FCC and ISED Test Report

HID Global Corporation (US)
BluFi™ POE 5G with Universal Power, Model: BluFI-UP00

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

Prepared for: HID Global Corporation (US)
600 Corporate Drive
Suite 300, Fort Lauderdale
FL 33334, UNITED STATES

FCC ID: 2BCL8BVBFPOEUP IC: 24824-BVBFPOEUP

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Document 75957186-06 Issue 03

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	Chief Engineer	Authorised Signatory	04 September 2023

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	Ahmad Javid	04 September 2023	
Testing	Thomas Biddlecombe	04 September 2023	

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: 2021, 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	06 July 2023
2	Second Issue - To update FCC ID	30 August 2023
3	Third Issue – Update of IC	04 September 2023

Table 1

1.2 Introduction

Applicant	HID Global Corporation (US)
Manufacturer	HID Global Corporation (US)
Model Number(s)	BluFI-UP00
Serial Number(s)	13967299199488037823 and 95740613335981387
Hardware Version(s)	1.4
Software Version(s)	WIFI 2015 BLE 451
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2021 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number Date	1180900792 30-November-2022
Date of Receipt of EUT	12-December-2022 and 11-April-2023
Start of Test	19-January-2023
Finish of Test	07-May-2023
Name of Engineer(s)	Ahmad Javid and Thomas Biddlecombe
Related Document(s)	ANSI C63.10 (2013) ANSI C63.4 (2014) ANSI C63.10 (2020)

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 Bluetooth Low Energy						
-	15.203	-	-	Antenna Requirement	N/T	The EUT meets the requirements of 15.203 as all installations will be professionally installed
2.1	15.205	3.3	8.10	Restricted Band Edges	Pass	
2.2	15.209 and 15.247 (d)	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	
2.4	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.5	15.247 (d)	5.5	N/A	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)*	•Gateway that can accept a variety of WIFI spectrums, 2.4 and 5 Ghz. •Gateway that uses a provides universal power adapter to handle multiple input voltages. Allows gateway to be powered by variety of HID and-or third-party accessories. These can include, but are not necessarily limited to: 9V, 12V, Solar, External Batteries, POE, USB, etc. •Compatible with Bluetooth low-energy (BLE) radio that is capable of transmitting and receiving all standard HID IOT sBeacon, tracking packets.
Manufacturer:	HID Global
Model:	BluFI-UP00
Part Number:	BVBFPOEUP
Hardware Version:	1.4
Software Version:	WIFI 2015 BLE 451
FCC ID of the product under test – see guidance here	2BCL8BVBFPOEUP
IC ID of the product under test – see guidance here	24824-BVBFPOEUP

Table 3

Intentional Radiators

Technology	BLE	BLE	BLE	WiFi	WiFi (5GHz)	
Frequency Range (MHz to MHz)	2402-2483.5	2402-2483.5	2402-2483.5	2412-2462	5.150-5.250	
Conducted Declared Output Power (dBm)	5	5	5	12	12	
Antenna Gain (dBi)	0	10	2	0	0	
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	1	1	1	2.4	20,40,80	
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GFSK	GFSK	GFSK	OFDM	OFDM	
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)						
Bottom Frequency (MHz)	2402	2402	2402	2402	5150	
Middle Frequency (MHz)	2439	2439	2439	2439	5200	
Top Frequency (MHz)	2483.5	2483.5	2483.5	2483.5	5250	

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	
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) ☐	

Table 5

AC Power Source

AC supply frequency:	N/A	Hz
Voltage	9-24V 57V POE	V
Max current:		A
Single Phase ☐ Three Phase ☐		

Table 6

DC Power Source

Nominal voltage:	9-24V DC or 57V PoE	V
Extreme upper voltage:	24V or 57V PoE	V
Extreme lower voltage:	9V	V
Max current:	0.11 at 9V	A

Table 7

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:		

Table 8

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☐

Table 9

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	+85	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)		dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance	50	Ohm
Temporary antenna connector ☐			State impedance	50	Ohm
Integral antenna ☑	Type:	Pifa	Gain	0	dBi
External antenna ☑	Type:	Dipole	Gain	9.4	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 ☐ All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information maybe photographs, length of wire antenna etc.					

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: Matthieu Behroozi
Position held: Product Manager
Date: 05 June 2023

1.5 Product Information

1.5.1 Technical Description

Gateway that can accept a variety of WIFI spectrums, 2.4 GHz and 5 GHz.

Gateway that uses a provides universal power adapter to handle multiple input voltages. Allows gateway to be powered by variety of HID and-or third-party accessories. These can include, but are not necessarily limited to: 9V, 12V, Solar, External Batteries, POE, USB, etc.

Compatible with Bluetooth low-energy (BLE) radio that is capable of transmitting and receiving all standard HID IOT sBeacon, tracking packets.

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: BluFI-UP00, Serial Number: 13967299199488037823			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: BluFI-UP00, Serial Number: 95740613335981387			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth Low Energy		
Restricted Band Edges	Ahmad Javid	UKAS
Spurious Radiated Emissions	Ahmad Javid	UKAS
Emission Bandwidth	Thomas Biddlecombe	UKAS
Maximum Conducted Output Power	Thomas Biddlecombe	UKAS
Authorised Band Edges	Ahmad Javid	UKAS
Power Spectral Density	Thomas Biddlecombe	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-247, Clause 3.3
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

Blu-FI-UP00, S/N: 95740613335981387 - Modification State 0

2.1.3 Date of Test

23-April-2023

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5 and 11.12.1.

The EUT was powered via its 9V – 56 V DC Adaptor on External Antenna BLE (C) which was identified as worst case during pre-compliance testing. See section 2.2.4 for details.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 11.12.2.5.2.

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	20.4 °C
Relative Humidity	35.1 %

2.1.6 Test Results

2.4 GHz Bluetooth Low Energy

Modulation	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
GFSK	2402	2390	54.80	44.13
GFSK	2480	2483.5	58.32	48.29

Table 16

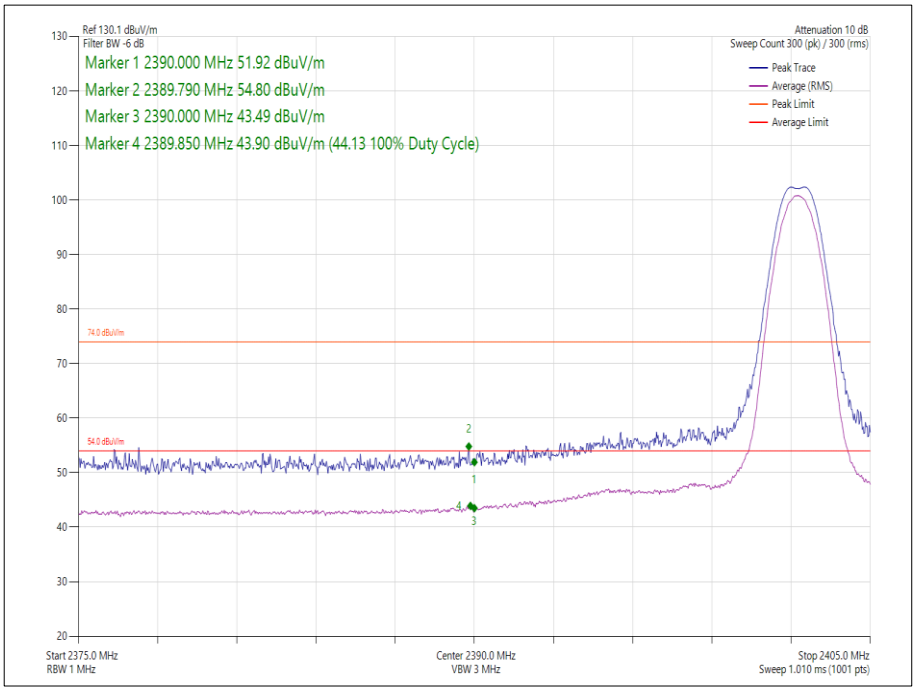

Figure 1 - GFSK - 2402 MHz - Band Edge Frequency 2390 MHz

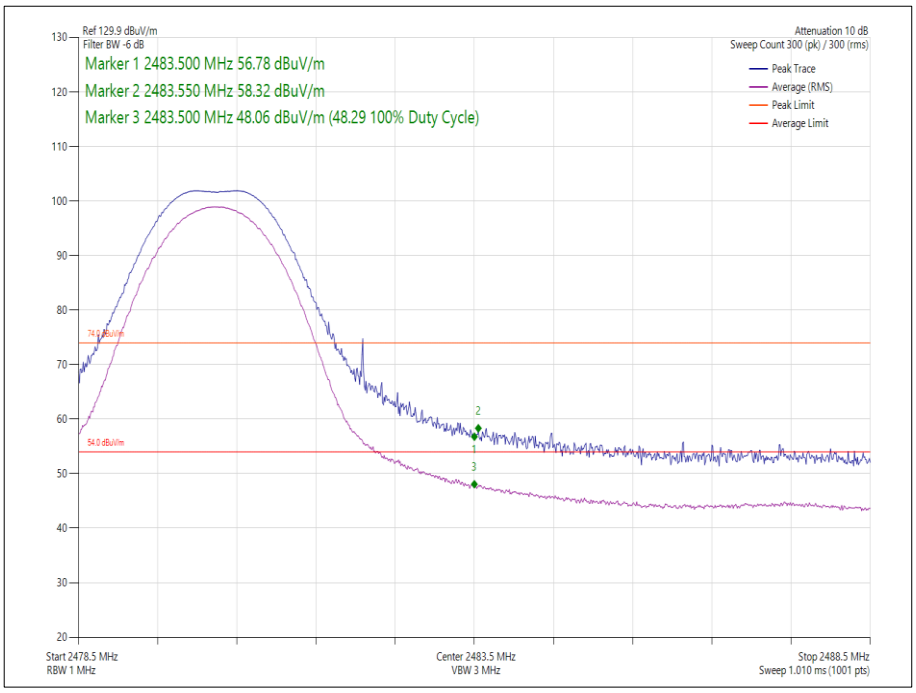

Figure 2 - GFSK - 2480 MHz - Band Edge Frequency 2483.5 MHz

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 RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
Hygrometer	Rotronic	A1	2138	12	28-Sep-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	24-Nov-2024
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Antenna (DRG 1-10.5GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
2.5m N(m)-SMA(m) Cable	Koaxis	AM12-KF141-NM20-2.50M-MK	5544	-	O/P Mon

Table 19

O/P Mon – Output Monitored using calibrated equipment
TU - Traceability Unscheduled

2.2 Spurious Radiated Emissions

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

BluFI-UP00, S/N: 13967299199488037823 - Modification State 0
BluFI-UP00, S/N: 95740613335981387 - Modification State 0

2.2.3 Date of Test

19-January-2023 to 07-May-2023

2.2.4 Test Method

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

At the request of the applicant, investigation measurements were performed from 1-8 GHz on each antenna port; BLE (A) Internal, BLE (B) External and BLE (C) External on CH20 and CH37 using the DC 9V – 56 V Power Adaptor. The worst case from these pre-scans was identified as BLE (C) External on CH37 and this mode was repeated using the PoE. The worst case means to power the equipment under test was using the DC 9V – 56 V Power Adaptor using BLE (C) External which is how the unit was configured for all tests in this section.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10, clause 11.12.2.5.2.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. For EUT's with multiple connectors of the same type, additional interconnecting cables were connected, and pre-scans performed to determine whether the level of the emissions were increased by >2 dB.

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.

2.2.5 Example Test Setup Diagram

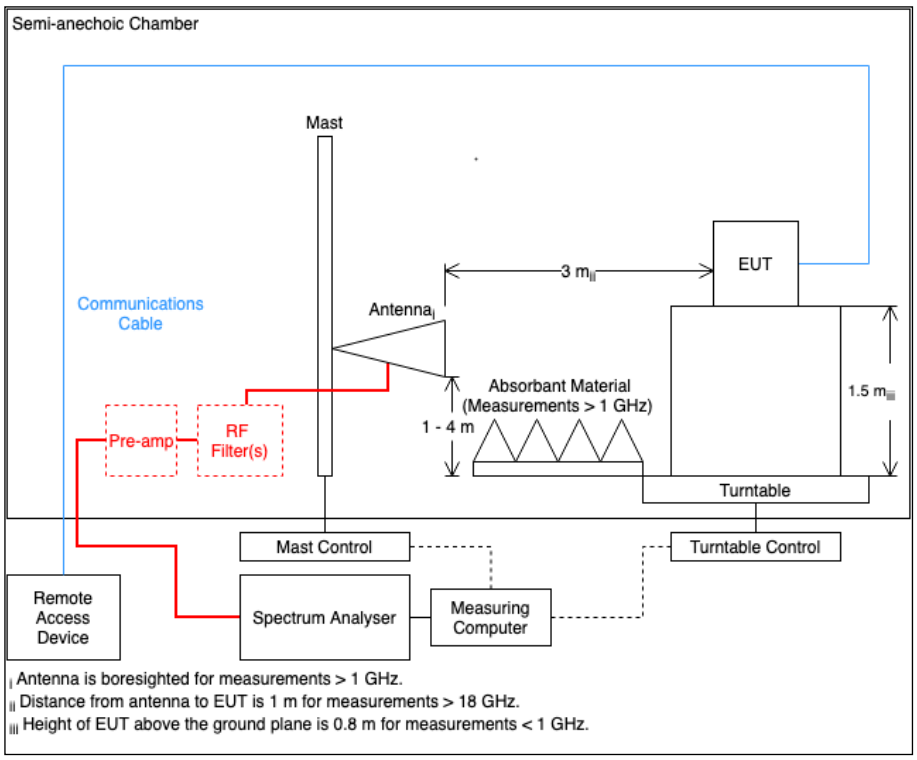

Figure 3

2.2.6 Environmental Conditions

Ambient Temperature	20.1 - 20.6 °C
Relative Humidity	32.1 - 38.6 %

2.2.7 Test Results

2.4 GHz Bluetooth Low Energy

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation
266.085	41.27	46.02	-4.75	Q-Peak	dBuV/m	285	100	Vertical

Table 20 - 2402 MHz (CH37), BLE, 30 MHz to 26 GHz

No other emissions found within 10 dB of the limit.

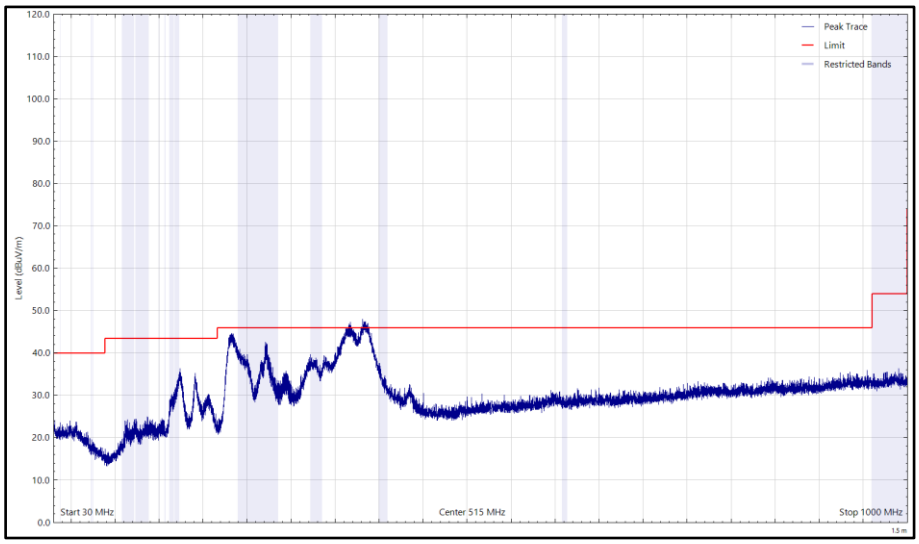

Figure 4 - 2402 MHz (CH37), BLE, 30 MHz to 1 GHz, Horizontal (Peak)

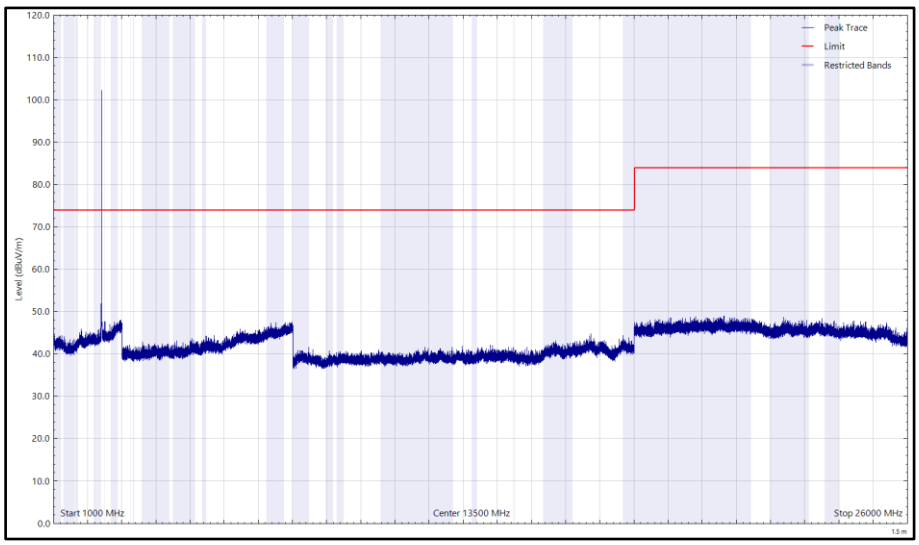

Figure 5 - 2402 MHz (CH37), BLE, 1 GHz to 26 GHz, Horizontal (Peak)

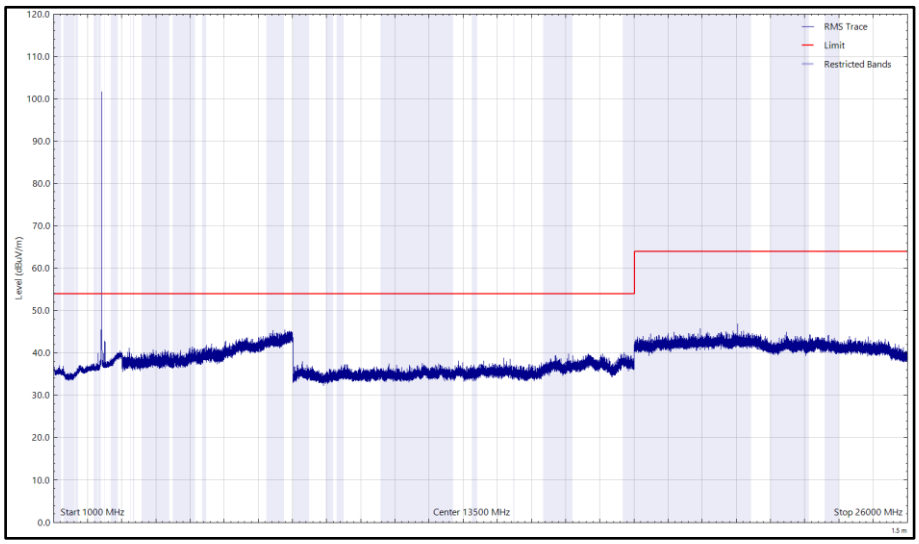

Figure 6 - 2402 MHz (CH37), BLE, 1 GHz to 26 GHz, Horizontal (rms)

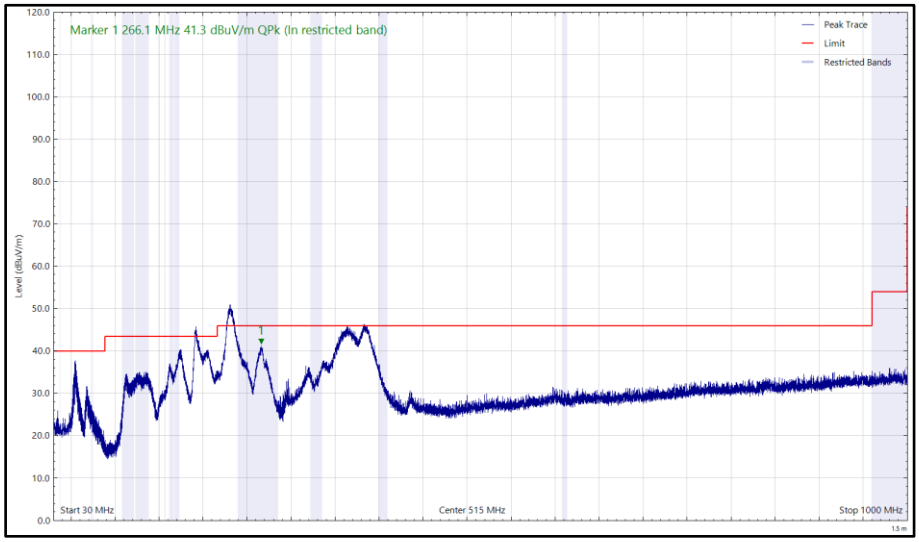

Figure 7 - 2402 MHz (CH37), BLE, 30 MHz to 1 GHz, Vertical (Peak)

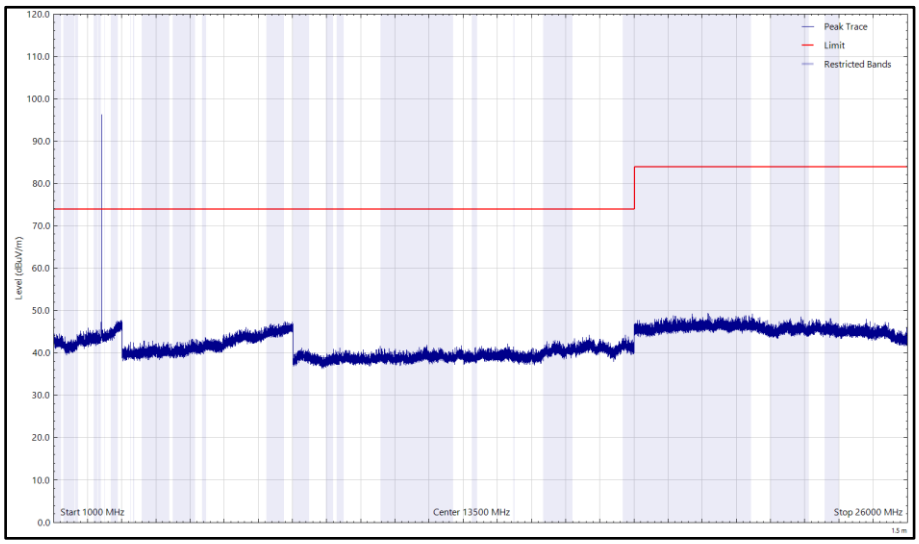

Figure 8 - 2402 MHz (CH37), BLE, 1 GHz to 26 GHz, Vertical (Peak)

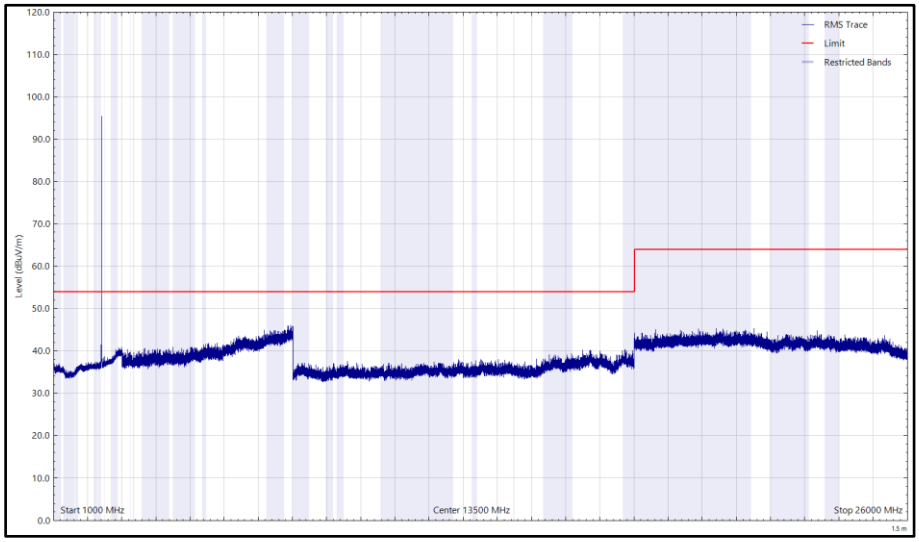

Figure 9 - 2402 MHz (CH37), BLE, 1 GHz to 26 GHz, Vertical (rms)

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation
*								

Table 21 - 2440 MHz (CH17), BLE, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

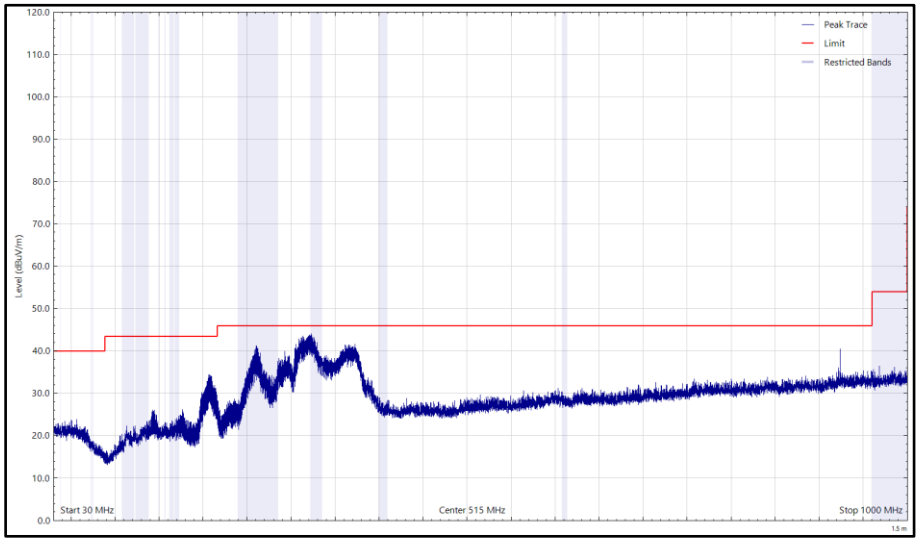

Figure 10 - 2440 MHz (CH17), BLE, 30 MHz to 1 GHz, Horizontal (Peak)

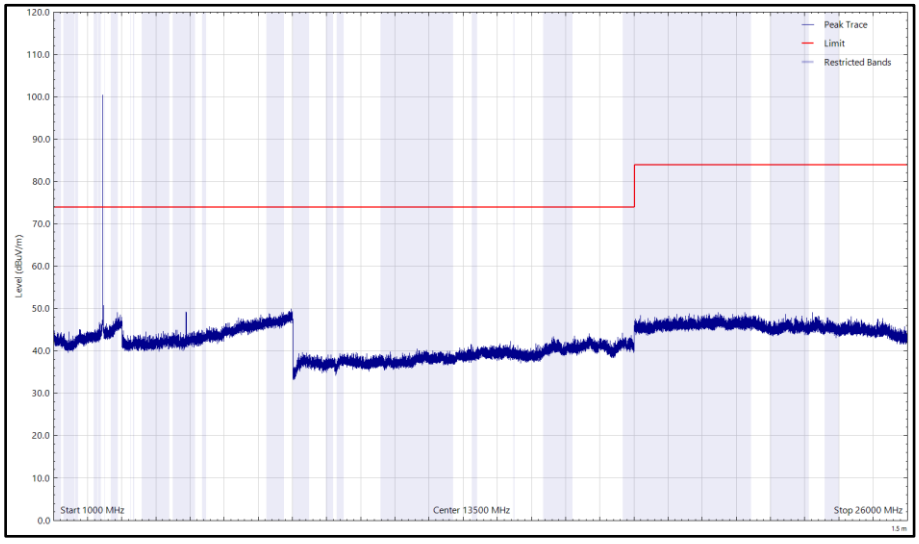

Figure 11 - 2440 MHz (CH17), BLE, 1 GHz to 26 GHz, Horizontal (Peak)

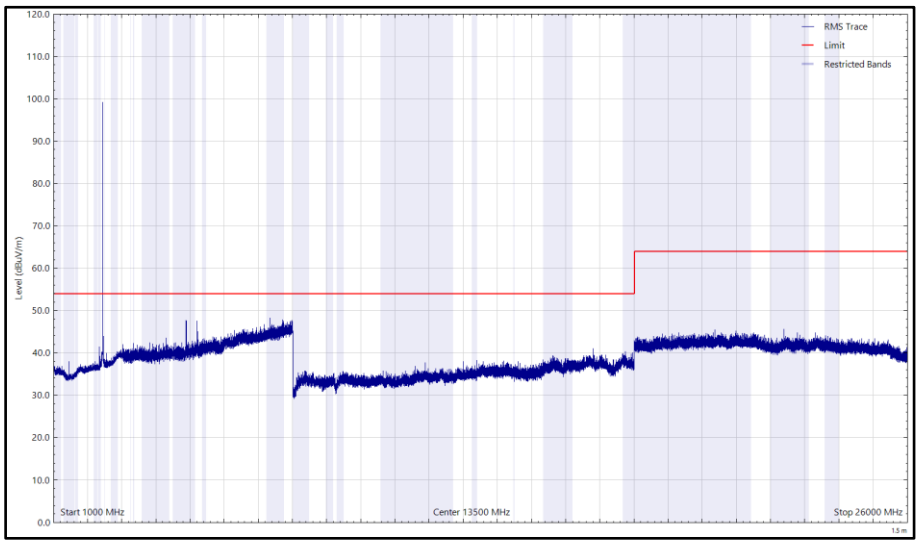

Figure 12 - 2440 MHz (CH17), BLE, 1 GHz to 26 GHz, Horizontal (rms)

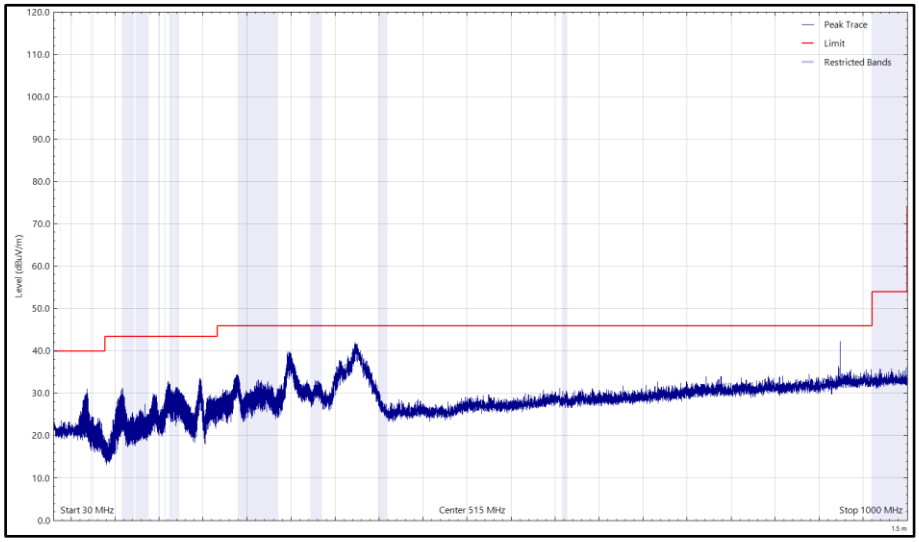

Figure 13 - 2440 MHz (CH17), BLE, 30 MHz to 1 GHz, Vertical (Peak)

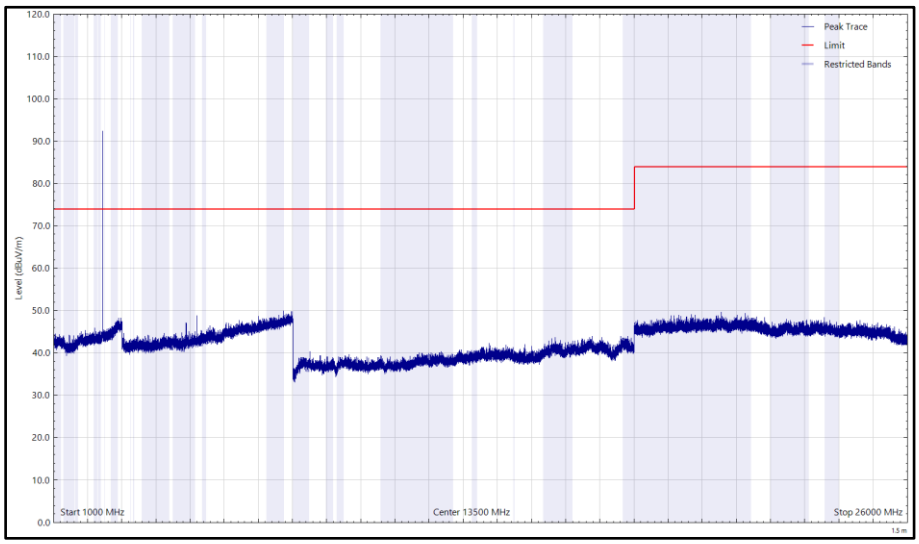

Figure 14 - 2440 MHz (CH17), BLE, 1 GHz to 26 GHz, Vertical (Peak)

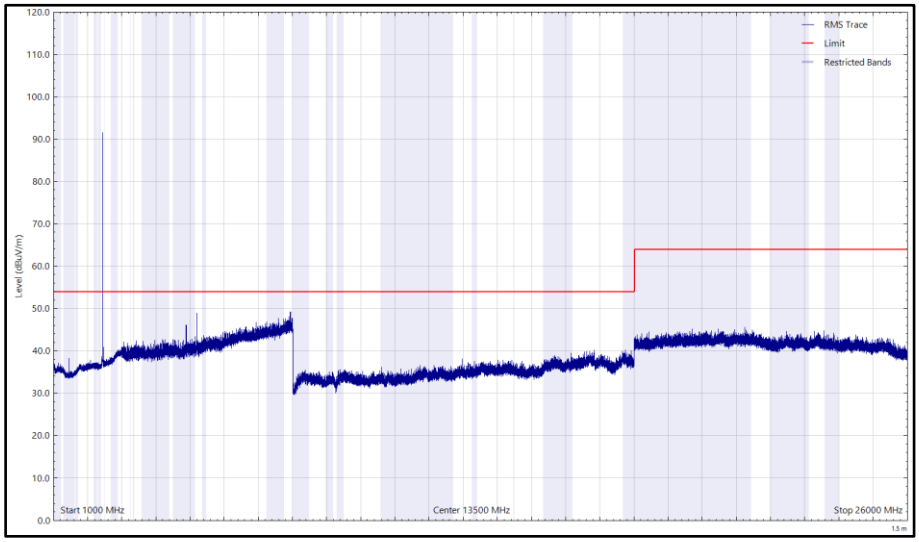

Figure 15 - 2440 MHz (CH17), BLE, 1 GHz to 26 GHz, Vertical (rms)

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation
*								

Table 22 - 2480 MHz (CH39), BLE, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

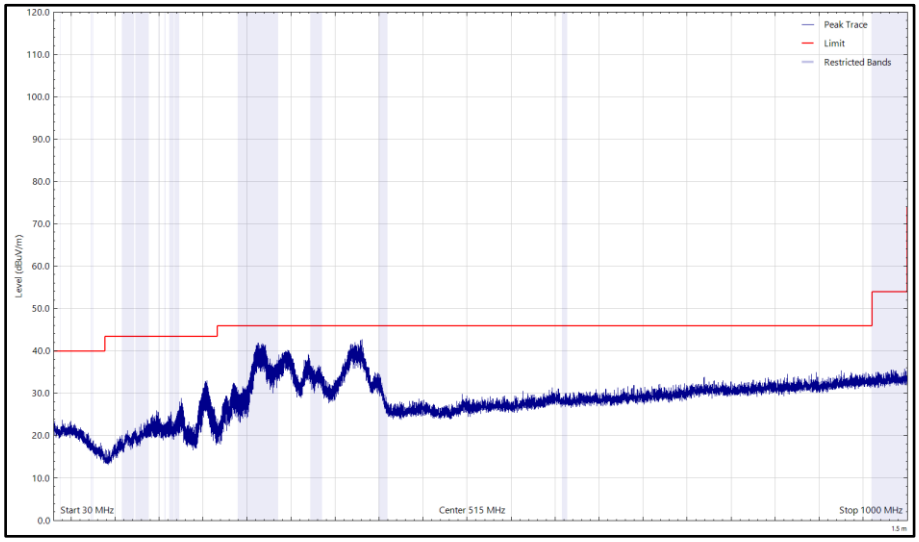

Figure 16 - 2480 MHz (CH39), BLE, 30 MHz to 1 GHz, Horizontal (Peak)

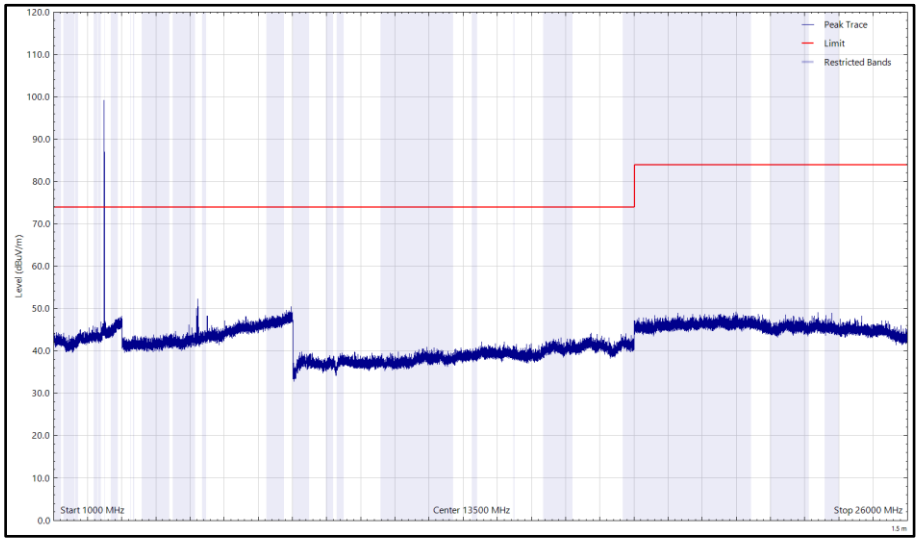

Figure 17 - 2480 MHz (CH39), BLE, 1 GHz to 26 GHz, Horizontal (Peak)

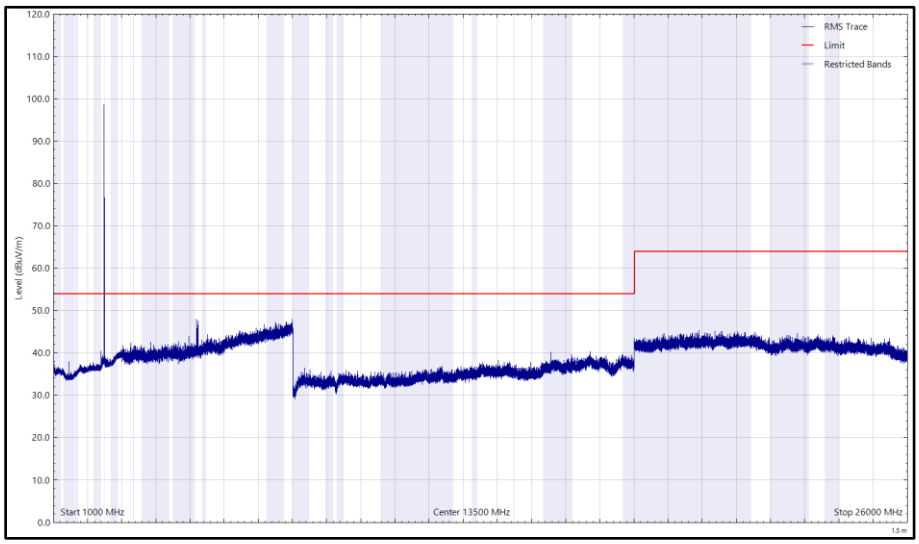

Figure 18 - 2480 MHz (CH39), BLE, 1 GHz to 26 GHz, Horizontal (rms)

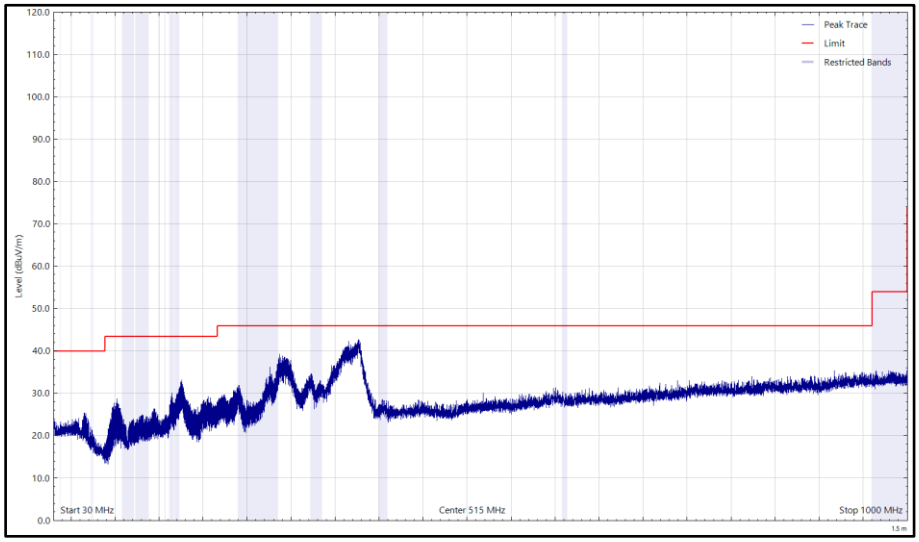

Figure 19 - 2480 MHz (CH39), BLE, 30 MHz to 1 GHz, Vertical (Peak)

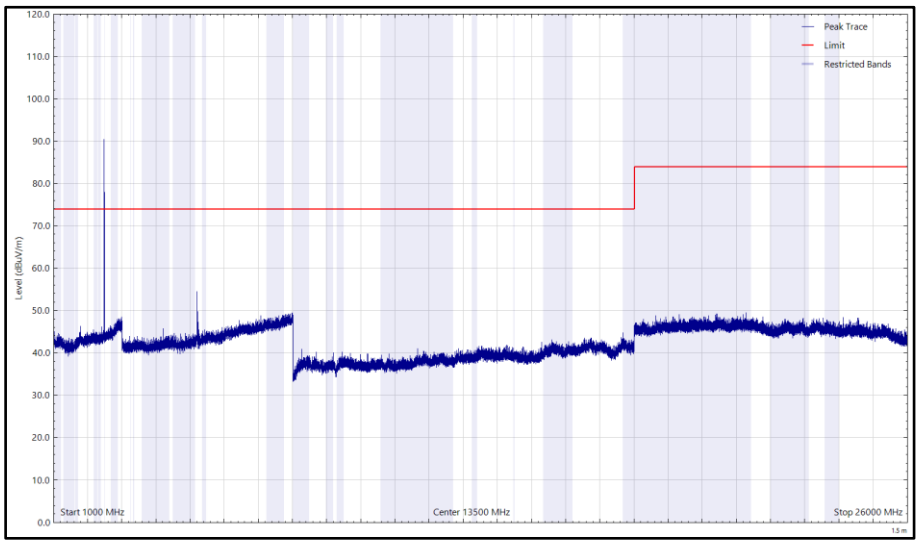

Figure 20 - 2480 MHz (CH39), BLE, 1 GHz to 26 GHz, Vertical (Peak)

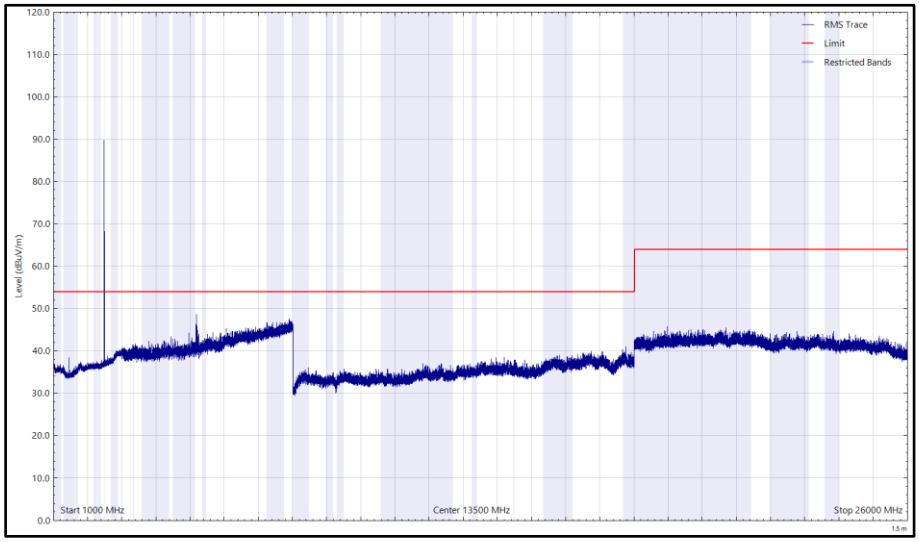

Figure 21 - 2480 MHz (CH39), BLE, 1 GHz to 26 GHz, Vertical (rms)

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.

2.2.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
True RMS Multimeter	Fluke	179	4007	12	18-Nov-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	24-Nov-2024
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Antenna (DRG 1-10.5GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	29-May-2023
Pre Amp 1 - 26.5 GHz	Agilent Technologies	8449B	5445	12	12-May-2023
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	20-Apr-2024
Cable (SMA to SMA 1m)	Junkosha	MWX221-01000AMSAMS/A	5513	12	14-Apr-2024
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	5522	12	14-Apr-2024
3 GHz High pass Filter	Wainwright	WHKX12-2580-3000-18000-80SS	5547	12	11-May-2023
7 GHz High pass Filter	Wainwright	WHKX12-5850-6800-18000-80SS	5550	12	19-May-2023
8 - 18 GHz Amplifier	Wright Technologies	APS06-0061	5595	12	25-Oct-2023
Cable (K Type 2m)	Junkosha	MWX241-02000KMSKMS/B	5936	12	14-May-2023
TRILOG Super Broadband Test Antenna	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Double Ridge Active Horn Antenna (18-40 GHz)	Com-Power	AHA-840	6189	24	02-Jun-2024
Attenuator 4dB	Pasternack	PE7074-4	6202	24	16-Jul-2024

Table 23

O/P Mon - Output Monitored using calibrated equipment
TU - Traceability Unscheduled

2.3 Emission Bandwidth

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

BVBFPOEUP, S/N: 95740613335981387 - Modification State 0

2.3.3 Date of Test

13-April-2023

2.3.4 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.

Unit was powered using a supplied PoE Injector.

2.3.5 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	41.9 %

2.3.6 Test Results

2.4 GHz Bluetooth Low Energy

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:	BLE GFSK (LE 1M)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (P7)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	0.728	-	-	-	≥500.0
2440	0.732	-	-	-	≥500.0
2480	0.716	-	-	-	≥500.0

Table 24 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.020	-	-	-	-
2440	1.024	-	-	-	-
2480	1.024	-	-	-	-

Table 25 - 99% Bandwidth Results

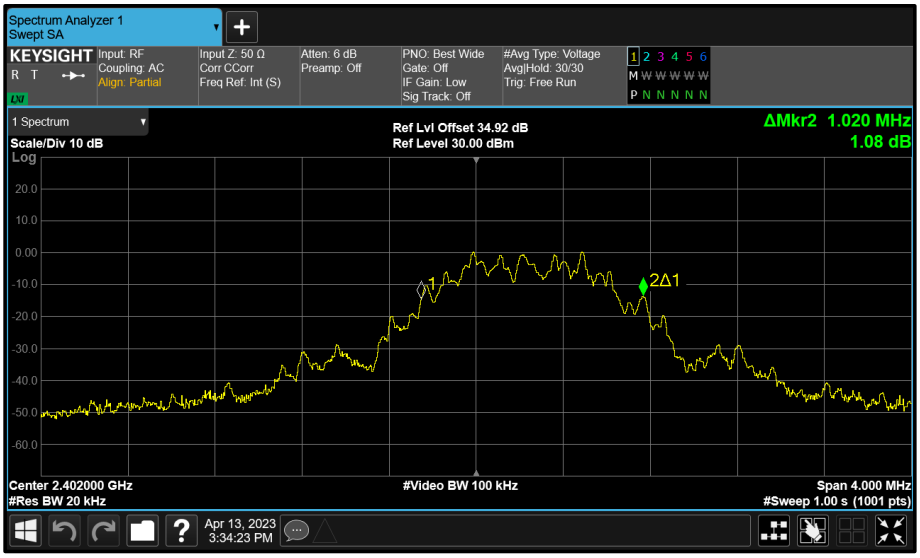

Figure 22 - P7 (A) 2402 MHz (CH37) 99% Bandwidth

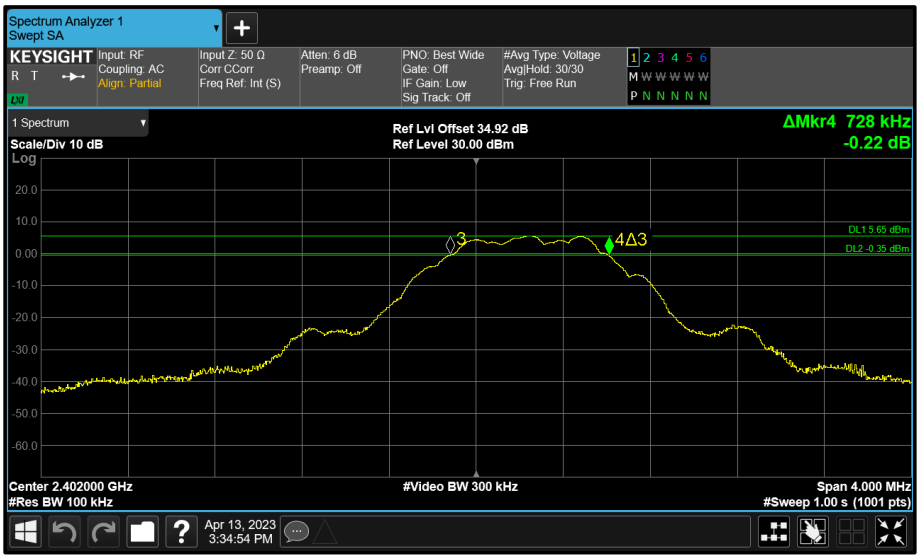

Figure 23 - P7 (A) 2402 MHz (CH37) 6 dB Bandwidth

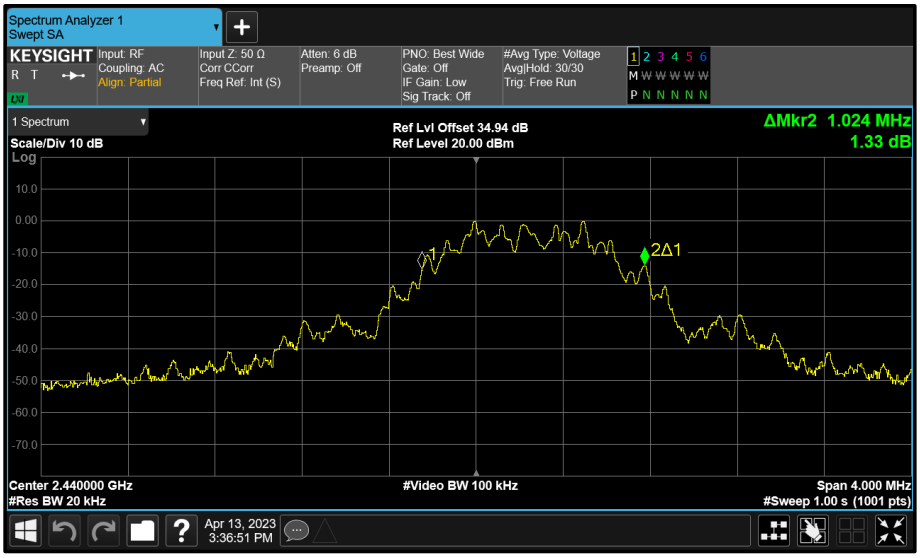

Figure 24 - P7 (A) 2440 MHz (CH17) 99% Bandwidth

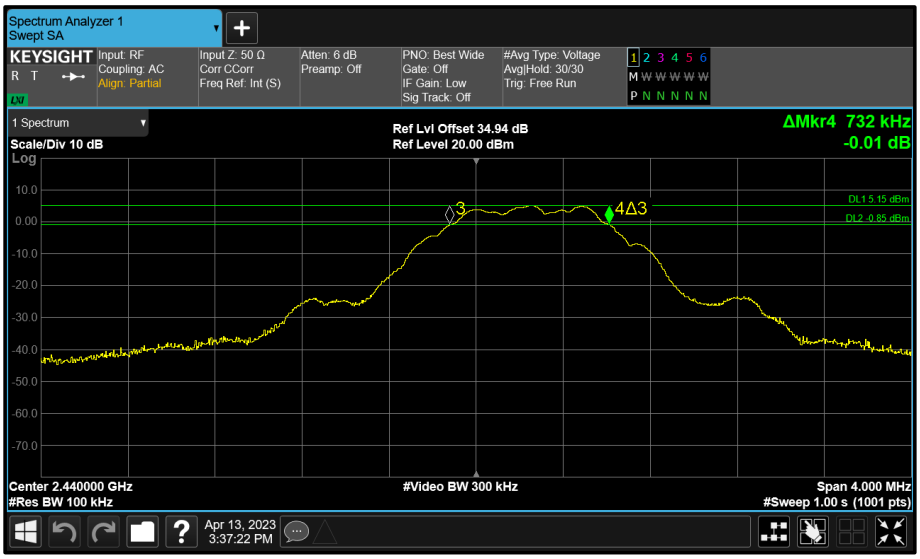

Figure 25 - P7 (A) 2440 MHz (CH17) 6 dB Bandwidth

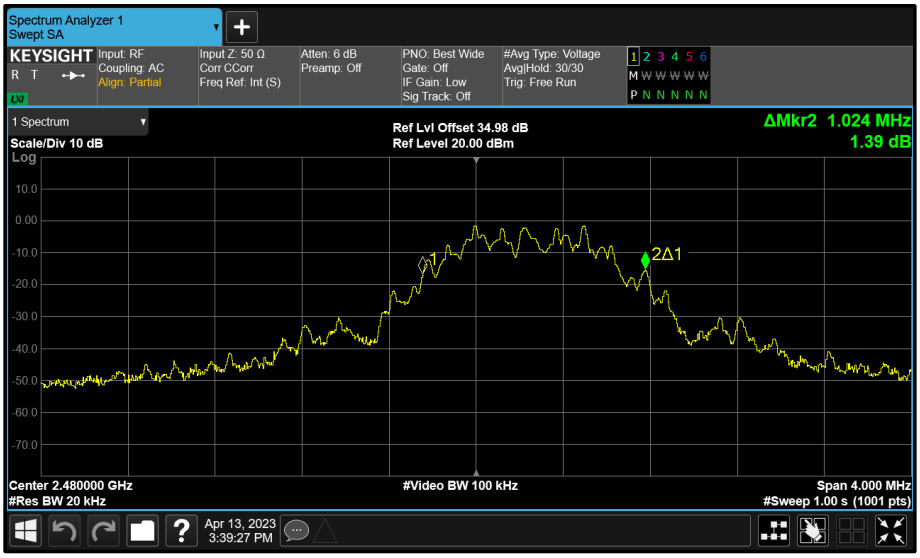

Figure 26 - P7 (A) 2480 MHz (CH39) 99% Bandwidth

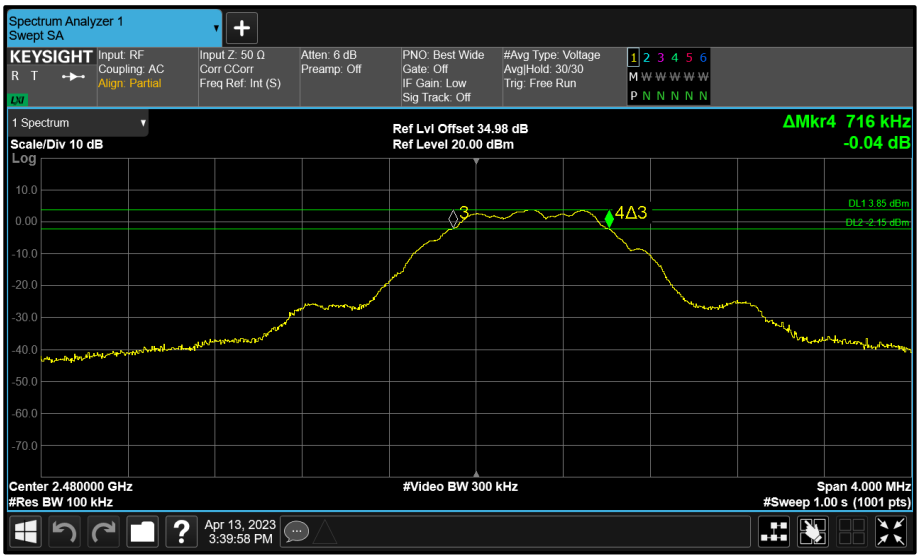

Figure 27 - P7 (A) 2480 MHz (CH39) 6 dB Bandwidth

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:	BLE GFSK (LE 1M)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (P8)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	-	0.716	-	-	≥500.0
2440	-	0.728	-	-	≥500.0
2480	-	0.736	-	-	≥500.0

Table 26 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	-	1.020	-	-	-
2440	-	1.024	-	-	-
2480	-	1.032	-	-	-

Table 27 - 99% Bandwidth Results

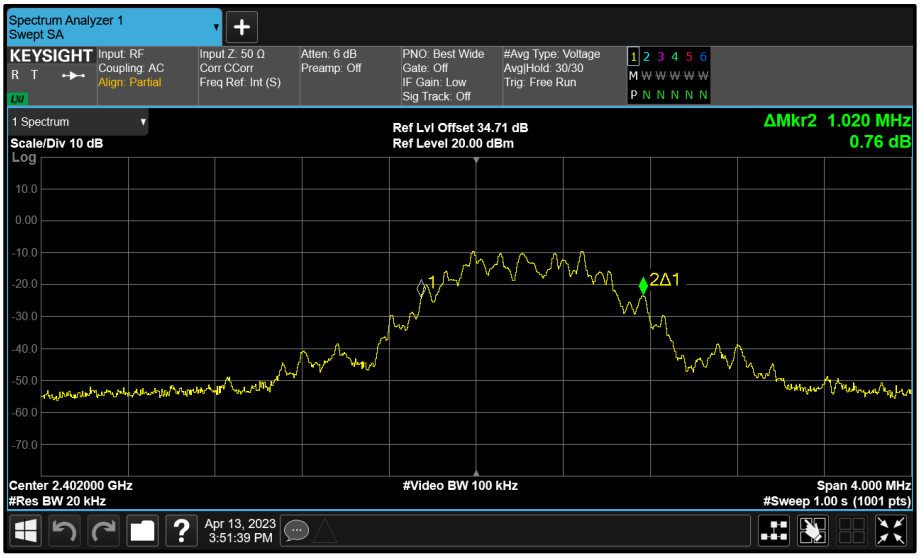

Figure 28 - P8 (B) 2402 MHz (CH37) 99% Bandwidth

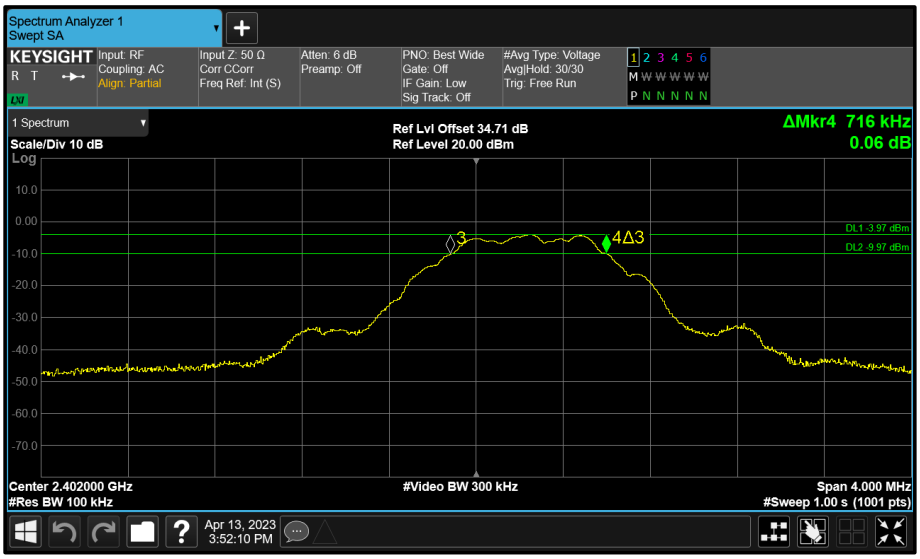

Figure 29 - P8 (B) 2402 MHz (CH37) 6 dB Bandwidth

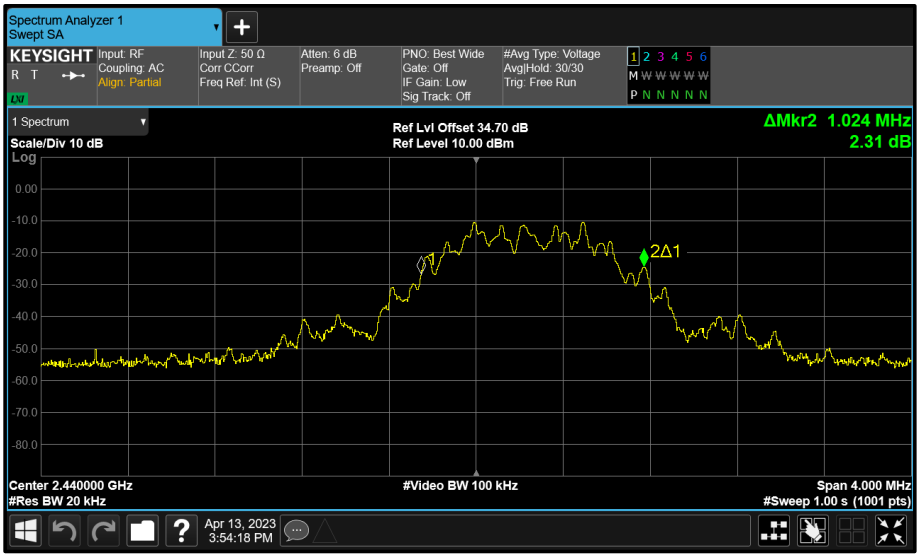

Figure 30 - P8 (B) 2440 MHz (CH17) 99% Bandwidth

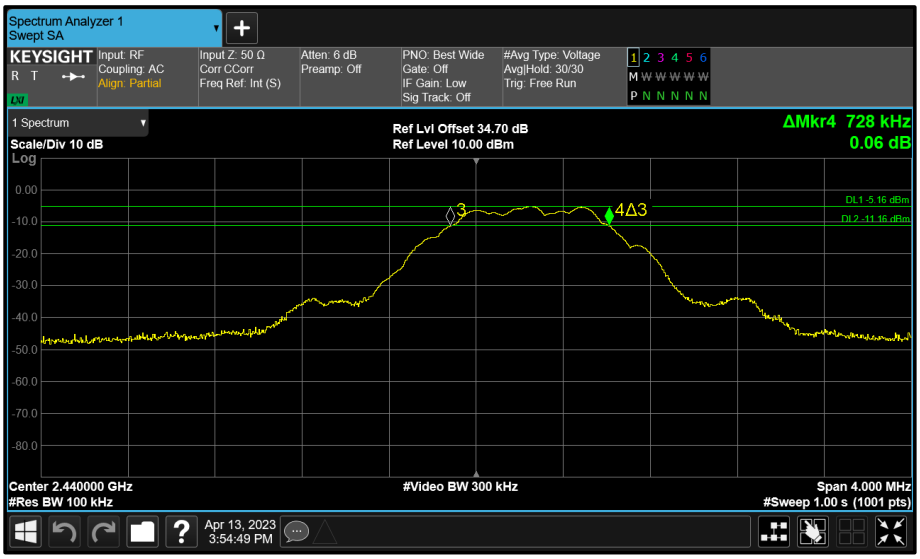

Figure 31 - P8 (B) 2440 MHz (CH17) 6 dB Bandwidth

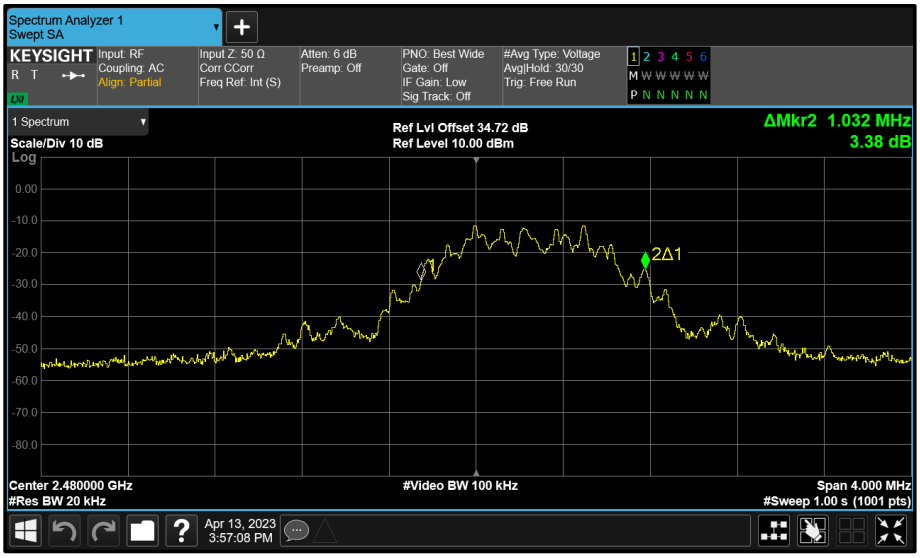

Figure 32 - P8 (B) 2480 MHz (CH39) 99% Bandwidth

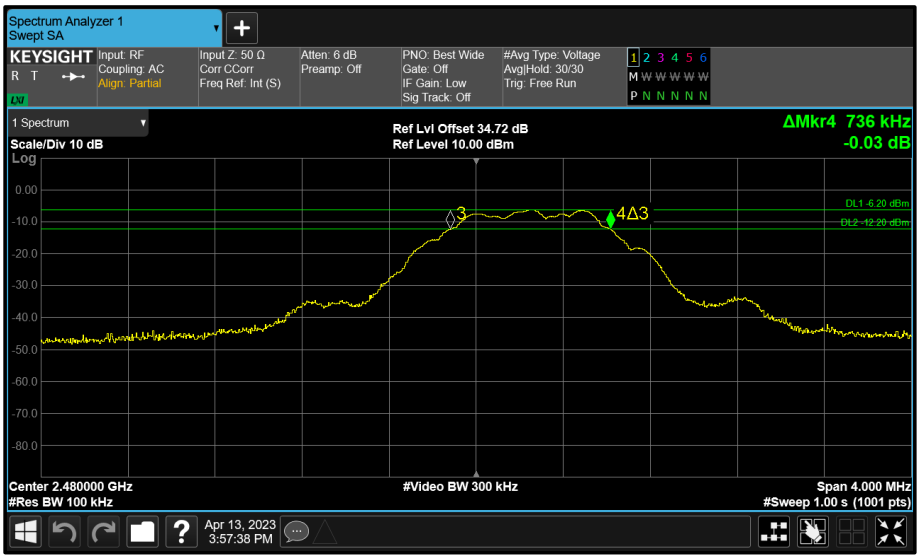

Figure 33 - P8 (B) 2480 MHz (CH39) 6 dB Bandwidth

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.

2.3.7 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
Hygrometer	Rotronic	I-1000	3220	12	15-Nov-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	21-Mar-2024
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	5759	12	05-Jul-2023

Table 28

2.4 Maximum Conducted Output Power

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

BVBFPOEUP, S/N: 95740613335981387 - Modification State 0

2.4.3 Date of Test

13-April-2023

2.4.4 Test Method

The test was performed in accordance with ANSI C63.10 clause 11.9.1.2 Method PKPM1.

Unit was powered using a supplied PoE Injector.

2.4.5 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	41.9 %

2.4.6 Test Results

2.4 GHz Bluetooth Low Energy

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 11.9.1.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	BLE GFSK (LE 1M)	Duty Cycle (%):	94.2
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (P7)	Peak Antenna Gain (dBi):	2.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	∑		
2402	5.44	-	-	-	-	30.00	-24.56
2440	4.91	-	-	-	-	30.00	-25.09
2480	3.47	-	-	-	-	30.00	-26.53

Table 29 - FCC Maximum Conducted (peak) 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	∑					
2402	5.44	-	-	-	-	30.00	-24.56	7.44	36.00	-28.56
2440	4.91	-	-	-	-	30.00	-25.09	6.91	36.00	-29.09
2480	3.47	-	-	-	-	30.00	-26.53	5.47	36.00	-30.53

Table 30 - ISED Maximum Conducted (peak) Output Power Results

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 11.9.1.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	BLE GFSK (LE 1M)	Duty Cycle (%):	94.1
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (P8)	Peak Antenna Gain (dBi):	10.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	∑		
2402	-	-3.94	-	-	-	30.00	-33.94
2440	-	-5.13	-	-	-	30.00	-35.13
2480	-	-6.07	-	-	-	30.00	-36.07

Table 31 - FCC Maximum Conducted (peak) 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	∑					
2402	-	-3.94	-	-	-	30.00	-33.94	6.06	36.00	-29.94
2440	-	-5.13	-	-	-	30.00	-35.13	4.87	36.00	-31.13
2480	-	-6.07	-	-	-	30.00	-36.07	3.93	36.00	-32.07

Table 32 - ISED Maximum Conducted (peak) 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 (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.

2.4.7 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
Hygrometer	Rotronic	I-1000	3220	12	15-Nov-2023
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	5759	12	05-Jul-2023
USB Power Sensor	Boonton	RTP5008	5830	12	07-Jul-2023
USB Power Sensor	Boonton	RTP5008	5832	12	07-Jul-2023

Table 33

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

BVBFPOEUP, S/N: 95740613335981387 - Modification State 0

2.5.3 Date of Test

23-April-2023

2.5.4 Test Method

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

The EUT was powered via its 9V – 56 V DC Adaptor on External Antenna BLE (C) which was identified as worst case during pre-compliance testing. See section 2.2.4 for details.

2.5.5 Environmental Conditions

Ambient Temperature	20.4 °C
Relative Humidity	35.1 %

2.5.6 Test Results

2.4 GHz Bluetooth Low Energy

Modulation	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	2402	2400	-51.53
GFSK	2480	2483.5	-53.80

Table 34

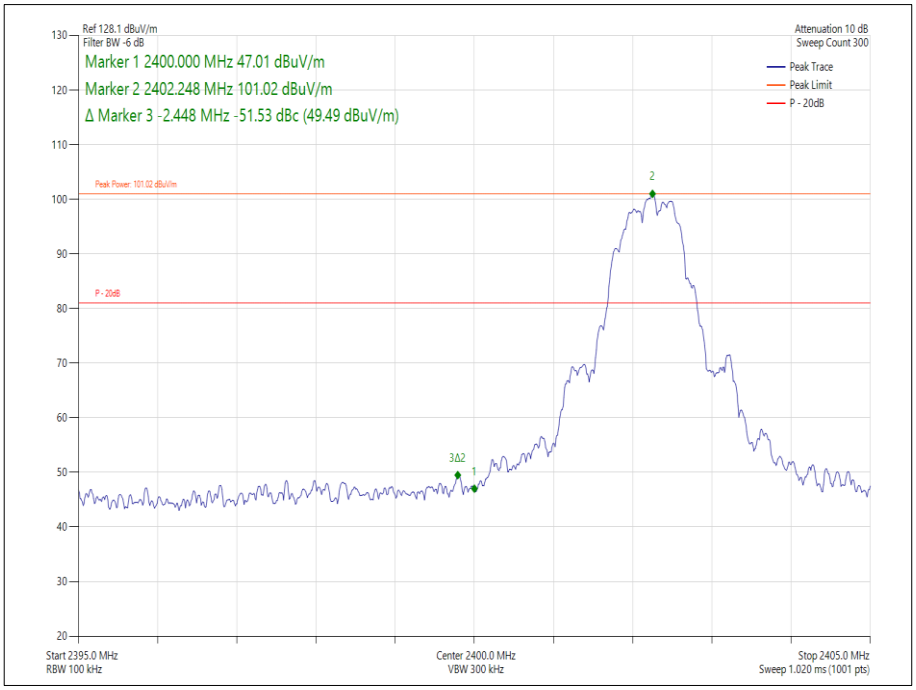

Figure 34 - GFSK, 2402 MHz - Band Edge Frequency 2400 MHz

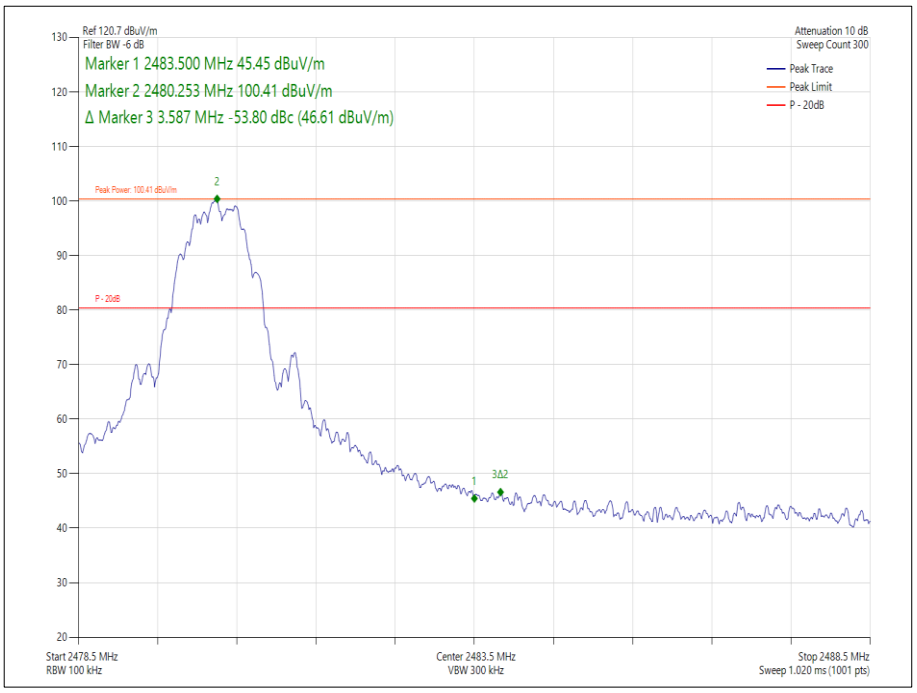

Figure 35 - GFSK, 2480 MHz - Band Edge Frequency 2483.5 MHz

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 RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
Hygrometer	Rotronic	A1	2138	12	28-Sep-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	24-Nov-2024
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Antenna (DRG 1-10.5GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
2.5m N(m)-SMA(m) Cable	Koaxis	AM12-KF141-NM20-2.50M-MK	5544	-	O/P Mon

Table 35

O/P Mon – Output Monitored using calibrated equipment
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

BVBFPOEUP, S/N: 95740613335981387 - Modification State 0

2.6.3 Date of Test

13-April-2023

2.6.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.5.

Where the EUT duty cycle was < 98 % and repeatable within 2 %, the spectrum analyser was set to trace (power) averaging and a duty cycle correction was added as calculated in the result tables below (Method AVGPSD-2).

Unit was powered using a supplied PoE Injector.

2.6.5 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	41.9 %

2.6.6 Test Results

2.4 GHz Bluetooth Low Energy

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 11.10.5
Additional Reference(s):	-		
Note(s):	DCCF was added to the spectrum analyser reference level offset.		

DUT Configuration			
Mode:	BLE GFSK (LE 1M)	Duty Cycle (%):	94.2
Antenna Configuration:	SISO	DCCF (dB):	0.26
Active Port(s):	A (P7)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	RBW (kHz)	PSD (dBm/RBW)					Limit (dBm/3 kHz)	Margin (dB)
		A	B	C	D	∑		
2402	3.0	-1.43	-	-	-	-	8.00	-9.43
2440	3.0	-2.65	-	-	-	-	8.00	-10.65
2480	3.0	-3.53	-	-	-	-	8.00	-11.53

Table 36 - Maximum Power Spectral Density Results

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 11.10.5
Additional Reference(s):	-		
Note(s):	DCCF was added to the spectrum analyser reference level offset.		

DUT Configuration			
Mode:	BLE GFSK (LE 1M)	Duty Cycle (%):	94.1
Antenna Configuration:	SISO	DCCF (dB):	0.26
Active Port(s):	B (P8)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	RBW (kHz)	PSD (dBm/RBW)					Limit (dBm/3 kHz)	Margin (dB)
		A	B	C	D	∑		
2402	3.0	-	-11.47	-	-	-	8.00	-19.47
2440	3.0	-	-12.90	-	-	-	8.00	-20.90
2480	3.0	-	-13.32	-	-	-	8.00	-21.32

Table 37 - 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
Hygrometer	Rotronic	I-1000	3220	12	15-Nov-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	21-Mar-2024
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	5759	12	05-Jul-2023

Table 38

3 Photographs

3.1 Test Setup Photographs

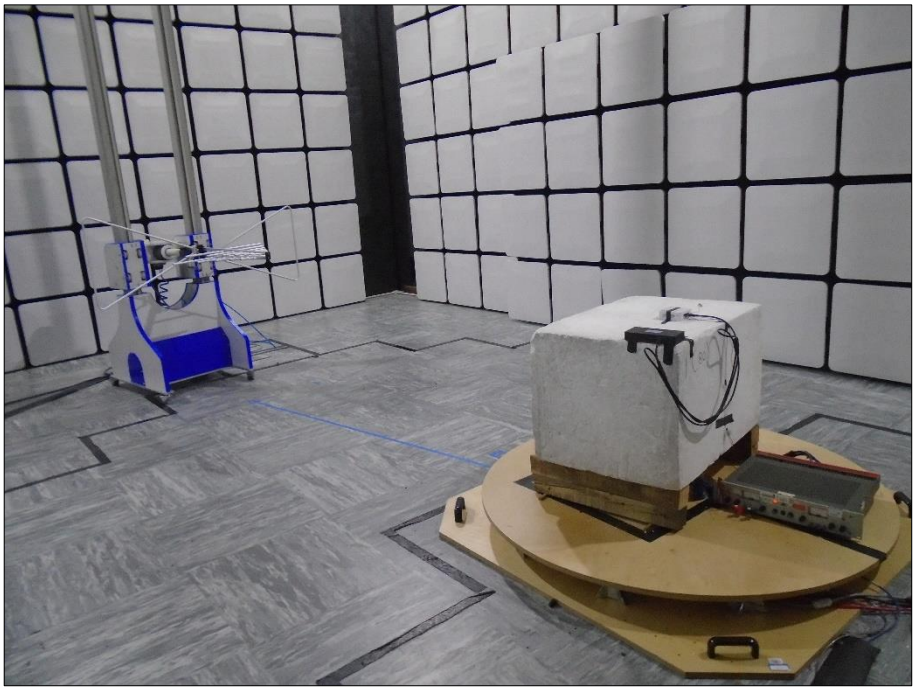

Figure 36 - Test Setup - 30 MHz to 1 GHz

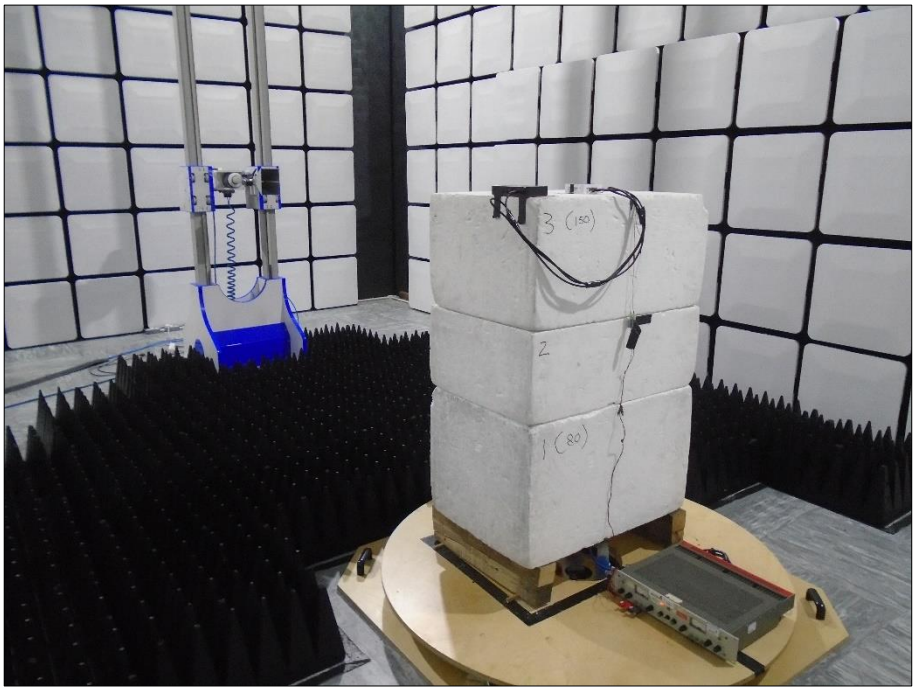

Figure 37 - Test Setup - 1 GHz to 8 GHz

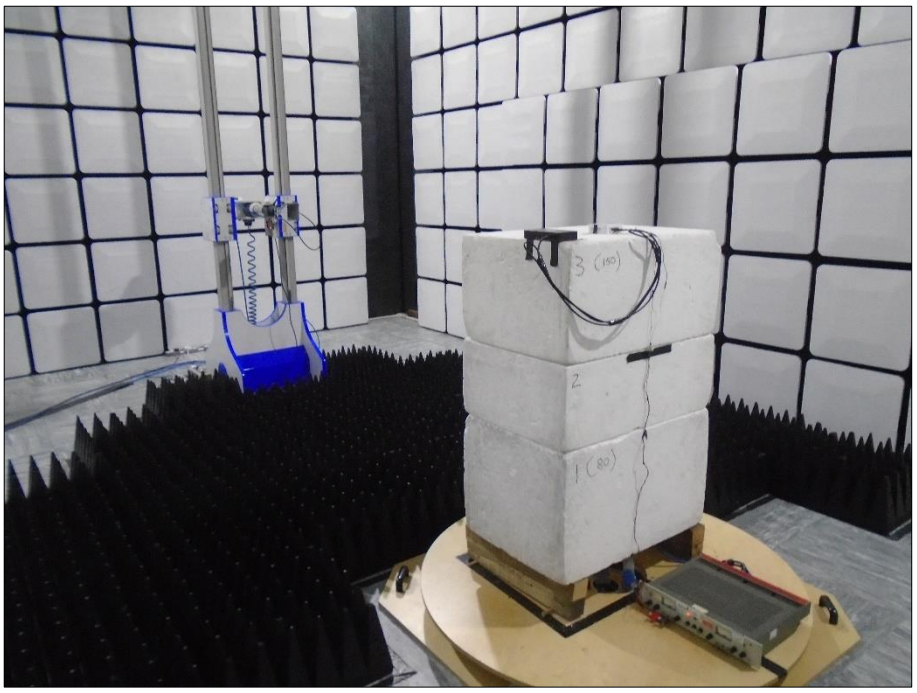

Figure 38 - Test Setup - 8 GHz to 18 GHz

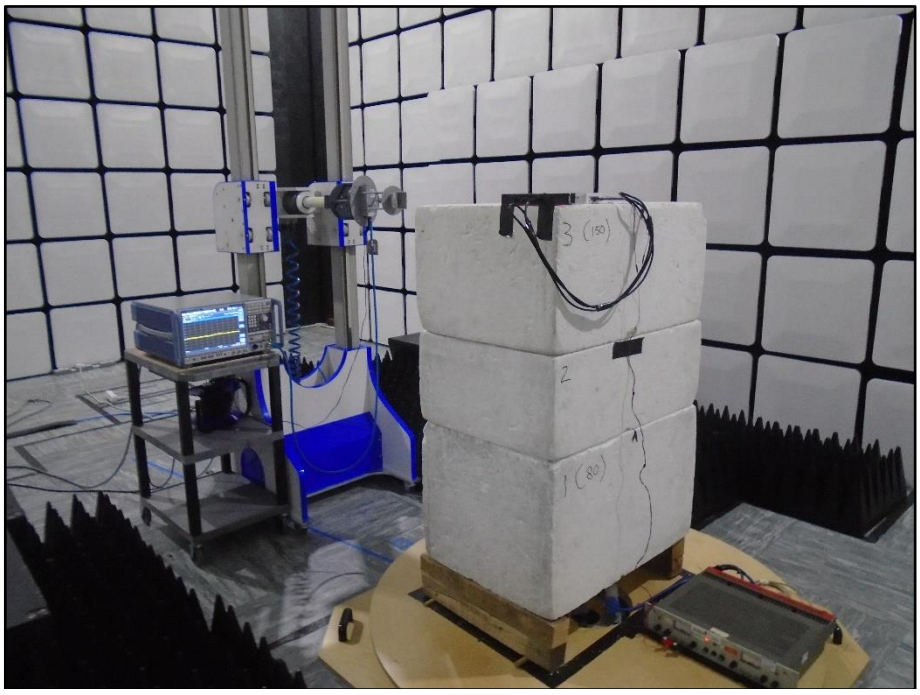

Figure 39 - Test Setup - 18 GHz to 26 GHz

4 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
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Emission Bandwidth	± 25.35 kHz
Maximum Conducted Output Power	± 1.38 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Power Spectral Density	± 1.49 dB

Table 39

Measurement Uncertainty Decision Rule – Accuracy Method

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (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.