FCC Test Report

DDK Positioning Limited
C-NavX1 Max Variant GNSS Precise Point Positioning Device, Model: C-NavX1 MAX

In accordance with FCC 47 CFR Part 15B

Prepared for: DDK Positioning Ltd
Balmoral Business Park Wellington Circle
Aberdeen, Scotland
AB12 3JG
United Kingdom

Add value.
Inspire trust.

FCC ID: 2A29Q-DDKX1

COMMERCIAL-IN-CONFIDENCE

Document 75952280-03 Issue 01

SIGNATURE			
			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
John Laydon	General Manager	Authorised Signatory	08 November 2021

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15B. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	William Mayo	08 November 2021	
Supervisor	Martin Perry	08 November 2021	

FCC Accreditation
330364 Bearley Test Laboratory

Industry Canada Accreditation
2932E Bearley Test Laboratory

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

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Contents

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	08 November 2021

Table 1

1.2 Introduction

Applicant	DDK Positioning Limited
Manufacturer	DDK Positioning Limited
Model Number(s)	C-NavX1 MAX
Serial Number(s)	DDK-CNavX1-0002
Hardware Version(s)	1.00
Software Version(s)	1.00
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2019
Order Number Date	DDK-SO/PO-20-0055 19-May-2021
Date of Receipt of EUT	24-June-2021
Start of Test	30-June-2021
Finish of Test	01-July-2021
Name of Engineer(s)	William Mayo (M Perry Supervising)
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	Modification State	Result	Comments/Base Standard
Configuration and Mode: DC Powered - Operating					
2.1	15.109	Radiated Disturbance	0	Pass	ANSI C63.4: 2014

Table 2

1.4 Declaration of Build Status

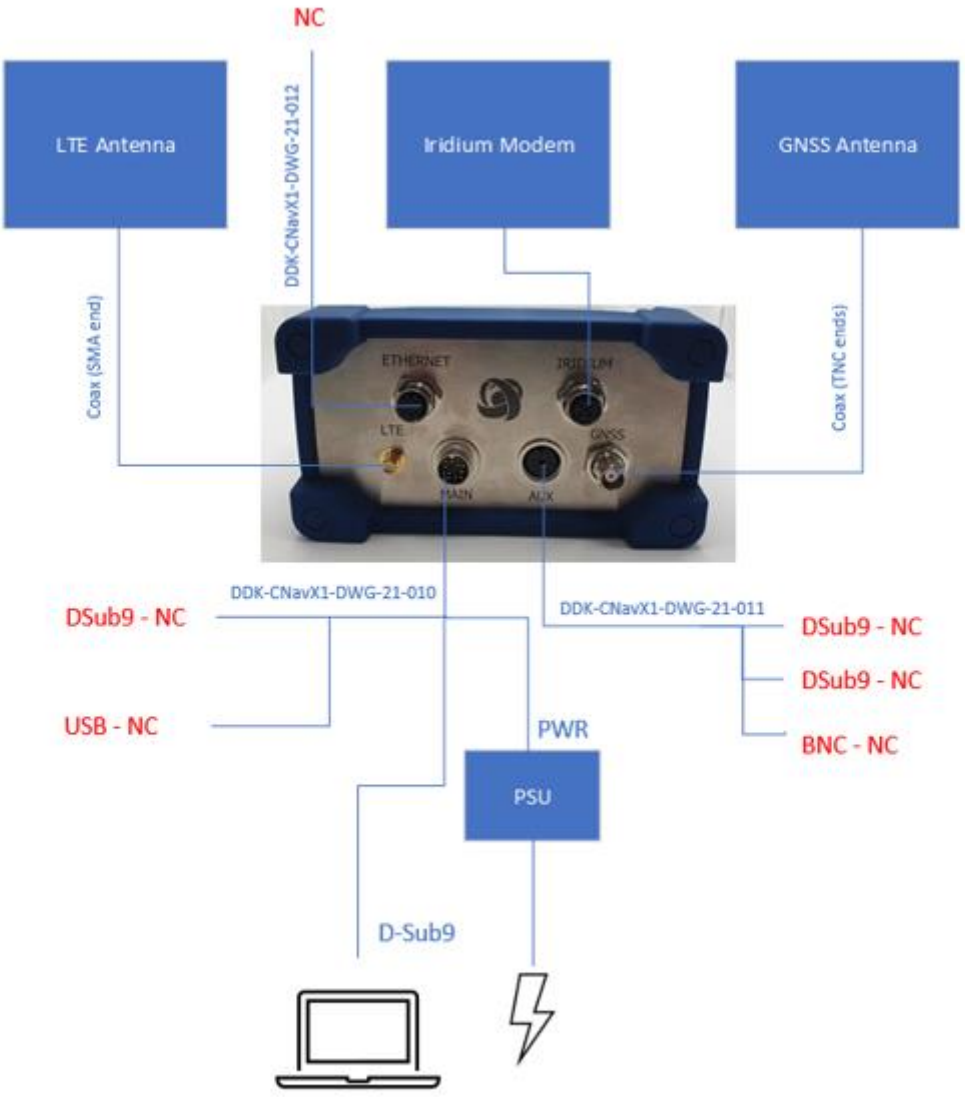
MAIN EUT	
MANUFACTURING DESCRIPTION	GNSS Precise Point Positioning Device
MANUFACTURER	DDK Positioning
MODEL	C-NavX1 MAX
PART NUMBER	C-NavX1
HARDWARE VERSION	1.00
SOFTWARE VERSION	1.00
PSU VOLTAGE/FREQUENCY/CURRENT	Input 9-36Vdc , 20W Output : 12Vdc – 1667mA
HIGHEST INTERNALLY GENERATED FREQUENCY	2600MHz (4G LTE)
FCC ID (if applicable)	2A29Q-DDKX1
INDUSTRY CANADA ID (if applicable)	n/a
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	Providing precise point positions from GNSS data and outputting these to the user's device for onward use
COUNTRY OF ORIGIN	United Kingdom
RF CHARACTERISTICS (if applicable)	
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	800-2600MHz
RECEIVER FREQUENCY OPERATING RANGE (MHz)	800-2600MHz
INTERMEDIATE FREQUENCIES	800MHz, 1400MHz, 1800MHz, 2100MHz, 2300MHz, 2600MHz (LTE) 1575.42MHz (L1 – GPS, SBAS, E1 - Galileo) 1598.0625-1609.3125MHz (L1 C/A – GLONASS) 1561.098 (B1I – BeiDou) 1616 MHz - 1626.5 MHz (Iridium)
EMISSION DESIGNATOR(S): **https://fccid.io/Emissions-Designator/**	G7W
MODULATION TYPES: (i.e. GMSK, QPSK)	QPSK
OUTPUT POWER (W or dBm)	23-33dBm (Quectel LTE)
SEPARATE BATTERY/POWER SUPPLY (if applicable)	
MANUFACTURING DESCRIPTION	AC/DC Power Supply
MANUFACTURER	XP Power
TYPE	AC/DC
PART NUMBER	VEC50US24
PSU VOLTAGE/FREQUENCY/CURRENT	Input 100-240Vac – 1.7A – 50/60Hz Output : 24Vdc – 2.08A
COUNTRY OF ORIGIN	China

Table 3

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

Name: Stuart Inglis
Position held: Technical Manager
Date: 23 June 2021

1.4.1 EUT Block Diagram



*NC denotes "No Connection". These elements should be situated out with the test environment.

Figure 1

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a DDK Positioning Limited, C-NavX1 MAX GNSS Precise Point Positioning Device.

The primary function of the EUT is to provide precise point positions from GNSS data and outputting these to the user's device for onward use.

Figure 2 - General View - Front

Figure 3 - General View - Rear

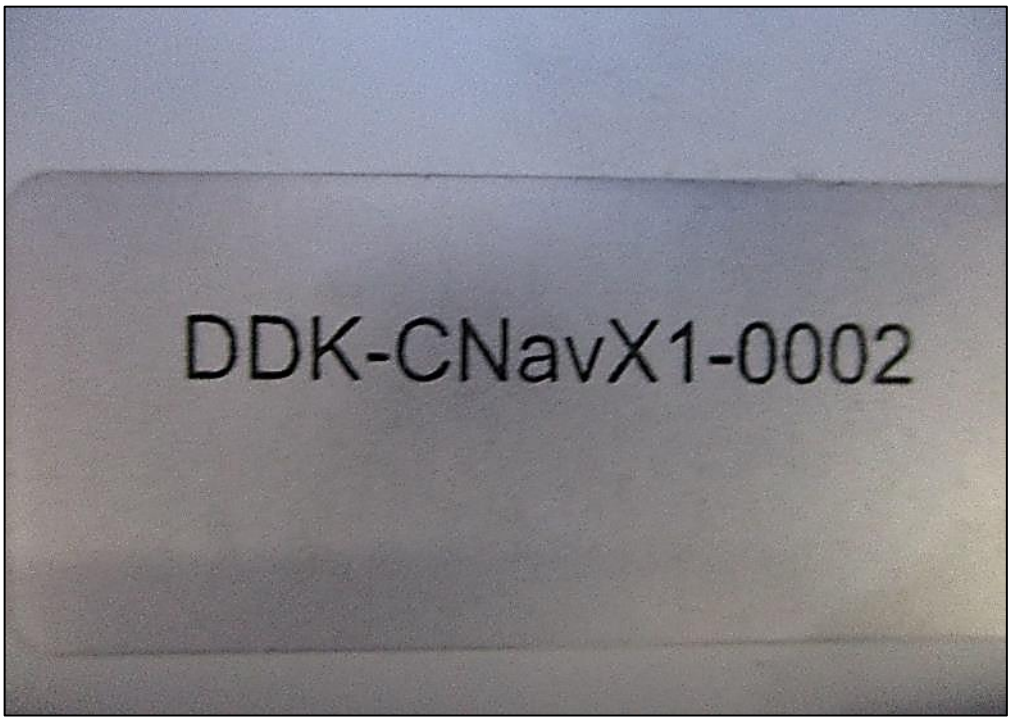


Figure 4 - General View - Serial Number

1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: DC Powered - Operating				
Main	2m	DC power and Control port	Multi Core	Yes
Ethernet Port	1m	Control/Signal	Category Unspecified	Yes
Aux Port	2m	Data/Signal	Multi Core	Yes
Iridium port	50m	Signal	Multi Core	Yes
GNSS Port	15m	Signal	Coax, TNC Ends	Yes
LTE Port	15m	Signal	Coax, SMA end	Yes

Table 4

1.5.3 Test Configuration

Mode	Description
DC Powered	• The EUT was powered via an AC/DC Charger with utilising a 230 Vac 50 Hz supply. • Main port populated with 4-way spider cable that provided DC power and connected to a customer supplied laptop via USB/RS232 converter. Remaining cables unterminated. • AUX port populated with 3-way spider cable and unterminated. • Ethernet port populated with unterminated 1m Ethernet cable • Iridium port was populated with an Iridium Modem • LTE port was populated with an LTE antenna • GNSS port was populated with a GNSS antenna

Table 5

1.5.4 Modes of Operation

Mode	Description
Operating	Once powered, the EUT automatically connected to satellites and generated an output of GNSS data on a display.

Table 6

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: C-NavX1 MAX, Serial Number: DDK-CNavX1-0002			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 7

1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - Operating		
Radiated Disturbance	William Mayo (M Perry supervising)	UKAS

Table 8

Office Address:

TÜV SÜD
Snitterfield Road
Bearley
Stratford on Avon
Warwickshire
CV37 0EX
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

C-NavX1 MAX, S/N: DDK-CNavX1-0002 - Modification State 0

2.1.3 Date of Test

30-June-2021 to 01-July-2021

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 and extrapolated to a 10 m distance using an inverse distance factor of 20 dB per decade 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

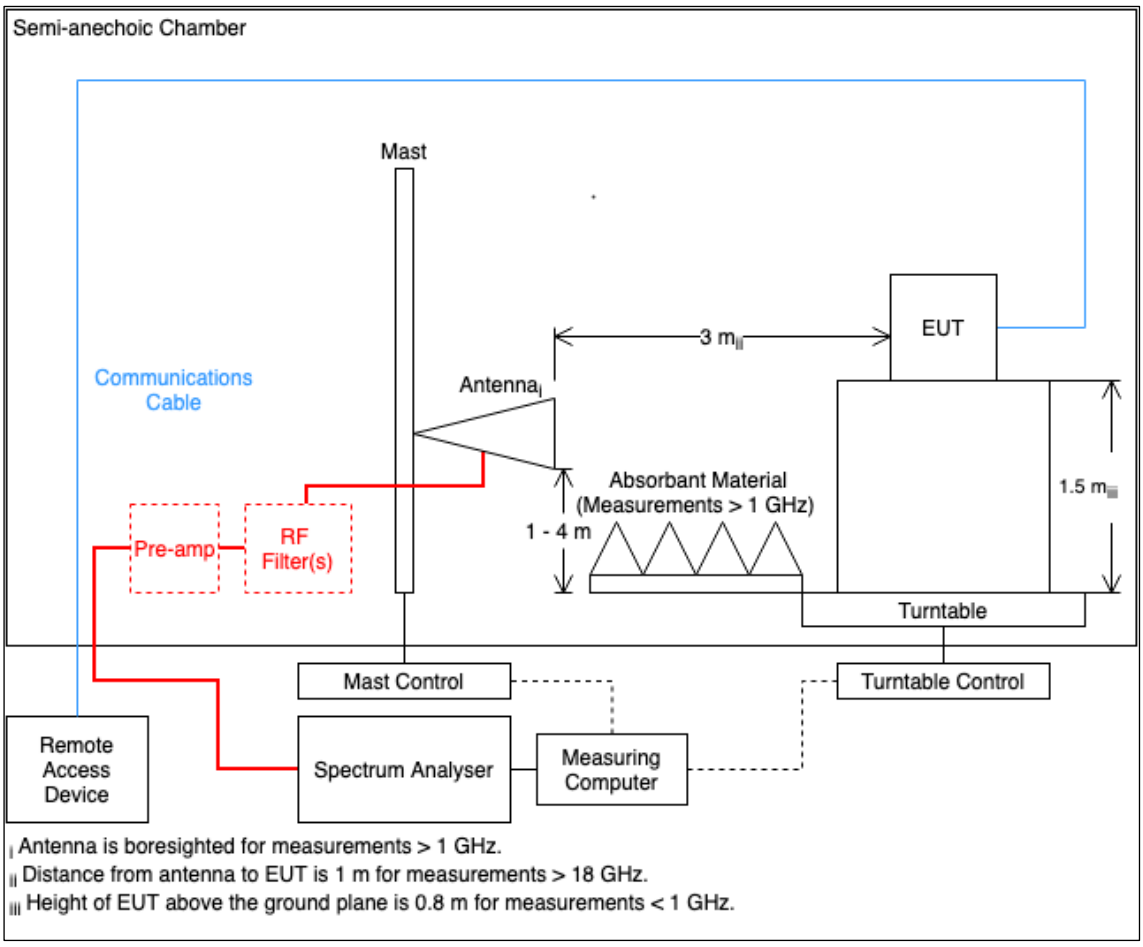


Figure 5

2.1.7 Environmental Conditions

Ambient Temperature	20.3 °C
Relative Humidity	59.4 %

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 9

2.1.9 Test Results

Results for Configuration and Mode: DC Powered - 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: 2.6 GHz (4G LTE)
Which necessitates an upper frequency test limit of: 13 GHz

Frequency Range of Test: 30 MHz to 1 GHz

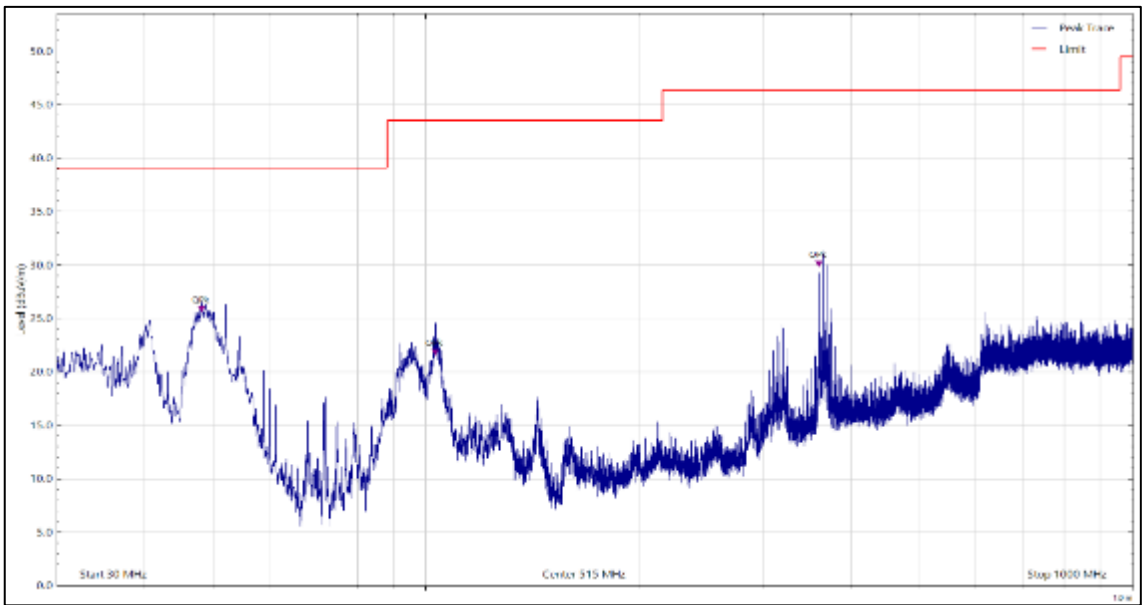


Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
48.211	25.4	39.1	-13.7	Q-Peak	213	118	Vertical	-
103.103	21.4	43.5	-22.1	Q-Peak	345	126	Vertical	-
360.194	29.7	46.4	-16.7	Q-Peak	150	110	Vertical	-

Table 10

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

Frequency Range of Test: 30 MHz to 1 GHz

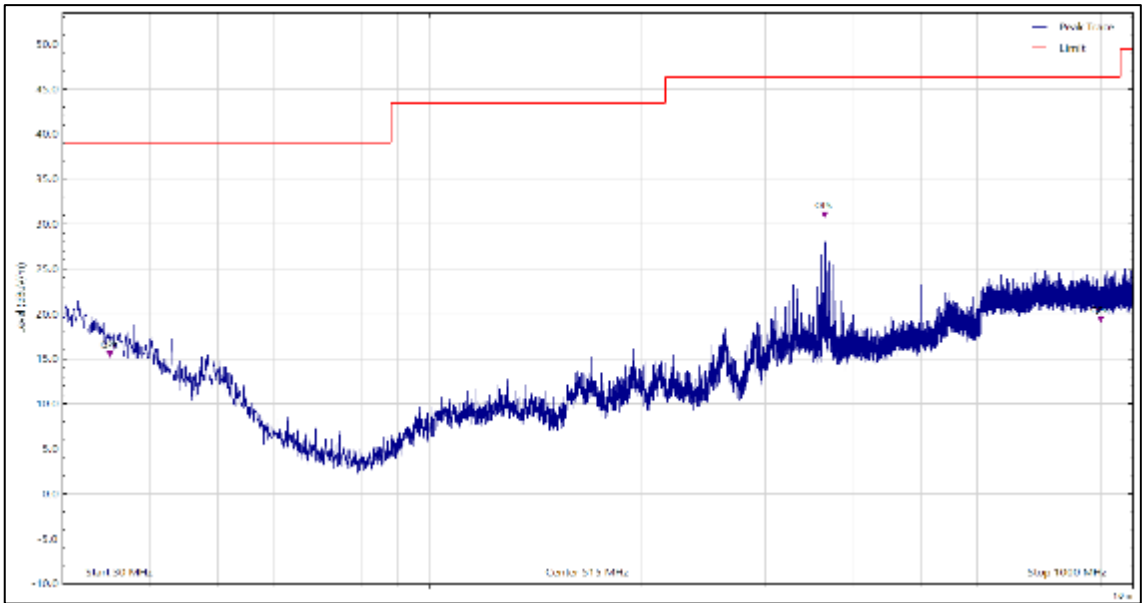


Figure 7 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
35.078	15.0	39.1	-24.1	Q-Peak	74	129	Horizontal	-
364.670	30.5	46.4	-15.9	Q-Peak	280	113	Horizontal	-
900.404	18.9	46.4	-27.5	Q-Peak	36	121	Horizontal	-

Table 11

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

Frequency Range of Test: 1 GHz to 13 GHz - Peak Detector

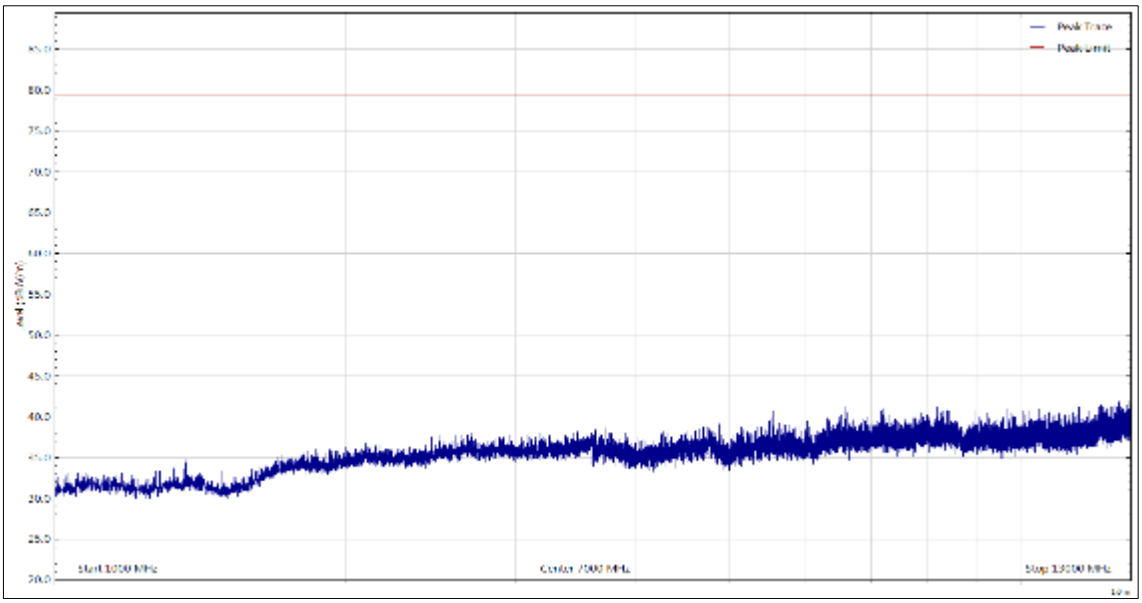


Figure 8 - 1 GHz to 13 GHz, Peak, Vertical

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

Table 12

*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.

Frequency Range of Test: 1 GHz to 13 GHz - CISPR Average Detector

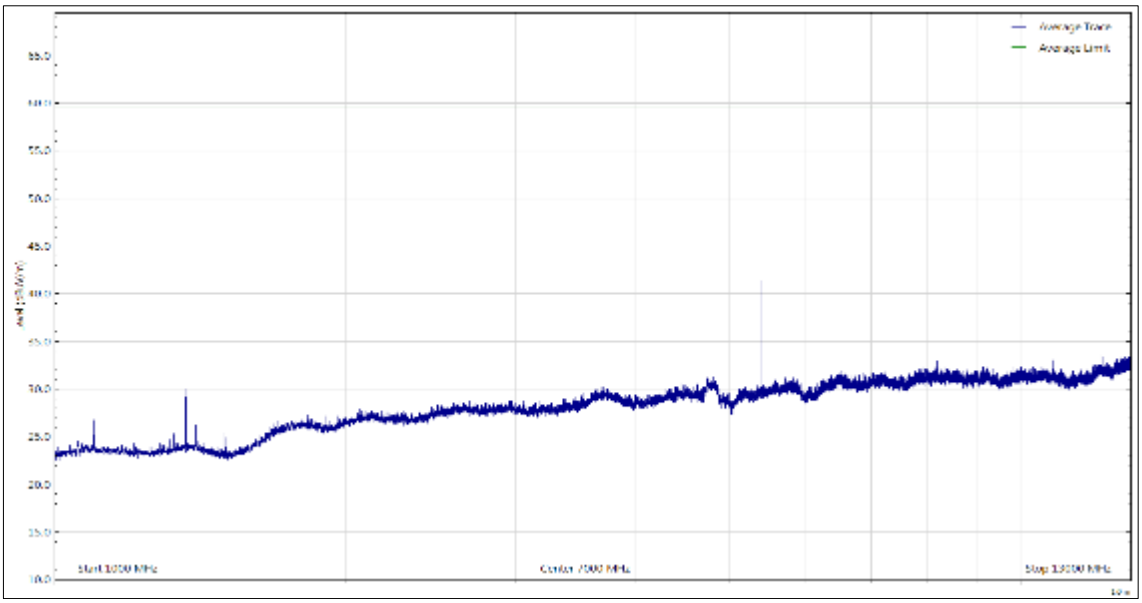


Figure 9 - 1 GHz to 13 GHz, CISPR Average, Vertical

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

Table 13

*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.

Frequency Range of Test: 1 GHz to 13 GHz - Peak Detector

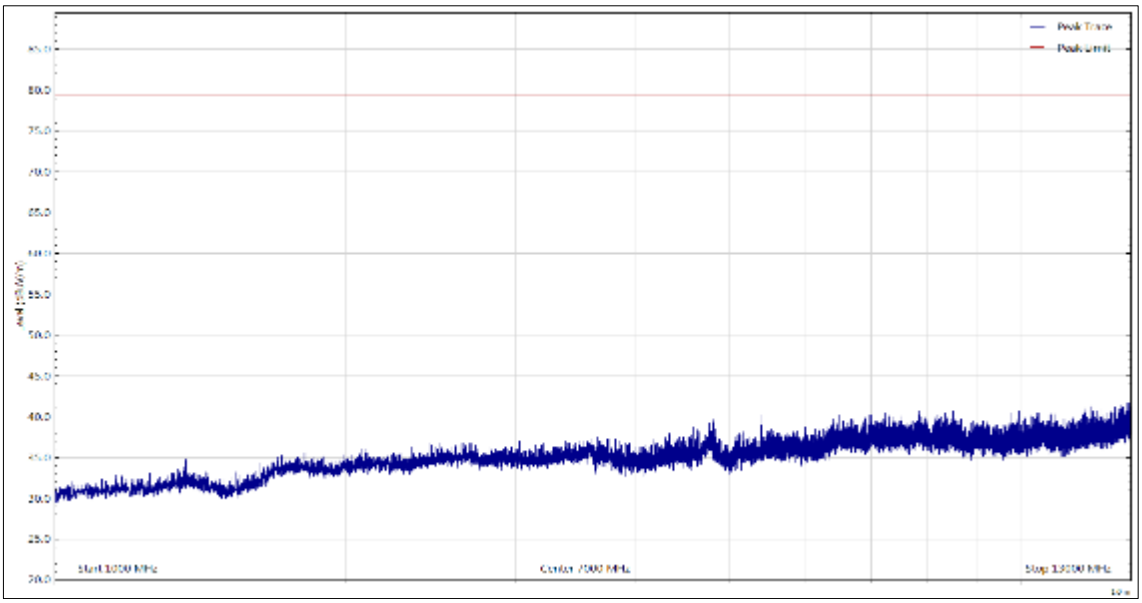


Figure 10 - 1 GHz to 13 GHz, Peak, Horizontal

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

Table 14

*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.

Frequency Range of Test: 1 GHz to 13 GHz - CISPR Average Detector

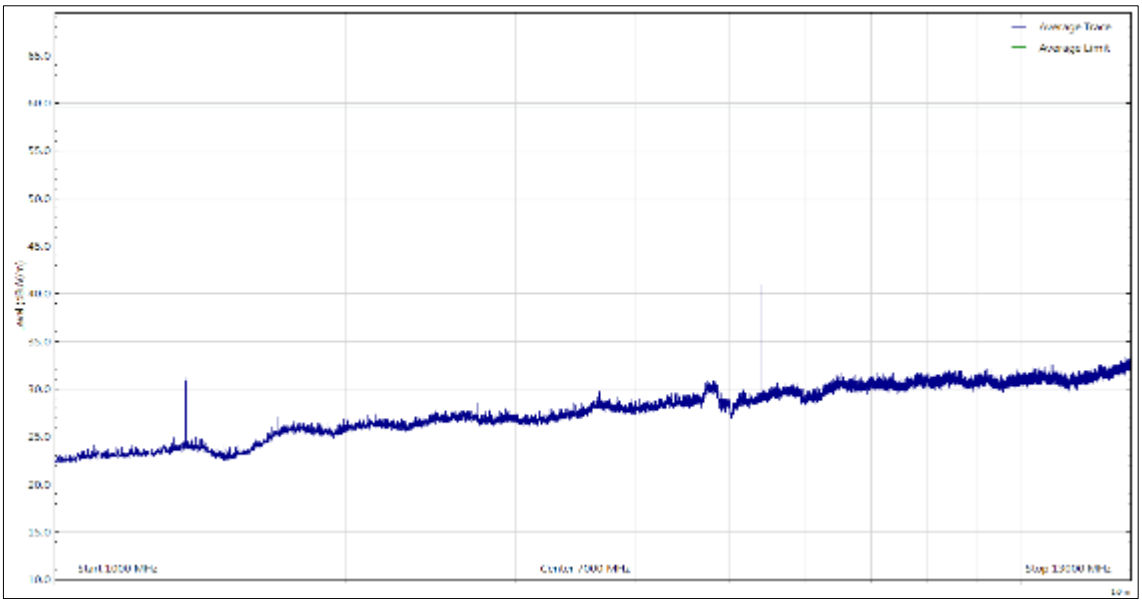


Figure 11 - 1 GHz to 13 GHz, CISPR Average, Horizontal

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

Table 15

*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.

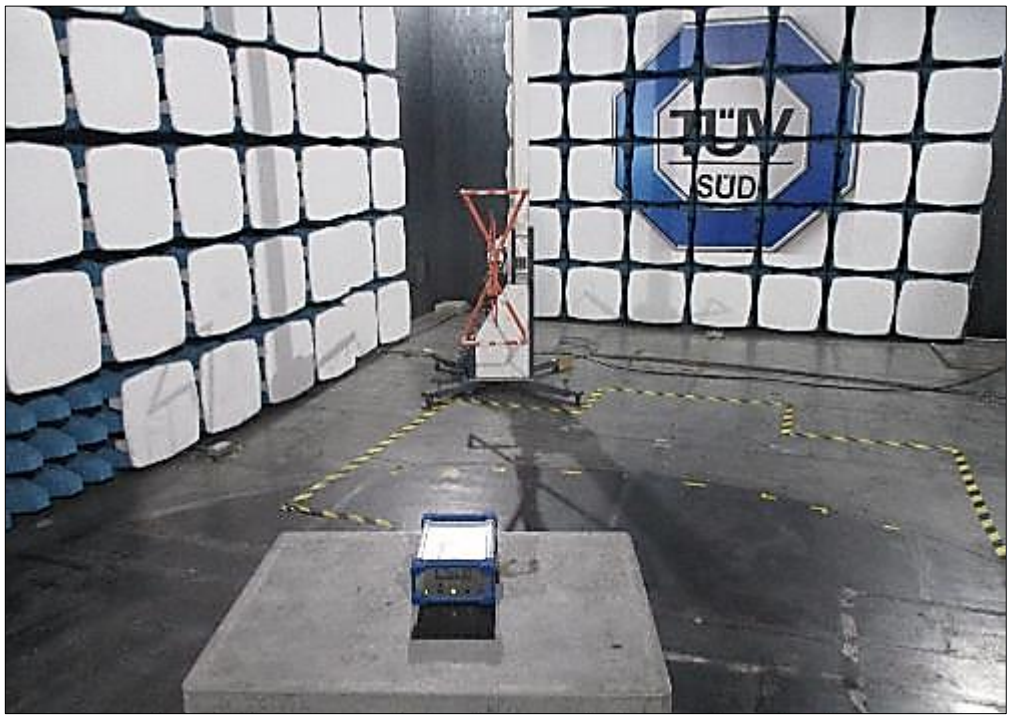


Figure 12 - Test Setup - 30 MHz to 1 GHz

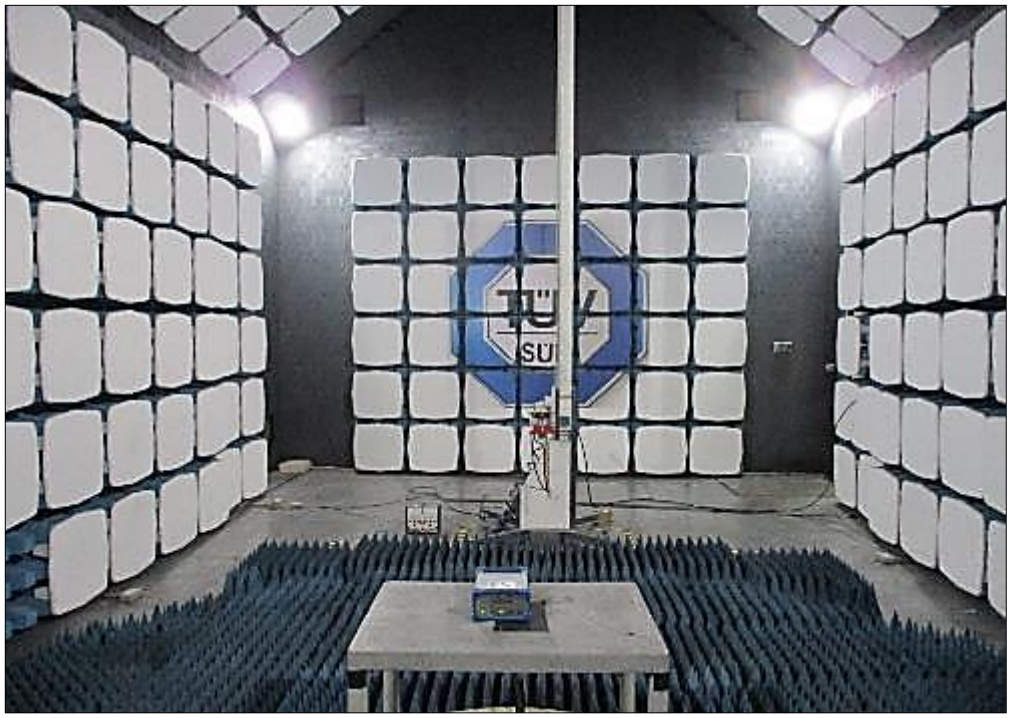


Figure 13 - Test Setup - 1 GHz to 13 GHz

2.1.10 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Bilog Antenna	Schaffner	CBL6143	1858	24	10-Nov-2022
4dB Attenuator	Pasternack	PE7047-4	5647	24	10-Nov-2022
1-18 GHz DRG Horn	ETS-Lindgren	3117	4737	24	28-Jul-2021
1-8 GHz Amplifier	Wright Technologies	APS04-0085	4674	12	18-Aug-2021
7m N-Type Cable	Teledyne Storm	SA90-195-7MTR	4168	6	19-Oct-2021
3m N-Type Cable	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4629	12	20-Jan-2022
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	27-Jan-2022
EMC 3m Semi Anechoic Chamber	Rainford	Hybrid	4160	36	16-Dec-2021
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	Software
EMC Mast controller	Innco Systems	Controller CO3000	4728	-	TU
Turntable Controller	Maturo	Maturo NCD	5275	-	TU
Turntable	Maturo	TT1.2WF 1011 3110.01	5780	-	TU

Table 16

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Power Supply Unit	Farnell	H60-25	1709	-	TU
Power Supply	Farnell	H60-25	1709	-	TU
Scientific Ambient Monitor	Testo	622	5698	12	17-Feb-2022

Table 17

TU - Traceability Unscheduled

3.2 Customer Support Equipment

Instrument	Manufacturer	Type No	Serial Number
Laptop	Lenovo	ThinkPad	R9-LLPTX 12/02
LTE Antenna	Poynting	A-OMNI-0291-V2	OMNI-291-V2-CH06876
GNSS L1/L2 DGPS Antenna	Alison Microwave	AD416-2	089
Iridium Modem	Iridium Satellite LLC	Model 9680	20160-10129

Table 18

4 Incident Reports

No Incident Reports were issued during testing covered by this test report.

5 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 19

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.