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Test Report for the FCC Testing of a Qubi 3C RFID v1 Workspace Management Device to FCC Rule 47CFR 15.225 for QED Advanced Systems Ltd

Test Report number: C14876TR2
Project number: C7190/1

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Laboratories Director

Issue	Description						Issue by	Date
2	Copy 1		Copy 2		PDF	X	DB	13th February 2022

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The results contained in this report are only applicable to the apparatus tested.

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	30th November 2022	First Issue
2	13th February 2023	Update of product name and addition of latest FCC identification
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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	QED Advanced Systems Limited
Address	22 Bridgwater Court
	Oldmixon Crescent
	Weston-super-Mare
	North Somerset
	BS24 9AY
	United Kingdom
Contact	Mr Ian Fisher
Email	Ian.fisher@qedas.com

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

Date received:	24th October 2022		
EUT name:	Qubi 3C RFID v1		
FCC ID:	2AB38QUBI3CB (whole product, module not certified)		
Serial no:	Not provided		
EUT description:	The apparatus is a Workspace Management Device using 13.56MHz near field communication		
Antenna	PCB track antenna		
Modulation schemes	Not stated		
Operating frequency band	13.553MHz to 13.567MHz		
No of units tested:	One		
EUT power:	120 VAC supplied via USB to mains adapter or laptop for mains conducted emissions test.		
Highest internal frequency:	13.56MHz		
Size of EUT (cm)	13.1 length	9.5 width	2.5 height
Mode/s of operation:	Transmitting continually at 13.56MHz modulated signal		
Test software:	Not stated		
Modifications incorporated during testing:	None		

Ports and Cables	**Cable Length**	**Screened/ unscreened**	**Connected to**
USB cable	5m	unscreened	External PC

Radio Module(s)

Module – certified with final product	**Frequency Range (MHz)**	**FCC Status**	**FCC ID**
STMicroelectronics – The ST95HF is an integrated transceiver IC for contactless applications.	13.56MHz	Not certified	None

3.2 EUT Photographs

Photographs are supplied separately.

3.3 Configuration of EUT

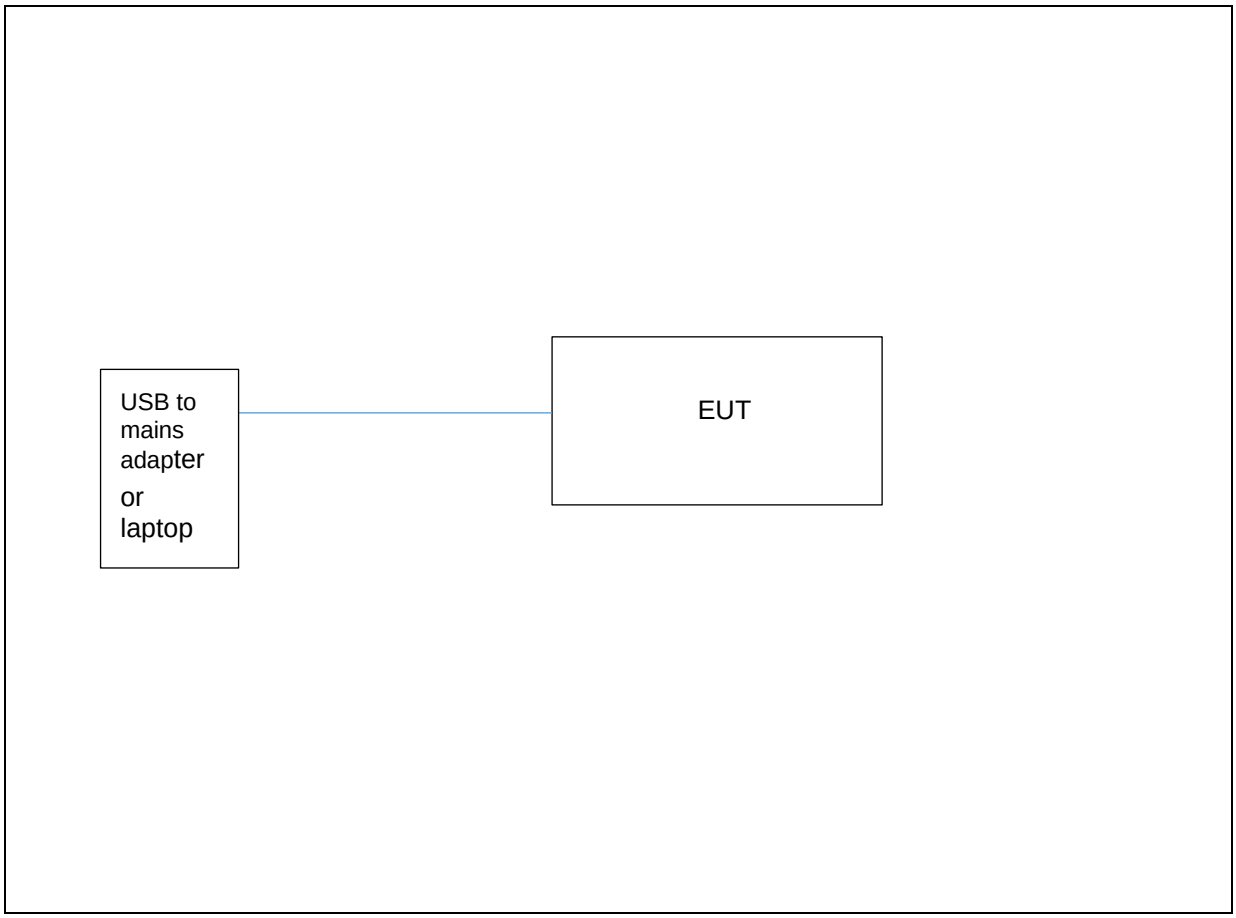

Figure 1 Diagram of EUT.

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

3.4 EUT Monitoring/Auxiliary Equipment

None.

3.5 Monitoring Software

None. The channel required was selected via software prior to the testing.

Section 4Test Specifications

The tests were performed in accordance with Eurofins York Quotation QuC7190/1.

For USA:

Test Standard	Relevant Section	Class/limit	Status
CFR 47 Part 15C & ANSI C63.10-2013	Section 15.225(a) Field strength within the band 13.553MHz-13.567MHz	As specified in Section 15.225(a)	Pass
	Section 15.225(a) Field strength within the bands 13.410MHz-13.552MHz and 13.567MHz to 13.710MHz	As specified in Section 15.225(b)	Pass
	15.225(b) Field strength within the bands 13.110MHz-13.410MHz and 13.710MHz to 14.010MHz	As specified in Section 15.225(c)	Pass
	Section 15.225(d) Field Strength outside the band 13.110MHz-14.010MHz	As specified in Section 15.209	Pass
	Section 15.225(e) Frequency tolerance of the carrier signal	As specified in Section 15.225(e)	Pass
	Section 15.31(e) Field strength variation with operating voltage	As specified in Section 15.31(e)	Pass
	15.215 (c) 20dB bandwidth	As specified in Section 15.215 (c)	Pass
	Section 15.207 Mains conducted emissions	As specified in Section 15.207(a) Test not applicable	Pass

Note 1 :All radiated testing was carried out at a test distance of 3m.

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 Conducted Emissions

Publication Number	Keyword	Publication Date
174176	Section 15.107, 15.207,18.307, C63.4, C63.10, Suitable Dummy Load, AC Power Line Conducted Measurement	03/06/2015

4.1.2 Radiated Emissions (9kHz to 30MHz)

Publication Number	Keyword	Publication Date
937606	Test Site Requirements for Part 15 and 18 Devices Operating Below 30 MHz	10/10/2014
460108	Radiated emission measurements below 30 MHz	06/15/2015

4.1.3 Radiated Emissions (30MHz to 1000MHz)

913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017

4.2 Compliance Statement

The Qubi 3C RFID v1,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
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 +/- 4.27dB for the frequency range from 9kHz to 30MHz +/- 5.81dB for the frequency range 30MHz to 1GHz +/- 4.64dB for the frequency range from 1GHz to 6GHz +/- 4.96dB for the frequency range from 6GHz to 18GHz +/- 4.77dB for the frequency range from 18GHz to 40GHz

5.2 Procedure and Test Software Version

Radiated tests:- 47CFR15.205 and 47CFR15.209

Eurofins York Test procedure (9kHz to 30MHz)	CEP22 Issue 2
Eurofins York test procedure (30MHz to 1GHz)	CEP23b Issue 2
Test software	RadiMation Version 2016.2.8

5.3 Radiated Emissions (9kHz to 30MHz)

5.3.1 Limits 47CFR 15.209

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.

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

5.3.3 Measurement Distance

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

5.3.4 Emissions measurements

5.3.5 Date of Test

24th October 2022

5.3.6 Test Area

LAB 5 (AC)

5.3.7 Tested by

M Render

5.3.8 AC Test Setup

The EUT was configured in the AC 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.

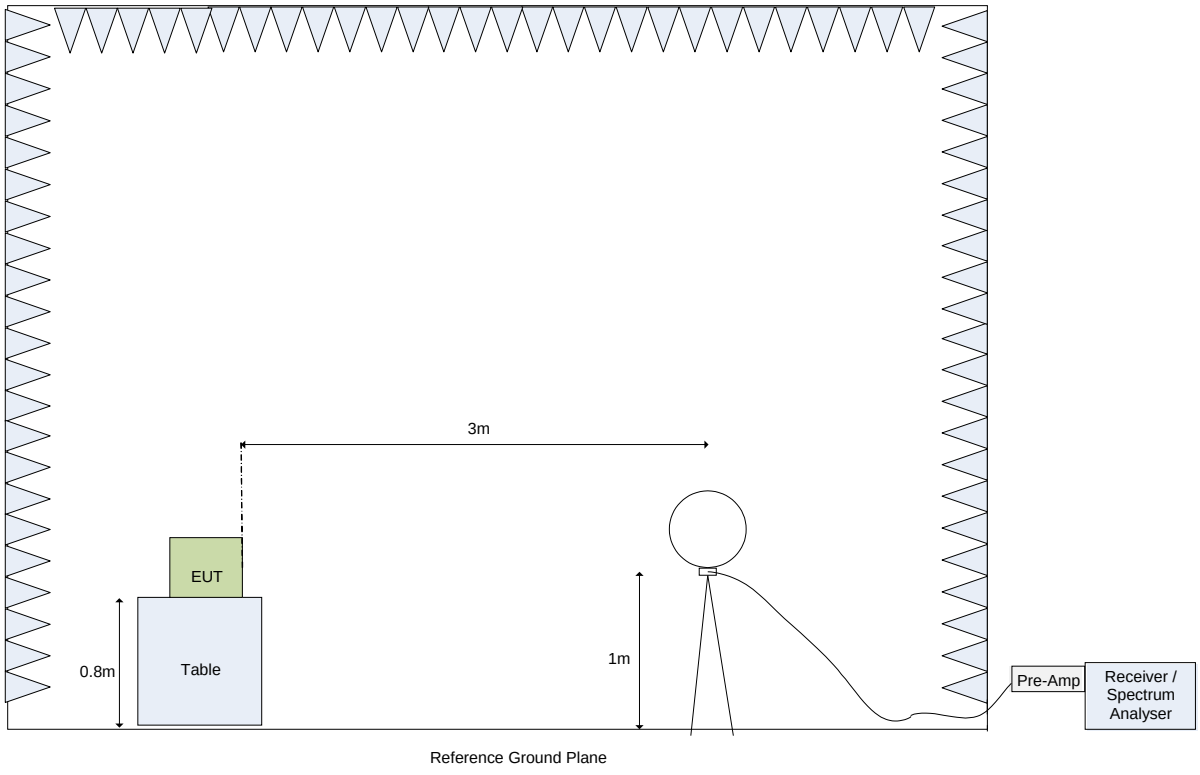

Figure 2: Test Setup for H-Field Measurements from 9kHz to 30MHz

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.

5.3.9 Magnetic field emissions,13.110MHz to 14.010MHz

The field strength is split into sub-bands as defined below in Section 47CFR 15.225:

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 anechoic chamber for initial measurements.

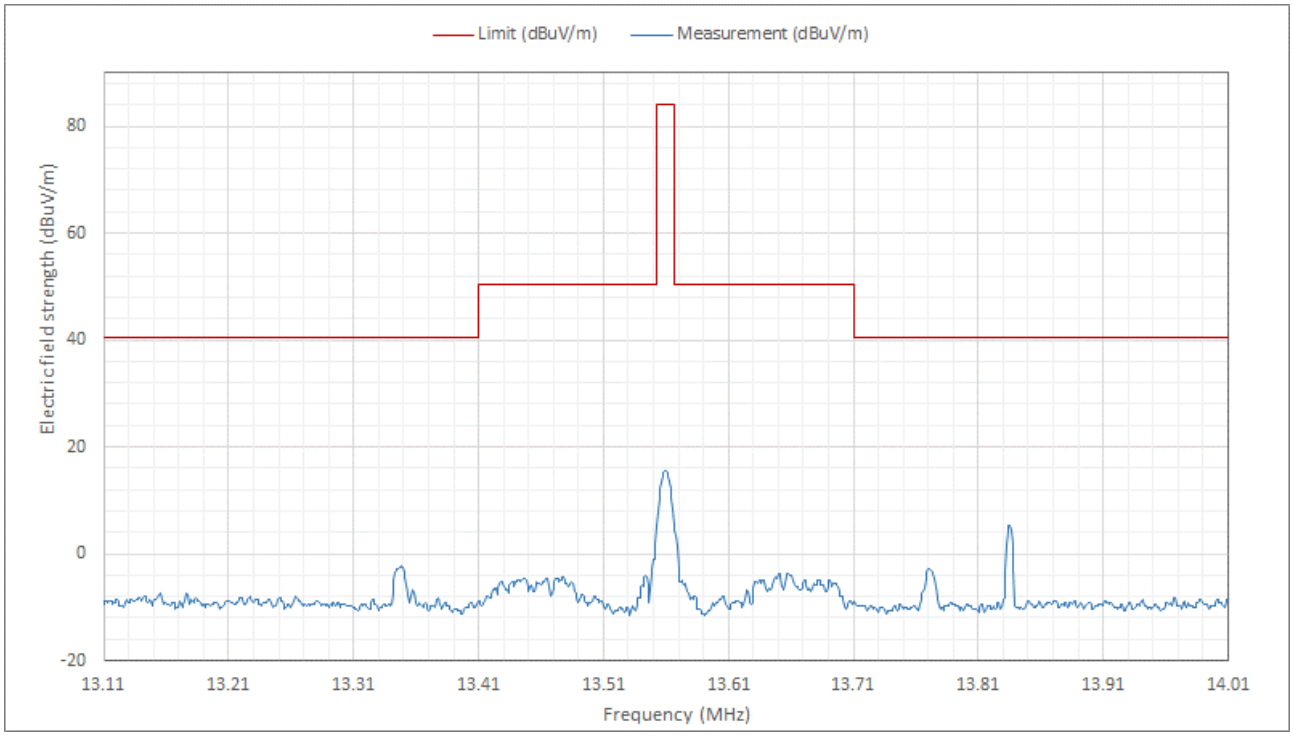

Figure 3 Radiated emissions – antenna in parallel orientation

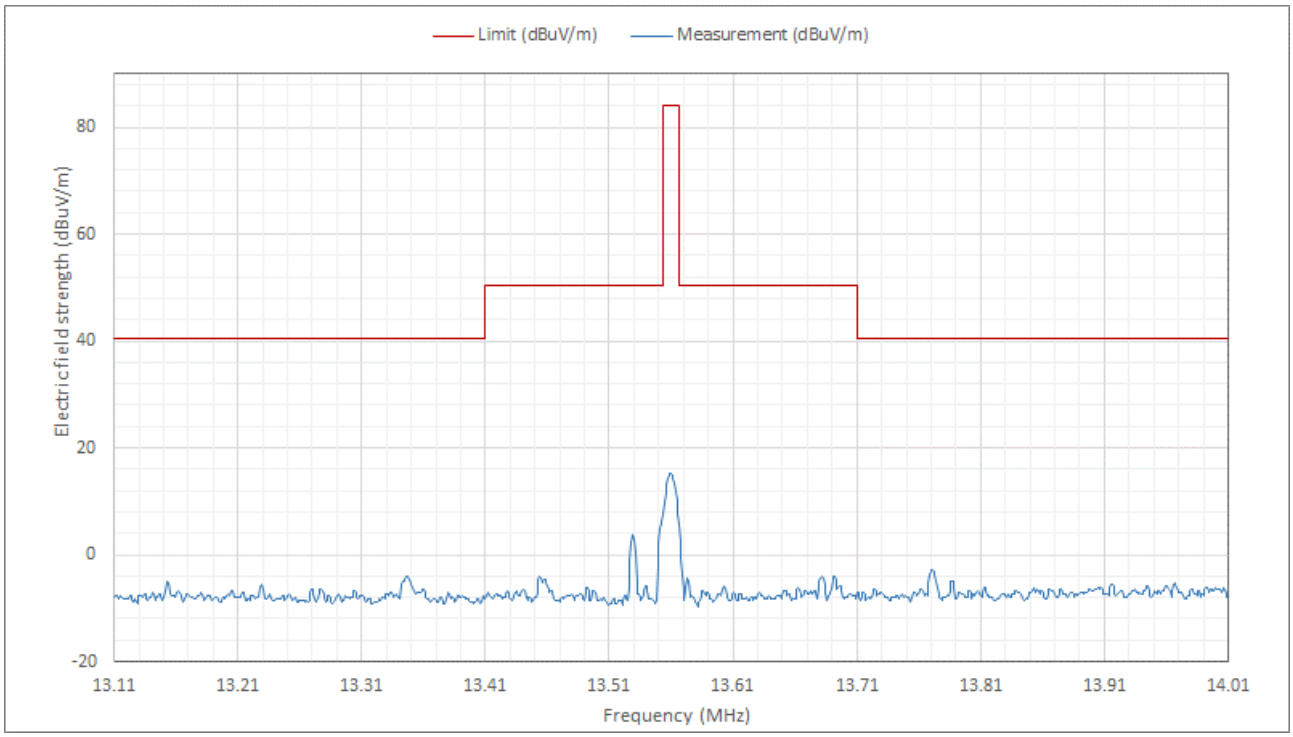

Figure 4 Radiated emissions – antenna in perpendicular orientation

5.3.10 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 AC as initial measurements.

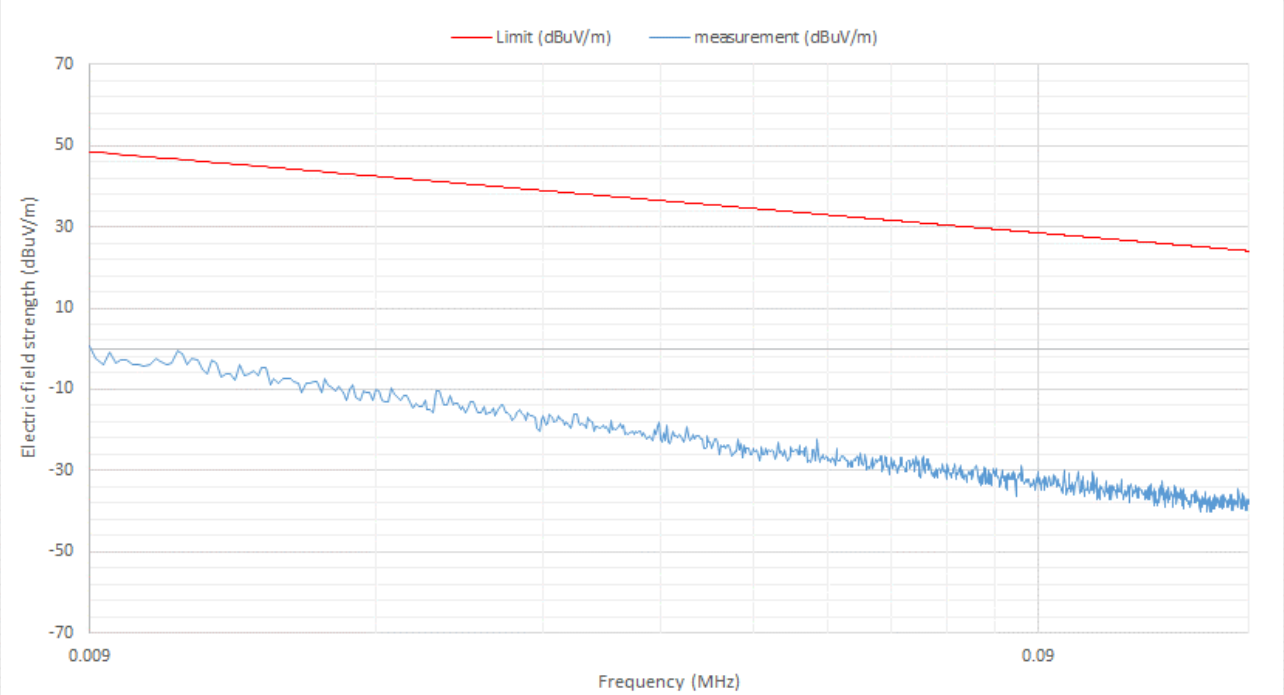

Figure 5 Magnetic field emissions Plot, 9kHz to 30Hz. Parallel

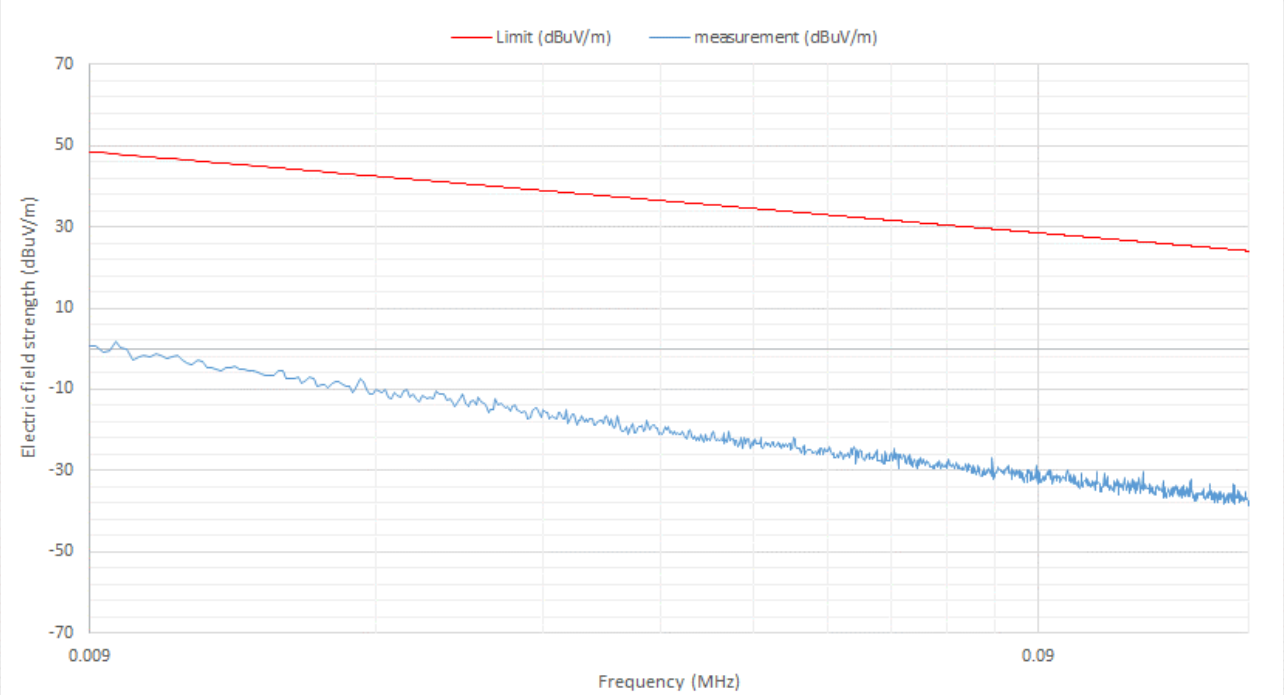

Figure 6 Magnetic field emissions Plot, 9kHz to 30Hz. Perpendicular

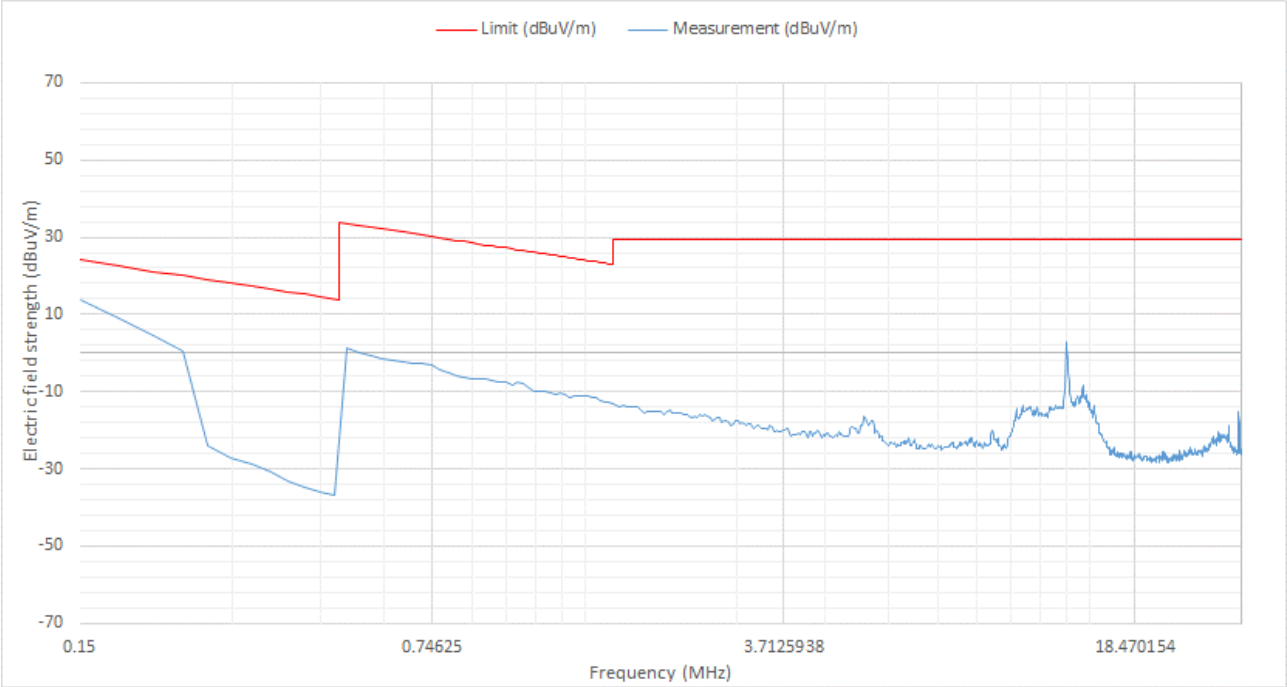

Figure 7 Magnetic field emissions Plot, 150kHz to 30MHz Parallel

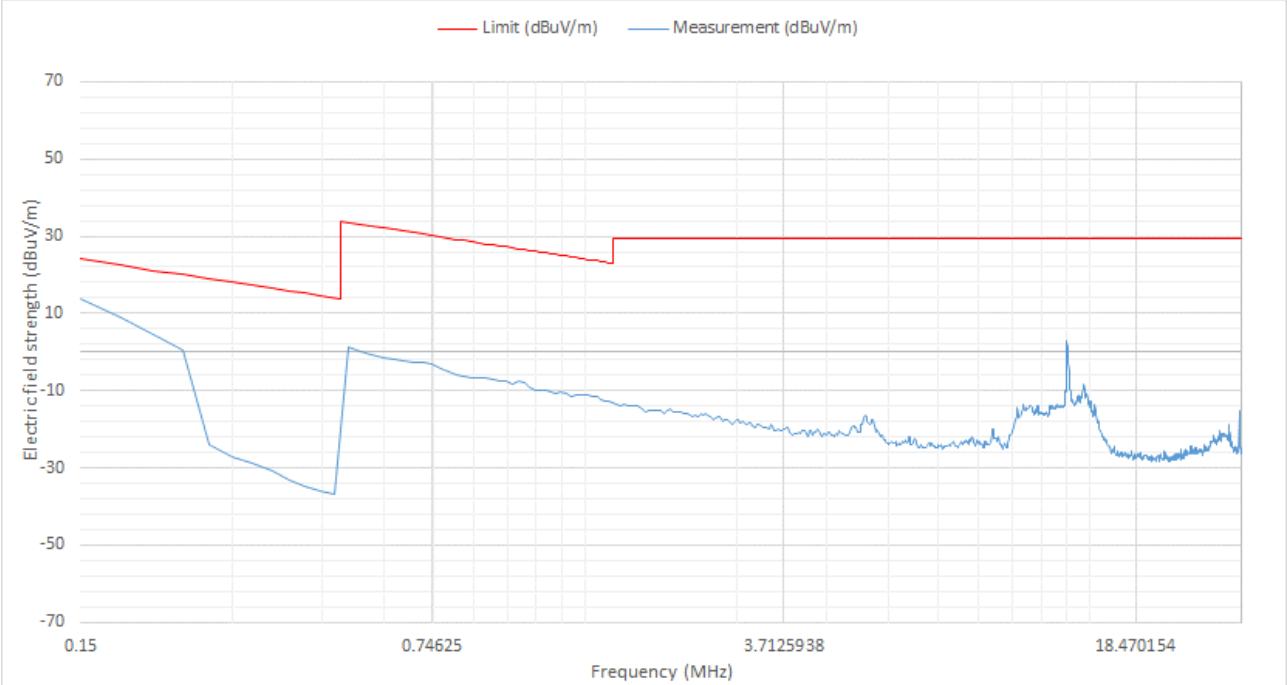

Figure 8 Magnetic field emissions Plot, 150kHz to 30MHz Perpendicular

Freq (MHz)	Rx (dBμV)	Pre-amp (dB)	Antenna factor (dB/m)	Distance correction factor 40dB/dec.	Spec. Distance	Result at spec. distance (dBμV/m)	Limit At spec. distance (dBμV/m)	Margin (dB)	Result
0.150	60.4	26.4	62.7	-80	300	16.70	24.10	-7.40	Below limit
1.403	14.2	29.4	43.7	-40	30	-11.50	29.50	-41.00	Below limit
7.400	10.54	29.2	34.0	-40	30	-24.66	29.50	-54.16	Below limit
12.800	21.9	29.2	32.8	-40	30	-14.50	29.50	-44.00	Below limit
13.580	34.6	26.2	32.7	-40	30	1.10	29.50	-28.40	Below limit
21.015	11.4	29.1	32.0	-40	30	-25.70	29.50	-55.20	Below limit

Table 1 Receiving antenna at 0.8m measurement height, Antenna parallel

No radiated spurious emissions were detected from the product other than the carrier (13.56MHz). The above representative noise floor emissions were taken.

5.4 Radiated Emissions (30MHz to 1GHz)

Radiated electric field emission measurements are applied as defined in 47CFR15.205 and 47CFR15.209.

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

Table 2 Specification limit

Note: FCC 47 CFR Part 15 Section 15.209 and 15.205 specifies 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

Table 3 Analyser settings

5.4.2 Emissions measurements

5.4.3 Date of Test

26th October 2022

5.4.4 Test Area

LAB 1 (SAC)

5.4.5 Tested by

M Render

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.

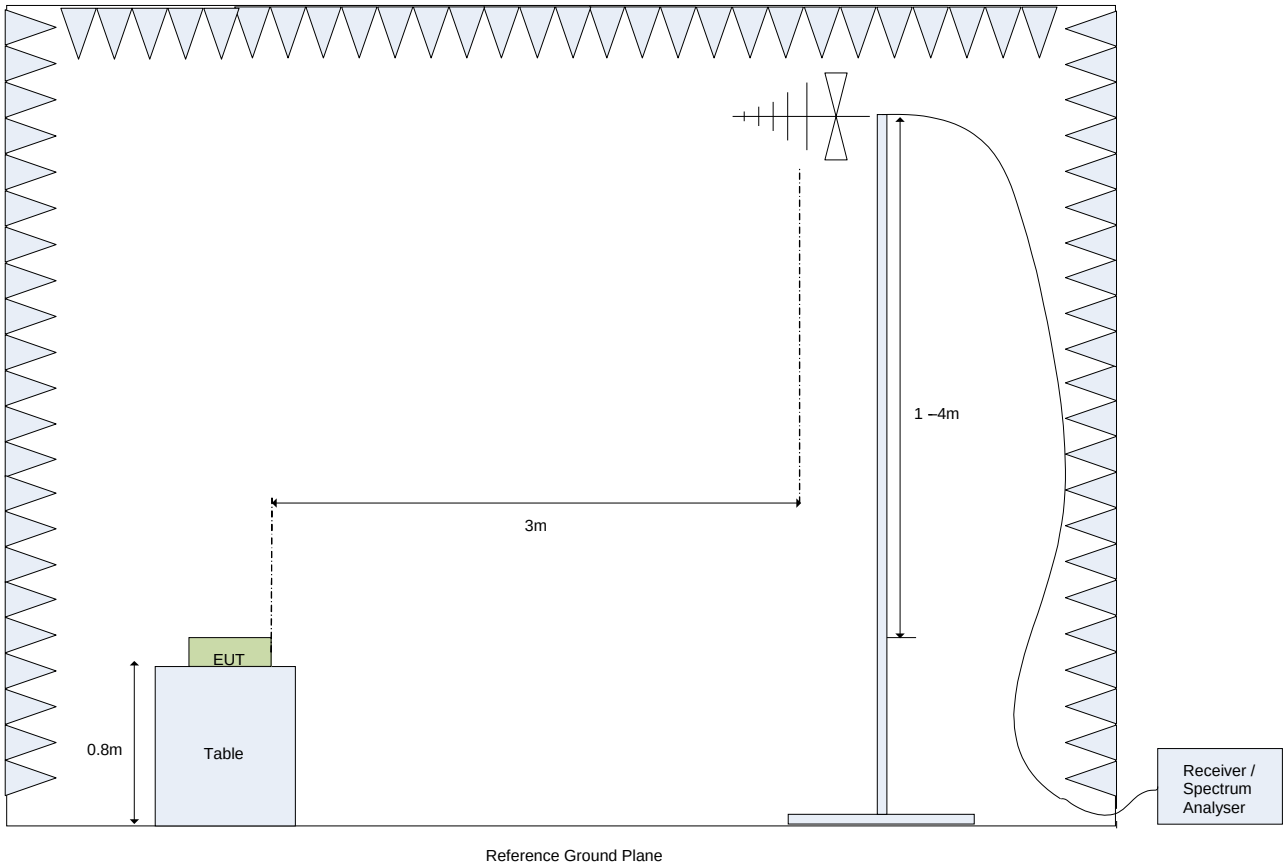

Figure 9 Test Setup for E-Field Measurements from 30MHz to 1GHz

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

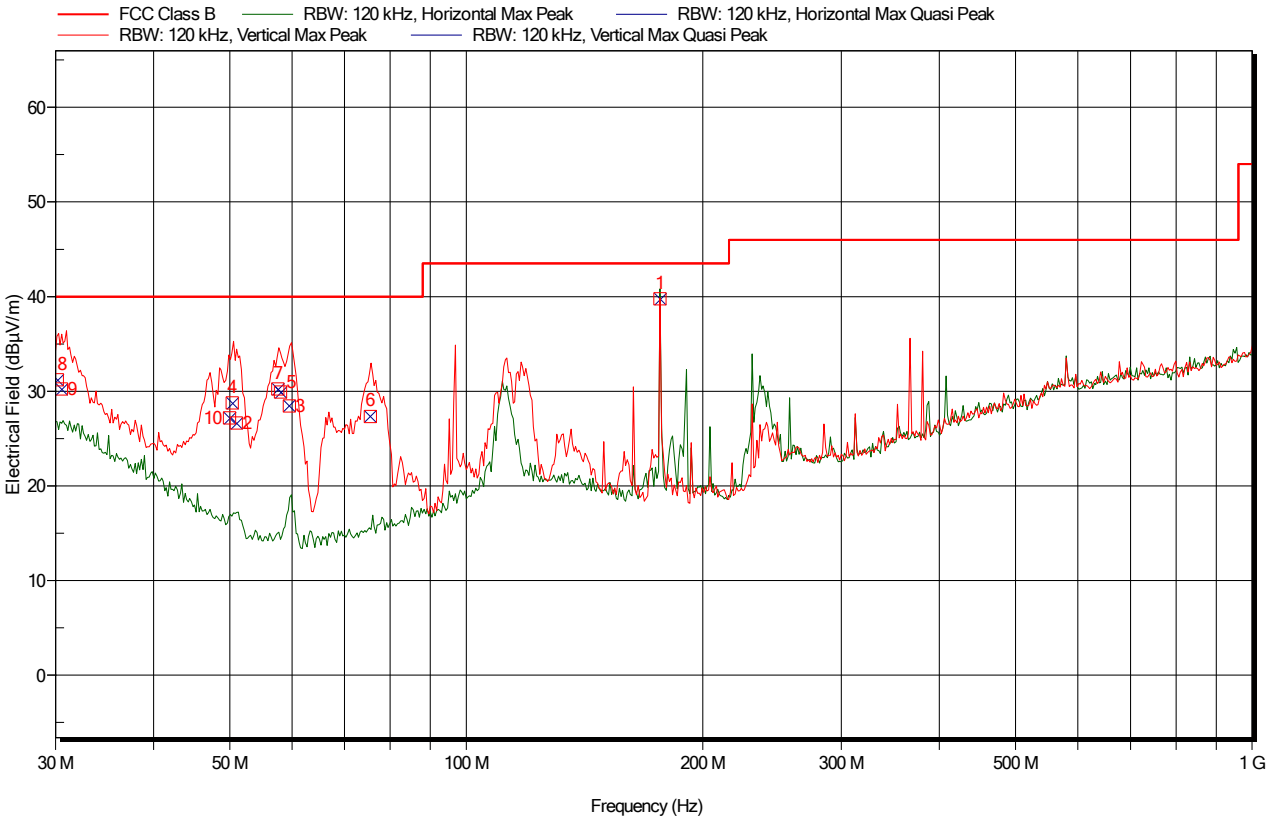

Figure 10 Electric field emissions Plot, 30MHz to 1GHz

Frequency	Quasi-Peak	Quasi Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height	Polarization
MHz	dBµV/m	dBµV/m	dB		degrees	m	
30.18	31.2	40	-8.8	Pass	65	1	Vertical
30.54	30.3	40	-9.7	Pass	315	1	Vertical
49.98	27.2	40	-12.8	Pass	40	1	Vertical
50.34	28.8	40	-11.2	Pass	170	1	Vertical
50.94	26.6	40	-13.4	Pass	280	1	Vertical
57.54	30.2	40	-9.8	Pass	45	1	Vertical
58.02	29.9	40	-10.1	Pass	90	1	Vertical
59.52	28.4	40	-11.6	Pass	250	1	Vertical
75.48	27.3	40	-12.7	Pass	95	1.3	Vertical
176.28	39.8	43.5	-3.7	Pass	210	2	Horizontal

Table 4 Electric Field Emissions Peaks, 30MHz to 1GHz

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 176.280MHz (Table 4)

FS (dBµV/m) = 23.20(dBµV) + 15.27(dB/m) +1.28(dB) = 39.75 (dBµV/m)

Section 6 Frequency Stability

6.1 Test Specification

FCC Rule	47CFR 15.225 (e) – Frequency tolerance with temperature variation
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 $\pm 1 \times 10^{-8}$

6.1.1 Date of Test

11th November 2022

6.1.2 Test Area

LAB 7 - bench

6.1.3 Tested by

M Render

6.1.4 Procedure

For frequency stability with respect to supply voltage the procedures of ANSIC63.10 Section 6.8.2 were followed. The measurements were performed at ambient room temperature.

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

6.1.5 Test Results

Supply voltage (V ac)		Frequency (MHz)	Nominal	Deviation	Limit	Result
115% of Nom	138	13.560558	13.56	0.0041	0.01	Within limit
85% of Nom	102	13.56021	13.56	0.0015	0.01	Within limit

Table 5 Frequency stability with supply voltage Results

Temperature (ºC)	Time	Frequency (MHz)	Nominal	Deviation (%)	Limit 47CFR15.225 (%)	Result
50	Startup	13.559567	13.56	0.003	0.01	Within Limit
	2min	13.559429	13.56	0.004	0.01	Within Limit
	5min	13.560845	13.56	-0.006	0.01	Within Limit
	10min	13.559573	13.56	0.003	0.01	Within Limit
40	Startup	13.559412	13.56	0.004	0.01	Within Limit
	2min	13.559774	13.56	0.002	0.01	Within Limit
	5min	13.559263	13.56	0.005	0.01	Within Limit
	10min	13.559428	13.56	0.004	0.01	Within Limit
30	Startup	13.559456	13.56	0.004	0.01	Within Limit
	2min	13.55952	13.56	0.004	0.01	Within Limit
	5min	13.559402	13.56	0.004	0.01	Within Limit
	10min	13.560172	13.56	-0.001	0.01	Within Limit
20	Startup	13.559301	13.56	0.005	0.01	Within Limit
	2min	13.560622	13.56	-0.005	0.01	Within Limit
	5min	13.559512	13.56	0.004	0.01	Within Limit
	10min	13.561207	13.56	-0.009	0.01	Within Limit
10	Startup	13.55937	13.56	0.005	0.01	Within Limit
	2min	13.560739	13.56	-0.005	0.01	Within Limit
	5min	13.5607	13.56	-0.005	0.01	Within Limit
	10min	13.559877	13.56	0.001	0.01	Within Limit
0	Startup	13.560034	13.56	0.000	0.01	Within Limit
	2min	13.559427	13.56	0.004	0.01	Within Limit
	5min	13.559487	13.56	0.004	0.01	Within Limit
	10min	13.559572	13.56	0.003	0.01	Within Limit
-10	Startup	13.559721	13.56	0.002	0.01	Within Limit
	2min	13.559485	13.56	0.004	0.01	Within Limit
	5min	13.560215	13.56	-0.002	0.01	Within Limit
	10min	13.559421	13.56	0.004	0.01	Within Limit
-20	Startup	13.559609	13.56	0.003	0.01	Within Limit
	2min	13.56009	13.56	-0.001	0.01	Within Limit
	5min	13.559528	13.56	0.003	0.01	Within Limit
	10min	13.559694	13.56	0.002	0.01	Within Limit

Table 6 Frequency stability with temperature results

Section 7 AC Mains Conducted Emissions

7.1 Test Specification

Regulation (USA)	47CFR15.207
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 +/- 3.45dB

7.2 Power Line Emission Limits

Frequency (MHz)	Class B (dBµV)	
	Quasi Peak	Average
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5.0	56.0	46.0
5.0 - 30	60.0	50.0

Table 7 Specification limit

Note: * The limit decreases linearly with the logarithm of the frequency in the range

7.3 Receiver Settings

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

Table 8 Analyser settings

7.4 Procedure and Test Software Version

Eurofins York test procedure	CEP19 Issue 5
Test software	RadiMation Version 2016.1.6

7.4.1 Date of Test

2nd November 2022

7.4.2 Test Area

LAB 2

7.4.3 Tested by

M Render

7.4.4 Test Setup

This test was applied to the EUT's Live and Neutral lines. The EUT was configured in the screened room on an 80cm high table was positioned 40cm from the room wall.

A calibrated mains extension lead was used to ensure a known impedance was presented to the EUT

The EUT was then powered from the mains supply via a Line Impedance Stabilisation Network (LISN).

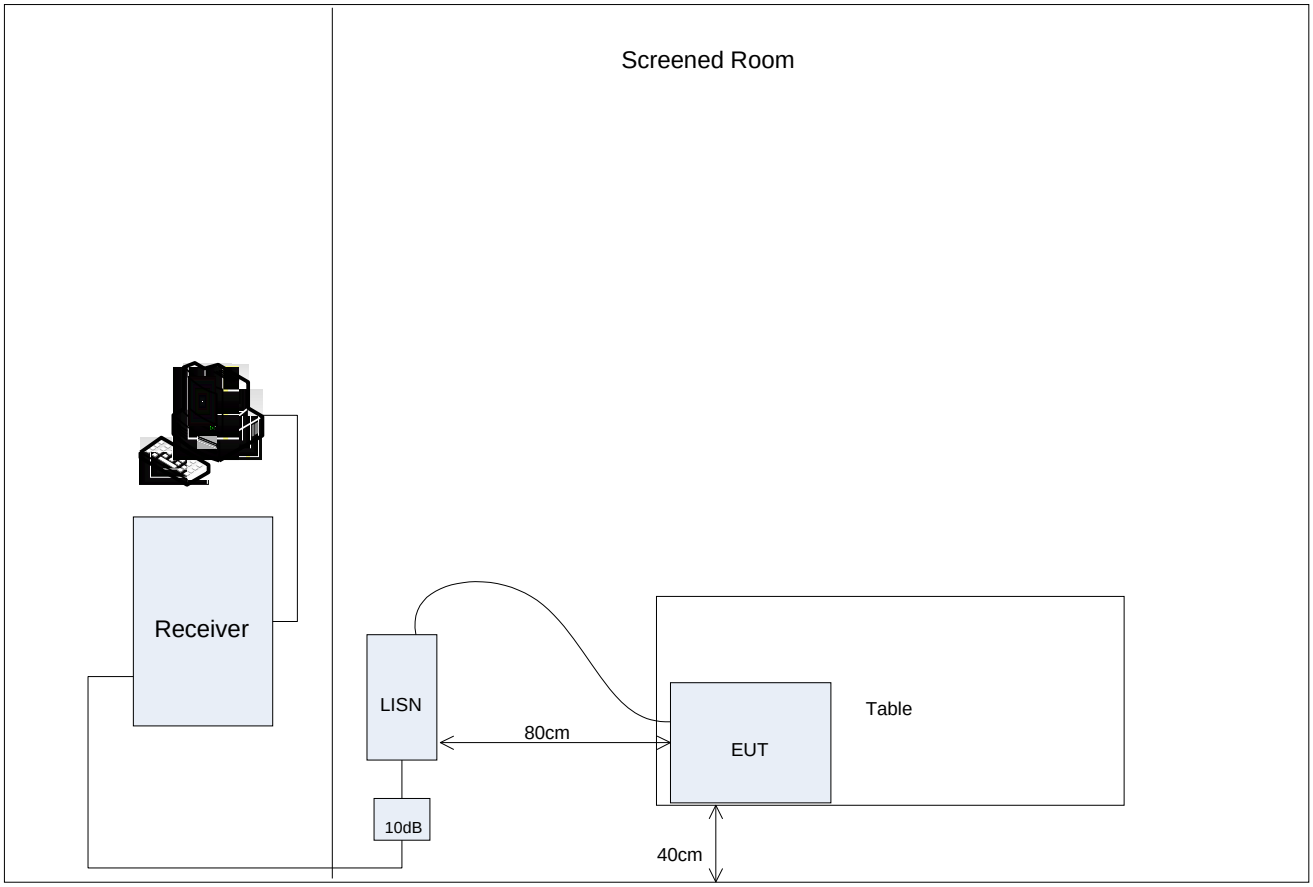

Figure 11 Test set up

7.5 Test Results

This section contains graphical and tabulated data. The following data is presented:

Mode of operation	Conductor	Test configuration	Result summary
13.56MHz	Live	Antenna connected	Pass
13.56MHz	Neutral	Antenna connected	Pass
13.56MHz	Live	50Ωload connected	Pass
13.56MHz	Neutral	50Ωload connected	Pass

Note:

From FCC KDB document 174176 D01 Line Conducted FAQ v01r01:

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:

(1) Perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;

(2) Retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band.

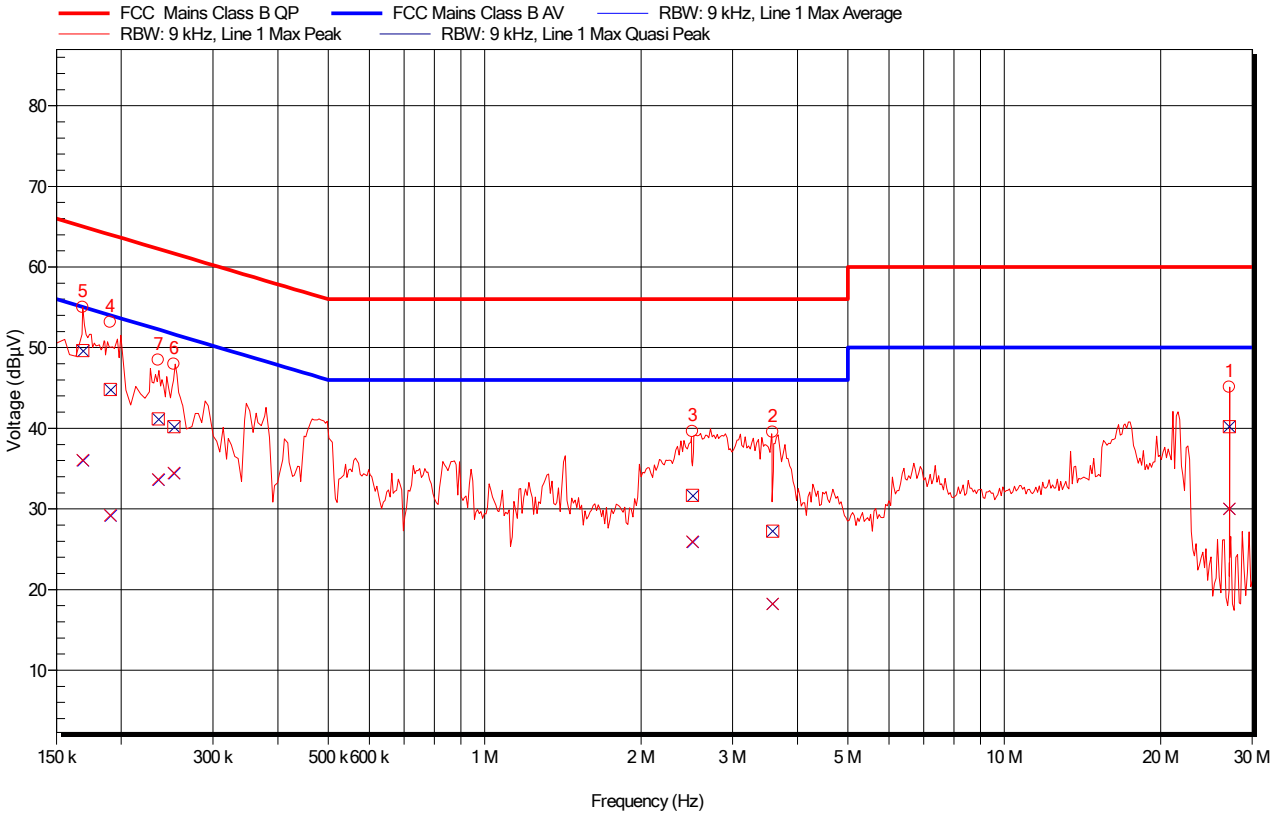

Figure 12 AC mains conducted emissions – Live – antenna in place

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.168	36.05	55.04	-18.99	Pass	49.64	65.04	-15.4	Pass
0.190	29.23	54.01	-24.78	Pass	44.80	64.01	-19.21	Pass
0.236	33.67	52.25	-18.58	Pass	41.15	62.25	-21.10	Pass
0.253	34.45	51.67	-17.22	Pass	40.19	61.67	-21.48	Pass
2.513	25.95	46.00	-20.05	Pass	31.68	56.00	-24.32	Pass
3.584	18.21	46.00	-27.79	Pass	27.23	56.00	-28.77	Pass
27.119	30.02	50.00	-19.98	Pass	40.20	60.00	-19.80	Pass

Table 9 Electric Field Emissions 150kHz to 30MHz – Live – antenna in place

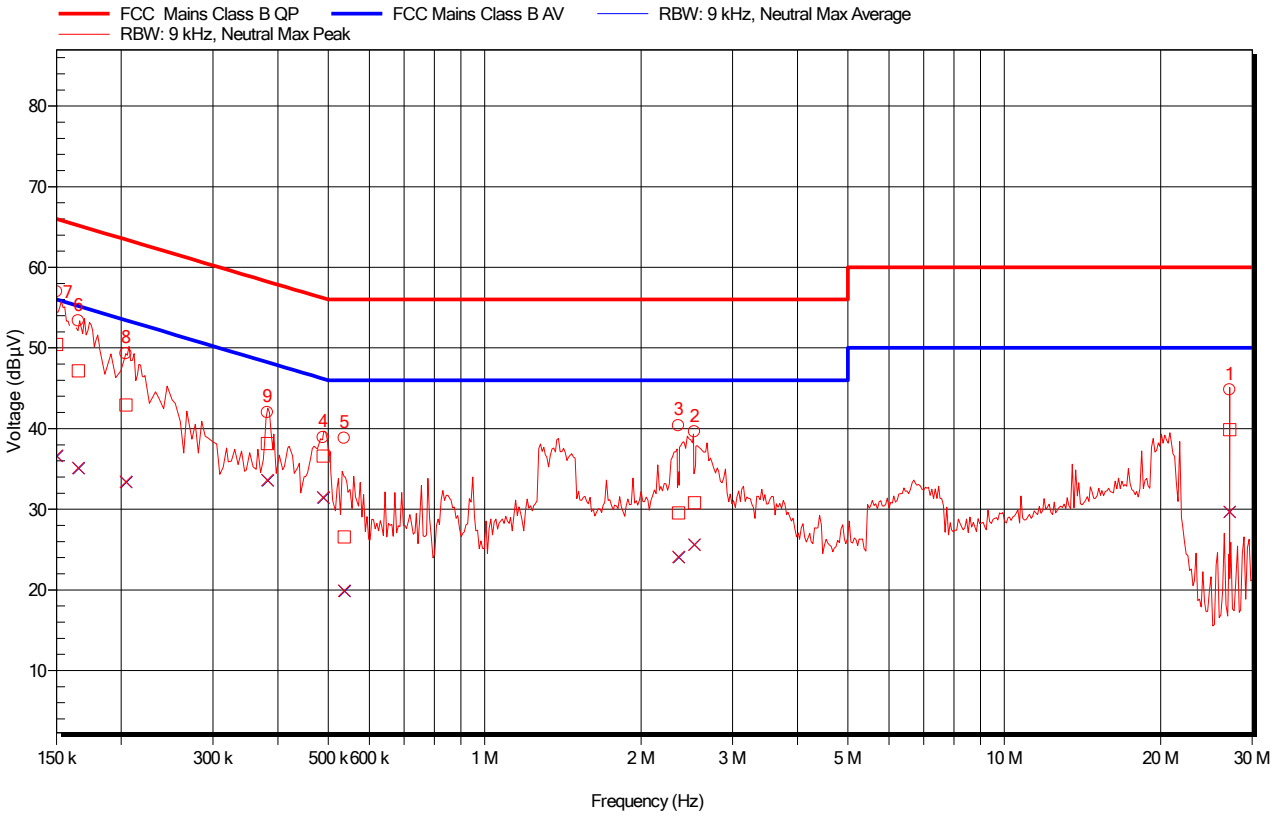

Figure 13: AC mains conducted emissions – Neutral – antenna in place

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.150	36.65	56.00	-19.35	Pass	50.46	66.00	-15.54	Pass
0.165	35.13	55.19	-20.07	Pass	47.15	65.19	-18.04	Pass
0.204	33.43	53.45	-20.02	Pass	42.94	63.45	-20.50	Pass
0.382	33.61	48.23	-14.62	Pass	38.14	58.23	-20.09	Pass
0.489	31.49	46.19	-14.70	Pass	36.61	56.19	-19.58	Pass
0.537	19.92	46.00	-26.08	Pass	26.57	56.00	-29.43	Pass
2.359	24.09	46.00	-21.91	Pass	29.57	56.00	-26.43	Pass
2.535	25.59	46.00	-20.41	Pass	30.80	56.00	-25.20	Pass
27.121	29.67	50.00	-20.33	Pass	39.86	60.00	-20.14	Pass

Table 10 Electric Field Emissions Peaks, 150kHz to 30MHz – Neutral – antenna in place

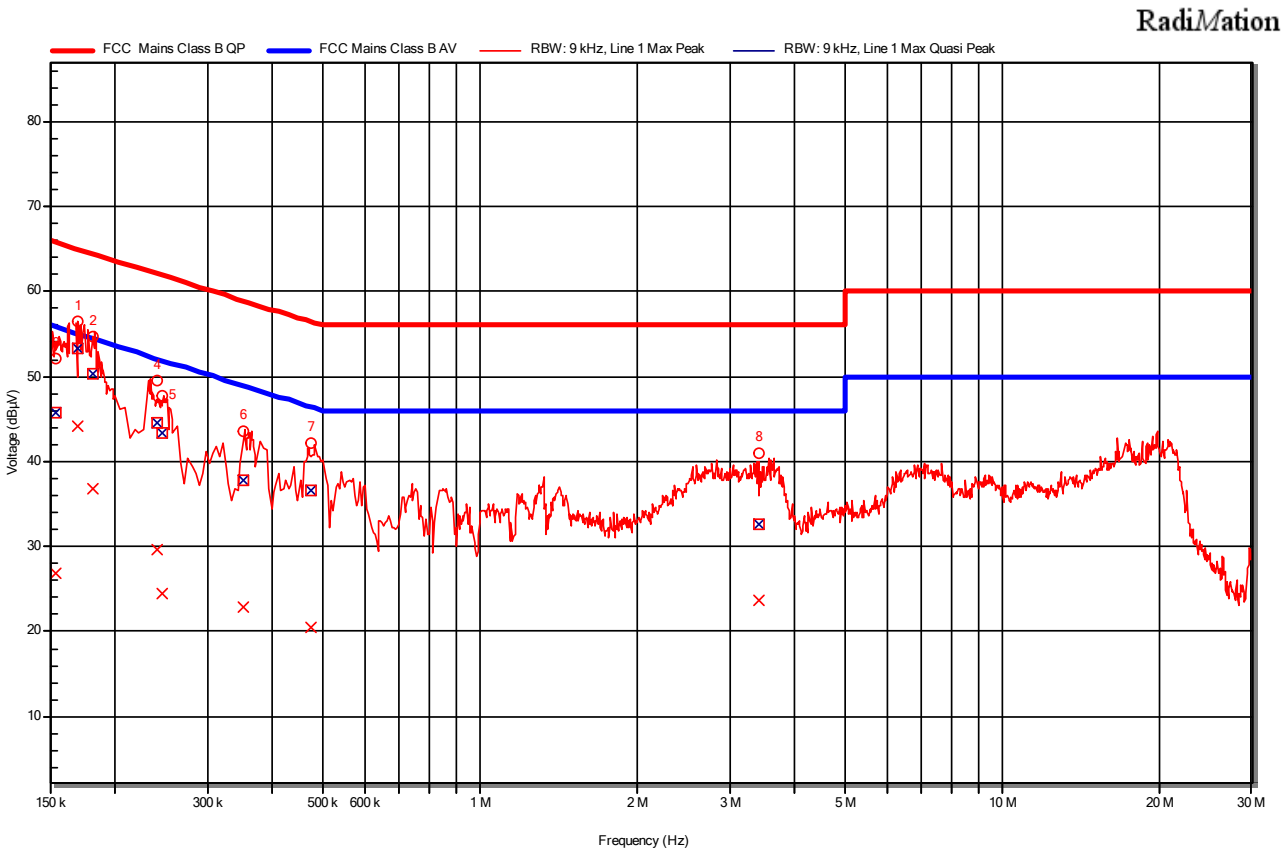

Figure 14: AC mains conducted emissions – Live – antenna replaced with 50Ω load

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.155	26.81	55.75	-28.94	Pass	45.83	65.75	-19.92	Pass
0.170	44.16	54.97	-10.81	Pass	53.33	64.97	-11.64	Pass
0.181	36.84	54.42	-17.58	Pass	50.28	64.42	-14.13	Pass
0.240	29.60	52.10	-22.50	Pass	44.46	62.10	-17.63	Pass
0.247	24.46	51.87	-27.40	Pass	43.44	61.87	-18.43	Pass
0.353	22.95	48.89	-25.94	Pass	37.85	58.89	-21.04	Pass
0.474	20.46	46.44	-25.99	Pass	36.64	56.44	-19.80	Pass
3.422	23.71	46.00	-22.29	Pass	32.60	56.00	-23.40	Pass

Table 11: Mains conducted emissions 150kHz to 30MHz – Live antenna replaced with 50Ω load

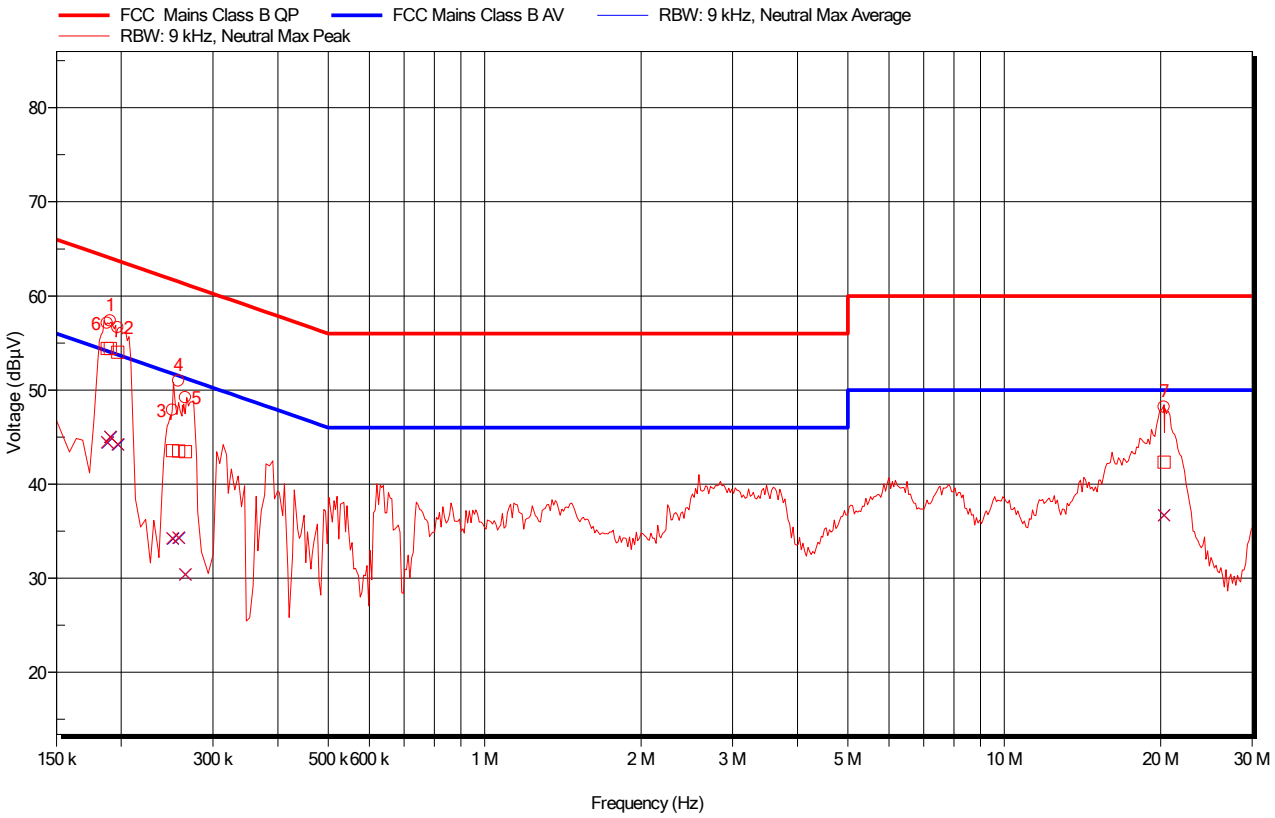

Figure 15 AC mains conducted emissions – Neutral - antenna replaced with 50Ω load

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.187	44.45	54.13	-9.68	Pass	54.41	64.13	-9.72	Pass
0.191	45.02	54.01	-9.00	Pass	54.40	64.01	-9.62	Pass
0.196	44.23	53.74	-9.51	Pass	54.00	63.74	-9.74	Pass
0.250	34.25	51.73	-17.48	Pass	43.54	61.73	-18.19	Pass
0.258	34.32	51.50	-17.17	Pass	43.53	61.50	-17.97	Pass
0.265	30.38	51.25	-20.88	Pass	43.46	61.25	-17.79	Pass
20.297	36.68	50.00	-13.32	Pass	42.34	60.00	-17.66	Pass

Table 12 Electric Field Emissions Peaks, 150kHz to 30MHz – Neutral antenna replaced with 50Ω load

7.5.1 Example calculation

This correction factors required consists of LISN Insertion loss (IL), Cable loss (CL) and Transient Limiter Loss (TL)

The Actual Signal Level (ASL) is calculated as follows:

ASL (dBµV) = Indicated Signal Level (dBµV) + IL (dB) + CL (dB) + TL (dB)

7.5.2 Sample Data

The Quasi-Peak level at 3.584MHz (Table 9).

ASL (dBµV) = 27.23dBµV =16.95 dBµV + 0.24 dB + 0.12dB + 9.92dB

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	Lab 1	20th January 2020	3 years
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	-	-
R & S ESR26	C0502	30th April 2022	12 Months
6dB Attenuator (For use with Bilog Antenna)	C0506B	15th July 2021	36 Months
Teseq CBL6112D Bilog Antenna	C0506	15th July 2021	36 Months
HF26 Cable	HF26	17th January 2022	12 Months
HF35 Cable	HF35	17th January 2022	12 Months
HF27 Cable	HF27	17th January 2022	12 Months

Radiated Emissions 9kHz to 30MHz Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 5 Fully-Anechoic Chamber	Lab 5	30th July 2021	36 Months
Schwarzbeck BBV 9745 preamplifier 9kHz – 2GHz	C0632	4th February 2021	24 months
ETS Lindgren 6512 loop antenna	B0921	21st February 2020	36 Months
RF cables	11, 12, 16 and HF13	10th January 2022	12 Months
Rohde & Schwarz ESW Test Receiver	C0658	8th November 2022	12 Months

Frequency stability measurement equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Keysight MXE EMI Receiver	C0339	25th January 2022	12 Months
JTS Environmental test chamber	C0108	18th May 2021	18th November 2022

AC Mains conducted emissions equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Rohde & Schwarz ESR7 Test receiver	C0449	30th January 2022	12 Months
Cables J7, J9 and LF3	-	11th January 2022	12 Months
Rohde & Schwarz ESH3-Z5 LISN 78119	78119	17th January 2022	12 Months
Teseq CFL 9206A transient limiter 10dB 9kHz - 30MHz	C0282	11th January 2022	12 Months
Kikusui PCR2000M power supply	-	-	-