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Test Report for the FCC and ISED Testing of a R-Link Wearable Watch to FCC Rules 47CFR 15.225 for Reactec Ltd

Test Report number: C15087TR3
Project number: G4062

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Issue	Description						Issue by	Date
2	Copy 1		Copy 2		PDF	√	JB	21st September 2023

Registered Address:
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Registered in England and Wales
Company Reg. No. 6048589
VAT Reg. No. GB 887 1276 83

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Test Report Change History

Issue	Date	Modification Details
1	7th June 2023	First Issue
2	25th August 2023	HVIN and FVIM updated
3	21st September 2023	References to RSS updated
4		
5		
6		
7		
8		
9		
10		

Section 1 Test Location

All testing was performed at;

Eurofins York	Unit 5
	Speedwell Road
	Castleford
	WF10 5PY
Tel:	01977 731173
Website	http://www.yorkemc.co.uk
UKAS Testing No.	1574

1.1 UKAS Accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Eurofins York latest accreditation schedule can be found at:
http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

Eurofins York Castleford Laboratory, is an Accredited facility recognised by the Federal Communications Commission (FCC) for certification testing. The appropriate FCC Designation Number is UK2013, dated 1st March 2021.

Eurofins York Castleford Laboratory is recognised by ISED for certification testing.
ISED Assigned Code: 22959

Section 2 Customer Information

Company name	Reactec Ltd
Address	Vantage Point
	3 Cutlins Road
	Edinburgh
	EH11 4DF
	United Kingdom
Contact	Mr Peter Gillespie
Email	PeterGillespie@reactec.com

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

Date received:	19th May 2023		
EUT name:	R-Link Wearable Watch		
PMN:	RLW-001		
HVIN:	A		
FVIN:	N/A		
Serial no/s:	P01 & P02		
EUT description:	Battery powered wristband vibration and proximity monitor for the purpose of measuring HAV (Hand Arm Vibration). EUT equipped with the following radio technology: Ultra Wideband Radio (Channel 5 and 9 supported) and BLE (2042MHz to 2480MHz) and RFID operating at 13.56MHz.		
Antenna	Internal Molex 1462360111 RFID Antenna		
Transmission	RFID		
Modulation schemes	Sub carrier load modulation		
Operating frequency	13.56MHz		
No of units tested:	Two		
EUT power:	5.0± 0.25V DC. Tested whilst the internal battery was being charged by a bench PSU.		
Highest internal frequency:	13.56MHz		
Size of EUT (m)	Length: 39 mm	Width: 39 mm	Height: 16 mm
Mode/s of operation:	RFID active operating at 13.56MHz		
Test software:	None		
Modifications incorporated during testing:	A temporary SMA connection was added to the second sample for the frequency stability & 20MHz bandwidth test.		

Ports and Cables	Cable Length	Screened/ unscreened	Connected to
SMA cable	25cm	Screened	Spectrum analyser
DC +5V	25cm	Unscreened	Bench PSU
DC Ground	25cm	Unscreened	Bench PSU

Radio Module(s)

Module	Frequency Range (MHz)	FCC Status	FCC ID
NXP CLRC6603 NFC 13.56MHz RFID	13.56	Not certified	-
Murata LBUA5QJ2AB Combo Module	BLE: 2402MHZ to 2480MHz UWB: 6250MHz to 8250MHz	Certified	VPYLB2AB

3.2 EUT Photographs

Photographs are supplied separately.

3.3 Configuration of EUT

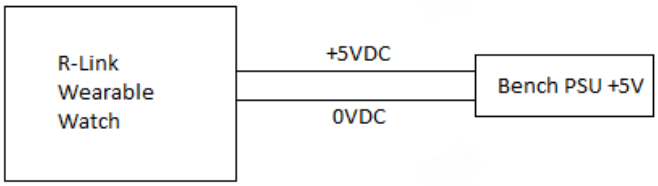

Figure 1 Diagram of EUT.

The apparatus contains the radio modules listed in table above in Section 3.1.

3.4 EUT Monitoring/Auxiliary Equipment

Bench PSU supplying +5VDC

3.5 Monitoring Software

None. The RFID operation was enabled via buttons on the EUT prior to testing.

Section 4 Test Specifications

The tests were performed in accordance with Eurofins York Quotation G4062.

For USA:

47CFR Part 15, Sub Part C Intentional Radiators **Section 15.225 Operation within the band 13.110-14.010MHz.** **Section 15.215 Additional provisions to the general radiated emission limitations. Section (C) 20dB bandwidth.**			
Which references the following test standard 47CFR 15.38 (G) (3): -			
ANSI C63-10: 2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.			
Test	**Method**	**Levels**	**Result**
Radiated Emissions Magnetic Field Measurements (Expressed as electric field) (9kHz to 30MHz) And Electric Field Measurements (30MHz – 1000MHz)	ANSI C63.10: 2013	(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.	Pass
Section 15.225 (e) – Frequency tolerance of the carrier signal	ANSI C63.10: 2013	The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage	Pass
Section 15.31(e) Field strength variation with operating voltage	ANSI C63.10: 2013	For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.	Pass
Section 15.215(C) 20dB bandwidth of the emission	ANSI C63.10: 2013	20dB bandwidth must remain within assigned frequency band	Pass

Note 1 :All radiated testing was carried out at a test distance of 3m and the data adjusted accordingly.

For Canada:

Regulation / Test Standard	RSS-210 Licence-Exempt Radio Apparatus: Category I Equipment Issue 10 August 2019 And, RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 5 April 2018 +A1 March 2019 +A2 February 2021

Requirement	ISED Regulation	Comments	Results Summary
Radiated Emissions Magnetic Field Measurements (Expressed as electric field) (9kHz to 30MHz) And Electric Field Measurements (30MHz – 1000MHz)	ISED RSS-210 § B.6 Referencing ISED RSS-Gen	Applies	Pass
Frequency tolerance of the carrier signal	ISED RSS-210 § B.6	Applies	Pass

4.1 Knowledge Database References

The following KDBs were referenced during the testing.
The latest knowledge database references are available via the FCC KDB website at:

https://apps.fcc.gov/kdb

4.1.1 Radiated Emissions (9kHz to 30MHz)

Publication Number	Keyword	Publication Date
414788	Test Site Requirements for Part 15 and 18 devices below 30Mhz	12/07/2018
460108	Radiated emission measurements below 30 MHz	12/17/2018

4.1.2 Radiated Emissions (30MHz to 1000MHz)

Publication Number	Keyword	Publication Date
746324	CE Mark and use of CISPR 22 limits	09/07/2018
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017

4.1.3 Radiated Emissions (1GHz to 40GHz)

Publication Number	Keyword	Publication Date
746324	CE Mark and use of CISPR 22 limits	09/07/2018
714737	15B, Average Detector for Unintentional Radiator	30/11/2010
414788	Test Site Validation Requirements above 1 GHZ.	12/07/2018
414788	Comparison Noise Emitter (CNE), reference noise source.	12/07/2018
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017
414788	Comparison Noise Emitters (CNE), test equipment, Broadband.	12/07/2018

4.1.4 Radiated Emissions - Apparatus Containing a Modular Transmitter

Publication Number	Keyword	Publication Date
996369	Modular Transmitter Integration Guide – Guidance for Host Product Manufacturers, Frequency Spectrum to be Investigated	24/04/2023

4.2 Compliance Statement

The R-Link Wearable Watch, as tested, was shown to meet requirements of the standards listed in Section 4 of this report.

Section 5 Radiated Emission Results

5.1 Test Specification

FCC Rule Part	47CFR 15.225 Operation in the band 13.110-14.010MHz
RSS Rule Part	ISED RSS-210 § B.6 Referencing ISED RSS-Gen
Standard	ANSI C63.10:2013
Measurement Uncertainty Radiated tests	The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95% is +/- 4.56dB for the frequency range from 9kHz to 30MHz +/- 6.26dB for the frequency range 30MHz to 1GHz +/- 5.16dB for the frequency range from 1GHz to 6GHz +/- 5.45dB for the frequency range from 6GHz to 18GHz +/- 5.25dB for the frequency range from 18GHz to 40GHz

5.2 Procedure and Test Software Version

Radiated tests:- 47CFR15.205, 47CFR15.209 and ISED RSS-Gen

Eurofins York Test procedure (9kHz to 30MHz)	CEP22 Issue 8
Eurofins York test procedure (30MHz to 1GHz)	CEP23 Issue 9
Eurofins York test procedure (1GHz to 40GHz)	CEP64 Issue 10
Test software	RadiMation Version 2016.2.8

5.3 Magnetic Field Radiated Emissions (9kHz to 30MHz)

5.3.1 Limits

Frequency	Limits (dBµV/m)
9kHz to 490kHz	2400/F(kHz) at 300m
490kHz to 1.705MHz	24000/F(kHz) at 30m
1,705MHz to 30MHz	30 at 30m

Note 1: FCC 47 CFR Part 15 Section 15.209 has different test limits from 300m to 30m depending upon the measurement frequency range. The measured was adjusted for a measurement distance of 3m.
Distance Correction Factor = 40log(test distance /specific distance).

5.3.2 Receiver Settings

Receiver Parameters	Setting
Detector Function	Peak
Start Frequency	9kHz
Stop Frequency	150Hz
Resolution Bandwidth	200Hz
Video Bandwidth	Auto

Receiver Parameters	Setting
Detector Function	Peak
Start Frequency	150kHz
Stop Frequency	30MHz
Resolution Bandwidth	10kHz
Video Bandwidth	Auto

Spectrum Mask: Analyser Settings within the bands,

13.553-13.567 MHz, 13.410-13.553 MHz, 13.567-13.710 MHz, 13.110-13.410 MHz and 13.710-14.010 MHz

Receiver Parameters	Setting
Detector Function	Peak – for initial investigation
Start Frequency	13.110MHz
Stop Frequency	14.010MHz
Resolution Bandwidth	10kHz
Video Bandwidth	30kHz

5.3.3 Emissions measurements

5.3.4 Date of Test

22nd May 2023

5.3.5 Test Area

LAB 5 (FAR)

5.3.6 Tested by

L Trickett

5.3.7 FAR Test Setup

The EUT was configured in the FAR on an 80cm high table.

The measurement was then performed with an antenna to EUT separation distance of 3m within the semi-anechoic chamber based upon the highest emissions results recorded on the outside test site.

The centre of the loop antenna was 1m above the ground and results were obtained with it parallel to the EUT and then perpendicular to the EUT.

The results are maximised in orientation 0-360 degrees.

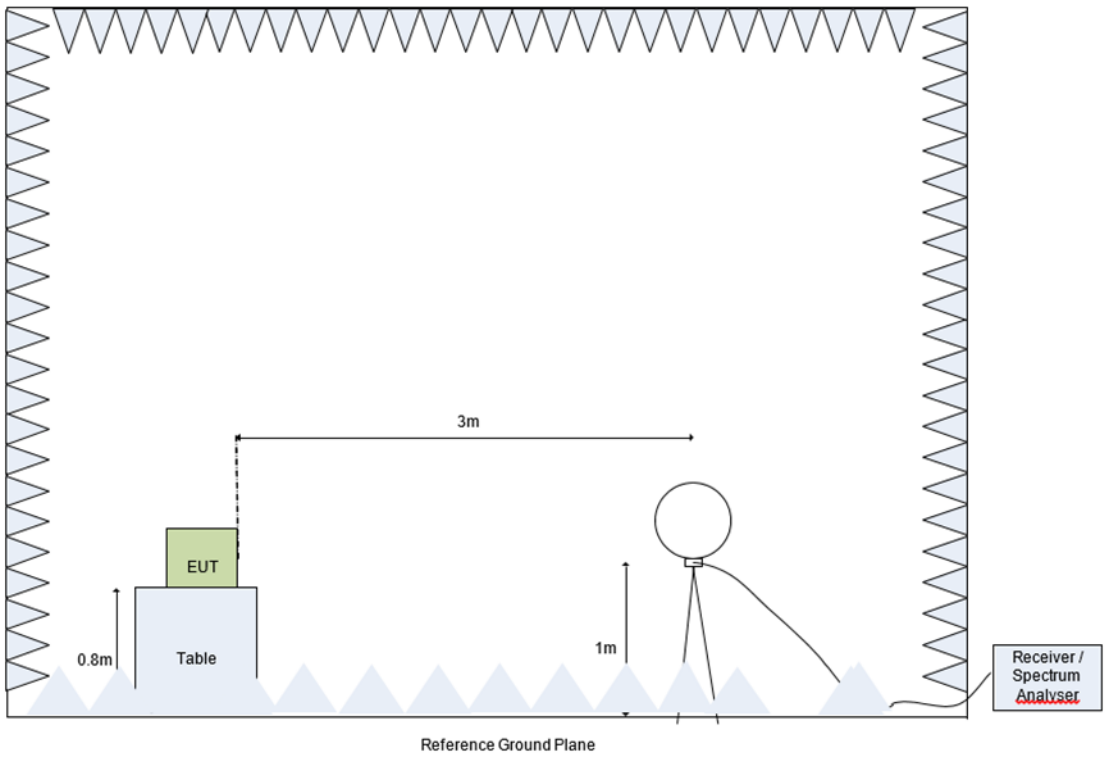

Figure 2: Test Setup for H-Field Measurements from 9kHz to 30MHz

Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.4-2014 Clause 5.1.3.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

5.3.8 Magnetic field emissions

The field strength is split into sub-bands as defined below in Section 47CFR 15.225 and ISED RSS-210 § B.6:

a) Section 15.225(a) Field strength within the band 13.553MHz-13.567MHz

Limit: 15848μV/m at 30m = 84dBμV/m at 30m

b) Section 15.225(b) Field strength within the bands 13.410MHz-13.552MHz and 13.567MHz to 13.710MHz

Limit: 3348μV/m at 30m = 50.5dBμV/m at 3m

c) Section 15.225(c) Field strength within the bands 13.110MHz-13.410MHz and 13.710MHz to 14.010MHz

Limit: 106μV/m at 30m = 40.5dBμV/m at 3m

The results of peak detector max-hold emission measurements are presented below. The measurements were taken using an FAR as initial measurements.

Measurements were performed at a 3m measurement distance.

The detector used was a peak detector.

For measurements in the band 0.009MHz to 0.490MHz the specified measurement distance is 300m. The distance correction will be:

Correction = 40*log (3/300) = -80dB

For measurements in the band 0.490MHz to 30MHz the specified measurement distance is 30m. The distance correction will be:

Correction = 40*log (3/30) = -40dB

5.3.9 Magnetic field emissions, 9kHz to 30MHz and outside the band 13.110MHz to 14.010MHz

The results of peak detector max-hold emission measurements are presented below. The measurements were taken using an FAR as initial measurements.

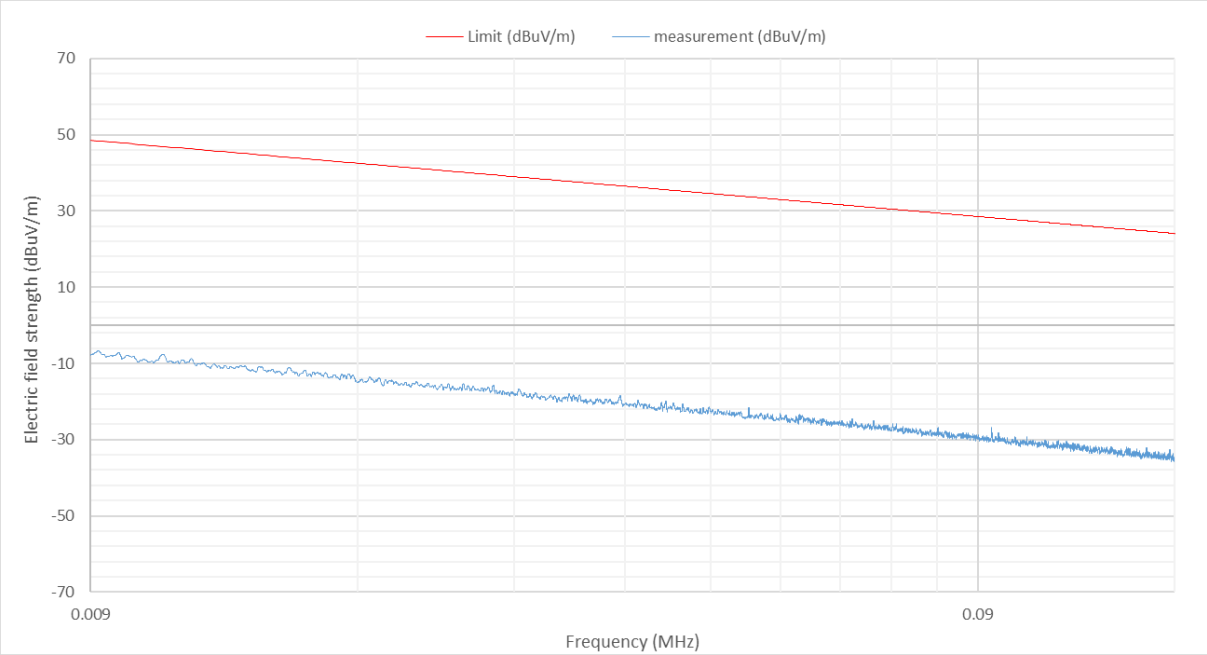

Figure 3 Magnetic field emissions Plot, 9kHz to 150kHz. Parallel

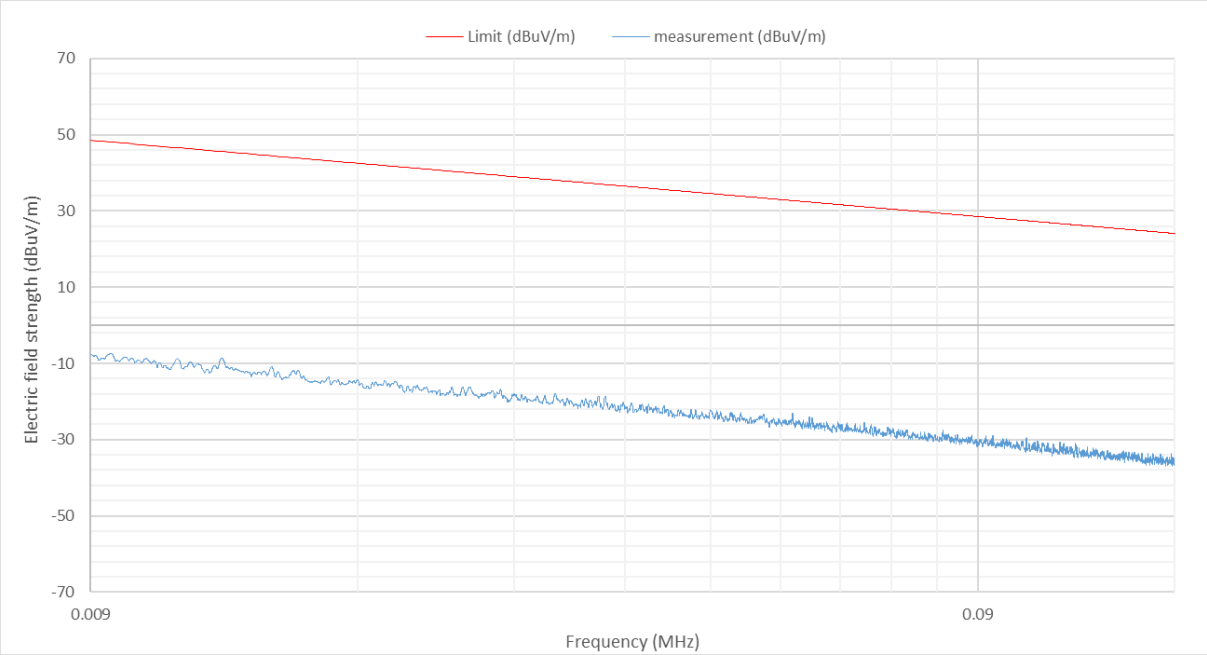

Figure 4 Magnetic field emissions Plot, 9kHz to 150kHz. Perpendicular

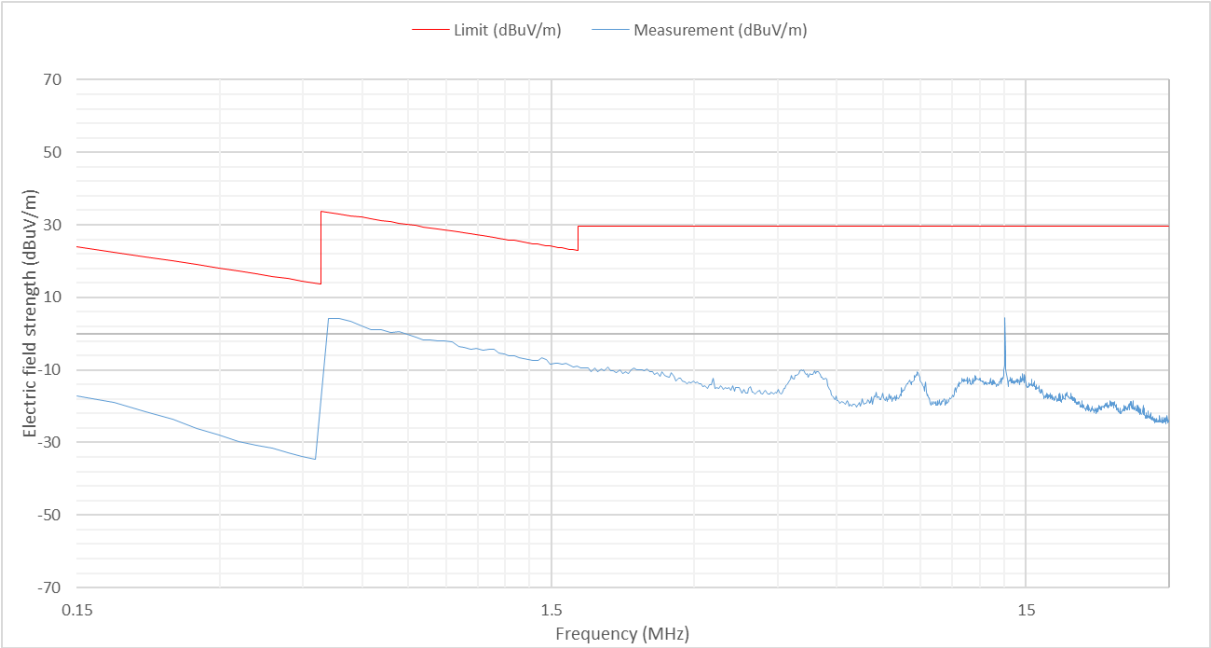

Figure 5 Magnetic field emissions Plot, 150kHz to 30MHz. Parallel

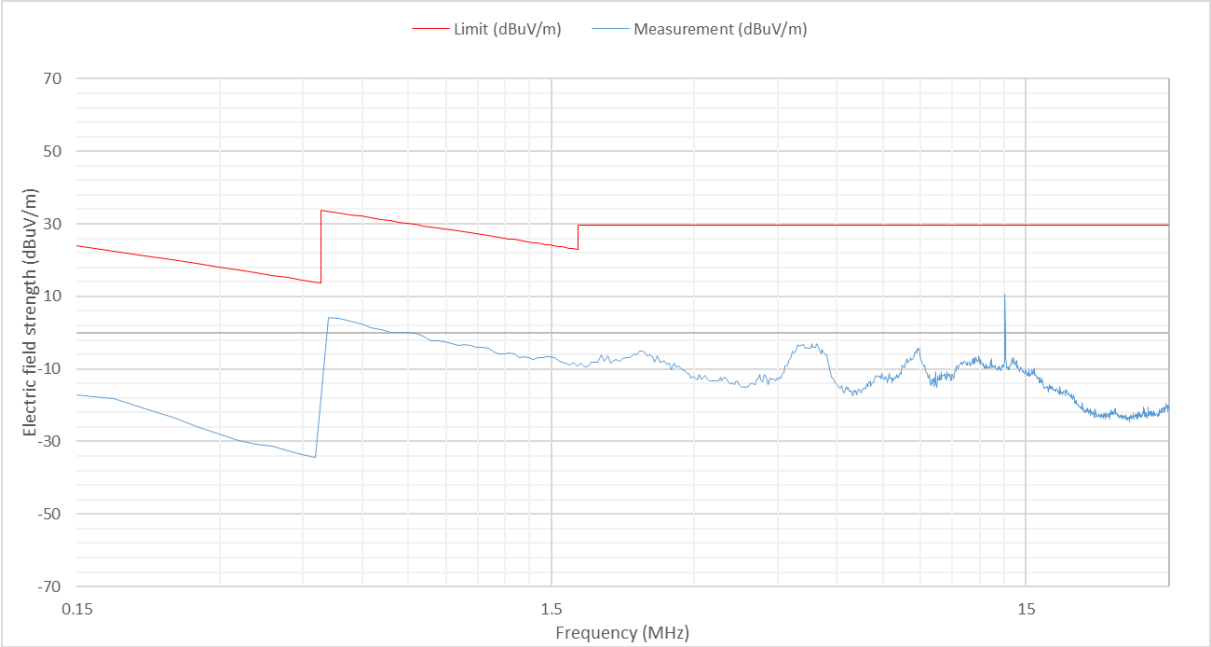

Figure 6 Magnetic field emissions Plot, 150kHz to 30MHz. Perpendicular

5.3.10 Field strength inside the band 13.110MHz to 14.010MHz

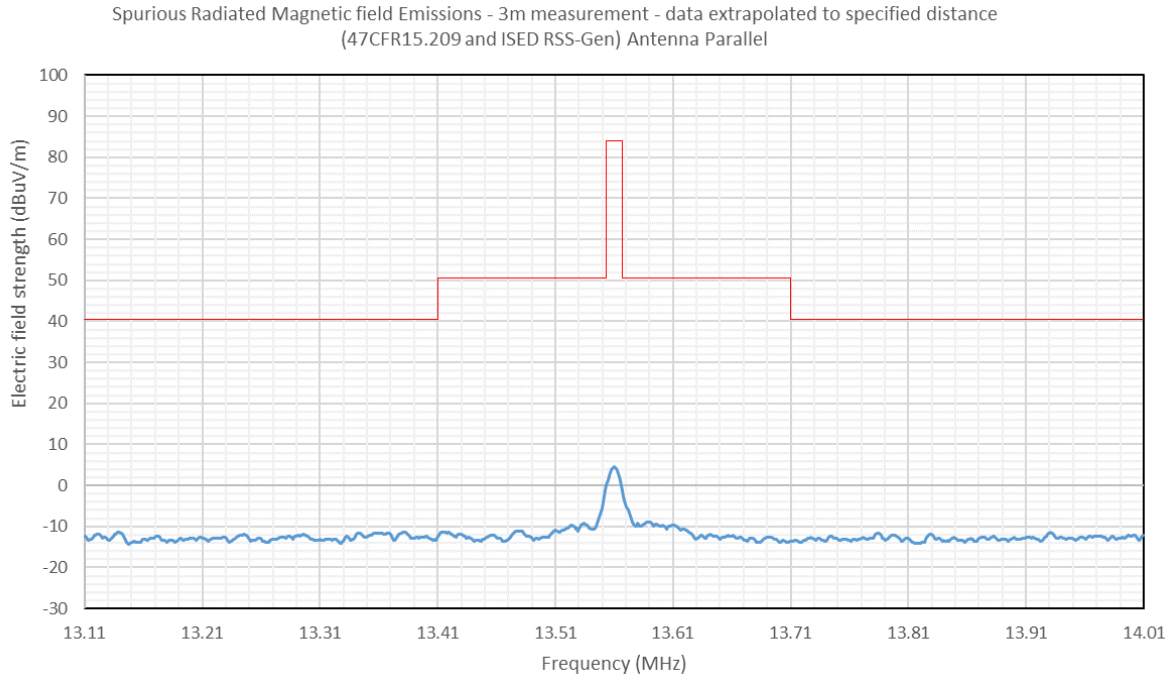

Figure 7 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Parallel – +5.00V

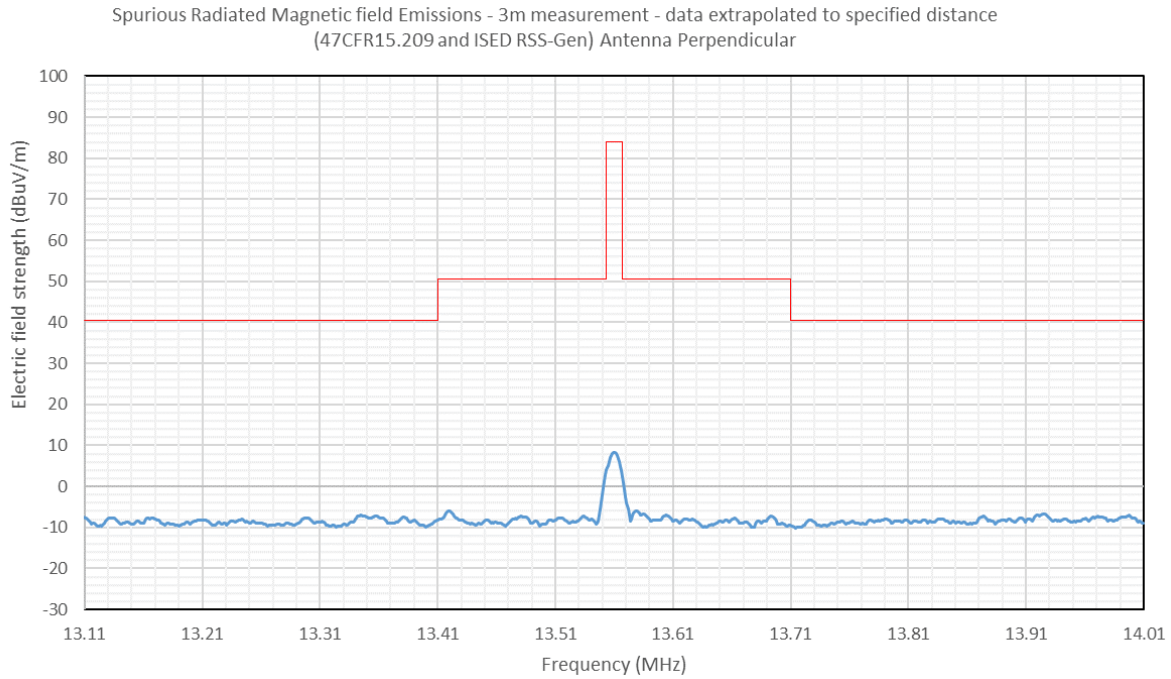

Figure 8 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Perpendicular +5.00V

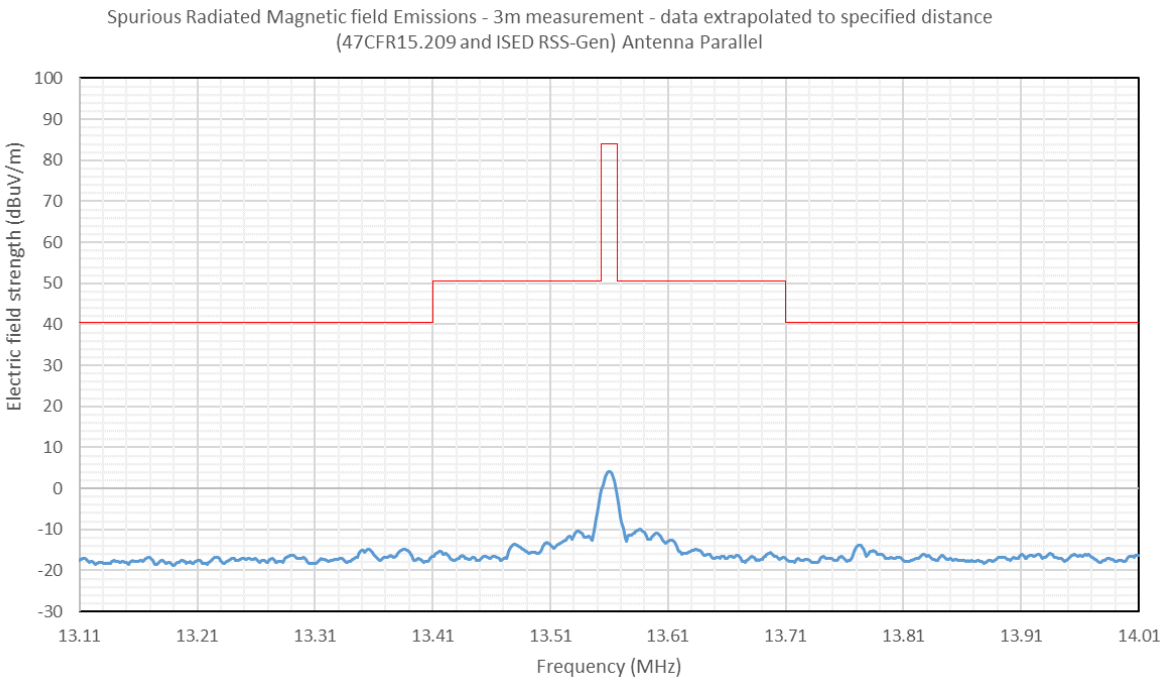

Figure 9 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Parallel – +4.25V

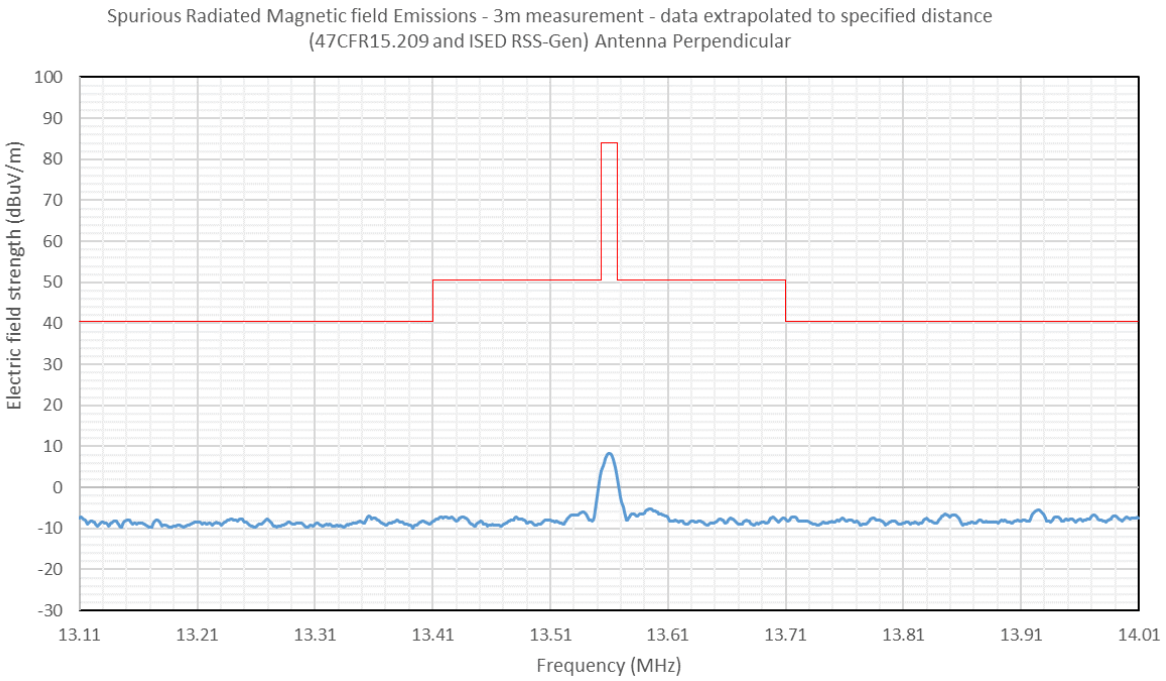

Figure 10 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Perpendicular – +4.25V

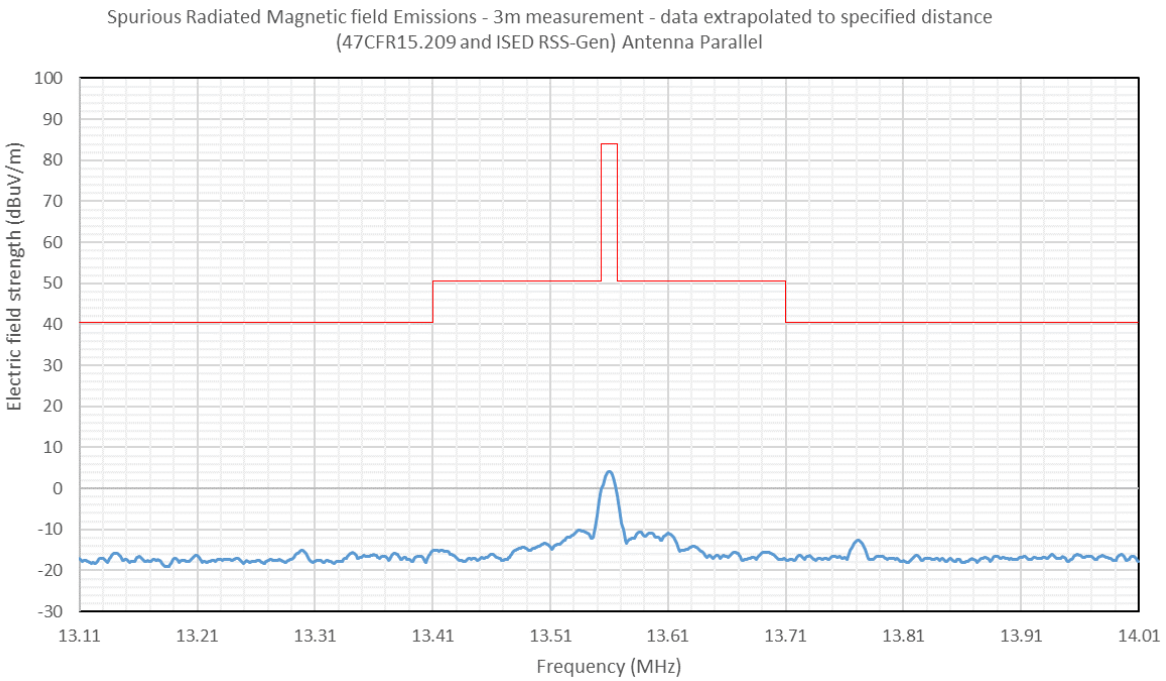

Figure 11 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Parallel – +5.75V

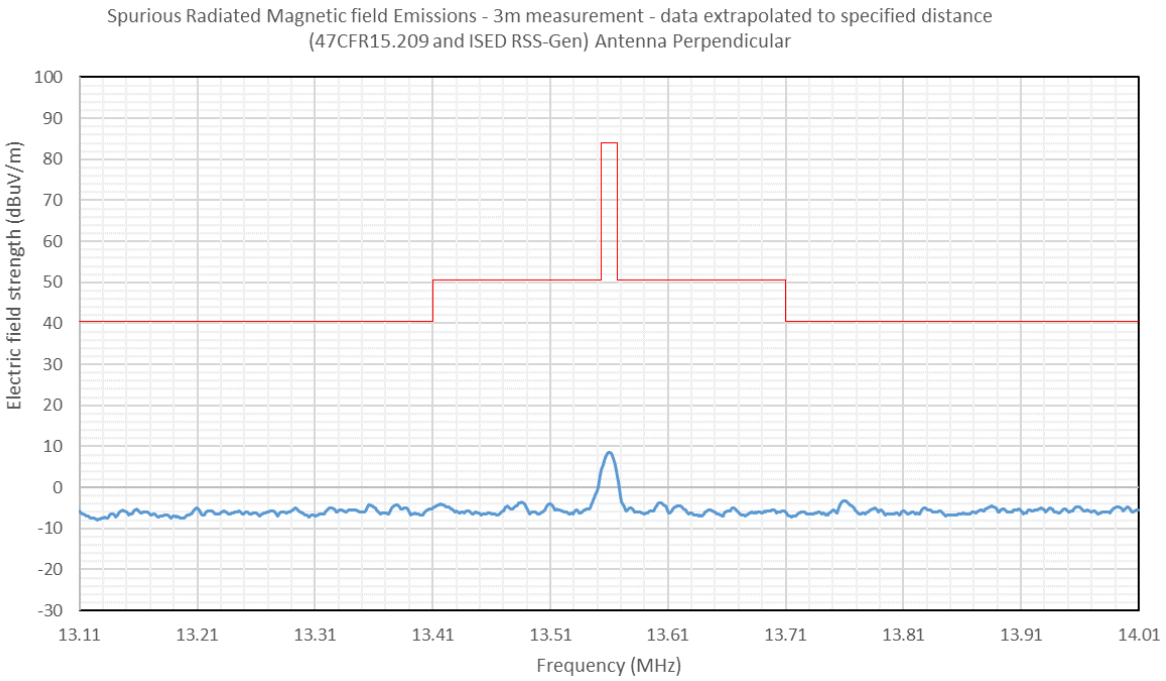

Figure 12 Magnetic field emissions Plot, 13.11MHz to 14.01MHz – Spectrum Mask – Perpendicular – +5.75V

5.3.11 Calculation of result

Field strength (FS) is calculated as follows from the receiver reading, Antenna factor (AF) in dB/m; Cable loss (CL) and pre-amplifier gain (G).

FS (dBµV/m) = Indicated Signal Level (dBµV) + AF(dB/m) –G(dB)+ CL (dB)

Cable loss was considered to have no influence on the measurement result in this case.

Freq (MHz)	Rx (dBµV)	Preamp gain G (dB)	Antenna factor (dB/m)	Result at 3m (dBµV/m)	Distance correction factor (40dB/decade)	Result at 30m (dBµV/m)	Limit At 30m (dBµV/m)	Margin (dB)	Result
13.56	42.40	30.70	32.74	44.44	-40	4.44	84	79.56	Below limit

13.56MHz result calculation – measurement antenna perpendicular

Freq (MHz)	Rx (dBµV)	Preamp gain G (dB)	Antenna factor (dB/m)	Result at 3m (dBµV/m)	Distance correction factor (40dB/decade)	Result at 30m (dBµV/m)	Limit At 30m (dBµV/m)	Margin (dB)	Result
13.56	46.46	30.70	32.74	48.50	-40	8.50	84	75.50	Below limit

13.56MHz result calculation – measurement antenna parallel

5.3.12 Data Extrapolation

Measurements were made at a 3m measurement distance since the NFC 13.56MHz signal was not detected at 10m. The data was extrapolated to the required specified distance as follows:

Between 9kHz and 490kHz the measurement distance according to 47CFR15.209 (a) is 300m:

$$\text{measurement at } 300\text{m} = \text{measurement at } 3\text{m} + 40\log\left(\frac{3}{300}\right)$$

$$\text{measurement at } 300\text{m} = \text{measurement at } 3\text{m} - 80\text{dB}$$

Between 490kHz and 30MHz the measurement distance according to 47CFR15.209 (a) is 30m:

$$\text{measurement at } 30\text{m} = \text{measurement at } 3\text{m} + 40\log\left(\frac{3}{30}\right)$$

$$\text{measurement at } 30\text{m} = \text{measurement at } 3\text{m} - 40\text{dB}$$

5.3.13 Measurement Summary

No further emissions were identified as being within 20dB of the specification limit using a peak detector. No further measurements were taken.

5.4 Radiated Emissions (30MHz to 1GHz)

Radiated electric field emission measurements are applied as defined in 47CFR15.205, 47CFR15.209 and ISED RSS-Gen.

5.4.1 Limits at 3m

Frequency (MHz)	Electric Field Strength Limit (dBµV/m) at 3m measurement distance
	Quasi Peak
30 - 88	40.0
88 -216	43.5
216 - 960	46.0
960- 1000	54.0

Note: FCC 47 CFR Part 15 Section 15.209 and 15.205 and ISED RSS-Gen specify test limits at 3m

Receiver Settings

Receiver Parameters	Setting
Detector Function	Quasi Peak
Start Frequency	30MHz
Stop Frequency	1000MHz
Resolution Bandwidth	120kHz
Video Bandwidth	Auto

5.4.2 Emissions measurements

5.4.3 Date of Test

25th May 2023

5.4.4 Test Area

LAB 1 (SAC)

5.4.5 Tested by

L Trickett

5.4.6 Test Setup

The EUT was configured in the SAC on an 80cm high polystyrene table.

The measurement was performed with an antenna to EUT separation distance of 3m. The results were maximised in orientation 0-360 degrees and height 1-4m.

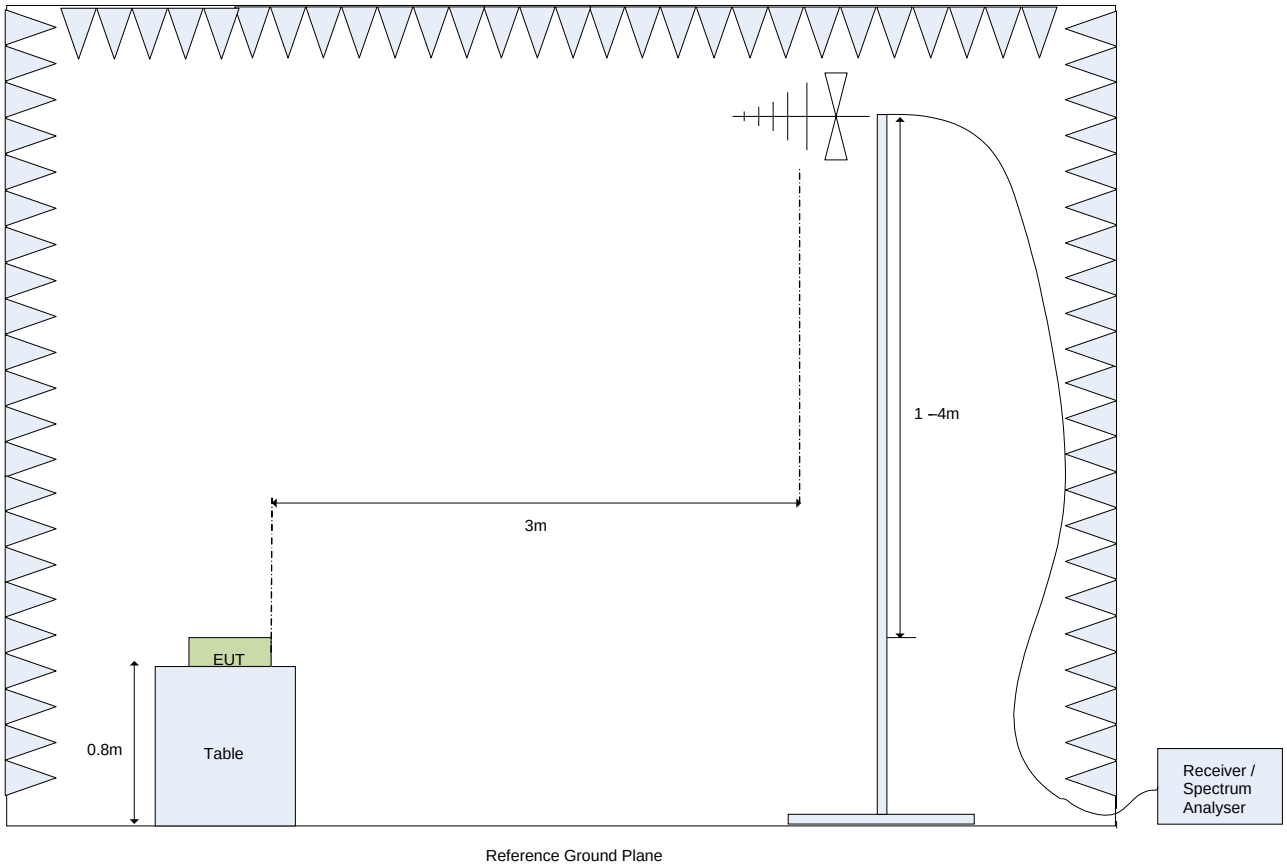

Figure 13 Test Setup for E-Field Measurements from 30MHz to 1GHz

Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.10-2013.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

5.4.7 Electric field emissions, 30MHz to 1GHz

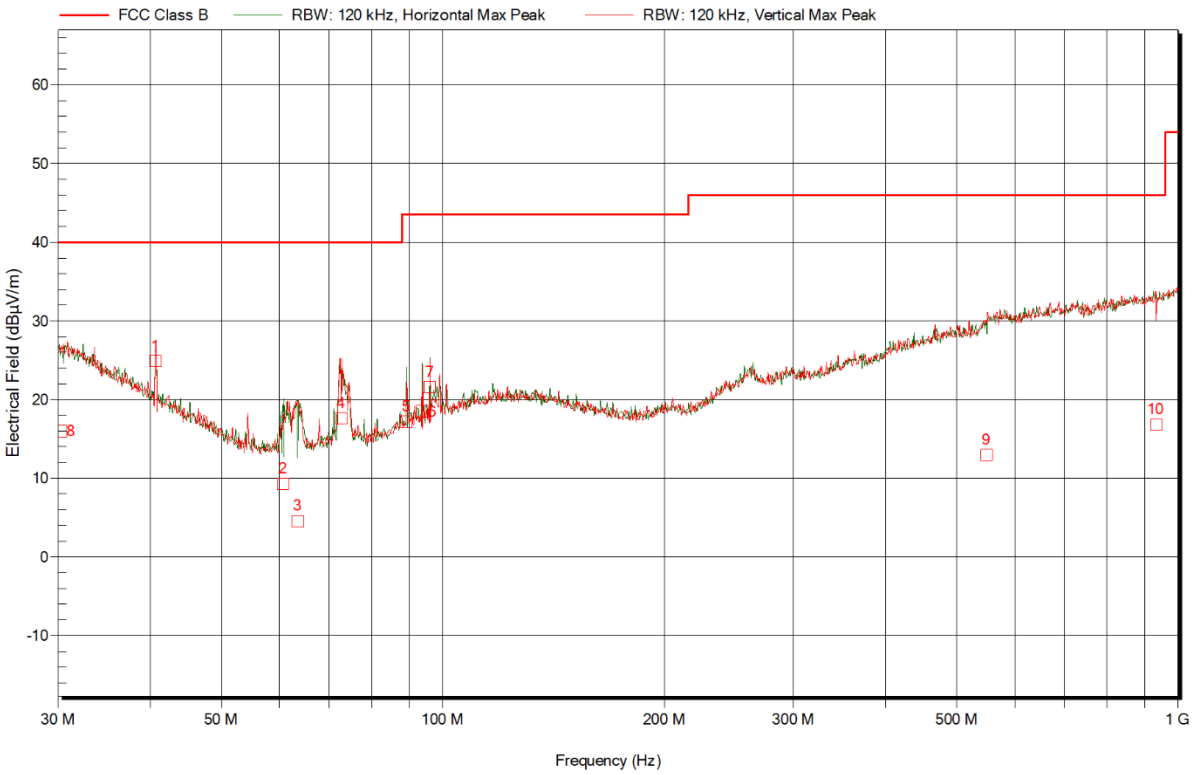

Figure 14 Electric field emissions Plot, 30MHz to 1GHz

Frequency	Quasi-Peak	Quasi Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height	Polarization
MHz	dBµV/m	dBµV/m	dB		degrees	m	
40.68	24.9	40.0	-15.1	Pass	100	1.0	Vertical
60.59	9.3	40.0	-30.7	Pass	5	1.0	Horizontal
63.50	4.6	40.0	-35.4	Pass	285	1.4	Horizontal
72.82	17.6	40.0	-22.4	Pass	305	1.9	Vertical
89.29	17.2	43.5	-26.3	Pass	40	1.2	Horizontal
93.70	18.5	43.5	-25.0	Pass	45	1.4	Vertical
96.01	21.6	43.5	-21.9	Pass	45	1.2	Vertical
30.30	16.0	40.0	-24.0	Pass	175	1.2	Horizontal
549.12	12.9	46.0	-33.1	Pass	60	1.9	Horizontal
933.78	16.8	46.0	-29.2	Pass	170	2.3	Vertical

Table 1 Electric Field Emissions Peaks, 30MHz to 1GHz.

Note: Emissions were investigated with EUT vertical and laid flat. Worse case emissions were detected with the EUT vertical.

5.4.8 Quasi Peak correction factors

The quasi peak correction is shown in the above table. This correction figure consists of), Antenna factor (AF); Attenuator loss (AL) and Cable loss (CL).

Field strength (FS) is calculated as follows:

FS (dBµV/m) = Indicated Signal Level (dBµV) + AF (dB) + AL (dB) + CL (dB)

5.4.9 Sample Data

The Quasi-Peak level at 933.78MHz

FS (dBµV/m) = -12.4(dBµV) + 26.6(dB/m) +2.6(dB) = 16.8(dBµV/m)

Section 6 Frequency Stability

6.1 Test Specification

FCC Rule Part	47CFR 15.225 (e) – Frequency tolerance with temperature variation
ISED Rule Part	ISED RSS-210 § B.6
Standard	ANSI C63.10:2013
Measurement Uncertainty	The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95% is ±1x10^{-8}

6.1.1 Date of Test

26th May 2027

6.1.2 Test Area

LAB 7 (Temperature chamber)

6.1.3 Tested by

L Trickett

6.1.4 Procedure

For frequency stability with respect to supply voltage the procedures of ANSI C63.10 Section 6.8.2 were followed. The measurements were performed at ambient room temperature.

Note: This test was performed radiated, in section 5.3.10 above.

For frequency stability with respect to ambient temperature the procedure of ANSI C63.10 Section 6.8.1 was followed.

6.1.5 Test Setup

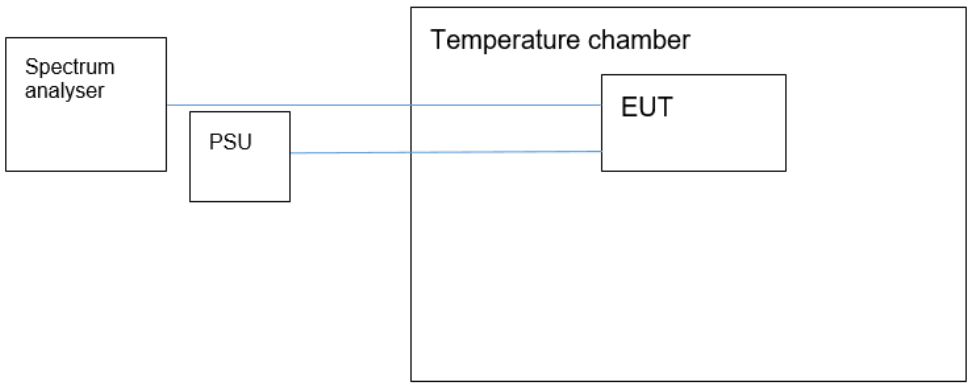

Table 2 Test arrangement for frequency stability testing

Note: For this test, a second, identical EUT was used with a temporary SMA antenna connector fitted for direct connection to the spectrum analyser.

6.1.6 Test Results

Temperature (ºC)	Time	Frequency (MHz)	Nominal	Deviation (%)	Limit 47CFR15.225 (%)	Result
50	Startup	13.5597931	13.56	-0.001525834	0.01	Within Limit
	2min	13.5599745	13.56	-0.000188053	0.01	Within Limit
	5min	13.5598281	13.56	-0.001267715	0.01	Within Limit
	10min	13.5598271	13.56	-0.001275090	0.01	Within Limit
40	Startup	13.5598513	13.56	-0.001096620	0.01	Within Limit
	2min	13.5598479	13.56	-0.001121694	0.01	Within Limit
	5min	13.5598487	13.56	-0.001115794	0.01	Within Limit
	10min	13.5598640	13.56	-0.001002960	0.01	Within Limit
30	Startup	13.5598995	13.56	-0.000741156	0.01	Within Limit
	2min	13.5598884	13.56	-0.000823016	0.01	Within Limit
	5min	13.5598858	13.56	-0.000842190	0.01	Within Limit
	10min	13.5599350	13.56	-0.000479353	0.01	Within Limit
20	Startup	13.5599385	13.56	-0.000453542	0.01	Within Limit
	2min	13.5599328	13.56	-0.000495578	0.01	Within Limit
	5min	13.5599309	13.56	-0.000509590	0.01	Within Limit
	10min	13.5599294	13.56	-0.000520652	0.01	Within Limit
10	Startup	13.5599682	13.56	-0.000234514	0.01	Within Limit
	2min	13.5599529	13.56	-0.000347346	0.01	Within Limit
	5min	13.5599607	13.56	-0.000289824	0.01	Within Limit
	10min	13.5599594	13.56	-0.000299411	0.01	Within Limit
0	Startup	13.5599828	13.56	-0.000126844	0.01	Within Limit
	2min	13.5599808	13.56	-0.000141593	0.01	Within Limit
	5min	13.5603676	13.56	0.002710841	0.01	Within Limit
	10min	13.5599801	13.56	-0.000146755	0.01	Within Limit
-10	Startup	13.5599796	13.56	-0.000150443	0.01	Within Limit
	2min	13.5599803	13.56	-0.000145280	0.01	Within Limit
	5min	13.5599794	13.56	-0.000151918	0.01	Within Limit
	10min	13.5599781	13.56	-0.000161505	0.01	Within Limit
-20	Startup	13.5599500	13.56	-0.000368733	0.01	Within Limit
	2min	13.5599538	13.56	-0.000340709	0.01	Within Limit
	5min	13.5599521	13.56	-0.000353246	0.01	Within Limit
	10min	13.5599495	13.56	-0.000372420	0.01	Within Limit

Table 3 Frequency stability with temperature Results

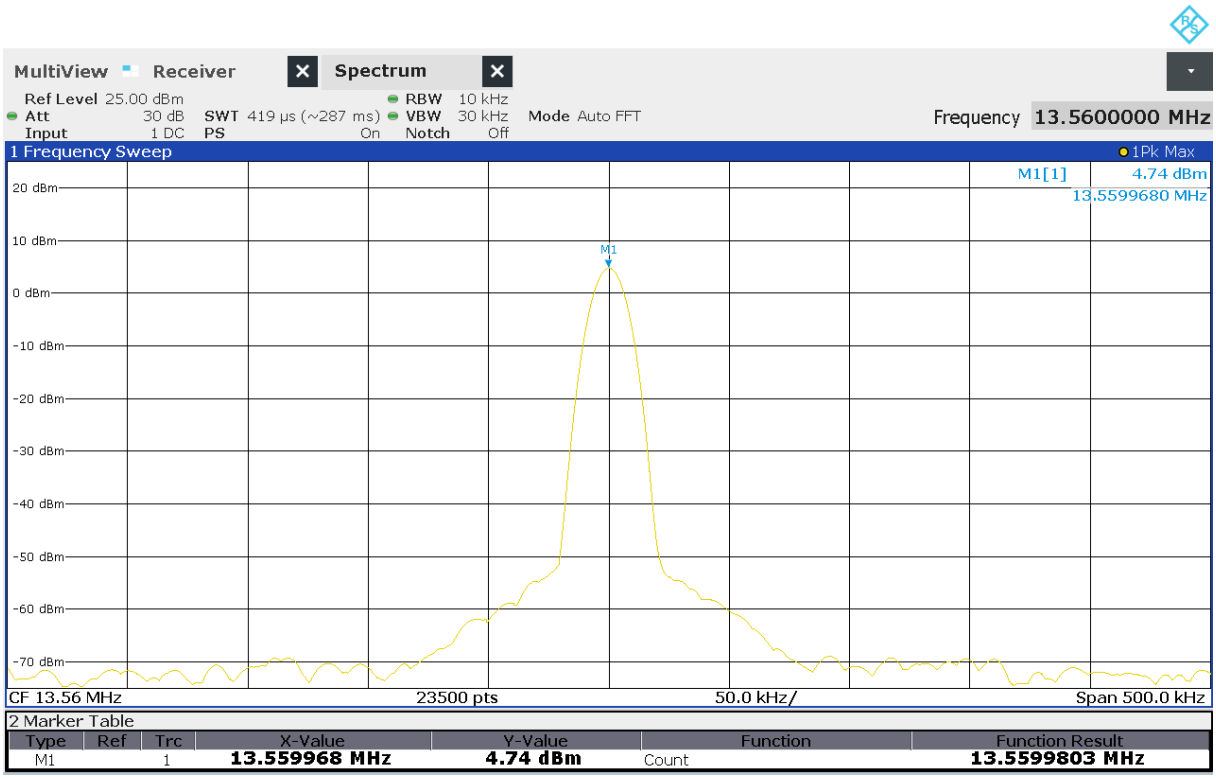

Figure 15 Example measurement of frequency stability at -10˚C after 2 minutes

Section 7 20dB Bandwidth

7.1 Test Specification

FCC Rule Part	47CFR 15.215 (c) – 20dB Bandwidth
ISED Rule Part	ISED RSS-Gen section 6.7
Standard	ANSI C63.10:2013
Measurement Uncertainty	The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95% is $\pm 1x10^{-8}$

7.1.1 Date of Test

7th June 2023

7.1.2 Test Area

LAB 5

7.1.3 Tested by

J Beevers

7.2 Procedure

For 20dB bandwidth the procedures of ANSI C63.10 Section 6.9.2 were followed.

Receiver Parameters	Setting
Detector Function	Peak
Span	2MHz
Resolution Bandwidth	10kHz
Video Bandwidth	30kHz
Sweep rate	Auto
Trace mode	Max hold

7.2.1 Test Results

The 20dB bandwidth was measured using the bandwidth function of the signal analyser and the procedures of Clause 6.9.2 of ANSI C63.10-2013.

The measured 20dB bandwidth was 118.04kHz which was contained within the operating band 13.110 to 14.01MHz.

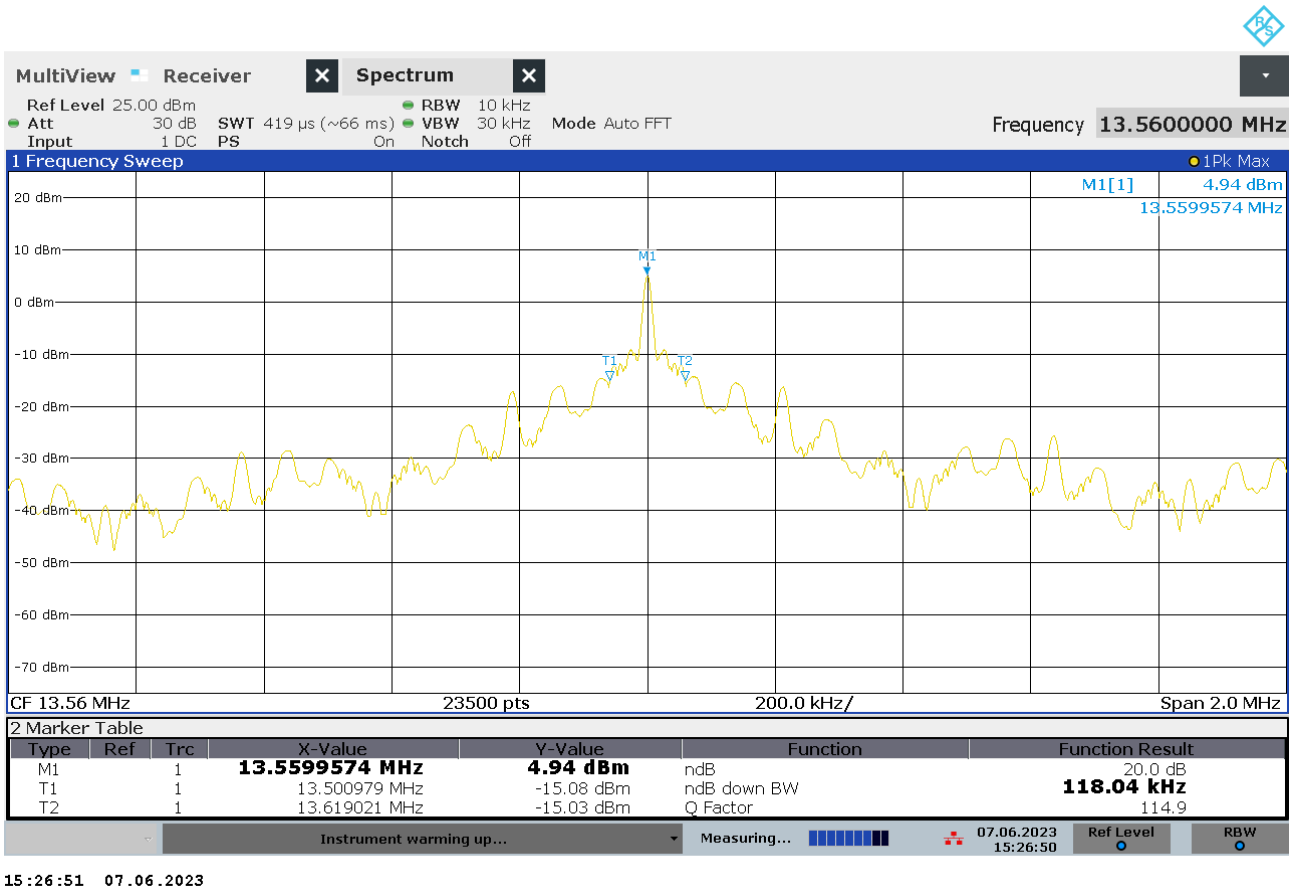

Figure 16 Bandwidth at 20dB Point.

Appendix A EUT Test Photos

Test set up photographs are supplied separately.

Appendix B Test Equipment List

Radiated Emissions 30MHz to 1GHz Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	C0471	6th December 2022	36 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	-	-
Rohde & Schwarz ESR 26	C0502	3rd May 2022	15 Months
RS Pro Bench power supply	C0619	-	-
Teseq CBL6112D Bilog Antenna	C0506	12th Jan 2023	12 Months
HF26 Cable	19148_06_13_001	30th November 2022	12 Months
HF35 Cable	19149.02.13.003	30th November 2022	12 Months
HF27 Cable	19149.03.13.004	30th November 2022	12 Months

Radiated Emissions 9kHz to 30MHz Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 5 Fully-Anechoic Room	C0578	23rd July 2021	36 Months
Schwarzbeck 9kHz to 2GHz preamp	C0632	9th February 2023	12 Months
ETS-Lindgren 6512 Passive loop antenna 10kHz to 30MHz	B0921	21st February 2020	40 Months
HF10 Cable	-	12th December 2022	12 Months
Cable 18	20748.04.14.002	30th November 2022	12 Months
Cable 24	20748.03.14.002	30th November 2022	12 Months
RS Pro Bench power supply	C0619	-	-
Rohde & Schwarz ESW 44	C0658	8th November 2022	12 Months

Frequency Stability Measurement Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Rohde & Schwarz ESW 44	C0658	8th November 2022	12 Months
Temperature Chamber	C0108	29th November 2022	18 Months
Cable 24	20748.03.14.002	30th November 2022	12 Months
RS Pro Bench power supply	C0619	-	-
RS Pro Stopwatch	C0484	-	-

----------END OF REPORT----------