FCC Test Report

Shot Scope Technologies Ltd
Shot Scope, Model: H4

In accordance with FCC 47 CFR Part 15B

Prepared for: Shot Scope Technologies Ltd
Unit 27, Castlebrae Business Centre
40 Peffer Place, Edinburgh
EH16 4BB, UNITED KINGDOM

FCC ID: 2AHWR-SS05

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Document 75954182-02 Issue 02

SIGNATURE			
A J Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andy Lawson	Chief Engineer, EMC	Authorised Signatory	25 May 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 15B. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	25 May 2022	G. Lawler.

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 15B: 2020 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	07 March 2022
2	Correction of title on the front page	25 May 2022

Table 1

1.2 Introduction

Applicant	Shot Scope Technologies Ltd
Manufacturer	Shot Scope Technologies Ltd
Model Number(s)	H4
Serial Number(s)	Not Serialised (FAR-0633998-002)
Hardware Version(s)	1.0
Software Version(s)	1.0
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2020
Order Number Date	PO-0071 21-December-2021
Date of Receipt of EUT	01-February-2022
Start of Test	02-February-2022
Finish of Test	20-February-2022
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.4: 2014

1.3 Brief Summary of Results

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

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: AC Powered - Operating Mode				
2.1	15.109	Radiated Disturbance	Pass	ANSI C63.4: 2014
Configuration and Mode: AC Powered - GNSS Receiver Operating				
2.2	15.107	Conducted Disturbance at Mains Terminals	Pass	ANSI C63.4: 2014
2.1	15.109	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2

1.4 Declaration of Build Status

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	Shot Scope H4 is a handheld unit worn by golfers to provide distance information from their position to their target. It also tracks how far each golf shot is hit and what golf club was used.
Manufacturer:	Shot Scope
Model:	SS04
Part Number:	H4
Hardware Version:	1.0
Software Version:	1.0
FCC ID of the product under test – see guidance here	2AHWR-SS05
IC ID of the product under test – see guidance here	

Table 3

Intentional Radiators

Technology	BLE					
Frequency Range (MHz to MHz)	2402 – 2481					
Conducted Declared Output Power (dBm)	-2					
Antenna Gain (dBi)	1.7					
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	2					
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GFSK					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	G1D					
Bottom Frequency (MHz)	2402					
Middle Frequency (MHz)	2440					
Top Frequency (MHz)	2480					

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	32 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	32.768 kHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒ 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:	5.5	V
Extreme lower voltage:	4.5	V
Max current:	0.1	A

Table 7

Battery Power Source

Voltage:	3.0 – 4.2	V
End-point voltage:	3.0	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☒ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Table 8

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒

Table 9

Temperature

Minimum temperature:	0	°C
Maximum temperature:	50	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)		dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	Chip	Gain	1.7	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: Lewis Allison
Position held: Chief Technology Officer
Date: 31/01/22

1.5 Product Information

1.5.1 Technical Description

Shot Scope H4 is a handheld unit worn by golfers to provide distance information from their position to their target. It also tracks how far each golf shot is hit and what golf club was used.

1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: AC Powered - Operating Mode				
AC Power Port - Neutral	Not Applicable	Supply AC Power to AD/DC converter	Neutral	No
AC Power Port - Live	Not Applicable	Supply AC Power to AC/DC converter	Live	No
Configuration and Mode: AC Powered - GNSS Receiver Operating				
AC Power Port - Neutral	Not Applicable	Supply AC Power to AD/DC converter	Neutral	No
AC Power Port - Live	Not Applicable	Supply AC Power to AC/DC converter	Live	No

Table 14

1.5.3 Test Configuration

Configuration	Description
AC Powered	The EUT was powered by an AC to DC converter, Sony Model AC-UUD12 supplied by TUV SUD.

Table 15

1.5.4 Modes of Operation

Mode	Description
Operating Mode	Charging mode for Radiated Emissions. The GNSS receiver was not operational for this test. The charger and charging cable were connected to facilitate charging
GNSS Receiver Operating	GNSS receive mode for Radiated Emissions. The GNSS receiver was operational for this test. The charger and charging cable were not connected. Mode for AC Line Conducted Emissions. The GNSS receiver was operational for this test. The AC charger and charging cable were also connected. The serial commands supplied by Shot Scope were executed to enable this test mode.

Table 16

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: H4, Serial Number: Not Serialised (FAR-0633998-002)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 17

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: AC Powered - Operating Mode		
Radiated Disturbance	Graeme Lawler	UKAS
Configuration and Mode: AC Powered - GNSS Receiver Operating		
Conducted Disturbance at Mains Terminals	Graeme Lawler	UKAS
Radiated Disturbance	Graeme Lawler	UKAS

Table 18

Office Address:

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

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109

2.1.2 Equipment Under Test and Modification State

H4, S/N: Not Serialised (FAR-0633998-002) - Modification State 0

2.1.3 Date of Test

02-February-2022 to 06-February-2022

2.1.4 Test Method

The EUT was set up on a non-conductive table 0.8 m above a reference ground plane within a semi-anechoic chamber on a remotely controlled turntable.

A pre-scan of the EUT emissions profile using a peak detector was made at a 3 m antenna distance whilst varying the antenna-to-EUT azimuth and polarisation.

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.

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak or CISPR Average detector as appropriate.

The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.1.5 Example Calculation

Below 1 GHz:

Quasi-Peak level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = Quasi-Peak level (dBµV/m) - Limit (dBµV/m)

Above 1 GHz:

CISPR Average level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = CISPR Average level (dBµV/m) - Limit (dBµV/m)

Peak level (dBµV/m) = Receiver level (dBµV) + Correction Factor (dB/m)
Margin (dB) = Peak level (dBµV/m) - Limit (dBµV/m)

2.1.6 Example Test Setup Diagram

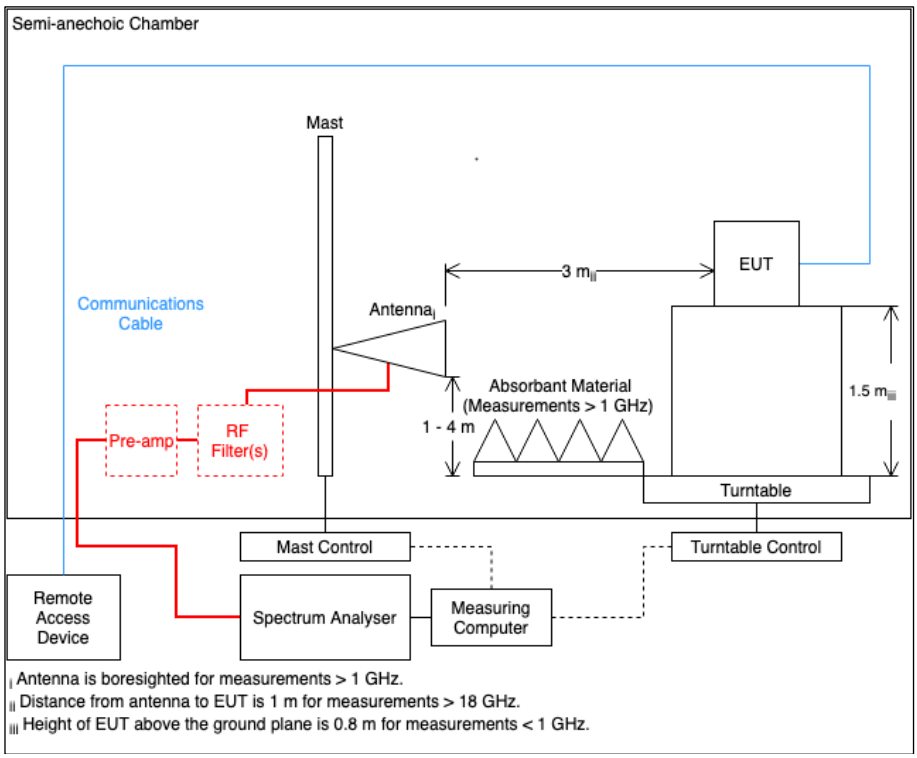

Figure 1

2.1.7 Environmental Conditions

Ambient Temperature	23.2 - 24.7 °C
Relative Humidity	28.2 - 30.9 %

2.1.8 Specification Limits

Required Specification Limits, Field Strength - Class A Test Limit at a 10 m Measurement Distance		
Frequency Range (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)
30 to 88	90	39.1
88 to 216	150	43.5
216 to 960	210	46.4
Above 960	300	49.5
Supplementary information: Note 1. A Quasi-Peak detector is to be used for measurements below 1 GHz. Note 2. A CISPR Average detector is to be used for measurements above 1 GHz. Note 3. The Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.		

Table 19

2.1.9 Test Results

Results for Configuration and Mode: AC Powered - Operating Mode.

This test was performed to the requirements of the Class A limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 2480 MHz
Which necessitates an upper frequency test limit of: 13 GHz

The EUT is handheld, body-worn, or ceiling-mounted equipment and has therefore been tested in three different orientations in accordance with ANSI C63.4, Clause 6.3.2.1.

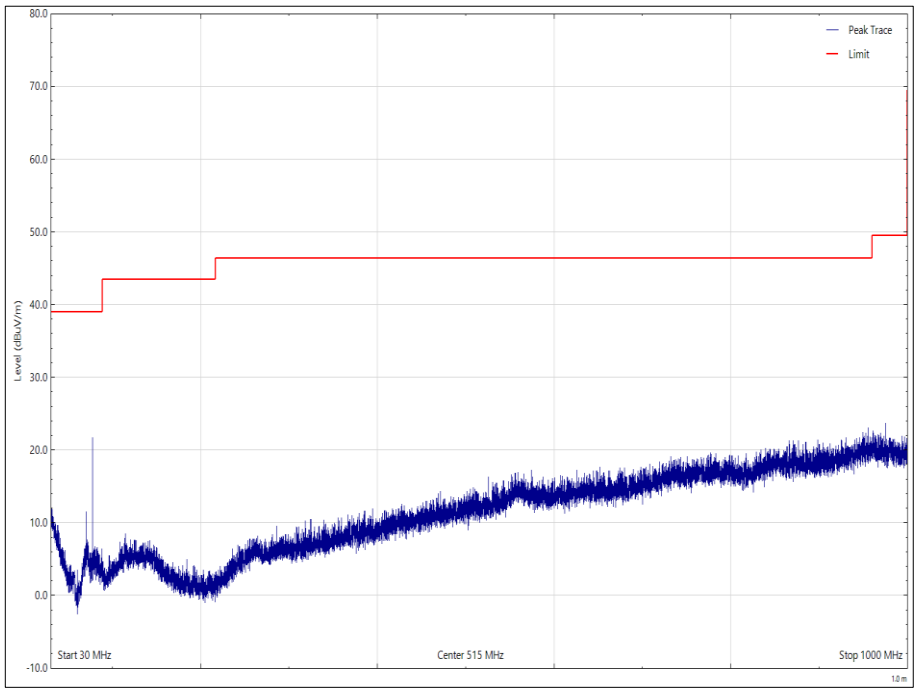

Figure 2 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - X Orientation

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

Table 20

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

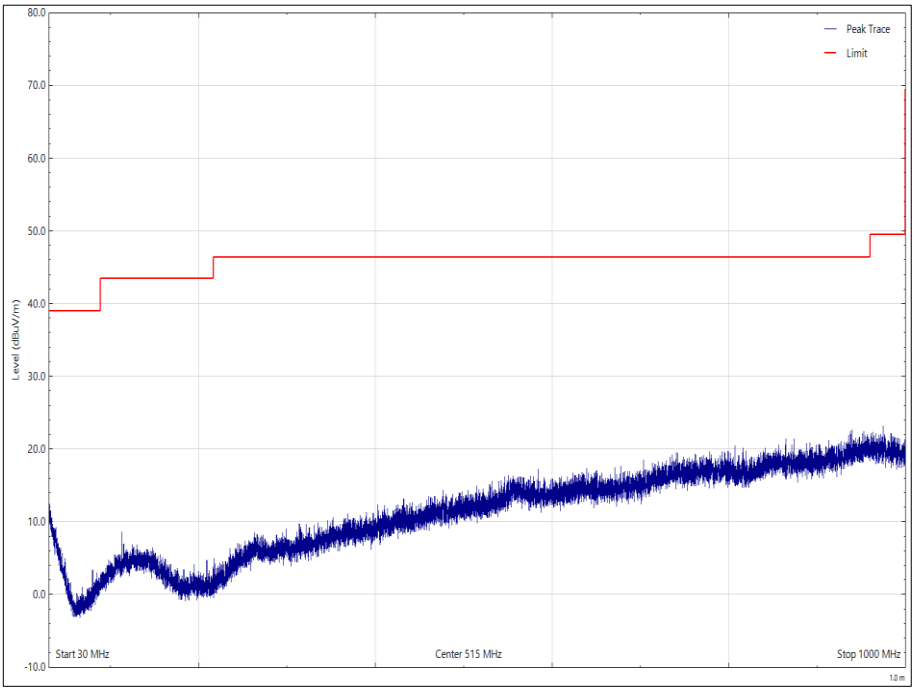

Figure 3 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - X Orientation

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

Table 21

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

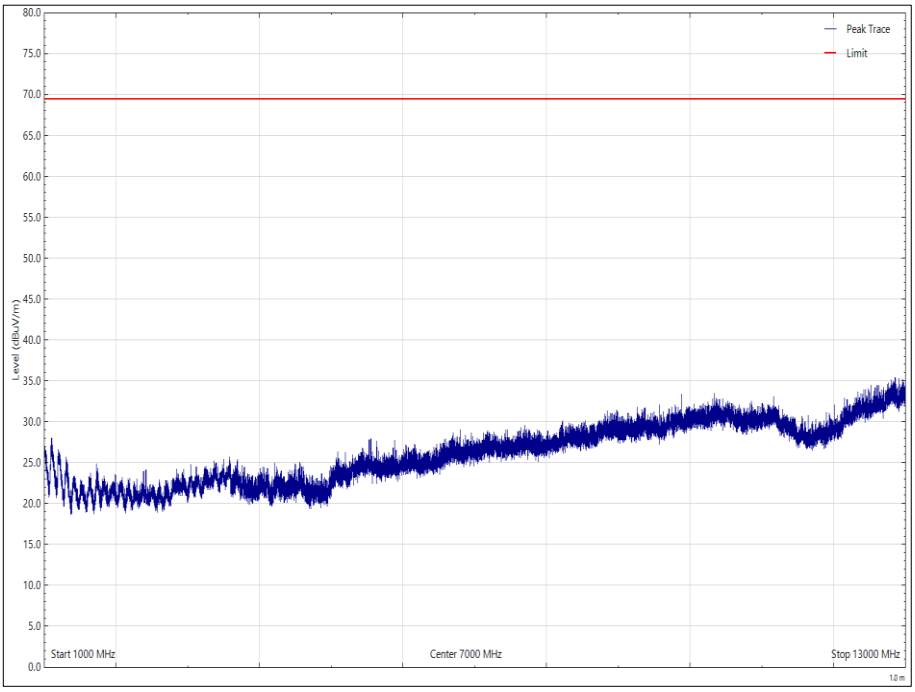

Figure 4 - 1 GHz to 13 GHz, Peak, Vertical - X Orientation

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

Table 22

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

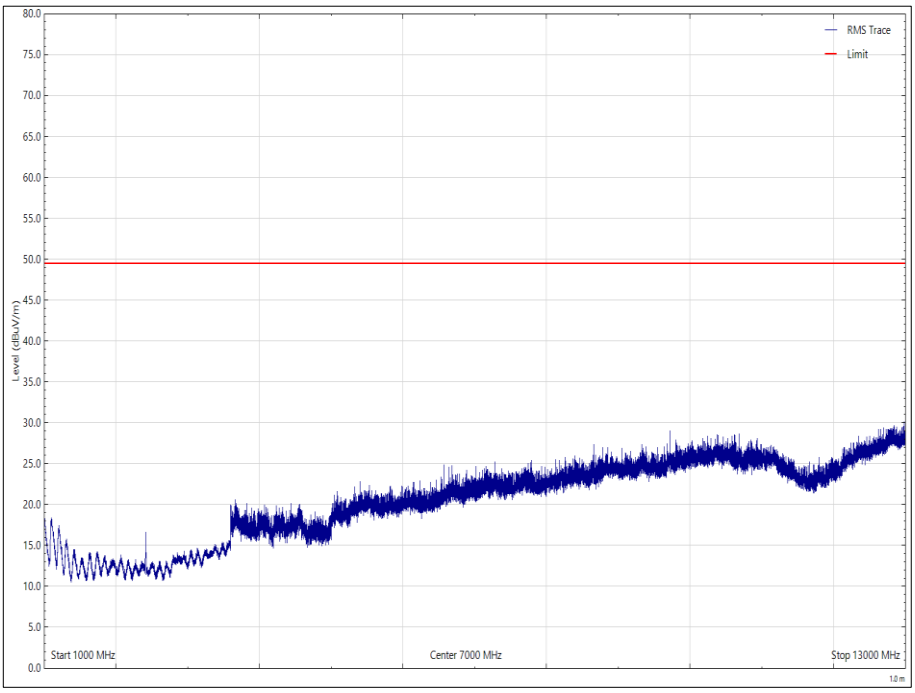

Figure 5 - 1 GHz to 13 GHz, CISPR Average, Vertical - X Orientation

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

Table 23

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

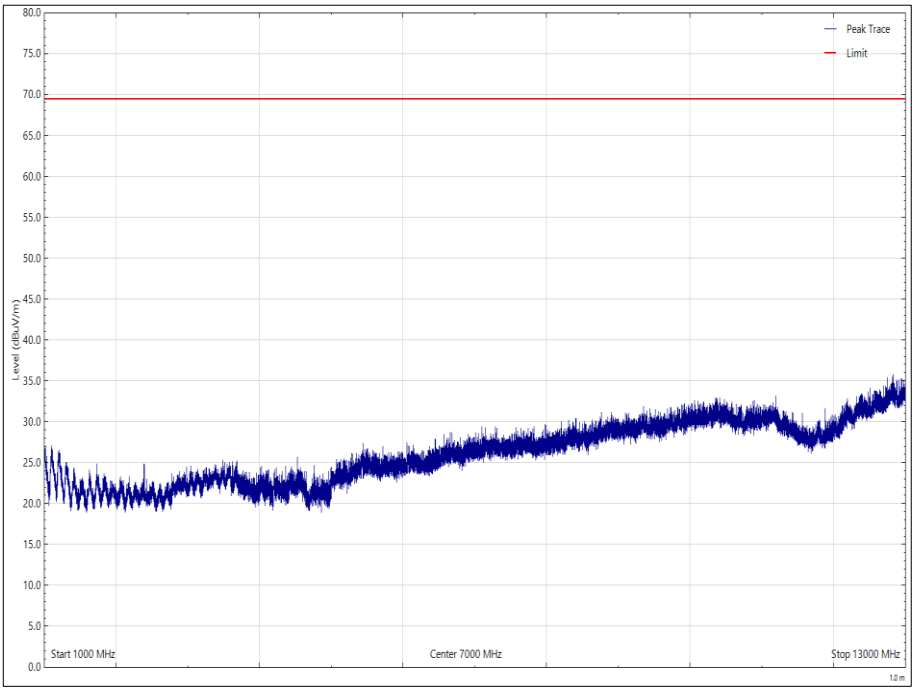

Figure 6 - 1 GHz to 13 GHz, Peak, Horizontal - X Orientation

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

Table 24

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

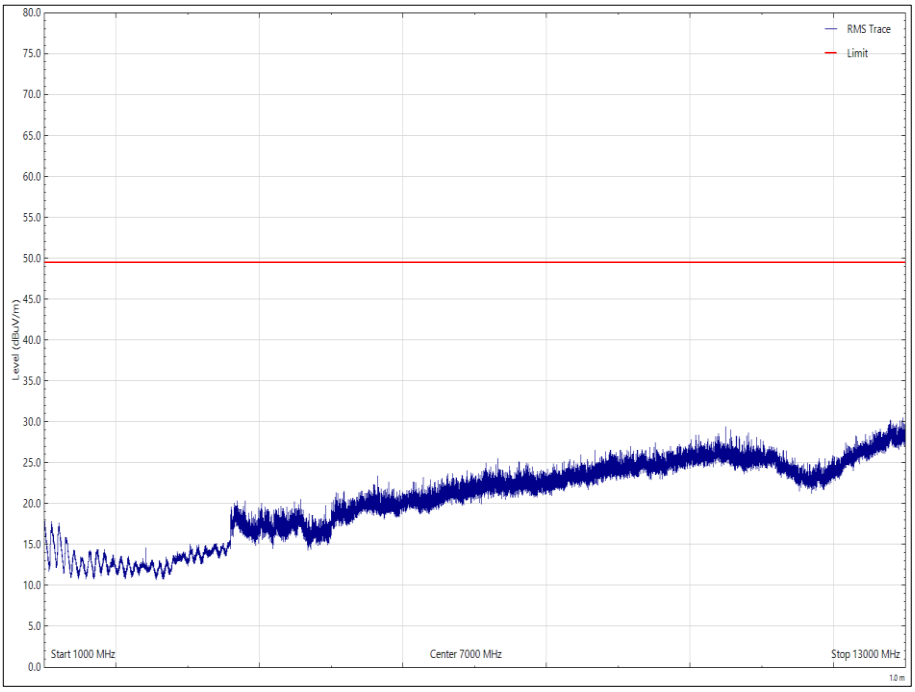

Figure 7 - 1 GHz to 13 GHz, CISPR Average, Horizontal - X Orientation

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

Table 25

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

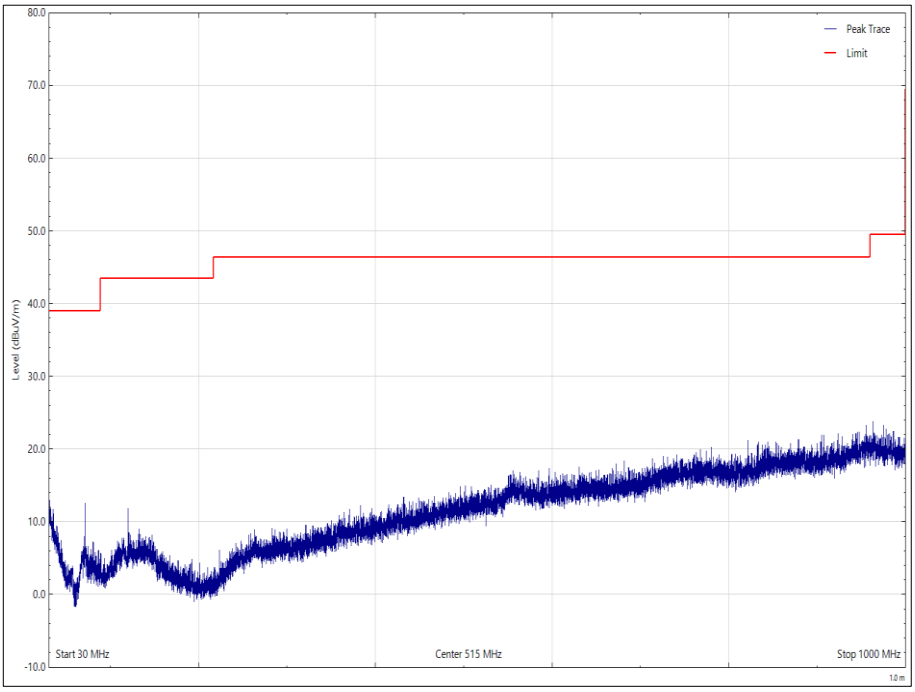

Figure 8 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Y Orientation

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

Table 26

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

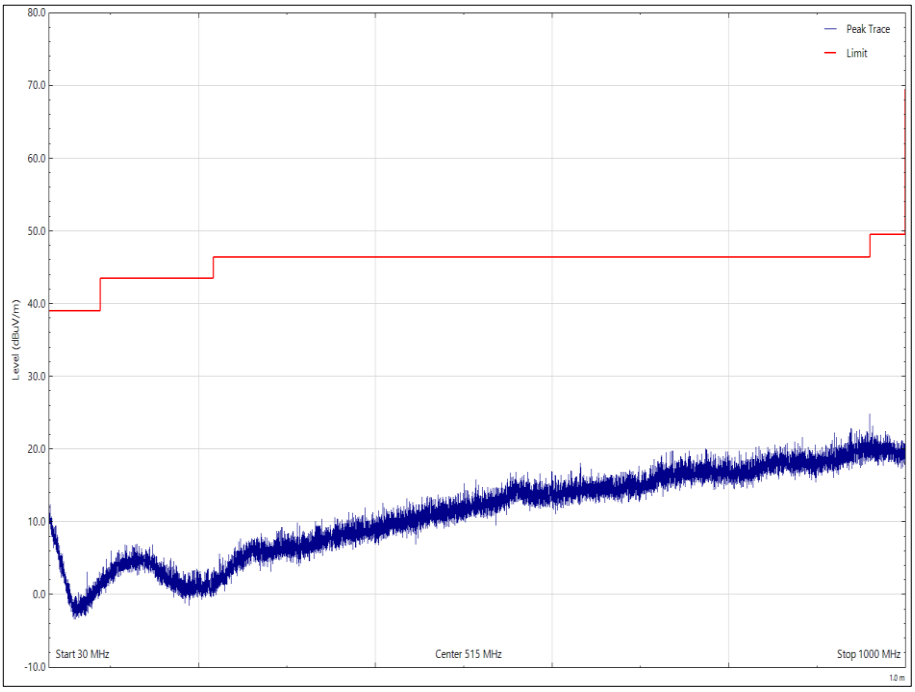

Figure 9 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Y Orientation

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

Table 27

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

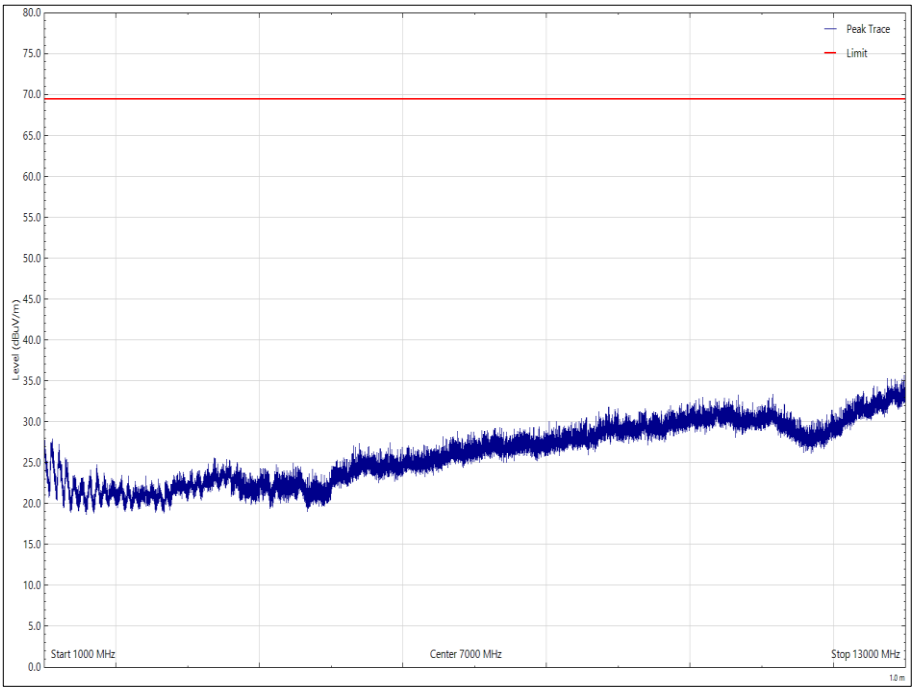

Figure 10 - 1 GHz to 13 GHz, Peak, Vertical - Y Orientation

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

Table 28

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

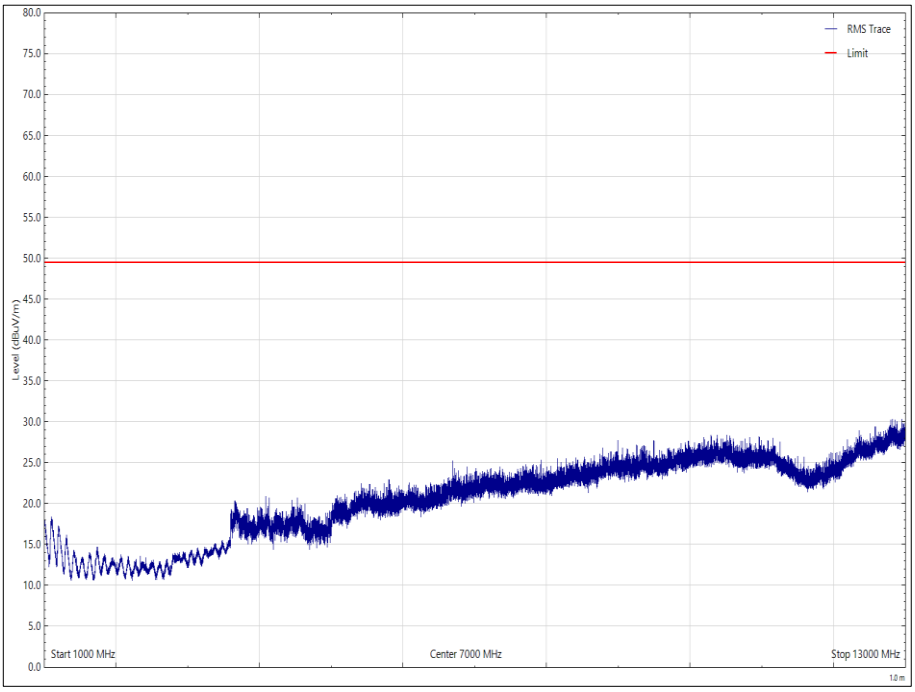

Figure 11 - 1 GHz to 13 GHz, CISPR Average, Vertical - Y Orientation

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

Table 29

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

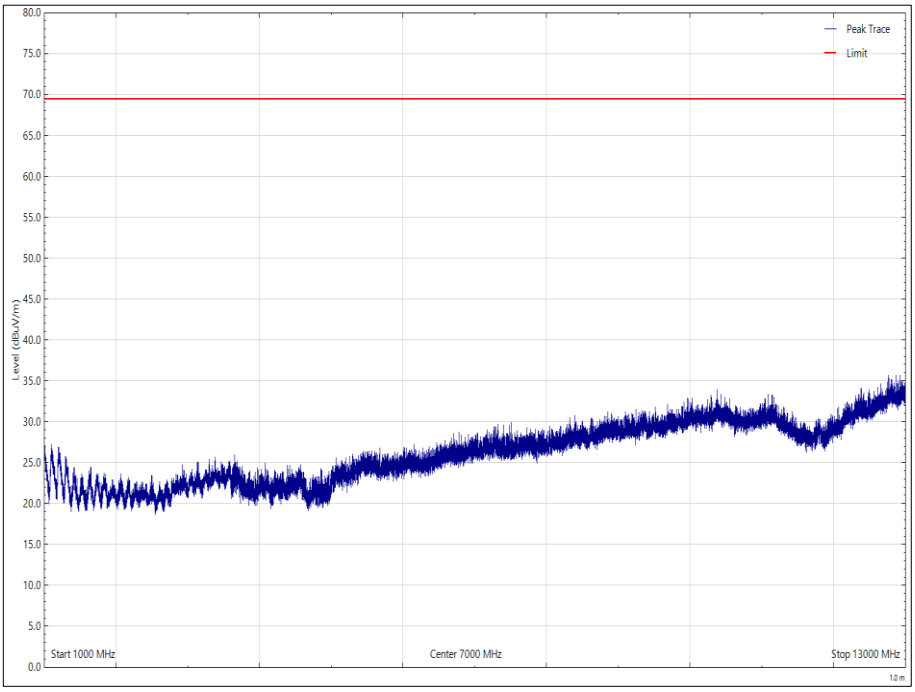

Figure 12 - 1 GHz to 13 GHz, Peak, Horizontal - Y Orientation

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

Table 30

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

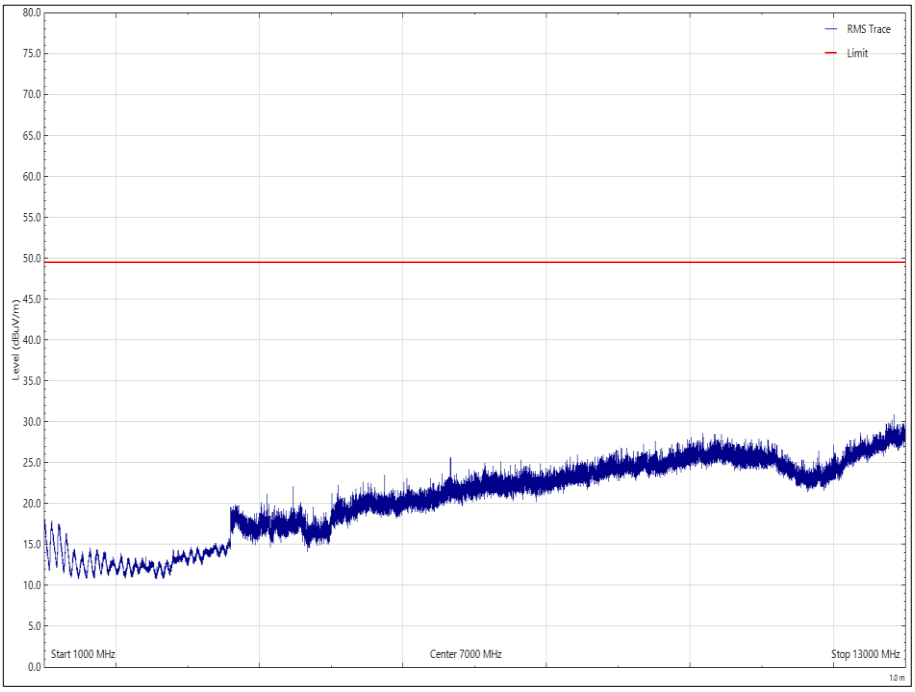

Figure 13 - 1 GHz to 13 GHz, CISPR Average, Horizontal - Y Orientation

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

Table 31

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

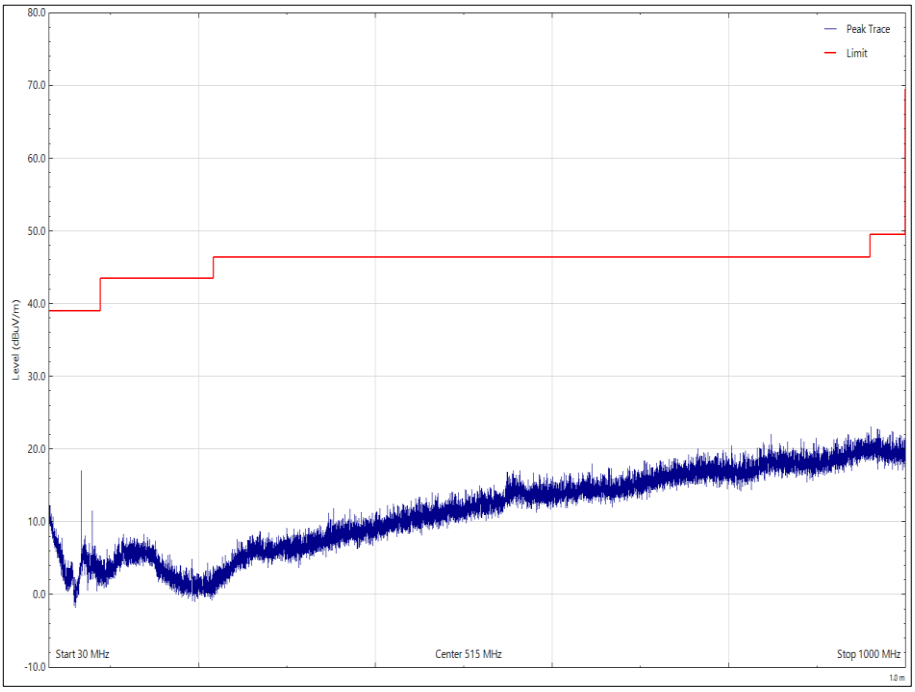

Figure 14 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Z Orientation

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

Table 32

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

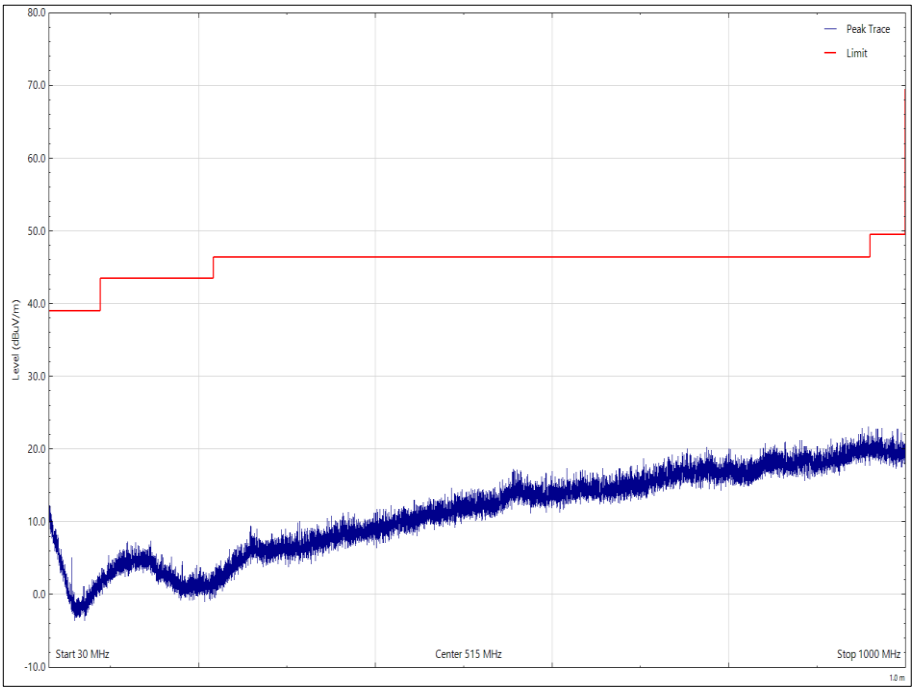

Figure 15 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Z Orientation

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

Table 33

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

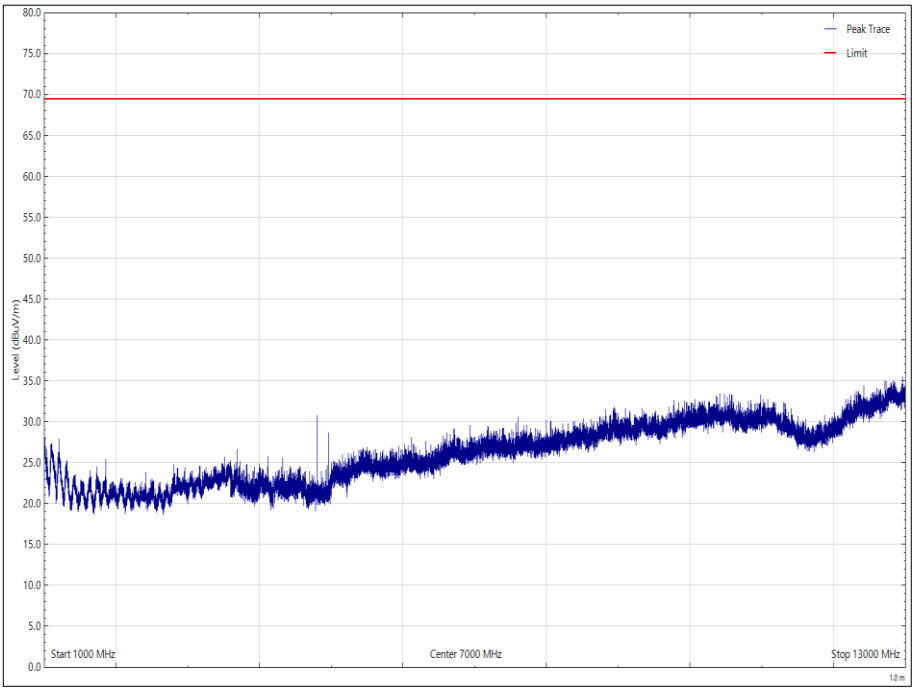

Figure 16 - 1 GHz to 13 GHz, Peak, Vertical - Z Orientation

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

Table 34

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

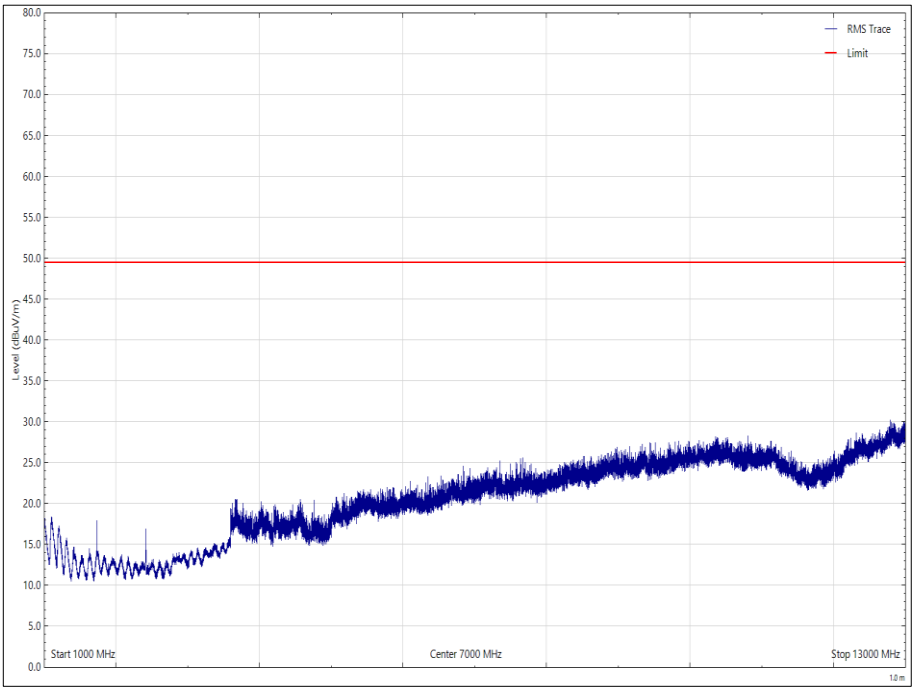

Figure 17 - 1 GHz to 13 GHz, CISPR Average, Vertical - Z Orientation

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

Table 35

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

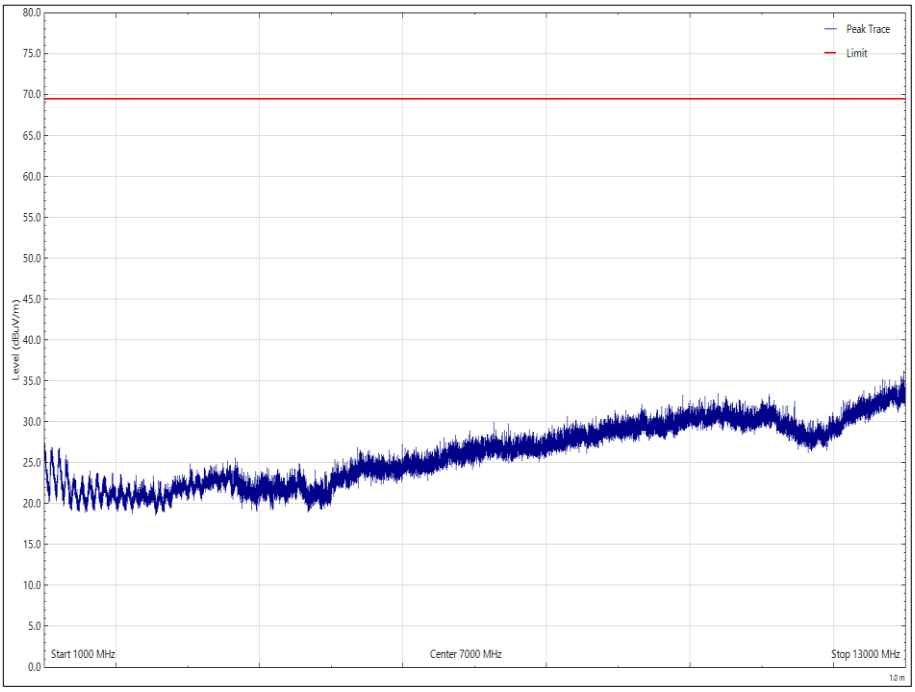

Figure 18 - 1 GHz to 13 GHz, Peak, Horizontal - Z Orientation

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

Table 36

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

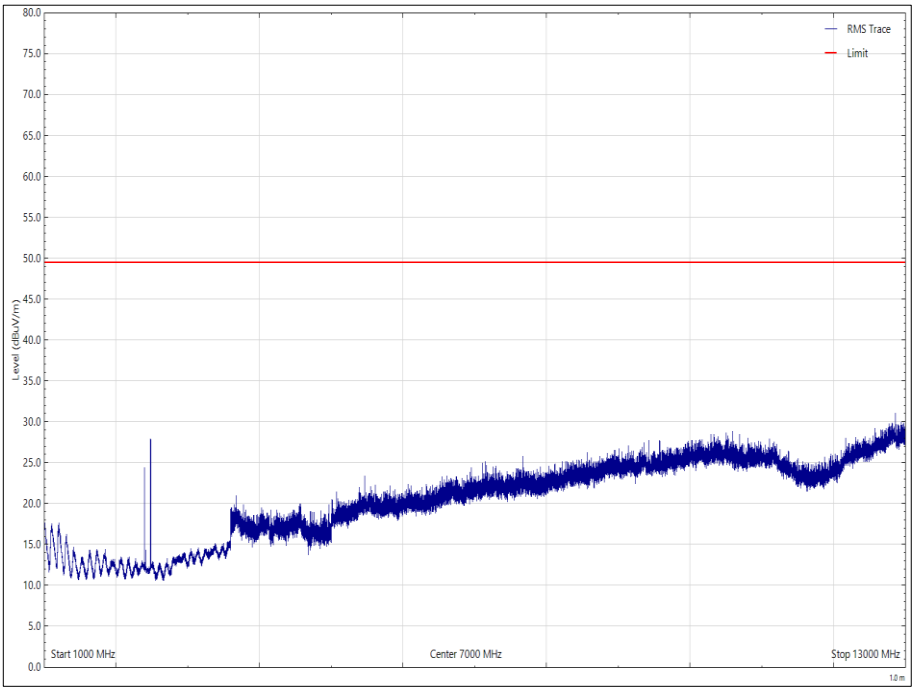

Figure 19 - 1 GHz to 13 GHz, CISPR Average, Horizontal - Z Orientation

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

Table 37

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

Results for Configuration and Mode: AC Powered - GNSS Receiver Operating.

This test was performed to the requirements of the Class A limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 2480 MHz
Which necessitates an upper frequency test limit of: 13 GHz

The EUT is handheld, body-worn, or ceiling-mounted equipment and has therefore been tested in three different orientations in accordance with ANSI C63.4, Clause 6.3.2.1.

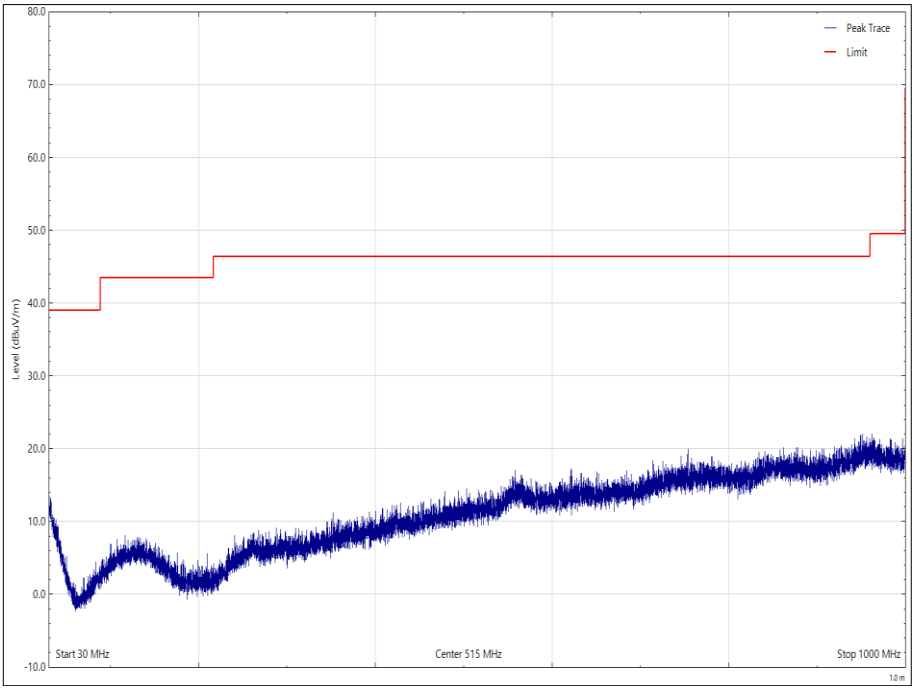

Figure 20 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - X Orientation

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

Table 38

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

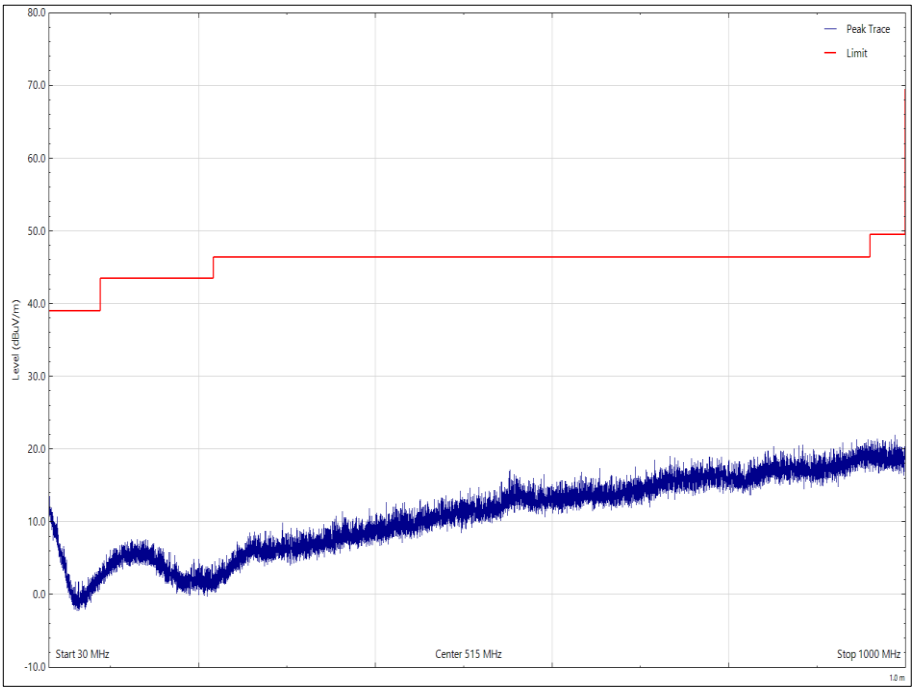

Figure 21- 30 MHz to 1 GHz, Quasi-Peak, Horizontal - X Orientation

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

Table 39

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

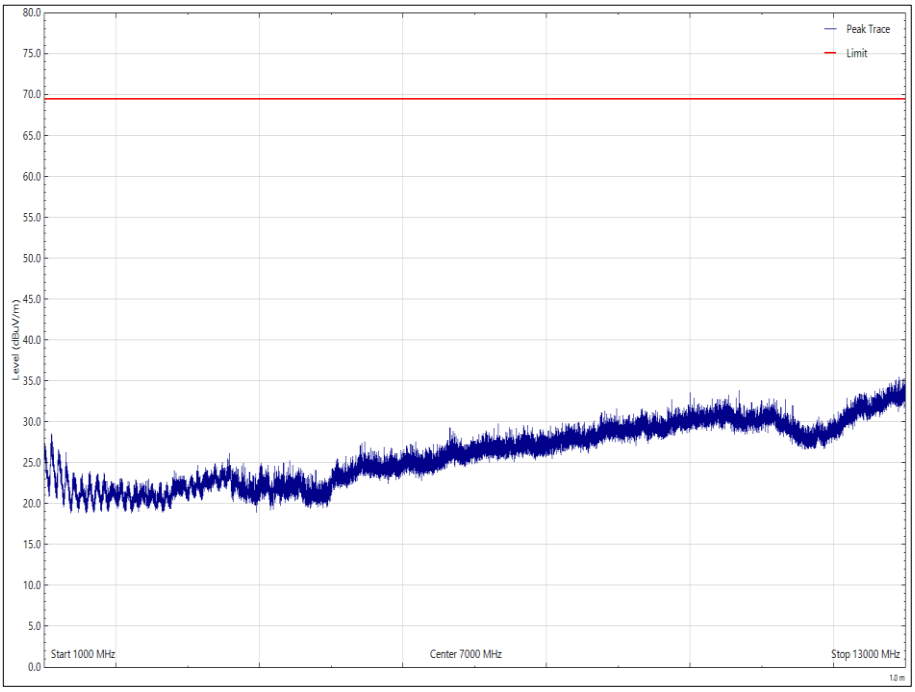

Figure 22 - 1 GHz to 13 GHz, Peak, Vertical - X Orientation

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

Table 40

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

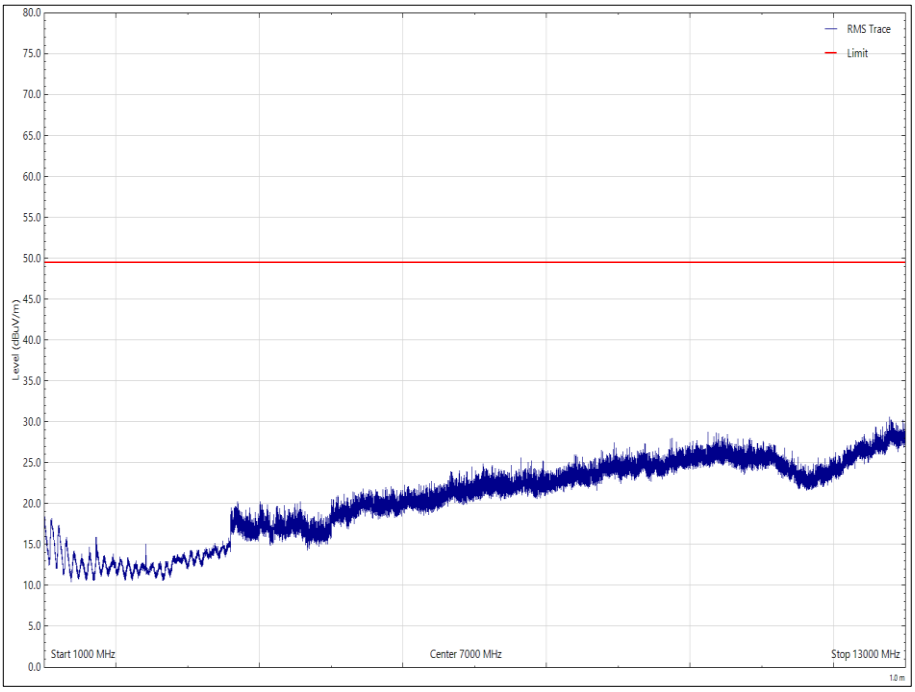

Figure 23 - 1 GHz to 13 GHz, CISPR Average, Vertical - X Orientation

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

Table 41

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

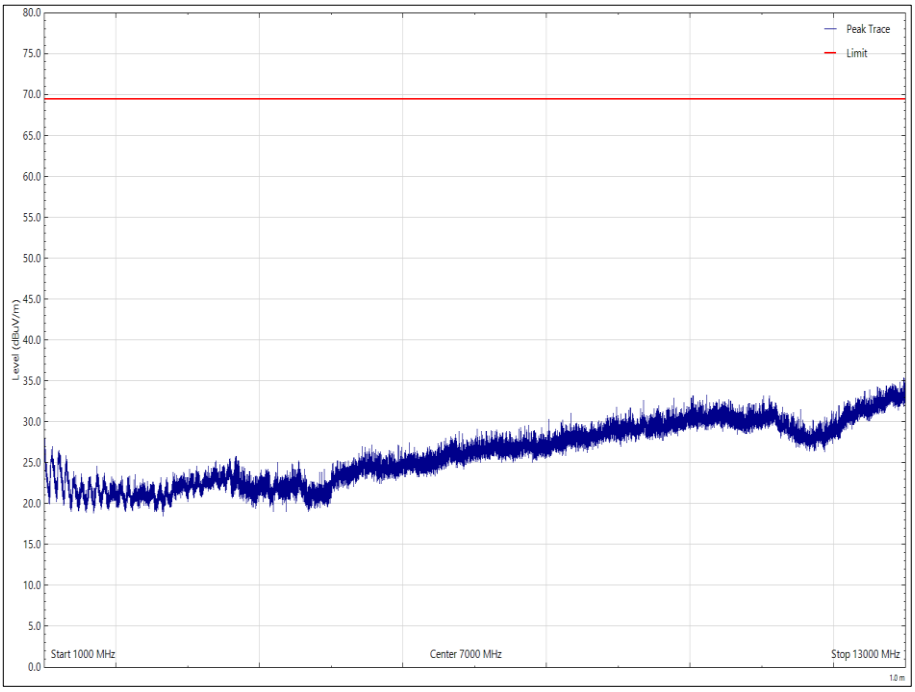

Figure 24 - 1 GHz to 13 GHz, Peak, Horizontal - X Orientation

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

Table 42

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

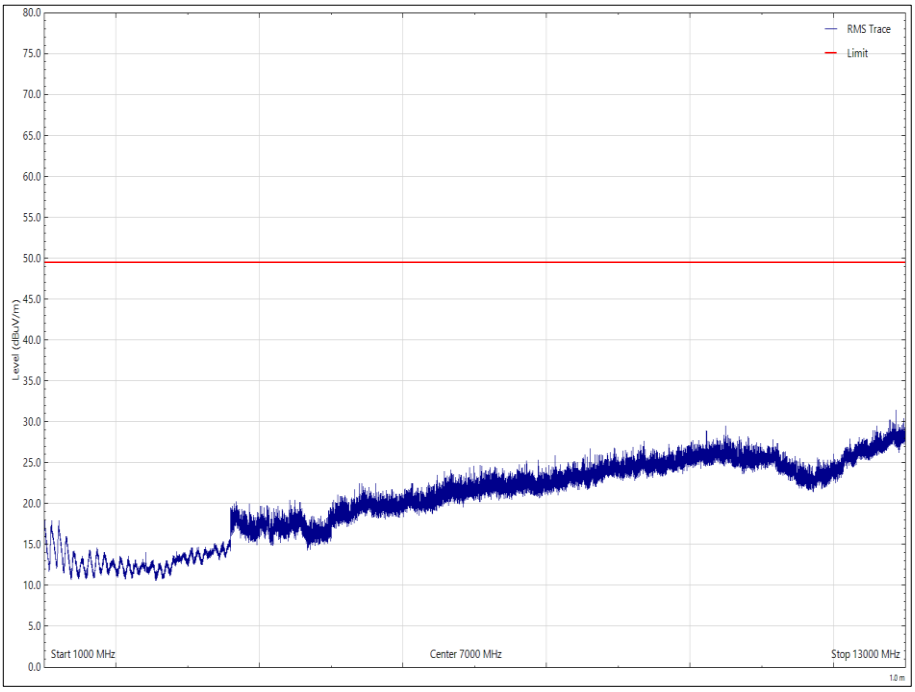

Figure 25 - 1 GHz to 13 GHz, CISPR Average, Horizontal - X Orientation

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

Table 43

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

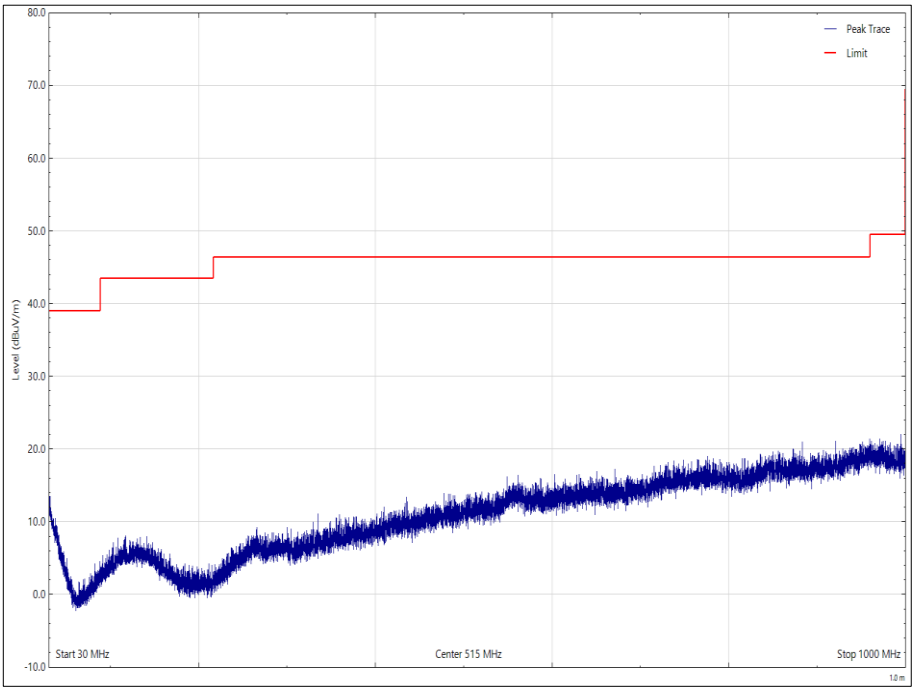

Figure 26 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Y Orientation

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

Table 44

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

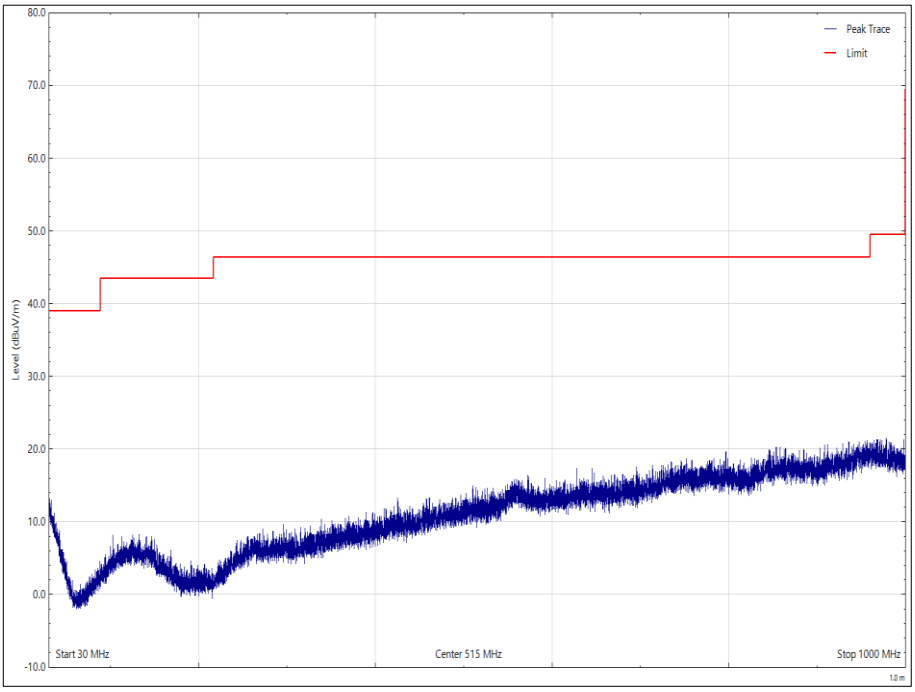

Figure 27- 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Y Orientation

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

Table 45

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

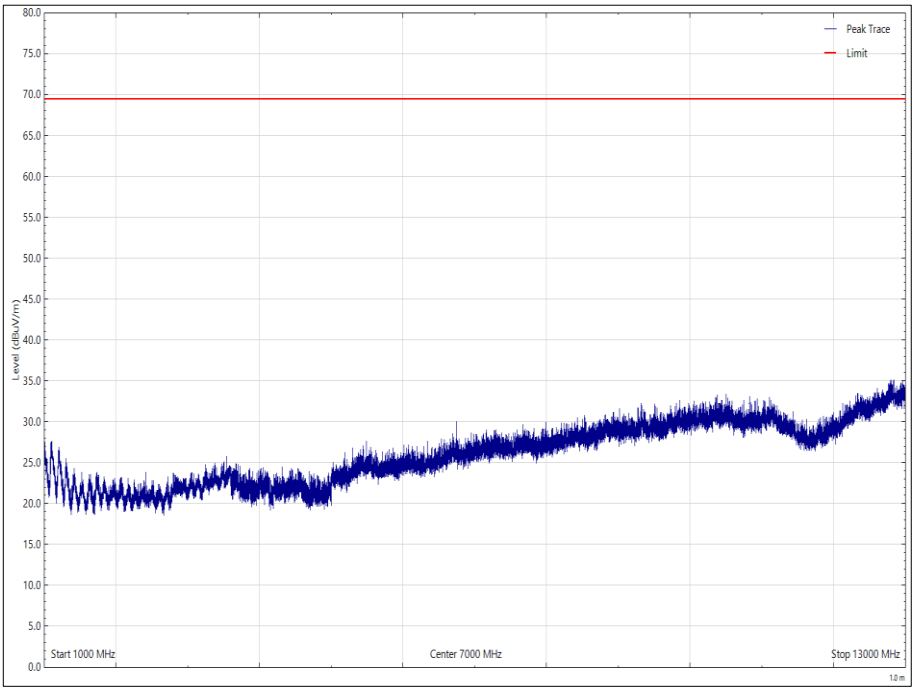

Figure 28 - 1 GHz to 13 GHz, Peak, Vertical - Y Orientation

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

Table 46

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

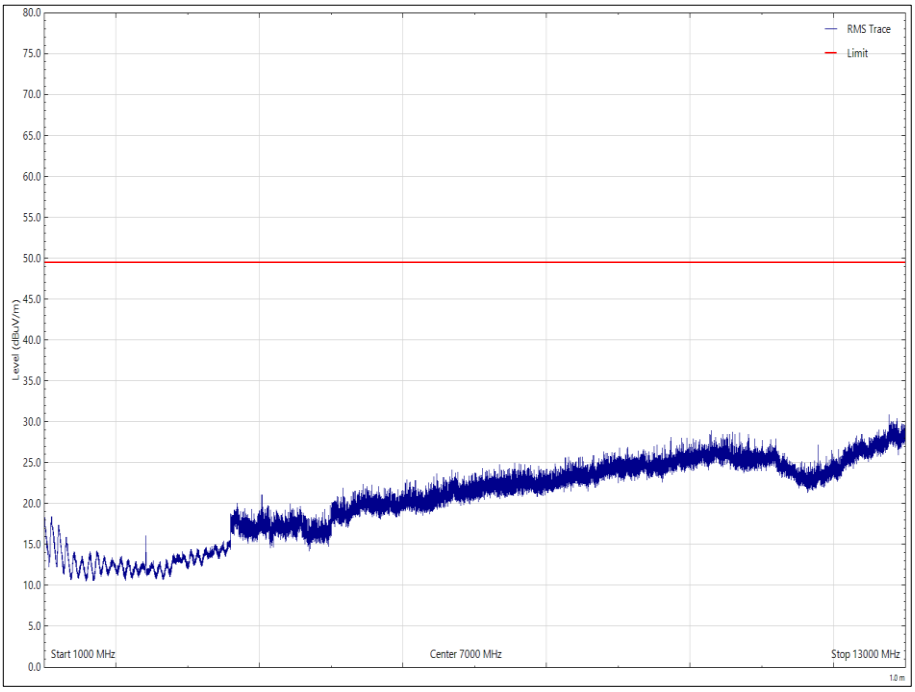

Figure 29- 1 GHz to 13 GHz, CISPR Average, Vertical - Y Orientation

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

Table 47

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

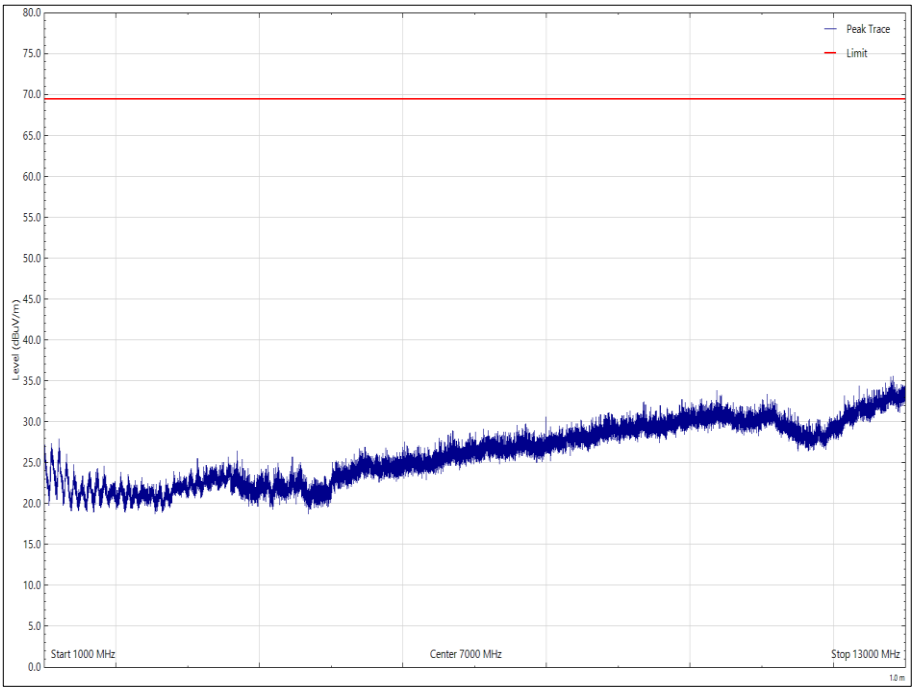

Figure 30- 1 GHz to 13 GHz, Peak, Horizontal - Y Orientation

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

Table 48

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

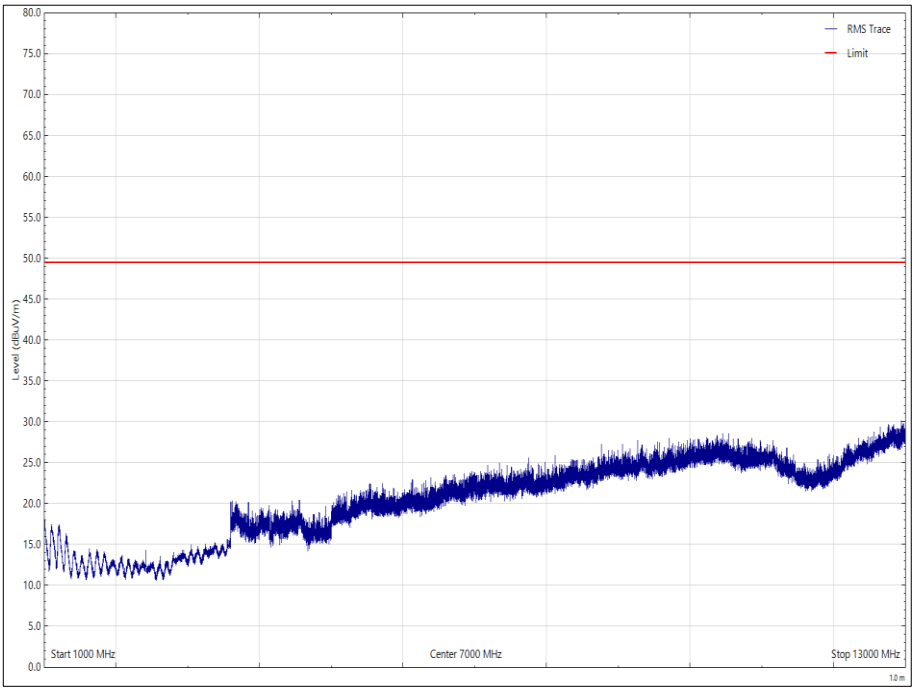

Figure 31 - 1 GHz to 13 GHz, CISPR Average, Horizontal - Y Orientation

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

Table 49

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

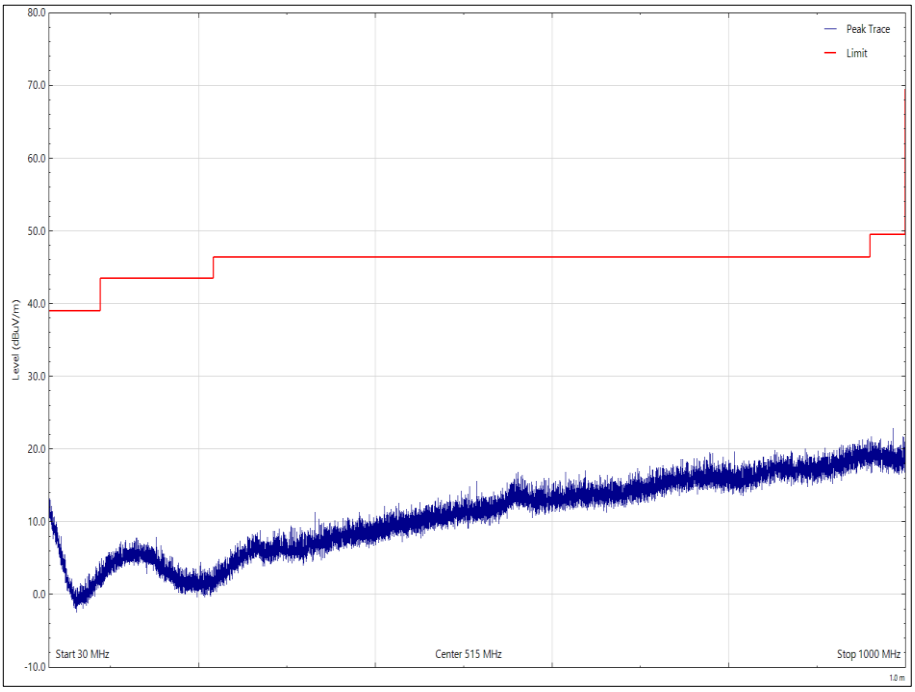

Figure 32 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - Z Orientation

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

Table 50

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

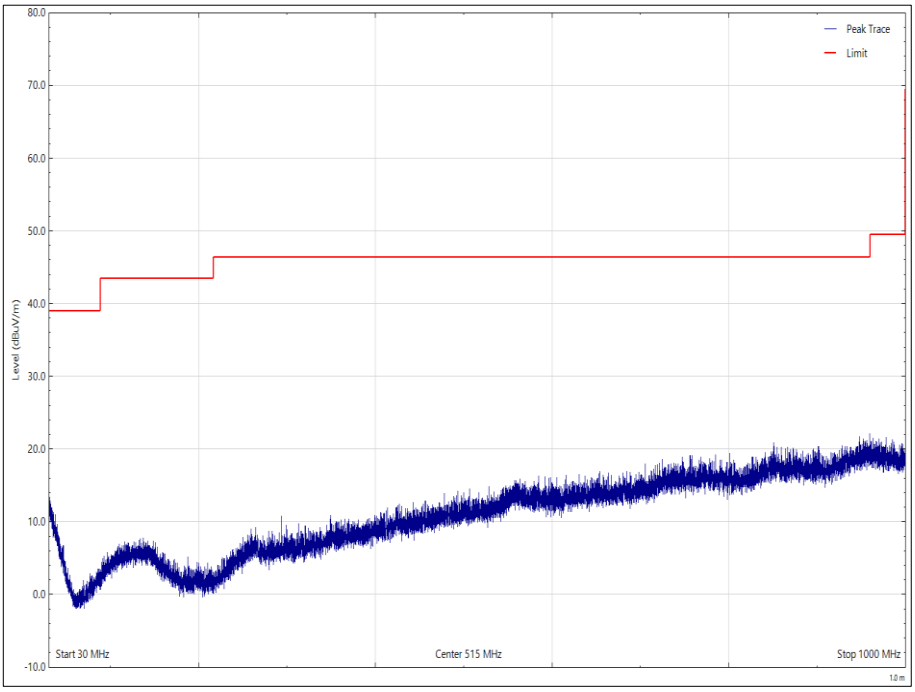

Figure 33 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - Z Orientation

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

Table 51

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

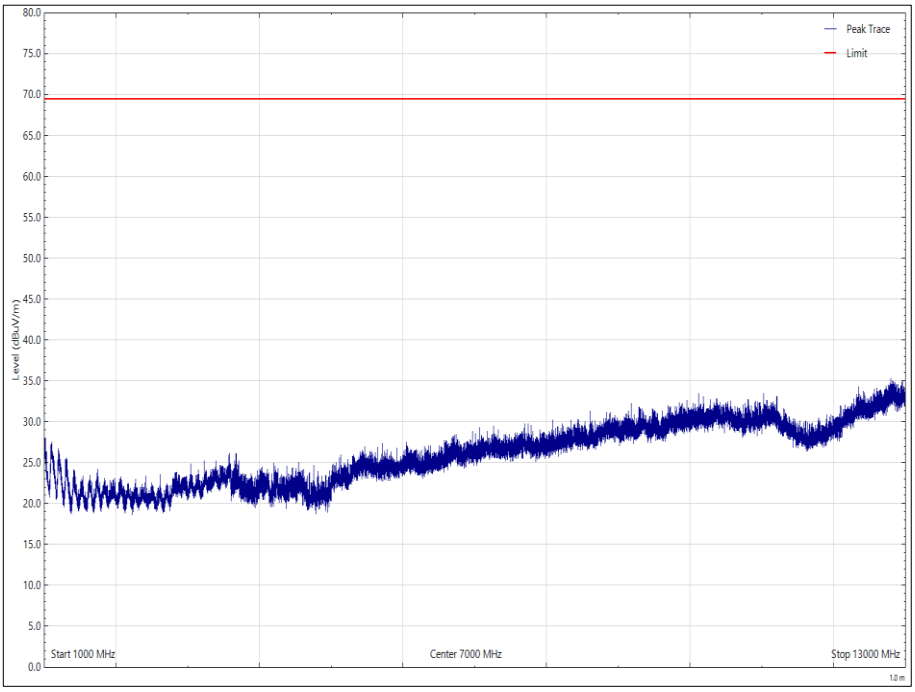

Figure 34- 1 GHz to 13 GHz, Peak, Vertical - Z Orientation

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

Table 52

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

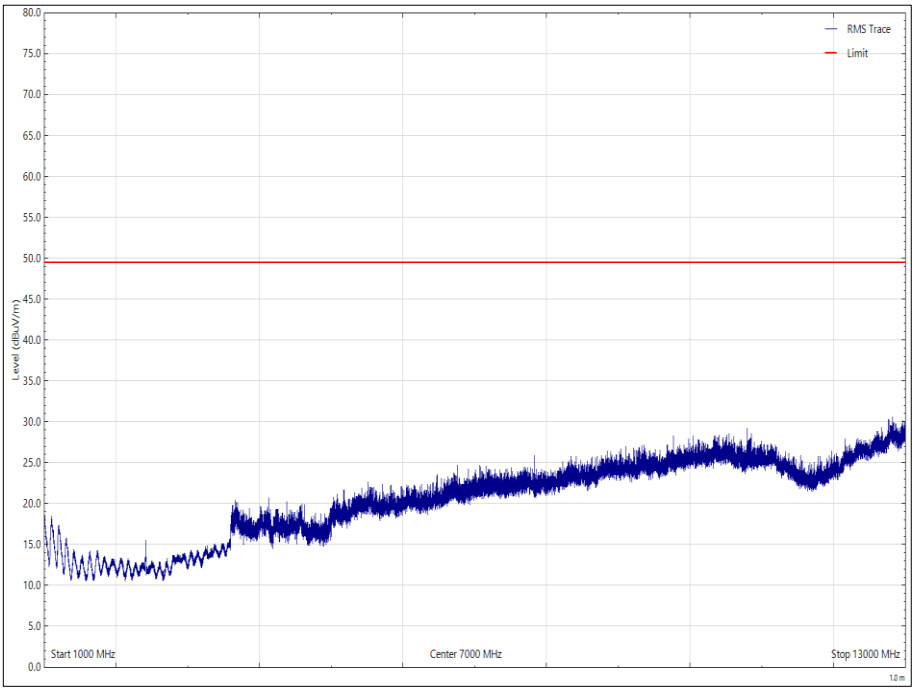

Figure 35 - 1 GHz to 13 GHz, CISPR Average, Vertical - Z Orientation

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

Table 53

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

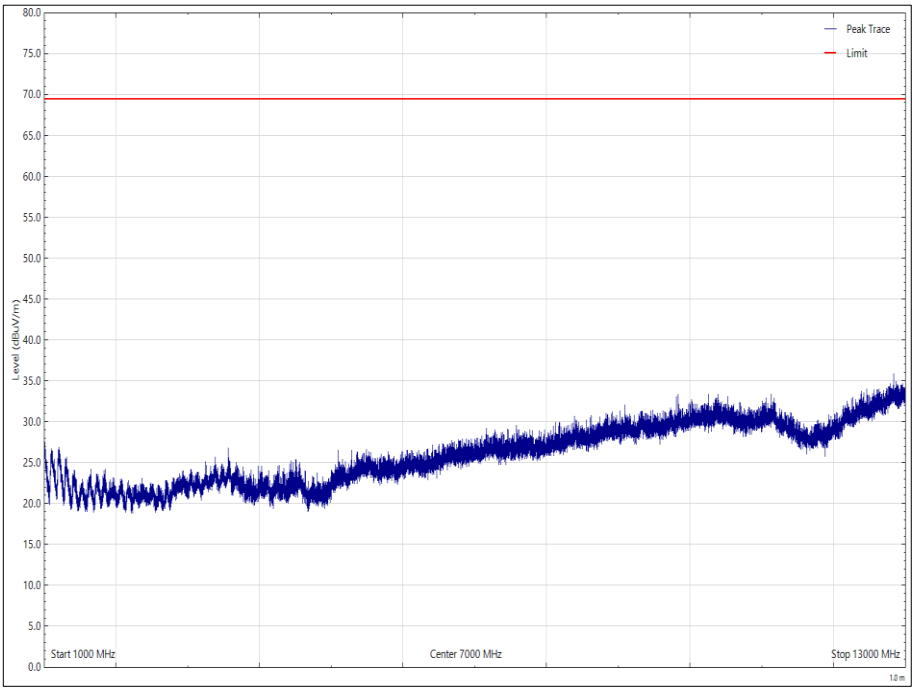

Figure 36 - 1 GHz to 13 GHz, Peak, Horizontal - Z Orientation

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

Table 54

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

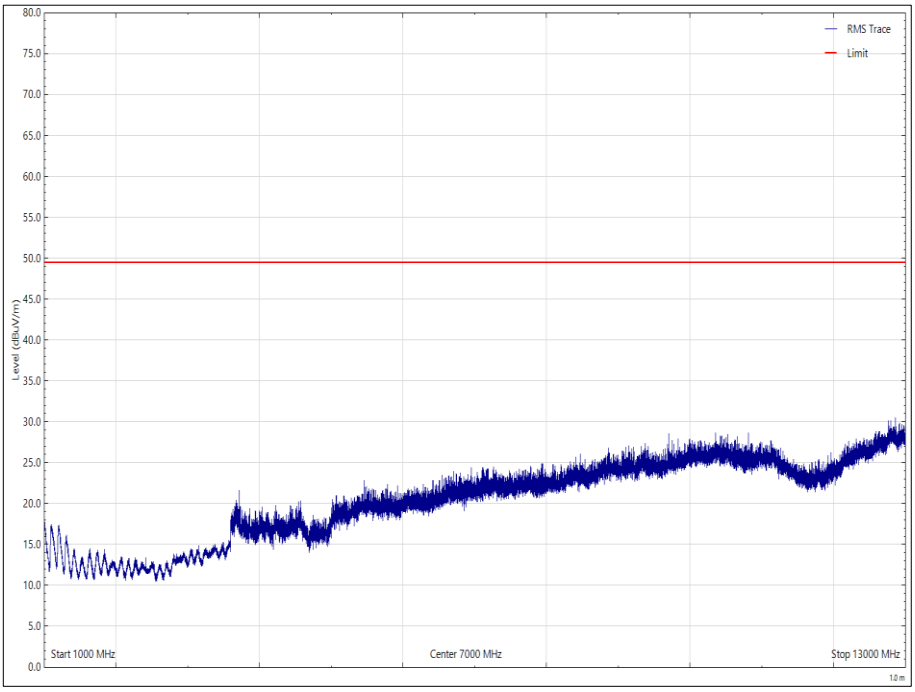

Figure 37 - 1 GHz to 13 GHz, CISPR Average, Horizontal - Z Orientation

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

Table 55

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

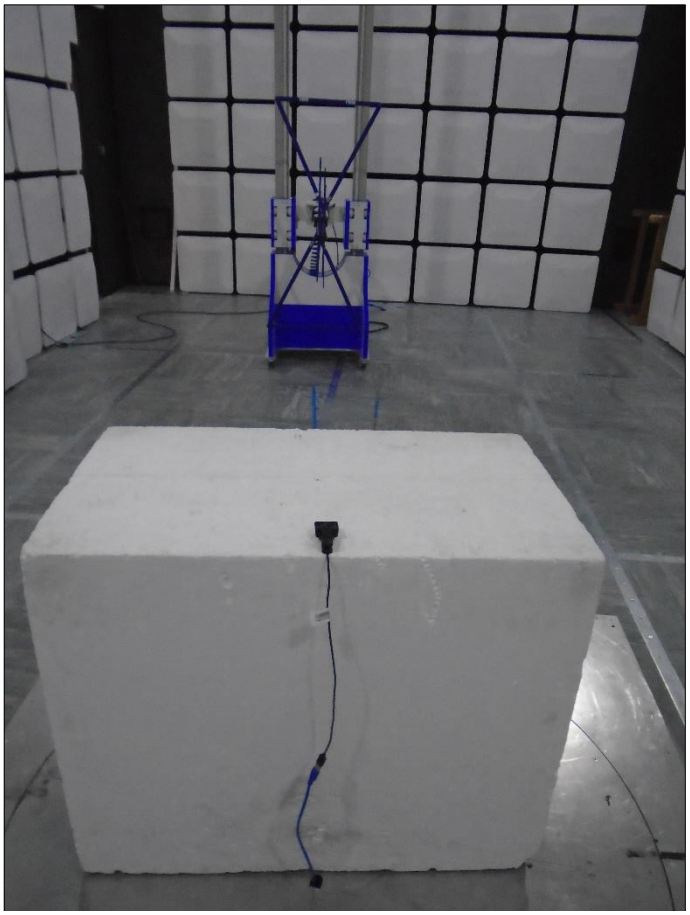

Figure 38- 30 MHz to 1 GHz - X Orientation

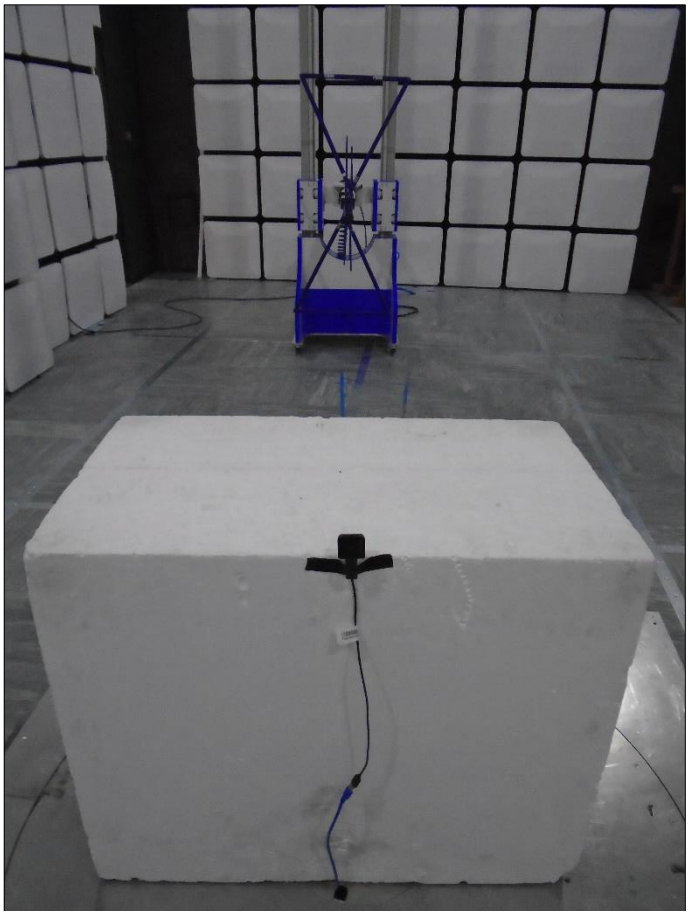

Figure 39 - 30 MHz to 1 GHz - Y Orientation

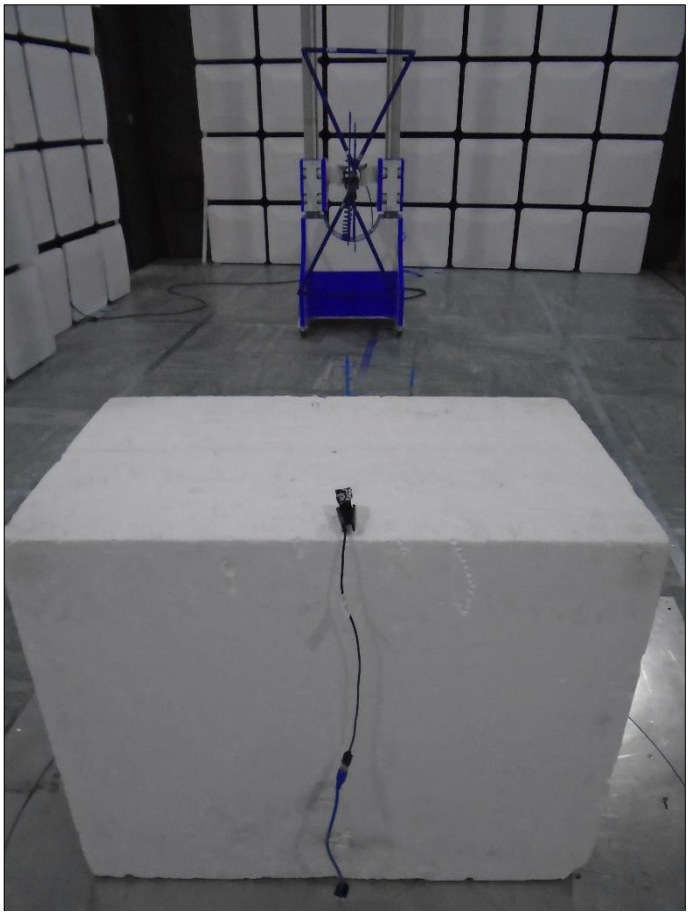

Figure 40- 30 MHz to 1 GHz - Z Orientation

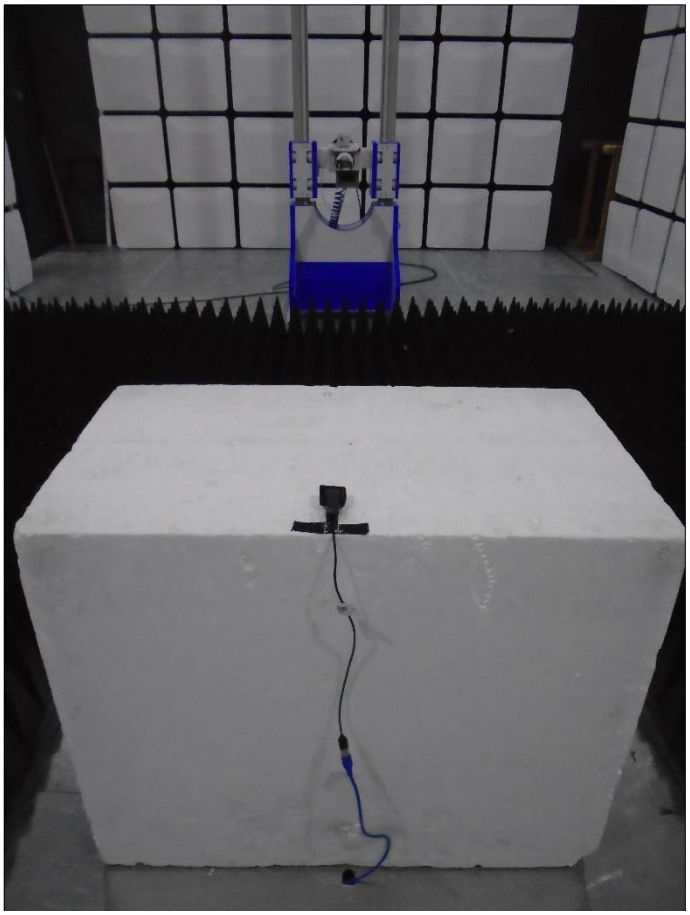

Figure 41- 1 GHz to 13 GHz - X Orientation

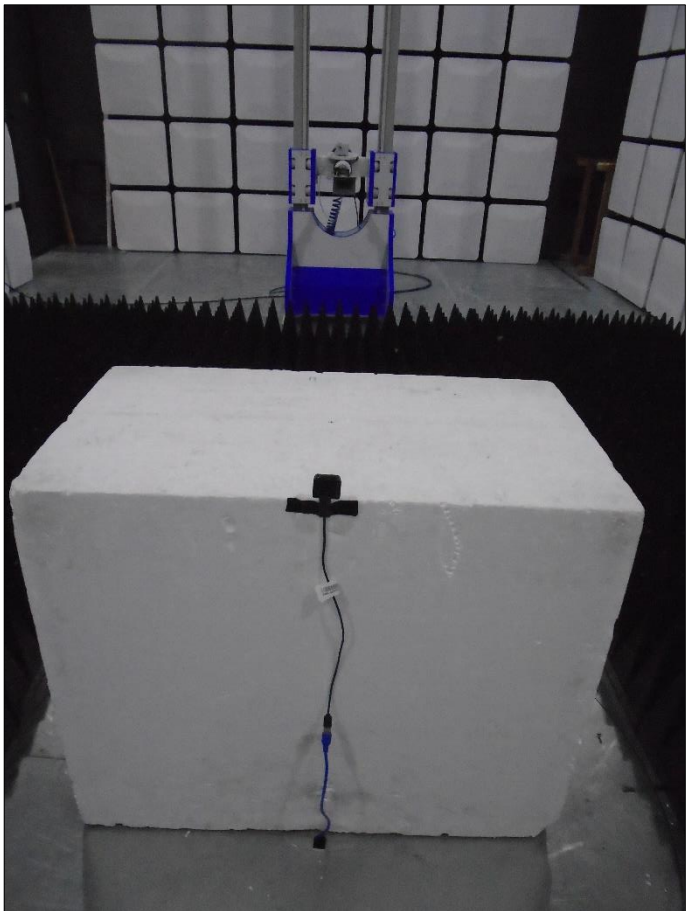

Figure 42 - 1 GHz to 13 GHz - Y Orientation

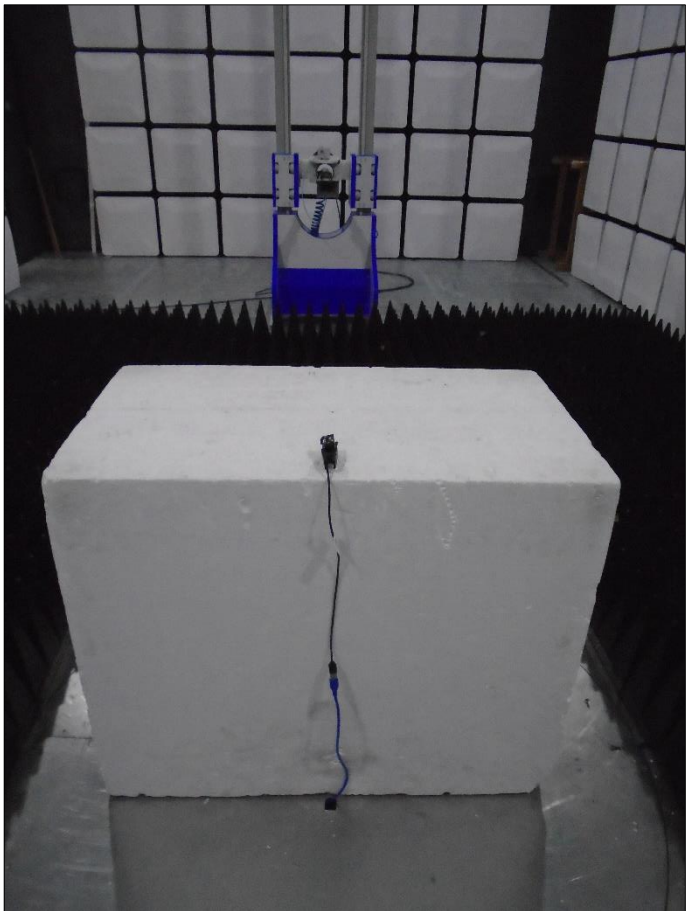

Figure 43 - 1 GHz to 13 GHz - Z Orientation

2.1.10 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Comb Generator	Schaffner	RSG1000	3034	-	TU
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Pre-Amplifier (1 GHz to 18 GHz)	Schwarzbeck	BBV 9718 C	5350	12	22-Sep-2022
Antenna (Bi-Log, 30 MHz to 1 GHz)	Teseq	CBL6111D	5615	24	16-Oct-2022
Antenna (DRG, 1 GHz to 10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	15-Oct-2022
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5610	12	15-Oct-2022

Table 56

TU - Traceability Unscheduled

2.2 Conducted Disturbance at Mains Terminals

2.2.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.107

2.2.2 Equipment Under Test and Modification State

H4, S/N: Not Serialised (FAR-0633998-002) - Modification State 0

2.2.3 Date of Test

20-February-2022

2.2.4 Test Method

The EUT was setup according to ANSI C63.4, clause 5.2.

The EUT was placed on a non-conductive table 0.8 m above a reference ground plane. A vertical coupling plane was placed 0.4 m from the EUT boundary.

A Line Impedance Stabilisation Network (LISN) was directly bonded to the ground-plane. The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN was 0.8 m.

Interconnecting cables that hanged closer than 0.4 m to the ground plane were folded back and forth in the centre forming a bundle 0.3 m to 0.4 m long.

Input and output cables were terminated with equipment or loads representative of real usage conditions.

The EUT was configured to give the highest level of emissions within reason of a typical installation as described by the manufacturer.

2.2.5 Example Calculation

Quasi-Peak level (dBµV) = Receiver level (dBµV) + Correction Factor (dB)
Margin (dB) = Quasi-Peak level (dBµV) - Limit (dBµV)

CISPR Average level (dBµV) = Receiver level (dBµV) + Correction Factor (dB)
Margin (dB) = CISPR Average level (dBµV) - Limit (dBµV)

2.2.6 Example Test Setup Diagram

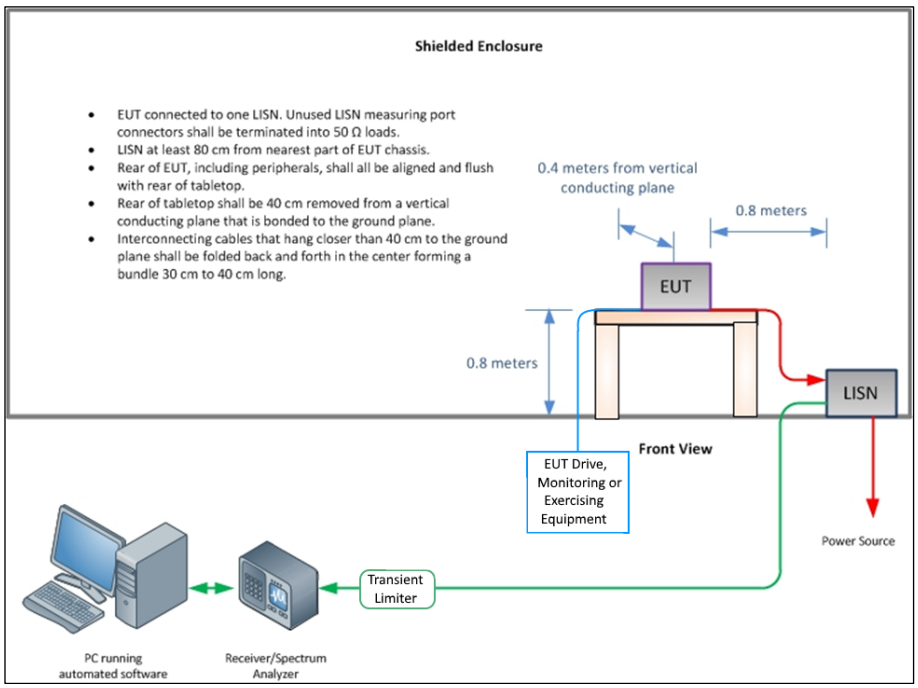

Figure 44 - Conducted Disturbance

2.2.7 Environmental Conditions

Ambient Temperature	19.6 °C
Relative Humidity	42.3 %

2.2.8 Specification Limits

Required Specification Limits - Class A			
Line Under Test	Frequency Range (MHz)	Quasi-Peak Test Limit (dBµV)	CISPR Average Test Limit (dBµV)
AC Power Port	0.15 to 0.5	79	66
	0.5 to 30	73	60
Supplementary information: None			

Table 57

2.2.9 Test Results

Results for Configuration and Mode: AC Powered - GNSS Receiver Operating.

This test was performed to the requirements of the Class A limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

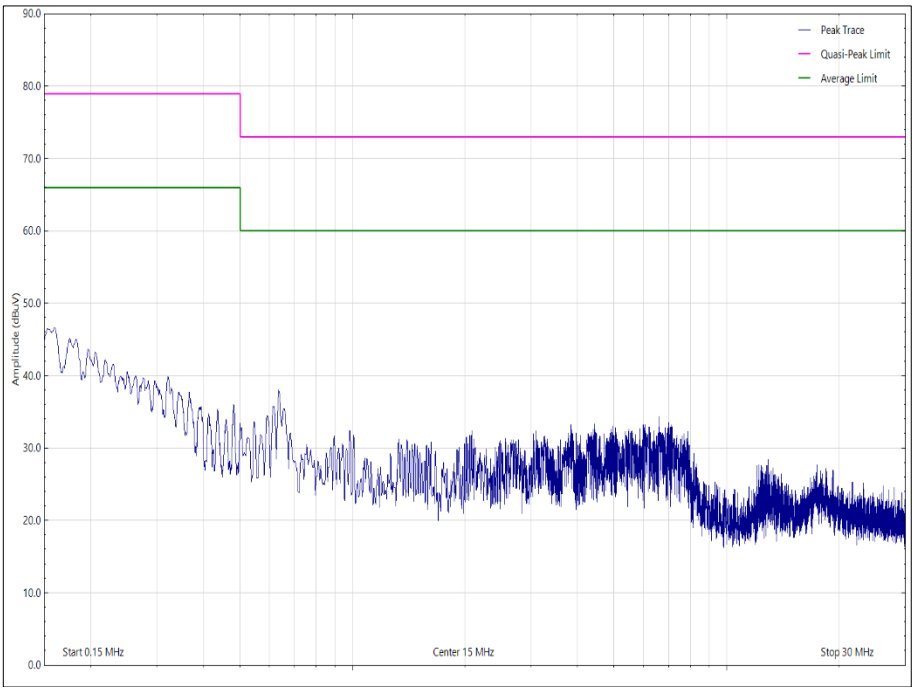

Figure 45 - Graphical Results - AC Power Port - Neutral

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

Table 58

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

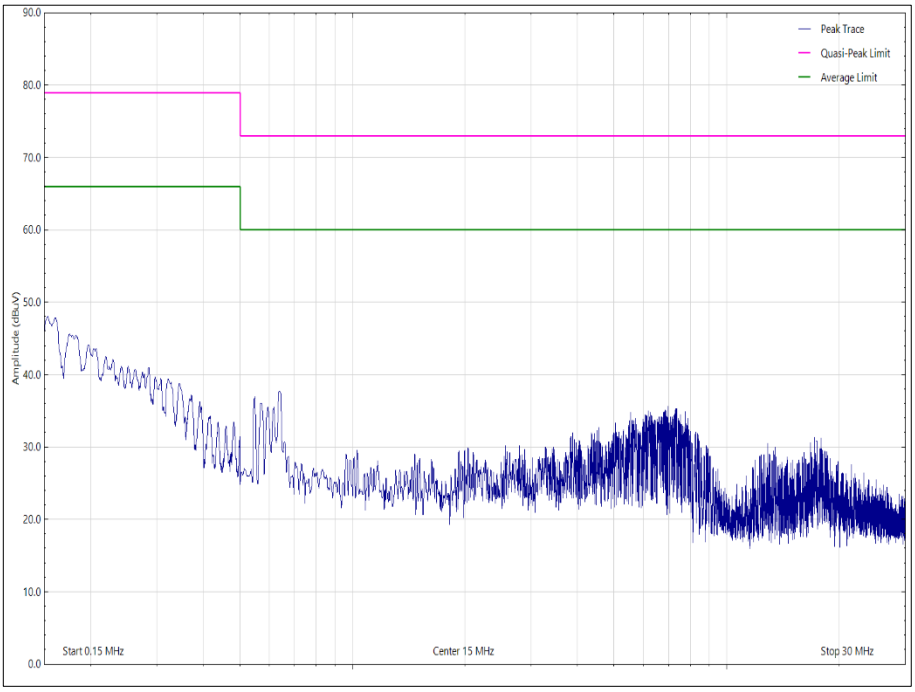

Figure 46 - Graphical Results - AC Power Port - Live

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

Table 59

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

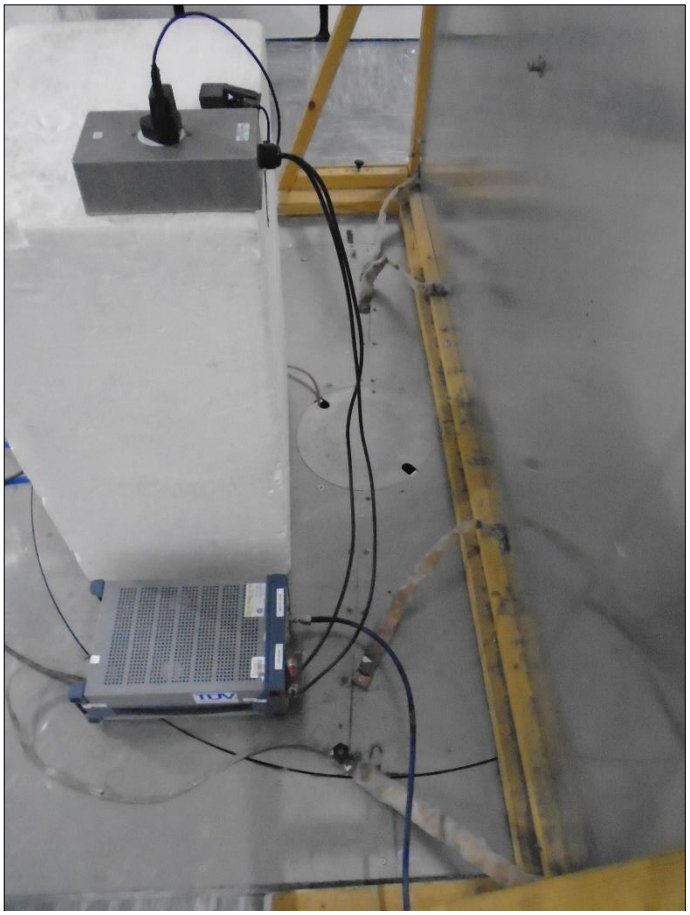

Figure 47 - AC Line Conducted Emissions

Figure 48- AC Line Conducted Emissions

2.2.10 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	31-Jan-2023
Transient Limiter	Hewlett Packard	11947A	2377	12	01-Mar-2022
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023

Table 60

3 Incident Reports

No incidents reports were raised.

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Radiated Disturbance	30 MHz to 1 GHz, Bilog Antenna, ±5.2 dB 1 GHz to 40 GHz, Horn Antenna, ±6.3 dB
Conducted Disturbance at Mains Terminals	150 kHz to 30 MHz, LISN, ±3.7 dB

Table 61

Worst case error for both Time and Frequency measurement 12 parts in 10^6.

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. (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.