

FCC and ISED Test Report

Apple Inc
Model: A2681

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

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

FCC ID: BCGA2681

IC: 579C-A2681



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Document 75954421-10 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	03 May 2022

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	Hollie Marshall	03 May 2022	

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	03 May 2022

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2681
Serial Number(s)	MW4P32N6T0, DQH576VJ7N, FMWFWQ0N1W and TN4J7KWW5H
Hardware Version(s)	REV 1.0
Software Version(s)	21E61410w, 21E71860f, 21E61410w and 21E71860f
Number of Samples Tested	4
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	0540246998
Date of Receipt of EUT	16-February-2022
Start of Test	22-February-2022
Finish of Test	13-April-2022
Name of Engineer(s)	Ian Hart, Daniel Cameron and Mohammad Malik
Related Document(s)	ANSI C63.10 (2013) ANSI C63.4 (2014) 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 - DTS						
-	15.203	-	-	Antenna Requirement	N/T	The devices complies with the provisions of this section, as it uses a permanently attached antenna
2.1	15.205	3.3	8.10	Restricted Band Edges	Pass	
2.2	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	
2.3	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.5	15.247 (d)	5.5	-	Authorised Band Edges	Pass	
2.6	15.247 (e)	5.2	6.12	Power Spectral Density	Pass	

Table 2



1.4 Product Information

1.4.1 Technical Description

The equipment under test was an Apple laptop computer with Bluetooth® and IEEE 802.11 a/b/g/n/ac/ax Wi-Fi in the 2.4 GHz and 5 GHz bands.

1.4.2 Test Set-up

For conducted tests, a conducted test point was provided by the manufacturer via a 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 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 LE + HDR was assessed as a DTS system. The EUT supports Bluetooth on the following mode of operations across its antenna ports:

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 a static channel selected within the test script.

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 Core 0	2400 to 2480	3.77	1.00
BT Core 1	2400 to 2480	3.45	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: A2681, Serial Number: TN4J7KWW5H			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2681, Serial Number: MW4P32N6T0			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2681, Serial Number: DQH576VJ7N			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2681, Serial Number: FMWFWQ0N1W			
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 - DTS		
Restricted Band Edges	Ian Hart and Mohammed Malik	UKAS
Emission Bandwidth	Daniel Cameron	UKAS
Maximum Conducted Output Power	Daniel Cameron	UKAS
Spurious Radiated Emissions	Ian Hart and Mohammad Malik	UKAS
Authorised Band Edges	Ian Hart and Mohammad Malik	UKAS
Power Spectral Density	Daniel Cameron	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-247, Clause 3.3
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

A2681, S/N: FMWFWQ0N1W - Modification State 0

2.1.3 Date of Test

22-February-2022 to 23-February-2022

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5 and 11.12.1.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 11.12.2.5.2.

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	20.6 - 22.2 °C
Relative Humidity	33.4 - 37.1 %

2.1.6 Test Results

2.4 GHz Bluetooth – DTS

Bluetooth LE - LE1M iPA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0	2390.0	52.61	40.75
GFSK/DH1	2480	Core 0	2483.5	53.88	42.20

Table 6 - Restricted Band Edge Results

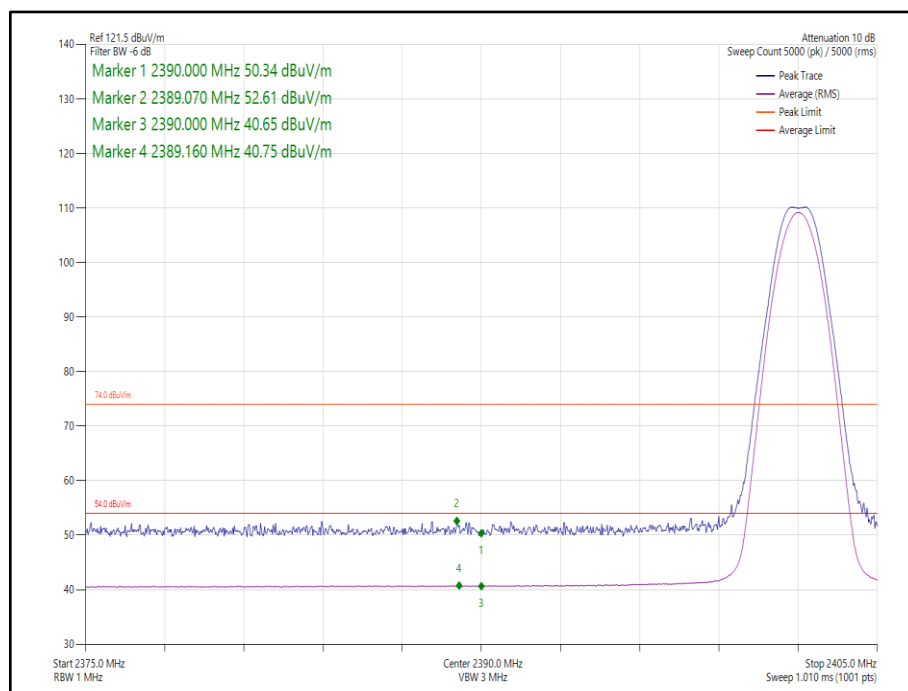


Figure 1 Core 0– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

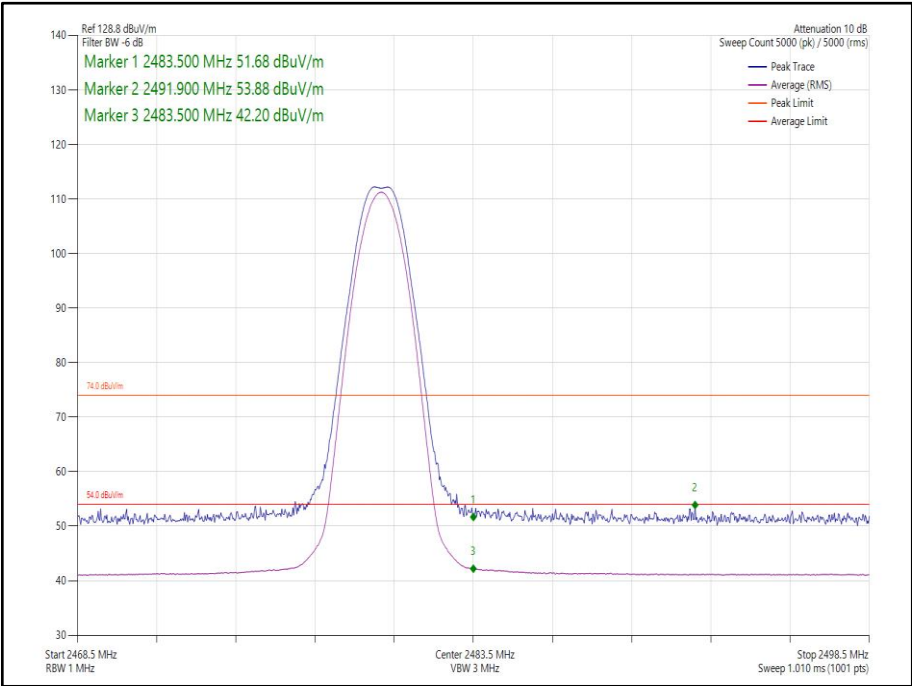


Figure 2 Core 0– GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz



Bluetooth LE - LE1M ePA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0	2390.0	52.57	41.30
GFSK/DH1	2480	Core 0	2483.5	56.86	45.54

Table 7 - Restricted Band Edge Results

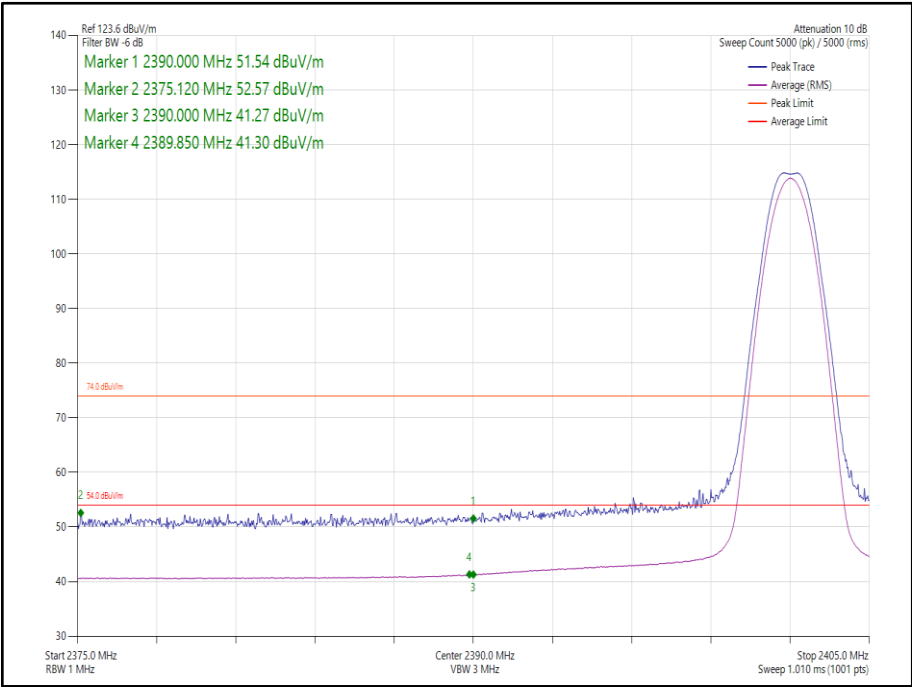


Figure 3 Core 0– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

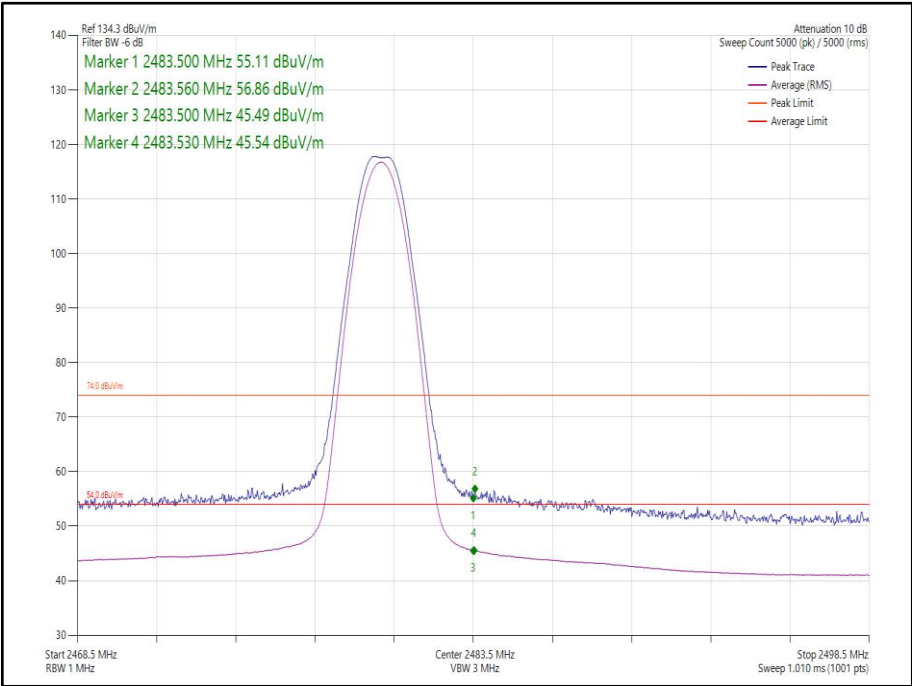


Figure 4 Core 0– GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz



Bluetooth LE - LE1M iPA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0-1	2390.0	52.72	41.26
GFSK/DH1	2480	Core 0-1	2483.5	54.12	43.09

Table 8 - Restricted Band Edge Results

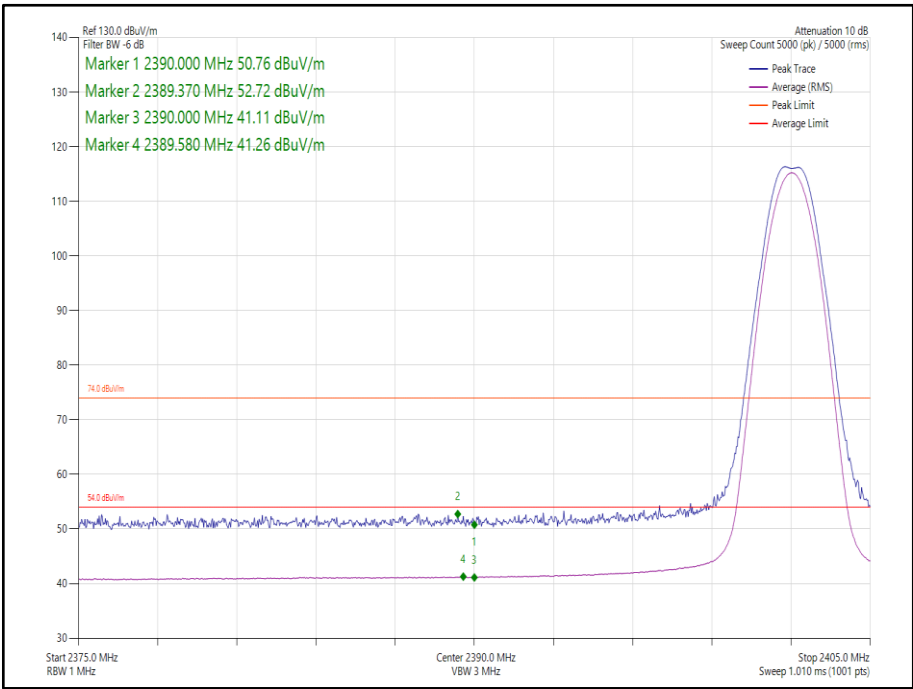


Figure 5 Core 0-1- GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

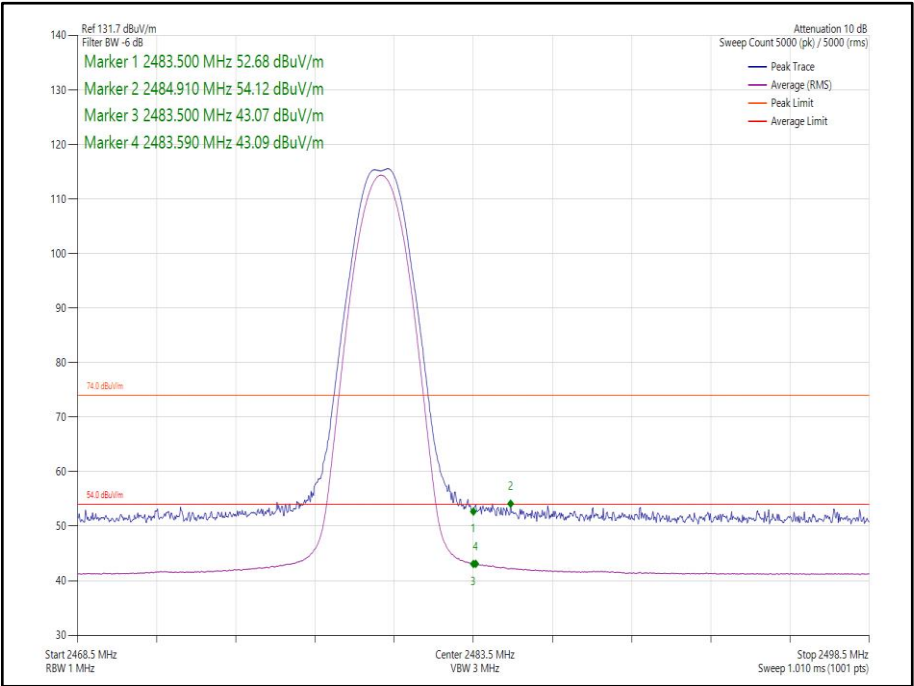


Figure 6 Core 0-1- GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz

Bluetooth LE - LE1M ePA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0-1	2390.0	54.25	42.71
GFSK/DH1	2480	Core 0-1	2483.5	59.24	48.21

Table 9 - Restricted Band Edge Results

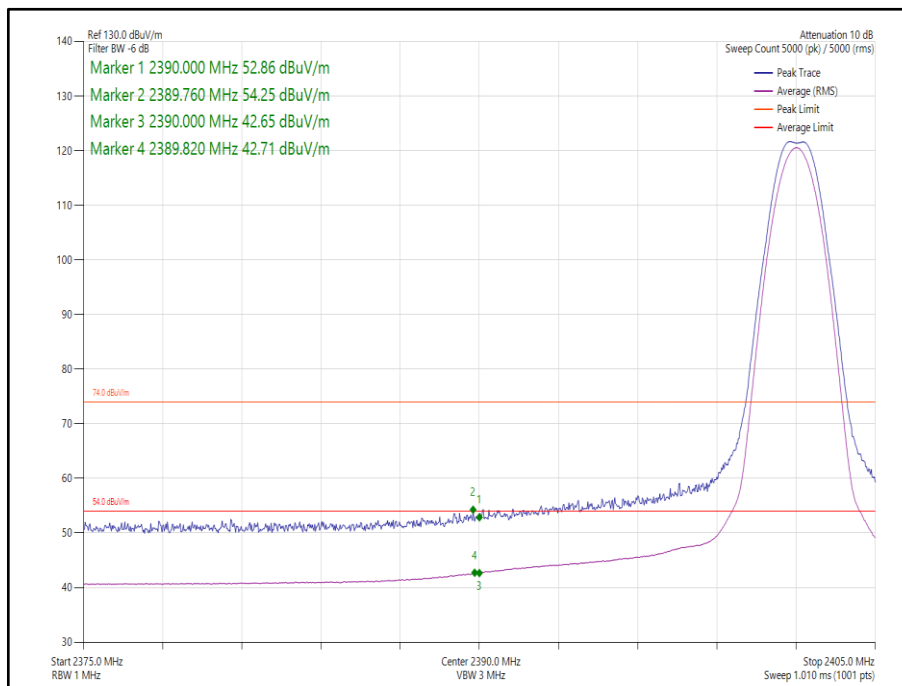


Figure 7 Core 0-1- GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

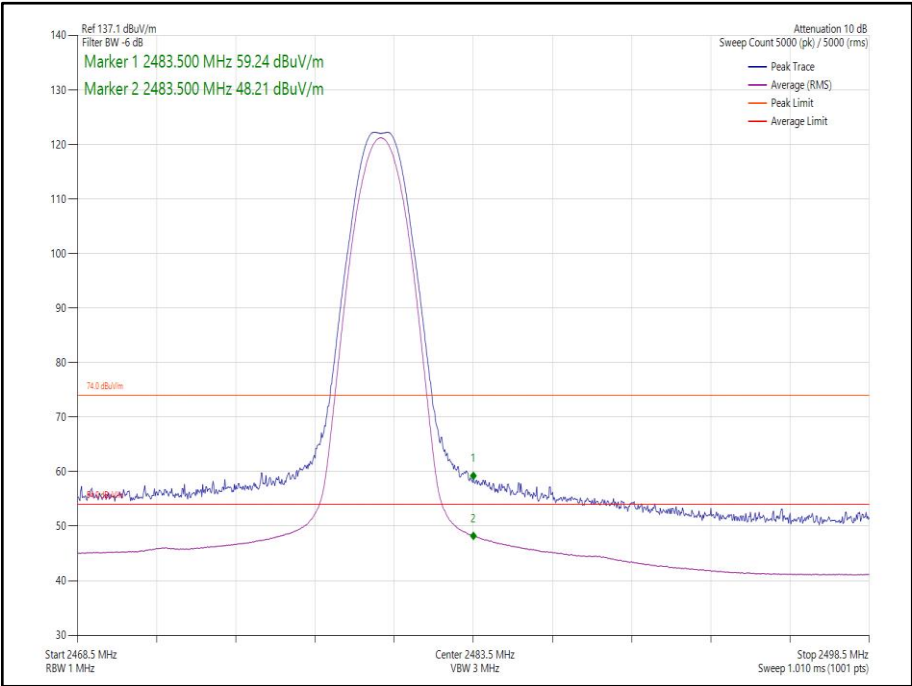


Figure 8 Core 0-1- GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz



Bluetooth LE – LE2M iPA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0	2390.0	52.71	41.29
GFSK/DH1	2480	Core 0	2483.5	58.02	47.38

Table 10 - Restricted Band Edge Results

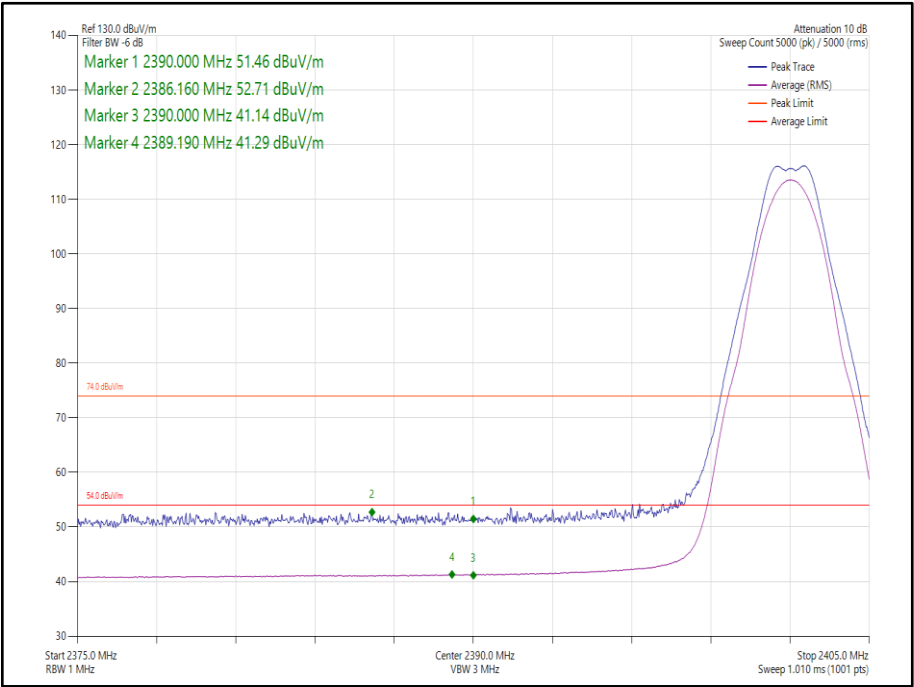


Figure 9 Core 0– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

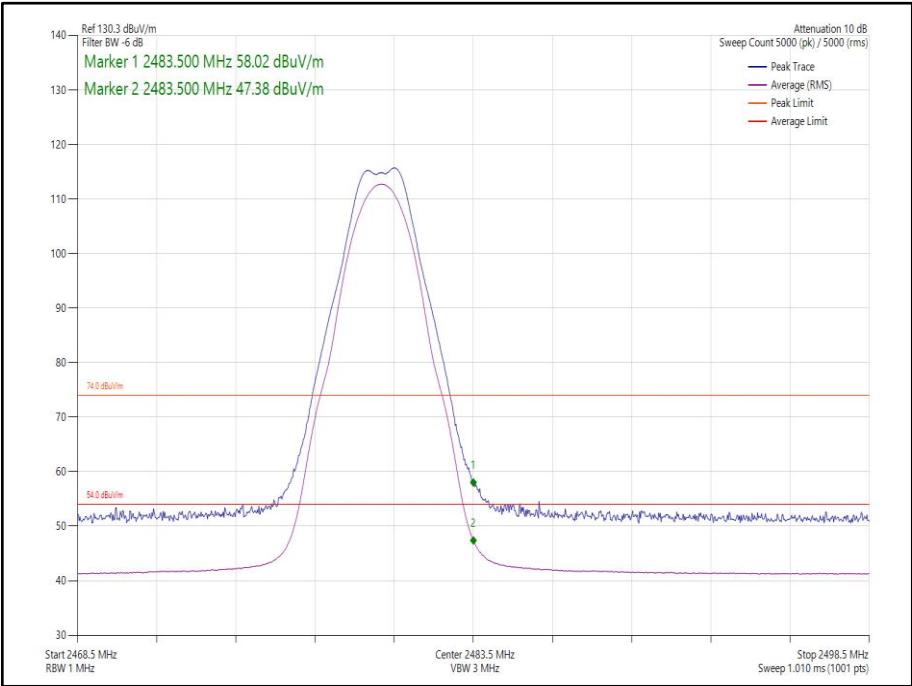


Figure 10 Core 0– GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz



Bluetooth LE – LE2M ePA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0	2390.0	53.15	41.29
GFSK/DH1	2480	Core 0	2483.5	59.99	49.21

Table 11 - Restricted Band Edge Results

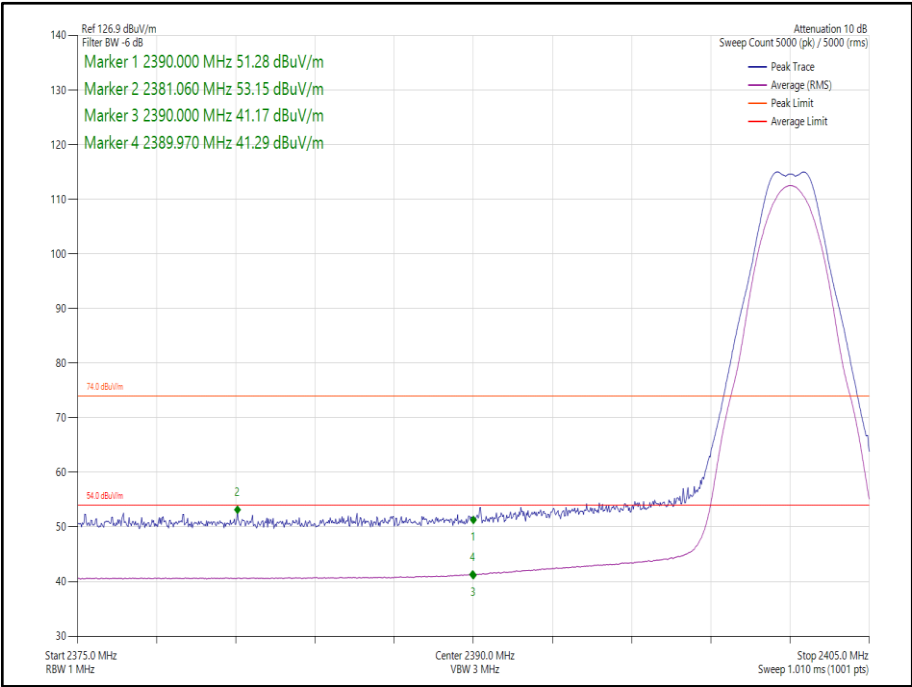


Figure 11 Core 0– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

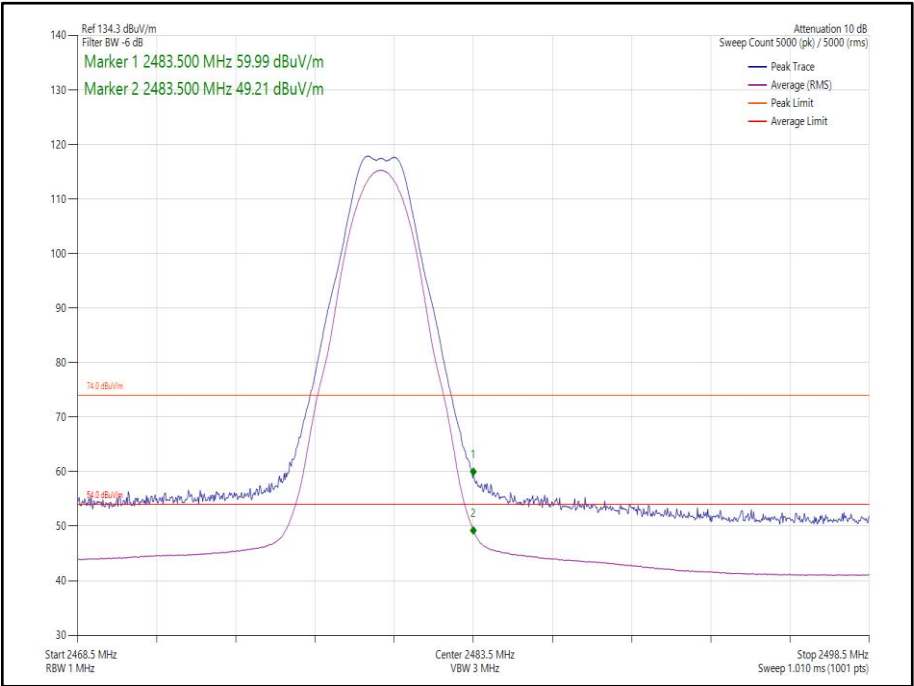


Figure 12 Core 0– GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz

Bluetooth LE – LE2M iPA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0-1	2390.0	52.71	41.29
GFSK/DH1	2480	Core 0-1	2483.5	58.02	47.38

Table 12 - Restricted Band Edge Results

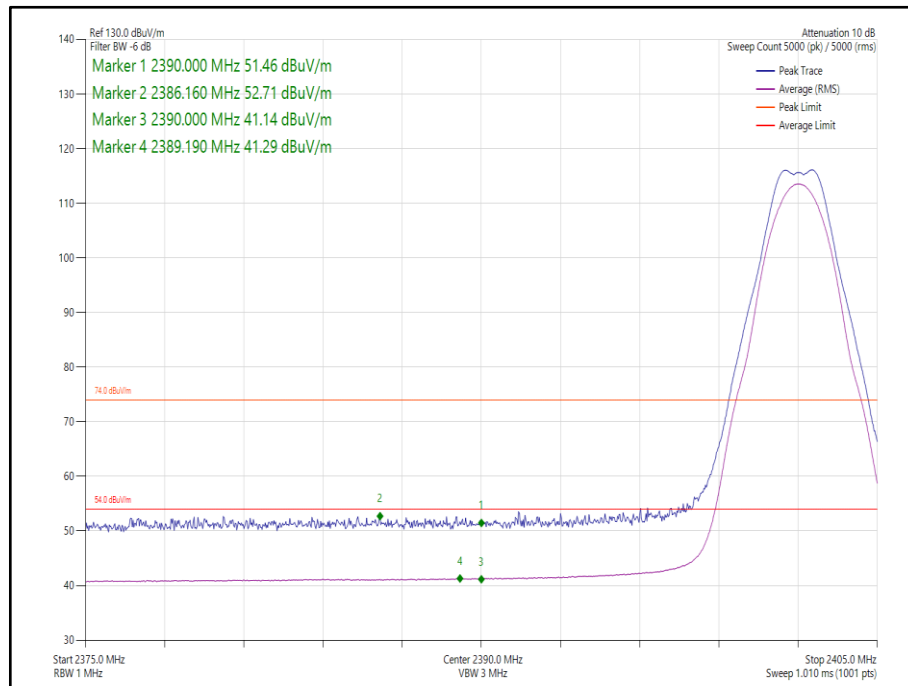


Figure 13 Core 0-1– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

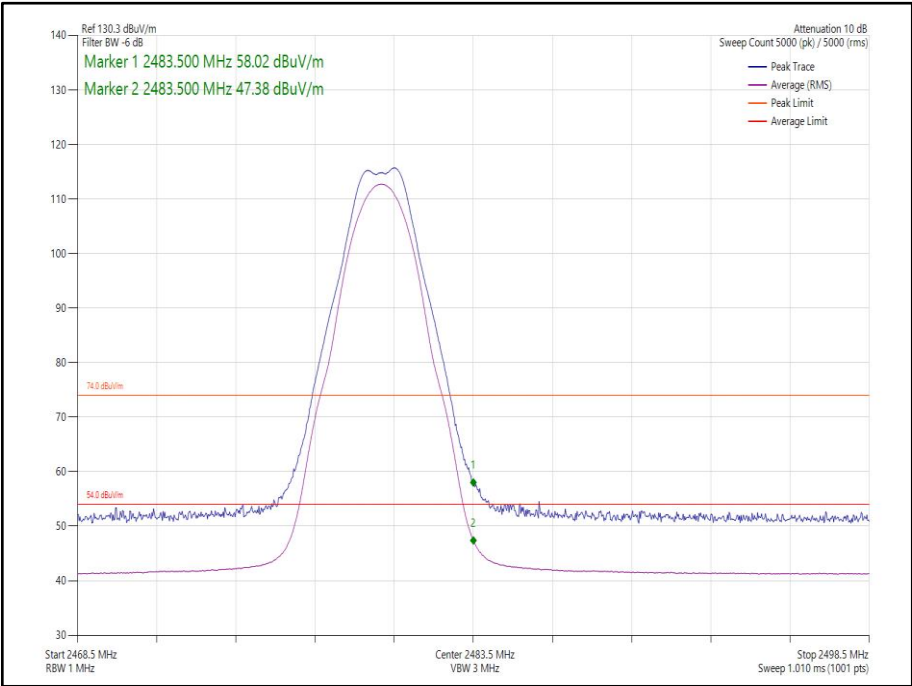


Figure 14 Core 0-1– GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz

Bluetooth LE – LE2M ePA

Modulation	Tx Frequency (MHz)	Core	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
GFSK/DH1	2402	Core 0-1	2390.0	55.63	43.13
GFSK/DH1	2480	Core 0-1	2483.5	61.69	51.23

Table 13 - Restricted Band Edge Results

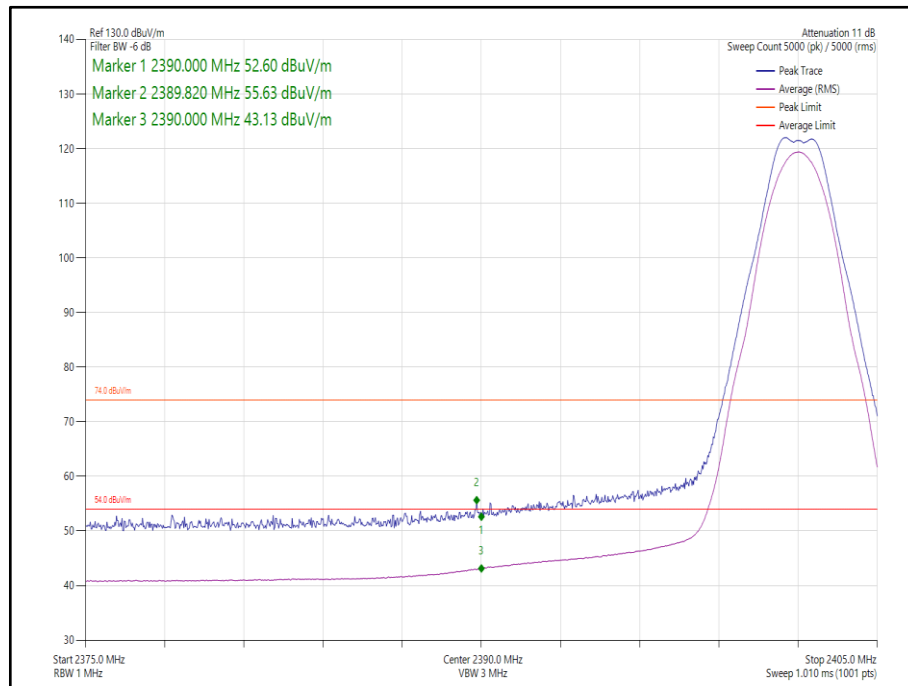


Figure 15 Core 0-1– GFSK/DH1 - 2402 MHz - Band Edge Frequency 2390.0 MHz

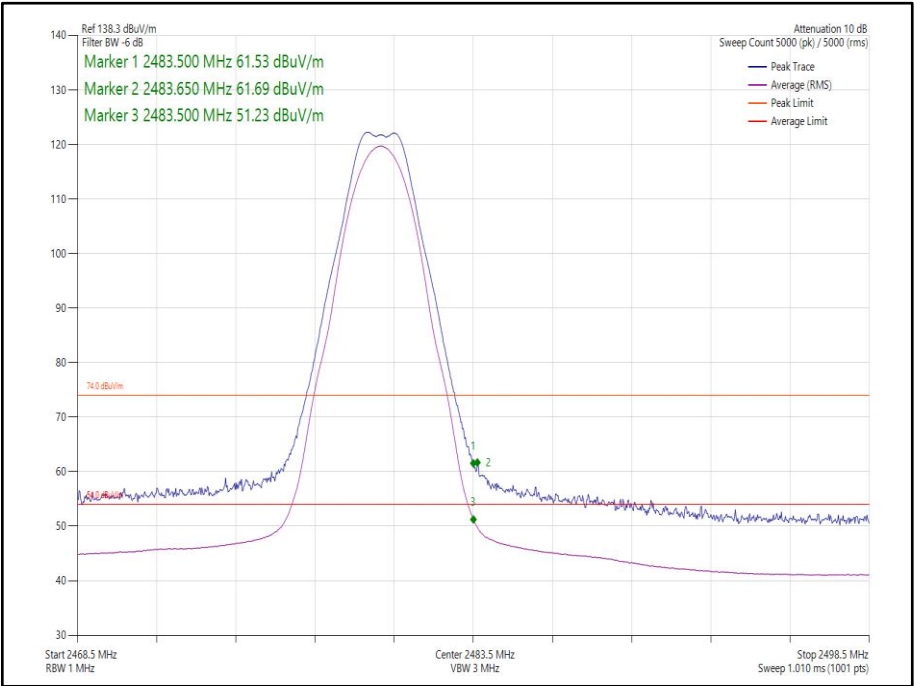


Figure 16 Core 0-1- GFSK/DH1 - 2480 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth – HDR4 ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
Static	GFSK	Core 0	4DH5	2404	2390.0	54.31	42.45
Static	GFSK	Core 0	4DH5	2476	2483.5	54.01	42.93

Table 14 - Restricted Band Edge Results

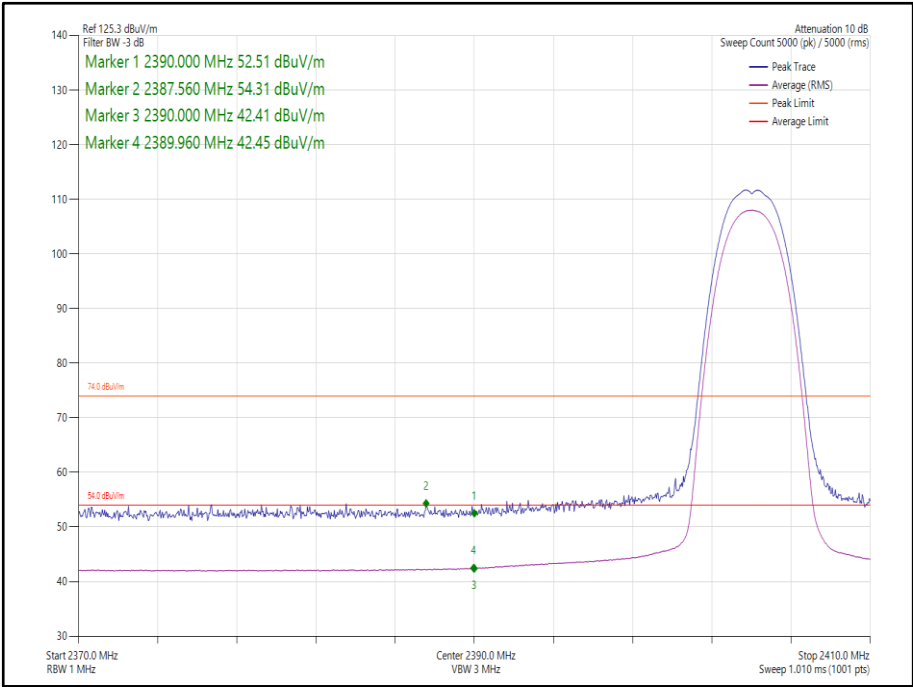


Figure 17 Core 0- Static - GFSK/4DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

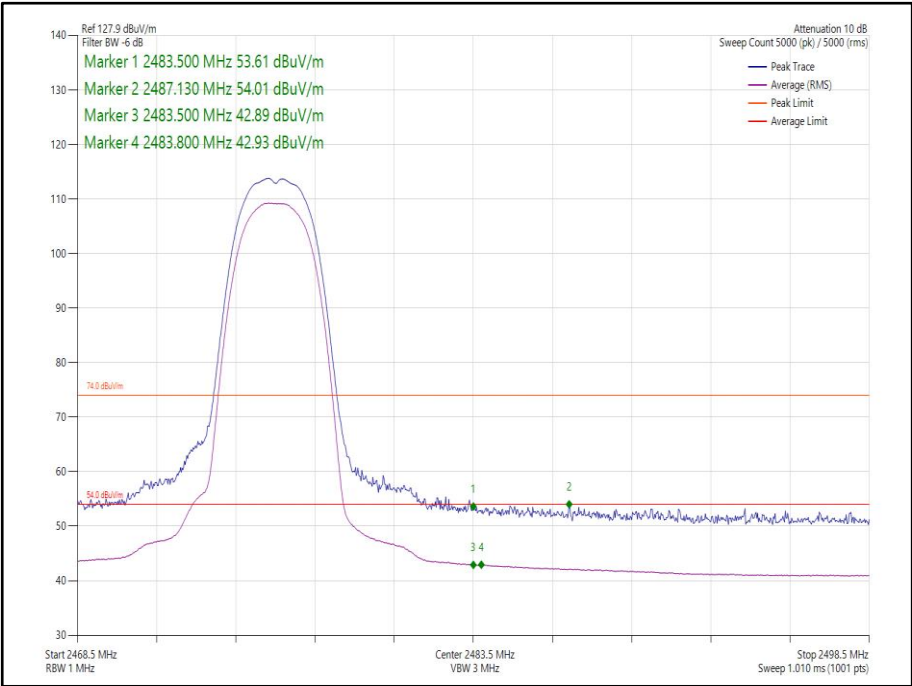


Figure 18 Core 0- Static - GFSK/4DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR4 iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0	4DH5	2404	2390.0	54.55	42.26
Static	GFSK	Core 0	4DH5	2476	2483.5	53.48	41.30

Table 15 - Restricted Band Edge Results

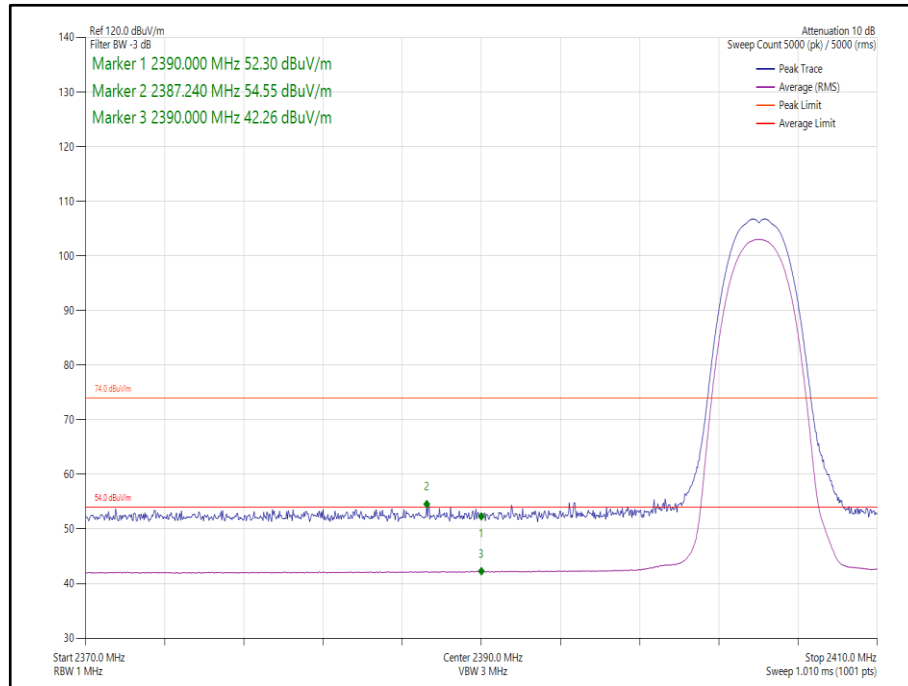


Figure 19 Core 0- Static - GFSK/4DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

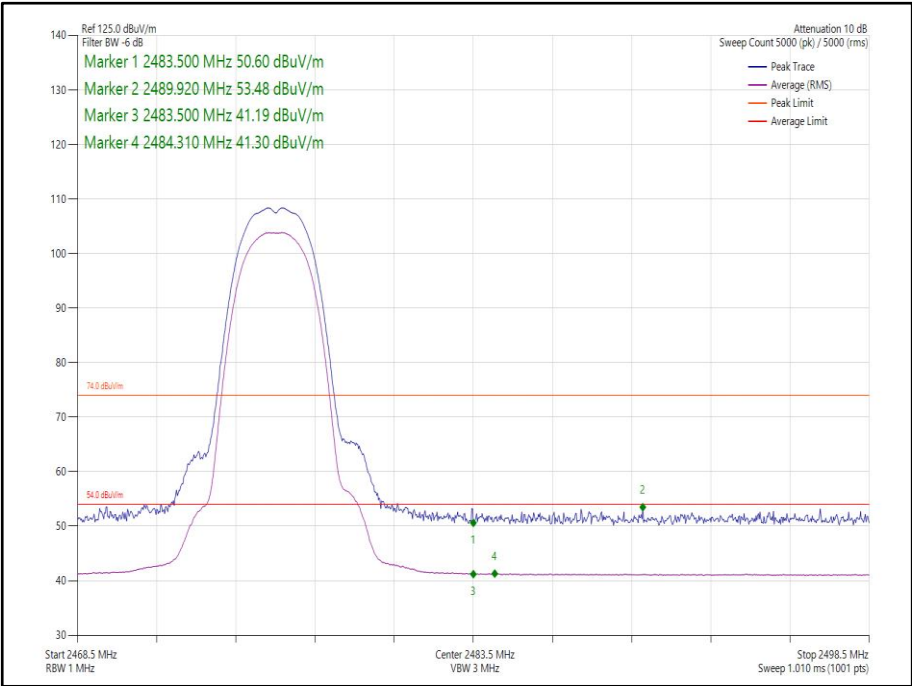


Figure 20 Core 0- Static - GFSK/4DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR4 ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0-1	4DH5	2404	2390.0	54.52	43.39
Static	GFSK	Core 0-1	4DH5	2476	2483.5	54.92	43.72

Table 16 - Restricted Band Edge Results

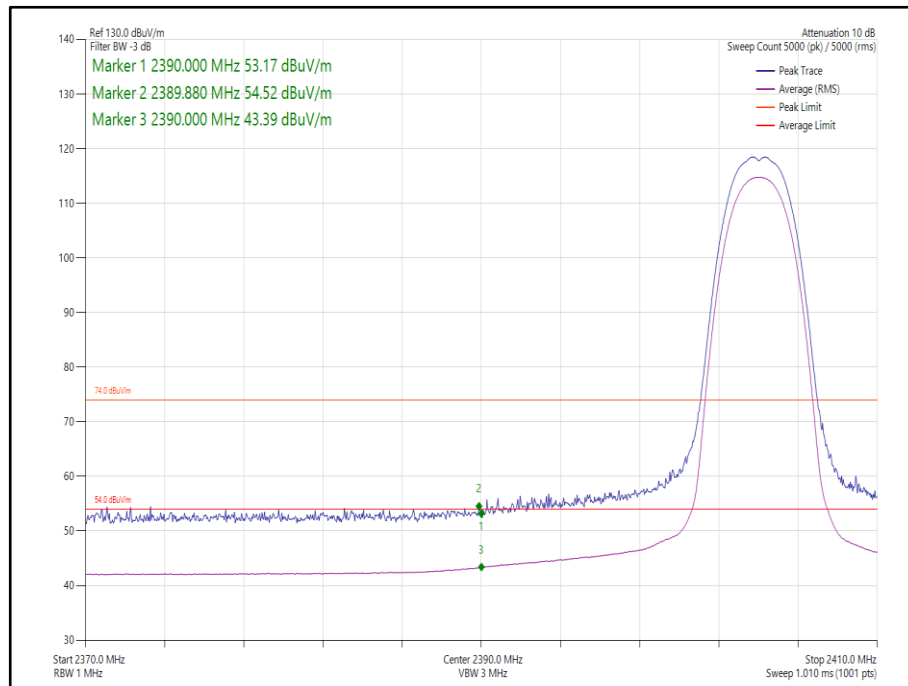


Figure 21 Core 0-1- Static - GFSK/4DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

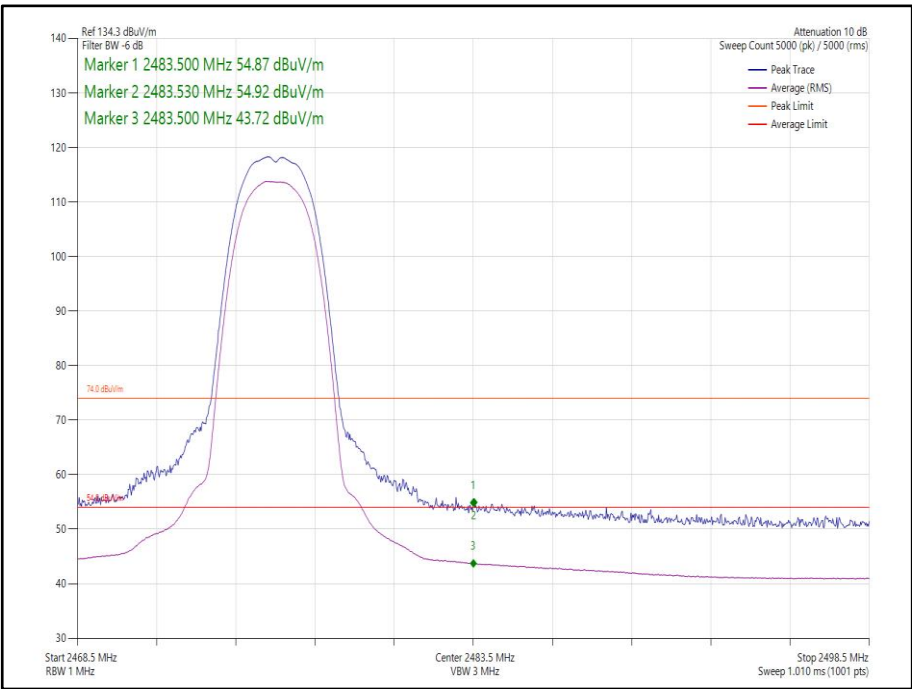


Figure 22 Core 0-1- Static - GFSK/4DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR4 iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0-1	4DH5	2404	2390.0	54.52	42.78
Static	GFSK	Core 0-1	4DH5	2476	2483.5	53.31	41.58

Table 17 - Restricted Band Edge Results

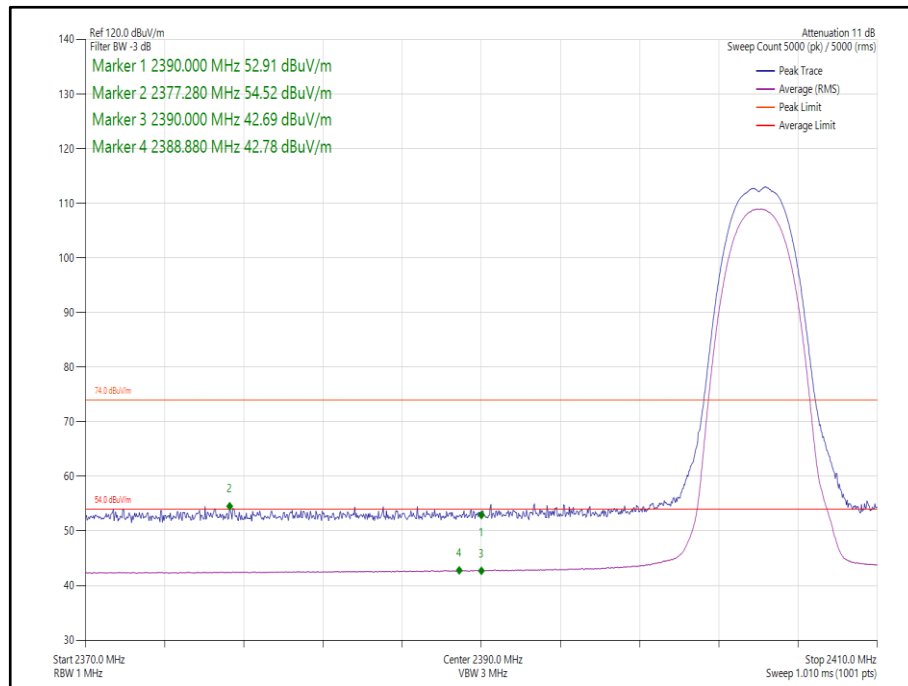


Figure 23 Core 0-1- Static - GFSK/4DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

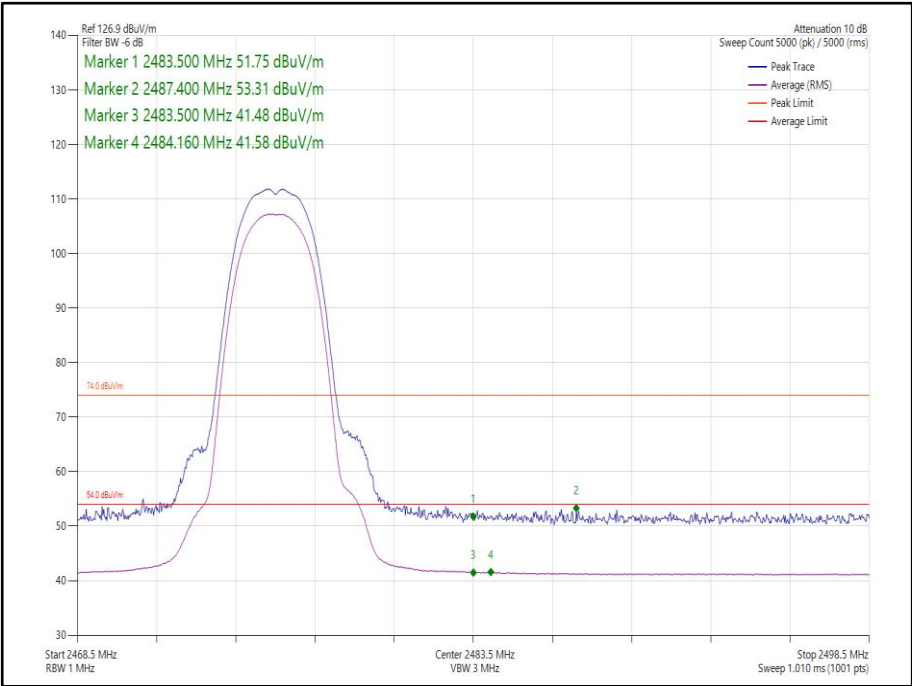


Figure 24 Core 0-1- Static - GFSK/4DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz

2.4 GHz Bluetooth – HDR8 iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0	4DH5	2404	2390.0	54.96	43.04
Static	GFSK	Core 0	4DH5	2476	2483.5	54.95	43.58

Table 18 - Restricted Band Edge Results

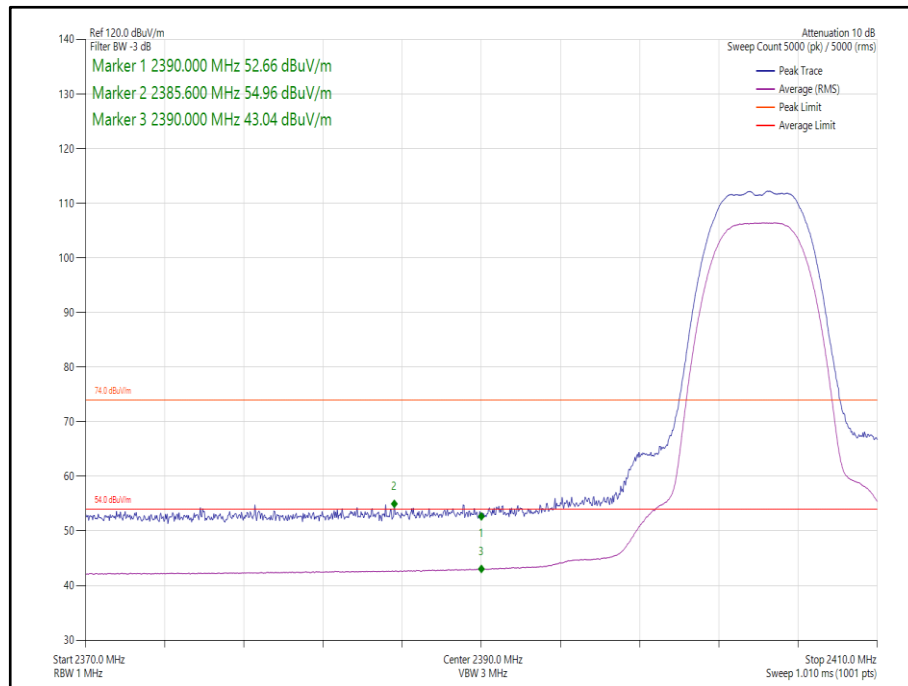


Figure 25 Core 0- Static - GFSK/8DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

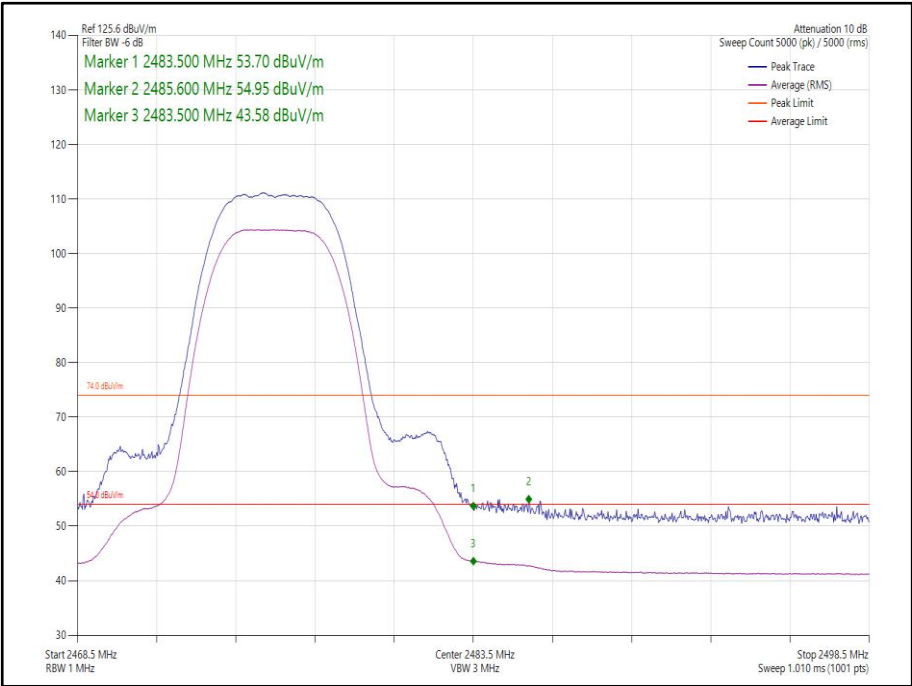


Figure 26 Core 0- Static - GFSK/8DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth – HDR8 ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0	4DH5	2404	2390.0	55.15	44.02
Static	GFSK	Core 0	4DH5	2476	2483.5	57.57	45.70

Table 19 - Restricted Band Edge Results

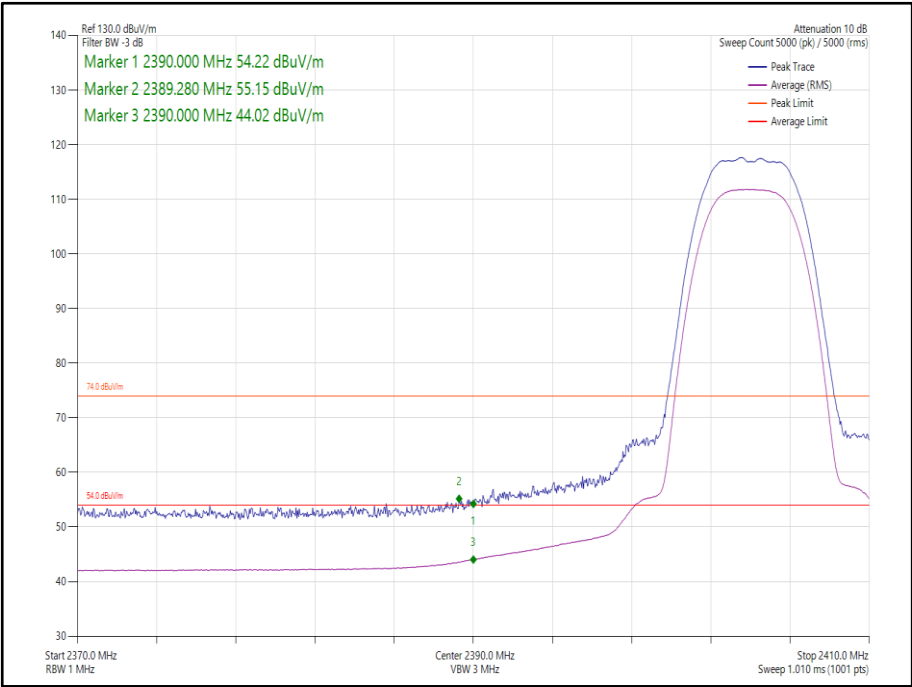


Figure 27 Core 0- Static - GFSK/8DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

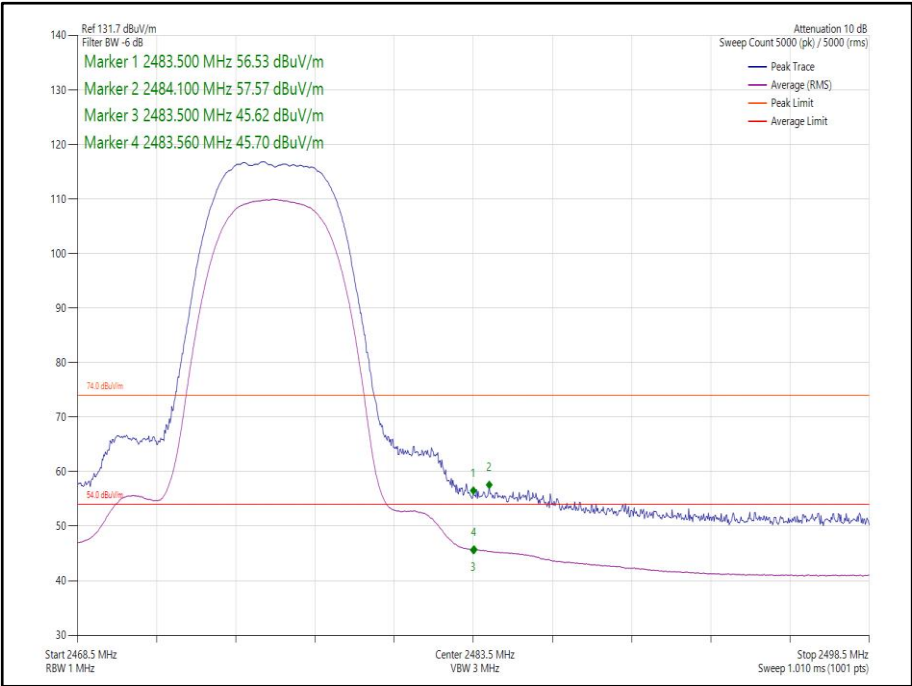


Figure 28 Core 0- Static - GFSK/8DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth – HDR8 iPA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0-1	4DH5	2404	2390.0	54.96	43.04
Static	GFSK	Core 0-1	4DH5	2476	2483.5	54.95	43.58

Table 20 - Restricted Band Edge Results

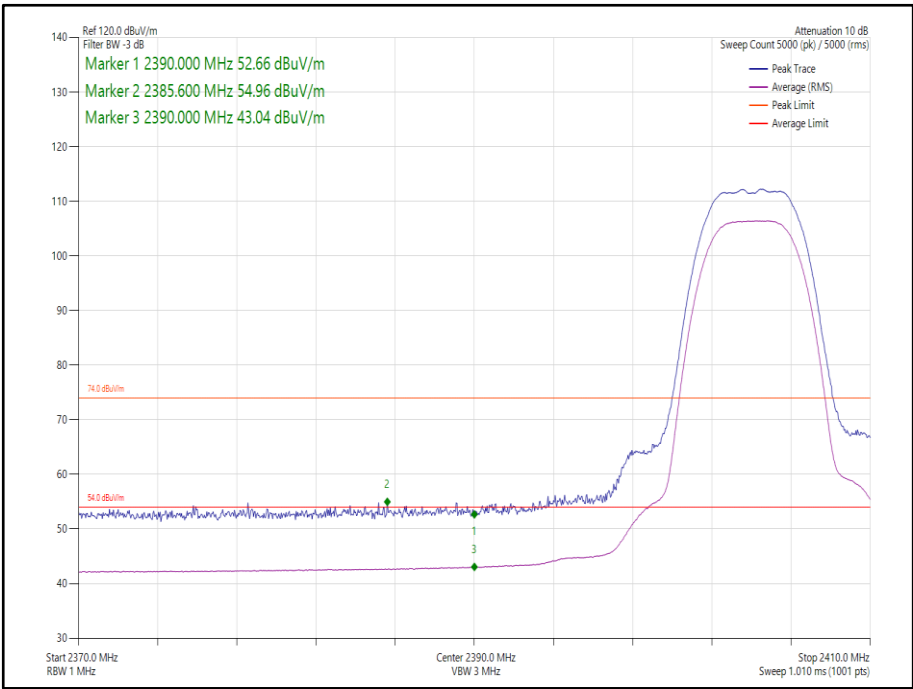


Figure 29 Core 0-1- Static - GFSK/8DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

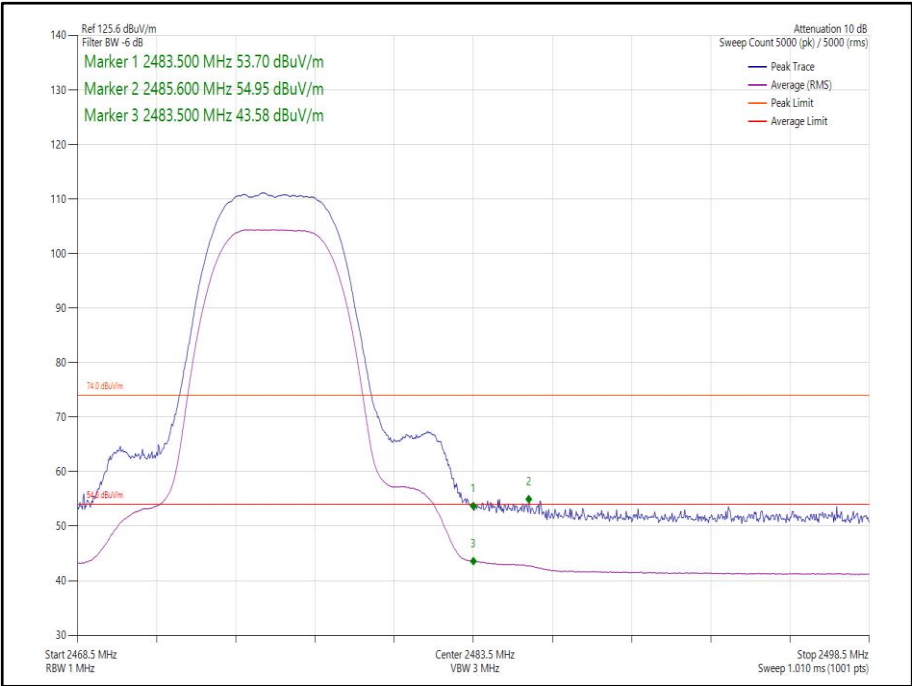


Figure 30 Core 0-1- Static - GFSK/8DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz



2.4 GHz Bluetooth – HDR8 ePA

Mode	Modulation	Core	Packet Type	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	GFSK	Core 0-1	4DH5	2404	2390.0	55.15	44.02
Static	GFSK	Core 0-1	4DH5	2476	2483.5	57.57	45.70

Table 21 - Restricted Band Edge Results

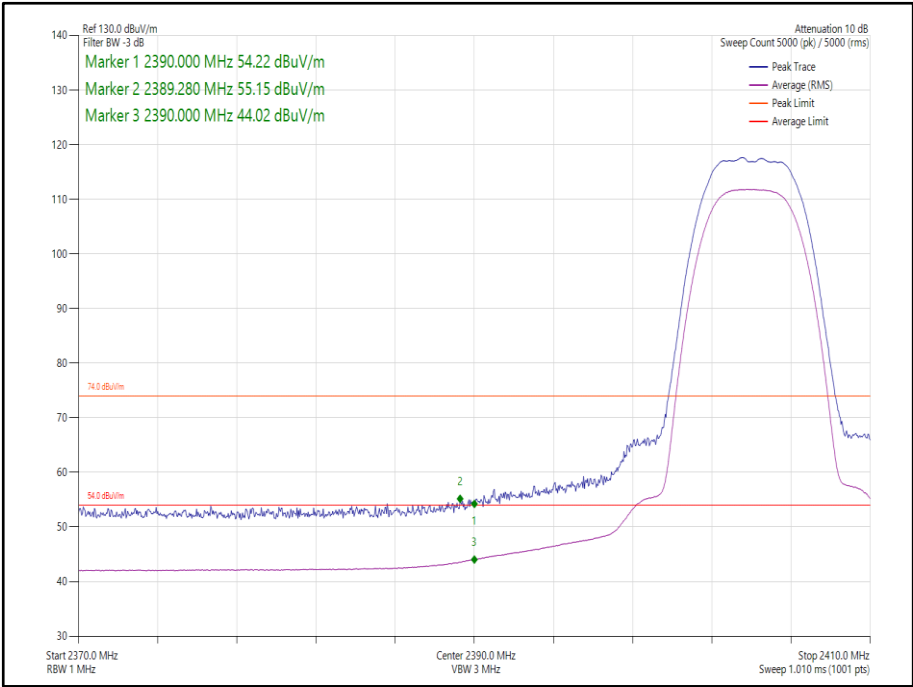


Figure 31 Core 0-1- Static - GFSK/8DH5 - 2404 MHz - Band Edge Frequency 2390.0 MHz

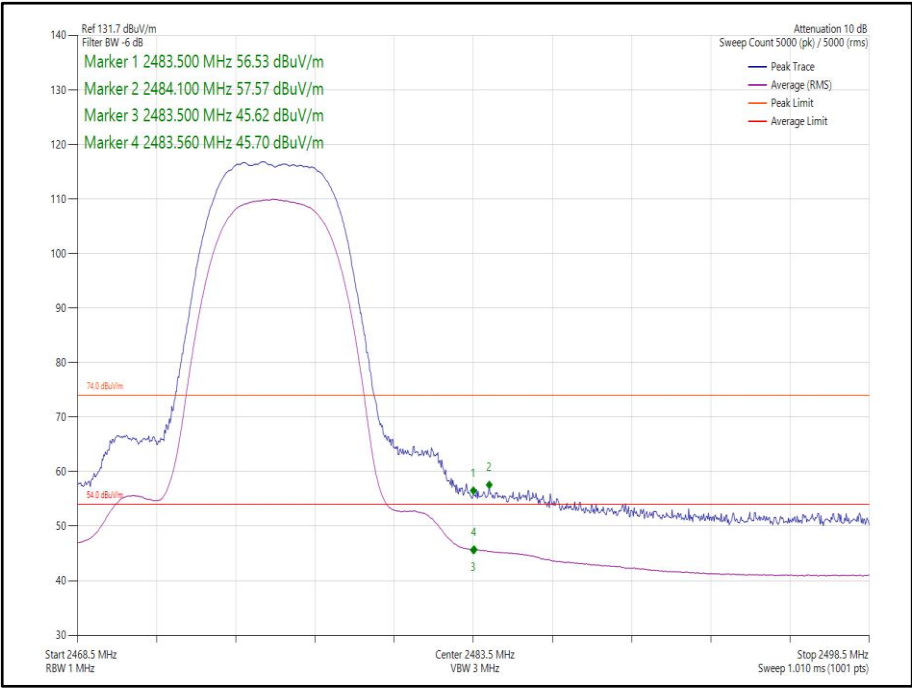


Figure 32 Core 0-1- Static - GFSK/8DH5 - 2476 MHz - Band Edge Frequency 2483.5 MHz

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 22

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 23

*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 EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (5)	Rainford	Rainford	1545	36	15-Apr-2024
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	01-Apr-2022
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	01-May-2022
1m -SMA Cable	Junkosha	MWX221-01000AMSAMS/A	5513	12	09-Apr-2022
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5517	12	09-Apr-2022
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	09-Apr-2022
8m N-Type Cable	Junkosha	MWX221-08000NMSNMS/B	5520	12	24-Mar-2023
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5527	12	15-Apr-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	22-Sep-2022
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	23-Sep-2022
EMI Test Receiver	Rohde & Schwarz	ESW44	5911	12	24-Feb-2023

Table 24



2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)
ISED RSS-247, Clause 5.2
ISED RSS-GEN, Clause 6.7

2.2.2 Equipment Under Test and Modification State

A2681, S/N: TN4J7KWW5H - Modification State 0

2.2.3 Date of Test

08-April-2022 to 13-April-2022

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.1 for 6 dB BW and 6.9.3 for 99% occupied bandwidth measurements.

2.2.5 Environmental Conditions

Ambient Temperature	22.9 - 24.4 °C
Relative Humidity	27.0 – 44.9 %



2.2.6 Test Results

2.4 GHz Bluetooth - DTS

Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

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

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	1.904	-	-	-	≥ 500.0
2441	1.896	-	-	-	≥ 500.0
2476	1.904	-	-	-	≥ 500.0

Table 25 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	2.328	-	-	-	-
2441	2.328	-	-	-	-
2476	2.328	-	-	-	-

Table 26 - 99% Bandwidth Results

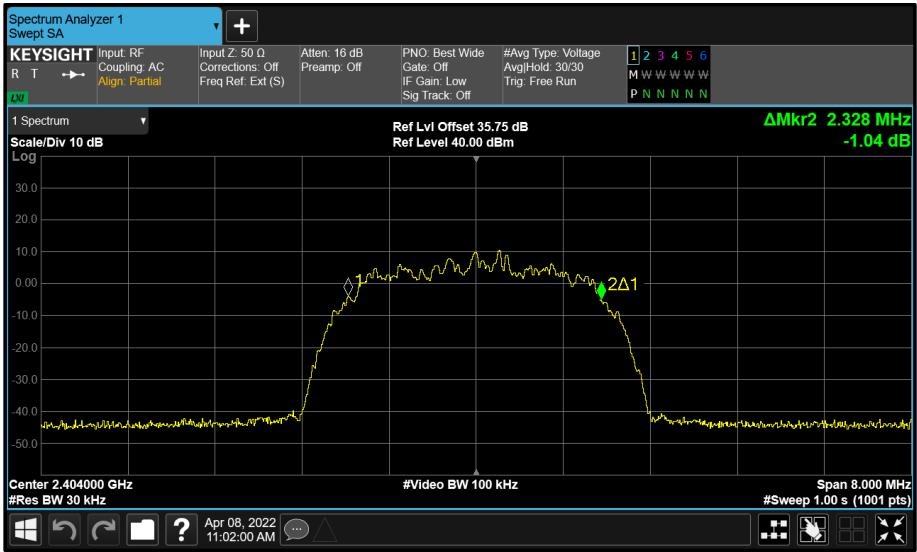


Figure 33 - Core 0 (A) 2404 MHz (CH2) 99% Bandwidth

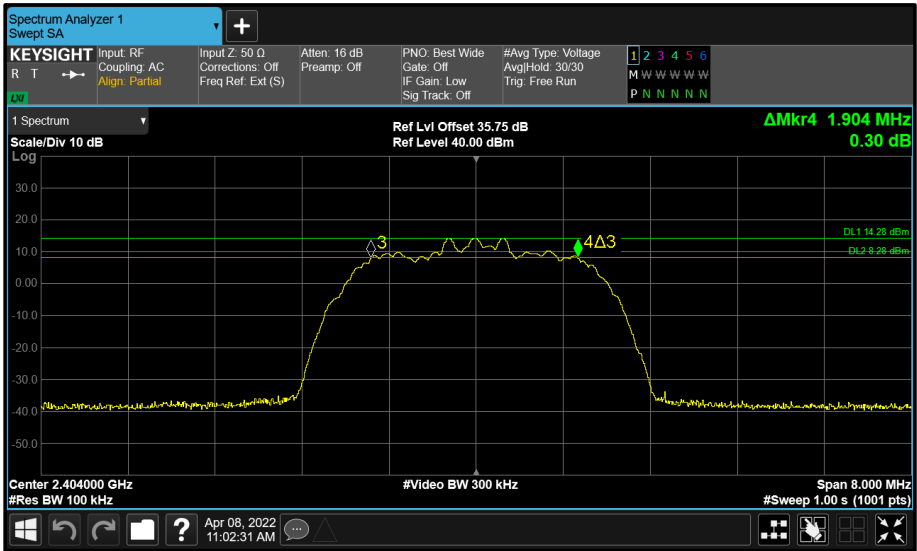


Figure 34 - Core 0 (A) 2404 MHz (CH2) 6 dB Bandwidth

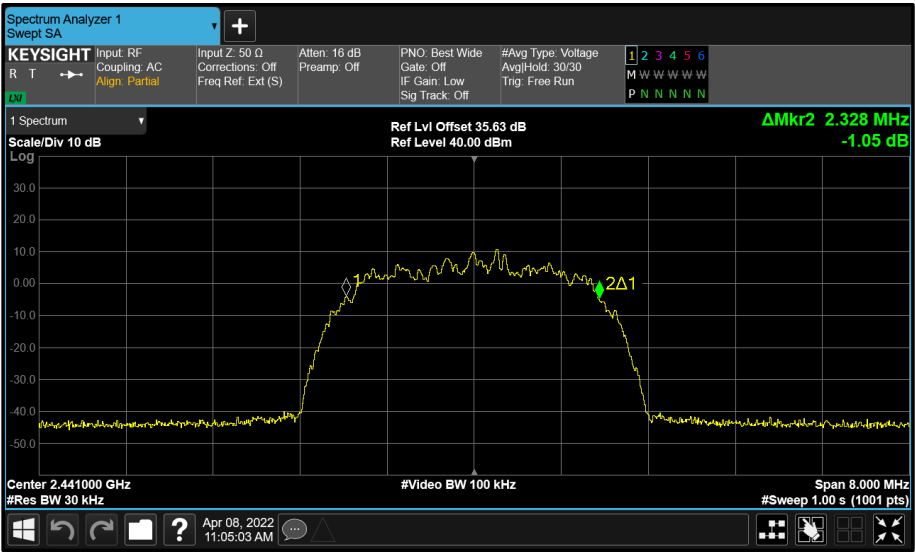


Figure 35 - Core 0 (A) 2441 MHz (CH39) 99% Bandwidth

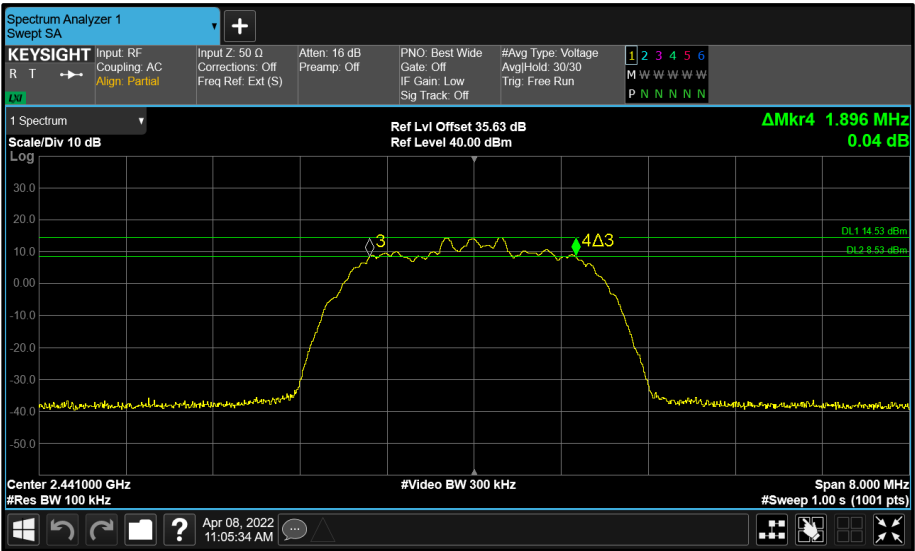


Figure 36 - Core 0 (A) 2441 MHz (CH39) 6 dB Bandwidth

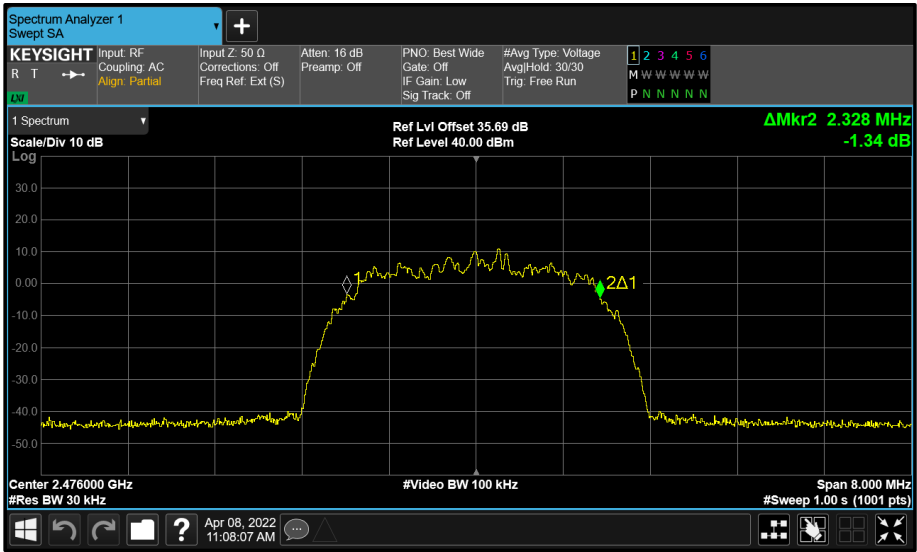


Figure 37 - Core 0 (A) 2476 MHz (CH74) 99% Bandwidth

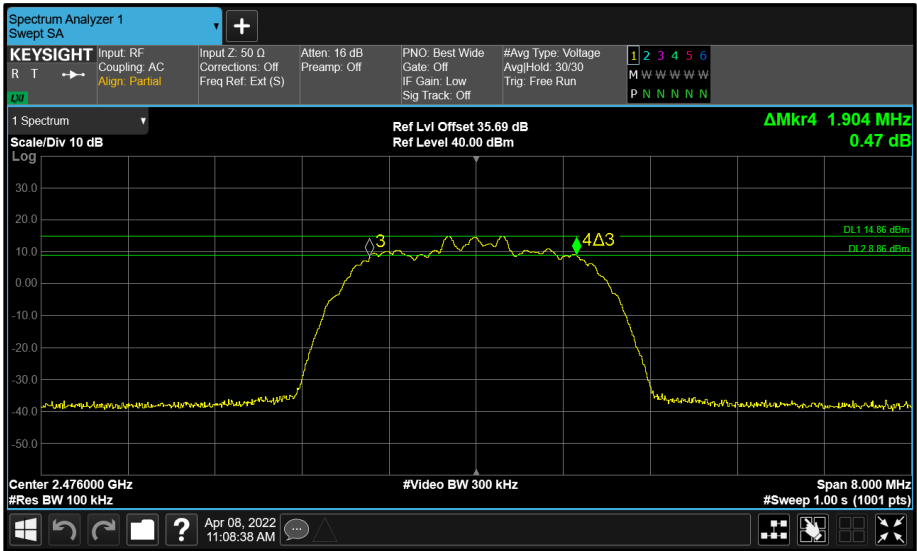


Figure 38 - Core 0 (A) 2476 MHz (CH74) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePa $\pi/4$ DQPSK (8-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	1.020	-	-	-	≥ 500.0
2441	0.990	-	-	-	≥ 500.0
2476	1.035	-	-	-	≥ 500.0

Table 27 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	4.440	-	-	-	-
2441	4.425	-	-	-	-
2476	4.440	-	-	-	-

Table 28 - 99% Bandwidth Results

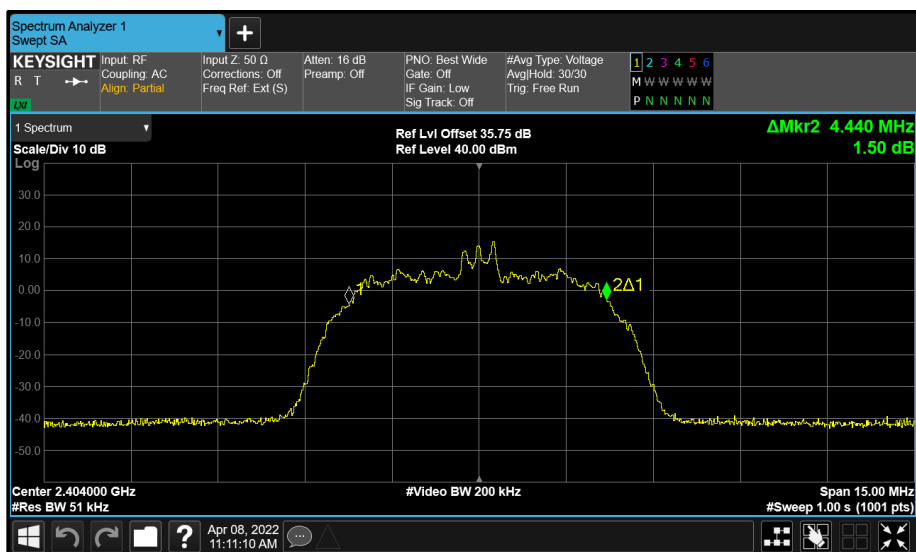


Figure 39 - Core 0 (A) 2404 MHz (CH2) 99% Bandwidth

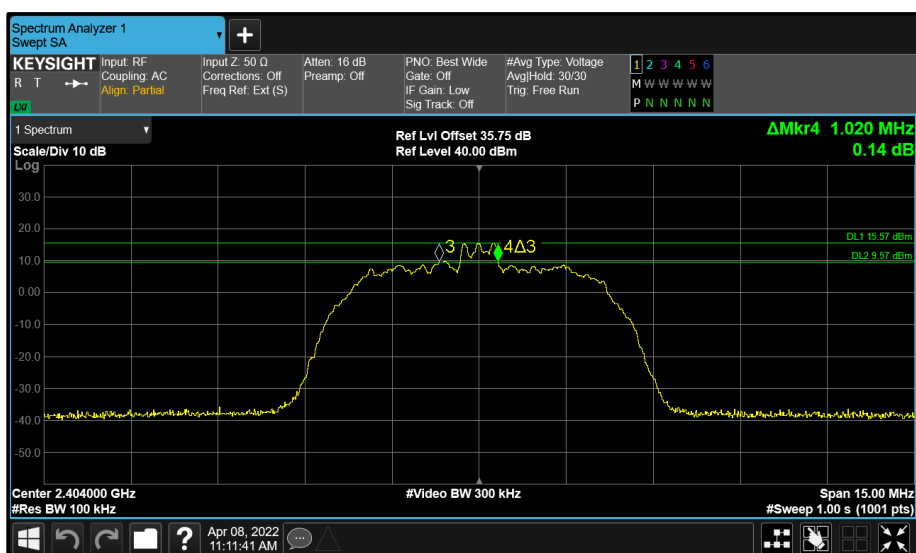


Figure 40 - Core 0 (A) 2404 MHz (CH2) 6 dB Bandwidth

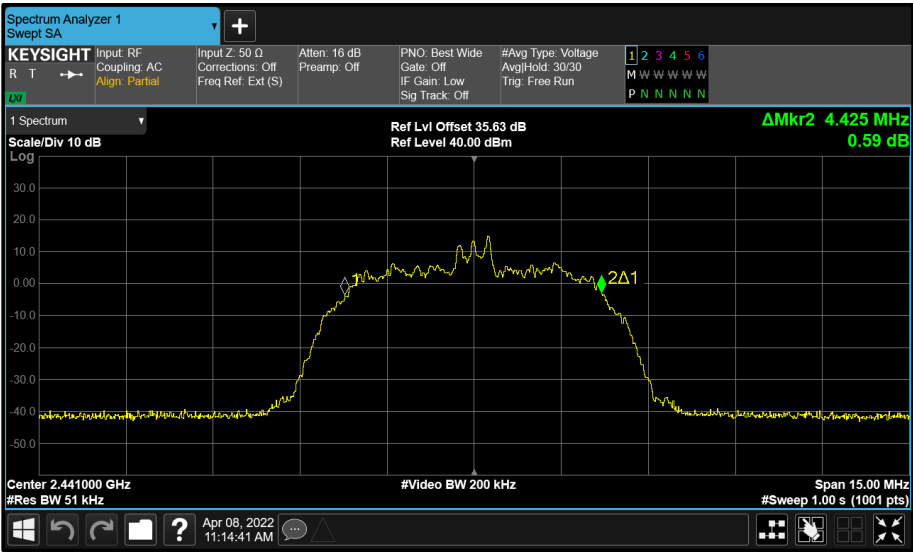


Figure 41 - Core 0 (A) 2441 MHz (CH39) 99% Bandwidth

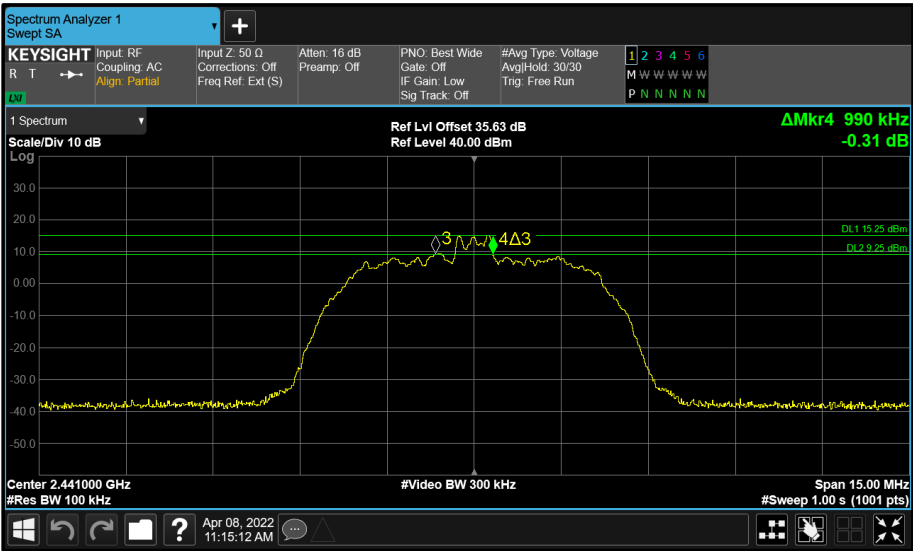


Figure 42 - Core 0 (A) 2441 MHz (CH39) 6 dB Bandwidth

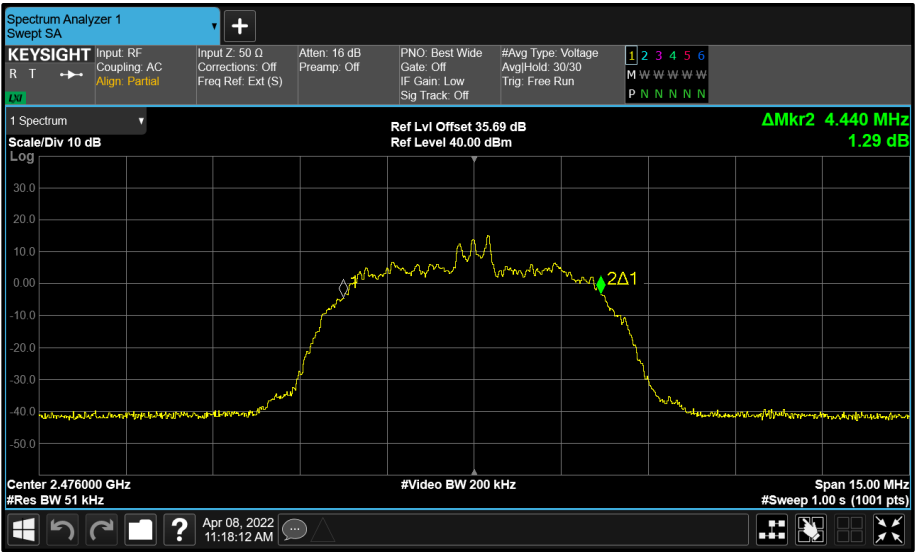


Figure 43 - Core 0 (A) 2476 MHz (CH74) 99% Bandwidth

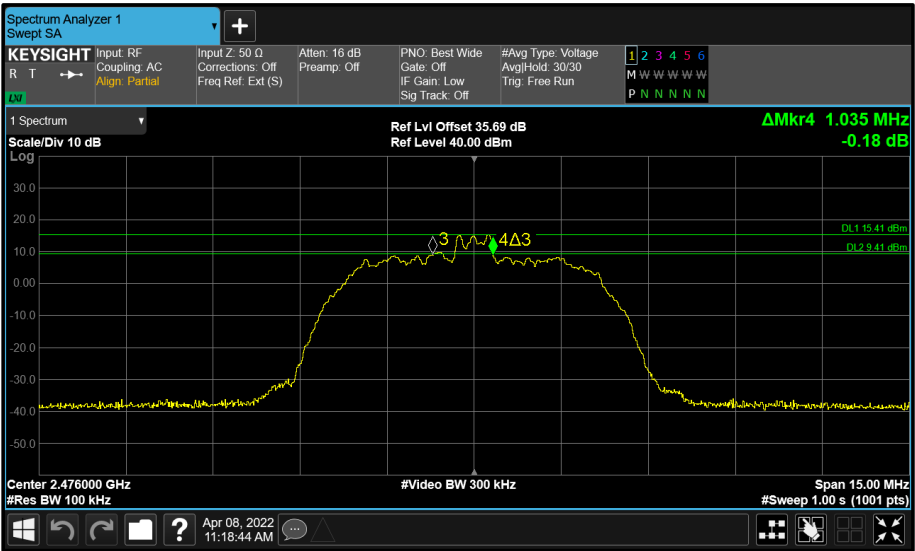


Figure 44 - Core 0 (A) 2476 MHz (CH74) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

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

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	1.904	1.896	-	-	≥ 500.0
2441	1.904	1.904	-	-	≥ 500.0
2476	1.896	1.896	-	-	≥ 500.0

Table 29 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	2.328	2.328	-	-	-
2441	2.328	2.328	-	-	-
2476	2.328	2.328	-	-	-

Table 30 - 99% Bandwidth Results

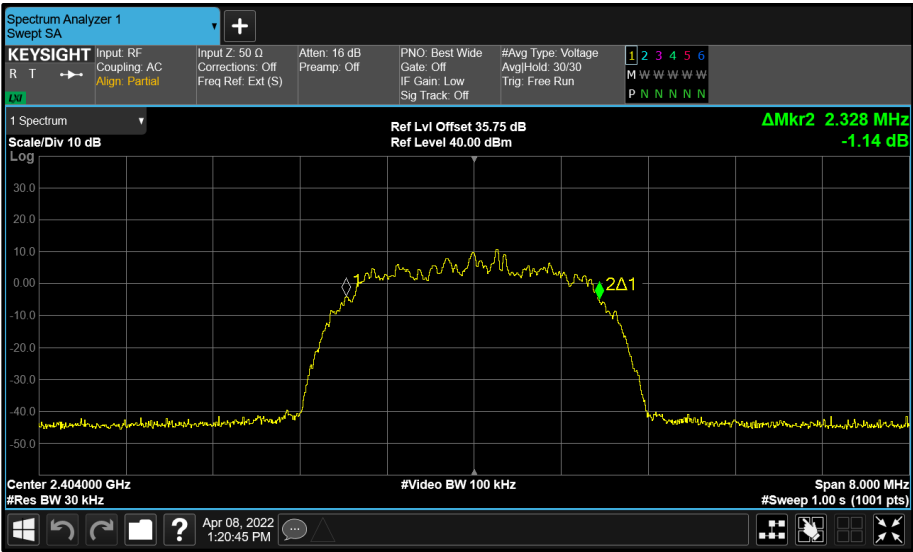


Figure 45 - Core 0 (A) 2404 MHz (CH2) 99% Bandwidth

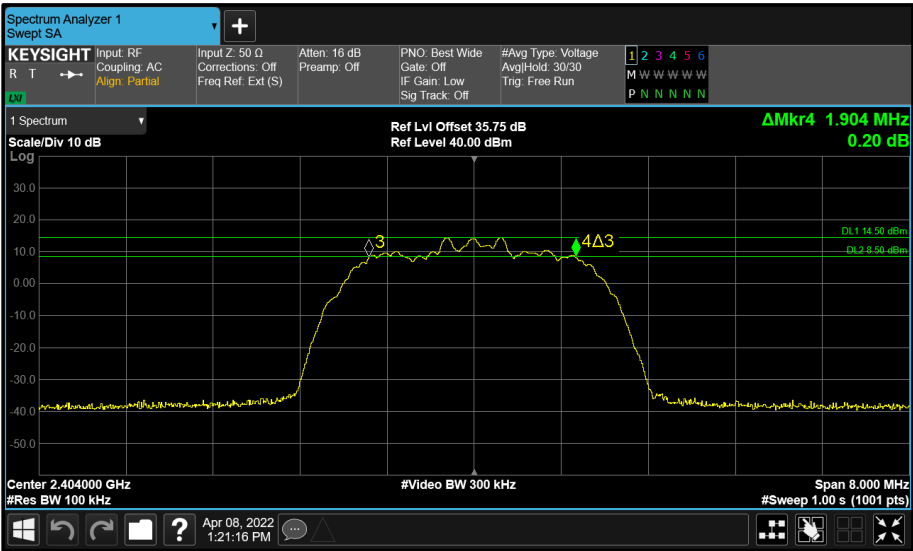


Figure 46 - Core 0 (A) 2404 MHz (CH2) 6 dB Bandwidth

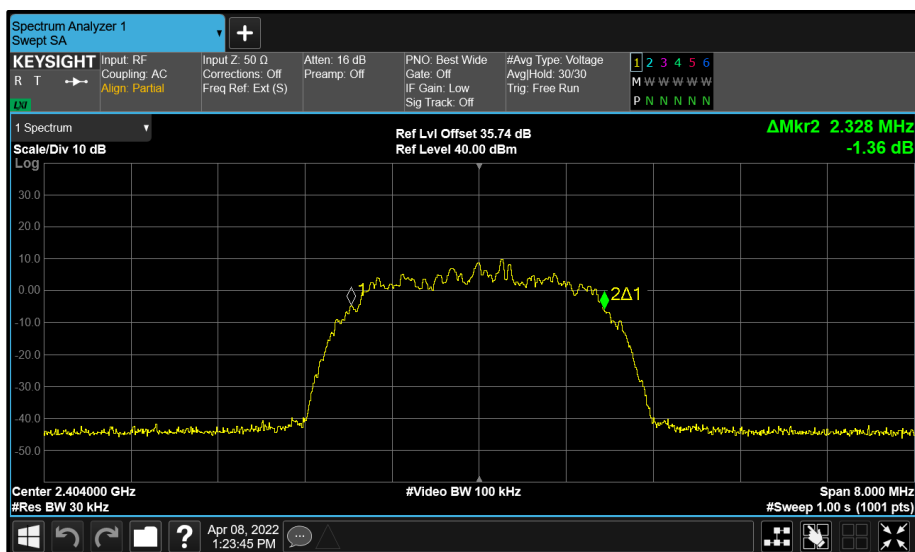


Figure 47 - Core 1 (B) 2404 MHz (CH2) 99% Bandwidth

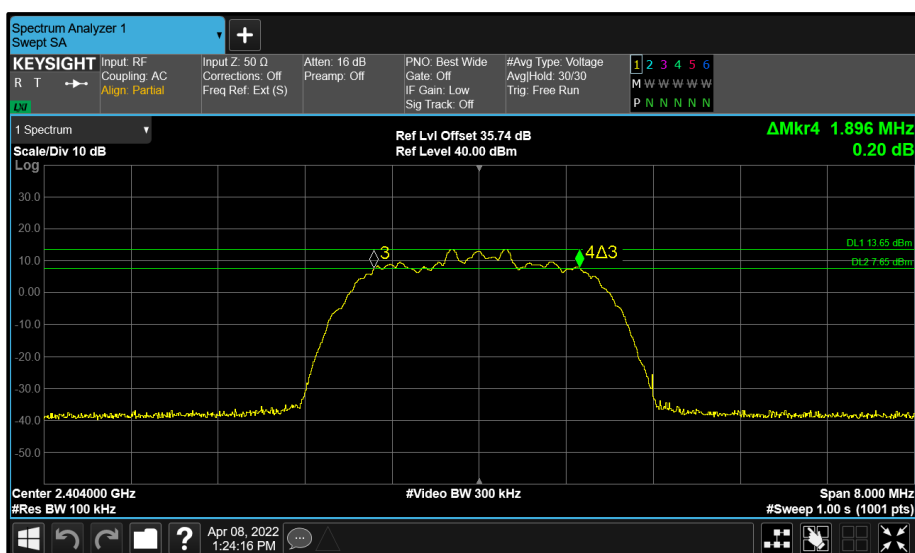


Figure 48 - Core 1 (B) 2404 MHz (CH2) 6 dB Bandwidth

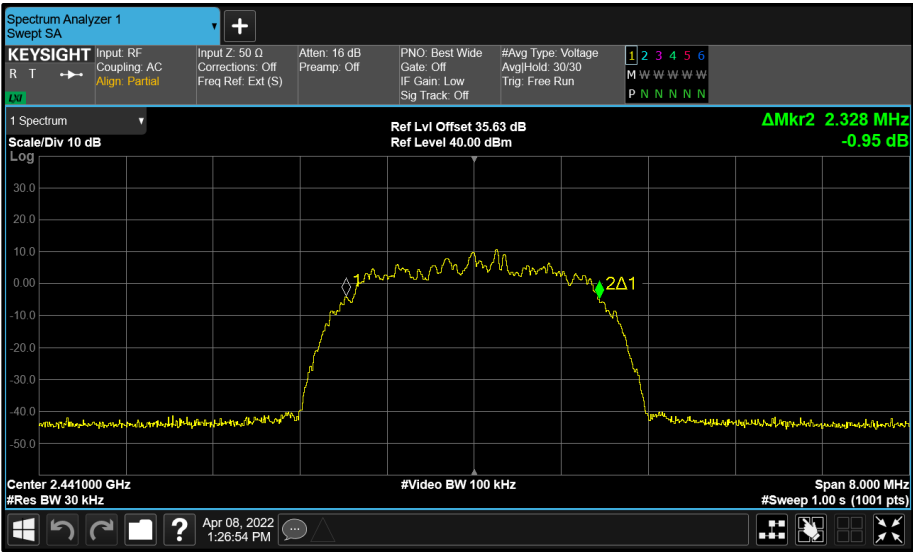


Figure 49 - Core 0 (A) 2441 MHz (CH39) 99% Bandwidth

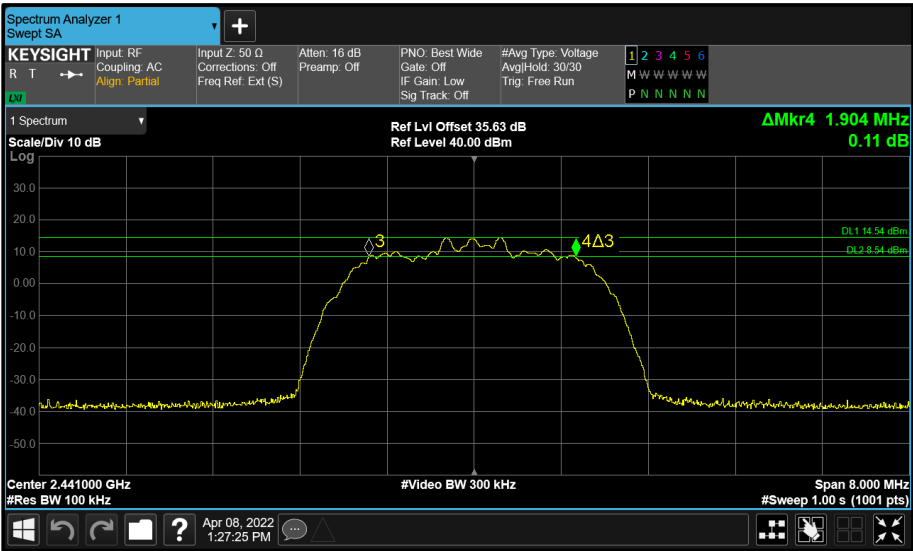


Figure 50 - Core 0 (A) 2441 MHz (CH39) 6 dB Bandwidth

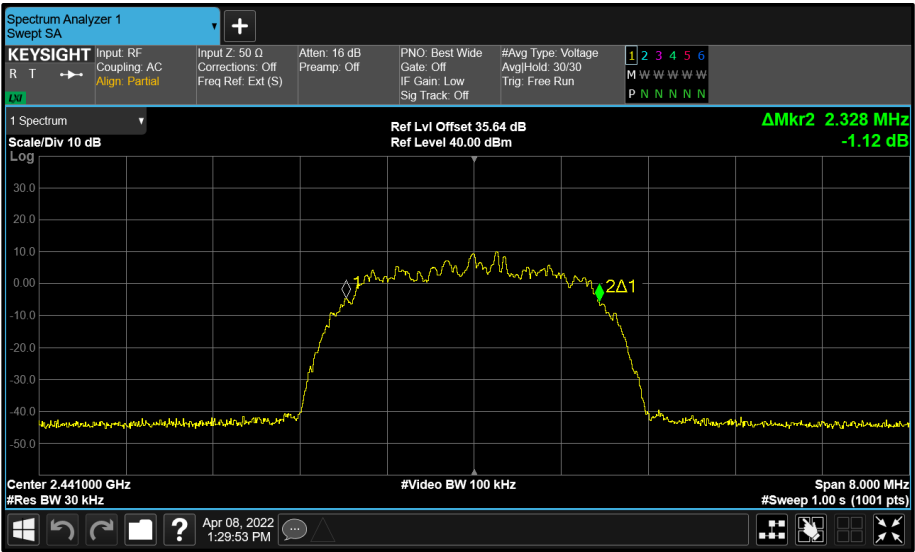


Figure 51 - Core 1 (B) 2441 MHz (CH39) 99% Bandwidth

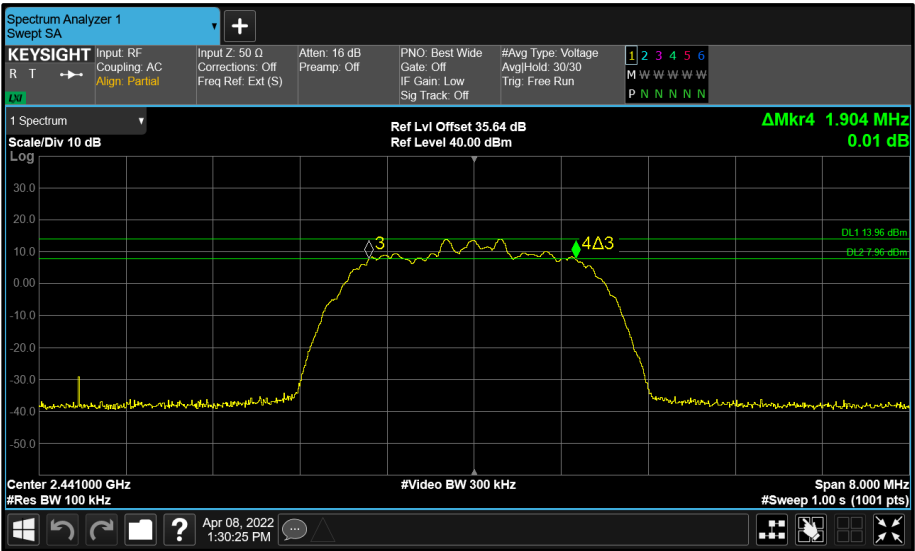


Figure 52 - Core 1 (B) 2441 MHz (CH39) 6 dB Bandwidth

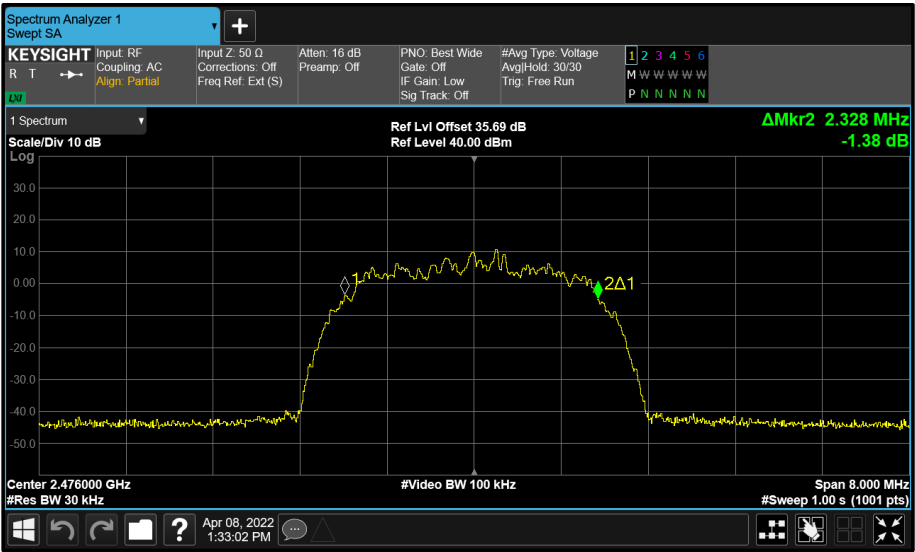


Figure 53 - Core 0 (A) 2476 MHz (CH74) 99% Bandwidth

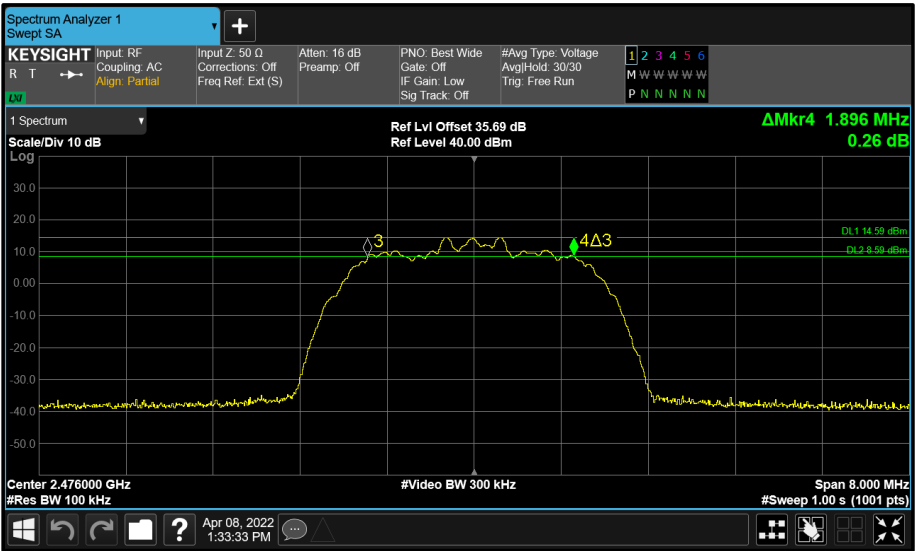


Figure 54 - Core 0 (A) 2476 MHz (CH74) 6 dB Bandwidth

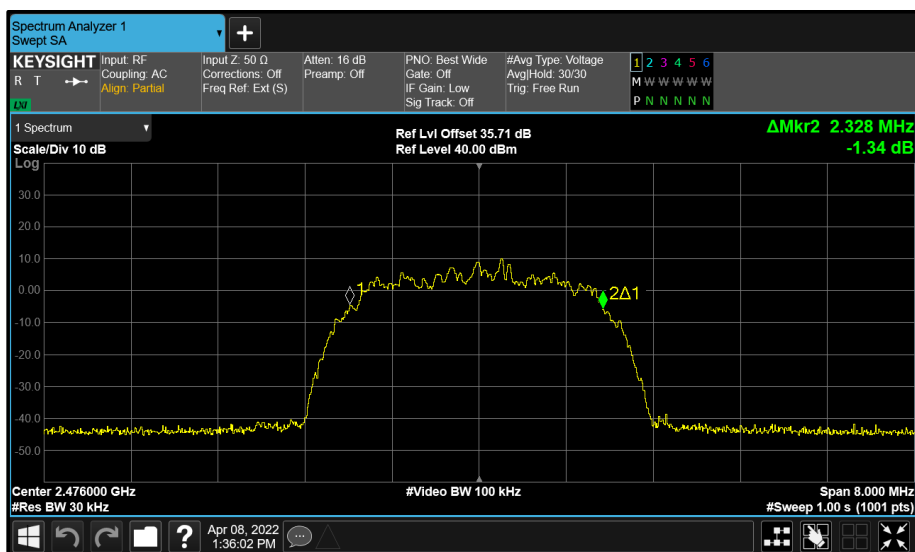


Figure 55 - Core 1 (B) 2476 MHz (CH74) 99% Bandwidth

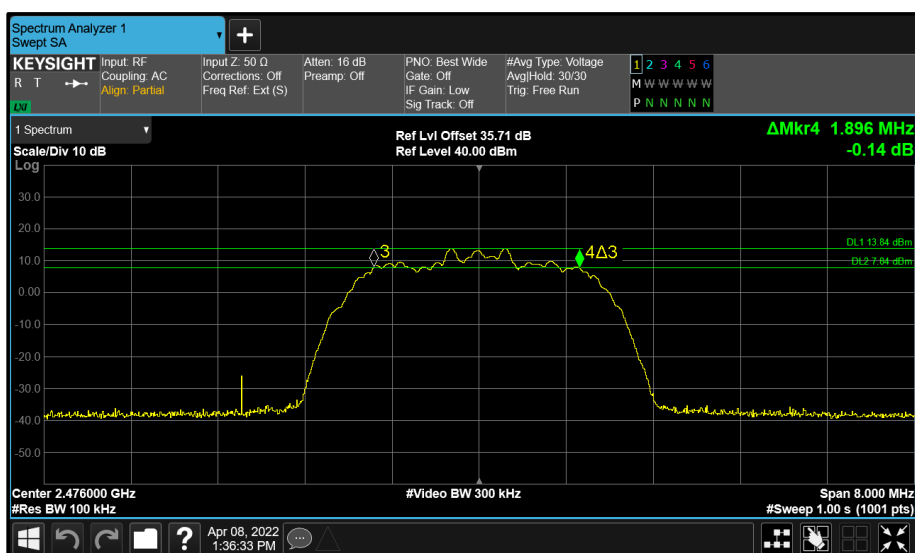


Figure 56 - Core 1 (B) 2476 MHz (CH74) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePa $\pi/4$ DQPSK (8-DH5)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	1.020	1.020	-	-	≥ 500.0
2441	1.005	1.020	-	-	≥ 500.0
2476	1.035	1.035	-	-	≥ 500.0

Table 31 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	4.425	4.440	-	-	-
2441	4.425	4.425	-	-	-
2476	4.455	4.455	-	-	-

Table 32 - 99% Bandwidth Results

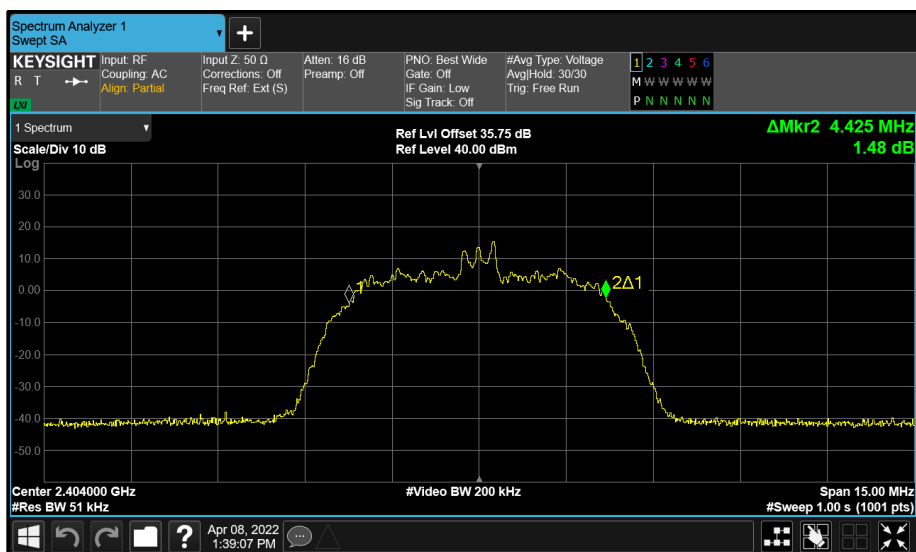


Figure 57 - Core 0 (A) 2404 MHz (CH2) 99% Bandwidth

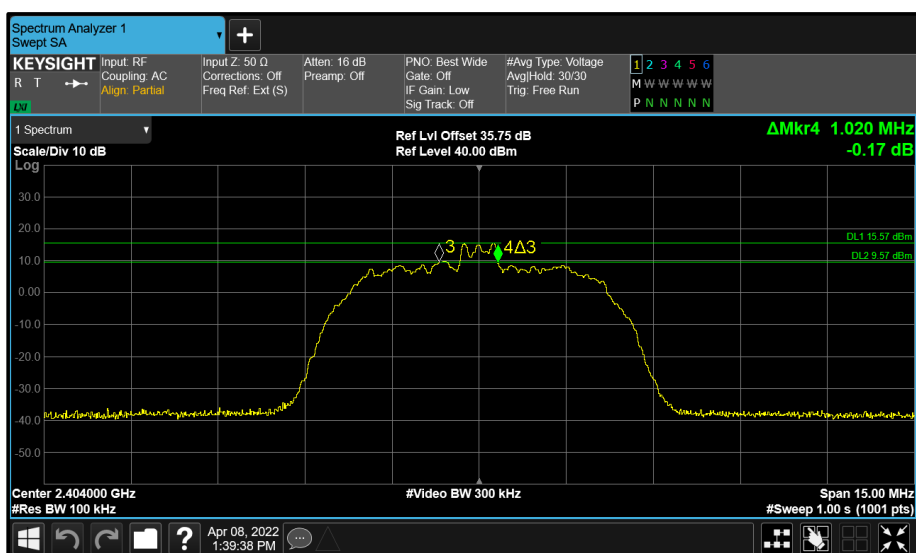


Figure 58 - Core 0 (A) 2404 MHz (CH2) 6 dB Bandwidth

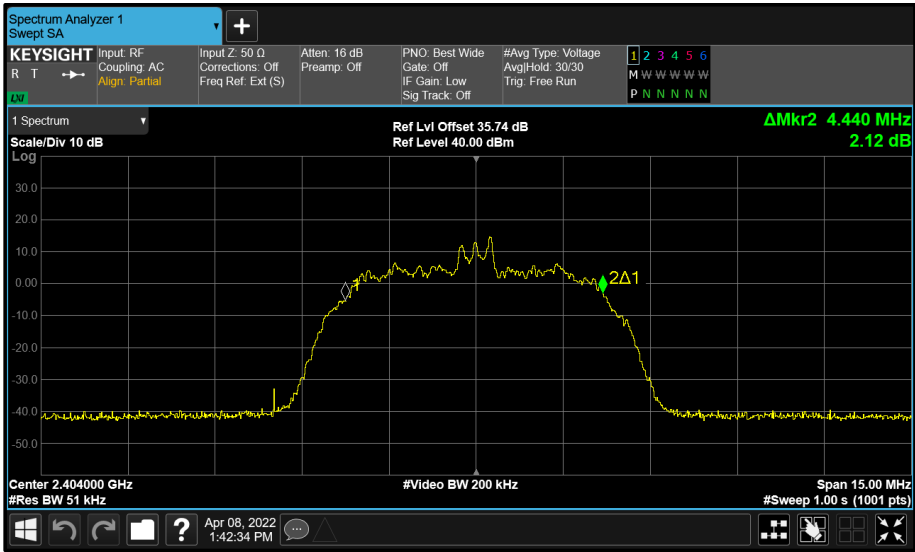


Figure 59 - Core 1 (B) 2404 MHz (CH2) 99% Bandwidth

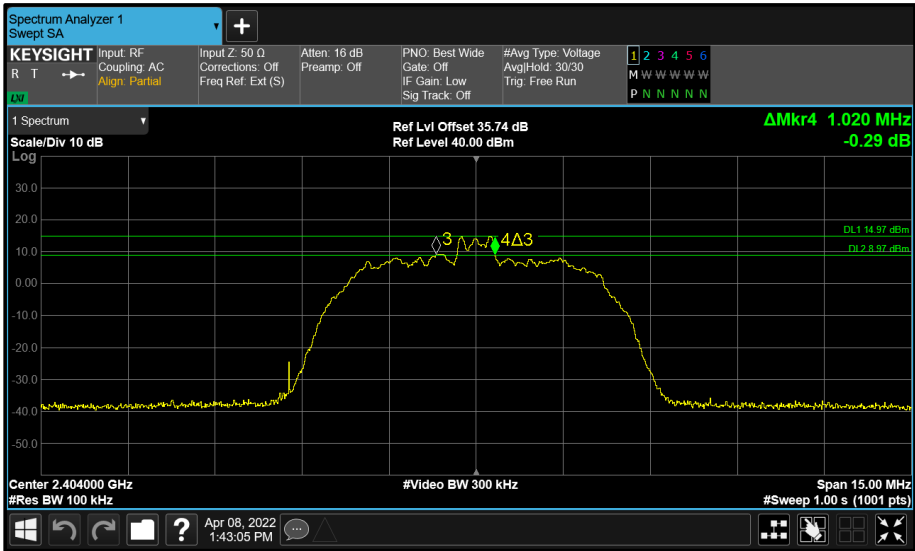


Figure 60 - Core 1 (B) 2404 MHz (CH2) 6 dB Bandwidth

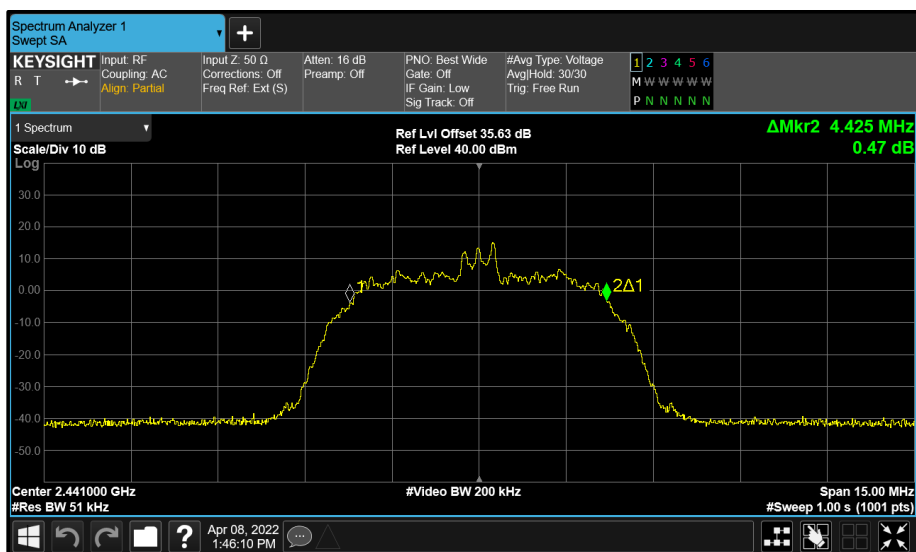


Figure 61 - Core 0 (A) 2441 MHz (CH39) 99% Bandwidth

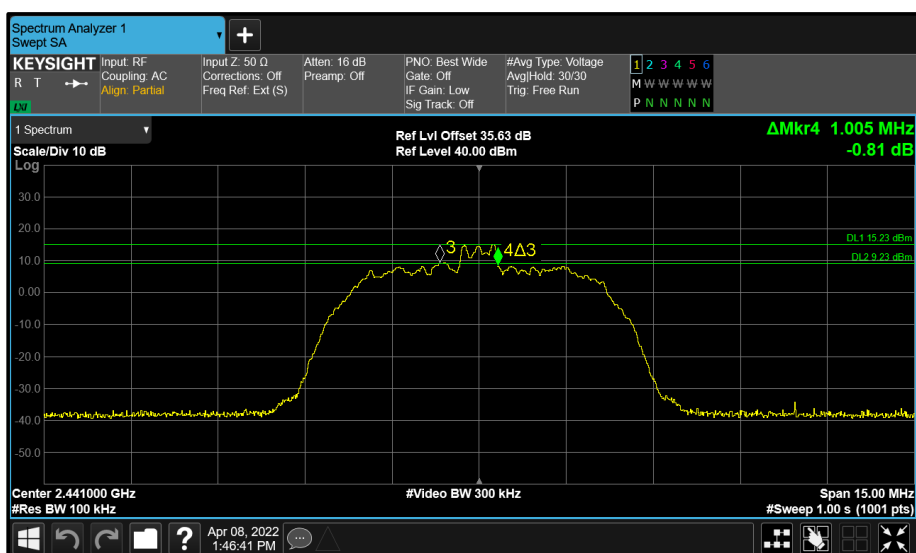


Figure 62 - Core 0 (A) 2441 MHz (CH39) 6 dB Bandwidth

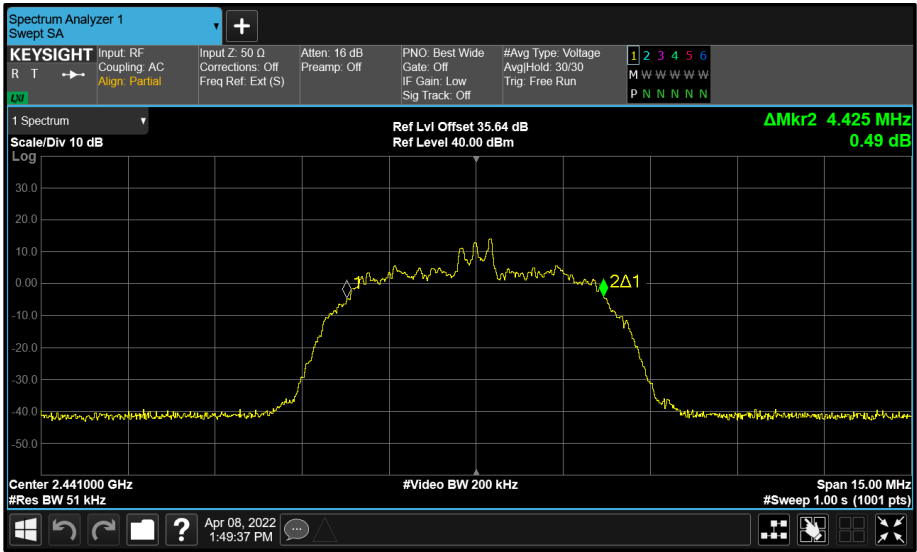


Figure 63 - Core 1 (B) 2441 MHz (CH39) 99% Bandwidth

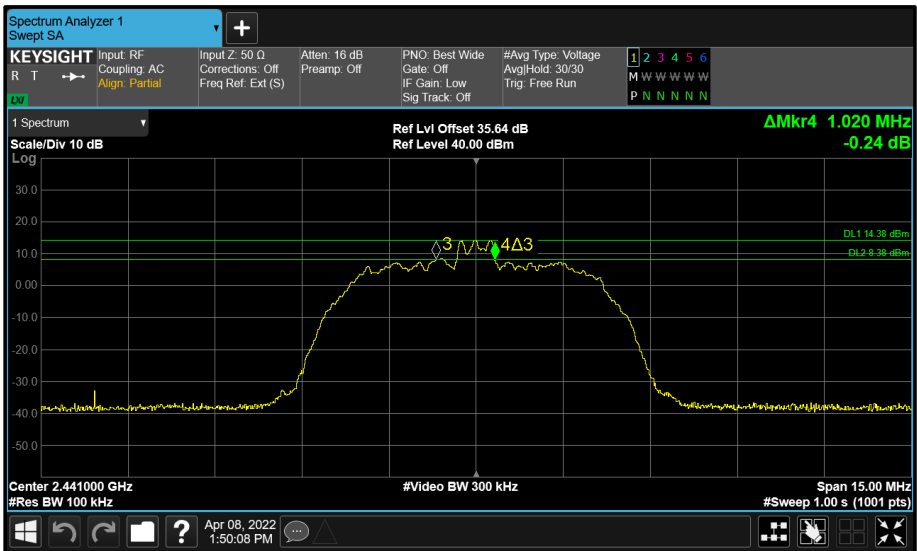


Figure 64 - Core 1 (B) 2441 MHz (CH39) 6 dB Bandwidth

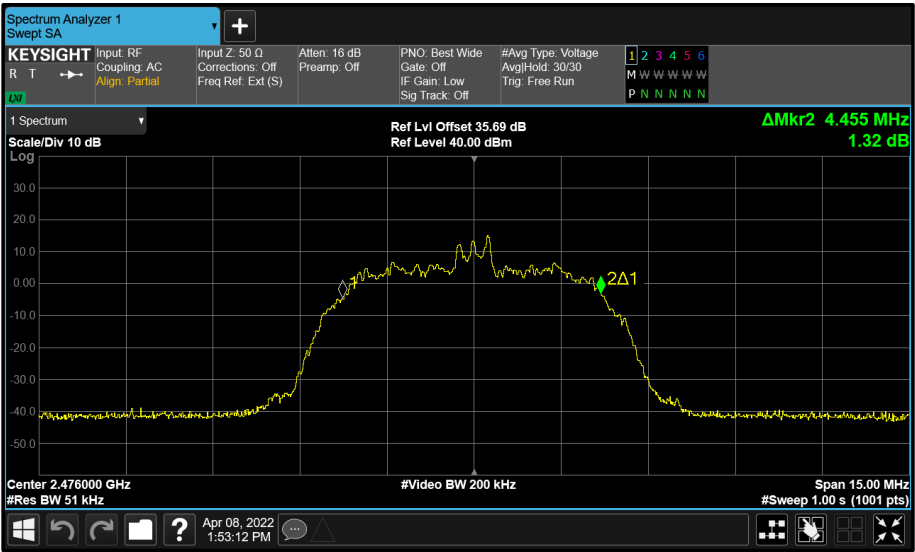


Figure 65 - Core 0 (A) 2476 MHz (CH74) 99% Bandwidth

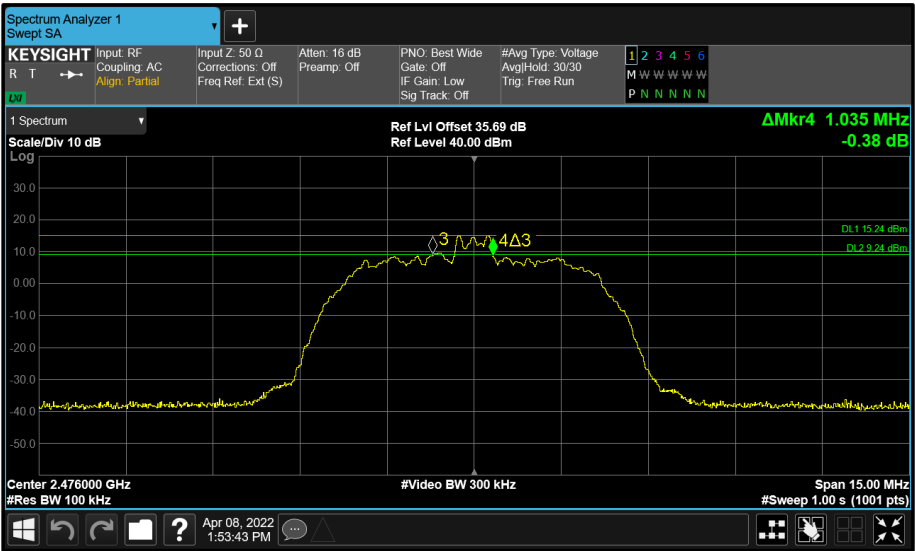


Figure 66 - Core 0 (A) 2476 MHz (CH74) 6 dB Bandwidth

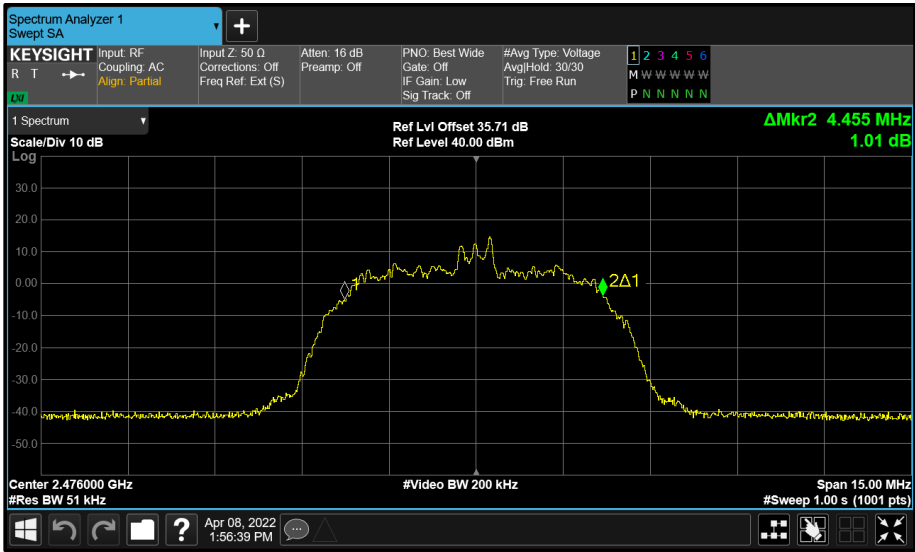


Figure 67 - Core 1 (B) 2476 MHz (CH74) 99% Bandwidth

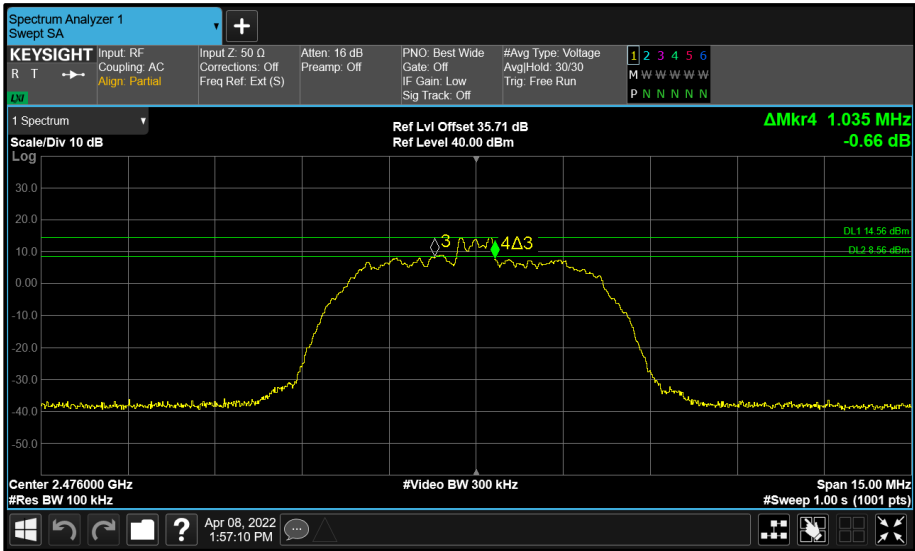


Figure 68 - Core 1 (B) 2476 MHz (CH74) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePa GFSK (LE 1M)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	0.772	-	-	-	≥500.0
2440	0.680	-	-	-	≥500.0
2480	0.708	-	-	-	≥500.0

Table 33 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.080	-	-	-	-
2440	1.036	-	-	-	-
2480	1.036	-	-	-	-

Table 34 - 99% Bandwidth Results

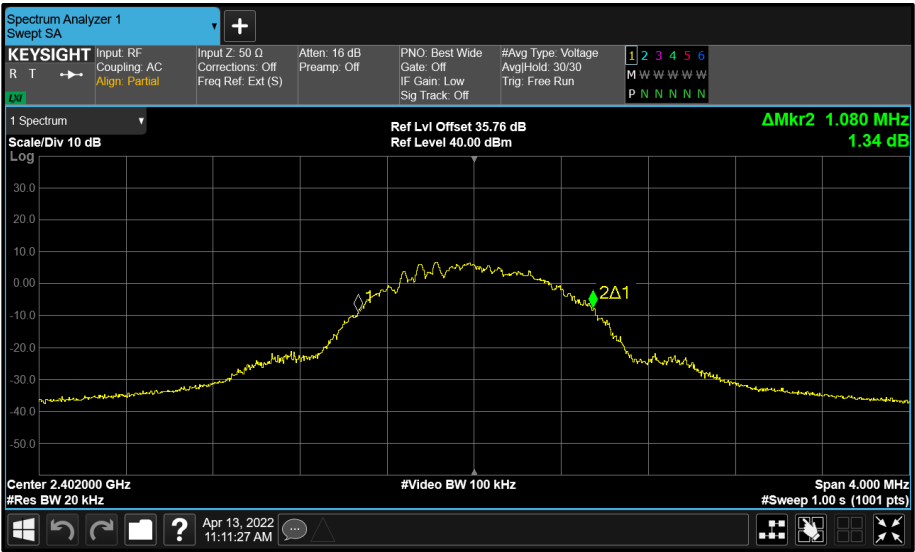


Figure 69 - Core 0 (A) 2402 MHz (CH37) 99% Bandwidth

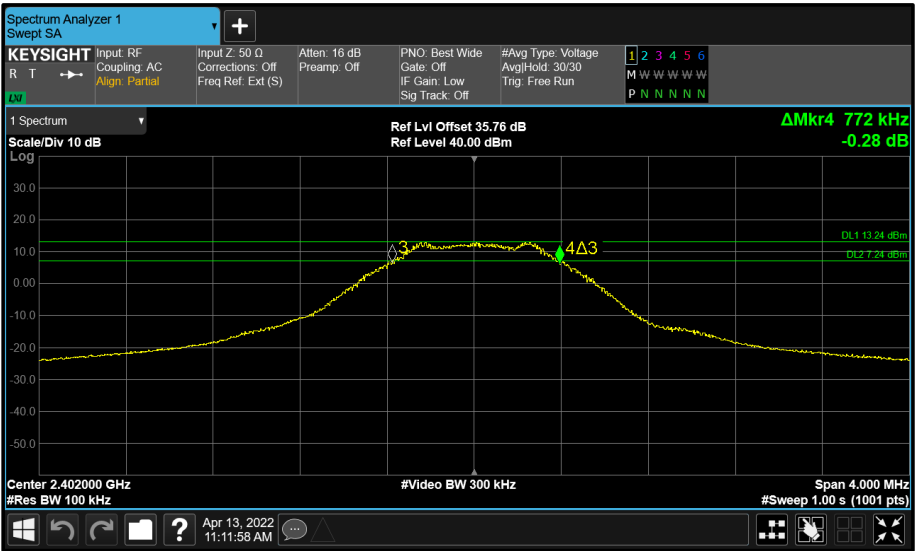


Figure 70 - Core 0 (A) 2402 MHz (CH37) 6 dB Bandwidth

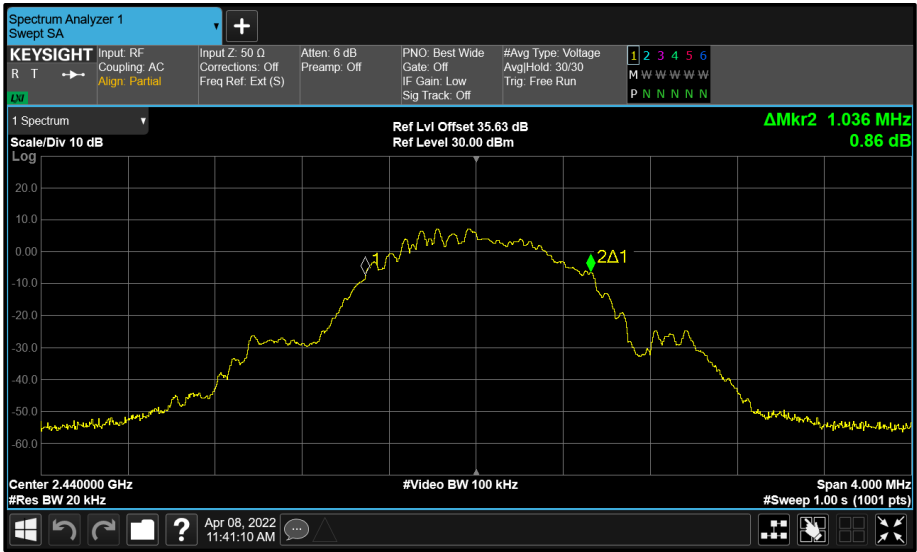


Figure 71 - Core 0 (A) 2440 MHz (CH17) 99% Bandwidth

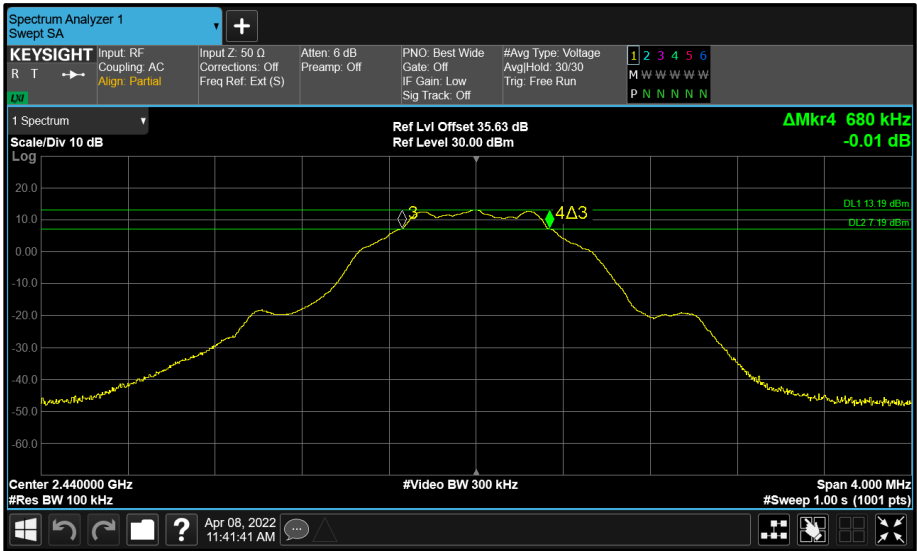


Figure 72 - Core 0 (A) 2440 MHz (CH17) 6 dB Bandwidth

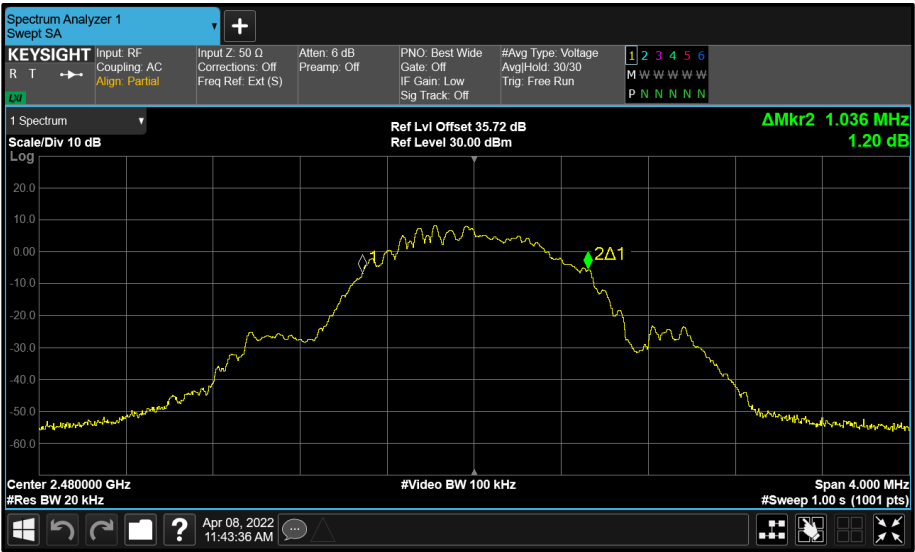


Figure 73 - Core 0 (A) 2480 MHz (CH39) 99% Bandwidth

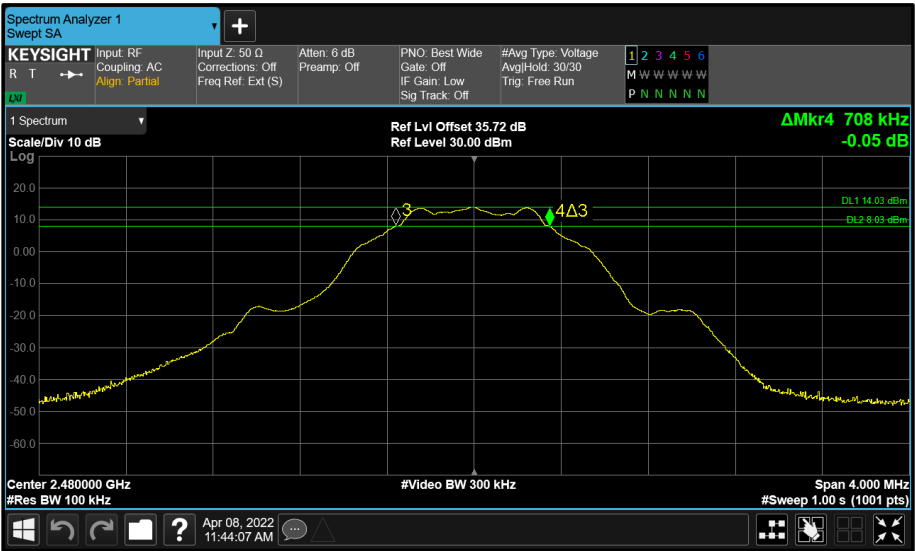


Figure 74 - Core 0 (A) 2480 MHz (CH39) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

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

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	0.728	0.728	-	-	≥500.0
2440	0.724	0.720	-	-	≥500.0
2480	0.728	0.716	-	-	≥500.0

Table 35 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.036	1.036	-	-	-
2440	1.036	1.036	-	-	-
2480	1.032	1.036	-	-	-

Table 36 - 99% Bandwidth Results



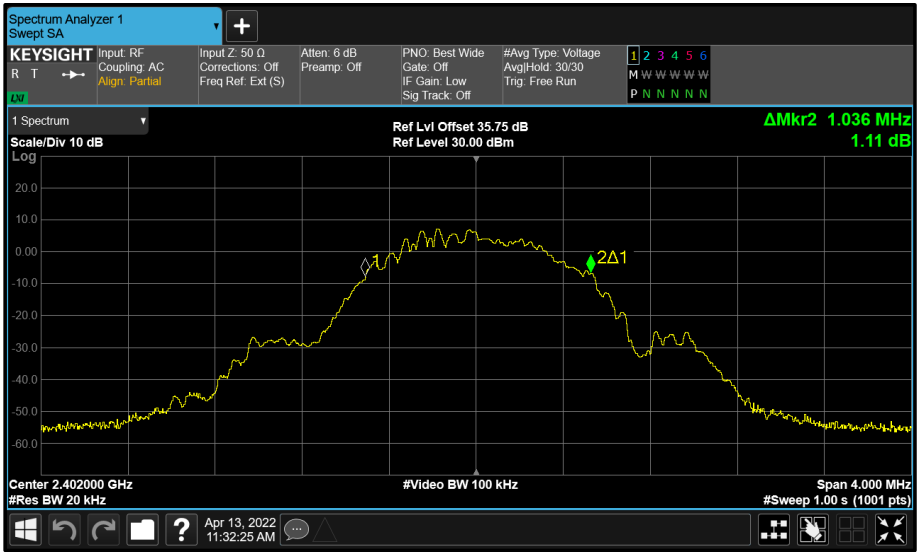


Figure 77 - Core 1 (B) 2402 MHz (CH37) 99% Bandwidth

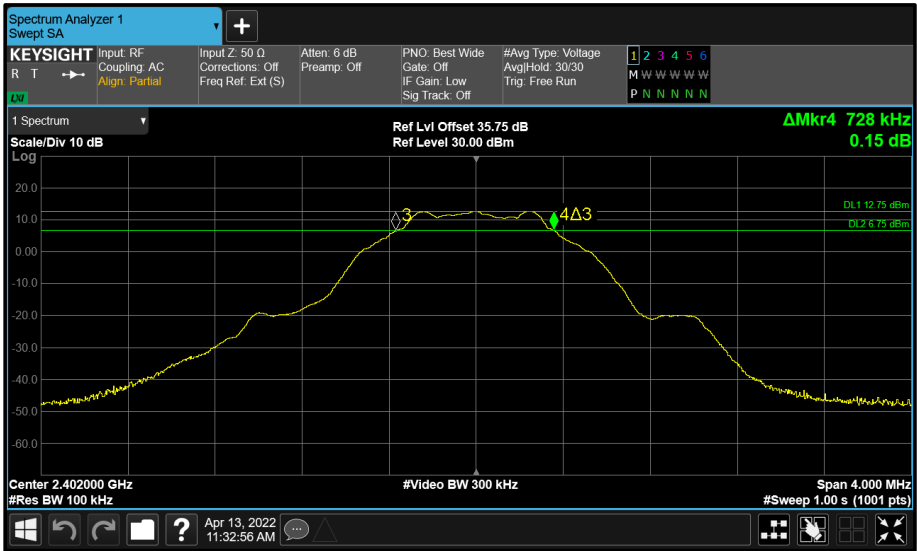


Figure 78 - Core 1 (B) 2402 MHz (CH37) 6 dB Bandwidth

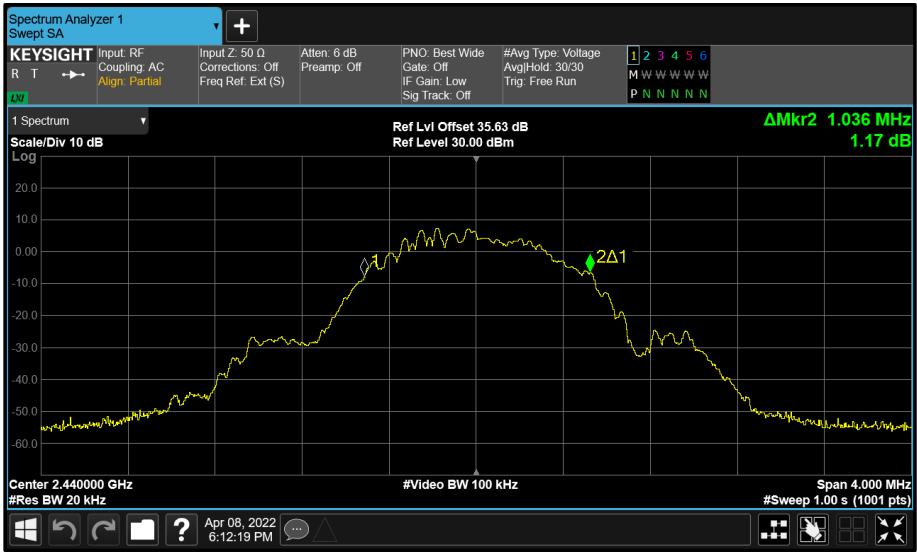


Figure 79 - Core 0 (A) 2440 MHz (CH17) 99% Bandwidth

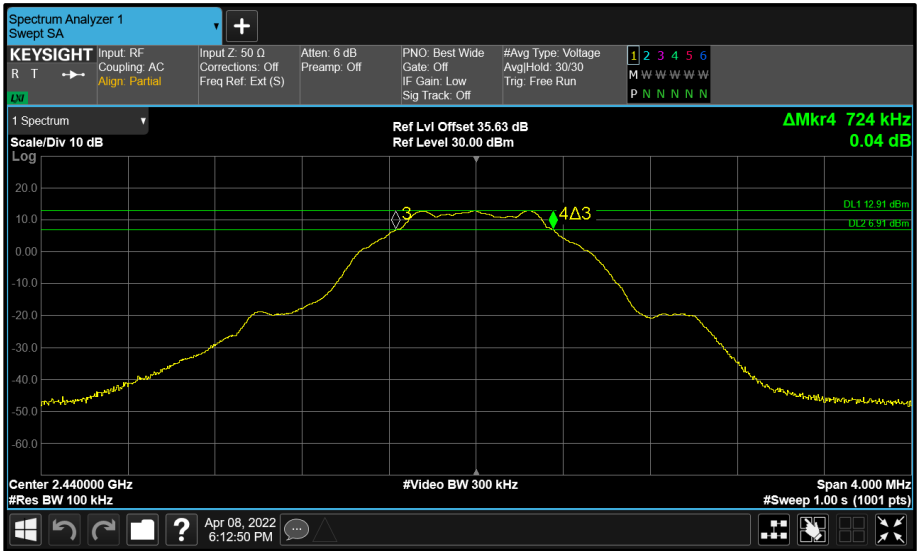


Figure 80 - Core 0 (A) 2440 MHz (CH17) 6 dB Bandwidth

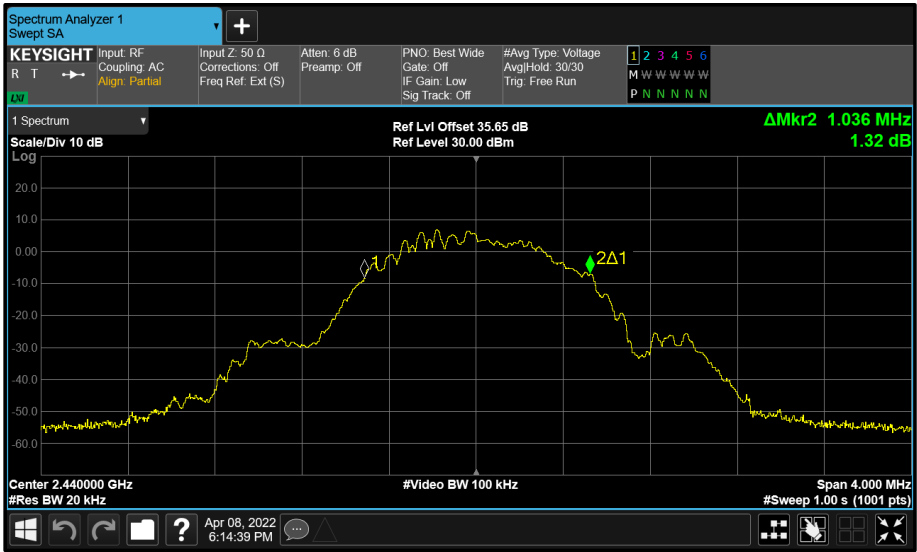


Figure 81 - Core 1 (B) 2440 MHz (CH17) 99% Bandwidth

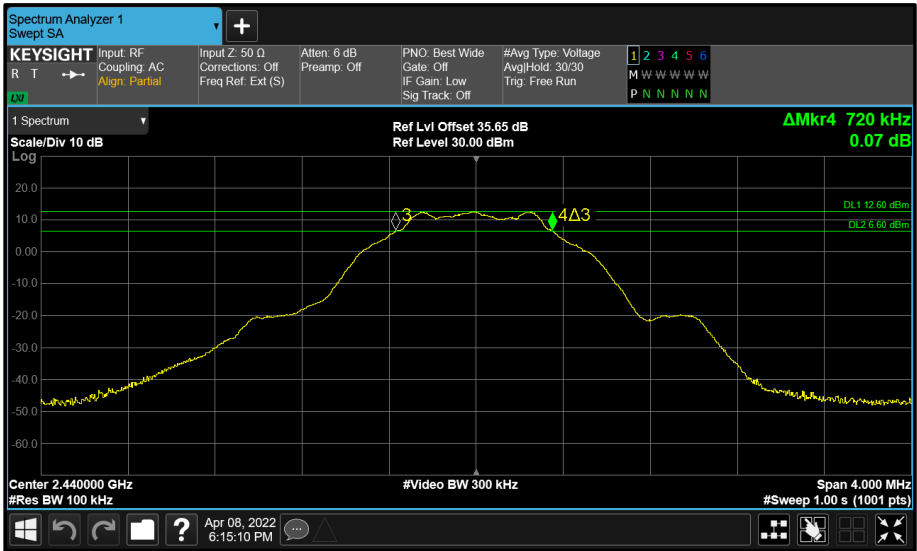


Figure 82 - Core 1 (B) 2440 MHz (CH17) 6 dB Bandwidth

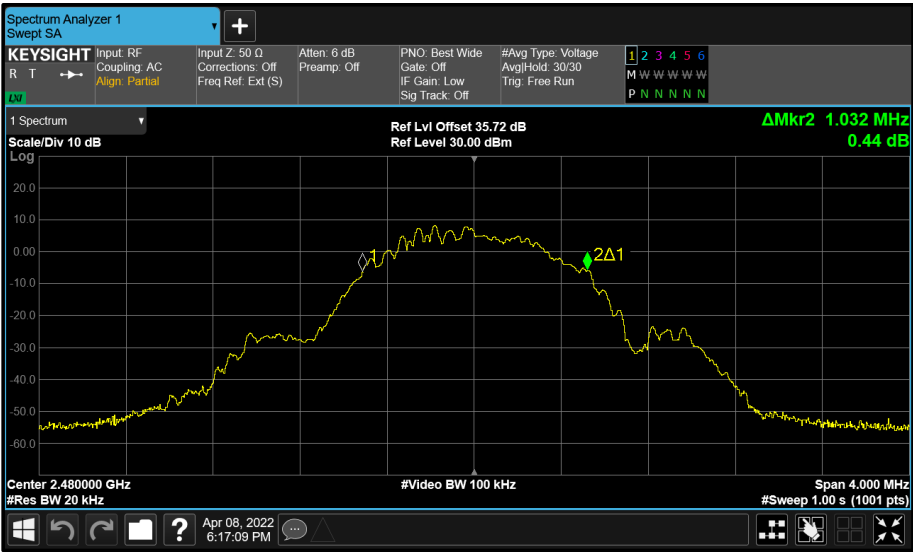


Figure 83 - Core 0 (A) 2480 MHz (CH39) 99% Bandwidth

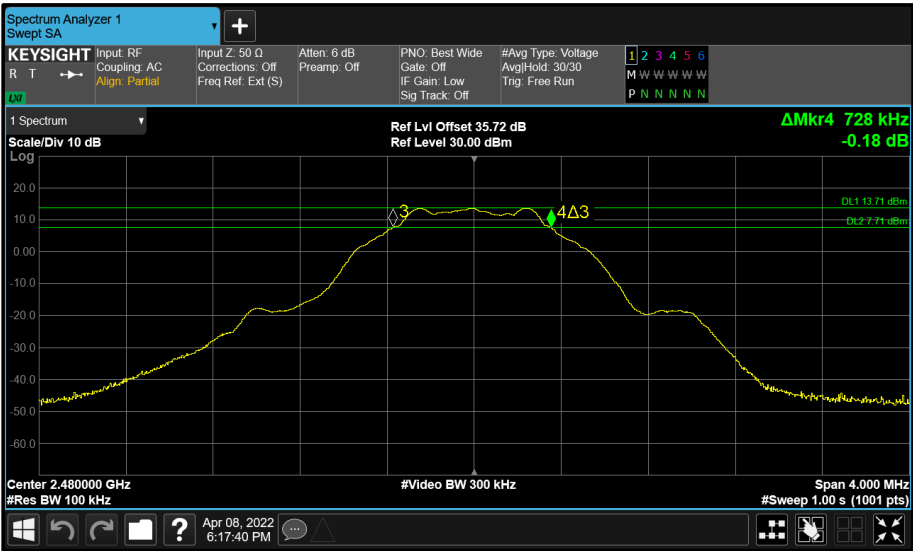


Figure 84 - Core 0 (A) 2480 MHz (CH39) 6 dB Bandwidth

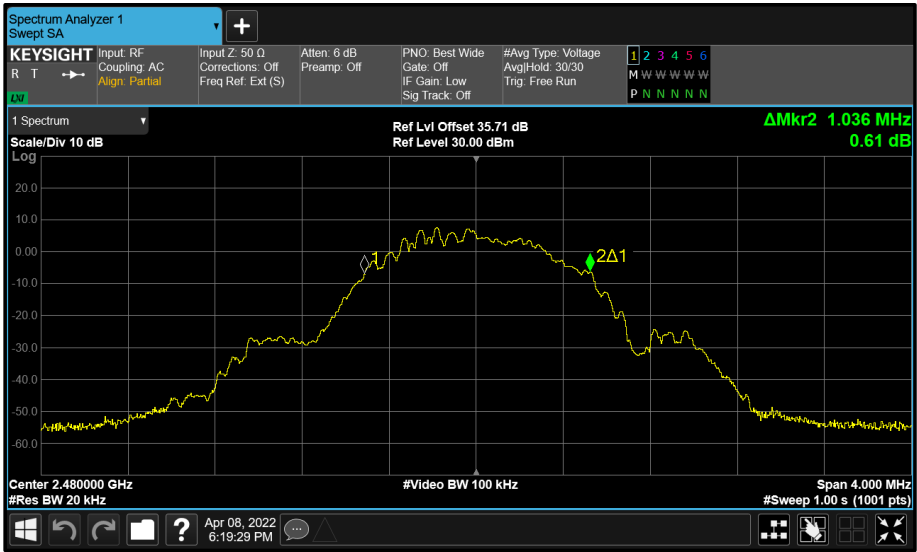


Figure 85 - Core 1 (B) 2480 MHz (CH39) 99% Bandwidth

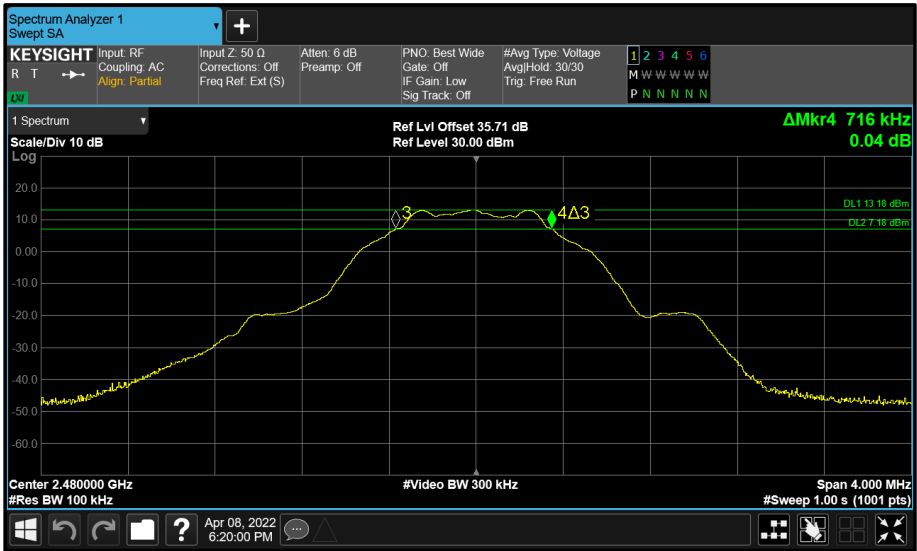


Figure 86 - Core 1 (B) 2480 MHz (CH39) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePa GFSK (LE 2M)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	A (Core 0)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.216	-	-	-	≥500.0
2440	1.160	-	-	-	≥500.0
2480	1.168	-	-	-	≥500.0

Table 37 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	2.016	-	-	-	-
2440	2.064	-	-	-	-
2480	2.056	-	-	-	-

Table 38 - 99% Bandwidth Results

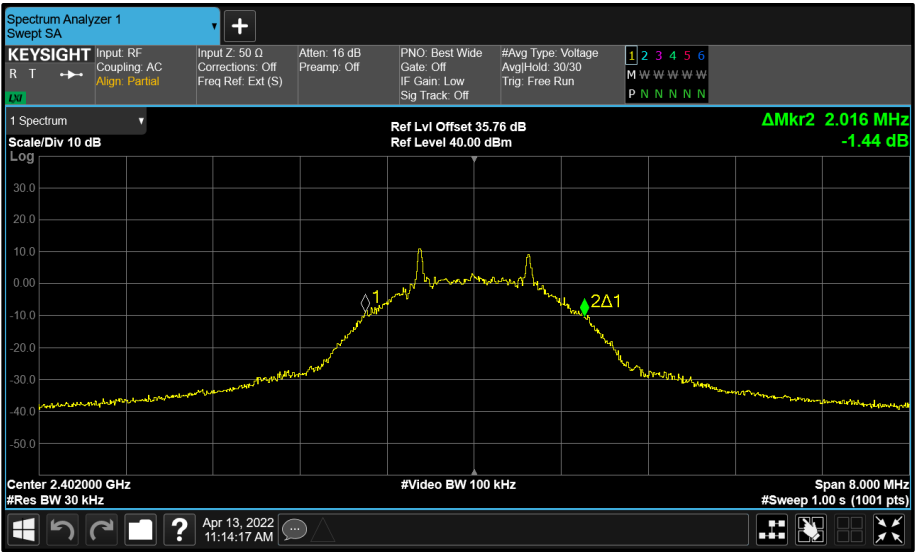


Figure 87 - Core 0 (A) 2402 MHz (CH37) 99% Bandwidth

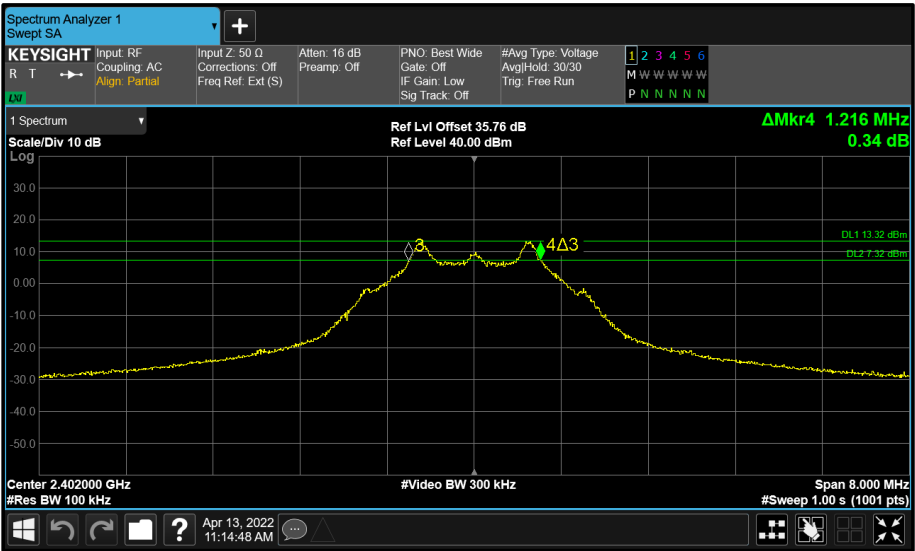


Figure 88 - Core 0 (A) 2402 MHz (CH37) 6 dB Bandwidth

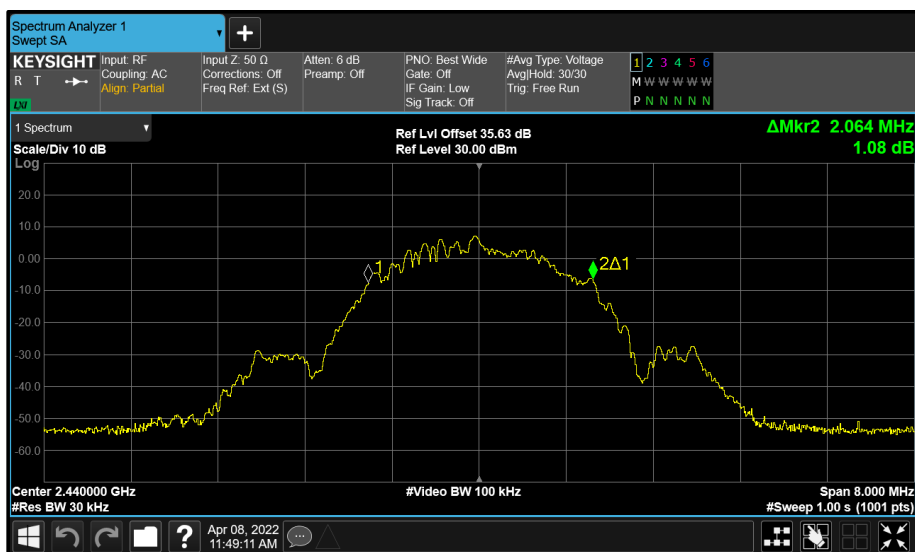


Figure 89 - Core 0 (A) 2440 MHz (CH17) 99% Bandwidth

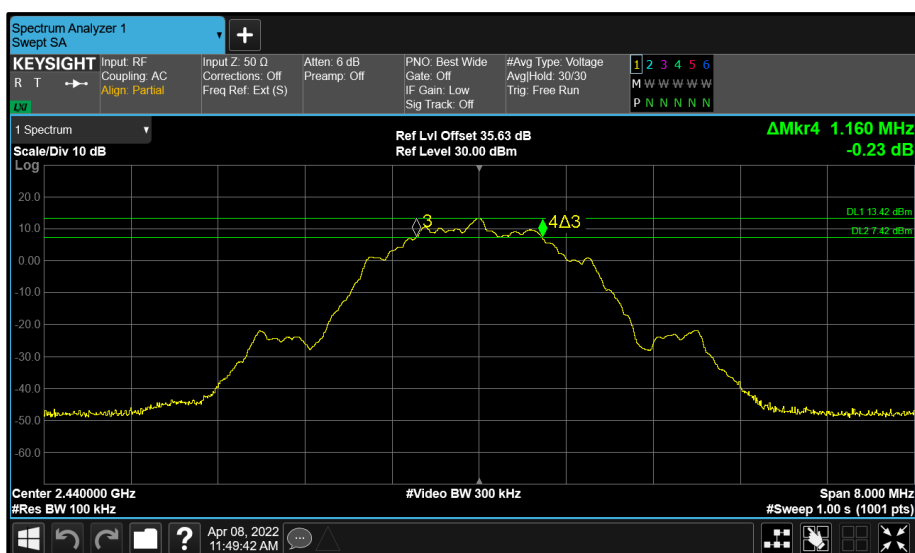


Figure 90 - Core 0 (A) 2440 MHz (CH17) 6 dB Bandwidth

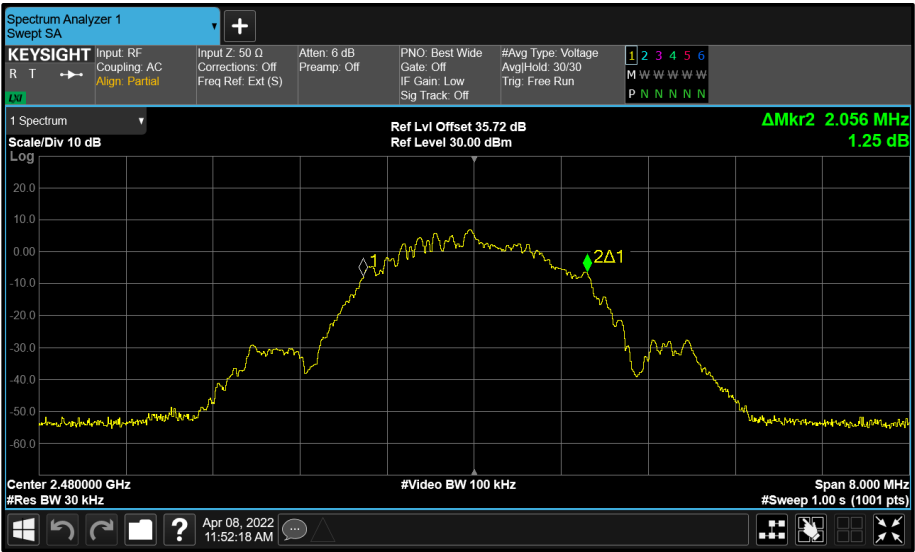


Figure 91 - Core 0 (A) 2480 MHz (CH39) 99% Bandwidth

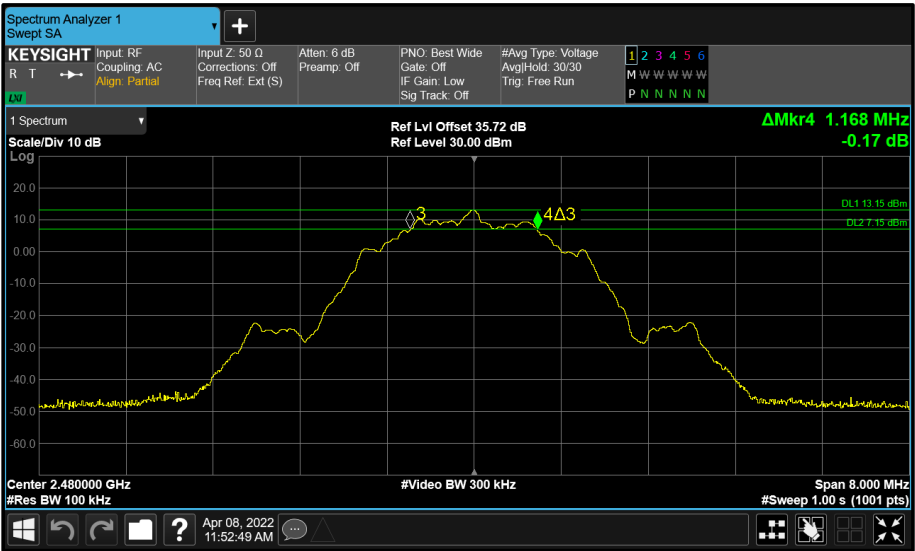


Figure 92 - Core 0 (A) 2480 MHz (CH39) 6 dB Bandwidth



Test Configuration			
Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause(s):	15.247 (a)(2)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	ePa GFSK (LE 2M)	Duty Cycle (%):	-
Antenna Configuration:	Beamforming	DCCF (dB):	-
Active Port(s):	A+B (Core 0 + Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	1.184	1.376	-	-	≥500.0
2440	1.160	1.152	-	-	≥500.0
2480	1.160	1.144	-	-	≥500.0

Table 39 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2402	2.056	2.064	-	-	-
2440	2.056	2.056	-	-	-
2480	2.056	2.056	-	-	-

Table 40 - 99% Bandwidth Results

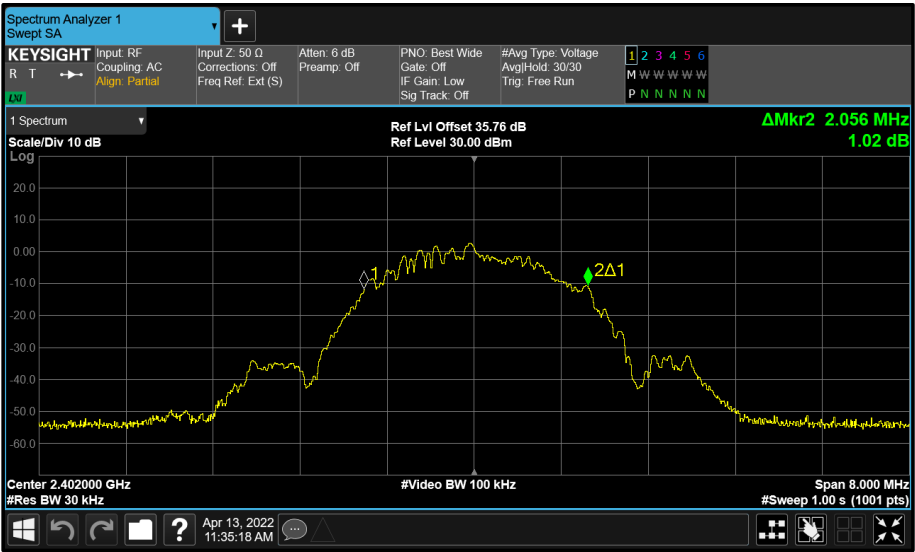


Figure 93 - Core 0 (A) 2402 MHz (CH37) 99% Bandwidth

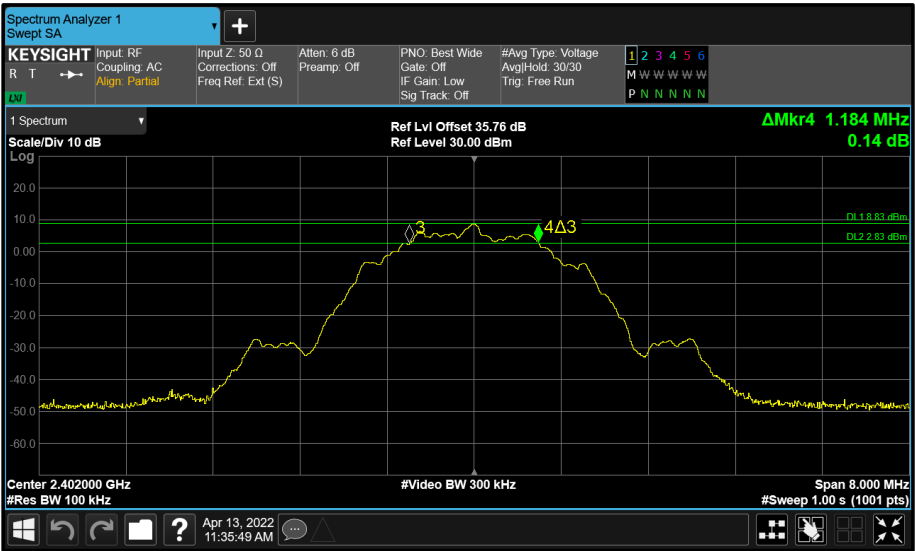


Figure 94 - Core 0 (A) 2402 MHz (CH37) 6 dB Bandwidth