FCC and ISED Test Report

Manufacturer: GRUNDFOS Holding A/S
MSR Module, Model: MSR2G42026

In accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN

(2.4 GHz Bluetooth Low Energy and IEEE 802.15.4)

TUV SUD Digitally signed by TUV SUD Date: 2026.07.27 11:36:42 +01'00'

Prepared for: GRUNDFOS Holding A/S
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FCC ID: OG3-MSR2G42026 IC: 10447A-MSR2G42026

COMMERCIAL-IN-CONFIDENCE

Document 75966363-02 Issue 04

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	27 July 2026

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

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Wenceslao Acosta Carrazco	27 July 2026	
	Ahmad Javid	27 July 2026	
	Joshua Peploe-Williams	27 July 2026	

FCC Accreditation: 492497/UK2010 Octagon House, Fareham Test Laboratory
ISED Accreditation: 12669A/UK0003 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY / ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on the test pages A sample of this product was tested to demonstrate limited compliance with FCC 47 CFR Part 15C 2024, ISED RSS-247: Issue 4 (2025-07), and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) for the tests detailed in section 1.3. The sample tested was found to comply with the requirements defined in the applied rules.

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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
01	First version	10-Apr-2026
02	Corrected antenna gain typo in Table 12 from .3 to 2.3	06-May-2026
03	Typographical correction of 802.15.4 conducted measurements bottom freq from 2402 to 2405 MHz	26-May-2026
04	Removing Test Setup Photos due to confidentiality	27-Jul-2026

Table 1

1.2 Introduction

Applicant	GRUNDFOS Holding A/S
Manufacturer	GRUNDFOS Holding A/S
Product Marketing Name (PMN) or Host Marketing Name (HMN)	MSR2G42026
Hardware Version Identification Number (HVIN): (Formally Model Number)	93560613
Serial Number(s)	2755 #4 and 2755 #5
Firmware Version Identification Number (FVIN)	MSRModule_CC2755Rx_V09.20.00.xxxx
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C, 2024 ISED RSS-247 Issue 4 (2025-07) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Order Number	6000035747
Date	21-November-2025
Date of Receipt of EUT	08-December-2025
Start of Test	15-December-2025
Finish of Test	23-December-2025
Name of Engineer(s)	Wenceslao Acosta Carrazco, Ahmad Javid and Joshua Peploe
Related Document(s)	ANSI C63.10-2020 +Cor.1-2023+C63.10a-2024

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and 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	N/A	N/A	Antenna Requirement	N/T	The device complies with the provisions of this section as it uses an integral antenna
2.1	15.205,	2.4	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.2	15.247 (d)	6.6	N/A	Authorised Band Edges	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.3	15.247 (d) and 15.209	2.4 and 6.6	6.13 and 8.9	Spurious Radiated Emissions	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.4	15.247 (a)(2)	6.3.1	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.5	15.247 (b)	6.3.2	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.6	15.247 (e)	6.3.1	6.12	Power Spectral Density	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
Configuration and Mode: IEEE 802.15.4						
2.1	15.205,	2.4	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024

2.2	15.247 (d)	6.6	N/A	Authorised Band Edges	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.3	15.247 (d) and 15.209	2.4 and 6.6	6.13 and 8.9	Spurious Radiated Emissions	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.4	15.247 (a)(2)	6.3.1	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.5	15.247 (b)	6.3.2	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024
2.6	15.247 (e)	6.3.1	6.12	Power Spectral Density	Pass	ANSI C63.10 (2020) +Cor.1-2023+C63.10a-2024

Table 2

1.4 Customer Supplied Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	The MSR module gives the opportunity for different types of wireless connectivity, including BLE running at 1 and 2Mbps, and 802.15.4 protocol using Thread or GLoWPAN.		
Manufacturer:	Grundfos Holding A/S		
Product Marketing Name (PMN) or Host Marketing Name (HMN): (If Applicable; HMN is applicable for devices integrating pre-approved modules, otherwise use PMN)	MSR2G42026		
Hardware Version Identification Number (HVIN): (Formally Model Number)	93560613		
Firmware Version Identification Number (FVIN)	MSRModule_CC2755Rx_V09.20.00.xxxx		
Hardware Version:	R01		
Software Version:	simplelink_lowpower_f3_sdk_9.20.00.xxxx		
For definitions of the above terms refer to RSS-GEN Section 9.			
FCC ID of the product under test – see guidance here		OG3-MSR2G42026	
IC ID of the product under test – see guidance here		10447A-MSR2G42026	
Device Category	Mobile ☐	Portable ☐	Fixed ☒
Equipment is fitted with an Audio Low Pass Filter		Yes ☐	No ☒

Table 3

Intentional Radiators

Technology	BLE	802.15.4			
Frequency Range (MHz to MHz)	2400 - 2483,5	2400 -2483,5			
Conducted Declared Output Power (dBm)	7.0	7.0 Top Channel -4 dBm			
Antenna Gain (dBi)	2,3	2.3			
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	1 2	2			
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	GFSK,	O-QPSK			
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	2M1FD	2M32GXW			
Bottom Frequency (MHz)	2402	2405			
Middle Frequency (MHz)	2440	2440			
Top Frequency (MHz)	2480	2480			

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	48 MHz
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:	NA	Hz
Voltage		V
Max current:		A
Single Phase ☐ Three Phase ☒		

Table 6

DC Power Source

Nominal voltage:	3.3	V
Extreme upper voltage:	3.6	V
Extreme lower voltage:	3.0	V
Max current:	0.03	A

Table 7

Battery Power Source

Voltage:	NA	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)	0.25	dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☒			State impedance	50	Ohm
Integral antenna ☒	Type:	PCBA Trace Antenna	Gain	2.3	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 ☐ 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: Jianyang Liu
Position held: Sr. Digital Compliance Specialist
Date: 27/11/2026

1.5 Product Information

1.5.1 Technical Description

The MSR module gives the opportunity for different types of wireless connectivity, including BLE running at 1 and 2Mbps, and 802.15.4 protocol using Thread or GLoWPAN.

1.5.2 Test Modes

The EUT was powered at 3.3V by a customer supplied carrying board which required a 5V input.

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
MSR2026, Model: MSR2G42026, Serial Number: 2755 #4			
0	As supplied by the customer	Not Applicable	Not Applicable
MSR2026, Model: MSR2G42026, Serial Number: 2755 #5			
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	Wenceslao Acosta Carrazco	UKAS
Authorised Band Edges	Wenceslao Acosta Carrazco	UKAS
Spurious Radiated Emissions	Ahmad Javid	UKAS
Emission Bandwidth	Joshua Peploe-Williams	UKAS
Maximum Conducted Output Power	Joshua Peploe-Williams	UKAS
Power Spectral Density	Joshua Peploe-Williams	UKAS
Configuration and Mode: IEEE 802.15.4		
Restricted Band Edges	Ahmad Javid	UKAS
Emission Bandwidth	Joshua Peploe-Williams	UKAS
Maximum Conducted Output Power	Joshua Peploe-Williams	UKAS
Authorised Band Edges	Ahmad Javid	UKAS
Power Spectral Density	Joshua Peploe-Williams	UKAS
Spurious Radiated Emissions	Ahmad Javid	UKAS

Table 15

Laboratory 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 2.4
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

MSR2G42026, S/N: 2755 #5 - Modification State 0

2.1.3 Date of Test

15-December-2025 to 18-December-2025

2.1.4 Test Method

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

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).

The EUT was powered as per 1.5.2.

For Bluetooth Low energy, EUT was tested with 1M on the advertising channels and 2M on the innermost channel, since the EUT does not support 2M on advertising channels.

2.1.5 Environmental Conditions

Ambient Temperature	20.1 - 21.6 °C
Relative Humidity	40.1 - 53.1 %

2.1.6 Test Results

2.4 GHz Bluetooth Low Energy

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
DTS	1M	2402	2390	55.32	42.88
DTS	1M	2480	2483.5	59.47	46.89
DTS	2M	2404	2390	55.38	42.93
DTS	2M	2478	2483.5	56.82	45.36

Table 16 - Restricted Band Edge Frequency Results

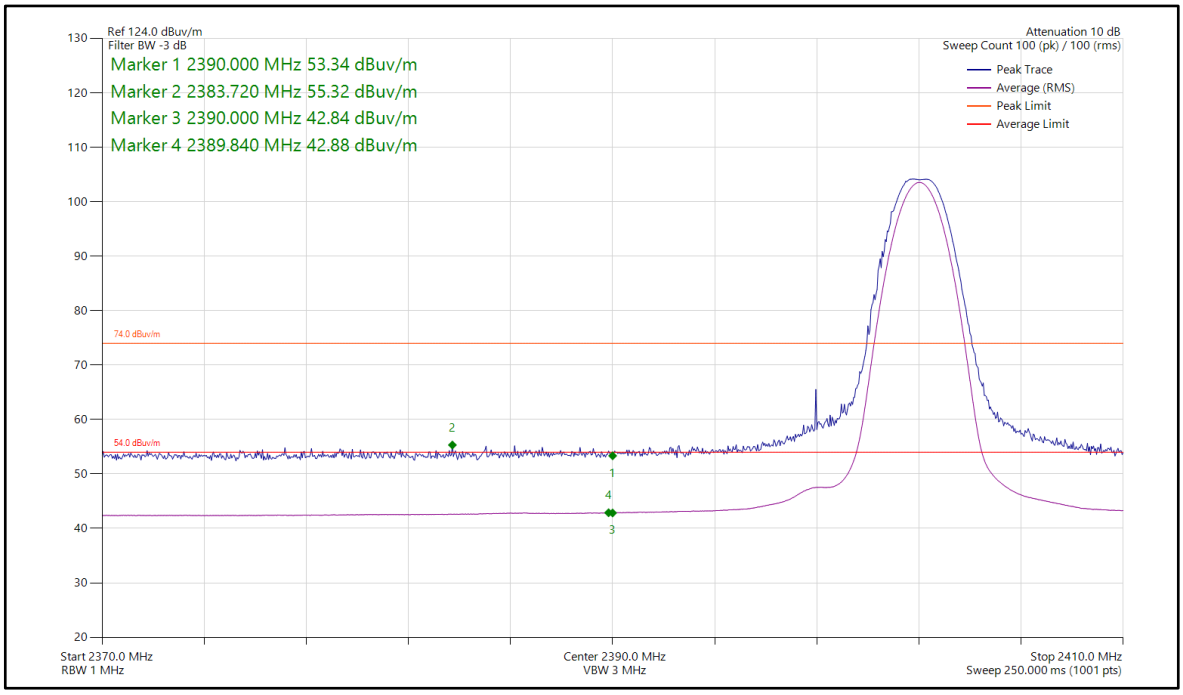

Figure 1 - BOT_BW_1_RBE, 2402 MHz, Band Edge Frequency 2390 MHz

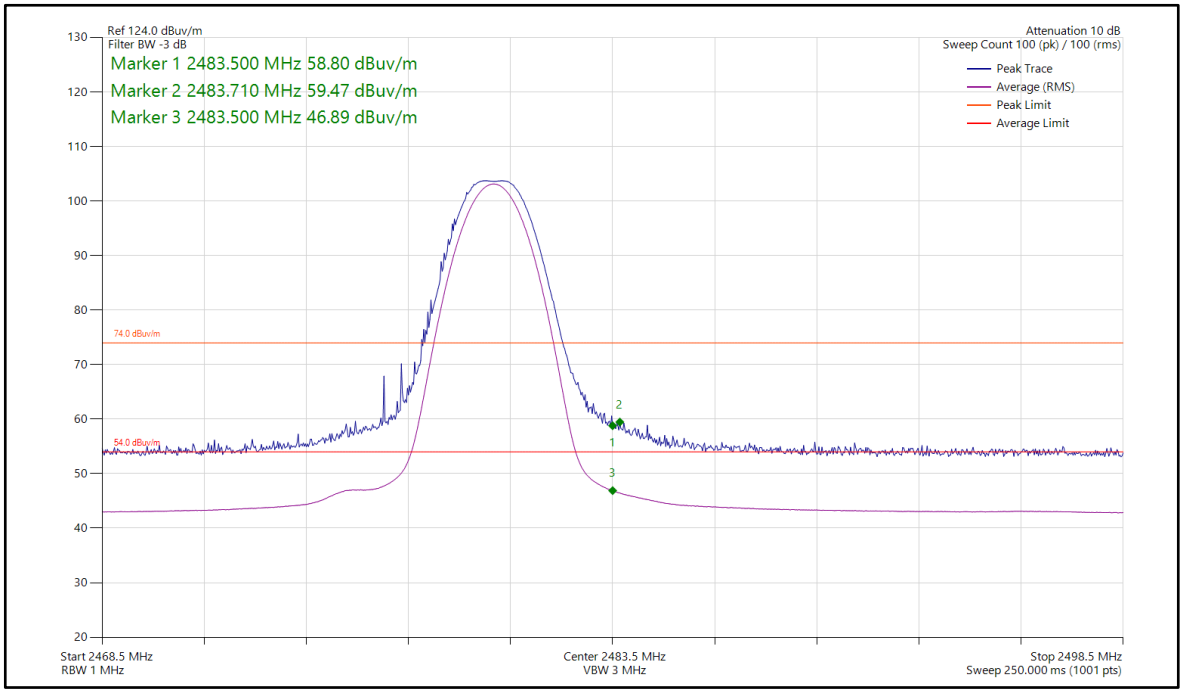

Figure 2 - TOP_BW_1_RBE, 2480 MHz, Band Edge Frequency 2483.5 MHz

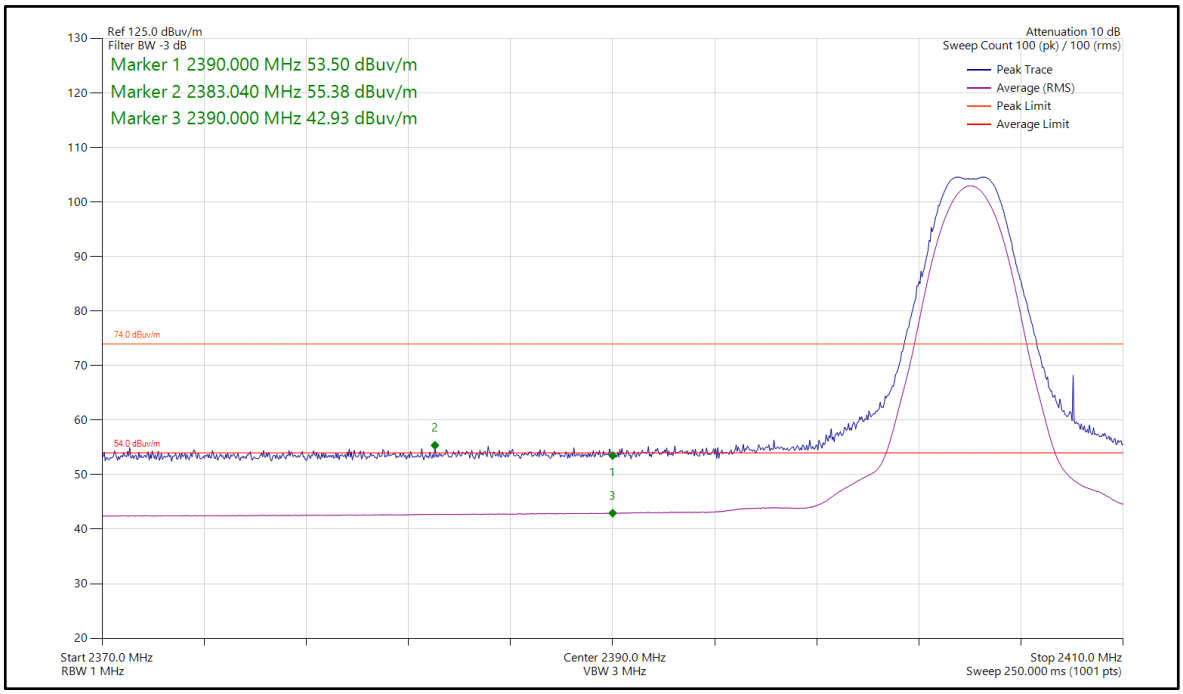

Figure 3 - BOT_BW_2_RBE, 2404 MHz, Band Edge Frequency 2390 MHz

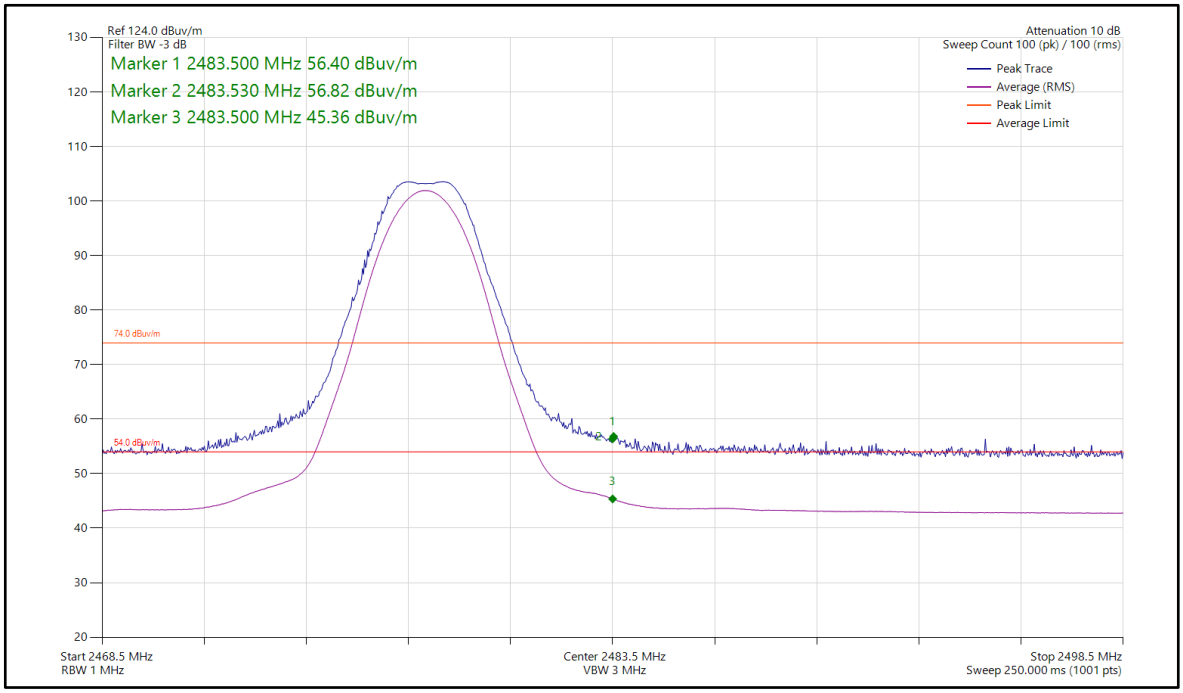

Figure 4 - TOP_BW_2_RBE, 2478 MHz, Band Edge Frequency 2483.5 MHz

IEEE 802.15.4

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
DTS	2405	2390	53.88	43.67
DTS	2475	2483.5	54.61	44.92
DTS	2480	2483.5	60.09	53.33

Table 17

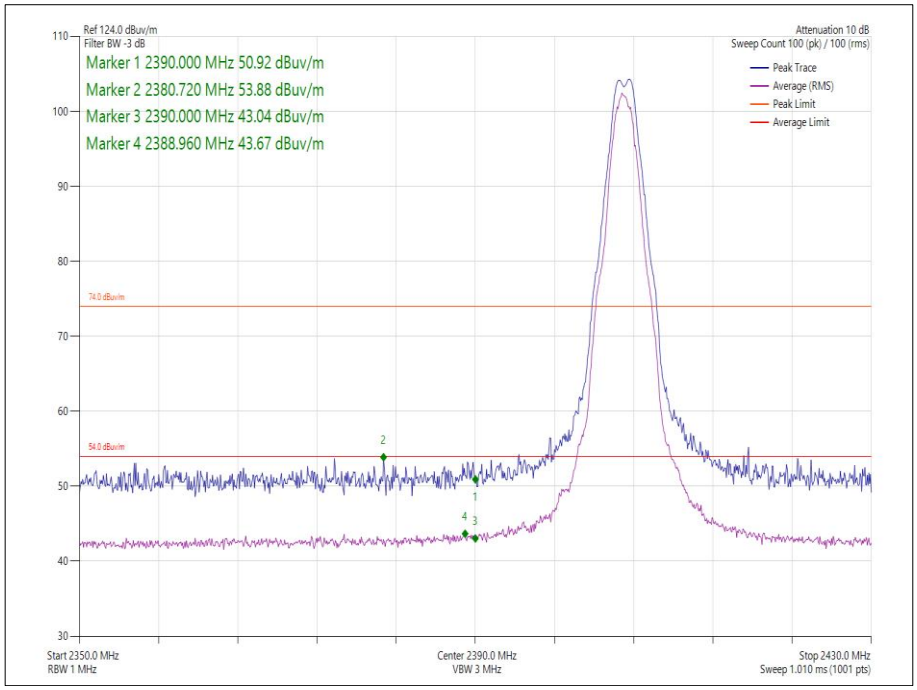

Figure 5 - 2405 MHz - Band Edge Frequency 2390 MHz

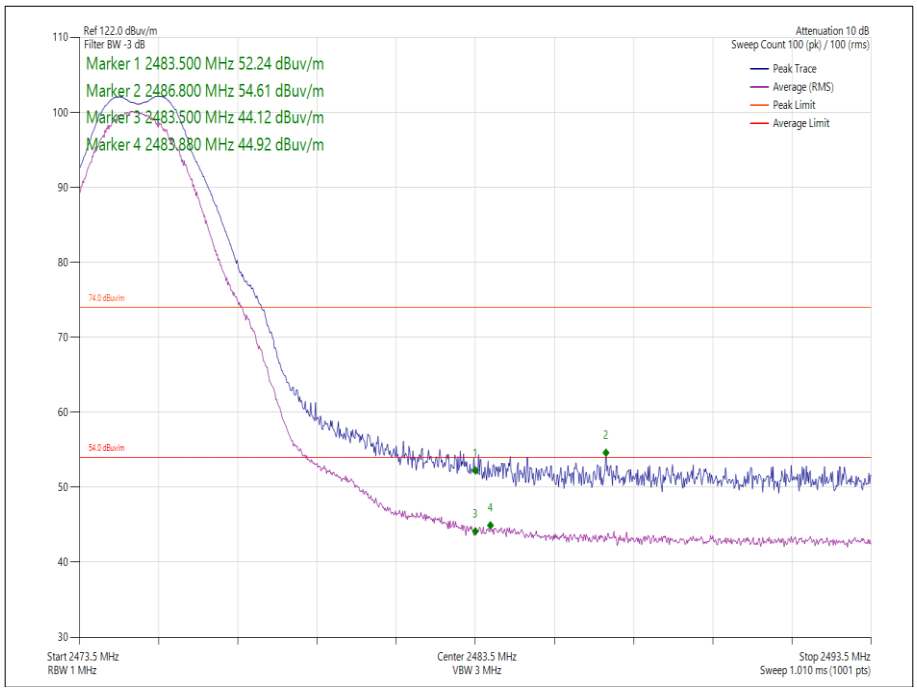

Figure 6 - 2475 MHz - Band Edge Frequency 2483.5 MHz

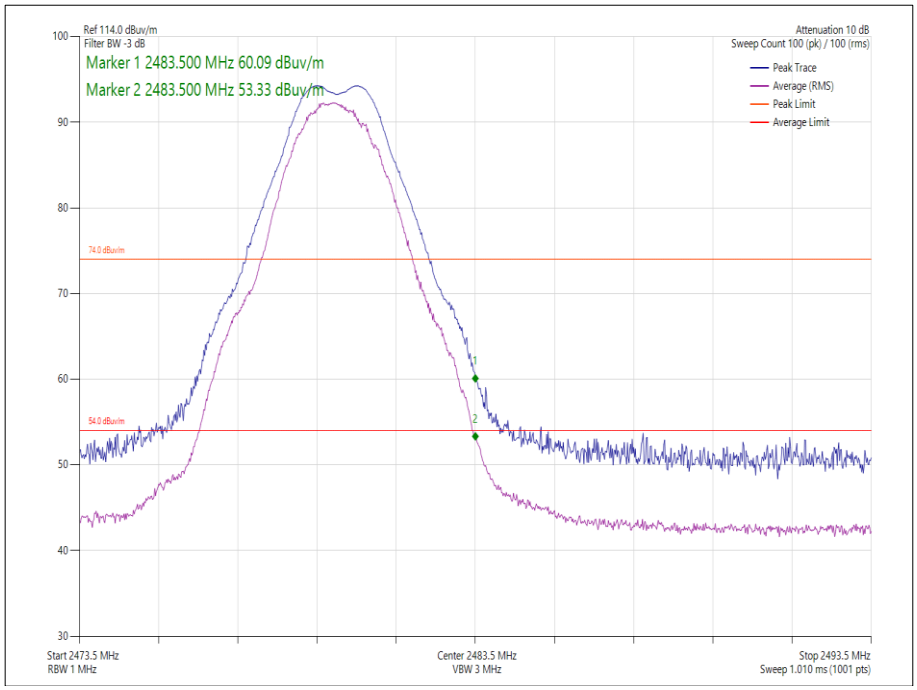

Figure 7 - 2480 MHz - Band Edge Frequency 2483.5 MHz

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 18

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 19

*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 and EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	79 Series III	411	12	09-Jan-2026
3m Semi-Anechoic Chamber	Rainford	RF Chamber 5	1545	36	23-Apr-2027
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Supply Unit	Farnell	TSV-70	2043	12	O/P Mon
Hygromer	Rotronic	I-1000	2784	12	04-Nov-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Hygrometer	Rotronic	HP21	4741	12	29-May-2026
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	4848	12	05-Jul-2026
Emissions Software	TUV SUD	EmX V3.6	5125	-	Software
3m Semi-Anechoic Chamber	Rainford	RF Chamber 11	5136	36	14-Nov-2027
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 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	05-Jul-2026
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5517	12	06-Jun-2026
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	14-Aug-2026
Power Supply	TTI	EX355R	5573	-	TU
Test Receiver	Rohde & Schwarz	ESW44	5802	12	05-Nov-2026
Cable (K-Type to K-Type, 2 m)	Junkosha	MWX241-02000KMSKMS/B	5934	12	12-Jun-2026
2m Coaxial Cable Assy	Junkosha	MWX221-02000AMSAMS/A	6360	12	13-May-2026
Cable Assy 8m (N to N) 18GHz	Junkosha	MWX221-08000NMSNMS/B	7049	12	01-Jun-2026
Cable Assy 8m (N to N) 18GHz	Junkosha	MWX221-08000NMSNMS/B	7050	12	03-Oct-2026

Table 20

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

2.2 Authorised Band Edges

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
ISED RSS-247, Clause 6.6

2.2.2 Equipment Under Test and Modification State

MSR2G42026, S/N: 2755 #5 - Modification State 0

2.2.3 Date of Test

15-December-2025 to 18-December-2025

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.
EUT was powered with 5 VDC for the duration of the measurement.

For Bluetooth Low energy, EUT was tested with 1M on the advertising channels and 2M on the innermost channel, since the EUT does not support 2M on advertising channels.

The EUT was powered as per 1.5.2.

2.2.5 Environmental Conditions

Ambient Temperature	20.1 - 20.9 °C
Relative Humidity	40.1 - 53.1 %

2.2.6 Test Results

2.4 GHz Bluetooth Low Energy

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
DTS	1M	2402	2400.0	-47.13
DTS	2M	2404	2400.0	-51.27

Table 21 - Authorized Band Edge Results

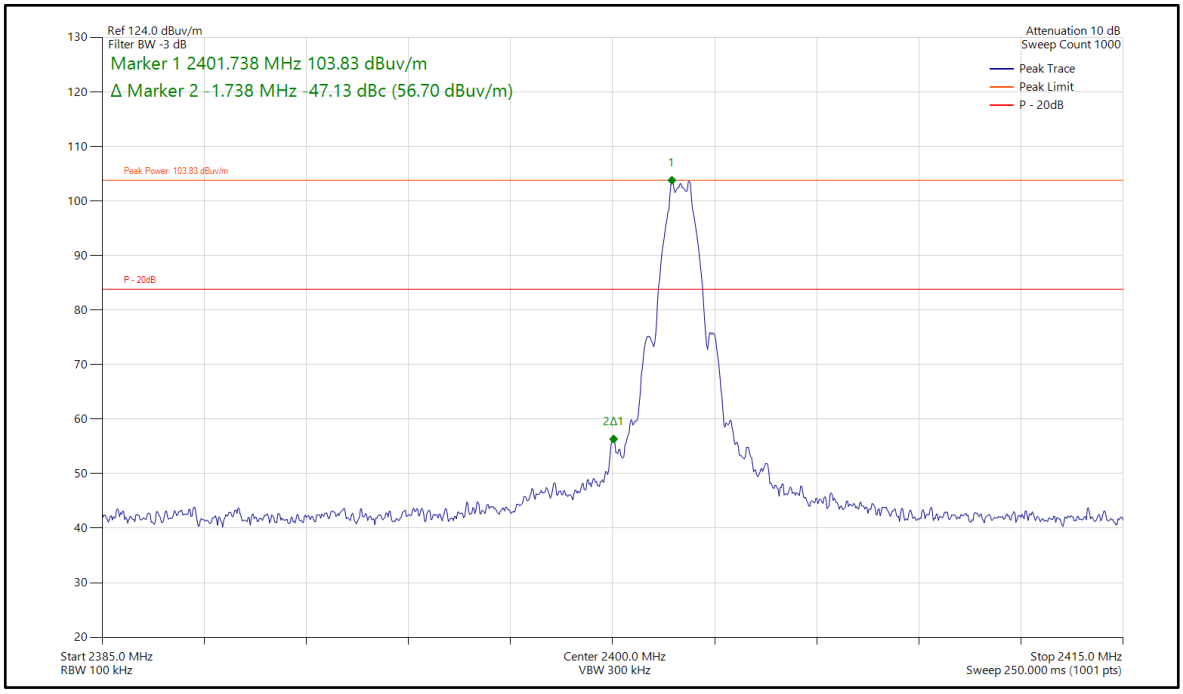

Figure 8 - BOT_BW_1_ABE, 2402 MHz, Band Edge Frequency 2400 MHz

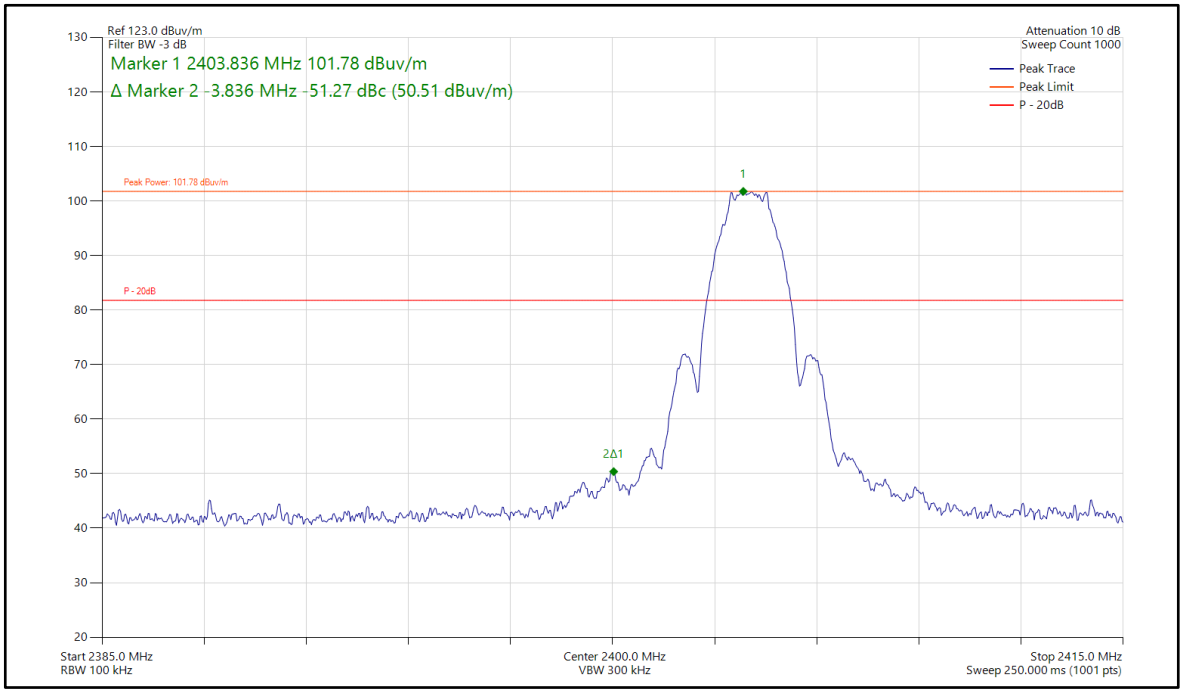

Figure 9 - BOT_BW_2_ABE, 2404 MHz, Band Edge Frequency 2400 MHz

IEEE 802.15.4

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
DTS	2405	2400	-49.81
DTS	2475	2483.5	-52.83
DTS	2480	2483.5	-43.01

Table 22

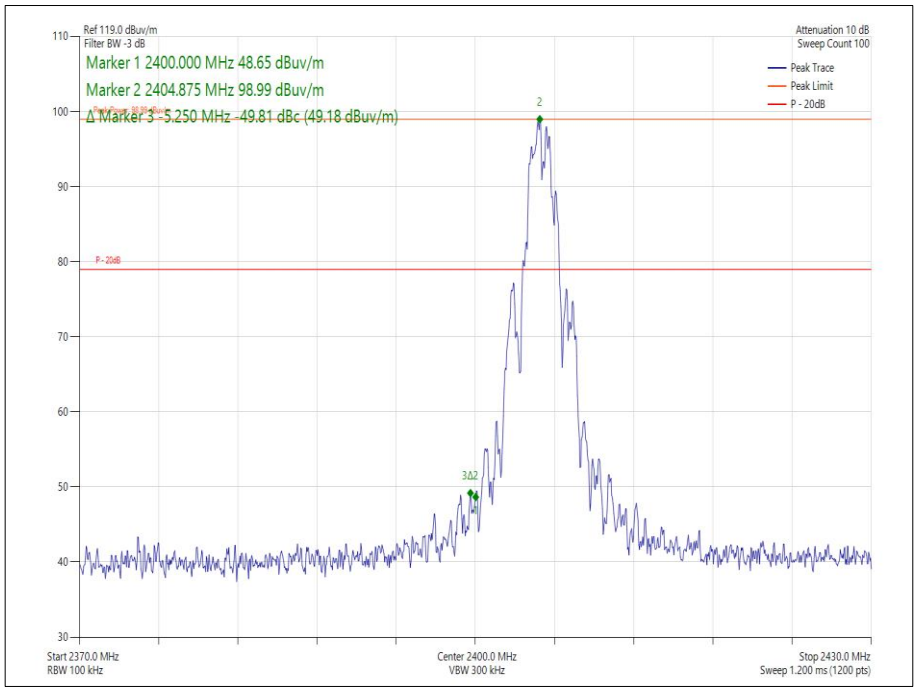

Figure 10 - Static, 2405 MHz - Band Edge Frequency 2400 MHz

Figure 11 - Static, 2475 MHz - Band Edge Frequency 2483.5 MHz

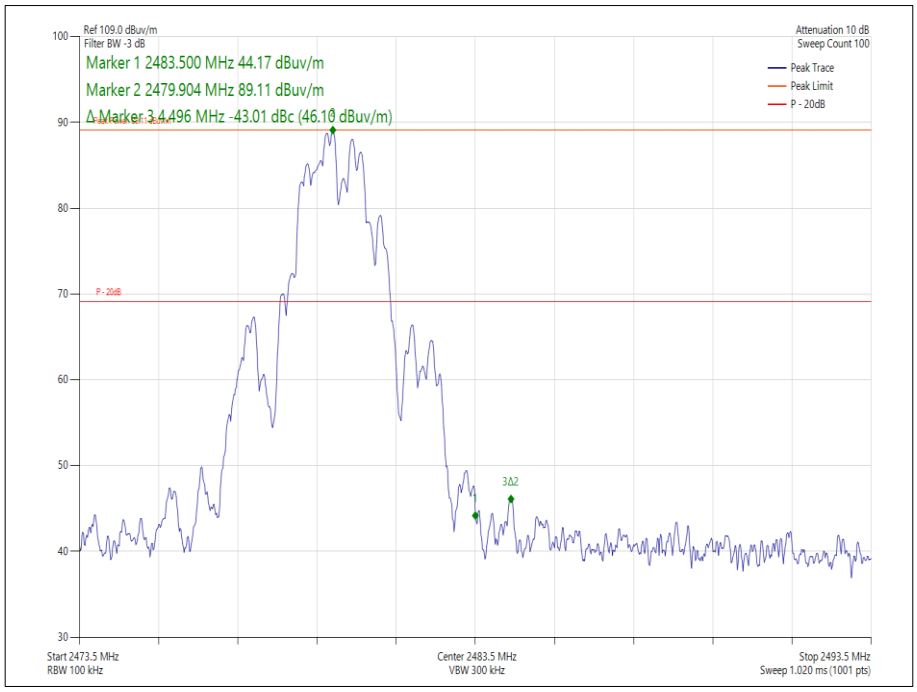

Figure 12 - Static, 2480 MHz - Band Edge Frequency 2483.5 MHz

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 6.6

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.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11 and EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	79 Series III	411	12	09-Jan-2026
3m Semi-Anechoic Chamber	Rainford	RF Chamber 5	1545	36	23-Apr-2027
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Supply Unit	Farnell	TSV-70	2043	12	O/P Mon
Hygromer	Rotronic	I-1000	2784	12	04-Nov-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Hygrometer	Rotronic	HP21	4741	12	29-May-2026
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	4848	12	05-Jul-2026
Emissions Software	TUV SUD	EmX V3.6	5125	-	Software
3m Semi-Anechoic Chamber	Rainford	RF Chamber 11	5136	36	14-Nov-2027
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 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	05-Jul-2026
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5517	12	06-Jun-2026
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	14-Aug-2026
Power Supply	TTI	EX355R	5573	-	TU
Test Receiver	Rohde & Schwarz	ESW44	5802	12	05-Nov-2026
Cable (K-Type to K-Type, 2 m)	Junkosha	MWX241-02000KMSKMS/B	5934	12	12-Jun-2026
2m Coaxial Cable Assy	Junkosha	MWX221-02000AMSAMS/A	6360	12	13-May-2026
Cable Assy 8m (N to N) 18GHz	Junkosha	MWX221-08000NMSNMS/B	7049	12	01-Jun-2026
Cable Assy 8m (N to N) 18GHz	Junkosha	MWX221-08000NMSNMS/B	7050	12	03-Oct-2026

Table 23

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

2.3 Spurious Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C Clause 15.247 (d) and 15.209
ISED RSS-247 Clause 2.4 and 6.6
ISED RSS-GEN Clause 6.13 and 8.9

2.3.2 Equipment Under Test and Modification State

MSR2G42026, S/N: 2755 #5 - Modification State 0

2.3.3 Date of Test

15-December-2025 to 18-December-2025

2.3.4 Test Method

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

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

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. As the EUT was considered mobile/portable and therefore reasonable to be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

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).

To determine the emission characteristic of the EUT above 18 GHz, the test antenna was swept over all faces of the EUT whilst observing a spectral display. The frequency of any emissions of interest was noted for formal measurement at the correct measurement distance of 1m. This procedure was repeated for all relevant transmit operating channels.

Above 18 GHz, the measurement distance was reduced to 1 m. The limit line was increased by 20*LOG(3/1) = 9.54 dB.

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.

The EUT was powered as per 1.5.2.

2.3.5 Example Test Setup Diagram

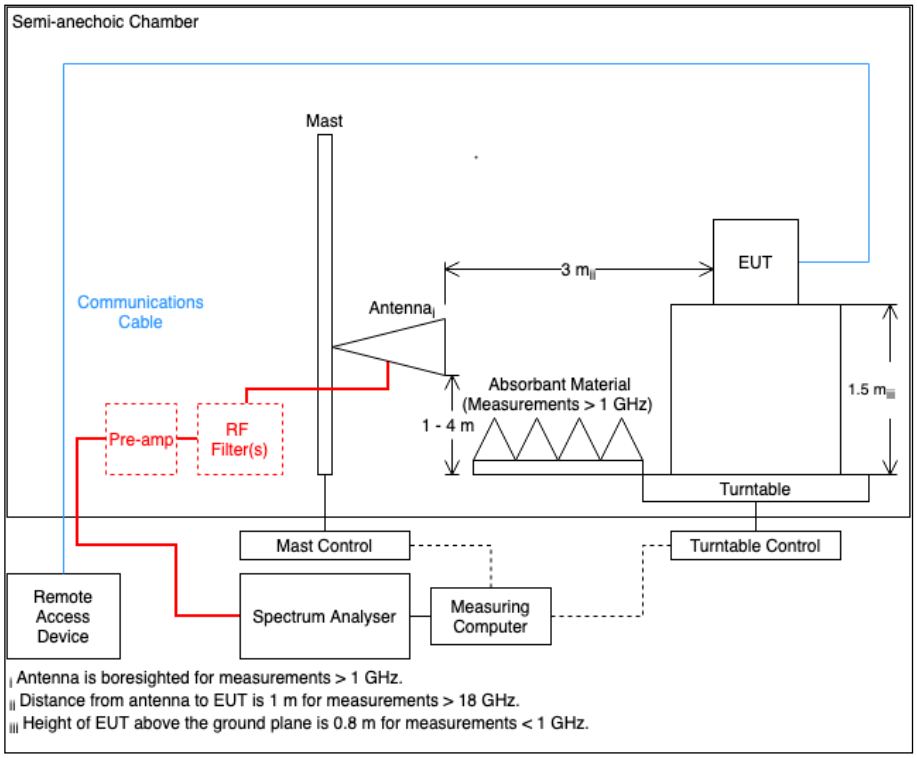

Figure 13

2.3.6 Environmental Conditions

Ambient Temperature	20.9 - 21.6 °C
Relative Humidity	40.1 - 42.3 %

2.3.7 Test Results

2.4 GHz Bluetooth Low Energy

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4803.465	45.68	54.00	-8.32	CISPR Avg	dBuv/m	0	157	Vertical	Z

Table 24 - BLE1M_Bot Channel_X, 2402 MHz, 30 MHz to 26 GHz

No other emissions found within 10 dB of the limit.

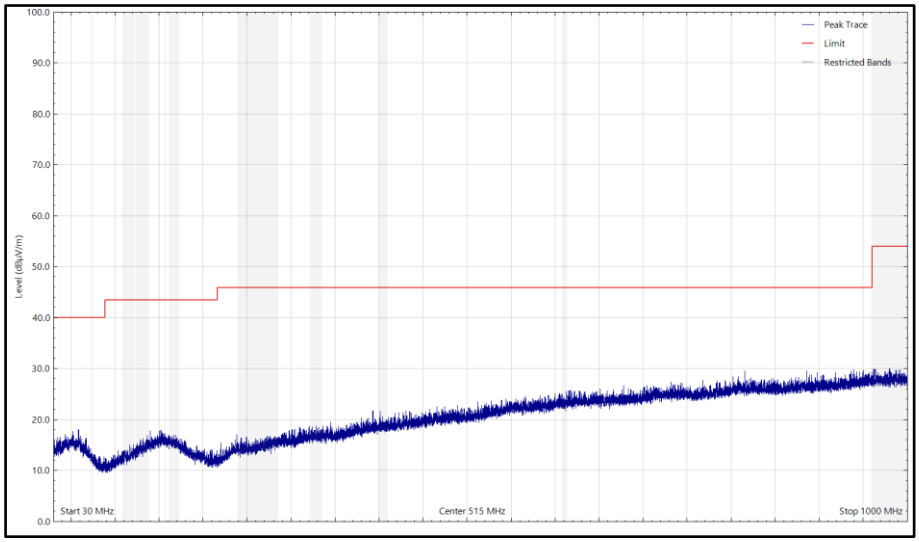

Figure 14 – BLE1M_Bot Channel_X, 2402 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

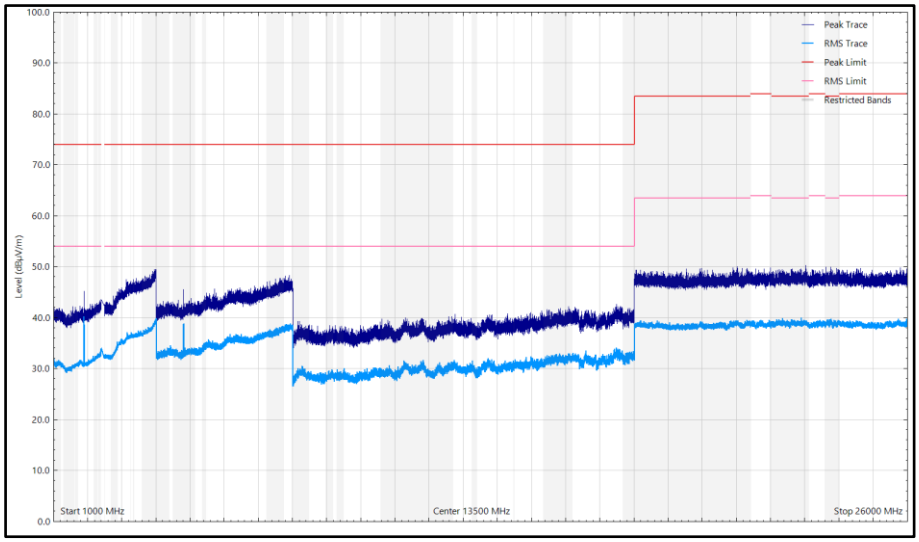

Figure 15 - BLE1M_Bot Channel_X, 2402 MHz, 1 GHz to 26 GHz, Horizontal

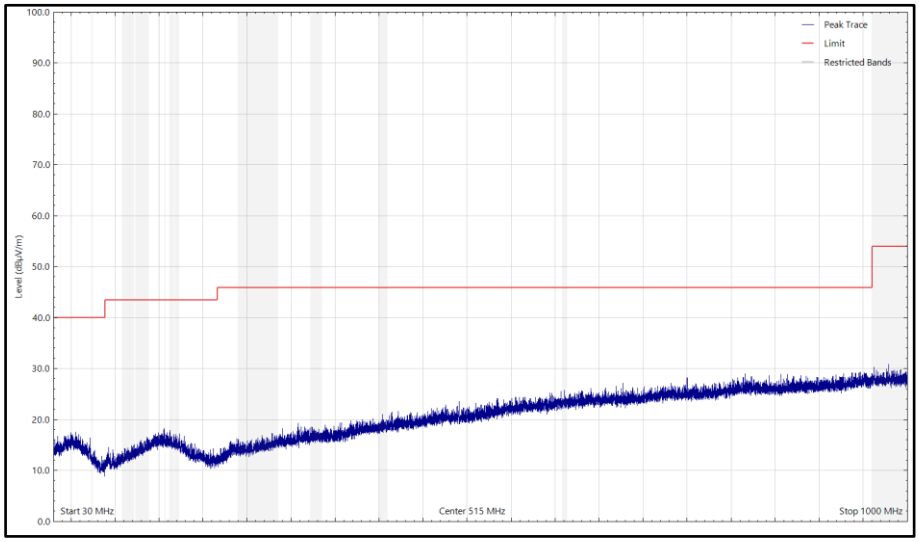

Figure 16 - BLE1M_Bot Channel_X, 2402 MHz, 30 MHz to 1 GHz, Vertical (Peak)

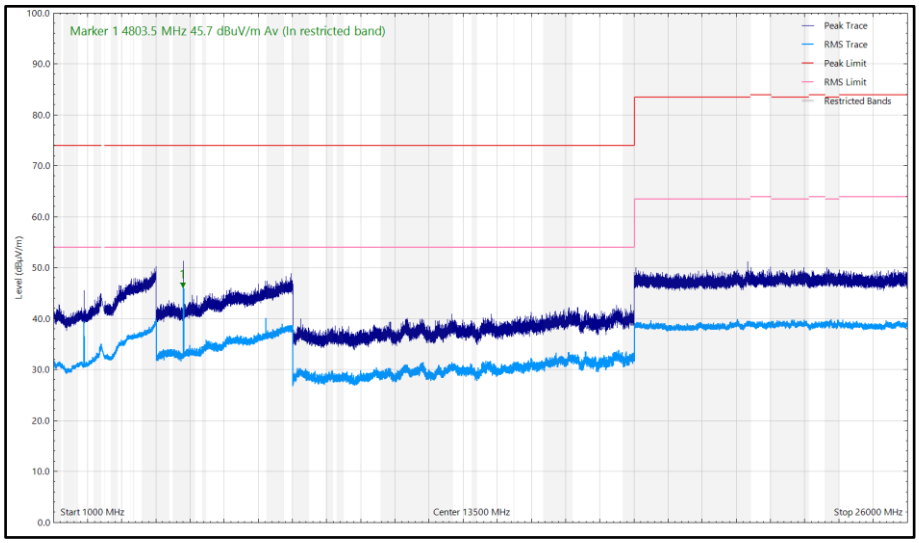

Figure 17 - BLE1M_Bot Channel_X, 2402 MHz, 1 GHz to 26 GHz, Vertical

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

Table 25 - BLE1M_Bot Channel_Y, 2402 MHz, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

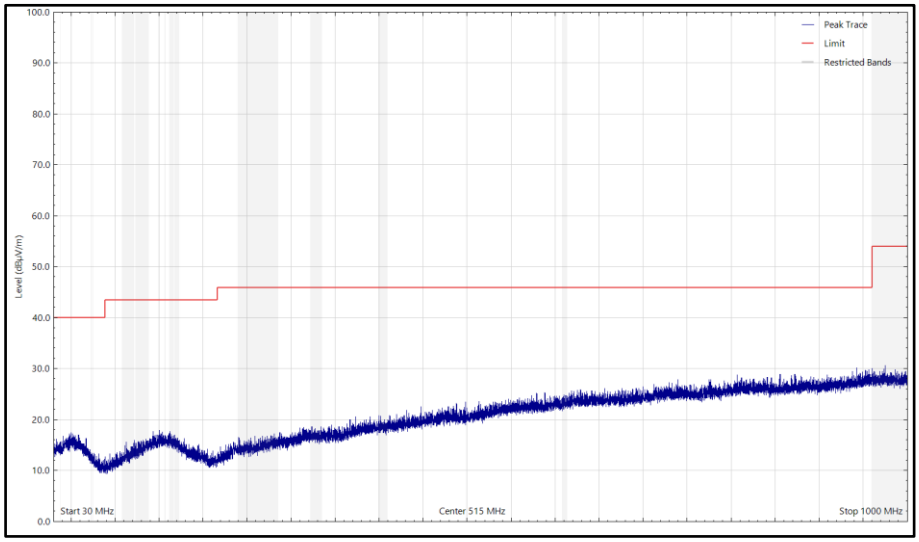

Figure 18 - BLE1M_Bot Channel_Y, 2402 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

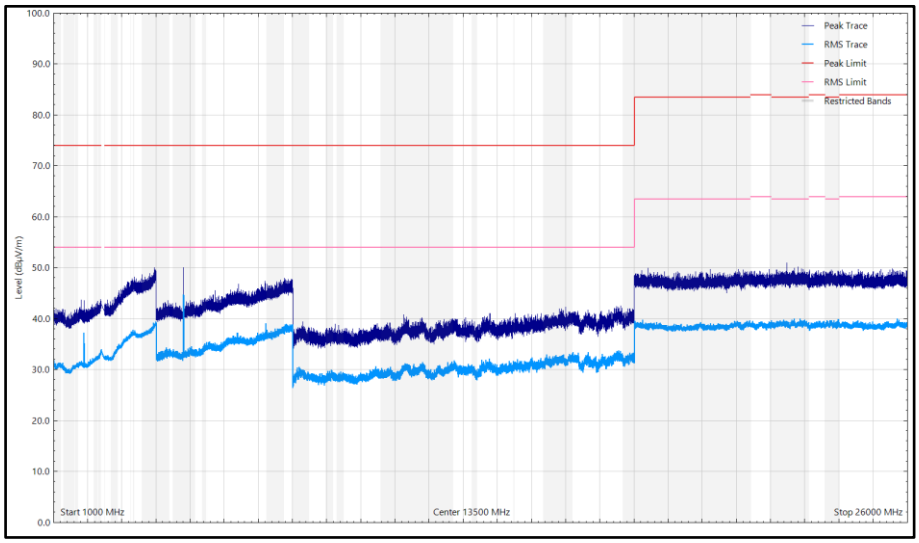

Figure 19 - BLE1M_Bot Channel_Y, 2402 MHz, 1 GHz to 26 GHz, Horizontal

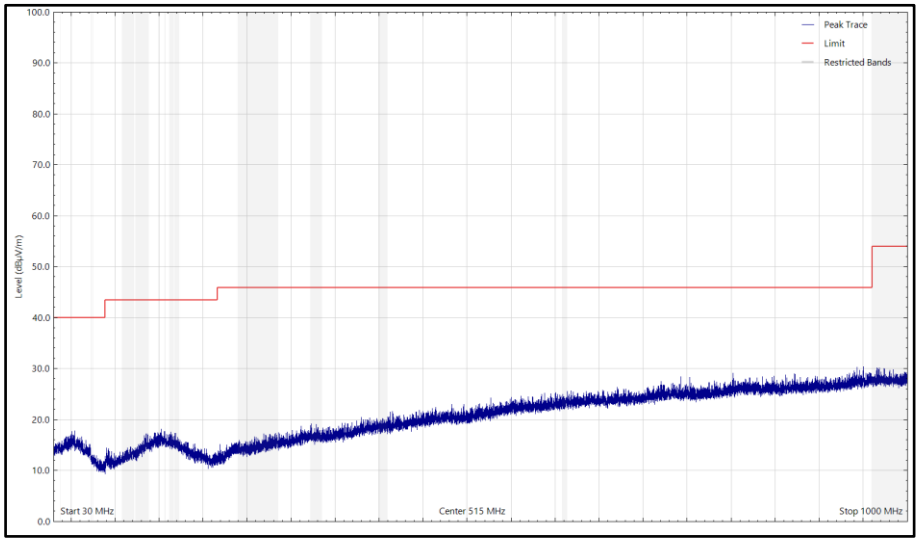

Figure 20 - BLE1M_Bot Channel_Y, 2402 MHz, 30 MHz to 1 GHz, Vertical (Peak)

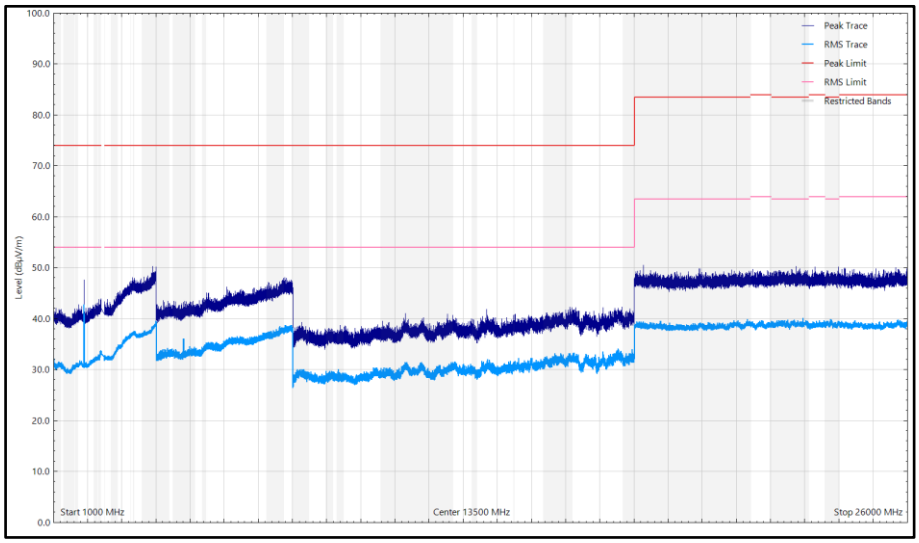

Figure 21 - BLE1M_Bot Channel_Y, 2402 MHz, 1 GHz to 26 GHz, Vertical

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

Table 26 - BLE1M_Bot Channel_Z, 2402 MHz, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

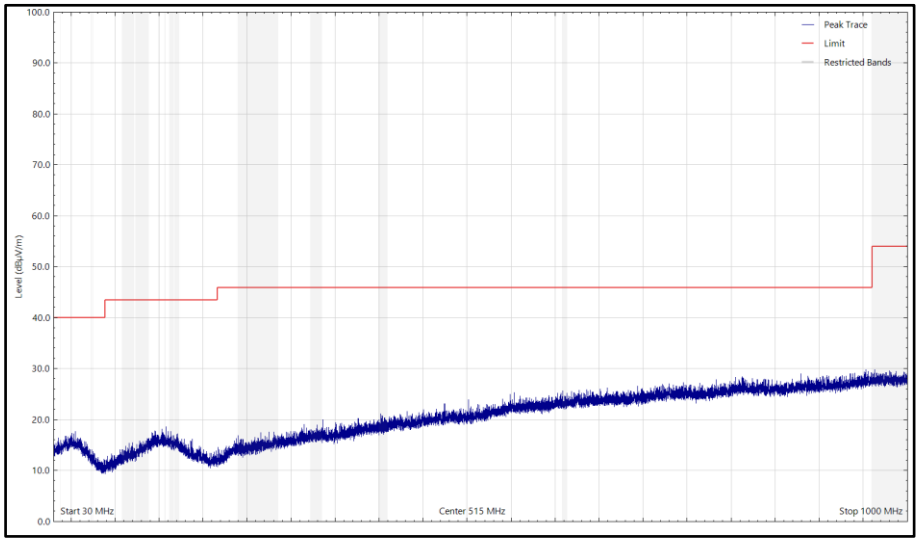

Figure 22 - BLE1M_Bot Channel_Z, 2402 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

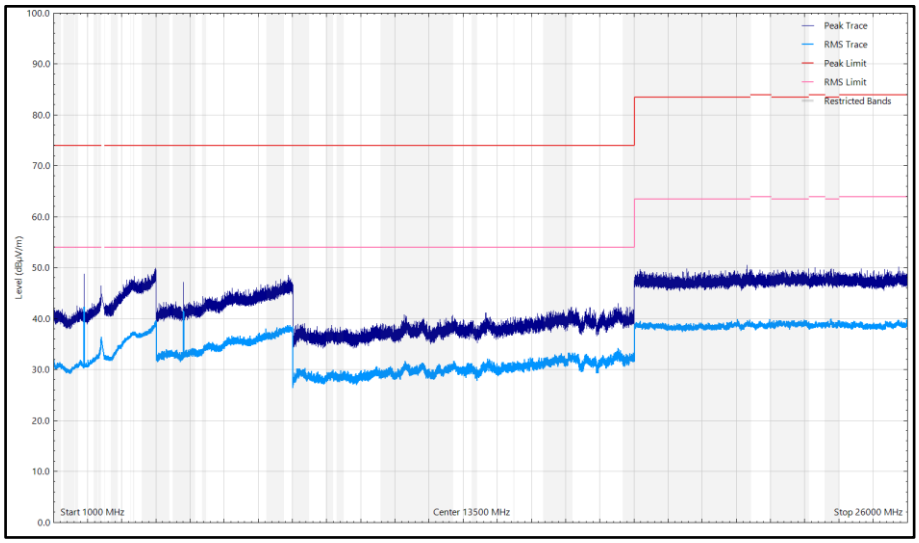

Figure 23 - BLE1M_Bot Channel_Z, 2402 MHz, 1 GHz to 26 GHz, Horizontal

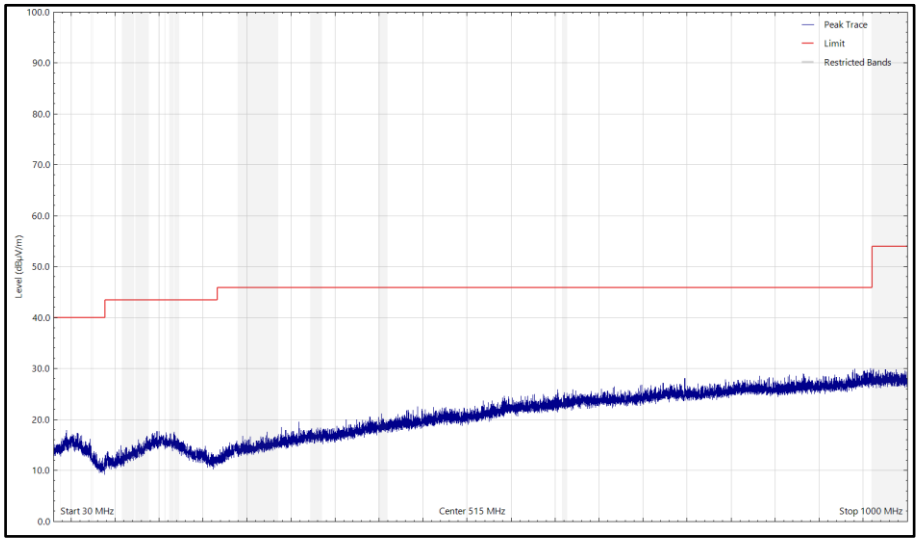

Figure 24 - BLE1M_Bot Channel_Z, 2402 MHz, 30 MHz to 1 GHz, Vertical (Peak)

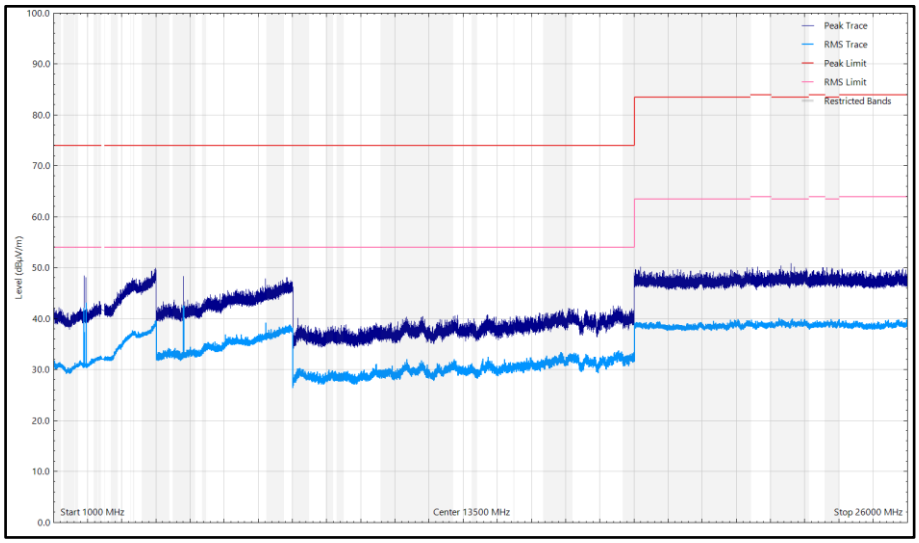

Figure 25 - BLE1M_Bot Channel_Z, 2402 MHz, 1 GHz to 26 GHz, Vertical

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4880.545	47.29	54.00	-6.71	CISPR Avg	dBuv/m	348	227	Vertical	

Table 27 - BLE1M_Mid Channel_X, 2440 MHz, 30 MHz to 26 GHz

No other emissions found within 10 dB of the limit.

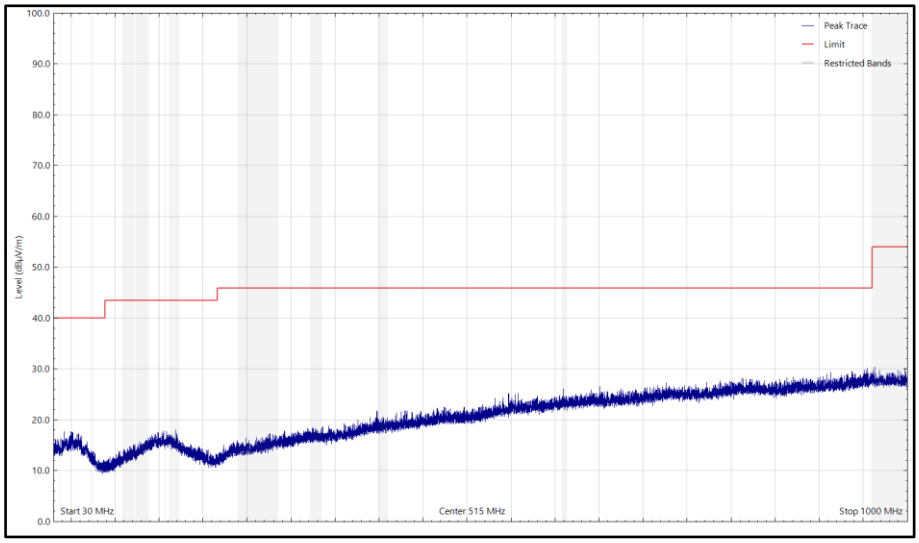

Figure 26 - BLE1M_Mid Channel_X, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

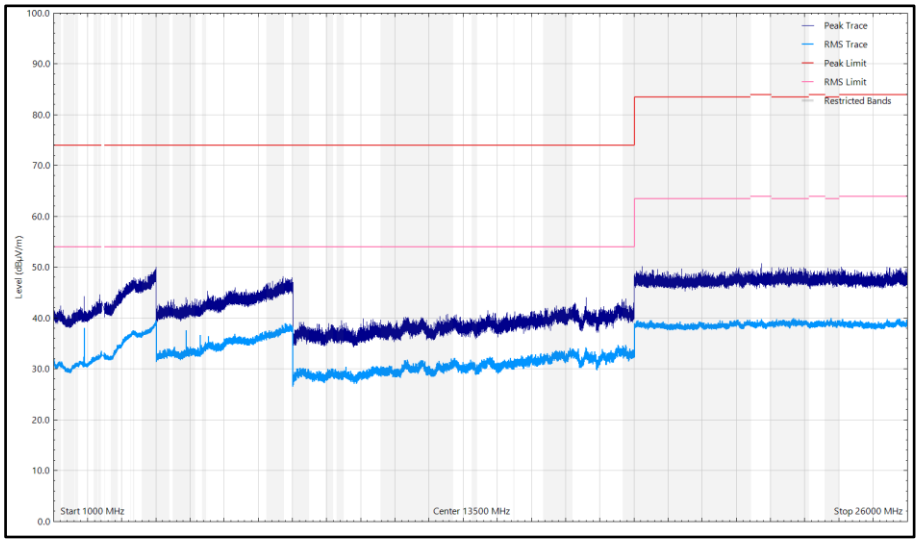

Figure 27 - BLE1M_Mid Channel_X, 2440 MHz, 1 GHz to 26 GHz, Horizontal

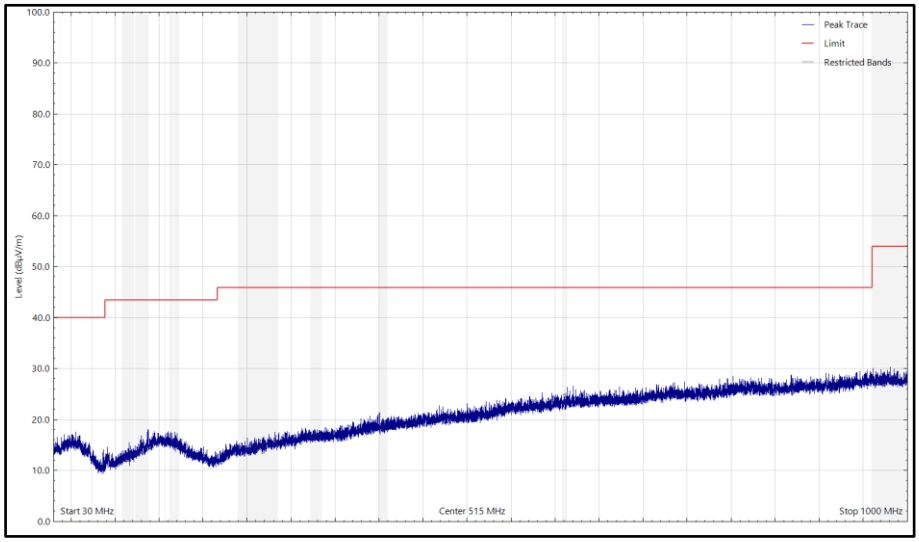

Figure 28 - BLE1M_Mid Channel_X, 2440 MHz, 30 MHz to 1 GHz, Vertical (Peak)

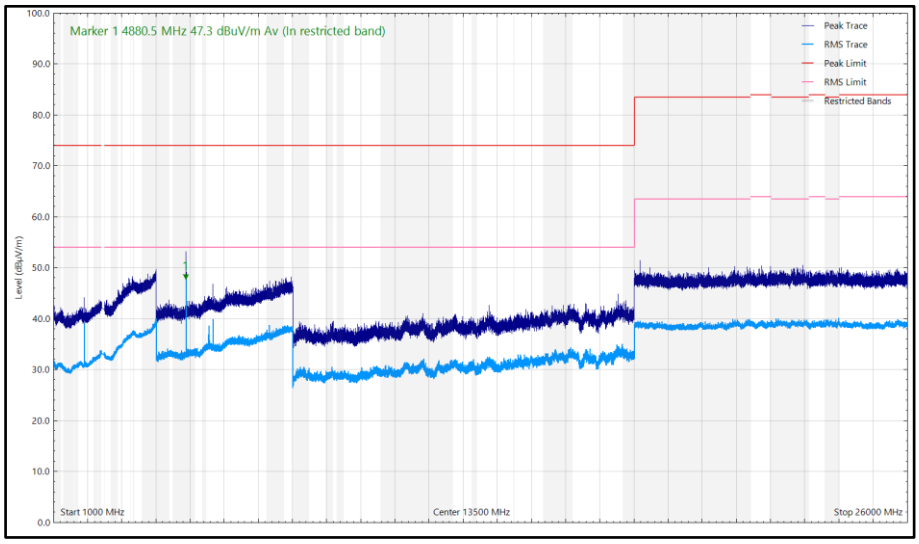

Figure 29 - BLE1M_Mid Channel_X, 2440 MHz, 1 GHz to 26 GHz, Vertical

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4880.485	44.66	54.00	-9.34	CISPR Avg	dBuv/m	0	160	Horizontal	

Table 28 - BLE1M_Mid Channel_Y, 2440 MHz, 30 MHz to 26 GHz

No other emissions found within 10 dB of the limit.

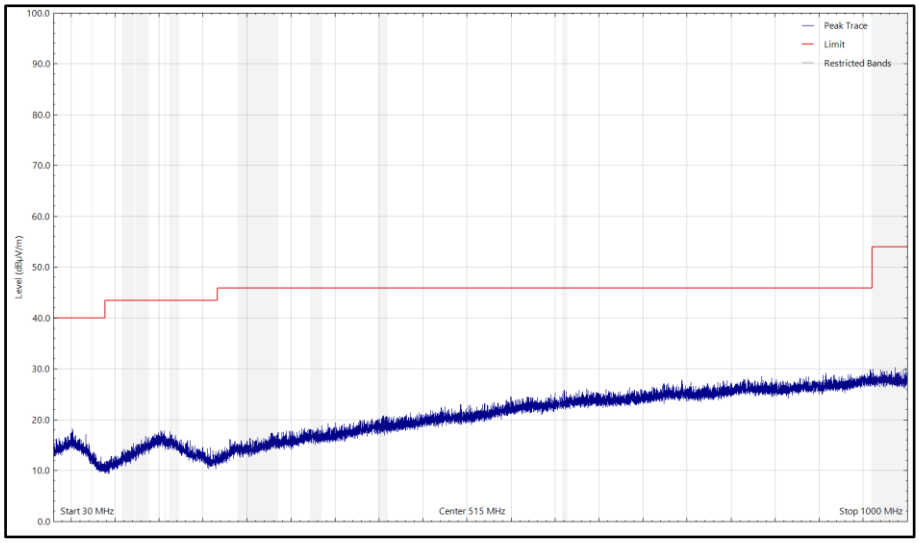

Figure 30 - BLE1M_Mid Channel_Y, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

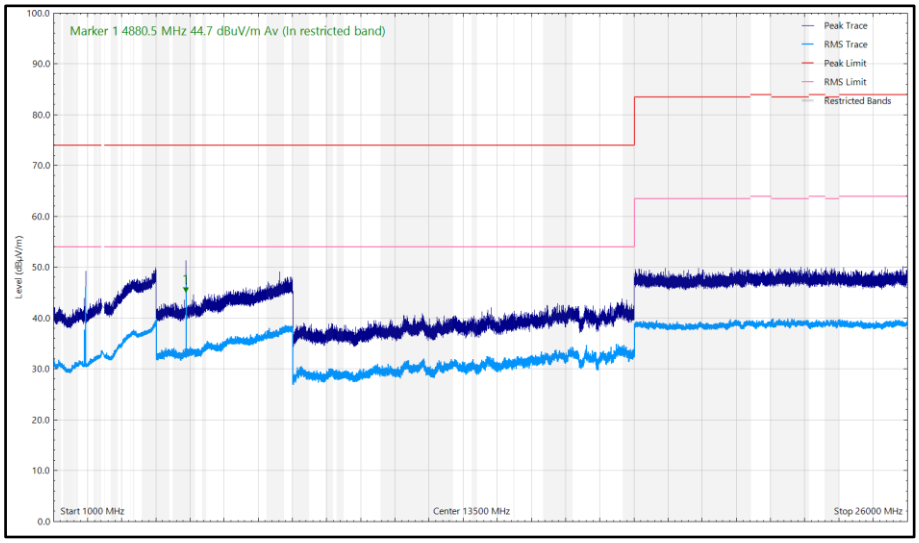

Figure 31 - BLE1M_Mid Channel_Y, 2440 MHz, 1 GHz to 26 GHz, Horizontal

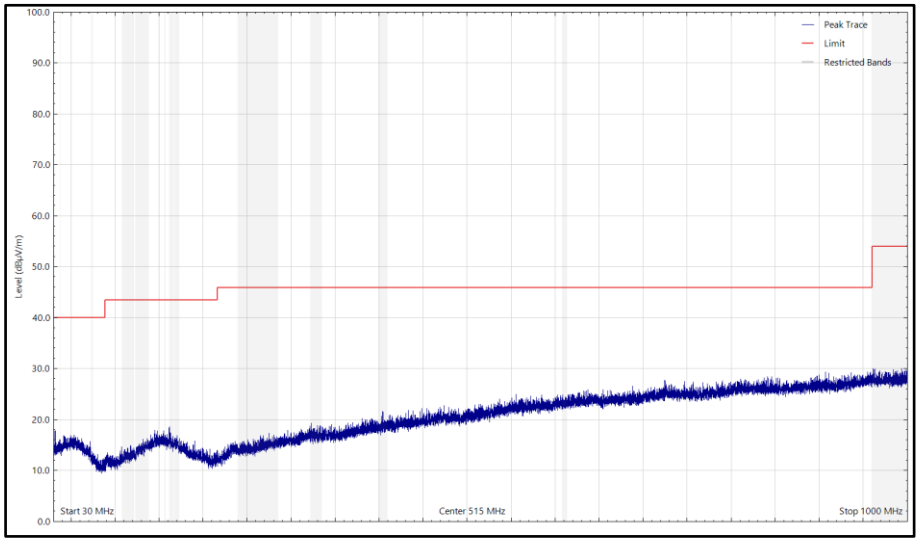

Figure 32 - BLE1M_Mid Channel_Y, 2440 MHz, 30 MHz to 1 GHz, Vertical (Peak)

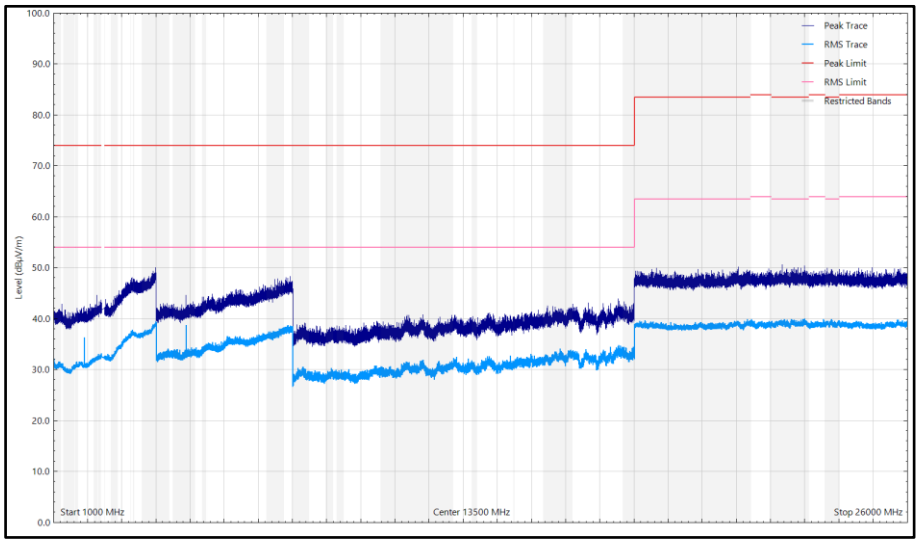

Figure 33 - BLE1M_Mid Channel_Y, 2440 MHz, 1 GHz to 26 GHz, Vertical

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

Table 29 - BLE1M_Mid Channel_Z, 2440 MHz, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

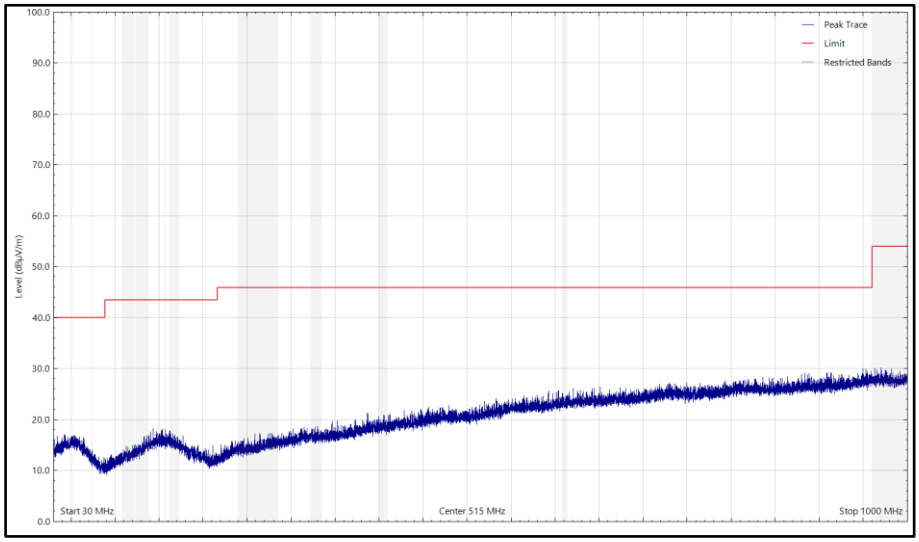

Figure 34 - BLE1M_Mid Channel_Z, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

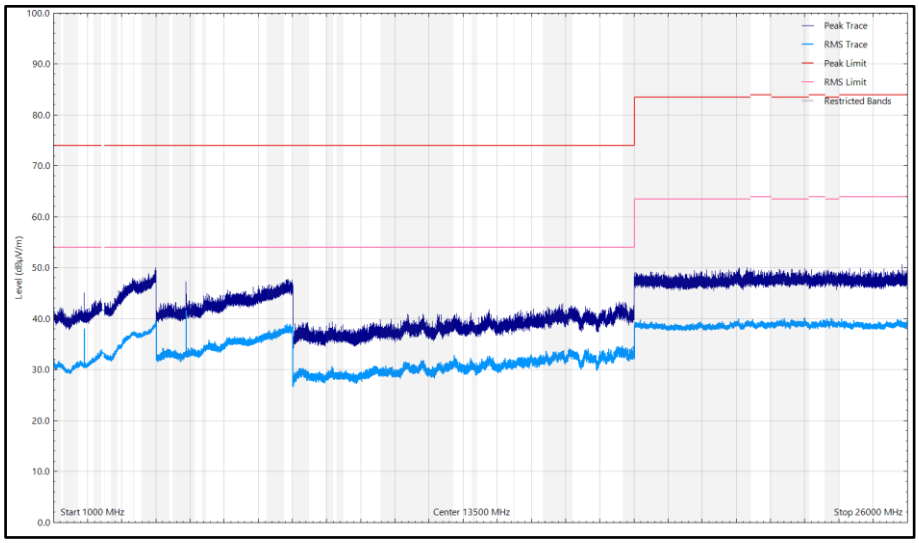

Figure 35 - BLE1M_Mid Channel_Z, 2440 MHz, 1 GHz to 26 GHz, Horizontal

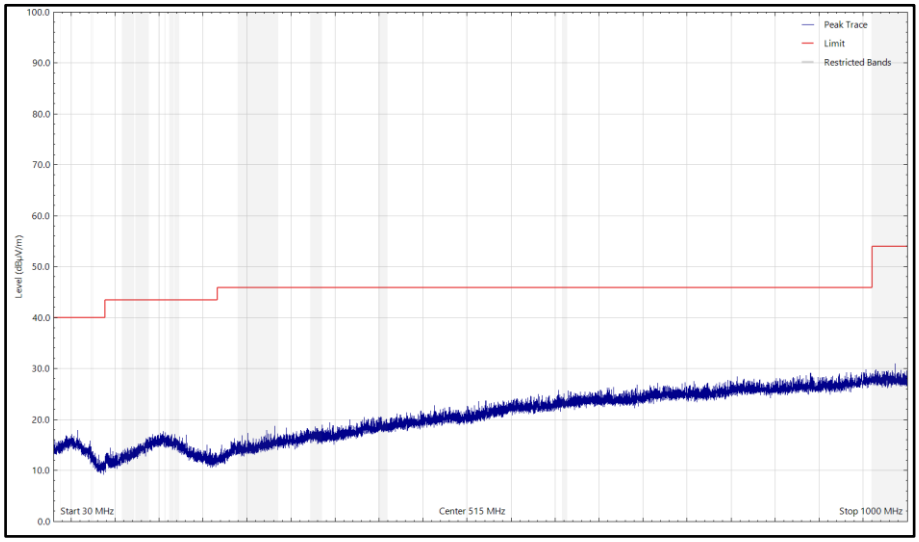

Figure 36 - BLE1M_Mid Channel_Z, 2440 MHz, 30 MHz to 1 GHz, Vertical (Peak)

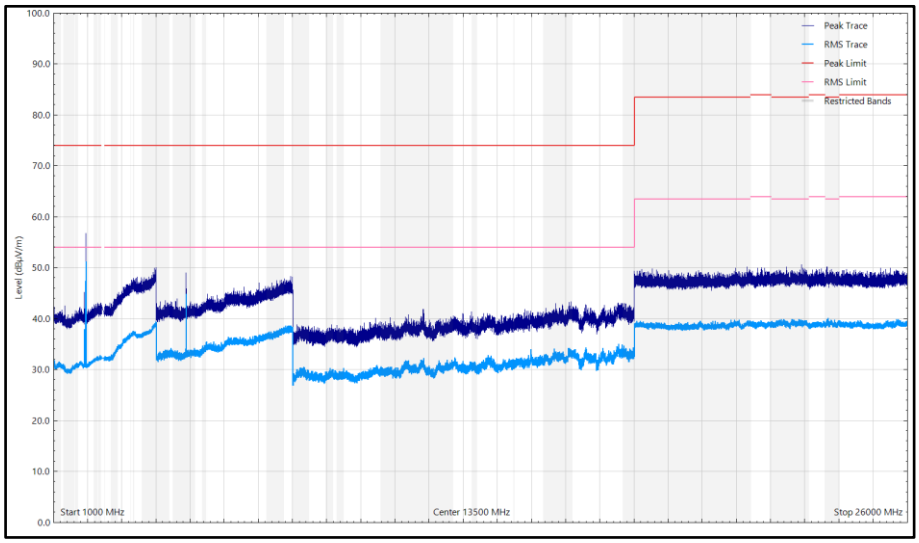

Figure 37 - BLE1M_Mid Channel_Z, 2440 MHz, 1 GHz to 26 GHz, Vertical

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4959.590	47.77	54.00	-6.23	CISPR Avg	dBuv/m	346	237	Vertical	

Table 30 - BLE1M_Top Channel_X, 2480 MHz, 30 MHz to 26 GHz

No other emissions found within 10 dB of the limit.

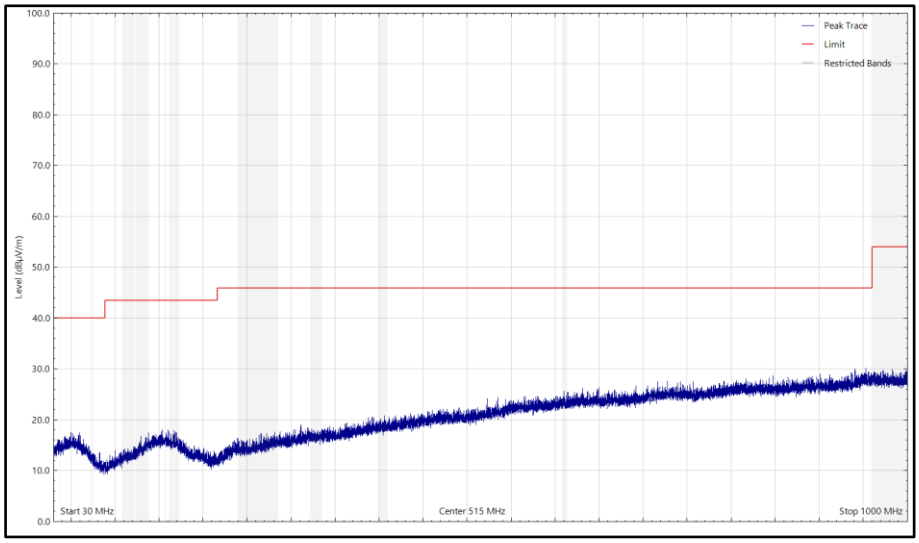

Figure 38 - BLE1M_Top Channel_X, 2480 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

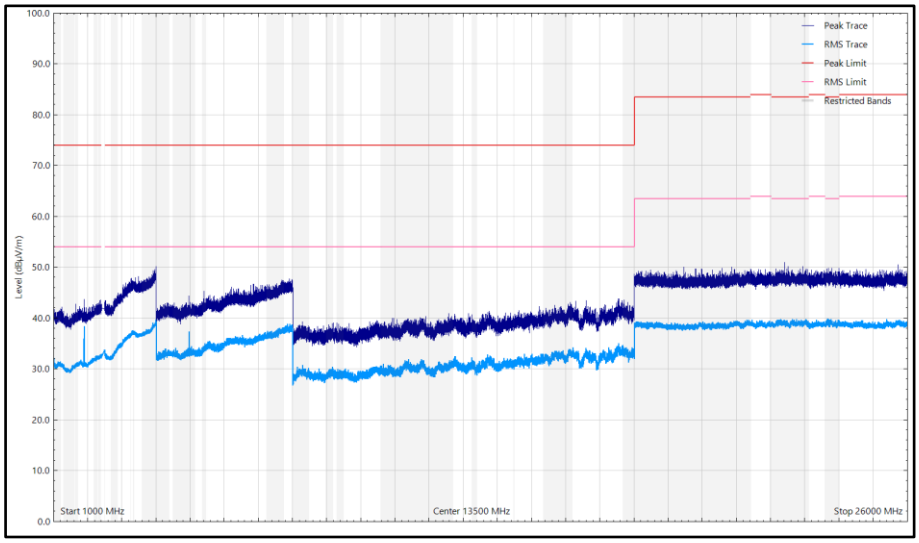

Figure 39 - BLE1M_Top Channel_X, 2480 MHz, 1 GHz to 26 GHz, Horizontal

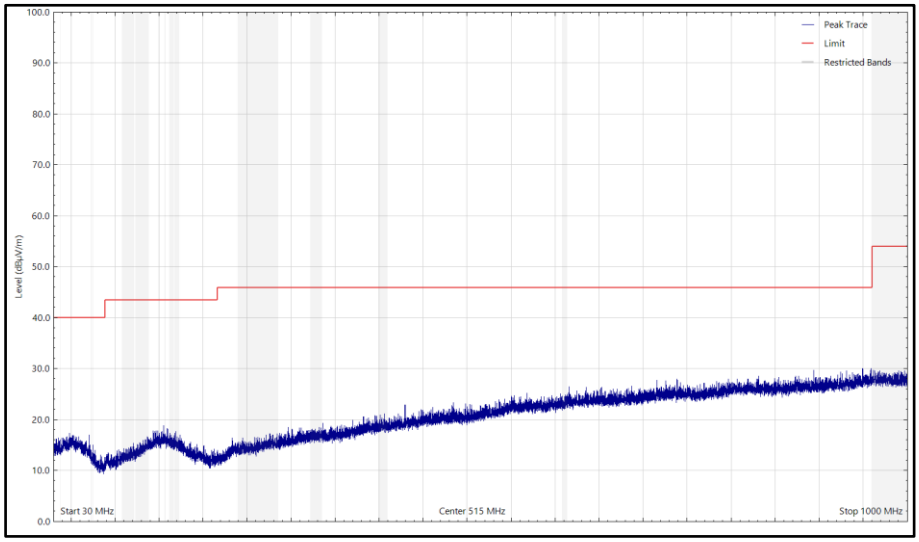

Figure 40 - BLE1M_Top Channel_X, 2480 MHz, 30 MHz to 1 GHz, Vertical (Peak)

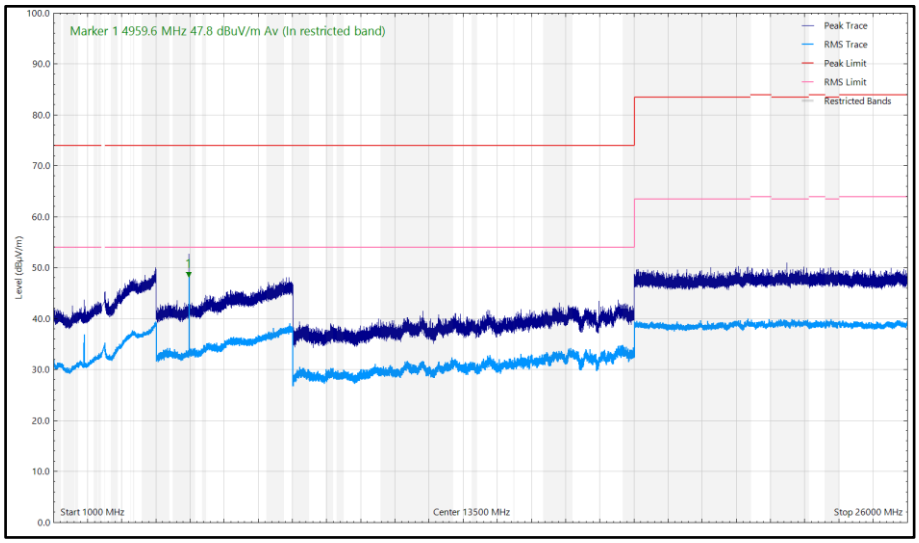

Figure 41 - BLE1M_Top Channel_X, 2480 MHz, 1 GHz to 26 GHz, Vertical

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

Table 31 - BLE1M_Top Channel_Y, 2480 MHz, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

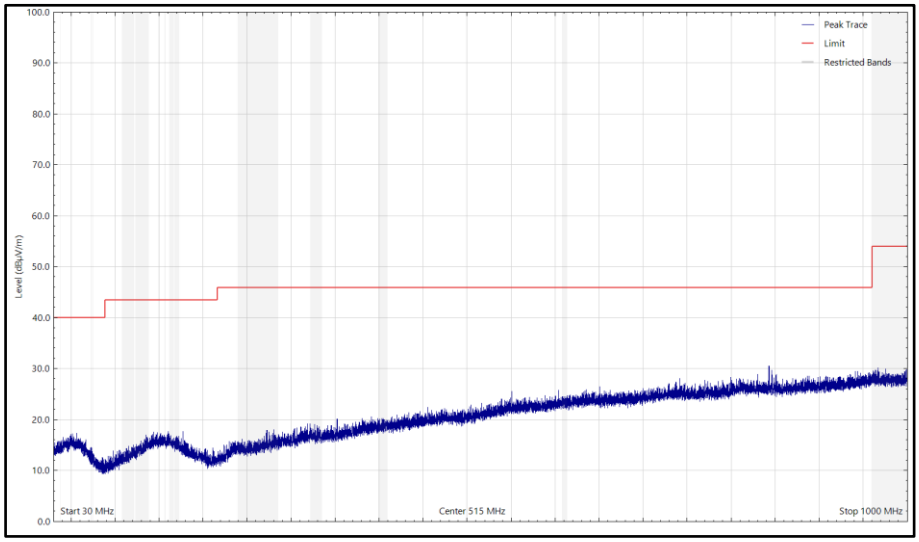

Figure 42 - BLE1M_Top Channel_Y, 2480 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

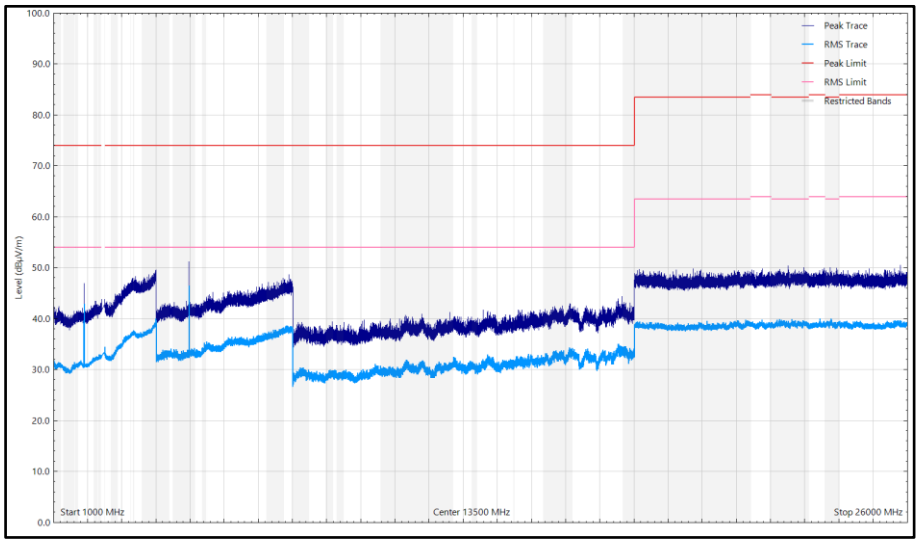

Figure 43 - BLE1M_Top Channel_Y, 2480 MHz, 1 GHz to 26 GHz, Horizontal

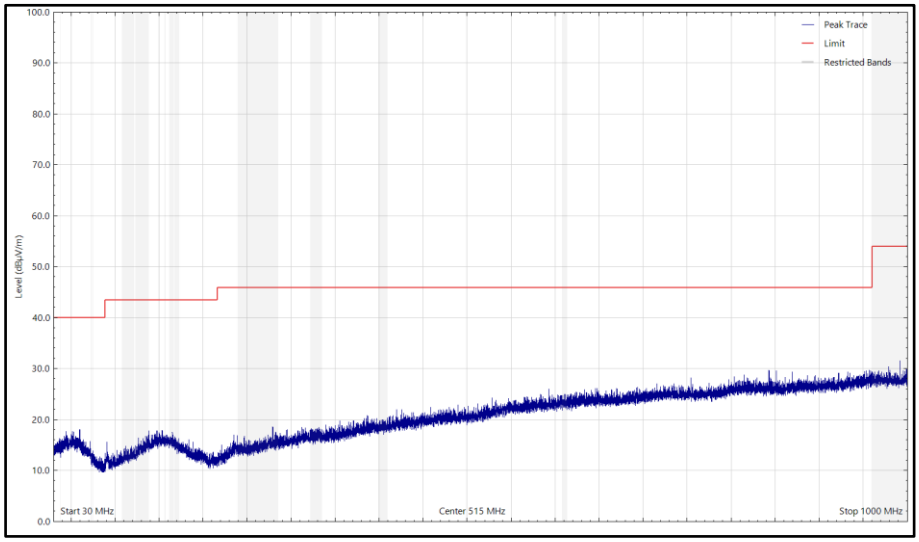

Figure 44 - BLE1M_Top Channel_Y, 2480 MHz, 30 MHz to 1 GHz, Vertical (Peak)

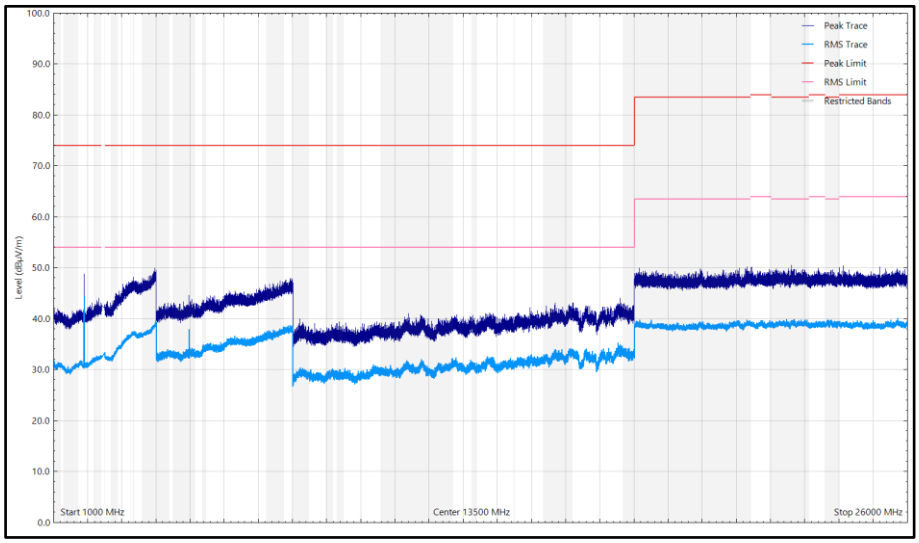

Figure 45 - BLE1M_Top Channel_Y, 2480 MHz, 1 GHz to 26 GHz, Vertical

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

Table 32 - BLE1M_Top Channel_Z, 2480 MHz, 30 MHz to 26 GHz

*No emissions found within 10 dB of the limit.

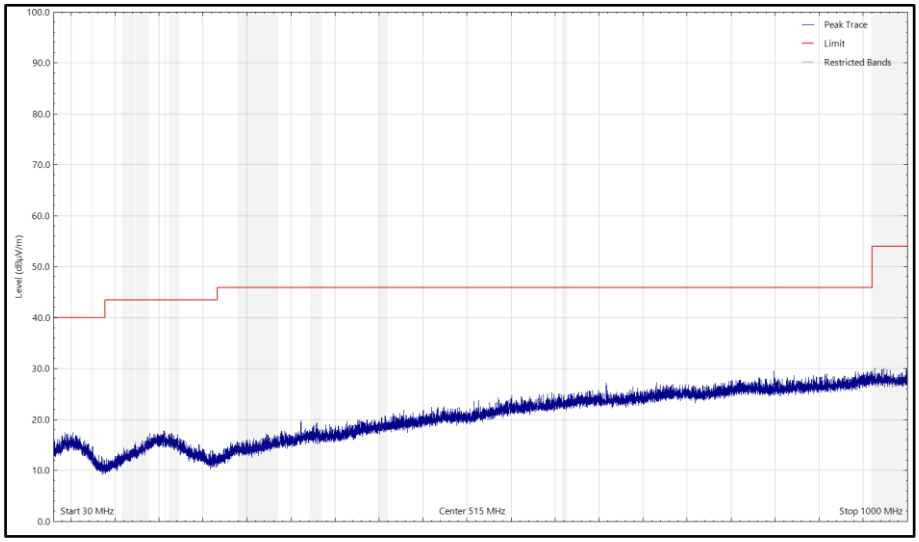

Figure 46 - BLE1M_Top Channel_Z, 2480 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

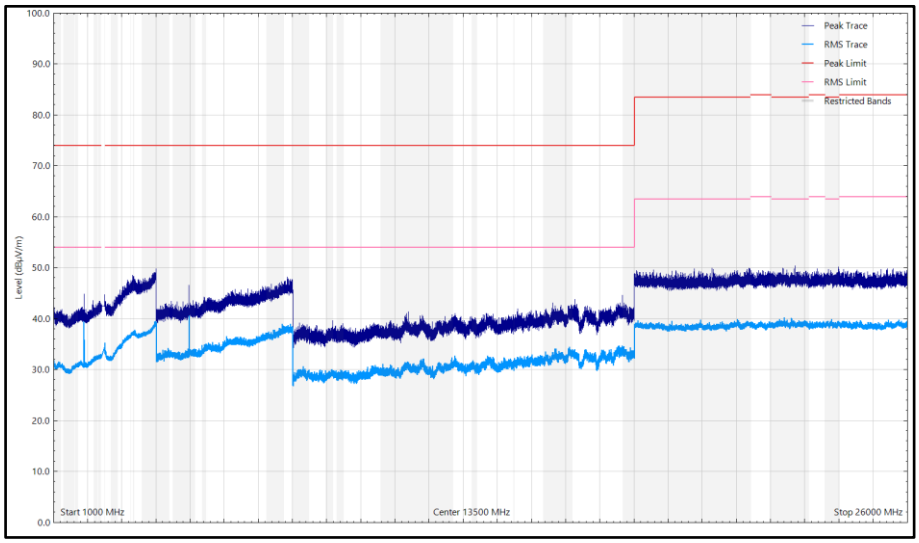

Figure 47 - BLE1M_Top Channel_Z, 2480 MHz, 1 GHz to 26 GHz, Horizontal

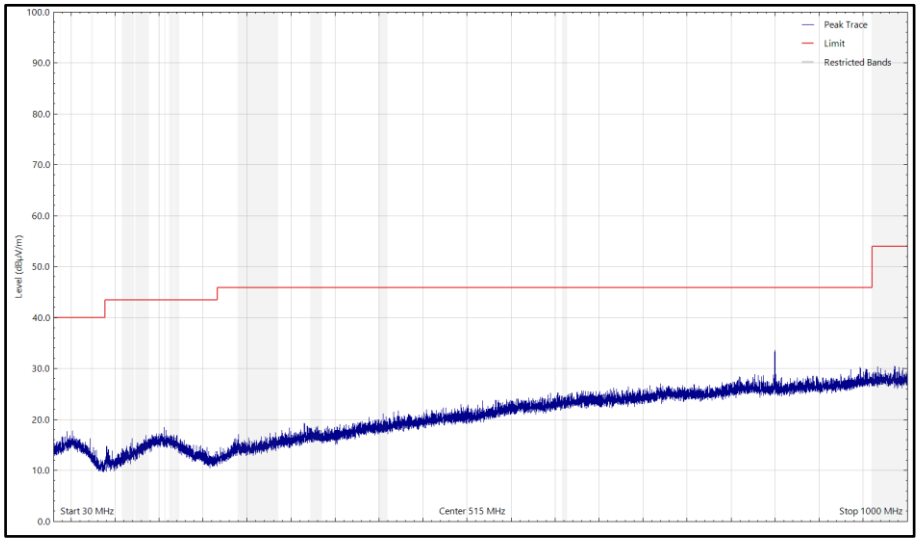

Figure 48 - BLE1M_Top Channel_Z, 2480 MHz, 30 MHz to 1 GHz, Vertical (Peak)

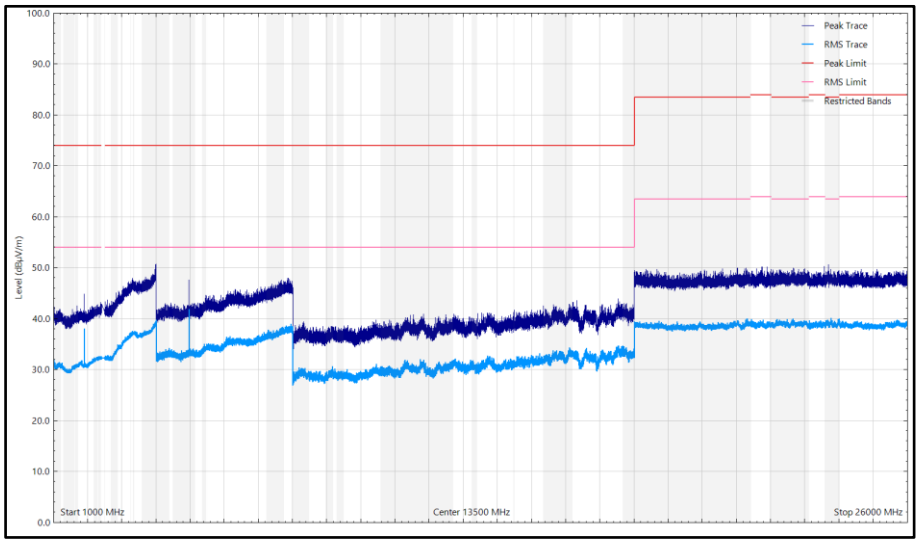

Figure 49 - BLE1M_Top Channel_Z, 2480 MHz, 1 GHz to 26 GHz, Vertical

IEEE 802.15.4

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4811.125	45.02	54.00	-8.98	CISPR Avg	dBuv/m	337	231	Vertical	

Table 33 - Zigbee_Bot Channel_X, 2405 MHz, 30 MHz to 18 GHz

No other emissions found within 10 dB of the limit.

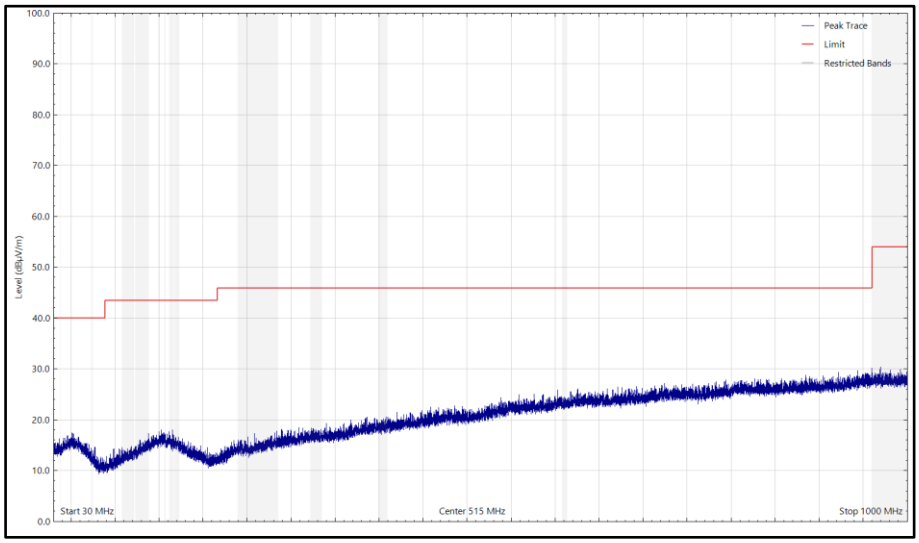

Figure 50 - Zigbee_Bot Channel_X, 2405 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

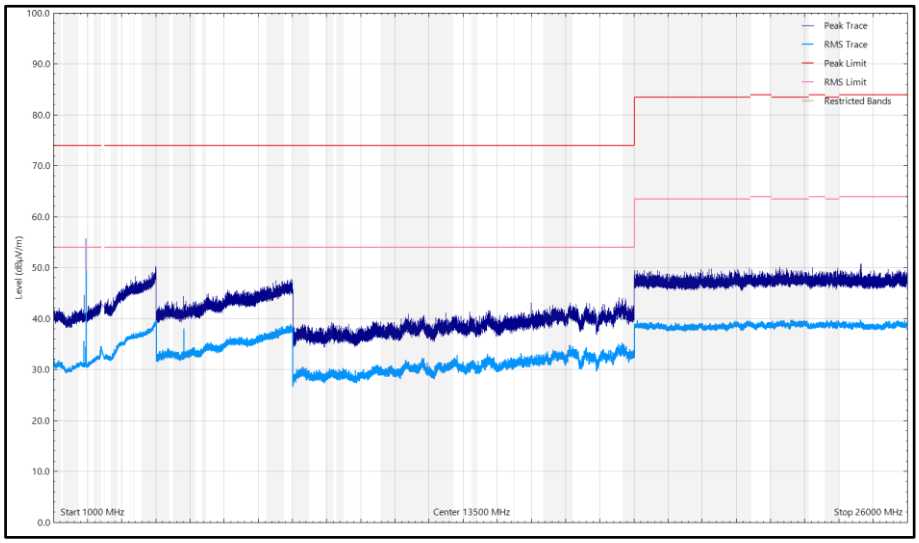

Figure 51 - Zigbee_Bot Channel_X, 2405 MHz, 1 GHz to 26 GHz, Horizontal

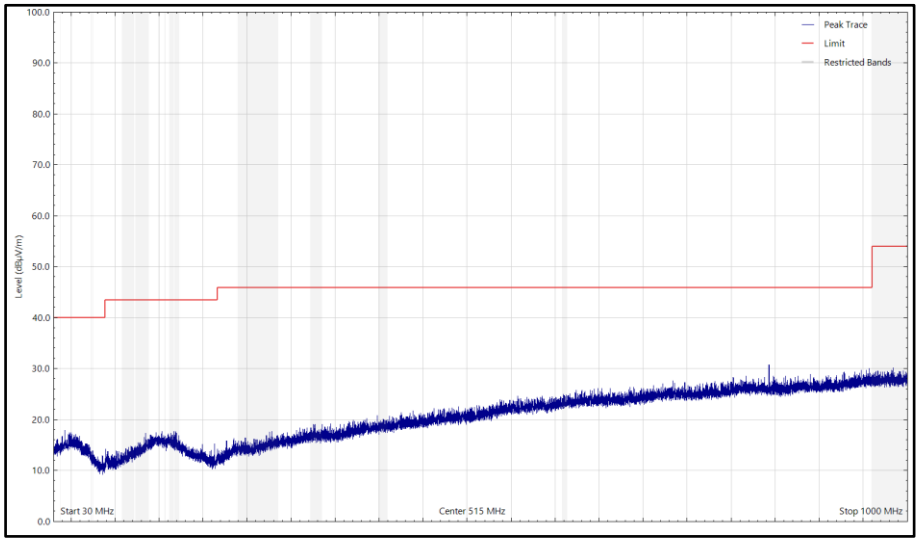

Figure 52 - Zigbee_Bot Channel_X, 2405 MHz, 30 MHz to 1 GHz, Vertical (Peak)

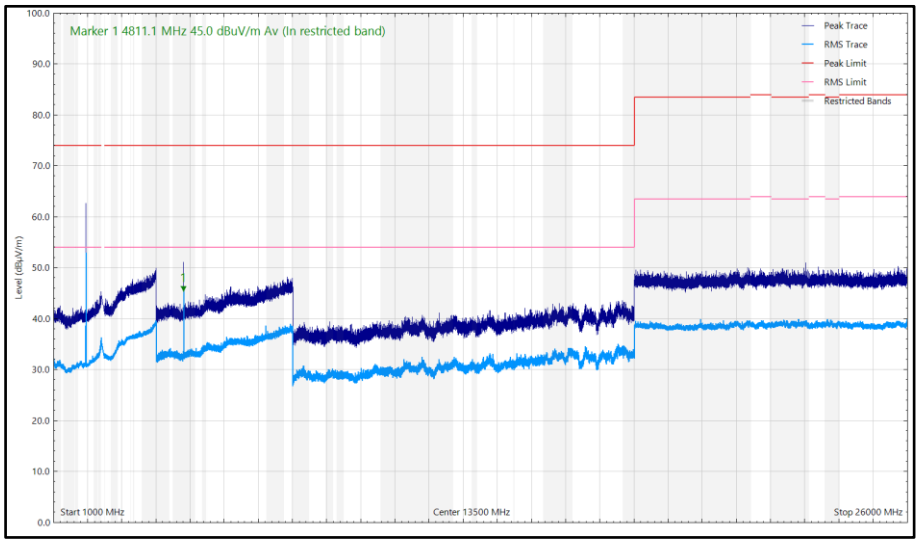

Figure 53 - Zigbee_Bot Channel_X, 2405 MHz, 1 GHz to 26 GHz, Vertical

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

Table 34 - Zigbee_Bot Channel_Y, 2405 MHz, 18 to 26 GHz

*No emissions found within 10 dB of the limit.

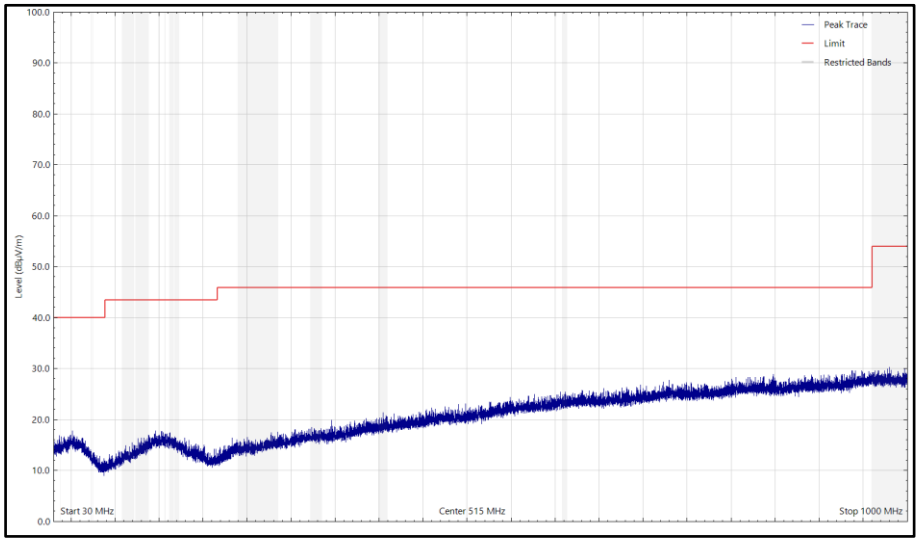

Figure 54 - Zigbee_Bot Channel_Y, 2405 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

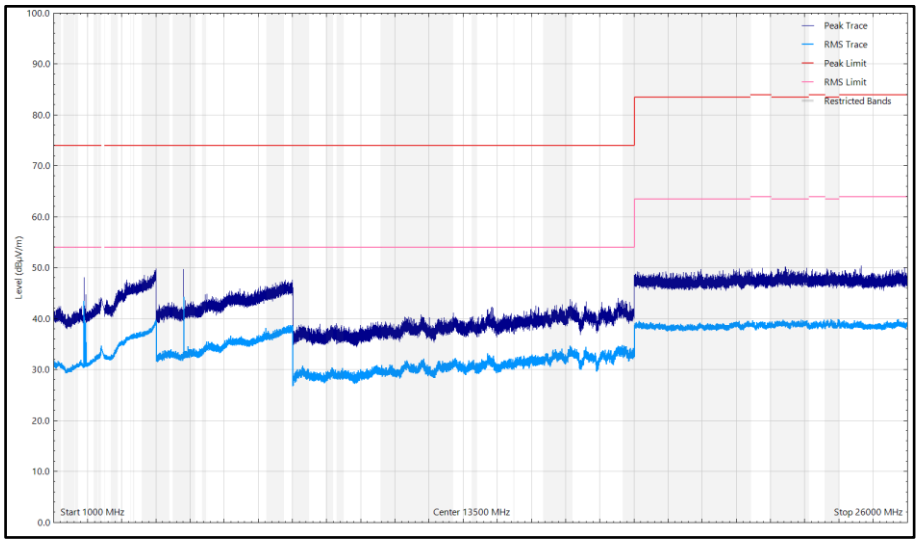

Figure 55 - Zigbee_Bot Channel_Y, 2405 MHz, 1 GHz to 26 GHz, Horizontal

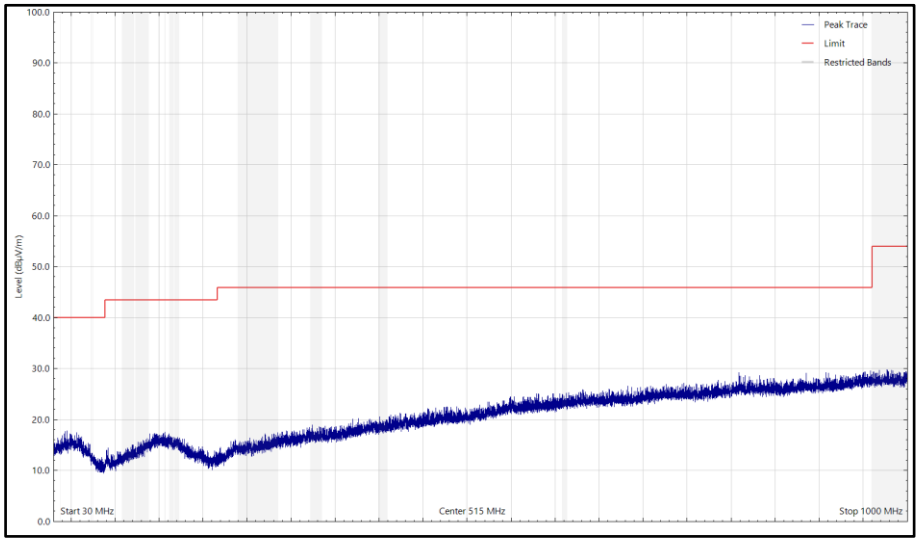

Figure 56 - Zigbee_Bot Channel_Y, 2405 MHz, 30 MHz to 1 GHz, Vertical (Peak)

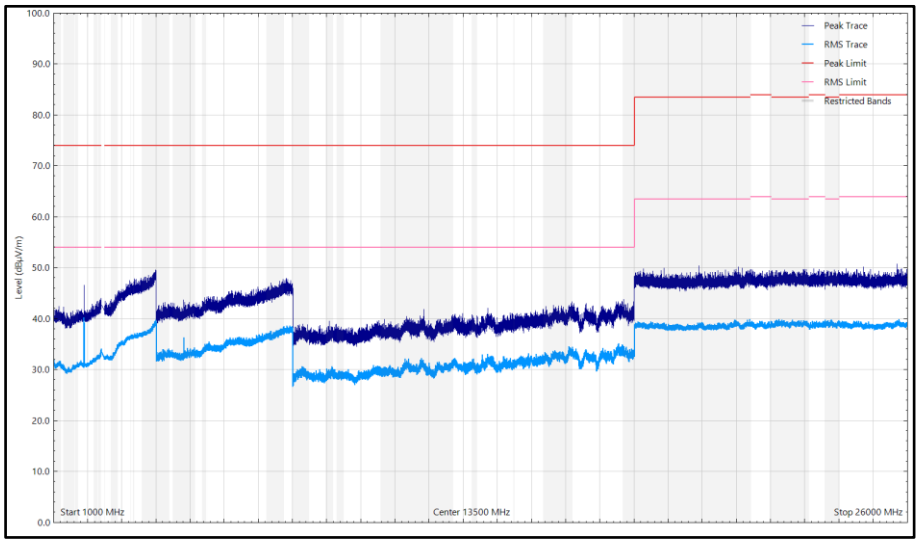

Figure 57 - Zigbee_Bot Channel_Y, 2405 MHz, 1 GHz to 26 GHz, Vertical

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

Table 35 - Zigbee_Bot Channel_Z, 2405 MHz, 30 MHz to 18 GHz

*No emissions found within 10 dB of the limit.

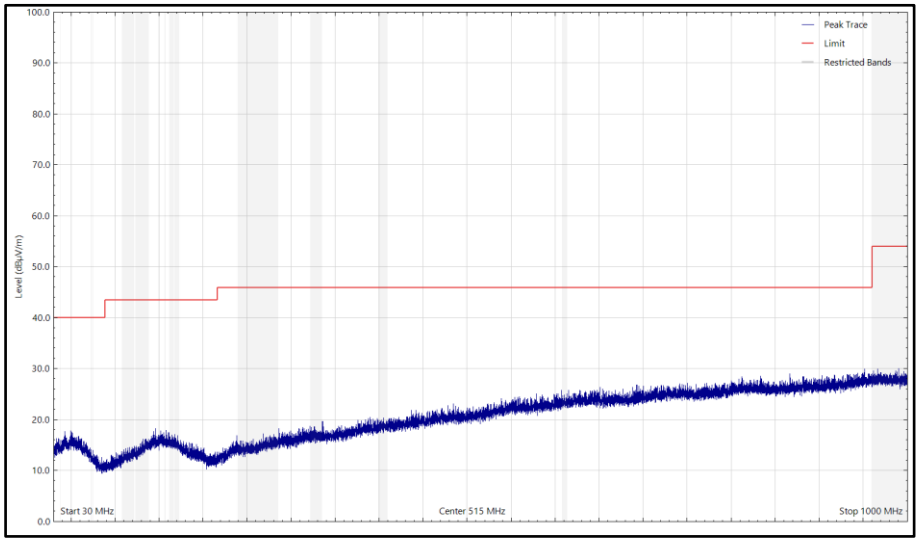

Figure 58 - Zigbee_Bot Channel_Z, 2405 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

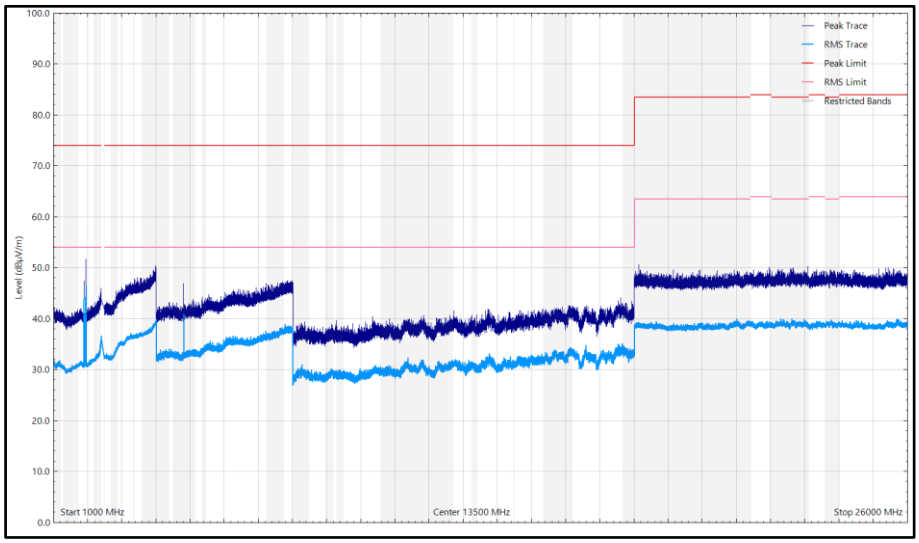

Figure 59 - Zigbee_Bot Channel_Z, 2405 MHz, 1 GHz to 26 GHz, Horizontal

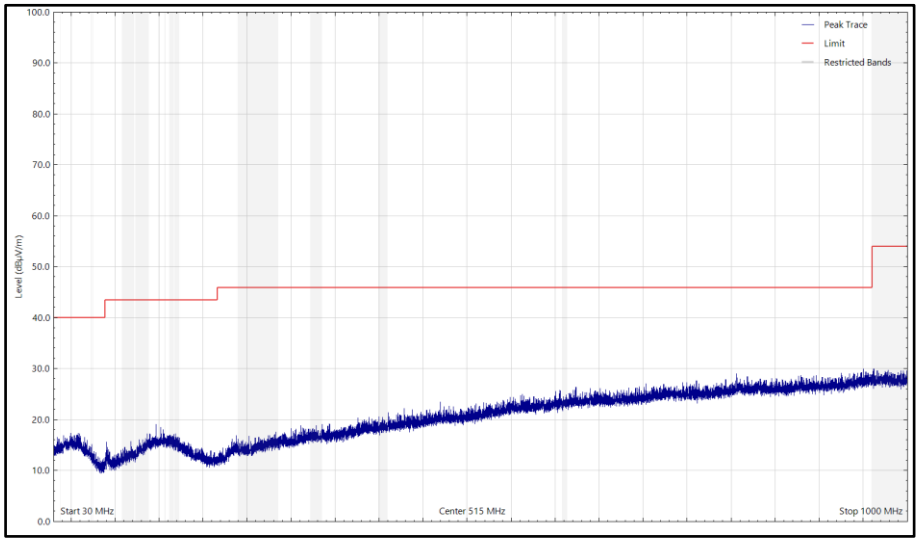

Figure 60 - Zigbee_Bot Channel_Z, 2405 MHz, 30 MHz to 1 GHz, Vertical (Peak)

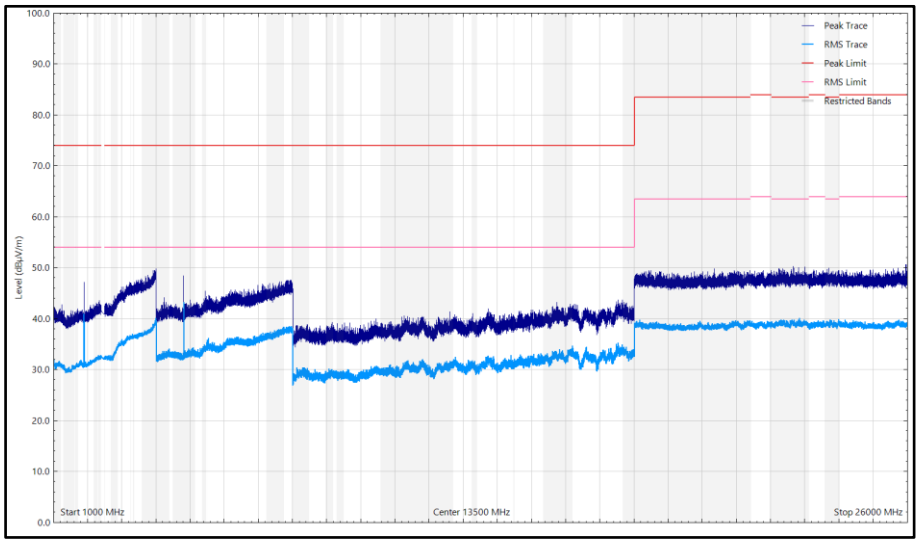

Figure 61 - Zigbee_Bot Channel_Z, 2405 MHz, 1 GHz to 26 GHz, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4881.040	47.11	54.00	-6.89	CISPR Avg	353	246	Vertical	

Table 36 - Zigbee_Mid Channel_X, 2440 MHz, 18 to 26 GHz

No other emissions found within 10 dB of the limit.

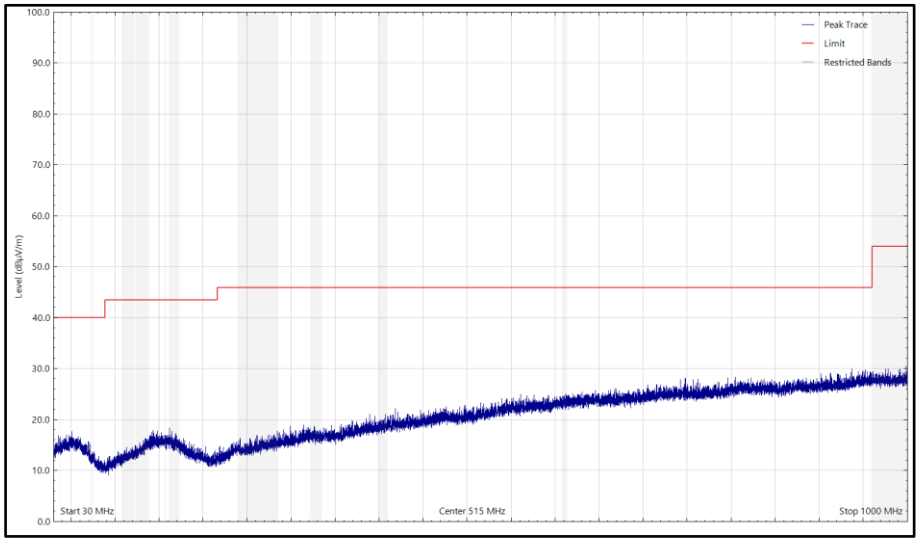

Figure 62 - Zigbee_Mid Channel_X, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

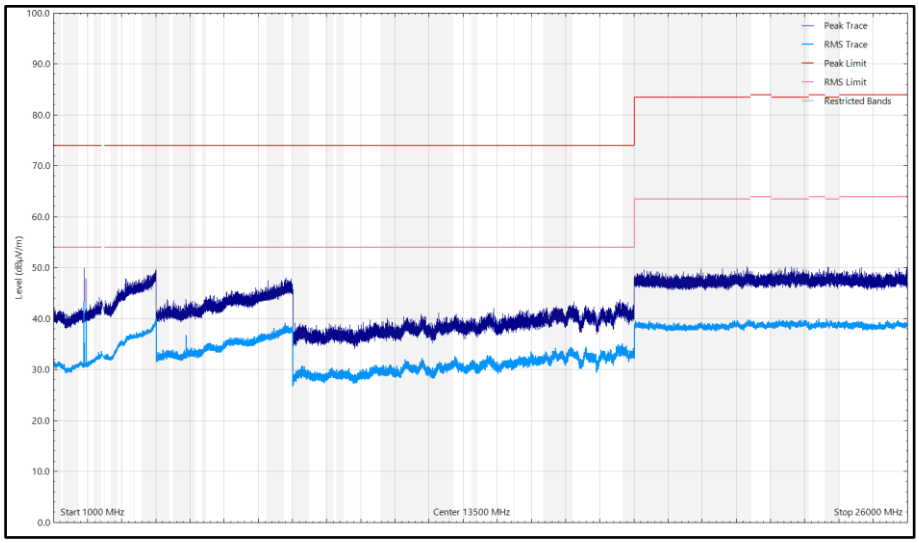

Figure 63 - Zigbee_Mid Channel_X, 2440 MHz, 1 GHz to 26 GHz, Horizontal

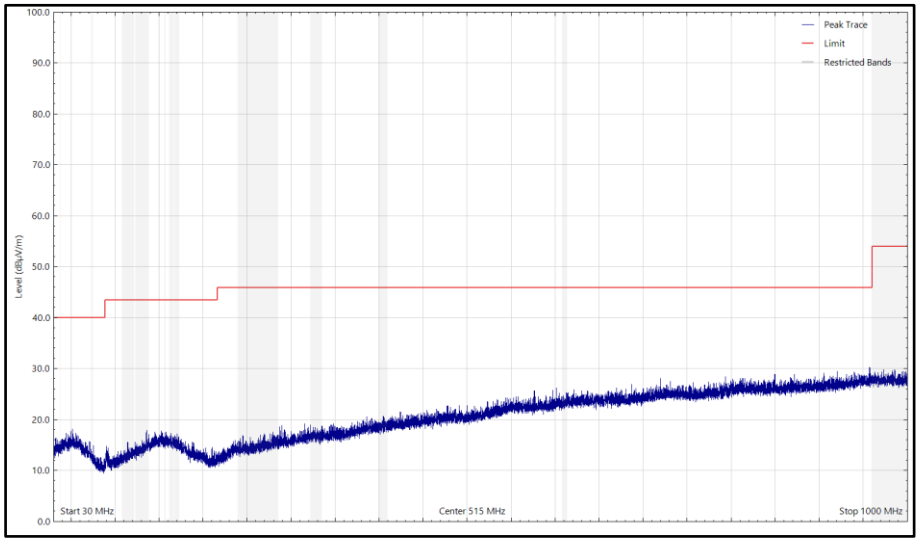

Figure 64 - Zigbee_Mid Channel_X, 2440 MHz, 30 MHz to 1 GHz, Vertical (Peak)

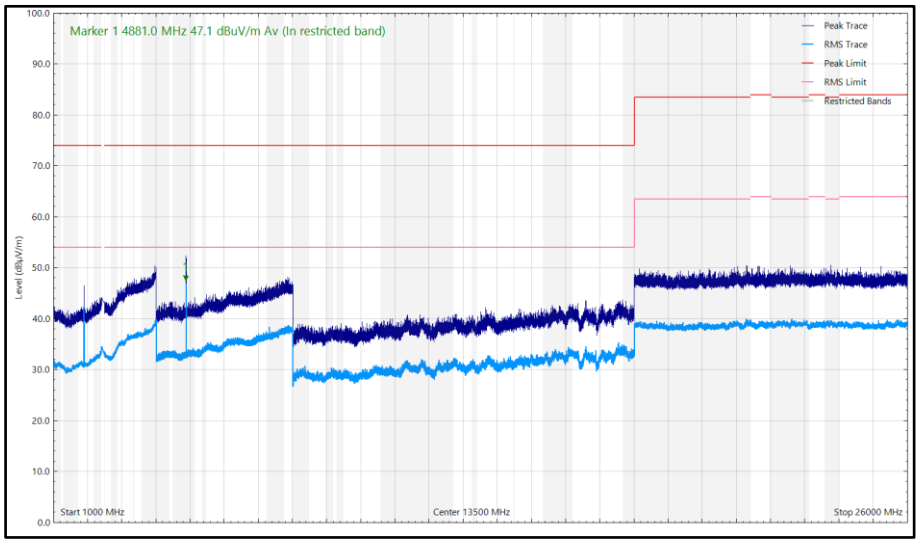

Figure 65 - Zigbee_Mid Channel_X, 2440 MHz, 1 GHz to 26 GHz, Vertical

Frequency (MHz)	Level	Limit	Margin (dB)	Detector	Unit	Angle (°)	Height (cm)	Polarisation	Orientation
4878.935	45.55	54.00	-8.45	CISPR Avg	dBuv/m	355	237	Horizontal	

Table 37 - Zigbee_Mid Channel_Y, 2440 MHz, 30 MHz to 18 GHz

No other emissions found within 10 dB of the limit.

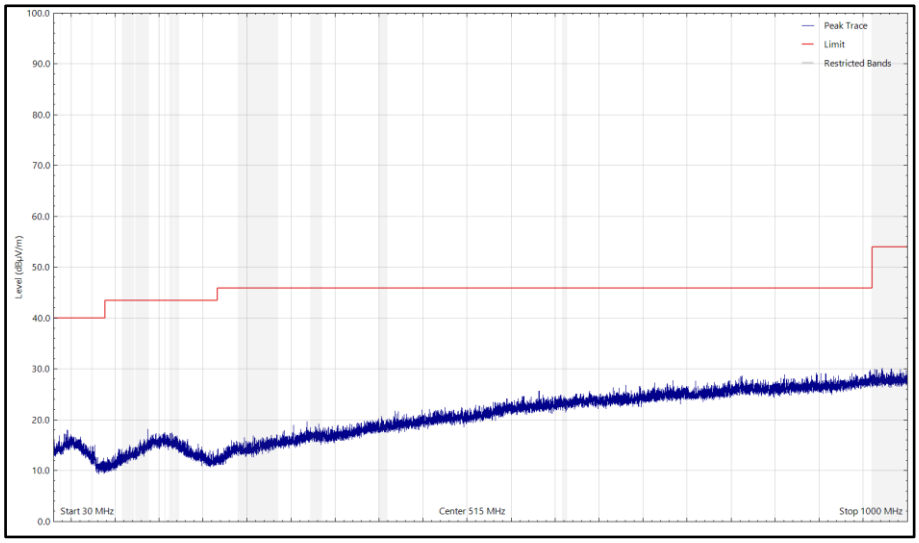

Figure 66 - Zigbee_Mid Channel_Y, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

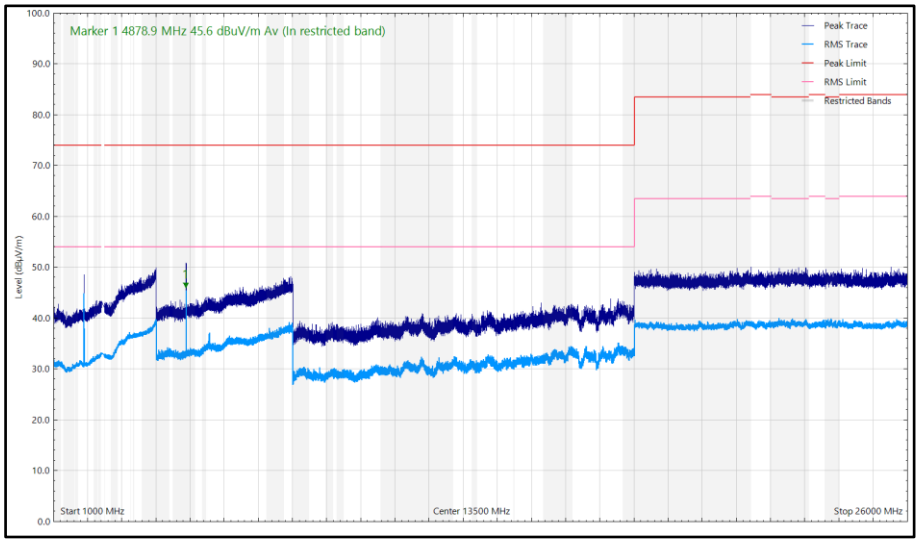

Figure 67 - Zigbee_Mid Channel_Y, 2440 MHz, 1 GHz to 26 GHz, Horizontal

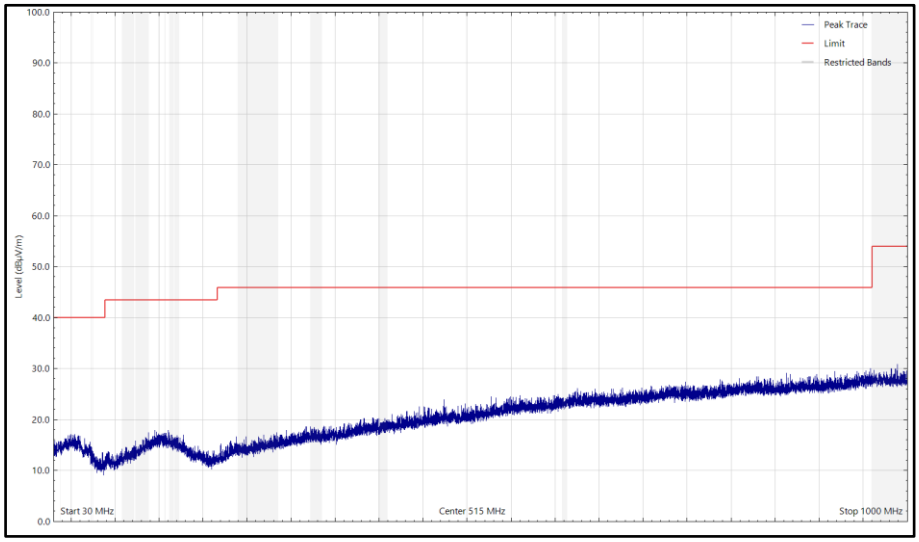

Figure 68 - Zigbee_Mid Channel_Y, 2440 MHz, 30 MHz to 1 GHz, Vertical (Peak)

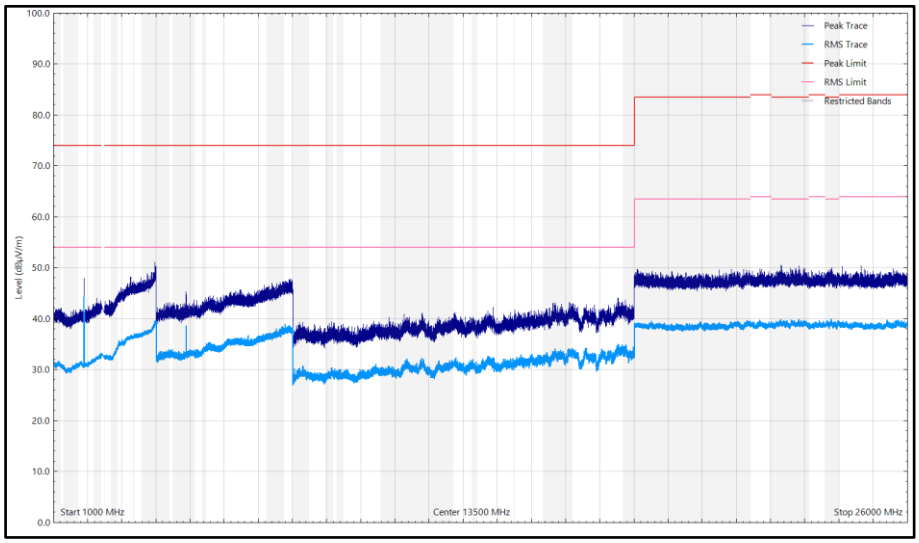

Figure 69 - Zigbee_Mid Channel_Y, 2440 MHz, 1 GHz to 26 GHz, Vertical

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

Table 38 - Zigbee_Mid Channel_Z, 2440 MHz, 18 to 26 GHz

*No emissions found within 10 dB of the limit.

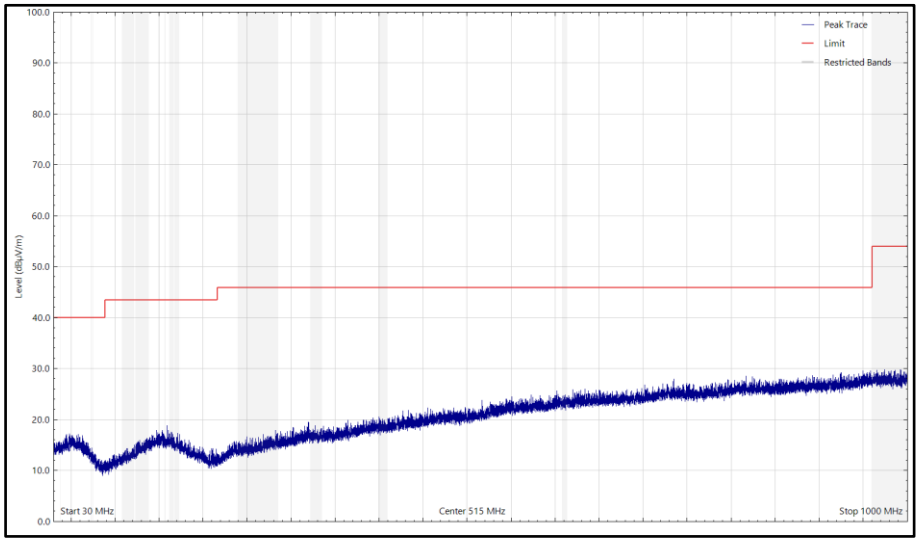

Figure 70 - Zigbee_Mid Channel_Z, 2440 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

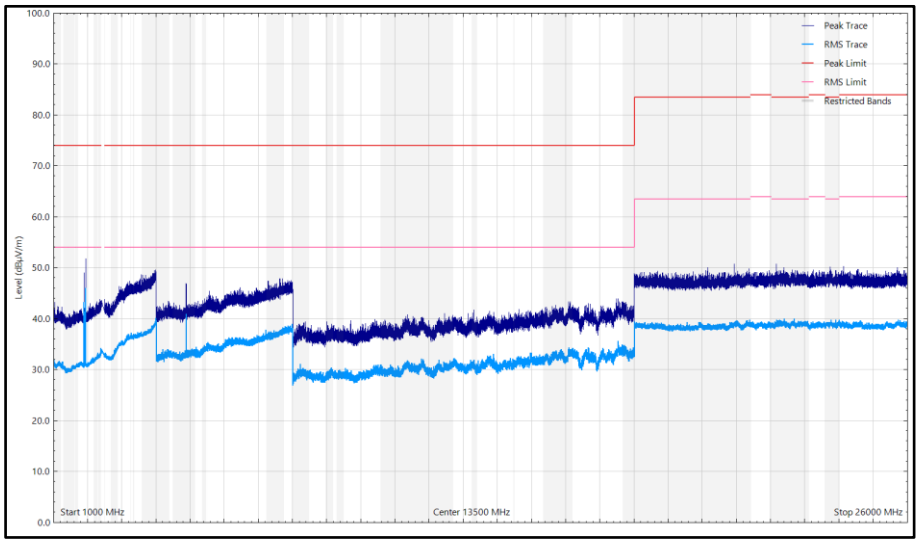

Figure 71 - Zigbee_Mid Channel_Z, 2440 MHz, 1 GHz to 26 GHz, Horizontal