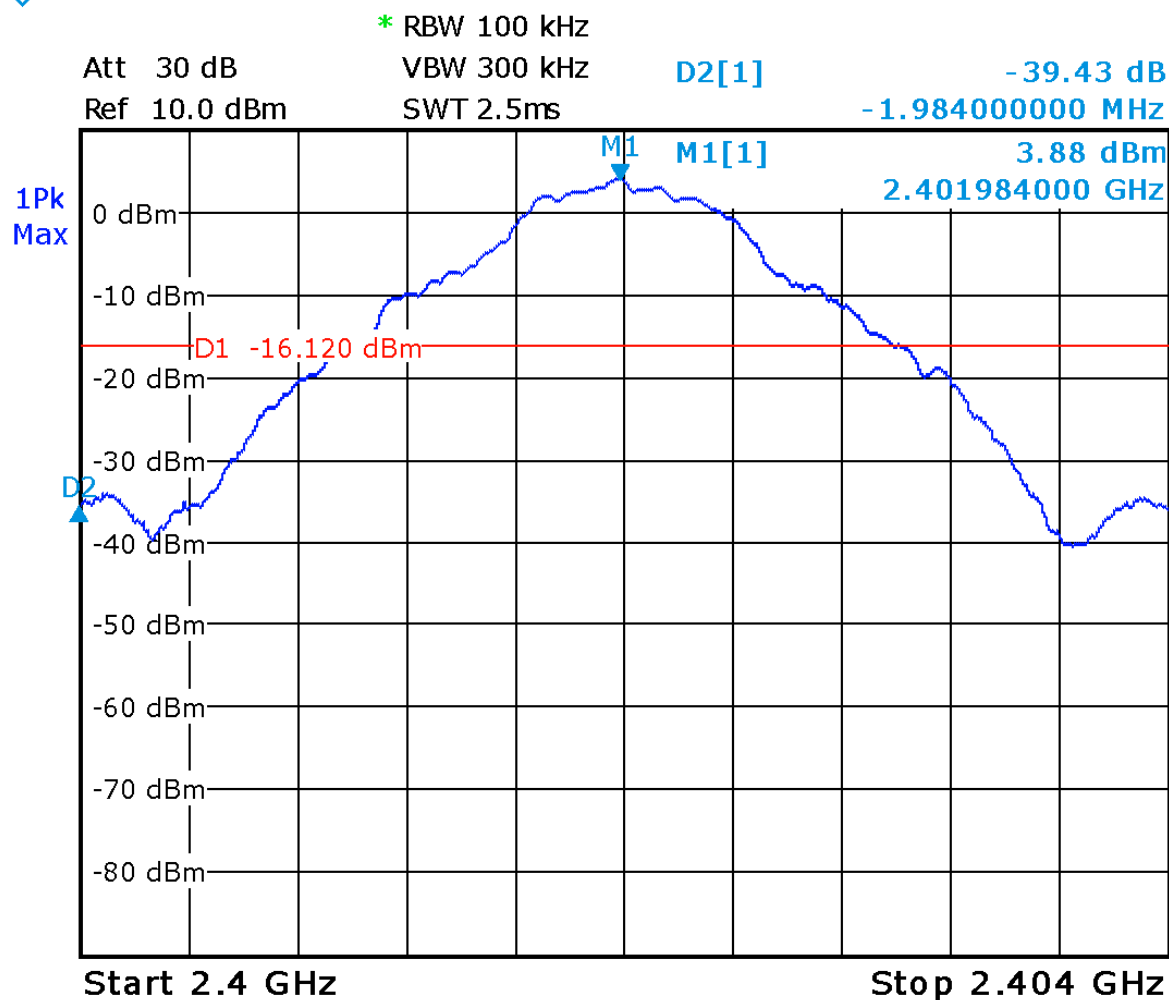
Hi Channel – 2483.5 Band Edge



Date: 4.JUL.2014 14:22:53


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Low Channel – 2400 MHz Band edge



Date: 4.JUL.2014 14:56:39


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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	GEMC 169
Quasi Peak Adapter	85650A	HP	2013-01-23	2015-01-23	GEMC 170
Spectrum Analyzer	ESL6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GEMC 160
RF Cable 9"	8120-5148-B	HP/Agilent	NCR	NCR	GEMC 6100

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Radiated Emissions – 15.247

Purpose

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

Limit(s) and Method

The method is given in Section 12.1 of FCC KDB 558074: April 9, 2013.

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 ‘Spurious Conducted Emissions’ for further details.

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m¹
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m¹
1.705 MHz – 30 MHz, 30 uV/m at 30 m¹
30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m¹) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m¹) at 3 m
Above 1000 MHz, 500 uV/m (54 dBuV/m²) at 3m
Above 1000 MHz, 500 uV/m (74 dBuV/m³) at 3m

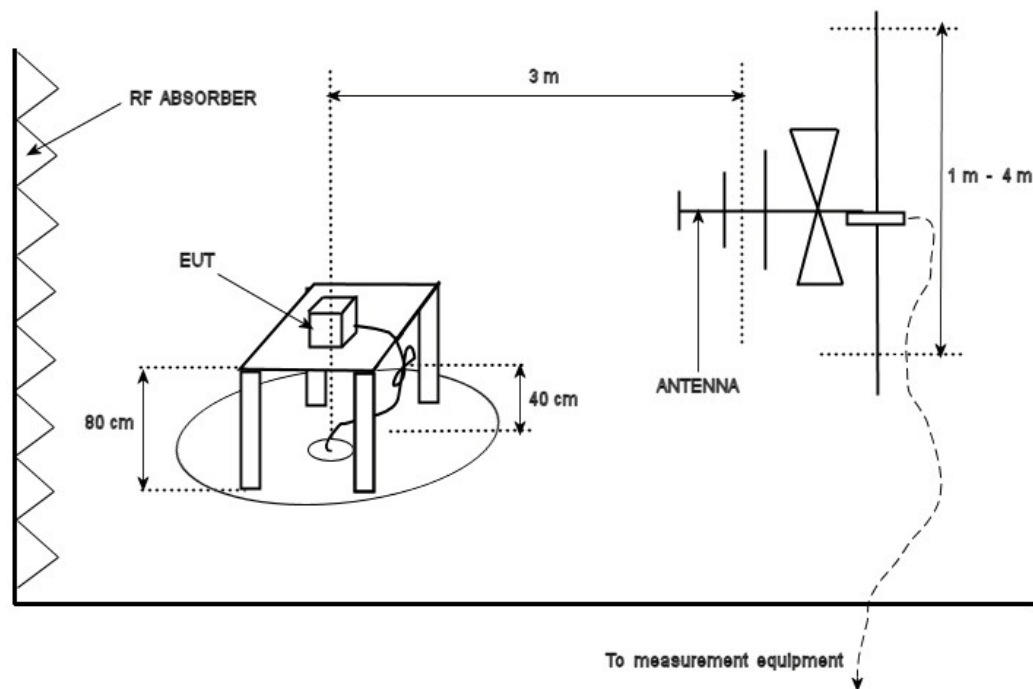
¹Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

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

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Typical Radiated Emissions Setup



Measurement Uncertainty


The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ± 4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

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

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

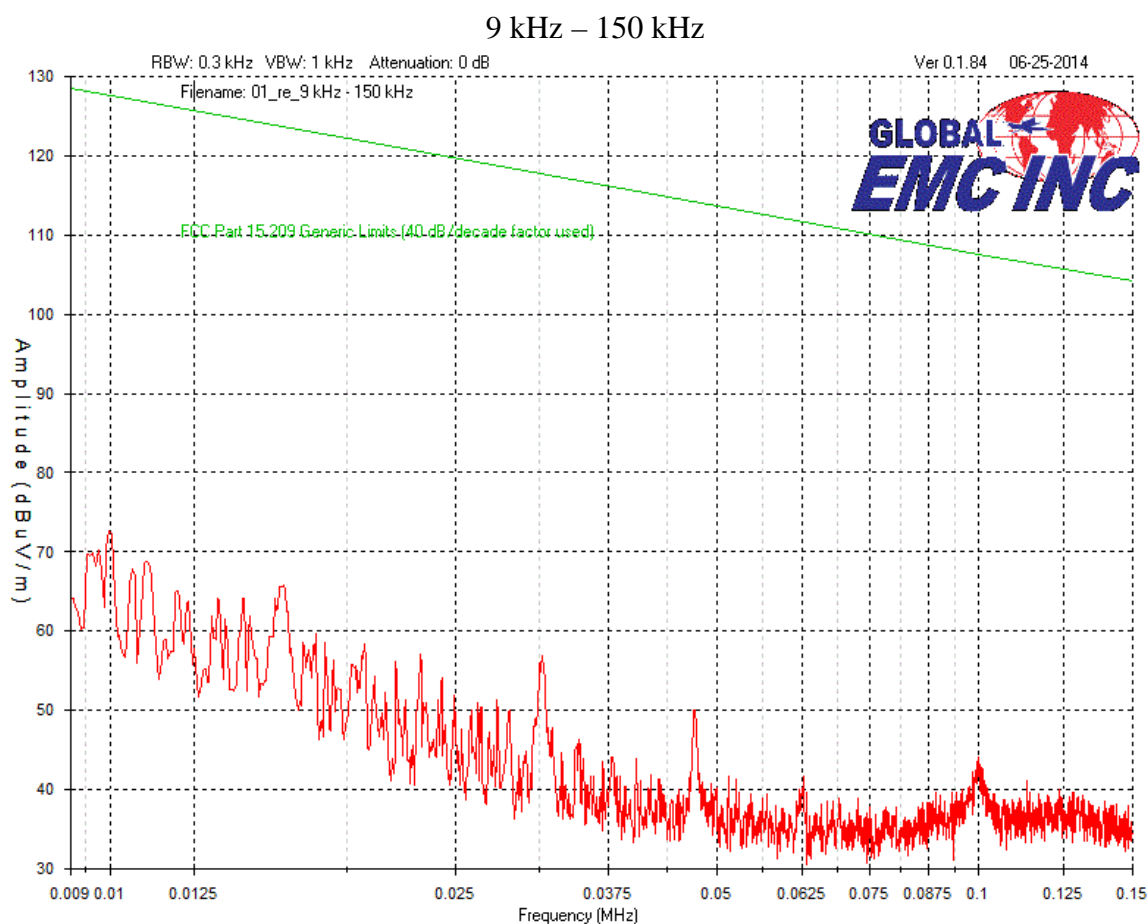
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

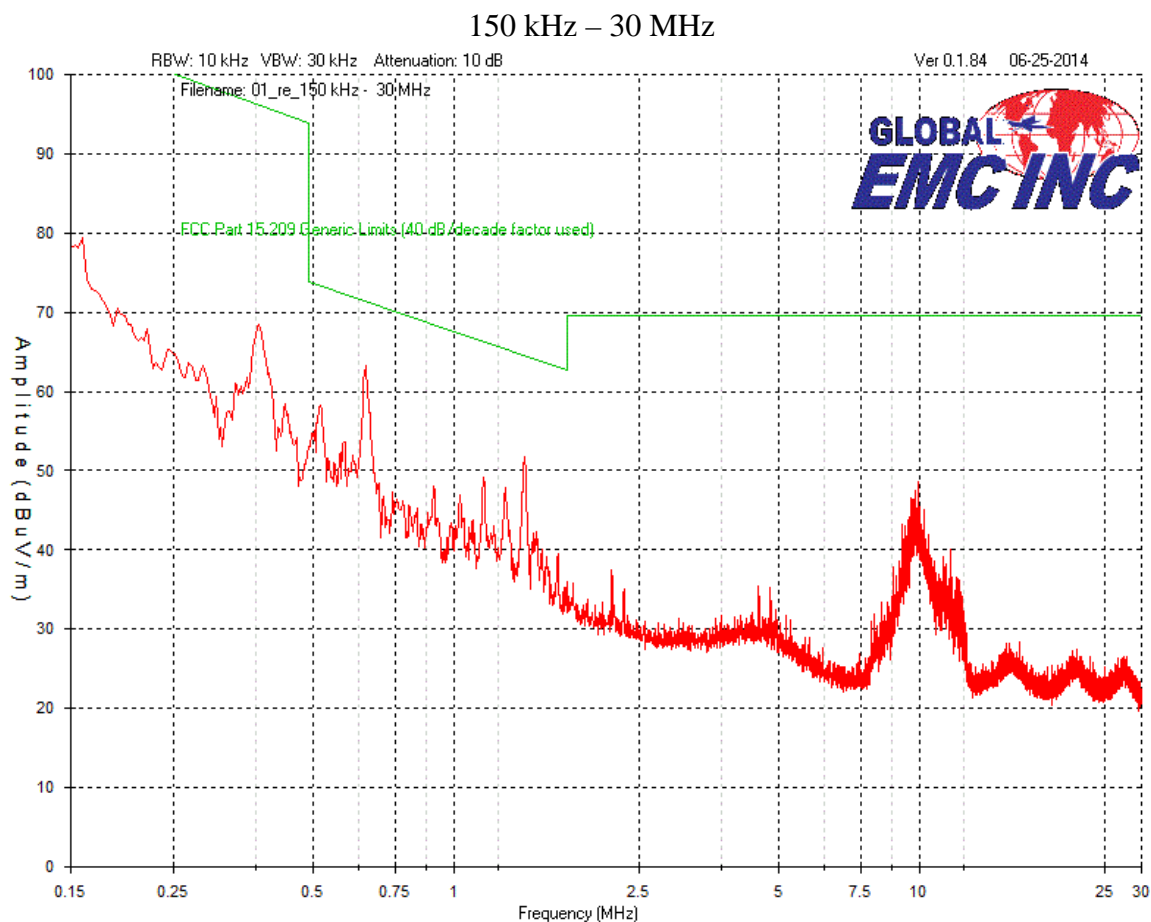
30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.


Low, middle and high channels were measured, each in three orthogonal axes were checked; however the worst case graphs are presented.

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

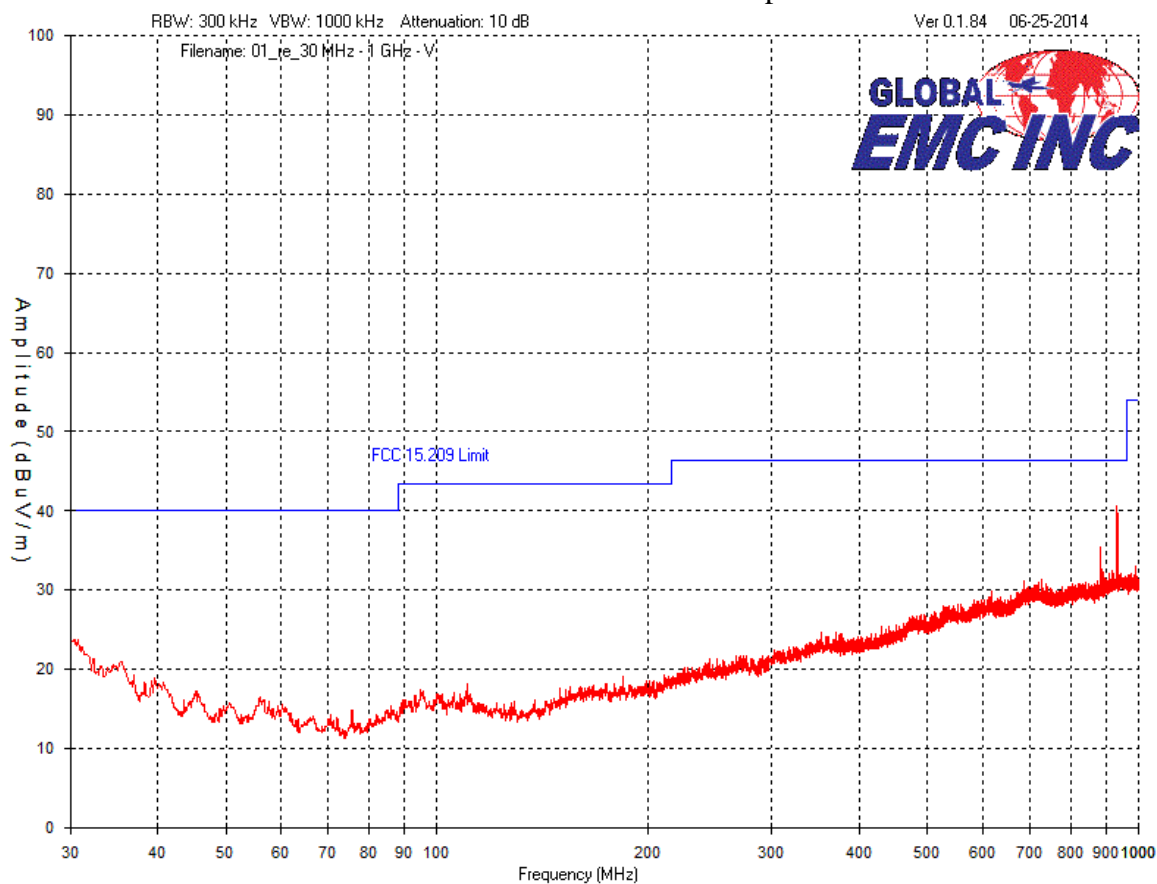



Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



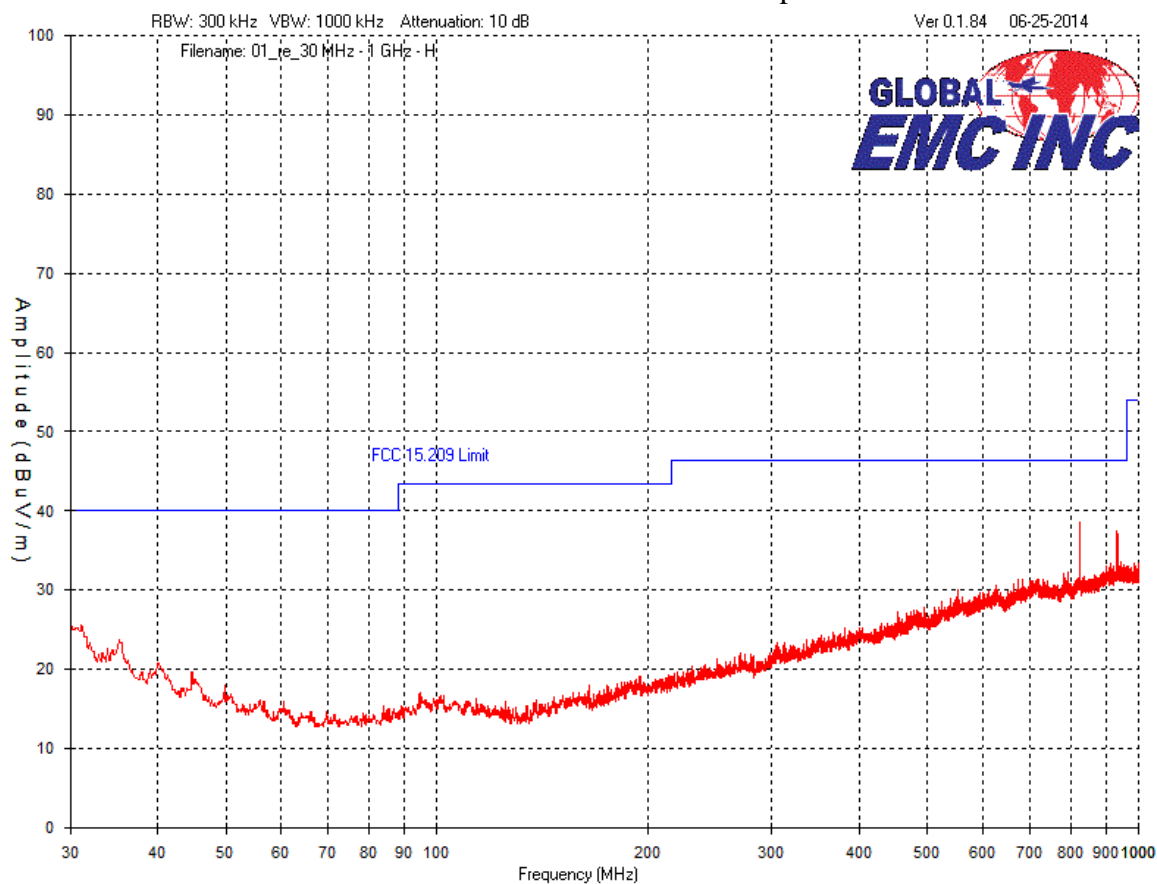
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


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



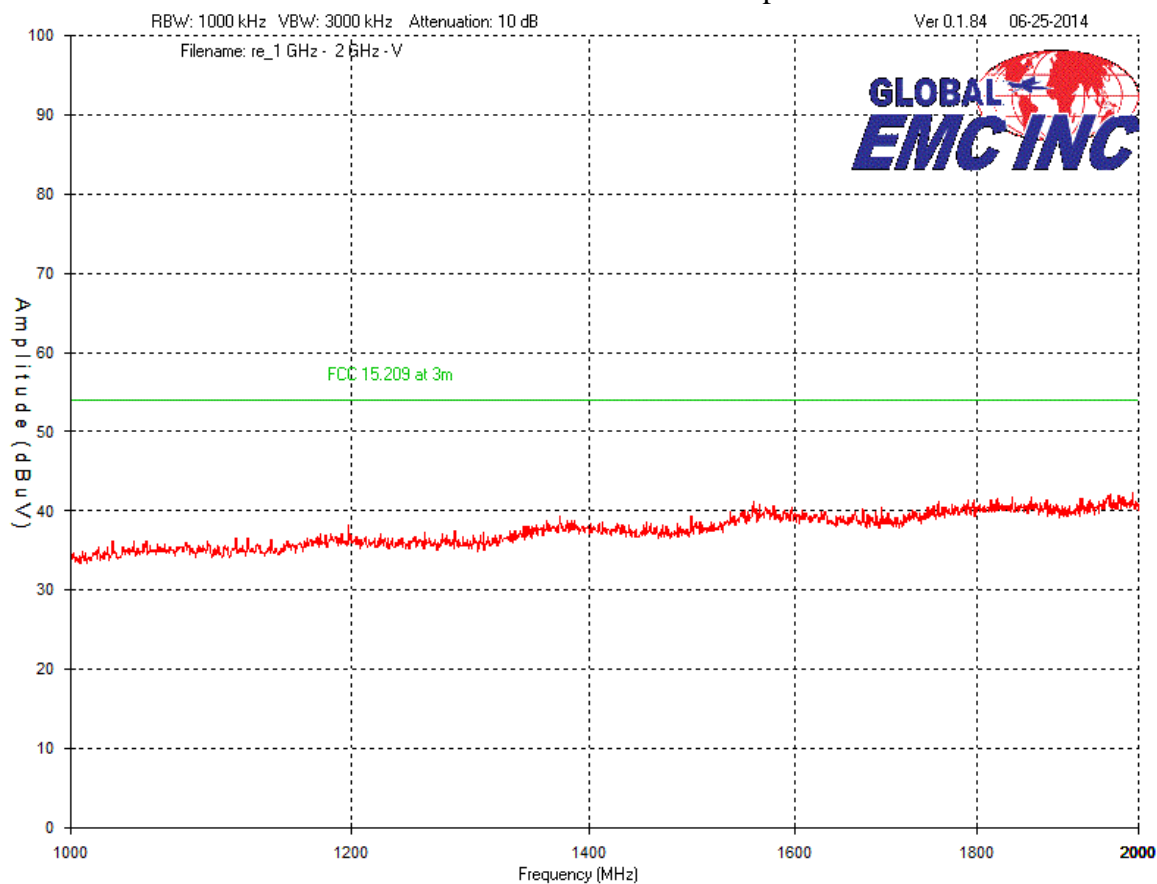
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


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



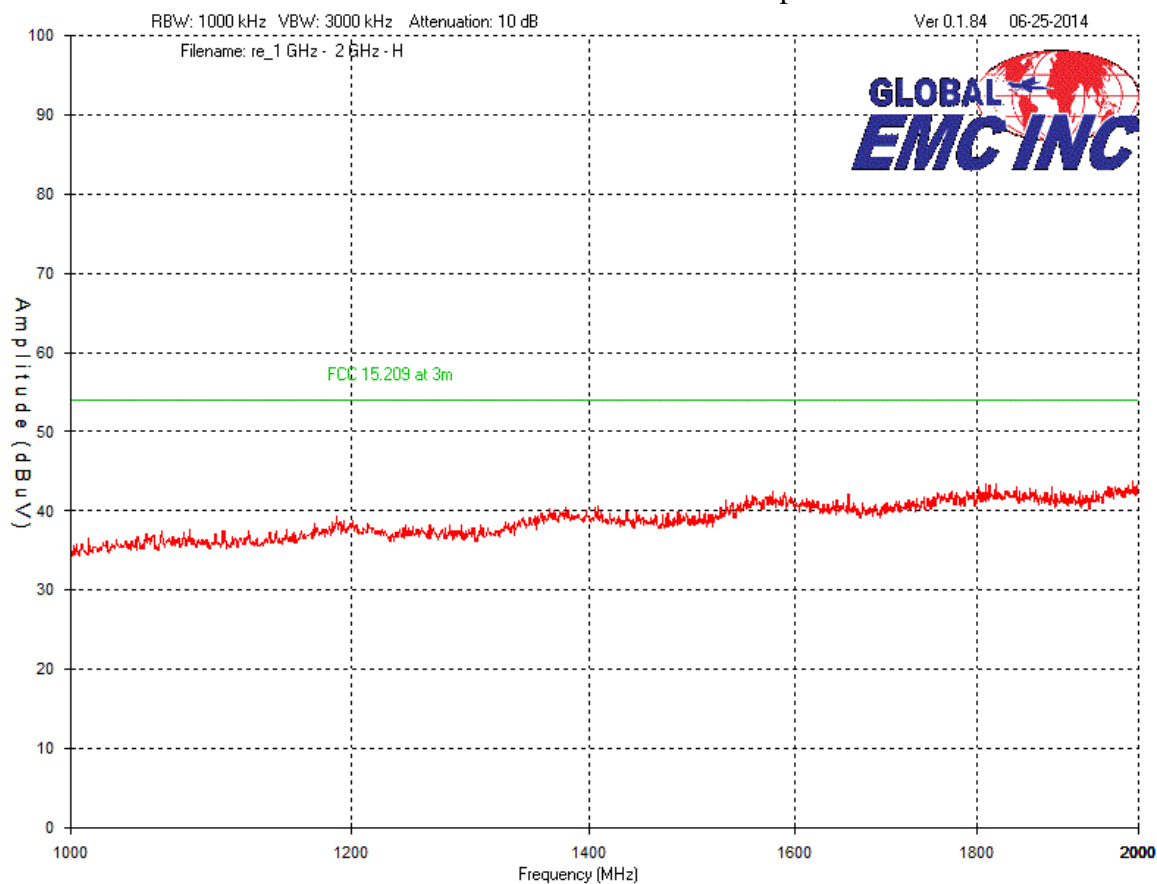
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


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



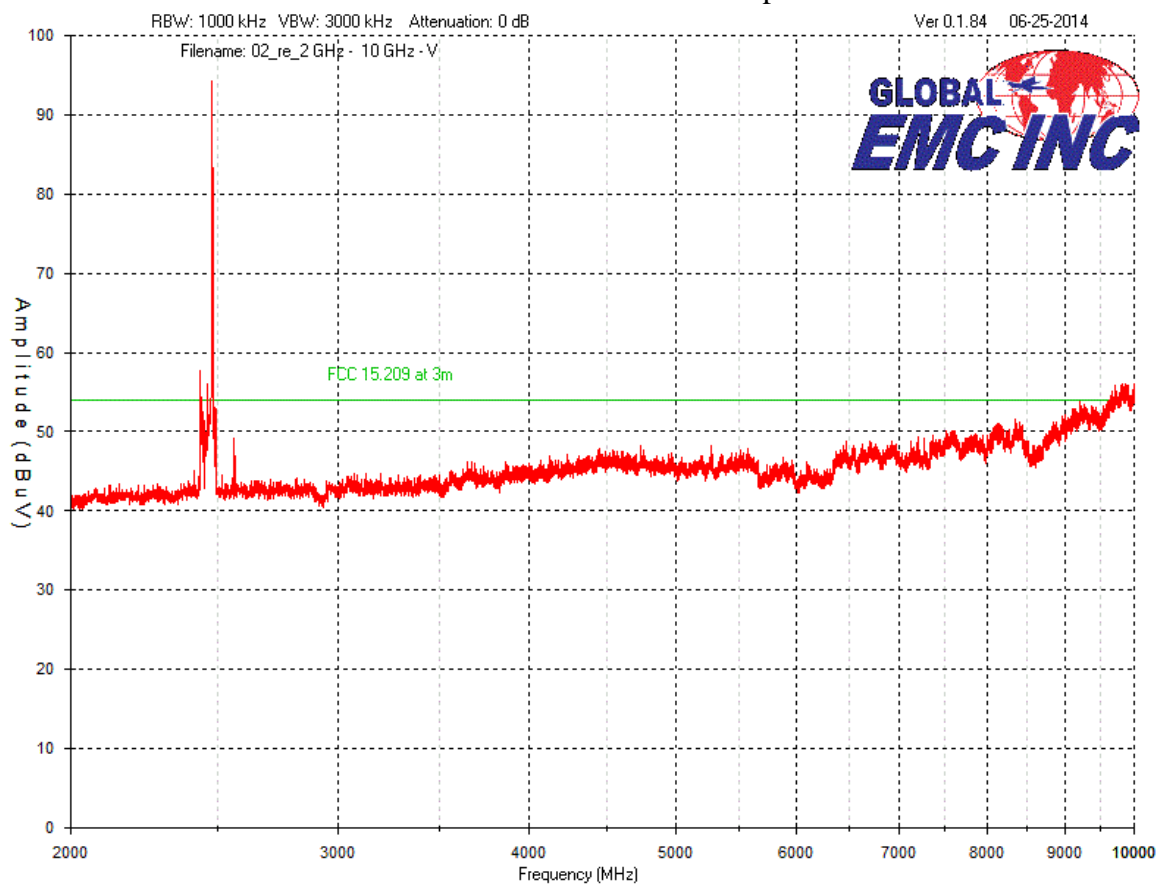
Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

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




Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

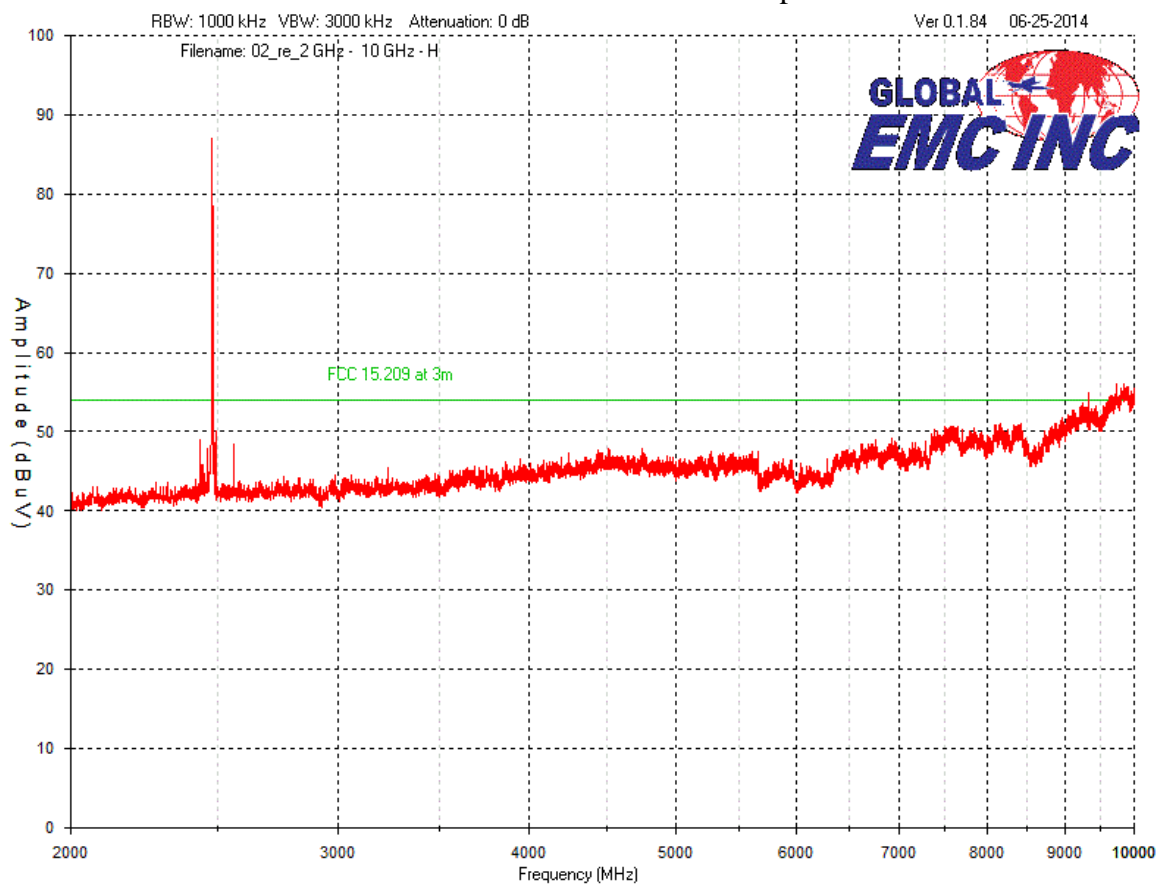
High Channel – 2 GHz – 10 GHz
Vertical - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 52 for measurements.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

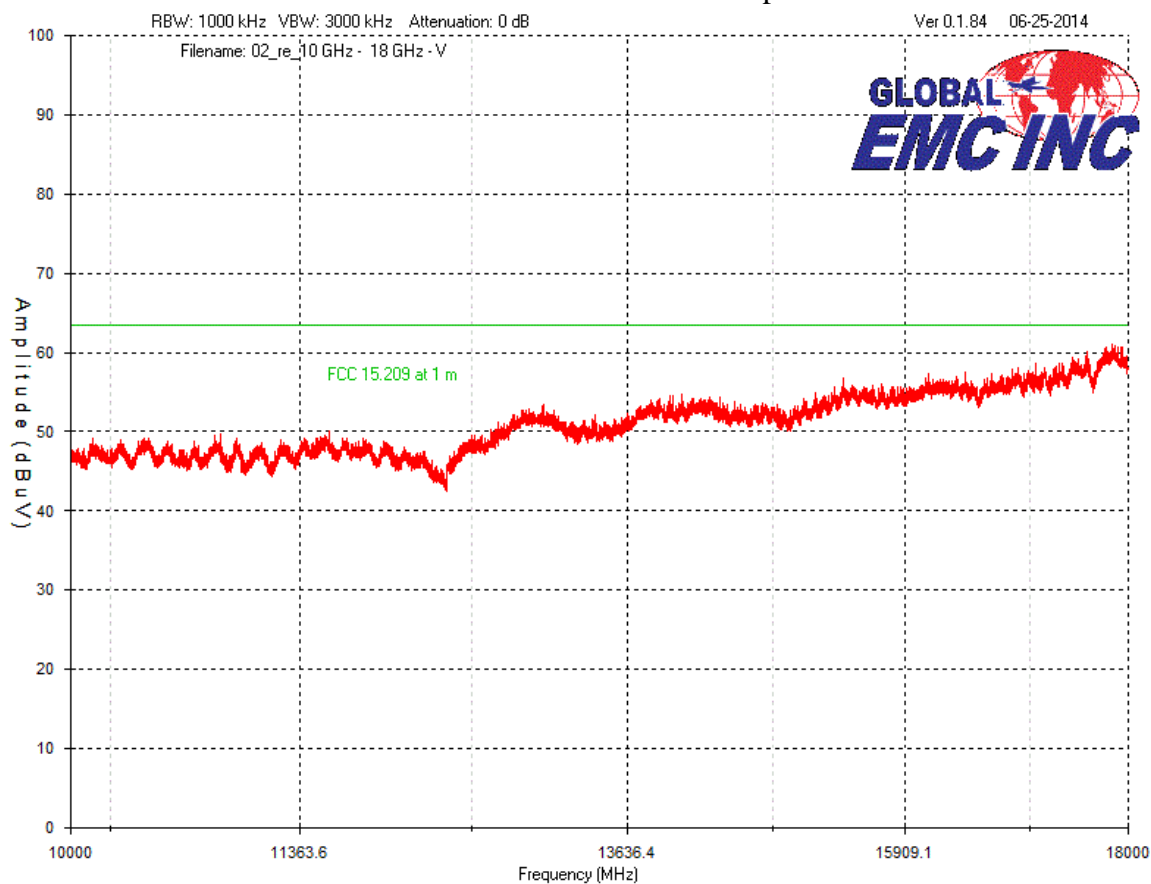
High Channel – 2 GHz – 10 GHz
Horizontal - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 52 for measurements.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

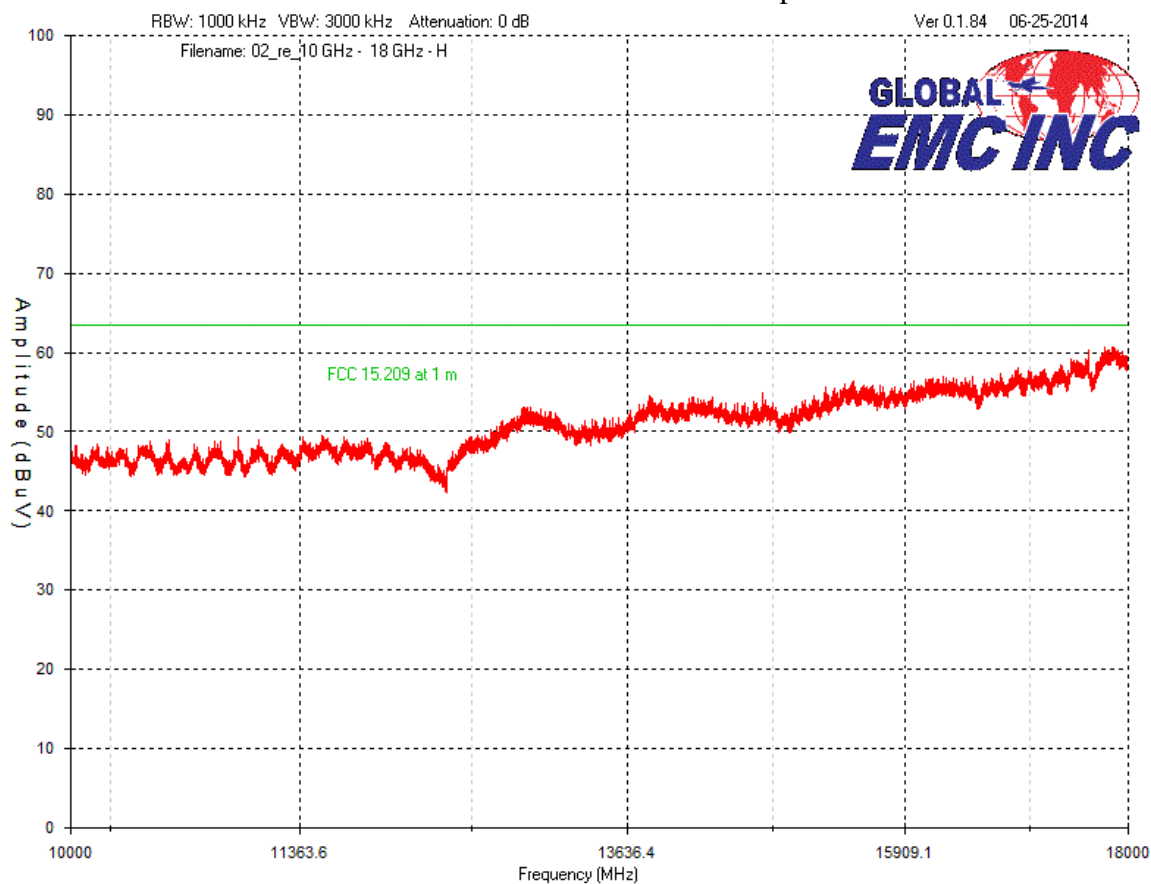
High Channel – 10 GHz – 18 GHz Vertical - Peak Emission Graph




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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

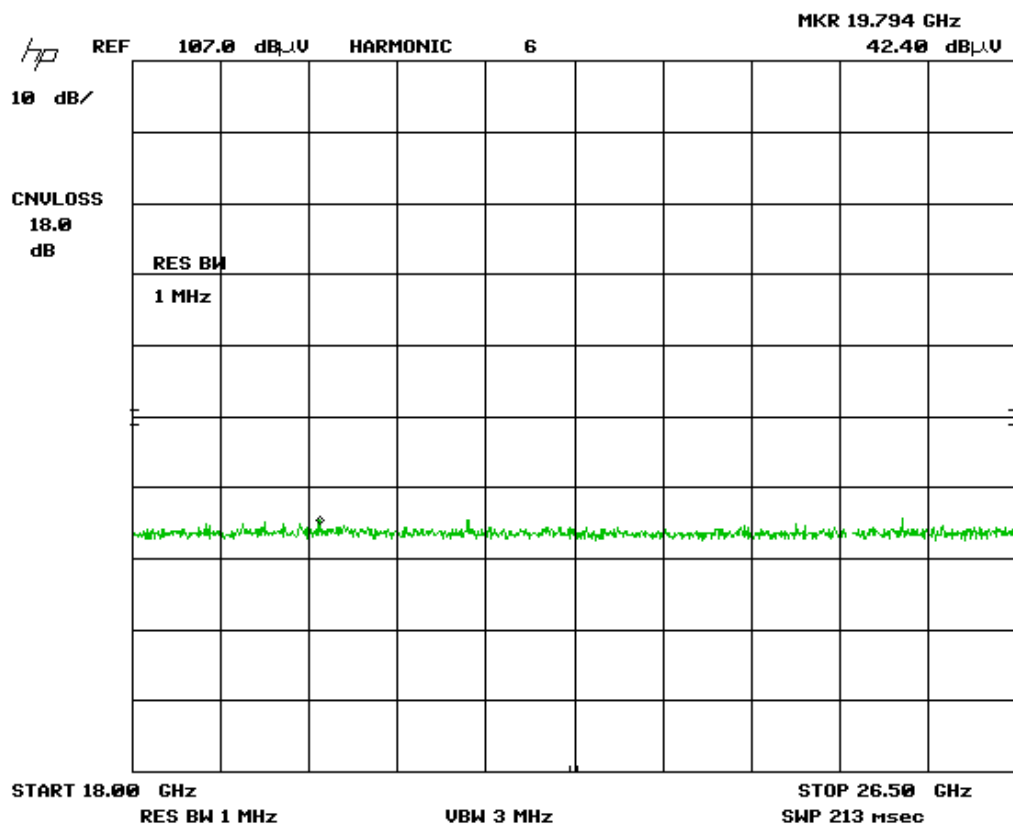
High Channel – 10 GHz – 18 GHz Horizontal - Peak Emission Graph




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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

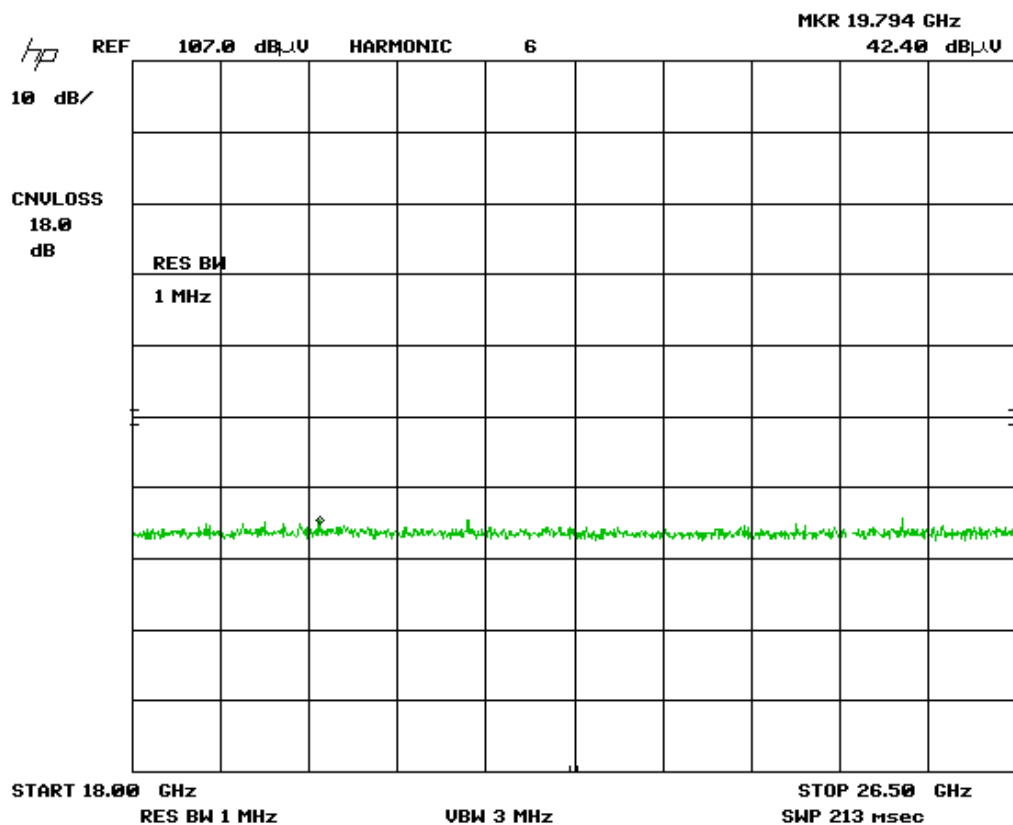
High Channel – 18 GHz – 26 GHz
Vertical - Peak Emission Graph




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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

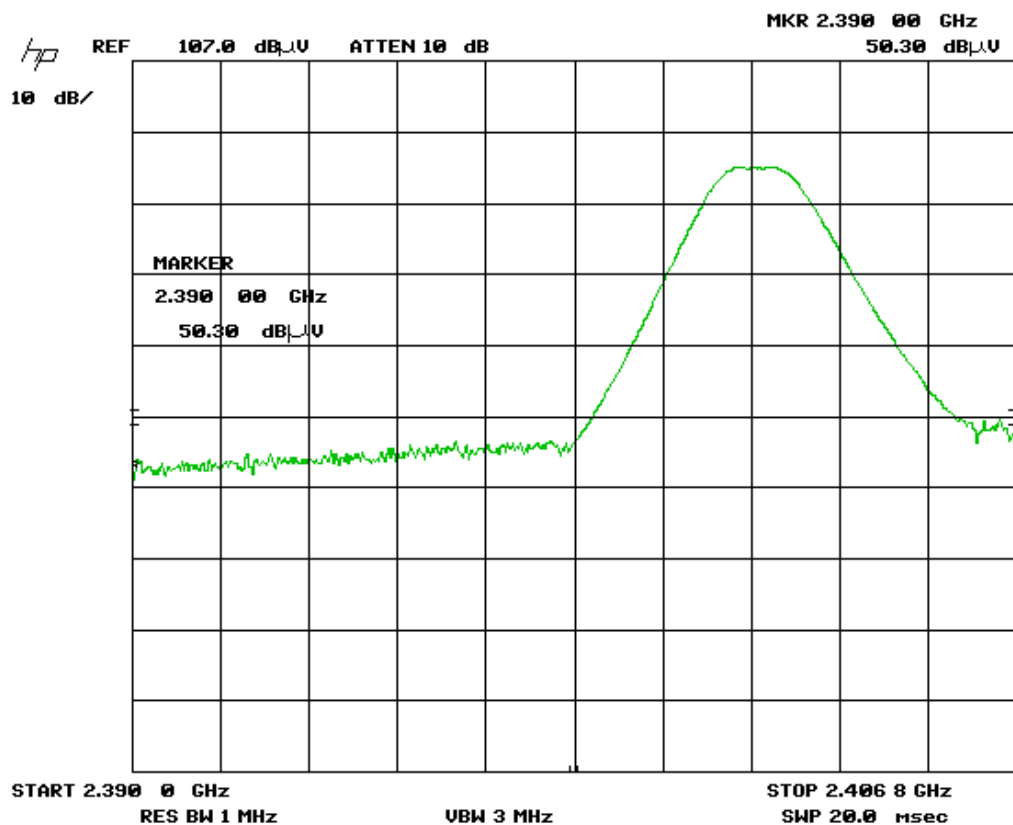
High Channel – 18 GHz – 26 GHz
Horizontal - Peak Emission Graph




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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

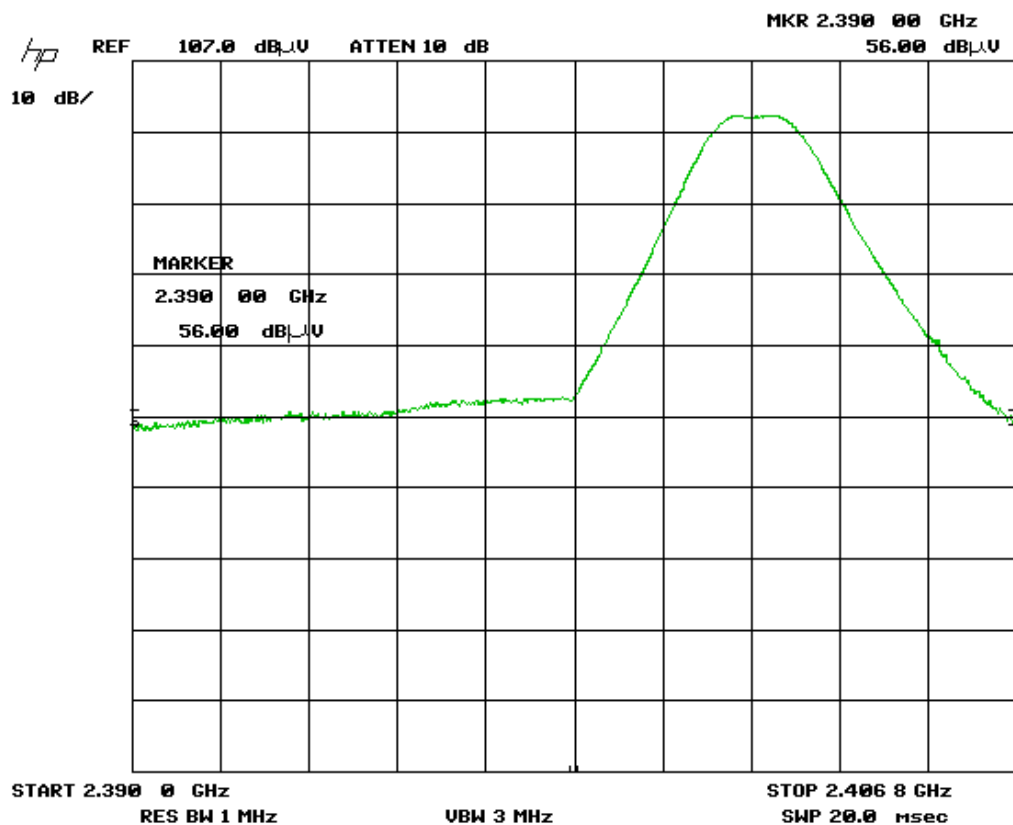
Band Edge – Low Channel
Vertical - Peak Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

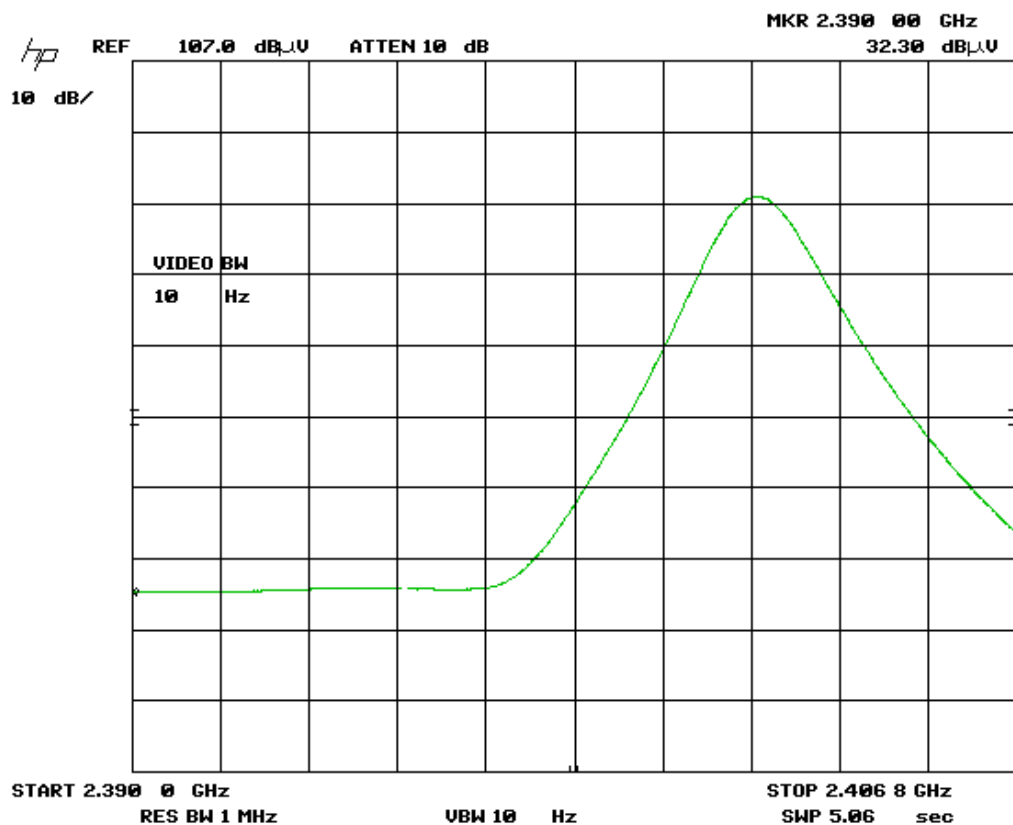
Band Edge – Low Channel
Horizontal - Peak Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

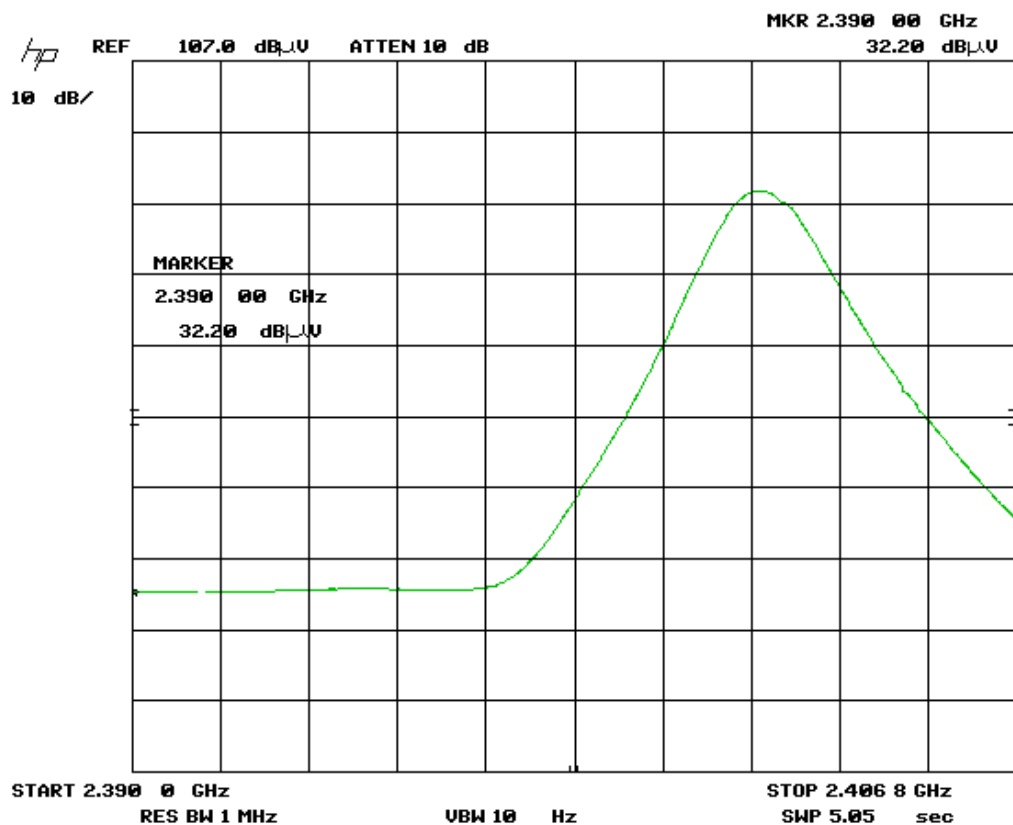
Band Edge – Low Channel
Vertical – Average Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

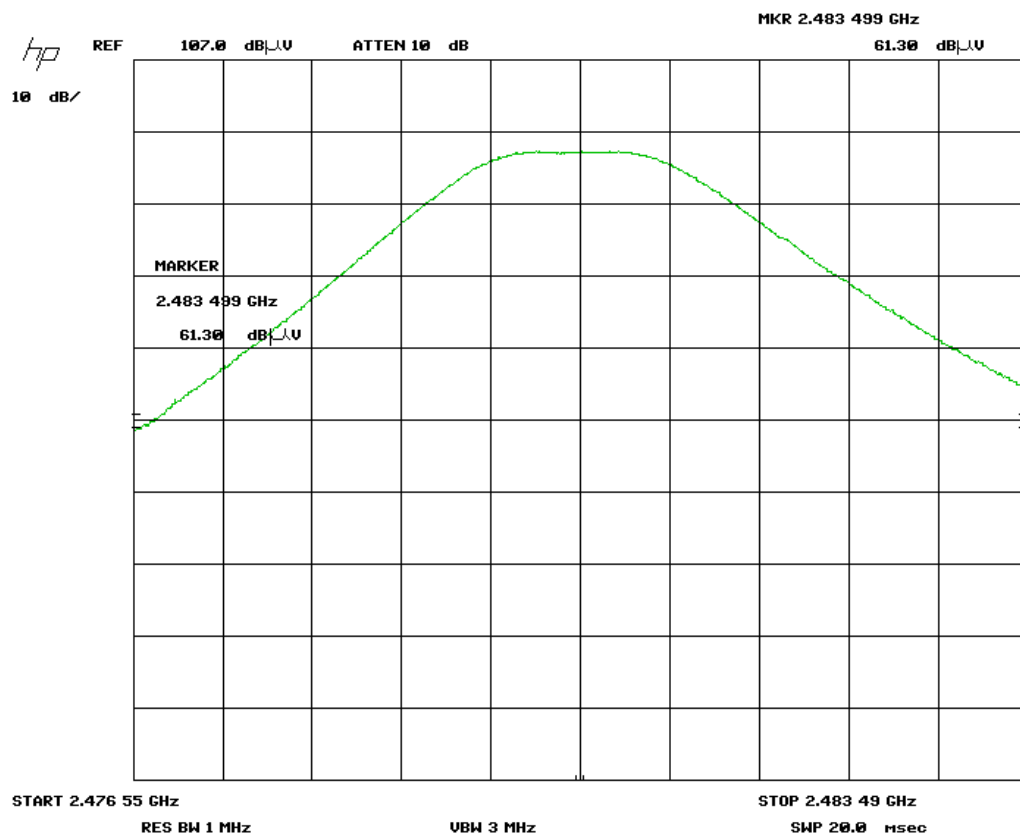
Band Edge – Low Channel
Horizontal - Average Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

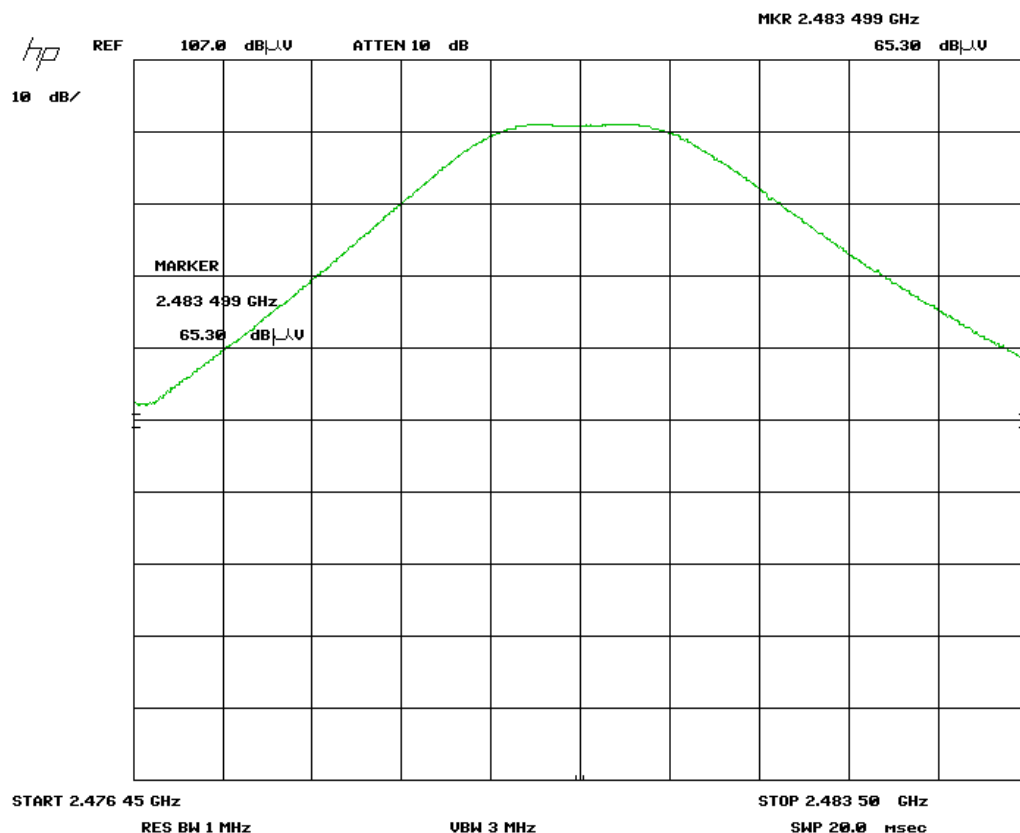
Band Edge – Hi Channel
Vertical - Peak Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

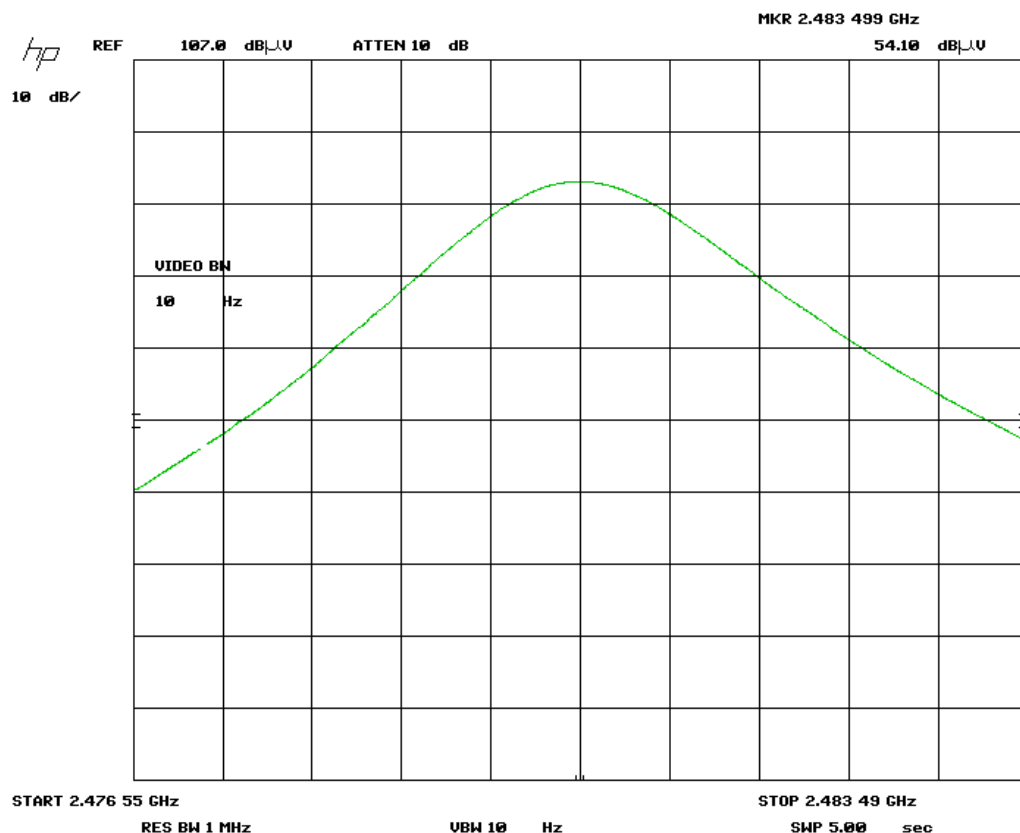
Band Edge – Hi Channel
Horizontal - Peak Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

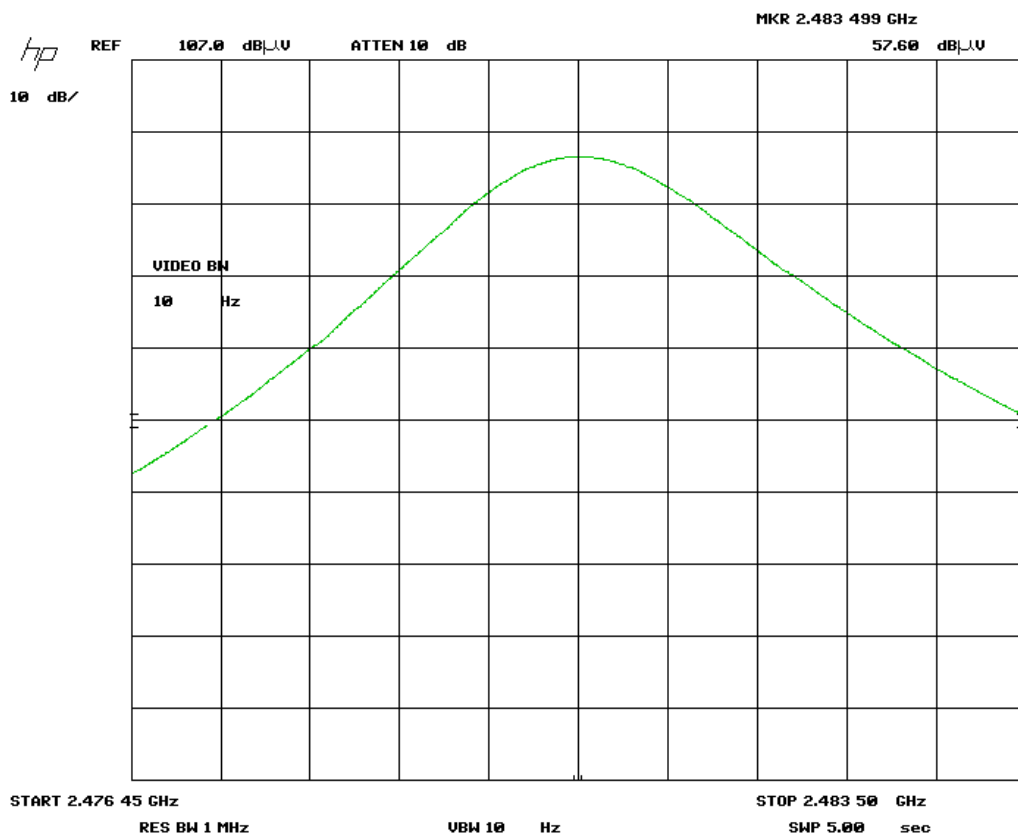
Band Edge – Hi Channel
Vertical - Average Emission




Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Band Edge – Hi Channel
Horizontal - Average Emission



Note: Bandedge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section for corrected values.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Final Measurements and Results

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


In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205, need to be verified with a final detector.

For frequency shown on the peak graphs and not listed in 15.205, measurements were taken for reference (these emissions were from the engineering control board used to set the WIFI device).


Emissions Table - Vertical									
Frequency (MHz)	Detector	Raw (dBUV)	Antenna Factor (dB/m)	Cable RE Factor (dB)	Pre-Amp (dB)	Level (dBUV/ m)	Limit (dB)	Margin (dB)	Pass /Fail
9859.67	AVG	36.01	40.1	9.4	-36.3	49.21	54	4.79	Pass
Emissions Table - Horizontal									
9739	AVG	36.1	40	9.3	-36.2	49.2	54	4.8	Pass

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Preselector	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Low Channel - X axis											
2402	Peak	Horz	99.4	30.6	5.4	0.0	36.2	99.2			PASS
2402	Avg	Horz	95.0	30.6	5.4	0.0	36.2	94.8			PASS
2402	Peak	Vert	92.2	30.7	5.4	0.0	36.2	92.1			PASS
2402	Avg	Vert	88.0	30.7	5.4	0.0	36.2	87.9			PASS
2390	Peak	Horz	56.0	30.6	5.4	0.0	36.2	55.8	74.0	18.2	PASS
2390	Avg	Horz	32.2	30.6	5.4	0.0	36.2	32.0	54.0	22.0	PASS
2390	Peak	Vert	50.3	30.7	5.4	0.0	36.2	50.2	74.0	23.8	PASS
2390	Avg	Vert	32.3	30.7	5.4	0.0	36.2	32.2	54.0	21.8	PASS
4804	Peak	Horz	46.7	33.4	7.7	0.0	35.7	52.1	74.0	21.9	PASS
4804	Avg	Horz	33.5	33.4	7.7	0.0	35.7	38.9	54.0	15.1	PASS
4804	Peak	Vert	45.3	33.4	7.7	0.0	35.7	50.7	74.0	23.3	PASS
4804	Avg	Vert	32.9	33.4	7.7	0.0	35.7	38.3	54.0	15.7	PASS
Low Channel Y - Axis											
2402	Peak	Horz	93.1	30.6	5.4	0.0	36.2	92.9			PASS
2402	Avg	Horz	88.8	30.6	5.4	0.0	36.2	88.6			PASS
2402	Peak	Vert	99.1	30.7	5.4	0.0	36.2	99.0			PASS
2402	Avg	Vert	94.6	30.7	5.4	0.0	36.2	94.5			PASS
2390	Peak	Horz	48.1	30.6	5.4	0.0	36.2	47.9	74.0	26.1	PASS
2390	Avg	Horz	32.2	30.6	5.4	0.0	36.2	32.0	54.0	22.0	PASS
2390	Peak	Vert	55.0	30.7	5.4	0.0	36.2	54.9	74.0	19.1	PASS
2390	Avg	Vert	32.4	30.7	5.4	0.0	36.2	32.3	54.0	21.7	PASS
4804	Peak	Horz	46.1	33.4	7.7	0.0	35.7	51.5	74.0	22.5	PASS
4804	Avg	Horz	32.9	33.4	7.7	0.0	35.7	38.3	54.0	15.7	PASS
4804	Peak	Vert	46.5	33.4	7.7	0.0	35.7	51.9	74.0	22.1	PASS
4804	Avg	Vert	34.3	33.4	7.7	0.0	35.7	39.7	54.0	14.3	PASS
7206	Peak	Vert	47.4	37.9	9.6	0.0	35.9	59.0	74.0	15.0	PASS
7206	Avg	Vert	34.4	37.9	9.6	0.0	35.9	46.0	54.0	8.0	PASS
7206	Peak	Horz	47.2	37.9	9.6	0.0	35.9	58.8	74.0	15.2	PASS
7206	Avg	Horz	34.5	37.9	9.6	0.0	35.9	46.1	54.0	7.9	PASS
Low Channel Z - Axis											
2402	Peak	Horz	97.6	30.6	5.4	0.0	36.2	97.4			PASS
2402	Avg	Horz	93.1	30.6	5.4	0.0	36.2	92.9			PASS
2402	Peak	Vert	95.2	30.7	5.4	0.0	36.2	95.1			PASS
2402	Avg	Vert	90.8	30.7	5.4	0.0	36.2	90.7			PASS
2390	Peak	Horz	54.7	30.6	5.4	0.0	36.2	54.5	74.0	19.5	PASS
2390	Avg	Horz	32.4	30.6	5.4	0.0	36.2	32.2	54.0	21.8	PASS
2390	Peak	Vert	51.1	30.7	5.4	0.0	36.2	51.0	74.0	23.0	PASS
2390	Avg	Vert	32.4	30.7	5.4	0.0	36.2	32.3	54.0	21.7	PASS
4804	Peak	Horz	46.3	33.4	7.7	0.0	35.7	51.7	74.0	22.3	PASS
4804	Avg	Horz	32.8	33.4	7.7	0.0	35.7	38.2	54.0	15.8	PASS
4804	Peak	Vert	46.2	33.4	7.7	0.0	35.7	51.6	74.0	22.4	PASS
4804	Avg	Vert	32.7	33.4	7.7	0.0	35.7	38.1	54.0	15.9	PASS
7206	Peak	Vert	47.4	37.9	9.6	0.0	35.9	59.0	74.0	15.0	PASS
7206	Avg	Vert	34.4	37.9	9.6	0.0	35.9	46.0	54.0	8.0	PASS
7206	Peak	Horz	47.5	37.9	9.6	0.0	35.9	59.1	74.0	14.9	PASS
7206	Avg	Horz	34.4	37.9	9.6	0.0	35.9	46.0	54.0	8.0	PASS


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

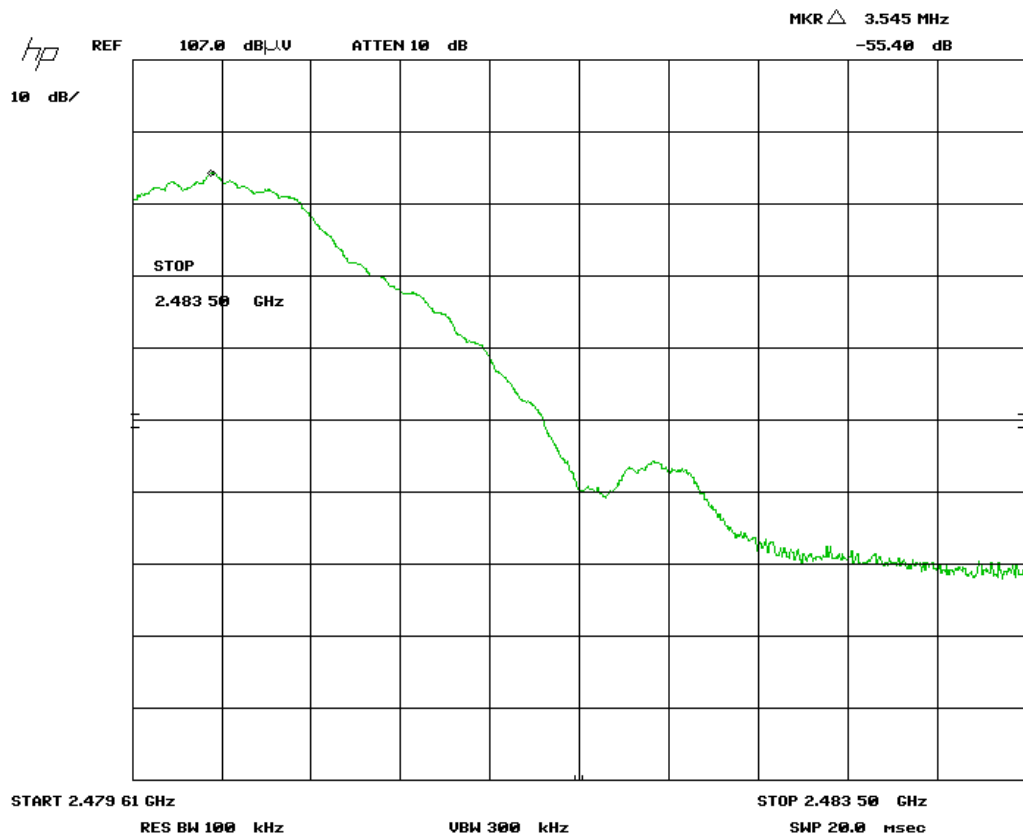
Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Preselector	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Mid channel X-Axis											
2440	Peak	Horz	97.5	30.6	5.4	0.0	36.2	97.3			PASS
2440	Avg	Horz	93.2	30.6	5.4	0.0	36.2	93.0			PASS
2440	Peak	Vert	93.7	30.7	5.4	0.0	36.2	93.6			PASS
2440	Avg	Vert	89.5	30.7	5.4	0.0	36.2	89.4			PASS
4880	Peak	Horz	46.1	33.4	7.7	0.0	35.7	51.5	74.0	22.5	PASS
4880	Avg	Horz	33.5	33.4	7.7	0.0	35.7	38.9	54.0	15.1	PASS
4880	Peak	Vert	44.7	33.4	7.7	0.0	35.7	50.1	74.0	23.9	PASS
4880	Avg	Vert	32.8	33.4	7.7	0.0	35.7	38.2	54.0	15.8	PASS
Mid channel Y-Axis											
2440	Peak	Horz	97.0	30.6	5.4	0.0	36.2	96.8			PASS
2440	Avg	Horz	92.7	30.6	5.4	0.0	36.2	92.5			PASS
2440	Peak	Vert	100.2	30.7	5.4	0.0	36.2	100.1			PASS
2440	Avg	Vert	95.6	30.7	5.4	0.0	36.2	95.5			PASS
4880	Peak	Horz	46.3	33.4	7.7	0.0	35.7	51.7	74.0	22.3	PASS
4880	Avg	Horz	33.2	33.4	7.7	0.0	35.7	38.6	54.0	15.4	PASS
4880	Peak	Vert	47.1	33.4	7.7	0.0	35.7	52.5	74.0	21.5	PASS
4880	Avg	Vert	35.2	33.4	7.7	0.0	35.7	40.6	54.0	13.4	PASS
7320	Peak	Vert	46.9	37.9	9.6	0.0	35.9	58.5	74.0	15.5	PASS
7320	Avg	Vert	34.3	37.9	9.6	0.0	35.9	45.9	54.0	8.1	PASS
7320	Peak	Horz	47.0	37.9	9.6	0.0	35.9	58.6	74.0	15.4	PASS
7320	Avg	Horz	34.2	37.9	9.6	0.0	35.9	45.8	54.0	8.2	PASS
Mid channel Z-Axis											
2440	Peak	Horz	97.3	30.6	5.4	0.0	36.2	97.1			PASS
2440	Avg	Horz	92.5	30.6	5.4	0.0	36.2	92.3			PASS
2440	Peak	Vert	97.6	30.7	5.4	0.0	36.2	97.5			PASS
2440	Avg	Vert	93.2	30.7	5.4	0.0	36.2	93.1			PASS
4880	Peak	Horz	45.4	33.4	7.7	0.0	35.7	50.8	74.0	23.2	PASS
4880	Avg	Horz	33.2	33.4	7.7	0.0	35.7	38.6	54.0	15.4	PASS
4880	Peak	Vert	46.3	33.4	7.7	0.0	35.7	51.7	74.0	22.3	PASS
4880	Avg	Vert	33.5	33.4	7.7	0.0	35.7	38.9	54.0	15.1	PASS

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Preselec	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
High channel - Horizontal (X)											
2480	Peak	Horz	98.2	30.8	5.4	0.0	36.2	98.2			PASS
2480	Avg	Horz	93.7	30.8	5.4	0.0	36.2	93.7			PASS
2480	Peak	Vert	94.4	30.9	5.4	0.0	36.2	94.5			PASS
2480	Avg	Vert	90.2	30.9	5.4	0.0	36.2	90.3			PASS
2483.5	Peak	Horz	38.7	30.8	5.4	0.0	36.2	38.7	74.0	35.3	PASS
2483.5	Avg	Horz	34.2	30.8	5.4	0.0	36.2	34.2	54.0	19.8	PASS
2483.5	Peak	Vert	35.9	30.9	5.4	0.0	36.2	36.0	74.0	38.0	PASS
2483.5	Avg	Vert	31.7	30.9	5.4	0.0	36.2	31.8	54.0	22.2	PASS
4960	Peak	Horz	48.9	33.5	4.3	0.0	35.7	51.0	74.0	23.0	PASS
4960	Avg	Horz	32.7	33.5	4.3	0.0	35.7	34.8	54.0	19.2	PASS
4960	Peak	Vert	45.4	33.5	4.3	0.0	35.7	47.5	74.0	26.5	PASS
4960	Avg	Vert	32.4	33.5	4.3	0.0	35.7	34.5	54.0	19.5	PASS
7440	Peak	Vert	45.9	38.6	7.1	0.0	35.9	55.7	74.0	18.3	PASS
7440	Avg	Vert	33.1	38.6	7.1	0.0	35.9	42.9	54.0	11.1	PASS
7440	Peak	Horz	46.4	38.6	7.1	0.0	35.9	56.2	74.0	17.8	PASS
7440	Avg	Horz	33.6	38.6	7.1	0.0	35.9	43.4	54.0	10.6	PASS
High channel - Vertical (Y)											
2480	Peak	Horz	92.0	30.8	5.4	0.0	36.2	92.0			PASS
2480	Avg	Horz	87.9	30.8	5.4	0.0	36.2	87.9			PASS
2480	Peak	Vert	95.7	30.9	5.4	0.0	36.2	95.8			PASS
2480	Avg	Vert	91.6	30.9	5.4	0.0	36.2	91.7			PASS
2483.5	Peak	Horz	36.6	30.8	5.4	0.0	36.2	36.6	74.0	37.4	PASS
2483.5	Avg	Horz	32.5	30.8	5.4	0.0	36.2	32.5	54.0	21.5	PASS
2483.5	Peak	Vert	37.7	30.9	5.4	0.0	36.2	37.8	74.0	36.2	PASS
2483.5	Avg	Vert	33.6	30.9	5.4	0.0	36.2	33.7	54.0	20.3	PASS
4960	Peak	Horz	46.8	33.5	7.7	0.0	35.7	52.3	74.0	21.7	PASS
4960	Avg	Horz	32.6	33.5	7.7	0.0	35.7	38.1	54.0	15.9	PASS
4960	Peak	Vert	45.9	33.5	7.7	0.0	35.7	51.4	74.0	22.6	PASS
4960	Avg	Vert	32.8	33.5	7.7	0.0	35.7	38.3	54.0	15.7	PASS
7440	Peak	Vert	46.6	38.6	9.6	0.0	35.9	58.9	74.0	15.1	PASS
7440	Avg	Vert	33.5	38.6	9.6	0.0	35.9	45.8	54.0	8.2	PASS
7440	Peak	Horz	46.2	38.6	9.6	0.0	35.9	58.5	74.0	15.5	PASS
7440	Avg	Horz	33.8	38.6	9.6	0.0	35.9	46.1	54.0	7.9	PASS
High channel - Z											
2480	Peak	Horz	97.2	30.8	5.4	0.0	36.2	97.2			PASS
2480	Avg	Horz	92.8	30.8	5.4	0.0	36.2	92.8			PASS
2480	Peak	Vert	94.7	30.9	5.4	0.0	36.2	94.8			PASS
2480	Avg	Vert	90.6	30.9	5.4	0.0	36.2	90.7			PASS
2483.5	Peak	Horz	38.3	30.8	5.4	0.0	36.2	38.3	74.0	35.7	PASS
2483.5	Avg	Horz	33.9	30.8	5.4	0.0	36.2	33.9	54.0	20.1	PASS
2483.5	Peak	Vert	35.6	30.9	5.4	0.0	36.2	35.7	74.0	38.3	PASS
2483.5	Avg	Vert	31.5	30.9	5.4	0.0	36.2	31.6	54.0	22.4	PASS

Note: Bandedge measurements were performed using the Marker Delta method.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	




Lowest Marker Delta value

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	GEMC169
Quasi Peak Adapter	85650A	HP	2013-01-23	2015-01-23	GEMC170
Spectrum Analyzer	ESL 6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GEMC 160
Loop Antenna	EM 6871	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
Attenuator 10 dB	8493B	Agilent	NCR	NCR	GEMC 133
4GHZ-12GHz High Pass filter	11SH10-4000/T12000-0/0	K & L Microwave	NCR	NCR	GEMC 119
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/29/2012	8/29/2014	GEMC 6403
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/23/2012	8/23/2014	GEMC 6365
Q-Par Horn Antenna (2 to 18 GHz Freq.)	WBH218HN	Q-par	1/23/2014	1/23/2016	GEMC 6375
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	8/27/2012	8/27/2014	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	28-Jan-14	28-Jan-16	GEMC 158
1-26G pre-amp	HP 8449B	HP	8/22/2012	8/22/2014	GEMC 6351
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Power Spectral Density – 15.247 DM

Purpose

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

Limits and Methods

The limits are defined in 15.247(e).

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


The method is given in Section 9.1.3 of FCC KDB 558074: April 9, 2013.

Results

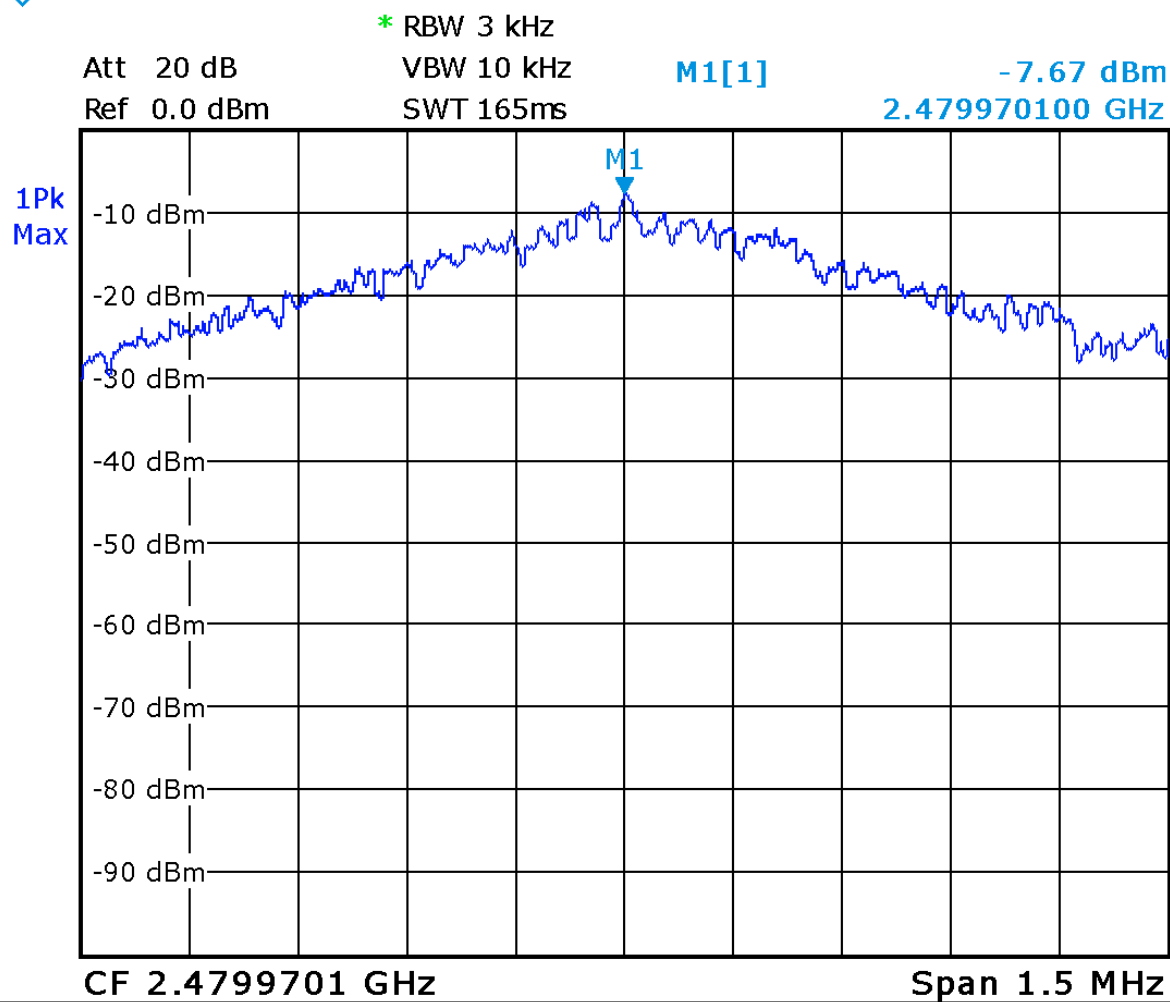
The EUT passed. Low, medium, and high band was tested. The maximum power spectral density is -7.67 dBm/3 kHz

Graph(s)


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.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

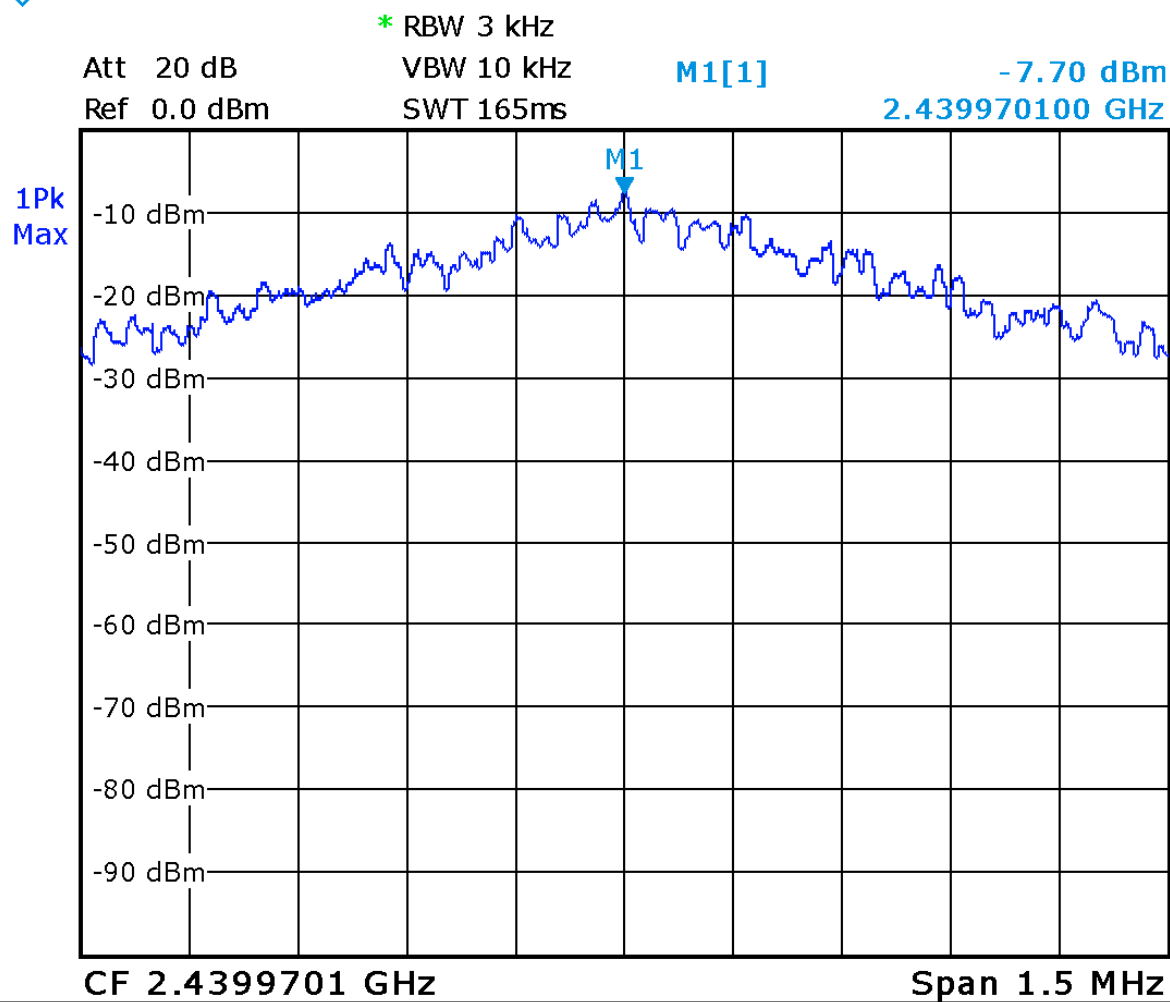
High Channel




Date: 4.JUL.2014 15:30:29

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

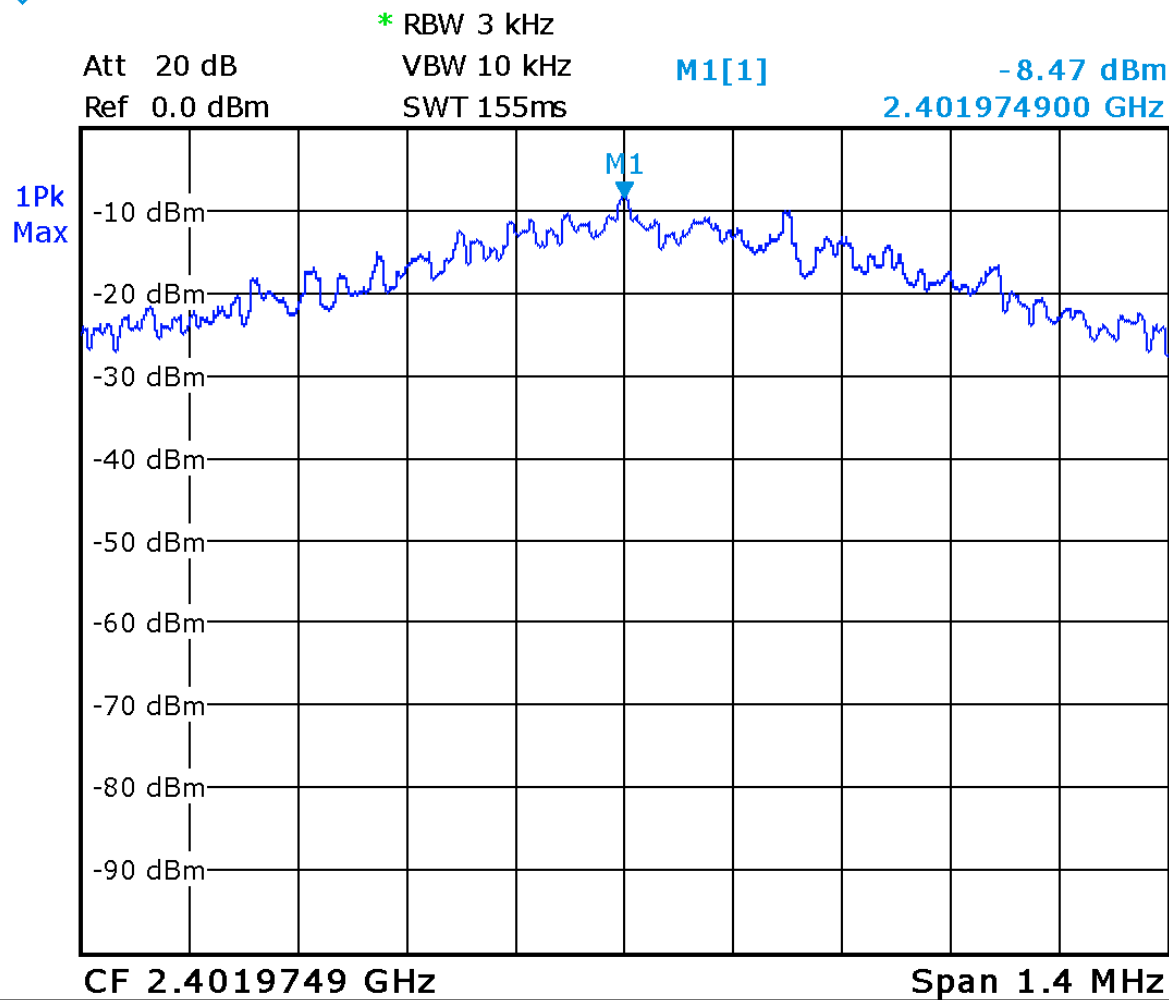
Mid Channel



Date: 4.JUL.2014 15:27:39


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Low Channel



Date: 4.JUL.2014 15:14:56


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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GMEC 160
RF Cable 9"	8120-5148-B	HP/Agilent	NCR	NCR	GEMC 6100

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Maximum Permissible Exposure – 15.247

Purpose

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

Limit(s) and Method

The limits, as defined in FCC 15.247(i) and FCC 1.1310 Table 1 (B) limits for general public exposure was applied. The limit for the frequency range of 1.5 GHz to 100 GHz was applied to the 15.247 device. This is a limit of 1.0 mW/cm^2 . The distance used for calculations was 0.5 cm, as this is the minimum distance an operator will be from the EUT during normal operation, as stated by the manufacturer.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Results

The EUT passed the requirements. The worst case calculated power density was 0.88 mW/cm^2 , this is under the 1.0 mW/cm^2 requirement.

Calculations

Method 1 (conducted power)

Internal antenna

$$P_d = (P_t * G) / (4 * \pi * R^2)$$

Where $P_t = 3.92 \text{ dBm}$ or 2.47 mW as per Peak power conducted output


Where $G = 0.5 \text{ dBi}$, or numerically 1.12

Where $R = 0.5 \text{ cm}$

$$P_d = (2.47 \text{ mW} * 1.12) / (4 * \pi * 0.5 \text{ cm}^2)$$

$$P_d = 2.77 \text{ mW} / 3.14 \text{ cm}^2$$

$$P_d = 0.88 \text{ mW/cm}^2$$

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

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 & Method

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


Method is as defined in ANSI C64.10:2009

Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

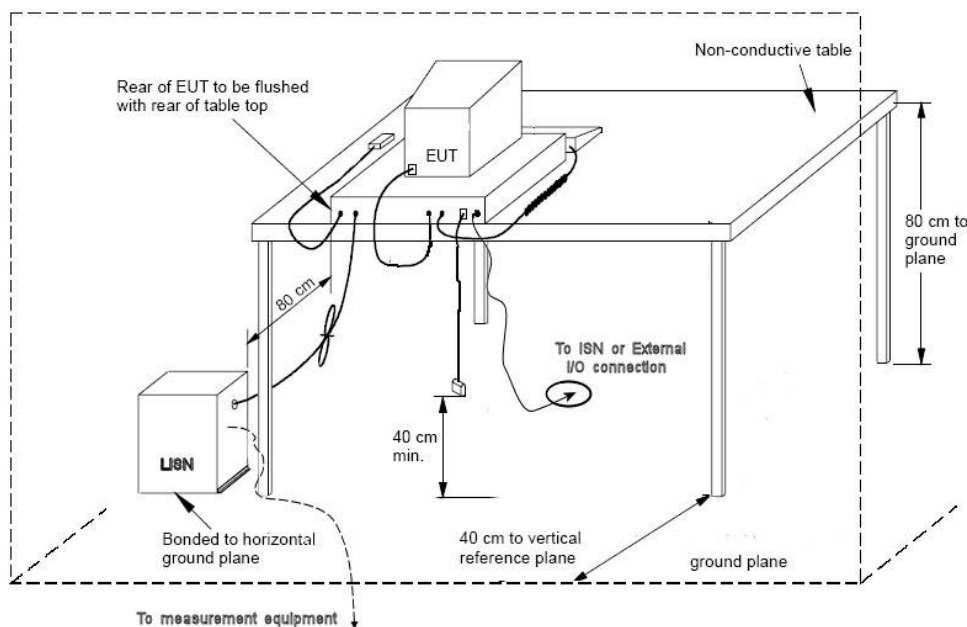
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Typical Setup Diagram




Measurement Uncertainty

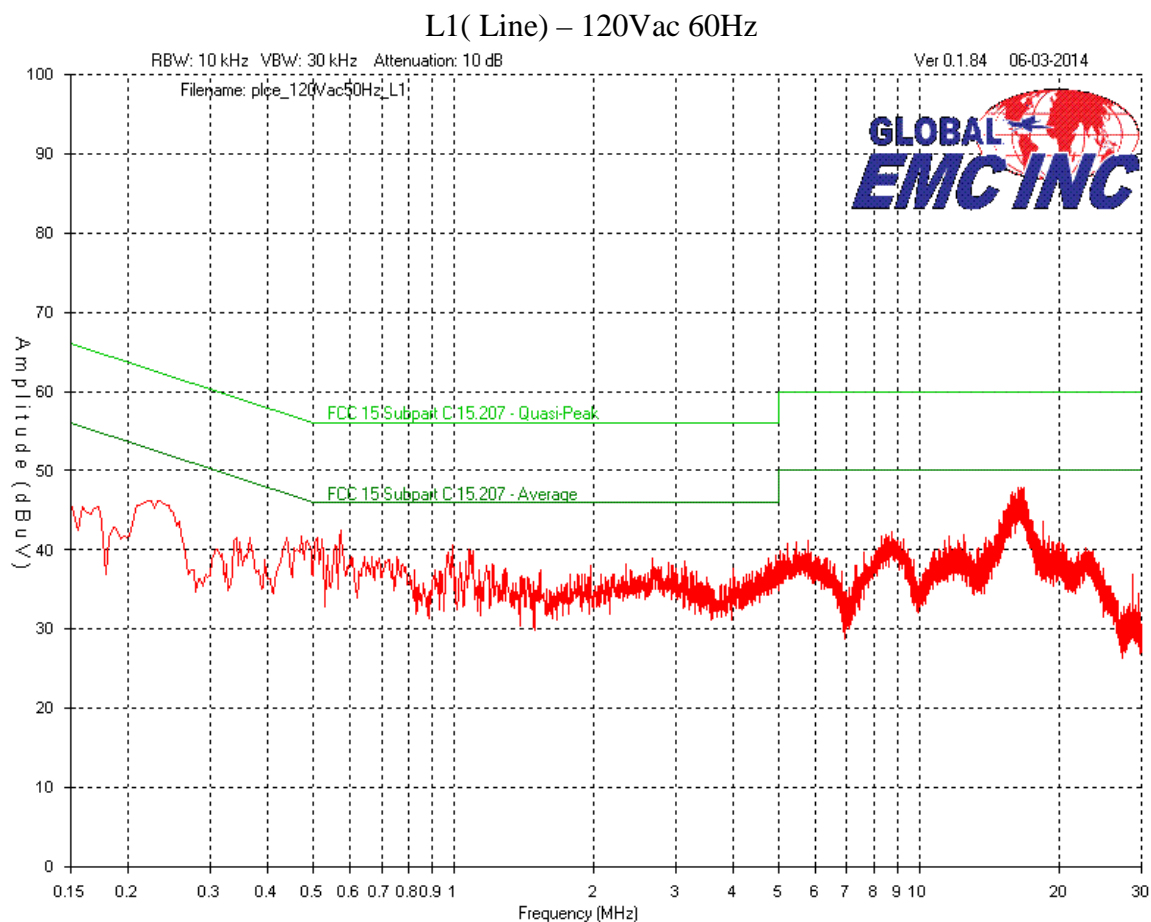
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ± 3.6 dB with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graph shown below is a peak measurement graph, measured with a resolution bandwidth greater than or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

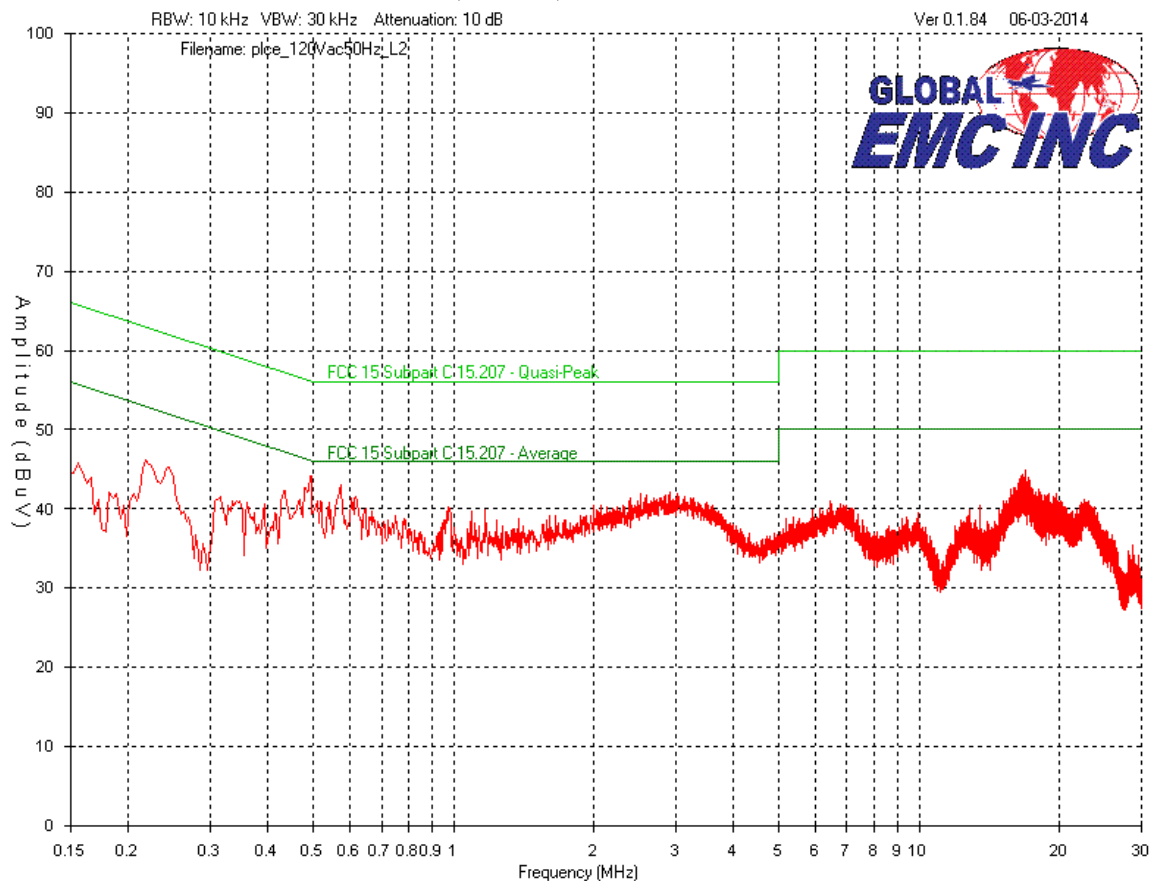
Power line conducted emissions were performed with the device in charging mode.


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

L2 (Neutral) – 120Vac 60Hz




Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Final Measurements

Product Category		Class B					
Product		Myo Armband					
Supply		120 VAC 60 Hz					
L1(Line) Emission Table							
Frequency (MHz)	Detector	Raw (dBuV)	Factors	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
16.2917	Peak	37.5	10.3	47.8	50	2.2	Pass
0.5718	Peak	32.3	10.2	42.5	46	3.5	Pass
0.4712	Peak	31.5	10.2	41.7	46.5	4.8	Pass
0.9968	Peak	30.5	10.2	40.7	46	5.3	Pass
1.078	Peak	29.8	10.2	40	46	6	Pass
0.2344	Peak	36.1	10.2	46.3	52.3	6	Pass
L2 (Neutral) Emission Table							
0.4939	Peak	34	10.2	44.2	46.1	1.9	Pass
0.5718	Peak	32.8	10.2	43	46	3	Pass
2.9079	Peak	31.9	10.2	42.1	46	3.9	Pass
16.8757	Peak	34.6	10.3	44.9	50	5.1	Pass
0.9709	Peak	30.1	10.2	40.3	46	5.7	Pass
1.172	Peak	29.7	10.2	39.9	46	6.1	Pass

Notes:


1. No peak emissions exceeded power line conducted emission average limits; therefore, the unit was deemed to meet power line conducted emission requirements base on peak emissions.
2. See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up for the highest line conducted emission

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	15-Nov-13	15-Nov-15	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	2013-02-06	2015-02-06	GEMC 65
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28

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

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


Appendix A – EUT Summary

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

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


General EUT Description

Client Details	
Organization / Address	Thalmic Labs, Inc. 24 Charles St. W., Kitchener, ON
Contact	Zack MacLennan
Phone	1-226-868-9740
Email	zack.maclennan@thalmic.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Myo Armband
EUT Model / SN (if known)	N/A
EUT revision	New product Rev. D
Equipment category	Consumer device
EUT is powered using	Battery 3.7V Nominal
Input voltage range(s) (V)	5.0V (Charging)
Frequency range(s) (Hz)	N/A
Rated input current (A)	~450mA (Charging)
Nominal power consumption (W)	~100mW
Number of power supplies in EUT	2
Transmits RF energy? (describe)	Yes 2.4GHz Bluetooth LE
Basic EUT functionality description	It is a wireless electronic wearable armband that is placed on the forearm. While connected to a device (laptop, phone, tablet, etc) over Bluetooth, using proprietary sensors it can detect electrical impulses generated by the muscles in your forearm. It can use these signals to determine which poses or gestures you are making with your hand / arm
High level block diagram of EUT (attachment)	See attached
Modes of operation	<p>The device is only useable when on your arm and connected to a device using its Bluetooth low energy radio</p> <p>The device is only meant to be charged while it is off your arm</p>
Step by step instructions for	See attached manual

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

setup and operation	
Customer to setup EUT on site?	Yes
EUT response time (ms)	$\leq 0.5\text{ms}$
EUT setup time (min)	~1min
Frequency of all clocks present in EUT	32MHz and 120MHz
I/O cable description Specify length and type	N/A
Available connectors on EUT	microUSB
Peripherals required to exercise EUT Ex. Signal generator	None
Dimensions of product	L 82mm W 51mm H 76mm
Method of monitoring EUT and description of failure for immunity.	Using software provided by Thalmic Labs, we can monitor the signals that are detected by the sensors on the Myo armband. During radiated immunity, if the device fails, the Myo device will no longer be transmitting data to the test PC.
Other notes to test lab (URL to product, etc).	Bluetooth antenna is 5.00mm away from skin, but transmit power is 0dBm (~1.0mW) so SAR should not be required

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	


EUT Configuration

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


- Wireless were configured to transmit at 100% duty cycle

Operational Setup

No devices are required to be attached to the EUT for its normal operation.

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Appendix B – EUT and Test Setup Photographs

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

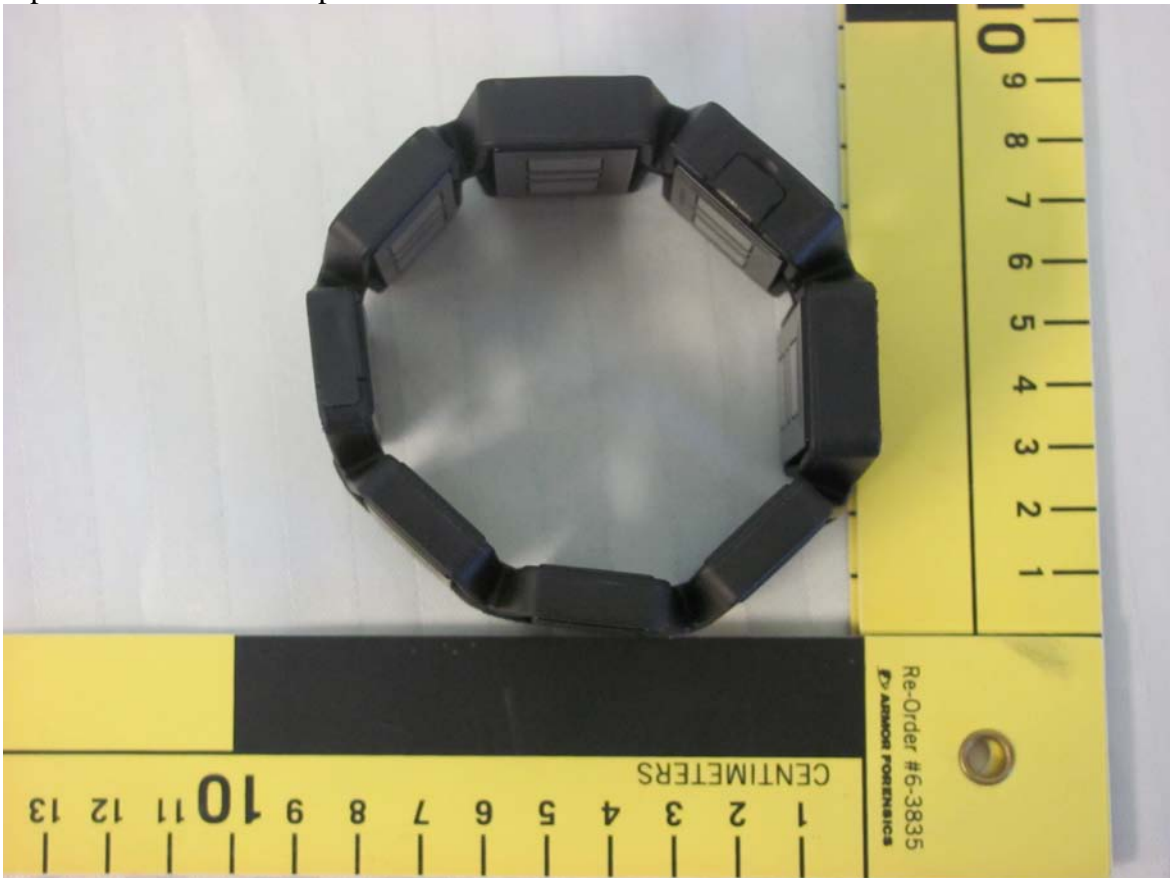


Illustration 1: EUT external top view


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	




Illustration 2: EUT external side view

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



Illustration 3: Radiated emission setup – photo 1

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

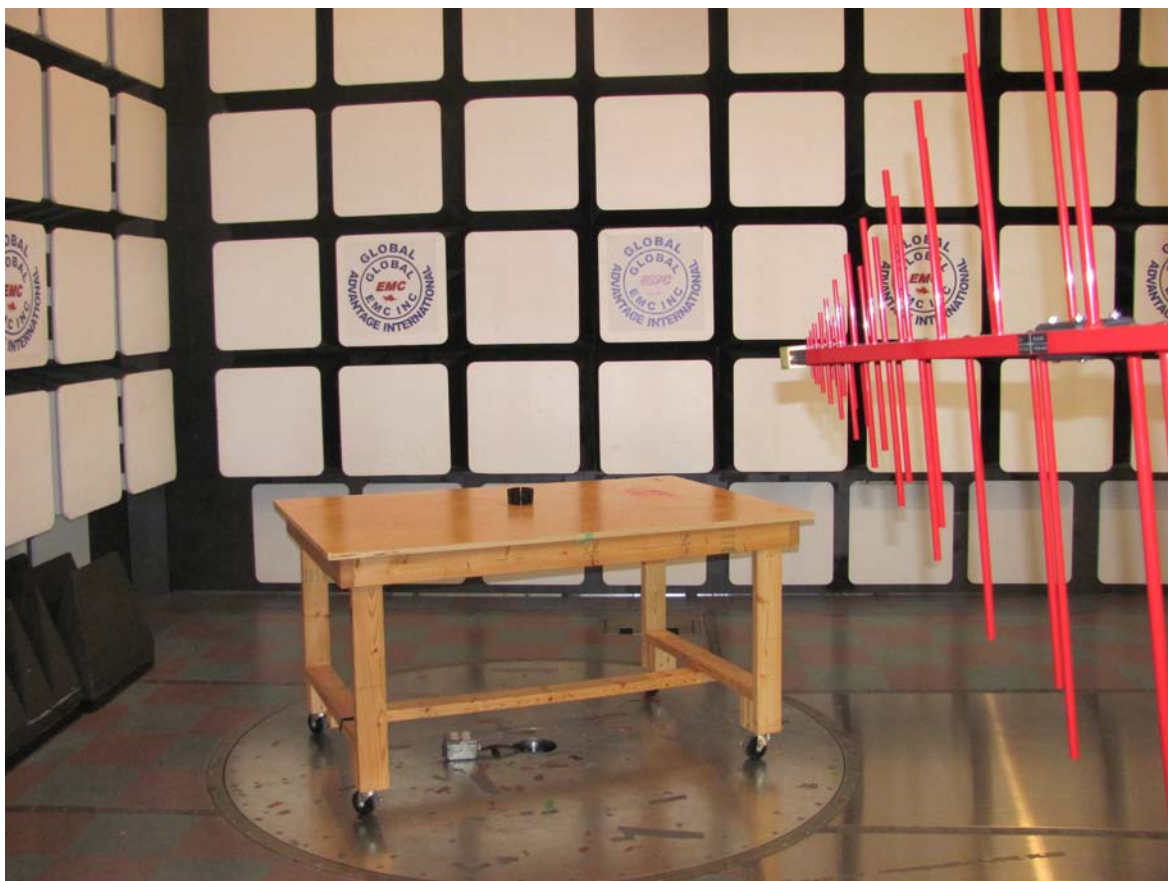


Illustration 4: Radiated emission setup - photo 2



Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



Illustration 5: Radiated setup - photo 3

Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	

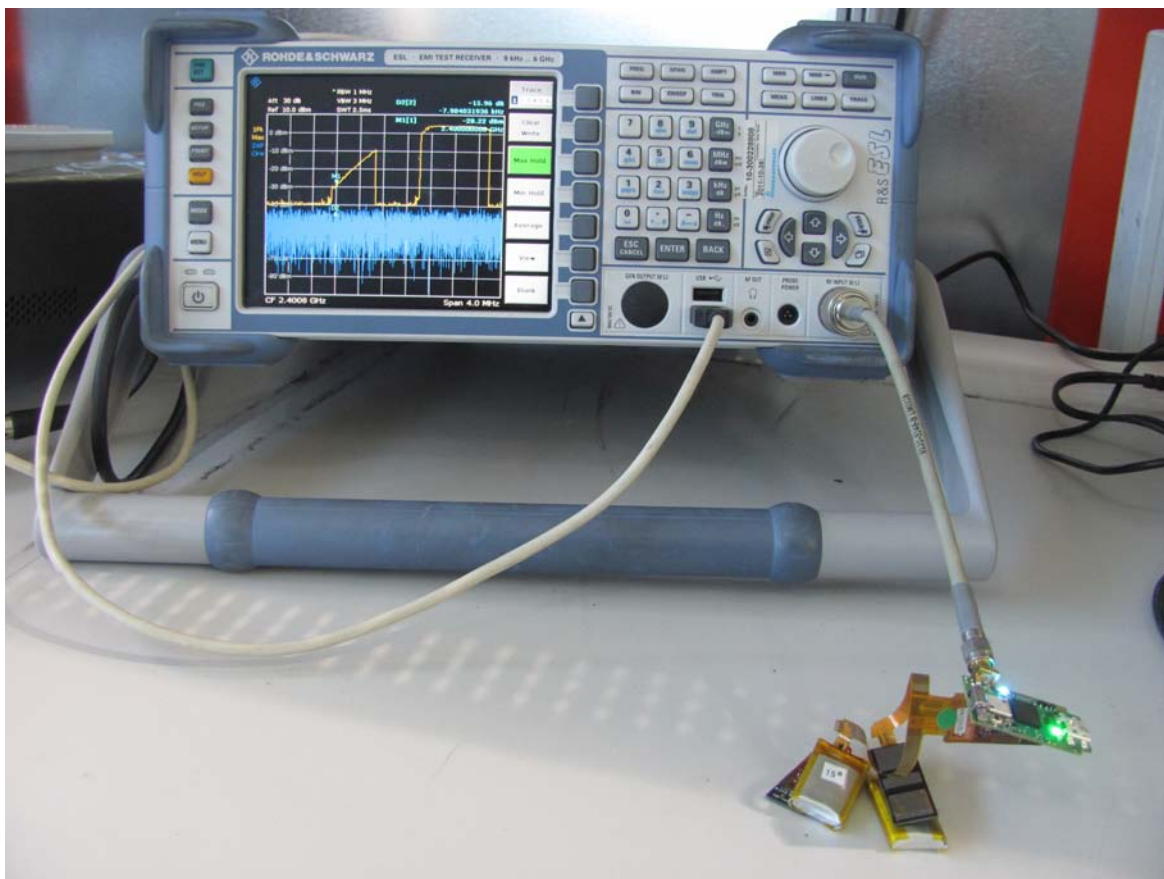


Illustration 6: Antenna conducted emission setup


Client	Thalmic Labs Inc	
Product	Myo Armband	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014	



Illustration 7: Power line conducted emission setup – photo 1