FCC, IC and ISED Test Report

Detnet South Africa (Pty) Ltd
Model: CE4 Commander DS600

In accordance with FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN

Prepared for: Detnet South Africa (Pty) Ltd
Block 1B, Founders Hill Office Park
Centenary Road
Modderfontein P O Box 10
1645
South Africa

FCC ID: 2ARNH-19182810 IC: 24476-19182810

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Document 75954038-01 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
John Laydon	General Manager	Authorised Signatory	02 February 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, ICES-003 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	William Mayo	02 February 2022	
Supervisor	John Laydon	02 February 2022	

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: 2020, ICES-003 Issue 7: 2020 and ISEDC RSS-GEN: Issue 5 and A1 (2019-03) for the tests detailed in section 1.3.

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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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	02 February 2022

Table 1

1.2 Introduction

Applicant	Detnet South Africa (Pty) Ltd
Manufacturer	Detnet South Africa (Pty) Ltd
Model Number(s)	CE4 Commander DS600
Serial Number(s)	Not Serialised (Storix ID 617158-02)
Hardware Version(s)	V6
Software Version(s)	48713
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B:2020 ICES-003 Issue 7: 2020 ISED RSS-GEN: Issue 5 and A1 (2019-03)
Order Number Date	4500519785 07-December-2021
Date of Receipt of EUT	19-November-2021
Start of Test	20-January-2022
Finish of Test	21-January-2022
Name of Engineer(s)	William Mayo (Supervised by John Laydon)
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, ICES-003 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Modification State	Result	Comments/Base Standard
	FCC	ICES	ISEDC				
Configuration and Mode: Battery Powered - GNSS Receiver operational							
2.1	15.209	-	-	Magnetic Emissions (H Field)	0	Pass	ANSI C63.4: 2014
2.2	15.109	3.2	7.1	Radiated Disturbance	0	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)*	Blasting control of electronic detonators
Manufacturer:	DetNet South Africa Pty (Ltd)
Model:	CE4 Commander DS600
Part Number:	
Hardware Version:	V6
Software Version:	48713
FCC ID of the product under test – see guidance here	2ARNH-19182810
IC ID of the product under test – see guidance here	24476-19182810

Table 3

Intentional Radiators

Technology	RF	WiFi	NFC			
Frequency Range (MHz to MHz)	902-928	2412-2457	13.553-13.567			
Conducted Declared Output Power (dBm)	27	18	6			
Antenna Gain (dBi)		2.1	2.1			
Supported Bandwidth(s) (MHz) (e.g., 1 MHz, 20 MHz, 40 MHz)	26	20				
Modulation Scheme(s) (e.g., GFSK, QPSK etc)	GFSK FHSS	OFDM	ASK			
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	900MF1D	2G4G1D	13M5D1D			
Bottom Frequency (MHz)	902.26	2412	-			
Middle Frequency (MHz)	914.74	2437	13.56			
Top Frequency (MHz)	927.74	2457	-			

Table 4

Un-intentional Radiators

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

Table 5

Battery Power Source

Voltage:	3.7	V
End-point voltage:	3.4	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☒ Please detail:	Lithium Polymer	

Table 6

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒

Table 7

Temperature

Minimum temperature:	-30	°C
Maximum temperature:	+60	°C

Table 8

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☐	Type:		Gain		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 9

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 10

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

Name: Suzette Menezes
Position held: Approvals Manager
Date: 09 December 2020

1.5 Product Description and Assumptions

The IntelliShot system is a system used in the mining blasting industry. There are 2 components of the system called a "Commander" and Tagger. The Commander is placed on the ground and can be used for long range communication capability which can be further enhanced by a repeater functionality giving the user a defined 6 km communication range allowing for improved safety at blast time. The Tagger is a unique hand-held device with a dual functionality. It allows the user to conduct on bench activities such as tagging (which writes the delay and location to the detonator) while also carrying out the full functionality test and creates a blast interference to the Commanders during the blasting stage. This allows the Tagger to not only assist in detonator troubleshooting, but it can also record the GPS location of the detonator.

A previous version of the Commander has been FCC and ISED approved.
This variant has the following changes.

Mechanical changes:

• Main enclosure colour changed from Pantone Yellow 1235C to Pantone Orange 21C. Base material remains PA 66. Other elements remain the same.

• Top two IOM, bezels, spring-loaded wire terminals, associated gaskets and fastening hardware removed.

• The DigiShot UI Faceplate lacks the holes for the above bezels and spring-loaded wire terminals. A Matt Polycarbonate product label is placed over this area.

• Same packaging will be used as the CE4 Commander, at roughly the same weight (14Kg). Packaging tests are conducted to the nearest Kg so the difference in weight from the lack of two IOM is negligible.

• Fitted with an improved UI front plate and sealing.

The requirement is for the DigiShot 600 Commander to have a unique FCC ID number. For ISED, the DigiShot 600 Commander can be added to the existing family certification with a unique product number/HVIN assigned.

1.6 Product Information

1.6.1 Technical Description

The Equipment under test (EUT) was a DetNet South Africa Pty Limited, CE4 Commander DS600.

The primary function of the EUT is as a blasting control for electronic detonators.

Figure 1 - General View

Figure 2 - Back View

Figure 3 – Equipment Notice

1.6.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Detonator Port	2m	Signal	2 Core	No

Table 11

1.6.3 Test Configuration

Configuration	Description
Battery Powered	Powered via an Internal Battery 3.7 V dc.

Table 12

1.6.4 Modes of Operation

Mode	Description
GNSS Receiver Operating	All RF elements powered yet in an idle state. GNSS set to receive.

Table 13

1.7 Deviations from the Standard

EUT tested in X plane only.

1.8 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: CE4 Commander DS600, Serial Number: Not Serialised (Storix ID 617158-02)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

1.9 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Battery Powered - GNSS Receiver Operating		
Magnetic Emissions (H Field)	William Mayo (Supervised by John Laydon)	UKAS
Radiated Disturbance	William Mayo (Supervised by John Laydon)	UKAS

Table 15

Office Address:

TÜV SÜD
Snitterfield Road
Bearley
Warwickshire
CV37 0EX

2 Test Details

2.1 Magnetic Emissions (H Field)

2.1.1 Specification Reference

FCC 47 CFR Part 15B Clause 15.209,

2.1.2 Equipment Under Test and Modification State

CE4 Commander DS600, S/N: Not Serialised (Storix ID 617158-02) - Modification State 0

2.1.3 Date of Test

28 Janaury 2022

2.1.4 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC 47 CFR Part 15B Clause 15.209
.
Measurements taken at a seperation distance of 3m.

2.1.5 Environmental Conditions

Ambient Temperature	13.0 °C
Relative Humidity	44.5 %

2.1.6 Specification Limits

Required Specification Limits Test Limit at a 3 m Measurement Distance		
Frequency Range (MHz)	Resolution Bandwidth (kHz)	Peak (dBµV/m)
0.009 to 0.490	0.2	88.52 to 53.8
0.490 to 1705	9	53.8 to 42.97
1705 to 30	9	50 to 50
Supplementary information: Note: Limits change linearly with a logarithmic change in frequency between designated points.		

Table 16

2.1.7 Test Results

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

Performance assessment of the EUT made during this test: *Pass*.
Detailed results are shown below.

Frequency Range of Test: 9kHz to 30MHz

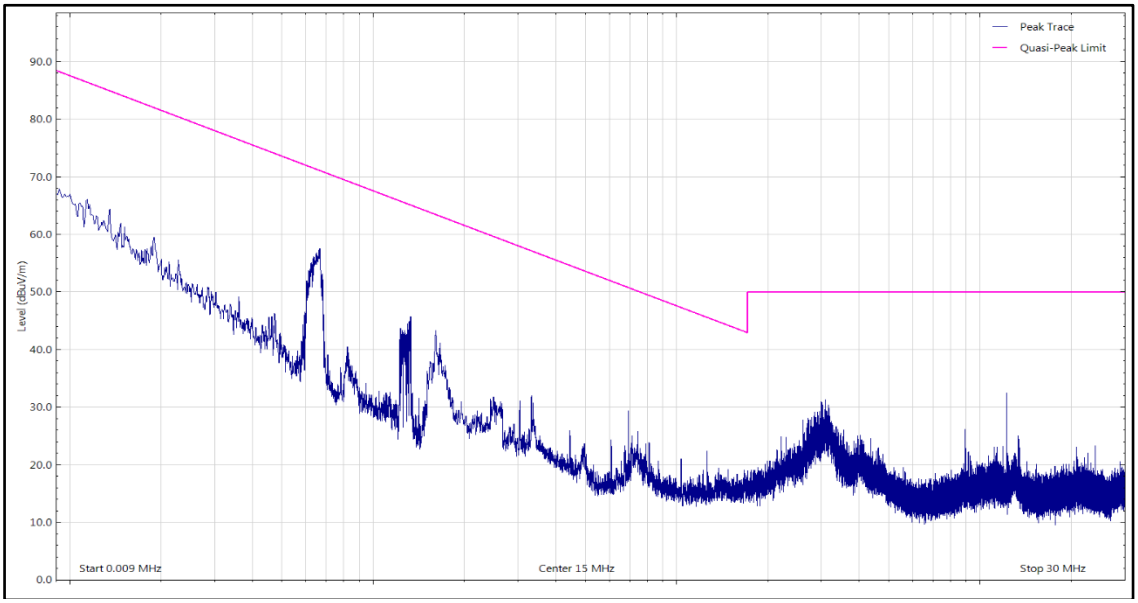

Figure 4 - Front On 9KHz-30MHz

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

Table 17

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: 9kHz to 30MHz

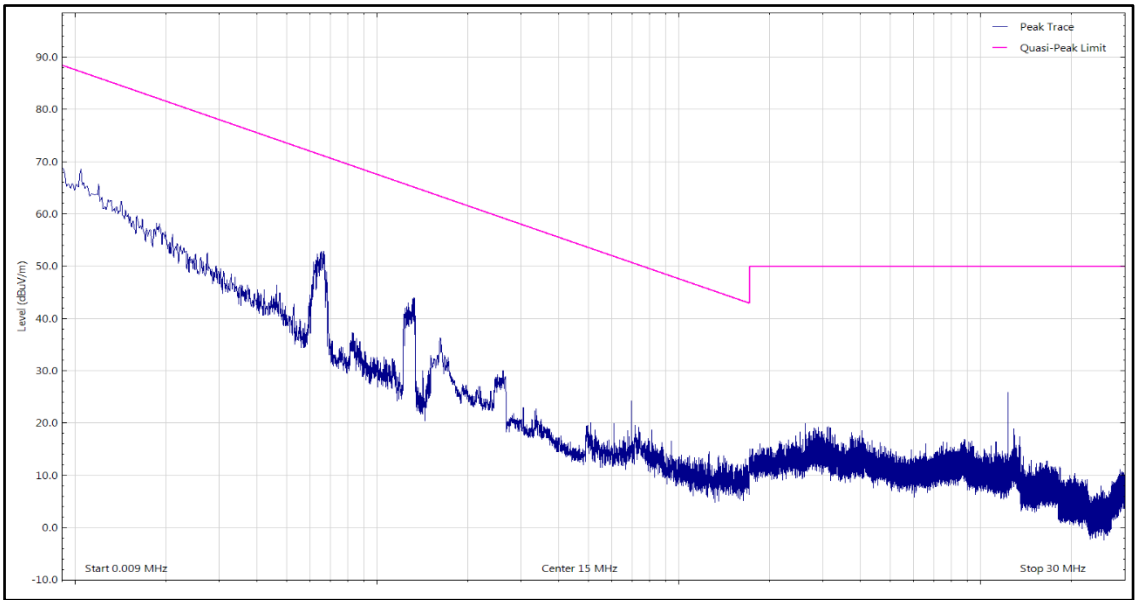

Figure 5 - Side On 9KHz-30MHz

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

Table 18

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.

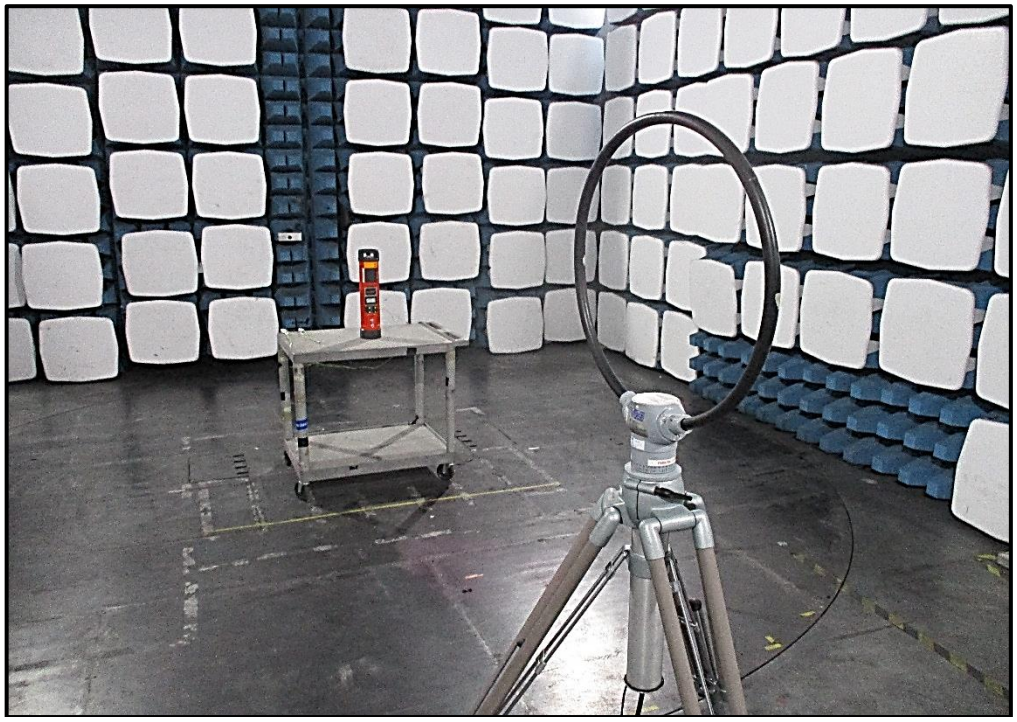

Figure 6 - Test Setup

2.1.8 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 Due
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	3633	24	22-Sep-2022
Test Receiver	Keysight Technologies	N9038A MXE	4629	12	20-Feb-2022
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software

Table 19

2.2 Radiated Disturbance

2.2.1 Specification Reference

FCC 47 CFR Part 15B Clause 15.109,
ICES-003 Clause 3.2
ISED RSS-GEN Clause 7.1

2.2.2 Equipment Under Test and Modification State

CE4 Commander DS600, S/N: Not Serialised (Storix ID 617158-02) - Modification State 0

2.2.3 Date of Test

20-January-2022 to 21-January-2022

2.2.4 Test Method

Battery Powered - GNSS Receiver Operating

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.

Pre-scans were performed with the EUT orientated in the X plane only 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.

2.2.5 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)

2.2.6 Example Test Setup Diagram

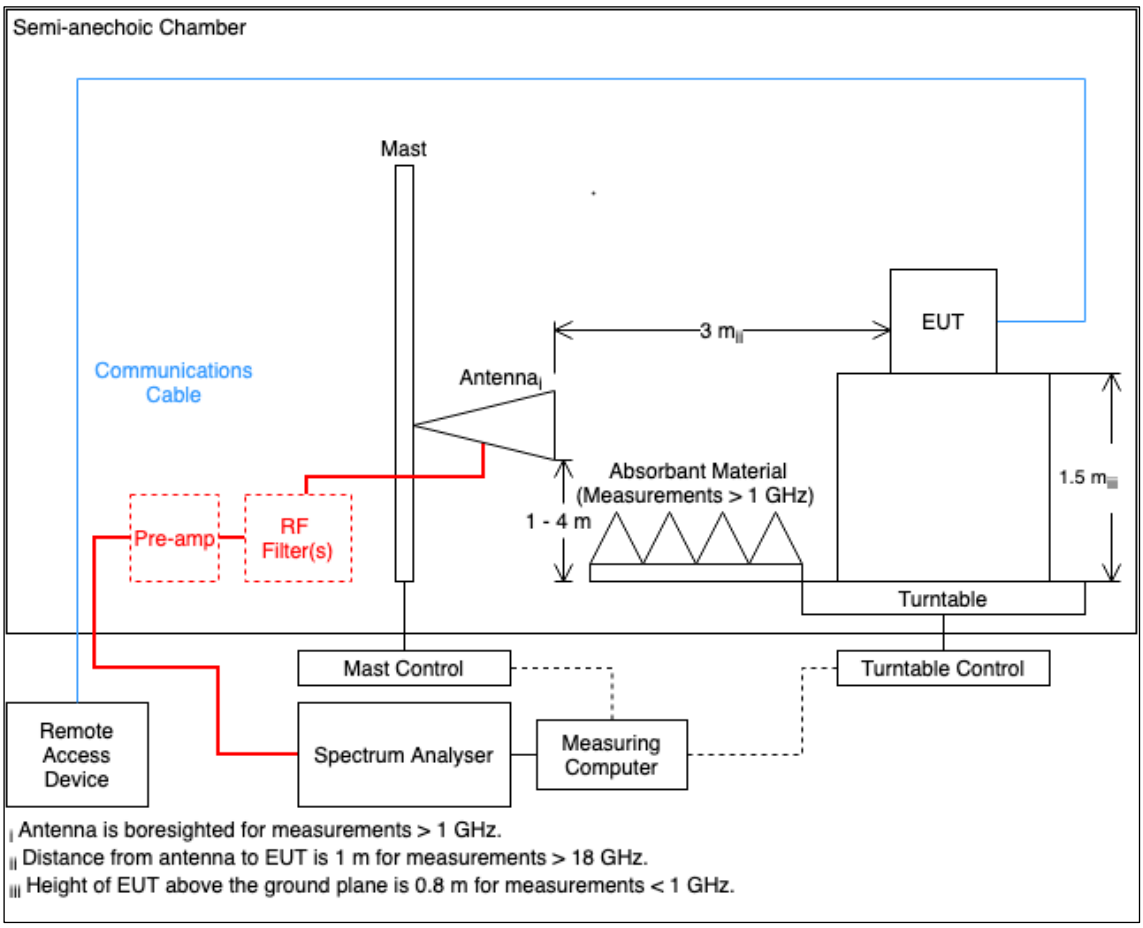

Figure 7

2.2.7 Environmental Conditions

Ambient Temperature	13.0 - 13.4 °C
Relative Humidity	43.4 - 44.5 %

2.2.8 Specification Limits

Required Specification Limits, Field Strength - Class B Test Limit at a 3 m Measurement Distance		
Frequency Range (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0
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 20

2.2.9 Test Results

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

This test was performed to the requirements of the Class B 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
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.

Frequency Range of Test: 30 MHz to 1 GHz

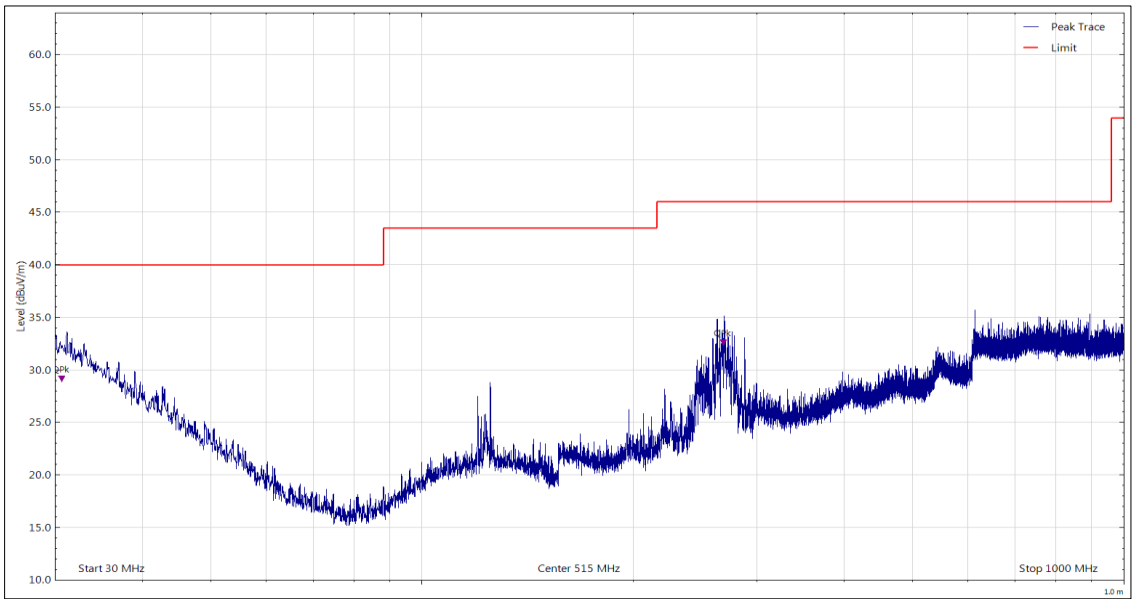

Figure 8 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.698	28.7	40.0	-11.3	Q-Peak	1	399	Horizontal
269.061	32.2	46.0	-13.8	Q-Peak	109	110	Horizontal

Table 21

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

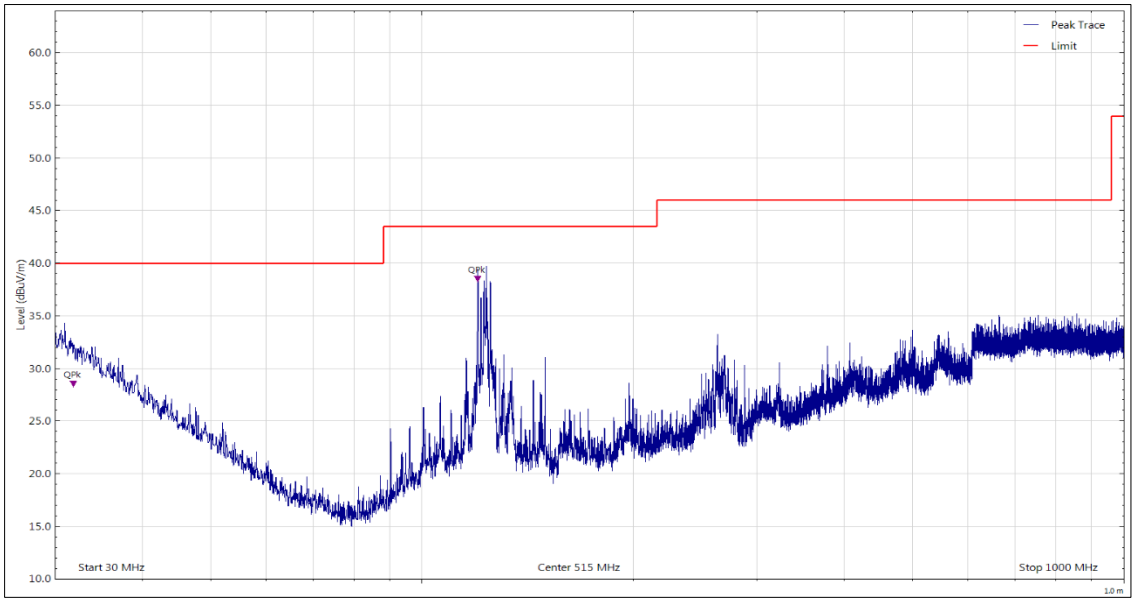

Figure 9 - 30 MHz to 1 GHz, Quasi-Peak, Vertical - X Orientation

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
31.873	28.1	40.0	-11.9	Q-Peak	239	110	Vertical
120.000	38.1	43.5	-5.4	Q-Peak	206	110	Vertical

Table 22

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

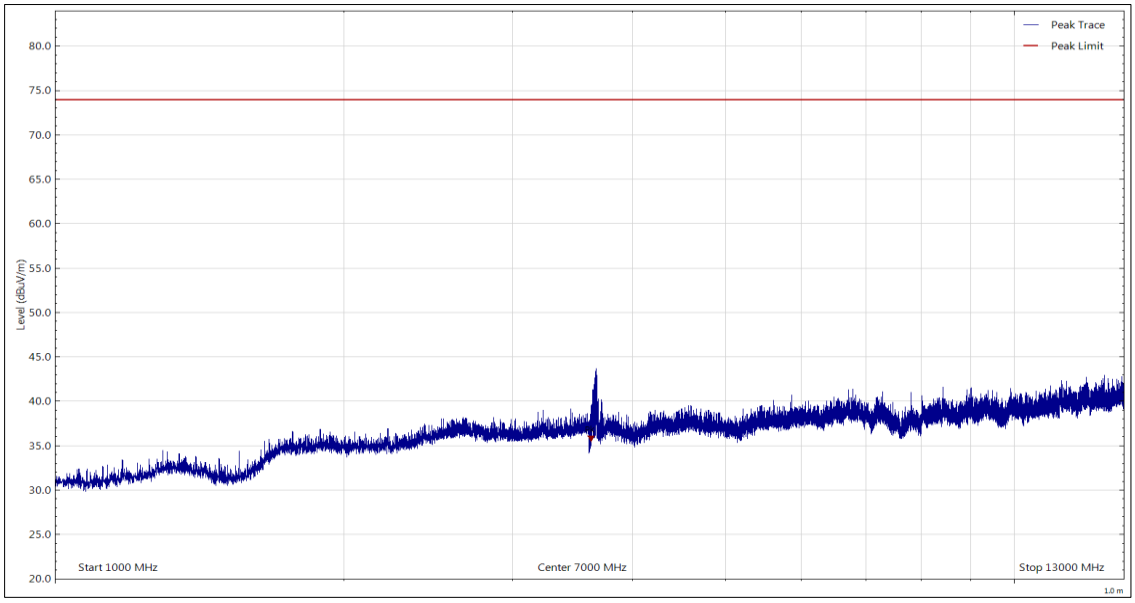

Figure 10 - 1 GHz to 13 GHz, Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
3619.902	35.3	74.0	-38.7	Peak	317	197	Horizontal

Table 23

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 – CISPR Average Detector

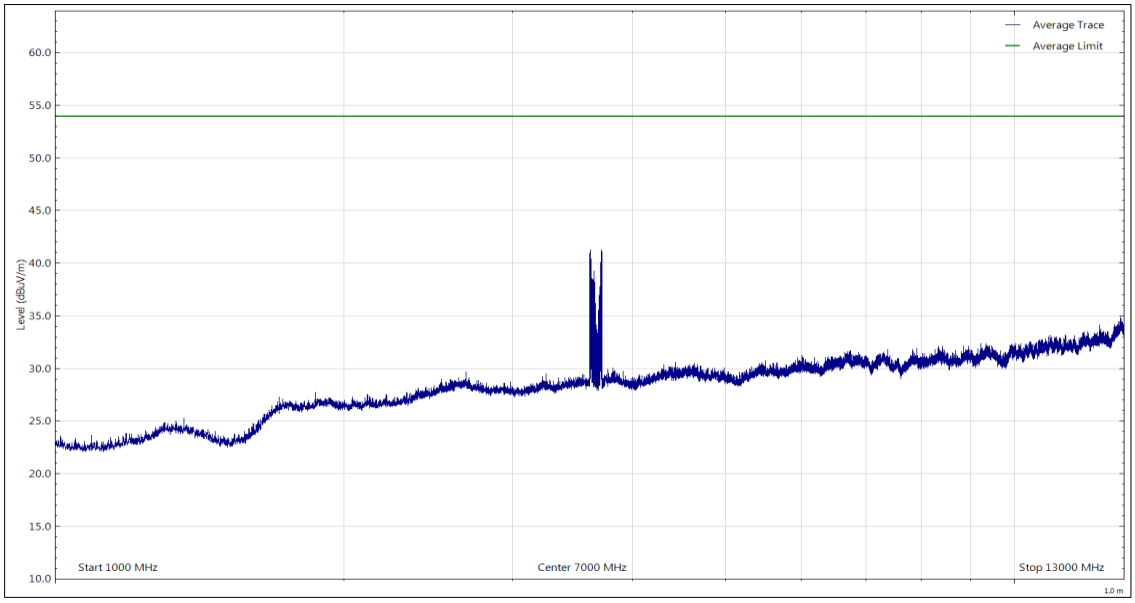

Figure 11 - 1 GHz to 13 GHz, CISPR Average, Horizontal

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

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.

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

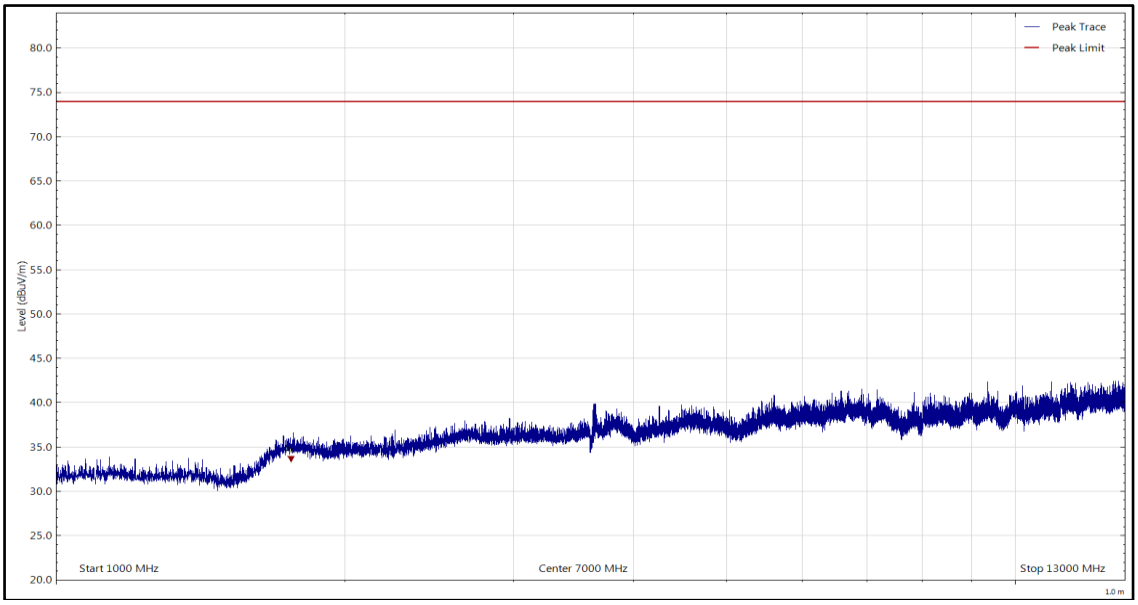

Figure 12 - 1 GHz to 13 GHz, Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1757.501	33.2	74.0	-40.9	Peak	0	349	Vertical

Table 25

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 - CISPR Average Detector

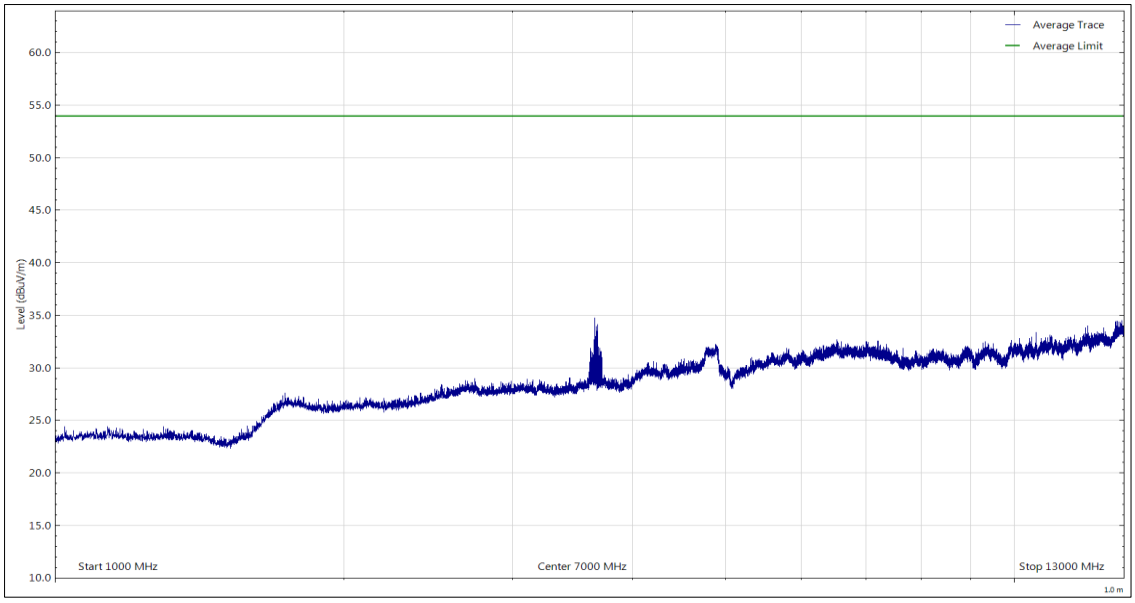

Figure 13 - 1 GHz to 13 GHz, CISPR Average, Vertical

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 14 - Test Setup - 30 MHz to 1 GHz

Figure 15 - Test Setup - 1 GHz to 13 GHz

2.2.10 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
Power Supply Unit	Farnell	LT30-2	1673	-	TU
Antenna (Bilog, 30 MHz to 3 GHz)	Schaffner	CBL6143	1858	24	10-Nov-2022
Screened Room (1)	Rainford	Hybrid	4160	36	11-Jan-2025
Cable (N-Type to N-Type, 7 m)	Teledyne Storm	SA90-195-7MTR	4173	12	08-Mar-2022
Test Receiver	Keysight Technologies	N9038A MXE	4629	12	20-Feb-2022
Pre-Amplifier (1 GHz to 8 GHz)	Wright Technologies	APS04-0085	4674	12	18-Aug-2022
8-18 GHz Amplifier	Wright Technologies	APS04-0086	4675	12	18-Aug-2022
Mast controller	Innco Systems	Controller CO3000	4728	-	TU
Antenna (Double Ridge Guide, 1 GHz to 18 GHz)	ETS-Lindgren	3117	4737	24	13-Aug-2023
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Cable (N-Type to N-Type, 3 m)	Rosenberger	LU7-036-3000	5163	12	13-Dec-2022
Turntable Controller	Maturo	Maturo NCD	5275	-	TU
Attenuator (4 dB, 2 W)	Pasternack	PE7047-4	5647	24	10-Nov-2022

Table 27

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Scientific Ambient Monitor	Testo	622	5698	12	17-Feb-2022

Table 28

4 Incident Reports

No incidents reports were raised.

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 29

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.