FCC Test Report

Apple Inc
Model: A3403

In accordance with FCC 47 CFR Part 15C (2.4 GHz Bluetooth LE/HDR)

TUV SUD Limited
Digitally signed by TUV SUD Limited
Date: 2024.10.16 10:31:16 +01'00'

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

FCC ID: BCGA3403

COMMERCIAL-IN-CONFIDENCE

Document 75961394-87 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Steve Marshall	Senior Engineer	Authorised Signatory	10 October 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. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Report Generation	Rachael Watkins	10 October 2024	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory
553713/UK2026 Concorde Park, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2023 for the tests detailed in section 1.3.

DISCLAIMER AND COPYRIGHT

This non-binding report has been prepared by TÜV SÜD with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD. No part of this document may be reproduced without the prior written approval of TÜV SÜD. © 2024 TÜV SÜD. This report relates only to the actual item/items tested.

ACCREDITATION

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation. Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited). Results of tests covered by our Flexible UKAS Accreditation Schedule are marked FS (Flexible Scope).

TÜV SÜD
is a trading name of TUV SUD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD 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

Contents

1 Report Summary 2

1.1 Report Modification Record 2
1.2 Introduction 2
1.3 Brief Summary of Results 3
1.4 Product Information 4
1.5 Deviations from the Standard 5
1.6 Identification of the EUT 6
1.7 EUT Modification Record 6
1.8 Test Location 7

2 Test Details 8

2.1 Restricted Band Edges 8
2.2 Emission Bandwidth 52
2.3 Maximum Conducted Output Power 158
2.4 Authorised Band Edges 170
2.5 Spurious Radiated Emissions 192
2.6 Power Spectral Density 208

3 Measurement Uncertainty 220

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	10-October-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
Start of Test	26-August-2024
Finish of Test	02-October-2024
Name of Engineer(s)	Manohar Thota, Colin Brain, Tom Biddlecombe, Ioan-Alexandru Bogatu, Ian Hart and Ahmed Al Derdiri
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 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: 2.4 GHz Bluetooth LE/HDR				
-	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	Restricted Band Edges	Pass	ANSI C63.10 (2020)
2.2	15.247 (a)(2)	Emission Bandwidth	Pass	ANSI C63.10 (2020)
2.3	15.247 (b)	Maximum Conducted Output Power	Pass	ANSI C63.10 (2020) KDB 662911 D01 v02r01
2.4	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10 (2020)
2.5	15.209 and 15.247 (d)	Spurious Radiated Emissions	Pass	ANSI C63.10 (2020) ANSI C63.4 (2014)
2.6	15.247 (e)	Power Spectral Density	Pass	ANSI C63.10 (2020) KDB 662911 D01 v02r01

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 three different cores (Core 0, 1, and 2). It also supports MIMO (Multiple Input/Multiple Output) beamforming operation on Cores 0+1. The EUT supports HDR4 (4-DH5), HDR8 (8-DH5), LE1M and LE2M.

Core 0 and Core 1 also operate at two power settings: low power "iPA" and high power "ePA", with core 2 only supporting the lower power mode. The EUT uses different output powers per core dependent on how many cores are used.

After preliminary investigations, conducted tests on the EUT were performed in the following modes:

SISO modes:

- HDR4 - iPA - Core 1
- HDR8 - iPA - Core 1
- LE1M - iPA - Core 1
- LE2M - iPA - Core 1
- HDR4 - iPA - Core 2
- HDR8 - iPA - Core 2
- LE1M - iPA - Core 2
- LE2M - iPA - Core 2
- HDR4 - ePA - Core 1
- HDR8 - ePA - Core 1
- LE1M - ePA - Core 0
- LE2M - ePA - Core 0

MIMO modes:

- HDR4 - iPA - Core 0 + Core 1
- HDR8 - iPA - Core 0 + Core1
- LE1M - iPA - Core 0 + Core 1
- LE2M - iPA - Core 0 + Core 1
- HDR4 - ePA - Core 0 + Core 1
- HDR8 - ePA - Core 0 + Core 1
- LE1M - ePA - Core 0 + Core 1
- LE2M - ePA - Core 0 + Core 1

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

SISO mode:

- LE1M - iPA - Core 2

MIMO modes:

- HDR4 - ePA - Core 0 + Core 1
- LE1M - iPA - 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 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	3.3	0.71
Core 1	2400 to 2480	6.3	0.71
Dedicated Core 2	2400 to 2480	5.2	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: A3403			
Serial Number	Hardware Version	Software Version	Firmware
LJHNW3N9XQ	REV1.0	24A32190v	22.1.65.459
JF4T7PYJ66	REV1.0	24A32191s	22.1.65.459
M7J9X1XPGD	REV1.0	24A32190v	22.1.65.459

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: A3403, Serial Number: LJHNW3N9XQ			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3403, Serial Number: JF4T7PYJ66			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3403, Serial Number: M7J9X1XPGD			
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 LE/HDR		
Emission Bandwidth	Tom Biddlecombe	UKAS
Maximum Conducted Output Power	Tom Biddlecombe	UKAS
Power Spectral Density	Tom 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 LE/HDR		
Restricted Band Edges	Manohar Thota and Colin Brain	UKAS
Authorised Band Edges	Manohar Thota and Colin Brain	UKAS
Spurious Radiated Emissions	Ioan-Alexandru Bogatu, Manohar Thota, Ian Hart and Ahmed Al Derdiri	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

2.1.2 Equipment Under Test and Modification State

A3403, S/N: JF4T7PYJ66 - Modification State 0

2.1.3 Date of Test

04-September-2024 to 24-September-2024

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 dBµV/m to µV/m:

10^(Field Strength in dBµV/m/20).

2.1.5 Environmental Conditions

Ambient Temperature	21.4 - 23.0 °C
Relative Humidity	45.9 - 49.0 %

2.1.6 Test Results

2.4 GHz Bluetooth LE/HDR

iPA - Core 0 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	54.17	41.59
Static	HDR8	2404	2390	53.52	41.89
Static	LE1M	2402	2390	53.66	41.54
Static	LE2M	2402	2390	53.98	41.57
Static	HDR4	2476	2483.5	52.46	40.49
Static	HDR8	2476	2483.5	53.30	41.63
Static	LE1M	2478	2483.5	52.65	40.47
Static	LE1M	2480	2483.5	52.35	40.61
Static	LE2M	2478	2483.5	52.60	40.50
Static	LE2M	2480	2483.5	52.46	40.32

Table 8 - SISO Restricted Band Edge Results

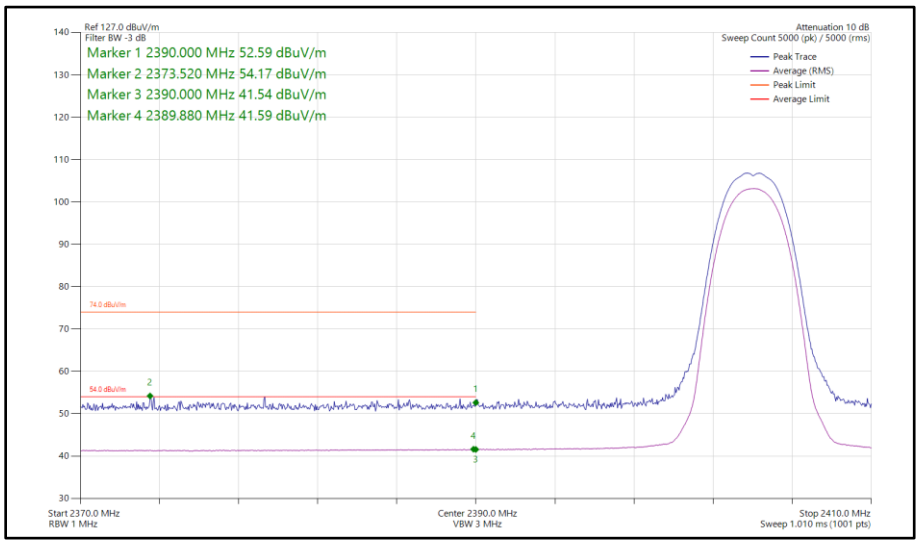

Figure 1 - Bluetooth HDR4, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz

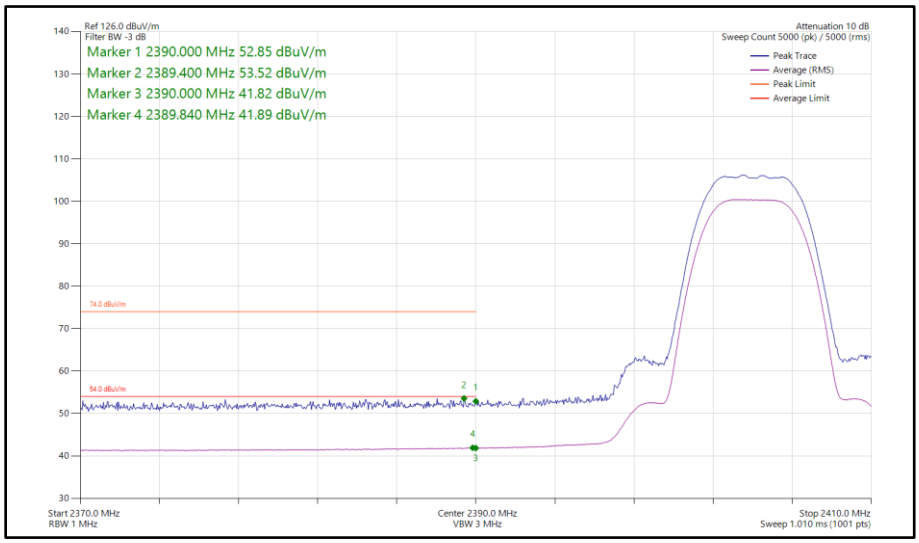

Figure 2 - Bluetooth HDR8, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz

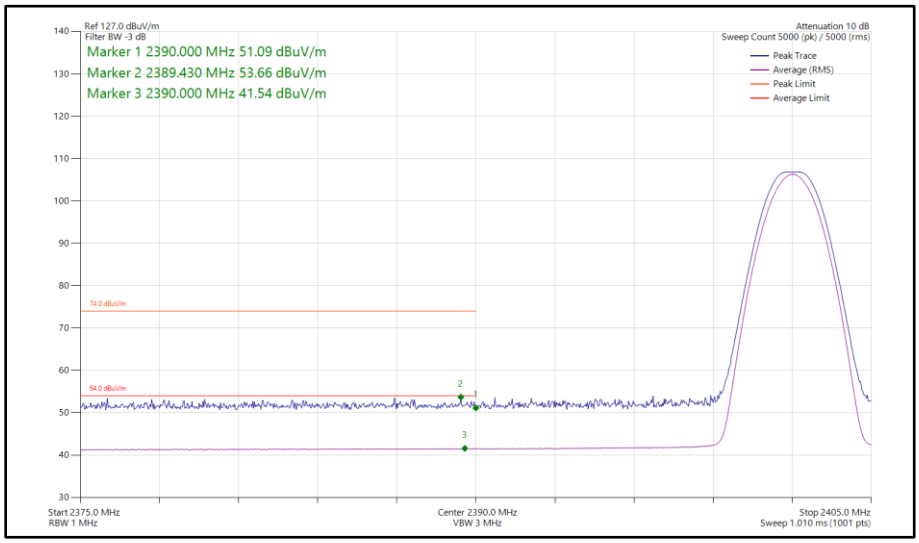

Figure 3 - Bluetooth LE1M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

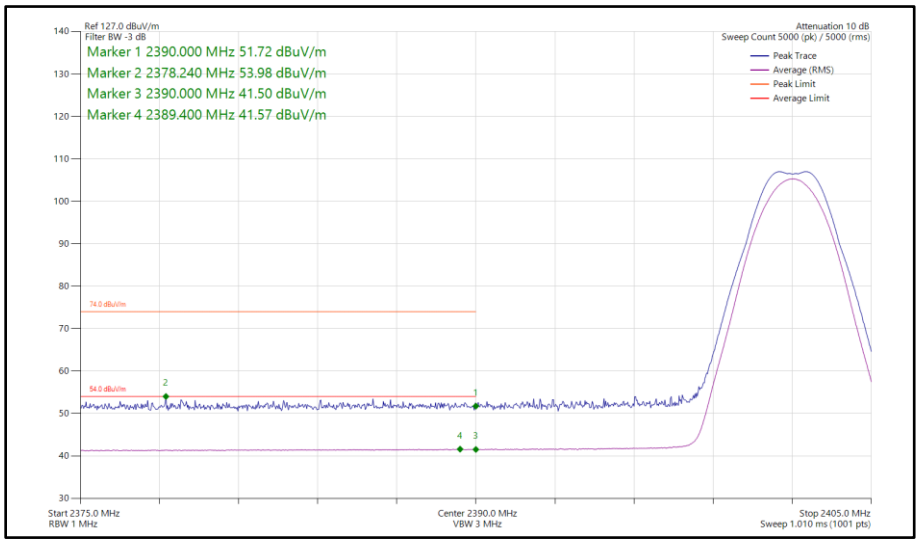

Figure 4 - Bluetooth LE2M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

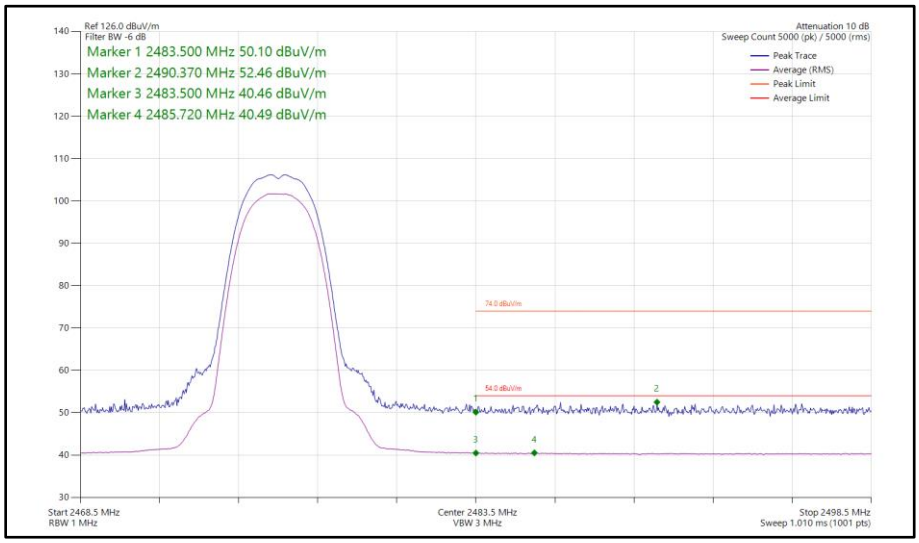

Figure 5 - Bluetooth HDR4, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

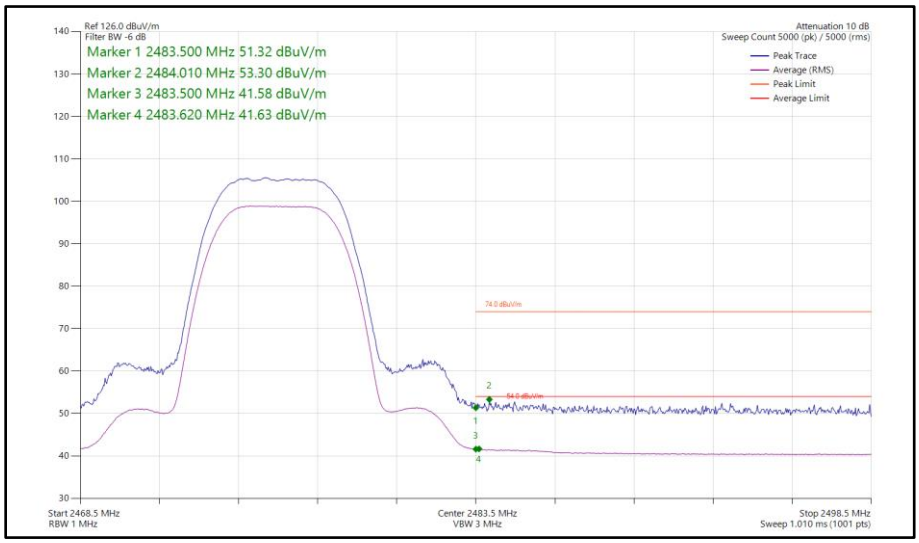

Figure 6 - Bluetooth HDR8, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

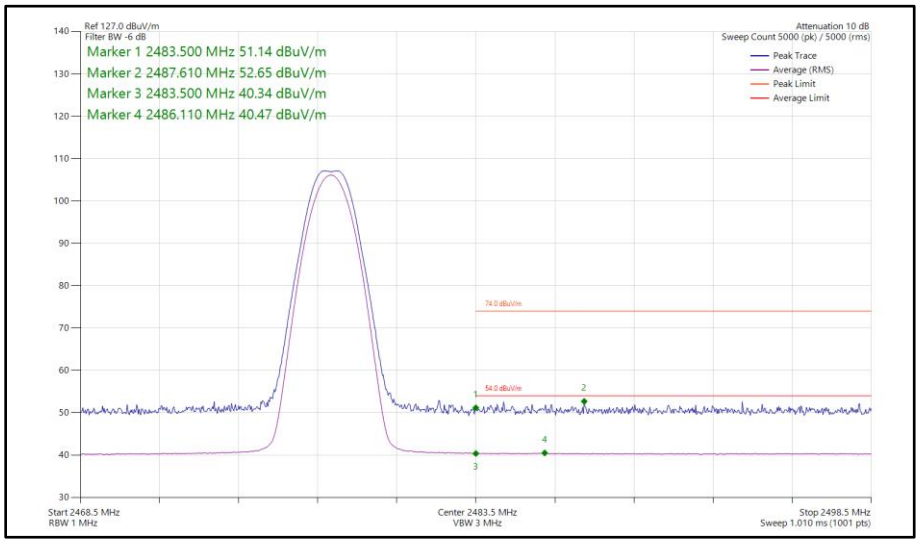

Figure 7 - Bluetooth LE1M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

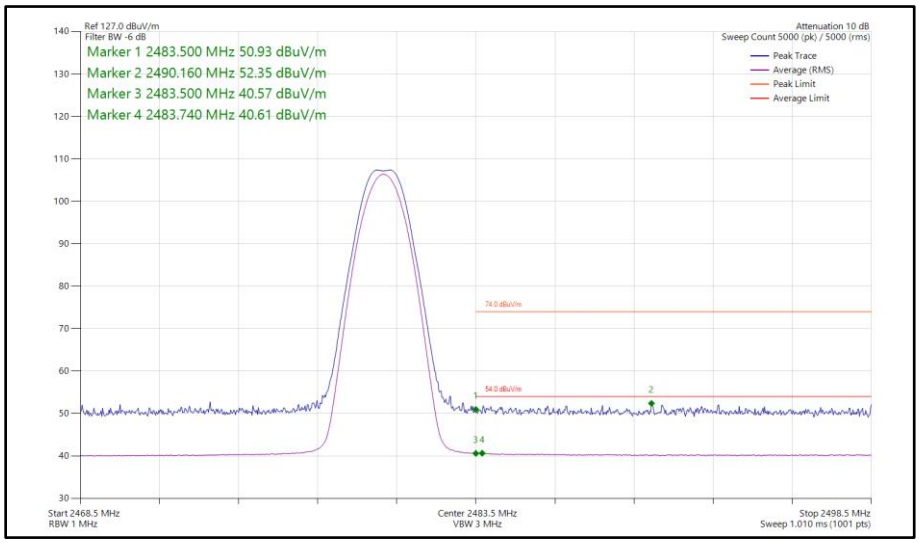

Figure 8 - Bluetooth LE1M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

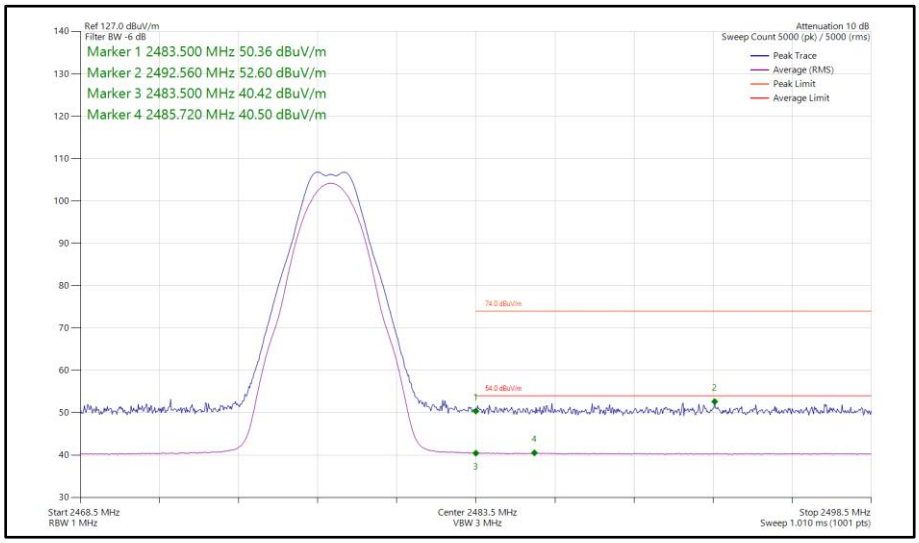

Figure 9 - Bluetooth LE2M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

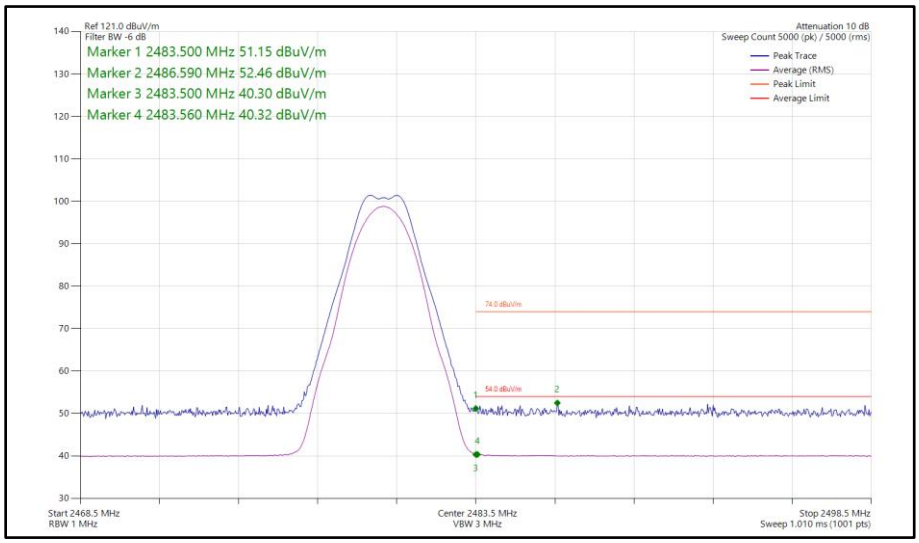

Figure 10 - Bluetooth LE2M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

iPA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	53.40	41.78
Static	HDR8	2404	2390	53.95	41.89
Static	LE1M	2402	2390	53.71	41.54
Static	LE2M	2402	2390	53.51	41.60
Static	HDR4	2476	2483.5	52.44	40.67
Static	HDR8	2476	2483.5	52.80	41.67
Static	LE1M	2478	2483.5	52.04	40.39
Static	LE1M	2480	2483.5	52.39	40.58
Static	LE2M	2478	2483.5	52.26	40.45
Static	LE2M	2480	2483.5	52.40	41.63

Table 9 - SISO Restricted Band Edge Results

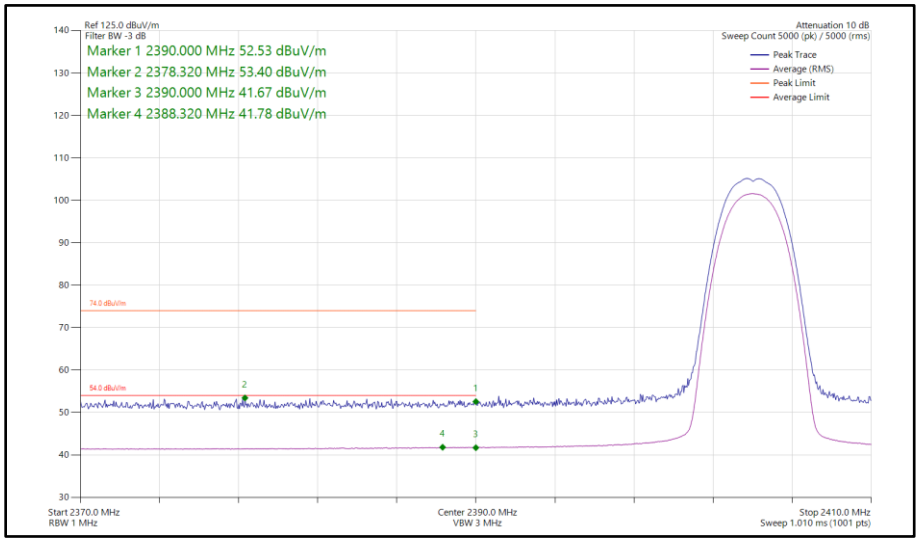

Figure 11 - Bluetooth HDR4, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

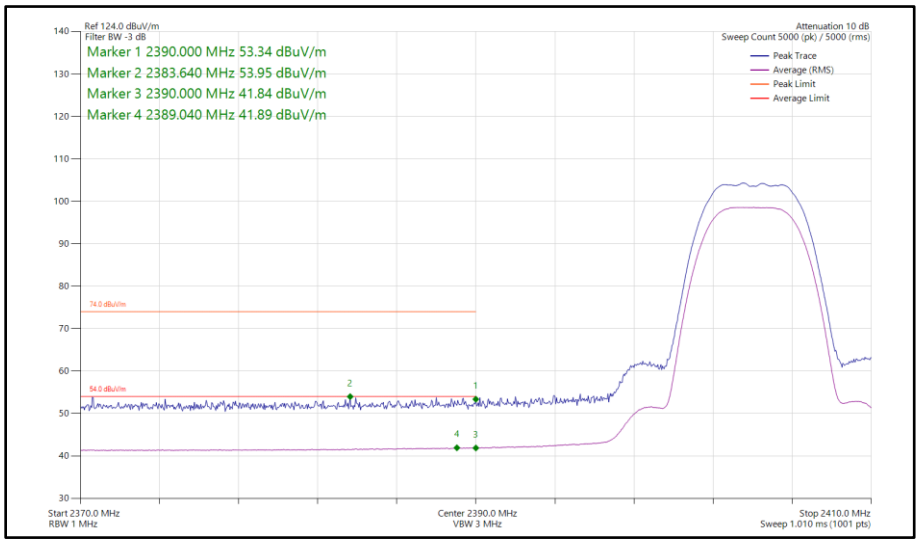

Figure 12 - Bluetooth HDR8, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

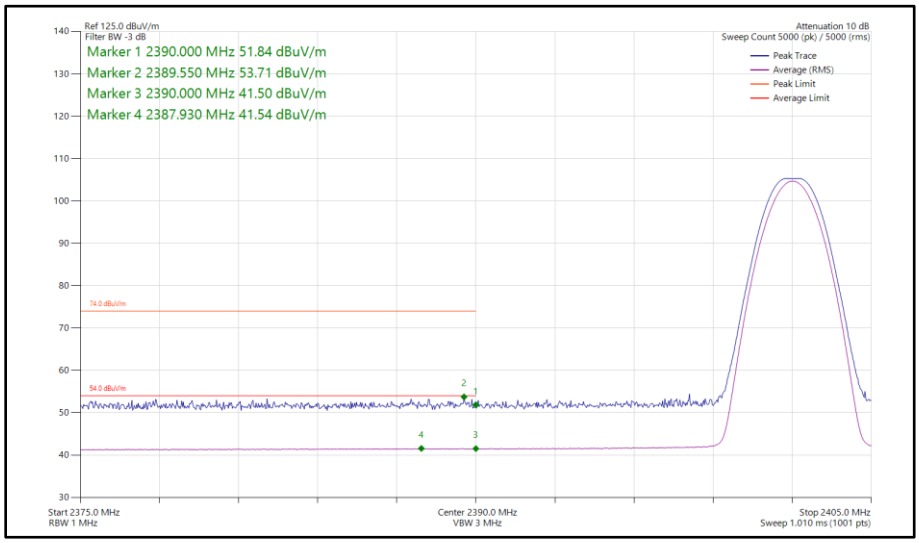

Figure 13 - Bluetooth LE1M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

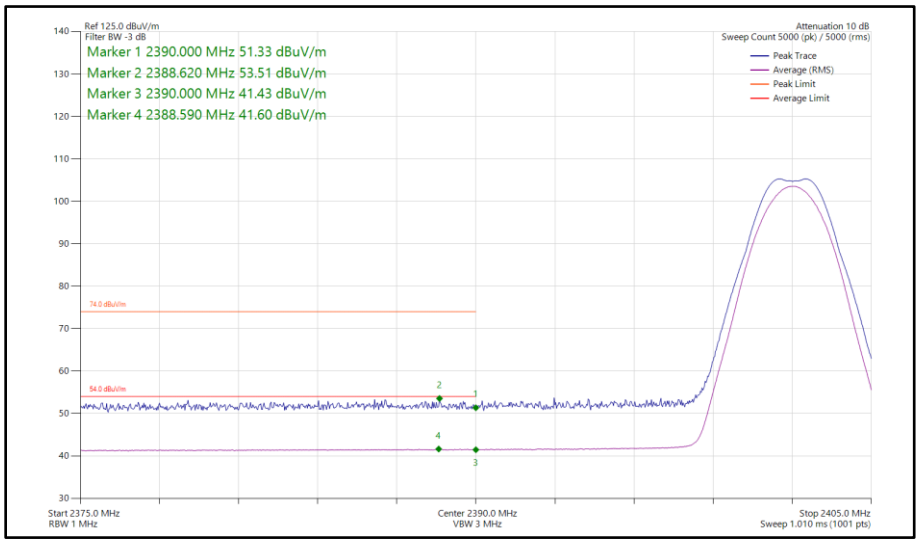

Figure 14 - Bluetooth LE2M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

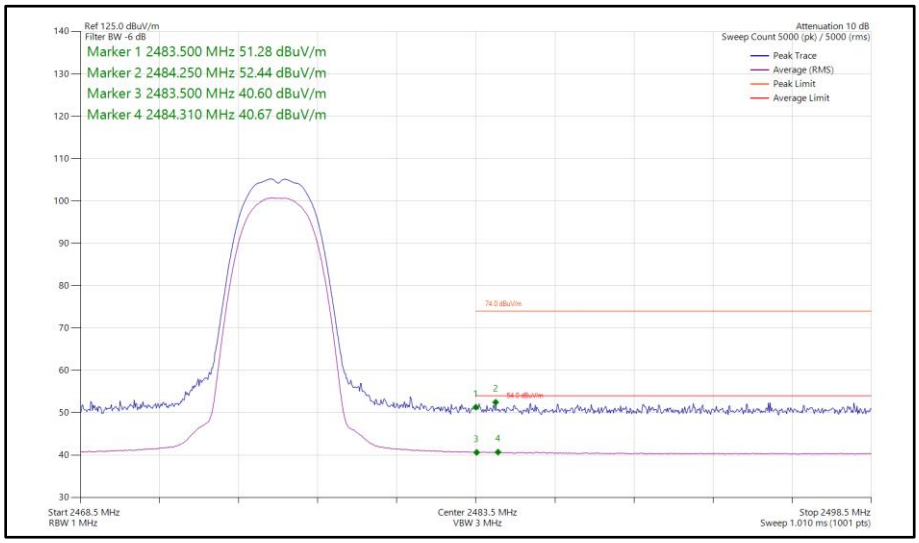

Figure 15 - Bluetooth HDR4, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz

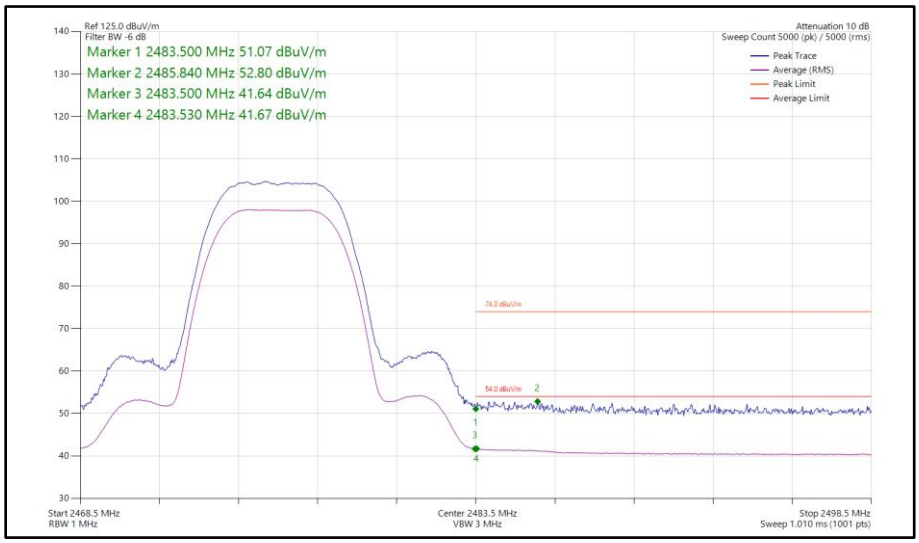

Figure 16 - Bluetooth HDR8, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz

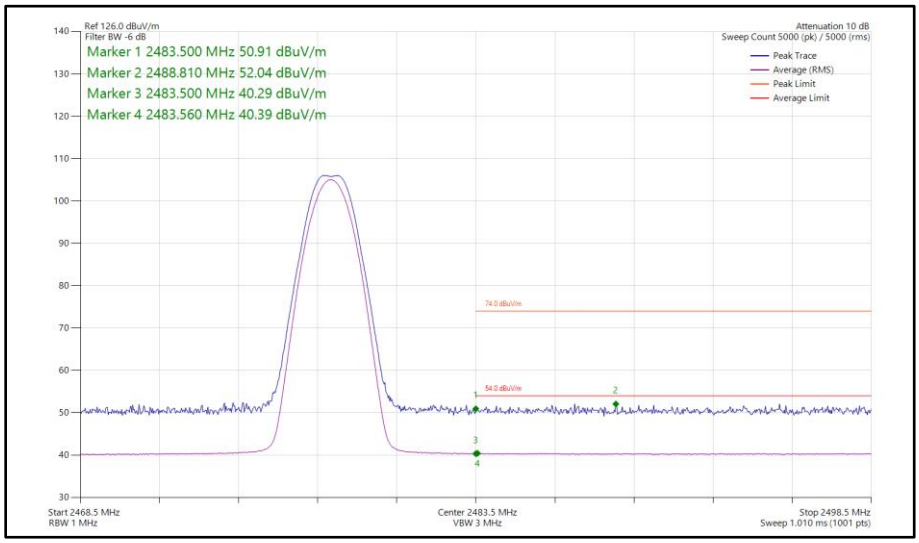

Figure 17 - Bluetooth LE1M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz

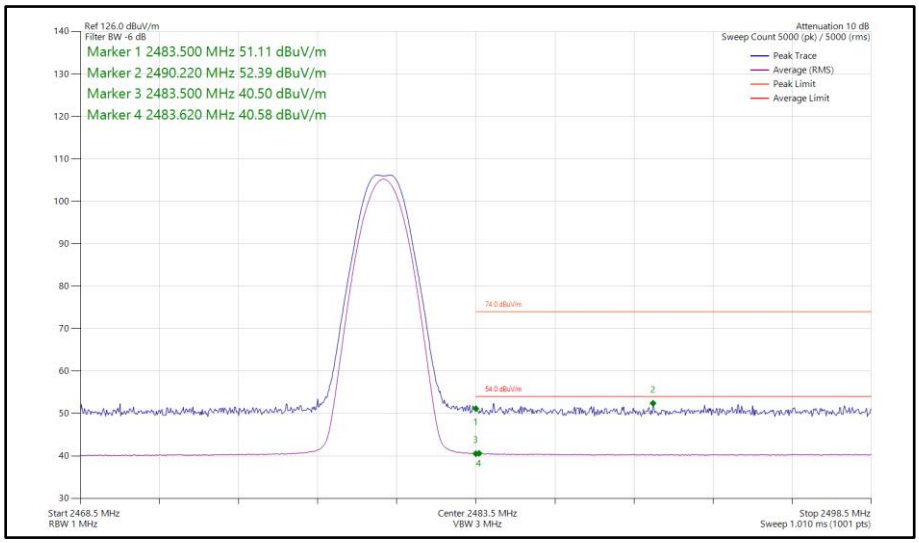

Figure 18 - Bluetooth LE1M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

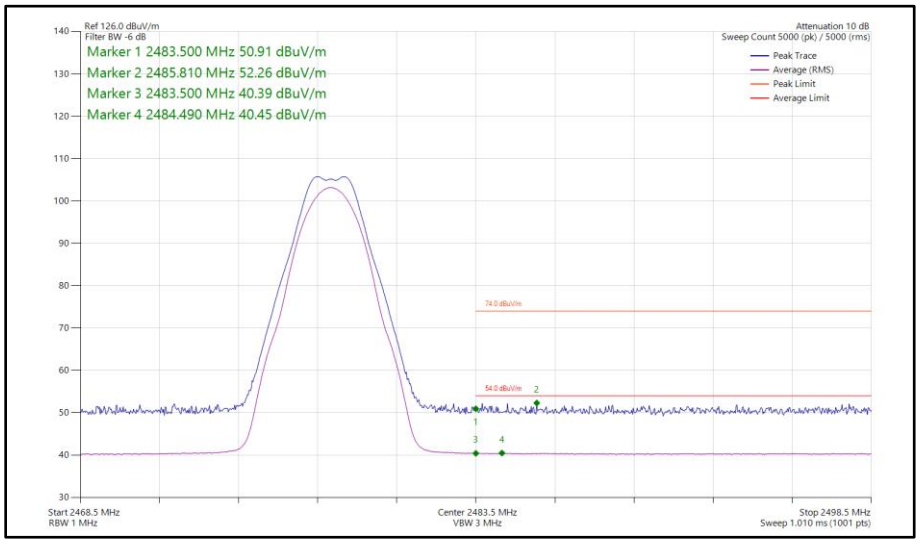

Figure 19 - Bluetooth LE2M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz

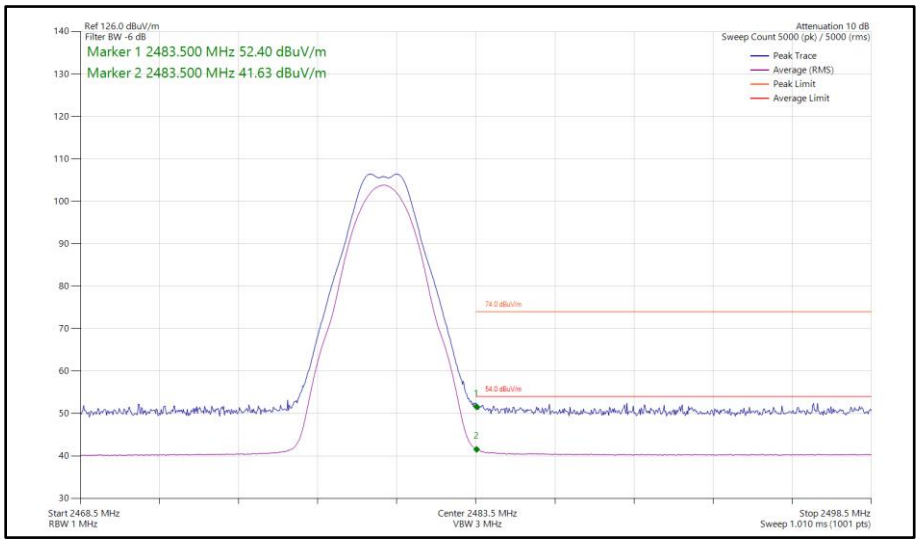

Figure 20 - Bluetooth LE2M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

iPA - Core 2 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	53.83	41.66
Static	HDR8	2404	2390	53.45	41.63
Static	LE1M	2402	2390	53.38	41.58
Static	LE2M	2402	2390	53.19	41.30
Static	HDR4	2476	2483.5	52.51	40.57
Static	HDR8	2476	2483.5	52.68	41.60
Static	LE1M	2478	2483.5	52.57	40.41
Static	LE1M	2480	2483.5	52.72	40.61
Static	LE2M	2478	2483.5	52.13	40.41
Static	LE2M	2480	2483.5	52.68	41.59

Table 10 - SISO Restricted Band Edge Results

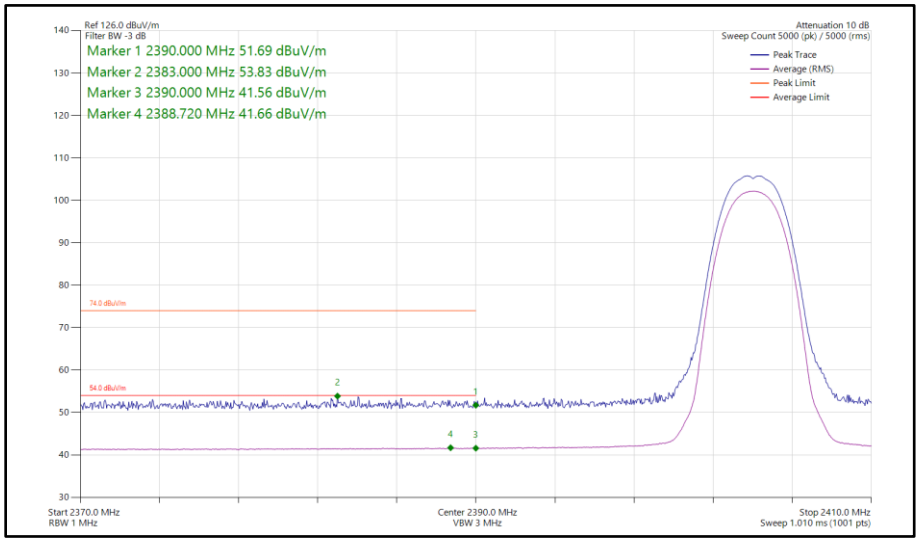

Figure 21 - Bluetooth HDR4, SISO, Core 2 - 2404 MHz
Band Edge Frequency 2390 MHz

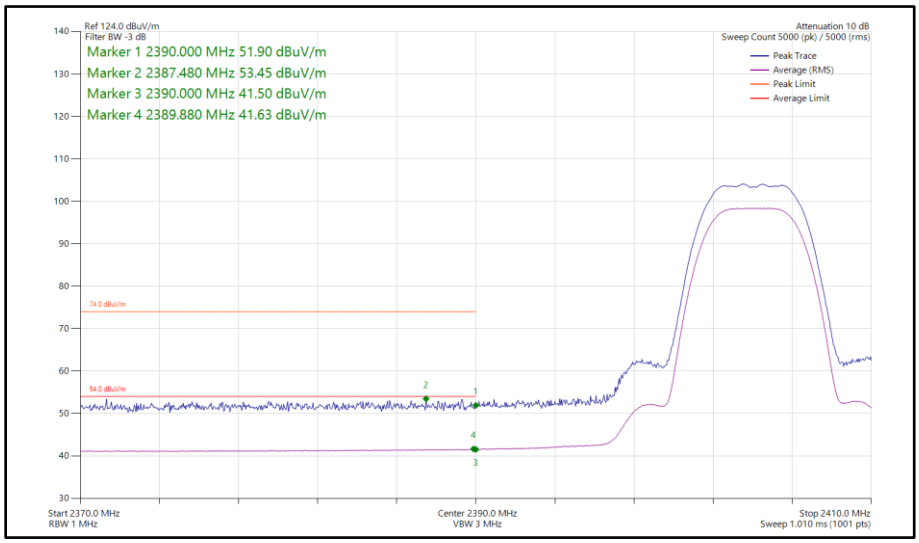

Figure 22 - Bluetooth HDR8, SISO, Core 2 - 2404 MHz
Band Edge Frequency 2390 MHz

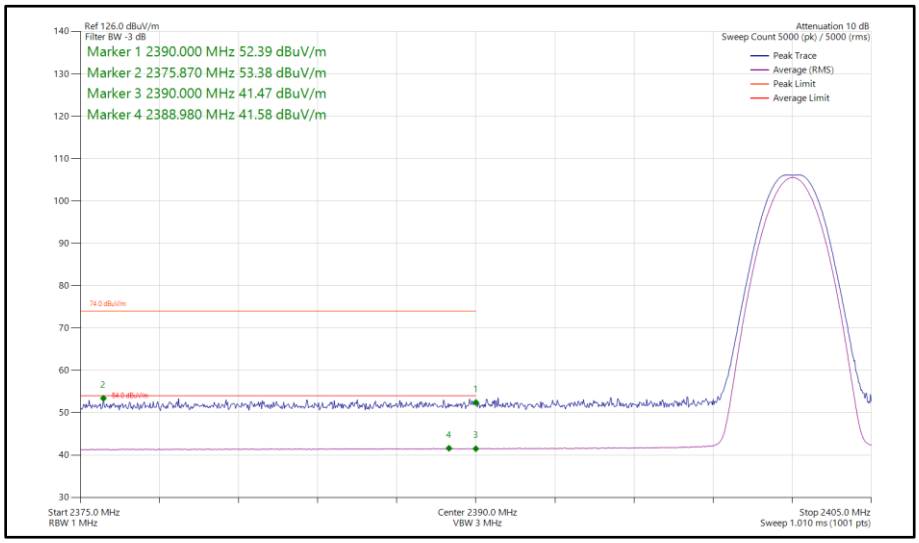

Figure 23 - Bluetooth LE1M, SISO, Core 2 - 2402 MHz
Band Edge Frequency 2390 MHz

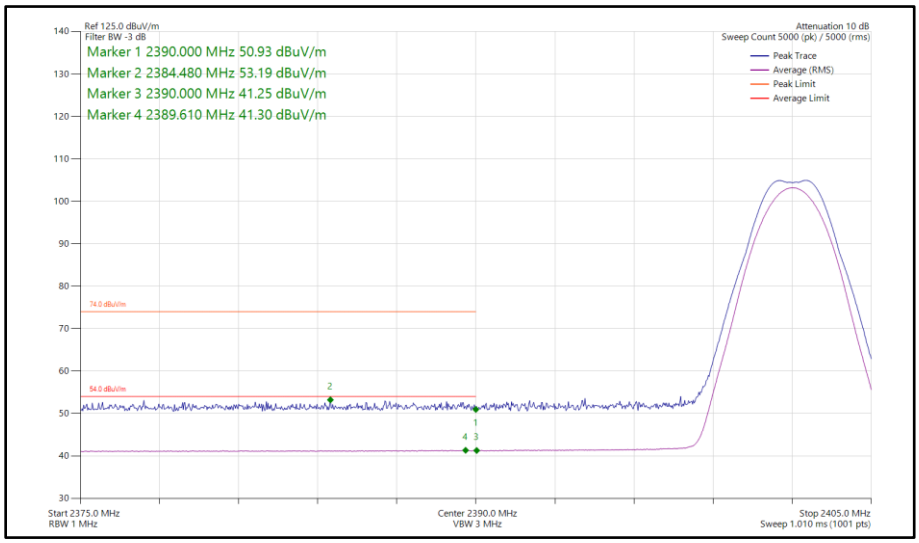

Figure 24 - Bluetooth LE2M, SISO, Core 2 - 2402 MHz
Band Edge Frequency 2390 MHz

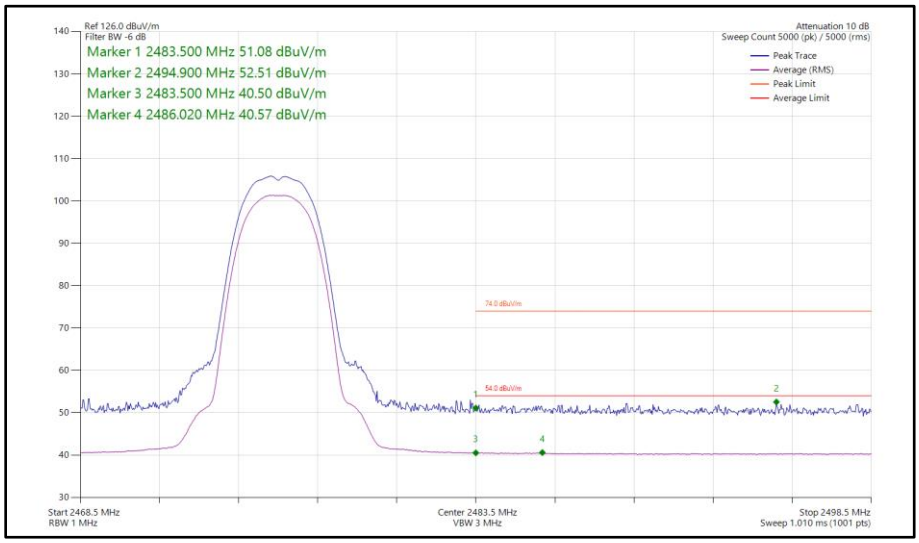

Figure 25 - Bluetooth HDR4, SISO, Core 2 - 2476 MHz
Band Edge Frequency 2483.5 MHz

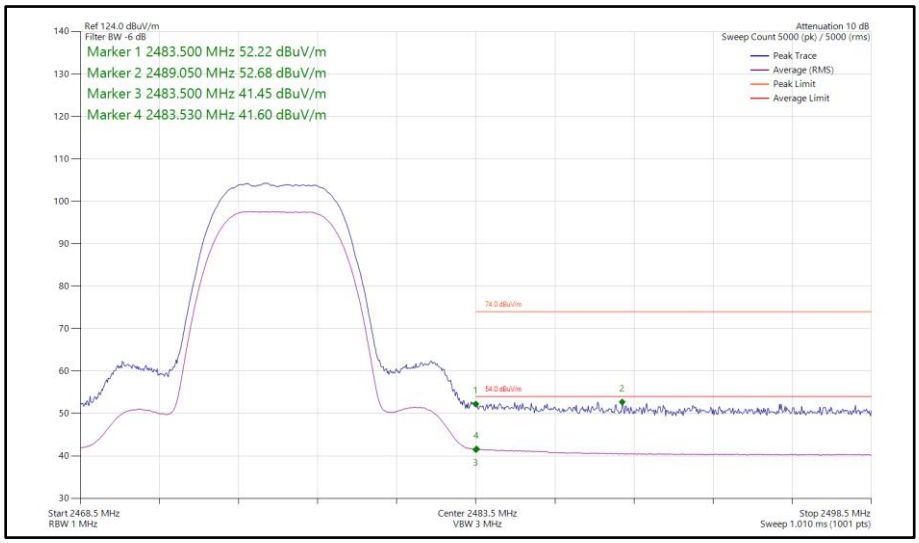

Figure 26 - Bluetooth HDR8, SISO, Core 2 - 2476 MHz
Band Edge Frequency 2483.5 MHz

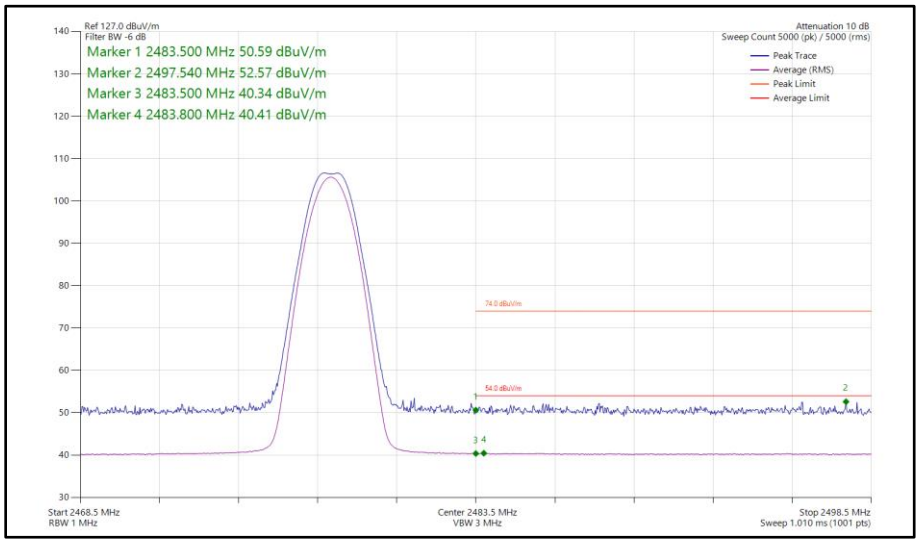

Figure 27 - Bluetooth LE1M, SISO, Core 2 - 2478 MHz
Band Edge Frequency 2483.5 MHz

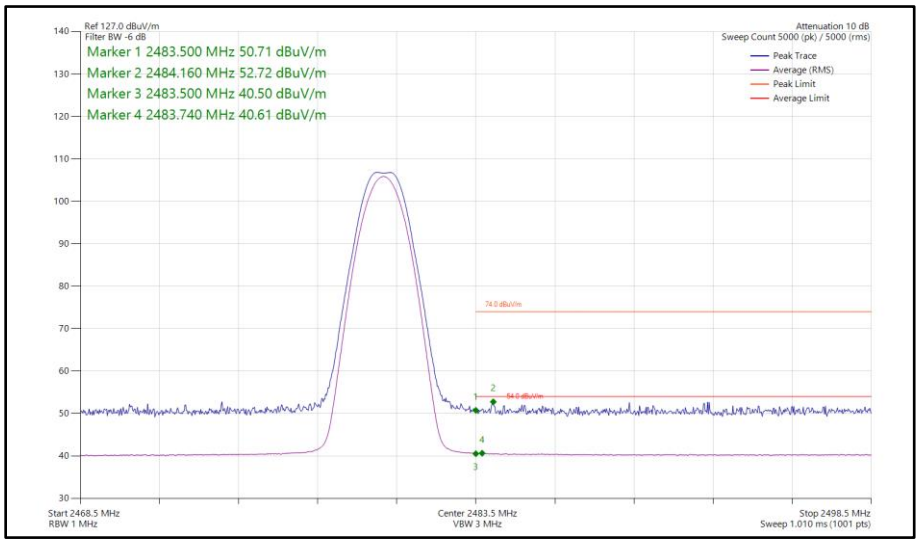

Figure 28 - Bluetooth LE1M, SISO, Core 2 - 2480 MHz
Band Edge Frequency 2483.5 MHz

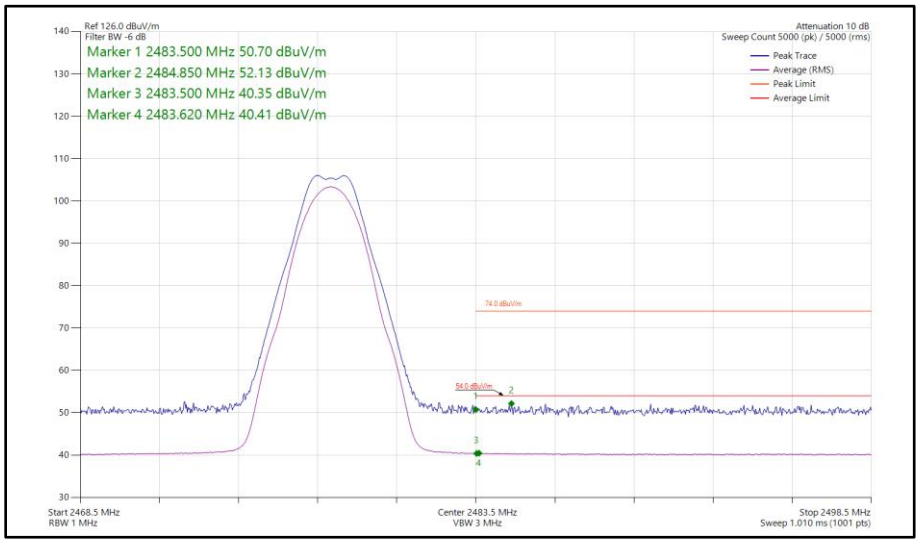

Figure 29 - Bluetooth LE2M, SISO, Core 2 - 2478 MHz
Band Edge Frequency 2483.5 MHz

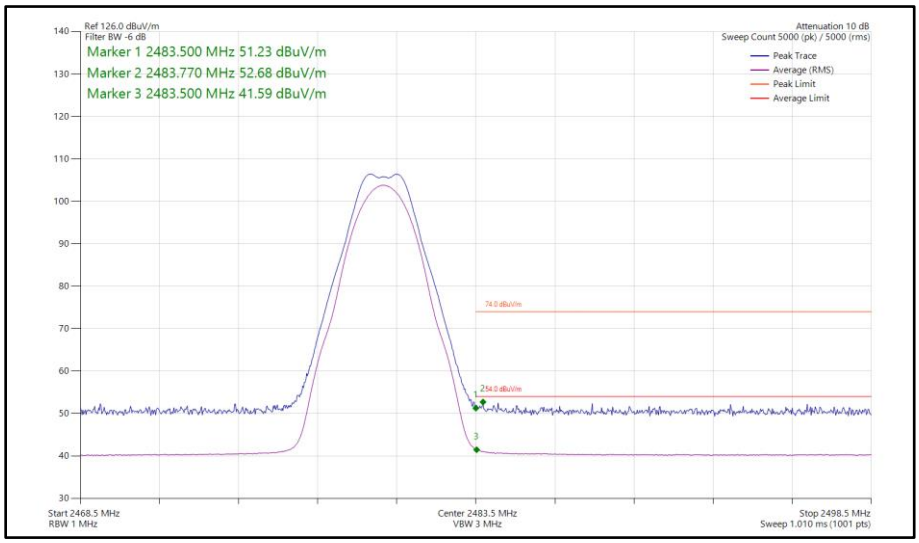

Figure 30 - Bluetooth LE2M, SISO, Core 2 - 2480 MHz
Band Edge Frequency 2483.5 MHz

iPA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	53.79	41.88
Static	HDR8	2404	2390	53.70	42.29
Static	LE1M	2402	2390	53.86	41.68
Static	LE2M	2402	2390	53.72	41.73
Static	HDR4	2476	2483.5	52.79	40.88
Static	HDR8	2476	2483.5	53.96	42.72
Static	LE1M	2478	2483.5	52.56	40.90
Static	LE1M	2480	2483.5	53.04	41.40
Static	LE2M	2478	2483.5	52.79	40.89
Static	LE2M	2480	2483.5	54.54	43.34

Table 11 - MIMO Restricted Band Edge Results

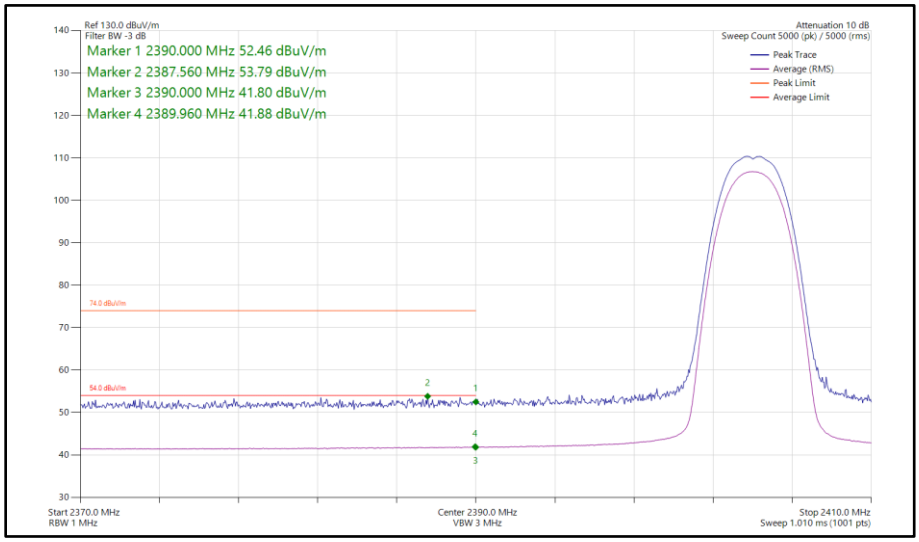

Figure 31 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2404 MHz Band Edge Frequency 2390 MHz

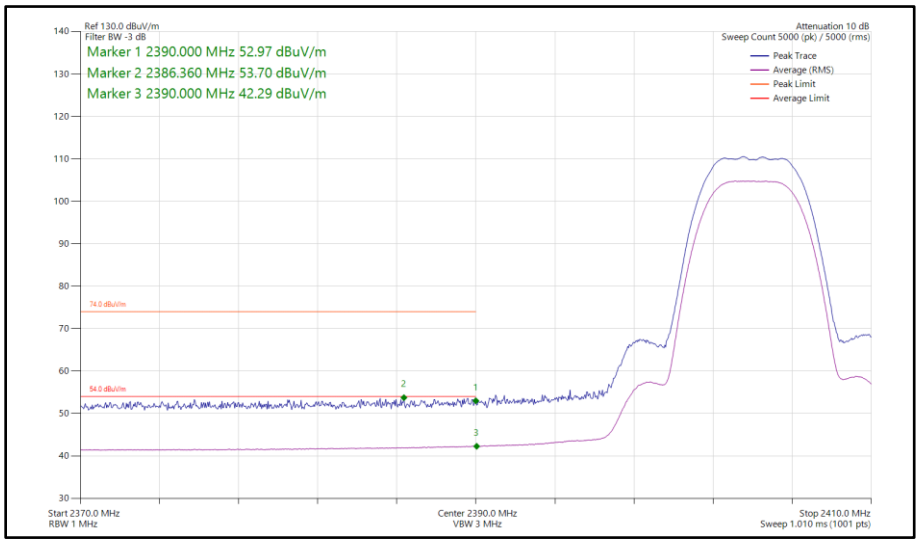

Figure 32 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2404 MHz Band Edge Frequency 2390 MHz

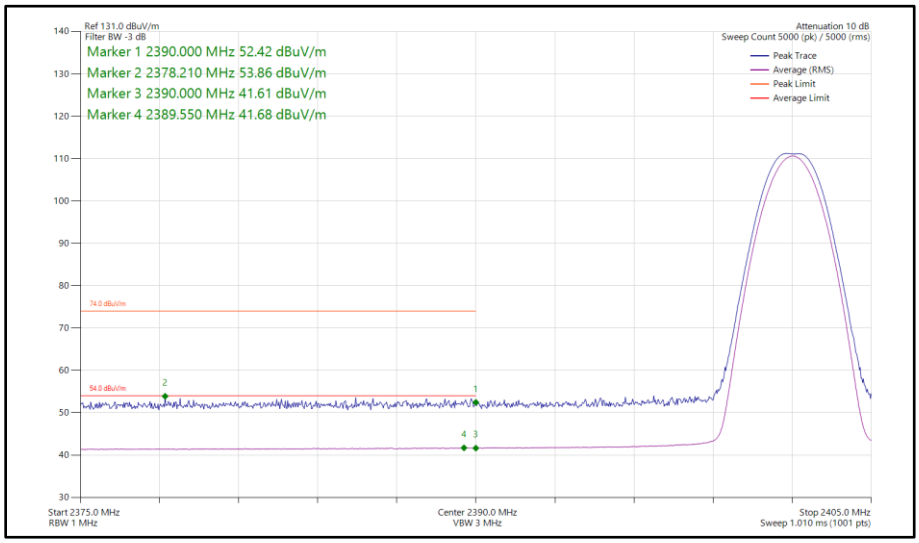

Figure 33 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2402 MHz Band Edge Frequency 2390 MHz

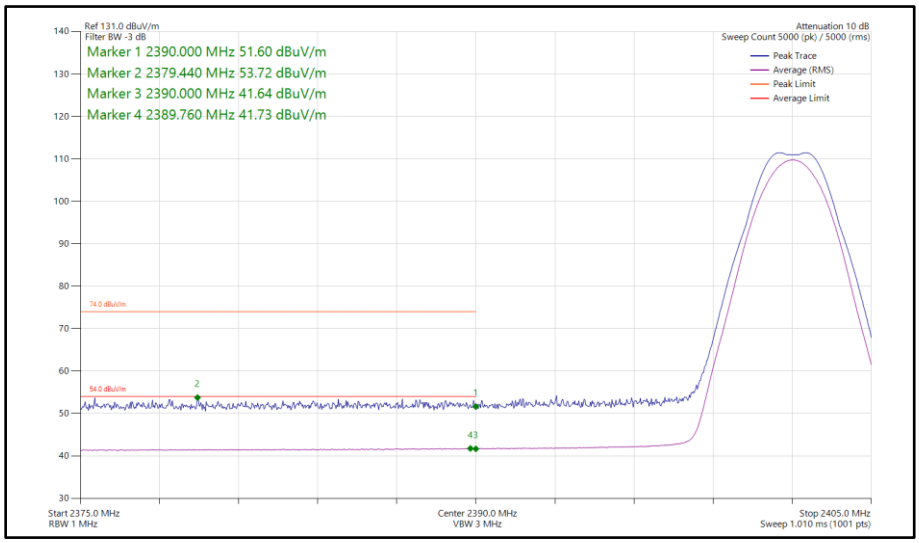

Figure 34 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2402 MHz Band Edge Frequency 2390 MHz

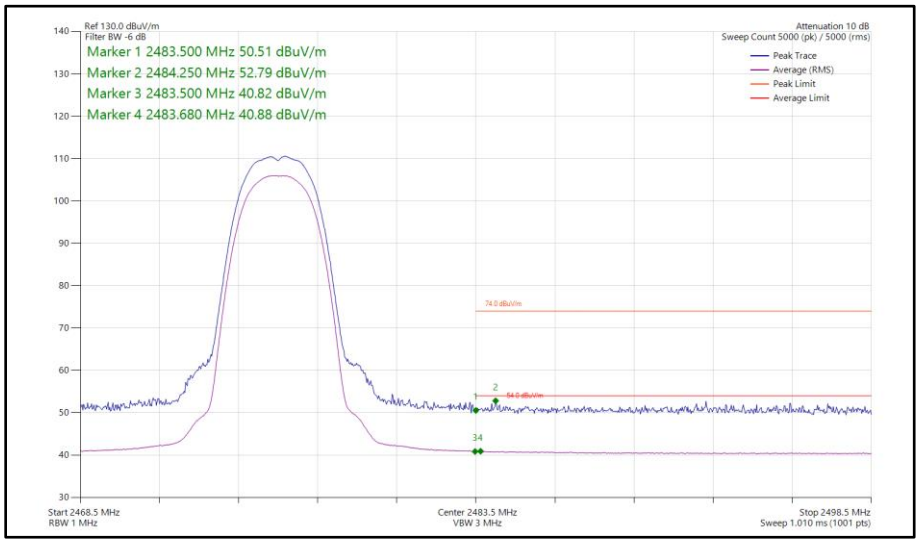

Figure 35 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2476 MHz Band Edge Frequency 2483.5 MHz

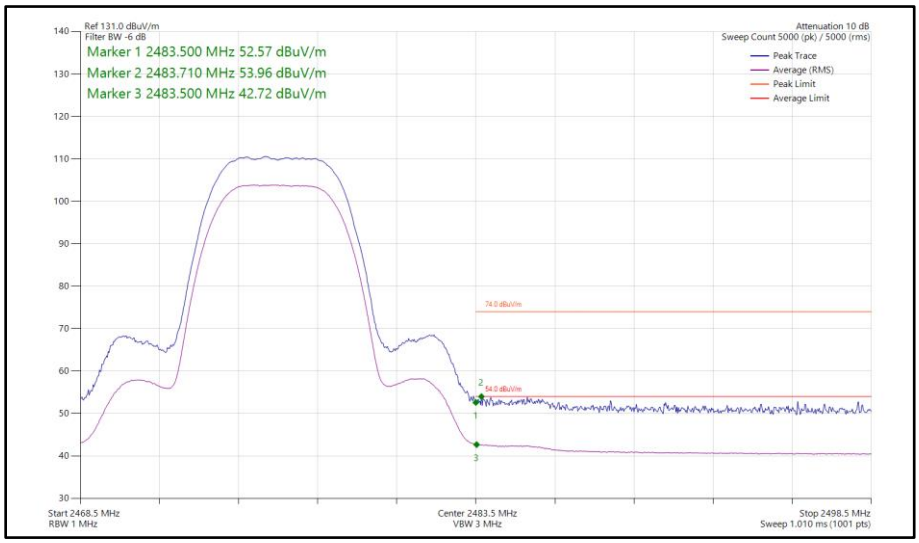

Figure 36 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2476 MHz Band Edge Frequency 2483.5 MHz

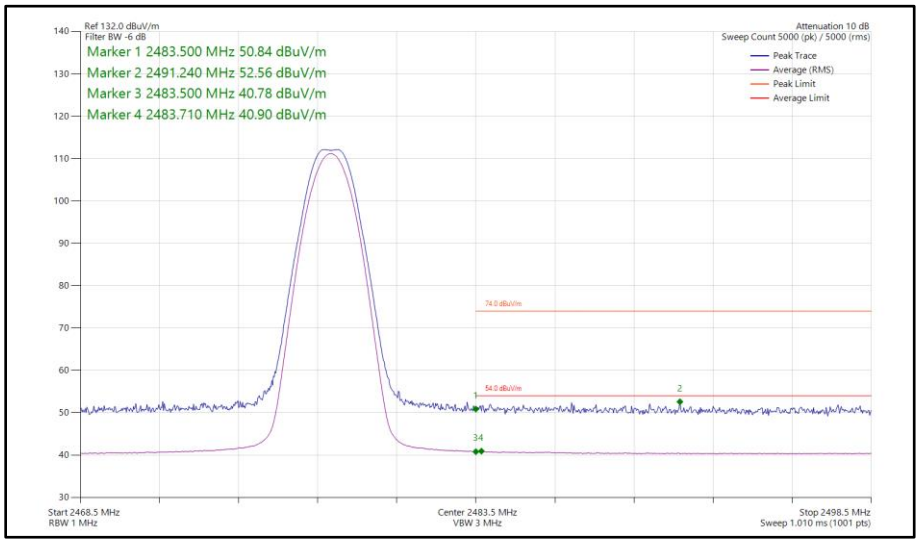

Figure 37 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2478 MHz Band Edge Frequency 2483.5 MHz

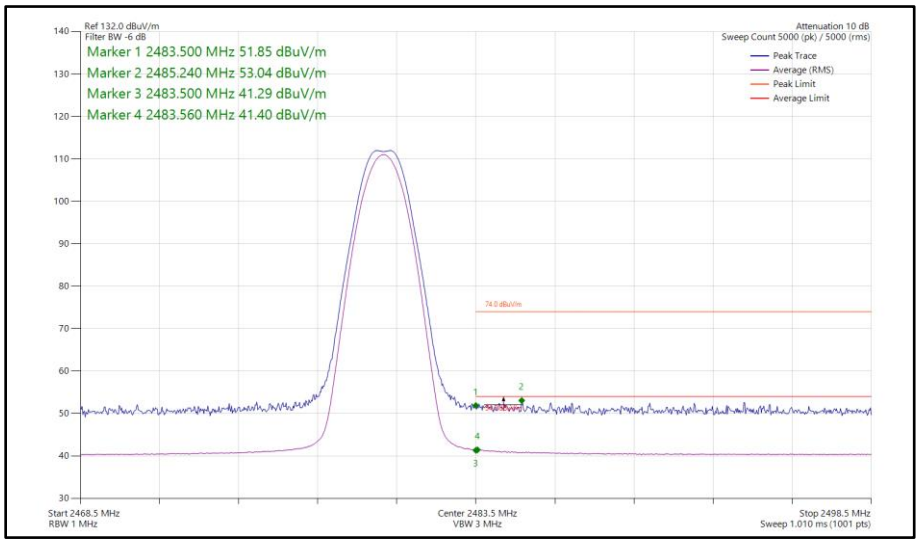

Figure 38 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2480 MHz Band Edge Frequency 2483.5 MHz

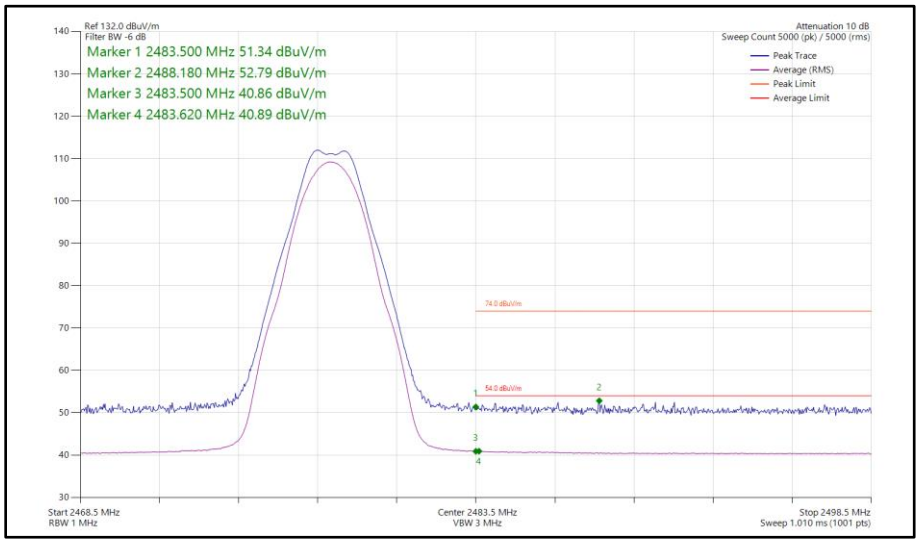

Figure 39 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2478 MHz Band Edge Frequency 2483.5 MHz

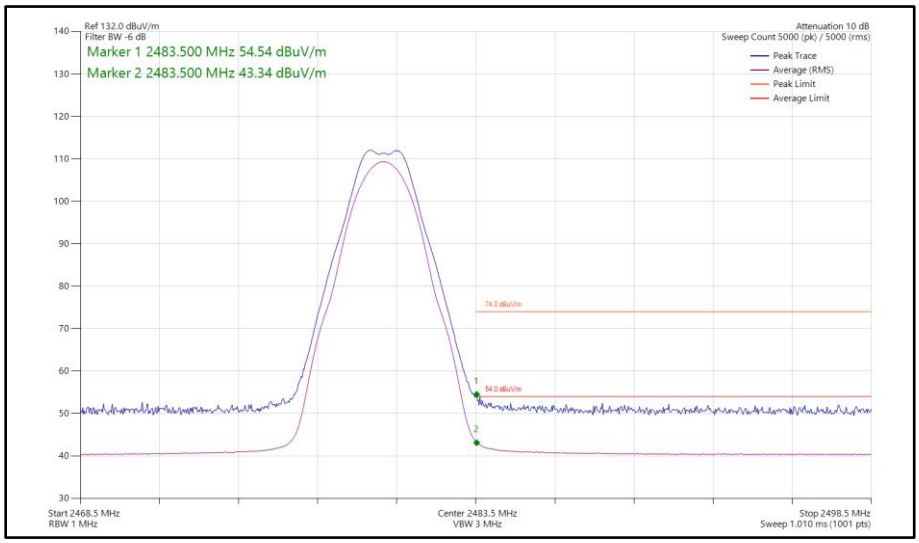

Figure 40 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2480 MHz Band Edge Frequency 2483.5 MHz

ePA - Core 0 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	55.17	43.44
Static	HDR8	2404	2390	56.65	45.15
Static	LE1M	2402	2390	55.74	43.58
Static	LE2M	2402	2390	55.10	43.52
Static	HDR4	2476	2483.5	55.35	43.86
Static	HDR8	2476	2483.5	58.95	47.65
Static	LE1M	2478	2483.5	54.96	43.26
Static	LE1M	2480	2483.5	55.85	44.61
Static	LE2M	2478	2483.5	55.26	44.05
Static	LE2M	2480	2483.5	58.26	47.95

Table 12 - SISO Restricted Band Edge Results

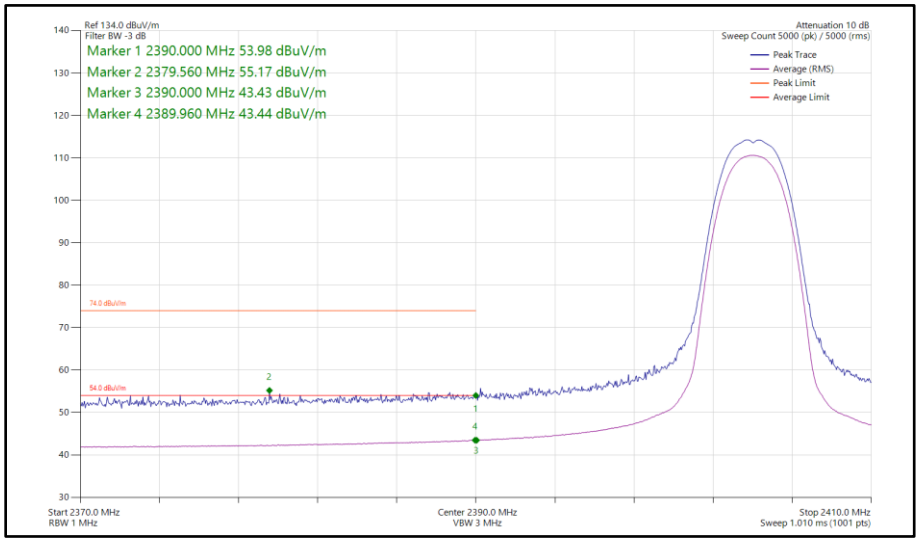

Figure 41 - Bluetooth HDR4, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz

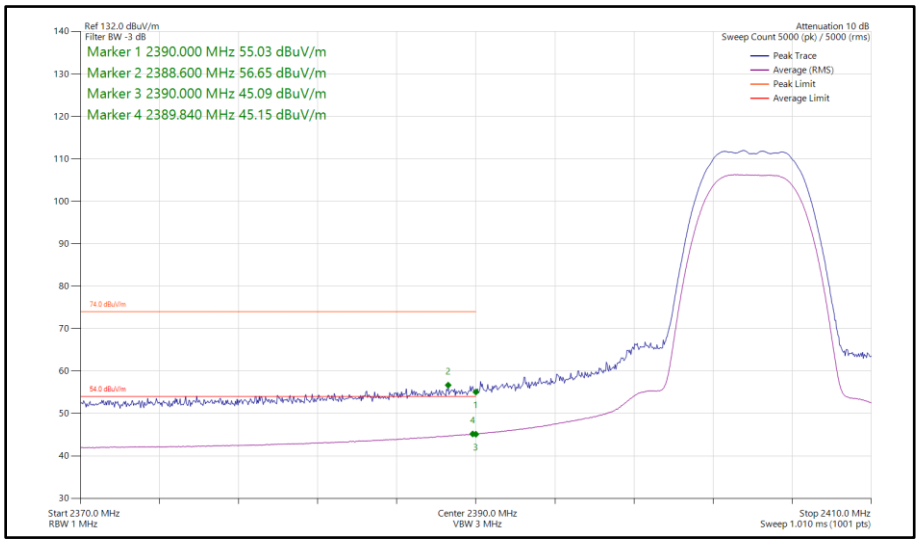

Figure 42 - Bluetooth HDR8, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz

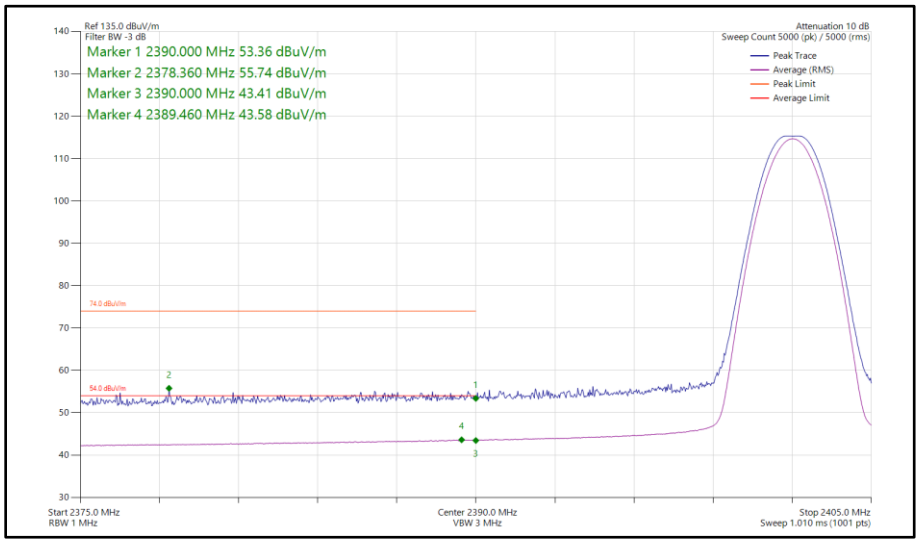

Figure 43 - Bluetooth LE1M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

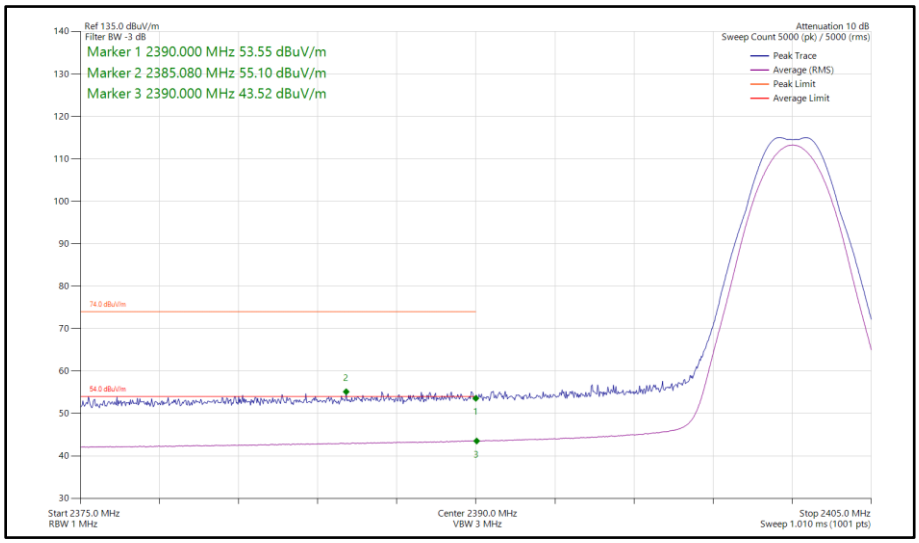

Figure 44 - Bluetooth LE2M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

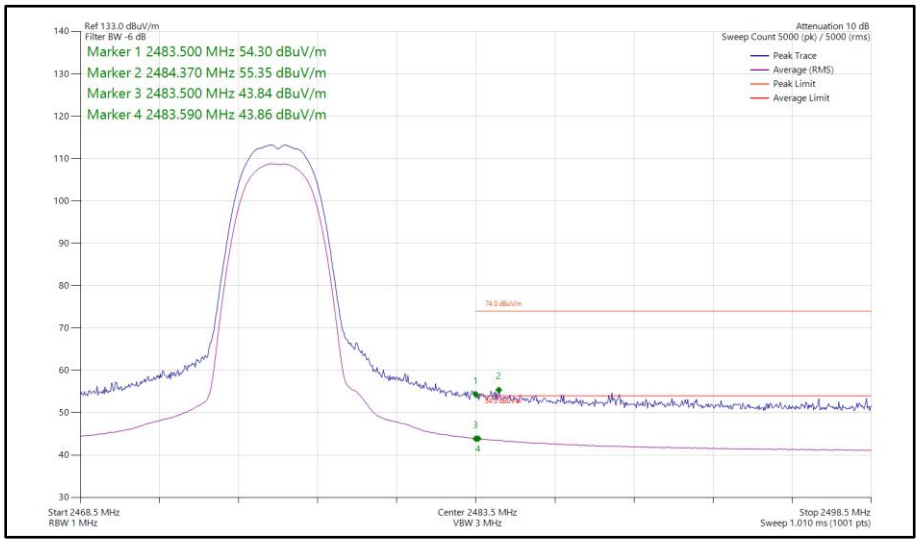

Figure 45 - Bluetooth HDR4, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

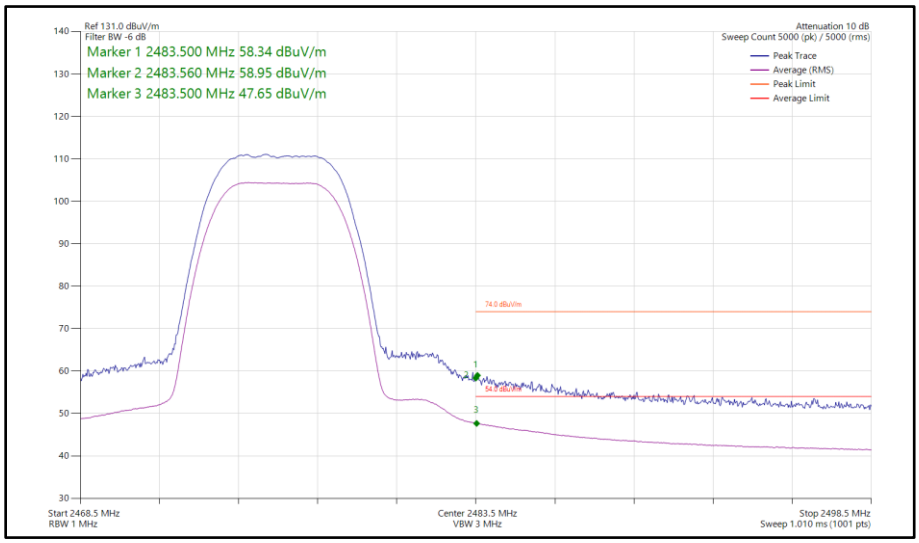

Figure 46 - Bluetooth HDR8, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

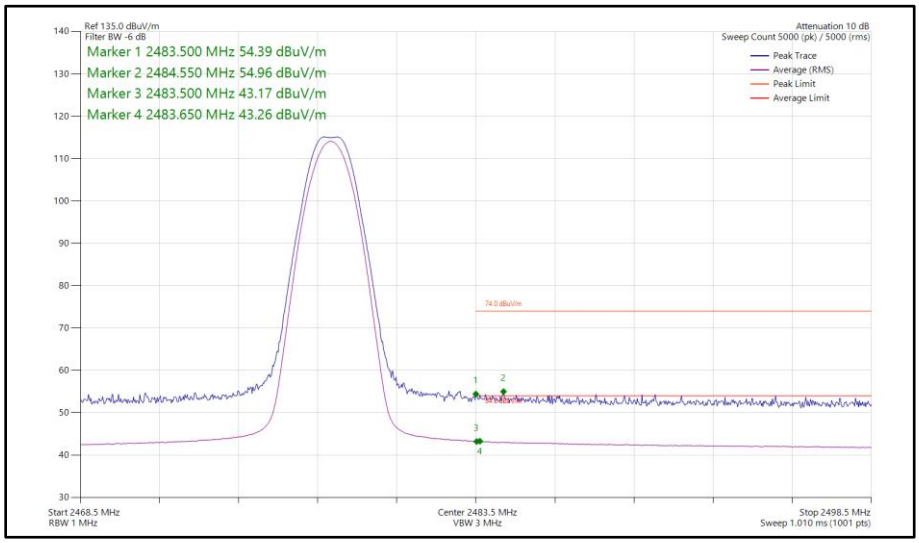

Figure 47 - Bluetooth LE1M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

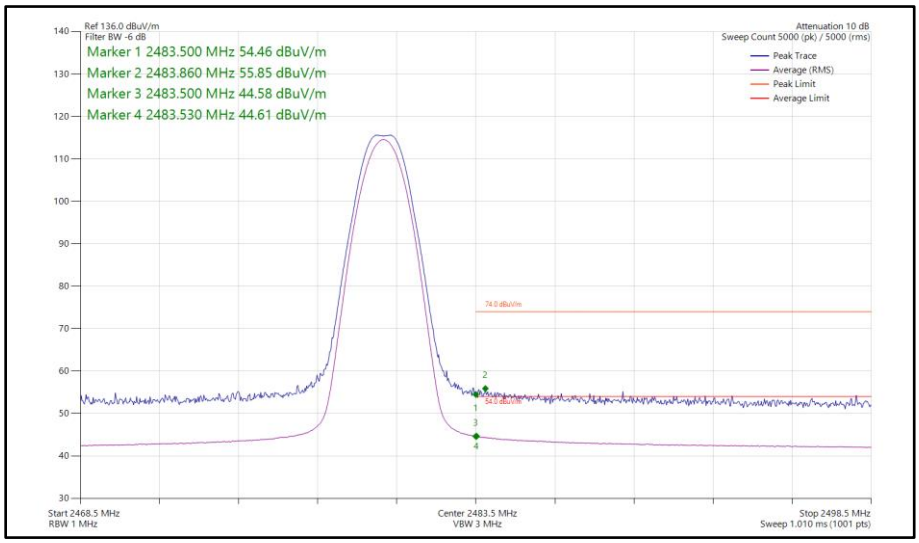

Figure 48 - Bluetooth LE1M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

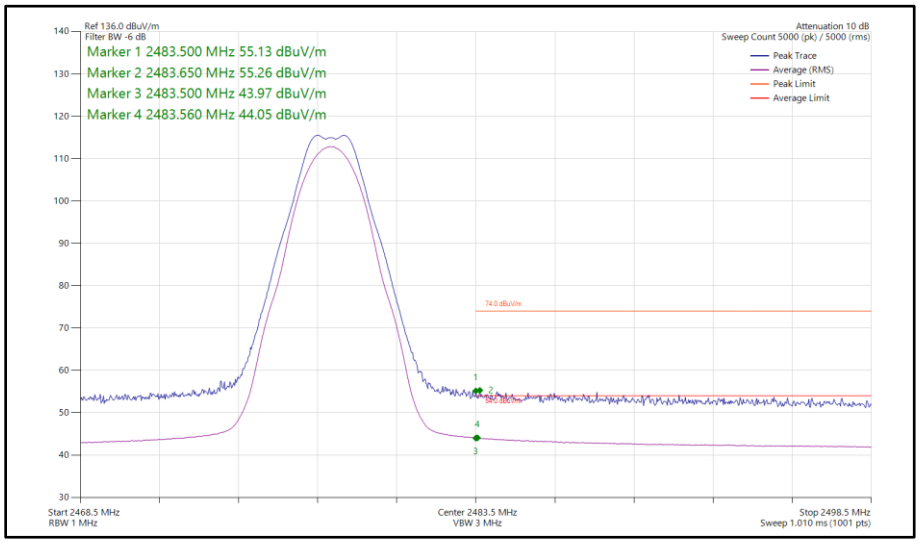

Figure 49 - Bluetooth LE2M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

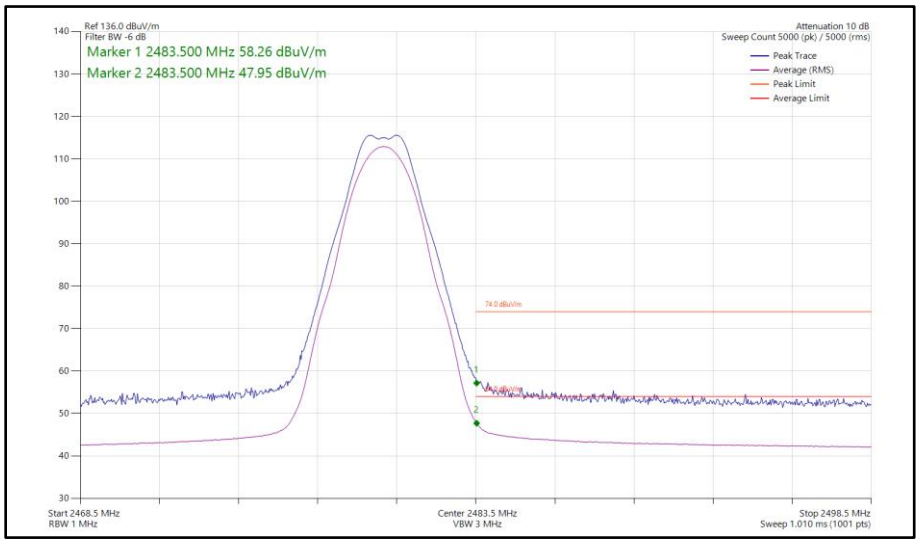

Figure 50 - Bluetooth LE2M, SISO, Core 0 - 2480 MHz Band Edge Frequency 2483.5 MHz

ePA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	55.14	43.51
Static	HDR8	2404	2390	56.09	44.34
Static	LE1M	2402	2390	54.67	43.02
Static	LE2M	2402	2390	54.95	42.90
Static	HDR4	2476	2483.5	54.67	43.17
Static	HDR8	2476	2483.5	56.09	45.03
Static	LE1M	2478	2483.5	53.77	42.29
Static	LE1M	2480	2483.5	54.17	43.34
Static	LE2M	2478	2483.5	54.30	42.82
Static	LE2M	2480	2483.5	56.82	45.94

Table 13 - SISO Restricted Band Edge Results

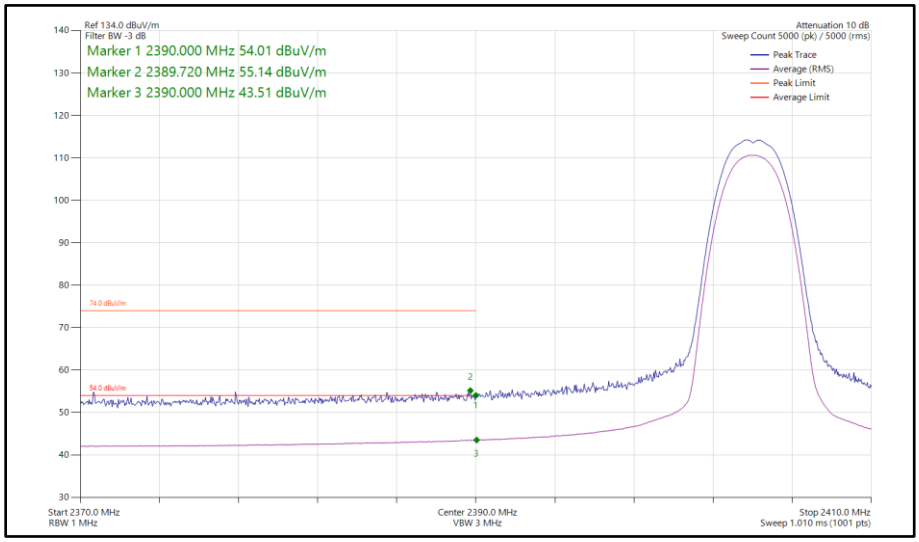

Figure 51 - Bluetooth HDR4, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

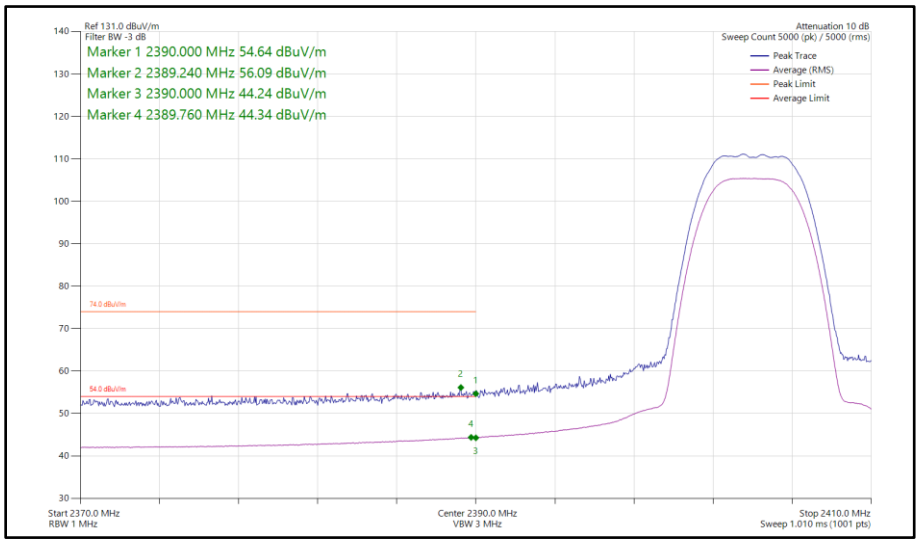

Figure 52 - Bluetooth HDR8, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

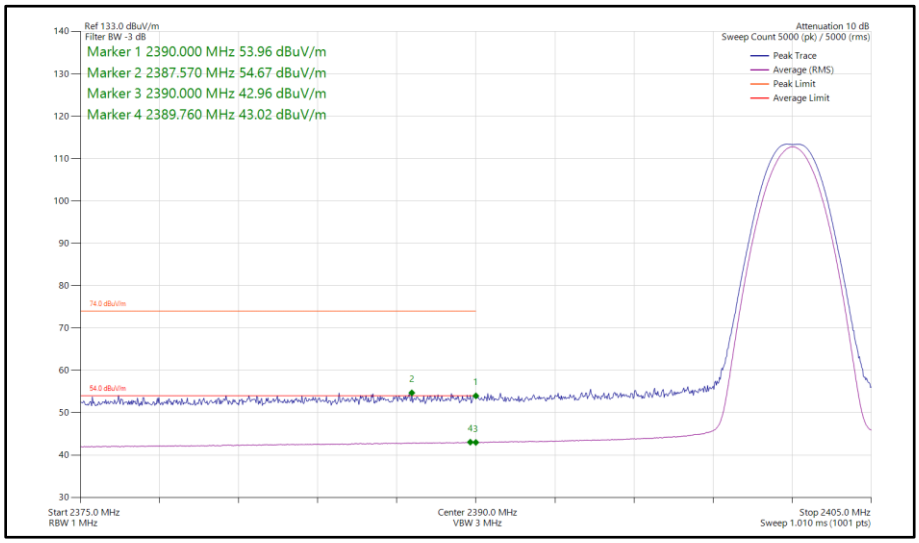

Figure 53 - Bluetooth LE1M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

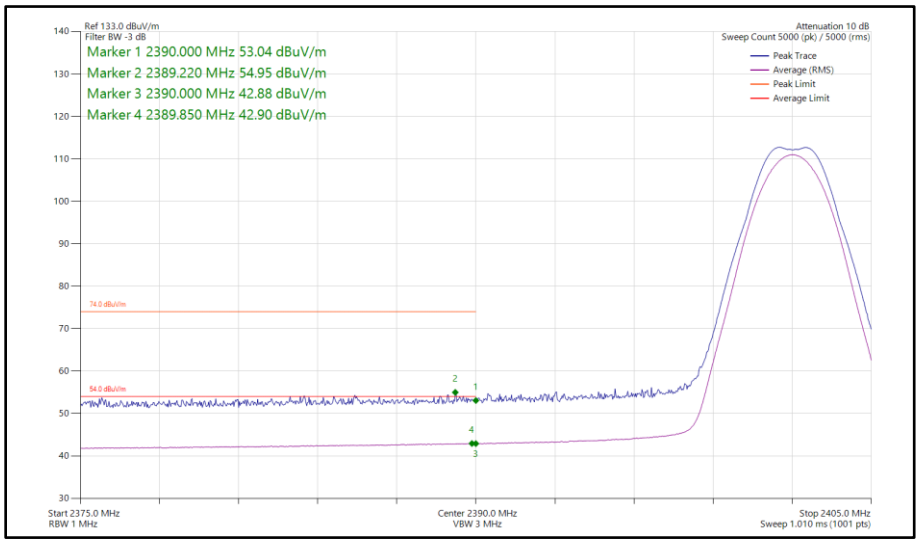

Figure 54 - Bluetooth LE2M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

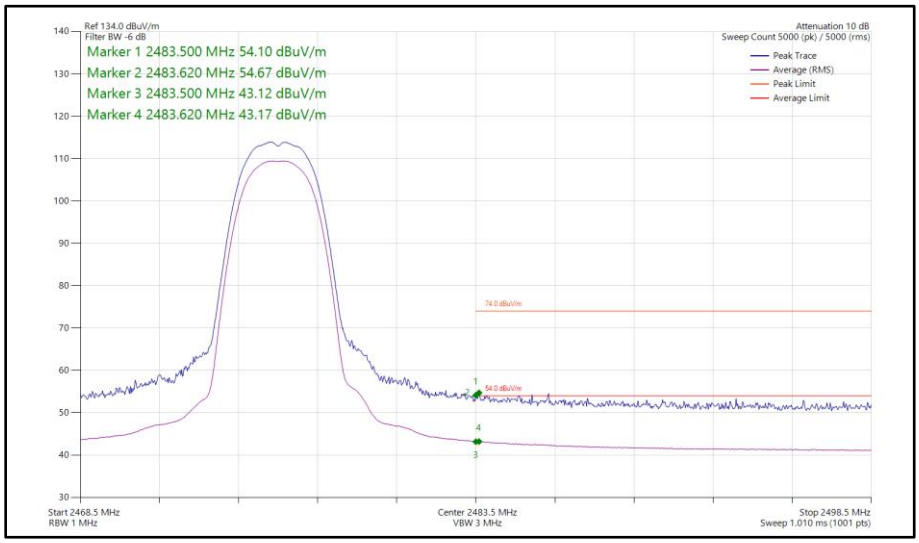

Figure 55 - Bluetooth HDR4, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz

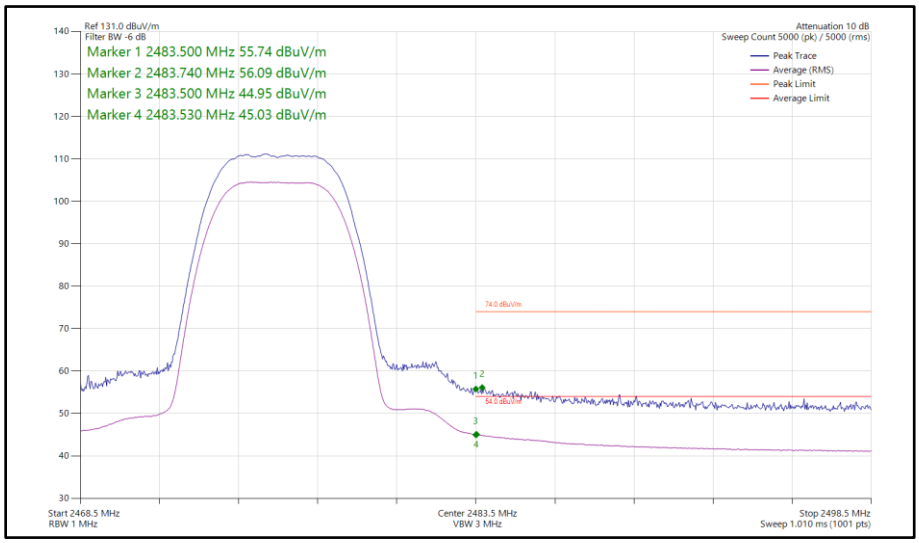

Figure 56 - Bluetooth HDR8, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz

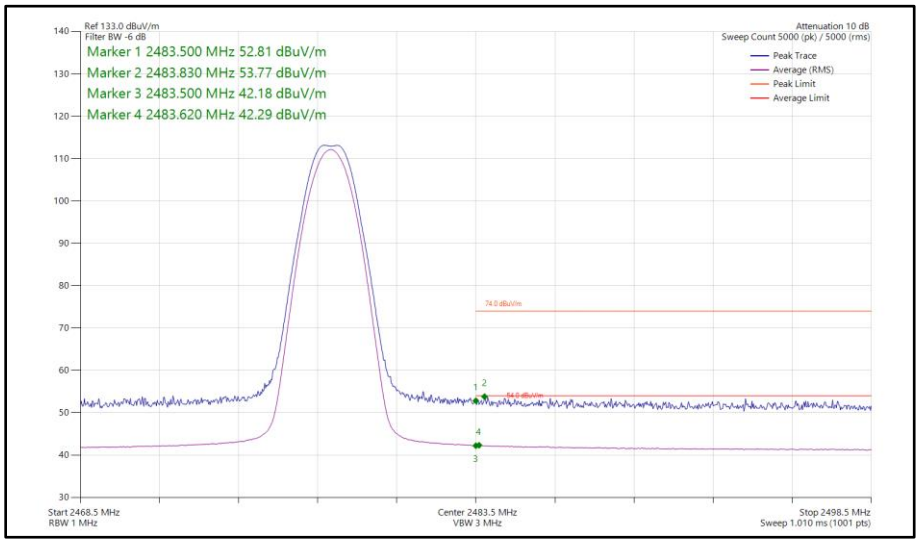

Figure 57 - Bluetooth LE1M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz

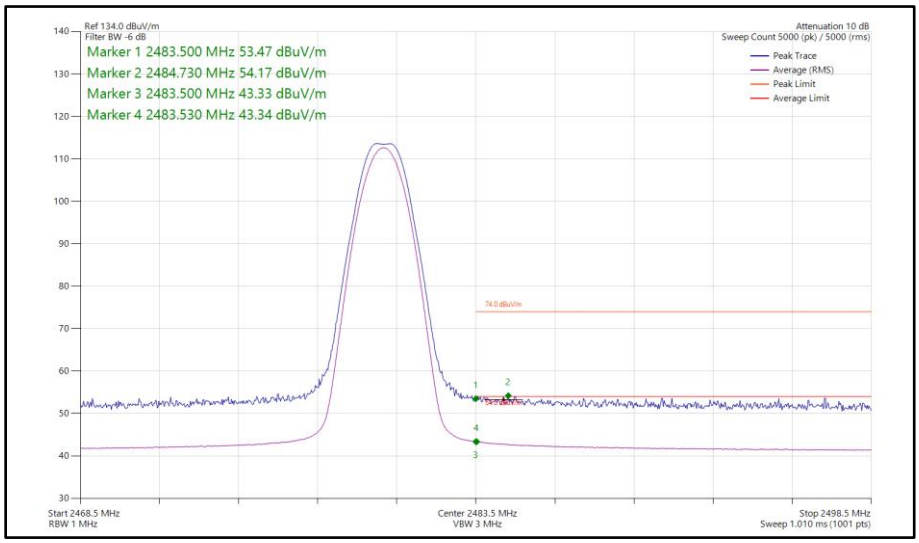

Figure 58 - Bluetooth LE1M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

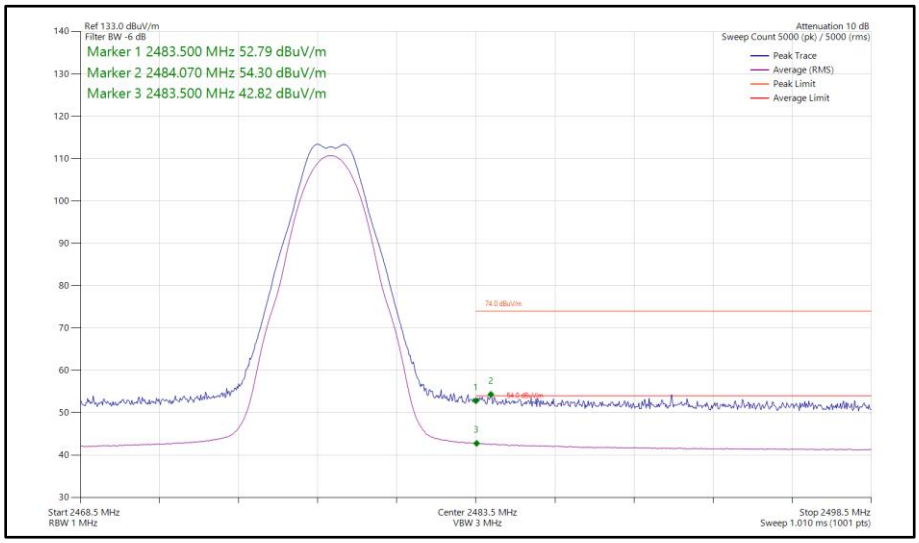

Figure 59 - Bluetooth LE2M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz

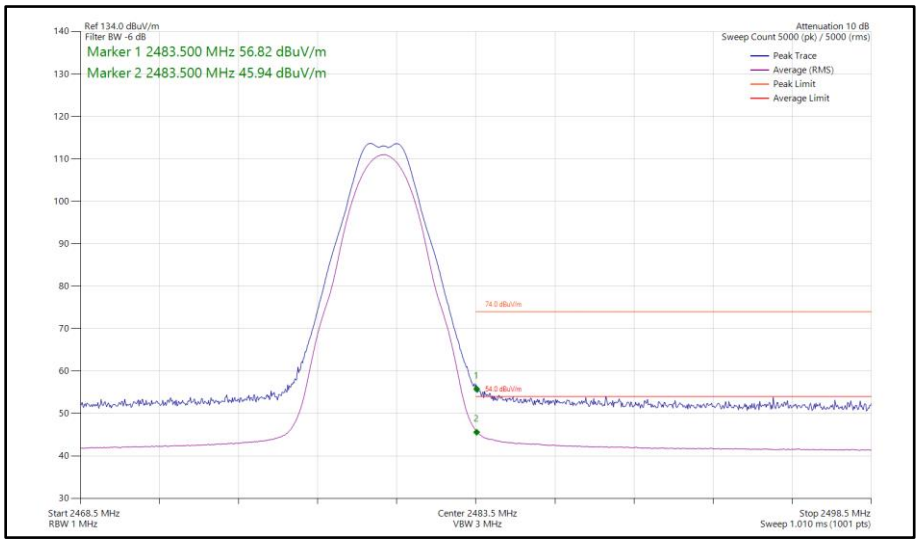

Figure 60 - Bluetooth LE2M, SISO, Core 1 - 2480 MHz Band Edge Frequency 2483.5 MHz

ePA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
Static	HDR4	2404	2390	56.73	45.02
Static	HDR8	2404	2390	58.16	46.42
Static	LE1M	2402	2390	57.28	45.49
Static	LE2M	2402	2390	57.38	45.85
Static	HDR4	2476	2483.5	56.57	45.22
Static	HDR8	2476	2483.5	59.15	47.52
Static	LE1M	2478	2483.5	56.85	45.56
Static	LE1M	2480	2483.5	58.76	47.47
Static	LE2M	2478	2483.5	56.65	45.80
Static	LE2M	2480	2483.5	62.27	51.03

Table 14 - MIMO Restricted Band Edge Results

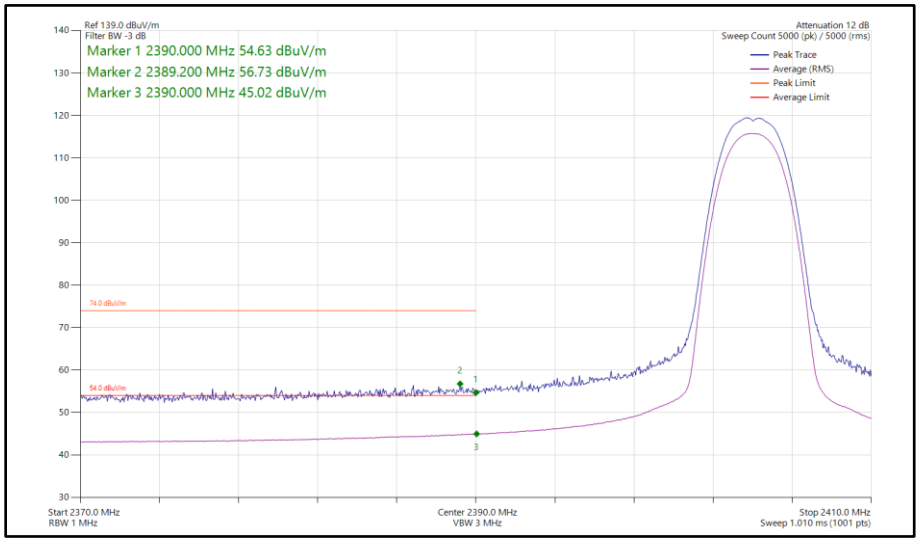

Figure 61 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2404 MHz Band Edge Frequency 2390 MHz

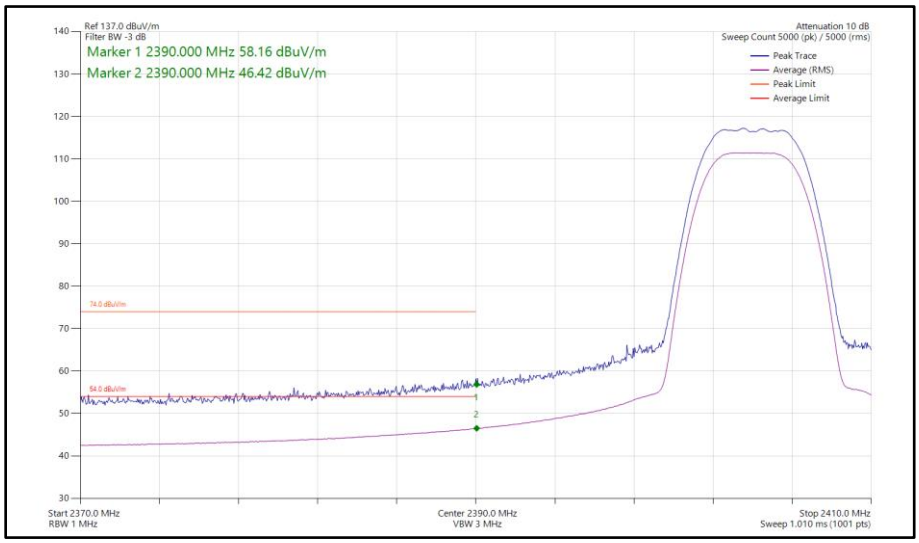

Figure 62 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2404 MHz Band Edge Frequency 2390 MHz

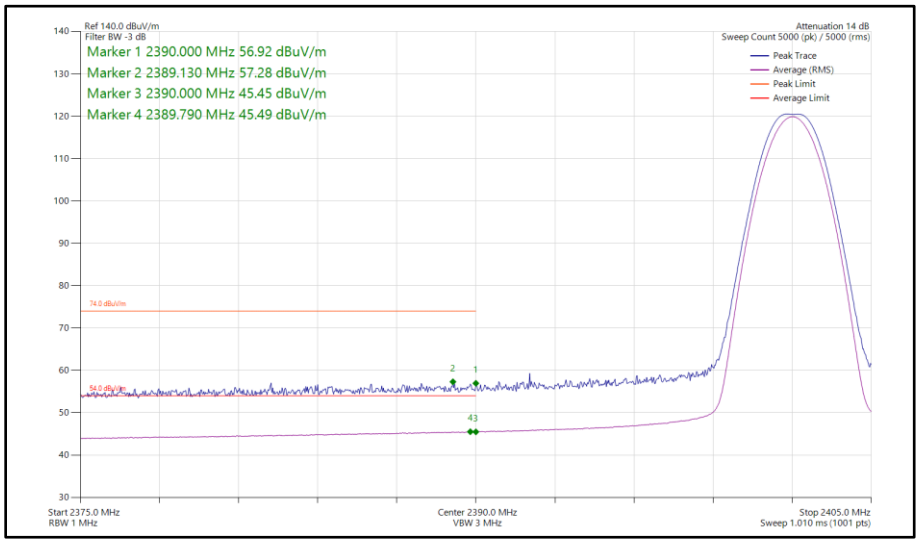

Figure 63 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2402 MHz Band Edge Frequency 2390 MHz

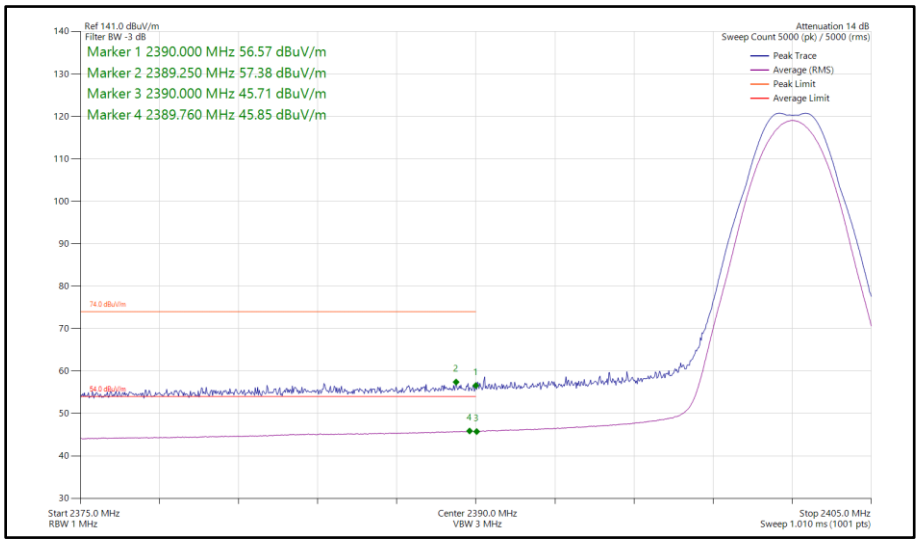

Figure 64 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2402 MHz Band Edge Frequency 2390 MHz

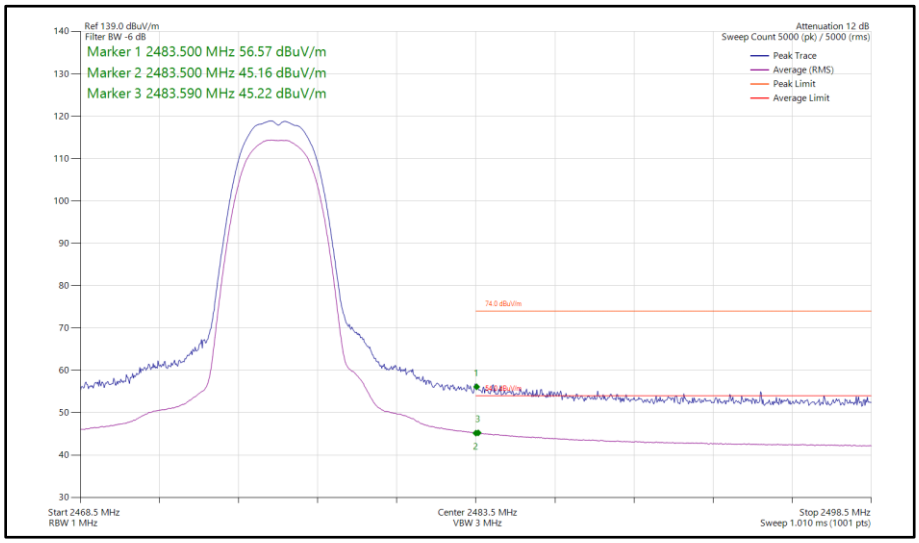

Figure 65 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2476 MHz Band Edge Frequency 2483.5 MHz

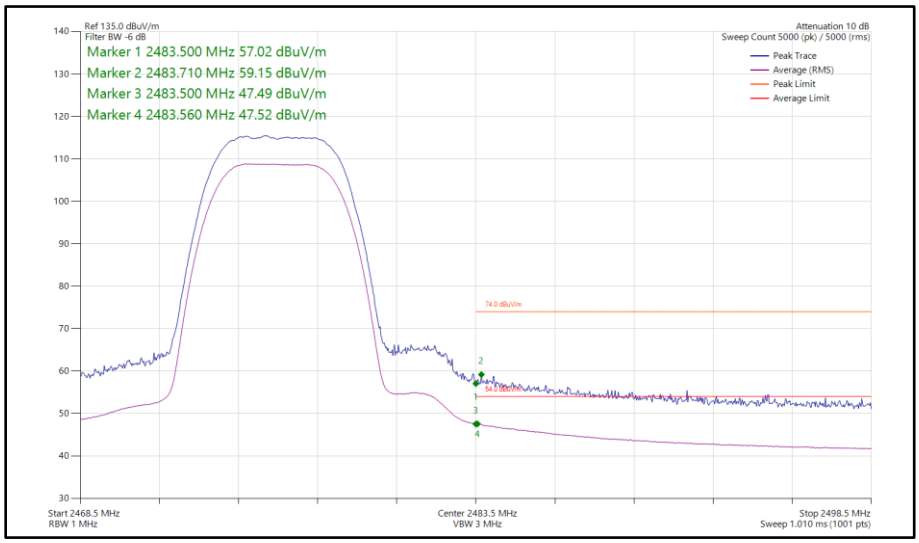

Figure 66 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2476 MHz Band Edge Frequency 2483.5 MHz

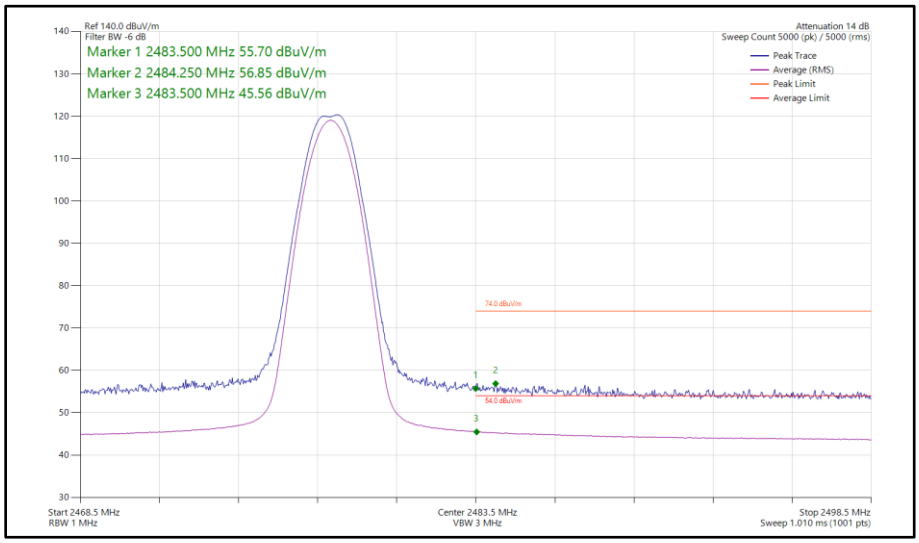

Figure 67 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2478 MHz Band Edge Frequency 2483.5 MHz

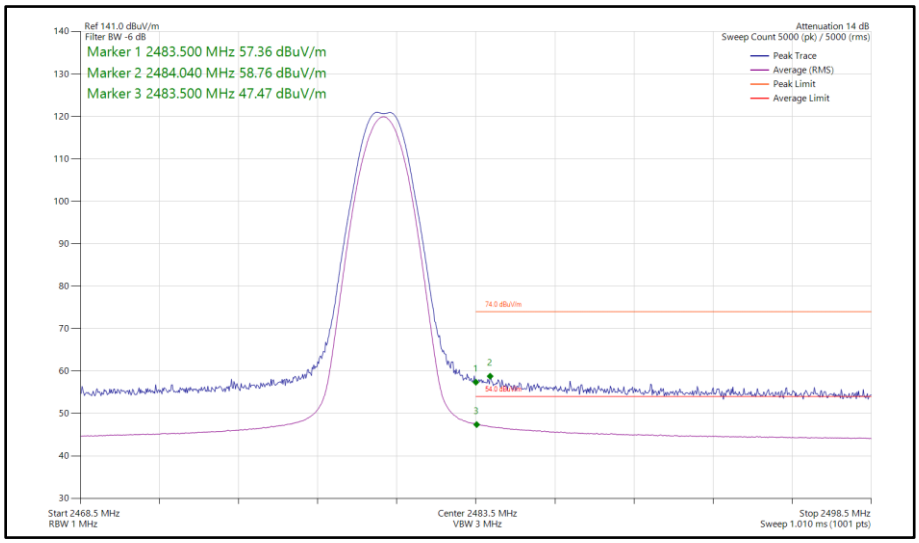

Figure 68 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2480 MHz Band Edge Frequency 2483.5 MHz

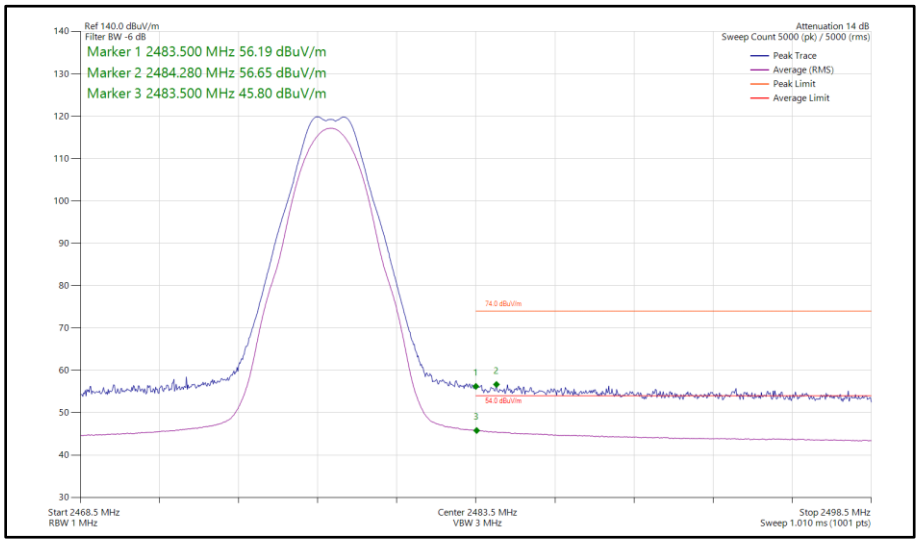

Figure 69 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2478 MHz Band Edge Frequency 2483.5 MHz

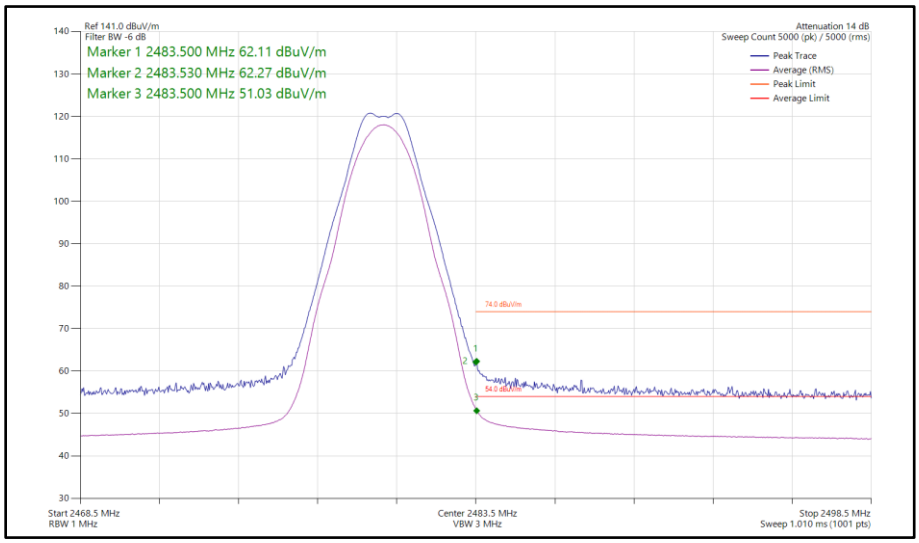

Figure 70 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2480 MHz Band Edge Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.209

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

Table 15

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
1500W (300V 12A) AC Power Supply	iTech	IT7324	5957	-	O/P Mon
3m Semi-Anechoic Chamber	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	6140	12	05-May-2025
SAC Switch Unit	TUV SUD	TUV_SSU_001	6144	12	11-Dec-2024
Digital Multimeter	Fluke	115	6146	12	06-Jun-2025
Humidity & Temperature meter	R.S Components	1364	6148	12	29-Jul-2025
EMI Test Receiver	Rohde & Schwarz	ESW44	6294	12	06-Jan-2025
Cable (SMA to SMA 1m)	Junkosha	MWX221-01000AMSAMS/A	6315	12	04-Feb-2025
Cable (SMA to SMA 3m)	Junkosha	MWX221-03000AMSAMS/A	6316	12	04-Feb-2025
Horn Antenna (1–8 GHz)	Schwarzbeck	BBHA 9120 B	6457	12	05-May-2025
8m Cable	Junkosha	MWX221-08000AMSAMS/B	6748	12	01-Feb-2025

Table 16

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

2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)

2.2.2 Equipment Under Test and Modification State

A3403, S/N: M7J9X1XPGD - Modification State 0

2.2.3 Date of Test

01-October-2024 to 02-October-2024

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	21.3 - 21.8 °C
Relative Humidity	48.5 - 53.1 %

2.2.6 Test Results

2.4 GHz Bluetooth LE/HDR

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 π/4 DQPSK (4-DH5)	Duty Cycle (%):	-
Antenna Configuration:	SISO	DCCF (dB):	-
Active Port(s):	B (Core 1)	Peak Antenna Gain (dBi):	-

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	-	1.896	-	-	≥500.0
2441	-	1.904	-	-	≥500.0
2476	-	1.888	-	-	≥500.0

Table 17 - 6 dB Bandwidth Results

Test Frequency (MHz)	99% Bandwidth (MHz)				Limit (kHz)
	A	B	C	D	
2404	-	2.328	-	-	-
2441	-	2.328	-	-	-
2476	-	2.336	-	-	-

Table 18 - 99% Bandwidth Results

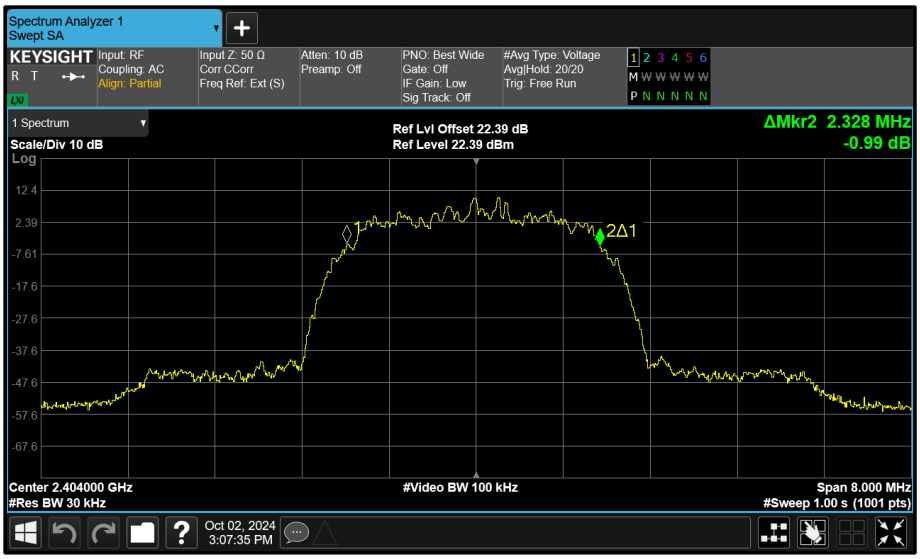

Figure 71 - Core 1 (B) 2404 MHz (CH2) 99% Bandwidth

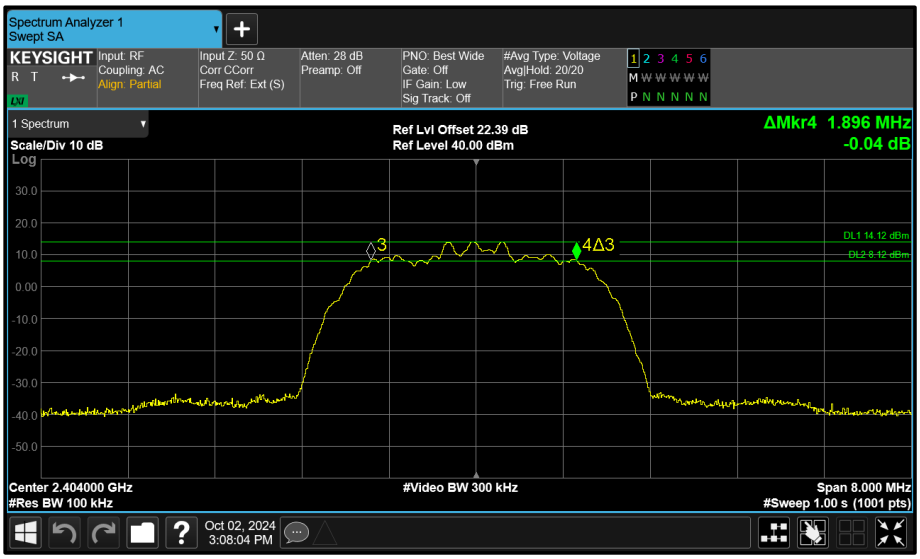

Figure 72 - Core 1 (B) 2404 MHz (CH2) 6 dB Bandwidth