FCC Test Report

Shot Scope Technologies Ltd
Shot Scope, Model: H4

In accordance with FCC 47 CFR Part 15C (13.56 MHz RFiD)

Prepared for: Shot Scope Technologies Ltd
Unit 27, Castlebrae Business Centre
40 Peffer Place, Edinburgh
EH16 4BB, UNITED KINGDOM

FCC ID: 2AHWR-SS05

Add value.
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Document 75954182-03 Issue 02

SIGNATURE			
			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	Senior Engineer	Authorised Signatory	26 May 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 15C. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Daniel Cameron	26 May 2022	
Testing	Graeme Lawler	26 May 2022	

FCC Accreditation
90987 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: 2020 for the tests detailed in section 1.3.

TÜV SÜD
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Concorde Way
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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	09-March-2022
2	Correction of title on the front page	26 May 2022

Table 1

1.2 Introduction

Applicant	Shot Scope Technologies Ltd
Manufacturer	Shot Scope Technologies Ltd
Model Number(s)	H4
Serial Number(s)	Not Serialised (FAR-0633998-002)
Hardware Version(s)	1.0
Software Version(s)	1.0
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020
Order Number Date	PO-0071 21-December-2021
Date of Receipt of EUT	31-January-2022
Start of Test	06-February-2022
Finish of Test	16-February-2022
Name of Engineer(s)	Daniel Cameron and Graeme Lawler
Related Document(s)	ANSI C63.10 (2014)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: 13.56 MHz RFID				
2.1	15.215 (c)	20 dB Bandwidth	Pass	
2.2	15.225 (a)(b)(c)(d)	Field Strength of any Emission	Pass	
2.3	15.225 (e)	Frequency Tolerance Under Temperature Variations	Pass	

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)*	Shot Scope H4 is a handheld unit worn by golfers to provide distance information from their position to their target. It also tracks how far each golf shot is hit and what golf club was used.	
Manufacturer:	Shot Scope	
Model:	SS04	
Part Number:	H4	
Hardware Version:	1.0	
Software Version:	1.0	
FCC ID of the product under test – see guidance here		2AHWR-SS05
IC ID of the product under test – see guidance here		

Table 3

Intentional Radiators

Technology	BLE	RFiD				
Frequency Range (MHz to MHz)	2402 – 2480	13.56				
Conducted Declared Output Power (dBm)	-2	-				
Antenna Gain (dBi)	1.7	-				
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	1	-				
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GFSK	ASK				
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	G1D1M00	-				
Bottom Frequency (MHz)	2402	-				
Middle Frequency (MHz)	2440	13.56				
Top Frequency (MHz)	2480	-				

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	32 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:	5	V
Extreme upper voltage:	5.5	V
Extreme lower voltage:	4.5	V
Max current:	0.1	A

Table 7

Battery Power Source

Voltage:	3.0 – 4.2	V
End-point voltage:	3.0	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:	0	°C
Maximum temperature:	50	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)		dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	Chip	Gain	1.7	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 12

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 13

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

Name: Lewis Allison
Position held: Chief Technology Officer
Date: 31/01/22

1.5 Product Information

1.5.1 Technical Description

Shot Scope H4 is a handheld unit worn by golfers to provide distance information from their position to their target. It also tracks how far each golf shot is hit and what golf club was used.

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: H4, Serial Number: Not Serialised (FAR-0633998-002)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

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: 13.56 MHz RFID		
20 dB Bandwidth	Daniel Cameron and Graeme Lawler	UKAS
Field Strength of any Emission	Graeme Lawler	UKAS
Frequency Tolerance Under Temperature Variations	Daniel Cameron	UKAS

Table 15

Office Address:

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

2 Test Details

2.1 20 dB Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.215 (c)

2.1.2 Equipment Under Test and Modification State

H4, S/N: Not Serialised (FAR-0633998-002) - Modification State 0

2.1.3 Date of Test

15-February-2022

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

2.1.5 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	36.7 %

2.1.6 Test Results

13.56 MHz RFID

Frequency (MHz)	20 dB Bandwidth (Hz)
13.56	960

Table 16

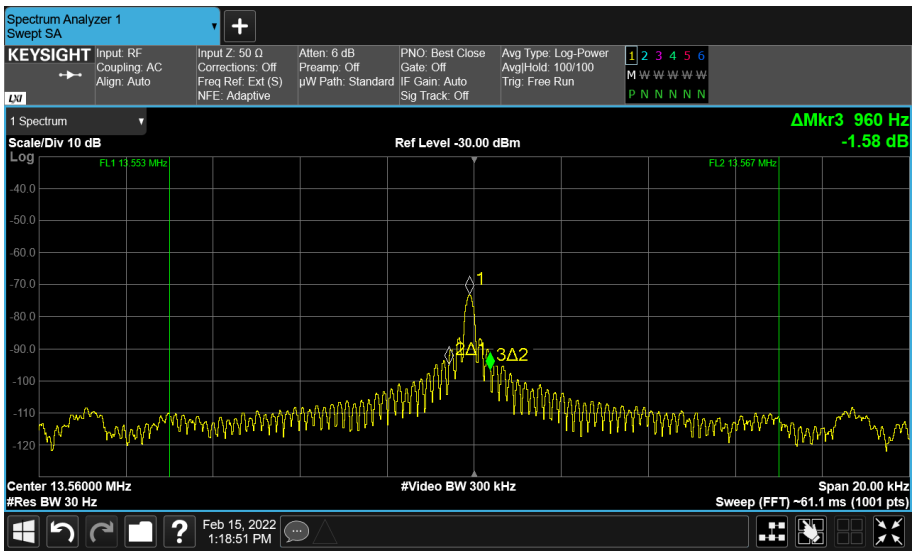

Figure 1 – 20 dB Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.215 (c)

The 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Loop Antenna	Solar	7334-1	4215	24	02-Jul-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
Signal Analyzer	Keysight Technologies	PXA N9030B	5432	12	20-Aug-2022
3.5mm Cable (1m)	Junkosha	MWX221/B	5837	12	23-Jul-2022

Table 17

2.2 Field Strength of any Emission

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (a)(b)(c)(d)

2.2.2 Equipment Under Test and Modification State

H4, S/N: Not Serialised (FAR-0633998-002) - Modification State 0

2.2.3 Date of Test

06-February-2022

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.

The level at 30 m was calculated using the dBµV/m measurement at 3 m and extrapolating this result to produce a level at 30 m. This value was then converted to obtain the value in µV/m

2.2.5 Environmental Conditions

Ambient Temperature	23.2 °C
Relative Humidity	30.9 %

2.2.6 Test Results

13.56 MHz RFID

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 3 m	Quasi-Peak Level (dBµV/m) at 30 m	Quasi-Peak Level (µV/m) at 3 m	Quasi-Peak Level (µV/m) at 30 m	Angle (°)	Height (cm)	Polarisation
13.56	28.88	7.49	27.79	2.37	355	150	Vertical

Table 18

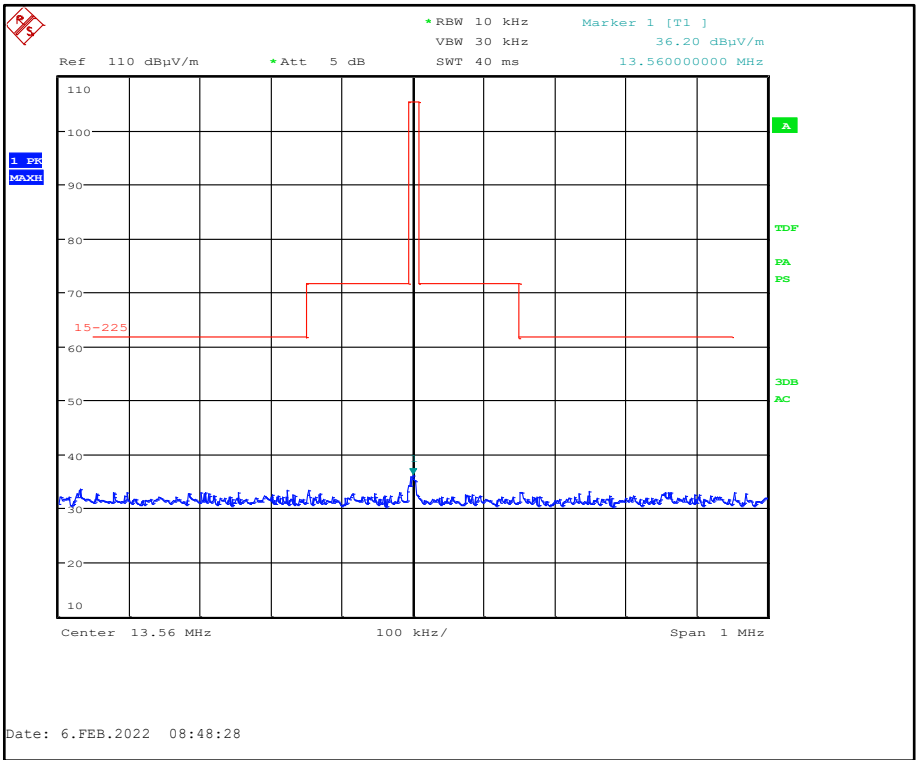

Figure 2- Plot of the Fundamental (13.56 MHz)

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 3 m	Quasi-Peak Level (dBµV/m) at 30 m	Quasi-Peak Level (µV/m) at 3 m	Quasi-Peak Level (µV/m) at 30 m	Angle (°)	Height (cm)	Polarisation
*							

Table 19 - 9 kHz to 30 MHz

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

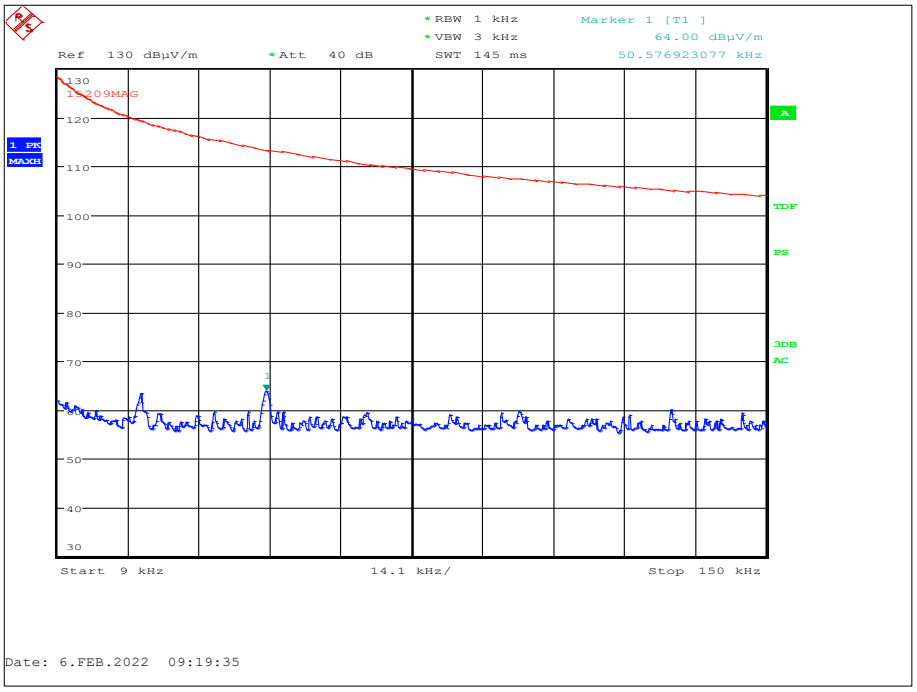

Figure 3 - 9 kHz to 150 kHz - X Orientation

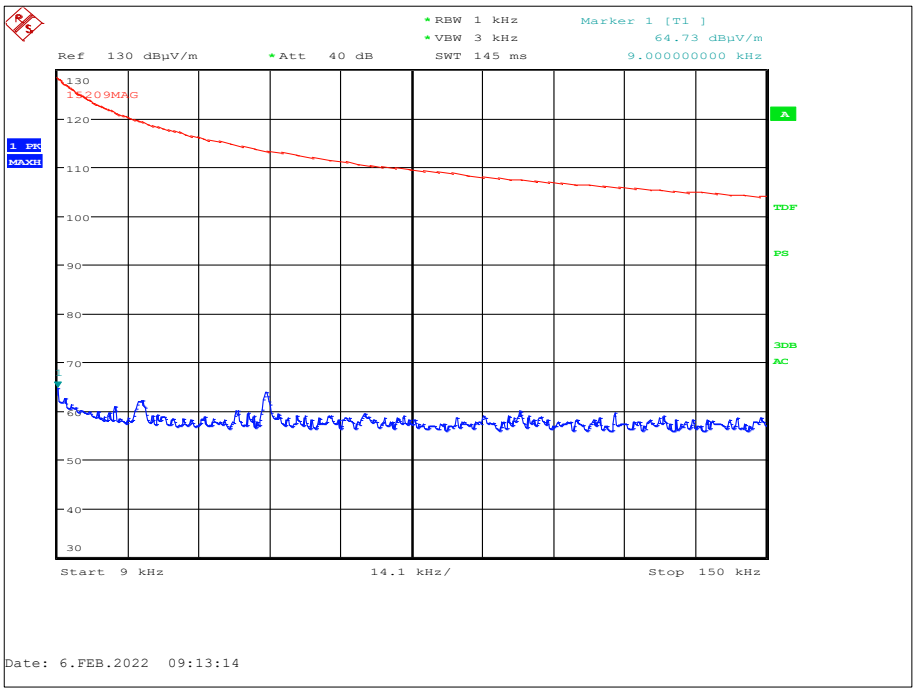

Figure 4 - 9 kHz to 150 kHz - Y Orientation

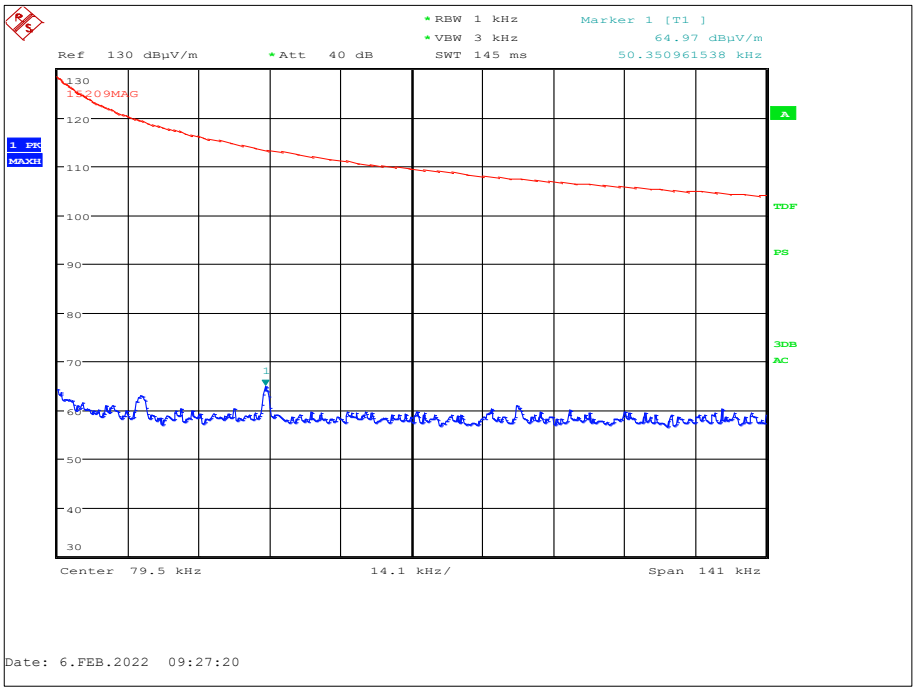

Figure 5 - 9 kHz to 150 kHz - Z Orientation

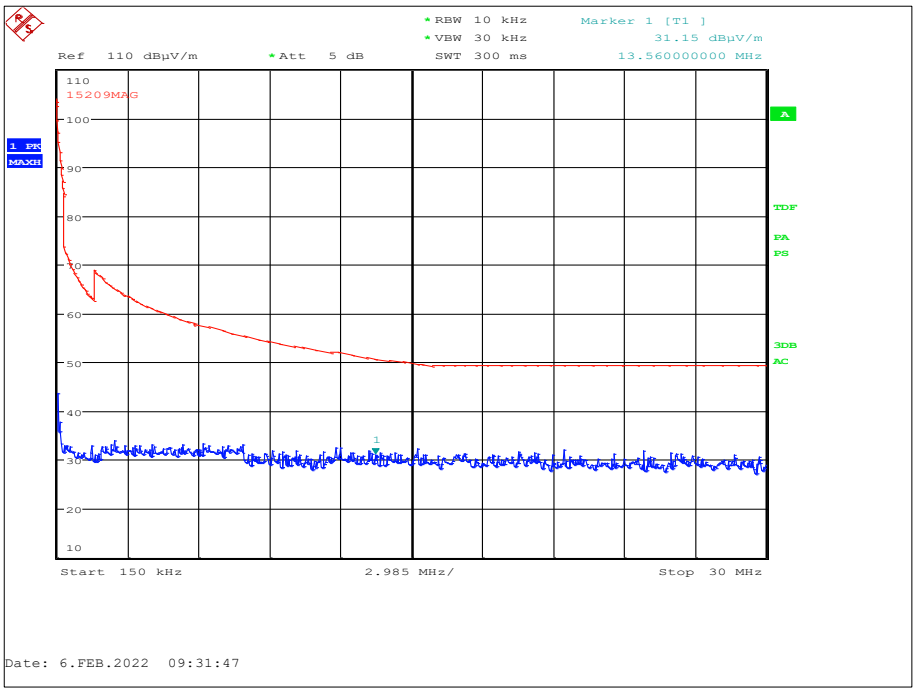

Figure 6 - 150 kHz to 30 MHz - X Orientation

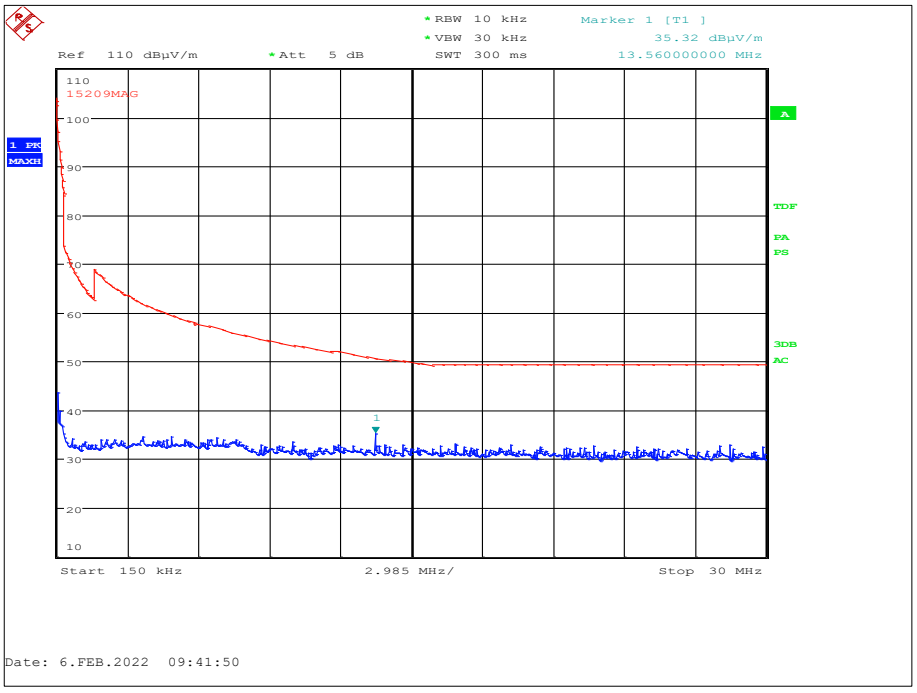

Figure 7 - 150 kHz to 30 MHz - Y Orientation

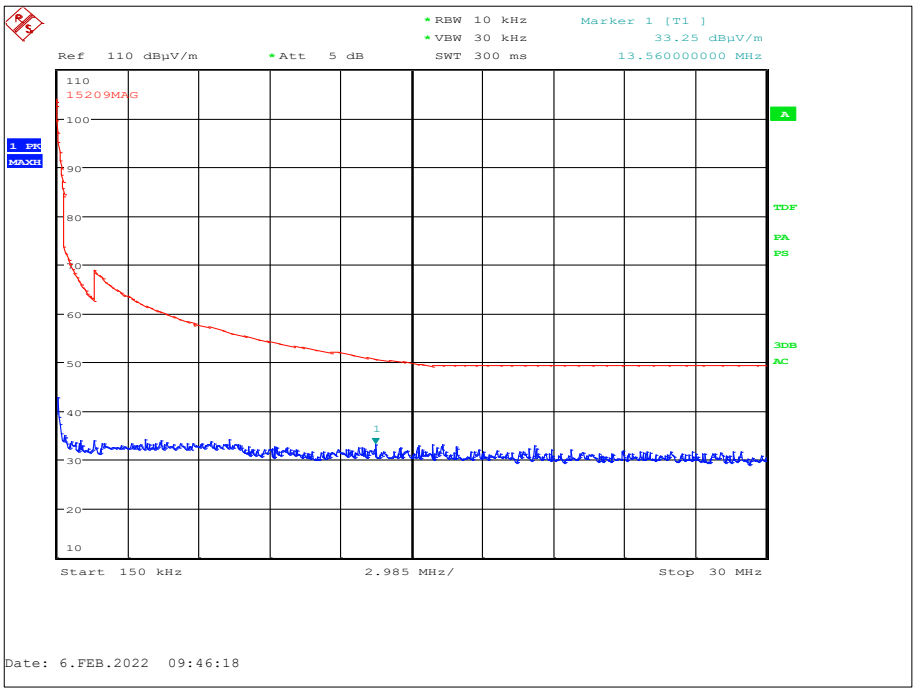

Figure 8 - 150 kHz to 30 MHz - Z Orientation

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

Table 20 - 30 MHz to 1 GHz

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

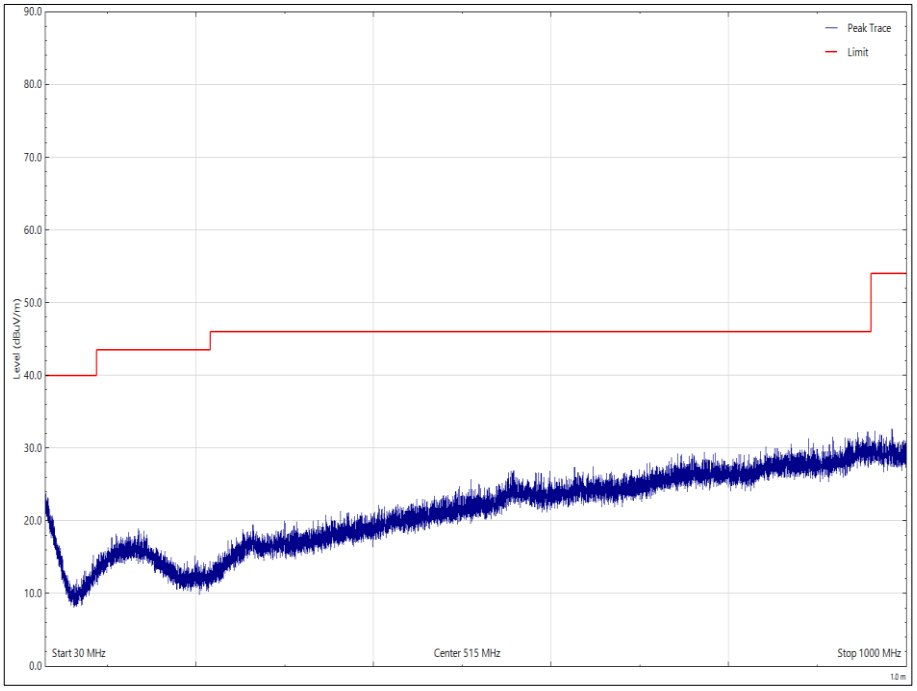

Figure 9 - 30 MHz to 1 GHz, Vertical

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

Table 21 - 30 MHz to 1 GHz

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

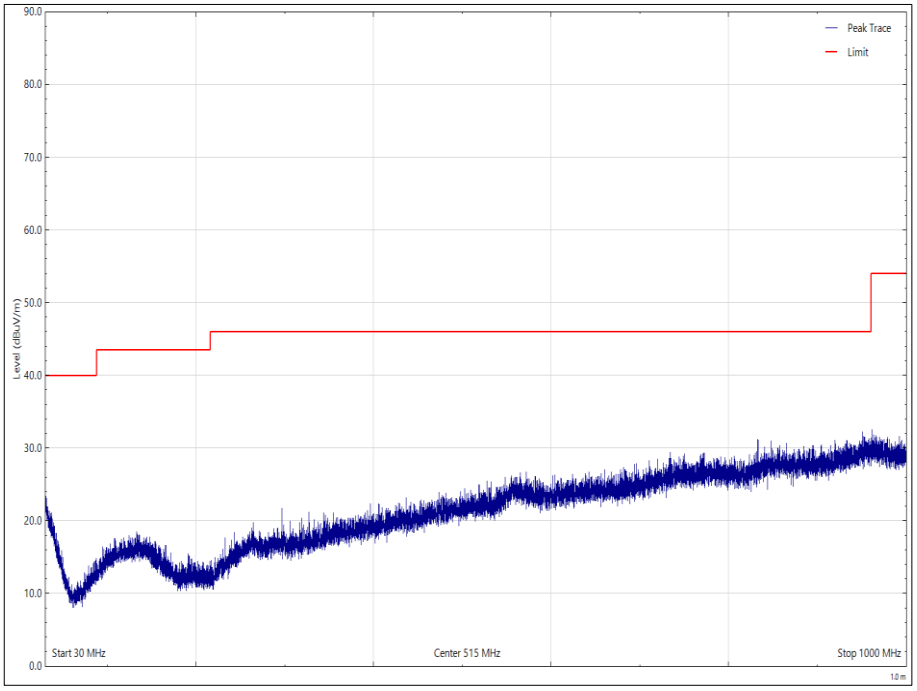

Figure 10 - 30 MHz to 1 GHz, Horizontal

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

Table 22 - 30 MHz to 1 GHz

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

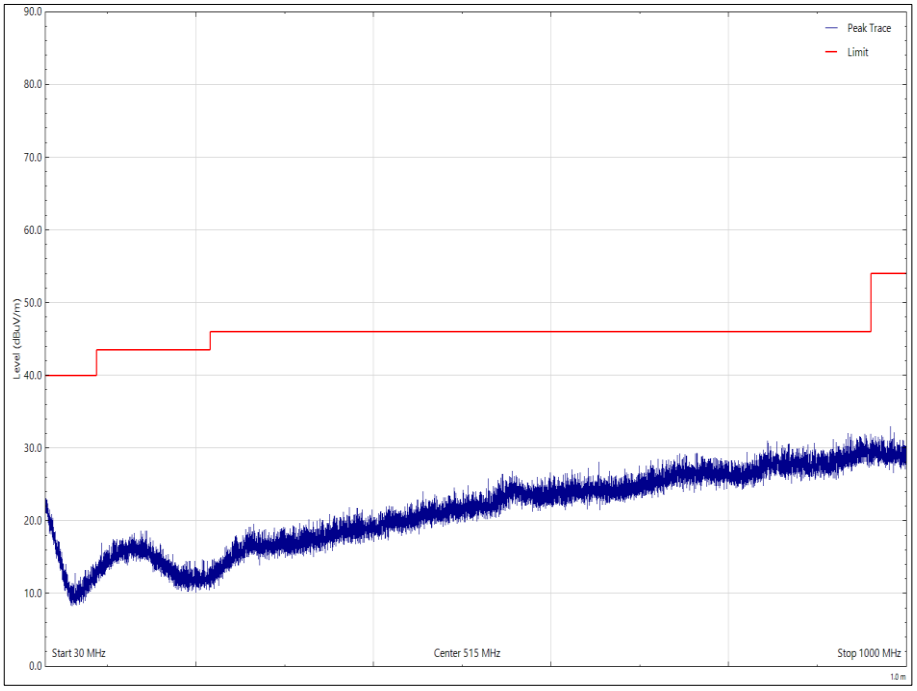

Figure 11 - 30 MHz to 1 GHz, Vertical

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

Table 23 - 30 MHz to 1 GHz

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

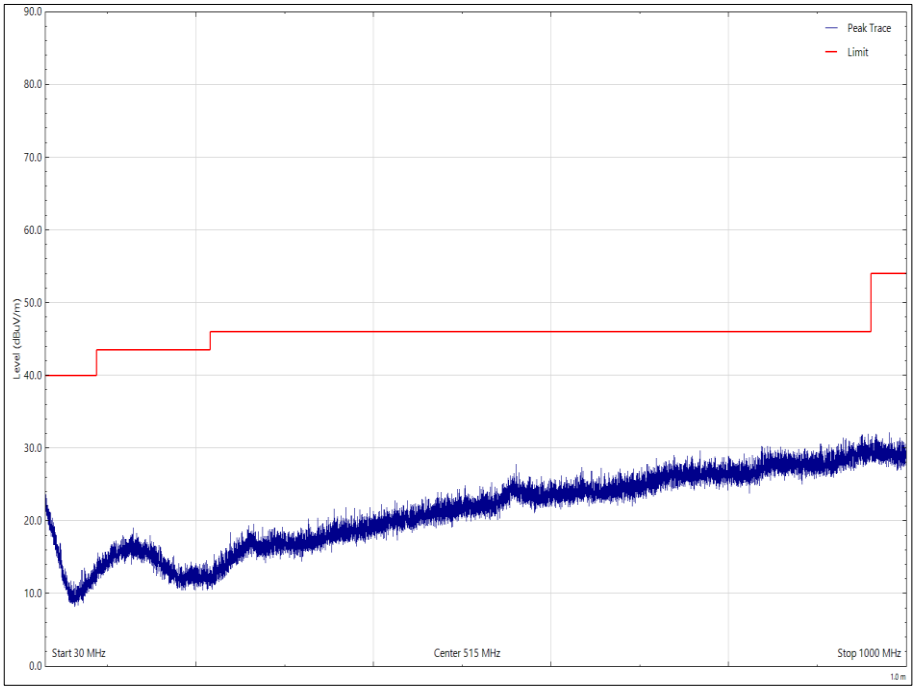

Figure 12 - 30 MHz to 1 GHz, Horizontal

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

Table 24 - 30 MHz to 1 GHz

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

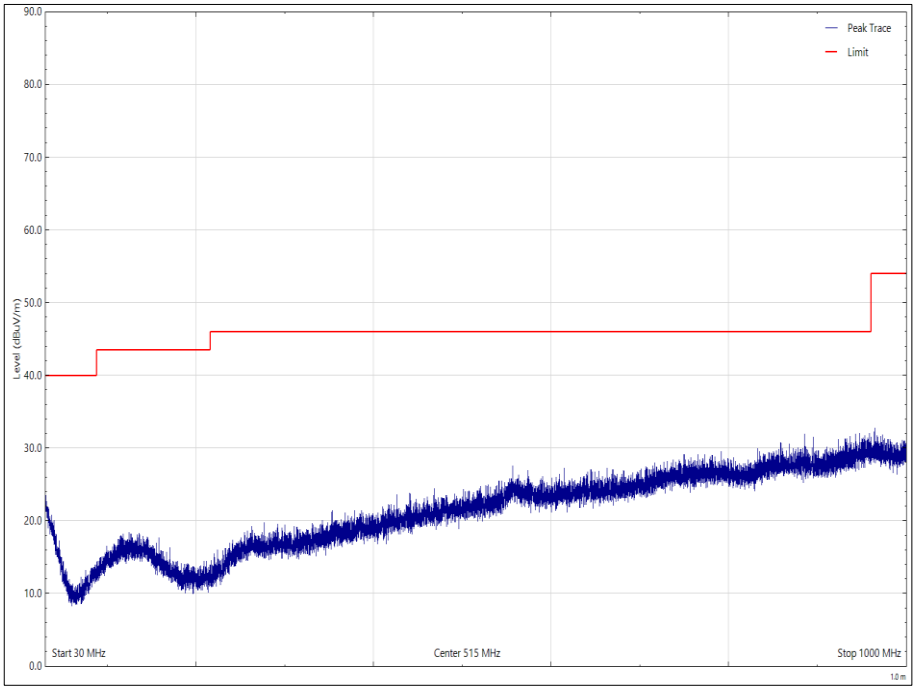

Figure 13 - 30 MHz to 1 GHz, Vertical

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

Table 25 - 30 MHz to 1 GHz

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

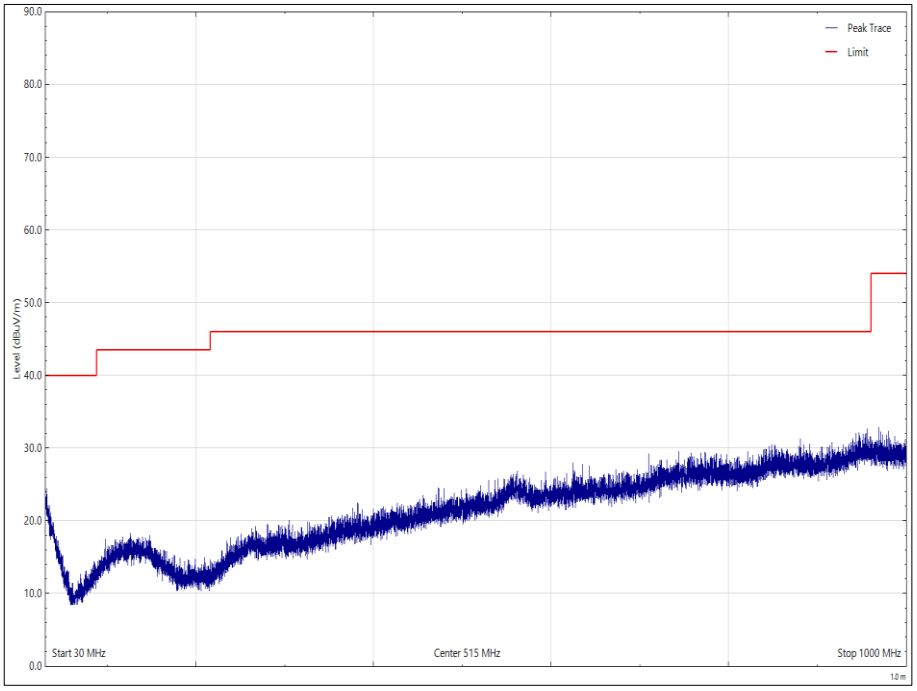

Figure 14 - 30 MHz to 1 GHz, Horizontal

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FCC 47 CFR Part 15, Limit Clause 15.225 (a)(b)(c)(d)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1.705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5

Table 26

2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
Comb Generator	Schaffner	RSG1000	3034	-	TU
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Emissions Software	TUV SUD	EmX V2.1.11 V.2.1.11	5125	-	Software
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Antenna (Bi-Log, 30 MHz to 1 GHz)	Teseq	CBL6111D	5615	24	16-Oct-2022
Antenna (Loop, 9 kHz to 30 MHz)	Teseq	HLA	5616	24	01-Jul-2022
Power Injector	Teseq	PI 6121	5620	24	01-Jul-2022
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023

Table 27

TU – Traceability Unscheduled

2.3 Frequency Tolerance Under Temperature Variations

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (e)

2.3.2 Equipment Under Test and Modification State

H4, S/N: Not Serialised (FAR-0633998-002) - Modification State 0

2.3.3 Date of Test

16-February-2022

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.8.

The worst frequency deviation across the ON time intervals (start up, 2, 5 and 10 minutes) was recorded for each of temperature variations.

2.3.5 Environmental Conditions

Ambient Temperature	24.3 °C
Relative Humidity	39.6 %

2.3.6 Test Results

13.56 MHz RFID

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
+50.0 °C	4.2 V DC	13.55986	-0.00103245	-10.32
+40.0 °C	4.2 V DC	13.55988	-0.00088496	-8.85
+30.0 °C	4.2 V DC	13.559895	-0.00077434	-7.74
+20.0 °C	4.2 V DC	13.559925	-0.00055310	-5.53
+10.0 °C	4.2 V DC	13.55994	-0.00044248	-4.42
0.0 °C	4.2 V DC	13.559935	-0.00047935	-4.79
-10.0 °C	4.2 V DC	13.55991	-0.00066372	-6.64
-20.0 °C	4.2 V DC	13.559855	-0.00106932	-10.69

Table 28 - Frequency Tolerance Under Temperature Variation

FCC 47 CFR Part 15, Limit Clause 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1 and RF Laboratory 2.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Loop Antenna	Solar	7334-1	4215	24	02-Jul-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	12-Apr-2022
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5429	12	23-Jun-2022
Signal Analyzer	Keysight Technologies	PXA N9030B	5432	12	20-Aug-2022

Table 29

3 Photographs

3.1 Test Setup Photographs

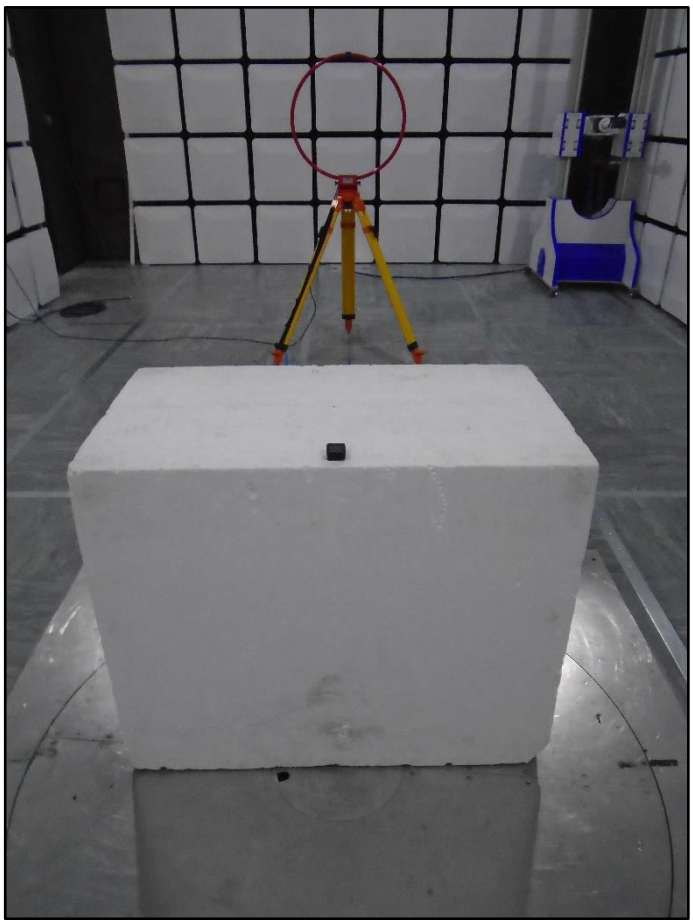

Figure 15 – Test Setup – 9 kHz to 30 MHz, Orientation X

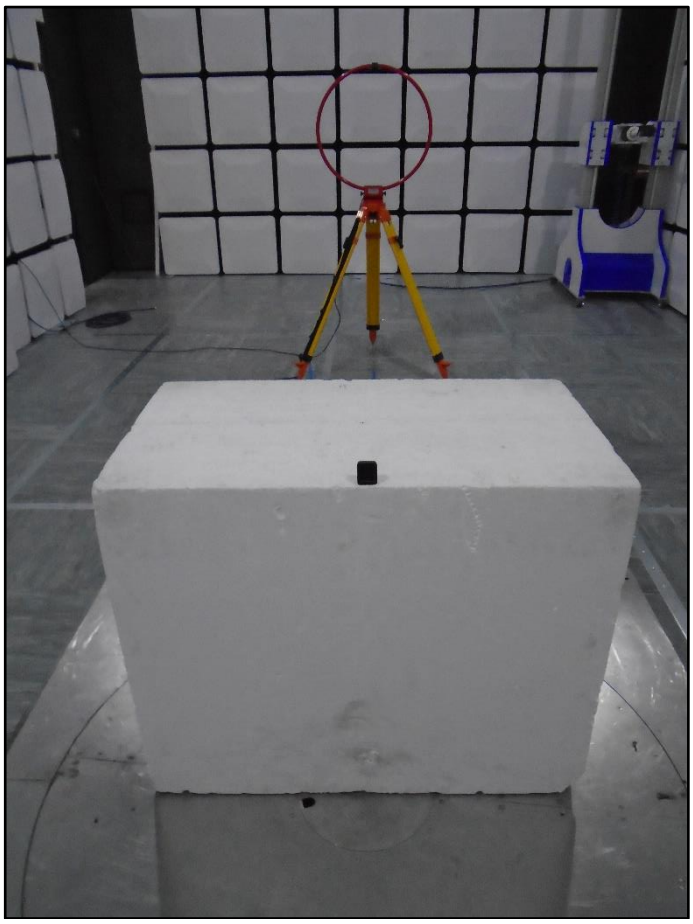

Figure 16 – Test Setup – 9 kHz to 30 MHz, Orientation Y

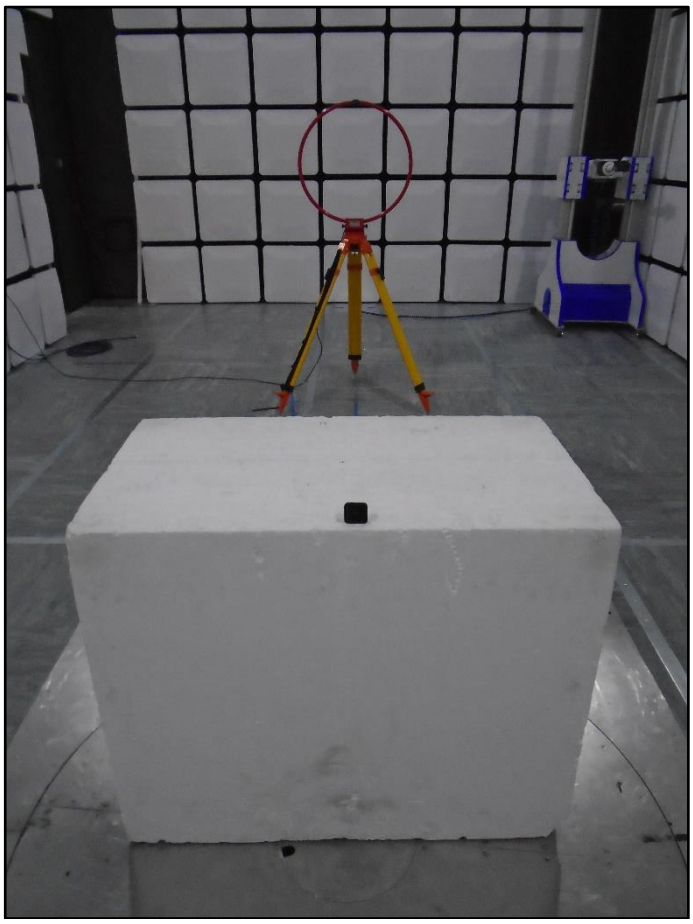

Figure 17 – Test Setup – 9 kHz to 30 MHz, Orientation Z

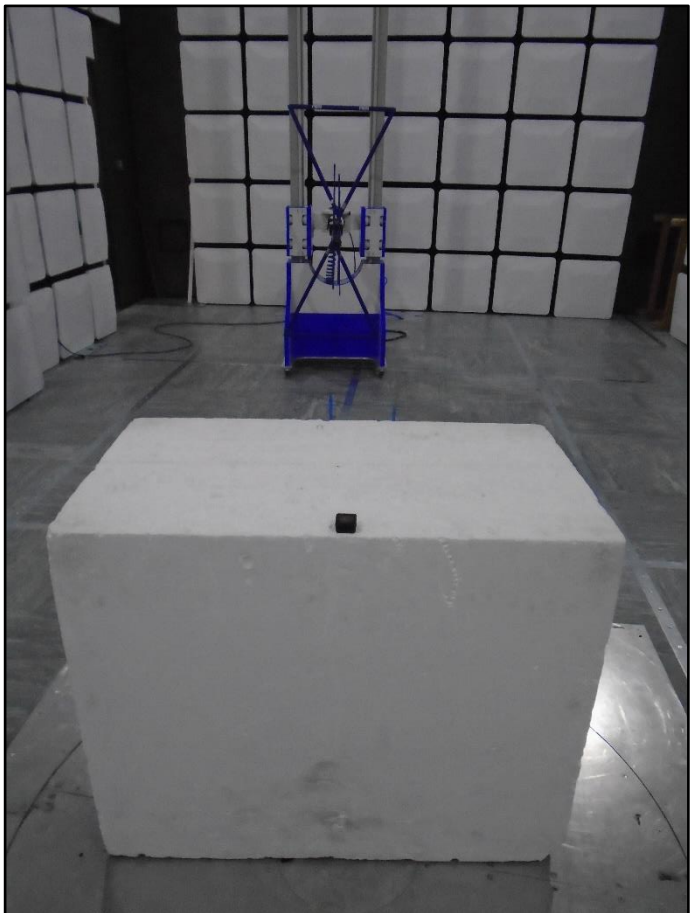

Figure 18 – Test Setup – 30 MHz to 1 GHz, Orientation X

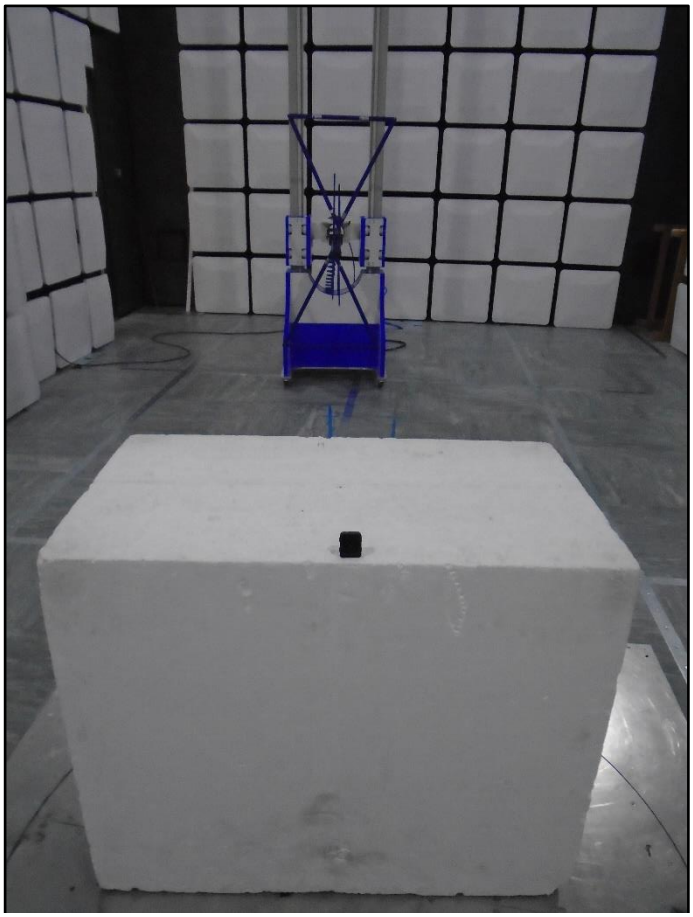

Figure 19 – Test Setup – 30 MHz to 1 GHz, Orientation Y

Figure 20 – Test Setup – 30 MHz to 1 GHz, Orientation Y

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
20 dB Bandwidth	± 93.27
Field Strength of any Emission	9 kHz to 30 MHz: ± 3.4 dB 30 MHz to 1 GHz: ± 5.2 dB
Frequency Tolerance Under Temperature Variations	± 18.807 Hz

Table 30

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.