FCC and ISED Test Report

Disruptive Technologies Research AS
Model: SDS Module (US)

In accordance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN (Short Range Device)

Prepared for: Disruptive Technologies Research AS
Strandveien 17
1366 Lysaker
Norway

FCC ID: 2ATFX-102545 IC: 25087-102545

COMMERCIAL-IN-CONFIDENCE

Document 75954295-04 Issue 01

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NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	10 August 2022

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

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Daniel Cameron	10 August 2022	
Testing	Graeme Lawler	10 August 2022	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A 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: 2020, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021) 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	10-August-2022

Table 1

1.2 Introduction

Applicant	Disruptive Technologies Research AS
Manufacturer	Disruptive Technologies Research AS
Model Number(s)	SDS Module (US)
Serial Number(s)	US 2 and US 1
Hardware Version(s)	0
Software Version(s)	0.1.0
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number Date	PO-DK-15 12-January-2022
Date of Receipt of EUT	31-March-2022
Start of Test	02-May-2022
Finish of Test	24-June-2022
Name of Engineer(s)	Daniel Cameron and Graeme Lawler
Related Document(s)	ANSI C63.10 (2020)

1.3 Brief Summary of Results

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

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: Radio chip/PCB combination - Standard						
-	15.203	-	-	Antenna Requirements	Pass	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	
2.2	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.3	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	
2.5	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	
Configuration and Mode: Radio chip/PCB combination - Boost						
2.6	15.247 (a)(1)	5.1	6.7	Frequency Hopping Systems - 20 dB Bandwidth	Pass	
2.7	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	
2.8	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	
2.9	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	
2.2	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.3	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	The SDS Module (US) is designed to support the proprietary Disruptive Technologies RF protocol, Secure Data Shot (SDS). The module shall be used in products for establishing an RF link with SDS enabled devices. The SDS Module has two antennas and two radio modes.
Manufacturer:	Zollner Elektronik AG, Manfred-Zollner-Str. 1, 93499 Zandt, Germany
Model:	SDS Module (US)
Part Number:	102545
Hardware Version:	0
Software Version:	0.1.0
FCC ID of the product under test – see guidance here	2ATFX-102545
IC ID of the product under test – see guidance here	25087-102545

Table 3

Intentional Radiators

Technology	SDS
Frequency Range (MHz to MHz)	903.250 to 926.750 (Standard) 902.775 to 927.225 (Boost)
Conducted Declared Output Power (dBm)	18 (Standard) 17 (Boost)
Antenna Gain (dBi)	-1.0 (Ant 1) -1.6 (Ant 2)
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	0.536 (Standard) 0.155 (Boost)
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GFSK
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	
Bottom Frequency (MHz)	902.775
Middle Frequency (MHz)	915.000
Top Frequency (MHz)	927.225

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	927.225 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	902.775 MHz
Class A Digital Device (Use in commercial, industrial or business environment) X Class B Digital Device (Use in residential environment only) ☐	

Table 5

AC Power Source

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

Table 6

DC Power Source

Nominal voltage:	5	V
Extreme upper voltage:	5.25	V
Extreme lower voltage:	4.5	V
Max current:	1	A

Table 7

Battery Power Source

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

Table 8

Charging

Can the EUT transmit whilst being charged	Yes ☐ No X

Table 9

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	70	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	0	dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector X			State impedance	50	Ohm
Integral antenna X	Type:	PIFA Plate PCB antenna	Gain	-1.0 (Ant 1) -1.6 (Ant 2)	dBi
External antenna ☐	Type:		Gain		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 ☐					

Table 12

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 13

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

Name: Øystein Moldsvor
Position held: VP Engineering
Date: 25 May 2022

1.5 Product Information

1.5.1 Technical Description

The SDS Module (US) is designed to support the proprietary Disruptive Technologies RF protocol, Secure Data Shot (SDS). The module shall be used in products for establishing an RF link with SDS enabled devices. The SDS Module has two antennas and two radio modes.

1.6 Deviations from the Standard

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

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: SDS Module (US), Serial Number: US 2			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: SDS Module (US), Serial Number: US 1			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Radio chip/PCB combination - Standard		
Emission Bandwidth	Daniel Cameron	UKAS
Maximum Conducted Output Power	Daniel Cameron	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Power Spectral Density	Daniel Cameron	UKAS
Configuration and Mode: Radio chip/PCB combination - Boost		
Frequency Hopping Systems - 20 dB Bandwidth	Daniel Cameron	UKAS
Frequency Hopping Systems - Channel Separation	Daniel Cameron	UKAS
Frequency Hopping Systems - Average Time of Occupancy	Daniel Cameron	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Daniel Cameron	UKAS
Maximum Conducted Output Power	Daniel Cameron	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS

Table 15

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Emission Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)
ISED RSS-247, Clause 5.2
ISED RSS-GEN, Clause 6.7

2.1.2 Equipment Under Test and Modification State

SDS Module (US), S/N: US 1 - Modification State 0

2.1.3 Date of Test

11-May-2022

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.1 for 6 dB BW and 6.9.3 for 99% occupied bandwidth measurements.

2.1.5 Environmental Conditions

Ambient Temperature	23.6 °C
Relative Humidity	47.9 %

2.1.6 Test Results

Radio chip/PCB combination - Standard

Test Configuration			
Frequency Range:	902-928 MHz	Band:	900 MHz
Limit Clause(s):	15.247 (a)(2) RSS-247 5.2 a)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	Standard	Duty Cycle (%):	-
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-
Active Port(s):	A (Ant 1)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
902.775	0.536	-	-	-	≥500.0
915.000	0.544	-	-	-	≥500.0
927.225	0.556	-	-	-	≥500.0

Table 16 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
902.775	0.680	-	-	-	-
915.000	0.712	-	-	-	-
927.225	0.772	-	-	-	-

Table 17 - 99% Bandwidth Results

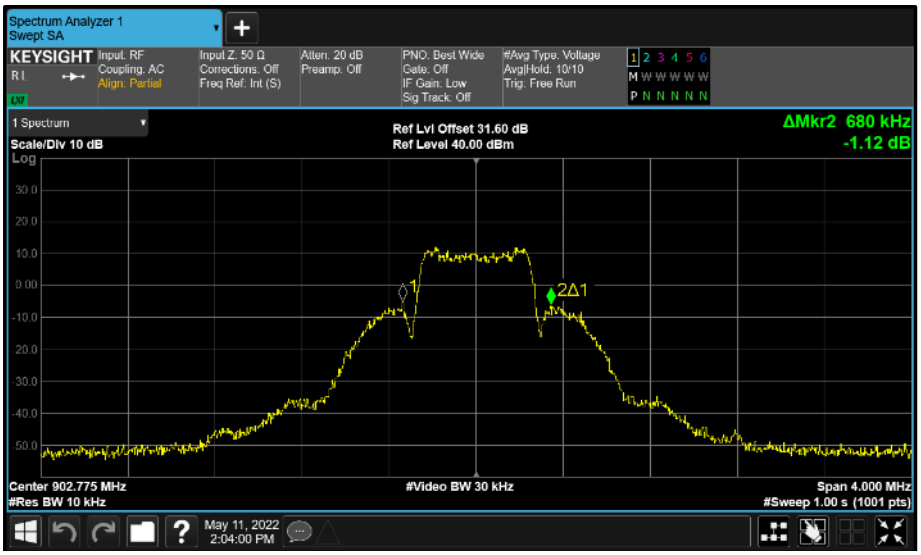

Figure 1 - Ant 1 (A) 902.775 MHz 99% Bandwidth

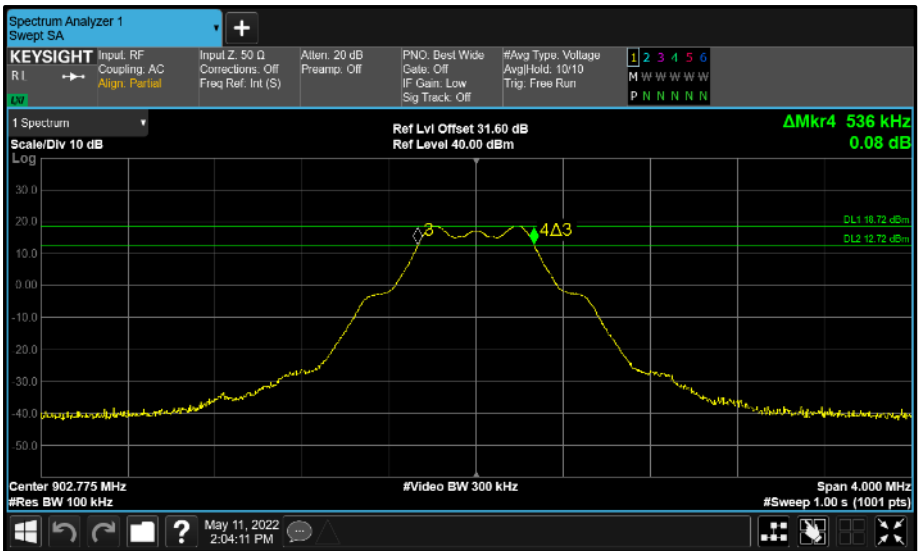

Figure 2 - Ant 1 (A) 902.775 MHz 6 dB Bandwidth

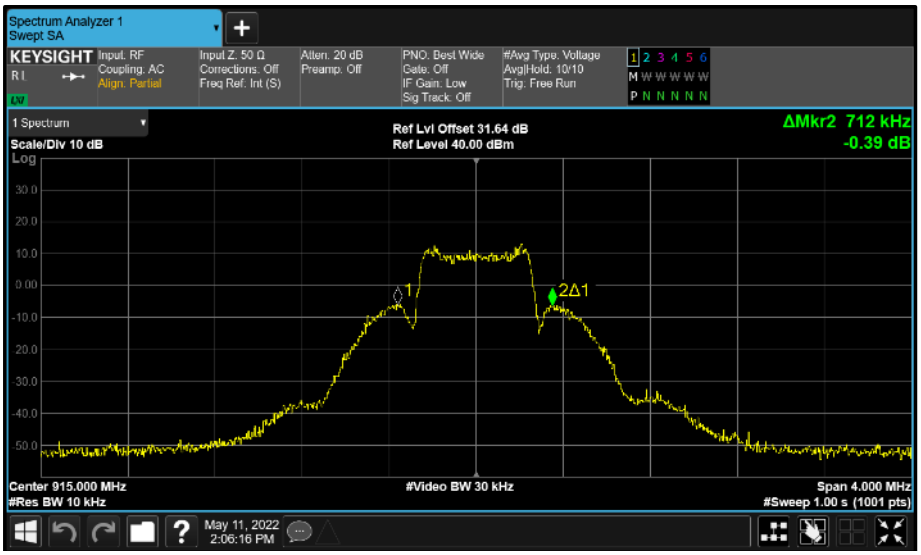

Figure 3 - Ant 1 (A) 915.000 MHz 99% Bandwidth

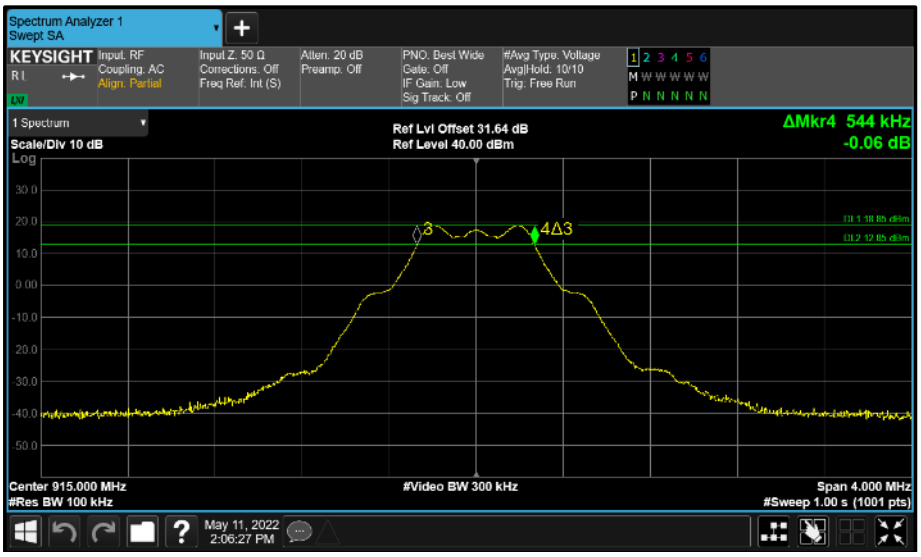

Figure 4 - Ant 1 (A) 915.000 MHz 6 dB Bandwidth

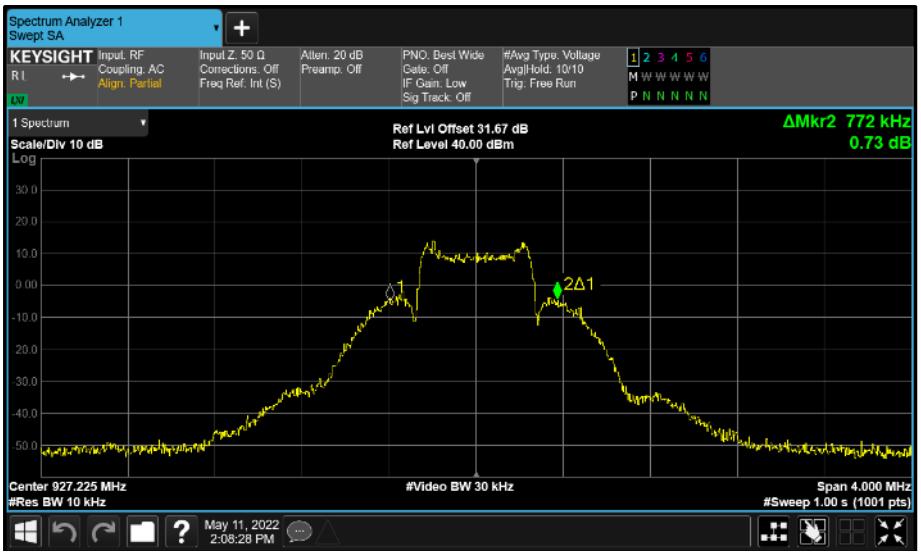

Figure 5 - Ant 1 (A) 927.225 MHz 99% Bandwidth

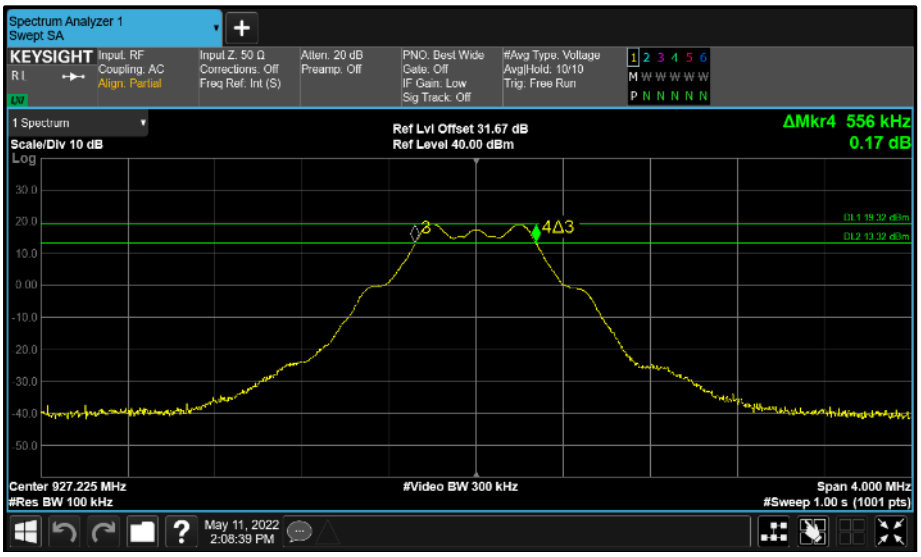

Figure 6 - Ant 1 (A) 927.225 MHz 6 dB Bandwidth

Test Configuration			
Frequency Range:	902-928 MHz	Band:	900 MHz
Limit Clause(s):	15.247 (a)(2) RSS-247 5.2 a)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	Standard	Duty Cycle (%):	-
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-
Active Port(s):	B (Ant2)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
902.775	-	0.544	-	-	≥500.0
915.000	-	0.540	-	-	≥500.0
927.225	-	0.552	-	-	≥500.0

Table 18 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
902.775	-	0.748	-	-	-
915.000	-	0.684	-	-	-
927.225	-	0.732	-	-	-

Table 19 - 99% Bandwidth Results

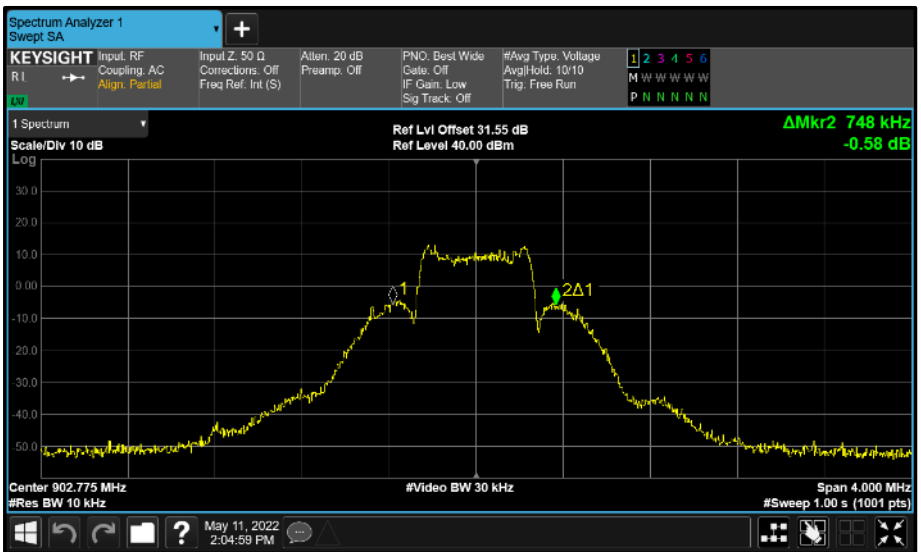

Figure 7 - Ant2 (B) 902.775 MHz 99% Bandwidth

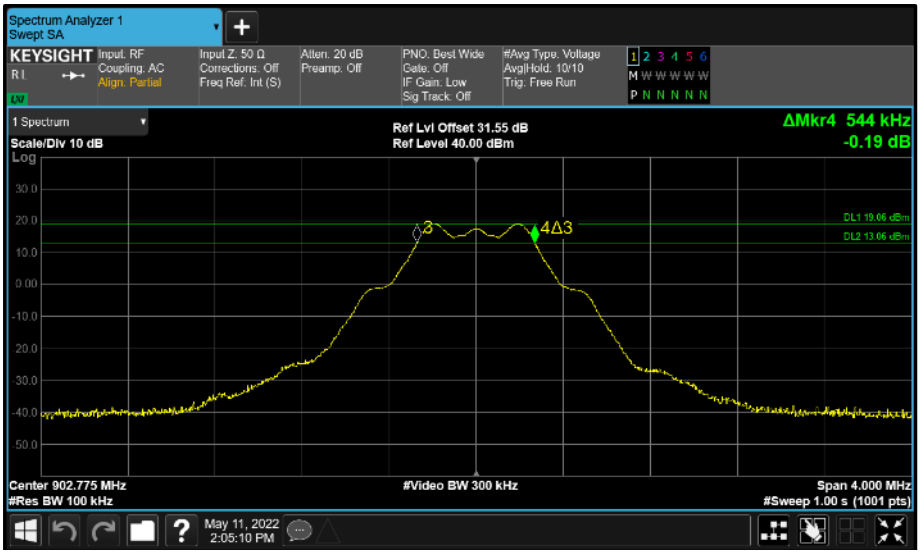

Figure 8 - Ant2 (B) 902.775 MHz 6 dB Bandwidth

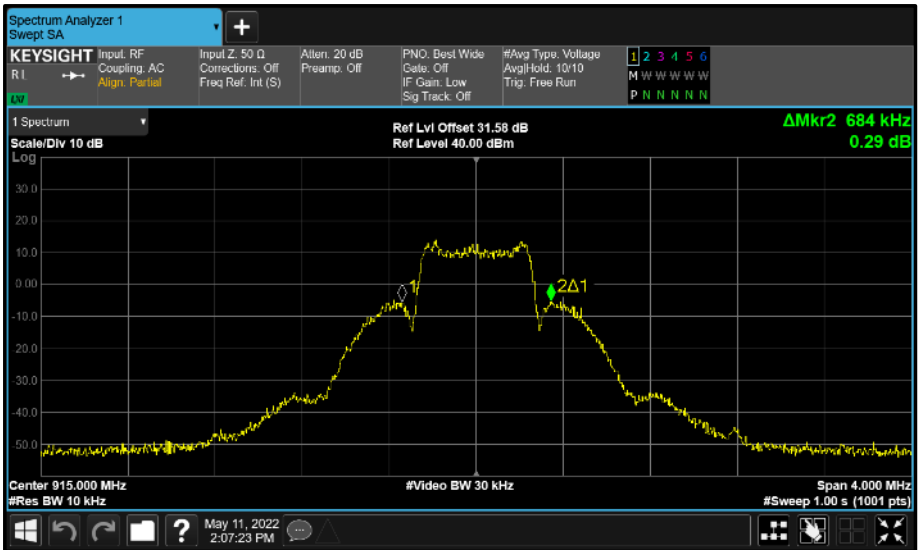

Figure 9 - Ant2 (B) 915.000 MHz 99% Bandwidth

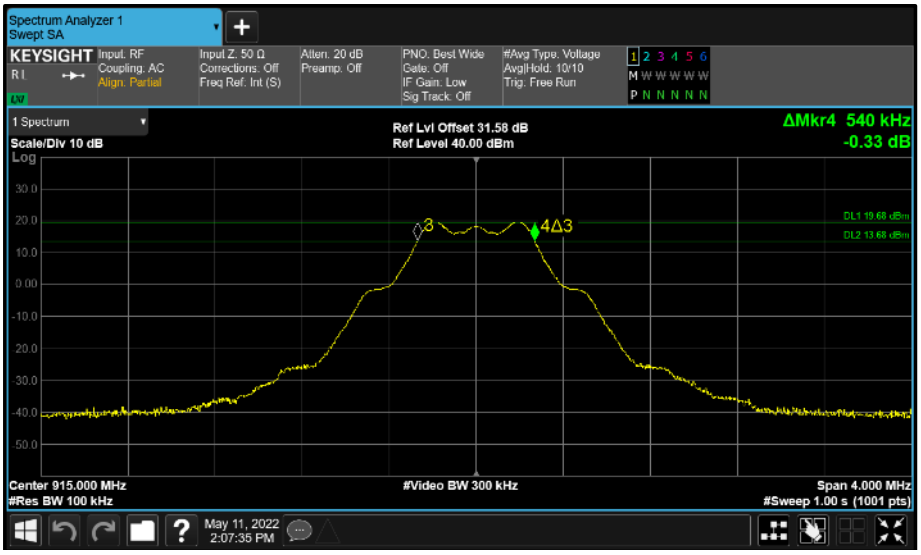

Figure 10 - Ant2 (B) 915.000 MHz 6 dB Bandwidth

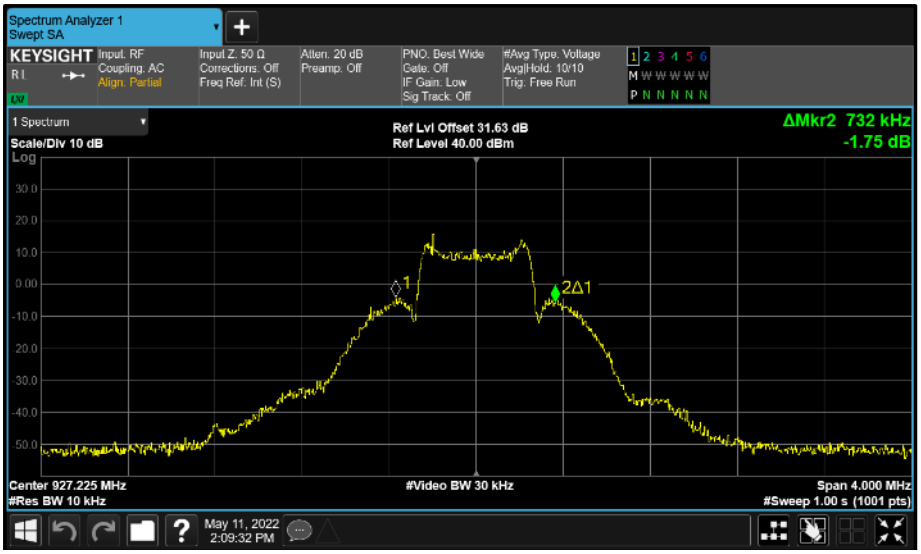

Figure 11 - Ant2 (B) 927.225 MHz 99% Bandwidth

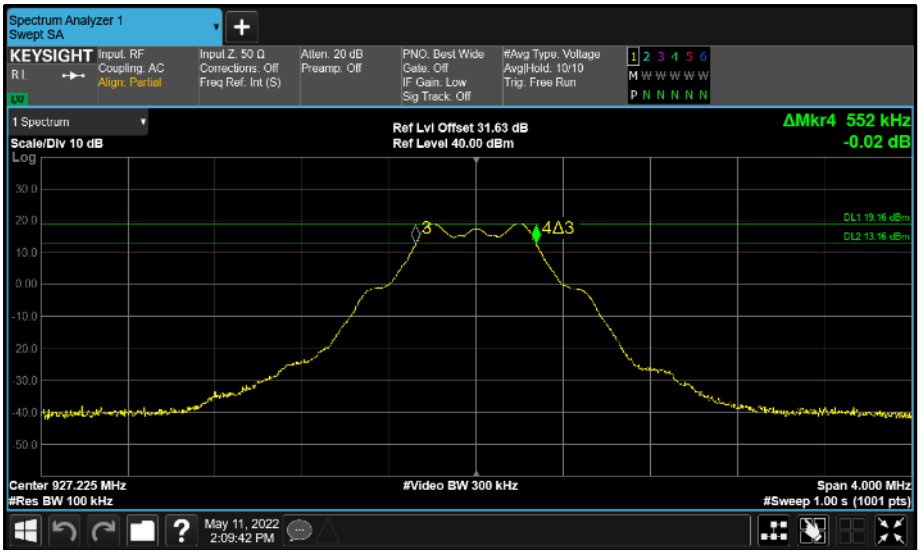

Figure 12 - Ant2 (B) 927.225 MHz 6 dB Bandwidth

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

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

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	21-Mar-2024
Signal Conditioning Unit	TUV SUD	SCU001	5546	12	06-Apr-2023

Table 20

2.2 Maximum Conducted Output Power

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

SDS Module (US), S/N: US 1 - Modification State 0

2.2.3 Date of Test

11-May-2022 to 24-June-2022

2.2.4 Test Method

Radio chip/PCB combination – Boost

The test was performed in accordance with ANSI C63.10 clause 7.8.5.

Radio chip/PCB combination – Standard

The test was performed in accordance with ANSI C63.10 clause 11.9.2.3.2 (AVGPM-G).

2.2.5 Environmental Conditions

Ambient Temperature	23.6 – 23.8 °C
Relative Humidity	45.0 - 47.9 %

2.2.6 Test Results

Radio chip/PCB combination - Standard

Test Configuration			
Frequency Range:	902-928 MHz	Band:	900 MHz
Limit Clause(s):	15.247 (b)(3) RSS-247 5.4 d)	Test Method(s):	C63.10 11.9.2.3.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	Standard	Duty Cycle (%):	100.0
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-1.00
Active Port(s):	A (Ant 1)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	∑		
902.775	18.39	-	-	-	-	30.00	-11.61
915.000	18.63	-	-	-	-	30.00	-11.37
927.225	19.06	-	-	-	-	30.00	-10.94

Table 21 - FCC Maximum Conducted (average) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	∑					
902.775	18.39	-	-	-	-	30.00	-11.61	17.39	36.00	-18.61
915.000	18.63	-	-	-	-	30.00	-11.37	17.63	36.00	-18.37
927.225	19.06	-	-	-	-	30.00	-10.94	18.06	36.00	-17.94

Table 22 - ISED Maximum Conducted (average) Output Power Results

Test Configuration			
Frequency Range:	902-928 MHz	Band:	900 MHz
Limit Clause(s):	15.247 (b)(3) RSS-247 5.4 d)	Test Method(s):	C63.10 11.9.2.3.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	Standard	Duty Cycle (%):	100.0
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-1.60
Active Port(s):	B (Ant2)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	∑		
902.775	-	18.78	-	-	-	30.00	-11.22
915.000	-	19.38	-	-	-	30.00	-10.62
927.225	-	18.82	-	-	-	30.00	-11.18

Table 23 - FCC Maximum Conducted (average) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	∑					
902.775	-	18.78	-	-	-	30.00	-11.22	17.18	36.00	-18.82
915.000	-	19.38	-	-	-	30.00	-10.62	17.78	36.00	-18.22
927.225	-	18.82	-	-	-	30.00	-11.18	17.22	36.00	-18.78

Table 24 - ISED Maximum Conducted (average) Output Power Results

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 RSS-247, Limit Clause 5.4 (d)

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

Radio chip/PCB combination – Boost

Port A (Ant 1)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
902.775	19.01	79.62
915.000	19.50	89.13
927.225	19.01	76.62

Table 25

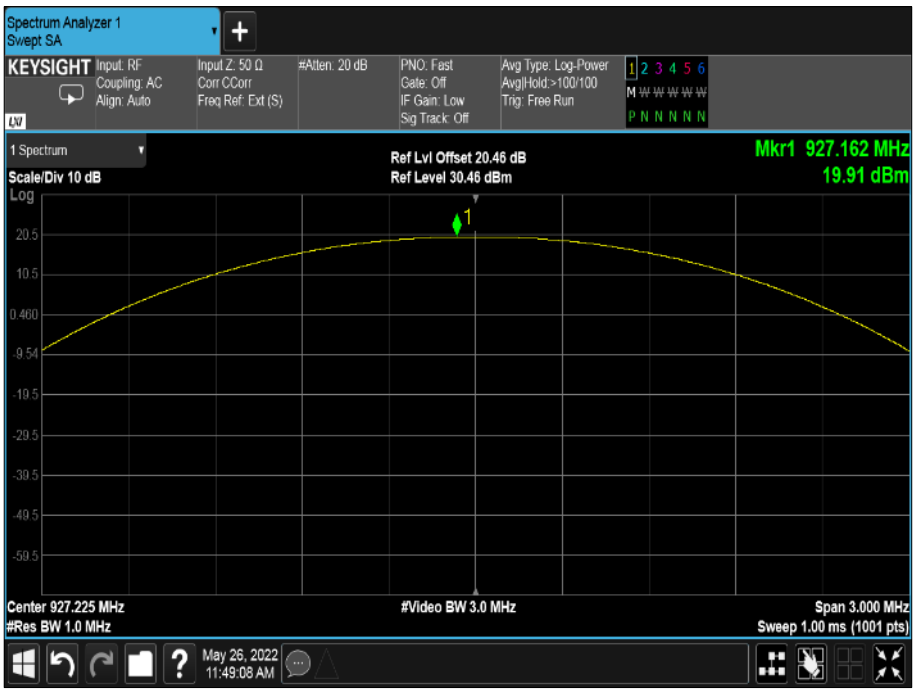

Figure 13 - 927.225 MHz

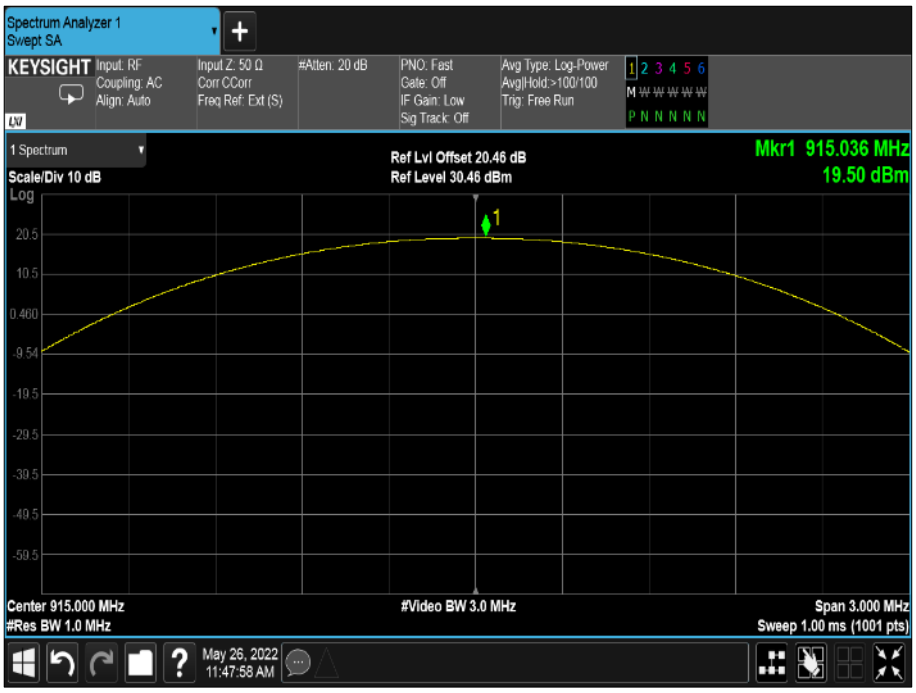

Figure 14 - 915.000 MHz

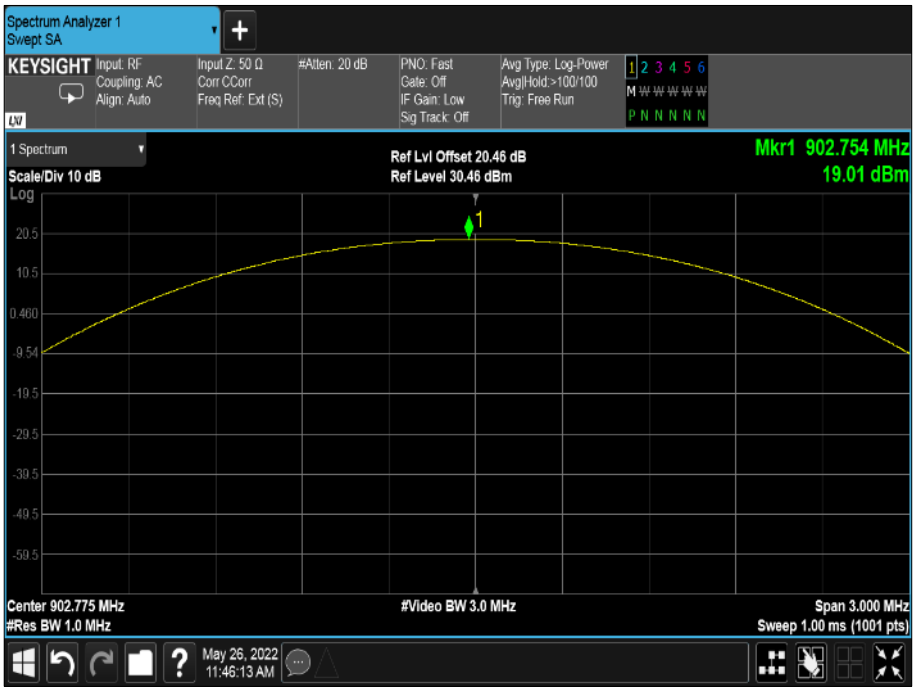

Figure 15 - 902.775 MHz

Port B (Ant 2)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
902.775	20.42	110.15
915.000	20.85	121.62
927.225	20.18	104.23

Table 26

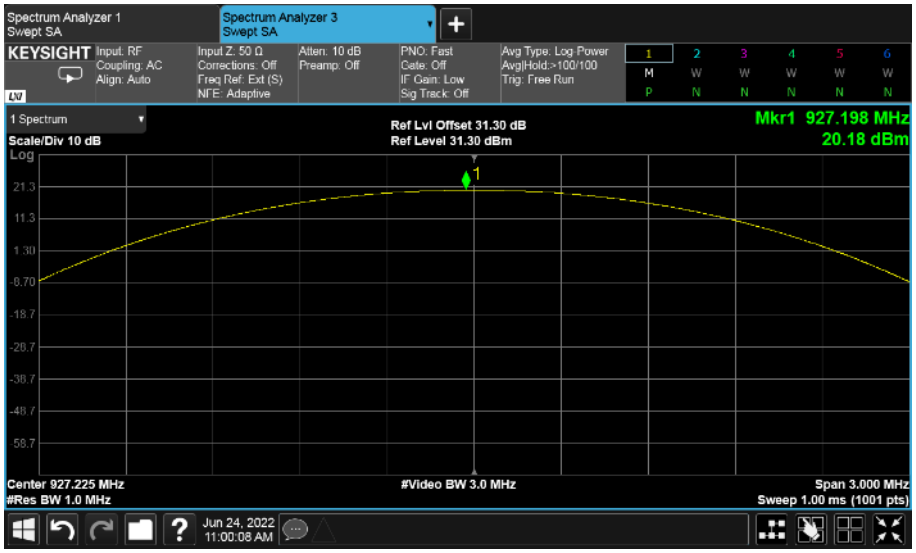

Figure 16 - 927.225 MHz

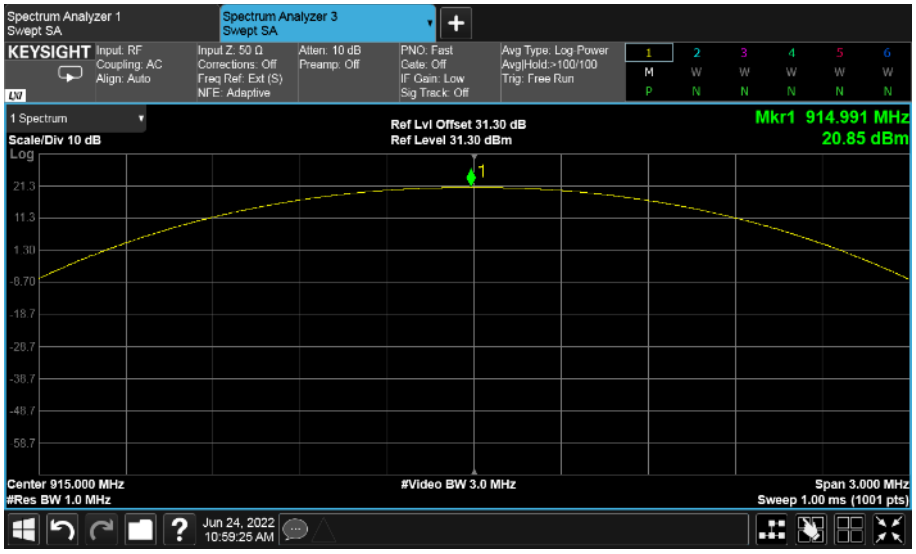

Figure 17 - 915.000 MHz

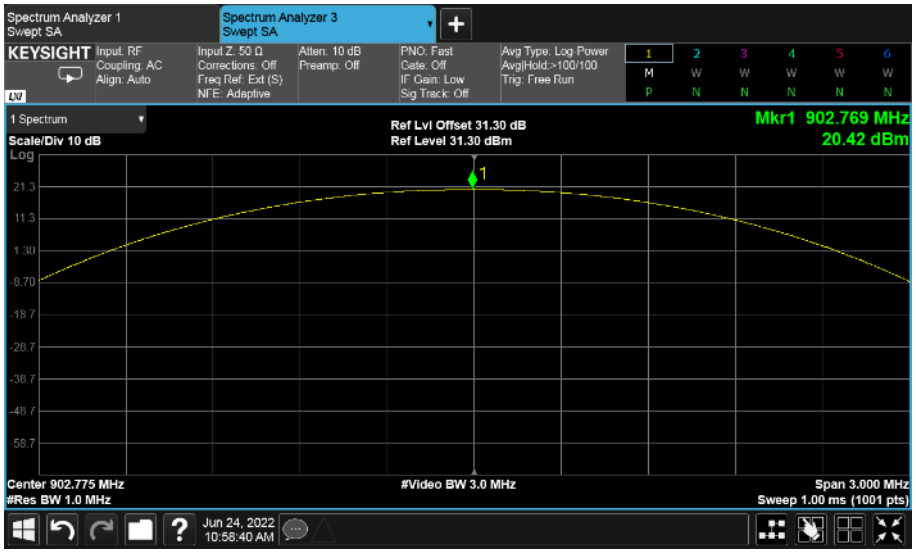

Figure 18 - 902.775 MHz

<u>FCC 47 CFR Part 15, Limit Clause 15.247 (b)(2)</u>

For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels.

<u>ISED RSS-247, Limit Clause 5.4 (a)</u>

For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1 and RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	24-Feb-2023
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Feb-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
EXA	Keysight Technologies	N9010B	4968	24	19-Jan-2024
Signal Analyser	Keysight Technologies	MXA	4994	24	10-Feb-2024
Network Analyser	Keysight Technologies	E5063A	5018	12	30-Jul-2022
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	22-Jul-2022
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	12	04-May-2023
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5503	12	18-May-2023
Signal Conditioning Unit	TUV SUD	SCU001	5546	12	06-Apr-2023
USB Power Sensor	Boonton	RTP5008	5820	12	06-Apr-2023
USB Power Sensor	Boonton	RTP5008	5831	12	06-Apr-2023
3.5mm Cable (1m)	Junkosha	MWX221/B	5837	12	23-Jul-2022

Table 27

2.3 Spurious Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.209
ISED RSS-247, Clause 3.3 and 5.5
ISED RSS-GEN, Clause 13 and 8.9

2.3.2 Equipment Under Test and Modification State

SDS Module (US), S/N: US 2 - Modification State 0

2.3.3 Date of Test

02-May-2022 to 08-May-2022

2.3.4 Test Method

Radio chip/PCB combination – Boost

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

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 EUT was placed on the non-conducting platform in a manner typical of a normal installation. As the EUT was considered mobile/portable and therefore reasonable to 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.

The plots shown are the characterisation of the EUT. With the exception of 614 MHz to 960 MHz where the 15.247 limit has been applied, 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.

The following conversion can be applied to convert from dBµV/m to µV/m:

10^(Field Strength in dBµV/m/20).

Where formal measurements have been necessary, the results have been presented in the emissions table.

Radio chip/PCB combination – Standard

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

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10, clause 11.12.2.5.2.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. As the EUT was considered mobile/portable and therefore reasonable to 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.

The plots shown are the characterisation of the EUT. With the exception of 614 MHz to 960 MHz where the 15.247 limit has been applied, 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.

The following conversion can be applied to convert from dBµV/m to µV/m:

10^(Field Strength in dBµV/m/20).

Where formal measurements have been necessary, the results have been presented in the emissions table.

2.3.5 Example Test Setup Diagram

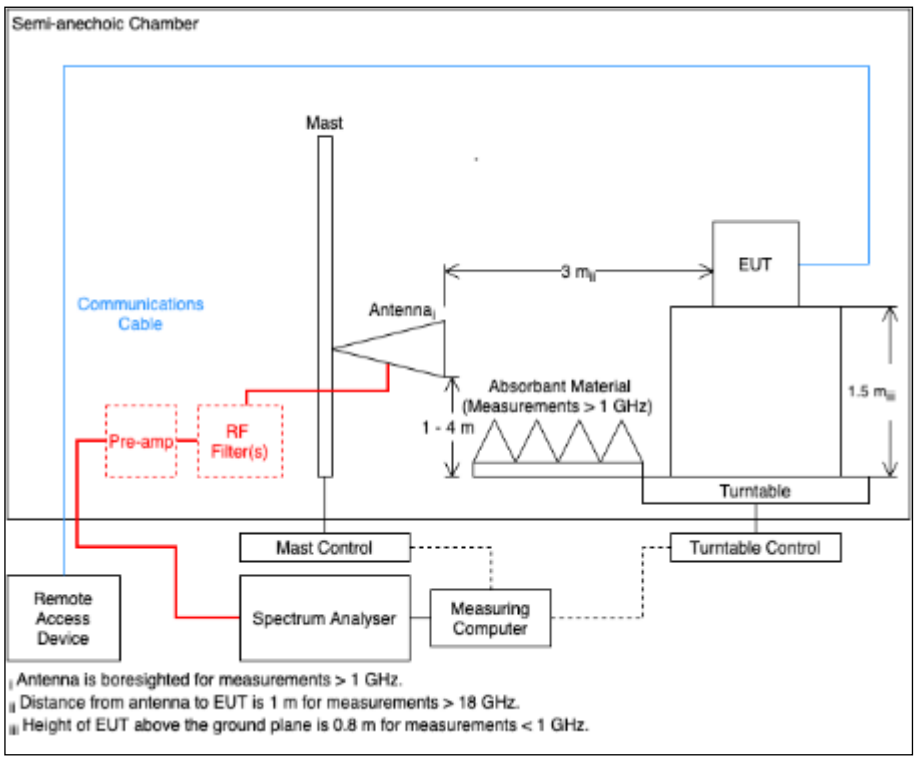

Figure 19

2.3.6 Environmental Conditions

Ambient Temperature	21.3 - 22.9 °C
Relative Humidity	41.7 - 43.5 %

2.3.7 Test Results

Radio chip/PCB combination - Standard

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

Table 28 - 902.775 MHz, 30 MHz to 1 GHz

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

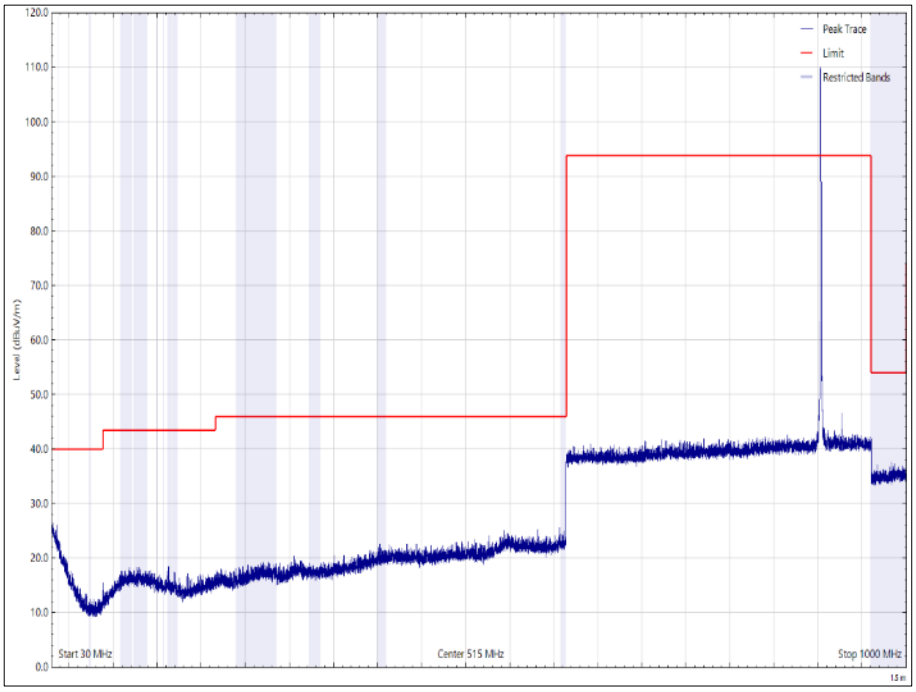

Figure 20 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, Z Orientation

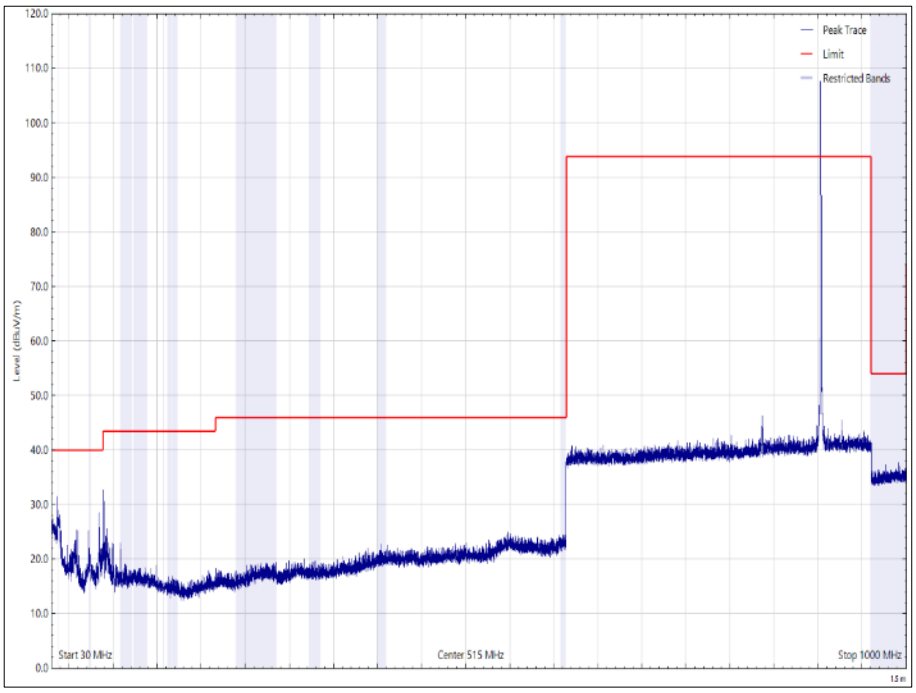

Figure 21 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, Z Orientation

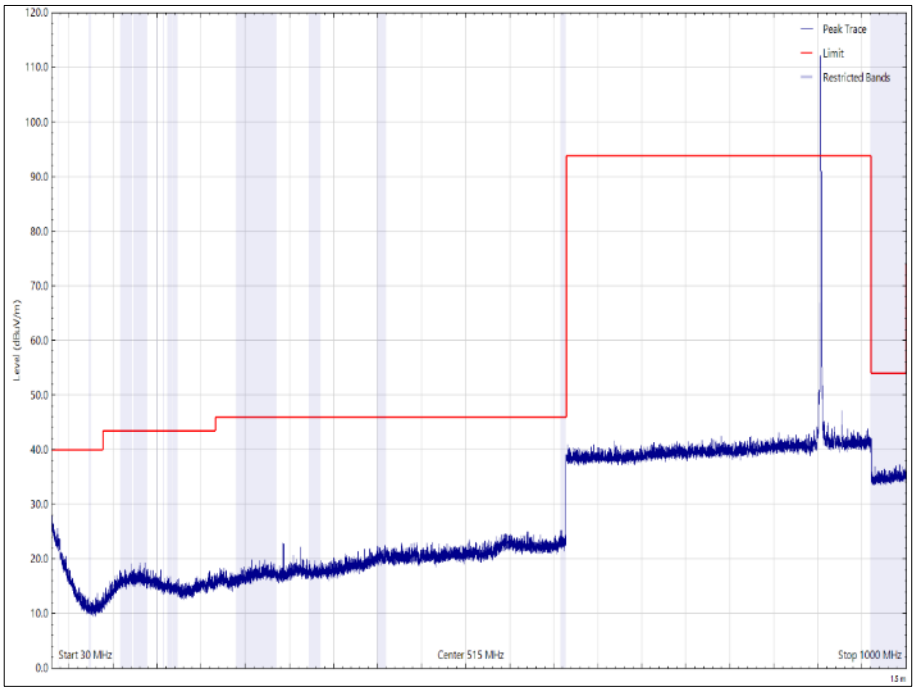

Figure 22 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, Y Orientation

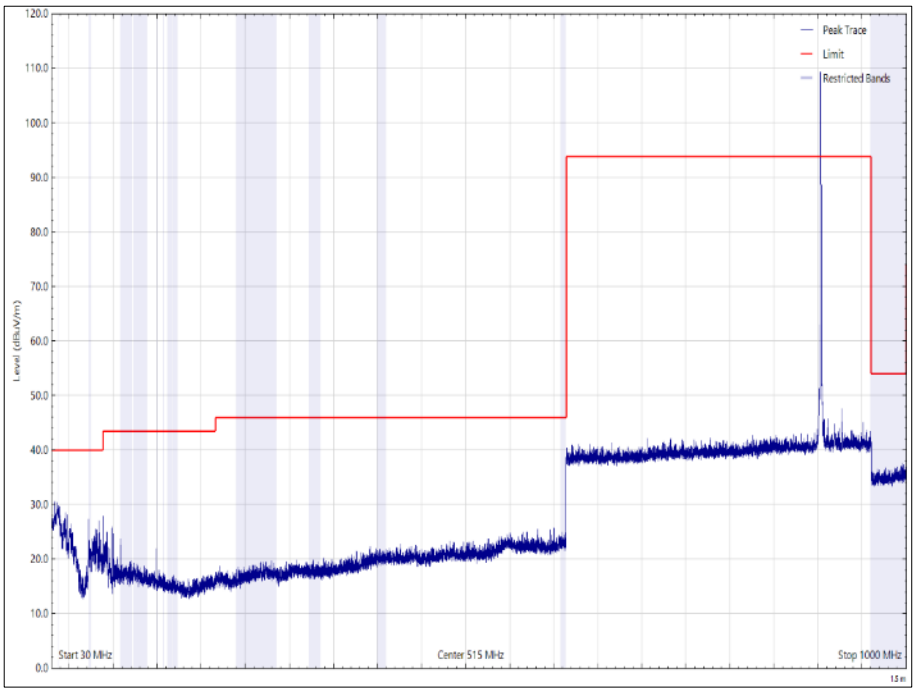

Figure 23 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, Y Orientation

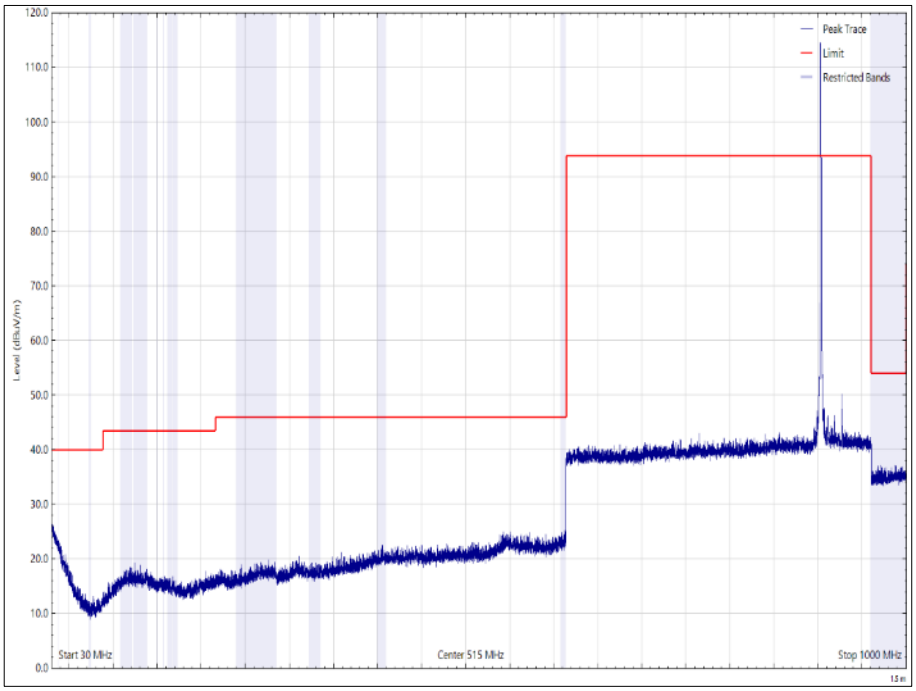

Figure 24 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, X Orientation

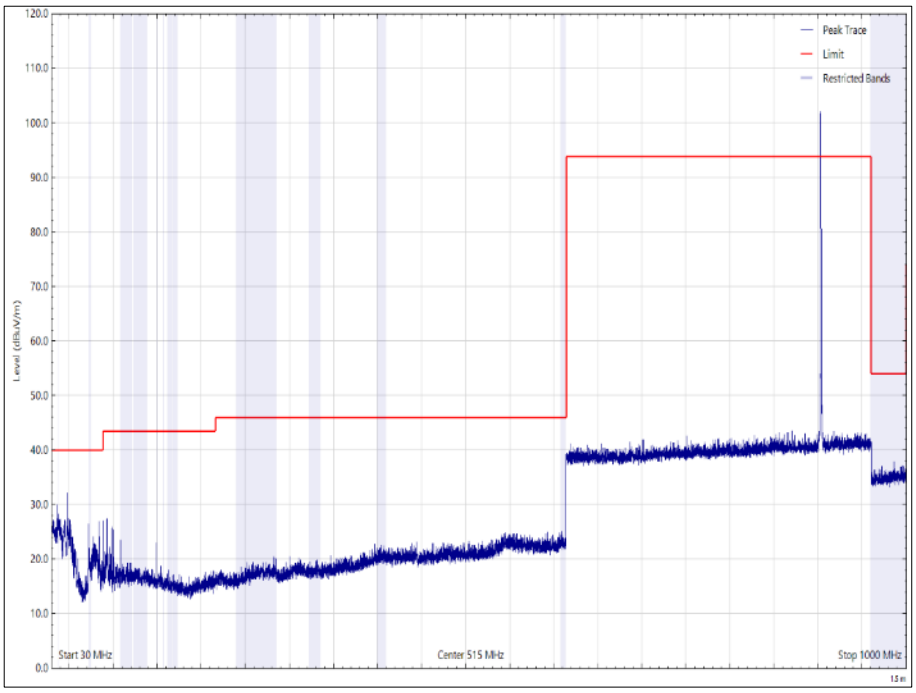

Figure 25 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, X Orientation

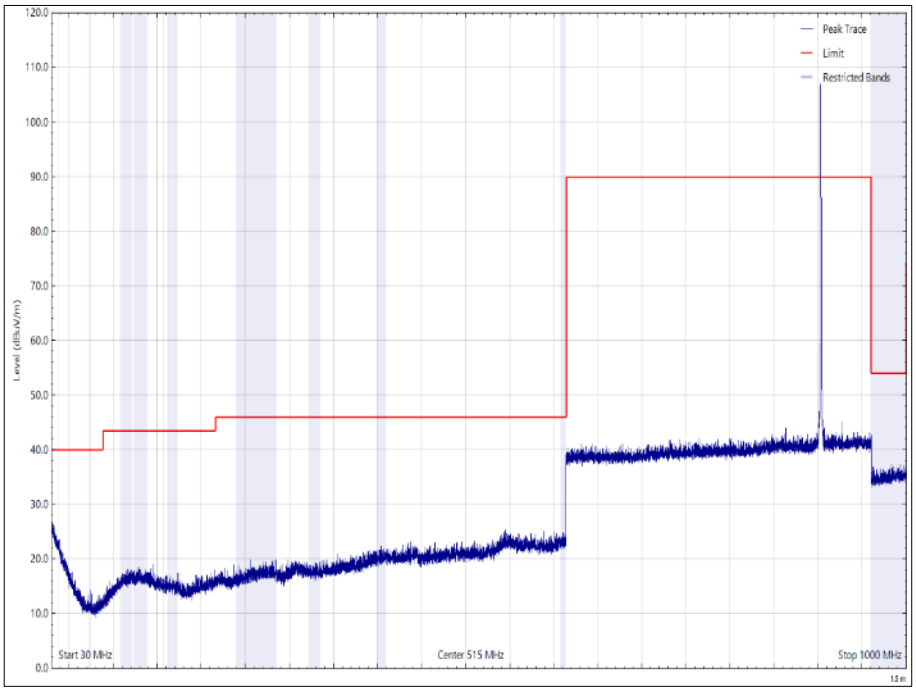

Figure 26 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, Z Orientation

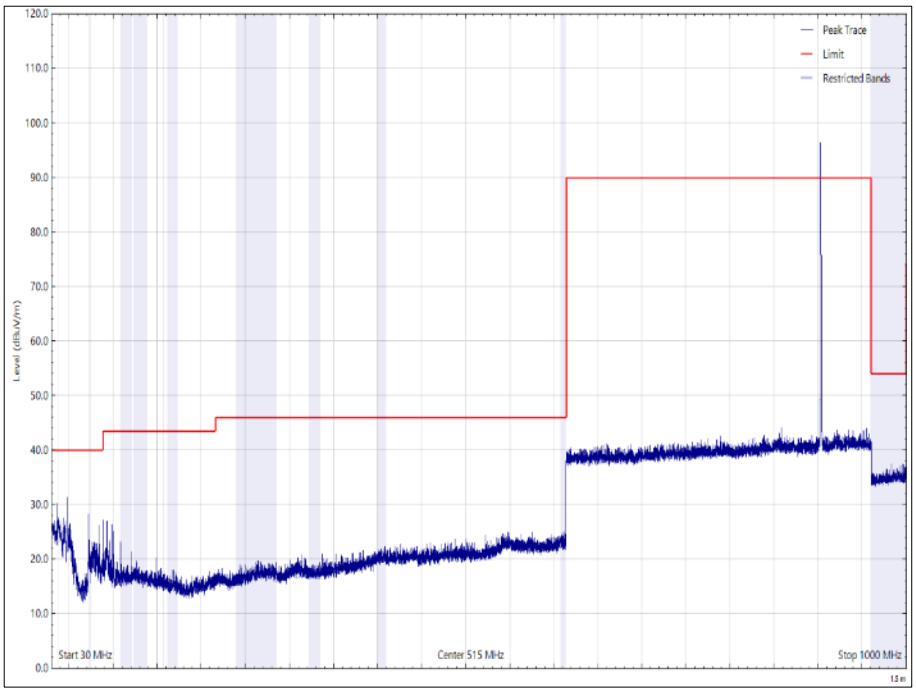

Figure 27 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, Z Orientation

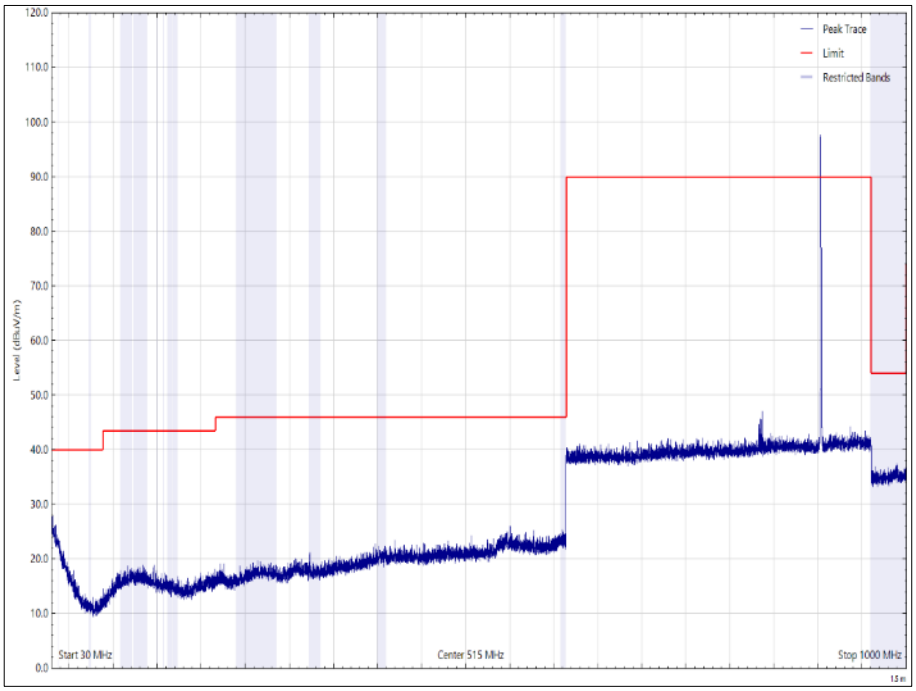

Figure 28 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, Y Orientation

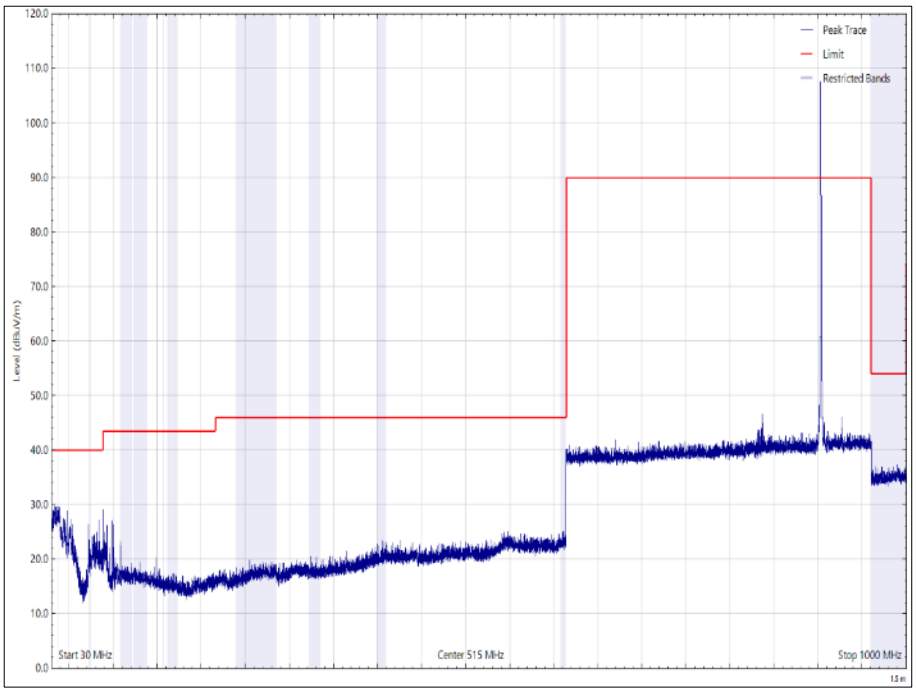

Figure 29 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, Y Orientation

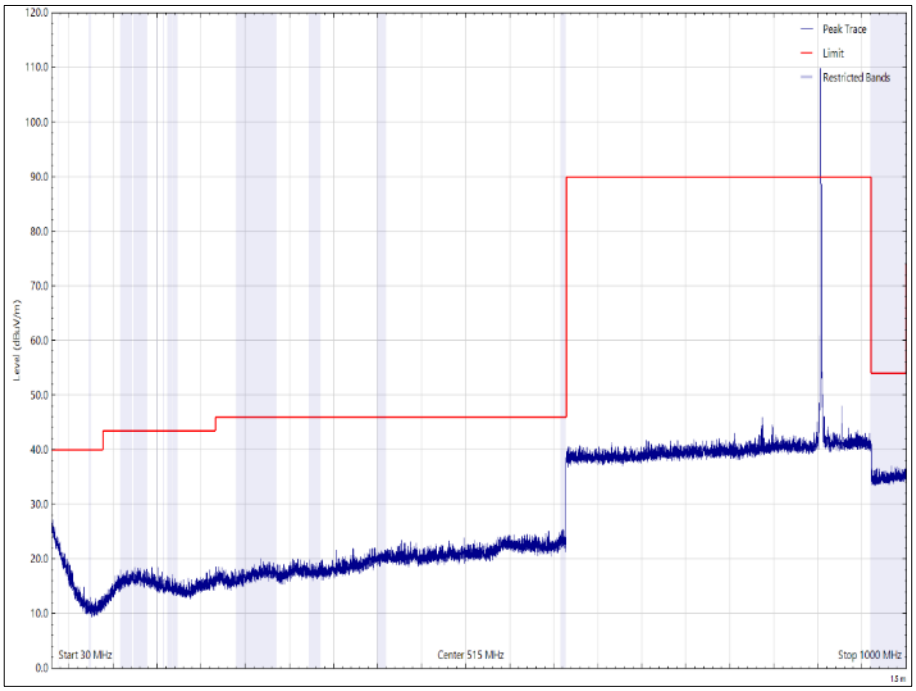

Figure 30 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, X Orientation

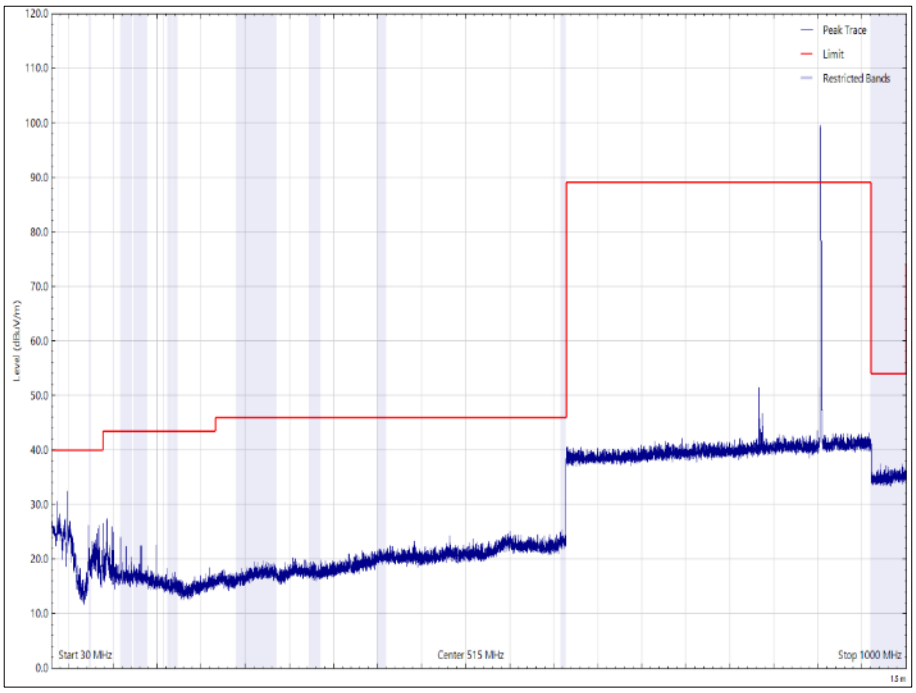

Figure 31 - 902.775 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, X Orientation

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

Table 29 - 902.775 MHz, 1 GHz to 10 GHz

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

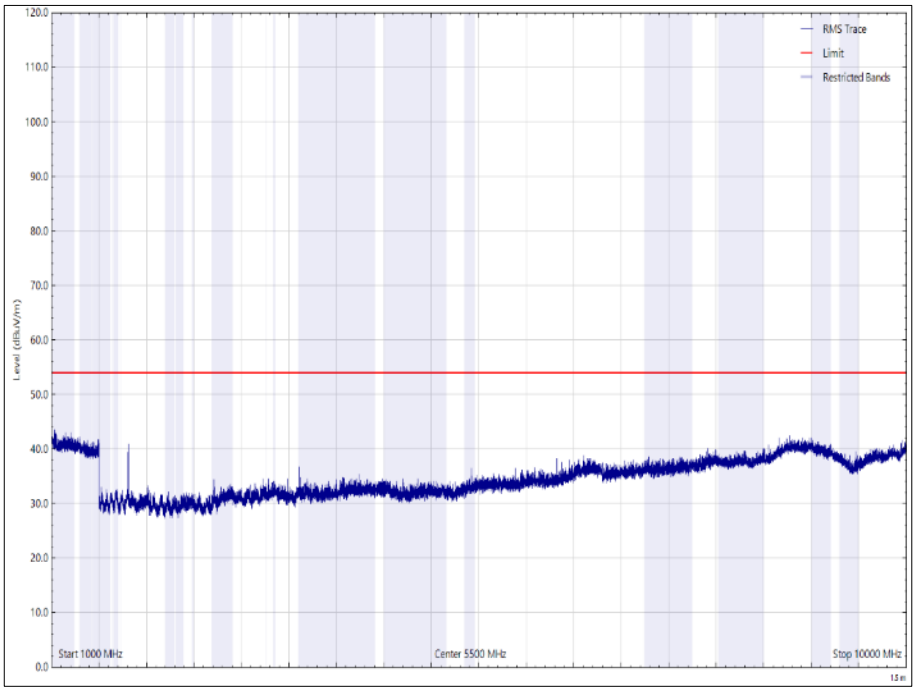

Figure 32 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, Z Orientation - Average

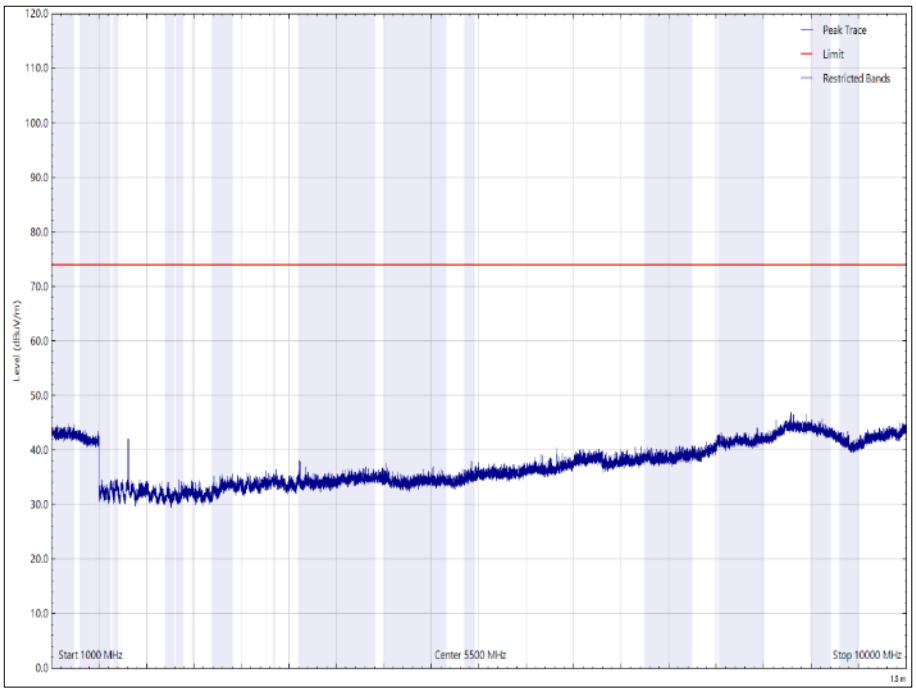

Figure 33 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, Z Orientation - Peak

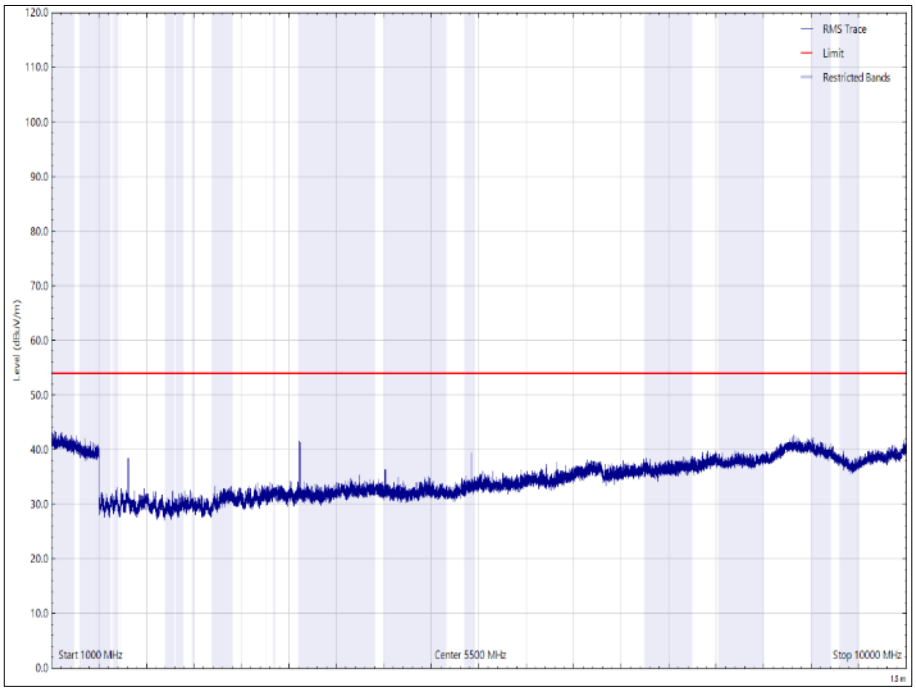

Figure 34 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, Z Orientation - Average

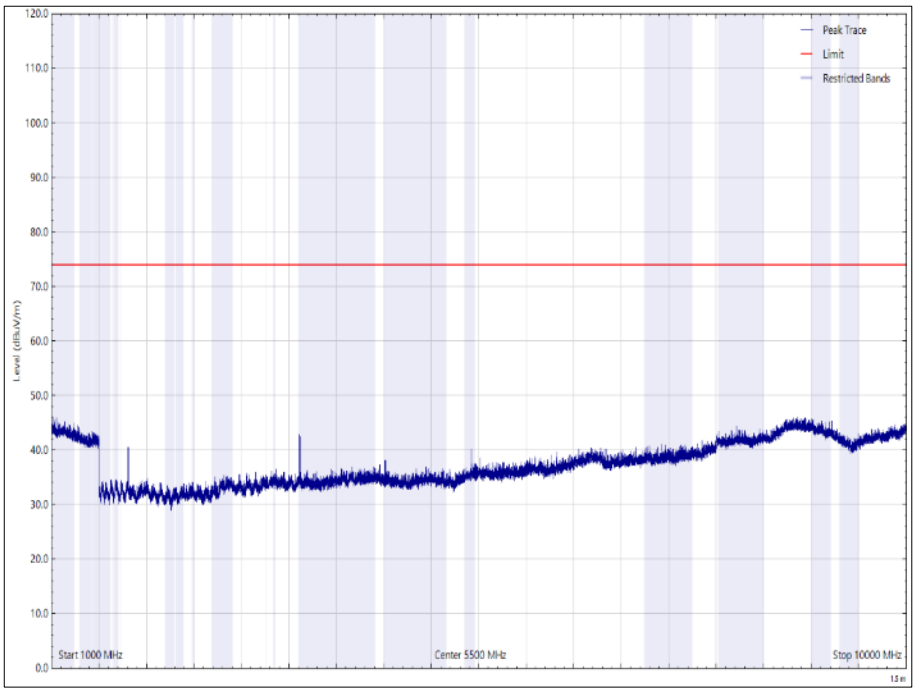

Figure 35 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, Z Orientation - Peak

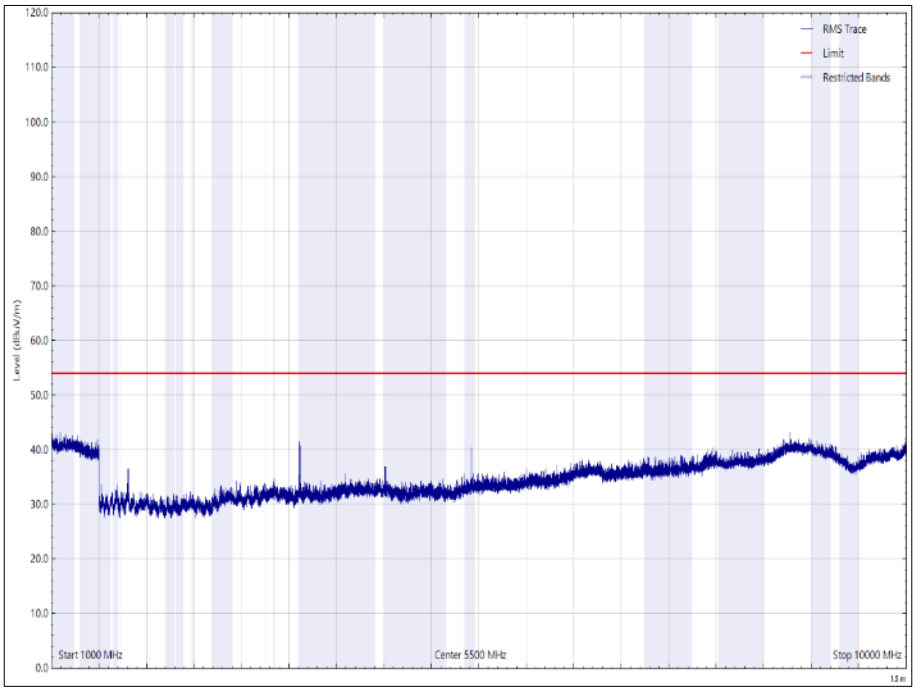

Figure 36 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, Y Orientation - Average

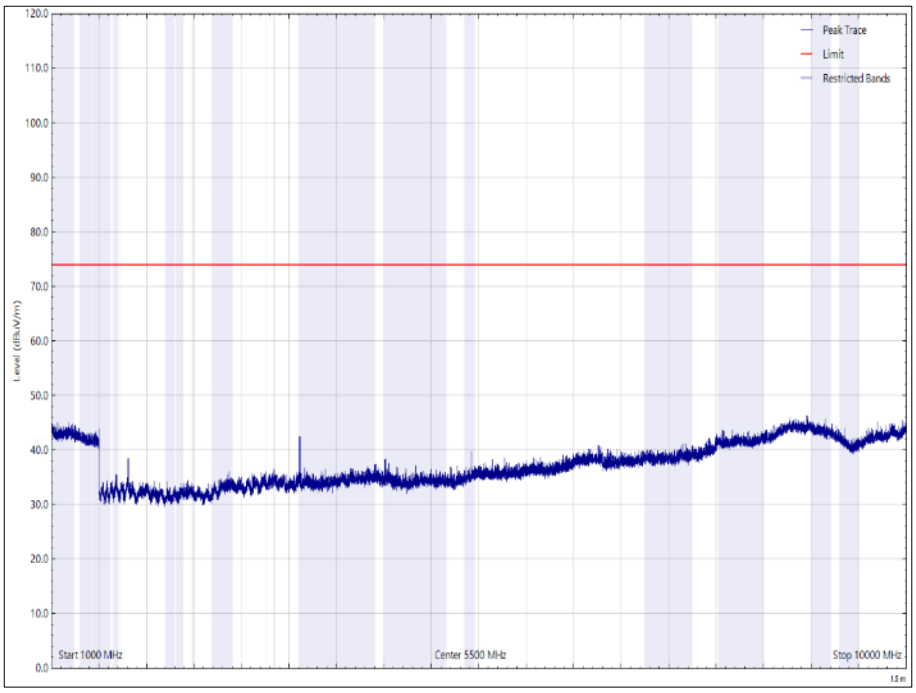

Figure 37 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, Y Orientation - Peak

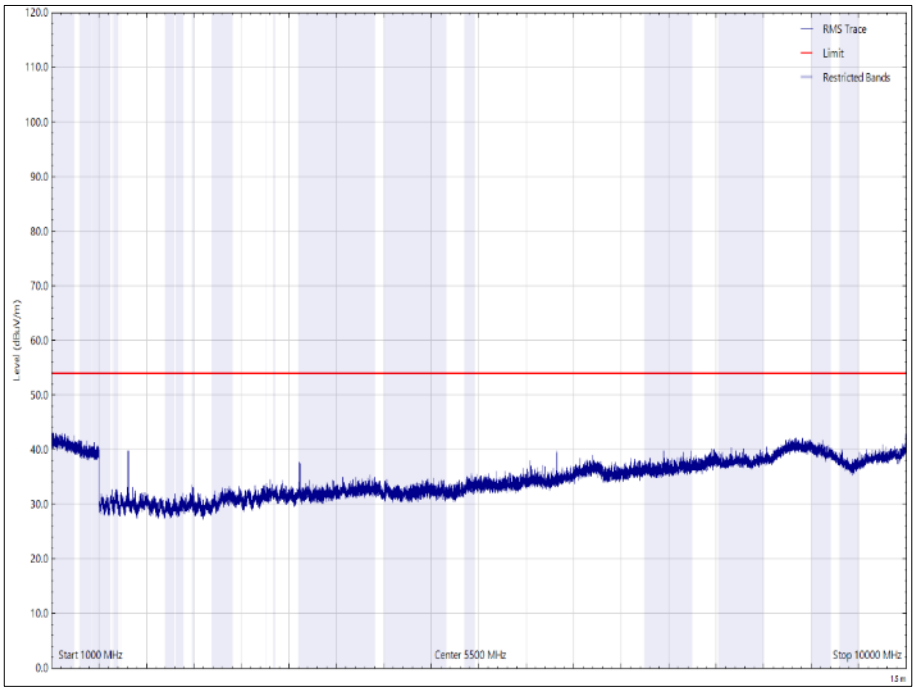

Figure 38 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, Y Orientation - Average

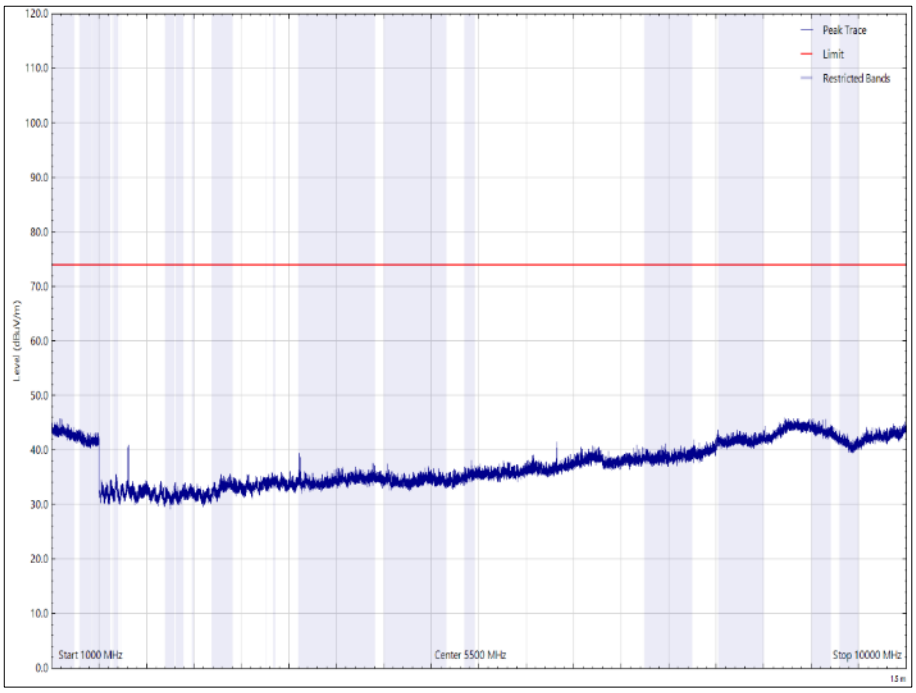

Figure 39 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, Y Orientation - Peak

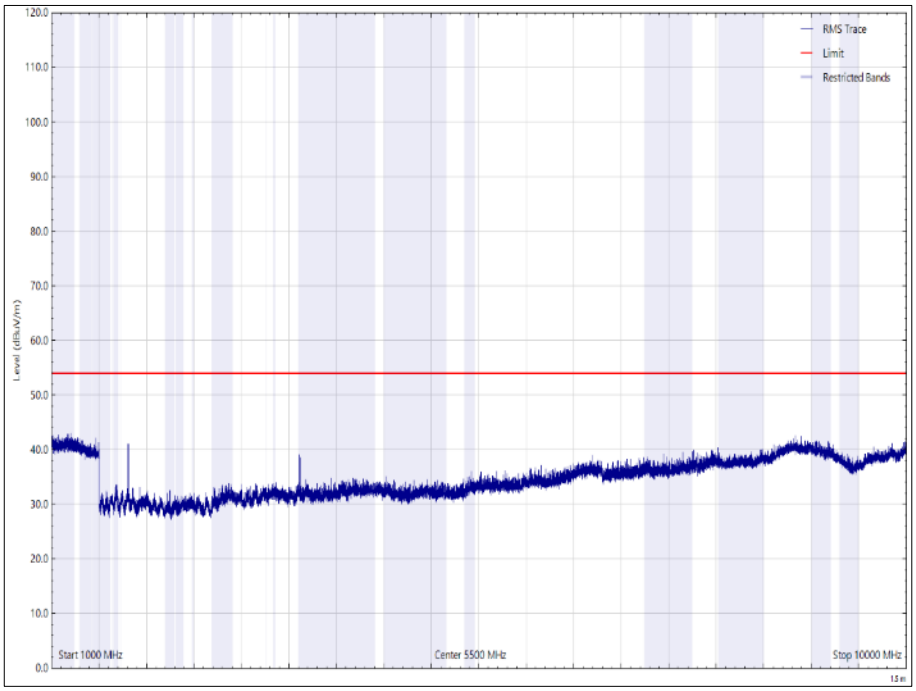

Figure 40 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, X Orientation - Average

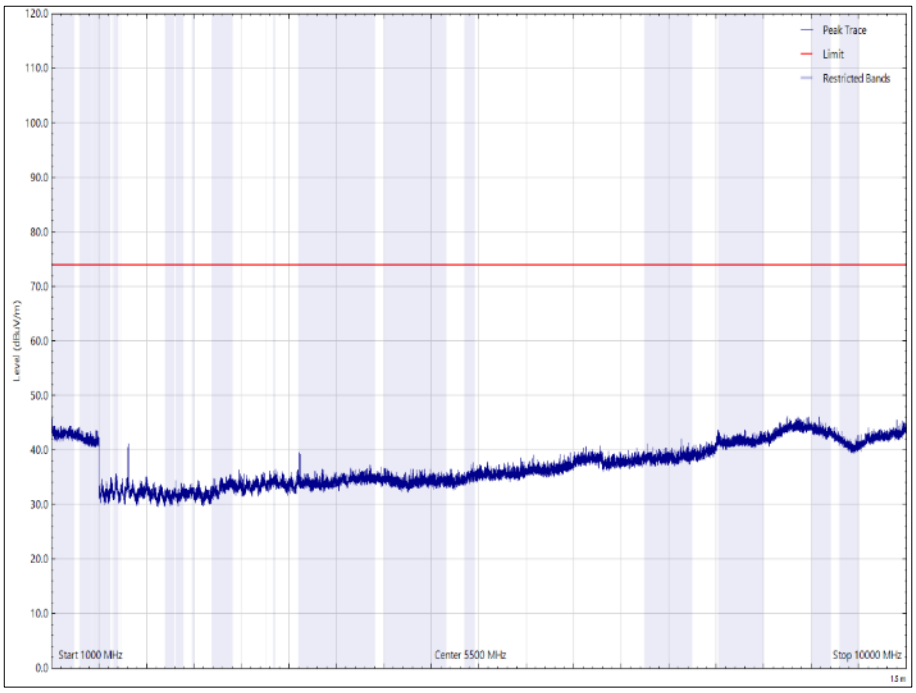

Figure 41 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Horizontal, X Orientation - Peak

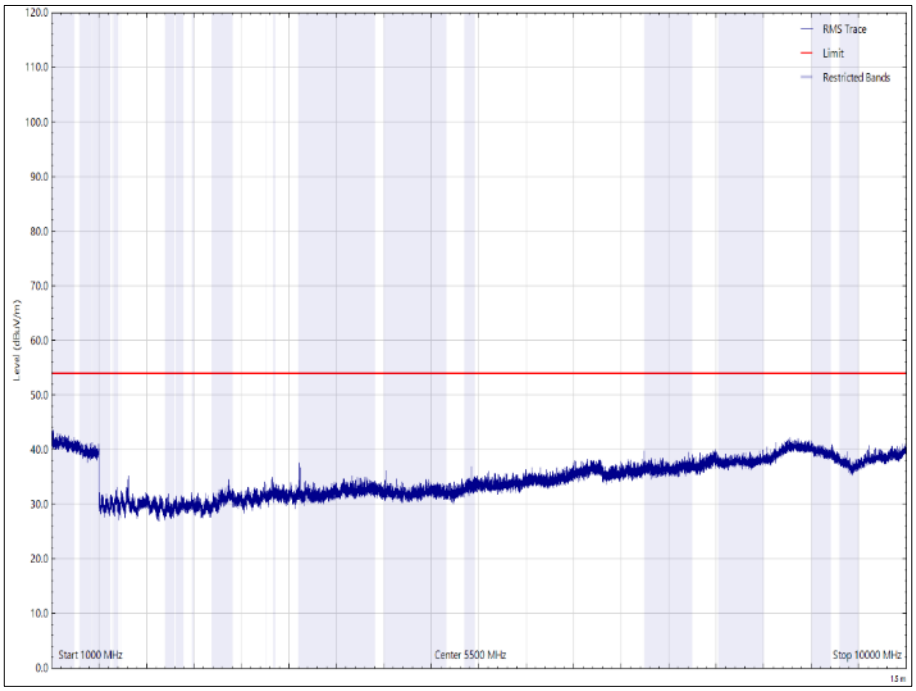

Figure 42 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, X Orientation - Average

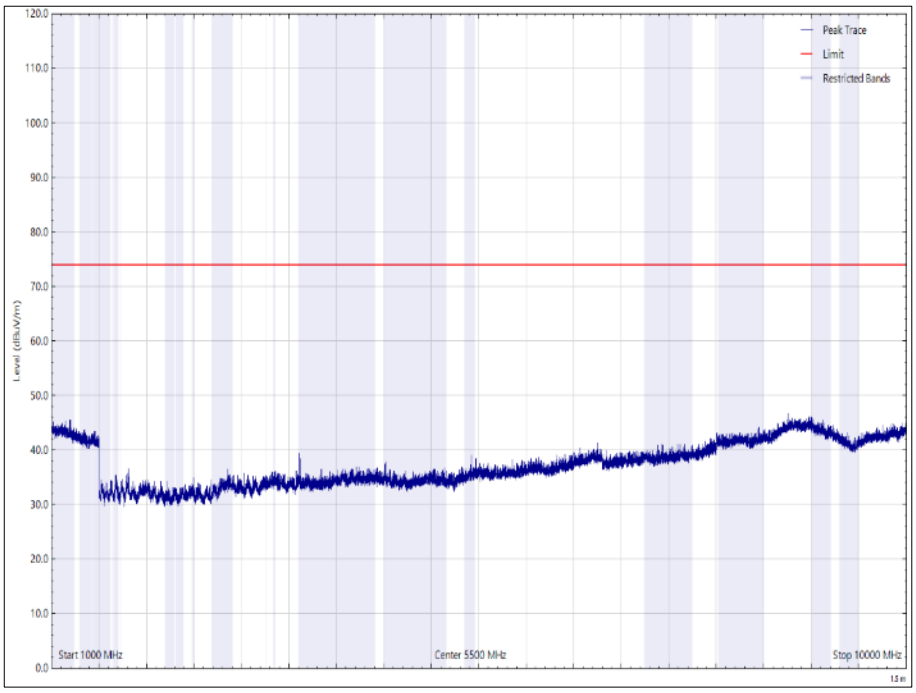

Figure 43 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 2, Vertical, X Orientation - Peak

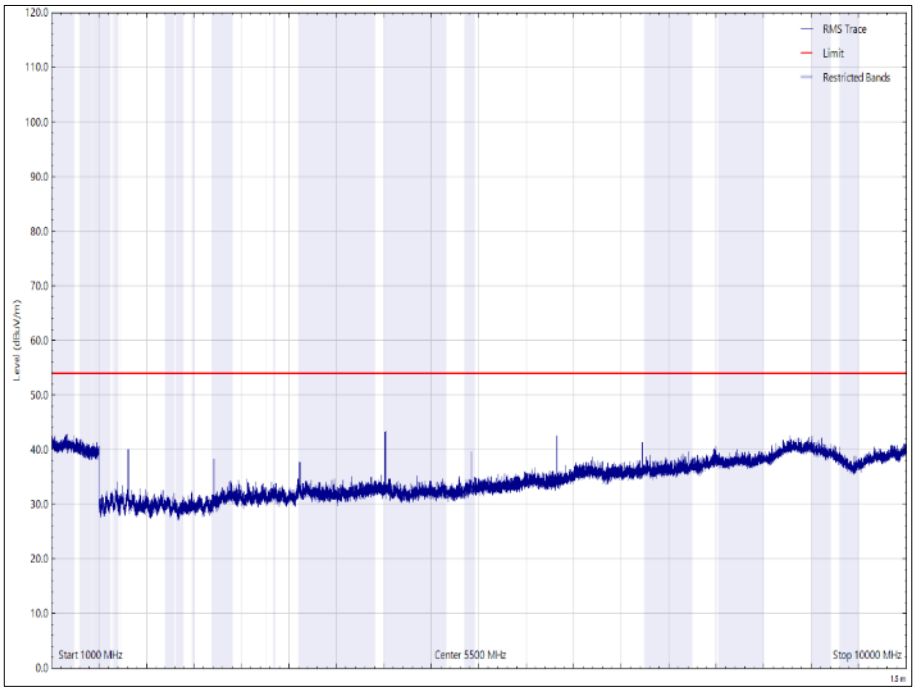

Figure 44 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, Z Orientation - Average

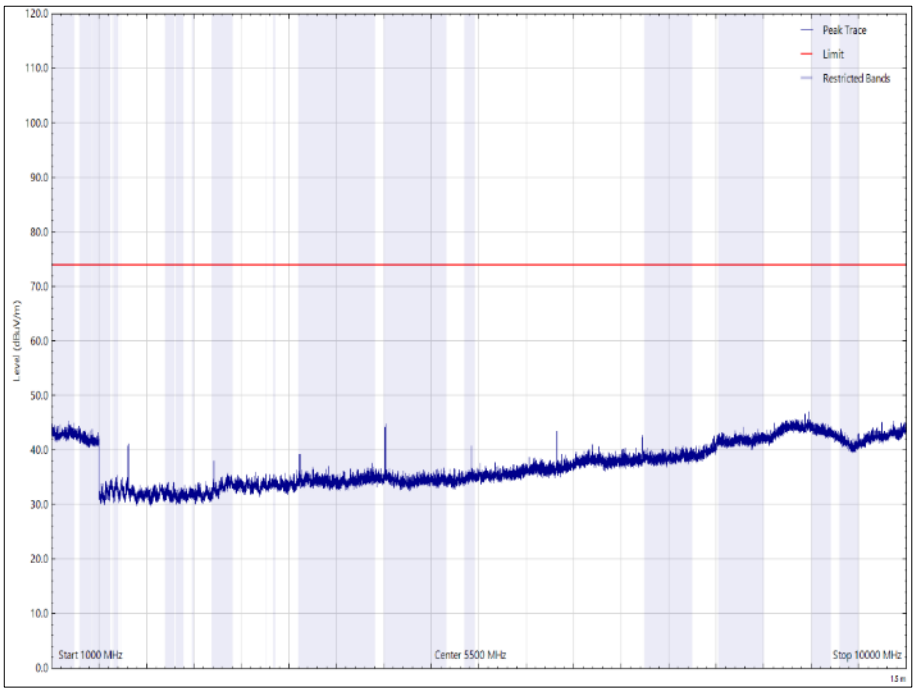

Figure 45 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, Z Orientation - Peak

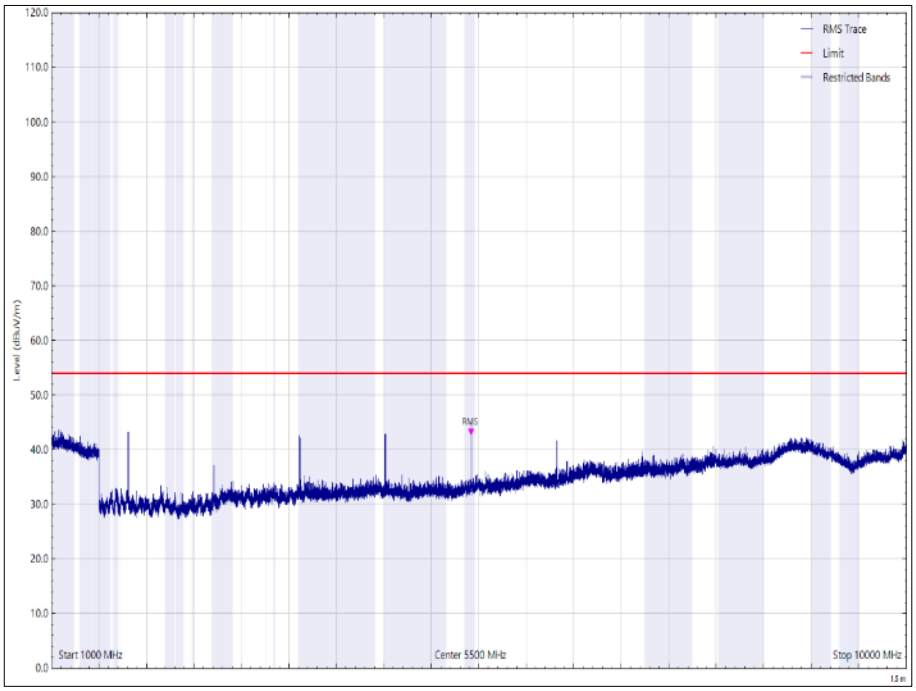

Figure 46 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, Z Orientation - Average

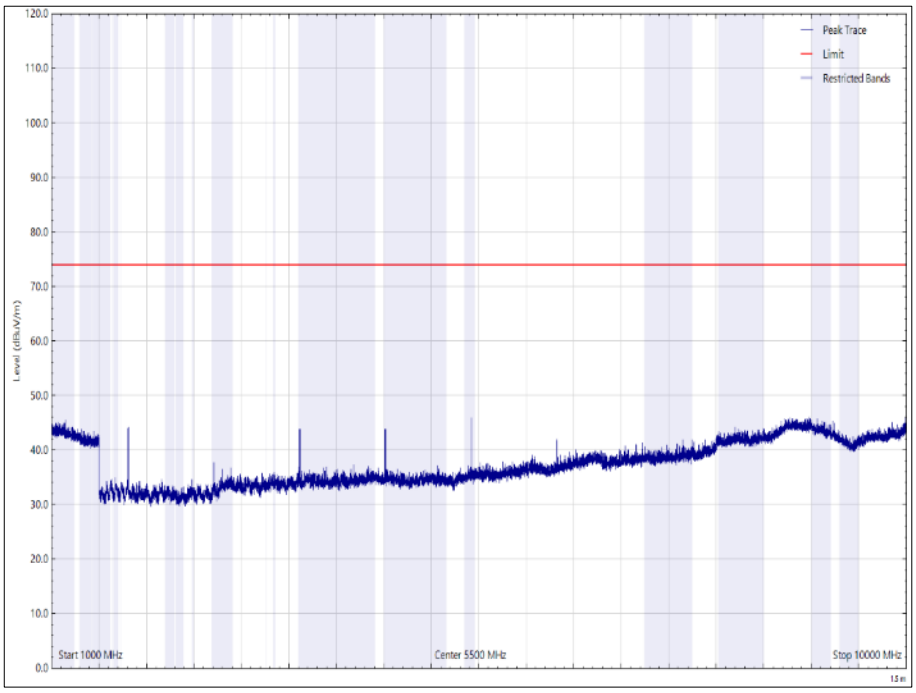

Figure 47 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, Z Orientation - Peak

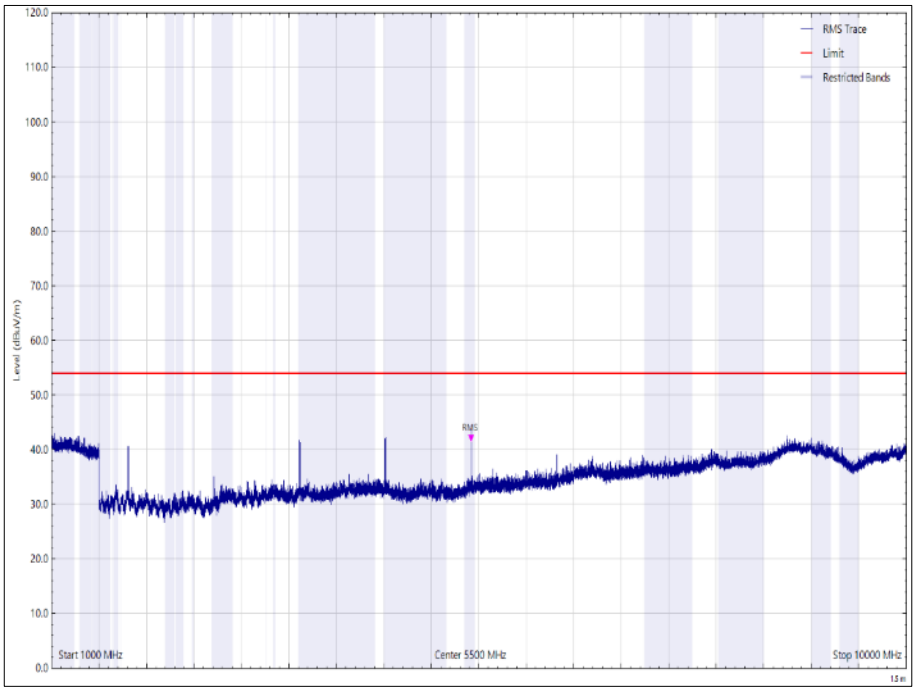

Figure 48 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, Y Orientation - Average

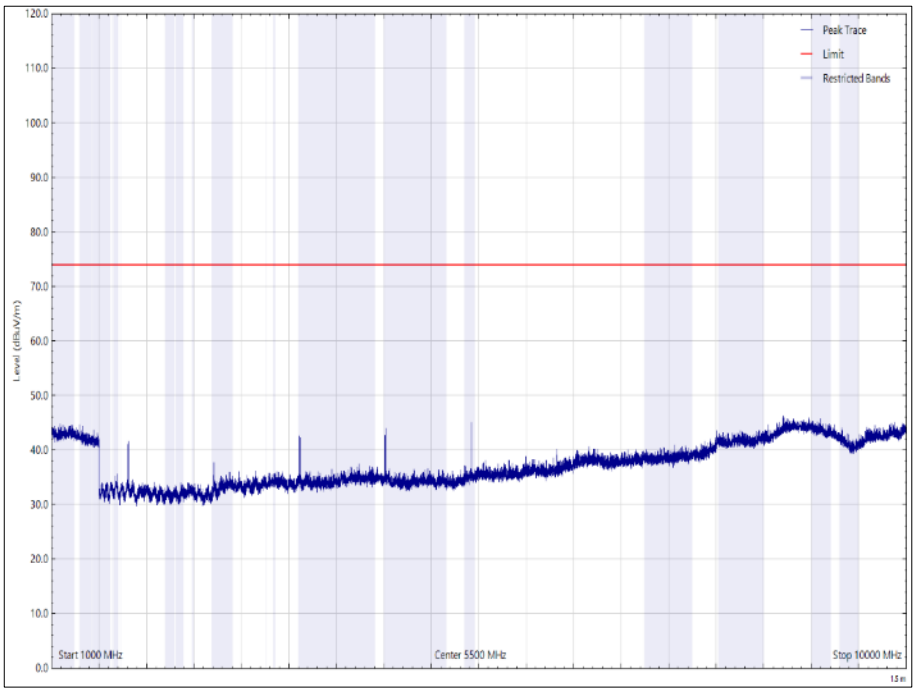

Figure 49 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, Y Orientation - Peak

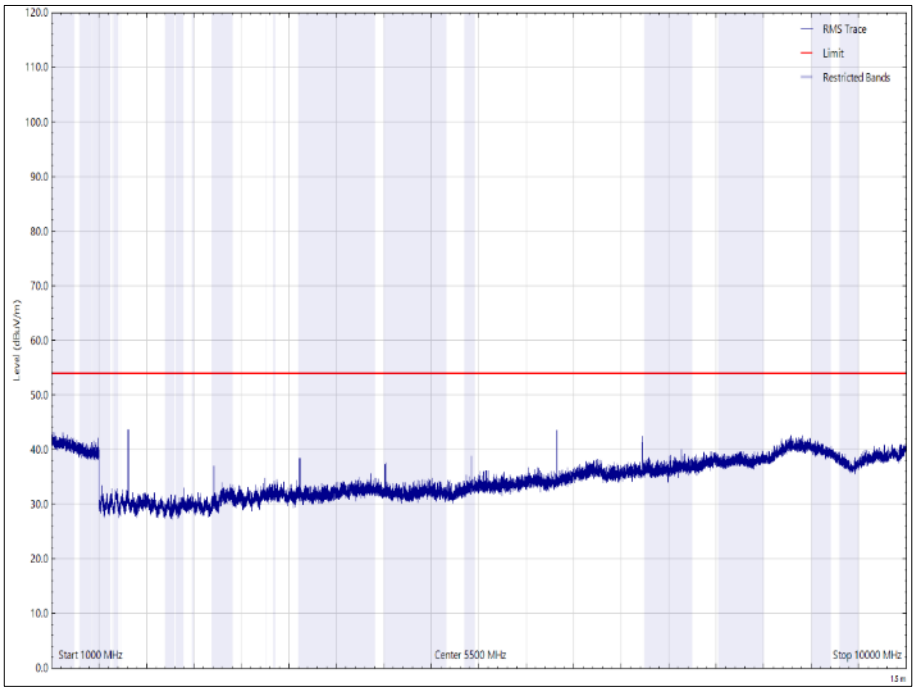

Figure 50 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, Y Orientation - Average

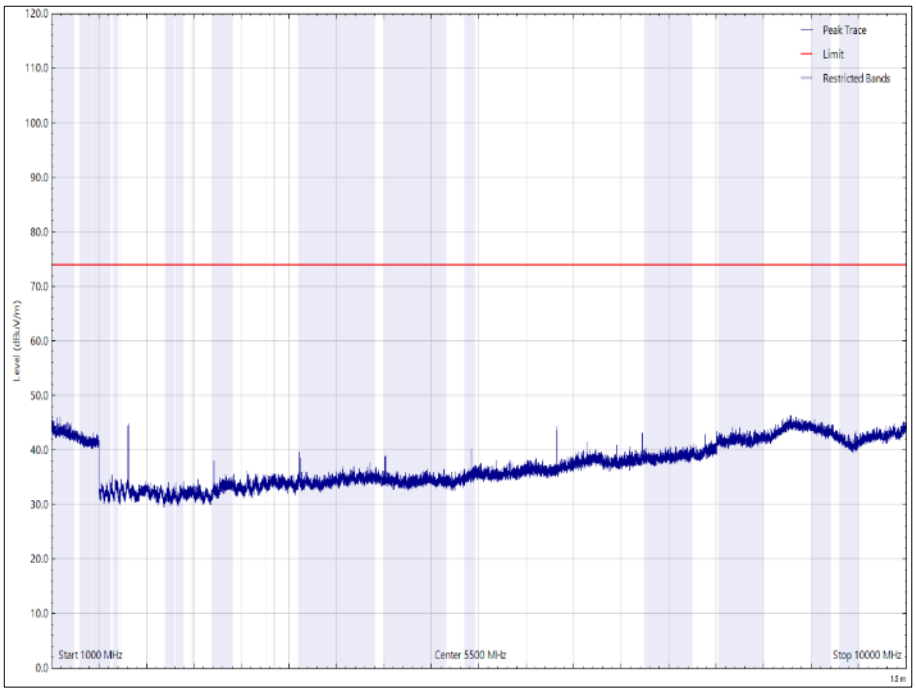

Figure 51 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, Y Orientation - Peak

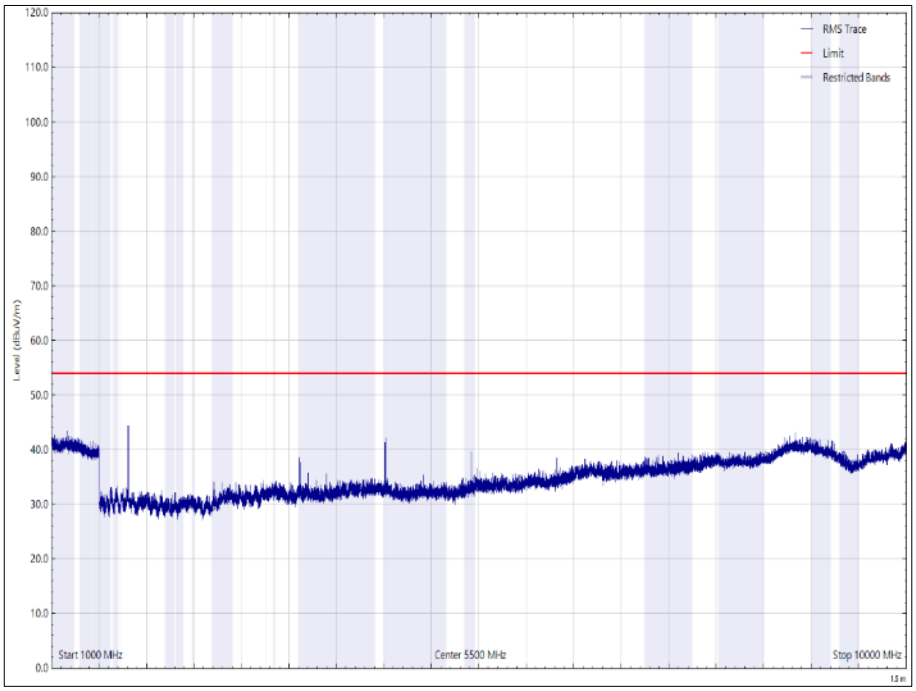

Figure 52 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, X Orientation - Average

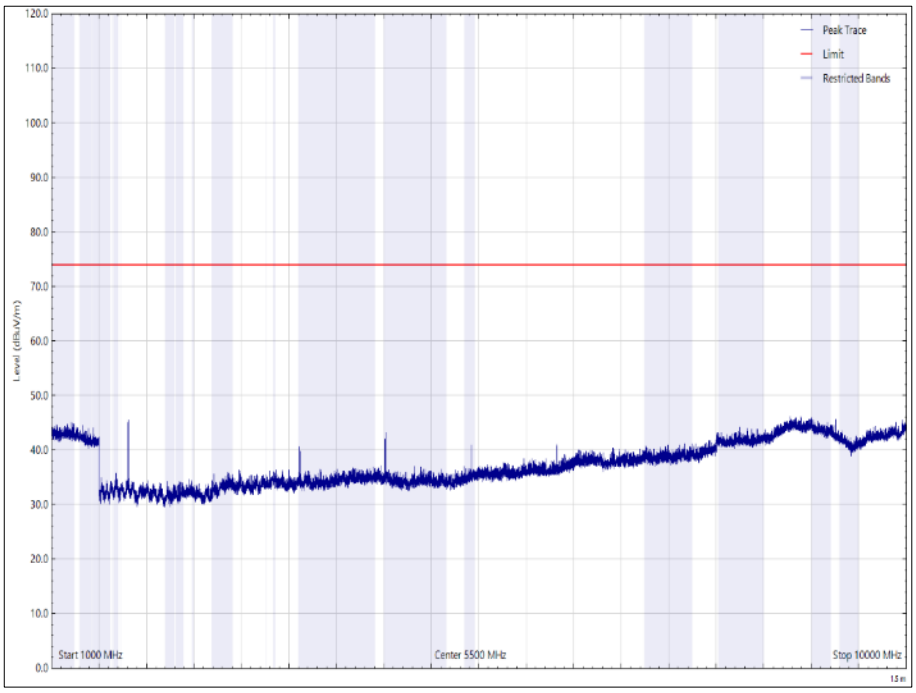

Figure 53 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Horizontal, X Orientation - Peak

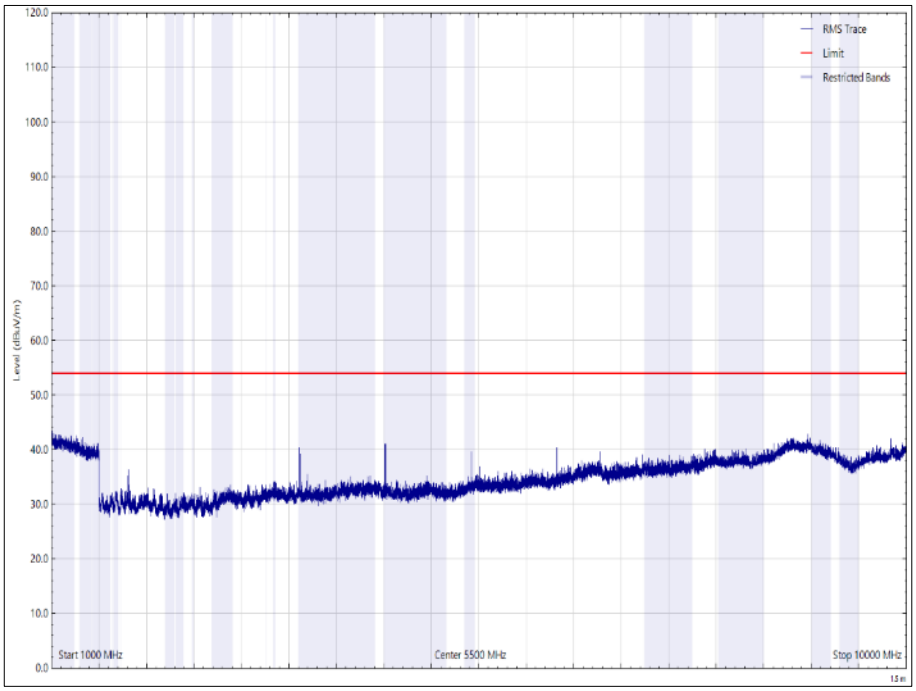

Figure 54 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, X Orientation - Average

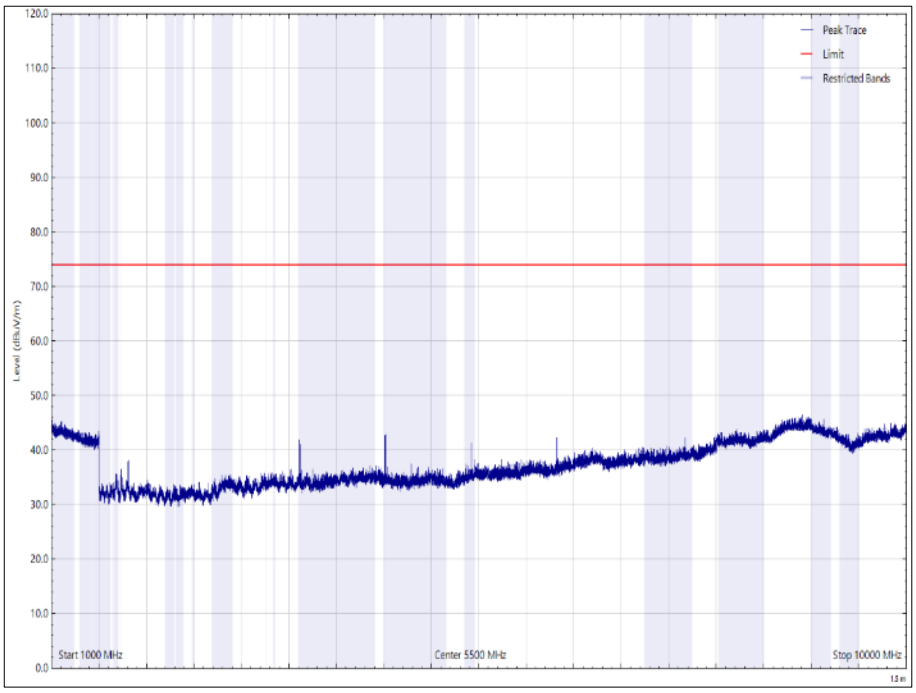

Figure 55 - 902.775 MHz, 1 GHz to 10 GHz - Antenna 1, Vertical, X Orientation - Peak

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

Table 30 - 915.000 MHz, 30 MHz to 1 GHz

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

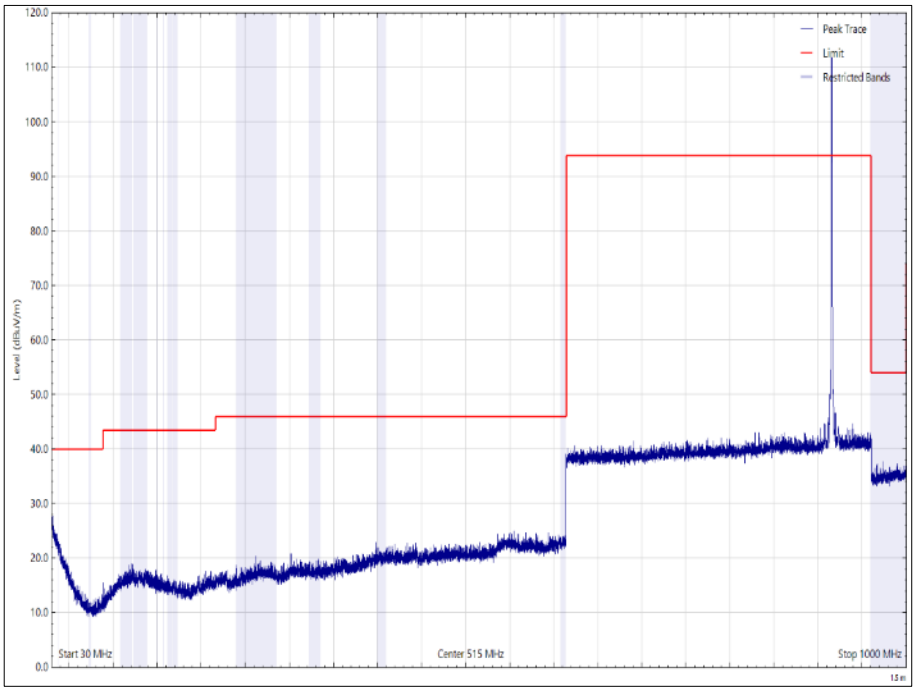

Figure 56 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, Z Orientation

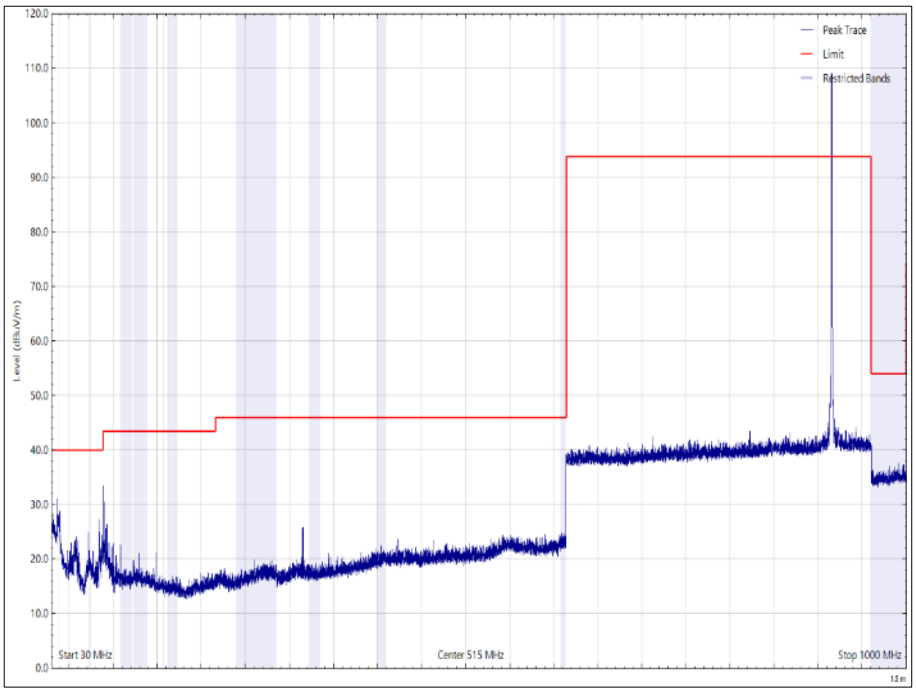

Figure 57 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, Z Orientation

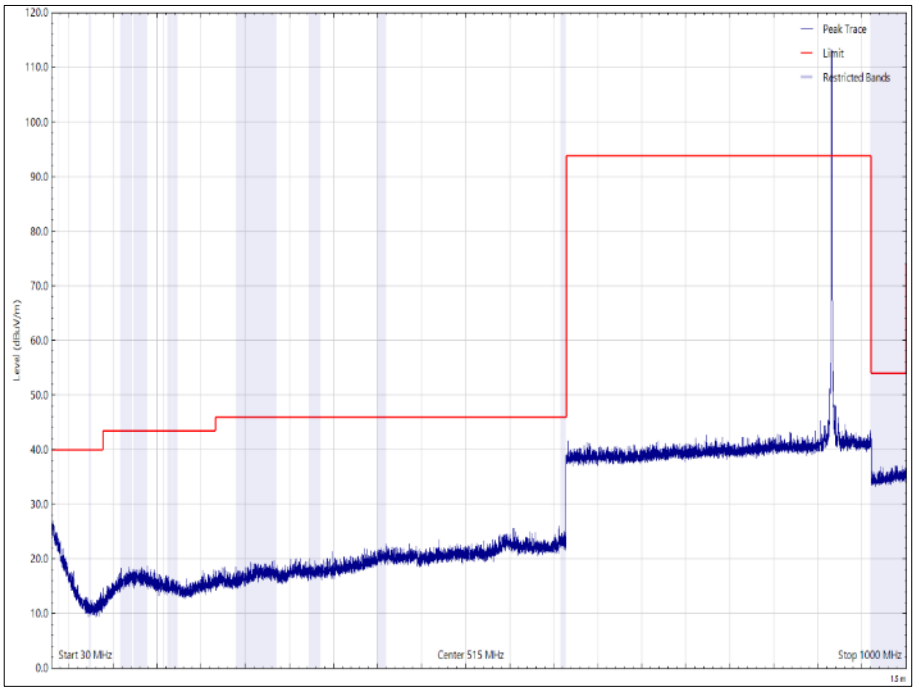

Figure 58 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, Y Orientation

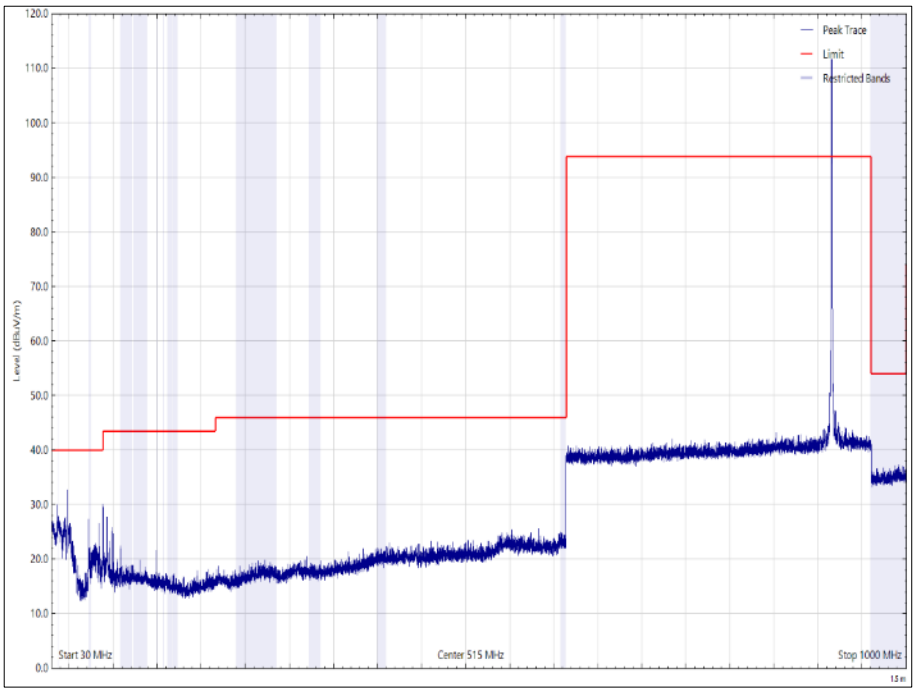

Figure 59 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, Y Orientation

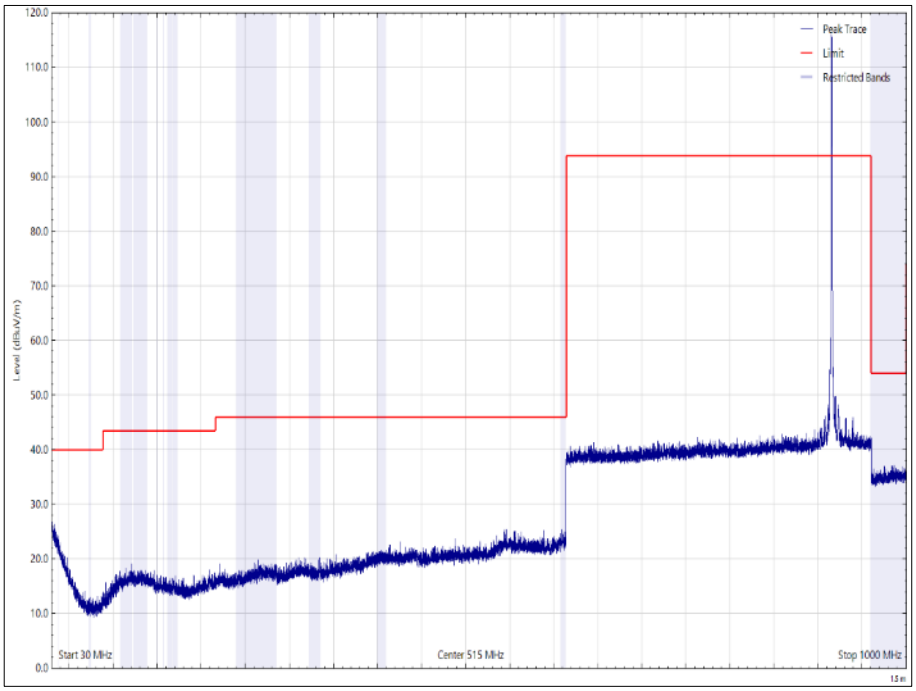

Figure 60 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Horizontal, X Orientation

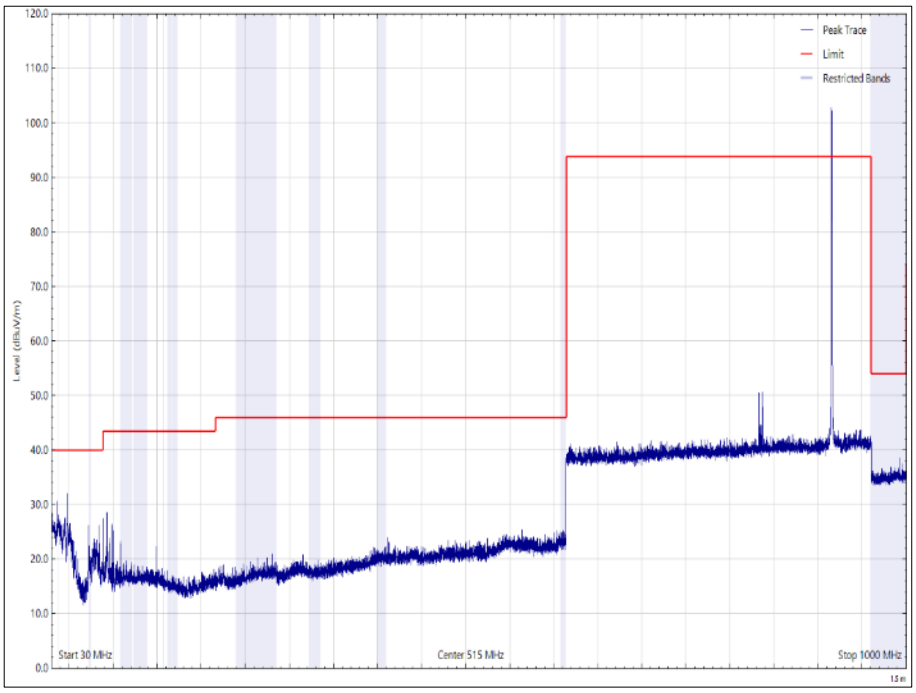

Figure 61 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 2, Vertical, X Orientation

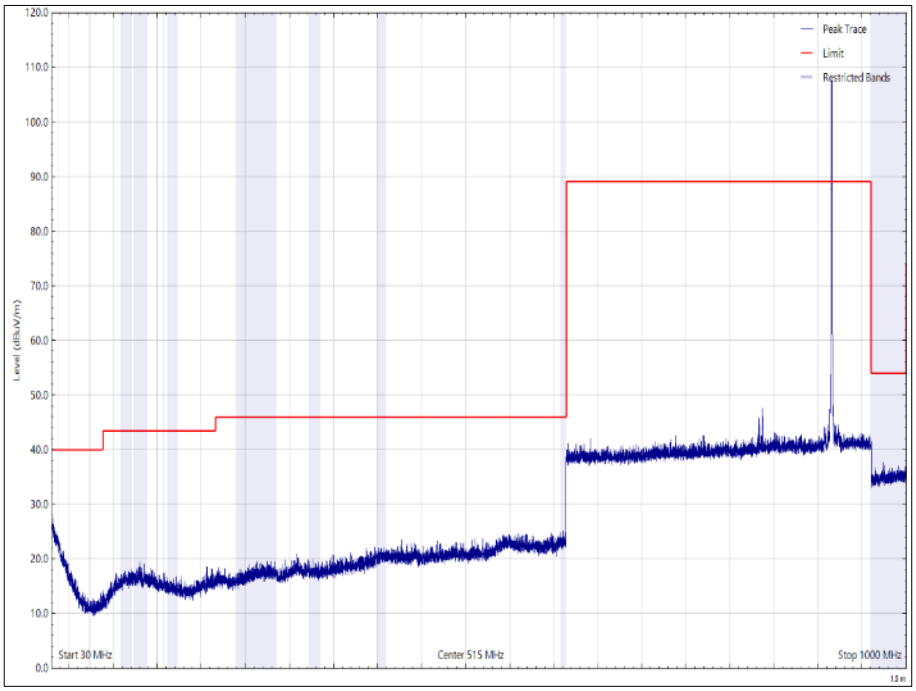

Figure 62 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, Z Orientation

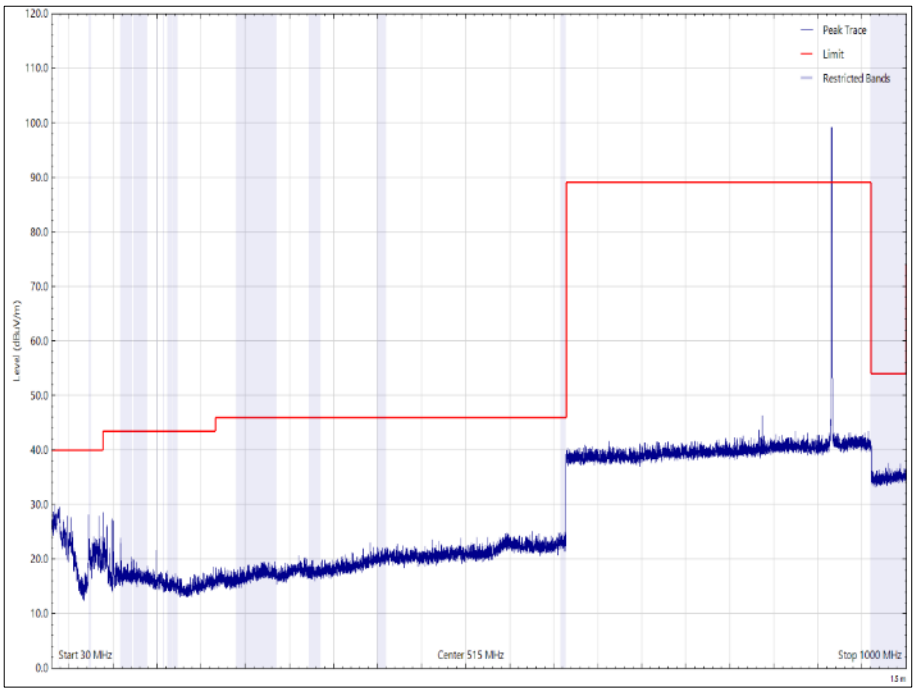

Figure 63 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, Z Orientation

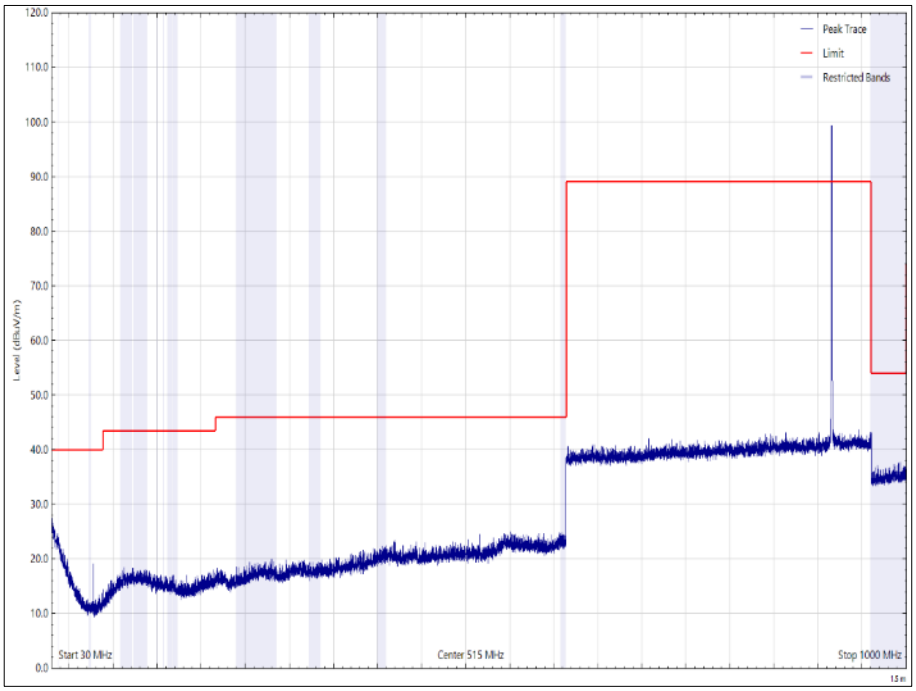

Figure 64 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, Y Orientation

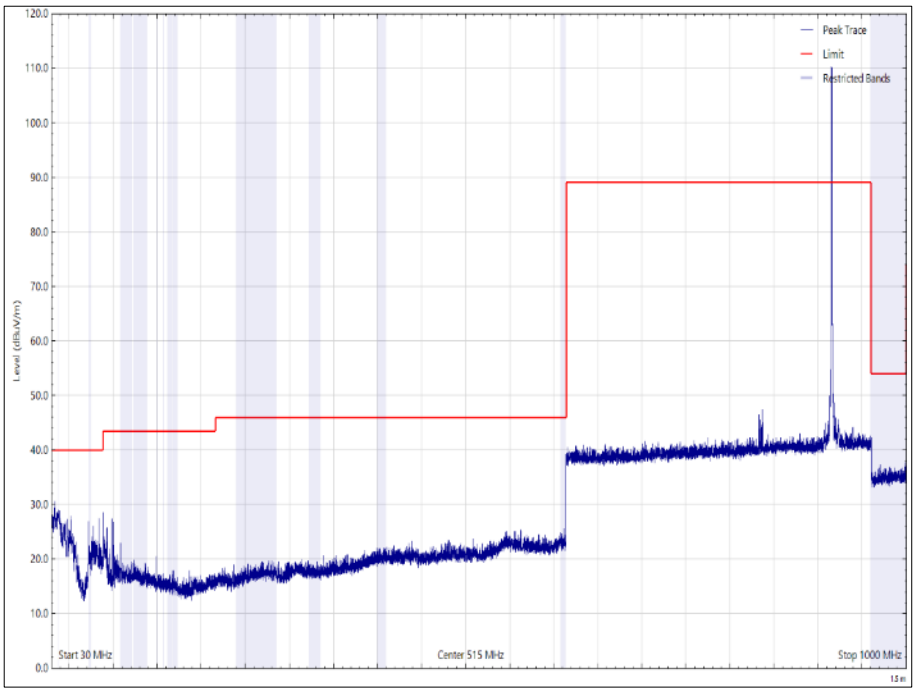

Figure 65 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, Y Orientation

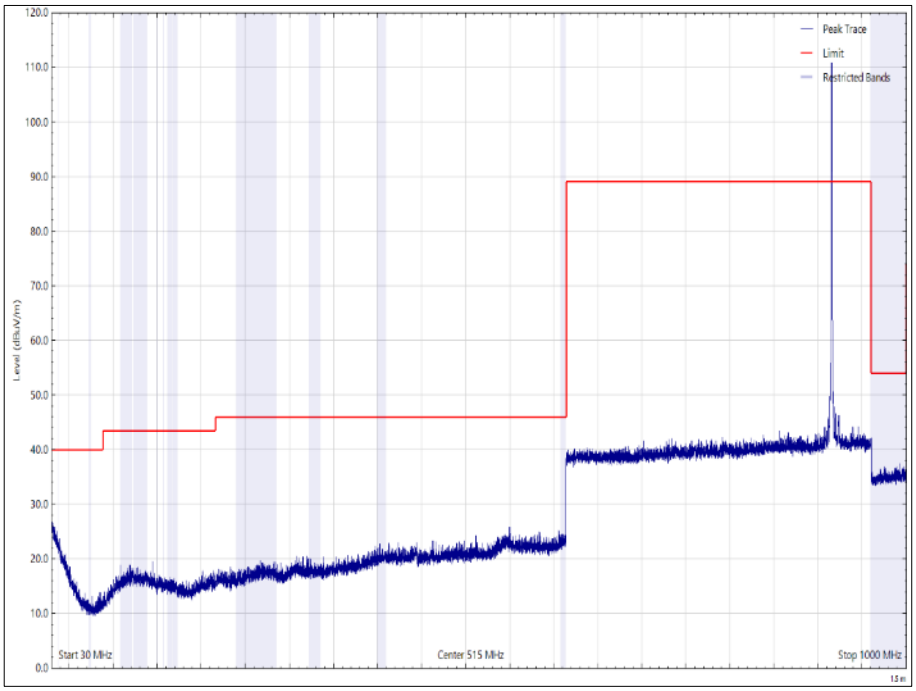

Figure 66 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Horizontal, X Orientation

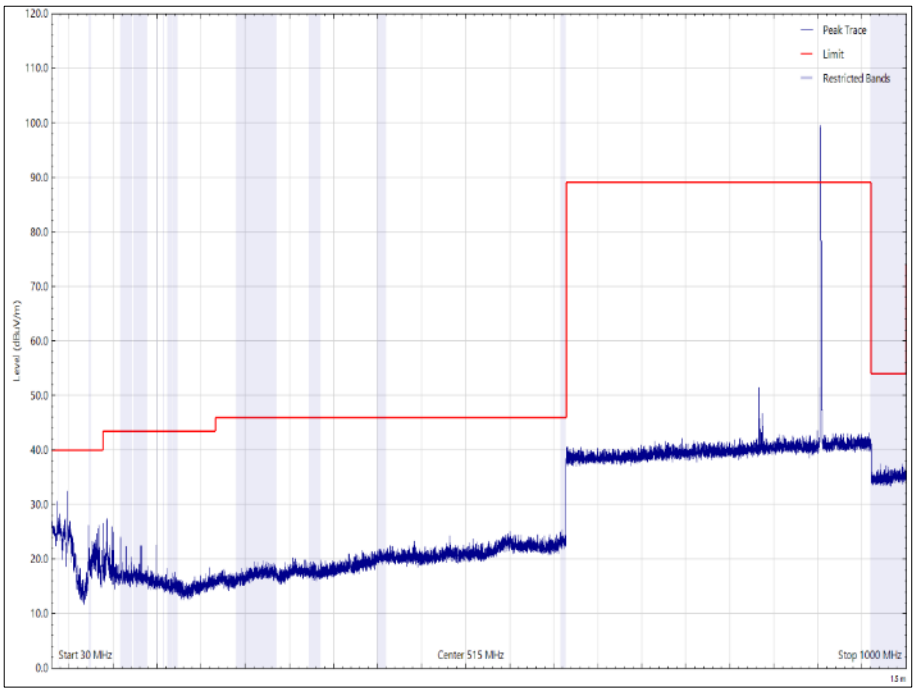

Figure 67 - 915.000 MHz, 30 MHz to 1 GHz - Antenna 1, Vertical, X Orientation

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

Table 31 - 915.000 MHz - 1 GHz to 10 GHz

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

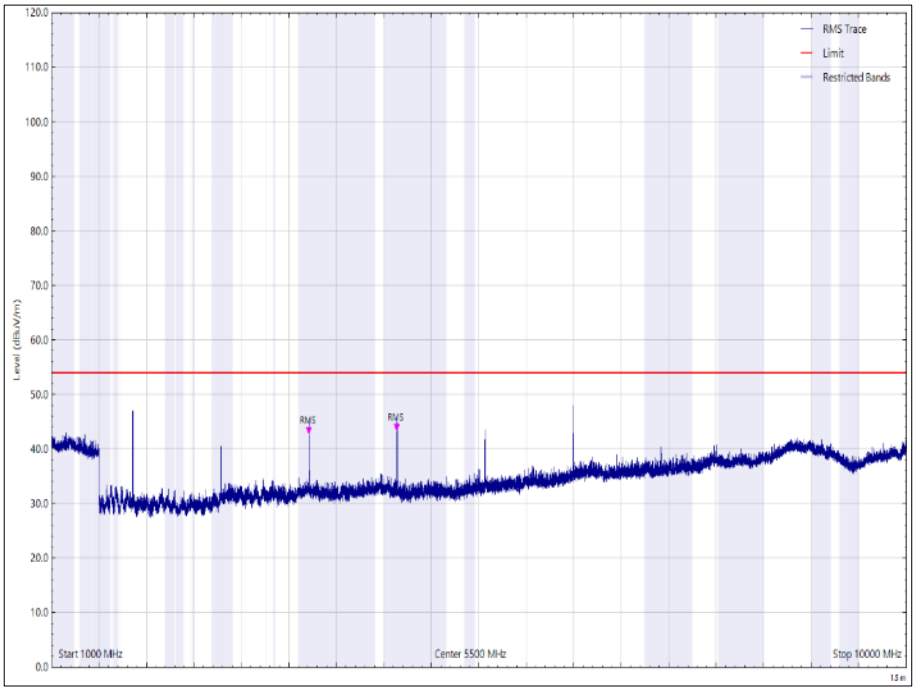

Figure 68 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, Z Orientation - Average

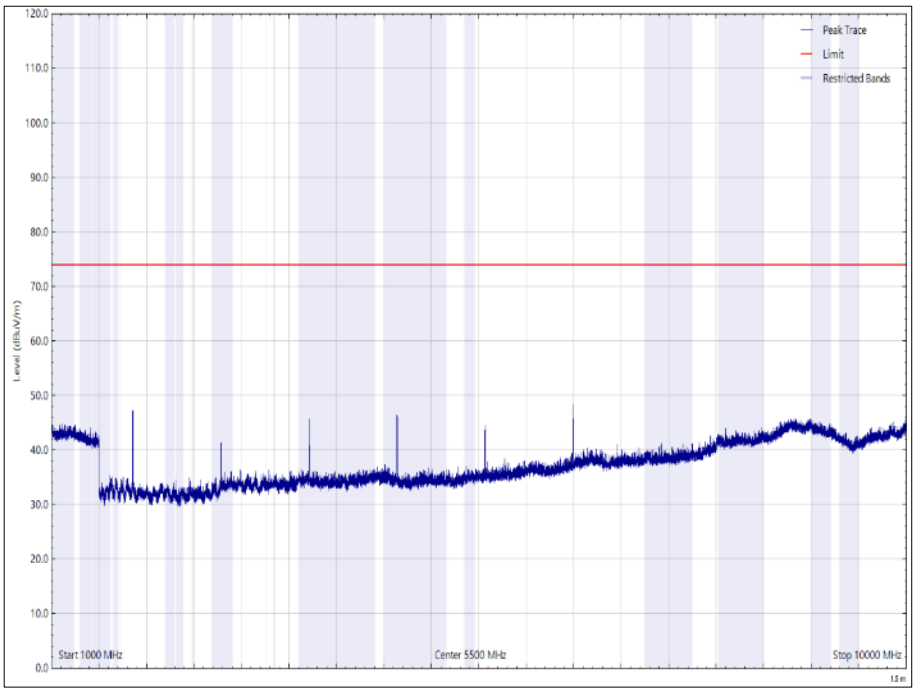

Figure 69 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, Z Orientation - Peak

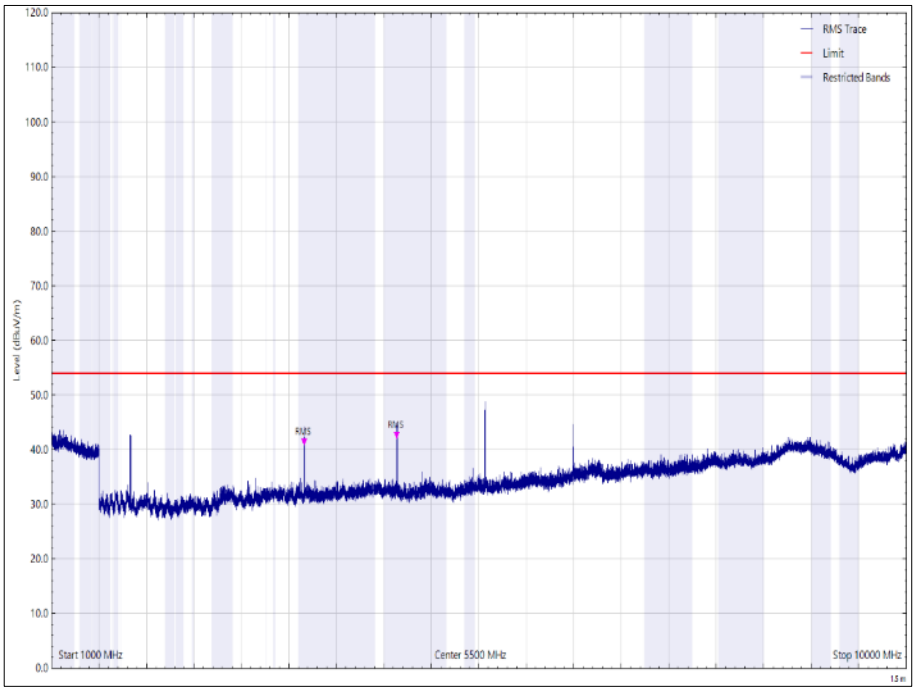

Figure 70 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, Z Orientation - Average

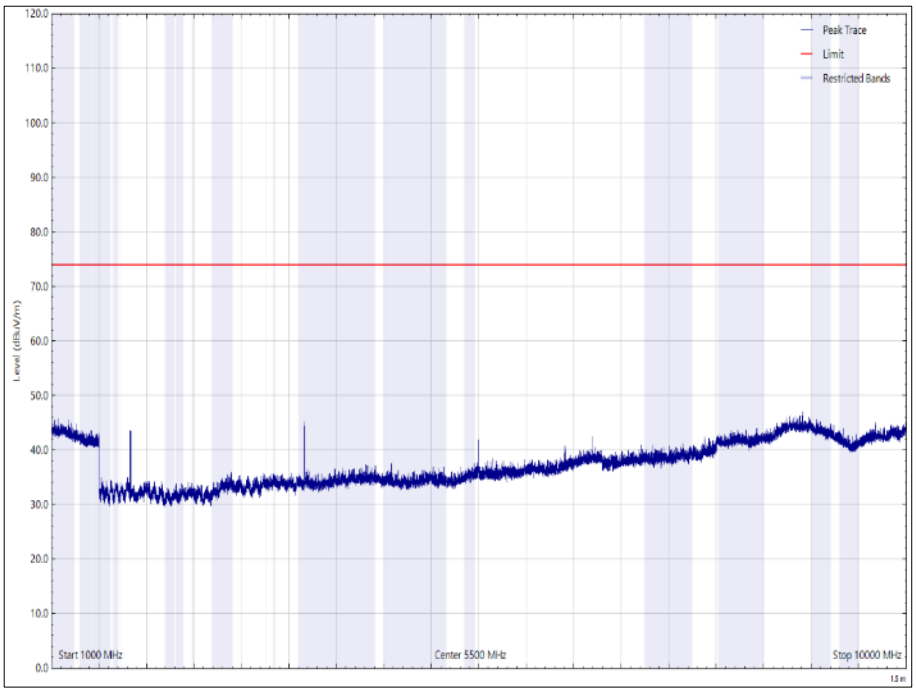

Figure 71 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, Z Orientation - Peak

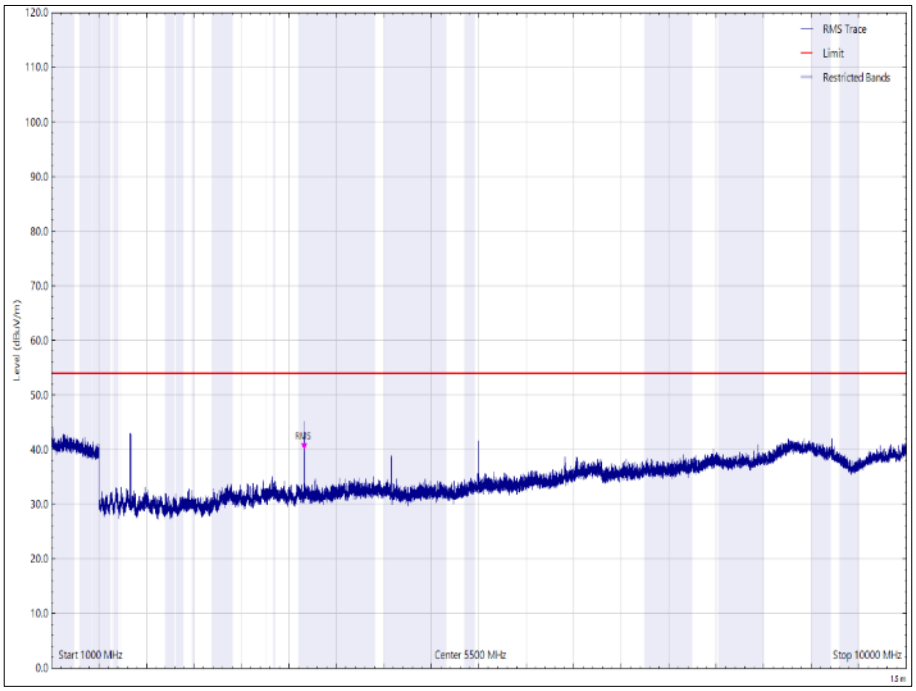

Figure 72 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, Y Orientation - Average

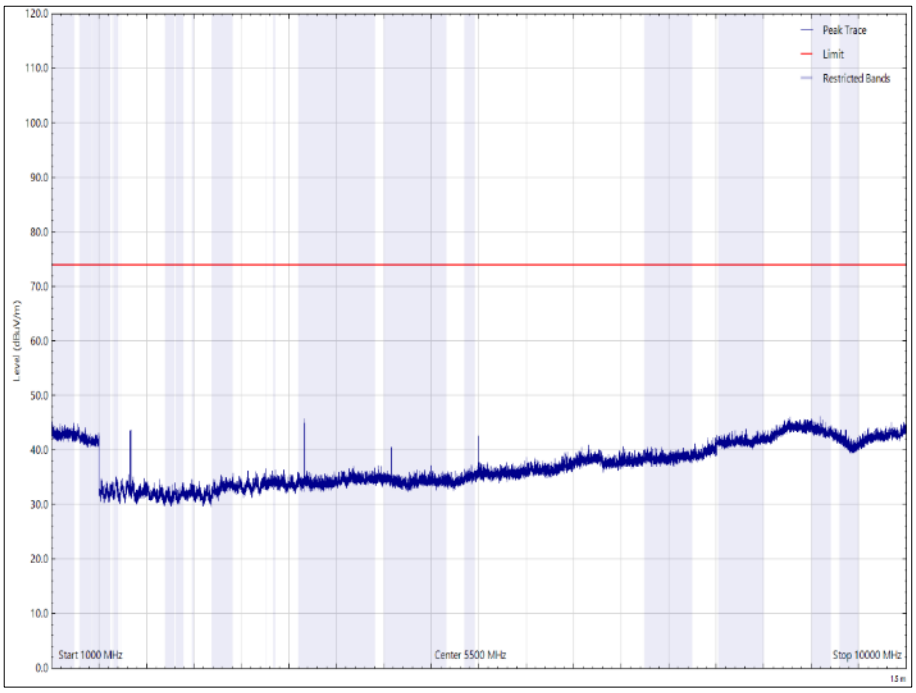

Figure 73 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, Y Orientation - Peak

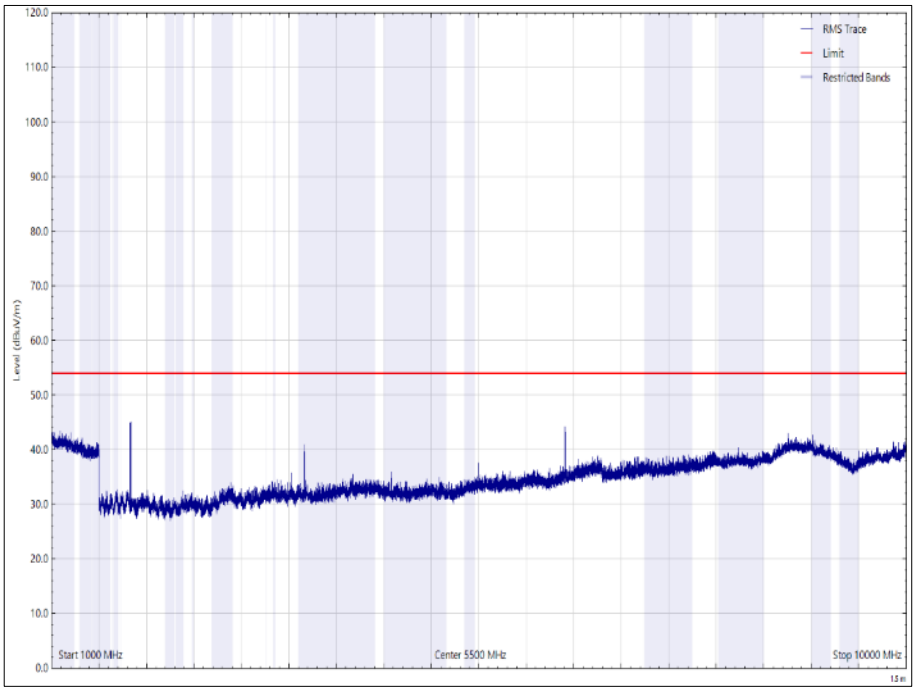

Figure 74 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, Y Orientation - Average

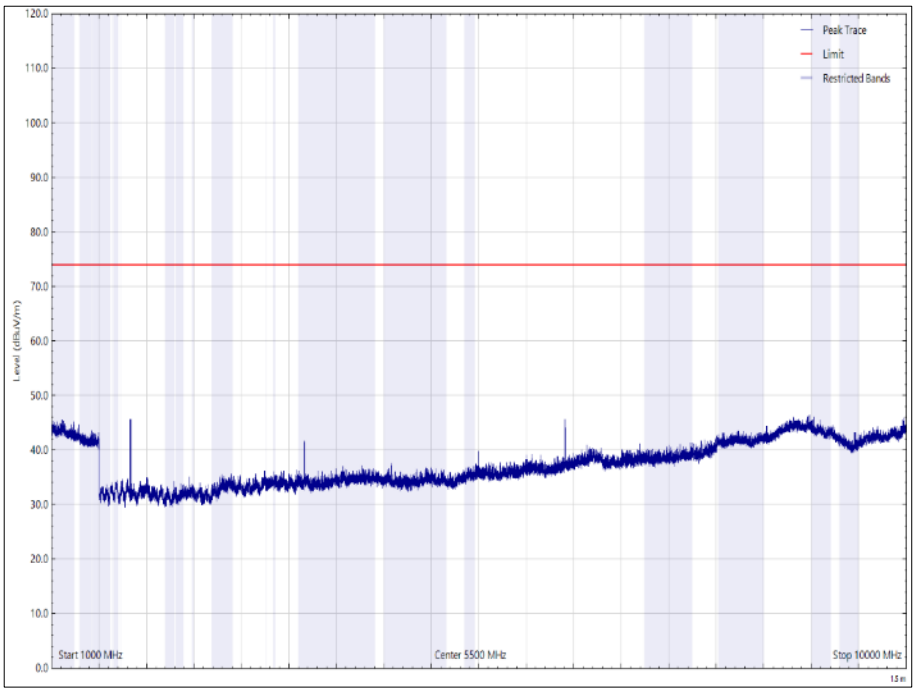

Figure 75 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, Y Orientation - Peak

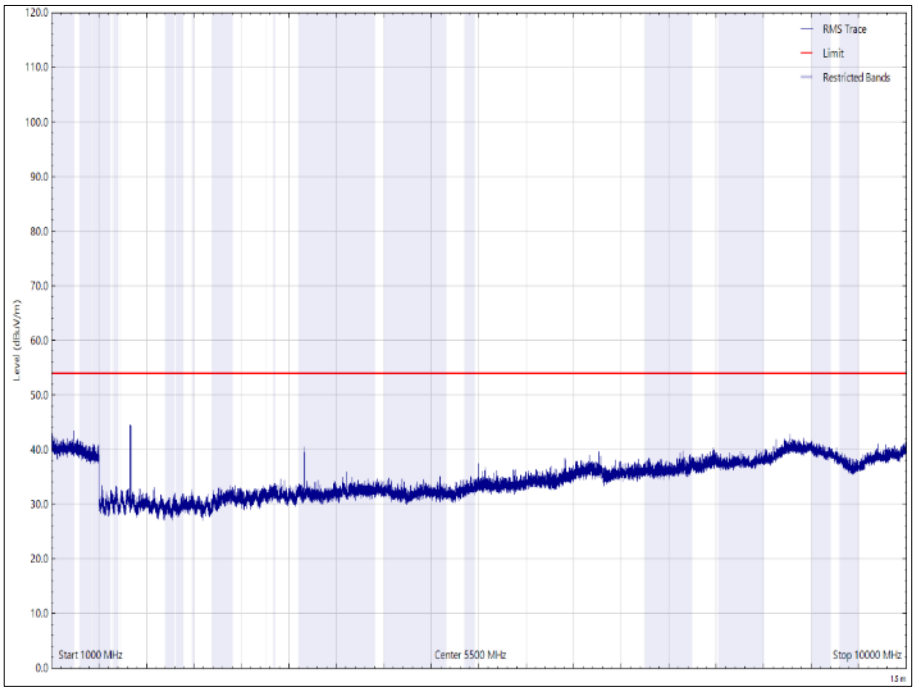

Figure 76 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, X Orientation - Average

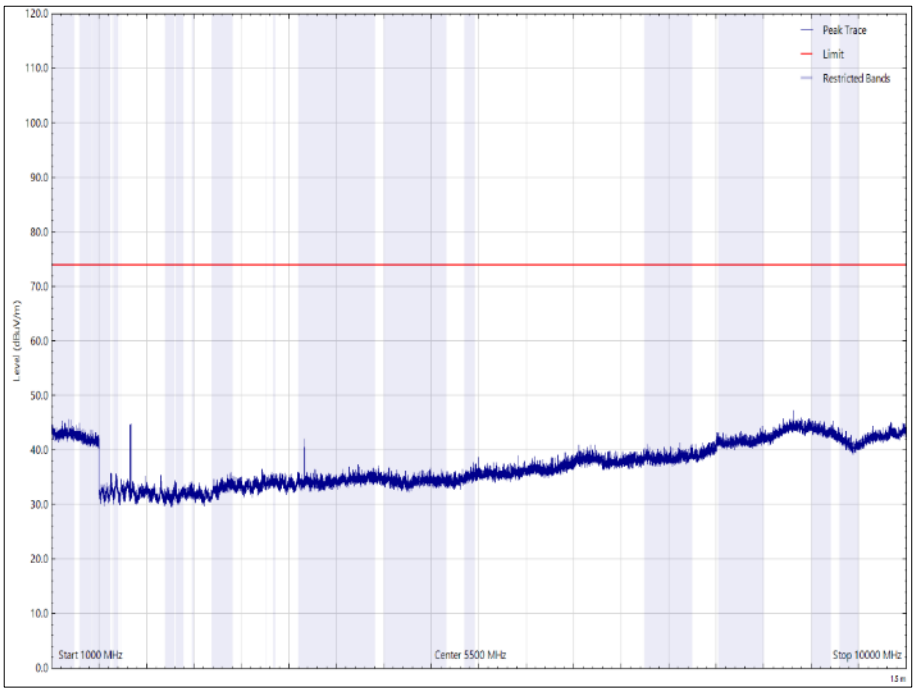

Figure 77 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Horizontal, X Orientation - Peak

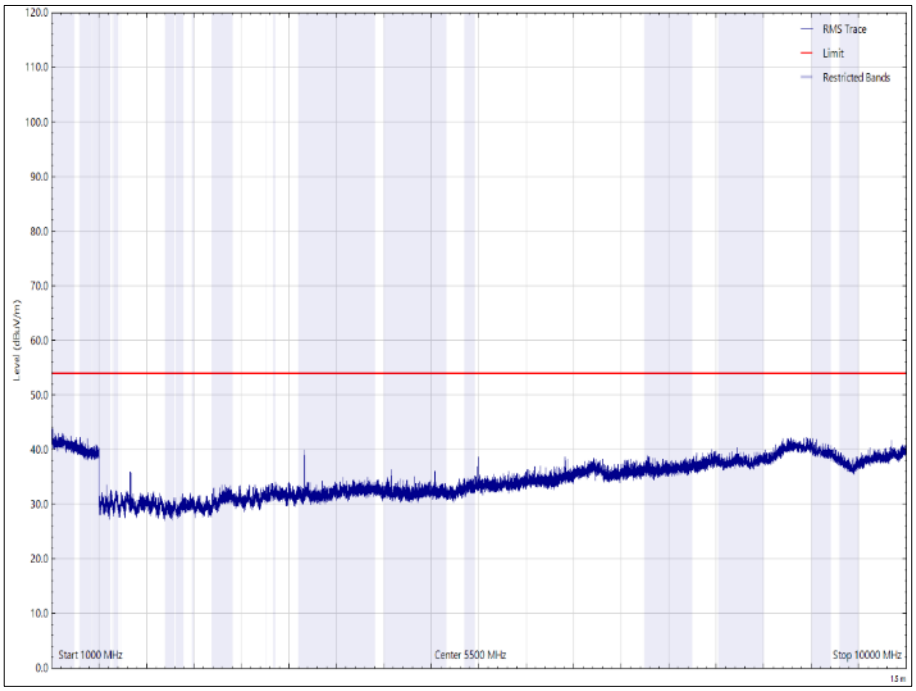

Figure 78 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, X Orientation - Average

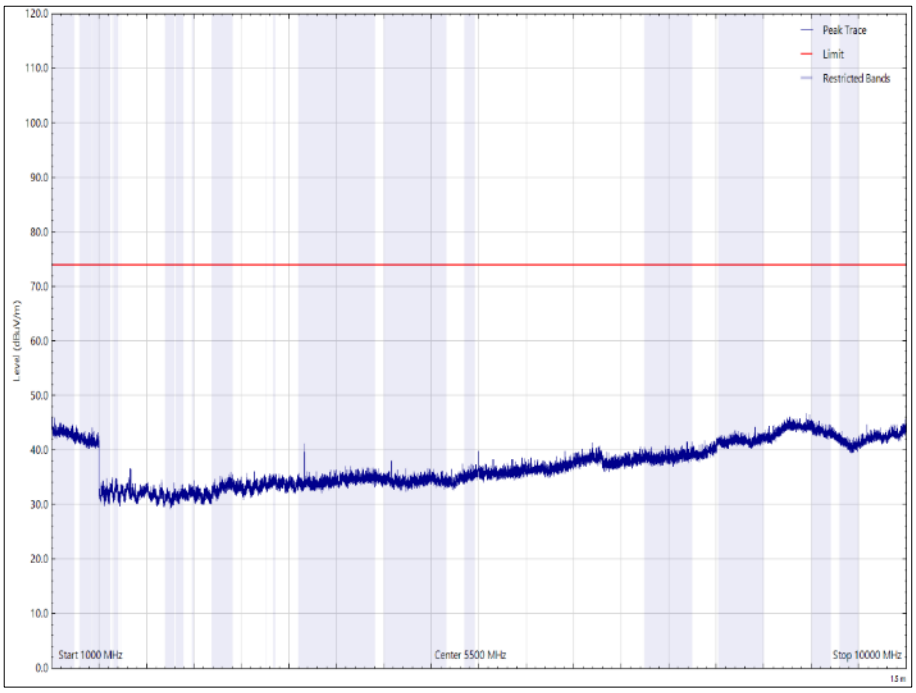

Figure 79 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 2, Vertical, X Orientation - Peak

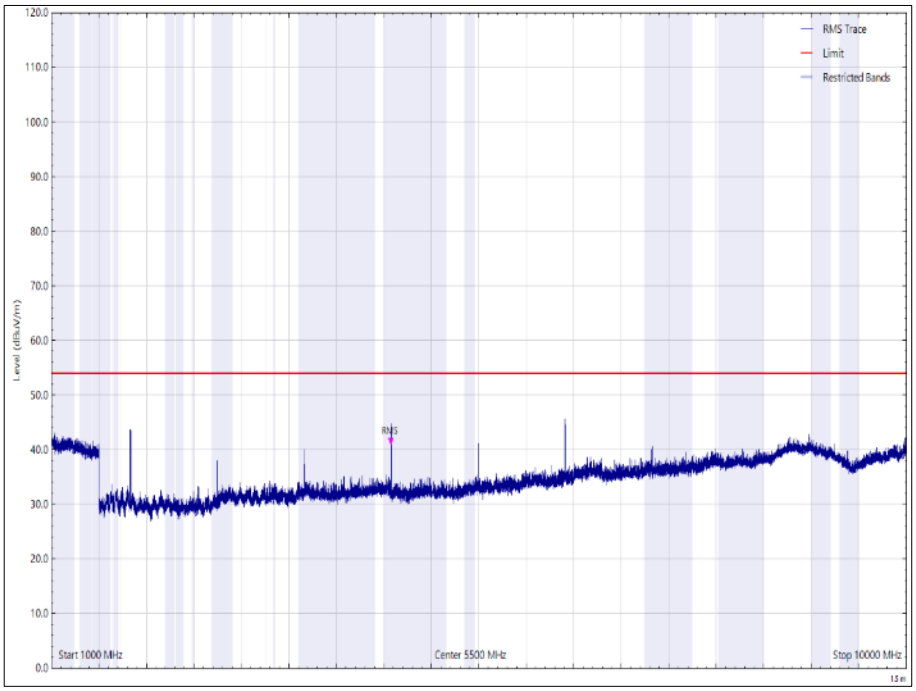

Figure 80 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, Z Orientation - Average

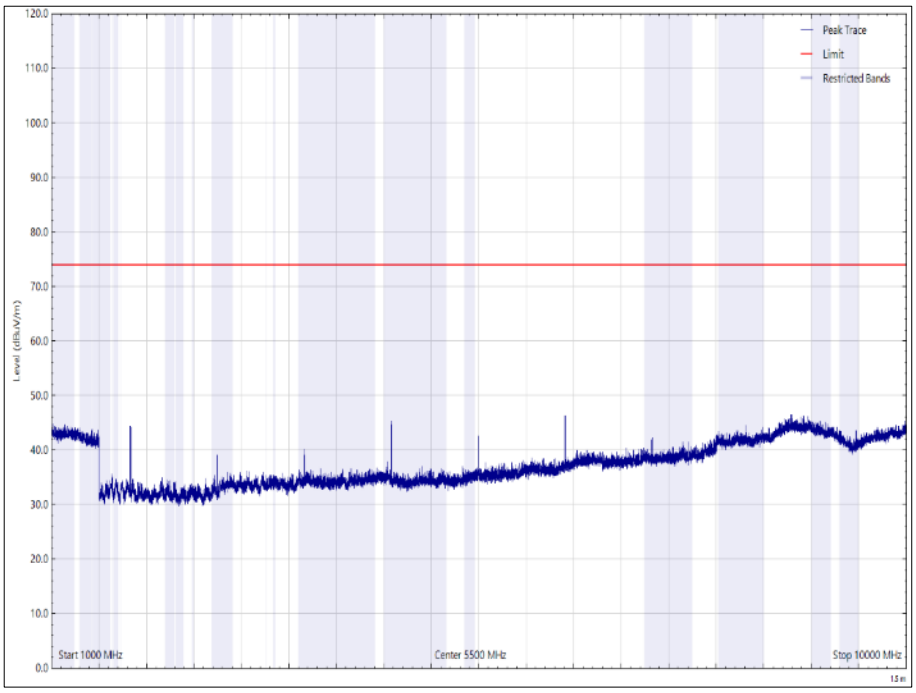

Figure 81 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, Z Orientation - Peak

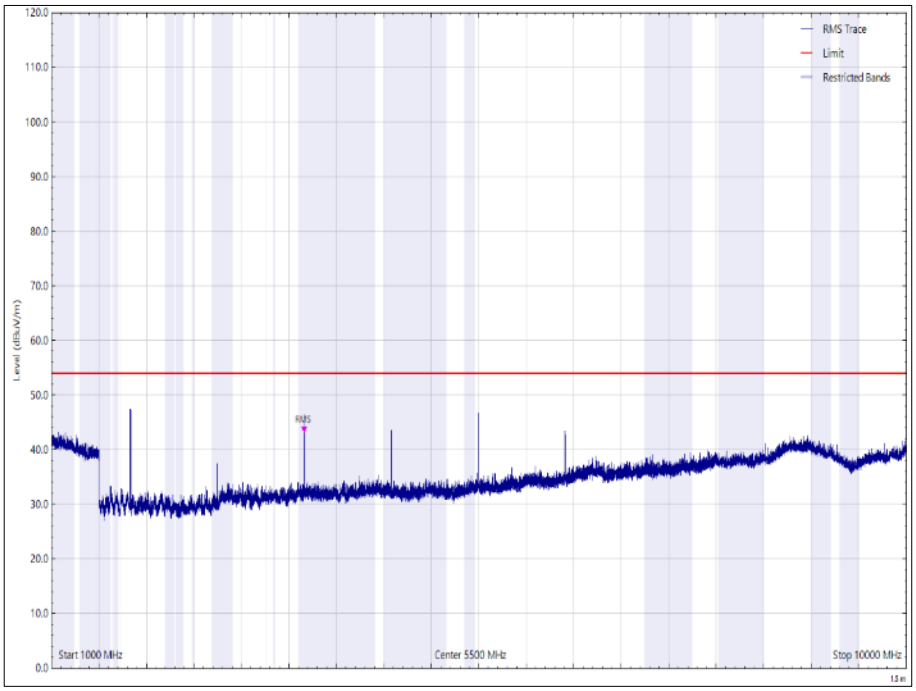

Figure 82 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, Z Orientation - Average

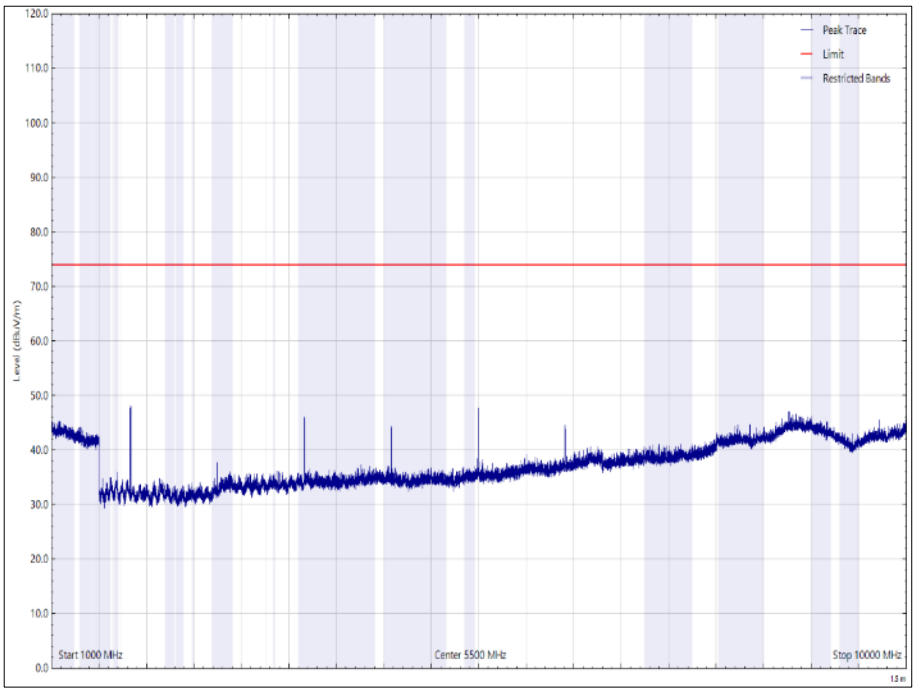

Figure 83 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, Z Orientation - Peak

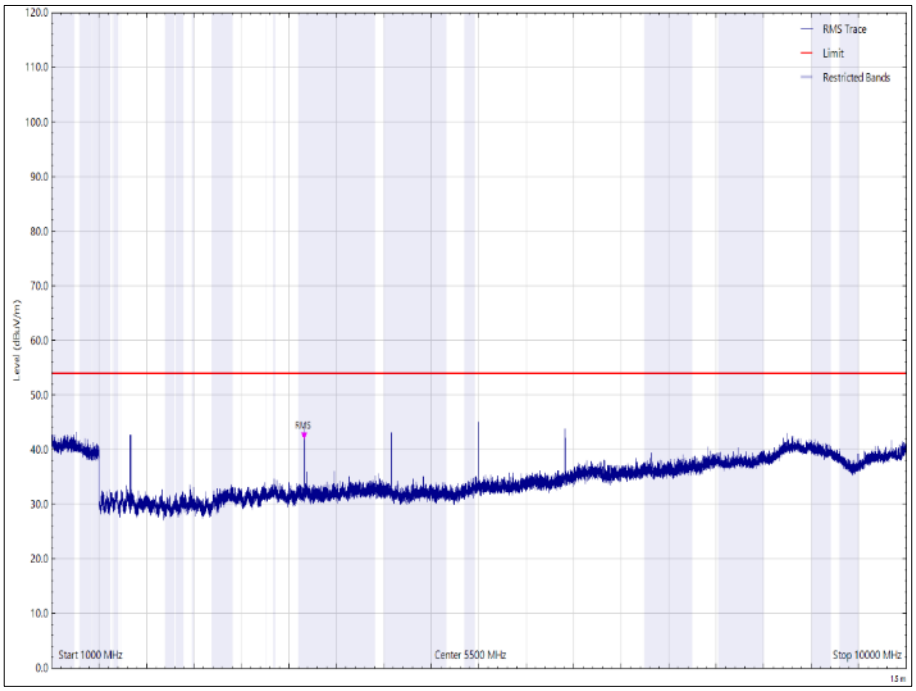

Figure 84 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, Y Orientation - Average

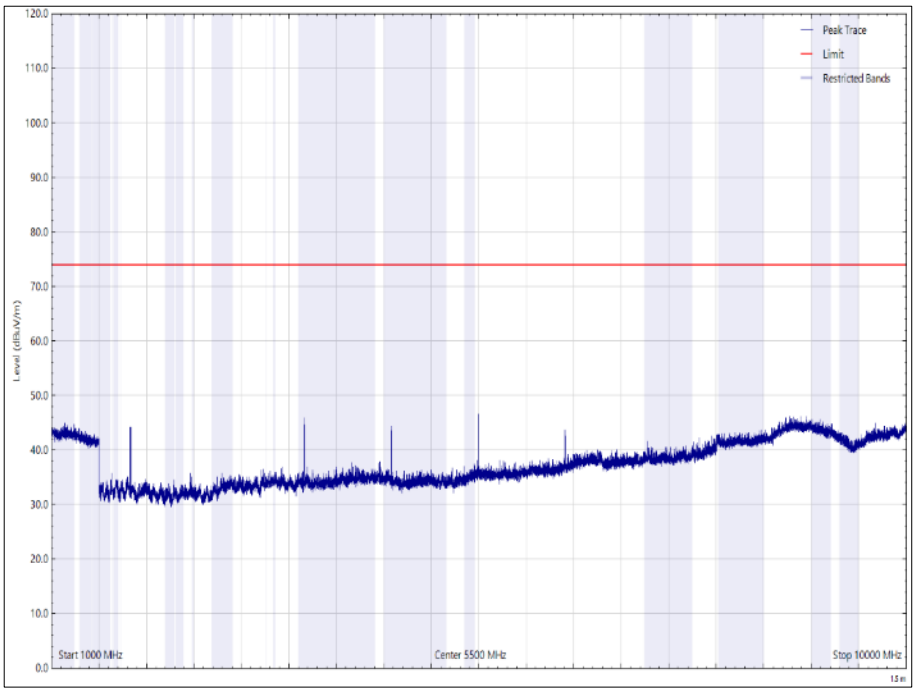

Figure 85 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, Y Orientation - Peak

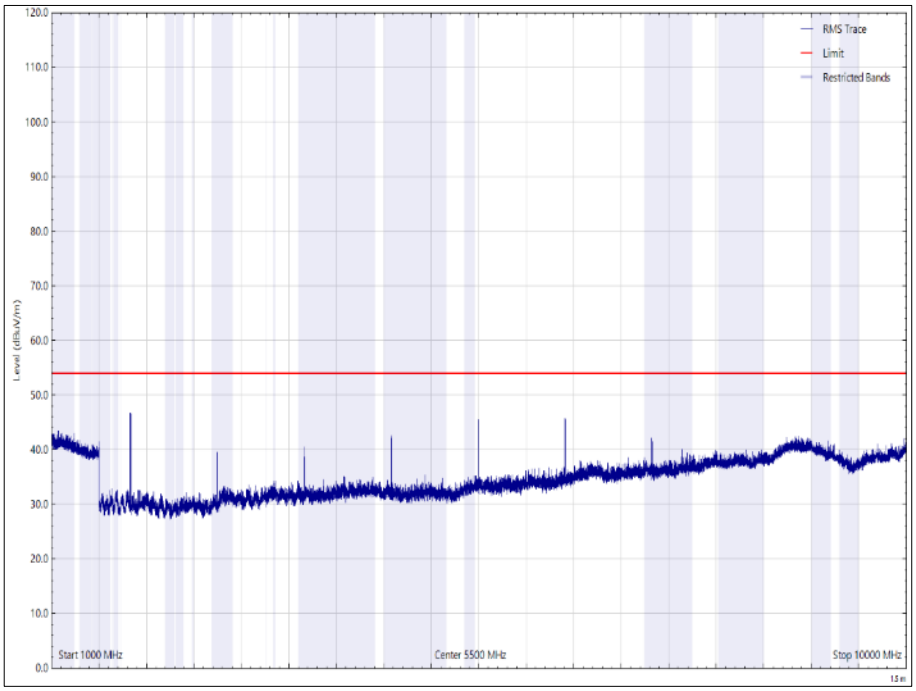

Figure 86 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, Y Orientation - Average

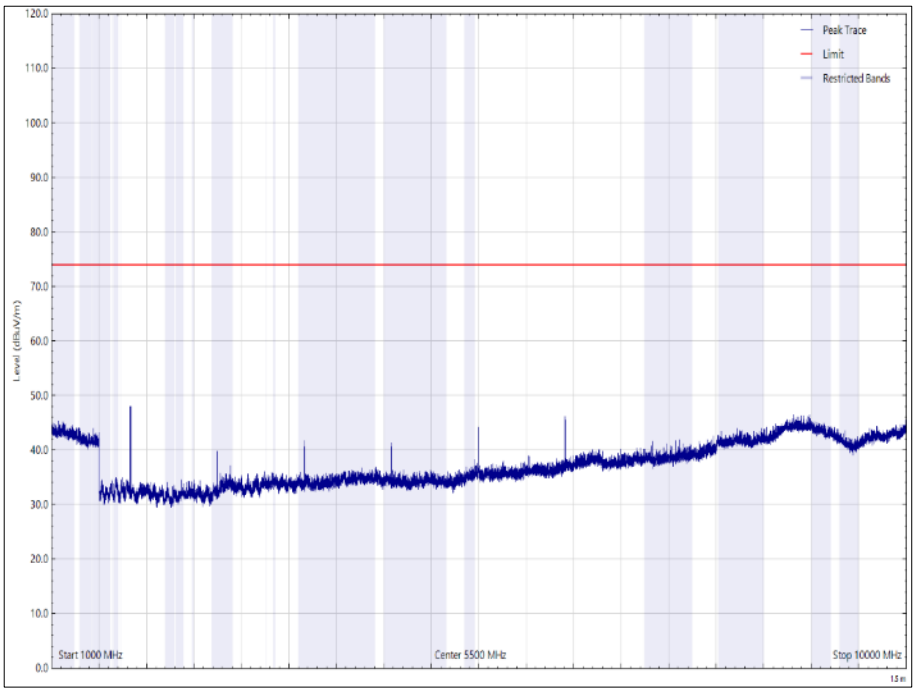

Figure 87 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, Y Orientation - Peak

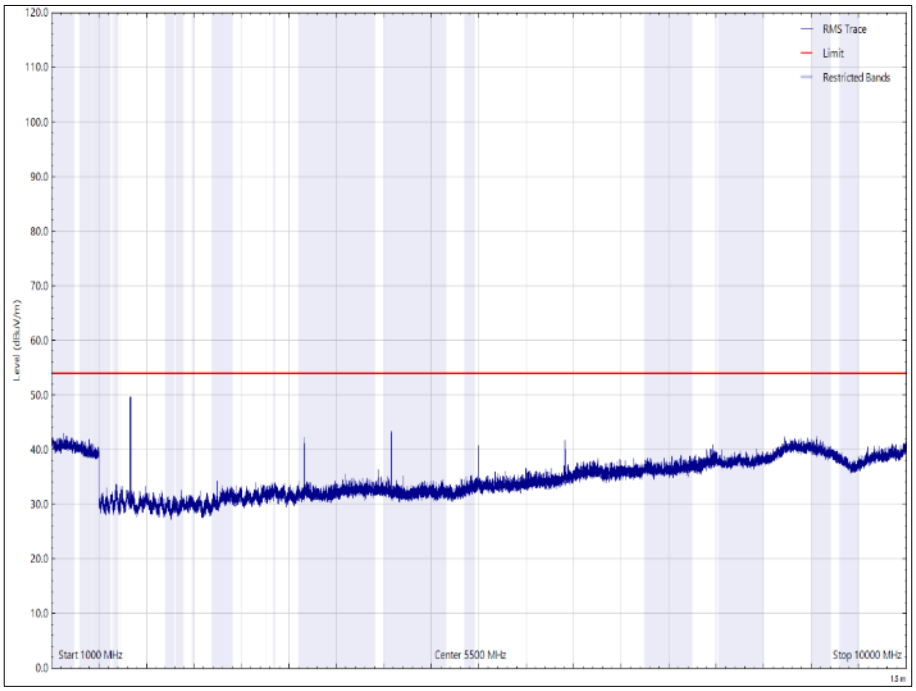

Figure 88 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, X Orientation - Average

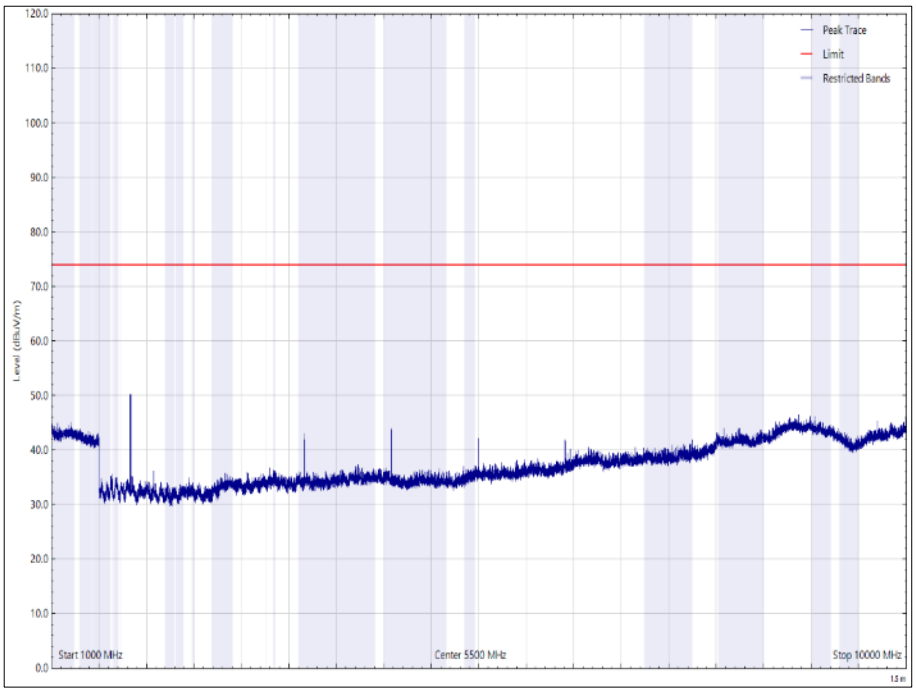

Figure 89 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Horizontal, X Orientation - Peak

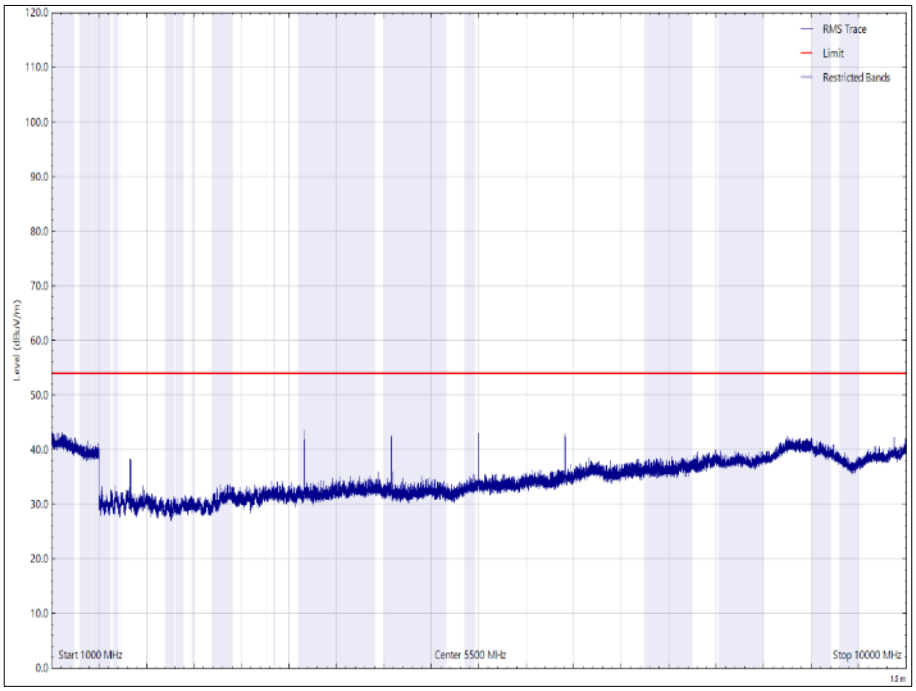

Figure 90 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, X Orientation - Average

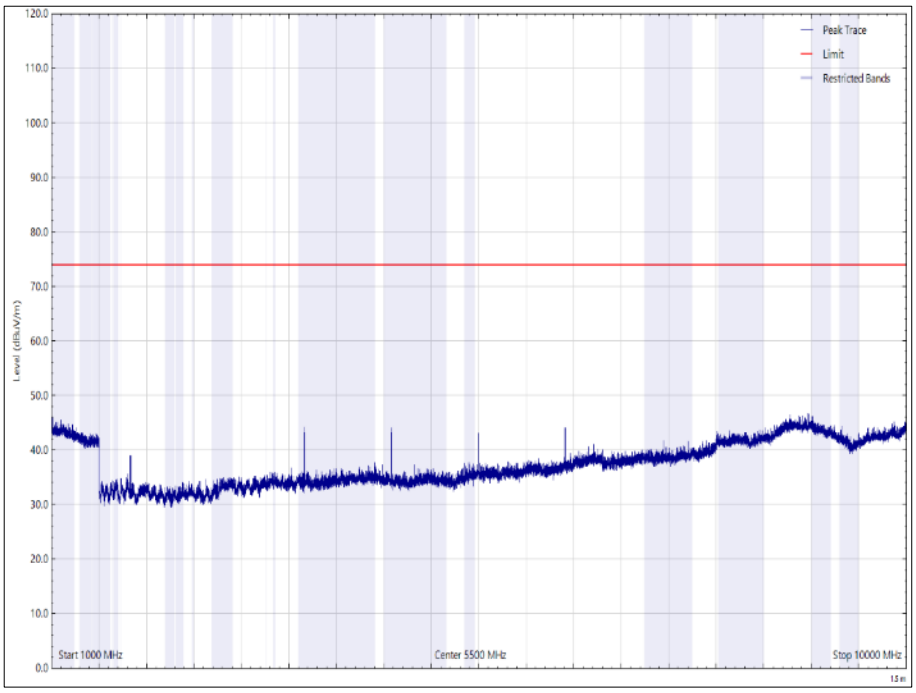

Figure 91 - 915.000 MHz - 1 GHz to 10 GHz - Antenna 1, Vertical, X Orientation - Peak