

FCC and ISEDC Test Report

Apple Inc
Model: A2179

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

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

FCC ID: BCGA2179

IC: 579C-A2179

COMMERCIAL-IN-CONFIDENCE

Document 75945251-10 Issue 02



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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Ryan Henley	Sales Manager (RF and Telecoms)	Authorised Signatory	07 February 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, ISEDC RSS-247 and ISEDC 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	07 February 2020	
Testing	Ahmad Javid	07 February 2020	
Testing	Mohammad Malik	07 February 2020	
Testing	Jay Balendrarajah	07 February 2020	
Testing	Cristian Onaca	07 February 2020	
Testing	Mohamud Mohamud	07 February 2020	
Testing	Faisal Malyar	07 February 2020	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISEDC 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: 2018, ISEDC RSS-247: Issue 2 (2017-02) and ISEDC 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	04 February 2020
2	Updated FCC ID	07 February 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2179
Serial Number(s)	C02ZC00AM8N2 and C02ZC00WM8M5
Hardware Version(s)	REV 1.0
Software Version(s)	19C4
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2018 ISED RSS-247: Issue 2 (2017-02) ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number	0540189084
Date	25-February-2019
Date of Receipt of EUT	14-November-2019 and 04-October-2019
Start of Test	15-November-2019
Finish of Test	31-January-2020
Name of Engineer(s)	Mehadi Choudhury, Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar
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, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR - iPA						
2.1	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.3	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.4	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
2.8	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR - ePA						
2.5	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10 (2013)
2.6	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10 (2013)
2.7	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10 (2013)
2.1	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.3	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.4	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
2.8	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)

Table 2



1.4 Product Information

1.4.1 Technical Description

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

1.4.2 Antenna Gain Table (BT)

Frequency (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
2400 - 2480	3.07	1.0

Table 3

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: A2179, Serial Number: C02ZC00WM8M5			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2179, Serial Number: C02ZC00AM8N2			
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 BDR/EDR - iPA		
Frequency Hopping Systems - 20 dB Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Restricted Band Edges	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Spurious Radiated Emissions	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR - ePA		
Frequency Hopping Systems - Average Time of Occupancy	Mehadi Choudhury	UKAS
Frequency Hopping Systems - Channel Separation	Mehadi Choudhury	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Mehadi Choudhury	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	Mehadi Choudhury	UKAS
Authorised Band Edges	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Restricted Band Edges	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Spurious Radiated Emissions	Ahmad Javid, Mohammad Malik, Jay Balendrarajah, Cristian Onaca, Mohamud Mohamud, Faisal Malyar	UKAS
Maximum Conducted Output Power	Mehadi Choudhury	UKAS

Table 5

Office Address:

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



2 Test Details

2.1 Frequency Hopping Systems - 20 dB Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.1.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00AM8N2 - Modification State 0

2.1.3 Date of Test

15-November-2019

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

2.1.5 Environmental Conditions

Ambient Temperature 24.7 °C
Relative Humidity 30.3 %

2.1.6 Test Results

2.4 GHz Bluetooth BDR/EDR - iPA

Frequency (MHz)	20 dB Bandwidth (kHz)		
	GFSK	$\pi/4$ DQPSK	8-DPSK
2402	958.00	1375.00	1357.00
2440	956.60	1375.00	1357.00
2480	955.60	1374.00	1357.00

Table 6



Figure 1 - 2402 MHz - GFSK

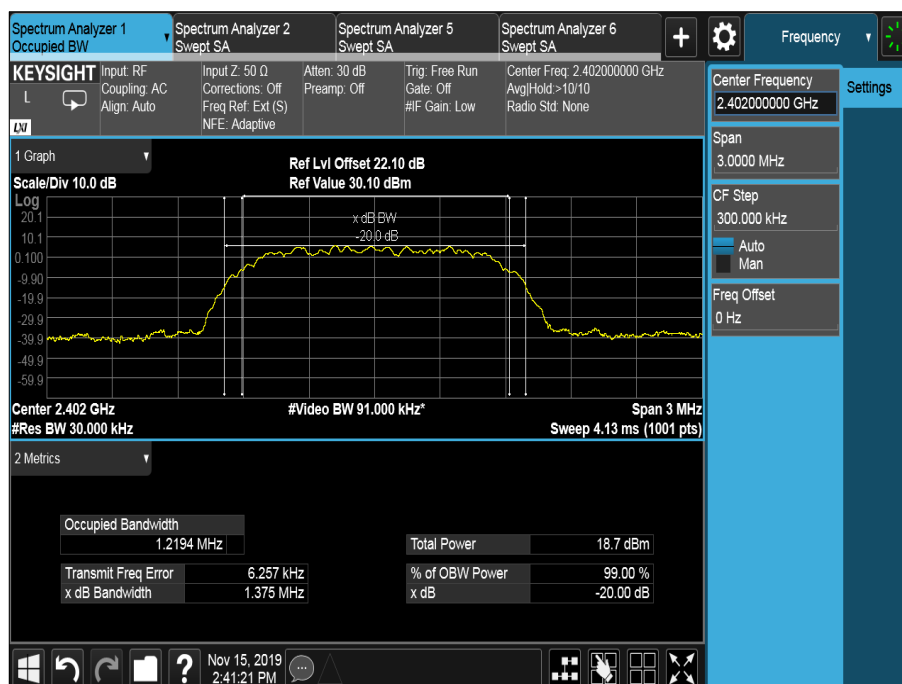


Figure 2 - 2402 MHz - $\pi/4$ DQPSK

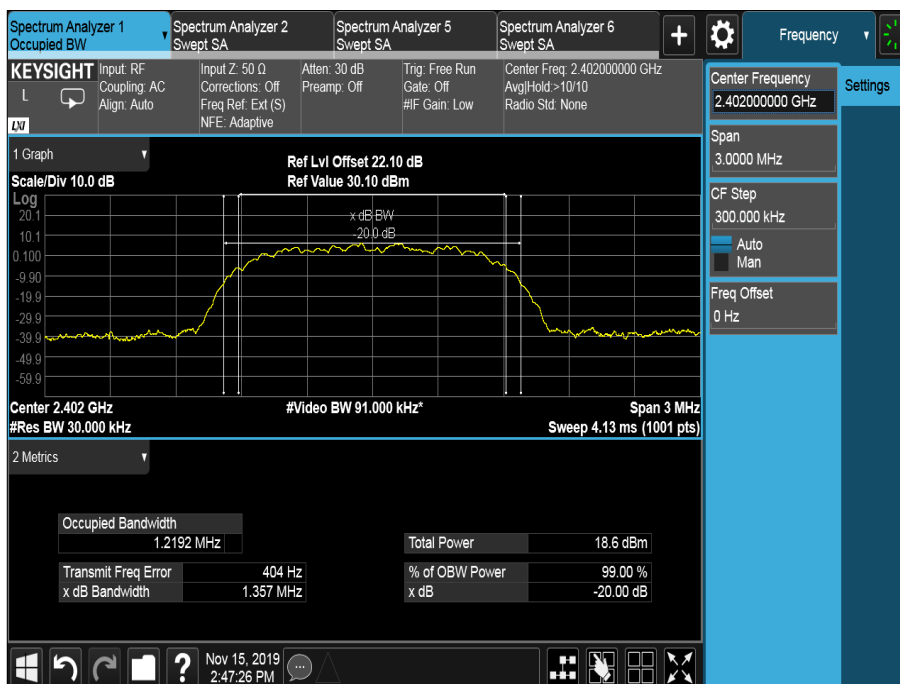


Figure 3 - 2402 MHz - 8-DPSK



Figure 4 - 2440 MHz - GFSK

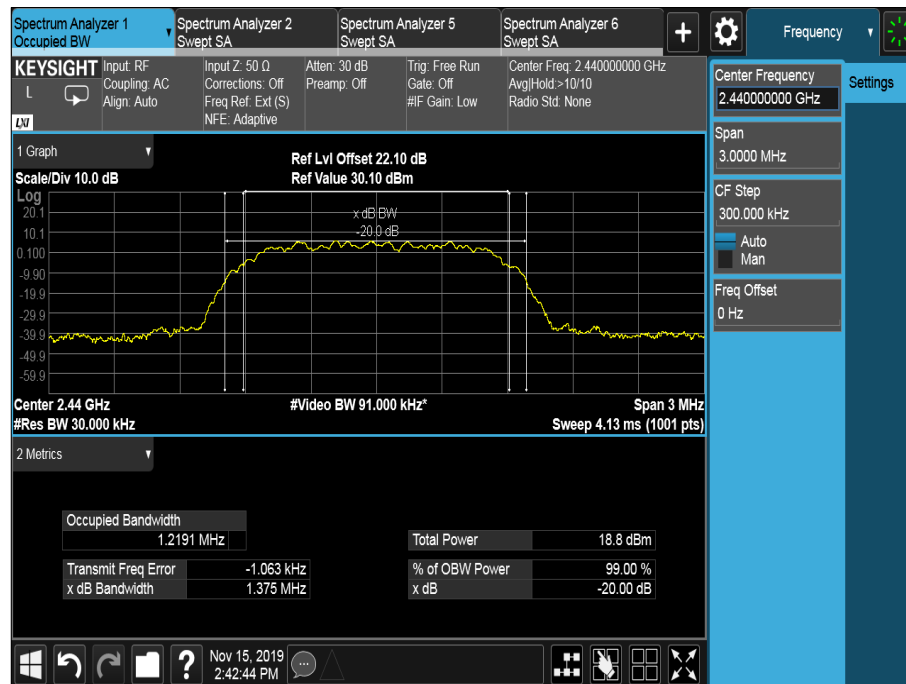


Figure 5 - 2440 MHz - $\pi/4$ DQPSK



Figure 6 - 2440 MHz - 8-DPSK



Figure 7 - 2480 MHz - GFSK



Figure 8 - 2480 MHz - $\pi/4$ DQPSK

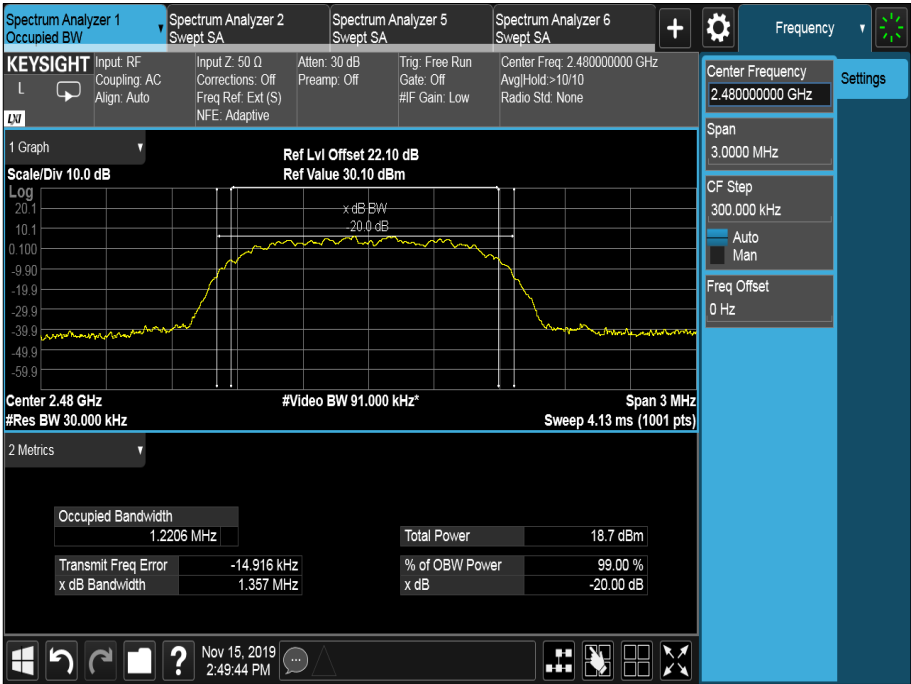


Figure 9 - 2480 MHz - 8-DPSK

Frequency (MHz)	20 dB Bandwidth (kHz)		
	GFSK	$\pi/4$ DQPSK	8-DPSK
2402	959.80	1378.00	1360.00
2440	958.90	1378.00	1361.00
2480	958.60	1378.00	1361.00

The screenshot displays a Keysight Spectrum Analyzer interface. At the top, there are four tabs for different analyzer types: Spectrum Analyzer 1 (Occupied BW), Spectrum Analyzer 2 (Swept SA), Spectrum Analyzer 3 (Swept SA), and Spectrum Analyzer 6 (Swept SA). The first tab is selected.

The main display area shows a spectrum plot with a yellow trace. The plot is titled "1 Graph" and has a "Scale/Div 10.0 dB". The y-axis is labeled "Log" and ranges from -50.9 to 20.1 dB. The x-axis is labeled "Center 2.402 GHz" and "#Res BW 30.000 kHz". The plot shows a signal with a peak at approximately 2.402 GHz. A measurement box indicates "Ref Lvl Offset 22.10 dB" and "Ref Value 30.10 dBm". Another measurement box shows "x dB BW" and "-20.0 dB".

Below the plot, there are several measurement parameters:

- Center 2.402 GHz
- #Res BW 30.000 kHz
- #Video BW 91.000 kHz
- Span 3 MHz
- Sweep 3.20 ms (1001 pts)

At the bottom, there is a table of measurements:

Occupied Bandwidth		Total Power	
	902.83 kHz		18.8 dBm
Transmit Freq Error		% of OBW Power	
	6.031 kHz		99.00 %
x dB Bandwidth		x dB	
	959.8 kHz		-20.00 dB

On the right side of the interface, there are controls for the detector and trace. The "Detector" section has buttons for "Normal", "Average (RMS)", "Peak", "Sample", and "Negative Peak". The "Detector Select" section has buttons for "Auto" and "Man". The "Trace Control" section has a "Trace" button and a "Detector" button.

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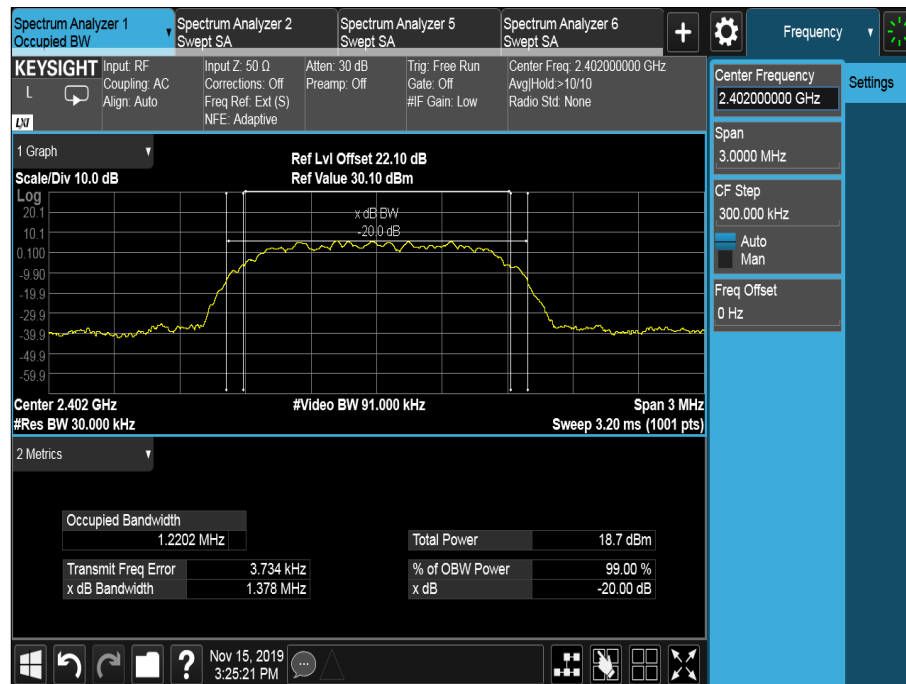


Figure 11 - 2402 MHz - $\pi/4$ DQPSK



Figure 12 - 2402 MHz - 8-DPSK

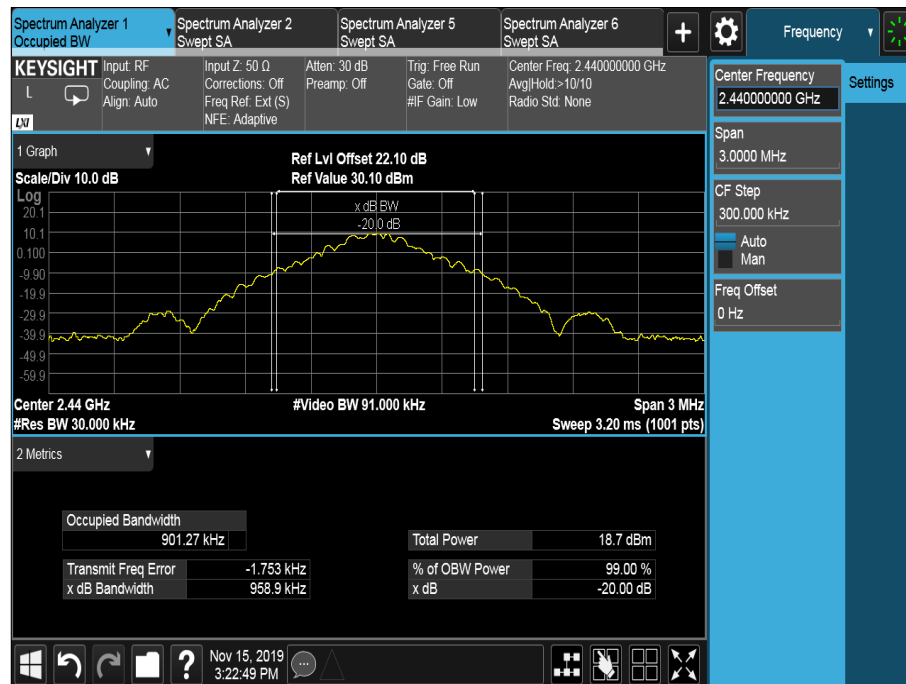


Figure 13 - 2440 MHz - GFSK

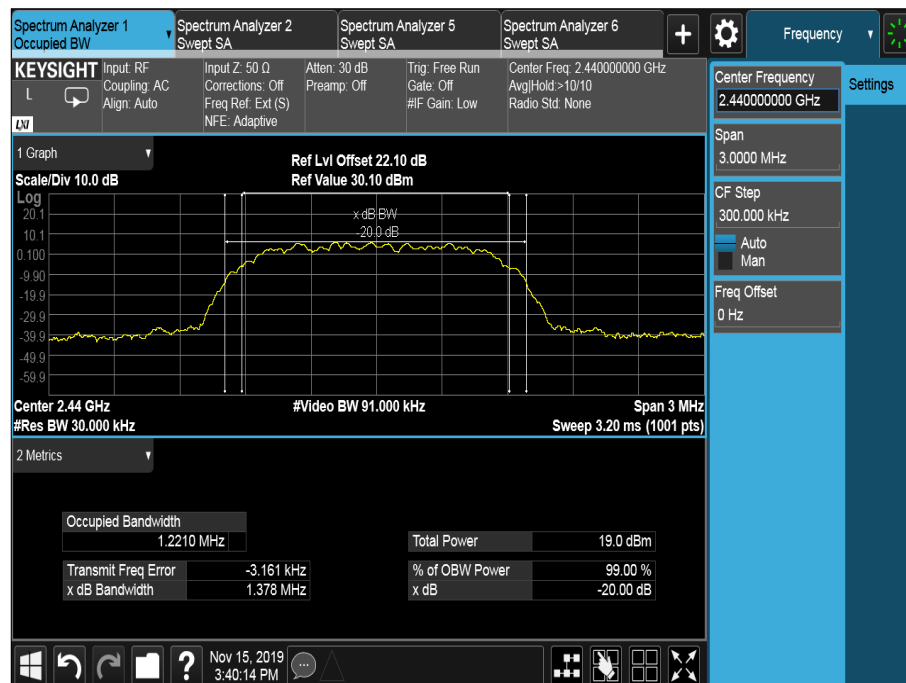


Figure 14 - 2440 MHz - $\pi/4$ DQPSK

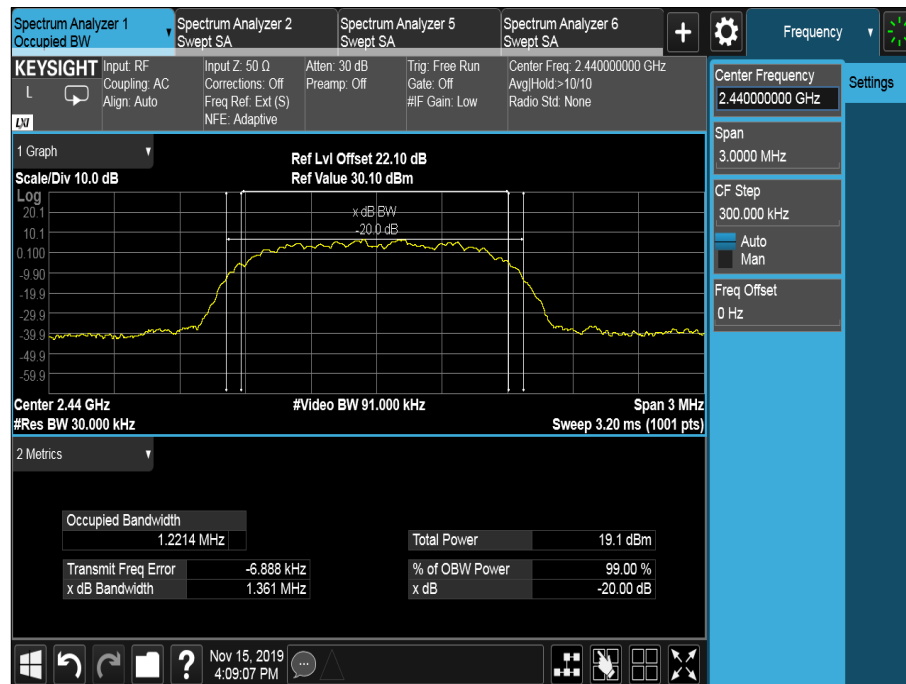


Figure 15 - 2440 MHz - 8-DPSK



Figure 16 - 2480 MHz - GFSK

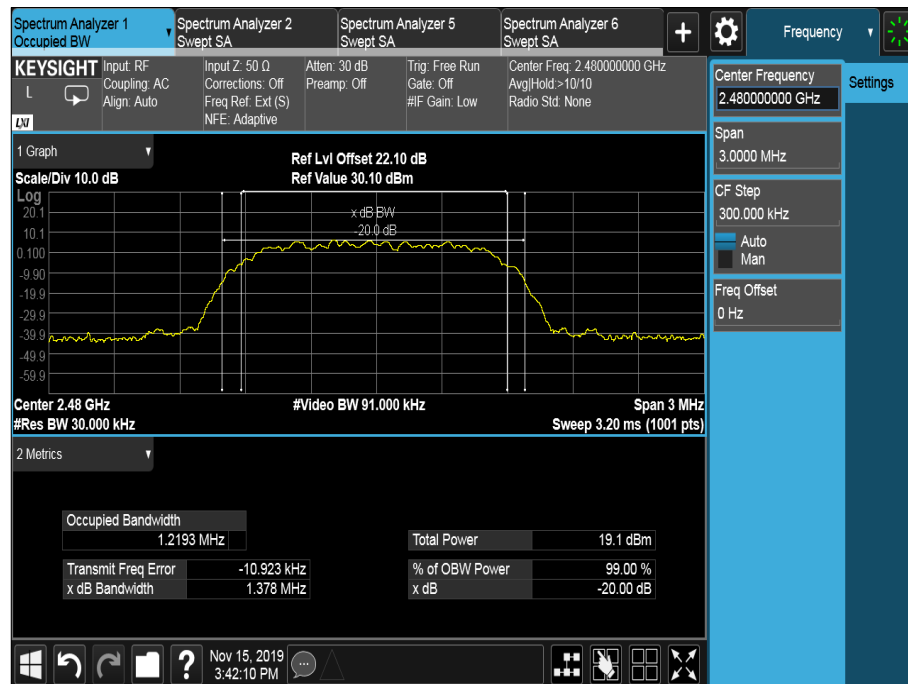


Figure 17 - 2480 MHz - $\pi/4$ DQPSK

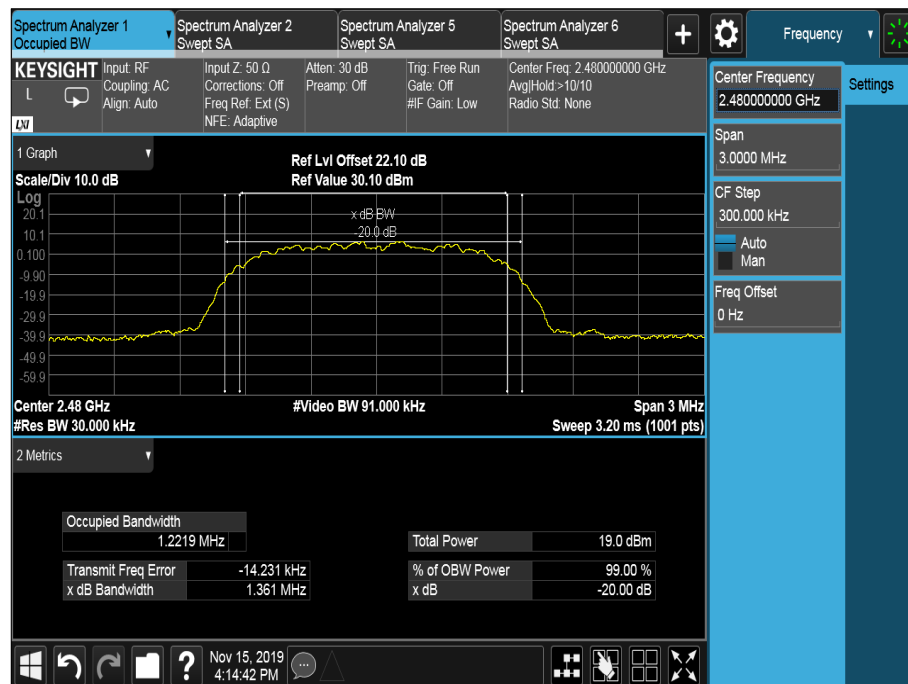


Figure 18 - 2480 MHz - 8-DPSK

FCC 47 CFR Part 15 and RSS-247 Limit Clause

None specified.



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
Attenuator (20 dB, 2 W)	Pasternack	PE7004-20	489	-	O/P Mon
Multimeter	Fluke	79 Series III	611	12	11-Sep-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
EXA	Keysight Technologies	N9010B	4969	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	06-Oct-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon

Table 8

O/P Mon – Output Monitored using calibrated equipment



2.2 Authorised Band Edges

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00WM8M5 - Modification State 0

2.2.3 Date of Test

19-November-2019 to 16-December-2019

2.2.4 Test Method

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

2.2.5 Environmental Conditions

Ambient Temperature 20.9-23.2 °C
Relative Humidity 40.8-56.2 %

2.2.6 Test Results

2.4 GHz Bluetooth BDR/EDR - iPA

Mode	Modulation	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	DH5	2402	2400.0	-49.02
Static	$\pi/4$ DQPSK	2DH5	2402	2400.0	-40.88
Static	8-DPSK	3DH5	2402	2400.0	-40.83
Hopping	GFSK	DH5	2402	2400.0	-48.38
Hopping	$\pi/4$ DQPSK	2DH5	2402	2400.0	-43.20
Hopping	8-DPSK	3DH5	2402	2400.0	-45.04

Table 9 - Authorised Band Edge Results

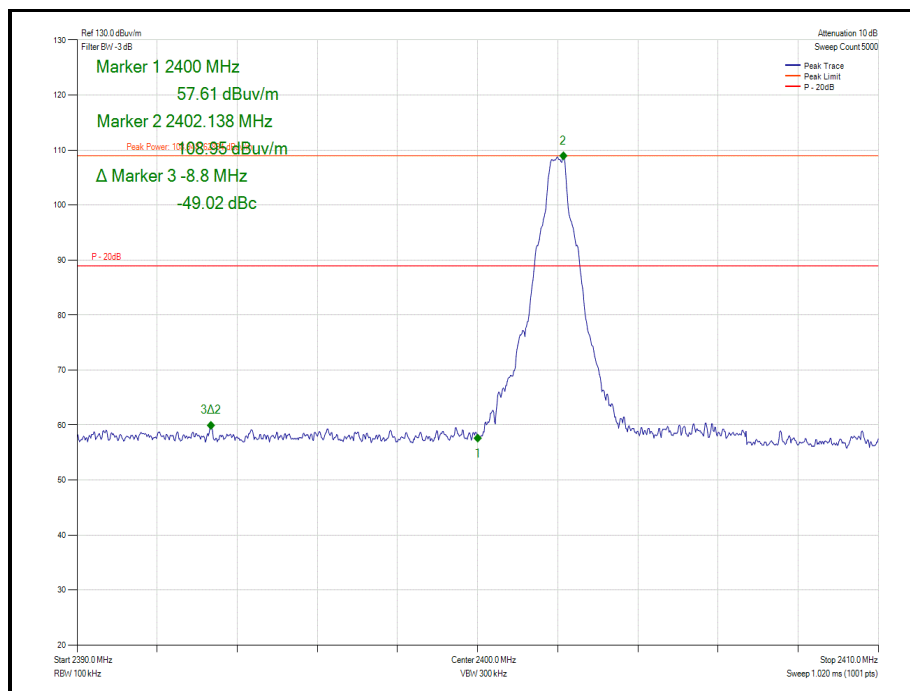


Figure 19 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

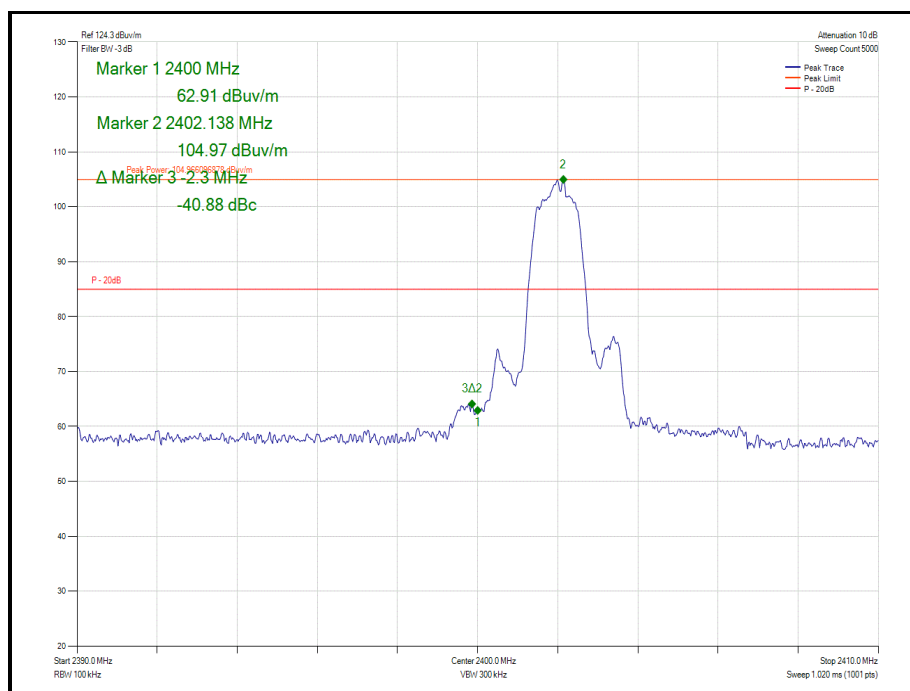


Figure 20 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz



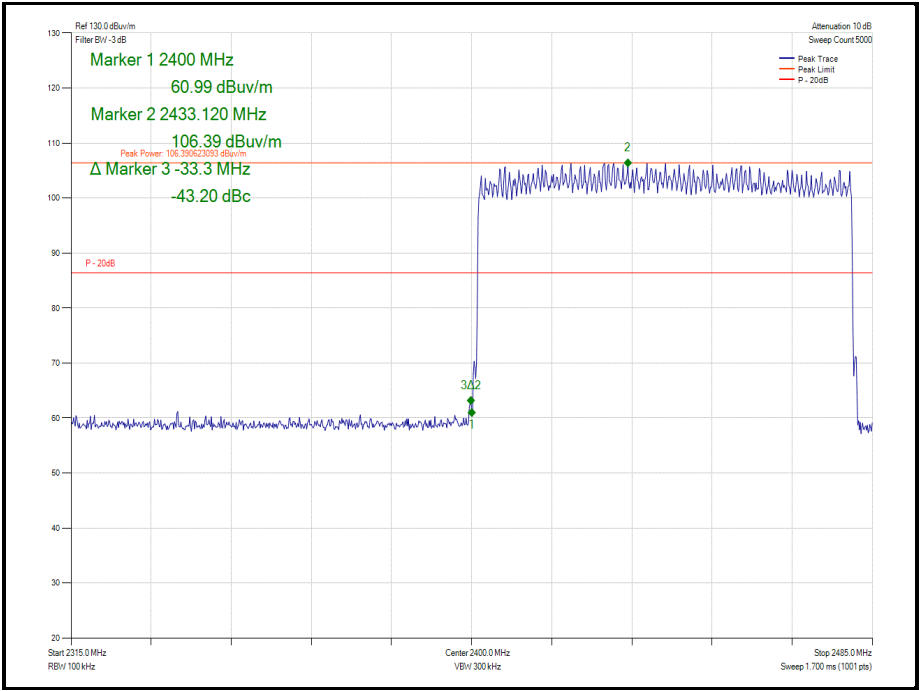


Figure 23 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

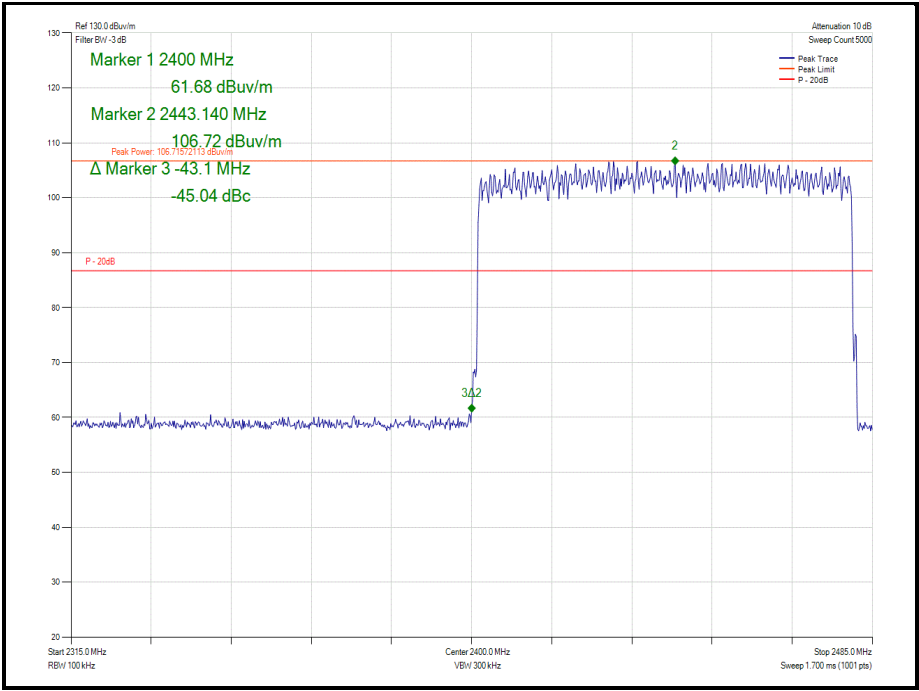


Figure 24 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

Mode	Modulation	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	DH5	2402	2400.0	-55.0
Static	$\pi/4$ DQPSK	2DH5	2402	2400.0	-51.25
Static	8-DPSK	3DH5	2402	2400.0	-50.32
Hopping	GFSK	DH5	2402	2400.0	-54.56
Hopping	$\pi/4$ DQPSK	2DH5	2402	2400.0	-52.95
Hopping	8-DPSK	3DH5	2402	2400.0	-51.13

Ref 140.0 dBuV/m
Filter BW -3 dB

Marker 1 2400 MHz
58.63 dBuV/m

Marker 2 2402.138 MHz
115.47 dBuV/m

Δ Marker 3 -9.2 MHz
-55.00 dBc

P - 20dB

Peak Power 115.47 dBuV/m

Peak Trace
Peak Limit
P - 20dB

Start 2350.0 MHz
RBW 100 kHz

Center 2400.0 MHz
VBW 300 kHz

Stop 2410.0 MHz
Sweep 1.020 ms (1001 pts)

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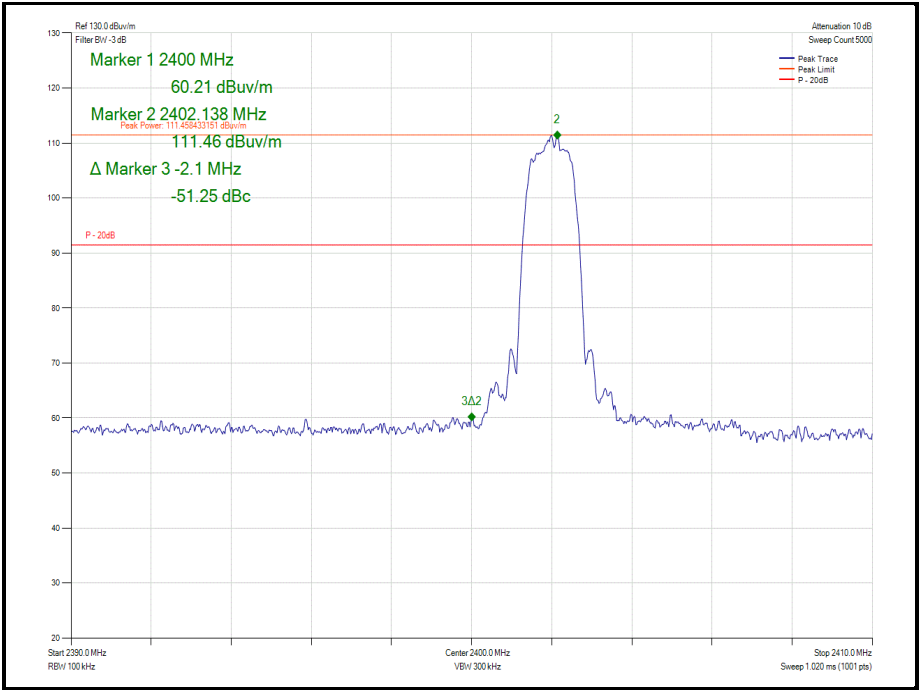


Figure 26 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

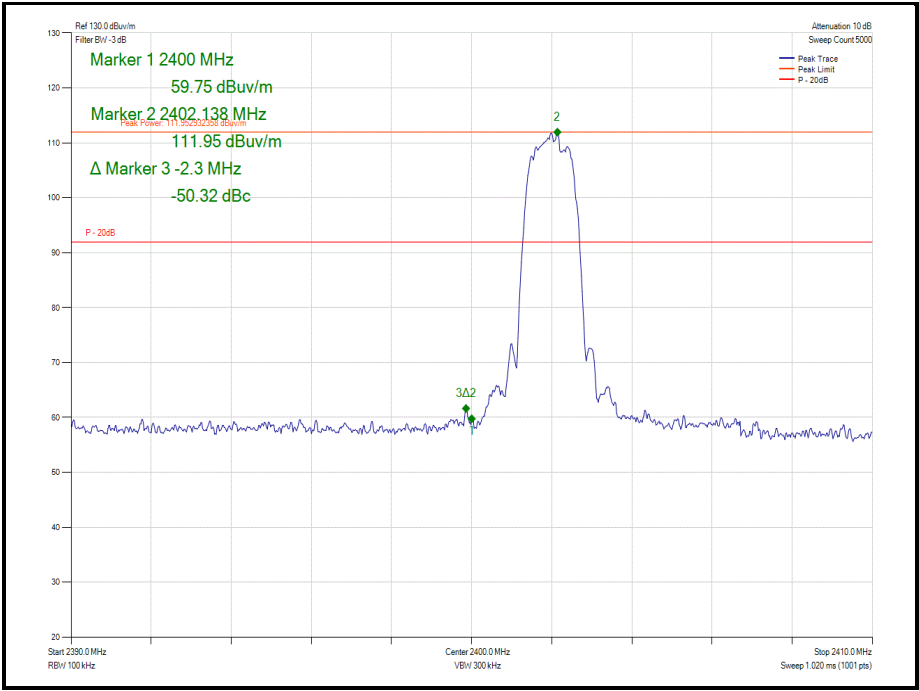


Figure 27 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

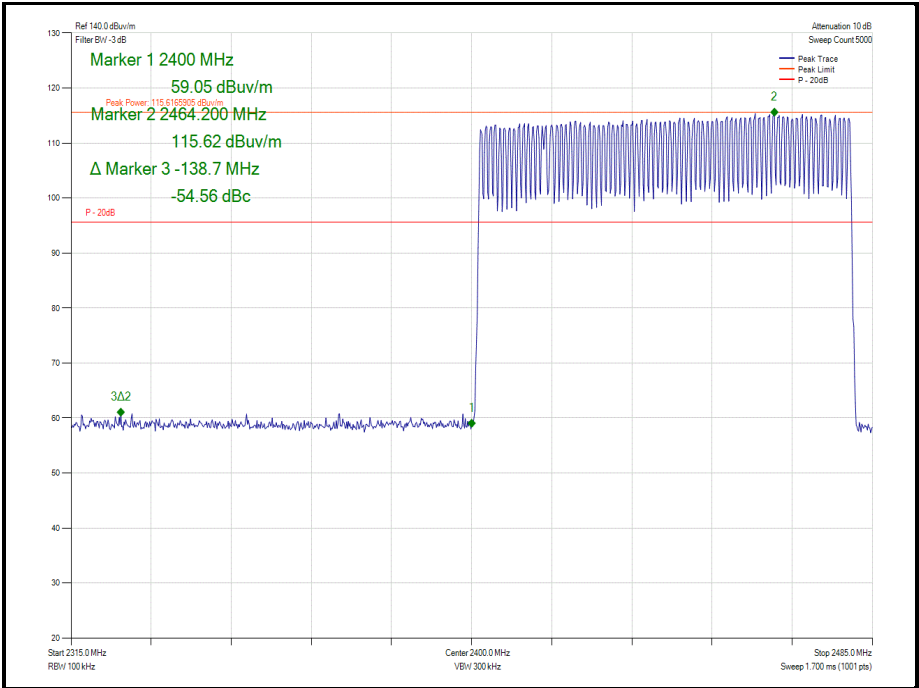


Figure 28 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

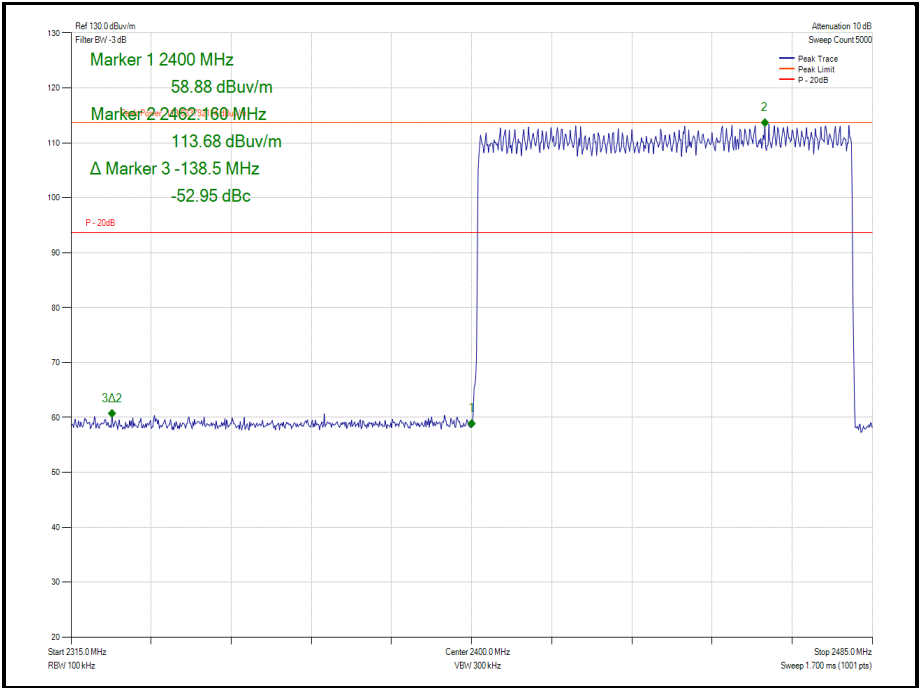


Figure 29 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

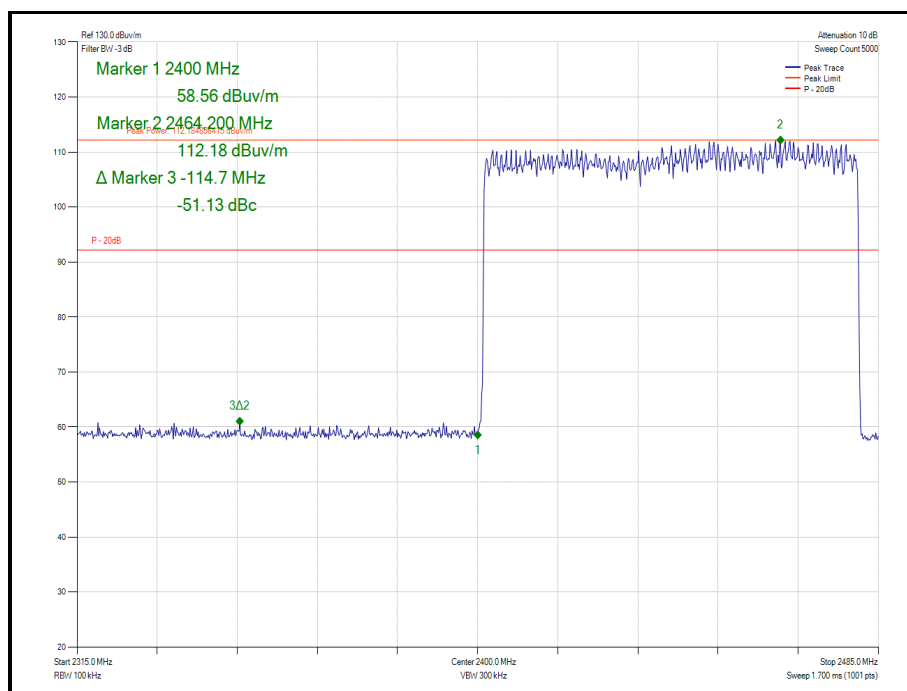


Figure 30 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

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.



2.2.7 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
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	14-Nov-2020
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019*
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-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	5095	12	04-Dec-2019*
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	LU7-071-1000	5105	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	06-Oct-2020
EmX Emissions Software	TUV SUD	EmX, V.V1.5.2	5125	-	N/A - Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	11-Mar-2020
Pre Amp 1 – 26.5 GHz	Agilent Technologies	8449B	5445	-	O/P Mon

Table 11

TU – Traceability Unscheduled

O/P Mon – Output monitored using calibrated equipment.

*As testing was performed over multiple days it may appear that some equipment was used outside of a valid calibration period, however, TUV SUD confirms that when equipment was used it held a valid calibration and has records of this.



2.3 Restricted Band Edges

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00WM8M5 - Modification State 0

2.3.3 Date of Test

19-November-2019 to 16-December-2019

2.3.4 Test Method

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

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10 clause 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:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.3.5 Environmental Conditions

Ambient Temperature	20.9-23.2 °C
Relative Humidity	40.8-56.2 %

2.3.6 Test Results

2.4 GHz Bluetooth BDR/EDR - iPA

Mode	Modulation	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	DH5	2402	2390.0	53.26	39.30
Static	$\pi/4$ DQPSK	2DH5	2402	2390.0	53.93	39.32
Static	8-DPSK	3DH5	2402	2390.0	53.54	39.29
Static	GFSK	DH5	2480	2483.5	57.06	40.70
Static	$\pi/4$ DQPSK	2DH5	2480	2483.5	55.75	41.05
Static	8-DPSK	3DH5	2480	2483.5	55.67	40.99

Table 12 - Restricted Band Edge Results

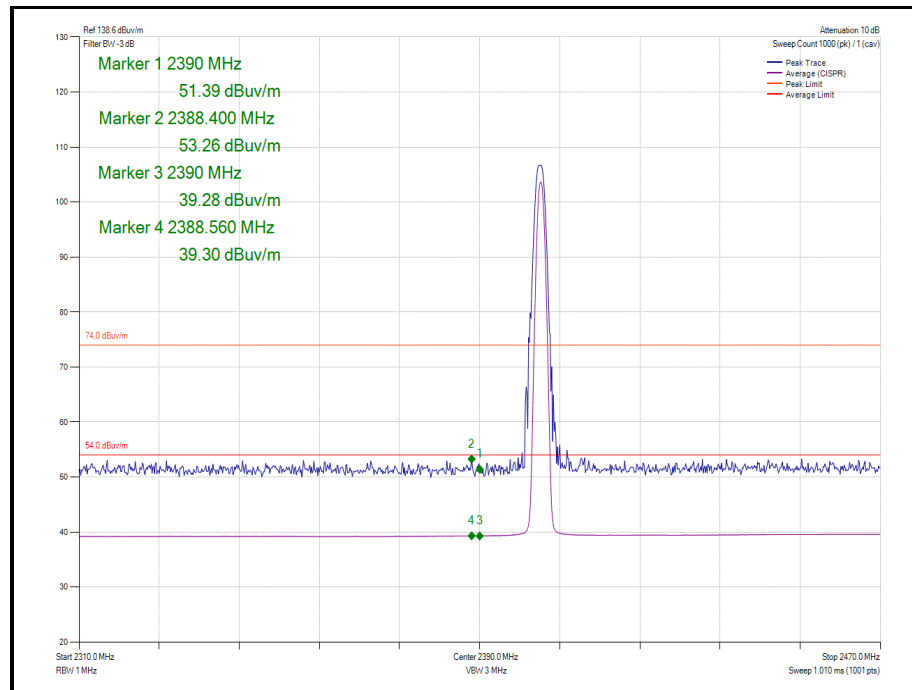


Figure 31 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

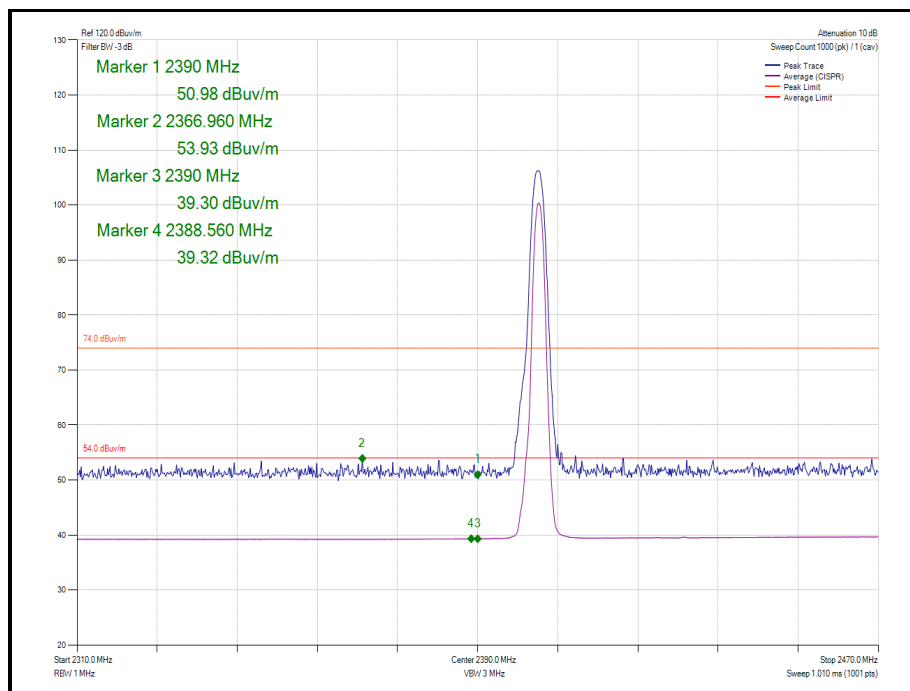


Figure 32 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

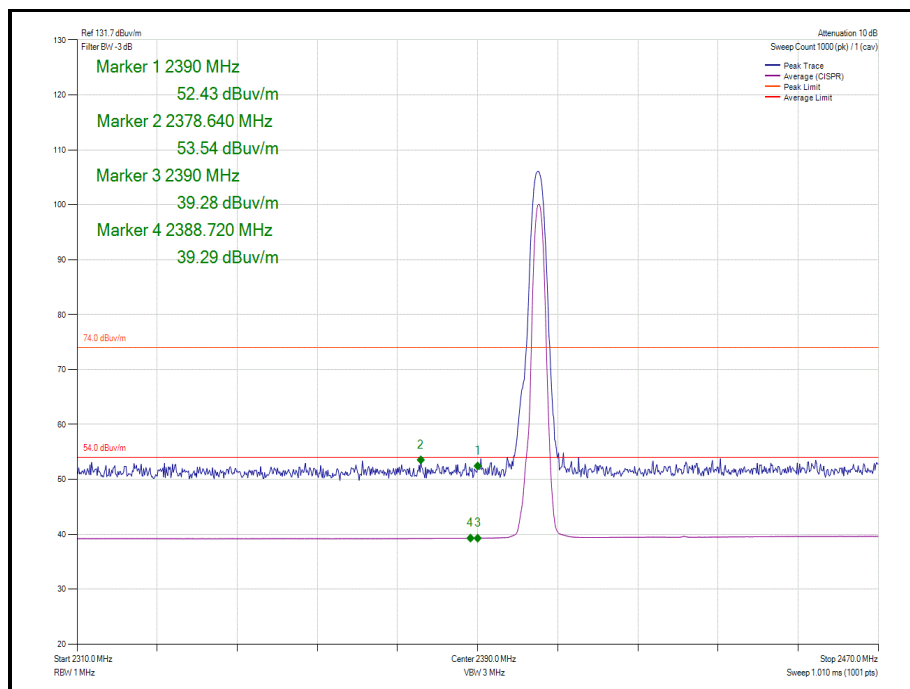


Figure 33 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

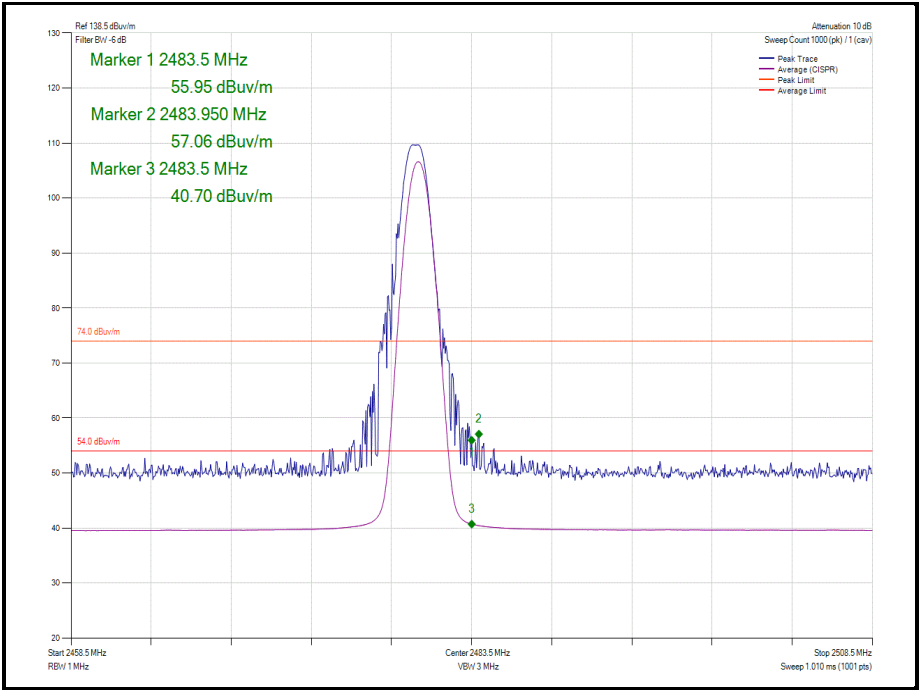


Figure 34 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

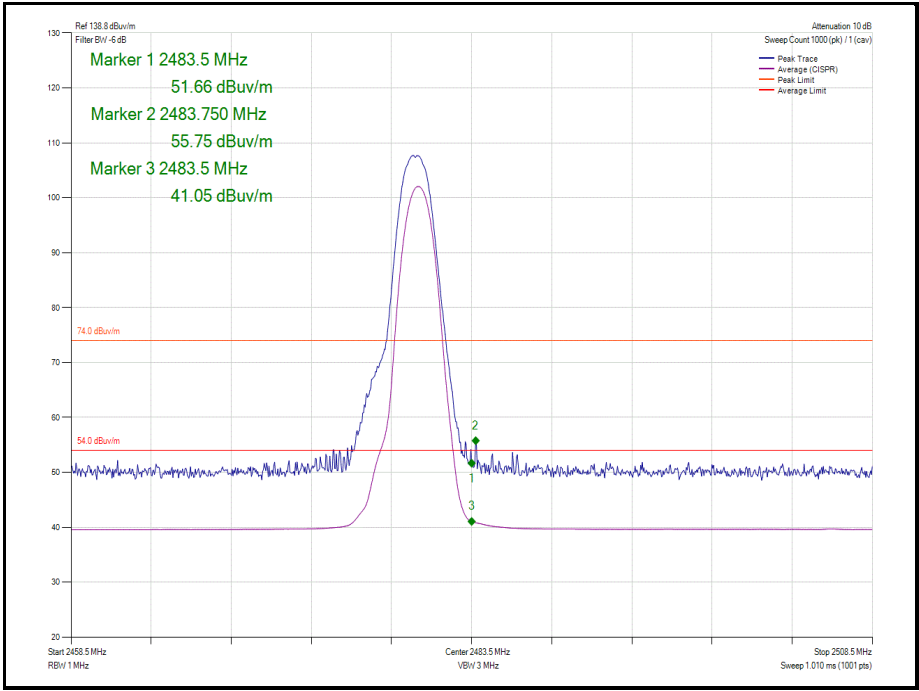


Figure 35 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

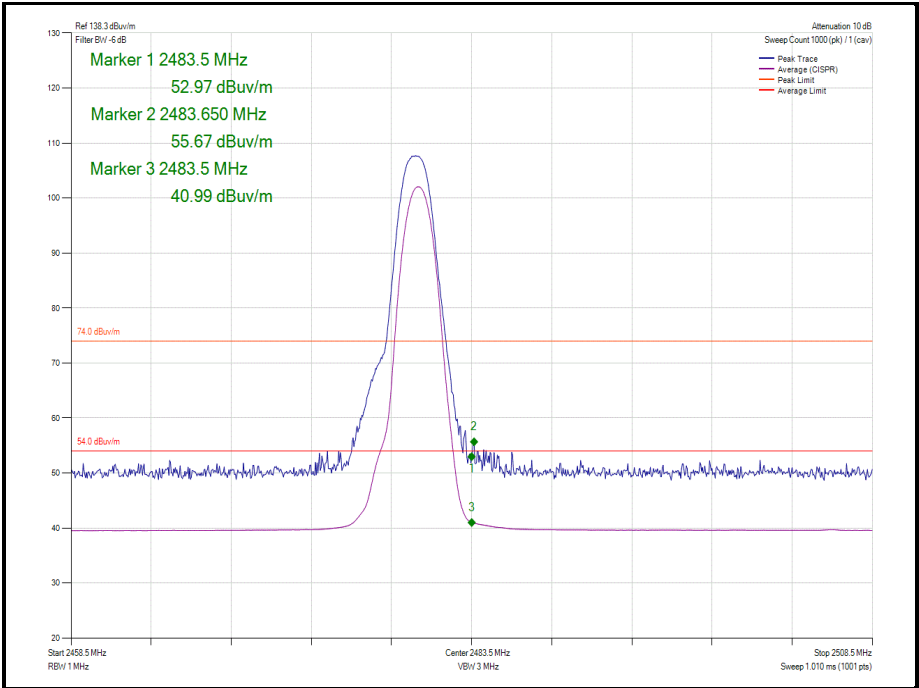


Figure 36 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth BDR/EDR - ePA

Mode	Modulation	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	DH5	2402	2390.0	53.45	39.30
Static	$\pi/4$ DQPSK	2DH5	2402	2390.0	51.70	39.37
Static	8-DPSK	3DH5	2402	2390.0	53.62	39.38
Static	GFSK	DH5	2480	2483.5	61.78	46.50
Static	$\pi/4$ DQPSK	2DH5	2480	2483.5	63.31	45.99
Static	8-DPSK	3DH5	2480	2483.5	64.83	46.00

Table 13 - Restricted Band Edge Results

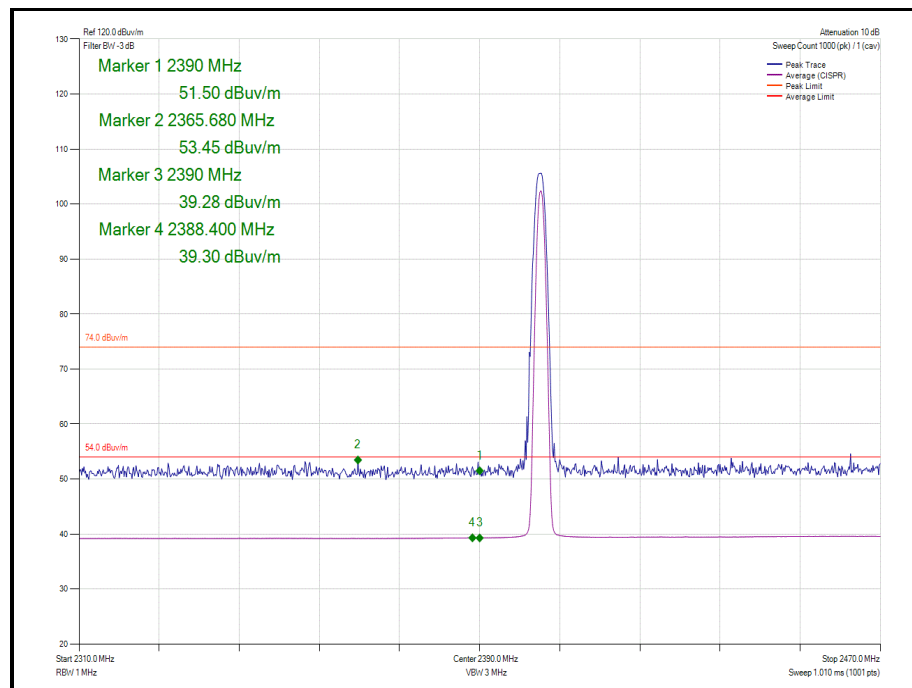


Figure 37 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

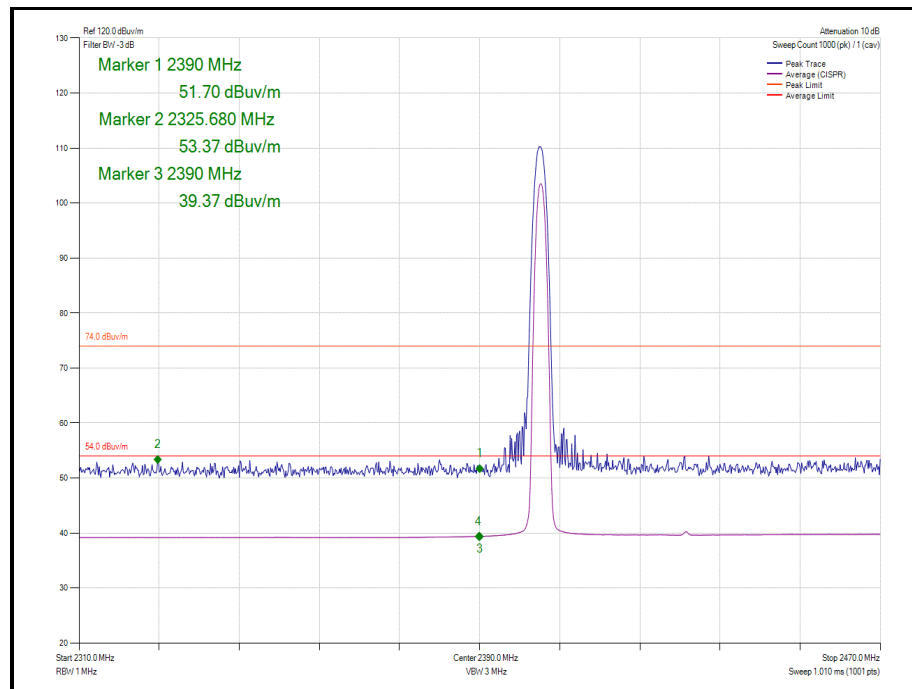


Figure 38 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

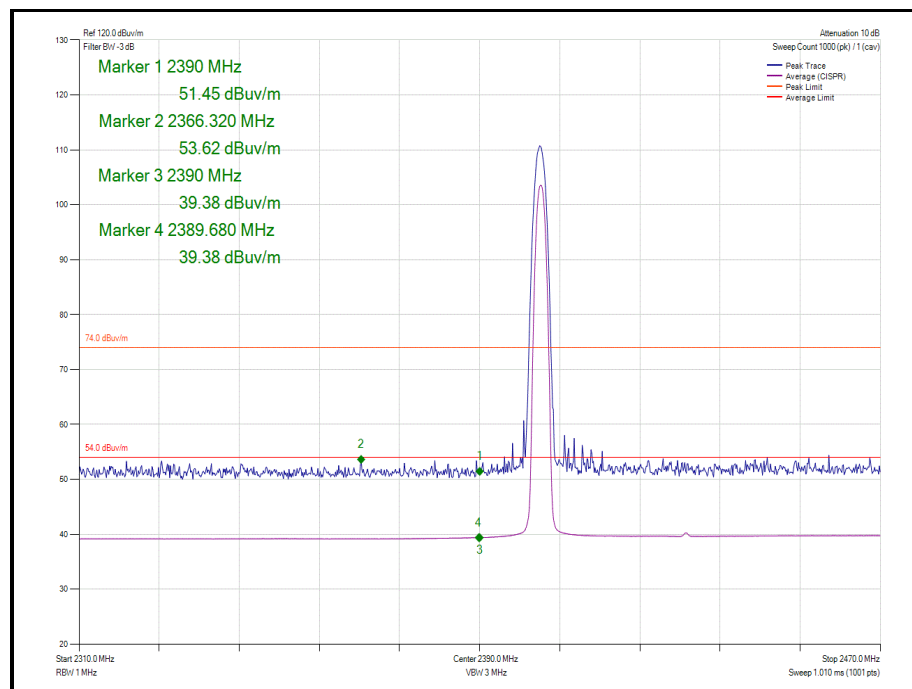


Figure 39 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

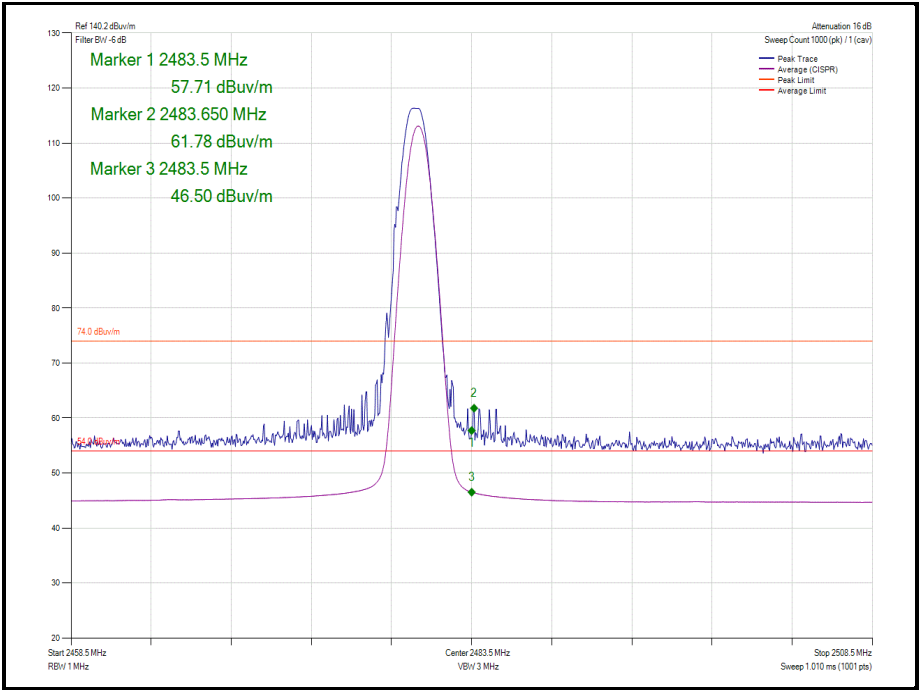


Figure 40 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

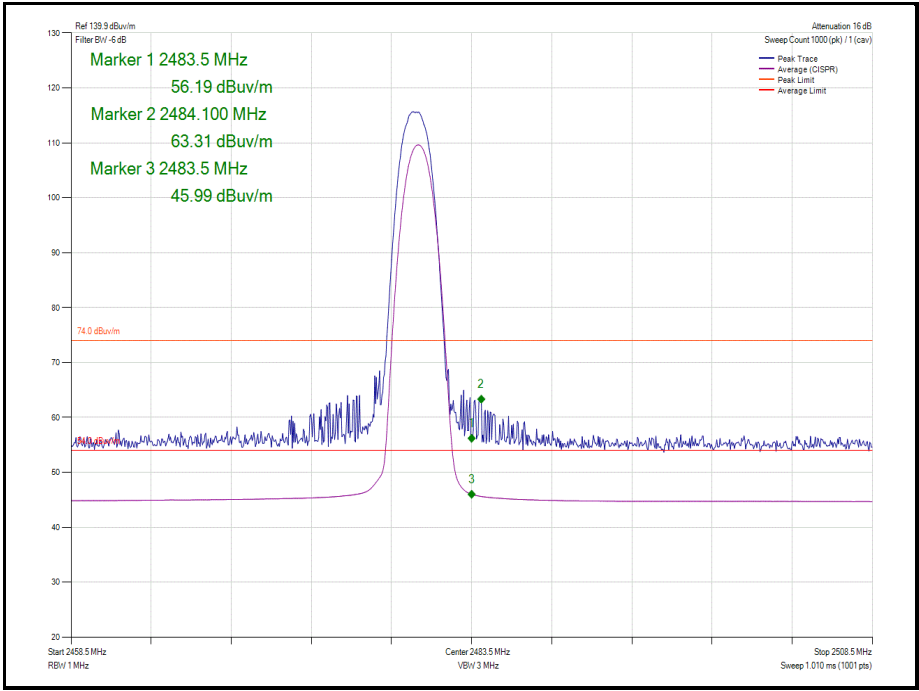


Figure 41 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz



Frequency (MHz)	Field Strength (μV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

ISED RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

*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.



2.3.7 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
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	14-Nov-2020
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019*
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-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	5095	12	04-Dec-2019*
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	LU7-071-1000	5105	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	06-Oct-2020
EmX Emissions Software	TUV SUD	EmX, V.V1.5.2	5125	-	N/A - Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	11-Mar-2020
Pre Amp 1 – 26.5 GHz	Agilent Technologies	8449B	5445	-	O/P Mon

Table 16

TU – Traceability Unscheduled

O/P Mon – Output monitored using calibrated equipment.

*As testing was performed over multiple days it may appear that some equipment was used outside of a valid calibration period, however, TUV SUD confirms that when equipment was used it held a valid calibration and has records of this.



2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00WM8M5 - Modification State 0

2.4.3 Date of Test

19-November-2019 to 16-December-2019

2.4.4 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 mid channel (2440 MHz) and any emissions identified then measured on bottom (2412 MHz) and top (2472 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 uV/m:
 $10^{(\text{Field Strength in dBuV/m} / 20)}$.

2.4.5 Environmental Conditions

Ambient Temperature	20.9-23.2 °C
Relative Humidity	40.8-56.2 %



2.4.6 Test Results

2.4 GHz Bluetooth BDR/EDR - iPA

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

Table 17 – 2440 MHz, 30 MHz to 1 GHz Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

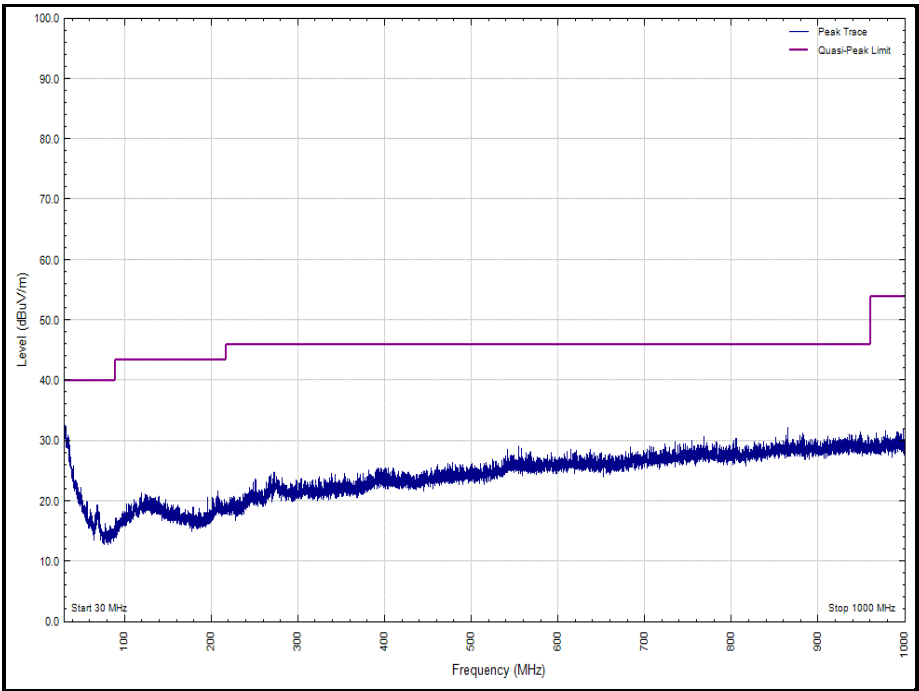


Figure 43 - 2440 MHz, 30 MHz to 1 GHz, Polarity: Horizontal

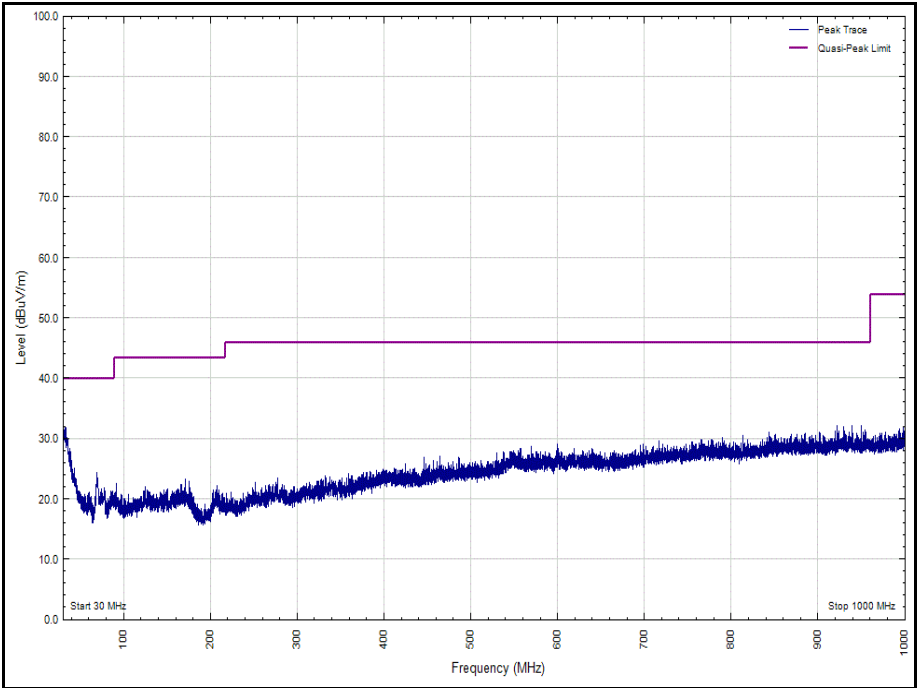


Figure 44 - 2440 MHz, 30 MHz to 1 GHz, Polarity: Vertical

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
4981.5	56.6	-	73.98	-	17.4	-
4989.6	-	35.4	-	53.98	-	18.6

Table 18 - 2402 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

No other emissions were detected within 10 dB of the limit

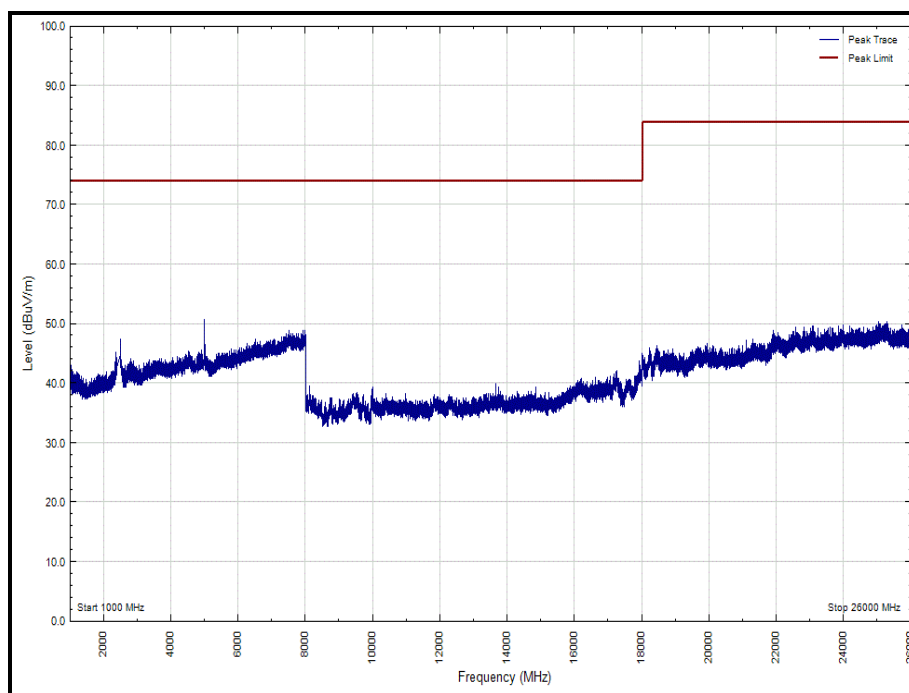


Figure 45 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

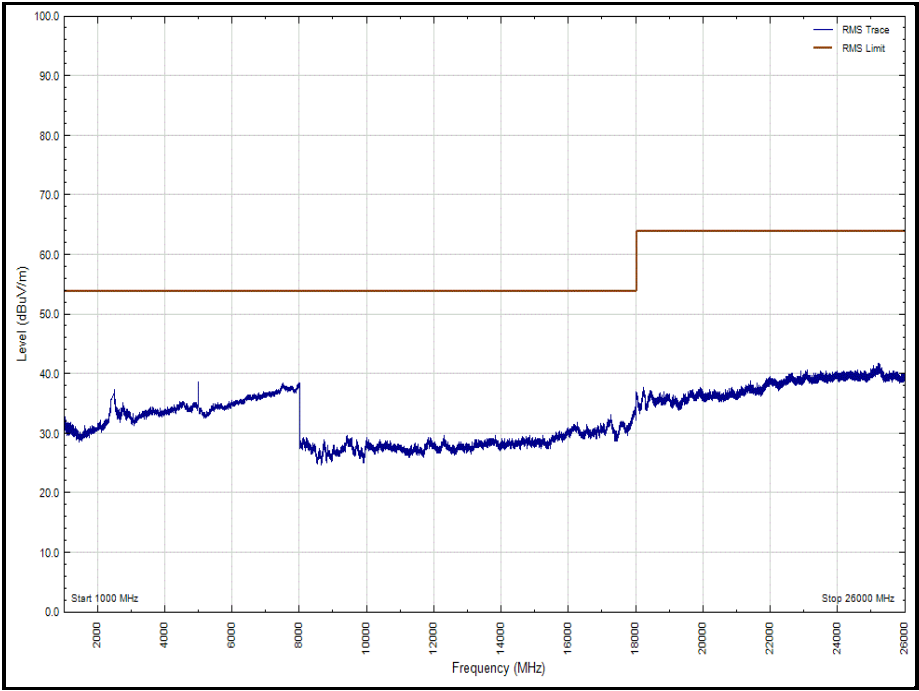


Figure 46 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

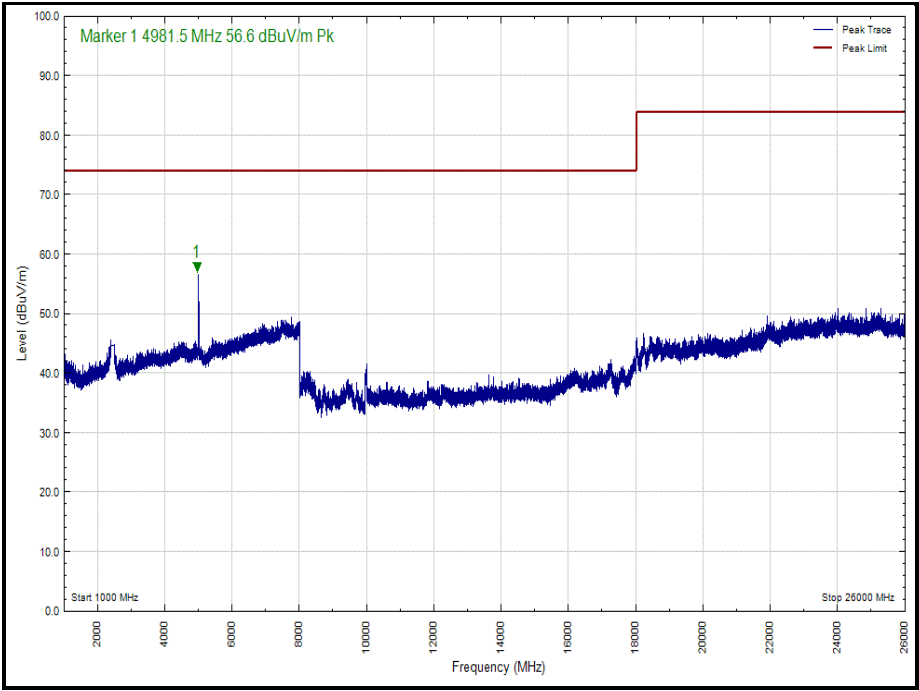


Figure 47 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

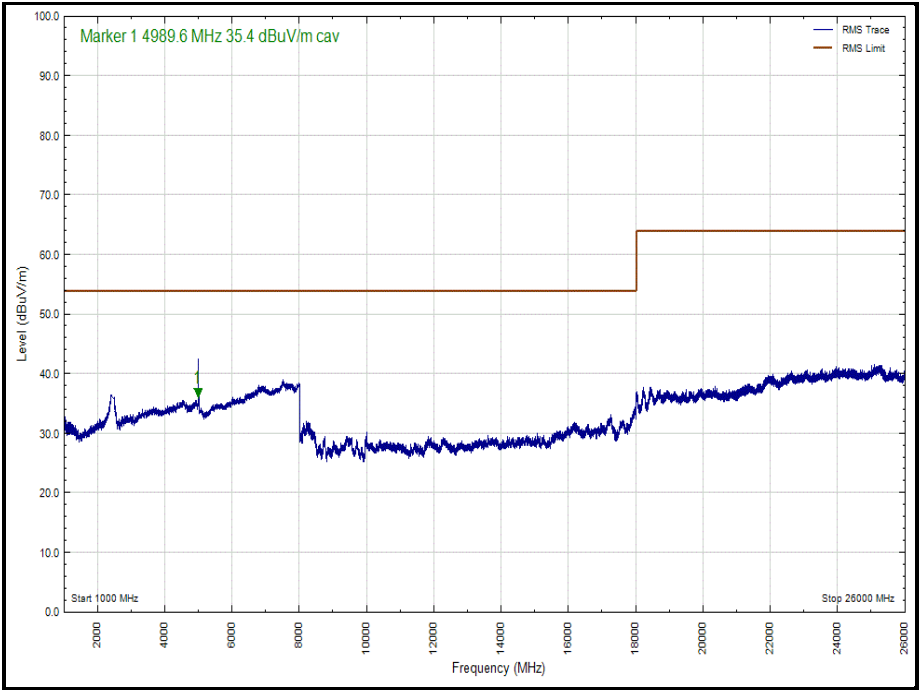


Figure 48 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
*						

Table 19 - 2440 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

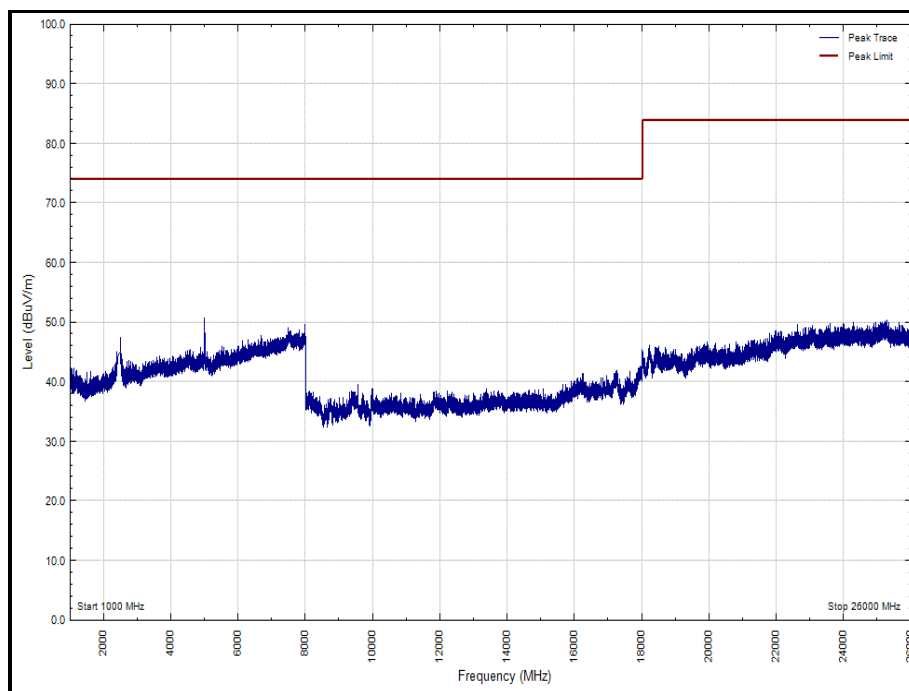


Figure 49 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

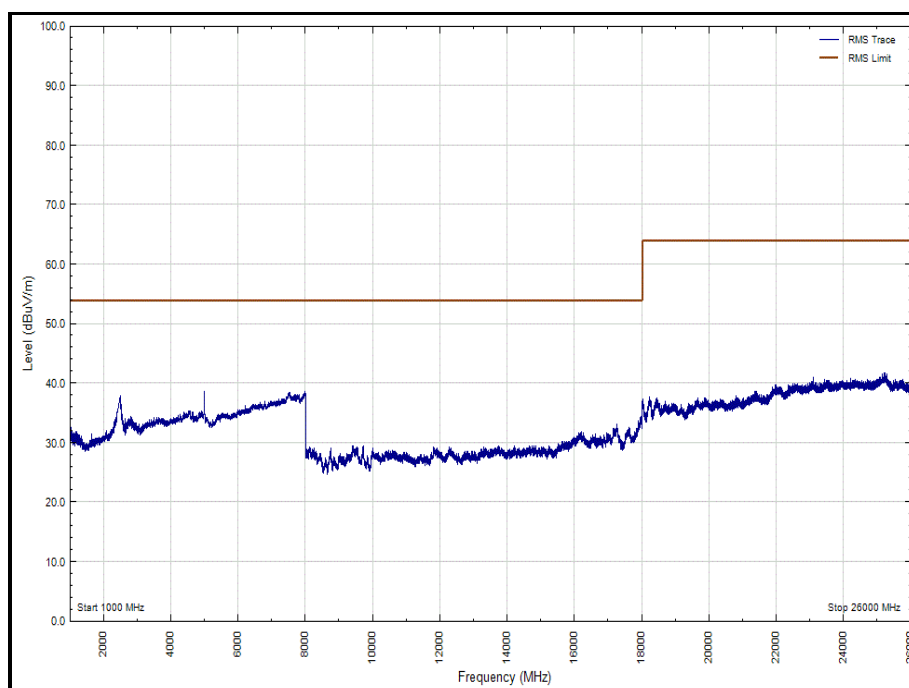


Figure 50 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

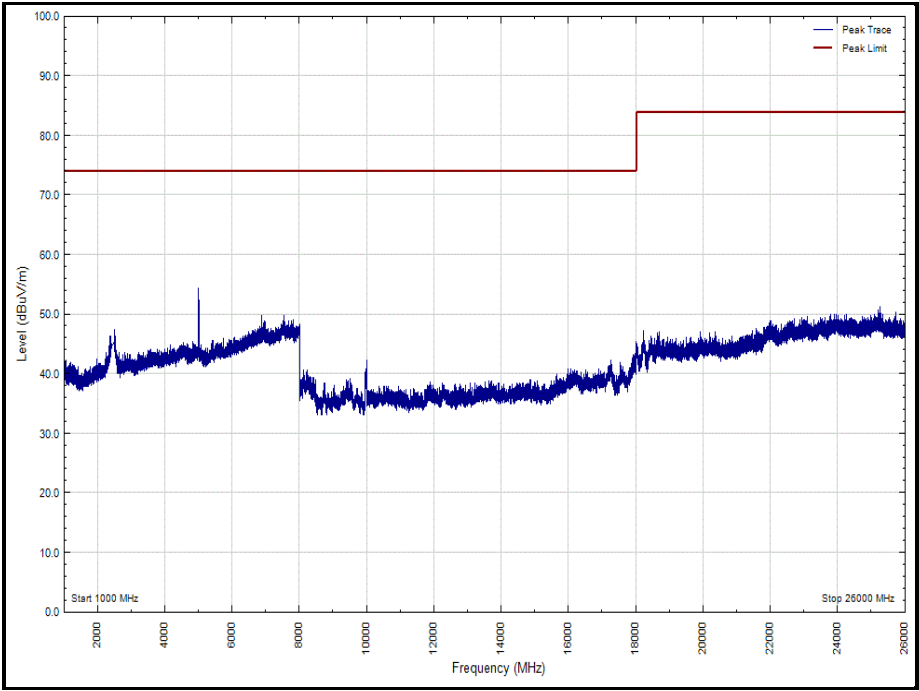


Figure 51 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

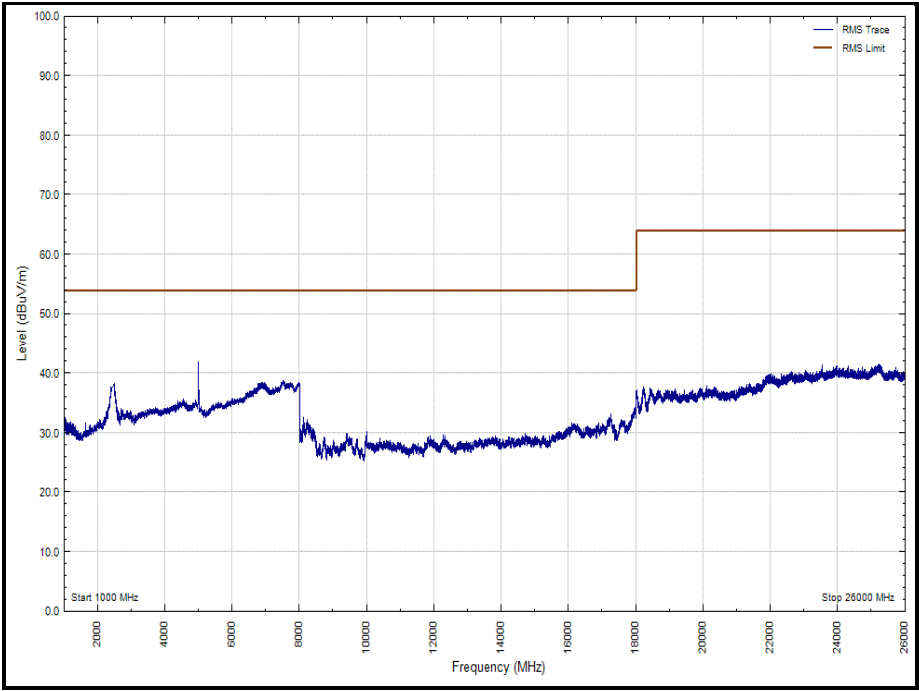


Figure 52 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
*						

Table 20 - 2480 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

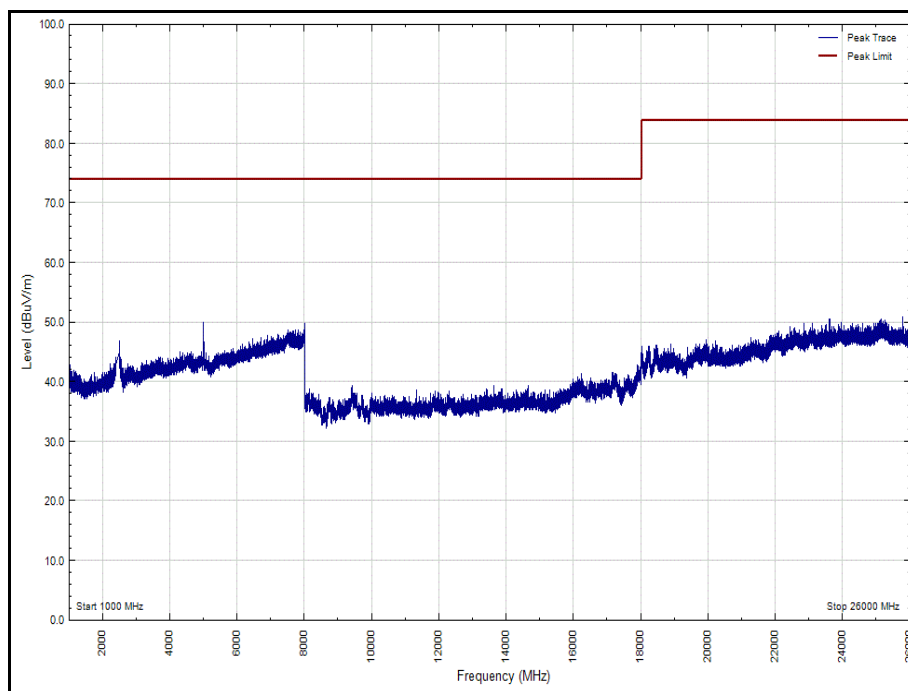


Figure 53 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

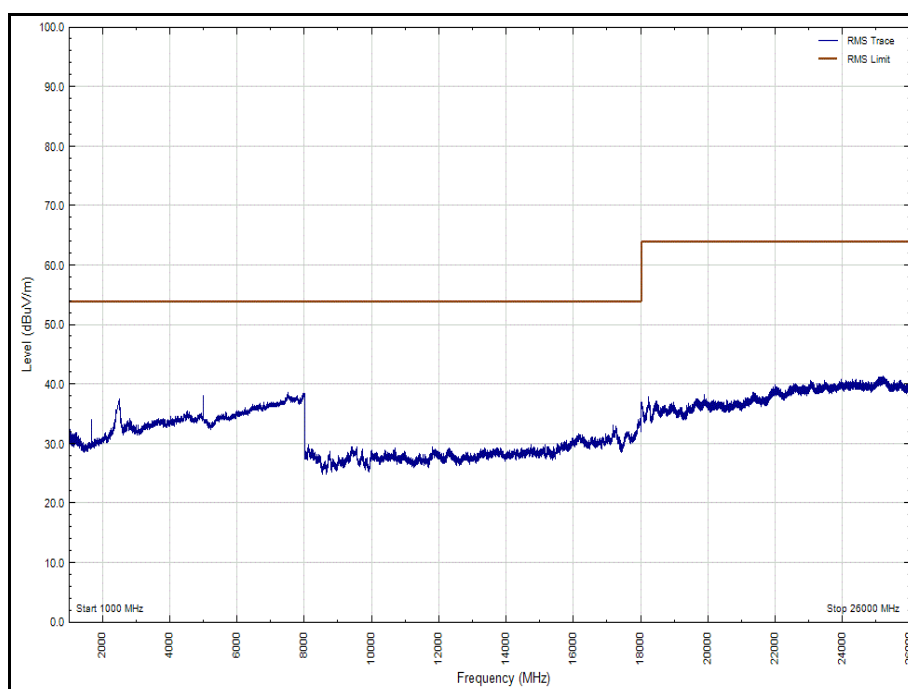


Figure 54 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

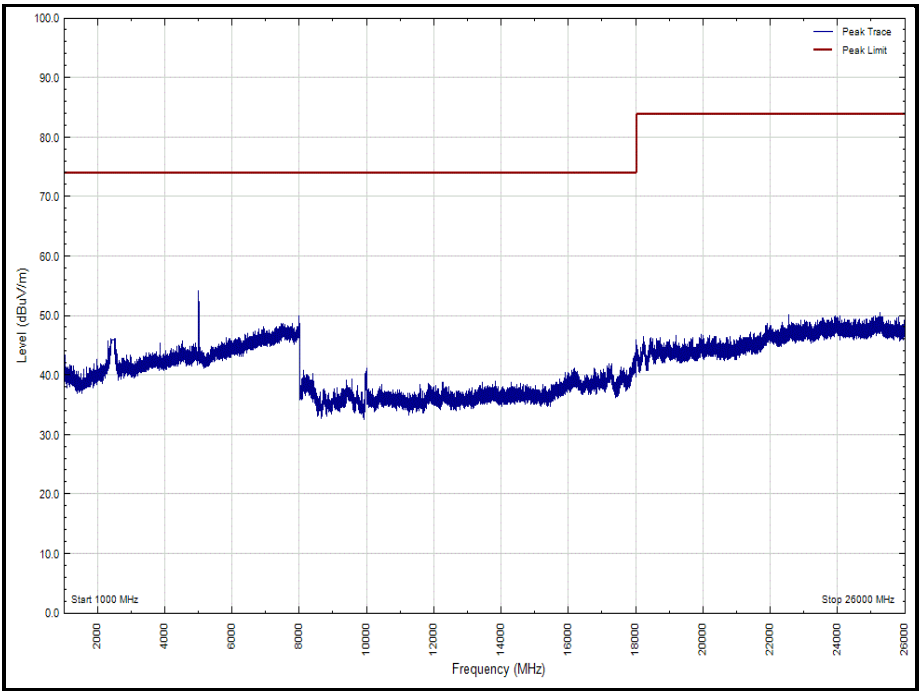


Figure 55 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

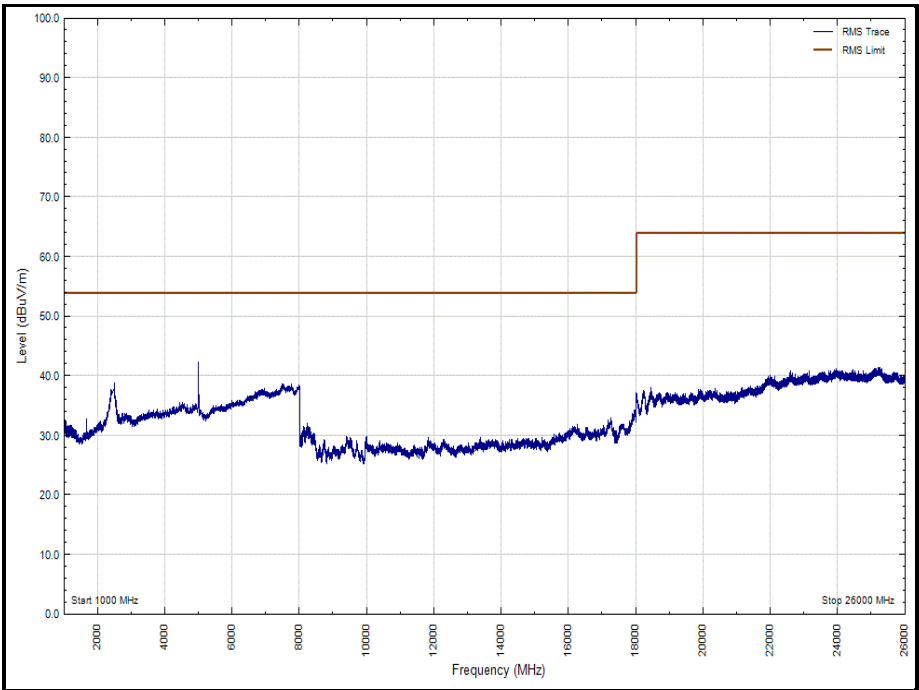


Figure 56 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)



2.4 GHz Bluetooth BDR/EDR - ePA

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

Table 21 – 2440 MHz, 30 MHz to 1 GHz Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

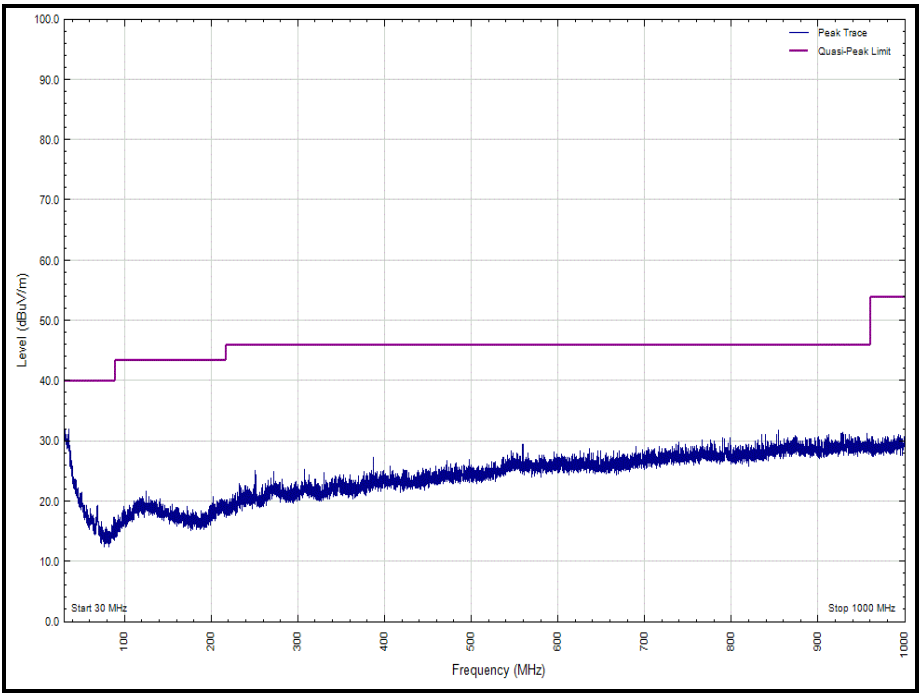


Figure 57 - 2440 MHz, 30 MHz to 1 GHz, Polarity: Horizontal

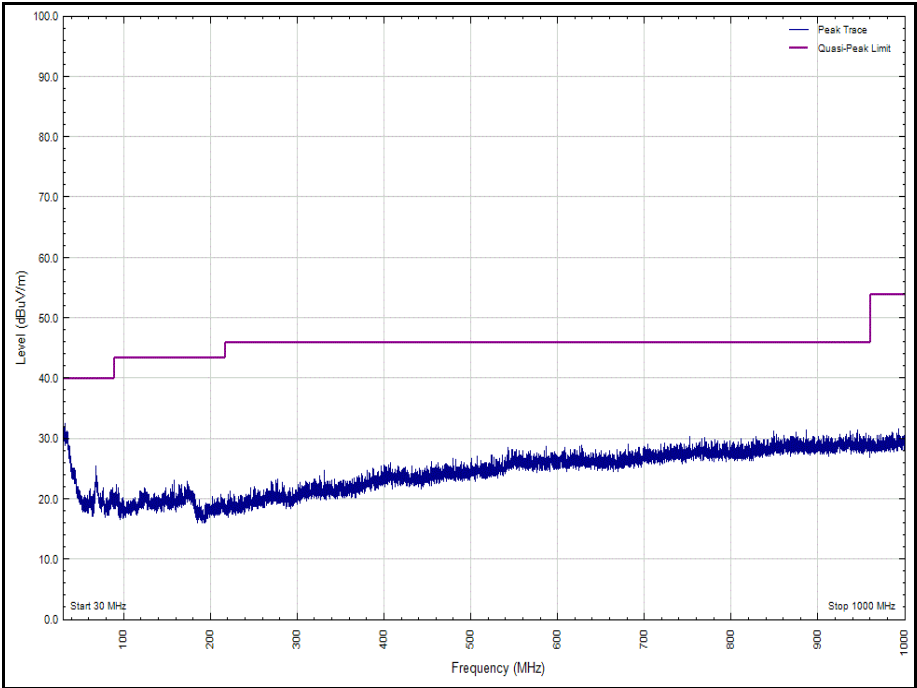


Figure 58 - 2440 MHz, 30 MHz to 1 GHz, Polarity: Vertical

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
*						

Table 22 - 2402 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

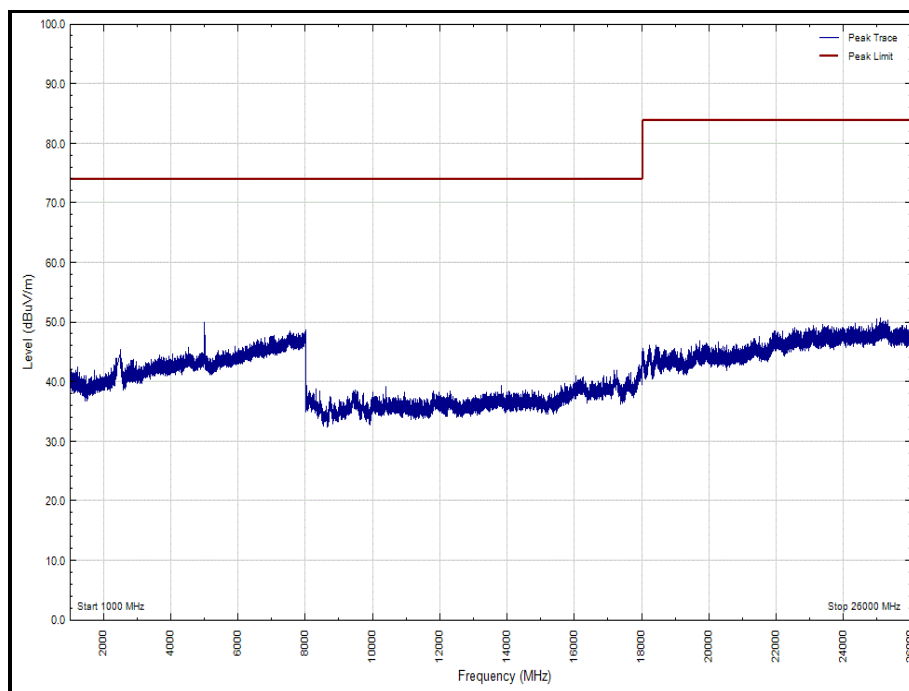


Figure 59 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

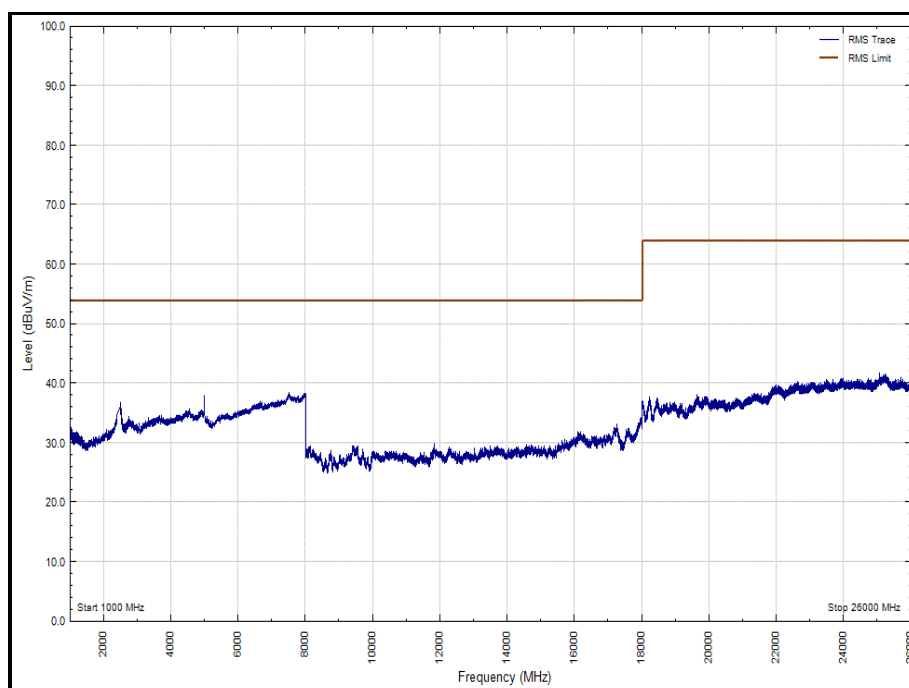


Figure 60 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

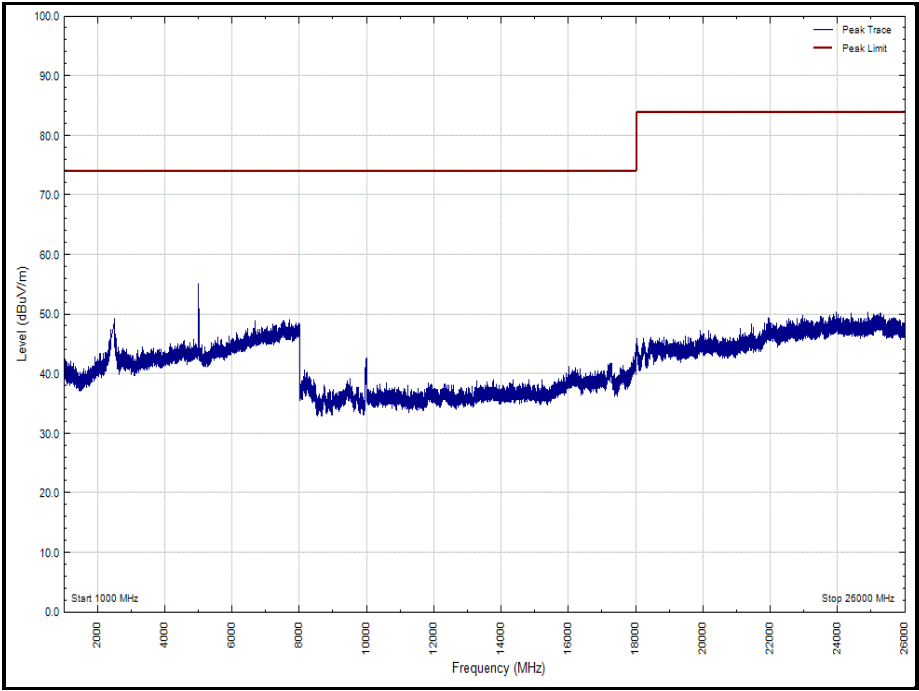


Figure 61 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

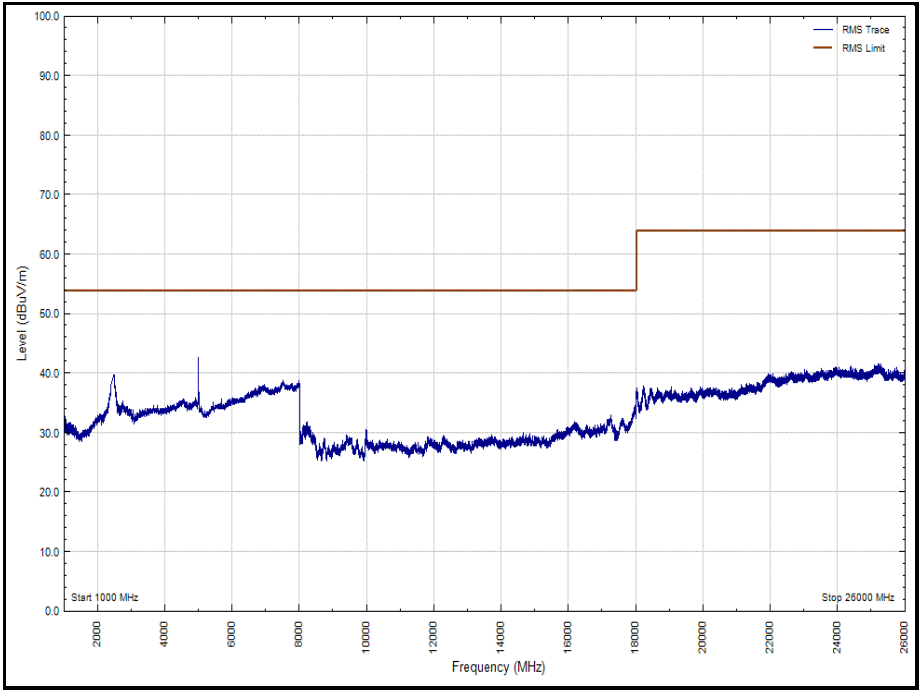


Figure 62 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
*						

Table 23 - 2440 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

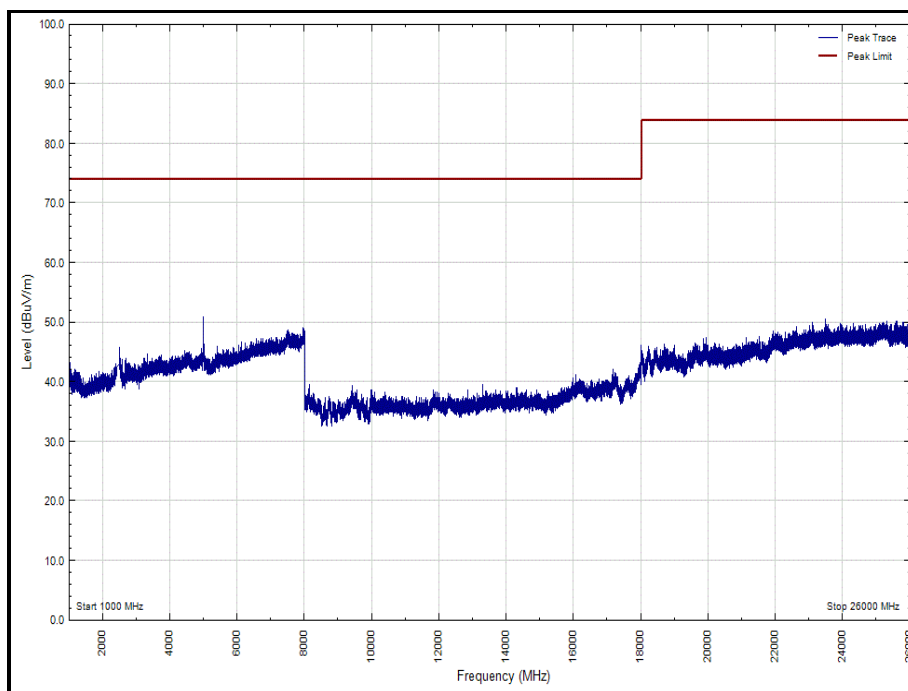


Figure 63 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

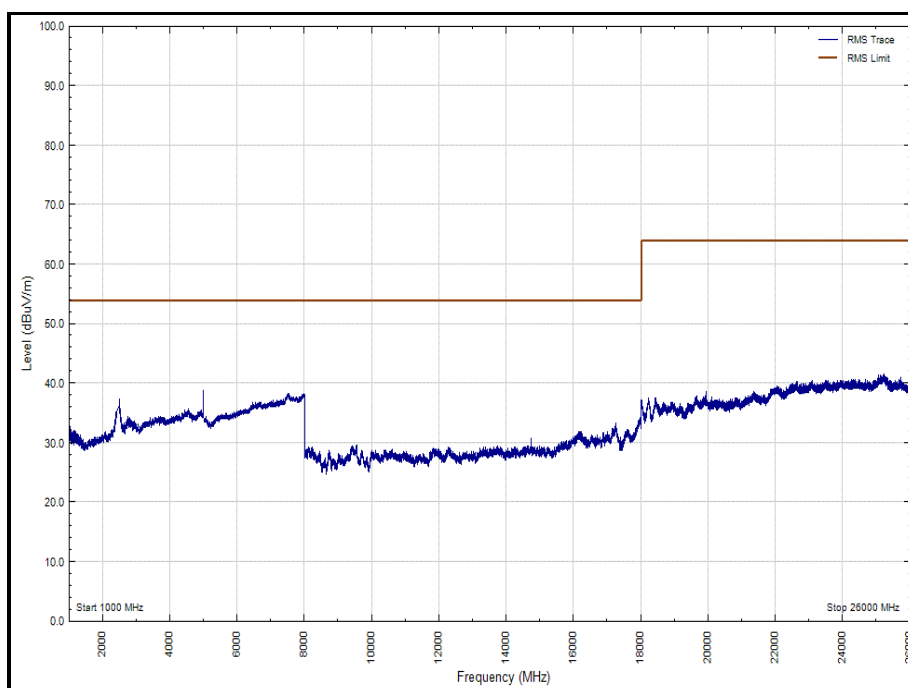


Figure 64 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

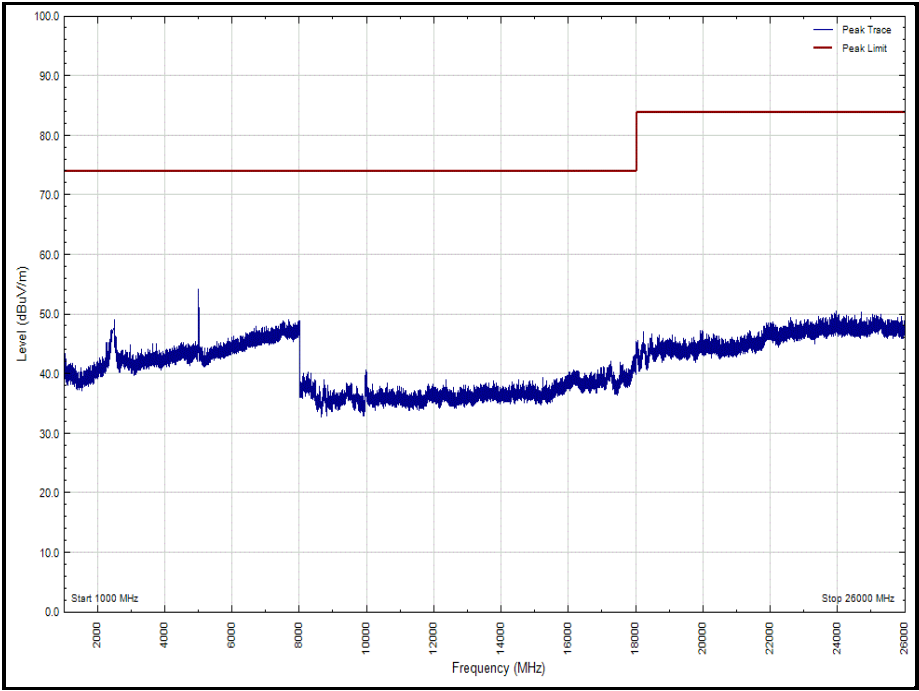


Figure 65 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

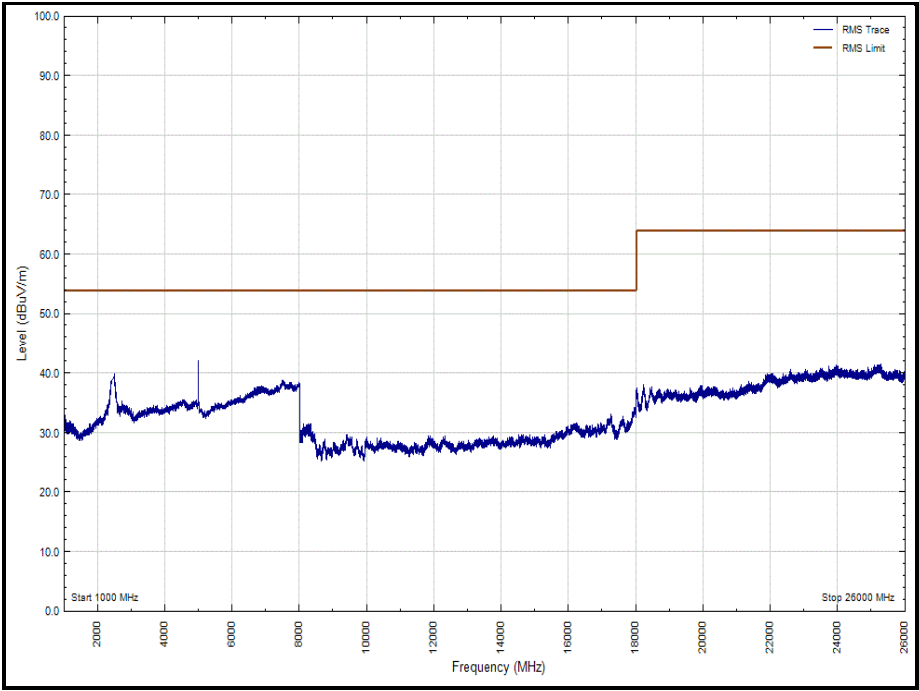


Figure 66 - 2440 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)

Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Margin (dB)	Average Margin (dB)
*						

Table 24 - 2480 MHz - 1 GHz to 26 GHz – Radiated Emissions Results

*No emissions were detected within 10 dB of the limit

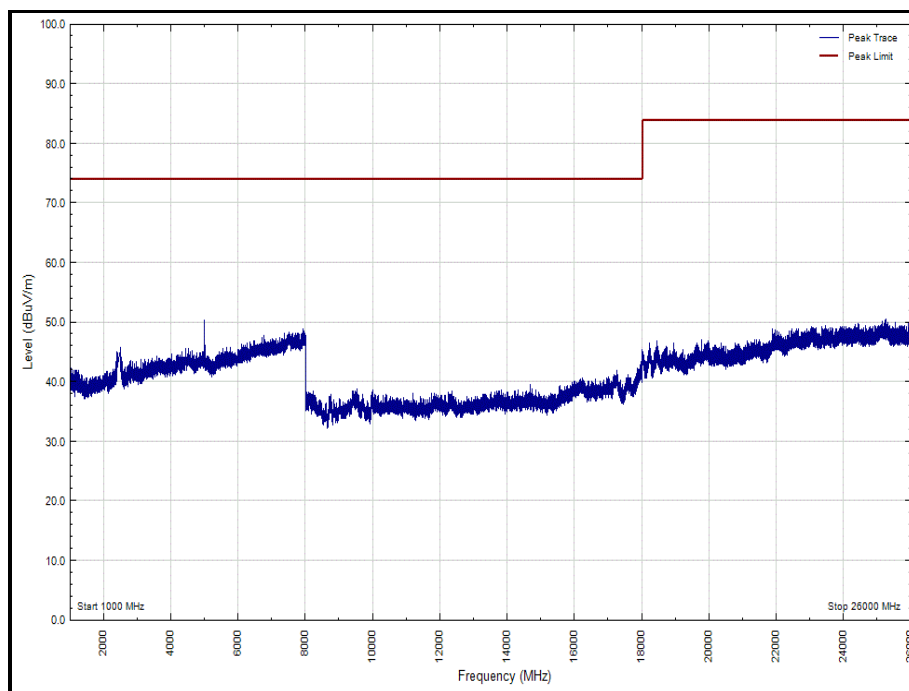


Figure 67 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Peak)

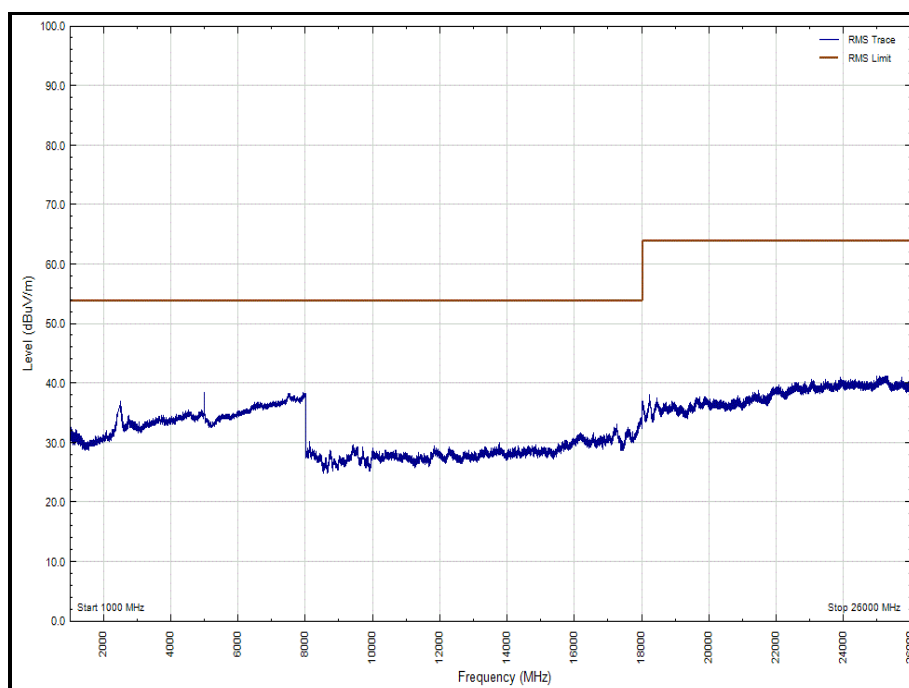


Figure 68 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal (Average)

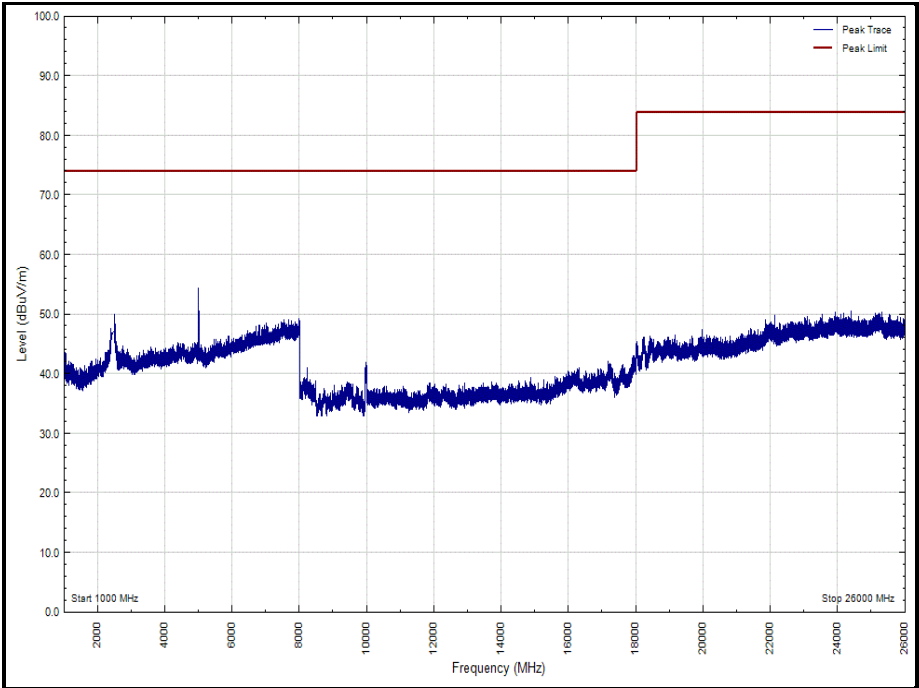


Figure 69 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Peak)

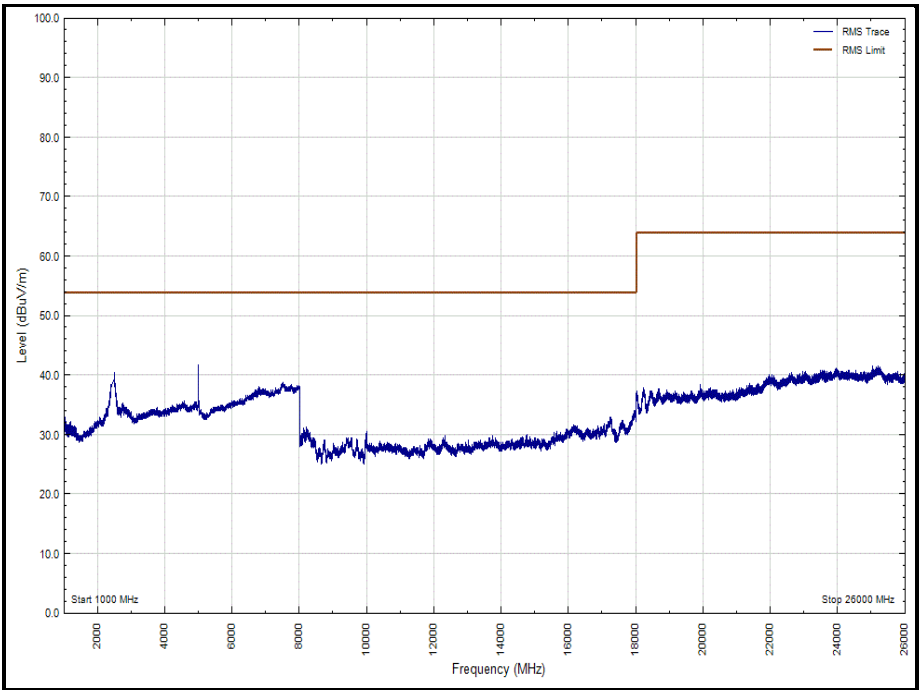


Figure 70 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical (Average)



FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.4.7 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-May-2020
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	14-Nov-2020
High Pass Filter (4GHz)	K&L Microwave	11SH10-4000/X18000-0/0	4599	12	05-Sep-2020
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5066	12	01-Oct-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5067	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
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5069	12	01-Oct-2020



Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5095	12	04-Dec-2019*
Cable (18 GHz)	Rosenberger	LU7-071-1000	5104	12	09-Dec-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
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	11-Mar-2020
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	11-Mar-2020
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5217	12	09-Apr-2020
Preamplifier (30 dB 18-40GHz)	Schwarzbeck	BBV 9721	5218	12	09-Apr-2020

Table 25

TU - Traceability Unscheduled

*As testing was performed over multiple days it may appear that some equipment was used outside of a valid calibration period, however, TUV SUD confirms that when equipment was used it held a valid calibration and has records of this.



2.5 Frequency Hopping Systems - Average Time of Occupancy

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.5.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00AM8N2 - Modification State 0

2.5.3 Date of Test

18-November-2019

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.4.

2.5.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 30.3 %

2.5.6 Test Results

2.4 GHz Bluetooth BDR/EDR - ePA

Packet Type	Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
DH1	0.37	320.00	118.40
DH3	1.63	148.00	241.24
DH5	2.88	111.00	319.68

Table 26

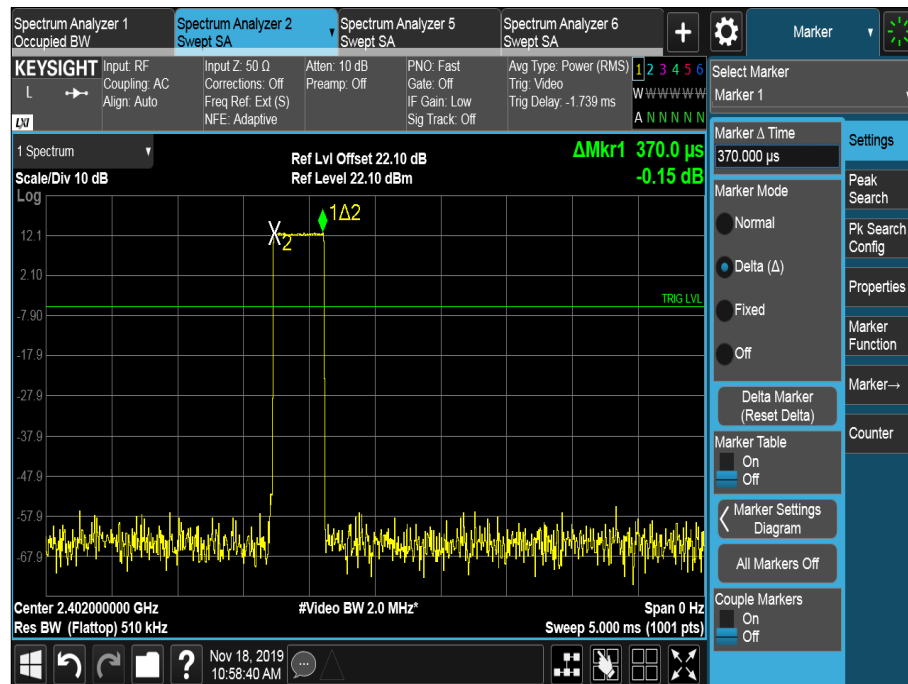


Figure 71 - DH1, Dwell Time

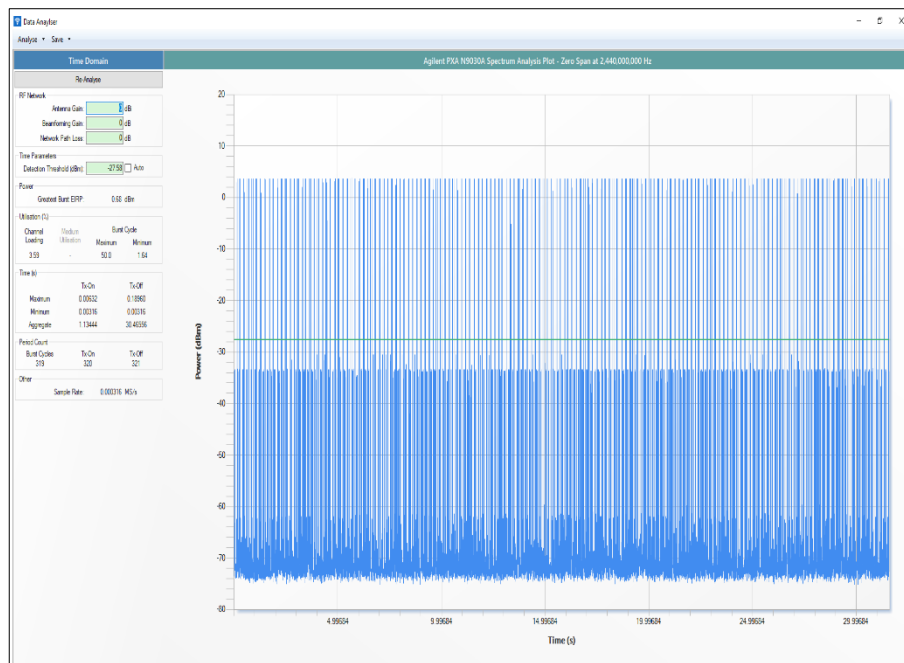


Figure 72 - DH1, Total Average Time of Occupancy

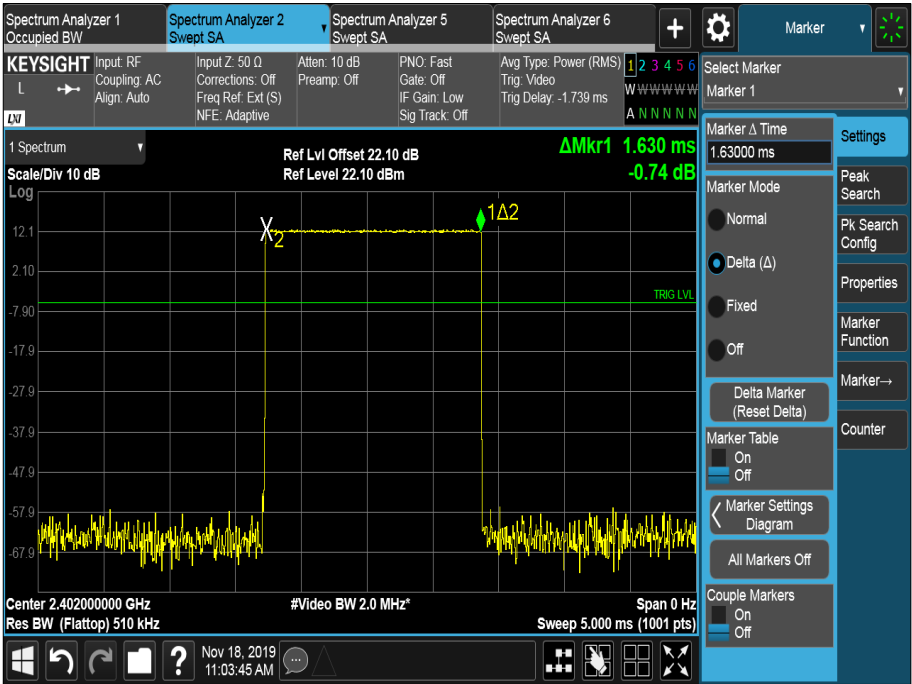


Figure 73 - DH3, Dwell Time

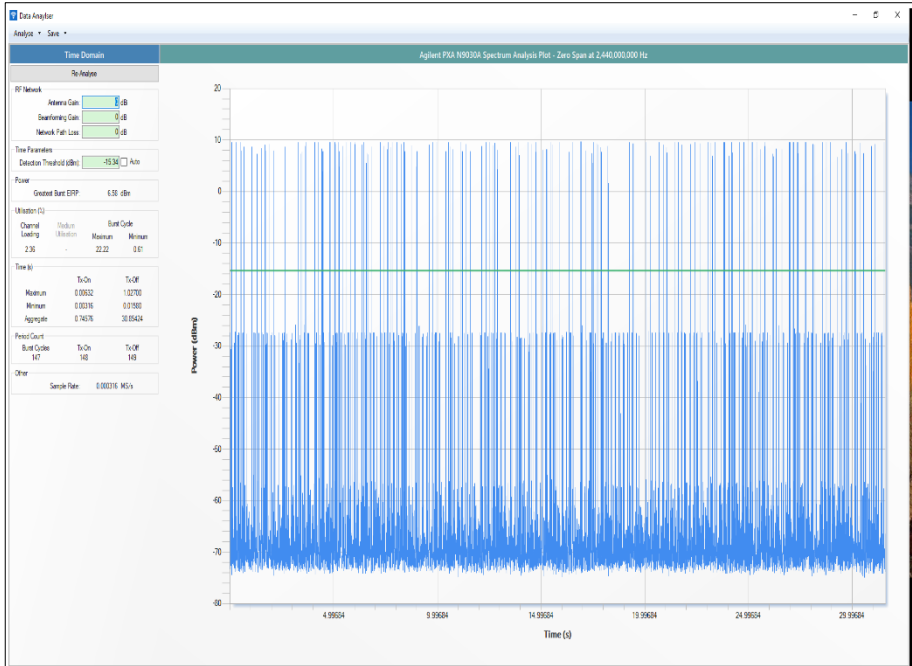


Figure 74 - DH3, Total Average Time of Occupancy

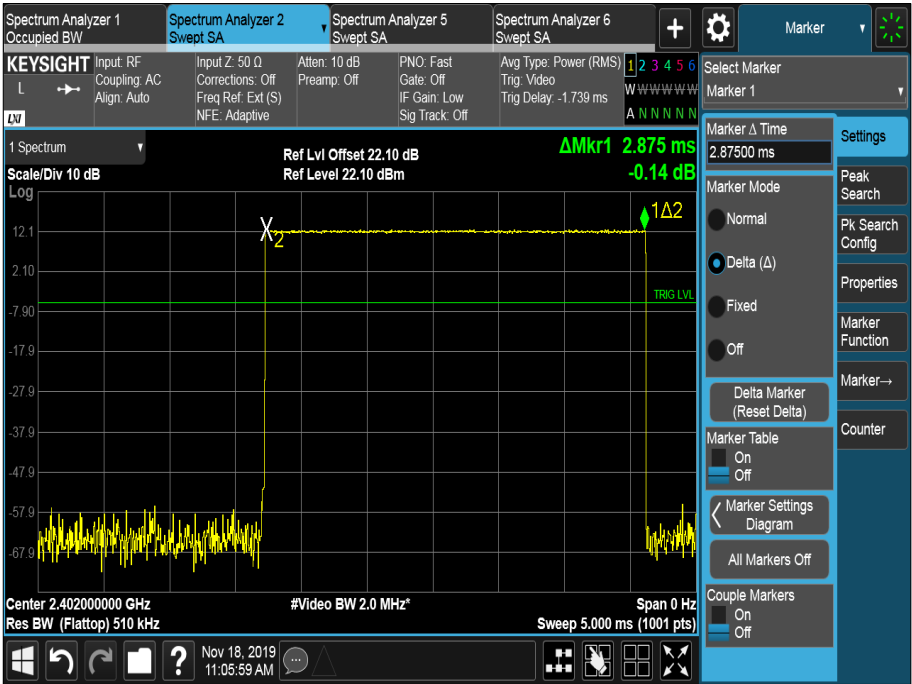


Figure 75 - DH5, Dwell Time

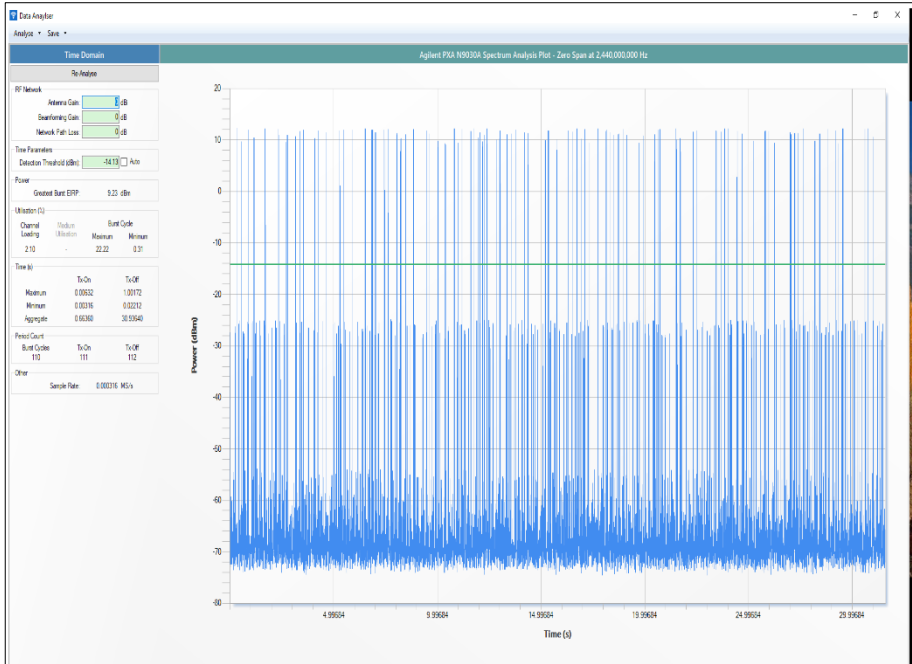


Figure 76 - DH5, Total Average Time of Occupancy



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

ISED RSS-247, Limit Clause 5.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

2.5.7 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
Attenuator (20 dB, 2 W)	Pasternack	PE7004-20	489	-	O/P Mon
Multimeter	Fluke	79 Series III	611	12	11-Sep-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
EXA	Keysight Technologies	N9010B	4969	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	06-Oct-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon

Table 27

O/P Mon – Output Monitored using calibrated equipment



2.6 Frequency Hopping Systems - Channel Separation

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.6.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00AM8N2 - Modification State 0

2.6.3 Date of Test

18-November-2019

2.6.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.2.

2.6.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 30.3 %

2.6.6 Test Results

2.4 GHz Bluetooth BDR/EDR - ePA

Modulation	Channel Separation (MHz)
GFSK	1.002
$\pi/4$ DQPSK	0.999
8-DPSK	1.002

Table 28



Figure 77 - GFSK



Figure 78 - $\pi/4$ DQPSK



Figure 79 - 8-DPSK



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

ISED RSS-247, Limit Clause 5.1 (b)

FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator (20 dB, 2 W)	Pasternack	PE7004-20	489	-	O/P Mon
Multimeter	Fluke	79 Series III	611	12	11-Sep-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
EXA	Keysight Technologies	N9010B	4969	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	06-Oct-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon

Table 29

O/P Mon – Output Monitored using calibrated equipment

2.7 Frequency Hopping Systems - Number of Hopping Channels

2.7.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.7.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00AM8N2 - Modification State 0

2.7.3 Date of Test

18-November-2019

2.7.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.3.

2.7.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 30.3 %

2.7.6 Test Results

2.4 GHz Bluetooth BDR/EDR - ePA

Number of Hopping Channels: 79

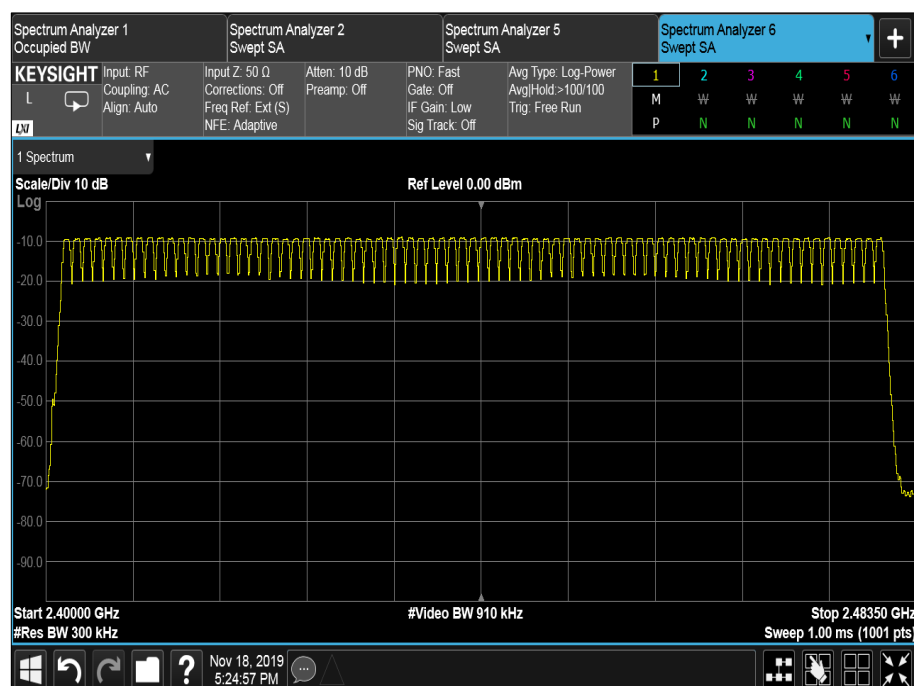


Figure 80 - Measurement Frequency Range: 2400 MHz to 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

≥ 15 channels

ISED RSS-247, Limit Clause 5.1 (d)

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

2.7.7 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
Attenuator (20 dB, 2 W)	Pasternack	PE7004-20	489	-	O/P Mon
Multimeter	Fluke	79 Series III	611	12	11-Sep-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
EXA	Keysight Technologies	N9010B	4969	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Cable (18 GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	06-Oct-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon

Table 30

O/P Mon – Output Monitored using calibrated equipment



2.8 Maximum Conducted Output Power

2.8.1 Specification Reference

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

2.8.2 Equipment Under Test and Modification State

A2179, S/N: C02ZC00AM8N2 - Modification State 0

2.8.3 Date of Test

06-January-2020 to 31-January-2020

2.8.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.5.

2.8.5 Environmental Conditions

Ambient Temperature 20.2 °C to 23.9 °C
Relative Humidity 28.8 % to 43.0 %

2.8.6 Test Results

2.4 GHz Bluetooth BDR/EDR - iPA

Frequency (MHz)	Modulation Scheme	Maximum Output Power	
		dBm	mW
2402	GFSK	12.86	19.32
2402	$\pi/4$ DQPSK	12.57	18.07
2402	8-DPSK	13.07	20.28
2441	GFSK	12.66	18.45
2441	$\pi/4$ DQPSK	12.49	17.74
2441	8-DPSK	12.98	19.86
2480	GFSK	13.29	21.33
2480	$\pi/4$ DQPSK	12.93	19.63
2480	8-DPSK	13.27	21.23

Table 31 - Maximum Conducted Output Power Results



Figure 81 - 2402 MHz - Maximum Output Power



Figure 82 - 2402 MHz - Maximum Output Power

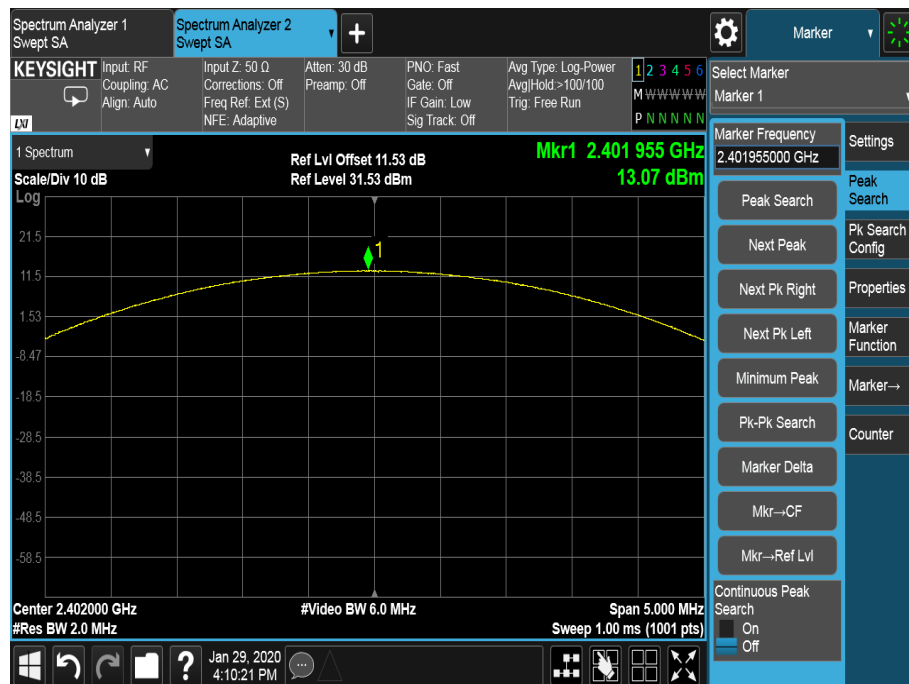


Figure 83 - 2402 MHz - Maximum Output Power

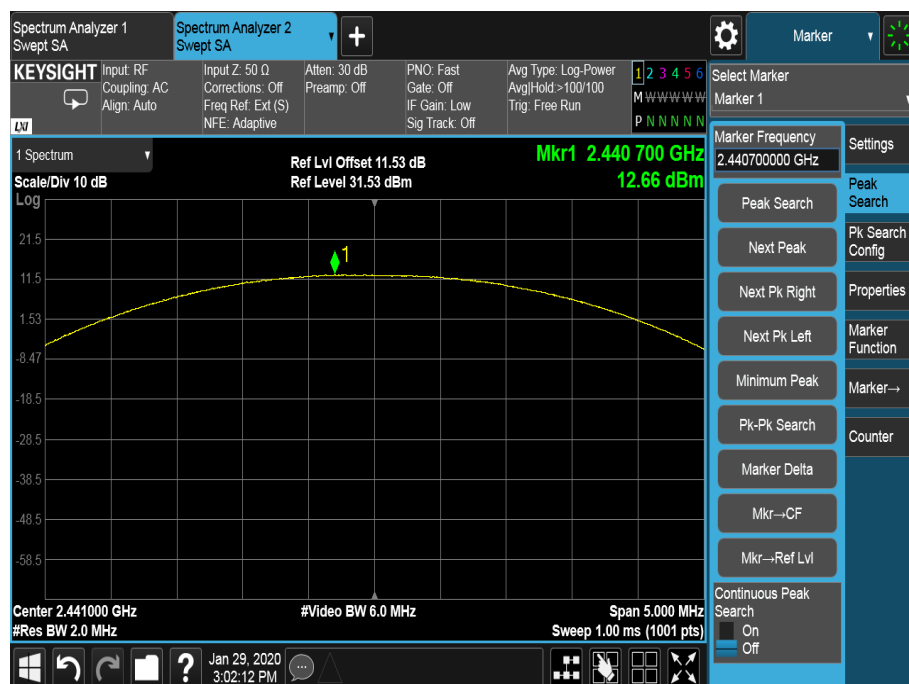


Figure 84 - 2441 MHz - Maximum Output Power

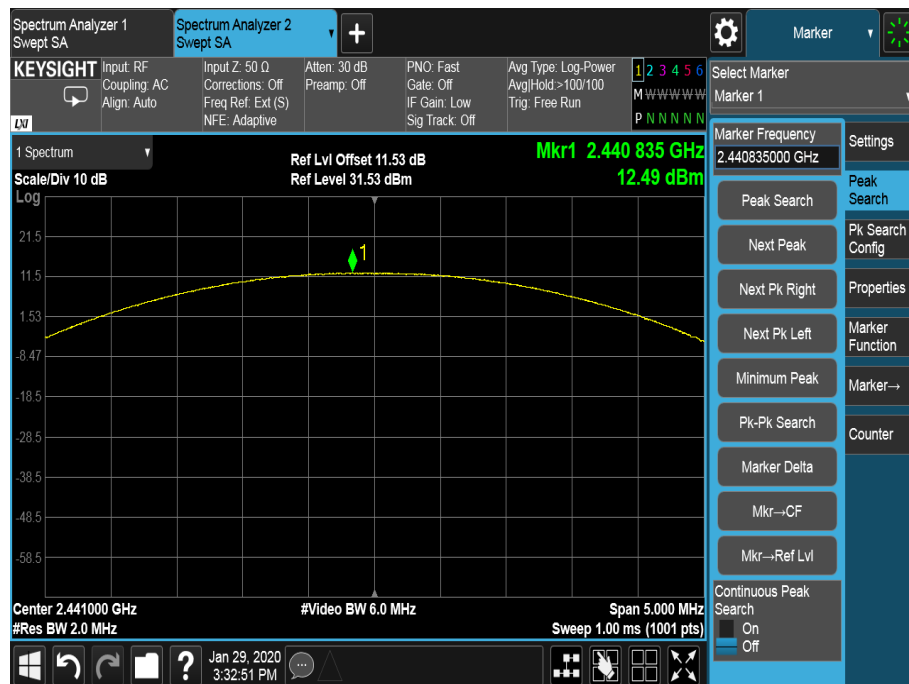


Figure 85 - 2441 MHz - Maximum Output Power

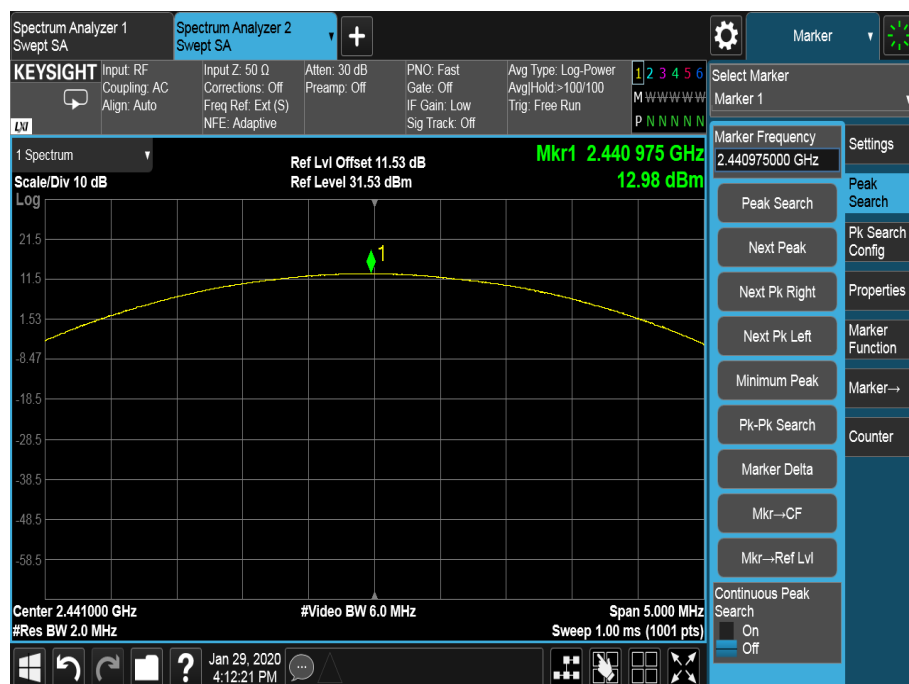


Figure 86 - 2441 MHz - Maximum Output Power



Figure 87 - 2480 MHz - Maximum Output Power



Figure 88 - 2480 MHz - Maximum Output Power

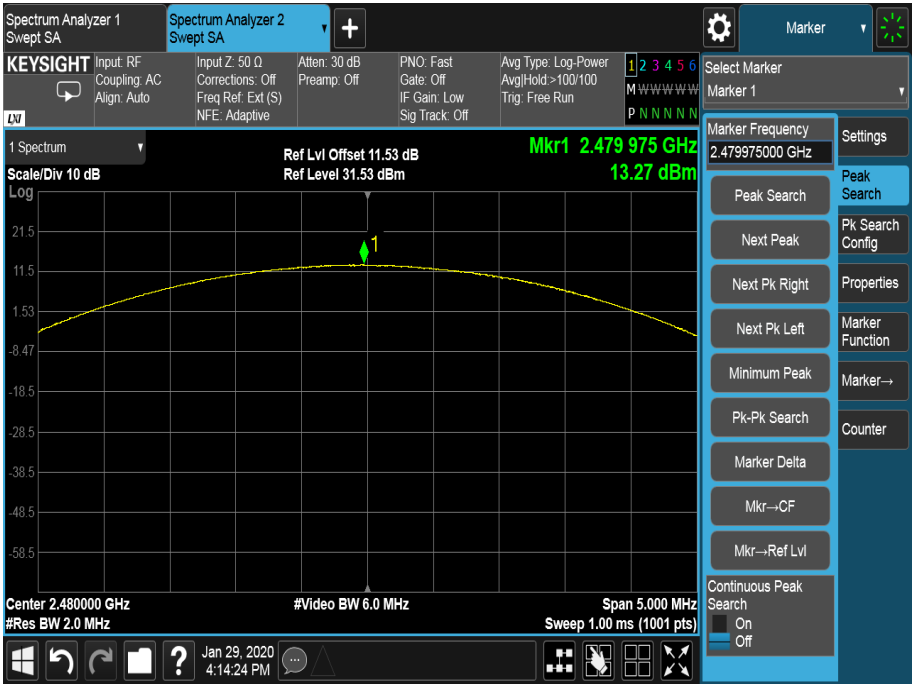


Figure 89 - 2480 MHz - Maximum Output Power



2.4 GHz Bluetooth BDR/EDR - ePA

Frequency (MHz)	Modulation Scheme	Maximum Output Power	
		dBm	mW
2402	GFSK	18.88	77.27
2402	$\pi/4$ DQPSK	18.50	70.79
2402	8-DPSK	19.06	80.54
2441	GFSK	18.50	70.79
2441	$\pi/4$ DQPSK	18.22	66.37
2441	8-DPSK	18.67	73.62
2480	GFSK	19.20	83.18
2480	$\pi/4$ DQPSK	18.73	74.64
2480	8-DPSK	19.14	82.03

Table 32 - Maximum Conducted Output Power Results

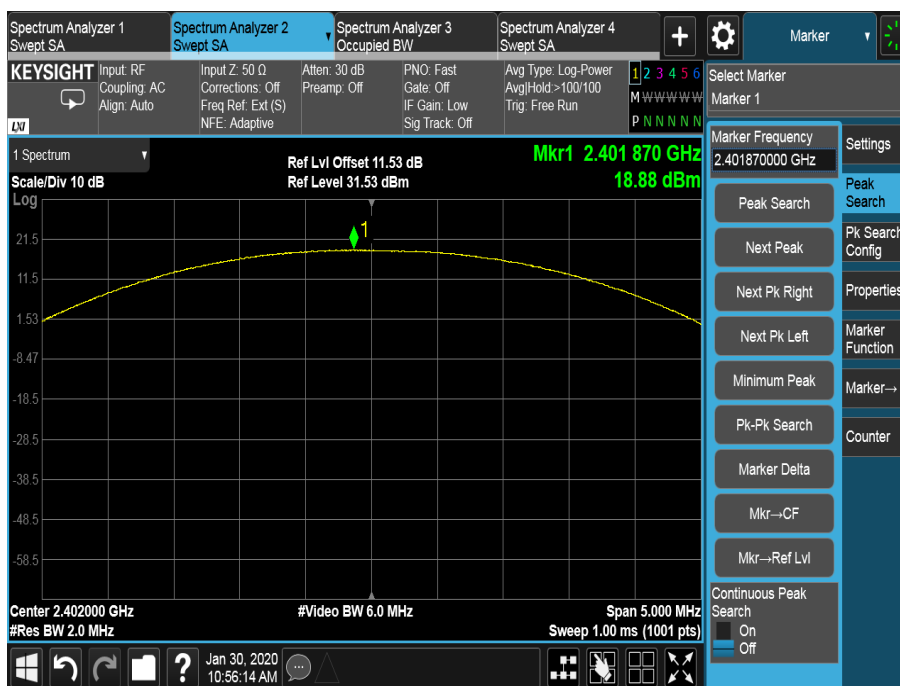


Figure 90 - 2402 MHz - Maximum Output Power



Figure 91 - 2402 MHz - Maximum Output Power



Figure 92 - 2402 MHz - Maximum Output Power

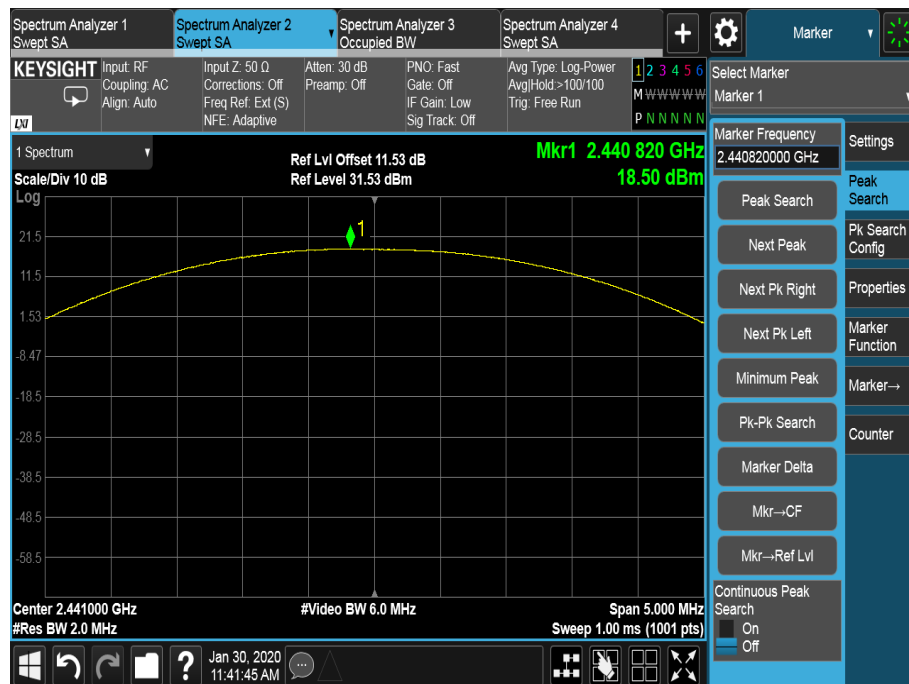


Figure 93 - 2441 MHz - Maximum Output Power

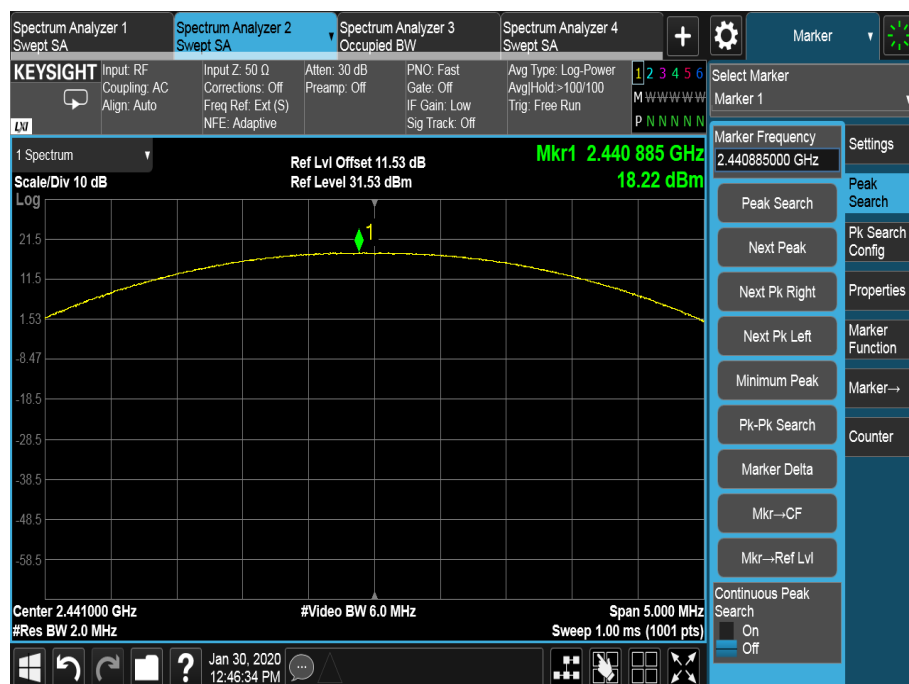


Figure 94 - 2441 MHz - Maximum Output Power



Figure 95 - 2441 MHz - Maximum Output Power

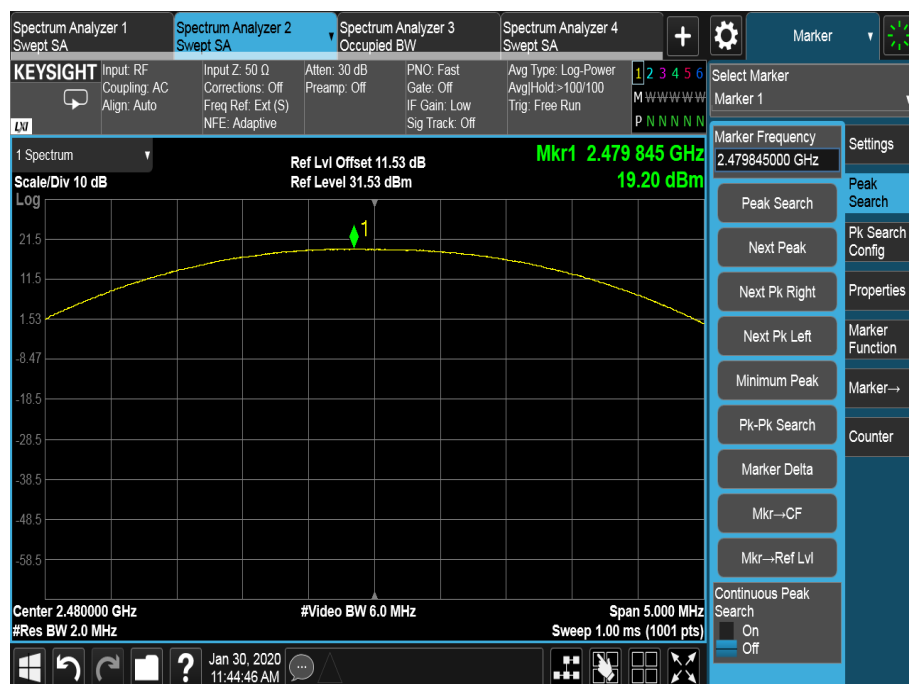


Figure 96 - 2480 MHz - Maximum Output Power



Figure 97 - 2480 MHz - Maximum Output Power



Figure 98 - 2480 MHz - Maximum Output Power



FCC 47 CFR Part 15, Limit Clause 15.247 (b)(1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

ISED RSS-247, Limit Clause 5.4 (b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channel; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channel. The e.i.r.p. shall not exceed 4 W except as provided in section 5.4(e) of the specification.

2.8.7 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
Attenuator (10 dB)	Weinschel	47-10-34	481	12	O/P Mon
Multimeter	Fluke	79 Series III	611	12	11-Sep-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygrometer	Rotronic	I-1000	3220	12	25-Sep-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4622	12	12-Jul-2020
EXA	Keysight Technologies	N9010B	4969	24	21-Jan-2020
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon

Table 33

O/P Mon – Output Monitored using calibrated equipment



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
Frequency Hopping Systems - Number of Hopping Channels	-
Frequency Hopping Systems - Channel Separation	± 30.426 kHz
Frequency Hopping Systems - Average Time of Occupancy	-
Spurious Radiated Emissions	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
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Frequency Hopping Systems - 20 dB Bandwidth	± 30.426 kHz

Table 34

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.