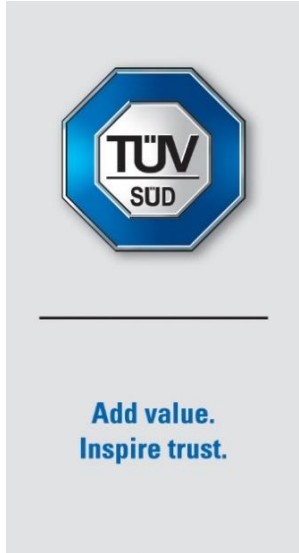


FCC and ISEDC Test Report:

Iridium Satellite LLC
Transceiver Module, Model: Certus™ 9770

In accordance with FCC 47 CFR Part 15B and
Industry Canada RSS-GEN

Prepared for: IRIDIUM SATELLITE LLC
1750 Tysons Blvd Suite 1400
McLean
VA 22102
USA



FCC ID: Q639770 IC: 4629A-9770

COMMERCIAL-IN-CONFIDENCE

Document Number: 75946605-03 | Issue: 01

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	31 October 2019

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 25, FCC 47 CFR Part 2 and Industry Canada RSS-170 and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	31 October 2019	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 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: 2018 and ISEDC RSS-GEN: Issue 5 + A1 (2019-03) for the tests detailed in section 1.3.

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

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1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	31 October 2019

Table 1

1.2 Introduction

Applicant	Iridium Satellite LLC
Manufacturer	Iridium Satellite LLC
Model Number(s)	Certus™ 9770
Serial Number(s)	Y0002M
Hardware Version(s)	P3142-009a change note P3142-CN-017 v0.2
Software Version(s)	PPDO v0.2.1
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2018 ISED RSS-GEN: Issue 5 + A1 (2019-03)
Order Number	59151
Date	19-July-2019
Date of Receipt of EUT	06-September-2019
Start of Test	08-September-2019
Finish of Test	15-September-2019
Name of Engineer(s)	Graeme Lawler



1.3 Brief Summary of Results

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

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15B	RSS-GEN			
Configuration and Mode: DC Powered - Iridium Receive					
2.1	15.109	7.1	Radiated Disturbance	Pass	ANSI C63.4 / ANSI C63.10

Table 2



1.4 Application Form

Equipment Description

Technical Description: <i>(Please provide a brief description of the intended use of the equipment)</i>	Transceiver module for connection to the Iridium satellite network
Manufacturer:	Iridium satellite LLC
Model:	CertusTM 9770
Part Number:	IRID0058PA3
Hardware Version:	P3142-009a change note P3142-CN-017 v0.2
Software Version:	PPDO v0.2.1
FCC ID (if applicable)	Q639770
IC ID (if applicable)	4629A-9770

Intentional Radiators

Technology	Iridium
Frequency Band (MHz)	1616-1626.5
Conducted Declared Output Power (dBm)	40
Antenna Gain (dBi)	3
Supported Bandwidth(s) (MHz)	36k,72k,288k
Modulation Scheme(s)	QPSK
ITU Emission Designator	41K7Q7W, 83K4Q7, 333K3Q7W
Bottom Frequency (MHz)	1616.5000
Middle Frequency (MHz)	1621.1667
Top Frequency (MHz)	1625.8330

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	3.2 GHz
Lowest frequency generated or used in the device or on which the device operates or tunes	19.2 MHz
Class A Digital Device (Use in commercial, industrial or business environment) <input checked="" type="checkbox"/>	
Class B Digital Device (Use in residential environment only) <input type="checkbox"/>	

AC Power Source

AC supply frequency: Click to edit (Hz)	
Click to edit V	Max current: Click to edit A
Single Phase <input type="checkbox"/> Three Phase <input type="checkbox"/>	



DC Power Source

Nominal voltage: 12 V
Extreme upper voltage: 14.5 V
Extreme lower voltage: 9.5 V
Max current: 1.6. A

Battery Power Source

Voltage: Click to edit V
End-point voltage: Click or tap here to enter text V (Point at which the battery will terminate)
Alkaline <input type="checkbox"/> Leclanche <input type="checkbox"/> Lithium <input type="checkbox"/> Nickel Cadmium <input type="checkbox"/> Lead Acid* <input type="checkbox"/> *(Vehicle regulated)
Other <input type="checkbox"/> Please detail: Click to edit

Charging

Can the EUT transmit whilst being charged	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
---	---

Temperature

Minimum temperature: -40 °C	Maximum temperature: +70 °C
-----------------------------	-----------------------------

Antenna Characteristics

Antenna connector <input checked="" type="checkbox"/> State impedance 50 Ohm
Temporary antenna connector <input type="checkbox"/> State impedance Click to edit Ohm
Integral antenna <input type="checkbox"/> Type Click to edit State impedance Click to edit dBi
External antenna <input checked="" type="checkbox"/> Type Click to edit State impedance 50 R

Ancillaries (if applicable)

Manufacturer: Click to edit	Part Number: Click to edit
Model: Click to edit	Country of Origin: Click to edit

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

Name: Les Nuttall
Position held: Snr Consultant
Date: 15/8/2019

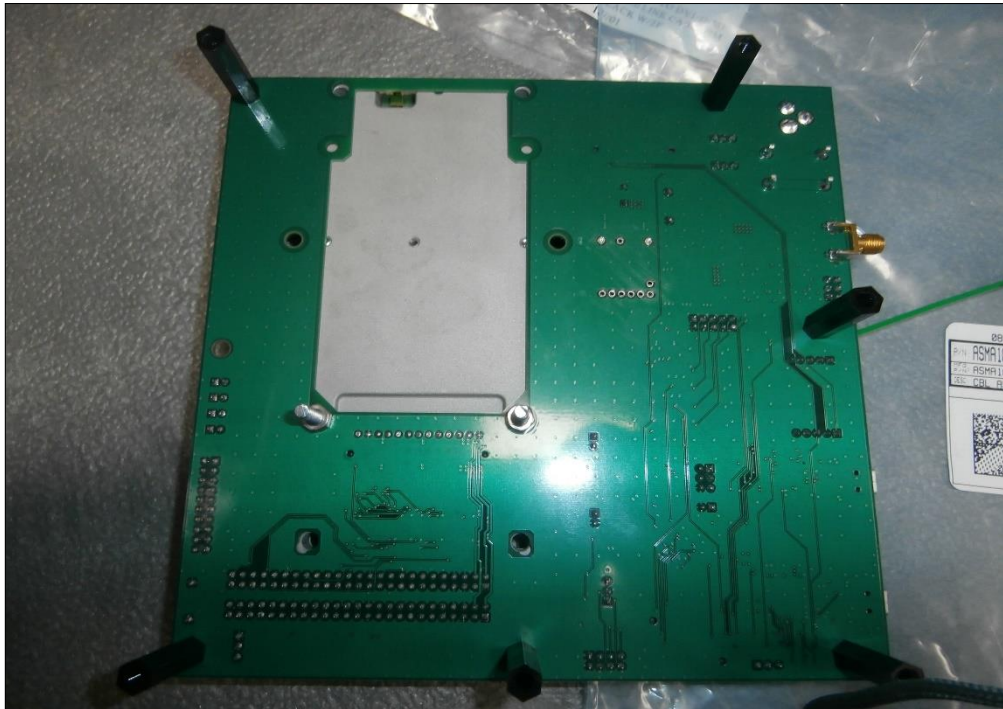


Figure 2 - Rear View

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: Certus™ 9770: Serial Number: Y0002M			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3



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: DC Powered - Iridium Receive		
Radiated Disturbance	Graeme Lawler	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
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
Industry Canada RSS-GEN, Clause 7.1

2.1.2 Equipment Under Test and Modification State

Certus™ 9770, S/N: Y0002M - Modification State 0

2.1.3 Date of Test

08-September-2019 to 15-September-2019

2.1.4 Test Method

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

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.

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

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was 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:

$$\begin{aligned} \text{Quasi-Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB)} \\ \text{Margin (dB)} &= \text{Quasi-Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)} \end{aligned}$$

Above 1 GHz:

$$\begin{aligned} \text{CISPR Average level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB)} \\ \text{Margin (dB)} &= \text{Limit (dB}\mu\text{V/m)} - \text{CISPR Average level (dB}\mu\text{V/m)} \end{aligned}$$

$$\begin{aligned} \text{Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB)} \\ \text{Margin (dB)} &= \text{Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)} \end{aligned}$$

2.1.6 Example Test Setup Diagram

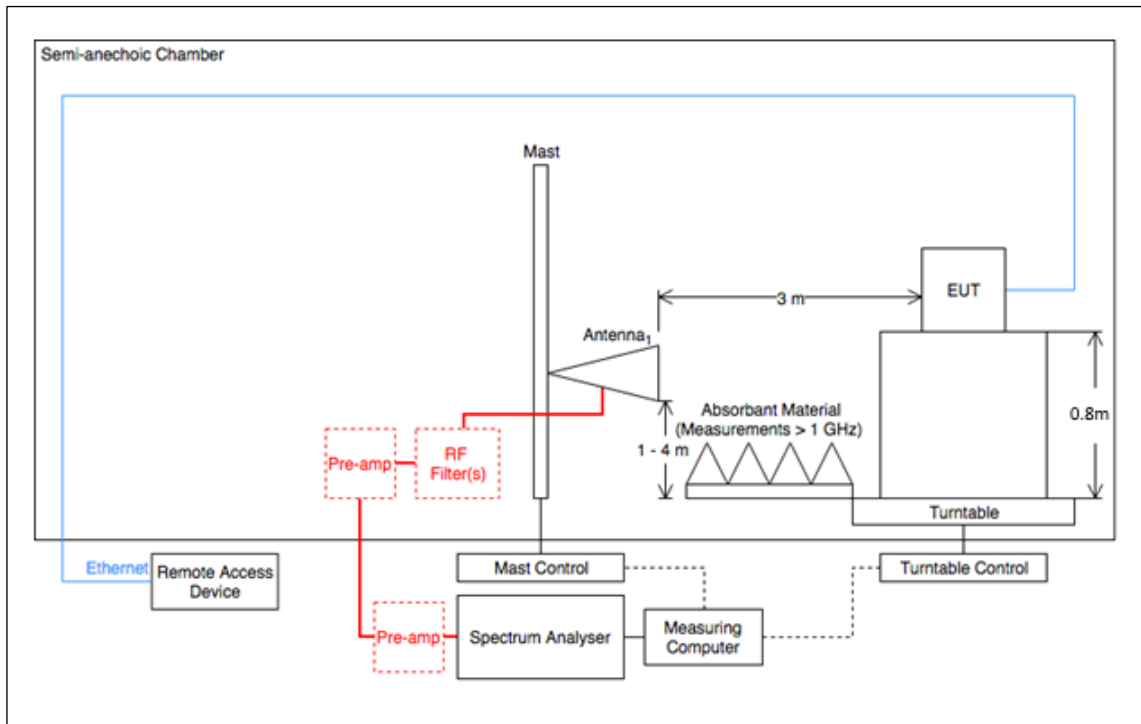


Figure 3 - Radiated Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature 16.3 - 17.5 °C
 Relative Humidity 55.0 - 74.7 %

2.1.8 Specification Limits

Required Specification Limits, Field Strength (Class A @ 10m)		
Frequency Range (MHz)	($\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)
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:
 Quasi-peak detector to be used for measurements below 1 GHz
 CISPR Average detector to be used for measurements above 1 GHz
 Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.

Table 5



2.1.9 Test Results

Results for Configuration and Mode: DC Powered - Iridium Receive.

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

Tested to Class A Test Limits.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 3.2 GHz
 Which necessitates an upper frequency test limit of: 18 GHz

Frequency Range of Test: 30 MHz to 1 GHz - X Orientation

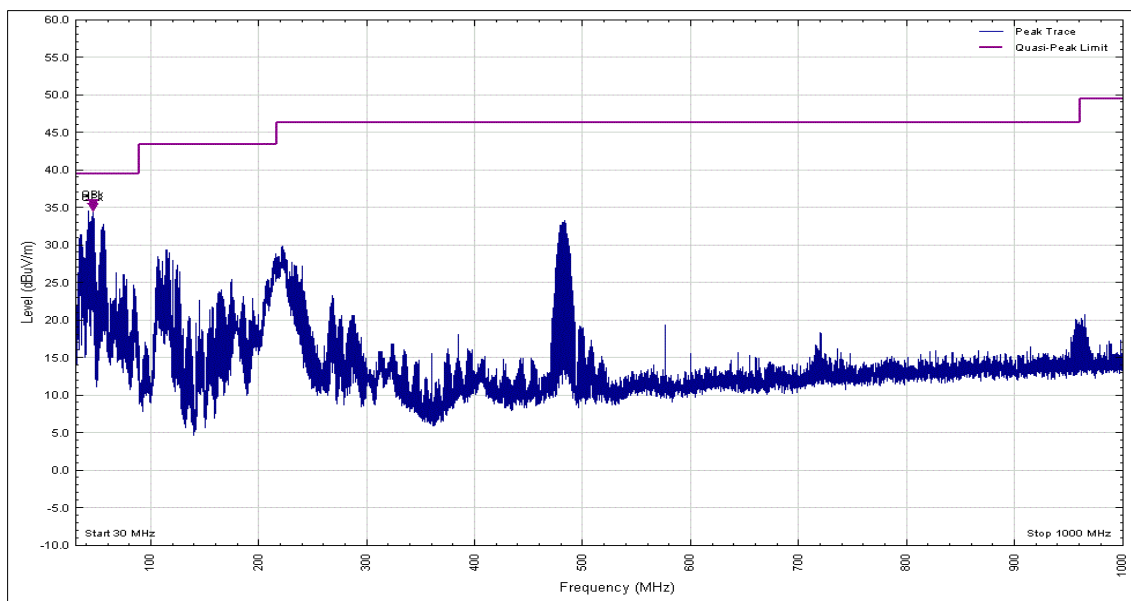


Figure 4 - Graphical Results - Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
46.471	34.1	39.5	-5.4	Q-Peak	74	100	Vertical
46.482	34.6	39.5	-4.9	Q-Peak	74	103	Vertical
55.764	30.2	39.5	-9.3	Q-Peak	70	105	Vertical

Table 6

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



Frequency Range of Test: 30 MHz to 1 GHz - X Orientation

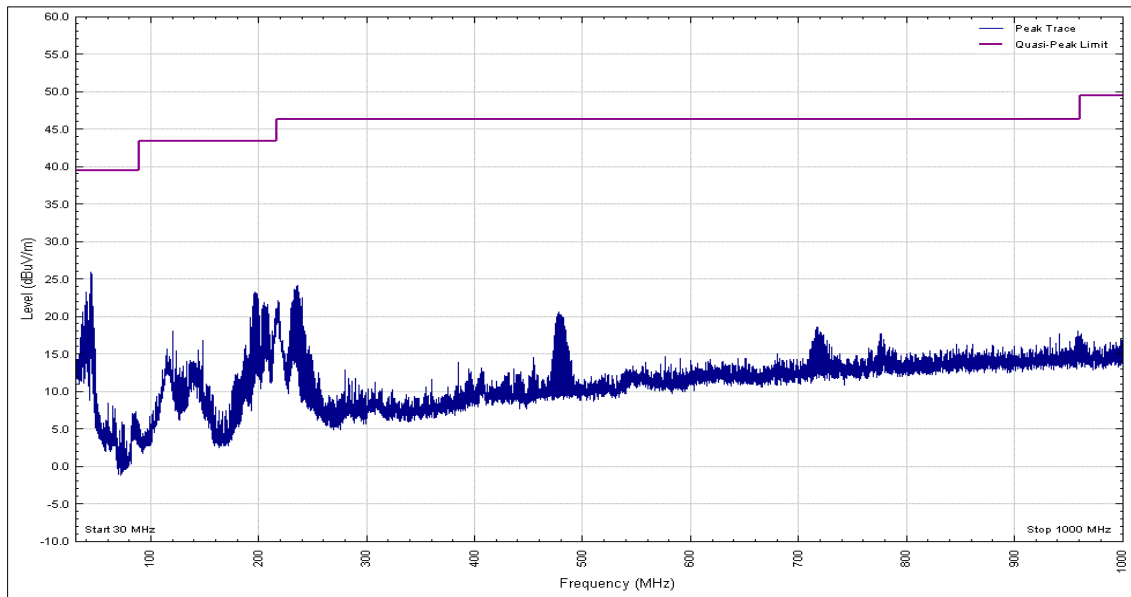


Figure 5 - Graphical Results - Horizontal Polarity

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

Table 7

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - X Orientation

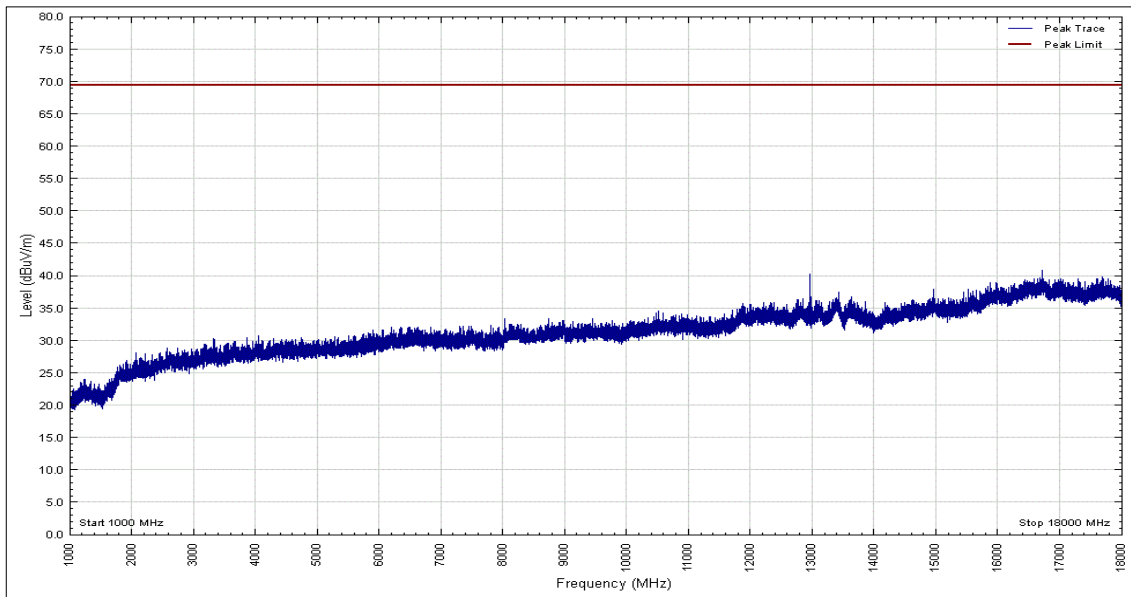


Figure 6 - Graphical Results - Vertical Polarity

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

Table 8

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - X Orientation

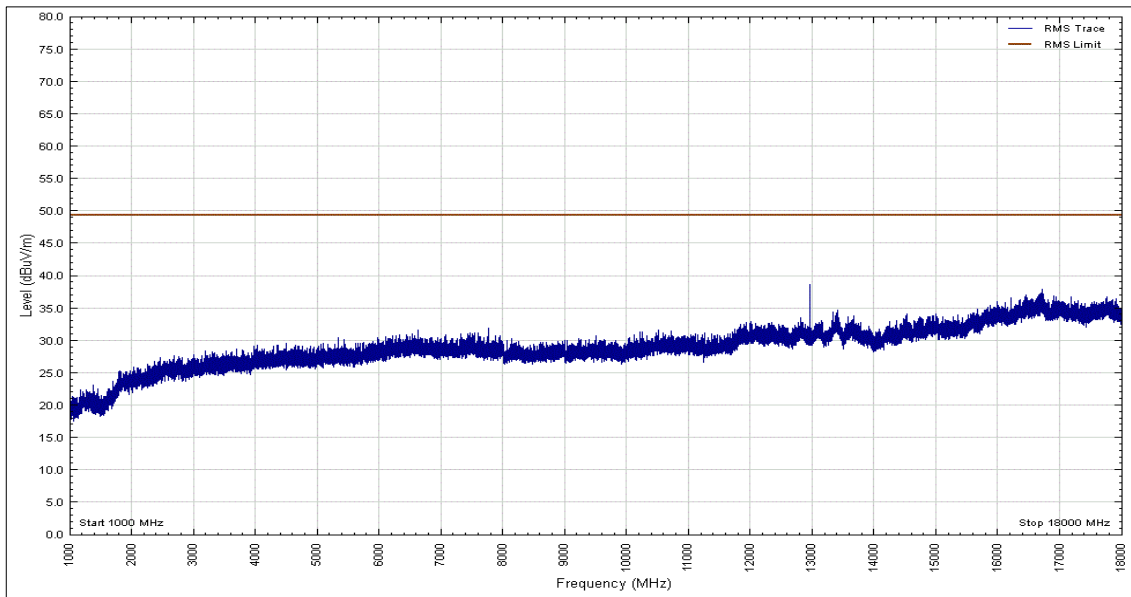


Figure 7 - Graphical Results - Vertical Polarity

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

Table 9

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - X Orientation

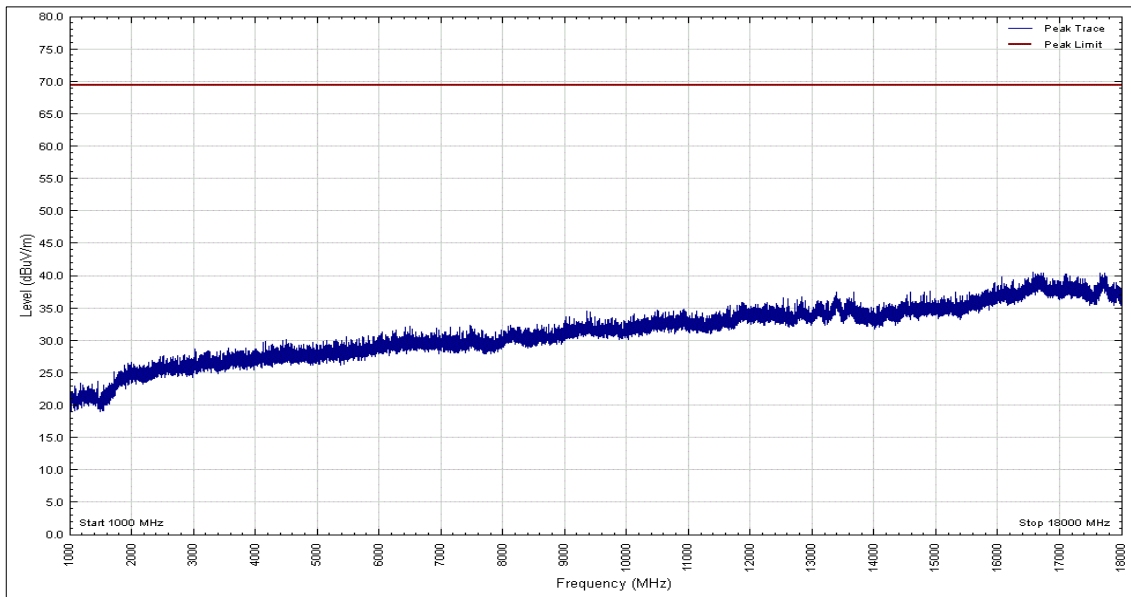


Figure 8 - Graphical Results - Horizontal Polarity

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

Table 10

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - X Orientation

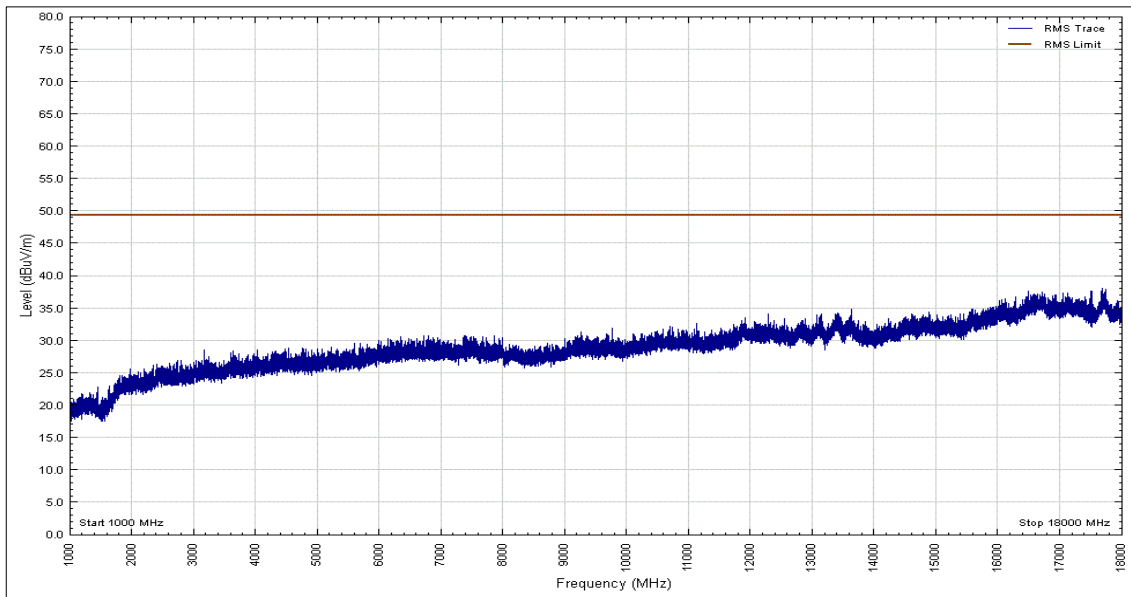


Figure 9 - Graphical Results - Horizontal Polarity

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

Table 11

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



Frequency Range of Test: 30 MHz to 1 GHz - Y Orientation

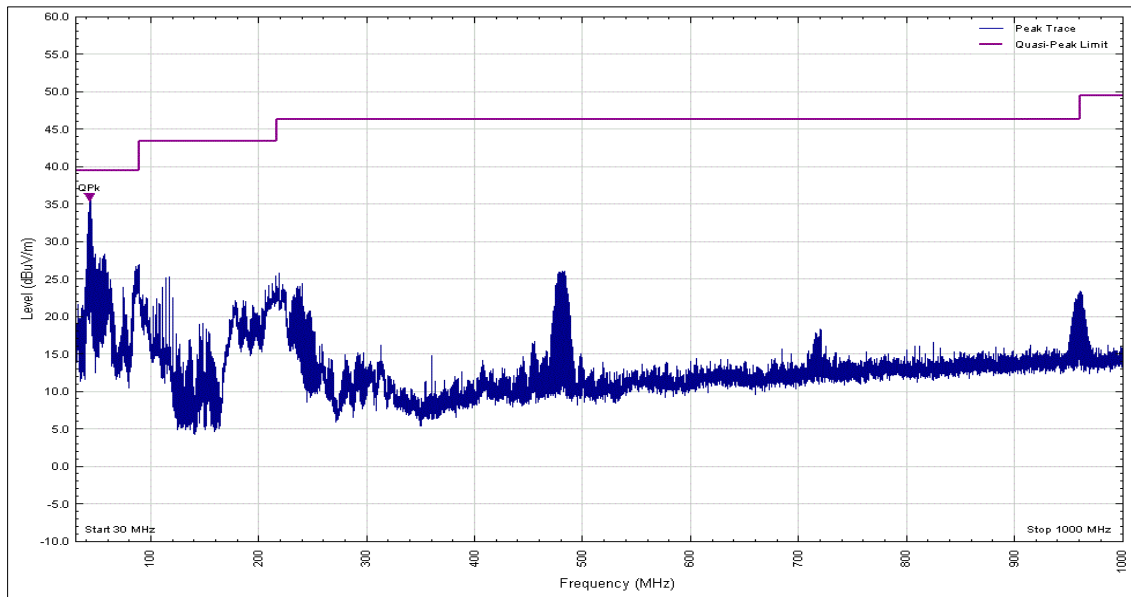


Figure 10 - Graphical Results - Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
43.092	34.9	39.5	-4.6	Q-Peak	222	103	Vertical
46.471	34.1	39.5	-5.4	Q-Peak	74	100	Vertical

Table 12

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



Frequency Range of Test: 30 MHz to 1 GHz - Y Orientation

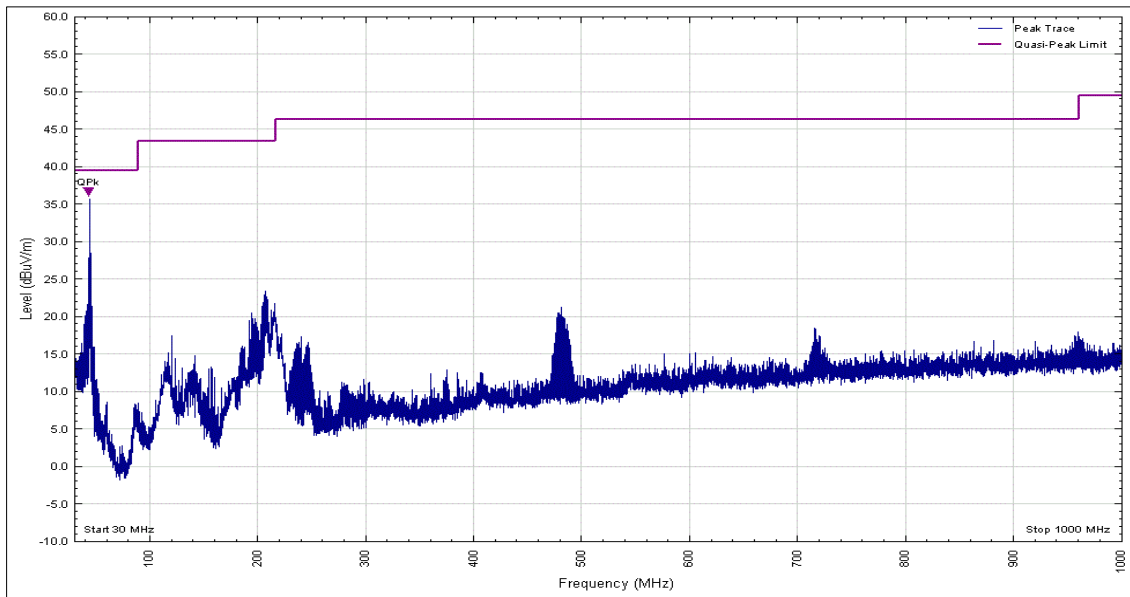


Figure 11 - Graphical Results - Horizontal Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
43.715	35.8	39.5	-3.8	Q-Peak	220	258	Horizontal

Table 13

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - Y Orientation

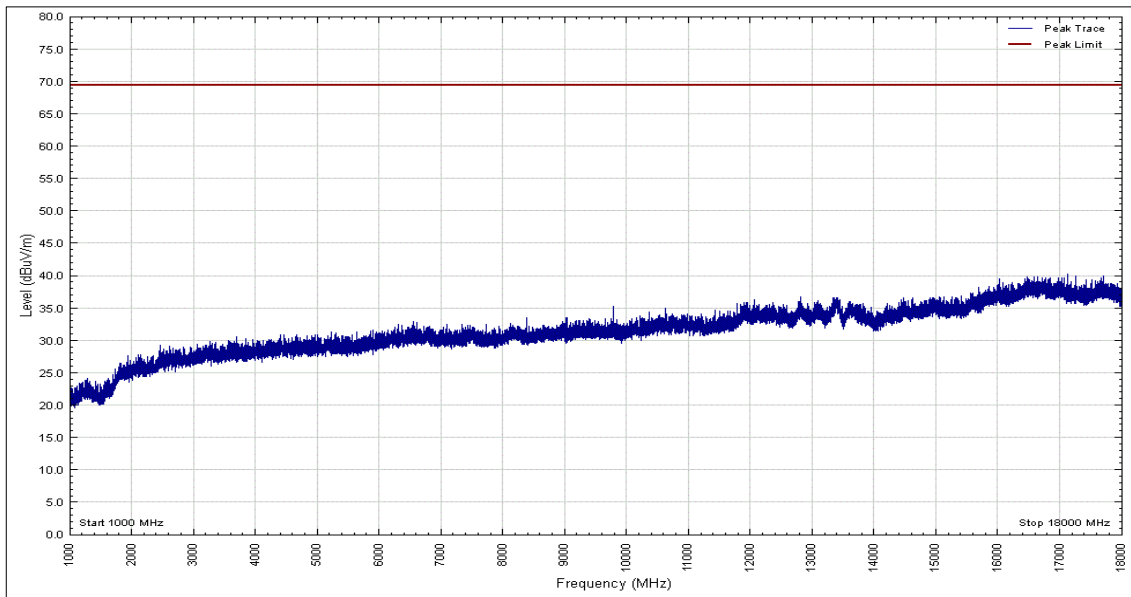


Figure 12 - Graphical Results - Vertical Polarity

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

Table 14

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - Y Orientation

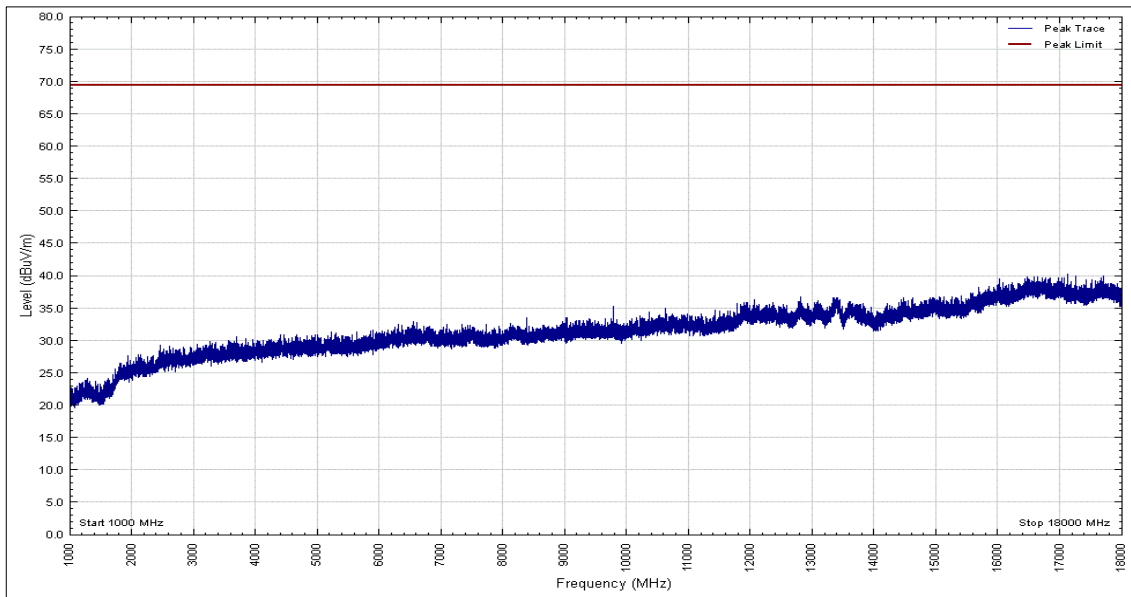


Figure 13 - Graphical Results - Vertical Polarity

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

Table 15

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - Y Orientation

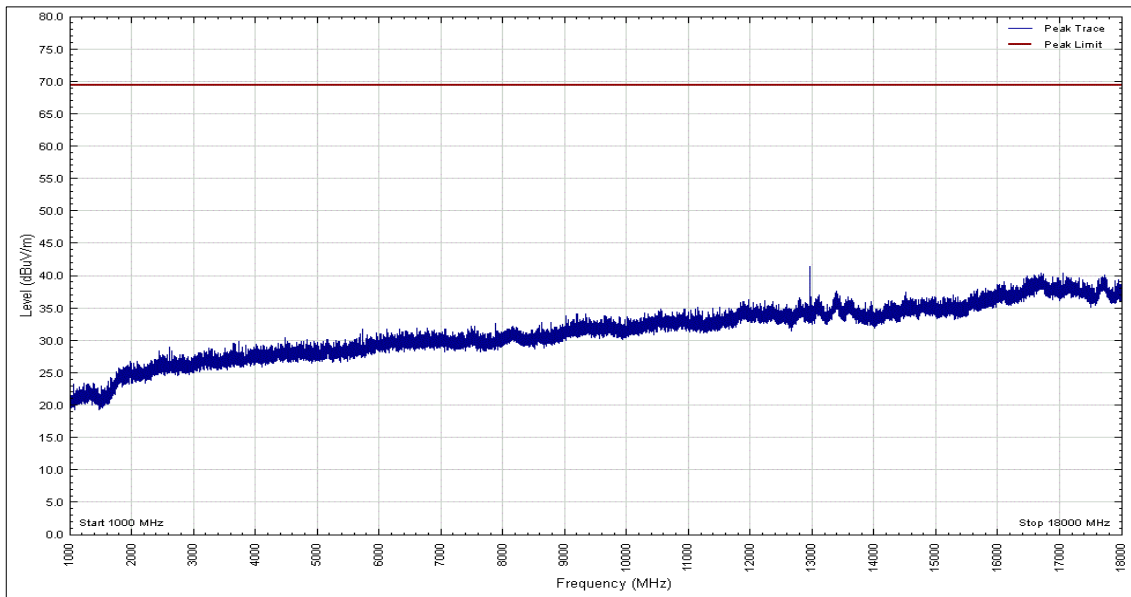


Figure 14 - Graphical Results - Horizontal Polarity

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

Table 16

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - Y Orientation

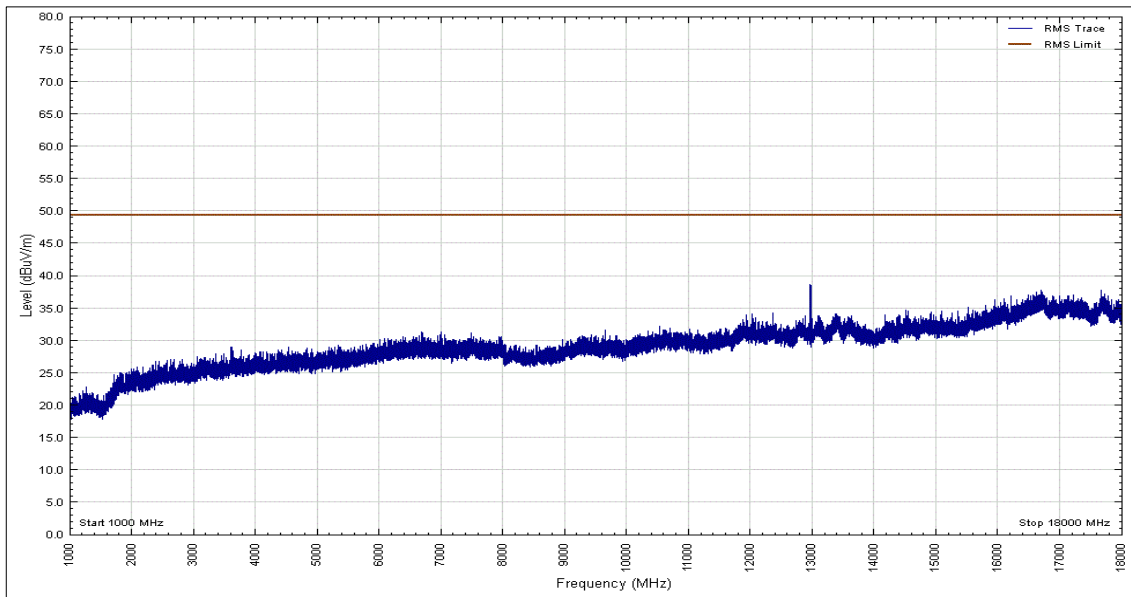


Figure 15 - Graphical Results - Horizontal Polarity

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

Table 17

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



Frequency Range of Test: 30 MHz to 1 GHz - Z Orientation

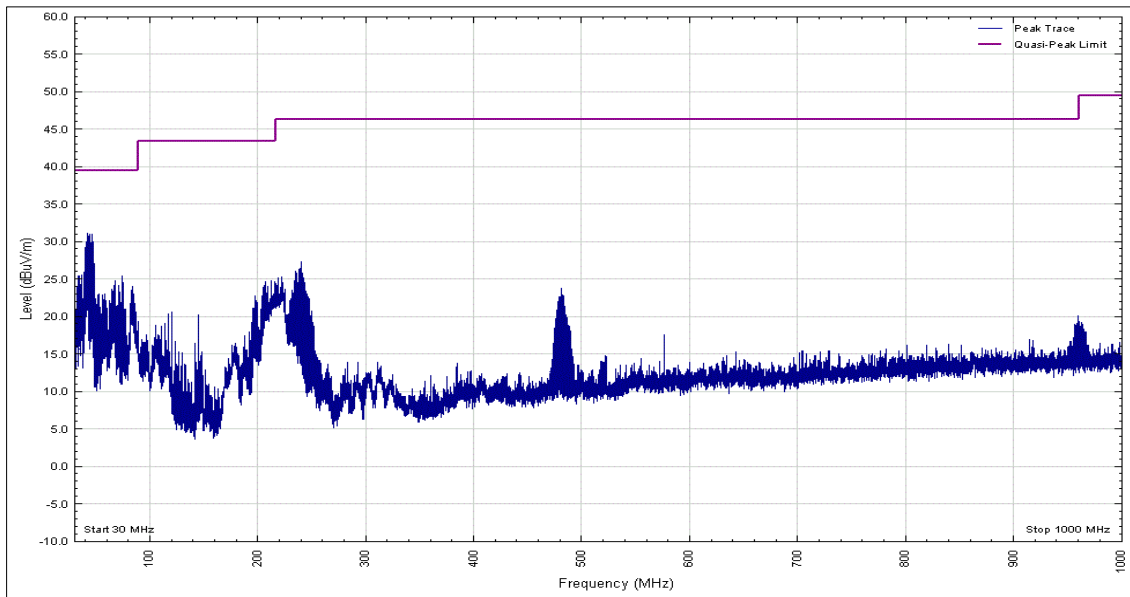


Figure 16 - Graphical Results - Vertical Polarity

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
43.101	30.8	39.5	-8.7	Q-Peak	170	104	Vertical

Table 18

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



Frequency Range of Test: 30 MHz to 1 GHz - Z Orientation

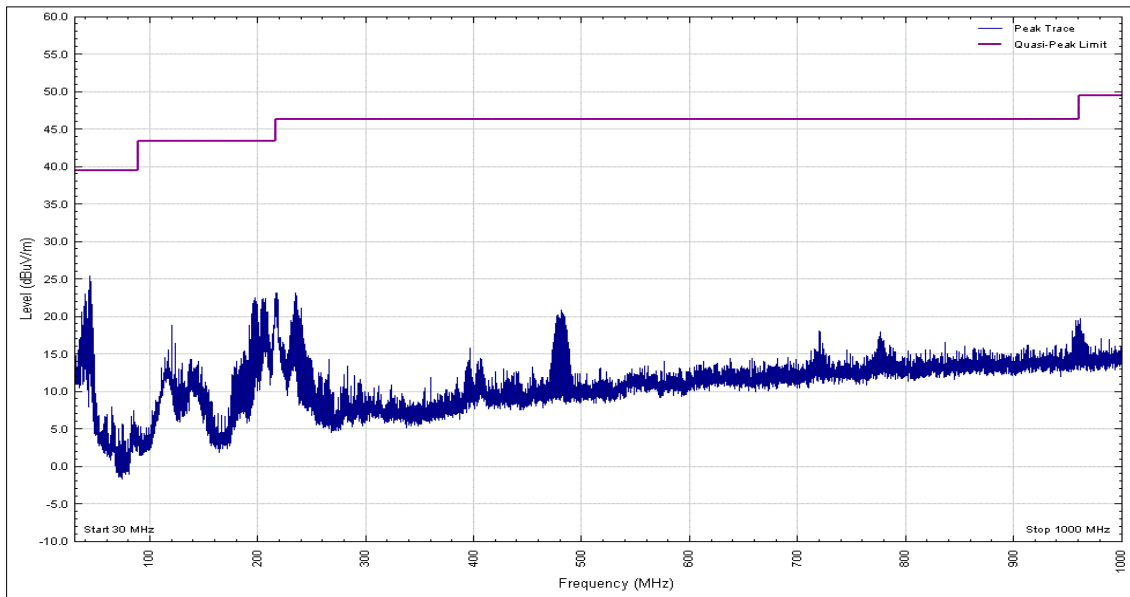


Figure 17 - Graphical Results - Horizontal Polarity

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

Table 19

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - Z Orientation

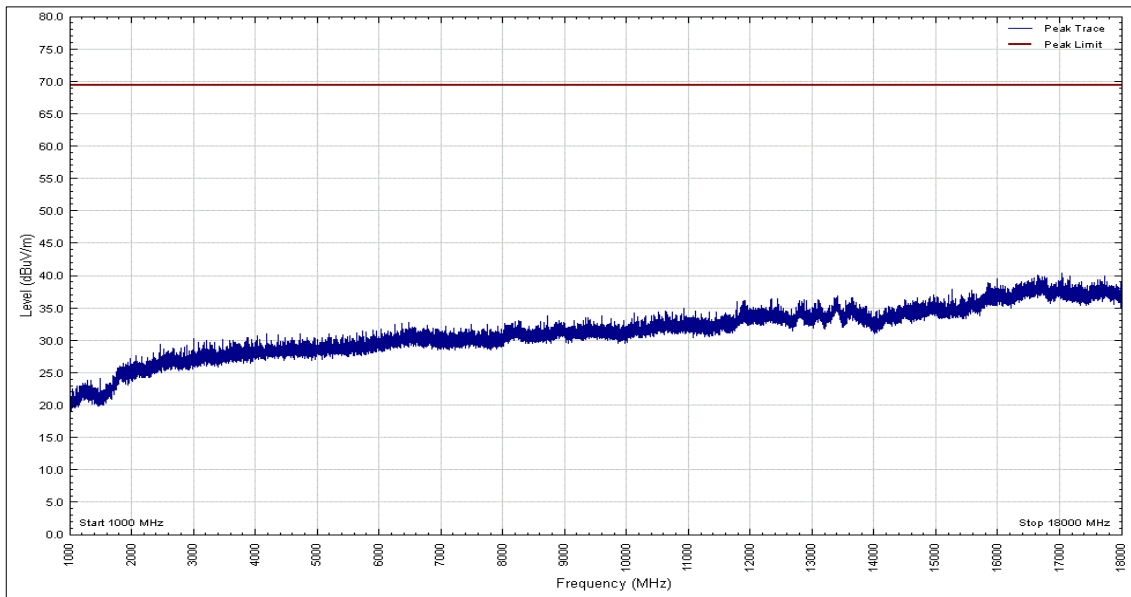


Figure 18 - Graphical Results - Vertical Polarity

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

Table 20

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - Z Orientation

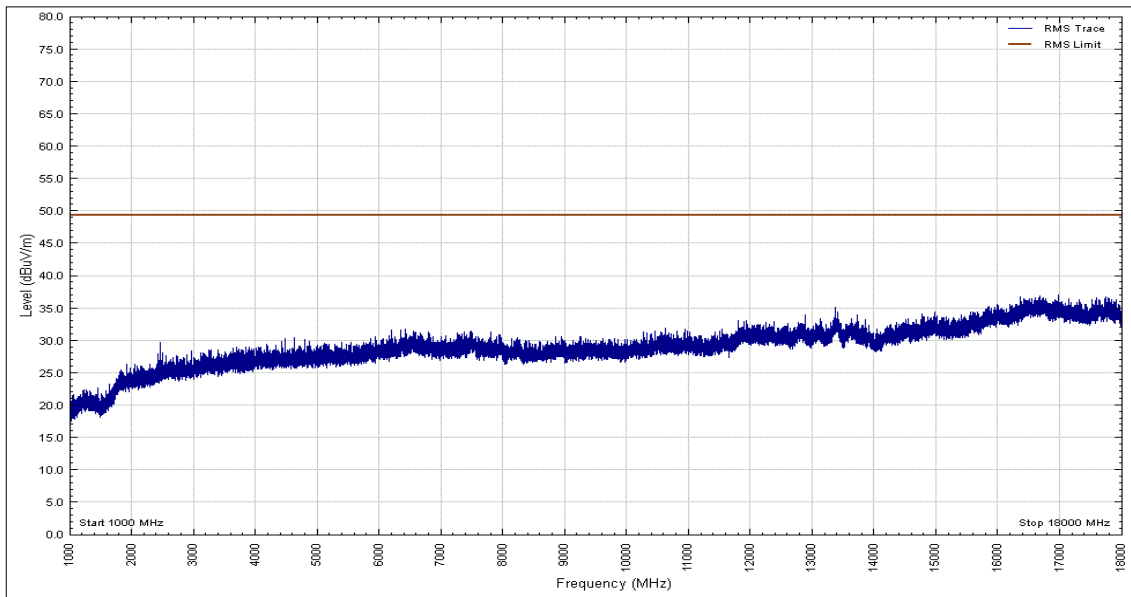


Figure 19 - Graphical Results - Vertical Polarity

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

Table 21

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



Frequency Range of Test: 1 GHz to 18 GHz - Peak - Z Orientation

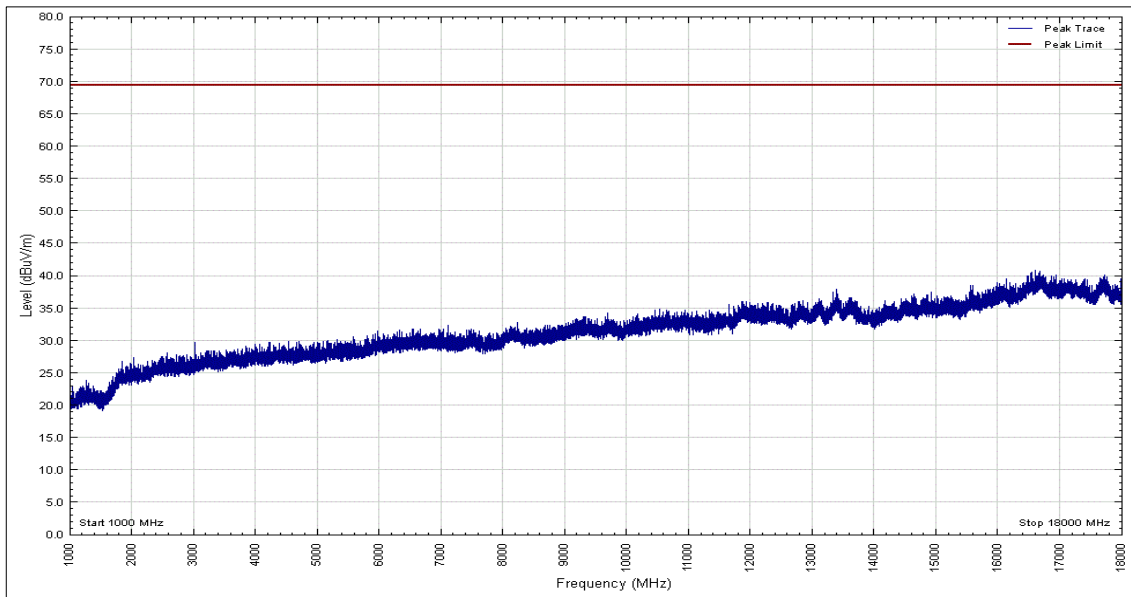


Figure 20 - Graphical Results - Horizontal Polarity

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

Table 22

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



Frequency Range of Test: 1 GHz to 18 GHz – CISPR Average - Z Orientation

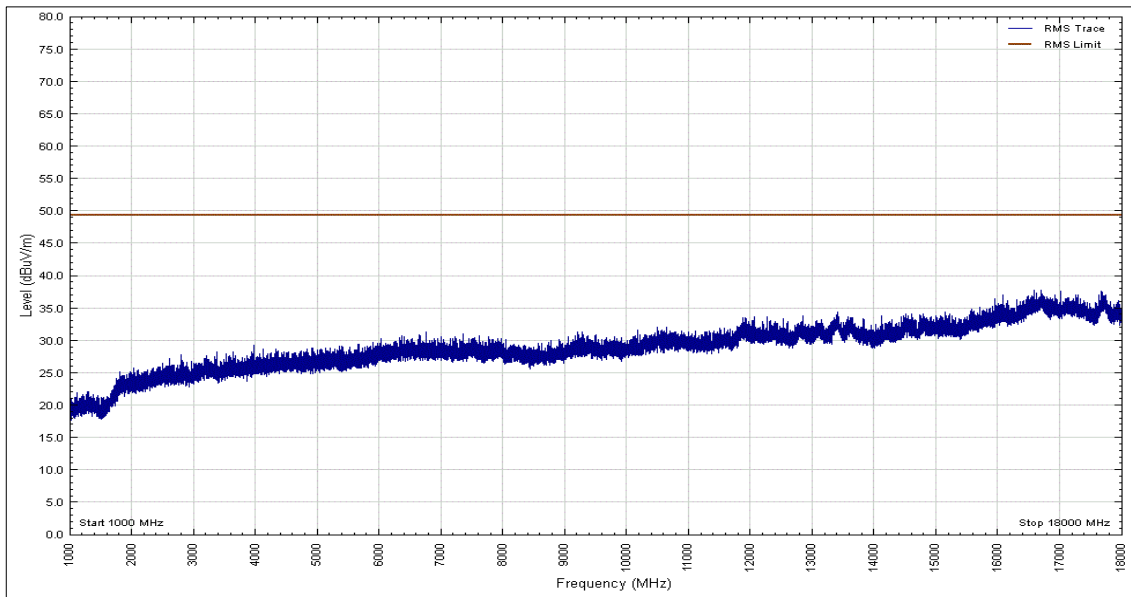


Figure 21 - Graphical Results - Horizontal Polarity

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

Table 23

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

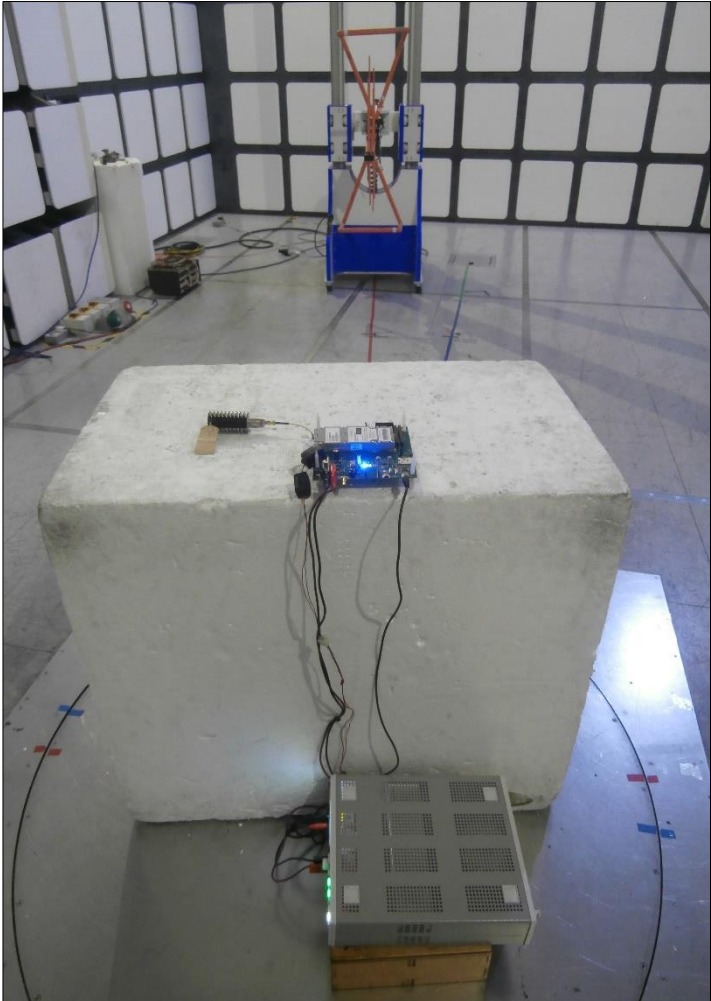


Figure 22 - 30 MHz to 1 GHz - X Orientation

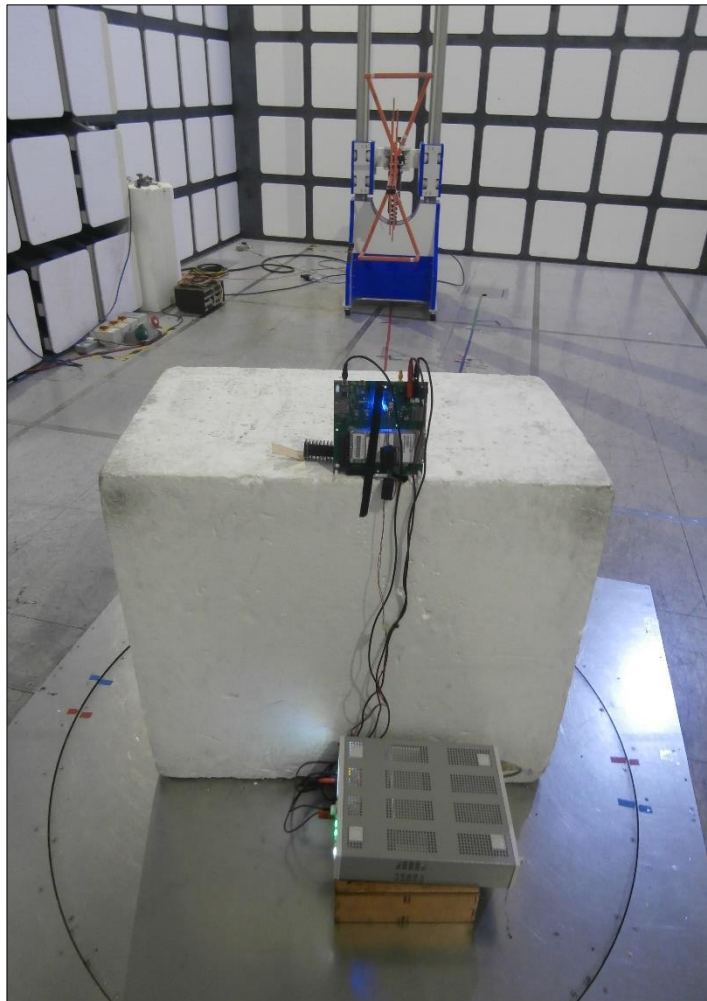


Figure 23 - 30 MHz to 1 GHz - Y Orientation

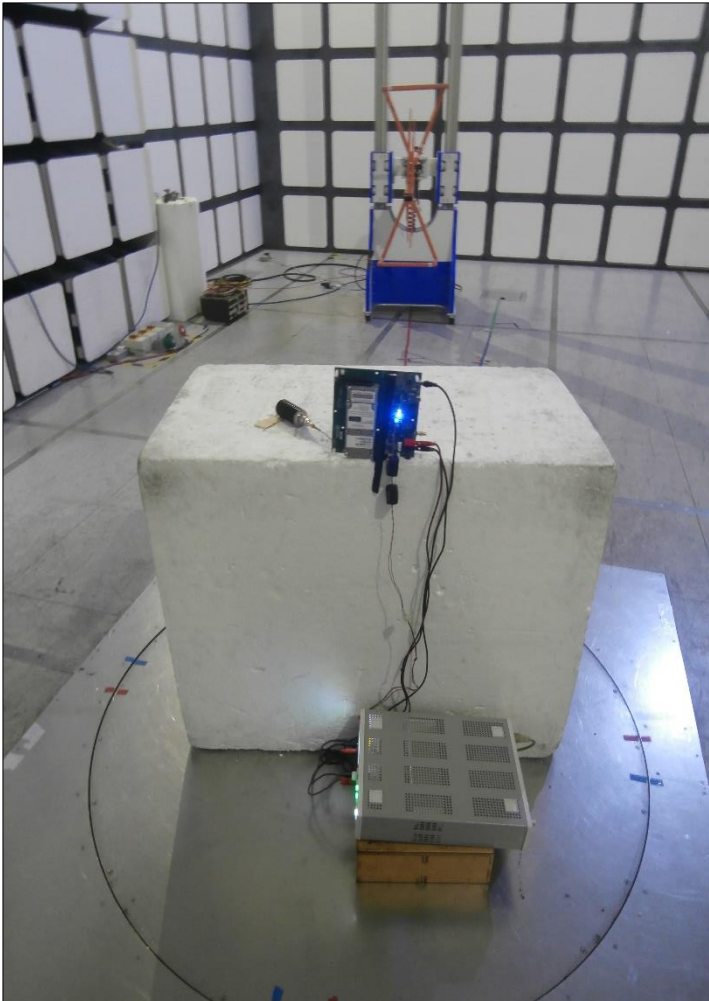


Figure 24 - 30 MHz to 1 GHz - Z Orientation

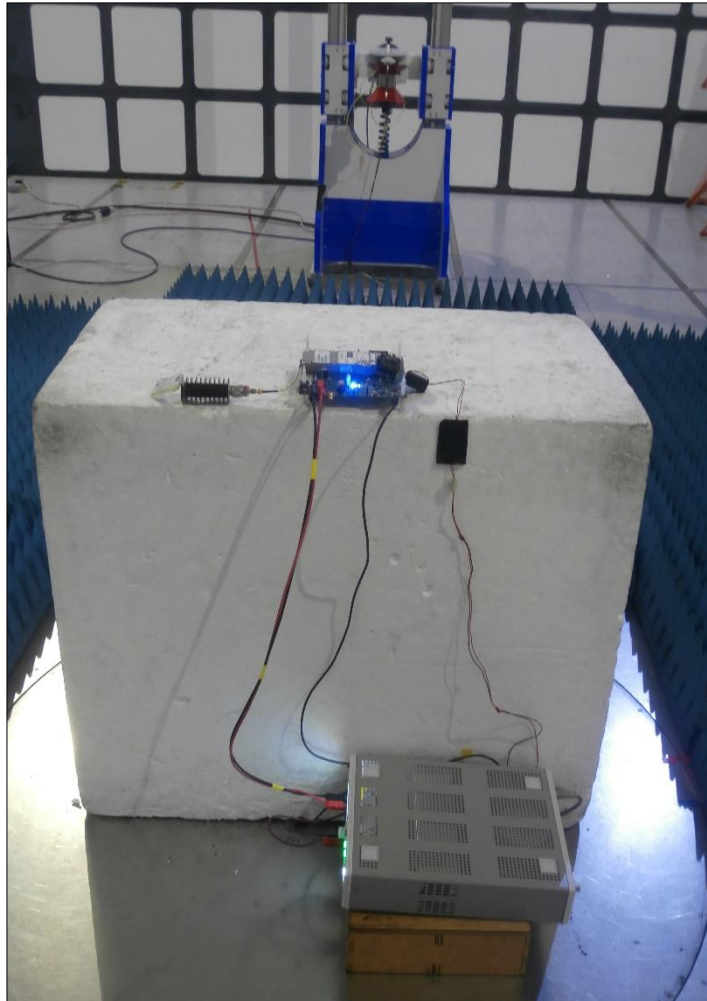


Figure 25 - 1 GHz to 9 GHz - X Orientation

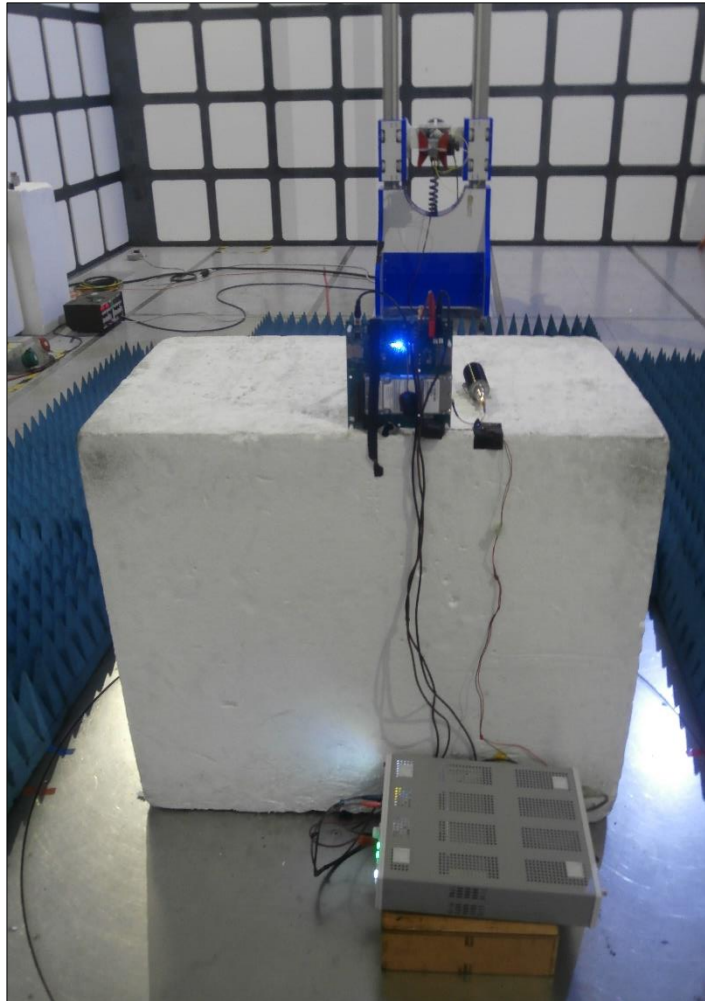


Figure 26 - 1 GHz to 9 GHz - Y Orientation

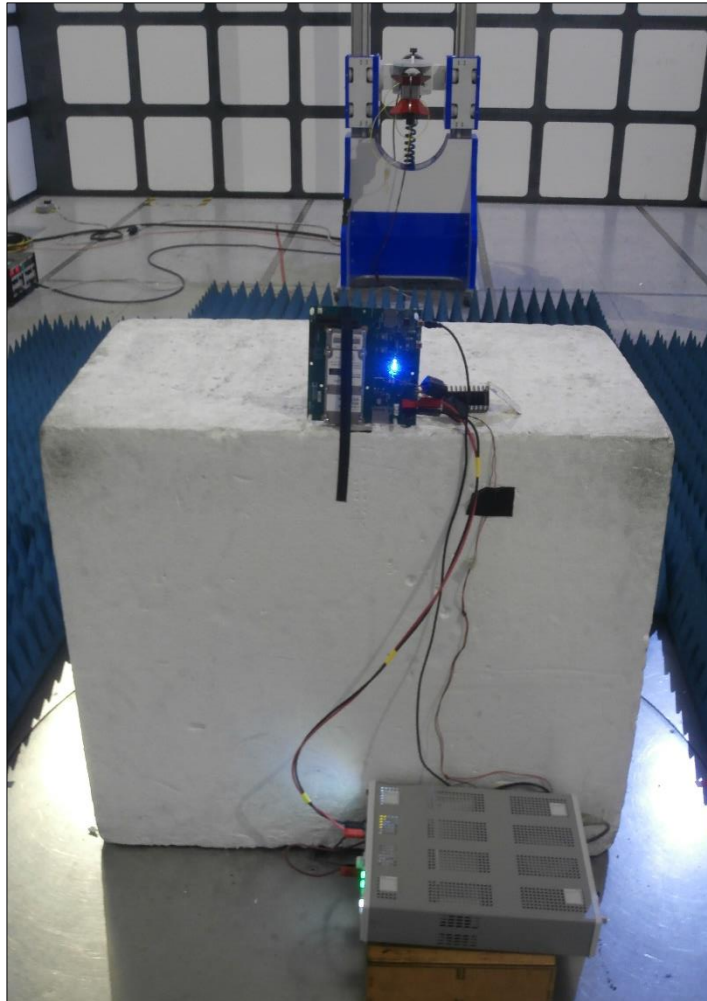


Figure 27 - 1 GHz to 9 GHz - Z Orientation



2.1.10 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
Test Receiver (ESW)	Rohde & Schwarz	ESW44	5351	12	31-Jul-2020
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	25-Oct-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
Comb Generator	Schaffner	RSG1000	3034	-	TU
True RMS Multimeter	Fluke	179	4006	12	22-Jan-2020
Termination (50ohm)	Weinschel	1426-4	4325	12	27-Jun-2020
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Oct-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5093	12	04-Oct-2019
1.5m 40GHz RF Cable	Scott Cables	KPS-1501-2000-KPS	5127	6	11-Dec-2019

Table 24

TU - Traceability Unscheduled



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

Table 25

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .
All measurement uncertainties have been calculated using CISPR guidelines.