

FCC and ISED Test Report

Apple Inc
Model: A2330

In accordance with FCC 47 CFR Part 15C,
ISED RSS-247 and ISED RSS-GEN
(Bluetooth DTS)

Prepared for: Apple Inc
One Apple Park Way
Cupertino, California, 95014, USA

FCC ID: BCGA2330 IC: 579C-A2330

COMMERCIAL-IN-CONFIDENCE

Document 75948763-10 Issue 01



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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	09 June 2020

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	Mehadi Choudhury	09 June 2020	
Testing	Malik Mohammad	09 June 2020	
Testing	Faisal Malyar	09 June 2020	
Testing	Ahmad Javid	09 June 2020	
Testing	Jaiyanth Balendrarajah	09 June 2020	
Testing	Ainsley Jenkins	09 June 2020	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2019, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.



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1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	09 June 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2330
Serial Number(s)	C07CG081PW8X, C07CF029PW92, C07CG05KPW8V and C07CG05BPW8V
Hardware Version(s)	REV1.0
Software Version(s)	20A2236b
Number of Samples Tested	4
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number	0540201015
Date	07-April-2020
Date of Receipt of EUT	08-April-2020 and 28-April-2020
Start of Test	11-April-2020
Finish of Test	07-June-2020
Name of Engineer(s)	Mehadi Choudhury, Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian
Related Document(s)	ANSI C63.10 (2013)



1.3 Brief Summary of Results

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

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth - LE1M (Core 0)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth - LE2M (Core 0)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth – LE1M (Core 1)						
2.6	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)



Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth – LE1M (Dedicated Core 2)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth – LE2M (Dedicated Core 2)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)



Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth - HDR4 (Core 0)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth - HDR8 (Core 0)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)



Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth – HDR8 (Dedicated Core 2)						
2.1	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10 (2013)
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a desktop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac/ax capabilities in the 2.4 GHz and 5 GHz bands.

1.4.2 Additional Information

Bluetooth is supported across all cores, however simultaneous transmission on multiple cores at the same time is not supported. Bluetooth operation on Core 2 is independent to operation on Core 0 or 1, therefore tests have been performed on Core 2 and repeated for the Core with the highest antenna gain out of Core 0 and Core 1.

For Radiated Spurious Emissions, tests were performed with the device operating independently on Core-0, Core-1 and Core 2.

BT Core	Frequency (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
0	2400 - 2480	5.00	0.7
1	2400 - 2480	0.25	0.7
2	2400 - 2480	0	0.7

Table 3 – Antenna Gains

1.5 Deviations from the Standard

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

1.6 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: A2330, Serial Number: C07CG081PW8X			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2330, Serial Number: C07CF029PW92			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2330, Serial Number: C07CG05BPW8V			
1	Firmware modified to test TxBF.	George Porter	23-April-2020
Model: A2330, Serial Number: C07CG05KPW8V			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 4



1.7 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 Bluetooth - LE1M (Core 0)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth - LE2M (Core 0)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth – LE1M (Dedicated Core 2)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Spurious Radiated Emissions	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS



Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth – LE1M (Core 1)		
Spurious Radiated Emissions	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth – LE2M (Dedicated Core 2)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth - HDR4 (Core 0)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth - HDR8 (Core 0)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS



Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Configuration and Mode: 2.4 GHz Bluetooth – HDR8 (Dedicated Core 2)		
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Power Spectral Density	Mehadi Choudhury	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS
Restricted Band Edges	Malik Mohammad, Faisal Malyar, Ahmad Javid, Jaiyanth Balendrarajah, Ainsley Jenkins and Liang Tian	UKAS

Table 5

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

A2330, S/N: C07CG05BPW8V - Modification State 1

2.1.3 Date of Test

13-May-2020 to 21-May-2020

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10 clause 11.9.2.2.5 (AVGSA-2A).

2.1.5 Environmental Conditions

Ambient Temperature 23.0 - 25.1 °C
Relative Humidity 21.6 - 31.5 %

2.1.6 Test Results

2.4 GHz Bluetooth - LE1M (Core 0)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2402	4.17	2.61
2440	4.98	3.15
2480	5.07	3.21

Table 6 - Maximum Conducted Output Power Results



2.4 GHz Bluetooth - LE2M (Core 0)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2402	4.40	2.75
2440	5.27	3.37
2480	5.33	3.41

Table 7 - Maximum Conducted Output Power Results

2.4 GHz Bluetooth – LE1M (Dedicated Core 2)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2402	8.74	7.48
2440	8.60	7.24
2480	8.72	7.45

Table 8 - Maximum Conducted Output Power Results

2.4 GHz Bluetooth – LE2M (Dedicated Core 2)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2402	9.00	7.94
2440	8.97	7.89
2480	8.95	7.85

Table 9 - Maximum Conducted Output Power Results

2.4 GHz Bluetooth - HDR4 (Core 0)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2404	5.44	3.50
2441	5.71	3.72
2478	5.81	3.81

Table 10 - Maximum Conducted Output Power Results

2.4 GHz Bluetooth - HDR8 (Core 0)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2404	5.44	3.50
2441	5.78	3.78
2478	5.73	3.74

Table 11 - Maximum Conducted Output Power Results



2.4 GHz Bluetooth - HDR8 (Dedicated Core 2)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2404	5.84	3.84
2441	5.95	3.94
2478	5.66	3.68

Table 12 - Maximum Conducted Output Power Results

2.4 GHz Bluetooth - HDR4 (Dedicated Core 2)

Frequency (MHz)	Maximum Output Power	
	dBm	mW
2404	5.78	3.78
2441	5.91	3.90
2478	5.67	3.69

Table 13 - Maximum Conducted 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.



2.1.7 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 Due
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	11-Dec-2020
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	28-Nov-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	11-Nov-2020
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5424	6	13-Jun-2020
20 dB Attenuator	Sealectro	60-674 102089	N/S	-	O/P Mon

Table 14

O/P Mon – Output Monitored using calibrated equipment



2.2 Power Spectral Density

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

A2330, S/N: C07CG05BPW8V - Modification State 1

2.2.3 Date of Test

14-May-2020 to 02-June-2020

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.6 (AVGPSD-2A).

2.2.5 Environmental Conditions

Ambient Temperature 21.7-24.4 °C
Relative Humidity 20.8-45.2 %

2.2.6 Test Results

2.4 GHz Bluetooth - LE1M (Core 0)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2402	-6.39	30
2440	-5.61	30
2480	-5.45	30

Table 15 - Power Spectral Density

2.4 GHz Bluetooth - LE2M (Core 0)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2402	-8.37	30
2440	-7.61	30
2480	-7.43	30

Table 16 - Power Spectral Density

2.4 GHz Bluetooth – LE1M (Dedicated Core 2)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2402	-1.39	30
2440	-1.61	30
2480	-1.33	30

Table 17 - Power Spectral Density



2.4 GHz Bluetooth – LE2M (Dedicated Core 2)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2402	-3.35	30
2440	-3.66	30
2480	-3.22	30

Table 18 - Power Spectral Density

2.4 GHz Bluetooth - HDR4 (Core 0)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2404	-7.33	62
2441	-7.52	62
2478	-7.44	62

Table 19 - Power Spectral Density

2.4 GHz Bluetooth - HDR8 (Core 0)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2404	-7.77	100
2441	-7.86	100
2478	-7.69	100

Table 20 - Power Spectral Density

2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2404	-7.20	62
2441	-7.21	62
2478	-7.63	62

Table 21 - Power Spectral Density

2.4 GHz Bluetooth – HDR8 (Dedicated Core 2)

Frequency (MHz)	Power Spectral Density (dBm)	Measurement Bandwidth (kHz)
2404	-8.50	100
2441	-7.61	100
2478	-7.96	100

Table 22 - Power Spectral Density



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.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	11-Dec-2020
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	28-Nov-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	08-Nov-2020
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5424	6	13-Jun-2020
20 dB Attenuator	Sealectro	60-674 102089	N/S	-	O/P Mon

Table 23

O/P Mon – Output Monitored using calibrated equipment



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

A2330, S/N: C07CG081PW8X - Modification State 0
A2330, S/N: C07CG05BPW8V - Modification State 1

2.3.3 Date of Test

21-April-2020 to 14-May-2020

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.2.

2.3.5 Environmental Conditions

Ambient Temperature 23.0 - 24.4 °C
Relative Humidity 20.8 - 27.7 %

2.3.6 Test Results

2.4 GHz Bluetooth - LE1M (Core 0)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2402	1065.5	689.4
2440	1067.2	700.1
2480	1075.5	712.2

Table 24 - Emission Bandwidth Results

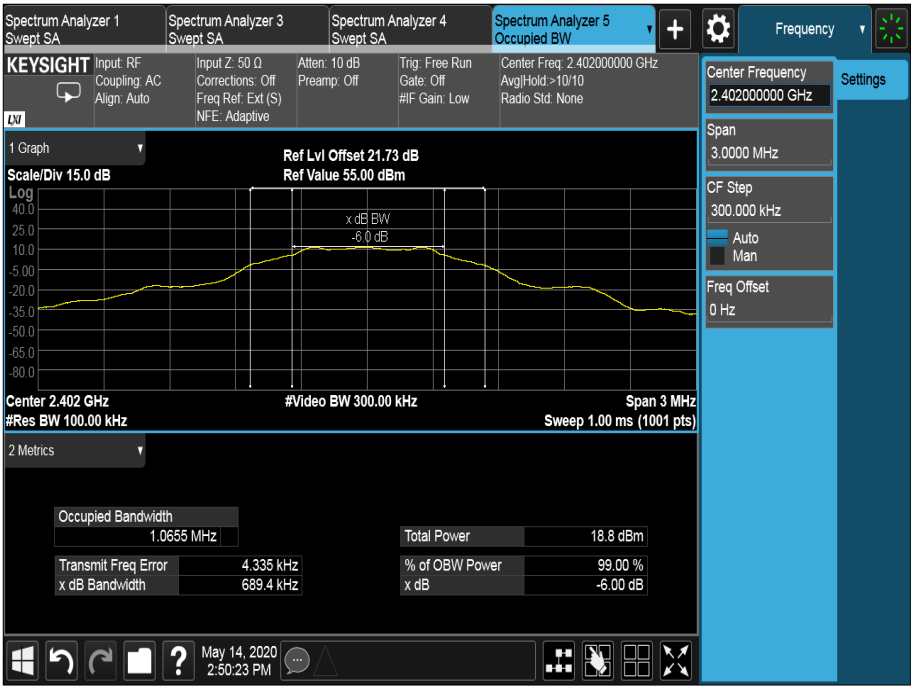


Figure 1 – 2402 MHz – Emission Bandwidth

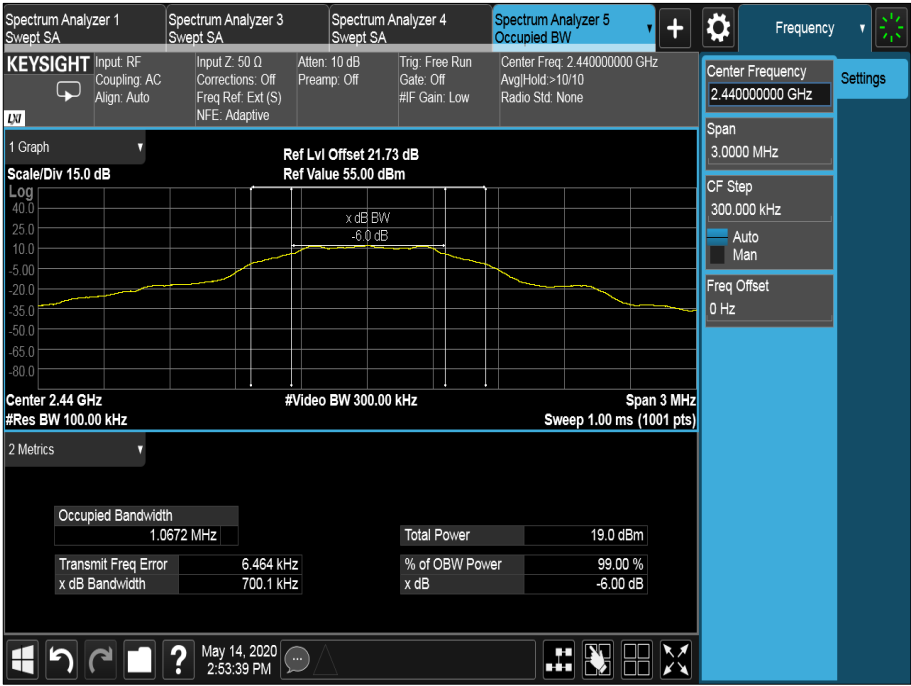


Figure 2 – 2440 MHz – Emission Bandwidth

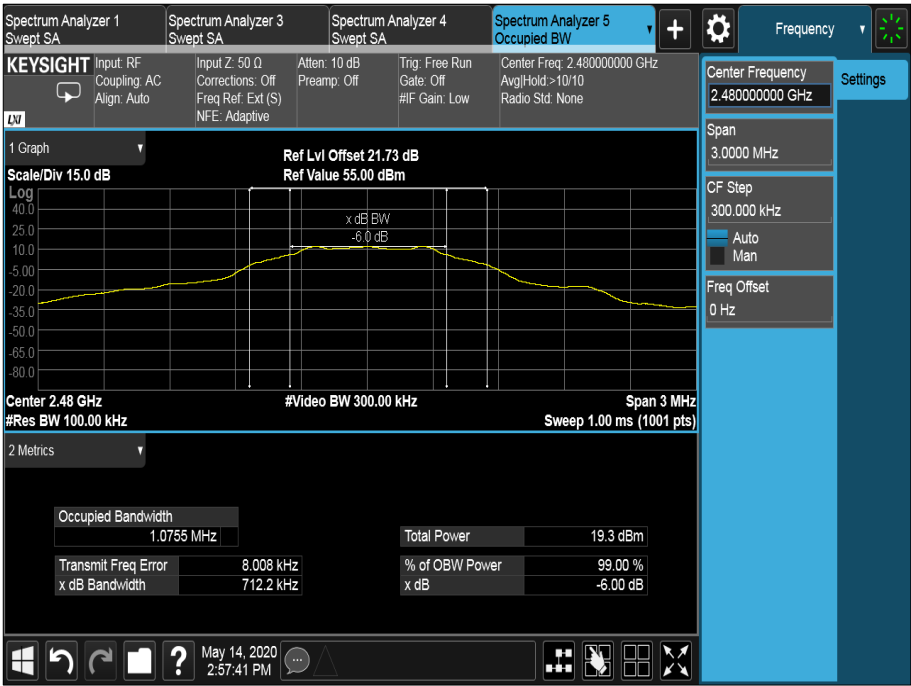


Figure 3 - 2480 MHz – Emission Bandwidth



2.4 GHz Bluetooth - LE2M (Core 0)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2402	2064.8	1175
2440	2067.3	1177
2480	2074.5	1229

Table 25 - Emission Bandwidth Results

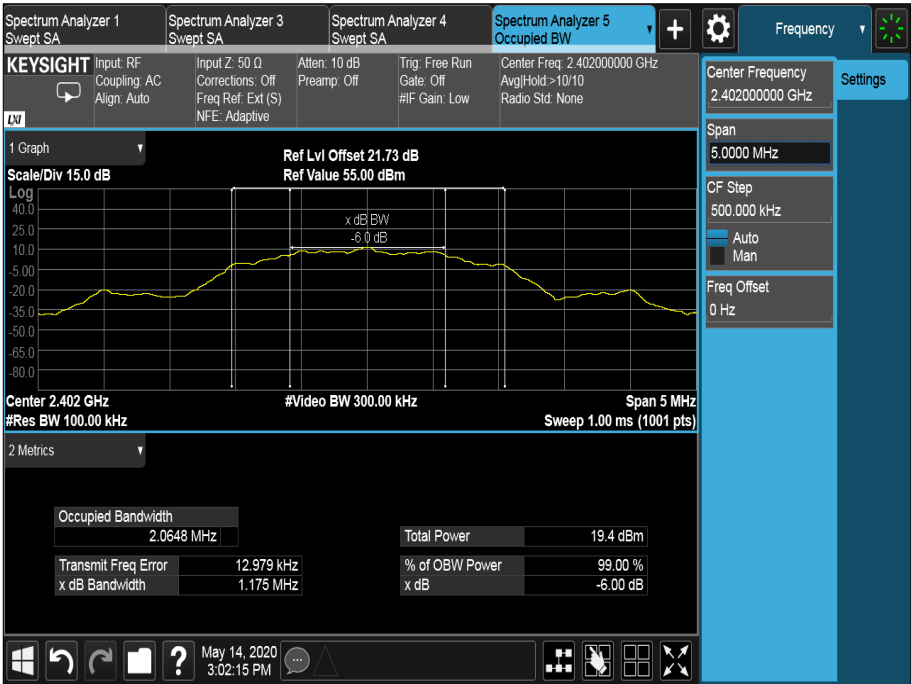


Figure 4 – 2402 MHz – Emission Bandwidth

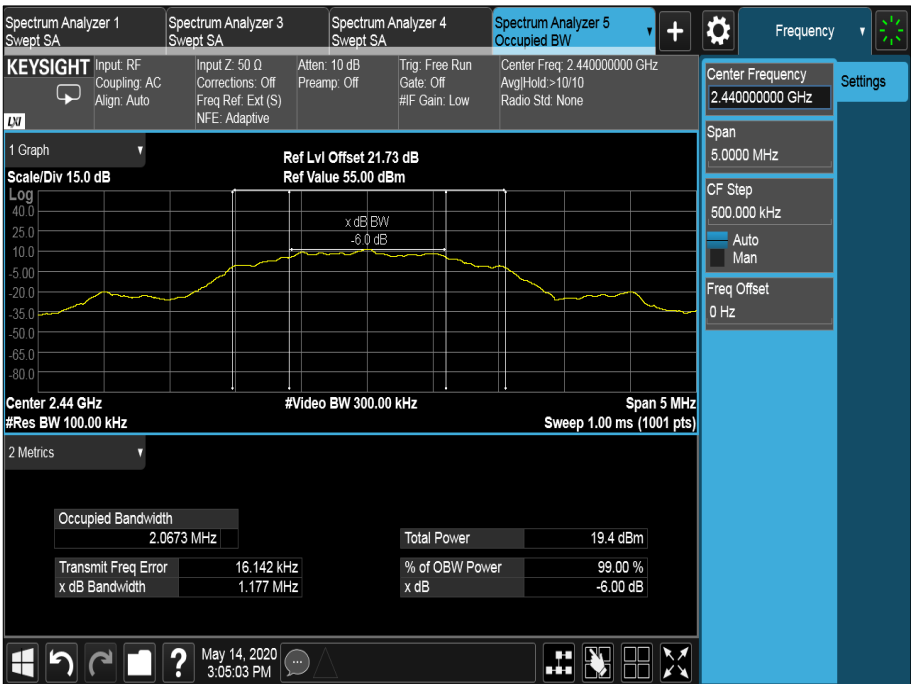


Figure 5 – 2440 MHz – Emission Bandwidth

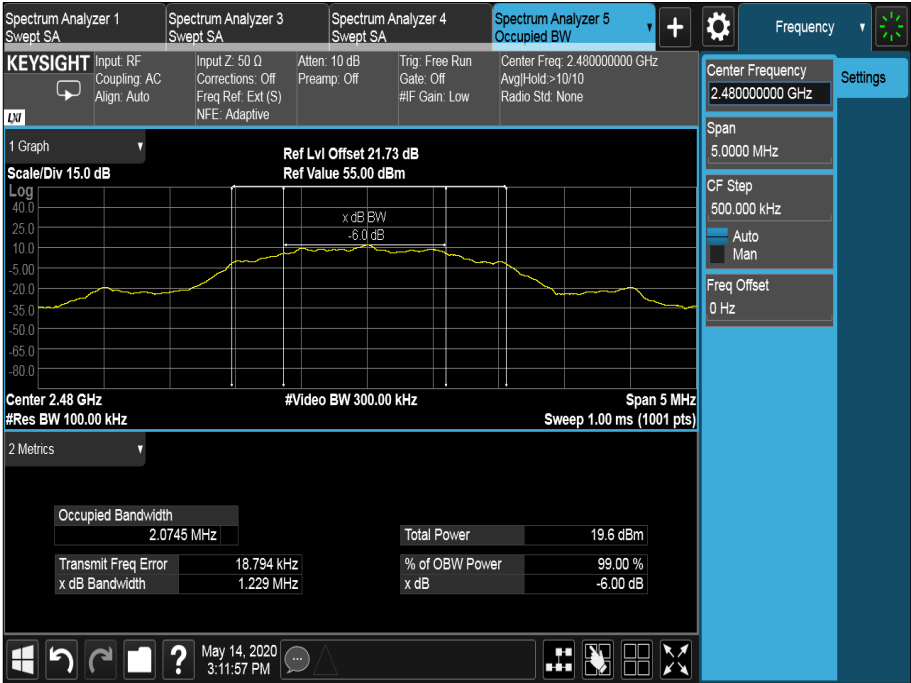


Figure 6 – 2480 MHz – Emission Bandwidth

2.4 GHz Bluetooth - LE1M (Dedicated Core 2)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2402	1069.1	664.6
2440	1068.7	664.5
2480	1067.8	668.9

Table 26 - Emission Bandwidth Results

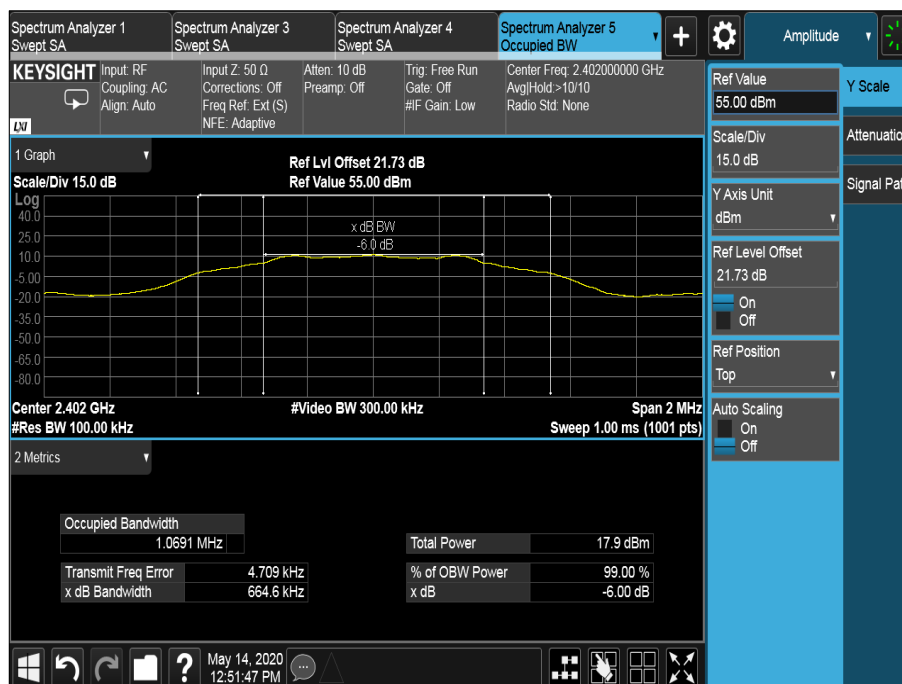


Figure 7 – 2402 MHz – Emission Bandwidth

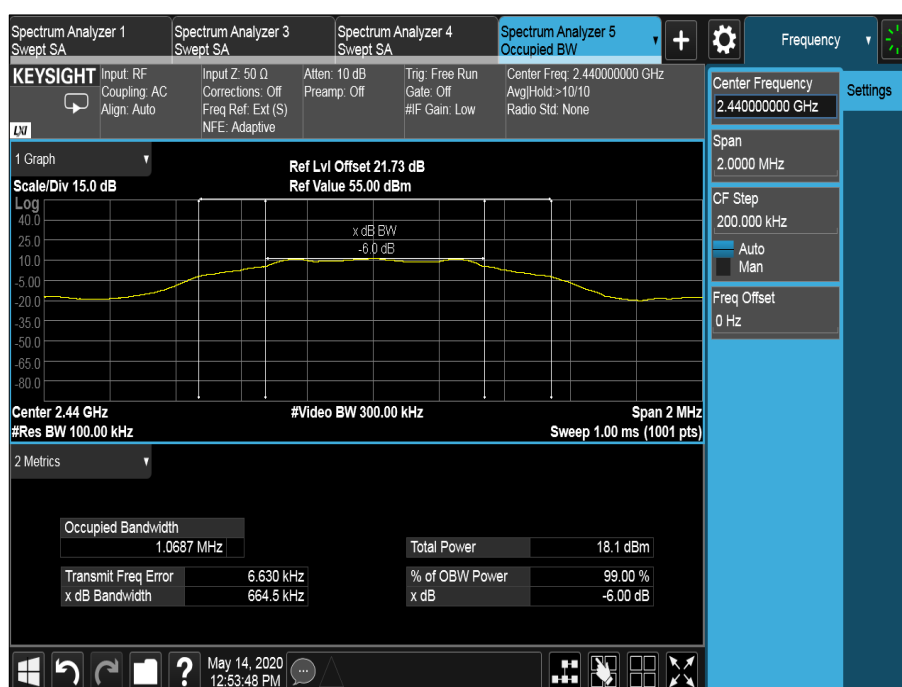


Figure 8 – 2440 MHz – Emission Bandwidth

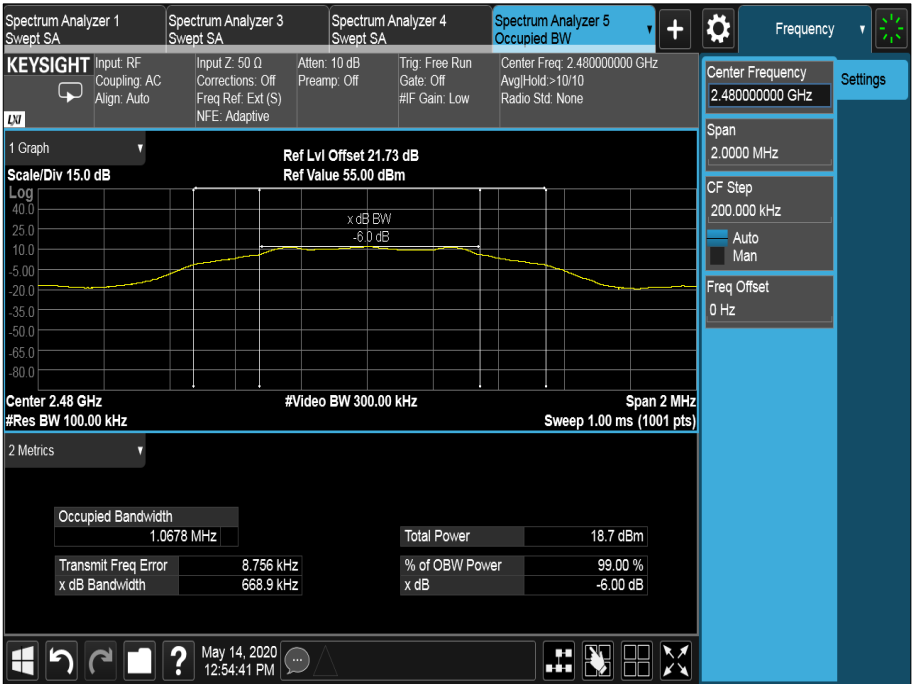


Figure 9 – 2480 MHz – Emission Bandwidth



2.4 GHz Bluetooth - LE2M (Dedicated Core 2)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2402	2062.6	1171
2440	2063.9	1168
2480	2064.3	1169

Table 27 - Emission Bandwidth Results

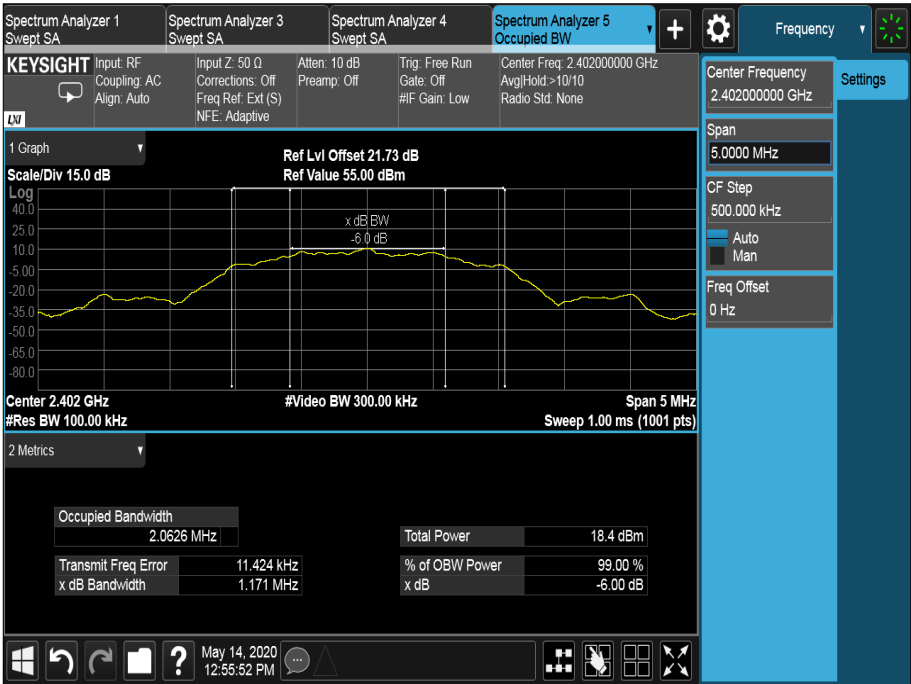


Figure 10 – 2402 MHz – Emission Bandwidth

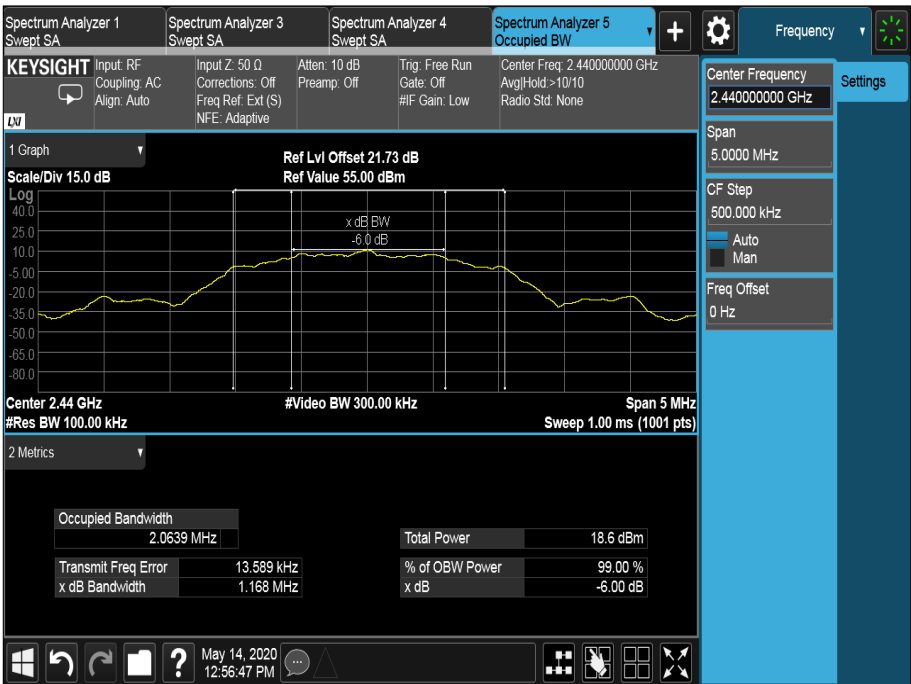


Figure 11 – 2440 MHz – Emission Bandwidth



Figure 12 – 2480 MHz – Emission Bandwidth

2.4 GHz Bluetooth - HDR4 (Core 0)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2404	2351.8	1567
2441	2348.1	1561
2478	2352.2	1574

Table 28 - Emission Bandwidth Results



Figure 13 – 2404 MHz – Emission Bandwidth

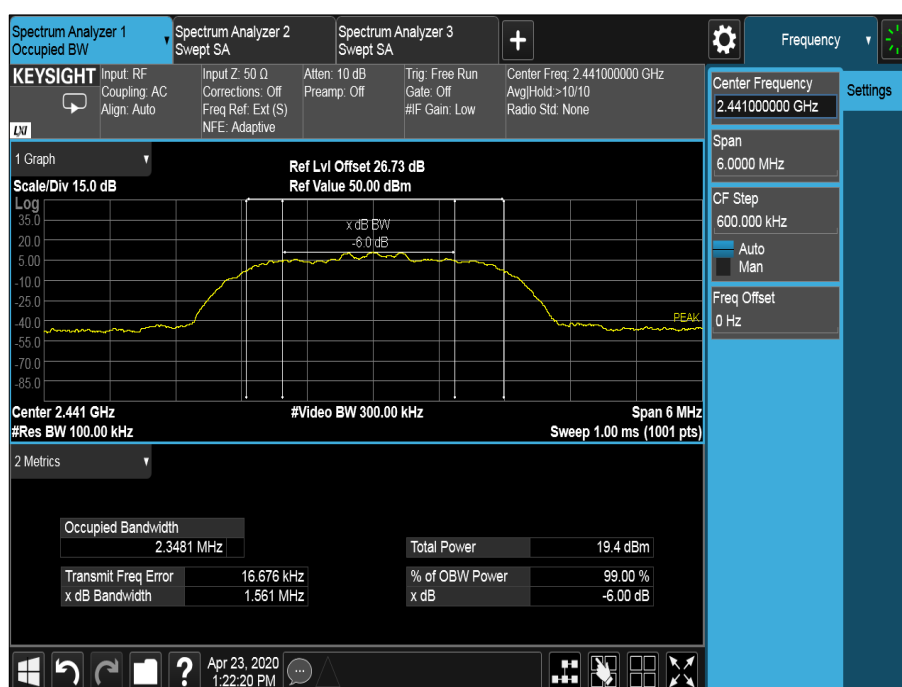


Figure 14 – 2441 MHz – Emission Bandwidth

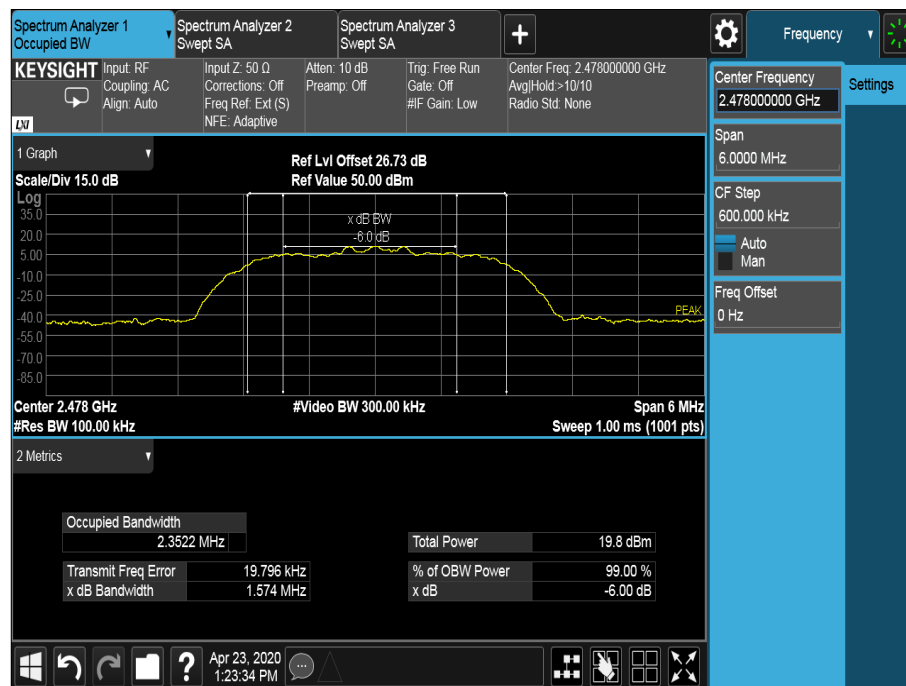


Figure 15 – 2478 MHz – Emission Bandwidth

2.4 GHz Bluetooth - HDR8 (Core 0)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2404	4539.1	940.4
2441	4538.3	946.0
2478	4541.7	946.3

Table 29 - Emission Bandwidth Results



Figure 16 – 2404 MHz – Emission Bandwidth

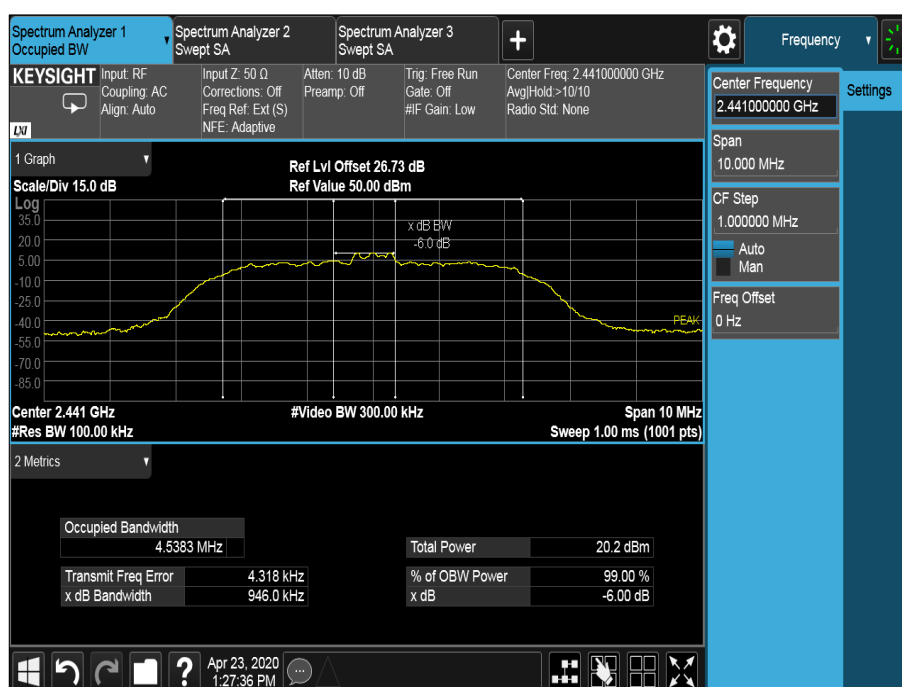


Figure 17 – 2441 MHz – Emission Bandwidth

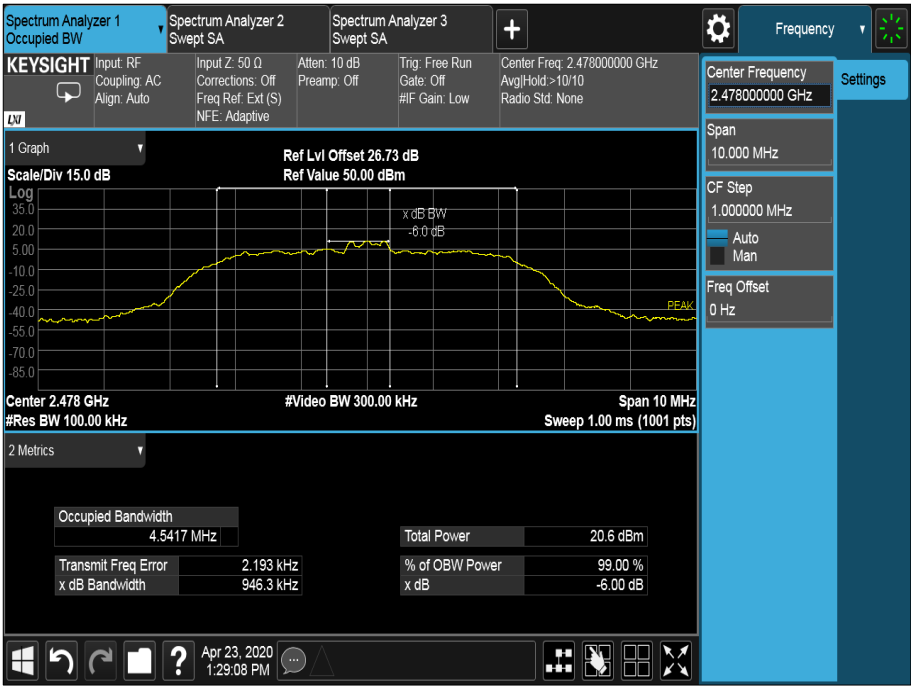


Figure 18 – 2478 MHz – Emission Bandwidth

2.4 GHz Bluetooth - HDR4 (Dedicated Core 2)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2404	2351.6	1576
2441	2351.5	1568
2478	2352.0	1576

Table 30 - Emission Bandwidth Results



Figure 19 - 2404 MHz – Emission Bandwidth

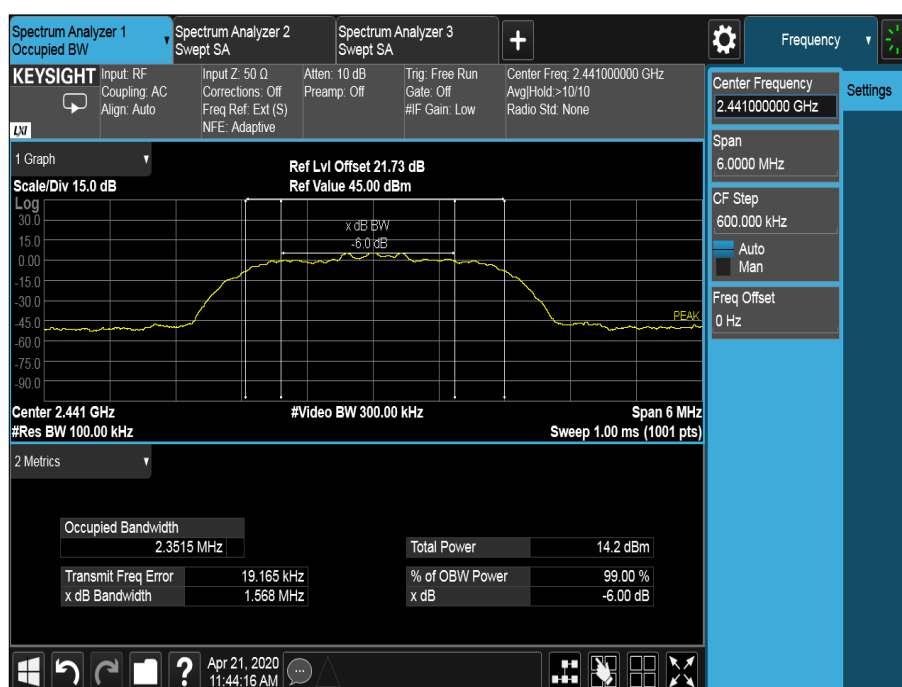


Figure 20 – 2441 MHz – Emission Bandwidth

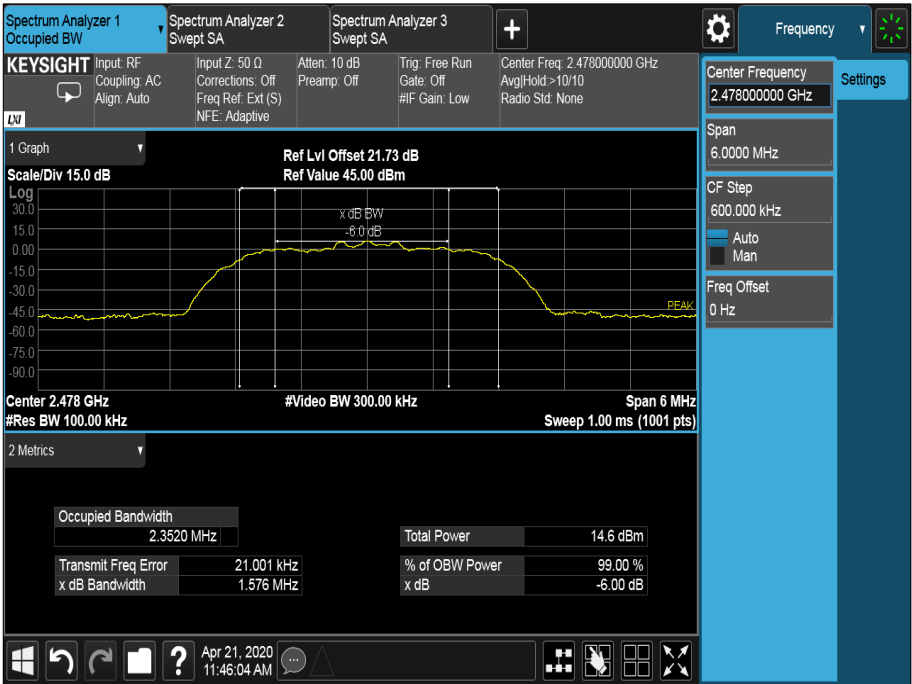


Figure 21 – 2478 MHz – Emission Bandwidth



2.4 GHz Bluetooth - HDR8 (Dedicated Core 2)

Frequency (MHz)	99 % Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)
2404	4541.0	1576.0
2441	4539.9	1568.0
2478	4541.9	1576.0

Table 31 - Emission Bandwidth Results

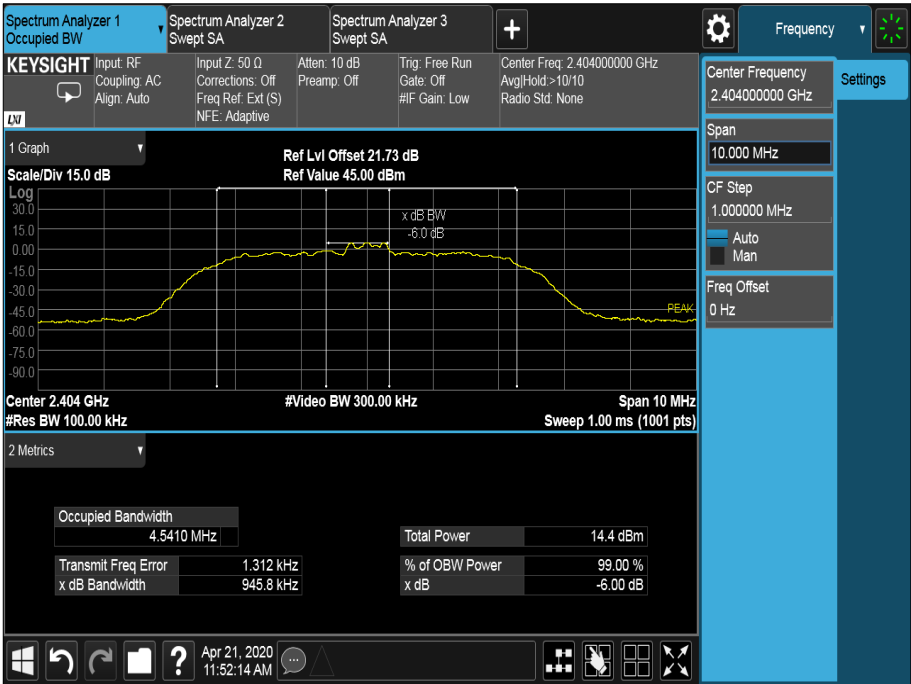


Figure 22 – 2404 MHz – Emission Bandwidth

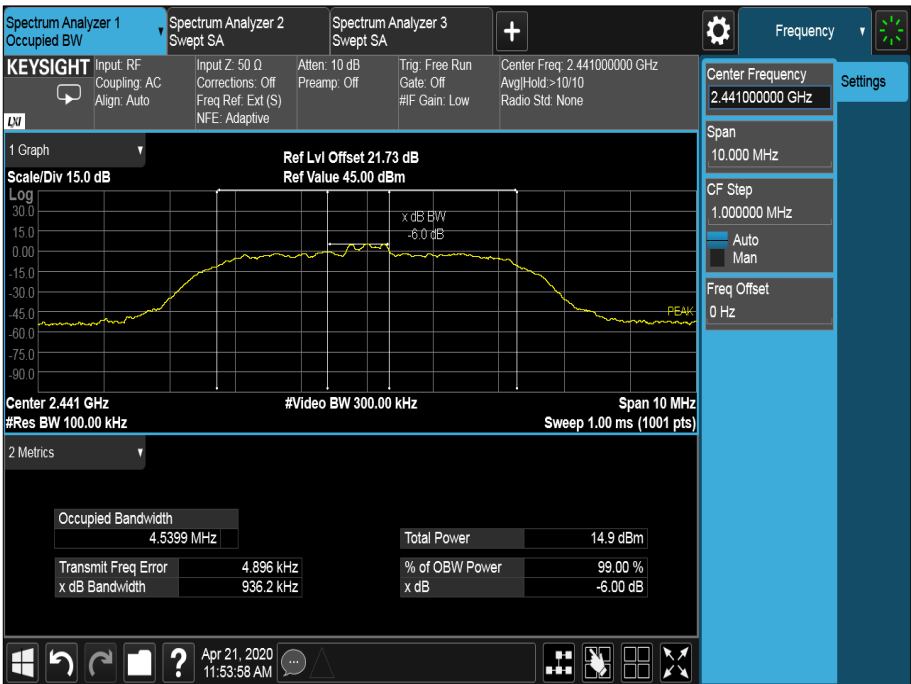
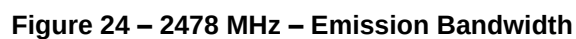


Figure 23 – 2441 MHz – Emission Bandwidth



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

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	11-Dec-2020
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	28-Nov-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	08-Nov-2020
EXA	Keysight Technologies	N9010B	4969	24	03-Feb-2022
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5424	6	13-Jun-2020
20 dB Attenuator	Sealectro	60-674 102089	N/S	-	O/P Mon

O/P Mon – Output Monitored using calibrated equipment

2.4 Authorised Band Edges

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

A2330, S/N: C07CF029PW92 - Modification State 0

2.4.3 Date of Test

11-April-2020 to 12-April-2020

2.4.4 Test Method

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

2.4.5 Environmental Conditions

Ambient Temperature 18.7 - 21.2 °C
Relative Humidity 35.4 - 41.2 %

2.4.6 Test Results

2.4 GHz Bluetooth - LE1M (Core 0)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	DH1	Core 0	2402	2400.0	-52.77

Table 33 - Authorised Band Edge Results

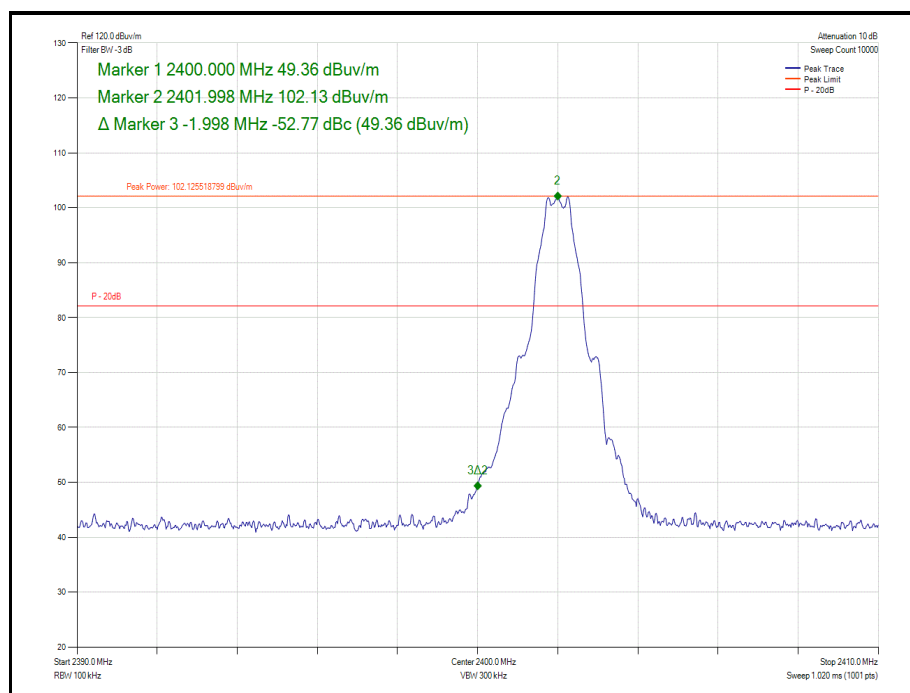


Figure 25 - GFSK/DH1, Core 0 - 2402 MHz – Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth - LE1M (Dedicated Core 2)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	DH1	Core 2	2402	2400.0	-58.73

Table 34 - Authorised Band Edge Results

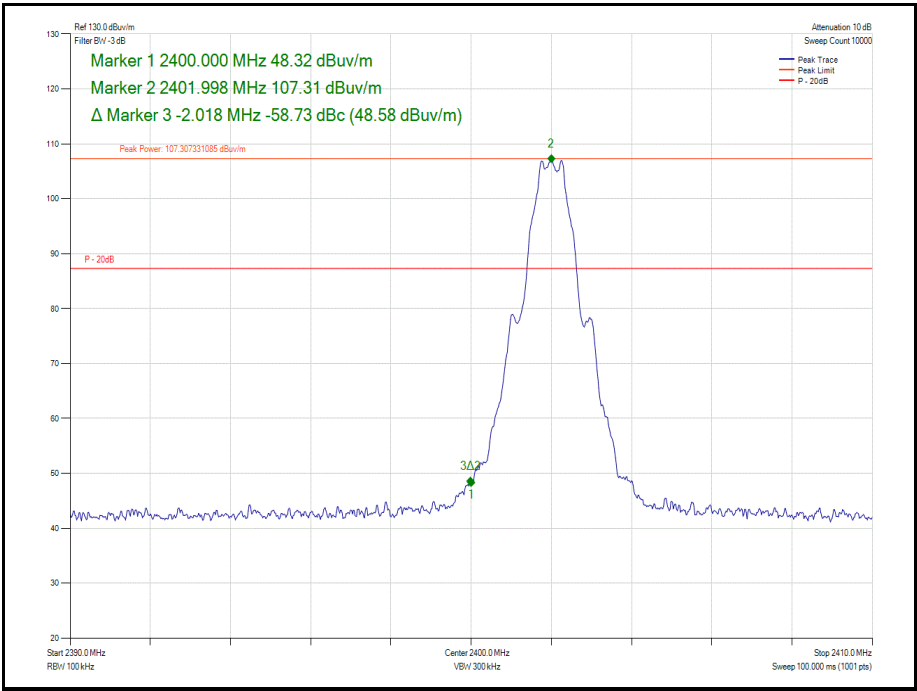


Figure 26 - GFSK/DH1, Core 2 - 2402 MHz – Band Edge Frequency 2400.0 MHz

2.4 GHz Bluetooth – LE2M (Core 0)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	DH1	Core 0	2402	2400.0	-31.42

Table 35 - Authorised Band Edge Results

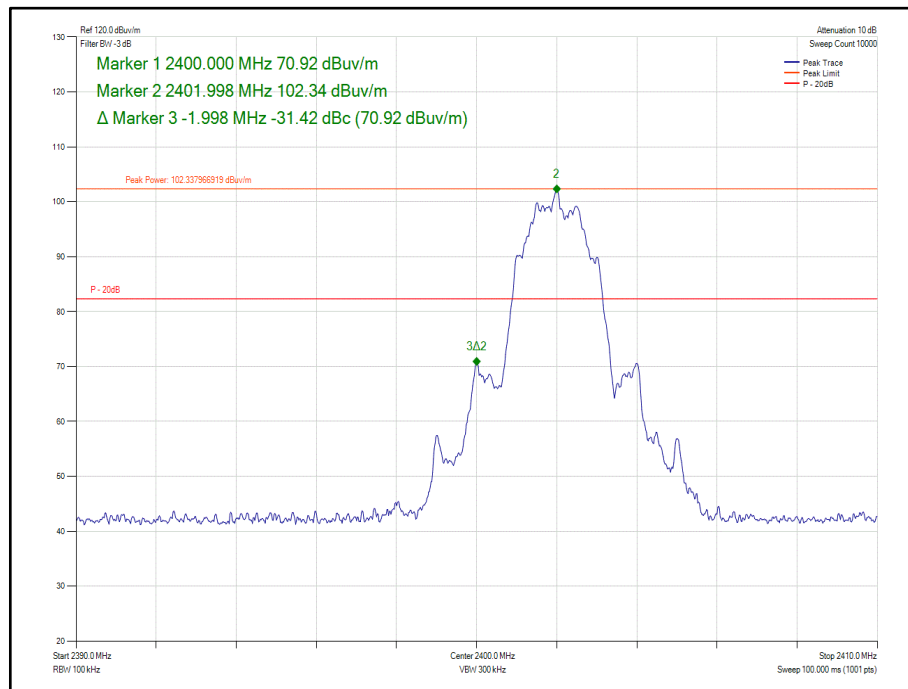


Figure 27 - GFSK/DH1, Core 0 - 2402 MHz – Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth – LE2M (Dedicated Core 2)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	DH1	Core 2	2402	2400.0	-32.49

Table 36 - Authorised Band Edge Results

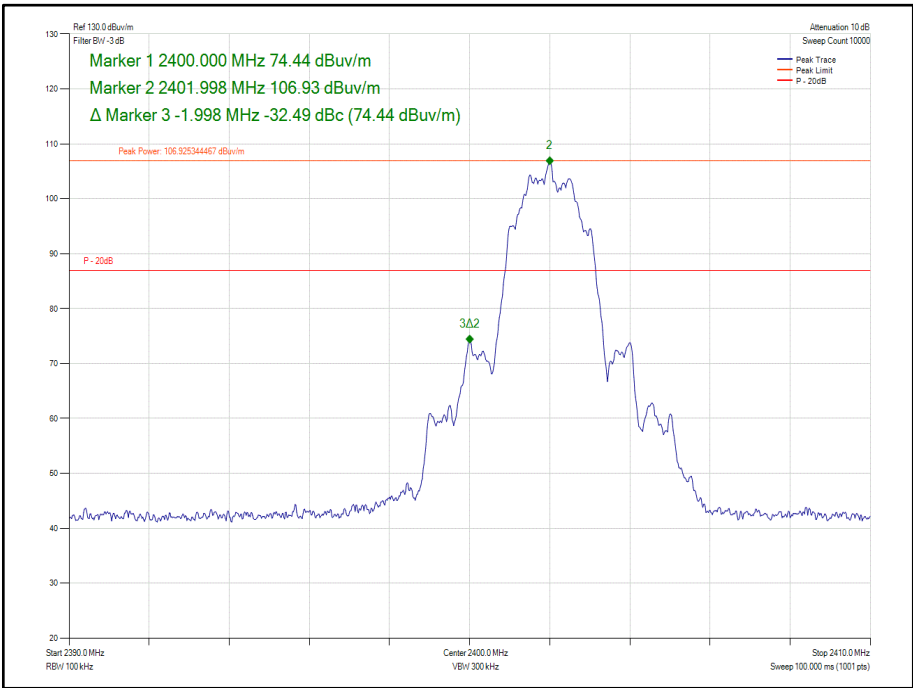


Figure 28 - GFSK/DH1, Core 2 - 2402 MHz – Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth – HDR4 (Core 0)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	4DH5	Core 0	2404	2400.0	-51.17

Table 37 - Authorised Band Edge Results

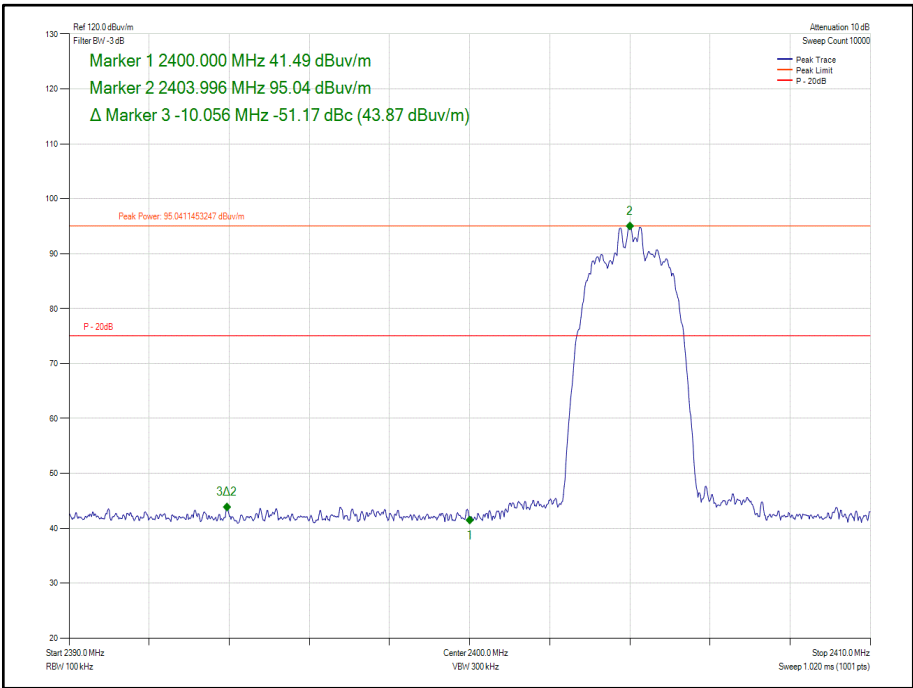


Figure 29 - GFSK/4DH5, Core 0 - 2404 MHz – Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	4DH5	Core 2	2404	2400.0	-57.97

Table 38 - Authorised Band Edge Results

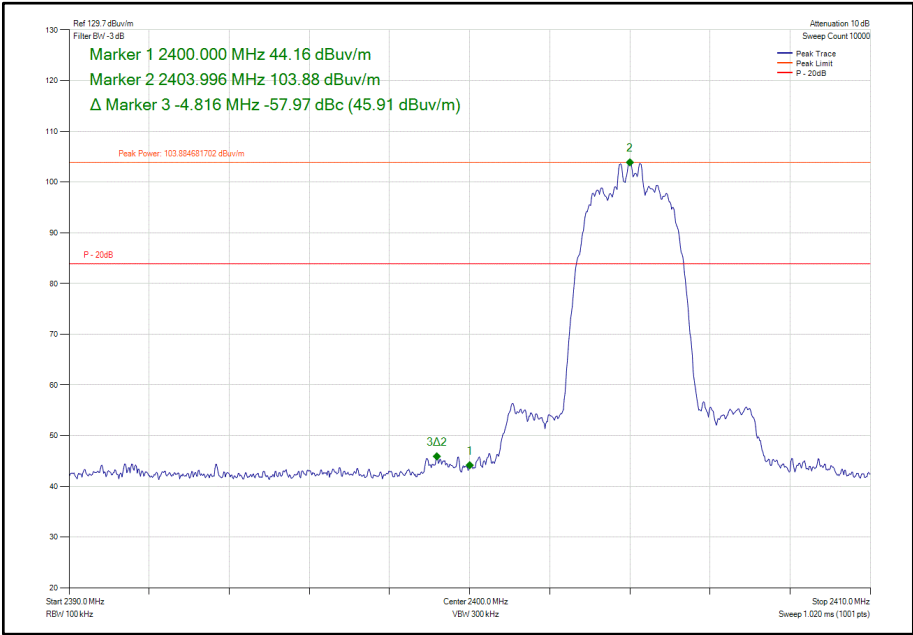


Figure 30 - GFSK/4DH5, Core 2 - 2404 MHz – Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	8DH5	Core 2	2404	2400.0	-50.34

Table 39 - Authorised Band Edge Results

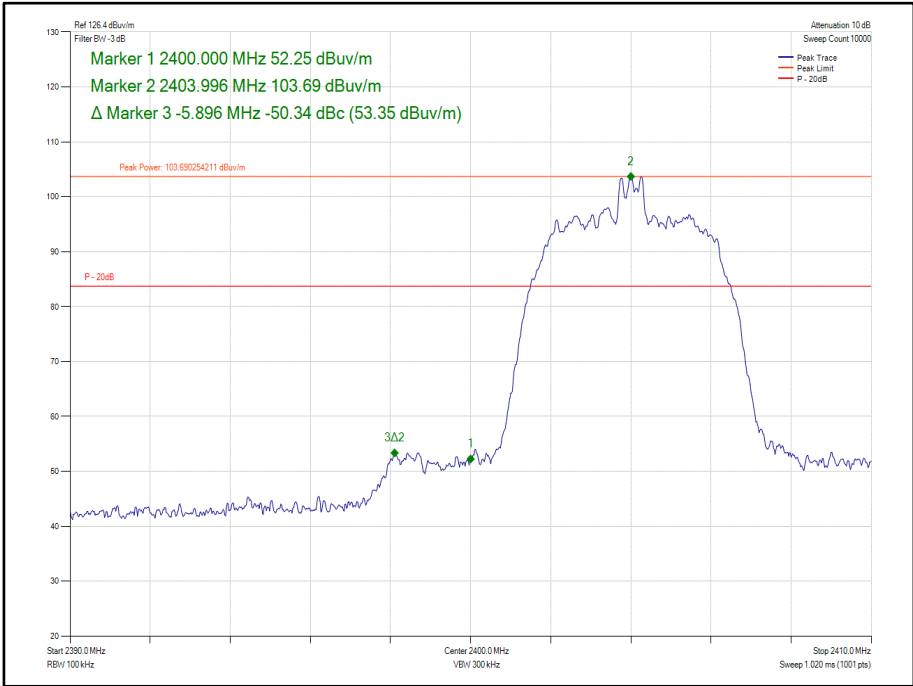


Figure 31 - GFSK/8DH5, Core 2 - 2404 MHz - Band Edge Frequency 2400.0 MHz

2.4 GHz Bluetooth – HD8 (Core 0)

Modulation	Packet Type	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
GFSK	8DH5	Core 0	2404	2400.0	-51.88

Table 40 - Authorised Band Edge Results

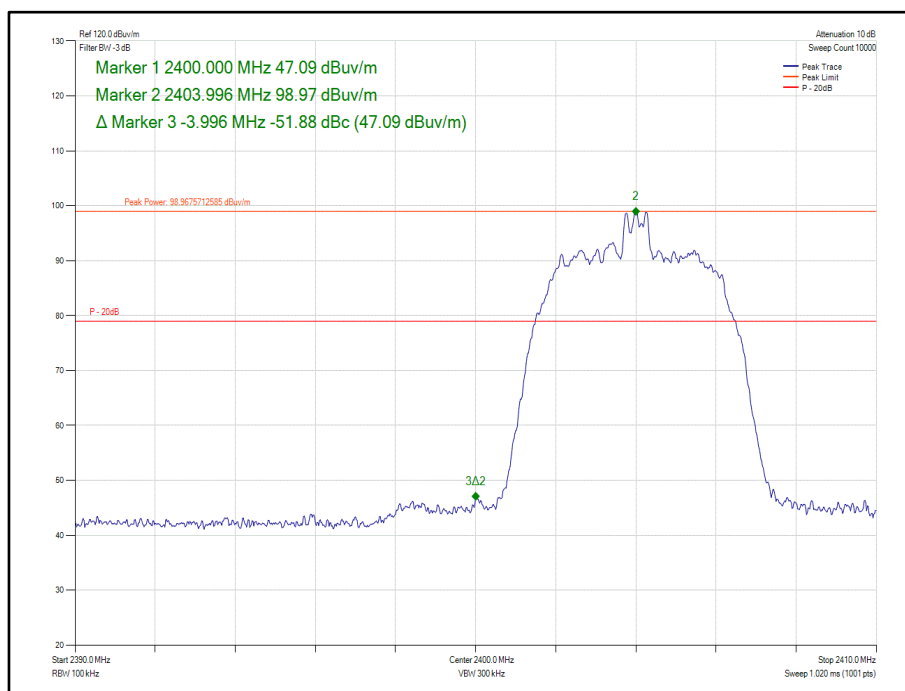


Figure 32 - GFSK/8DH5, Core 0 - 2404 MHz - Band Edge Frequency 2400.0 MHz

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.



2.4.7 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 Due
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	07-Aug-2020
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5092	12	06-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5102	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5104	12	09-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	06-Oct-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	10-Mar-2021
Pre Amp 1 - 26.5 GHz	Agilent Technologies	8449B	5445	-	O/P Mon

Table 41

TU - Traceability Unscheduled
O/P Mon – Output Monitored



2.5 Restricted Band Edges

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

A2330, S/N: C07CF029PW92 - Modification State 0

2.5.3 Date of Test

11-April-2020 to 07-June-2020

2.5.4 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.

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

The following conversion can be applied to convert from dB μ V/m to μ V/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$

2.5.5 Environmental Conditions

Ambient Temperature 18.7 - 21.2 °C
Relative Humidity 35.4 - 41.2 %

2.5.6 Test Results

2.4 GHz Bluetooth – LE1M (Core 0)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
GFSK/DH1	Core 0	2402	2390.0	54.20	42.20
GFSK/DH1	Core 0	2480	2483.5	53.66	41.38

Table 42 - Restricted Band Edge Results

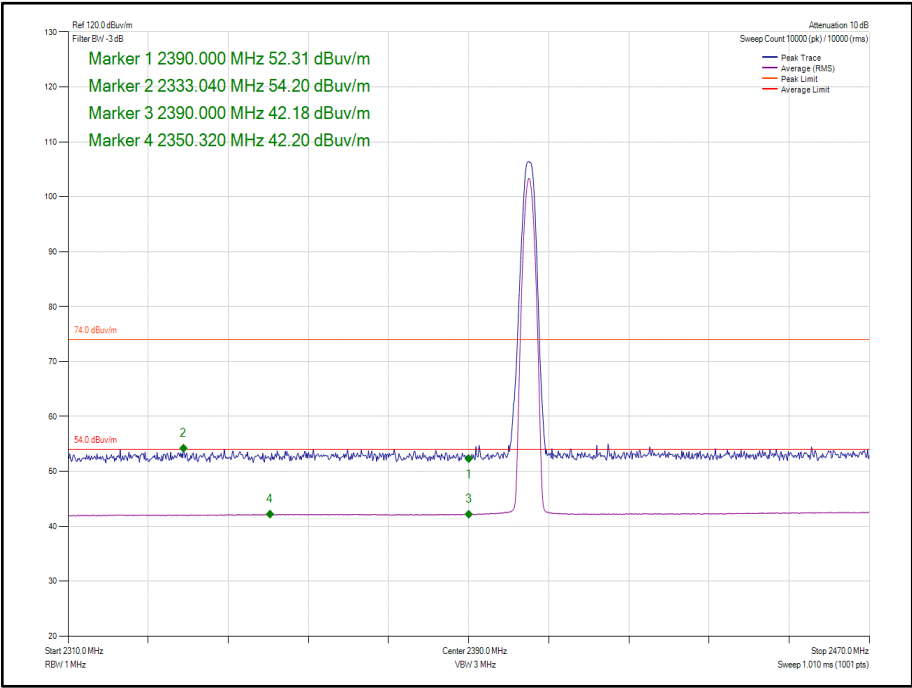


Figure 33 – GFSK/DH1, Core 0 - 2402 MHz - Band Edge Frequency 2390.0 MHz

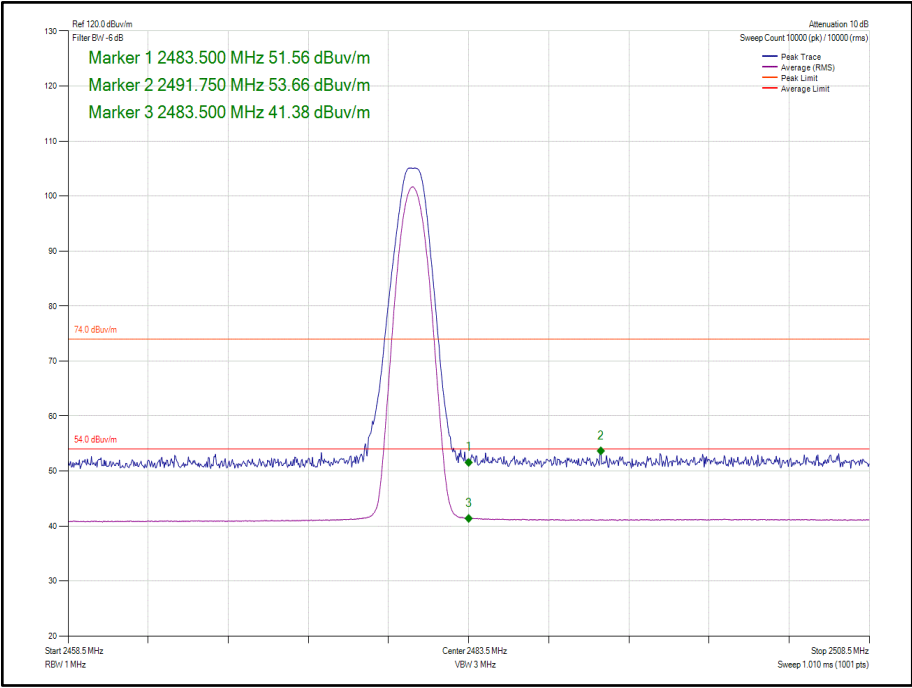


Figure 34 – GFSK/DH1, Core 0 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – LE1M (Dedicated Core 2)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	Core 2	2402	2390.0	54.56	42.19
GFSK/DH1	Core 2	2480	2483.5	61.22	49.19

Table 43 - Restricted Band Edge Results

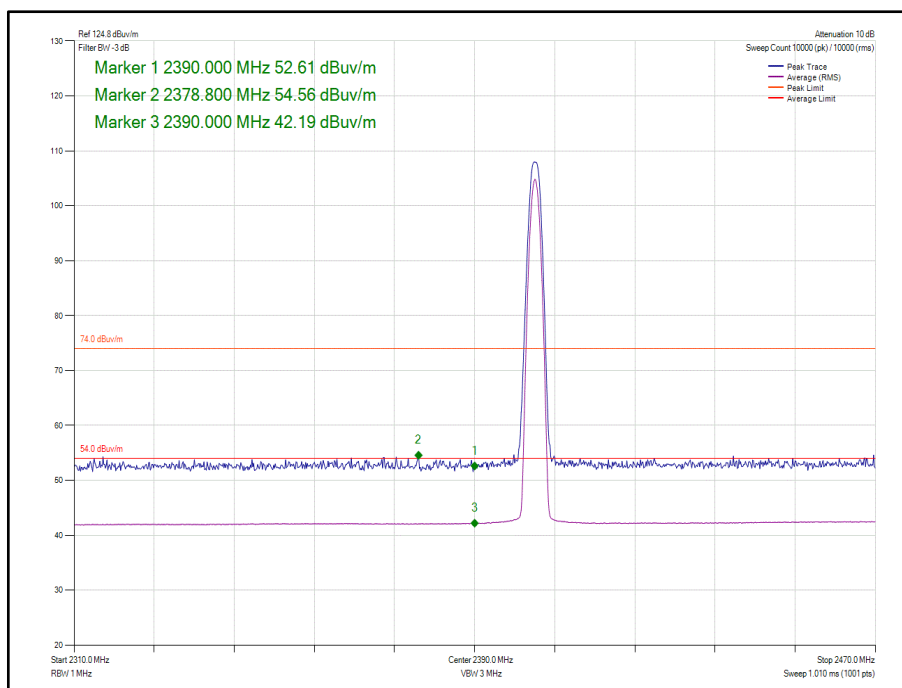


Figure 35 – GFSK/DH1, Core 2 - 2402 MHz - Band Edge Frequency 2390.0 MHz

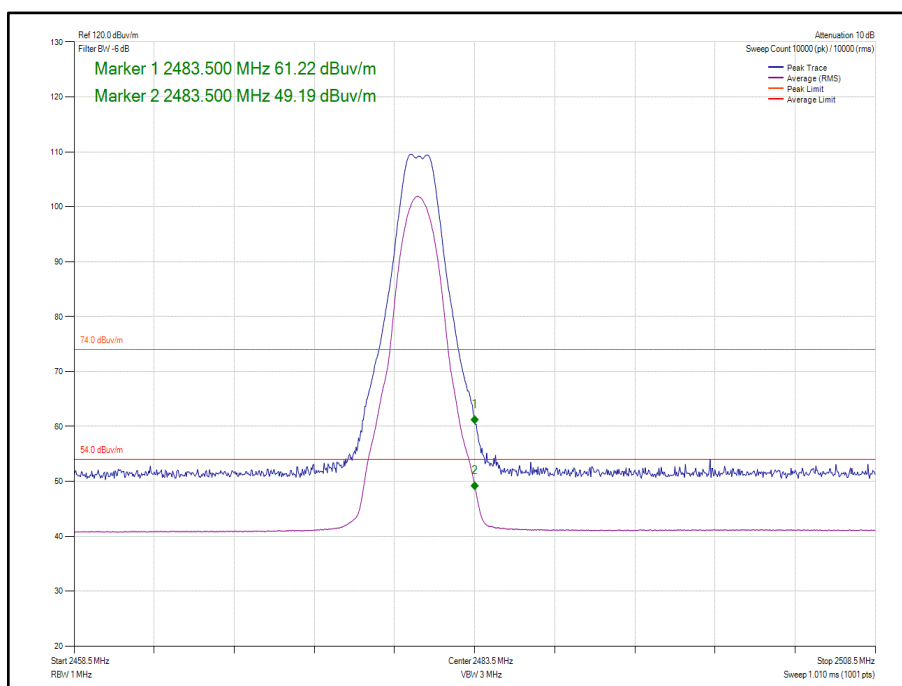


Figure 36 – GFSK/DH1, Core 2 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – LE2M (Core 0)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	Core 0	2402	2390.0	54.30	42.20
GFSK/DH1	Core 0	2480	2483.5	58.55	46.01

Table 44 - Restricted Band Edge Results

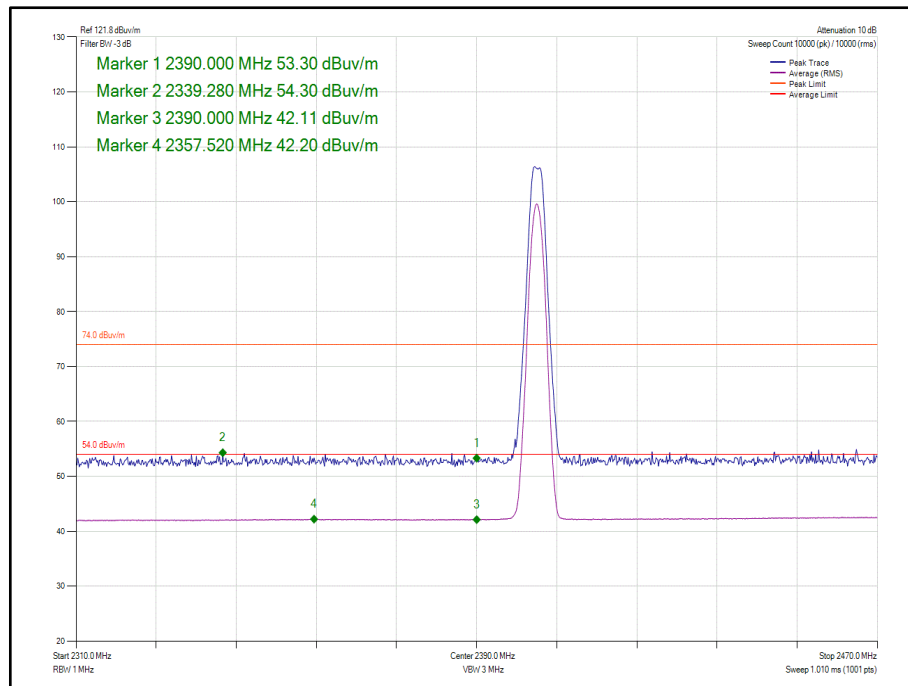


Figure 37 – GFSK/DH1, Core 0 - 2402 MHz - Band Edge Frequency 2390.0 MHz

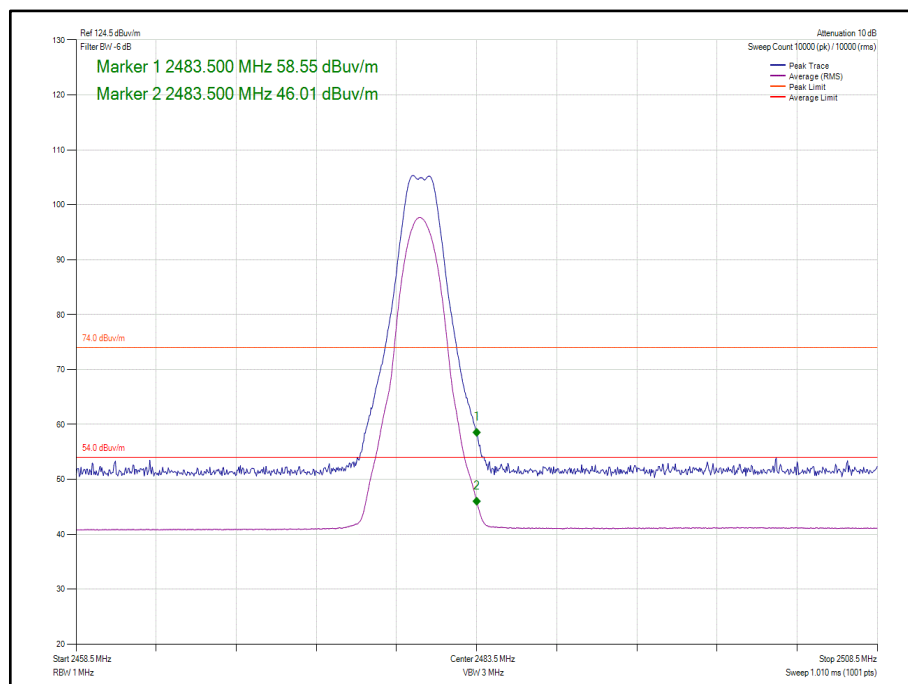


Figure 38 – GFSK/DH1, Core 0 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – LE2M (Dedicated Core 2)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
GFSK/DH1	Core 2	2402	2390.0	54.40	42.15
GFSK/DH1	Core 2	2480	2483.5	61.22	49.19

Table 45 - Restricted Band Edge Results

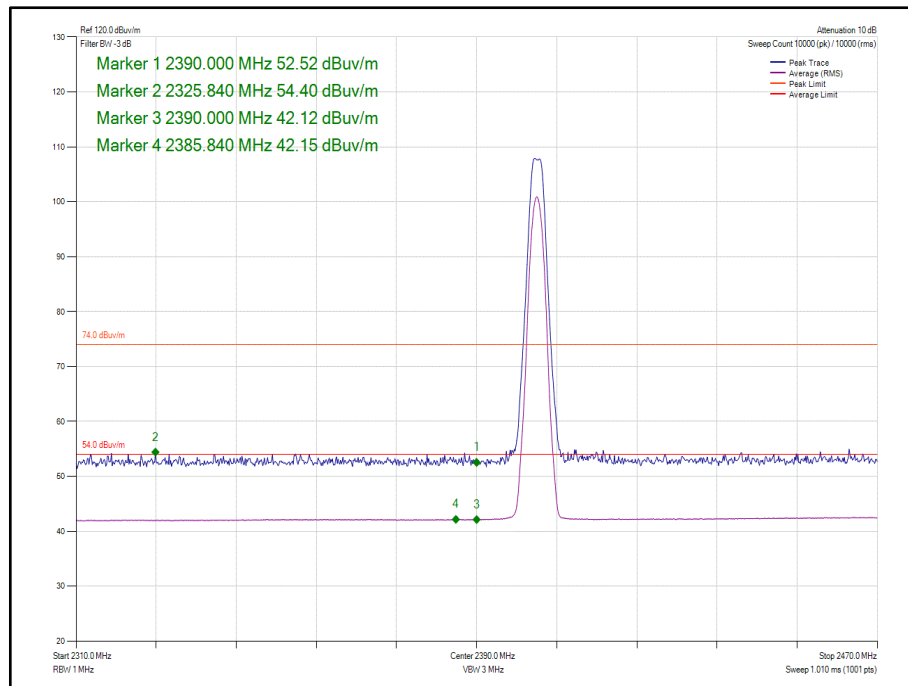


Figure 39 – GFSK/DH1, Core 2 - 2402 MHz - Band Edge Frequency 2390.0 MHz

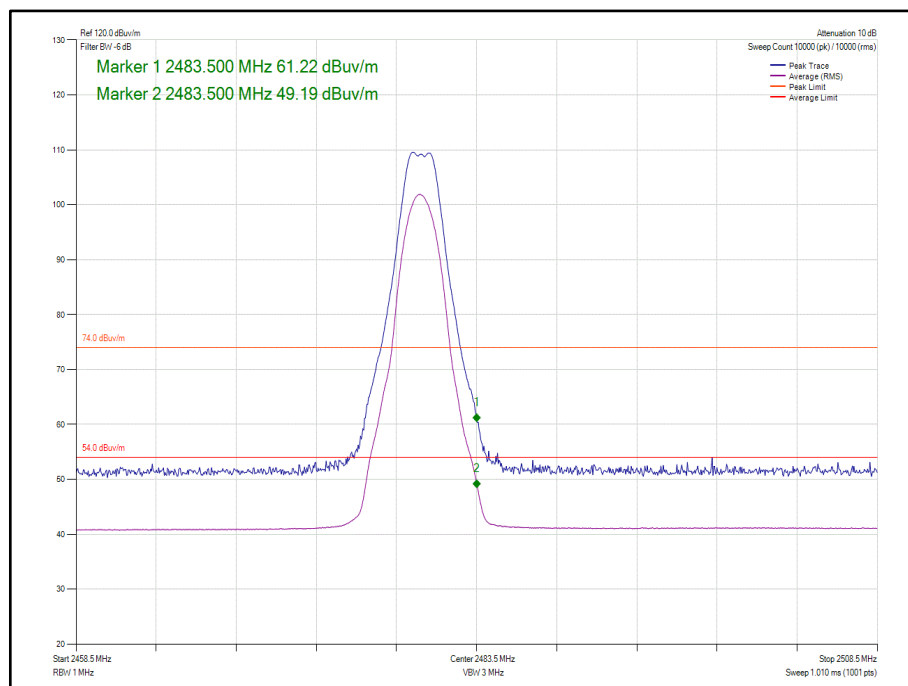


Figure 40 – GFSK/DH1, Core 2 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR4 (Core 0)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/4DH5	Core 0	2404	2390.0	54.67	42.19
GFSK/4DH5	Core 0	2476	2483.5	53.15	41.26

Table 46 - Restricted Band Edge Results

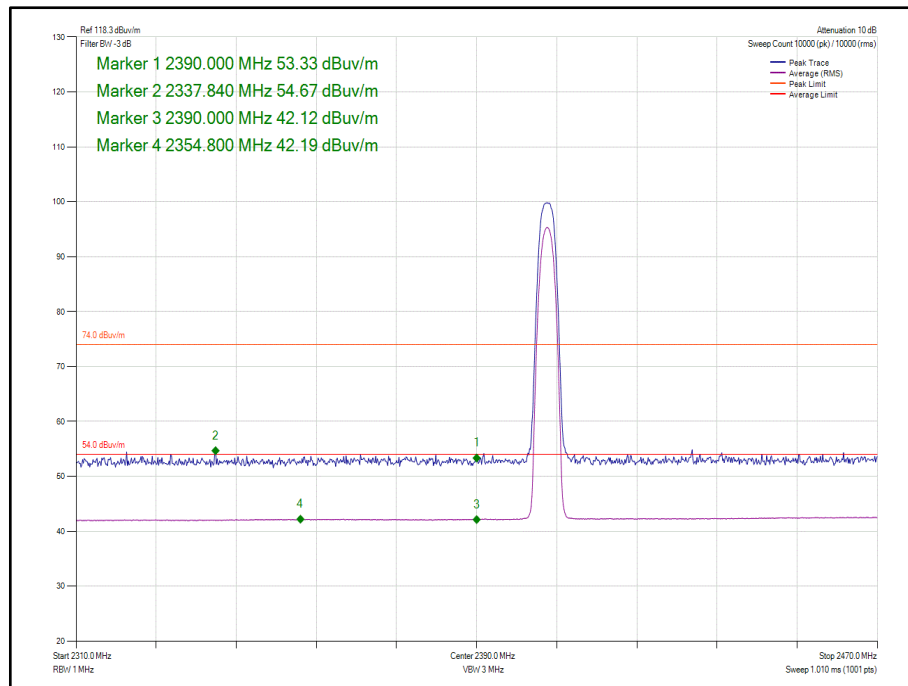


Figure 41 – GFSK/4DH5, Core 0 - 2404 MHz - Band Edge Frequency 2390.0 MHz

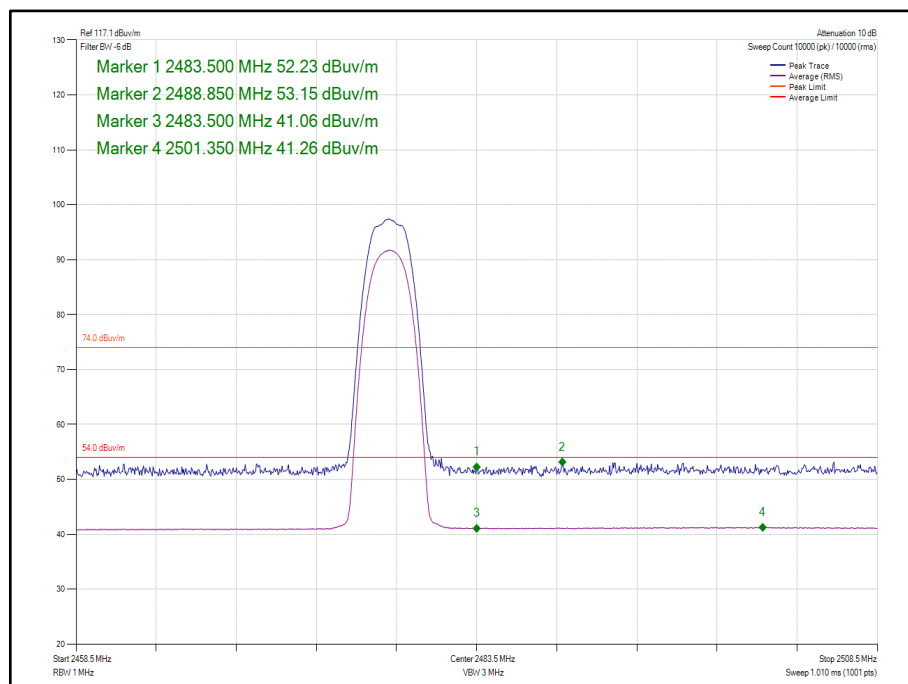


Figure 42 – GFSK/4DH5, Core 0 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR4 (Dedicated Core 2)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/4DH5	Core 2	2404	2390.0	54.36	42.29
GFSK/4DH5	Core 2	2476	2483.5	53.60	41.78

Table 47 - Restricted Band Edge Results

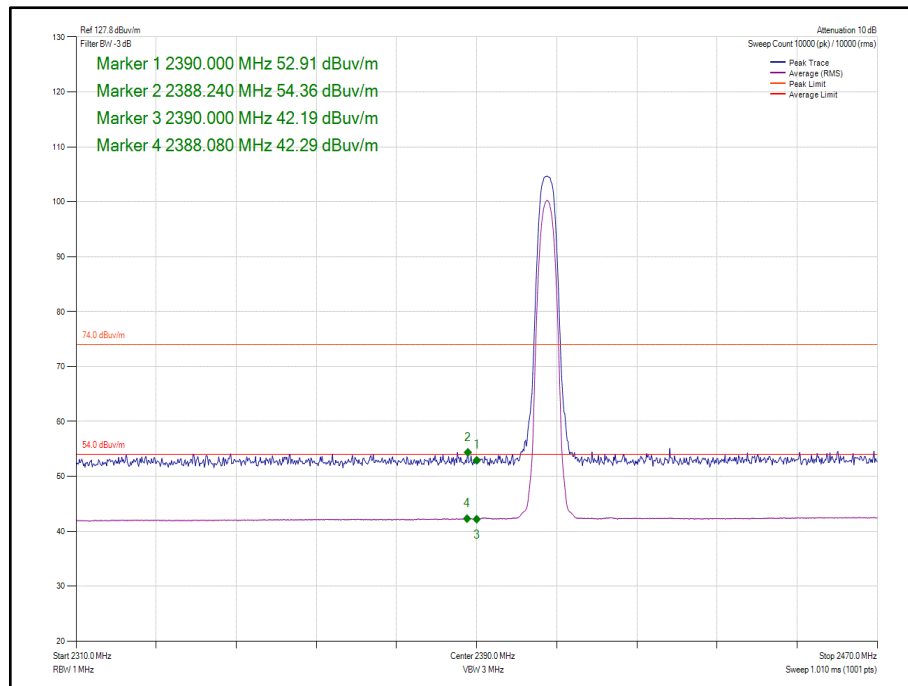


Figure 43 – GFSK/4DH5, Core 2 - 2404 MHz - Band Edge Frequency 2390.0 MHz

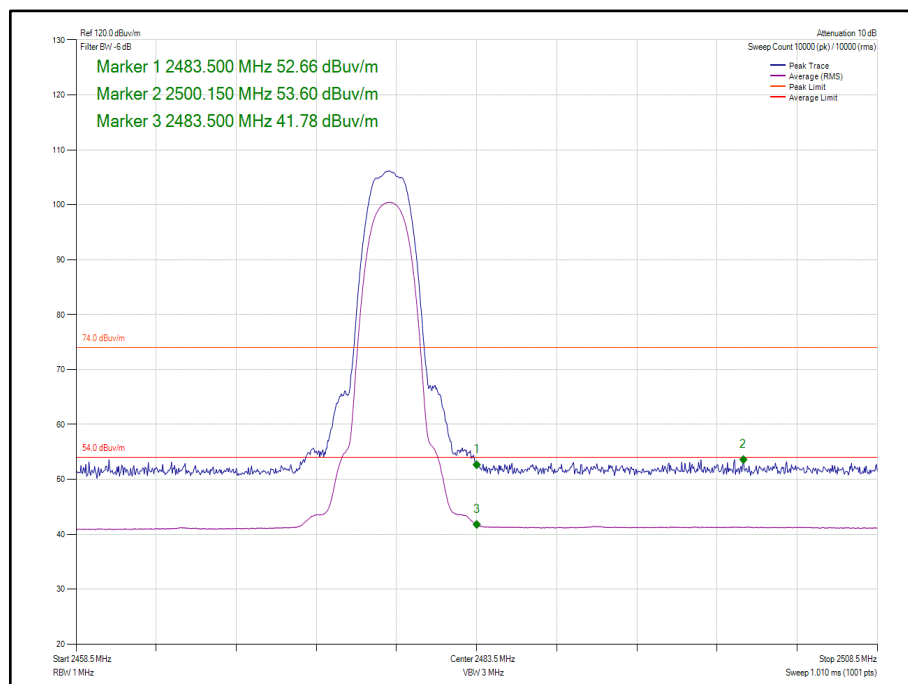


Figure 44 – GFSK/4DH5, Core 2 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR8 (Core 0)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/8DH5	Core 0	2404	2390.0	54.50	42.22
GFSK/8DH5	Core 0	2476	2483.5	53.57	41.50

Table 48 - Restricted Band Edge Results

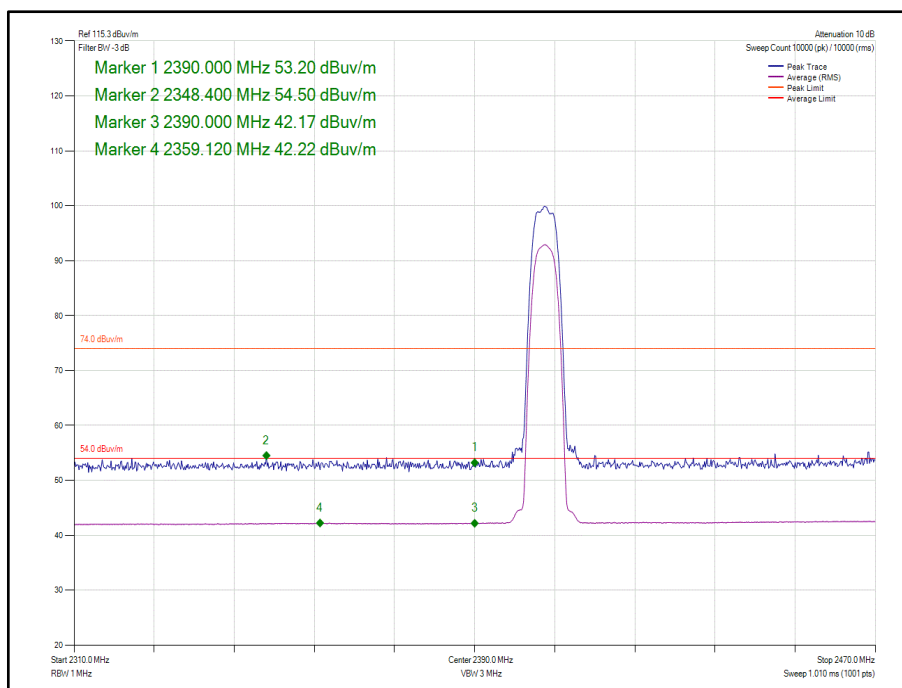


Figure 45 – GFSK/8DH5, Core 0 - 2404 MHz - Band Edge Frequency 2390.0 MHz

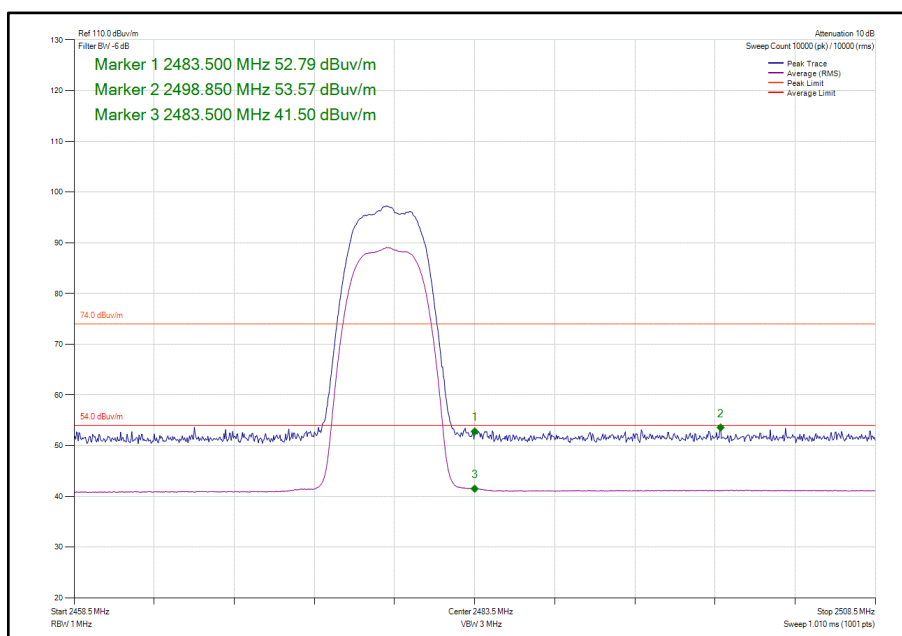


Figure 46 – GFSK/8DH5, Core 0 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR8 (Dedicated Core 2)

Modulation	Core	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
GFSK/8DH5	Core 2	2404	2390.0	54.60	42.32
GFSK/8DH5	Core 2	2476	2483.5	58.11	45.13

Table 49 - Restricted Band Edge Results

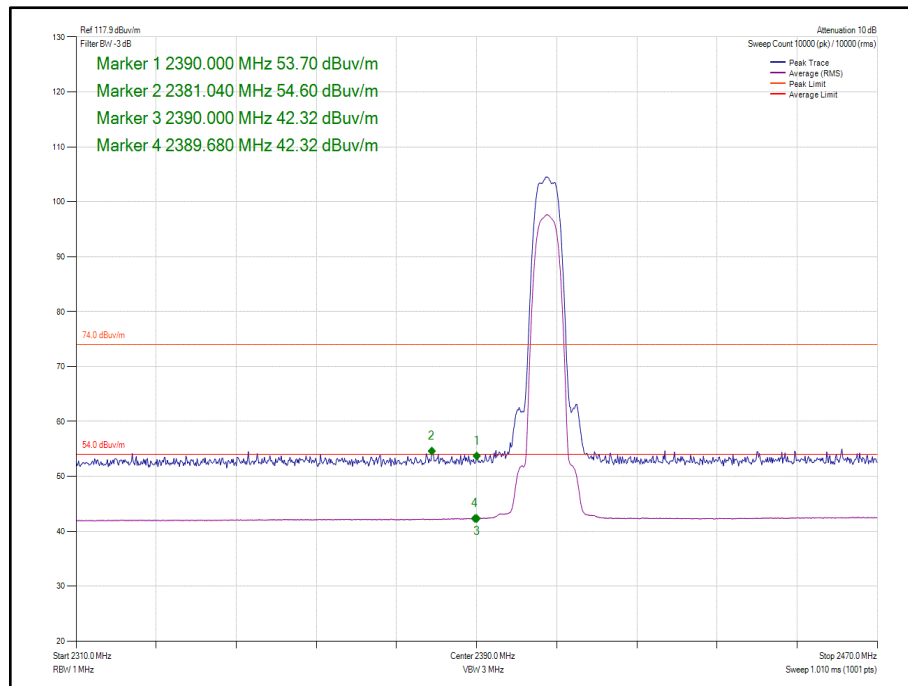


Figure 47 – GFSK/8DH5, Core 2 - 2404 MHz - Band Edge Frequency 2390.0 MHz

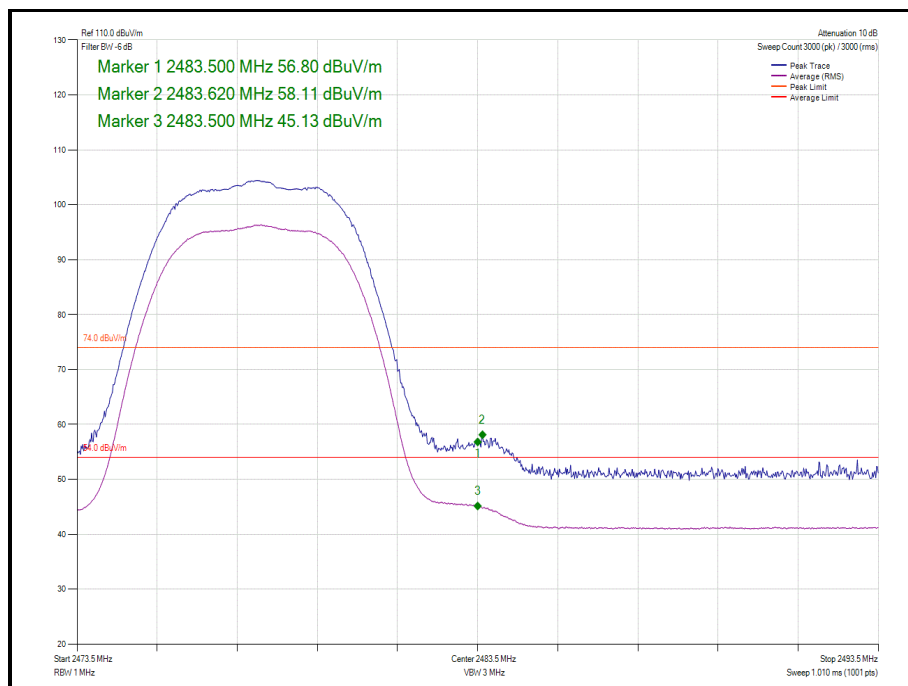


Figure 48 – GFSK/8DH5, Core 2 - 2476 MHz - Band Edge Frequency 2483.5 MHz



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 50

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 51

*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.



2.5.7 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 Due
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	07-Aug-2020
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	09-Jun-2020
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	17-Mar-2021
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5092	12	06-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5102	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5104	12	09-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	06-Oct-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	10-Mar-2021
Pre Amp 1 - 26.5 GHz	Agilent Technologies	8449B	5445	-	O/P Mon

Table 52

TU - Traceability Unscheduled
O/P Mon – Output Monitored

2.6 Spurious Radiated Emissions

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

A2330, S/N: C07CF029PW92 - Modification State 0
A2330, S/N: C07CG05KPW8V - Modification State 0

2.6.3 Date of Test

18-April-2020 to 29-May-2020

2.6.4 Test Method

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

In the 30 MHz to 1 GHz range pre-scans were only performed on the middle channel (2440 MHz).

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m @ 3m and 64/84 dBuV/m @ 1m) when compared to 20 dBc (Peak) and 30 dBc (Average) 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 $\mu\text{V/m}$:
 $10^{(\text{Field Strength in dBuV/m} / 20)}$.

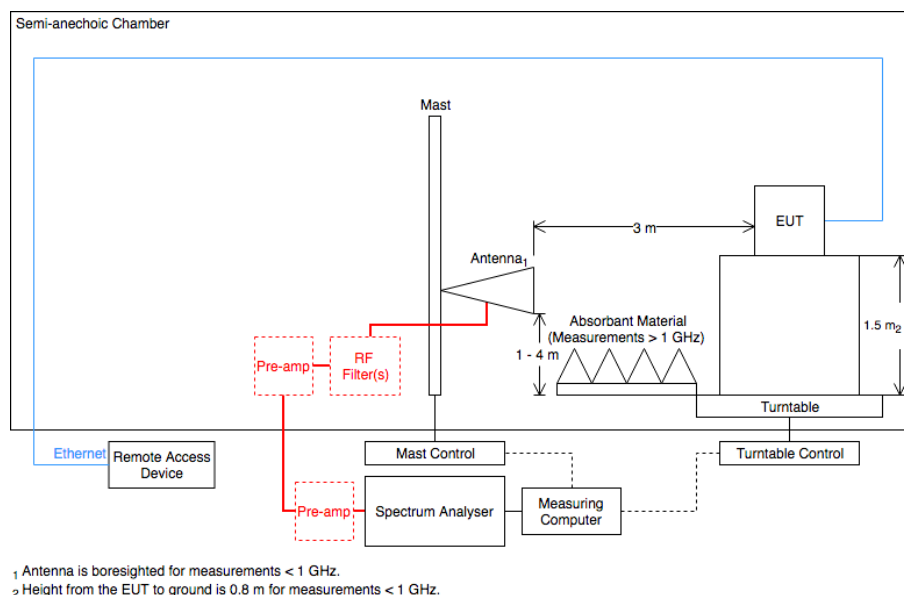


Figure 49 - Radiated Emissions Test Setup Diagram

2.6.5 Environmental Conditions

Ambient Temperature 19.2 - 21.6 °C
Relative Humidity 32.5 - 37.9 %

2.6.6 Test Results

2.4 GHz Bluetooth – LE1M (Core 0)

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1600.9	36.7	54.0	-17.3	RMS	69	105	Vertical
1601.3	36.0	54.0	-18.0	RMS	69	148	Vertical

Table 53 - Channel 0 (2402 MHz), LE1M, Core 0, 1 GHz to 26 GHz

* No other emissions found within 6 dB of the limit.

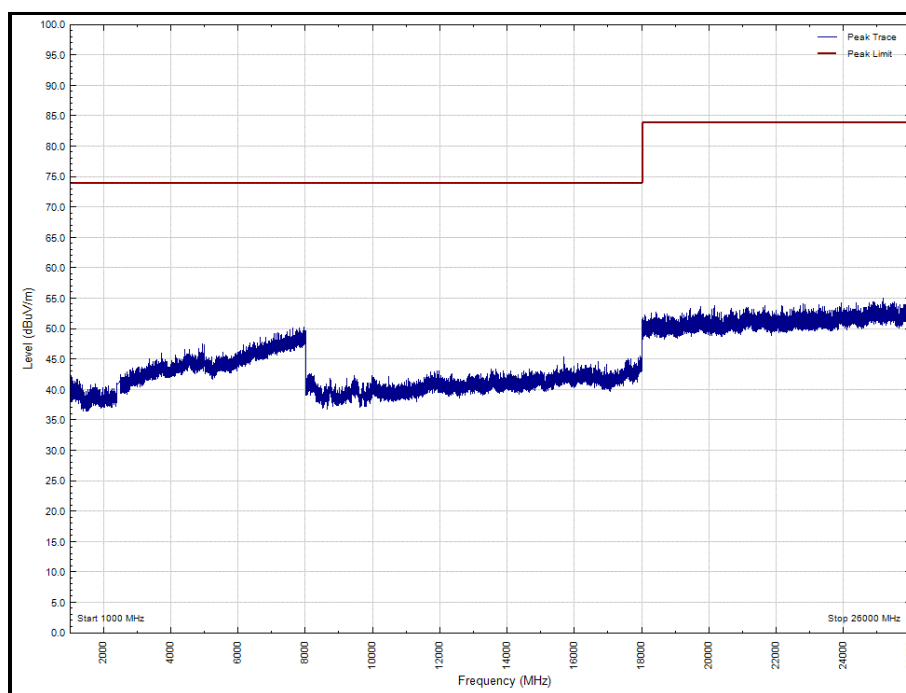


Figure 50 - Channel 0 (2402 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (Peak)

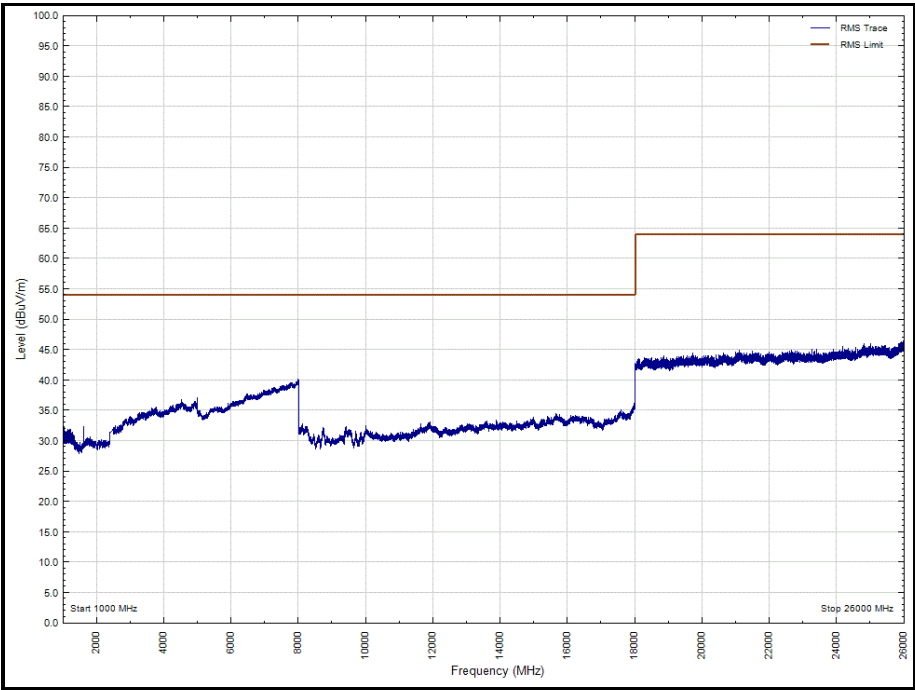


Figure 51 - Channel 0 (2402 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (rms)

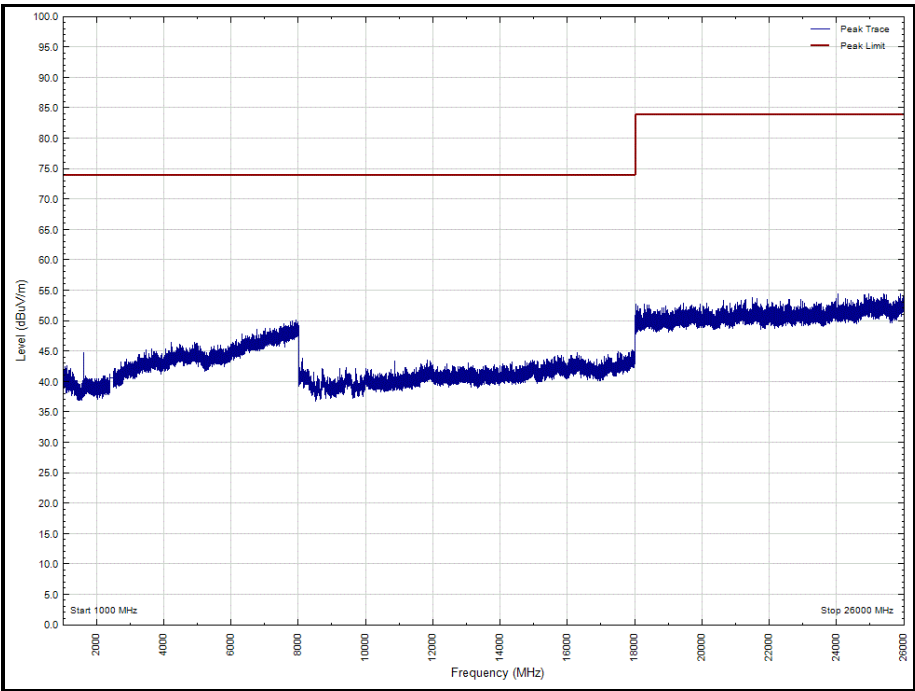


Figure 52 - Channel 0 (2402 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (Peak)

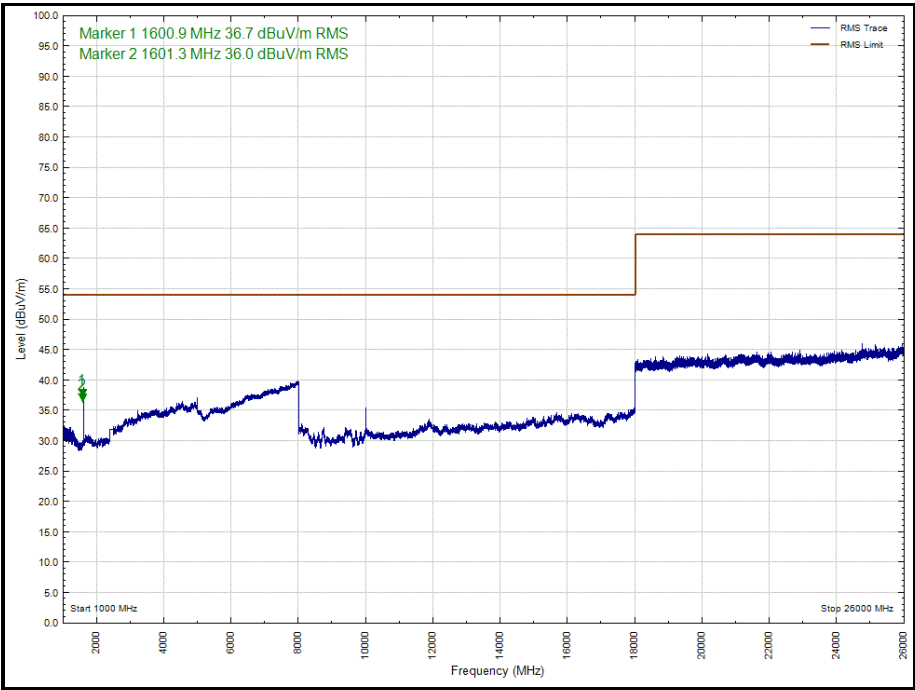


Figure 53 - Channel 0 (2402 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (rms)

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
37.8	35.5	40.0	-4.5	QP	31	100	Horizontal
118.7	32.4	44.0	-11.6	QP	301	110	Vertical
136.4	31.5	44.0	-12.5	QP	160	104	Vertical
166.1	27.1	44.0	-16.9	QP	249	110	Horizontal
243.0	22.1	46.0	-23.9	QP	94	100	Horizontal
272.0	21.8	46.0	-24.2	QP	314	314	Horizontal
278.9	21.8	46.0	-24.2	QP	84	107	Horizontal
335.1	23.1	46.0	-22.9	QP	279	100	Vertical

Table 54 - Channel 17 (2440 MHz), LE1M, Core 0, 30 MHz to 26 GHz

*No other emissions found within 6 dB of the limit.

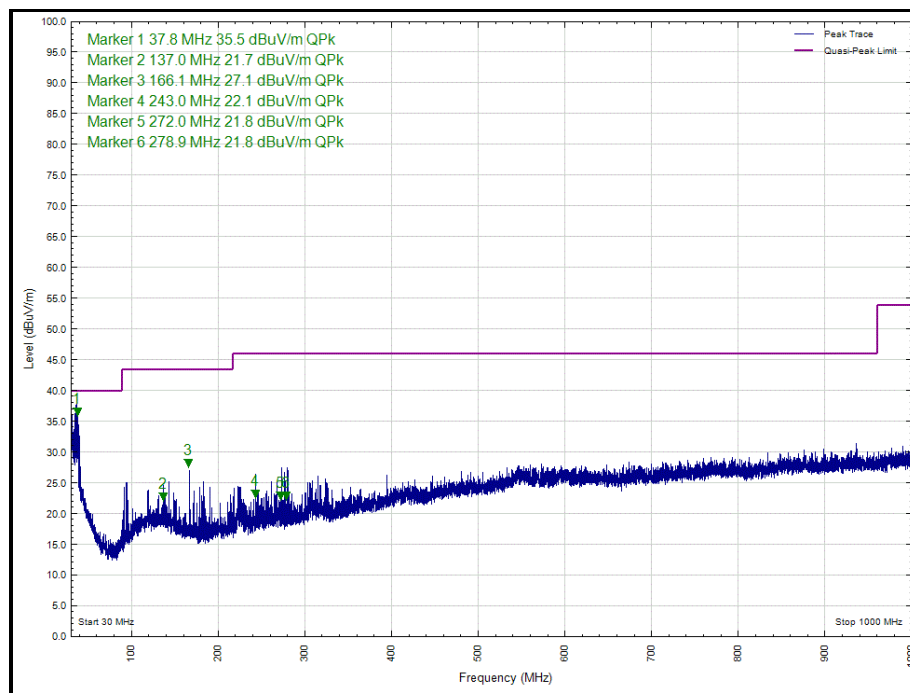


Figure 54 - Channel 17 (2440 MHz), LE1M, Core 0, 30 MHz to 1 GHz, Horizontal (Peak)

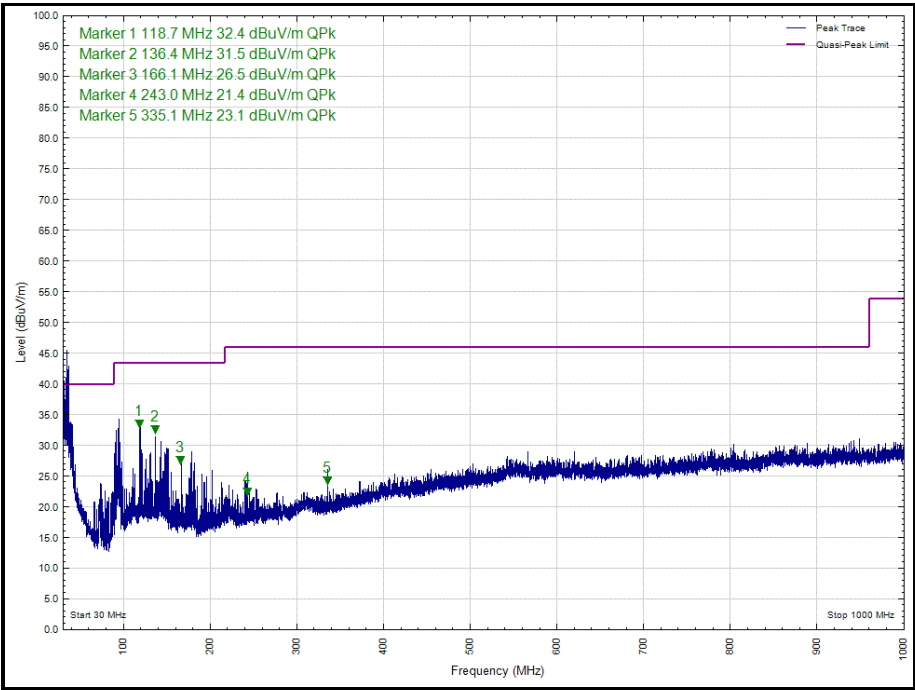


Figure 55 - Channel 17 (2440 MHz), LE1M, Core 0, 30 MHz to 1 GHz, Vertical (Peak)

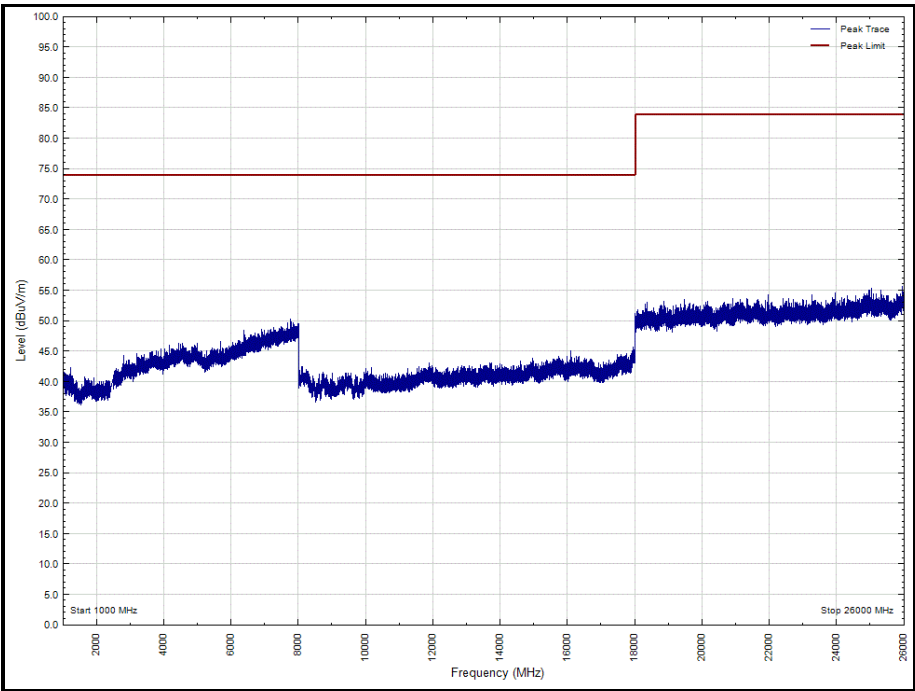


Figure 56 - Channel 17 (2440 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (Peak)

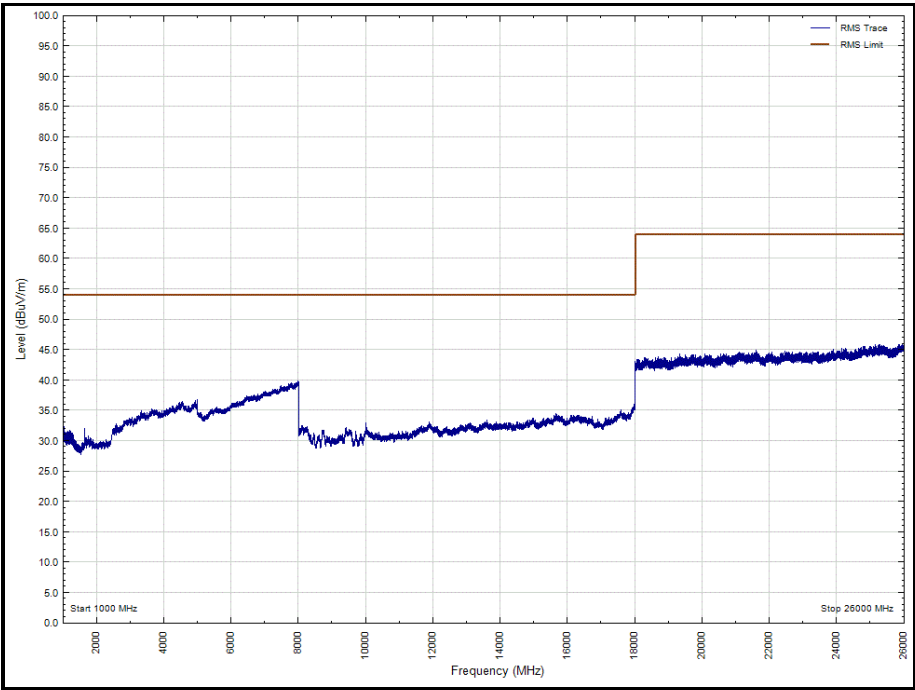


Figure 57 - Channel 17 (2440 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (rms)

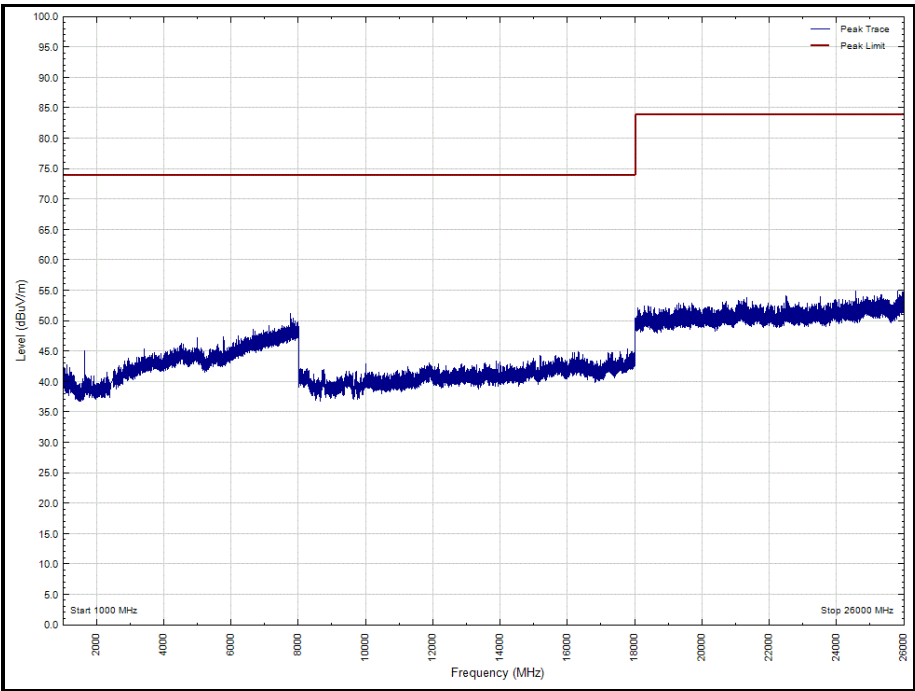


Figure 58 - Channel 17 (2440 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (Peak)

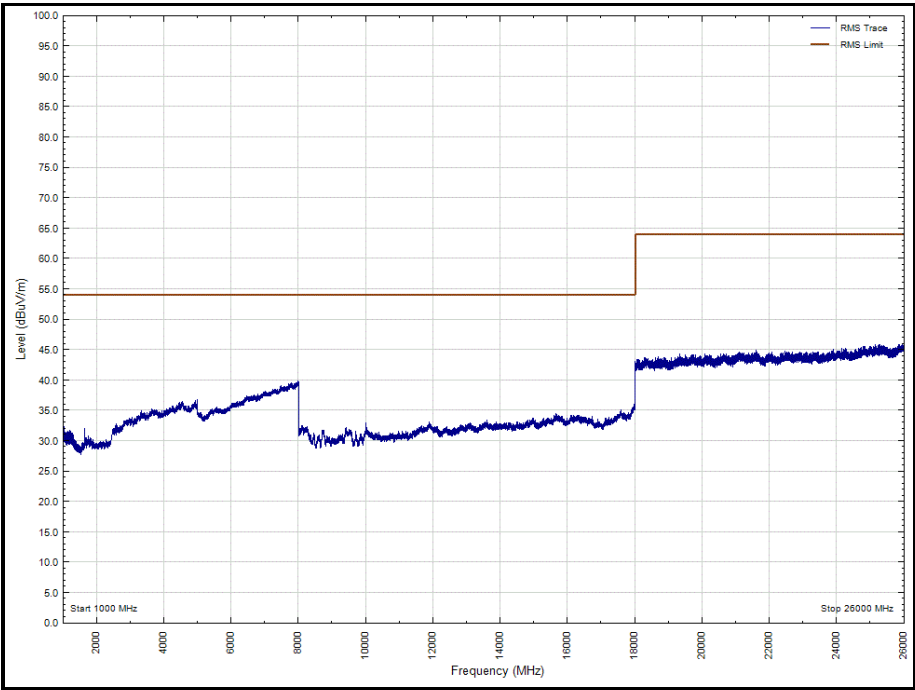


Figure 59 - Channel 17 (2440 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (rms)



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

Table 55 - Channel 39 (2480 MHz), LE1M, Core 0, 1 GHz to 26 GHz

* No emissions found within 6 dB of the limit.

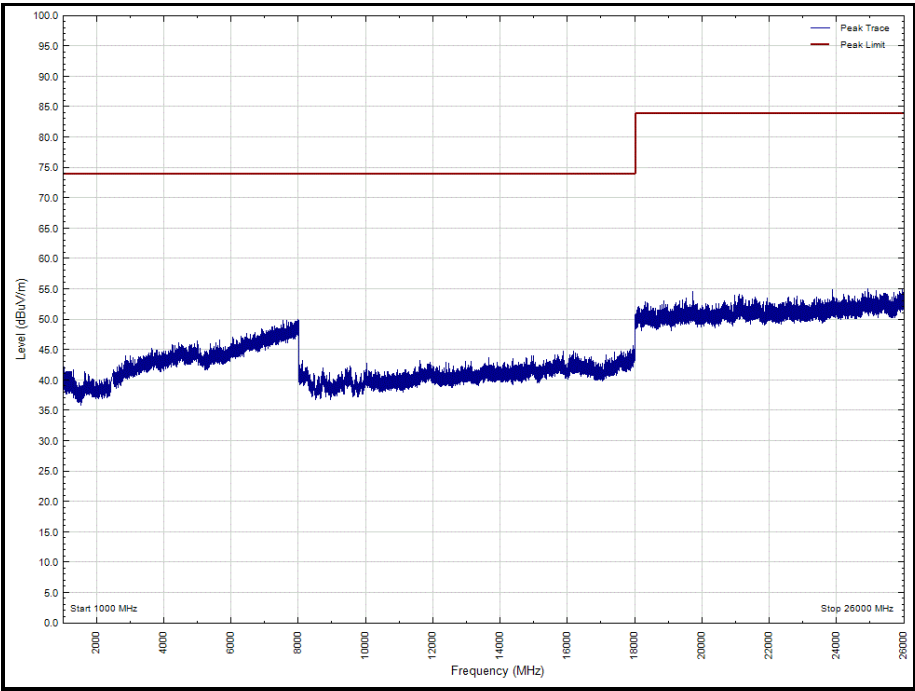


Figure 60 - Channel 39 (2480 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (Peak)

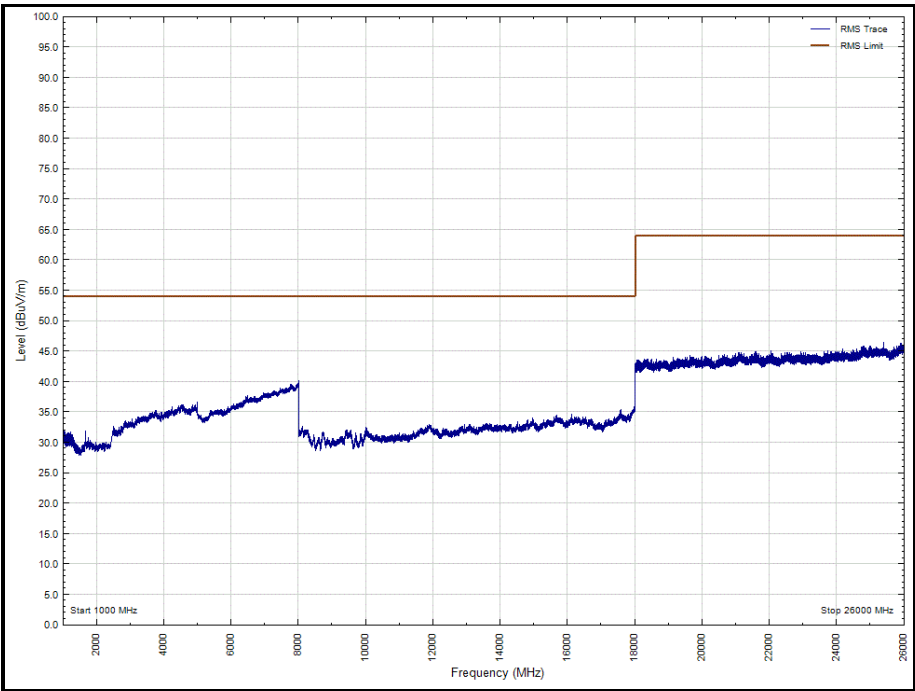


Figure 61 - Channel 39 (2480 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Horizontal (rms)

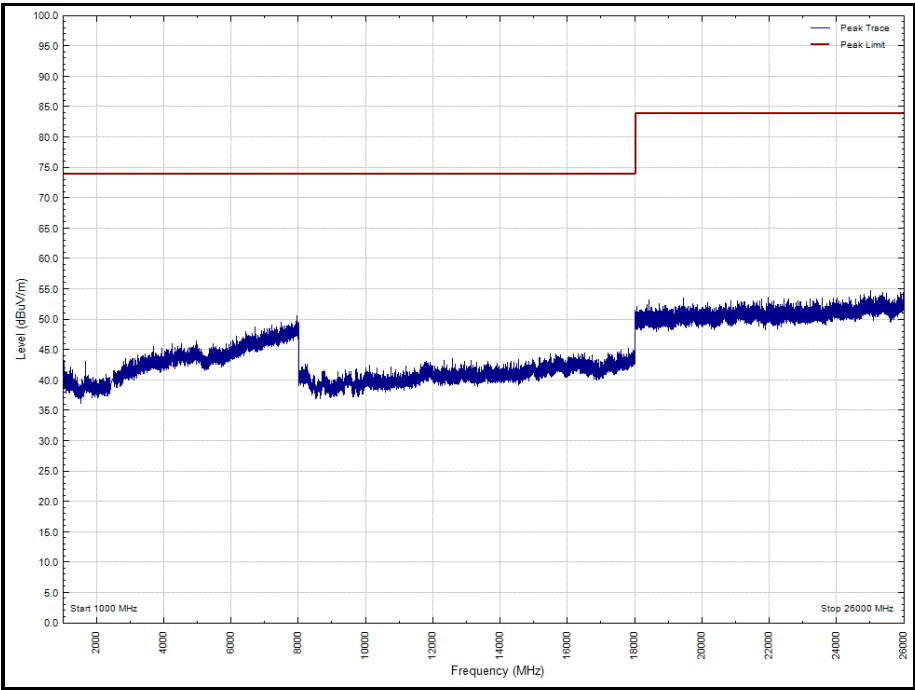


Figure 62 - Channel 39 (2480 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (Peak)

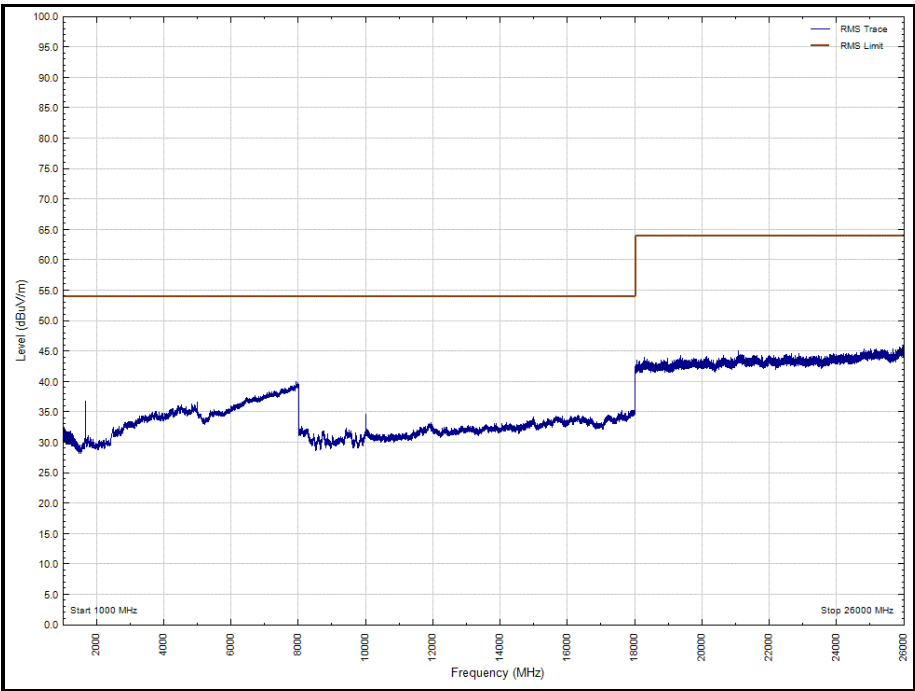


Figure 63 - Channel 39 (2480 MHz), LE1M, Core 0, 1 GHz to 26 GHz, Vertical (rms)



2.4 GHz Bluetooth – LE1M (Core 1)

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

Table 56 - Channel 0 (2402 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

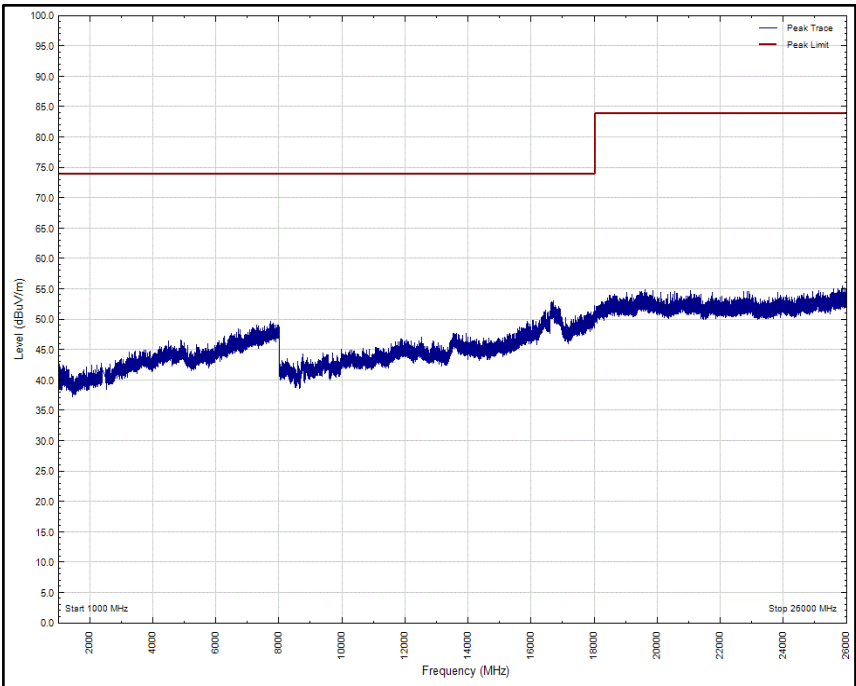


Figure 64 - Channel 0 (2402 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (Peak)

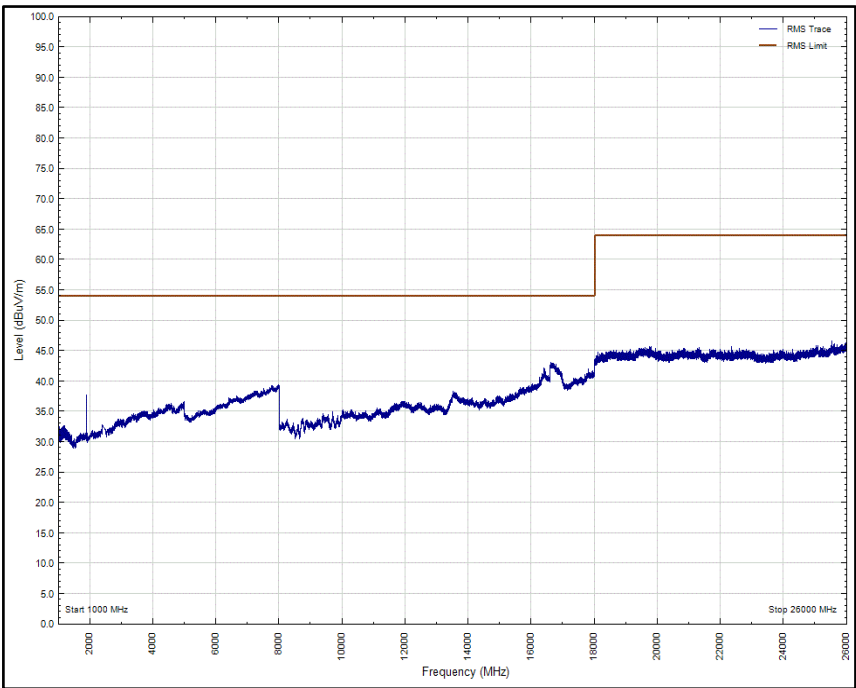


Figure 65 - Channel 0 (2402 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (rms)

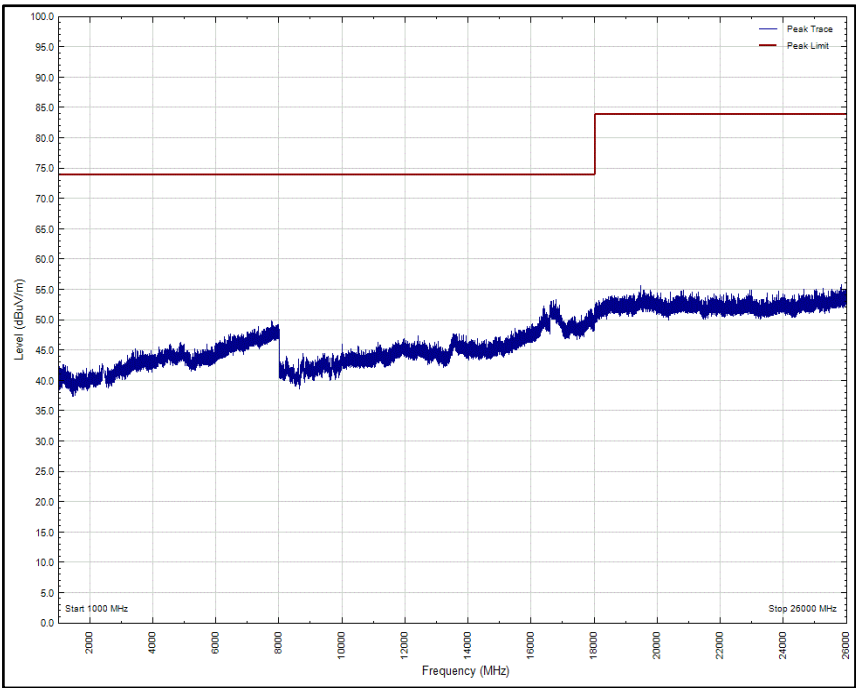


Figure 66 - Channel 0 (2402 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (Peak)

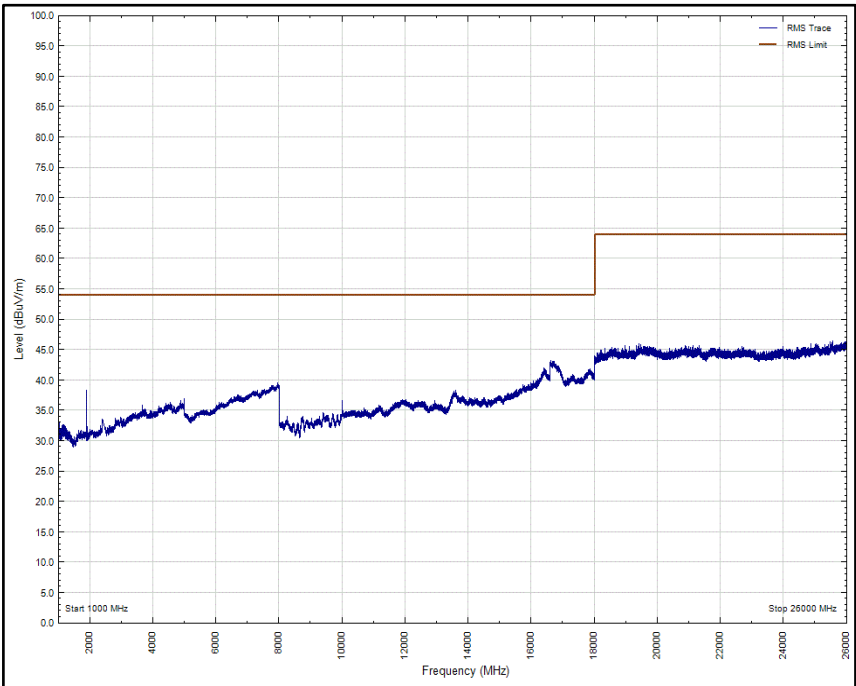


Figure 67 - Channel 0 (2402 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (rms)

Frequency (MHz)	Level (dBuv/m)	Limit (dBuv/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
36.085	28.5	40.0	-11.5	Q-Peak	342	106	Vertical
48.049	23.9	40.0	-16.1	Q-Peak	306	110	Vertical
92.892	31.2	43.5	-12.3	Q-Peak	354	100	Vertical
120.257	33.3	43.5	-10.2	Q-Peak	227	100	Vertical

Table 57 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 30 MHz to 26 GHz

*No other emissions found within 6 dB of the limit.

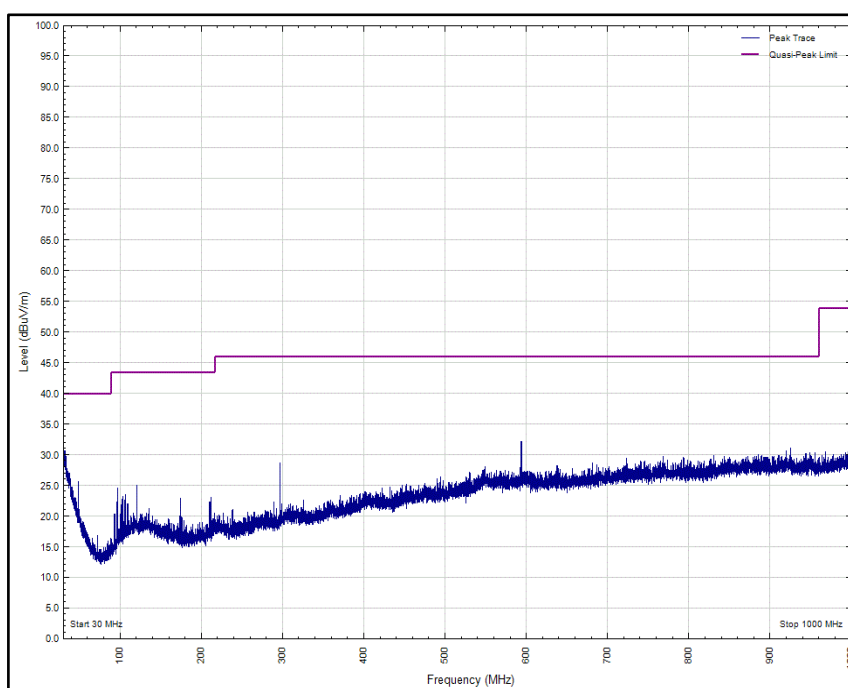


Figure 68 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 30 MHz to 1 GHz, Horizontal (Peak)

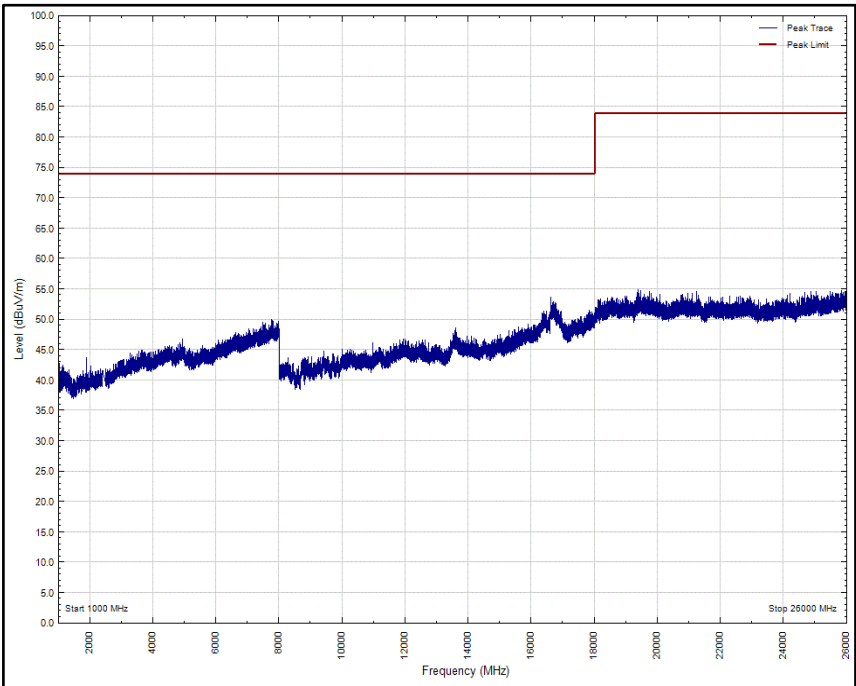


Figure 69 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (Peak)

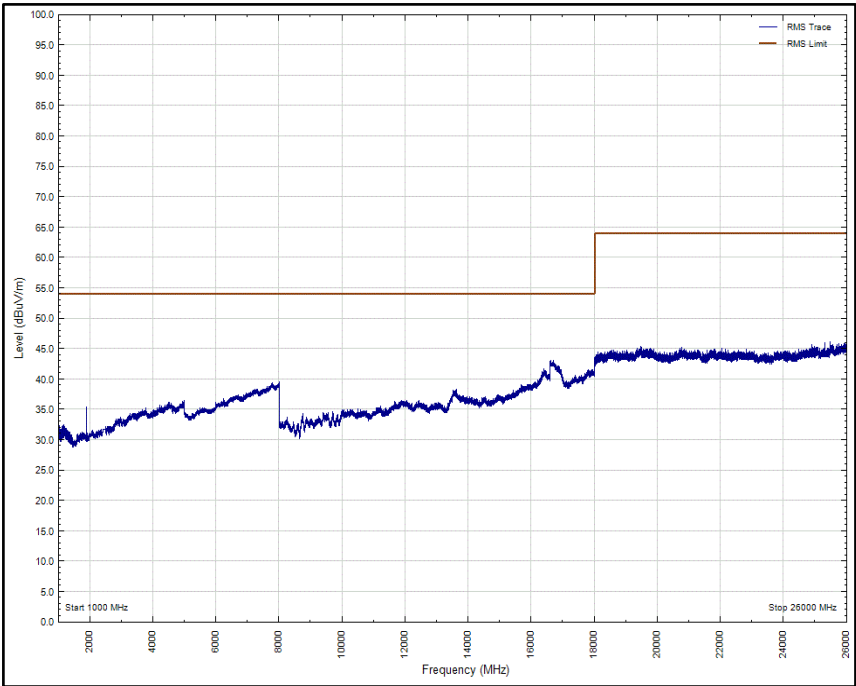


Figure 70 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (rms)

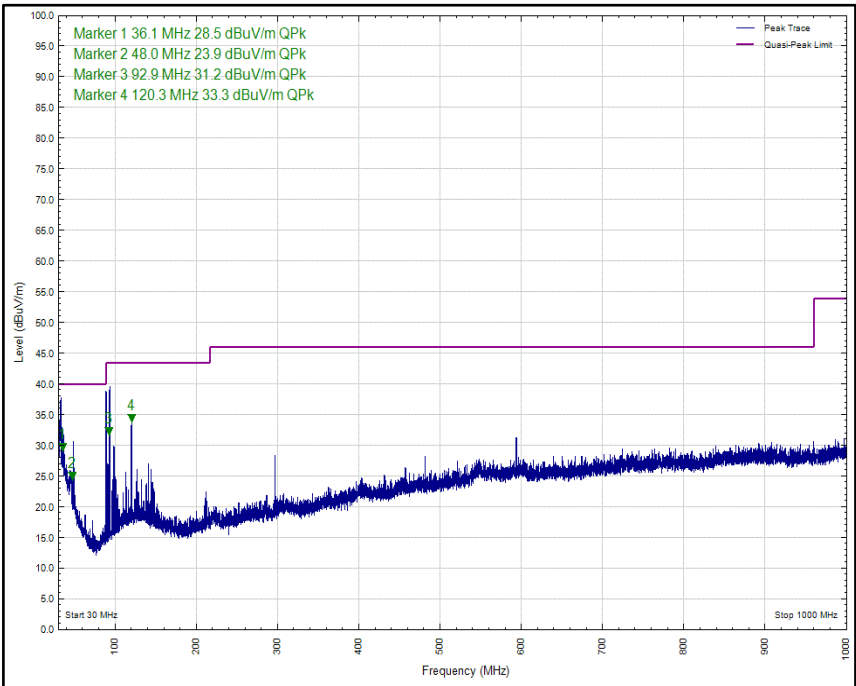


Figure 71 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 30 MHz to 1 GHz, Vertical (Peak)

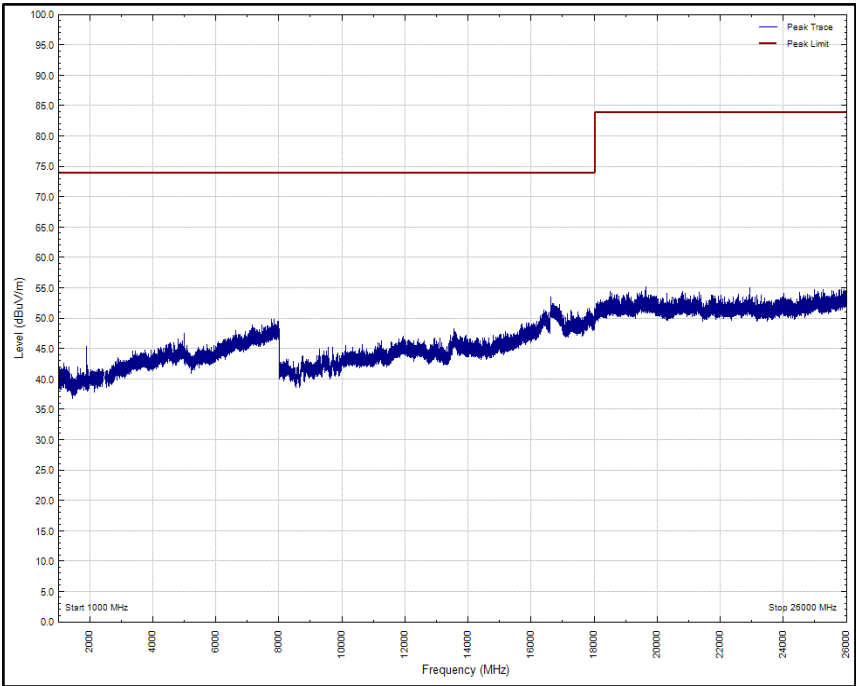


Figure 72 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (Peak)

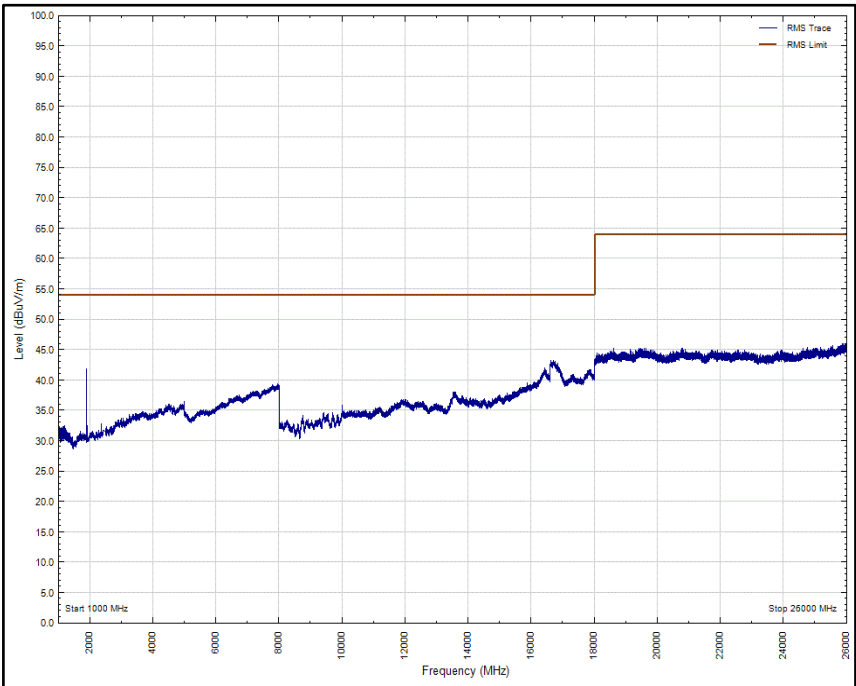


Figure 73 - Channel 17 (2440 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (rms)



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

Table 58 - Channel 39 (2480 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz

* No emissions found within 6 dB of the limit.

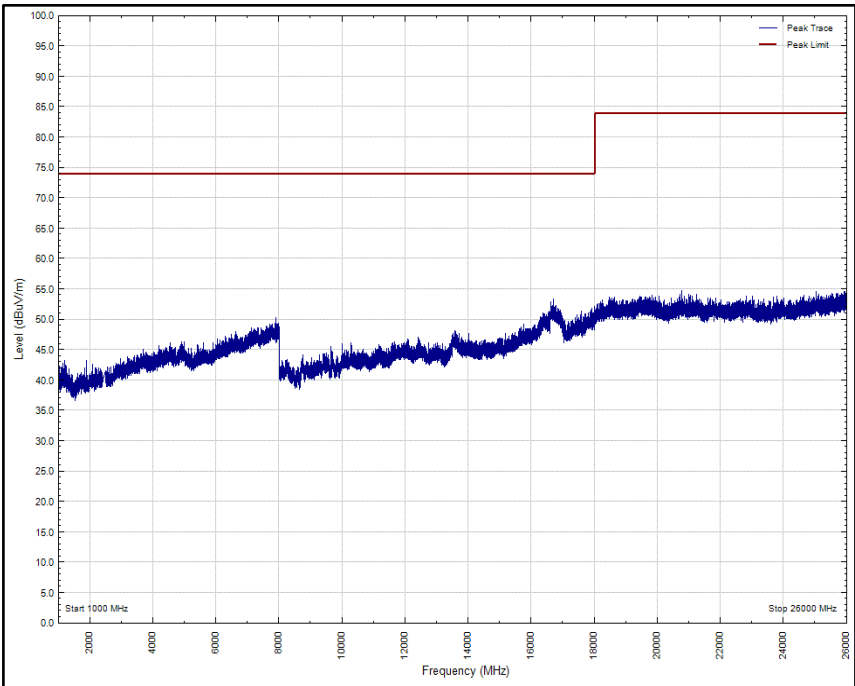


Figure 74 - Channel 39 (2480 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (Peak)

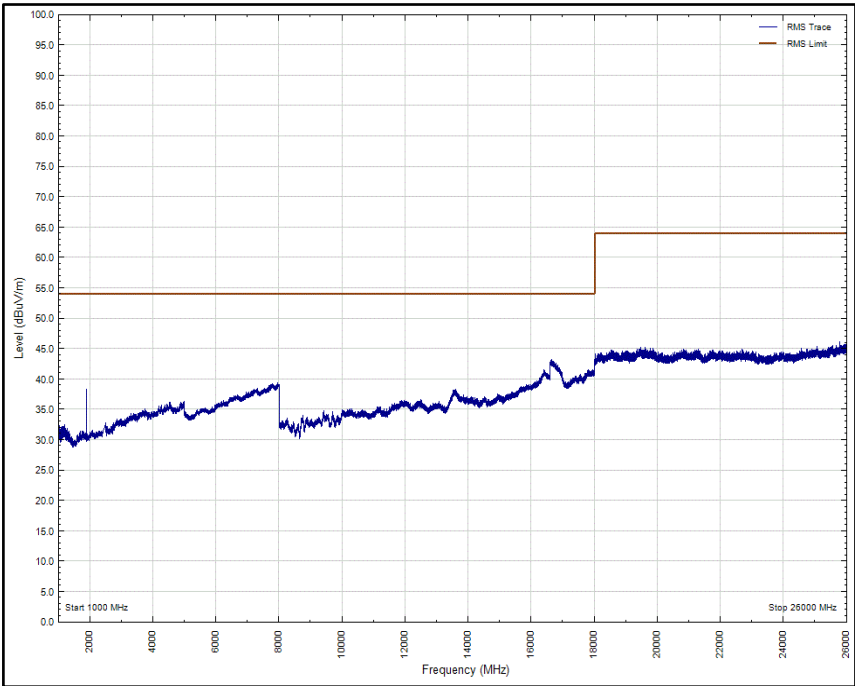


Table 59 - Channel 39 (2480 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Horizontal (rms)

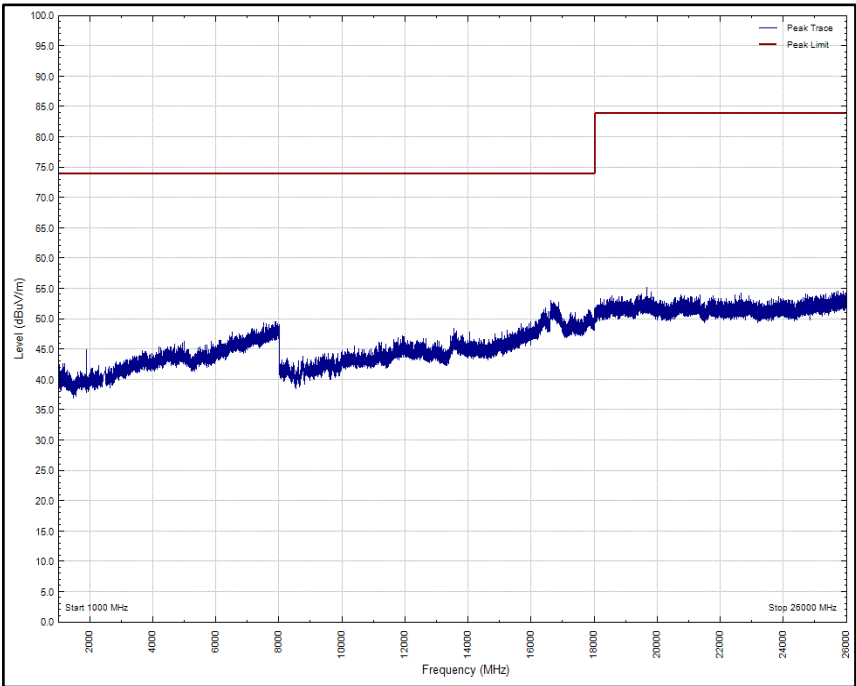


Figure 75 - Channel 39 (2480 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (Peak)

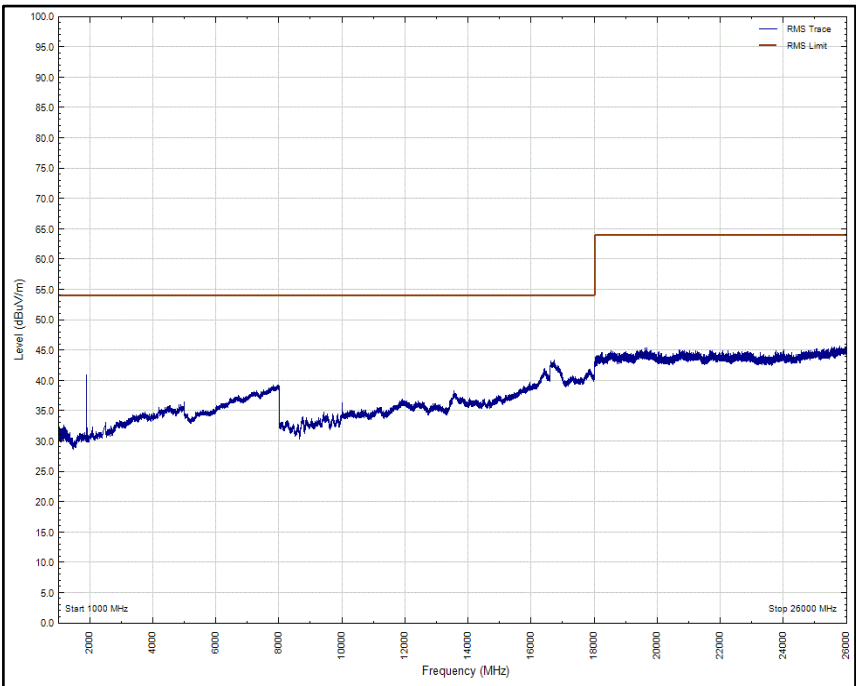


Figure 76 - Channel 39 (2480 MHz), LE1M, iPA, Core 1, 1 GHz to 26 GHz, Vertical (rms)



2.4 GHz Bluetooth – LE1M (Dedicated Core 2)

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

Table 60 - Channel 0 (2402 MHz), LE1M, Core 2, 1 GHz to 26 GHz

* No emissions found within 6 dB of the limit.

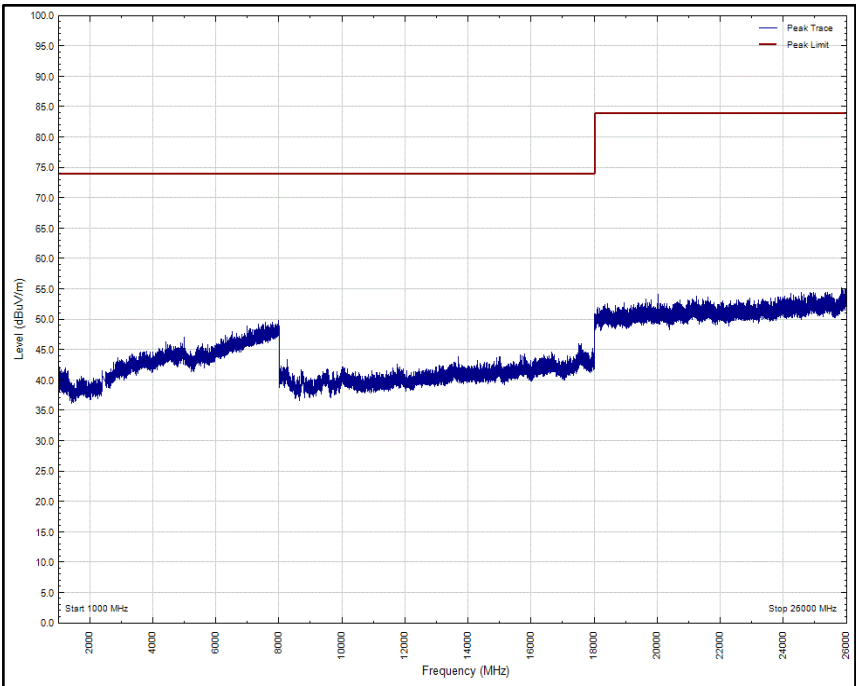


Figure 77 - Channel 0 (2402 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (Peak)

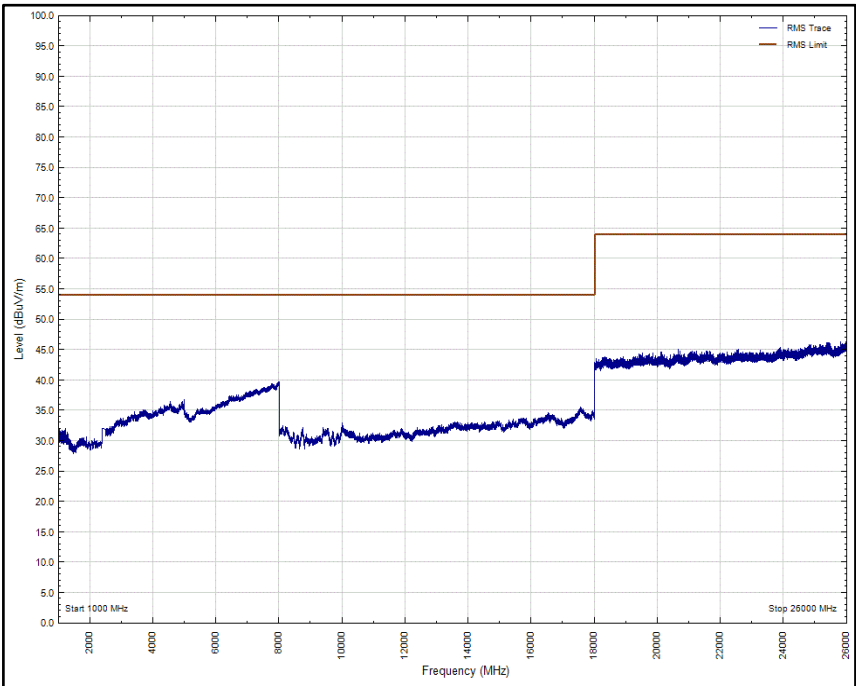


Figure 78 - Channel 0 (2402 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (rms)

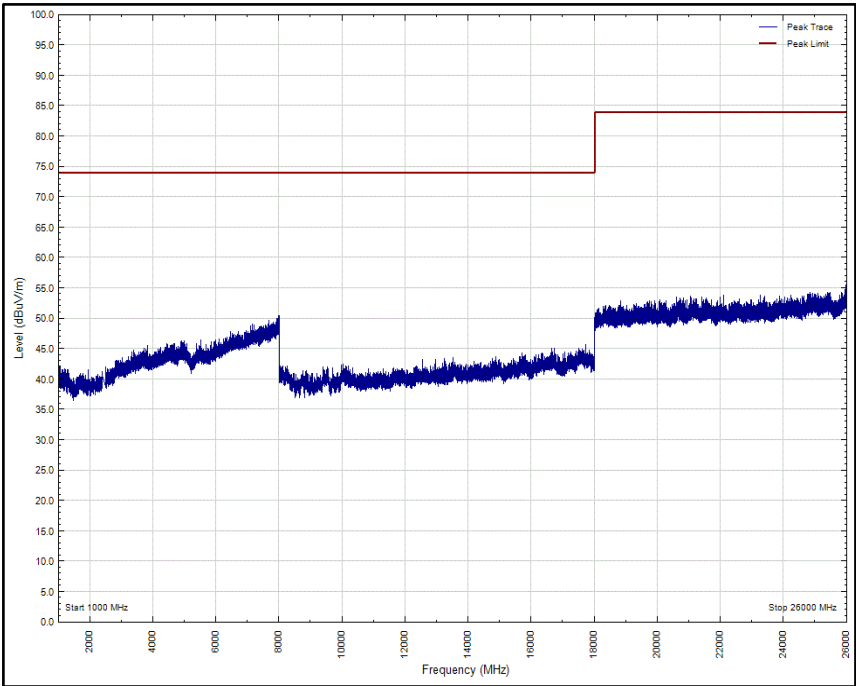


Figure 79 - Channel 0 (2402 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (Peak)

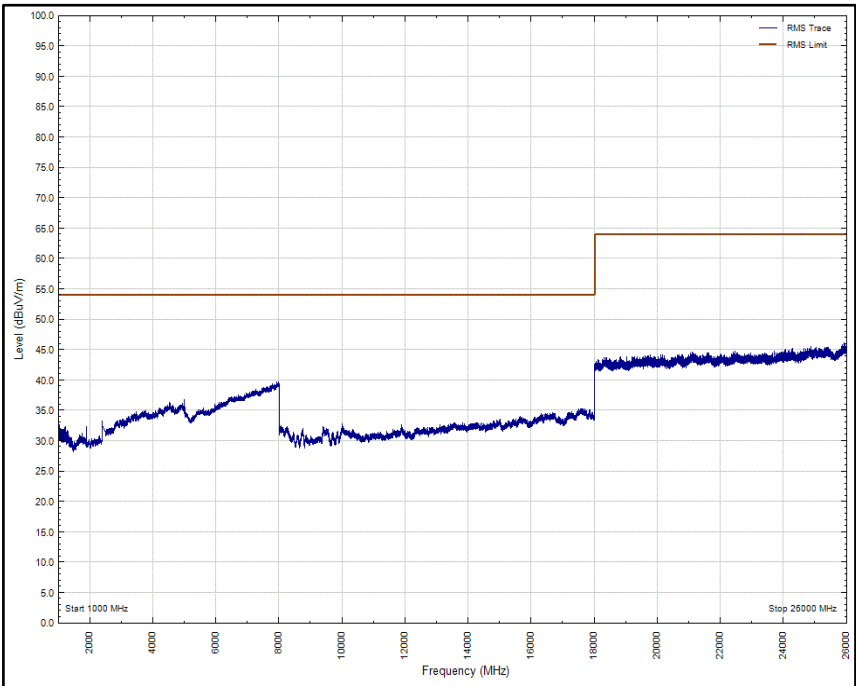


Figure 80 - Channel 0 (2402 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (rms)



Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
118.890	34.2	43.5	-9.3	Q-Peak	155	397	Horizontal
150.000	23.7	43.5	-19.8	Q-Peak	119	104	Vertical
166.440	27.0	43.5	-16.5	Q-Peak	251	100	Vertical

Table 61 - Channel 17 (2440 MHz), LE1M, Core 2, 30 MHz to 26 GHz

*No other emissions found within 6 dB of the limit.

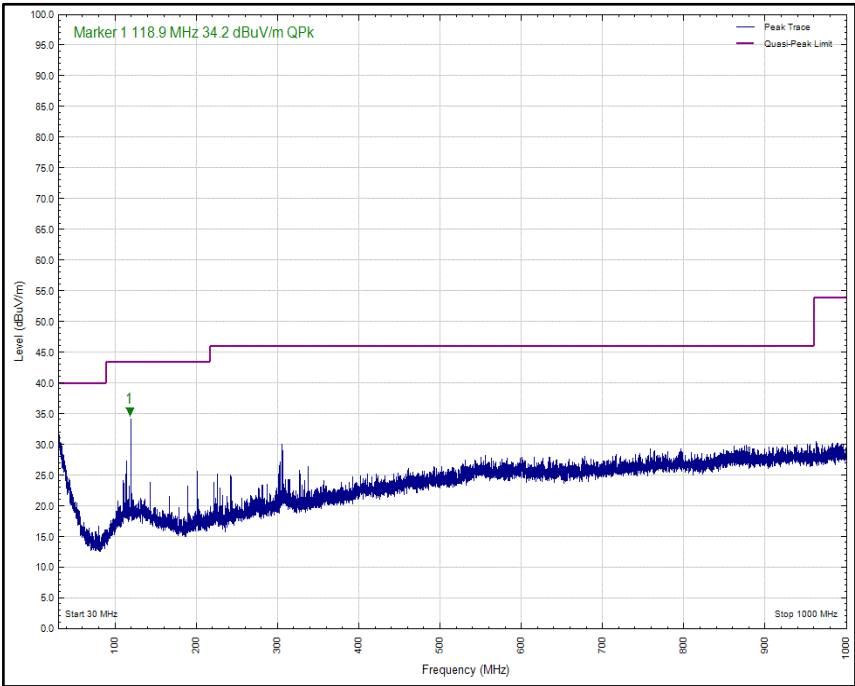


Figure 81 - Channel 17 (2440 MHz), LE1M, Core 2, 30 MHz to 1 GHz, Horizontal (Peak)

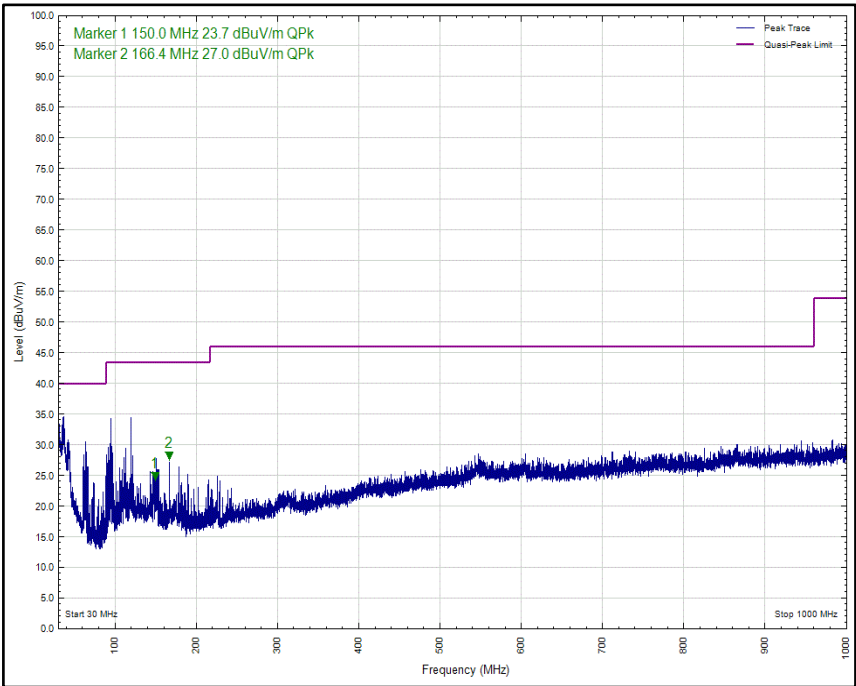


Figure 82 - Channel 17 (2440 MHz), LE1M, Core 2, 30 MHz to 1 GHz, Vertical (Peak)

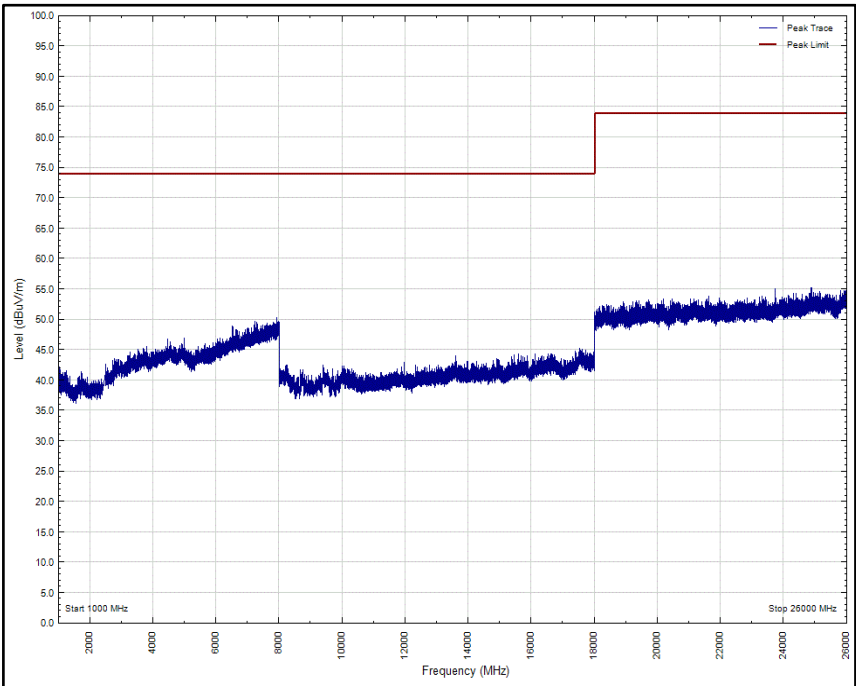


Figure 83 - Channel 17 (2440 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (Peak)

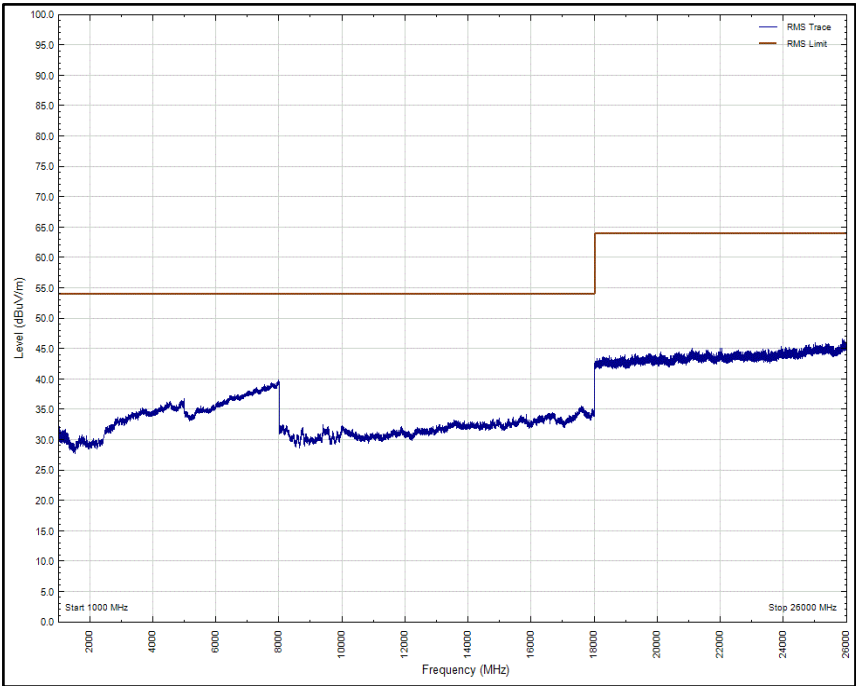


Figure 84 - Channel 17 (2440 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (rms)

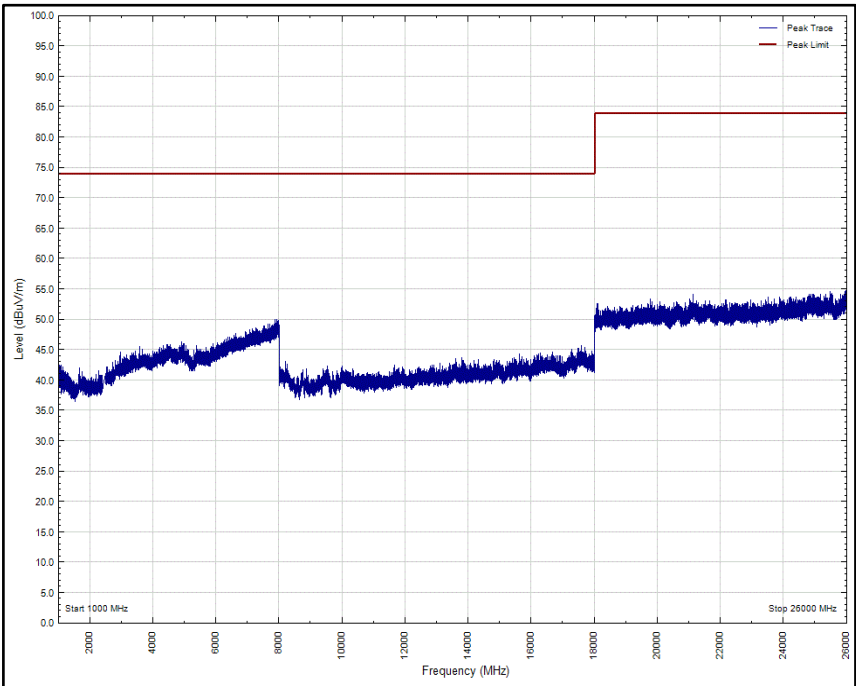


Figure 85 - Channel 17 (2440 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (Peak)

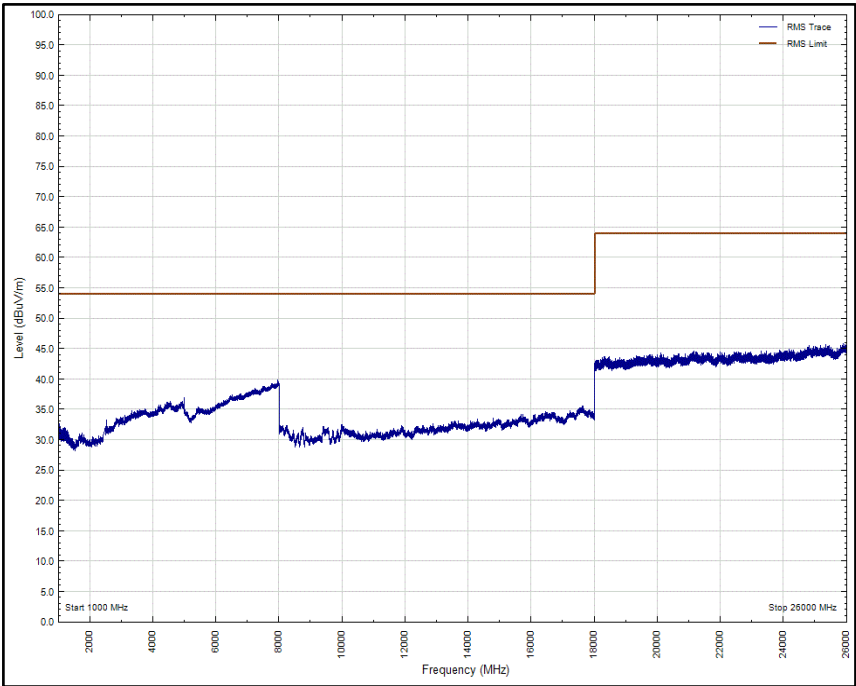


Figure 86 - Channel 17 (2440 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (rms)



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

Table 62 - Channel 39 (2480 MHz), LE1M, Core 2, 1 GHz to 26 GHz

* No emissions found within 6 dB of the limit.

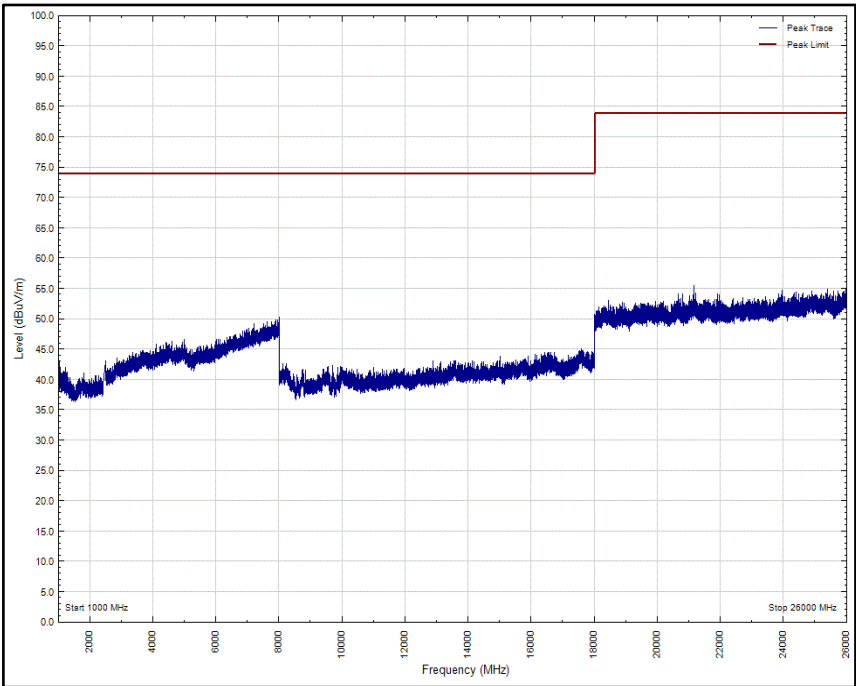


Figure 87 - Channel 39 (2480 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (Peak)

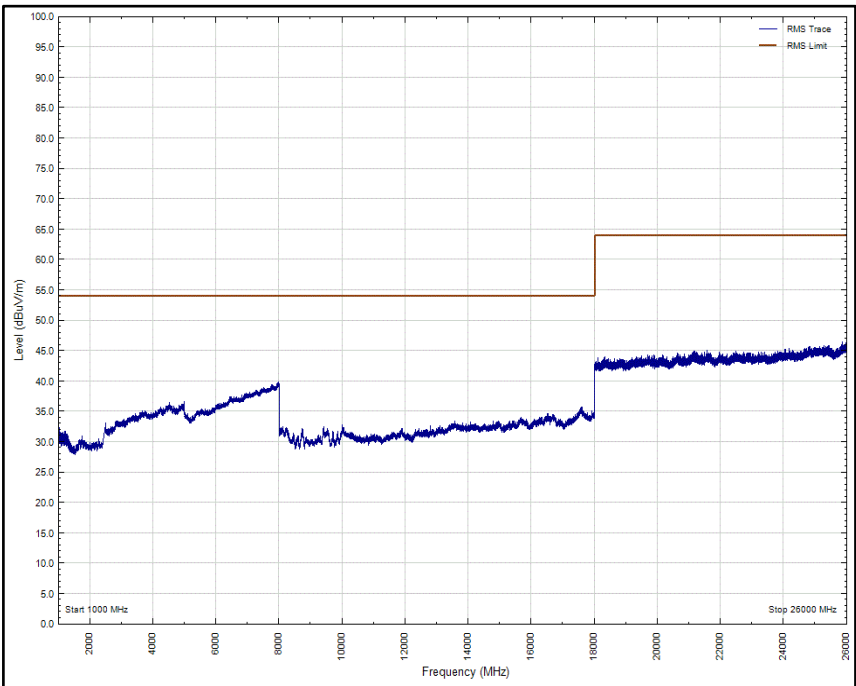


Figure 88 - Channel 39 (2480 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Horizontal (rms)

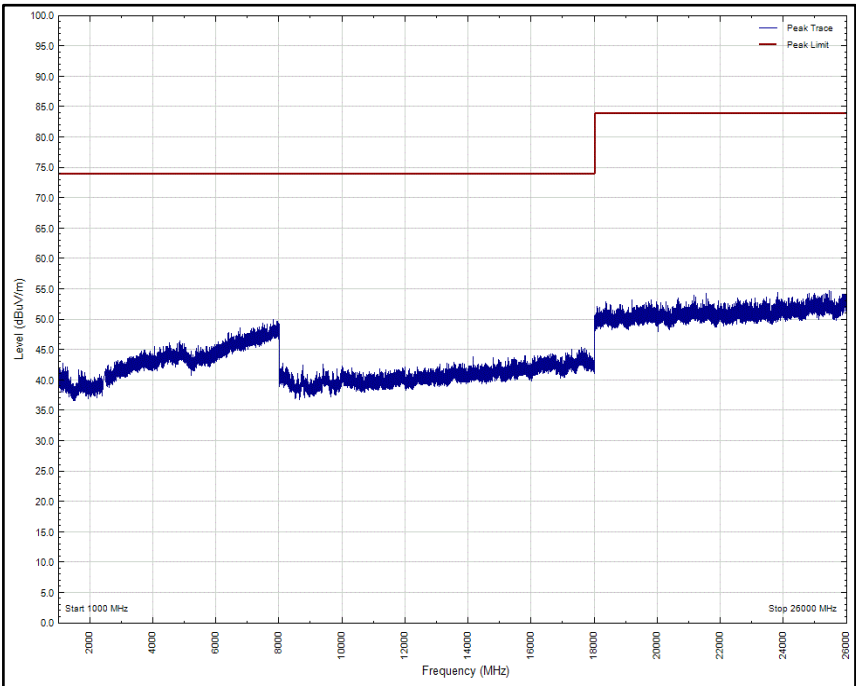


Figure 89 - Channel 39 (2480 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (Peak)

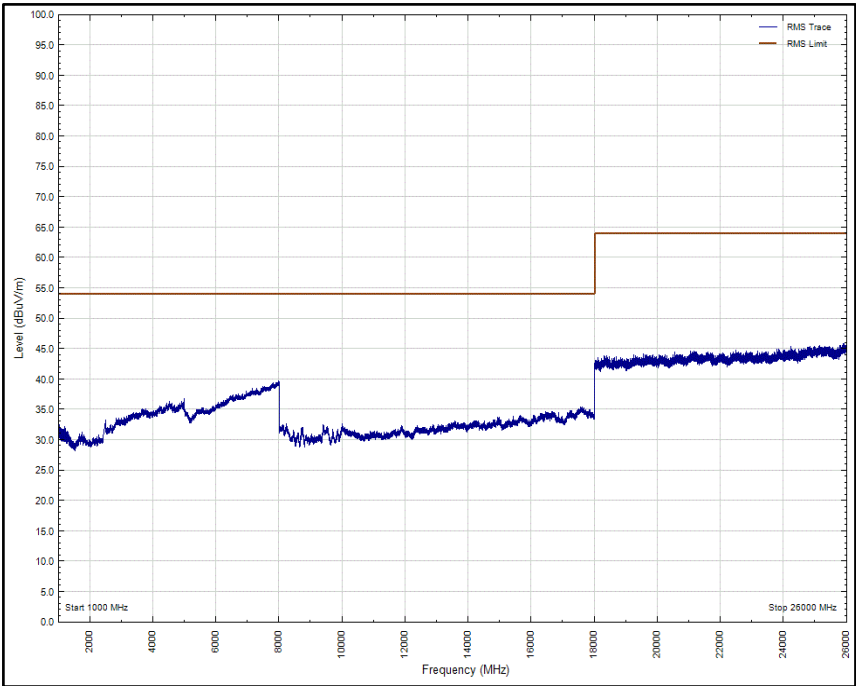


Figure 90 - Channel 39 (2480 MHz), LE1M, Core 2, 1 GHz to 26 GHz, Vertical (rms)



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.



2.6.7 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 Due
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-July-2020
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	06-Jun-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	04-Aug-2020
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	07-Aug-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5066	12	01-Oct-2020
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5068	12	01-Oct-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5092	12	06-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5102	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5103	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5104	12	09-Dec-2020
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	06-Oct-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	10-Mar-2021
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	10-Mar-2021
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5217	12	09-Jul-2020
Preamplifier (30dB 18-40GHz)	Schwarzbeck	BBV 9721	5218	12	09-Jul-2020
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5219	12	11-Jan-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	17-Mar-2021

Table 63

TU - Traceability Unscheduled



3 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Maximum Conducted Output Power	± 3.2 dB
Power Spectral Density	± 3.2 dB
Emission Bandwidth	± 58.64 kHz
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
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

Table 64

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.