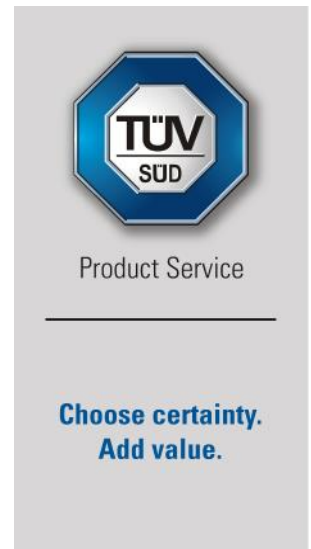


Report on the FCC and IC Testing of the
 ruwido austria gmbh
 Conducted sample (Test FW). Model: Type 2806,
 Model: 806A01
 Radiated Sample (Test FW). Model: Type 2806;
 Model: 806A01
 In accordance with FCC 47 CFR Part 15C and
 ISED Canada RSS-247 and ISED Canada RSS-
 GEN



Prepared for: ruwido austria gmbh
 Koestendorfer Str. 8
 5202 Neumarkt
 Austria

FCC ID: XYN806A
 IC: 8748A-806A

COMMERCIAL-IN-CONFIDENCE

Date: 2019-06-06
 Document Number: TR-51994-26567-01 | Issue: 03

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2019-06-06	<i>Steindl Martin</i>
Authorised Signatory	Matthias Stumpe	2019-06-06	<i>Stumpe</i>

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 ISED Canada RSS-247 and ISED Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2019-06-06	<i>Steindl Martin</i>

Laboratory Accreditation Laboratory recognition ISED Canada test site registration
 DAKS 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, ISED Canada RSS-247 and ISED Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11).

DISCLAIMER AND COPYRIGHT

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ACCREDITATION

Our BNetzA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our BNetzA Accreditation. Results of tests not covered by our BNetzA Accreditation Schedule are marked NBA (Not BNetzA Accredited).

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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	2018-03-23
2	Changed ICES to IC	2018-07-09
3	Industry Canada changed to ISED Canada, space character in FCC ID deleted	2019-06-06

Table 1

1.2 Introduction

Applicant	ruwido austria gmbh
Manufacturer	ruwido austria gmbh
Model Number(s)	Type 2806; Model: 806A01
Serial Number(s)	DUT1 and DUT3
Hardware Version(s)	
Software Version(s)	
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C, ISED Canada RSS-247 and ISED Canada RSS-GEN:2016 and Issue 2 (2017-02) and Issue 4 (2014-11)
Test Plan/Issue/Date	N/A
Order Number Date	N/A
Date of Receipt of EUT	2018-02-23
Start of Test	2018-02-28
Finish of Test	2018-03-05
Name of Engineer(s)	Martin Steindl
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r02



1.3 Brief Summary of Results

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

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Stand alone Transmitting Continuously				
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	15.247 (a)(2), 5.2 and 6.6	Emission Bandwidth	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	15.205 N/A and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.247 (d) and 5.5	Spurious Conducted Emissions	Pass	ANSI C63.10 (2013)
2.7	15.247 (d), 15.205, 5.5 and 6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)

Table 2



1.4 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: DUT1			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: DUT3			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.5 Test Location

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

Test Name	Name of Engineer(s)
Configuration and Mode: Stand alone Transmitting Continuously	
Maximum Conducted Output Power	Martin Steindl
Power Spectral Density	Martin Steindl
Emission Bandwidth	Martin Steindl
Authorised Band Edges	Martin Steindl
Restricted Band Edges	Martin Steindl
Spurious Conducted Emissions	Martin Steindl
Spurious Radiated Emissions	Martin Steindl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany7



2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT1 - Modification State 0

2.1.3 Date of Test

2018-02-28

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

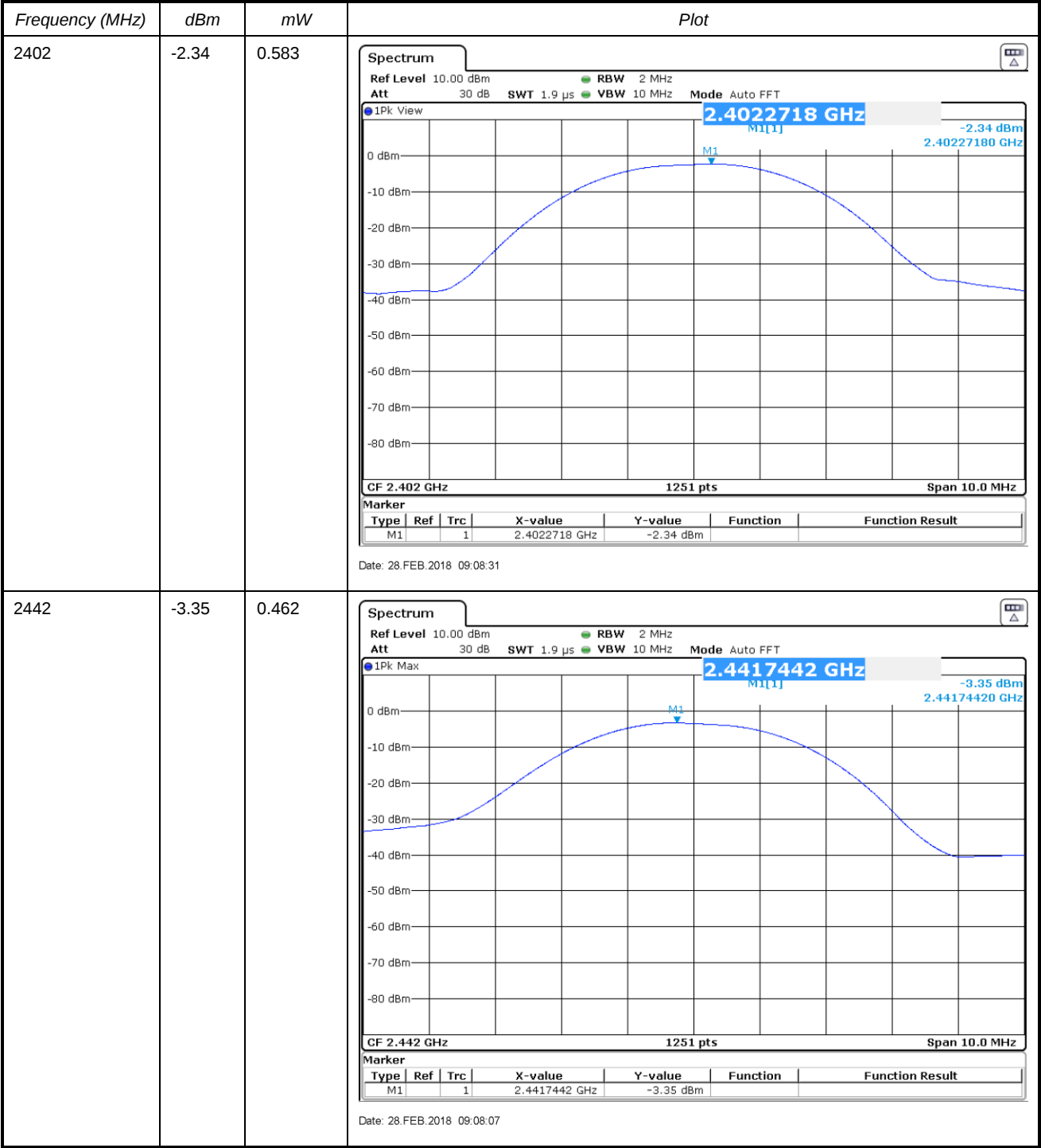
Ambient Temperature	22.0 °C
Relative Humidity	13.0 %



Product Service

2.1.6 Test Results

Stand alone Transmitting Continuously





Product Service

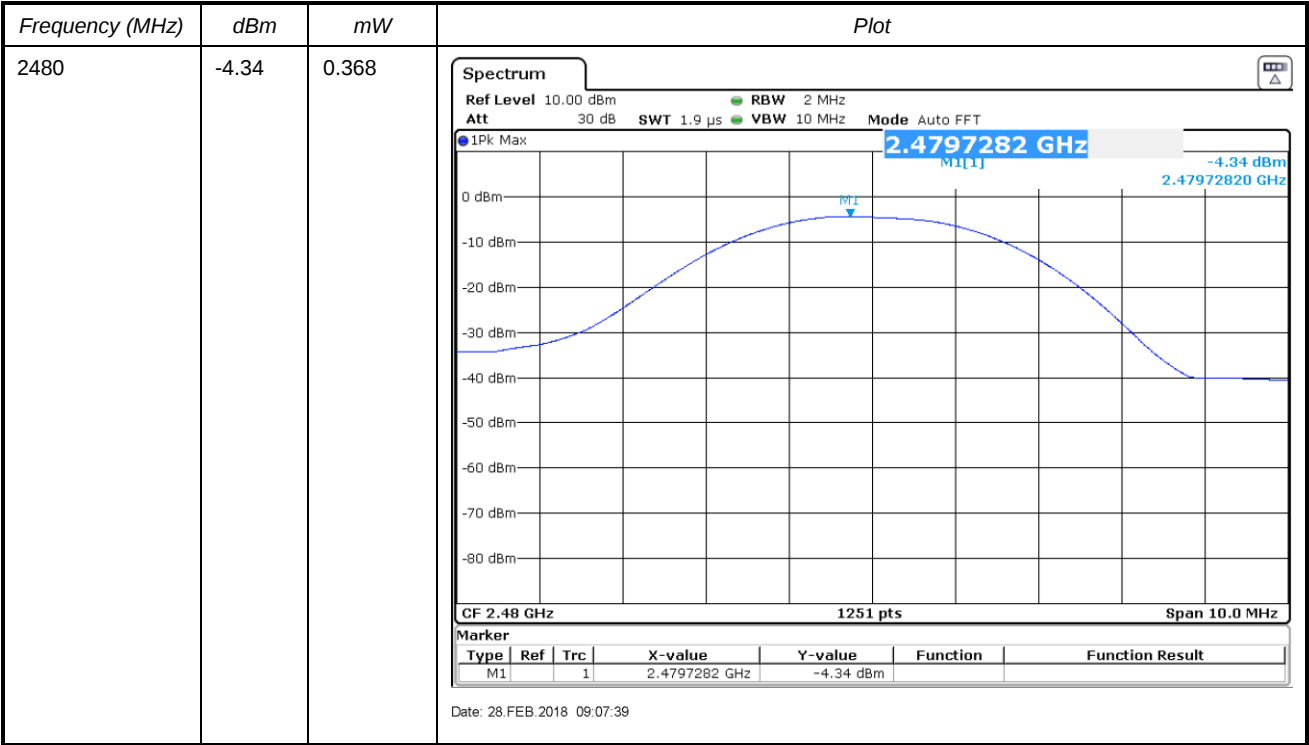


Table 5
FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

ISED Canada RSS-247, Limit Clause 5.4 (d)
For DTSSs 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 Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSV40	Rohde & Schwarz	101448	20219	12	2019-01

Table 6

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.2 Power Spectral Density

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT1 - Modification State 0

2.2.3 Date of Test

2018-02-28

2.2.4 Test Method

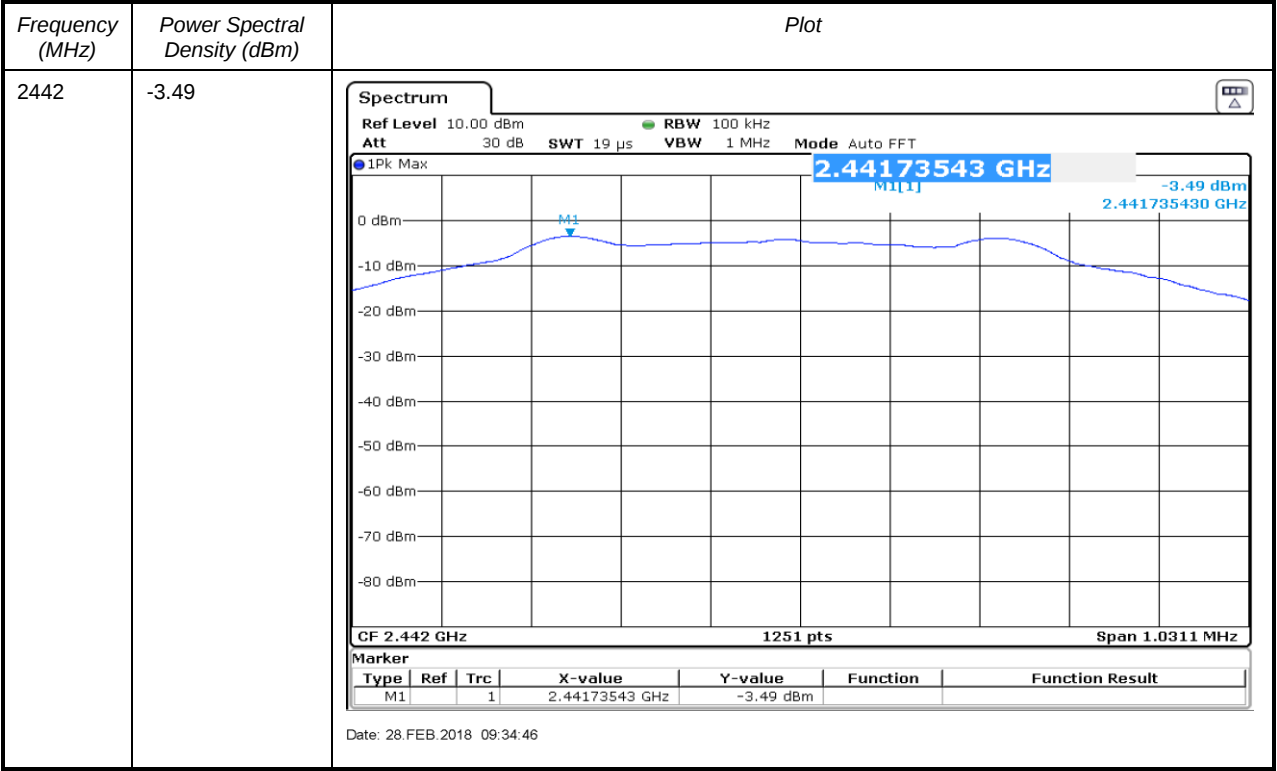
This test was performed in accordance with ANSI C63.10, clause 11.10.2.

2.2.5 Environmental Conditions

Ambient Temperature 22.0 °C
Relative Humidity 13.0 %

2.2.6 Test Results

Stand alone Transmitting Continuously





Product Service

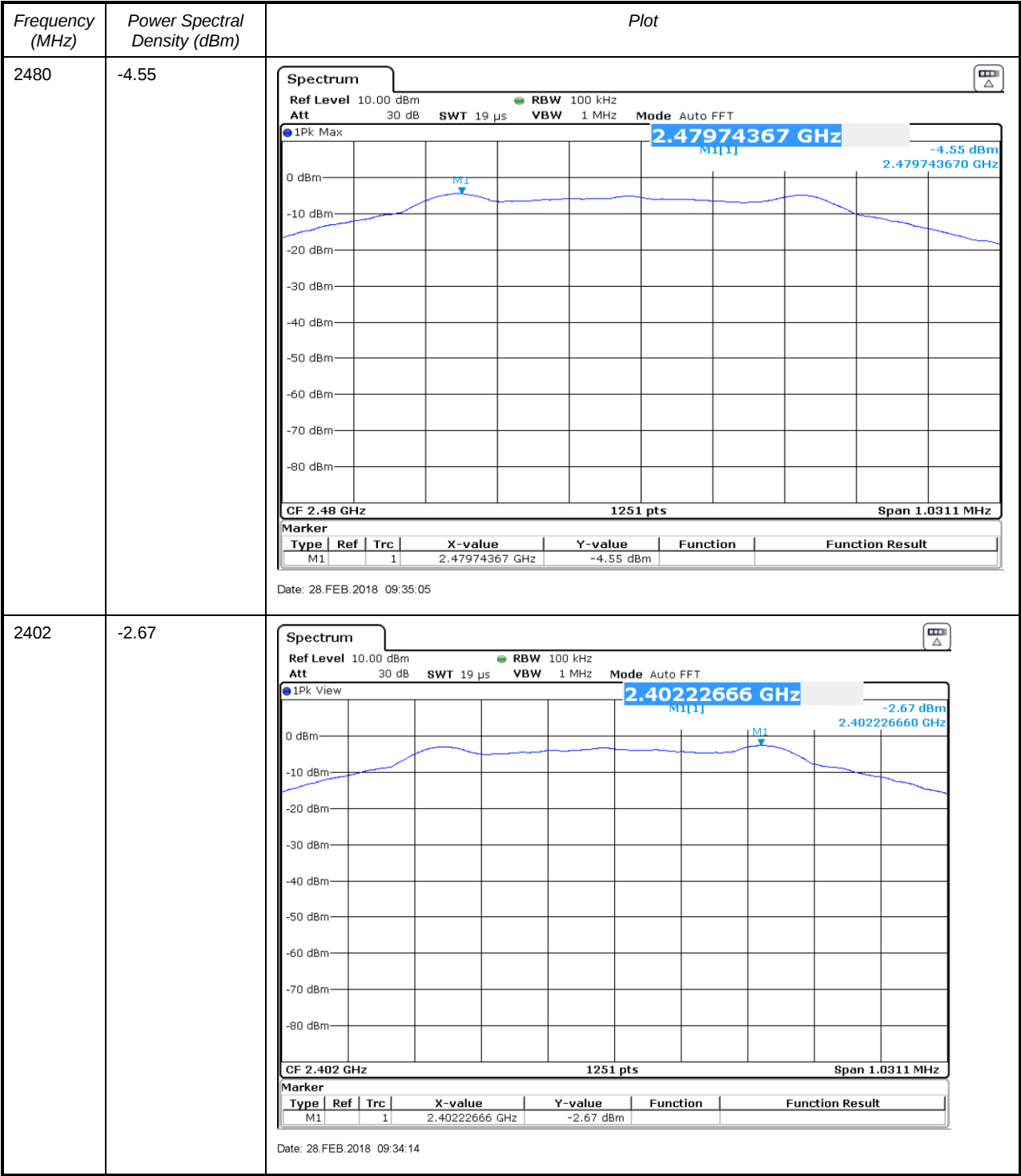


Table 7

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.

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



Product Service

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.

2.2.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSV40	Rohde & Schwarz	101448	20219	12	2019-01

Table 8

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



Product Service

2.3 Emission Bandwidth

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT1 - Modification State 0

2.3.3 Date of Test

2018-02-28 to 2018-03-05

2.3.4 Test Method

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

2.3.5 Environmental Conditions

Ambient Temperature 22.0 °C
Relative Humidity 13.0 %

2.3.6 Test Results

Stand alone Transmitting Continuously

Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2402	0.6874	1.0720
2442	0.6914	1.0800
2480	0.6874	1.0640

Table 9



Product Service

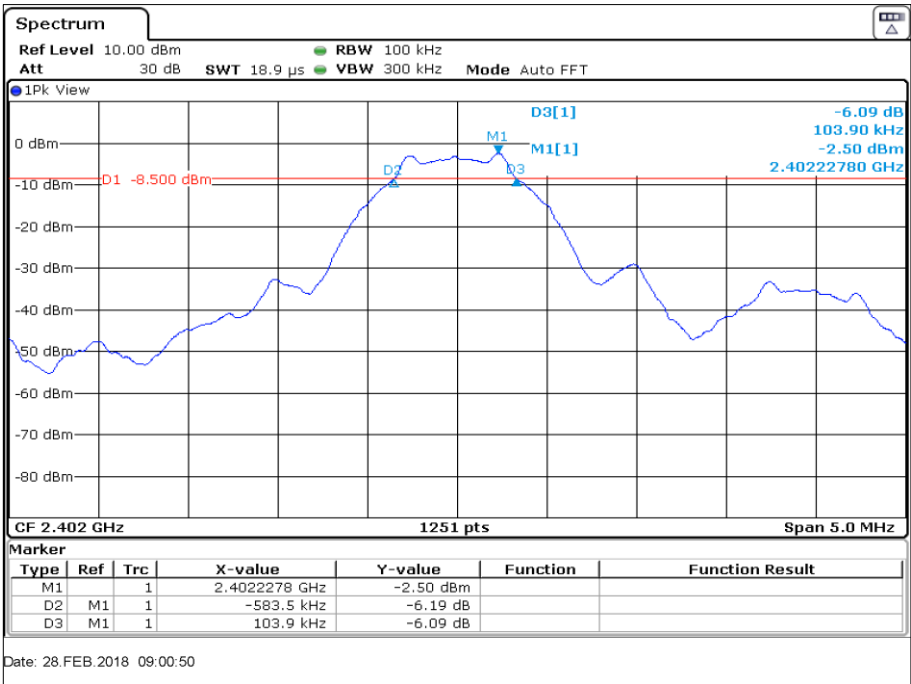


Figure 1 - 2402 MHz – 6 dB Bandwidth

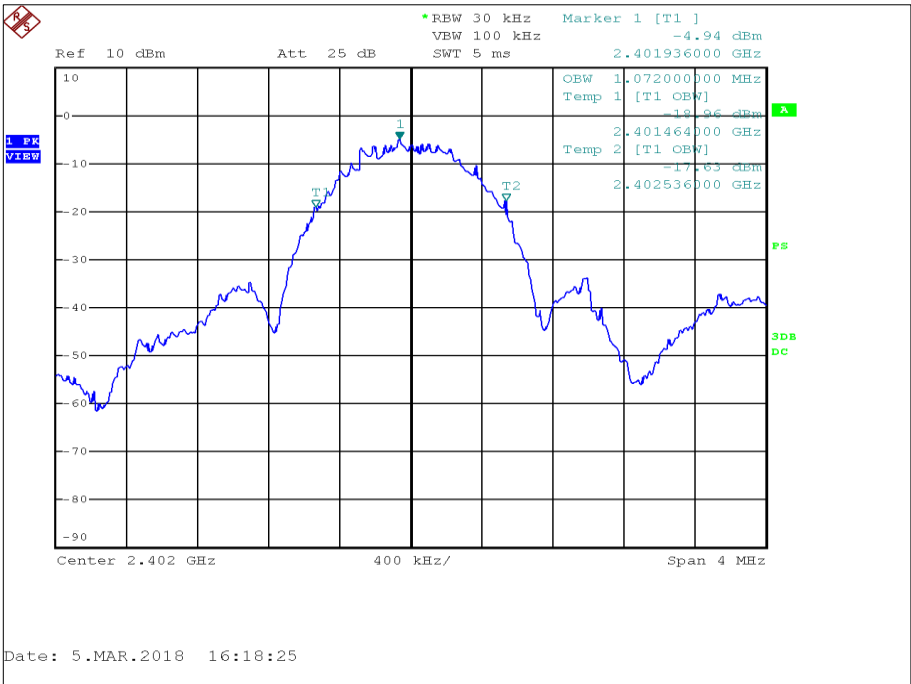


Figure 2 - 2402 MHz – 99% Occupied Bandwidth



Product Service

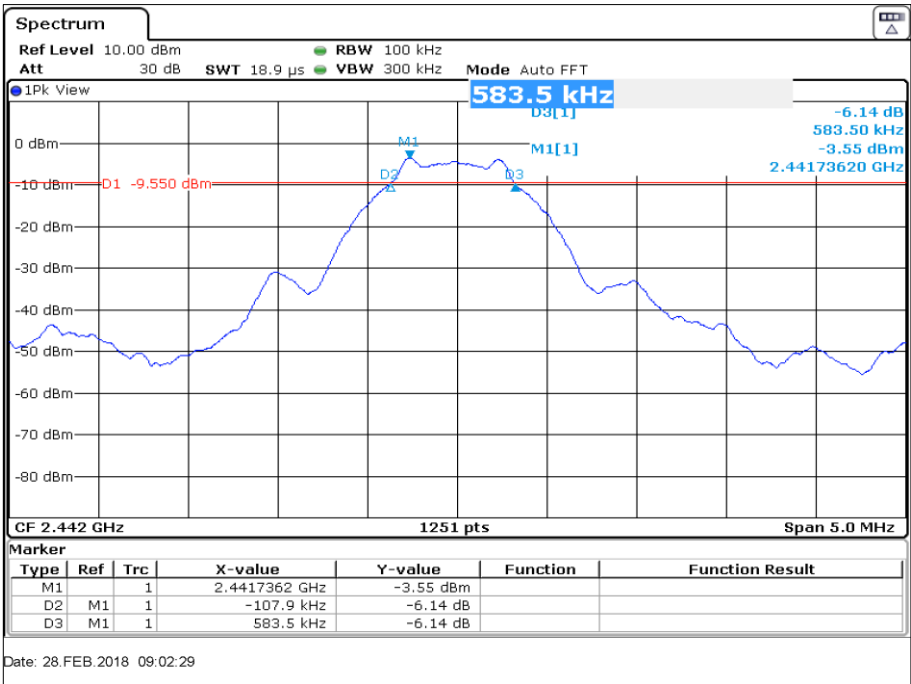


Figure 3 - 2442 MHz – 6 dB Bandwidth

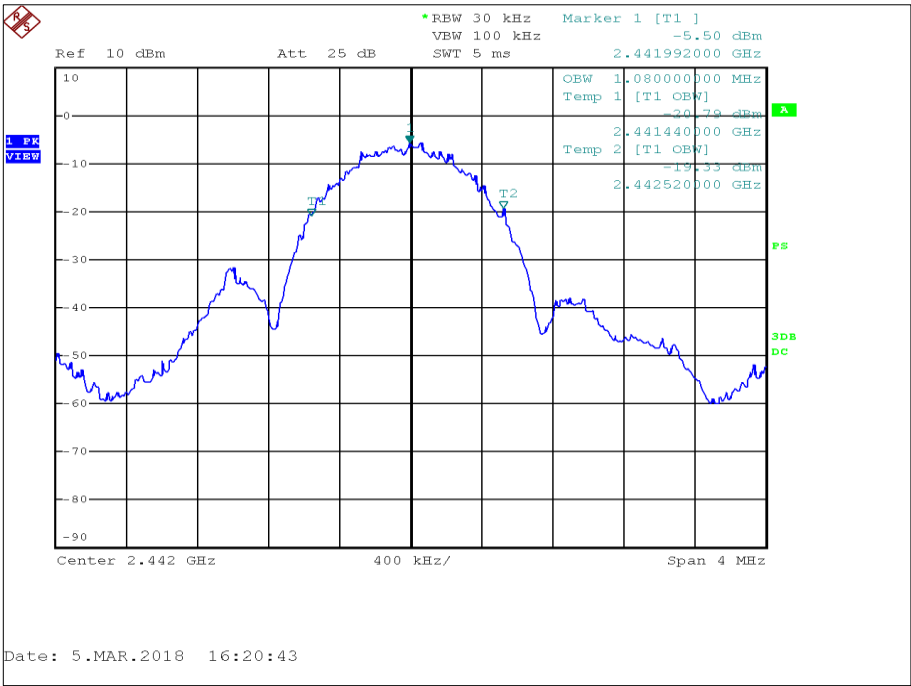


Figure 4 - 2442 MHz – 99% Occupied Bandwidth



Product Service

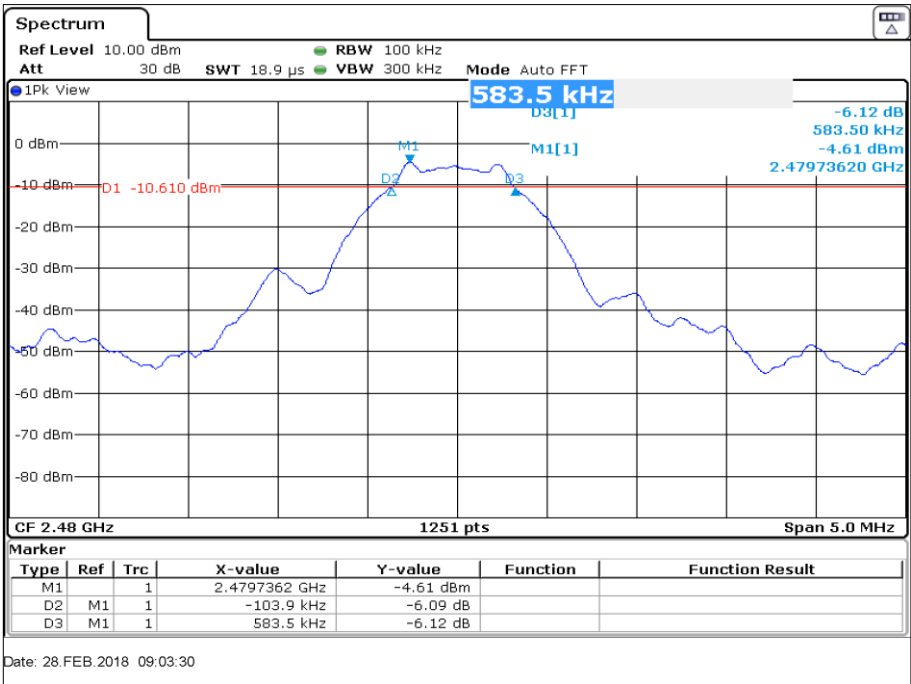


Figure 5 - 2480 MHz – 6 dB Bandwidth

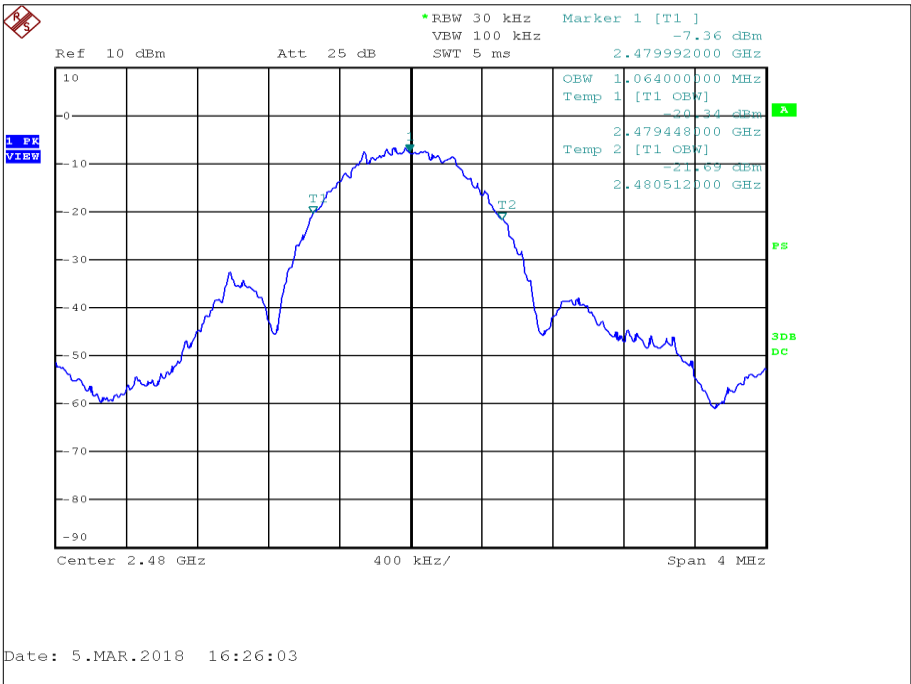


Figure 6 - 2480 MHz – 99% Occupied Bandwidth

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

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



Product Service

2.3.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSV40	Rohde & Schwarz	101448	20219	12	2019-01

Table 10

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, ISED Canada RSS-247 and ISED Canada RSS-GEN, Clause 15.247 (d), 5.5 and N/A

2.4.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT3 - Modification State 0

2.4.3 Date of Test

2018-03-02

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	20.0 °C
Relative Humidity	959.0 %

2.4.6 Test Results

Stand alone Transmitting Continuously

Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBμV/m)
2402	2400.0	41.7
2480	2483.5	42.1

Table 11



Product Service

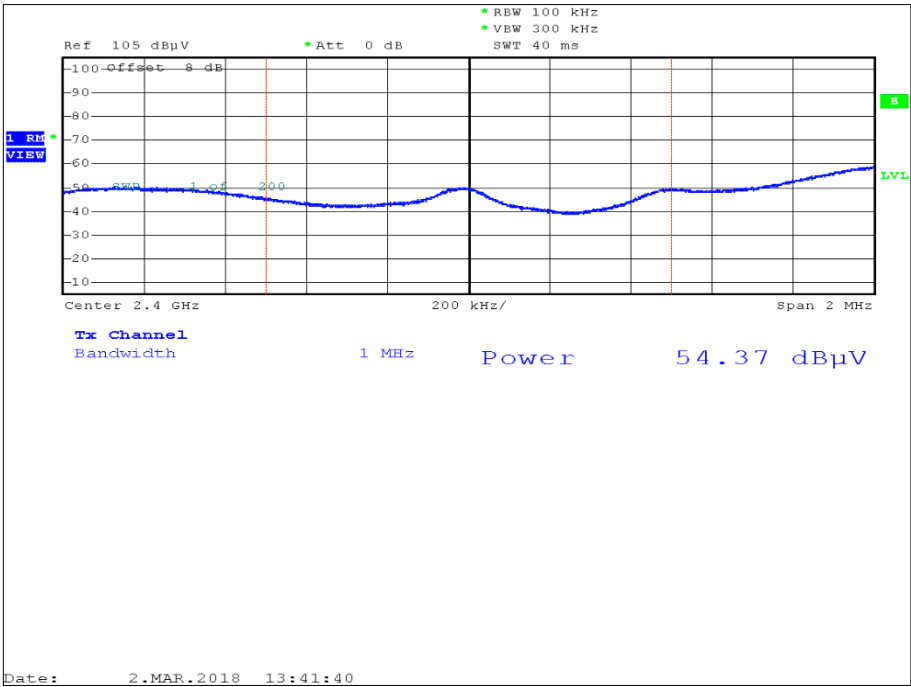


Figure 7 - 2402 MHz - Measured Frequency 2400.0 MHz

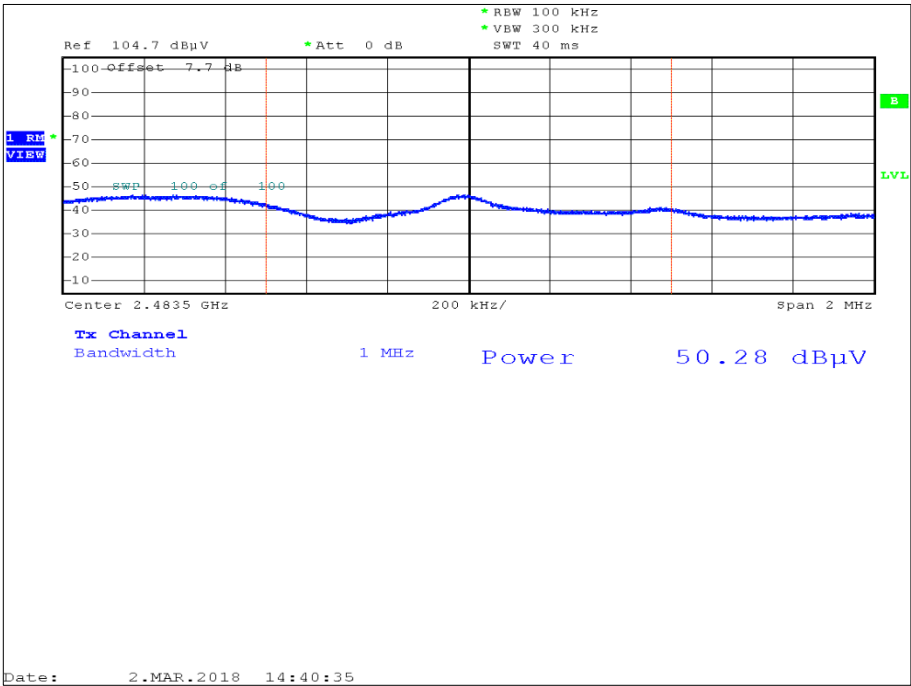


Figure 8 - 2480 MHz - Measured Frequency 2483.5 MHz

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.



Product Service

ISED 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 Fully anechoic room - cabin no. 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSP30	Rohde & Schwarz	100063	19533	12	2018-08

Table 12

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.5 Restricted Band Edges

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT3 - Modification State 0

2.5.3 Date of Test

2018-03-02

2.5.4 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:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$

2.5.5 Environmental Conditions

Ambient Temperature 20.0 °C
Relative Humidity 16.0 %

2.5.6 Test Results

Stand alone Transmitting Continuously

Frequency (MHz)	Measured Frequency (MHz)	Level (dBμV/m)
2402	2400.0	54.4
2480	2483.5	50.3

Table 13



Product Service

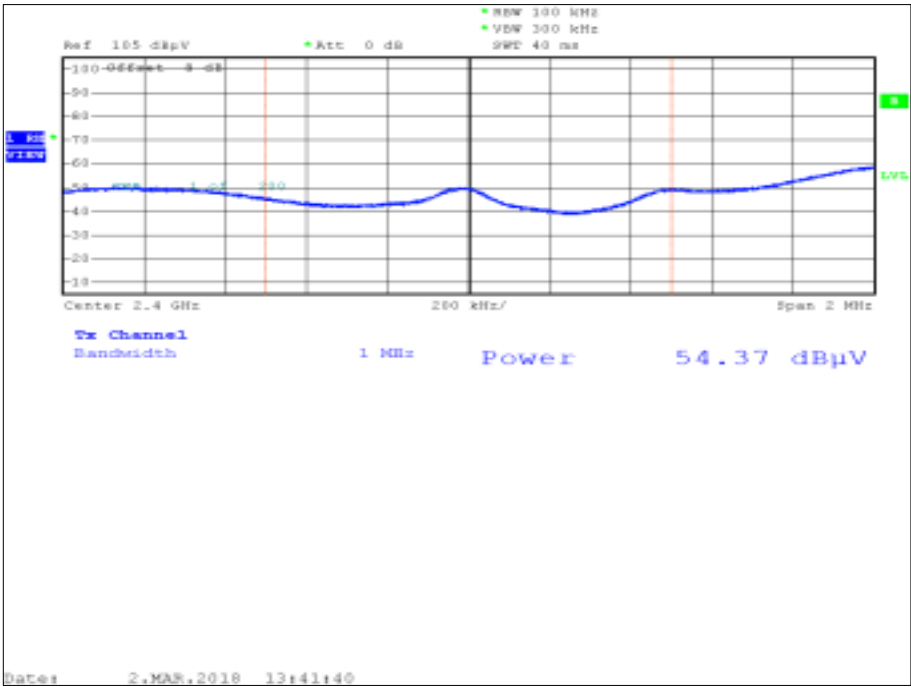


Figure 9 - 2402 MHz - Measured Frequency 2400.0 MHz

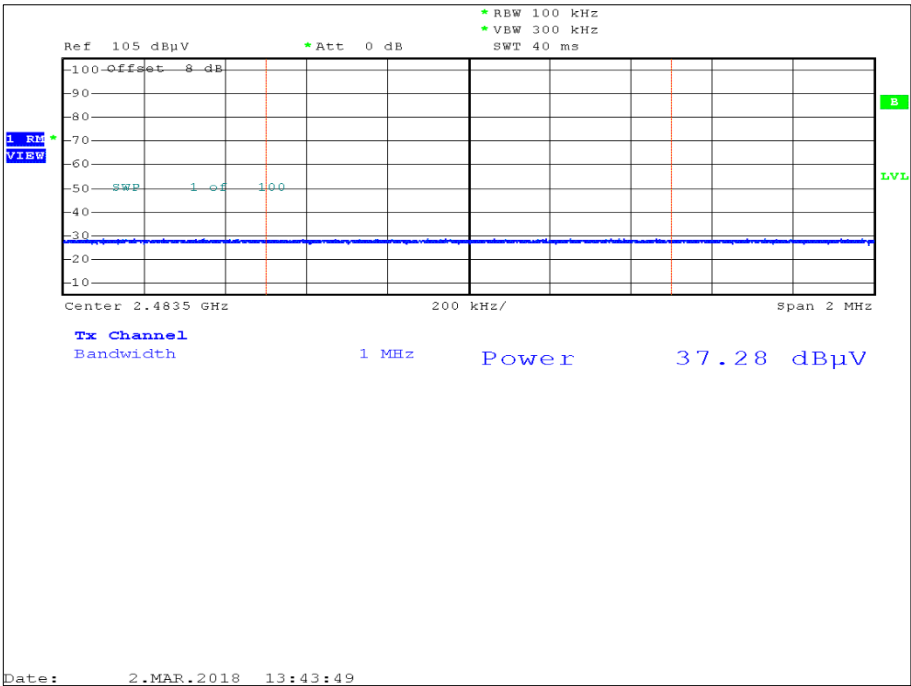


Figure 10 - 2402 MHz - Measured Frequency 2483.5 MHz



Product Service

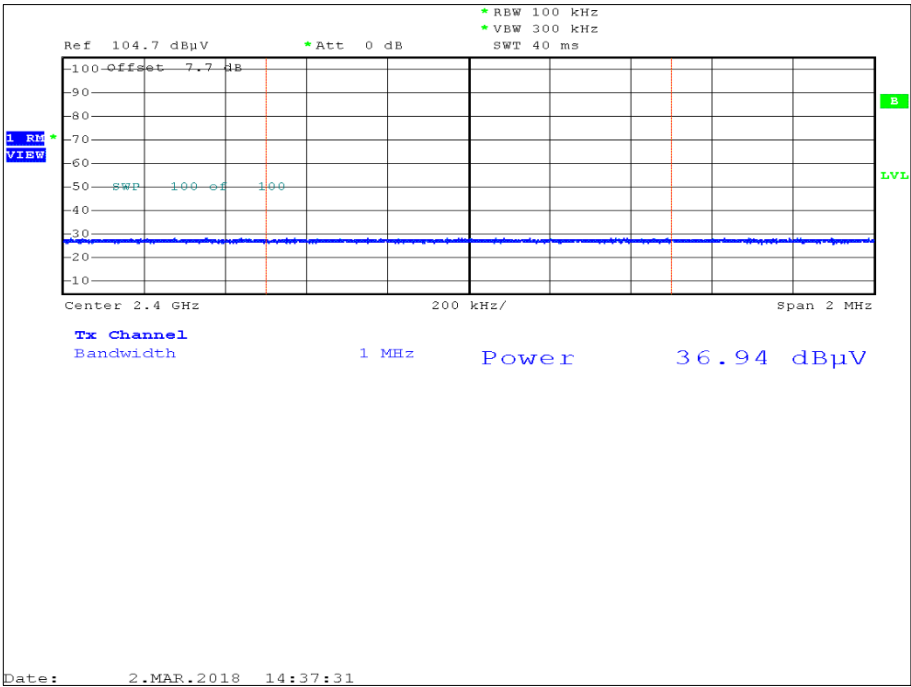


Figure 11 - 2480 MHz - Measured Frequency 2400.0 MHz

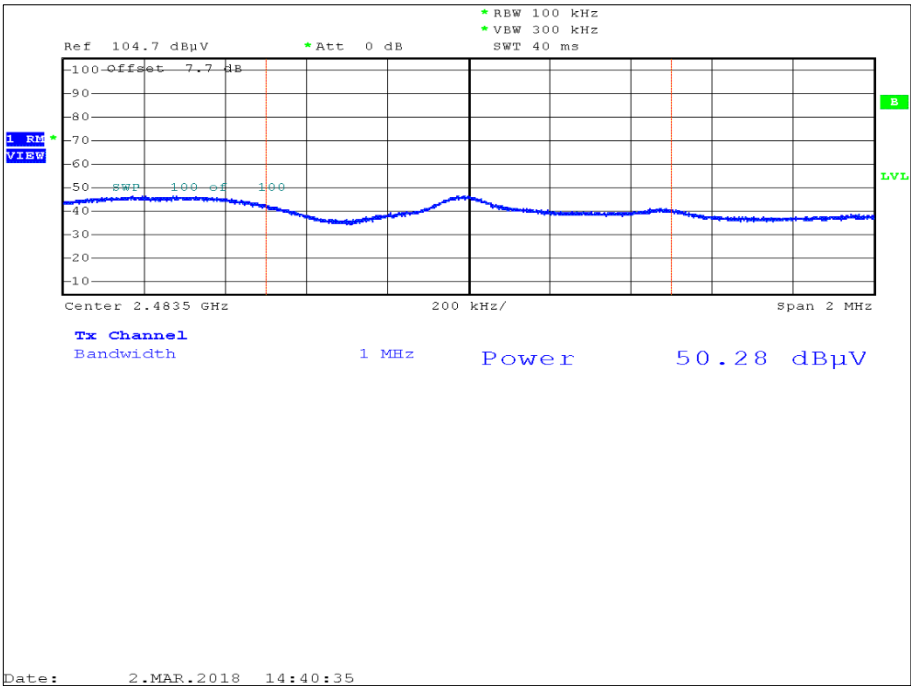


Figure 12 - 2480 MHz - Measured Frequency 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 14

ISED Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 15

*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.

2.5.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSP30	Rohde & Schwarz	100063	19533	12	2018-08

Table 16

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



2.6 Spurious Conducted Emissions

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT1 - Modification State 0

2.6.3 Date of Test

2018-02-28

2.6.4 Test Method

WLAN and other

The test was performed in accordance with KDB 558074 D01 v03r02, clause 11.0.

Bluetooth

The test was performed in accordance with ????

2.6.5 Environmental Conditions

Ambient Temperature	22.0 - 23.0 °C
Relative Humidity	13.0 %



Product Service

2.6.6 Test Results

Stand alone Transmitting Continuously

Testing was performed on the data rate with maximum conducted output power. This data rate type was:

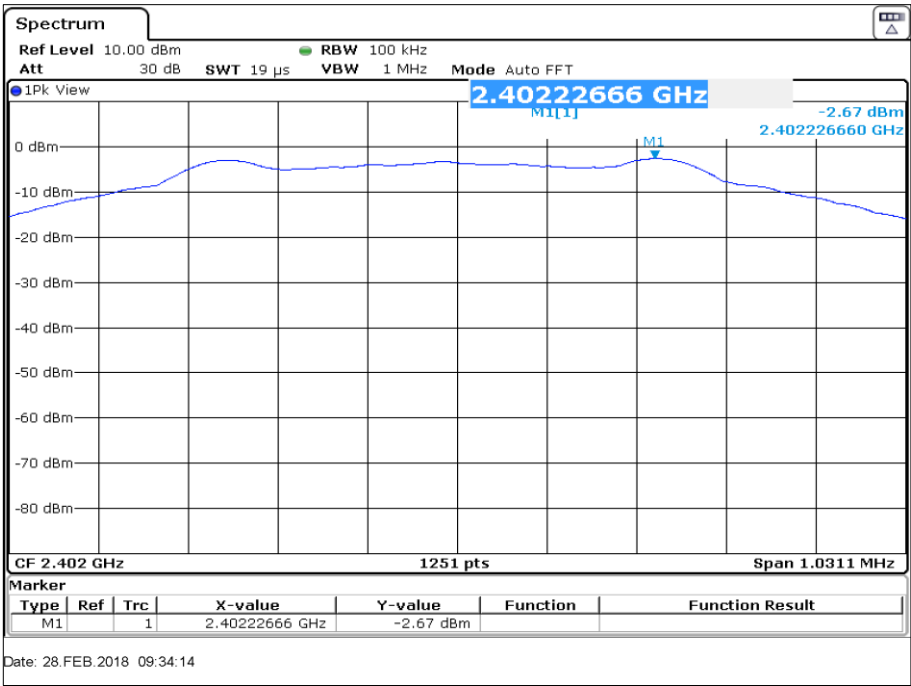


Figure 13 - 2402 MHz - Carrier Frequency

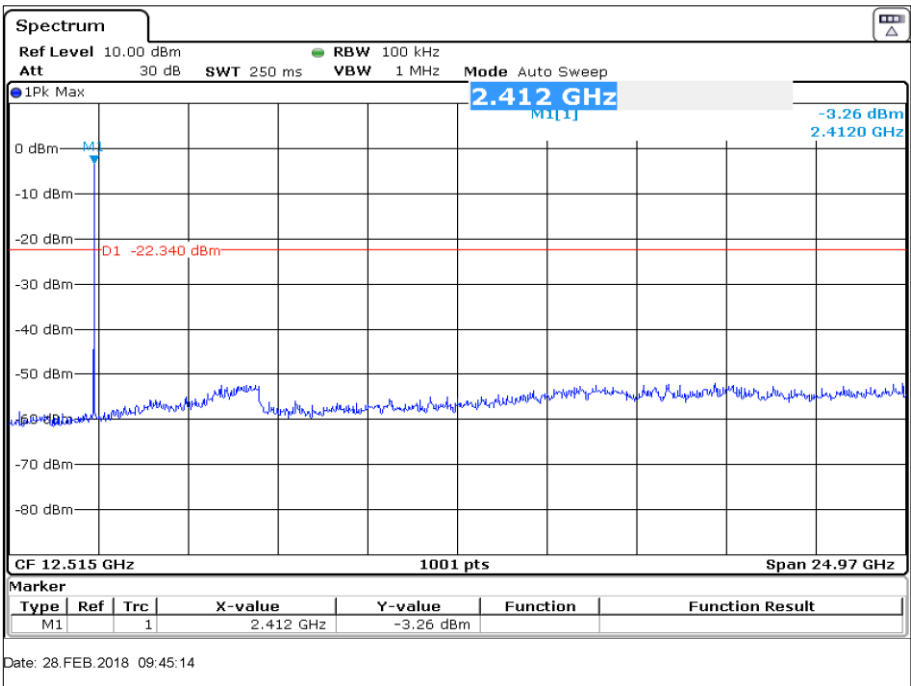


Figure 14 - 2402 MHz - 30 MHz - 25 GHz



Product Service

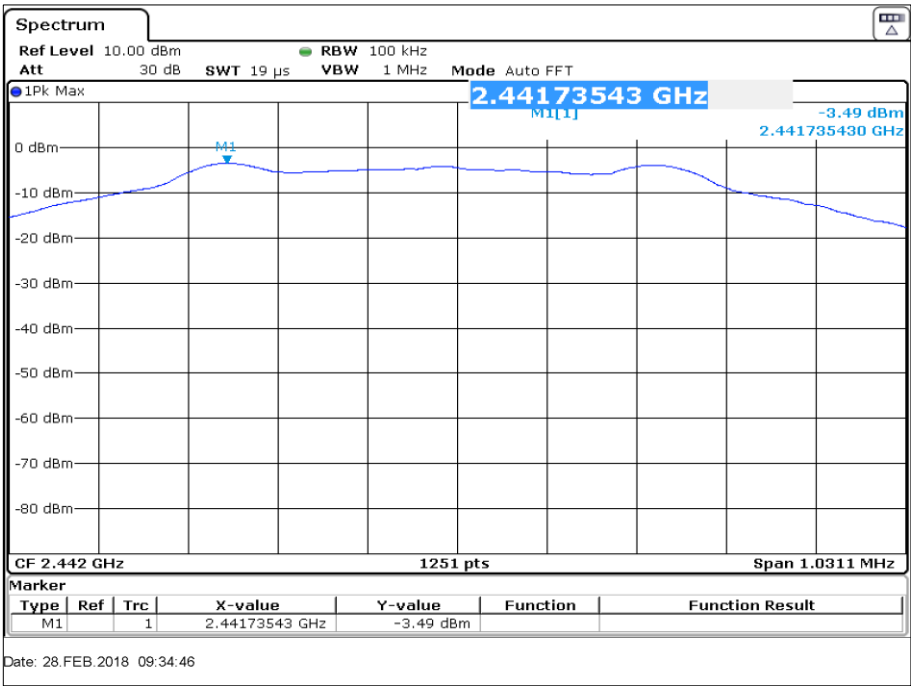


Figure 15 - 2442 MHz - Carrier Frequency

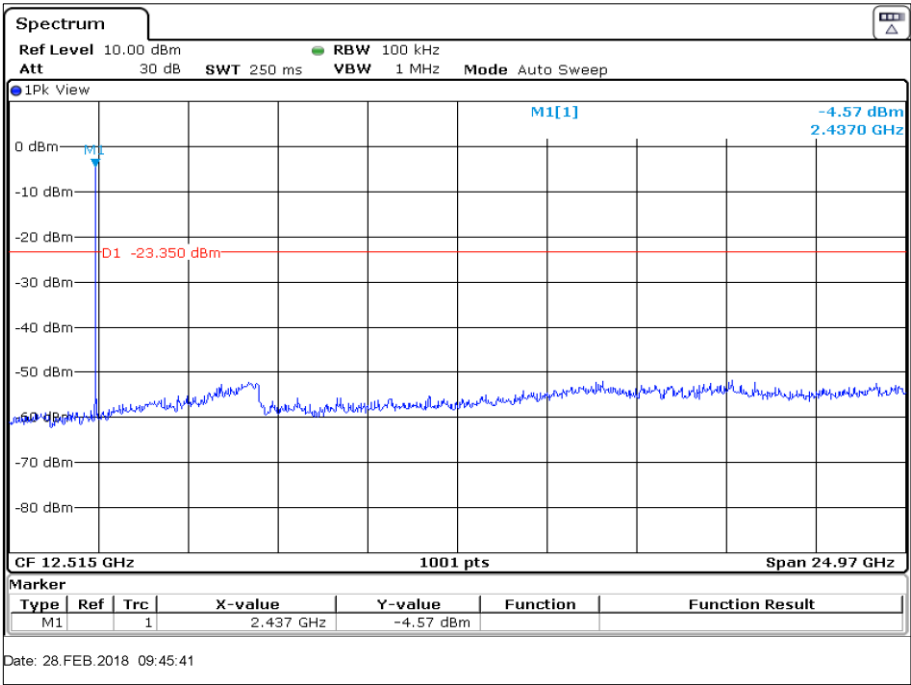


Figure 16 - 2442 MHz - 30 MHz - 25 GHz



Product Service

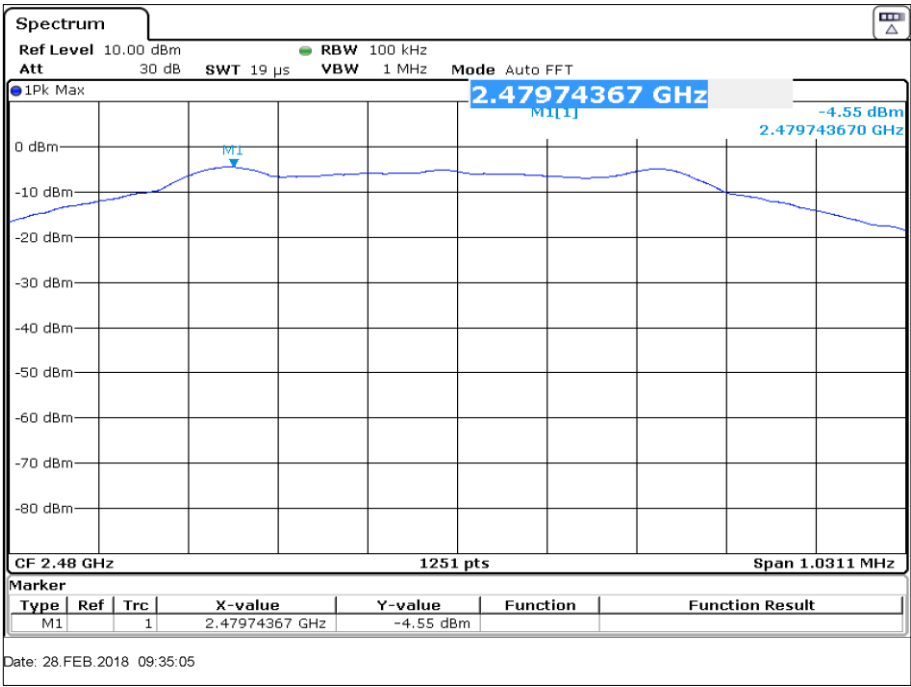


Figure 17 - 2480 MHz - Carrier Frequency

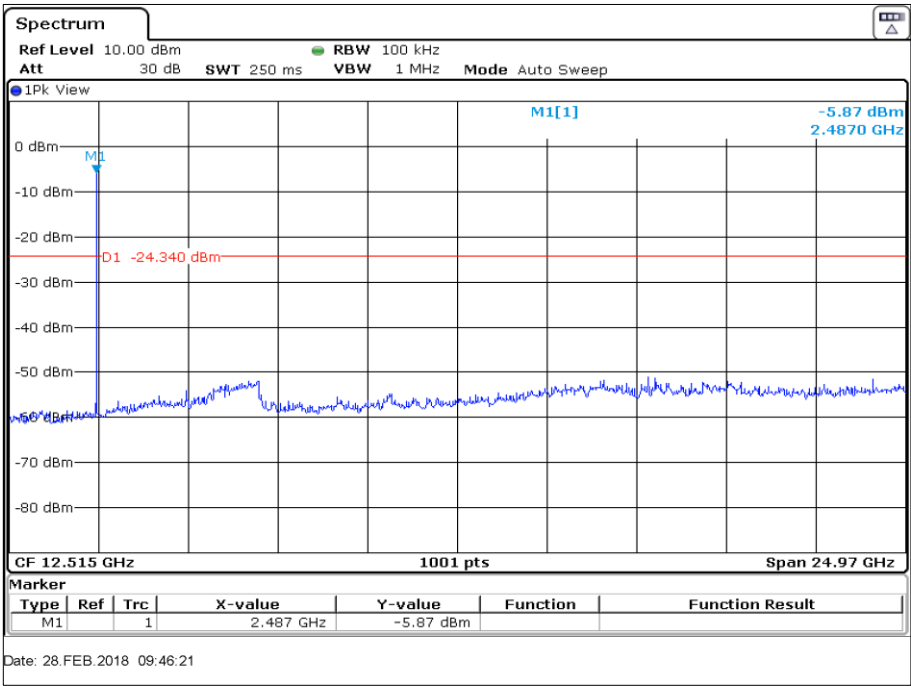


Figure 18 - 2480 MHz - 30 MHz - 25 GHz

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.



Product Service

2.6.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSV40	Rohde & Schwarz	101448	20219	12	2019-01

Table 17

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

N/A - Not Applicable



2.7 Spurious Radiated Emissions

2.7.1 Specification Reference

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

2.7.2 Equipment Under Test and Modification State

Type 2806, Model: 806A01, S/N: DUT3 - Modification State 0

2.7.3 Date of Test

2018-02-28 to 2018-03-05

2.7.4 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 dBuV/m to uV/m:
 $10^{(\text{Field Strength in dBuV/m}/20)}$

2.7.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	13.0 %



2.7.6 Test Results

Stand alone Transmitting Continuously

Testing was performed on the EUT which resulted in the highest conducted output power. The EUT used during testing was. For configurations supporting multiple bandwidths, emission measurements were only made in the bandwidth with the highest conducted output power. All emission tests were performed in three orthogonal axes.

The frequency range 9 kHz – 1 GHz was tested for the middle frequency, only.

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
160.905	vertical	Quasi-Peak	-5.5	10.4		4.9	57.8	53.0
168.400	vertical	Quasi-Peak	-6.6	10.6		4.0	43.5	39.5
168.860	vertical	Quasi-Peak	-5.6	10.6		5.0	43.5	38.5
2402.000	horizontal	Peak	63.6	34.2		97.8		
4804.000	horizontal	Average	7.6	42.1		49.7	54.0	4.3

- 2402 MHz - 9 kHz to 25 GHz Emissions Results

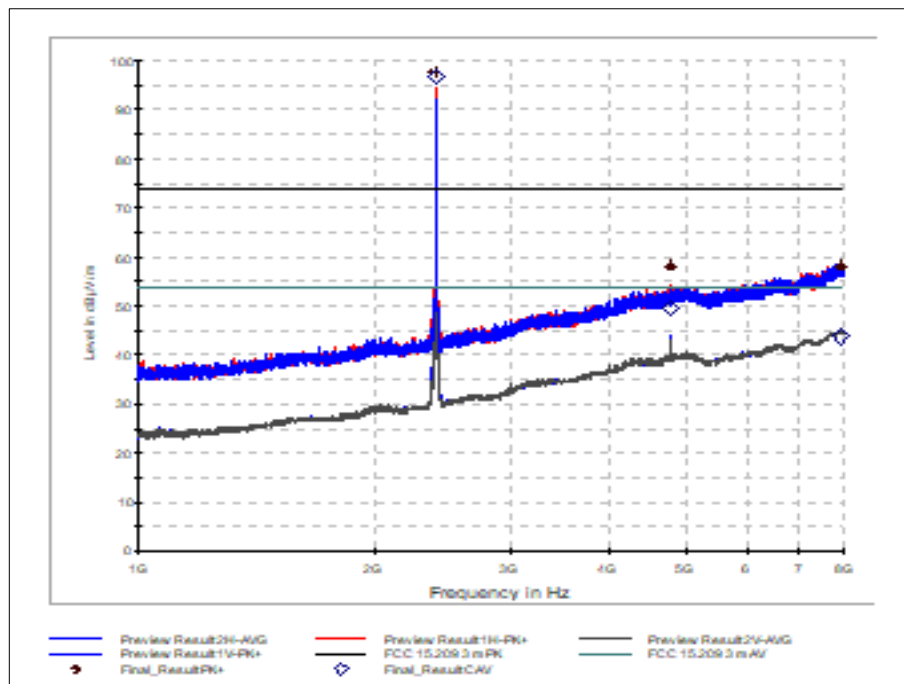


Figure 19 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

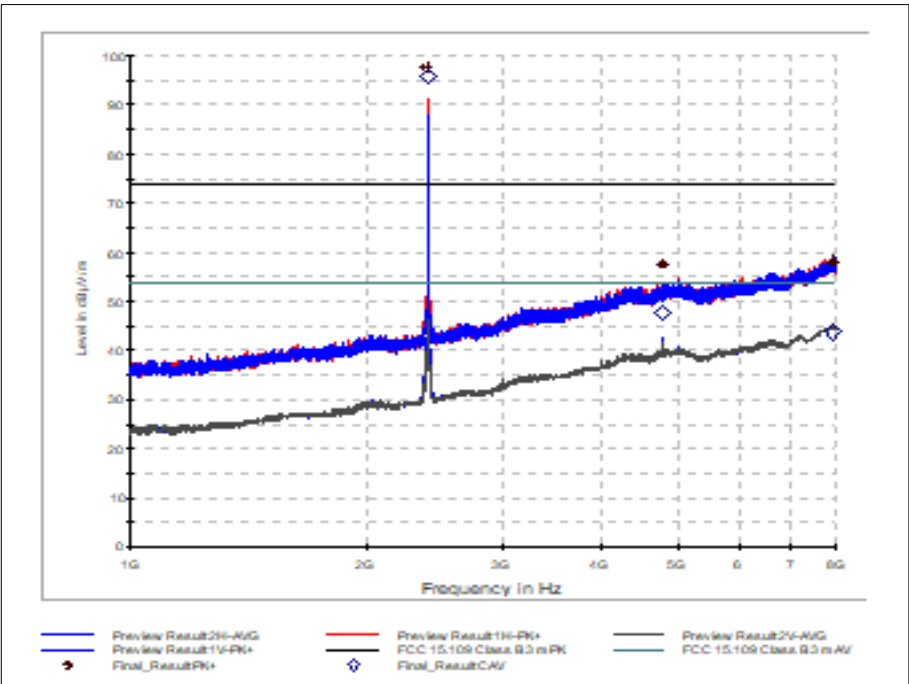


Figure 20 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

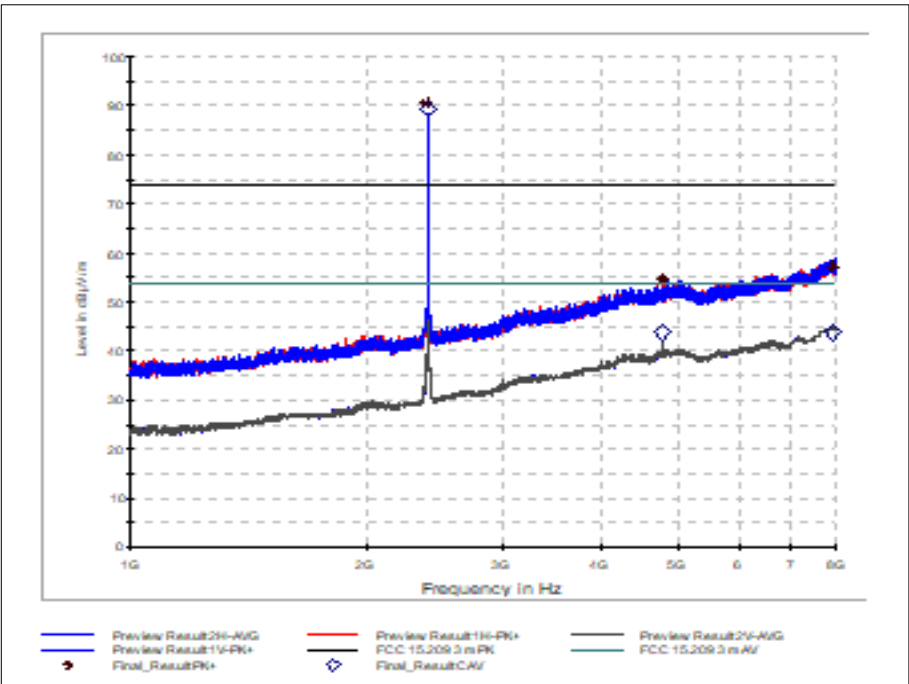


Figure 21 - 2402 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

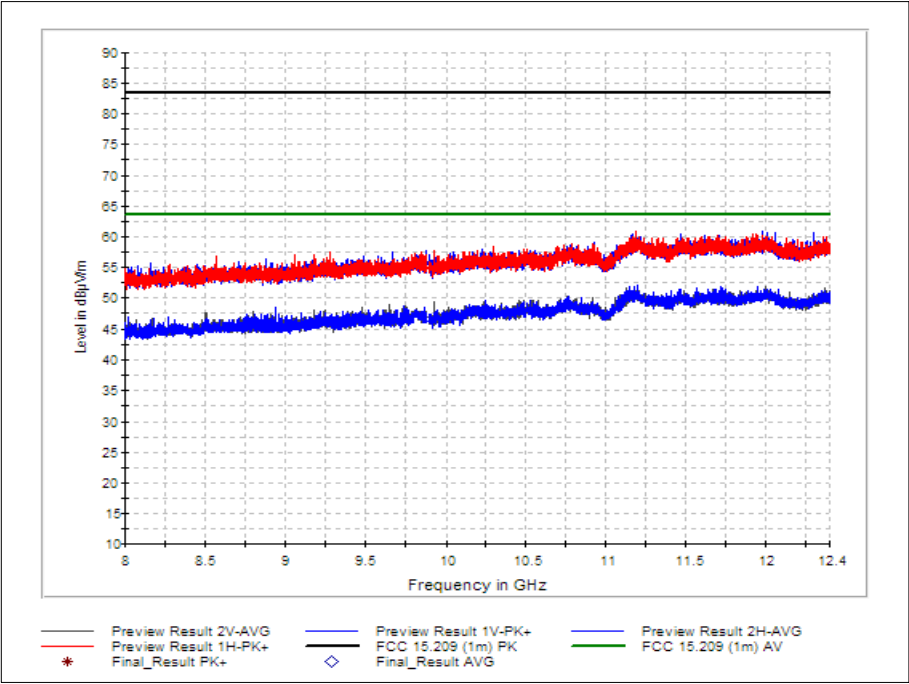


Figure 22 - 2402 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

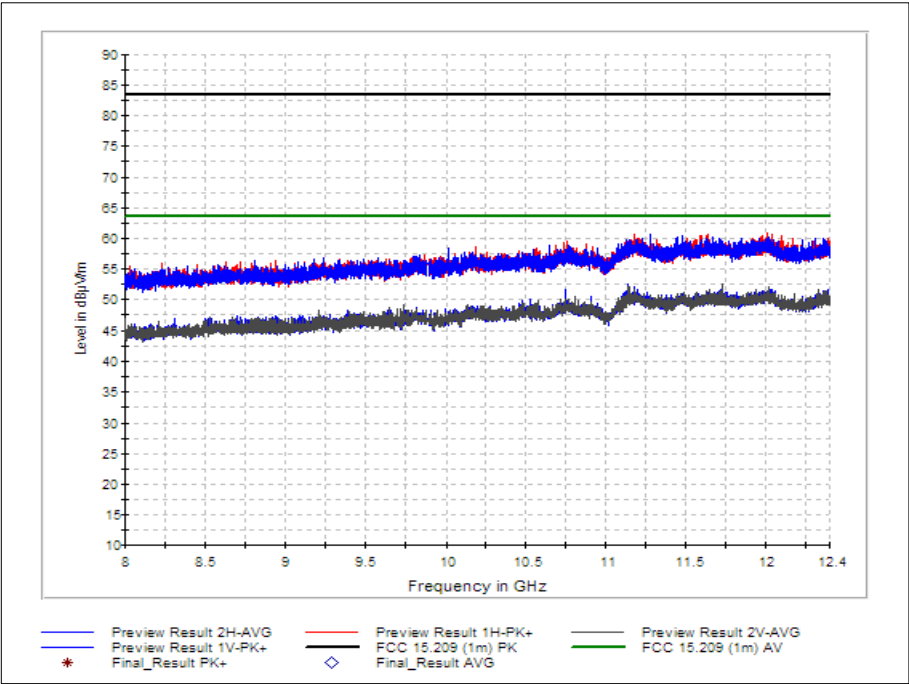


Figure 23 - 2402 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical



Product Service

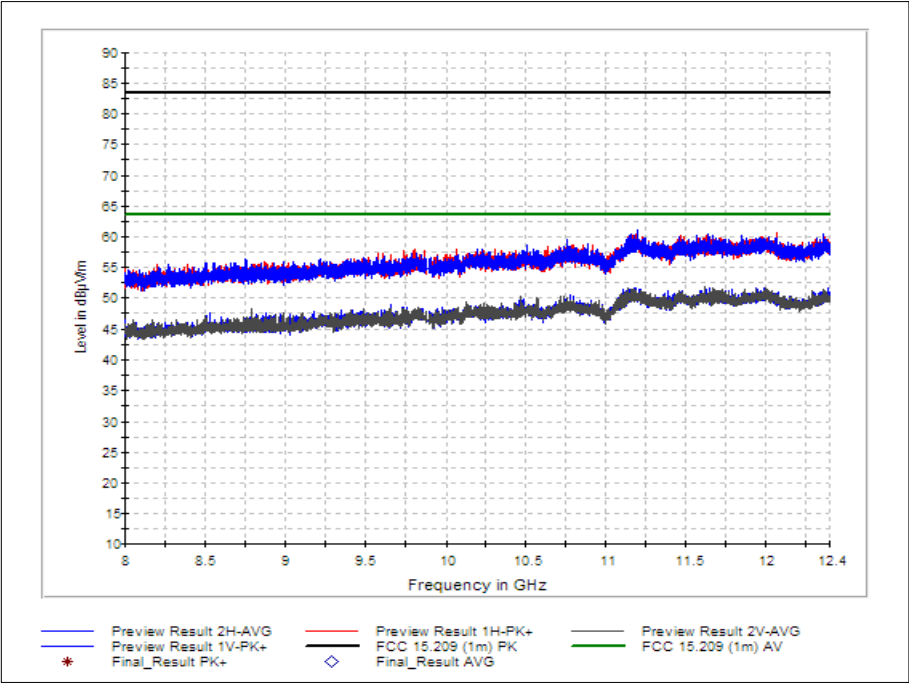


Figure 24 - 2402 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

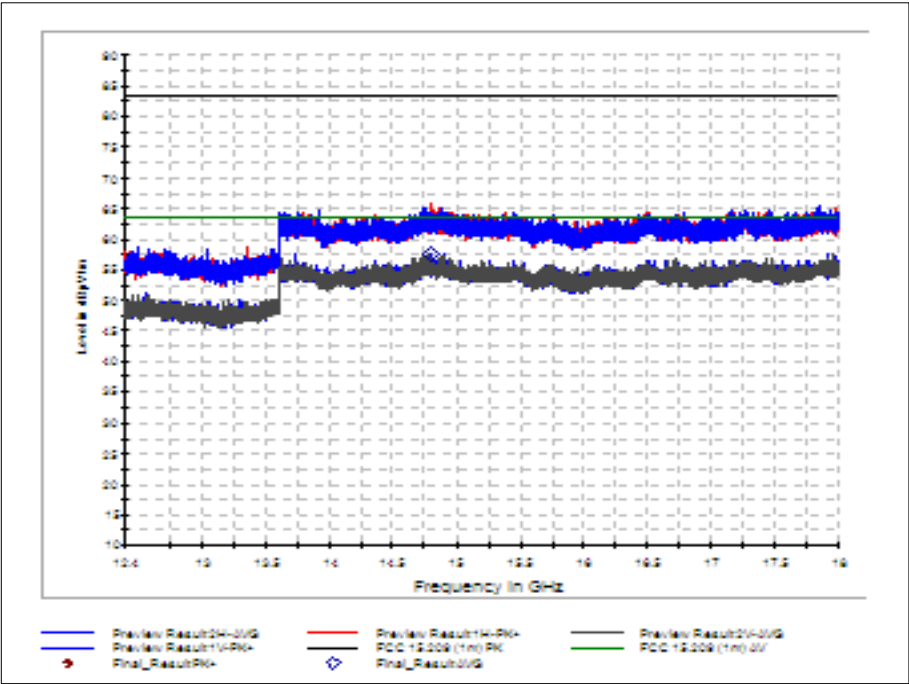


Figure 25 - 2402 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical



Product Service

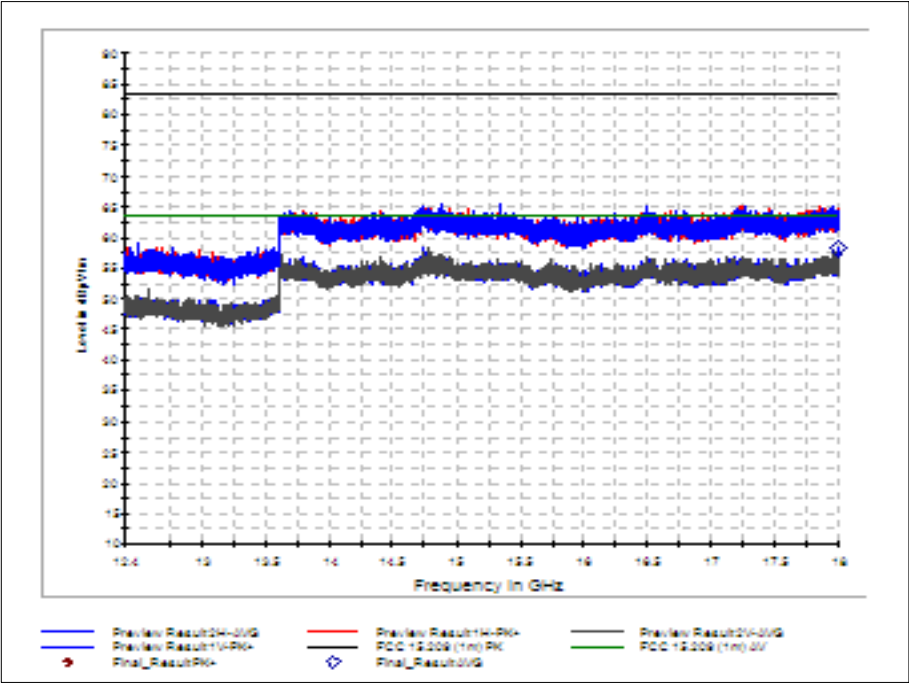


Figure 26 - 2402 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

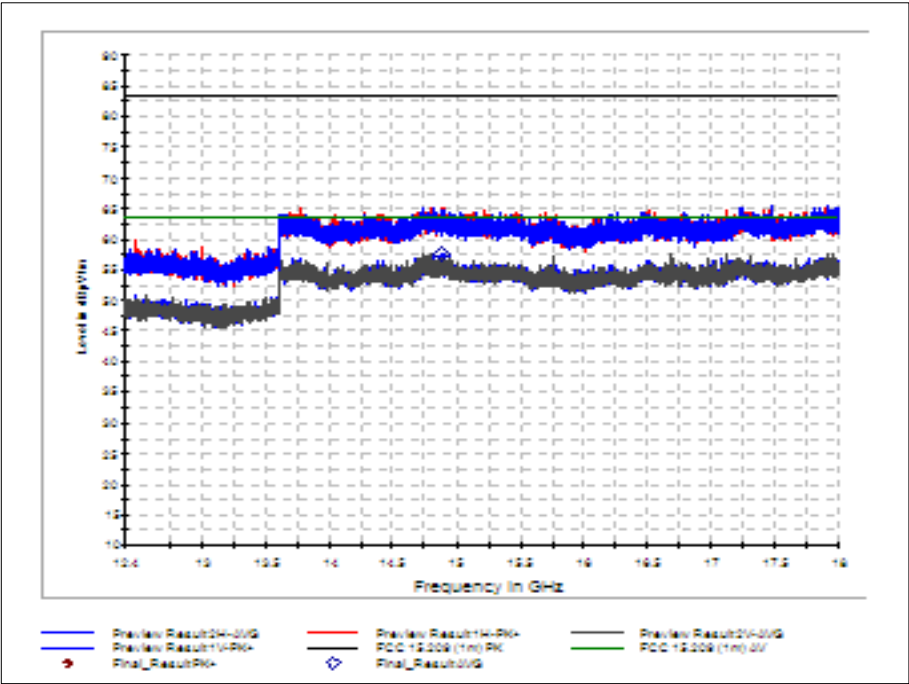


Figure 27 - 2402 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

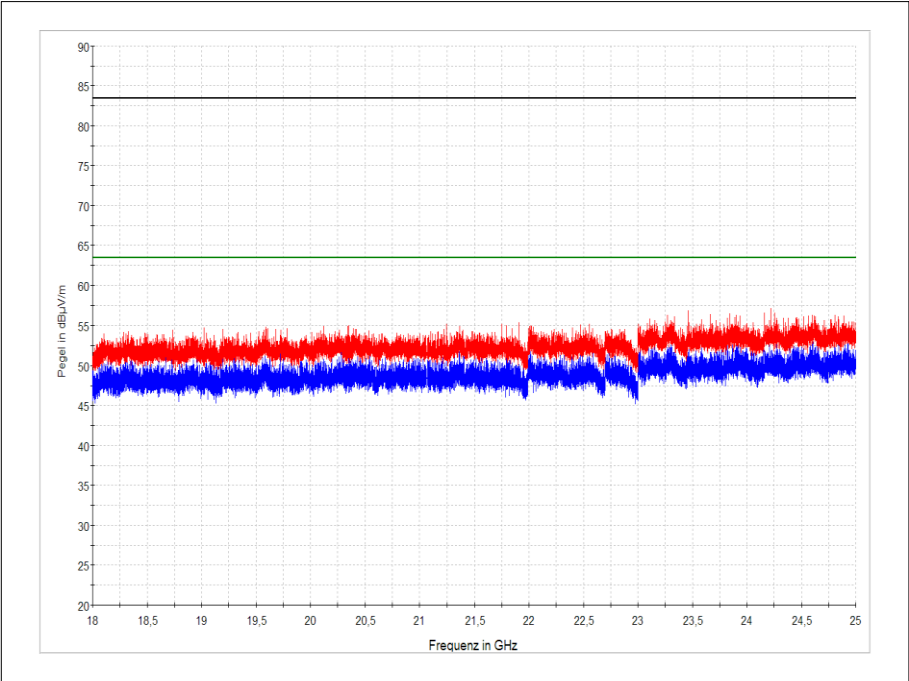


Figure 28 - 2402 MHz - 18 GHz - 25 GHz - Horizontal

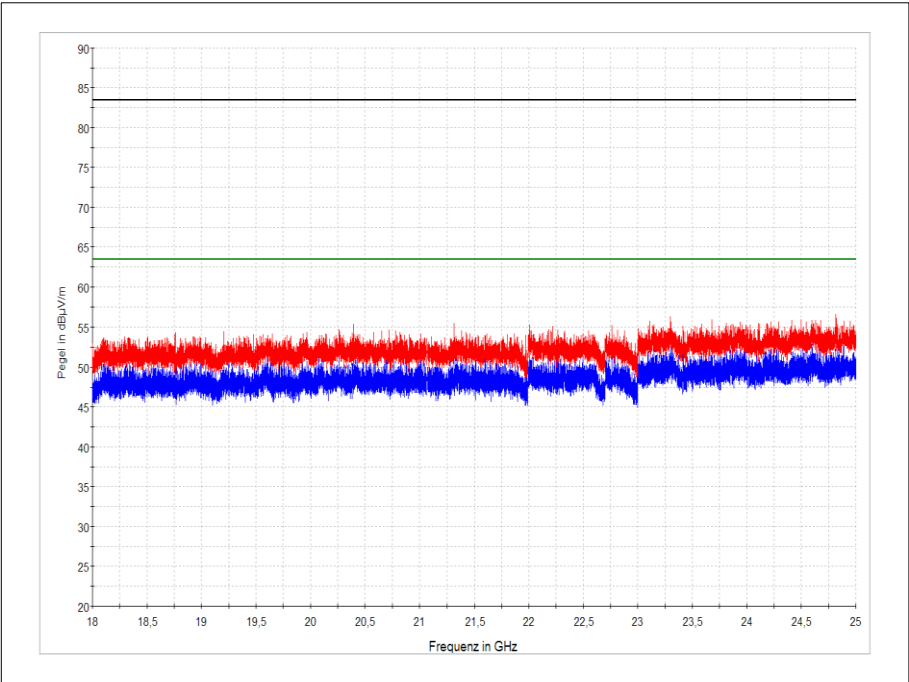


Figure 29 - 2402 MHz - 18 GHz - 25 GHz - Vertical

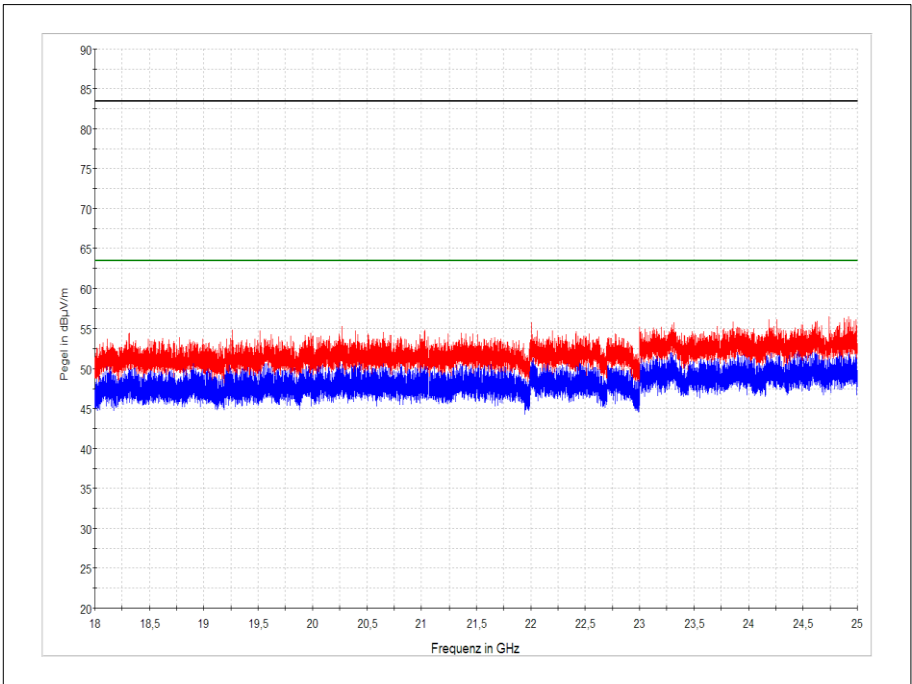


Figure 30 - 2402 MHz - 18 GHz - 25 GHz - Horizontal

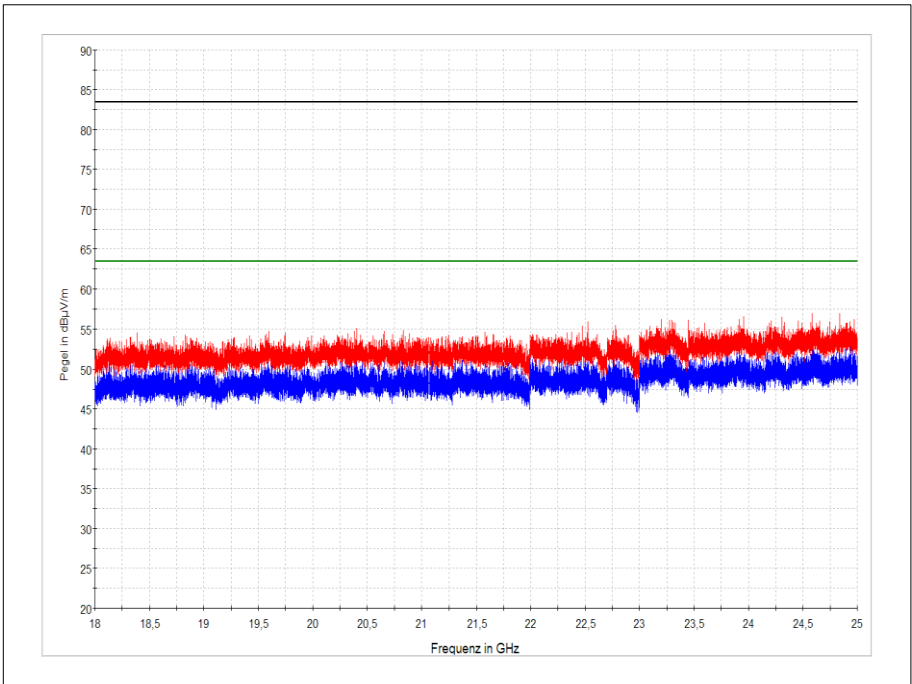


Figure 31 - 2402 MHz - 18 GHz - 25 GHz - Vertical

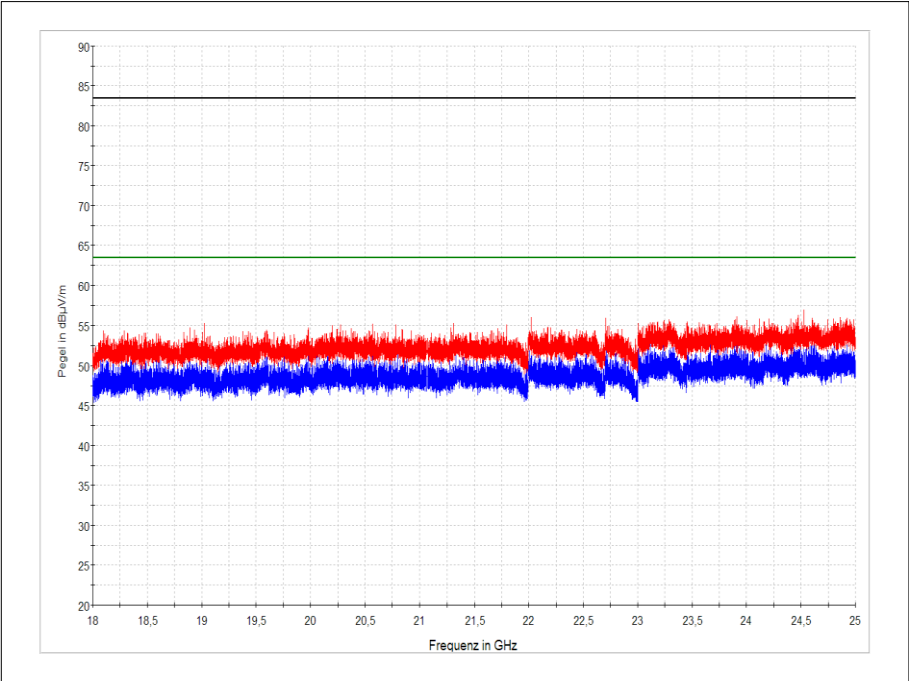


Figure 32 - 2402 MHz - 18 GHz - 25 GHz - Horizontal

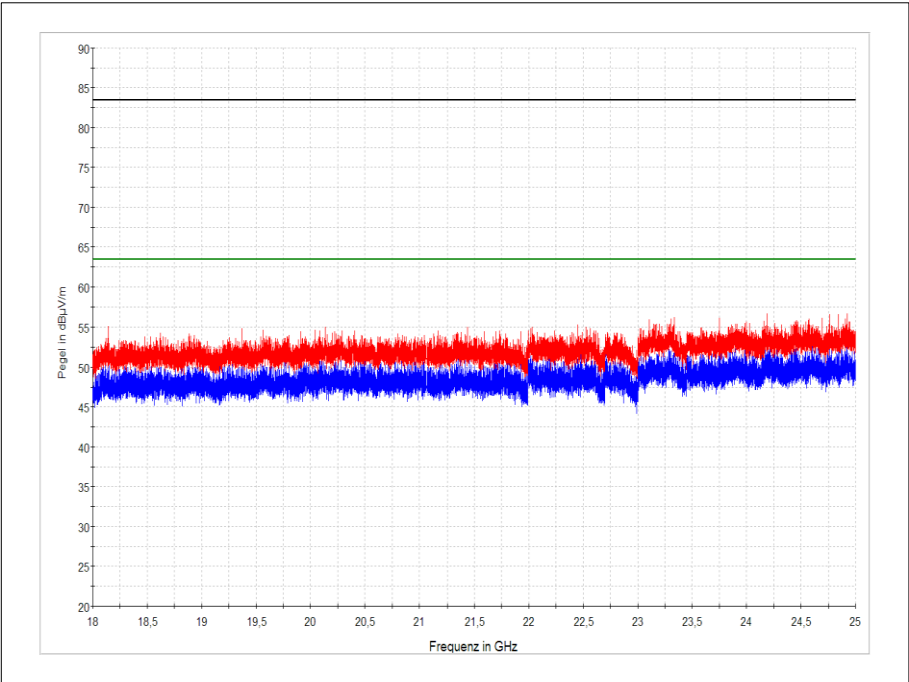


Figure 33 - 2402 MHz - 18 GHz - 25 GHz - Vertical



Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
160.905	vertical	Quasi-Peak	-5.5	10.4		4.9	55.6	50.7
168.400	vertical	Quasi-Peak	-6.6	10.6		4.0	43.5	39.5
168.860	vertical	Quasi-Peak	-5.6	10.6		5.0	43.5	38.5
2442.000	horizontal	Peak	61.2	34.4		95.6		
4884.000	horizontal	Average	2.6	42.5		45.1	54.0	9.0

- 2442 MHz – 9 kHz to 25 GHz Emissions Results

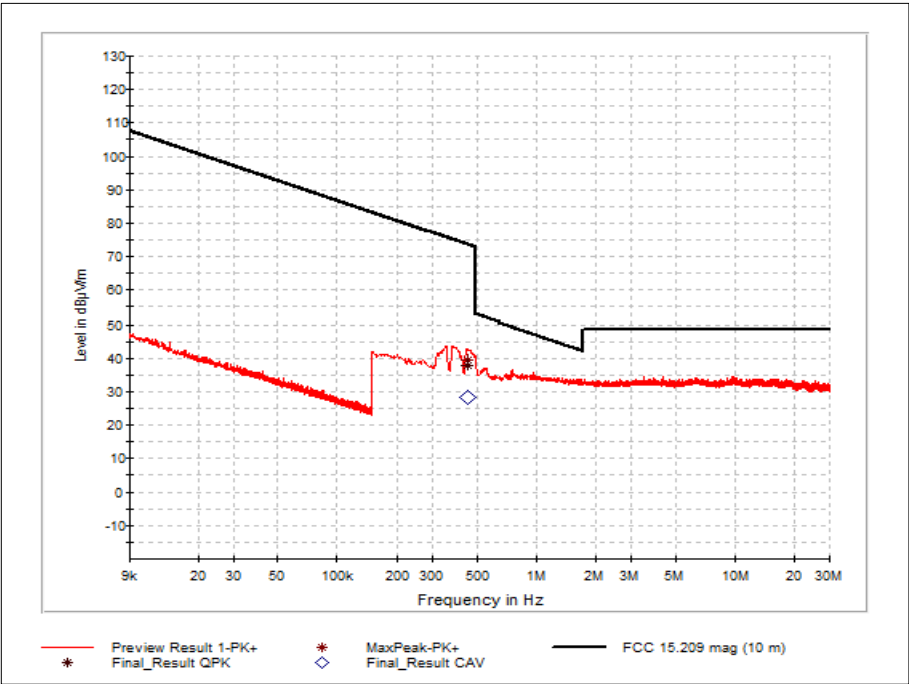


Figure 34 - 2442 MHz - 9 kHz - 30 MHz - Horizontal and Vertical



Product Service

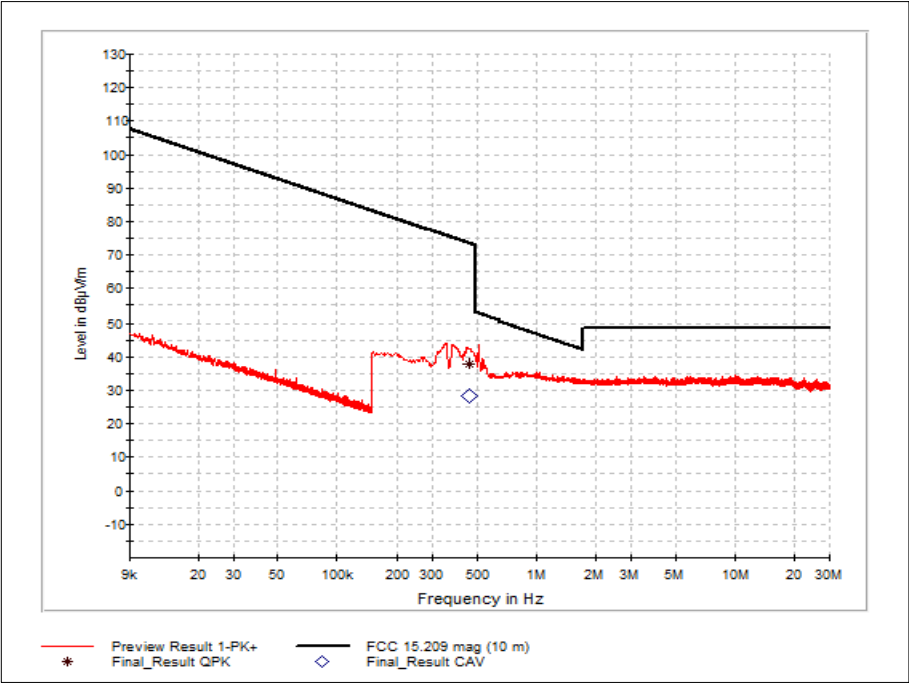


Figure 35 - 2442 MHz - 9 kHz - 30 MHz - Horizontal and Vertical

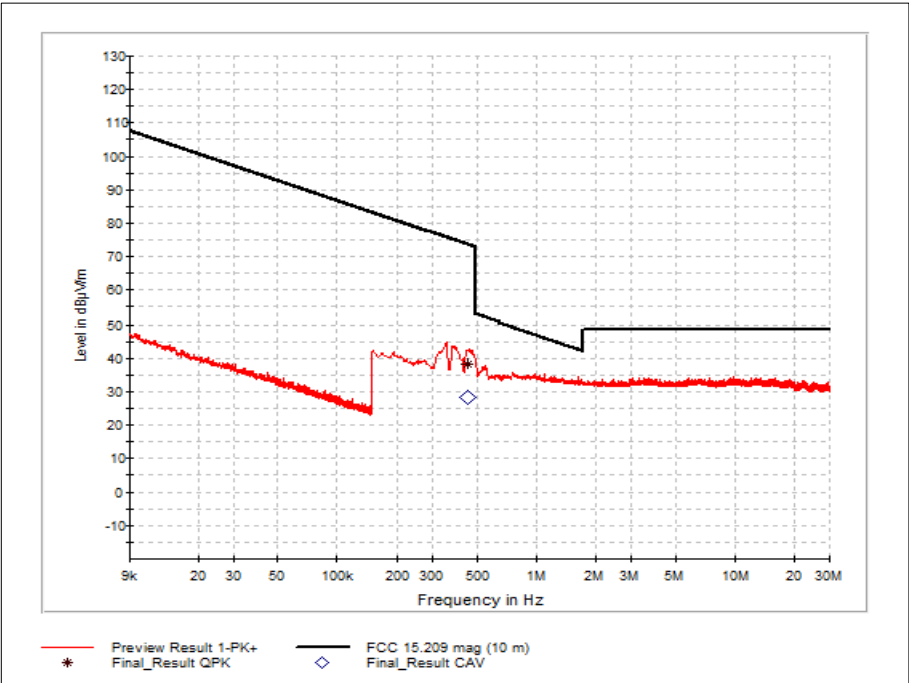


Figure 36 - 2442 MHz - 9 kHz - 30 MHz - Horizontal and Vertical



Product Service

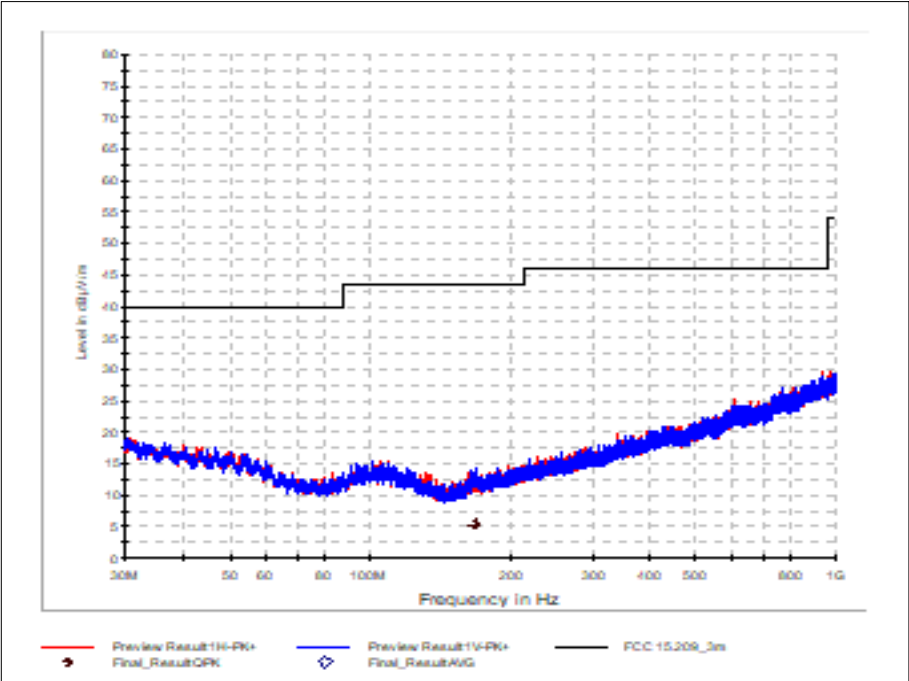


Figure 37 - 2442 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

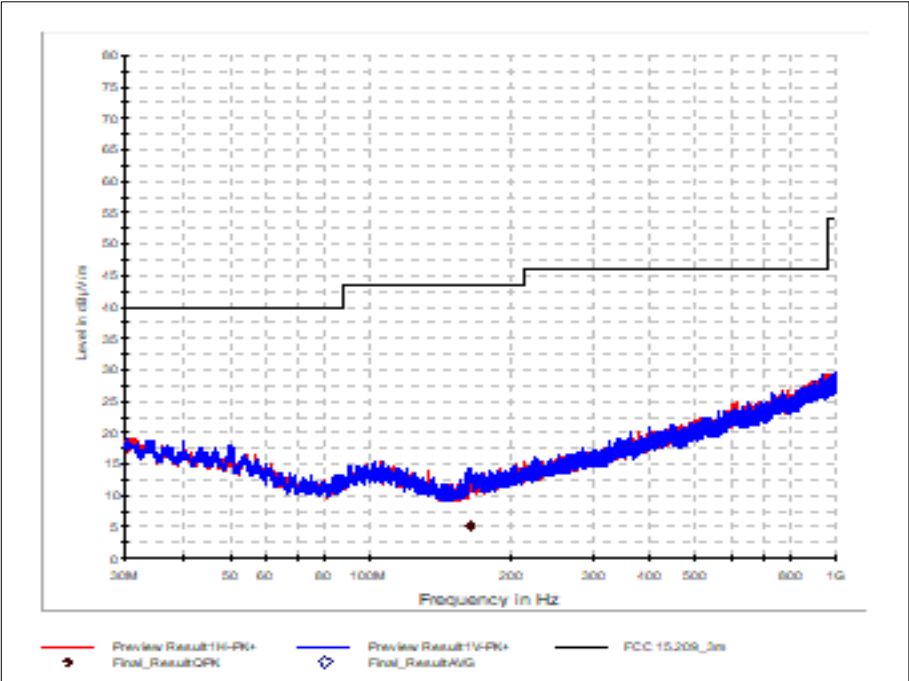


Figure 38 - 2442 MHz - 30 MHz to 1 GHz - Horizontal and Vertical



Product Service

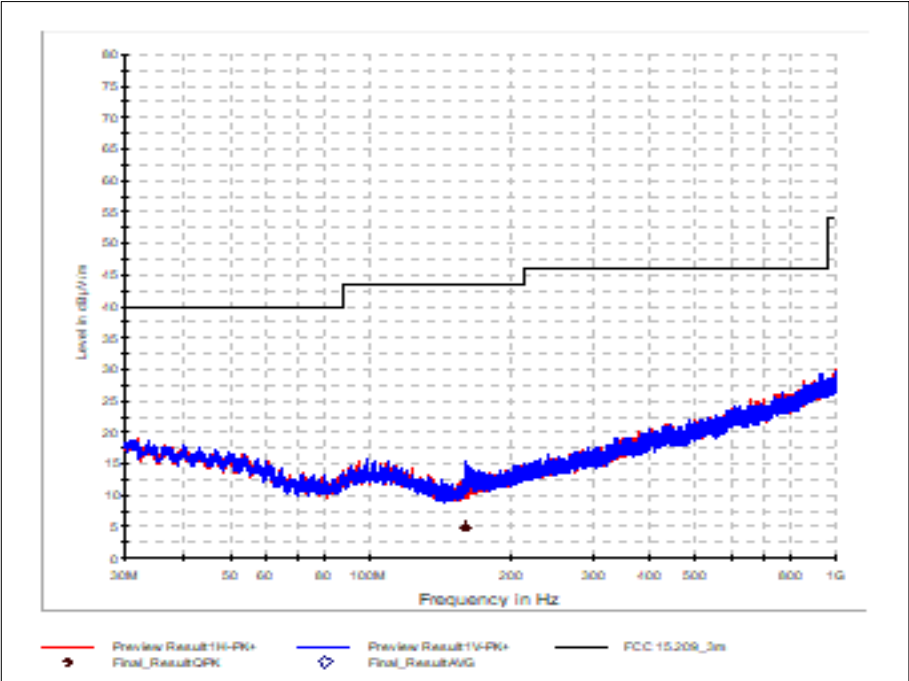


Figure 39 - 2442 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

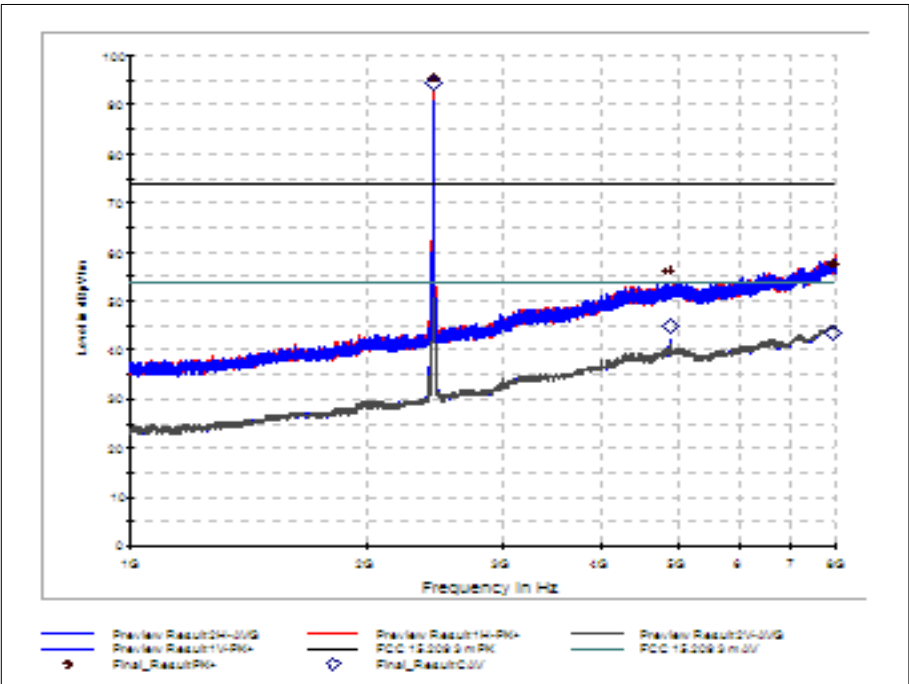


Figure 40 - 2442 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

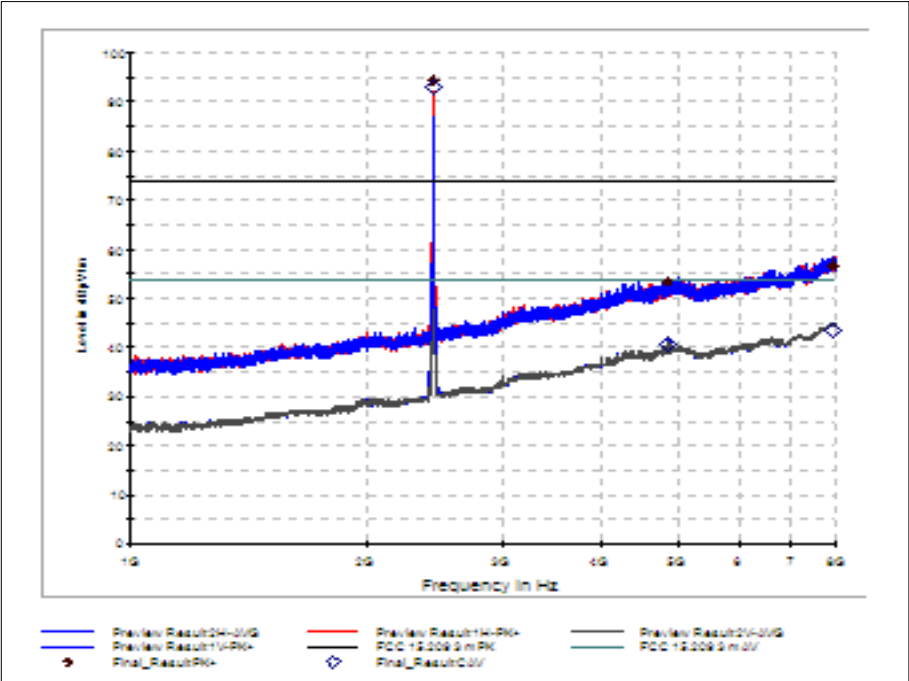


Figure 41 - 2442 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

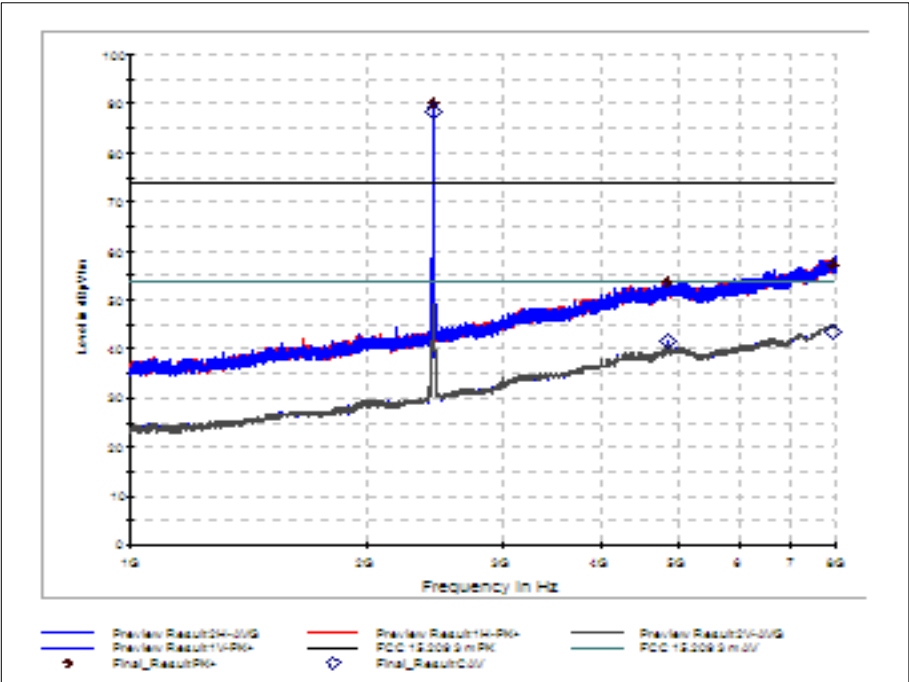


Figure 42 - 2442 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

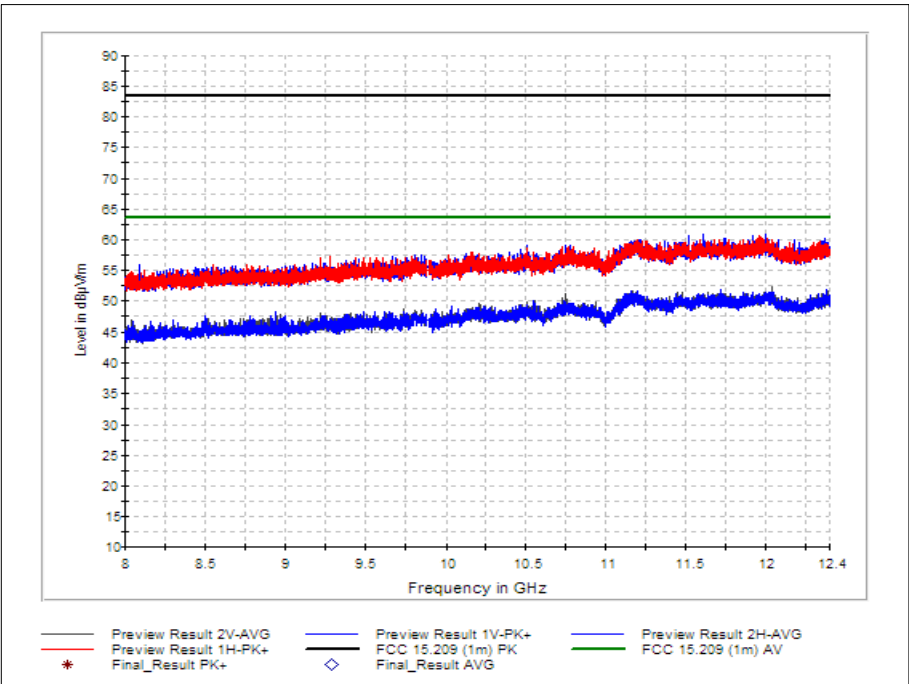


Figure 43 - 2442 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

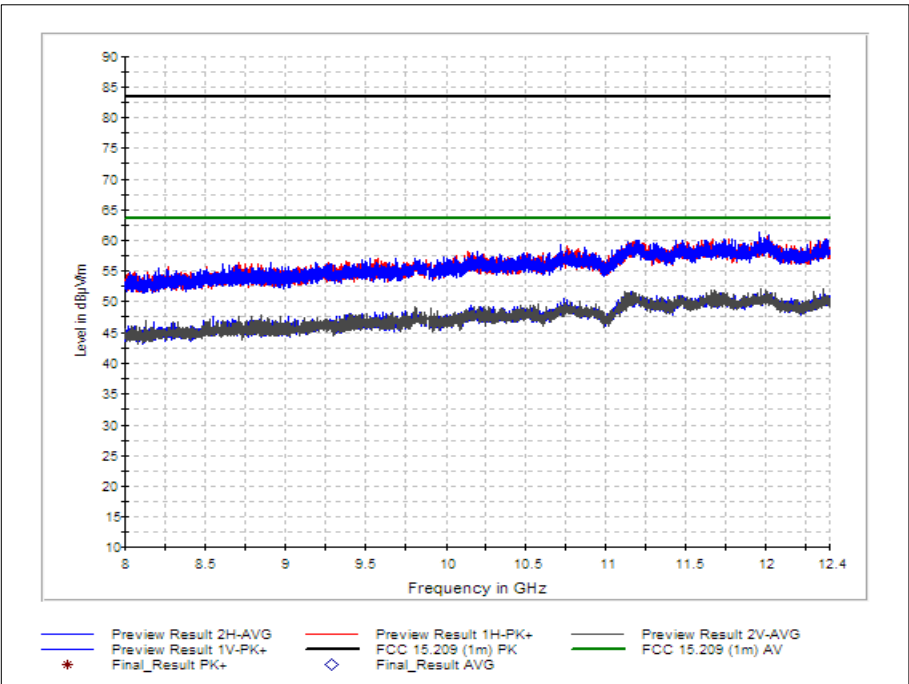


Figure 44 - 2442 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical



Product Service

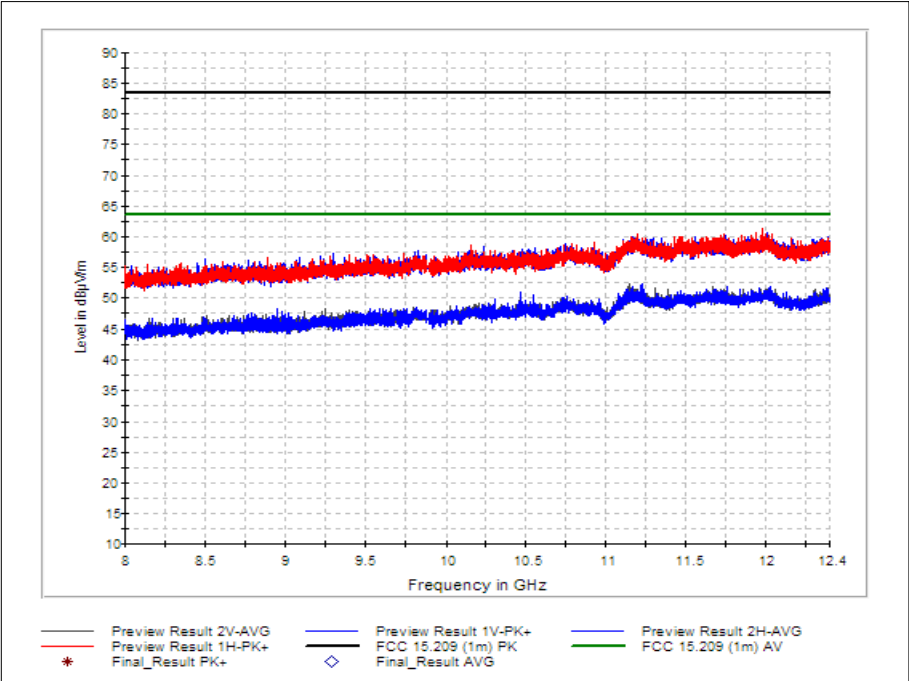


Figure 45 - 2442 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

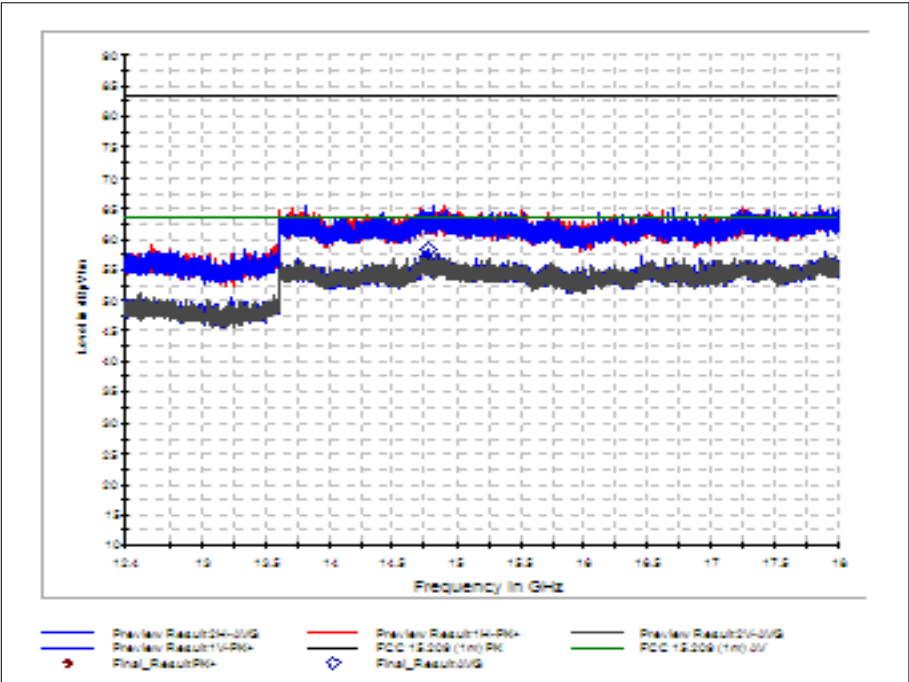


Figure 46 - 2442 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical



Product Service

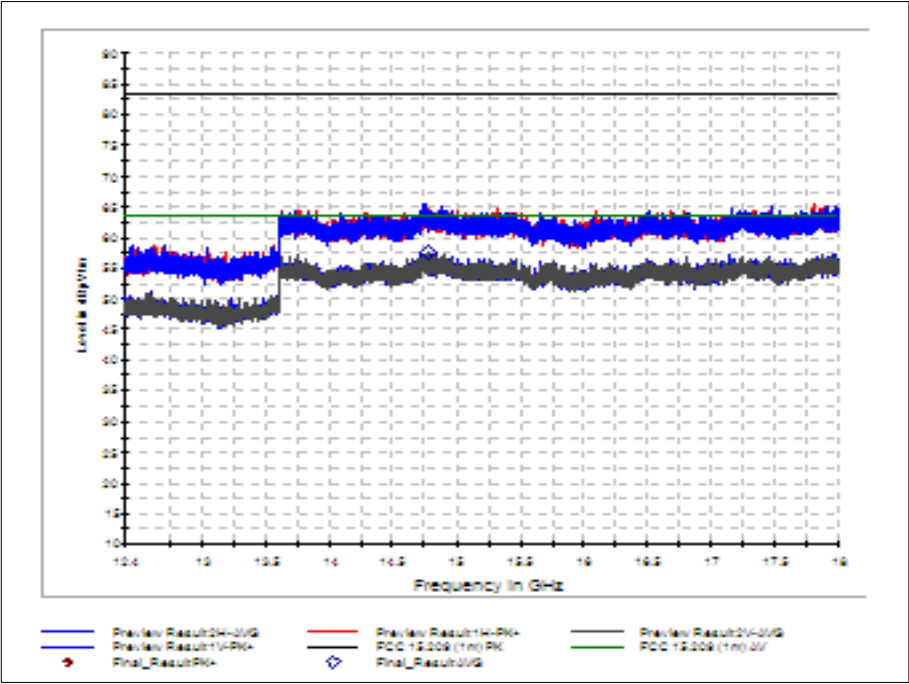


Figure 47 - 2442 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

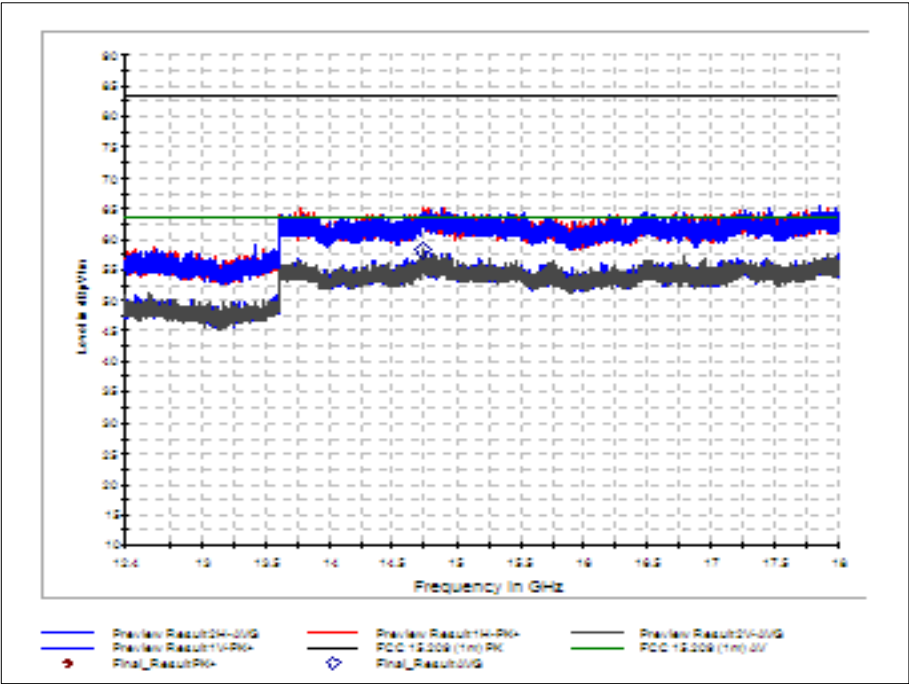


Figure 48 - 2442 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

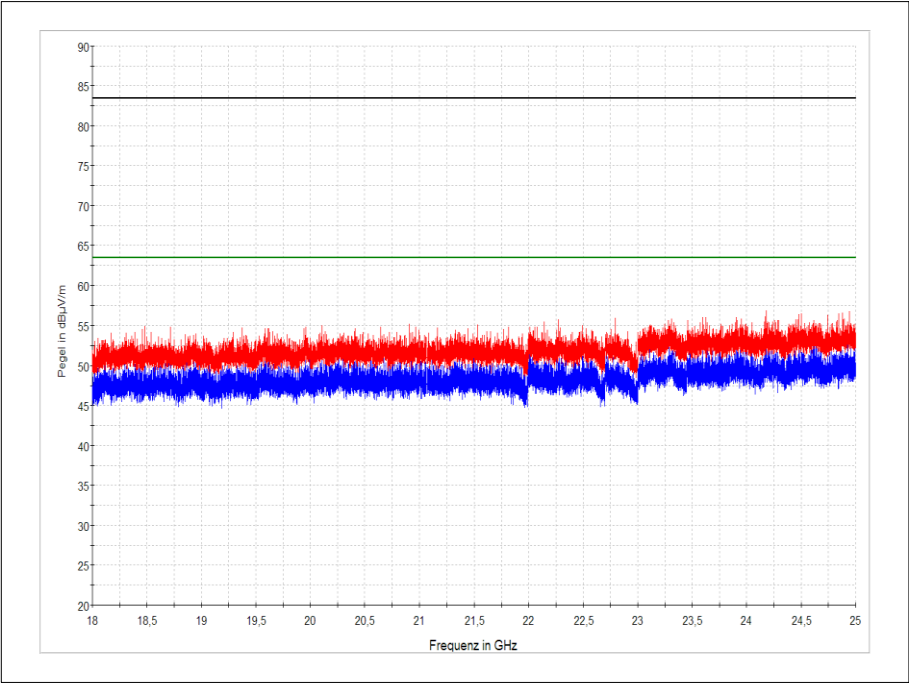


Figure 49 - 2442 MHz - 18 GHz - 25 GHz - Horizontal

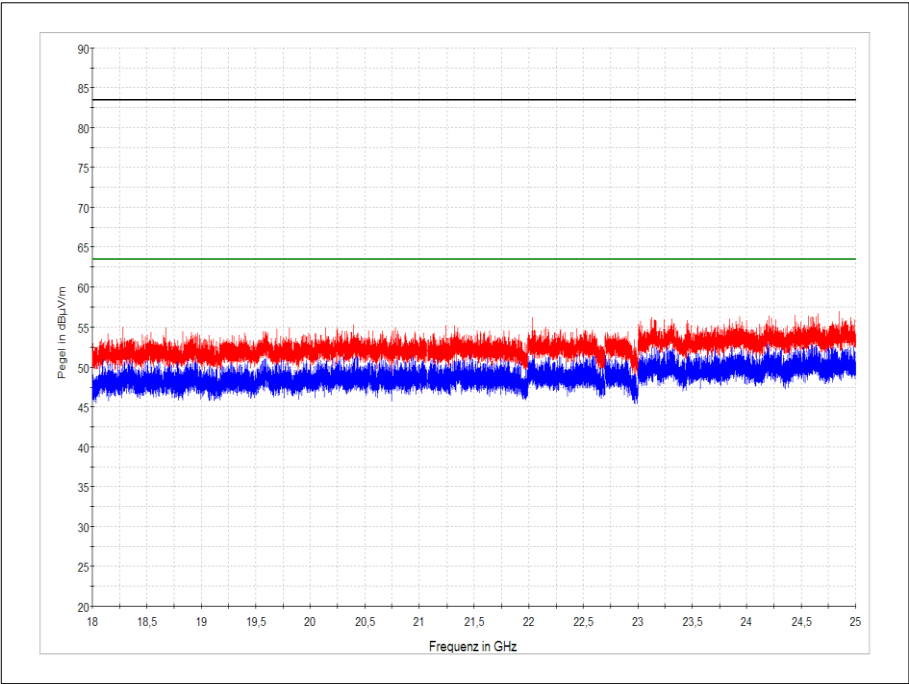


Figure 50 - 2442 MHz - 18 GHz - 25 GHz - Vertical

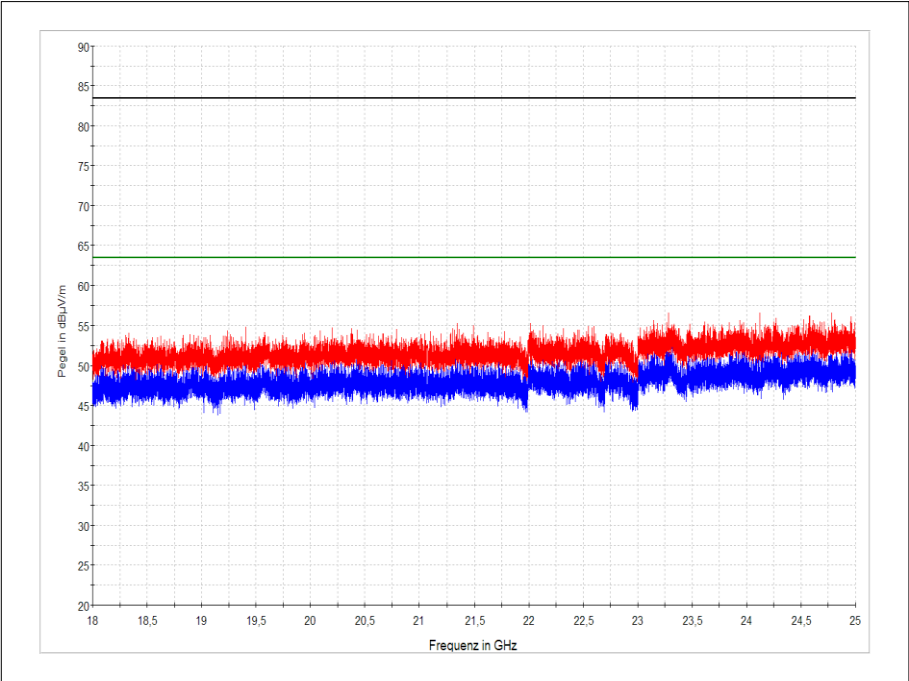


Figure 51 - 2442 MHz - 18 GHz - 25 GHz - Horizontal

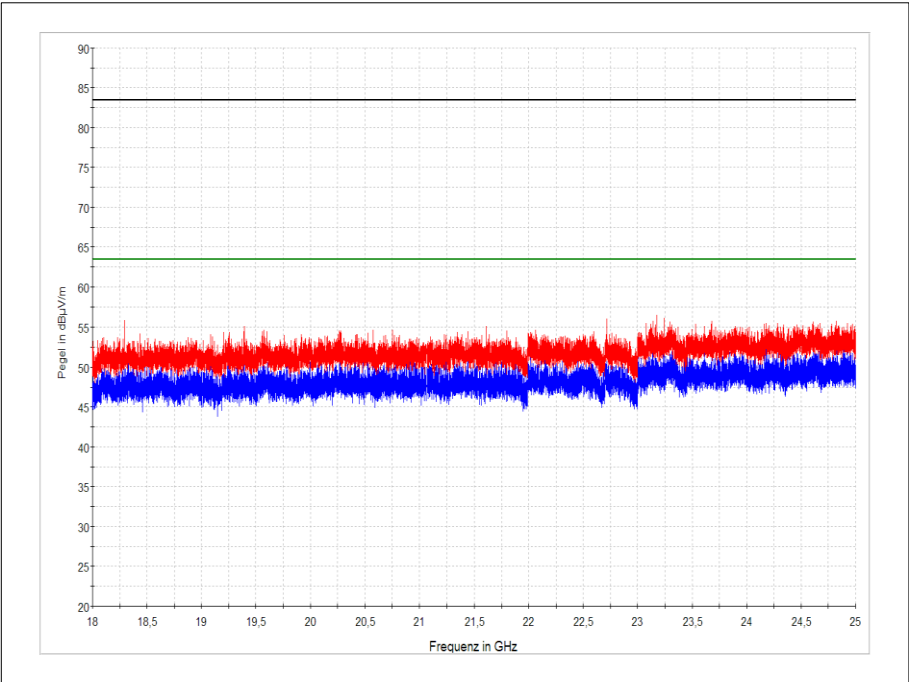


Figure 52 - 2442 MHz - 18 GHz - 25 GHz - Vertical

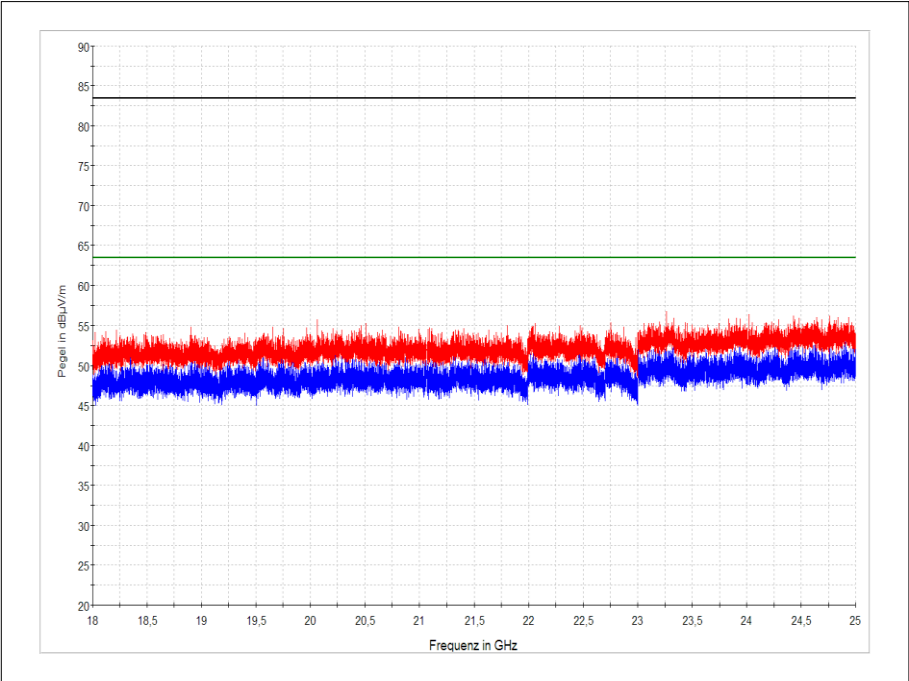


Figure 53 - 2442 MHz - 18 GHz - 25 GHz - Horizontal

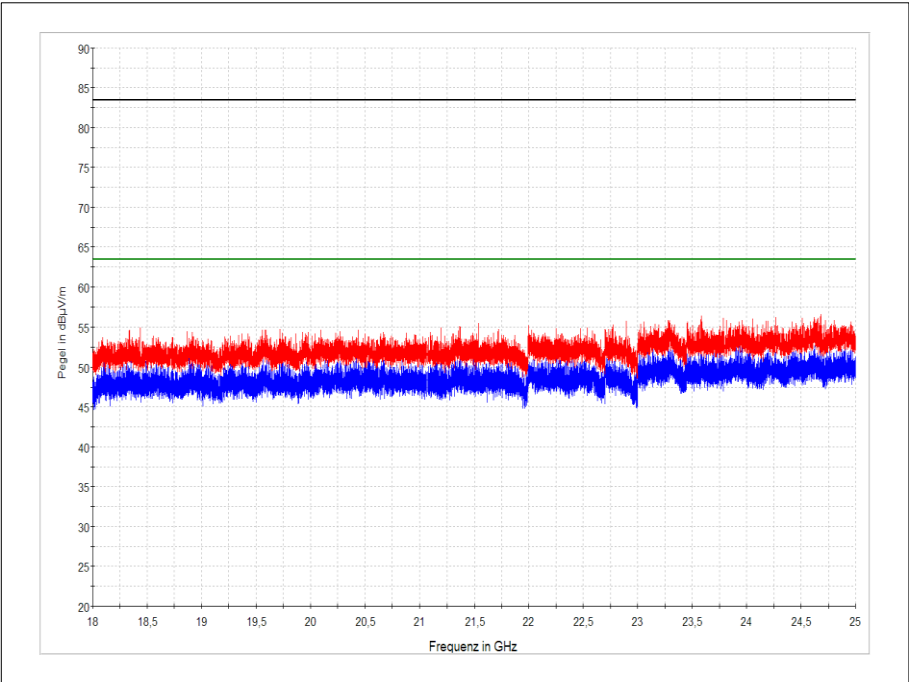


Figure 54 - 2442 MHz - 18 GHz - 25 GHz - Vertical



Product Service

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
160.905	vertical	Quasi-Peak	-5.5	10.4		4.9	53.1	48.2
168.400	vertical	Quasi-Peak	-6.6	10.6		4.0	43.5	39.5
168.860	vertical	Quasi-Peak	-5.6	10.6		5.0	43.5	38.5
2480.000	horizontal	Peak	58.4	34.7		93.1		
4958.000	vertical	Average	0.1	42.7		42.8	54.0	11.2

- 2480 MHz – 9 kHz to 25 GHz Emissions Results

No other emissions were detected within 10 dB of the limit.

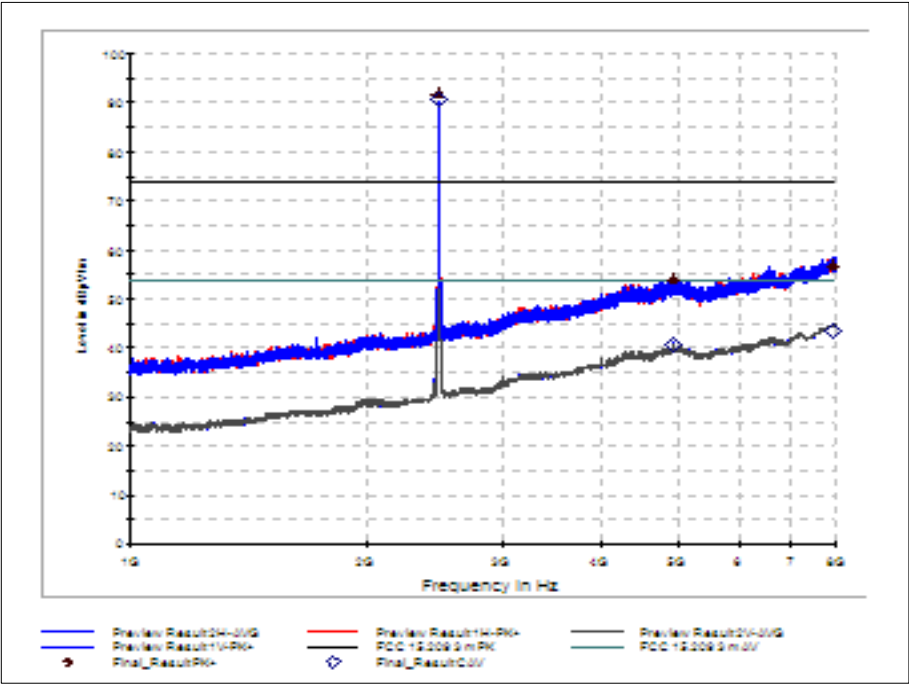


Figure 55 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

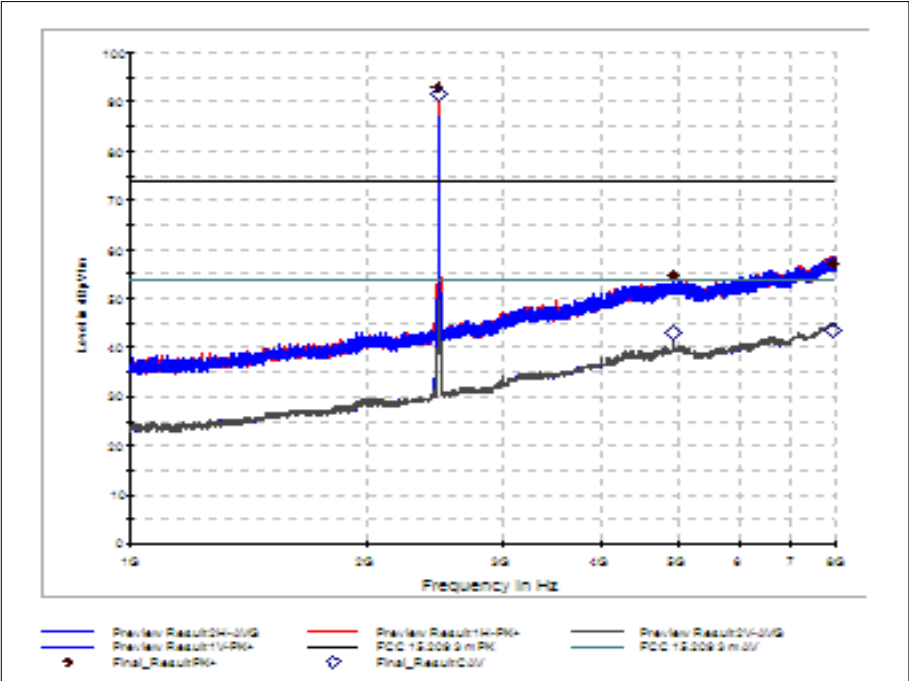


Figure 56 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical

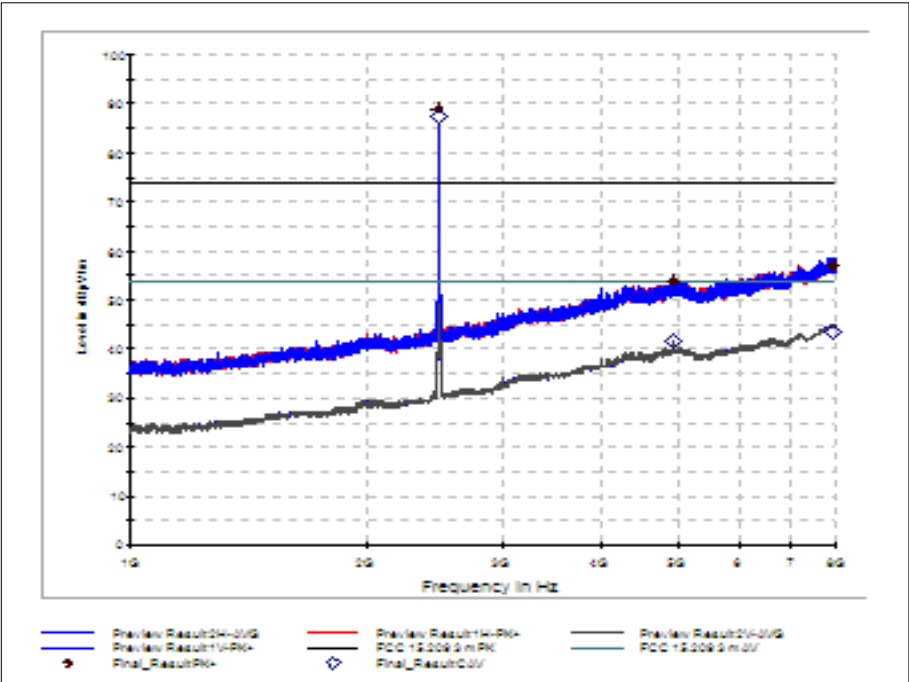


Figure 57 - 2480 MHz - 1 GHz to 8 GHz - Horizontal and Vertical



Product Service

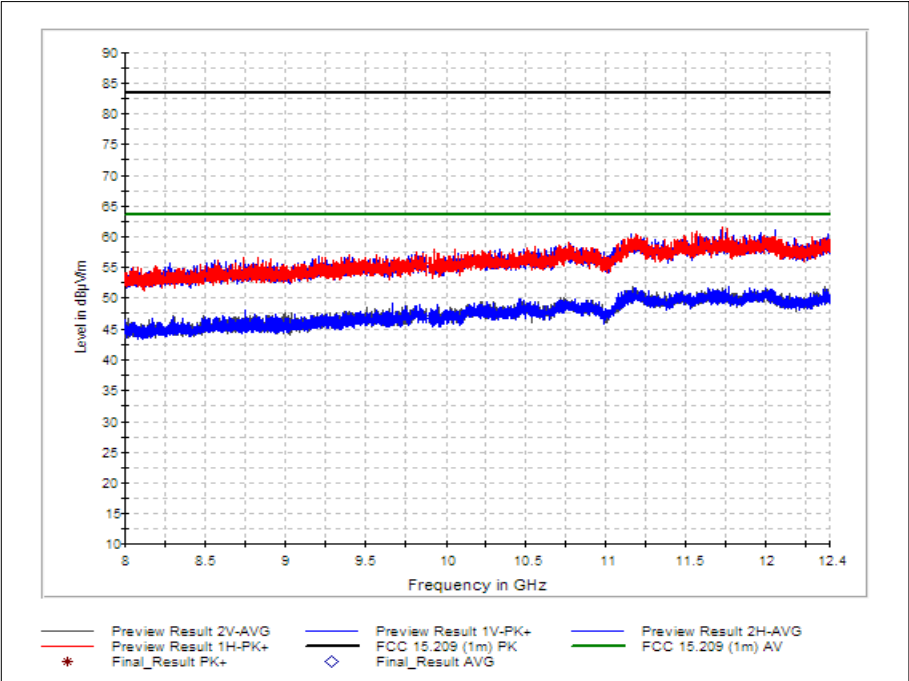


Figure 58 - 2480 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

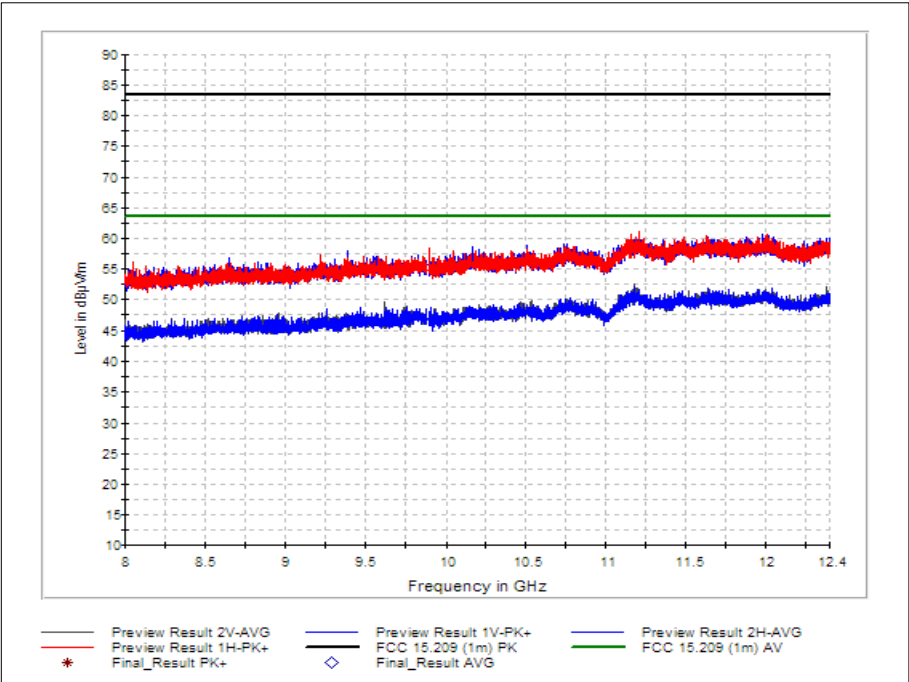


Figure 59 - 2480 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical



Product Service

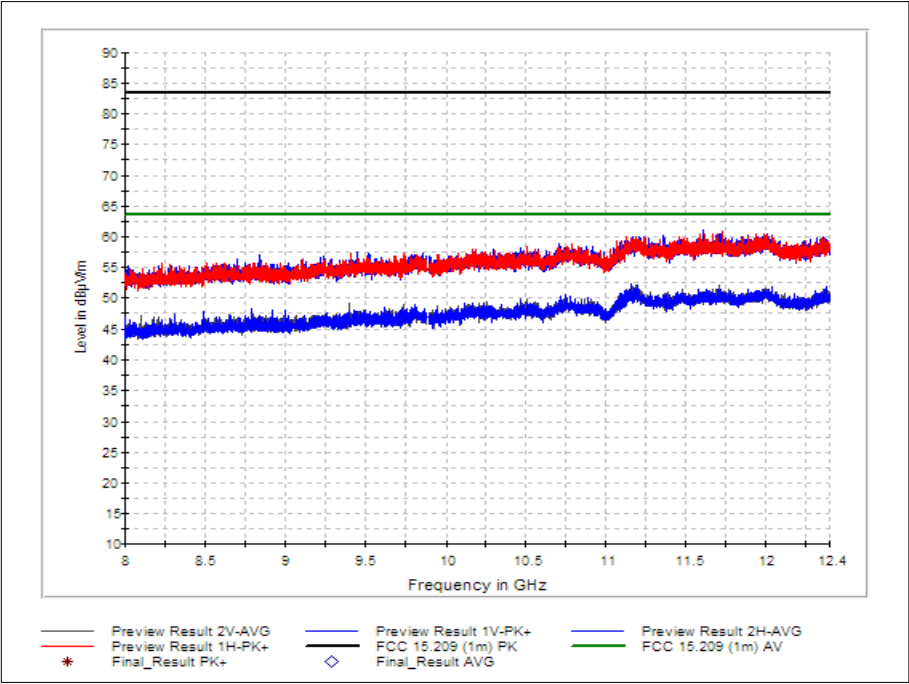


Figure 60 - 2480 MHz - 8 GHz to 12.4 GHz - Horizontal and Vertical

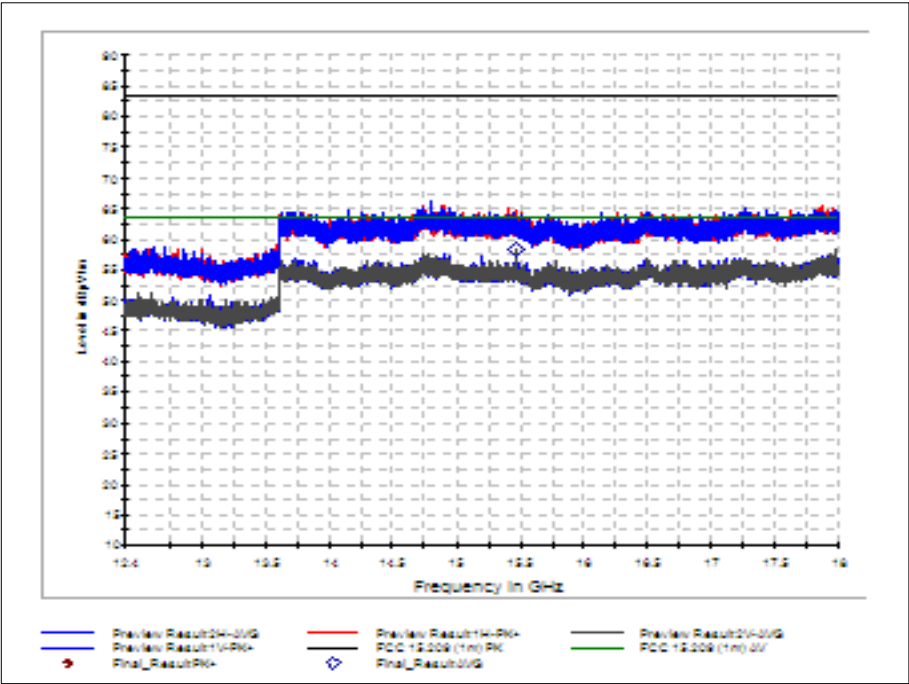


Figure 61 - 2480 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical



Product Service

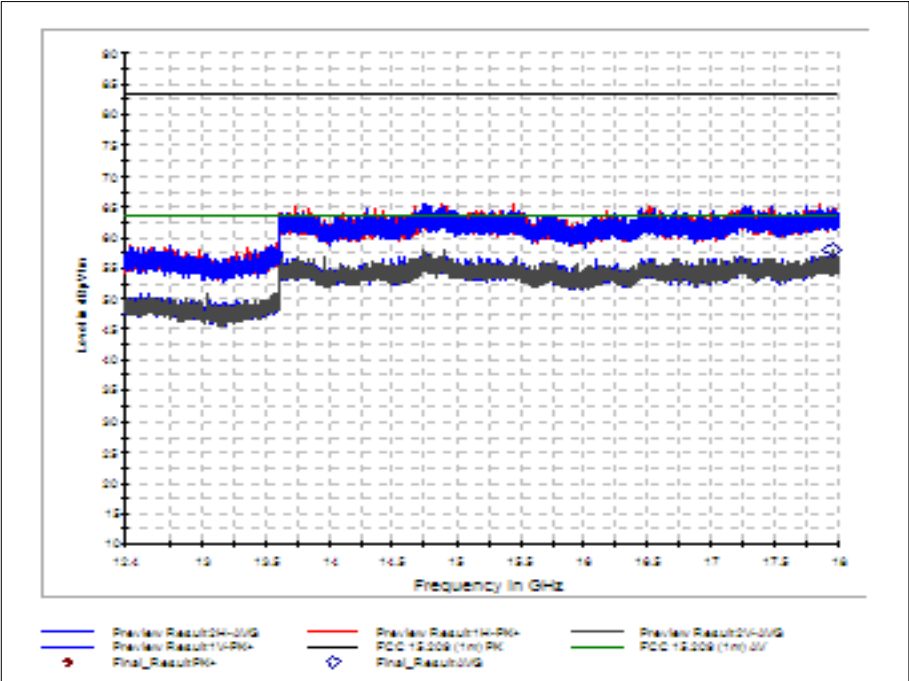


Figure 62 - 2480 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

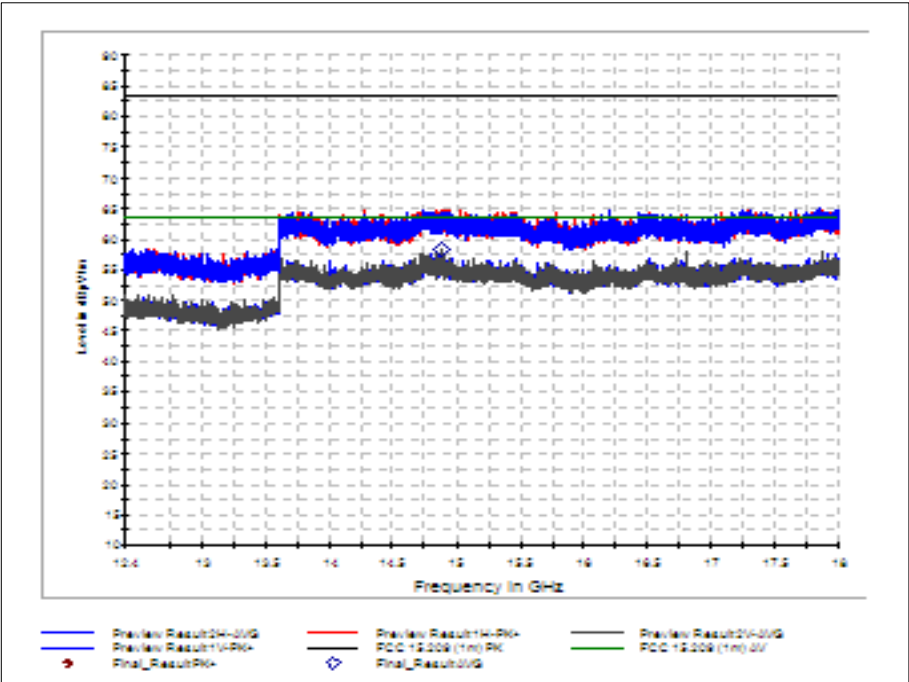


Figure 63 - 2480 MHz - 12.4 GHz - 18 GHz - Horizontal and Vertical

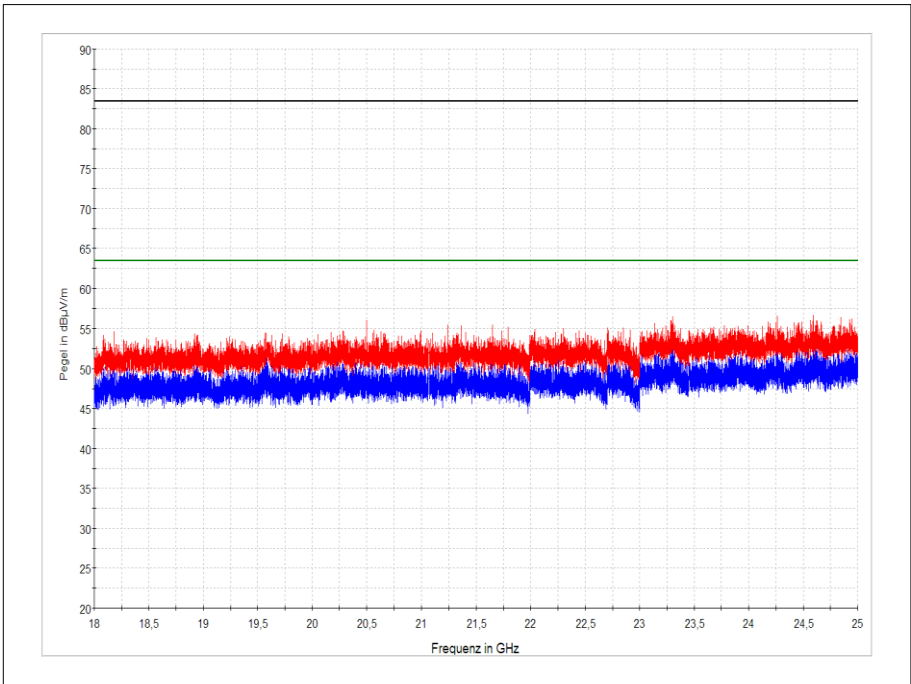


Figure 64 - 2480 MHz - 18 GHz - 25 GHz - Horizontal

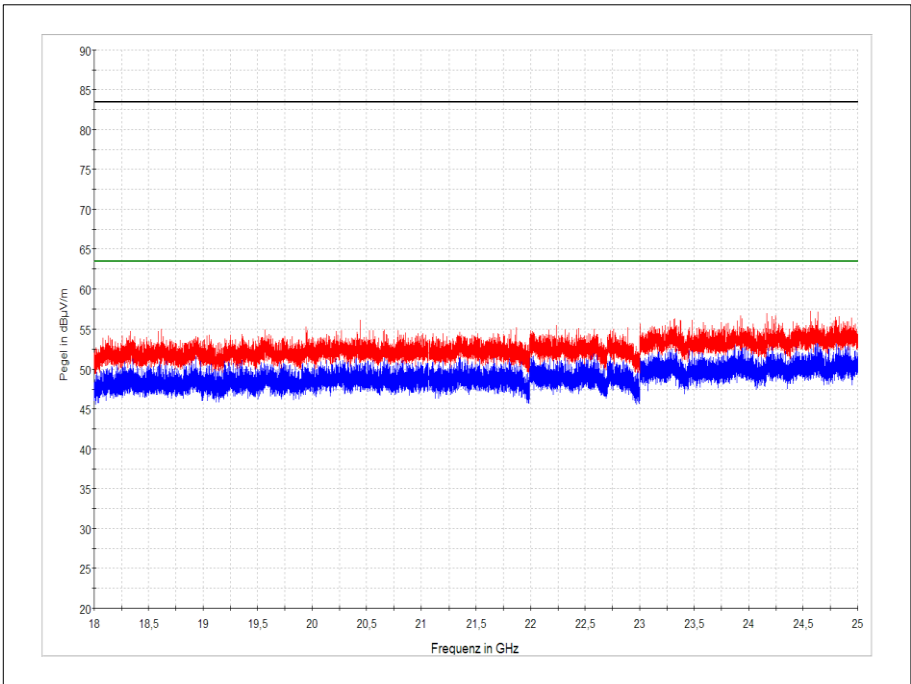


Figure 65 - 2480 MHz - 18 GHz - 25 GHz - Vertical

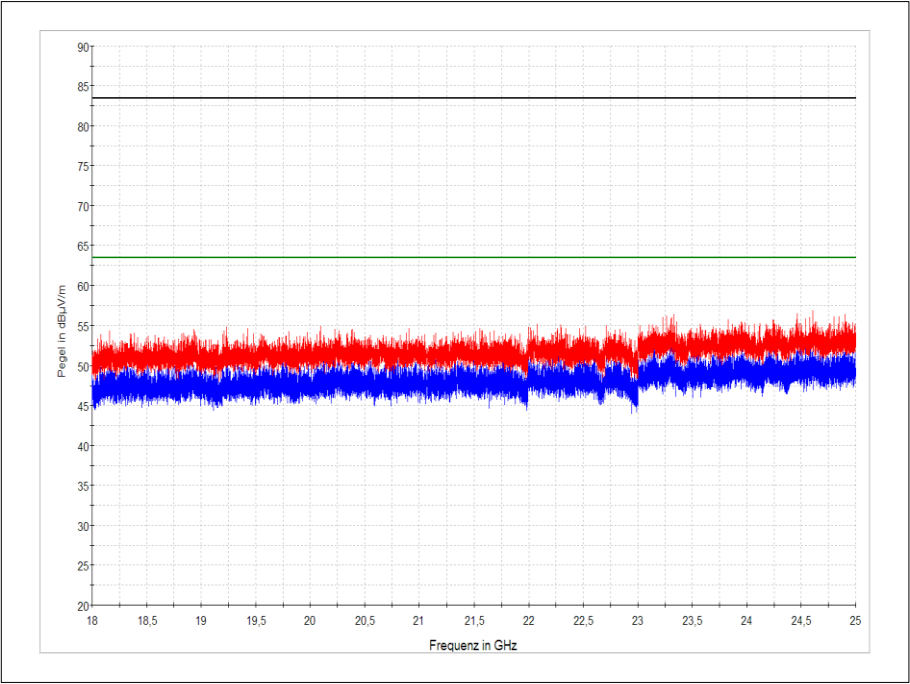


Figure 66 - 2480 MHz - 18 GHz - 25 GHz - Horizontal

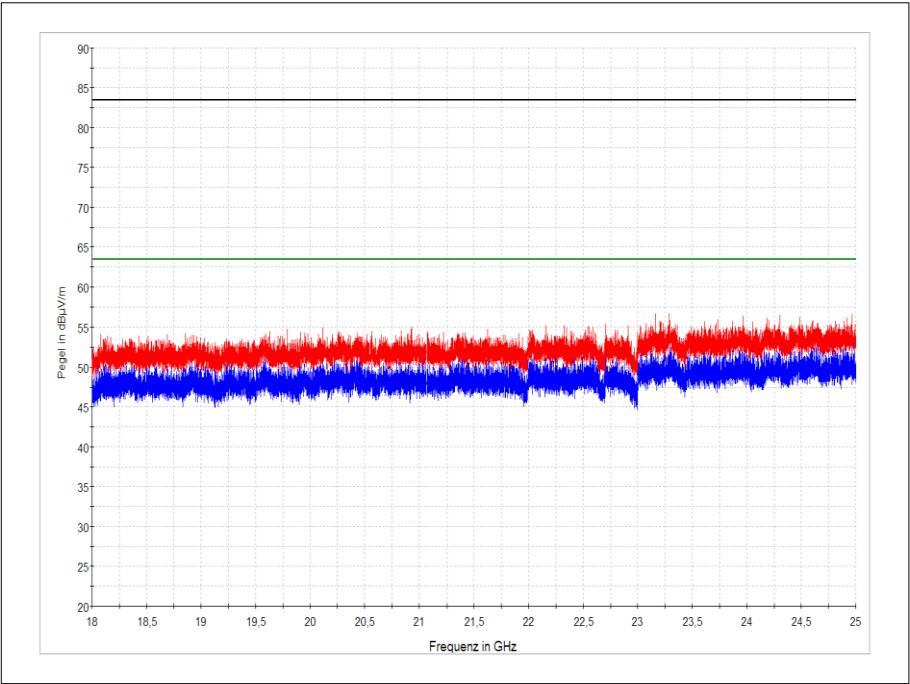


Figure 67 - 2480 MHz - 18 GHz - 25 GHz - Vertical

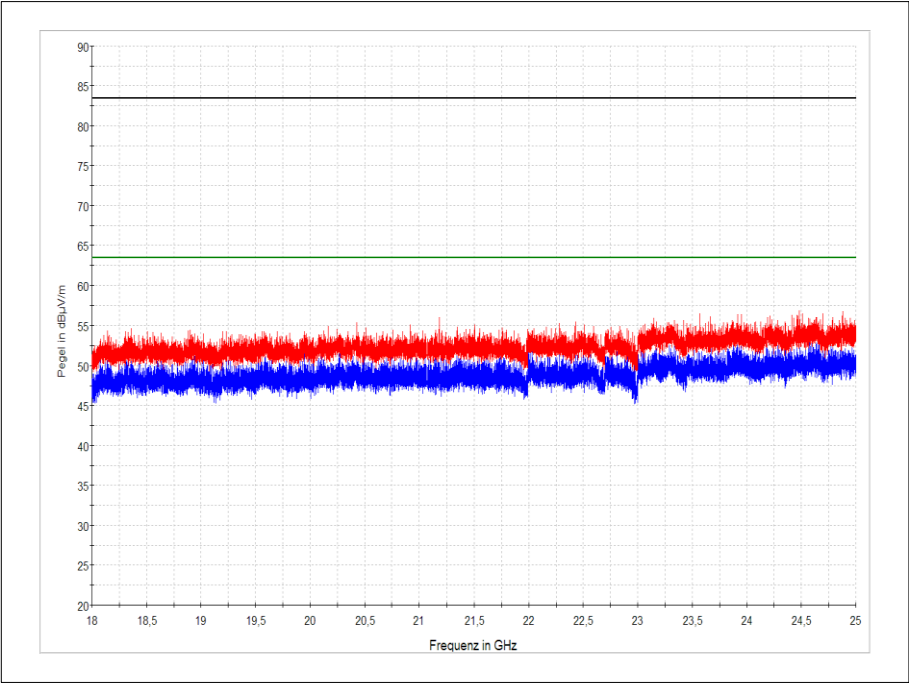


Figure 68 - 2480 MHz - 18 GHz - 25 GHz - Horizontal

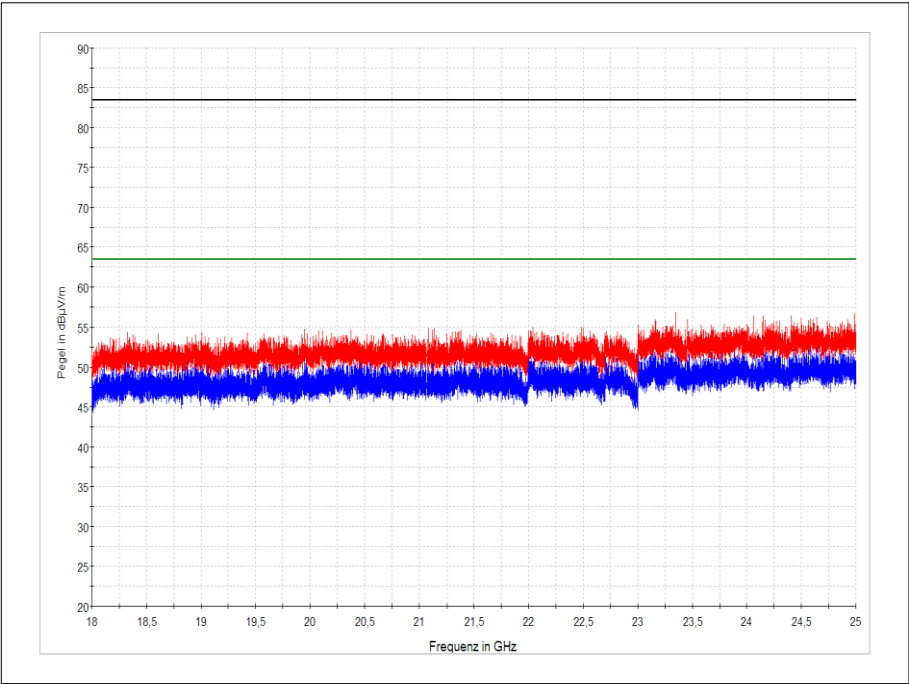


Figure 69 - 2480 MHz - 18 GHz - 25 GHz - Vertical



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)

ISED 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.



2.7.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
FSV40	Rohde & Schwarz	101448	20219	12	2019-01
ESW26	Rohde & Schwarz	101315	28268	12	2018-06
HFH2-Z2	Rohde & Schwarz	882964/0001	18876	24	2018-07
VULB9163	Schwarzbeck	9163-408	19918	36	2019-07
HF907	Rohde & Schwarz	100154	19933	24	2019-06
9160-07	EMCO	9112-1008	18874	No calibration needed. Mechanical check before use	
9160-08	EMCO	9112-1002	18875		
9160-09	EMCO	9403-1025	19125		

Table 18

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



2.8 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 4, section 3.2
Guide:	IC RSS-102 Issue 5, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: $CP = \dots\dots\dots \text{ W}$ The effective isotropic radiated power (EIRP in watts) is calculated using ☐ the numerical antenna gain: $G = \dots\dots\dots$ $EIRP = G \cdot CP \Rightarrow EIRP = \dots\dots\dots \text{ W}$ ☐ the field strength¹ in V/m: $FS = \dots\dots\dots \text{ V/m}$ $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots\dots\dots \text{ W}$ with: Distance between the antennas in m: $D = \dots\dots\dots \text{ m}$			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by1: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = 1.8 \text{ mW}$ with: Field strength in V/m: $FS = 97.8 \text{ dB}\mu\text{V/m} = 77.6 \text{ mV/m}$ Distance between the two antennas in m: $D = 3 \text{ m}$			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): $TP = 1.8 \text{ mW}$				

¹ The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses. If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.



Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is				
☒ less than or equal to 20 cm	☐ greater than 20 cm	☒		
Transmitting device is				
☐ in the vicinity of the human head	☒ body-worn	☒		



SAR evaluation										
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.										
Frequency (MHz)	Exemption limits (mW) ² at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 ³	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106
Carrier frequency:	$f = 2402 \text{ MHz}$									
Distance:	$d = 5 \text{ mm}$									
Transmitter output power:	$TP = 1.8 \text{ mW}$									
Limit:	$TP_{limit} = 4.0 \text{ mW}$									
☐ SAR evaluation is documented in test report no.										

² The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

³ Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.



Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows: ☐ below 20 MHz⁴ and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance). ☐ between 3 kHz and 10 MHz exposure limits apply as following: ☐ In a uncontrolled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than $2.7 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}$ at any part of the body where f is in Hz. The instantaneous RF field strength is equal or less than 83 V/m_{rms} and equal or less than 90 A/m_{rms}. ☐ In a controlled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than $1.35 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}$ at any part of the body where f is in Hz. The instantaneous RF field strength is equal or less than 170 V/m_{rms} and equal or less than 180 A/m_{rms}. ☐ at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5} \text{ W}$ (adjusted for tune-up tolerance, where f is in MHz). ☐ at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance). ☐ at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \cdot 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz. ☐ at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance). In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.				
Carrier frequency: f = MHz Transmitter output power: TP = mW Limit: TP_{limit} = mW				☐
☐ RF exposure evaluation is documented in test report no.				

⁴ Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

3 Photographs

3.1 Equipment Under Test (EUT)



Figure 70 - Top view of EUT



Figure 71 - Rear view of EUT



Figure 72 – Test Setup for frequencies 9 kHz – 30 MHz

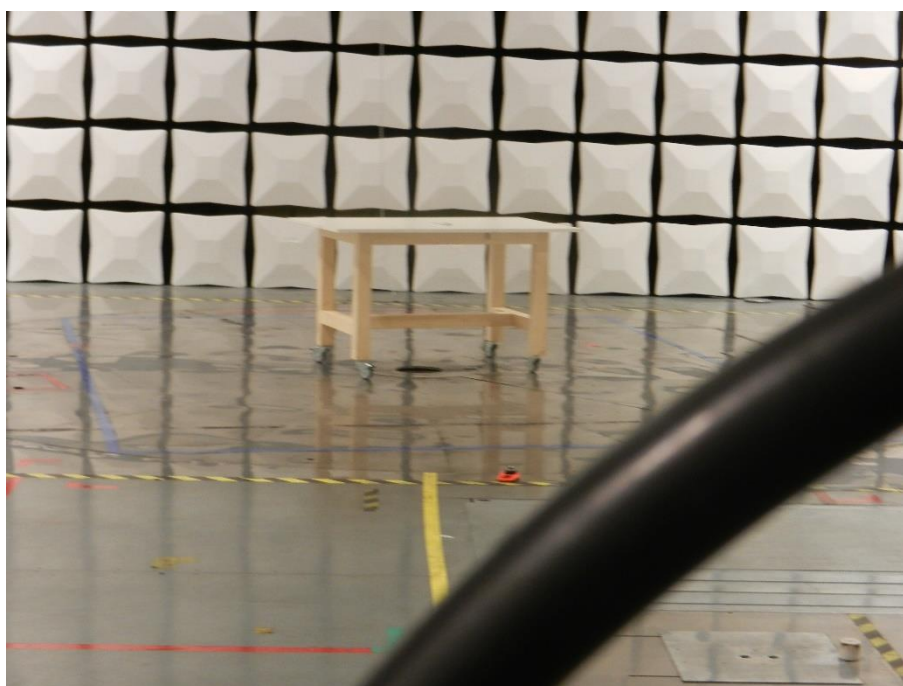


Figure 73 – Test Setup for frequencies 9 kHz – 30 MHz

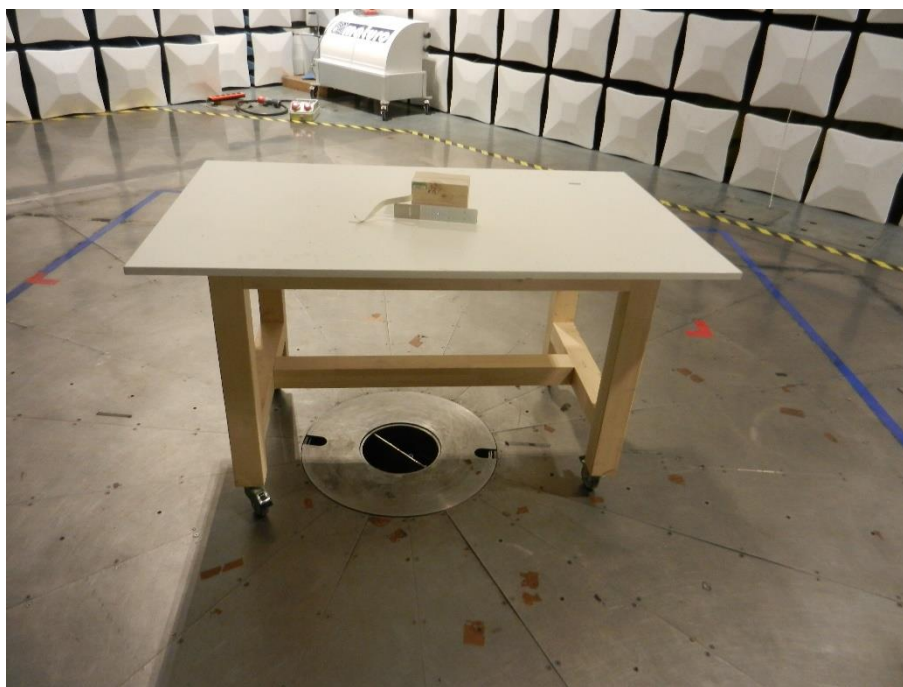


Figure 74 – Test Setup for frequencies 9 kHz – 30 MHz



Figure 75 – Test Setup for frequencies 9 kHz – 30 MHz



Figure 76 – Test Setup for frequencies 9 kHz – 30 MHz

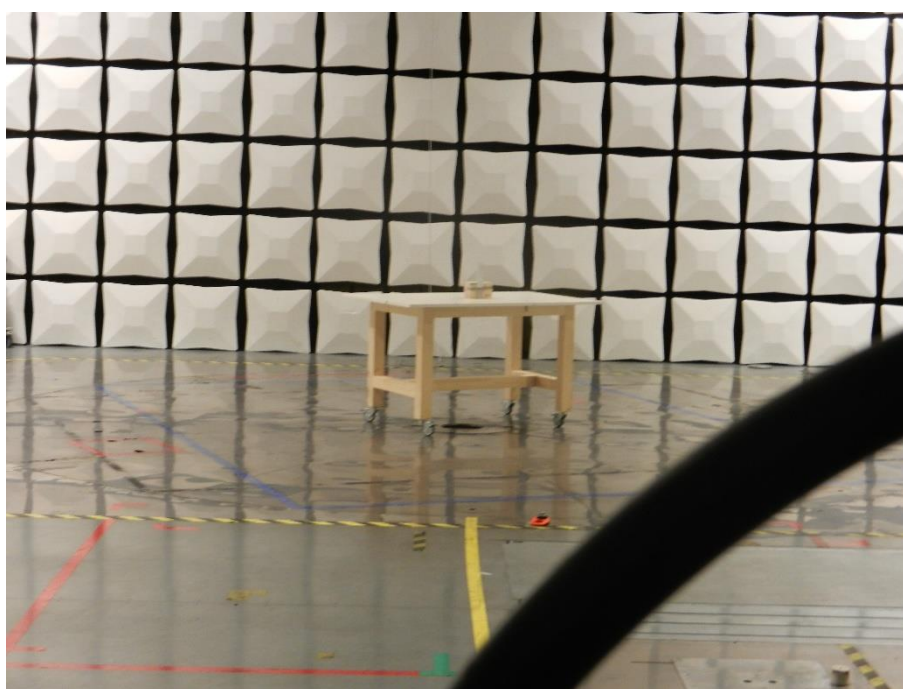


Figure 77 – Test Setup for frequencies 9 kHz – 30 MHz

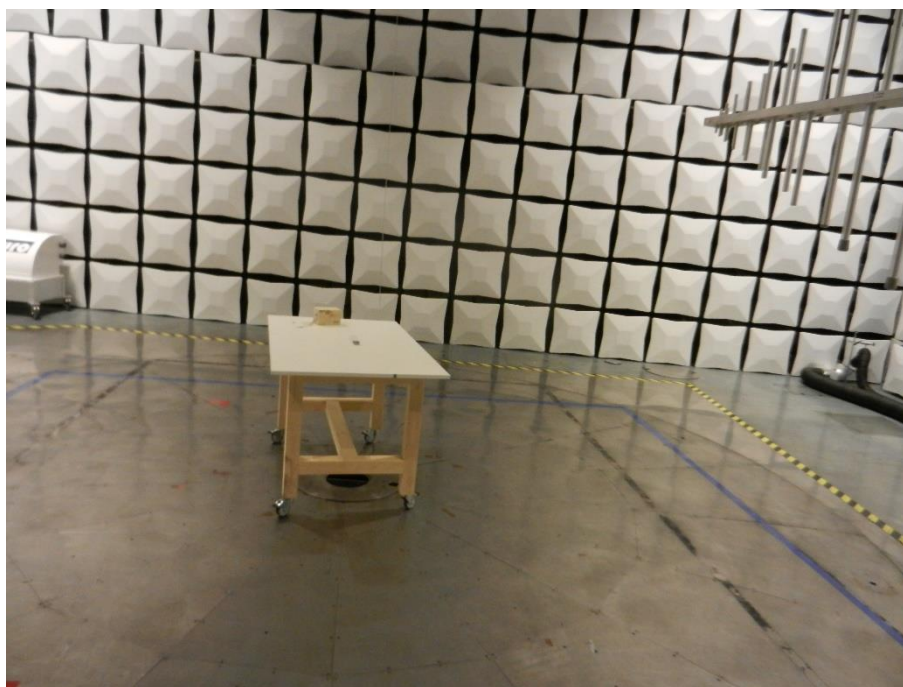


Figure 78 – Test Setup for frequencies 30 MHz – 1 GHz

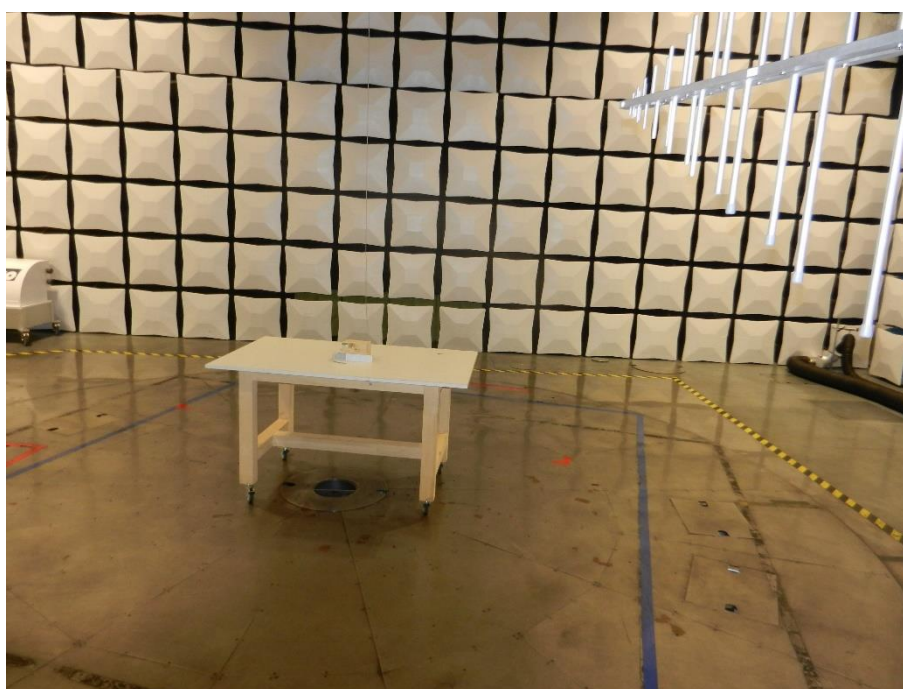


Figure 79 – Test Setup for frequencies 30 MHz – 1 GHz

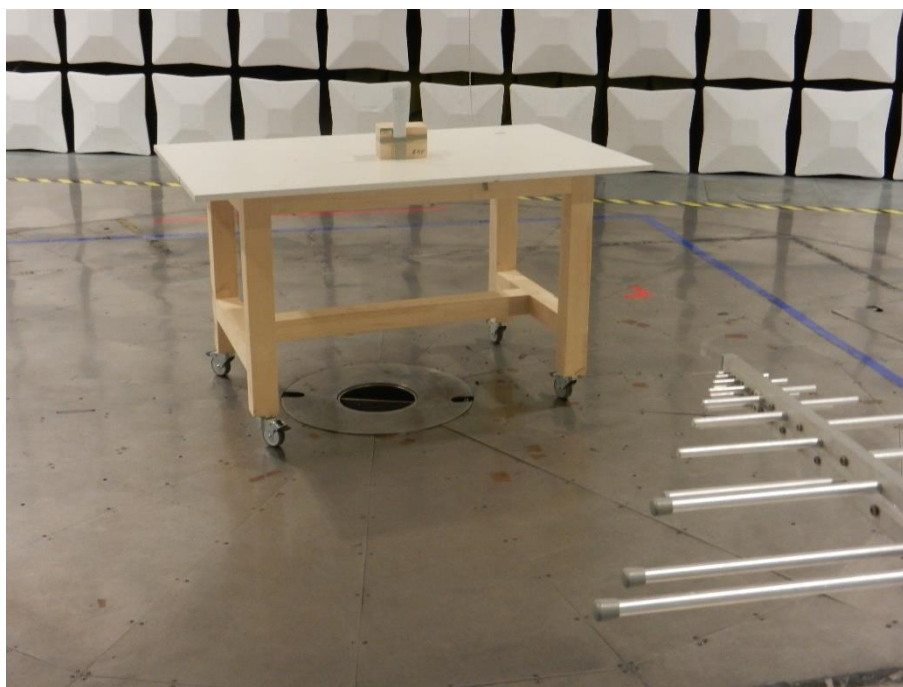


Figure 80 – Test Setup for frequencies 30 MHz – 1 GHz

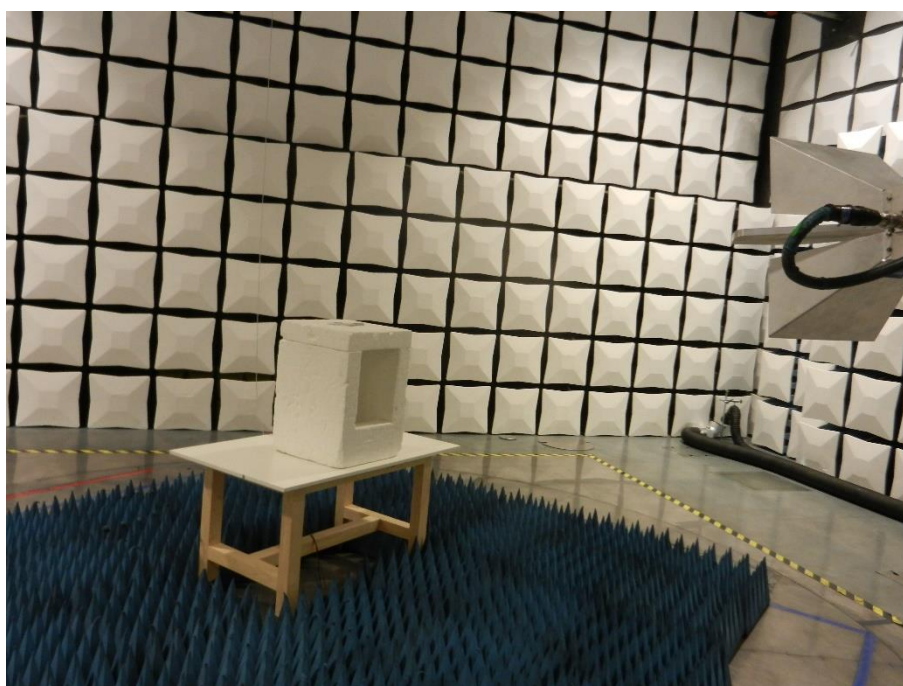


Figure 81 – Test Setup for frequencies >1 GHz



Figure 82 – Test Setup for frequencies >1 GHz

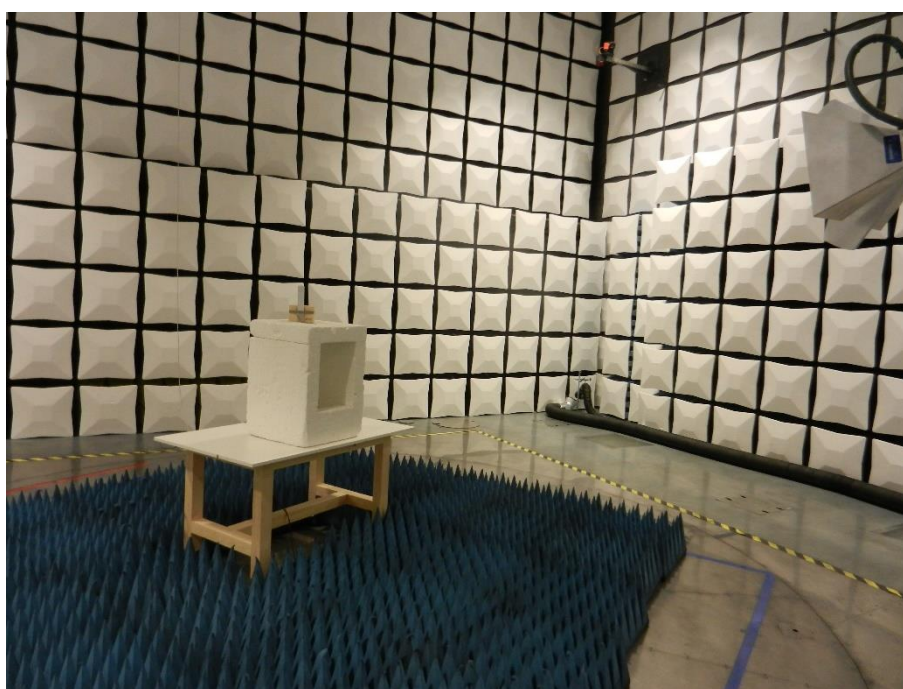


Figure 83 – Test Setup for frequencies >1 GHz



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

Table 19



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 20



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 21

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 $k_p = 2$, 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 $k_p = 2$, 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 $k_p = 2.05$, 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 $k_p = 2$, 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 $k_p = 2$, providing a level of confidence of $p = 95.45\%$

Note 7:

The expanded uncertainty reported according to ETSI TR 100 028 V1.4.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of $k_p = 1.96$, 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 $k_p = 1.96$, providing a level of confidence of $p = 95.45\%$



Product Service