FCC Test Report

MiX Telematics International (Pty) Ltd
Telematics Unit, Model: MiX 46MC-4G-B

In accordance with FCC 47 CFR Part 15C

Prepared for: MiX Telematics Europe Ltd
Cherry Orchard North
Kembrey Business Park
Swindon
Wiltshire
SN2 8UH
United Kingdom

Add value.
Inspire trust.

FCC ID: 2AFMS-4XMCXG

COMMERCIAL-IN-CONFIDENCE

Document 75948420-07 Issue 02

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Stephen Marshall	Senior Engineer	Authorised Signatory	16 April 2021

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD 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. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	16 April 2021	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2019 for the tests detailed in section 1.3.

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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	06 May 2020
2	To include additional declared variants	16 April 2021

Table 1

1.2 Introduction

Applicant	MiX Telematics Europe Ltd
Manufacturer	MiX Telematics International (Pty) Ltd
Model Number(s)	MiX 46MC-4G-B
Manufacturer Declared Variant(s)	MiX 46MC-4G MiX 460C-4G-B MiX 460C-4G
Serial Number(s)	53000102
Hardware Version(s)	1
Software Version(s)	48
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019
Order Number Date	P0093369 20-February-2020
Date of Receipt of EUT	02-March-2020
Start of Test	02-March-2020
Finish of Test	08-March-2020
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Bluetooth Low Energy transmitter				
2.1	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.2	15.205	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.3	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
-	15.247 (a)(2)	6 dB Bandwidth	N/T	Refer to document 75936634-08 for results
-	15.247 (b)(3)	Maximum Conducted Output Power	N/T	Refer to document 75936634-08 for results
-	15.247 (e)	Power Spectral Density	N/T	Refer to document 75936634-08 for results

Table 2

N/T – Not Tested

*The manufacturer has declared the radio device is electrically identical and therefore the conducted results will be the same.

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment)*	The MiX 46MC-4G is a fleet product that incorporates the latest market trends. It consists mainly of an on-board computer, an LTE CAT M1 modem with 2G fall-back, a GNSS, an accelerometer, Low Energy Bluetooth, I/O, 2 x CAN, 2 x RS232, 4 x positive drives and 434 / 915 MHz short range transceiver.
Manufacturer:	MiX Telematics International (Pty) Ltd.
Model:	MiX 46MC-4G; MiX 46MC-4G-B
Part Number:	440FT0194; 440FT0195
Hardware Version:	1
Software Version:	4.8
FCC ID (if applicable)	2AFMS-4XMCXG
IC (if applicable)	

Intentional Radiators

Technology	LTE Band 12	LTE Band 13	LTE Band 5	LTE Band 4	LTE Band 3	LTE Band 2	SRD915	SRD2400
Frequency Band (MHz)	699-716	777-787	824-849	1710-1755	1710-1785	1880-1910	902-928	2400-2480
Conducted Declared Output Power (dBm)	23	23	23	23	23	23	20	7
Antenna Gain (dBi)	0.76	1.39	0.21	1.46	1.46	2.07	0	1.4
Supported Bandwidth(s) (MHz)	1.4	1.4	1.4	1.4	1.4	1.4	0.025	1
Modulation Scheme(s)	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	2FSK	GFSK
ITU Emission Designator	1M40W7D	1M40W7D	1M40W7D	1M40W7D	1M40W7D	1M40W7D	38K4F7D	1M00G7D
Bottom Frequency (MHz)	699	777	824	1710	1710	1850	902	2402
Middle Frequency (MHz)	707.5	782	836.5	1747.5	1747.5	1880	915	2440
Top Frequency (MHz)	716	787	849	1755	1785	1910	928	2480

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	699 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐ Class B Digital Device (Use in residential environment only) ☒	

AC Power Source

AC supply frequency:	N/A	Hz
Voltage	N/A	V
Max current:	N/A	A
Single Phase ☐ Three Phase ☐		

DC Power Source

Nominal voltage:	13.8/27.6 V DC	V
Extreme upper voltage:	32	V
Extreme lower voltage:	10.5	V
Max current:	2A typical; 4.5A absolute max (7.5A Fused)	A

Battery Power Source

Voltage:	3.2	V
End-point voltage:	3.2	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☒ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Charging

Can the EUT transmit whilst being charged	Yes ☒ No ☐

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	60	°C

Antenna Characteristics

Antenna connector ☒			State impedance	50	Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	LTE BLE SRD915 GNSS	Gain	3 1.4 0 4	dBi
External antenna ☒	Type:	GNSS	Gain	4	dBi
For external antenna only: Standard Antenna Jack ☒ If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed ☒ Non-standard Antenna Jack ☐					

Ancillaries (if applicable)

Manufacturer:	MiX Telematics	Part Number:	440FT0033
Model:	Main Harness MP10	Country of Origin:	South Africa
Manufacturer:	MiX Telematics	Part Number:	440FT0032
Model:	Code Plug Harness with Socket CP4	Country of Origin:	South Africa
Manufacturer:	MiX Telematics	Part Number:	440FT0931
Model:	Serial Harness SR1	Country of Origin:	South Africa
Manufacturer:	RF Design	Part Number:	440FT0933
Model:	External GNSS Antenna PA2	Country of Origin:	South Africa

I hereby declare that the information supplied is correct and complete.

Name: Ben van der Merwe
Position held: Senior RF Engineer
Date: 29 April 2020

1.5 Manufacturer's Declared Variant(s)

The following product variants (with part numbers) are available:

Part ID	Official Name	Description
440FT0194	MiX 46MC-4G	MiX 4000 LTE with 2G fall back (Model 46MC-4G) Electronic Unit; with Magix 434MHz and 915MHz support.
440FT0195	MiX 46MC-4G-B	MiX 4000 LTE with 2G fall back (Model 46MC-4G-B) Electronic Unit with Battery (plugged in) with Magix 434MHz and 915MHz support.

The variants MiX 46MC-4G and MiX 46MC-4G-B, present the same electrical, physical and electro mechanics characteristics, the same PCB (440AWZ124), layout and components.

The only difference between them is that the model MiX 46MC-4G-B has an internal backup battery, allowing the device to work after the disconnection of the vehicle´s battery.

The following variants use the same PCB (440AWZ124) and circuit (440CDZ192), but it is not utilizing the Short Range Device feature (434 MHz) (components not populated):

Assembly Number	Assembly Name	Description
U0095MT	MiX 460C-4G	MiX 460C-4G Electronic Unit with u-blox SARA-R412M modem; No on-board Magix support
U0097MT	MiX 460C-4G-B	MiX 460C-4G with Backup Battery Electronic Unit with u-blox SARA-R412M modem; No on-board Magix support

1.6 Product Information

1.6.1 Technical Description

The MiX 46MC-4G is a fleet product that incorporates the latest market trends. It consists mainly of an on-board computer, an LTE CAT M1 modem with 2G fall-back, a GNSS, an accelerometer, Bluetooth Low Energy, I/O, 2 x CAN, 2 x RS232, 4 x positive drives and 434 / 915 MHz short range transceiver.

1.6.2 Equipment Under Test Power Settings

Authorized and Restricted Band Edges were performed at a power level setting of 10 dBm.

For Spurious Radiated Emissions, the power settings for the transmitter were set at the following.
Bottom channel (2402 MHz) = 1dBm
Middle channel (2440 MHz) = 5dBm
Top channel (2480 MHz) = 10 dBm

However, the conducted output power for the top channel in production software, will not be set above 6.45 dBm as reflected in the test results of the refenced report number 75936634-08.

1.7 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.8 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
Model: MiX 46MC-4G-B, Serial Number: 53000102			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.9 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Bluetooth Low Energy transmitter		
Authorised Band Edges	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham, Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Authorised Band Edges

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

MiX 46MC-4G-B, S/N: 53000102 - Modification State 0

2.1.3 Date of Test

02-March-2020

2.1.4 Test Method

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

2.1.5 Environmental Conditions

Ambient Temperature 19.4 °C
Relative Humidity 33.1 %

2.1.6 Test Results

Bluetooth Low Energy transmitter

Modulation	Frequency (MHz)	Band Edge Frequency (MHz))	Level (dBc)
GFSK	2402	2400	-57.10

Table 5 - Authorised Band Edge Results

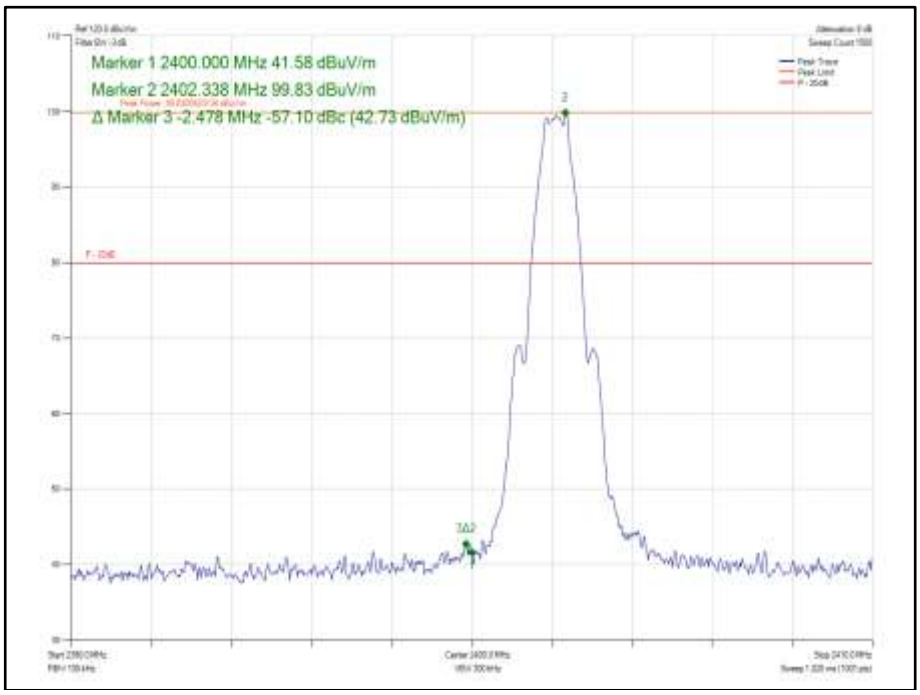

Figure 1 – GFSK, 2402 MHz - Measured Frequency 2400 MHz

<u>FCC 47 CFR Part 15, Limit Clause 15.247 (d)</u>

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.

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
DC Power Supply	Hewlett Packard	6269B	1909	-	TU
Multimeter	Iso-tech	IDM101	2417	12	11-Nov-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 6

TU - Traceability Unscheduled

2.2 Restricted Band Edges

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205

2.2.2 Equipment Under Test and Modification State

MiX 46MC-4G-B, S/N: 53000102 - Modification State 0

2.2.3 Date of Test

02-March-2020

2.2.4 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 4.1.4.2.5. 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).

2.2.5 Environmental Conditions

Ambient Temperature	19.4 °C
Relative Humidity	33.1 %

2.2.6 Test Results

<u>Bluetooth Low Energy transmitter</u>

Modulation	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
GFSK	2402	2390	51.54	40.44
GFSK	2480	2483.5	53.54	42.00

Table 7 - Restricted Band Edge Results

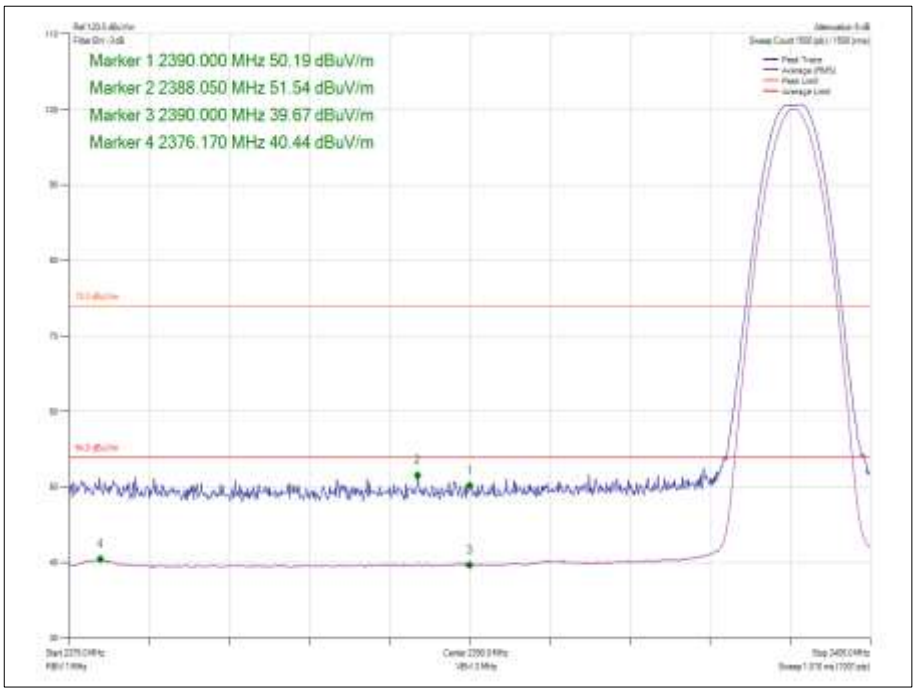

Figure 2 - GFSK - 2402 MHz - Measured Frequency 2390 MHz

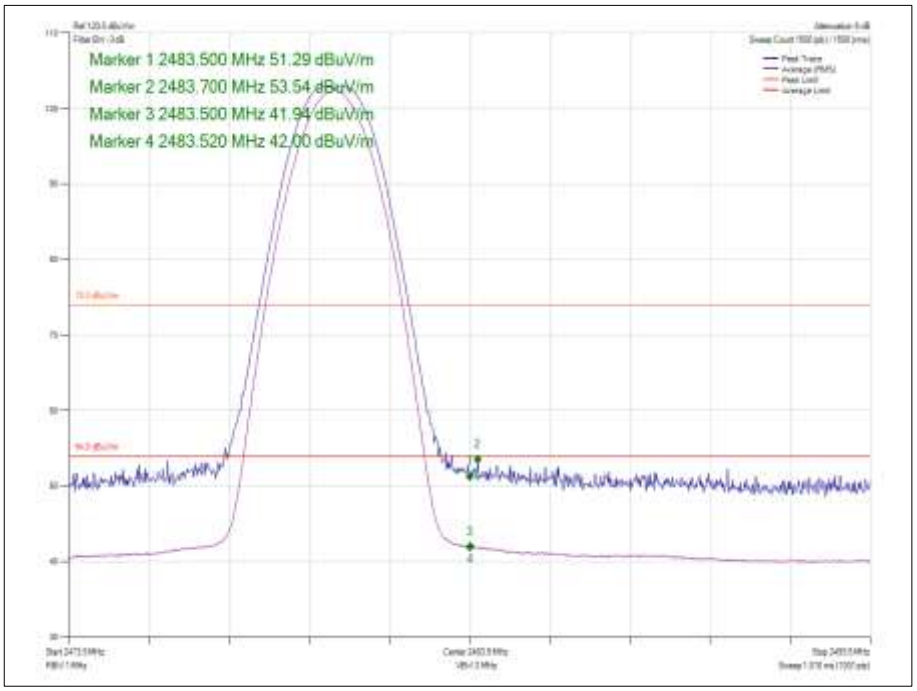

Figure 3 - GFSK - 2480 MHz - Measured Frequency 2483.5 MHz

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 8

2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
DC Power Supply	Hewlett Packard	6269B	1909	-	TU
Multimeter	Iso-tech	IDM101	2417	12	11-Nov-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 9

TU - Traceability Unscheduled

2.3 Spurious Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205

2.3.2 Equipment Under Test and Modification State

MiX 46MC-4G-B, S/N: 53000102 - Modification State 0

2.3.3 Date of Test

02-March-2020 to 08-March-2020

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. For an EUT which could reasonable be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4, clause 6.2.4. For EUT's with multiple connectors of the same type, additional interconnecting cables were connected, and pre-scans performed to determine whether the level of the emissions were increased by >2 dB. For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10, 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, (74/54 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.

Above 18 GHz, the measurement distance was reduced to 1 m. At a measurement distance of 1 meter the limit line was increased by 20*LOG(3/1) = 9.54 dB.

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

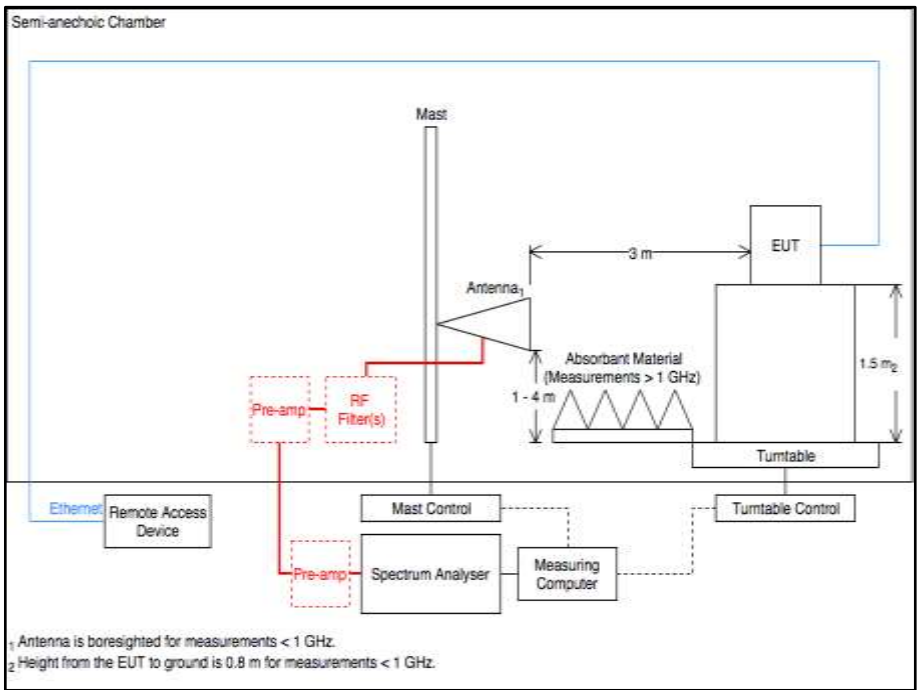

Figure 4 - Radiated Emissions Test Setup Diagram

2.3.5 Environmental Conditions

Ambient Temperature 19.4 - 22.1 °C
Relative Humidity 32.9 - 33.1 %

2.3.6 Test Results

Bluetooth Low Energy transmitter

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
*								

Table 10 - 2402 MHz, 30 MHz to 1 GHz - Emission Results

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

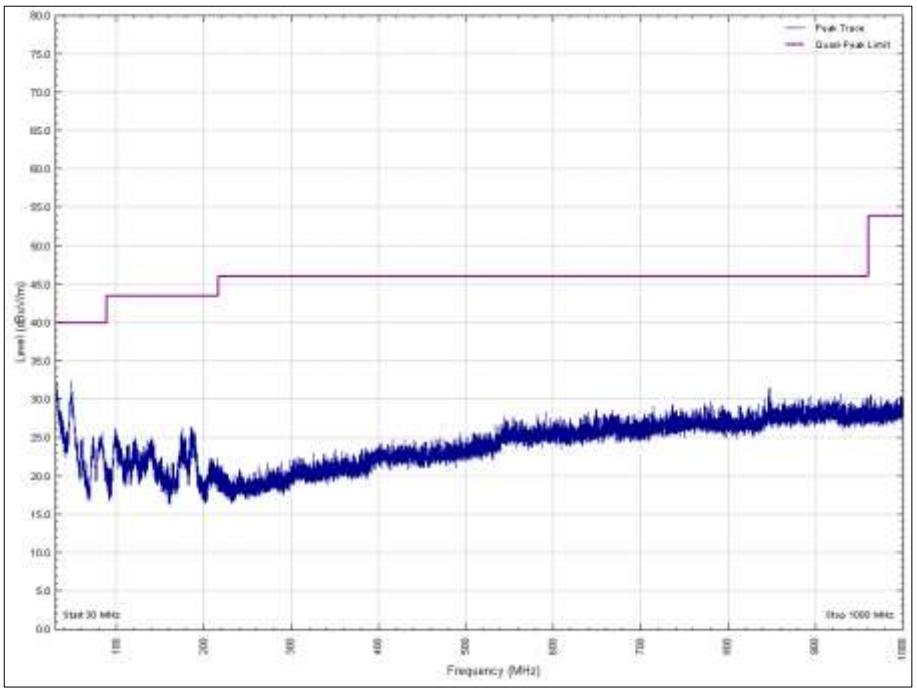

Figure 5 - 2402 MHz, 30 MHz to 1 GHz, Vertical, X Orientation

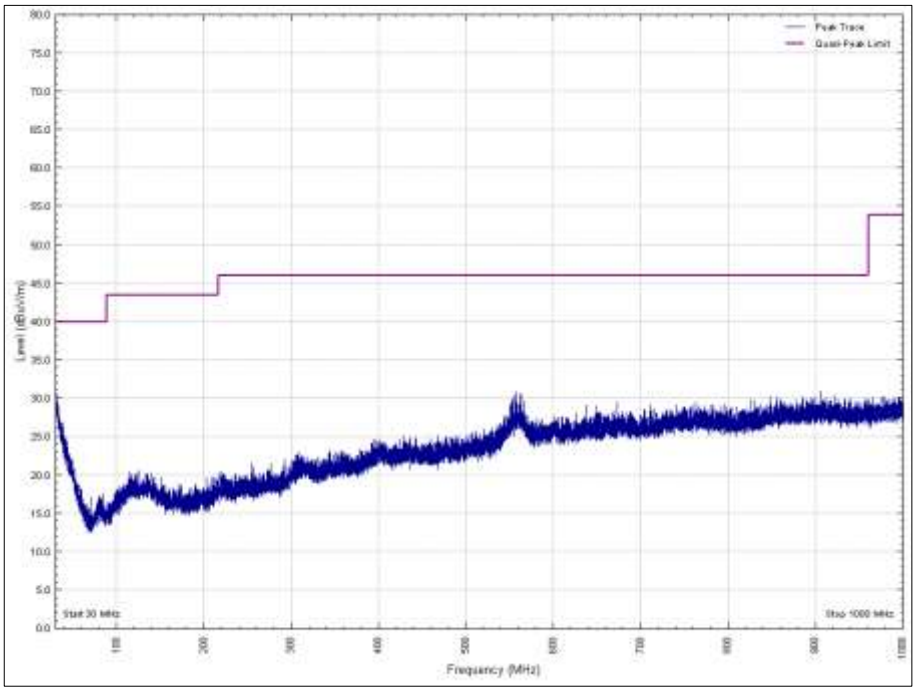

Figure 6 - 2402 MHz, 30 MHz to 1 GHz, Horizontal, X Orientation

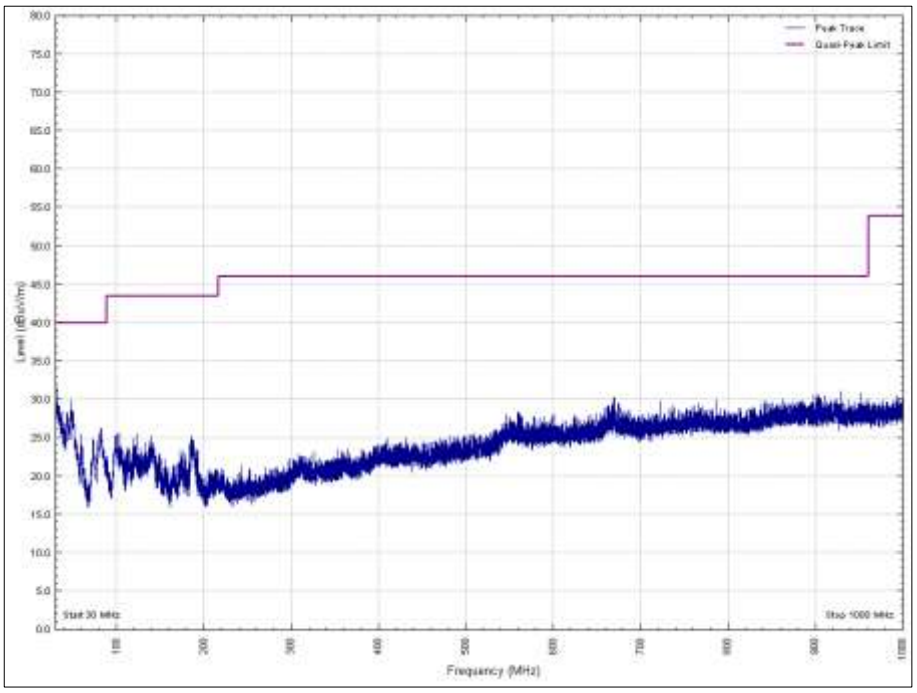

Figure 7 - 2402 MHz, 30 MHz to 1 GHz, Vertical, Y Orientation

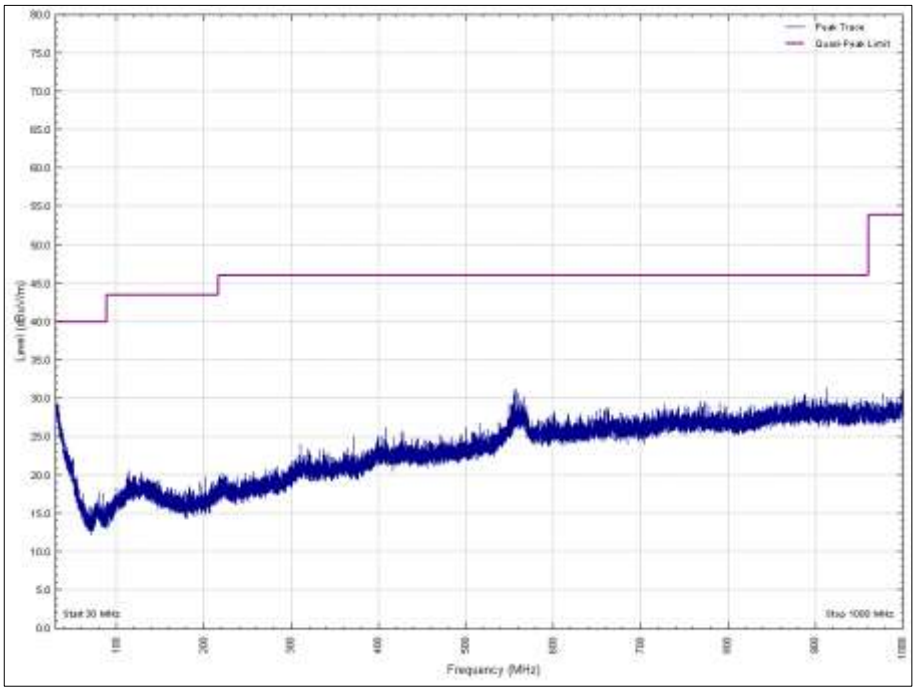

Figure 8 - 2402 MHz, 30 MHz to 1 GHz, Horizontal, Y Orientation

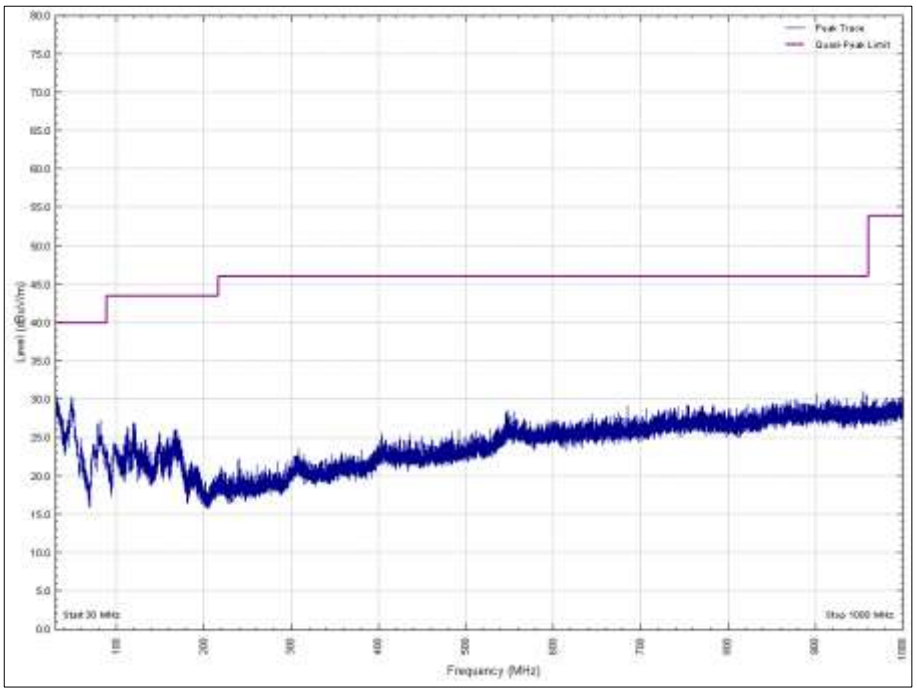

Figure 9 - 2402 MHz, 30 MHz to 1 GHz, Vertical, Z Orientation

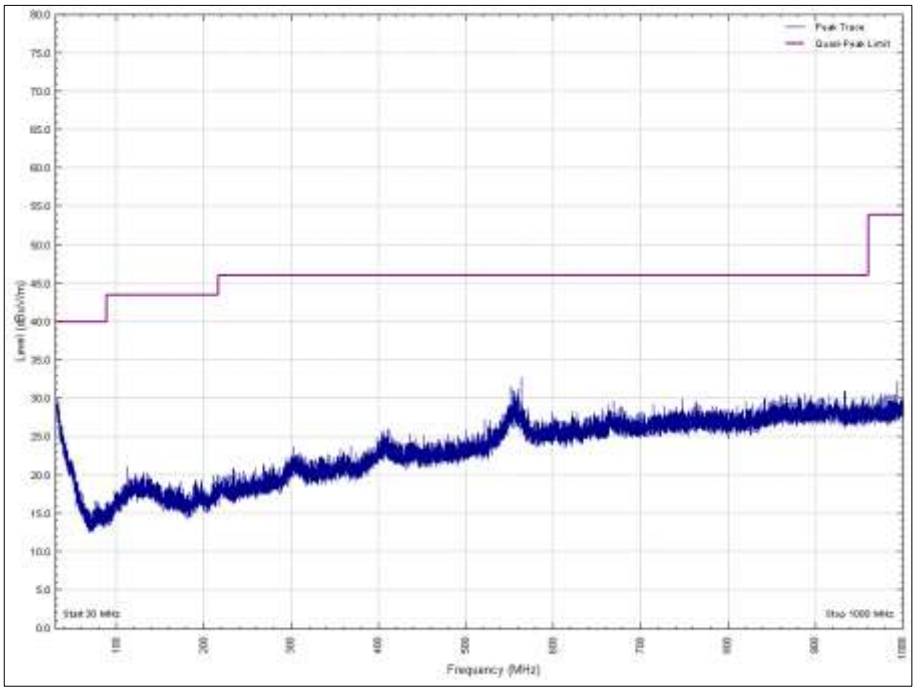

Figure 10 - 2402 MHz, 30 MHz to 1 GHz, Horizontal, Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4803.763	53.29	53.98	0.69	CISPR Average	230	331	Vertical	Y
4803.693	47.93	53.98	6.05	CISPR Average	221	162	Horizontal	Y
4803.734	50.72	53.98	3.26	CISPR Average	265	100	Vertical	Z
4803.793	46.79	53.98	7.19	CISPR Average	201	100	Vertical	X
4804.773	50.37	53.98	3.61	CISPR Average	299	276	Horizontal	X
4804.738	52.84	53.98	1.14	CISPR Average	223	262	Horizontal	Z

Table 11 - 2402 MHz, 1 GHz to 25 GHz Emissions Results

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

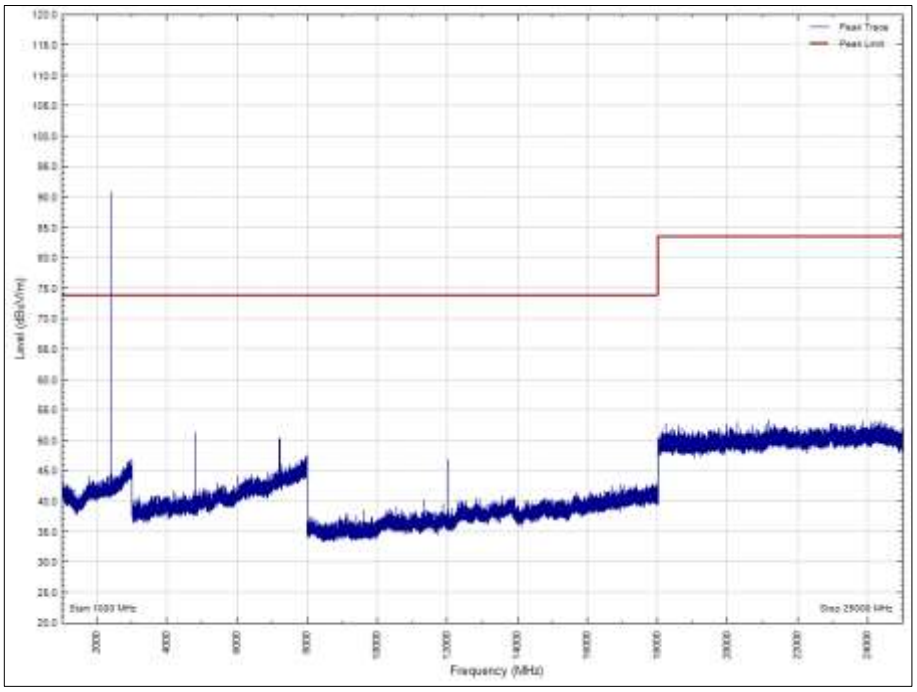

Figure 11 - 2402 MHz, 1 GHz to 25 GHz, Vertical, X Orientation: - Peak

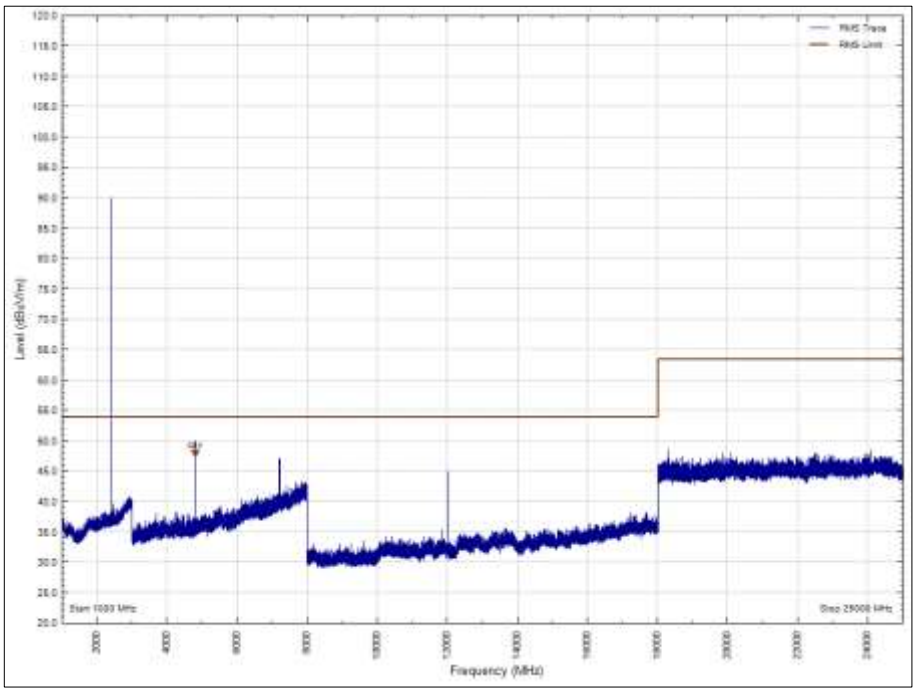

Figure 12 - 2402 MHz, 1 GHz to 25 GHz, Vertical, X Orientation: - Average

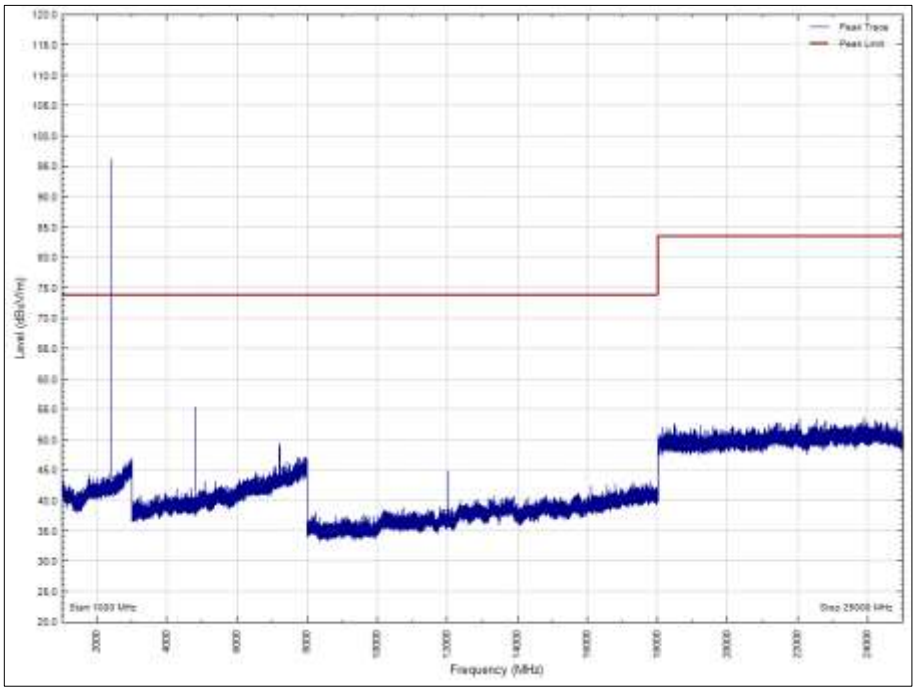

Figure 13 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, X Orientation: - Peak

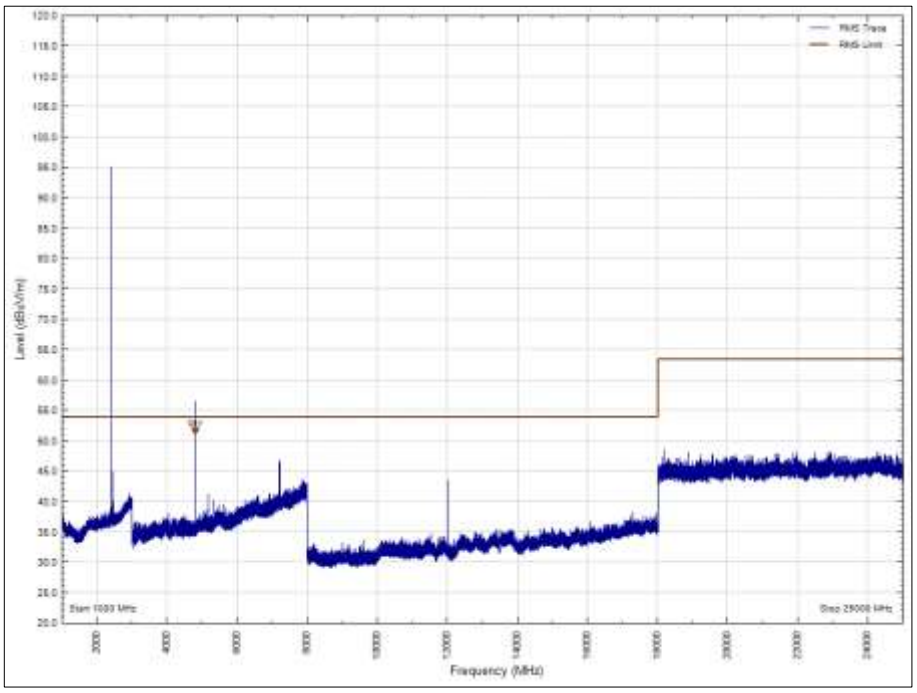

Figure 14 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, X Orientation: - Average

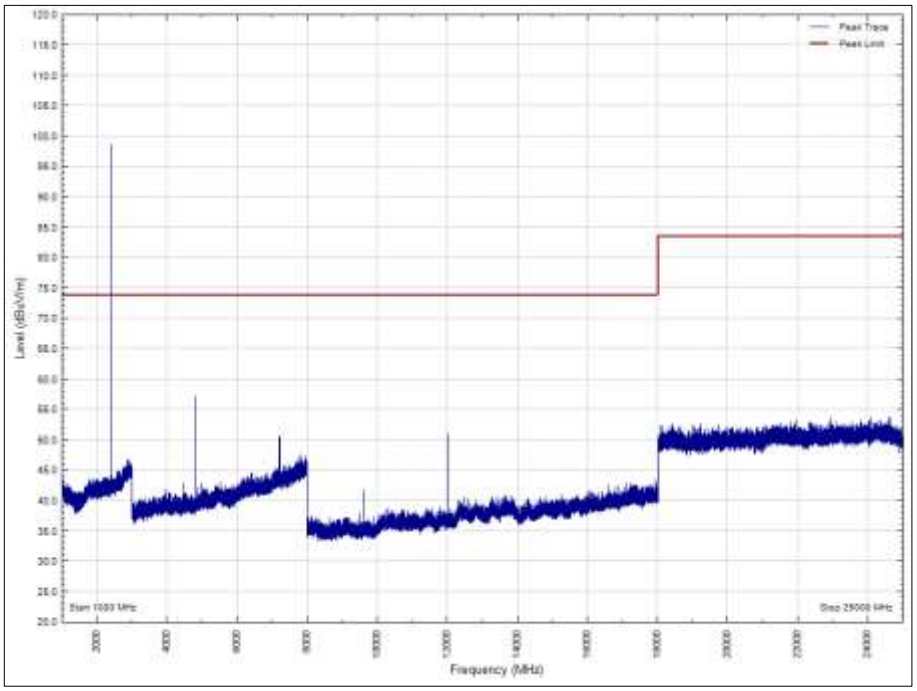

Figure 15 - 2402 MHz, 1 GHz to 25 GHz, Vertical, Y Orientation: - Peak

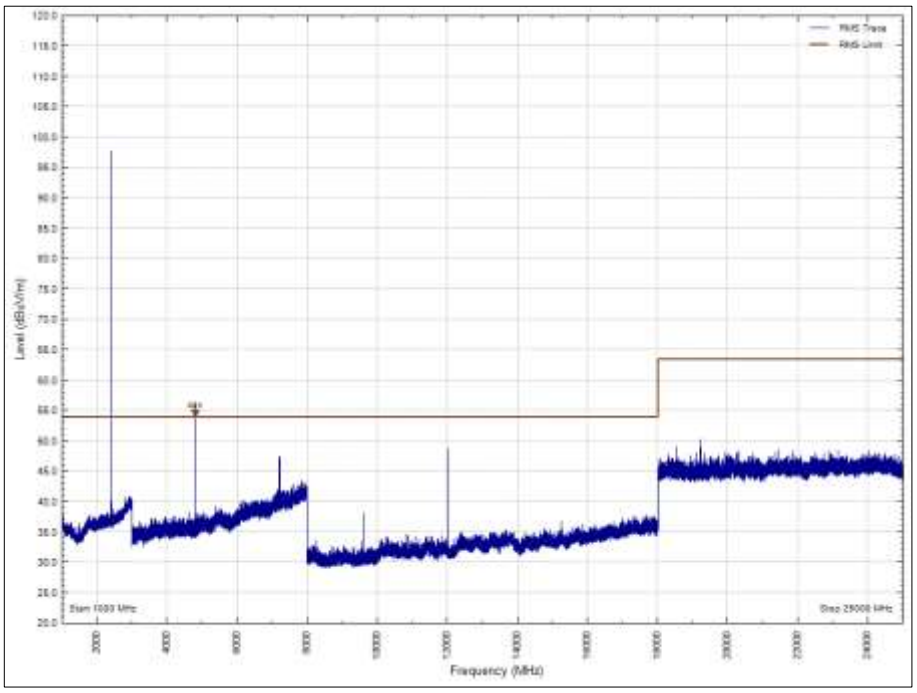

Figure 16 - 2402 MHz, 1 GHz to 25 GHz, Vertical, Y Orientation: - Average

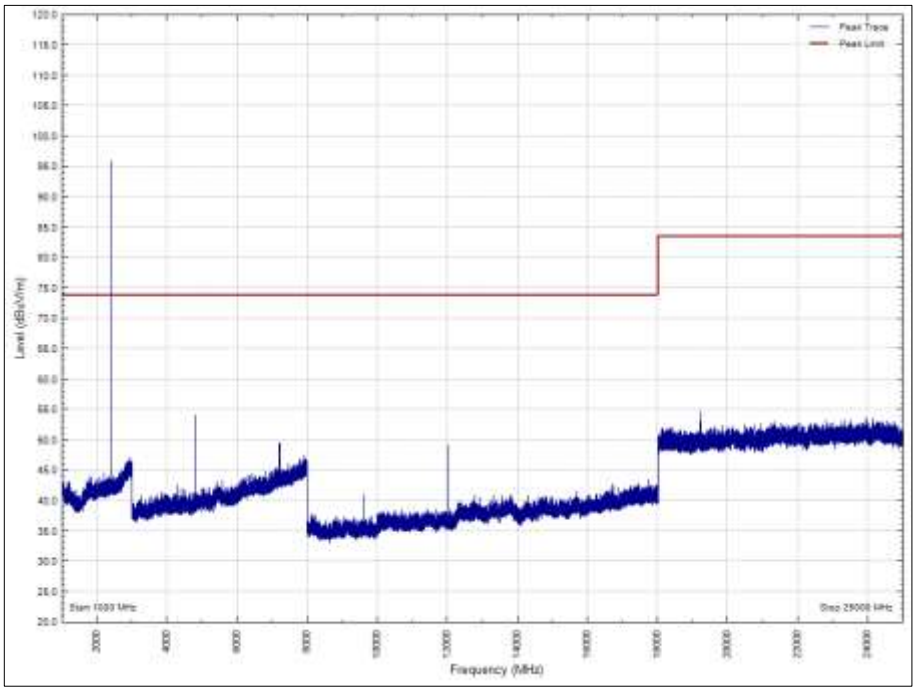

Figure 17 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, Y Orientation: - Peak

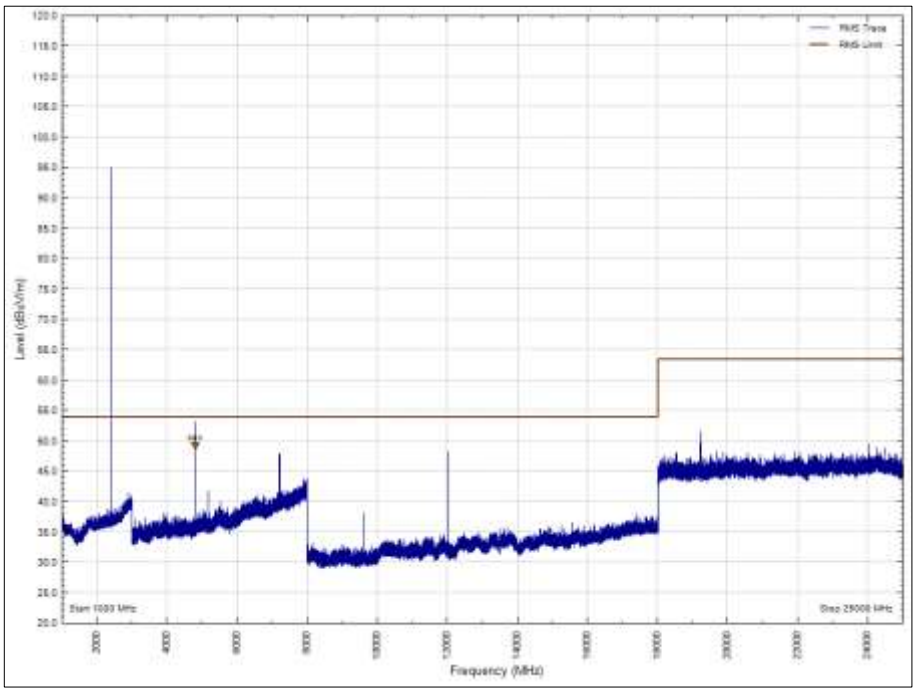

Figure 18 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, Y Orientation: - Average

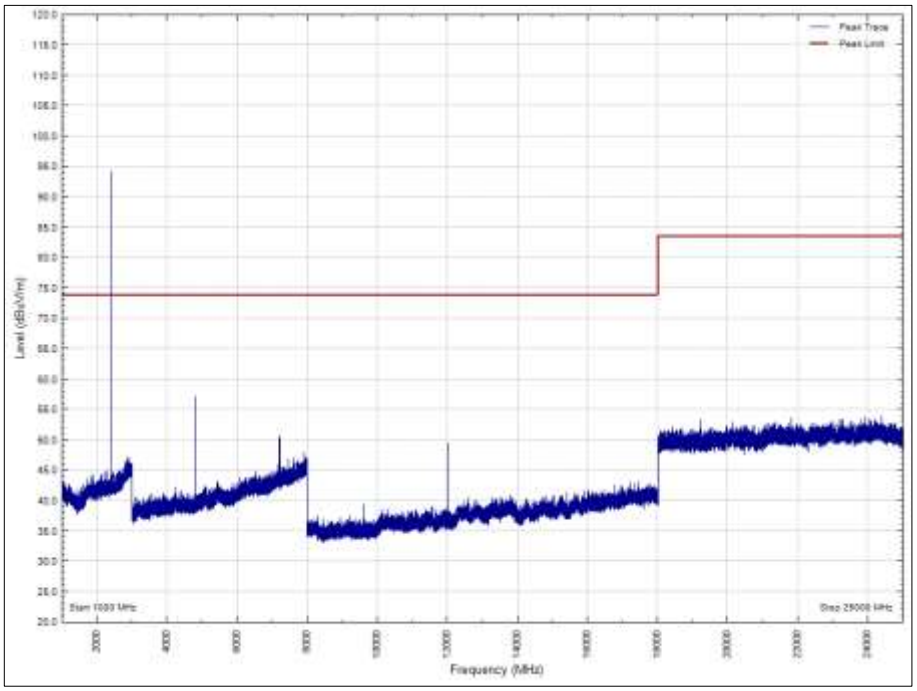

Figure 19 - 2402 MHz, 1 GHz to 25 GHz, Vertical, Z Orientation: - Peak

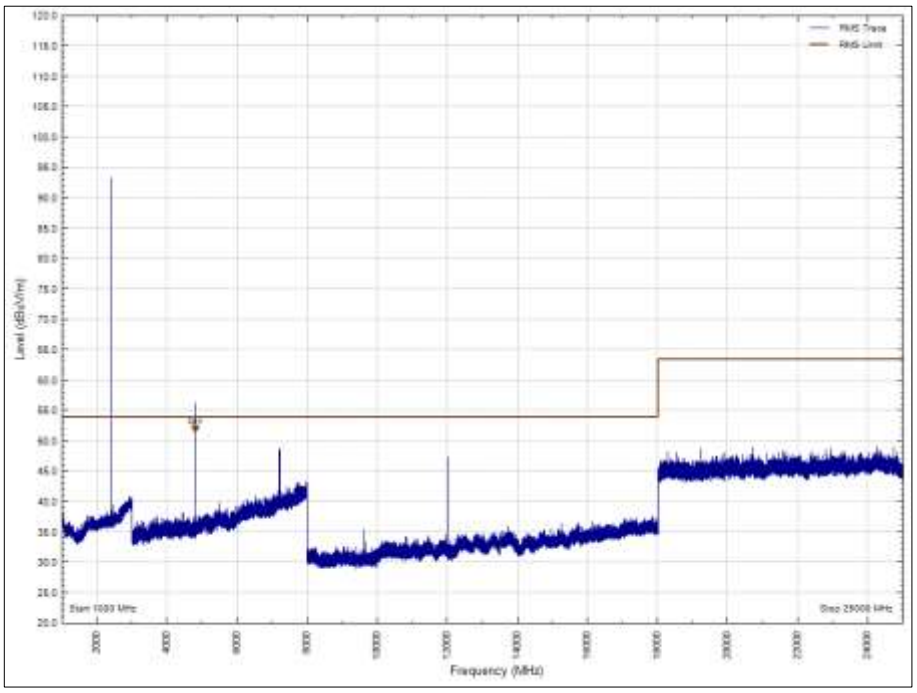

Figure 20 - 2402 MHz, 1 GHz to 25 GHz, Vertical, Z Orientation: - Average

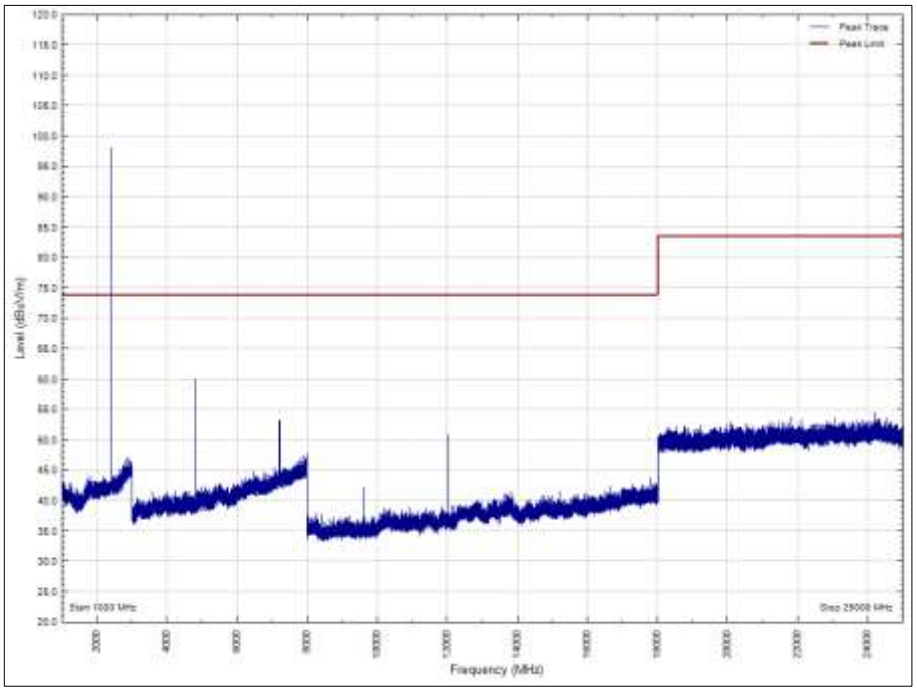

Figure 21 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, Z Orientation: - Peak

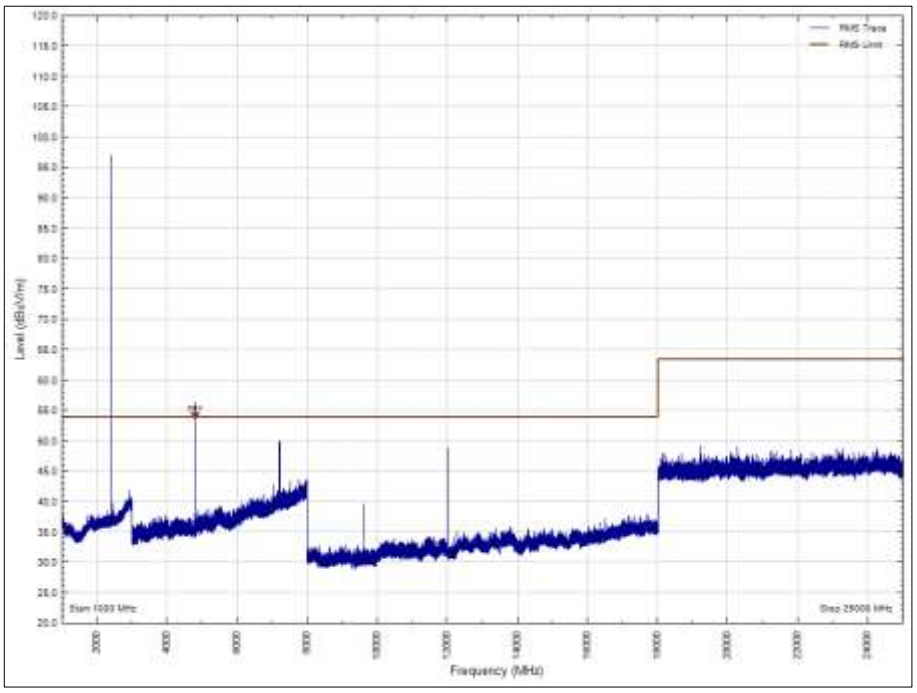

Figure 22 - 2402 MHz, 1 GHz to 25 GHz, Horizontal, Z Orientation: - Average

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
*								

Table 12 - 2440 MHz, 30 MHz to 1 GHz - Emission Results

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

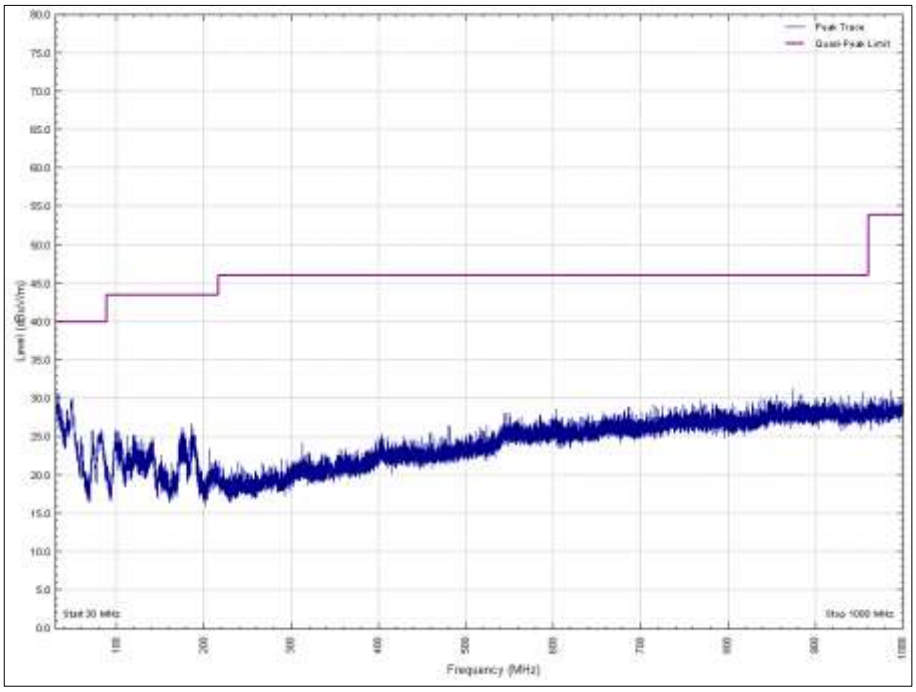

Figure 23 - 2440 MHz, 30 MHz to 1 GHz, Vertical, X Orientation

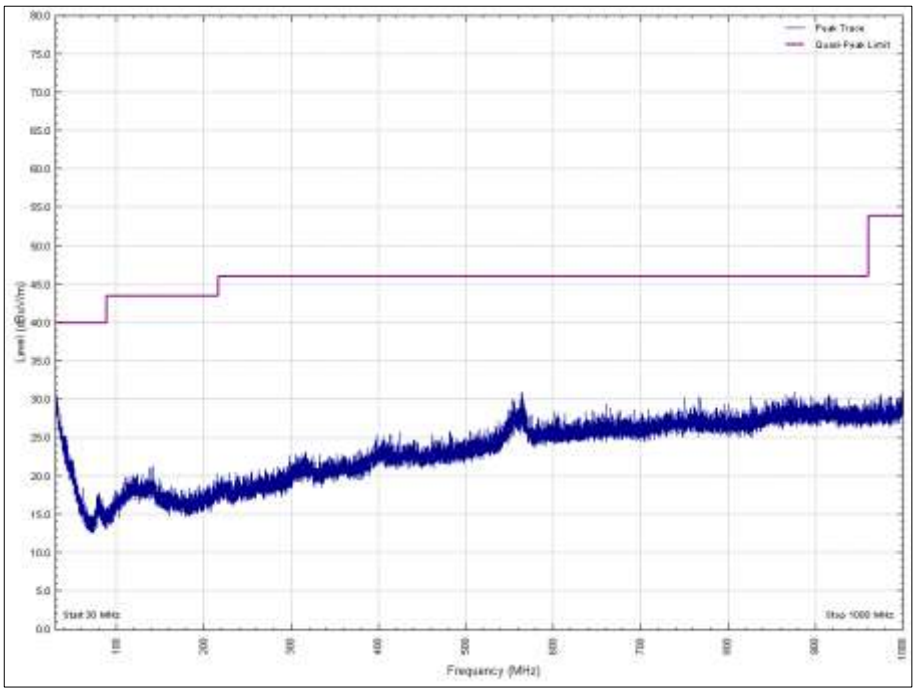

Figure 24 - 2440 MHz, 30 MHz to 1 GHz, Horizontal, X Orientation

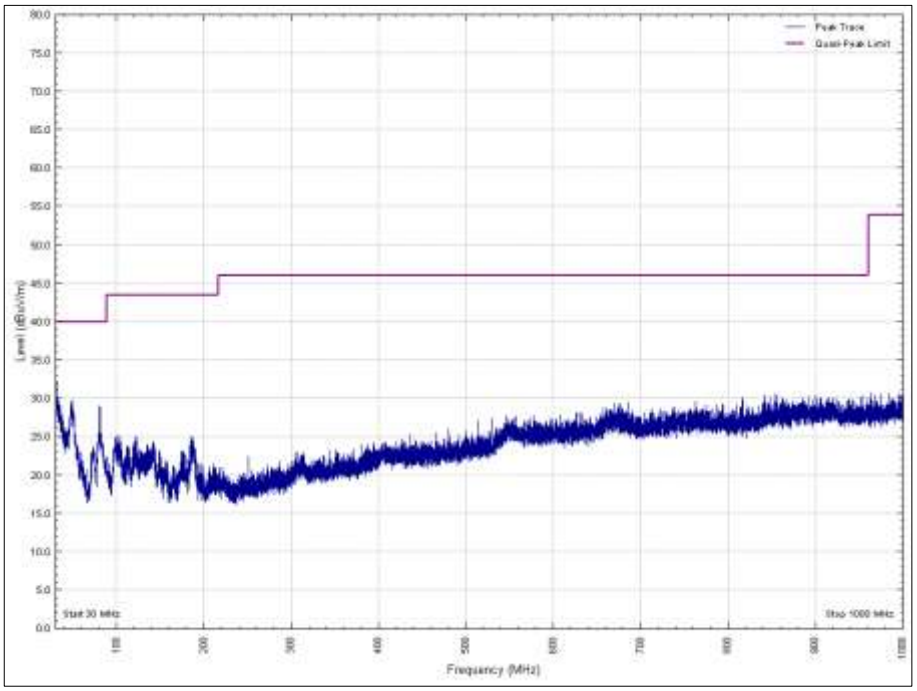

Figure 25 - 2440 MHz, 30 MHz to 1 GHz, Vertical, Y Orientation

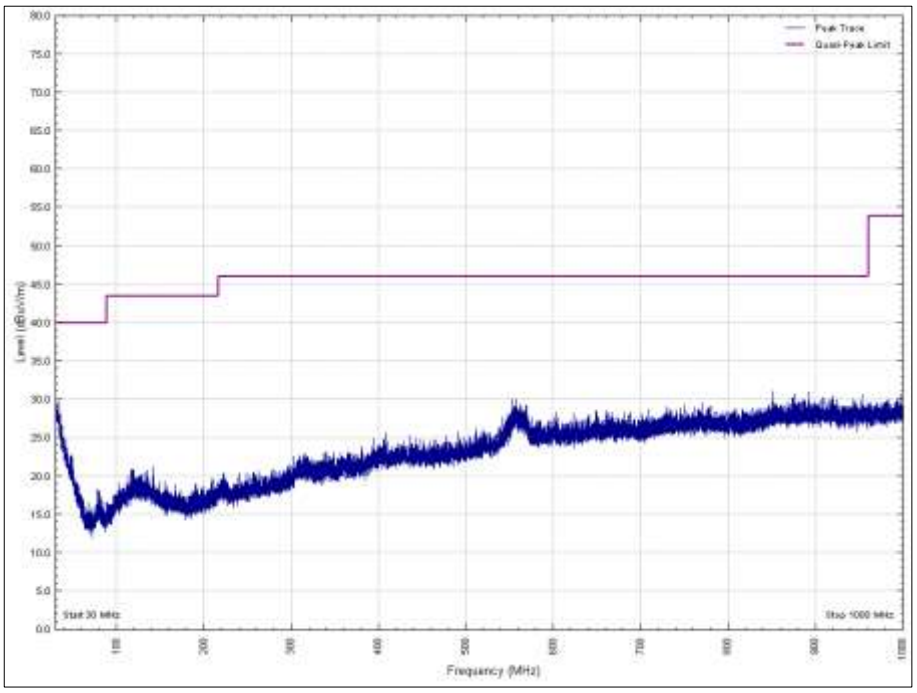

Figure 26 - 2440 MHz, 30 MHz to 1 GHz, Horizontal, Y Orientation

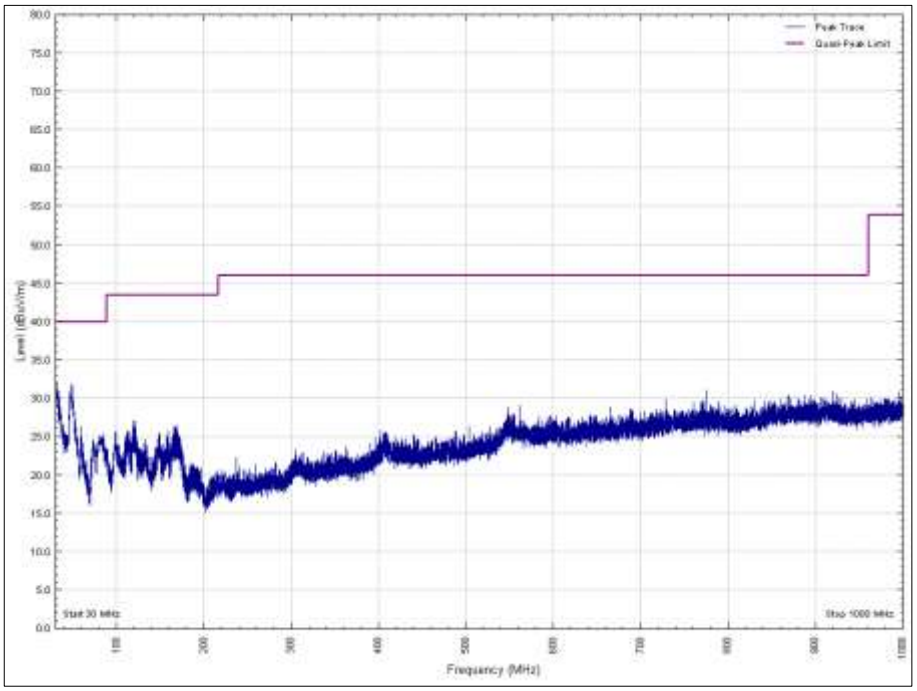

Figure 27 - 2440 MHz, 30 MHz to 1 GHz, Vertical, Z Orientation

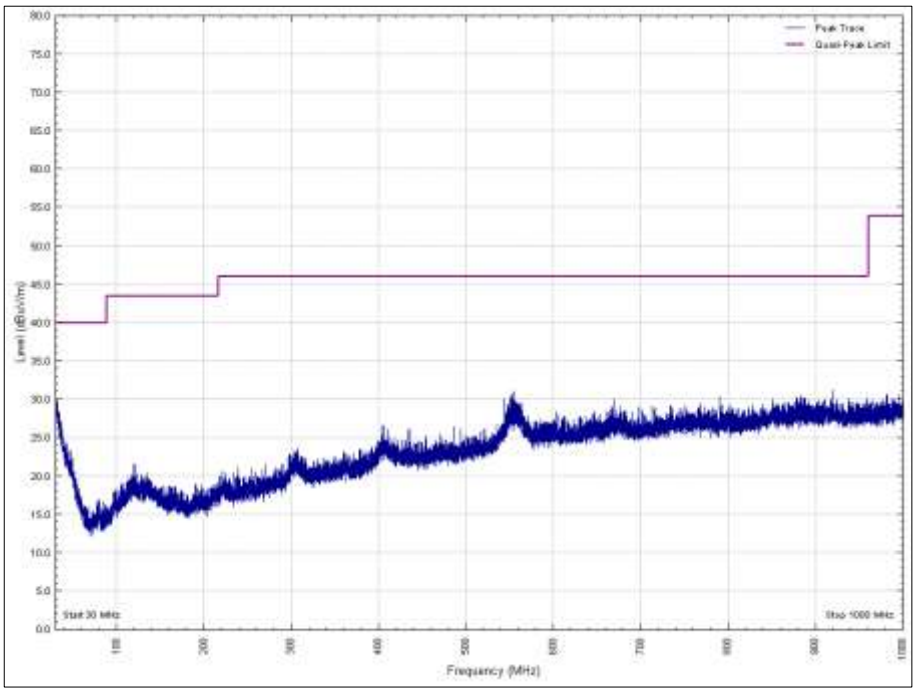

Figure 28 - 2440 MHz, 30 MHz to 1 GHz, Horizontal, Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4879.750	47.21	53.98	6.77	CISPR Average	264	100	Vertical	X
4880.711	50.87	53.98	3.11	CISPR Average	309	104	Horizontal	X
4879.770	51.80	53.98	2.18	CISPR Average	228	368	Vertical	Y
4879.640	46.97	53.98	7.01	CISPR Average	245	187	Horizontal	Y
4879.736	50.12	53.98	3.86	CISPR Average	267	112	Vertical	Z
4880.759	52.06	53.98	1.92	CISPR Average	237	219	Horizontal	Z
7321.166	46.92	53.98	7.06	CISPR Average	143	114	Vertical	X
7321.094	48.17	53.98	5.81	CISPR Average	16	222	Vertical	Y
7319.435	44.12	53.98	9.86	CISPR Average	201	100	Horizontal	Y
7321.040	48.09	53.98	5.89	CISPR Average	67	109	Horizontal	Z

Table 13 - 2440 MHz - 1 GHz to 25 GHz Emissions Results

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

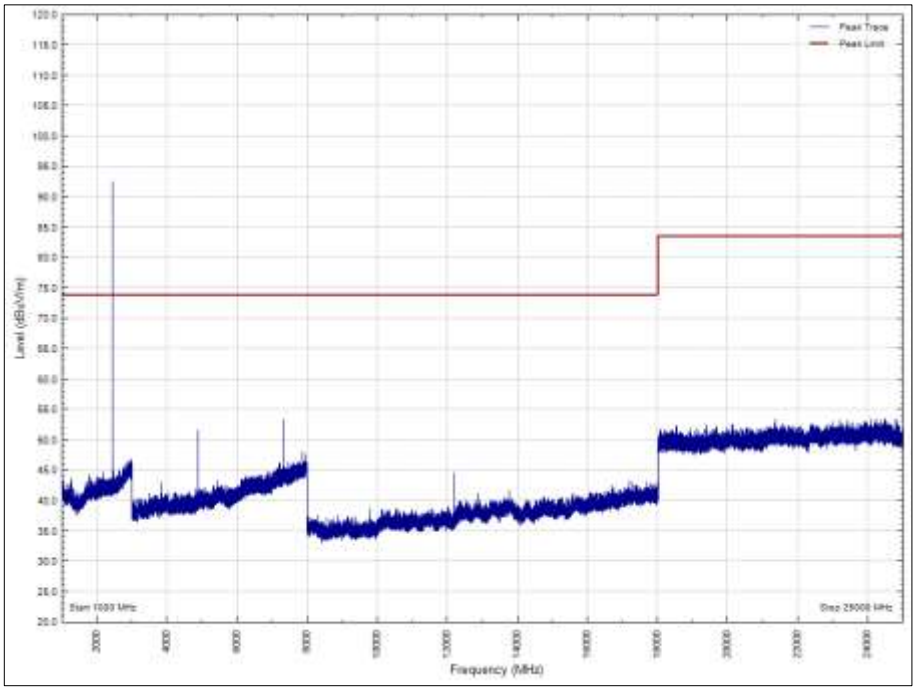

Figure 29 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: X, Peak

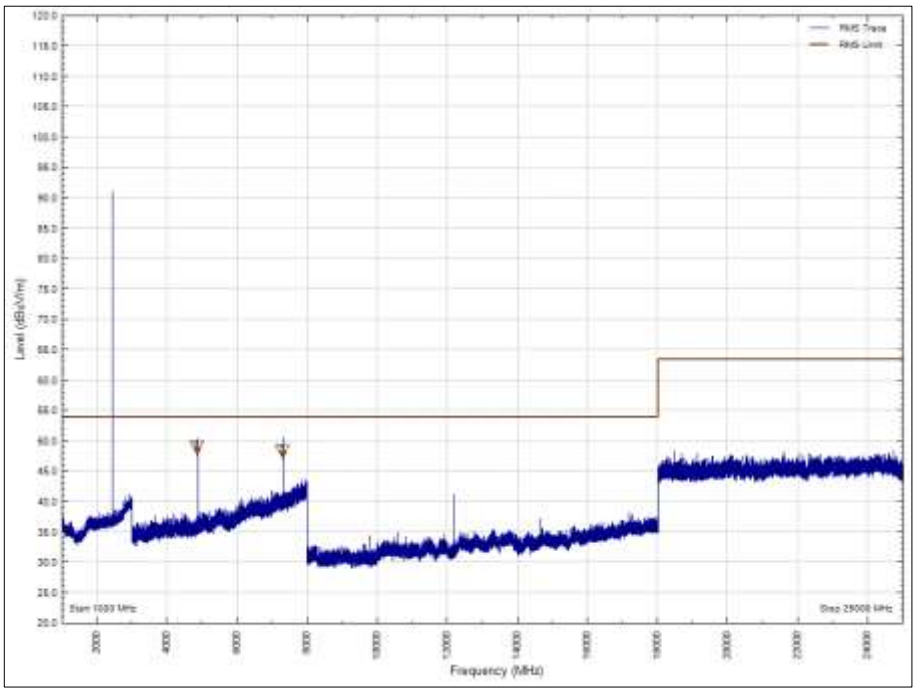

Figure 30 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: X, Average

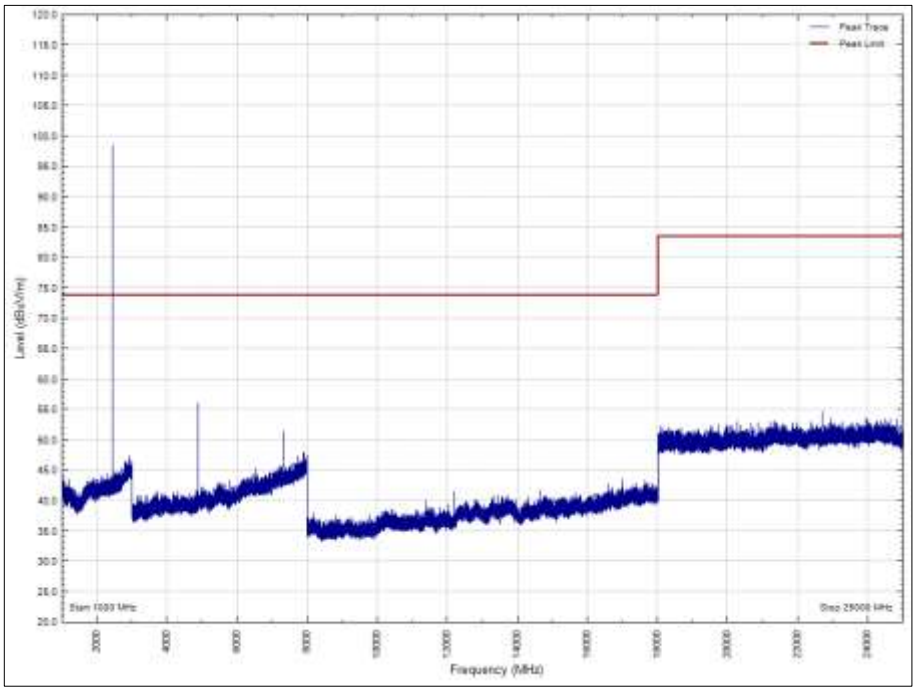

Figure 31 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: X, Peak

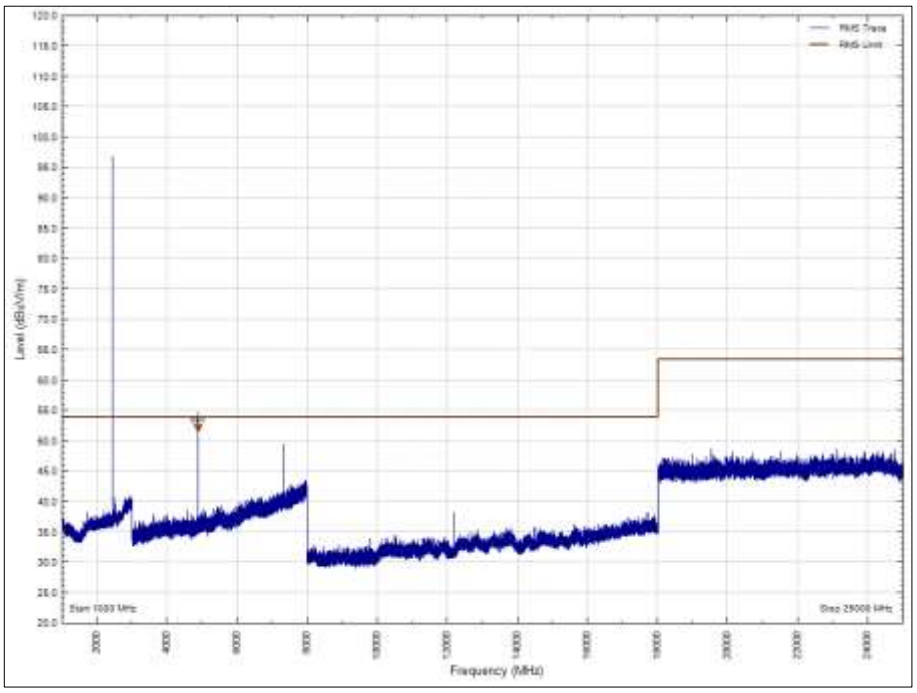

Figure 32 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: X, Average

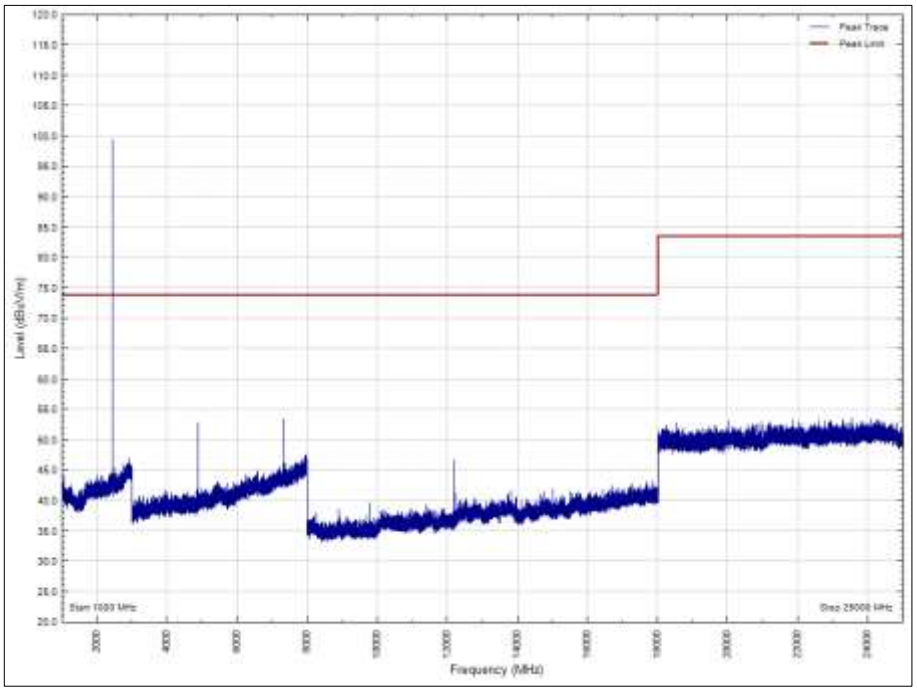

Figure 33 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Y, Peak

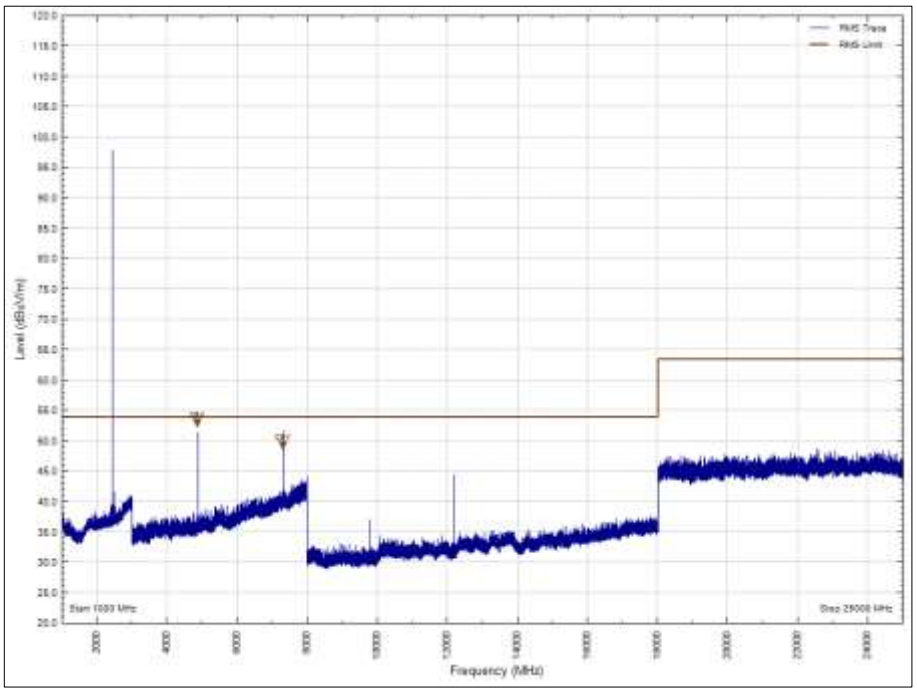

Figure 34 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Y, Average

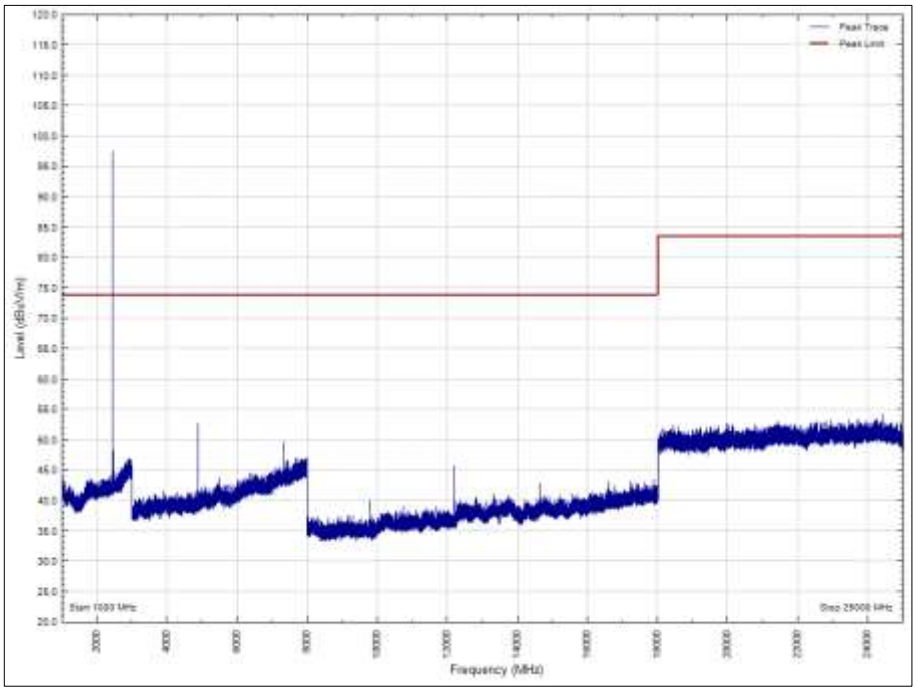

Figure 35 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Y, Peak

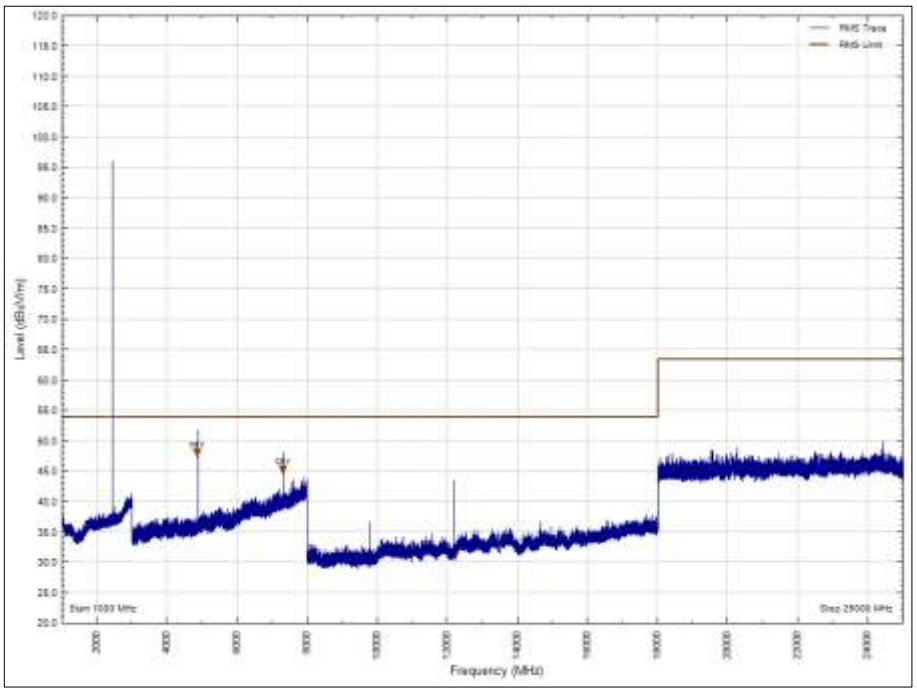

Figure 36 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Y, Average

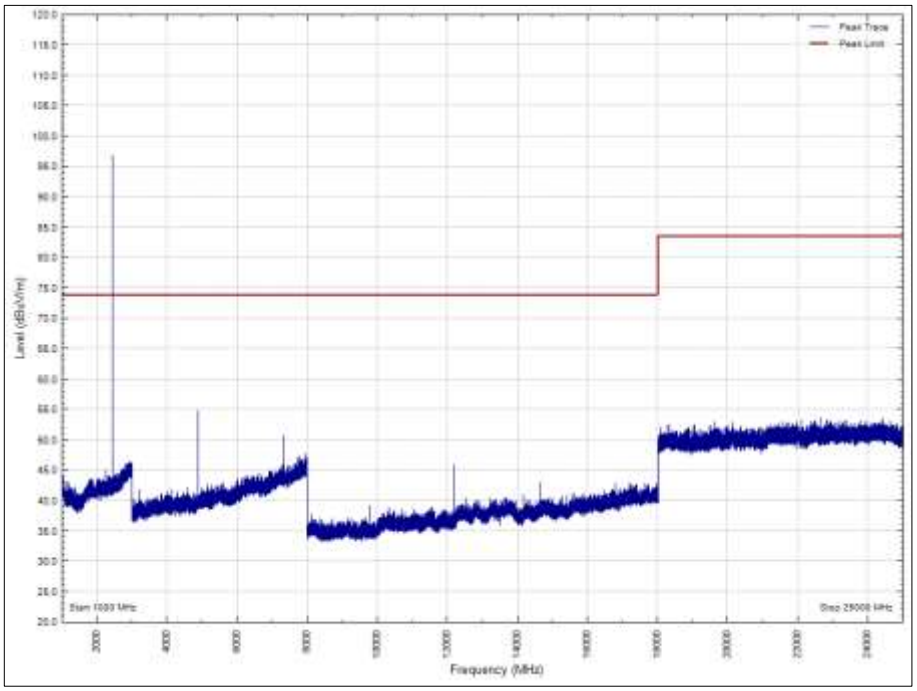

Figure 37 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Z, Peak

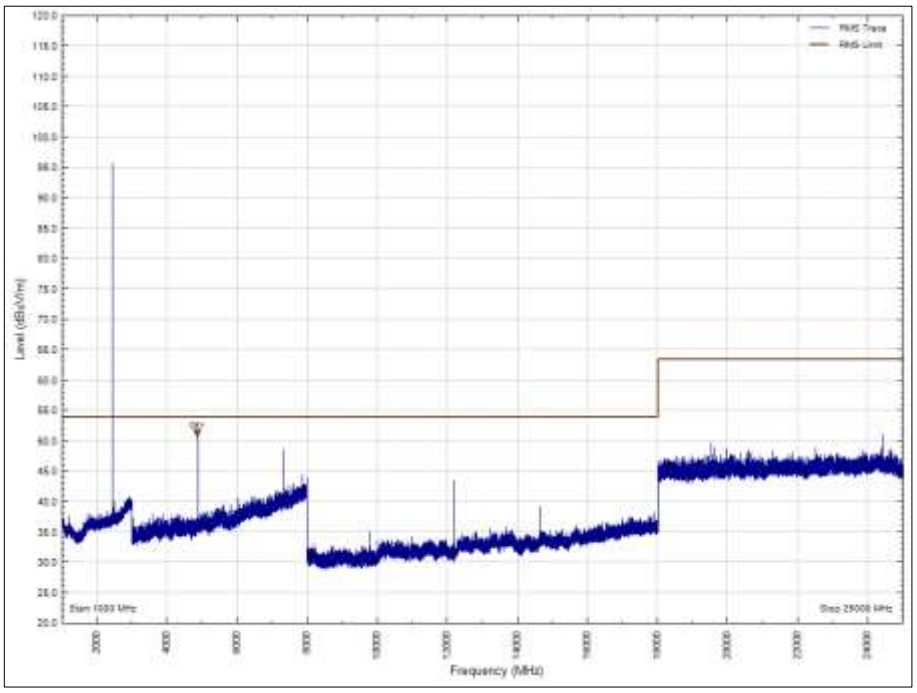

Figure 38 - 2440 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Z, Average

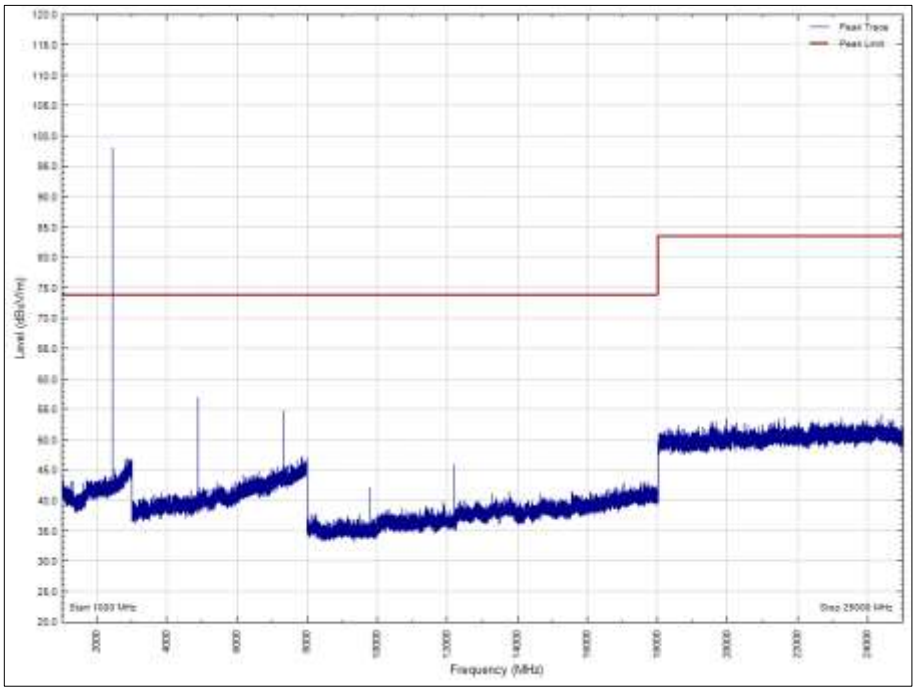

Figure 39 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Z, Peak

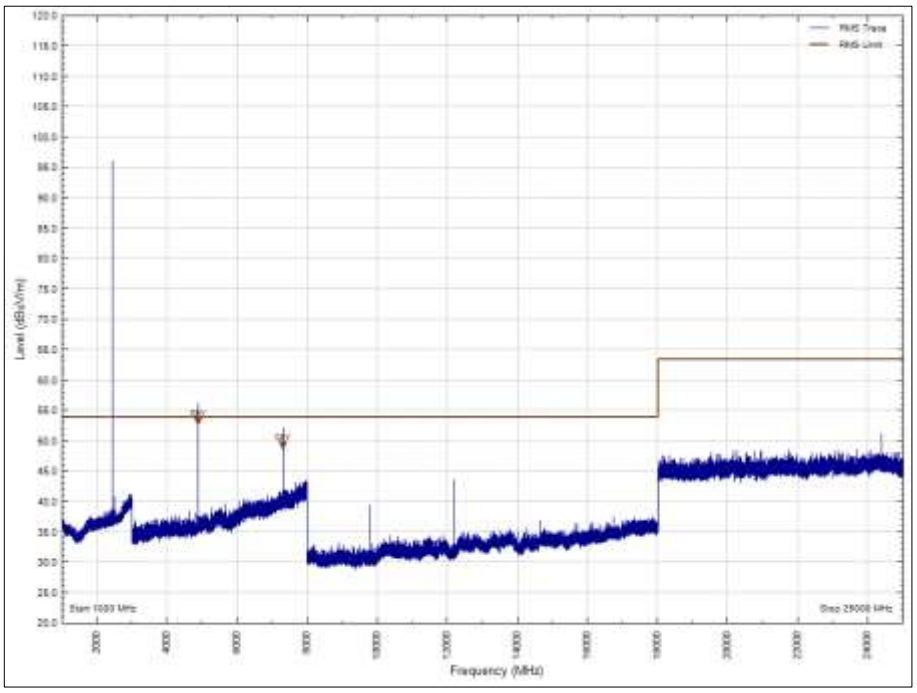

Figure 40 - 2440 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Z, Average

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
*								

Table 14 - 2480 MHz, 30 MHz to 1 GHz - Emission Results

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

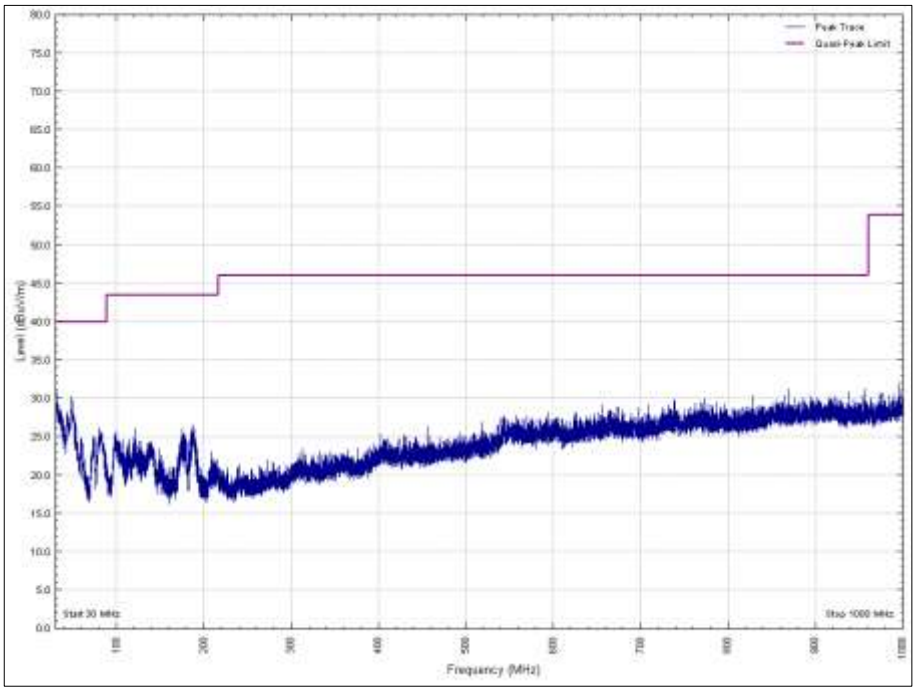

Figure 41 - 2480 MHz, 30 MHz to 1 GHz, Vertical, X Orientation

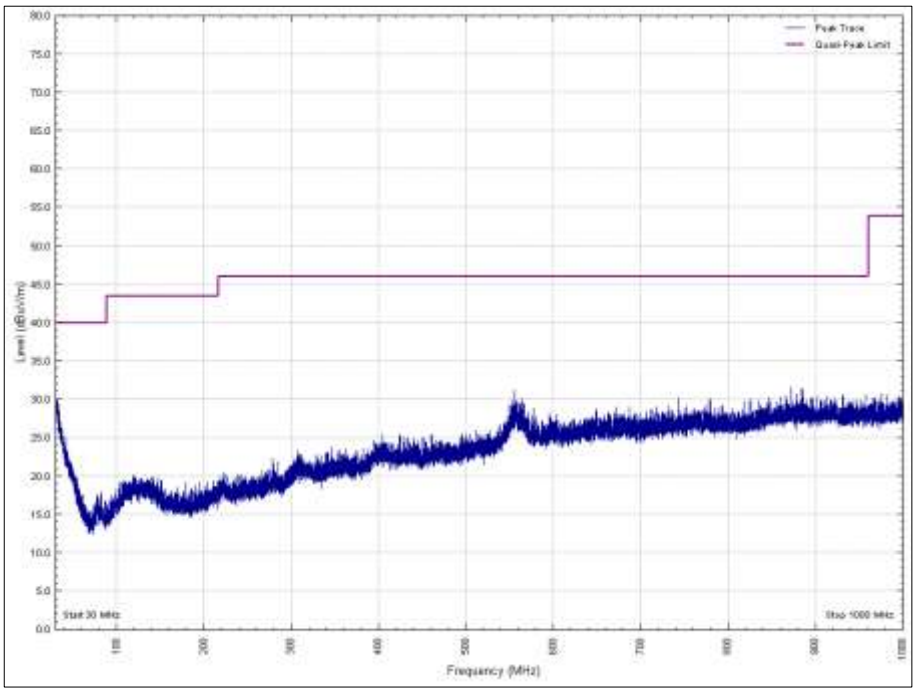

Figure 42 - 2480 MHz, 30 MHz to 1 GHz, Horizontal, X Orientation

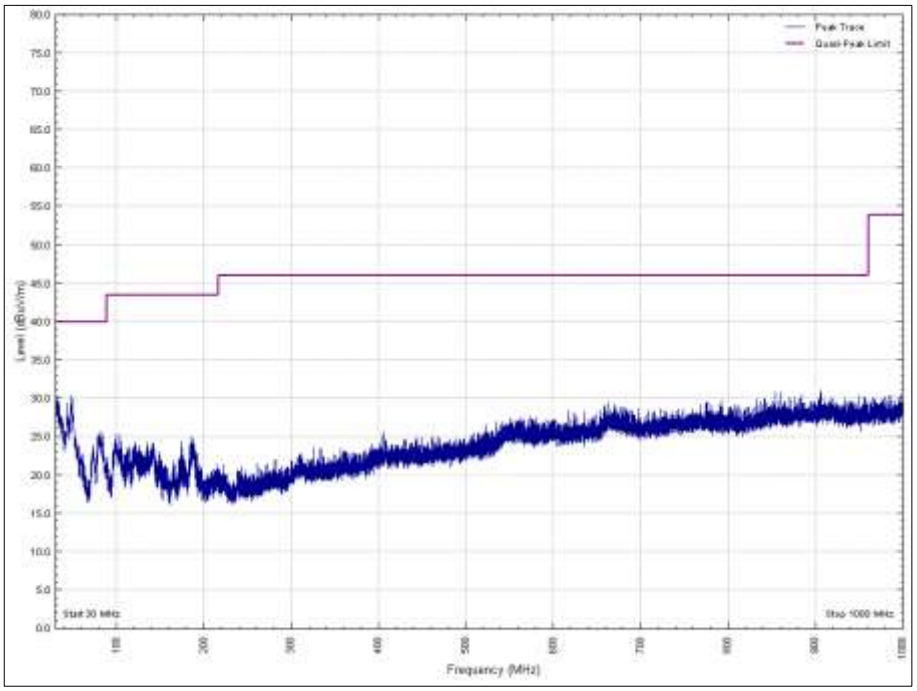

Figure 43 - 2480 MHz, 30 MHz to 1 GHz, Vertical, Y Orientation

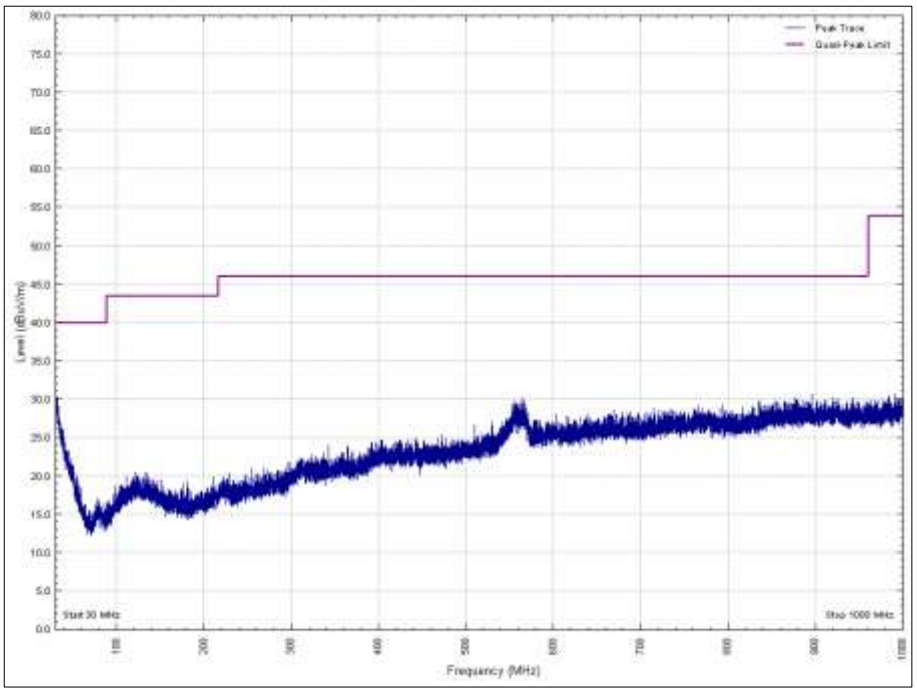

Figure 44 - 2480 MHz, 30 MHz to 1 GHz, Horizontal, Y Orientation

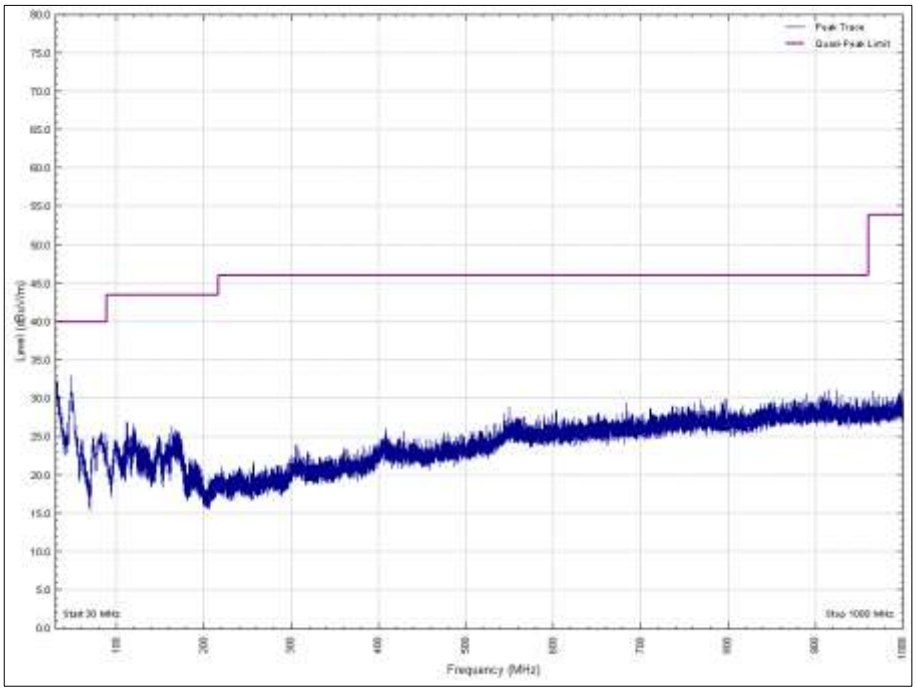

Figure 45 - 2480 MHz, 30 MHz to 1 GHz, Vertical, Z Orientation

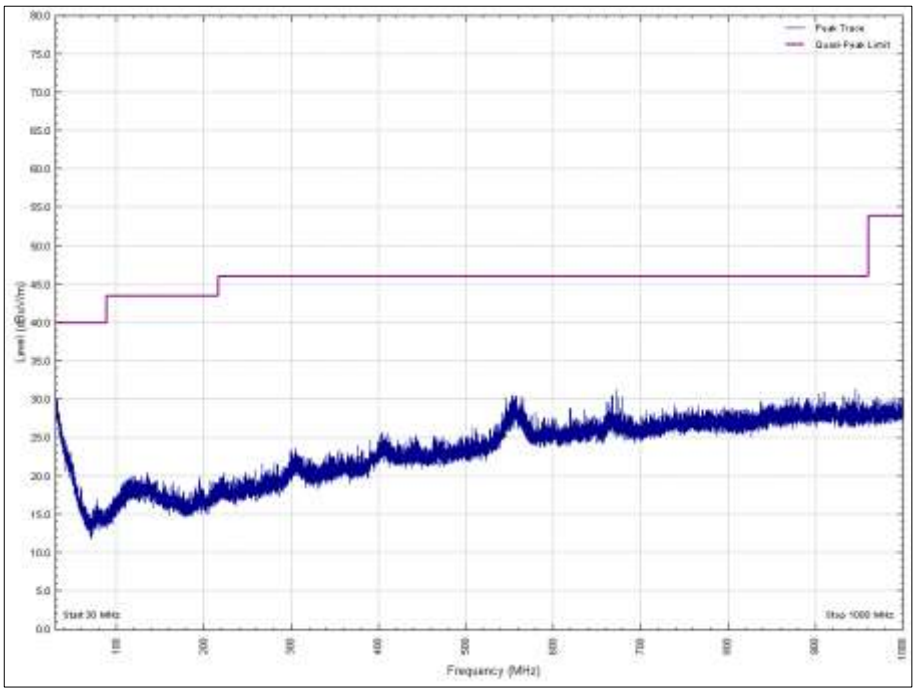

Figure 46 - 2480 MHz, 30 MHz to 1 GHz, Horizontal, Z Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
7441.166	47.17	53.98	6.81	CISPR Average	139	100	Vertical	X
7439.667	46.19	53.98	7.79	CISPR Average	40	103	Horizontal	X
7441.156	49.94	53.98	4.04	CISPR Average	16	225	Vertical	Y
7441.170	46.41	53.98	7.57	CISPR Average	129	166	Horizontal	Y
7439.685	47.23	53.98	6.75	CISPR Average	54	114	Vertical	Z
7441.143	51.25	53.98	2.73	CISPR Average	75	266	Horizontal	Z

Table 15 - 2480 MHz - 1 GHz to 25 GHz Emissions Results

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

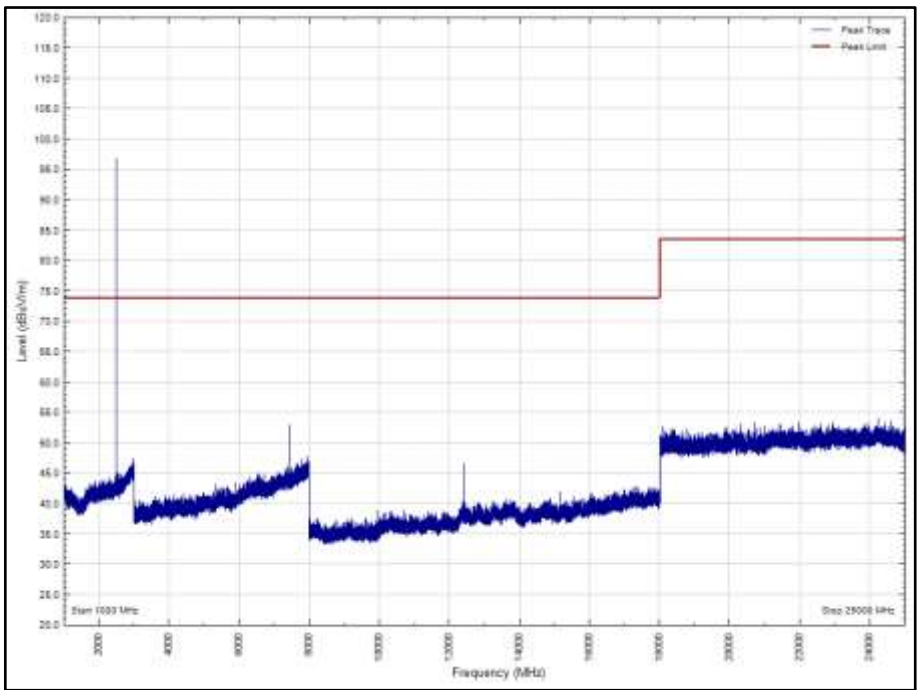

Figure 47 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: X, Peak

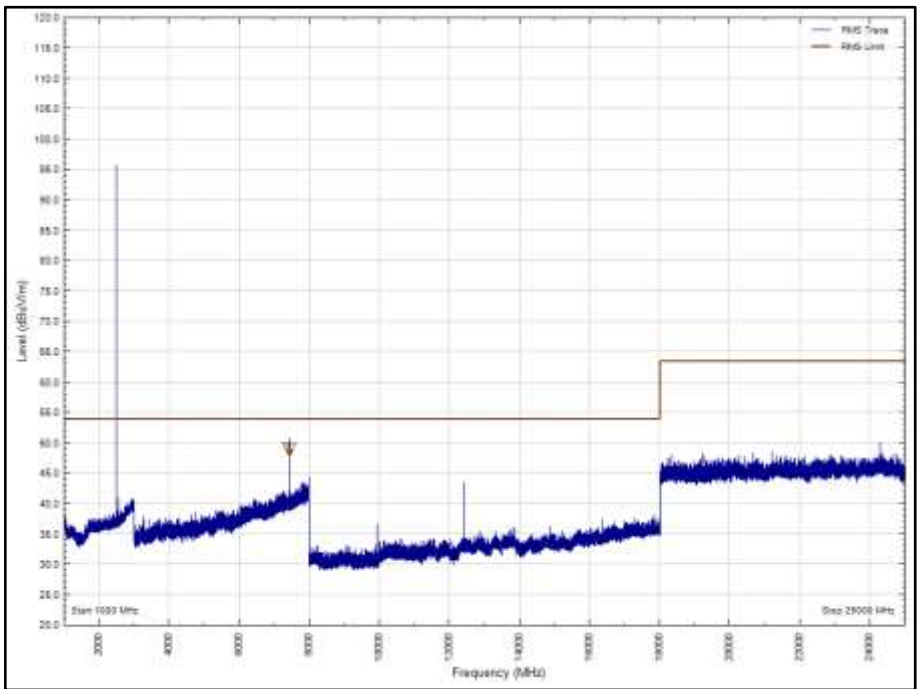

Figure 48 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: X, Average

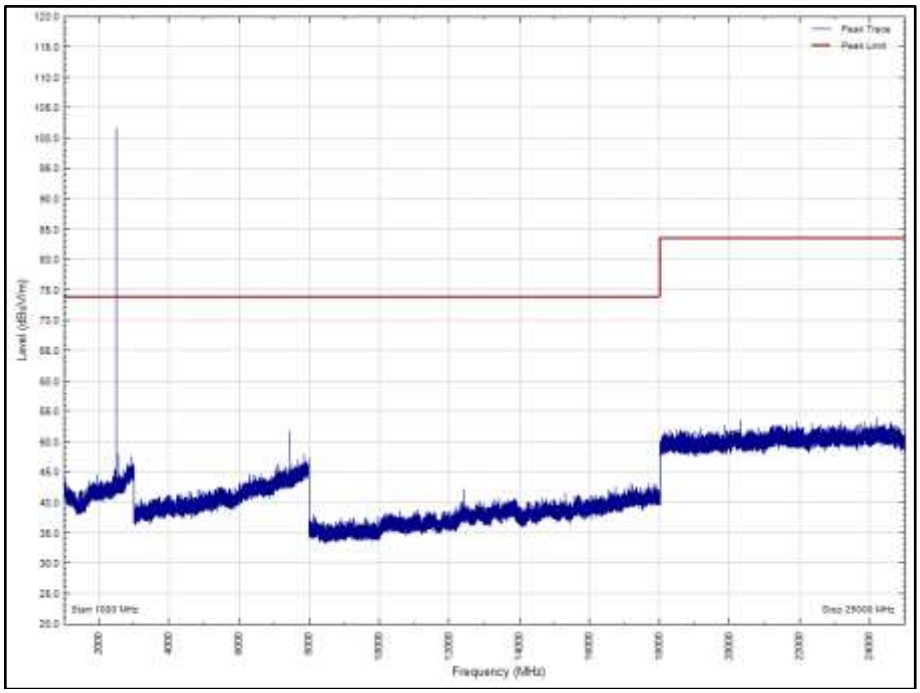

Figure 49 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: X, Peak

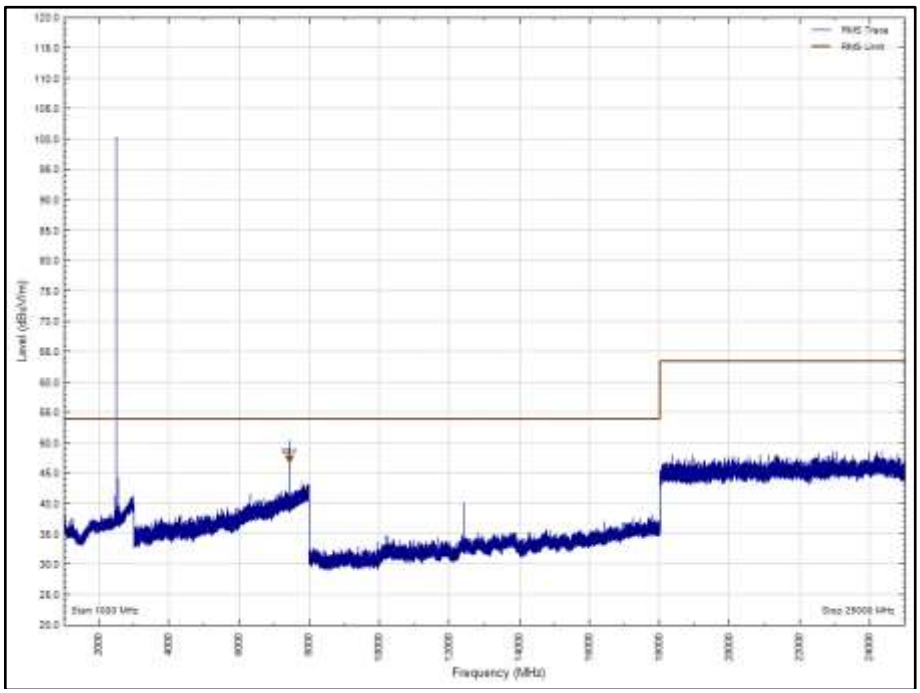

Figure 50 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: X, Average

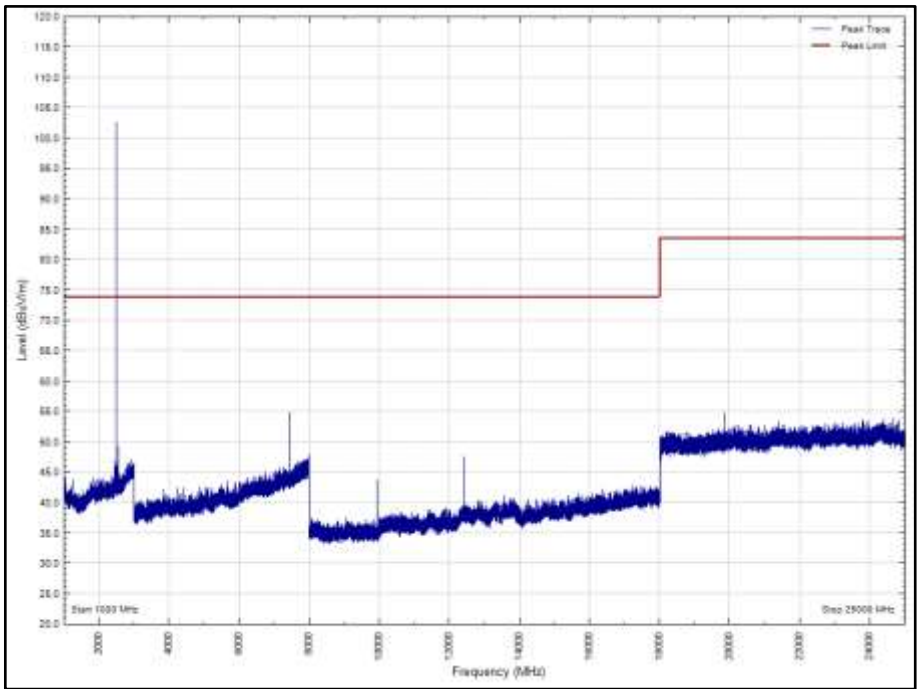

Figure 51 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Y, Peak

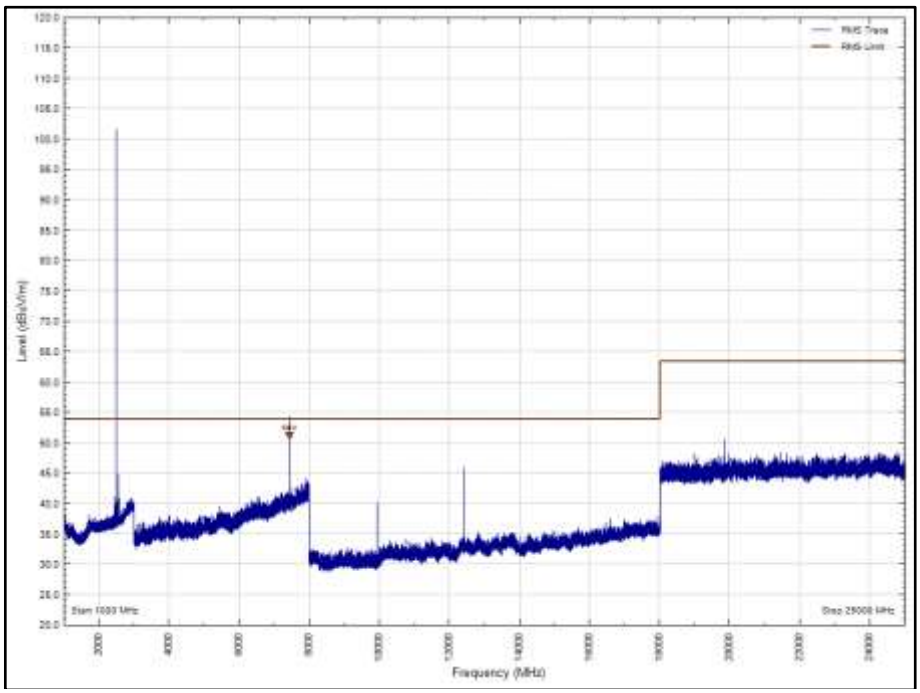

Figure 52 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Y, Average

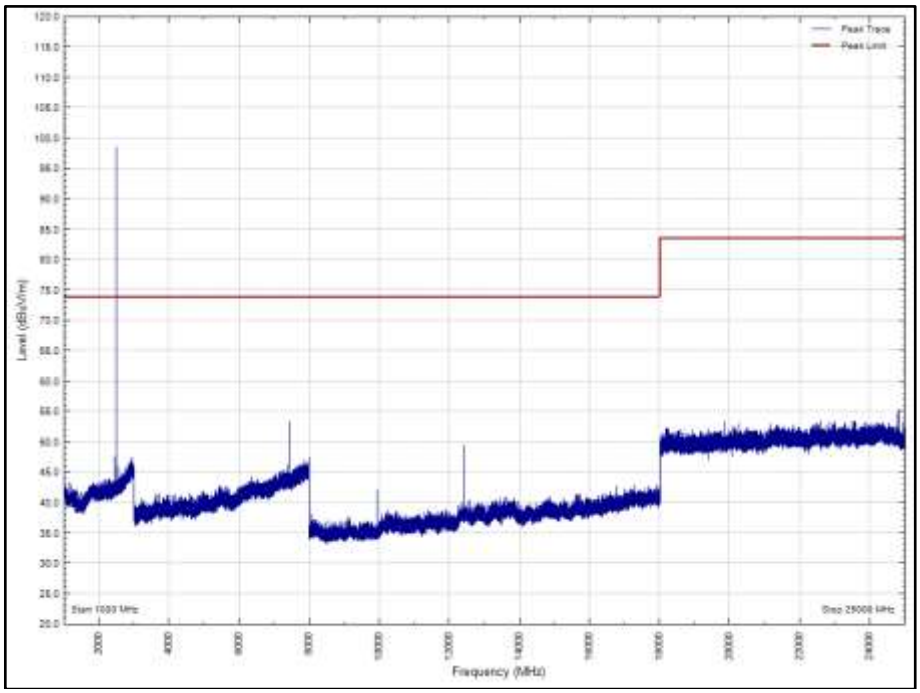

Figure 53 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Y, Peak

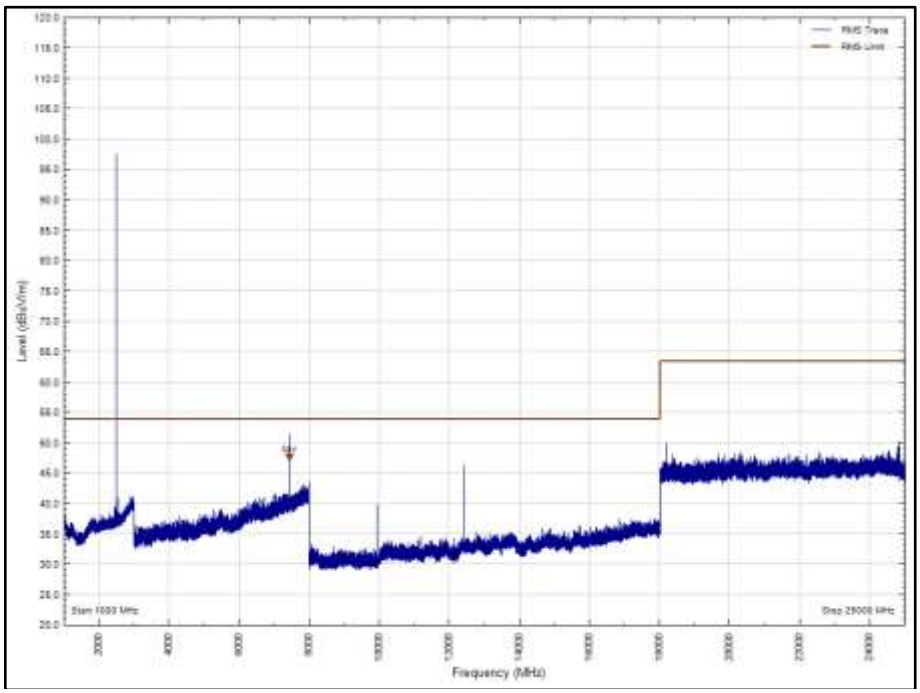

Figure 54 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Y, Average

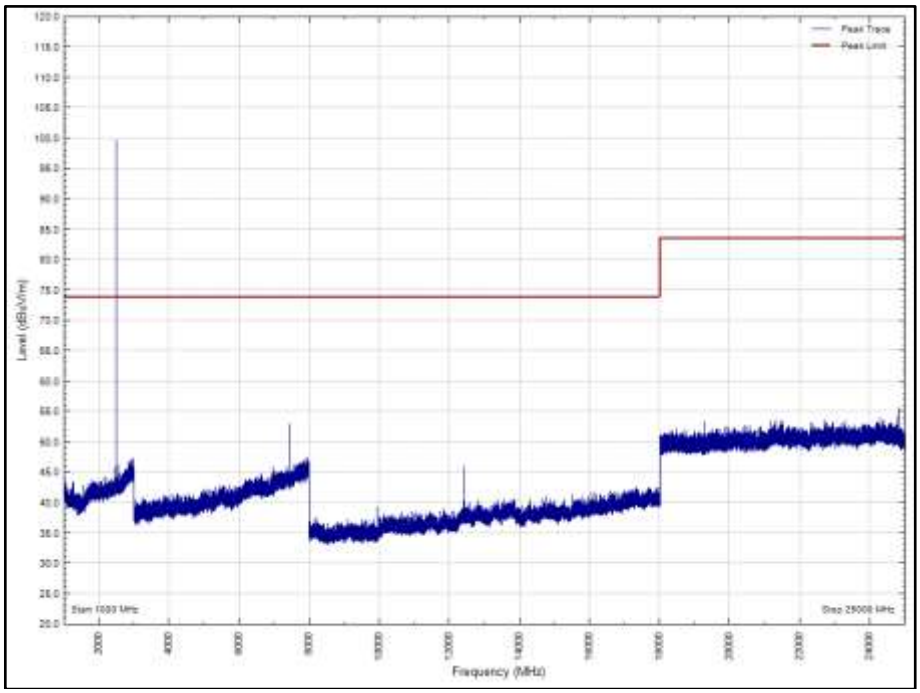

Figure 55 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Z, Peak

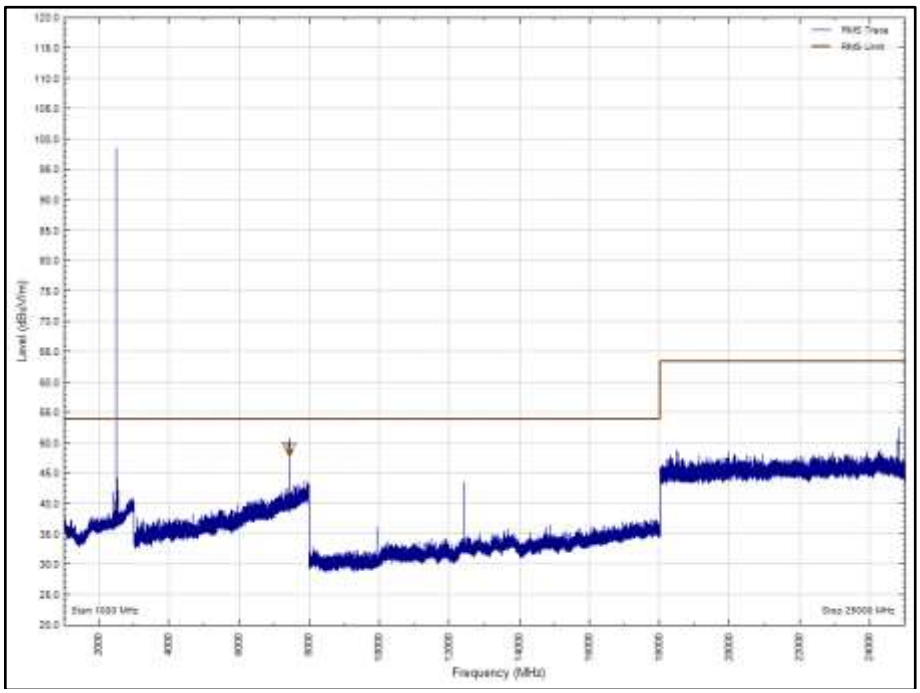

Figure 56 - 2480 MHz - 1 GHz to 25 GHz, Vertical, EUT Orientation: Z, Average

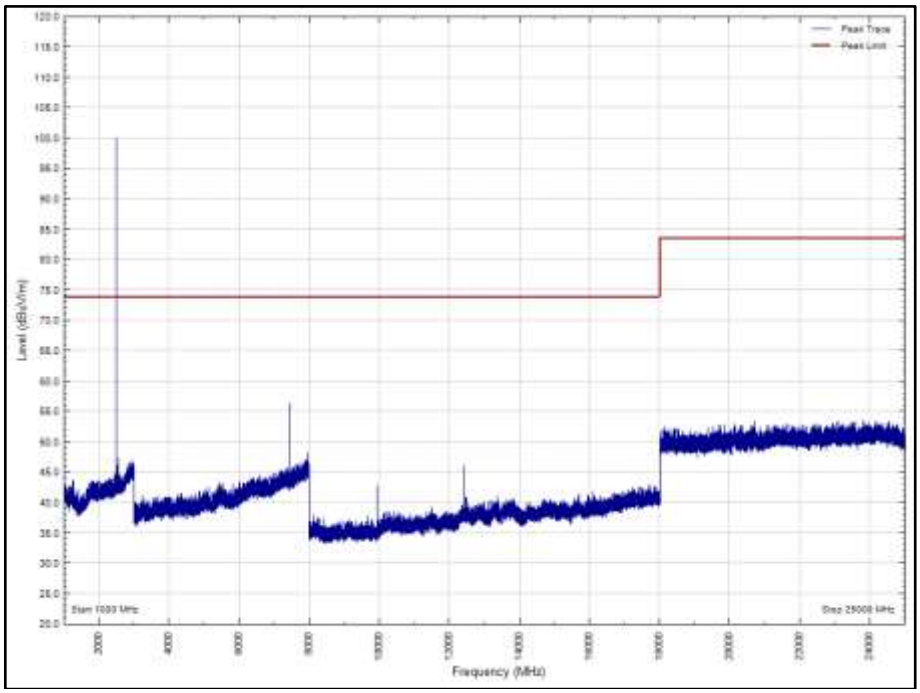

Figure 57 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Z, Peak

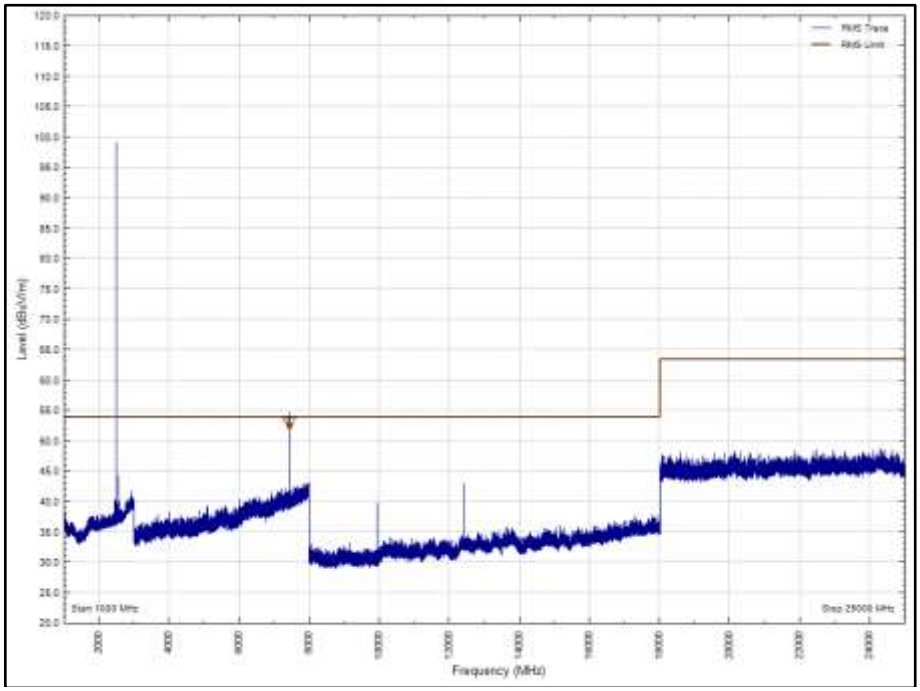

Figure 58 - 2480 MHz - 1 GHz to 25 GHz, Horizontal, EUT Orientation: Z, Average

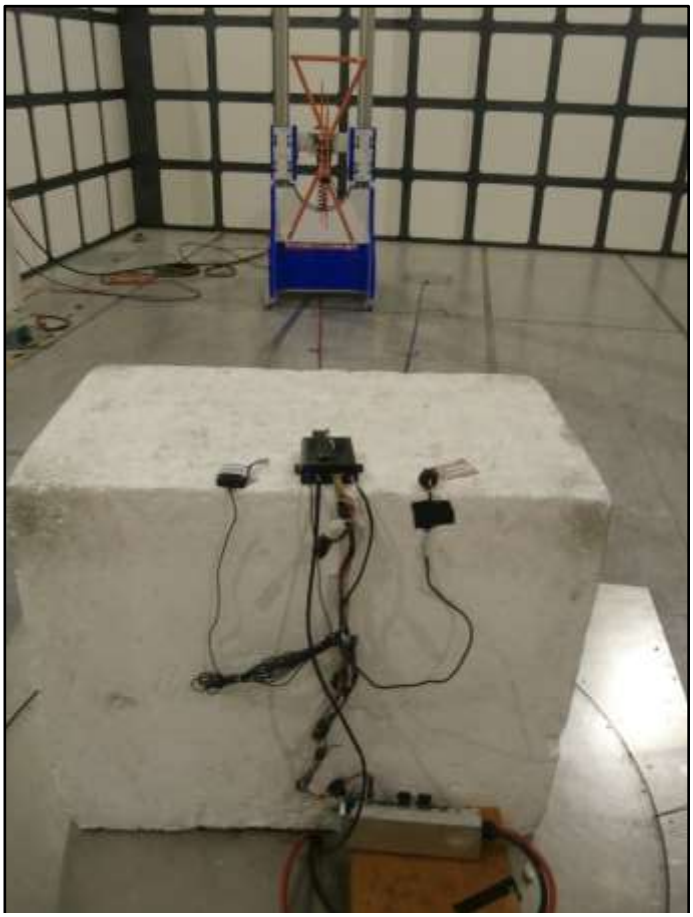

Figure 59 - Test Setup – 30 MHz to 1 GHz – X Orientation

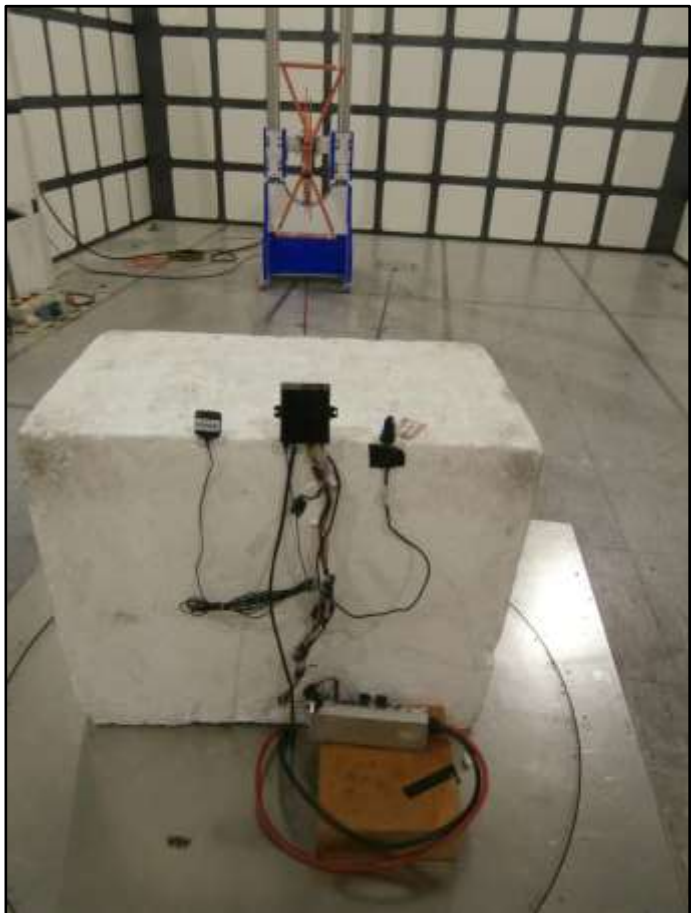

Figure 60 - Test Setup - 30 MHz to 1 GHz – Y Orientation

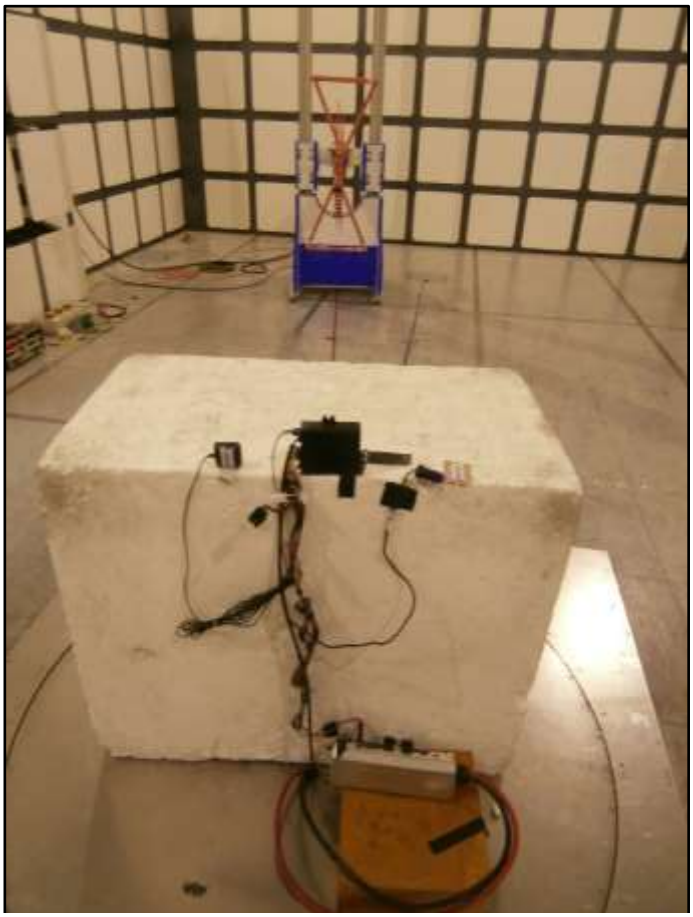

Figure 61 - Test Setup - 30 MHz to 1 GHz – Z Orientation

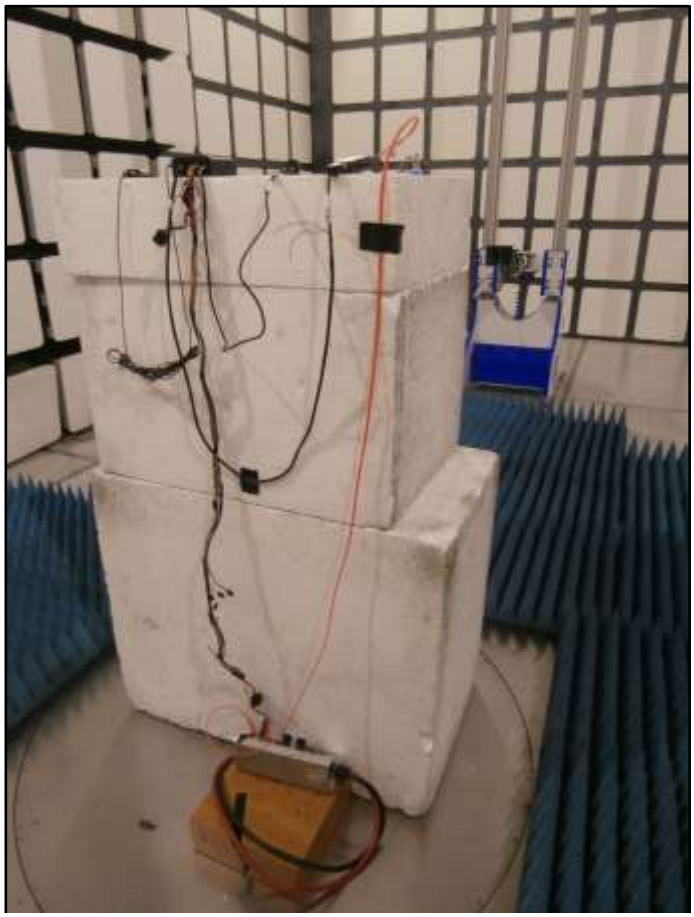

Figure 62 - Test Setup - 1 GHz to 18 GHz – X Orientation

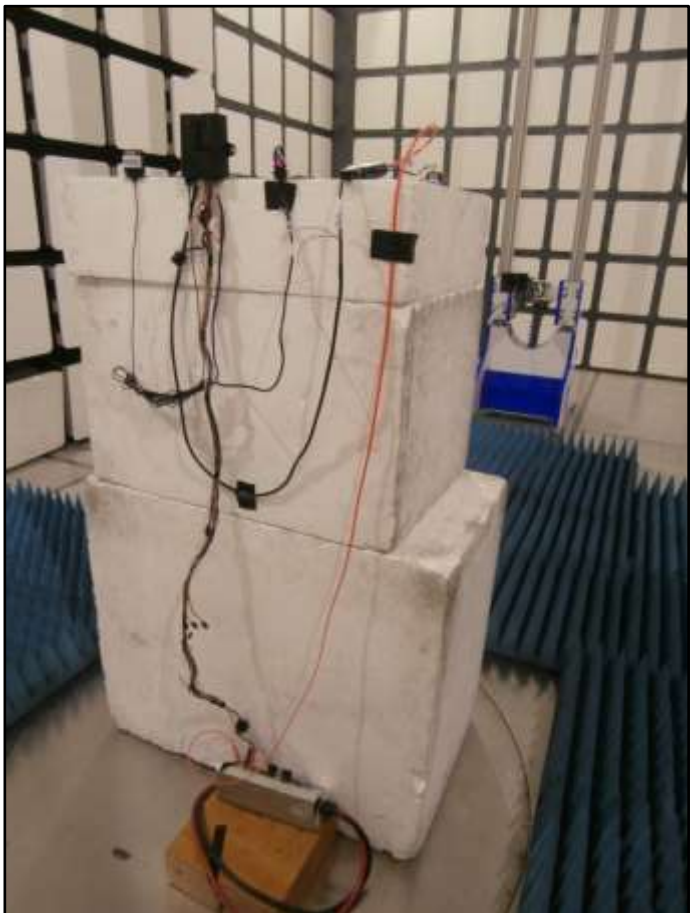

Figure 63 - Test Setup - 1 GHz to 18 GHz – Y Orientation

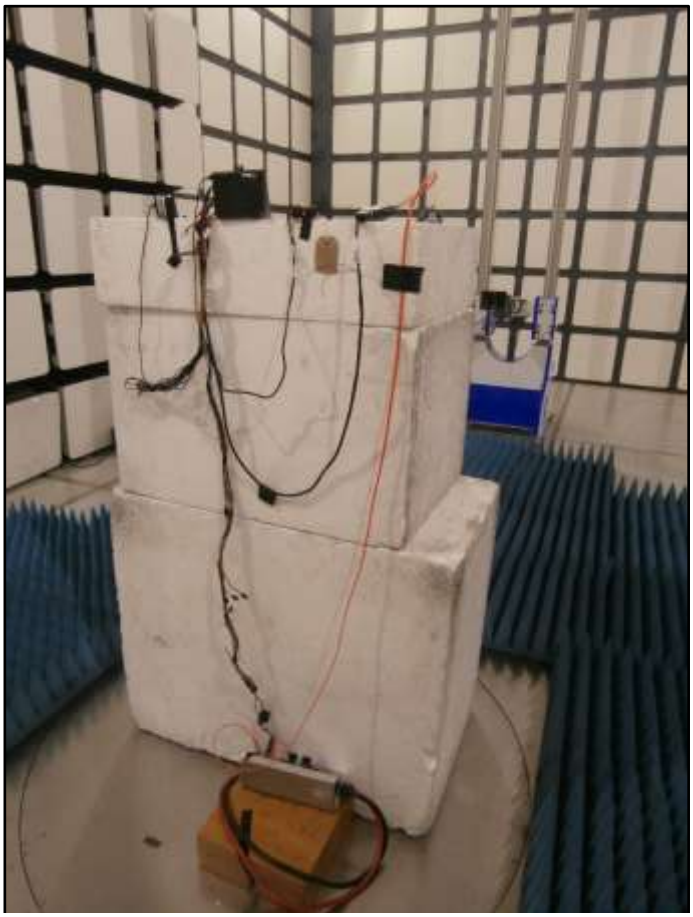

Figure 64 - Test Setup - 1 GHz to 18 GHz – Z Orientation

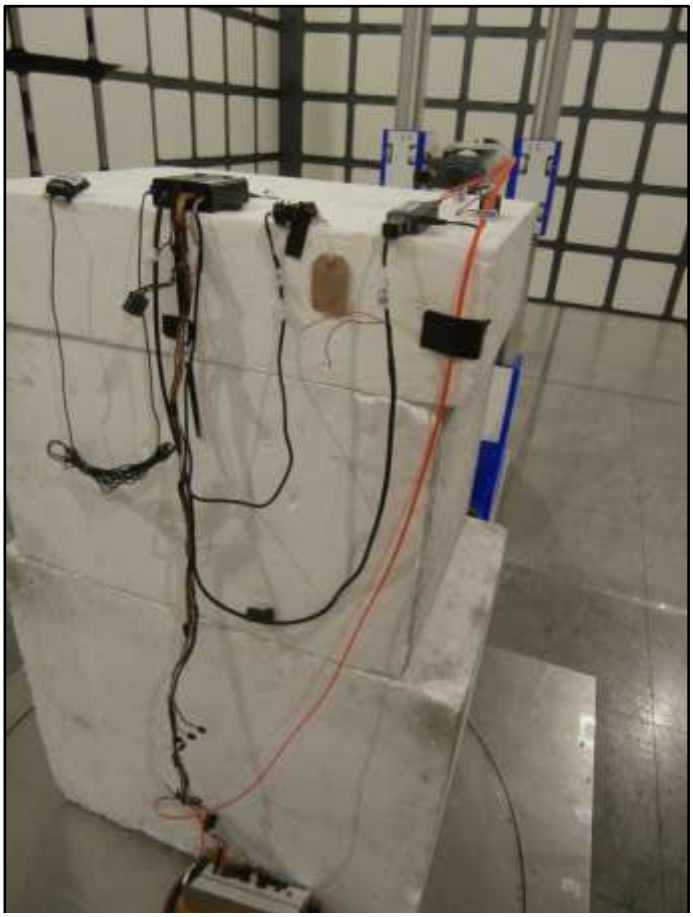

Figure 65 - Test Setup - 18 GHz to 25 GHz – X Orientation

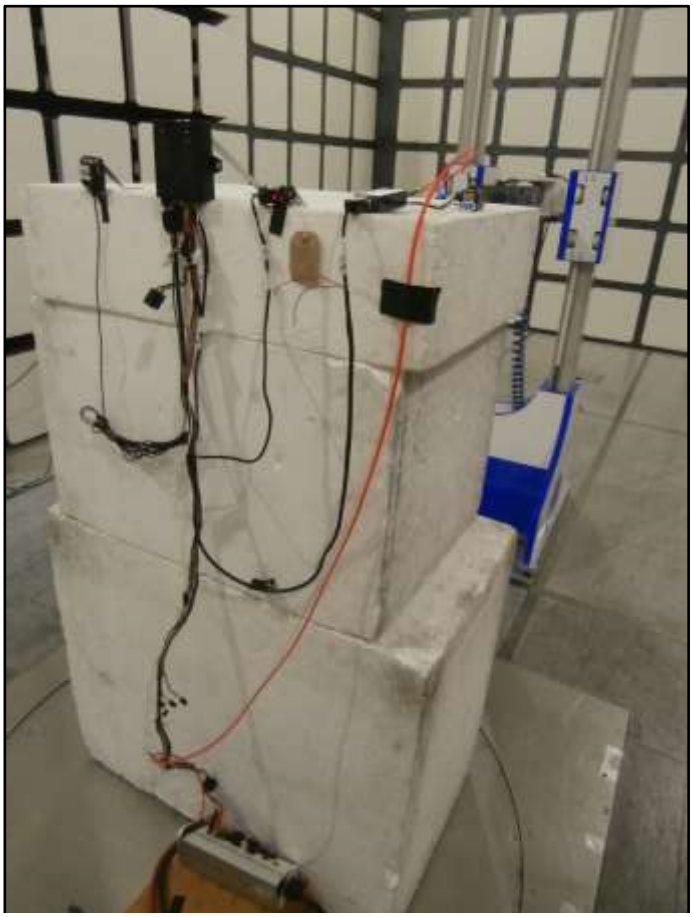

Figure 66 - Test Setup - 18 GHz to 25 GHz – Y Orientation

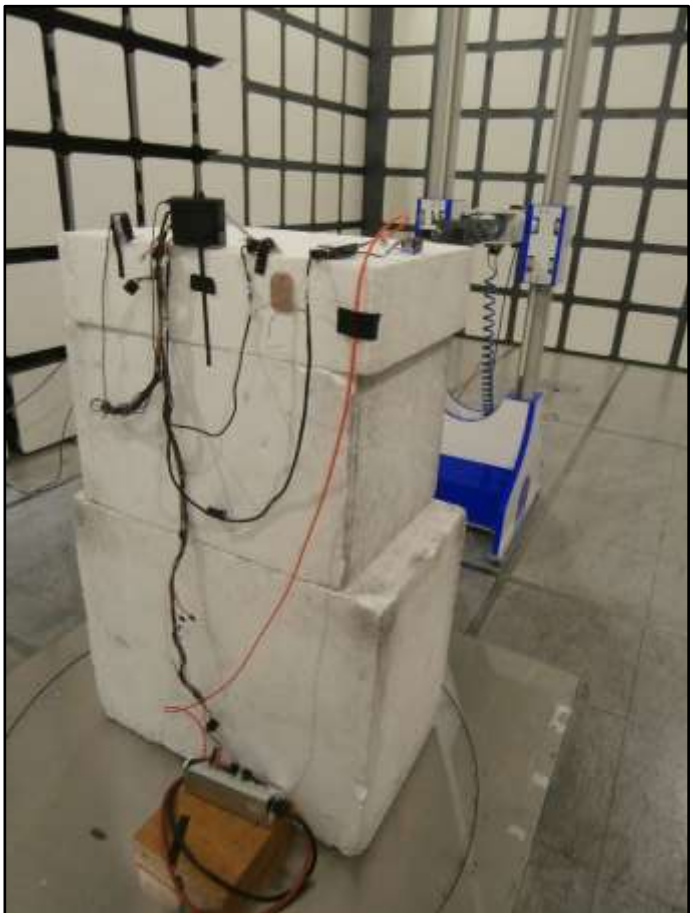

Figure 67 - Test Setup - 18 GHz to 25 GHz – Z Orientation

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)

2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	04-Aug-2020
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	18-Feb-2021
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	11-Dec-2020
DC Power Supply	Hewlett Packard	6269B	1909	-	TU
Multimeter	Iso-tech	IDM101	2417	12	11-Nov-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	03-Jan-2021
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	11-Jun-2020
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	O/P Mon
Antenna (DRG Horn 7.5-18GHz)	Schwarzbeck	HWRD750	5348	12	04-Sep-2020
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5350	12	21-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 16

TU - Traceability Unscheduled
O/P Mon – Output Monitored

3 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB

Table 17

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.