FCC and ISED Test Report

Trackunit ApS
Access Control Unit: Pass, Model: K300

In accordance with FCC 47 CFR Part 15, ISED RSS-210, ISED RSS-247 and ISED RSS-GEN (NFC and BLE / 2.4 GHz Wi-Fi)

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

Add value.
Inspire trust.

FCC ID: ZMF-K300 / Contains FCC ID: ZMF-TUBLEWIM01
IC: 9746A-K300 / Contains IC: 9746A-TUBLEWIM01

COMMERCIAL-IN-CONFIDENCE

Document 75959427-08 Issue 01

SIGNATURE			
S. Mh			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	18 April 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 15, ISEDC RSS-210, ISEDC RSS-247 and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Pier-Angelo Lorusso	18 April 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 15: 2022, ISEDC RSS-210: Issue 10 (2019-12) + A1 (04-2020), ISEDC RSS-247: Issue 3 (08-2023) and ISEDC RSS-GEN: Issue 05 (2018-04) + 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	18-April-2024

Table 1

1.2 Introduction

Applicant	Trackunit ApS
Manufacturer	Trackunit ApS
Model Number(s)	K300
Serial Number(s)	15000024
Hardware Version(s)	Prototype 3, Rev B
Software Version(s)	0.2.0
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15: 2022 ISEDC RSS-210: Issue 10 (12-2019) + A1 (04-2020) ISEDC RSS-247: Issue 3 (08-2023) ISEDC RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	TripleID EMC and RF
Date	20-September-2023
Date of Receipt of EUT	20-November-2023
Start of Test	29-November-2023
Finish of Test	28-March-2024
Name of Engineer(s)	Pier-Angelo Lorusso, Roscoe Harrison
Related Document(s)	ANSI C63.10 (2020) ANSI C63.4 (2014) 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 15, ISEDC RSS-210, ISEDC RSS-247 and ISEDC RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 15C	RSS-210	RSS-247	RSS-GEN			
Configuration and Mode: NFC Tx + BLE Tx							
2.1	15.247 (d)	B.6	5.5	6.13	Radiated Spurious Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013) ANSI C63.4 (2014) KDB 996369 D04 Module Integration Guide v02
Configuration and Mode: NFC Tx + 2.4GHz WLAN							
2.1	15.247 (d)	B.6	5.5	6.13	Radiated Spurious Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013) ANSI C63.4 (2014) KDB 996369 D04 Module Integration Guide v02

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)*	This equipment is an Access Control unit to be mounted in and on vehicles/machinery. It has a keypad, BLE/WLAN, and NFC. It can be connected to a Trackunit Raw Telematics unit via CAN bus and to power lines of the vehicles/machinery.		
Manufacturer:	Trackunit ApS		
Model:	K300		
Part Number:	9833.xxxxxx		
Hardware Version:	Prototype 3, Rev B		
Software Version:	0.2.0		
FCC ID of the product under test – see guidance here		ZMF-K300 / Contains FCC ID: ZMF-TUBLEWIM01	
IC ID of the product under test – see guidance here		9746A-K300 / Contains IC: 9746A-TUBLEWIM01	
Device Category	Mobile ☐	Portable ☐	Fixed ☒
Equipment is fitted with an Audio Low Pass Filter		Yes ☐	No ☒

Table 3

Intentional Radiators

Technology	NFC	Bluetooth Low Energy	2.4 GHz Wi-Fi
Frequency Range (MHz to MHz)	13.56 MHz	2402-2480	2412-2462
Conducted Declared Output Power (dBm)	N/A	14 dBm [1)] <10 dBm EIRP for wolrldwide deployment	16 dBm [1)] <10 dBm EIRP for wolrldwide deployment
Antenna Gain (dBi)	N/A	1.66	1.66
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	0.014	1, 2	20
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	Manchester, 10% ASK	GFSK	DSSS, OFDM
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	14k0A1D	1M00F7D, 2M00F7D	20M0G7D
Bottom Frequency (MHz)	13.553	2402	2412
Middle Frequency (MHz)	13.560	2441	2437
Top Frequency (MHz)	13.567	2480	2462

Table 4

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.

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) ☐	

Table 5

AC Power Source

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

Table 6

DC Power Source

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

Table 7

Battery Power Source

Voltage:	N/A	V
End-point voltage:	N/A	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	Yes ☐ No ☐

Table 9

Temperature

Minimum temperature:	-30	°C
Maximum temperature:	70	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	N/A	dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	BLE/Wi-Fi: Antenna on module	Gain	1.66	dBi
Integral antenna ☒	Type:	NFC: Loop antenna	Gain	N/A	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.					

Table 12

Ancillaries (if applicable)

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

Table 13

We 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: 20.Nov.2023

1.5 Product Information

1.5.1 Technical Description

This equipment is an Access Control unit to be mounted in and on vehicles/machinery. It has a keypad, BLE/WLAN, and NFC. It can be connected to a Trackunit Raw Telematics unit via CAN bus and to power lines of the vehicles/machinery.

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: K300, Serial Number: 15000024			
0	As supplied by the customer	Not Applicable	Not Applicable
1	As documented in K300 Hand Modification for TA which is held by the manufacturer	Trackunit	Not Applicable

Table 14

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: NFC Tx + BLE Tx		
Radiated Spurious Emissions	Pier-Angelo Lorusso Roscoe Harrison	UKAS
Configuration and Mode: NFC Tx + 2.4GHz WLAN		
Radiated Spurious Emissions	Pier-Angelo Lorusso Roscoe Harrison	UKAS

Table 15

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 15, Clause 15.247 (d)
ISEDC RSS-210, Clause B.6
ISEDC RSS-247, Clause 5.5
ISEDC RSS-GEN, Clause 6.13

2.1.2 Equipment Under Test and Modification State

K300, S/N: 15000024 - Modification State 0
K300, S/N: 15000024 - Modification State 1

2.1.3 Date of Test

29-November-2023 to 28-March-2024

2.1.4 Test Method

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

The EUT was powered via a DC Power Supply unit at a + 12 V DC nominal voltage.

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.

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4 for each type of port on the EUT.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2, 11.11, 11.12, 12.7.2 or 12.7.3 depending on the nature of the emission measured.

The plots shown are the characterisation of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to non-restricted band limits. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.1.5 Example Test Setup Diagram

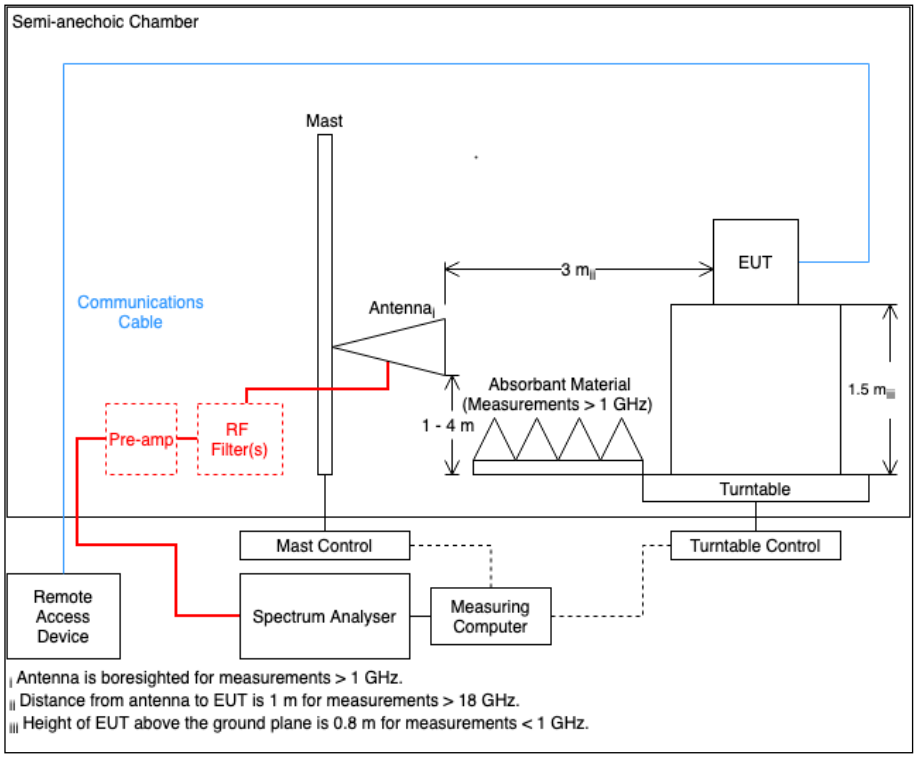

Figure 1

2.1.6 Environmental Conditions

Ambient Temperature	19.1 - 20.2 °C
Relative Humidity	36.4 - 52.5 %

2.1.7 Test Results

NFC Tx + BLE Tx

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation
53.930	30.63	40.00	-9.37	Peak	dBuv/m	348	354	Vertical
65.888	31.40	40.00	-8.60	Peak	dBuv/m	260	327	Vertical
94.715	36.63	43.50	-6.87	Peak	dBuv/m	276	118	Vertical
132.447	36.69	43.50	-6.81	Peak	dBuv/m	185	309	Horizontal
189.910	37.79	43.50	-5.71	Peak	dBuv/m	87	148	Horizontal
244.118	36.98	46.00	-9.02	Peak	dBuv/m	258	105	Horizontal
501.676	39.03	46.00	-6.97	Peak	dBuv/m	237	100	Vertical
501.710	39.00	46.00	-7.00	Peak	dBuv/m	0	100	Horizontal
515.403	38.38	46.00	-7.62	Peak	dBuv/m	3	100	Horizontal
528.927	38.45	46.00	-7.55	Peak	dBuv/m	262	110	Vertical
951.851	42.28	46.00	-3.72	Peak	dBuv/m	8	105	Vertical
956.263	42.43	46.00	-3.57	Peak	dBuv/m	128	361	Horizontal
2361.749	51.20	54.00	-2.80	RMS	dBuV/m	303	144	Horizontal
2361.759	52.46	54.00	-1.54	RMS	dBuV/m	356	181	Vertical
2374.644	49.04	54.00	-4.96	RMS	dBuV/m	253	178	Horizontal
2388.122	51.48	54.00	-2.52	RMS	dBuV/m	4	100	Vertical
2388.192	51.63	54.00	-2.37	RMS	dBuV/m	247	149	Horizontal

Table 16 - NFC_BLE, 13.56 MHz_2402 MHz, 30 MHz to 13 GHz

No other emissions found within 10 dB of the limit.

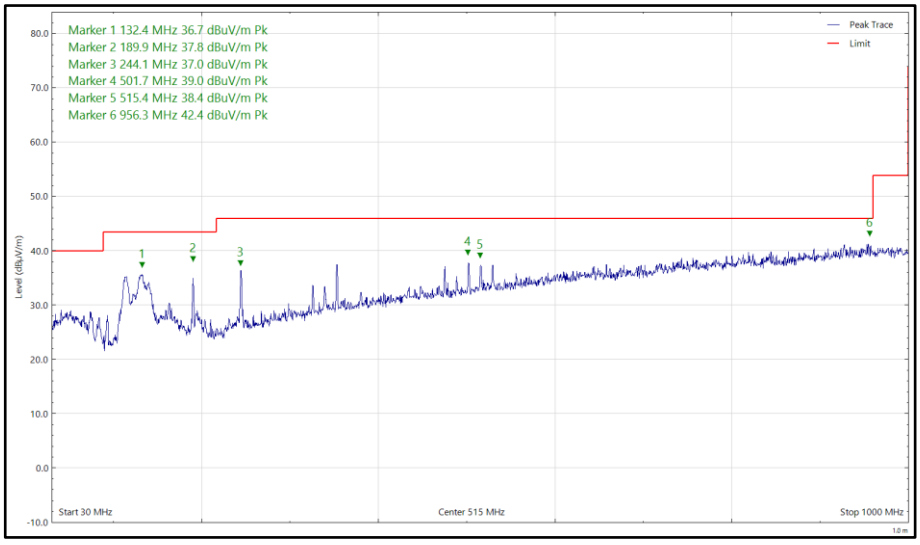

Figure 2 - NFC_BLE, 13.56 MHz_2402 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

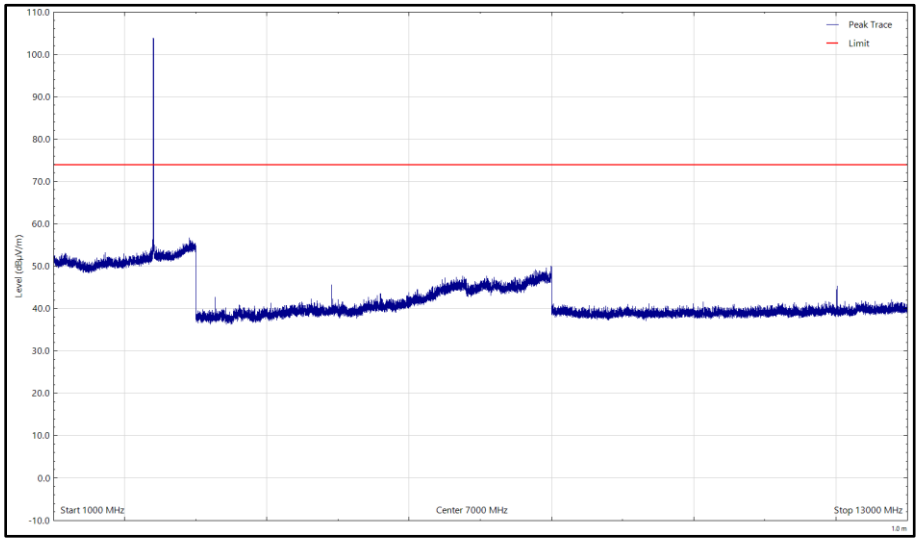

Figure 3 - NFC_BLE, 13.56 MHz_2402 MHz, 1 GHz to 13 GHz, Horizontal (Peak)

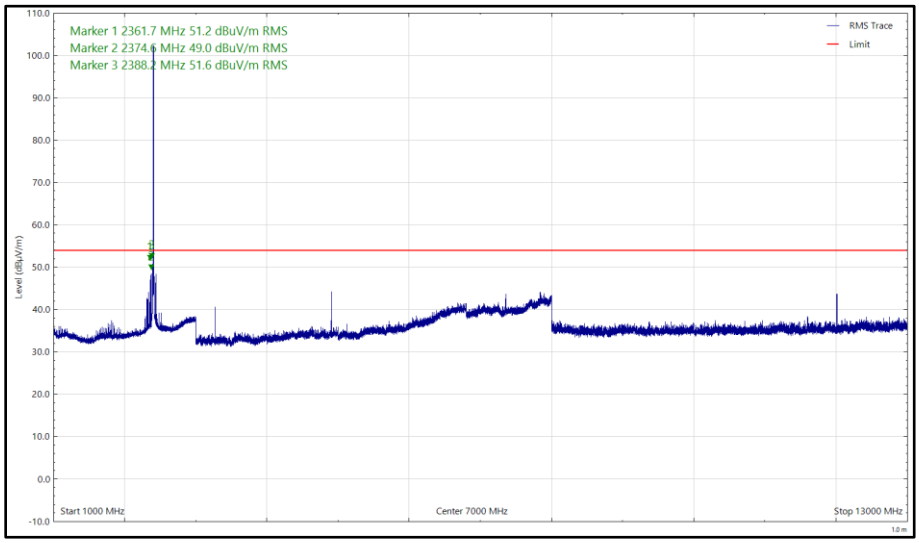

Figure 4 - NFC_BLE, 13.56 MHz_2402 MHz, 1 GHz to 13 GHz, Horizontal (rms)

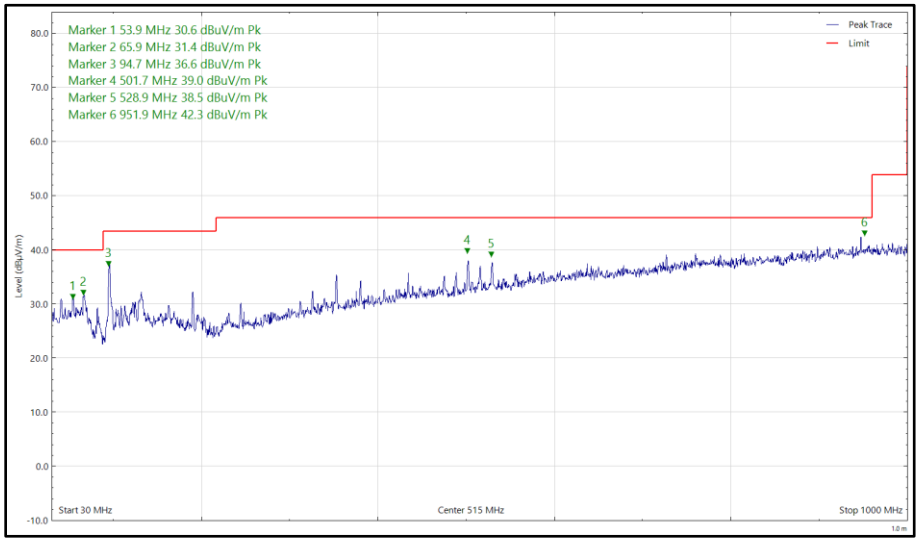

Figure 5 - NFC_BLE, 13.56 MHz_2402 MHz, 30 MHz to 1 GHz, Vertical (Peak)

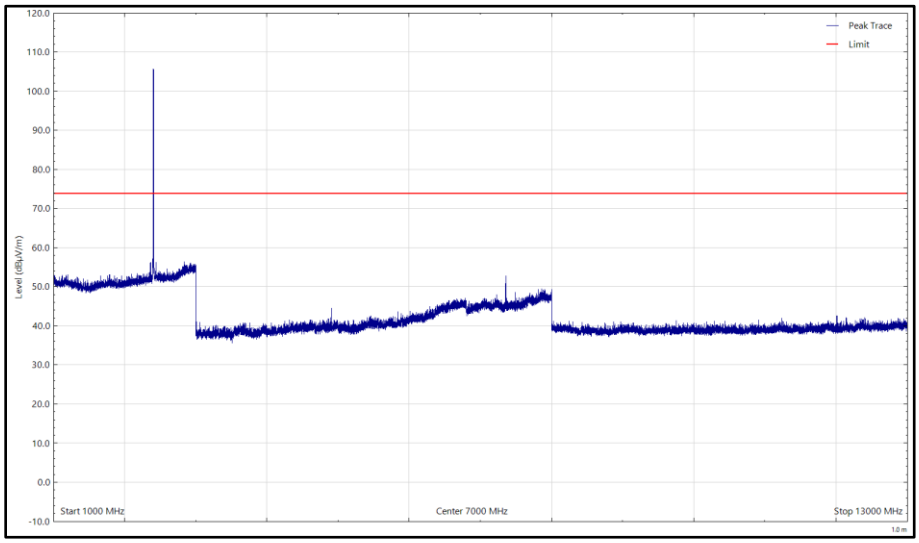

Figure 6 - NFC_BLE, 13.56 MHz_2402 MHz, 1 GHz to 13 GHz, Vertical (Peak)

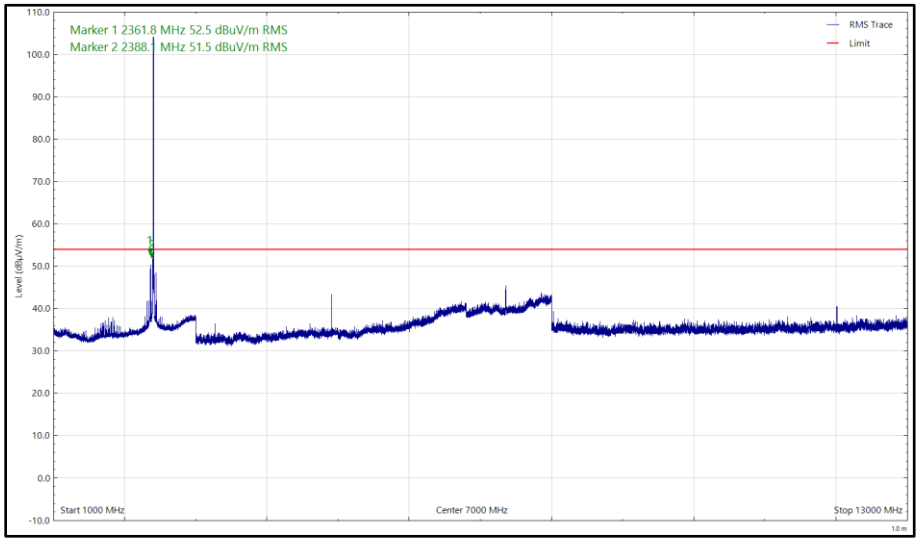

Figure 7 - NFC_BLE, 13.56 MHz_2402 MHz, 1 GHz to 13 GHz, Vertical (rms)

NFC Tx + 2.4GHz WLAN

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
53.742	31.69	40.00	-8.31	Peak	353	364	Vertical
92.614	34.20	43.50	-9.30	Peak	317	104	Vertical
112.985	36.85	43.50	-6.65	Peak	70	125	Horizontal
131.122	37.00	43.50	-6.50	Peak	271	288	Horizontal
189.958	35.23	43.50	-8.27	Peak	172	100	Vertical
352.550	37.60	46.00	-8.40	Peak	91	286	Horizontal
501.744	37.89	46.00	-8.11	Peak	327	100	Horizontal
528.949	38.12	46.00	-7.88	Peak	89	105	Vertical
789.373	39.75	46.00	-6.25	Peak	1	100	Vertical
874.853	40.55	46.00	-5.45	Peak	14	166	Horizontal
953.258	41.89	46.00	-4.11	Peak	350	332	Vertical

Table 17 - NFC_WIFI, 13.56 MHz_2412 MHz, 30 MHz to 13 GHz

No other emissions found within 10 dB of the limit.

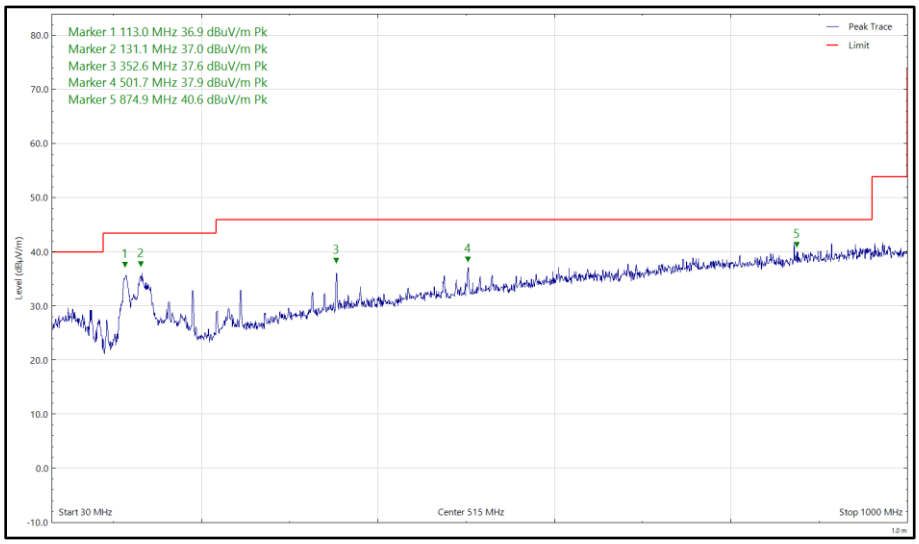

Figure 8 - NFC_WIFI, 13.56 MHz_2412 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

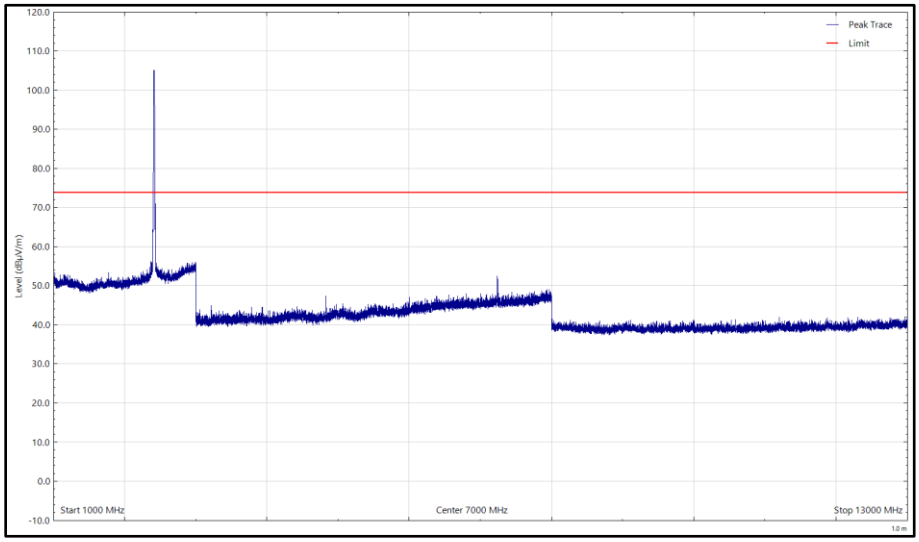

Figure 9 - NFC_WIFI, 13.56 MHz_2412 MHz, 1 GHz to 13 GHz, Horizontal (Peak)

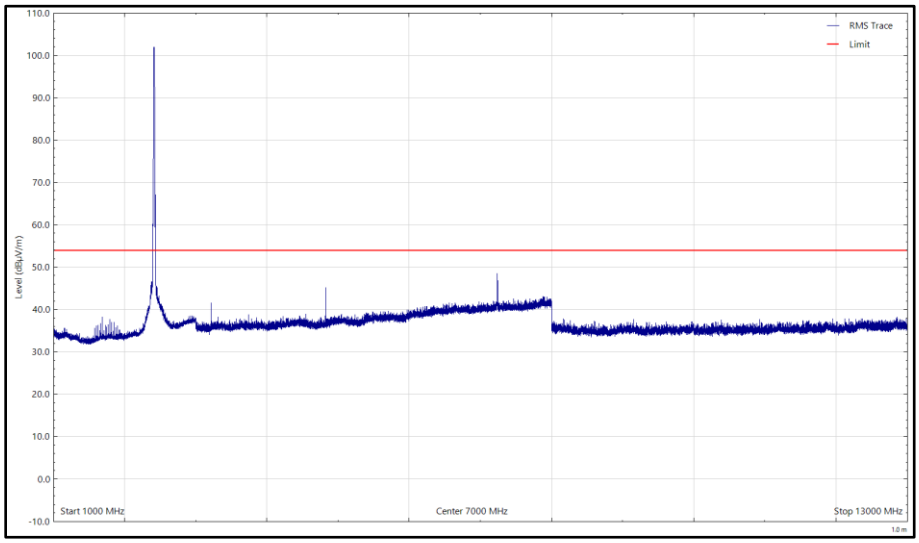

Figure 10 - NFC_WIFI, 13.56 MHz_2412 MHz, 1 GHz to 13 GHz, Horizontal (rms)

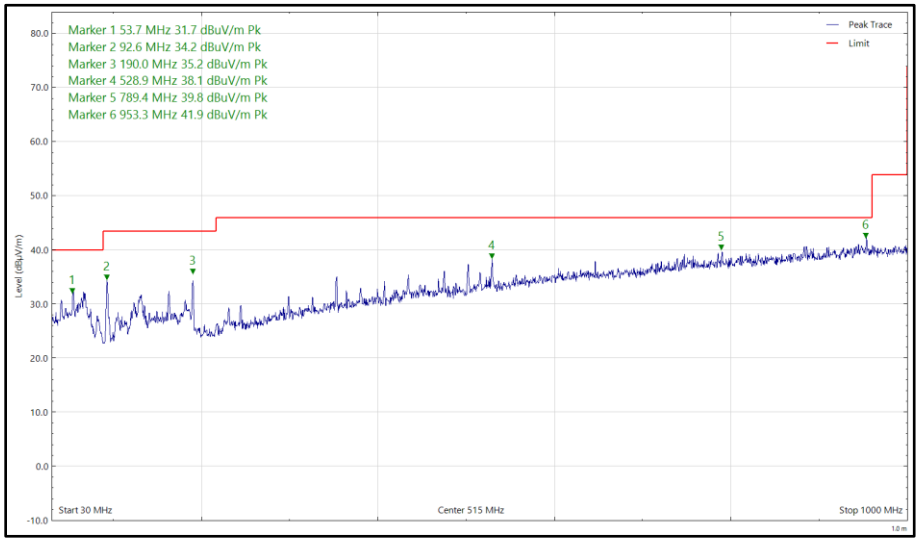

Figure 11 - NFC_WIFI, 13.56 MHz_2412 MHz, 30 MHz to 1 GHz, Vertical (Peak)

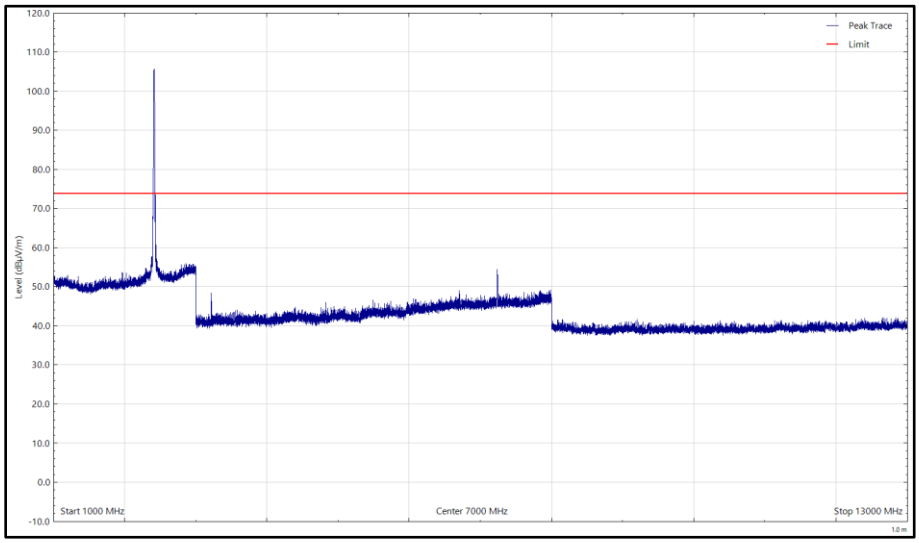

Figure 12 - NFC_WIFI, 13.56 MHz_2412 MHz, 1 GHz to 13 GHz, Vertical (Peak)

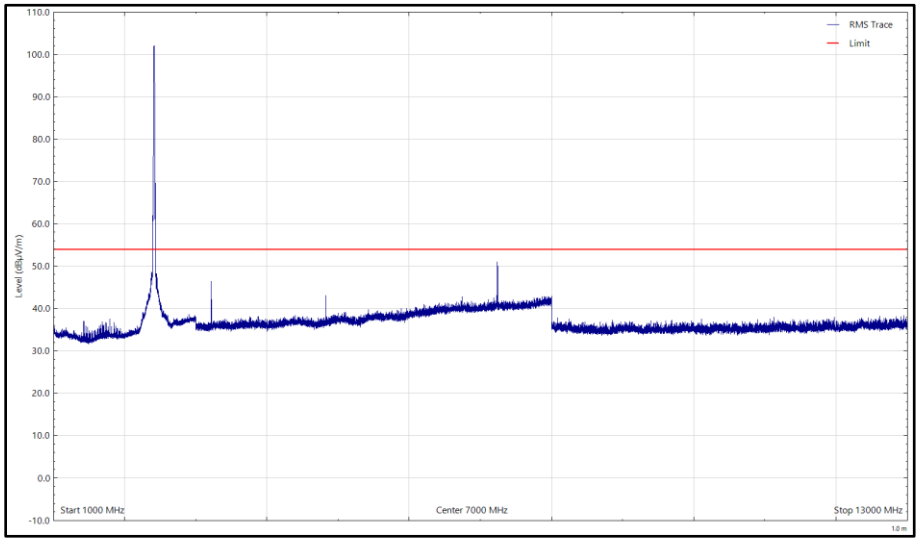

Figure 13 - NFC_WIFI, 13.56 MHz_2412 MHz, 1 GHz to 13 GHz, Vertical (rms)

FCC 47 CFR Part CFR Part 15 and ISED RSS-247

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 15.209 / RSS-GEN Clause 8.9	Peak: 74 dBµV/m at 3m, Average 54 dBµV/m at 3m (Restricted bands > 1 GHz)

Table 18

2.1.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11 and RF Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
Dual Power Supply Unit	Hewlett Packard	6253A	271	-	O/P Mon
Screened Room	Rainford	RF Chamber 5	1545	36	15-Apr-2024
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Multimeter	Fluke	177	3812	12	14-Apr-2024
Hygrometer	Rotronic	HP21	4410	12	08-Aug-2024
Cable (N-Type to N-Type, 1m)	Florida Labs	NMS-235SP-39.4-NMS	4510	12	04-Feb-2025
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	4848	12	09-Jul-2024
Test Receiver	Rohde & Schwarz	ESW44	5084	12	31-Aug-2024
Emissions Software	TUV SUD	EmX V3.1.12	5125	-	Software
3m Semi-Anechoic Chamber	Rainford	RF Chamber 11	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
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5216	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 18 GHz)	Schwarzbeck	BBV 9718 C	5261	12	14-Apr-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, 2m)	Junkosha	MWX221-02000AMSAMS/A	5517	12	21-May-2024
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-	5518	12	14-Apr-2024

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
		02000AMSAMS/A			
Cable (N-Type to N-Type, 8m)	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
3 GHz High pass Filter	Wainwright	WHKX12-2580-3000-18000-80SS	5548	12	16-Aug-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	26-Oct-2024
Antenna (Tri-log, 30 MHz to 1 GHz)	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Attenuator (4 dB)	Pasternack	PE7074-4	6202	24	16-Jul-2024

Table 19

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

3 Photographs

3.1 Test Setup Photographs

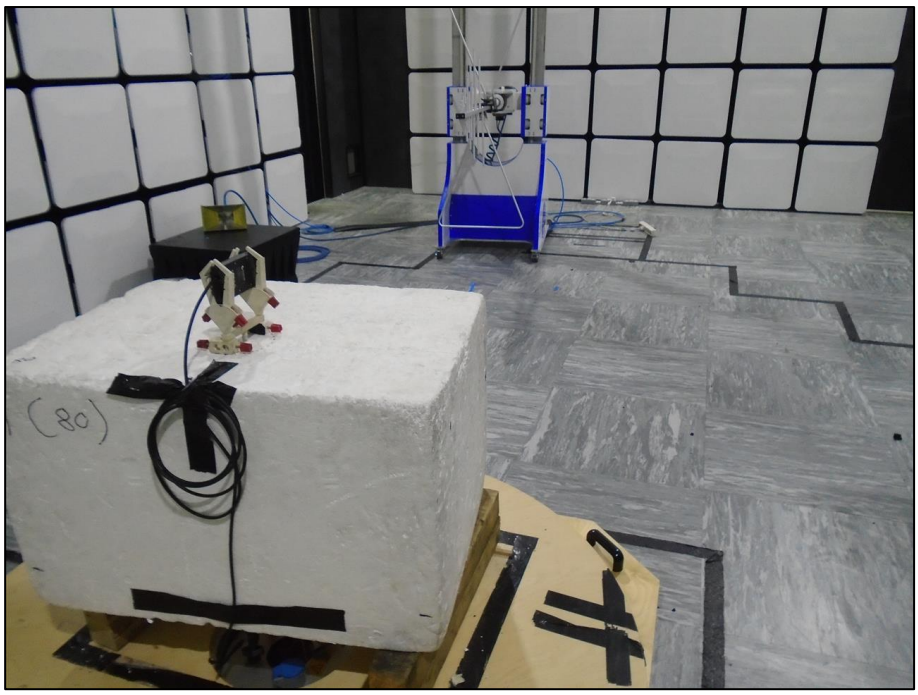

Figure 14 - Test Setup - 30 MHz to 1 GHz

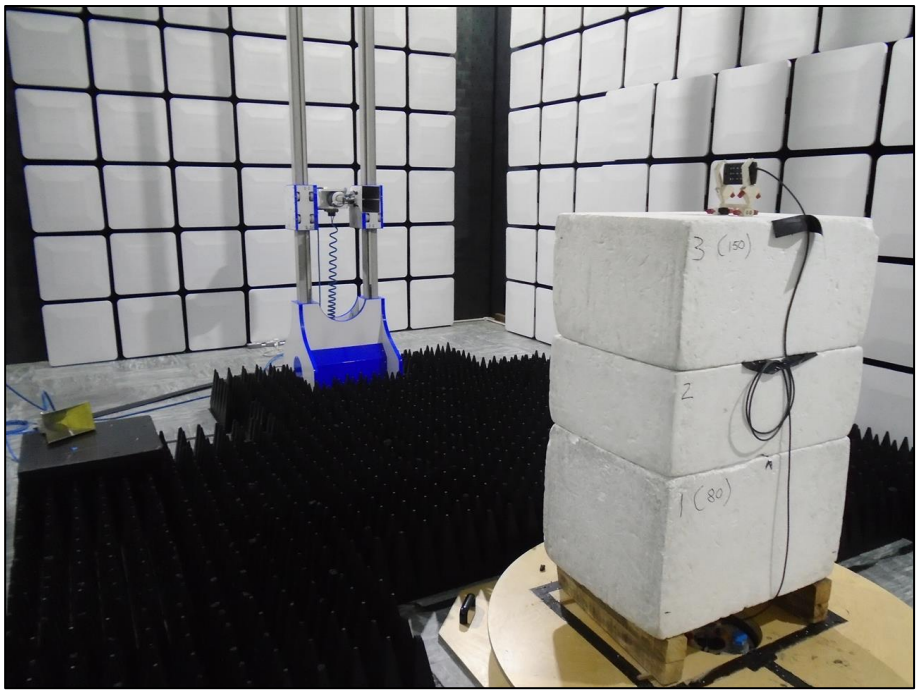

Figure 15 - Test Setup - 1 GHz to 8 GHz

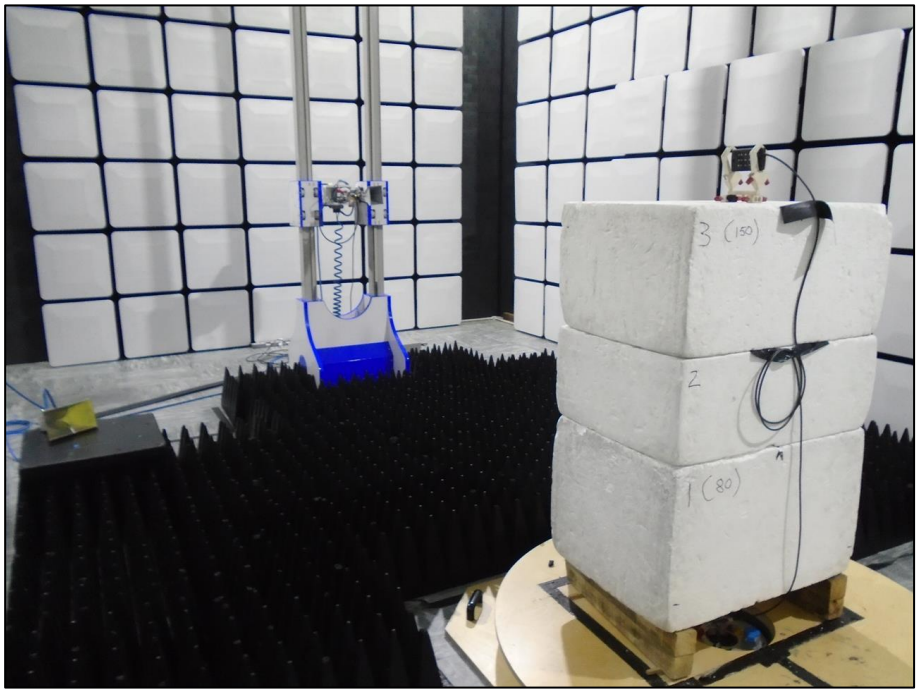

Figure 16 - Test Setup - 8 GHz to 13 GHz

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 20

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.