

FCC Test Report

Apple Inc
Model: A3185



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

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

FCC ID: BCGA3185

COMMERCIAL-IN-CONFIDENCE

Document 75961394-95 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Steve Marshall	Senior Engineer	Authorised Signatory	16 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	Lauren Walters	16 October 2024	

FCC Accreditation
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 TÜV SÜD Ltd
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



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	5
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	45
2.3	Maximum Conducted Output Power	151
2.4	Authorised Band Edges	173
2.5	Spurious Radiated Emissions	190
2.6	Power Spectral Density	206
3	Measurement Uncertainty	222



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	16-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	02-August-2024
Finish of Test	23-September-2024
Name of Engineer(s)	Colin Brain, Dale Hills, Ioan-Alexandru Bogatu, Manohar Thota, Thomas Randall, Tony Baby, Jayvir Makwana, Mahmud Bari Chowdhury, Ahmed Al Derdiri, Akhil Rajendran Bhaskaran Nair and Ian Hart
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 C63.4 (2014) ANSI C63.10 (2020)
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 (4-DH5) - iPA - Core 1
- HDR8 (8-DH5) - 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 + Core 1
- 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:

- LE1M - iPA - Core 0 + Core 1
- HDR4 - 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 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	4.5	0.71
Core 1	2400 to 2480	4.8	0.71
Dedicated Core 2	2400 to 2480	4.8	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: A3185			
Serial Number	Hardware Version	Software Version	Firmware
KXCL61LP9Q	REV1.0	24A32191s	22.1.65.459
FWGHH4D25Q	REV1.0	24A32191s	22.1.65.459
LD12H296C1	REV1.0	24A32191s	22.1.65.459
GRJJT9QH7L	REV1.0	24A32191s	22.1.65.459
GHGG6N440H	REV1.0	24A32191s	22.1.65.459
HM9QNWPCFQ	REV1.0	24A32191s	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: A3185, Serial Number: LD12H296C1			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3185, Serial Number: FWGHH4D25Q			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3185, Serial Number: KXCL61LP9Q			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3185, Serial Number: GRJJT9QH7L			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3185, Serial Number: GHGG6N440H			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A3185, Serial Number: HM9QNWPCFQ			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5



1.8 Test Location

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	Colin Brain, Dale Hills, Ioan-Alexandru Bogatu, Manohar Thota, Thomas Randall and Tony Baby	UKAS
Emission Bandwidth	Jayvir Makwana and Mahmud Bari Chowdhury	UKAS
Maximum Conducted Output Power	Jayvir Makwana and Mahmud Bari Chowdhury	UKAS
Authorised Band Edges	Colin Brain, Dale Hills, Ioan-Alexandru Bogatu, Manohar Thota, Thomas Randall and Tony Baby	UKAS
Spurious Radiated Emissions	Ahmed Al Derdiri, Akhil Rajendran Bhaskaran Nair, Ian Hart, Thomas Randall and Vineeth Nagaraj	UKAS
Power Spectral Density	Jayvir Makwana and Mahmud Bari Chowdhury	UKAS

Table 6

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

A3185, S/N: KXCL61LP9Q - Modification State 0
A3185, S/N: FWGHH4D25Q - Modification State 0

2.1.3 Date of Test

02-August-2024 to 08-August-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 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	22.2 - 23.1 °C
Relative Humidity	41.2 - 63.9 %

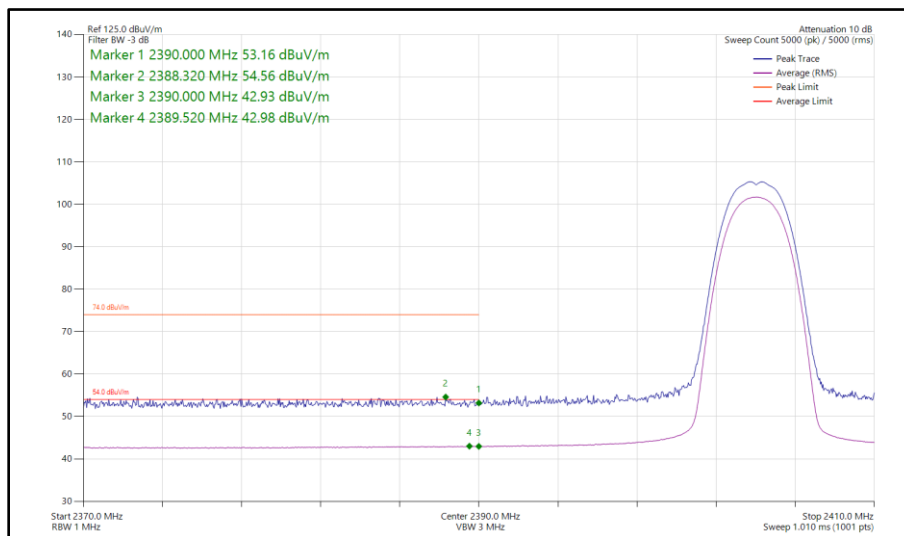
2.1.6 Test Results

2.4 GHz Bluetooth LE/HDR

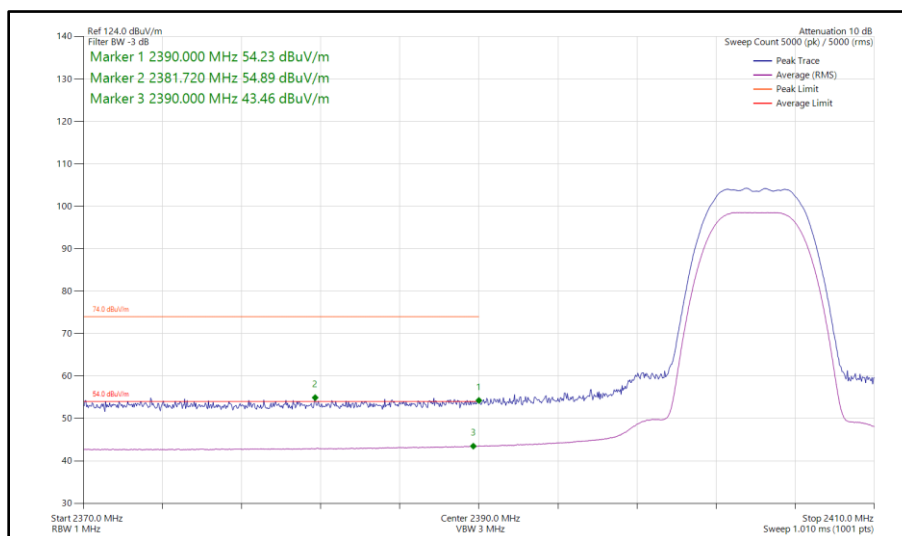
iPA - Core 0 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	54.56	42.98
Static	HDR8	2404	2390	54.89	43.46
Static	LE1M	2402	2390	55.26	43.03
Static	LE2M	2402	2390	54.95	43.07
Static	HDR4	2476	2483.5	53.72	41.91
Static	HDR8	2476	2483.5	54.78	43.35
Static	LE1M	2480	2483.5	54.16	42.52
Static	LE2M	2478	2483.5	53.68	42.14
Static	LE2M	2480	2483.5	57.43	46.84

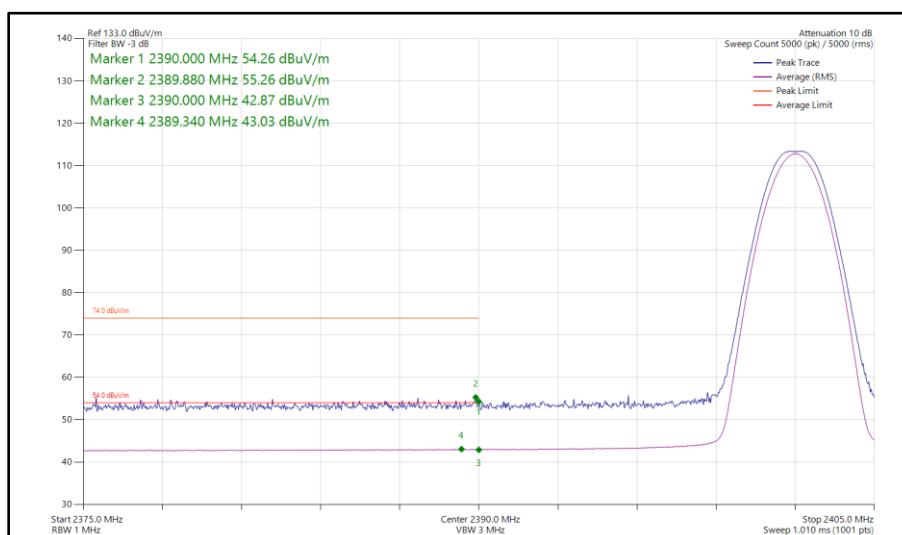
Table 7 - SISO Restricted Band Edge Results



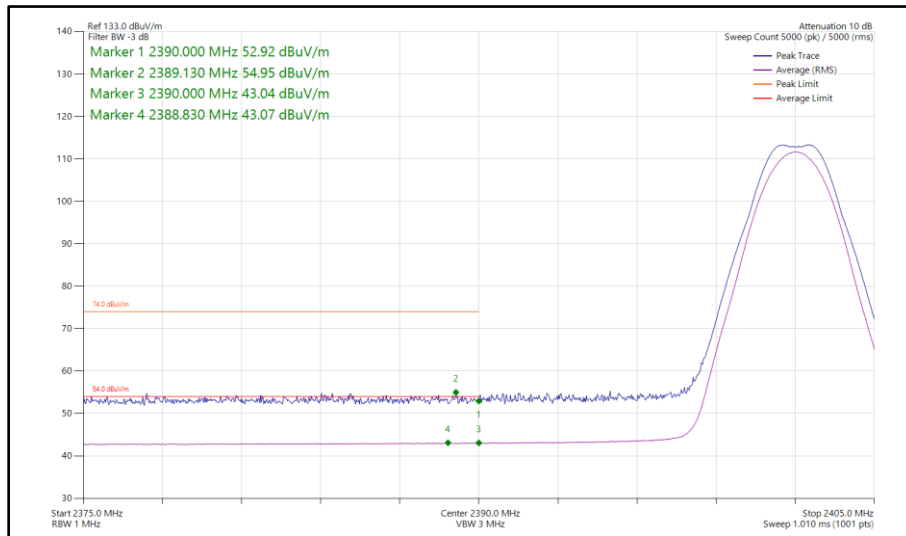
**Figure 1 - Bluetooth HDR4, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz**



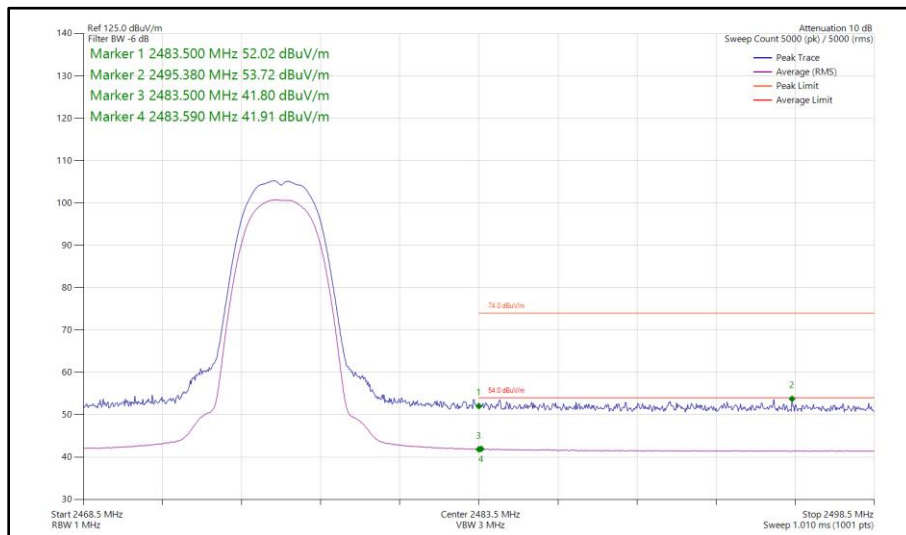
**Figure 2 - Bluetooth HDR8, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz**



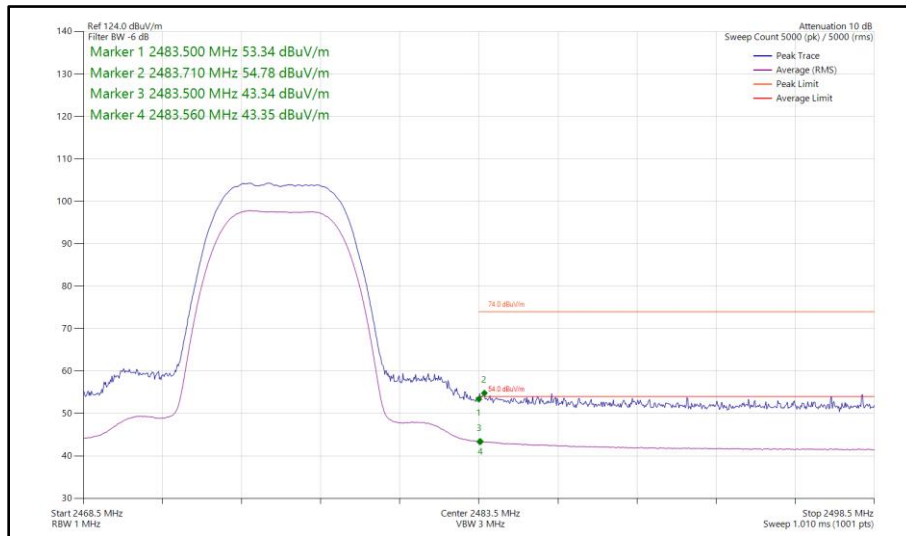
**Figure 3 - Bluetooth LE1M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz**



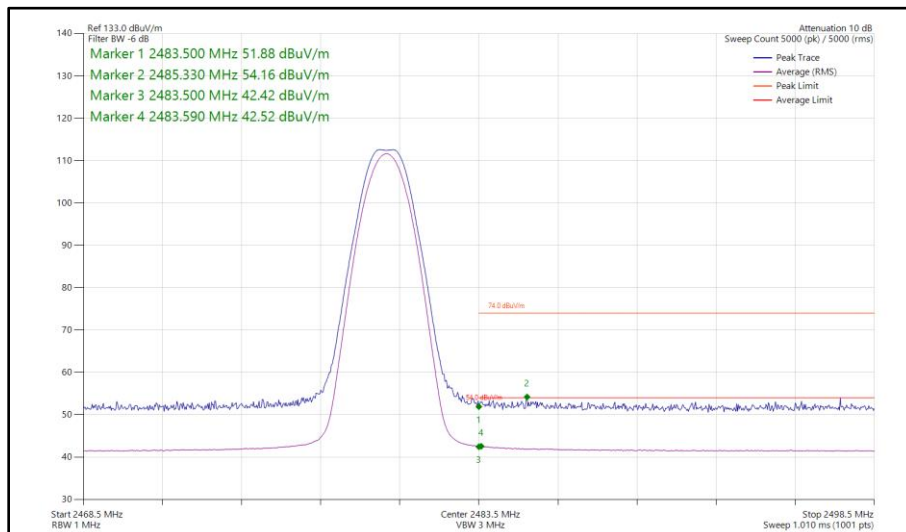
**Figure 4 - Bluetooth LE2M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz**



**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 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

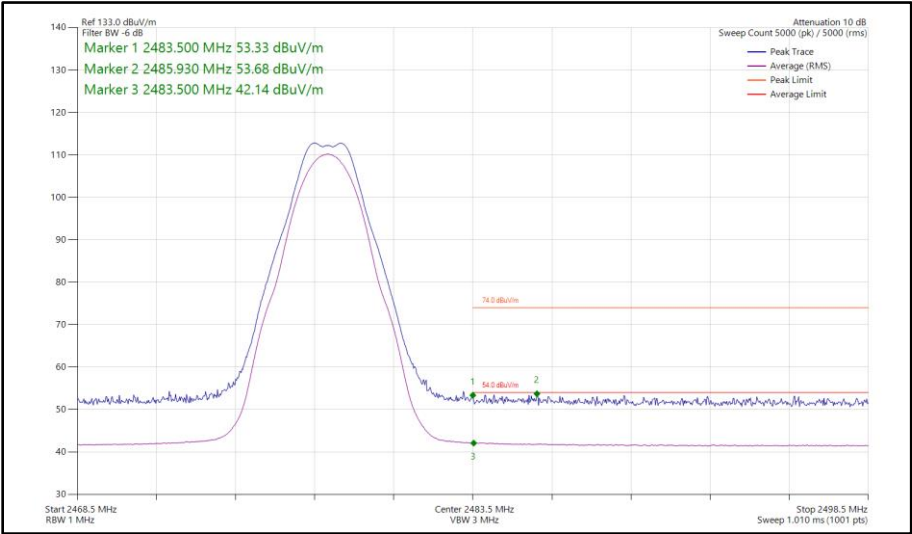


Figure 8 - Bluetooth LE2M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

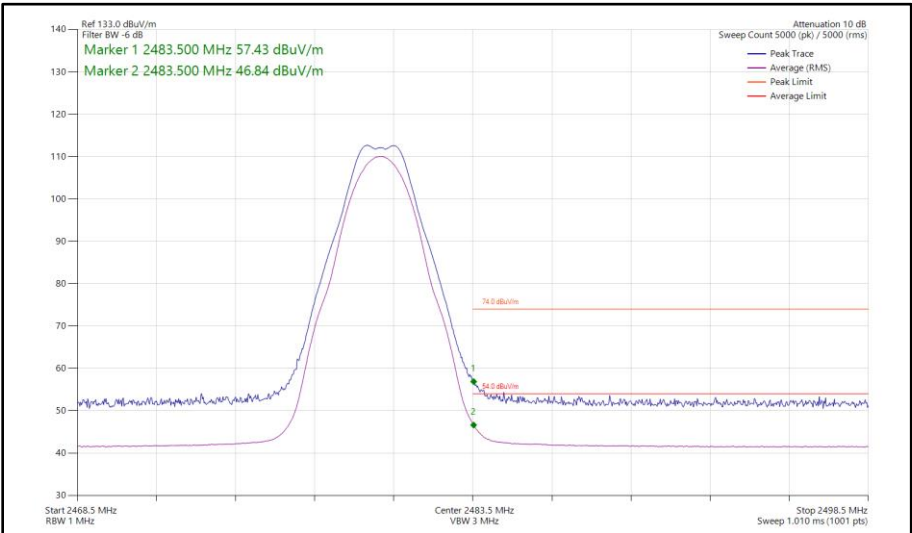


Figure 9 - Bluetooth LE2M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

iPA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	54.96	43.09
Static	HDR8	2404	2390	55.10	43.29
Static	LE1M	2402	2390	55.47	43.36
Static	LE2M	2402	2390	55.69	43.56
Static	HDR4	2476	2483.5	53.39	41.86
Static	HDR8	2476	2483.5	53.83	42.57
Static	LE1M	2480	2483.5	55.69	43.90
Static	LE2M	2478	2483.5	54.84	43.49
Static	LE2M	2480	2483.5	56.72	46.05

Table 8 - SISO Restricted Band Edge Results

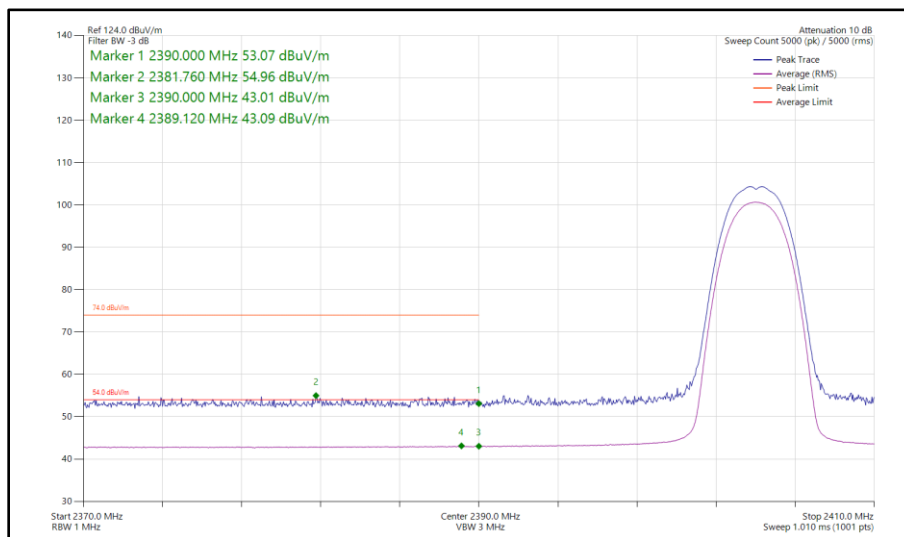


Figure 10 - Bluetooth HDR4, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

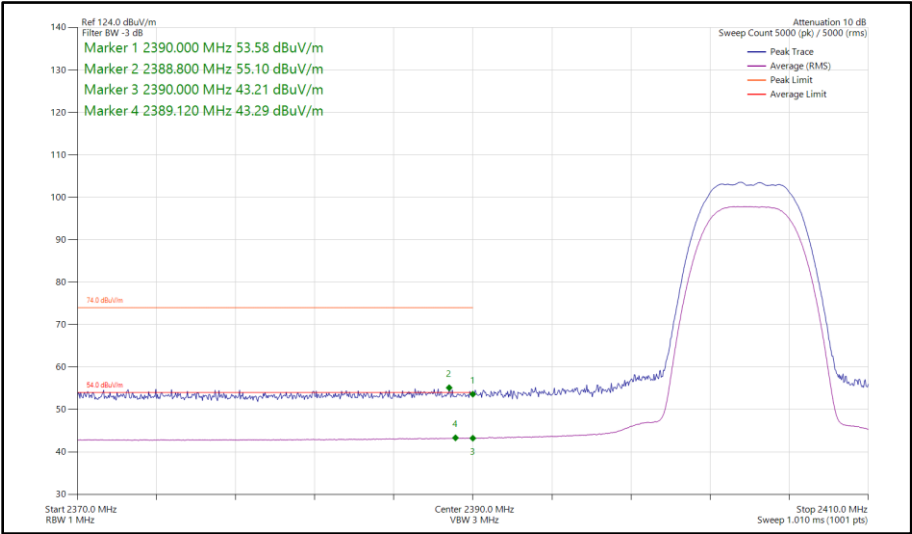


Figure 11 - Bluetooth HDR8, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

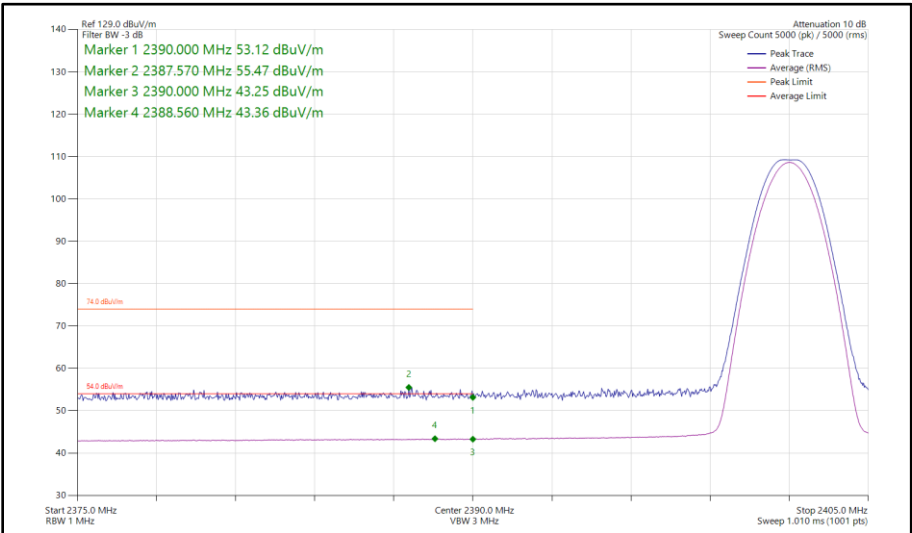
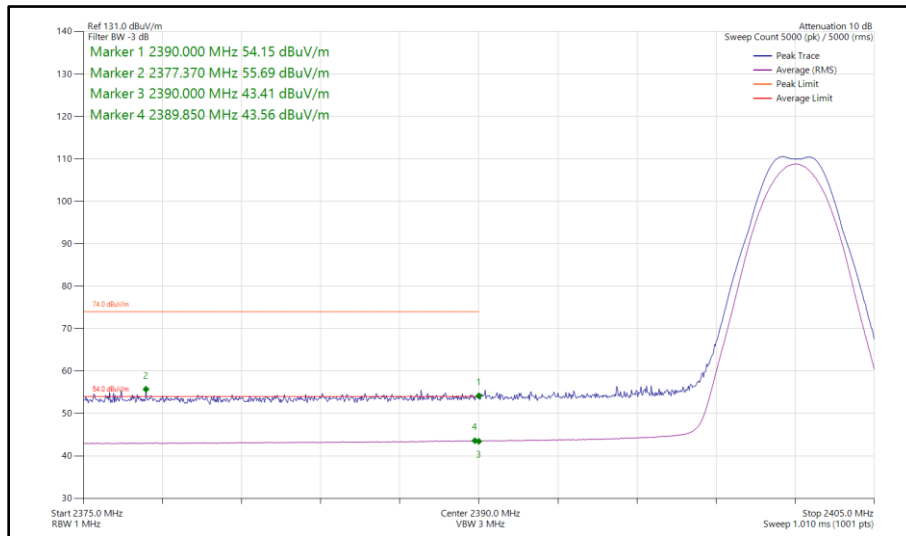
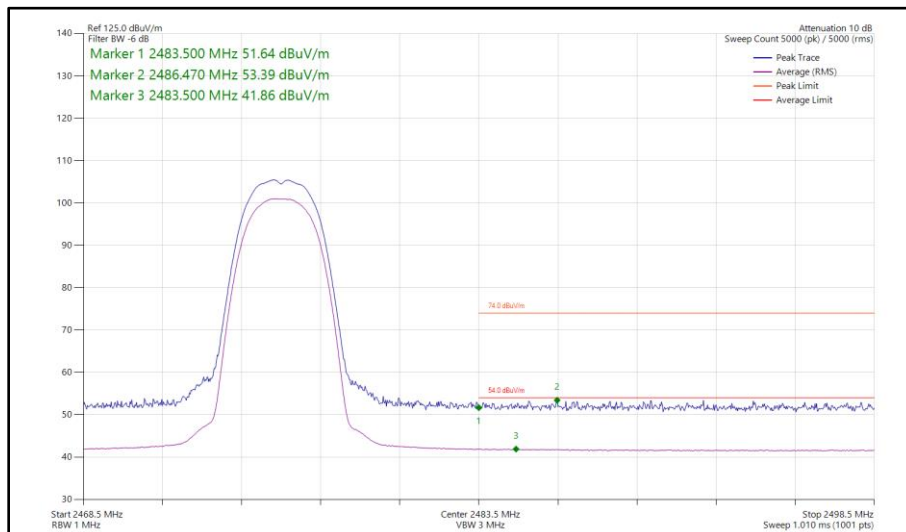


Figure 12 - Bluetooth LE1M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz



**Figure 13 - Bluetooth LE2M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



**Figure 14 - Bluetooth HDR4, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**

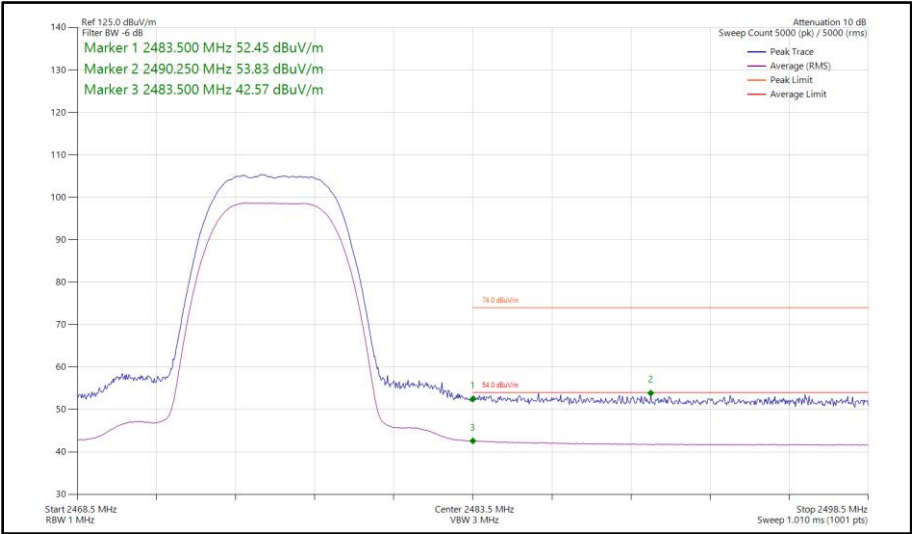


Figure 15 - Bluetooth HDR8, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz

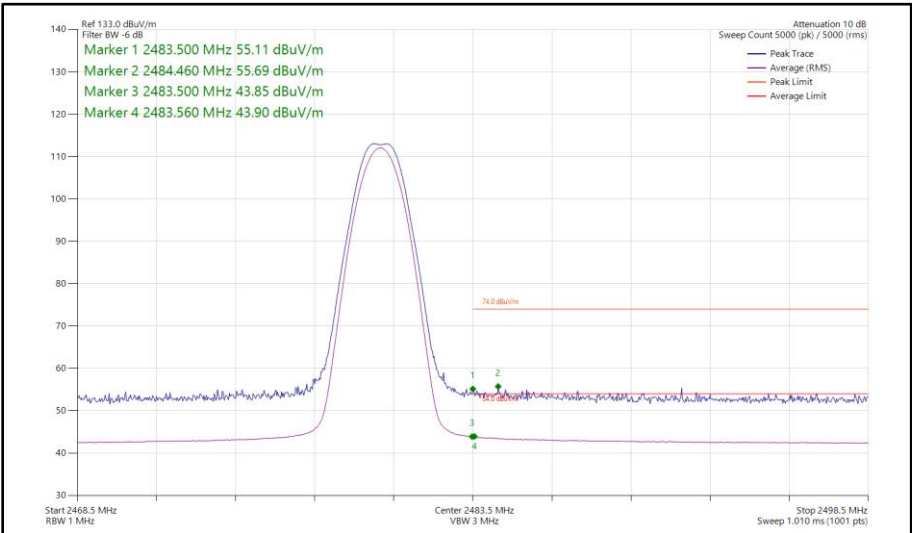
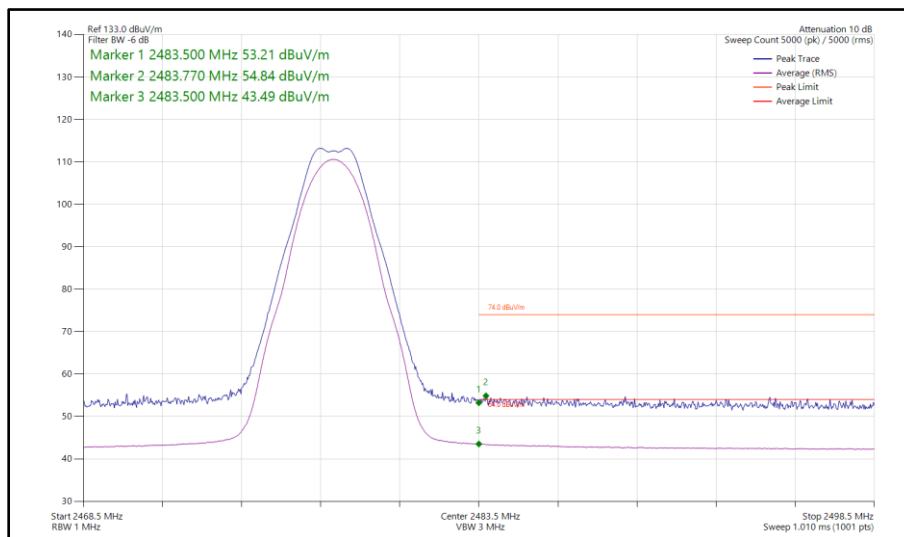
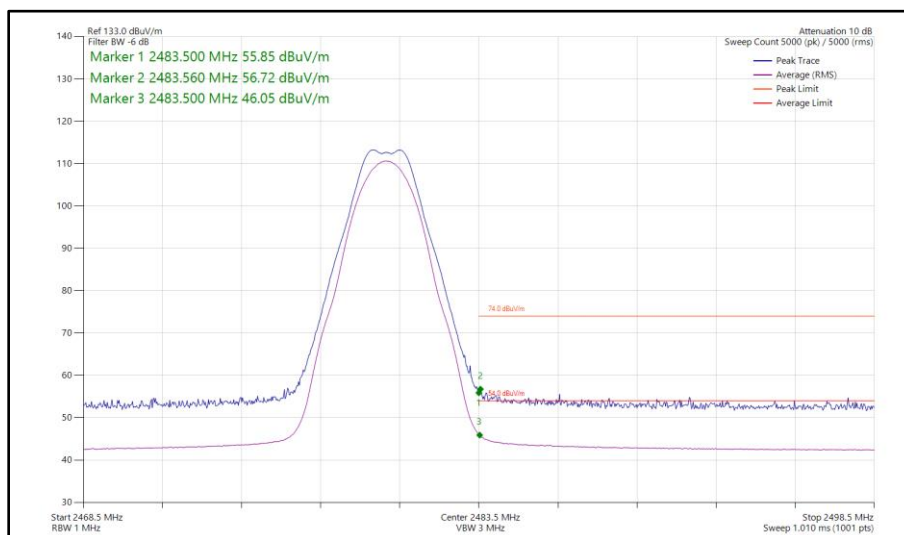


Figure 16 - Bluetooth LE1M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz



**Figure 17 - Bluetooth LE2M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz**

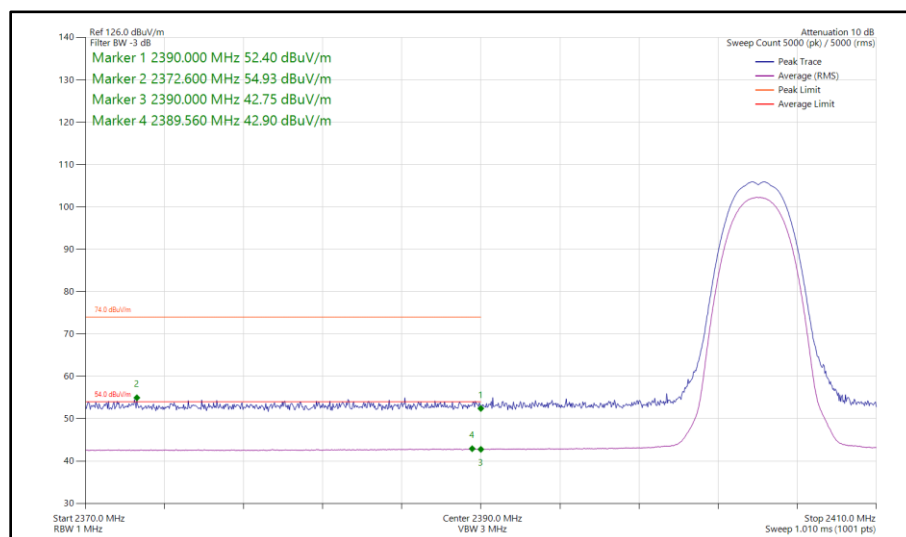


**Figure 18 - Bluetooth LE2M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

iPA - Core 2 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	54.93	42.90
Static	HDR8	2404	2390	55.14	43.05
Static	LE1M	2402	2390	54.57	42.95
Static	LE2M	2402	2390	55.28	42.96
Static	HDR4	2476	2483.5	53.64	41.82
Static	HDR8	2476	2483.5	53.98	42.56
Static	LE1M	2480	2483.5	53.89	42.68
Static	LE2M	2478	2483.5	54.36	42.34
Static	LE2M	2480	2483.5	60.02	50.39

Table 9 - SISO Restricted Band Edge Results



**Figure 19 - Bluetooth HDR4, SISO, Core 2 - 2404 MHz
Band Edge Frequency 2390 MHz**

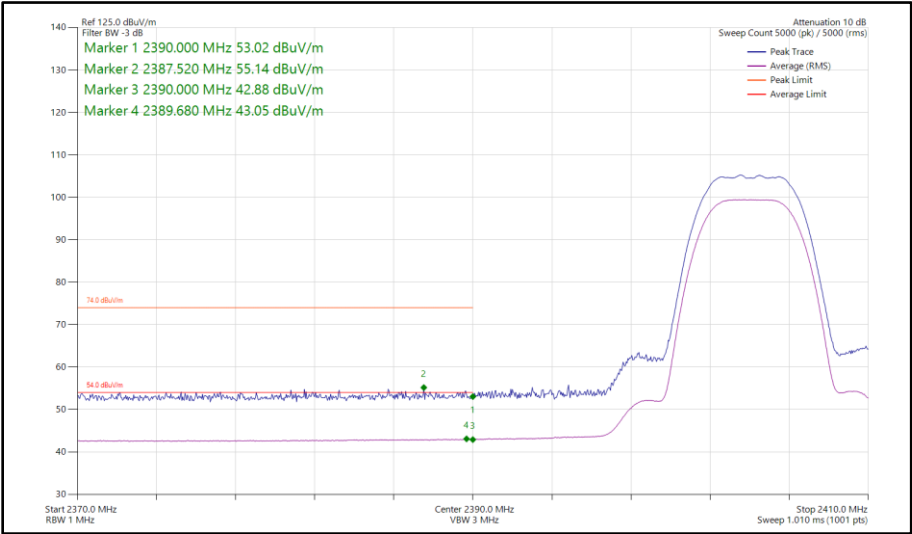


Figure 20 - Bluetooth HDR8, SISO, Core 2 - 2404 MHz
Band Edge Frequency 2390 MHz

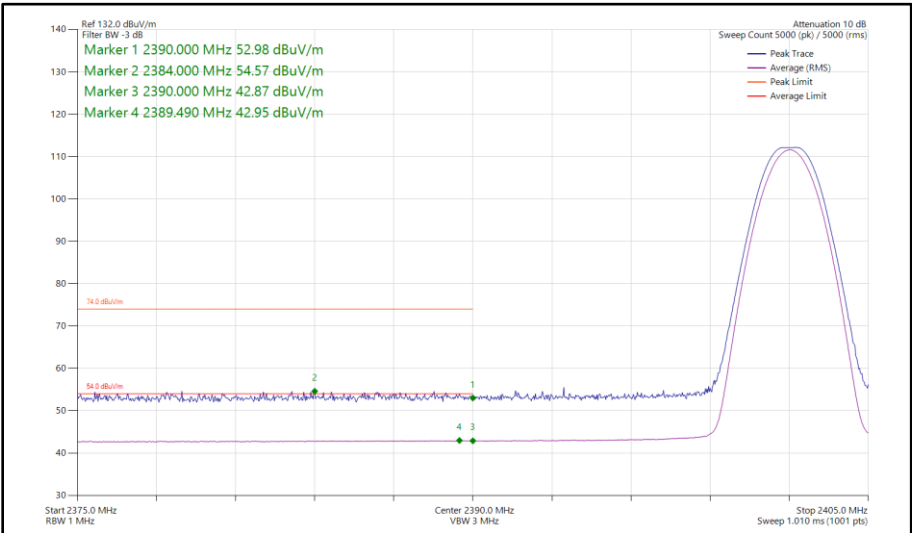
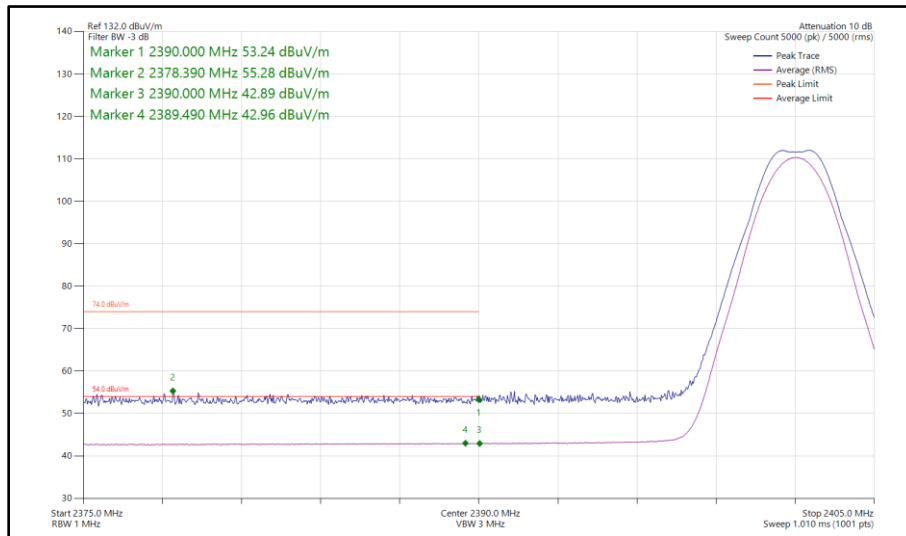
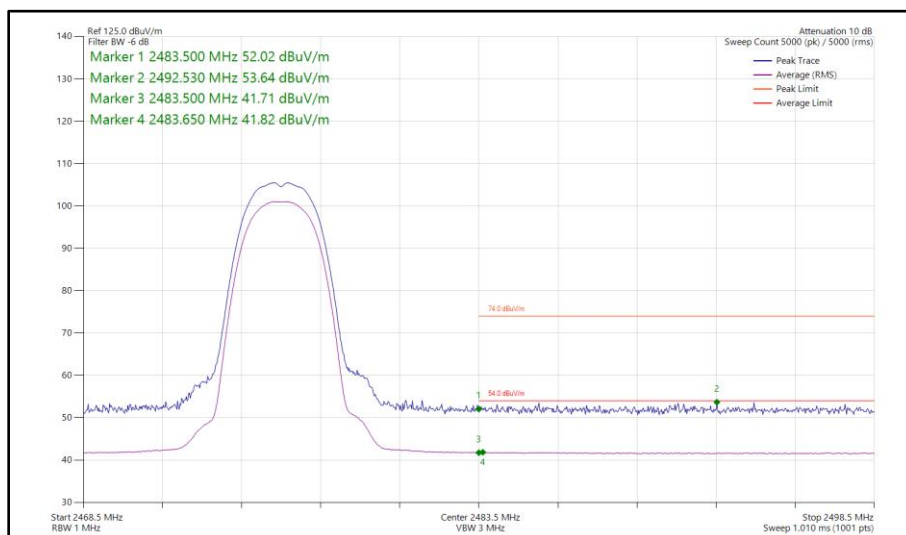


Figure 21 - Bluetooth LE1M, SISO, Core 2 - 2402 MHz
Band Edge Frequency 2390 MHz



**Figure 22 - Bluetooth LE2M, SISO, Core 2 - 2402 MHz
Band Edge Frequency 2390 MHz**



**Figure 23 - Bluetooth HDR4, SISO, Core 2 - 2476 MHz
Band Edge Frequency 2483.5 MHz**

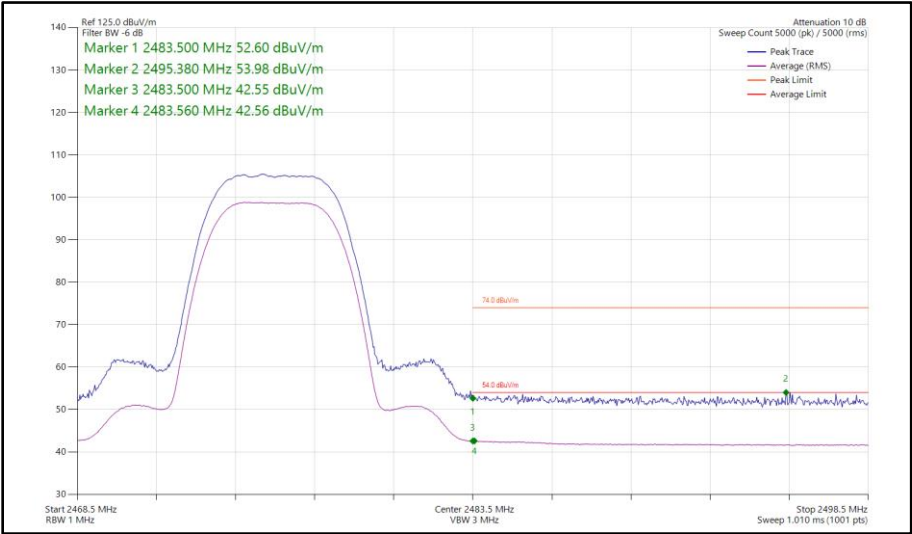


Figure 24 - Bluetooth HDR8, SISO, Core 2 - 2476 MHz
Band Edge Frequency 2483.5 MHz

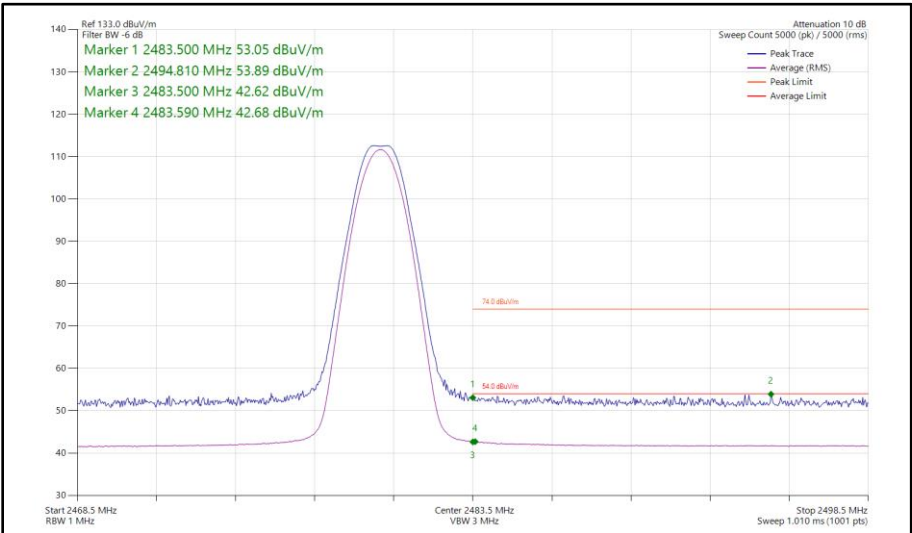


Figure 25 - Bluetooth LE1M, SISO, Core 2 - 2480 MHz
Band Edge Frequency 2483.5 MHz

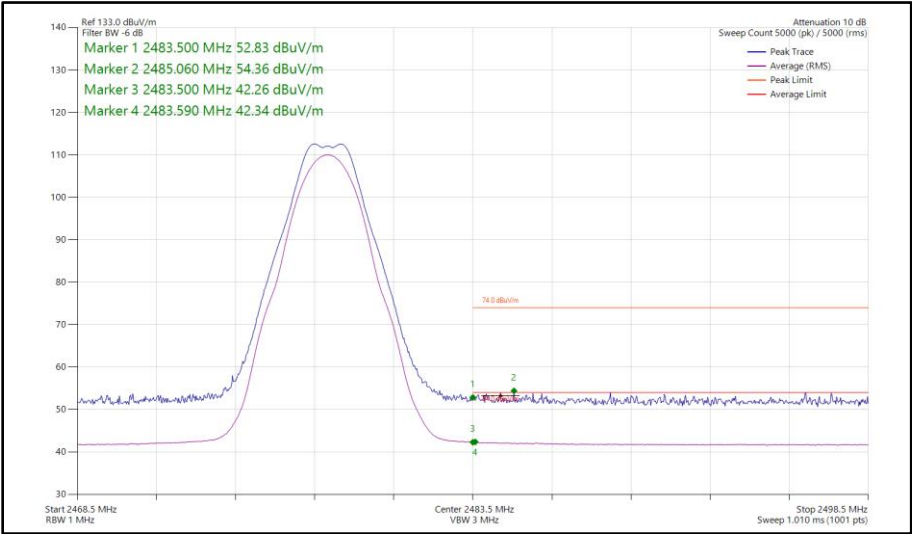


Figure 26 - Bluetooth LE2M, SISO, Core 2 - 2478 MHz
Band Edge Frequency 2483.5 MHz

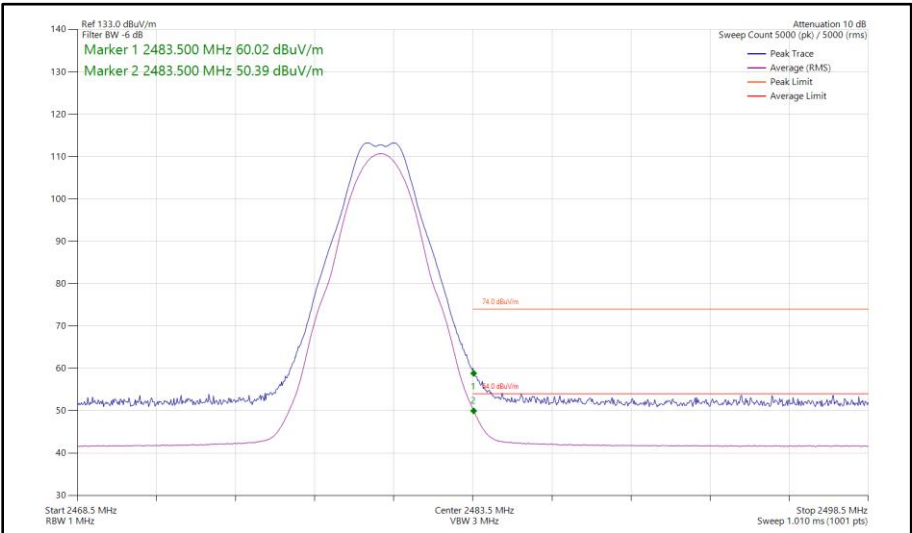


Figure 27 - Bluetooth LE2M, SISO, Core 2 - 2480 MHz
Band Edge Frequency 2483.5 MHz

iPA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	55.31	43.21
Static	HDR8	2404	2390	55.61	43.70
Static	LE1M	2402	2390	55.41	43.65
Static	LE2M	2402	2390	55.55	43.72
Static	HDR4	2476	2483.5	53.95	42.37
Static	HDR8	2476	2483.5	55.74	44.10
Static	LE1M	2480	2483.5	55.46	44.32
Static	LE2M	2478	2483.5	55.32	43.57
Static	LE2M	2480	2483.5	58.67	48.57

Table 10 - MIMO Restricted Band Edge Results

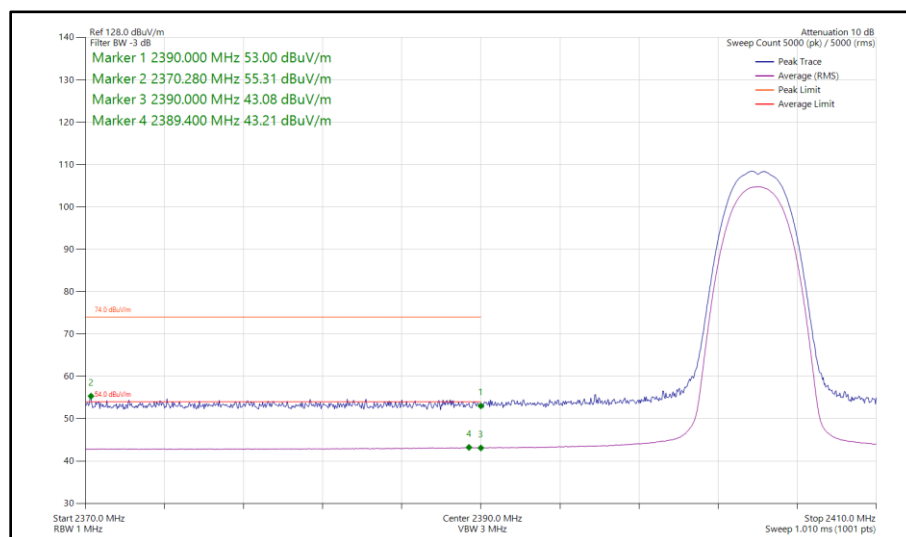
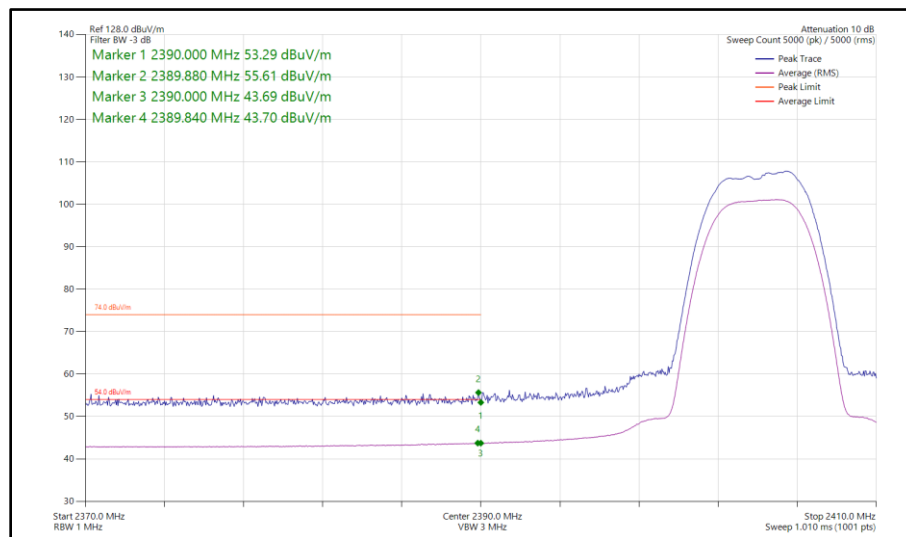
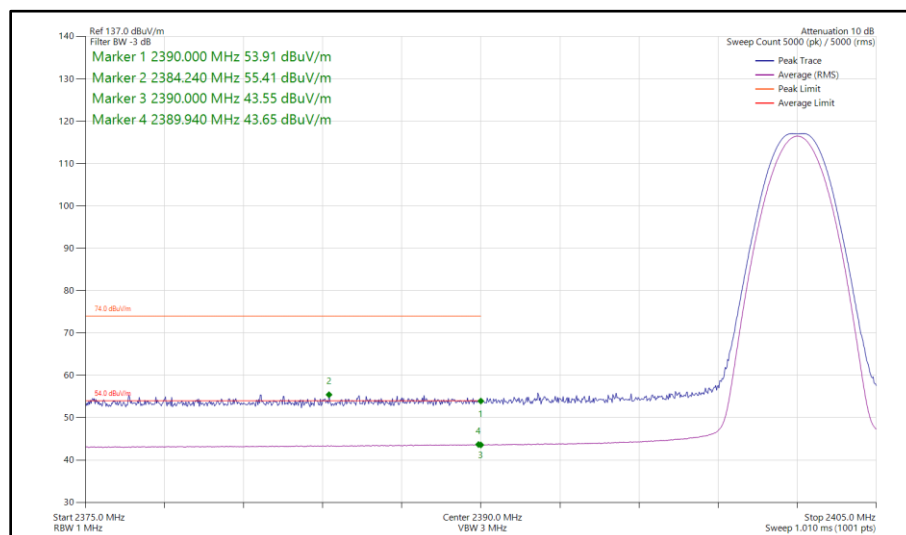


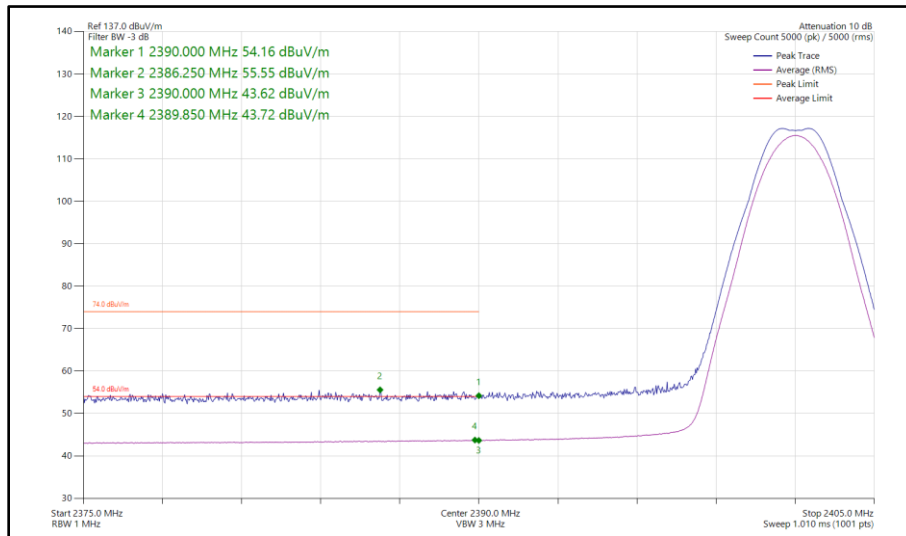
Figure 28 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz



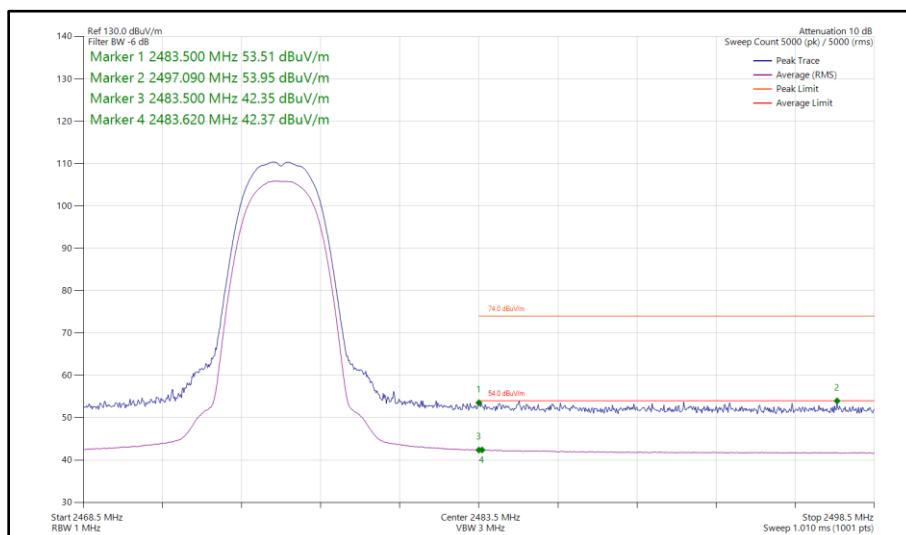
**Figure 29 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz**



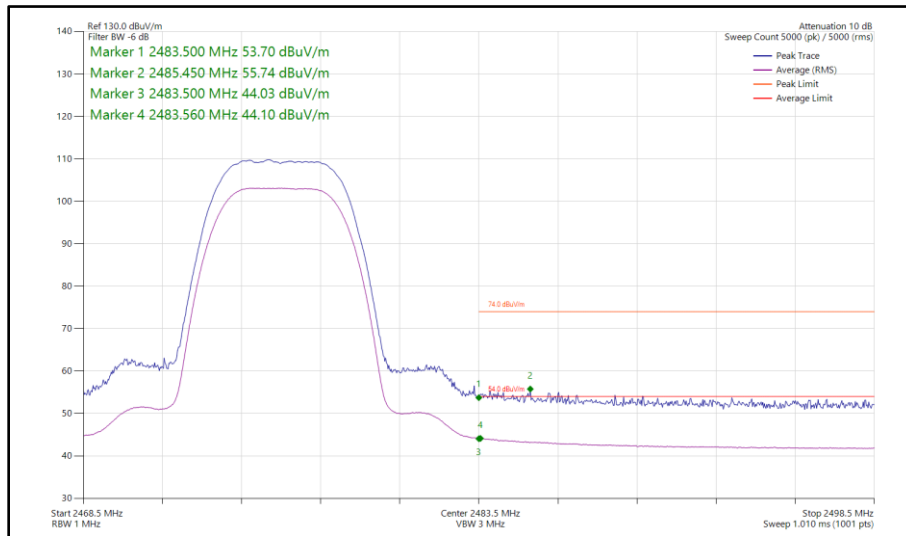
**Figure 30 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



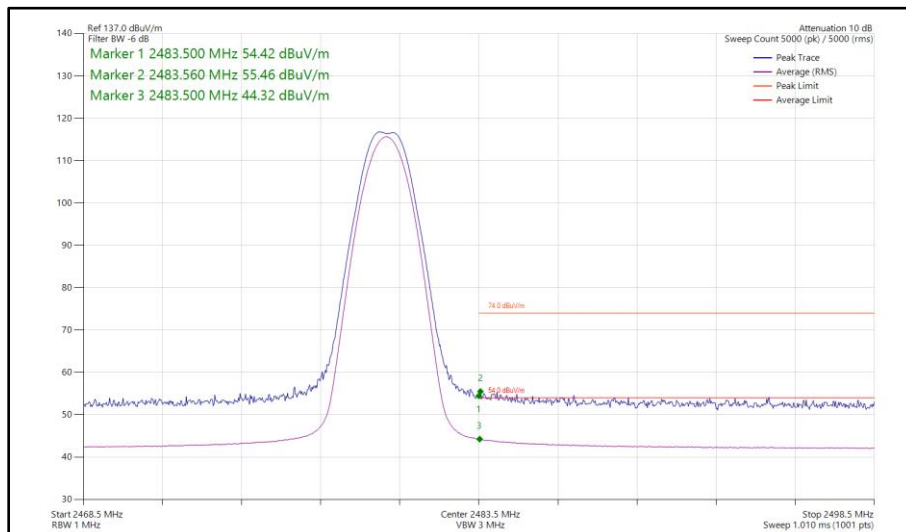
**Figure 31 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



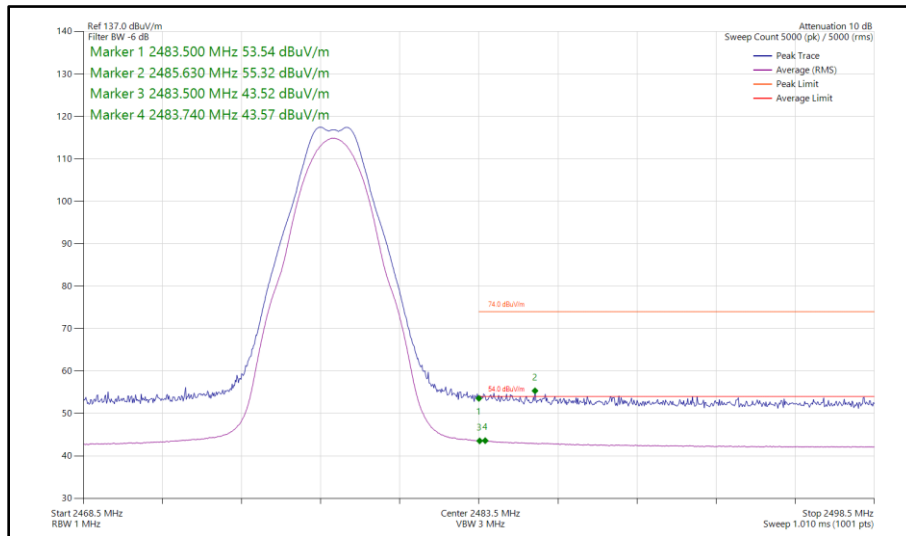
**Figure 32 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**



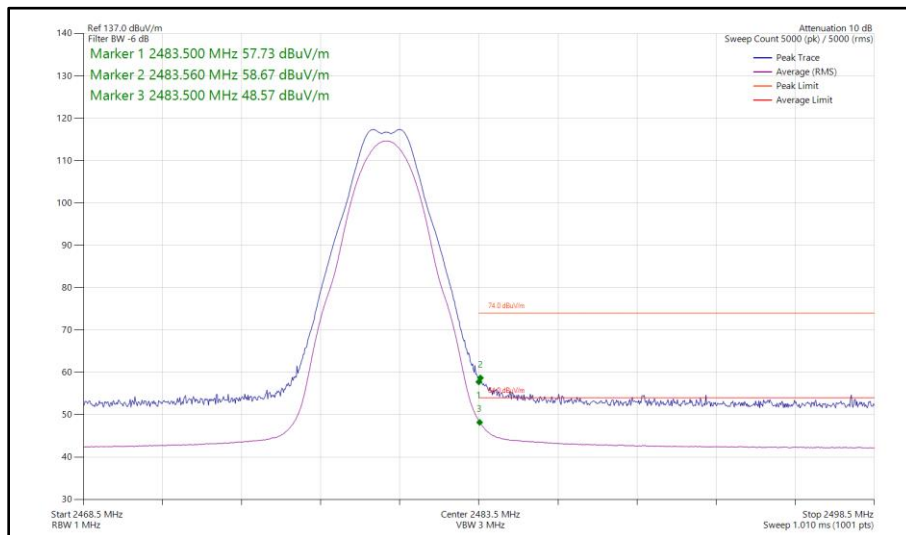
**Figure 33 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 34 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 35 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 36 - 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 (dBμV/m)
Static	HDR4	2404	2390	56.45	44.99
Static	HDR8	2404	2390	58.91	47.90
Static	LE1M	2402	2390	57.40	46.01
Static	LE2M	2402	2390	58.14	46.14
Static	HDR4	2476	2483.5	56.74	45.53
Static	HDR8	2476	2483.5	62.72	50.82
Static	LE1M	2480	2483.5	58.79	47.43
Static	LE2M	2478	2483.5	57.87	46.60
Static	LE2M	2480	2483.5	61.29	51.05

Table 11 - SISO Restricted Band Edge Results

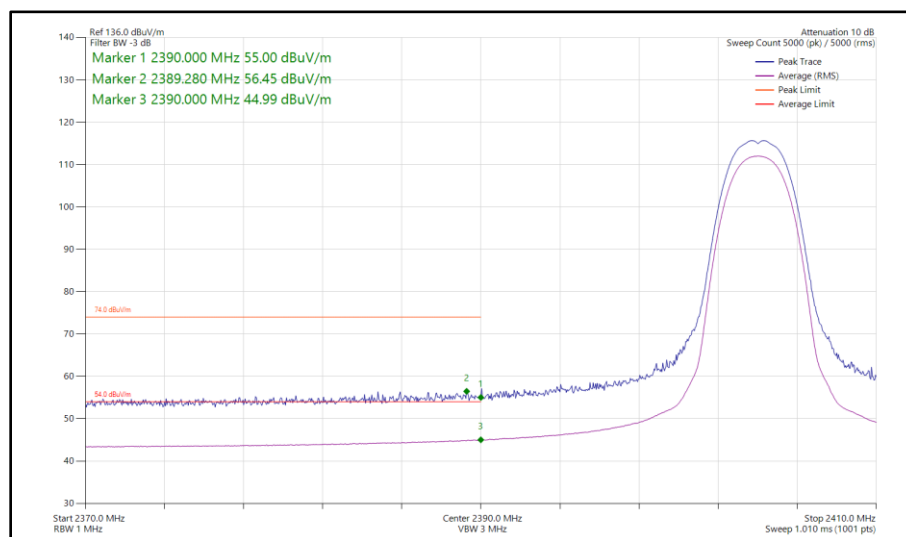
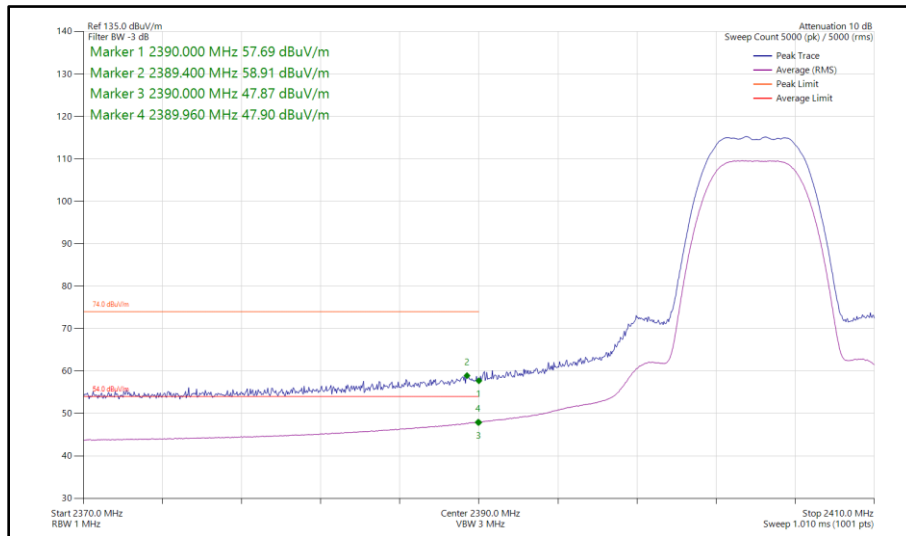
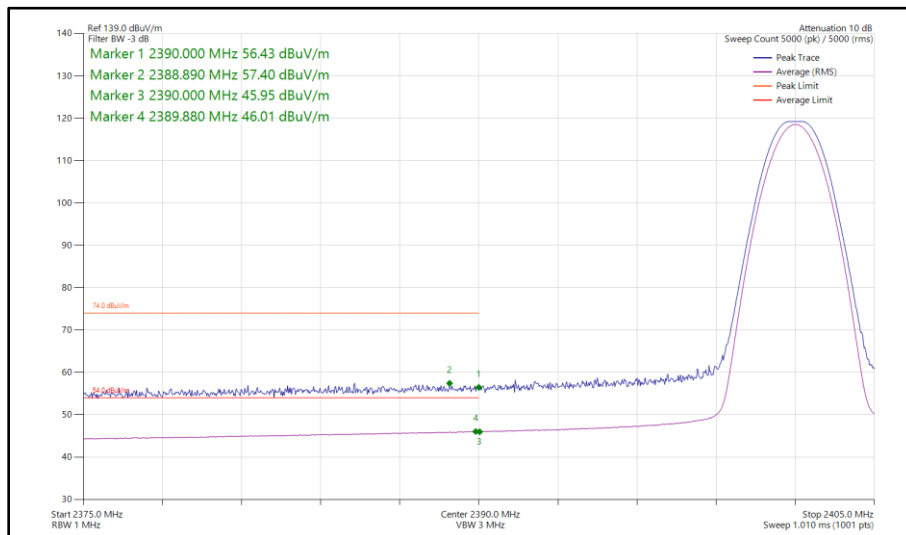


Figure 37 - Bluetooth HDR4, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz



**Figure 38 - Bluetooth HDR8, SISO, Core 0 - 2404 MHz
Band Edge Frequency 2390 MHz**



**Figure 39 - Bluetooth LE1M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz**

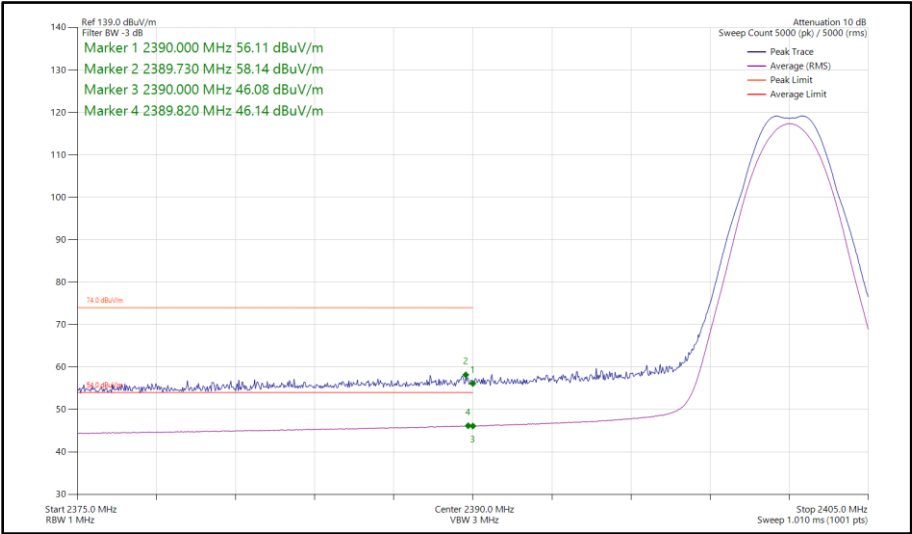


Figure 40 - Bluetooth LE2M, SISO, Core 0 - 2402 MHz
Band Edge Frequency 2390 MHz

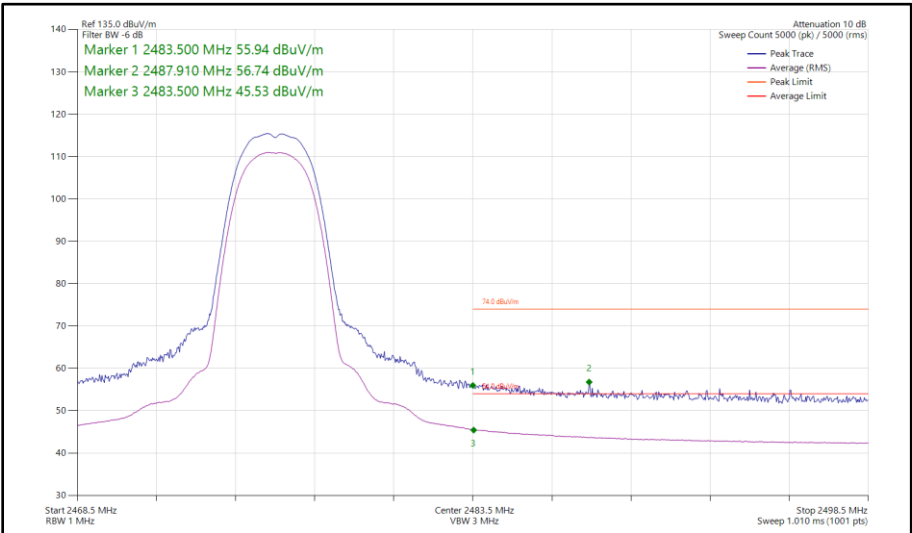


Figure 41 - Bluetooth HDR4, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

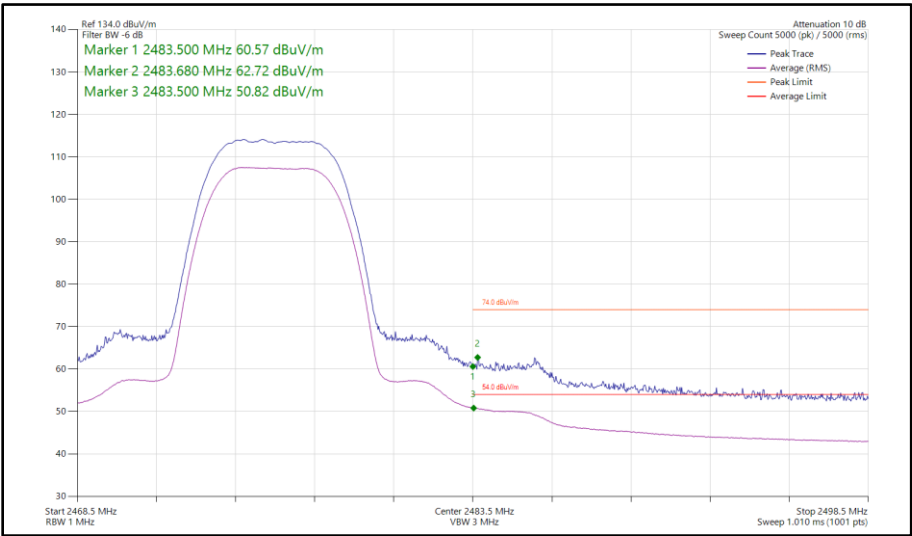


Figure 42 - Bluetooth HDR8, SISO, Core 0 - 2476 MHz
Band Edge Frequency 2483.5 MHz

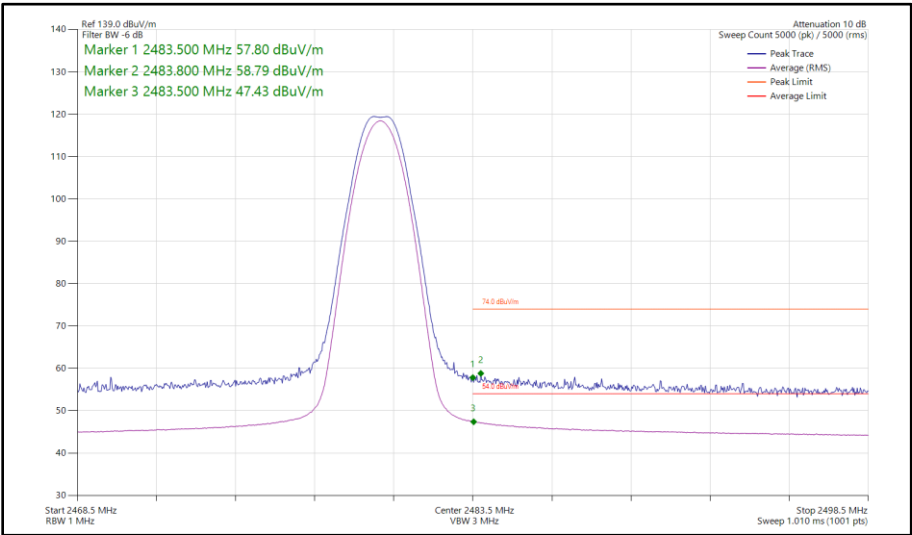


Figure 43 - Bluetooth LE1M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

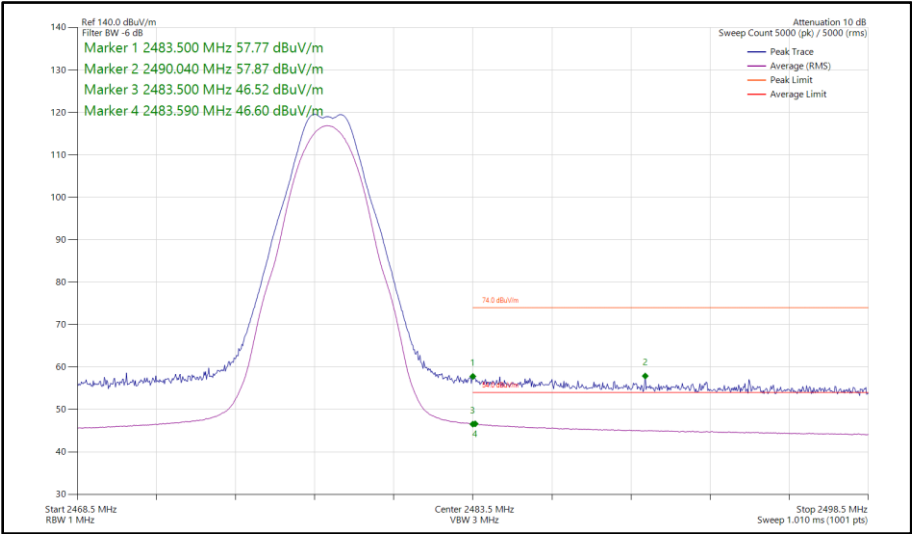


Figure 44 - Bluetooth LE2M, SISO, Core 0 - 2478 MHz
Band Edge Frequency 2483.5 MHz

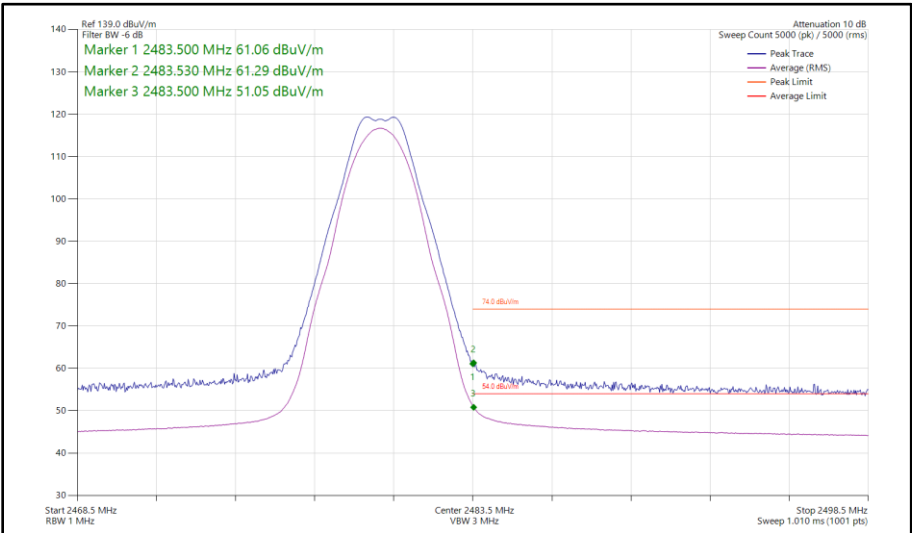
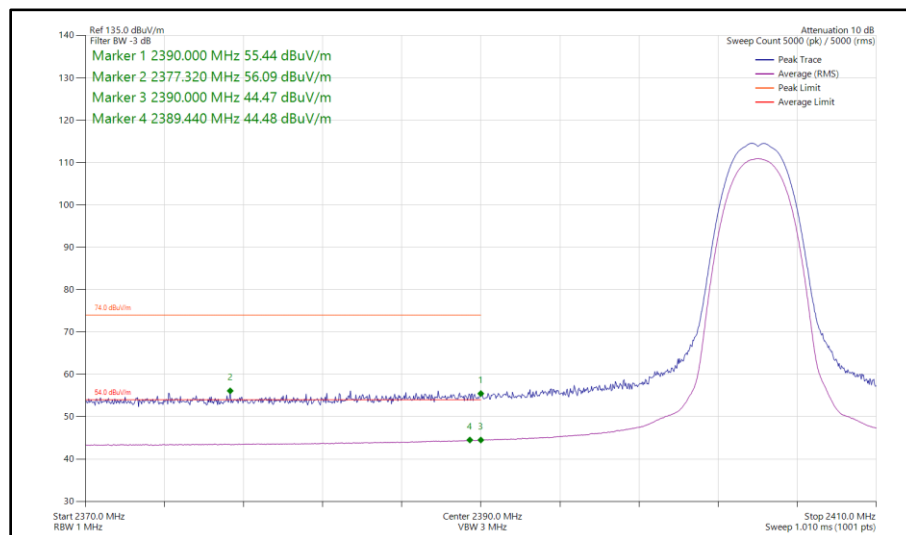


Figure 45 - Bluetooth LE2M, SISO, Core 0 - 2480 MHz
Band Edge Frequency 2483.5 MHz

ePA - Core 1 (SISO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	56.09	44.48
Static	HDR8	2404	2390	57.71	46.01
Static	LE1M	2402	2390	56.80	45.26
Static	LE2M	2402	2390	57.20	45.56
Static	HDR4	2476	2483.5	56.02	45.09
Static	HDR8	2476	2483.5	62.57	50.16
Static	LE1M	2480	2483.5	59.39	48.48
Static	LE2M	2478	2483.5	58.15	47.45
Static	LE2M	2480	2483.5	61.78	51.40

Table 12 - SISO Restricted Band Edge Results



**Figure 46 - Bluetooth HDR4, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz**

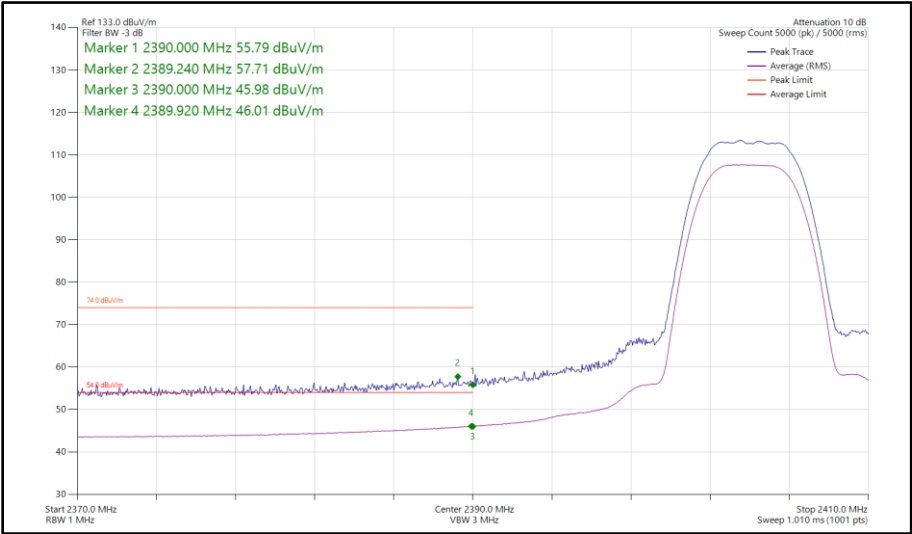


Figure 47 - Bluetooth HDR8, SISO, Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz

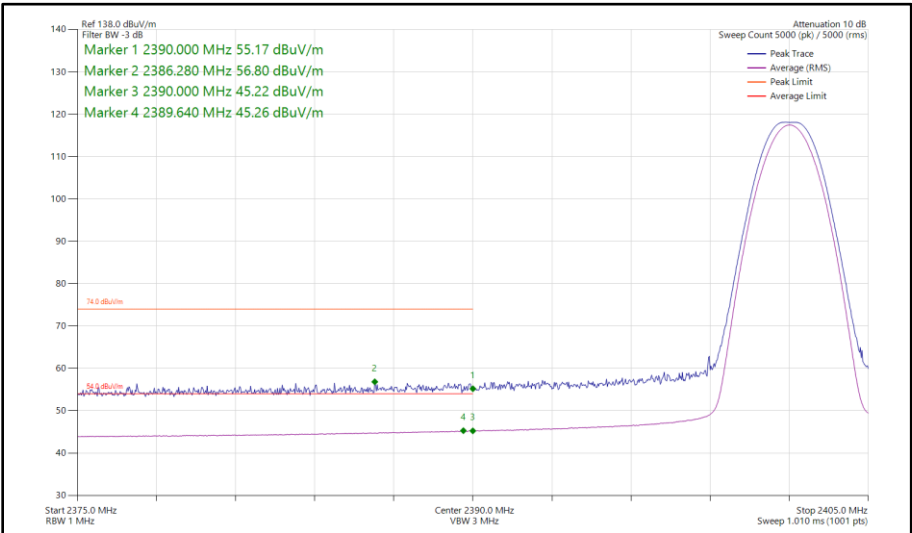


Figure 48 - Bluetooth LE1M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

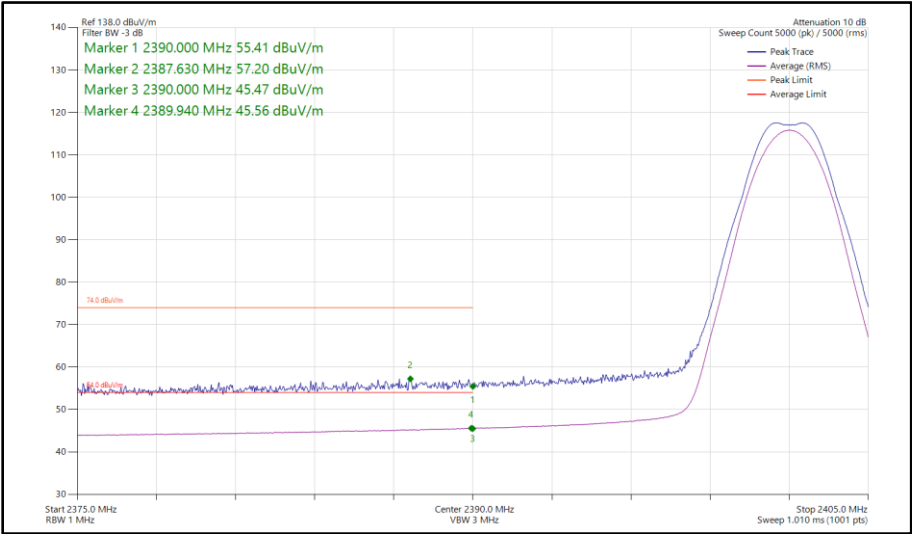


Figure 49 - Bluetooth LE2M, SISO, Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz

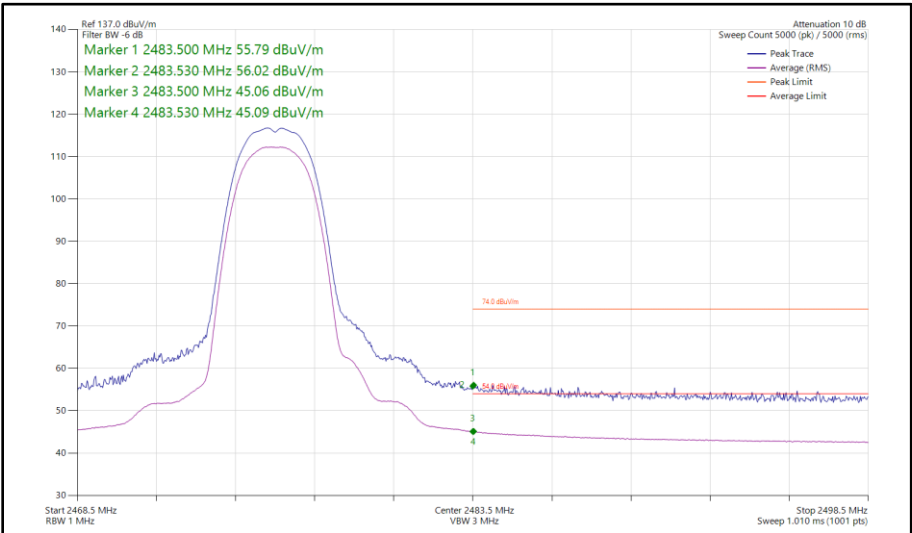
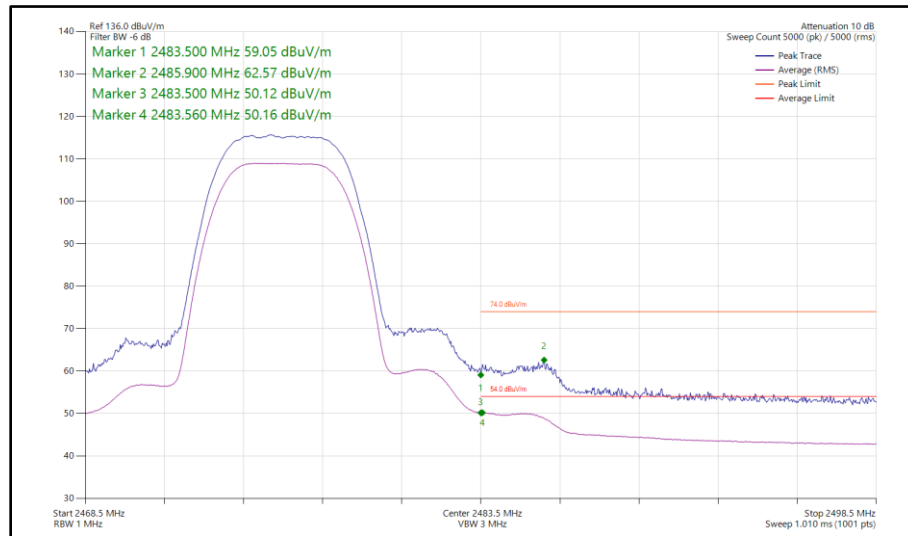
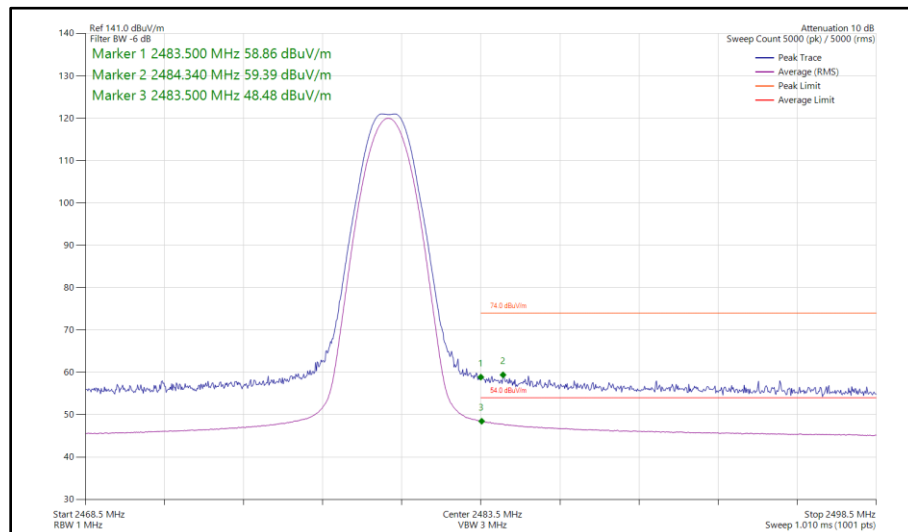


Figure 50 - Bluetooth HDR4, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz



**Figure 51 - Bluetooth HDR8, SISO, Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 52 - Bluetooth LE1M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**

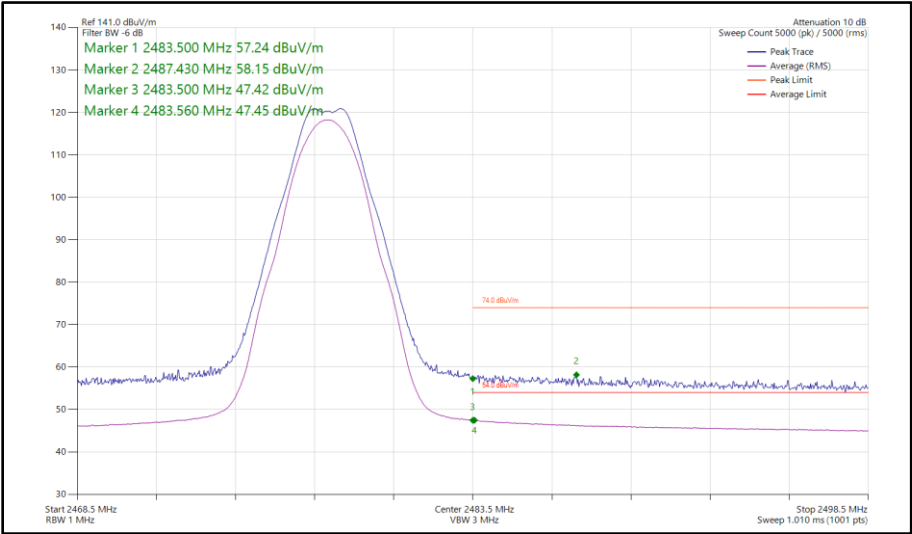


Figure 53 - Bluetooth LE2M, SISO, Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz

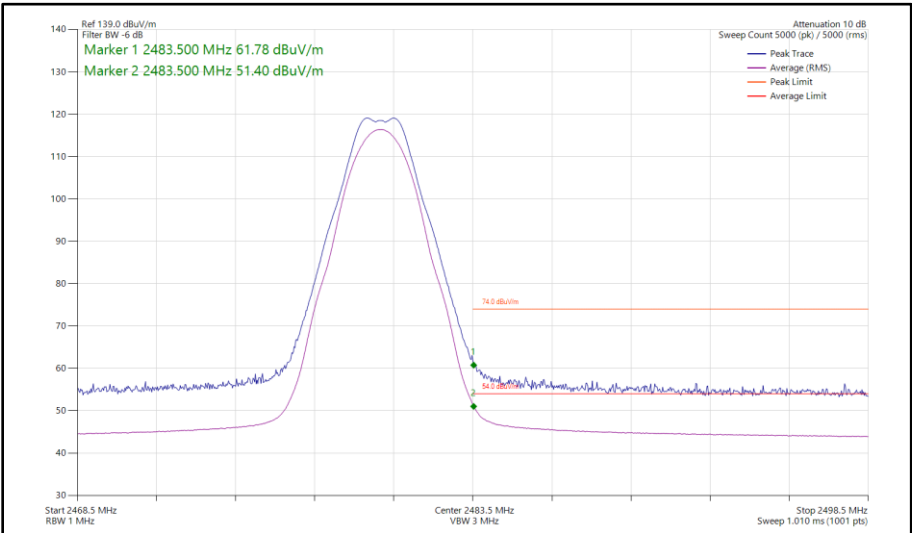
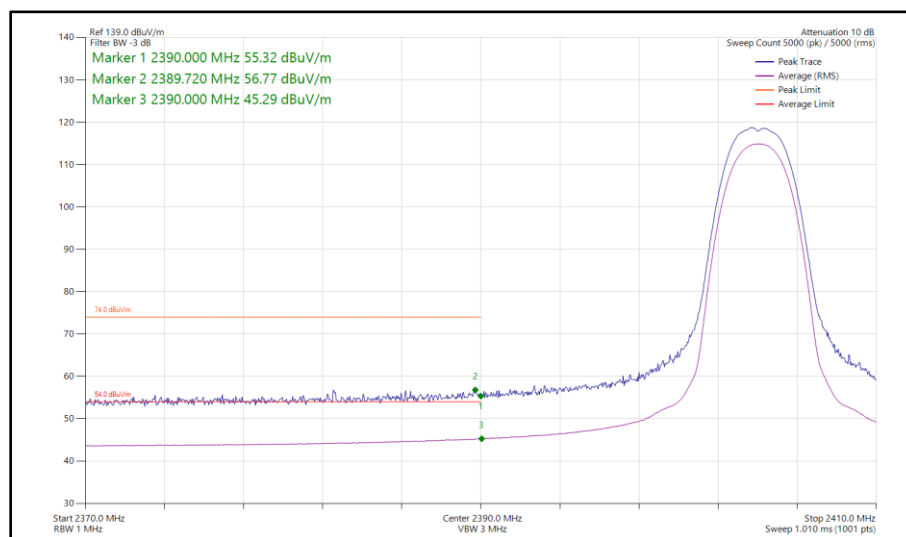


Figure 54 - Bluetooth LE2M, SISO, Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz

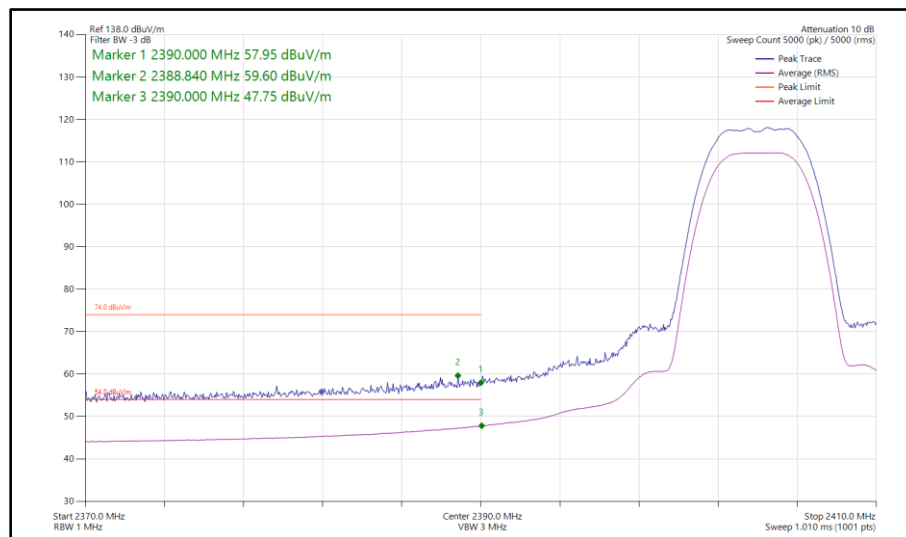
ePA - Core 0 - Core 1 (MIMO)

Mode	Packet Type	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
Static	HDR4	2404	2390	56.77	45.29
Static	HDR8	2404	2390	59.60	47.75
Static	LE1M	2402	2390	57.56	46.14
Static	LE2M	2402	2390	59.07	46.61
Static	HDR4	2476	2483.5	57.64	46.82
Static	HDR8	2476	2483.5	62.82	51.24
Static	LE1M	2480	2483.5	61.96	51.18
Static	LE2M	2478	2483.5	61.11	49.55
Static	LE2M	2480	2483.5	62.03	51.26

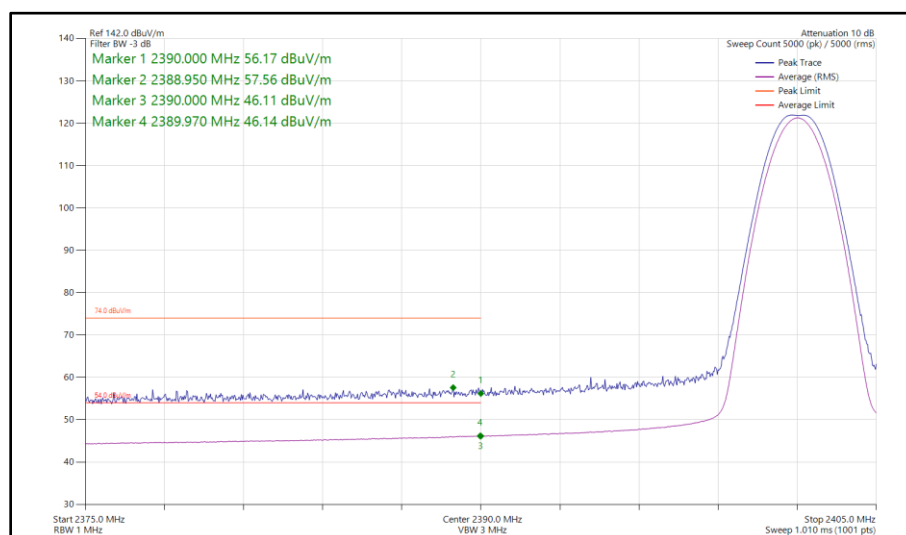
Table 13 - MIMO Restricted Band Edge Results



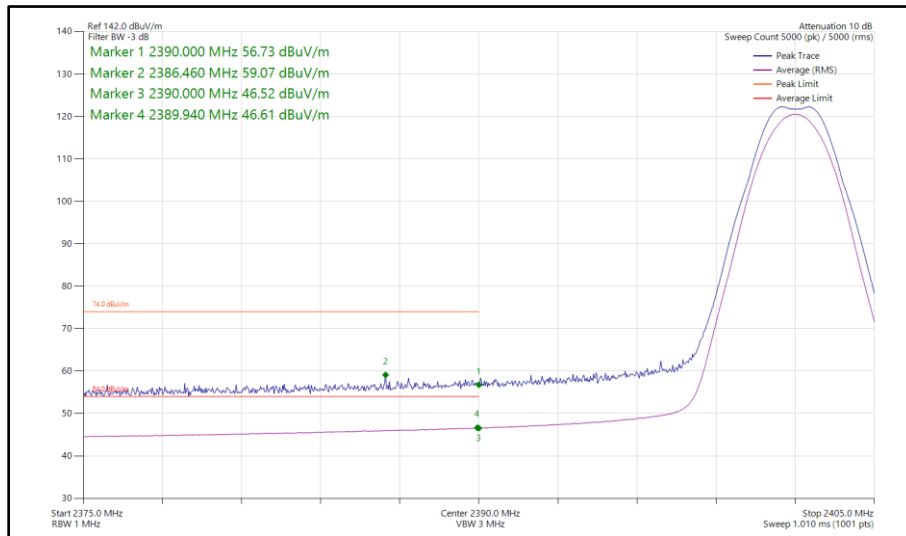
**Figure 55 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz**



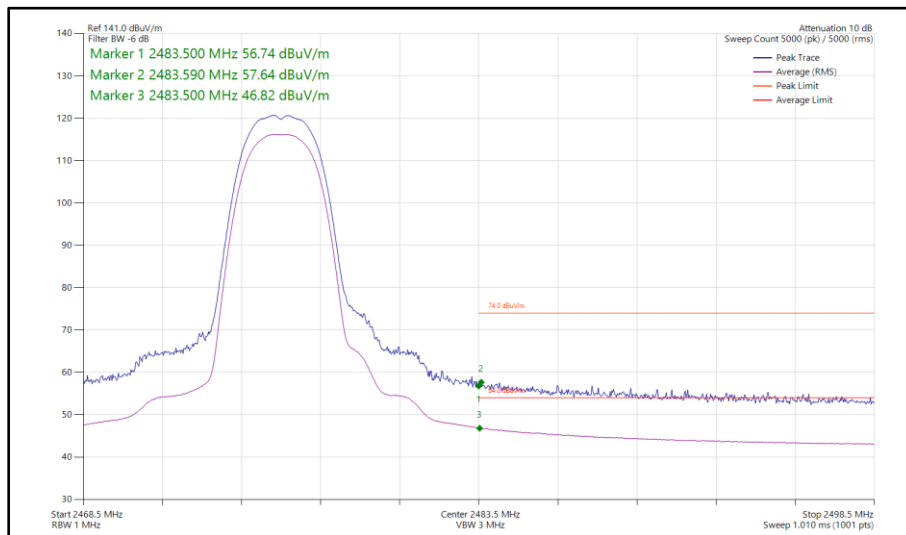
**Figure 56 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2404 MHz
Band Edge Frequency 2390 MHz**



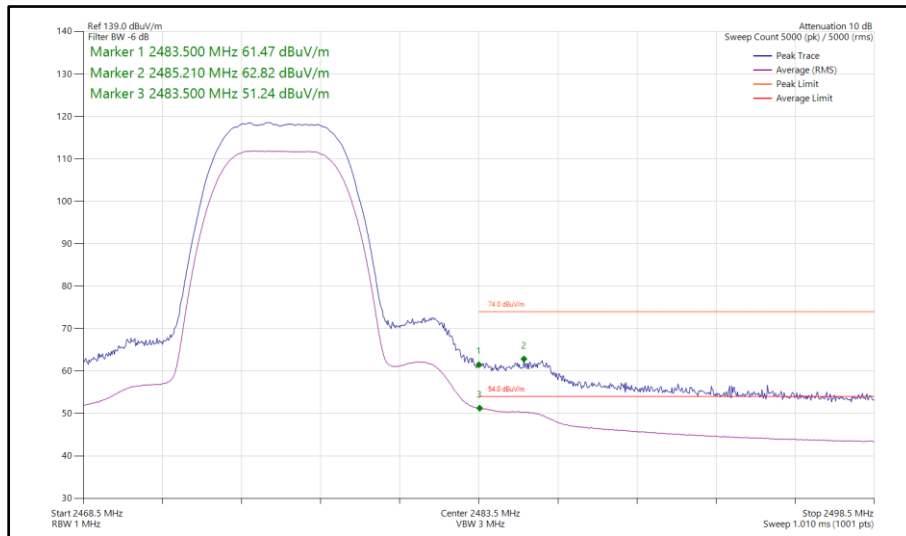
**Figure 57 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



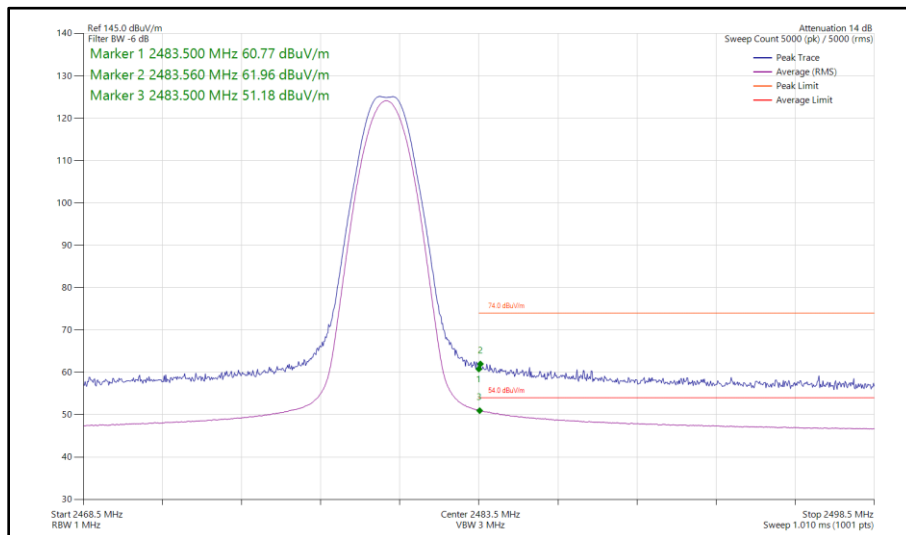
**Figure 58 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2402 MHz
Band Edge Frequency 2390 MHz**



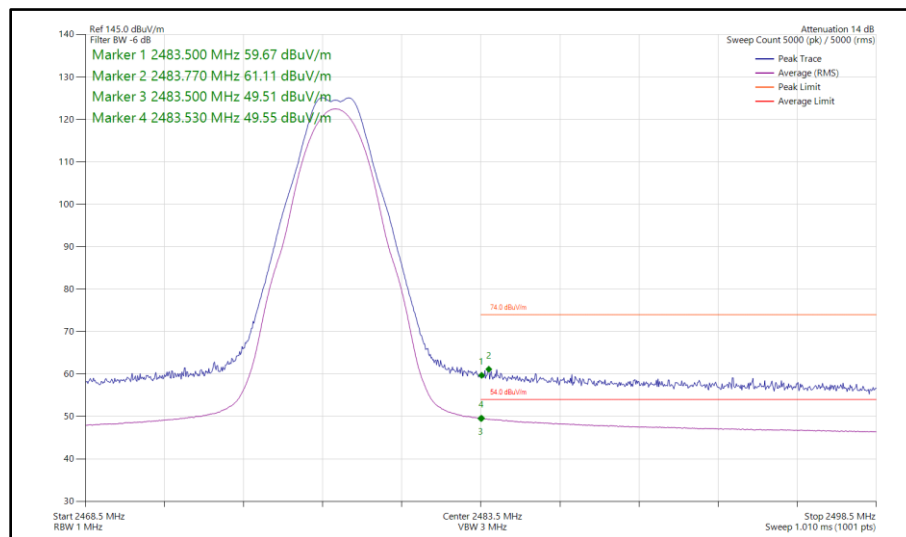
**Figure 59 - Bluetooth HDR4, MIMO, Core 0 - Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**



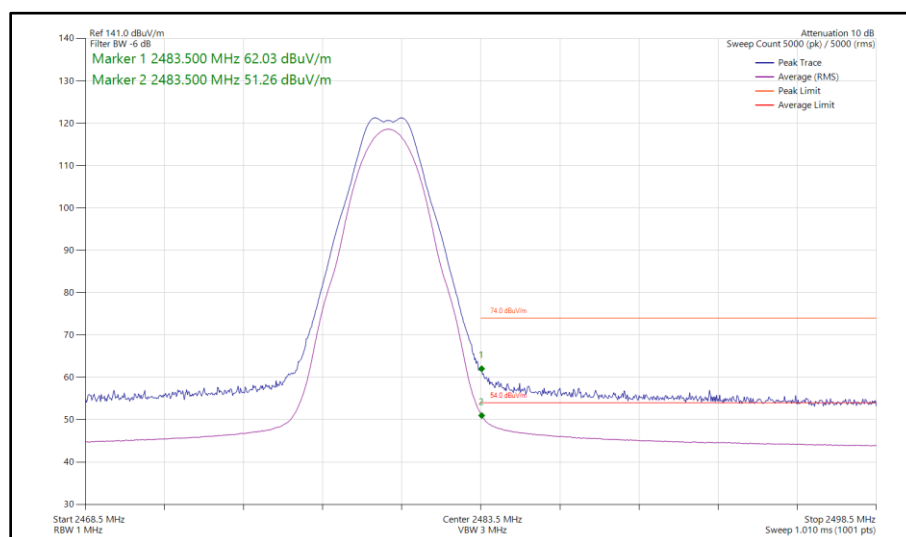
**Figure 60 - Bluetooth HDR8, MIMO, Core 0 - Core 1 - 2476 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 61 - Bluetooth LE1M, MIMO, Core 0 - Core 1 - 2480 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 62 - Bluetooth LE2M, MIMO, Core 0 - Core 1 - 2478 MHz
Band Edge Frequency 2483.5 MHz**



**Figure 63 - 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 ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 14



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, Chamber16	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
Cable (N to N 7m)	Junkosha	MWX221-07000NMSNMS/B	6005	12	20-May-2025
Cable (SMA to SMA 1m)	Junkosha	MWX221-01000AMSAMS/A	6018	12	10-Jun-2025
Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA9120B	6142	12	05-May-2025
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 8m)	Junkosha	MWX221-08000AMSAMS/B	6319	12	04-Feb-2025
SAC Switch Unit	TUV SUD	TUV_SSU_004 PLC	6349	12	07-May-2025

Table 15

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

A3185, S/N: GRJTT9QH7L - Modification State 0
A3185, S/N: HM9QNWPCFQ - Modification State 0
A3185, S/N: GHGG6N440H - Modification State 0

2.2.3 Date of Test

05-September-2024 to 22-September-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	21.0 - 22.8 °C
Relative Humidity	52.9 - 57.5 %



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) RSS-247 5.2 a)	Test Method(s):	C63.10 6.9.3 C63.10 11.8.1
Additional Reference(s):	-		

DUT Configuration			
Mode:	iPA $\pi/4$ 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	-	1.600	-	-	≥ 500.0
2441	-	1.896	-	-	≥ 500.0
2476	-	1.896	-	-	≥ 500.0

Table 16 - 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 17 - 99% Bandwidth Results

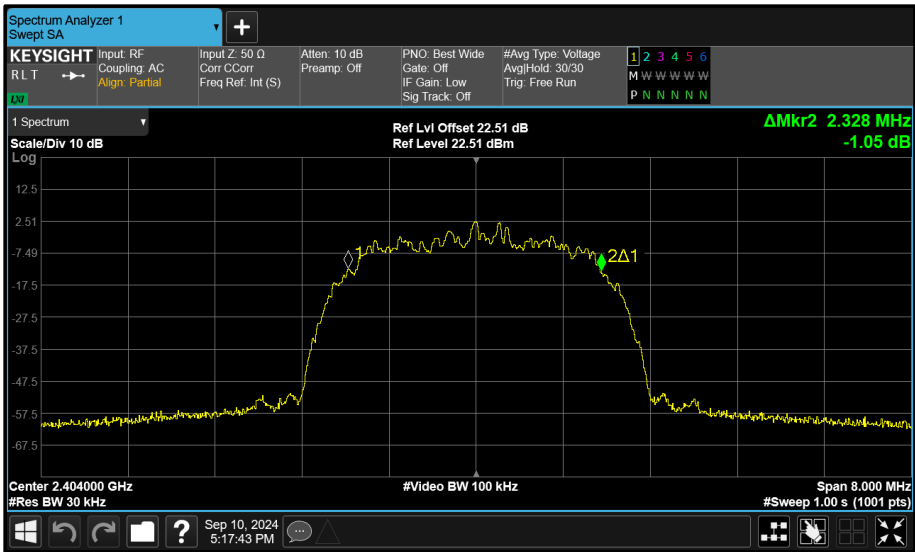


Figure 64 - Core 1 (B) 2404 MHz (CH2) 99% Bandwidth

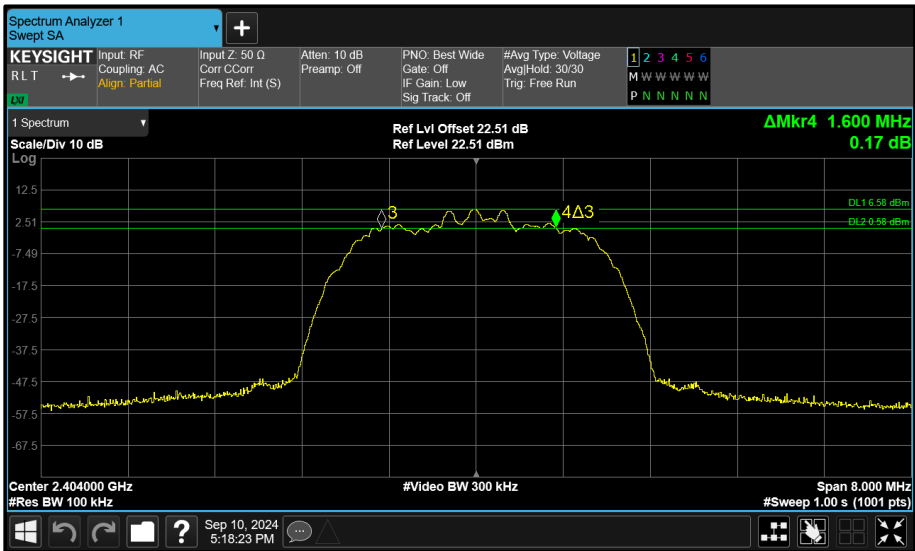


Figure 65 - Core 1 (B) 2404 MHz (CH2) 6 dB Bandwidth

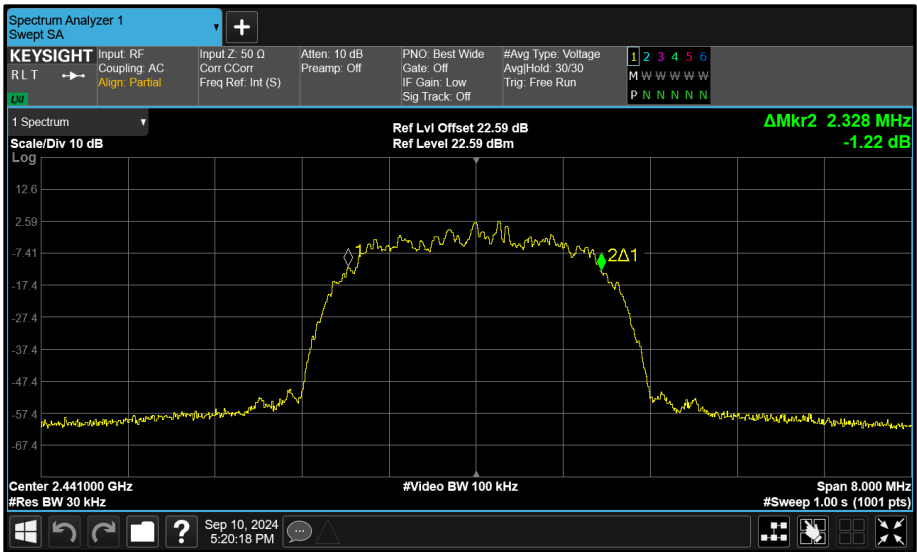


Figure 66 - Core 1 (B) 2441 MHz (CH39) 99% Bandwidth

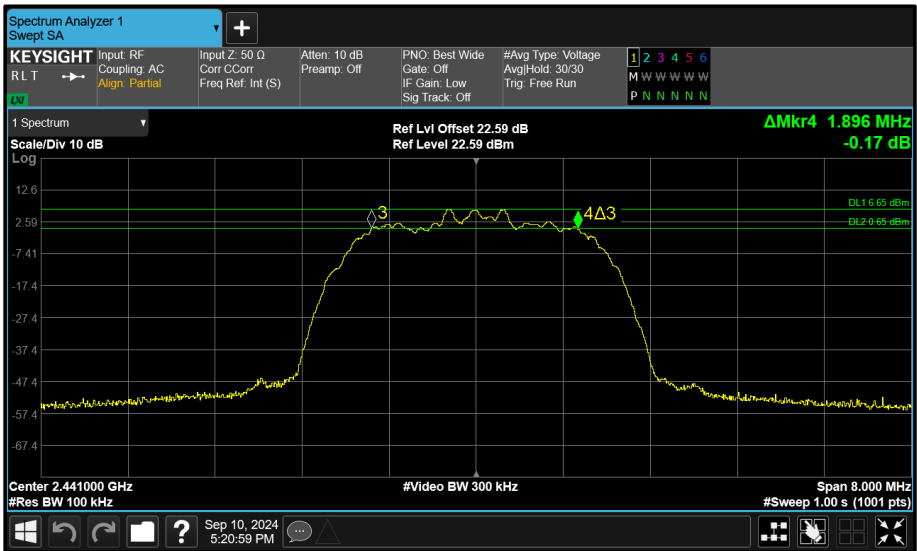


Figure 67 - Core 1 (B) 2441 MHz (CH39) 6 dB Bandwidth