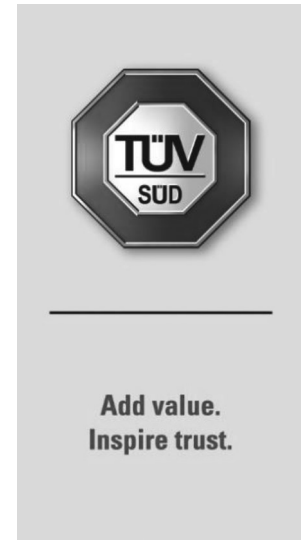


FCC and ISED Test Report  
 GRUNDFOS Holding A/S  
 Grundfos Wi-fi Module, Model: RA4G2WIFI  
 In accordance with FCC 47 CFR Part 15C, ISED  
 RSS-247 and ISED RSS-GEN  
 (2.4 GHz WLAN)

Prepared for: GRUNDFOS Holding A/S  
 Poul Due Jensens Vej 7, Bjerringbro  
 8850, DENMARK

FCC ID: OG3-RA2G4WIFI IC: 10447A-RA2G4WIFI



COMMERCIAL-IN-CONFIDENCE

Document 75954955-03 Issue 01

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Matthew Russell	Senior Engineer (RF)	Authorised Signatory	11 October 2022

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

ENGINEERING STATEMENT

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

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Paul Dickson	11 October 2022	
Testing	Daniel Cameron	11 October 2022	
Testing	Ahmad Javid	11 October 2022	

FCC Accreditation  
 90987 Octagon House, Fareham Test Laboratory

ISED Accreditation  
 12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

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

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# 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	11 October 2022

**Table 1**

## 1.2 Introduction

Applicant	GRUNDFOS Holding A/S
Manufacturer	GRUNDFOS Holding A/S
Model Number(s)	RA4G2WIFI
Serial Number(s)	Not serialised (Storix ID 651117-02) and Not serialised (Storix ID 651117-01)
Hardware Version(s)	V004
Software Version(s)	TI service pack ver. 4.7.0.3.3.1.0.5.3.1.0.26
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	Signed QAF
Date	28-February-2022
Date of Receipt of EUT	23-May-2022
Start of Test	18-June-2022
Finish of Test	18-September-2022
Name of Engineer(s)	Paul Dickson, Daniel Cameron and Ahmad Javid
Related Document(s)	ANSI C63.10 (2013) ANSI C63.10 (2020) KDB 662911 D01 v02r01



### 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			
Configuration and Mode: 2.4 GHz WLAN					
-	15.203	-	Antenna Requirement	N/T	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.205	3.3	Restricted Band Edges	Pass	
2.2	15.247 (a)(2)	5.2	Emission Bandwidth	Pass	
2.3	15.247 (b)	5.4	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.209	3.5 and 5.5	Spurious Radiated Emissions	Pass	
2.5	15.247 (d)	5.5	Authorised Band Edges	Pass	
2.6	15.247 (e)	5.2	Power Spectral Density	Pass	

**Table 2**



## 1.4 Application Form

### Equipment Description

Technical Description: <i>(Please provide a brief description of the intended use of the equipment including the technologies the product supports)</i>	The WIFI module is a complete integrated WLAN 802.11b/g/n radio transceiver solution based on the TI CC3130R SimpleLink wireless network processor.	
Manufacturer:	Grundfos Holding A/S	
Model:	RA2G4WIFI	
Part Number:	92701736	
Hardware Version:	V004	
Software Version:	TI service pack ver. 4.7.0.3.3.1.0.5.3.1.0.26	
FCC ID of the product under test – see guidance here	OG3-RA2G4WIFI	
IC ID of the product under test – see guidance here	10447A-RA2G4WIFI	

**Table 3**

### Intentional Radiators

Technology	2.4GHz WiFi		
Frequency Range (MHz to MHz)	2400-2483.5		
Conducted Declared Output Power (dBm)	16.05 dBm		
Antenna Gain (dBi)	2.15		
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	20		
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	DSSS, OFDM		
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)			
Bottom Frequency (MHz)	2412		
Middle Frequency (MHz)	2437		
Top Frequency (MHz)	2462		

**Table 4**

### Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2483.5MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	2400MHz
Class A Digital Device (Use in commercial, industrial or business environment) <input type="checkbox"/>	
Class B Digital Device (Use in residential environment only) <input type="checkbox"/>	

**Table 5**



AC Power Source

AC supply frequency:		Hz
Voltage		V
Max current:		A
Single Phase <input type="checkbox"/> Three Phase <input type="checkbox"/>		

**Table 6**

DC Power Source

Nominal voltage:	3.3	V
Extreme upper voltage:	3.6	V
Extreme lower voltage:	2.1	V
Max current:	272	mA

**Table 7**

Battery Power Source

Voltage:		V
End-point voltage:		V (Point at which the battery will terminate)
Alkaline <input type="checkbox"/> Leclanche <input type="checkbox"/> Lithium <input type="checkbox"/> Nickel Cadmium <input type="checkbox"/> Lead Acid* <input type="checkbox"/> *(Vehicle regulated)		
Other <input type="checkbox"/>	Please detail:	

**Table 8**

Charging

Can the EUT transmit whilst being charged	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
---	---

**Table 9**

Temperature

Minimum temperature:	-40	°C
Maximum temperature:	85	°C

**Table 10**

Cable Loss

Adapter Cable Loss (Conducted sample)	0.2dB	dB
---------------------------------------	-------	----

**Table 11**



Antenna Characteristics

Antenna connector <input type="checkbox"/>		State impedance		Ohm
Temporary antenna connector <input type="checkbox"/>		State impedance		Ohm
Integral antenna <input checked="" type="checkbox"/>	Type:		Gain	2.15 dBi
External antenna <input type="checkbox"/>	Type:		Gain	dBi
For external antenna only: Standard Antenna Jack <input type="checkbox"/> If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed <input type="checkbox"/> Non-standard Antenna Jack <input type="checkbox"/>				

**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: Digital Compliance  
 Date: 26-Sept-2022



**1.5 Product Information**

**1.5.1 Technical Description**

The WIFI module is a complete integrated WLAN 802.11b/g/n radio transceiver solution based on the TI CC3130R SimpleLink wireless network processor.

**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: RA4G2WIFI, Serial Number: Not serialised (Storix ID 651117-01)			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: RA4G2WIFI, Serial Number: Not serialised (Storix ID 651117-02)			
0	As supplied by the customer	Not Applicable	Not Applicable

**Table 14**

**1.8 Test Location**

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz WLAN		
Restricted Band Edges	Paul Dickson	UKAS
Emission Bandwidth	Daniel Cameron	UKAS
Maximum Conducted Output Power	Daniel Cameron	UKAS
Spurious Radiated Emissions	Ahmad Javid	UKAS
Authorised Band Edges	Paul Dickson	UKAS
Power Spectral Density	Daniel Cameron	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

RA4G2WIFI, S/N: Not serialised (Storix ID 651117-02) - Modification State 0

#### 2.1.3 Date of Test

18-June-2022 to 23-June-2022

#### 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 dB $\mu$ V/m to  $\mu$ V/m:

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

#### 2.1.5 Environmental Conditions

Ambient Temperature	18.6 - 19.8 °C
Relative Humidity	42.2 - 56.2 %

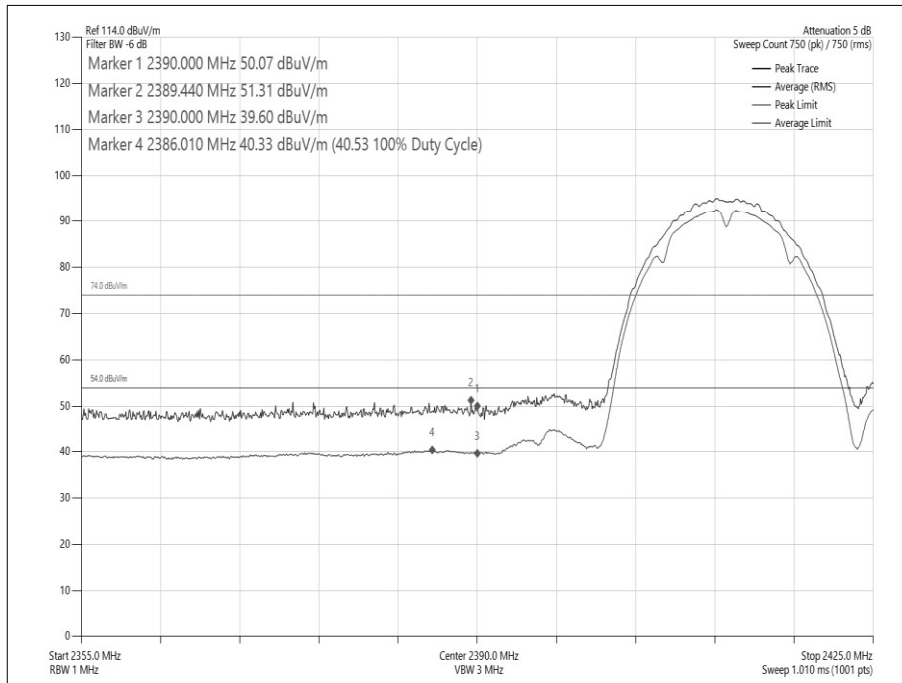


**2.1.6 Test Results**

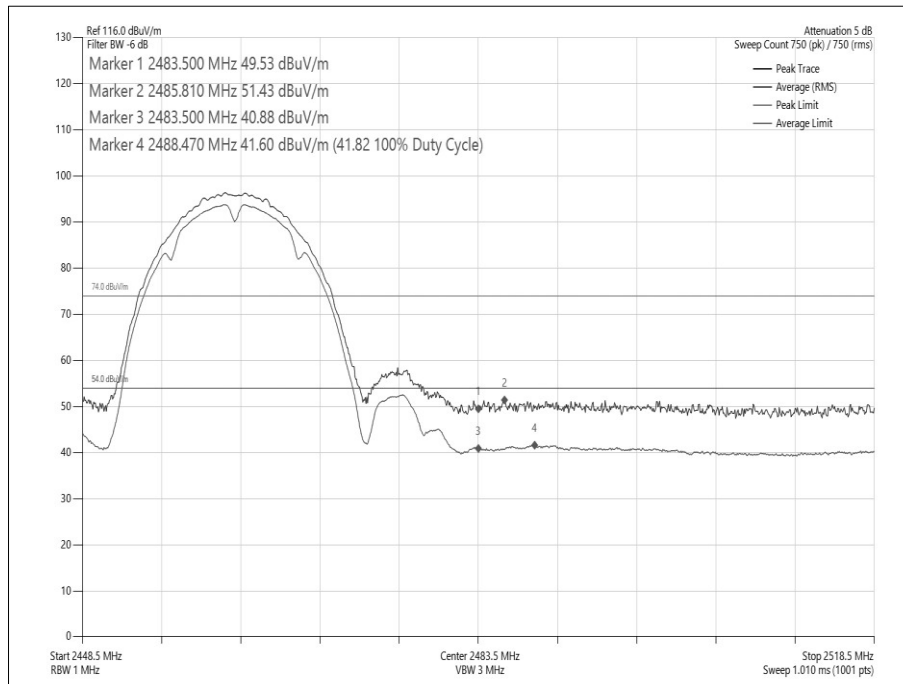
2.4 GHz WLAN

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Data Rate/MCS with the Highest Power	1 Mbps-802.11b	2412	2390	51.31	40.53
Data Rate/MCS with the Highest Power	1 Mbps-802.11b	2462	2483.5	51.43	41.82
Data Rate/MCS with the Highest Power	6 Mbps-802.11g	2412	2390	50.68	40.22
Data Rate/MCS with the Highest Power	6 Mbps-802.11g	2462	2483.5	51.94	40.77
Data Rate/MCS with the Highest Power	MCS0-HT-20	2412	2390	51.95	40.49
Data Rate/MCS with the Highest Power	MCS0-HT-20	2462	2483.5	52.15	41.04

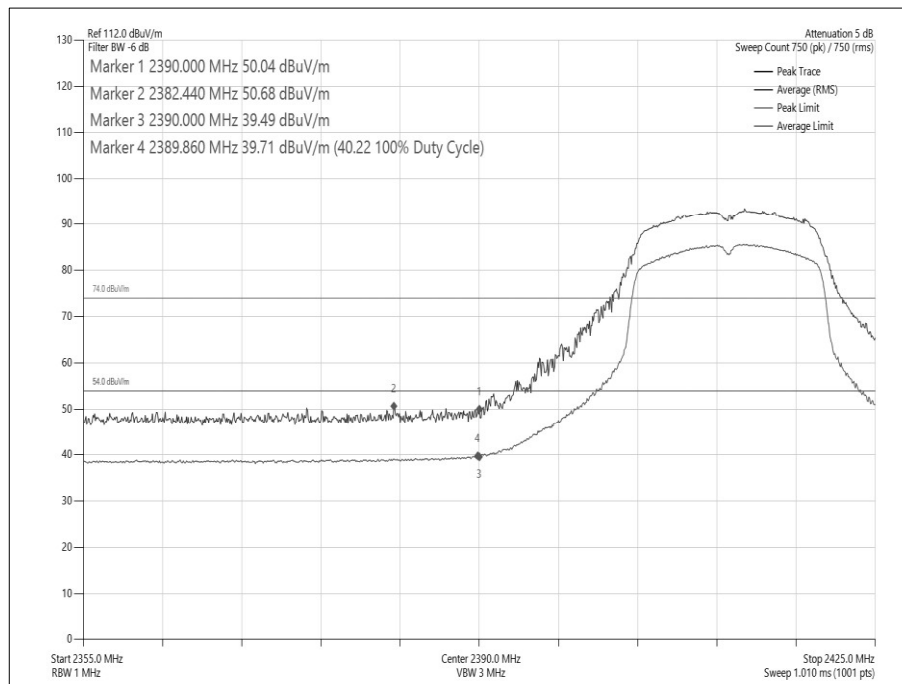
**Table 16**



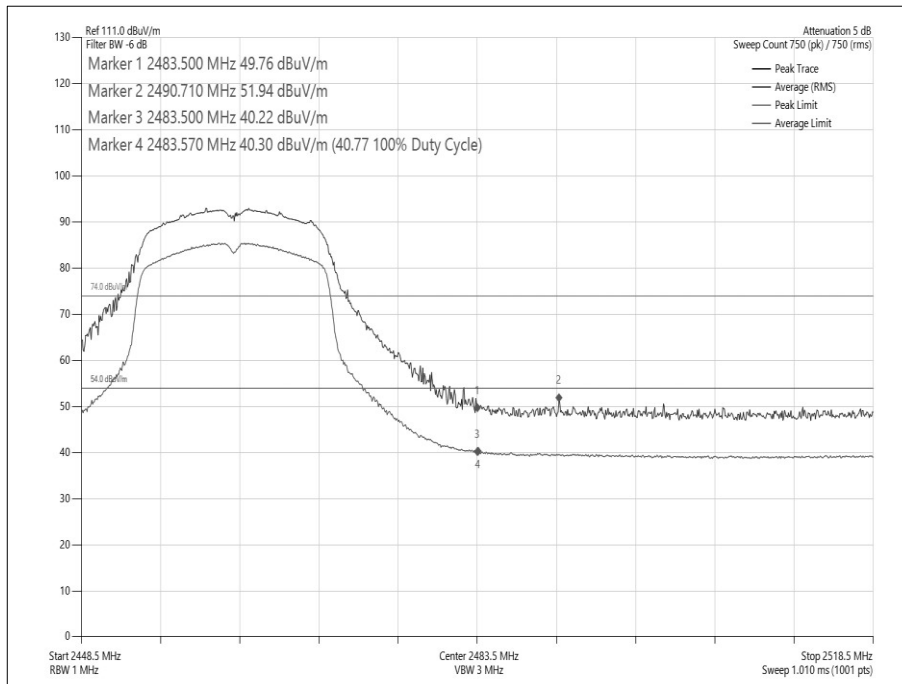
**Figure 1 - Data Rate/MCS with the Highest Power - 1 Mbps-802.11b - 2412 MHz - Measured Frequency 2390 MHz**



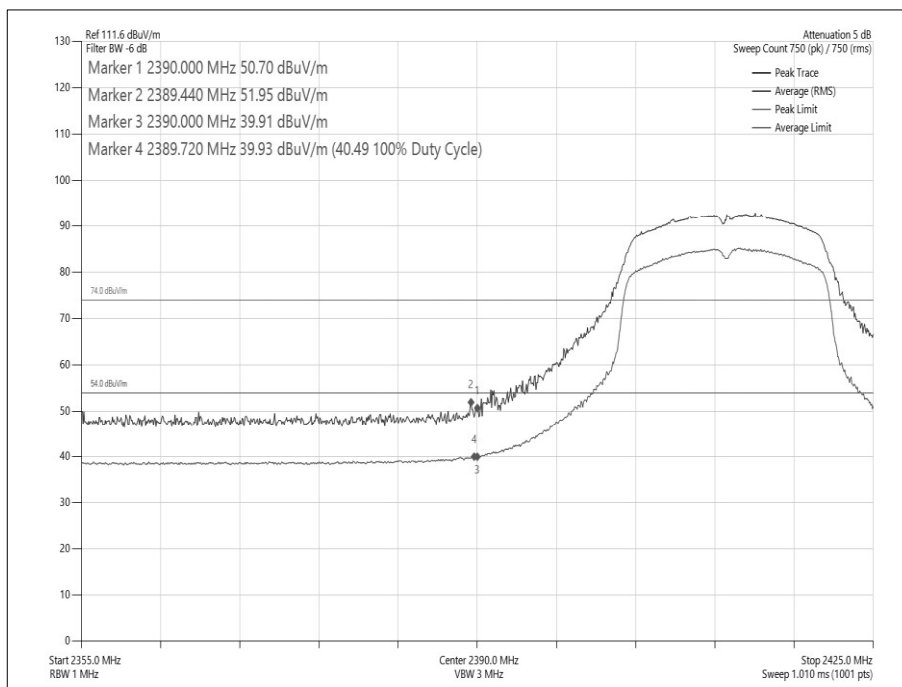
**Figure 2 - Data Rate/MCS with the Highest Power - 1 Mbps-802.11b - 2462 MHz - Measured Frequency 2483.5 MHz**



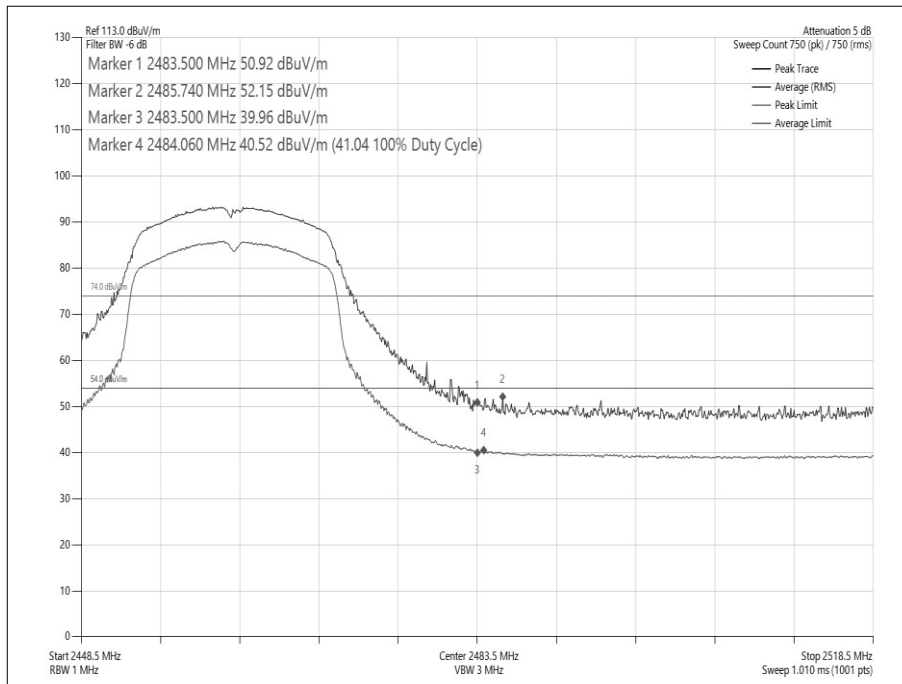
**Figure 3 - Data Rate/MCS with the Highest Power - 6 Mbps-802.11g - 2412 MHz - Measured Frequency 2390 MHz**



**Figure 4 - Data Rate/MCS with the Highest Power - 6 Mbps-802.11g - 2462 MHz - Measured Frequency 2483.5 MHz**



**Figure 5 - Data Rate/MCS with the Highest Power - MCS0-HT-20 - 2412 MHz - Measured Frequency 2390 MHz**



**Figure 6 - Data Rate/MCS with the Highest Power - MCS0-HT-20 - 2462 MHz - Measured Frequency 2483.5 MHz**

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ( $\mu\text{V}/\text{m}$ 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 ( $\mu\text{V}/\text{m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960*	500

**Table 18**

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



**2.1.7 Test Location and Test Equipment Used**

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	179	4006	12	29-Mar-2023
Cable (SMA to SMA, 2 m)	Rhophase	3PS-1801A-2000-3PS	4113	12	27-Jan-2023
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Emissions Software	TUV SUD	EmX V3.1.1	5125	-	Software
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5212	12	06-Sep-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	23-Sep-2022
Antenna (DRG, 1 GHz to 10 GHz)	Schwarzbeck	BBHA9120B	5611	12	15-Oct-2022
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5912	12	17-Feb-2023

**Table 19**

TU - Traceability Unscheduled



## **2.2 Emission Bandwidth**

### **2.2.1 Specification Reference**

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

### **2.2.2 Equipment Under Test and Modification State**

RA4G2WIFI, S/N: Not serialised (Storix ID 651117-01) - Modification State 0

### **2.2.3 Date of Test**

24-July-2022

### **2.2.4 Test Method**

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

### **2.2.5 Environmental Conditions**

Ambient Temperature	23.3 °C
Relative Humidity	60.2 %



**2.2.6 Test Results**

2.4 GHz WLAN

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:	802.11b	Duty Cycle (%):	-
Data Rate:	1 Mbps	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	9.180	-	-	-	≥500.0
2437	9.180	-	-	-	≥500.0
2462	9.180	-	-	-	≥500.0

**Table 20 - 6 dB Bandwidth Results**

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	14.040	-	-	-	-
2437	14.100	-	-	-	-
2462	14.040	-	-	-	-

**Table 21 - 99% Bandwidth Results**





Figure 7 - Port A (A) 2412 MHz (CH1)  
 99% Bandwidth



Figure 8 - Port A (A) 2412 MHz (CH1) 6  
 dB Bandwidth



Figure 9 - Port A (A) 2437 MHz (CH6)  
 99% Bandwidth



Figure 10 - Port A (A) 2437 MHz (CH6) 6  
 dB Bandwidth



Figure 11 - Port A (A) 2462 MHz (CH11)  
 99% Bandwidth



Figure 12 - Port A (A) 2462 MHz (CH11)  
 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:	802.11g	Duty Cycle (%):	-
Data Rate:	6 Mbps	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	15.180	-	-	-	≥500.0
2437	15.200	-	-	-	≥500.0
2462	15.240	-	-	-	≥500.0

**Table 22 - 6 dB Bandwidth Results**

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	16.380	-	-	-	-
2437	17.120	-	-	-	-
2462	16.380	-	-	-	-

**Table 23 - 99% Bandwidth Results**



Figure 13 - Port A (A) 2412 MHz (CH1)  
 99% Bandwidth

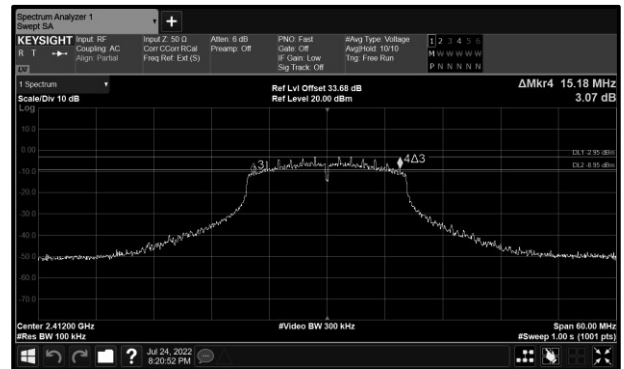


Figure 14 - Port A (A) 2412 MHz (CH1) 6  
 dB Bandwidth



Figure 15 - Port A (A) 2437 MHz (CH6)  
 99% Bandwidth

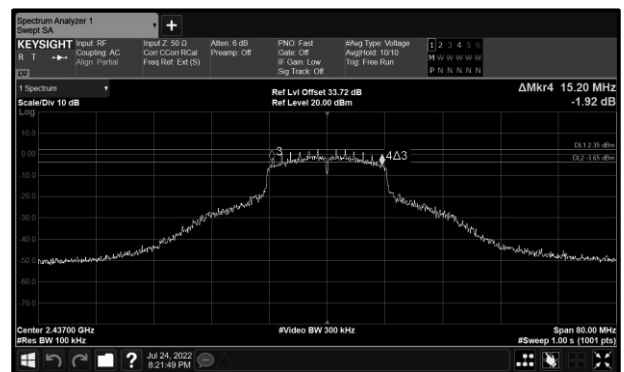


Figure 16 - Port A (A) 2437 MHz (CH6) 6  
 dB Bandwidth

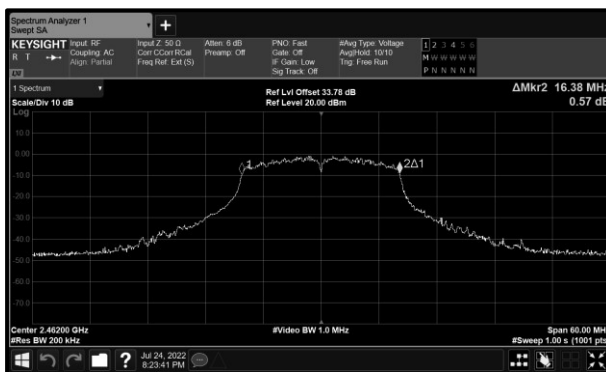


Figure 17 - Port A (A) 2462 MHz (CH11)  
 99% Bandwidth



Figure 18 - Port A (A) 2462 MHz (CH11)  
 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:	802.11n HT20	Duty Cycle (%):	-
Modulation Coding Scheme:	MCS0	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	-
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	15.180	-	-	-	≥500.0
2437	15.240	-	-	-	≥500.0
2462	15.240	-	-	-	≥500.0

**Table 24 - 6 dB Bandwidth Results**

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2412	17.460	-	-	-	-
2437	17.700	-	-	-	-
2462	17.460	-	-	-	-

**Table 25 - 99% Bandwidth Results**

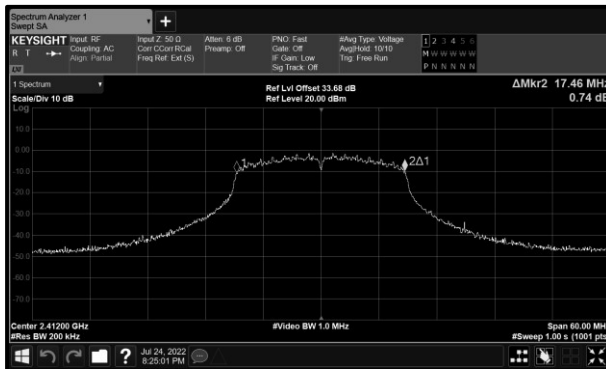


Figure 19 - Port A (A) 2412 MHz (CH1)  
99% Bandwidth

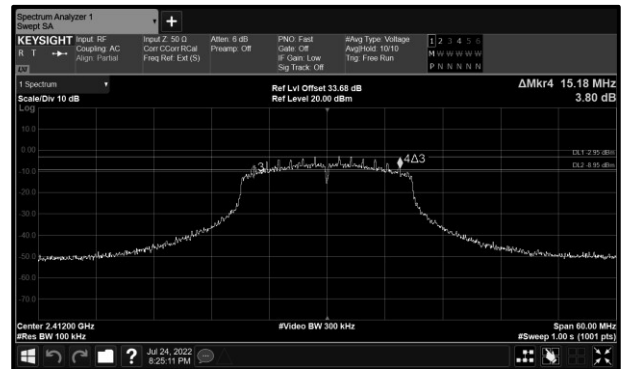


Figure 20 - Port A (A) 2412 MHz (CH1) 6  
dB Bandwidth

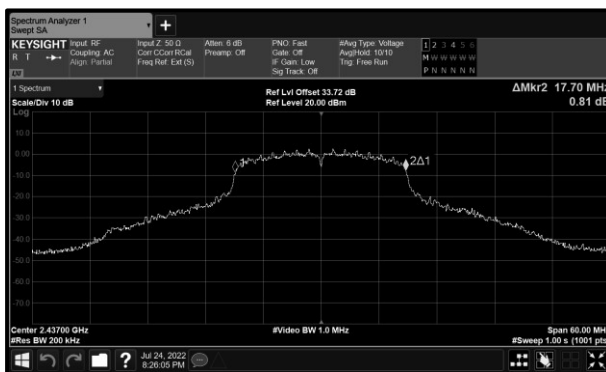


Figure 21 - Port A (A) 2437 MHz (CH6)  
99% Bandwidth

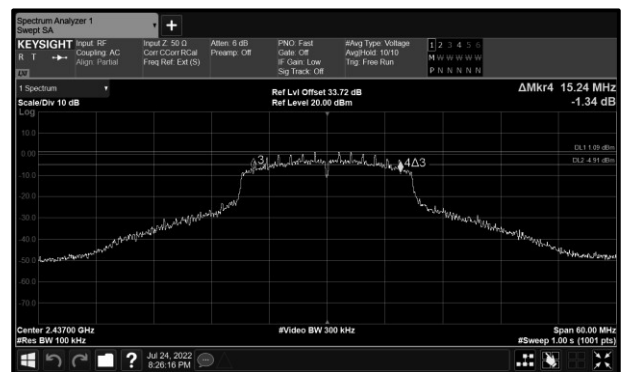


Figure 22 - Port A (A) 2437 MHz (CH6) 6  
dB Bandwidth

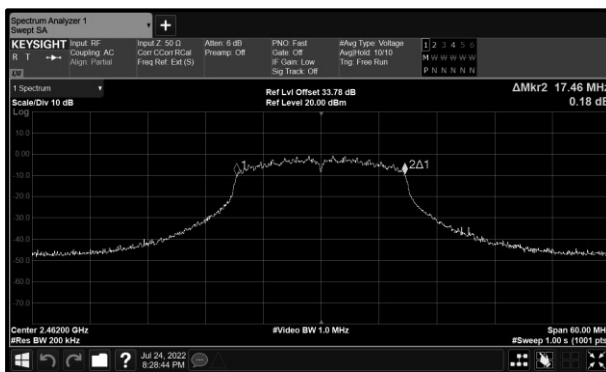


Figure 23 - Port A (A) 2462 MHz (CH11)  
99% Bandwidth

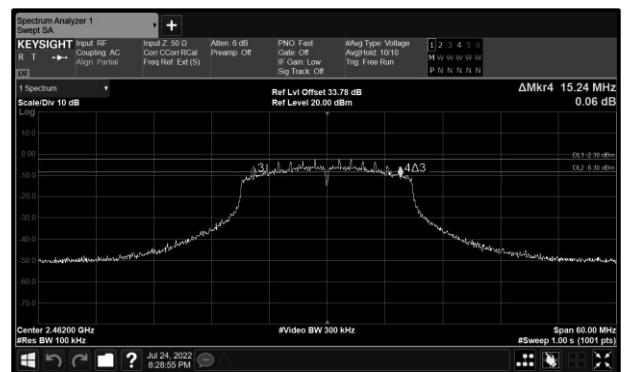


Figure 24 - Port A (A) 2462 MHz (CH11)  
6 dB Bandwidth

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 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Fluke	79 Series III	0611	12	21-Dec-2022
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	30-Jul-2022
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Signal Analyser	Keysight Technologies	N9020B	5919	24	13-Mar-2024
Signal Conditioning Unit	TUV SUD	SCU003	5932	12	10-May-2023
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5970	-	O/P Mon
Modular Power System mainframe	Keysight Technologies	N6701C	6151	-	O/P Mon

**Table 26**

O/P Mon – Output Monitored using calibrated equipment



**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**

RA4G2WIFI, S/N: Not serialised (Storix ID 651117-01) - Modification State 0

**2.3.3 Date of Test**

24-July-2022

**2.3.4 Test Method**

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

**2.3.5 Environmental Conditions**

Ambient Temperature	23.3 °C
Relative Humidity	60.2 %



**2.3.6 Test Results**

2.4 GHz WLAN

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:	802.11b	Duty Cycle (%):	94.7
Data Rate:	1 Mbps	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	3.00
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2412	15.50	-	-	-	-	30.00	-14.50
2437	15.63	-	-	-	-	30.00	-14.37
2462	15.86	-	-	-	-	30.00	-14.14

**Table 27 - FCC Maximum Conducted (Peak), Orientation: 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					
2412	15.50	-	-	-	-	30.00	-14.50	18.50	36.00	-17.50
2437	15.63	-	-	-	-	30.00	-14.37	18.63	36.00	-17.37
2462	15.86	-	-	-	-	30.00	-14.14	18.86	36.00	-17.14

**Table 28 - ISED Maximum Conducted (Peak), Orientation: 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:	802.11g	Duty Cycle (%):	88.4
Data Rate:	6 Mbps	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	3.00
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2412	16.53	-	-	-	-	30.00	-13.47
2437	17.93	-	-	-	-	30.00	-12.07
2462	17.32	-	-	-	-	30.00	-12.68

**Table 29 - FCC Maximum Conducted (Peak), Orientation: 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					
2412	16.53	-	-	-	-	30.00	-13.47	19.53	36.00	-16.47
2437	17.93	-	-	-	-	30.00	-12.07	20.93	36.00	-15.07
2462	17.32	-	-	-	-	30.00	-12.68	20.32	36.00	-15.68

**Table 30 - ISED Maximum Conducted (Peak), Orientation: 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:	802.11n HT20	Duty Cycle (%):	87.9
Modulation Coding Scheme:	MCS0	DCCF (dB):	-
Antenna Configuration:	SISO	Peak Antenna Gain (dBi):	3.00
Active Port(s):	A (Port A)	Active Chain(s):	0

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2412	16.54	-	-	-	-	30.00	-13.46
2437	17.33	-	-	-	-	30.00	-12.67
2462	17.28	-	-	-	-	30.00	-12.72

**Table 31 - FCC Maximum Conducted (Peak), Orientation: 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					
2412	16.54	-	-	-	-	30.00	-13.46	19.54	36.00	-16.46
2437	17.33	-	-	-	-	30.00	-12.67	20.33	36.00	-15.67
2462	17.28	-	-	-	-	30.00	-12.72	20.28	36.00	-15.72

**Table 32 - ISED Maximum Conducted (Peak), Orientation: 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.



**2.3.7 Test Location and Test Equipment Used**

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Fluke	79 Series III	611	12	21-Dec-2022
Hygrometer	Rotronic	I-1000	3220	12	05-Nov-2022
Signal Conditioning Unit	TUV SUD	SCU003	5932	12	10-May-2023
USB Power Sensors, 50MHz to 8GHz	Boonton	RTP5008	5921	12	17-Feb-2023
DC Power Module 60V 20A 300W	Keysight Technologies	N6754A	5970	-	O/P Mon
Modular Power System mainframe	Keysight Technologies	N6701C	6151	-	O/P Mon

**Table 33**

O/P Mon – Output Monitored using calibrated equipment



## **2.4 Spurious Radiated Emissions**

### **2.4.1 Specification Reference**

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

### **2.4.2 Equipment Under Test and Modification State**

RA4G2WIFI, S/N: Not serialised (Storix ID 651117-01) - Modification State 0

### **2.4.3 Date of Test**

15-September-2022 to 18-September-2022

### **2.4.4 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.

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:

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

Above 18 GHz, the measurement distance was reduced to 1 m. The limit line was increased by  $20 \cdot \text{LOG}(3/1) = 9.54$  dB.

At a measurement distance of 1 meter the limit line was increased by  $20 \cdot \text{LOG}(3/1) = 9.54$  dB.

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

### 2.4.5 Test Setup Diagram

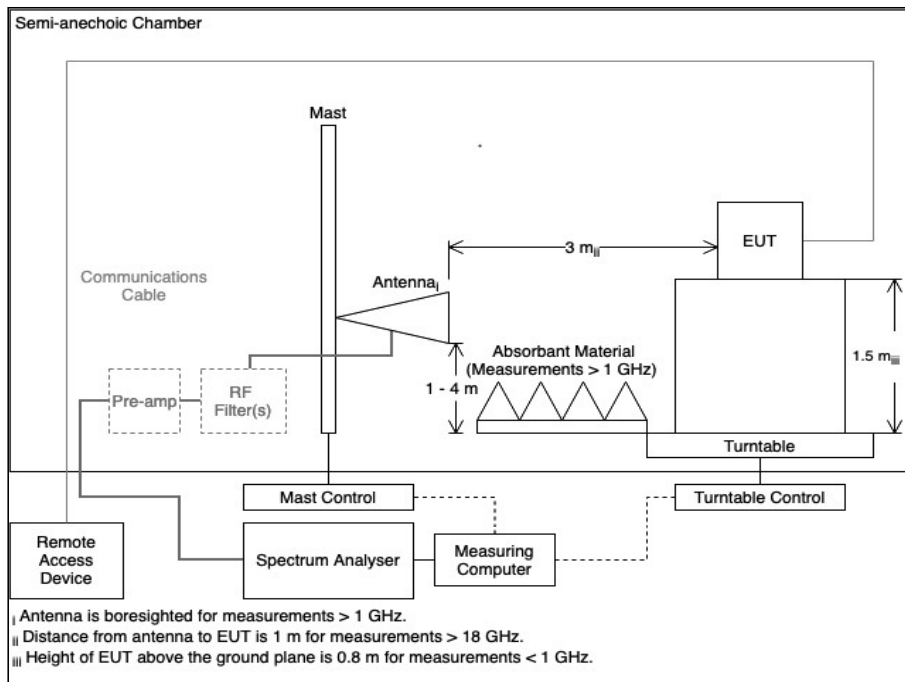


Figure 25

### 2.4.6 Environmental Conditions

Ambient Temperature	20.4 - 22.6 °C
Relative Humidity	38.6 - 43.4 %



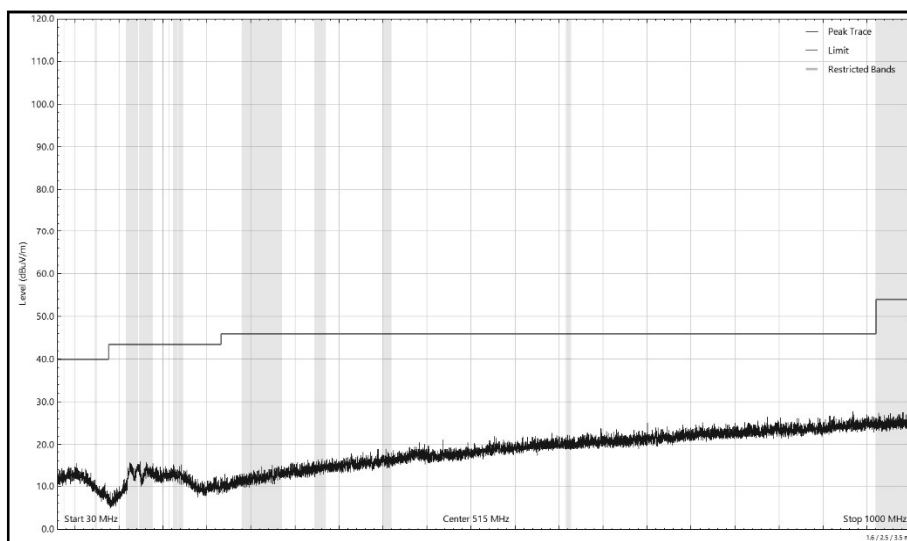
**2.4.7 Test Results**

2.4 GHz WLAN

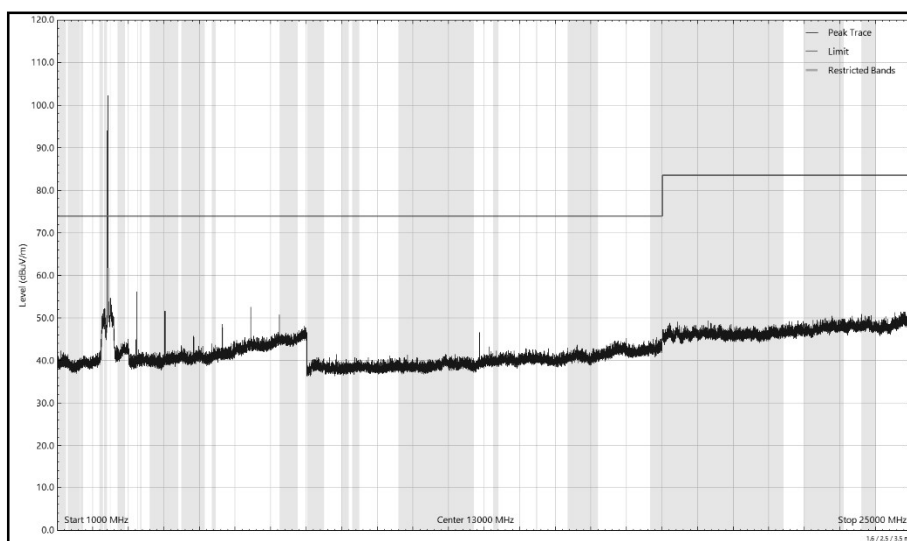
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4018.917	45.7	54.0	-8.3	RMS	288	127	Horizontal
4019.132	50.1	54.0	-3.9	RMS	203	101	Vertical
4824.051	46.9	54.0	-7.1	RMS	315	103	Vertical

**Table 34 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation X**

No other emissions found within 10 dB of the limit.



**Figure 26 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: X**



**Figure 27 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: X**

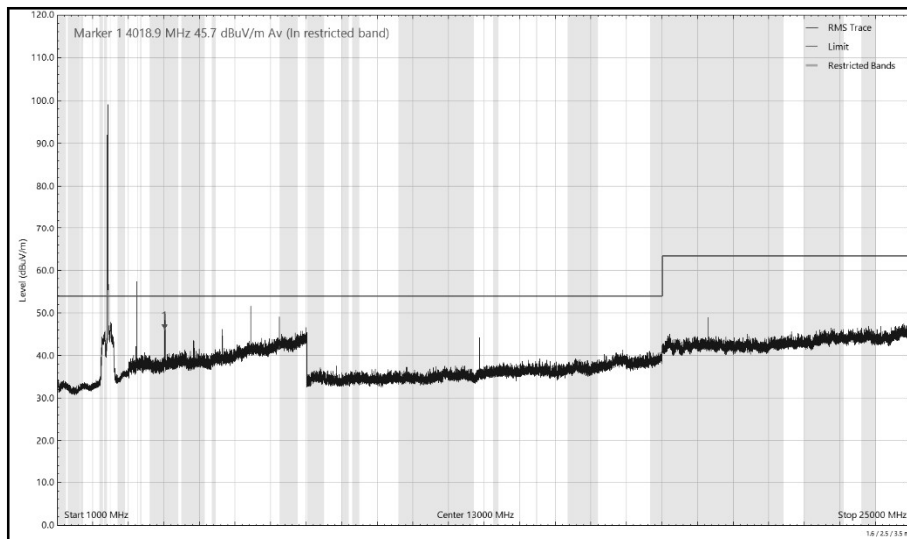


Figure 28 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: X

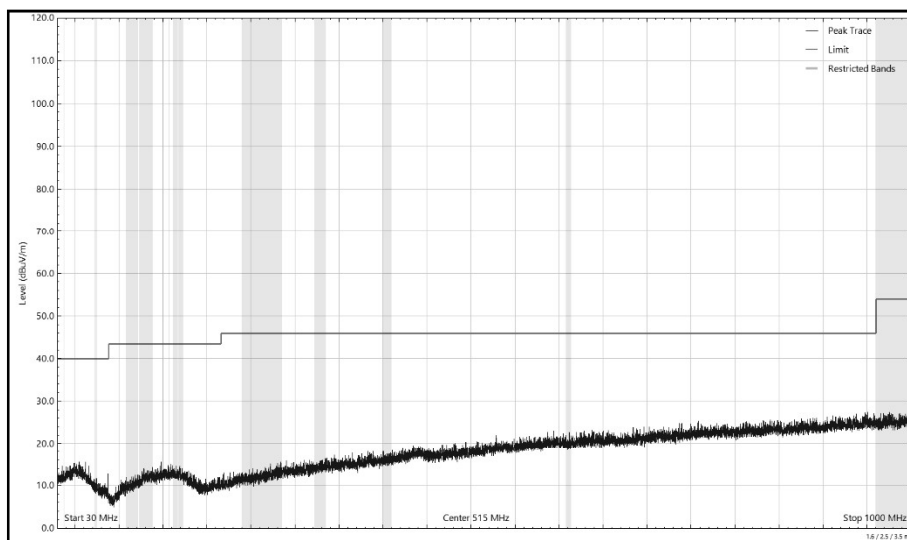


Figure 29 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: X

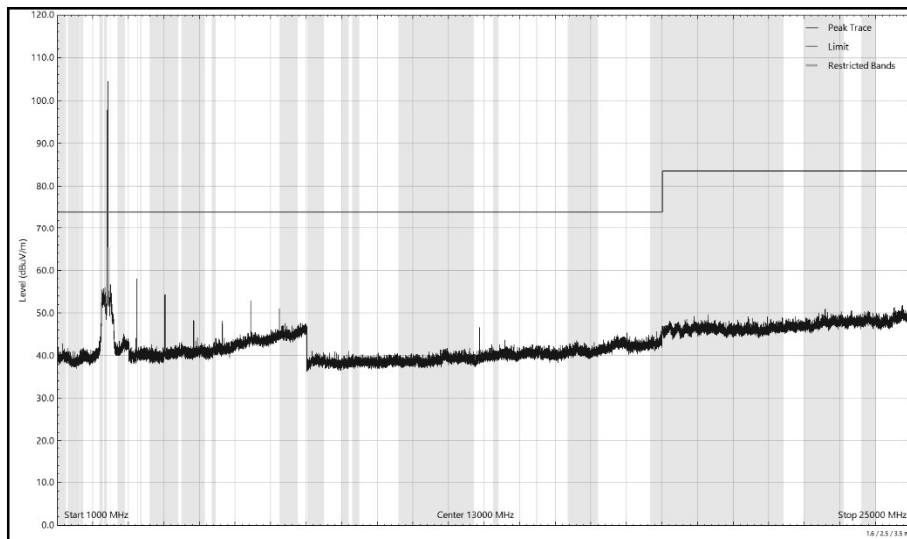


Figure 30 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: X

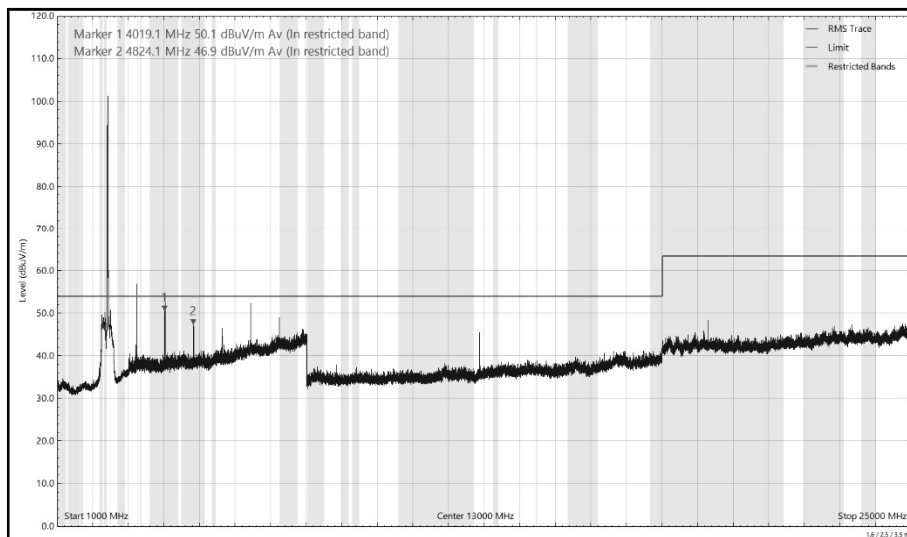


Figure 31 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: X

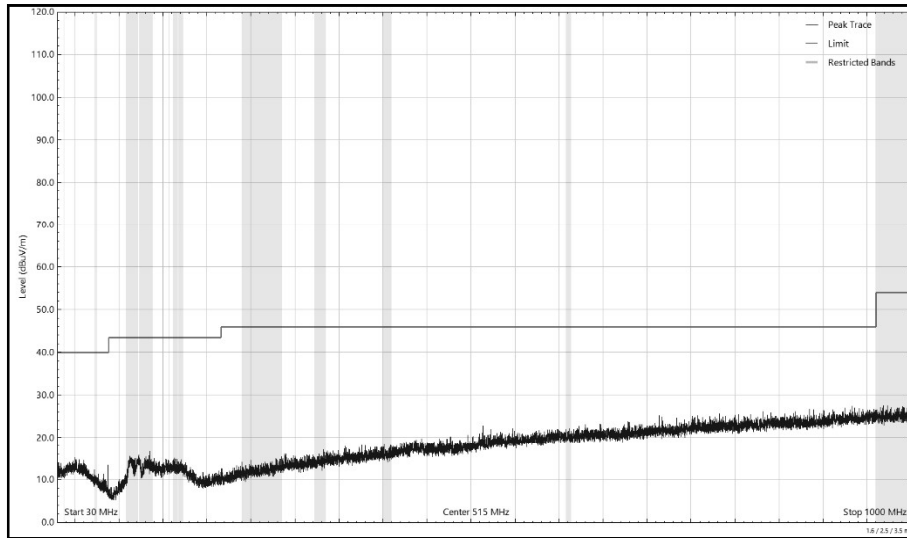




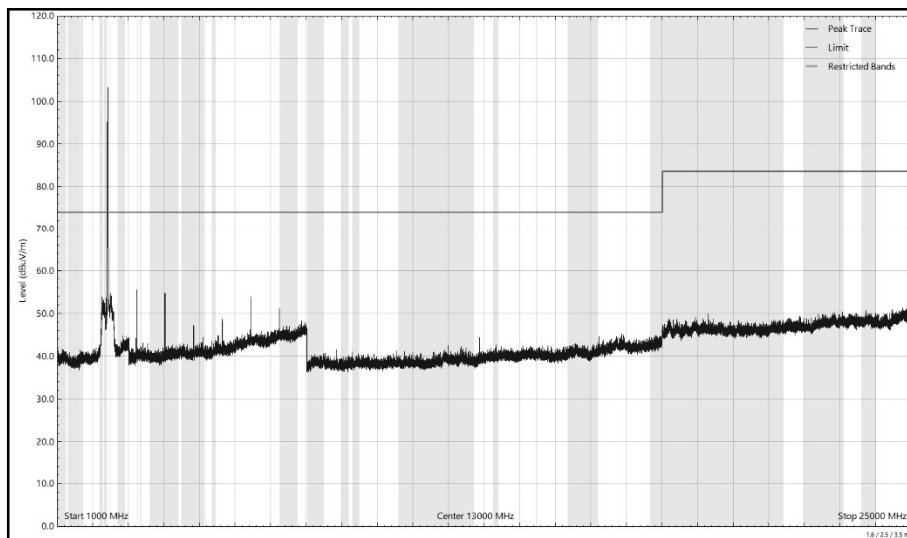
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4019.087	45.5	54.0	-8.5	RMS	214	107	Vertical
4020.932	49.4	54.0	-4.6	RMS	275	102	Horizontal
4823.907	45.6	54.0	-8.4	RMS	13	239	Horizontal
4823.917	44.3	54.0	-9.7	RMS	38	243	Vertical

**Table 35 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation: Y**

No other emissions found within 10 dB of the limit.



**Figure 32 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: Y**



**Figure 33 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: Y**

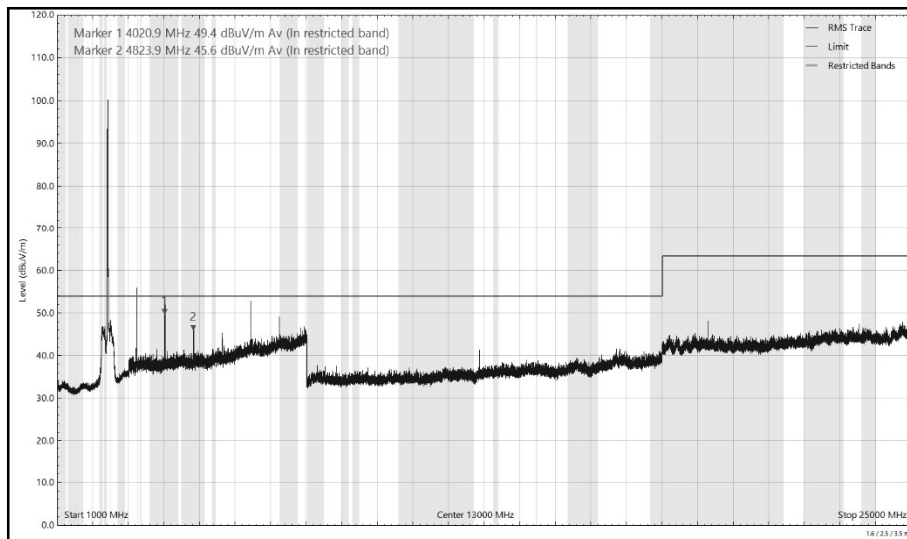


Figure 34 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: Y

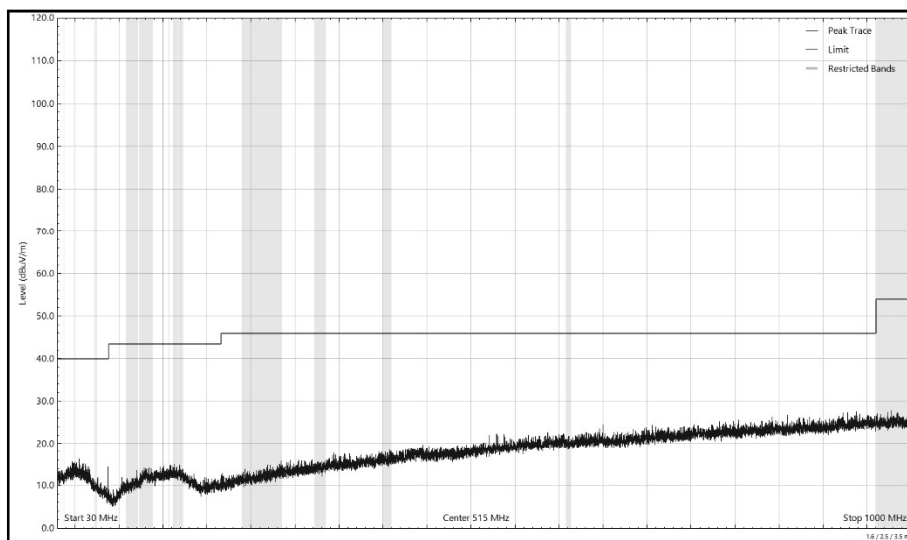


Figure 35 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: Y

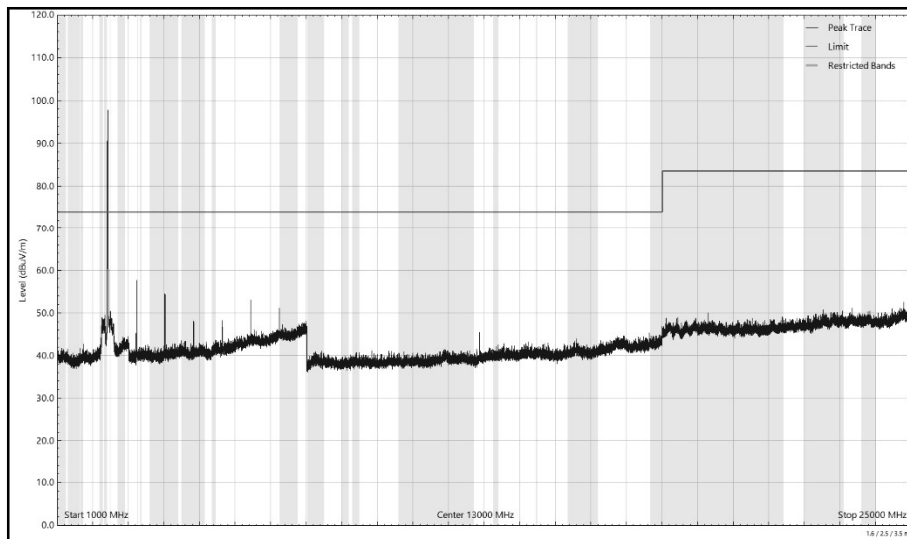


Figure 36 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: Y

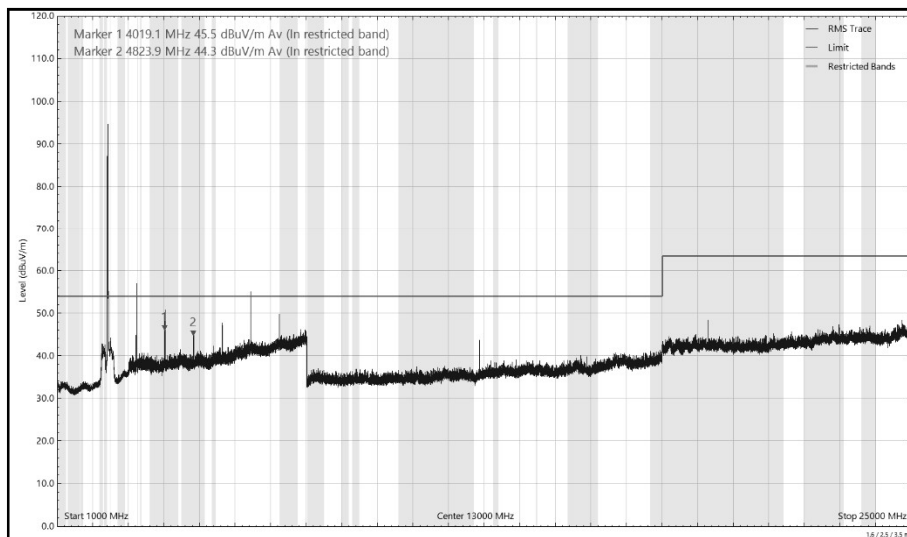


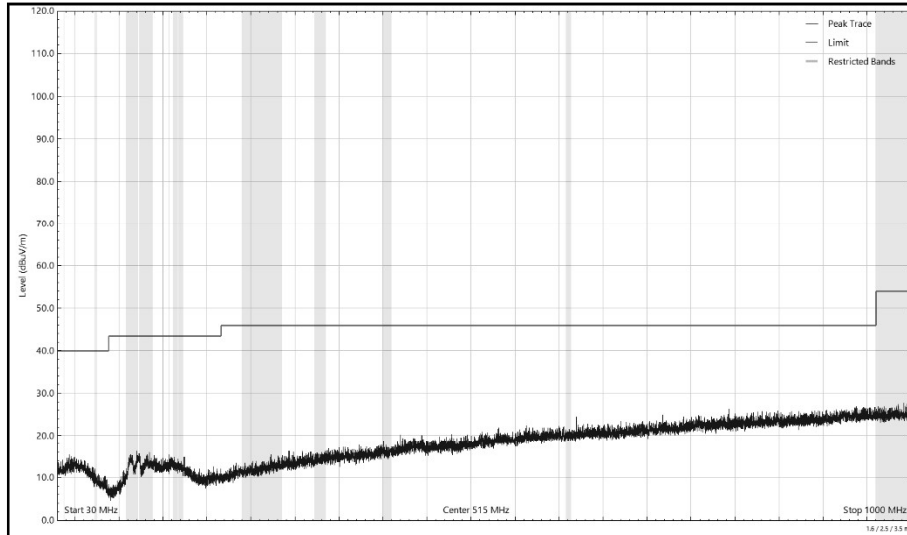
Figure 37 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: Y



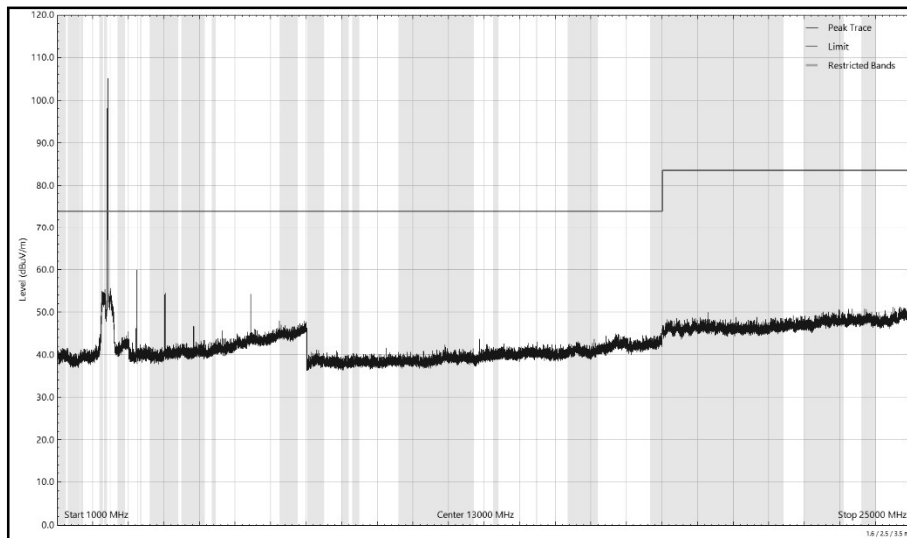
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4019.307	45.7	54.0	-8.3	RMS	285	100	Vertical
4020.902	48.5	54.0	-5.5	RMS	223	152	Horizontal

**Table 36 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation Z**

No other emissions found within 10 dB of the limit.



**Figure 38 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: Z**



**Figure 39 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: Z**

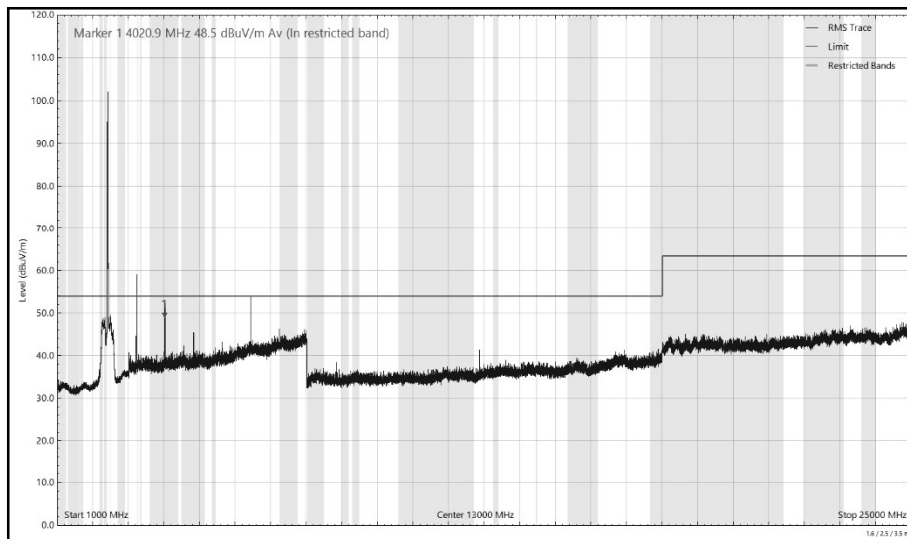


Figure 40 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: Z

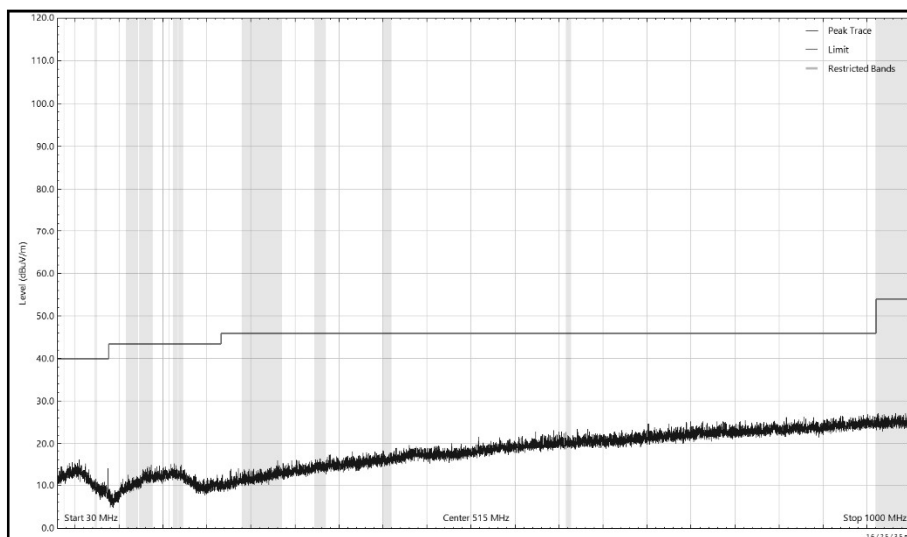


Figure 41 - 2412 MHz (CH1), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: Z

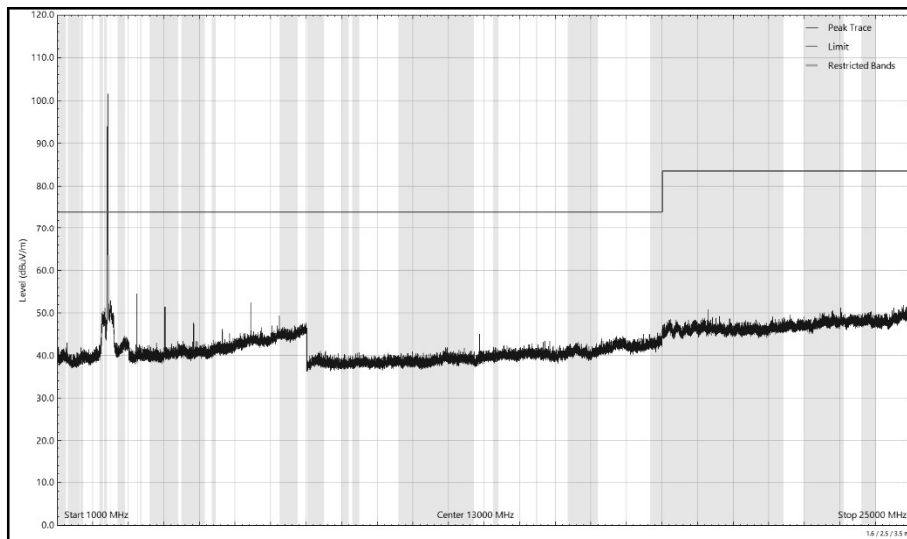


Figure 42 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: Z

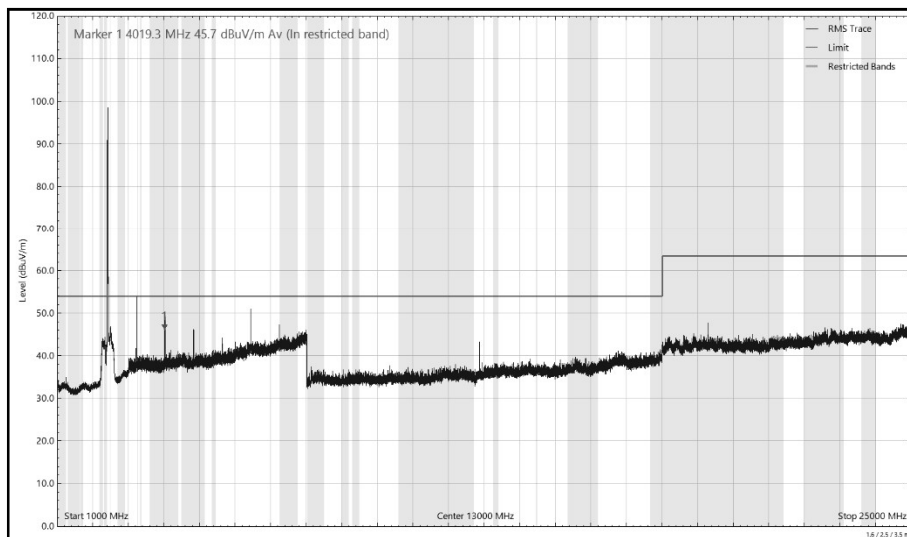


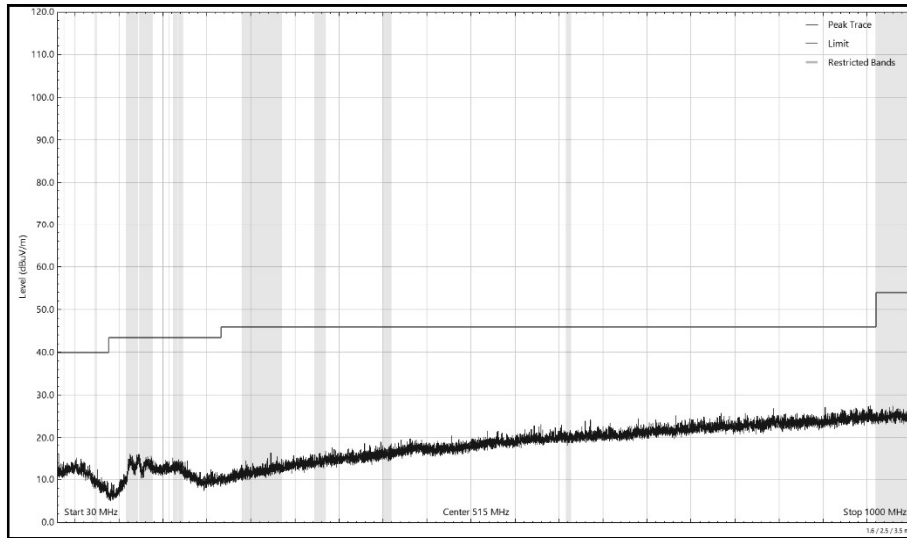
Figure 43 - 2412 MHz (CH1), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: Z



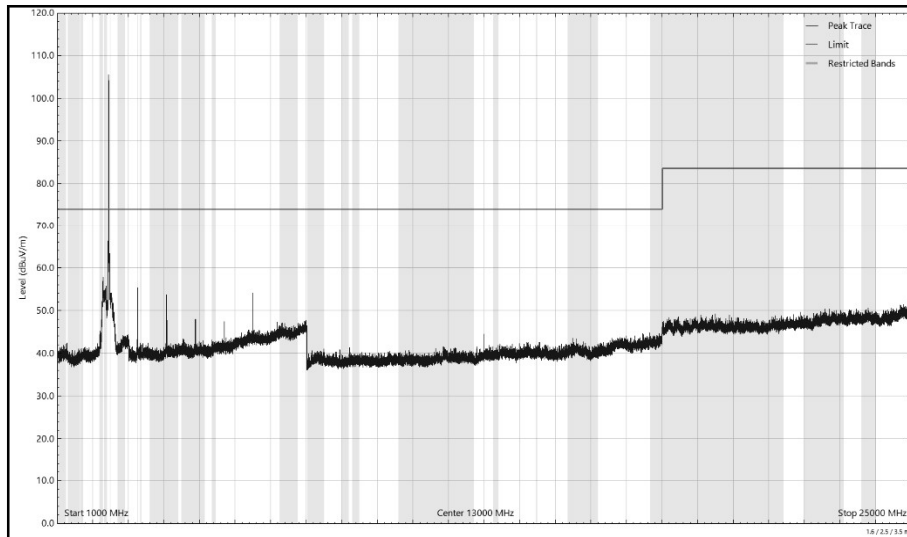
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4060.708	47.7	54.0	-6.3	RMS	346	284	Vertical
4060.730	48.0	54.0	-6.0	RMS	217	152	Horizontal
4873.879	46.3	54.0	-7.7	RMS	341	103	Horizontal
4873.949	45.2	54.0	-8.8	RMS	360	100	Vertical

**Table 37 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation X**

No other emissions found within 10 dB of the limit.



**Figure 44 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: X**



**Figure 45 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: X**

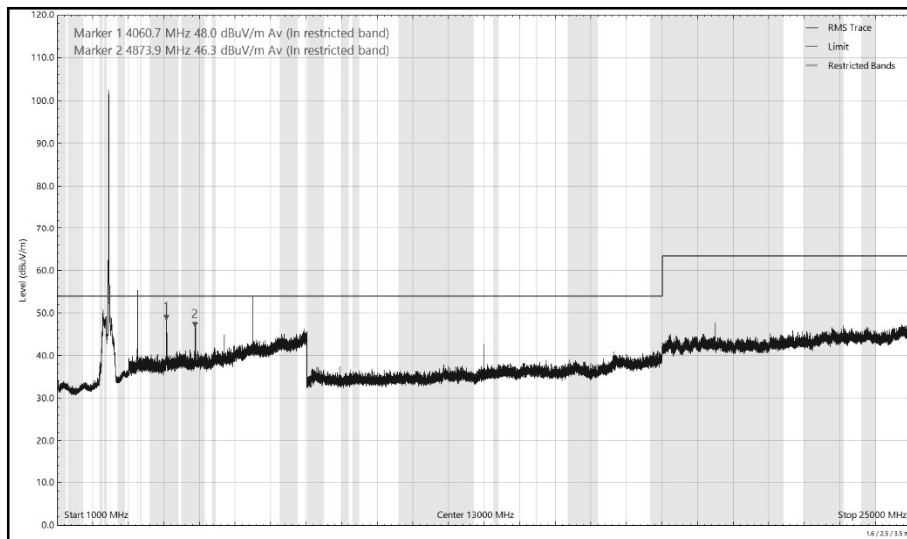


Figure 46 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: X

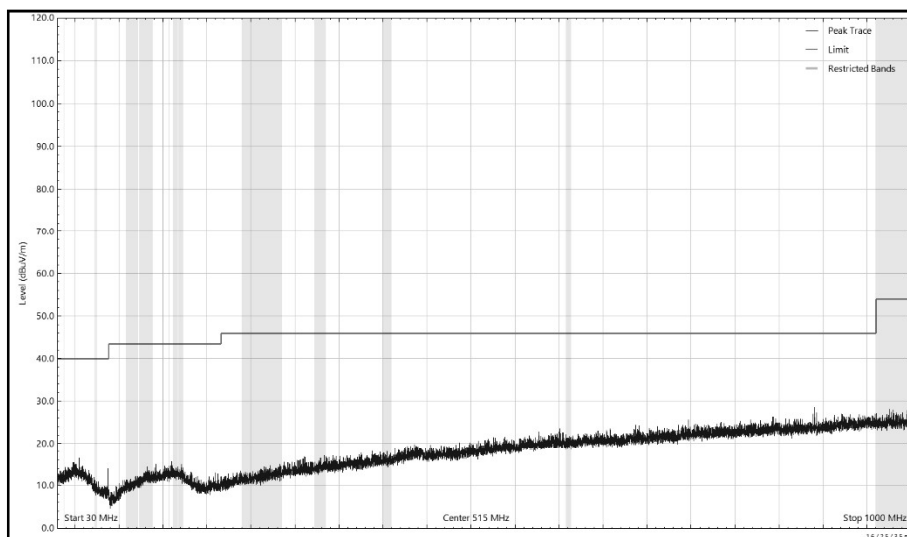


Figure 47 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: X



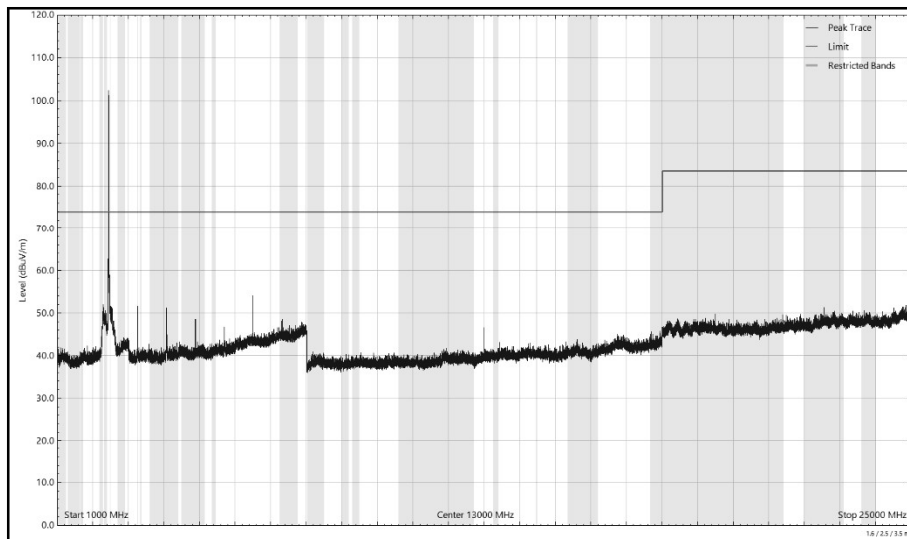


Figure 48 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: X

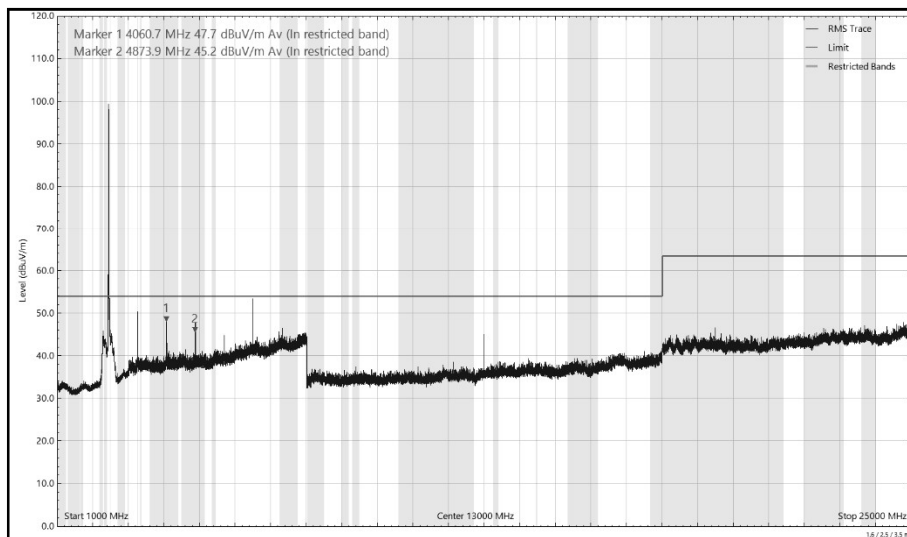


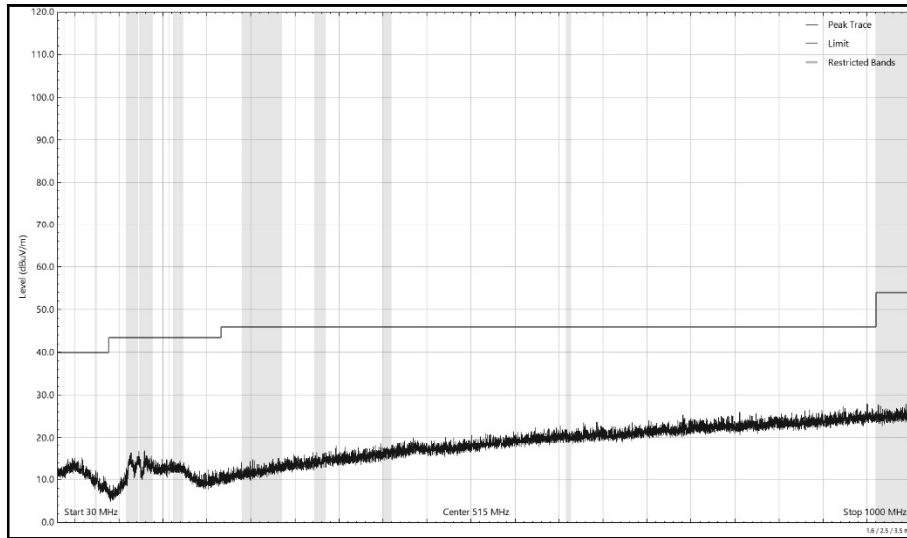
Figure 49 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: X



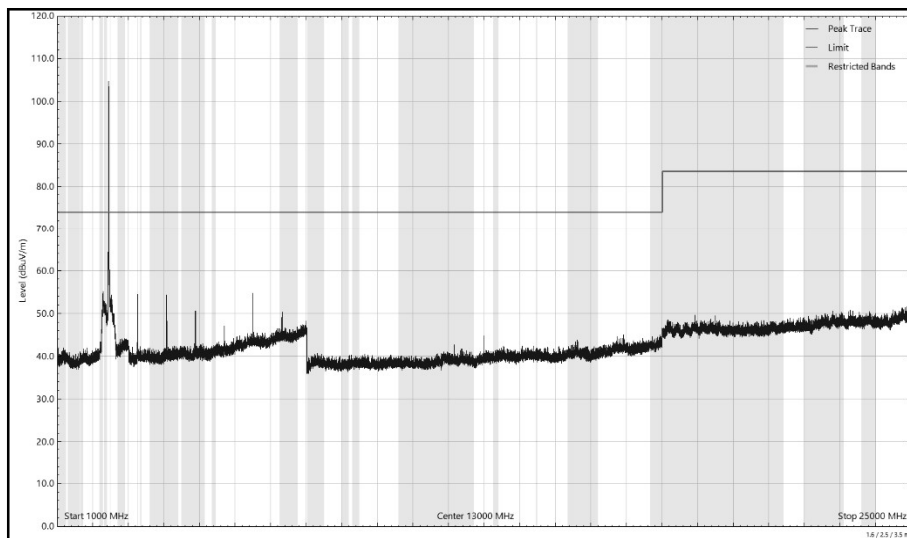
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4060.639	46.1	54.0	-7.9	RMS	213	192	Vertical
4061.944	46.5	54.0	-7.5	RMS	116	165	Horizontal
4873.950	48.3	54.0	-5.8	RMS	78	105	Horizontal
4873.965	44.8	54.0	-9.2	RMS	360	248	Vertical

**Table 38 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation Y**

No other emissions found within 10 dB of the limit.



**Figure 50 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: Y**



**Figure 51 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: Y**

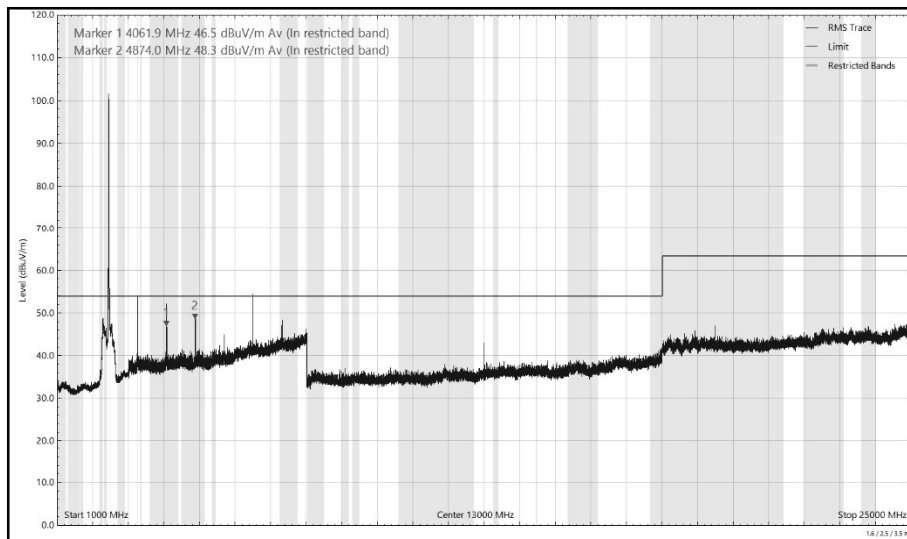


Figure 52 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: Y

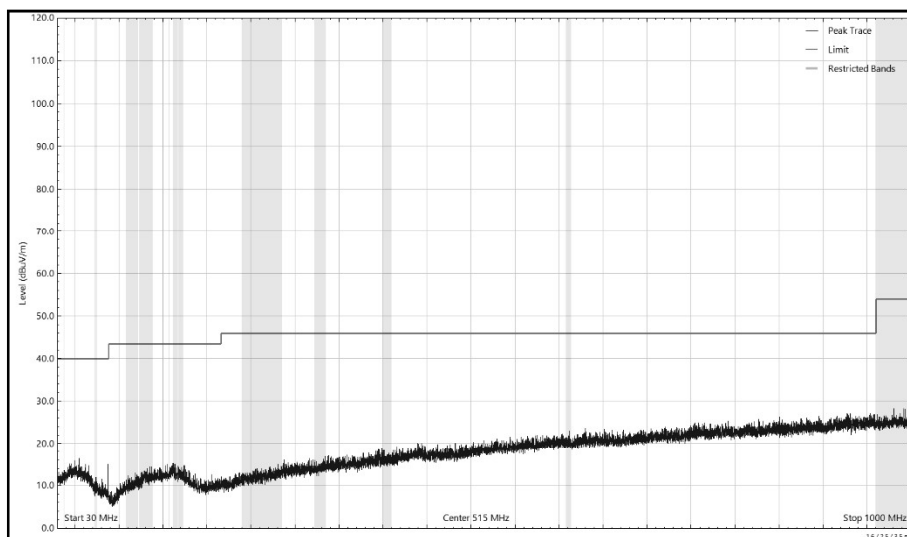


Figure 53 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: Y

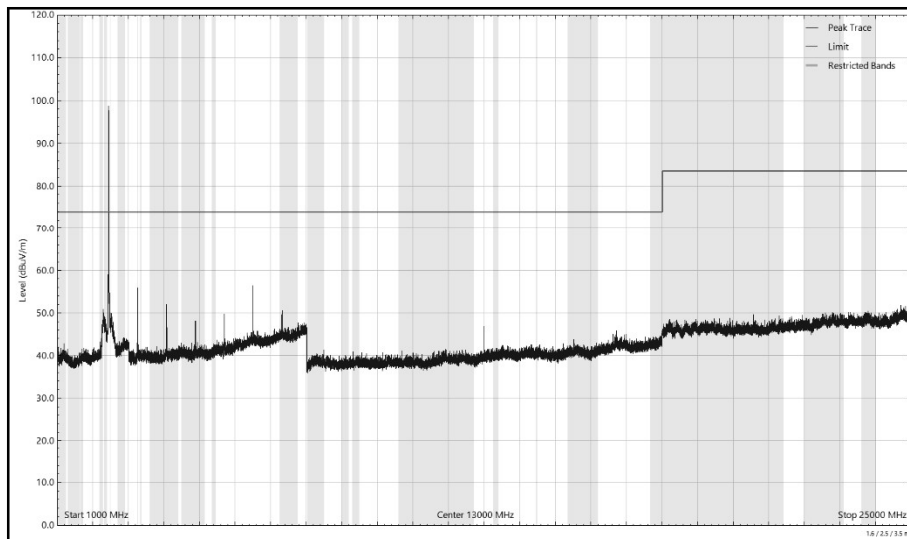


Figure 54 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: Y

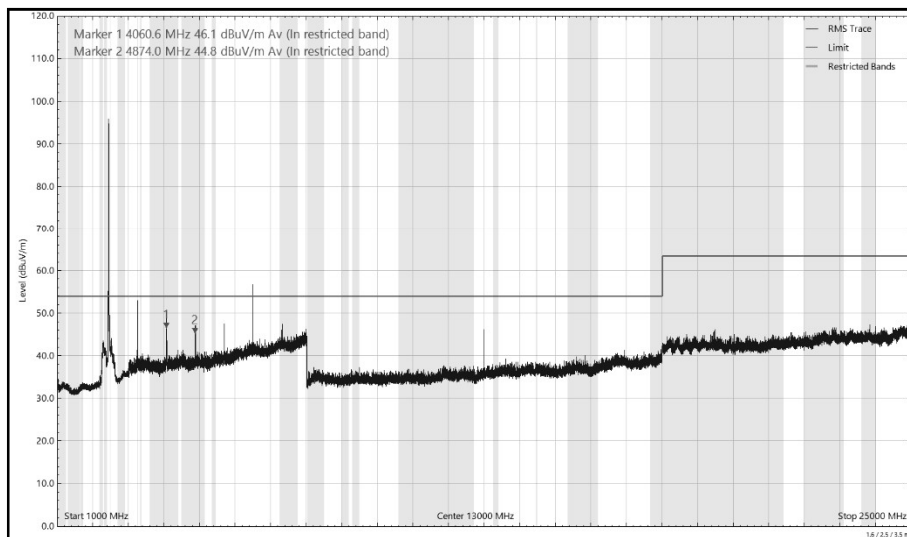


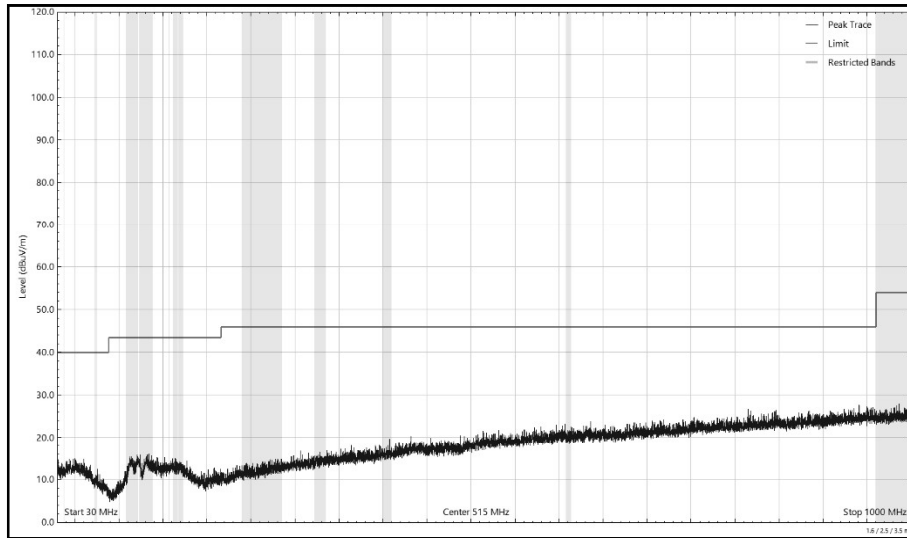
Figure 55 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: Y



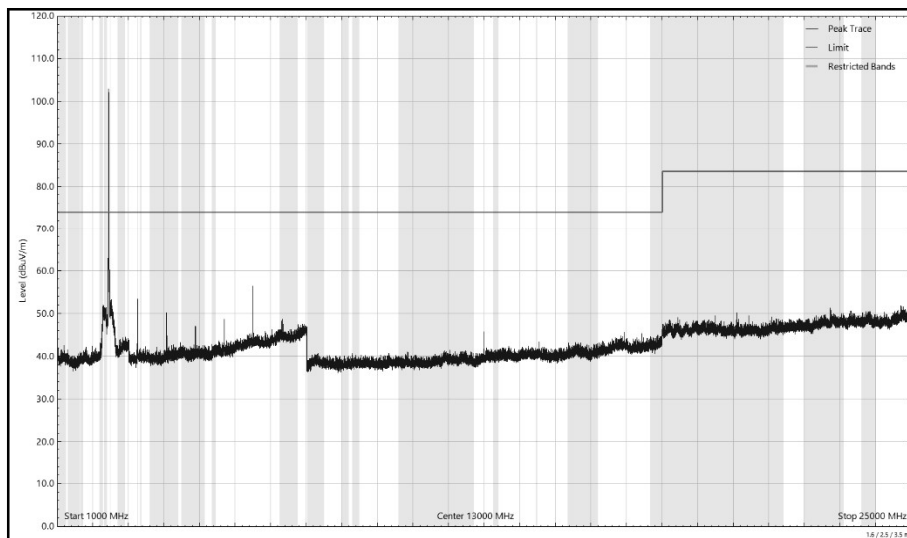
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4060.779	49.1	54.0	-4.9	RMS	185	101	Vertical
4062.514	44.4	54.0	-9.6	RMS	280	101	Horizontal
4873.975	45.1	54.0	-8.9	RMS	109	242	Horizontal
4873.981	48.6	54.0	-5.4	RMS	314	106	Vertical

**Table 39 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation Z**

No other emissions found within 10 dB of the limit.



**Figure 56 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: Z**



**Figure 57 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: Z**

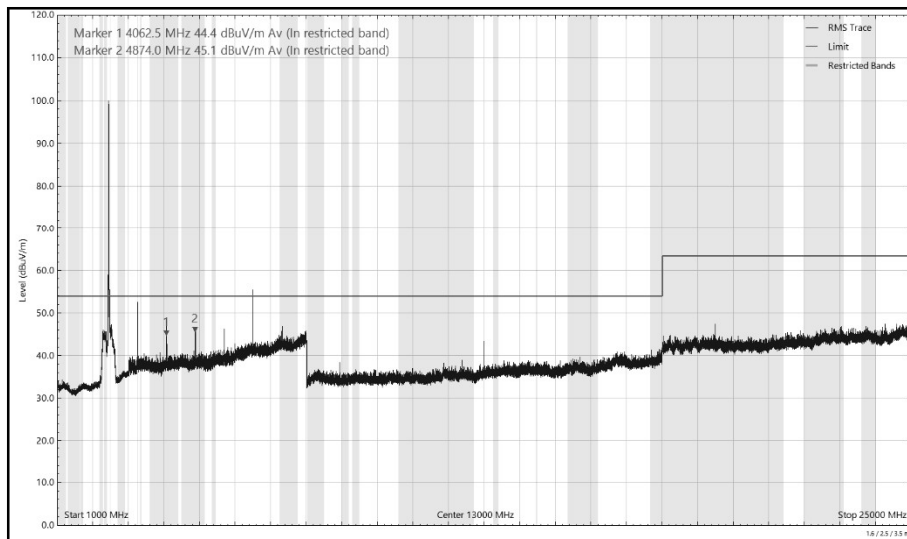


Figure 58 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: Z

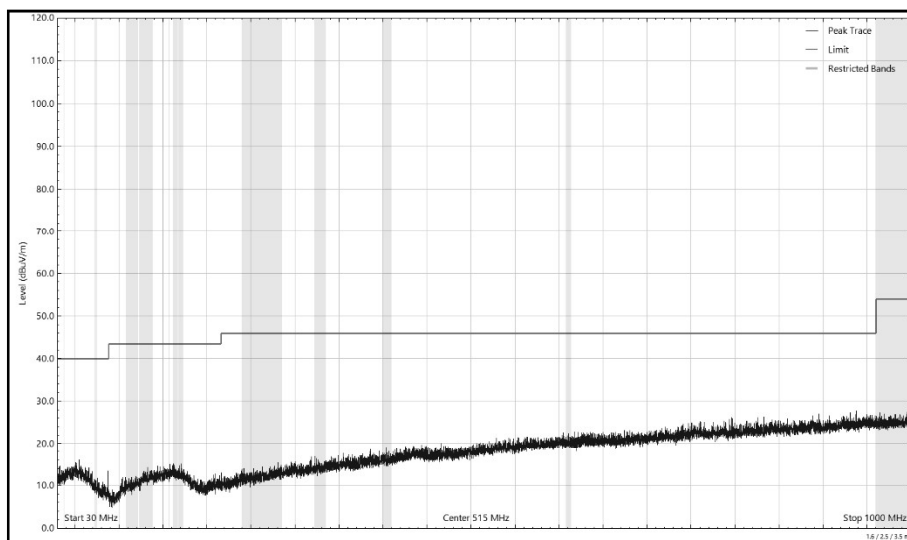


Figure 59 - 2437 MHz (CH6), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: Z

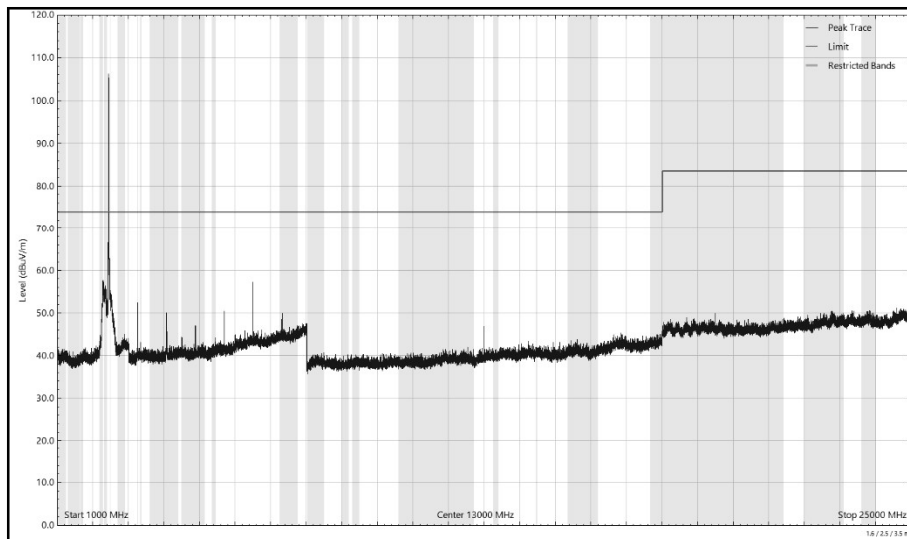


Figure 60 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (Peak), Orientation: Z

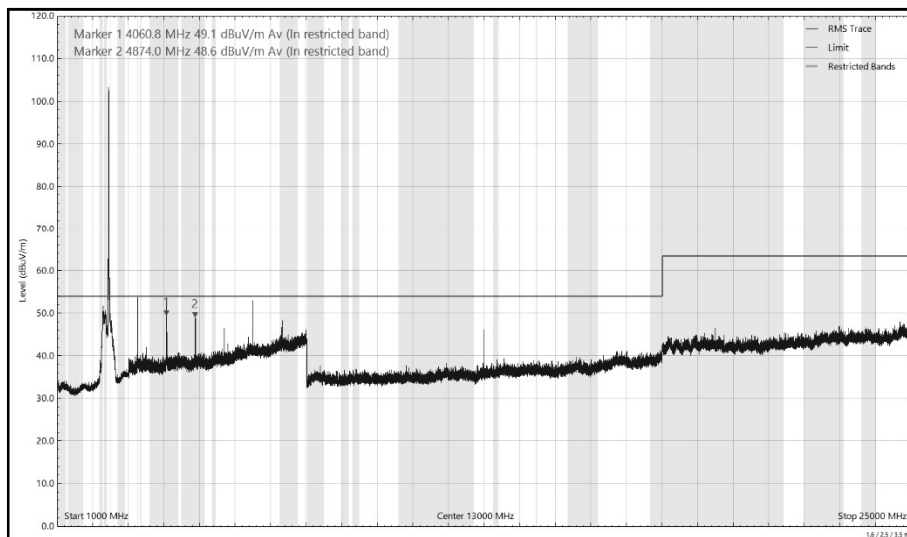


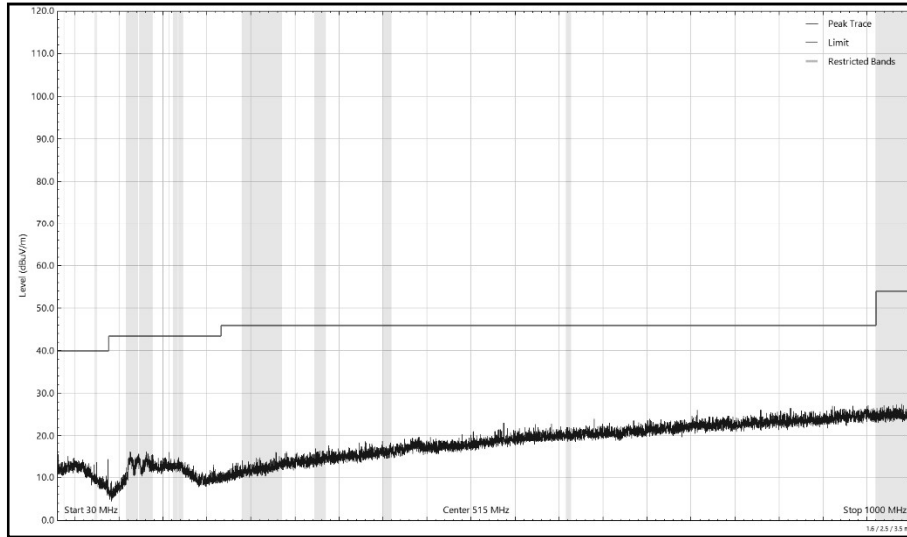
Figure 61 - 2437 MHz (CH6), 802.11b, Core 0, 1 GHz to 25 GHz, Vertical (rms), Orientation: Z



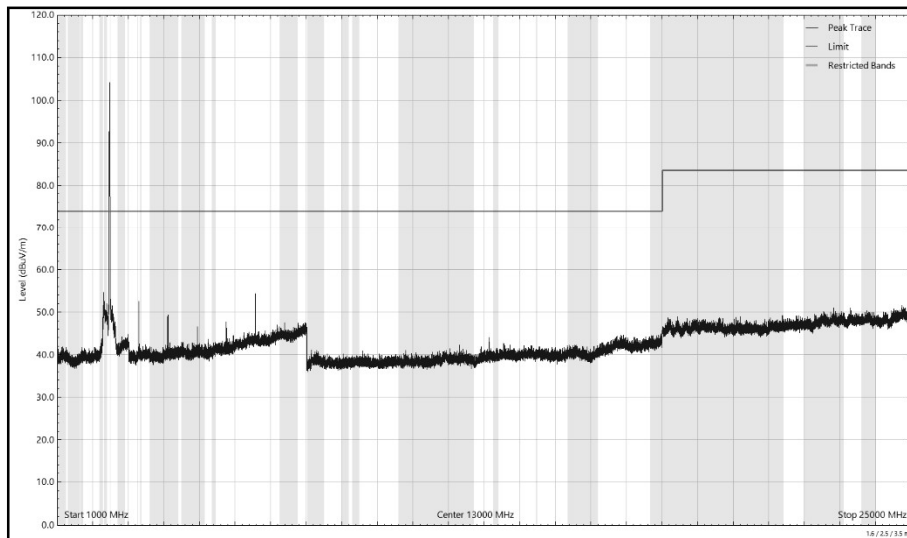
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
4104.231	47.9	54.0	-6.1	RMS	183	100	Vertical
4923.848	45.1	54.0	-8.9	RMS	327	113	Vertical

**Table 40 - 2462 MHz (CH11), 802.11b, Core 0, 30 MHz to 25 GHz, Orientation X**

No other emissions found within 10 dB of the limit.



**Figure 62 - 2462 MHz (CH11), 802.11b, Core 0, 30 MHz to 1 GHz, Horizontal (Peak), Orientation: X**



**Figure 63 - 2462 MHz (CH11), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (Peak), Orientation: X**



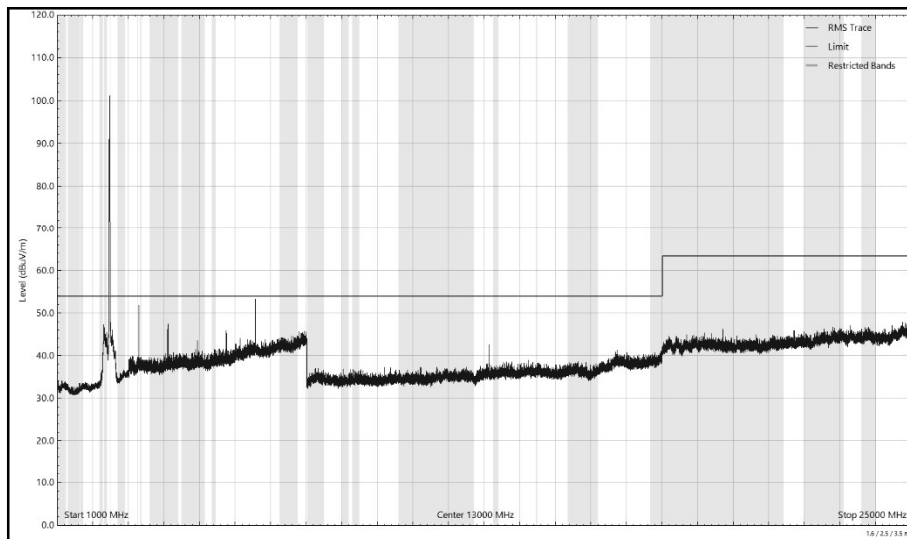


Figure 64 - 2462 MHz (CH11), 802.11b, Core 0, 1 GHz to 25 GHz, Horizontal (rms), Orientation: X

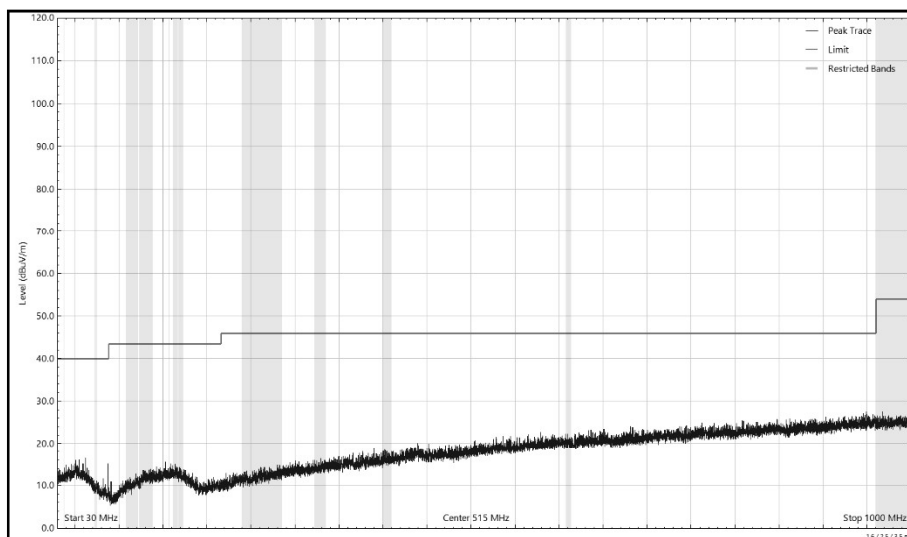


Figure 65 - 2462 MHz (CH11), 802.11b, Core 0, 30 MHz to 1 GHz, Vertical (Peak), Orientation: X