FCC and Industry Canada Testing of the Laerdal Medical AS Newborn Heart Rate Meter. Model: NeoBeat In accordance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN

Product Service

Choose certainty.
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Prepared for: Laerdal Medical AS
P.O.Box 377, Tanke Svilandsgate 30
NO-4002 Stavanger
Norway

FCC ID: QHQ-20-09917
IC: 20263-2009917

COMMERCIAL-IN-CONFIDENCE

Date: 2018-07-12
Document Number: TR-11437-04760-03 | Issue: 03

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Matthias Stumpe	2018-11-08	
Authorized Signatory	Markus Biberger	2018-11-08	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Matthias Stumpe	2018-11-08	

Laboratory Accreditation	Laboratory recognition	Industry Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02	Registration No. BNetzA-CAB-16/21-15	3050A-2

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11).

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1)
DL-InfoV (Germany) at
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Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2018-01-22
2	RF Exposure Assessment (SAR Exemption report) added. IC ID "20263-2009917" added to report HVIN and PMN for Neo Beat and Neo Beat Mini added to report	2018-10-24
3	HVIN corrected and 99%BW added	2018-11-08

Table 1

1.2 Introduction

Applicant		Laerdal Medical AS
Manufacturer		Laerdal Medical AS
Model Number(s)	(HVIN):	NeoBeat NeoBeat Mini
	(PMN):	NeoBeat NeoBeat Mini
Serial Number(s)		Prototype DTM1
Hardware Version(s)		20-09917 NeoBeat PCA rev. I
Software Version(s)		---
Number of Samples Tested		1
Test Specification/Issue/Date		FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11)
Test Plan/Issue/Date		---
Order Number Date		--- ---
Date of Receipt of EUT		2017-10-16
Start of Test		2017-11-13
End of Test		2018-01-14
Name of Engineer(s)		Matthias Stumpe
Related Document(s)		ANSI C63.10 (2013) KDB 662911 D01 v02r02

Product Service

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Heart Rate Monitor - Normal operation				
2.1	15.247 (b), 5.4 and 6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.2	15.247 (e), 5.2 and 6.12	Power Spectral Density	Pass	ANSI C63.10 (2013) KDB 662911 D01 v02r02
2.3	15.205 N/A and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.4	15.247 (d), 5.5 and N/A	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.247 (a)(2), 5.2 and 6.6	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.7	15.207, N/A and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: Heart Rate Monitor - X-Position - normal Operation				
2.6	15.247 (d), 15.205, 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: Heart Rate Monitor - Y-Position - normal Operation				
2.6	15.247 (d), 15.205, 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: Heart Rate Monitor Z-Position - normal Operation				
2.6	15.247 (d), 15.205, 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)

Table 2

Product Service

1.4 Product Information

1.4.1 Technical Description

Test item: NeoBeat Newborn Heart Rate Meter / NeoBeat Mini Newborn Heart Rate Meter
Description: Heart rate meter / ECG for newborns
Model/Type reference: NeoBeat 532-00033 / NeoBeat Mini 531-00033

Hardware version: 20-09917 NeoBeat PCA rev. I prototype with changes
Changes:
C405, R216, R218 removed
C511 changed to 0 ohms resistor
L500 changed to 4.7 nH

1.5 Description of Equipment Under Test

1.5.1 Technical data of EUT

Application frequency range:	2400 MHz - 2483.5 MHz	
Frequency range:	2402 MHz – 2480 MHz	
Operating frequency:	2402 MHz – 2480 MHz	
Type of modulation:	GFSK (Bluetooth Low Energy, BLE)	
Pulse train:	---	
Pulse width:	---	
Number of RF channels:	40	
Channel spacing:	2 MHz	
Designation of emission: [1]		
Type of antennas:	Internal Antenna	
Antenna size:	NA	
Connection of antenna:	NA	
Type of power supply:	DC supply (Battery supply) AC supply for Battery Charger	
Specification of power supply:	Nominal voltage:	5 V DC Battery supply 110-230V / 50/60Hz for Charger

1.5.2 List of ports and cables

Port	*Description*	*Classification* [2]	*Cable type*	*Cable length*
1	AC Power Supply for battery charging.	AC power	Unshielded	1.5 m

1.6 Deviations from the Standard

No deviations

[1] Also known as “Class of Emission”.
[2] Ports shall be classified as AC power, DC power or Signal/Control port.

Product Service

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: Prototype DTM1			
0	As supplied by the customer: Hardware version: 20-09917 NeoBeat PCA rev. I prototype with changes Changes: C405, R216, R218 removed C511 changed to 0 ohms resistor L500 changed to 4.7 nH No additionl changes have been made during testing.	Not Applicable	Not Applicable

Table 3

Product Service

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Heart Rate Monitor - Normal operation	
Maximum Conducted Output Power	Matthias Stumpe
Power Spectral Density	Matthias Stumpe
Restricted Band Edges	Matthias Stumpe
Authorised Band Edges	Matthias Stumpe
Emission Bandwidth	Matthias Stumpe
AC Power Line Conducted Emissions	Matthias Stumpe
Configuration and Mode: Heart Rate Monitor - X-Position - normal Operation	
Spurious Radiated Emissions	Matthias Stumpe
Configuration and Mode: Heart Rate Monitor - Y-Position - normal Operation	
Spurious Radiated Emissions	Matthias Stumpe
Configuration and Mode: Heart Rate Monitor Z-Position - normal Operation	
Spurious Radiated Emissions	Matthias Stumpe

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (b), 5.4 and 6.12

2.1.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.1.3 Date of Test

2017-11-14 to 2018-01-14

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.9.1.1.

2.1.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

2.1.6 Test Results

Heart Rate Monitor - Normal operation

Frequency (MHz)	dBm	mW
2402	-12.1	0.062
2440	-12.3	0.059
2480	-11.9	0.065

Table 5

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Industry Canada RSS-247, Limit Clause 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 6

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.2 Power Spectral Density

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (e), 5.2 and 6.12

2.2.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.2.3 Date of Test

2017-11-14

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.2.

2.2.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

2.2.6 Test Results

Heart Rate Monitor - Normal operation

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	Power Spectral Density (dBm)
2402	-22.8
2440	-23.0
2480	-21.9

Table 7

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

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.

Industry Canada RSS-247, Limit Clause 5.2(b)

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Product Service

2.2.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 8

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.3 Restricted Band Edges

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.205 N/A and 8.10

2.3.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.3.3 Date of Test

2017-11-14

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10 clause 4.1.4.2.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.3.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

2.3.6 Test Results

Heart Rate Monitor - Normal operation

Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
2402	2390.0	< 40	< 50
2480	2483.5	< 40	< 40

Table 9

Product Service

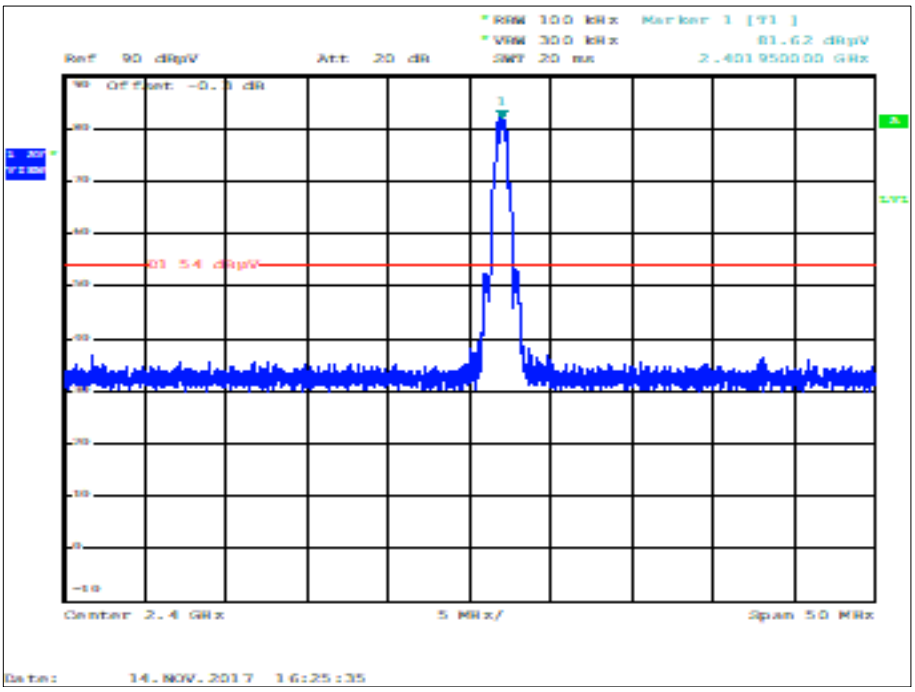

Figure 1 - 2402 MHz - Measured Frequency 2390.0 MHz - Peak

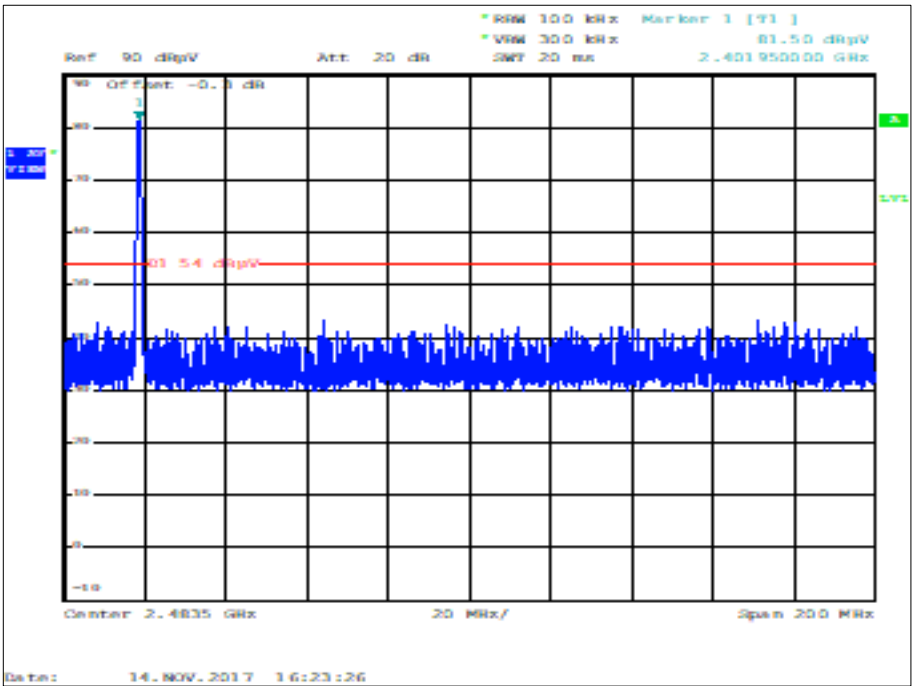

Figure 2 - 402 MHz - Measured Frequency 2390.0 MHz - Average

Product Service

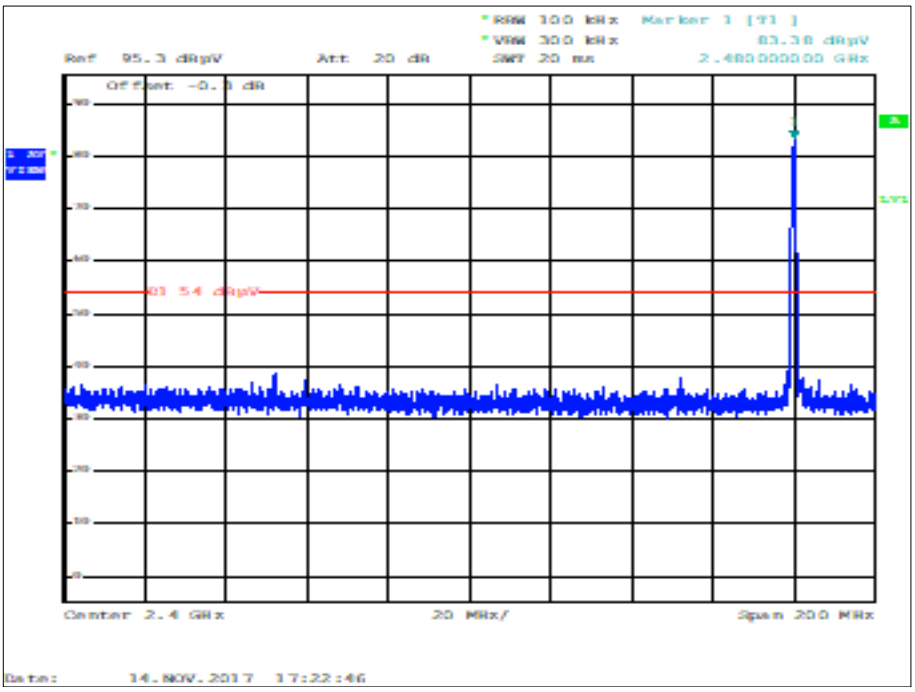

Figure 3 2480 MHz - Measured Frequency 2483.5 MHz - Peak

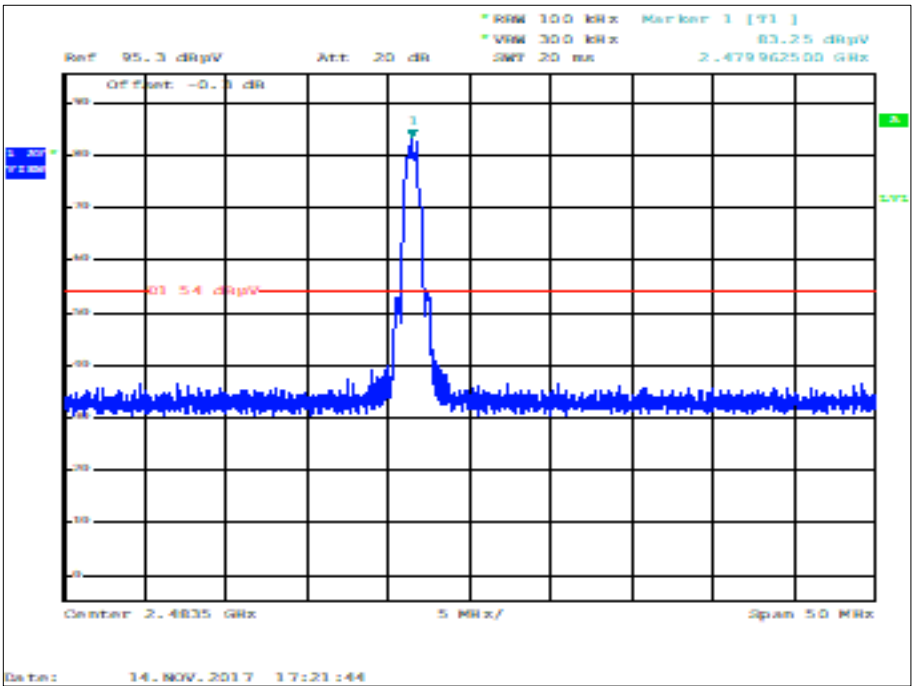

Figure 4 - 2480 MHz - Measured Frequency 2483.5 MHz - Average

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 10

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 11

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.3.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 12

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.4 Authorised Band Edges

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (d), 5.5 and N/A

2.4.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.4.3 Date of Test

2017-11-14

2.4.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.4.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

2.4.6 Test Results

Heart Rate Monitor - Normal operation

Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)
2402	2400.0	< -30
2480	2483.5	< -40

Table 13

Product Service

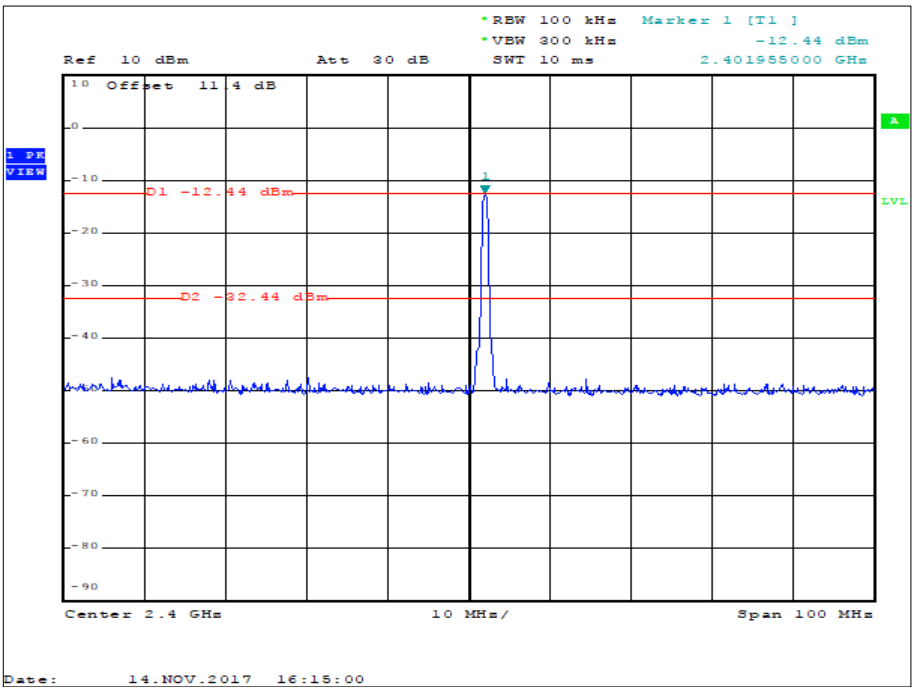

Figure 5 - GFSK/ - 2402 MHz - Measured Frequency 2400.0 MHz

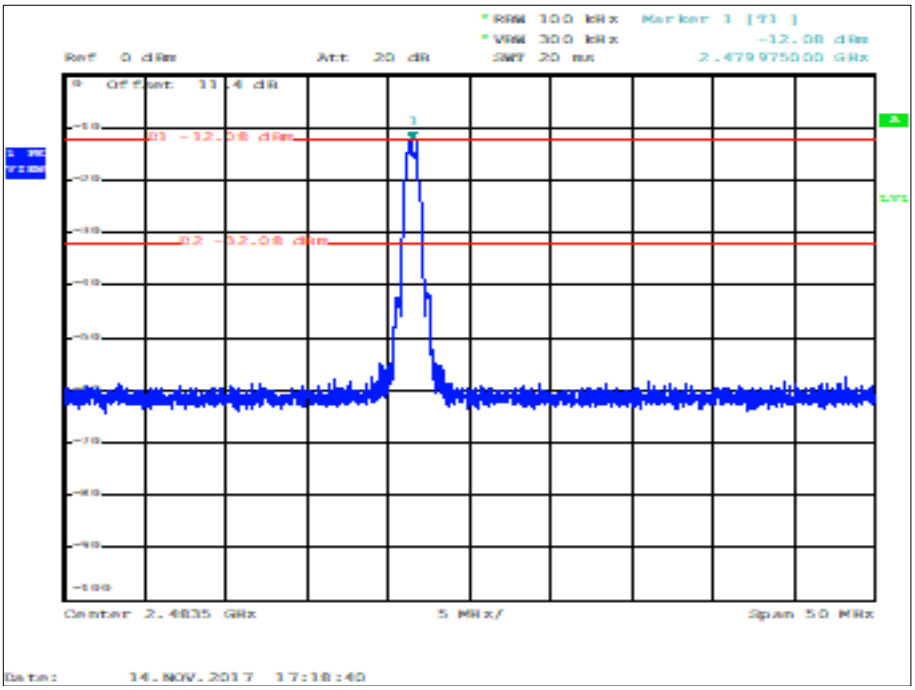

Figure 6 - GFSK/ - 2480 MHz - Measured Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.4.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 14

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.5 Emission Bandwidth

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (a)(2), 5.2 and 6.6

2.5.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.5.3 Date of Test

2017-11-14

2.5.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.2.

2.5.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

2.5.6 Test Results

Heart Rate Monitor - Normal operation

Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2402	0.696	1.083
2440	0.696	1.042
2480	0.712	1.042

Table 15

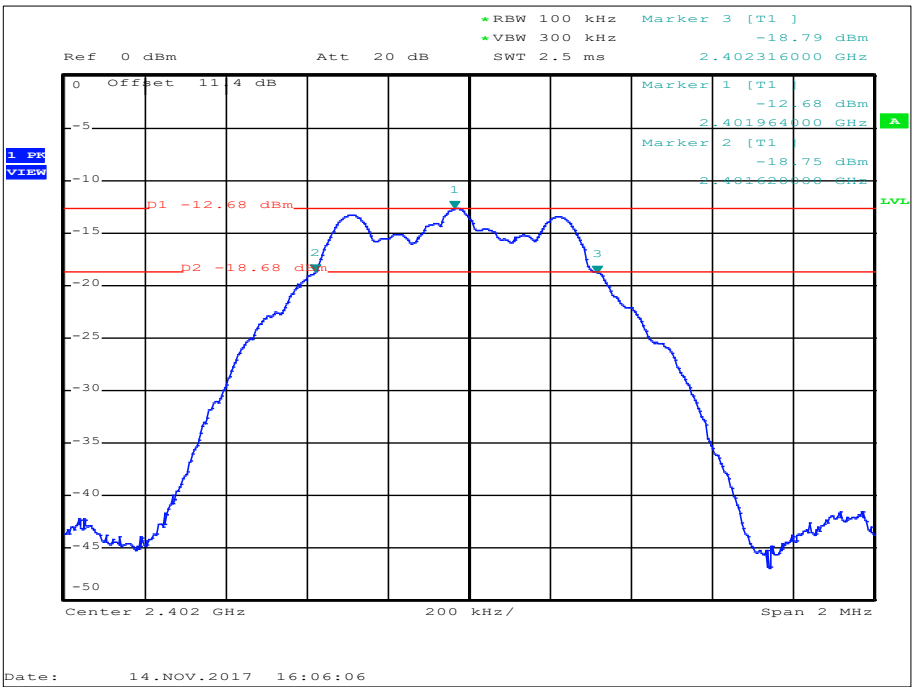

Figure 7 - 2402 MHz – Emission Bandwidth

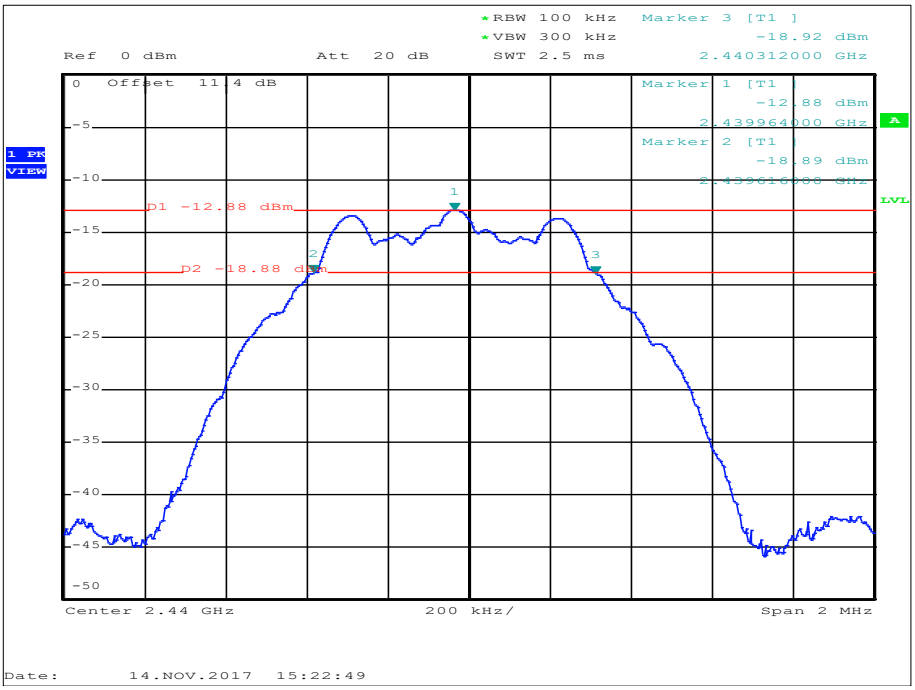

Figure 8 - 2440 MHz – Emission Bandwidth

Product Service

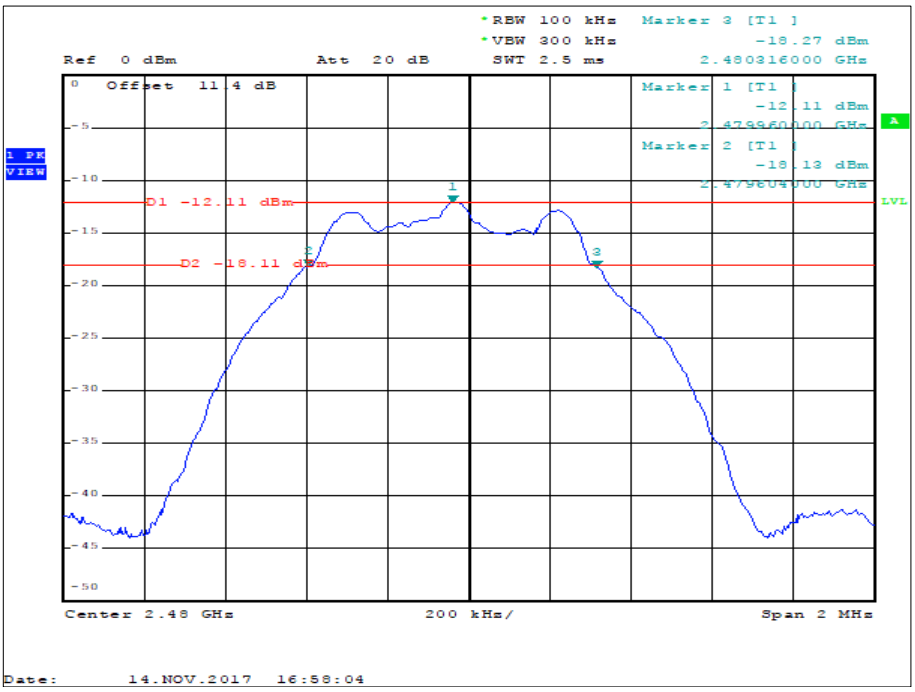

Figure 9 - 2480 MHz – Emission Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and Industry Canada RSS-247, Clause 5.2(a)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

2.5.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 16

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.6 Spurious Radiated Emissions

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (d), 15.205, 5.5 and 6.13

2.6.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.6.3 Date of Test

2017-11-13 to 2017-11-15

2.6.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

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Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

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Product Service

bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.6.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	34,0 %

Product Service

2.6.6 Test Results

Heart Rate Monitor - X-Position - normal Operation

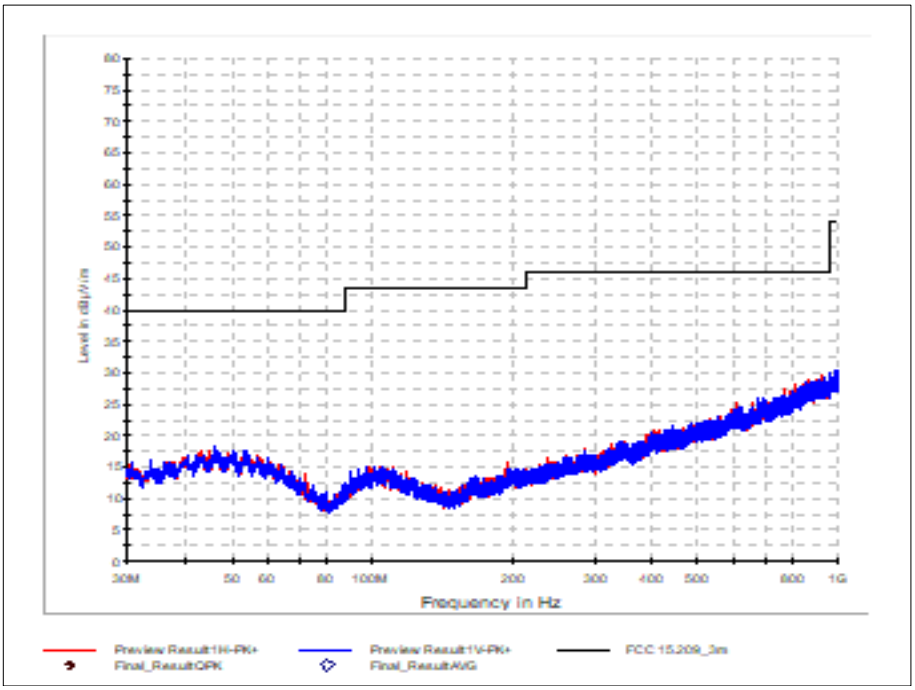


Figure 10 - 2402 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.40175	89.7 dBµV/m	77.0 dBµV/m	NA *[#1]*	NA *[#1]*	NA *[#1]*	NA *[#1]*
2.40200	90.1 dBµV/m	78.1 dBµV/m	NA *[#1]*	NA *[#1]*	NA *[#1]*	NA *[#1]*

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 17 - 2402 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

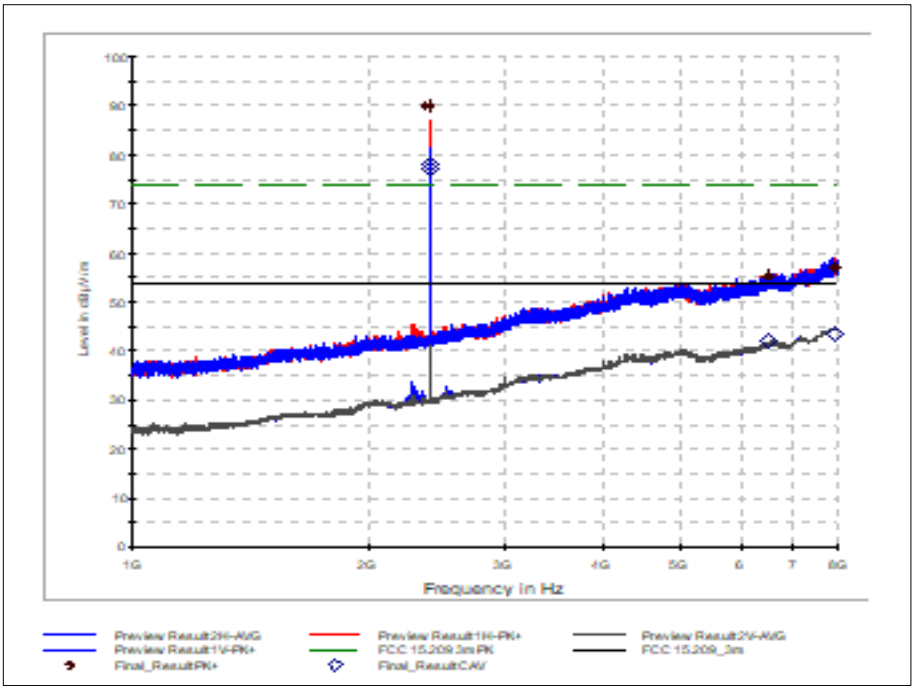


Figure 11 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

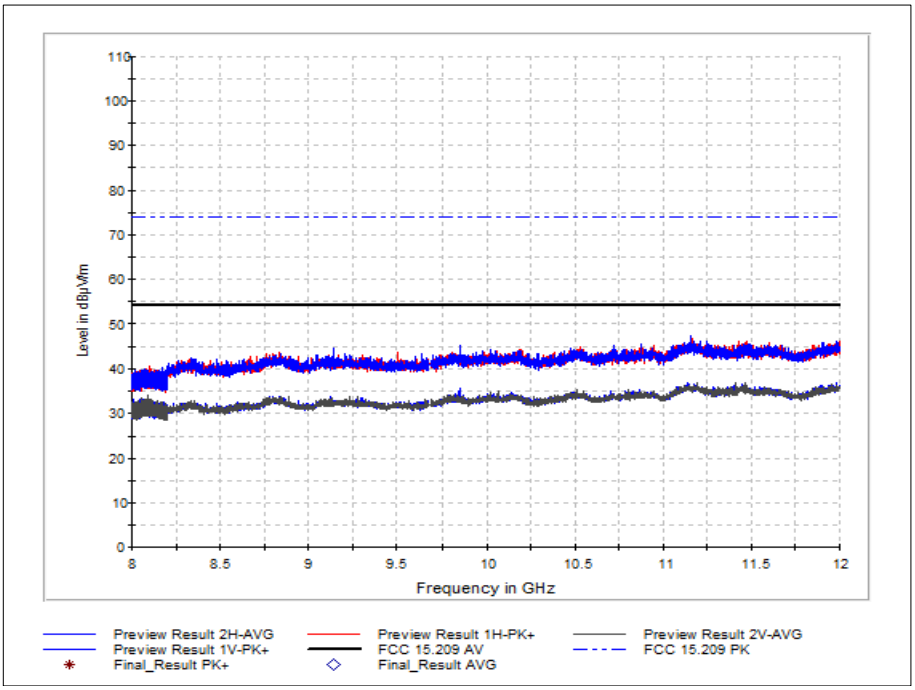


Figure 12 - 2402 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

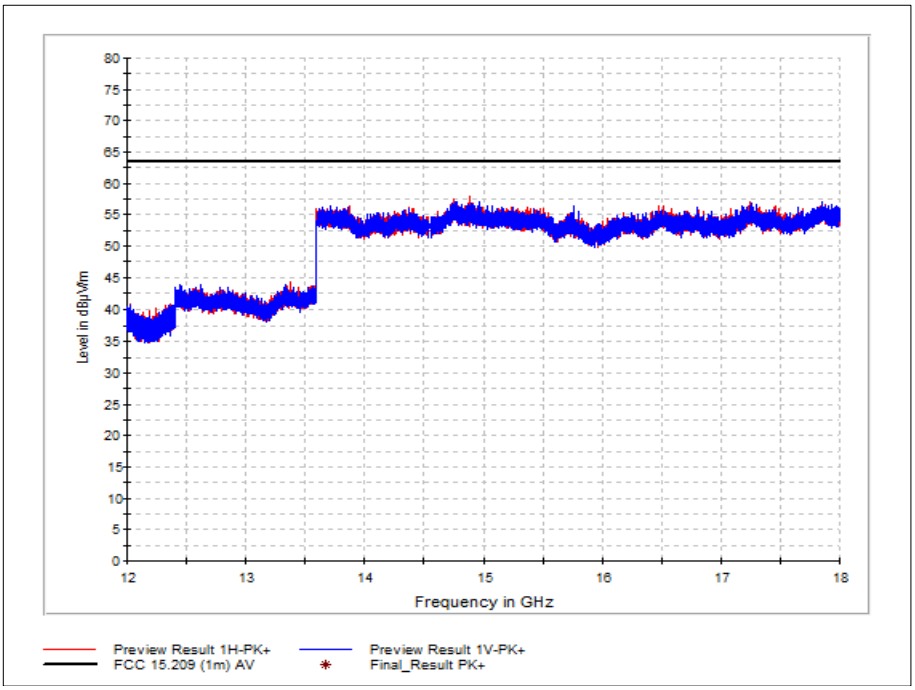


Figure 13 - 2402 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

Product Service

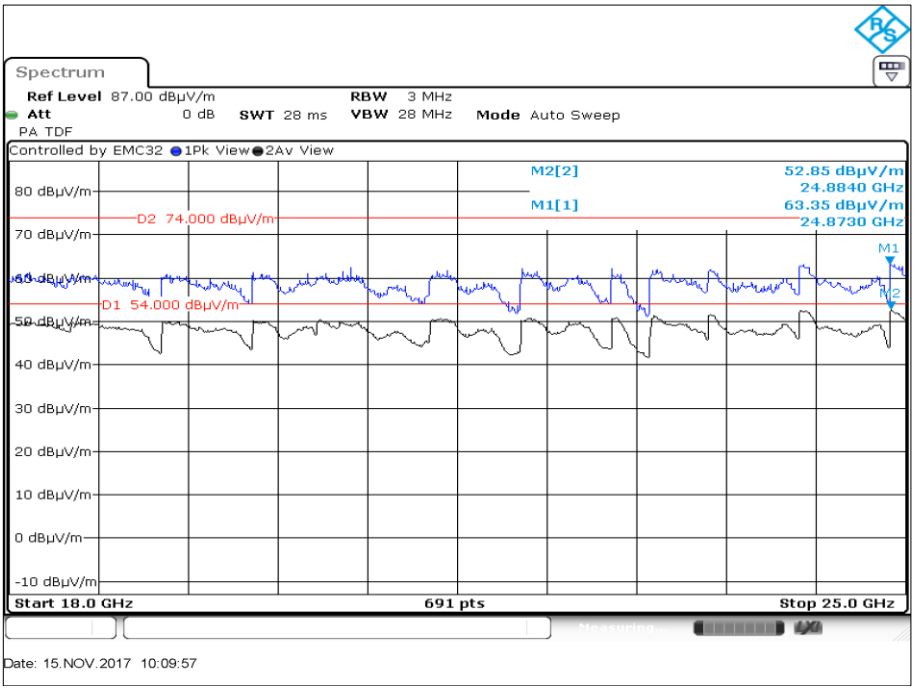


Figure 14 - 2402 MHz - 18 GHz to 26 GHz - Vertical

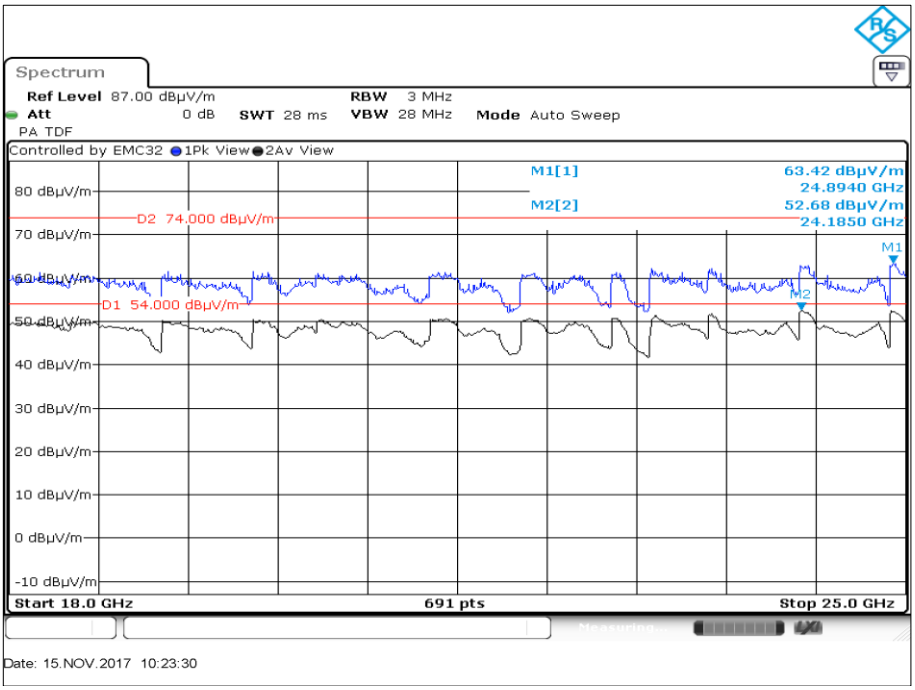


Figure 15 - 2402 MHz - 18 GHz to 26 GHz - Horizontal

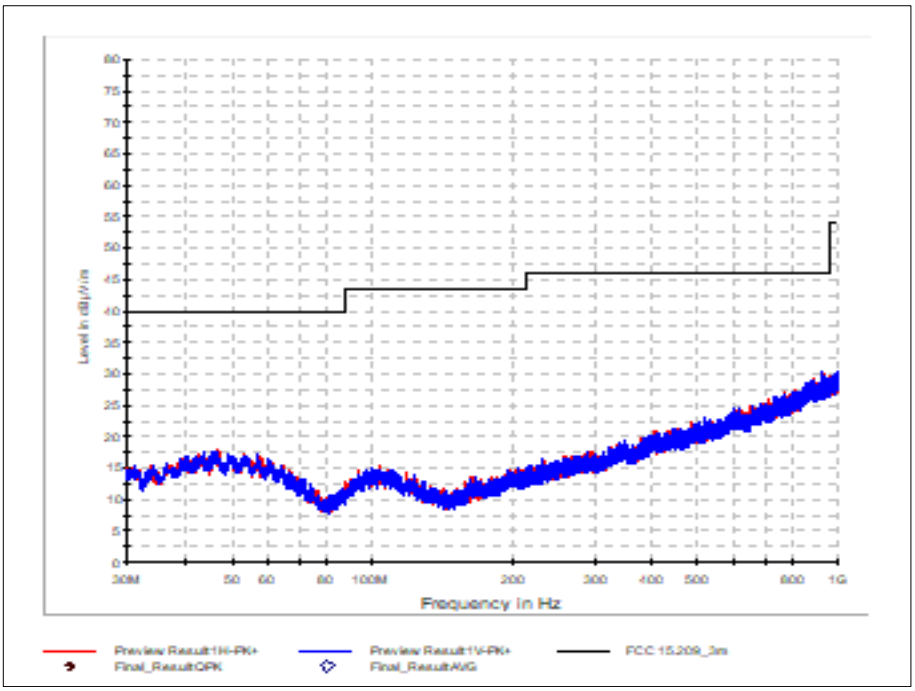


Figure 16 - 2440 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.44000	85.5 dBµV/m	54.0 dBµV/m	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 18 - 2440 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

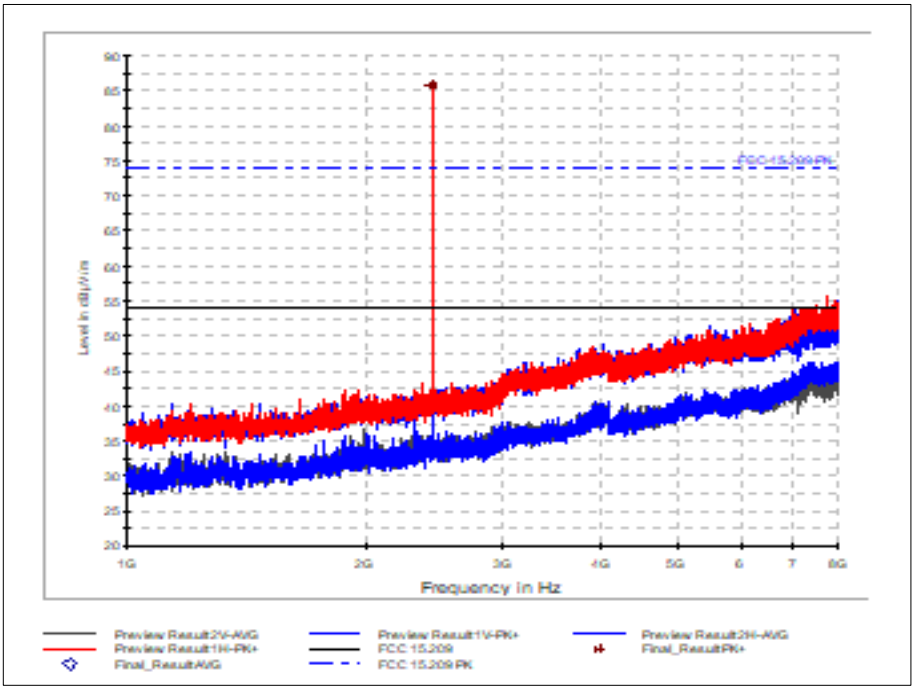


Figure 17 - 2440 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

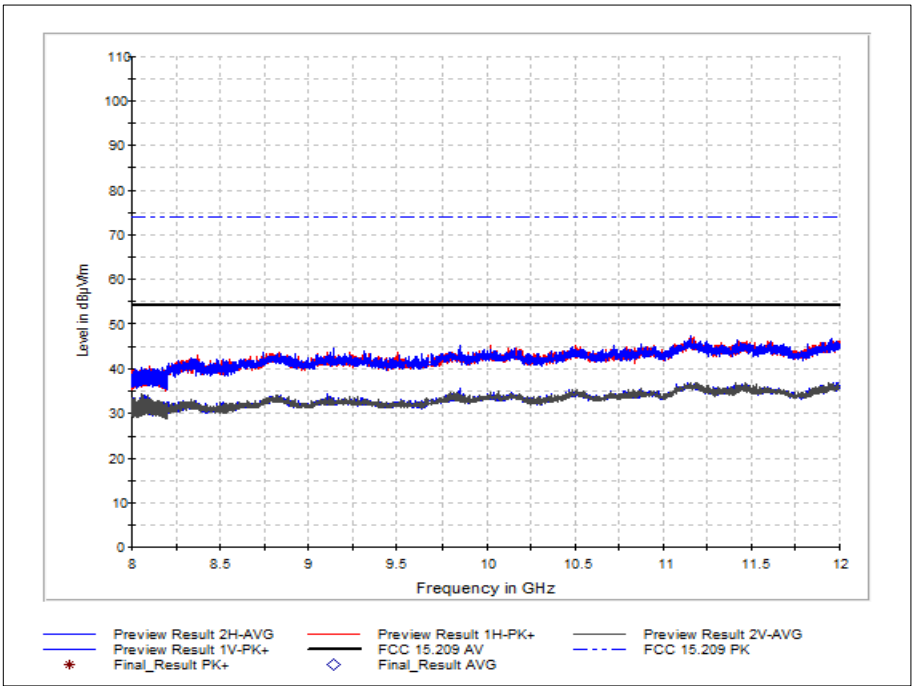


Figure 18 - 2440 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

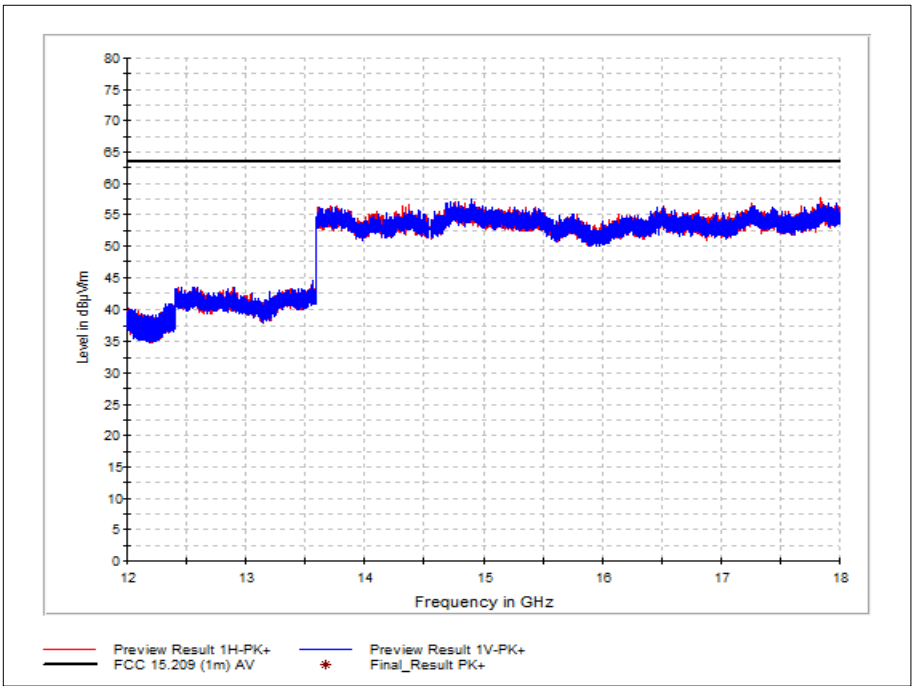


Figure 19 - 2440 MHz - 12 GHZ to 18 GHz - Horizontal and Vertical

Product Service

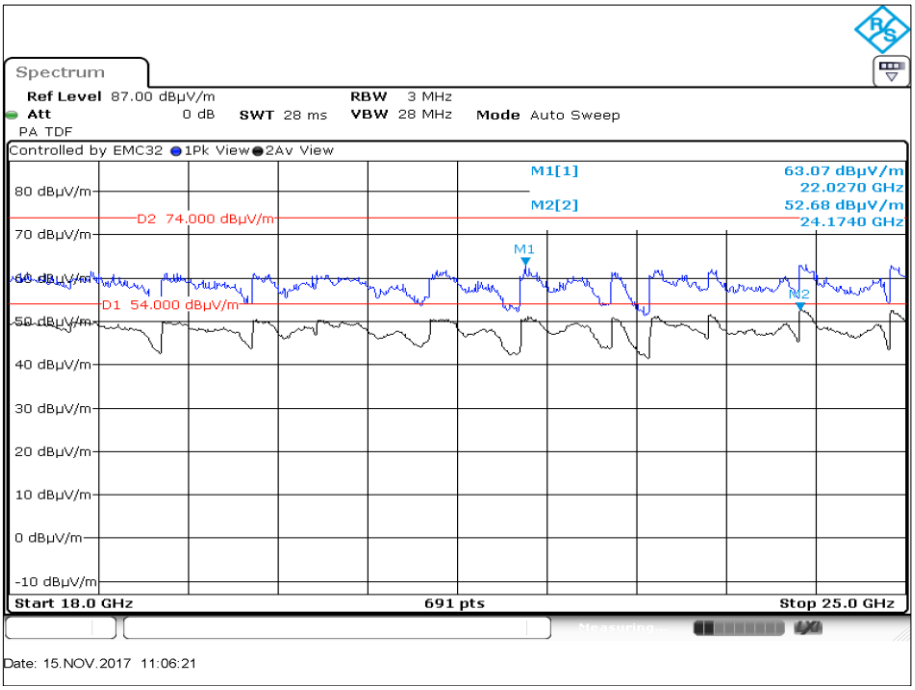


Figure 20 - 2440 MHz - 18 GHz to 26 GHz - Vertical

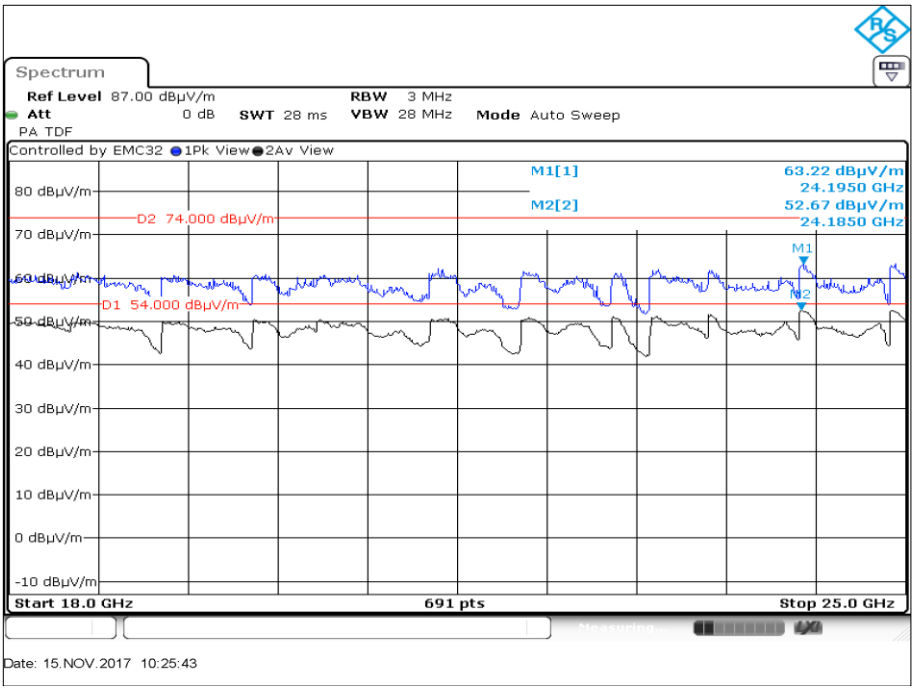


Figure 21 - 2440 MHz - 18 GHz to 26 GHz - Horizontal

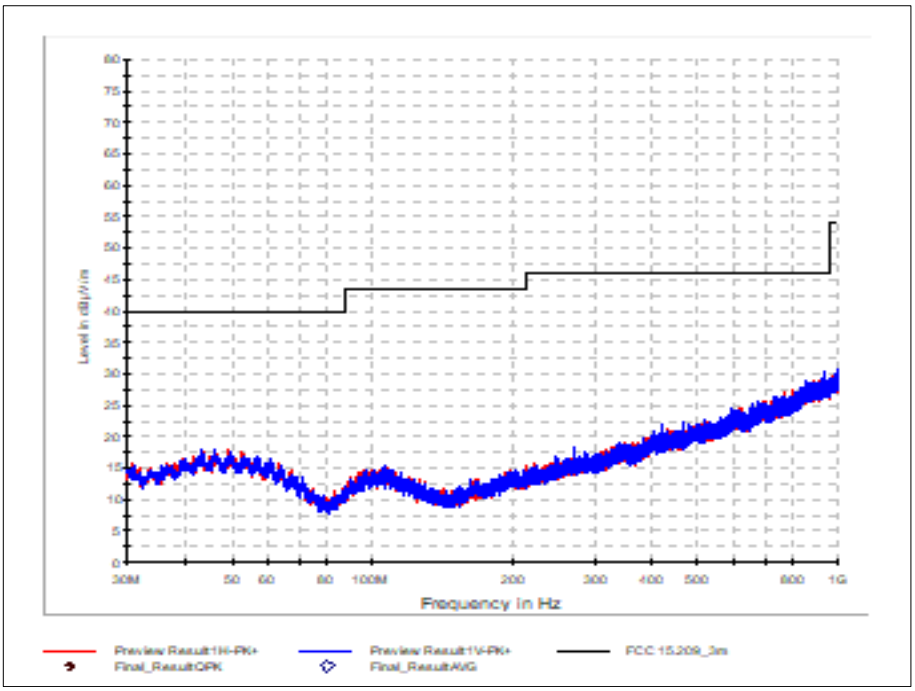


Figure 22 - 2480 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.48000	87.3	75.4	NA #1	NA #1	NA #1	NA #1
2.48025	87.5	73.8	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 19 - 2480 MHz - 1 GHz to 26 Emissions Results

No other emissions were detected within 6 dB of the limit.

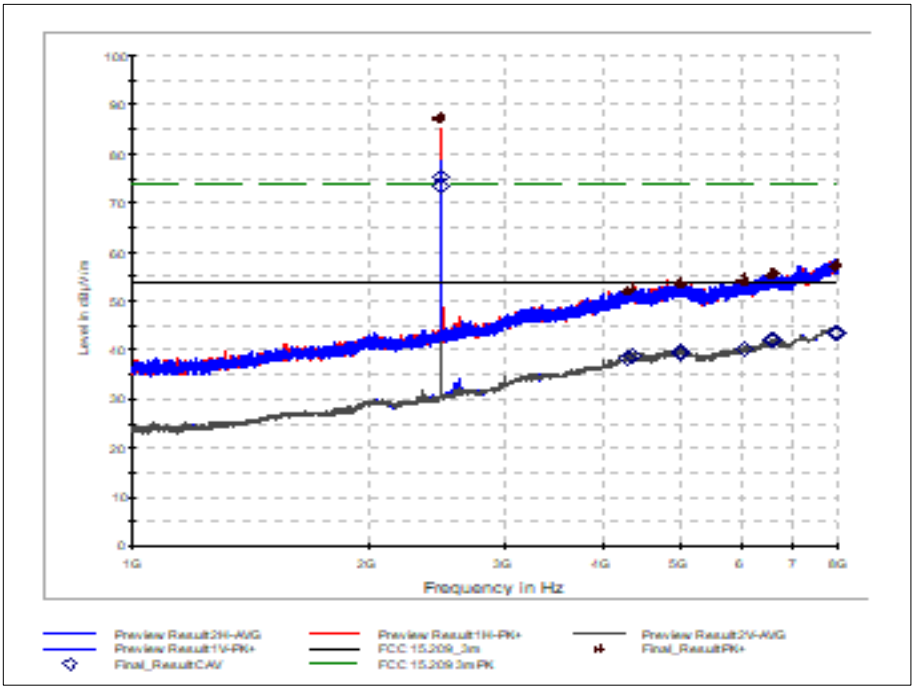


Figure 23 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

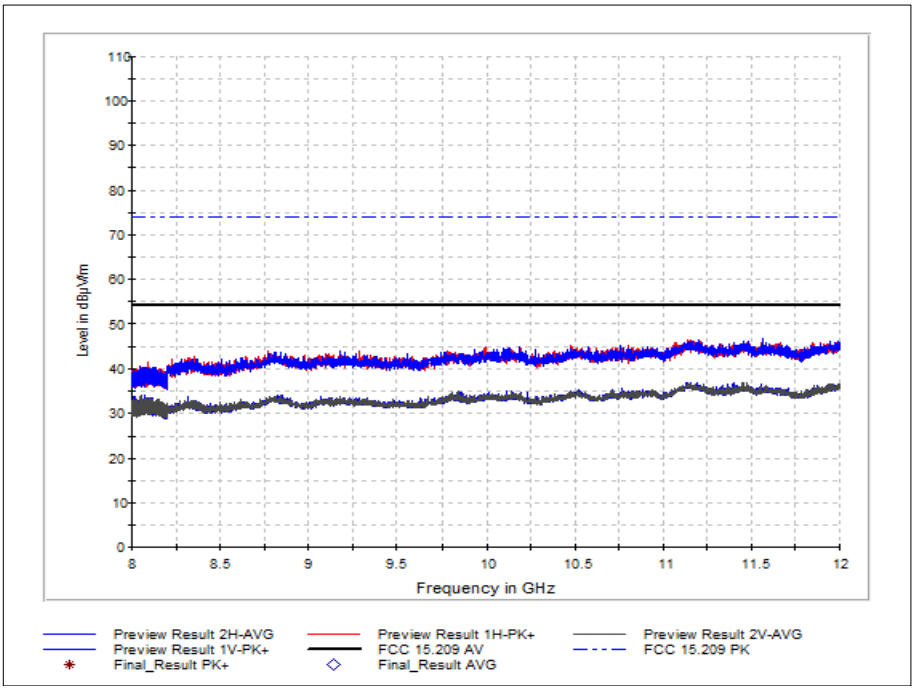


Figure 24 - 2480 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

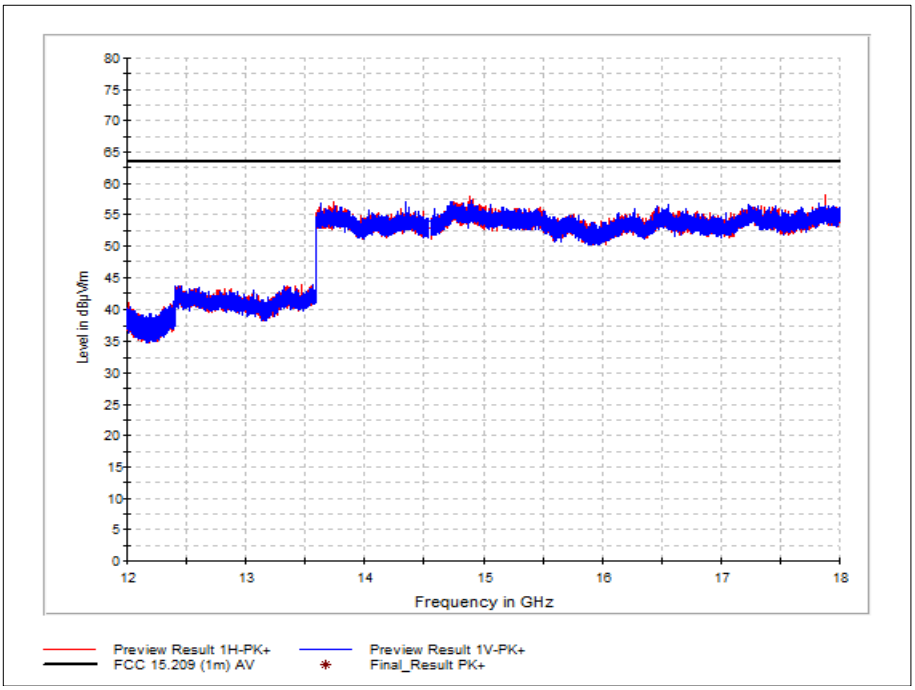


Figure 25 - 2480 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

Product Service

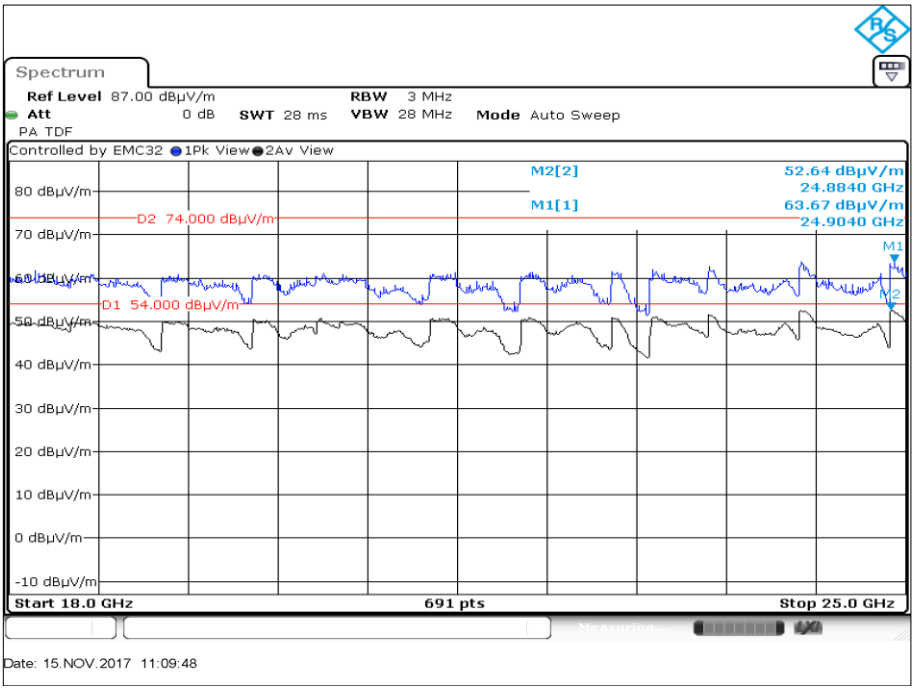


Figure 26 - 2480 MHz - 18 GHz to 26 GHz - Vertical

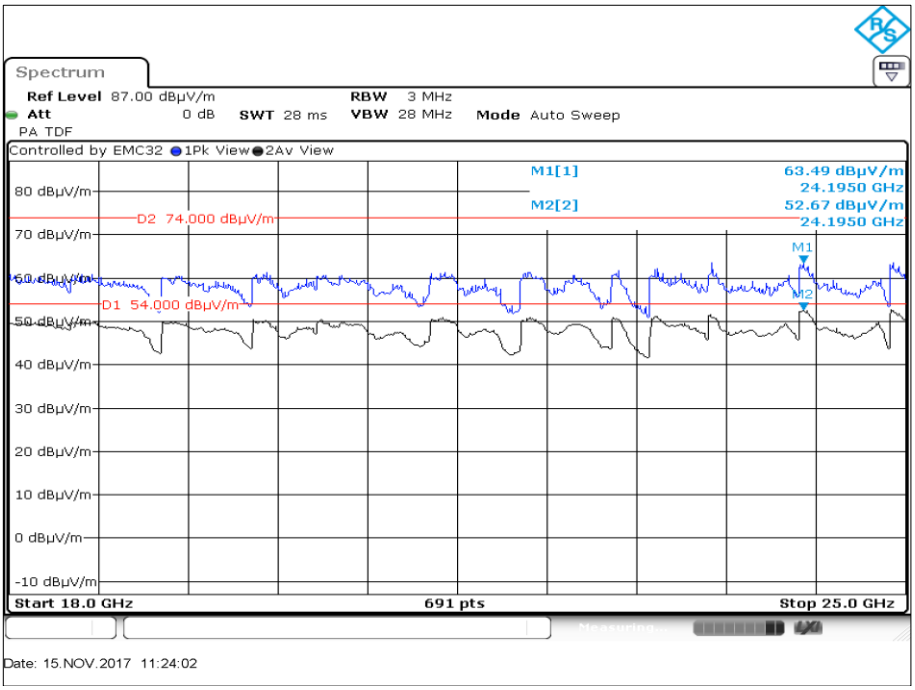


Figure 27 - 2480 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Heart Rate Monitor - Y-Position - normal Operation

2402 MHz - 30 MHz to 1 GHz Emissions Results

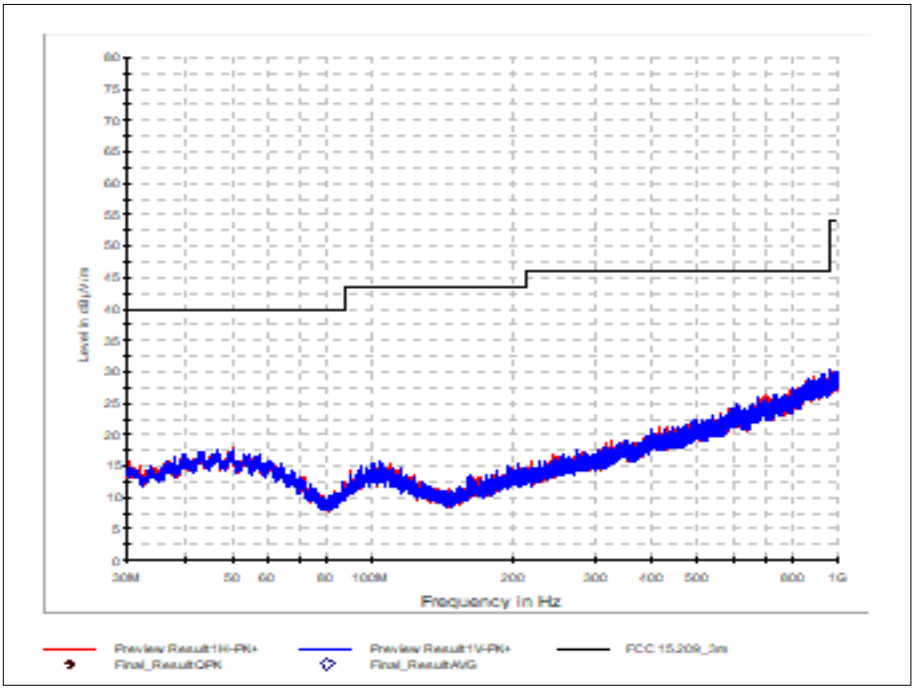


Figure 28 - 2402 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.40200	87.5 dBµV/m	75.6 dBµV/m	NA #1	NA #1	NA #1	NA #1
2.40225	87.5 dBµV/m	79.9 dBµV/m	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 20 - 2402 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

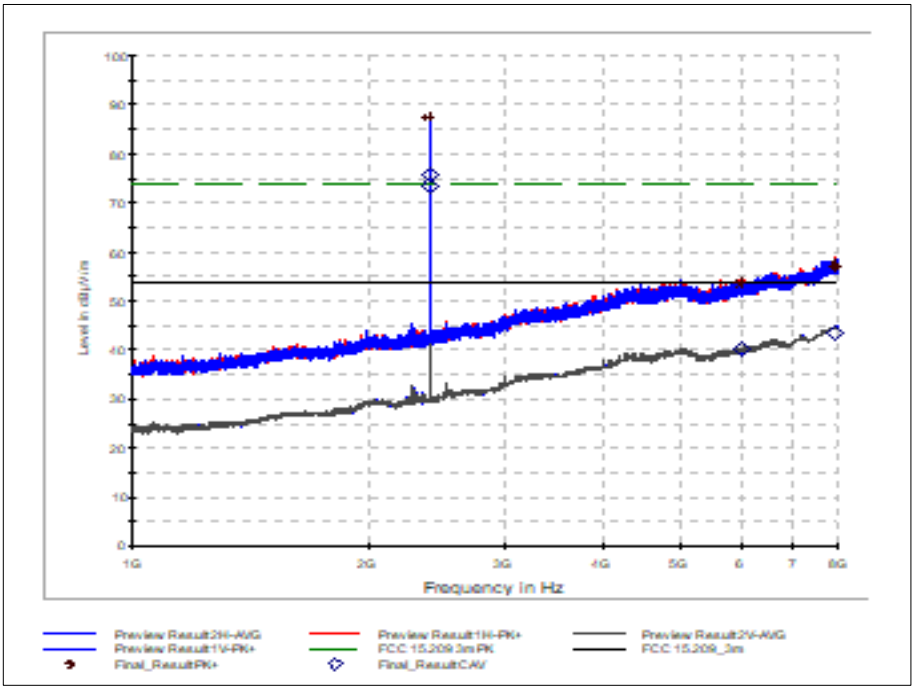


Figure 29 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

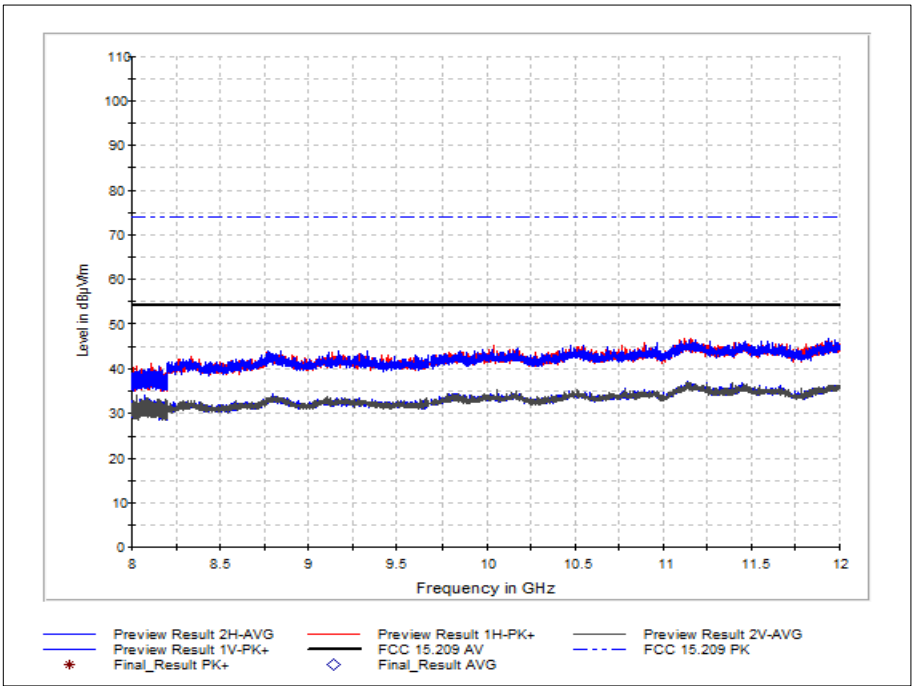


Figure 30 - 2402 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

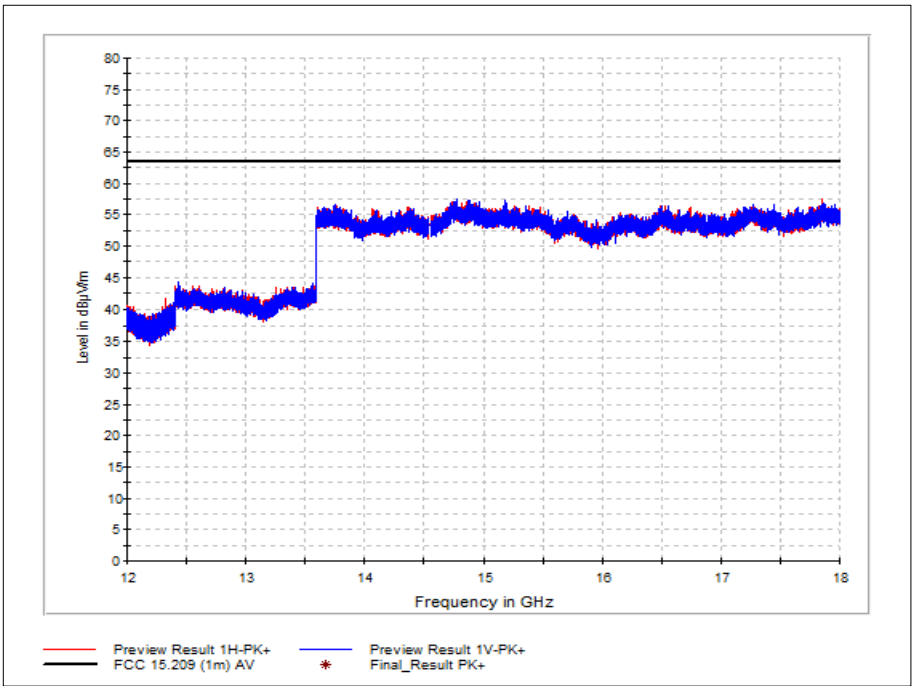


Figure 31 - 2402 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

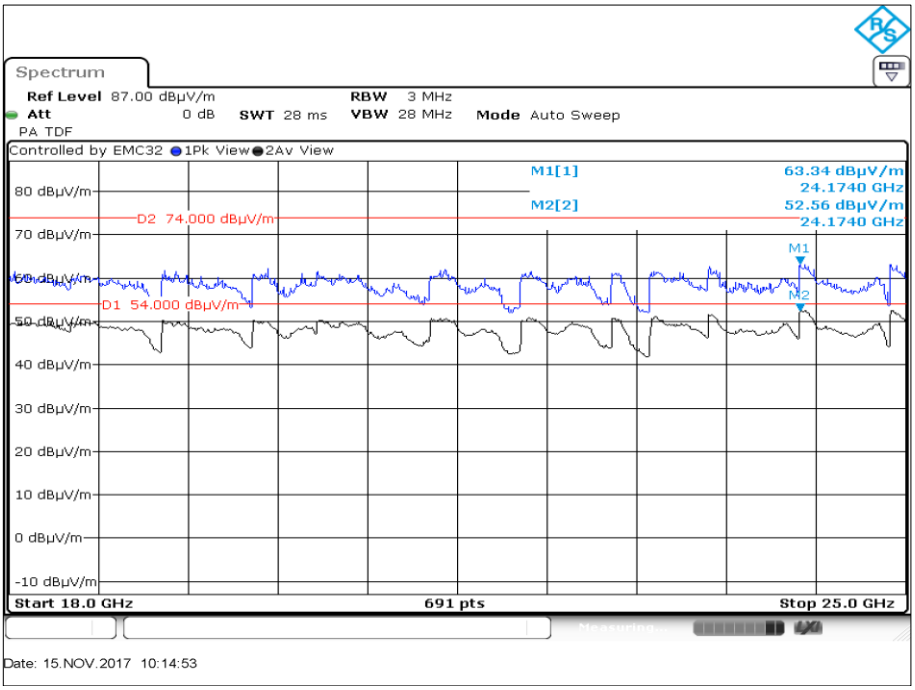


Figure 32 - 2402 MHz - 18 GHz to 26 GHz - Vertical

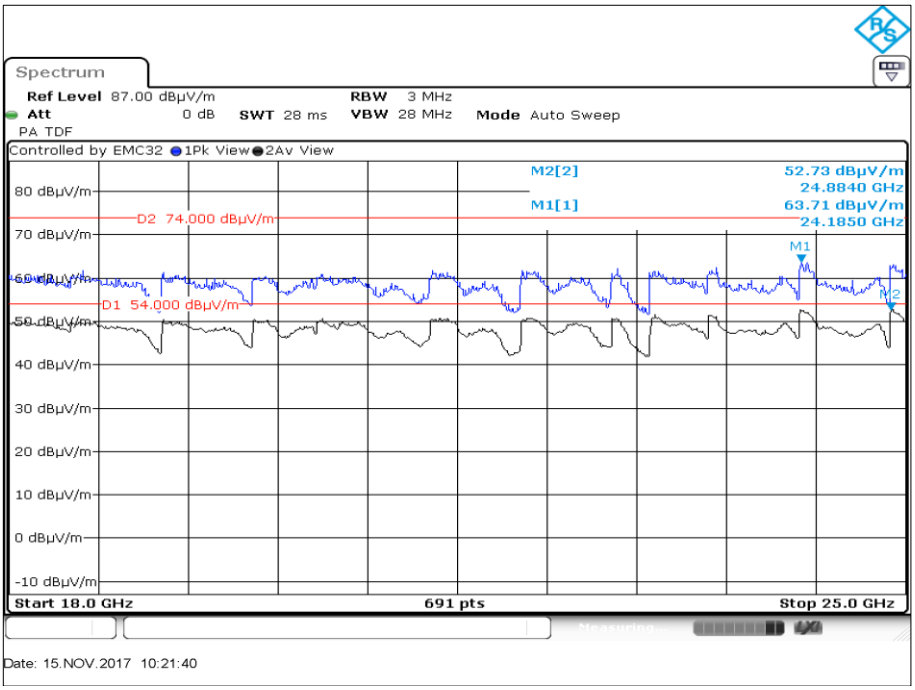


Figure 33 - 2402 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

2440 MHz - 30 MHz to 1 GHz Emissions Results

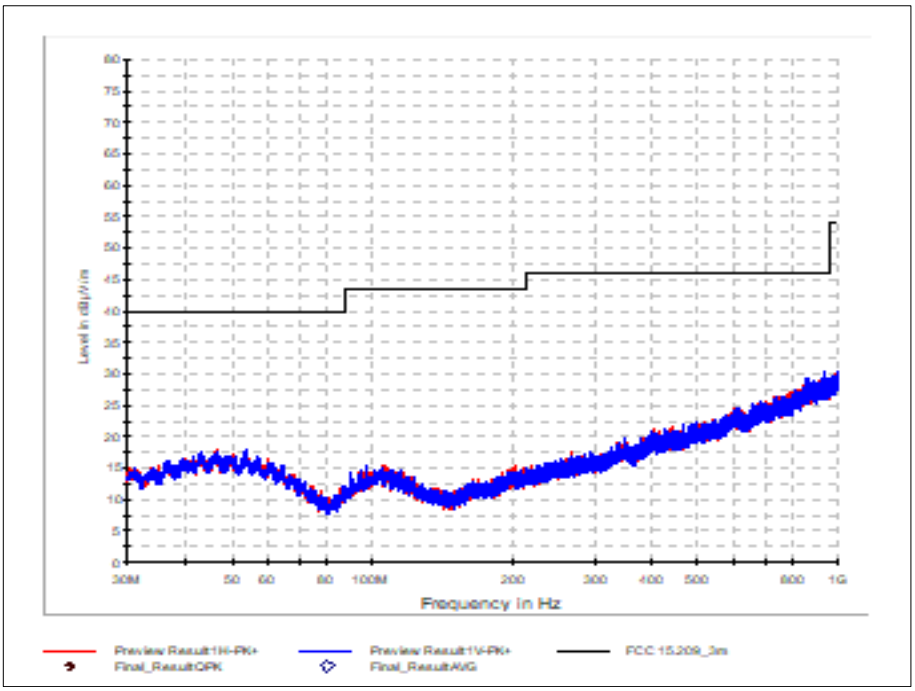


Figure 34 - 2440 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2,44000	86.2	---	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 21 - 2440 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

Product Service

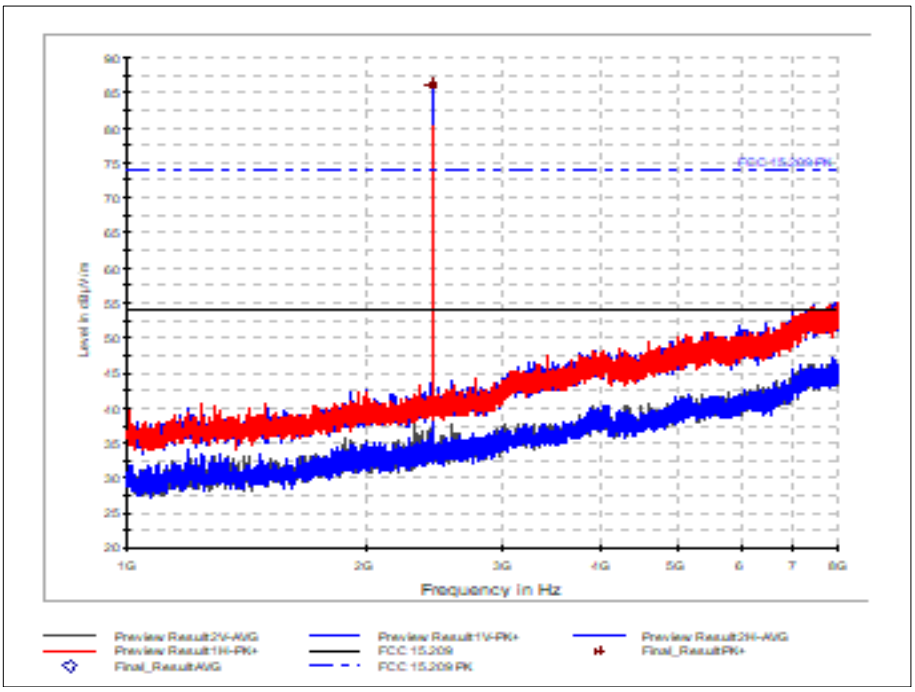


Figure 35 - 2440 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

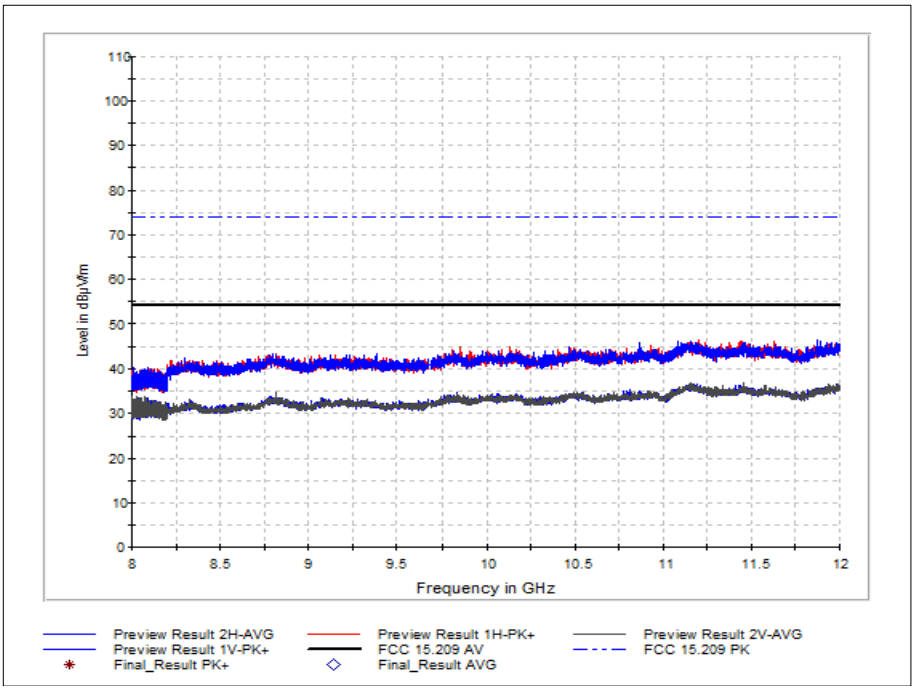


Figure 36 - 2440 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

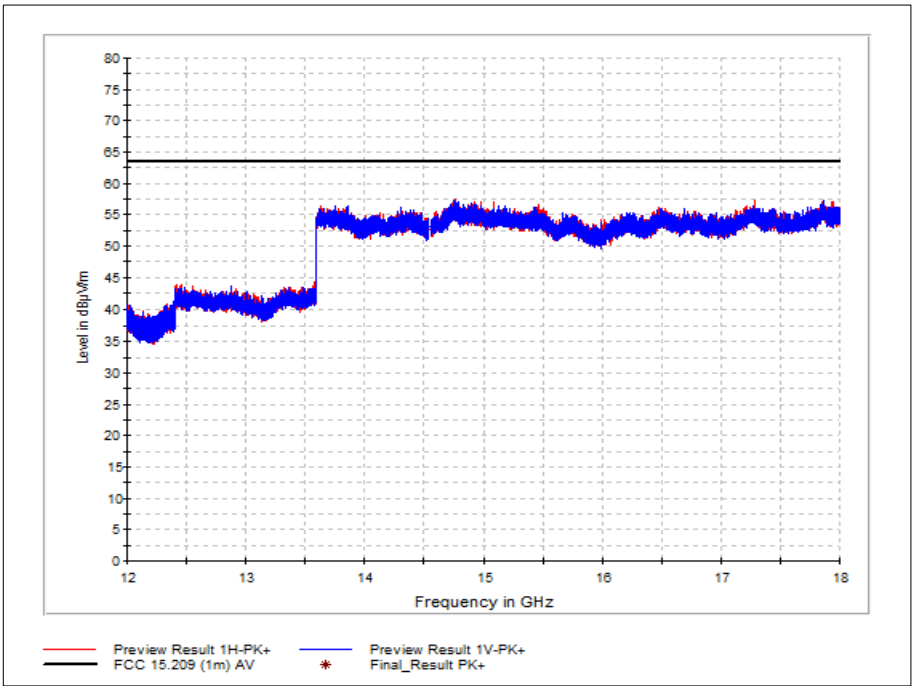


Figure 37 - 2440 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

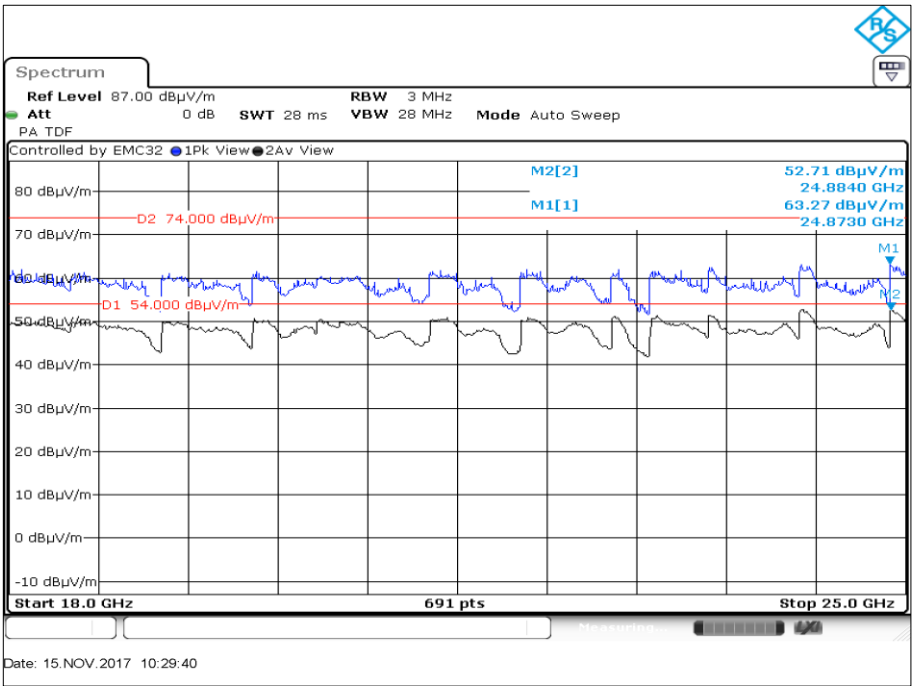


Figure 38 - 2440 MHz - 18 GHz to 26 GHz - Vertical

Product Service

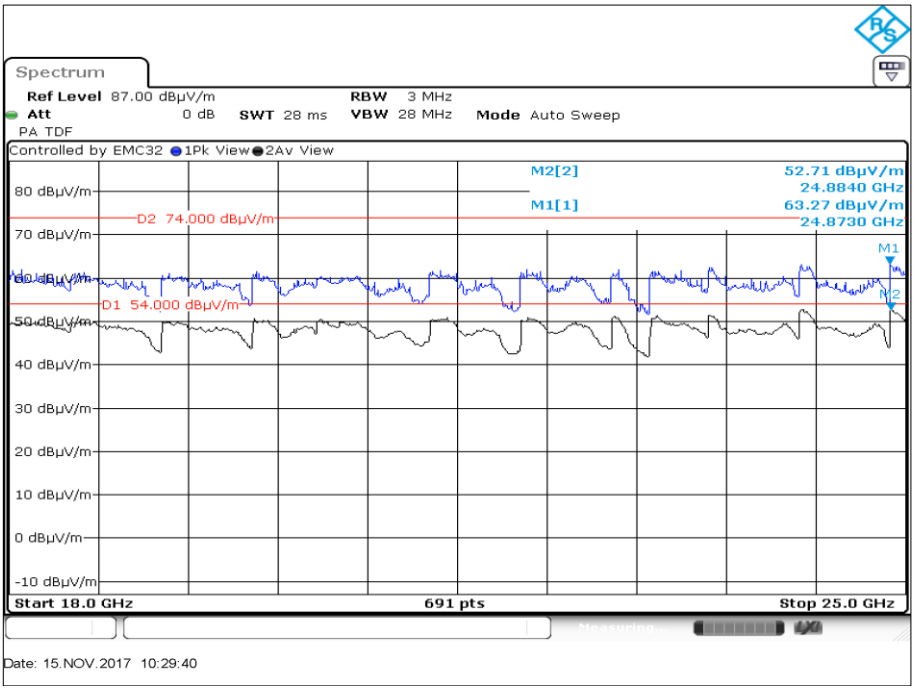


Figure 39 - 2440 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

2480 MHz - 30 MHz to 1 GHz Emissions Results

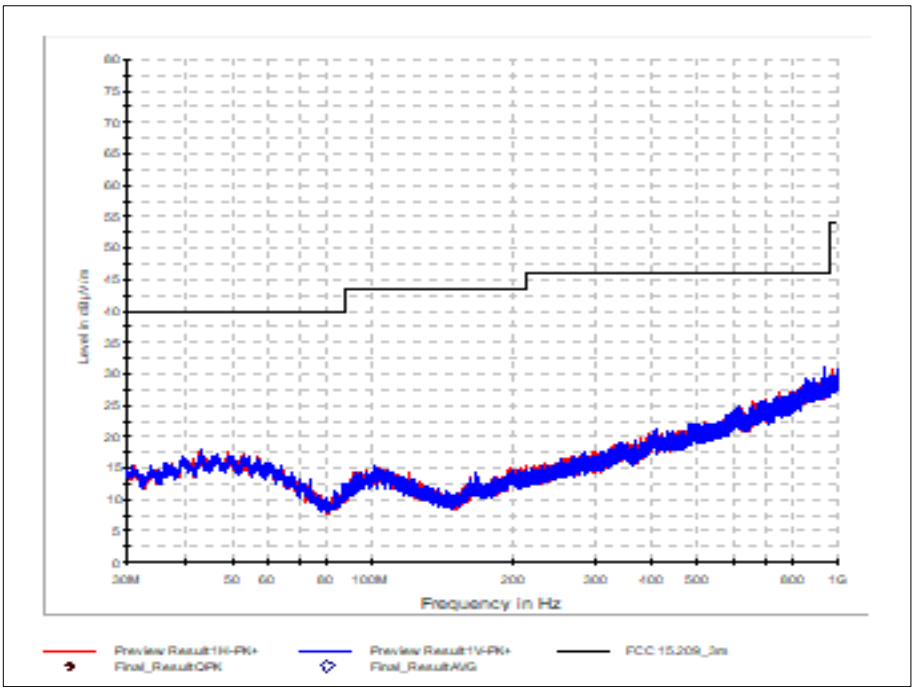


Figure 40 - 2480 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.48000	85.3	73.3	NA #1	NA #1	NA #1	NA #1
2.48025	85.3	71.6	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 22 - 2480 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

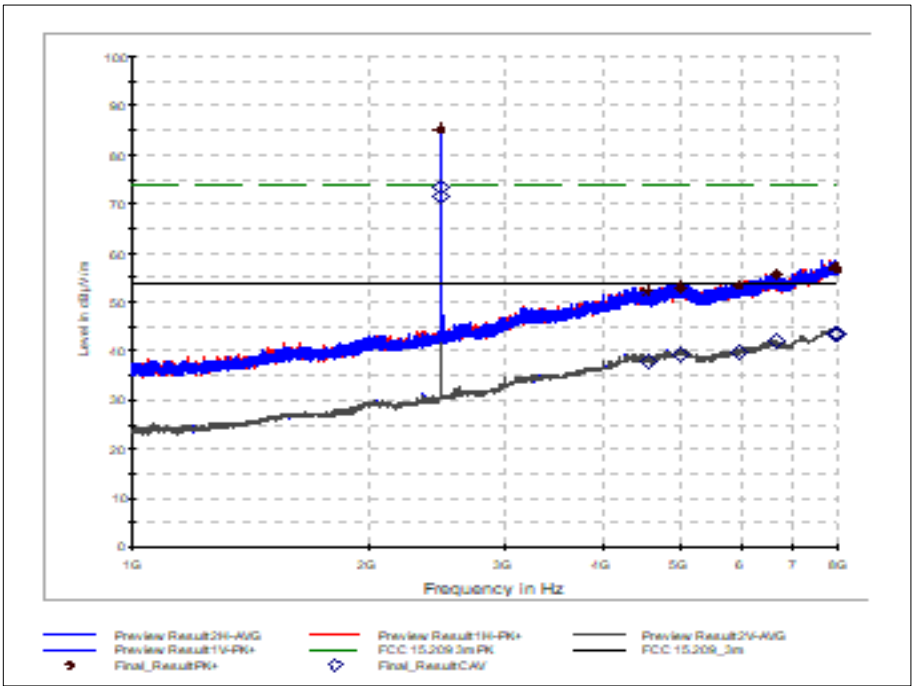


Figure 41 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

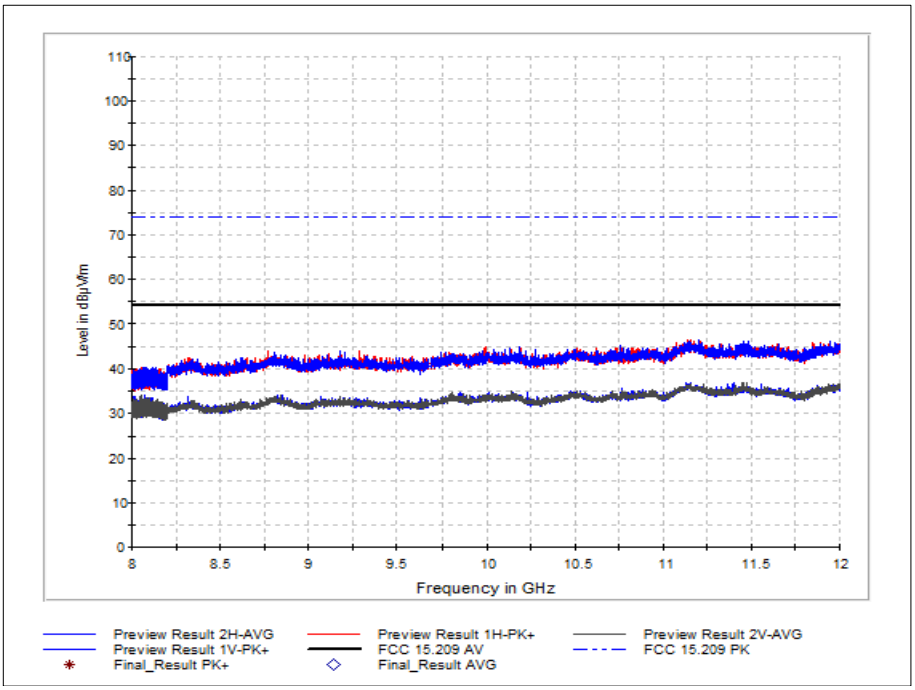


Figure 42 - 2480 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

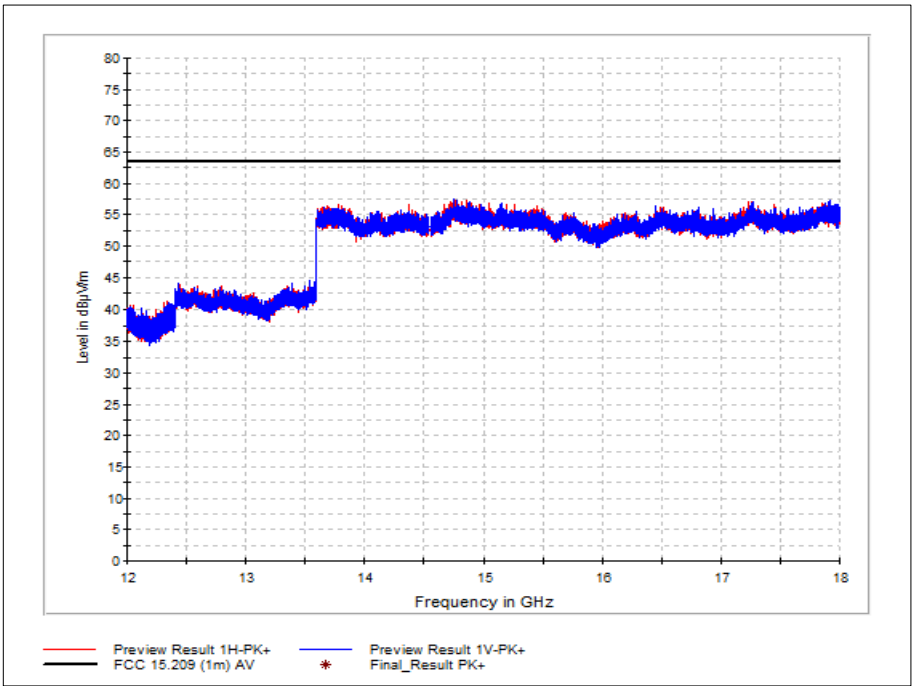


Figure 43 - 2480 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

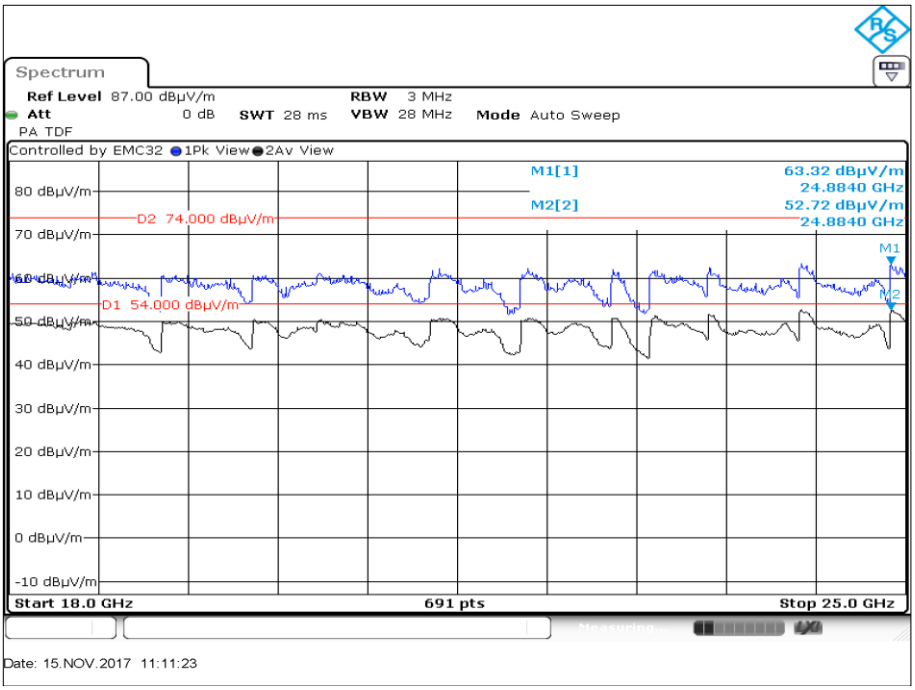


Figure 44 - 2480 MHz - 18 GHz to 26 GHz - Vertical

Product Service

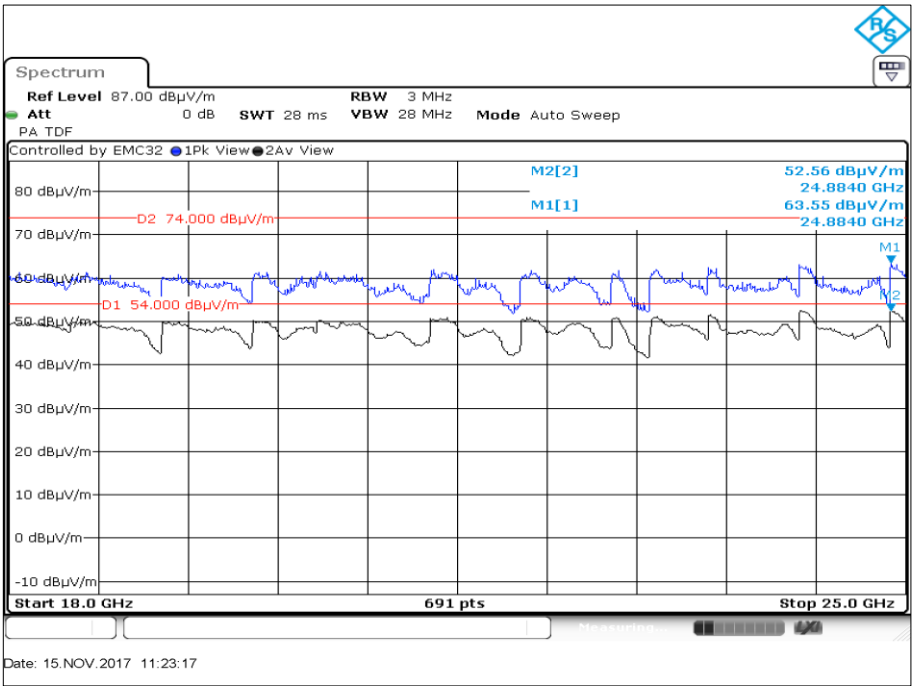


Figure 45 - 2480 MHz - 18 GHz to 26 GHz - Horizontal

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Heart Rate Monitor Z-Position - normal Operation

2402 MHz - 30 MHz to 1 GHz Emissions Results

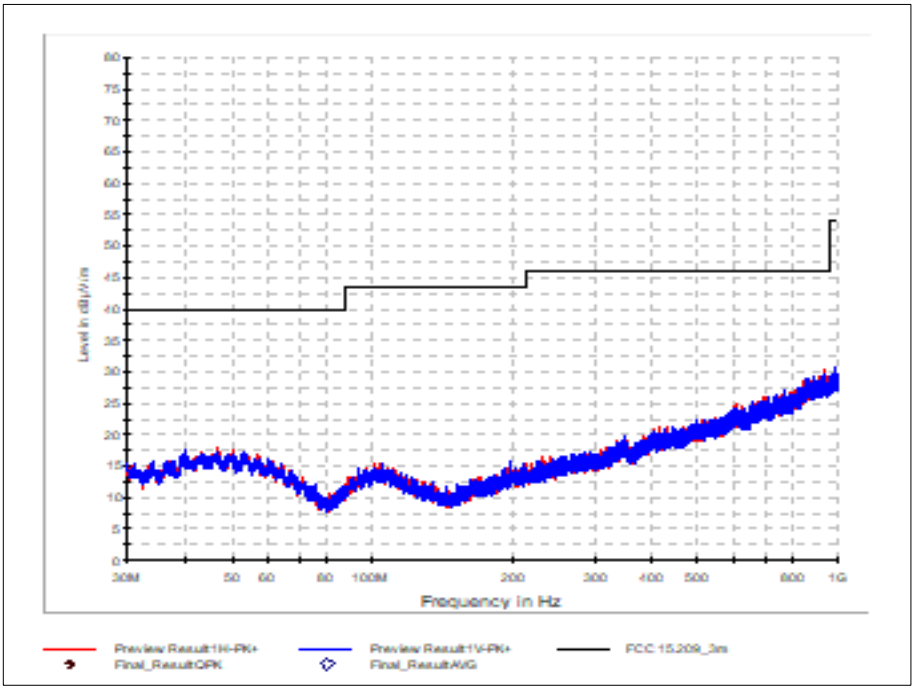


Figure 46 - 2402 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.40175	89.6 dBµV/m	76.9 dBµV/m	NA #1	NA #1	NA #1	NA #1
2.40200	89.7 dBµV/m	77.8 dBµV/m	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 23 - 2402 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

Product Service

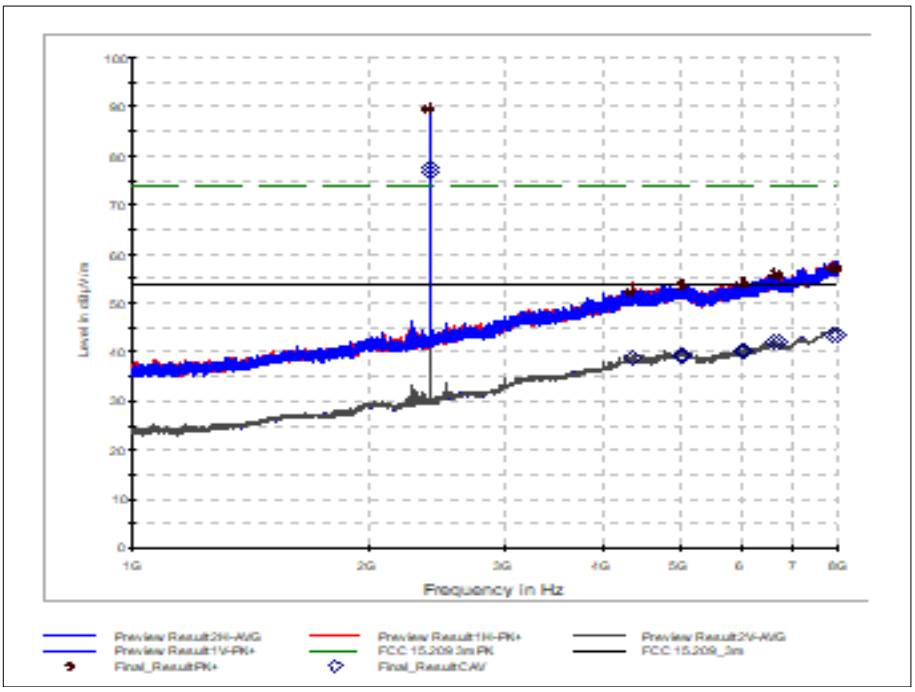


Figure 47 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

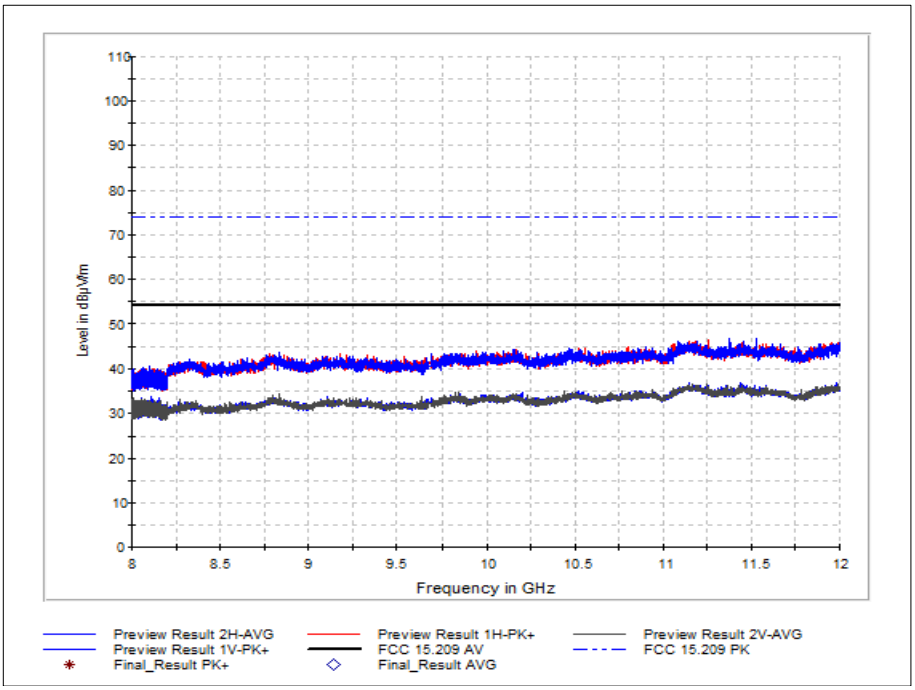


Figure 48 - 2402 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

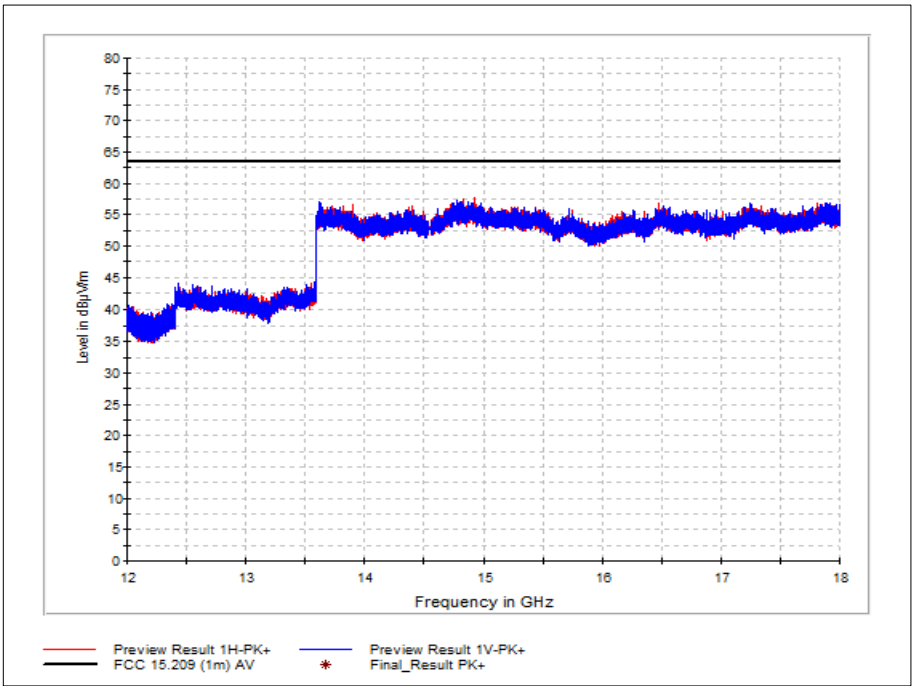


Figure 49 - 2402 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

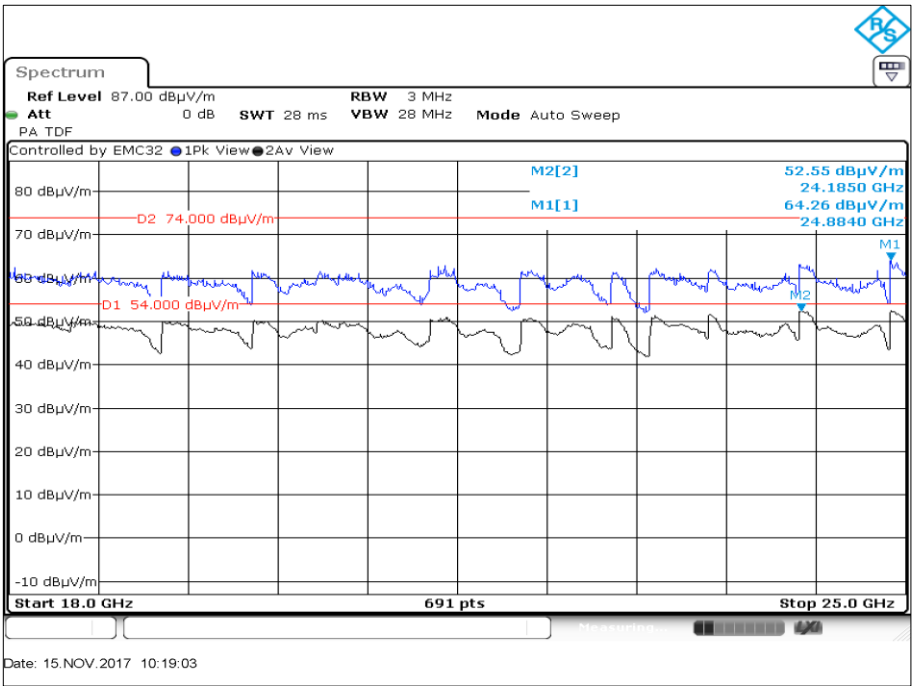


Figure 50 - 2402 MHz - 18 GHz to 26 GHz - Vertical

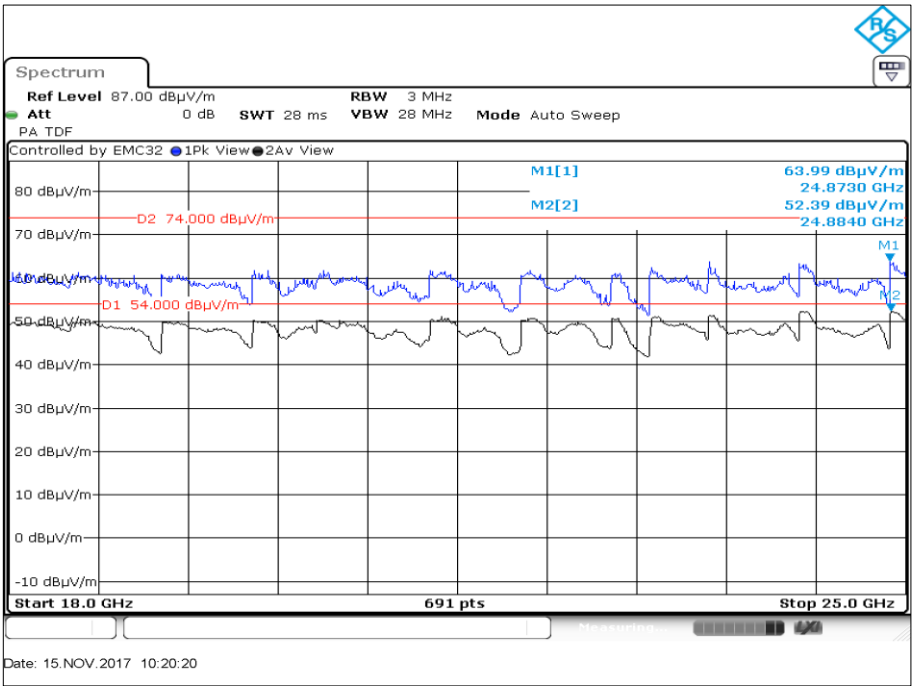


Figure 51 - 2402 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

2440 MHz - 30 MHz to 1 GHz Emissions Results

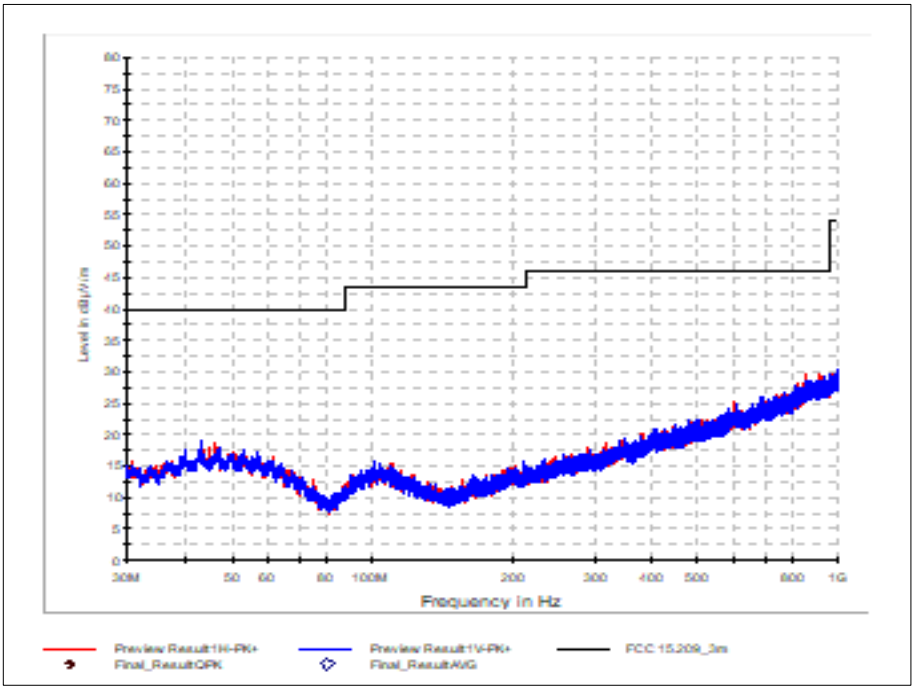


Figure 52 - 2440 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.44000	86.5 dBµV/m	---	NA #1	NA #1	NA #1	NA #1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 24 - 2440 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

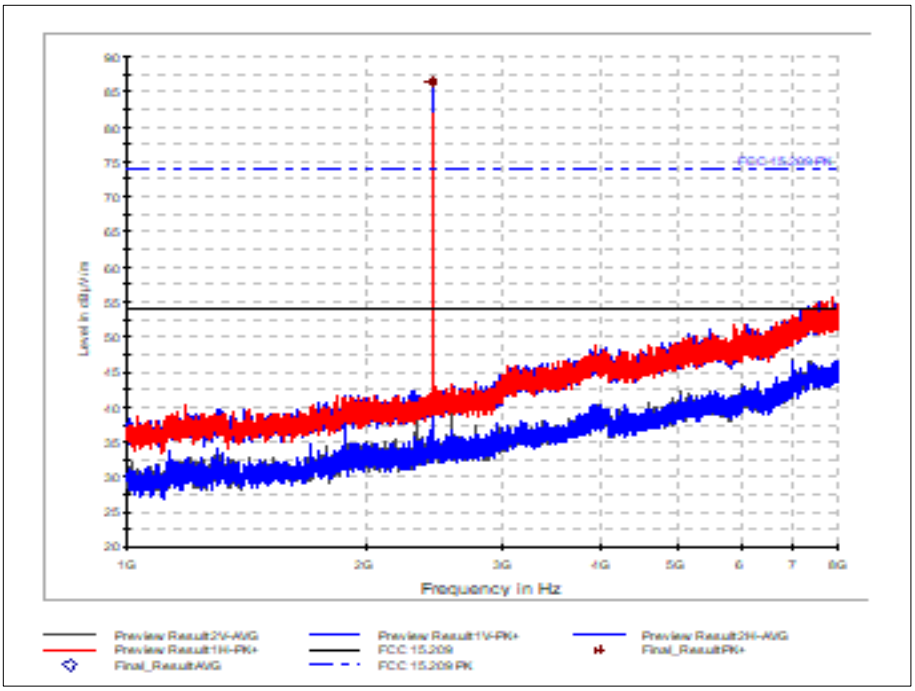


Figure 53 - 2440 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

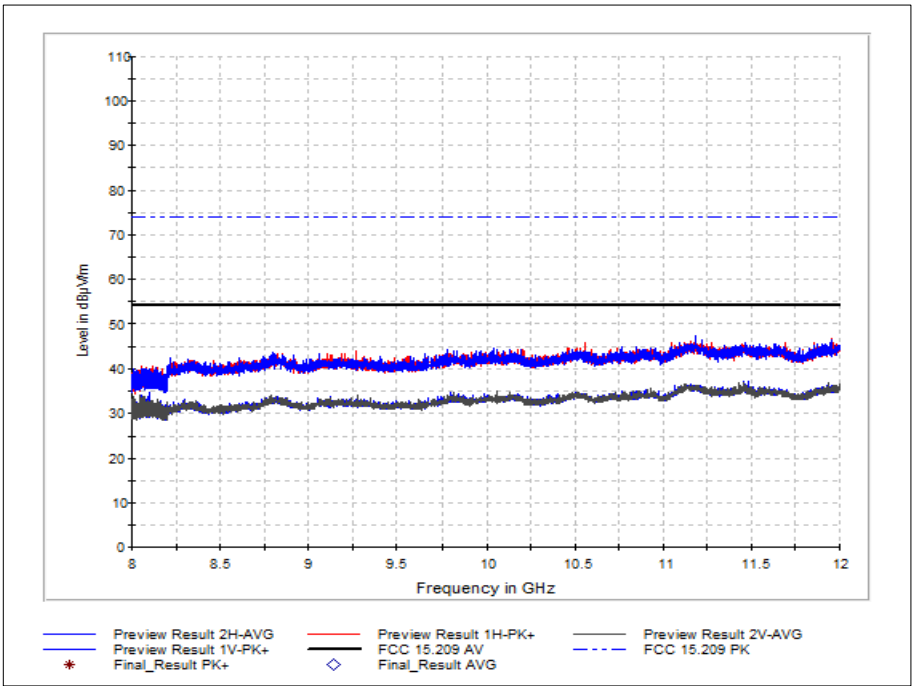


Figure 54 - 2440 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

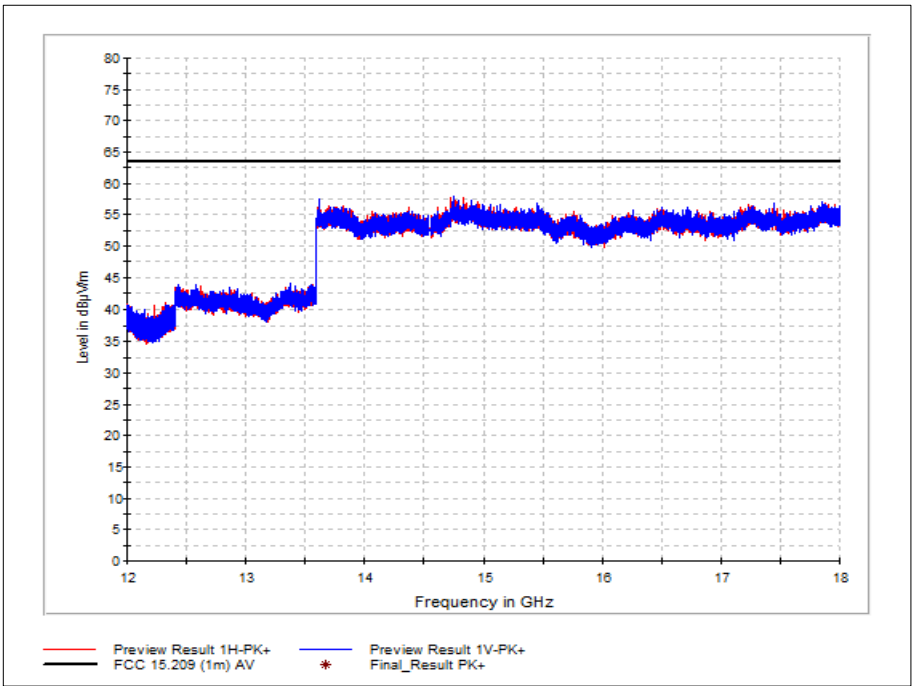


Figure 55 - 2440 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

Product Service

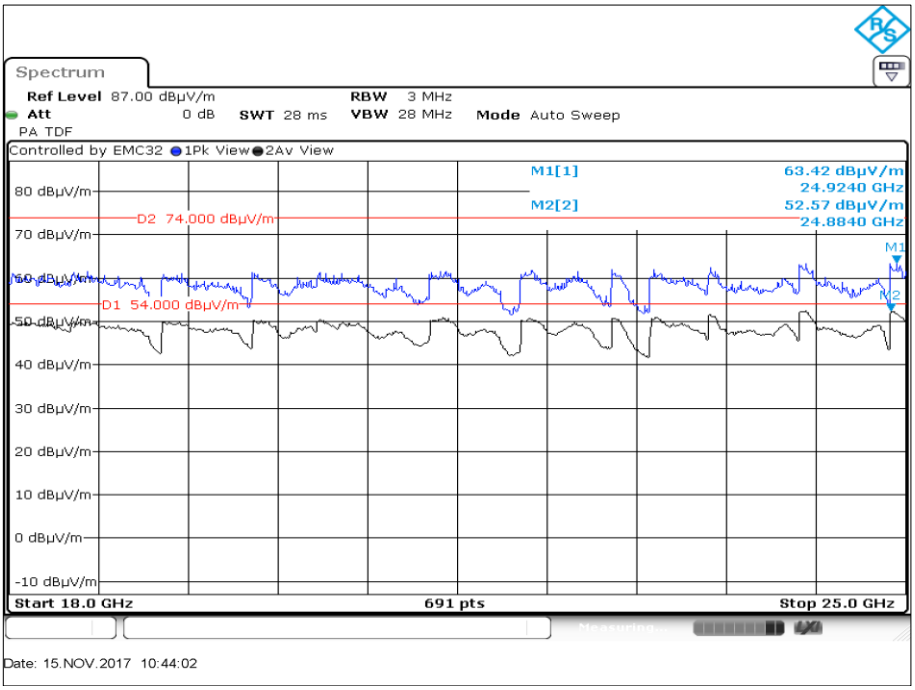


Figure 56 - 2440 MHz - 18 GHz to 26 GHz - Vertical

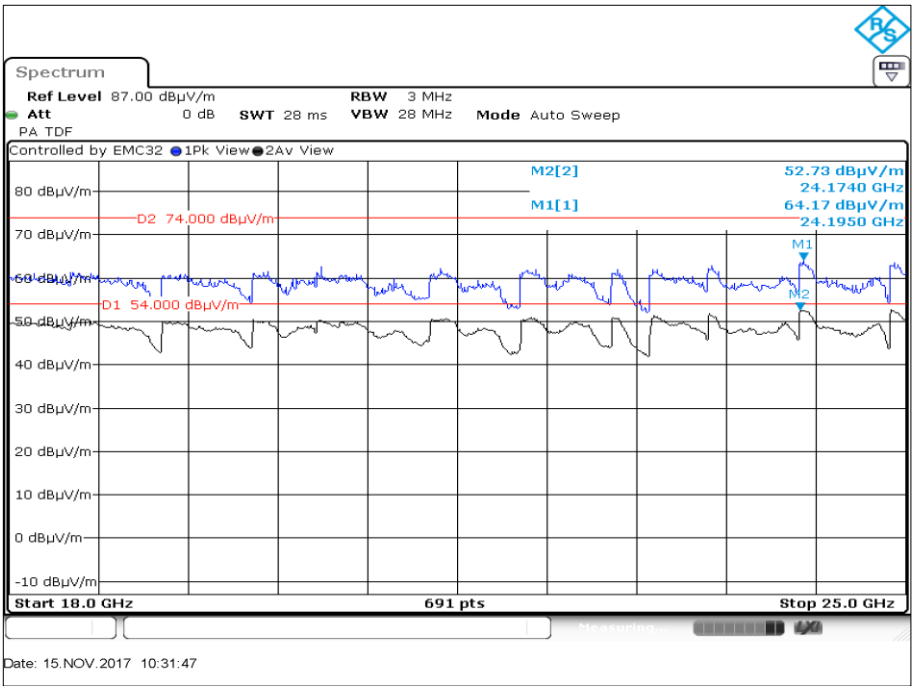


Figure 57 - 2440 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

2480 MHz - 30 MHz to 1 GHz Emissions Results

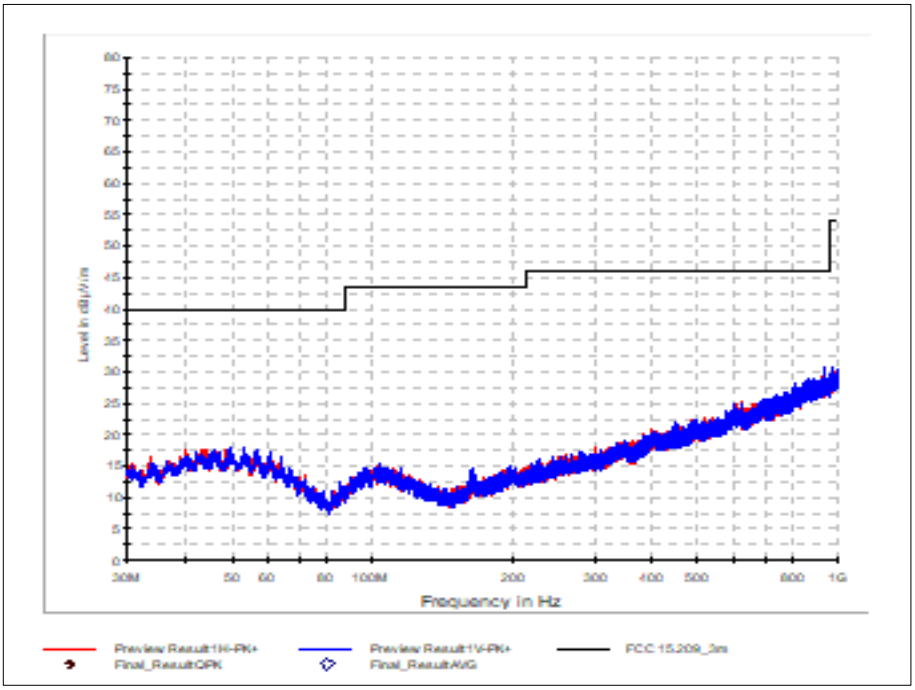


Figure 58 - 2480 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.48000	86.8 dBµV/m	74.8 dBµV/m	NA #1	NA…#1	NA…#1	NA…#1

#1: Intentional radiation within radiation limits, see chapter 2.1

Table 25 - 2480 MHz - 1 GHz to 26 GHz Emissions Results

No other emissions were detected within 6 dB of the limit.

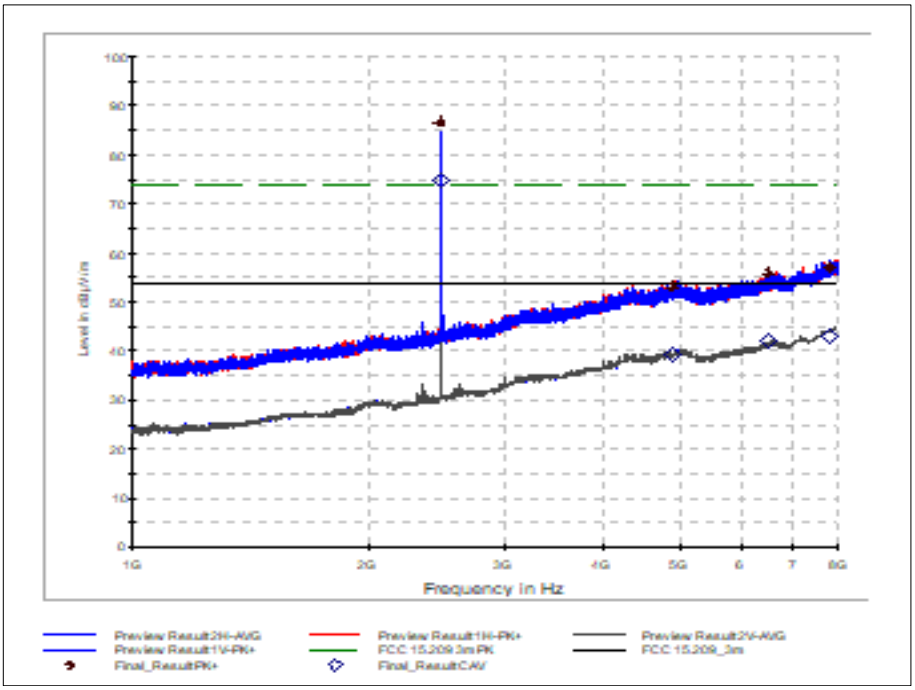


Figure 59 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

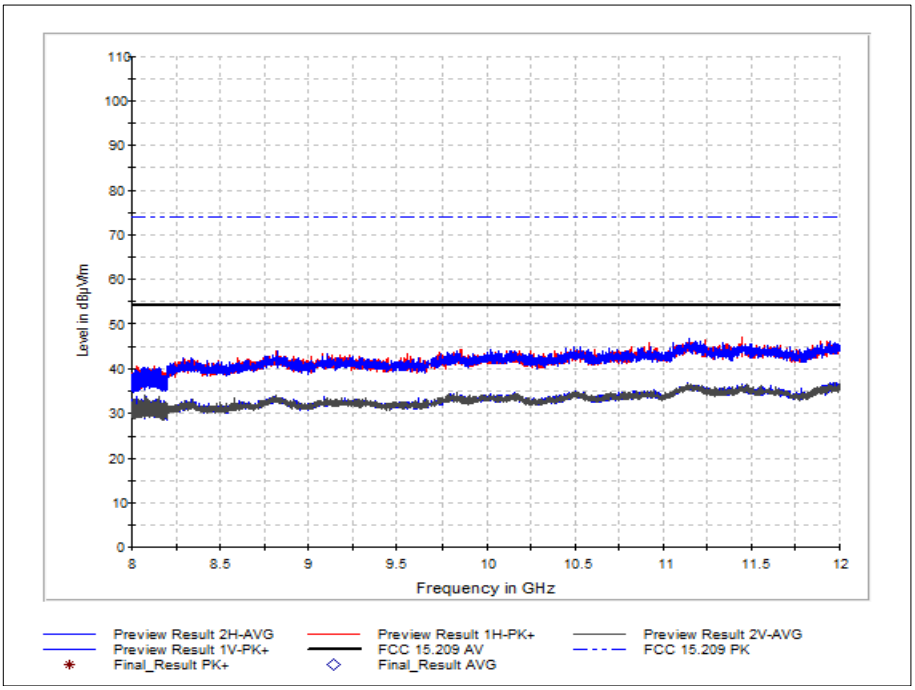


Figure 60 - 2480 MHz - 8 GHz to 12 GHz - Horizontal and Vertical

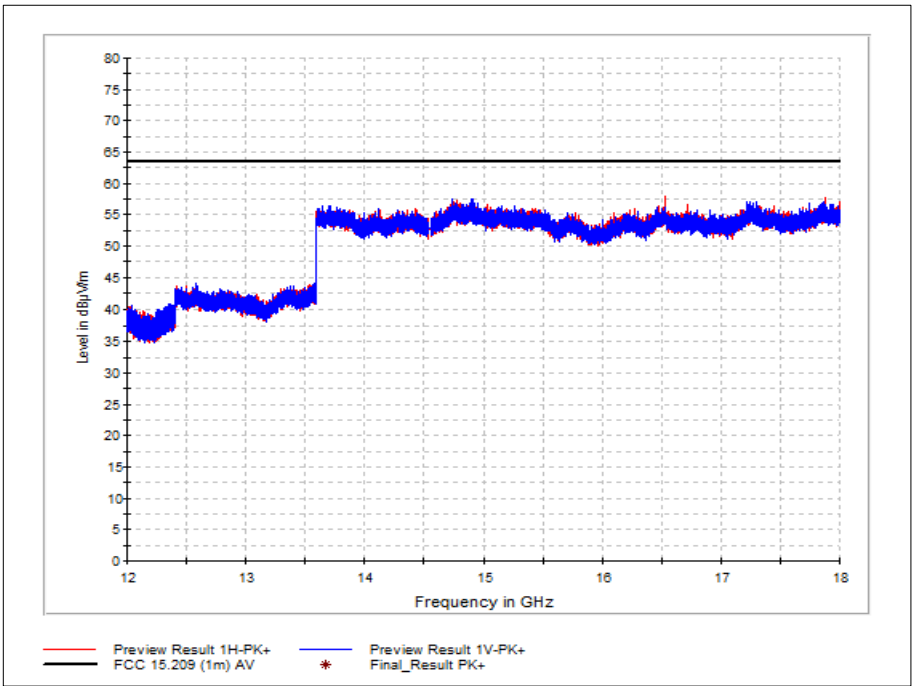


Figure 61 - 2480 MHz - 12 GHz to 18 GHz - Horizontal and Vertical

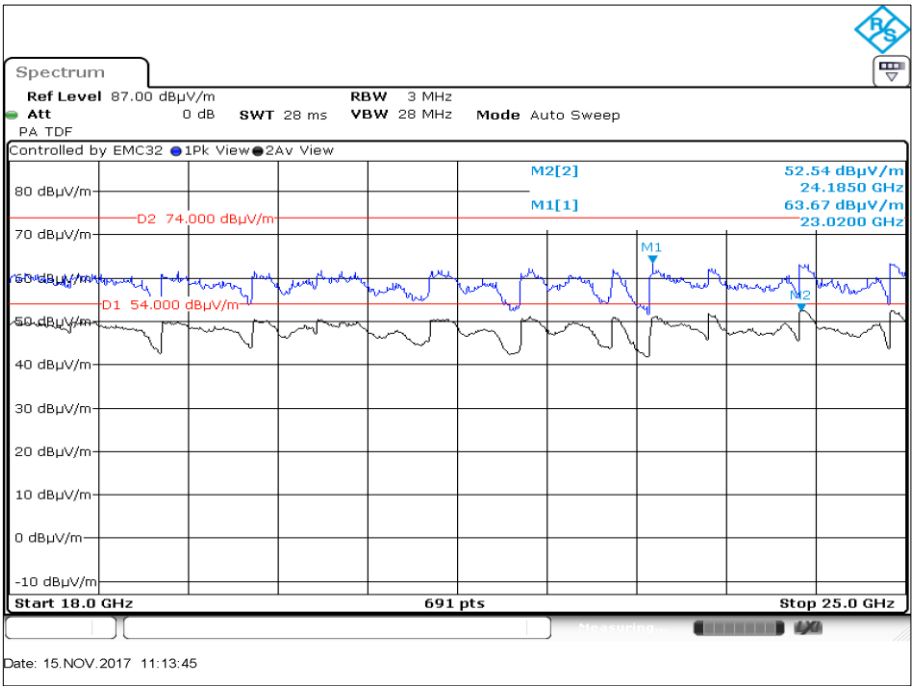


Figure 62 - 2480 MHz - 18 GHz to 26 GHz - Vertical

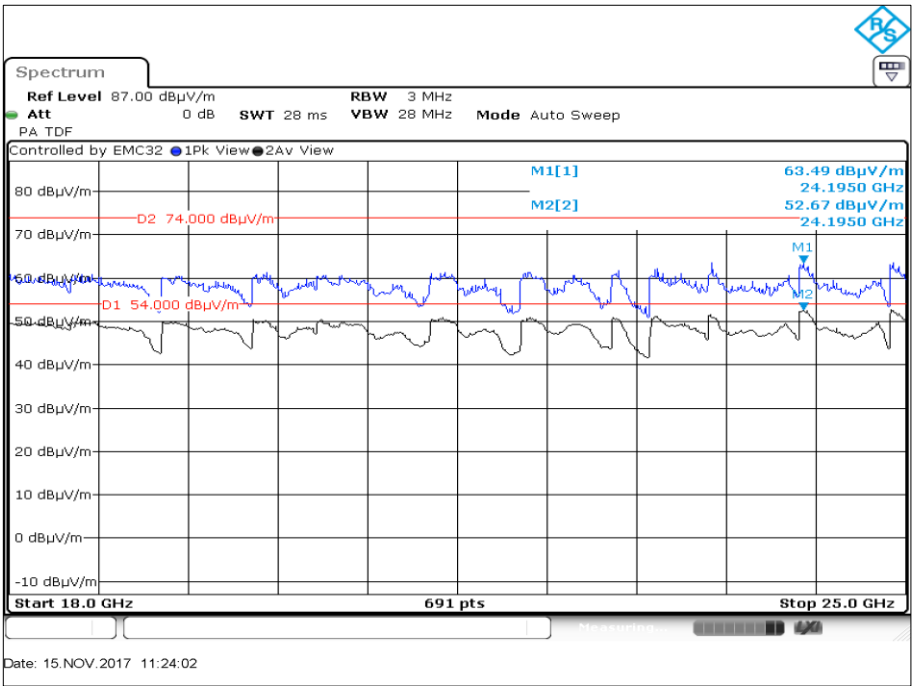


Figure 63 - 2480 MHz - 18 GHz to 26 GHz - Horizontal

Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Product Service

2.6.7 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Double ridged horn antenna	Rohde & Schwarz	HF907	2073	24	2019-06-30
TRILOG antenna	Schwarzbeck	VULB 9163	19691	24	2017-10-22
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2018-06-30

Table 26

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.7 AC Power Line Conducted Emissions

2.7.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.207, N/A and 8.8

2.7.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.7.3 Date of Test

2017-11-16

2.7.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

2.7.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	31,0 %

2.7.6 Test Results

Heart Rate Monitor - Normal operation

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Product Service

Live Line Emissions Results

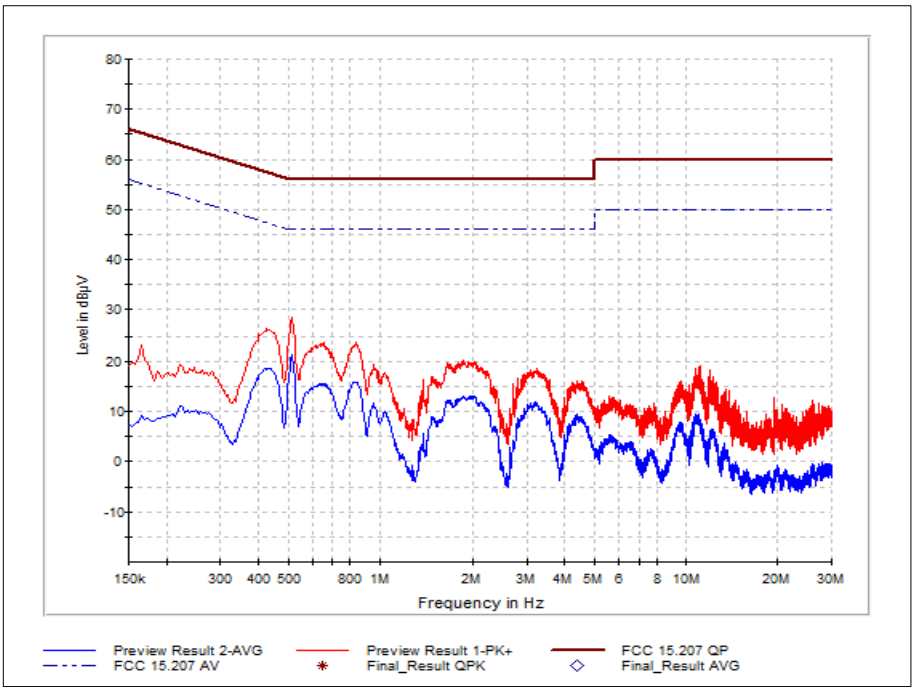


Figure 64 - Live Line - 150 kHz to 30 MHz

Neutral Line Emissions Results

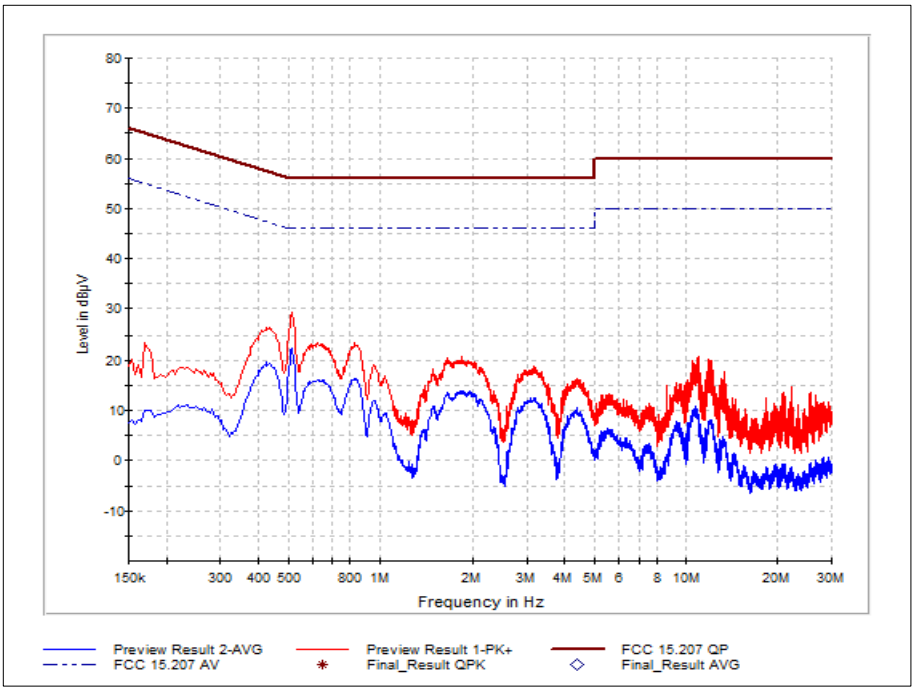


Figure 65 - Neutral Line - 150 kHz to 30 MHz

FCC 47 CFR Part 15, Limit Clause 15.207 and Industry Canada RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 27

*Decreases with the logarithm of the frequency.

2.7.7 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. 9.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
V-network	Rohde & Schwarz	ESH3-Z5	18919	36	2019-10-31
EMI test receiver	Rohde & Schwarz	ESPI7	19578	12	2018-09-30

Table 28

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

2.8 RF Exposure Assessment

2.8.1 Specification Reference

CFR 47 Pt.1.1310, RSS-102 Issue 5

2.8.2 Equipment Under Test and Modification State

NeoBeat, S/N: Prototype DTM1 - Modification State 0

2.8.3 Test Method

The test was performed in accordance with KDB 447498 D01 v06, chapter 4.3.1 a
The test was performed in accordance with RSS-102, Issue 5, chapter 2.5

2.8.4 Test Results

In accordance with KDB 447498 D01 v06, chapter 4.3.1 a:

Maximum Radiated Field strength: (see chapter 2.6.6 in this report)	90.1 dBµV/m [at 3m and at 2.402 GHz]
Calculated Equivalent Radiated Power.	0.307 mW (e.i.r.p.)
Minimum separation distance:	5 mm

(0.307 / 0.5) * (2.402)^0,5 = 0.95 (Limit: < 3.0)

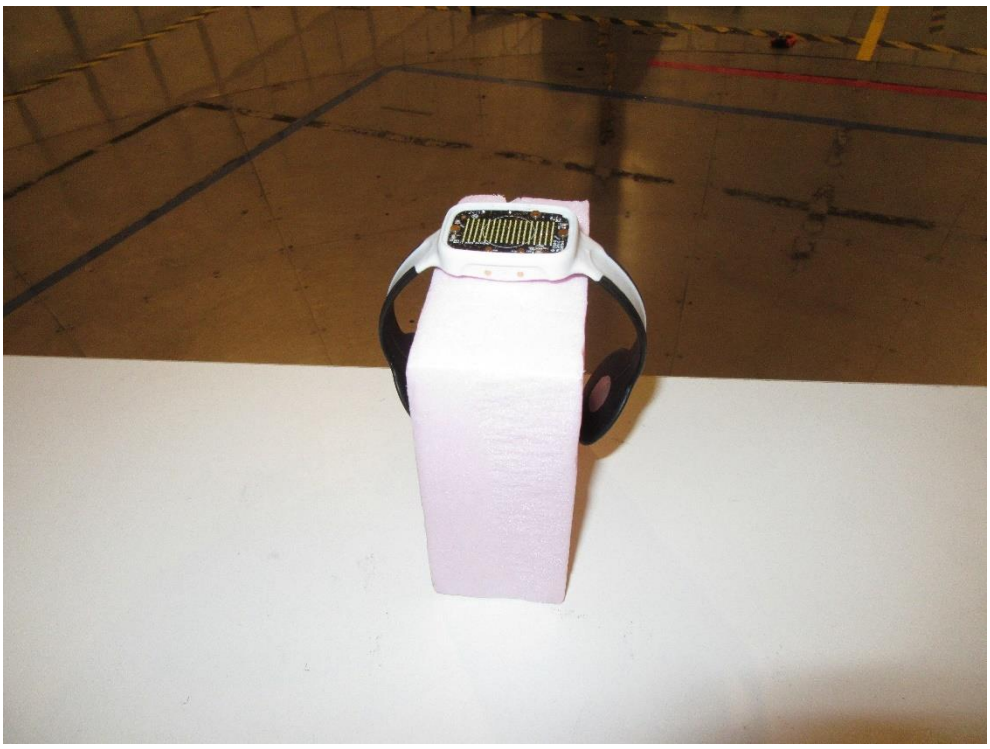
In accordance with RSS-102, Issue 5, chapter 2.5:

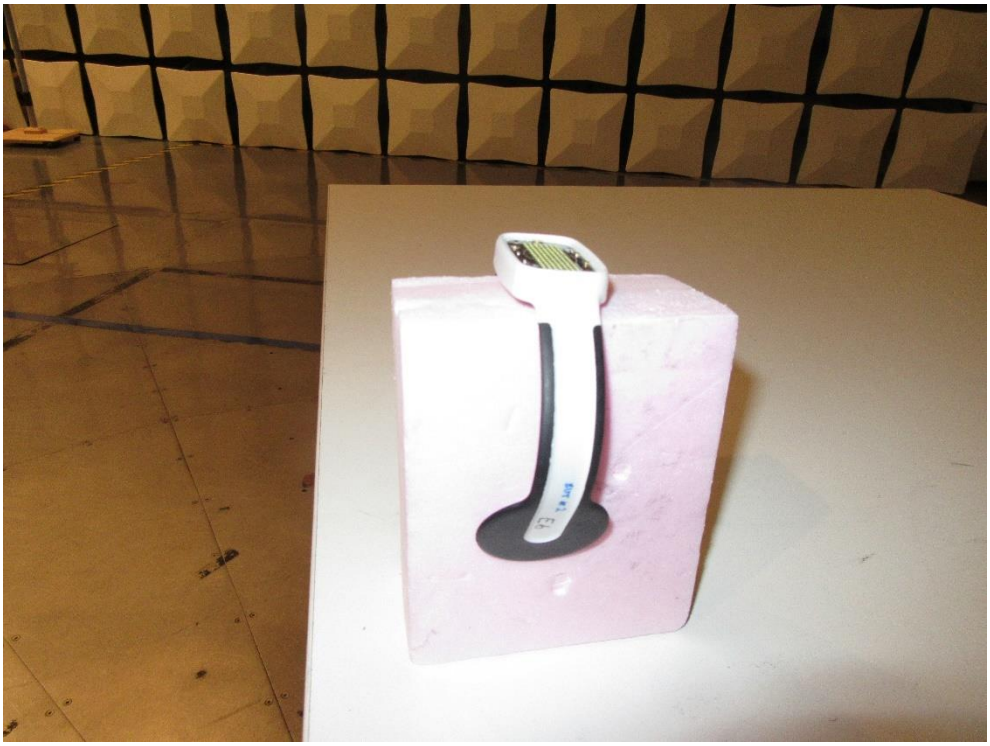
Maximum Radiated Field strength: (see chapter 2.6.6 in this report)	90.1 dBµV/m [at 3m and at 2.402 GHz]
Calculated Equivalent Radiated Power:	0.307 mW (e.i.r.p.)
Minimum separation distance:	5 mm
SAR evaluation Exemption limit:	4 mW (at 2450MHz, separation distance ≤5mm)

Product Service

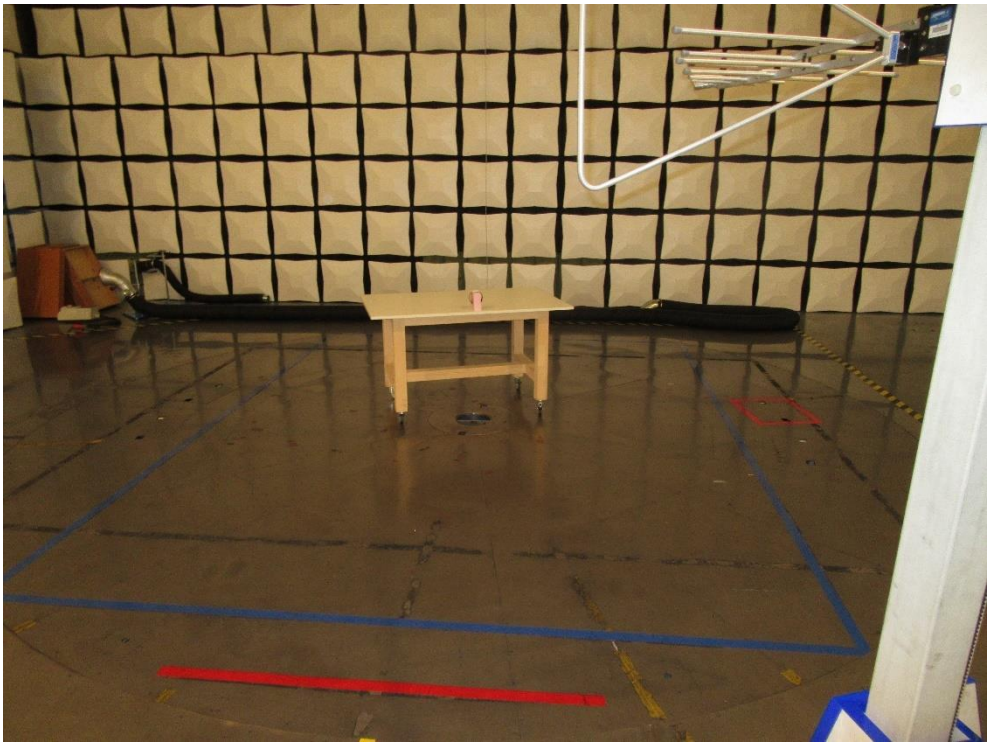
3 Photographs

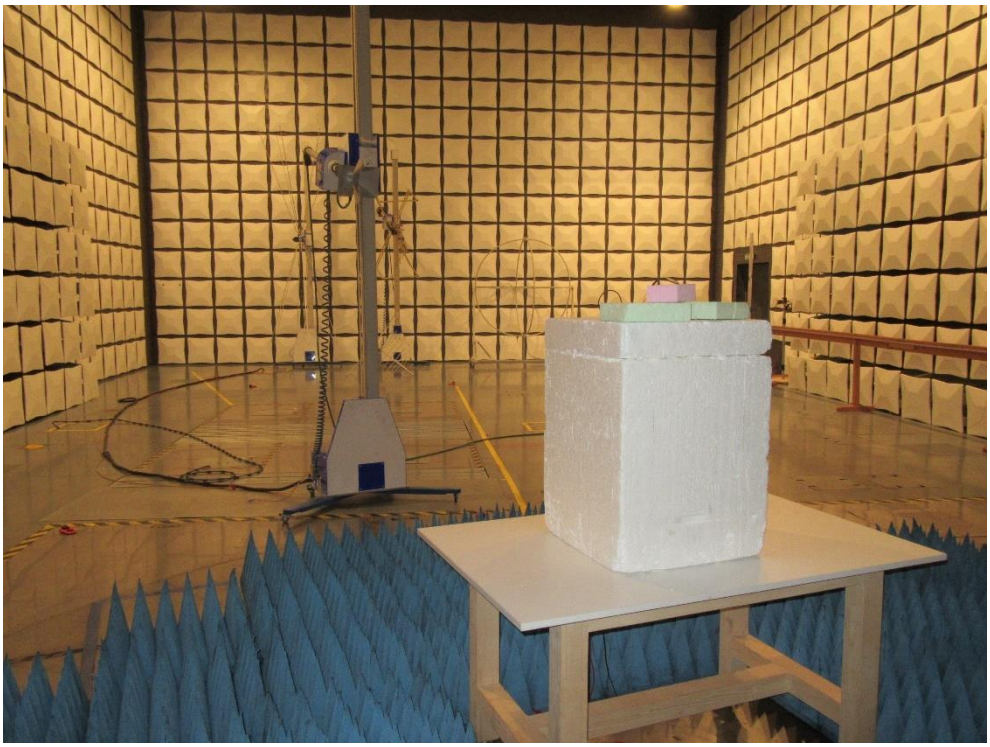
3.1 Equipment Under Test (EUT)



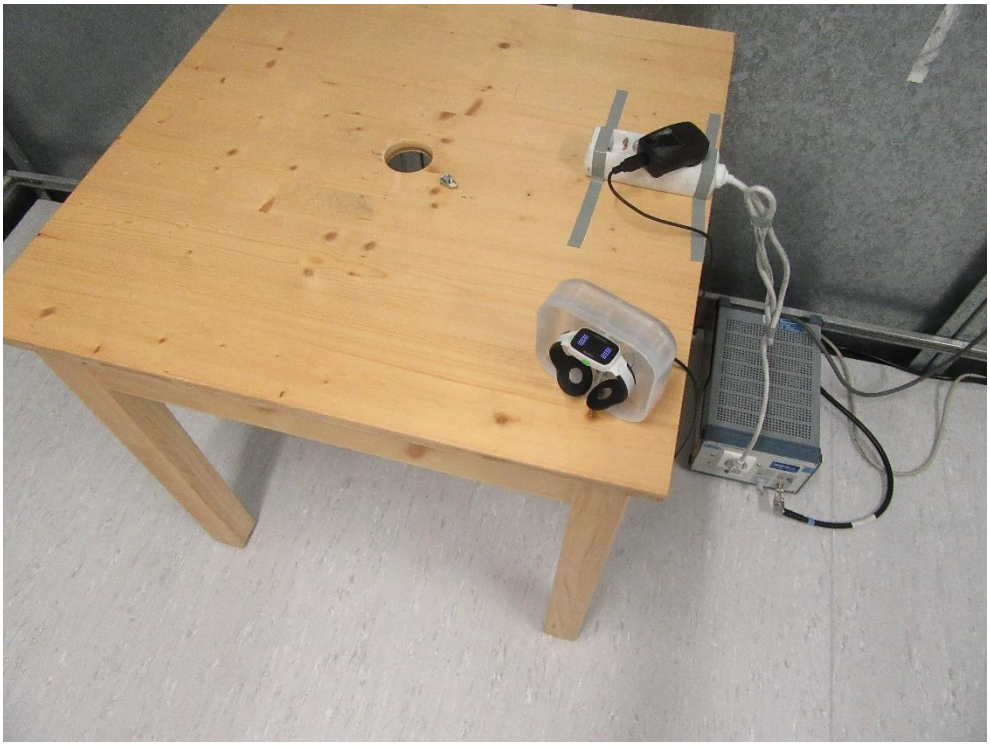


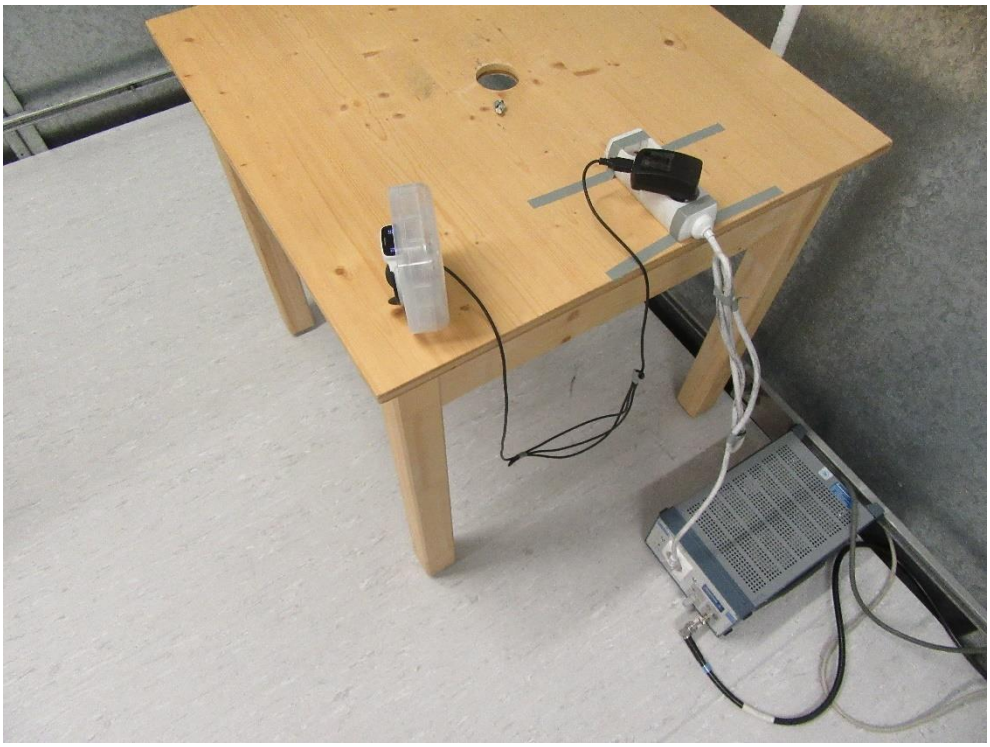
Product Service





Product Service





Product Service

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power, conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power, conducted, spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power, radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density, conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2,89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2,89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 29

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 30

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 31

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05, providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%
Note 8:
The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%

Product Service

Product Service

Product Service