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RADIO TEST REPORT – 412912-1TR1FWL

Type of assessment:
Final product testing

Applicant:
GSI Electronics Inc.

Product:
Pig RFID reader apparatus with telecommunication functionality using LFID @ 134.2KHz

Model:
EDGE GSF LFID W/ Auto Tuning

Model variant(s):
EDGE ESF LFID W/ Auto Tuning

FCC ID:
2AFLZGSFLFIDAUT

IC Registration number:
11880A-GSFLFIDAUT

Specifications:

- FCC 47 CFR Part 15, Subpart C – §15.209
- RSS-210, Issue 5, Apr. 2018, section 8.9

Date of issue: August 18, 2021

Abdoulaye Ndiaye, EMC/RF Specialist	
Tested by	Signature
Yong Huang, EMC/RF Specialist	
Reviewed by	Signature

Lab locations

Company name	Nemko Canada Inc.			
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Test site registration	**Organization**	**Recognition numbers and location**		
	FCC/ISED	FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

Limits of responsibility

Note that this report's results relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of this report.
This test report has been completed following the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15 Subpart C, §15.209	Radiated emission limits; general requirements.
RSS-GEN, Issue 5, Apr. 2018, section 8.9	Transmitter Emission Limits for Licence-Exempt Radio Apparatus

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Unless noted in section 1.2, all testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	August 18, 2021	Original report issued
R1TRF	October 12, 2021	Table 7 updated. Fundamental field strength at 3 m for comparison to the limit at 3 m replaced by fundamental field strength at 300 m for comparison to the limit at 300 m

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

As per customer, the antenna could read and transmit both. One second one modulation, another second for another one. There are many transmissions in one second. Can be read both type RFID tags. FSK (HDX protocol) and ASK (FDX protocol) both modulations were tested at the same time as per client.

2.3 Model variant declaration

As declared by the applicant, the EUT model EDGE GSF LFID W/ Auto Tuning has been chosen to be representative for all other models in the model family.
The model family, and the description of the variations, are as follows:
The EDGE GSF LFID W/ Auto Tuning and EDGE ESF LFID W/ Auto Tuning have only a different marketing name.

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	30 % – 60 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the present document, the nominal voltage shall be the declared voltage, or any of the stated voltages ±5 %, for which the equipment was designed.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information within this section and its impact on the test plan and resulting measurements.

5.2 Applicant/Manufacturer

Applicant name	GSI Electronics Inc.
Applicant address	5200 Armand-Frappier, J3Z 1G5, St Hubert, QC, Canada
Manufacturer name	Same as applicant
Manufacture address	Same as applicant

5.3 EUT information

Product	Pig RFID reader apparatus with telecommunication functionality using LFID @ 134.2KHz
Model	EDGE GSF LFID W/ Auto Tuning
Serial number	0727238

5.4 Technical information

All used IC test site(s) Reg. number	2040G-5
RSS number and Issue number	RSS-GEN, Issue 5, Apr. 2018, section 8.9
Operating frequency	134.2 kHz
Modulation type	FSK (HDX protocol) and ASK (FDX protocol)
Occupied bandwidth (99 %)	6.234 kHz
Power requirements	24 V_{DC} through 100-240 V_{AC} Pig feeder apparatus
Antenna information	The EUT uses a non-detachable coil antenna to the intentional radiator. The Antenna Gain is 0dBi
Software information	The EUT is set in the Telecom certification mode. The version of the firmware used for certification tests is V1.1.2.790. In this mode the radio devices are turned ON. One sprayer output is activated.

5.5 Product description and theory of operation

Sows wear RFID tags.
- When they are hungry, they spot an empty stall with an open door.
- The stall contains an RFID tag reader (EDGE GSF LFID W/Auto tuning), a feed pan and a water nipple
- In each stall there is a computerized feeder device (EDGE GSF + EDGE GSF LFID W/Auto tuning)
- The feeder (EDGE GSF) delivers the exact amount of feed the sow is allowed to eat for this meal. Several parameters can be set for each sow.

EDGE GSF LFID W/Auto tuning generates short magnetic pulses that wirelessly charge a capacitor inside an HDX or FDX tag. When the charge field turns off, the tag uses the stored power to send the tag number back to the reader without interference from the reader. The EDGE GSF LFID W/Auto tuning uses two different modulations: FSK (HDX protocol) and ASK (FDX protocol). It can read two protocols: HDX protocol and FDX protocol. The EDGE GSF LFID W/Auto tuning alternates many times between two modulations during a second for transmission and reception process.

5.6 EUT setup details

5.6.1 EUT Exercise and monitoring

Methods used to exercise the EUT and all relevant ports:

- The EUT was configured in accordance with customer supplied “Telecommunication” software loads to exercise all ports as applicable
- EDGE GSF LFID W/ Auto tuning was in continuous transmit mode

Configuration details:

- The EUT was set up in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end-user.
- The type and construction of cables used in the measurement setup were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
  - None
- The EUT was set up in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local AE and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
  - None

Monitoring details:

- − The overall system operation was monitored visually for any changes in programmed state or operations.

5.6.2 EUT test configuration

Table 5.6-1: *EUT sub-assemblies*

Description	Brand name	Serial number, Part number, Model, Revision level
Electronic Sow Feeder RFID reader (LFID Antenna)	GSI	SN: 0727238, MN: EDGE GSF LFID W/ Autotuning

Table 5.6-2: *EUT interface ports*

Description	Qty.
DC Power Port	1

Table 5.6-3: *Support equipment*

Description	Brand name	Serial number, Part number, Model, Revision level
Electronic Sow Feeder	GSI	SN: 0684812, MN: EDGE GSF Feeder

Table 5.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
5 conductor communication cable	LFID W/ Autotuning	EDGE GSF Feeder	2

EUT test configuration continued

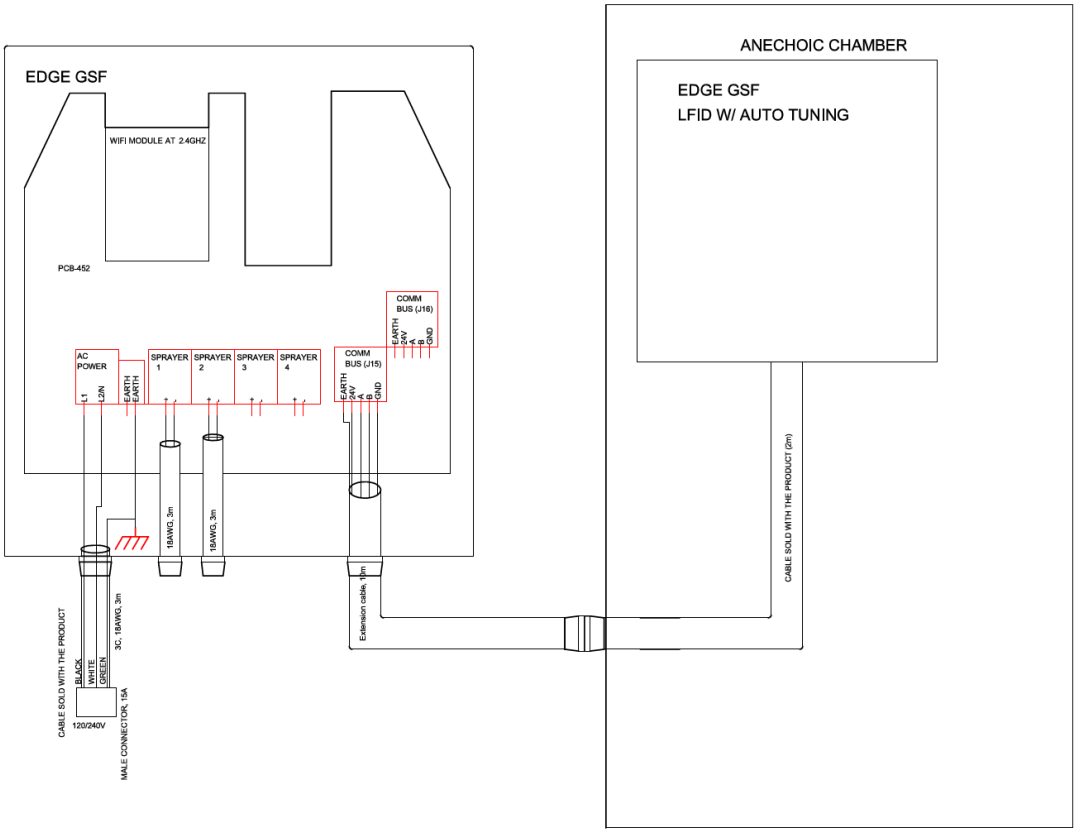

Figure 5.6-1: *block diagram*

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Montreal

6.2 Testing period

Test start date	July 23, 2021	Test end date	July 26, 2021

6.3 Sample information

Receipt date	July 16, 2021	Nemko sample ID number	Item #1

6.4 Test results

Table 6.4-1: *FCC 47 CFR Part 15, Subpart C, general requirements test results*

Clause	Test description	Verdict
§15.207(a)	Conducted limits[1]	Pass
§15.215(c)	20 dB bandwidth	Pass
§15.209	Radiated emission limits; general requirements.	Pass

Notes: [1] The EUT is AC powered

Table 6.4-2: *ISED RSS GEN, Issue 5, test results*

Clause	Test description	Verdict
7.3	Receiver radiated emission limits	Not applicable
7.4	Receiver conducted emission limits	Not applicable
8.8	AC power- line conducted emissions limits[1]	Pass
8.9	Transmitter Emission Limits for License-Exempt Radio Apparatus	Pass

Notes: According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.
[1]The EUT is AC powered

Section 7 Testing data

7.1 FCC 15.209 and RSS-GEN section 8.9 Radiated emission limits; general requirements

7.1.1 Definitions and limits

FCC:

(f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device.

ISED:

Except when the requirements applicable to a given device state otherwise, emissions from licence‑exempt transmitters shall comply with the field strength limits shown in Table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 7.1-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Definitions and limits; continued

Table 7.1-2: *ISED restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	Above 38.6
8.41425–8.41475	167.72–173.2	3500–4400	
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 7.1-2 and above 38.6 GHz are designated for license-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs

Table 7.1-3: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

7.1.2 Test summary

Verdict	Pass		
Tested by	Abdoulaye Ndiaye	Test date	July 23, 2021

7.1.3 Observations, and special notes

- The spectrum was searched from 9kHz to 1GHz.
- Radiated measurements were performed at a distance of 3 m.
- The spectral plots within this section are a summation of vertical and horizontal scans. The spectral plots within this section have been corrected with all relevant transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally, where less than 6 measurements per detector have been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- The spectrum was scanned from 9 kHz up to 1 GHz.

7.1.4 Setup details

Spectrum analyzer settings for frequencies blow 150 kHz

Detector mode	Quasi-Peak
Resolution bandwidth	300 Hz
Video bandwidth	9 kHz
Trace mode	Max Hold
Measurement time	100 ms

Spectrum analyzer settings for frequencies from 150 kHz to 30 MHz:

Detector mode	Quasi-Peak
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Trace mode	Max Hold
Measurement time	100 ms

Table 7.1-4: *Radiated emissions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber (Emissions)	TDK	SAC-3	FA002532e	2 year	February 25, 2022
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	March 16, 2022
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	March 3, 2022
Active loop antenna (0.01–30 MHz)	Com-Power	AL-130	FA002722	1 year	March 5, 2022
3 Phase AC Power Supply	apc AC Power	AFC-33045T	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	March 15, 2022

Notes: NCR - no calibration required, VOU - verify on use

Table 7.1-5: *Radiated emissions test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.20

7.1.5 Test data

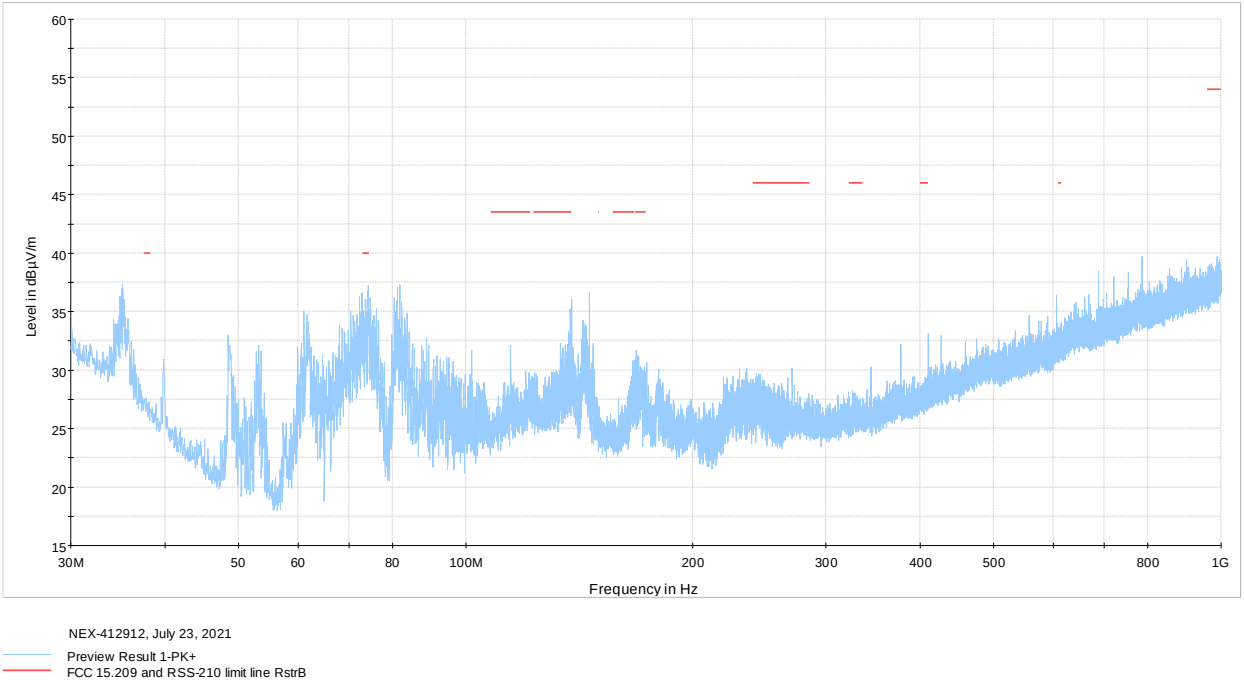

Figure 7.1-1: *Radiated emissions spectral plot (30 to 1000 MHz)*

Test data continued

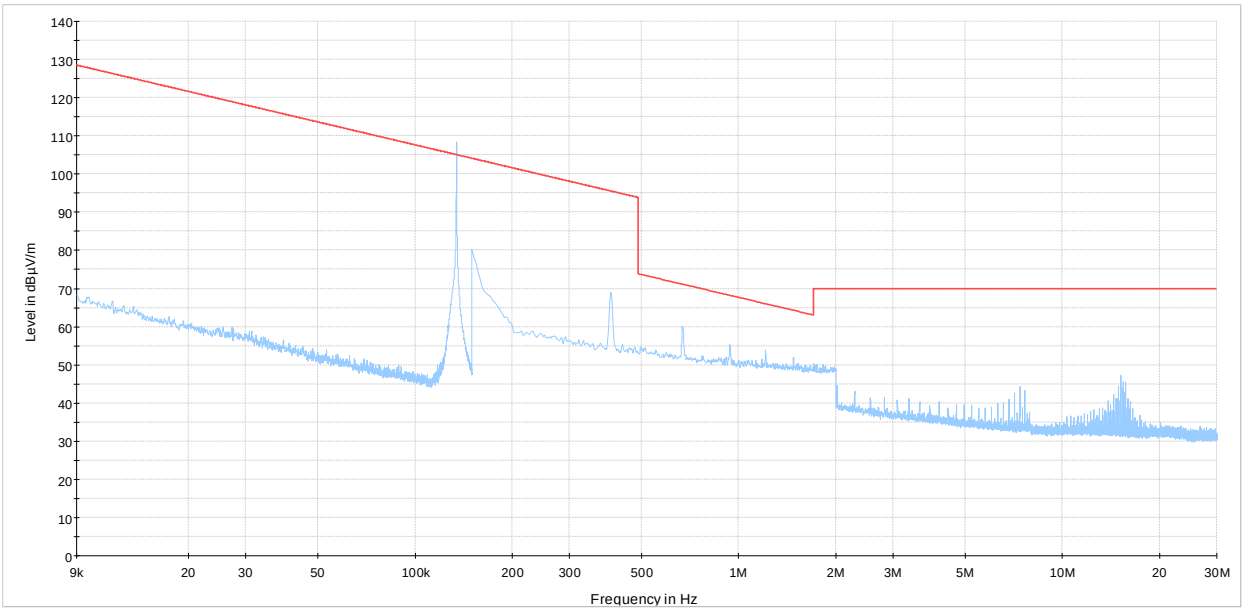

Table 7.1-6: *Peak Field Measurements in various distances*

Frequency (kHz)	Peak field strength (dBµV/m) in Chamber at 3m	Peak field strength (dBµV/m) at 5m	Peak field strength (dBµV/m) at 15m
134.2	107.35	59.2	34.08

As per ANSI C63.10 Clause 6.4.4.4 and FCC 15.209/ RSS Gen limits, final values method and Final limit line method are applied respectively:

Sample calculation of final values:

$$\text{Extrapolation Factor (dB/decade)} = \begin{cases} -40 \text{ (dB/decade)} & \text{if } d_1 = d_2 \\ \dfrac{\text{Reading Value } d_2 \text{ (dBµV)} - \text{Reading Value } d_1 \text{ (dBµV)}}{\text{Log}(d_2) - \text{Log}(d_1)} & \text{if } d_1 \neq d_2 \end{cases}$$

Extrapolation Factor (dB) = (Log(d) - Log(d_2)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_2 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

Please note that d1 = 5m and d2 = 15m

Extrapolation Factor (dB) = -52.6 dB/dec

Test data continued

Table 7.1-7: *Radiated emissions results from 9 kHz to 30 MHz as per Limit Method*

Frequency (kHz)	Peak field strength (dBµV/m) at 5m	Peak field strength (dBµV/m) at 300m	Limit at 300m (dBµV/m)	Margin (dB) at 3m
FCC and RSS Gen				
134.2	59.2	-34.33	25.0	59.33
Note	Emissions on 134.2 kHz is from intentional transmission of EUT			

As per ANSI C63.10 Clause 6.4.4.7, FCC 15.209 and RSS Gen (Table 7.1-1 of this report):

limits at 300m (µV/m) = 2400/F(KHz) with F(kHZ) = 134.2. Then limits at 300m (dB) = 17.9 µV/m = 25.0 dBµV/ m

Peak Field at 300m (dBµV/ m) = Peak Field at 5m + Extrapolation Factor *Log (300m/5m)

Table 7.1-8: *Radiated emissions results from 30 MHz to 1GHz*

Frequency (MHz)	Quasi-Peak field strength[1 and 3] (dBµV/m)	Quasi-Peak limit (dBµV/m)	Quasi-Peak margin (dB)	Correction factor[2] (dB)
FCC and RSS Gen				
74.256	34.7	40.0	5.3	13.1
137.589	26.1	43.5	17.4	18.7

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Sample calculation: 37.5 dBµV/m (field strength) = 21.3 dBµV (receiver reading) + 16.2 dB (Correction factor)

7.2 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

7.2.1 Definitions and limits

FCC:
Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

IC:
A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 7.2-1: *Conducted emissions limit*

Frequency of emission,	Conducted limit, dBµV	
MHz	**Quasi-peak**	**Average****
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

7.2.2 Test summary

Verdict	Pass		
Tested by	Abdoulaye Ndiaye	Test date	July 23, 2021

7.2.3 Observations, and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Tests were performed according to KDB 174176: (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.

7.2.4 Setup details

Receiver settings:

Frequency span	150 kHz to 30 MHz
Detector mode	Peak and Average (preview mode); Quasi-Peak (final measurements)
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Trace mode	Max Hold
Measurement time	100 ms

Table 7.2-2: *Conducted emissions – from AC mains power ports equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	March 16, 2022
3 Phase AC Power Supply	apc AC Power	AFC-33045T	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	March 15, 2022
LISN	Rohde & Schwarz	ENV216	FA002514	1 year	January 29, 2022

Notes: VOU - verify on use

Table 7.2-3: *Conducted emissions – from AC mains power ports test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.20

7.2.5 Test data

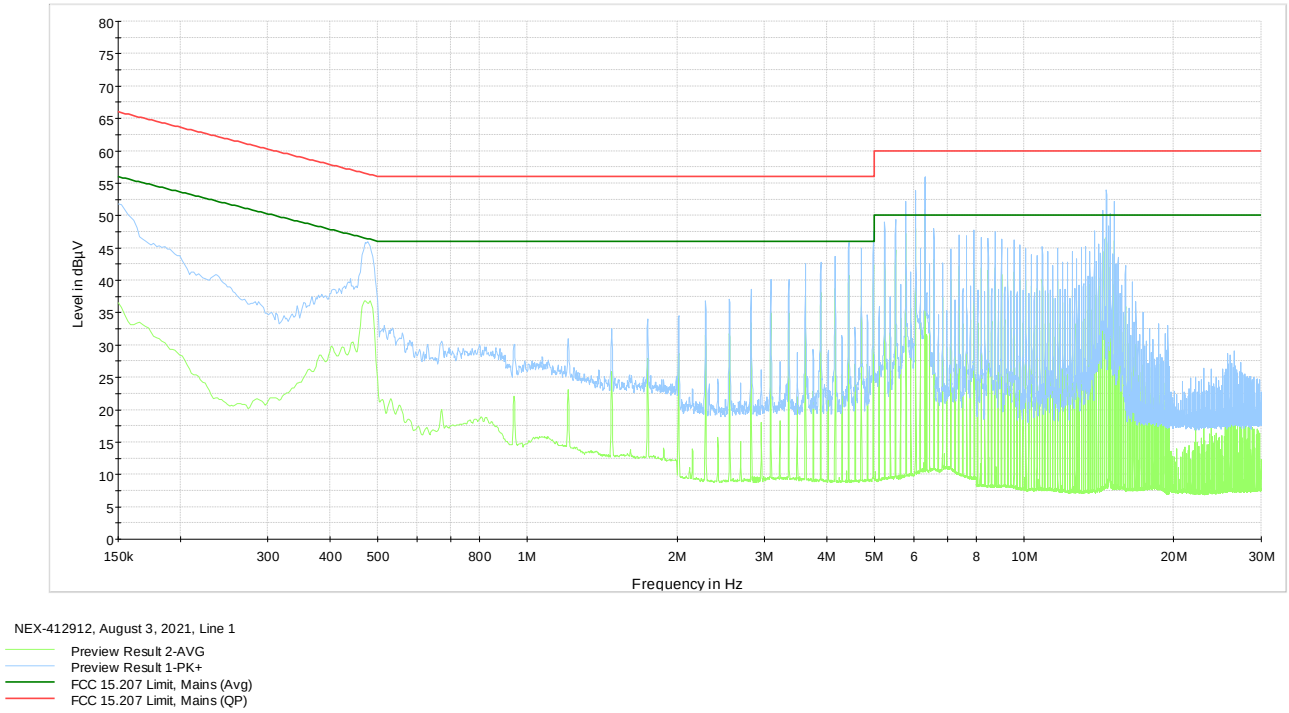

Figure 7.2-1: *Conducted emissions – from AC mains power ports spectral plot on the phase line*

Test data continued

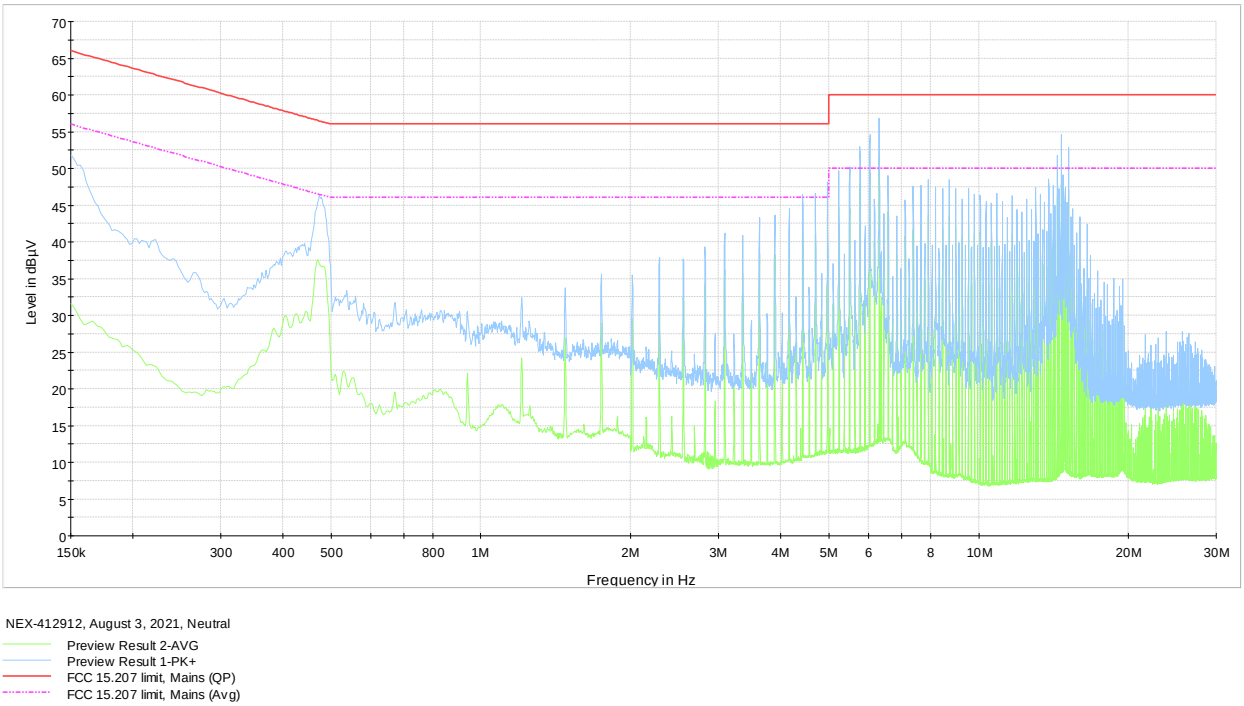

Figure 7.2-2: *Conducted emissions – from AC mains power ports spectral plot on the neutral line*

Test data continued

Table 7.2-4: *Conducted emissions – from AC mains power ports results*

Frequency (MHz)	Quasi-Peak result[1 and 3] (dBµV)	Quasi-Peak limit (dBµV)	Quasi-Peak margin (dB)	Conductor	Correction factor[2] (dB)
5.775	50.1	60.0	9.9	Line 1	10.1
6.042	51.8	60.0	8.2	Line 1	10.1
6.310	54.2	60.0	5.8	Line 1	10.1
14.637	50.7	60.0	9.3	Line 1	10.5
15.175	47.9	60.0	12.1	Line 1	10.5
0.474	43.9	56.4	12.5	Neutral	10.0
5.505	48.3	60.0	11.7	Neutral	10.1
5.775	50.9	60.0	9.1	Neutral	10.1
6.042	52.6	60.0	7.4	Neutral	10.1
6.312	55.1	60.0	4.9	Neutral	10.1
14.637	50.6	60.0	9.4	Neutral	10.5
15.175	47.0	60.0	13.0	Neutral	10.5

Frequency (MHz)	CAverage result[1 and 3] (dBµV)	CAverage limit (dBµV)	CAverage margin (dB)	Conductor	Correction factor[2] (dB)
5.237	40.5	50.0	9.5	Line 1	10.1
5.505	40.9	50.0	9.1	Line 1	10.1
5.775	45.9	50.0	4.1	Line 1	10.1
6.042	47.7	50.0	2.3	Line 1	10.1
6.312	46.9	50.0	3.1	Line 1	10.1
14.369	44.0	50.0	6.0	Line 1	10.5
14.637	39.9	50.0	10.1	Line 1	10.5
15.175	40.2	50.0	9.8	Line 1	10.5
4.431	40.1	46.0	5.9	Neutral	10.0
4.969	42.5	46.0	3.5	Neutral	10.1
5.505	40.0	50.0	10.0	Neutral	10.1
5.775	47.2	50.0	2.8	Neutral	10.1
6.042	48.7	50.0	1.3	Neutral	10.1
6.312	48.4	50.0	1.6	Neutral	10.1
14.369	43.9	50.0	6.1	Neutral	10.5
14.502	37.8	50.0	12.2	Neutral	10.5
14.907	44.1	50.0	5.9	Neutral	10.5

Notes:
[1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Sample calculation: 37.5 dBµV (result) = 27.4 dBµV (receiver reading) + 10.1 dB (Correction factor)

7.3 FCC 15.209 and RSS-GEN section 8.9 Radiated emission limits; general requirements

7.3.1 Definitions and limits

FCC

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

IC

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

7.3.1 Test summary

Verdict	Pass		
Tested by	Abdoulaye Ndiaye	Test date	July 26, 2021

7.3.2 Observations, and special notes

None

7.3.3 Setup details

Receiver settings:

Detector mode	Peak
Resolution bandwidth	1 kHz
Video bandwidth	RBW × 3
Trace mode	Max Hold

Table 7.3-1: *Occupied (emissions) Bandwidth equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber (Emissions)	TDK	SAC-3	FA002532e	2 year	February 25, 2022
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	March 16, 2022
Active loop antenna (0.01–30 MHz)	Com-Power	AL-130	FA002722	1 year	March 5, 2022
3 Phase AC Power Supply	apc AC Power	AFC-33045T	FA002677	—	VOU
Power Meter	HIOKI	PW3337	FA002727	1 year	March 15, 2022

Notes: NCR - no calibration required, VOU - verify on use

7.3.4 Test data

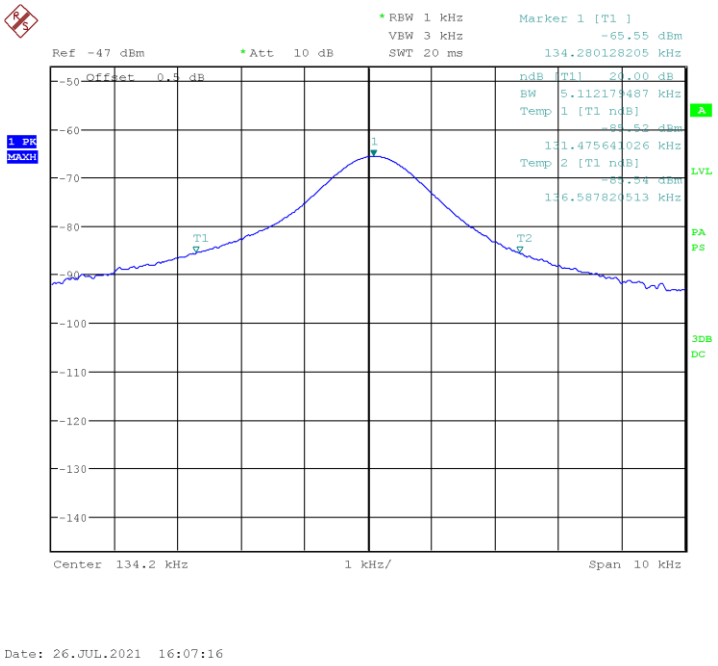

Figure 7.3-1: *20 dB bandwidth*

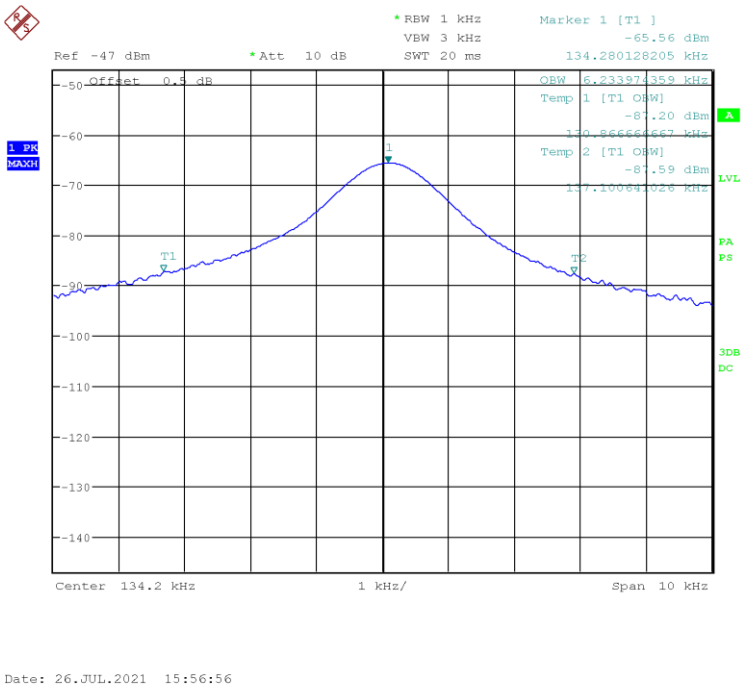

Figure 7.3-2: *99% bandwidth*

Section 8 EUT photos

8.1 External photos

Figure 8.1-1: *Front view photo - EDGE GSF LFID W/ Auto Tuning*

External photos continued

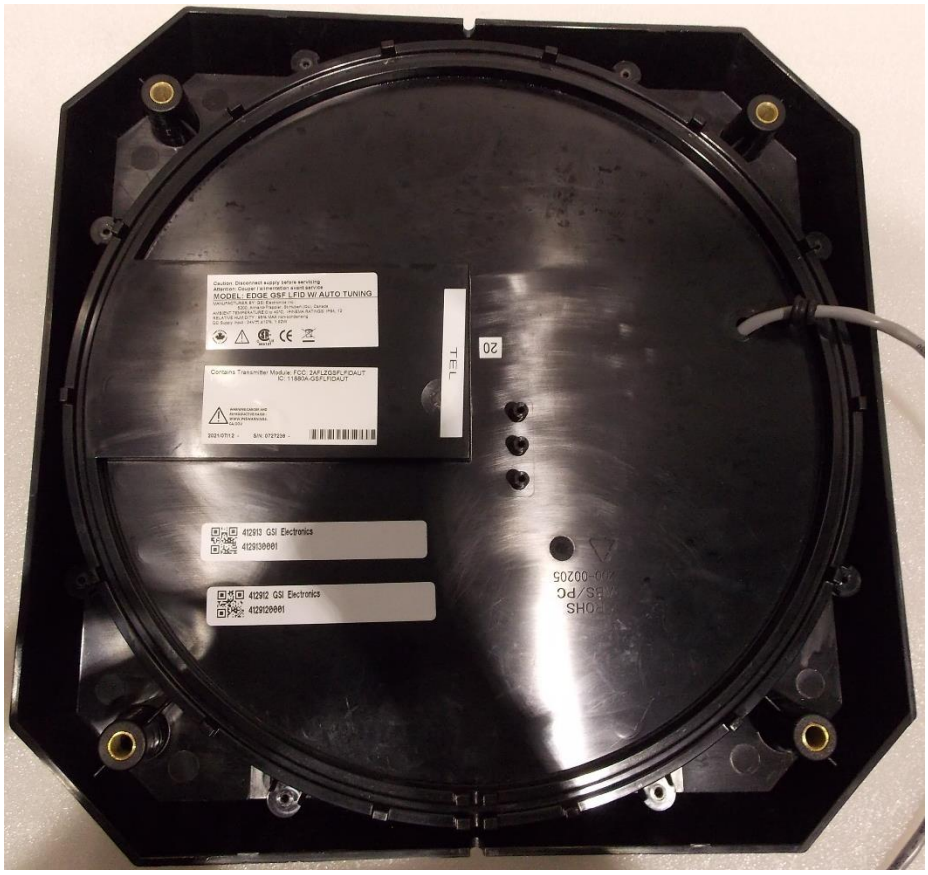

Figure 8.1-2: *Rear view photo - EDGE GSF LFID W/ Auto Tuning*

External photos continued

Figure 8.1-3: *Side view photo - EDGE GSF LFID W/ Auto Tuning*

Figure 8.1-4: *Side view photo - EDGE GSF LFID W/ Auto Tuning*

Figure 8.1-5: *Top view photo - EDGE GSF LFID W/ Auto Tuning*

Figure 8.1-6: *Bottom view photo - EDGE GSF LFID W/ Auto Tuning*

End of the test report