RF Test Report

As per

RSS-210 Issue 10:2019 + A1:2020
&
FCC Part 15 Subpart 15.209

Low Power License Exempt Radio Communication Devices Intentional Radiators

on the

Kiosk Secure RFID Encoder

Issued by: **TÜV SÜD Canada Inc.**
1280 Teron Rd
Ottawa, Canada

Testing produced for
dormakaba
See Appendix A for full client & EUT details.

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ACCREDITED
Testing Laboratory
Certificate #2955.19

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Report Scope

This report addresses the EMC verification testing and test results of the **Kiosk Secure RFID Encoder**, herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-210 Issue 10:2019 + A1:2020

FCC Part 15 Subpart C 15.207 & 15.209

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

Summary

The results contained in this report relate only to the item(s) tested.

EUT	**Kiosk Secure RFID Encoder**
FCC Certification #, FCC ID:	Q8SRFIDENC1
Industry Canada Certification #, IC:	4652A-RFIDENC1
EUT passed all tests performed	Yes
Tests conducted by	Scott Drysdale

Note:

For testing dates, see "Testing Environmental Conditions and Dates".

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.209 RSS-GEN (Table 4)	Transmitter Spurious Radiated Emissions	Quasi-Peak Average	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	Quasi-Peak, Average	Pass See Justification
Overall Result			**Pass**

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

For the antenna requirement specified in FCC 15.203, for RFID the EUT uses a custom pcb trace loop antenna which is also not meant to be replaceable by the user.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the Z-axis. Worst case results are presented.

Power line conducted emissions was performed in AC powered via a USB charger as representative. As the EUT is designed for Class A operation, the Class A limits in 15.107 and ICES-003 were applied.

The EUT does not have an antenna port and all measurements were performed using the radiated method. Antenna gain is not specified as the device has been tested to comply with the applicable radiated emissions limits via radiated emissions measurements and antenna port conducted emissions do not apply.

Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)
Margin = 50.5dBµV/m – (50dBµV + 10dB/m + 2.5dB – 20dB)
Margin = 8.0 dB (pass)

Applicable Standards, Specifications and Methods

ANSI C63.4:2017	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2020	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2023	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
RSS-GEN Issue 5 2018	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 10:2019 + A1:2020	Licence-Exempt Radio Apparatus: Category I Equipment
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories

Document Revision Status

Revision 000 - First Issue. Aug 7, 2024

Revision 001 – Signed document after review. Aug 9, 2024

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

BW – Bandwidth. Unless otherwise stated, this is refers to the 20 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Ottawa, Ontario. The testing lab has calibrated 10m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 3m and a height of up to 3m. The chambers are equipped with a turntable that is capable of testing devices up to 5000lb in weight and are equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. This facility is capable of testing products that are rated for single phase or 3-phase AC input and DC capability is also available. Radiated emission measurements are performed using Loop antenna, Biconical antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the vertical ground plane if applicable.

Calibrations and Accreditations

The 10m semi-anechoic chamber is registered with Federal Communications Commission, Innovation, Science and Economic Development Canada and Voluntary Control Council for Interference (Japan). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, where applicable, a 16-point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. All measuring equipment is calibrated on an annual or biennial basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
June 26, 2024	Radiated Emissions	SD	20-23	50.0	98-106.5
June 26, 2024	Power line Conducted Emissions	SD	20-23	50.0	98-106.5

Detailed Test Results Section

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The method is as defined in ANSI C63.4. The limits are as defined in FCC Part 15 Section 15.107 and ICES-003, Class A.:

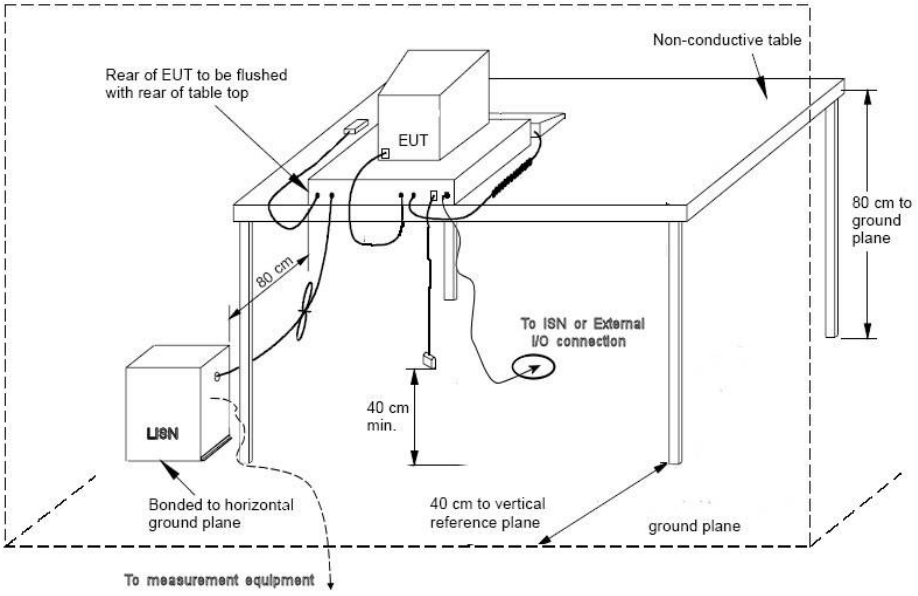
CLASS A

Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	66 dBµV	150 kHz – 500 kHz	79 dBµV
500 kHz – 30 MHz	60 dBµV	500 kHz – 30 MHz	73 dBµV

Both Quasi-Peak and Average limits are applicable, and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

If the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Typical Setup Diagram



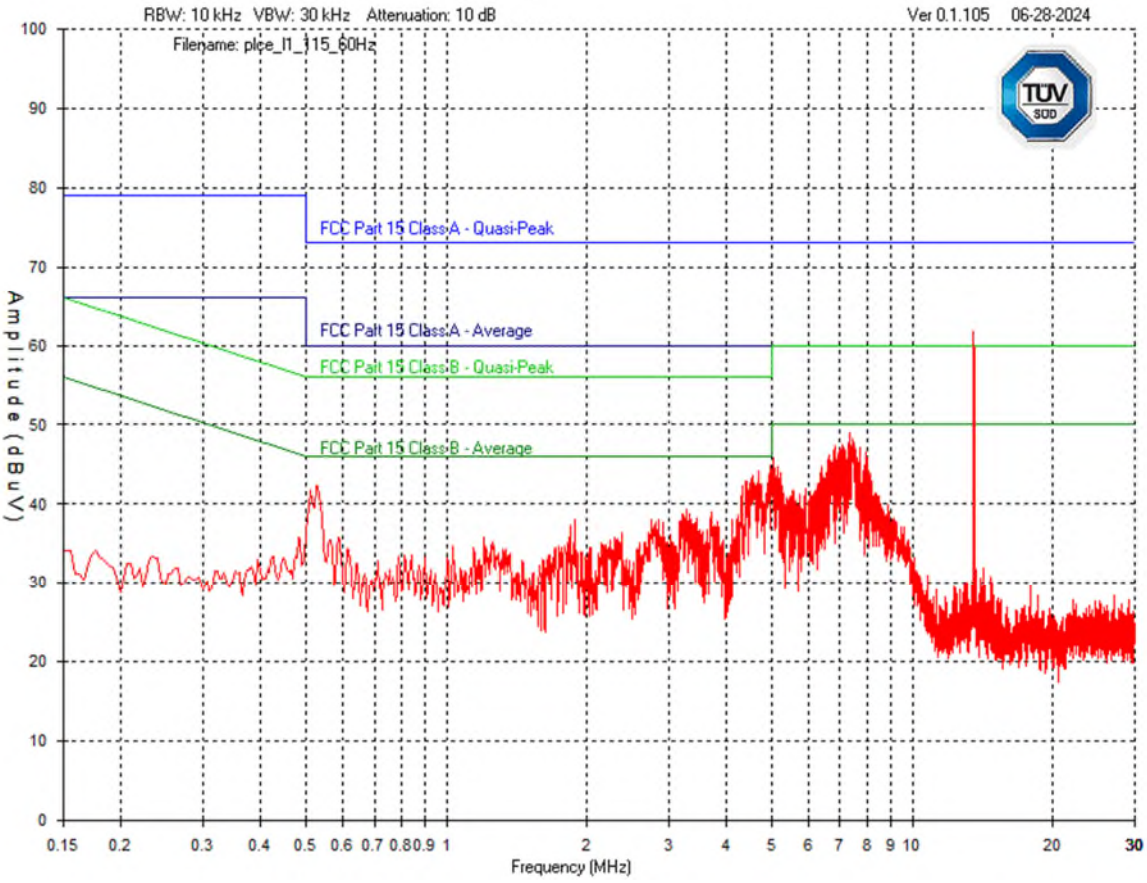
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.27dB with a 'k=2' coverage factor and a 95% confidence level.

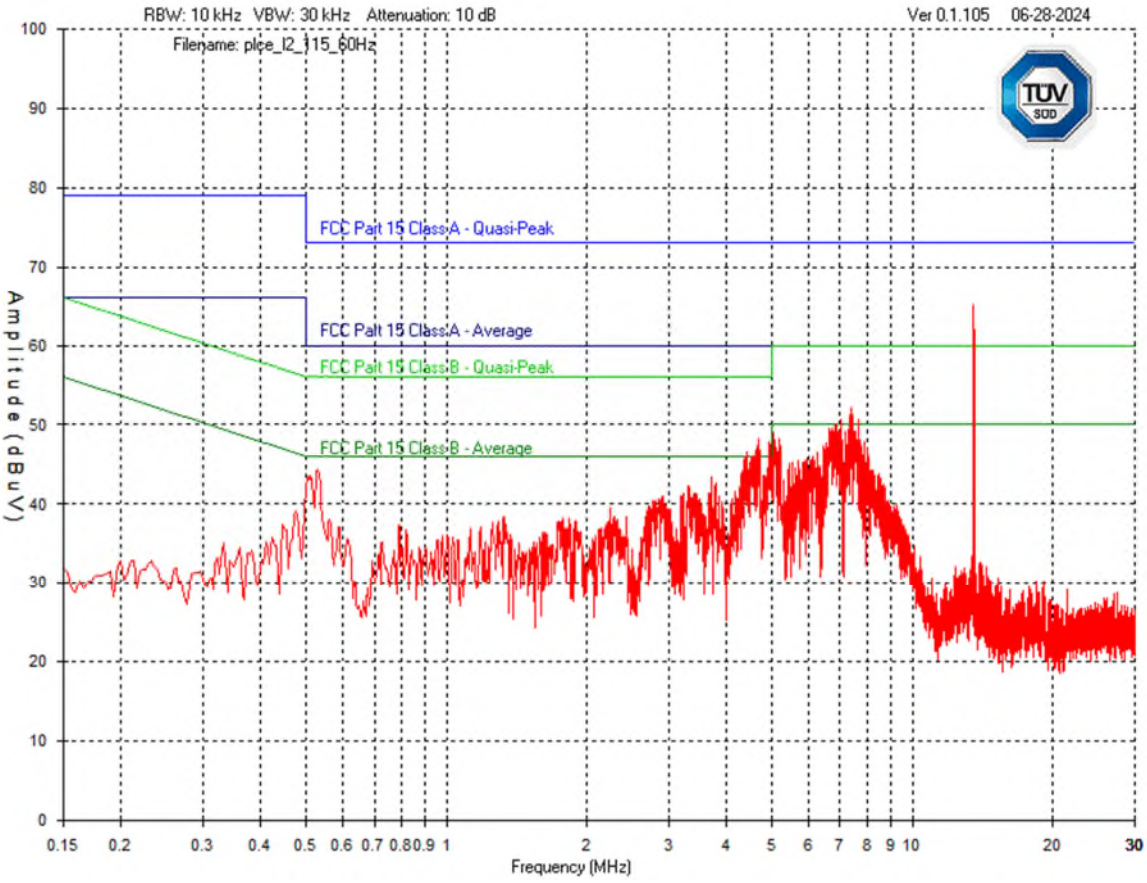
Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

Line (L1) – 120Vac 60Hz



Neutral (L2) – 120Vac 60Hz



Final Measurements

Average Emissions Table
Line 1

Freq MHz	Raw Reading (dBuV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
13.56	44.5	10	0.2	0.3	55	60	5	Pass

Average Emissions Table
Line 2

Freq MHz	Raw Reading (dBuV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
13.56	47.2	10	0.2	0.3	57.7	60	2.3	Pass

Quasi-Peak Emissions Table (all readings performed peak as worst case)
Line 1

Freq MHz	Raw Reading (dBuV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
13.56	51.2	10	0.2	0.3	61.7	73	11.3	Pass
7.3511	38.7	10	0.1	0.2	49	73	24	Pass
7.4606	38	10	0.1	0.2	48.3	73	24.7	Pass
4.6884	33.9	10	0.1	0.2	44.2	73	28.8	Pass
4.9275	33.5	10	0.1	0.2	43.8	73	29.2	Pass
7.3013	37.5	10	0.1	0.2	47.8	73	25.2	Pass

Quasi-Peak Emissions Table (all readings performed peak as worst case)
Line 2

Freq MHz	Raw Reading (dBuV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
13.5594	54.6	10	0.2	0.3	65.1	73	7.9	Pass
7.3809	41.9	10	0.1	0.2	52.2	73	20.8	Pass
4.6851	37.9	10	0.1	0.2	48.2	73	24.8	Pass
4.9275	37.5	10	0.1	0.2	47.8	73	25.2	Pass
7.3511	41	10	0.1	0.2	51.3	73	21.7	Pass
7.4274	40.9	10	0.1	0.2	51.2	73	21.8	Pass

All peak emissions, except for 13.56 MHz, were below the average limit thus the EUT was deemed to meet power line conducted emission limits for these readings based on peak emission.

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Test Equipment List

Description	Make	Model number	Asset ID	Calibr. date	Calibr. due
EMI Receiver	Rohde & Schwarz	ESU-40	LAVE04092	2024-04-26	2025-04-26
Transient Limiter	Hewlett Packard	11947A	SSG012403	2024-04-18	2025-04-18
Coaxial Cable	Huber & Suhner	104PEA	SSG013080	2024-02-01	2025-02-01
Line Impedance Stabilization Network	FCC	FCC-LISN-50/250-16-2-01	LAVE4005	2024-04-17	2025-04-17

Radiated Emission Field Strength (RFID -15.209)

Purpose

The purpose of this test is to ensure that the RF energy emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect other devices which may be using the same spectrum allocations for similar or other purposes and also ensures the transmit range of the device is within the pre-determined suitable range. This also ensures public safety by not exceeding a level which has been deemed safe for human exposure.

Limits and Method

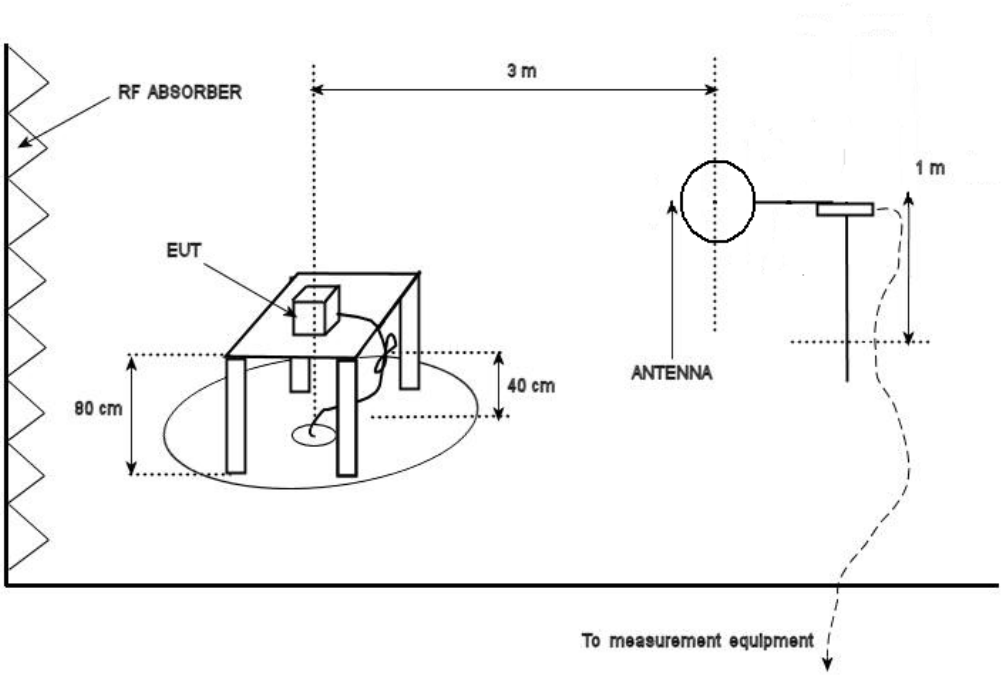
The limits are defined in FCC Part 15.209(a).
Method is using a loop antenna and converting to voltage based on the impedance of free space.

Fundamental Frequency (kHz)	Field Strength Limit (uV/m) at 300m	Limit (dBuV/m)[1] at 3m
13.6 MHz	2400/F (kHz)	69.5

[1]Limit is with a Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1
Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

In accordance with FCC Part 15, section 15.31(f)(2), testing was performed at a 3 meter test distance and an extrapolation factor of 40 dB/decade was applied. For example, an extrapolation of 300m to 3m is 20Log(uV/m) + 40Log(300m/3m).

Typical Radiated Emissions Setup



Measurement Uncertainty

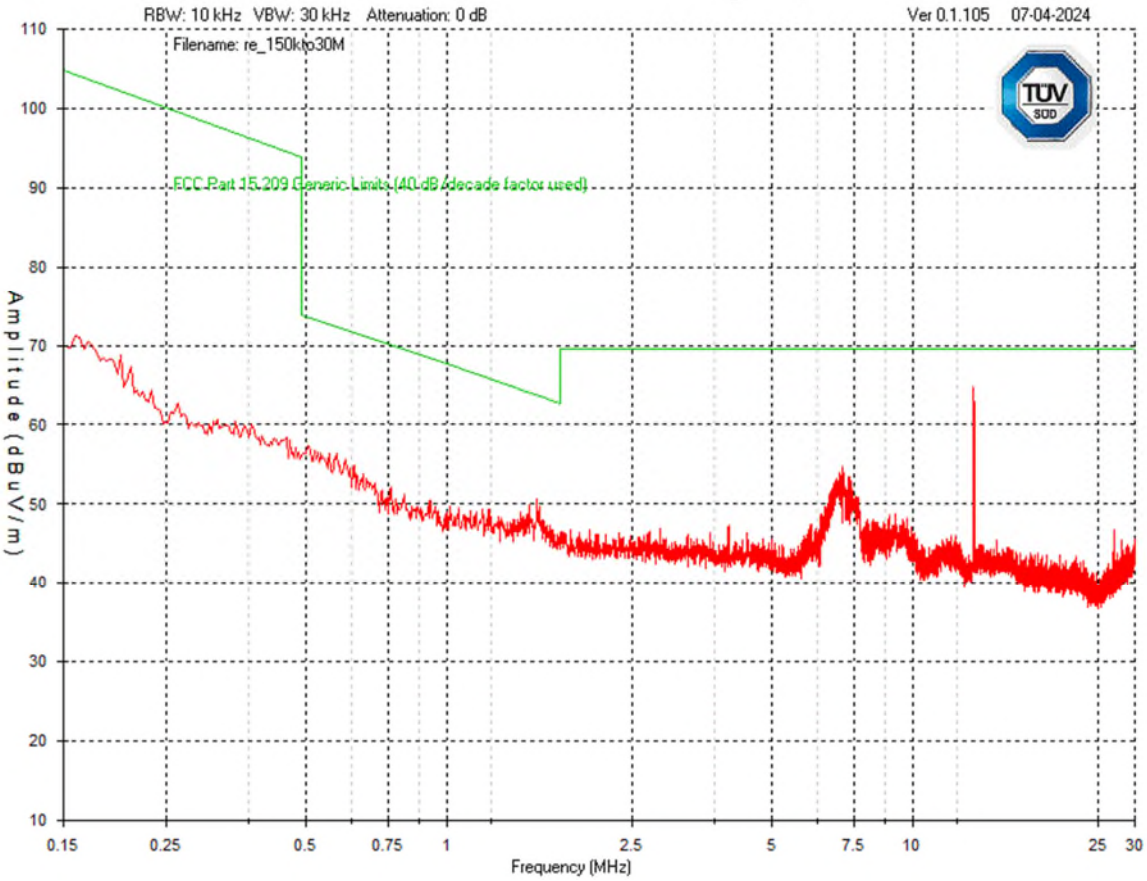
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

The graphs shown below are maximized peak measurement graphs over a full 0-360°. The loop was orientated at 0 degrees and 90 degrees and a maximized reading is shown. The marker shows the raw value. See the Final Measurements section below for corrected values.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

Peak Emission at Carrier Frequency



Final Measurements

Freq.	Detector Peak/QP	EUT Axis	Received Signal (dBµV)	dBuA/ dBuV Conv. factor	Antenna Factor, Cable (dB/m)	Level (dBµV/m)	Emission Limit dB(µV/m)	Margin dB	Result
13.56	Peak	Z	27.2	51.5	-13.9	64.8	69.5	4.7	Pass

Emissions Table

Note:

Peak = Peak measurement

QP = Quasi-Peak measurement

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up and EUT axis.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Apr 4, 2024	Apr 4, 2026	LAVE04092
Loop Antenna	EM 6879	Electro-Metrics	May 4, 2024	May 4, 2025	LAVE4040
RF Cable	Huber & Suhner	104PEA	May 8, 2024	May 8, 2025	SSG012041

Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The limits are as defined in FCC Part 15 Section 15.209(a). The method is as defined in ANSI C63.10.

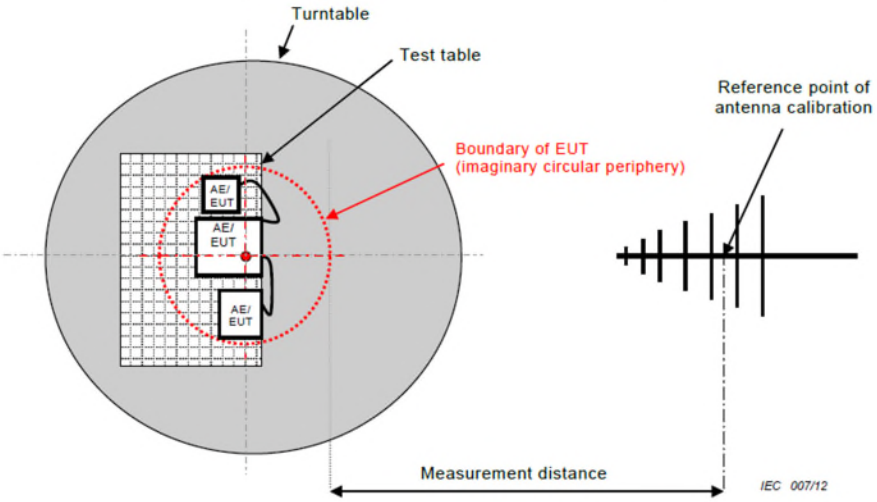
The limits apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8[1]
0.490 MHz – 1.705 MHz	73.8 to 63[1]
1.705 MHz – 30 MHz	69.5[1]
30 MHz – 88 MHz	40.0[1]
88 MHz – 216 MHz	43.5[1]
216 MHz – 960 MHz	46.0[1]
Above 960 MHz	54.0[1]
Above 1000 MHz	54.0[2]
Above 1000 MHz	74.0[3]

[1]Limit is with Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

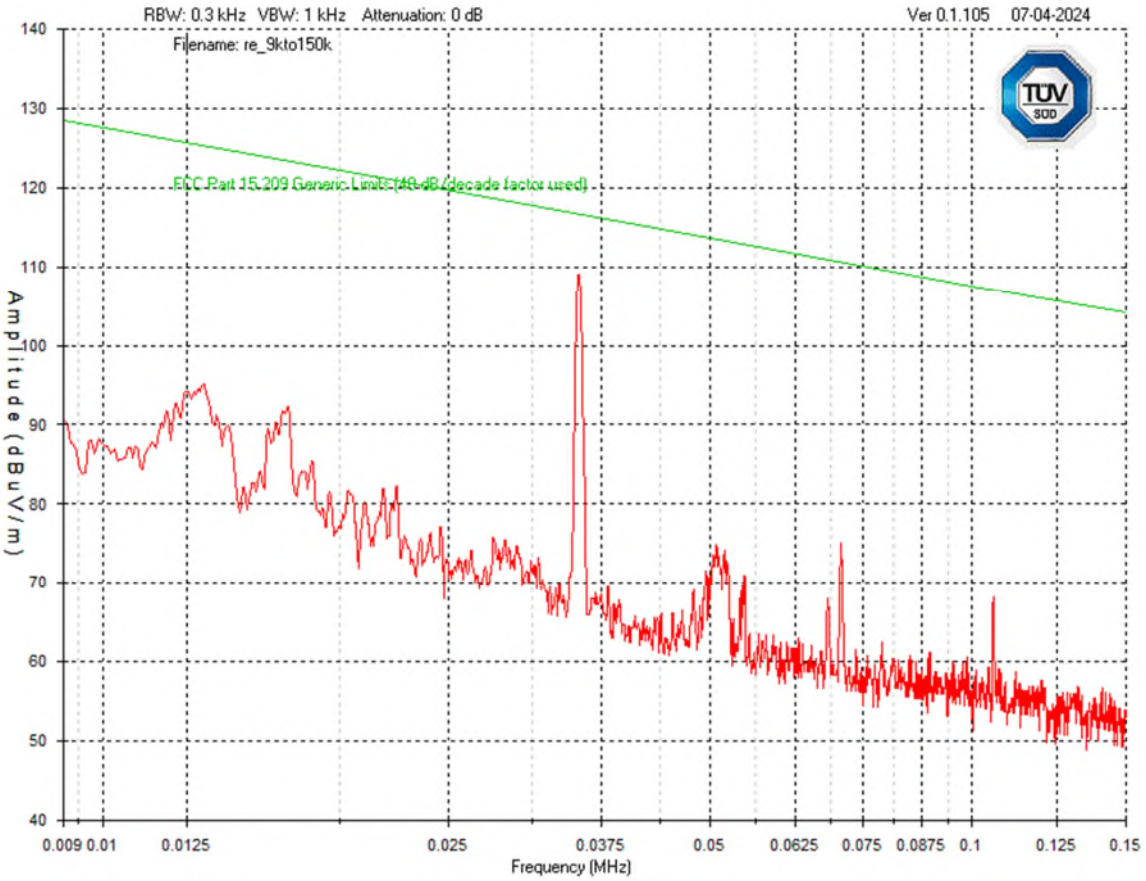
The graphs shown below are obtained at a 3m test distance and are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

In accordance with FCC Part 15, Subpart A, Section 15.33(a), the device is scanned to at least the 10^{th} harmonic (A minimum of 1.25MHz).

Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31(f), an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example, an extrapolation of 30m to 3m for frequencies below 30MHz is 20Log(uV/m) + 40Log(30m/3m).

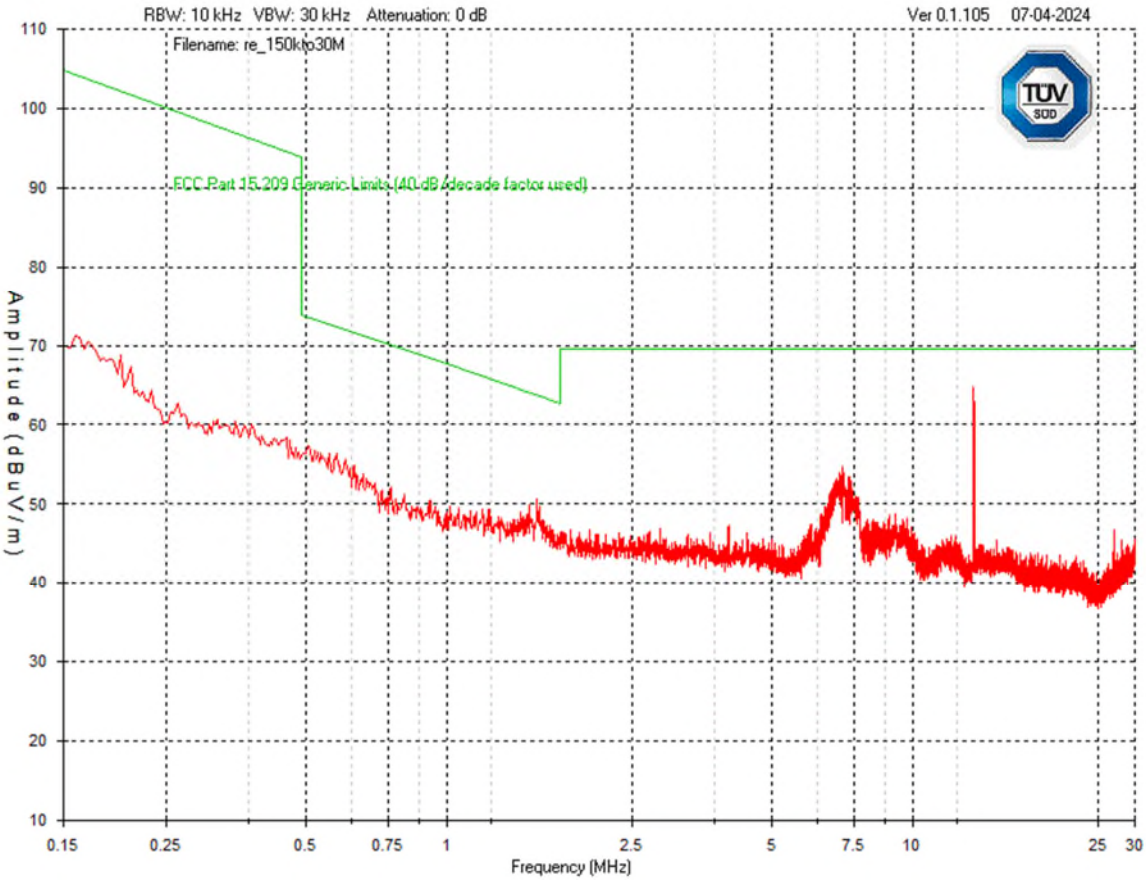
The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the Z-axis.

9 kHz – 150 kHz



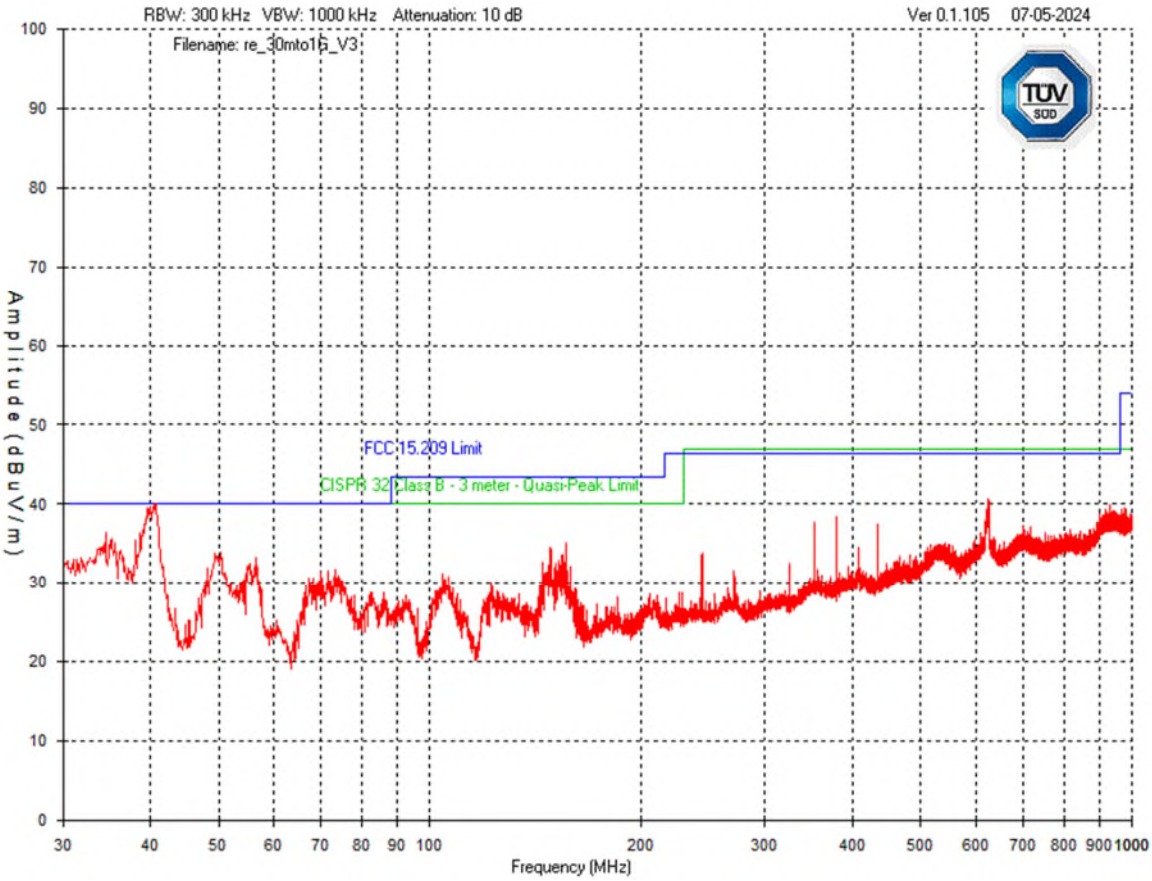
Note: Emission shown at 35 kHz was ambient signal.

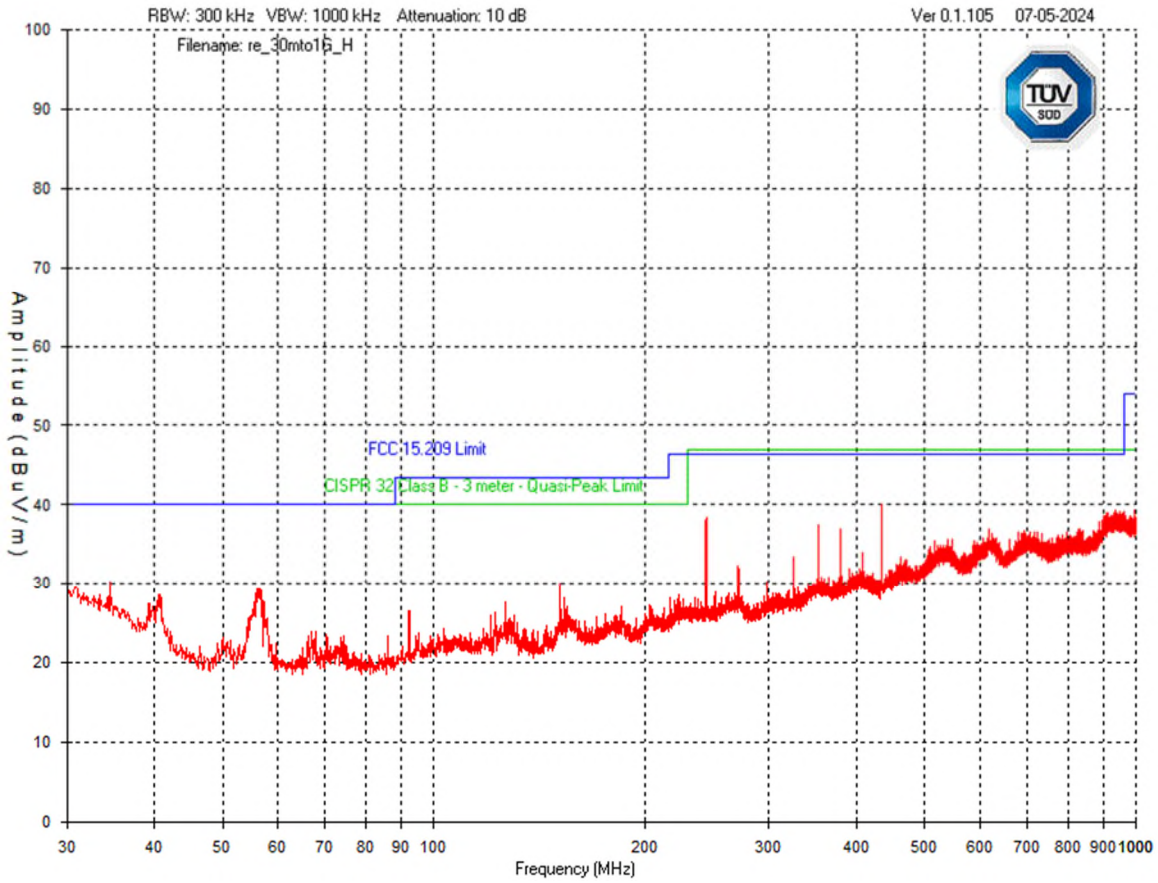
150 kHz – 30 MHz



Note: Spike shown at 13.56 MHz is intentional RFID signal.

30 MHz to 1 GHz RFID On





Note: testing was performed to 10 GHz, no emissions above 1 GHz were detected and the reading were below the applicable limit(s).

Final Measurements

The EUT passed. No quasi-peak or average measurement is required as all peak emissions are more than 10dB below the limit, other then as noted in the tables below.

30 MHz to 1 GHz

Vertical

Frequency (MHz)	Detector	Raw Reading (dBuV)	Ant – Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Preamp- Factor (dB)	Level (dBuV/m)	Limit	Margin
40.6807	QP	44	14	3	0.3	-27.1	34.2	40	5.8
34.5636	PK	42.4	17.6	3	0.3	-27	36.3	40	3.7
624.234	PK	37.9	25.9	3	1.1	-27.3	40.6	46.4	5.8
50.2933	PK	47.3	10.6	3	0.4	-27.3	34	40	6
56.6046	PK	46.6	10.5	3	0.4	-27.3	33.2	40	6.8
379.841	PK	41.4	20.5	3	0.9	-27.3	38.5	46.4	7.9

Horizontal

Frequency (MHz)	Detector	Raw Reading (dBuV)	Ant – Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Preamp- Factor (dB)	Level (dBuV/m)	Limit	Margin
433.924	PK	42.6	20.8	3	0.9	-27.3	40	46.4	6.4
244.196	PK	44.9	17.1	3	0.7	-27.3	38.4	46.4	8
352.654	PK	40.3	20.7	3	0.8	-27.3	37.5	46.4	8.9
379.744	PK	40	20.5	3	0.9	-27.3	37.1	46.4	9.3
34.5636	PK	36.4	17.6	3	0.3	-27	30.3	40	9.7
56.4104	PK	42.8	10.6	3	0.4	-27.3	29.5	40	10.5

Note

PK = Peak

QP = Quasi-Peak

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Apr 4, 2024	Apr 4, 2026	LAVE04092
Pre-Amp	8447D	HP	April 26, 2023	April 26, 2025	SSG013045
Loop Antenna	EM 6879	Electro-Metrics	May 4, 2024	May 4, 2025	LAVE4040
RF Cable	Huber & Suhner	104PEA	May 8, 2024	May 8, 2025	SSG012041
BiLog Antenna	3142-E	ETS Lindgren	June 16, 2023	June 16, 2025	LAVE4002

Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

Client	
Organization / Address	Dormakaba Canada Inc 105 blvd Marcel-Laurin, Montréal, Quebec, H4N 2M3
EUT Details	
EUT Name	**Kiosk Secure RFID Encoder**
Equipment Category	RFID
Basic EUT Functionality	It encodes RFID keycards and other media with data commands.
Input Voltage	5V (external DC source via USB port)
Connectors available on EUT	USB, Ethernet.
Peripherals Required for Test	13.6MHz RFID Encoder
Release type	Final
Intentional Radiator Frequency	13.6MHz for RFID applications
EUT Configuration	Configured to continuously transmit RFID

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT and Test Setup Photos'.

Appendix B – EUT and Test Setup Photos

See the Test Setup exhibit which is separate from this test report for the EUT and Test Setup photos.