

FCC and ISED Test Report

Apple Inc
Model: A3241



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

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

FCC ID: BCGA3241

IC: 579C-A3241

COMMERCIAL-IN-CONFIDENCE

Document 75962766-37 Issue 02

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve White	Senior Technical Specialist	Authorised Signatory	16 December 2024

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
Report Generation	Lauren Walters	16 December 2024	

FCC Accreditation 492497/UK2010 Octagon House, Fareham Test Laboratory 553713/UK2026 Concorde Park, Fareham Test Laboratory	ISED Accreditation 12669A/UK0003 Octagon House, Fareham Test Laboratory 28798/UK0003 Concorde Park, Fareham Test Laboratory
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EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2023, ISED RSS-247: Issue 3 (2023-08) and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) for the tests detailed in section 1.3.



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Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TÜV SÜD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuvsud.com/en

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



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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	12-Dec-2024
2	Hopping results added to section 2.7	16-Dec-2024

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
EUT/Sample Identification	Refer to section 1.6
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2023 ISED RSS-247: Issue 3 (2023-08) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Start of Test	28-September-2024
Finish of Test	08-November-2024
Name of Engineer(s)	Thomas Biddlecombe, Akhil Rajendran Bhaskaran Nair, Colin Brain, Ioan-Alexandru Bogatu, Tony Baby and Vineeth Nagaraj
Related Document(s)	ANSI C63.4 (2014) ANSI C63.10 (2020) KDB 662911 D01 v02r01



1.3 Brief Summary of Results

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

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR						
-	15.203	-	-	Antenna Requirement	N/T	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.205	3.3	8.10	Restricted Band Edges	Pass	ANSI C63.10 (2020)
2.2	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10 (2020)
2.3	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10 (2020)
2.4	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10 (2020)
2.5	15.247 (a)(1)	5.1	6.7	Frequency Hopping Systems - 99% & 20 dB Bandwidth	Pass	ANSI C63.10 (2020)
2.6	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2020) KDB 662911 D01 v02r01
2.7	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2020)
2.8	15.209 and 15.247 (d)	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	ANSI C63.4 (2014) ANSI C63.10 (2020)

Table 2



1.4 Product Information

1.4.1 Technical Description

The equipment under test (EUT) was a portable laptop computer.

1.4.2 Test Modes

The EUT's 2.4 GHz Bluetooth radio supports SISO (Single Input/Single Output) operation on two different cores (Core 0 & Core 1). It also supports MIMO (Multiple Input/Multiple Output) beamforming operation on Core 0 + Core 1.

The EUT supports Basic Rate and Enhanced Data Rate modes for FHSS operation.

Core 0 & Core 1 also operate at two power settings: low power "iPA" and high power "ePA", with the EUT using different output powers per core dependent on how many cores are used.

After preliminary investigations, conducted tests on the EUT and Radiated Band Edge were performed in the following modes:

SISO modes:

- DH5 - iPA - Core 0
- 2-DH5 - iPA - Core 0
- 3-DH5 - iPA - Core 0
- 2-DH5 - ePA - Core 0
- 3-DH5 - ePA - Core 0

MIMO modes:

- DH5 - iPA - Core 0 + Core 1
- 2-DH5 - iPA - Core 0 + Core 1
- 3-DH5 - iPA - Core 0 + Core 1
- 2-DH5 - ePA - Core 0 + Core 1
- 3-DH5 - ePA - Core 0 + Core 1

Spurious Radiated Emissions tests were limited to the modes shown below, with the device configured to operate at maximum output power. As this was deemed to be worst case.

MIMO modes:

- DH5 - iPA - Core 0 + Core 1
- 2-DH5 - ePA - Core 0 + Core 1



1.4.3 Test Setup

For conducted tests the EUT antennas were disconnected and replaced with U. FL to SMA test cables to enable conducted testing on each core. The loss of these test cables were known and compensated for in any conducted measurements.

For all tests the EUT was put into a continuous transmit/receive test mode with the chipset manufacturer's test commands. These ran the specified modulation types on either a fixed single channel or in Hopping mode, to ensure the measured signals were representative.

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

1.4.4 Antenna Gain Table

Antenna Port	Frequency Range (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
Core 0	2400 to 2480	5.4	0.71
Core 1	2400 to 2480	5.1	0.71

Table 3

1.5 Deviations from the Standard

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



1.6 Identification of the EUT

The table below details identification of the EUT(s) that have been used to carry out the testing within this report.

Model: A3241		
Serial Number	Hardware Version	Software Version
HJKCRQM3K9	REV1.0	24A12461c
K2K9N270NG	REV1.0	24A12461c
DT7LYX5QXT	REV1.0	24A12461c
FWKQMY7GHY	REV1.0	24A12461c

Table 4

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: A3241, Serial Number: K2K9N270NG			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3241, Serial Number: HJKCRQM3K9			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3241, Serial Number: DT7LYX5QXT			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3241, Serial Number: FWKQMY7GHY			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5



1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR		
Frequency Hopping Systems - Average Time of Occupancy	Thomas Biddlecombe	UKAS
Frequency Hopping Systems - Channel Separation	Thomas Biddlecombe	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Thomas Biddlecombe	UKAS
Frequency Hopping Systems - 99% & 20 dB Bandwidth	Thomas Biddlecombe	UKAS
Maximum Conducted Output Power	Thomas Biddlecombe	UKAS

Table 6

Office Address:

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

TÜV SÜD conducted the following tests at our Concorde Park Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz Bluetooth BDR/EDR		
Restricted Band Edges	Akhil Rajendran Bhaskaran Nair	UKAS
Authorised Band Edges	Akhil Rajendran Bhaskaran Nair	UKAS
Spurious Radiated Emissions	Akhil Rajendran Bhaskaran Nair, Colin Brain, Ioan-Alexandru Bogatu, Tony Baby and Vineeth Nagaraj	UKAS

Table 7

Office Address:

TÜV SÜD
Concorde Park
Concorde Way
Fareham
Hampshire
PO15 5FG
United Kingdom



2 Test Details

2.1 Restricted Band Edges

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
ISED RSS-247, Clause 3.3
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

A3241, S/N: HJKCRQM3K9 - Modification State 0

2.1.3 Date of Test

28-September-2024

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 4.1.5.2.6.

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:
 $10^{\frac{\text{Field Strength in dB}\mu\text{V/m}}{20}}$

2.1.5 Environmental Conditions

Ambient Temperature	21.6 °C
Relative Humidity	41.5 %

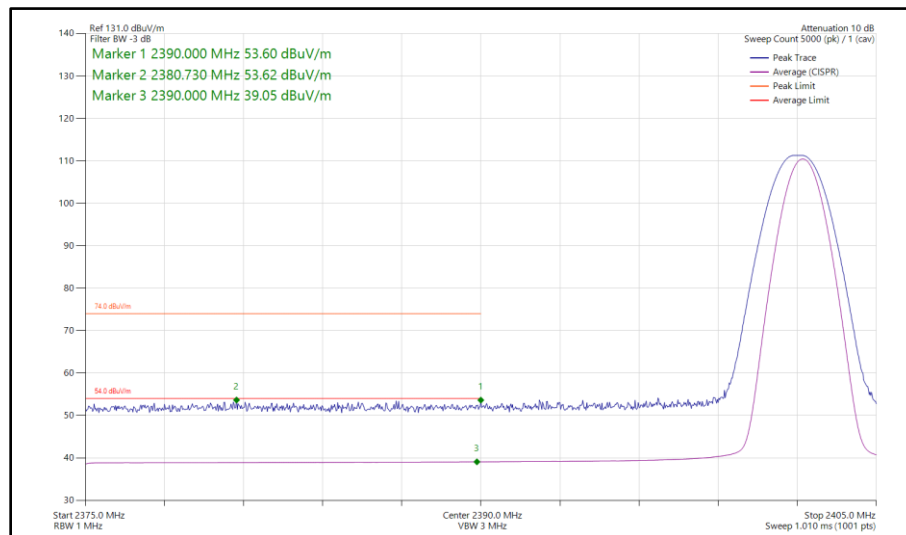
2.1.6 Test Results

2.4 GHz Bluetooth BDR/EDR

iPA - Core 0 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	DH5	2402	2390	53.62	39.05
Static	2-DH5	2402	2390	54.06	39.57
Static	3-DH5	2402	2390	54.46	39.71
Static	DH5	2480	2483.5	54.30	41.41
Static	2-DH5	2480	2483.5	54.08	41.80
Static	3-DH5	2480	2483.5	53.69	41.88

Table 8 - SISO Restricted Band Edge Results



**Figure 1 - Bluetooth DH5, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz**

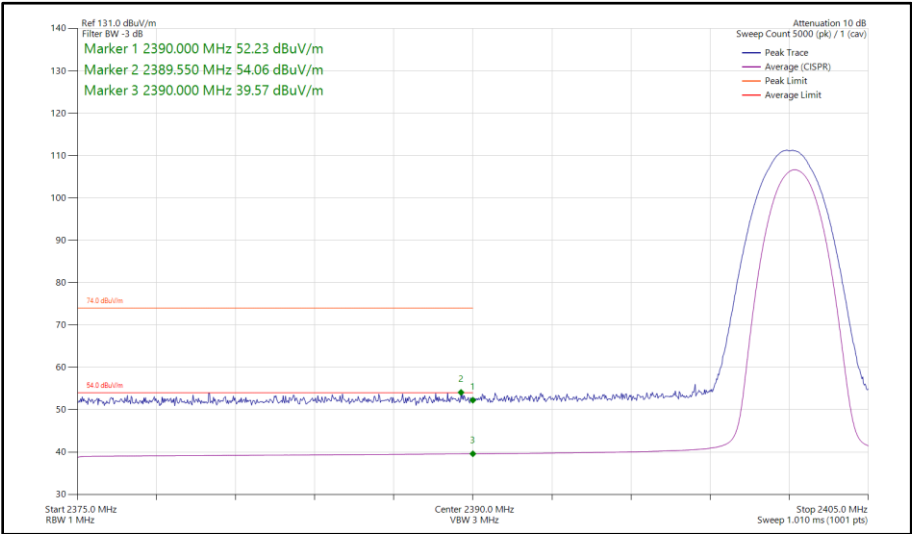


Figure 2 - Bluetooth 2-DH5, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

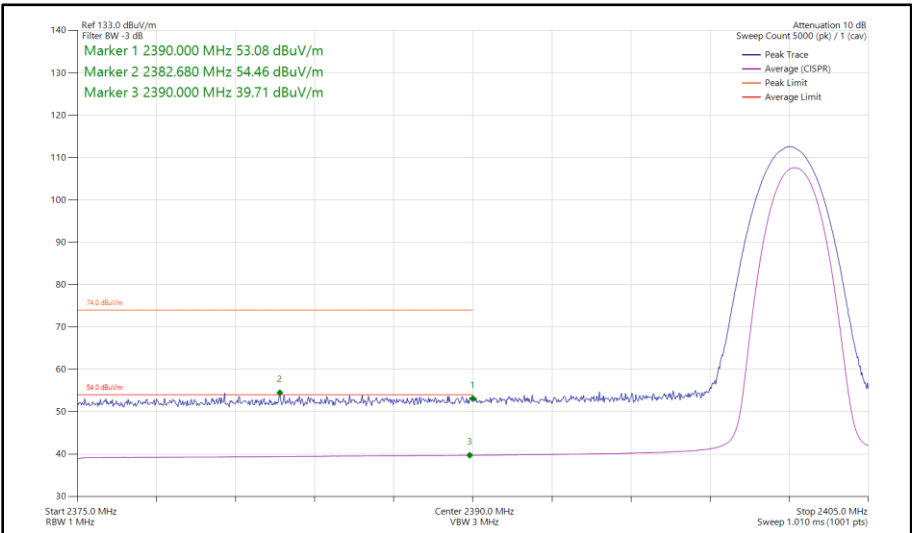


Figure 3 - Bluetooth 3-DH5, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

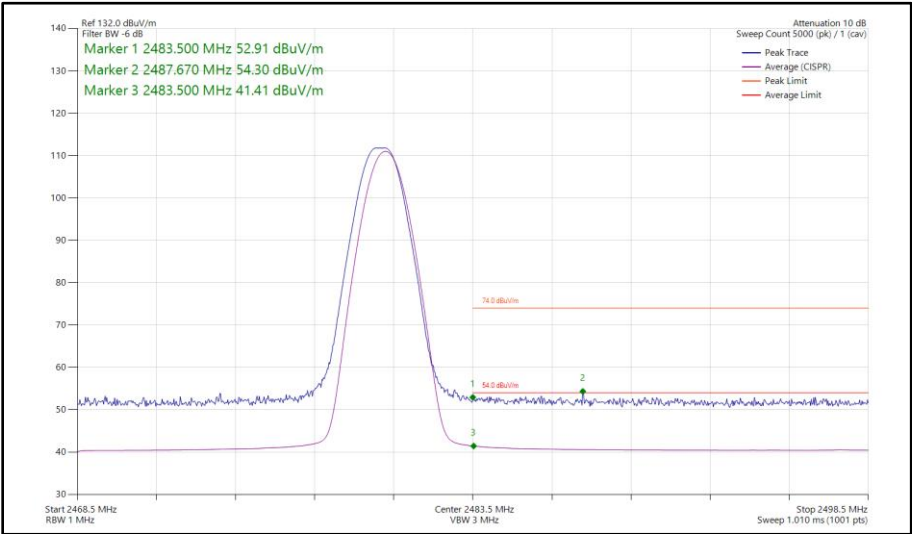


Figure 4 - Bluetooth DH5, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

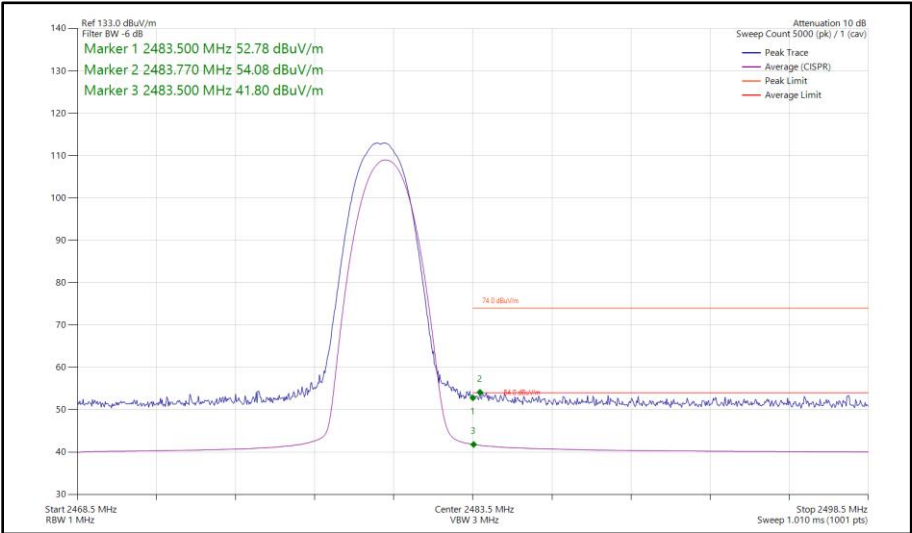
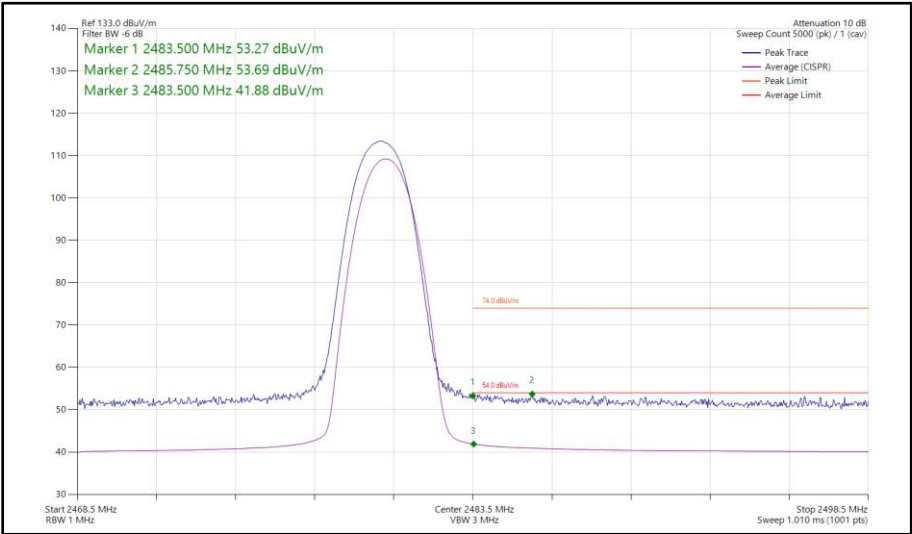


Figure 5 - Bluetooth 2-DH5, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

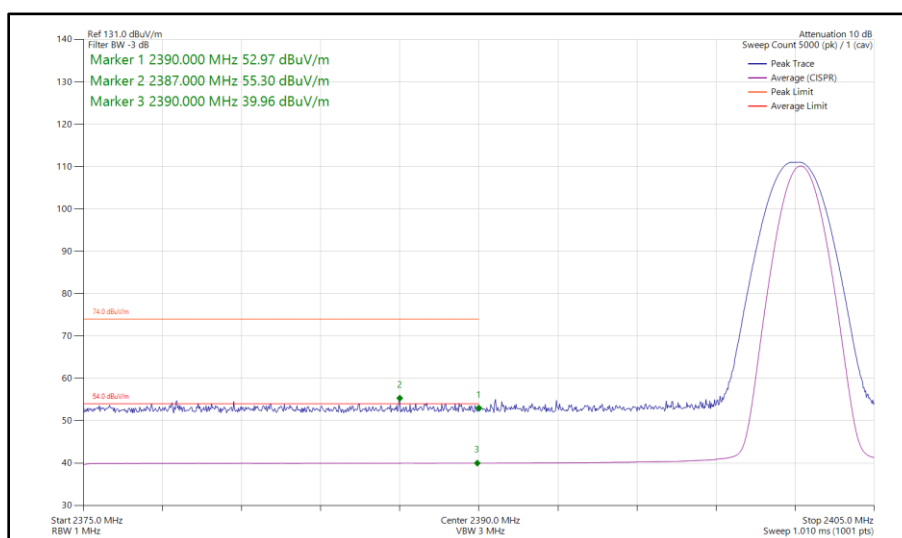


**Figure 6 - Bluetooth 3-DH5, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

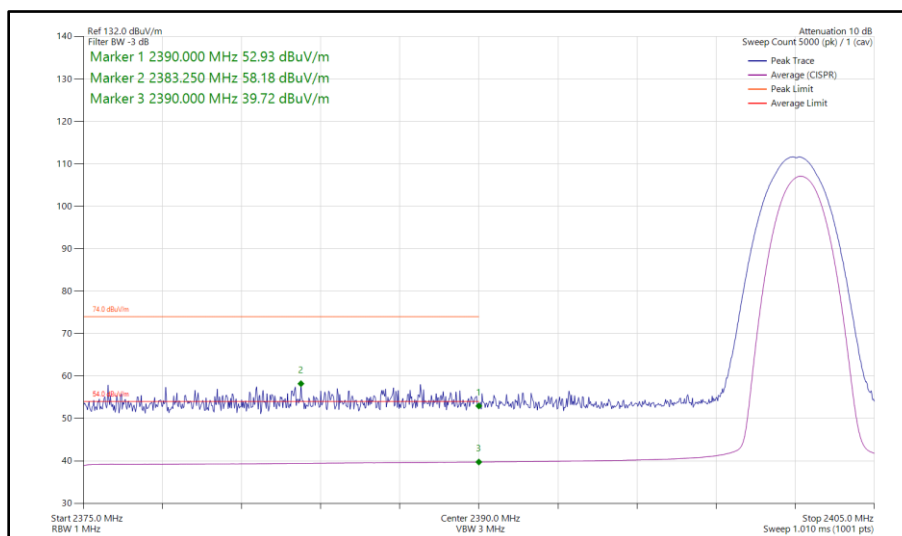
iPA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
Static	DH5	2402	2390	55.30	39.96
Static	2-DH5	2402	2390	58.18	39.72
Static	3-DH5	2402	2390	58.64	39.75
Static	DH5	2480	2483.5	53.82	41.41
Static	2-DH5	2480	2483.5	53.57	41.62
Static	3-DH5	2480	2483.5	53.76	41.79

Table 9 - SISO Restricted Band Edge Results



**Figure 7 - Bluetooth DH5, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



**Figure 8 - Bluetooth 2-DH5, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**

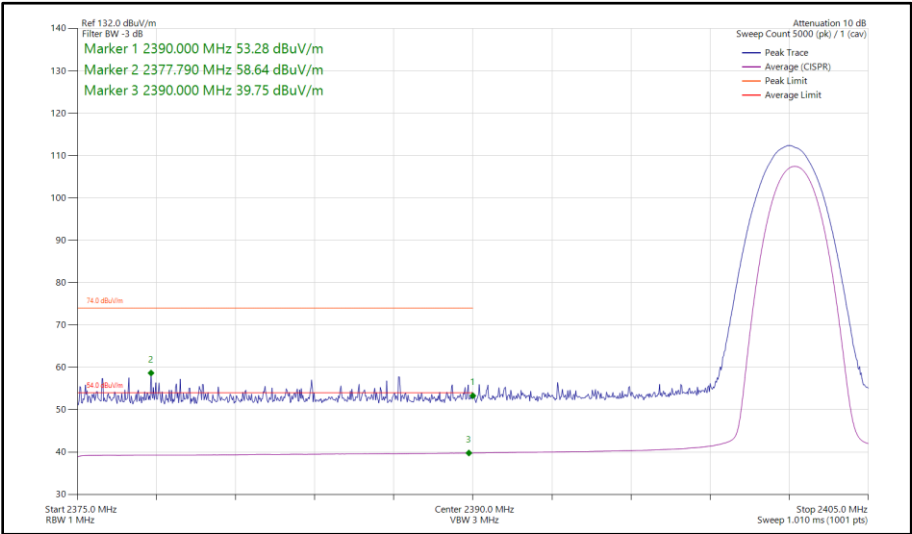


Figure 9 - Bluetooth 3-DH5, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

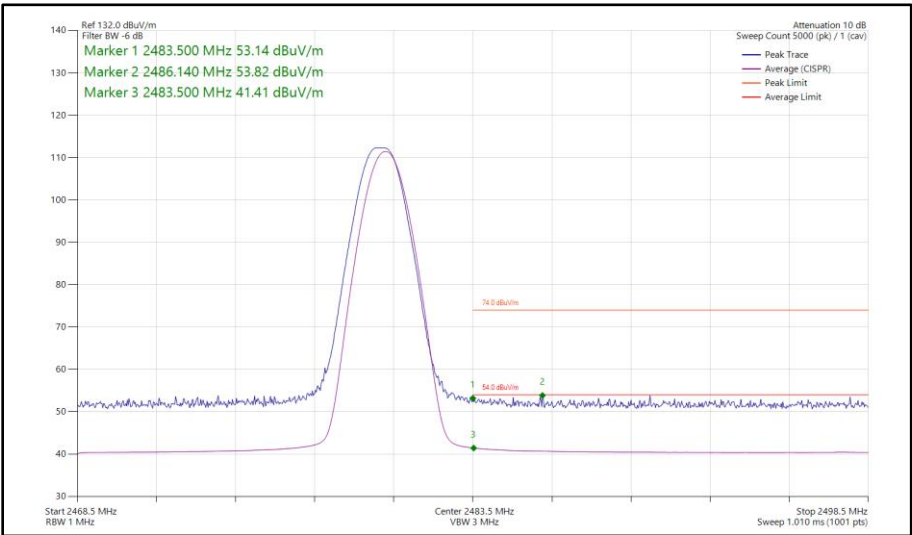
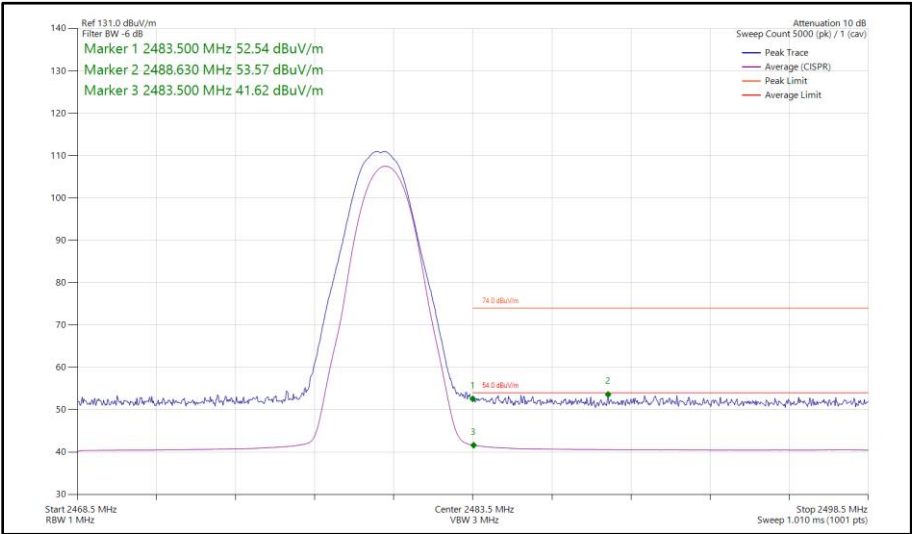
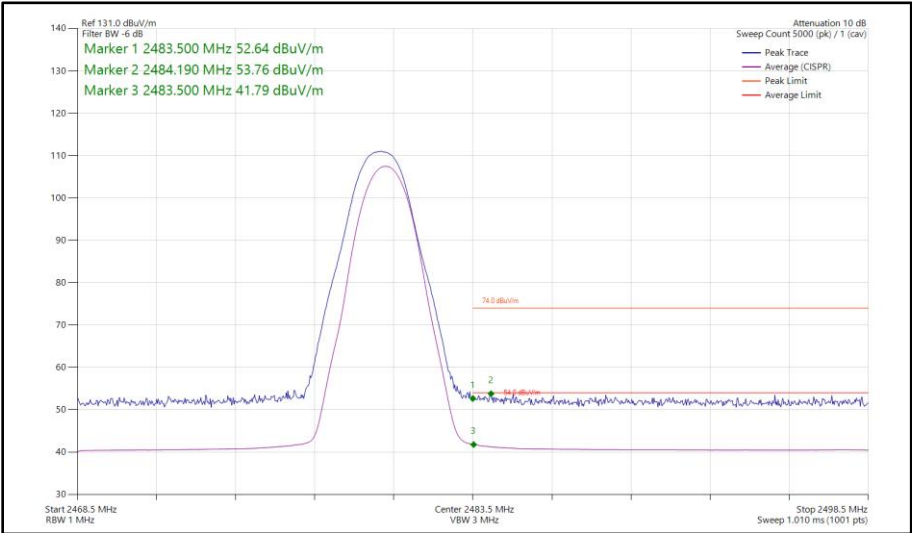


Figure 10 - Bluetooth DH5, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz



**Figure 11 - Bluetooth 2-DH5, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 12 - Bluetooth 3-DH5, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

iPA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	DH5	2402	2390	54.51	39.98
Static	2-DH5	2402	2390	58.78	40.36
Static	3-DH5	2402	2390	57.39	40.88
Static	DH5	2480	2483.5	55.50	43.15
Static	2-DH5	2480	2483.5	55.65	43.50
Static	3-DH5	2480	2483.5	56.70	43.82

Table 10 - MIMO Restricted Band Edge Results

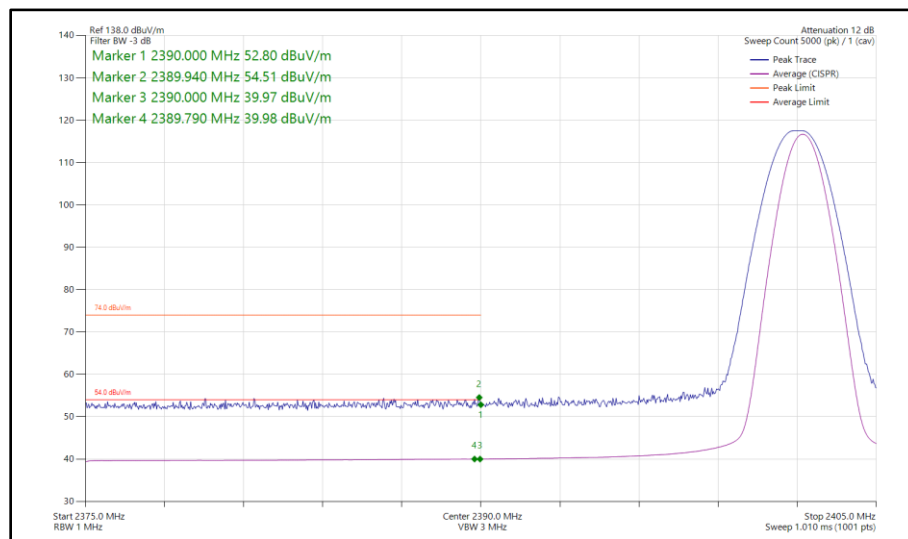


Figure 13 - Bluetooth DH5, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

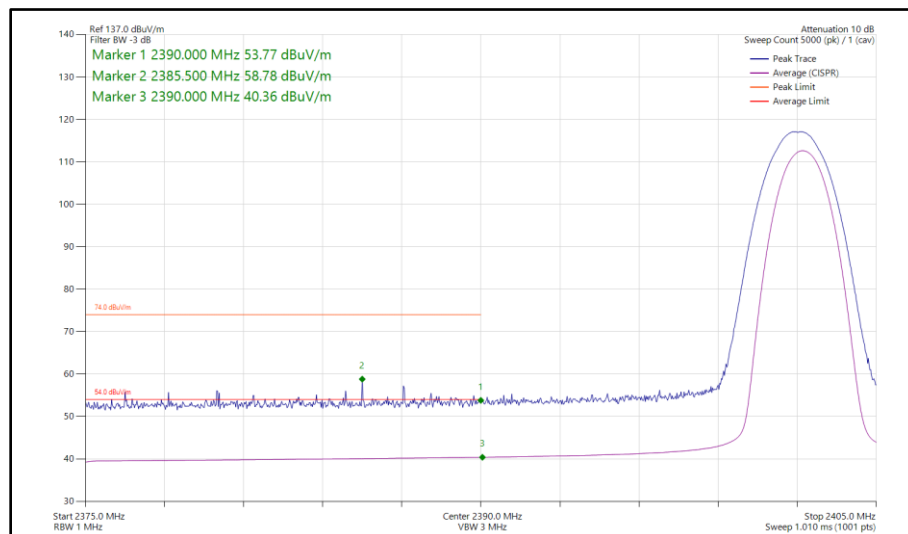
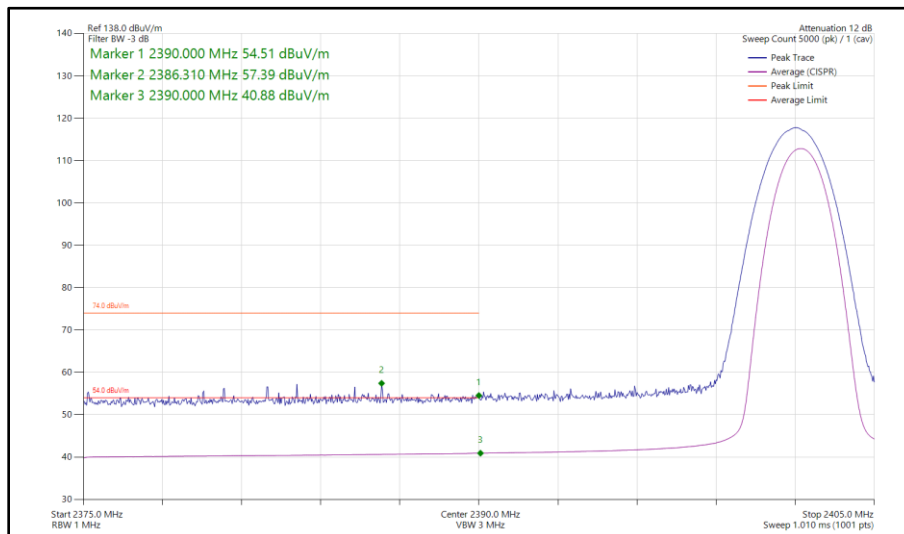
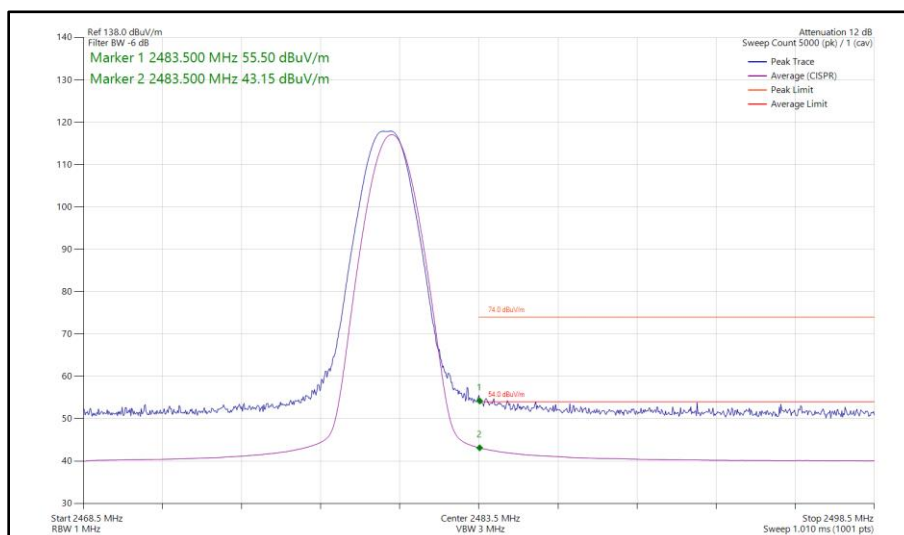


Figure 14 - Bluetooth 2-DH5, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz



**Figure 15 - Bluetooth 3-DH5, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



**Figure 16 - Bluetooth DH5, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

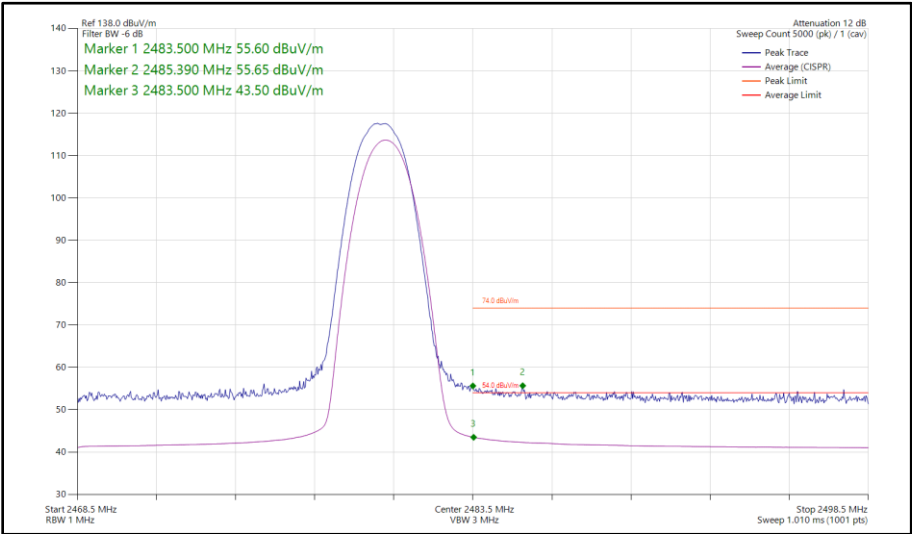


Figure 17 - Bluetooth 2-DH5, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

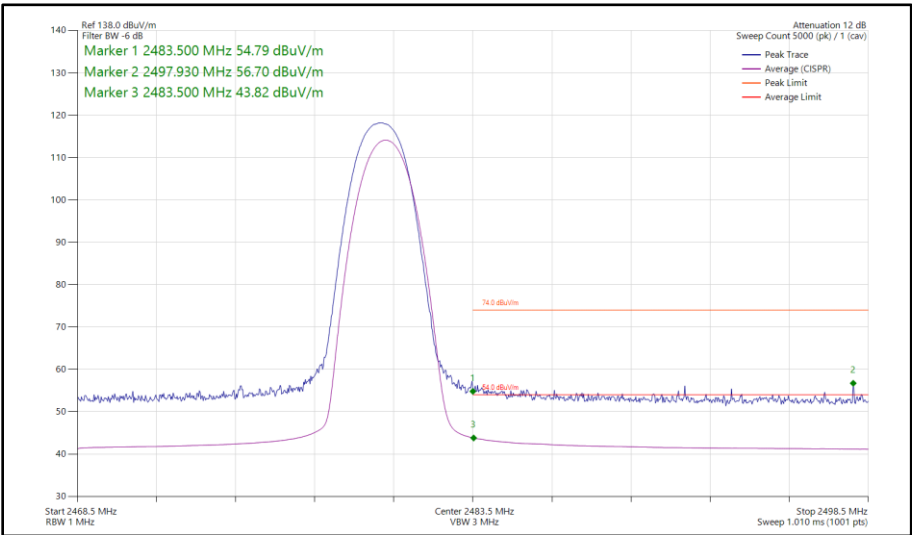


Figure 18 - Bluetooth 3-DH5, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

ePA - Core 0 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	2-DH5	2402	2390	57.28	42.83
Static	3-DH5	2402	2390	59.65	45.35
Static	2-DH5	2480	2483.5	63.64	49.62
Static	3-DH5	2480	2483.5	64.76	50.77

Table 11 - SISO Restricted Band Edge Results

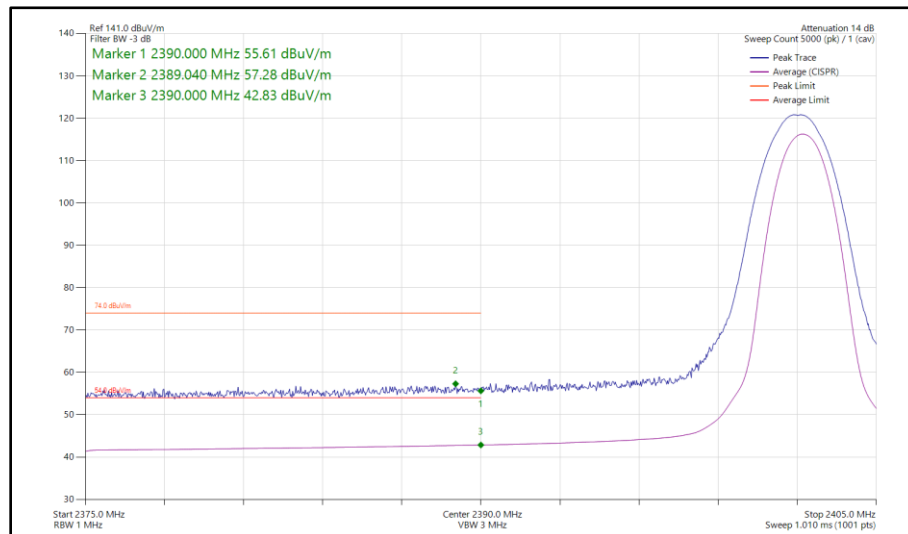


Figure 19 - Bluetooth 2-DH5, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

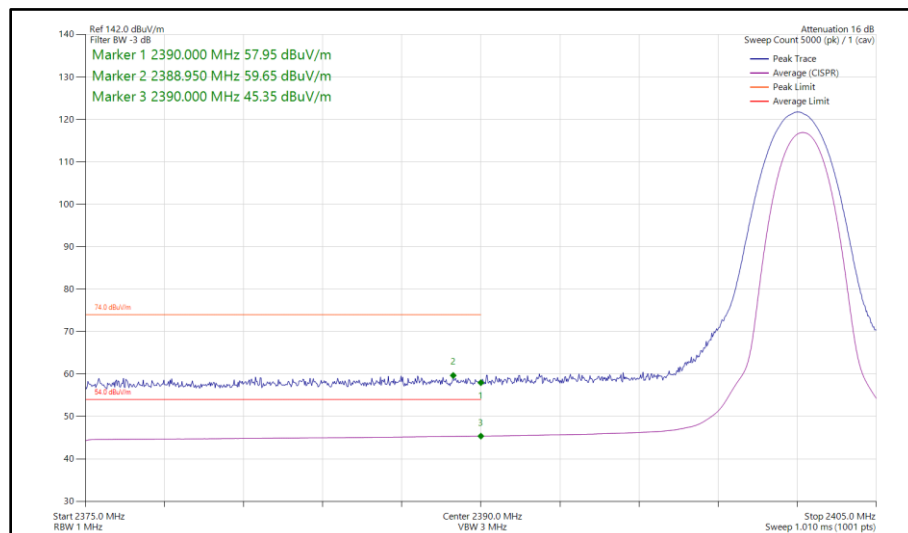


Figure 20 - Bluetooth 3-DH5, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

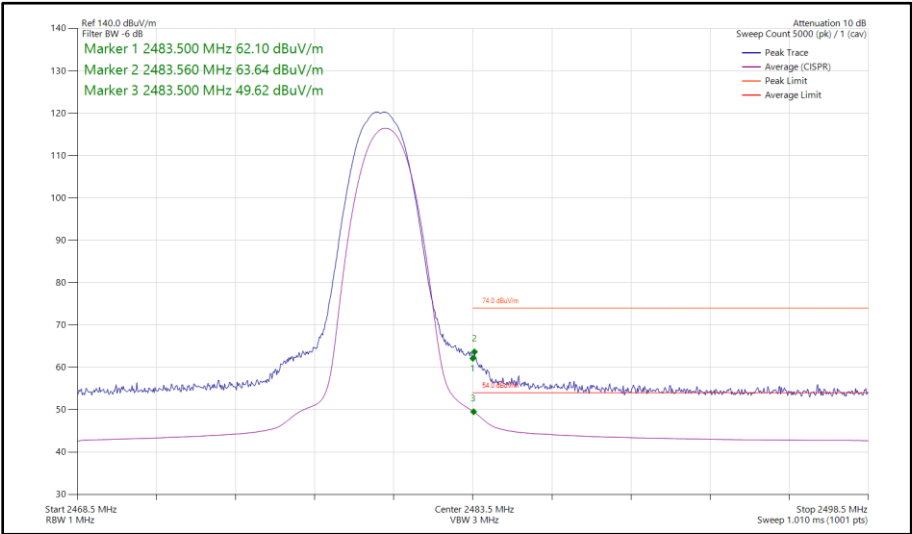


Figure 21 - Bluetooth 2-DH5, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

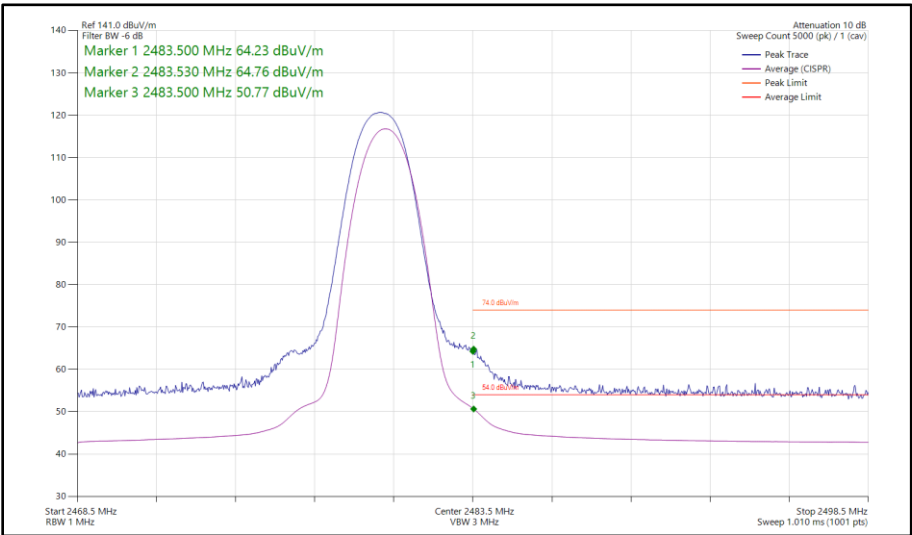


Figure 22 - Bluetooth 3-DH5, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

ePA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	2-DH5	2402	2390	58.42	42.93
Static	3-DH5	2402	2390	57.33	42.76
Static	2-DH5	2480	2483.5	62.08	49.86
Static	3-DH5	2480	2483.5	63.78	50.53

Table 12 - SISO Restricted Band Edge Results

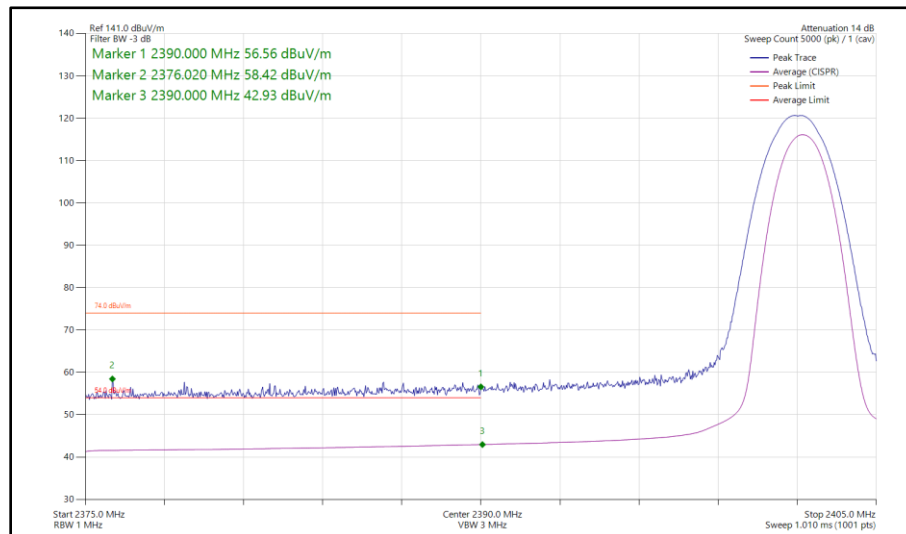


Figure 23 - Bluetooth 2-DH5, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

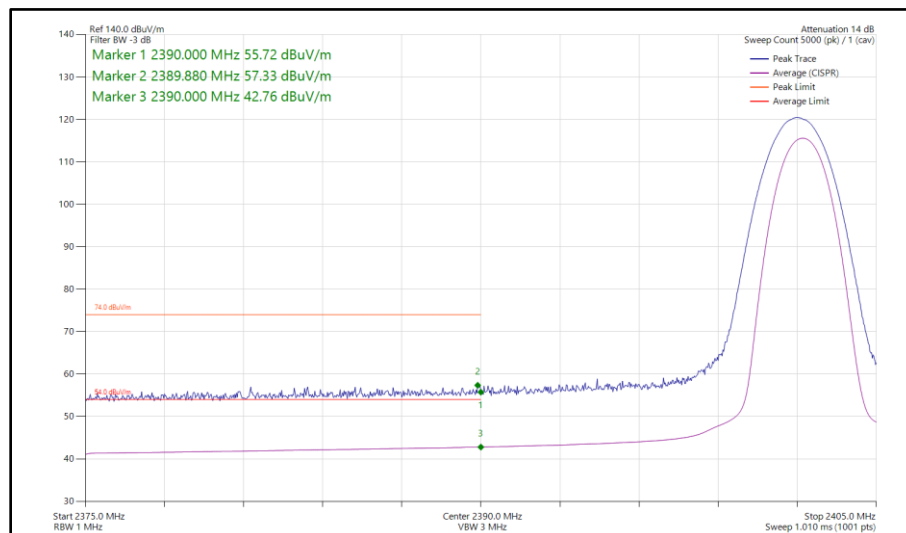
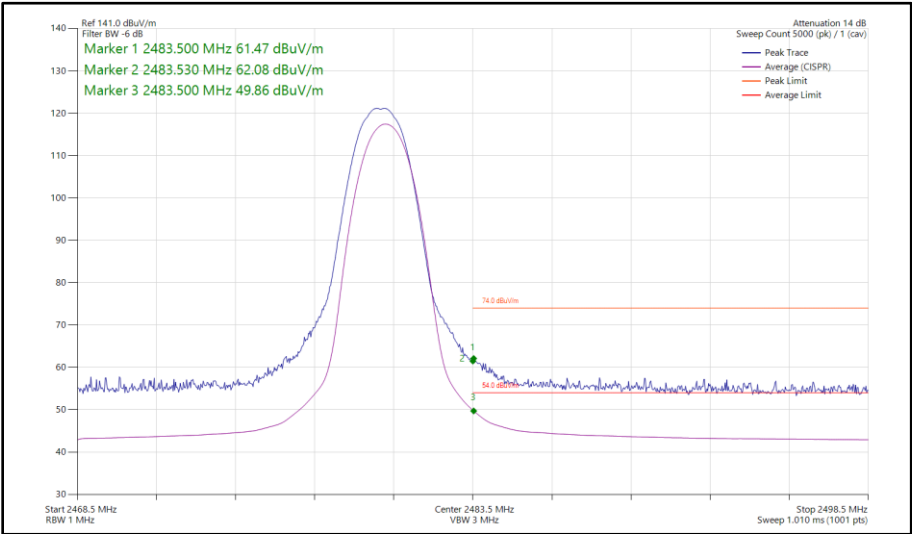
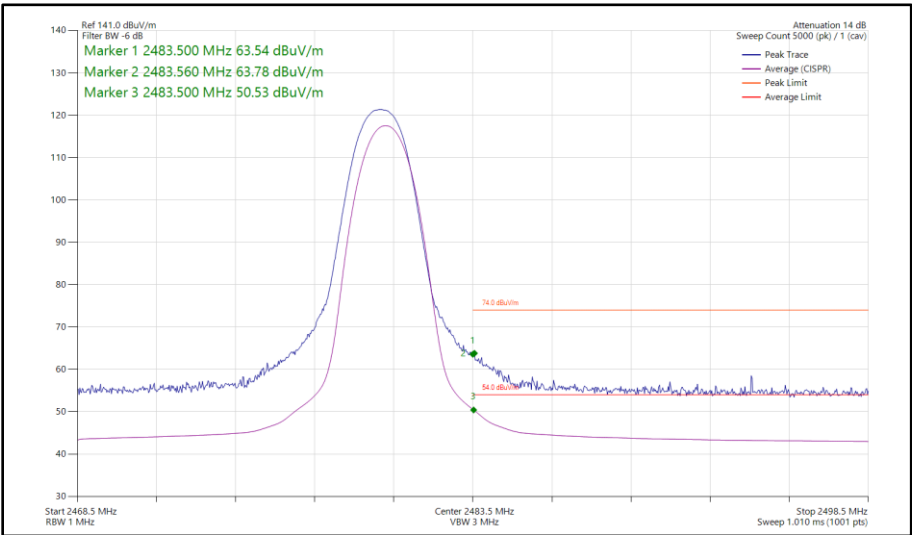


Figure 24 - Bluetooth 3-DH5, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz



**Figure 25 - Bluetooth 2-DH5, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 26 - Bluetooth 3-DH5, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

ePA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	2-DH5	2402	2390	64.22	49.63
Static	3-DH5	2402	2390	64.59	49.98
Static	2-DH5	2480	2483.5	54.28	41.85
Static	3-DH5	2480	2483.5	54.07	41.92

Table 13 - MIMO Restricted Band Edge Results

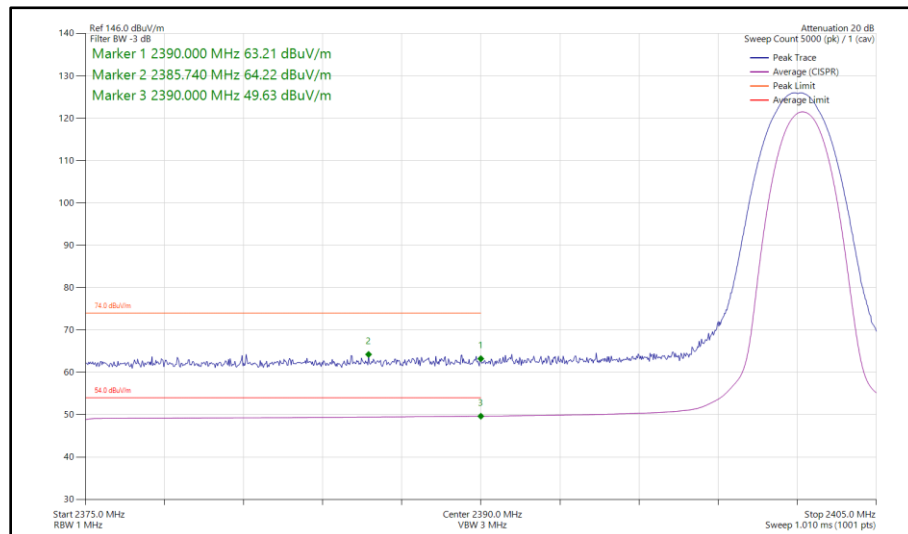


Figure 27 - Bluetooth 2-DH5, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

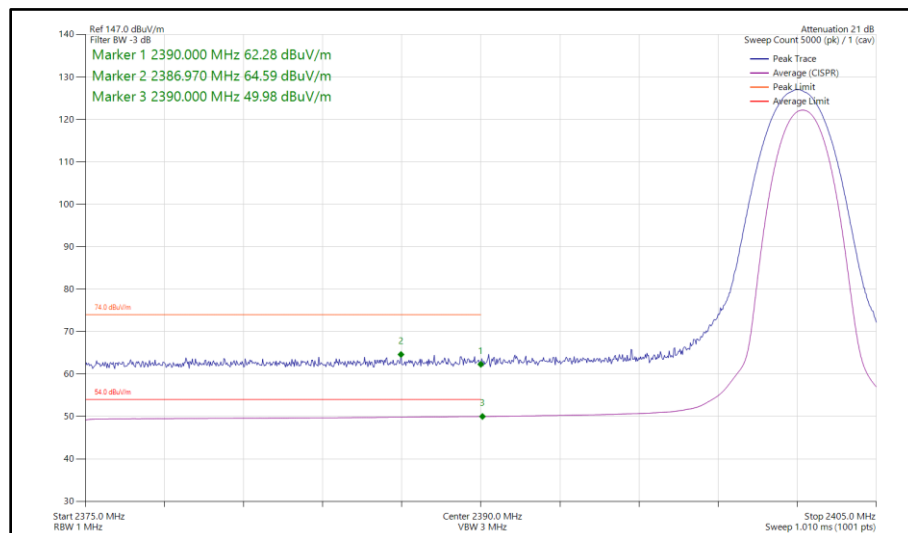
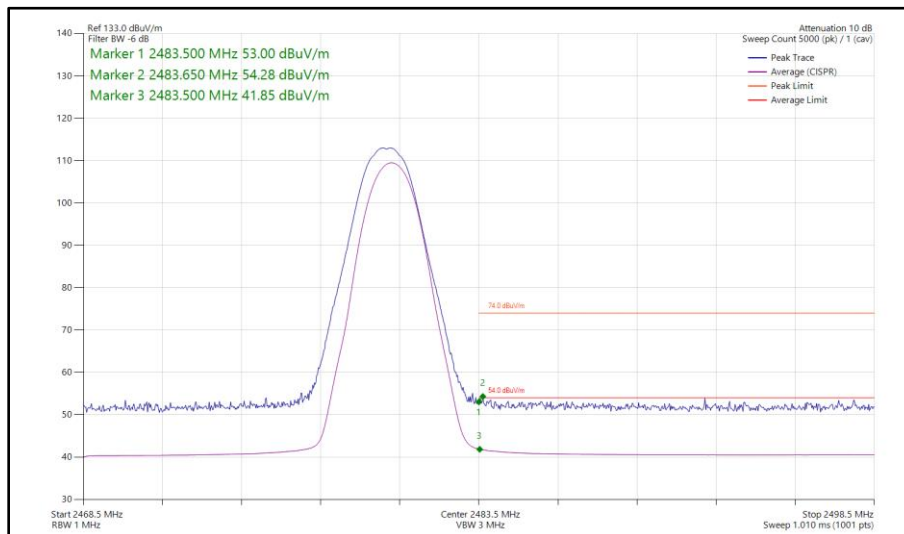
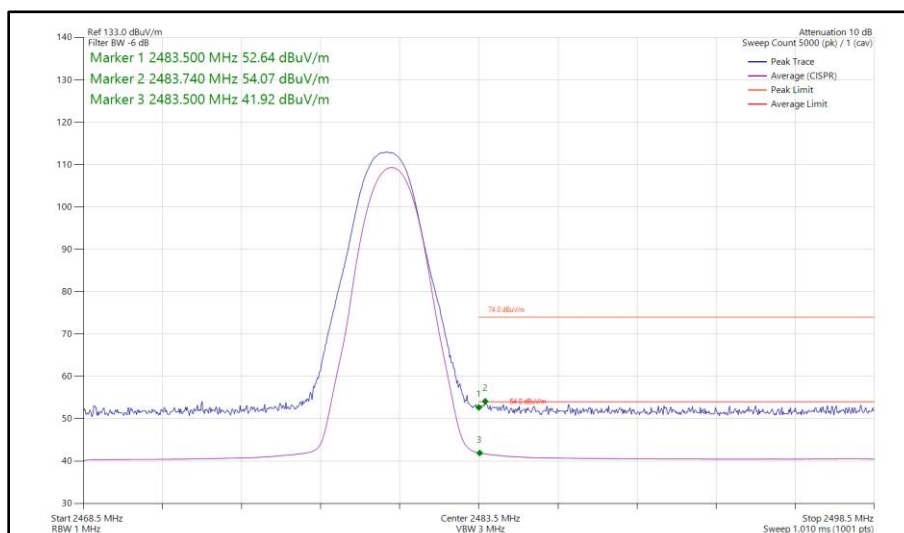


Figure 28 - Bluetooth 3-DH5, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz



**Figure 29 - Bluetooth 2-DH5, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 30 - Bluetooth 3-DH5, MIMO, Core 0 - Core 1 - 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 14

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 15

*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 16.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
Emissions Software	TUV SUD	EmX V3.4.2	5125	-	Software
Cable 2.92m	Junkosha	MWX241-01000KMS	5413	12	23-May-2025
EMI Test Receiver	Rohde & Schwarz	ESW44	5912	12	07-Aug-2025
1500W (300V 12A) AC Power Supply	iTech	IT7324	5957	-	O/P Mon
3m Semi-Anechoic Chamber, Chamber 16	Albatross Projects	RF Chamber 16	5972	36	24-May-2025
Mast & Turntable Controller	Maturo Gmbh	FCU3.0	5973	-	TU
Tilt Antenna Mast	Maturo Gmbh	BAM4.5-P	5974	-	TU
Turntable	Maturo Gmbh	TT1.5SI	5975	-	TU
Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA9120B	6142	12	05-May-2025
Digital Multimeter	Fluke	115	6147	12	06-Jun-2025
SAC Switch Unit	TUV SUD	TUV_SSU_004 PLC	6349	12	07-May-2025
USB Spectrum Analyser	Signal Hound	SA124B	6383	-	TU
8M SMA Cable	Junkosha	MWX221-08000AMSAMS/B	6833	12	14-Aug-2025
Handheld Hygrometer	Fluke	971	6838	12	27-Aug-2025
Cable Assembly	SpecTech	PE300-60	6857	-	TU
Cable Assembly	SpecTech	PE300-60	6858	-	TU

Table 16

TU - Traceability Unscheduled

O/P Mon - Output Monitored using calibrated equipment



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

A3241, S/N: FWKQMY7GHY - Modification State 0

2.2.3 Date of Test

02-November-2024 to 08-November-2024

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	21.0 - 21.6 °C
Relative Humidity	46.6 - 51.0 %



2.2.6 Test Results

2.4 GHz Bluetooth BDR/EDR

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 $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	77.2
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	2.898	109	315.8	400.0

Table 17 - Time of Occupancy Results

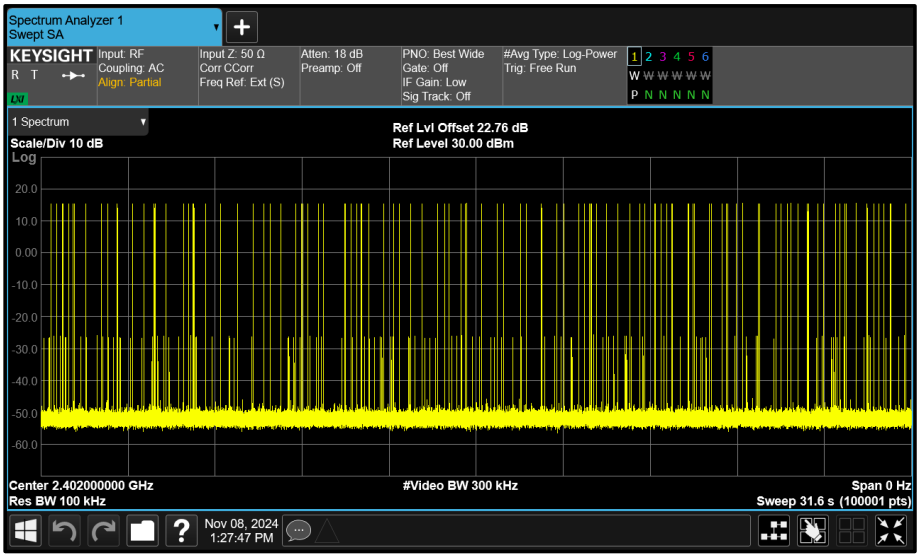


Figure 31 - $\pi/4$ DQPSK - 2402 MHz Accumulated Transmit Time



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:	ePA 8-DPSK (3-DH5)	Duty Cycle (%):	77.2
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	2.900	100	290.0	400.0

Table 18 - Time of Occupancy Results

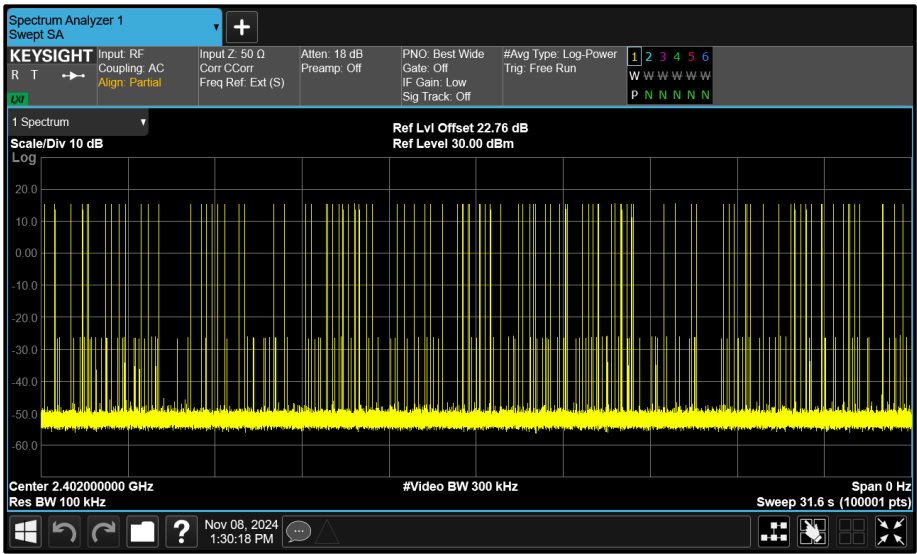


Figure 32 - 8-DPSK - 2402 MHz Accumulated Transmit Time



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:	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):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.897	96	278.2	400.0

Table 19 - Time of Occupancy Results



Figure 33 - $\pi/4$ DQPSK - 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:	ePA 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):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.900	94	272.6	400.0

Table 20 - Time of Occupancy Results



Figure 34 - 8-DPSK - 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	2.892	108	312.3	400.0

Table 21 - Time of Occupancy Results

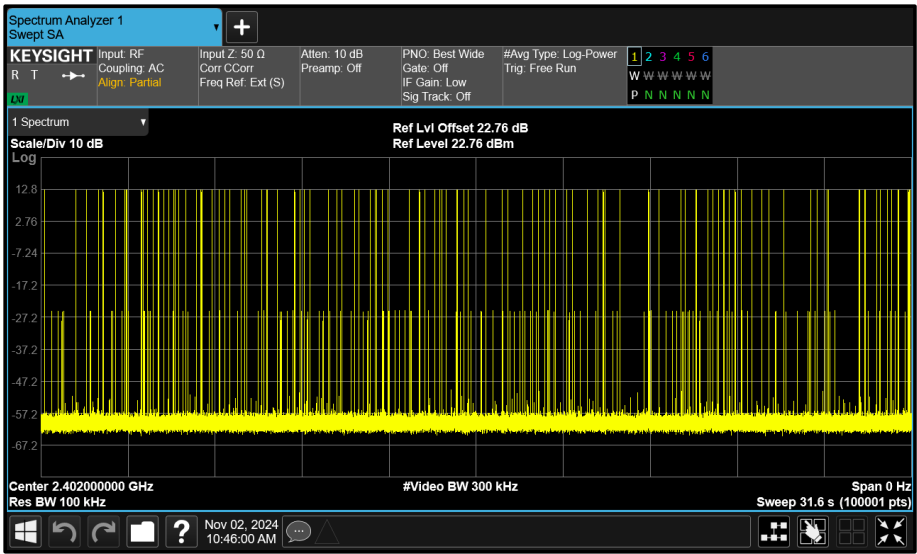


Figure 35 - GFSK - 2402 MHz Accumulated Transmit Time



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 $\pi/4$ DQPSK (2-DH5)	Duty Cycle (%):	77.1
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	2.896	113	327.2	400.0

Table 22 - Time of Occupancy Results

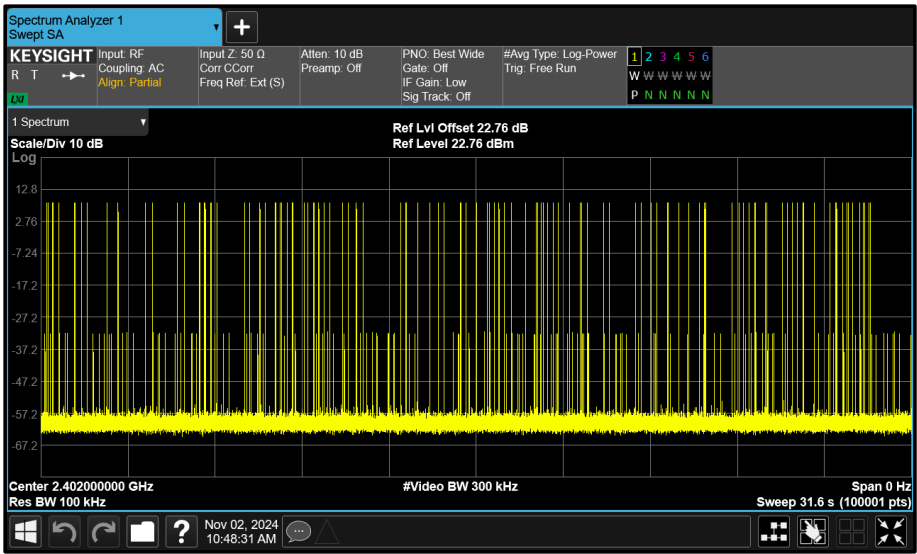


Figure 36 - $\pi/4$ DQPSK - 2402 MHz Accumulated Transmit Time



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 8-DPSK (3-DH5)	Duty Cycle (%):	77.2
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	2.896	110	318.6	400.0

Table 23 - Time of Occupancy Results

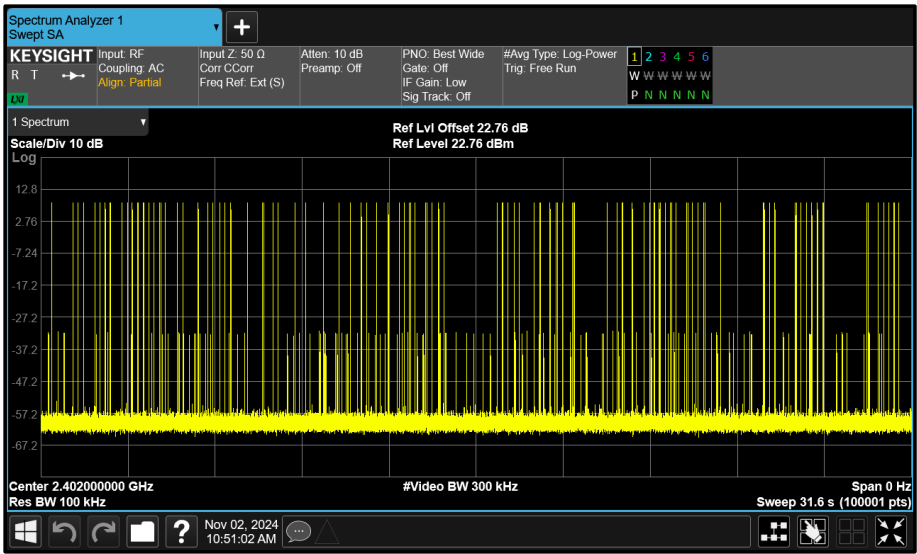


Figure 37 - 8-DPSK - 2402 MHz Accumulated Transmit Time



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 (%):	77.0
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + 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	2.895	105	303.9	400.0

Table 24 - Time of Occupancy Results

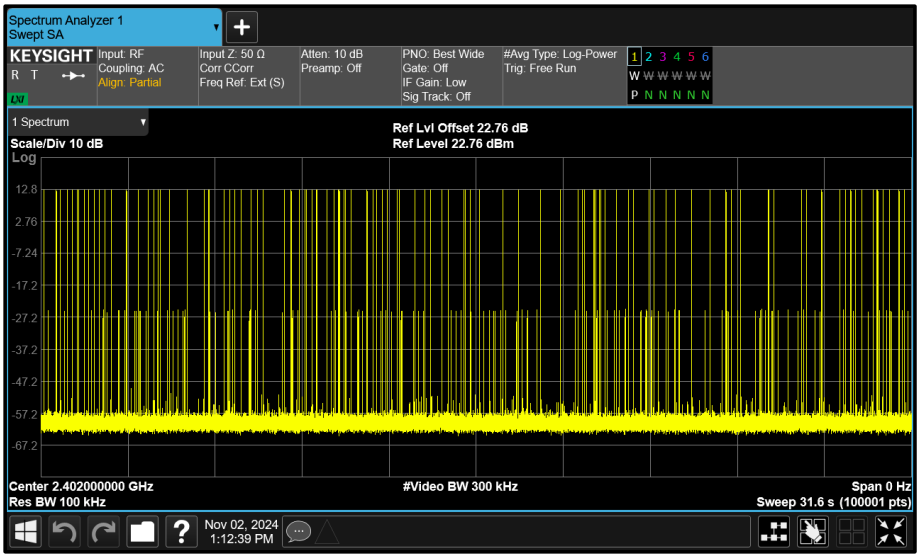


Figure 38 - GFSK - 2402 MHz Accumulated Transmit Time



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 $\pi/4$ 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):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.895	116	335.8	400.0

Table 25 - Time of Occupancy Results

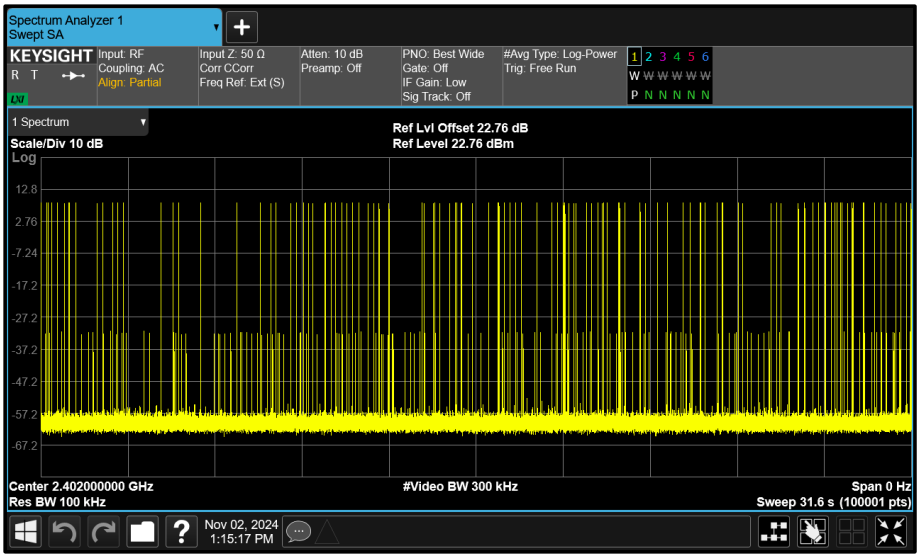


Figure 39 - $\pi/4$ DQPSK - 2402 MHz Accumulated Transmit Time



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 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):	-

Test Frequency (MHz)	Time of Occupancy			Limit (ms)
	Dwell Time (ms)	Number of Transmissions	Time of Occupancy (ms)	
2402	2.898	104	301.3	400.0

Table 26 - Time of Occupancy Results

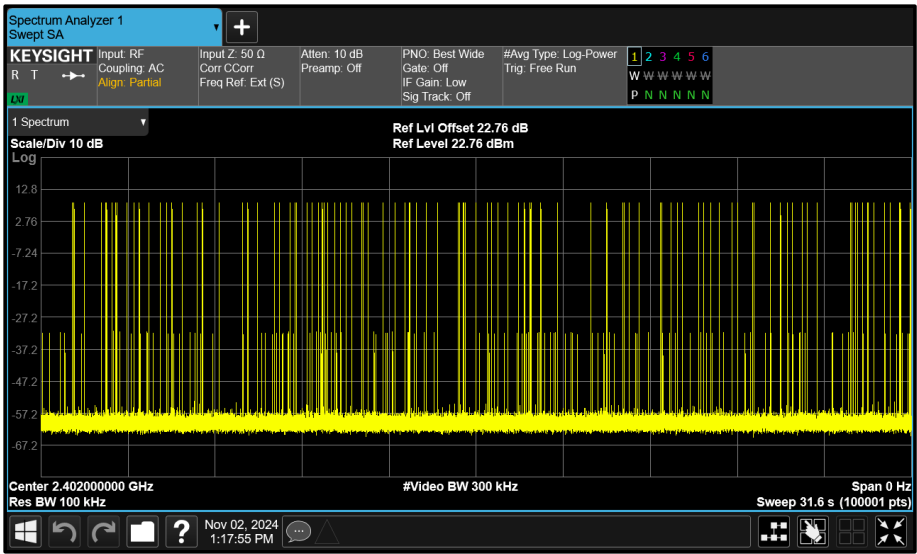


Figure 40 - 8-DPSK - 2402 MHz Accumulated Transmit Time

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 2.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
True RMS Multimeter	Fluke	79 Series III	411	12	12-Jan-2025
Hygrometer	Rotronic	Hygropalm 0	3028	12	12-Aug-2025
AC Programmable Power Supply	iTech	IT7324	5226	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	18-Sep-2025
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	02-Aug-2025

Table 27

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

A3241, S/N: FWKQMY7GHY - Modification State 0

2.3.3 Date of Test

02-November-2024 to 08-November-2024

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	21.0 - 21.6 °C
Relative Humidity	46.6 - 51.0 %



2.3.6 Test Results

2.4 GHz Bluetooth BDR/EDR

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	1.356	2440.990	2441.990	1.000	≥ 904.0

Table 28 - Carrier Frequency Separation Results

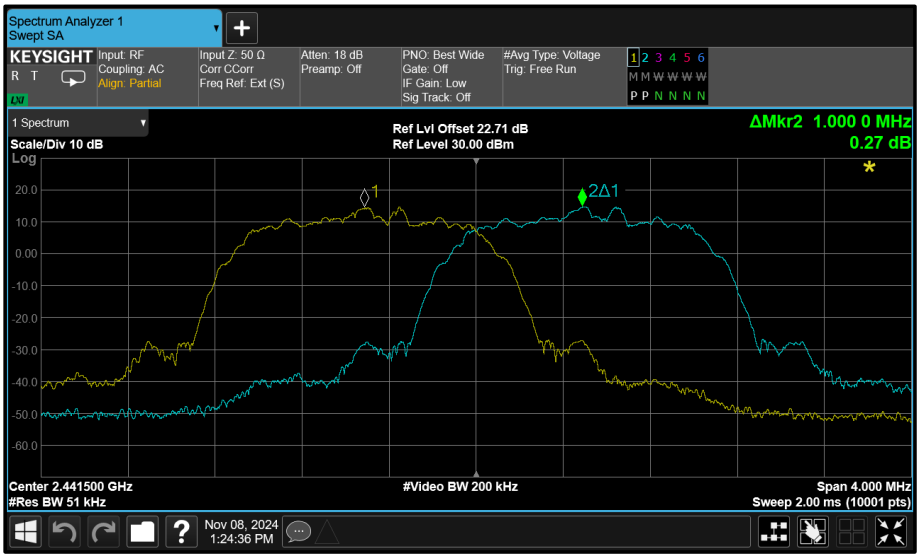


Figure 41 - $\pi/4$ DQPSK - 2441 MHz (CH39)



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:	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	1.320	2440.999	2441.998	0.999	≥880.3

Table 29 - Carrier Frequency Separation Results

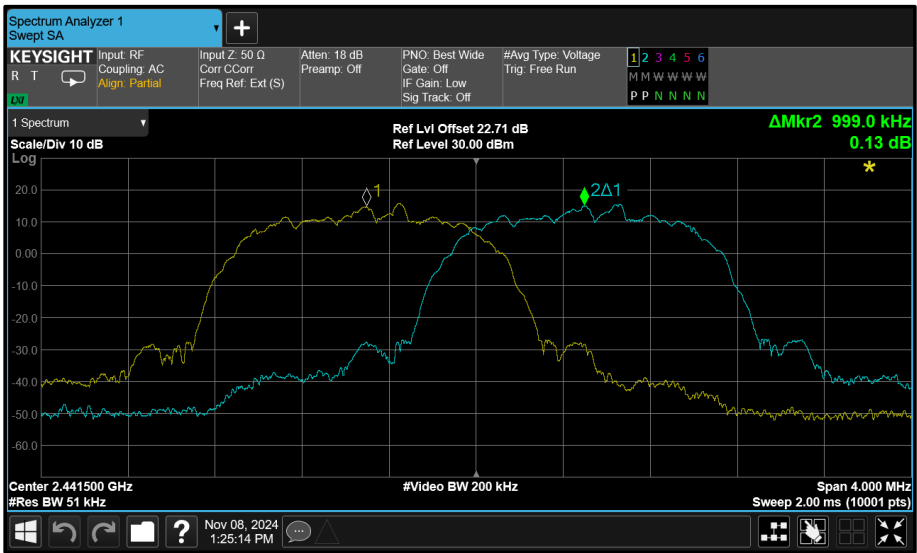


Figure 42 - 8-DPSK - 2441 MHz (CH39)



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:	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)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.353	2440.987	2441.987	1.000	≥ 902.1

Table 30 - Carrier Frequency Separation Results

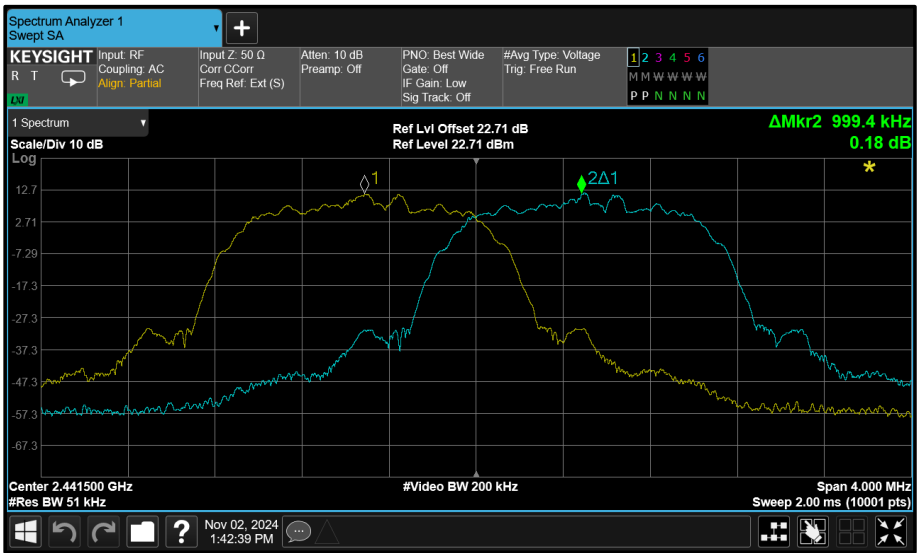


Figure 43 - $\pi/4$ DQPSK - 2441 MHz (CH39)



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:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.322	2440.996	2441.996	1.000	≥881.6

Table 31 - Carrier Frequency Separation Results

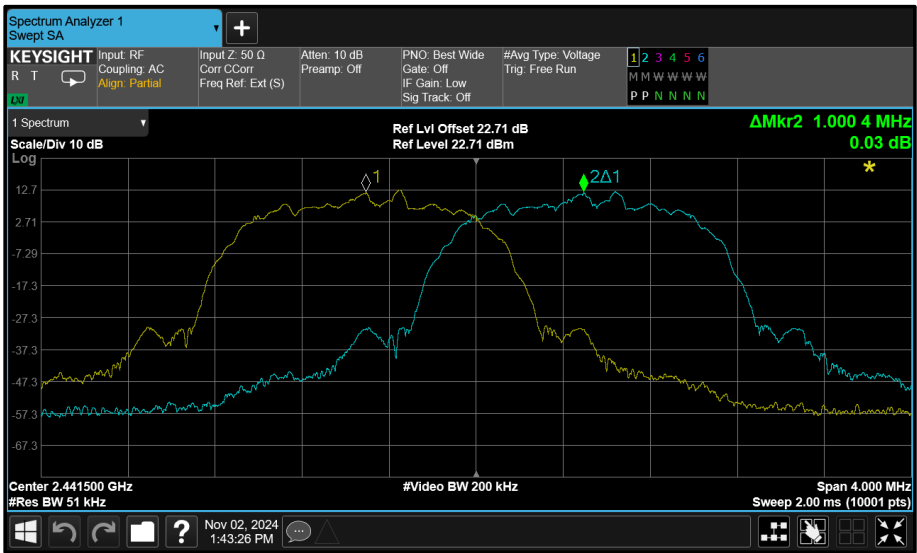


Figure 44 - 8-DPSK - 2441 MHz (CH39)



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	0.927	2441.009	2442.010	1.001	≥618.2

Table 32 - Carrier Frequency Separation Results

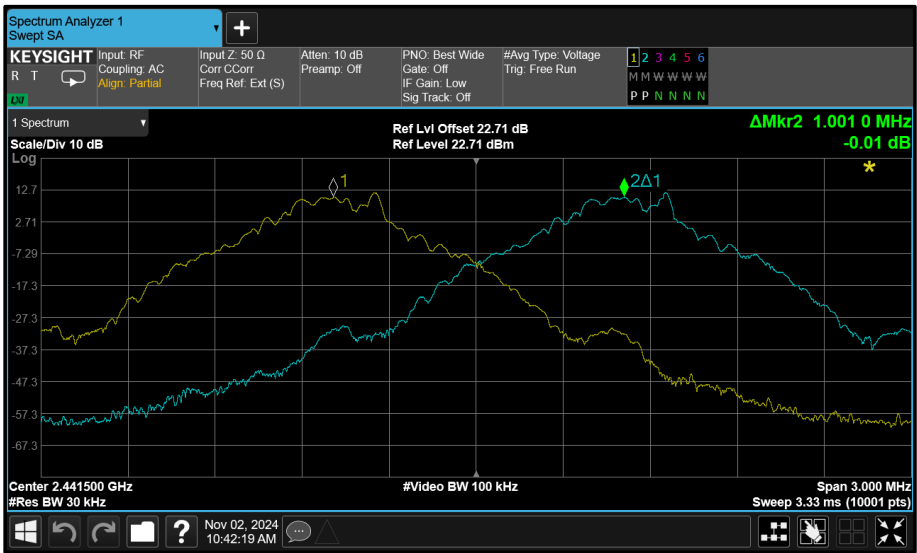


Figure 45 - GFSK - 2441 MHz (CH39)



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	1.352	2440.991	2441.991	1.000	≥ 901.6

Table 33 - Carrier Frequency Separation Results

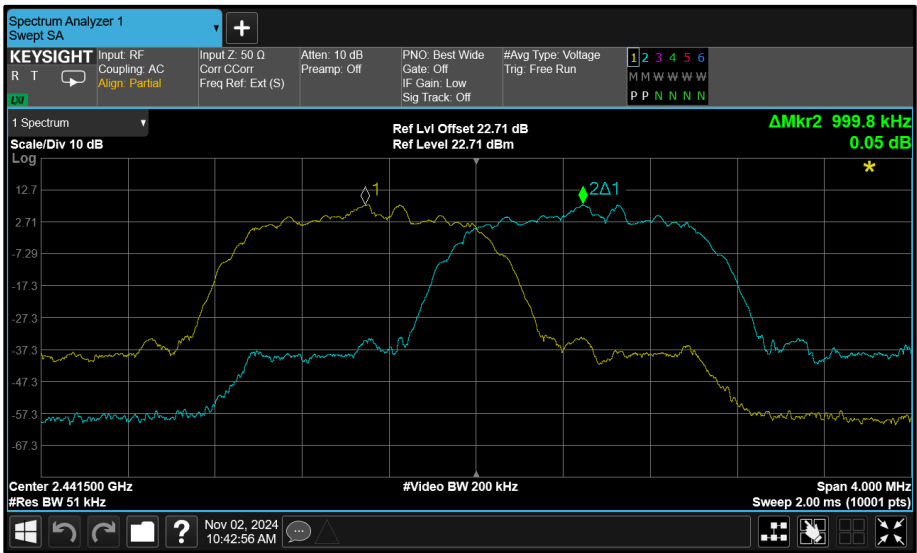


Figure 46 - $\pi/4$ DQPSK - 2441 MHz (CH39)



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	1.321	2441.000	2442.000	1.000	≥880.8

Table 34 - Carrier Frequency Separation Results



Figure 47 - 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:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	0.926	2441.007	2442.010	1.003	≥617.6

Table 35 - Carrier Frequency Separation Results

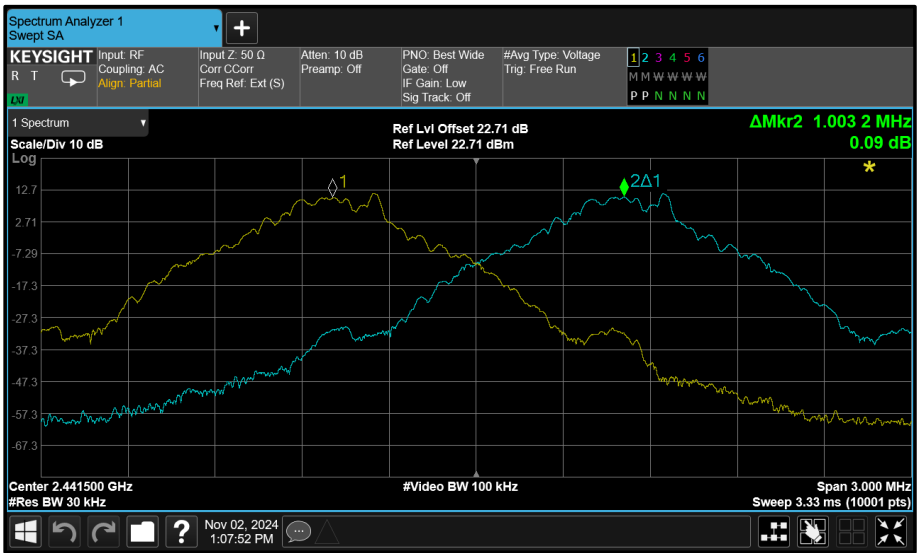


Figure 48 - GFSK - 2441 MHz (CH39)



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:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.353	2440.991	2441.991	1.000	≥ 901.9

Table 36 - Carrier Frequency Separation Results

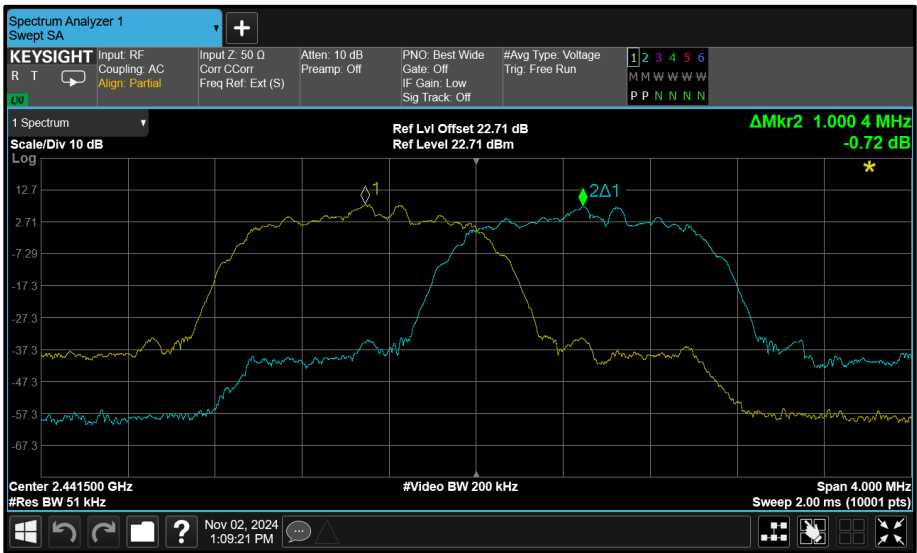


Figure 49 - $\pi/4$ DQPSK - 2441 MHz (CH39)



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:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	20 dB Bandwidth (MHz)	Carrier Frequency Separation (MHz)			Limit (kHz)
		F1C	F2C	FHS	
2441	1.323	2440.999	2441.999	1.000	≥882.1

Table 37 - Carrier Frequency Separation Results

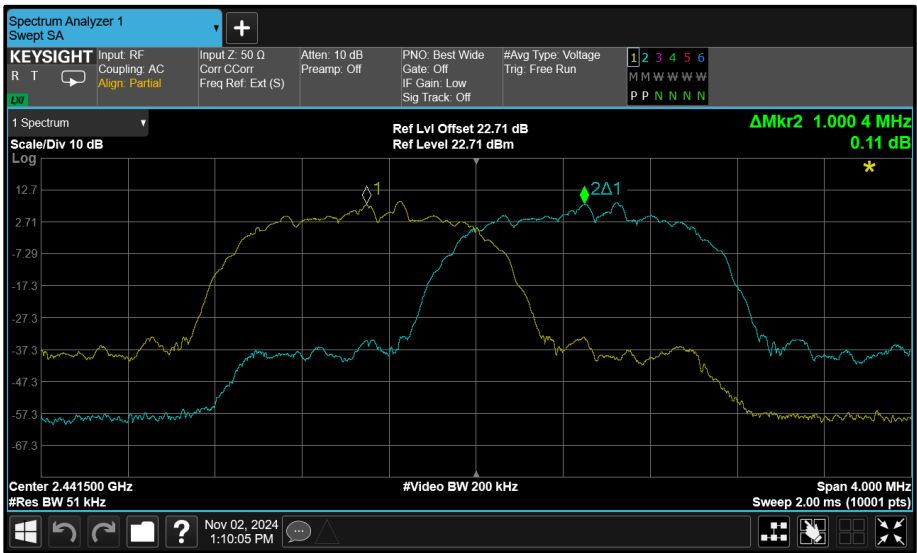


Figure 50 - 8-DPSK - 2441 MHz (CH39)



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 2.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
True RMS Multimeter	Fluke	79 Series III	411	12	12-Jan-2025
Hygrometer	Rotronic	Hygropalm 0	3028	12	12-Aug-2025
AC Programmable Power Supply	iTech	IT7324	5226	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	18-Sep-2025
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	02-Aug-2025

Table 38

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

A3241, S/N: FWKQMY7GHY - Modification State 0

2.4.3 Date of Test

02-November-2024 to 08-November-2024

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	21.0 - 21.6 °C
Relative Humidity	46.6 - 51.0 %

2.4 GHz Bluetooth BDR/EDR

Number of Hopping Frequencies	Limit
79	≥15.0

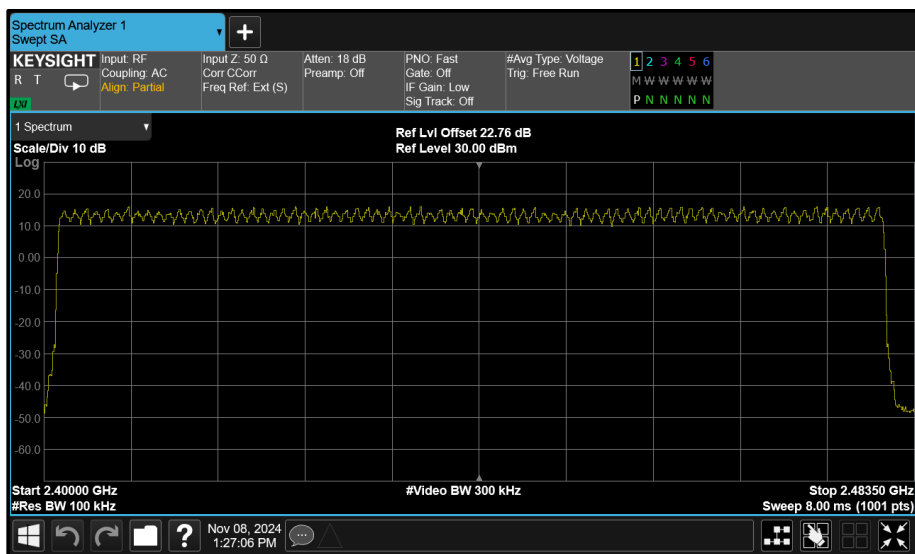


Figure 51 - $\pi/4$ DQPSK (2-DH5) - Number of Hopping Channels



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:	ePA 8-DPSK (3-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 40 - Number of Hopping Frequencies Results

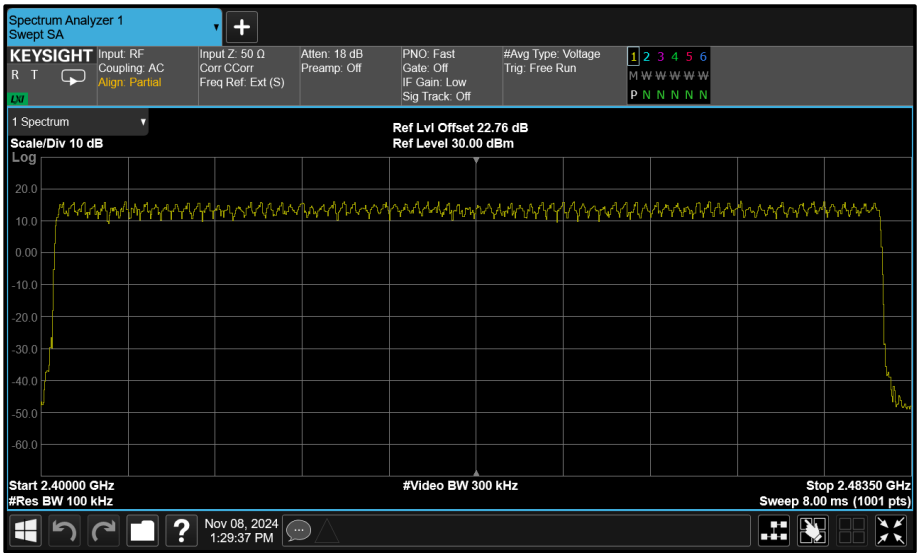


Figure 52 - 8-DPSK (3-DH5) - Number of Hopping Channels



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:	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):	-

Number of Hopping Frequencies	Limit
79	≥ 15.0

Table 41 - Number of Hopping Frequencies Results

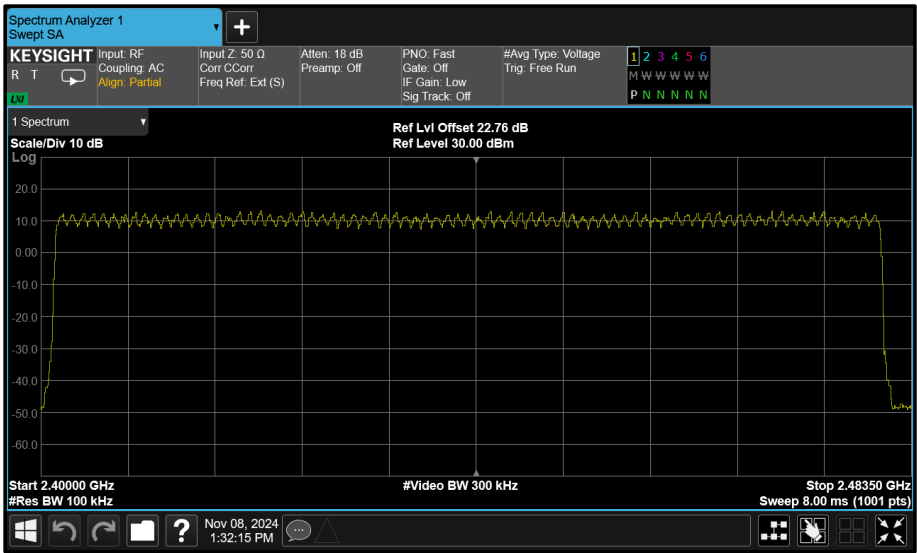


Figure 53 - $\pi/4$ DQPSK (2-DH5) - Number of Hopping Channels



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:	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):	-

Number of Hopping Frequencies	Limit
79	≥15.0

Table 42 - Number of Hopping Frequencies Results

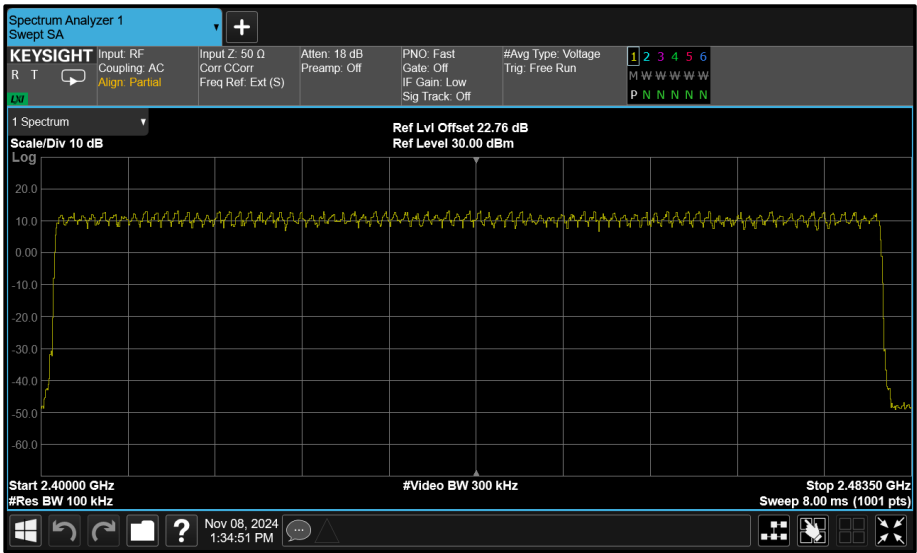


Figure 54 - 8-DPSK (3-DH5) - Number of Hopping Channels



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 43 - Number of Hopping Frequencies Results

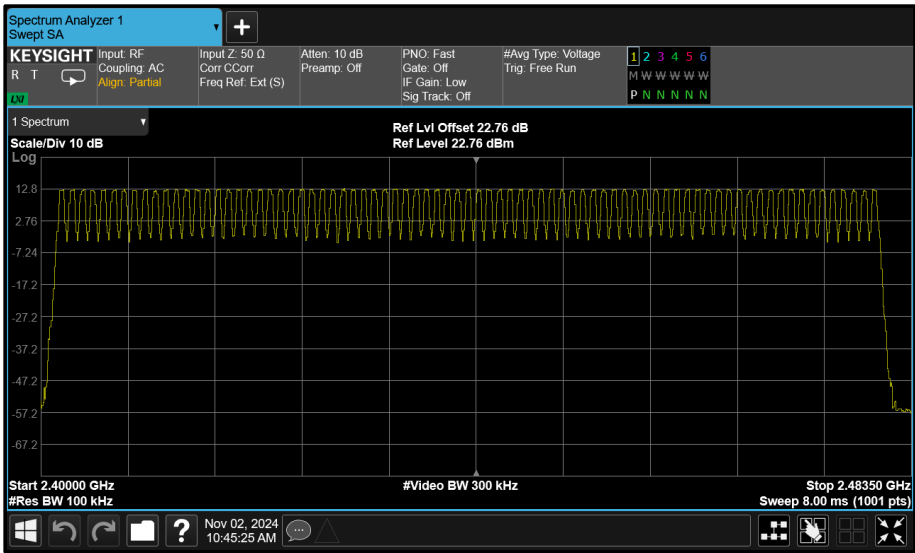


Figure 55 - GFSK (DH5) - Number of Hopping Channels



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 $\pi/4$ DQPSK (2-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 44 - Number of Hopping Frequencies Results

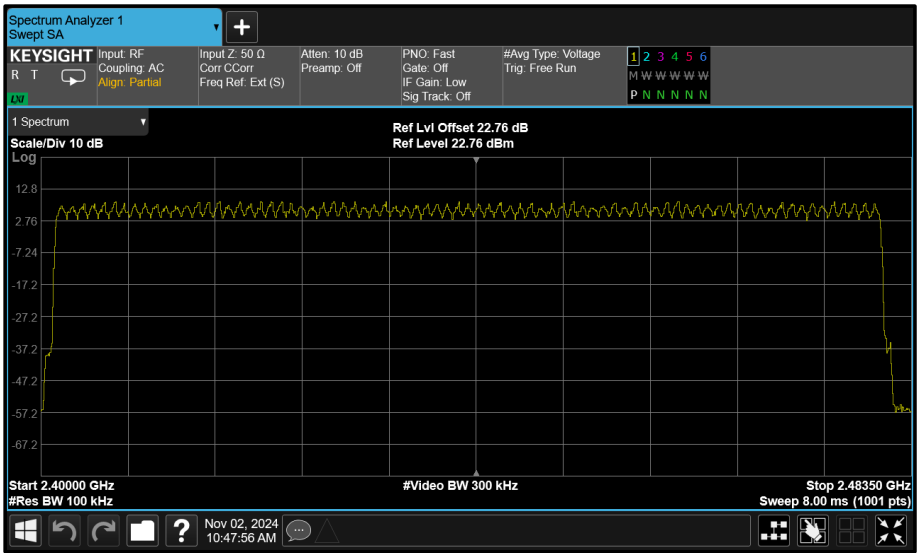


Figure 56 - $\pi/4$ DQPSK (2-DH5) - Number of Hopping Channels



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 8-DPSK (3-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 45 - Number of Hopping Frequencies Results

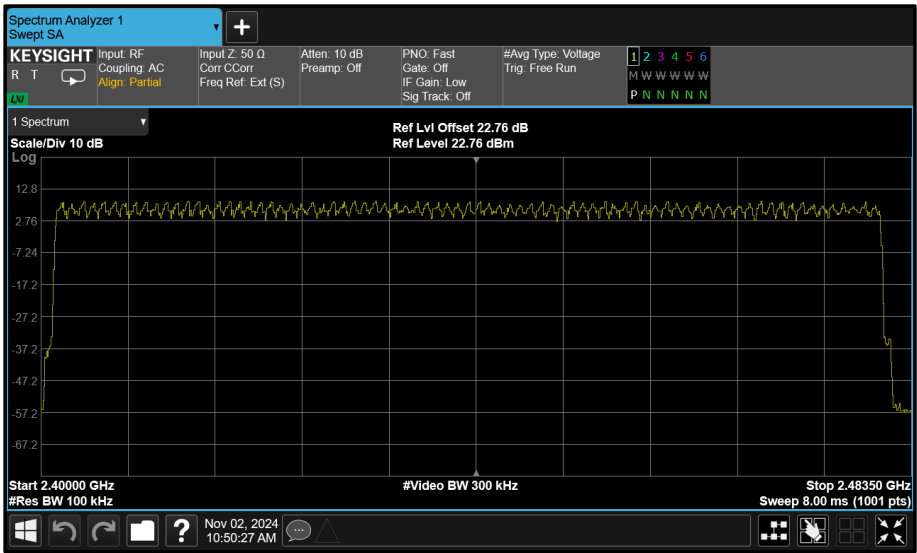


Figure 57 - 8-DPSK (3-DH5) - Number of Hopping Channels



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:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Number of Hopping Frequencies		Limit
79		≥15.0

Table 46 - Number of Hopping Frequencies Results

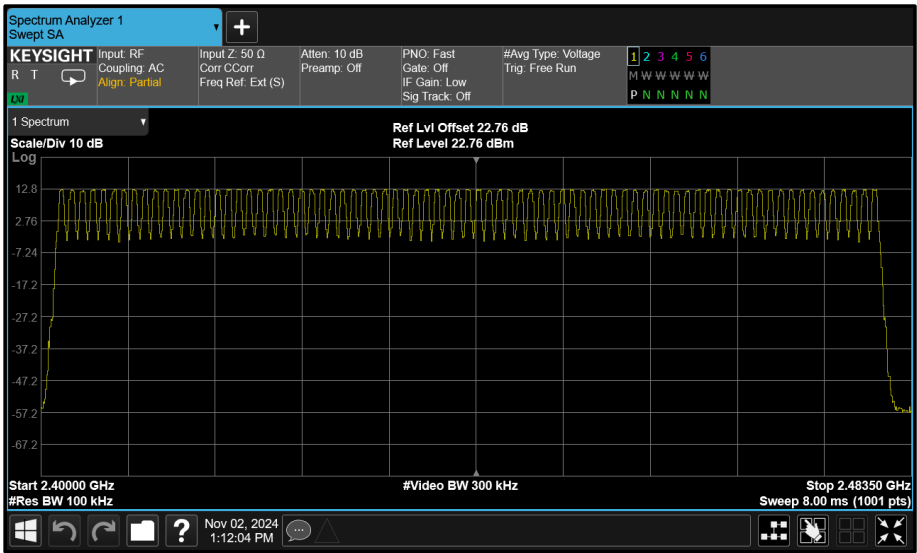


Figure 58 - GFSK (DH5) - Number of Hopping Channels



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

Number of Hopping Frequencies	Limit
79	≥ 15.0

Table 47 - Number of Hopping Frequencies Results

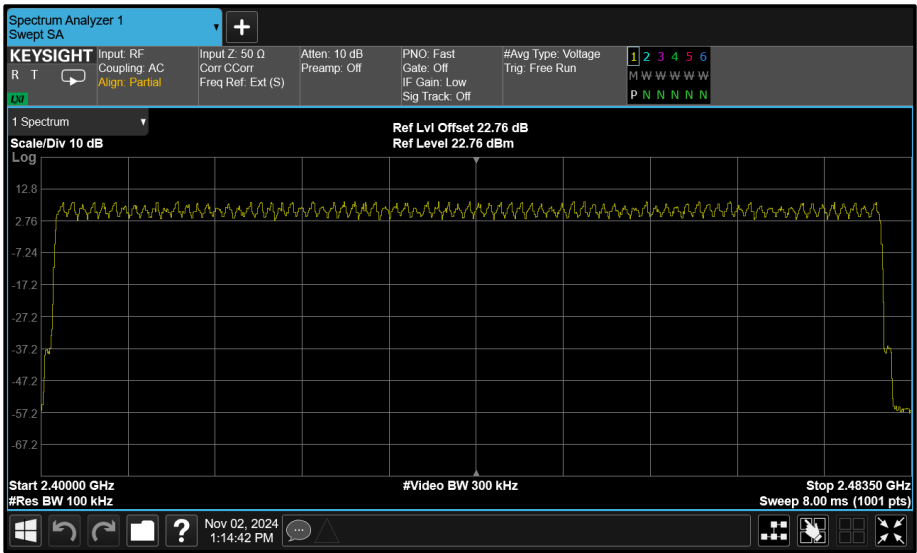


Figure 59 - $\pi/4$ DQPSK (2-DH5) - Number of Hopping Channels



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

Number of Hopping Frequencies	Limit
79	≥15.0

Table 48 - Number of Hopping Frequencies Results

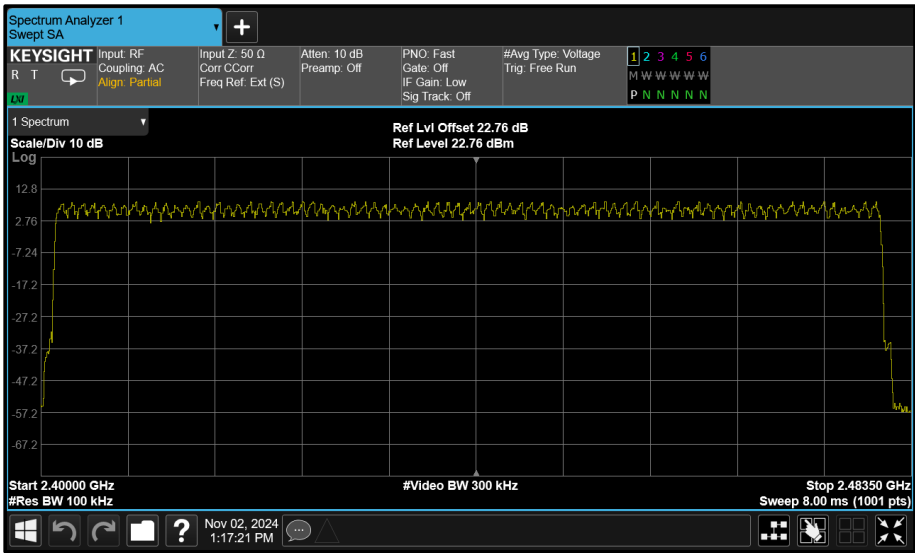


Figure 60 - 8-DPSK (3-DH5) - Number of Hopping Channels

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 2.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Expiry Date
True RMS Multimeter	Fluke	79 Series III	411	12	12-Jan-2025
Hygrometer	Rotronic	Hygropalm 0	3028	12	12-Aug-2025
AC Programmable Power Supply	iTech	IT7324	5226	-	O/P Mon
MXA Signal Analyser	Keysight Technologies	N9020B	5528	24	18-Sep-2025
Signal Conditioning Unit	TUV SUD	SPECTRUM_SCU001	6350	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6638	12	02-Aug-2025
SCU Cable Assembly	TUV SUD	SPECTRUM_SCU_CA	6639	12	02-Aug-2025

Table 49

O/P Mon - Output Monitored using calibrated equipment



2.5 Frequency Hopping Systems - 99% & 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

A3241, S/N: FWKQMY7GHY - Modification State 0

2.5.3 Date of Test

02-November-2024 to 08-November-2024

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2 for 20 dB Bandwidth and ANSI C63.10, clause 6.9.3 for 99% Bandwidth.

2.5.5 Environmental Conditions

Ambient Temperature	21.0 - 21.6 °C
Relative Humidity	46.6 - 50.9 %



2.5.6 Test Results

2.4 GHz Bluetooth BDR/EDR

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 6.9.3 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	1.325	-	-	-
2441	1.330	-	-	-
2480	1.325	-	-	-

Table 50 - 20 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.184	-	-	-	-
2441	1.184	-	-	-	-
2480	1.184	-	-	-	-

Table 51 - 99% Bandwidth Results

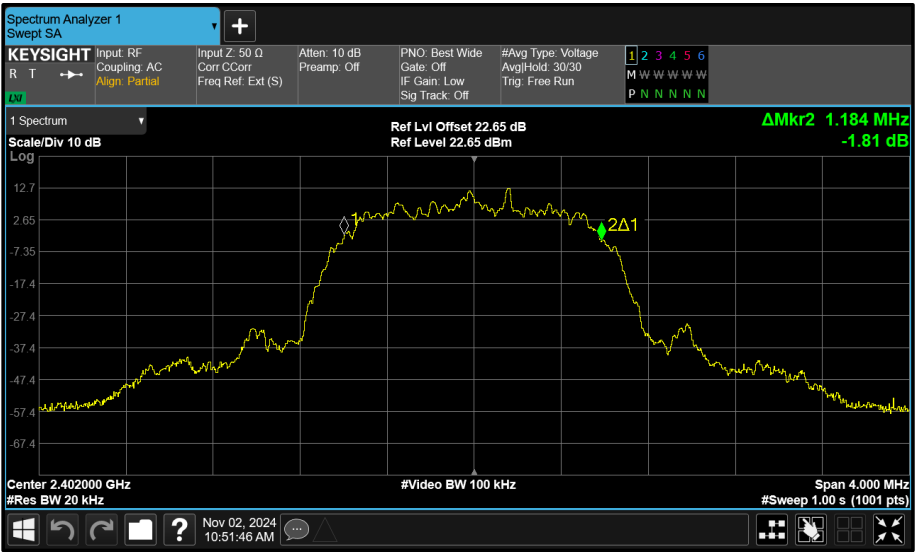


Figure 61 - Core 0 (A) 2402 MHz (CH0) 99% Bandwidth

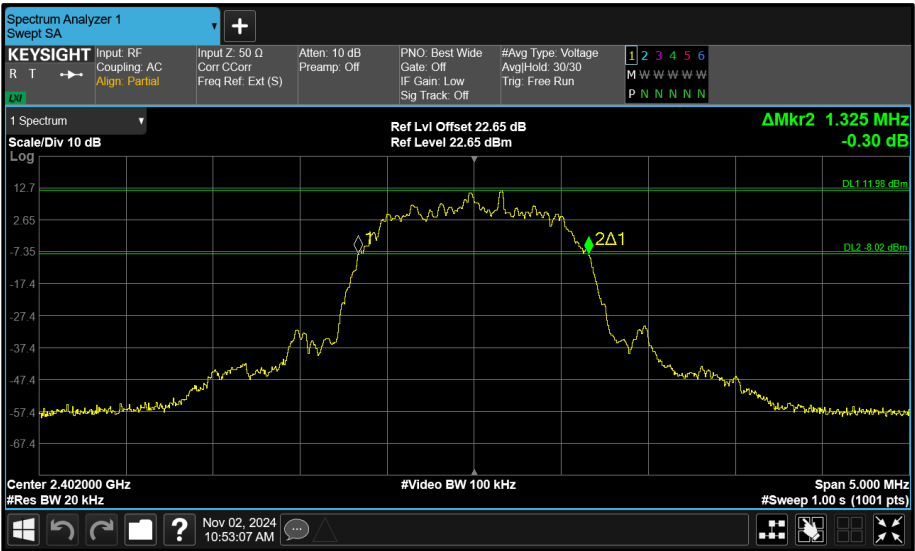


Figure 62 - Core 0 (A) 2402 MHz (CH0) 20 dB Bandwidth

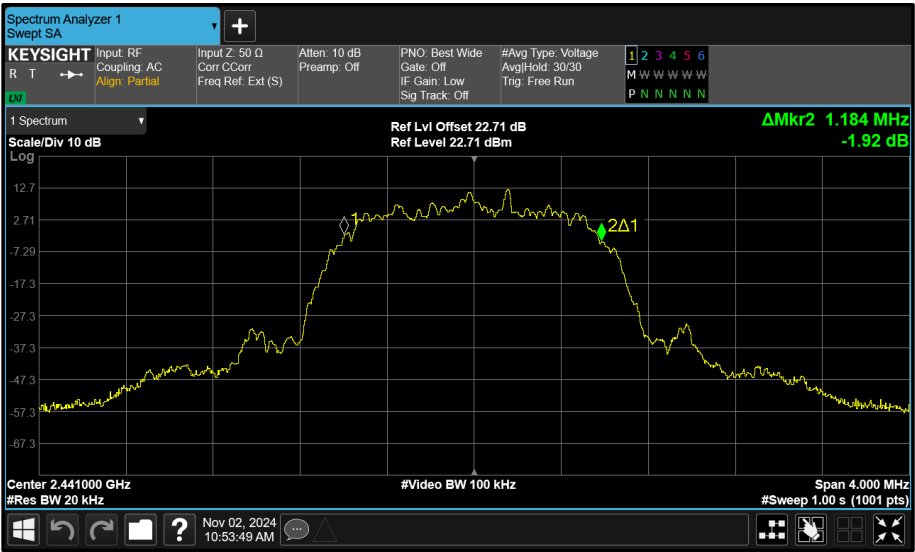


Figure 63 - Core 0 (A) 2441 MHz (CH39) 99% Bandwidth

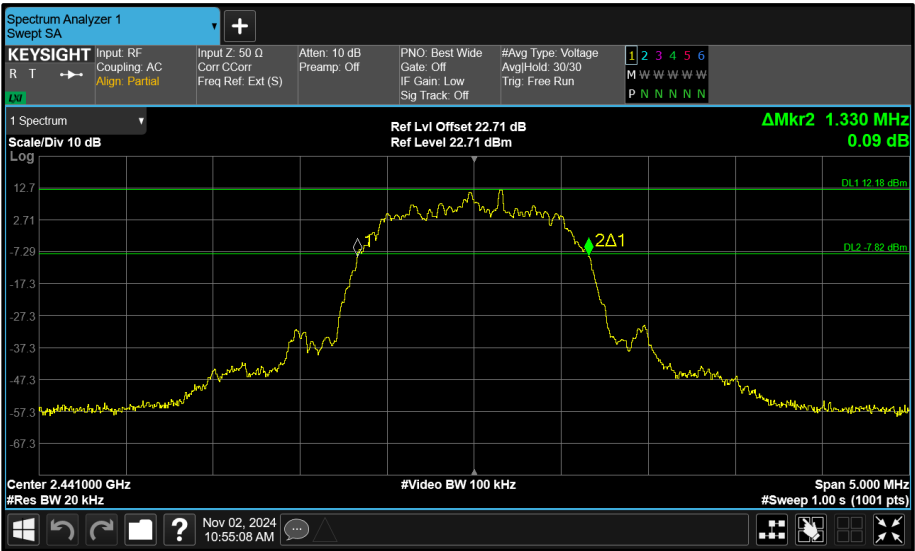


Figure 64 - Core 0 (A) 2441 MHz (CH39) 20 dB Bandwidth

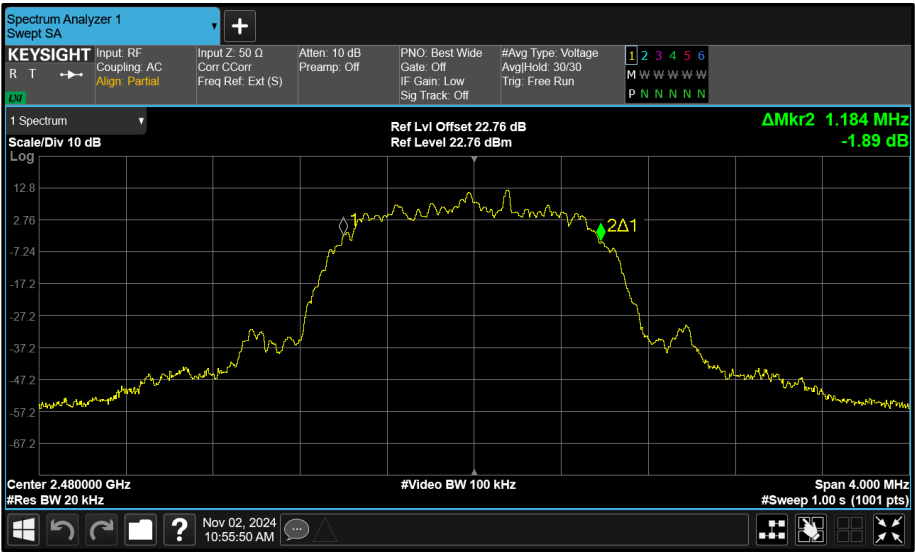


Figure 65 - Core 0 (A) 2480 MHz (CH78) 99% Bandwidth

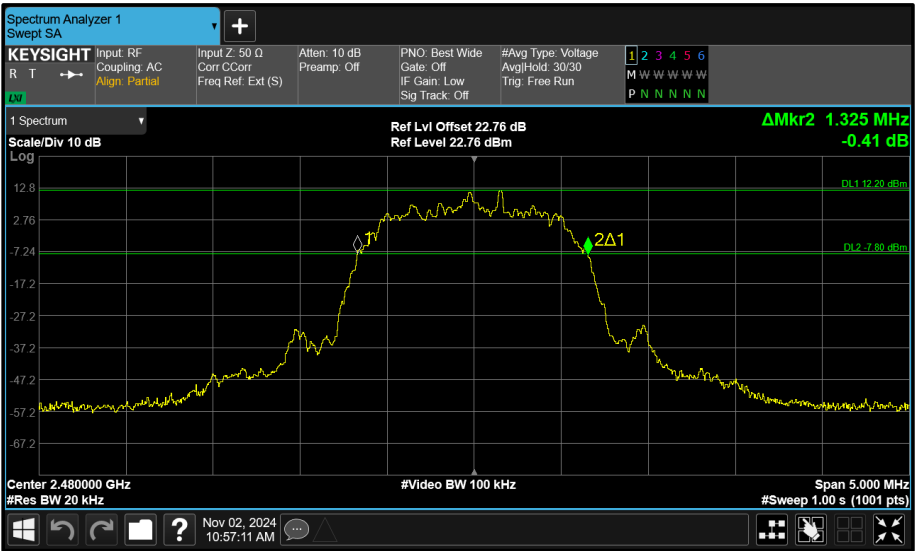


Figure 66 - Core 0 (A) 2480 MHz (CH78) 20 dB Bandwidth