

C and ISED Test Report

Apple Inc

Model: A2442

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

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

FCC ID: BCGA2442 IC: 579C-A2442

COMMERCIAL-IN-CONFIDENCE

Document 75952057-09 Issue 01



SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
S Marshall	Senior Engineer	Authorised Signatory	22 September 2021

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	Mohammad Malik	22 September 2021	
Testing	George Porter	22 September 2021	
Testing	Liang Tian	22 September 2021	
Testing	Taha Shafique	22 September 2021	
Testing	Jaiyanth Balendrarajah	22 September 2021	
Testing	Ahmad Javid	22 September 2021	
Testing	Jason Hicks	22 September 2021	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

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



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1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	22-September-2021

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2442
Serial Number(s)	DNQHW6Y3WY and XH2DGXFKY6
Hardware Version(s)	REV1.0
Software Version(s)	DNQHW6Y3WY: 21A102280p XH2DGXFKY6: 21A102281b
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C:2020 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	0540218229
Date	22-April-2021
Date of Receipt of EUT	31-March-2021 and 16-July-2021
Start of Test	29-June-2021
Finish of Test	08-September-2021
Name of Engineer(s)	Mohammad Malik, George Porter, Liang Tian, Taha Shafique, Jaiyanth Balendrarajah, Ahmad Javid and Jason Hicks
Related Document(s)	ANSI C63.4 (2014) ANSI C63.10 (2013) KDB 662911 D01 v02r01



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, 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 - FHSS						
-	15.203			Antenna Requirement	N/T	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.205	-	8.10	Restricted Band Edges	Pass	
2.2	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	
2.3	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	
2.4	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	
2.5	15.247 (a)(1)	5.1	6.7	Frequency Hopping Systems - 20 dB Bandwidth	Pass	
2.6	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.7	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.8	15.247 (d)	5.5	-	Authorised Band Edges	Pass	

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/ax capabilities in the 2.4 GHz and 5 GHz bands.

1.4.2 Test Setup

For conducted tests, a conducted test point was provided by the manufacturer via a flex strip and UFL connector and cable. The loss of these test cables were known and compensated for in any conducted measurements.

For tests in SISO operation, conducted tests were performed on the BT Dedicated Core (Core 2) as well as the Core with the highest antenna gain as Core 0 and Core 1 are identical but with unequal antenna gains. The EUT supports TxBF on Core 0 + Core 1.

Bluetooth BDR/EDR was assessed as a FHSS system. The EUT supports Bluetooth on the following mode of operations across its antenna ports:

BT Dedicated Core (Core 2) – SISO (iPA)
BT Core 0 – SISO (iPA and ePA), TxBF (iPA and ePA)
BT Core 1 – SISO (iPA and ePA), TxBF (iPA and ePA)

For all tests, the EUT was put into a continuous transmit test mode with the manufacturer's test commands via a script running in the EUTs terminal application. The EUT then transmitted the required type of modulation/packet type on either a static channel selected within the test script or frequency hopping over the maximum number of supported channels.

All testing was performed with the EUT powered via a 120 V AC, 60 Hz source.

1.4.3 Antenna Gain Table

Antenna Port	Frequency Range (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
BT Dedicated Core (Core 2)	2400 to 2480	6.10	1.00
BT Core 0	2400 to 2480	7.60	1.00
BT Core 1	2400 to 2480	6.70	1.00

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: A2442, Serial Number: DNQHW6Y3WY			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2442, Serial Number: XH2DGXFKY6			
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 - FHSS		
Restricted Band Edges	Mohammad Malik, Taha Shafique, Jaiyanth Balendrarajah and Ahmad Javid	UKAS
Frequency Hopping Systems - Average Time of Occupancy	George Porter	UKAS
Frequency Hopping Systems - Channel Separation	George Porter and Jason Hicks	UKAS
Frequency Hopping Systems - Number of Hopping Channels	George Porter	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	George Porter and Jason Hicks	UKAS
Maximum Conducted Output Power	George Porter and Jason Hicks	UKAS
Spurious Radiated Emissions	Liang Tian	UKAS
Authorised Band Edges	Mohammad Malik, Taha Shafique, Jaiyanth Balendrarajah and Ahmad Javid	UKAS

Table 5

Office Address:

TÜV SÜD
 Octagon House
 Concorde Way
 Fareham
 Hampshire
 PO15 5RL
 United Kingdom



2 Test Details

2.1 Restricted Band Edges

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

A2442, S/N: DNQHW6Y3WY - Modification State 0

2.1.3 Date of Test

29-June-2021 to 08-July-2021

2.1.4 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:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.1.5 Environmental Conditions

Ambient Temperature	19.6 - 23.6 °C
Relative Humidity	44.1 - 58.0 %



2.1.6 Test Results

2.4 GHz Bluetooth (FHSS)

iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	0	DH5	2402	2390.0	54.06	40.16
Static	$\pi/4$ DQPSK	0	2DH5	2402	2390.0	54.61	39.87
Static	8-DPSK	0	3DH5	2402	2390.0	54.61	39.87
Static	GFSK	0	DH5	2480	2483.5	55.15	41.95
Static	$\pi/4$ DQPSK	0	2DH5	2480	2483.5	55.73	42.24
Static	8-DPSK	0	3DH5	2480	2483.5	54.61	42.38

Table 6 - Restricted Band Edge Results

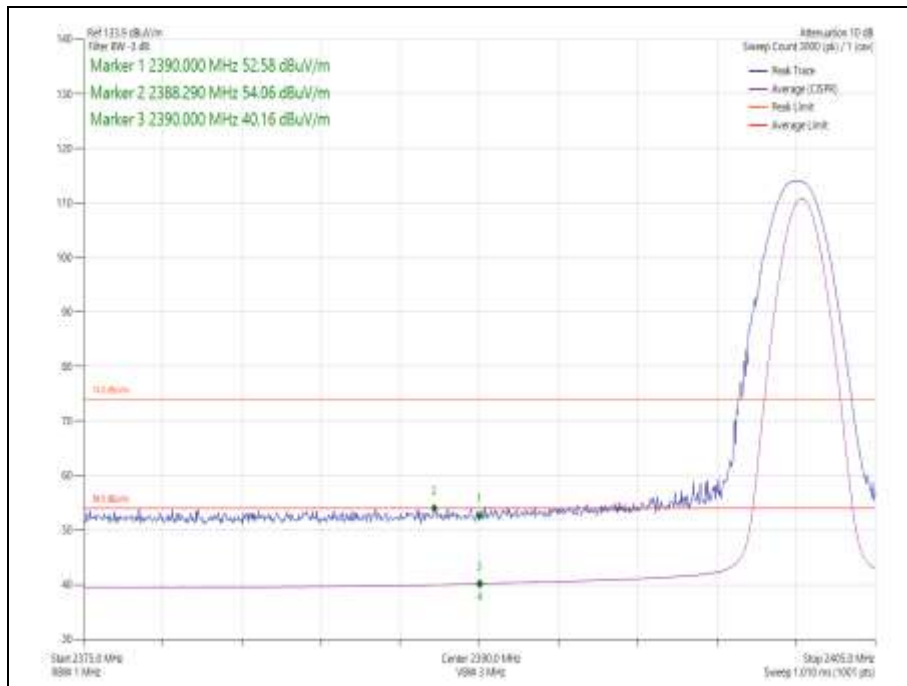


Figure 1 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

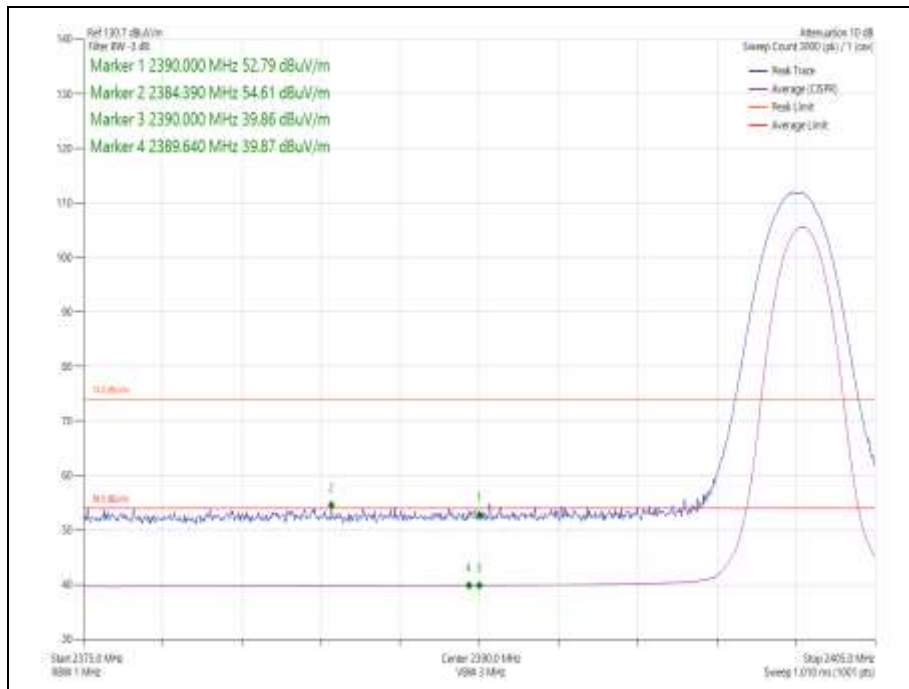


Figure 2 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

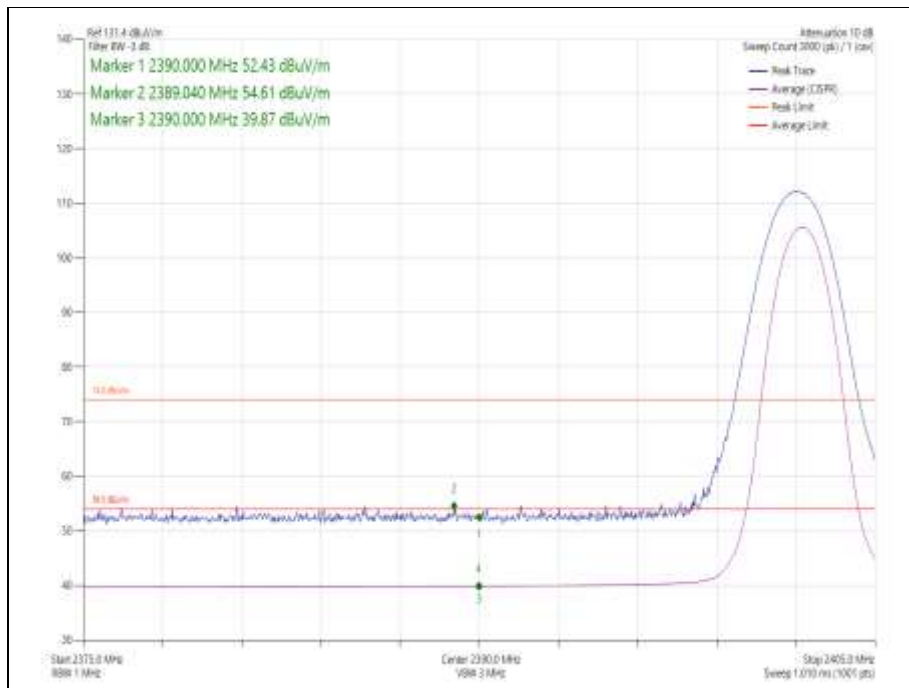


Figure 3 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

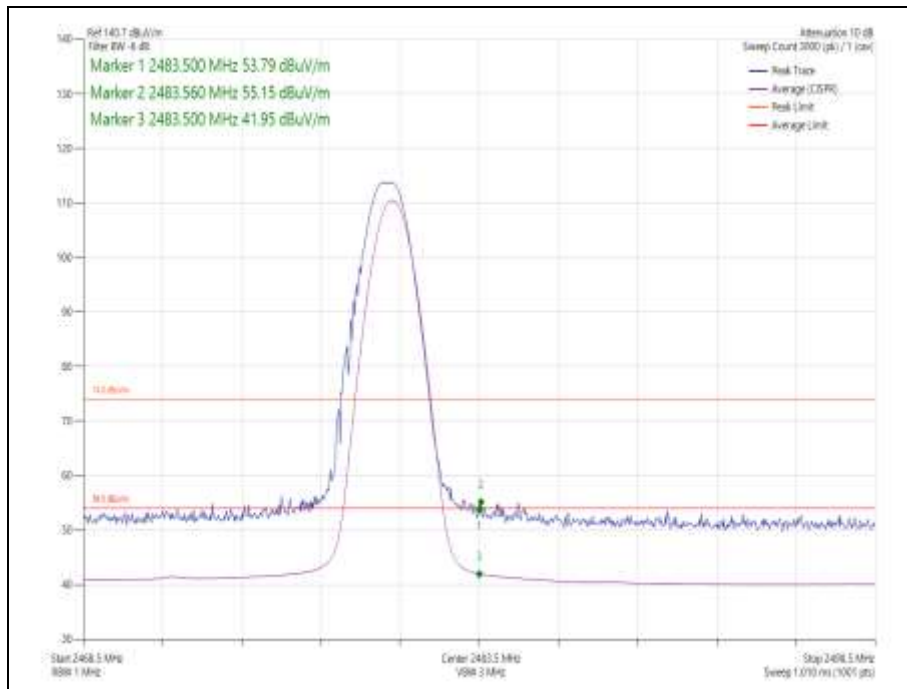


Figure 4 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

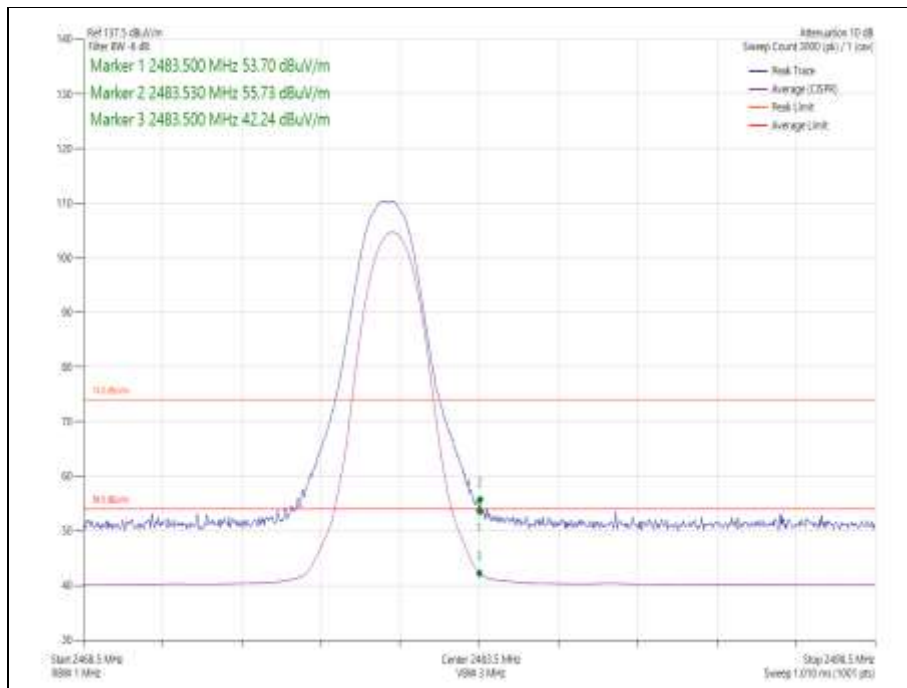


Figure 5 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

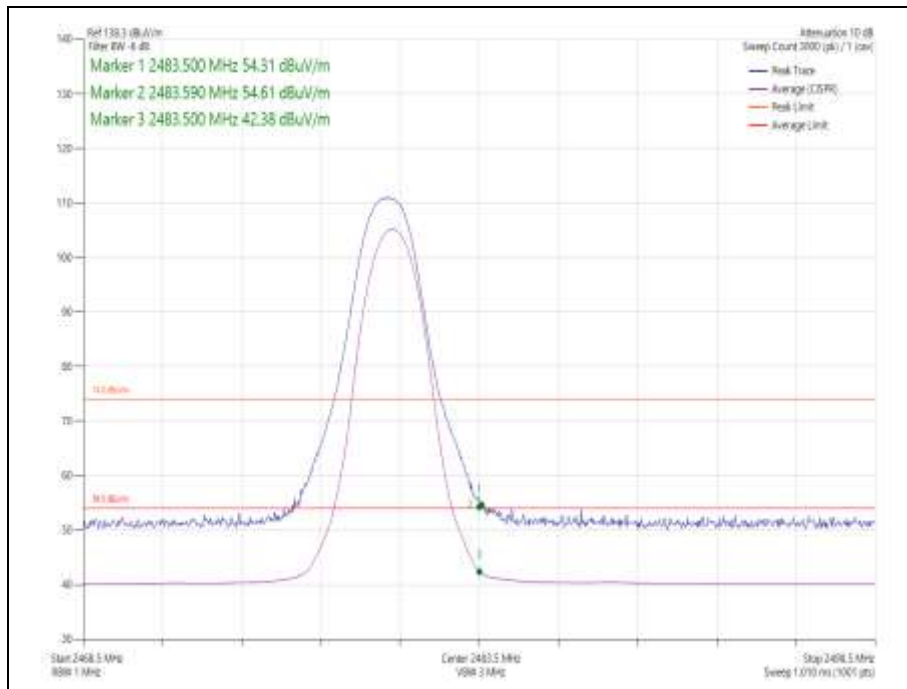


Figure 6 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth (FHSS)

ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
Static	GFSK	0	DH5	2402	2390.0	55.62	41.60
Static	$\pi/4$ DQPSK	0	2DH5	2402	2390.0	55.52	40.91
Static	8-DPSK	0	3DH5	2402	2390.0	56.53	40.91
Static	GFSK	0	DH5	2480	2483.5	60.43	44.92
Static	$\pi/4$ DQPSK	0	2DH5	2480	2483.5	58.37	44.24
Static	8-DPSK	0	3DH5	2480	2483.5	59.90	44.15

Table 7 - Restricted Band Edge Results

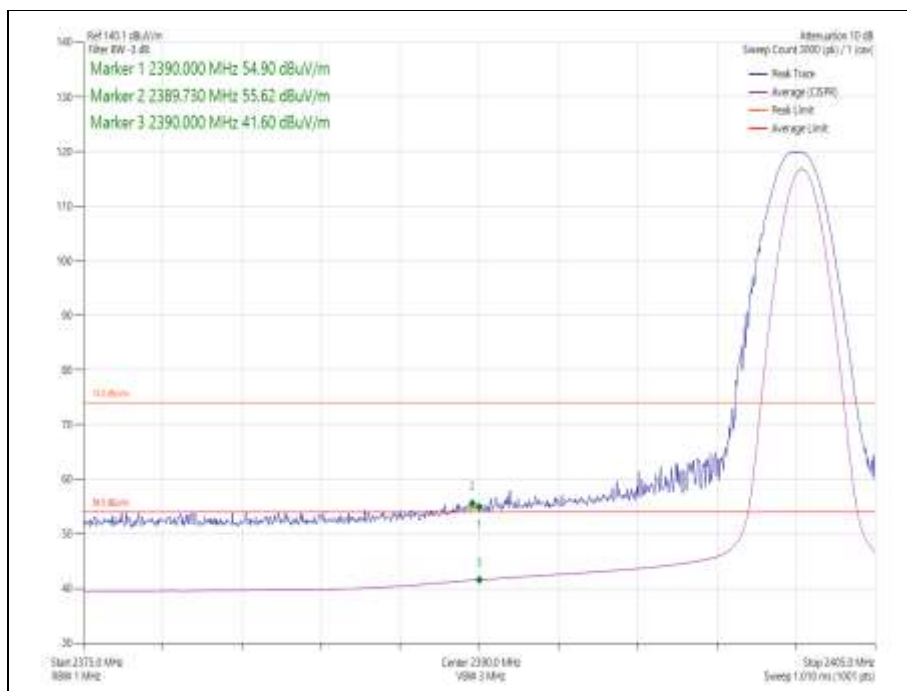


Figure 7 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

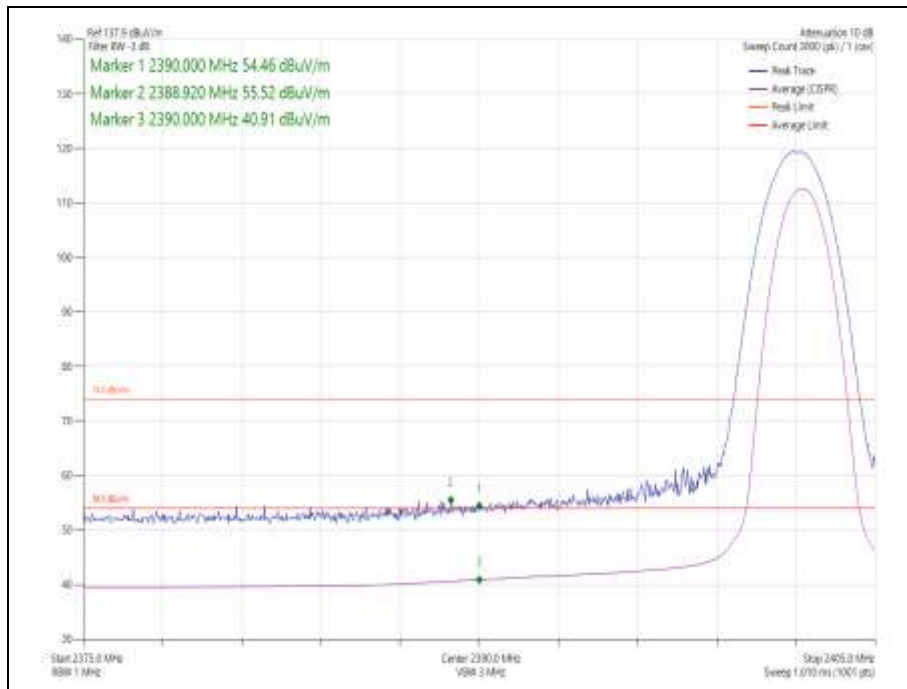


Figure 8 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

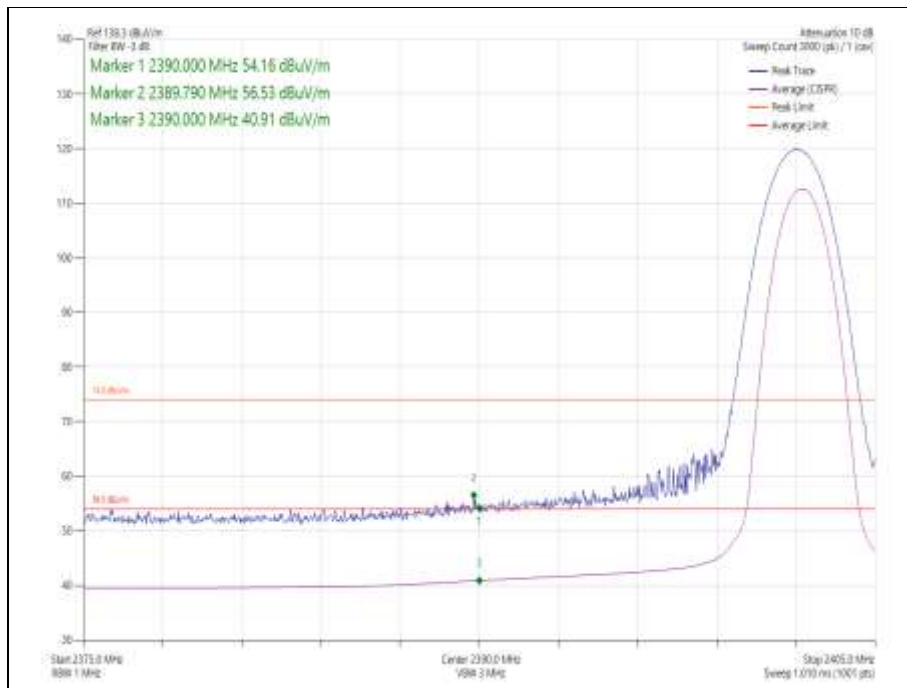


Figure 9 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

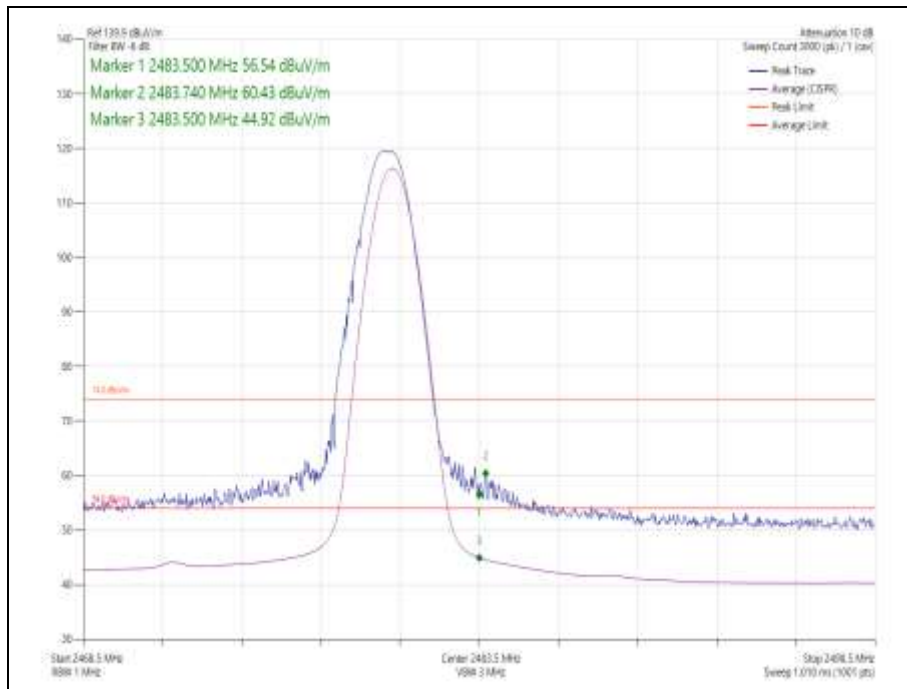


Figure 10 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

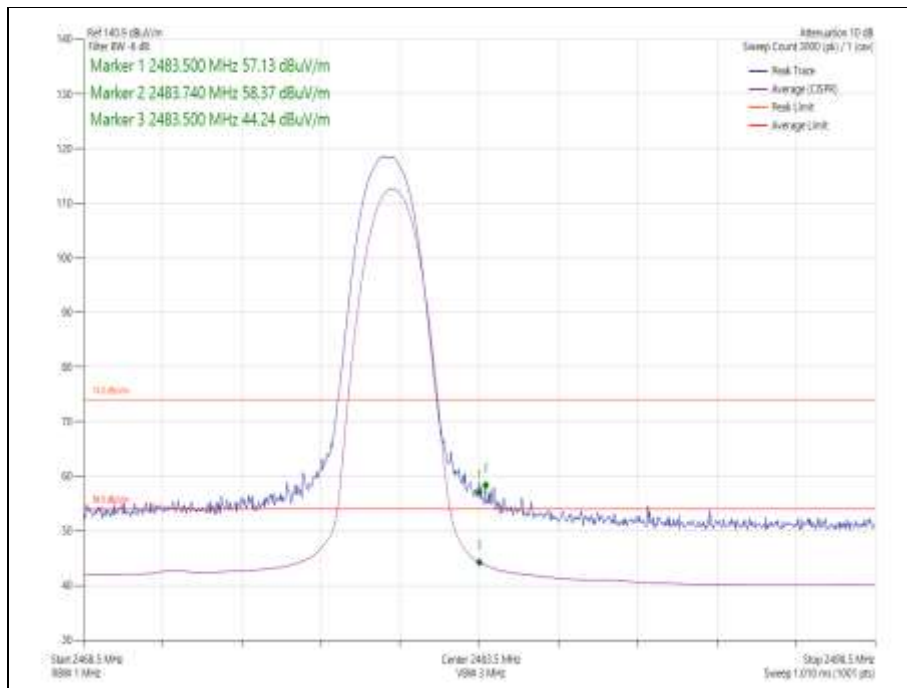


Figure 11 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

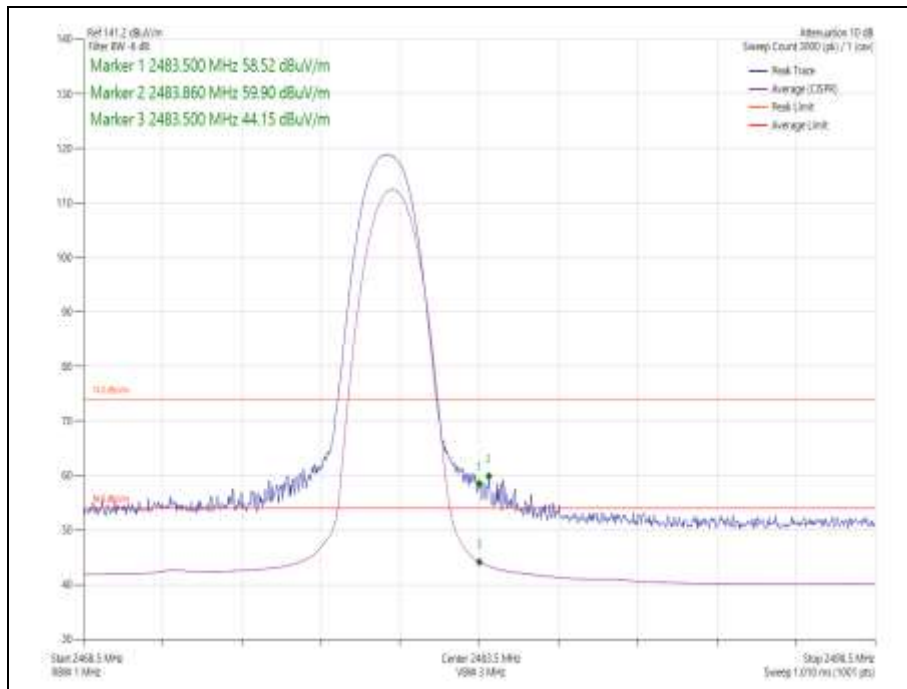


Figure 12 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth (FHSS)

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Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	2	DH5	2402	2390.0	54.70	39.63
Static	$\pi/4$ DQPSK	2	2DH5	2402	2390.0	54.84	39.72
Static	8-DPSK	2	3DH5	2402	2390.0	54.10	39.75
Static	GFSK	2	DH5	2480	2483.5	53.46	40.97
Static	$\pi/4$ DQPSK	2	2DH5	2480	2483.5	53.80	41.29
Static	8-DPSK	2	3DH5	2480	2483.5	54.54	41.41

Table 8 - Restricted Band Edge Results

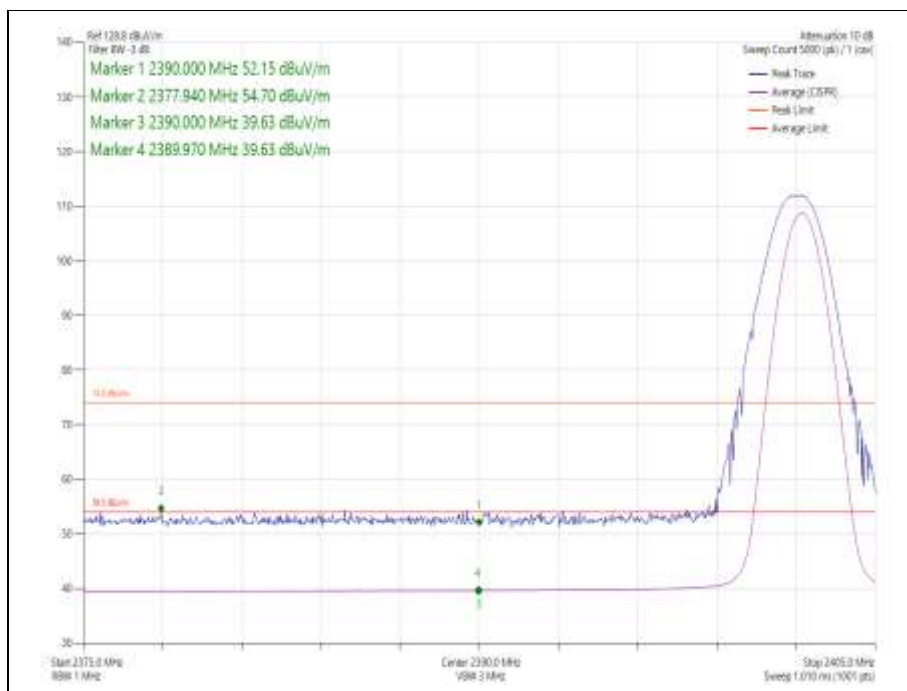


Figure 13 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

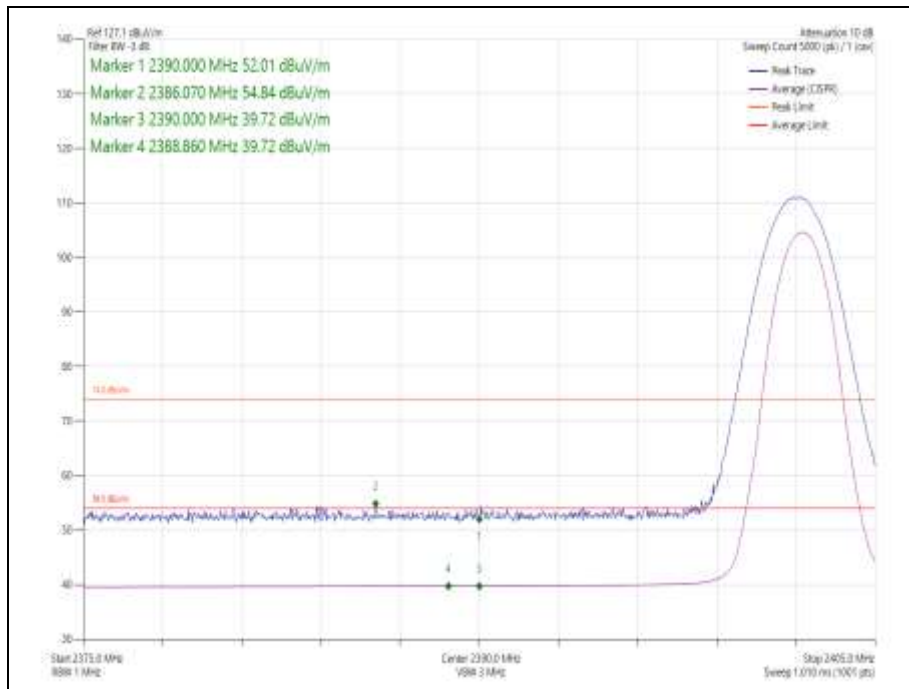


Figure 14 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

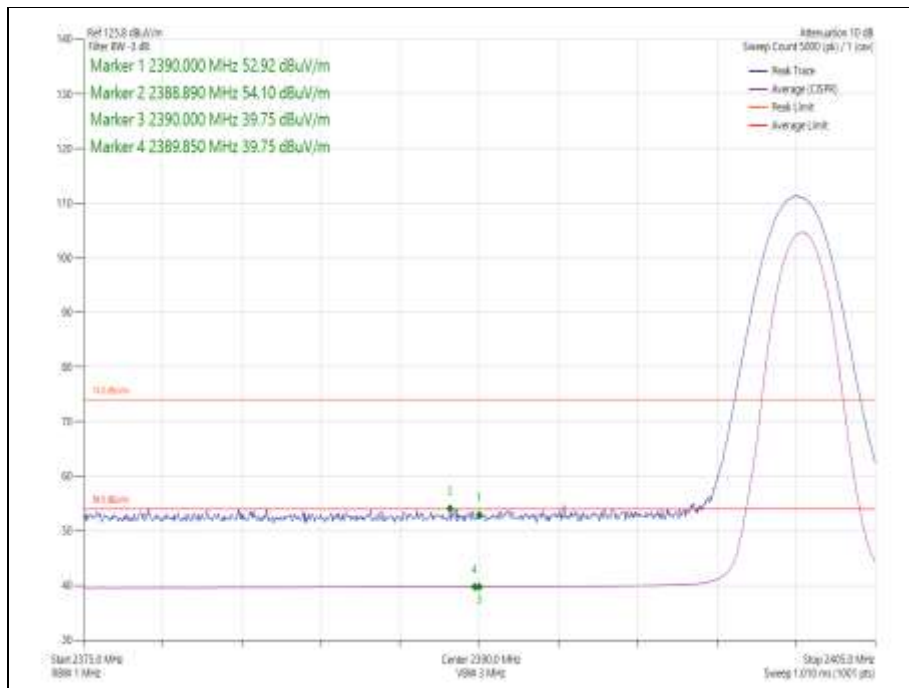


Figure 15 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

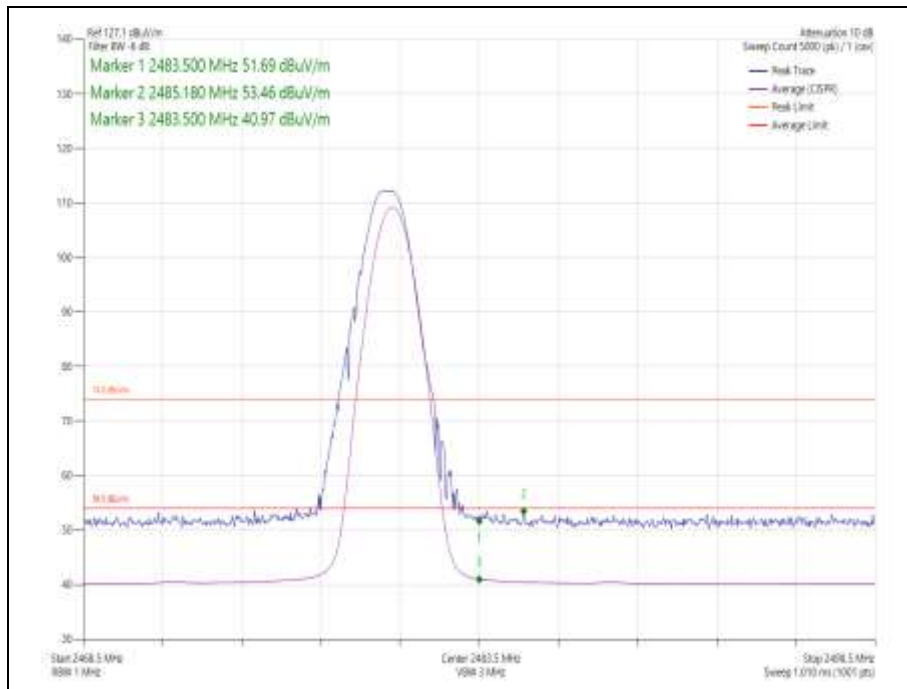


Figure 16 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

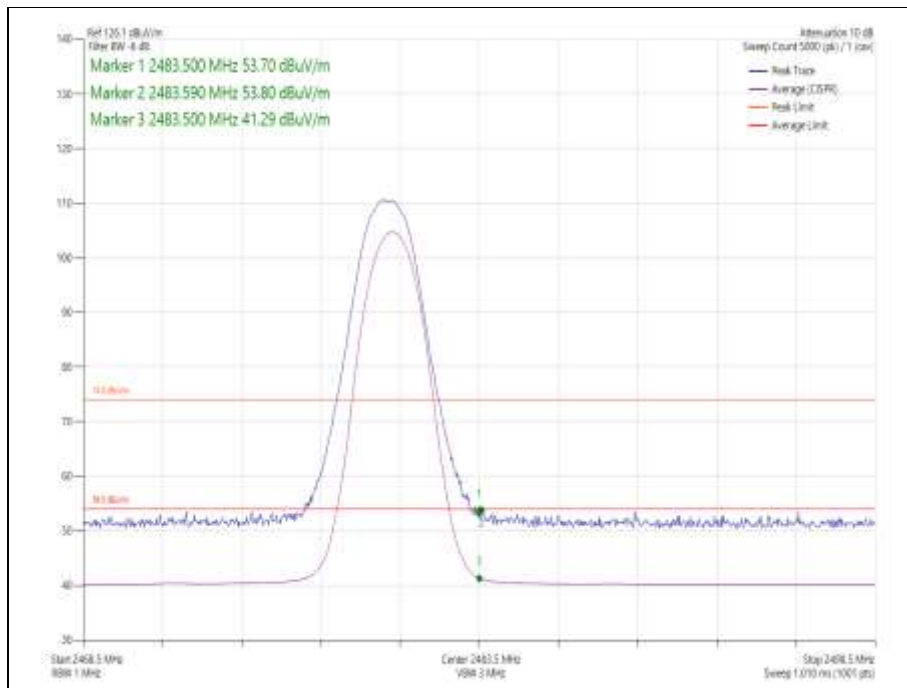


Figure 17 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

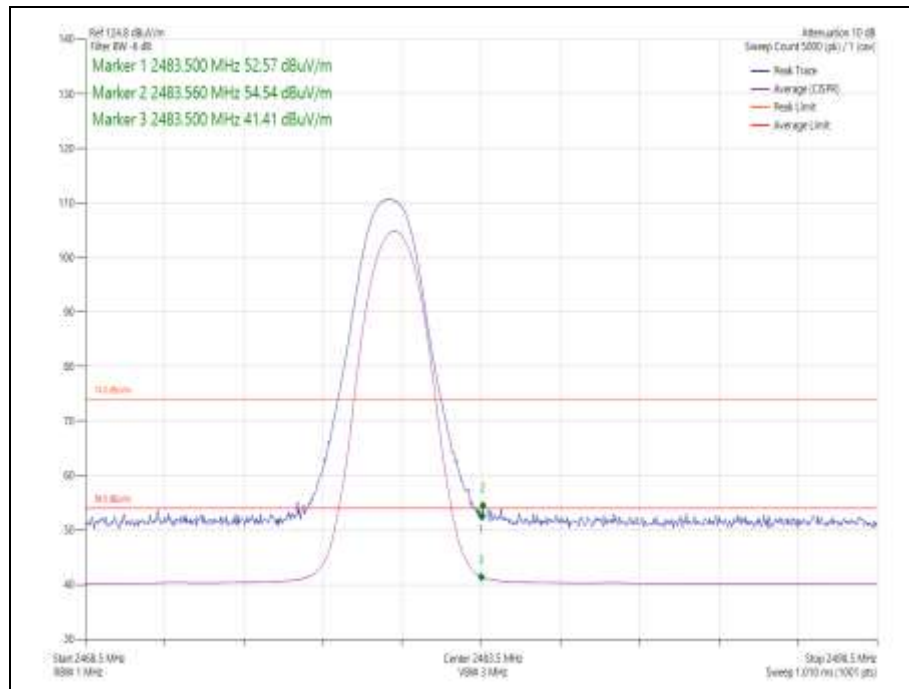


Figure 18 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth (FHSS)

iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	0-1	DH5	2402	2390.0	56.16	40.57
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2390.0	55.29	40.03
Static	8-DPSK	0-1	3DH5	2402	2390.0	55.60	40.07
Static	GFSK	0-1	DH5	2480	2483.5	59.51	43.25
Static	$\pi/4$ DQPSK	0-1	2DH5	2480	2483.5	59.82	43.25
Static	8-DPSK	0-1	3DH5	2480	2483.5	62.23	43.53

Table 9 - Restricted Band Edge Results

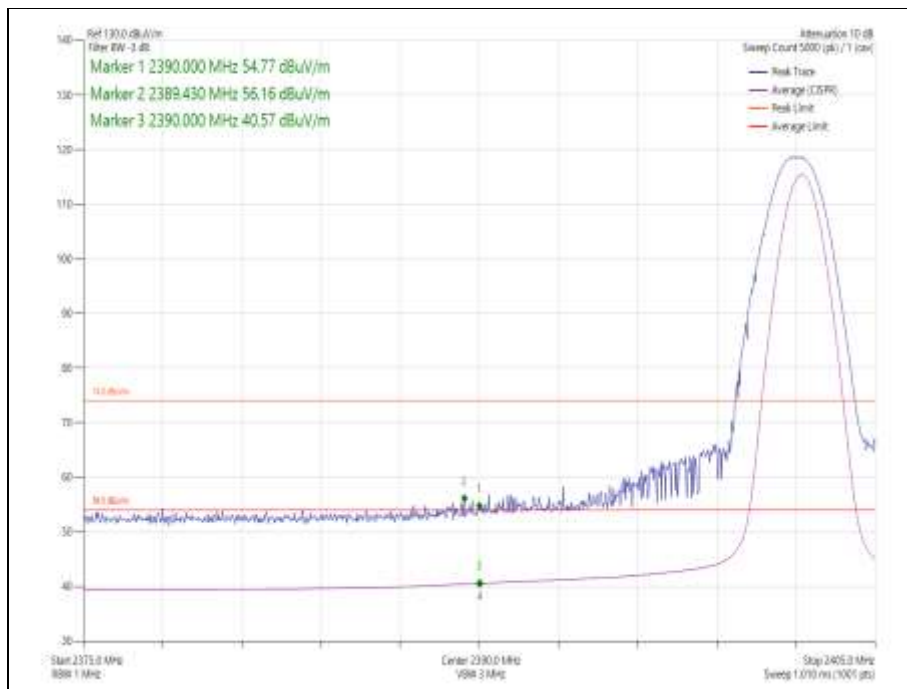


Figure 19 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

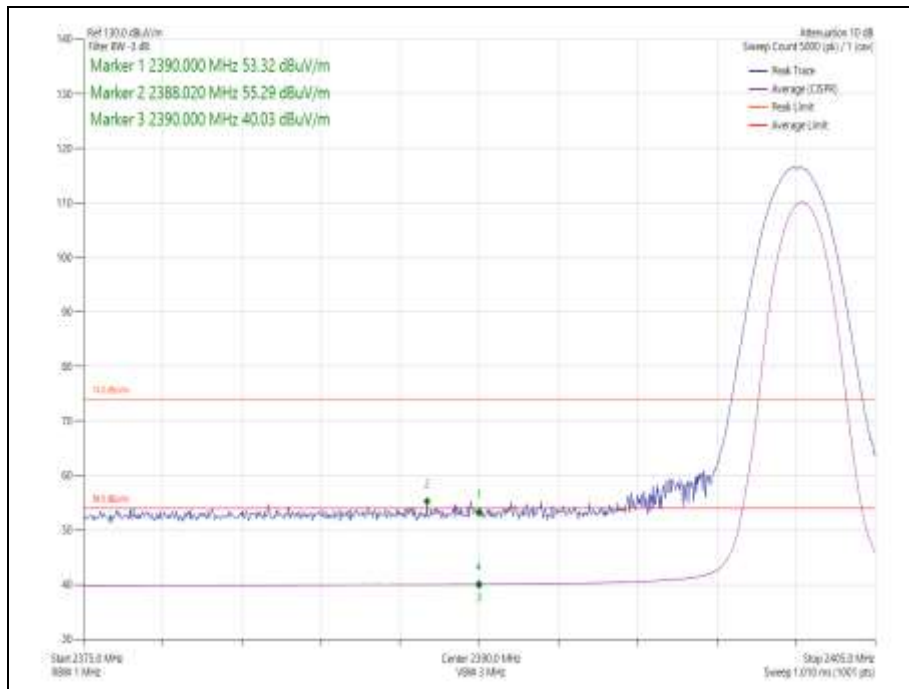


Figure 20 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

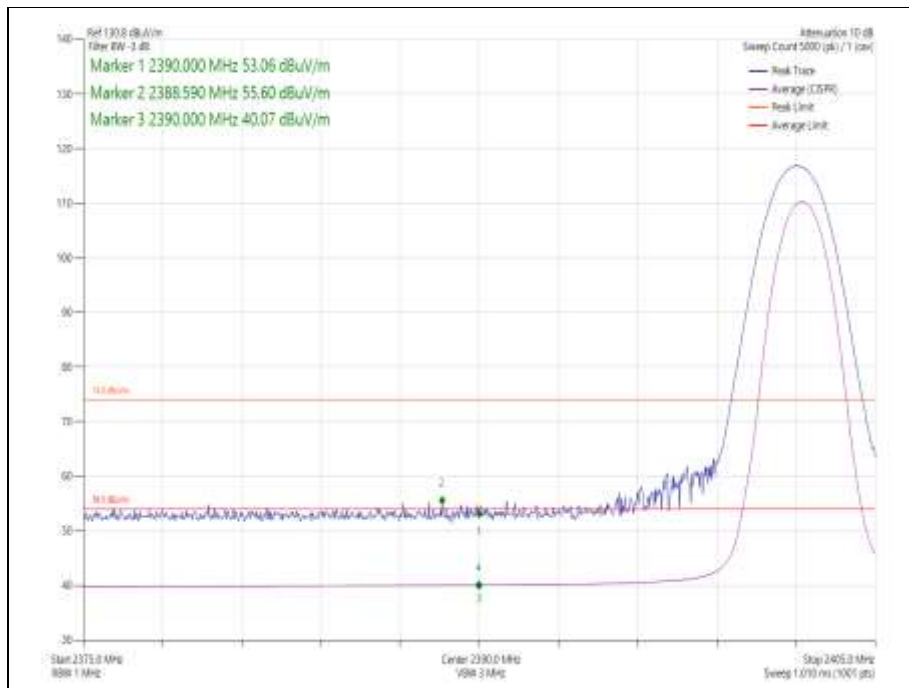


Figure 21 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

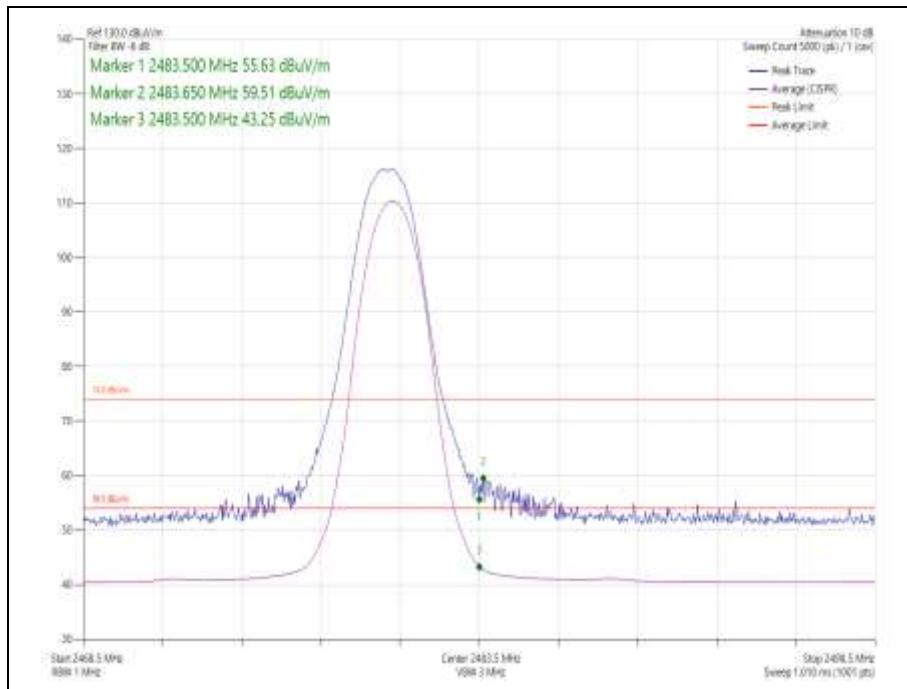


Figure 22 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

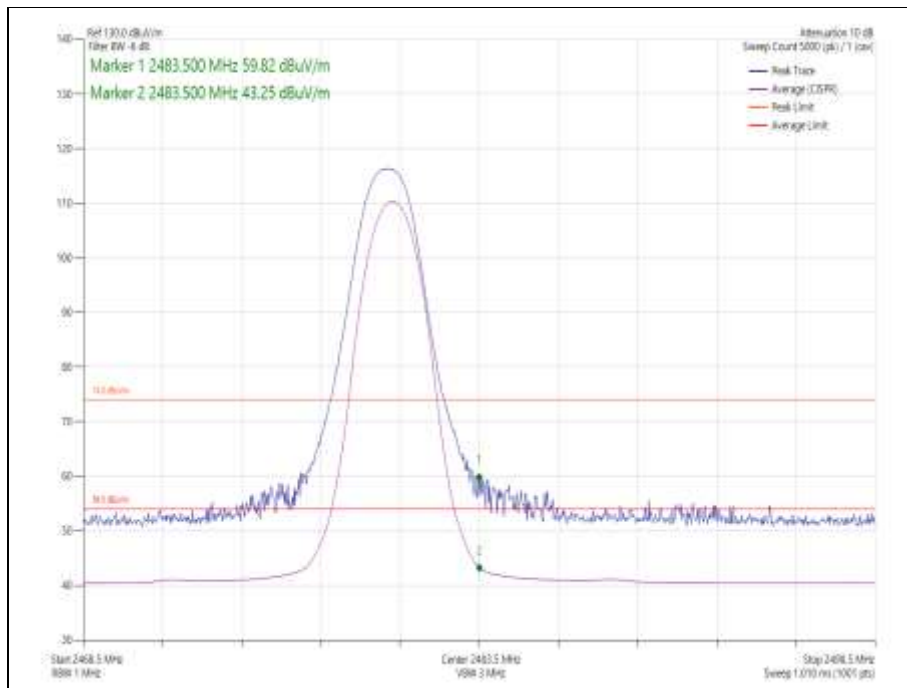


Figure 23 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

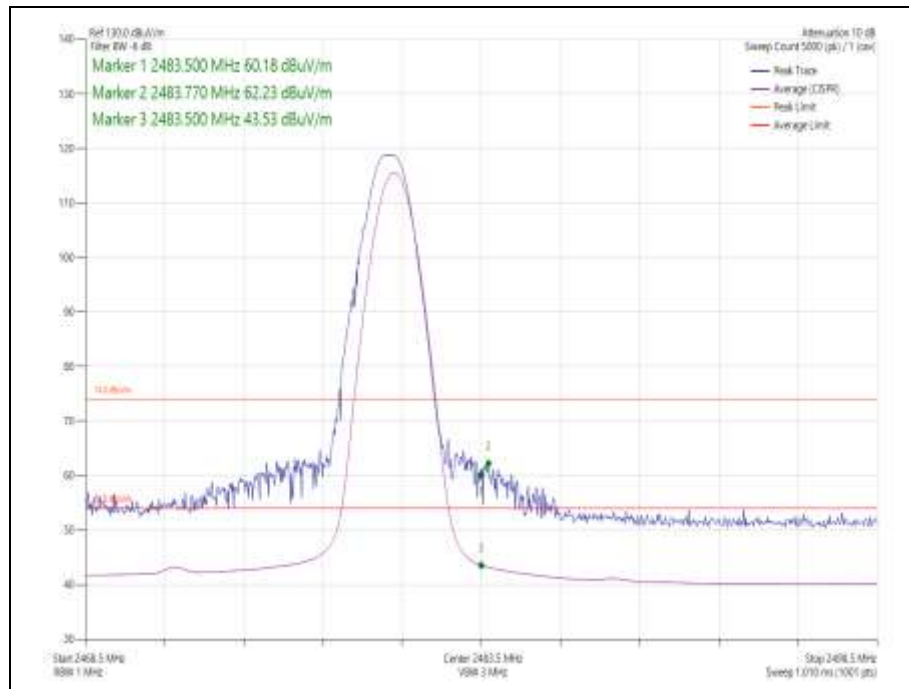


Figure 24 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth (FHSS)

ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	0-1	DH5	2402	2390.0	61.26	42.64
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2390.0	60.10	41.95
Static	8-DPSK	0-1	3DH5	2402	2390.0	61.62	41.84
Static	GFSK	0-1	DH5	2480	2483.5	67.17	47.44
Static	$\pi/4$ DQPSK	0-1	2DH5	2480	2483.5	66.44	46.50
Static	8-DPSK	0-1	3DH5	2480	2483.5	67.05	46.58

Table 10 - Restricted Band Edge Results

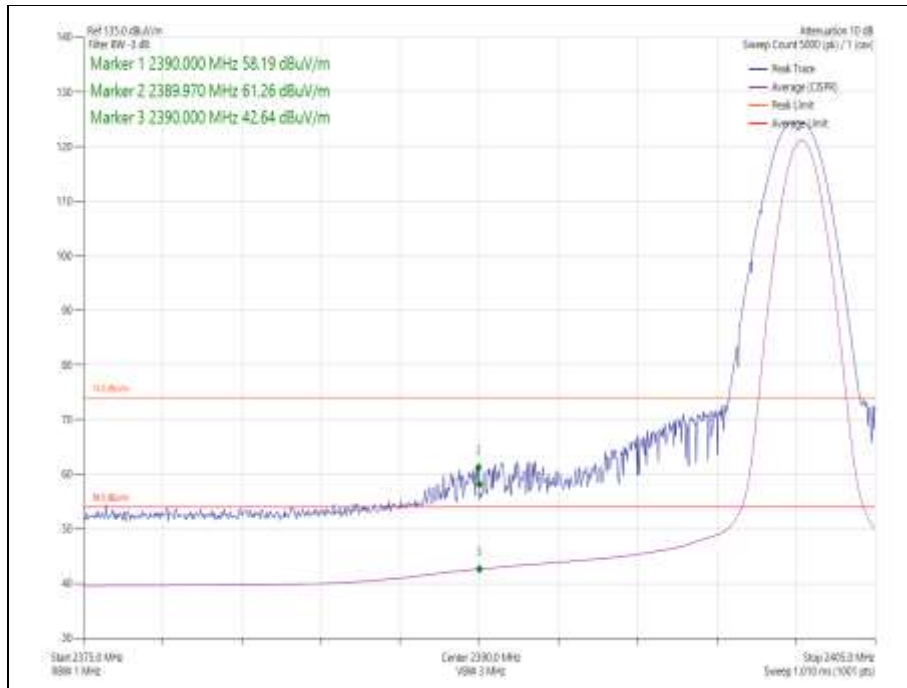


Figure 25 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

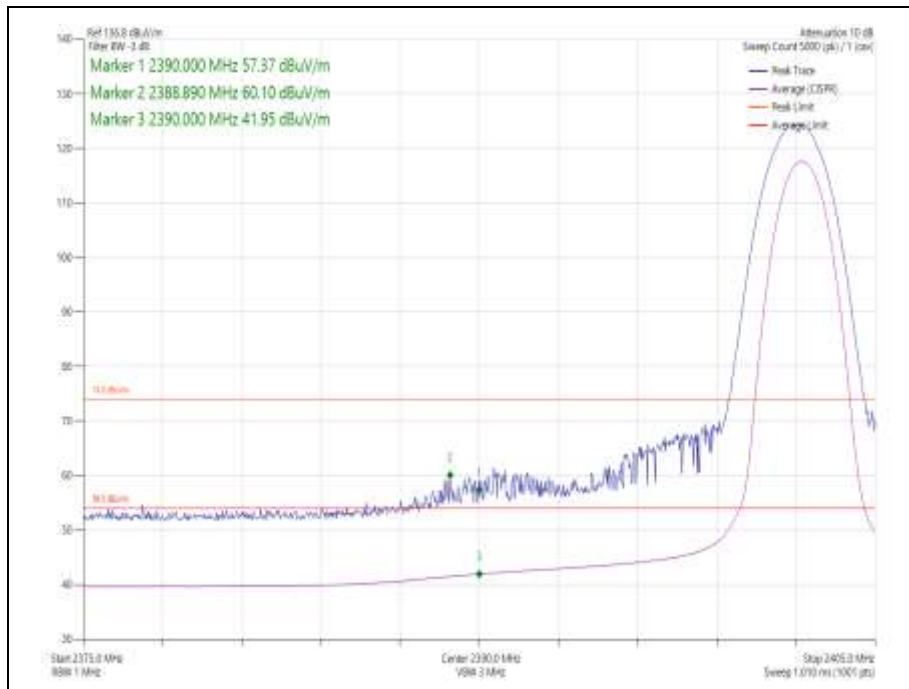


Figure 26 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

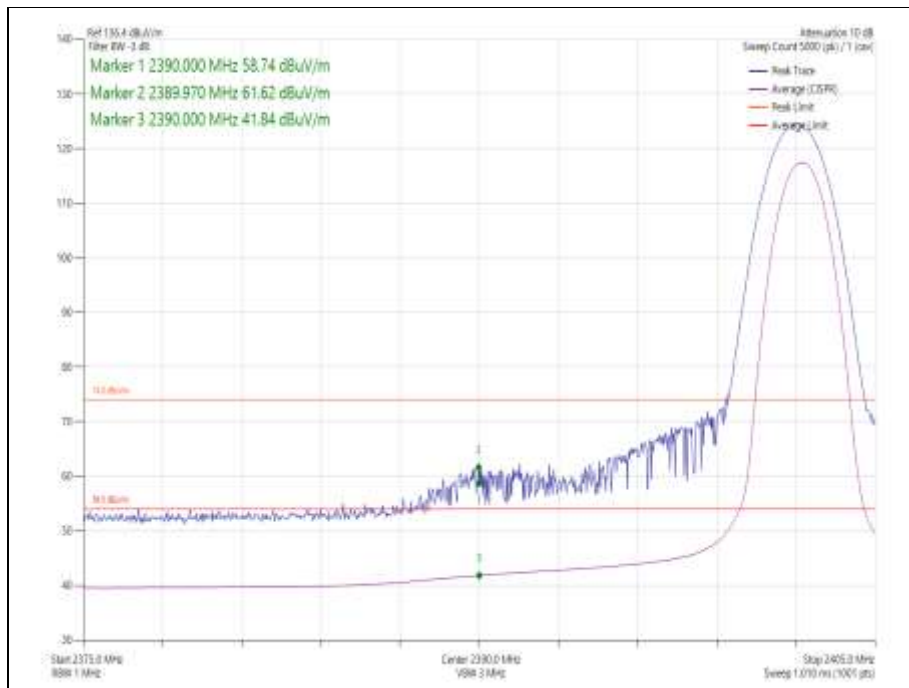


Figure 27 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

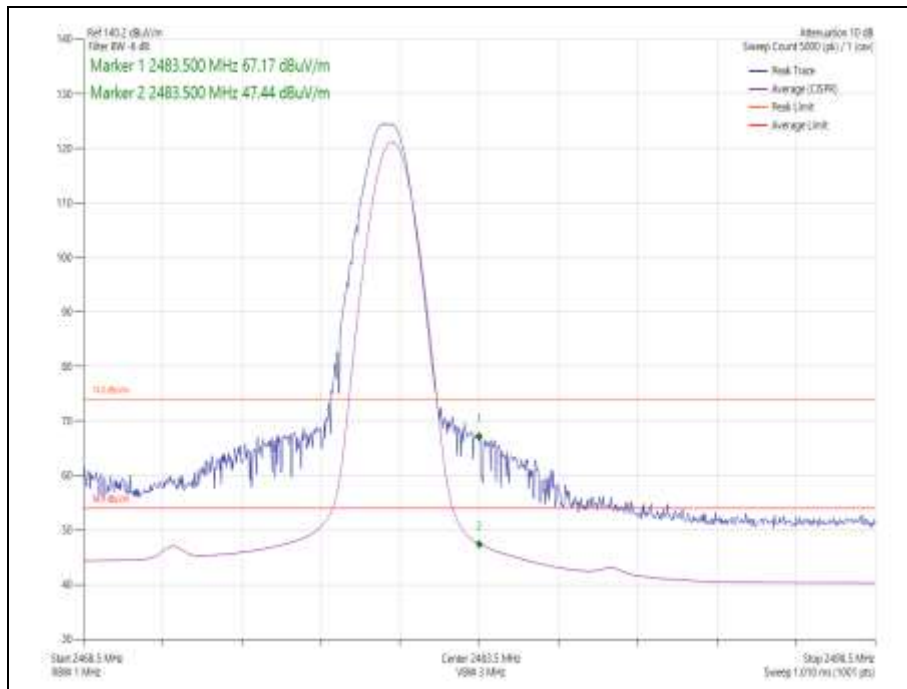


Figure 28 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

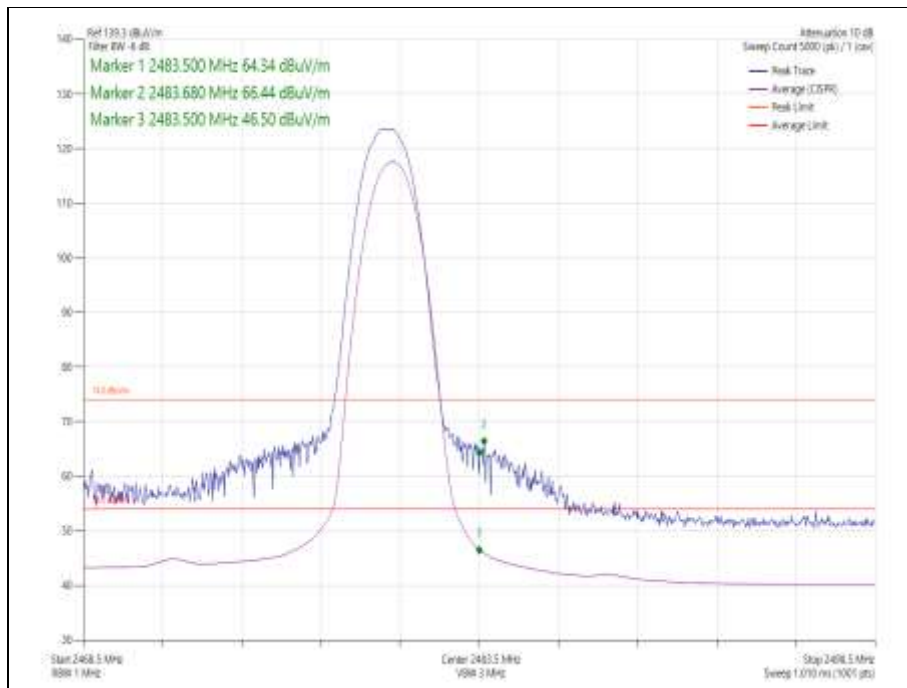


Figure 29 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

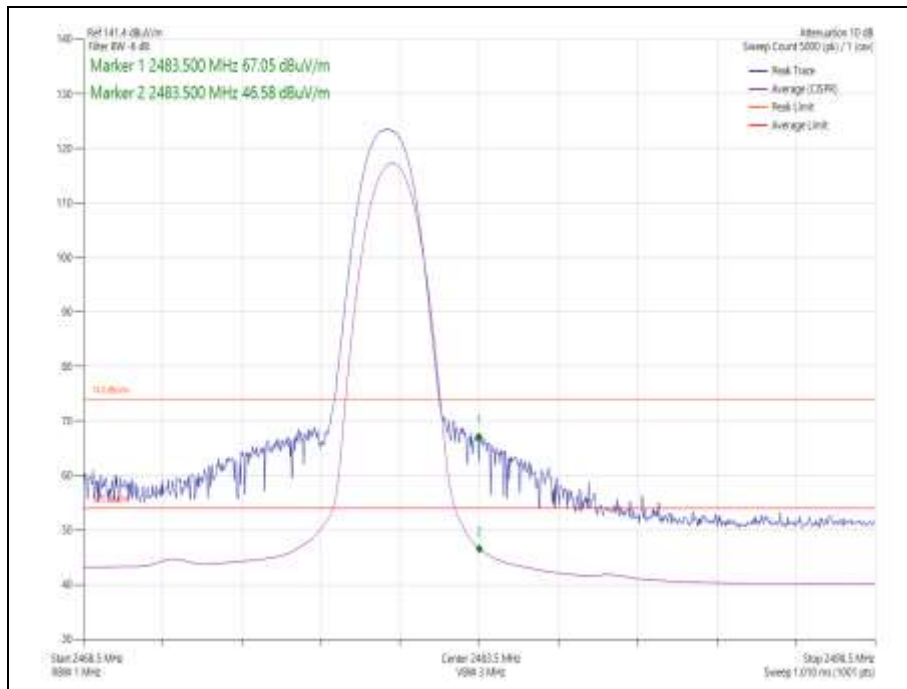


Figure 30 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

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 11

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 12

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



2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	08-Mar-2022
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	09-Jul-2022
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	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
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	01-Apr-2022
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021

Table 13

TU - Traceability Unscheduled



2.2 Frequency Hopping Systems - Average Time of Occupancy

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

A2442, S/N: XH2DGXFKY6 - Modification State 0

2.2.3 Date of Test

01-September-2021

2.2.4 Test Method

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

2.2.5 Environmental Conditions

Ambient Temperature	22.2 °C
Relative Humidity	51.9 %



2.2.6 Test Results

2.4 GHz Bluetooth - FHSS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.4
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.888	95	274.4	400.0

Table 14 - Time of Occupancy Results



Figure 31 - GFSK - 2402 MHz Accumulated Transmit Time



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.4
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.888	101	291.7	400.0

Table 15 - Time of Occupancy Results



Figure 32 - GFSK - 2402 MHz Accumulated Transmit Time



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.4
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.888	113	326.3	400.0

Table 16 - Time of Occupancy Results



Figure 33 - GFSK - 2402 MHz Accumulated Transmit Time

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.

Industry Canada 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.



2.2.7 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 Expires
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
AC Programmable Power Supply	iTech	IT7324	5225	-	AC Programmable Power Supply
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 17



2.3 Frequency Hopping Systems - Channel Separation

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

A2442, S/N: XH2DGXFKY6 - Modification State 0

2.3.3 Date of Test

01-September-2021

2.3.4 Test Method

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

2.3.5 Environmental Conditions

Ambient Temperature	22.2 °C
Relative Humidity	51.9 %



2.3.6 Test Results

2.4 GHz Bluetooth - FHSS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.855	2441.003	2442.003	1.000	≥570.0

Table 18 - Carrier Frequency Separation Results



Figure 34 - GFSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.325	2440.986	2441.986	1.000	≥ 883.3

Table 19 - Carrier Frequency Separation Results



Figure 35 - $\pi/4$ DQPSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.260	2440.994	2441.994	1.000	≥840.0

Table 20 - Carrier Frequency Separation Results



Figure 36 - 8-DPSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.855	2441.004	2442.004	1.000	≥570.0

Table 21 - Carrier Frequency Separation Results



Figure 37 - GFSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.325	2440.986	2441.985	0.999	≥ 883.3

Table 22 - Carrier Frequency Separation Results



Figure 38 - $\pi/4$ DQPSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.265	2440.993	2441.994	1.001	≥843.3

Table 23 - Carrier Frequency Separation Results



Figure 39 - 8-DPSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.855	2441.004	2442.004	1.000	≥620.6

Table 24 - Carrier Frequency Separation Results



Figure 40 - GFSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.325	2440.985	2441.985	1.000	≥ 883.3

Table 25 - Carrier Frequency Separation Results



Figure 41 - $\pi/4$ DQPSK - 2441 MHz (CH39)



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1) RSS-247 5.1 b)	Test Method(s):	C63.10 7.8.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.265	2440.993	2441.994	1.001	≥843.3

Table 26 - Carrier Frequency Separation Results



Figure 42 - 8-DPSK - 2441 MHz (CH39)



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.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	03-Dec-2021
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	03-Dec-2021
AC Programmable Power Supply	iTech	IT7324	5225	-	AC Programmable Power Supply
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 27



2.4 Frequency Hopping Systems - Number of Hopping Channels

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

A2442, S/N: XH2DGXFKY6 - Modification State 0

2.4.3 Date of Test

01-September-2021

2.4.4 Test Method

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

2.4.5 Environmental Conditions

Ambient Temperature	22.2 °C
Relative Humidity	51.9 %



2.4.6 Test Results

2.4 GHz Bluetooth - FHSS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.3
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Number of Hopping Frequencies	Limit
79	≥15.0

Table 28 - Number of Hopping Frequencies Results



Figure 43 - GFSK (DH5) - Number of Hopping Channels



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.3
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Number of Hopping Frequencies	Limit
79	≥15.0

Table 29 - Number of Hopping Frequencies Results



Figure 44 - GFSK (DH5) - Number of Hopping Channels



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247(a)(1)(iii) RSS-247 5.1 d)	Test Method(s):	C63.10 7.8.3
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Number of Hopping Frequencies	Limit
79	≥15.0

Table 30 - Number of Hopping Frequencies Results



Figure 45 - GFSK (DH5) - Number of Hopping Channels

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.



2.4.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	03-Dec-2021
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	03-Dec-2021
AC Programmable Power Supply	iTech	IT7324	5225	-	AC Programmable Power Supply
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 31



2.5 Frequency Hopping Systems - 20 dB Bandwidth

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1
ISED RSS-GEN, Clause 6.7

2.5.2 Equipment Under Test and Modification State

A2442, S/N: XH2DGXFKY6 - Modification State 0

2.5.3 Date of Test

07-September-2021 to 08-September-2021

2.5.4 Test Method

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

2.5.5 Environmental Conditions

Ambient Temperature	22.2 - 23.5 °C
Relative Humidity	45.0 - 66.9 %



2.5.6 Test Results

2.4 GHz Bluetooth - FHSS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	0.855	-	-	-
2441	0.855	-	-	-
2480	0.855	-	-	-

Table 32 - 20 dB Bandwidth Results



Figure 46 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 47 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 48 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	0.855	0.855	-	-
2441	0.855	0.855	-	-
2480	0.855	0.852	-	-

Table 33 - 20 dB Bandwidth Results



Figure 49 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 50 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 51 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 52 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 53 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 54 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.330	-	-	-
2441	1.325	-	-	-
2480	1.330	-	-	-

Table 34 - 20 dB Bandwidth Results



Figure 55 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 56 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 57 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.260	-	-	-
2441	1.260	-	-	-
2480	1.260	-	-	-

Table 35 - 20 dB Bandwidth Results



Figure 58 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 59 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 60 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.330	1.330	-	-
2441	1.325	1.325	-	-
2480	1.330	1.330	-	-

Table 36 - 20 dB Bandwidth Results



Figure 61 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 62 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 63 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 64 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 65 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 66 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.260	1.260	-	-
2441	1.260	1.260	-	-
2480	1.260	1.265	-	-

Table 37 - 20 dB Bandwidth Results



Figure 67 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 68 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 69 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 70 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 71 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 72 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	0.855	-	-	-
2441	0.855	-	-	-
2480	0.855	-	-	-

Table 38 - 20 dB Bandwidth Results



Figure 73 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 74 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 75 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	-	-	0.855	-
2441	-	-	0.855	-
2480	-	-	0.855	-

Table 39 - 20 dB Bandwidth Results



Figure 76 - Core 2 (C) 2402 MHz (CH0) 20 dB Bandwidth



Figure 77 - Core 2 (C) 2441 MHz (CH39) 20 dB Bandwidth



Figure 78 - Core 2 (C) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	0.855	0.855	-	-
2441	0.852	0.855	-	-
2480	0.858	0.858	-	-

Table 40 - 20 dB Bandwidth Results



Figure 79 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 80 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 81 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 82 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 83 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 84 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.325	-	-	-
2441	1.325	-	-	-
2480	1.325	-	-	-

Table 41 - 20 dB Bandwidth Results



Figure 85 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 86 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 87 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.260	-	-	-
2441	1.265	-	-	-
2480	1.260	-	-	-

Table 42 - 20 dB Bandwidth Results



Figure 88 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 89 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 90 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	-	-	1.325	-
2441	-	-	1.325	-
2480	-	-	1.325	-

Table 43 - 20 dB Bandwidth Results



Figure 91 - Core 2 (C) 2402 MHz (CH0) 20 dB Bandwidth



Figure 92 - Core 2 (C) 2441 MHz (CH39) 20 dB Bandwidth



Figure 93 - Core 2 (C) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	-	-	1.260	-
2441	-	-	1.260	-
2480	-	-	1.260	-

Table 44 - 20 dB Bandwidth Results



Figure 94 - Core 2 (C) 2402 MHz (CH0) 20 dB Bandwidth



Figure 95 - Core 2 (C) 2441 MHz (CH39) 20 dB Bandwidth



Figure 96 - Core 2 (C) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.325	1.325	-	-
2441	1.330	1.325	-	-
2480	1.325	1.325	-	-

Table 45 - 20 dB Bandwidth Results



Figure 97 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 98 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 99 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 100 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 101 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 102 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	FCC 15.247 (a)(1) RSS-247 5.1	Test Method(s):	C63.10 6.9.2
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)			
	A	B	C	D
2402	1.260	1.260	-	-
2441	1.265	1.265	-	-
2480	1.260	1.260	-	-

Table 46 - 20 dB Bandwidth Results



Figure 103 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth



Figure 104 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 105 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth



Figure 106 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 107 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth



Figure 108 - Core 1 (B) 2480 MHz (CH78) 20 dB Bandwidth

FCC 47 CFR Part 15 and ISED RSS-247 Limit Clause

None specified.



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 Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	03-Dec-2021
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	03-Dec-2021
AC Programmable Power Supply	iTech	IT7324	5225	-	AC Programmable Power Supply
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 47



2.6 Maximum Conducted Output Power

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

A2442, S/N: XH2DGXFKY6 - Modification State 0

2.6.3 Date of Test

07-September-2021 to 08-September-2021

2.6.4 Test Method

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

MIMO output port summing was performed in accordance with KDB 662911 D01.

2.6.5 Environmental Conditions

Ambient Temperature	22.2 - 23.5 °C
Relative Humidity	45.0 - 66.9 %



2.6.6 Test Results

2.4 GHz Bluetooth - FHSS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	12.92	-	-	-	-	28.40	-15.48
2441	12.99	-	-	-	-	28.40	-15.41
2480	12.96	-	-	-	-	28.40	-15.44

Table 48 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	12.92	-	-	-	-	30.00	-17.08	20.52	36.00	-15.48
2441	12.99	-	-	-	-	30.00	-17.01	20.59	36.00	-15.41
2480	12.96	-	-	-	-	30.00	-17.04	20.56	36.00	-15.44

Table 49 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	ePA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	13.30	13.17	-	-	16.20	25.83	-9.62
2441	13.30	13.10	-	-	16.19	25.83	-9.63
2480	12.95	12.83	-	-	15.88	25.83	-9.95

Table 50 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	13.30	13.17	-	-	16.20	30.00	-13.80	26.38	36.00	-9.62
2441	13.30	13.10	-	-	16.19	30.00	-13.81	26.37	36.00	-9.63
2480	12.95	12.83	-	-	15.88	30.00	-14.12	26.05	36.00	-9.95

Table 51 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	76.8
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	18.92	-	-	-	-	28.40	-9.48
2441	19.18	-	-	-	-	28.40	-9.22
2480	19.04	-	-	-	-	28.40	-9.36

Table 52 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	18.92	-	-	-	-	30.00	-11.08	26.52	36.00	-9.48
2441	19.18	-	-	-	-	30.00	-10.82	26.78	36.00	-9.22
2480	19.04	-	-	-	-	30.00	-10.96	26.64	36.00	-9.36

Table 53 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	76.9
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	19.74	-	-	-	-	28.40	-8.66
2441	19.77	-	-	-	-	28.40	-8.63
2480	19.54	-	-	-	-	28.40	-8.86

Table 54 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	19.74	-	-	-	-	30.00	-10.26	27.34	36.00	-8.66
2441	19.77	-	-	-	-	30.00	-10.23	27.37	36.00	-8.63
2480	19.54	-	-	-	-	30.00	-10.46	27.14	36.00	-8.86

Table 55 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	ePA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	77.1
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	16.01	15.87	-	-	18.94	25.83	-6.89
2441	15.81	15.41	-	-	18.61	25.83	-7.22
2480	16.01	15.67	-	-	18.83	25.83	-6.99

Table 56 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	16.01	15.87	-	-	18.94	30.00	-11.06	29.11	36.00	-6.89
2441	15.81	15.41	-	-	18.61	30.00	-11.39	28.78	36.00	-7.22
2480	16.01	15.67	-	-	18.83	30.00	-11.17	29.01	36.00	-6.99

Table 57 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	76.9
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	16.15	16.09	-	-	19.07	25.83	-6.75
2441	16.39	16.11	-	-	19.21	25.83	-6.61
2480	16.59	16.24	-	-	19.39	25.83	-6.44

Table 58 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	16.15	16.09	-	-	19.07	30.00	-10.93	29.25	36.00	-6.75
2441	16.39	16.11	-	-	19.21	30.00	-10.79	29.39	36.00	-6.61
2480	16.59	16.24	-	-	19.39	30.00	-10.61	29.56	36.00	-6.44

Table 59 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	13.42	-	-	-	-	28.40	-14.98
2441	12.98	-	-	-	-	28.40	-15.42
2480	12.96	-	-	-	-	28.40	-15.44

Table 60 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	13.42	-	-	-	-	30.00	-16.58	21.02	36.00	-14.98
2441	12.98	-	-	-	-	30.00	-17.02	20.58	36.00	-15.42
2480	12.96	-	-	-	-	30.00	-17.04	20.56	36.00	-15.44

Table 61 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	6.10

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	13.06	-	-	29.90	-16.84
2441	-	-	12.98	-	-	29.90	-16.92
2480	-	-	13.19	-	-	29.90	-16.71

Table 62 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	-	-	13.06	-	-	30.00	-16.94	19.16	36.00	-16.84
2441	-	-	12.98	-	-	30.00	-17.02	19.08	36.00	-16.92
2480	-	-	13.19	-	-	30.00	-16.81	19.29	36.00	-16.71

Table 63 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	iPA GFSK (DH5)	Duty Cycle (%):	76.7
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	13.25	13.12	-	-	16.17	25.83	-9.65
2441	13.32	13.05	-	-	16.16	25.83	-9.66
2480	12.90	12.74	-	-	15.81	25.83	-10.02

Table 64 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	13.25	13.12	-	-	16.17	30.00	-13.83	26.35	36.00	-9.65
2441	13.32	13.05	-	-	16.16	30.00	-13.84	26.34	36.00	-9.66
2480	12.90	12.74	-	-	15.81	30.00	-14.19	25.98	36.00	-10.02

Table 65 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	77.1
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	12.09	-	-	-	-	28.40	-16.31
2441	11.69	-	-	-	-	28.40	-16.71
2480	11.80	-	-	-	-	28.40	-16.60

Table 66 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	12.09	-	-	-	-	30.00	-17.91	19.69	36.00	-16.31
2441	11.69	-	-	-	-	30.00	-18.31	19.29	36.00	-16.71
2480	11.80	-	-	-	-	30.00	-18.20	19.40	36.00	-16.60

Table 67 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	76.9
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	7.60

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	12.47	-	-	-	-	28.40	-15.93
2441	12.11	-	-	-	-	28.40	-16.29
2480	12.23	-	-	-	-	28.40	-16.17

Table 68 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	12.47	-	-	-	-	30.00	-17.53	20.07	36.00	-15.93
2441	12.11	-	-	-	-	30.00	-17.89	19.71	36.00	-16.29
2480	12.23	-	-	-	-	30.00	-17.77	19.83	36.00	-16.17

Table 69 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	76.8
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	6.10

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	11.77	-	-	29.90	-18.13
2441	-	-	11.60	-	-	29.90	-18.30
2480	-	-	11.82	-	-	29.90	-18.08

Table 70 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	-	-	11.77	-	-	30.00	-18.23	17.87	36.00	-18.13
2441	-	-	11.60	-	-	30.00	-18.40	17.70	36.00	-18.30
2480	-	-	11.82	-	-	30.00	-18.18	17.92	36.00	-18.08

Table 71 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	76.9
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	C (Core 2)	Peak Antenna Gain (dBi):	6.10

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	12.18	-	-	29.90	-17.72
2441	-	-	12.00	-	-	29.90	-17.90
2480	-	-	12.22	-	-	29.90	-17.68

Table 72 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	-	-	12.18	-	-	30.00	-17.82	18.28	36.00	-17.72
2441	-	-	12.00	-	-	30.00	-18.00	18.10	36.00	-17.90
2480	-	-	12.22	-	-	30.00	-17.78	18.32	36.00	-17.68

Table 73 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	iPA $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	76.8
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	11.87	12.06	-	-	14.94	25.83	-10.89
2441	11.73	11.53	-	-	14.59	25.83	-11.23
2480	11.86	11.66	-	-	14.75	25.83	-11.08

Table 74 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	11.87	12.06	-	-	14.94	30.00	-15.06	25.11	36.00	-10.89
2441	11.73	11.53	-	-	14.59	30.00	-15.41	24.77	36.00	-11.23
2480	11.86	11.66	-	-	14.75	30.00	-15.25	24.92	36.00	-11.08

Table 75 - ISED Maximum Conducted (peak) Output Power Results



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (b)(1) RSS-247 5.4 b)	Test Method(s):	C63.10 7.8.5
Additional Reference(s):	662911 D01 v02r01 F)2)d)(i), 662911 D01 v02r01 E)1)		

DUT Configuration			
Mode:	iPA 8-DPSK (3-DH5)	Duty Cycle (%):	76.9
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	10.17

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	12.39	12.58	-	-	15.47	25.83	-10.36
2441	12.16	12.01	-	-	15.07	25.83	-10.76
2480	12.25	12.20	-	-	15.20	25.83	-10.63

Table 76 - FCC Maximum Conducted (peak) Output Power Results

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	A	B	C	D	Σ					
2402	12.39	12.58	-	-	15.47	30.00	-14.53	25.64	36.00	-10.36
2441	12.16	12.01	-	-	15.07	30.00	-14.93	25.24	36.00	-10.76
2480	12.25	12.20	-	-	15.20	30.00	-14.80	25.37	36.00	-10.63

Table 77 - ISED Maximum Conducted (peak) Output Power Results

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

ISED RSS-247, Limit Clause 5.4 (b)

For DTs 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.



2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Iso-tech	IDM101	2421	12	30-Oct-2021
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
AC Programmable Power Supply	iTech	IT7324	5225	-	O/P Mon
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022
USB Power Sensor	Boonton	RTP5008	5830	12	10-May-2022
USB Power Sensor	Boonton	RTP5008	5832	12	10-May-2022
USB Power Sensor	Boonton	RTP5008	5833	12	10-May-2022

Table 78

O/P Mon – Output Monitored using calibrated equipment



2.7 Spurious Radiated Emissions

2.7.1 Specification Reference

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

2.7.2 Equipment Under Test and Modification State

A2442, S/N: DNQHW6Y3WY - Modification State 0

2.7.3 Date of Test

03-August-2021 to 07-August-2021

2.7.4 Test Method

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

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. One port of each type was loaded with a suitable ancillary/accessory.

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

The plots shown are the characterisation of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

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

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

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

In the 30 MHz to 1 GHz range pre-scans were only performed on the main radio mid channel (2441 MHz).

2.7.5 Example Test Setup Diagram

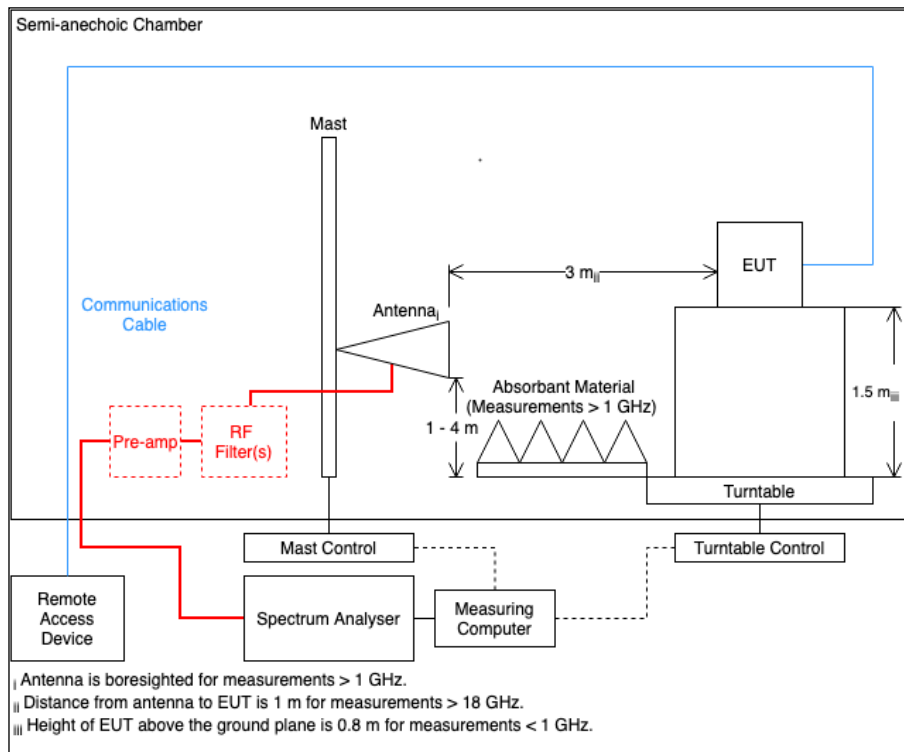


Figure 109

2.7.6 Environmental Conditions

Ambient Temperature 20.8 - 23.4 °C
 Relative Humidity 50.5 - 60.9 %



2.7.7 Test Results

2.4 GHz Bluetooth - FHSS

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

Table 79 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

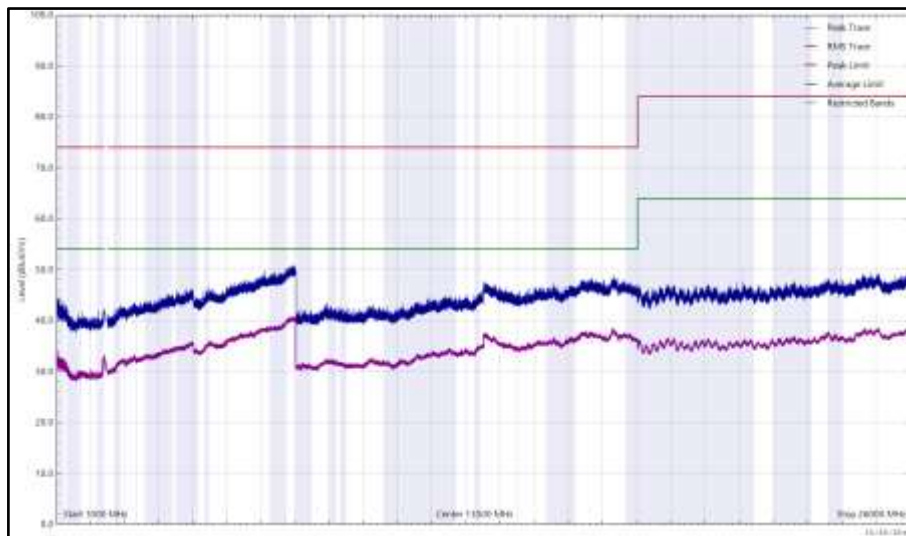


Figure 110 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

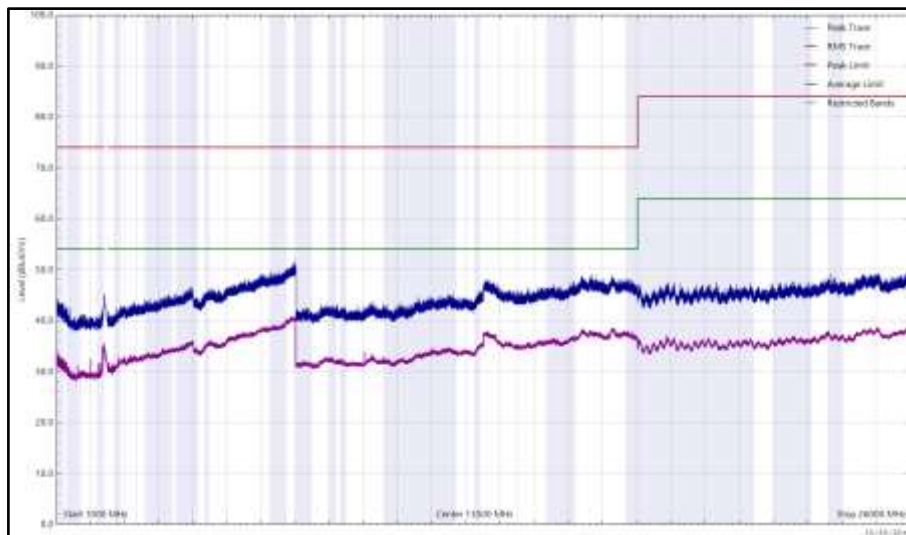


Figure 111 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 80 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

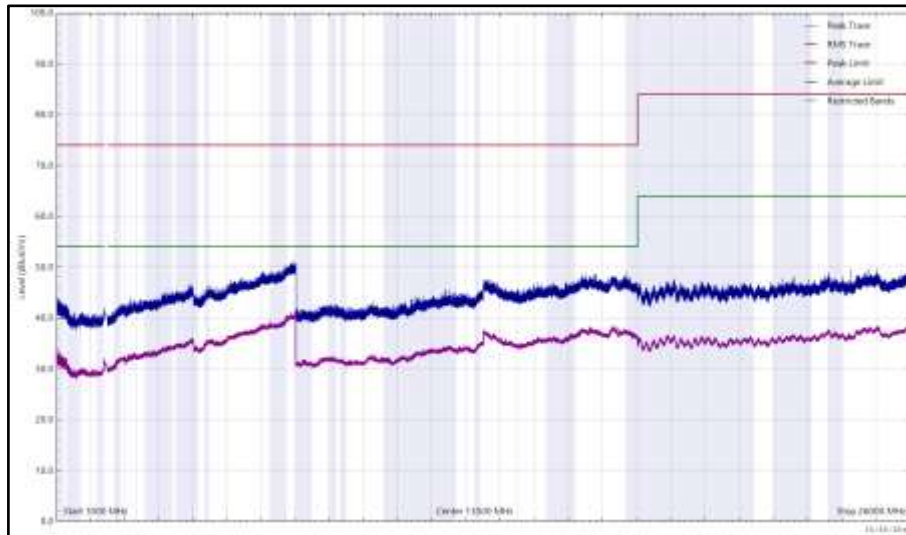


Figure 112 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

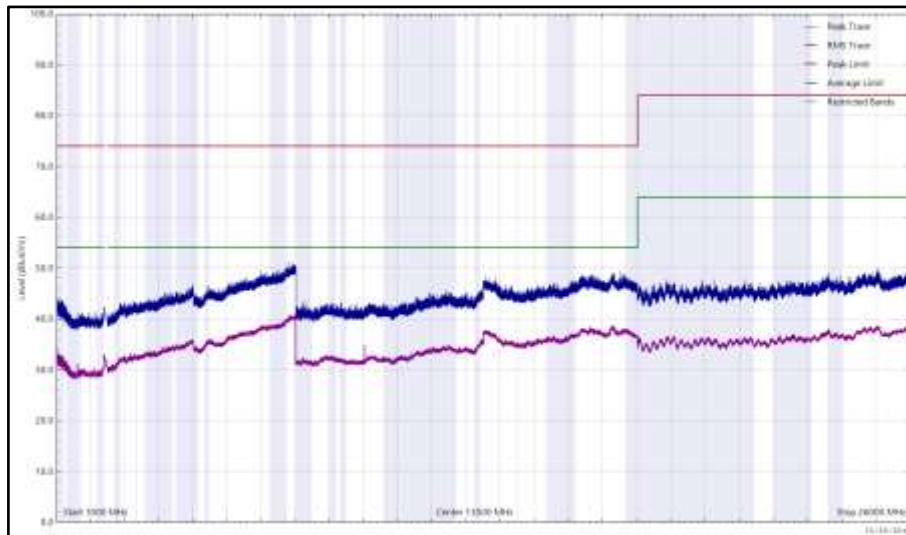


Figure 113 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical



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

Table 81 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

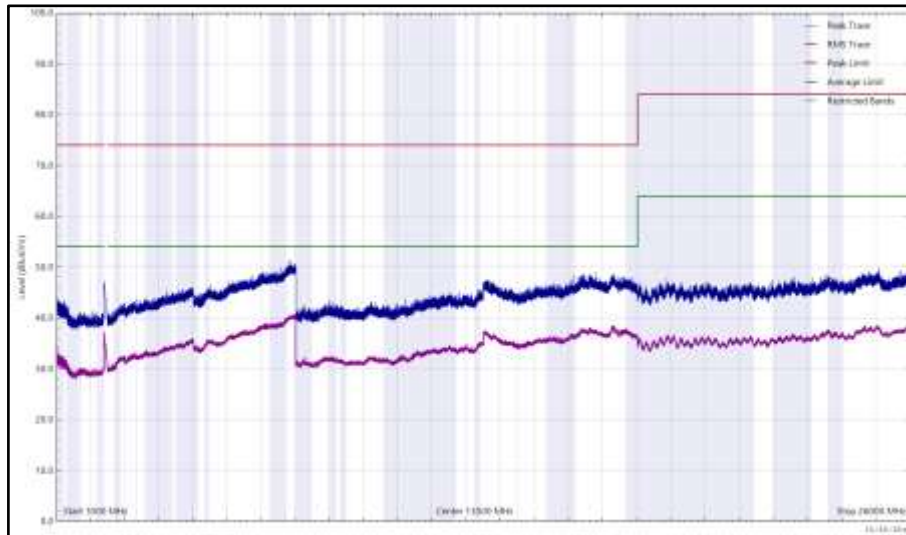


Figure 114 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

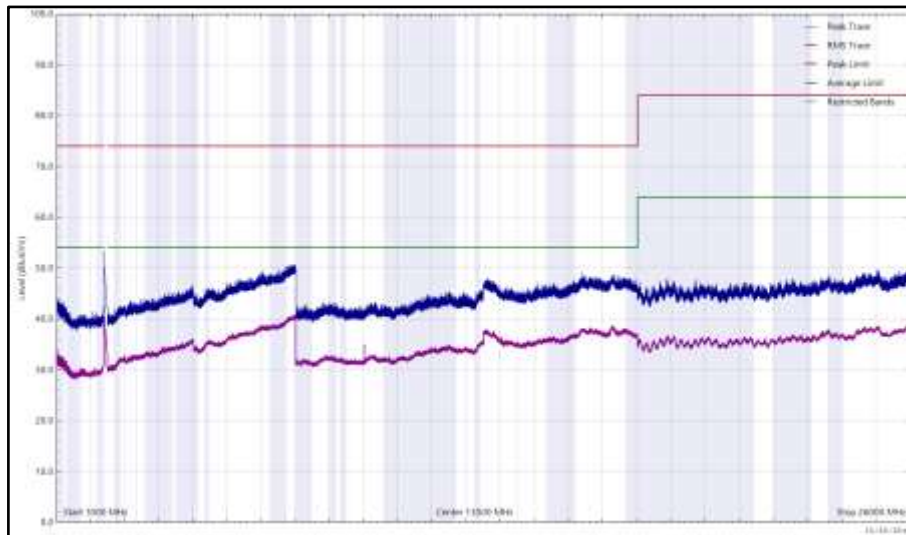


Figure 115 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 82 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

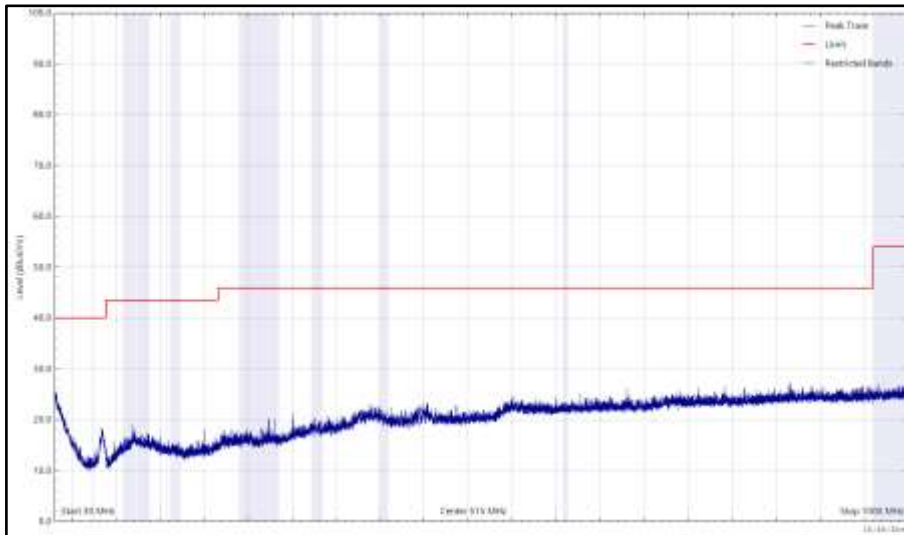


Figure 116 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 1 GHz, Horizontal (Peak)

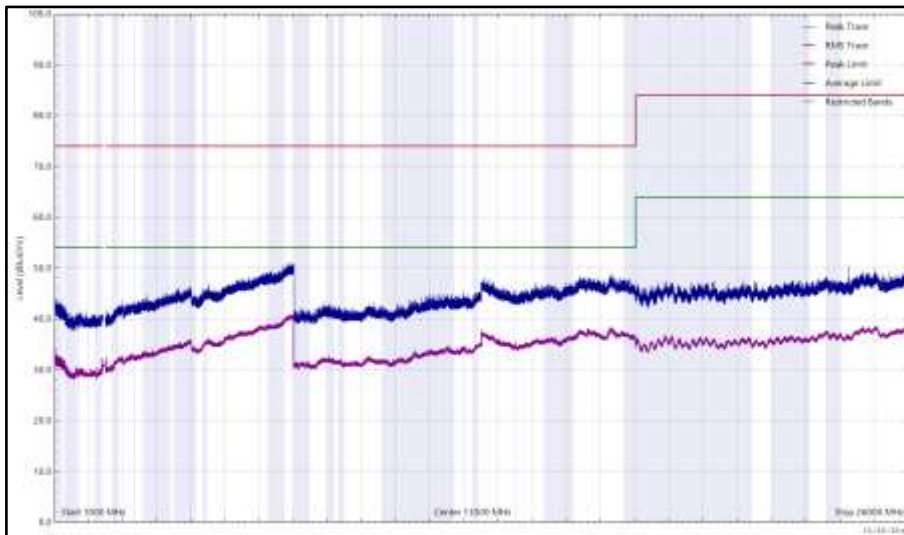


Figure 117 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

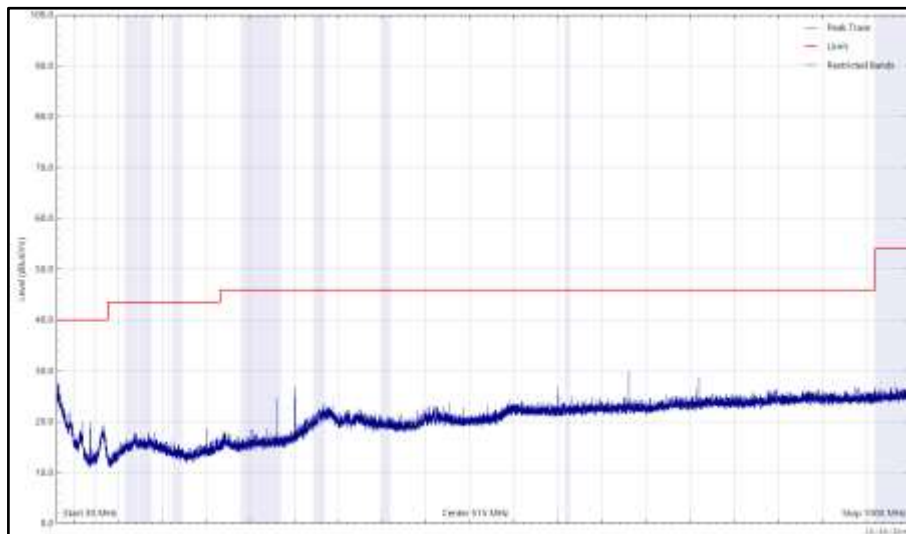


Figure 118 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 1 GHz, Vertical (Peak)

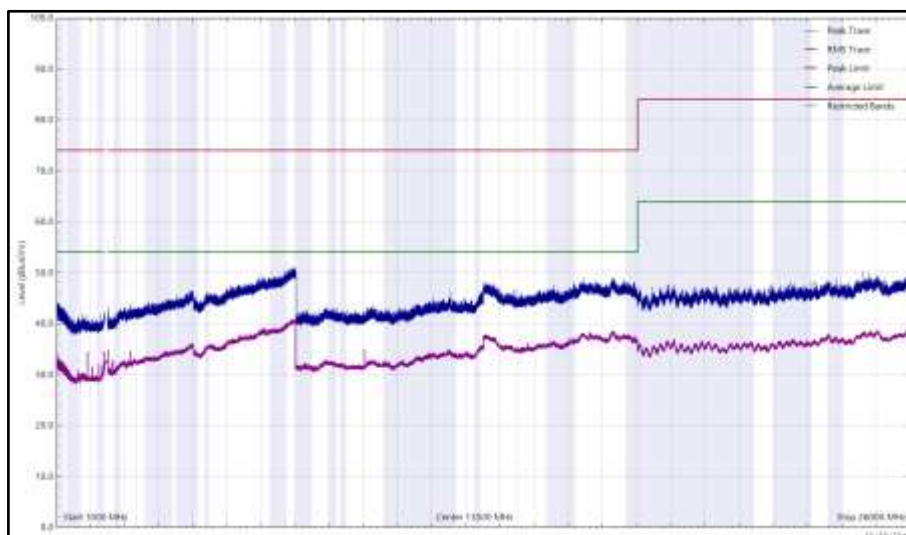


Figure 119 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 83 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

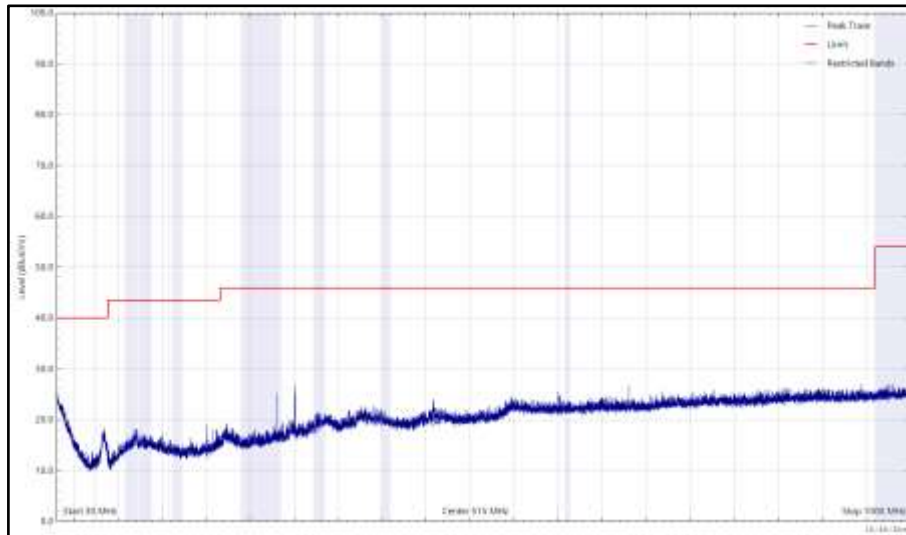


Figure 120 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 1 GHz, Horizontal (Peak)

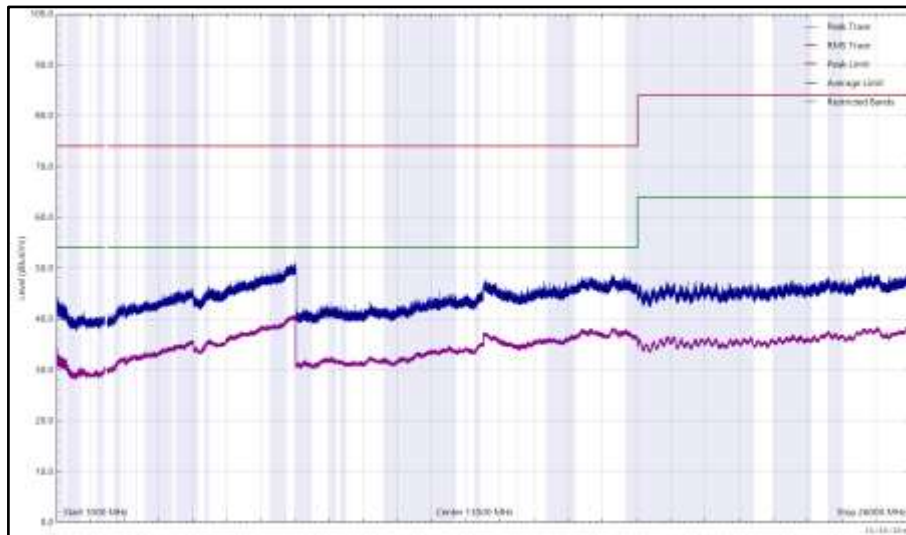


Figure 121 - 2441 MHz (CH39), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

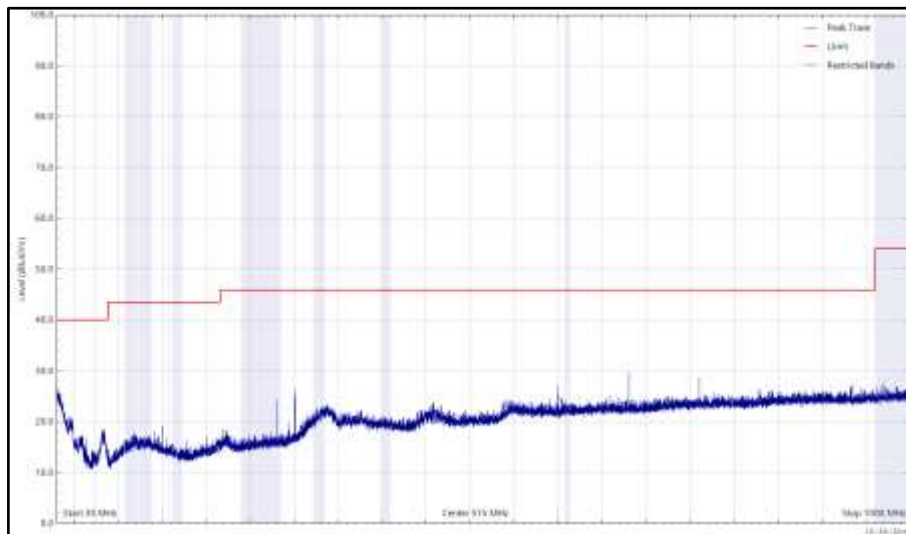


Figure 122 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 1 GHz, Vertical (Peak)

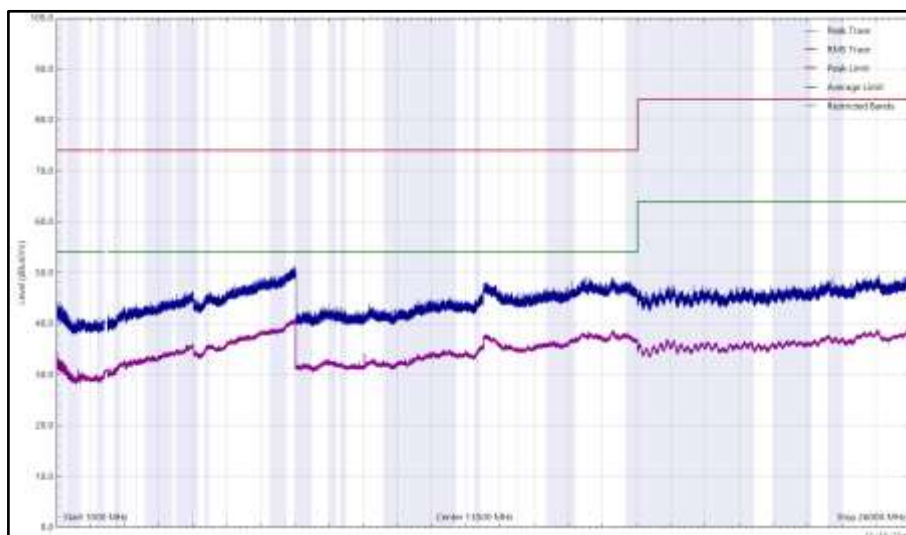


Figure 123 - 2441 MHz (CH39), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical



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

Table 84 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

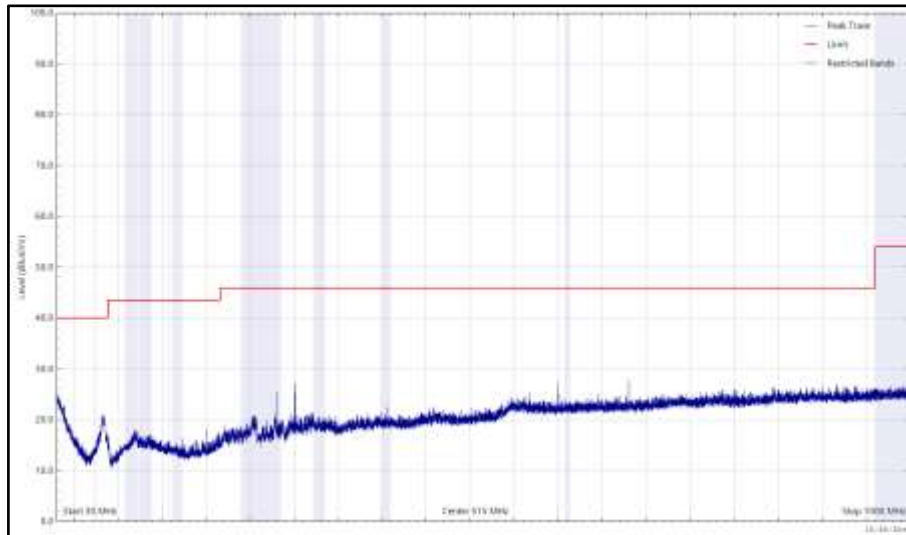


Figure 124 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 1 GHz, Horizontal (Peak)

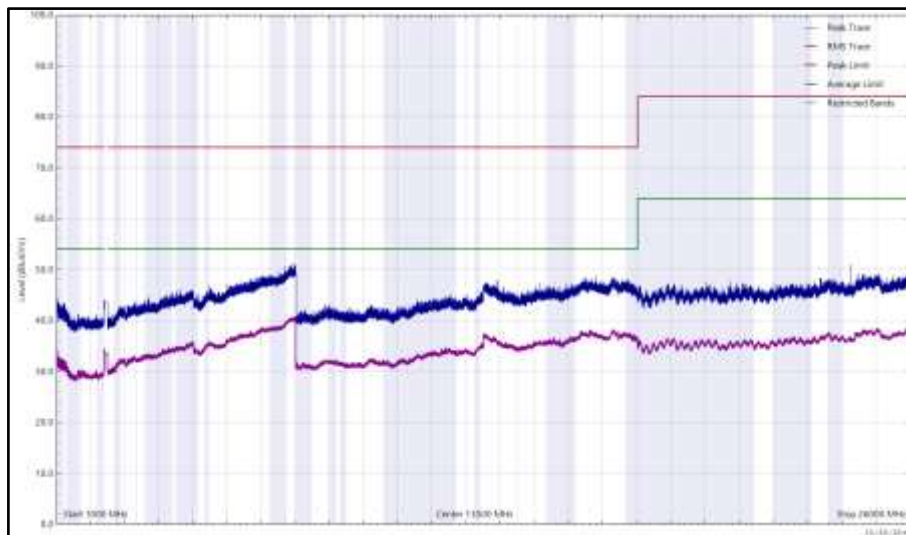


Figure 125 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

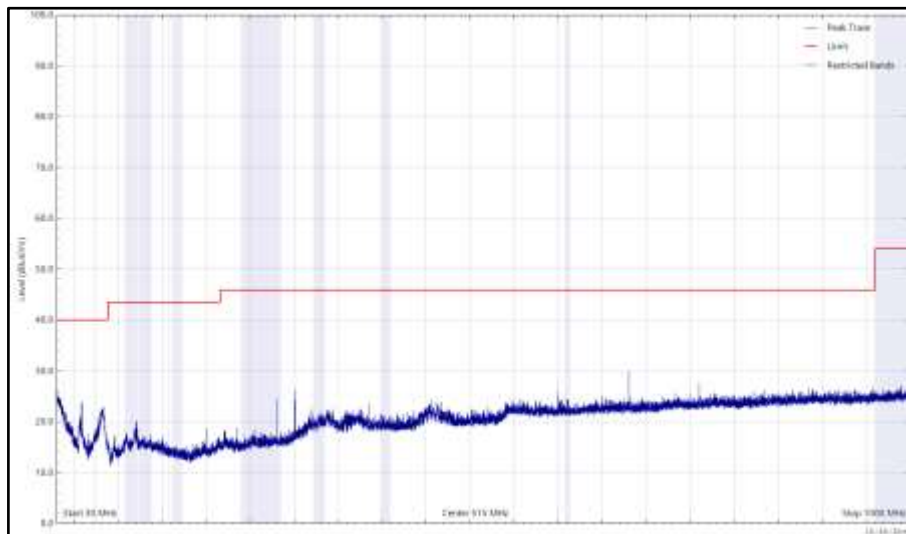


Figure 126 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 1 GHz, Vertical (Peak)

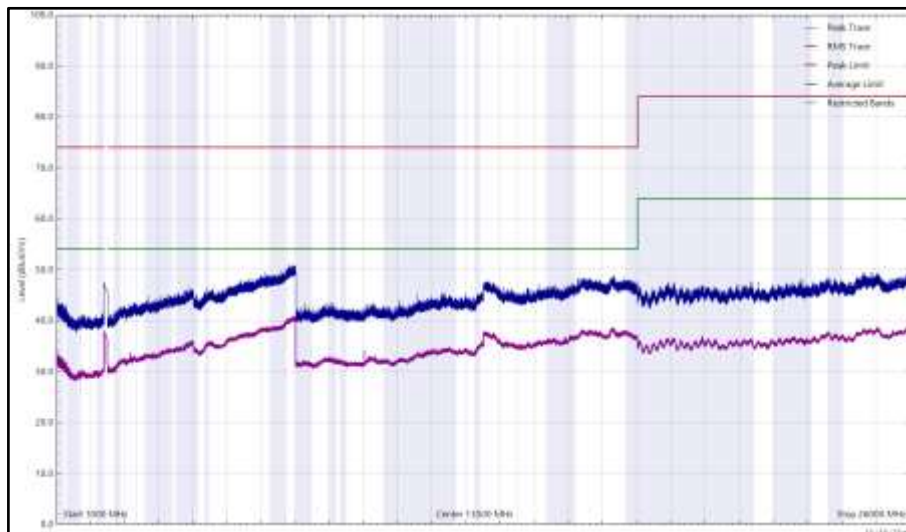


Figure 127 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 85 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

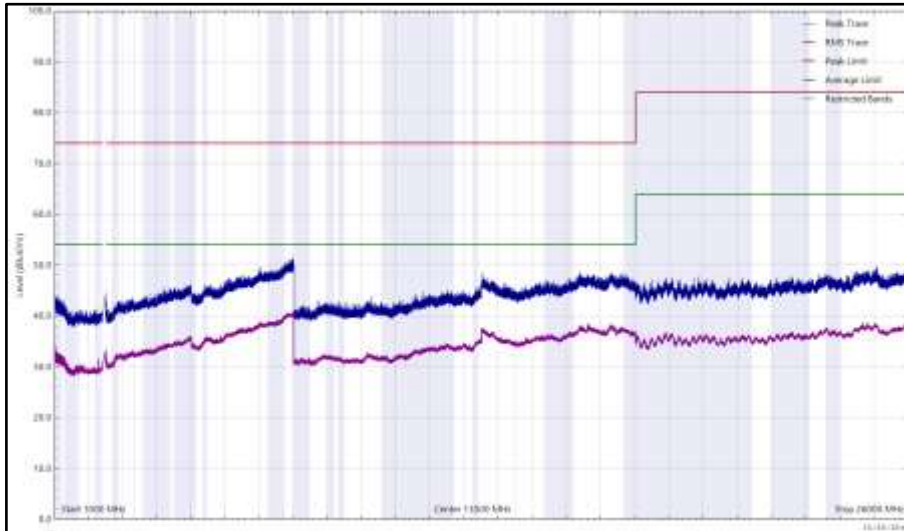


Figure 128 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

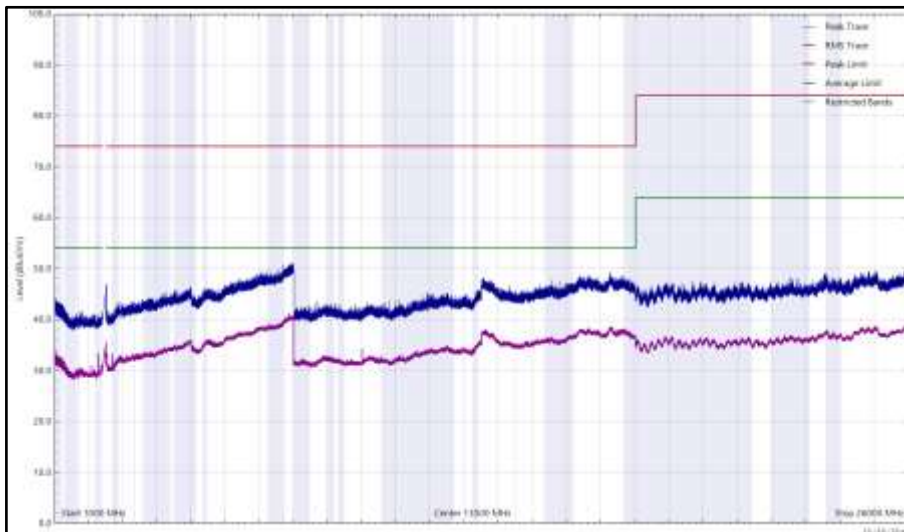


Figure 129 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 86 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

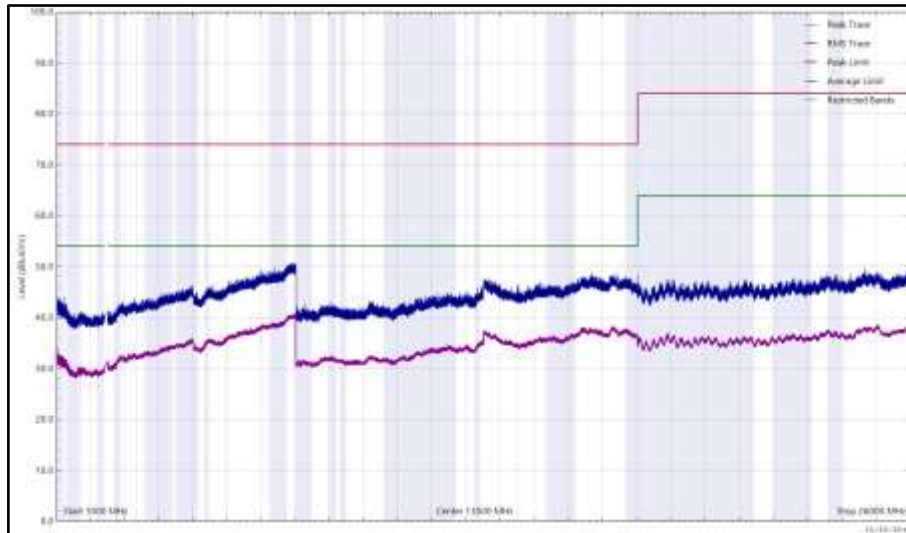


Figure 130 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

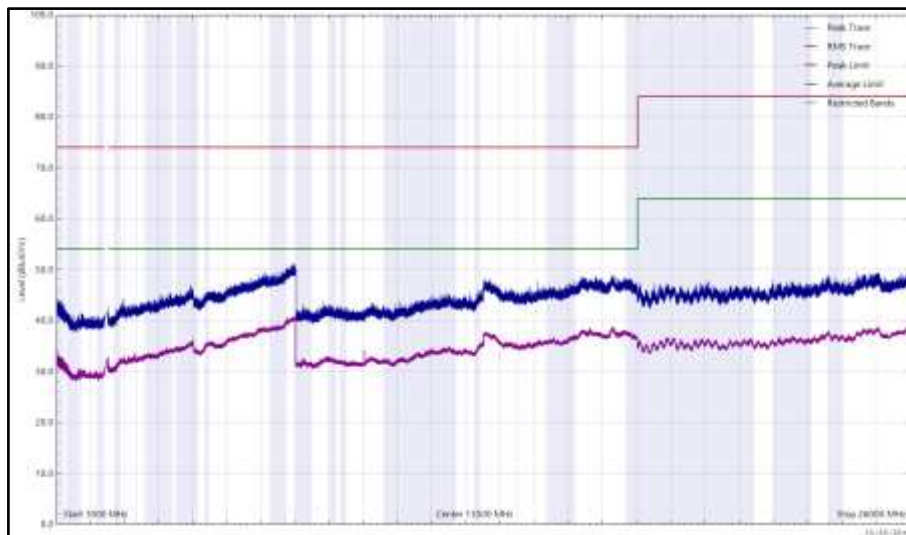


Figure 131 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical



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

Table 87 - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz

*No emissions found within 6 dB of the limit.

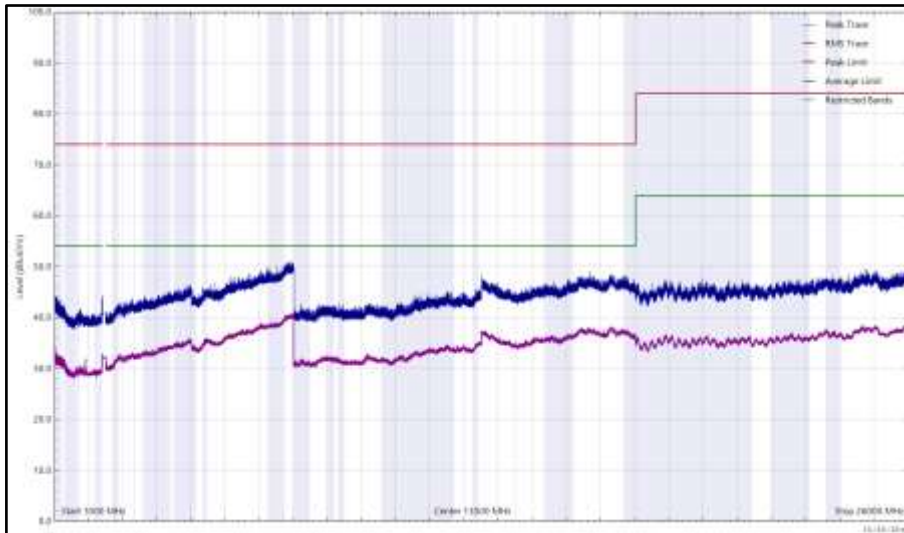


Figure 132 - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

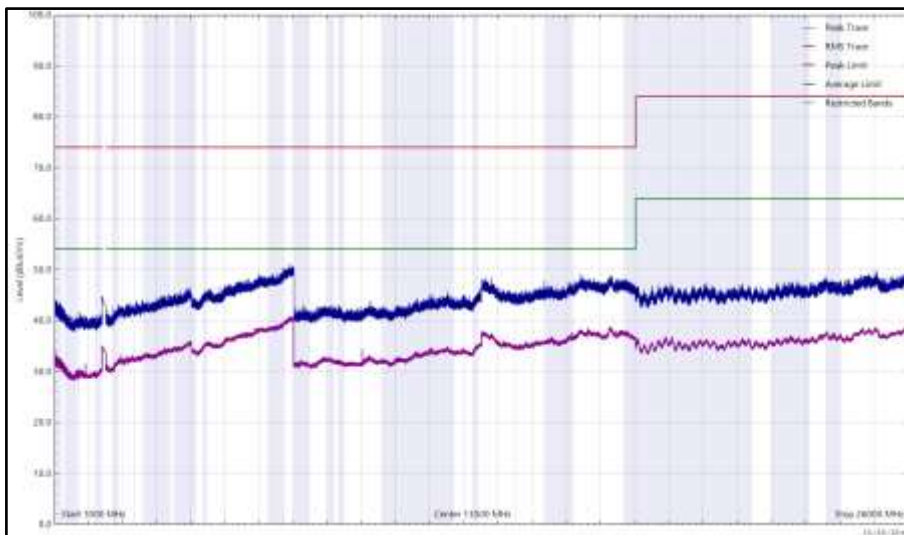


Figure 133 - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

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

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

ISED RSS-247, Limit Clause 5.5

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

In addition, radiated emissions which fall in the restricted bands, as defined in RSS-GEN, clause 8.10, must also comply with the radiated emission limits specified in RSS-GEN clause 8.9.



2.7.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (5)	Rainford	Rainford	1545	36	15-Apr-2024
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	Maturo GmbH	NCD	3917	-	TU
True RMS Multimeter	Fluke	179	4007	12	29-Oct-2021
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	16-Nov-2021
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	01-Apr-2022
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
8 - 18 GHz pre amp	Wright Technologies	PS06-0061/PS06-0060	4971	6	04-Nov-2021
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5067	12	02-Oct-2021
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5069	12	12-Oct-2021
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	Software
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	26-Mar-2022
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5261	12	08-Apr-2022
Antenna (DRG Horn 7.5-18GHz)	Schwarzbeck	HWRD750	5348	12	22-Sep-2021
1m -SMA Cable	Junkosha	MWX221-01000AMSAMS/A	5513	12	09-Apr-2022
1m -SMA Cable	Junkosha	MWX221-01000AMSAMS/A	5514	12	09-Apr-2022
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5517	12	09-Apr-2022
8m N-Type Cable	Junkosha	MWX221-08000NMSNMS/B	5520	12	24-Mar-2022
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	15-Apr-2022
7 GHz High pass Filter	Wainwright	WHKX12-5850-6800-18000-80SS	5549	12	20-May-2022
1200 MHz Low Pass Filter (01)	Mini-Circuits	VLF-1200+	5559	12	24-May-2022



Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Preamplifier (30dB 18-40GHz)	Schwarzbeck	BBV 9721	5608	12	14-Oct-2021
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5609	12	14-Oct-2021

Table 88

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



2.8 Authorised Band Edges

2.8.1 Specification Reference

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

2.8.2 Equipment Under Test and Modification State

A2442, S/N: DNQHW6Y3WY - Modification State 0

2.8.3 Date of Test

29-June-2021 to 08-July-2021

2.8.4 Test Method

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

2.8.5 Environmental Conditions

Ambient Temperature	19.6 - 23.6 °C
Relative Humidity	43.2 - 58.8 %



2.8.6 Test Results

2.4 GHz Bluetooth (FHSS)

iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	0	DH5	2402	2400.0	-66.22
Static	$\pi/4$ DQPSK	0	2DH5	2402	2400.0	-54.36
Static	8-DPSK	0	3DH5	2402	2400.0	-54.70
Hopping	GFSK	0	DH5	2402	2400.0	-66.33
Hopping	$\pi/4$ DQPSK	0	2DH5	2402	2400.0	-57.30
Hopping	8-DPSK	0	3DH5	2402	2400.0	-57.47

Table 89 - Authorised Band Edge Results

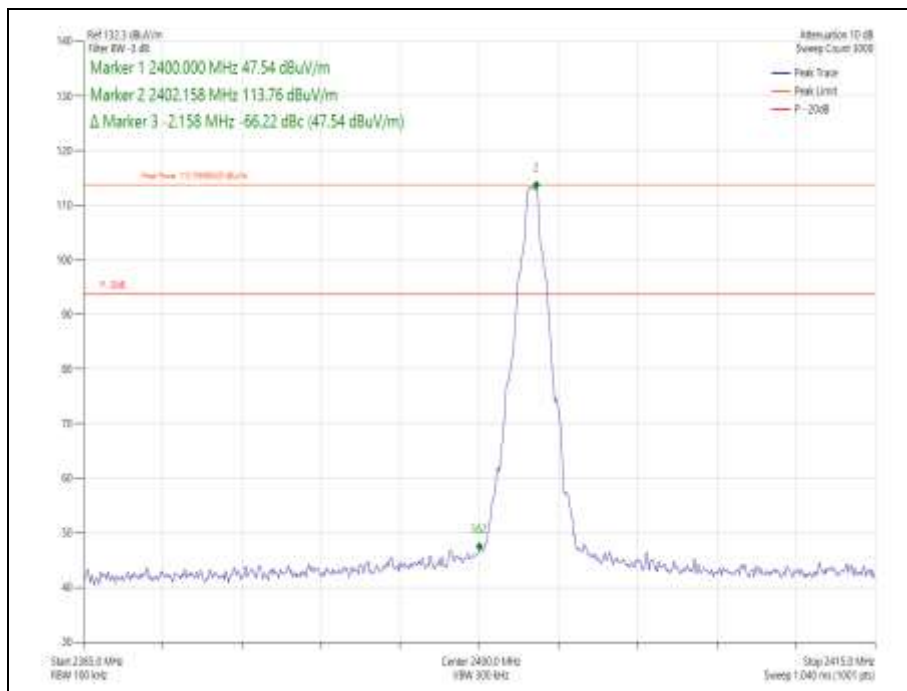


Figure 134 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

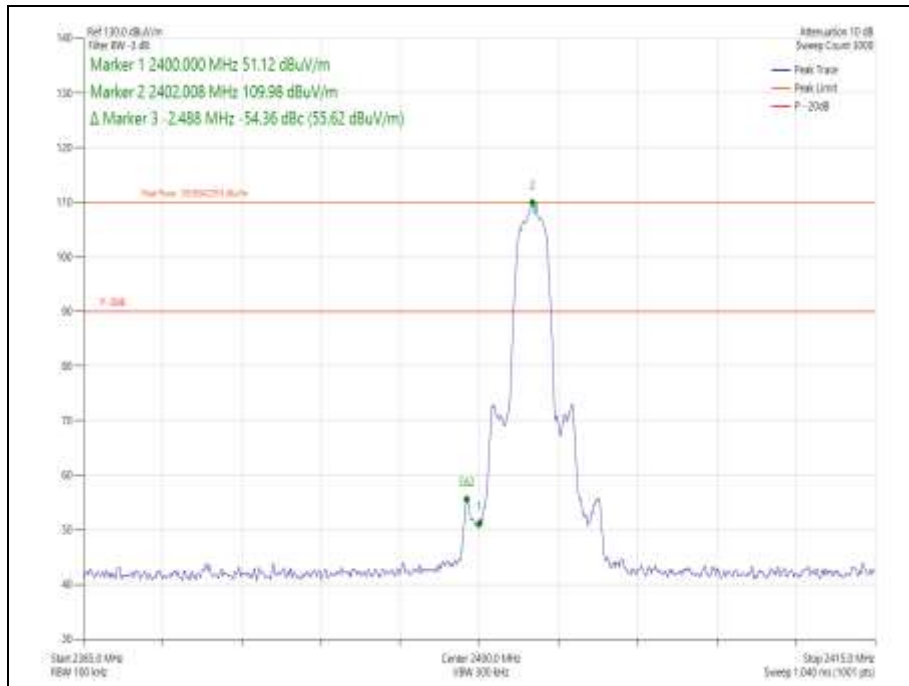


Figure 135 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

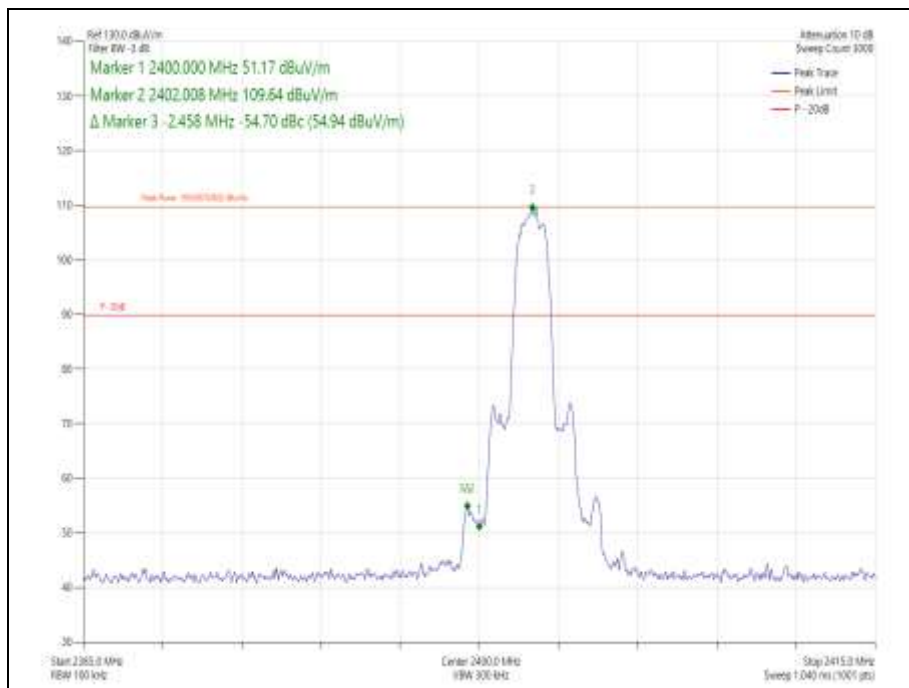


Figure 136 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

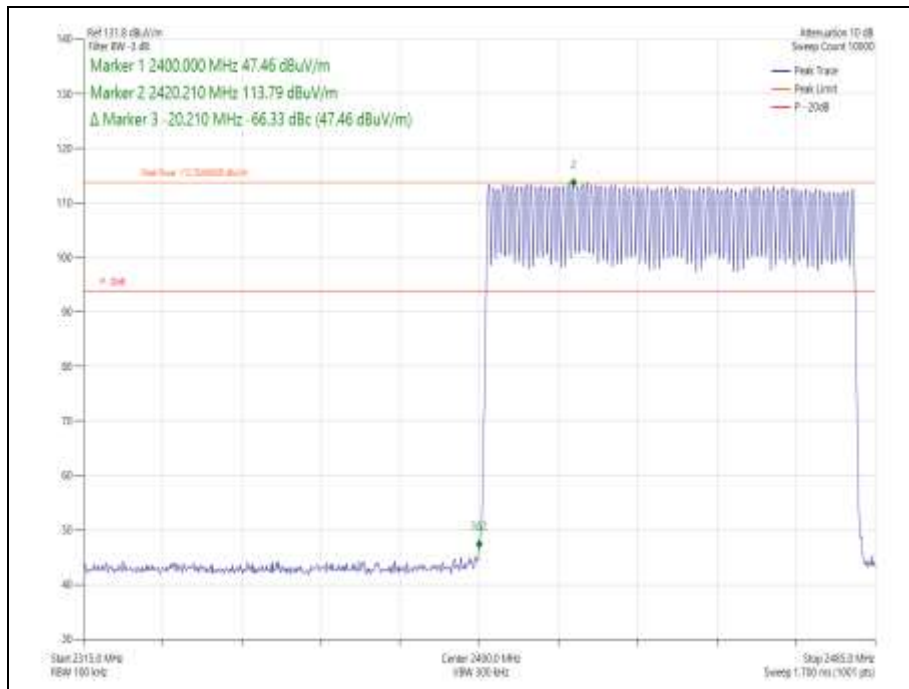


Figure 137 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

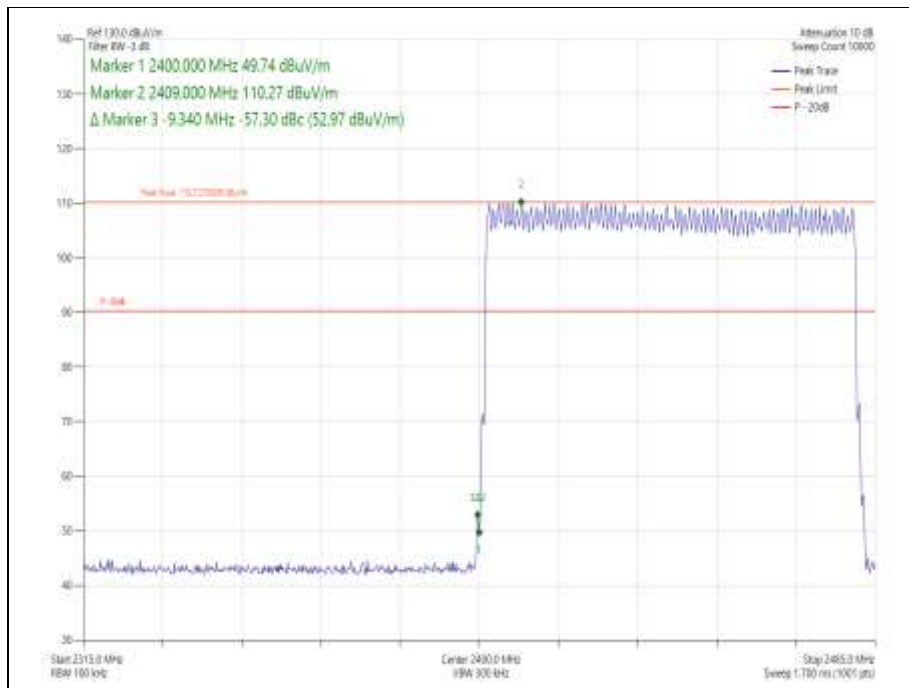


Figure 138 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

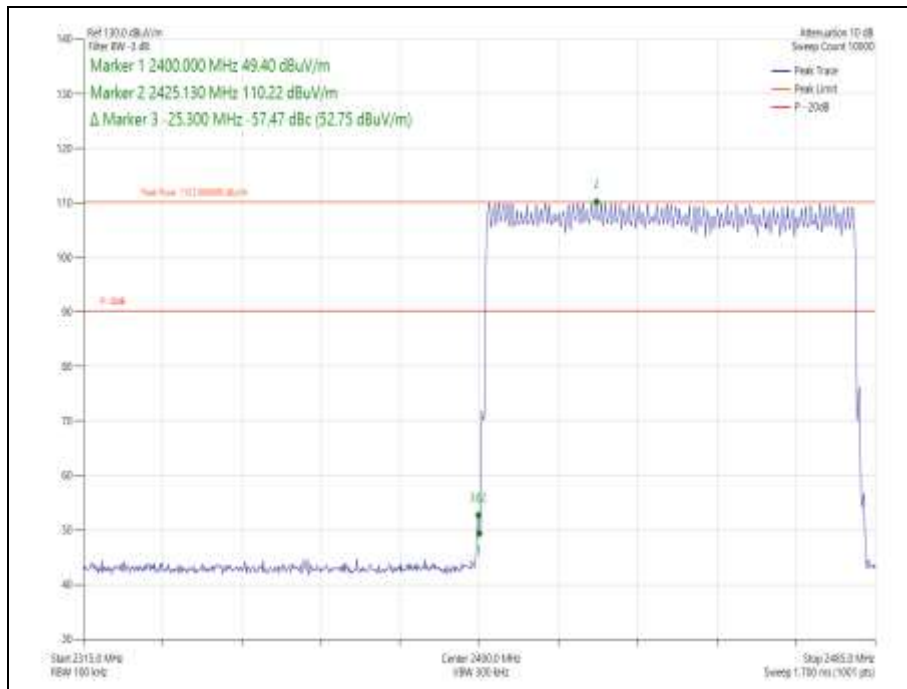


Figure 139 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth (FHSS)

ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	0	DH5	2402	2400.0	-67.27
Static	$\pi/4$ DQPSK	0	2DH5	2402	2400.0	-62.65
Static	8-DPSK	0	3DH5	2402	2400.0	-62.19
Hopping	GFSK	0	DH5	2402	2400.0	-66.49
Hopping	$\pi/4$ DQPSK	0	2DH5	2402	2400.0	-65.02
Hopping	8-DPSK	0	3DH5	2402	2400.0	-64.24

Table 90 - Authorised Band Edge Results

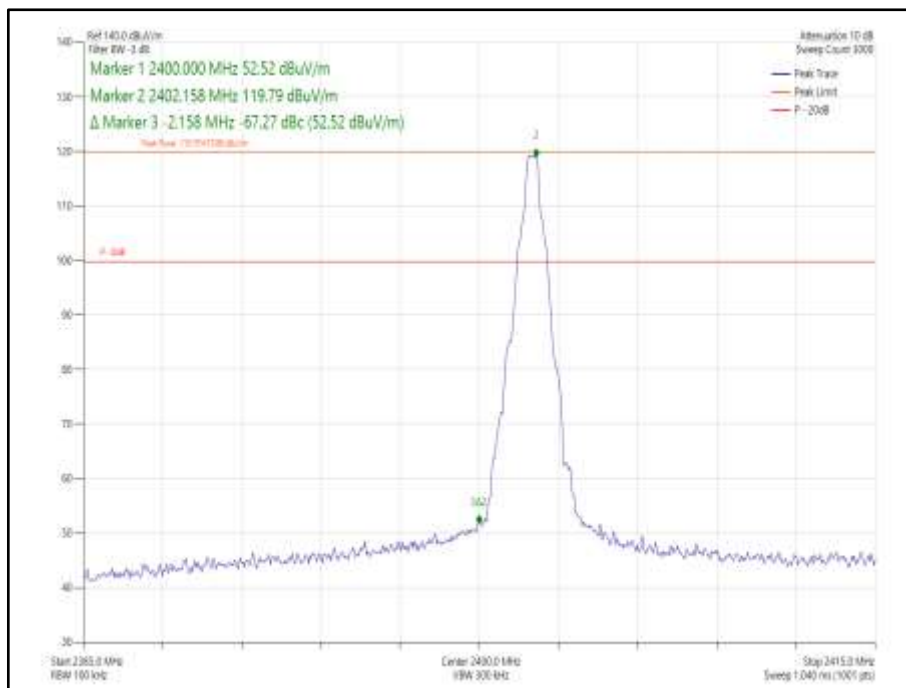


Figure 140 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

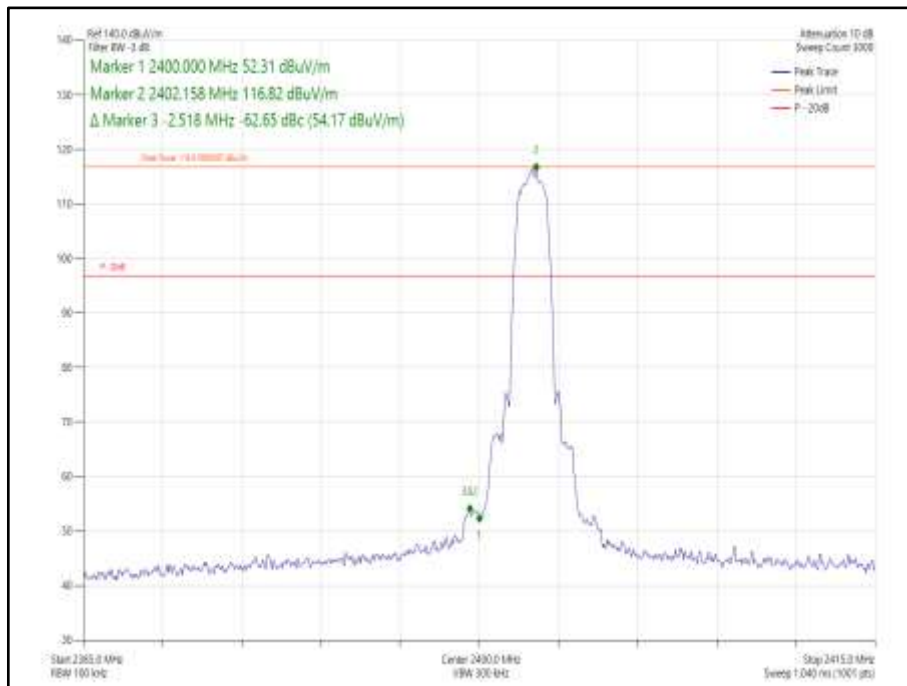


Figure 141 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

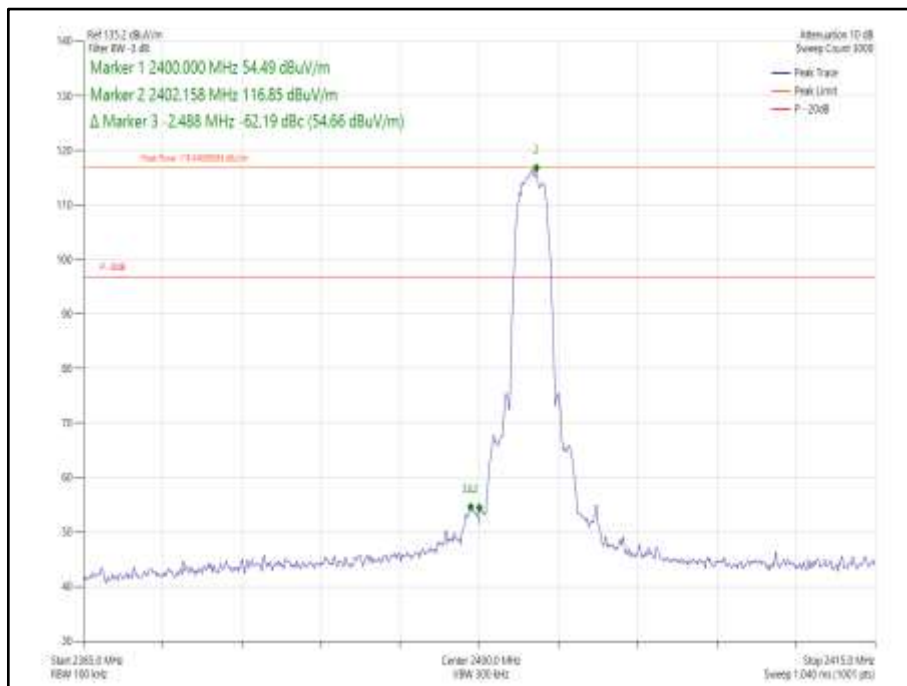


Figure 142 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

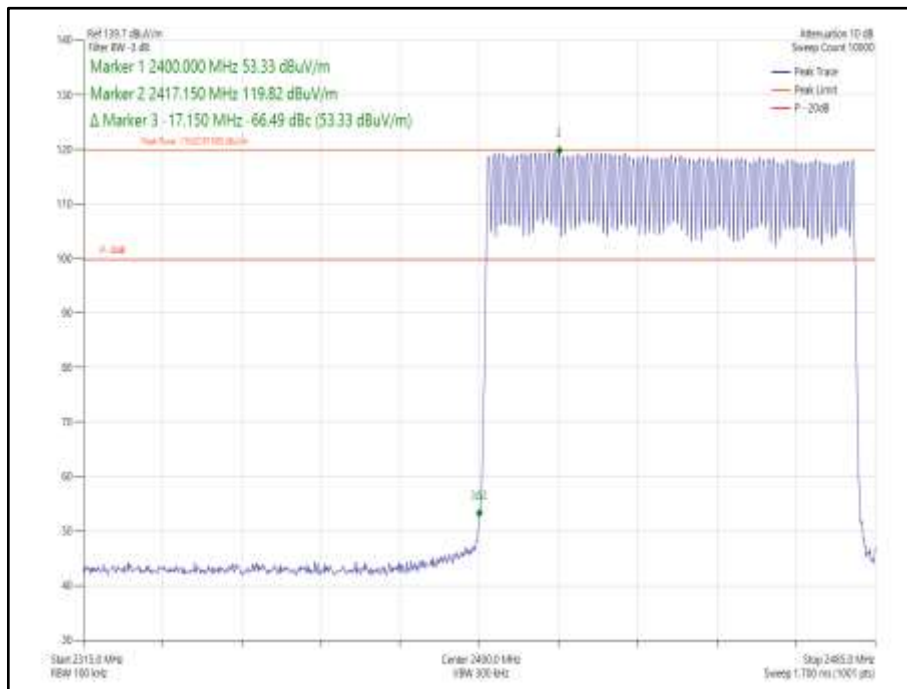


Figure 143 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

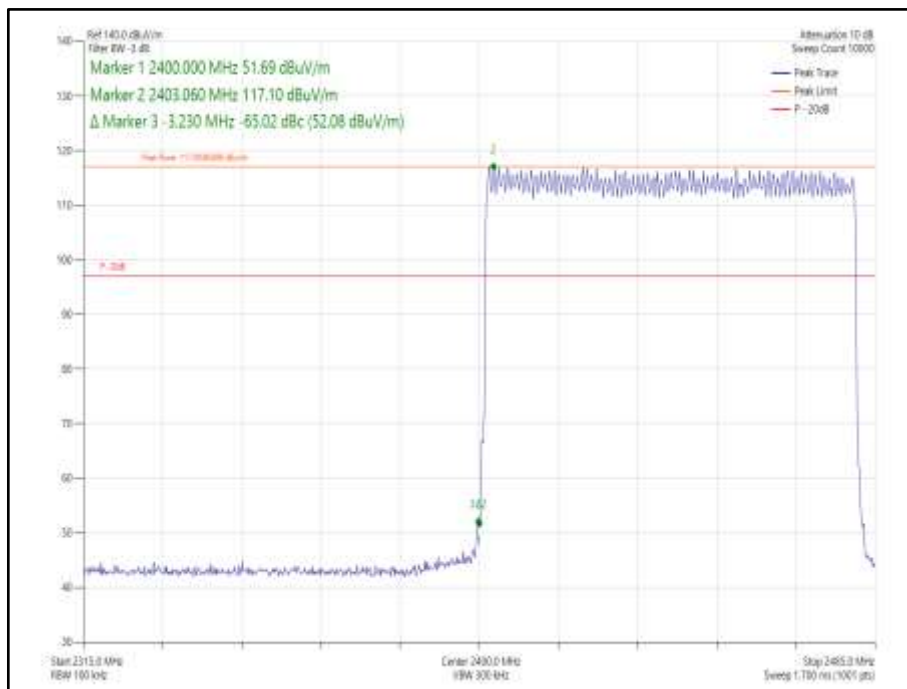


Figure 144 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

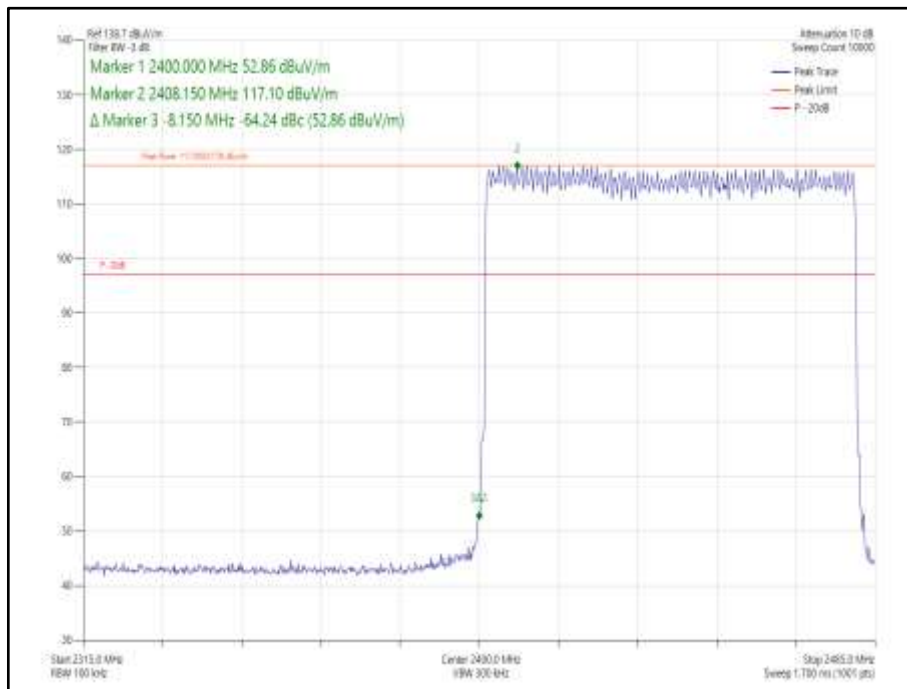


Figure 145 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth (FHSS)

iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	2	DH5	2402	2400.0	-63.40
Static	$\pi/4$ DQPSK	2	2DH5	2402	2400.0	-59.12
Static	8-DPSK	2	3DH5	2402	2400.0	-58.62
Hopping	GFSK	2	DH5	2402	2400.0	-63.14
Hopping	$\pi/4$ DQPSK	2	2DH5	2402	2400.0	-61.32
Hopping	8-DPSK	2	3DH5	2402	2400.0	-60.69

Table 91 - Authorised Band Edge Results

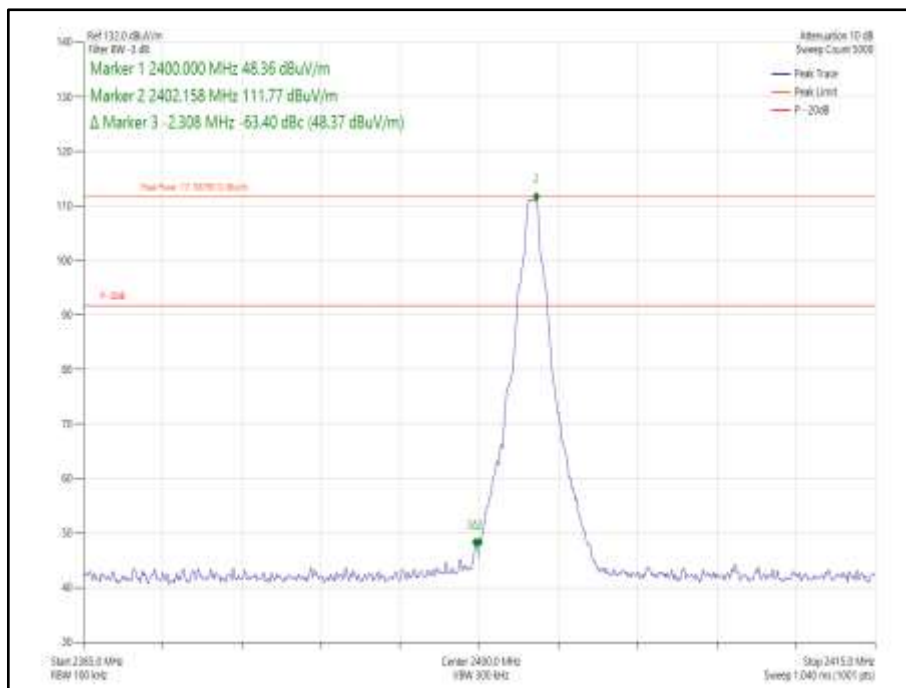


Figure 146 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

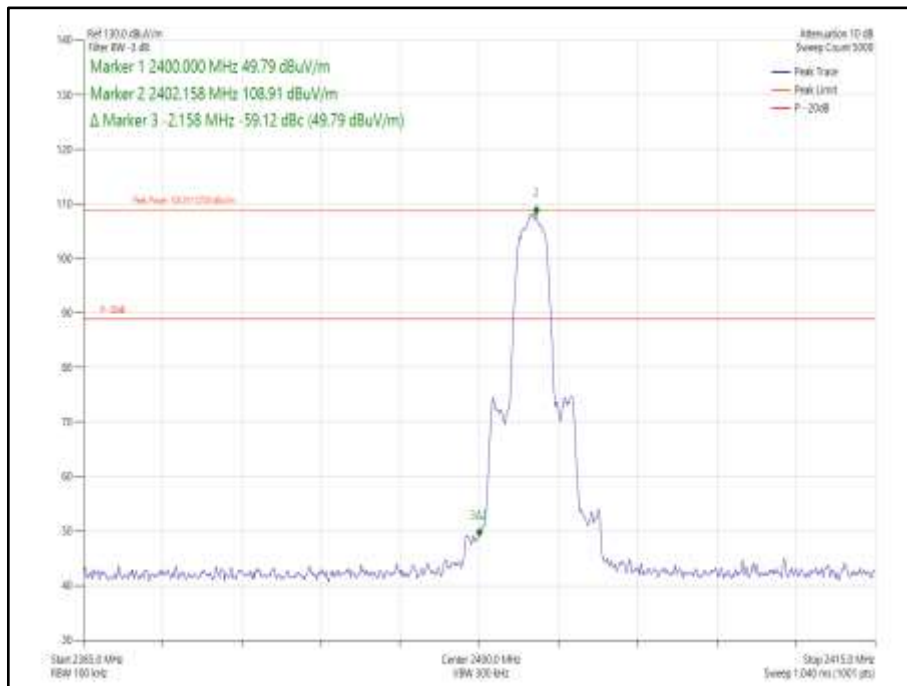


Figure 147 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

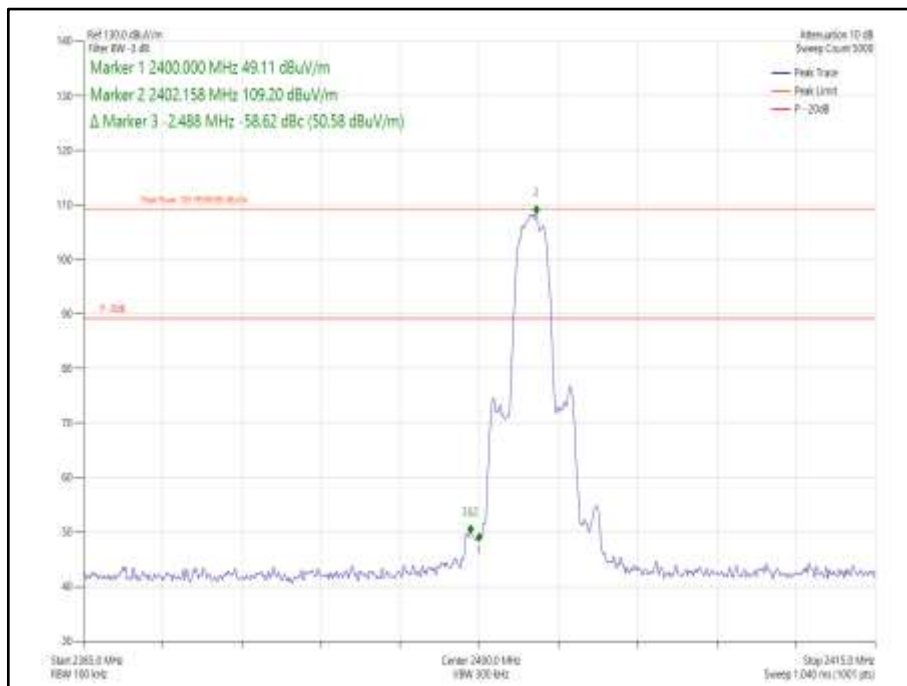


Figure 148 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

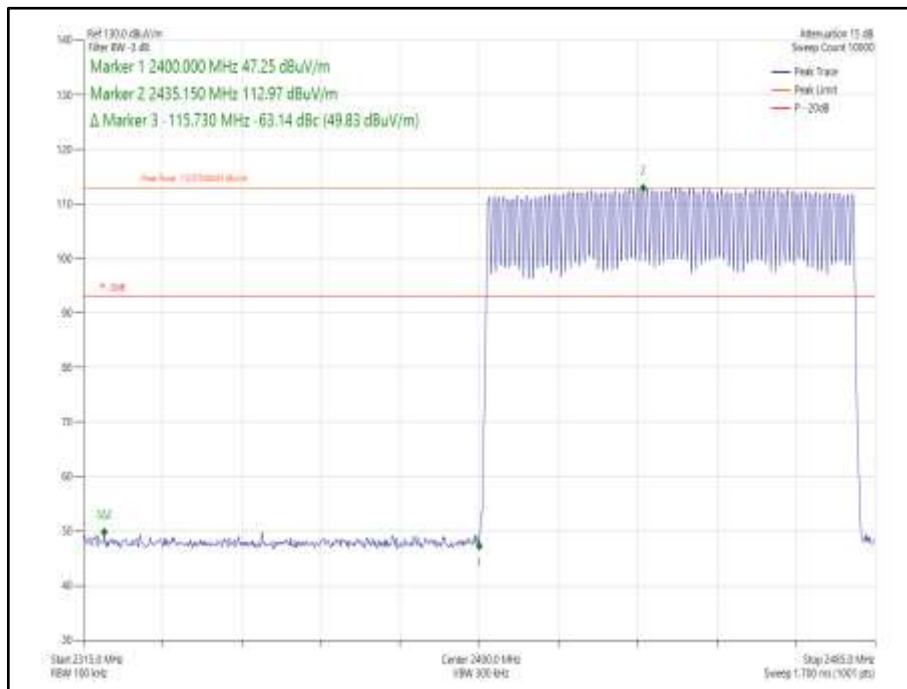


Figure 149 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

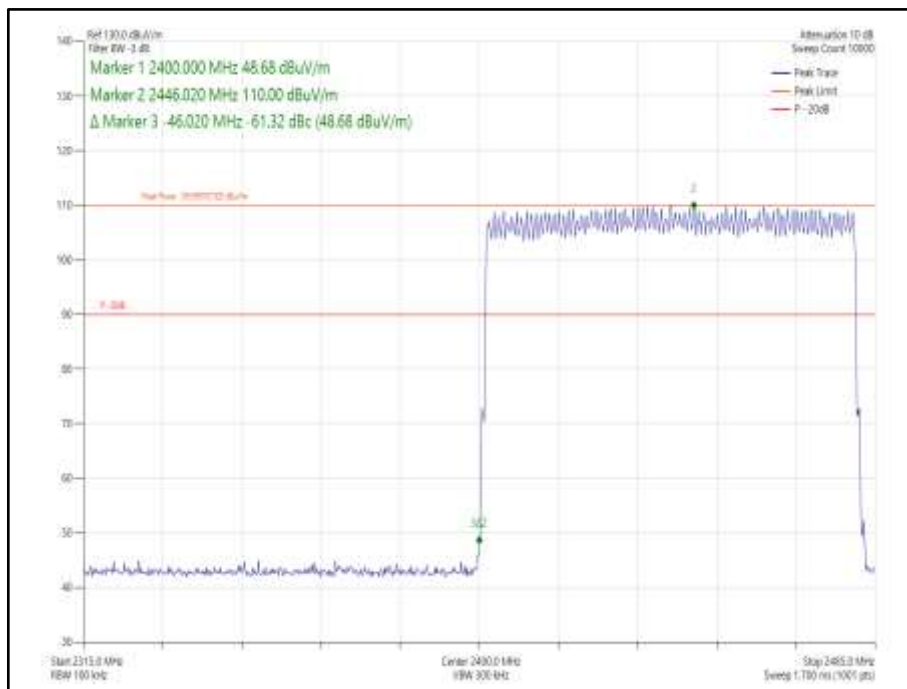


Figure 150 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

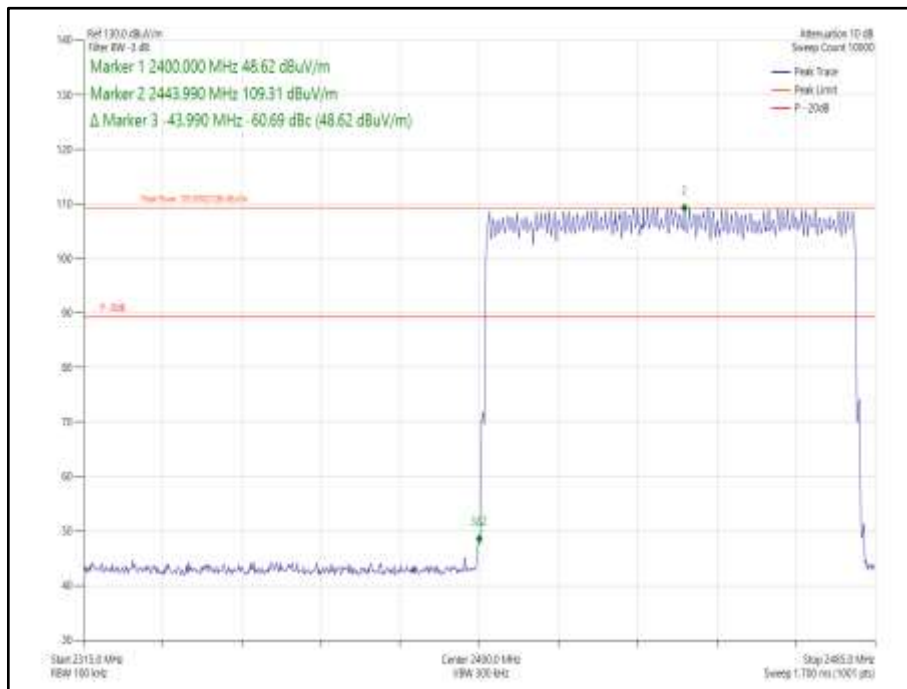


Figure 151 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth (FHSS)

iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	0-1	DH5	2402	2400.0	-65.79
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-59.37
Static	8-DPSK	0-1	3DH5	2402	2400.0	-59.42
Hopping	GFSK	0-1	DH5	2402	2400.0	-67.58
Hopping	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-63.69
Hopping	8-DPSK	0-1	3DH5	2402	2400.0	-63.74

Table 92 - Authorised Band Edge Results

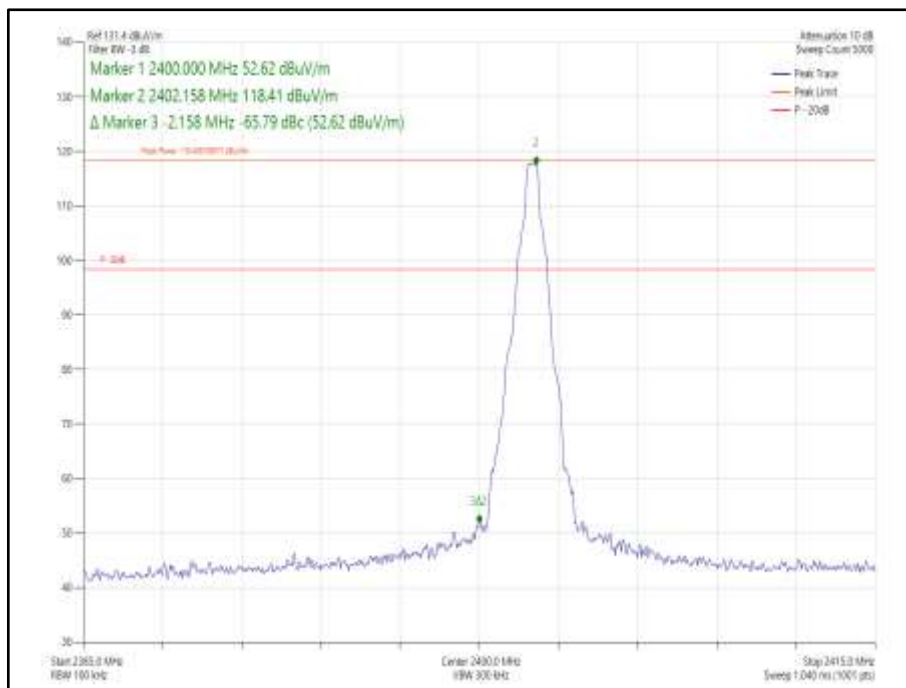


Figure 152 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

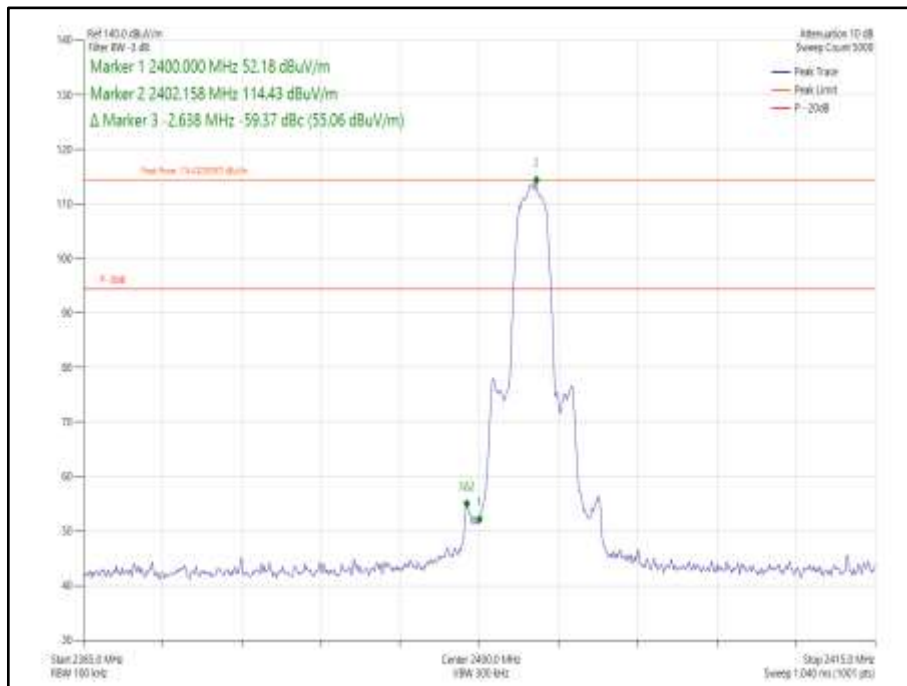


Figure 153 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

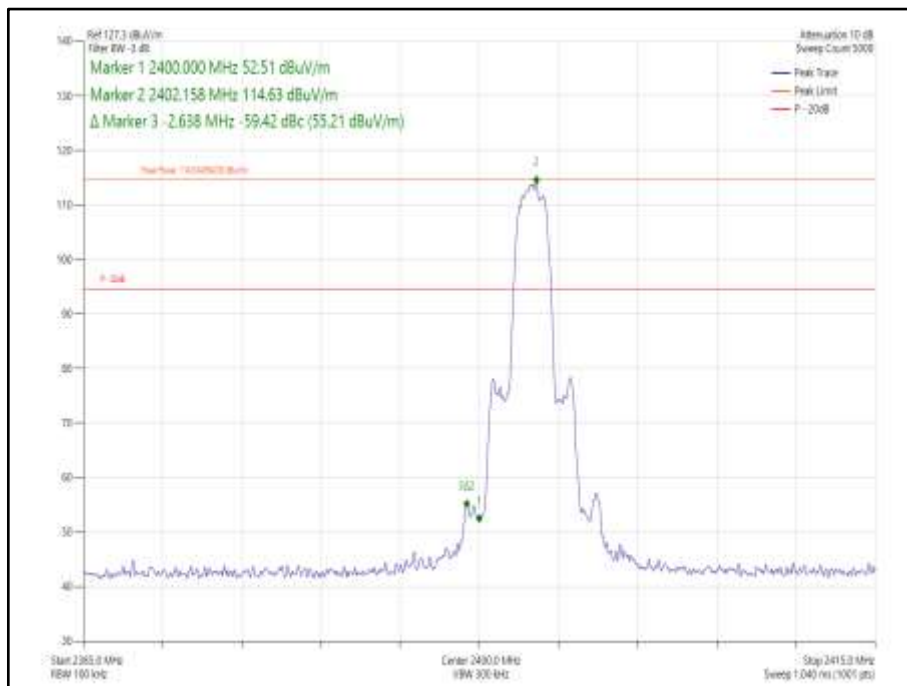


Figure 154 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

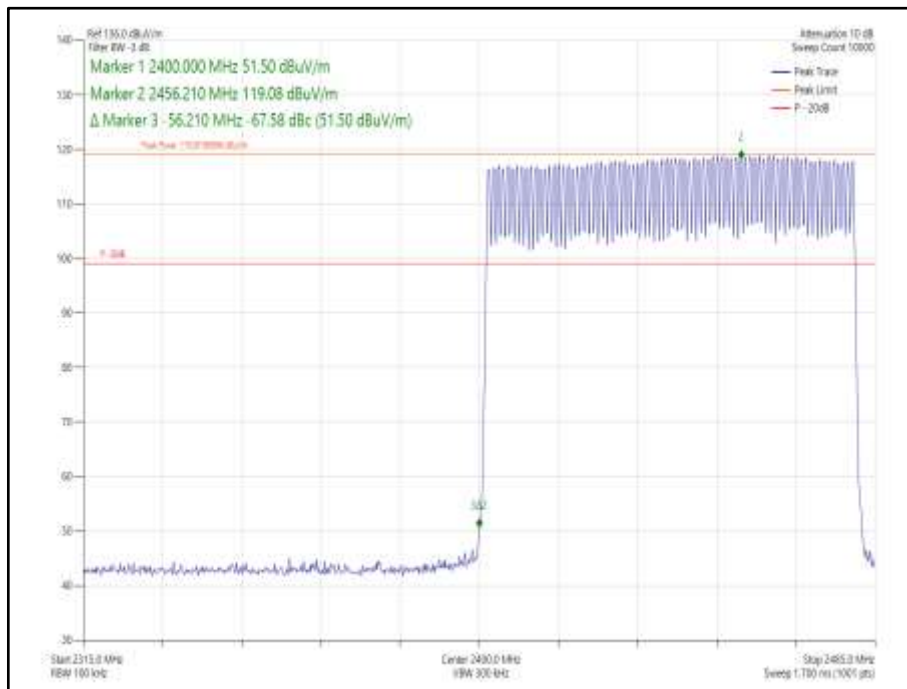


Figure 155 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

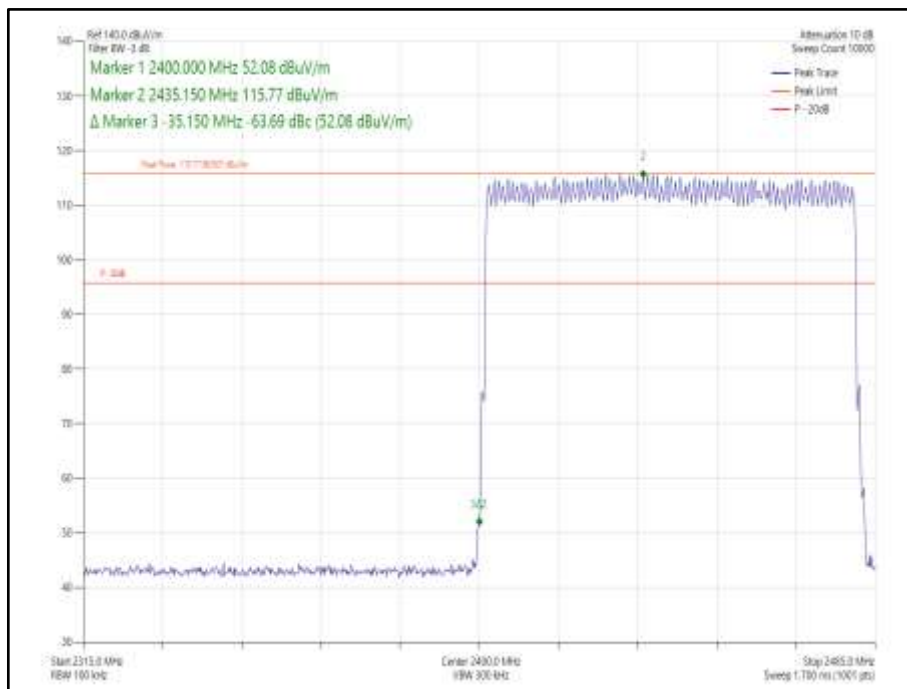


Figure 156 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

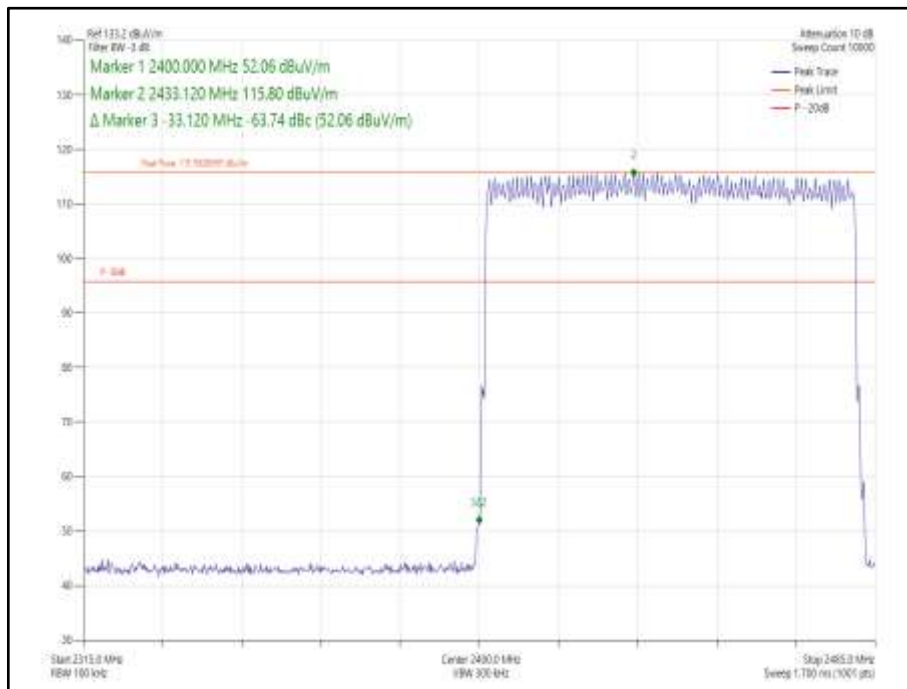


Figure 157 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz



2.4 GHz Bluetooth (FHSS)

ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	0-1	DH5	2402	2400.0	-66.11
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-63.99
Static	8-DPSK	0-1	3DH5	2402	2400.0	-63.10
Hopping	GFSK	0-1	DH5	2402	2400.0	-69.67
Hopping	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-64.75
Hopping	8-DPSK	0-1	3DH5	2402	2400.0	-64.27

Table 93 - Authorised Band Edge Results

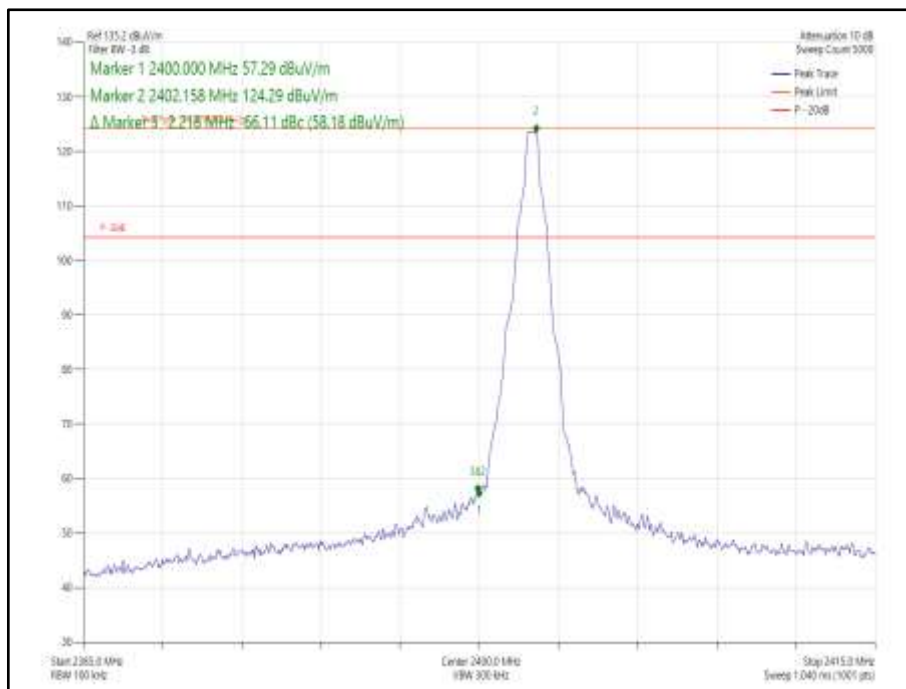


Figure 158 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

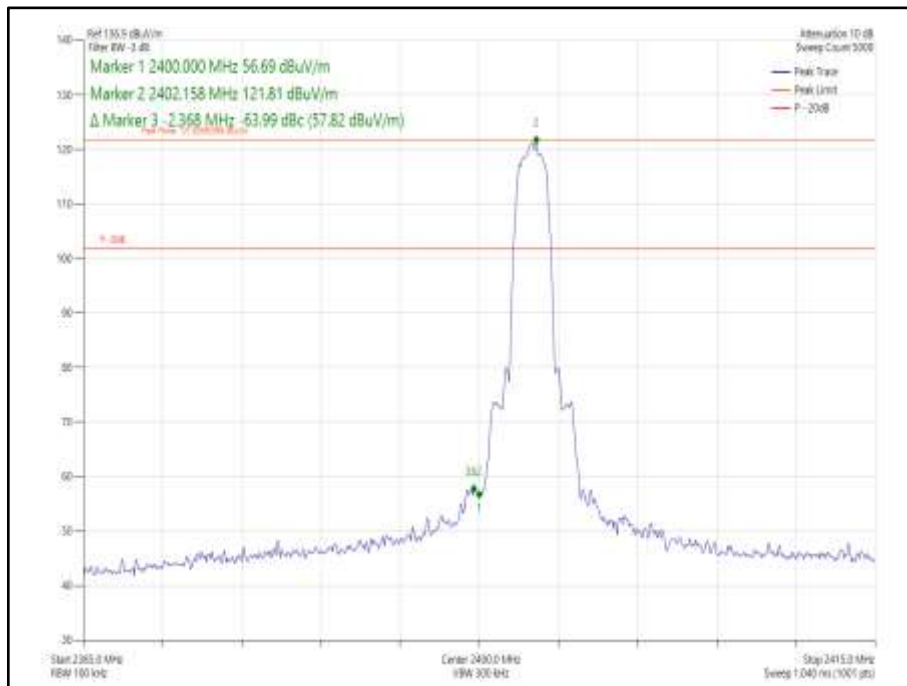


Figure 159 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

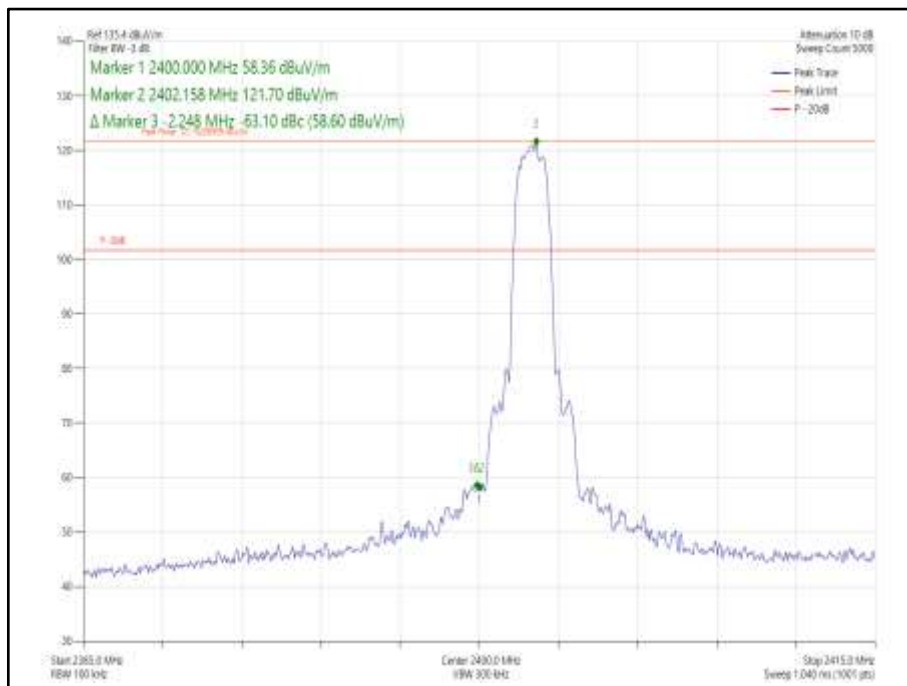


Figure 160 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

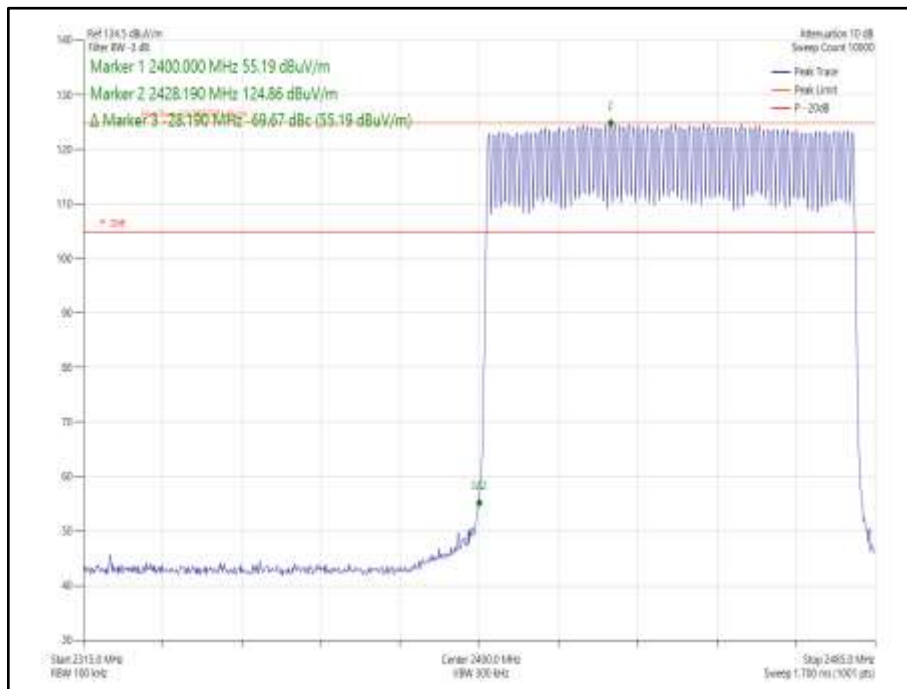


Figure 161 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

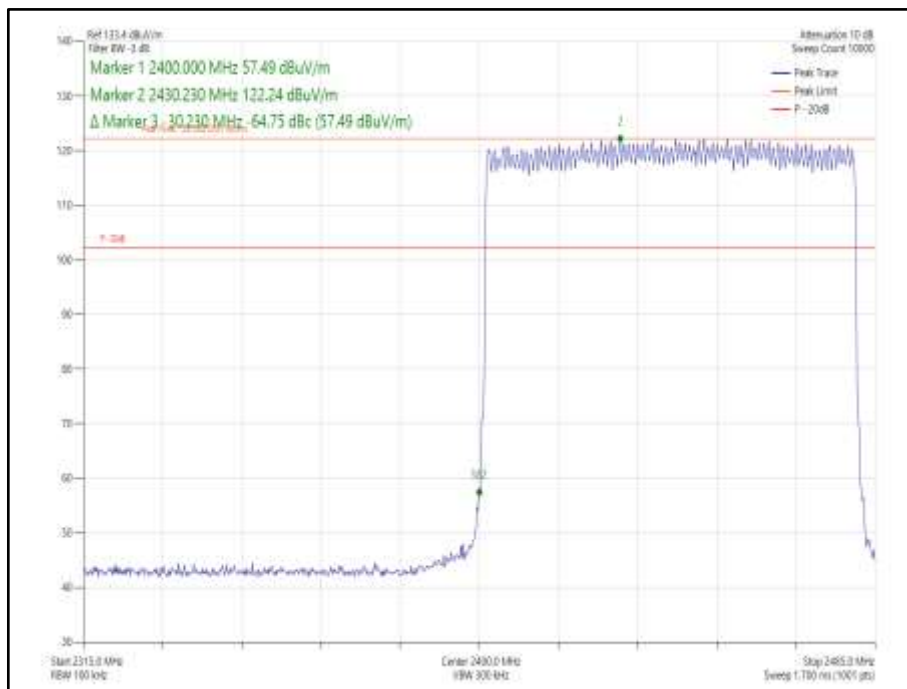


Figure 162 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

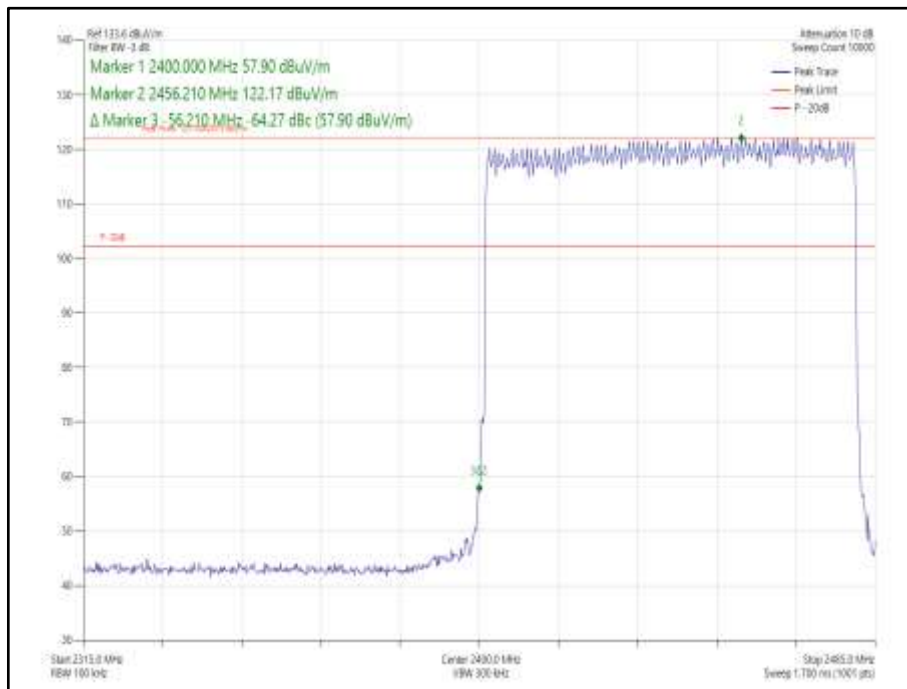


Figure 163 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

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.



2.8.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	08-Mar-2022
Cable (18 GHz)	Rosenberger	LU7-071-2000	5107	12	09-Jul-2022
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	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
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	01-Apr-2022
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021

Table 94

TU - Traceability Unscheduled



3 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Frequency Hopping Systems - Average Time of Occupancy	-
Frequency Hopping Systems - Channel Separation	± 20.508 kHz (Same as 20 dB Bandwidth)
Frequency Hopping Systems - Number of Hopping Channels	-
Frequency Hopping Systems - 20 dB Bandwidth	± 20.508 kHz
Maximum Conducted Output Power	± 3.2 dB
Spurious Radiated Emissions	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

Table 95

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.