FCC and ISED Test Report

Trackunit ApS
Model: TU700-5

In accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 15, FCC 47 CFR Part 22, FCC 47 CFR Part 27, RSS-130, RSS-GEN, ISED RSS-132, ISED RSS-139 and ISED RSS-247
(WLAN 2.4GHz, GSM 850, BLE, LTE Cat M1, LTE Cat NB2)

Add value.
Inspire trust.

Prepared for: Trackunit ApS, Gasværksvej 24, 4. Sal
Aalborg, 9000, DENMARK

FCC IDs: ZMF-TUBLEWIM01, ZMF-TUCELLM01
IC IDs: 9746A-TUBLEWIM01, 9746A-TUCELLM01

COMMERCIAL-IN-CONFIDENCE

Document 75958850-09 Issue 02

SIGNATURE			
			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	14 March 2024

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 2, FCC 47 CFR Part 15, FCC 47 CFR Part 22, FCC 47 CFR Part 27, ISED RSS-GEN, ISED RSS-130, ISED RSS-132, ISED RSS-139, ISED RSS-247. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Pier-Angelo Lorusso	14 March 2024	

FCC Accreditation
492497/UK2010 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 2: 2021 FCC 47 CFR Part 15: 2021, FCC 47 CFR Part 22: 2022, FCC 47 CFR Part 27: 2022, ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02), RSS-130 Issue 2 (2019-02), ISED RSS-132: Issue 4 (2023-01), ISED RSS-139: Issue 4 (2022-09), ISED RSS-247: Issue 3 (2023-08) 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	07-December-2023
2	Change FCC and IC ID, correction to BLE and 2.4GHz WLAN ant gains, and update to the latest version of RSS-247	14-March-2024

Table 1

1.2 Introduction

Applicant	Trackunit ApS
Manufacturer	Trackunit ApS
Model Number(s)	TU700-5
Serial Number(s)	10010116
Hardware Version(s)	Prototype 3, revision F
Software Version(s)	1.0.1
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 2: 2021 FCC 47 CFR Part 15: 2021 FCC 47 CFR Part 22: 2022 FCC 47 CFR Part 27: 2022 ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) ISED RSS-130 Issue 2 (2019-02) ISED RSS-132: Issue 4 (2023-01) ISED RSS-139: Issue 4 (2022-09) ISED RSS-247: Issue 3 (2023-08)
Order Number	TU700 EMC + RF Compliance
Date	13-June-2023
Date of Receipt of EUT	21-September-2023
Start of Test	09-October-2023
Finish of Test	10-October-2023
Name of Engineer(s)	Pier-Angelo Lorusso
Related Document(s)	KDB 996369 D04 (2020-10) 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 2, FCC 47 CFR Part 15, FCC 47 CFR Part 22, FCC 47 CFR Part 27, ISED RSS-GEN, ISED RSS-130, ISED RSS-132, ISED RSS-139, ISED RSS-247 is shown below.

Section	Specification Clause									Test Description	Result	Comments/Base Standard
	Part 2	Part 15	Part 22	Part 27	RSS-GEN	RSS-130	RSS-132	RSS-139	RSS-247			
Configuration and Mode: GSM 850 + BLE												
2.1	2.1053	15.247 (d)	22.917 (a)	-	6.13 and 8.9		5.5		5.5	Radiated Spurious Emissions	Pass	ANSI C63.26: 2015
Configuration and Mode: LTE Cat M1 FDD B4 (1700 MHz) + 2.4 GHz Wi-Fi												
2.1	2.1053	15.247 (d)	-	27.53 (h) (1)	6.13 and 8.9		-	5.5	5.6	Radiated Spurious Emissions	Pass	ANSI C63.26: 2015
Configuration and Mode: LTE Cat NB2 FDD B13 (700 MHz) + 2.4 GHz Wi-Fi												
2.1	2.1053	15.247 (d)	-	27.53 (c) (2) (4)	6.13 and 8.9	4.7	-		5.5	Radiated Spurious Emissions	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 including the technologies the product supports)*	Telematic unit for Fleet Management. This equipment is a telematic device to be mounted in and on construction machines / vehicles. The equipment contains technologies 4G LTE Cat M1, Narrow band IoT NB2, 2G GPRS/EGPRS, BLE, WLAN, and GNSS. This equipment is intended to be connected to power lines of the host equipment.		
Manufacturer:	Trackunit Aps		
Model:	TU700-5		
Part Number:	9795.XXXXXX(X)		
Hardware Version:	Prototype 3, revision F		
Software Version:	1.0.1		
FCC ID of the product under test – see guidance here		ZMF-TUCELLM01, ZMF-TUBLEWIM01	
IC ID of the product under test – see guidance here		9746A-TUCELLM01, 9746A-TUBLEWIM01	
Device Category	Mobile ☐	Portable ☐	Fixed ☒
Equipment is fitted with an Audio Low Pass Filter		Yes ☐	No ☒

Intentional Radiators*

Technology	GSM 850	PCS 1900	Bluetooth Low Energy	2.4 GHz Wi-Fi
Frequency Range (MHz to MHz)	824-849	1850-1910	2402-2480	2412-2462
Conducted Declared Output Power (dBm)	33	30	14 dBm [1)] <10 dBm EIRP for wolrldwide deployment	16 dBm [1)] <10 dBm EIRP for wolrldwide deployment
Antenna Gain (dBi)	<4.7	<5.4	1.66	1.66
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	0.2	0.2	1, 2	20
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GMSK, 8PSK	GMSK, 8PSK	GFSK	DSSS, OFDM
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	200KG7D	200KG7D	1M00F7D, 2M00F7D	20M0G7D
Bottom Frequency (MHz)	824	1850	2402	2412
Middle Frequency (MHz)	836.5	1880	2441	2437
Top Frequency (MHz)	849	1910	2480	2462

1) Maximum output power was used during the type approval testing of the Trackunit end product. For worldwide deployment of the Trackunit end product a reduced output power of <10 dBm EIRP will be used common across all regions.

Technology	LTE Cat M1 B2	LTE Cat M1 B4	LTE Cat M1 B5	LTE Cat M1 B12	LTE Cat M1 B13	LTE Cat M1 B25
Frequency Range (MHz to MHz)	1850-1910	1710-1755	824-849	699-716	777-787	1850-1915
Conducted Declared Output Power (dBm)	21	21	21	21	21	21
Antenna Gain (dBi)	5.4	5.4	4.7	3.9	3.0	5.4
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	1.4	1.4	1.4	1.4	1.4	1.4
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	QPSK, 16QAM	QPSK, 16QAM	QPSK, 16QAM	QPSK, 16QAM	QPSK, 16QAM	QPSK, 16QAM
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	1M40G7D	1M40G7D	1M40G7D	1M40G7D	1M40G7D	1M40G7D
Bottom Frequency (MHz)	1850	1710	824	699	777	1850
Middle Frequency (MHz)	1880	1732.5	836.5	707.5	782	1882.5
Top Frequency (MHz)	1910	1755	849	716	787	1915

Technology	LTE Cat M1 B26	LTE Cat M1 B66	LTE Cat M1 B85	LTE Cat NB2 B2	LTE Cat NB2 B4	LTE Cat NB2 B5
Frequency Range (MHz to MHz)	814-824 824-849	1710-1780	698-716	1850-1910	1710-1755	824-849
Conducted Declared Output Power (dBm)	21	21	21	21	21	21
Antenna Gain (dBi)	4.7	5.4	3.9	5.4	5.4	4.7
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	1.4	1.4	1.4	0.2	0.2	0.2
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	QPSK, 16QAM	QPSK, 16QAM	QPSK, 16QAM	BPSK, QPSK	BPSK, QPSK	BPSK, QPSK
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	1M40G7D	1M40G7D	1M40G7D	180KG7D	180KG7D	180KG7D
Bottom Frequency (MHz)	814	1710	698	1850	1710	824
Middle Frequency (MHz)	831.5	1745	707	1880	1732.5	836.5
Top Frequency (MHz)	849	1780	716	1910	1755	849

Technology	LTE Cat NB2 B12	LTE Cat NB2 B13	LTE Cat NB2 B25	LTE Cat NB2 B66	LTE Cat NB2 B71	LTE Cat NB2 B85
Frequency Range (MHz to MHz)	699-716	777-787	1850-1915	1710-1780	663-698	698-716
Conducted Declared Output Power (dBm)	21	21	21	21	21	21
Antenna Gain (dBi)	3.9	3.0	5.4	5.4	N/A	3.9
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	0.2	0.2	0.2	0.2	0.2	0.2
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	BPSK, QPSK	BPSK, QPSK	BPSK, QPSK	BPSK, QPSK	BPSK, QPSK	BPSK, QPSK
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	180KG7D	180KG7D	180KG7D	180KG7D	180KG7D	180KG7D
Bottom Frequency (MHz)	699	777	1850	1710	663	698
Middle Frequency (MHz)	707.5	782	1882.5	1745	680.5	707
Top Frequency (MHz)	716	787	1915	1780	698	716

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2.480 GHz
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:	N/A	Hz
Voltage	N/A	V
Max current:	N/A	A
Single Phase ☐ Three Phase ☐		

DC Power Source

Nominal voltage:	12 / 24 / 36 / 48	V
Extreme upper voltage:	58	V
Extreme lower voltage:	9	V
Max current:	0.5	A

Battery Power Source

Voltage:	3.6	V
End-point voltage:	2.75	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

Cable Loss

Adapter Cable Loss (Conducted sample)	N/A	dB

Antenna Characteristics

Antenna connector ☐			State impedance	N/A	Ohm
Temporary antenna connector ☐			State impedance	N/A	Ohm
Integral antenna ☒	Type:	Cellular: Inverted F antenna on PCB	Gain	5.4	dBi
Integral antenna ☒	Type:	BLE/Wi-Fi: Antenna on module	Gain	1.66	dBi
Integral antenna ☒	Type:	GNSS: Inverted F antenna on PCB	Gain	4.8	dBi
External antenna ☐	Type:		Gain	N/A	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.

Ancillaries (if applicable)

Manufacturer:	N/A	Part Number:	N/A
Model:	N/A	Country of Origin:	N/A

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

Name: Lan My Tran/ Bjarke Ebbesen
Position held: Product Compliance Specialist/ Team Lead, Hardware Engineering

Date: 11 March 2024

1.5 Product Information

1.5.1 Technical Description

The equipment under test (EUT) was Telematic unit for Fleet Management which is to be mounted in and on construction machines / vehicles. The EUT contains technologies 4G LTE Cat M1, Narrow band IoT NB2, 2G GPRS/EGPRS, BLE, WLAN, and GNSS, and is intended to be connected to power lines of the host equipment. The EUT contains the following modules:

Module	FCC ID	IC ID
Trackunit TUCELLM01	ZMF- TUCELLM01	9746A-TUCELLM01
Trackunit TUBLEWIM01	ZMF- TUBLEWIM01	9746A-TUBLEWIM01

Table 3

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: TU700-5, Serial Number: 10010116			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 4

Prior to testing, handmade modifications were made to Modification State 0 (Hardware version: Prototype 3, Revision F). The cellular antenna was shortened using controlled router and 2 capacitors were added to the design. To be able to mass-produce the product including those changes, the cellular antenna was shortened in the PCB design, and the capacitors were added on the same location using a dedicated PCB footprint.
Those changes were included in (PCB) Version 4, and the BOM for automated SMD population was updated to reflect those changes in Version 4, revision D. Therefore, Modification State 0 (Hardware version: Prototype 3, Revision F) can be considered as equivalent to Hardware version: 4, revision D.

1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: GSM 850 + BLE		
Radiated Spurious Emissions	Pier-Angelo Lorusso	UKAS
Configuration and Mode: LTE Cat M1 FDD B4 (1700 MHz) + 2.4 GHz Wi-Fi		
Radiated Spurious Emissions	Pier-Angelo Lorusso	UKAS
Configuration and Mode: LTE Cat NB2 FDD B13 (700 MHz) + 2.4 GHz Wi-Fi		
Radiated Spurious Emissions	Pier-Angelo Lorusso	UKAS

Table 5

Office Address:

TÜV SÜD
Octagon House
Concorde Way
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 2, Clause 2.1053
FCC 47 CFR Part 15: Clause 15.247 and 15.247 (d)
FCC 47 CFR Part 22: Clause 22.917 (a)
FCC 47 CFR Part 27: Clause 27.53 (h) (1) and 27.53 (c) (2) (4)
ISED RSS-GEN Clause 6.13
ISED RSS-130 clause 4.7
ISED RSS-132: Clause 5.5
ISED RSS-139: Clause 5.6 and 5.7
ISED RSS-247: Clause 5.5

2.1.2 Equipment Under Test and Modification State

TU700-5, S/N: 10010116 - Modification State 0

2.1.3 Date of Test

09-October-2023 to 10-October-2023

2.1.4 Test Method

A preliminary profile of the Radiated Spurious Emissions was obtained up to the 5th harmonic of the lowest intentional transmitter, as required by KDB 996369 D04, clause 3.2, by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber.

Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Test method for licensed transmitter:

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

EUT was powered via a Power Supply Unit at 12V DC Nominal.

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

Field strength measurements were performed and then converted to Equivalent Power Measurements in accordance with ANSI C63.26, Clause 5.2.7 equation c)

Example calculation:

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

82.2 (dBuV/m) + 20log(3) – 104.8 = EIRP (dBm)

-13.0 = EIRP (dBm)

2.1.5 Example Test Setup Diagram

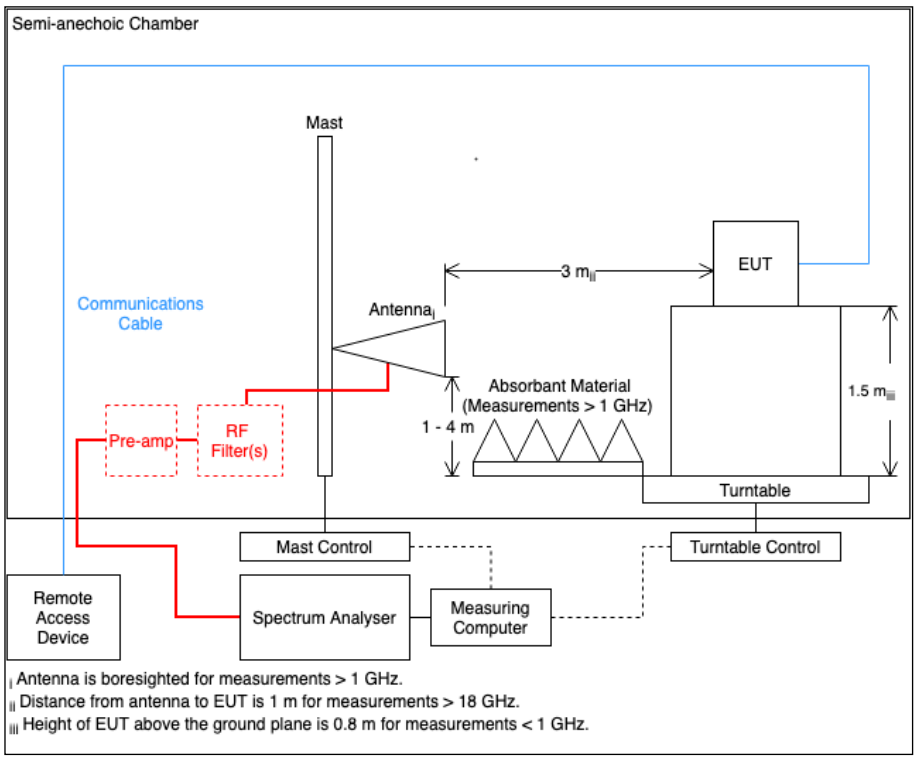

Figure 1

2.1.6 Environmental Conditions

Ambient Temperature	21.1 - 22.5 °C
Relative Humidity	53.5 - 54.7 %

2.1.7 Test Results

GSM 850 + BLE

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 6 - GSM850_BLE, 836.4_2402, 30 MHz to 5 GHz

No emissions found within 10 dB of the limit.

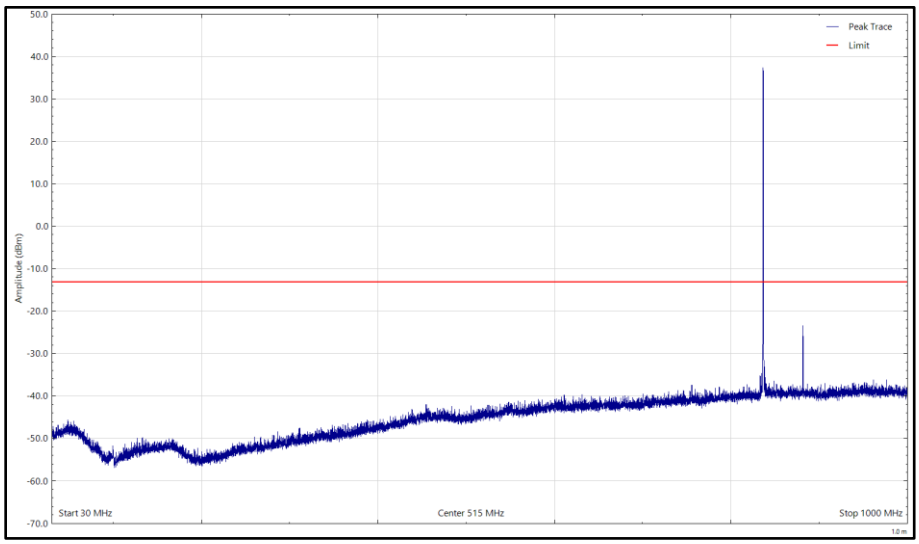

Figure 2 - GSM850_BLE, 836.4_2402, 30 MHz to 1 GHz, Horizontal (Peak)

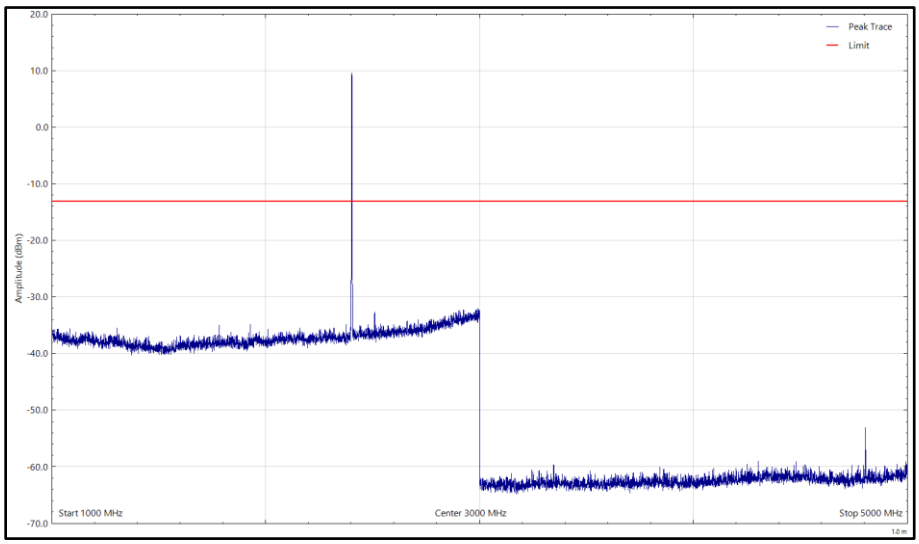

Figure 3 - GSM850_BLE, 836.4_2402, 1 GHz to 5 GHz, Horizontal (Peak)

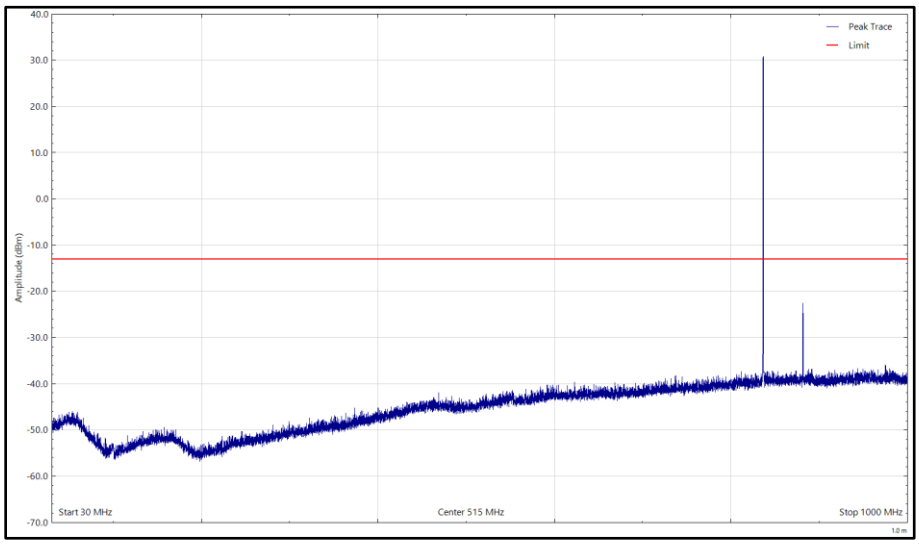

Figure 4 - GSM850_BLE, 836.4_2402, 30 MHz to 1 GHz, Vertical (Peak)

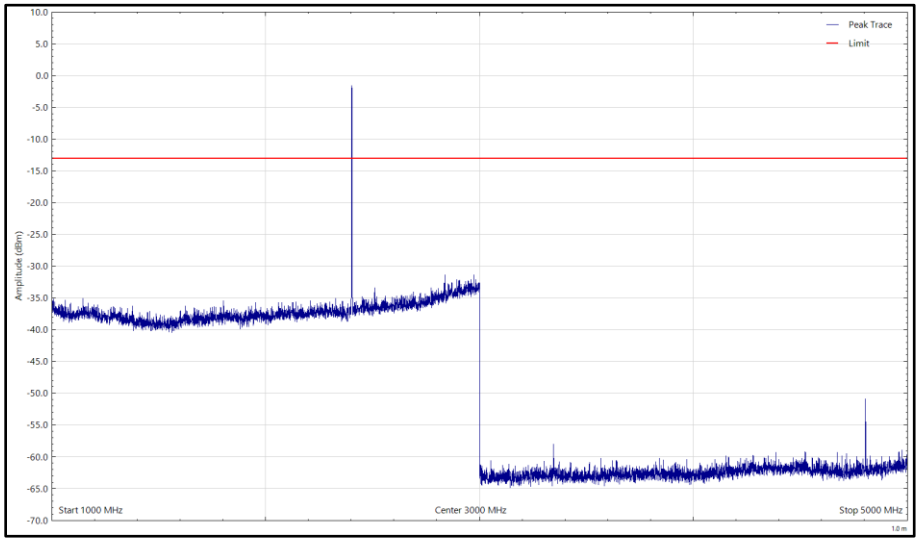

Figure 5 - GSM850_BLE, 836.4_2402, 1 GHz to 5 GHz, Vertical (Peak)

FCC 47 CFR Part 22.917 (a) and ISED RSS-132 Clause 5.5

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:

Clause	Limit
Part 22.917 (a) / RSS-132 Clause 5.5	-13 dBm (EIRP) / 82 dBµV/m at 3m.

Table 7

LTE Cat M1 FDD B4 (1700 MHz) + 2.4 GHz Wi-Fi

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 8 - LTE Cat M1 B4_WIFI, 1732.5_2412, 30 MHz to 13 GHz

No emissions found within 10 dB of the limit.

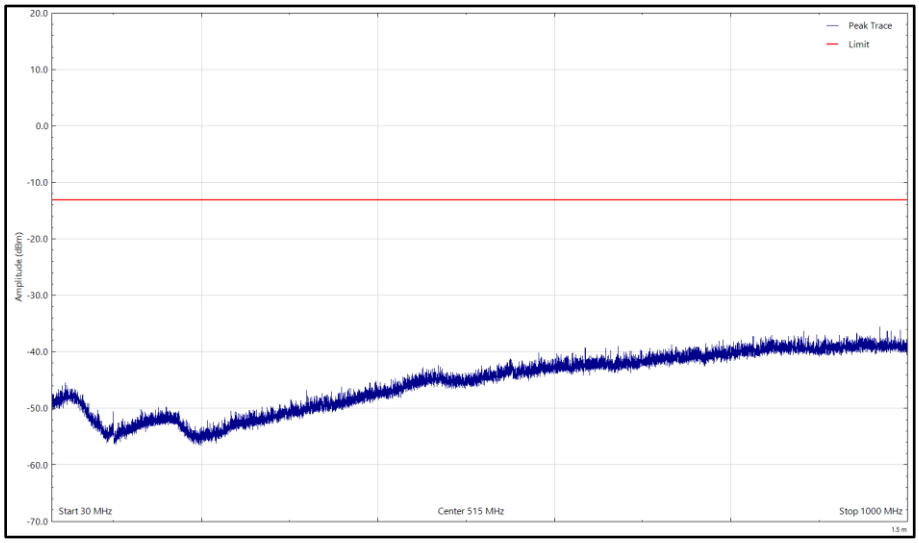

Figure 6 - LTE Cat M1 B4_WIFI, 1732.5_2412, 30 MHz to 1 GHz, Horizontal (Peak)

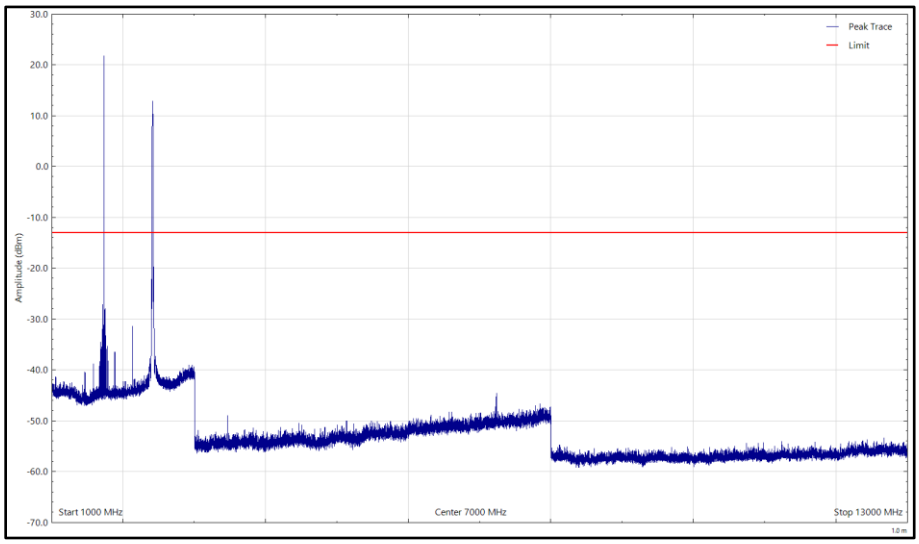

Figure 7 - LTE Cat M1 B4_WIFI, 1732.5_2412, 1 GHz to 13 GHz, Horizontal (Peak)

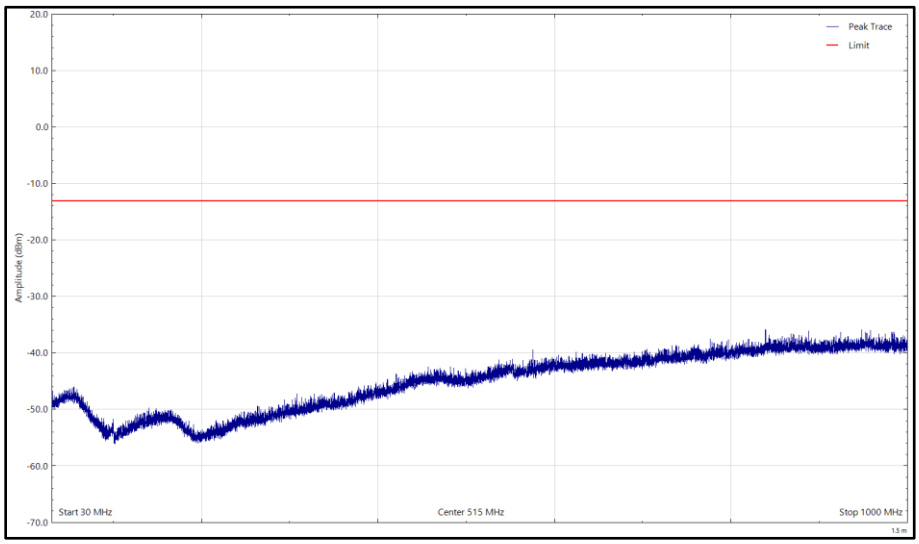

Figure 8 - LTE Cat M1 B4_WIFI, 1732.5_2412, 30 MHz to 1 GHz, Vertical (Peak)

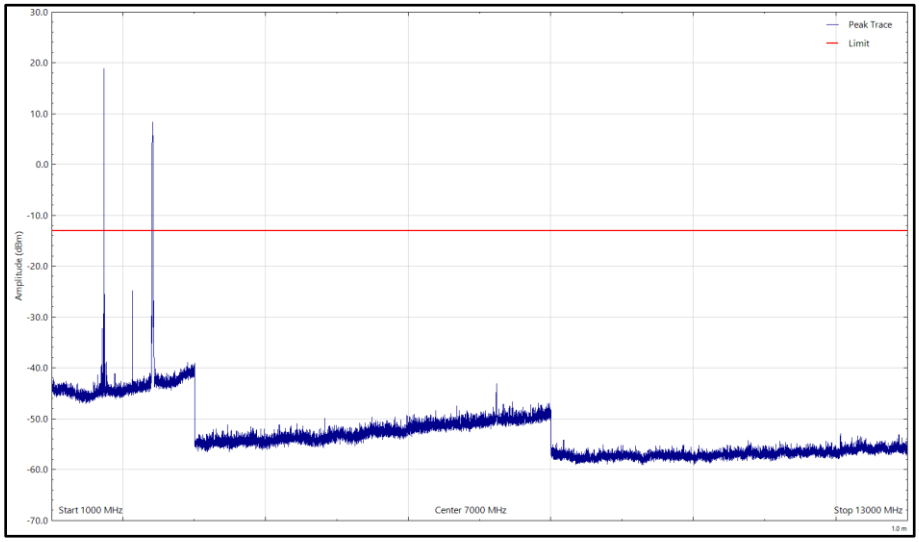

Figure 9 - LTE Cat M1 B4_WIFI, 1732.5_2412, 1 GHz to 13 GHz, Vertical (Peak)

FCC 47 CFR Part 27.53 (h) and ISED RSS-139 Clause 5.6

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:

Clause	Limit
Part 27.53 (h) / RSS-139 Clause 5.6	-13 dBm (EIRP) / 82 dBµV/m at 3m.

Table 9

LTE Cat NB2 FDD B13 (700 MHz) + 2.4 GHz Wi-Fi

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
2658.874	-23.52	-13.00	-10.52	Peak	166	210	Horizontal
2662.436	-23.41	-13.00	-10.41	Peak	47	375	Vertical
2804.880	-22.64	-13.00	-9.64	Peak	96	227	Vertical
2920.964	-21.28	-13.00	-8.28	Peak	9	159	Horizontal
2991.909	-21.78	-13.00	-8.78	Peak	166	214	Vertical

Table 10 - LTE Cat NB B13_WIFI, 783_2412, 30 MHz to 5 GHz

No other emissions found within 10 dB of the limit.

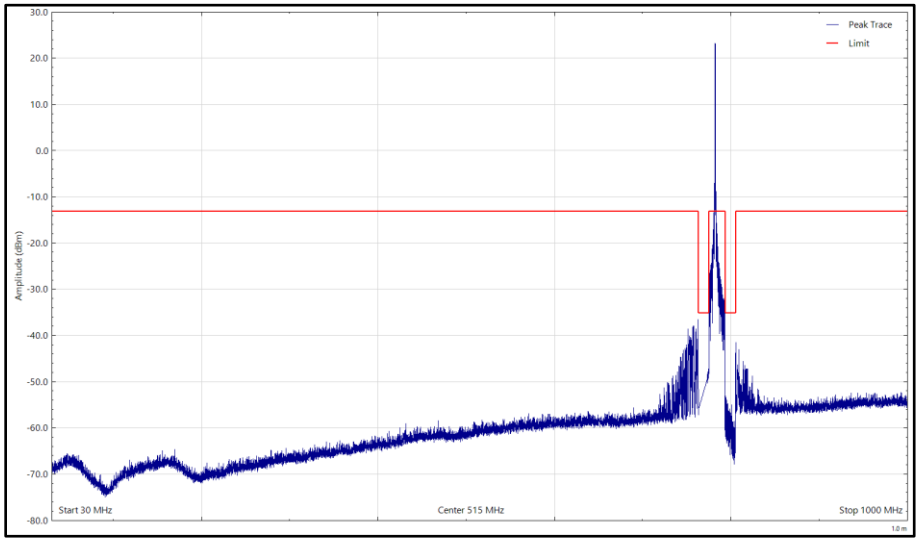

Figure 10 - LTE Cat NB B13_WIFI, 783_2412, 30 MHz to 1 GHz, Horizontal (Peak)

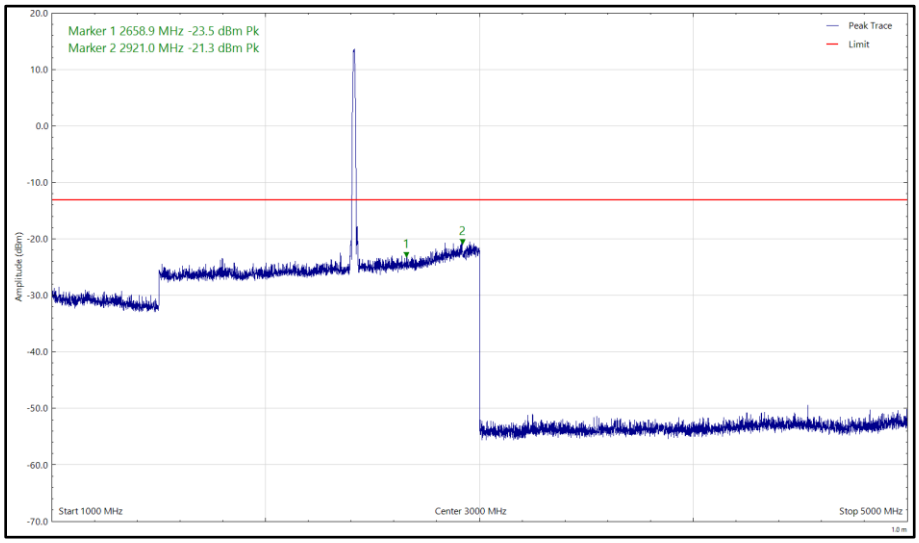

Figure 11 - LTE Cat NB B13_WIFI, 783_2412, 1 GHz to 5 GHz, Horizontal (Peak)

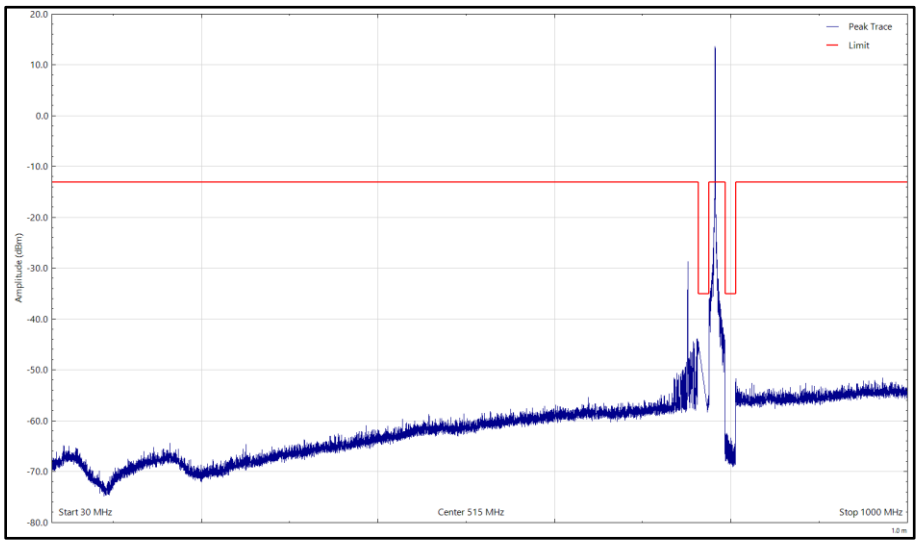

Figure 12 - LTE Cat NB B13_WIFI, 783_2412, 30 MHz to 1 GHz, Vertical (Peak)

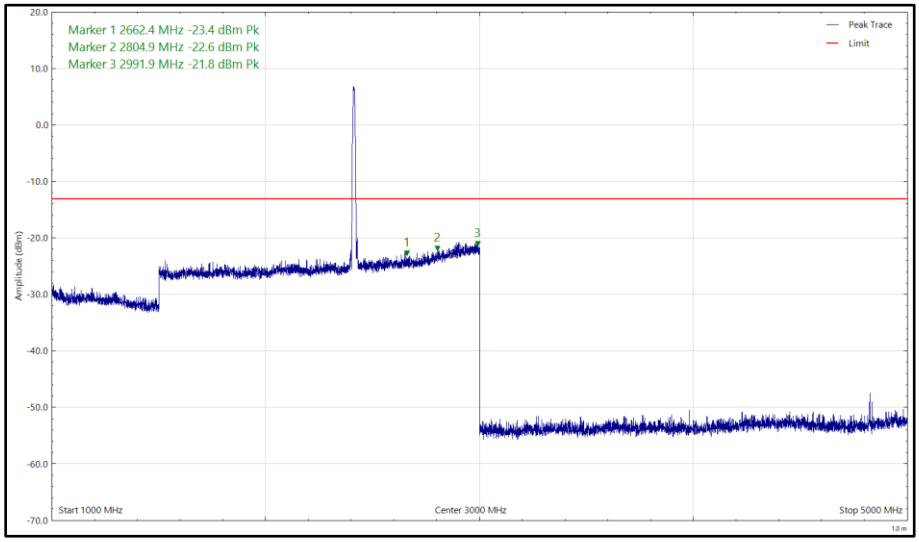

Figure 13 - LTE Cat NB B13_WIFI, 783_2412, 1 GHz to 5 GHz, Vertical (Peak)

FCC 47 CFR Part 27.53 (c) and ISED RSS-130, clauses 4.7.1 and 4.7.2

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:

Clause	Limit
Part 27.53 (c) / RSS-130, clauses 4.7	-13 dBm (EIRP) / 82 dBµV/m at 3m.

Table 11

2.1.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Antenna (Log Periodic)	Schaffner	UPA6108	3108	12	26-Aug-2024
True RMS Multimeter	Fluke	179	4007	12	18-Nov-2023
High Pass filter	Wainwright	WHKX12-1290-1500-18000-80SS	4962	12	14-Jun-2024
Test Receiver	Rohde & Schwarz	ESW44	5084	12	31-Aug-2024
Emissions Software	TUV SUD	EmX V3.1.12 V.	5125	-	N/A - Software
Screened Room (11)	Rainford	Rainford	5136	36	24-Nov-2024
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	09-Jul-2024
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	28-Mar-2024
Pre-Amplifier (1 GHz to 26.5 GHz)	Agilent Technologies	8449B	5445	12	25-May-2024
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	20-Apr-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	21-May-2024
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
8m N-Type Cable	Junkosha	MWX221-08000NMSNMS/B	5521	12	05-Jun-2024
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	5522	12	14-Apr-2024
7 GHz High pass Filter	Wainwright	WHKX12-5850-6800-18000-80SS	5550	12	30-May-2024

Pre-Amplifier (8 GHz to 18 GHz)	Wright Technologies	APS06-0061	5595	12	25-Oct-2023
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5610	12	16-Oct-2023
Antenna (Tri-log, 30 MHz to 1 GHz)	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Cable (N to N 3m)	Junkosha	MWX221-03000NMSNMS/A	6024	12	14-Sep-2024
Attenuator (4 dB)	Pasternack	PE7074-4	6202	24	16-Jul-2024
Spectrum Analyser	Anritsu	MT8821C	6543	12	23-Feb-2024

Table 12

O/P Mon – Output Monitored using calibrated equipment
TU - Traceability Unscheduled

3 Photographs

3.1 Test Setup Photographs

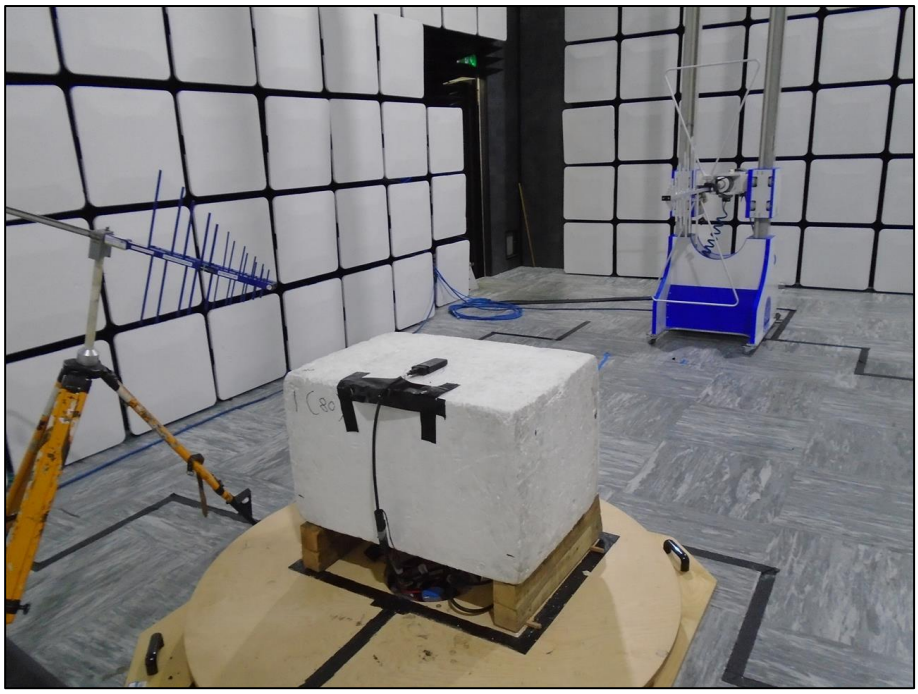

Figure 14 - Test Setup - 30 MHz to 1 GHz

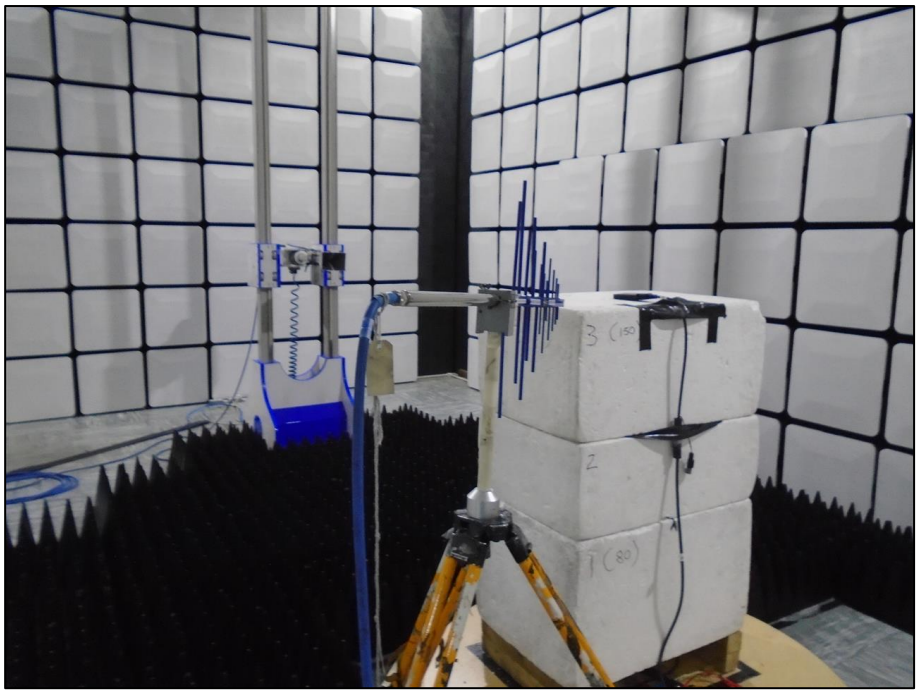

Figure 15 - Test Setup - 1 GHz to 5 GHz

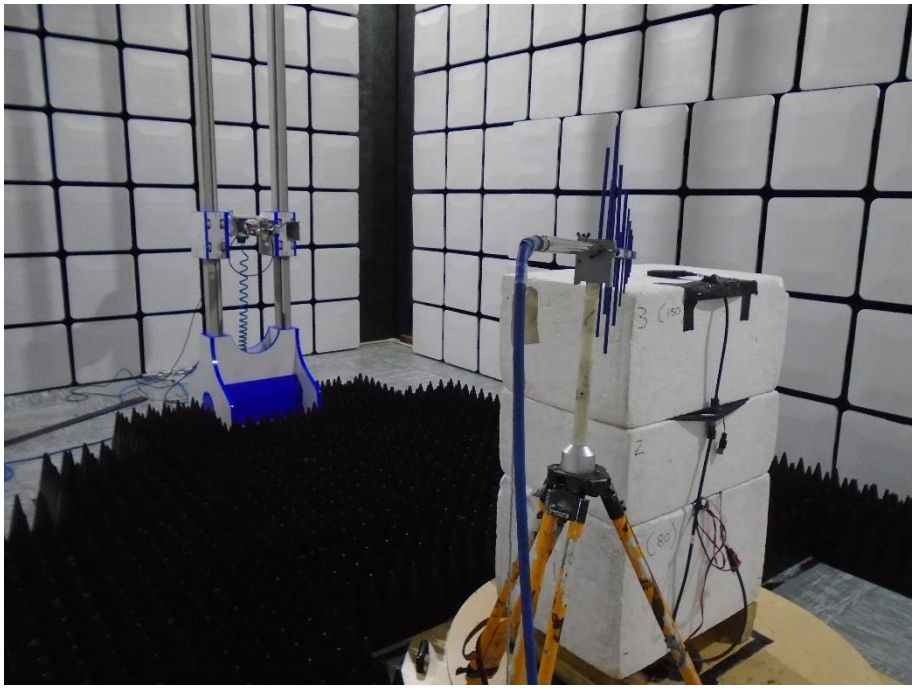

Figure 16 - Test Setup - 1 GHz to 13 GHz

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 – Accuracy Method

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.