



# TEST REPORT

**Test Report No. : UL-RPT-RP14147309-316A**

**Manufacturer** : Tecniplast S.p.A

**Model No. / HVIN** : THRE

**PMN** : DVCTOPHOLDEREVOSTKIT

**FCC ID** : 2ANSW-THRE

**IC Certification No.** : IC: 23204-THRE

**Technology** : RFID

**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.225;  
Innovation, Science and Economic Development Canada  
RSS-Gen Issue 5 February 2021 Sections 6.7, 6.11, 6.12, 6.13 & 8.8,  
RSS-210 Issue 10 April 2010 Section B.6

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
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 4.0 supersedes all previous versions.

**Date of Issue:** 17 November 2022

**Checked by:**

Ben Mercer  
Lead Project Engineer, Radio Laboratory

**Issued by:**

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## **Customer Information**

<b>Company Name:</b>	Tecniplast S.p.A
<b>Address:</b>	Via I Maggio 6, 21020 Buguggiate (Va), Italy

## **Report Revision History**

<b>Version Number</b>	<b>Issue Date</b>	<b>Revision Details</b>	<b>Revised By</b>
1.0	31/08/2022	Initial version	Ben Mercer
2.0	27/09/2022	Radiated Spurious Emissions and AC Conducted Emissions repeated with a single reader. Updated report serial number suffix to 316.	Ben Mercer
3.0	14/11/2022	Test equipment cal due dates corrected and references to 50 ohm terminated sample removed.	Ben Mercer
4.0	17/11/2022	HVIN corrected.	Ben Mercer

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## **1. Attestation of Test Results**

### **1.1. Description of EUT**

The equipment under test was an RFID reader operating at 13.56 MHz.

### **1.2. General Information**

<b>Specification Reference:</b>	47CFR15.225
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
<b>Specification Reference:</b>	RSS-Gen Issue 5 February 2021
<b>Specification Title:</b>	General Requirements for Compliance of Radio Apparatus
<b>Specification Reference:</b>	RSS-210 Issue 10 April 2020
<b>Specification Title:</b>	Licence-exempt Radio Apparatus: Category I Equipment.
<b>Site Registration:</b>	FCC: 689609; ISEDC: 20903
<b>FCC Lab. Designation.:</b>	UK2011
<b>ISEDC CABID:</b>	UK0001
<b>Location of Testing:</b>	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	28 June 2022 to 16 September 2022

### **1.3. Summary of Test Results**

FCC Reference (47CFR)	ISEDC Canada Reference	Measurement	Result
Part 15.225(a)(b)(c)(d)	RSS-Gen 6.12 RSS-210 B.6(a)	Transmitter Fundamental Field Strength	
Part 15.209(a)/15.225(d)	RSS-Gen 6.13 RSS-210 B.6(a)(iii & iv)	Transmitter Radiated Emissions	
Part 15.209(a)/15.225(c)(d)	RSS-Gen 6.13 RSS-210 B.6(a)(iii & iv)	Transmitter Band Edge Radiated Emissions	
Part 2.1049	N/A	Transmitter 20 dB Bandwidth	
N/A	RSS-Gen 6.7	Transmitter Occupied Bandwidth	
Part 15.225(e)	RSS-Gen 6.11 RSS-210 B.6 (b)	Transmitter Frequency Stability (Temperature & Voltage Variation)	
Part 15.207	RSS-Gen 8.8	Transmitter AC Conducted Emissions	
<b>Key to Results</b>			
	= 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	X

UL International (UK) Ltd is accredited by United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

### **2.2. Methods and Procedures**

<b>Reference:</b>	ANSI C63.4-2014
<b>Title:</b>	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	FCC KDB 414788 D01 Radiated Test Site v01r01 July 12, 2018
<b>Title:</b>	Test Sites for Radiated Emission Measurements
<b>Reference:</b>	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	AC Power-Line Conducted Emissions Frequently Asked Questions
<b>Reference:</b>	Notice 2020 - DRS0023
<b>Title:</b>	Guidance on magnetic field strength radiated emission measurements (9 kHz - 30 MHz)

### **2.3. 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.

## **2.4. 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
Transmitter Fundamental Field Strength	13 MHz to 14 MHz	95%	±5.32 dB
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±3.30 dB
20 dB Bandwidth	13 MHz to 14 MHz	95%	±4.59 %
Occupied Bandwidth	13 MHz to 14 MHz	95%	±3.92 %
Frequency Stability	13 MHz to 14 MHz	95%	±1.62 ppm
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±1.96 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.

## **2.5. Test and Measurement Equipment**

### **Test Equipment Used for Transmitter Fundamental Field Strength / Band Edge Radiated Emissions / Transmitter 20 dB Bandwidth / Occupied Bandwidth Tests**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	09 Dec 2022	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	06 Sep 2022	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2023	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	05 May 2023	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	09 Dec 2022	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	05 Sep 2023	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2023	12
A3154	Pre-Amplifier	Com Power	PAM-103	18020012	18 Aug 2023	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	05 May 2023	12
A553	Antenna	Chase	CBL6111A	1593	23 Dec 2022	12
A3112	Attenuator	AtlanTecRF	AN18-06	219706#2	23 Dec 2022	12
M2003	Thermohygrometer	Testo	608-H1	45046641	09 Dec 2022	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	26 Oct 2022	12
M1874	Test Receiver	Rhode & Schwarz	ESU26	100553	19 May 2023	12
A3167	Pre Amplifier	Com-Power	PAM-103	18020010	20 Nov 2022	12
A3161	Antenna	Teseq	CBL6111D	50859	03 May 2023	12

### **Test Equipment Used for Frequency Stability Tests**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	09 Dec 2022	12
M2018	Signal Analyser	Rohde & Schwarz	FSV7	102699	22 Oct 2022	12
M1249	Digital Thermometer	Fluke Corporation	52II	88800049	05 Oct 2022	12
M1818	Digital Multimeter	Fluke Corporation	79 III	71811580	27 Apr 2023	12
A209728	Passive Loop Antenna	Schwarzbeck	HFRAE 5163	00207	Calibrated Before Use	1
E0518	Environmental Chamber	TAS	LTCL 1200	24000107	Calibrated Before Use	-
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	Calibrated Before Use	-

**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	08 Dec 2022	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	25 Nov 2022	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	31 May 2023	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	01 Sep 2023	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)**

<b>Brand Name:</b>	Digilab
<b>Model Name / HVIN:</b>	THRE
<b>PMN:</b>	DVCTOPHOLDEREVOSTKIT
<b>Test Sample Serial Number:</b>	1210 ( <i>Radiated sample #1</i> )
<b>Hardware Version:</b>	0B
<b>Software Version:</b>	0.1.0
<b>Firmware Version:</b>	0.9.4
<b>FCC ID:</b>	2ANSW-THRE
<b>Industry Canada Certification Number:</b>	IC: 23204-THRE

<b>Brand Name:</b>	Digilab
<b>Model Name / HVIN:</b>	THRE
<b>PMN:</b>	DVCTOPHOLDEREVOSTKIT
<b>Test Sample Serial Number:</b>	1211 ( <i>Radiated sample #2</i> )
<b>Hardware Version:</b>	0B
<b>Software Version:</b>	0.1.0
<b>Firmware Version:</b>	0.9.4
<b>FCC ID:</b>	2ANSW-THRE
<b>Industry Canada Certification Number:</b>	IC: 23204-THRE

### **3.2. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

### **3.3. Additional Information Related to Testing**

<b>Tested Technology:</b>	RFID	
<b>Category of Equipment:</b>	Transceiver	
<b>Channel Spacing:</b>	Single channel device	
<b>Transmit Frequency Range:</b>	13.56 MHz	
<b>Modulation:</b>	ASK	
<b>Power Supply Requirement:</b>	Nominal	120 VAC 60 Hz
	Minimum	102 VAC 60 Hz
	Maximum	138 VAC 60 Hz
<b>Tested Temperature Range:</b>	Minimum	5°C
	Maximum	40°C

### **3.4. Description of Test Setup**

#### **Support Equipment**

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

<b>Description:</b>	RFID Tags. Quantity 2.
<b>Brand Name:</b>	Mifare Ultralight
<b>Model Name or Number:</b>	ISO 14443-3A
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB Cable Type A to Type A. Length 3m. Quantity 5.
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Ethernet Cable. Length 3m. Quantity 1.
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	EU740
<b>Serial Number:</b>	FV2VB2J

<b>Description:</b>	USB Hub
<b>Brand Name:</b>	Belkin
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Control Panel
<b>Brand Name:</b>	Digilab
<b>Model Name or Number:</b>	Top Holder reader EVO
<b>Serial Number:</b>	22009001

<b>Description:</b>	Control Panel
<b>Brand Name:</b>	Digilab
<b>Model Name or Number:</b>	Top Holder reader EVO
<b>Serial Number:</b>	22009002

## **Operating Modes**

The EUT was tested in the following operating mode(s):

- Constantly transmitting at full power with a modulated carrier in RFID test mode with an RFID Tag present
- Constantly transmitting at full power with a modulated carrier in RFID test mode without an RFID Tag present

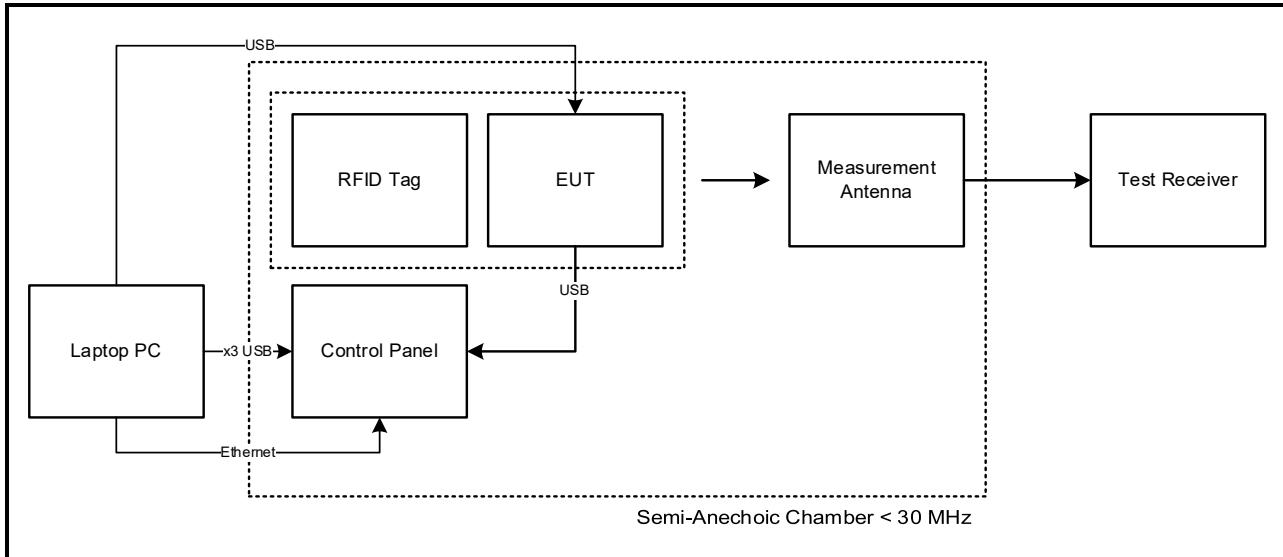
## **Configuration and Peripherals**

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

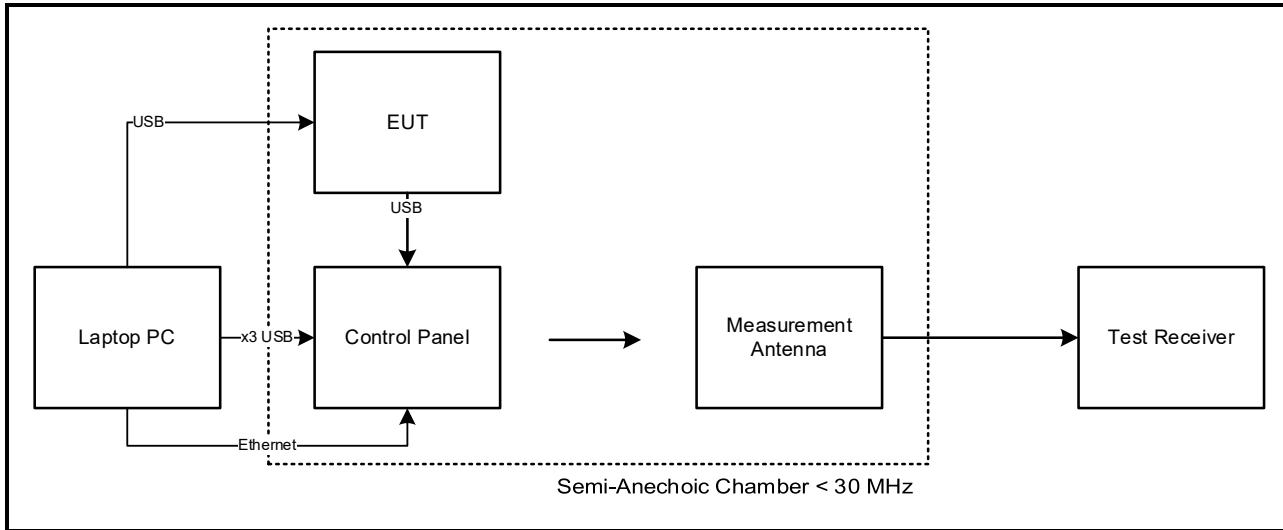
- The customer had pre-loaded test firmware on the EUT that enabled continuous transmission once the reader(s) were connected to the control panel. When an RFID Tag was used, the tag was presented to each reader at the maximum separation distance that generated a signal
- For Fundamental Field Strength, Radiated Band Edge, 20 dB Bandwidth, Radiated Emissions, 99% Occupied Bandwidth and Frequency Stability tests, testing was performed with the control panel connected to one reader via USB Cable. Testing was performed with and without an RFID tag. The worst case was as follows:
  - Radiated emission tests: with the RFID tag present
- For AC conducted emissions tests, testing was performed with the control panel connected to one reader via USB Cable. Initial measurements were performed with and without an RFID tag. The worst case was as follows:
  - AC conducted emissions tests: without the RFID tag present
- All active ports were terminated.
- The supplied mains cable had a ferrite labelled FAR-RITE V0 fitted, located at the control panel end. The cable was wrapped twice around the ferrite. This configuration was used for all tests.
- The EUT was powered by a 120 VAC 60 Hz single phase mains supply.

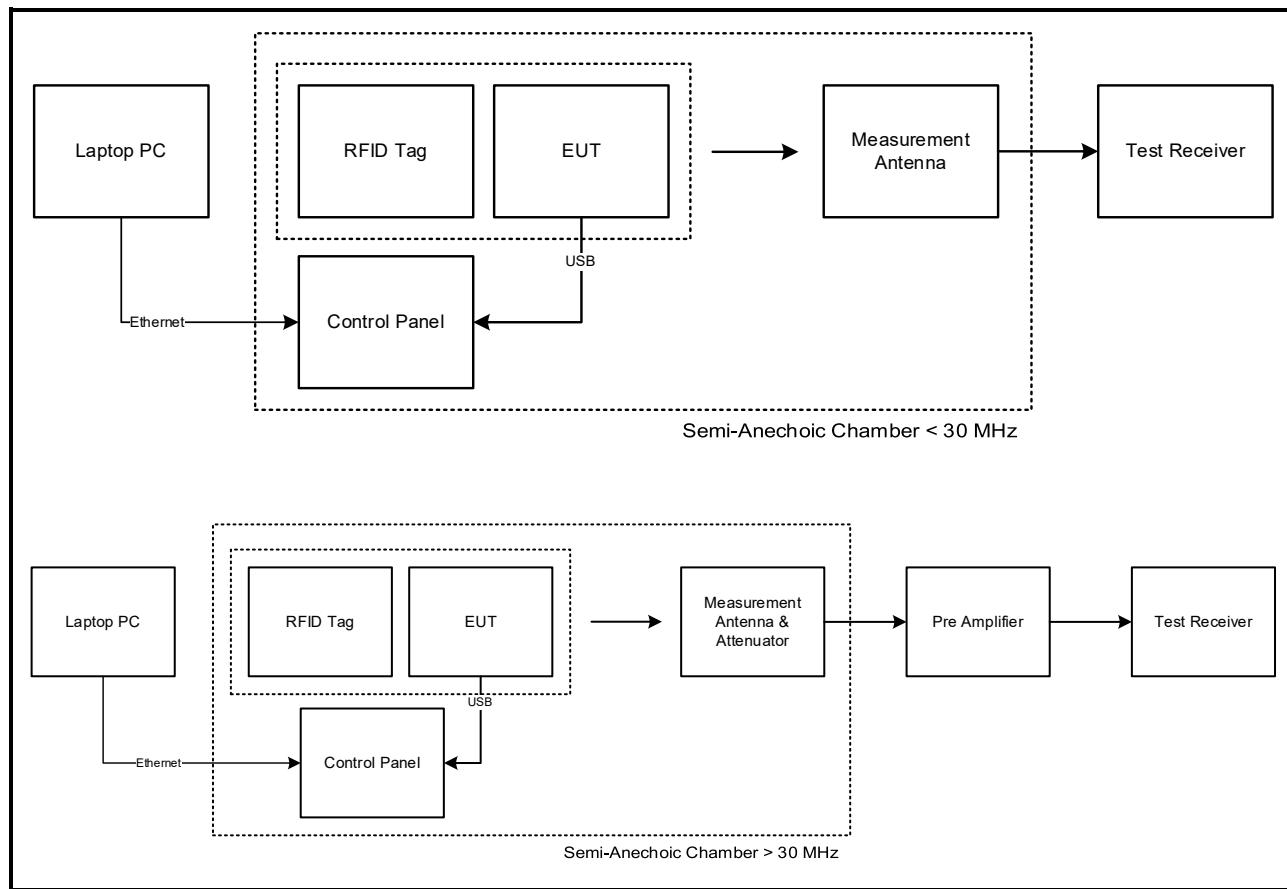
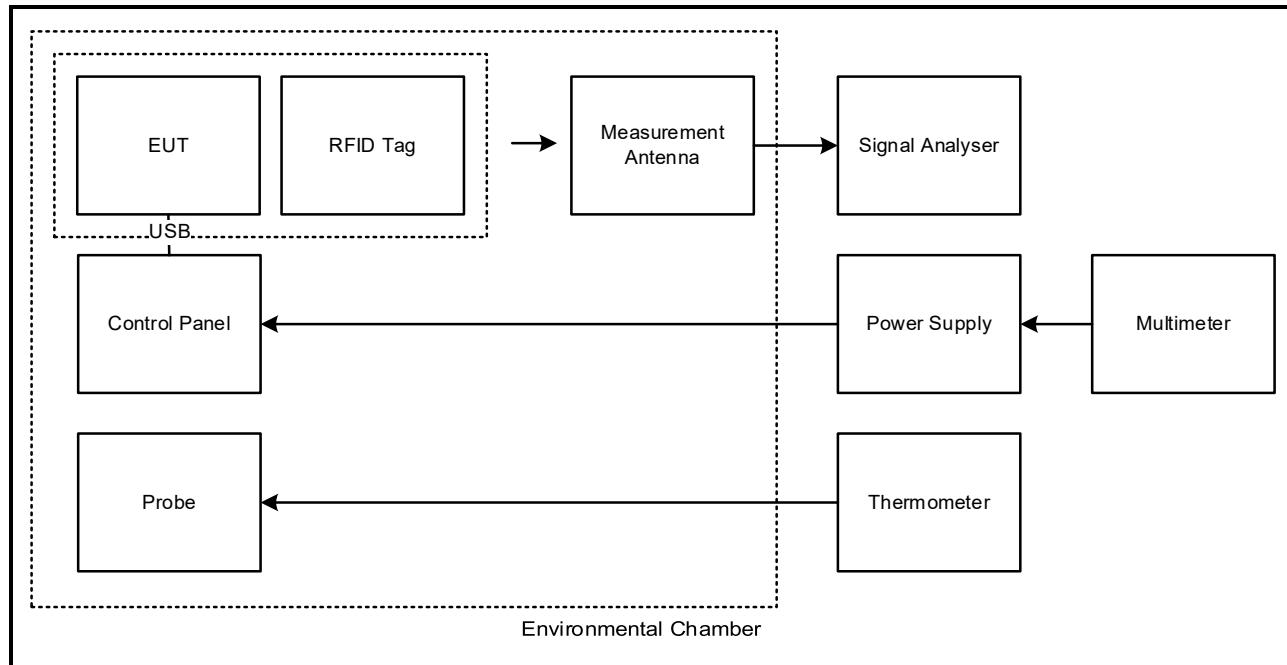
## Test Setup Diagrams

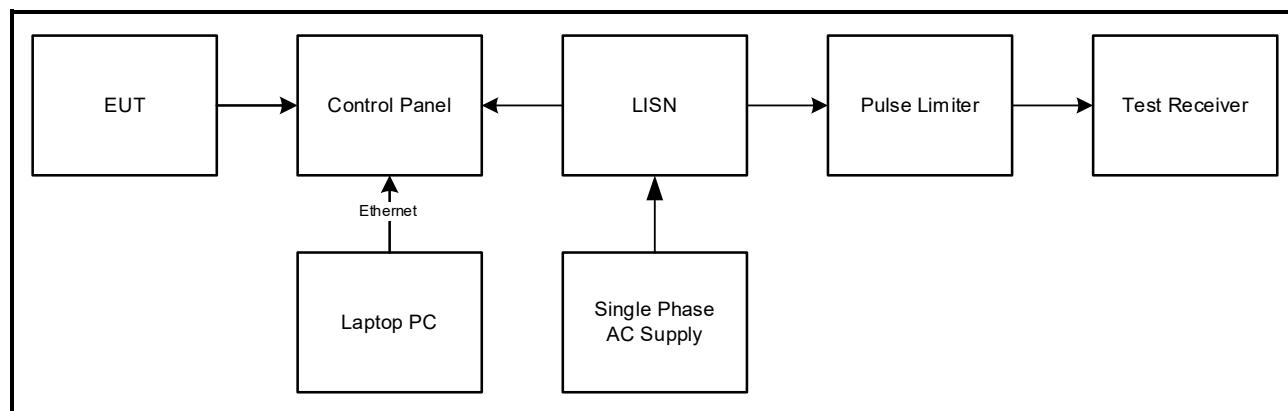
### Test Setup for Transmitter 20 dB / 99% Occupied Bandwidth, Fundamental Field Strength / Band Edge Radiated Emissions with NFC Tag Present:



### Test Setup for Transmitter 20 dB / 99% Occupied Bandwidth, Fundamental Field Strength / Band Edge Radiated Emissions with no NFC Tag Present:



**Test Setup for Transmitter Radiated Emissions:****Test Setup for Frequency Stability:**

**Test Setup for AC Conducted Emissions:**

## 4. Radiated Test Results

### 4.1. Transmitter Fundamental Field Strength

#### Test Summary:

<b>Test Engineers:</b>	Nick Raptopoulos & Andrew Edwards	<b>Test Date:</b>	28 June 2022
<b>Test Sample Serial Number:</b>	1211		

<b>FCC Reference:</b>	Part 15.225(a)(b)(c)(d)
<b>ISED Canada Reference:</b>	RSS-Gen 6.12 / RSS-210 B.6(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.4

#### Environmental Conditions:

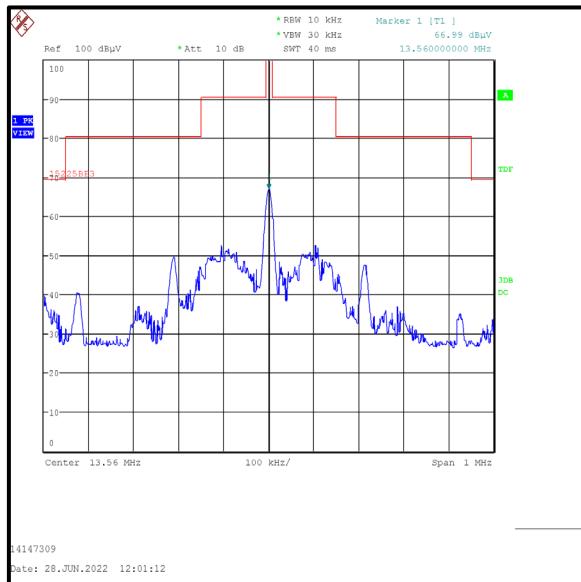
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	44

#### Note(s):

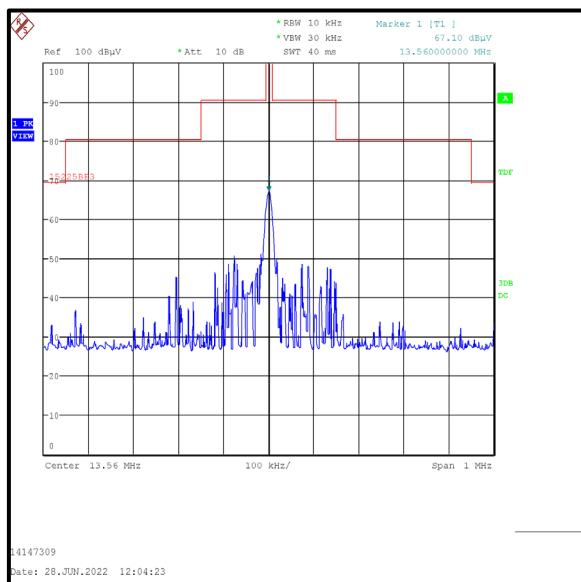
1. FCC: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2.
2. ISED: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2. As allowed by ANSI C63.10 clause 5.2; an alternative test site that can demonstrate equivalence to an open area test site may be used for measurements below 30 MHz. Therefore, measurements were performed in a semi-anechoic chamber. The correlation data between semi-anechoic chamber and an open field test site is available upon request.
3. Pre-scan measurements were performed using a spectrum analyser with a peak detector and measurement bandwidth of 10 kHz. The fundamental field strength was maximized by rotating the measurement antenna and EUT.
4. The spectrum analyser was then switched to test receiver mode and the final measurement on the maximised level was performed. In accordance with ANSI C63.10 Clause 4.2.3.2.1 and CISPR 16-1-1, a quasi-peak detector was used in conjunction with a measurement bandwidth of 9 kHz and 15 second sweep time. Quasi-peak levels were recorded at the 3 metre measurement distance. These levels were then reduced by 40 dB to the correct test distance (using a linear distance extrapolation factor of 40 dB/decade)

**Transmitter Fundamental Field Strength (continued)****Results: Tagging measurements / Quasi Peak**

Frequency (MHz)	Antenna Polarity	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
13.56	90° to EUT	63.9	23.9*	84.0	60.1	Complied

**Results: Non – Tagging measurements / Quasi Peak**

Frequency (MHz)	Antenna Polarity	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
13.56	90° to EUT	61.3	21.3*	84.0	62.7	Complied



## **4.2. Transmitter Radiated Spurious Emissions**

### **Test Summary:**

<b>Test Engineers:</b>	John Ferdinand & Nick Tye	<b>Test Dates:</b>	08 September 2022 to 16 September 2022
<b>Test Sample Serial Number:</b>	1211		

<b>FCC Reference:</b>	Parts 15.225(d) & 15.209(a)
<b>ISED Canada Reference:</b>	RSS-Gen 6.13 / RSS-210 B.6(a)(iii & iv)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3, 6.4 and 6.5 and notes below
<b>Frequency Range:</b>	9 kHz to 1000 MHz

### **Environmental Conditions:**

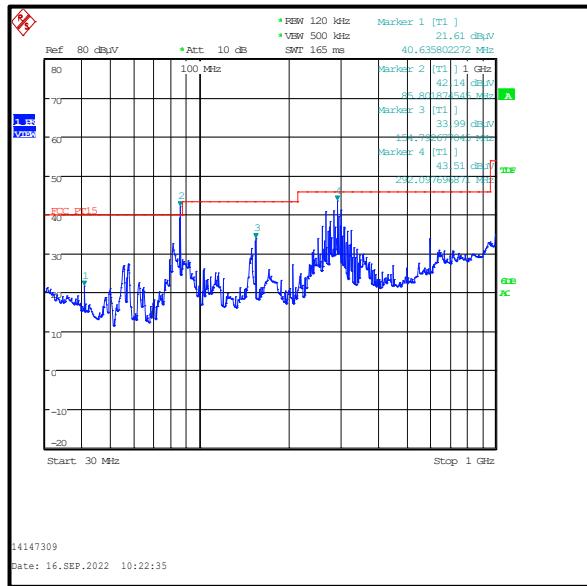
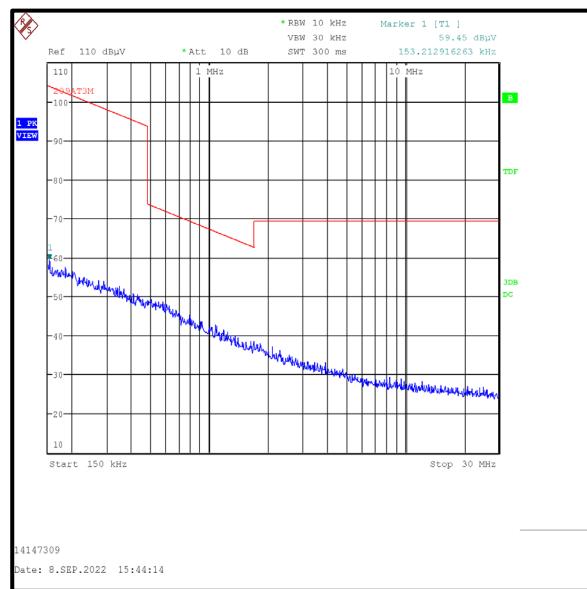
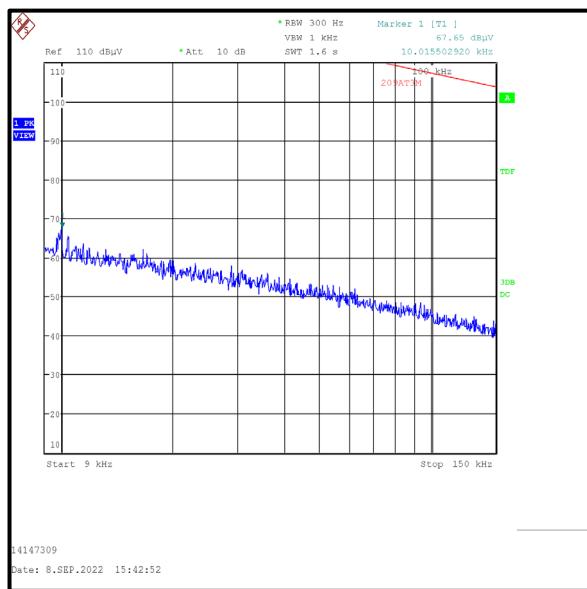
<b>Temperature (°C):</b>	22 to 24
<b>Relative Humidity (%):</b>	47 to 53

### **Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions were greater than 20 dB below the applicable limit, below the noise floor of the measurement system or ambient.
3. FCC: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2.
4. ISED: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2. As allowed by ANSI C63.10 clause 5.2; an alternative test site that can demonstrate equivalence to an open area test site may be used for measurements below 30 MHz. Therefore, measurements were performed in a semi-anechoic chamber. The correlation data between semi-anechoic chamber and an open field test site is available upon request.
5. Measurements from 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) 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.
6. Pre-scans were performed, and markers placed on the highest measured levels. The test receiver was configured as follows: During 9 kHz to 150 kHz measurements, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz, trace mode was Max Hold. During 30 MHz to 1 GHz measurements, the resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. Final measurements were performed using a CISPR Quasi-Peak detector and measurement time set to 15 seconds.
7. Measurements <30 MHz were performed in terms of electrical field strength (dB $\mu$ 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 to convert to magnetic field strength or H-Field value (dB $\mu$ A/m).
8. In accordance with ANSI C63.10 Section 6.5.4, the highest six emissions were recorded in the table below.

**Transmitter Radiated Spurious Emissions (continued)****Results: Tagging measurements / Quasi Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
40.681	Vertical	28.6	40.0	11.4	Complied
85.666	Vertical	38.2	40.0	1.8	Complied
154.335	Horizontal	31.3	43.5	12.2	Complied
291.272	Horizontal	42.1	46.0	3.9	Complied
376.357	Horizontal	28.5	46.0	17.5	Complied
600.009	Vertical	33.7	46.0	12.3	Complied

**Results: Tagging measurements**

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

### **4.3. Transmitter Band Edge Radiated Emissions**

#### **Test Summary:**

<b>Test Engineers:</b>	Nick Raptopoulos & Andrew Edwards	<b>Test Date:</b>	28 June 2022
<b>Test Sample Serial Number:</b>	1211		

<b>FCC Reference:</b>	Parts 15.225(c)(d) & 15.209(a)
<b>ISED Canada Reference:</b>	RSS-Gen 6.13 / RSS-210 B.6(a)(iii & iv)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.10.5.2 and Notes below

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	44

#### **Note(s):**

1. FCC: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2.
2. ISED: Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3 & 6.4.4.2. As allowed by ANSI C63.10 clause 5.2; an alternative test site that can demonstrate equivalence to an open area test site may be used for measurements below 30 MHz. Therefore, measurements were performed in a semi-anechoic chamber. The correlation data between semi-anechoic chamber and an open field test site is available upon request.
3. \*Field strength measurements performed at 3 metres in a semi-anechoic chamber were extrapolated to a distance of 30 metres by subtracting 40 dB (using a linear distance extrapolation factor of 40 dB/decade).
4. For Tagging measurements: Test receiver resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto trace mode was Max Hold. The span was set to 2 MHz, with frequency lines were placed on the lower and upper band edges. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
5. For Non – tagging measurements: Test receiver resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto trace mode was Max Hold. The span was set to 1 MHz, with frequency lines were placed on the lower and upper band edges. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.

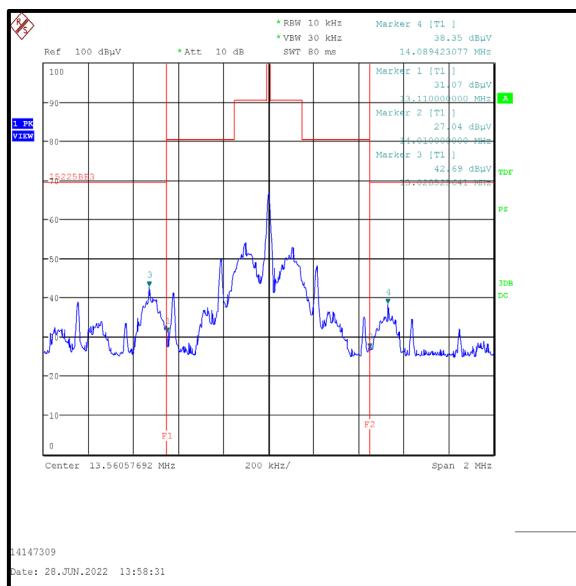
## **Transmitter Band Edge Radiated Emissions (continued)**

## Results: Tagging measurements / Peak / Lower Band Edge

Frequency (MHz)	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
13.031	42.7	2.7*	29.5	26.8	Complied
13.11	31.1	-8.9*	29.5	38.4	Complied

## Results: Tagging measurements / Peak / Upper Band Edge

Frequency (MHz)	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
14.01	27.0	-13.0*	29.5	42.5	Complied
14.089	38.4	-1.6*	29.5	31.1	Complied

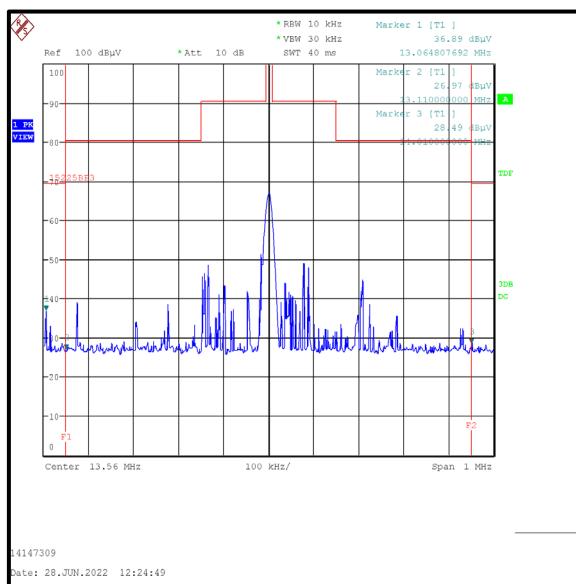


**Transmitter Band Edge Radiated Emissions (continued)****Results: Non – Tagging measurements / Peak / Lower Band Edge**

Frequency (MHz)	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
13.06	36.9	-3.1*	29.5	32.6	Complied
13.11	27.0	-13.0*	29.5	42.5	Complied

**Results: Non – Tagging measurements / Peak / Upper Band Edge**

Frequency (MHz)	Measured level at 3 m (dB $\mu$ V/m)	Extrapolated level at 30 m (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
14.01	28.5	-11.5*	29.5	41.0	Complied



#### **4.4. Transmitter 20 dB Bandwidth**

## **Test Summary:**

<b>Test Engineers:</b>	Nick Raptopoulos & Andrew Edwards	<b>Test Date:</b>	28 June 2022
<b>Test Sample Serial Number:</b>	1211		

<b>FCC Reference:</b>	Part 2.1049
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.2

### **Environmental Conditions:**

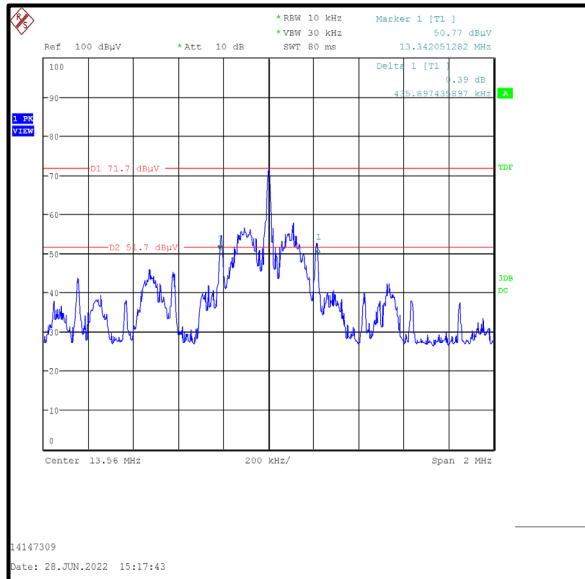
Temperature (°C):	24
Relative Humidity (%):	44

**Note(s):**

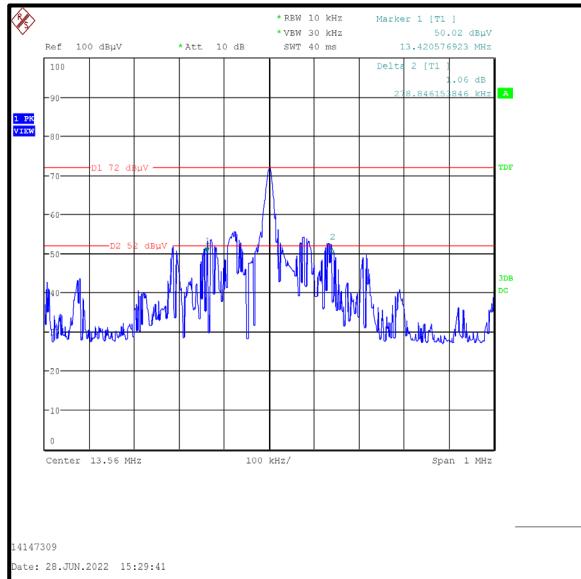
1. When testing the EUT with the Tag present, the signal analyser resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 2 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. The delta value was recorded in the tables below.
2. When testing the EUT with the Tag present, the signal analyser resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 1 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. The delta value was recorded in the tables below.

## **Results:**

Mode	20 dB Bandwidth (kHz)
Tagging measurements	435.897
Non – Tagging measurements	278.846



## Tagging measurements



## Non – Tagging measurements

## 4.5. Transmitter 99% Occupied Bandwidth

### Test Summary:

<b>Test Engineers:</b>	Nick Raptopoulos & Andrew Edwards	<b>Test Date:</b>	28 June 2022
<b>Test Sample Serial Number:</b>	1211		

<b>ISED Canada Reference:</b>	RSS-Gen 6.7
<b>Test Method Used:</b>	RSS-Gen 6.7

### Environmental Conditions:

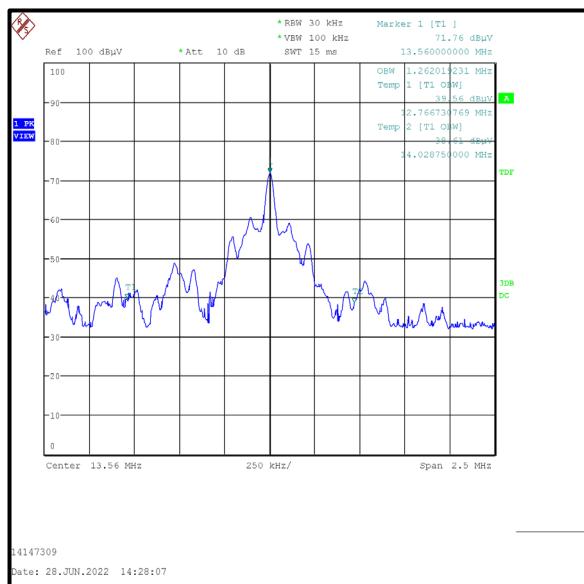
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	44

### Note(s):

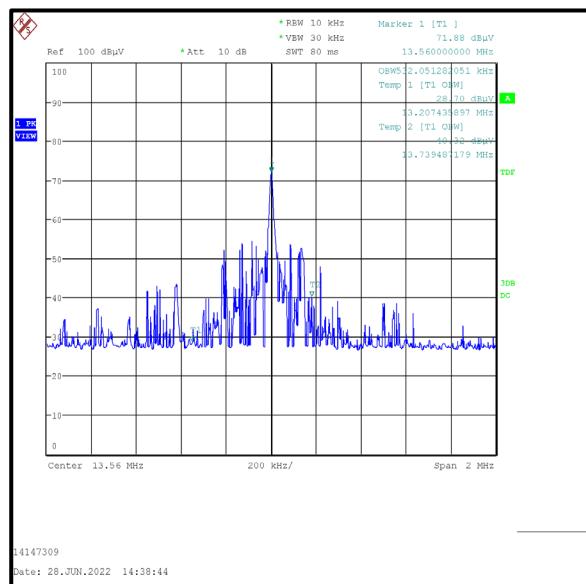
1. When testing the EUT with the Tag present, the signal analyser resolution bandwidth was set to 30 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 2.5 MHz. The signal analyser's 99% Occupied Bandwidth function was enabled the value was recorded in the table below.
2. When testing the EUT without the Tag present, the signal analyser resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 2 MHz. The signal analyser's 99% Occupied Bandwidth function was enabled the value was recorded in the table below.

### Results:

Mode	99% Occupied Bandwidth (kHz)
Tagging measurements	1262.019
Non – Tagging measurements	532.051



Tagging measurements



Non – Tagging measurements

**4.6. Transmitter Frequency Stability (Temperature & Voltage Variation)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	14 July 2022
<b>Test Sample Serial Number:</b>	1211		

<b>FCC Reference:</b>	Part 15.225(e)
<b>ISED Canada Reference:</b>	RSS-Gen 6.11 / RSS-210 B.6 (b)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.8.1 and 6.8.2

**Environmental Conditions:**

<b>Ambient Temperature (°C):</b>	22
<b>Ambient Relative Humidity (%):</b>	57

**Note(s):**

1. Testing at voltage extremes was performed with the EUT powered by an external Variable AC power supply.
2. The manufacturer declared the minimum and maximum temperature as 5 and 40°C
3. Frequency error was measured using a calibrated Rohde & Schwarz spectrum analyser.
4. Temperature was monitored throughout the test with a calibrated digital thermometer.
5. Voltage was monitored throughout the test with a calibrated digital voltmeter.

**Results: Temperature Variation**

Temperature (°C)	Time after Start-up			
	0 minutes	2 minutes	5 minutes	10 minutes
5	13.560581 MHz	13.560537 MHz	13.560515 MHz	13.560568 MHz
20	13.560511 MHz	13.560415 MHz	13.560528 MHz	13.560521 MHz
45	13.560374 MHz	13.560308 MHz	13.560229 MHz	13.560405 MHz

**Results:**

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
13.560581	581	0.004285	0.01	0.005715	Complied

**Results: Voltage Variation / FCC Requirements**

Supply Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
102	13.560000	13.560532	532	0.003923	0.01	0.006077	Complied
120	13.560000	13.560528	528	0.003894	0.01	0.006106	Complied
138	13.560000	13.560544	544	0.004012	0.01	0.005988	Complied

## **5. AC Power Line Conducted Emissions Test Results**

### **5.1. Transmitter AC Conducted Spurious Emissions**

#### **Test Summary:**

<b>Test Engineers:</b>	Miriam Thompson & Andrew Edwards	<b>Test Date:</b>	09 September 2022
<b>Test Sample Serial Number:</b>	1210		

<b>FCC Reference:</b>	Part 15.207
<b>ISED Canada Reference:</b>	RSS-Gen 8.8
<b>Test Method Used:</b>	ANSI C63.10 Section 6.2 and notes below

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	59

#### **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 charging station.
3. Pre-scans were performed, and markers placed on the highest live and neutral measured levels. Final measurements were performed on the highest six 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 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.155	Live	45.5	65.8	20.3	Complied
0.186	Live	43.6	64.2	20.6	Complied
0.519	Live	37.2	56.0	18.8	Complied
4.323	Live	33.9	56.0	22.1	Complied
6.167	Live	33.5	60.0	26.5	Complied
7.202	Live	34.1	60.0	25.9	Complied

**Results: Live / Average / 120 VAC 60 Hz**

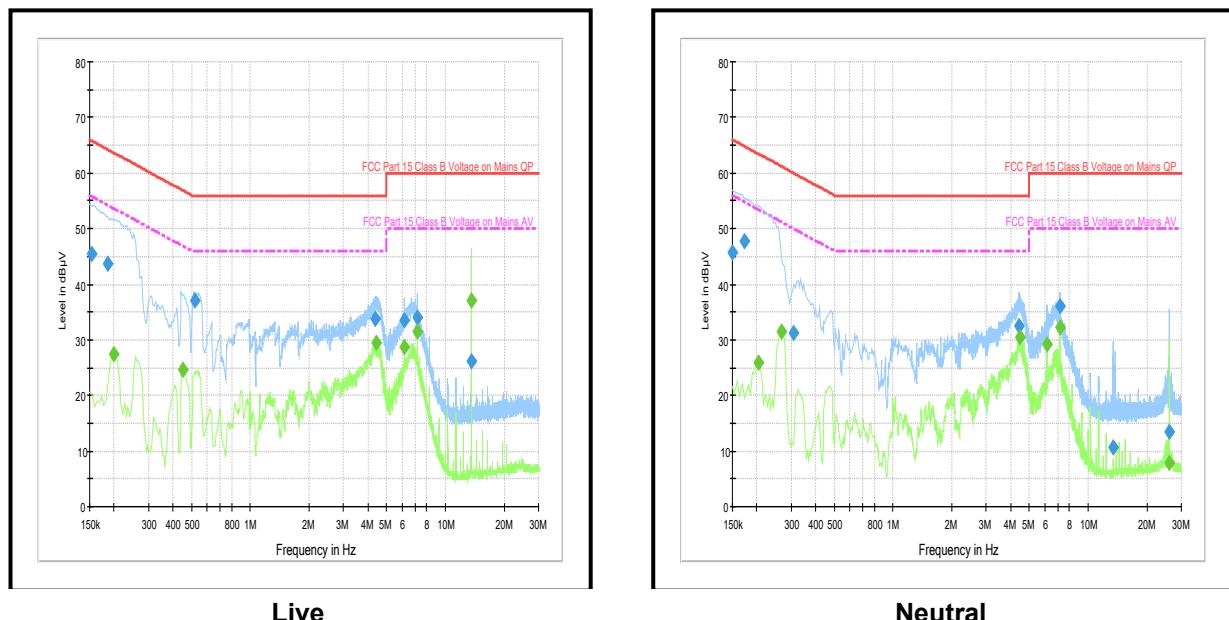
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.200	Live	27.4	53.6	26.2	Complied
0.452	Live	24.8	46.8	22.0	Complied
4.412	Live	29.5	46.0	16.5	Complied
6.167	Live	28.7	50.0	21.3	Complied
7.197	Live	31.6	50.0	18.4	Complied
13.560	Live	37.0	50.0	13.0	Complied

**Results: Neutral / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.150	Neutral	45.7	66.0	20.3	Complied
0.173	Neutral	47.7	64.8	17.1	Complied
0.308	Neutral	31.3	60.0	28.7	Complied
4.403	Neutral	32.4	56.0	23.6	Complied
7.193	Neutral	36.1	60.0	23.9	Complied
26.003	Neutral	13.5	60.0	46.5	Complied

**Results: Neutral / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.20	Neutral	25.9	53.4	27.5	Complied
0.267	Neutral	31.4	51.2	19.8	Complied
4.475	Neutral	30.6	46.0	15.4	Complied
6.167	Neutral	29.3	50.0	20.7	Complied
7.197	Neutral	32.4	50.0	17.6	Complied
26.061	Neutral	7.9	50.0	42.1	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 120 VAC 60 Hz with unmodified sample**

*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 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.254	Live	39.0	61.6	22.6	Complied
0.465	Live	42.4	56.6	14.2	Complied
0.492	Live	42.2	56.1	13.9	Complied
1.194	Live	36.0	56.0	20.0	Complied
1.262	Live	36.1	56.0	19.9	Complied
4.713	Live	35.0	56.0	21.0	Complied

**Results: Live / Average / 240 VAC 60 Hz**

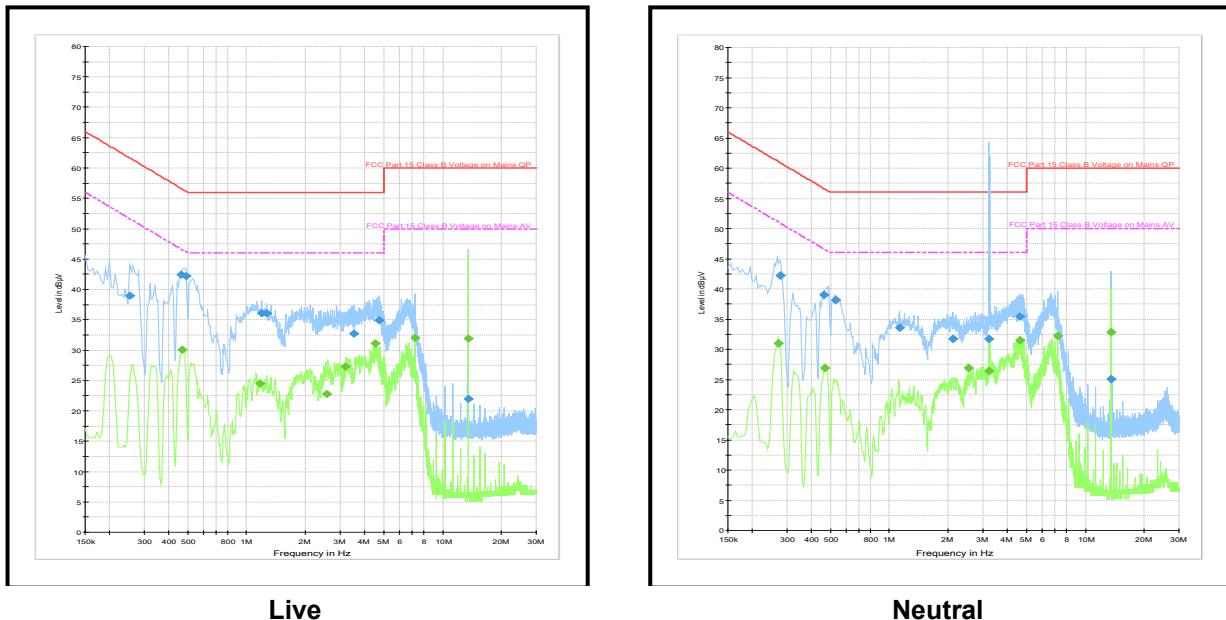
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.470	Live	30.0	46.5	16.5	Complied
1.163	Live	24.5	46.0	21.5	Complied
3.179	Live	27.3	46.0	18.7	Complied
4.542	Live	31.1	46.0	14.9	Complied
7.197	Live	32.0	50.0	18.0	Complied
13.565	Live	32.0	50.0	18.0	Complied

**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.276	Neutral	42.2	60.9	18.7	Complied
0.465	Neutral	39.0	56.6	17.6	Complied
0.533	Neutral	38.1	56.0	17.9	Complied
1.122	Neutral	33.6	56.0	22.4	Complied
3.218	Neutral	31.8	56.0	24.2	Complied
4.605	Neutral	35.5	56.0	20.5	Complied

**Results: Neutral / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.470	Neutral	26.9	46.5	19.6	Complied
2.535	Neutral	26.9	46.0	19.1	Complied
3.224	Neutral	26.4	46.0	19.6	Complied
4.610	Neutral	31.5	46.0	14.5	Complied
7.197	Neutral	32.3	50.0	17.7	Complied
13.556	Neutral	32.9	50.0	17.2	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 240 VAC 60 Hz with unmodified sample**

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

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