

FCC Test Report

Shot Scope Technologies Ltd
GPS + Performance tracking watch,
Model: V3 SS03

In accordance with FCC 47 CFR Part 15C

Prepared for: Shot Scope Technologies Ltd
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FCC ID: 2AHWR-SS04

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Document 75947856-07 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	11 May 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. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Nandhini Mathivanan	11 May 2020	
Testing	Graeme Lawler	11 May 2020	

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: 2019 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	11 May 2020

Table 1

1.2 Introduction

Applicant	Shot Scope Technologies Ltd
Manufacturer	Shot Scope Technologies Ltd
Model Number(s)	V3 SS03
Serial Number(s)	Not serialised (0075947856-TSR0001) Not serialised (0075947856-TSR0004)
Hardware Version(s)	1.0
Software Version(s)	1.0
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019
Order Number	2019-0069 TUV
Date	06-January-2020
Date of Receipt of EUT	18-March-2020
Start of Test	25-March-2020
Finish of Test	09-April-2020
Name of Engineer(s)	Nandhini Mathivanan and Graeme Lawler
Related Document(s)	ANSI C63.10 (2013)



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	ANSI C63.10 (2013)
2.2	15.225 (a)(b)(c)(d)	Field Strength of any Emission	Pass	ANSI C63.10 (2013)
2.3	15.225 (e)	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)

Table 2



1.4 Application Form

Equipment Description

Technical Description: (Please provide a brief description of the intended use of the equipment)	Shot Scope V3 is a watch 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:	SS03
Part Number:	V3
Hardware Version:	1.0
Software Version:	1.0
FCC ID (if applicable)	2AHWR-SS04
IC ID (if applicable)	Not Applicable

Intentional Radiators

Technology	BLE
Frequency Band (MHz)	2402 – 2480
Conducted Declared Output Power (dBm)	-2
Antenna Gain (dBi)	1.7
Supported Bandwidth(s) (MHz)	2
Modulation Scheme(s)	GFSK
ITU Emission Designator	1M05F1D
Bottom Frequency (MHz)	2402
Middle Frequency (MHz)	2440
Top Frequency (MHz)	2480

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:	5	V
Extreme upper voltage:	5.5	V
Extreme lower voltage:	4.5	V
Max current:	0.1	A

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:	

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒
---	---

Temperature

Minimum temperature:	0	°C
Maximum temperature:	50	°C

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 ☐					

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

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

Name: Lewis Allison
Position held: Chief Technology Officer
Date: 20/03/20

1.5 Product Information

1.5.1 Technical Description

Shot Scope V3 is a watch 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.

1.5.2 Test Setup Diagram(s)

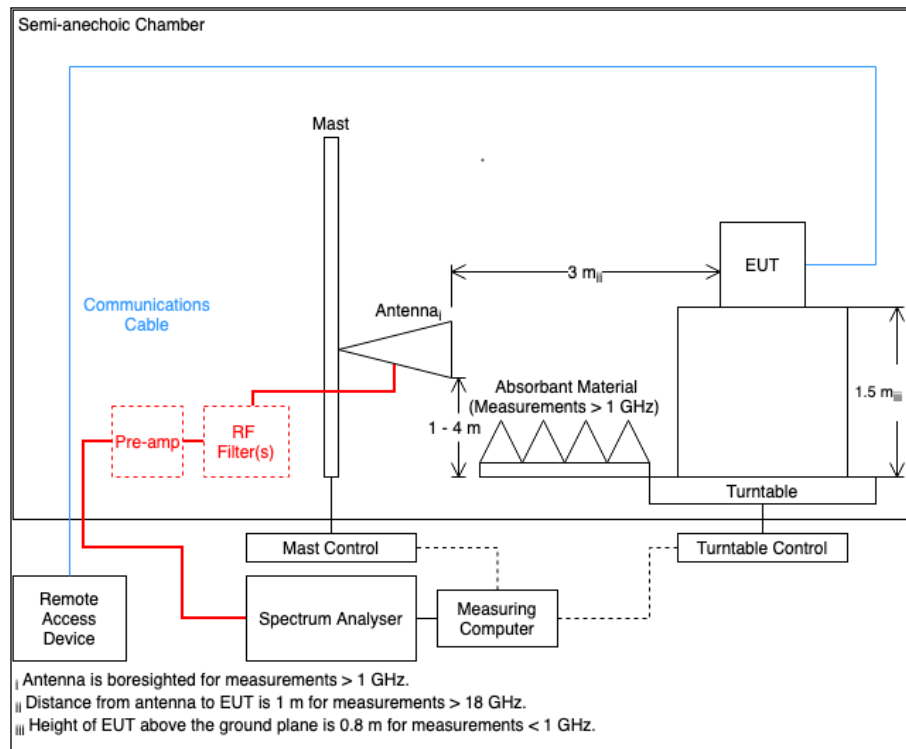


Figure 1 – Radiated Spurious Emissions

1.5.3 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was placed on the non-conducting platform. The EUT can be used in multiple planes, therefore pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

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: V3 SS03, Serial Number: Not serialised (0075947856-TSR0001)			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: V3 SS03, Serial Number: Not serialised (0075947856-TSR0004)			
0	As supplied by the customer	Not Applicable	Not Applicable

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

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
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

V3 SS03, S/N: Not serialised (0075947856-TSR0004) - Modification State 0

2.1.3 Date of Test

09-April-2020

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.1.

2.1.5 Environmental Conditions

Ambient Temperature 23.4 °C

Relative Humidity 37.7 %

2.1.6 Test Results

13.56 MHz RFI

Frequency (MHz)	20 dB Bandwidth (Hz)
13.560	439

Table 5

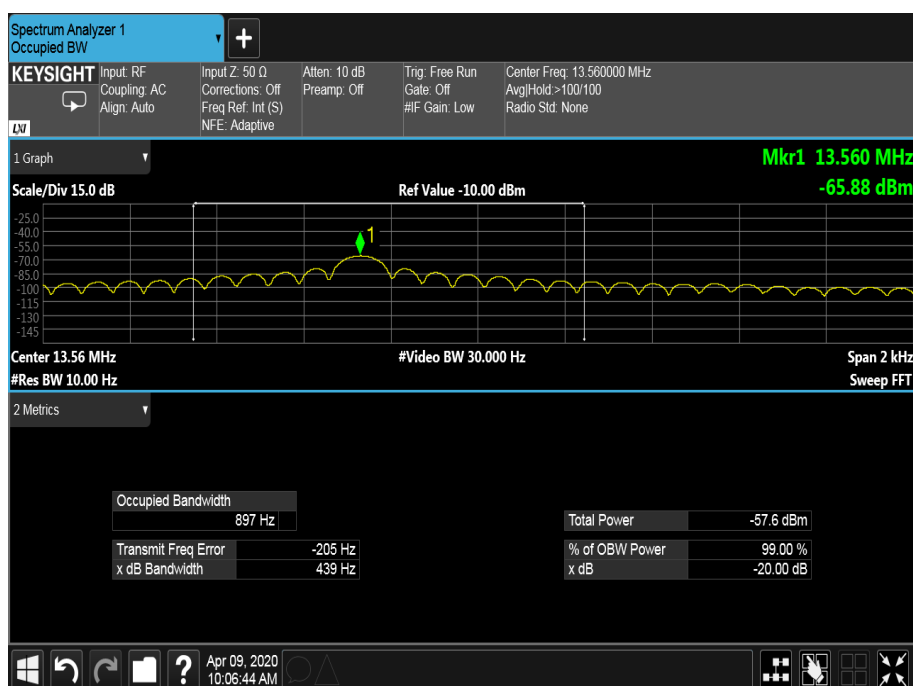


Figure 2



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 Due
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
RF Coupler	TUV SUD	TÜV	415	-	TU
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
EXA	Keysight Technologies	N9010B	4968	24	23-Dec-2021
Cable (18 GHz)	Rosenberger	LU7-071-2000	5106	12	09-Dec-2020

Table 6

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment



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

V3 SS03, S/N: Not serialised (0075947856-TSR0001) - Modification State 0

2.2.3 Date of Test

25-March-2020

2.2.4 Test Method

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

Pre-scan measurements were made at a distance of 3 m as shown by the plots below using a peak detector. Final emission measurements were then made using a Quasi-Peak detector and recorded in the tables below. The limit lines shown on the plot were extrapolated from either 300 m or 30 m to the measurement distance of 3 m in accordance with ANSI C63.10 Clause 6.4.4.2.

2.2.5 Environmental Conditions

Ambient Temperature	19.7 °C
Relative Humidity	21.1 %

2.2.6 Test Results

13.56 MHz RFiD

Frequency	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	63.08	41.69	121.48	1425.61	289	150	Vertical

Table 7 - Carrier Results



Figure 3 - Plot of the Fundamental 13.56 MHz

13.56 MHz RfID, Field Strength of any Emission Results, 9 kHz to 30 MHz

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

Table 8

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

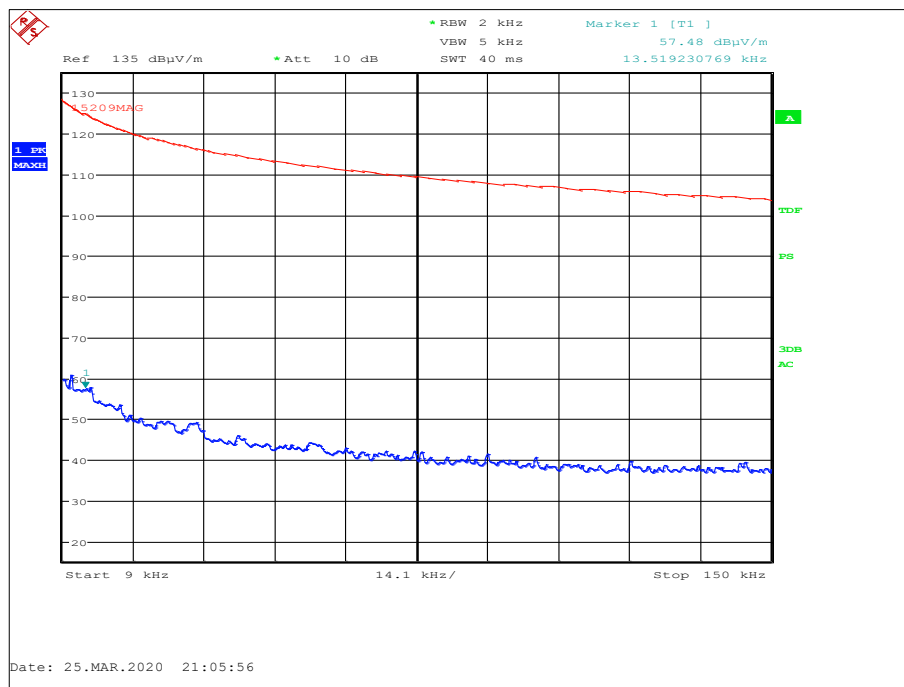


Figure 4 - 9 kHz to 150 kHz

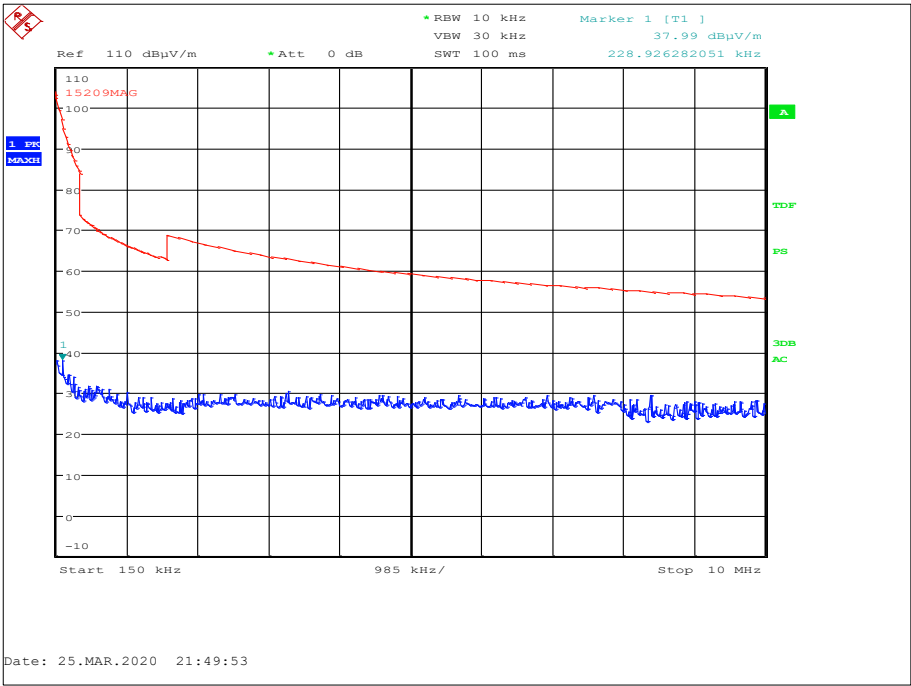


Figure 5 - 150 kHz to 10 MHz

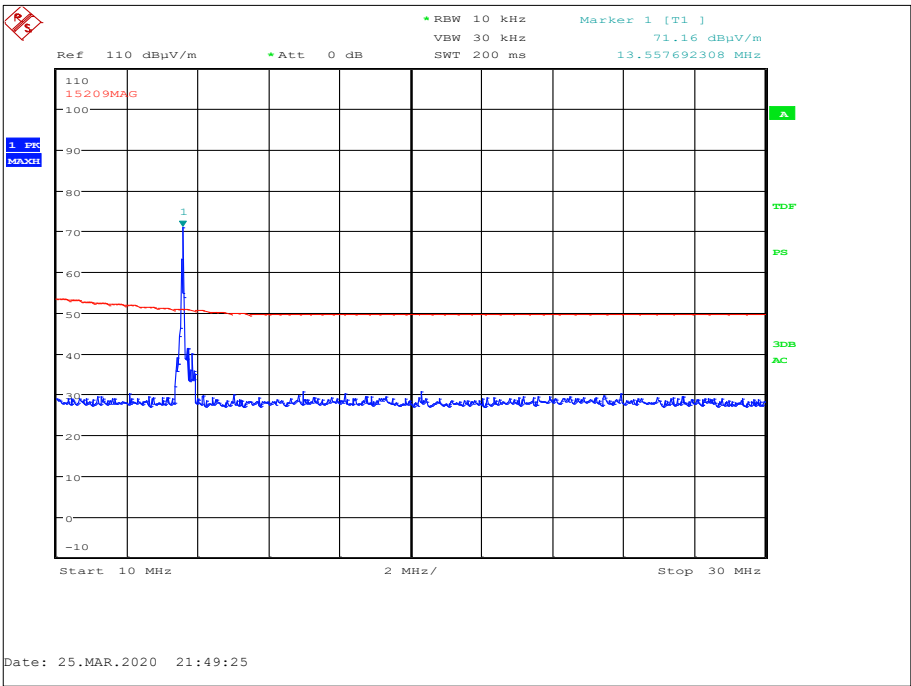


Figure 6 - 10 MHz to 30 MHz



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

Table 9 - 30 MHz to 1 GHz

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

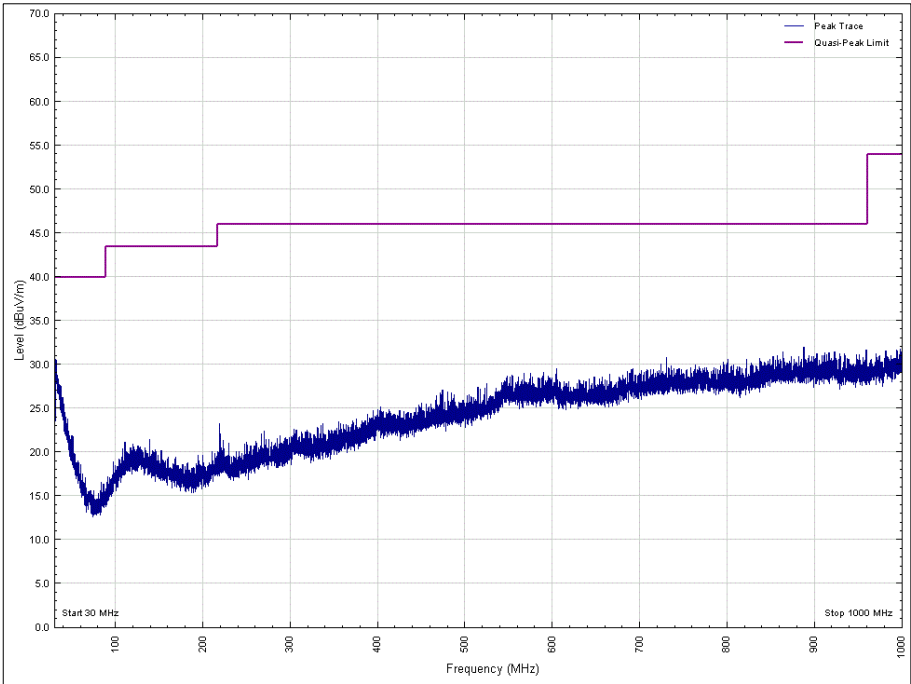


Figure 7 – 30 MHz to 1 GHz, Vertical

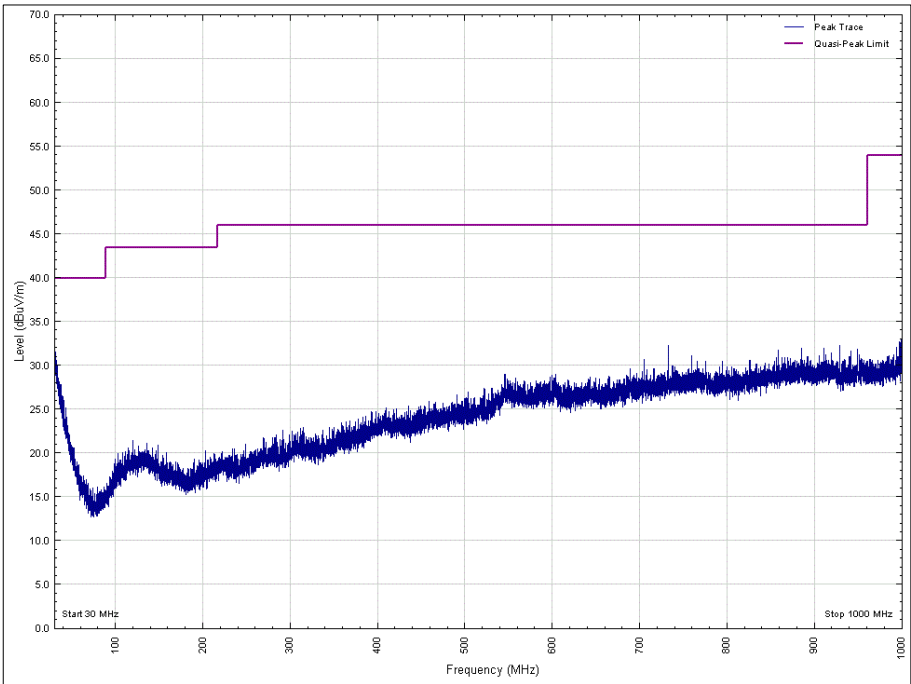


Figure 8 - 30 MHz to 1 GHz, Horizontal



1705 to 30 in limit table should read 1.705 to 30 (template probably needs updatingRemarks

The level at 30 m was calculated using the dB μ V/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 μ V/m.

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 (μ V/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 10



2.2.7 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
Dual Power Supply Unit	Thurlby	PL320	288	-	O/P Mon
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	11-Jan-2021
Antenna (Dish/Tripod/Adaptor, 1GHz-18GHz)	Rohde & Schwarz	AC-008	334	-	TU
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
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
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	03-Jan-2021
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
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EmX Emissions Software	TUV SUD	EmX V.V1.5.8	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	06-Feb-2021

Table 11

TU – Traceability Unscheduled

O/P Mon – Output Monitored Using Calibrated Equipment



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

V3 SS03, S/N: Not serialised (0075947856-TSR0004) - Modification State 0

2.3.3 Date of Test

09-April-2020

2.3.4 Test Method

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

This test was performed using a fully charged battery.

2.3.5 Environmental Conditions

Ambient Temperature 23.4 °C

Relative Humidity 37.7 %

2.3.6 Test Results

13.56 MHz RFiD

Temperature	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
-20.0 °C	13.559810	0.0014	14.01
-10.0 °C	13.559816	0.0014	13.57
0 °C	13.559806	0.0014	14.31
+10.0 °C	13.559786	0.0016	15.78
+20.0 °C	13.559750	0.0018	18.44
+30.0 °C	13.559698	0.0022	22.27
+40.0 °C	13.559668	0.0024	24.48
+50.0 °C	13.559646	0.0026	26.11

Table 12 - 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.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
Digital Temperature Indicator + T/C	Fluke	51	412	12	23-Sep-2020
RF Coupler	TUV SUD	TÜV	415	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
EXA	Keysight Technologies	N9010B	4968	24	23-Dec-2021
Cable (18 GHz)	Rosenberger	LU7-071-2000	5106	12	09-Dec-2020

Table 13

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Test Setup Photographs

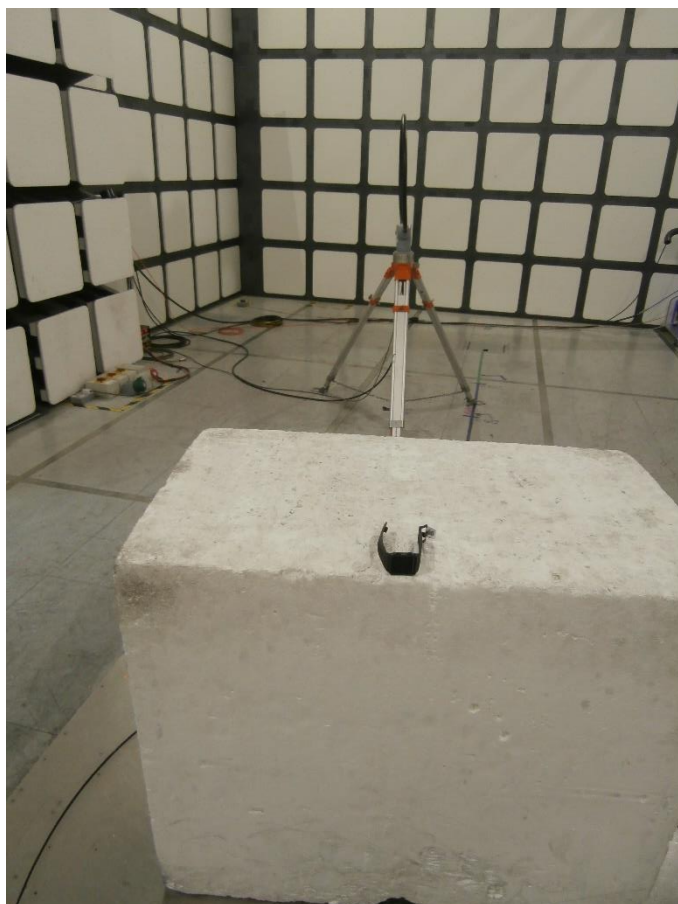


Figure 9 – 9 kHz to 30 MHz, Edge On

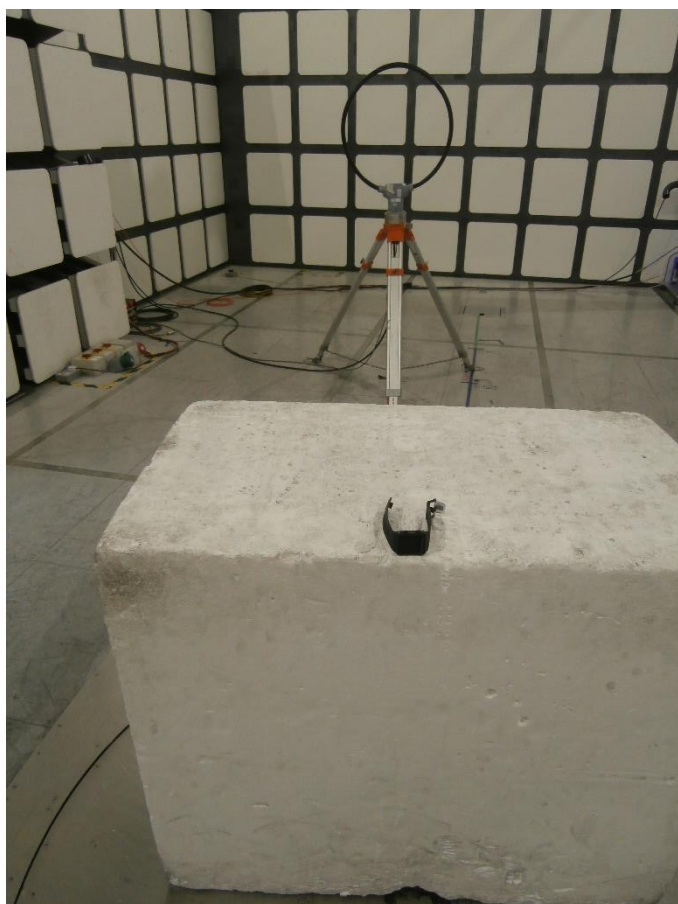


Figure 10 – 9 kHz to 30 MHz, Face On

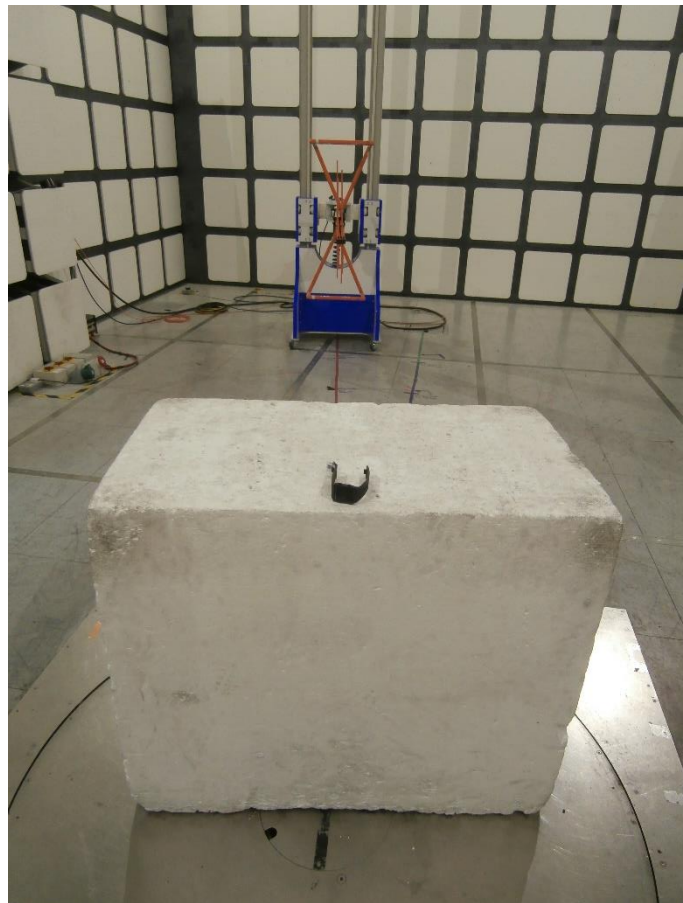


Figure 11 – 30 MHz to 1 GHz



4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Frequency Tolerance Under Temperature Variations	± 33.89 Hz
Field Strength of any Emission	9 kHz to 30 MHz: ± 3.4 dB 30 MHz to 1 GHz: ± 5.2 dB
20 dB Bandwidth	± 19.50 Hz

Table 14

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.