FCC and ISED Test Report

MiX Telematics International (Pty) Ltd
Telematics Unit, Model: MiX 3400-B

In accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 15, FCC 47 CFR Part 22, FCC 47 CFR Part 24, ISED RSS-132, ISED RSS-133, ISED RSS-247
and ISED RSS-GEN
(2.4 GHz Bluetooth Low Energy + LTE Cat M1)

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-3400XG IC: Not Applicable

Add value.
Inspire trust.

COMMERCIAL-IN-CONFIDENCE

Document 75952029-06 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	08 September 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 2, FCC 47 CFR Part 15, FCC 47 CFR Part 22, FCC 47 CFR Part 24, ISED RSS-132, ISED RSS-133, ISED RSS-247 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	Graeme Lawler	08 September 2022	

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 2: 2020, FCC 47 CFR Part 15: 2020, FCC 47 CFR Part 22: 2020, FCC 47 CFR Part 24: 2020, ISED RSS-132: Issue 3 (2013-01), ISED RSS-133: Issue 6 (2013-01) + A1 (2018-01), ISED RSS-247: Issue 2 (2017-02) and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) for the tests detailed in section 1.3.

TÜV SÜD
is a trading name of TUV SUD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuvsud.com/en

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

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-September-2022

Table 1

1.2 Introduction

Applicant	MiX Telematics International (Pty) Ltd
Manufacturer	MiX Telematics International (Pty) Ltd
Model Number(s)	MiX 3400-B
Manufacturer's Declared Variant(s)	MiX 3400-B (TLA) U0140MT MiX 3400-B (VZN) U0142MT
Serial Number(s)	33000054
Hardware Version(s)	1
Software Version(s)	5.2.x
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 2: 2020 FCC 47 CFR Part 15: 2020 FCC 47 CFR Part 22: 2020 FCC 47 CFR Part 24: 2020 ISED RSS-132: Issue 3 (2013-01) ISED RSS-133: Issue 6 (2013-01) + A1 (2018-01) ISED RSS-247: Issue 2 (2017-02) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Order Number Date	P0094972 20-April-2021
Date of Receipt of EUT	26-May-2022
Start of Test	28-August-2022
Finish of Test	28-August-2022
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.26: 2015 ANSI C63.10: 2013 ANSI C63.10: 2020 KDB 996369 D04 Module Integration Guide v02

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 24, ISED RSS-132, ISED RSS-133, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause								Test Description	Result	Comments/Base Standard
	FCC Part 2	FCC Part 15	FCC Part 22	FCC Part 24	RSS-132	RSS-133	RSS-247	RSS-GEN			
Configuration and Mode: Bluetooth Low Energy + LTE Cat M1 FDD Band 2											
2.1	2.1053	15.247 (d)	-	24.238	-	6.5	5.5	6.13	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.10 ANSI C63.26
Configuration and Mode: Bluetooth Low Energy + LTE Cat M1 FDD Band 5											
2.1	2.1053	15.247 (d)	22.917	-	5.5		5.5	6.13	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.10 ANSI C63.26

Table 2

1.4 Manufacturer's Declared Variant(s)

The following information was provided by the customer:

Modem	Technology	P/N	Model	Model	Region/	Network operator
BG96	LTE Cat M1/2G	U0051MT	MiX 3400-B	MiX 3400 Electronic Unit with Backup Battery and Quectel BG96 modem	1 & 2	Various
BG96	LTE Cat M1/2G	U0140MT	MiX 3400-B (TLA)	MiX 3400 Electronic Unit with Backup Battery and Quectel BG96 Cat M1 modem (with Telstra modem FW)	3 Australia	Telstra
BG96	LTE Cat M1/2G	U0142MT	MiX 3400-B (VZN)	MiX 3400 Electronic Unit with Backup Battery and Quectel BG96 Cat M1 modem (with Verizon modem FW)	2	Verizon

The models listed in the table above present the same electrical, physical and electro mechanics characteristics e.g., the same layout, PCB, components, and enclosure.
The MiX 3400-B, MiX 3400-B (VZN) and MiX 3400-B (TLA) use the same modem hardware, but the modem firmware is specific to the regions and network operators listed above.

1.5 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	The MiX3000 series product, that is aimed on the easy-install and light fleet market. It consists mainly of an on-board-computer, modem, GNSS, accelerometer, Low Energy Bluetooth, 2 x analogue inputs, serial communication ports (3 x CAN, L & K-Line, LIN, J1850/J1708 and RS232), 3 x LED's, switchable positive-drive and an audible buzzer. The range includes variants with LTE CAT1/2G and CAT M1/2G modems. All variants make use of the same PCB with the integrated modem, as the only discernible difference with the variant modems populated at the same location on a compatible PCB land pattern. MiX 3400-B Electronic Unit (EU) with Backup Battery and Quectel BG96 modem. MiX 3410 Electronic Unit (EU) with Backup Battery and Quectel EG912Y-EU modem.
Manufacturer:	MiX Telematics International (Pty) Ltd.
Model:	MiX 3400-B
Part Number:	U0051MT
Hardware Version:	1
Software Version:	5.2.x
FCC ID of the product under test – see guidance here	2AFMS-3400XG
IC ID of the product under test – see guidance here	-

Table 3

Intentional Radiators

Technology	LTE Band 2	LTE Band 3	LTE Band 4	LTE Band 5	LTE Band 12	LTE Band 13
Frequency Range (MHz to MHz)	1850-1910	1710-1785	1710-1755	824-849	699-716	777-787
Conducted Declared Output Power (dBm)	23	23	23	23	23	23
Antenna Gain (dBi)	2.07	1.46	1.46	0.21	0.76	1.39
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/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM	QPSK/ 16-QAM
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	1M40W7D	1M40W7D	1M40W7D	1M40W7D	1M40W7D	1M40W7D
Bottom Frequency (MHz)	1850	1710	1710	824	699	777
Middle Frequency (MHz)	1880	1747.5	1747.5	836.5	707.5	782
Top Frequency (MHz)	1910	1785	1755	849	716	787

Table 4

Technology	SRD2400
Frequency Band (MHz)	2400-2480
Conducted Declared Output Power (dBm)	4
Antenna Gain (dBi)	2.1
Supported Bandwidth(s) (MHz)	1
Modulation Scheme(s)	GFSK
ITU Emission Designator	1M00F1D
Bottom Frequency (MHz)	2402
Middle Frequency (MHz)	2440
Top Frequency (MHz)	2480

Table 5

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2690 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	699MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐ Class B Digital Device (Use in residential environment only) ☒	

Table 6

AC Power Source

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

Table 7

DC Power Source

Nominal voltage:	13.8/27.6	V
Extreme upper voltage:	32	V
Extreme lower voltage:	10.5	V
Max current:	0.5A typical ; 2.5A absolute max (7.5A Fused)	A

Table 8

Battery Power Source

Voltage:	3.2	V
End-point voltage:	2.7	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☒ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Table 9

Charging

Can the EUT transmit whilst being charged	Yes ☒ No ☐

Table 10

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	60	°C

Table 11

Cable Loss

Adapter Cable Loss (Conducted sample)		dB

Table 12

Antenna Characteristics

Antenna connector ☐			State impedance	50	Ohm
Temporary antenna connector ☒			State impedance	50	Ohm
Integral antenna ☒	Type:	LTE BLE GNSS	Gain	3 2.1 4	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 13

Ancillaries (if applicable)

Manufacturer:	MiX Telematics	Part Number:	A0061MT
Model:	MiX 3000 Universal OBDII Plugin Harness for light vehicles	Country of Origin:	South Africa
Manufacturer:	MiX Telematics	Part Number:	A0062MT
Model:	MiX 3000 Universal J1939 Plugin Harness for heavy vehicles	Country of Origin:	South Africa
Manufacturer:	MiX Telematics	Part Number:	440FT0931
Model:	Serial Harness SR1	Country of Origin:	South Africa

Table 14

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

Name: Ben van der Merwe
Position held: Senior Engineer
Date: 27 May 2022

1.6 Product Information

1.6.1 Technical Description

The MiX3000 series product, which is aimed on the easy-install and light fleet market. It consists mainly of an on-board computer, a modem, a GNSS, an accelerometer, Low Energy Bluetooth, 2 x analogue inputs, serial ports (3 x CAN, L & K-Line, LIN, J1850/J1708 and RS232), 3 x LED, a relay drive and a buzzer.

The range includes variants with LTE CAT1/2G and CAT M1/2G modems. All these variants make use of the same PCB, the only difference is the modem to be populated and all the modems have the same footprint.

MiX 3400-B Electronic Unit (EU) with Backup Battery and Quectel BG96 modem. MiX 3410 Electronic Unit (EU) with Backup Battery and Quectel EG912Y-EU modem.

1.7 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

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: MiX 3400-B, Serial Number: 33000054			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 15

1.9 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Bluetooth Low Energy + LTE Cat M1 FDD Band 2		
Radiated Spurious Emissions (Simultaneous Transmission)	Graeme Lawler	UKAS
Configuration and Mode: Bluetooth Low Energy + LTE Cat M1 FDD Band 5		
Radiated Spurious Emissions (Simultaneous Transmission)	Graeme Lawler	UKAS

Table 16

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 (d)
FCC 47 CFR Part 22, Clause 22.917
FCC 47 CFR Part 24, Clause 24.238
ISED RSS-132, Clause 5.5
ISED RSS-133, Clause 6.5
ISED RSS-247, Clause 5.5
ISED RSS-GEN, Clause 6.13

2.1.2 Equipment Under Test and Modification State

MiX 3400-B, S/N: 33000054 - Modification State 0

2.1.3 Date of Test

28-August-2022

2.1.4 Test Method

A preliminary profile of the Radiated Spurious Emissions was obtained up to the 10th harmonic 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.

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

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

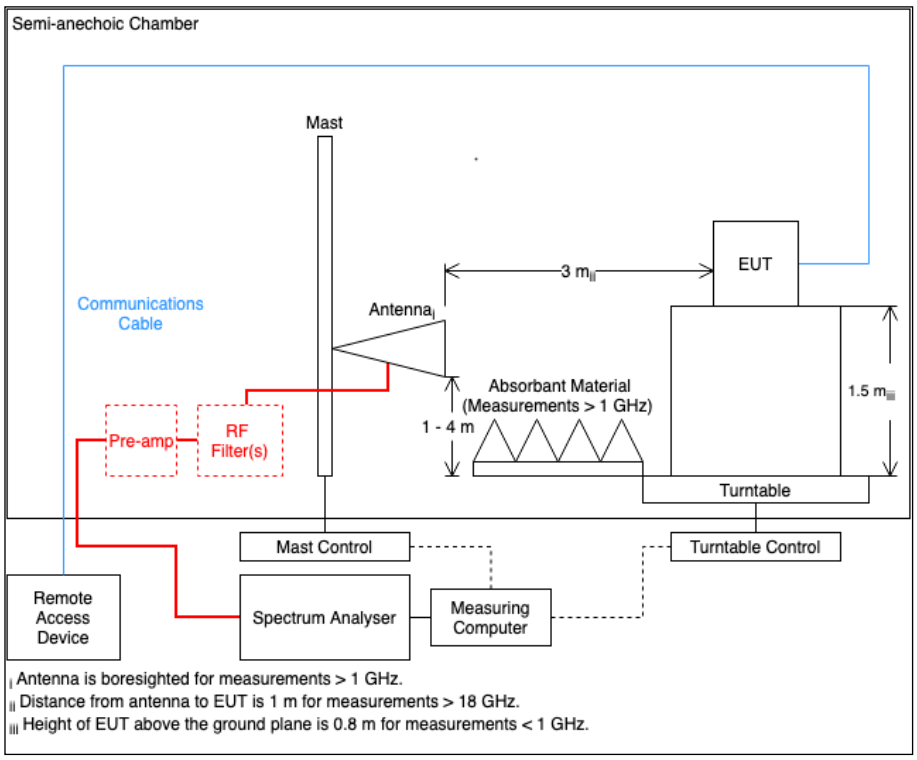

Figure 1

2.1.6 Environmental Conditions

Ambient Temperature	22.8 °C
Relative Humidity	56.6 %

2.1.7 Test Results

Bluetooth Low Energy + LTE Cat M1 FDD Band 2

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

Table 17 - BLE - 2440 MHz & CAT M1 LTE B2 – 1880 MHz, 30 MHz to 25 GHz

*No emissions found within 10 dB of the limit.

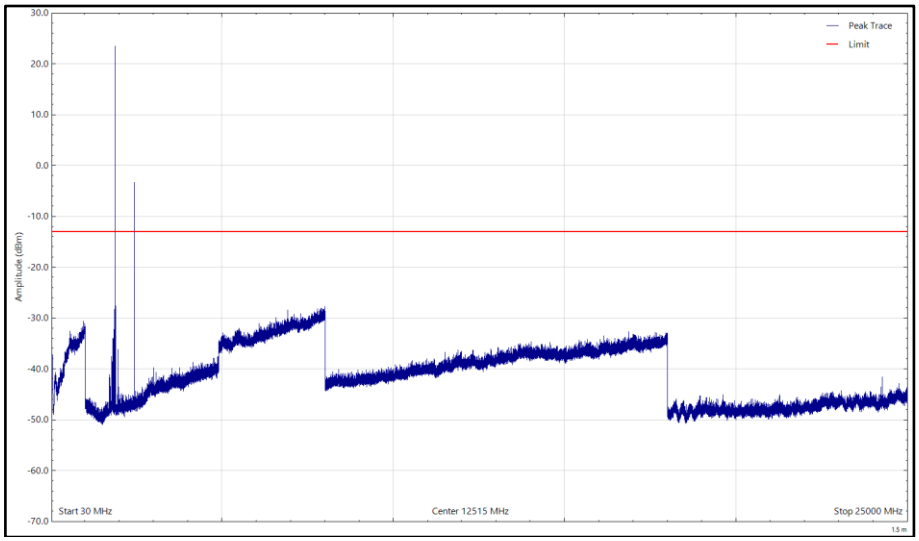

Figure 2 - BLE 2440 MHz & CAT M1 LTE B2, 30 MHz to 25 GHz, Horizontal (Peak)

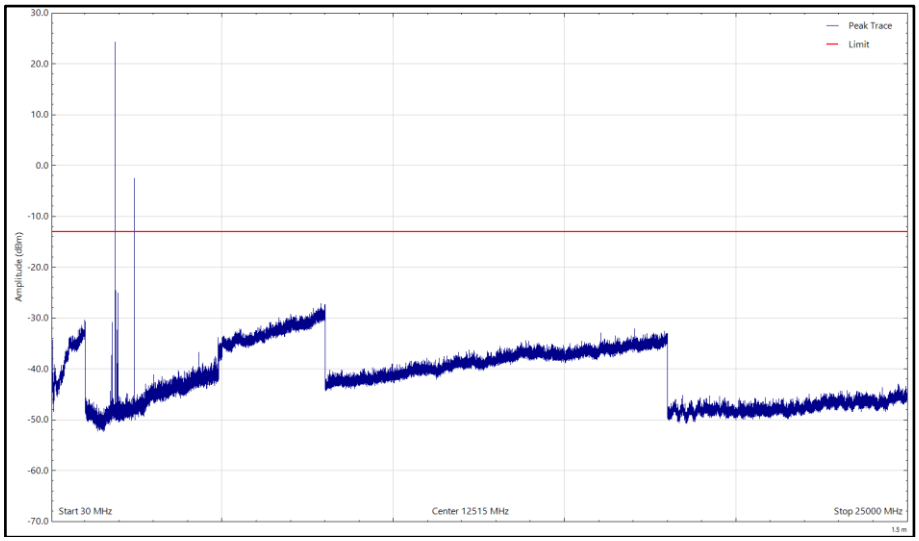

Figure 3 - BLE - 2440 MHz & CAT M1 LTE B2 – 1880 MHz, 30 MHz to 25 GHz, Vertical (Peak)

Bluetooth Low Energy + LTE Cat M1 FDD Band 5

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

Table 18 - BLE 2440 MHz & CAT M1 LTE B5, 30 MHz to 25 GHz

*No emissions found within 10 dB of the limit.

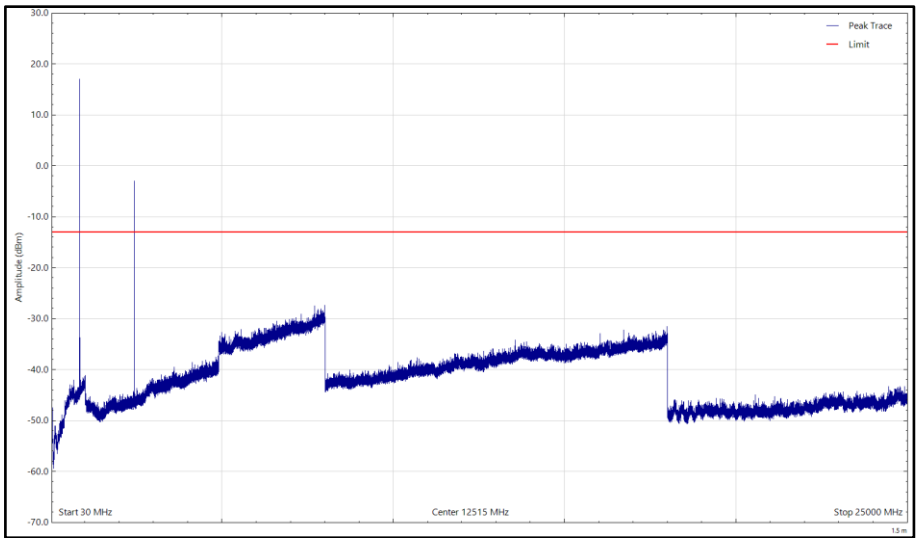

Figure 4 - BLE 2440 - MHz & CAT M1 LTE B5 – 836.5 MHz, 30 MHz to 25 GHz, Horizontal (Peak)

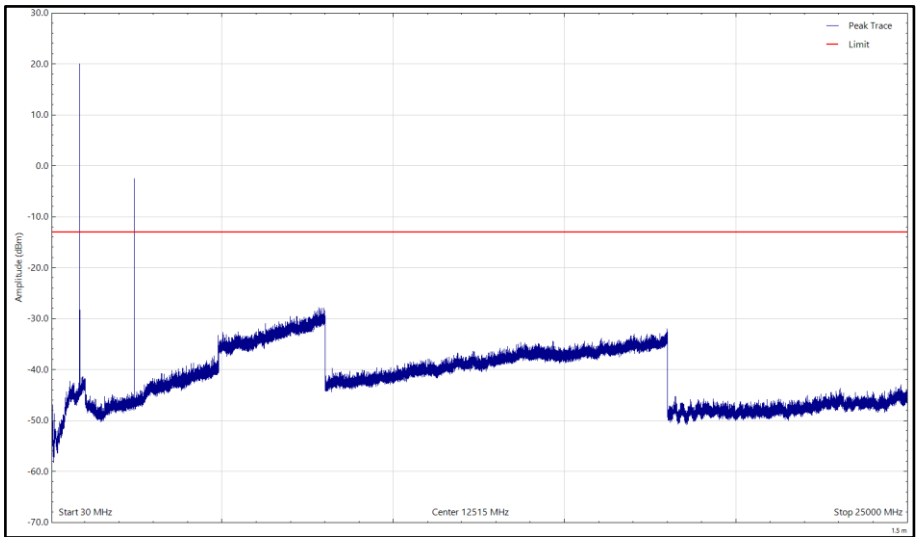

Figure 5 - BLE - 2440 MHz & CAT M1 LTE B5 – 836.5 MHz, 30 MHz to 25 GHz, Vertical (Peak)

FCC 47 CFR Part 22, FCC 47 CFR Part 24 and ISED RSS-132, ISED RSS-133

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.
Part 24.238 (a) / RSS-133 Clause 6.5	-13 dBm (EIRP) / 82 dBµV/m at 3m.

Table 19

2.1.8 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 Expires
Antenna with attenuator (Bilog, 30 MHz to 3 GHz)	Schaffner	CBL6143	287	24	14-Oct-2022
True RMS Multimeter	Fluke	79 Series III	411	12	13-Oct-2022
Screened Room (5)	Rainford	Rainford	1545	36	15-Apr-2024
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	O/P Mon
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Antenna (DRG 1-10.5GHz)	Schwarzbeck	BBHA9120B	4848	12	28-May-2023
Emissions Software	TUV SUD	EmX V3.1.4	5125	-	Software
Antenna (DRG, 15 GHz to 40 GHz)	Schwarzbeck	BBHA 9170	5217	12	25-Jan-2023
Pre-Amplifier (18 GHz to 40 GHz)	Schwarzbeck	BBV 9721	5218	12	25-Jan-2023
Antenna (DRG Horn 7.5-18GHz)	Schwarzbeck	HWRD750	5348	12	15-Oct-2022
Cable (sma to sma 2m)	Junkosha	MWX221-02000AMSAMS/A	5517	12	12-Apr-2023
Cable (N to N 8m)	Junkosha	MWX221-08000NMSNMS/B	5520	12	24-Mar-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	28-Apr-2023
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	22-Sep-2022
Radio Communications Analyser	Anritsu	MT8821C	5738	12	08-Mar-2023
Cable (K Type 2m)	Junkosha	MWX241-01000KMSKMS/B	5934	12	14-May-2023

Table 20

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

3 Photographs

3.1 Test Setup Photographs

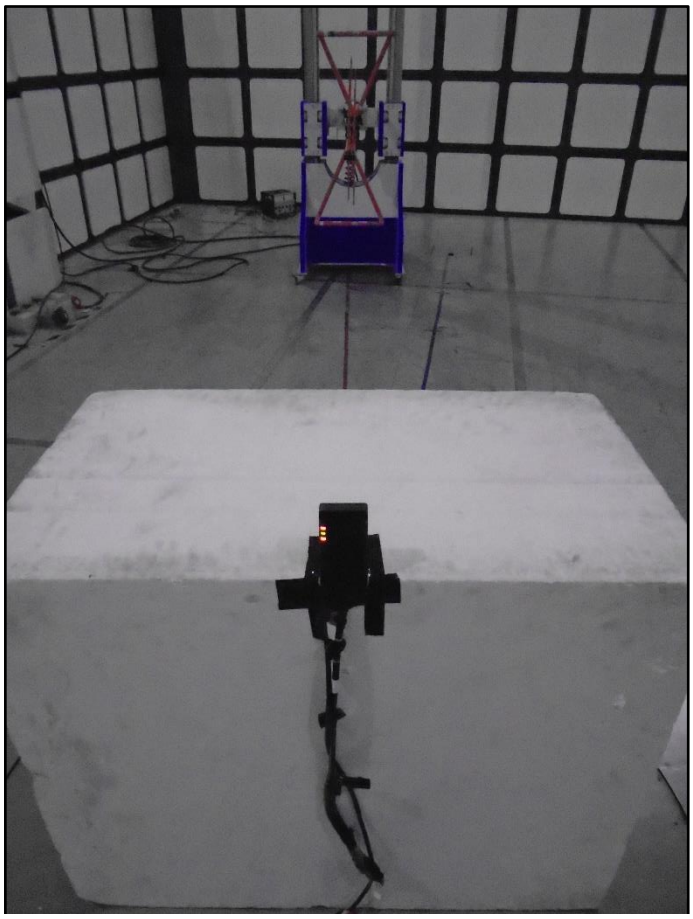

Figure 6 - 30 MHz to 1 GHz

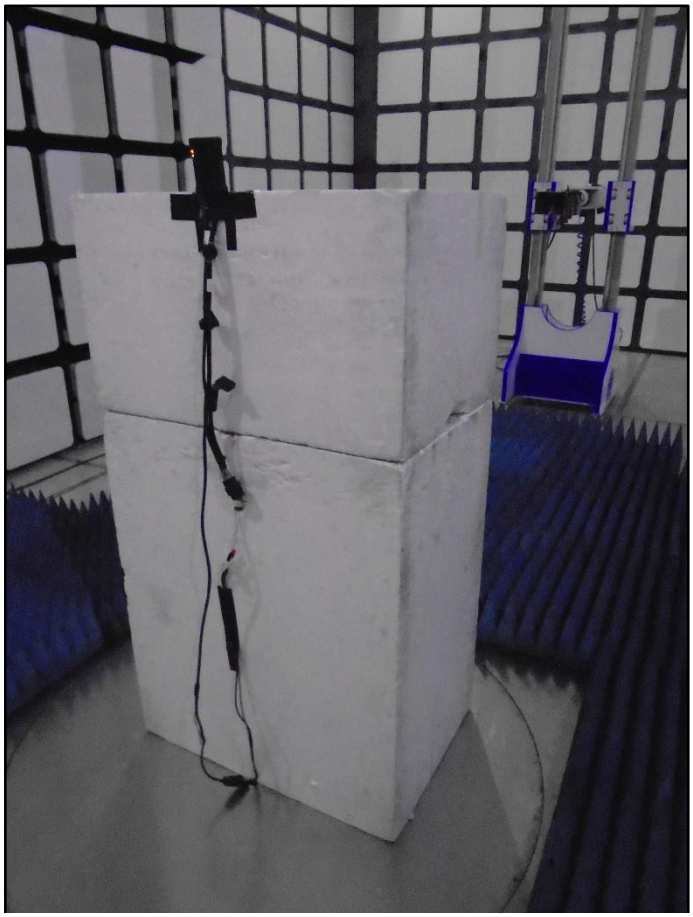

Figure 7 - 1 GHz to 18 GHz

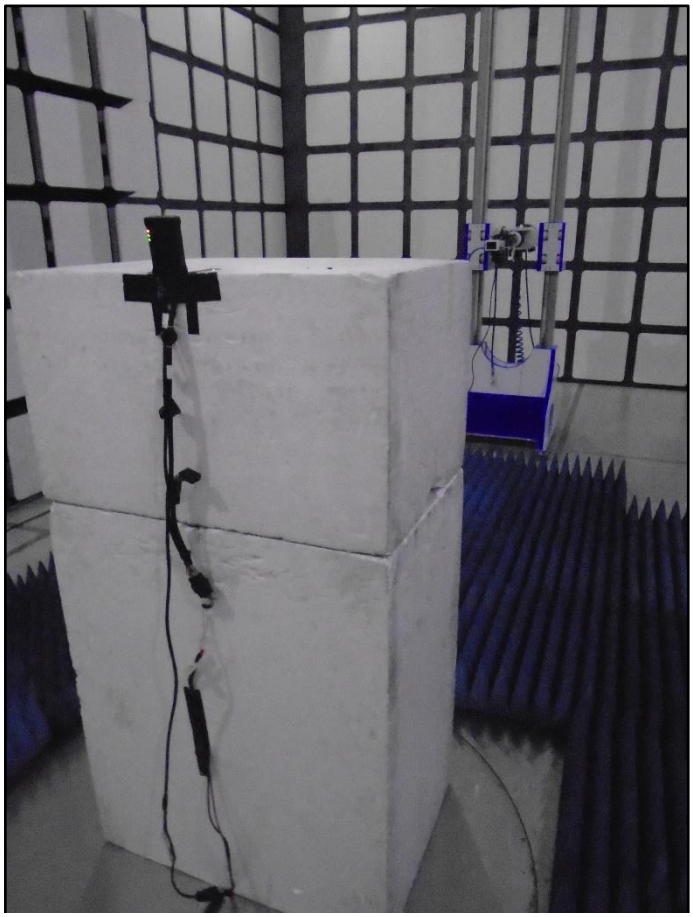

Figure 8 - 18 GHz to 25 GHz

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 21

Measurement Uncertainty Decision Rule – Accuracy Method

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.