

FCC and ISED Test Report

Apple Inc
Model: A2485

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: BCGA2485

IC: 579C-A2485

COMMERCIAL-IN-CONFIDENCE

Document 75952054-09 Issue 01



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NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	24 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	Jaiyanth Balendrarajah	24 September 2021	
Testing	Mohammad Malik	24 September 2021	
Testing	Jason Hicks	24 September 2021	
Testing	Faisal Malyar	24 September 2021	
Testing	Ahmad Javid	24 September 2021	
Testing	Taha Shafique	24 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	24-September-2021

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2485
Serial Number(s)	HV9QMW620K and CQ2R1P6HF2
Hardware Version(s)	REV1.0
Software Version(s)	HV9QMW620K: 21A102280u CQ2R1P6HF2: 21A102280u
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	0540211248
Date	22-April-2021
Date of Receipt of EUT	31-March-2021 and 16-July-2021
Start of Test	24-June-2021
Finish of Test	07-September-2021
Name of Engineer(s)	Jaiyanth Balendrarajah, Mohammad Malik, Jason Hicks, Faisal Malyar, Ahmad Javid, and Taha Shafique
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, ISSED RSS-247 and ISSED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth - FHSS						
-	15.203	-	-	Antenna Requirement	N/T	The devices complies with the provisions of this section, as it uses a permanently attached integral antenna.
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	5.40	1.00
BT Core 0	2400 to 2480	5.10	1.00
BT Core 1	2400 to 2480	7.00	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: A2485, Serial Number: HV9QMW620K			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2485, Serial Number: CQ2R1P6HF2			
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	Jaiyanth Balendrarajah, Liang Tian and Mohammad Malik	UKAS
Frequency Hopping Systems - Average Time of Occupancy	Jason Hicks	UKAS
Frequency Hopping Systems - Channel Separation	Jason Hicks	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Jason Hicks	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	Jason Hicks	UKAS
Maximum Conducted Output Power	Jason Hicks	UKAS
Spurious Radiated Emissions	Mohammad Malik, Faisal Malyar, Ahmad Javid, Taha Shafique and Jaiyanth Balendrarajah	UKAS
Authorised Band Edges	Jaiyanth Balendrarajah, Liang Tian and Mohammad Malik	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

A2485, S/N: HV9QMW620K - Modification State 0

2.1.3 Date of Test

24-June-2021 to 26-June-2021

2.1.4 Test Method

The 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	21.2 - 23.0 °C
Relative Humidity	48.1 - 51.2 %

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	1	DH5	2402	2390.0	54.26	40.13
Static	$\pi/4$ DQPSK	1	2DH5	2402	2390.0	54.64	39.95
Static	8-DPSK	1	3DH5	2402	2390.0	54.67	39.95
Static	GFSK	1	DH5	2480	2483.5	54.66	41.91
Static	$\pi/4$ DQPSK	1	2DH5	2480	2483.5	53.12	40.71
Static	8-DPSK	1	3DH5	2480	2483.5	53.92	40.70

Table 6 - Restricted Band Edge Results

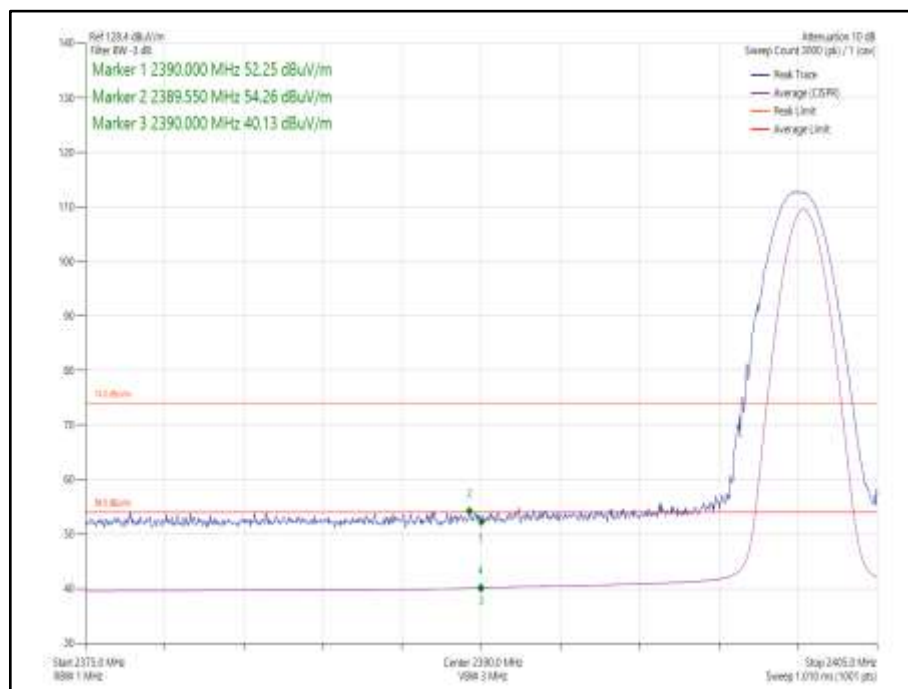


Figure 1 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

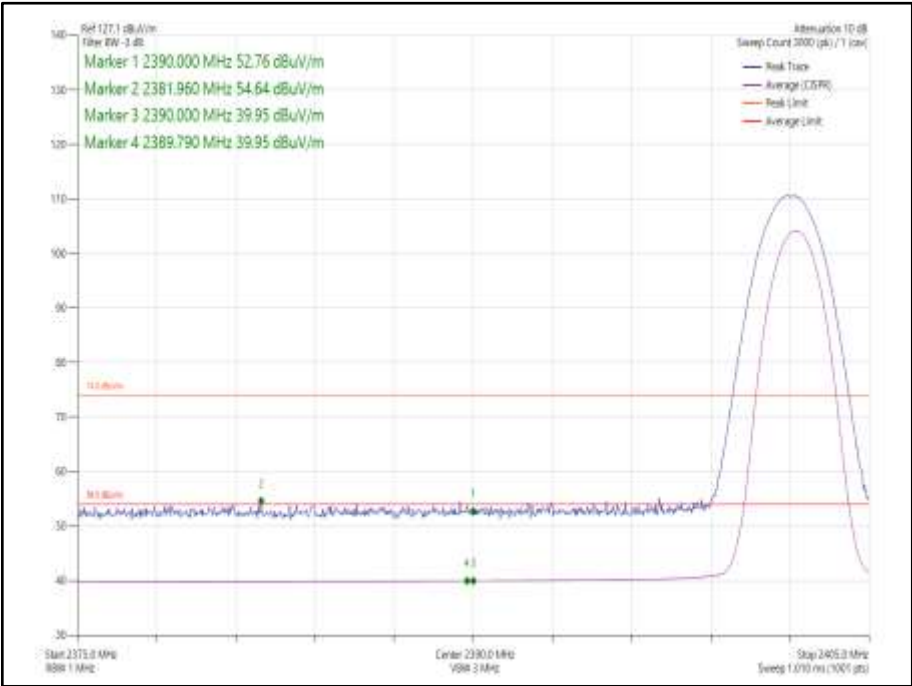


Figure 2 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

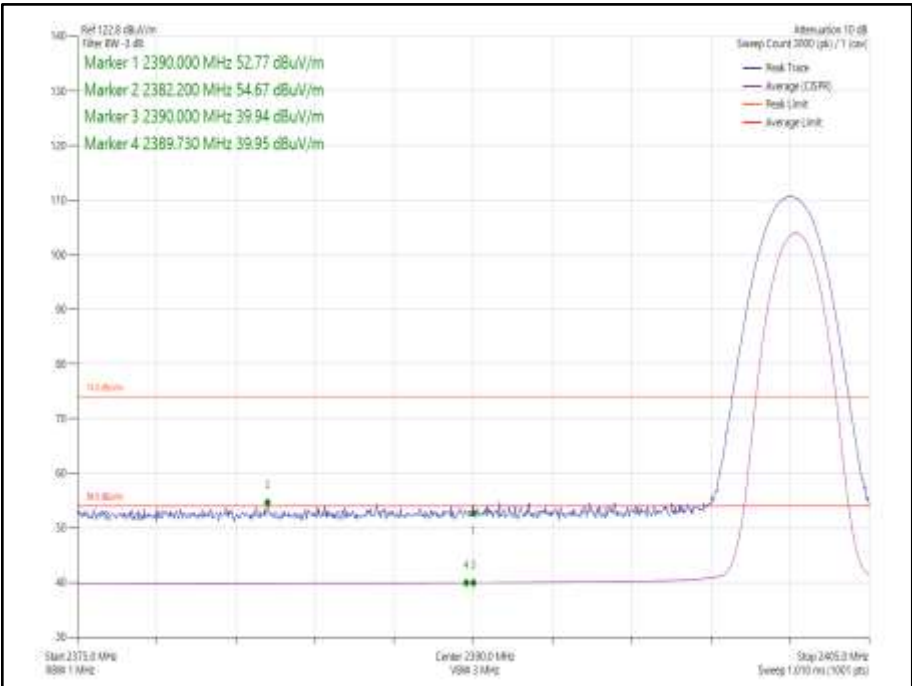


Figure 3 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

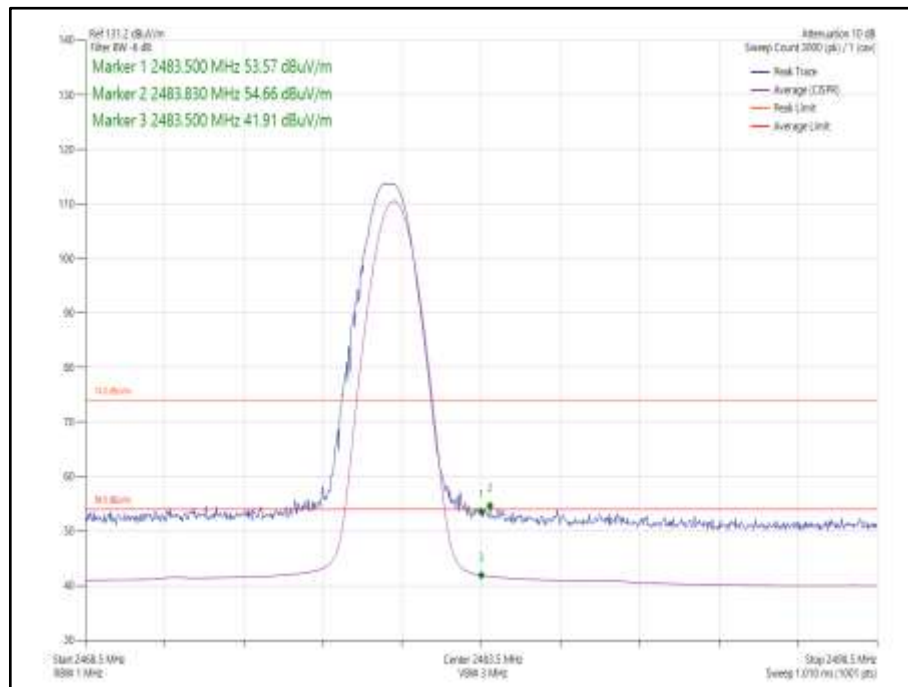


Figure 4 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

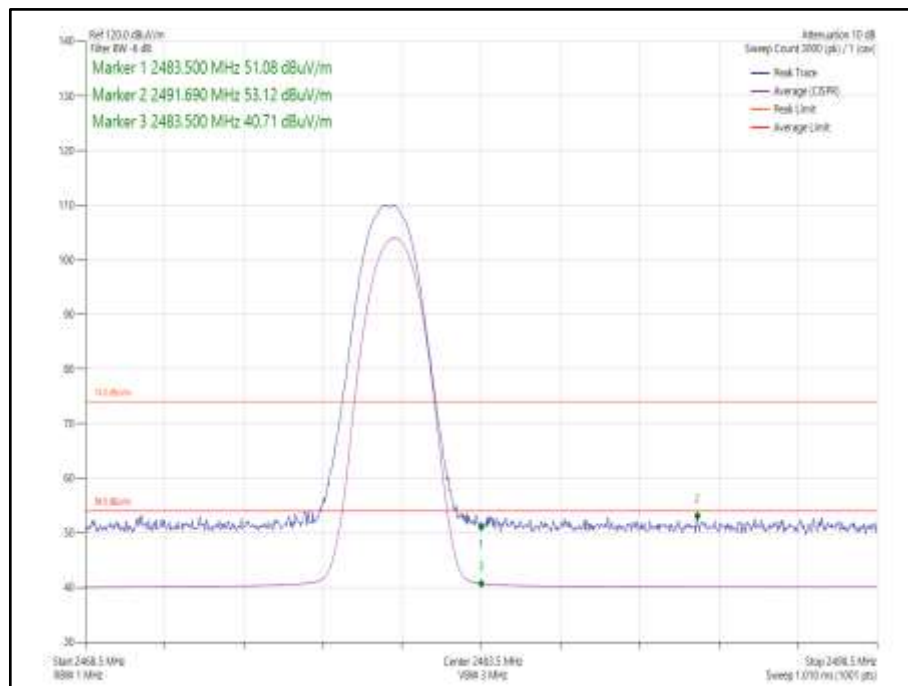


Figure 5 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

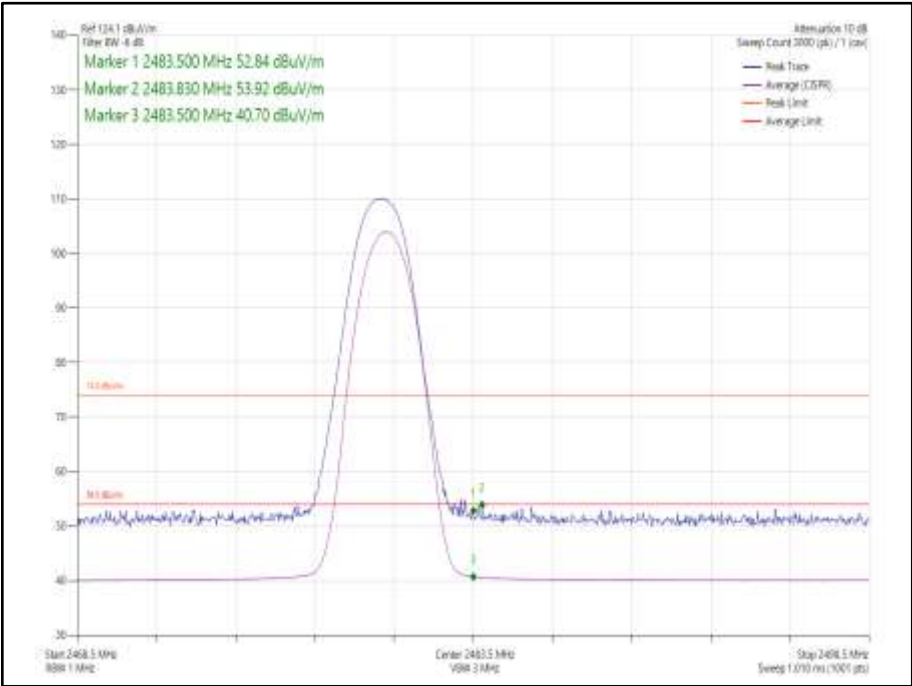


Figure 6 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

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	1	DH5	2402	2390.0	54.87	40.76
Static	$\pi/4$ DQPSK	1	2DH5	2402	2390.0	54.54	40.47
Static	8-DPSK	1	3DH5	2402	2390.0	54.86	40.50
Static	GFSK	1	DH5	2480	2483.5	59.46	44.94
Static	$\pi/4$ DQPSK	1	2DH5	2480	2483.5	56.99	44.34
Static	8-DPSK	1	3DH5	2480	2483.5	60.59	44.76

Table 7 - Restricted Band Edge Results

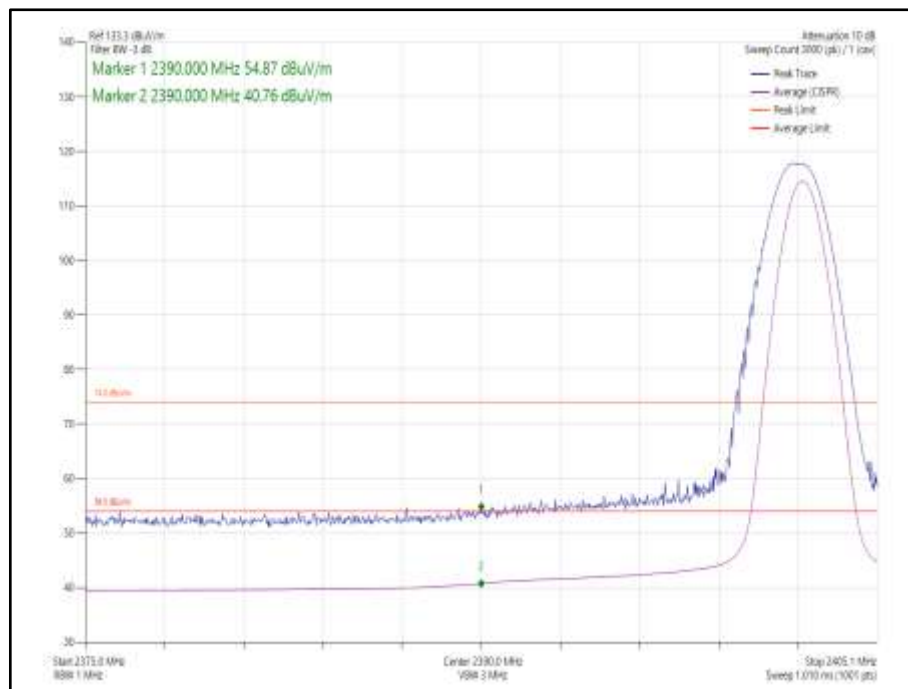


Figure 7 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

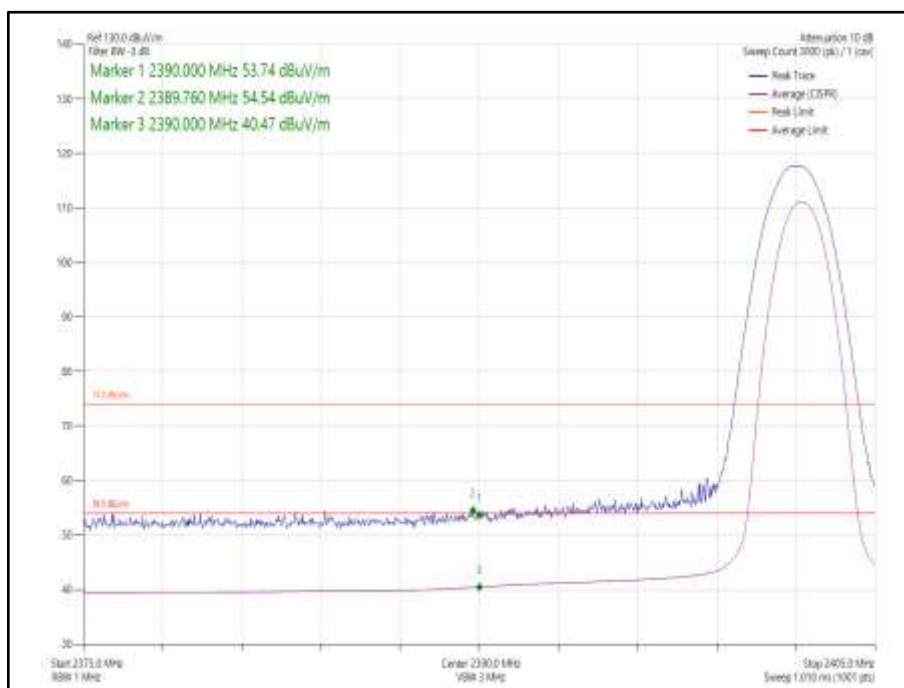


Figure 8 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

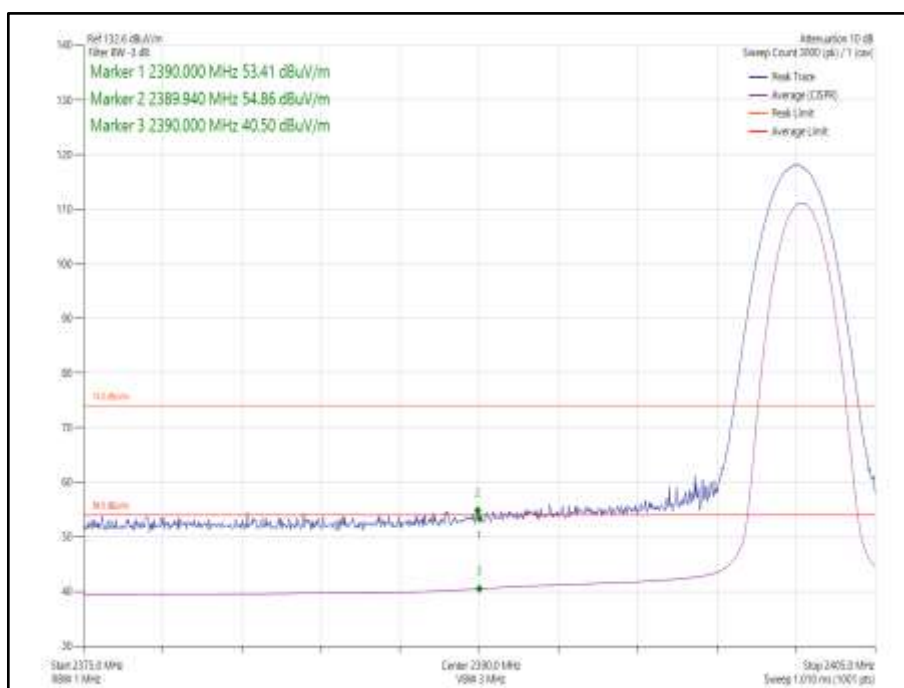


Figure 9 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

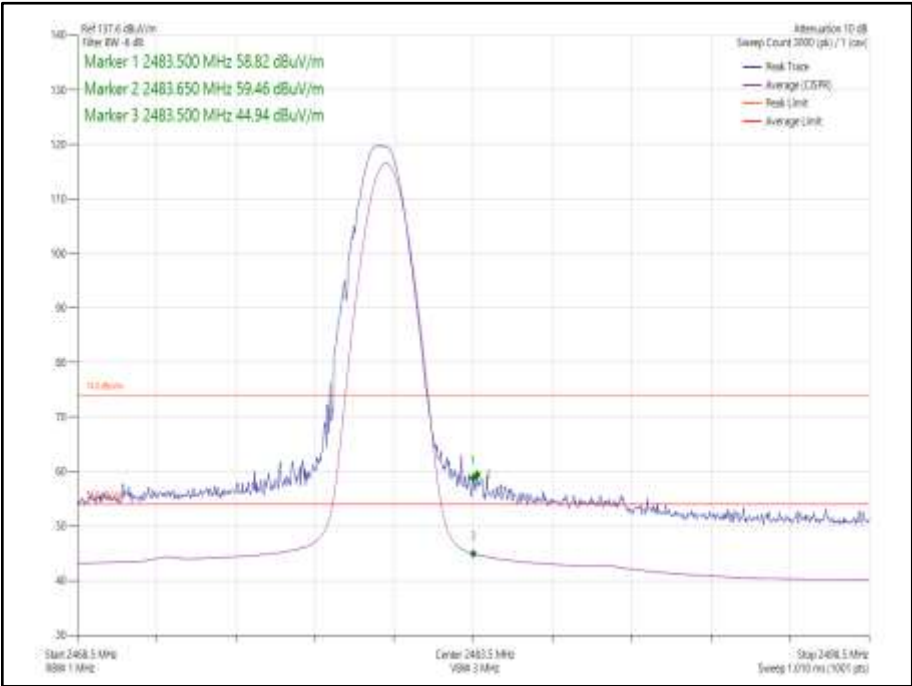


Figure 10 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

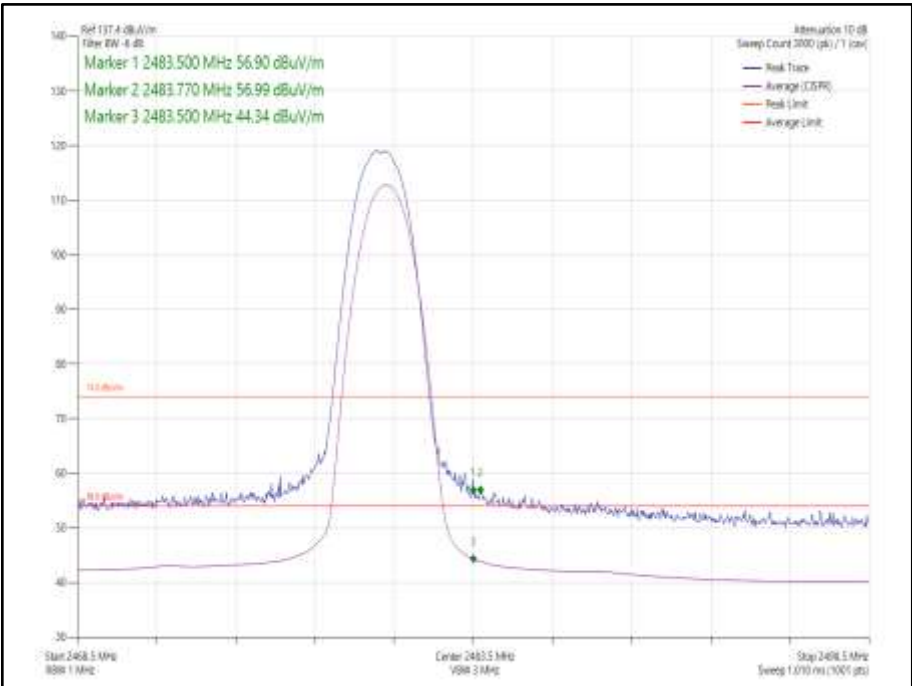


Figure 11 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

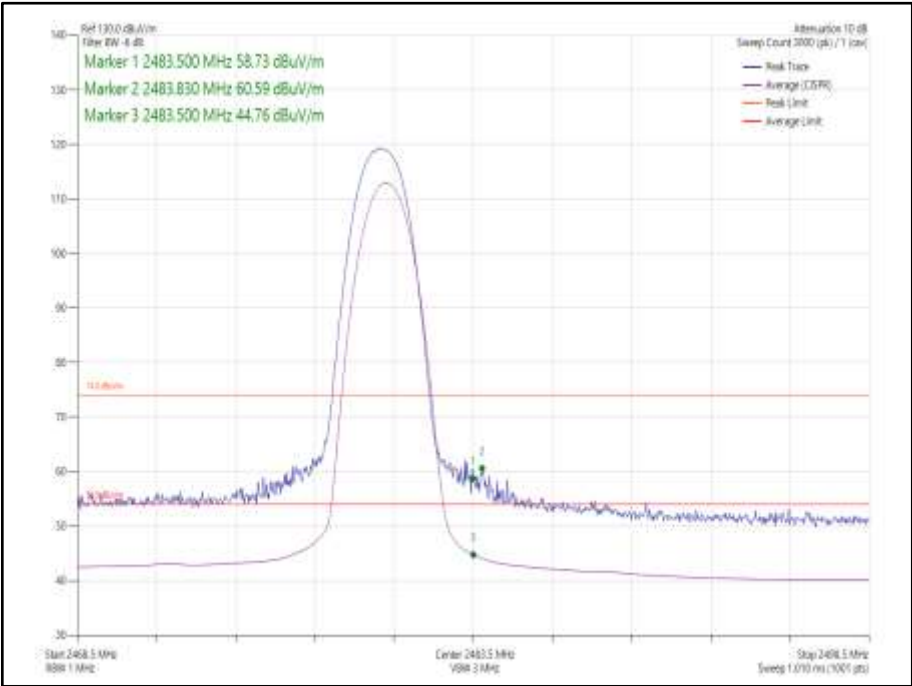


Figure 12 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth (FHSS)

iPA

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	54.66	39.82
Static	$\pi/4$ DQPSK	2	2DH5	2402	2390.0	54.24	39.95
Static	8-DPSK	2	3DH5	2402	2390.0	55.06	39.92
Static	GFSK	2	DH5	2480	2483.5	53.25	41.11
Static	$\pi/4$ DQPSK	2	2DH5	2480	2483.5	53.19	41.04
Static	8-DPSK	2	3DH5	2480	2483.5	54.36	41.15

Table 8 - Restricted Band Edge Results

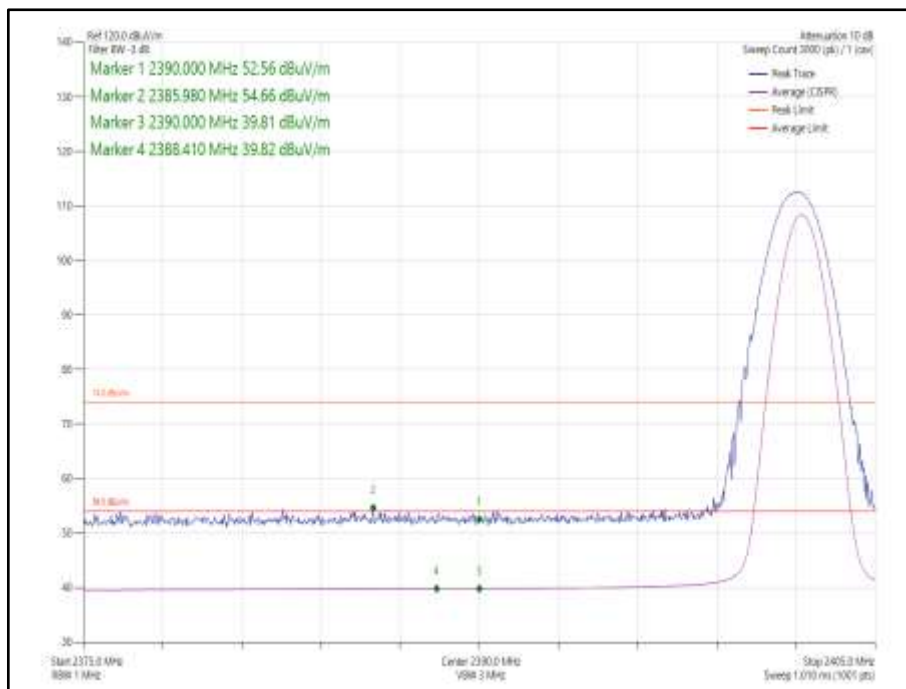


Figure 13 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

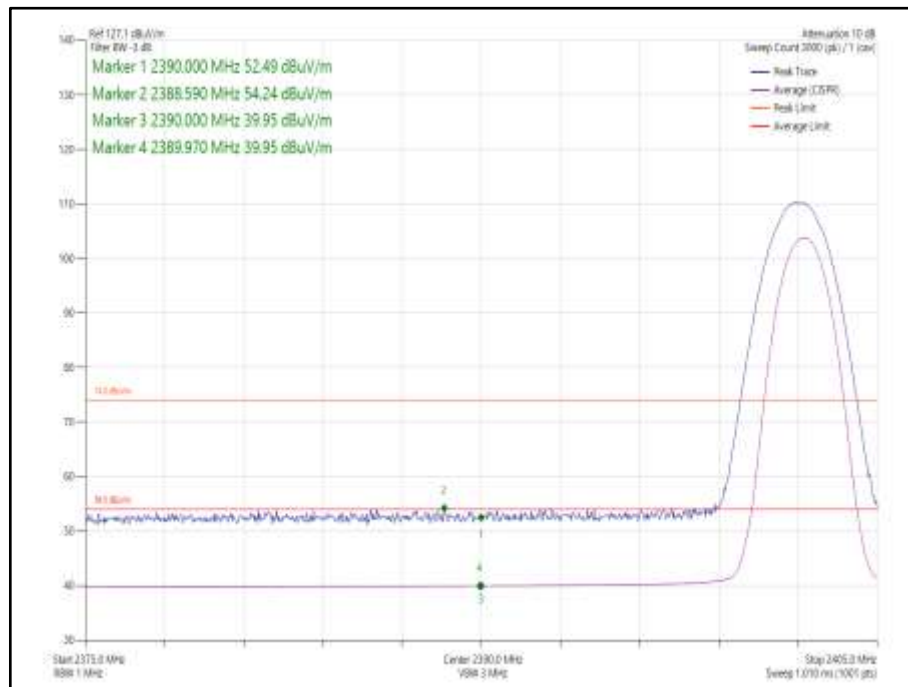


Figure 14 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

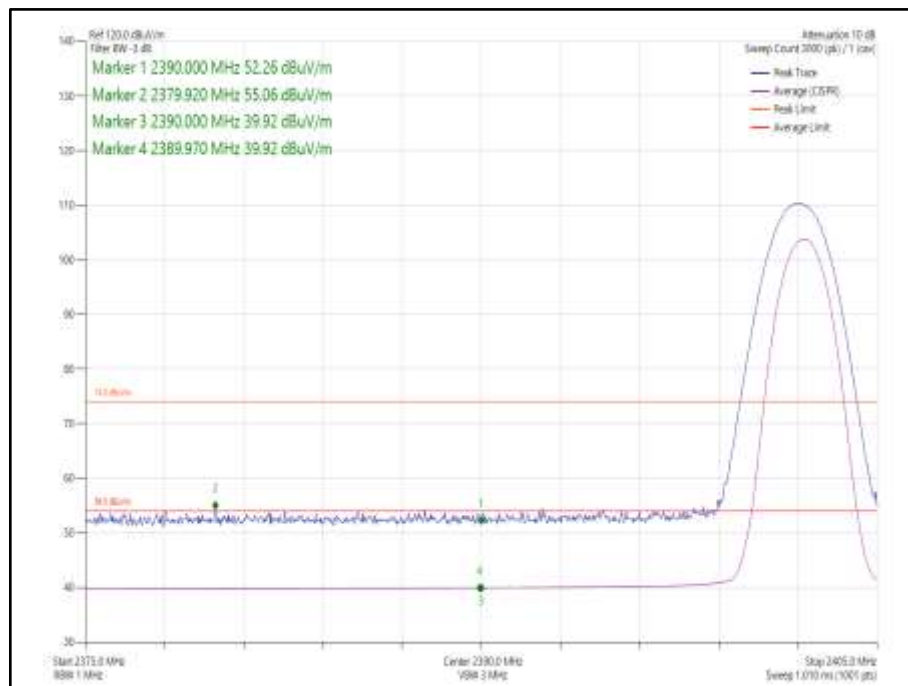


Figure 15 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

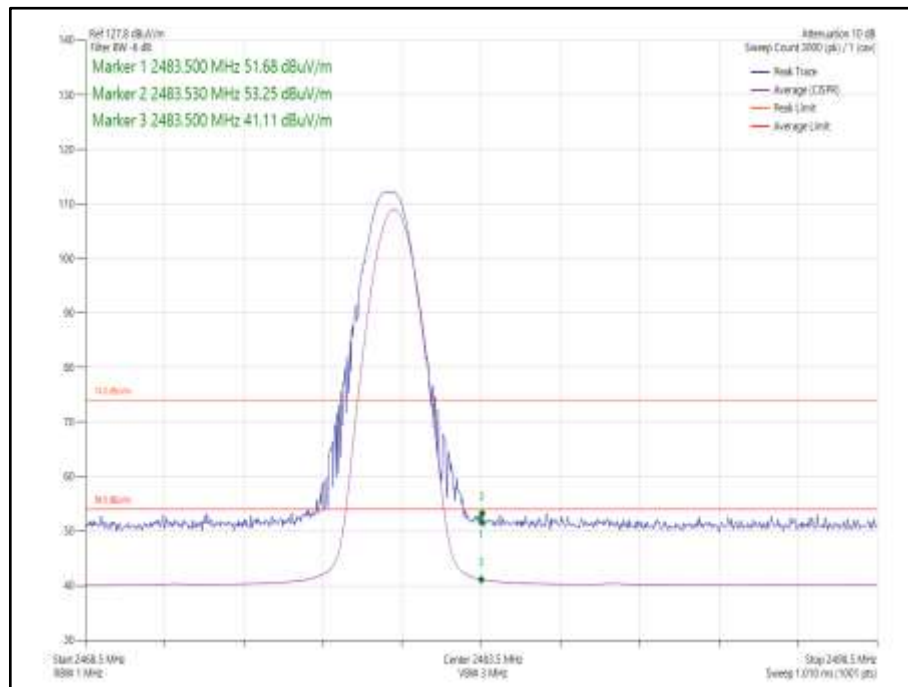


Figure 16 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

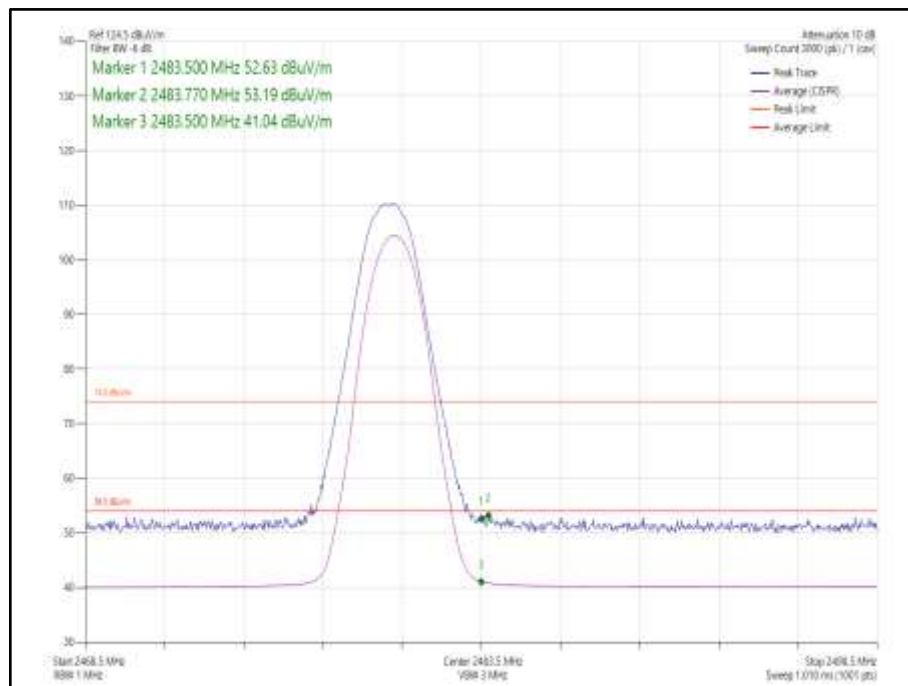


Figure 17 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

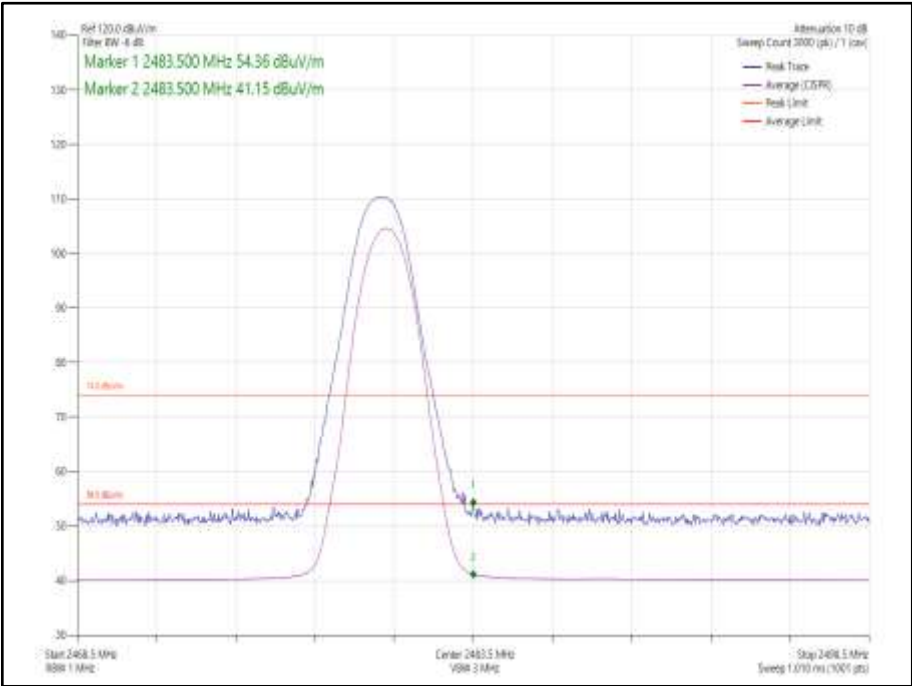


Figure 18 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

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	54.21	40.07
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2390.0	54.34	39.96
Static	8-DPSK	0-1	3DH5	2402	2390.0	54.33	39.95
Static	GFSK	0-1	DH5	2480	2483.5	60.36	43.10
Static	$\pi/4$ DQPSK	0-1	2DH5	2480	2483.5	57.63	42.38
Static	8-DPSK	0-1	3DH5	2480	2483.5	57.12	42.36

Table 9 - Restricted Band Edge Results

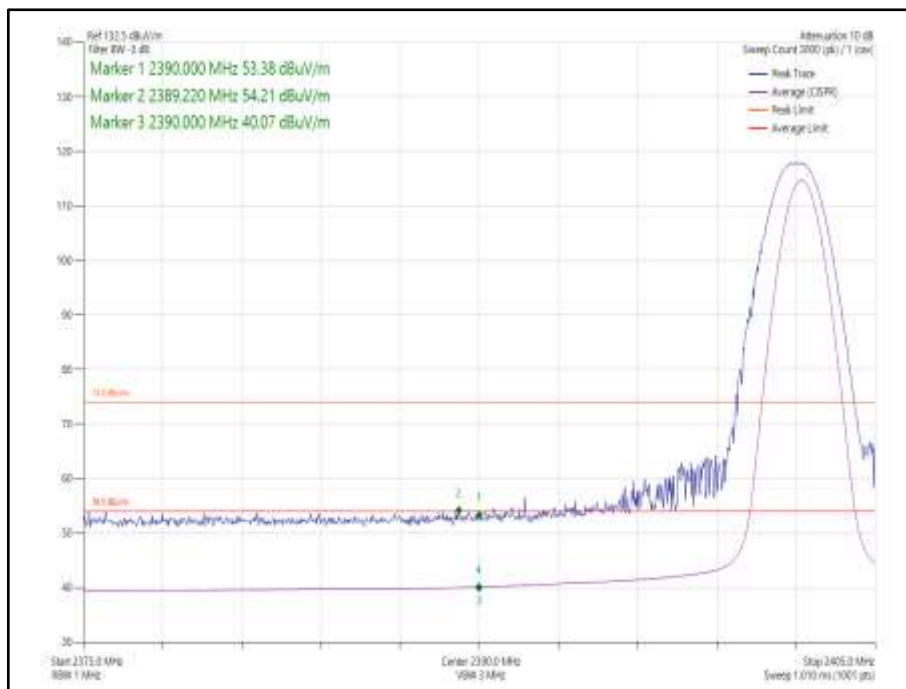


Figure 19 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

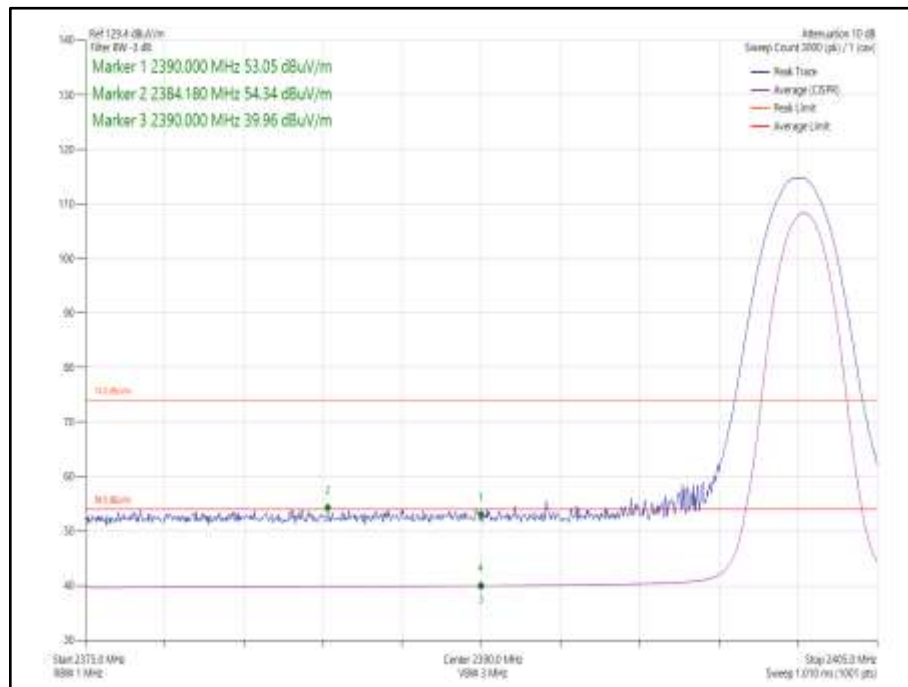


Figure 20 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

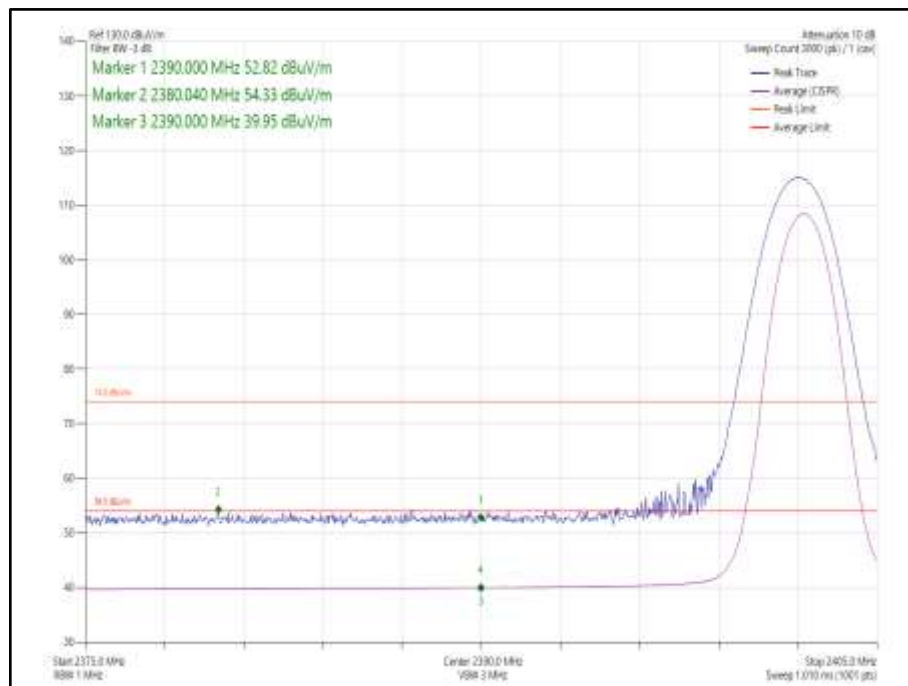


Figure 21 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

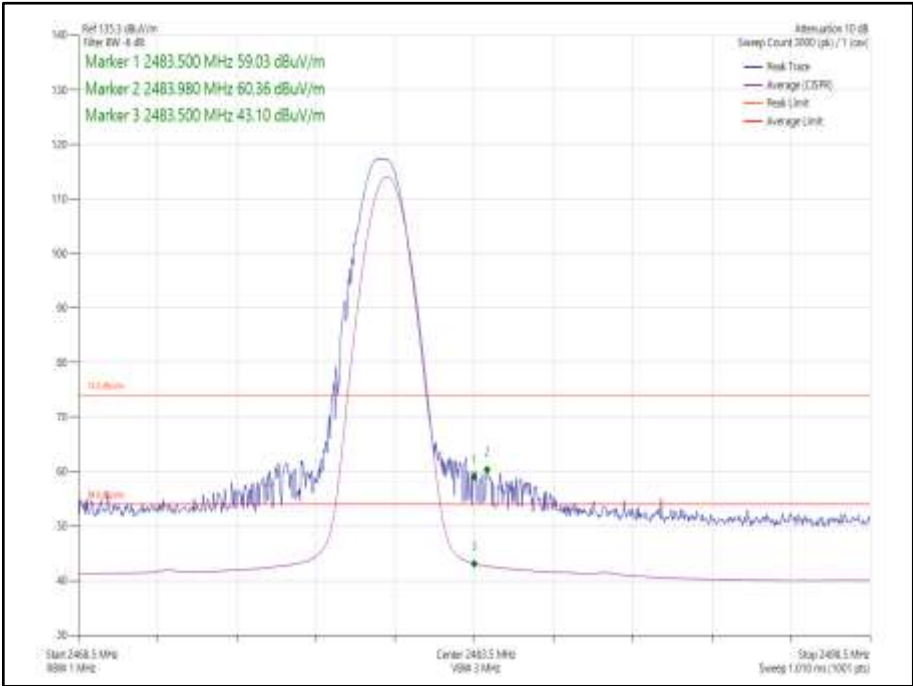


Figure 22 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

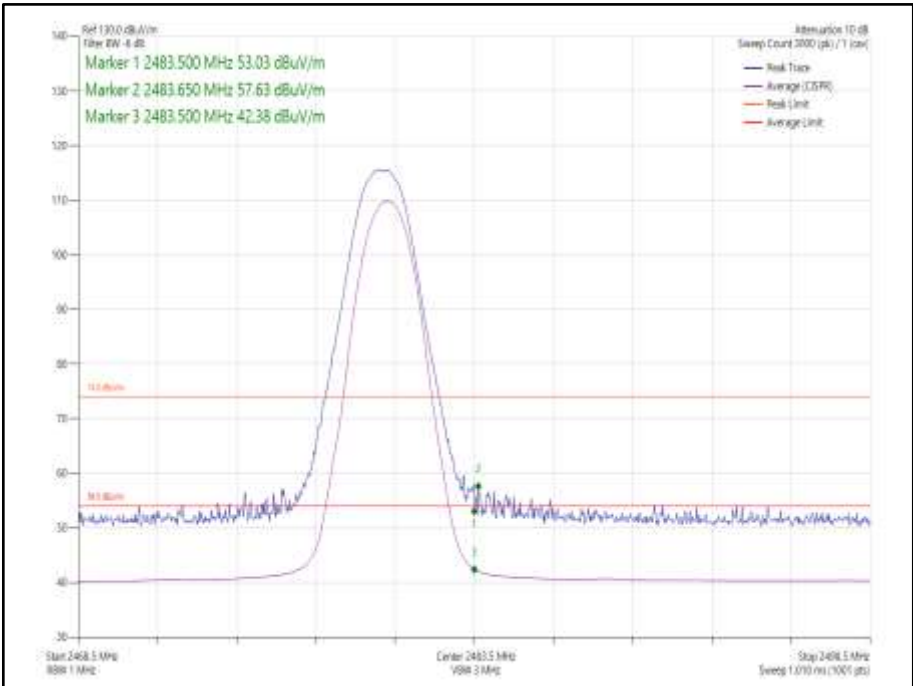


Figure 23 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

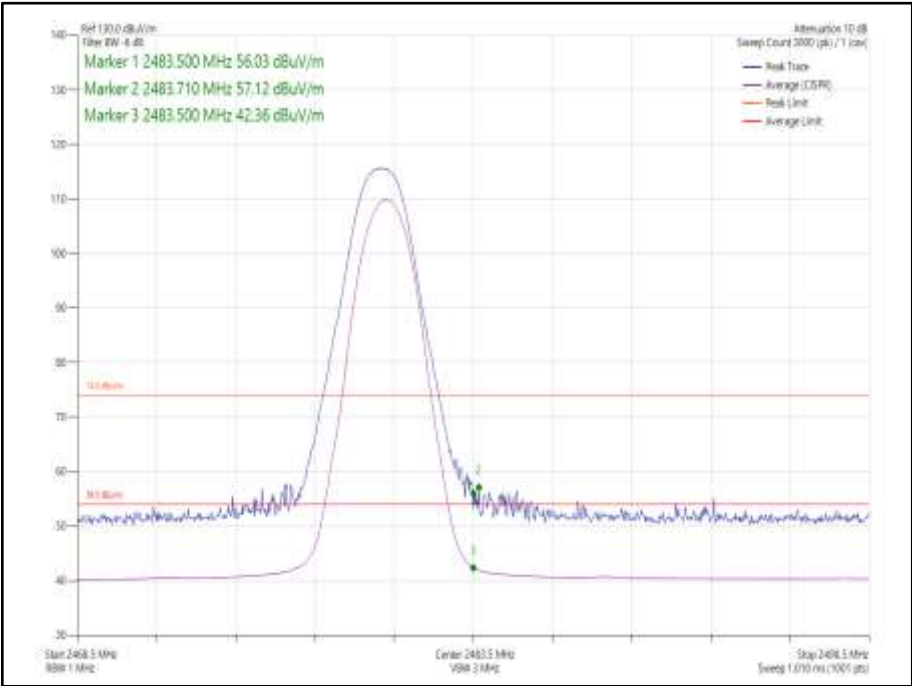


Figure 24 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

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	56.68	41.13
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2390.0	56.94	40.89
Static	8-DPSK	0-1	3DH5	2402	2390.0	57.15	40.73
Static	GFSK	0-1	DH5	2480	2483.5	64.83	46.22
Static	$\pi/4$ DQPSK	0-1	2DH5	2480	2483.5	63.83	45.70
Static	8-DPSK	0-1	3DH5	2480	2483.5	66.34	45.94

Table 10 - Restricted Band Edge Results

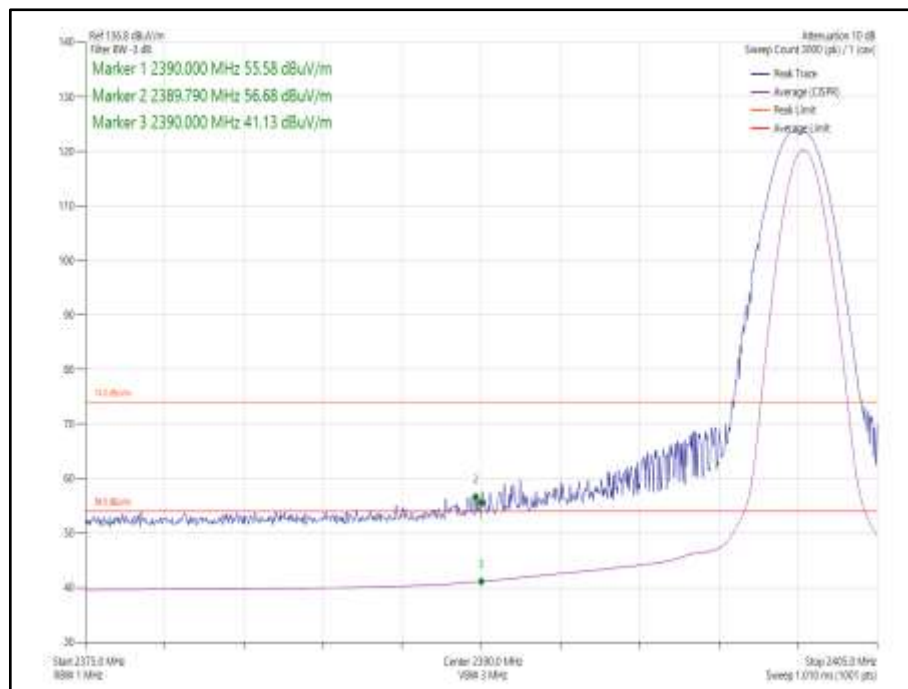


Figure 25 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

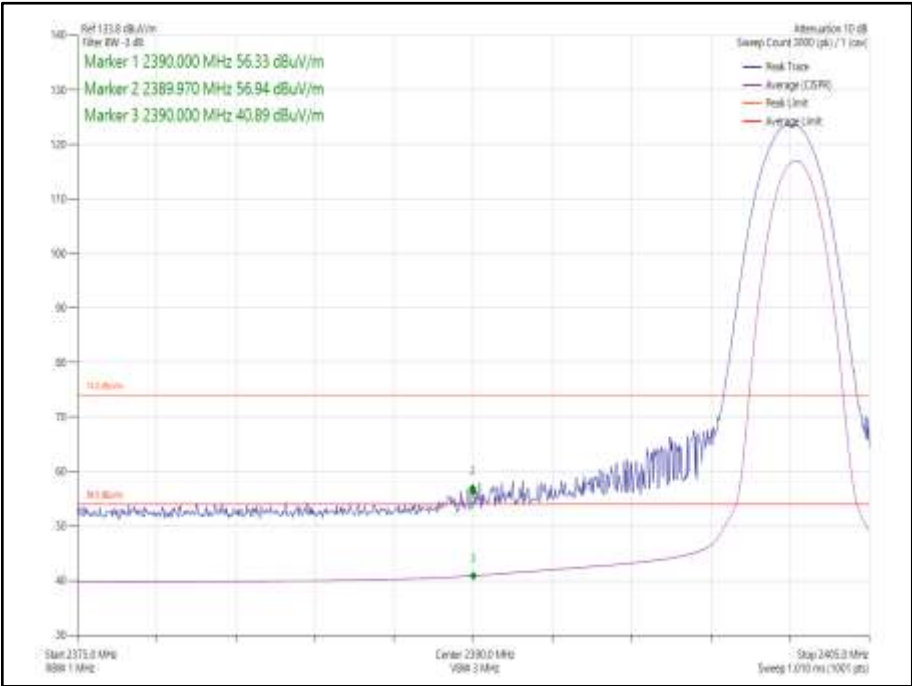


Figure 26 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2390.0 MHz

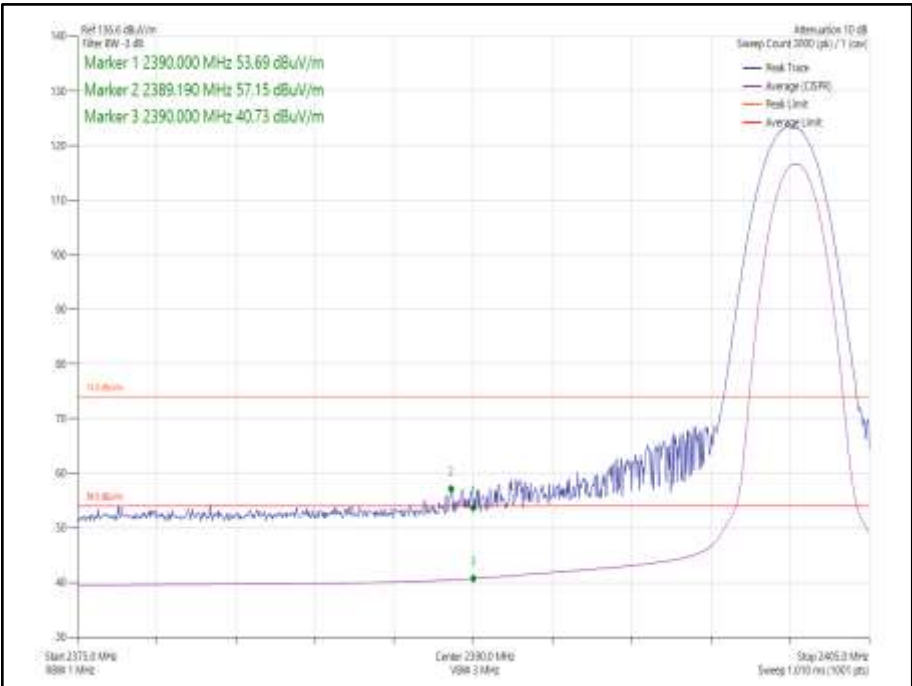


Figure 27 - Static - 8-DPSK/3DH5 - 2402 MHz Band Edge Frequency 2390.0 MHz

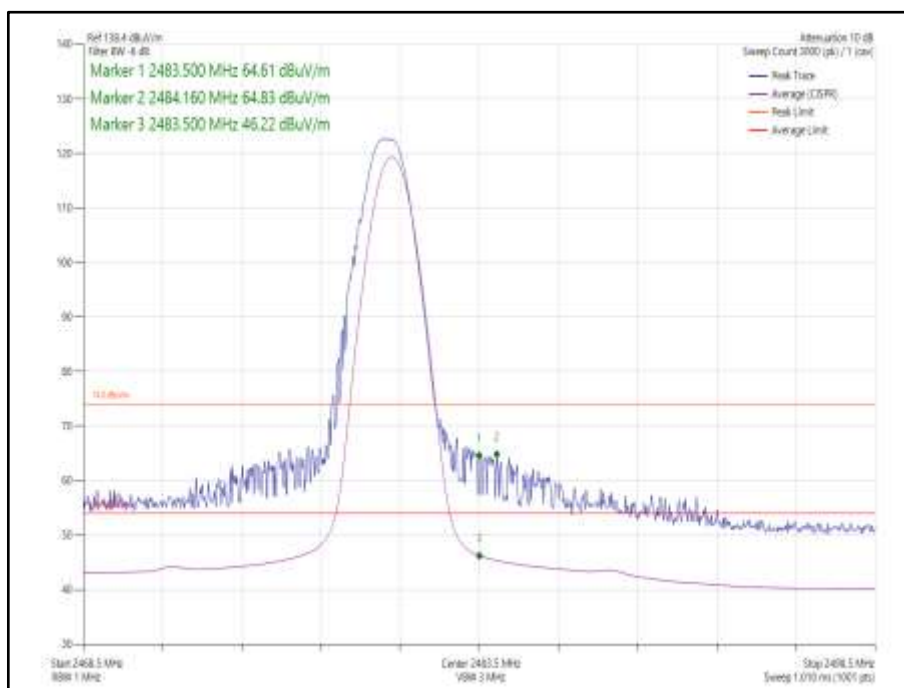


Figure 28 - Static - GFSK/DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

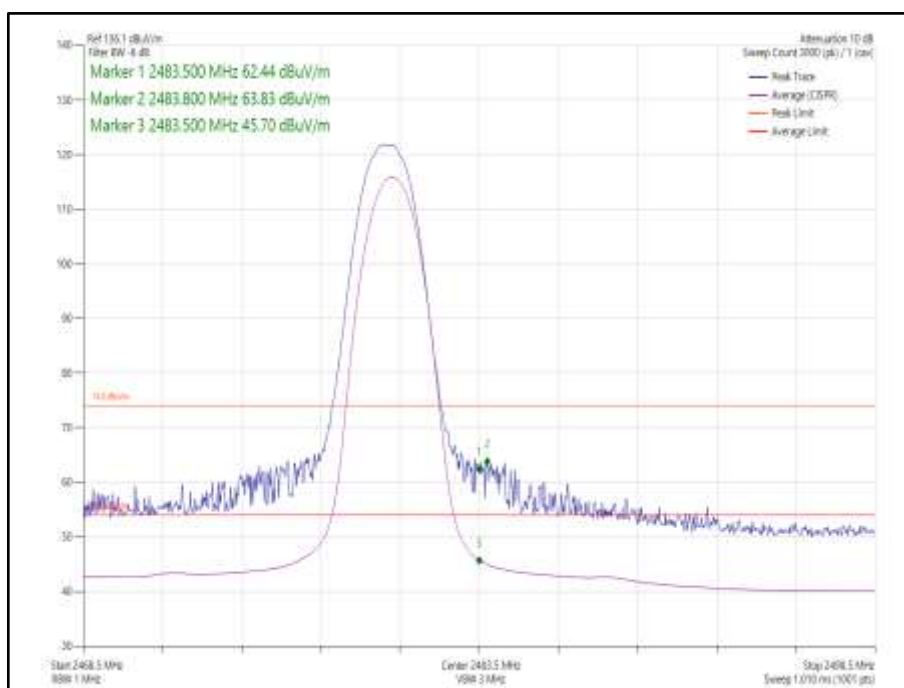


Figure 29 - Static - $\pi/4$ DQPSK/2DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

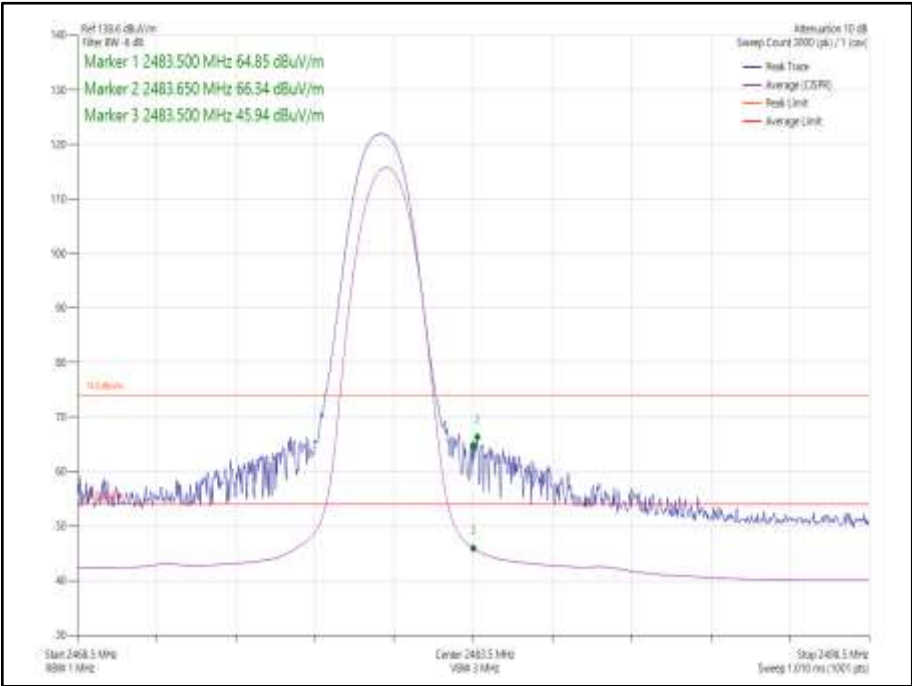


Figure 30 - Static - 8-DPSK/3DH5 - 2480 MHz - Band Edge Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/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 (µV/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
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	01-Apr-2022
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	08-Mar-2022
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	Software
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5517	12	09-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

A2485, S/N: CQ2R1P6HF2 - Modification State 0

2.2.3 Date of Test

07-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	22.5 °C
Relative Humidity	66.9 %

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):	B (Core 1)	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	116	335.0	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):	B (Core 1)	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	102	294.6	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	112	323.4	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	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 17

O/P Mon – Output Monitored using calibrated equipment



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

A2485, S/N: CQ2R1P6HF2 - Modification State 0

2.3.3 Date of Test

07-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	22.5 °C
Relative Humidity	66.9 %

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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.855	2441.018	2442.018	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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.330	2441.001	2442.002	1.001	≥ 886.7

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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.260	2441.009	2442.010	1.001	≥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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.855	2441.018	2442.018	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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.325	2441.001	2442.001	1.000	≥ 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):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.265	2441.009	2442.009	1.000	≥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	2441.018	2442.018	1.000	≥570.0

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	1.330	2441.001	2442.002	1.001	≥ 886.7

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	2441.010	2442.009	0.999	≥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
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
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 27

O/P Mon – Output Monitored using calibrated equipment



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

A2485, S/N: CQ2R1P6HF2 - Modification State 0

2.4.3 Date of Test

07-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	22.5 °C
Relative Humidity	66.9 %

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):	B (Core 1)	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):	B (Core 1)	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)

FHSSs 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
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
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 31

O/P Mon – Output Monitored using calibrated equipment



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

A2485, S/N: CQ2R1P6HF2 - Modification State 0

2.5.3 Date of Test

07-September-2021

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.1.

2.5.5 Environmental Conditions

Ambient Temperature	22.5 °C
Relative Humidity	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):	B (Core 1)	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

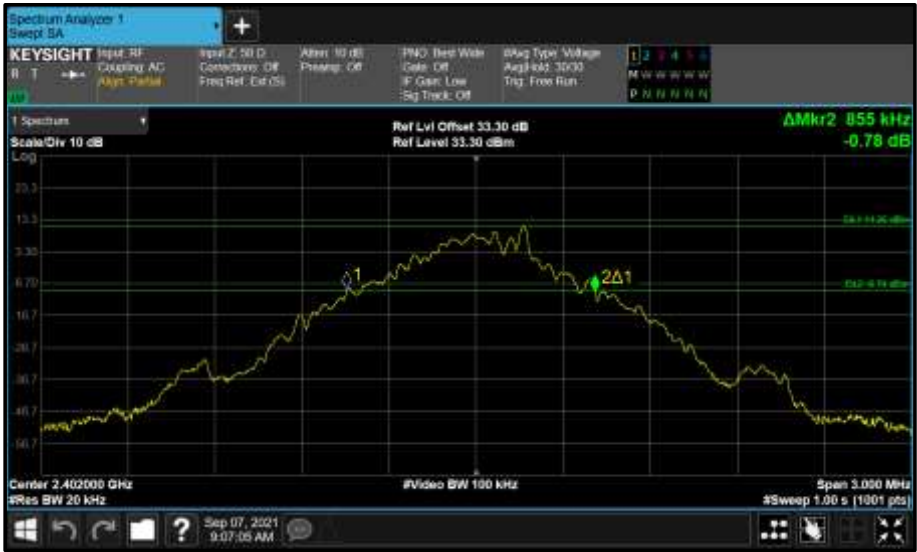


Figure 46 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth

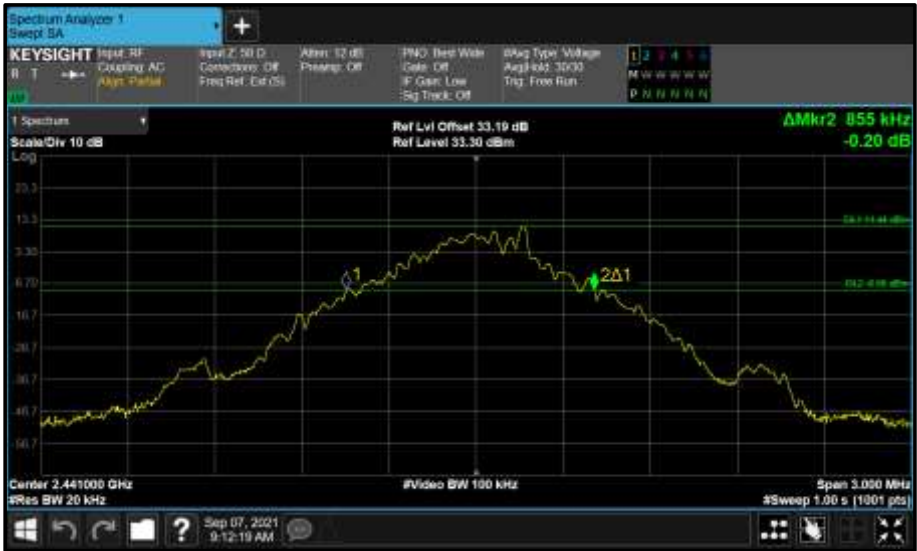


Figure 47 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth





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):	B (Core 1)	Peak Antenna Gain (dBi):	-

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

Table 33 - 20 dB Bandwidth Results



Figure 49 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 50 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 51 - 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:	SISO	DCCF (dB):	-
Active Port(s):	B (Core 1)	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 34 - 20 dB Bandwidth Results



Figure 52 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 53 - Core 1 (B) 2441 MHz (CH39) 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:	iPA GFSK (DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Core 1)	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 35 - 20 dB Bandwidth Results







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 36 - 20 dB Bandwidth Results

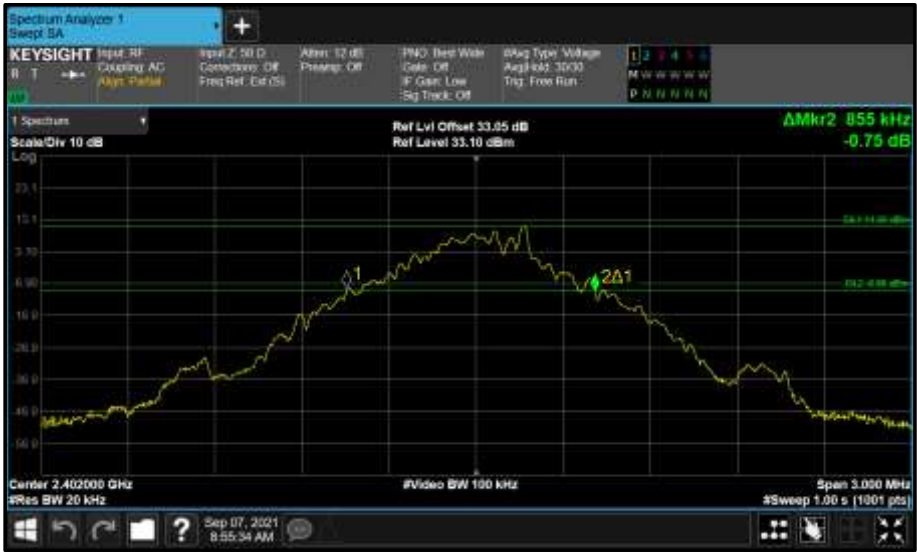


Figure 58 - Core 2 (C) 2402 MHz (CH0) 20 dB Bandwidth

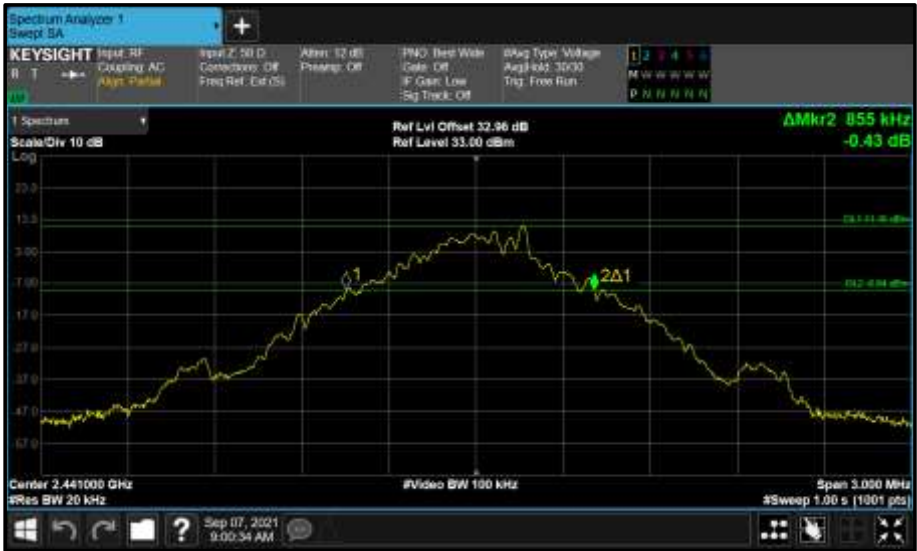


Figure 59 - Core 2 (C) 2441 MHz (CH39) 20 dB Bandwidth

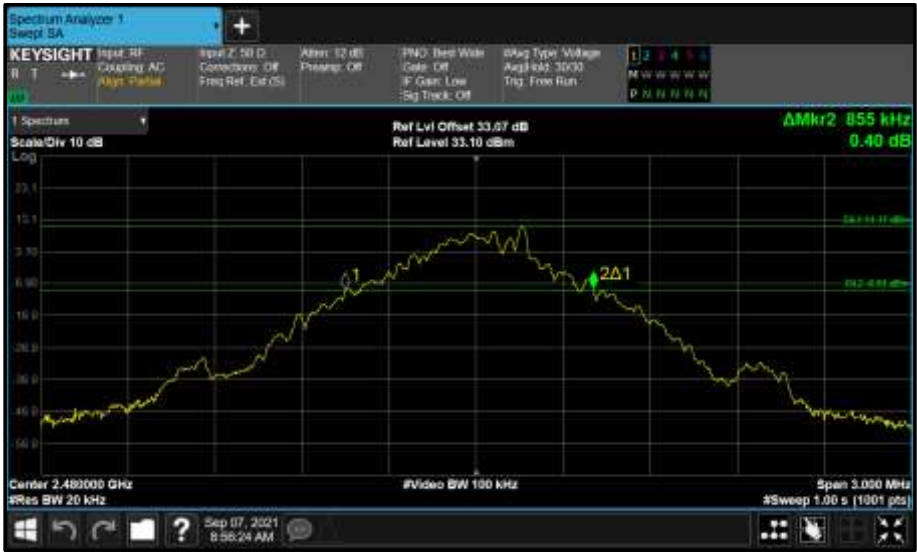


Figure 60 - Core 2 (C) 2480 MHz (CH78) 20 dB Bandwidth



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:	SISO	DCCF (dB):	-
Active Port(s):	B (Core 1)	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 37 - 20 dB Bandwidth Results



Figure 61 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 62 - Core 1 (B) 2441 MHz (CH39) 20 dB Bandwidth



Figure 63 - 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:	SISO	DCCF (dB):	-
Active Port(s):	B (Core 1)	Peak Antenna Gain (dBi):	-

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

Table 38 - 20 dB Bandwidth Results

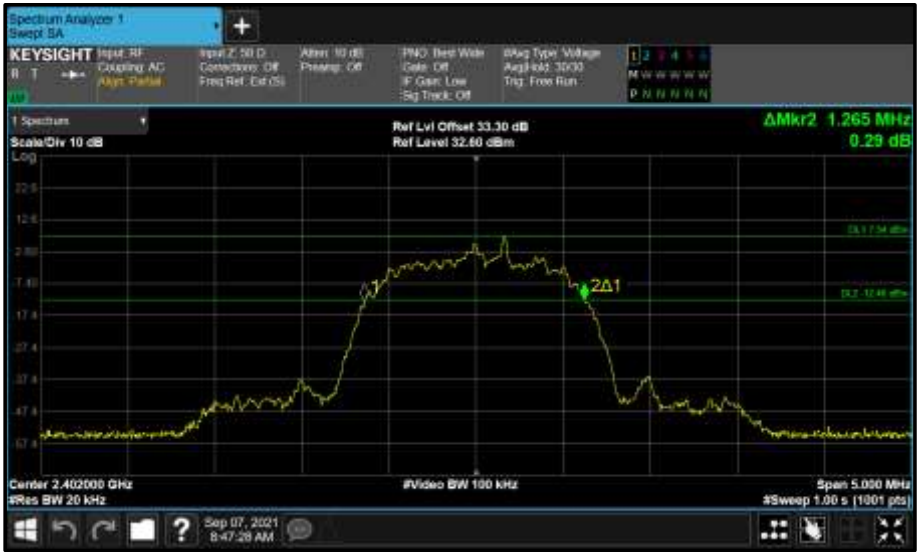


Figure 64 - Core 1 (B) 2402 MHz (CH0) 20 dB Bandwidth



Figure 65 - Core 1 (B) 2441 MHz (CH39) 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:	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	-	-	1.330	-
2480	-	-	1.325	-

Table 39 - 20 dB Bandwidth Results



Figure 67 - Core 2 (C) 2402 MHz (CH0) 20 dB Bandwidth



Figure 68 - Core 2 (C) 2441 MHz (CH39) 20 dB Bandwidth



Figure 69 - 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	-	-	1.265	-
2480	-	-	1.260	-

Table 40 - 20 dB Bandwidth Results





Figure 72 - Core 2 (C) 2480 MHz (CH78) 20 dB Bandwidth

FCC 47 CFR Part 15 and ISSED 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	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	5529	24	04-Mar-2022
Signal Commissioning Unit	TUV SUD	SCU002	5759	12	30-Jun-2022

Table 41

O/P Mon – Output Monitored using calibrated equipment



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

A2485, S/N: CQ2R1P6HF2 - Modification State 0

2.6.3 Date of Test

07-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	22.5 °C
Relative Humidity	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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	13.32	-	-	-	29.00	-15.68
2441	-	13.30	-	-	-	29.00	-15.70
2480	-	13.21	-	-	-	29.00	-15.79

Table 42 - 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	-	13.32	-	-	-	30.00	-16.68	20.32	36.00	-15.68
2441	-	13.30	-	-	-	30.00	-16.70	20.30	36.00	-15.70
2480	-	13.21	-	-	-	30.00	-16.79	20.21	36.00	-15.79

Table 43 - 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):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	13.07	13.22	-	-	16.14	26.89	-10.75
2441	13.10	13.20	-	-	16.14	26.89	-10.75
2480	13.22	13.30	-	-	16.23	26.89	-10.66

Table 44 - 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	13.07	13.22	-	-	16.14	30.00	-13.86	25.25	36.00	-10.75
2441	13.10	13.20	-	-	16.14	30.00	-13.86	25.25	36.00	-10.75
2480	13.22	13.30	-	-	16.23	30.00	-13.77	25.34	36.00	-10.66

Table 45 - 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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	19.37	-	-	-	29.00	-9.63
2441	-	19.16	-	-	-	29.00	-9.84
2480	-	19.40	-	-	-	29.00	-9.60

Table 46 - 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	-	19.37	-	-	-	30.00	-10.63	26.37	36.00	-9.63
2441	-	19.16	-	-	-	30.00	-10.84	26.16	36.00	-9.84
2480	-	19.40	-	-	-	30.00	-10.60	26.40	36.00	-9.60

Table 47 - ISSED 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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	20.00	-	-	-	29.00	-9.00
2441	-	19.68	-	-	-	29.00	-9.32
2480	-	19.62	-	-	-	29.00	-9.38

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	-	20.00	-	-	-	30.00	-10.00	27.00	36.00	-9.00
2441	-	19.68	-	-	-	30.00	-10.32	26.68	36.00	-9.32
2480	-	19.62	-	-	-	30.00	-10.38	26.62	36.00	-9.38

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 $\pi/4$ 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):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	19.32	19.16	-	-	22.20	26.89	-4.68
2441	19.30	19.18	-	-	22.24	26.89	-4.65
2480	18.76	18.85	-	-	21.79	26.89	-5.10

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	19.32	19.16	-	-	22.20	30.00	-7.80	31.32	36.00	-4.68
2441	19.30	19.18	-	-	22.24	30.00	-7.76	31.35	36.00	-4.65
2480	18.76	18.85	-	-	21.79	30.00	-8.21	30.90	36.00	-5.10

Table 51 - ISSED 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):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	19.29	19.43	-	-	22.19	26.89	-4.69
2441	19.75	19.30	-	-	22.53	26.89	-4.36
2480	19.29	19.45	-	-	22.36	26.89	-4.53

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	19.29	19.43	-	-	22.19	30.00	-7.81	31.31	36.00	-4.69
2441	19.75	19.30	-	-	22.53	30.00	-7.47	31.64	36.00	-4.36
2480	19.29	19.45	-	-	22.36	30.00	-7.64	31.47	36.00	-4.53

Table 53 - ISSED 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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	13.20	-	-	-	29.00	-15.80
2441	-	13.23	-	-	-	29.00	-15.77
2480	-	13.27	-	-	-	29.00	-15.73

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	-	13.20	-	-	-	30.00	-16.80	20.20	36.00	-15.80
2441	-	13.23	-	-	-	30.00	-16.77	20.23	36.00	-15.77
2480	-	13.27	-	-	-	30.00	-16.73	20.27	36.00	-15.73

Table 55 - ISSED 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):	5.40

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	13.14	-	-	30.00	-16.86
2441	-	-	13.04	-	-	30.00	-16.96
2480	-	-	13.05	-	-	30.00	-16.95

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	-	-	13.14	-	-	30.00	-16.86	18.54	36.00	-17.46
2441	-	-	13.04	-	-	30.00	-16.96	18.44	36.00	-17.56
2480	-	-	13.05	-	-	30.00	-16.95	18.45	36.00	-17.55

Table 57 - ISSED 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):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	13.08	13.24	-	-	16.14	26.89	-10.75
2441	13.11	13.18	-	-	16.12	26.89	-10.76
2480	13.15	13.29	-	-	16.21	26.89	-10.68

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	13.08	13.24	-	-	16.14	30.00	-13.86	25.25	36.00	-10.75
2441	13.11	13.18	-	-	16.12	30.00	-13.88	25.24	36.00	-10.76
2480	13.15	13.29	-	-	16.21	30.00	-13.79	25.32	36.00	-10.68

Table 59 - ISCED 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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	11.98	-	-	-	29.00	-17.02
2441	-	12.00	-	-	-	29.00	-17.00
2480	-	12.03	-	-	-	29.00	-16.97

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	-	11.98	-	-	-	30.00	-18.02	18.98	36.00	-17.02
2441	-	12.00	-	-	-	30.00	-18.00	19.00	36.00	-17.00
2480	-	12.03	-	-	-	30.00	-17.97	19.03	36.00	-16.97

Table 61 - ISSED 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):	B (Core 1)	Peak Antenna Gain (dBi):	7.00

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	12.55	-	-	-	29.00	-16.45
2441	-	12.48	-	-	-	29.00	-16.52
2480	-	12.49	-	-	-	29.00	-16.51

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	-	12.55	-	-	-	30.00	-17.45	19.55	36.00	-16.45
2441	-	12.48	-	-	-	30.00	-17.52	19.48	36.00	-16.52
2480	-	12.49	-	-	-	30.00	-17.51	19.49	36.00	-16.51

Table 63 - ISSED 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):	5.40

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	11.91	-	-	30.00	-18.09
2441	-	-	11.71	-	-	30.00	-18.29
2480	-	-	12.00	-	-	30.00	-18.00

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	-	-	11.91	-	-	30.00	-18.09	17.31	36.00	-18.69
2441	-	-	11.71	-	-	30.00	-18.29	17.11	36.00	-18.89
2480	-	-	12.00	-	-	30.00	-18.00	17.40	36.00	-18.60

Table 65 - ISSED 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):	5.40

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	-	-	12.37	-	-	30.00	-17.63
2441	-	-	12.21	-	-	30.00	-17.79
2480	-	-	12.44	-	-	30.00	-17.56

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	-	-	12.37	-	-	30.00	-17.63	17.77	36.00	-18.23
2441	-	-	12.21	-	-	30.00	-17.79	17.61	36.00	-18.39
2480	-	-	12.44	-	-	30.00	-17.56	17.84	36.00	-18.16

Table 67 - ISSED 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 (%):	77.1
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	11.81	11.98	-	-	14.89	26.89	-12.00
2441	11.87	12.11	-	-	14.95	26.89	-11.94
2480	11.94	11.98	-	-	14.95	26.89	-11.94

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	11.81	11.98	-	-	14.89	30.00	-15.11	24.00	36.00	-12.00
2441	11.87	12.11	-	-	14.95	30.00	-15.05	24.06	36.00	-11.94
2480	11.94	11.98	-	-	14.95	30.00	-15.05	24.06	36.00	-11.94

Table 69 - ISSED 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 (%):	77.2
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	9.11

Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)
	A	B	C	D	Σ		
2402	12.30	12.54	-	-	15.40	26.89	-11.48
2441	12.28	12.55	-	-	15.36	26.89	-11.53
2480	12.38	12.50	-	-	15.41	26.89	-11.48

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	12.30	12.54	-	-	15.40	30.00	-14.60	24.52	36.00	-11.48
2441	12.28	12.55	-	-	15.36	30.00	-14.64	24.47	36.00	-11.53
2480	12.38	12.50	-	-	15.41	30.00	-14.59	24.52	36.00	-11.48

Table 71 - 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 DTSS employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.



2.6.7 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
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
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	12-Apr-2022
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 72

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 and 8.9

2.7.2 Equipment Under Test and Modification State

A2485, S/N: HV9QMW620K - Modification State 0

2.7.3 Date of Test

15-August-2021 to 19-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 dBuV/m to uV/m:
 $10^{(\text{Field Strength in dBuV/m}/20)}$

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

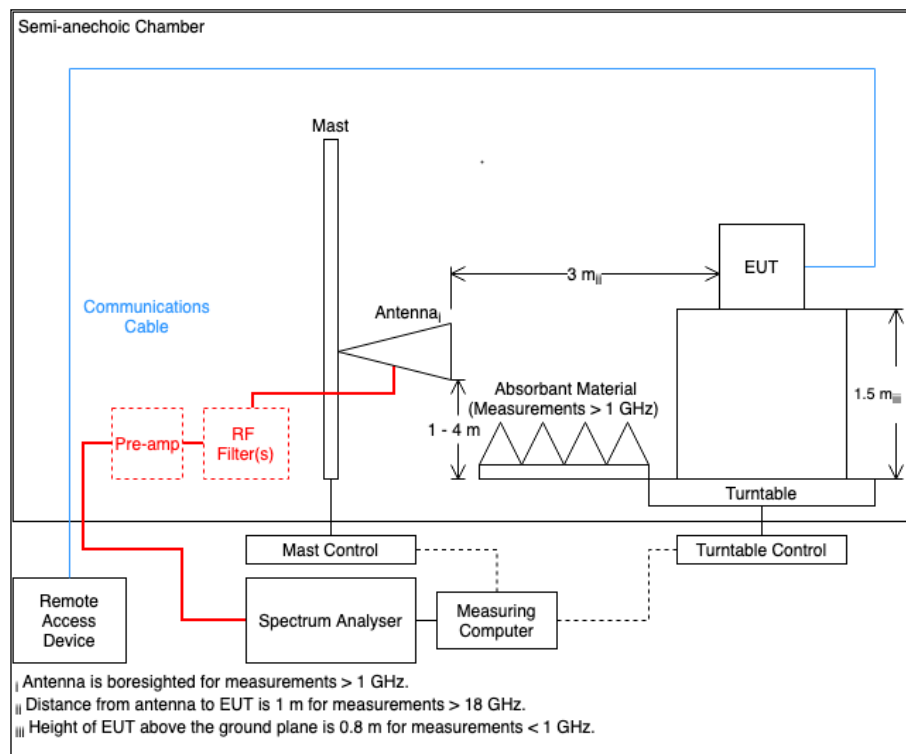


Figure 73

2.7.6 Environmental Conditions

Ambient Temperature	21.3 - 22.8 °C
Relative Humidity	42.6 - 52.1 %

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 73 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

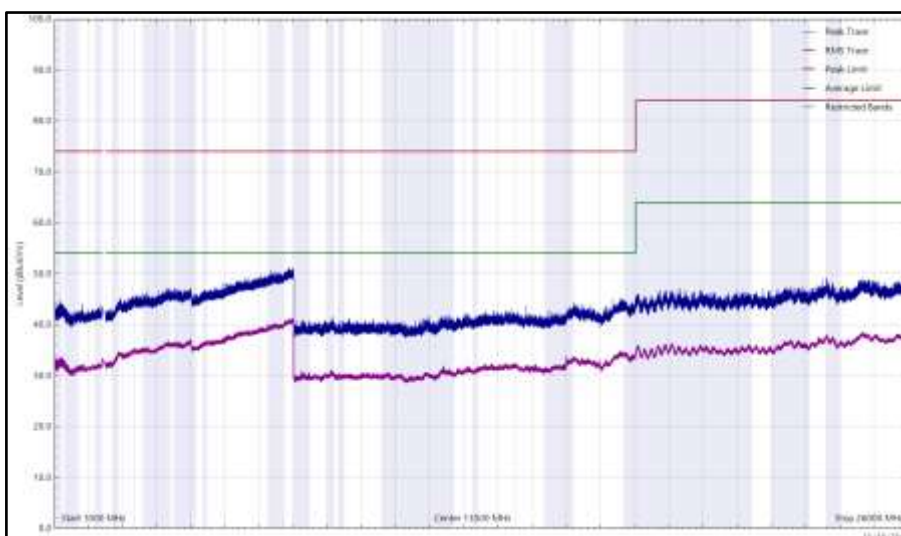


Figure 74 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

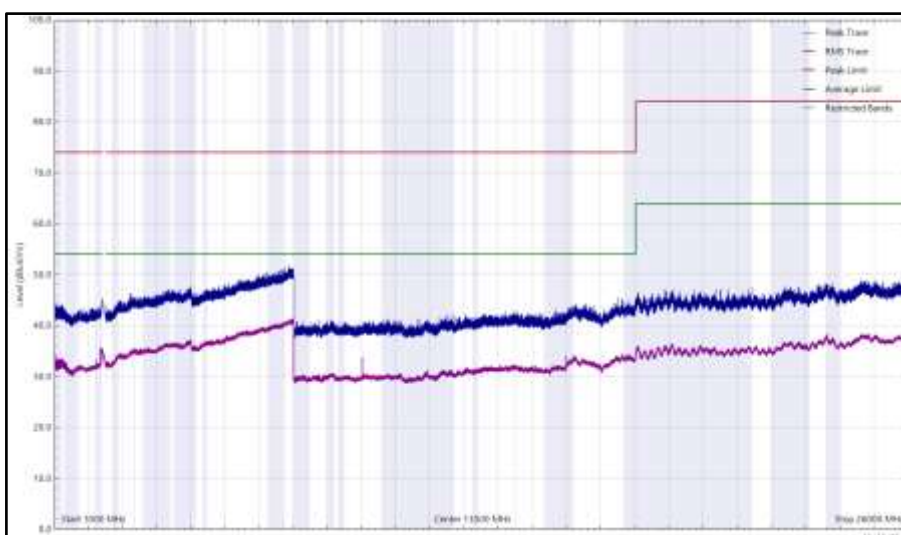


Figure 75 - 2402 MHz (CH0), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical

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

Table 74 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

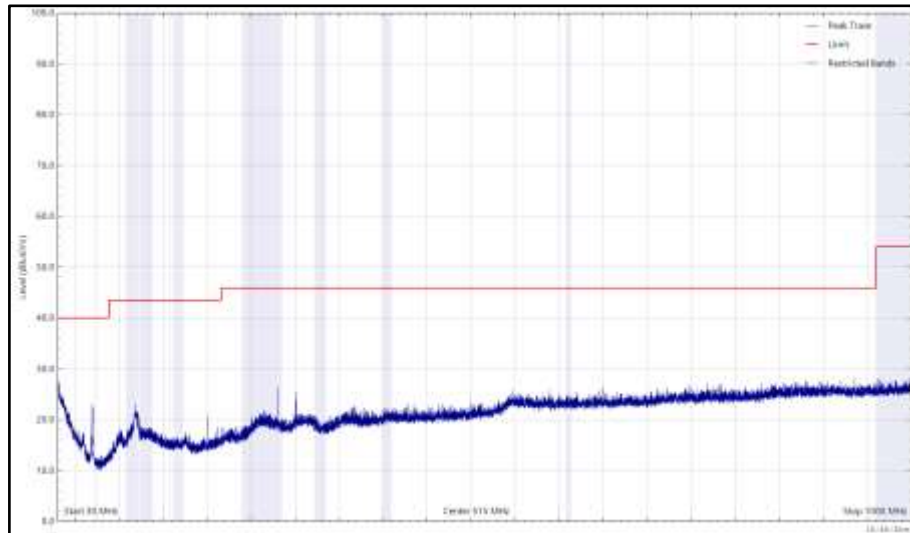


Figure 76 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 1 GHz, Horizontal (Peak)

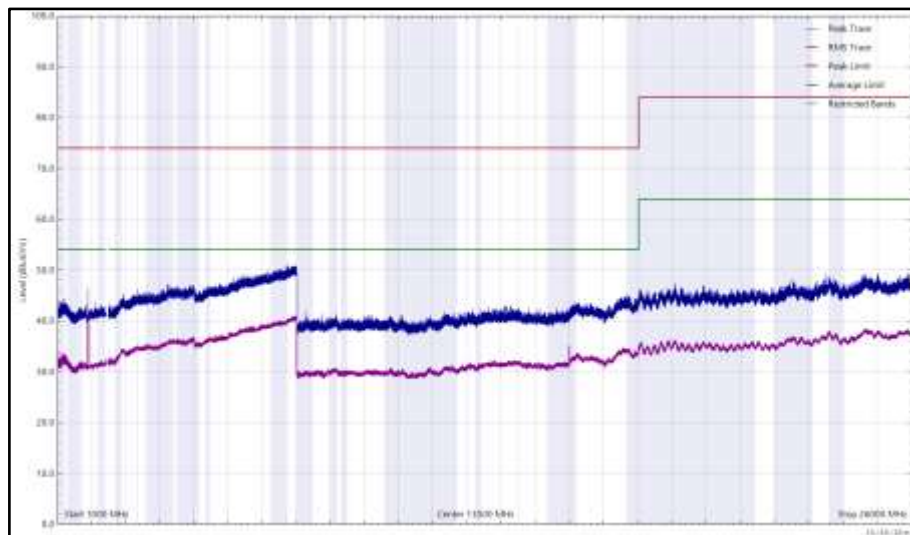


Figure 77 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

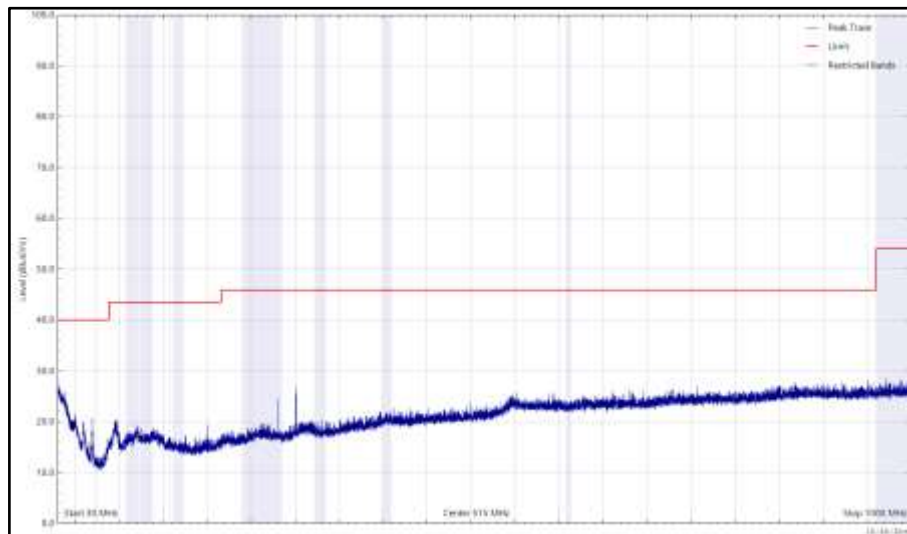


Figure 78 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 30 MHz to 1 GHz, Vertical (Peak)

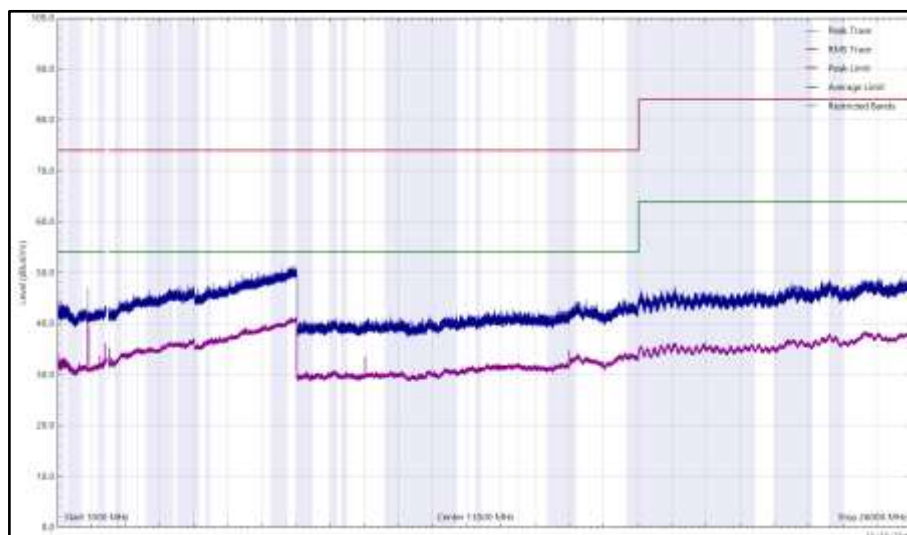


Figure 79 - 2441 MHz (CH39), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical

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

Table 75 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

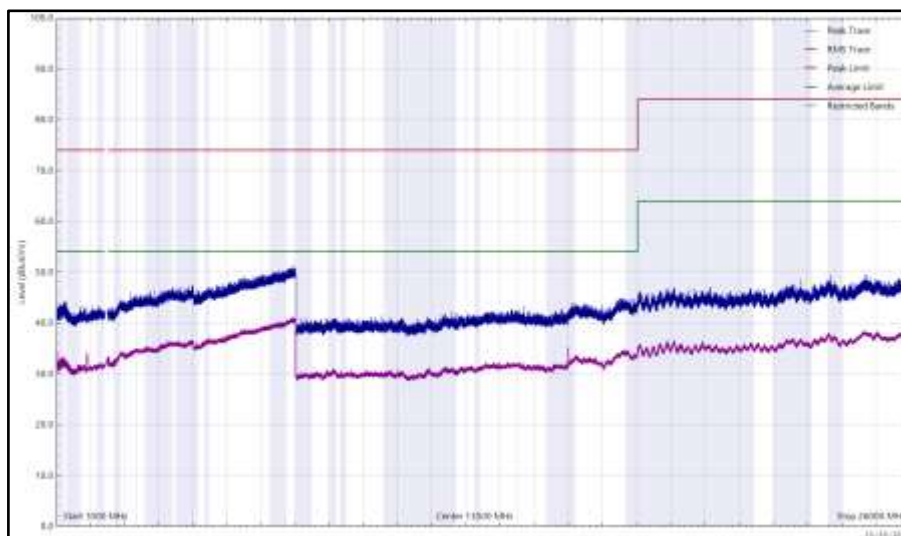


Figure 80 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

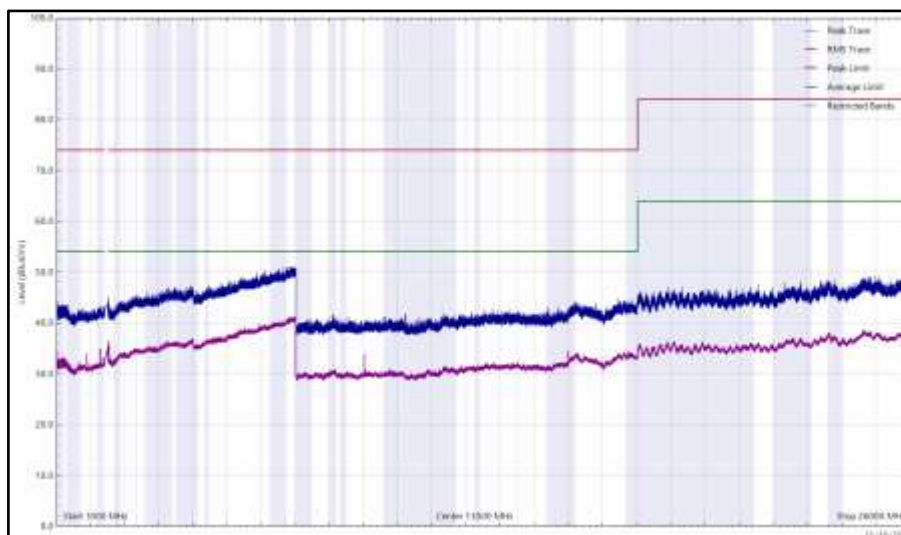


Figure 81 - 2480 MHz (CH78), DH5, iPA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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

Table 76 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

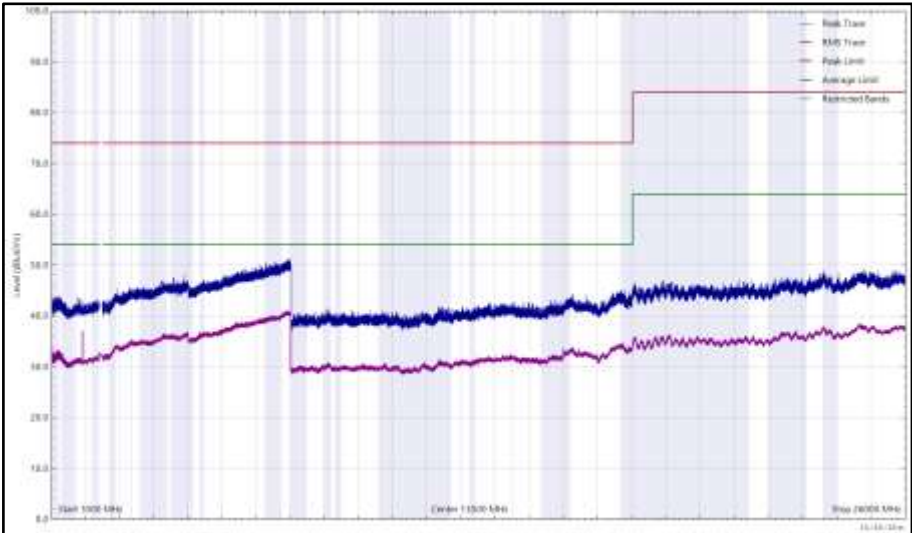


Figure 82 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

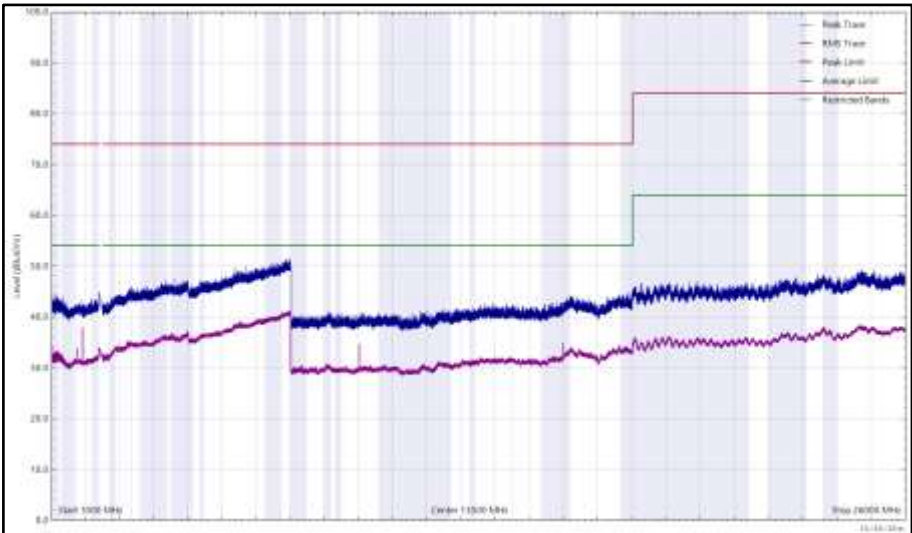


Figure 83 - 2402 MHz (CH0), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical

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

Table 77 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

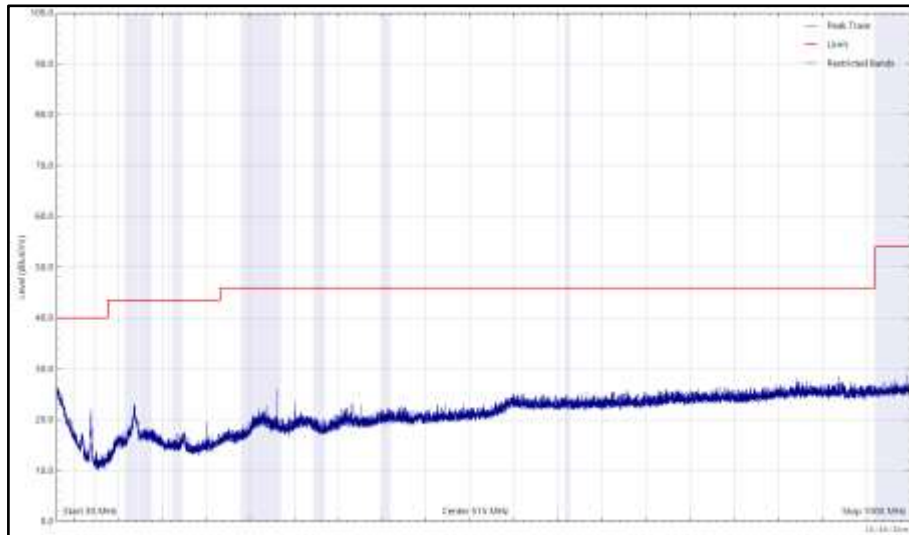


Figure 84 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 1 GHz, Horizontal (Peak)

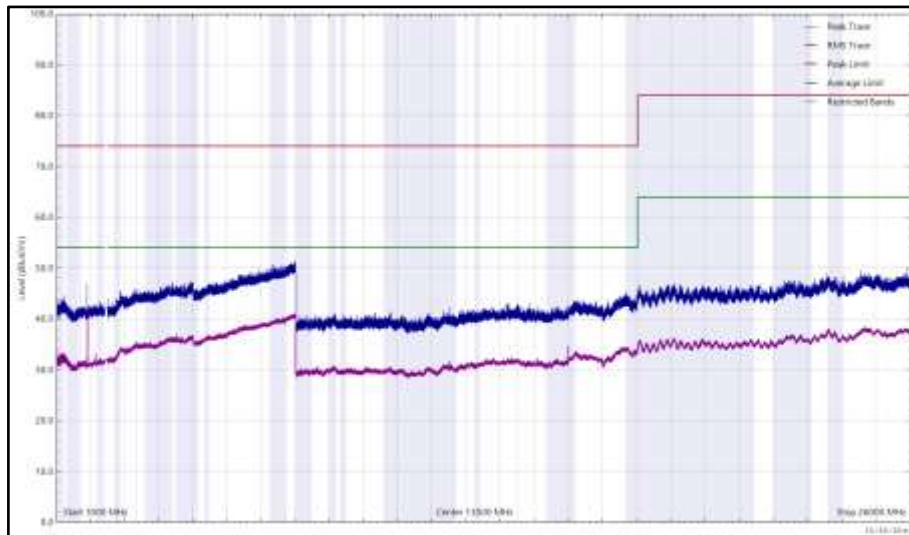


Figure 85 - 2441 MHz (CH39), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

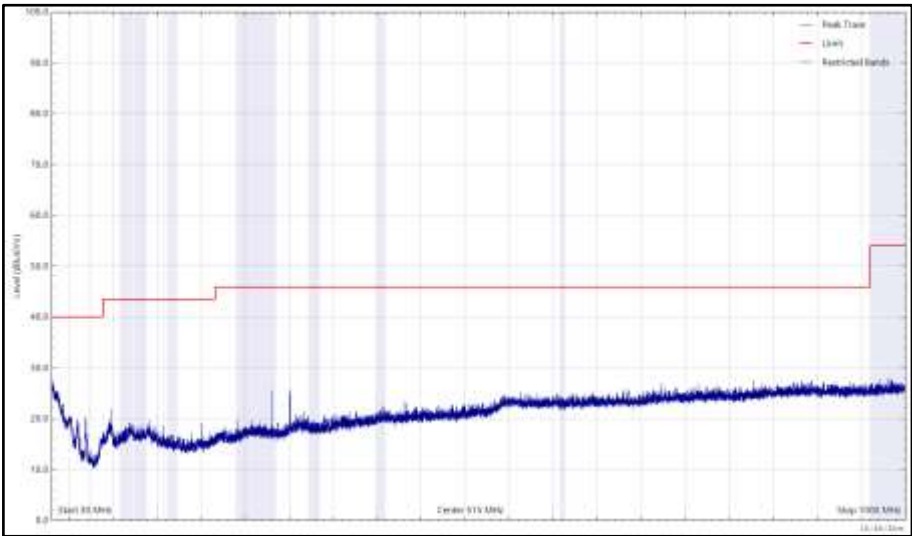


Figure 86 - 2441 MHz (CH39), DH5, iPA, Core 2, 30 MHz to 1 GHz, Vertical (Peak)

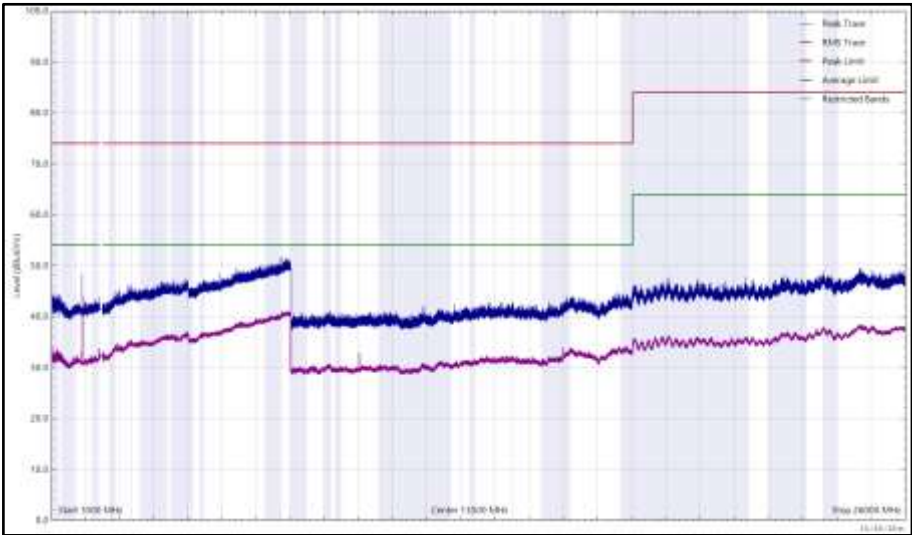


Figure 87 - 2441 MHz (CH39), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical



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

Table 78 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

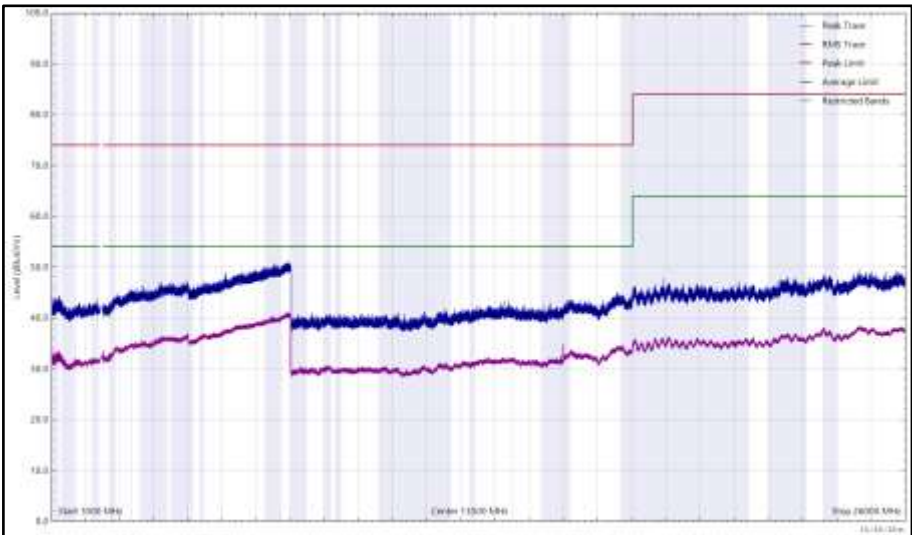


Figure 88 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 GHz to 26 GHz, Horizontal

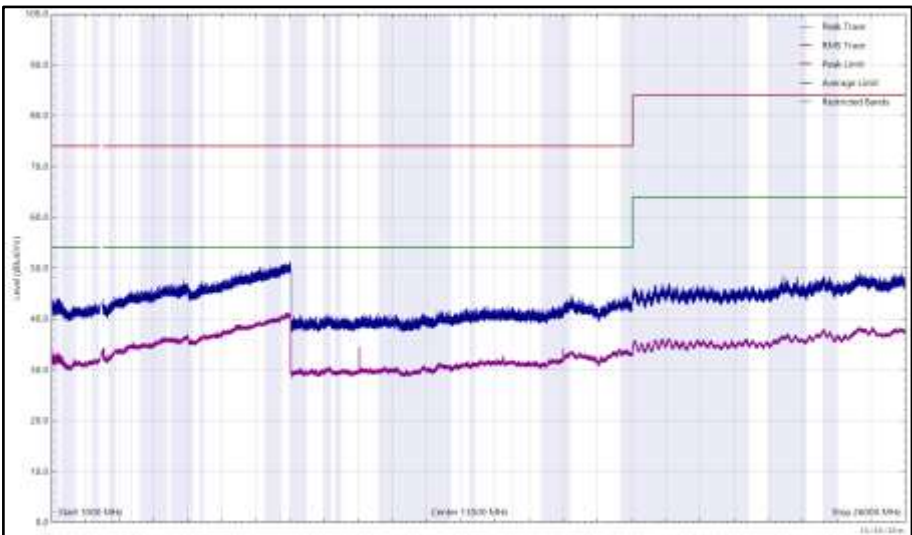


Figure 89 - 2480 MHz (CH78), DH5, iPA, Core 2, 1 GHz to 26 GHz, Vertical

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

Table 79 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

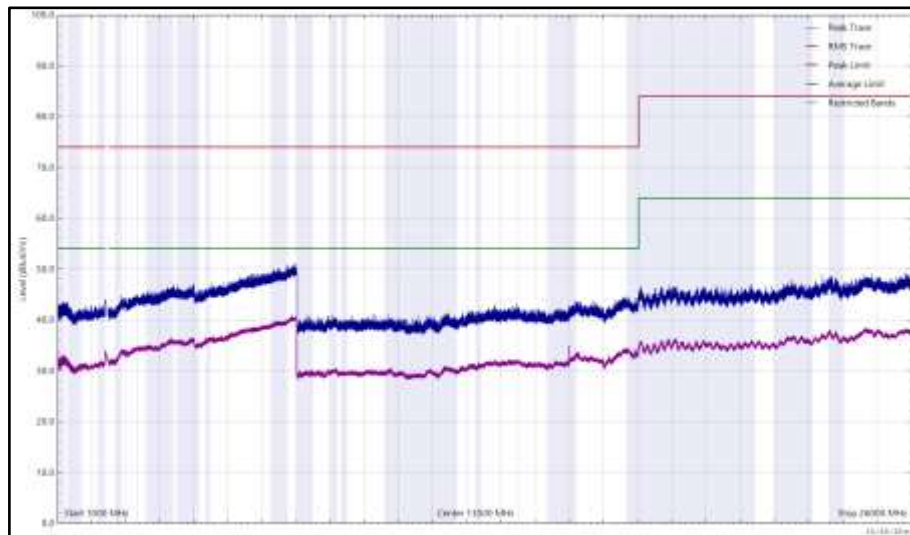


Figure 90 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

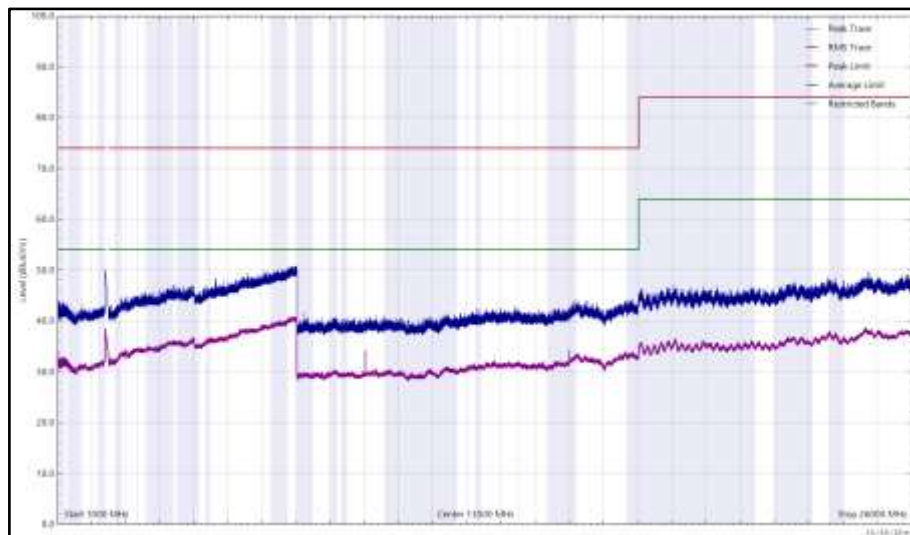


Figure 91 - 2402 MHz (CH0), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical

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

Table 80 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 26 GHz

*No emissions found within 6 dB of the limit.

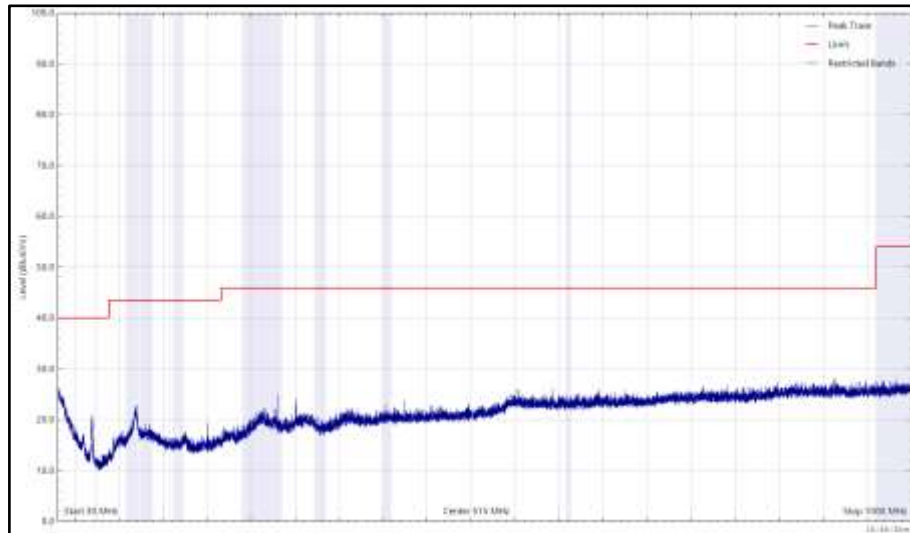


Figure 92 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 1 GHz, Horizontal (Peak)

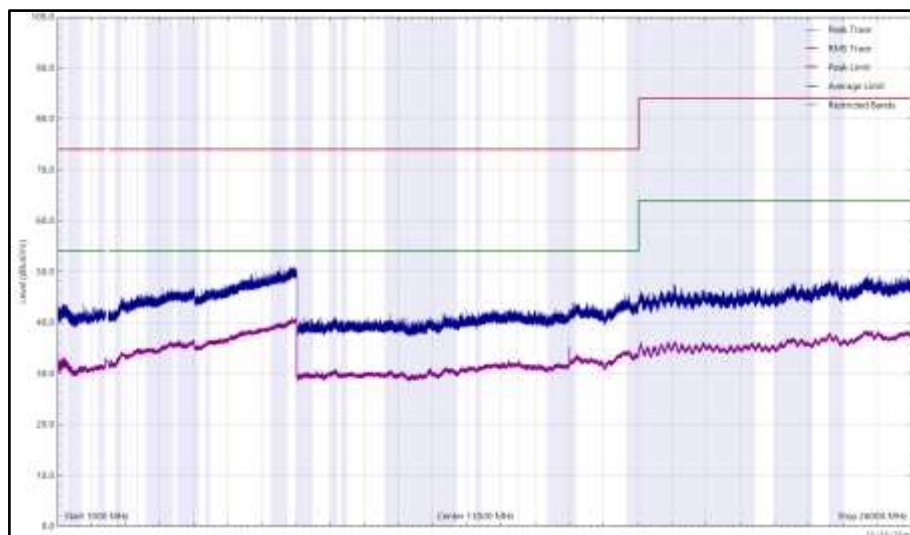


Figure 93 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

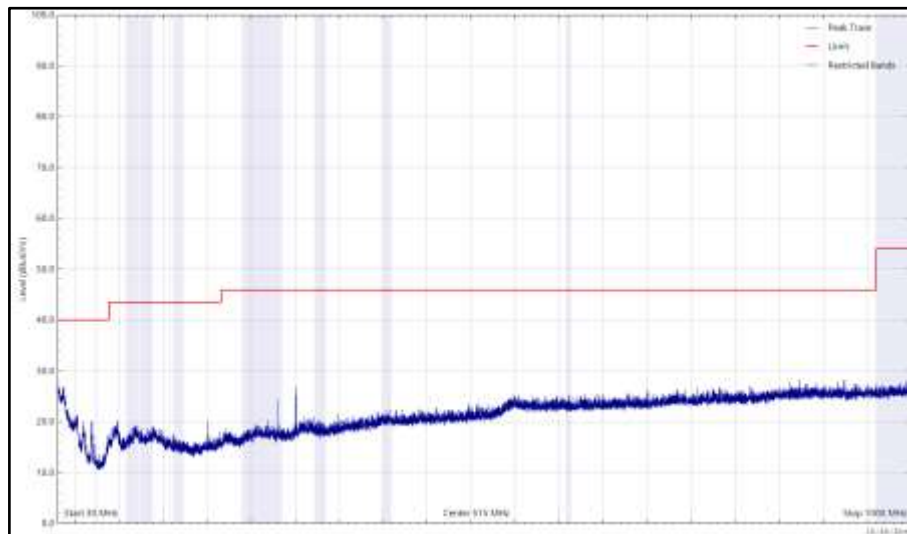


Figure 94 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 30 MHz to 1 GHz, Vertical (Peak)

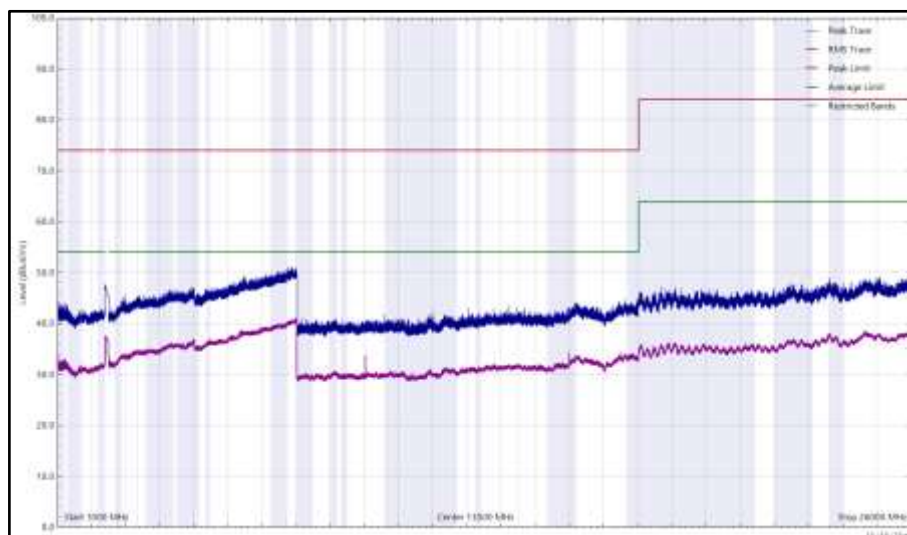


Figure 95 - 2441 MHz (CH39), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical

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

Table 81 - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 to 26 GHz

*No emissions found within 6 dB of the limit.

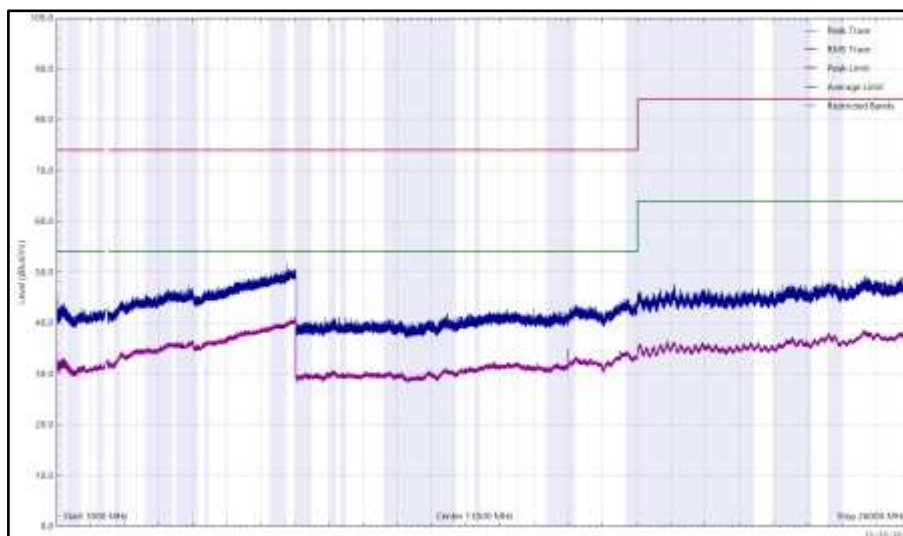


Figure 96 - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Horizontal

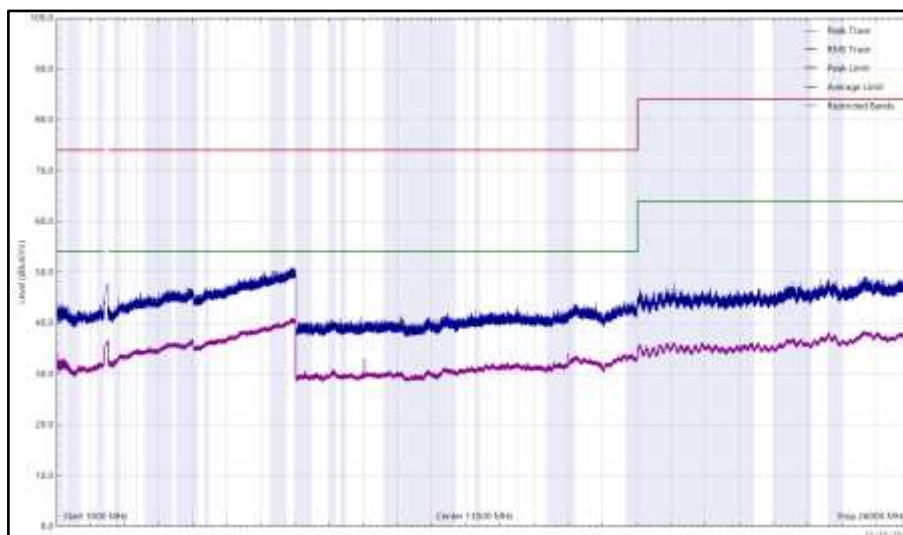


Figure 97> - 2480 MHz (CH78), 2DH5, ePA, Core 0 + Core 1, 1 GHz to 26 GHz, Vertical



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 RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Current Probe	Ailtech	94111-1	522	12	14-Jun-2022
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
True RMS Multimeter	Fluke	179	4007	12	29-Oct-2021
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5066	12	12-Oct-2021
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5068	12	12-Oct-2021
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	08-Mar-2022
Cable (18 GHz)	Rosenberger	LU7-071-1000	5102	12	12-Oct-2021
Cable (18 GHz)	Rosenberger	LU7-071-1000	5103	12	12-Oct-2021
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
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	01-Apr-2022
Pre Amp 1 - 26.5 GHz	Agilent Technologies	8449B	5445	12	06-May-2022
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	09-Apr-2022
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2022
2m K Type Cable	Junkosha	MWX241-02000KMSKMS/A	5524	12	24-Mar-2022
3 GHz High pass Filter	Wainwright	WHKX12-2580-3000-18000-80SS	5547	12	07-May-2022
7 GHz High pass Filter	Wainwright	WHKX12-5850-6800-18000-80SS	5550	12	20-May-2022
1200 MHz Low Pass Filter (02)	Mini-Circuits	VLF-1200+	5560	12	24-May-2022
8 - 18 GHz Amplifier	Wright Technologies	APS06-0061	5595	12	25-Aug-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	08-Sep-2021
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5609	12	14-Oct-2021

Table 82



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

A2485, S/N: HV9QMW620K - Modification State 0

2.8.3 Date of Test

24-June-2021 to 26-June-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	21.2 - 23.0 °C
Relative Humidity	48.1 - 51.2 %

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	1	DH5	2402	2400.0	-65.13
Static	$\pi/4$ DQPSK	1	2DH5	2402	2400.0	-63.39
Static	8-DPSK	1	3DH5	2402	2400.0	-63.62
Hopping	GFSK	1	DH5	2402	2400.0	-65.01
Hopping	$\pi/4$ DQPSK	1	2DH5	2402	2400.0	-64.88
Hopping	8-DPSK	1	3DH5	2402	2400.0	-63.52

Table 83 - Authorised Band Edge Results

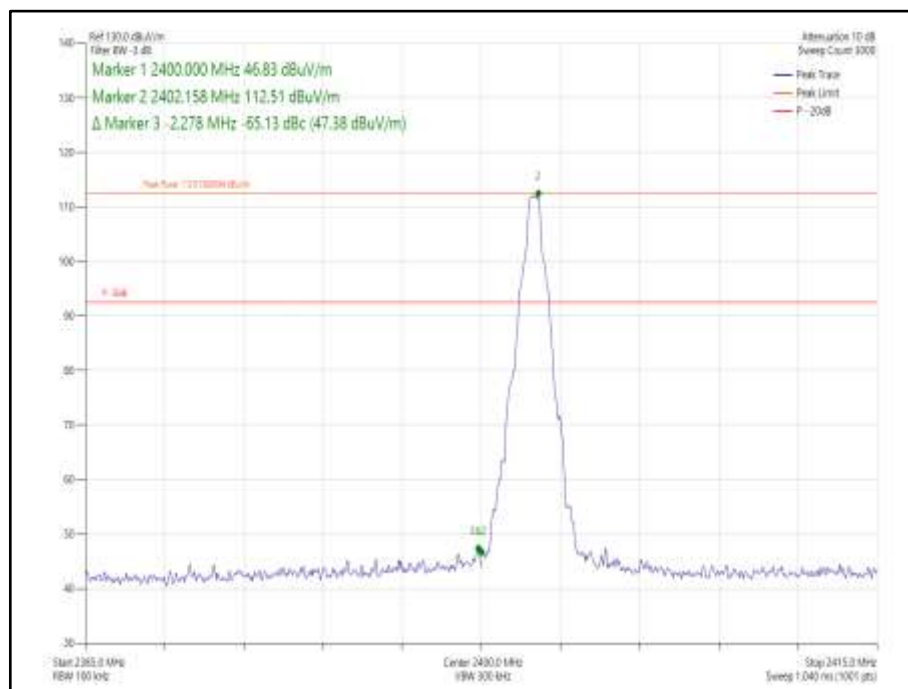


Figure 98 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

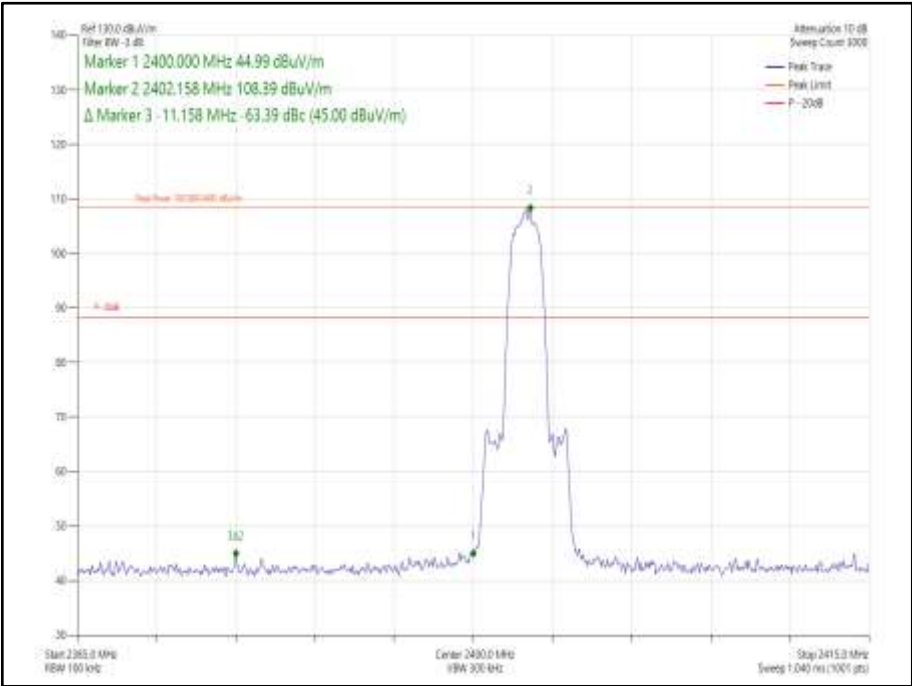


Figure 99 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

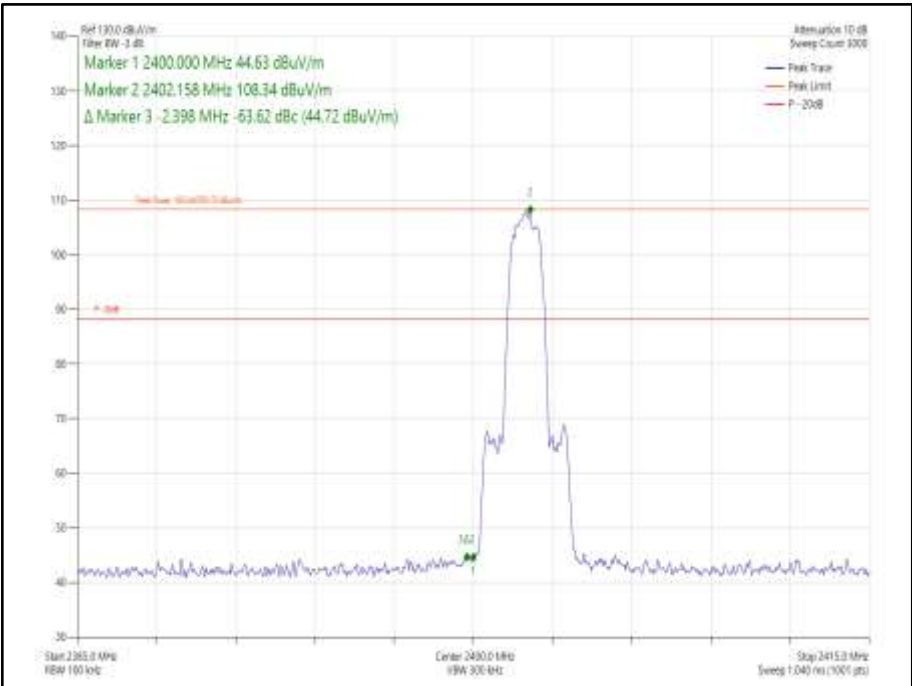


Figure 100 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz



Figure 101 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

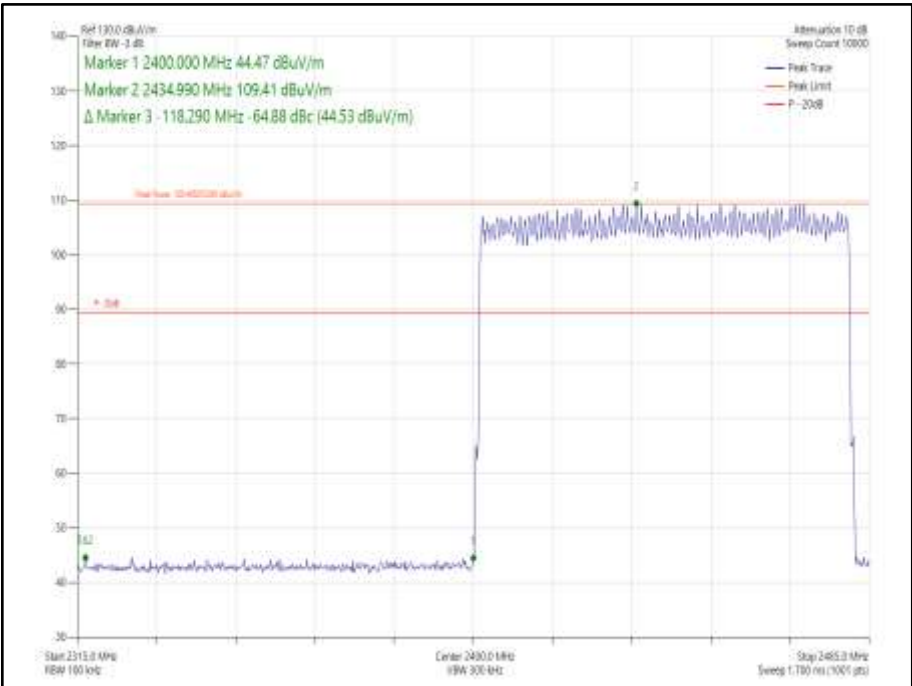


Figure 102 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

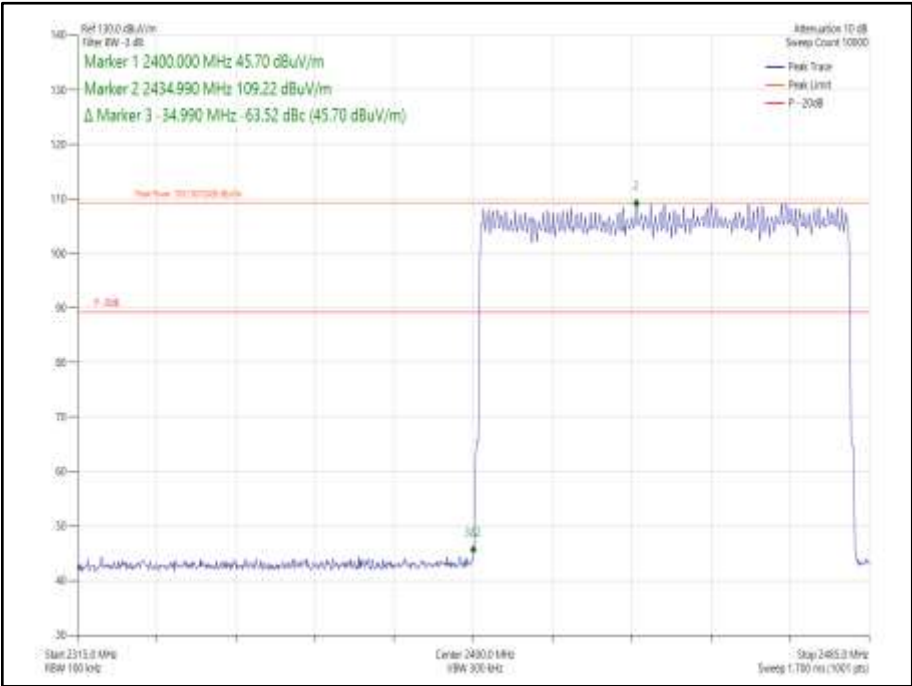


Figure 103 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	1	DH5	2402	2400.0	-66.67
Static	$\pi/4$ DQPSK	1	2DH5	2402	2400.0	-65.72
Static	8-DPSK	1	3DH5	2402	2400.0	-64.17
Hopping	GFSK	1	DH5	2402	2400.0	-69.94
Hopping	$\pi/4$ DQPSK	1	2DH5	2402	2400.0	-67.50
Hopping	8-DPSK	1	3DH5	2402	2400.0	-64.96

Table 84 - Authorised Band Edge Results

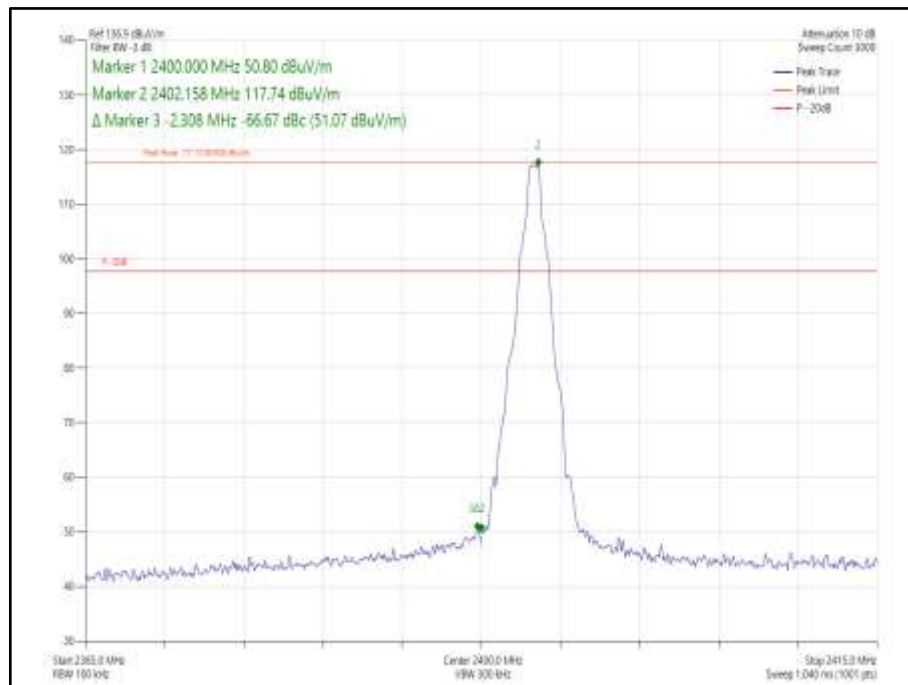


Figure 104 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

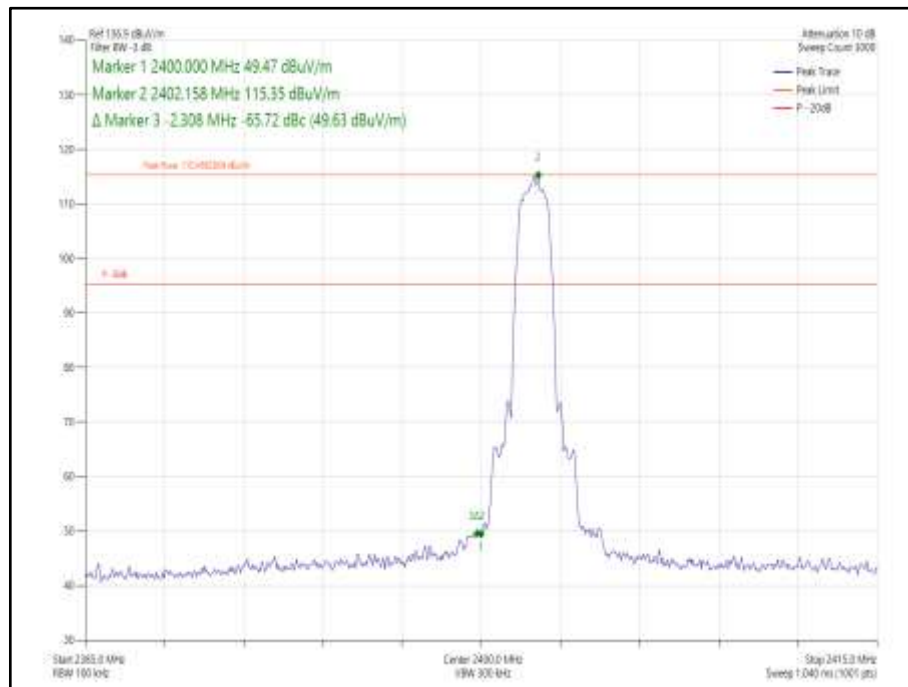


Figure 105 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

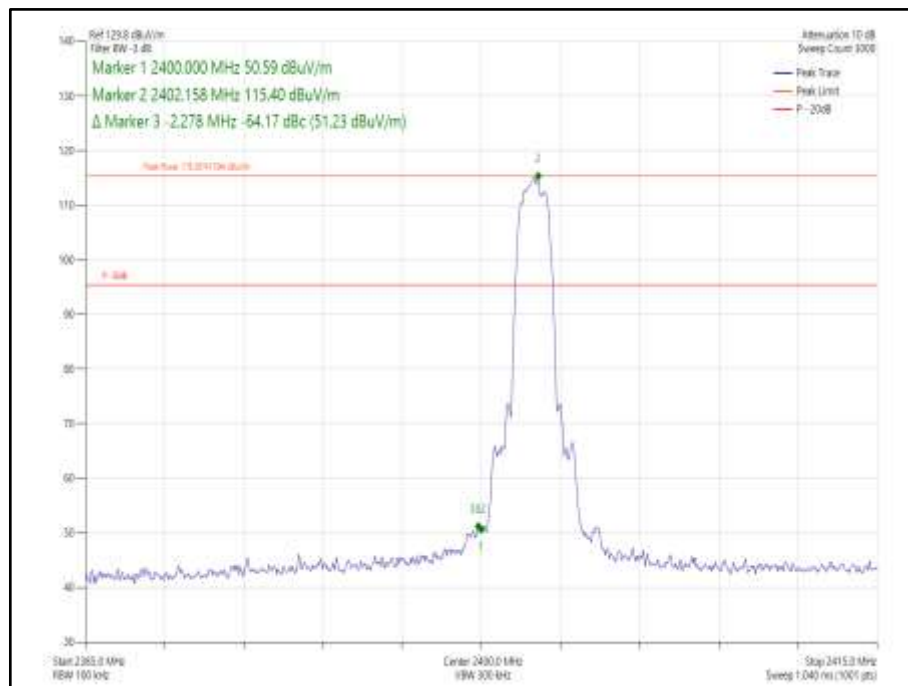


Figure 106 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

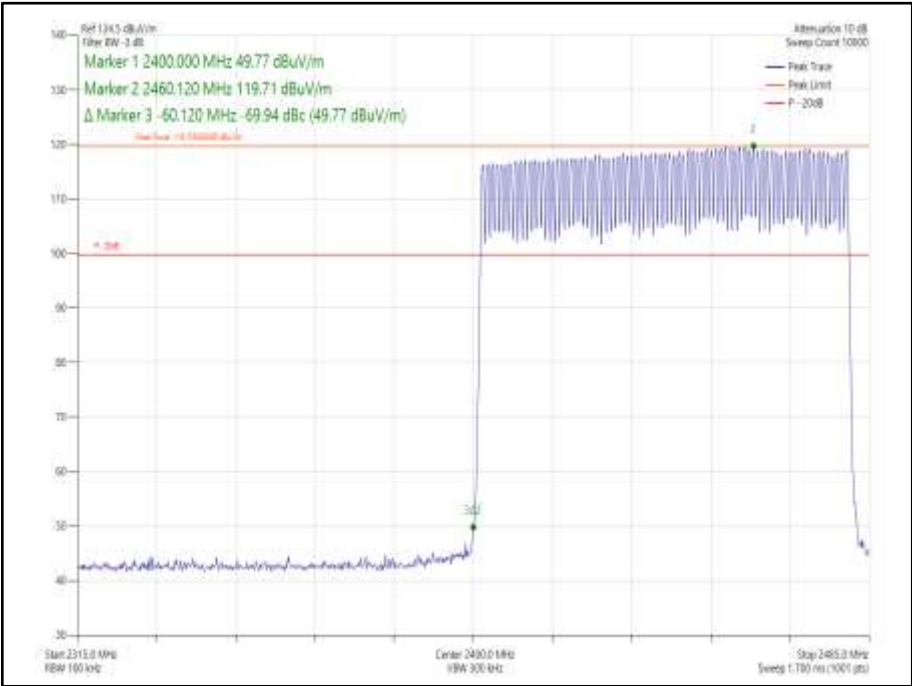


Figure 107 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

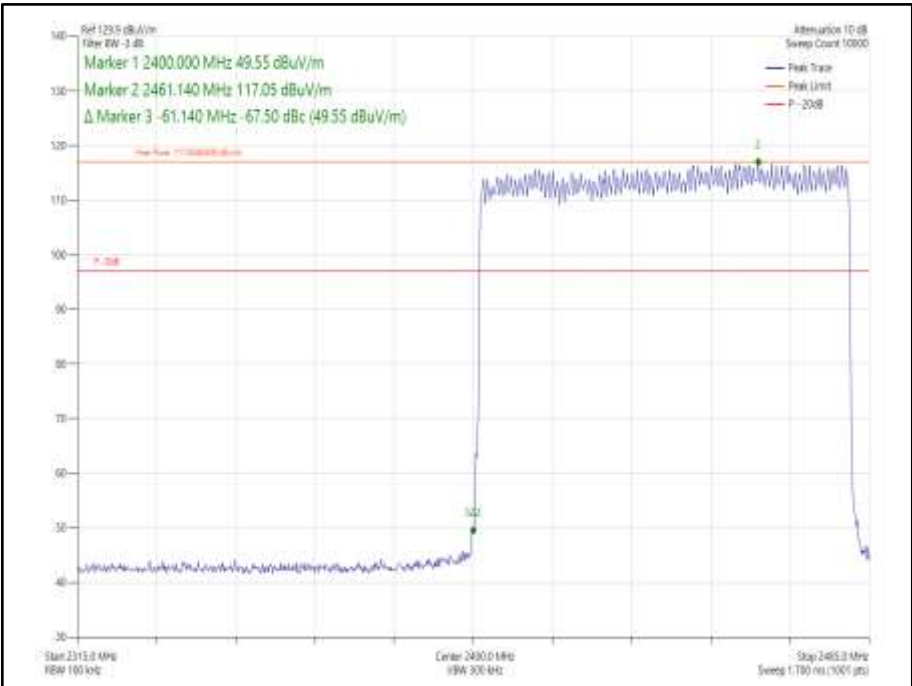


Figure 108 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

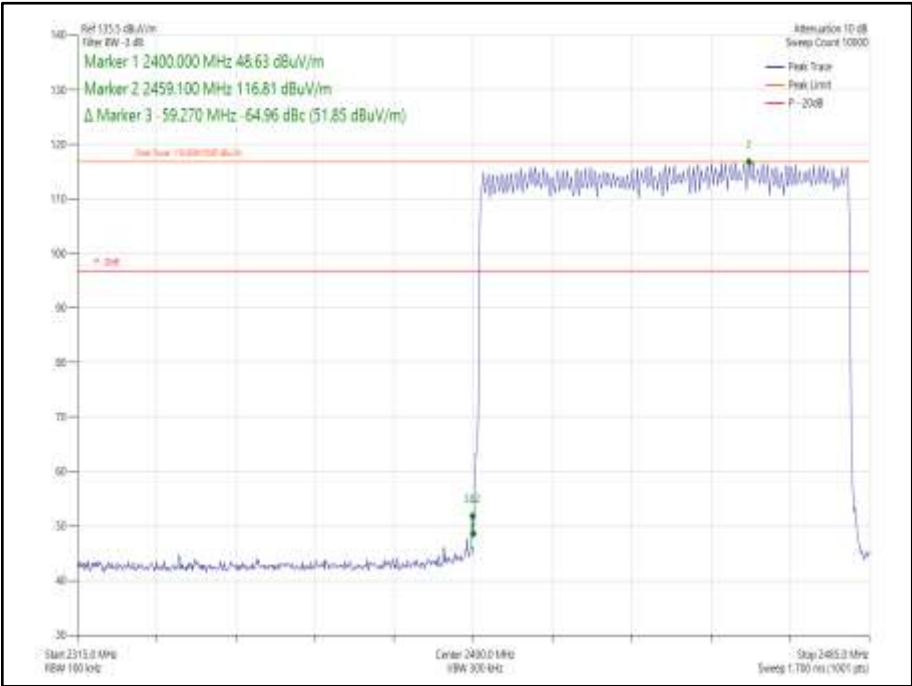


Figure 109 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

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	-66.11
Static	$\pi/4$ DQPSK	2	2DH5	2402	2400.0	-64.02
Static	8-DPSK	2	3DH5	2402	2400.0	-63.71
Hopping	GFSK	2	DH5	2402	2400.0	-67.25
Hopping	$\pi/4$ DQPSK	2	2DH5	2402	2400.0	-64.44
Hopping	8-DPSK	2	3DH5	2402	2400.0	-64.64

Table 85 - Authorised Band Edge Results

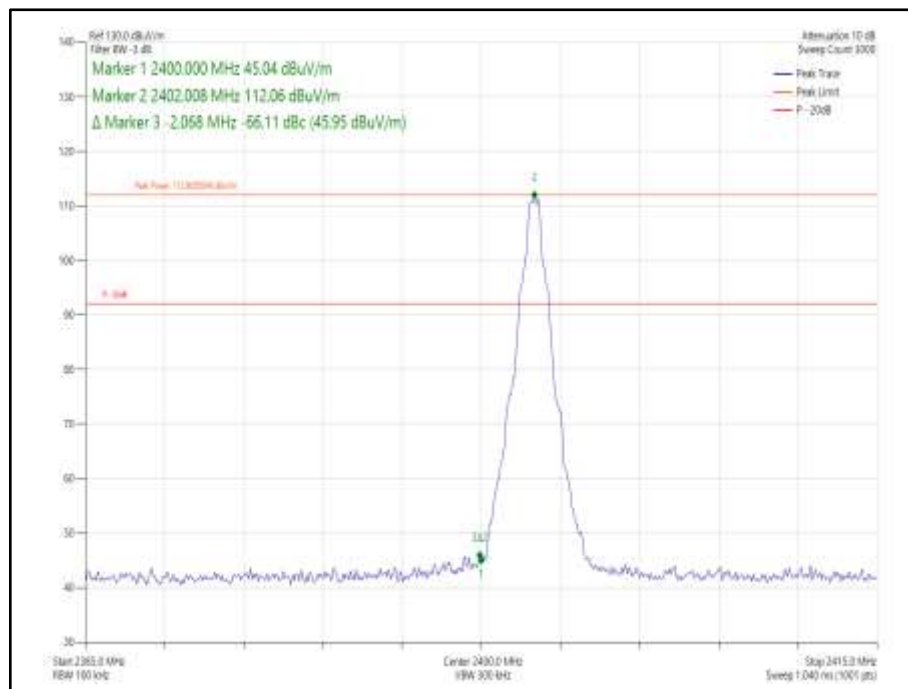


Figure 110 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

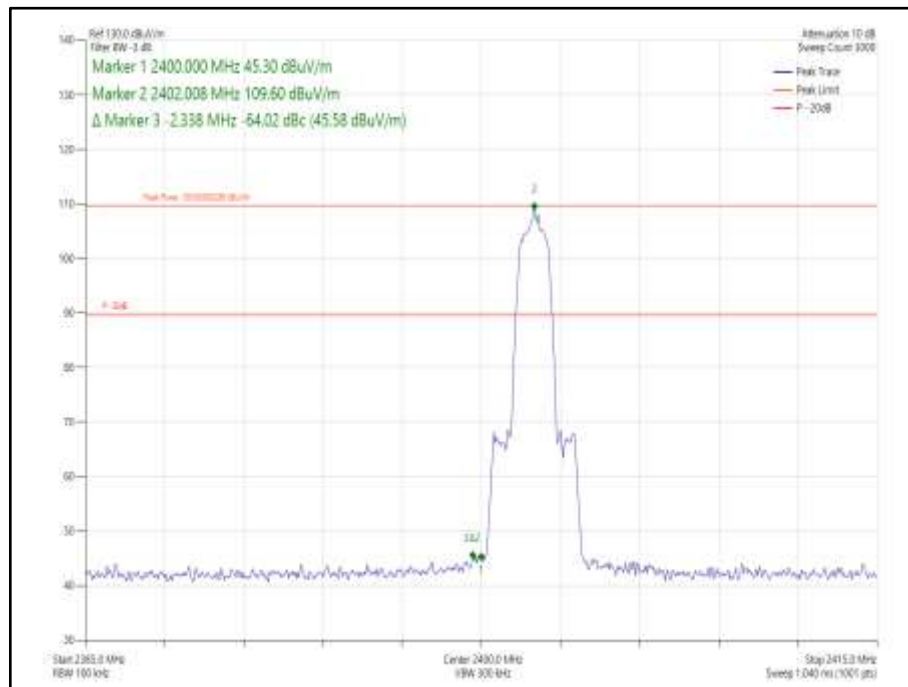


Figure 111 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

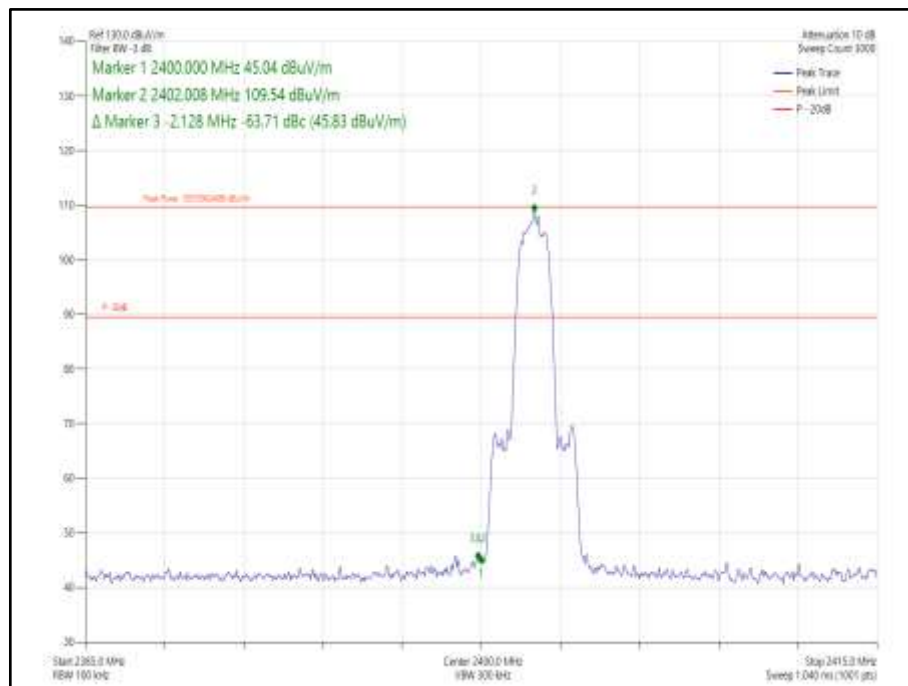


Figure 112 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

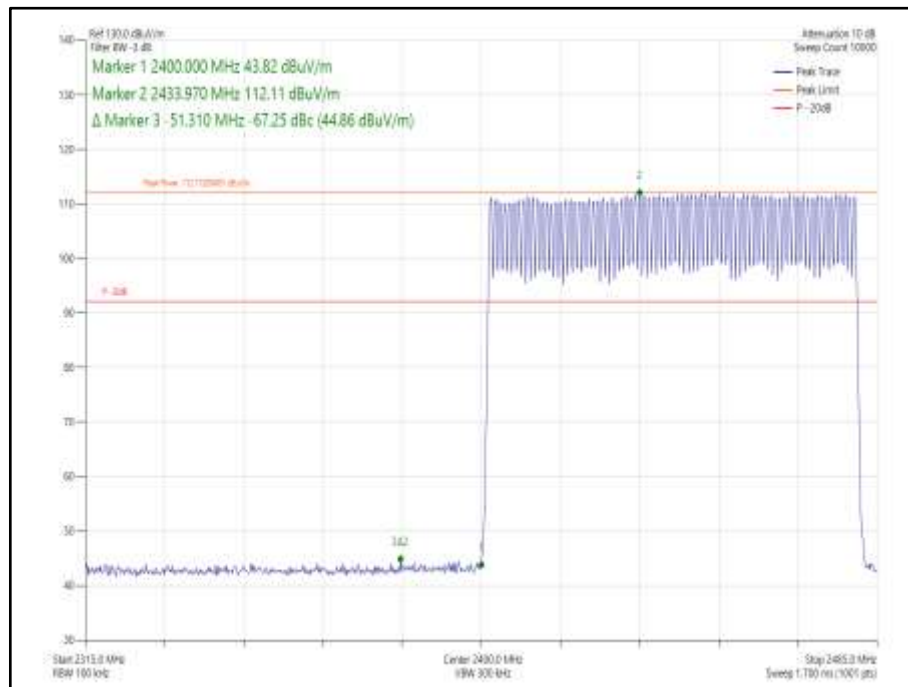


Figure 113 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

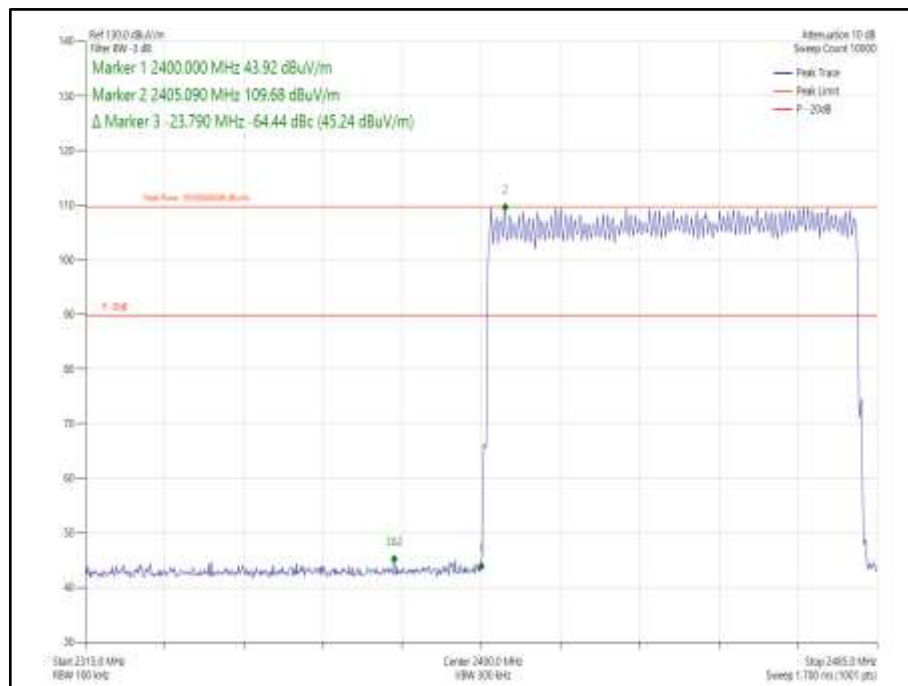


Figure 114 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

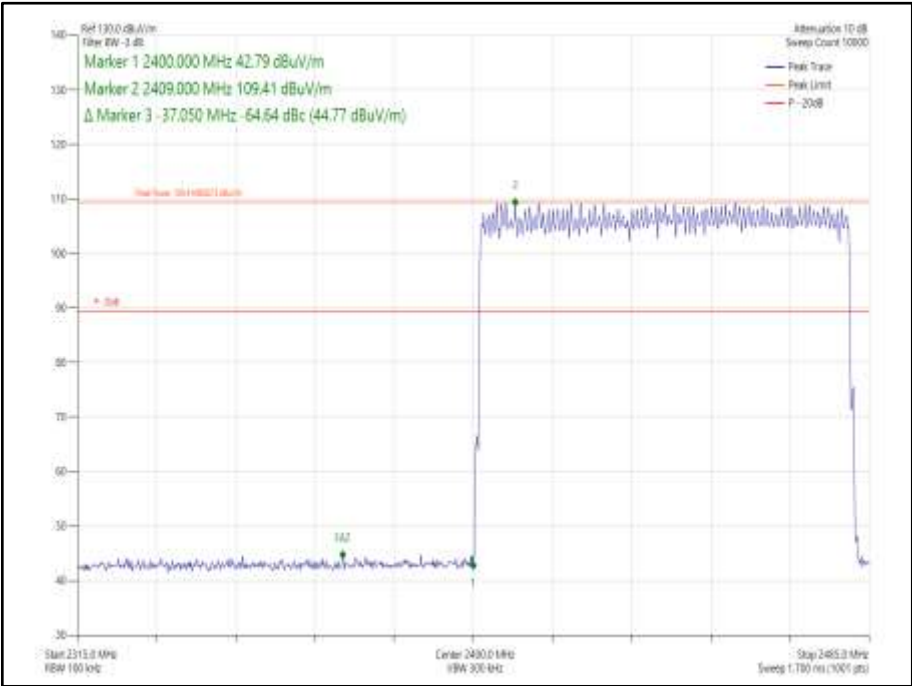


Figure 115 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

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	-68.01
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-57.39
Static	8-DPSK	0-1	3DH5	2402	2400.0	-57.60
Hopping	GFSK	0-1	DH5	2402	2400.0	-68.43
Hopping	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-62.76
Hopping	8-DPSK	0-1	3DH5	2402	2400.0	-61.89

Table 86 - Authorised Band Edge Results

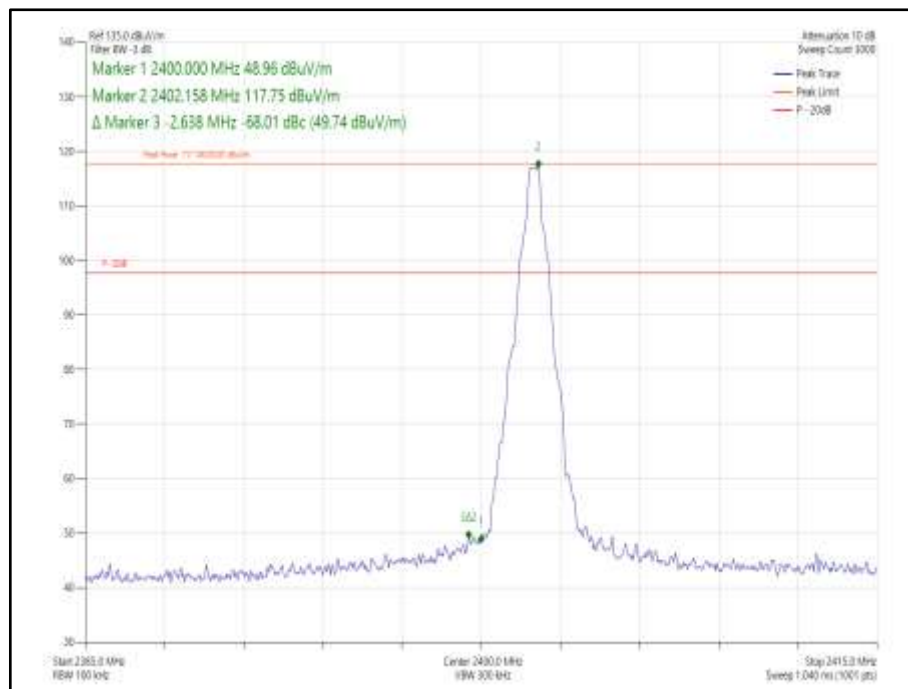


Figure 116 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

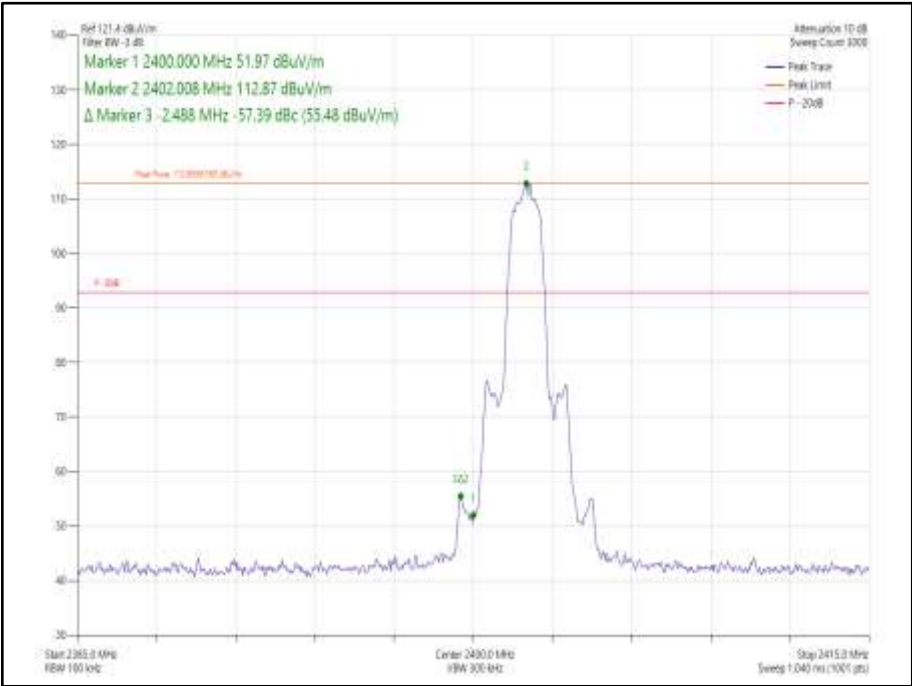


Figure 117 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

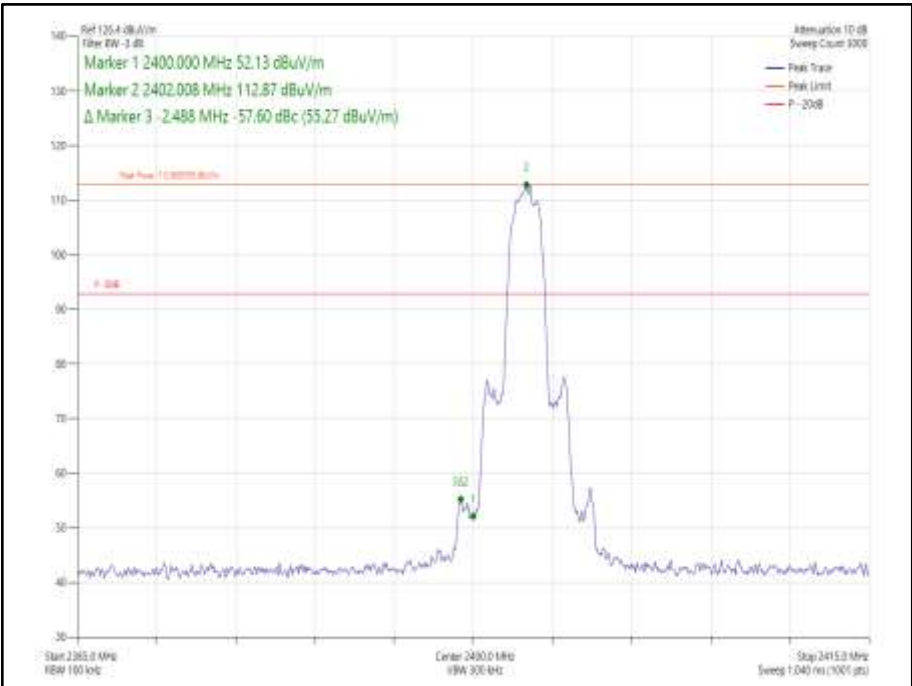


Figure 118 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

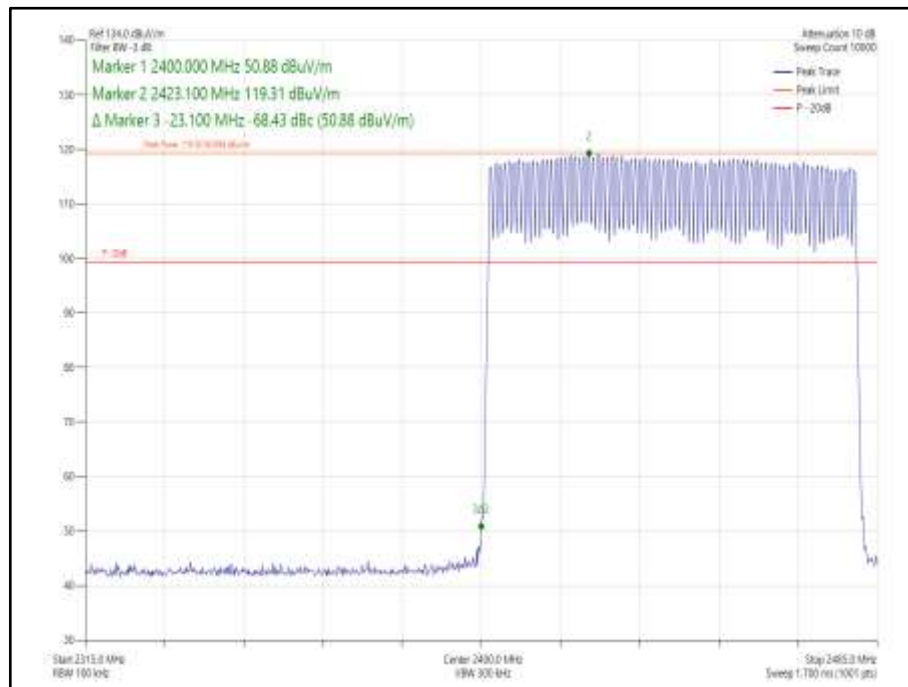


Figure 119 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

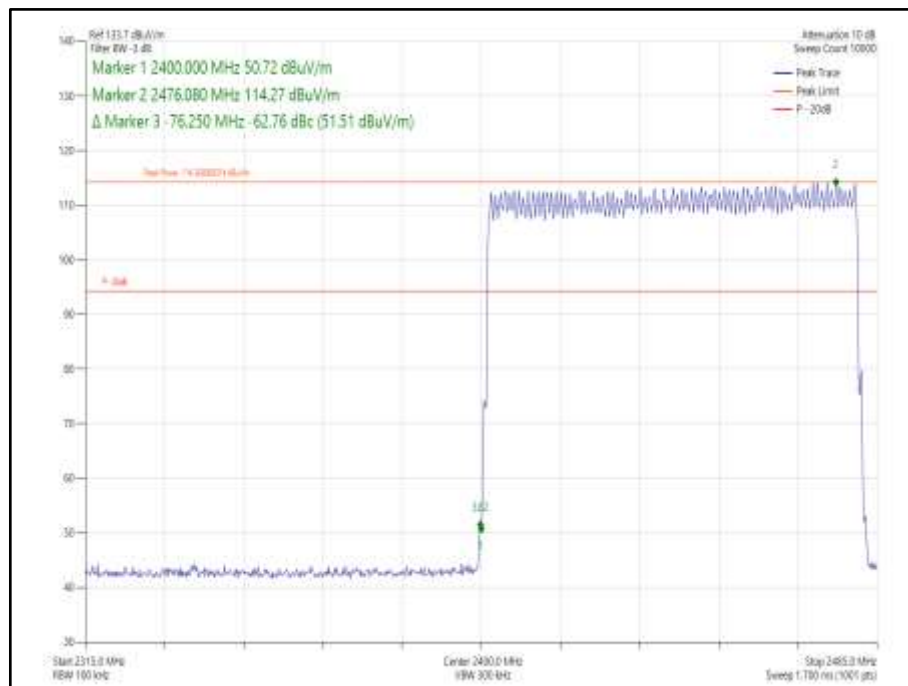
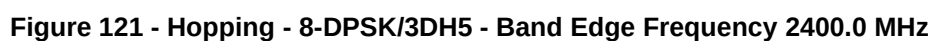


Figure 120 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz



ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	GFSK	0-1	DH5	2402	2400.0	-65.91
Static	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-63.53
Static	8-DPSK	0-1	3DH5	2402	2400.0	-62.25
Hopping	GFSK	0-1	DH5	2402	2400.0	-67.58
Hopping	$\pi/4$ DQPSK	0-1	2DH5	2402	2400.0	-65.05
Hopping	8-DPSK	0-1	3DH5	2402	2400.0	-63.50

Table 87 - Authorised Band Edge Results

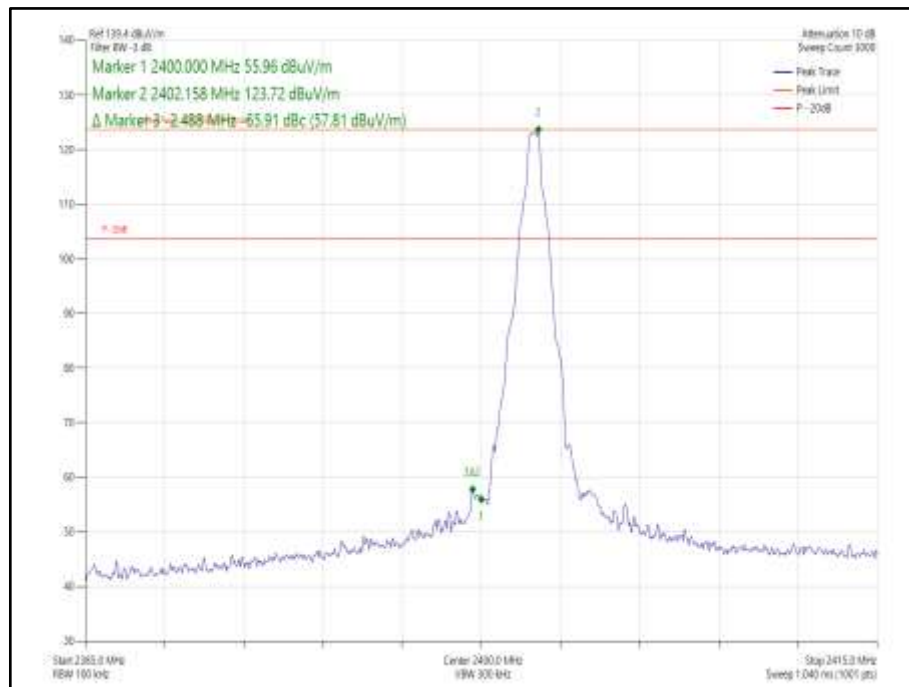


Figure 122 - Static - GFSK/DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

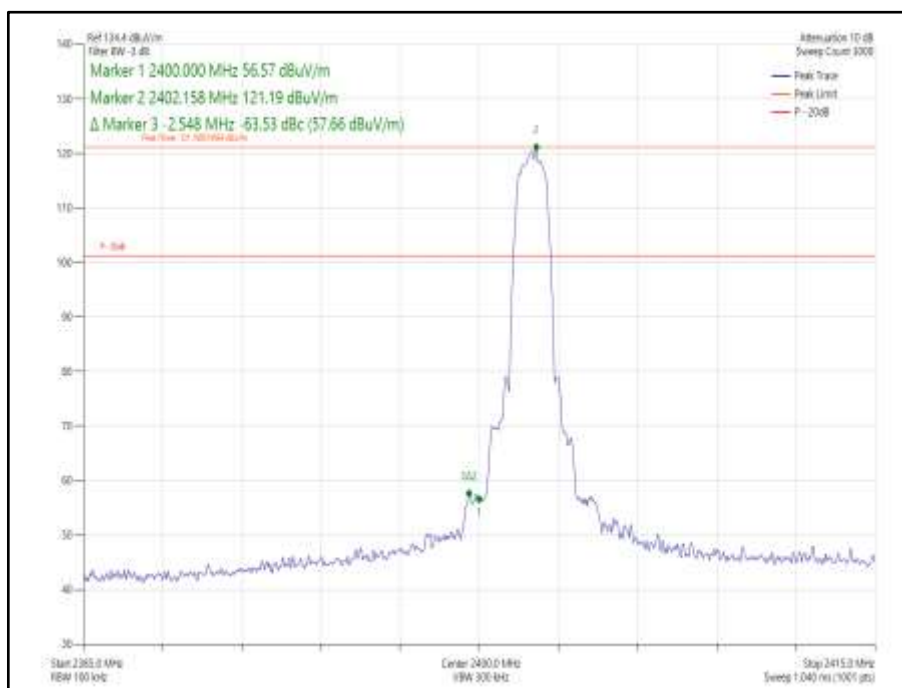


Figure 123 - Static - $\pi/4$ DQPSK/2DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

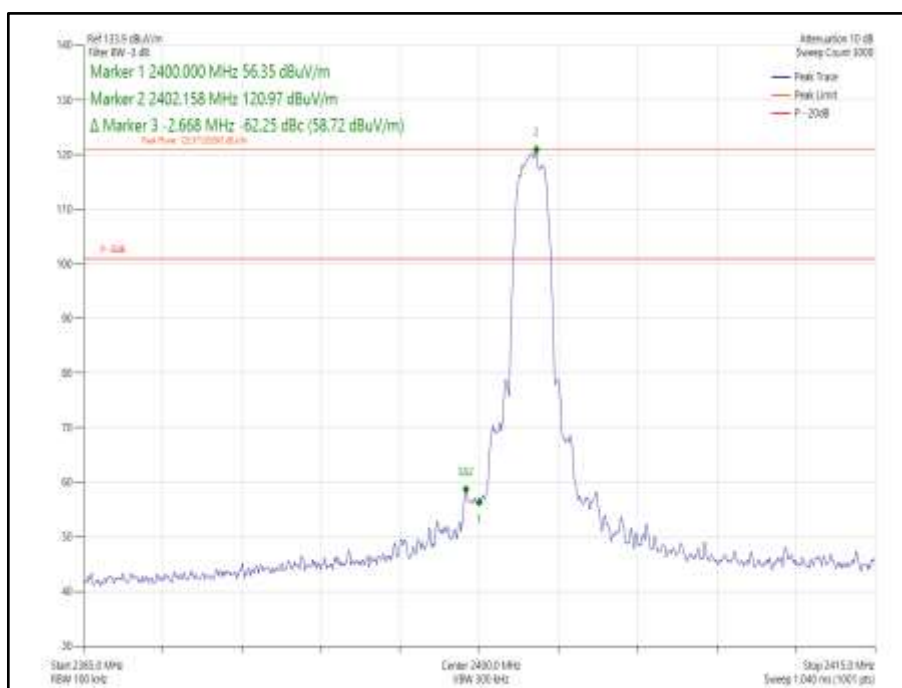


Figure 124 - Static - 8-DPSK/3DH5 - 2402 MHz - Band Edge Frequency 2400.0 MHz

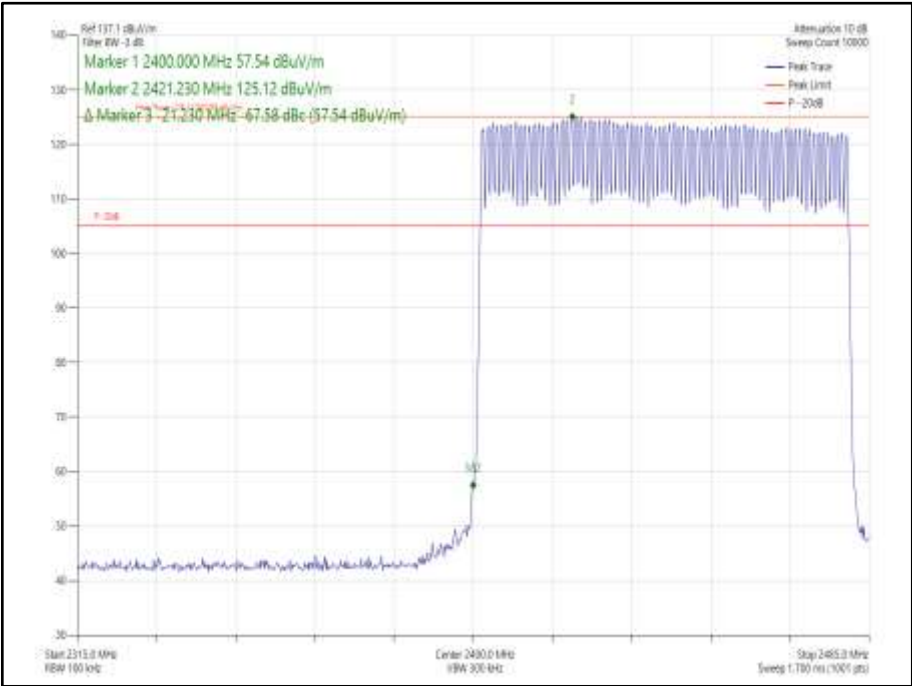


Figure 125 - Hopping - GFSK/DH5 - Band Edge Frequency 2400.0 MHz

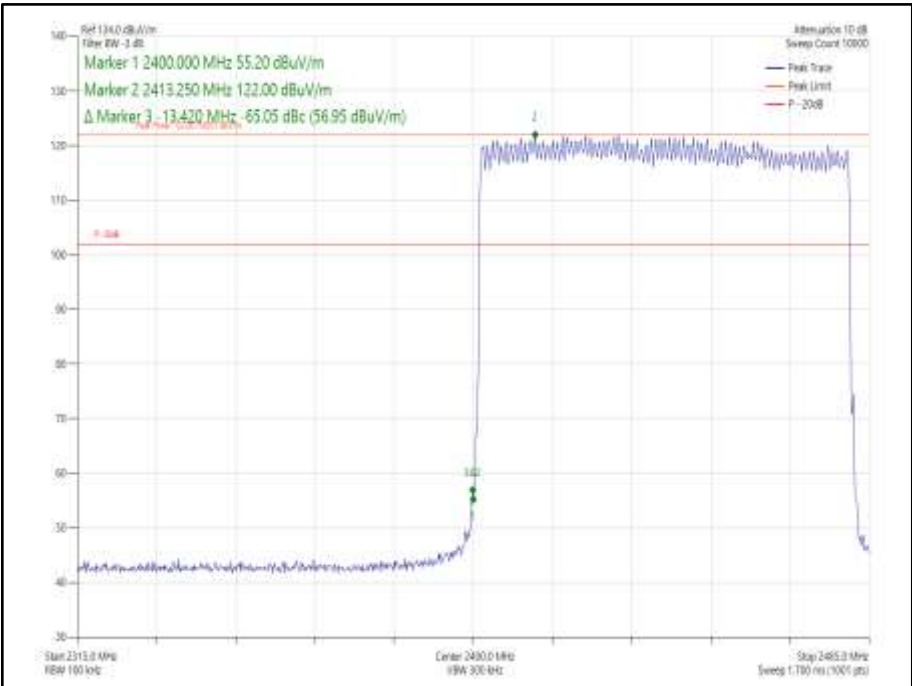


Figure 126 - Hopping - $\pi/4$ DQPSK/2DH5 - Band Edge Frequency 2400.0 MHz

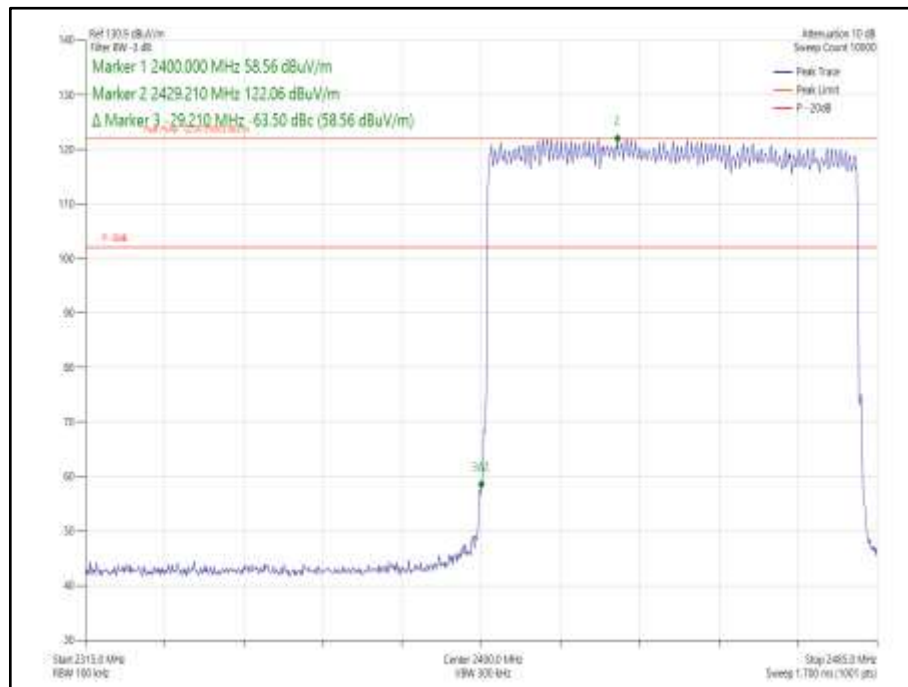


Figure 127 - Hopping - 8-DPSK/3DH5 - Band Edge Frequency 2400.0 MHz

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
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	01-Apr-2022
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	08-Mar-2022
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	Software
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5517	12	09-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 88

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 89

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.