

FCC and ISEDC Test Report

SRT Marine Systems

AIS Class B Transceiver, Model: VMS-100s

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

Prepared for: SRT Marine Systems plc
Wireless House
Westfield Industrial Estate
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Add value.
Inspire trust.

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IC: 7075A-4290002A

COMMERCIAL-IN-CONFIDENCE

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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Kim Archer	Sales Manager	Authorised Signatory	14 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 15B and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE

NAME	RESPONSIBLE FOR	DATE
Graeme Lawler	Testing	14 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 04 (2014-11) 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	14 October 2019

Table 1

1.2 Introduction

Applicant	SRT Marine Systems plc
Manufacturer	SRT Marine Systems plc
Model Number(s)	VMS-100s
Serial Number(s)	EP2-15
Hardware Version(s)	V3
Software Version(s)	150201.01.xx.xx
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2018 ISED RSS-GEN: Issue 04 (2014-11)
Order Number	POR007580
Date	06-June-2019
Date of Receipt of EUT	25-July-2019
Start of Test	04-September-2019
Finish of Test	24-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 ISED RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15B	RSS-GEN			
Configuration and Mode: DC Powered - AIS Transmitter off, 2.4 GHz (WiFi/BT) On, 5 GHz WiFi On					
2.1	15.109	7.1	Radiated Disturbance	Pass	Class A Limits Applied

Table 2



1.4 Declaration of Build Status

Equipment Description

Technical Description: (Please provide a brief description of the intended use of the equipment)	Class B SOTDMA AIS Transceiver
Manufacturer:	SRT Marine Systems plc
Model:	VMS-100s
Part Number:	429-0002
Hardware Version:	V3
Software Version:	150201.01.xx.xx
FCC ID (if applicable)	UYW-4290002
IC ID (if applicable)	7075A-4290002A

Intentional Radiators

Technology	AIS	WiFi / Bluetooth	WiFi
Frequency Band (MHz)	156 - 162	2400 - 2500	5180 - 5825
Conducted Declared Output Power (dBm)	37	15	15
Antenna Gain (dBi)	3	0.5	0.5
Supported Bandwidth(s) (MHz)	0.015	20	20
Modulation Scheme(s)	GMSK	CCK/DSSS	OFDM
ITU Emission Designator	25K0G1B	12M2GXW	17M9GXW
Bottom Frequency (MHz)	156.025	2400	5180
Middle Frequency (MHz)	159.025	2450	5502.5
Top Frequency (MHz)	162.025	2500	5825

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	5825 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	136.37 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒	
Class B Digital Device (Use in residential environment only) ☐	

AC Power Source

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



DC Power Source

Nominal voltage:	12 – 24	V
Extreme upper voltage:	31.2	V
Extreme lower voltage:	9.6	V
Max current:	6	A

Battery Power Source

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

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☐
---	--

Temperature

Minimum temperature:	-15	°C
Maximum temperature:	55	°C

Antenna Characteristics

Antenna connector ☒	State impedance	50	Ohm
Temporary antenna connector ☐	State impedance		Ohm
Integral antenna ☐	Type:		dBI
External antenna ☒	Type:	Marine VHF vertical	dBI

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

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

Name: Abdul Mohammed
 Position held: Compliance Engineer
 Date: 09/10/2019

1.5 Product Information

1.5.1 Technical Description

The Equipment Under Test (EUT) was an SRT Marine Systems plc, AIS Class B Transceiver, Model: VMS-100s

A full description and detailed product specification details are available from the manufacturer.



Figure 1 - General View



Figure 2 - Rear View



1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: DC Powered - AIS Transmitter off, WiFi on				
VHF Antenna Port	Unlimited	To connect VHF Antenna to AIS Transceiver	PL-259	Yes
GNSS Antenna	Unlimited	Receive of GNSS Data	TNC Coaxial	No
DC Power Lead	Unlimited	Supply of Power to EUT	2-pin Circular Connector	No
Serial Cable (NMEA)	Unlimited	Transmission of Serial Data	12-pin Circular Connector	No

Table 3

1.5.3 Test Configuration

Configuration	Description
DC Powered	The EUT was powered from a 12 V DC external supply (The device can operate at 24 V DC but 12 V DC was considered worst case as this results in the highest current draw). The VHF Antenna Port was connected to a 50 ohm Load. The GNSS Antenna port was connected to a suitable GNSS Antenna. The serial cable was connected to a laptop.

Table 4

1.5.4 Modes of Operation

Mode	Description
AIS Transmitter off, 2.4 GHz (WiFi/BT) On, 5 GHz WiFi On	The AIS Transmitter was disabled using test commands. The 2.4 GHz WiFi/BT and 5 GHz WiFi was enabled on the EUT but not connected to an access point or paired to another device. Transmissions from the 2.4 GHz transmitters were intermittent, this band was notched out during the test. The GNSS receiver was in a state of trying to acquire a position. NMEA data from the EUT was logging on a laptop running Tera-Term.

Table 5



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: VMS-100S: Serial Number: EP2-15			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

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 - AIS Transmitter off, 2.4 GHz (WiFi/BT) On, 5 GHz WiFi On		
Radiated Disturbance	Graeme Lawler	UKAS

Table 7

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
ISED RSS-GEN, Clause 7.1

2.1.2 Equipment Under Test and Modification State

VMS-100S, S/N: EP2-15 - Modification State 0

2.1.3 Date of Test

04-September-2019 to 10-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 reasonably 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:

Quasi-Peak level (dBµV/m) at 3m = Receiver level (dBµV) + 3m Correction Factor (dB)
Margin (dB) = Limit (dBµV/m) – Quasi-Peak level (dBµV/m)

Above 1 GHz:

CISPR Average level (dBµV/m) at 3m = Receiver level (dBµV) + 3m Correction Factor (dB)
Margin (dB) = Limit (dBµV/m) – CISPR Average level (dBµV/m)

Peak level (dBµV/m) at 3m = Receiver level (dBµV) + 3m Correction Factor (dB)
Margin (dB) = Limit (dBµV/m) – Peak level (dBµV/m)

2.1.6 Example Test Setup Diagram

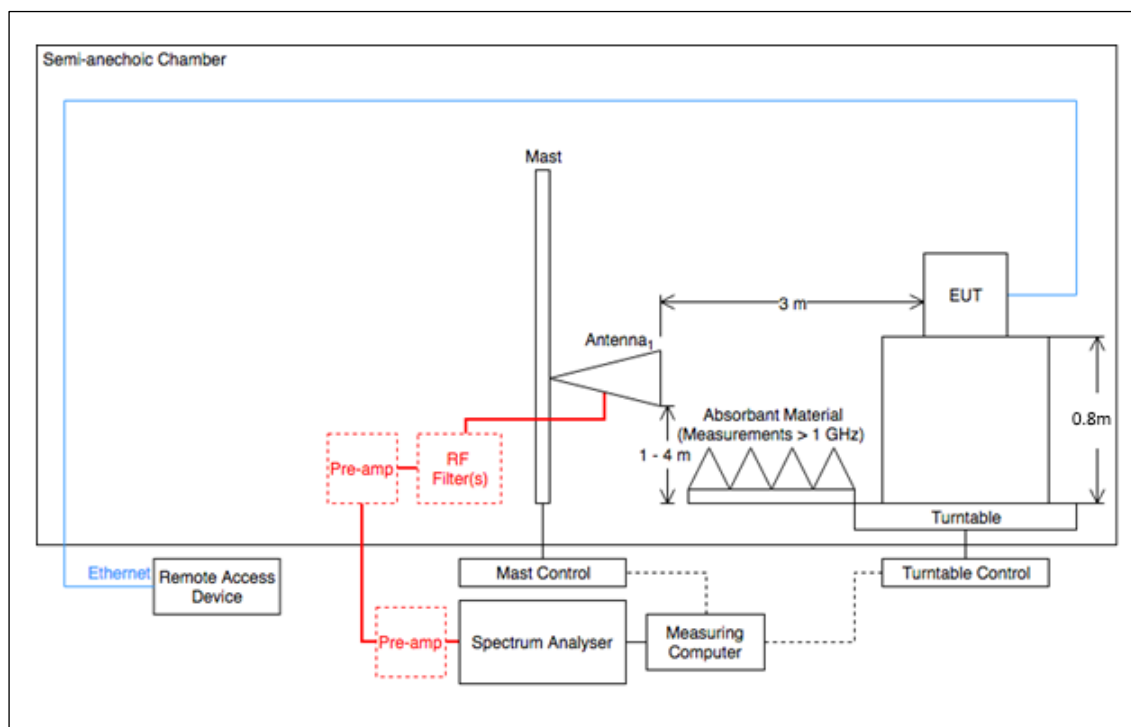


Figure 3 - Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature 16.2 °C
Relative Humidity 80.0 %

2.1.8 Specification Limits

Required Specification Limits, Field Strength (Class A @ 10m)		
Frequency Range (MHz)	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)
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 8



2.1.9 Test Results

Results for Configuration and Mode: DC Powered - AIS Transmitter off, 2.4 GHz (WiFi/BT) On, 5 GHz WiFi On.

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: 5825 MHz
Which necessitates an upper frequency test limit of: 30 GHz

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

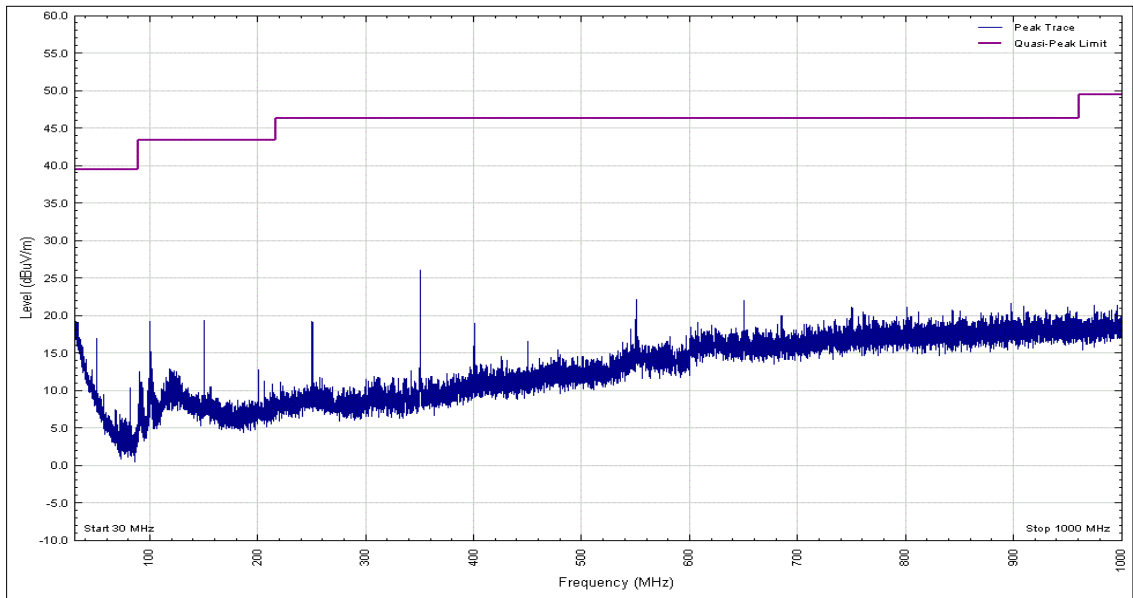


Figure 4 - Graphical Results - Vertical Polarity

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

Table 9

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



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

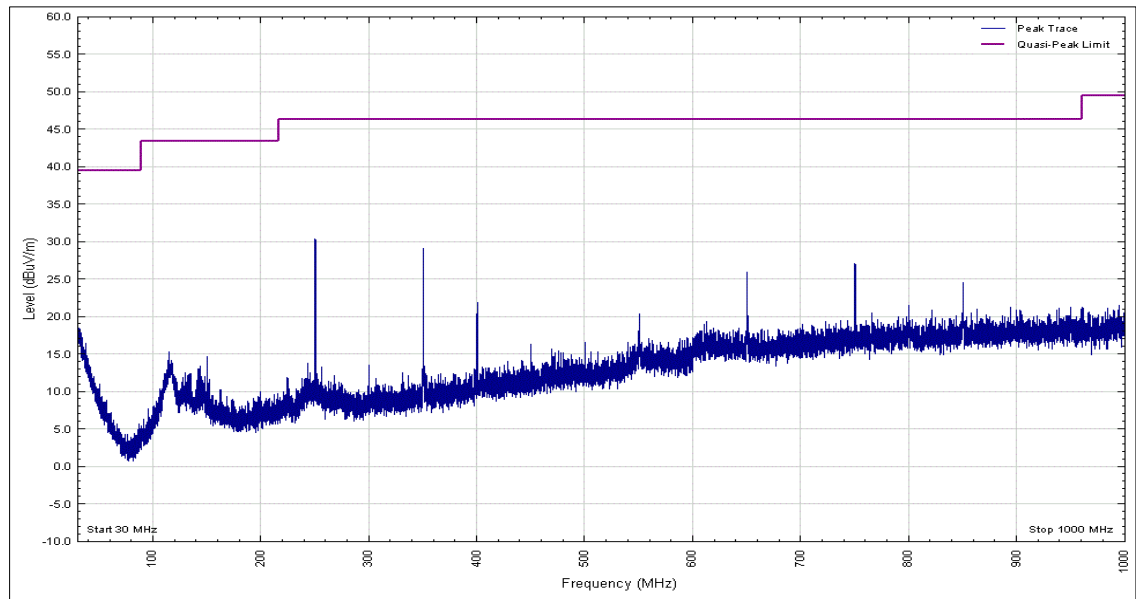


Figure 5 - Graphical Results - Horizontal Polarity

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

Table 10

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



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

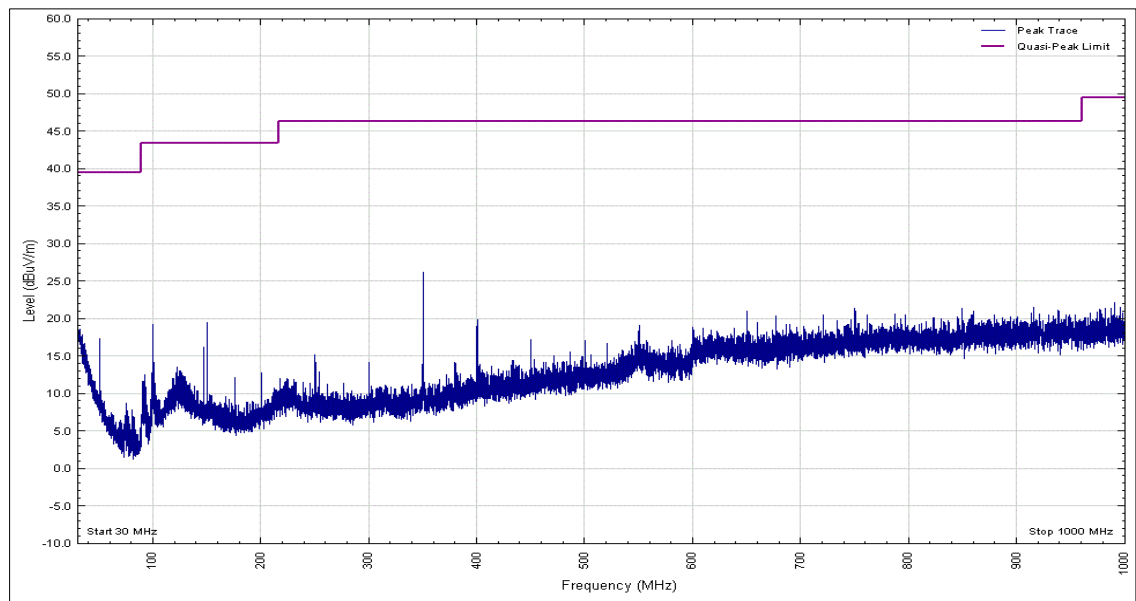


Figure 6 - Graphical Results - Vertical Polarity

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

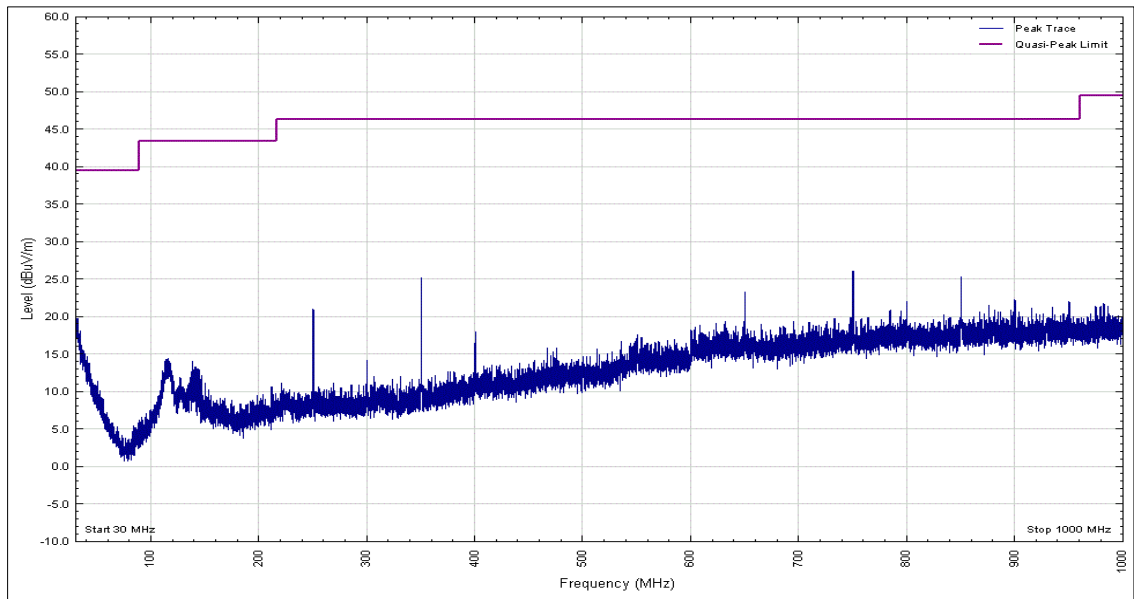


Figure 7 - Graphical Results - Horizontal Polarity

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

Table 12

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



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

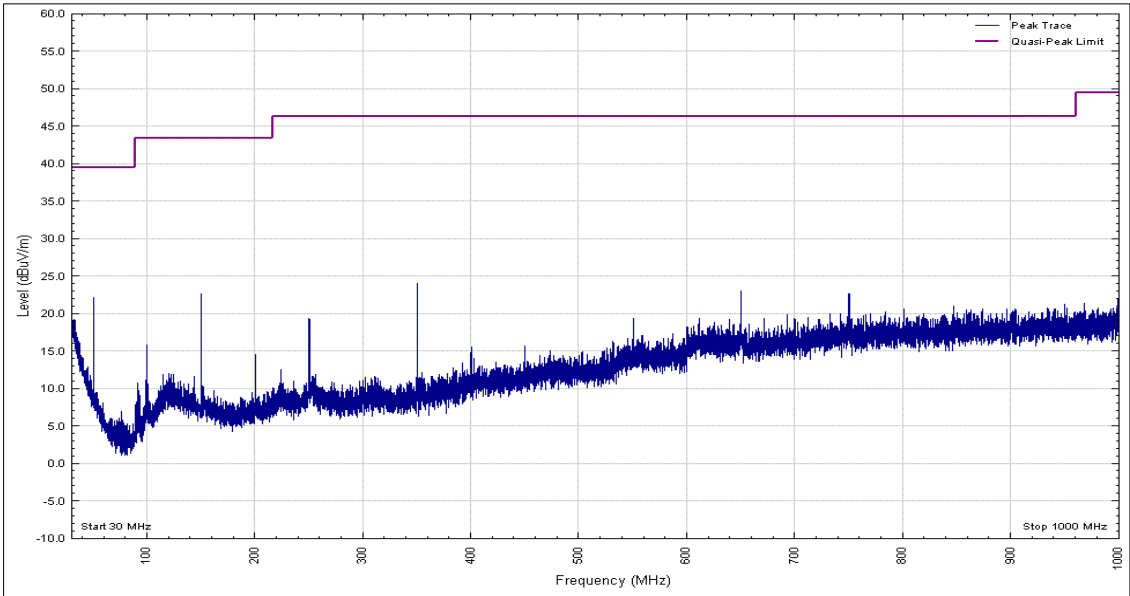


Figure 8 - Graphical Results - Vertical Polarity

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

Table 13

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



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

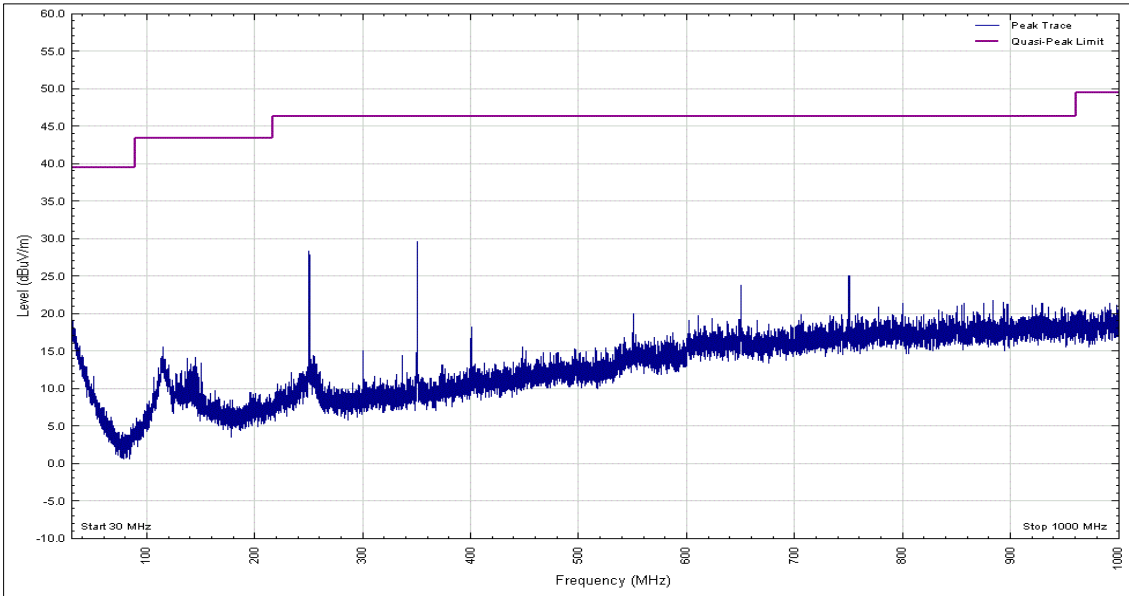


Figure 9 - Graphical Results - Horizontal Polarity

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 30 GHz - X Orientation Peak

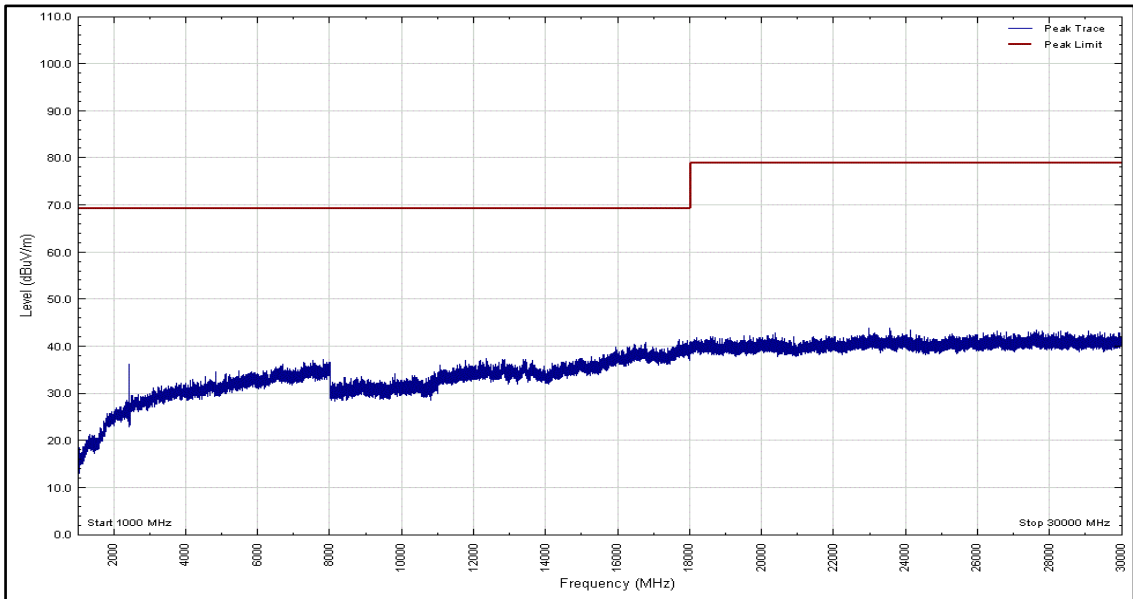


Figure 10 - Graphical Results - Vertical Polarity

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 30 GHz - X Orientation Average

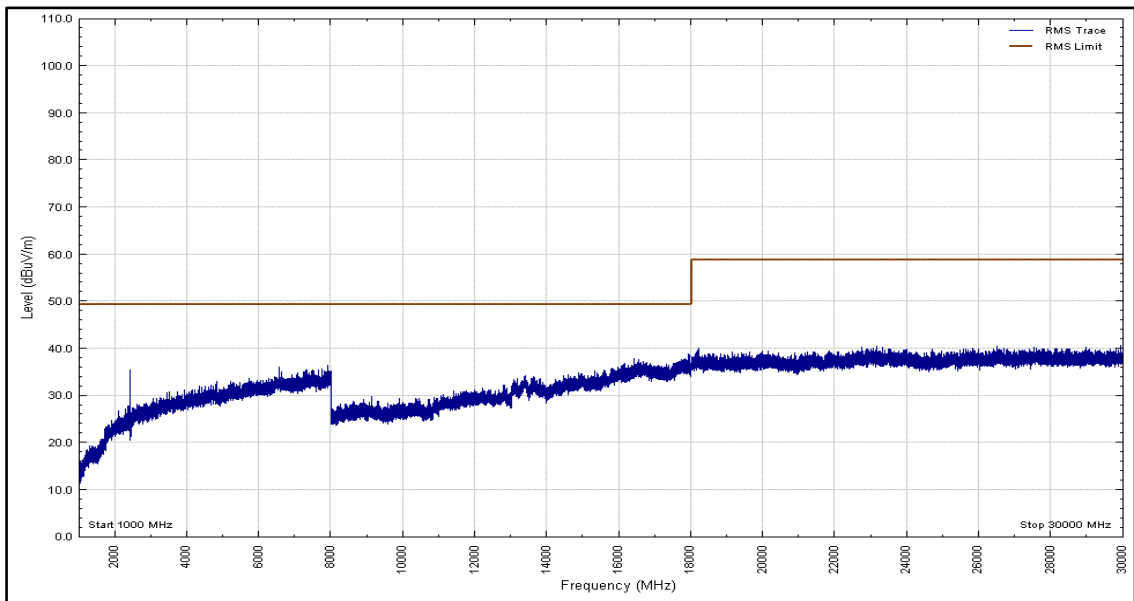


Figure 11 - Graphical Results - Vertical Polarity

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 30 GHz - X Orientation Peak

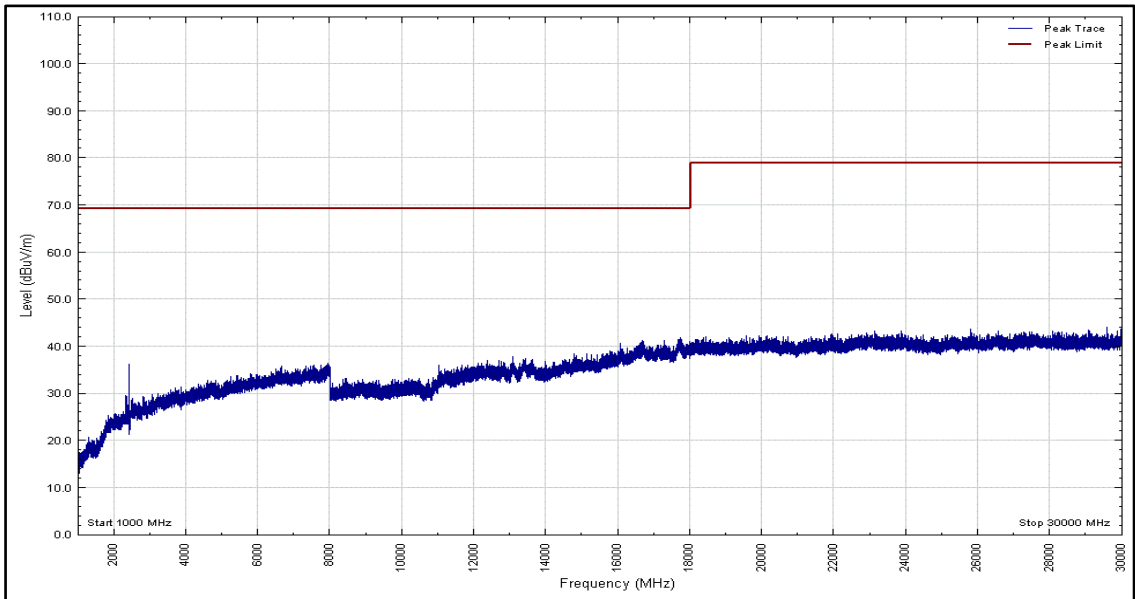


Figure 12 - Graphical Results - Horizontal Polarity

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: 1 GHz to 30 GHz - X Orientation Average

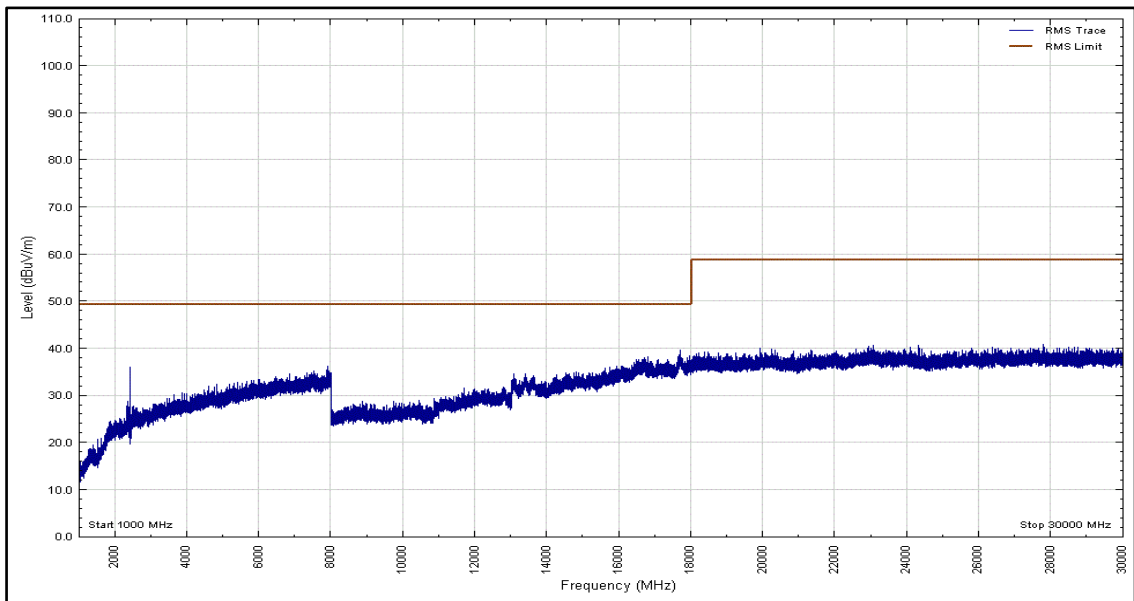


Figure 13 - Graphical Results - Horizontal Polarity

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

Table 18

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



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

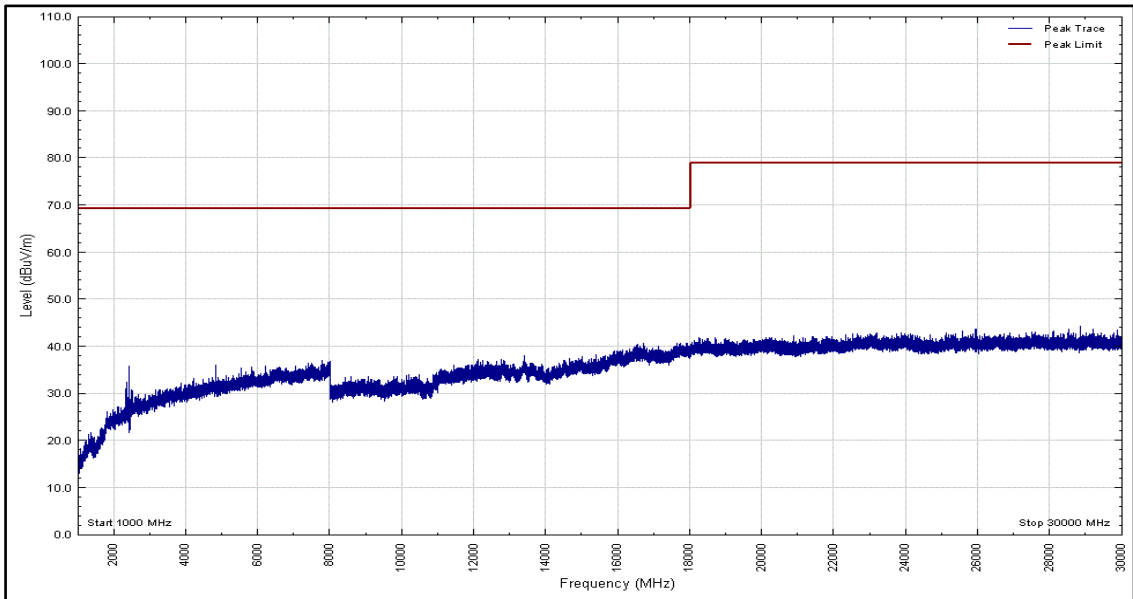


Figure 14 - Graphical Results - Vertical Polarity

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 30 GHz - Y Orientation Average

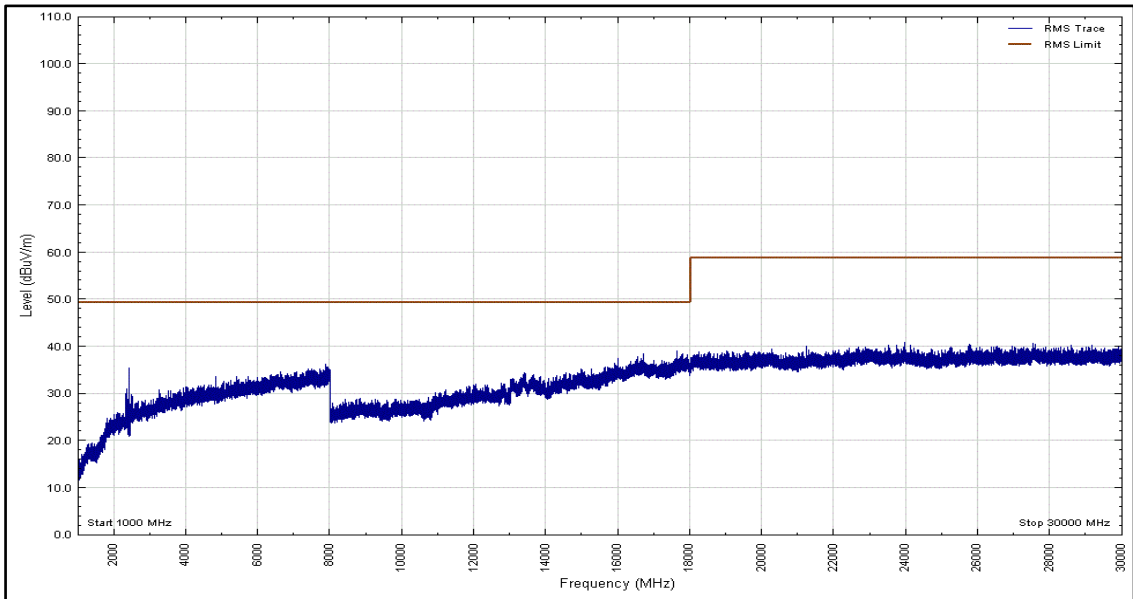


Figure 15 - Graphical Results - Vertical Polarity

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 30 GHz - Y Orientation Peak

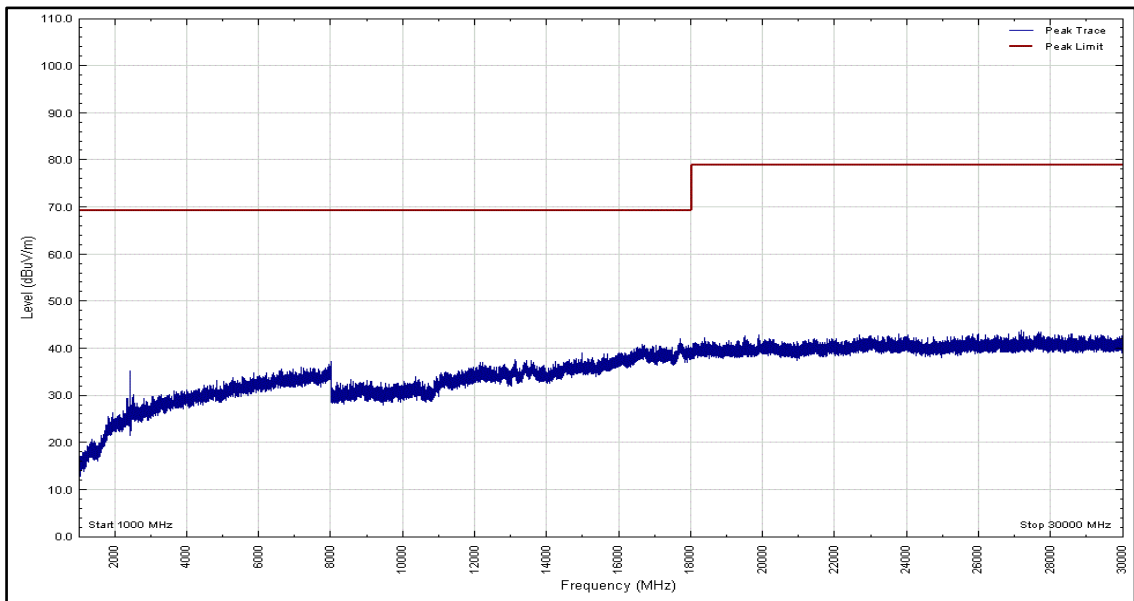


Figure 16 - Graphical Results - Horizontal Polarity

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 30 GHz - Y Orientation Average

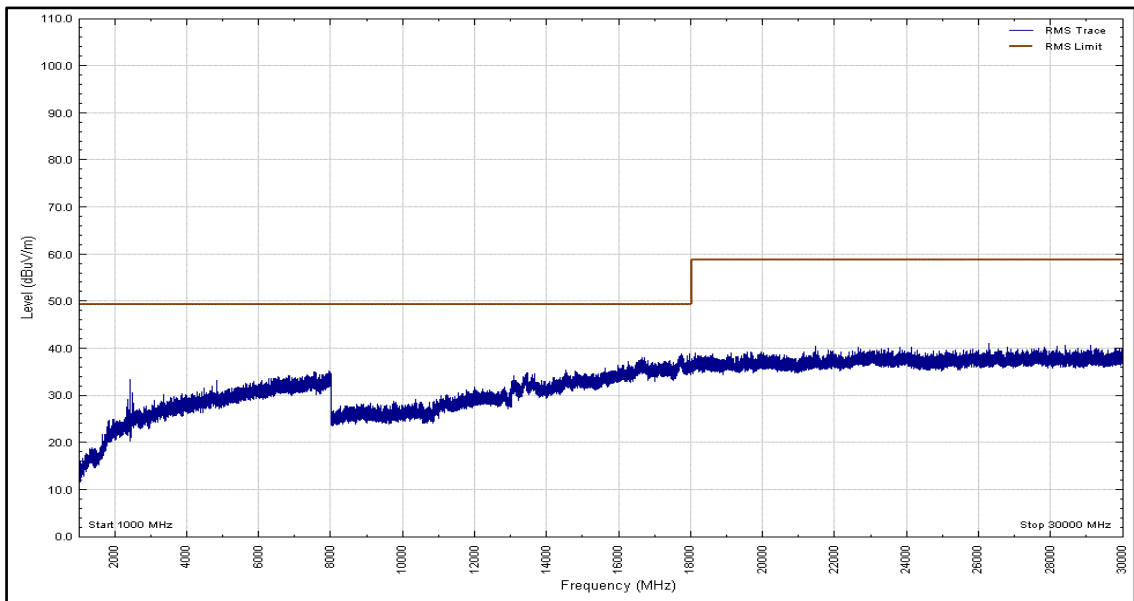


Figure 17 - Graphical Results - Horizontal Polarity

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 30 GHz - Z Orientation Peak

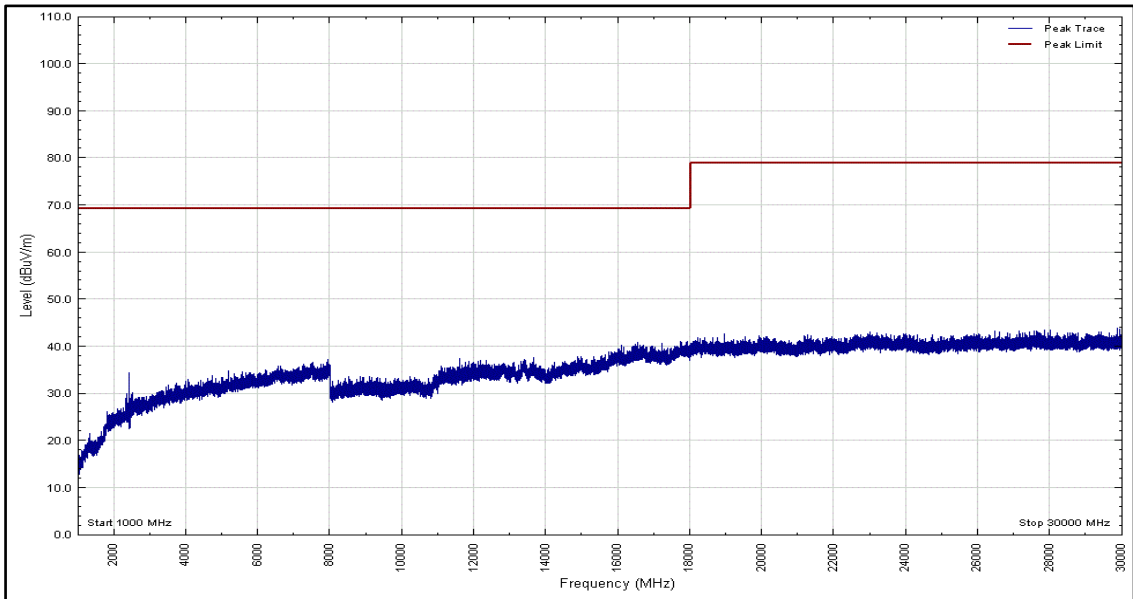


Figure 18 - Graphical Results - Vertical Polarity

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.



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

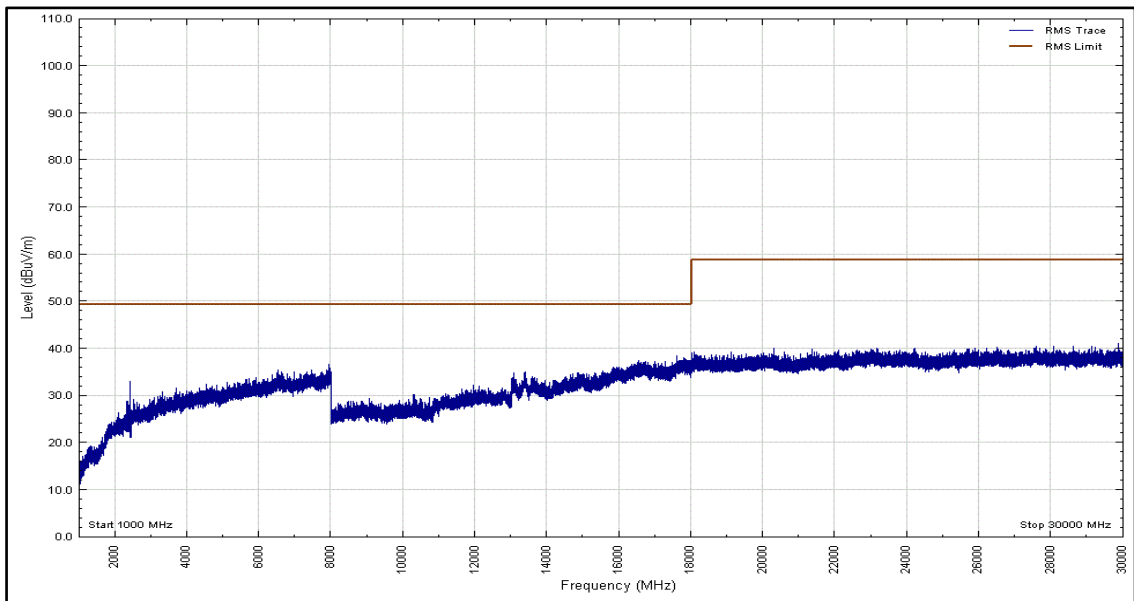


Figure 19 - Graphical Results - Vertical Polarity

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

Table 24

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



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

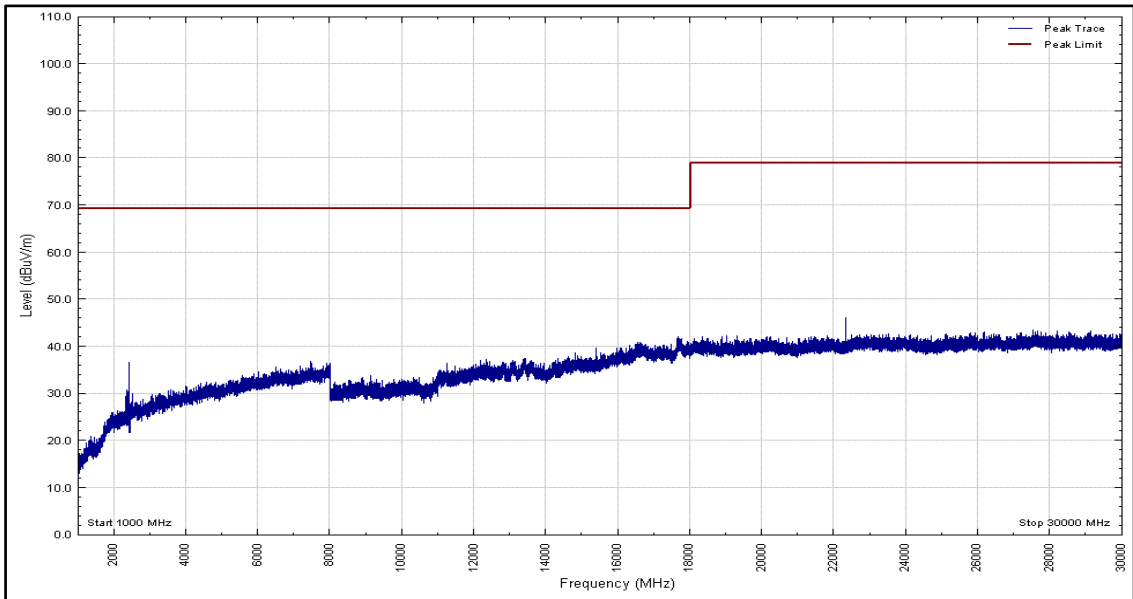


Figure 20 - Graphical Results - Horizontal Polarity

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

Table 25

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



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

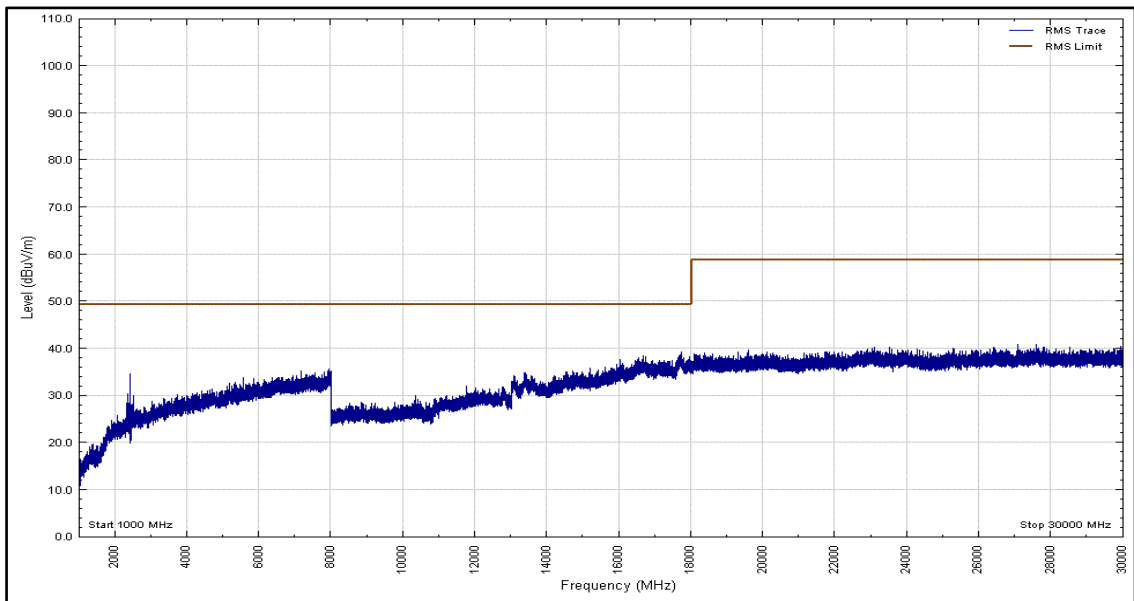


Figure 21 - Graphical Results - Horizontal Polarity

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

Table 26

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

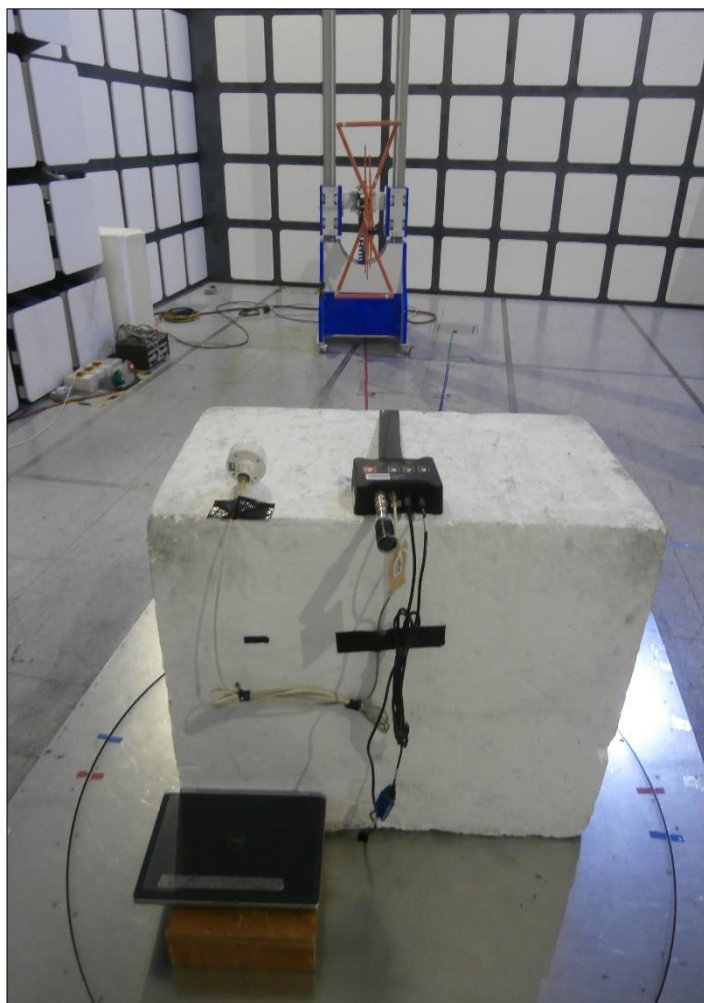


Figure 22 - Test Setup 30 MHz to 1 GHz - X Orientation

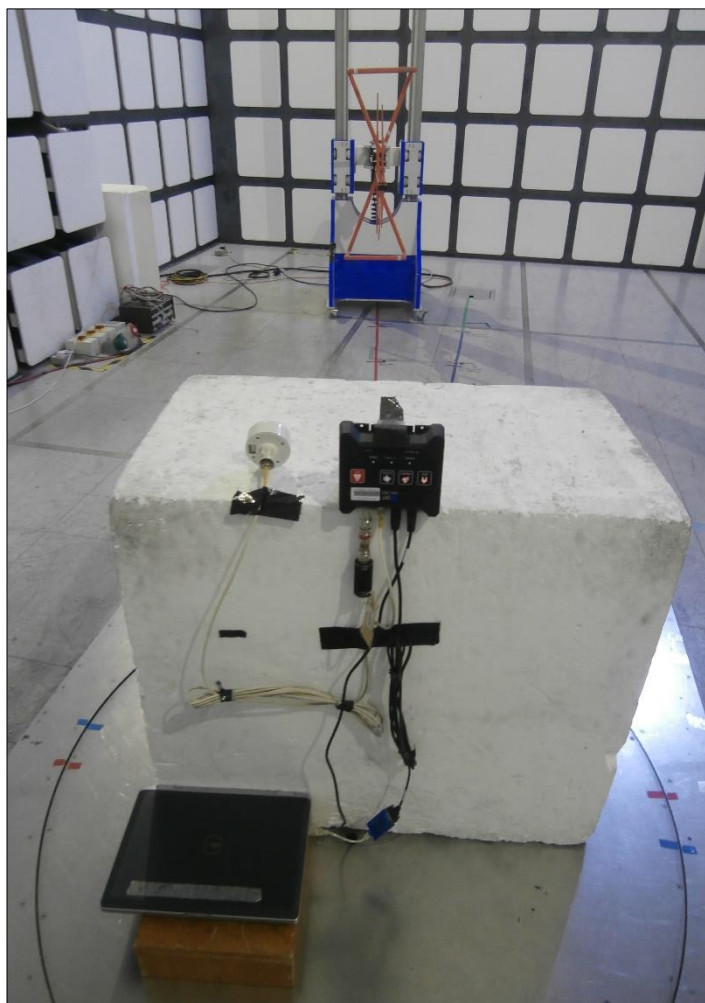


Figure 23 - Test Setup 30 MHz to 1 GHz - Y Orientation

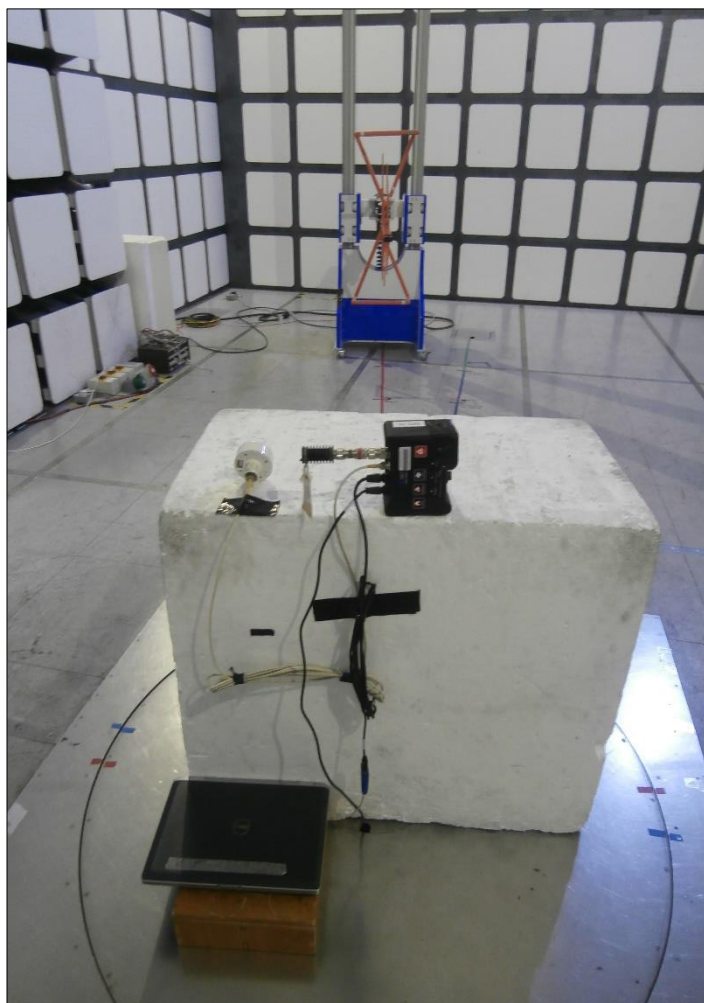


Figure 24 - Test Setup 30 MHz to 1 GHz - Z Orientation



Figure 25 - Test Setup 1 GHz to 18 GHz - X Orientation

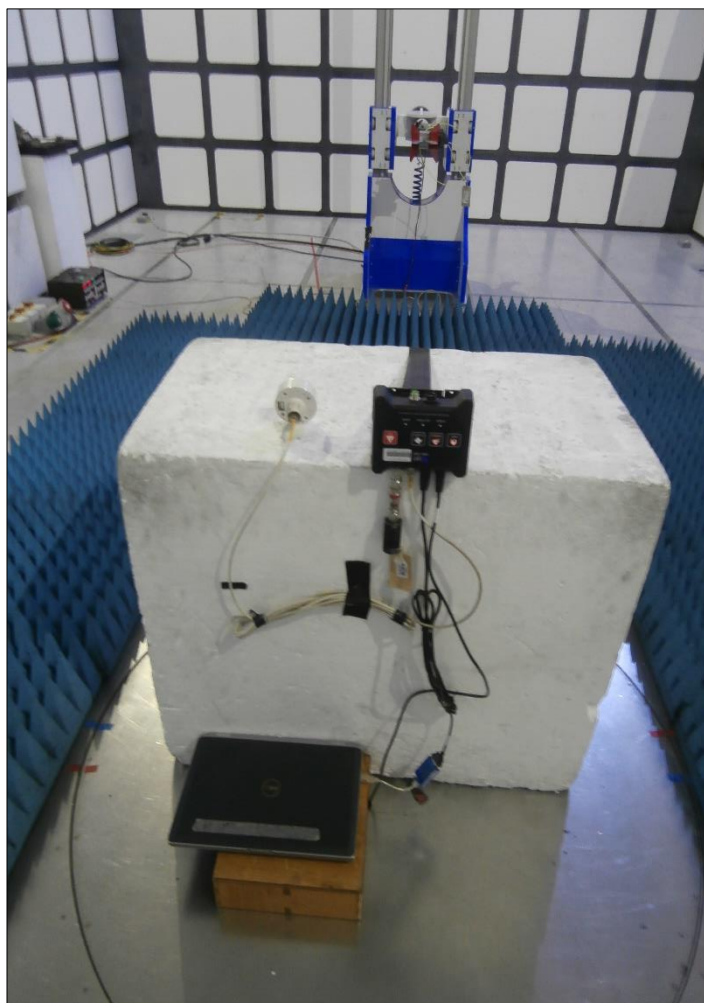


Figure 26 - Test Setup 1 GHz to 18 GHz - Y Orientation

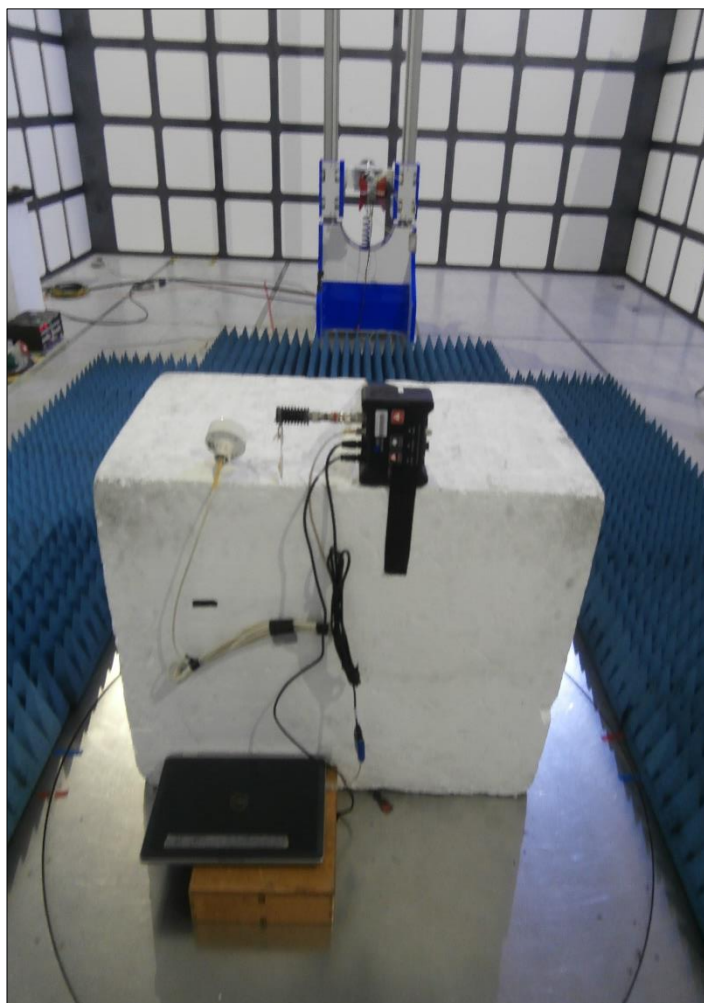


Figure 27 – Test Setup 1 GHz to 18 GHz - Z Orientation

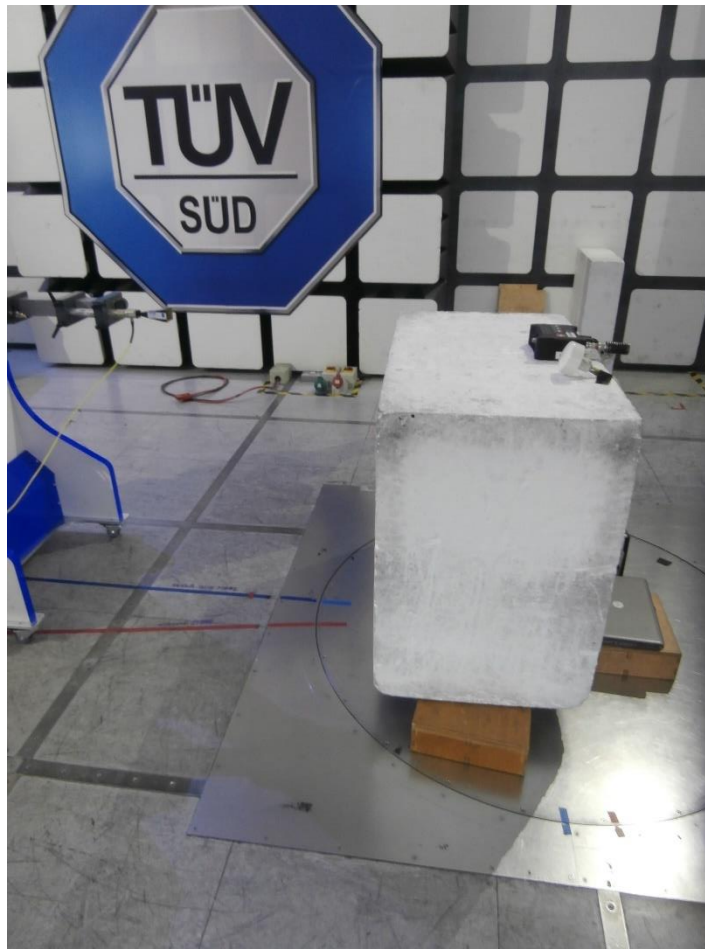


Figure 6 – Test Setup 18 GHz to 30 GHz - X Orientation



Figure 7 – Test Setup 18 GHz to 30 GHz - Y Orientation



Figure 8 – Test Setup 18 GHz to 30 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
Power Supply Unit	Hewlett Packard	6282A	132	-	TU
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	14-Dec-2019
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	05-Feb-2020
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	26-Oct-2019
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	25-Oct-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5067	12	02-Oct-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5093	12	04-Oct-2019
EmX Software	TUV SUD	EmX	5125	-	Software
1.5m 40GHz RF Cable	Scott Cables	KPS-1501-2000-KPS	5127	6	11-Dec-2019
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5219	12	15-Feb-2020
Test Receiver (ESW)	Rohde & Schwarz	ESW44	5351	12	31-Jul-2020

Table 27

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 28

Worst case error for both Time and Frequency measurement 12 parts in 10⁶.
All measurement uncertainties have been calculated using CISPR guidelines.