FCC and ISED Test Report

Sepura Limited
TETRA mobile radio, Model: SCG2221 Basic

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

Prepared for: Sepura Limited
9000 Cambridge Research Park
Beach Drive, Waterbeach
Cambridge, CB25 9TL
United Kingdom

FCC ID: XX6SCG2221X IC: 8739A-SCG2221X

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Document 75957883-01 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
John Laydon	General Manager	Authorised Signatory	19-September-2023

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	Ravi Kishore Darshanam	19-September-2023	

FCC Accreditation
330364 Bearley Test Laboratory

ISED 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: 2021, ICES-003 Issue 7: 2020 and ISEDC RSS-GEN: Issue 5 + A2 (2021-02) 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	19-September-2023

Table 1

1.2 Introduction

Applicant	Sepura Limited
Manufacturer	Sepura Limited
Model Number(s)	SCG2221 Basic
Serial Number(s)	1PR002250GPB2NA
Hardware Version(s)	PLX-8V015550-02 (Hardware Mod State 7)
Software Version(s)	1807 004 10138
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B:2021 ICES-003 Issue 7: 2020 ISED RSS-GEN: Issue 5 + A2 (2021-02)
Order Number	PLC-PO025039-1
Date	20-February-2023
Date of Receipt of EUT	24-March-2023
Start of Test	23-March-2023
Finish of Test	23-March-2023
Name of Engineer(s)	Ravi Kishore Darshanam
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 is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC	ICES	ISED			
Configuration and Mode: Basic Unit - Configuration 1						
2.1	15.109	3.2	7.1	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)*	The SCG2221 is a TETRA mobile radio in the SCG22 series of radios, operating in the VHF band, with TETRA operating frequencies 136-174 MHz. The SCG2221 supports GNSS and a range of accessories and ancillary equipment. The SCG2221 may be installed in a vehicle or in a desk mount unit.		
Manufacturer:	Sepura Limited		
Model:	SCG2221 Basic		
Part Number:	SCG2221		
Hardware Version:	PLX-8V015550-02 (Hardware Mod State 7)		
Software Version:	1807 004 10138		
FCC ID of the product under test – see guidance here		XX6SCG2221X	
IC ID of the product under test – see guidance here		8739A-SCG2221X	
Device Category	Mobile ☒	Portable ☐	Fixed ☐
Equipment is fitted with an Audio Low Pass Filter		Yes ☒	No ☐

Table 3

Intentional Radiators

Technology	TETRA					
Frequency Range (MHz to MHz)	136-174					
Conducted Declared Output Power (dBm)	40					
Antenna Gain (dBi)	No antenna supplied.					
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	0.025					
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	π/4 DQPSK					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	20K0DXW					
Bottom Frequency (MHz)	136					
Middle Frequency (MHz)	155					
Top Frequency (MHz)	174					

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	1610 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:	13.6	V
Extreme upper voltage:	15.6	V
Extreme lower voltage:	10.8	V
Max current:	4	A

Table 7

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:		

Table 8

Charging

Can the EUT transmit whilst being charged Unit does not charge	Yes ☐ No ☐

Table 9

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	55	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	N/A	dB

Table 11

Antenna Characteristics

Antenna connector ☒			State impedance	50	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 ☐

All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information maybe photographs, length of wire antenna etc.

Antenna Gains are from

https://www.panorama-antennas.com/site/Mobile-Radio/PMR-Antennas/AFQNT-VAR

Table 12

Ancillaries (if applicable)

Manufacturer:	Panorama Antennas	Part Number:	AFQNT-H5
Model:	TETRA antenna	Country of Origin:	UK
Manufacturer:	Sepura	Part Number:	300-00063
Model:	GNSS Antenna	Country of Origin:	UK
Manufacturer:	Sepura	Part Number:	300-02012 rev001
Model:	Extended SCG Loudspeaker / IO USB Host lead	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-02010
Model:	SCG Power/ignition Lead	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00069
Model:	Mobile Remote Cable 5.0M	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00670
Model:	HBC Interface and Hands-free Box	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00079
Model:	Remote Microphone And Switch Set	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00292

Model:	Remote Microphone (Handsfree Kit) 3m	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-01801
Model:	Handset Based Console (HBC3)	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00062
Model:	Fist microphone	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-01808
Model:	SCC3 (colour console)	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-01961
Model:	CC VAC RSM (Long Cable)	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-00719
Model:	Loudspeaker	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-02009
Model:	USB Data/Programming Lead	Country of Origin:	UK
Manufacturer:	Sepura	Part Number:	300-02012
Model:	SCG Loudspeaker / IO USB Host lead	Country of Origin:	UK
Manufacturer:	Sepura	Part Number:	300-00784
Model:	AMPS attachments	Country of Origin:	UK
Manufacturer:	Sepura	Part Number:	300-00068
Model:	Mobile Remote Cable 3.0M	Country of Origin:	UK

Table 13

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

Name: Chris Beecham
Position held: Conformance Engineer
Date: 21/03/2023

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a Sepura Limited Tetra radio, Model: SCG2221 Basic Unit.

It is a TETRA mobile radio in the SCG22 series of radios operating in the VHF band with TETRA operating frequencies of 136 to 174 MHz.

The EUT supports GNSS and a range of accessories and ancillary equipment.

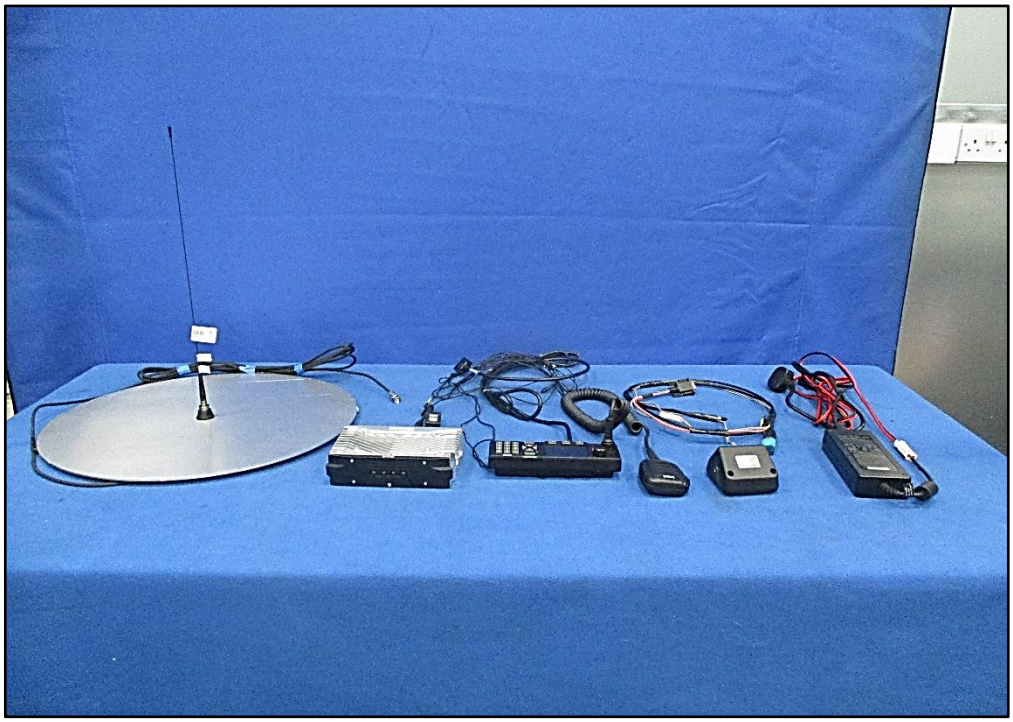

Figure 1 – EUT Overall unit

Figure 2 – EUT Front & LHS view

Figure 3 - EUT Rear & RHS view

Figure 4 – EUT ID Label

1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Tetra Antenna Port	5m	Connection to Tetra Antenna	Data	Coax
AC Power Adapter	2 m	DC Power to EUT	Data	No
Speaker	5 m	Connect to Speaker	Data	No
USB cable	5 m	Connect to USB	Data	No
SCC3 / HBC3 Port	3 m	Connection to SCC3 / HBC3 Port	Data	No
microphone	3m	Connected to SCC3	Data	No
Remote	3m	Connected to SCC3	Data	No

Table 14

1.5.3 Test Configuration

Configuration	Description
Basic Unit	The EUT is powered 13.6V DC through AC adapter The EUT was populated with one SCC3 unit each with a Vehicle RSM connected. Also, a Hands-Free Kit was connected to the SCC3 unit. Loudspeakers of type 300-00719 were connected.

Table 15

1.5.4 Modes of Operation

Mode	Description
Configuration 1	All transmitters were configured to idle. GPS was set to receive. The SCG2221 was configured in a 155.025 MHz DMO setup with no call operating.

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: SCG2221 Basic Unit, Serial Number: 1PR002250GPB2NA			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 17

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: Basic Unit - Configuration 1		
Radiated Disturbance	Ravi Kishore Darshanam	UKAS

Table 18

Office Address:

Snitterfield Road
Bearley
Warwickshire
CV37 OEX
United Kingdom

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

SCG2221 Basic, S/N: 1PR002250GPB2NA - Modification State 0

2.1.3 Date of Test

23-March-2023

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 Fixed 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

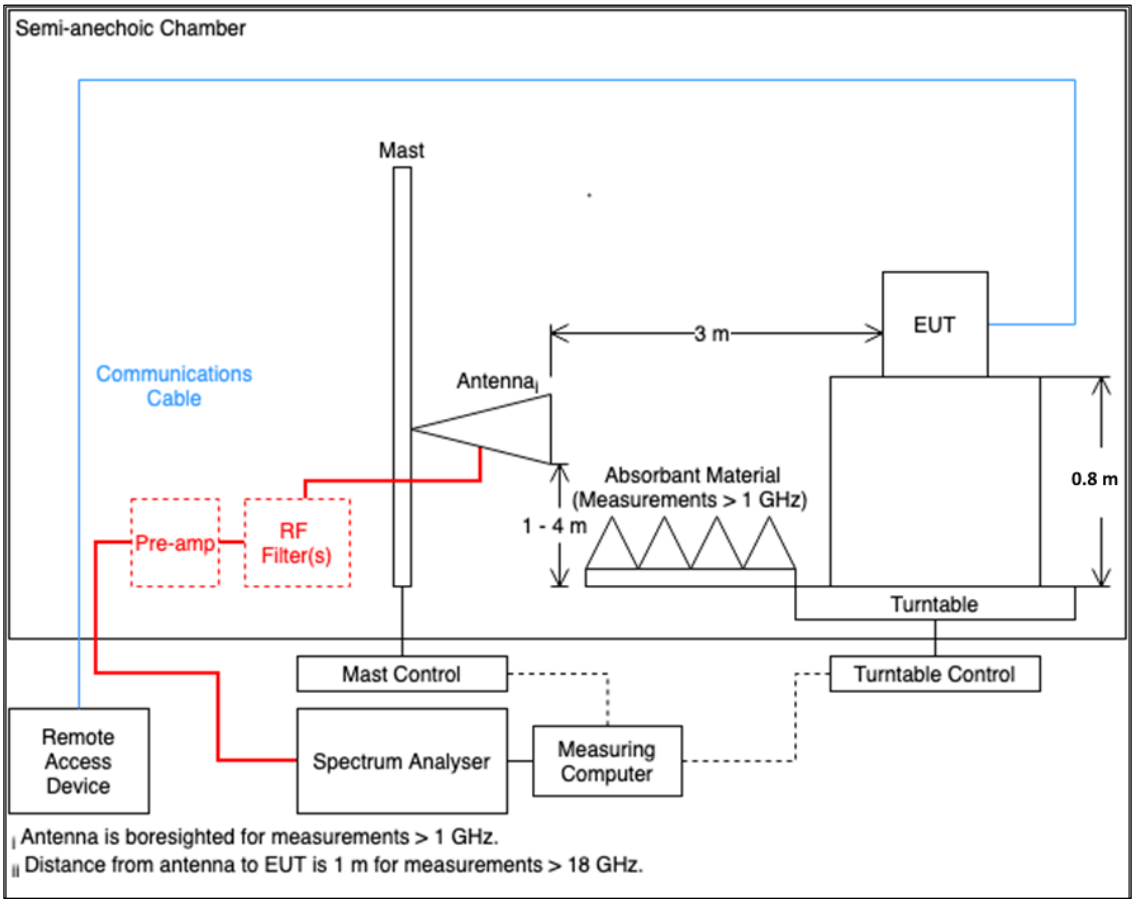

Figure 5 - Radiated Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	46.3 %
Atmospheric Pressure	1005.0 mbar

2.1.8 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 19

2.1.9 Test Results

Results for Configuration and Mode: Basic Unit - Configuration 1.

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: 1610MHz
Which necessitates an upper frequency test limit of: 13 GHz

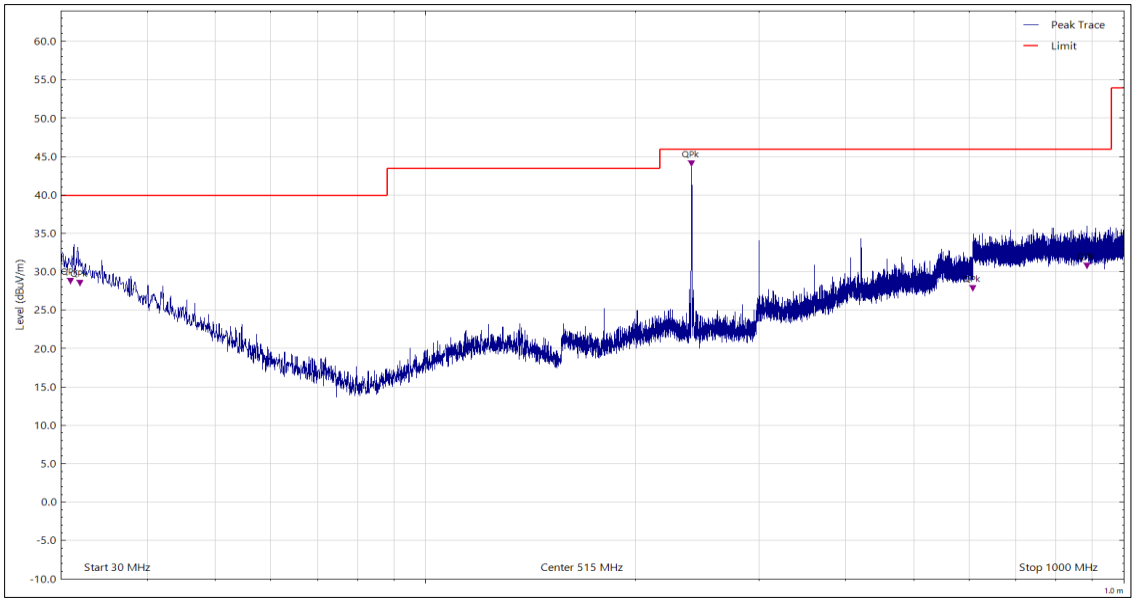

Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.964	28.17	40.00	-11.83	Q-Peak	146	350	Horizontal
32.000	27.93	40.00	-12.07	Q-Peak	231	258	Horizontal
240.039	43.54	46.00	-2.46	Q-Peak	37	100	Horizontal
607.437	27.30	46.00	-18.70	Q-Peak	9	330	Horizontal
885.494	30.14	46.00	-15.86	Q-Peak	39	386	Horizontal

Table 20

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.

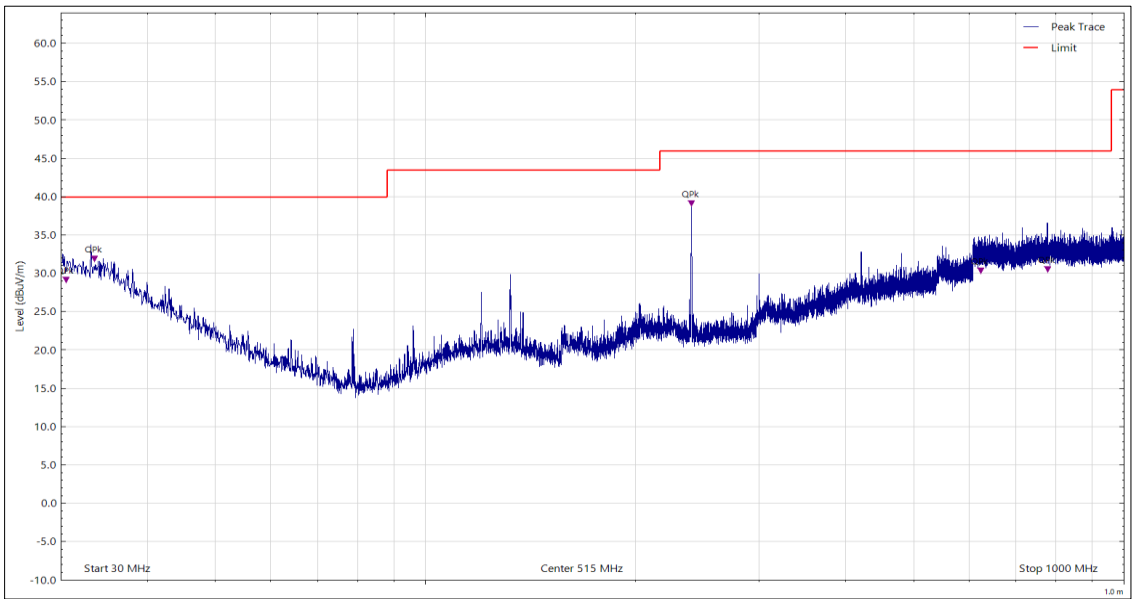

Figure 7 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.578	28.51	40.00	-11.49	Q-Peak	360	100	Vertical
33.536	31.33	40.00	-8.67	Q-Peak	0	158	Vertical
240.073	38.48	46.00	-7.52	Q-Peak	6	102	Vertical
624.258	29.75	46.00	-16.25	Q-Peak	125	218	Vertical
777.723	29.93	46.00	-16.07	Q-Peak	23	209	Vertical

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.

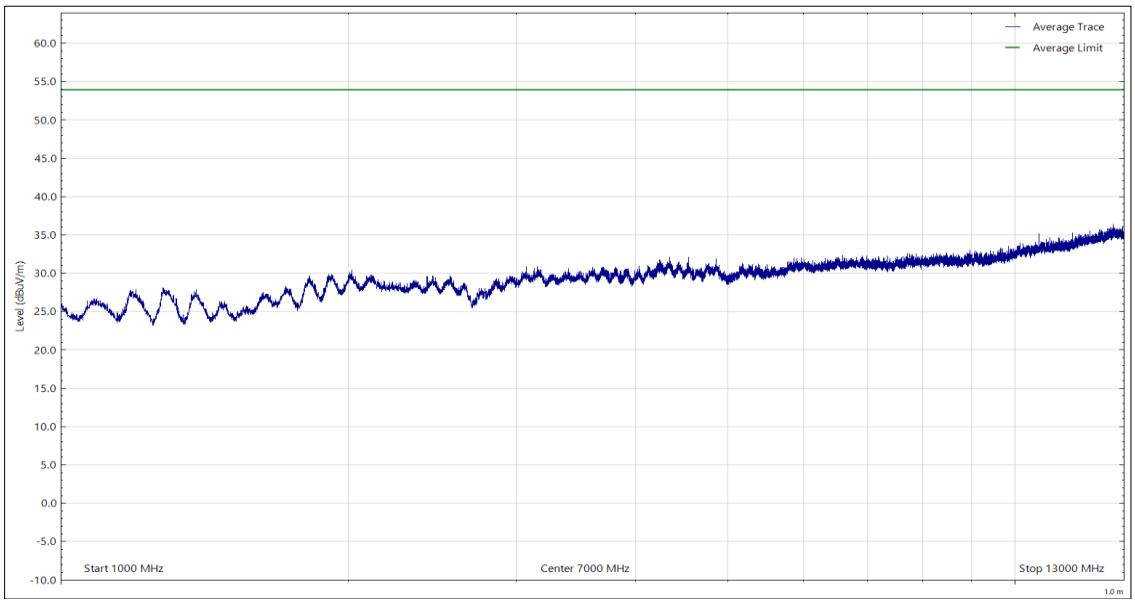

Figure 8 - 1 GHz to 13 GHz, CISPR Average, Horizontal

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.

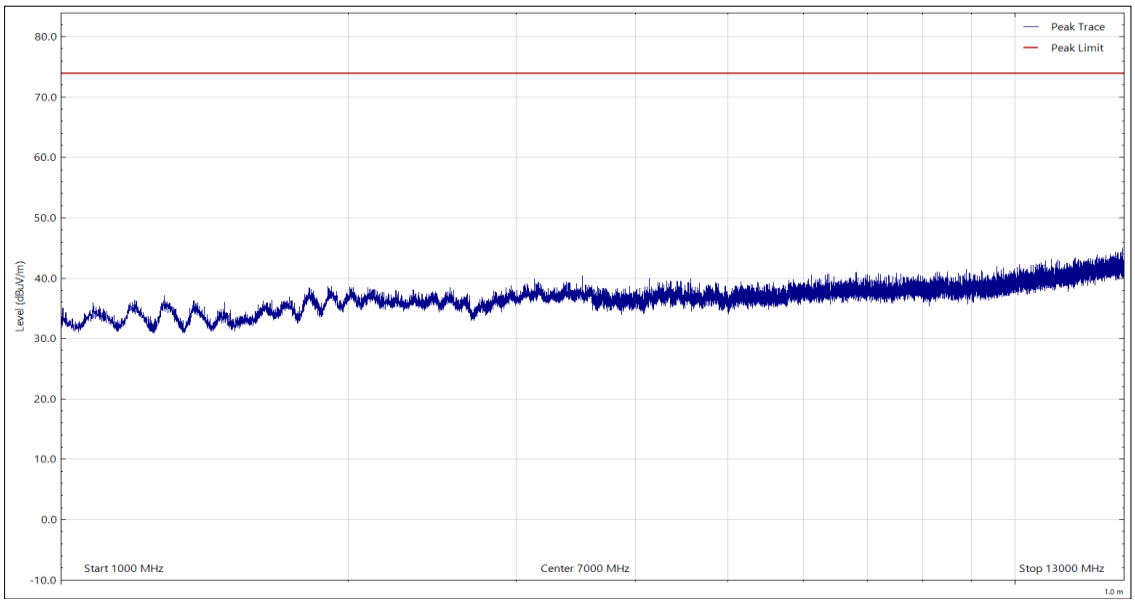

Figure 9 - 1 GHz to 13 GHz, Peak, Horizontal

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.

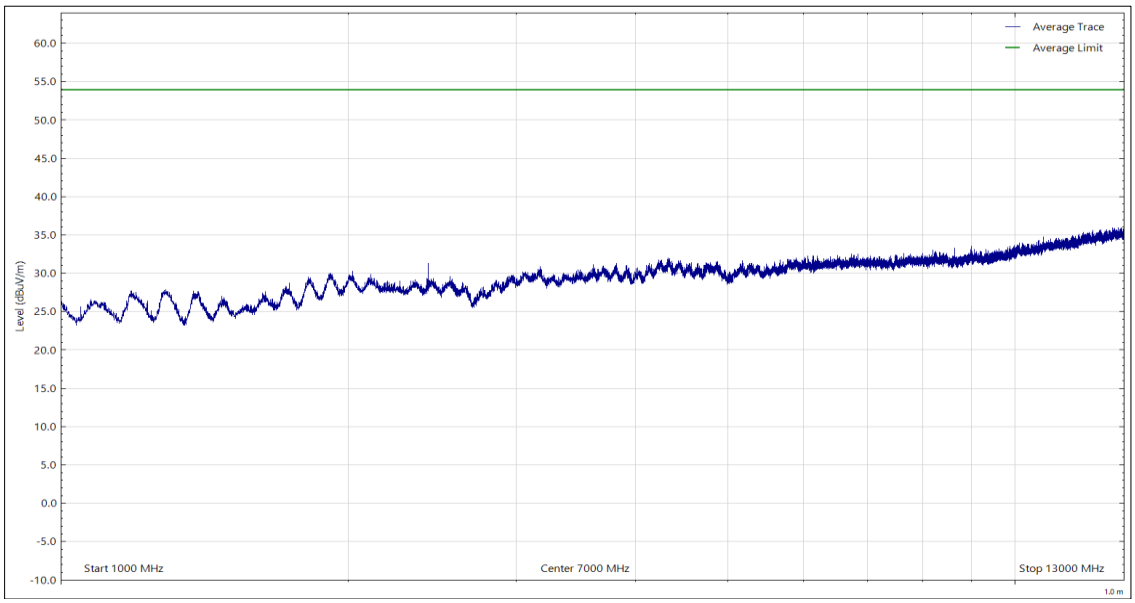

Figure 10 - 1 GHz to 13 GHz, CISPR Average, Vertical

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.

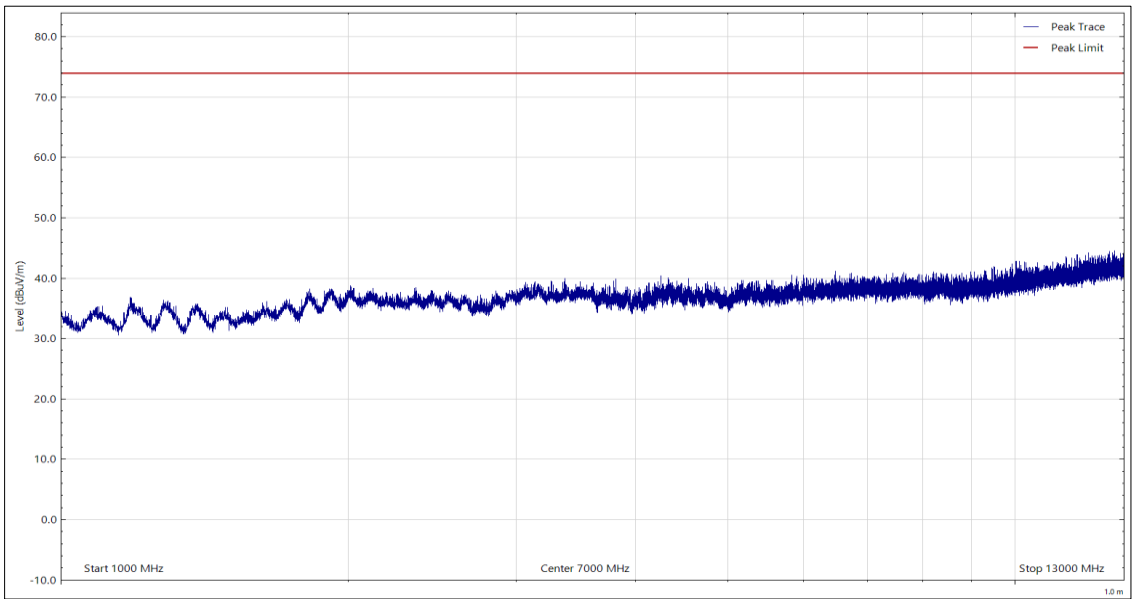

Figure 11 - 1 GHz to 13 GHz, Peak, Vertical

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 12 - Test Setup - 30 MHz to 1 GHz

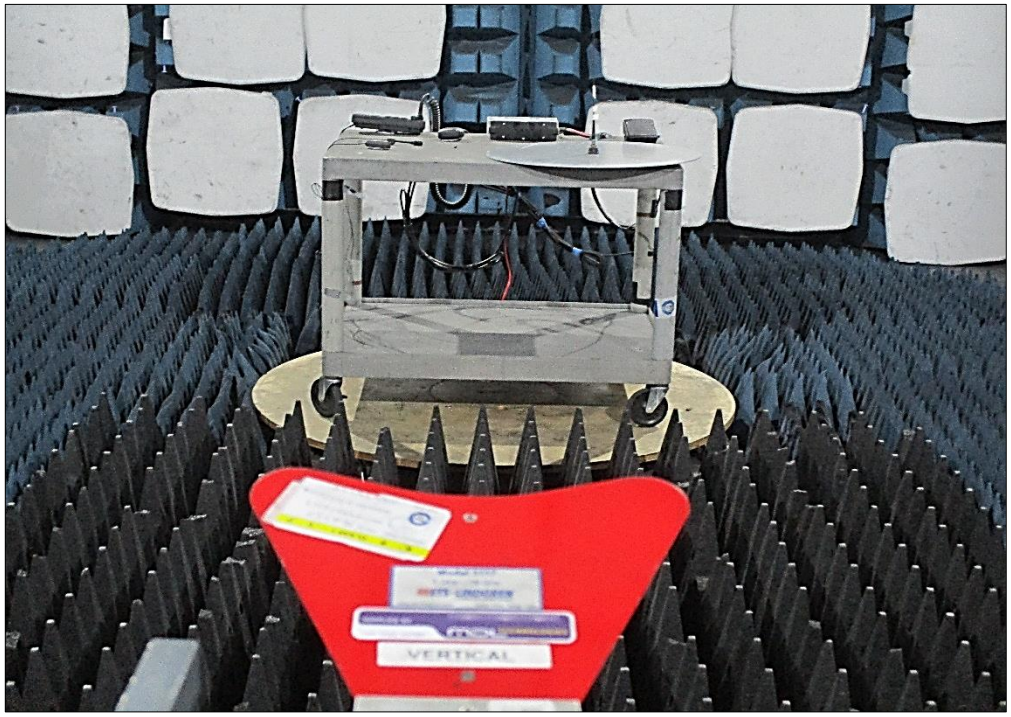

Figure 13 - Test Setup - 1 GHz to 13 GHz

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
Antenna (Bilog, 30 MHz to 3 GHz)	Schaffner	CBL6143	1858	24	30-Apr-2023
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	13-Apr-2023
Mast controller	Innco Systems	Controller CO3000	4728	-	TU
Antenna (Double Ridge Guide, 1 GHz to 18 GHz)	ETS-Lindgren	3117	4737	24	11-Mar-2024
Test Receiver	Keysight Technologies	N9038A MXE	4974	12	30-Jan-2024
Emissions Software	TUV SUD	EmX V3.1.10	5125	-	Software
Cable (N-Type to N-Type, 3 m)	Rosenberger	LU7-036-3000	5163	12	18-Dec-2023
Cable (18GHz SMA 1m)	Rosenberger	LU7-071-1000	5165	12	18-Dec-2023
Turntable Controller	Maturo	Maturo NCD	5275	-	TU
Broadband Pre-Amplifier (0.5 - 18 GHz)	Schwarzbeck	BBV 9718 D	5882	12	01-Mar-2024

Table 26

TU - Traceability Unscheduled

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygrometer	Rotronic	I-1000	2830	12	13-Oct-2023

Table 27

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 28

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 115:2021, Clause 4.4.3 (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.