

FCC and ISED Test Report

SureFlap Limited
Hub, Model: iHB v2

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

Prepared for: SureFlap Limited
Ground floor
Building 2030
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Add value.
Inspire trust.

FCC ID: XO9-IHB002

IC: 8906A-IHB002

COMMERCIAL-IN-CONFIDENCE

Document 75950946-04 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	20 May 2021

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	Graeme Lawler	20 May 2021	
Testing	Daniel Cameron	20 May 2021	

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: 2019, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.



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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	20-May-2021

Table 1

1.2 Introduction

Applicant	SureFlap Limited
Manufacturer	SureFlap Limited
Model Number(s)	iHB v2
Serial Number(s)	H001-0020390 and H001-0020388
Hardware Version(s)	V1
Software Version(s)	01713-FF
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number	4120
Date	08-January-2021
Date of Receipt of EUT	10-March-2021
Start of Test	16-March-2021
Finish of Test	21-April-2021
Name of Engineer(s)	Graeme Lawler and Daniel Cameron
Related Document(s)	ANSI C63.4 (2014) 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, ISSED RSS-247 and ISSED 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 (802.15.4)						
-	15.203	-	-	Antenna Requirement	N/T	The EUT has an integral antenna. See application form for details.
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 15.205	3.3 and 5.5	6.13	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)	This is product (Hub) is used to connect with all Sure PetCare Connected products. It is connected to end user's router and act as a link between the "Connected" family product and the server/App. The hub communicates with the "Connected" family product via 802.15.4 2.4 GHz wireless link.	
Manufacturer:	SureFlap Limited	
Model:	iHB v2	
Part Number:	iHB v2	
Hardware Version:	V1	
Software Version:	01713-FF	
FCC ID of the product under test – see guidance here	XO9-IHB002	
IC ID of the product under test – see guidance here	8906A-IHB002	

Intentional Radiators

Technology	2.4 GHz					
Frequency Range (MHz to MHz)	2425 - 2480					
Conducted Declared Output Power (dBm)	7.5					
Antenna Gain (dBi)	3					
Supported Bandwidth(s) (MHz) (e.g 1 MHz, 20 MHz, 40 MHz)	2.5					
Modulation Scheme(s) (e.g GFSK, QPSK etc)	O-QPSK					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	2M48F1D					
Bottom Frequency (MHz)	2425					
Middle Frequency (MHz)	2450					
Top Frequency (MHz)	2480					

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480
Lowest frequency generated or used in the device or on which the device operates or tunes	
Class A Digital Device (Use in commercial, industrial or business environment) ☐	
Class B Digital Device (Use in residential environment only) ☒	

AC Power Source

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



DC Power Source

Nominal voltage:	5	V
Extreme upper voltage:		V
Extreme lower voltage:		V
Max current:	1	A

Battery Power Source

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

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒
---	---

Temperature

Minimum temperature:	0	°C
Maximum temperature:	35	°C

Antenna Characteristics

Antenna connector ☐	State impedance		Ohm
Temporary antenna connector ☐	State impedance		Ohm
Integral antenna ☒	Type:		Gain 3 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 ☐			

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

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

Name: Dr David Hallas
Position held: Managing Director
Date: 10-Feb-2021



1.5 Product Information

1.5.1 Technical Description

This product (Hub) is used to connect with all Sure PetCare Connected products. It is connected to end user's router and act as a link between the "Connected" family product and the server/App. The hub communicates with the "Connected" family product via 802.15.4, 2.4 GHz wireless link.

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: iHB v2, Serial Number: H001-0020390			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: iHB v2, Serial Number: H001-0020388			
0	As supplied by the customer	Not Applicable	Not Applicable
1	Power on top channel reduced by 4dB	Client	20-April-2021

Table 3

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 (802.15.4)		
Restricted Band Edges	Graeme Lawler	UKAS
Emission Bandwidth	Daniel Cameron	UKAS
Maximum Conducted Output Power	Daniel Cameron	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Power Spectral Density	Daniel Cameron	UKAS

Table 4

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

iHB v2, S/N: H001-0020388 - Modification State 0
iHB v2, S/N: H001-0020388 - Modification State 1

2.1.3 Date of Test

10-April-2021 to 21-April-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 11.12.2.5.1 to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dB μ V/m to μ V/m:

$10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$

2.1.5 Environmental Conditions

Ambient Temperature	21.5 - 22.7 °C
Relative Humidity	26.7 - 26.8 %



2.1.6 Test Results

2.4 GHz (802.15.4)

Mode	Channel Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	2425	2390.0	54.70	43.02
Static	2480	2483.5	61.29	52.68

Table 5

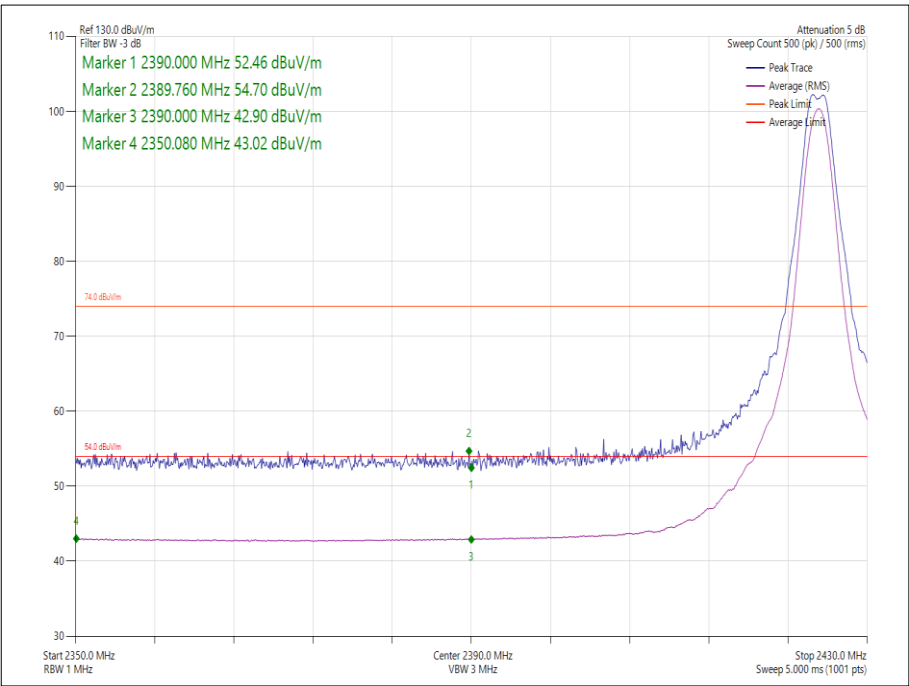


Figure 1 - 2389.760 MHz - Band Edge Frequency 2390 MHz

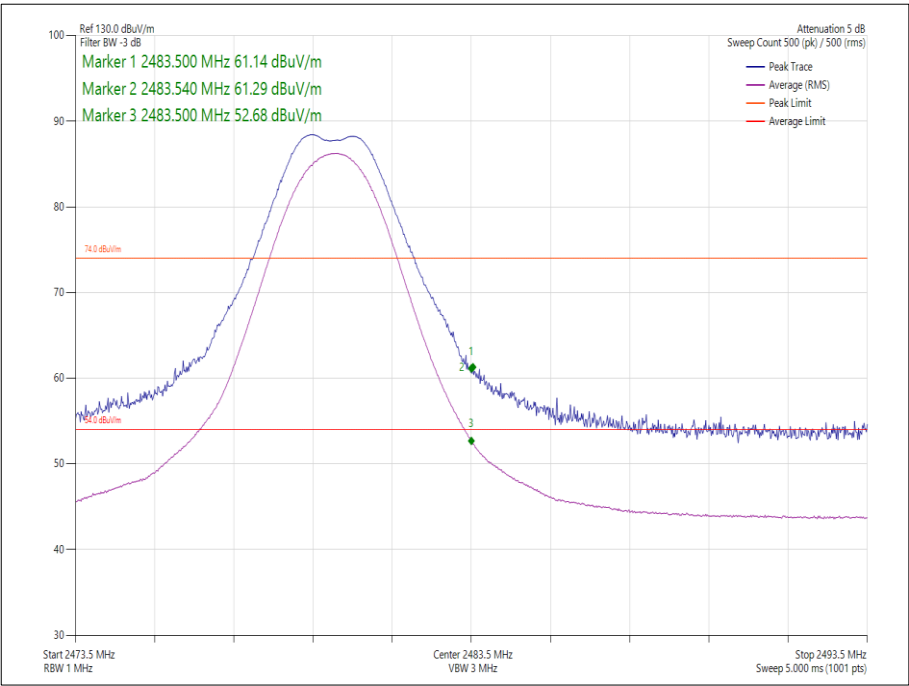


Figure 2 - 2483.540 MHz - Band Edge Frequency 2483.5 MHz

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 6

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 7

*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
EmX Emissions Software	TUV SUD	V2.1.4	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	18-Feb-2022
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021
Broadband Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	22-Sep-2021
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast TAM 4.0-P	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
3m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023
Cable Assembly - 18GHz 8m	Junkosha	MWX221-08000NMSNMS/B	5732	6	05-Aug-2021

Table 8

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

iHB v2, S/N: H001-0020390 - Modification State 0

2.2.3 Date of Test

16-March-2021

2.2.4 Test Method

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

2.2.5 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	36.5 %



2.2.6 Test Results

2.4 GHz (802.15.4)

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2) RSS-247 5.2 a)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	802.15.4	Duty Cycle (%):	-
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Antenna Gain (dBi):	-
Active Port(s):	C (Port 1)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)					Limit (kHz)
	A	B	C	D	Minimum	
2425	-	-	1.536	-	1.536	≥500.0
2450	-	-	1.560	-	1.560	≥500.0
2480	-	-	1.596	-	1.596	≥500.0

Table 9 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)					Limit (kHz)
	A	B	C	D	Minimum	
2425	-	-	2.328	-	2.328	-
2450	-	-	2.352	-	2.352	-
2480	-	-	2.412	-	2.412	-

Table 10 - 99% Bandwidth Results

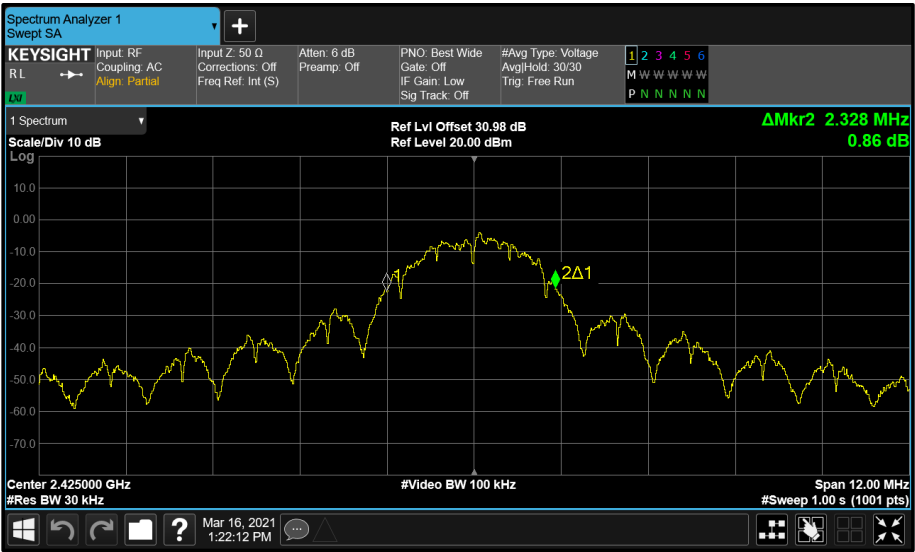


Figure 3 - Port 1 (C) 2425 MHz (CH15) 99% Bandwidth

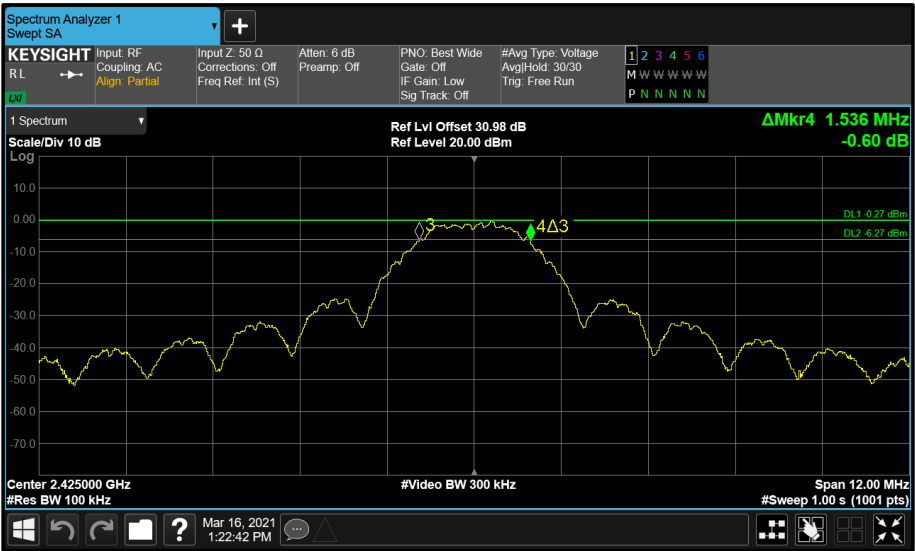


Figure 4 - Port 1 (C) 2425 MHz (CH15) 6 dB Bandwidth

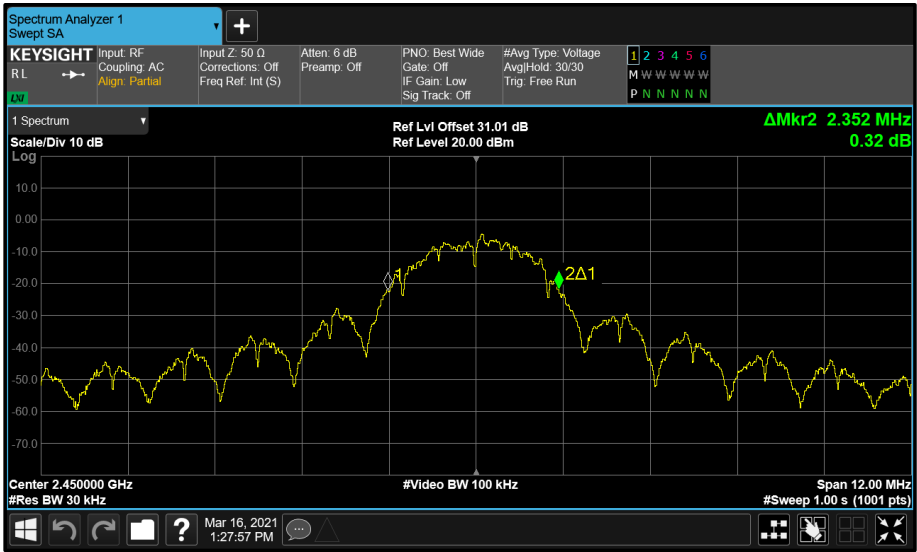


Figure 5 - Port 1 (C) 2450 MHz (CH20) 99% Bandwidth

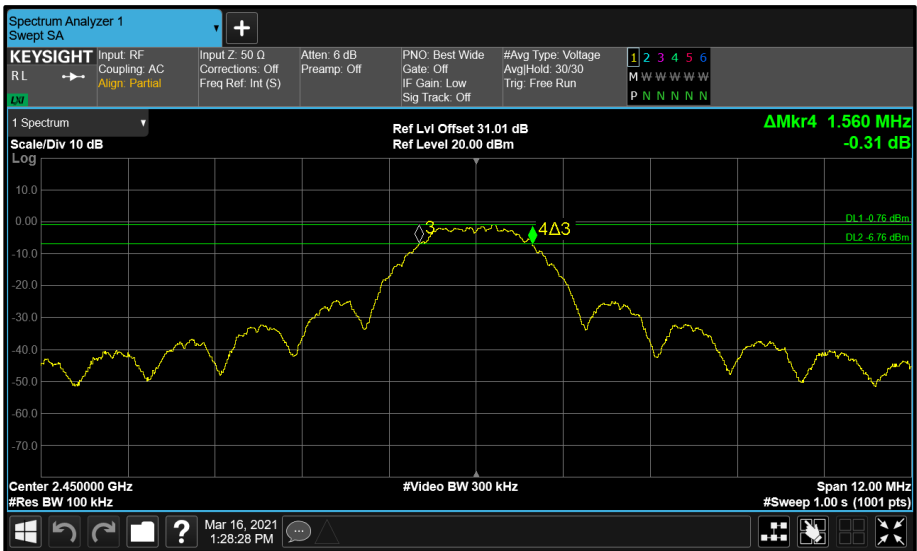


Figure 6 - Port 1 (C) 2450 MHz (CH20) 6 dB Bandwidth

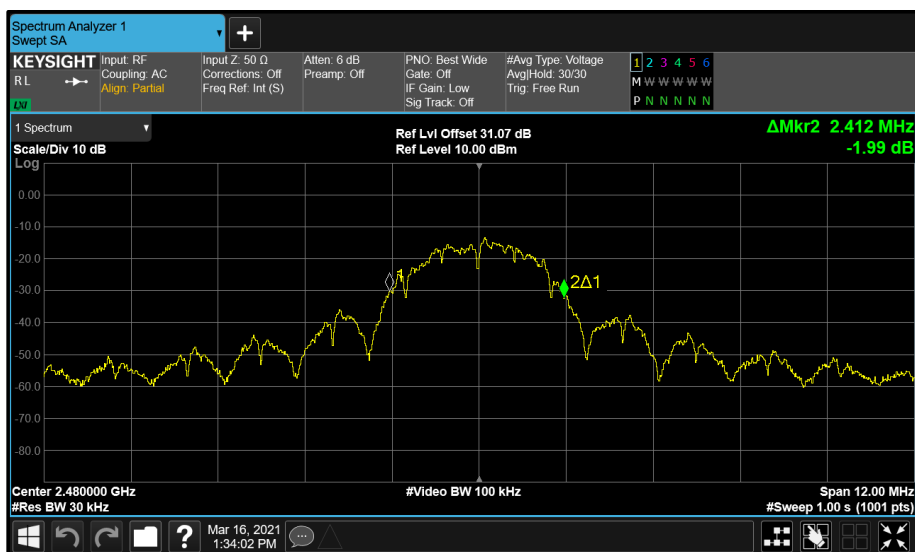


Figure 7 - Port 1 (C) 2480 MHz (CH26) 99% Bandwidth

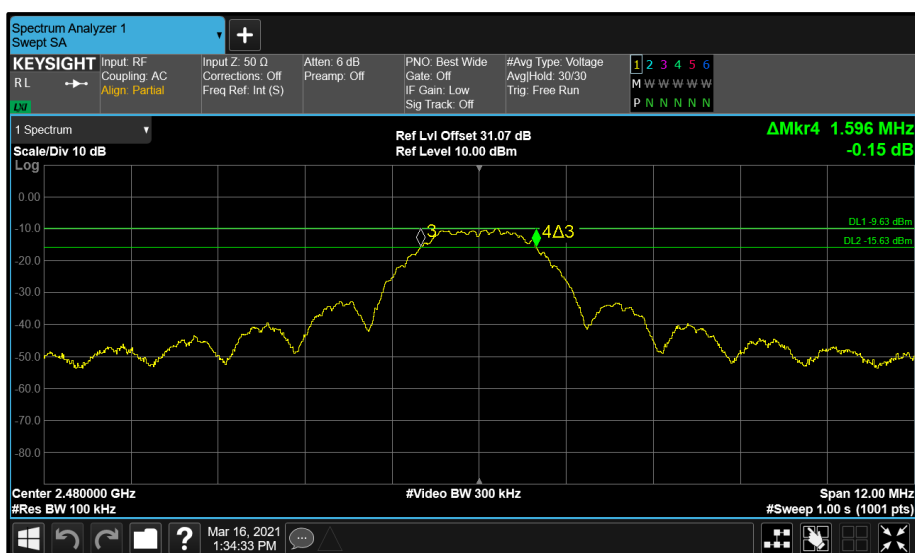


Figure 8 - Port 1 (C) 2480 MHz (CH26) 6 dB Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and ISSED 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.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	19-Mar-2021
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU001	5546	12	15-Apr-2021

Table 11



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

iHB v2, S/N: H001-0020390 - Modification State 0

2.3.3 Date of Test

16-March-2021

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 11.9.2.3.2 (AVGPM-G).

2.3.5 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	36.5 %



2.3.6 Test Results

2.4 GHz (802.15.4)

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(3) RSS-247 5.4 d)	Test Method(s):	C63.10 11.9.2.3.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	802.15.4	Duty Cycle (%):	100.0
Data Rate:	-	DCCF (dB):	-
Antenna Configuration:	SISO	Antenna Gain (dBi):	3.00
Active Port(s):	C (Port 1)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2425	-	-	2.62	-	-	30.00	-27.38
2450	-	-	2.24	-	-	30.00	-27.76
2480	-	-	-6.52	-	-	30.00	-36.52

Table 12 - FCC Maximum Conducted (average) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2425	-	-	2.62	-	-	30.00	-27.38	5.62	36.00	-30.38
2450	-	-	2.24	-	-	30.00	-27.76	5.24	36.00	-30.76
2480	-	-	-6.52	-	-	30.00	-36.52	-3.52	36.00	-39.52

Table 13 - ISED Maximum Conducted (average) Output Power Results

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 (b)

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 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	19-Mar-2021
USB Power Sensor	Boonton	RTP5006	5278	12	27-Apr-2021
Signal Commissioning Unit	TUV SUD	SCU001	5546	12	15-Apr-2021

Table 14



2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
ISED RSS-247, Clause 3.3 and 5.5
ISED RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

iHB v2, S/N: H001-0020388 - Modification State 0

2.4.3 Date of Test

10-April-2021 to 11-April-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. Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4.

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 11.12.2.5.1.

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 dBuV/m to uV/m:

$10^{(\text{Field Strength in dBuV/m}/20)}$.

To determine the emission characteristic of the EUT above 18 GHz, the test antenna distance was reduced to 1 meter and the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54$ dB.

2.4.5 Example Test Setup Diagram

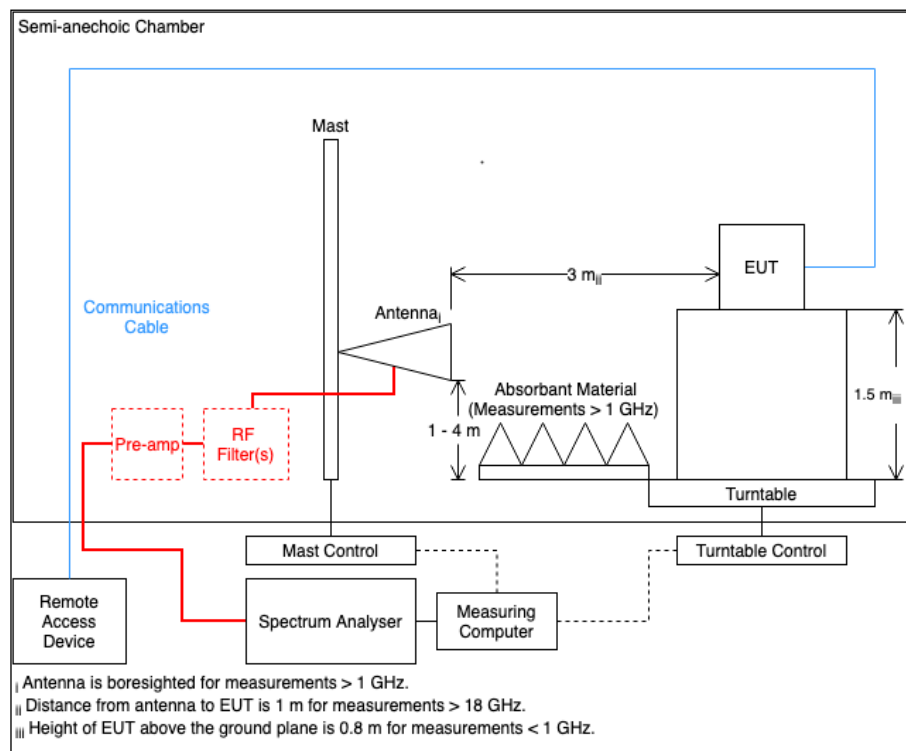


Figure 9

2.4.6 Environmental Conditions

Ambient Temperature	22.7 - 23.2 °C
Relative Humidity	26.8 - 27.8 %



2.4.7 Test Results

2.4 GHz (802.15.4)

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

Table 15 - 2425 MHz, 30 MHz to 1 GHz

*No emissions were detected within 10 dB of the limit.

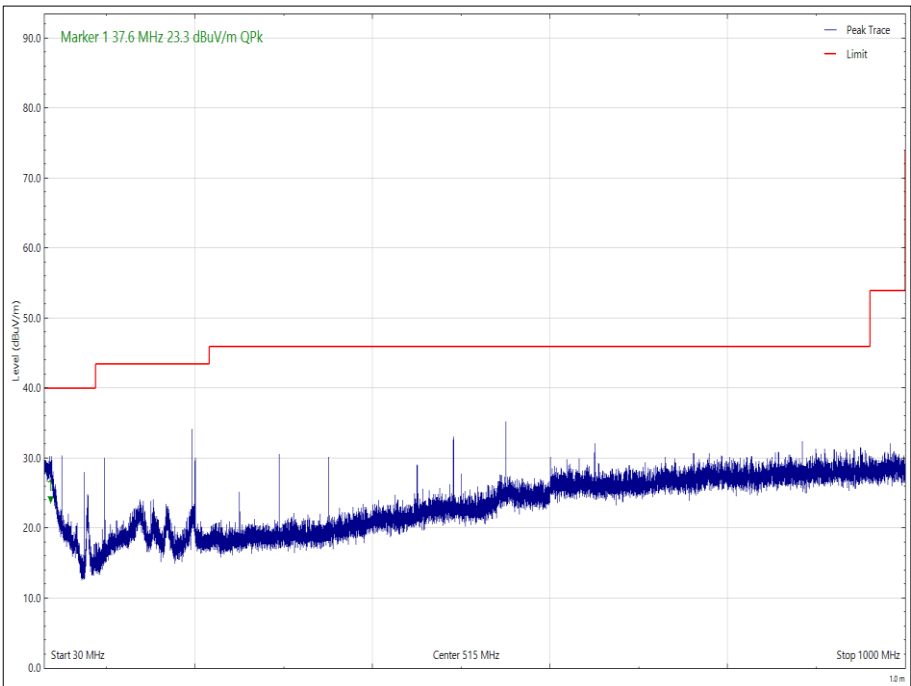


Figure 10 - 2425 MHz, 30 MHz to 1 GHz, Vertical

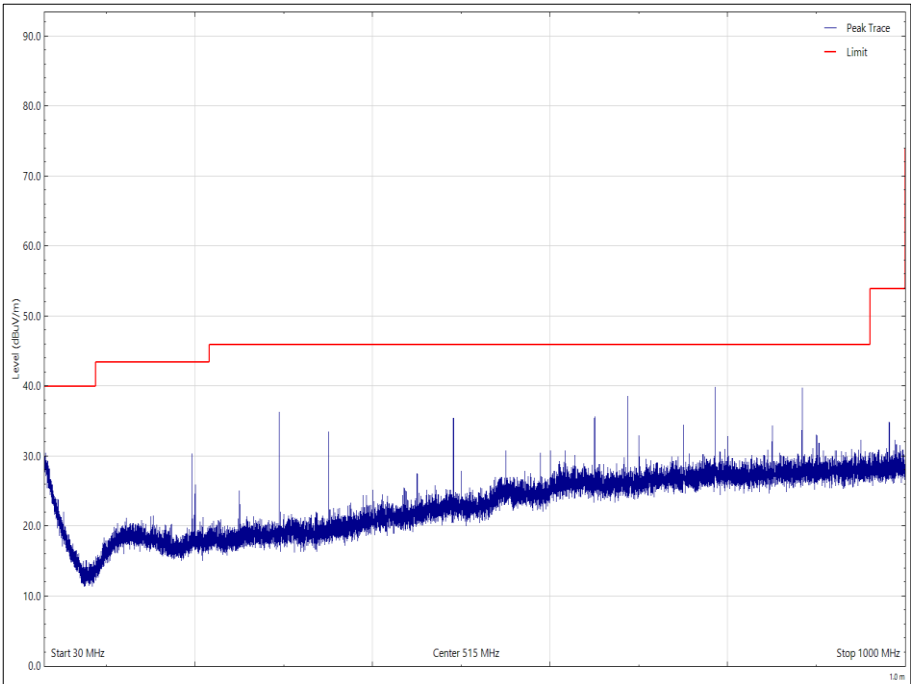


Figure 11 - 2425 MHz, 30 MHz to 1 GHz, Horizontal



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4850.820	44.29	53.98	9.69	Average	36	100	Vertical	-
12127.310	45.72	53.98	8.26	Average	246	103	Vertical	-
12136.835	47.25	53.98	6.73	Average	195	129	Horizontal	-

Table 16 - 2425 MHz, 1 GHz to 25 GHz

No other emissions were detected within 10 dB of the limit.

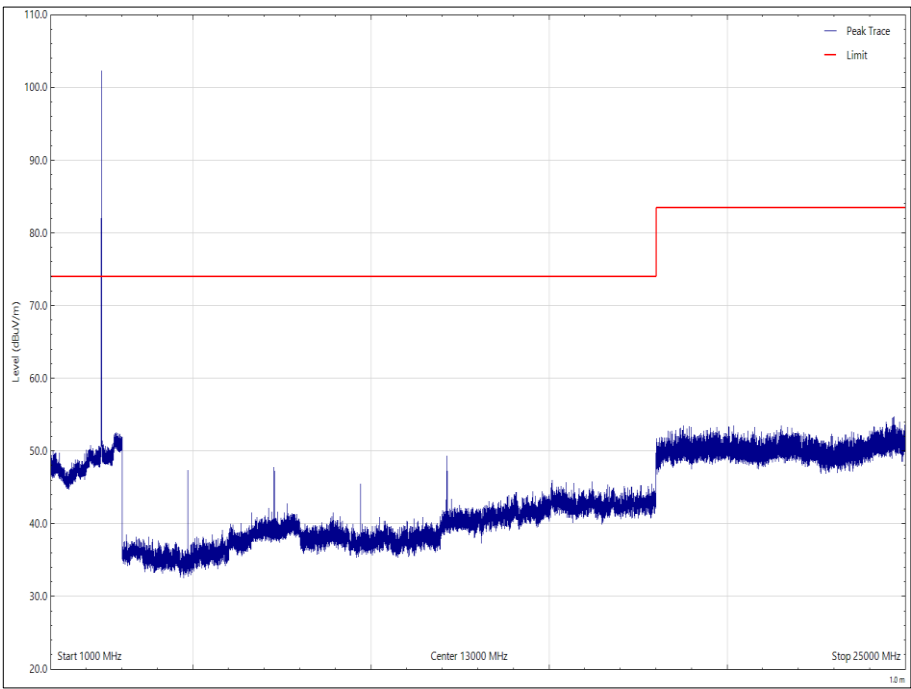


Figure 12 - 2425 MHz, 1 GHz to 25 GHz, Vertical - Peak

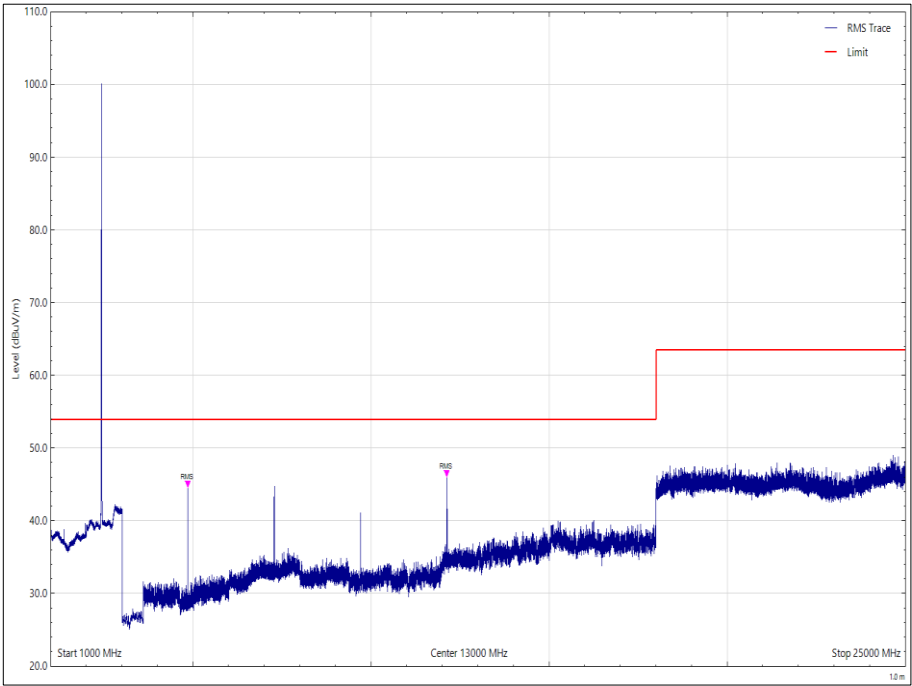


Figure 13 - 2425 MHz, 1 GHz to 25 GHz, Vertical - Average

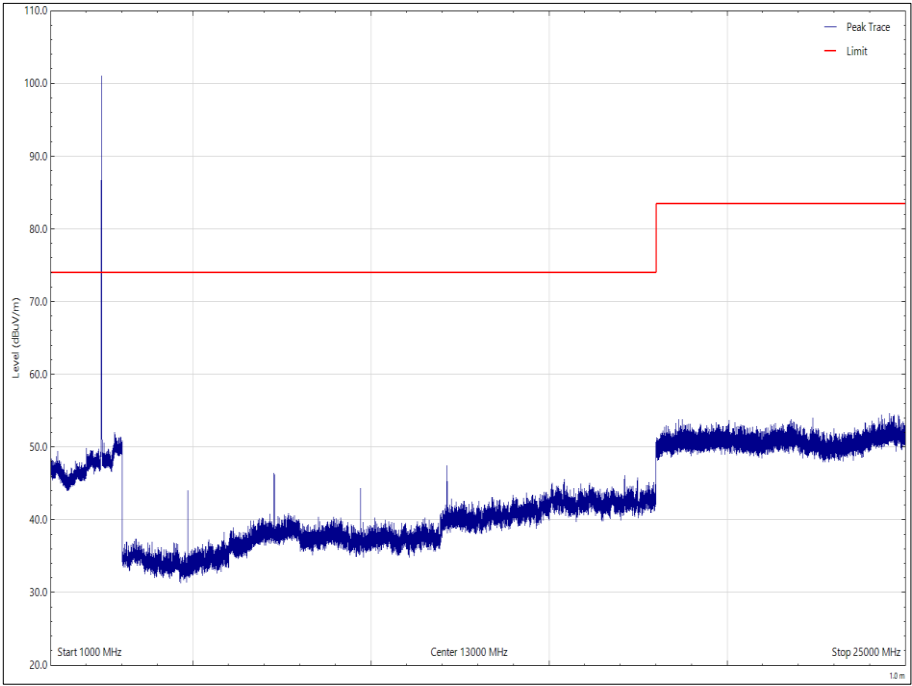


Figure 14 - 2425 MHz, 1 GHz to 25 GHz, Horizontal - Peak

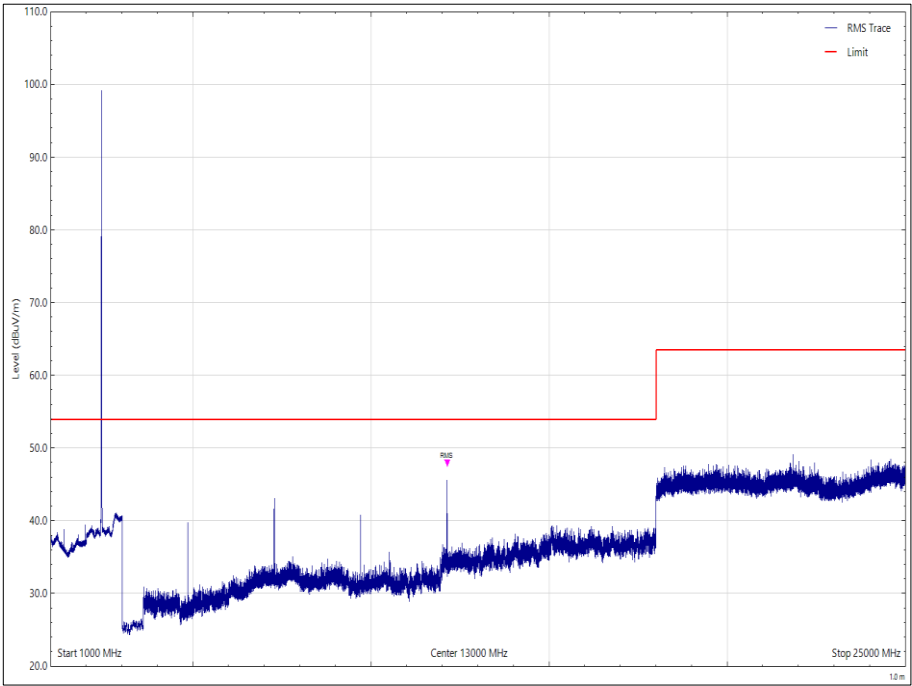


Figure 15 - 2425 MHz, 1 GHz to 25 GHz, Horizontal - Average

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

Table 17 - 2450 MHz, 30 MHz to 1 GHz

*No emissions were detected within 10 dB of the limit.

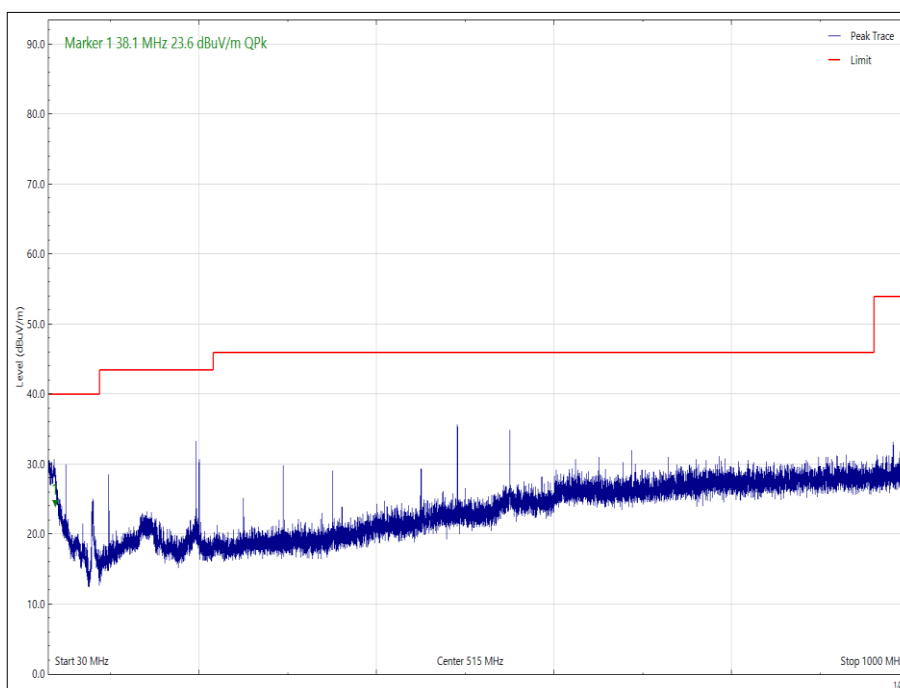


Figure 16 - 2450 MHz, 30 MHz to 1 GHz, Vertical

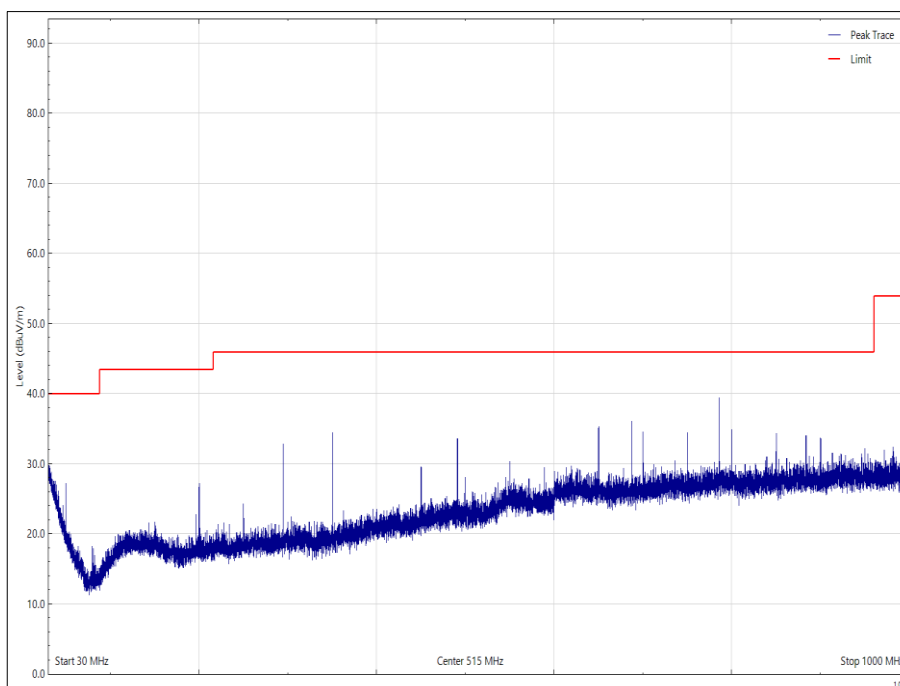


Figure 17 - 2450 MHz, 30 MHz to 1 GHz, Horizontal



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
12252.240	46.85	53.98	7.13	Average	178	178	Vertical	-
12252.250	45.76	53.98	8.22	Average	197	100	Horizontal	-

Table 18 - 2450 MHz - 1 GHz to 25 GHz

No other emissions were detected within 10 dB of the limit.

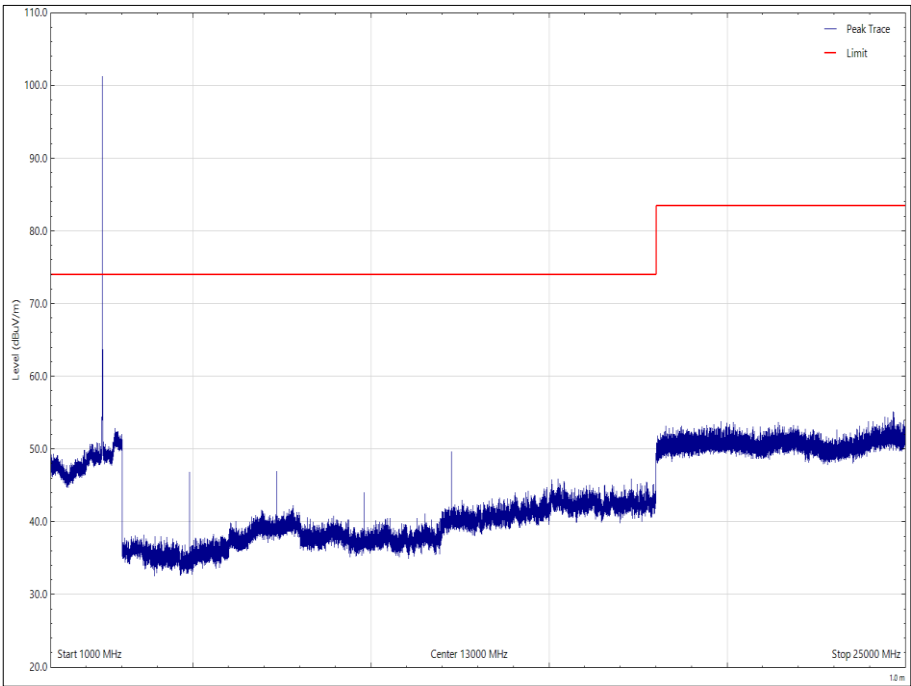


Figure 18 - 2450 MHz - 1 GHz to 25 GHz, Vertical - Peak

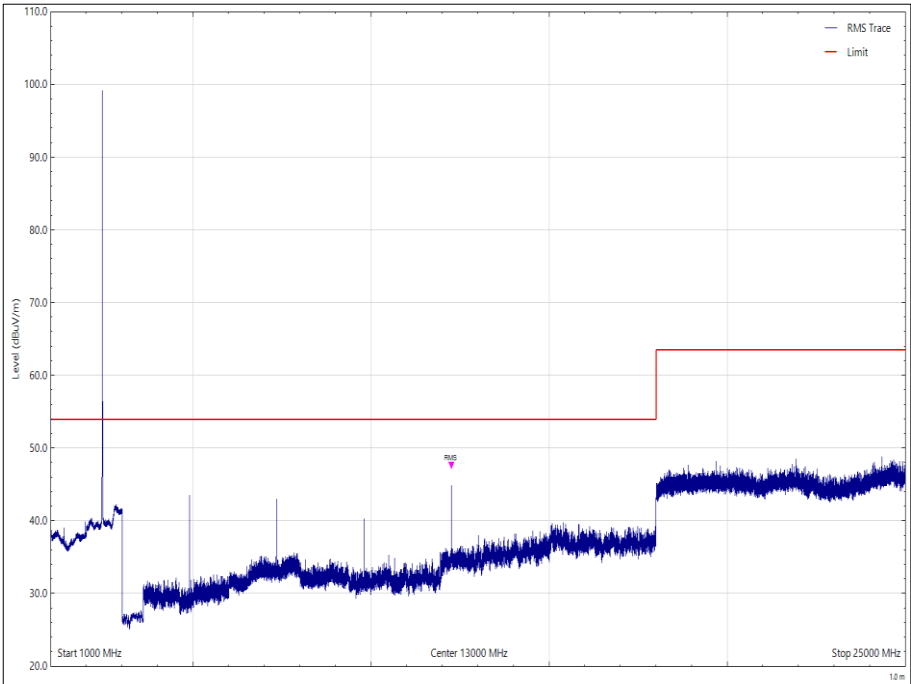


Figure 19 - 2450 MHz - 1 GHz to 25 GHz, Vertical - Average

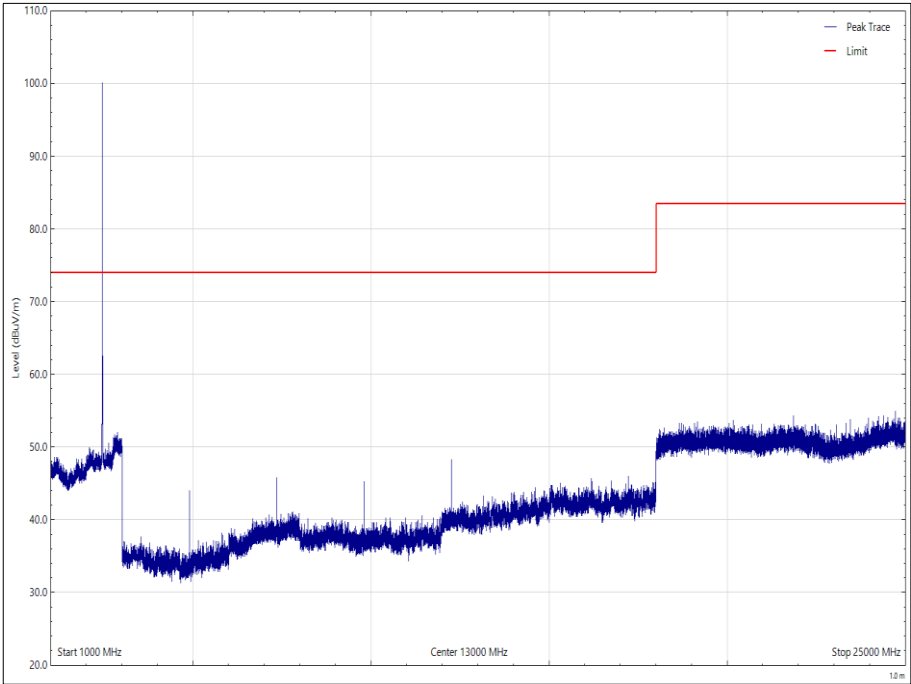


Figure 20 - 2450 MHz - 1 GHz to 25 GHz, Horizontal - Peak

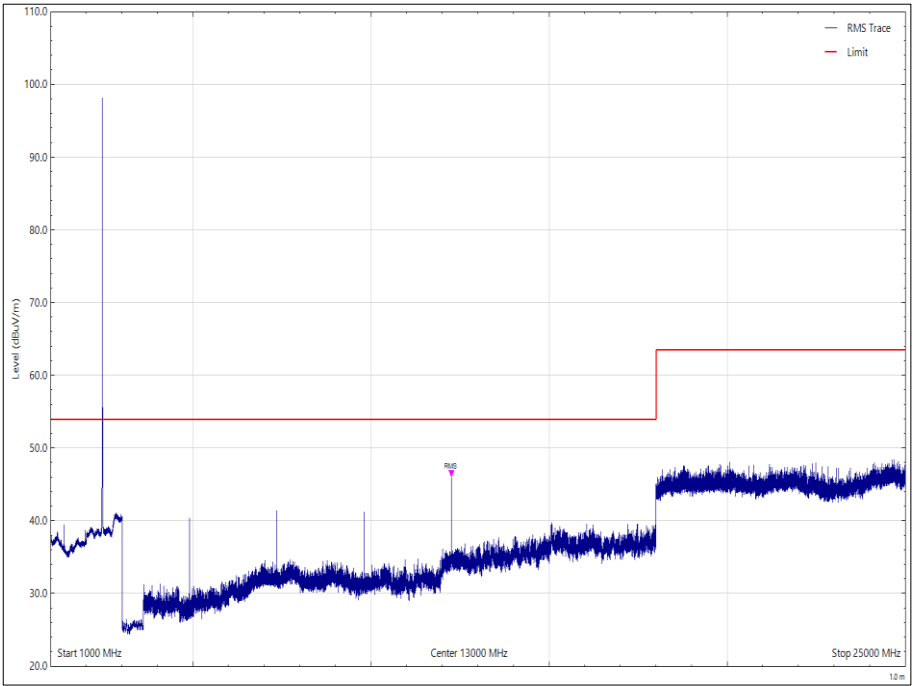


Figure 21 - 2450 MHz - 1 GHz to 25 GHz, Horizontal - Average

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

Table 19 - 2480 MHz, 30 MHz to 1 GHz

*No emissions were detected within 10 dB of the limit.

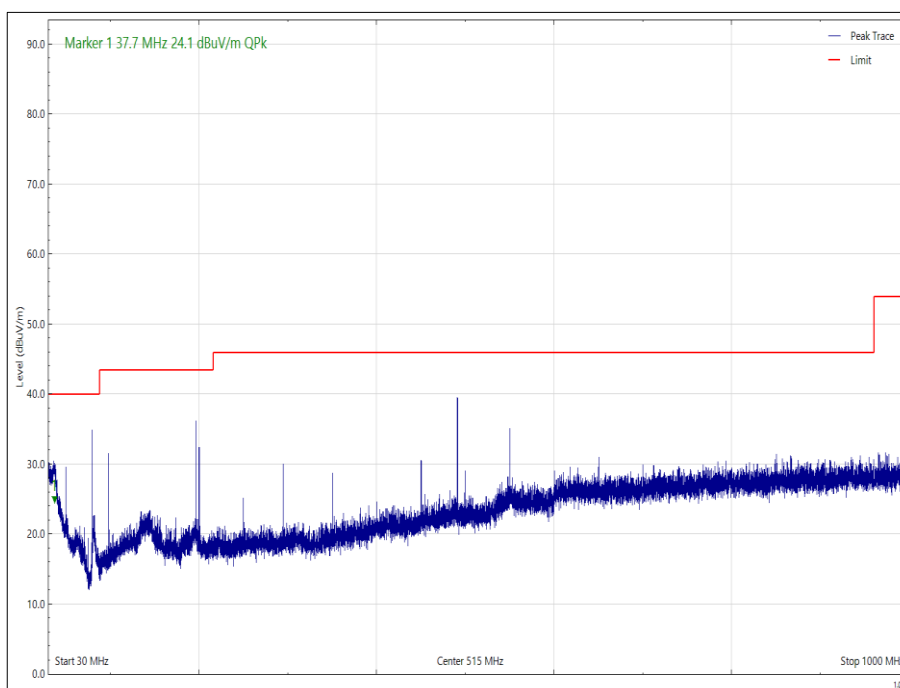


Figure 22 - 2480 MHz, 30 MHz to 1 GHz, Vertical

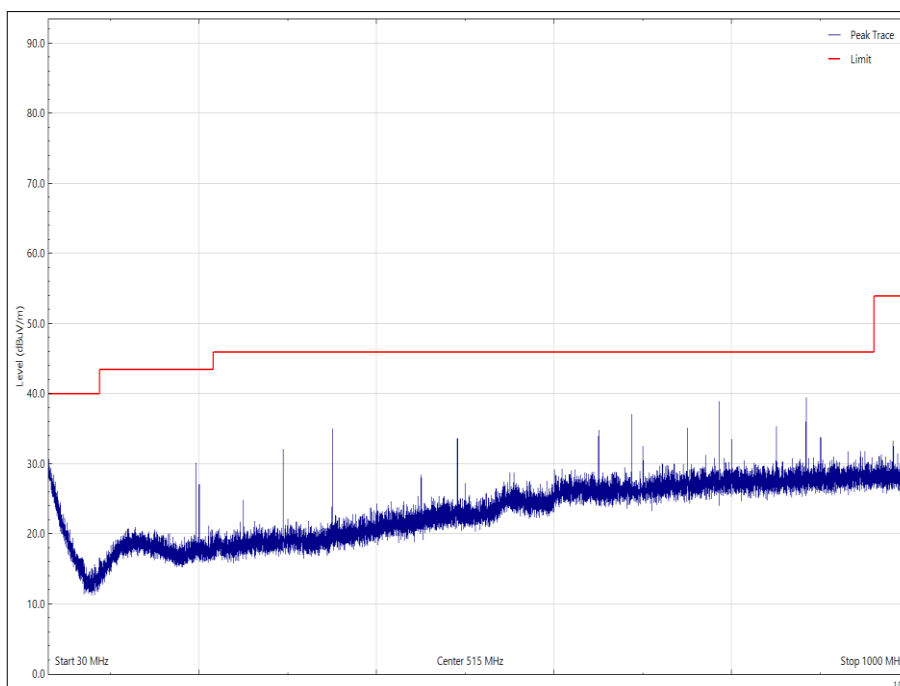


Figure 23 - 2480 MHz, 30 MHz to 1 GHz, Horizontal



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

Table 20 - 2480 MHz - 1 GHz to 25 GHz

*No emissions were detected within 10 dB of the limit.

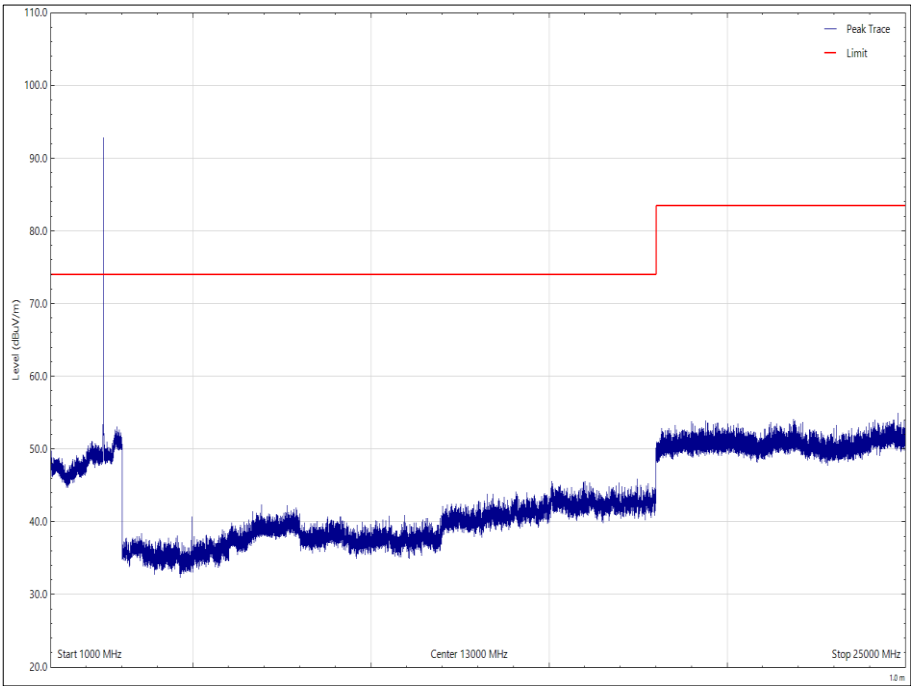


Figure 24 - 2480 MHz - 1 GHz to 25 GHz, Vertical - Peak

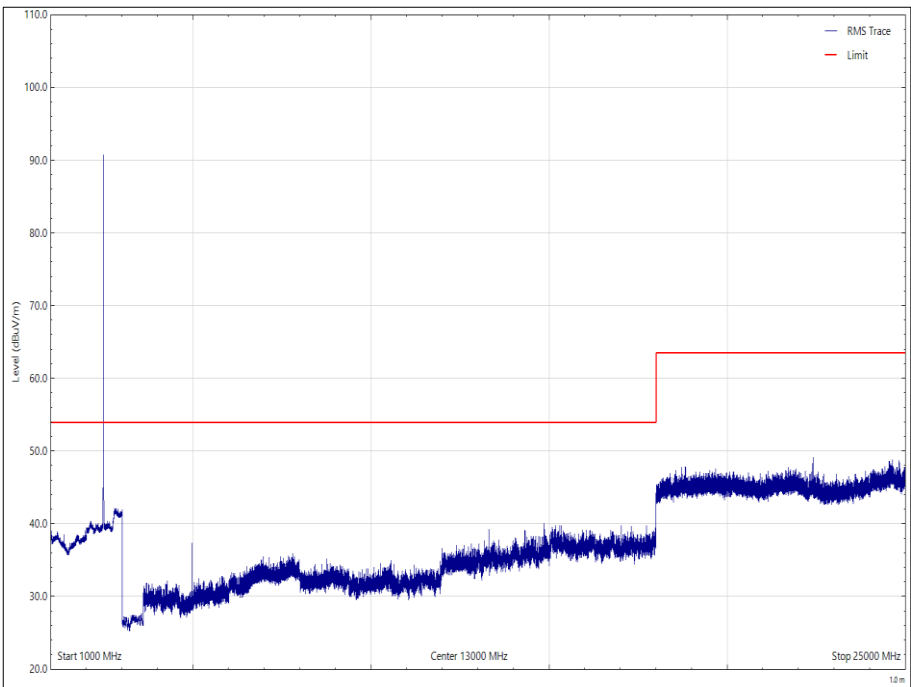


Figure 25 - 2480 MHz - 1 GHz to 25 GHz, Vertical - Average

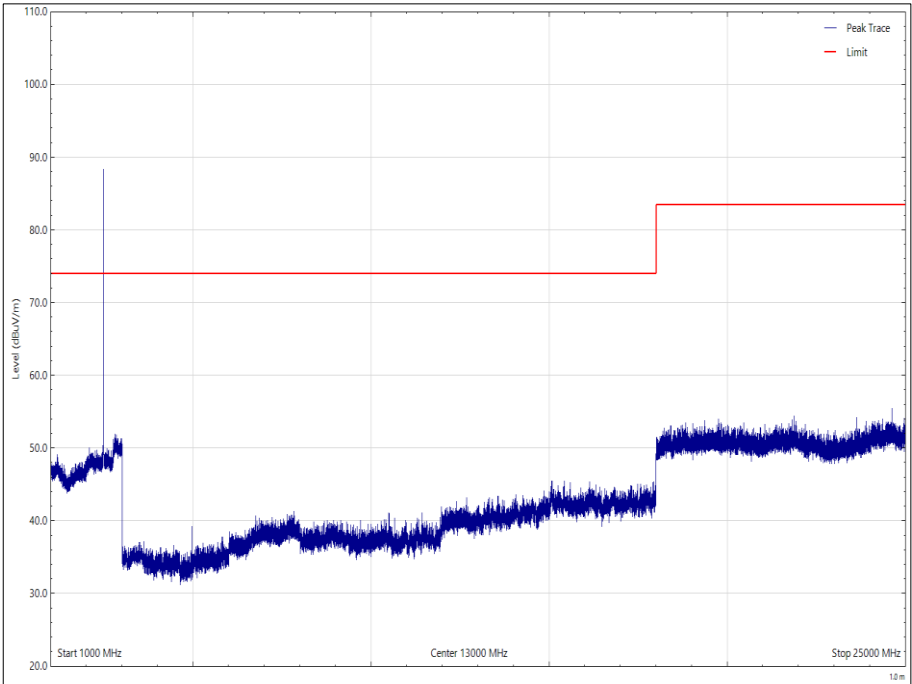


Figure 26 - 2480 MHz - 1 GHz to 25 GHz, Horizontal - Peak

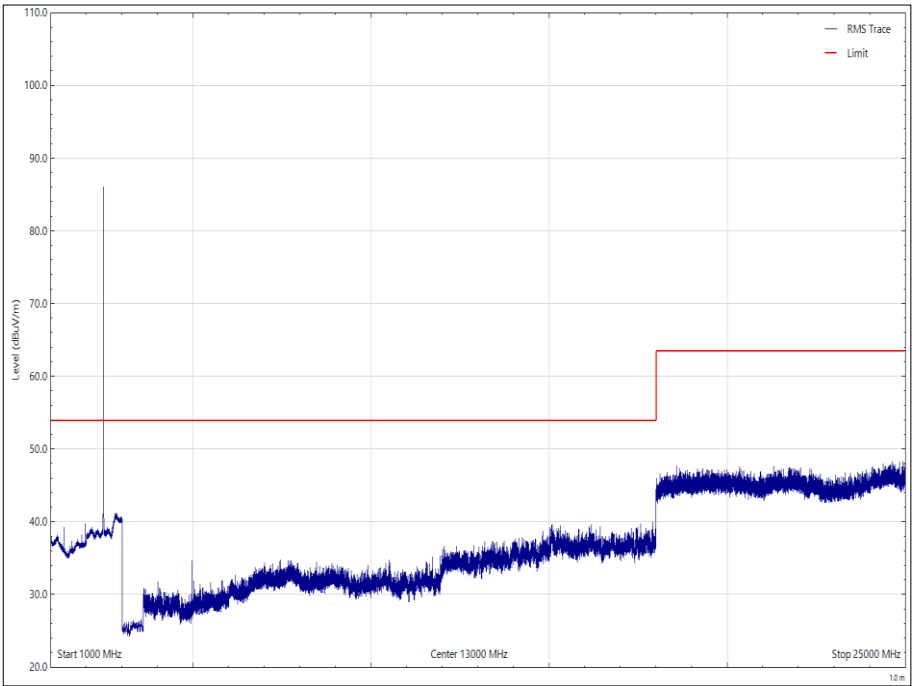


Figure 27 - 2480 MHz - 1 GHz to 25 GHz, Horizontal - Average

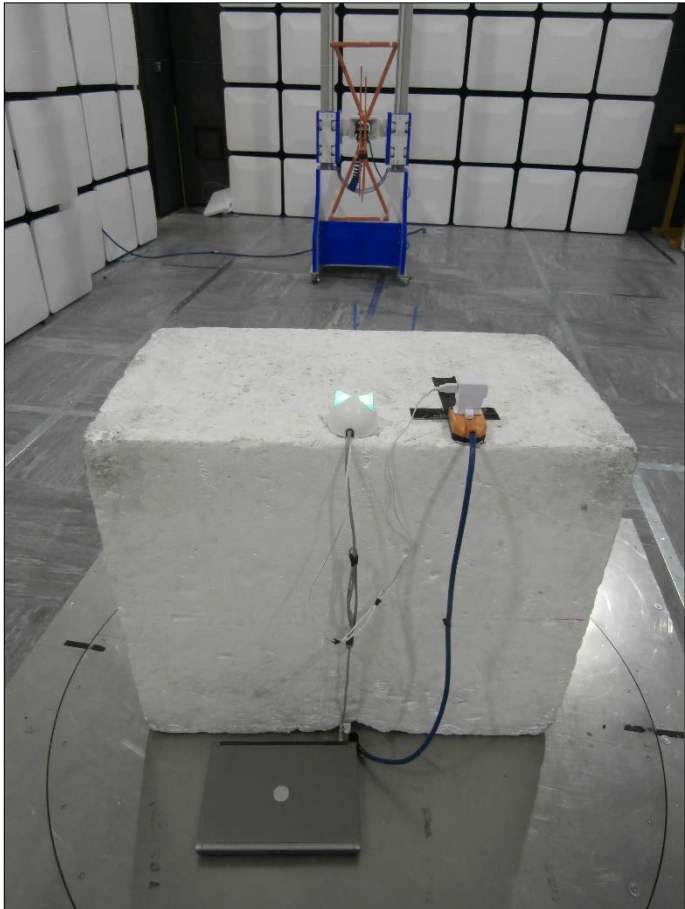


Figure 28 - Test Setup - 30 MHz to 1 GHz

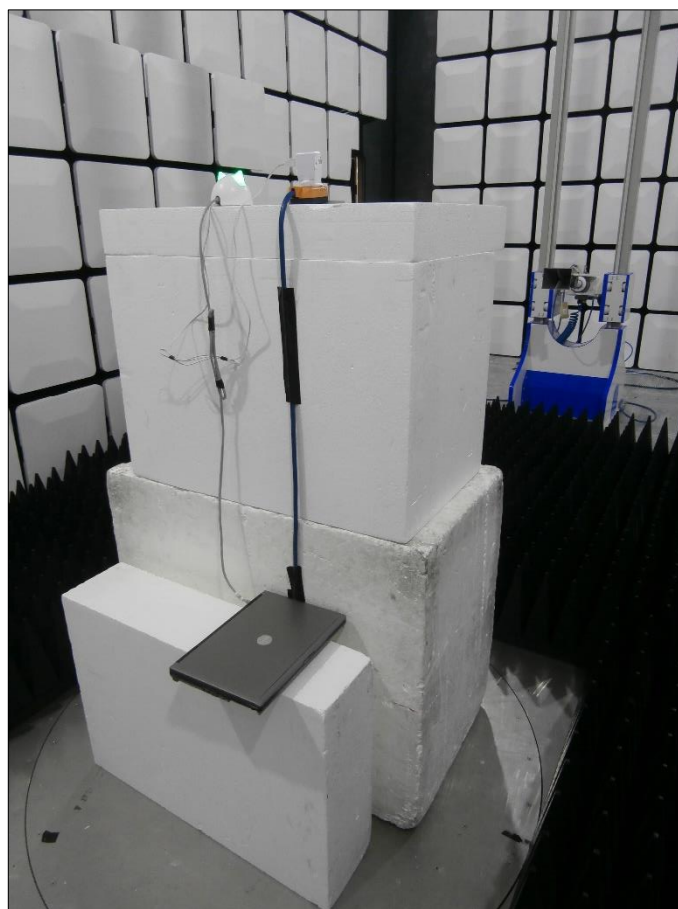


Figure 29 - Test Setup - 1 GHz to 18 GHz



Figure 30 - Test Setup - 18 GHz to 25 GHz

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.



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 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	27-Jul-2022
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	14-Oct-2022
Pre-Amplifier, (8 GHz to 18 GHz)	Phase One	PS04-0086	1533	12	05-Feb-2022
18GHz - 40GHz Pre-Amplifier	Phase One	PS04-0087	1534	12	18-Feb-2022
Comb Generator	Schaffner	RSG1000	3034	-	TU
EmX Emissions Software	TUV SUD	V2.1.4	5125	-	Software
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5350	12	21-Sep-2021
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	18-Feb-2022
Cable 2.92m	Junkosha	MWX241/B	5411	12	22-Jun-2021
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
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	05-May-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5610	12	22-Sep-2021
Broadband Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	22-Sep-2021
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast TAM 4.0-P	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
3m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023
Cable Assembly - 18GHz 8m	Junkosha	MWX221-08000NMSNMS/B	5732	6	05-Aug-2021

Table 21

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

iHB v2, S/N: H001-0020388 - Modification State 0

2.5.3 Date of Test

10-April-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 22.7 °C
Relative Humidity 26.8 %

2.5.6 Test Results

2.4 GHz (802.15.4)

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	2425	2400.0	-54.33
Static	2480	2483.5	-35.77

Table 22

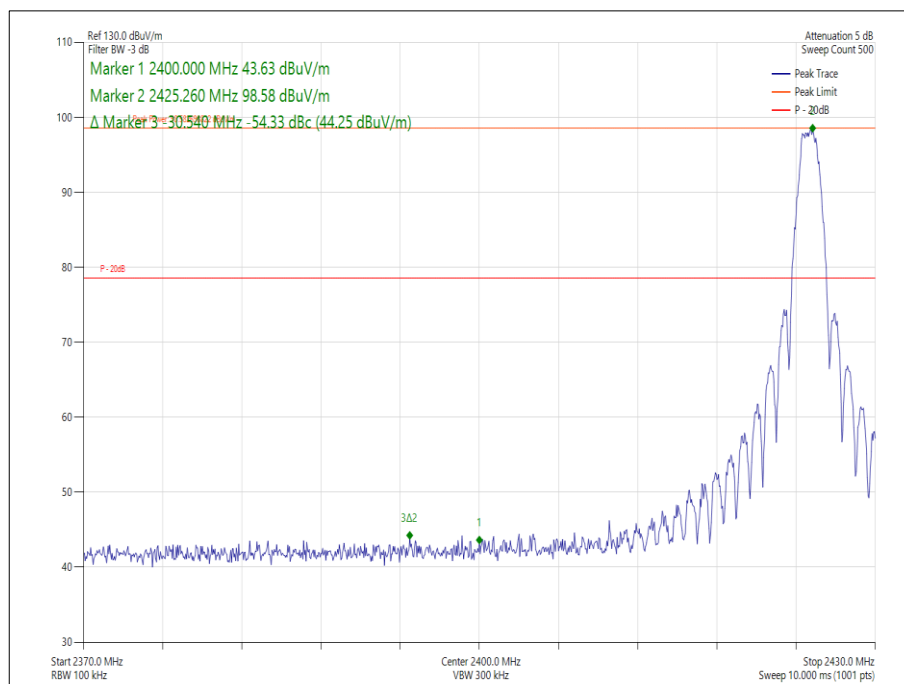


Figure 31 - Static, 2425 MHz - Measured Frequency 2400 MHz

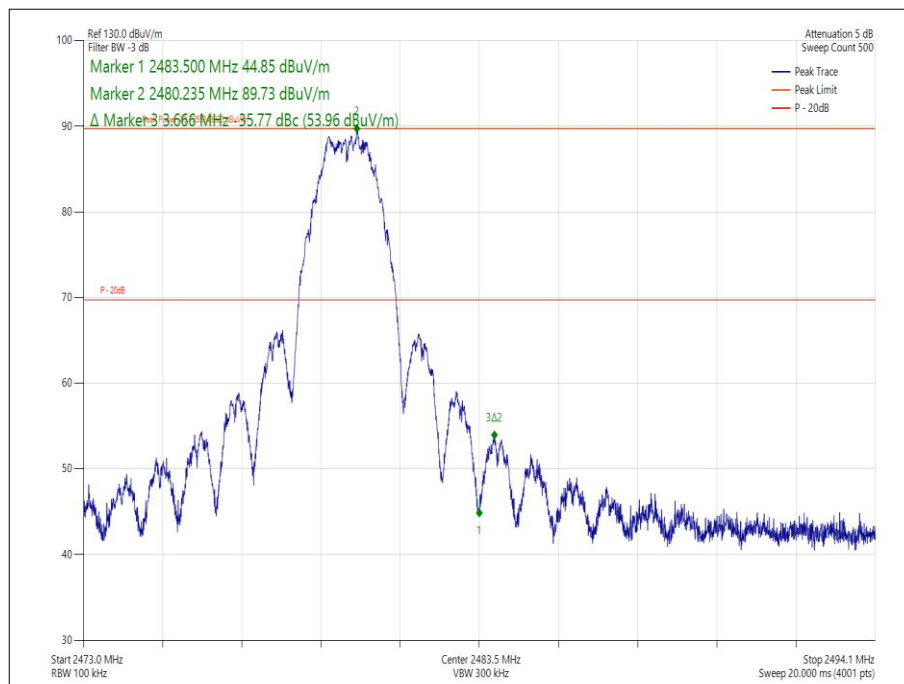


Figure 32 - Static, 2480 MHz - Measured Frequency 2.4835 MHz

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
EmX Emissions Software	TUV SUD	V2.1.4	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	18-Feb-2022
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021
Broadband Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	22-Sep-2021
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast TAM 4.0-P	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
3m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023
Cable Assembly - 18GHz 8m	Junkosha	MWX221-08000NMSNMS/B	5732	6	05-Aug-2021

Table 23

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

iHB v2, S/N: H001-0020390 - Modification State 0

2.6.3 Date of Test

16-March-2021

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 23.7 °C
Relative Humidity 36.5 %

2.6.6 Test Results

2.4 GHz (802.15.4)

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (e) RSS-247 5.2 b)	Test Method(s):	C63.10 11.10.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	802.15.4	Duty Cycle (%):	100.0
Data Rate:	-	DCCF (dB):	0.00
Antenna Configuration:	SISO	Antenna Gain (dBi):	-
Active Port(s):	C (Port 1)	Active Chain(s):	0

Test Frequency (MHz)	RBW (kHz)	PSD (dBm/RBW)					Limit (dBm/3 kHz)	Margin (dB)
		A	B	C	D	Σ		
2425	3.0	-	-	-12.07	-	-	8.00	-20.07
2450	3.0	-	-	-12.52	-	-	8.00	-20.52
2480	3.0	-	-	-20.48	-	-	8.00	-28.48

Table 24 - Maximum Power Spectral Density Results



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 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	19-Mar-2021
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU001	5546	12	15-Apr-2021

Table 25



3 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Emission Bandwidth	± 118.55 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 26

Measurement Uncertainty Decision Rule

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.