

FCC and ISED Test Report

Sepura Limited
Tetra Mobile Radio, Model: SCG22

In accordance with FCC 47 CFR Part 15C,
FCC 47 CFR Part 90, ISED RSS-119 and
ISED RSS-247

Prepared for: Sepura Limited
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FCC ID: XX6SCG2229

IC: 8739A-SCG2229

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Document 75948283-07 Issue 02

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	22 June 2020

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 15C, FCC 47 CFR Part 90, ISED RSS-119 and ISED RSS-247. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	22 June 2020	

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

ISED Accreditation

12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2019, FCC 47 CFR Part 90: 2019, ISED RSS-119: Issue 12 (05-2015) and ISED RSS-247: Issue 2 (02-2017) 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	06 May 2020
2	To include new results after re-testing was required as the correct matching components were fitted to Bluetooth/Wi-Fi RF circuit.	22 June 2020

Table 1

1.2 Introduction

Applicant	Sepura Limited
Manufacturer	Sepura Limited
Model Number(s)	SCG22
Serial Number(s)	1PR002007GPH5XV
Hardware Version(s)	Pre-production PLX-89015561_Rev49b
Software Version(s)	1785 004 10138
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019 FCC 47 CFR Part 90: 2019 ISED RSS-119: Issue 12 (05-2015) ISED RSS-247: Issue 2 (02-2017)
Order Number	PLC-PO015398-1
Date	12-February-2020
Date of Receipt of EUT	10-March-2020
Start of Test	16-March-2020
Finish of Test	07-June-2020
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.26: 2015



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, FCC 47 CFR Part 90, ISED RSS-119 and ISED RSS-247 is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 15C	Part 90	RSS-119	RSS-247			
Configuration and Mode: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Classic (middle Tx channel).							
2.1	15.247 (d), and 15.205	90.210	5.8	5.5	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.26: 2015
Configuration and Mode: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Low Energy (middle Tx channel).							
2.1	15.247 (d), and 15.205	90.210	5.8	5.5	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.26: 2015
Configuration and Mode: Vehicle RSM - TETRA (middle Tx channel - 450 to 470 MHz band) + 2.4 GHz Wi-Fi (middle Tx channel).							
2.1	15.247 (d), and 15.205	90.210	5.8	5.5	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.26: 2015

Table 2



1.4 Application Form

Equipment Description

Technical Description: (Please provide a brief description of the intended use of the equipment)	TETRA mobile radio for use within cars, trucks, mobile and fixed control rooms, motorcycles, boats and trains, with Wi-Fi, Bluetooth, GPS and Ethernet functions
Manufacturer:	Sepura
Model:	SCG22 Series
Part Number:	SCG2229
Hardware Version:	Pre-production PLX-89015561_Rev49b
Software Version:	1785 004 10138
FCC ID (if applicable)	XX6SCG2229
IC ID (if applicable)	8739A-SCG2229

Intentional Radiators

Technology	TETRA	Bluetooth LE	Bluetooth Classic / EDR	Wi-Fi 802.11b, g	Wi-Fi 802.11n 20	Wi-Fi 802.11n 40
Frequency Band (MHz)	380 - 470	2402 - 2480	2402 - 2480	2412 - 2462	2412 - 2462	2422 - 2452
Conducted Declared Output Power (dBm)	41.5	7.4	7.382	16.5	16.5	16.5
Antenna Gain (dBi)	2	Element 3: 2 dBi	Element 3: 2 dBi	Element 3: 2 dBi	Element 3: 2 dBi	Element 3: 2 dBi
Supported Bandwidth(s) (MHz)	0.025 / 0.02	1	1	20	20	40
Modulation Scheme(s)	$\pi/4$ DQPSK	GFSK	GFSK $\pi/4$ DQPSK 8DPSK	802.11b: CCK, DBPSK, DQPSK 802.11g: BPSK, QPSK, 16QAM, 64QAM	BPSK, QPSK, 16QAM, 64QAM	BPSK, QPSK, 16QAM, 64QAM
ITU Emission Designator	22K0DXW 20K0DXW	1M18F1D	1M01F1D 1M01G1D	19M7G1D	19M7D1D	36M8D1D
Bottom Frequency (MHz)	380	2402	2402	2412	2412	2422
Middle Frequency (MHz)	425	2441	2441	2437	2437	2437
Top Frequency (MHz)	470	2480	2480	2462	2462	2452



Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 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) ☐	

AC Power Source

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

DC Power Source

Nominal voltage:	12	V
Extreme upper voltage:	15.6	V
Extreme lower voltage:	10.8	V
Max current:	5	A

Battery Power Source None

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:	-20	°C
Maximum temperature:	+60	°C



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 ☐				

Ancillaries (if applicable)

Manufacturer:	Sepura	Part Number:	GPSB4
Model:	GPSB4 Vehicle Roof Antenna	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	AFB-TET
Model:	AFB-VAR 380-430 MHz antenna	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	AFB-UT
Model:	AFB-VAR 406-472 MHz antenna	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-02012 rev001
Model:	Extended SCG Loudspeaker / IO USB Host lead	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	300-02014 rev001
Model:	Extended SCG Expansion Board Loudspeaker / 8 GPIO lead	Country of Origin:	Unknown
Manufacturer:	Sepura	Part Number:	Netgear GS105 ProSAFE Gigabit Switch
Model:	Netgear GS105 ProSAFE Gigabit Switch	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:	300-00082
Model:	Detachable Loudspeaker extension Cable	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:	300-01837
Model:	Loudspeaker	Country of Origin:	Unknown

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

Name: Chris Beecham
Position held: Conformance Engineer
Date: 10 March 2020



1.5 Product Information

1.5.1 Technical Description

TETRA mobile radio for use within cars, trucks, mobile and fixed control rooms, motorcycles, boats and trains, with Wi-Fi, Bluetooth, GPS and Ethernet functions.

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: SCG22, Serial Number: 1PR002007GPH5XV			
0	As supplied by the customer	Not Applicable	Not Applicable
1	The correct matching components were fitted to the Bluetooth/Wi-Fi RF circuit. New hardware version: PLX-89015561_Rev49b	Manufacturer	June-2020

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: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Classic (middle Tx channel).		
Radiated Spurious Emissions (Simultaneous Transmission)	Graeme Lawler	UKAS
Configuration and Mode: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Low Energy (middle Tx channel).		
Radiated Spurious Emissions (Simultaneous Transmission)	Graeme Lawler	UKAS
Configuration and Mode: Vehicle RSM - TETRA (middle Tx channel - 450 to 470 MHz band) + 2.4 GHz Wi-Fi (middle Tx channel).		
Radiated Spurious Emissions (Simultaneous Transmission)	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 Spurious Emissions (Simultaneous Transmission)

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
FCC 47 CFR Part 90, Clause 90.210
ISED RSS-119, Clause 5.8
ISED RSS-247, Clause 5.5

2.1.2 Equipment Under Test and Modification State

SCG22, S/N: 1PR002007GPH5XV - Modification State 0: Configuration and Mode: Vehicle RSM - TETRA (middle Tx channel - 450 to 470 MHz band) + 2.4 GHz Wi-Fi (middle Tx channel).

SCG22, S/N: 1PR002007GPH5XV - Modification State 1: Configuration and Mode: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Low Energy (middle Tx channel).

SCG22, S/N: 1PR002007GPH5XV - Modification State 1: (Configuration and Mode: Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Classic (middle Tx channel).

2.1.3 Date of Test

16-March-2020 to 07-June-2020

2.1.4 Test Method

Testing was performed in accordance with ANSI C63.26, clause 5.5.

Prescans and final measurements were performed using the direct field strength method.

The Regulatory limit of -13dBm / MHz has been converted to a field strength limit in accordance with ANSI C63.26 clause 5.2.7 equation c)

Example calculation

$E \text{ (dBuV/m)} = \text{EIRP (dBm)} - 20\log(d) + 104.8$ where (d) is the measurement distance.

$E \text{ (dBuV/m)} = -13 - 20\log(3) + 104.8$

$E \text{ (dBuV/m)} = 82.26$

The EUT was placed on the non-conducting platform in a manner typical of a normal installation.

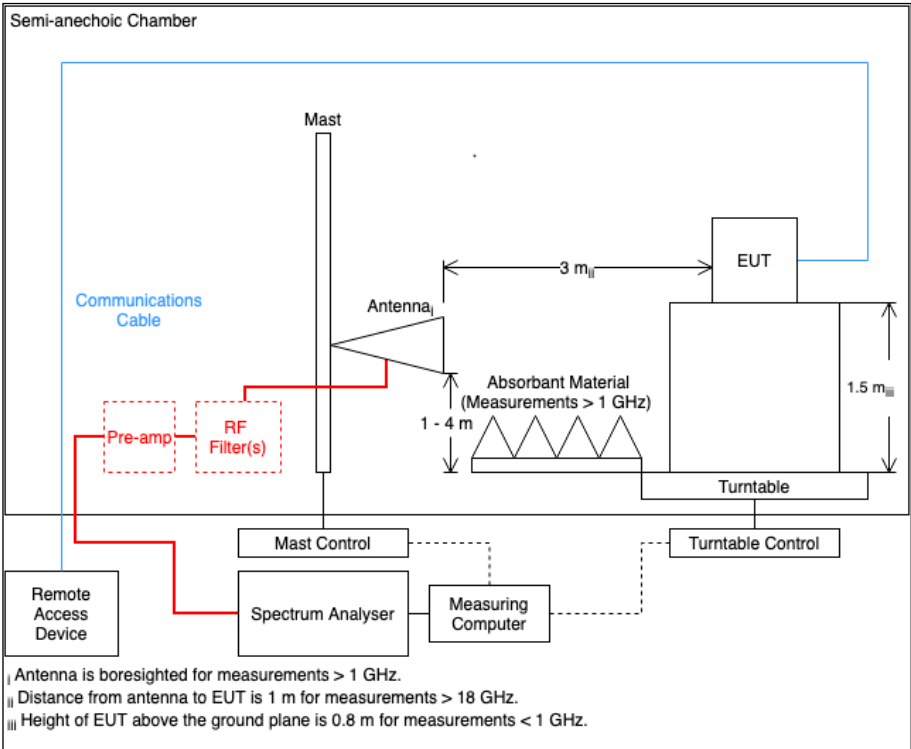


Figure 1 – Radiated Spurious Emissions

2.1.5 Environmental Conditions

Ambient Temperature 18.3 - 20.5 °C
Relative Humidity 25.1 - 45.9 %

2.1.6 Test Results

Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Classic (middle Tx channel).

The EUT was configured for simultaneous transmission in the following mode of operation:

Technology	Frequency Band (MHz)	Channel Frequency (MHz)
Tetra	450 MHz to 470 MHz	460.025
Bluetooth	2400 MHz to 2483.5 MHz	2441

Table 5 - Modes of Operation



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

Table 6 - 30 MHz to 25 GHz

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

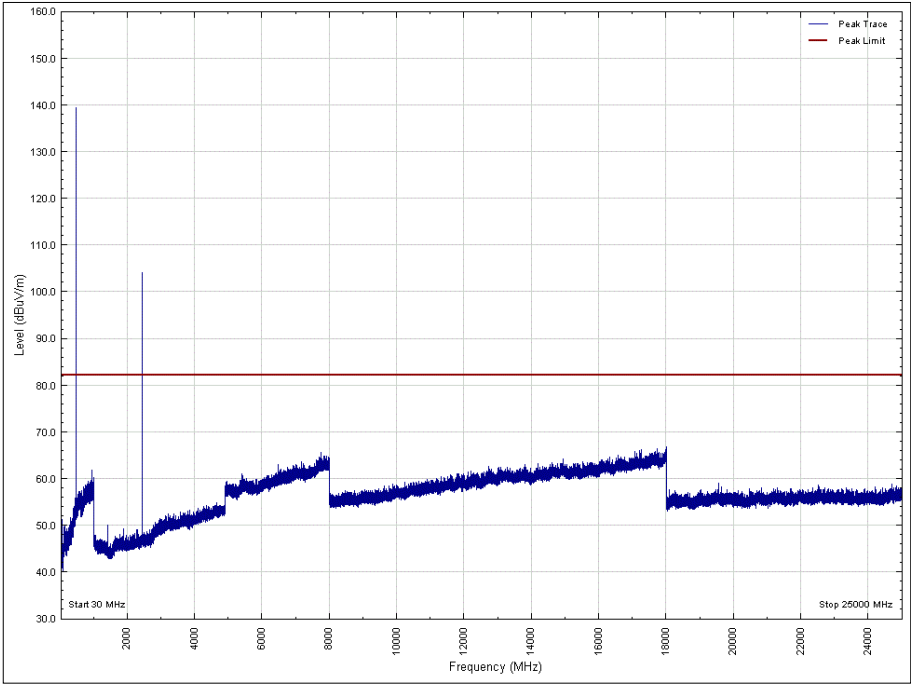


Figure 2 - 30 MHz to 25 GHz – Vertical

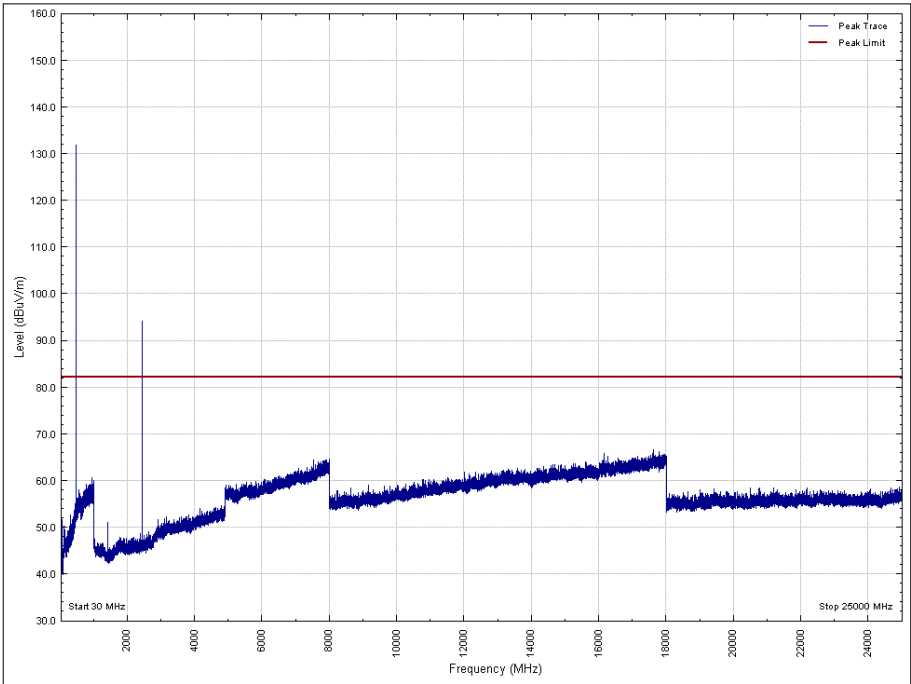


Figure 3 - 30 MHz to 25 GHz - Horizontal



Vehicle RSM - TETRA (Tx channel - 450 to 470 MHz band) + Bluetooth Low Energy (middle Tx channel).

The EUT was configured for simultaneous transmission in the following mode of operation:

Technology	Frequency Band (MHz)	Channel Frequency (MHz)
Tetra	450 MHz to 470 MHz	460.025
Bluetooth Low Energy	2400 MHz to 2483.5 MHz	2440

Table 7 - Modes of Operation

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

Table 8 - 30 MHz to 25 GHz

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

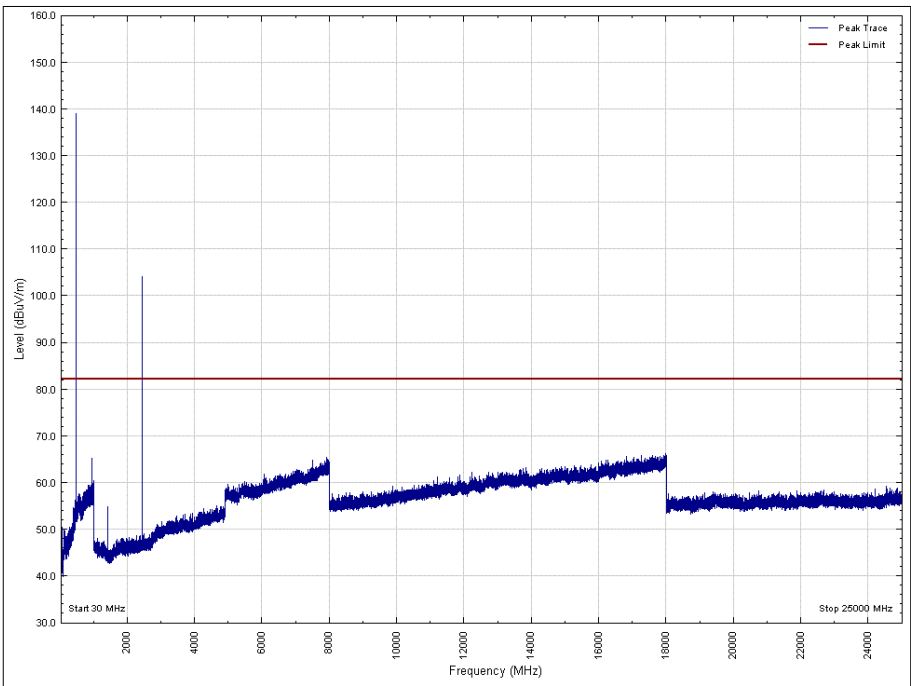


Figure 4 - 30 MHz to 25 GHz – Vertical

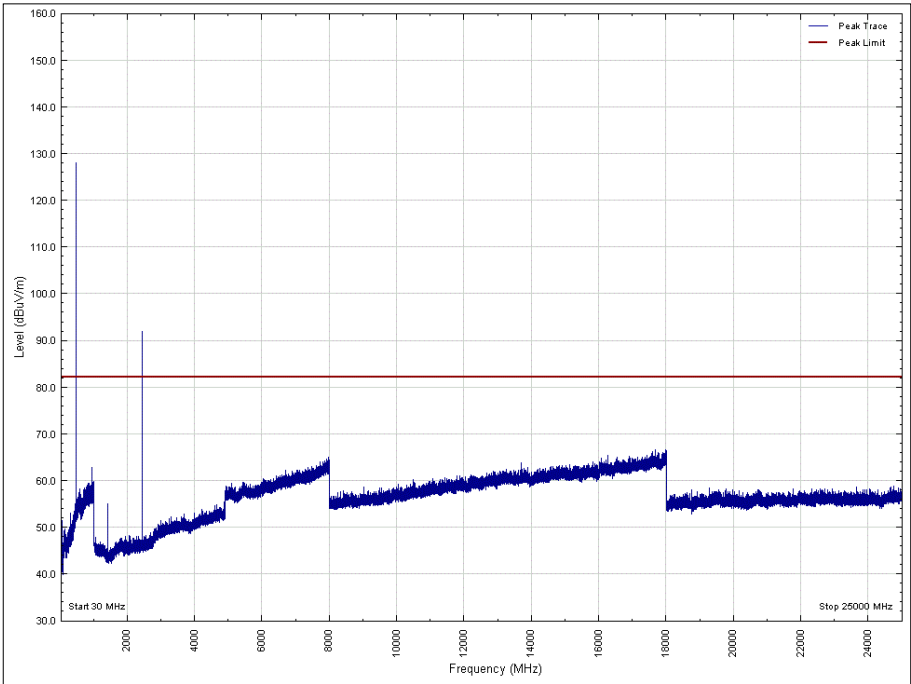


Figure 5 - 30 MHz to 25 GHz - Horizontal



Vehicle RSM - TETRA (middle Tx channel - 450 to 470 MHz band) + 2.4 GHz Wi-Fi (middle Tx channel).

The EUT was configured for simultaneous transmission in the following mode of operation:

Technology	Frequency Band (MHz)	Channel Frequency (MHz)
Tetra	450 MHz to 470 MHz	460.025
802.11b	2400 MHz to 2483.5 MHz	2437

Table 9 - Modes of Operation

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

Table 10 - 30 MHz to 25 GHz

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

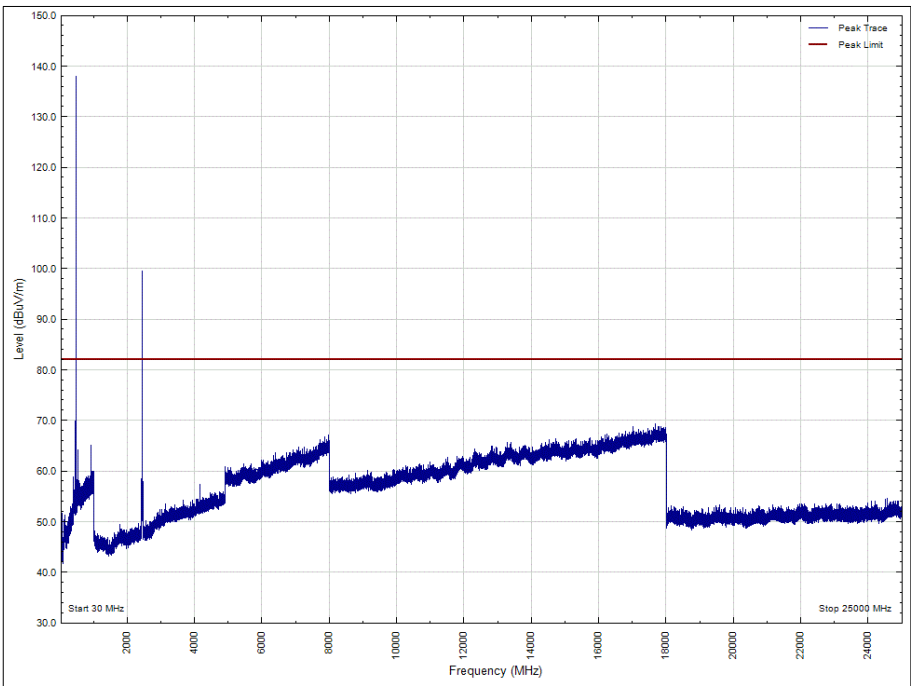


Figure 6 - 30 MHz to 25 GHz - Vertical

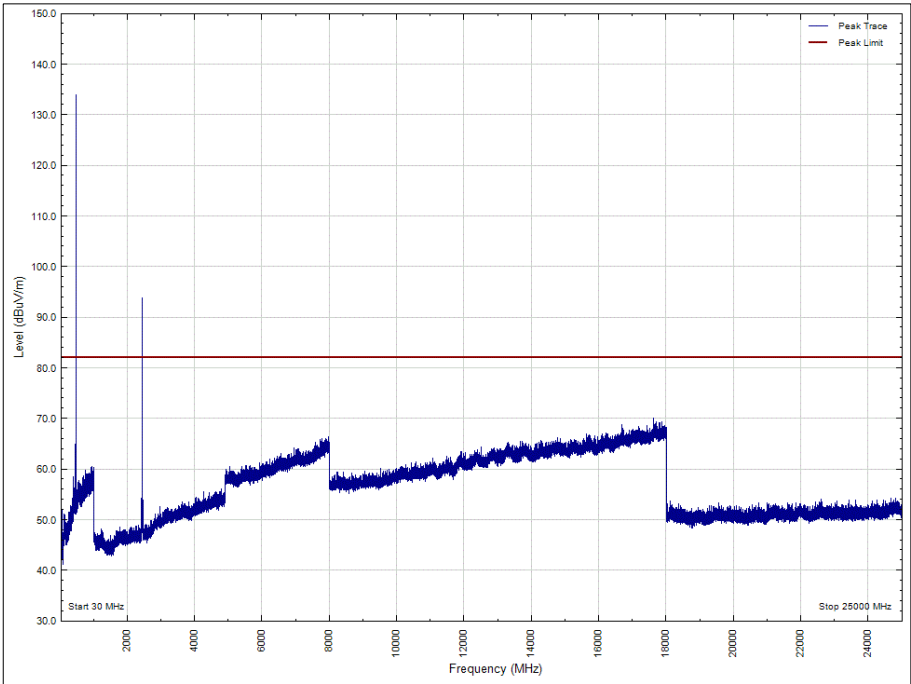


Figure 7 - 30 MHz to 25 GHz - Horizontal

FCC 47 CFR Parts 15.247(d), 15.205, 90.210 and RSS-247 clause 5.5 and RSS-119 clause 5.8

The least stringent limit from the applicable rule parts was used to determine compliance for Radiated Emissions testing of multiple transmission sources.

The least stringent applicable limit was:

Rule Part	Limit
Part 90.210 (b) / RSS-119 clause 5.8	-13 dBm (EIRP) / 82.26 dBuV/m at 3m.

Table 11 - Limit Table



2.1.7 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
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-Aug-2020
18 GHz -40 GHz Pre-Amplifier	Phase One	PS04-0087	1534	12	18-Feb-2021
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
DC Power Supply	Hewlett Packard	6269B	1909	-	TU
Multimeter	Iso-tech	IDM 101	2118	12	7-Feb-2021
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Multimeter	Iso-tech	IDM101	2417	12	11-Nov-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	4848	12	10-March-2021
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Hygrometer	Rotronic	HP21	4989	12	02-May-2020*
Cable (18 GHz)	Rosenberger	LU7-071-1000	5103	12	6-Oct-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5261	12	7-Apr-2021
Antenna (DRG 7.5-18GHz)	Schwarzbeck	HWRD750	5348	12	04-Sep-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	06-Feb-20201
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	16-Mar-2021
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	6-Feb-2021

Table 12

TU - Traceability Unscheduled

*NOTE: Testing was performed over multiple dates, however TUV SUD confirms that at the time of use, all equipment held a valid calibration and has records of this.

3 Photographs

3.1 Test Setup Photographs



Figure 8 – 30 MHz to 1 GHz

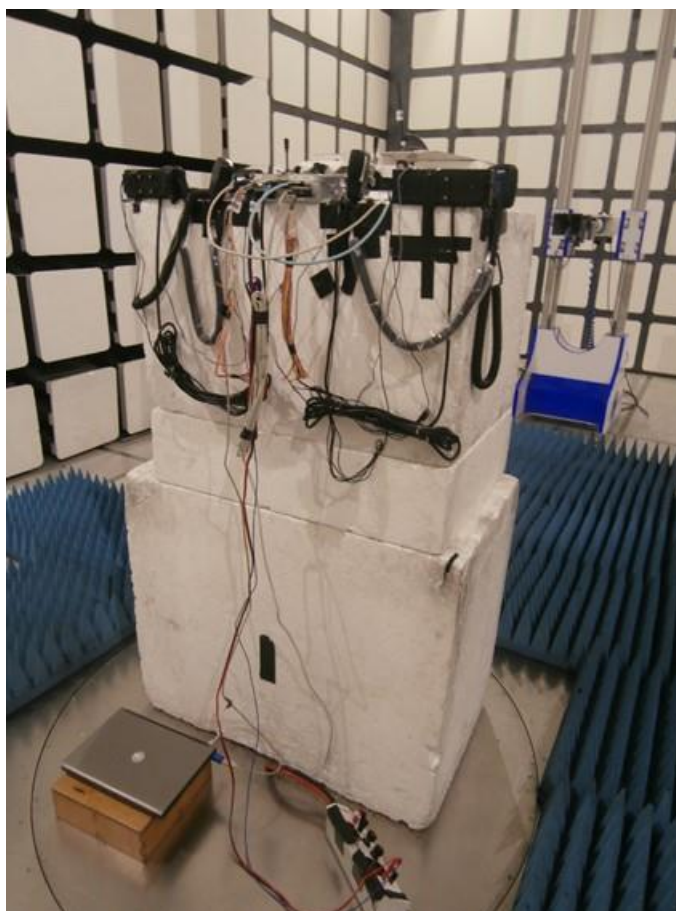


Figure 9 – 1 GHz to 8 GHz

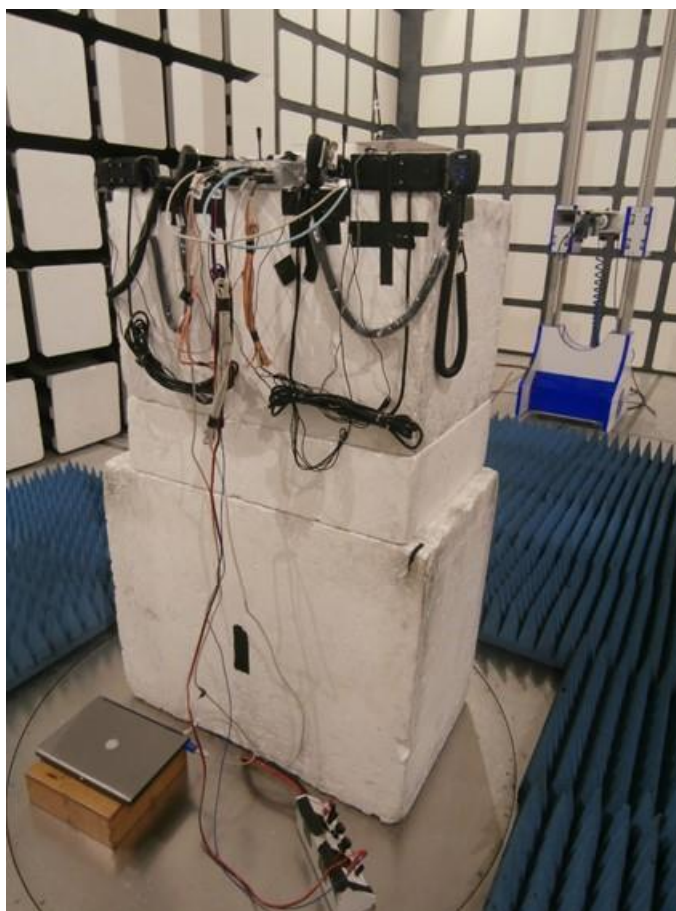


Figure 10 – 8 GHz to 18 GHz

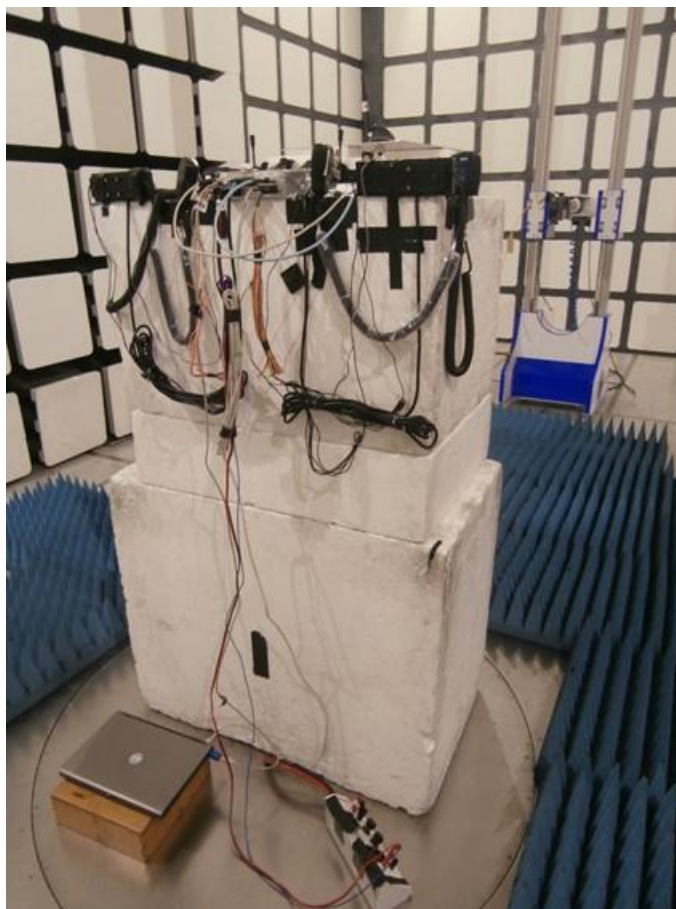


Figure 11 – 18 GHz to 25 GHz



4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Radiated Spurious Emissions (Simultaneous Transmission)	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB

Table 13

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.