

TEST REPORT

Test Report No. : UL-RPT-RP15124648-516A

Customer : SECO S.p.A.
Model No. / HVIN : SYS-D90-ITE
PMN : SYS-D90-ITE
FCC ID : 2ALZB-7150PN
ISED Certification No. : IC: 22688-7150PN
Technology : WLAN 2.4 GHz, *Bluetooth* LE & NFC
Test Standard(s) : FCC Parts 15.209(a), 15.247(d) & 15.225(d)
Innovation, Science and Economic Development Canada
RSS-Gen 6.13, RSS-247 5.5 & RSS-210 B.6(a)
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 3.0 supersedes all previous versions.

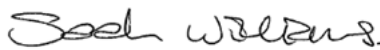
Date of Issue: 12 September 2024

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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	21/06/2024	Initial Version	Ben Mercer
2.0	29/07/2024	Implemented TCB feedback	Ben Mercer
3.0	12/09/2024	Implemented TCB feedback	Ben Mercer

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1 Attestation of Test Results

1.1 Description of EUT

The equipment under test was a HMI touchscreen containing an NFC reader and a 2.4 GHz WLAN / *Bluetooth* module.

1.2 General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Specification Reference:	47CFR15.225
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
Specification Reference:	RSS-210 Issue 10 December 2019
Specification Title:	Licence-Exempt Radio Apparatus: Category I Equipment
Specification Reference:	RSS-Gen Issue 5, February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 3 August 2023
Specification Title:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
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, G24 8AH, United Kingdom
Test Dates:	13 March 2024 to 19 March 2024

1.3 Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
WLAN & NFC			
Part 15.247(d) / 15.209(a) & 15.225(d)	RSS-Gen 6.13 / RSS-247 5.5 & RSS-210 B.6(a)	Transmitter Out of Band Radiated Emissions	
Bluetooth & NFC			
Part 15.247(d) / 15.209(a) & 15.225(d)	RSS-Gen 6.13 / RSS-247 5.5 & RSS-210 B.6(a)	Transmitter Out of Band Radiated 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	-

UL International (UK) Ltd is accredited by the 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

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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

Measurement system instrumentation shall be used with an accuracy specification meeting the accuracy specification limits according to IEC/IECEE OD-5014.

As applicable, unless specified otherwise in this report, the compliance “Decision Rule” is based on Simple Acceptance. If the measured value is on the limit, the result is defined as a pass. In this case the risk of a false positive is 50%. For further information regarding risk assessment refer to ILAC G8:09/2019.

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
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Spurious Emissions	1 GHz to 18 GHz	95%	±3.13 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 Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	27 Dec 2024	12
K0001	3m RSE Chamber	MVG Industries UK Ltd.	N/A	N/A	06 Sep 2024	12
M236226	Test Receiver	Rohde & Schwarz	ESW26	103134	21 Apr 2024	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	21 Aug 2024	12
A3154	Pre-Amplifier	Com Power	PAM-103	18020012	21 Aug 2024	12
A231925	Antenna	Teseq	CBL6111D	63584	27 Apr 2024	12
A3010	Attenuator	AtlanTecRF	AN18-06	208801#5	27 Apr 2024	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	23 Aug 2024	12
A3139	Antenna	Schwarzbeck	HWRD750	00027	23 Aug 2024	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	832827#1	23 Jan 2025	12
A3085	Low Pass Filter	AtlanTecRF	AFL-02000	18051600014	23 Jan 2025	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	23 Jan 2025	12
A3095	High Pass Filter	AtlanTecRF	AFH-07000	18051600012	23 Jan 2025	12
A3165	Antenna	ETS-Lindgren	6502	00224383	13 Apr 2024	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	04 Mar 2025	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721 - 023	27 Feb 2025	12

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	itema
Model Name or Number / HVIN:	SYS-D90-ITE
PMN:	SYS-D90-ITE
Test Sample Serial Number:	230202056 (<i>Radiated sample #1</i>)
Hardware Version:	system: SYS-D90-ITE-00-C0 main board: CD90-1532-0886-C0
Software Version:	U-Boot 2020.04 Linux seco-imx8mm-c61 5.4.70
FCC ID:	2ALZB-7150PN
ISED Canada Certification Number:	IC: 22688-7150PN
Date of Receipt:	26 January 2024

3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3 Additional Information Related to Testing

Technology Tested:	NFC
Channel Bandwidth:	Single Channel Device
Transmit Frequency Range:	13.56 MHz

Technology Tested:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps		
Power Supply Requirement(s):	Nominal	24 VDC	
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Middle	19	2442

Technology Tested:	WLAN (IEEE 802.11b,g,n) / Digital Transmission System		
Type of Unit:	Transceiver		
Modulation Type:	DBPSK		
Data Rate:	802.11b	1 Mbps (SISO)	
Power Supply Requirement(s):	Nominal	24 VDC	
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2412 MHz to 2472 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Middle	7	2442

3.4 Description of Available Antennas

The EUT utilizes an integrated antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2.4 GHz	3.0

3.5 Description of Test Setup

Support Equipment

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

Description:	USB Docking Station
Brand Name:	Think Pad
Model Name or Number:	USB-C Dock/40A9
Serial Number:	ZAF0LGYW

Description:	USB Hub
Brand Name:	Lemorele
Model Name or Number:	TC19
Serial Number:	None Stated

Description:	AC/DC Power Supply
Brand Name:	Mean Well
Model Name or Number:	GSM90B24-P1M
Serial Number:	EC06435803

Description:	Ethernet Cable x2
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	USB Cable x2
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Micro USB Cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Operating Modes

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

- Transmitting simultaneously with *Bluetooth* LE and NFC at maximum power.
- Transmitting simultaneously with WLAN and NFC at maximum power.

Configuration and Peripherals

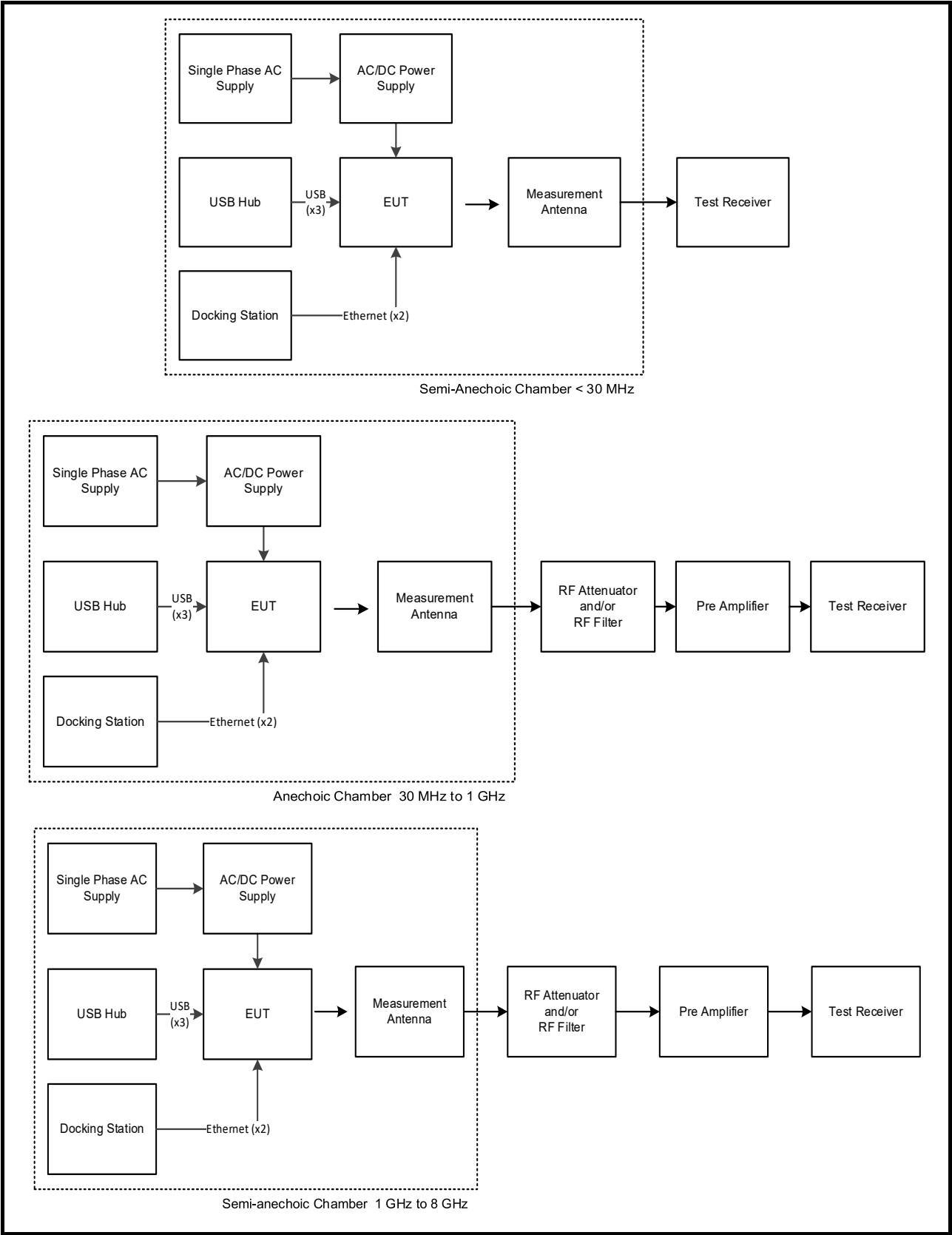
The EUT was tested in the following configuration(s):

- NFC and WLAN co-location, with EUT configured to simultaneously transmit two signals (NFC 13.56 MHz and 2.4 GHz WLAN 802.11b 1 Mbit/s on channel 7 / 2442 MHz).
- NFC and Bluetooth co-location, with EUT configured to simultaneously transmit two signals (NFC 13.56 MHz and *Bluetooth* LE 1 Mbit/s on channel 19 / 2442 MHz).
- The EUT was configured using a terminal application via EUT touch screen. The application was used to enable continuous transmission modes and to select the test channels, data rates and modulation schemes as required. The customer supplied configuration instructions '*SYS-D90-ITE_RF_TEST_GUIDE_20240116.pdf*'.
- All active ports were terminated.

Test Setup Diagrams

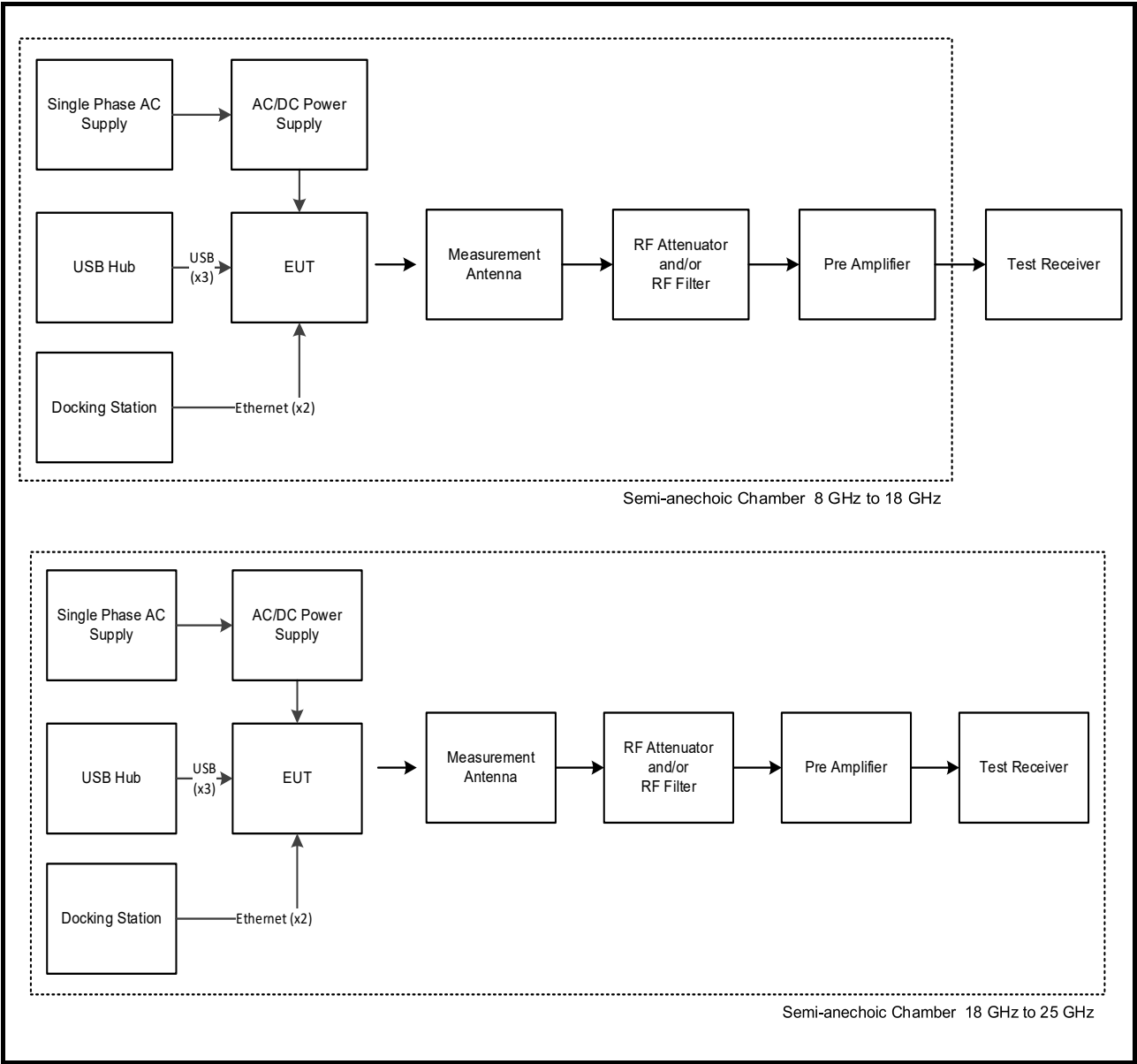
Radiated Tests:

Test Setup for Transmitter Radiated Emissions



Test Setup Diagrams (continued)

Test Setup for Transmitter Radiated Emissions (continued)



4 Radiated Test Results

4.1 Transmitter Out of Band Radiated Emissions – 2.4 GHz WLAN / NFC

Test Summary:

Test Engineer:	Andrew Harding	Test Dates:	13 March 2024 to 19 March 2024
Test Sample Serial Number:	230202056		

FCC Reference:	Parts 15.209(a), 15.247(d) & 15.225(d)
ISED Canada Reference:	RSS-Gen 6.13, RSS-247 5.5 & RSS-210 B.6(a)
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4, 6.5, 6.6, 11.11 & 11.12
Frequency Range	9 kHz to 25 GHz

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	41 to 44

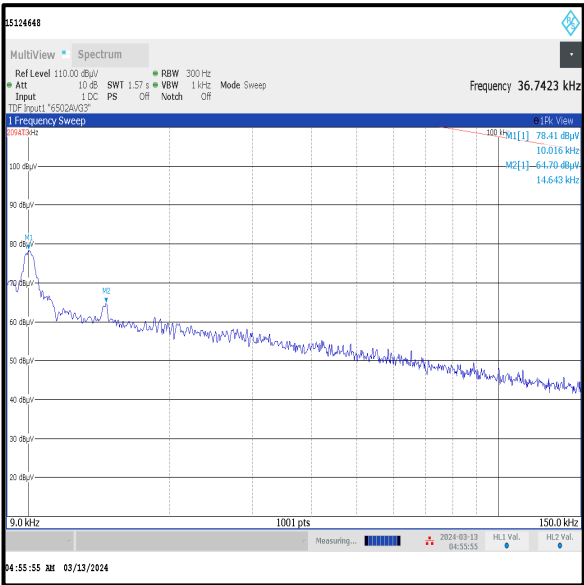
Transmitter Out of Band Radiated Emissions – 2.4 GHz WLAN / NFC (continued)**Note(s):**

1. All intermodulation products were found to be ambient, > 20 dB below the appropriate limit or below the noise floor of the measurement system. The highest pre-scan emission value has been recorded in the table below.
2. The NFC fundamental is shown on the 150 kHz to 30 MHz plot.
3. The 2.4 GHz WLAN fundamental is shown on the 1 GHz to 3 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. 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. In accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
6. 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.
7. Measurements from 30 MHz to 1 GHz 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.
8. Pre-scans were performed with the EUT in all 3 orientations. The worst-case plots are presented below.
9. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor 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.
10. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-Gen Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency X kHz resulted in a level of Y dB μ V/m, which is equivalent to $Y - 51.5 = Z$ dB μ A/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to the 15.209(a) limit.

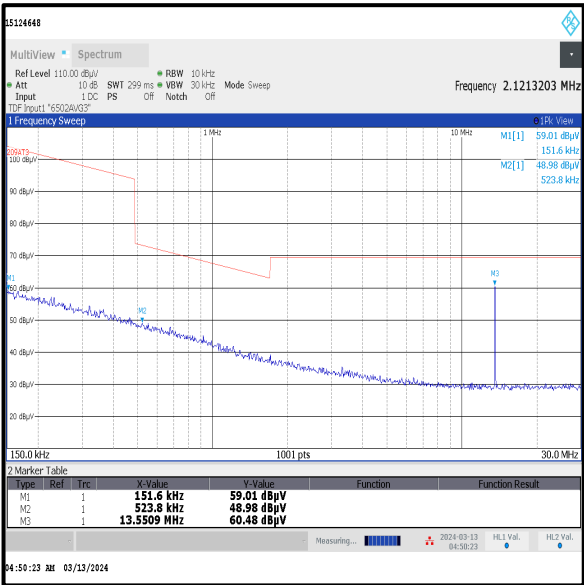
Transmitter Out of Band Radiated Emissions – 2.4 GHz WLAN / NFC (continued)

Results: Peak

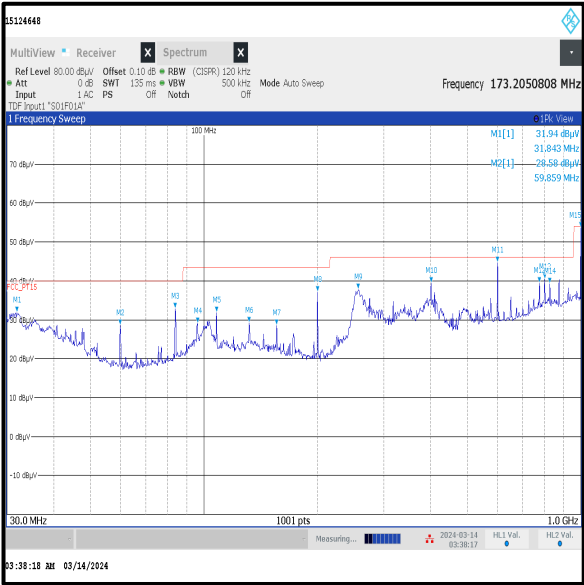
Emission Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1000.250	58.1	74.0	15.9	Complied



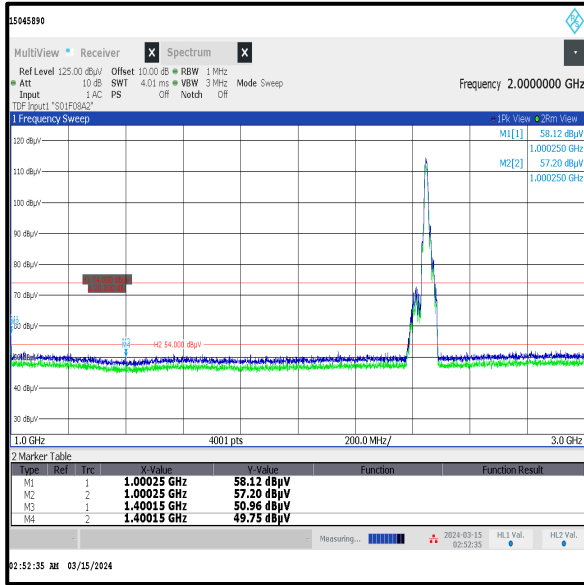
X Orientation (Screen Horizontal) / Vertical
Antenna Polarisation



X Orientation (Screen Horizontal) / Vertical
Antenna Polarisation



X Orientation (Screen Horizontal) / Combined
Antenna Polarisation

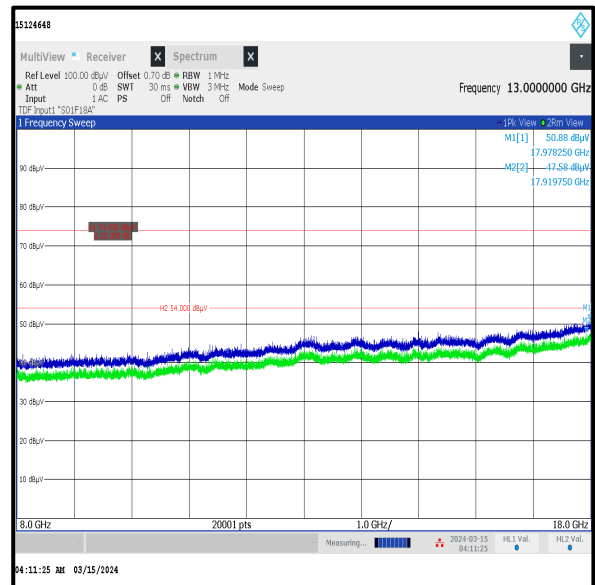


X Orientation (Screen Horizontal) / Combined
Antenna Polarisation

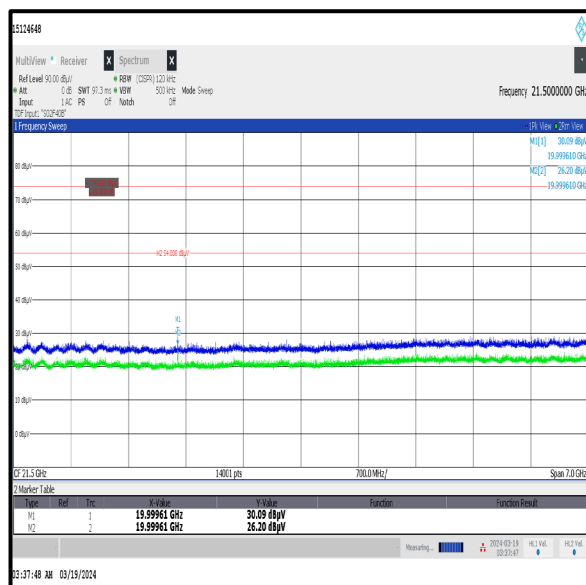
Transmitter Out of Band Radiated Emissions – 2.4 GHz WLAN / NFC (continued)



X Orientation (Screen Horizontal) / Combined Antenna Polarisation



X Orientation (Screen Horizontal) / Combined Antenna Polarisation



X Orientation (Screen Horizontal) / Combined Antenna Polarisation

4.2 Transmitter Out of Band Radiated Emissions – *Bluetooth LE / NFC*

Test Summary:

Test Engineer:	Andrew Harding	Test Dates:	13 March 2024 to 19 March 2024
Test Sample Serial Number:	230202056		

FCC Reference:	Parts 15.209(a), 15.247(d) & 15.225(d)
ISED Canada Reference:	RSS-Gen 6.13, RSS-247 5.5 & RSS-210 B.6(a)
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4, 6.5, 6.6, 11.11 & 11.12
Frequency Range	9 kHz to 25 GHz

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	41 to 44

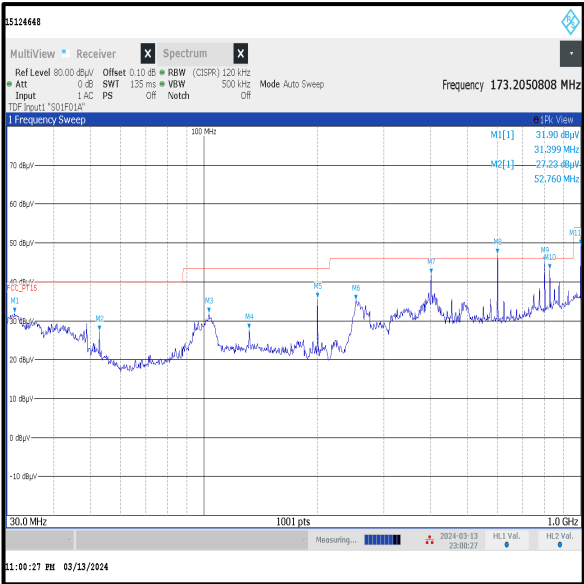
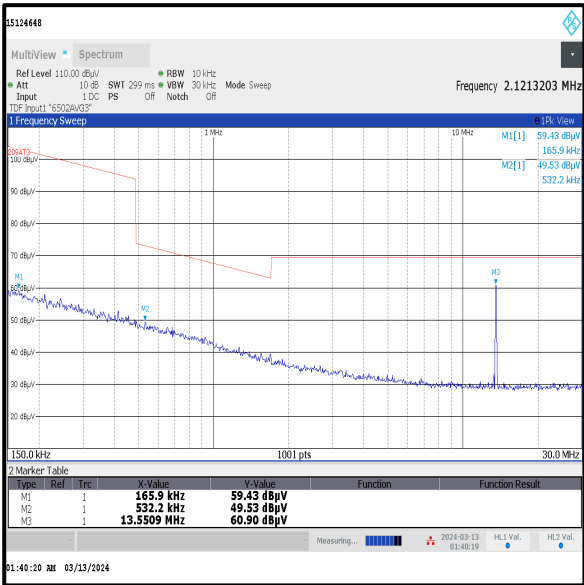
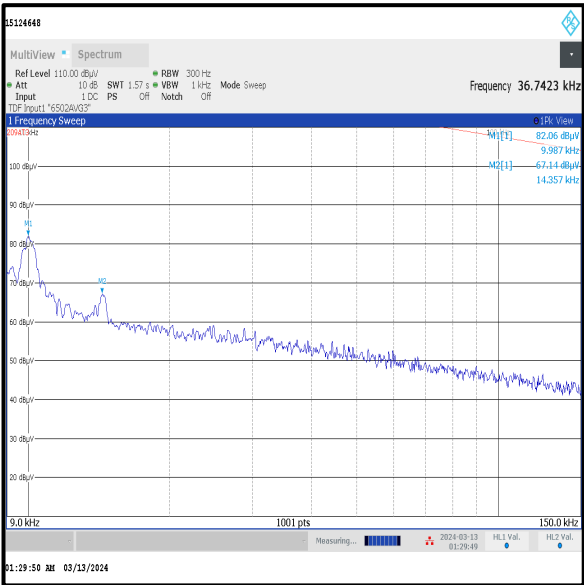
Transmitter Out of Band Radiated Emissions – Bluetooth LE / NFC (continued)**Note(s):**

1. All intermodulation products were found to be ambient, > 20 dB below the appropriate limit or below the noise floor of the measurement system. The highest pre-scan emission value has been recorded in the table below.
2. The emission on the 30 MHz to 1 GHz plot identified by marker 8 is not an intermodulation product. Although the peak pre-scan value exceeds the limit, the final quasi-peak level has been measured in test report UL-RPT-RP15124648-616A and is compliant.
3. The NFC fundamental is shown on the 150 kHz to 30 MHz plot.
4. The *Bluetooth* LE fundamental is shown on the 1 GHz to 3 GHz plot.
5. Measurements were made using appropriate RF attenuators and filters where required.
6. 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. In accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. 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. 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.
8. Measurements from 30 MHz to 1 GHz 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.
9. Pre-scans were performed with the EUT in all 3 orientations. The worst-case plots are presented below.
10. Pre-scans above 1 GHz were performed in a fully-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor 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.
11. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-Gen Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency X kHz resulted in a level of Y dB μ V/m, which is equivalent to $Y - 51.5 = Z$ dB μ A/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to the 15.209(a) limit.

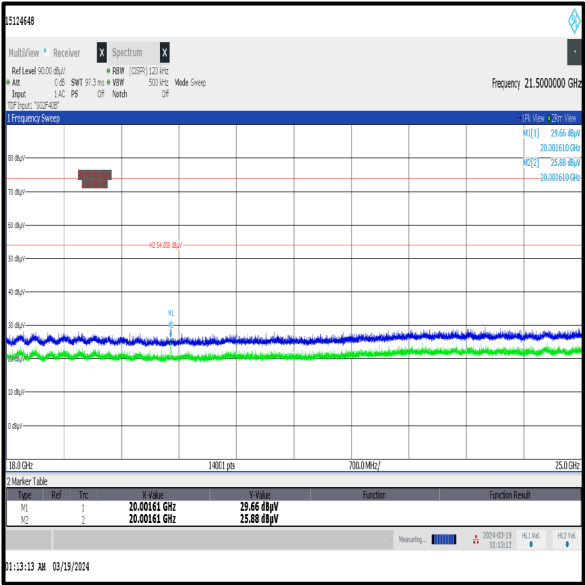
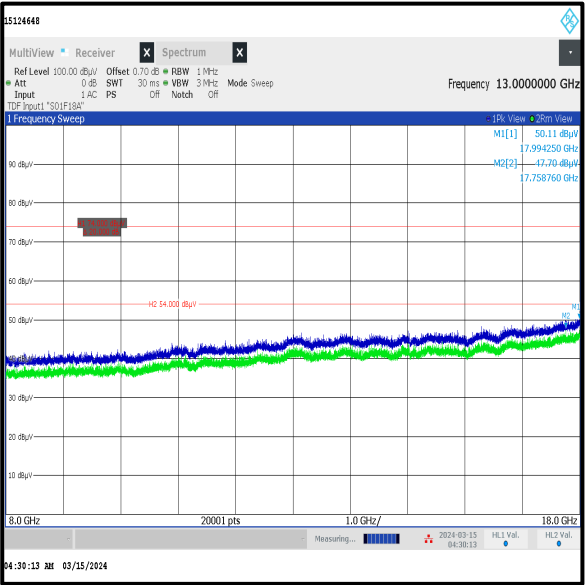
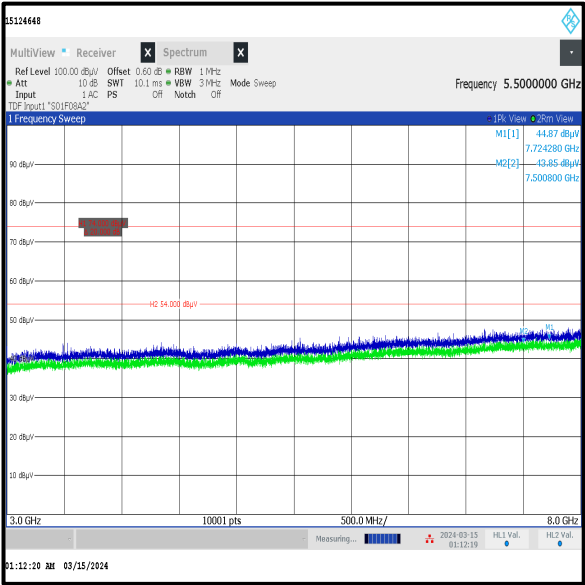
Transmitter Out of Band Radiated Emissions – Bluetooth LE / NFC (continued)

Results:

Emission Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1000.250	54.7	74.0	19.3	Complied



Transmitter Out of Band Radiated Emissions – Bluetooth LE / NFC (continued)



--- END OF REPORT ---