FCC and ISED Test Report

Paxton Access Ltd
Unified Paxlock,
Model: 900-640BL and 900-650BL

In accordance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN (2.4 GHz 802.15.4 Zigbee)

Prepared for: Paxton Access Ltd
Paxton House, Home Farm Road, Brighton
BN1 9HU, United Kingdom

FCC ID: USE 900640 IC: 10217A-900640

COMMERCIAL-IN-CONFIDENCE

Document 75953683-05 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	18 February 2022

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Paul Dickson	18 February 2022	
Testing	Nandhini Mathivanan	18 February 2022	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2020, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021) for the tests detailed in section 1.3.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	18-February-2022

Table 1

1.2 Introduction

Applicant	Paxton Access Ltd
Manufacturer	Paxton Access Ltd
Model Number(s)	900-640BL and 900-650BL
Serial Number(s)	FAR 0615114-017 and 7391114
Hardware Version(s)	z-pl33_rev4 ppc-pl33C
Software Version(s)	3.0.5
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number Date	203866 22-October-2021
Date of Receipt of EUT	11-November-2021 and 14-January-2022
Start of Test	07-December-2021
Finish of Test	19-January-2022
Name of Engineer(s)	Paul Dickson and Nandhini Mathivanan
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz NET 2 Radio - 802.15.4						
-	15.203	-	-	Antenna Requirement	Pass	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.205	-	8.10	Restricted Band Edges	Pass	
2.2	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	
2.3	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.5	15.247 (d)	5.5	-	Authorised Band Edges	Pass	
2.6	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	The Paxlock is the battery powered smart electronic lock providing both access control and reader functions. The unit combines a 125kHz and 13.56 MHz proximity reader, a wireless bluetooth & Zigbee interface both 2.4GHz and a locking mechanism. PaxLock is a complete standalone system, there's nothing to wire together and no mains connection is required. The unit is powered by four replaceable AA batteries. The purpose of the equipment is to receive validated user input via a radio signal from a passive proximity token (card or keyfob) and then provide a digital output to the internal locking mechanism for access control. An event of this process is then transmitted to the PC through the wireless interface and stored as an archive. User's access rights are configured at the PC and the PaxLock unit is then updated as required using the same wireless method.
Manufacturer:	Paxton Access Limited
Model:	900-640WT Paxton PaxLock Pro - Mortise, Galaxy, white 900-640BL Paxton PaxLock Pro - Mortise, Galaxy, black 900-650WT Paxton PaxLock Pro - Mortise, Eclipse, white 900-650BL Paxton PaxLock Pro - Mortise, Eclipse, black 900-620WT Paxton PaxLock Pro - Latch, Galaxy, white 900-620BL Paxton PaxLock Pro - Latch, Galaxy, black 900-630WT Paxton PaxLock Pro - Latch, Eclipse, white 900-630BL Paxton PaxLock Pro - Latch, Eclipse, black
Part Number:	900-640WT Paxton PaxLock Pro - Mortise, Galaxy, white 900-640BL Paxton PaxLock Pro - Mortise, Galaxy, black 900-650WT Paxton PaxLock Pro - Mortise, Eclipse, white 900-650BL Paxton PaxLock Pro - Mortise, Eclipse, black 900-620WT Paxton PaxLock Pro - Latch, Galaxy, white 900-620BL Paxton PaxLock Pro - Latch, Galaxy, black 900-630WT Paxton PaxLock Pro - Latch, Eclipse, white 900-630BL Paxton PaxLock Pro - Latch, Eclipse, black
Hardware Version:	z-pl33_rev4 ppc-pl33C
Software Version:	3.0.5
FCC ID of the product under test – see guidance here	USE 900640
IC ID of the product under test – see guidance here	10217A-900640

Table 3

Intentional Radiators

Technology	RFID (HITAG)	RFID (MIFARE)	Bluetooth low energy	802.15.4		
Frequency Range (MHz to MHz)	0.125	13.56	2400-2483.5	2400-2483.5		
Conducted Declared Output Power (dBm)			<10mW	<10mW		
Antenna Gain (dBi)			4 dBi	4 dBi		
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)			40 channels of 2MHz total 80MHz bandwidth	16 Channels 11-26 5MHz each channel		
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	RFID	RFID	BT LE	802.15.4		
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	5K0K1D	5K33K1D	1M00F1D	2M45G1D		
Bottom Frequency (MHz)			2402 MHz	2405 MHz		
Middle Frequency (MHz)	0.125MHz	13.56MHz	2440 MHz	2440 MHz		
Top Frequency (MHz)			2480 MHz	2475 MHz		

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	48 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	125KHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐ Class B Digital Device (Use in residential environment only) ☒	

Table 5

AC Power Source

AC supply frequency:		Hz
Voltage		V
Max current:		A
Single Phase ☐ Three Phase ☐		

Table 6

DC Power Source

Nominal voltage:		V
Extreme upper voltage:		V
Extreme lower voltage:		V
Max current:		A

Table 7

Battery Power Source

Voltage:	6	V
End-point voltage:	6	V *(Point at which the battery will terminate)*
Alkaline ☒ Leclanche ☐ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Table 8

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒

Table 9

Temperature

Minimum temperature:	-20° (External variant) & 0° (Internal variant)	°C
Maximum temperature:	+55° (External variant) & +49 (Internal variant)	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	N/A	dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	Chip Antenna WE-MCA	Gain	4	dBi
External antenna ☐	Type:		Gain		dBi
For external antenna only: Standard Antenna Jack ☐ If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed ☐ Non-standard Antenna Jack ☐					

Table 12

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 13

I hereby declare that the information supplied is correct and complete.

Name: Kevin Feeney
Position held: Compliance Engineer
Date: 19 January 2022

1.5 Product Information

1.5.1 Technical Description

The Paxlock is the battery powered smart electronic lock providing both access control and reader functions. The unit combines a 125kHz and 13.56 MHz proximity reader, a wireless bluetooth interface (2.4GHz) and 802.15.4 Zigbee (2.4GHz) interface and a locking mechanism.

Paxlock is a complete standalone system, there's nothing to wire together and no mains connection is required. The unit is powered by four replaceable AA batteries.

The purpose of the equipment is to receive validated user input via a radio signal from a passive proximity token (card or keyfob) and then provide a digital output to the internal locking mechanism for access control. An event of this process is then transmitted to the PC through the wireless interface and stored as an archive. User's access rights are configured at the PC and the Paxlock unit is then updated as required using the same wireless method.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: 900-640BL, Serial Number: FAR 0615114-017			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: 900-650BL, Serial Number: 7391114			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz NET 2 Radio - 802.15.4		
Restricted Band Edges	Paul Dickson	UKAS
Emission Bandwidth	Nandhini Mathivanan	UKAS
Maximum Conducted Output Power	Nandhini Mathivanan	UKAS
Spurious Radiated Emissions	Paul Dickson	UKAS
Authorised Band Edges	Paul Dickson	UKAS
Power Spectral Density	Nandhini Mathivanan	UKAS

Table 15

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Restricted Band Edges

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

900-640BL, S/N: FAR 0615114-017 - Modification State 0

2.1.3 Date of Test

07-December-2021

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5. These are shown for information purposes and were used to determine the worst-case measurement point. Final average measurements were then taken in accordance with ANSI C63.10, clause 4.1.4.2.2 to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.1.5 Environmental Conditions

Ambient Temperature	22.9 °C
Relative Humidity	29.1 %

2.1.6 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
Static	2405	2390	53.27	41.03
Static	2475	2483.5	54.24	41.75

Table 16

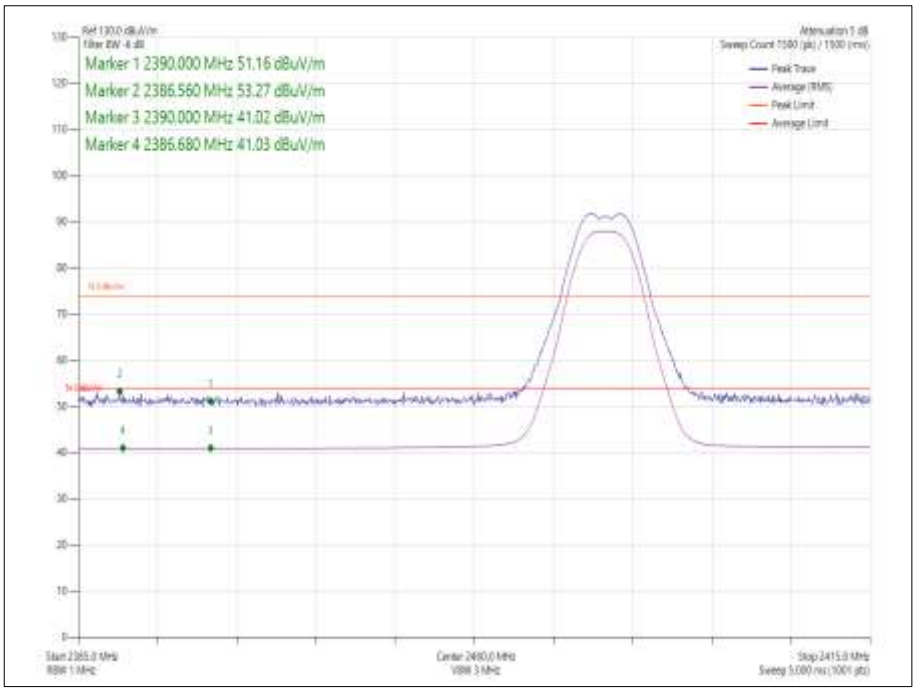

Figure 1 - 2405 MHz - Band Edge Frequency 2390 MHz

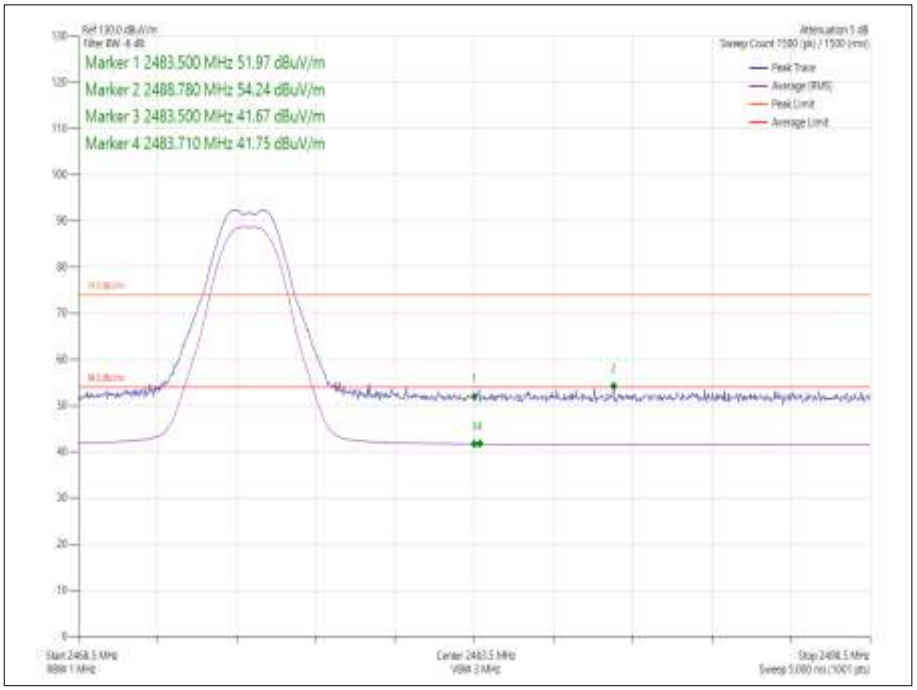

Figure 2 - 2475 MHz - Band Edge Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 17

ISED RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960*	500

Table 18

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Cable (sma-sma, 2 m)	Junkosha	MWX221-02000DMS	5428	12	20-Oct-2022
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Antenna (DRG, 1 GHz to 10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	15-Oct-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023

Table 19

TU - Traceability Unscheduled

2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)
ISED RSS-247, Clause 5.2
ISED RSS-GEN, Clause 6.7

2.2.2 Equipment Under Test and Modification State

900-650BL, S/N: 7391114- Modification State 0

2.2.3 Date of Test

18-January-2022

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.1 for 6 dB BW and 6.9.3 for 99% occupied bandwidth measurements.

2.2.5 Environmental Conditions

Ambient Temperature	21.8 °C
Relative Humidity	32.3 %

2.2.6 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2405	2320.3	1668
2440	2332.5	1664
2475	2325.3	1670

Table 20

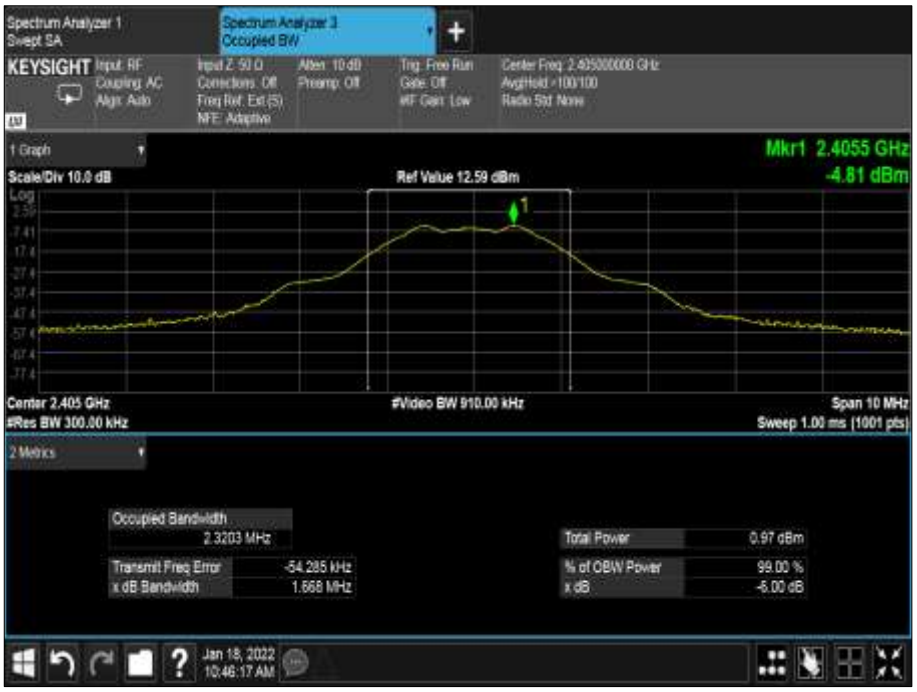

Figure 3 – 2405 MHz

Figure 4 – 2440 MHz

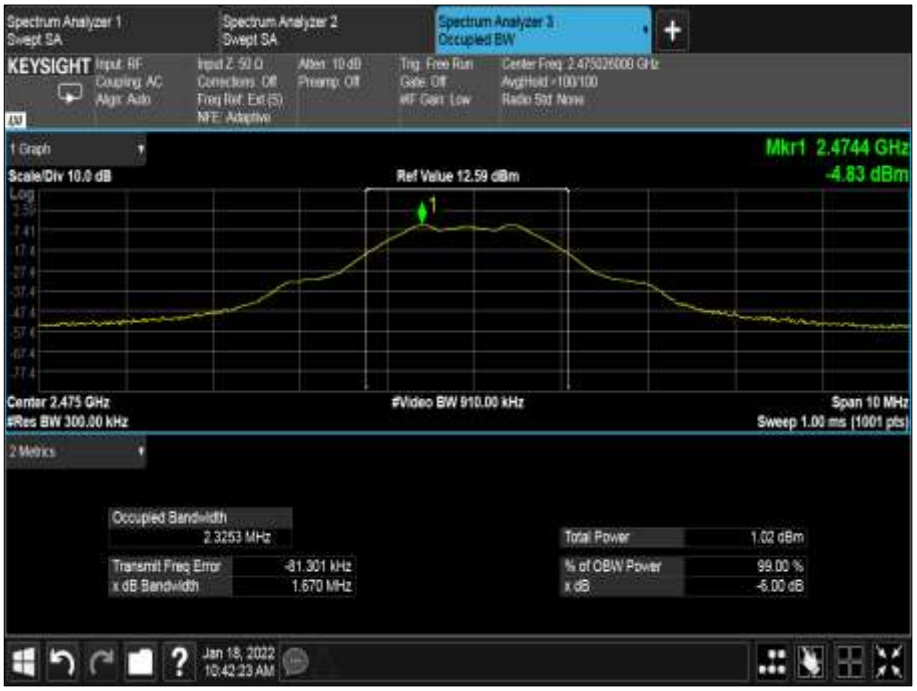

Figure 5 – 2475 MHz

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and ISED RSS-247, Clause 5.2(a)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1 and RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	20-Oct-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
10dB/5W Attenuator	Aaren	AT40A-404-D18-10	5486	12	14-Apr-2022

Table 21

2.3 Maximum Conducted Output Power

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)
ISED RSS-247, Clause 5.4
ISED RSS-GEN, Clause 6.12

2.3.2 Equipment Under Test and Modification State

900-650BL, S/N: 7391114- Modification State 0

2.3.3 Date of Test

18-January-2022 to 19-January-2022

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 11.9.1.1

2.3.5 Environmental Conditions

Ambient Temperature	21.8 - 22.1 °C
Relative Humidity	32.3 - 34.5 %

2.3.6 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2405	6.07	4.05
2440	5.99	3.98
2475	5.82	3.82

Table 22

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

ISED RSS-247, Limit Clause 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	31-Jan-2022
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	20-Oct-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
10dB/5W Attenuator	Aaren	AT40A-404-D18-10	5486	12	14-Apr-2022

Table 23

2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.209
ISED RSS-247, Clause 3.3 and 5.5
ISED RSS-GEN, Clause, 6.13 and 8.9

2.4.2 Equipment Under Test and Modification State

900-640BL, S/N: FAR 0615114-017 - Modification State 0

2.4.3 Date of Test

07-December-2021 to 17-December-2021

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2.

The plots shown are the characterisation of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

At a measurement distance of 1 meter the limit line was increased by 20*LOG(3/1) = 9.54 dB.

Where formal measurements have been necessary, the results have been presented in the emissions table.

2.4.5 Example Test Setup Diagram

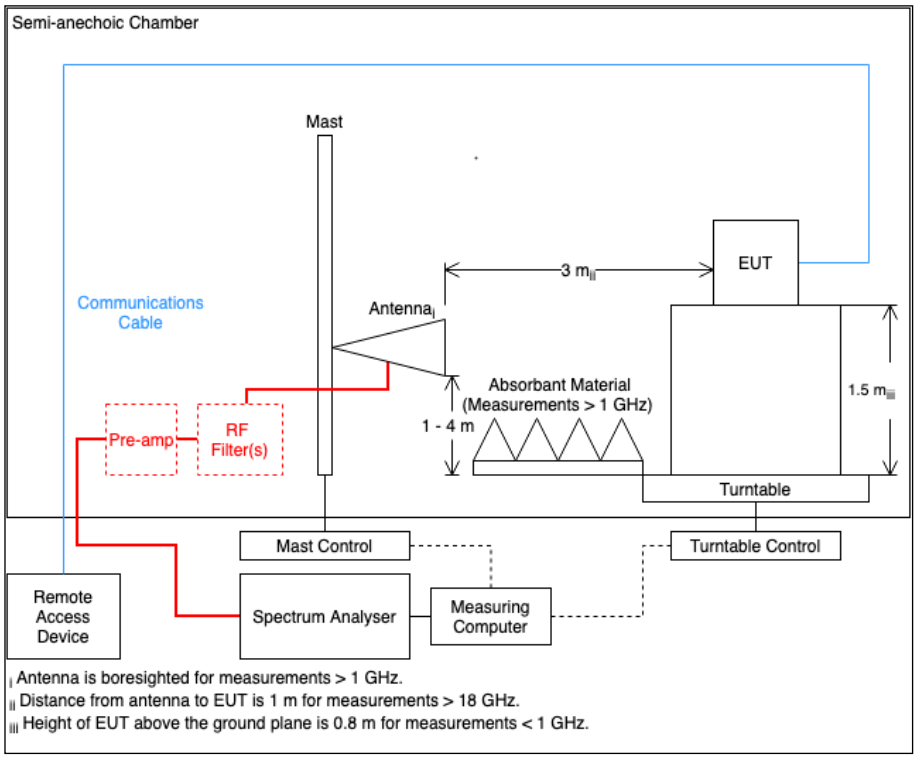

Figure 6

2.4.6 Environmental Conditions

Ambient Temperature	20.5 - 29.2 °C
Relative Humidity	27.5 - 42.4 %

2.4.7 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 24 - 2405 MHz (CH11), 30 MHz to 25 GHz

*No emissions found within 6 dB of the limit.

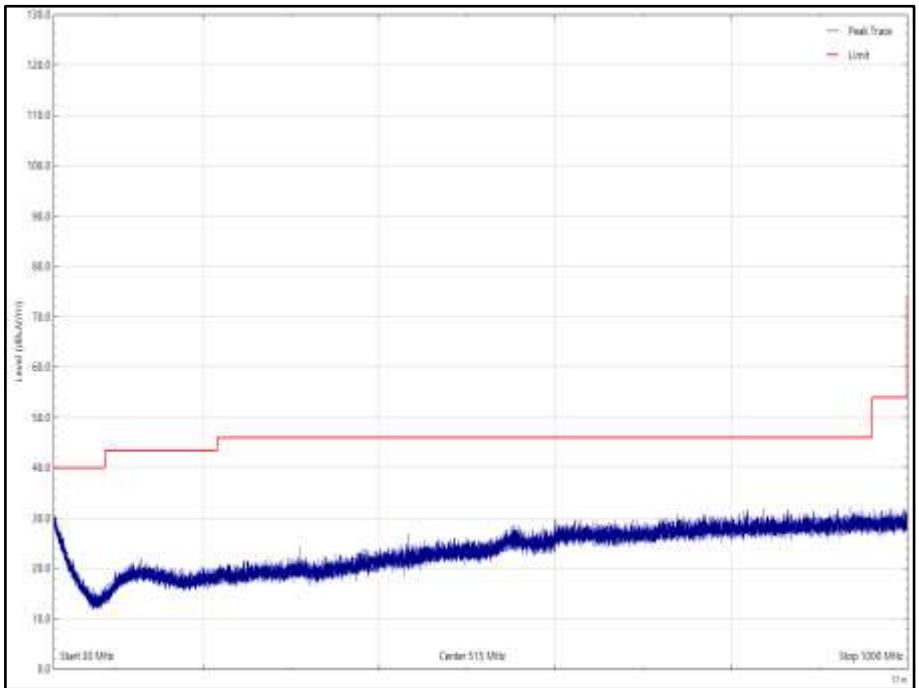

Figure 7 - 2405 MHz (CH11), 30 MHz to 1 GHz, Horizontal (Peak)

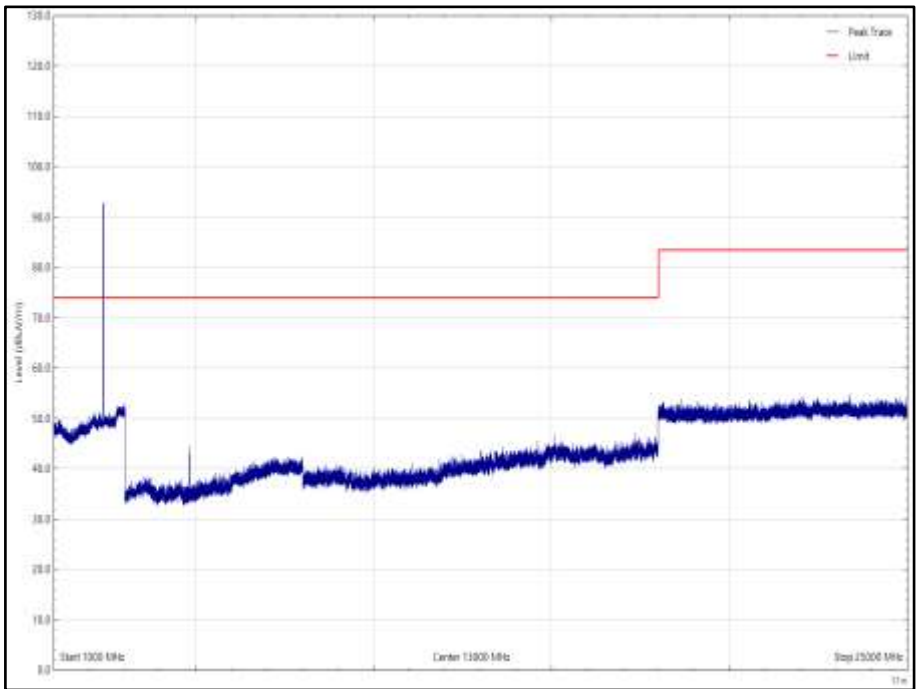

Figure 8 - 2405 MHz (CH11), 1 GHz to 25 GHz, Horizontal (Peak)

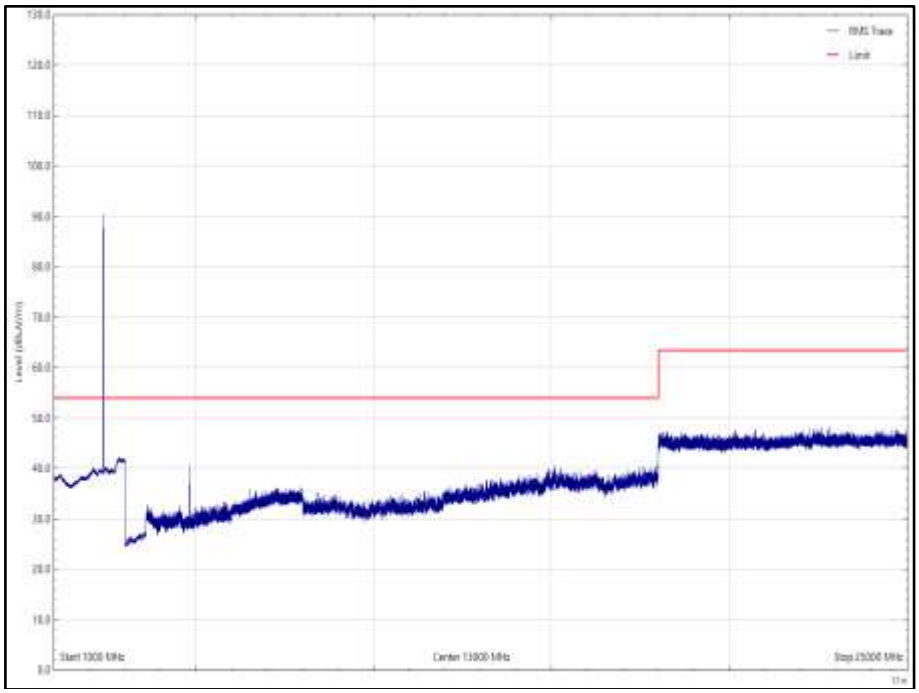

Figure 9 - 2405 MHz (CH11), 1 GHz to 25 GHz, Horizontal (rms)

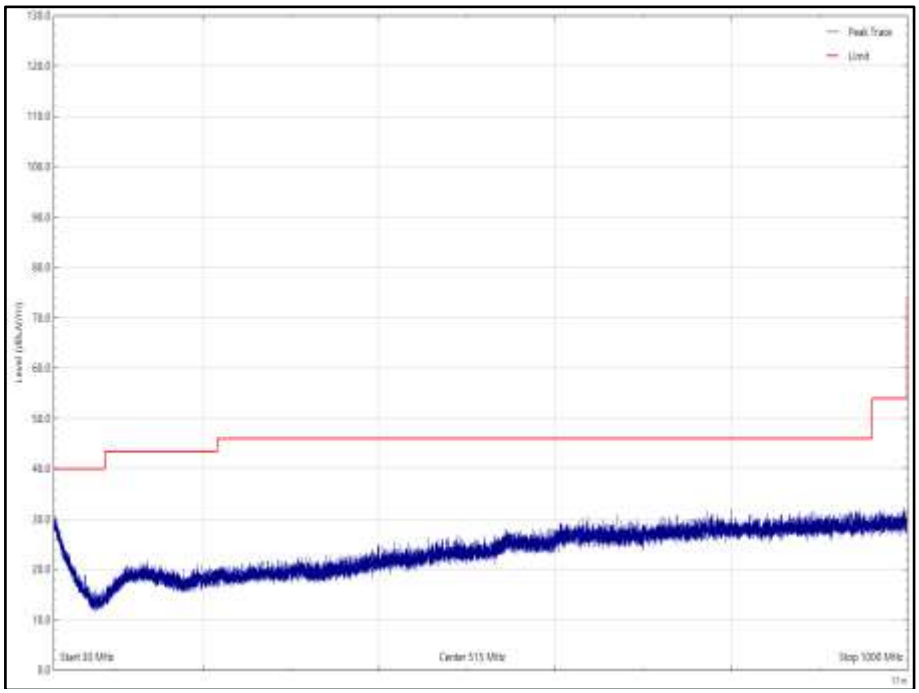

Figure 10 - 2405 MHz (CH11), 30 MHz to 1 GHz, Vertical (Peak)

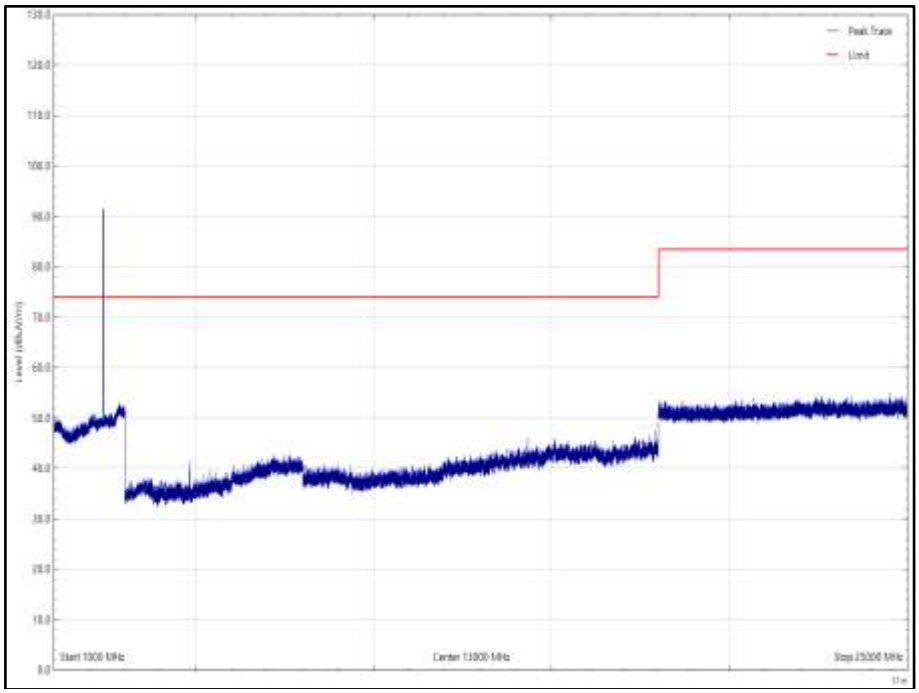

Figure 11 - 2405 MHz (CH11), 1 GHz to 25 GHz, Vertical (Peak)

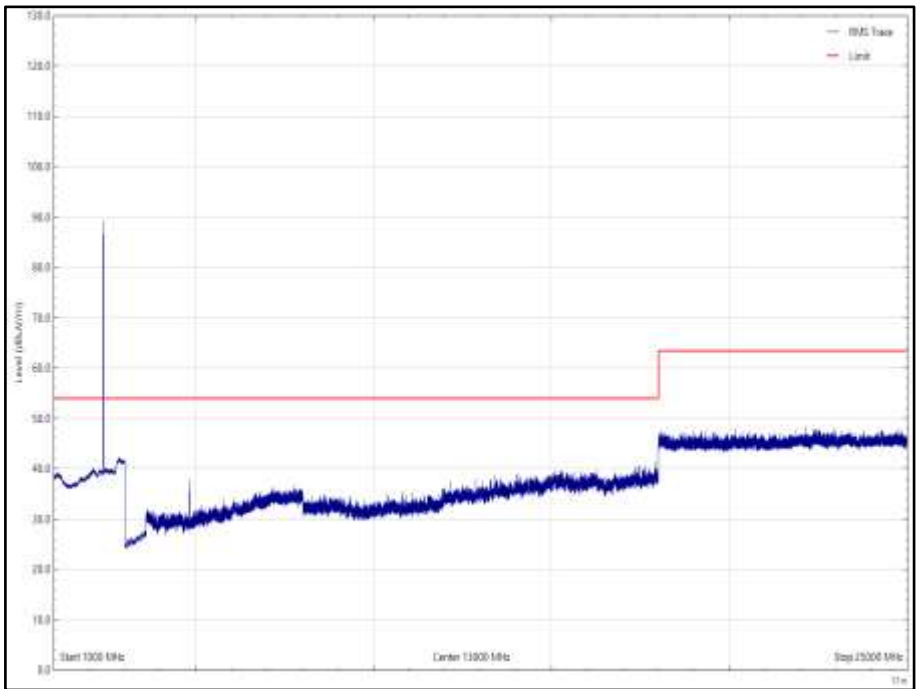

Figure 12 - 2405 MHz (CH11), 1 GHz to 25 GHz, Vertical (rms)

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 25 - 2440 MHz (CH18), 30 MHz to 25 GHz

*No emissions found within 6 dB of the limit.

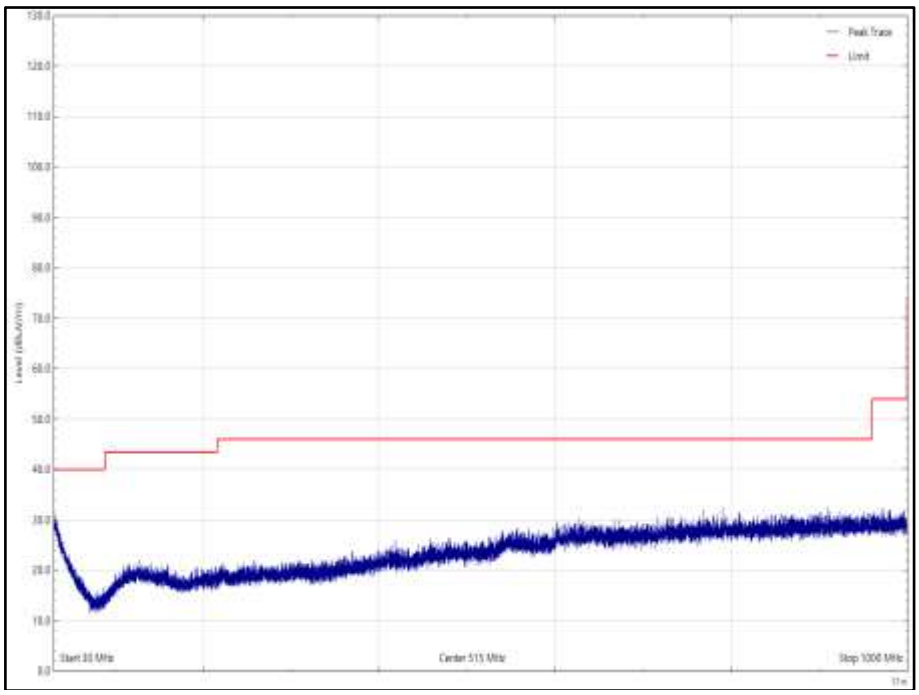

Figure 13 - 2440 MHz (CH18), 30 MHz to 1 GHz, Horizontal (Peak)

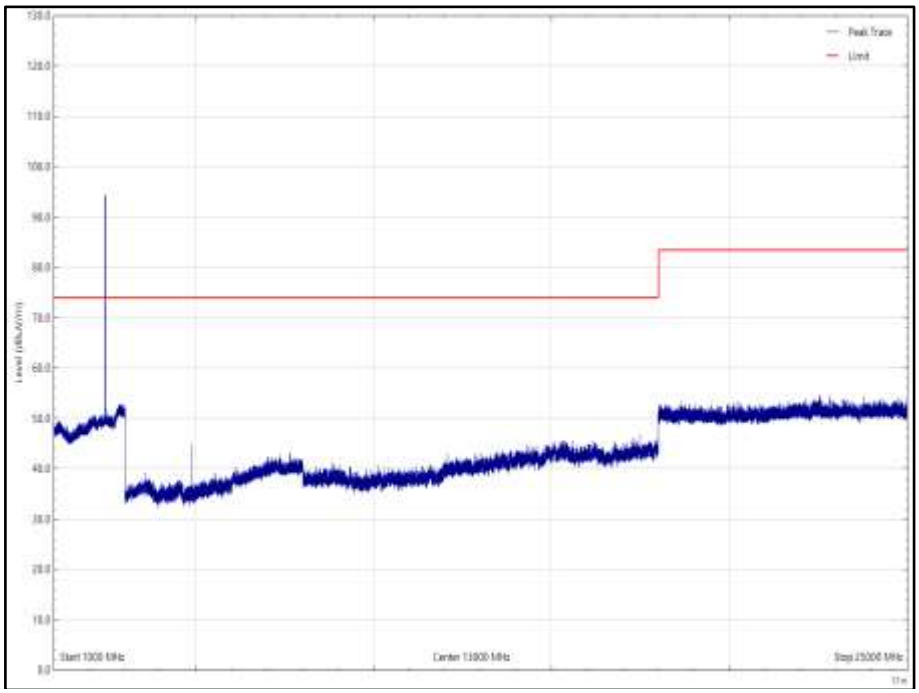

Figure 14 - 2440 MHz (CH18), 1 GHz to 25 GHz, Horizontal (Peak)

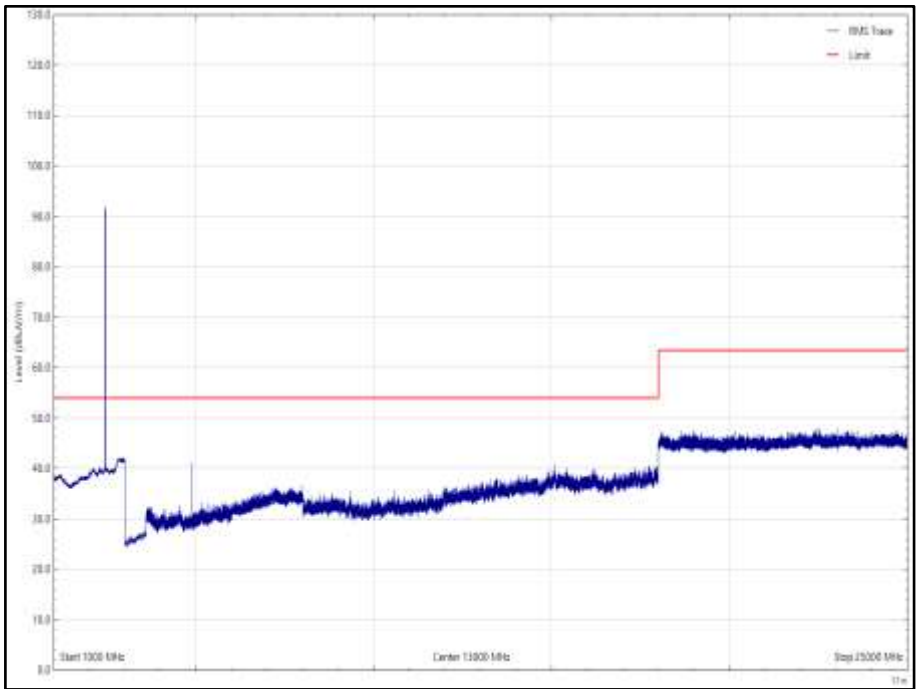

Figure 15 - 2440 MHz (CH18), 1 GHz to 25 GHz, Horizontal (rms)

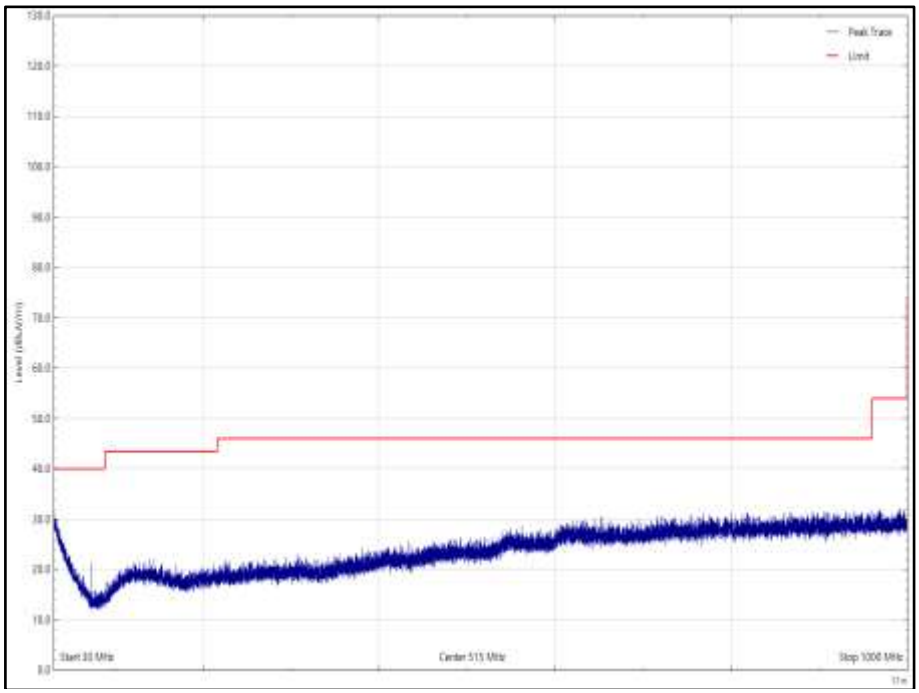

Figure 16 - 2440 MHz (CH18), 30 MHz to 1 GHz, Vertical (Peak)

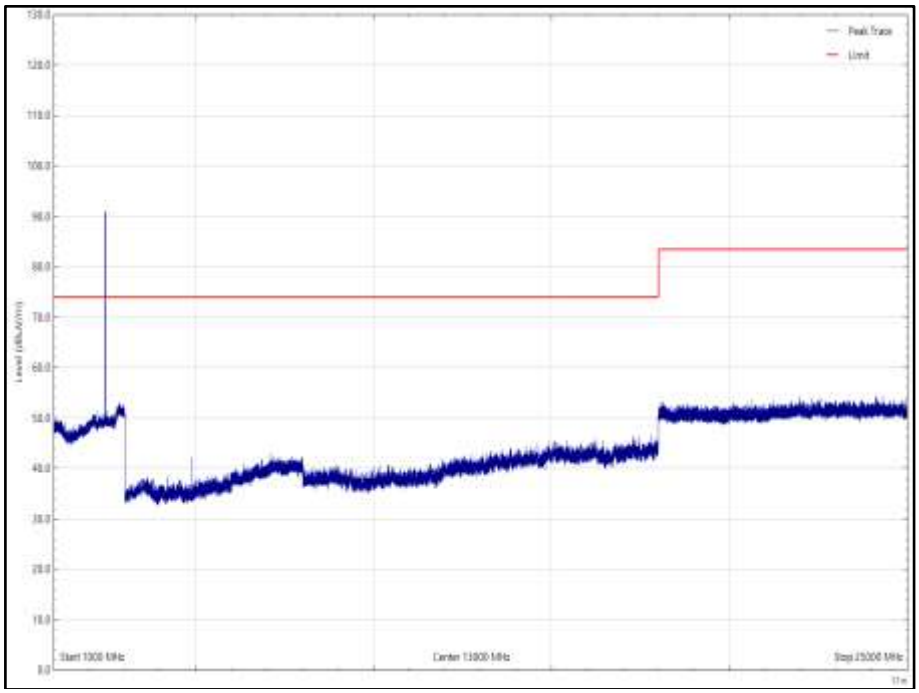

Figure 17 - 2440 MHz (CH18), 1 GHz to 25 GHz, Vertical (Peak)

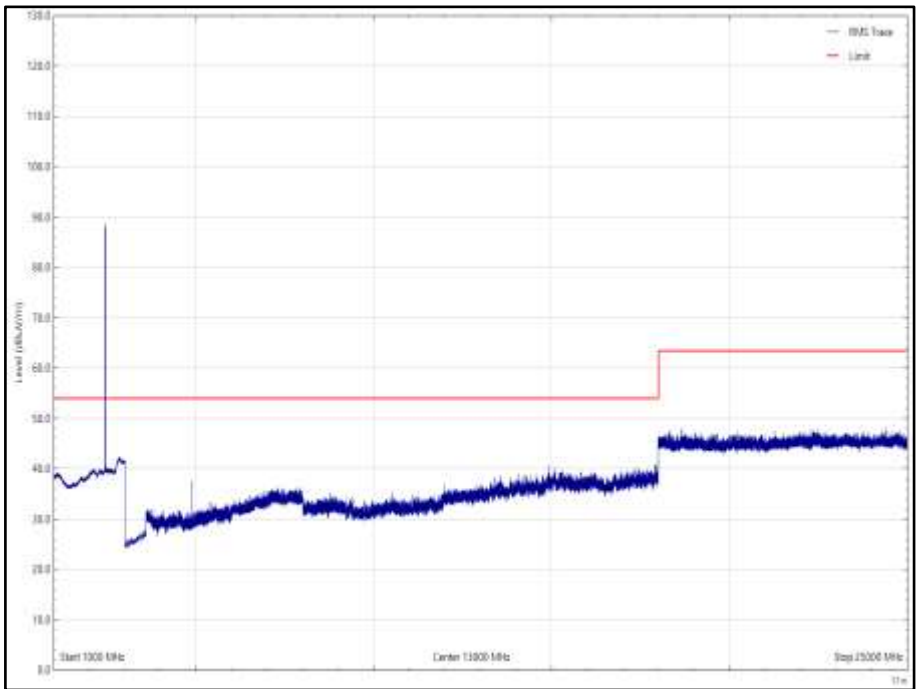

Figure 18 - 2440 MHz (CH18), 1 GHz to 25 GHz, Vertical (rms)

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4950.944	43.8	54.0	-10.2	RMS	48	270	Horizontal

Table 26 - 2475 MHz (CH25), 30 MHz to 25 GHz

No other emissions found within 6 dB of the limit.

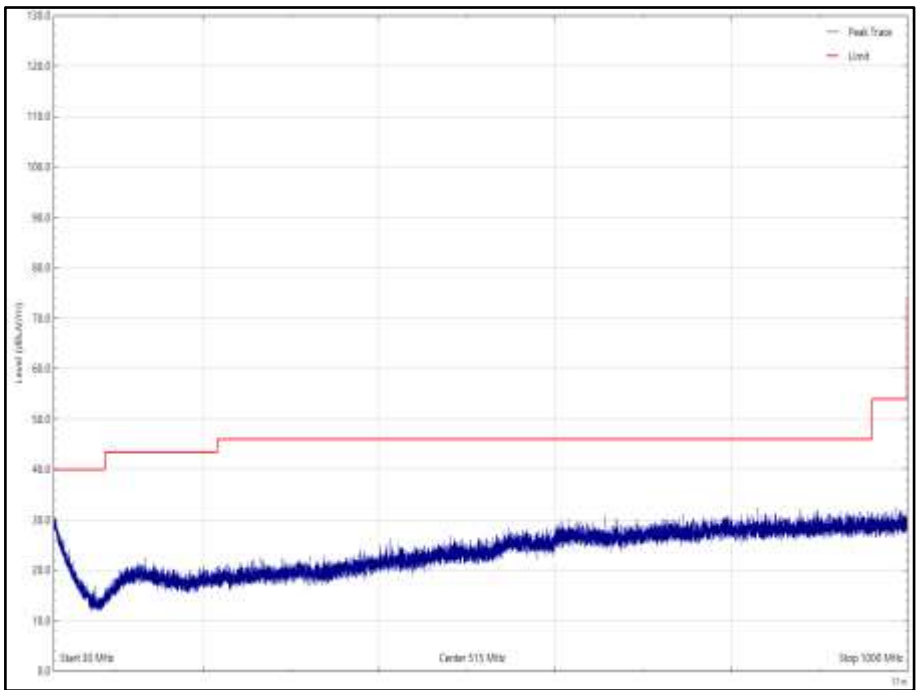

Figure 19 - 2475 MHz (CH25), 30 MHz to 1 GHz, Horizontal (Peak)

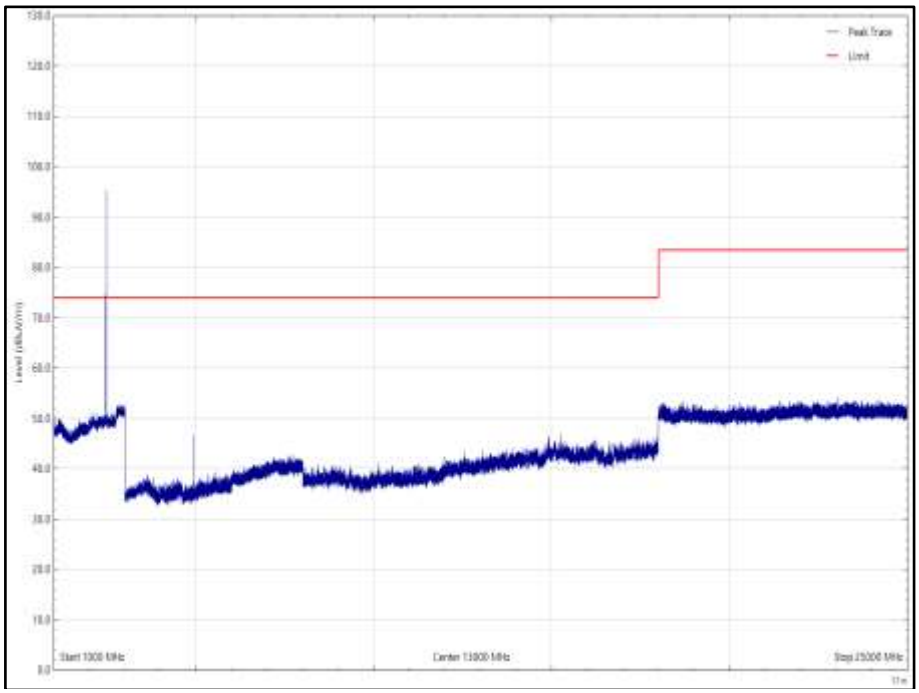

Figure 20 - 2475 MHz (CH25), 1 GHz to 25 GHz, Horizontal (Peak)

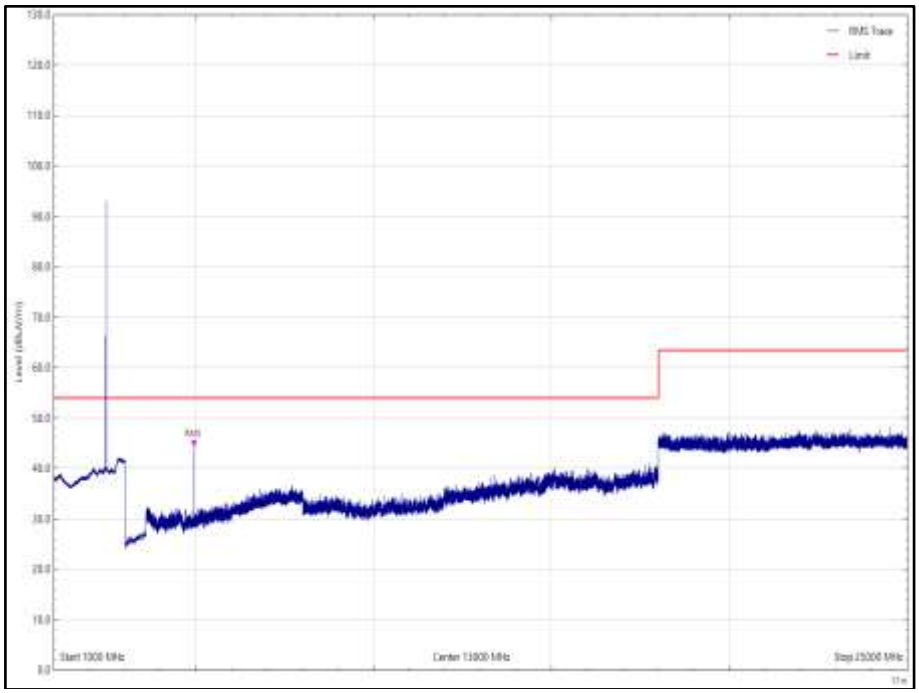

Figure 21 - 2475 MHz (CH25), 1 GHz to 25 GHz, Horizontal (rms)

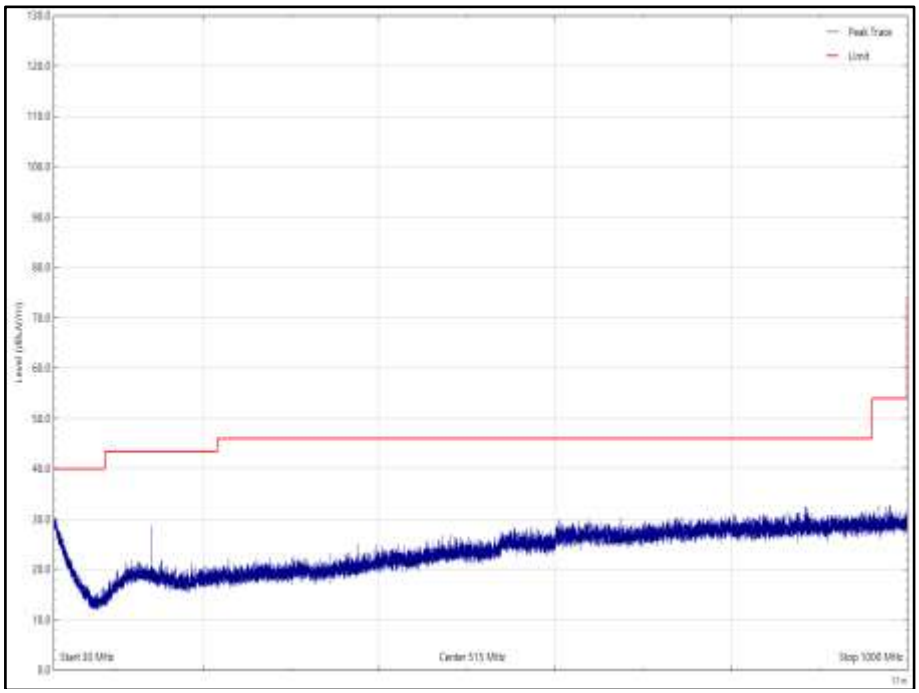

Figure 22 - 2475 MHz (CH25), 30 MHz to 1 GHz, Vertical (Peak)

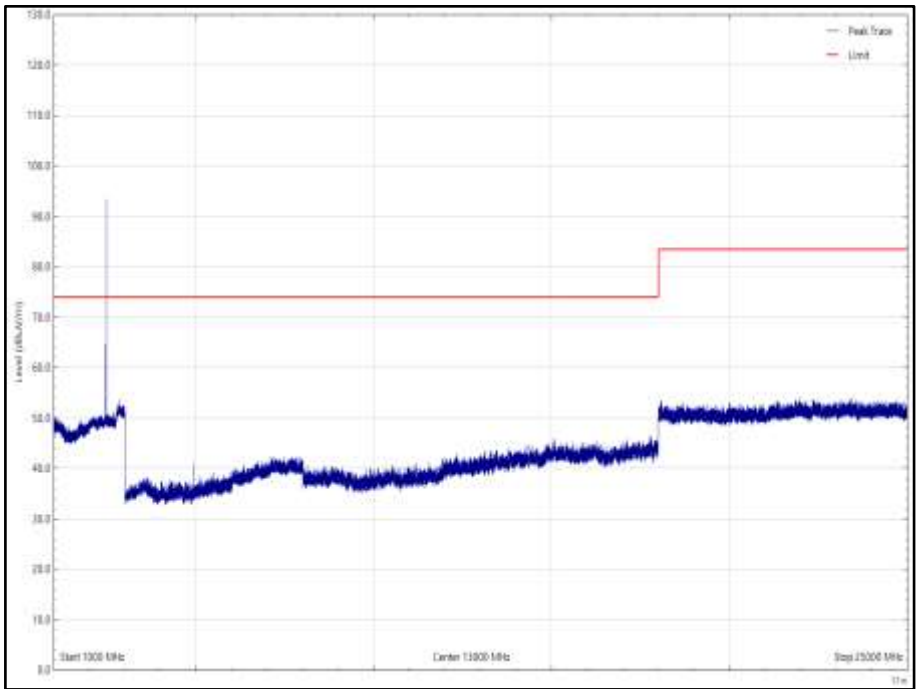

Figure 23 - 2475 MHz (CH25), 1 GHz to 25 GHz, Vertical (Peak)

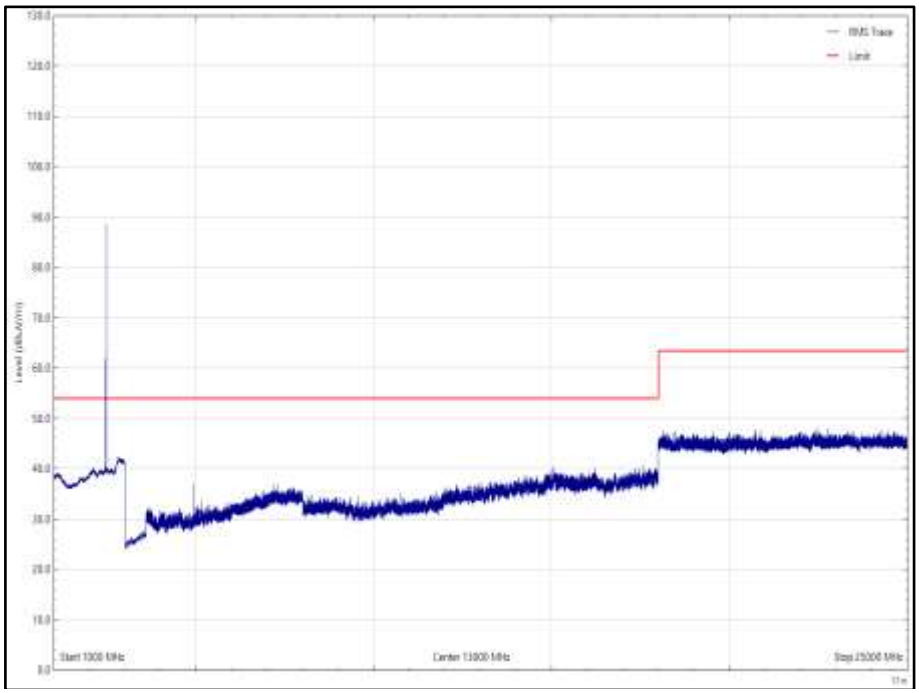

Figure 24 - 2475 MHz (CH25), 1 GHz to 25 GHz, Vertical (rms)

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

In addition, radiated emissions which fall in the restricted bands, as defined in RSS-GEN, clause 8.10, must also comply with the radiated emission limits specified in RSS-GEN clause 8.9.

2.4.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Antenna (DRG, 18 GHz to 40 GHz)	Link Microtek Ltd	AM180HA-K-TU2	230	24	27-Jul-2022
Antenna with attenuator (Bilog, 30 MHz to 3 GHz)	Schaffner	CBL6143	287	24	14-Oct-2022
Pre-Amplifier (8 GHz to 18 GHz)	Phase One	PS04-0086	1533	12	05-Feb-2022
Pre-Amplifier (18 GHz to 40 GHz)	Phase One	PSO4-0087	1534	12	02-Aug-2022
Comb Generator	Schaffner	RSG1000	3034	-	TU
Multimeter	Fluke	79 Series II	3057	12	23-Aug-2022
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Cable (N-Type to N-Type, 1 m)	Rosenberger	LU7-036-1000	5031	12	23-Jul-2022
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Pre-Amplifier (1 GHz to 18 GHz)	Schwarzbeck	BBV 9718 C	5350	12	22-Sep-2022
Cable (sma-sma, 2 m)	Junkosha	MWX221-02000DMS	5428	12	20-Oct-2022
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5511	12	09-Apr-2022
1m K-Type Cable	Junkosha	MWX241-01000KMSKMS/A	5512	12	09-Apr-2022
2m K Type Cable	Junkosha	MWX241-02000KMSKMS/A	5524	12	24-Mar-2022
3 GHz High pass Filter	Wainwright	WHKX12-2580-3000-18000-80SS	5548	12	07-May-2022
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5610	12	15-Oct-2022
Antenna (DRG, 1 GHz to 10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	15-Oct-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023

Table 27

TU - Traceability Unscheduled

2.5 Authorised Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
ISED RSS-247, Clause 5.5

2.5.2 Equipment Under Test and Modification State

900-640BL, S/N: FAR 0615114-017 - Modification State 0

2.5.3 Date of Test

07-December-2021

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.5.5 Environmental Conditions

Ambient Temperature	22.9 °C
Relative Humidity	29.1 %

2.5.6 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	2405	2400	-43.25
Static	2475	2483.5	-43.45

Table 28

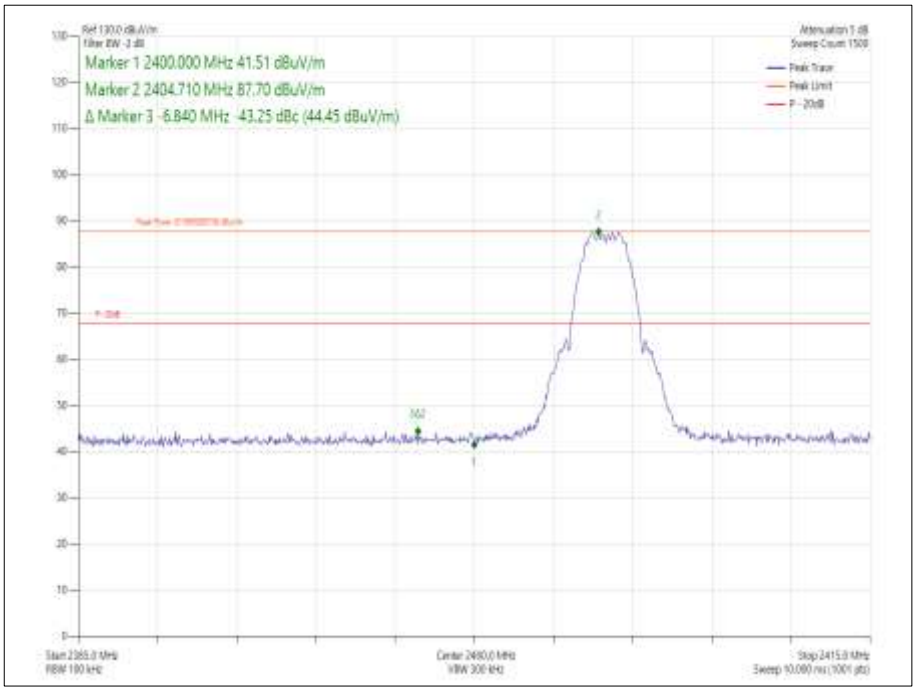

Figure 28 - Static, 2405 MHz - Band Edge Frequency 2400 MHz

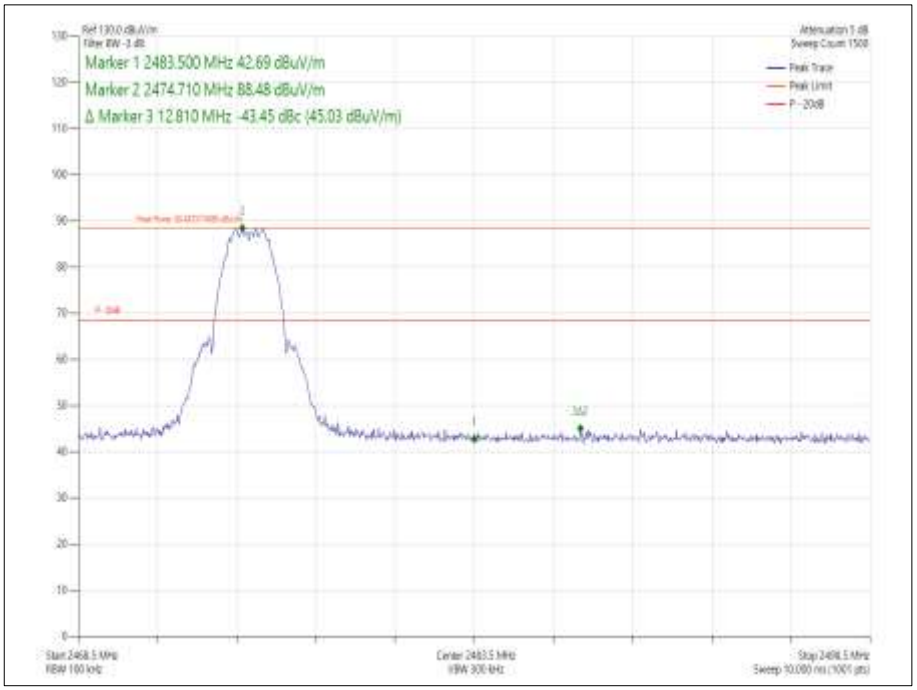

Figure 29 - Static, 2475 MHz - Band Edge Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.5.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Cable (sma-sma, 2 m)	Junkosha	MWX221-02000DMS	5428	12	20-Oct-2022
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
Antenna (DRG, 1 GHz to 10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	15-Oct-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023

Table 29

TU - Traceability Unscheduled

2.6 Power Spectral Density

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (e)
ISED RSS-247, Clause 5.2
ISED RSS-GEN, Clause 6.12

2.6.2 Equipment Under Test and Modification State

900-650BL, S/N: 7391114- Modification State 0

2.6.3 Date of Test

18-January-2022 to 19-January-2022

2.6.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.2

2.6.5 Environmental Conditions

Ambient Temperature	21.8 - 22.1 °C
Relative Humidity	32.3 - 34.5 %

2.6.6 Test Results

2.4 GHz NET 2 Radio - 802.15.4

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2405	2.09	100.00
2440	2.06	100.00
2475	1.94	100.00

Table 30

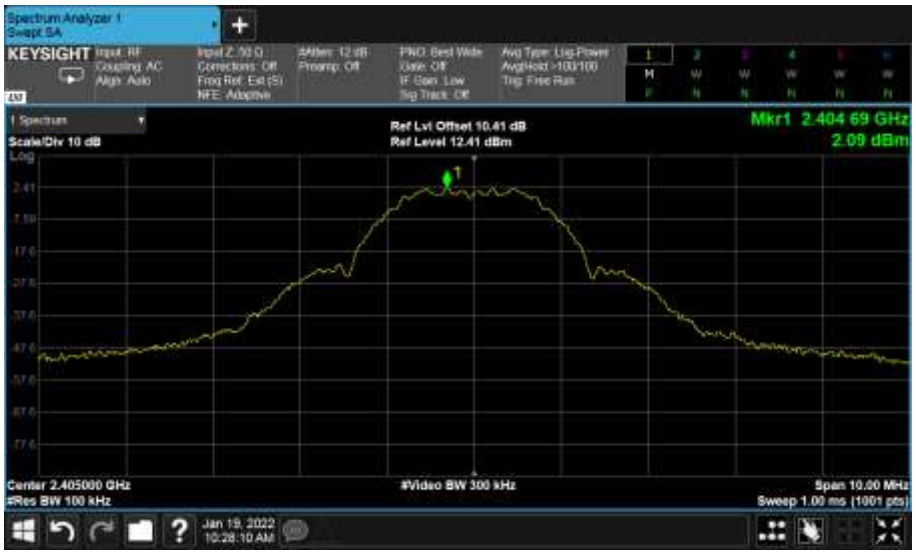

Figure 3 – 2405 MHz

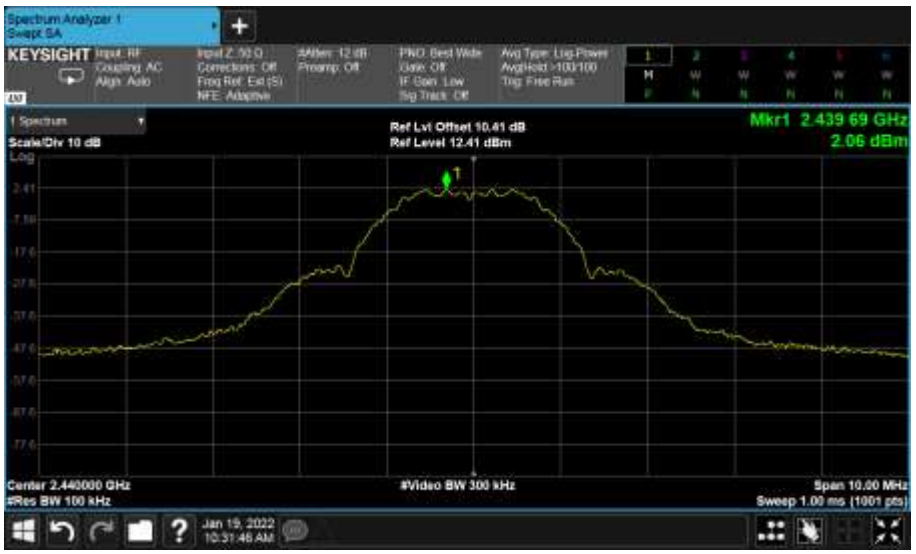

Figure 3 – 2440 MHz

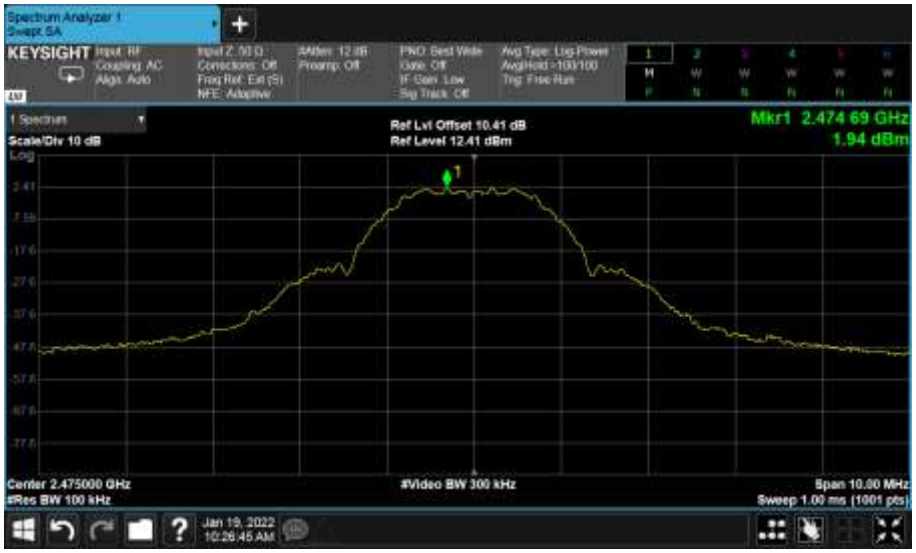

Figure 3 – 2475 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

ISED RSS-247, Limit Clause 5.2(b)

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	31-Jan-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jun-2022
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	20-Oct-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
10dB/5W Attenuator	Aaren	AT40A-404-D18-10	5486	12	14-Apr-2022

Table 31

3 Photographs

3.1 Test Setup Photographs

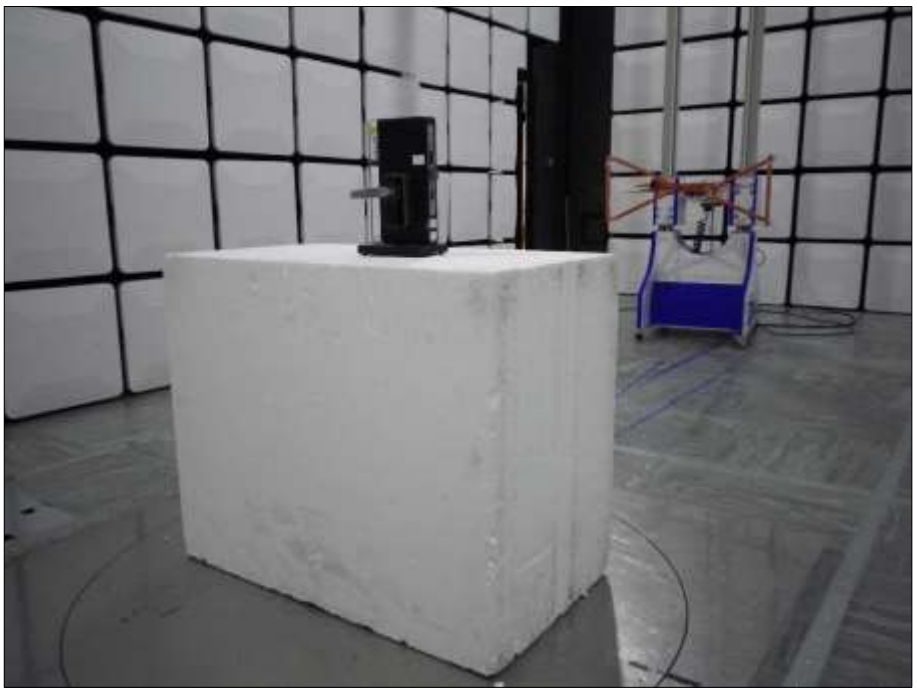

Figure 25 - Test Setup - 30 MHz to 1 GHz

Figure 26 - Test Setup - 1 GHz to 18 GHz

Figure 27 - Test Setup - 18 GHz to 25 GHz

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Antenna Requirement	-
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Emission Bandwidth	± 133.240 kHz
Maximum Conducted Output Power	± 3.2 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Power Spectral Density	± 3.2 dB

Table 32

Measurement Uncertainty Decision Rule – Accuracy Method

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, Clause 4.4.3 and 4.5.1. (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.