



TEST REPORT

Test Report No. : UL-RPT-RP12983720-1516A

Manufacturer : Sports & Wellbeing Analytics Limited

Model No. / HVIN : CC0002

PMN : Protecht

FCC ID : 2AT9A-CC0002NA

ISED Certification No. : IC: 25409-CC0002NA

Test Standard(s) : FCC Parts 15.207, 15.209 & 15.215(c);
ISED Canada RSS-210 7.2, RSS-Gen 6.7, 6.13 & 7.2

Test Laboratory : UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH,
United Kingdom

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 09 November 2021

Checked by:

Sarah Williams
RF Operations Leader, Radio Laboratory

Company Signatory:

Ben Mercer
Lead Project Engineer, Radio Laboratory



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UL International (UK) Ltd

Unit 1-3 Horizon, Kingsland Business Park, Wade Road, Basingstoke, Hampshire, RG24 8AH, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

Customer Information

Company Name:	Sports & Wellbeing Analytics Limited
Address:	3 New Mill Court Swansea Enterprise Park Swansea SA7 9FG United Kingdom

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	26/05/2021	Initial version	Sarah Williams
2.0	09/11/2021	HVIN amended	Ben Mercer

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1. Attestation of Test Results

1.1. Description of EUT

The Equipment Under Test (EUT) was a Wireless Power Transfer (WPT) Charging case incorporated within it. The EUT incorporates a WPT module to wirelessly charge 24 sports mouthguards at once. The EUT is marketed as a WPT source.

1.2. General Information

Specification Reference:	47CFR15.207, 47CFR15.209 and 47CFR15.215
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207, 15.209 & 15.215
Specification Reference:	RSS-Gen Issue 5, February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-210 Issue 10, December 2019
Specification Title:	Licence-Exempt radio Apparatus: Category I Equipment
Site Registration:	FCC: 685609, ISEDC: 20903
FCC Lab. Designation No.:	UK2011
ISEDC CABID:	UK0001
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	05 November 2020 to 01 April 2021

1.3. Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
Part 15.215(c)	RSS-Gen 6.7	Transmitter 20 dB Bandwidth	
Part 15.209	RSS-210 7.2 & RSS-Gen 6.13	Transmitter Radiated Emissions	
Part 15.207	RSS-Gen 7.2	Transmitter AC Conducted Emissions	
Key to Results  = Complied  = Did not comply			

1.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

2.Summary of Testing

2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	-

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2.2. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC KDB 414788 D01 Radiated Test Site v01r01 July 12, 2018
Title:	Test Sites For Radiated Emission Measurements
Reference:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions
Reference:	Notice 2020 - DRS0023
Title:	Guidance on magnetic field strength radiated emission measurements (9 kHz - 30 MHz)

2.3. Calibration and Uncertainty

Measuring Instrument Calibration

In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

Measurement Uncertainty & Decision Rule

Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±2.40 dB
20 dB Bandwidth	130 kHz to 144 kHz	95%	±4.59 %
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±3.30 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

2.4. Test and Measurement Equipment

Test Equipment Used for Transmitter 20 dB Bandwidth Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	10 Dec 2021	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	14 Oct 2021	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	24 Apr 2021	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	21 Sep 2021	12

Test Equipment Used for Transmitter Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	10 Dec 2021	12
M2043	Thermohygrometer	Testo	608-H1	45120017	10 Dec 2021	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	14 Oct 2021	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	12 Oct 2021	12
A3198	Magnetic Loop Antenna	ETS-Lindgren	6502	00221887	01 Apr 2021	12
*A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	21 Sep 2021	12
M2054	Precision Steel Rule 1 m / 39 in	RS	Not marked or stated	1218213/42	11 Sep 2023	12
A3244	Distance Measuring Wheel	Kingfisher	Not marked or stated	Not marked or stated	Calibrated before use	-
A2955	Protractor	Not marked or stated	9781907550980	#1	Calibration not required	-
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	24 Apr 2021	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	29 Sep 2021	12
A553	Antenna	Chase	CBL6111A	1593	21 Sep 2021	12
A3112	Attenuator	AtlanTecRF	AN18-06	219706#2	21 Sep 2021	12

*Test equipment was used for measurements performed on 01 April 2021.

Test and Measurement Equipment (continued)**Test Equipment Used for AC Conducted Emissions Test**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2037	Thermohygrometer	Testo	608-H1	45124925	09 Dec 2021	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	03 Aug 2021	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	07 Apr 2021	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	10 Oct 2021	12

Test Measurement Software/Firmware Used:

Name	Version	Release Date
Rohde & Schwarz EMC32	6.30.0	2018

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Sports & Wellbeing Analytics Limited
Model Name or Number / HVIN:	CC0002
PMN:	Protecht
Test Sample Serial Number:	CC0002.19
Hardware Version:	V2.0 (2020), V2.1 (2021) <see section 3.2>
Software Version:	N/A
FCC ID:	2AT9A-CC0002NA
ISED Canada Certification Number:	IC: 25409-CC0002NA

3.2. Modifications Incorporated in the EUT

The manufacturer modified the power supply filter from FN 283-10-06 to FN283-1-06. All testing after March 2021 was carried out with the modified filter. AC conducted emissions, 20 dB bandwidth and radiated emission measurements within the 3m semi-anechoic chamber were repeated after the modification was implemented.

3.3. Additional Information Related to Testing

Tested Technology:	Wireless Power Transfer	
Power Supply Requirement:	Nominal	120 VAC 60 Hz
Type of Unit:	Transceiver	
WPT Frequency	130 kHz to 144 kHz	

3.4 Description of Test Setup

Support Equipment

The following support equipment was used to exercise the EUT during testing:

Brand Name:	PROTECHT
Model Name or Number:	Instrumented Mouthguard electronics. Quantity 24
Hardware Version:	4.1

Operating Modes

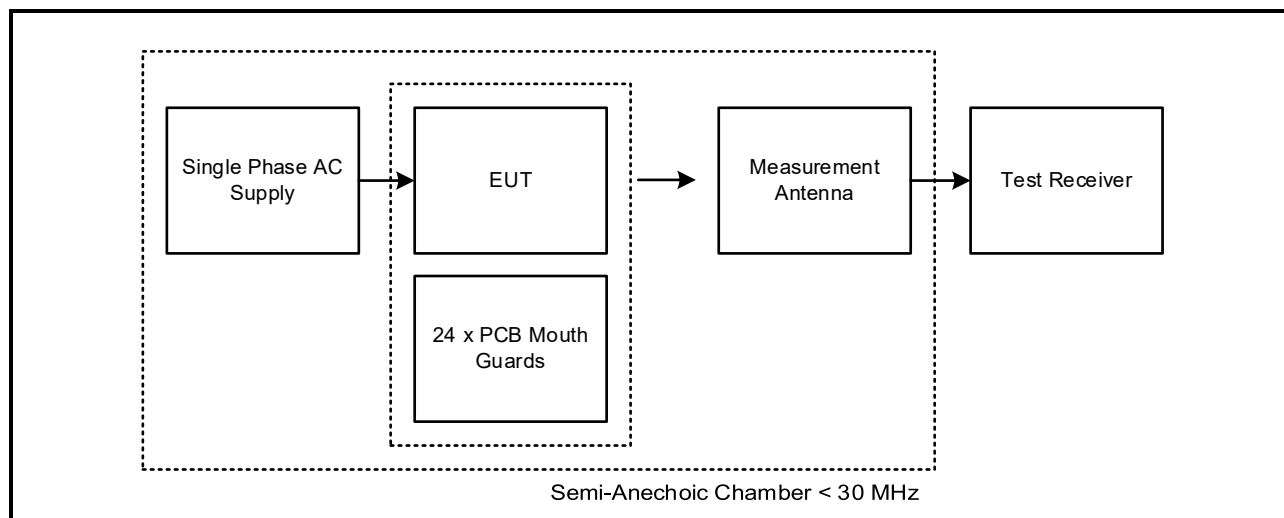
The EUT was tested in the following operating mode:

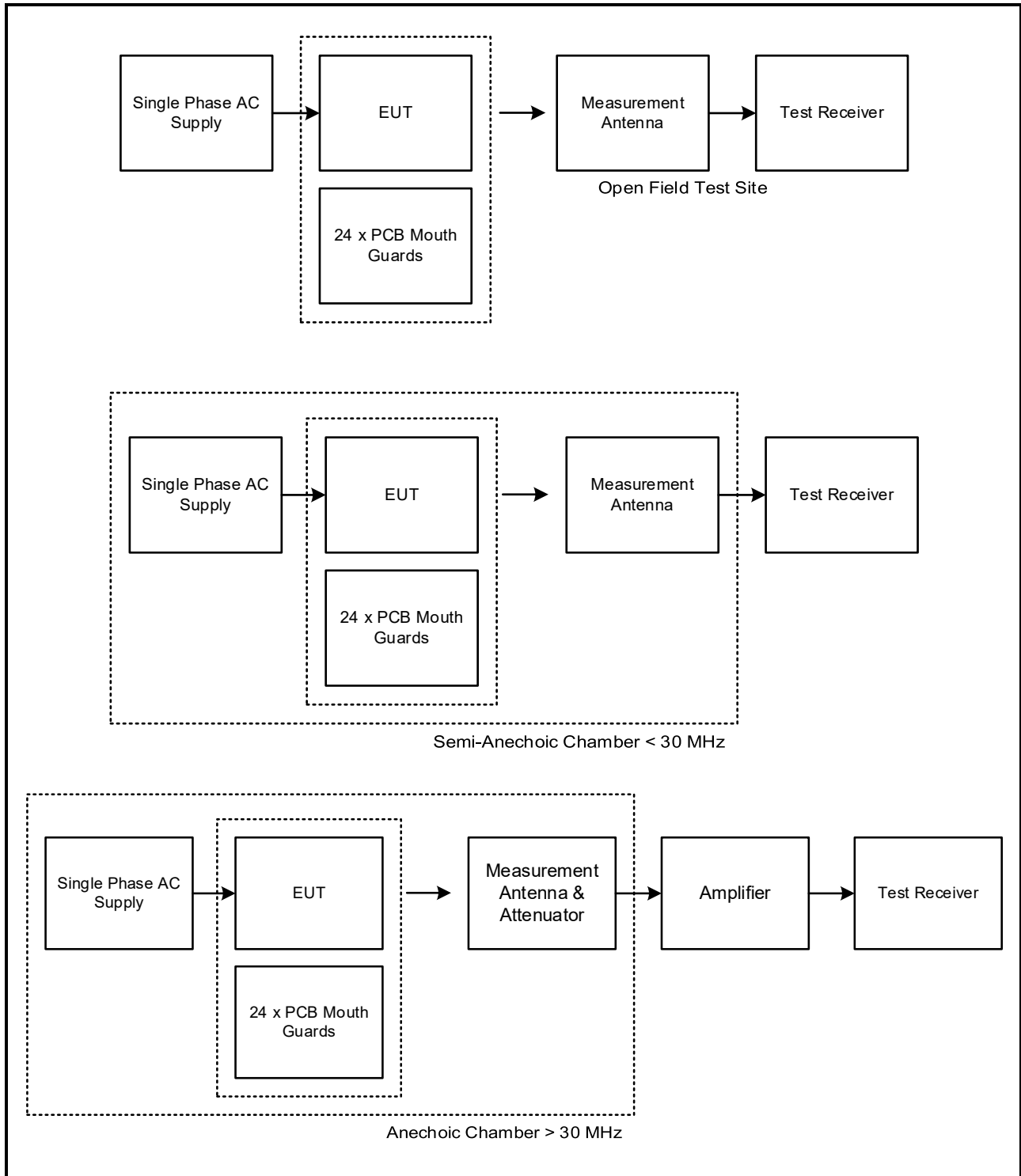
- WPT – Charging mode.

Configuration and Peripherals

The EUT was tested in the following configuration(s):

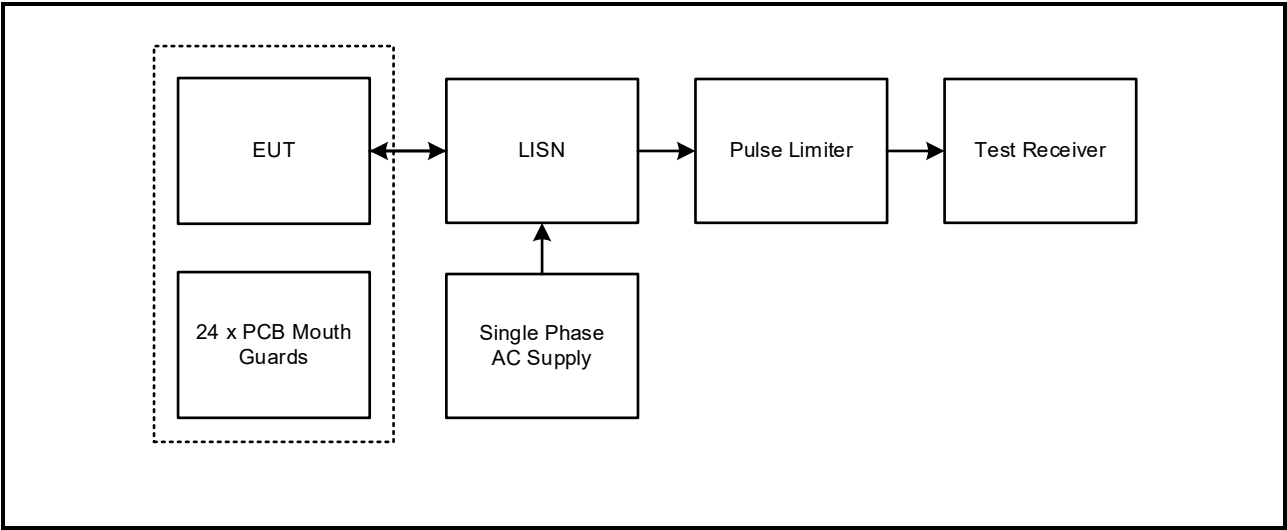
- Tests were performed with a mouthguard (WPT client) placed on each of the 24 WPT coils within the charging case (WPT source). The case was powered from a 120 VAC 60 Hz single phase mains supply. The mouthguards contained a charging indicator LED that was monitored throughout testing.
- For testing purposes the customer supplied the mouthguard PCBs removed from their normal housing. This enabled the PCB to wirelessly charge throughout all tests.
- The EUT was placed in its normal mode of operation.
- It was not possible for the EUT to wirelessly charge the mouthguard without a zero separation gap and monitor the charging status throughout. Therefore all testing was performed using a zero separation gap.
- Refer to Appendix 1 of this test report for details of radiated tests on an open field test site.

Test Setup Diagrams**Radiated Tests:****Test Setup for Transmitter 20 dB Bandwidth:**

Test Setup Diagrams (continued)**Test Setup for Transmitter Radiated Emissions:**

Test Setup Diagrams (continued)

Test Setup for AC Conducted Emissions:



4 Radiated Test Results

4.1. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	01 April 2021
Test Sample Serial Number:	CC0002.19		

FCC Reference:	Part 15.215(c)
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

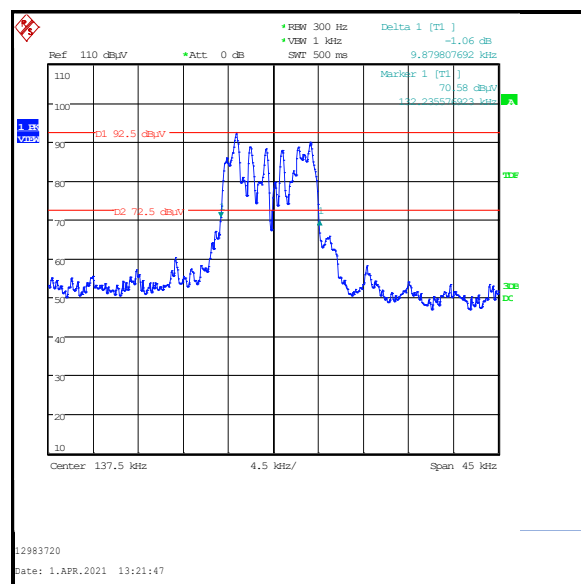
Temperature (°C):	23
Relative Humidity (%):	39

Note(s):

- The signal analyser resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 45 kHz. Normal and delta markers were placed 20 dB down from the peak of the carrier.

Results:

20 dB Bandwidth (kHz)
9.880



4.2. Transmitter Radiated Spurious Emissions**Test Summary:**

Test Engineers:	Andrew Edwards & Nick Tye	Test Dates:	10 November 2020 & 01 April 2021
Test Sample Serial Number:	CC0002.19		

FCC Reference:	Part 15.209
ISED Canada Reference:	RSS-210 7.2 & RSS-Gen 6.13
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5 FCC KDB 414788 and Notes below Notice 2020 - DRS0023
Frequency Range:	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	15 to 23
Relative Humidity (%):	39 to 74

Transmitter Radiated Spurious Emissions (continued)**Note(s):**

1. Limits below 30 MHz are specified at a test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. In accordance with FCC KDB 414788, an attempt was made to perform measurements at the distances specified in Part 15.209(a) on an open field test site. It was not possible to determine the spurious emission values at the test distances specified below 30 MHz on an open field test site, therefore in accordance with 47CFR15.31(f), measurements were made at closer distances. Attempts were made to measure spurious emissions at 3, 30 and 300 metres on an open field test site on 10 November 2020. Unfortunately, spurious emissions from the EUT could not be seen above the ambient emissions present at the open field test site or the noise floor of the measurement system. Additional measurement were performed in a semi-anechoic chamber tests on 01 April 2021 and results are shown in this section. In addition, the open field test result plots for measurements between 9 kHz and 30 MHz are also shown. These measurement plots are identical to background scan plots of the open field test site. Background scans of the open field test site and further information are shown in Appendix 1 of this test report.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss. Markers were placed on the peaks of the pre-scan plot and final measurements were performed using a quasi-peak detector.
4. Measurements between 30 MHz and 1 GHz on 01 April 2021 were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. The emission marked with * in the 9 kHz to 30 MHz results table is the fundamental emission of the WPT system. The measured level at 3 metres was extrapolated to the required distance of 300 metres by using 40 dB/decade (two decades = 80 dB). The fundamental emission does not fall within a restricted band.
6. Final measurement values include corrections for antenna factor and cable losses where applicable.
7. All other emissions shown on the pre-scan plots were investigated and found to be >20 dB below the applicable limit or below the measurement system noise floor.
8. A transducer factor was used on the test receiver during open field tests. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.
9. EUT rotation position in the result tables is relative to the position of the EUT to the measurement antenna. 0 degrees means the front of the EUT is facing directly towards the measurement antenna.
10. **Final measurements for <30 MHz were performed in terms of electrical field strength (dB μ V/m). In accordance with Notice 2020 - DRS0023 and the RSS-Gen limit, -51.5 dB has been applied to the electrical field strength level in order to convert to magnetic field strength or H-Field value (dB μ A/m).

Transmitter Radiated Spurious Emissions (continued)**FCC Results: 9 kHz to 30 MHz / Quasi Peak**

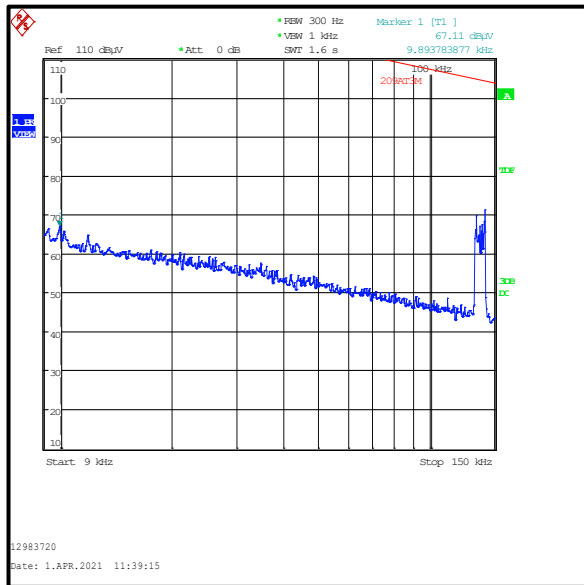
Frequency (kHz)	Antenna Orientation	EUT Rotation Position (degrees)	Measured level at 3 metres (dB μ V/m)	Measured level at 3 m extrapolated to 300 m (dB μ V/m)	Limit at 300 m (dB μ V/m)	Margin (dB)	Result
133.686*	Antenna Horizontally mounted, tip 90° to ground plane	139	66.0	-14.0	25.1	39.1	Complied

ISED Results: 9 kHz to 30 MHz / Quasi Peak

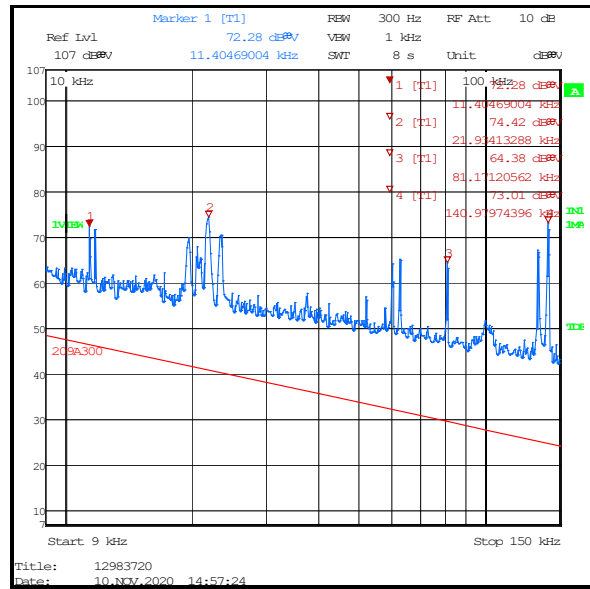
Frequency (kHz)	Antenna Orientation	EUT Rotation Position (degrees)	Measured level at 3 metres (dB μ A/m)	Measured level at 3 m extrapolated to 300 m (dB μ A/m)	Limit at 300 m (dB μ A/m)	Margin (dB)	Result
133.686*	Antenna Horizontally mounted, tip 90° to ground plane	139	**14.5	-65.5	-26.4	39.1	Complied

Results: 30 MHz to 1000 MHz / Quasi Peak

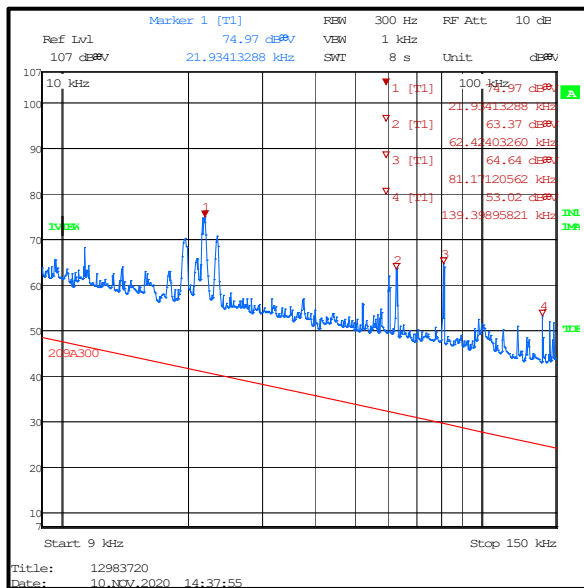
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
95.985	Horizontal	21.1	43.5	22.4	Complied

Transmitter Radiated Spurious Emissions (continued)

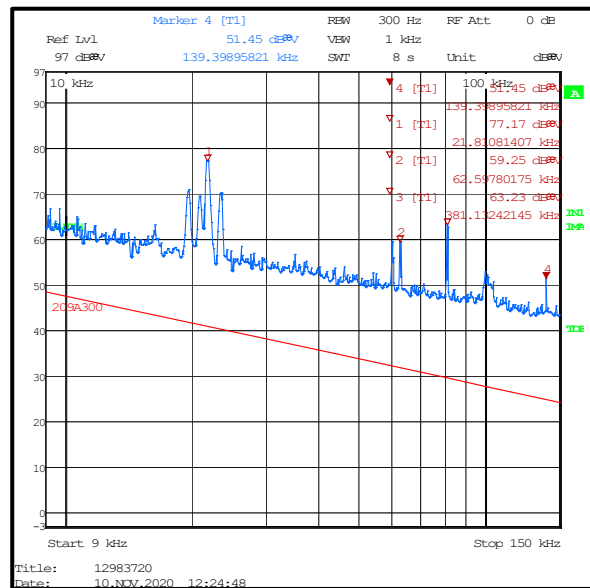
9 kHz to 150 kHz / peak detector / measured at 3 metres extrapolated to 300 metres / measured in a semi-anechoic chamber



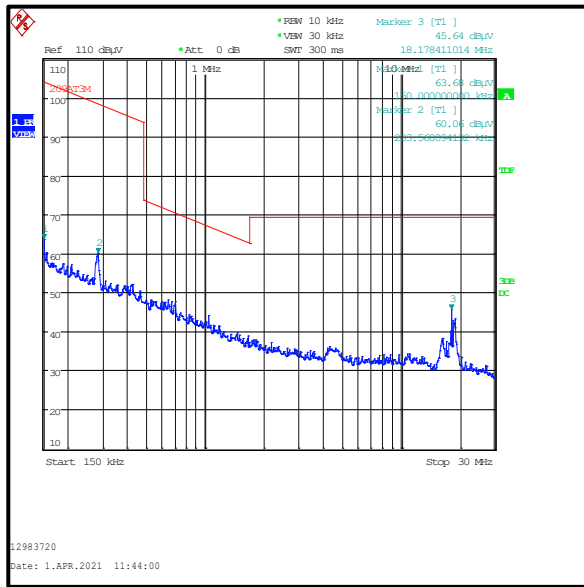
9 kHz to 150 kHz / peak detector / EUT operating / measured at 3 metres on an open field test site



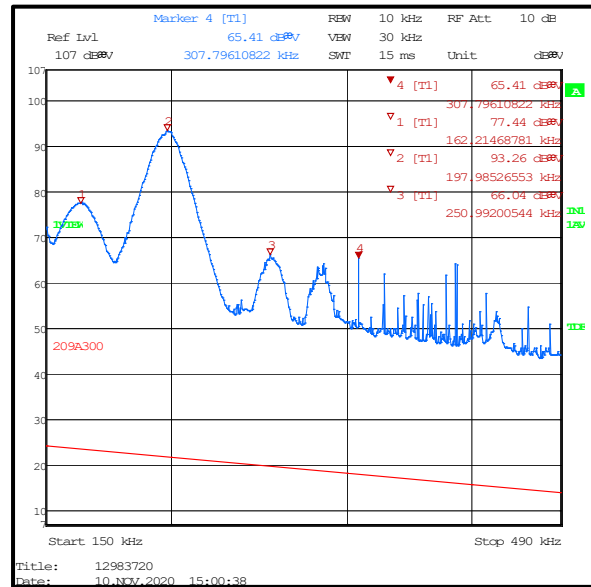
9 kHz to 150 kHz / peak detector / EUT operating / measured at 30 metres on an open field test site



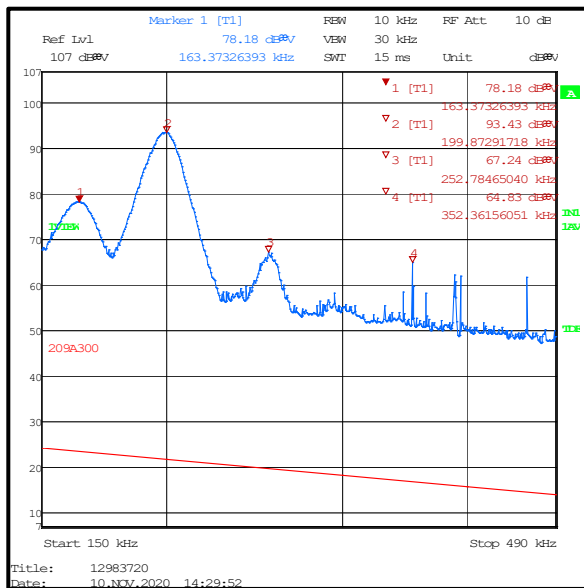
9 kHz to 150 kHz / peak detector / EUT operating / measured at 300 metres on an open field test site

Transmitter Radiated Spurious Emissions (continued)

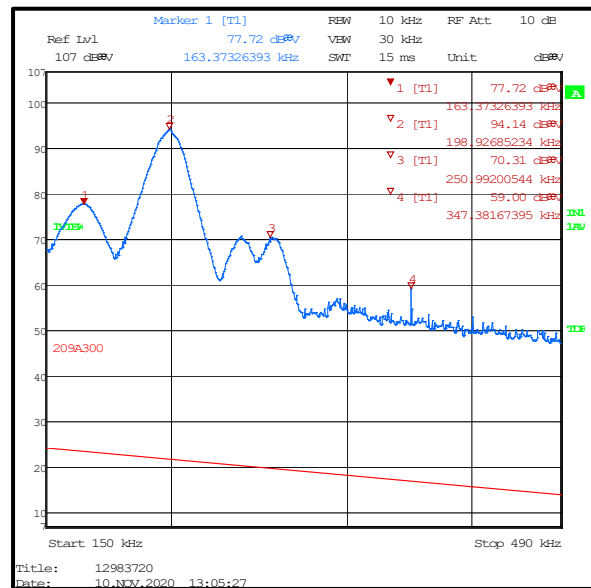
150 kHz to 30 MHz / peak detector (worst case) / EUT operating / measured at 3 metres / measured in a semi-anechoic chamber



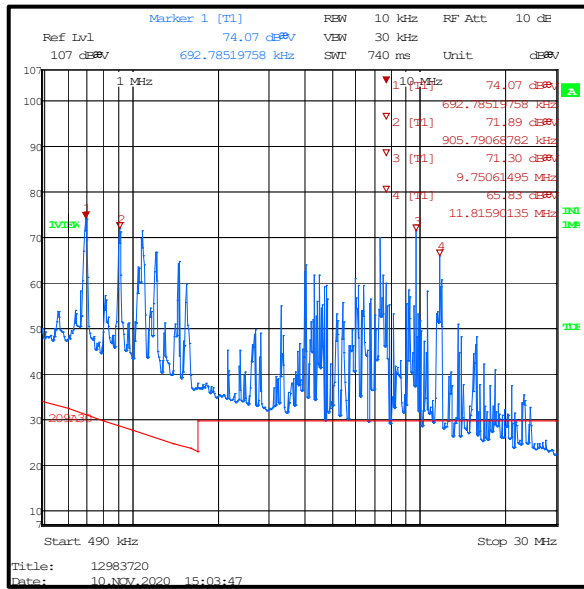
150 kHz to 490 kHz / average detector / EUT operating / measured at 3 metres on an open field test site



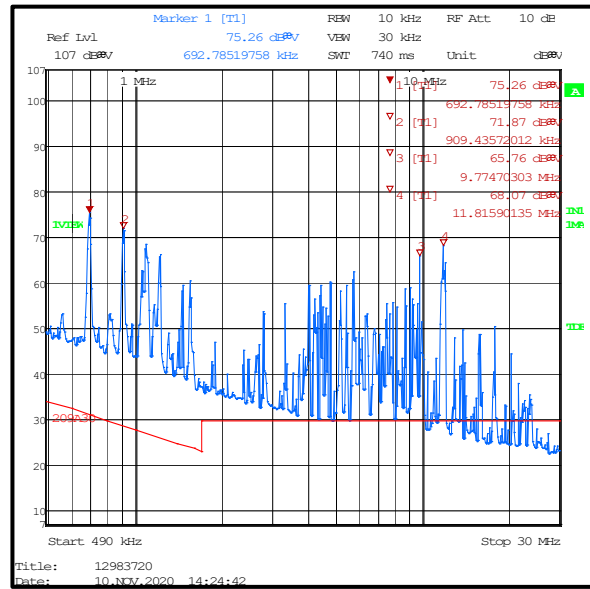
150 kHz to 490 kHz / average detector / EUT operating / measured at 30 metres on an open field test site



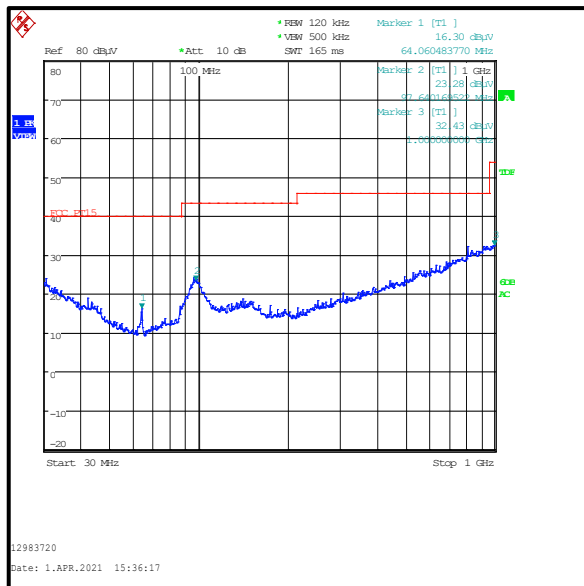
150 kHz to 490 kHz / average detector / EUT operating / measured at 300 metres on an open field test site

Transmitter Radiated Spurious Emissions (continued)

**490 kHz to 30 MHz / peak detector / EUT operating /
 measured at 3 metres on an open field test site**



**490 kHz to 30 MHz / peak detector / EUT operating /
 measured at 30 metres on an open field test site**



**30 MHz to 1 GHz / peak detector (worst case) /
 measured at 3 metres in a semi-anechoic chamber**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

4.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Alison Johnston	Test Date:	15 March 2021
Test Sample Serial Number:	CC0002.19		

FCC Reference:	Part 15.207
ISED Canada Reference:	RSS-Gen 7.2
Test Method Used:	ANSI C63.10 Section 6.2 and notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	29

Note(s):

1. The EUT was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the equipment.
3. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
4. A pulse limiter was fitted between the LISN and the test receiver.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak – 120 VAC**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.200	Live	24.4	63.6	39.2	Complied
0.281	Live	28.9	60.8	31.9	Complied
0.402	Live	14.2	57.8	43.6	Complied
18.375	Live	36.3	60.0	23.7	Complied
19.505	Live	35.7	60.0	24.3	Complied
25.058	Live	41.5	60.0	18.5	Complied

Results: Live / Average – 120 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.200	Live	18.5	53.6	35.1	Complied
0.236	Live	17.6	52.3	34.7	Complied
0.375	Live	10.0	48.4	38.4	Complied
18.429	Live	30.9	50.0	19.1	Complied
19.509	Live	29.0	50.0	21.0	Complied
25.058	Live	40.6	50.0	9.4	Complied

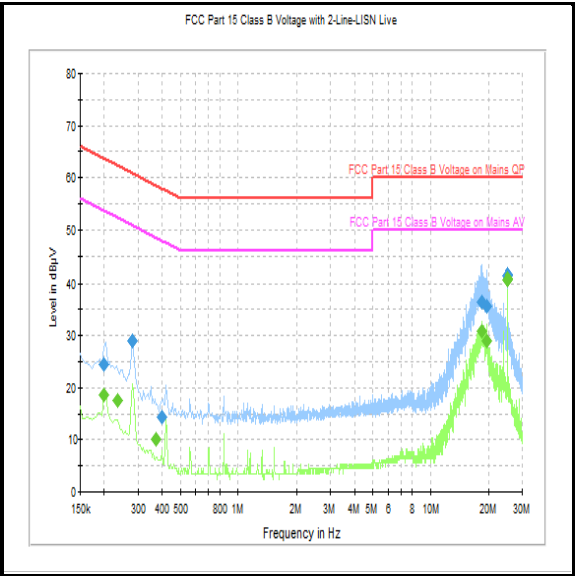
Results: Neutral / Quasi Peak – 120 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Neutral	24.2	63.4	39.2	Complied
0.236	Neutral	19.3	62.3	43.0	Complied
0.407	Neutral	13.0	57.7	44.7	Complied
18.560	Neutral	36.0	60.0	24.0	Complied
20.837	Neutral	30.0	60.0	30.0	Complied
25.058	Neutral	41.1	60.0	18.9	Complied

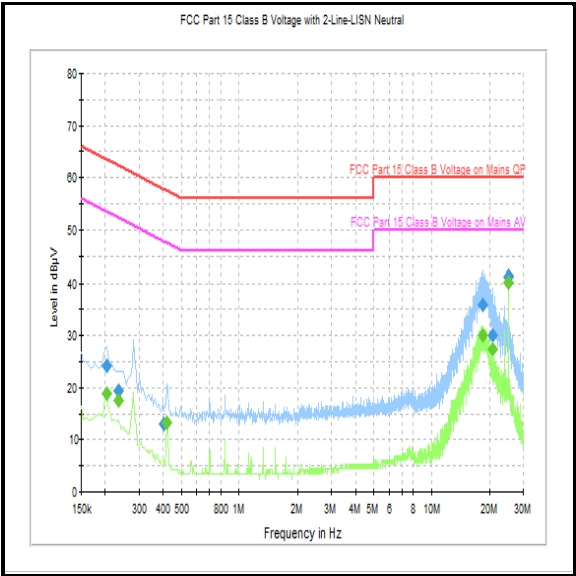
Results: Neutral / Average – 120 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Neutral	18.8	53.4	34.6	Complied
0.236	Neutral	17.6	52.3	34.7	Complied
0.420	Neutral	13.3	47.4	34.1	Complied
18.447	Neutral	29.9	50.0	20.1	Complied
20.747	Neutral	27.5	50.0	22.5	Complied
25.058	Neutral	40.0	50.0	10.0	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak – 240 VAC**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Live	23.6	63.4	39.8	Complied
0.281	Live	28.5	60.8	32.3	Complied
0.420	Live	17.7	57.4	39.7	Complied
18.569	Live	37.5	60.0	22.5	Complied
20.904	Live	28.6	60.0	31.4	Complied
25.058	Live	41.4	60.0	18.6	Complied

Results: Live / Average – 240 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.200	Live	18.0	53.6	35.6	Complied
0.281	Live	21.8	50.8	29.0	Complied
0.420	Live	18.6	47.4	28.8	Complied
19.415	Live	29.3	50.0	20.7	Complied
20.837	Live	24.4	50.0	25.6	Complied
25.058	Live	40.6	50.0	9.4	Complied

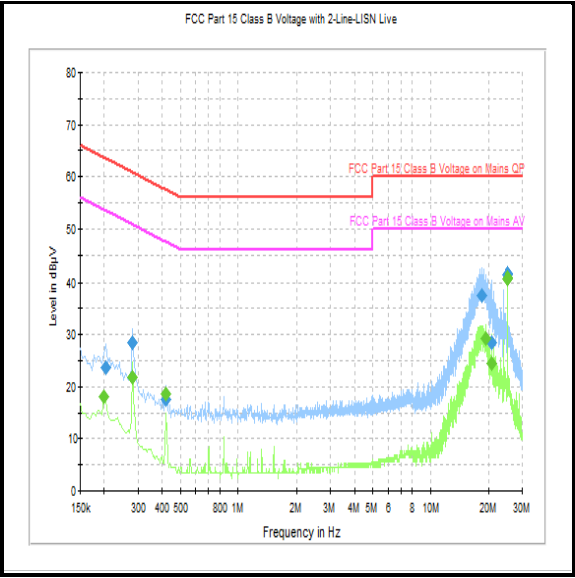
Results: Neutral / Quasi Peak – 240 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.200	Neutral	24.3	63.6	39.3	Complied
0.281	Neutral	28.5	60.8	32.3	Complied
0.420	Neutral	17.6	57.4	39.8	Complied
18.686	Neutral	35.2	60.0	24.8	Complied
20.850	Neutral	28.4	60.0	31.6	Complied
25.058	Neutral	52.8	60.0	7.2	Complied

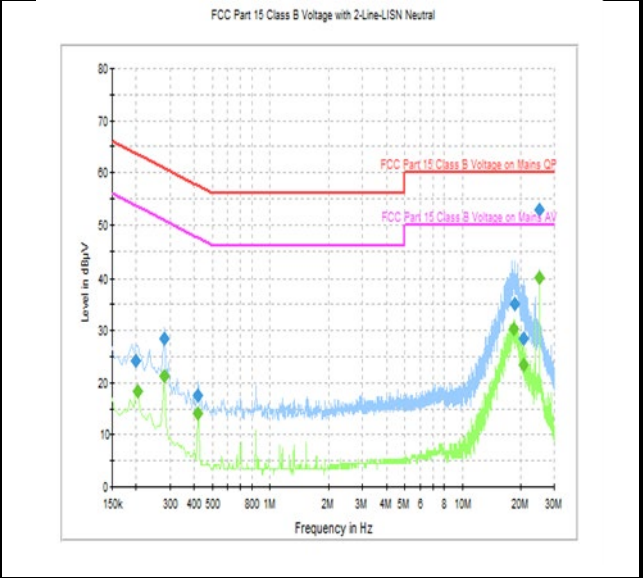
Results: Neutral / Average – 240 VAC

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Neutral	18.3	53.4	35.1	Complied
0.281	Neutral	21.2	50.8	29.6	Complied
0.420	Neutral	14.2	47.4	33.2	Complied
18.447	Neutral	30.2	50.0	19.8	Complied
20.837	Neutral	23.5	50.0	26.5	Complied
25.058	Neutral	40.1	50.0	9.9	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5. Appendix 1

Test setup/arrangement of EUT during open field tests on 10 November 2020

Refer to test setup photos document

Appendix 1 (continued)**GPS coordinates**

Mag loop location (lower marker on photo)
N51° 08.739' W001° 26.328'

30 metre test point (middle marker on photo)
N51° 08.755' W001° 26.325'

300 metre test point (upper marker on photo)
N51° 08.895' W001° 26.289'



Appendix 1 (continued)**Details of 3 metre and 30 metre open field test site used on 10 November 2020**

Temperature: 15 to 16°C

Relative Humidity: 71 to 74%

Ground conditions: Dry

Refer to test setup photos document**Set up for 3 metre measurements*****Refer to test setup photos document*****Set up for 30 metre measurements**

Appendix 1 (continued)**Measurements at 3 metres**

The test site was free from underground metal objects.

The EUT (Charging Case) was powered by 120 VAC 60 Hz and connected to a single phase supply. A power cable was run across the site to the EUT. An RCD was fitted to the power source. An RCD was fitted to the power source.

The EUT was placed on a plastic table at a height of 0.8 metres above ground level. All associated cables and support equipment were arranged according to ANSI C63.10-2013 Section 6.12.

The test receiver used for measurements was located in a vehicle 30 metres from the magnetic loop antenna. Power to the test equipment was from a single phase supply.

The test distance was from the centre of the mag loop antenna to the closest periphery of the EUT. This distance was maintained as the EUT was rotated.

Initially, The EUT was rotated through 360 degrees in 60 degree steps at both measurement distances. The mag loop antenna was rotated through 90 degrees in 30 degree steps at every position the EUT was moved to. The EUT and mag loop antenna were then rotated in small increments in order to maximise emission levels.

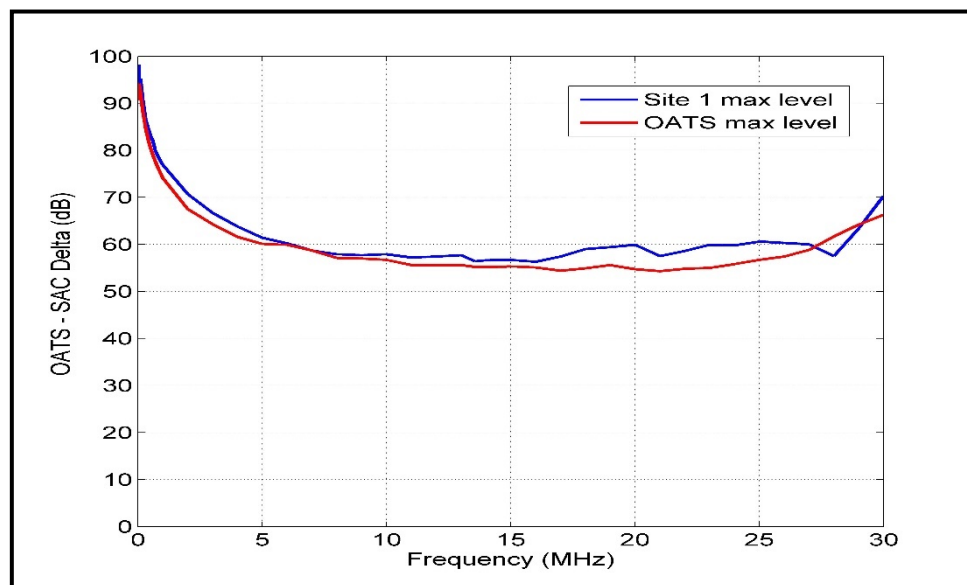
Appendix 1 (continued)

Comparison of open field test site with semi-anechoic chamber measurements at 3 metres

Radiated measurements were performed at an open field test site and within a 3 metre semi-anechoic chamber.

For the signal source, a modified loop antenna was connected to a signal generator at the transmit side. A standard active magnetic loop antenna was connected to a spectrum analyser at the receive side. The signal generator was set to its maximum supported output power and the signal was transmitted to the spectrum analyser via the two antennas and associated RF cables.

A sweep in small frequency increments was performed from 9 kHz to 30 MHz. The sweep was repeatedly performed with both antennas rotated about the axis in various orientations. Received levels for all orientations were recorded and the maximum levels for the open field test site and the semi-anechoic chamber are shown on the graph below. Full data for both tests are archived on the UL International (UK) Ltd IT server and available for inspection on request.



The conclusion was that the open field test site compares well with the semi-anechoic chamber at a measurement distance of 3 metres. If anything, the semi-anechoic chamber results are generally slightly higher. This means that if the measurement passes in the semi-anechoic chamber, it will pass with a higher margin on an open field test site.

The magnetic loop antenna used to perform these measurements is the same antenna or same type of antenna used during measurements contained in this test report.

Appendix 1 (continued)**Verification of open field test site and semi-anechoic chamber measurements at 3 metres prior to performing measurements**

Two reference units are used for verification of the measurement system before testing commences. Both reference units are door entry systems modified by the manufacturer for test purposes only.

One reference unit transmits a continuous, unmodulated signal at a fixed frequency of 125 kHz when a 12 Volt power pack is connected. The output power is fixed and known to be stable.

The second transmits a continuous, modulated signal at a fixed frequency of 13.56 MHz when a 12 Volt power pack is connected. The output power is fixed and known to be stable.

Both frequencies are commonly used RFID frequencies

A UL International (UK) Ltd internal verification document explains the procedure in detail. A brief description is given below.

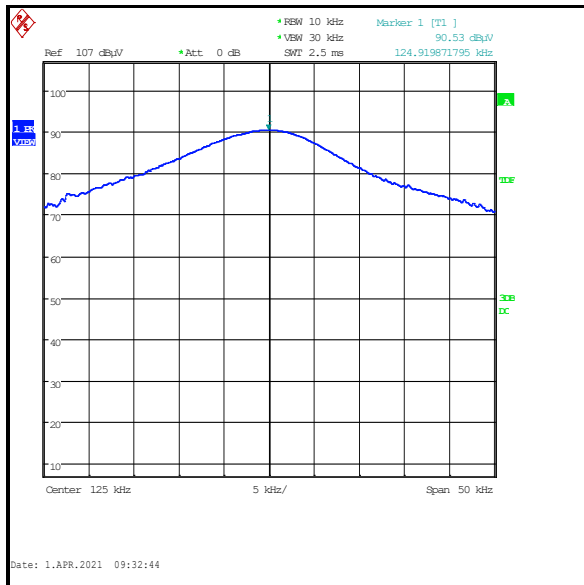
The centre of the magnetic loop antenna is placed exactly 3 metres from the reference unit. The reference unit is placed on a plastic table at a height of 0.8 metres above floor level and the centre of the mag loop antenna is 1 metre above the floor level. The mag loop antenna and reference unit are oriented in certain positions to ensure repeatability.

Each reference unit is connected to a 12 Volt power pack and once transmitting, the maximum raw received level at each of the two frequencies is read on the spectrum analyser by using the marker peak function. The measured level has to be within certain levels as specified in the UL International (UK) Ltd internal test procedure. The plot of the verification measurement is archived on the UL International (UK) Ltd IT server. The peak level of each reference unit is recorded on a spreadsheet which is also archived on the UL International (UK) Ltd IT server..

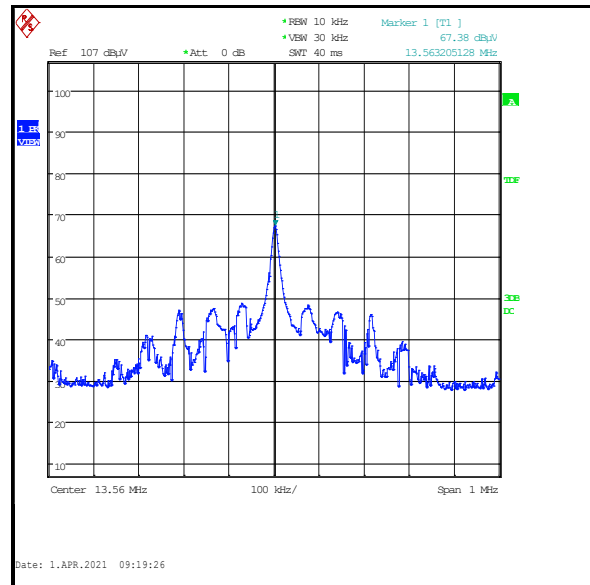
The internal verification procedure and verification plots are available for inspection on request.

Radiated measurements below 30 MHz were performed in a semi-anechoic chamber at a distance of 3 metres.

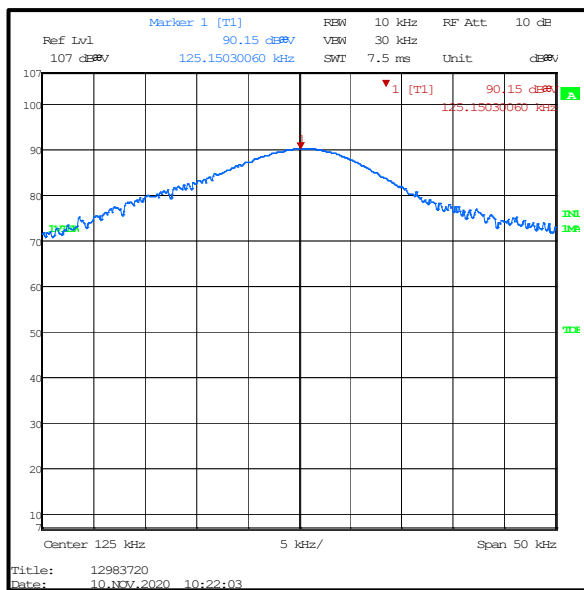
Verification plots of the two reference units at a measurement distance of 3 metres are shown on the following page. Plots were taken on an open field test site (10 November 2020) and in a semi-anechoic chamber (01 April 2021).

Appendix 1 (continued)

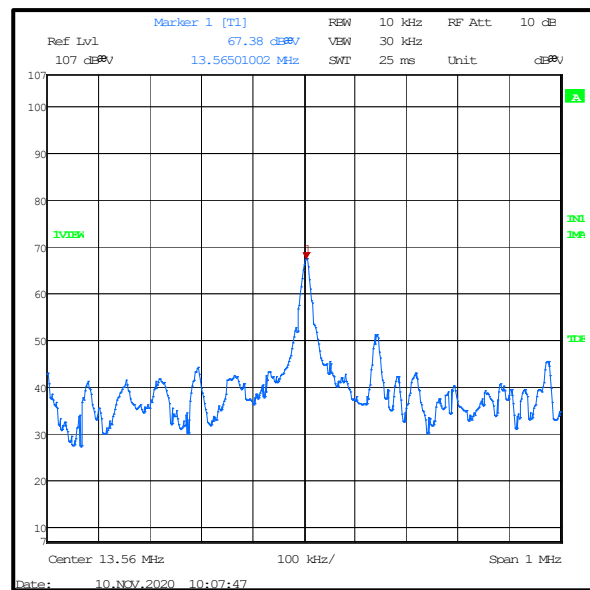
125 kHz reference unit signal at 3 metres in a semi-anechoic chamber on 01 April 2021



13.56 MHz reference unit signal at 3 metres in a semi-anechoic chamber on 01 April 2021



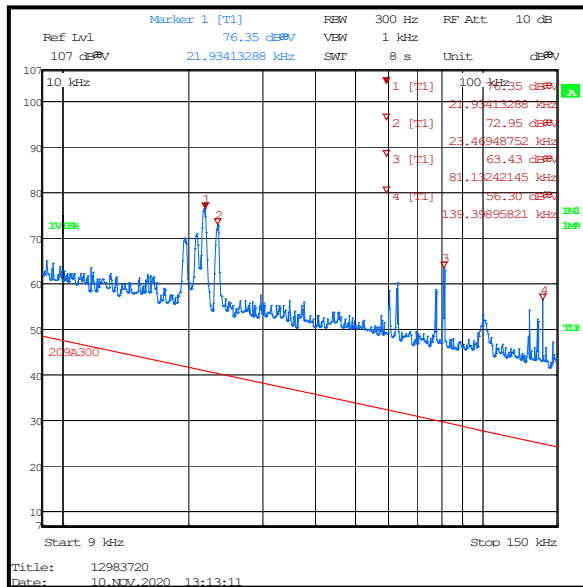
125 kHz reference unit signal at 3 metres on an open field test site on 10 November 2020



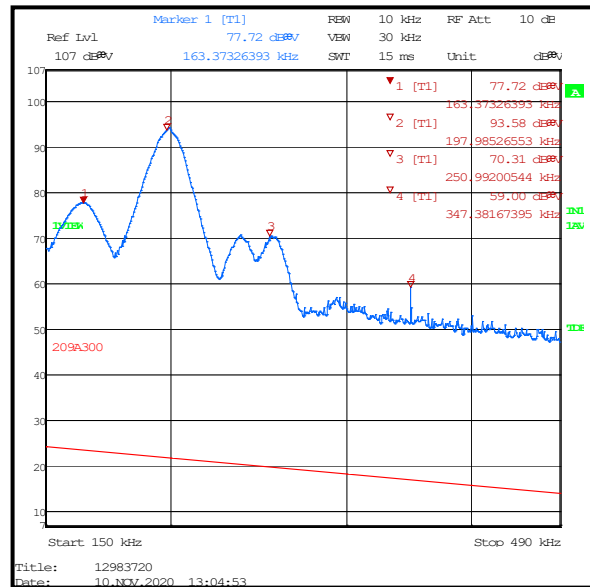
13.56 MHz reference unit signal at 3 metres on an open field test site on 10 November 2020

Note(s):

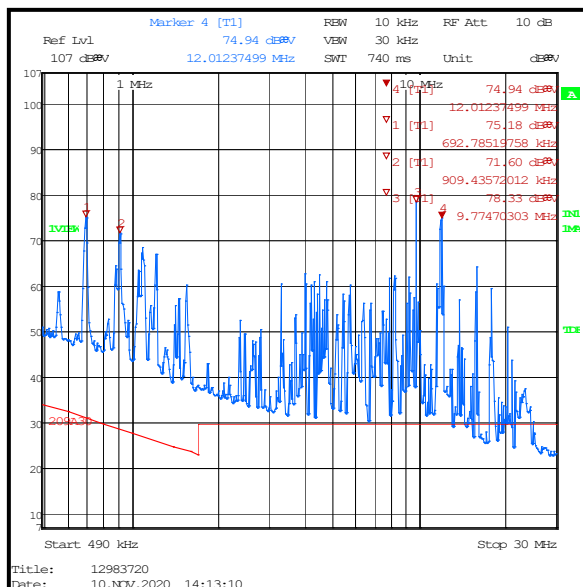
1. The above plots show comparable measurements of reference units on an open field test site and in a semi-anechoic chamber at spot frequencies.

Appendix 1 (continued)**Background scans of the open field test site**

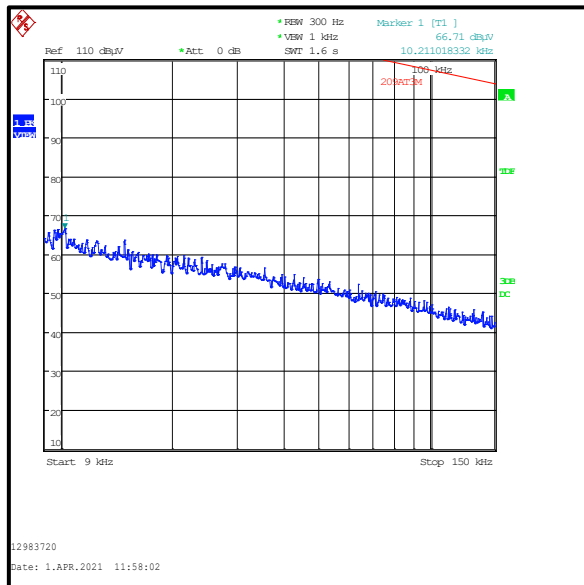
Frequency range: 9 kHz to 150 kHz
Peak detector / background scan



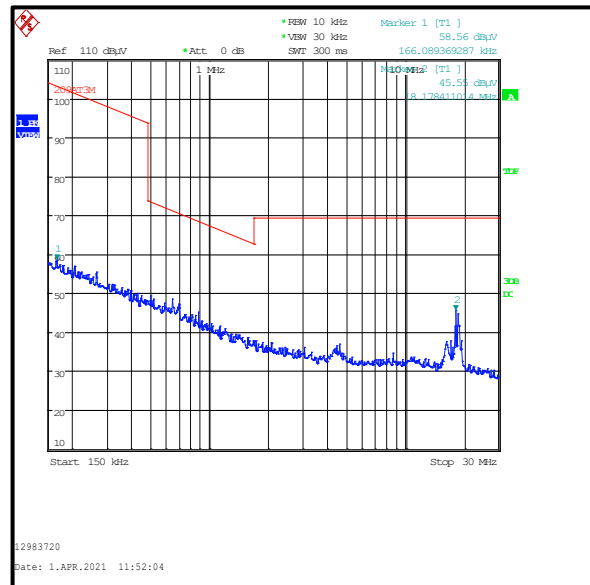
Frequency range: 150 kHz to 490 kHz
Average detector / background scan



Frequency range: 490 kHz to 30 MHz
Peak detector / background scan

Appendix 1 (continued)**Background scans in semi-Anechoic Chamber**

Frequency range: 9 kHz to 150 kHz
Peak detector / background scan



Frequency range: 150 kHz to 30 MHz
Peak detector / background scan

Note(s):

1. The above plots are background scans within the semi-Anechoic chamber and on the open field test site. The EUT and generator (when used) were turned off when the background scans were performed.

--- END OF REPORT ---