FCC and ISED Test Report

Apple Inc
Model: A2992

In accordance with FCC 47 CFR Part 15E, ISED RSS-247 and ISED RSS-GEN (5 GHz WLAN)

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

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Document 75957632-47 Issue 01

SIGNATURE			
P J Harrison			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Phil Harrison	Chief Engineer	Authorised Signatory	11 October 2023

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 15E, ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Report Generation	Lauren Walters	11 October 2023	

FCC Accreditation
553713/UK2026 Concorde Park, Fareham Test Laboratory

ISED Accreditation
28798 Concorde Park, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15E: 2021, ISED RSS-247: Issue 2 (2017-02) and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) for the tests detailed in section 1.3.

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Contents

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	??

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2992
Serial Number(s)	Y349994YRC, C69CLQX700, JNWG0WYT4M, JYH72K1GF6 and YK6L37Y361
Hardware Version(s)	REV 1.0
Software Version(s)	23A32391n, 23A32391n, 23A32391n, 23A32391n and 23A300
Number of Samples Tested	5
Test Specification/Issue/Date	FCC 47 CFR Part 15E: 2021 ISED RSS-247: Issue 2 (2017-02) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Start of Test	03-July-2023
Finish of Test	13-September-2023
Name of Engineer(s)	Ahmed Al Derdiri, Manohar Thota, Nicolae Mihailiuc, Tony Baby, David Hill, Feda Hussein, Mustafa Murad, Babitha Babu, Stefan Gilfedder and Tjiyandjeua Tjizumaue
Related Document(s)	ANSI C63.10 (2013) ANSI C63.10 (2020) KDB 662911 D01 v02r01 KDB 789033 D02 v02r01 KDB 905462 D02 v02 KDB 905462 D03 v01r02

1.3 Brief Summary of Results

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

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC Part 15E	RSS-247	RSS-GEN			
Configuration and Mode: 5 GHz WLAN						
-	15.203	-	-	Antenna Requirement	N/T	The device complies with the provisions of this section, as it uses permanently attached integral antennas.
2.1	15.205	3.3	8.10	Restricted Band Edges	Pass	
2.2	15.407 (a)	6.2	-	Emission Bandwidth	Pass	
2.3	15.407 (a)	6.2	-	Maximum Conducted Output Power	Pass	
2.4	15.407 (a)	6.2	-	Maximum Conducted Power Spectral Density	Pass	
2.5	15.407 (b)	6.2	-	Authorised Band Edges	Pass	
2.6	15.209 and 15.407 (b)	6.2	6.13 and 8.9	Spurious Radiated Emissions	Pass	
2.7	15.407 (h)(2)(iii)(iv)	6.3.2(c)(d)(e)	-	Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Pass	

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 5 GHz 802.11 radio supported Single Input/Single Output (SISO) and 2x2 Multiple Input/Multiple Output (MIMO) modes. 802.11a supports 20 MHz bandwidth only. 802.11n supports 20 MHz and 40 MHz bandwidths and 802.11ac and ax support 20 MHz, 40 MHz, 80 MHz & 160 MHz bandwidths.

802.11a mode supports SISO operation only. 802.11n, ac and ax support SISO, Cyclic Delay Diversity (CDD) and Space Division Multiplexing (SDM). 802.11n and ac also additionally support Transmit Beamforming (TxBF) mode for 20 MHz, 40 MHz and 80 MHz operation. The EUT supports 802.11ax Single User (SU) and Multi-User (MU) with all Resource Unit (RU) sizes from 52 subcarriers, up to the maximum allowed, dependent on channel bandwidth. Additionally, RU-26 is supported in U-NII-1 and U-NII-3.

The EUT uses different output powers dependent on how many cores are active. The EUT also uses different power tables for Cyclic Delay Diversity (CDD), Space Division Multiplexing (SDM) and Transmit Beamforming (TxBF) modes. It uses the same conducted power across all cores in any given mode, but due to the different antenna gains the radiated powers per core differ.

US and CA country codes changed the power table used for U-NII band 1. Therefore U-NII-1 channels were tested using both power settings for each country's respective limits.

Band edge testing was performed in all modes with multiple modulation types, with only the worst-case reported. After band edge and additional preliminary investigations were performed to find worst-case operation, the EUT was tested in the following supported transmit modes:

SISO Modes (Core 0):

- 802.11a – 12 Mbps
- 802.11n HT20 – MCS2
- 802.11n HT40 – MCS2
- 802.11ac VHT80 – MCS2x1
- 802.11ac VHT160 – MCS2x1
- 802.11ax HE20 SU – MCS2x1
- 802.11ax HE40 SU – MCS2x1
- 802.11ax HE80 SU – MCS2x1
- 802.11ax HE160 SU – MCS2x1
- 802.11ax HE20 MU RU26/52/106 – MCS2x1

2x2 MIMO Modes (Core 0+1 for U-NII-1 / 2A / 2C / 3):

- 802.11n/ac (V)HT20 - CDD (MCS2), SDM (MCS10) and TxBF (MCS2x1)
- 802.11n/ac (V)HT40 - CDD (MCS2), SDM (MCS10) and TxBF (MCS2x1)
- 802.11ac VHT80 – CDD (MCS2x1), SDM (MCS2x2) and TxBF (MCS2x1)
- 802.11ac VHT160 – CDD (MCS2x1) and SDM (MCS2x2)
- 802.11ax HE20 SU – CDD (MCS2x1) and SDM (MCS2x2)
- 802.11ax HE40 SU – CDD (MCS2x1) and SDM (MCS2x2)
- 802.11ax HE80 SU – CDD (MCS2x1) and SDM (MCS2x2)
- 802.11ax HE160 SU – CDD (MCS2x1) and SDM (MCS2x2)
- 802.11ax HE20 MU RU26/52/106 – CDD (MCS2x1) and SDM (MCS2x2)

*Notes: The RU offset for bottom and middle channels were placed in the lowest position and on the top channel, the offset was placed in the upper most position. HT (802.11n) modes were used for CDD and SDM. VHT (802.11ac) modes were used for TxBF.

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 testing except DFS the EUT was put into a continuous transmit test mode with the chipset manufacturer's test commands. The EUT then transmitted the required type of packeted 802.11 data frames of fixed length, containing the standard headers and with pseudo-random data content, ensuring the measured signals were representative and contained all the symbols at the highest power control level.

The test setup used for DFS is described in the test result section of the present document.

1.4.4 Antenna Gain Table

Antenna Port	Frequency Range (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
Core 0	5150 to 5250	8.40	1.07
	5250 to 5350	9.10	1.07
	5470 to 5725	4.40	1.17
	5725 to 5850	4.50	1.18
Core 1	5150 to 5250	5.50	1.07
	5250 to 5350	5.70	1.07
	5470 to 5725	4.90	1.17
	5725 to 5850	4.10	1.18

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: A2992, Serial Number: Y349994YRC			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2992, Serial Number: C69CLQX700			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2992, Serial Number: JYH72K1GF6			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2992, Serial Number: YK6L37Y361			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2992, Serial Number: JNWG0WYT4M			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 4

1.7 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 5 GHz WLAN		
Restricted Band Edges	Ahmed Al Derdiri, Manohar Thota, Nicolae Mihailiuc and Tony Baby	UKAS
Emission Bandwidth	David Hill, Feda Hussein and Mustafa Murad	UKAS
Maximum Conducted Output Power	David Hill and Feda Hussein	UKAS
Maximum Conducted Power Spectral Density	David Hill, Feda Hussein and Mustafa Murad	UKAS
Authorised Band Edges	Ahmed Al Derdiri, Manohar Thota, Nicolae Mihailiuc and Tony Baby	UKAS
Spurious Radiated Emissions	Ahmed Al Derdiri, Nicolae Mihailiuc and Tony Baby	UKAS
Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Babitha Babu, Stefan Gilfedder and Tjiyandjeua Tjizumaue	UKAS

Table 5

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 15E, Clause 15.205
ISED RSS-247, Clause 3.3
ISED RSS-GEN, Clause 8.10

2.1.2 Equipment Under Test and Modification State

A2992, S/N: Y349994YRC - Modification State 0
A2992, S/N: C69CLQX700 - Modification State 0

2.1.3 Date of Test

03-July-2023 to 17-July-2023

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.5.

Restricted Band Edge measurements were performed with the device operating across the various SISO and MIMO modes supported by the device.

The measurements displayed within this report have been limited to those modes which have been shown to be worst case.

Where duty cycle corrections were required for average results, these are included in the result tables but are not shown on the plots.

Further measurements are held on file by TÜV SÜD and are available if required.

2.1.5 Environmental Conditions

Ambient Temperature	20.9 - 23.4 °C
Relative Humidity	36.8 - 50.7 %

2.1.6 Test Results

5 GHz WLAN

20 MHz Bandwidth - Core 0 (SISO)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11a	54 Mbps	-	-	5180	5150	66.34	51.40
802.11a	54 Mbps	-	-	5200	5150	62.28	48.19
802.11n HT20	MCS2	-	-	5180	5150	63.73	51.35
802.11n HT20	MCS7	-	-	5200	5150	66.03	48.43
802.11ax HE20	MCS2x1	SU	-	5180	5150	63.86	51.43
802.11ax HE20	MCS11x1	106	54	5180	5150	64.78	47.81
802.11ax HE20	MCS11x1	SU	-	5200	5150	67.37	48.98
802.11a	54 Mbps	-	-	5300	5350	63.55	49.02
802.11a	12 Mbps	-	-	5320	5350	64.42	51.44
802.11n HT20	MCS7	-	-	5300	5350	65.24	49.05
802.11n HT20	MCS7	-	-	5320	5350	69.20	51.29
802.11ax HE20	MCS11x1	SU	-	5300	5350	68.37	49.81
802.11ax HE20	MCS11x1	SU	-	5320	5350	69.30	50.95
802.11ax HE20	MCS11x1	106	53	5320	5350	62.31	48.73
802.11a	24 Mbps	-	-	5500	5460	63.56	48.06
802.11a	54 Mbps	-	-	5520	5460	62.28	48.09
802.11n HT20	MCS7	-	-	5500	5460	63.59	46.44
802.11n HT20	MCS7	-	-	5520	5460	62.67	47.70
802.11ax HE20	MCS2x1	SU	-	5500	5460	63.56	50.09
802.11ax HE20	MCS11x1	106	54	5500	5460	63.15	47.23
802.11ax HE20	MCS11x1	SU	-	5520	5460	63.68	47.26

Table 6 - SISO Restricted Band Edge Results

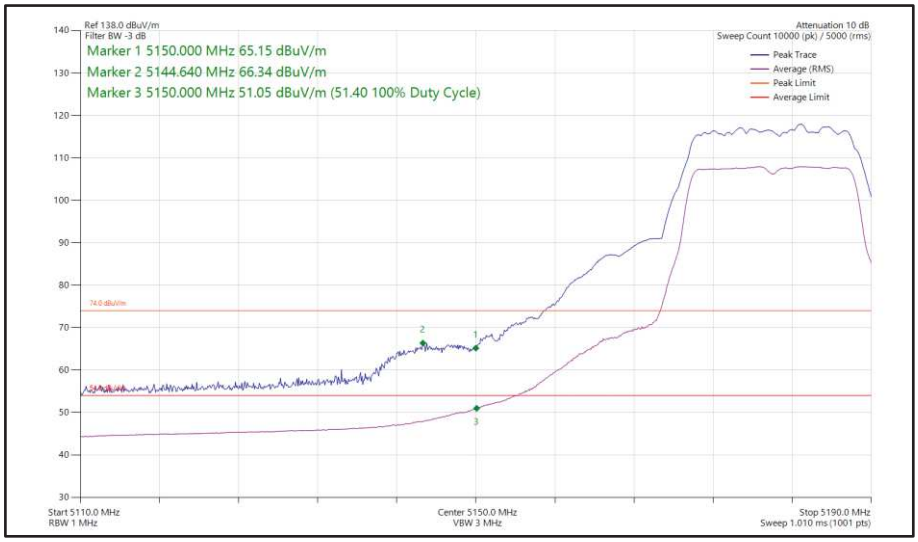

Figure 1 - 802.11a, SISO, Core 0 - 5180 MHz
Band Edge Frequency 5150 MHz

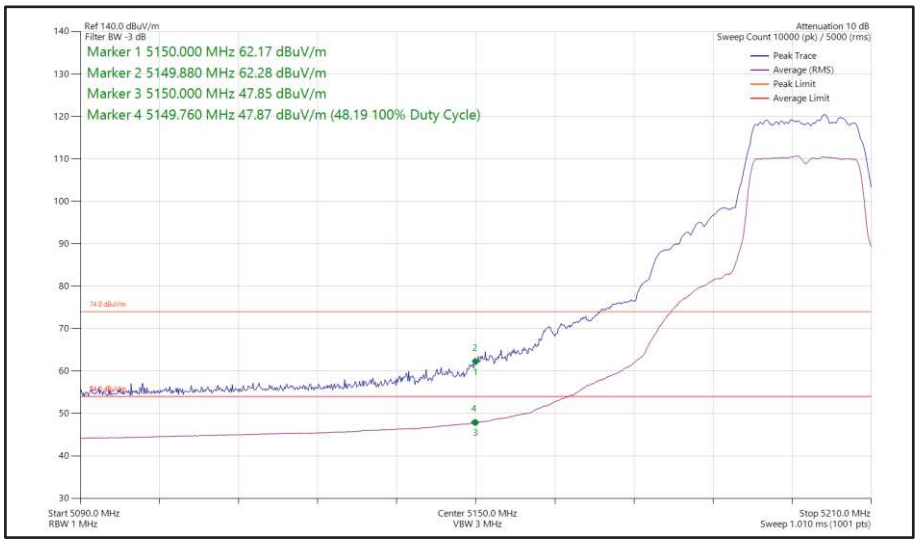

Figure 2 - 802.11a, SISO, Core 0 - 5200 MHz
Band Edge Frequency 5150 MHz

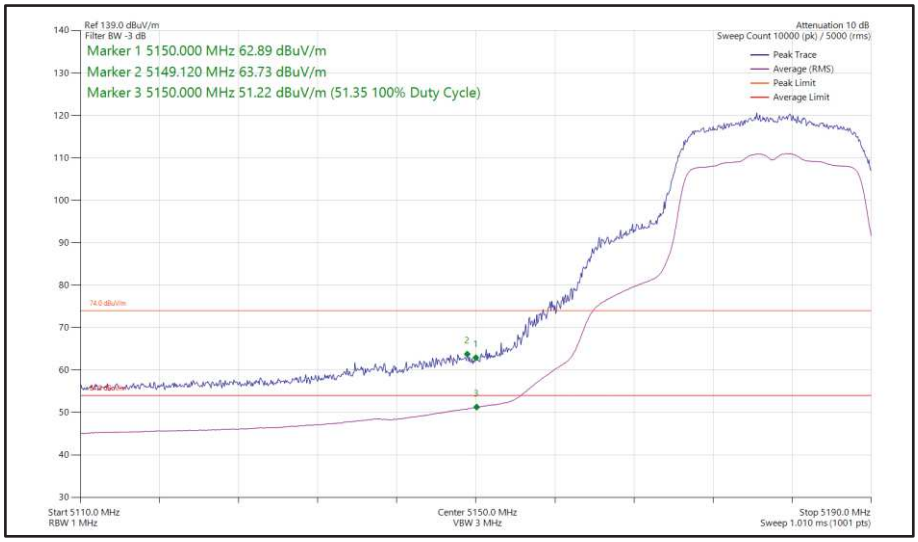

Figure 3 - 802.11n HT20, SISO, Core 0 - 5180 MHz
Band Edge Frequency 5150 MHz

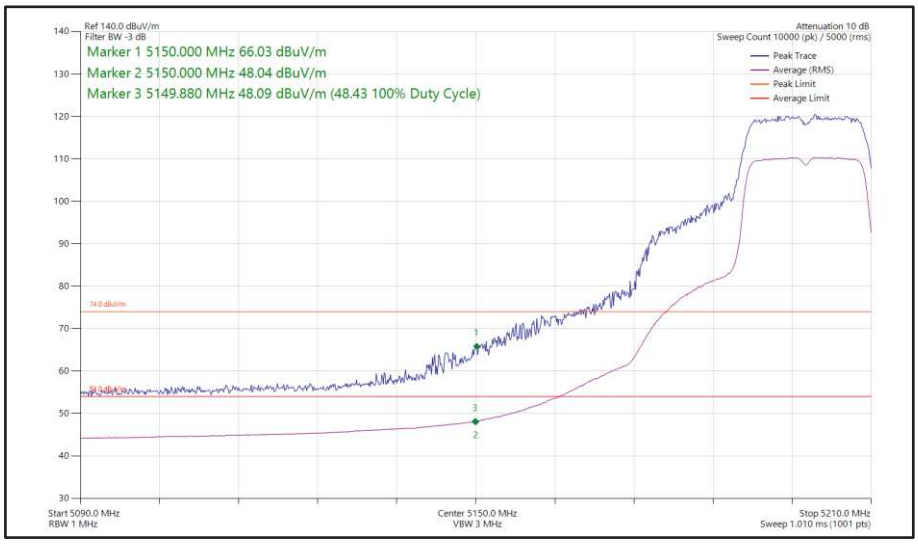

Figure 4 - 802.11n HT20, SISO, Core 0 - 5200 MHz
Band Edge Frequency 5150 MHz

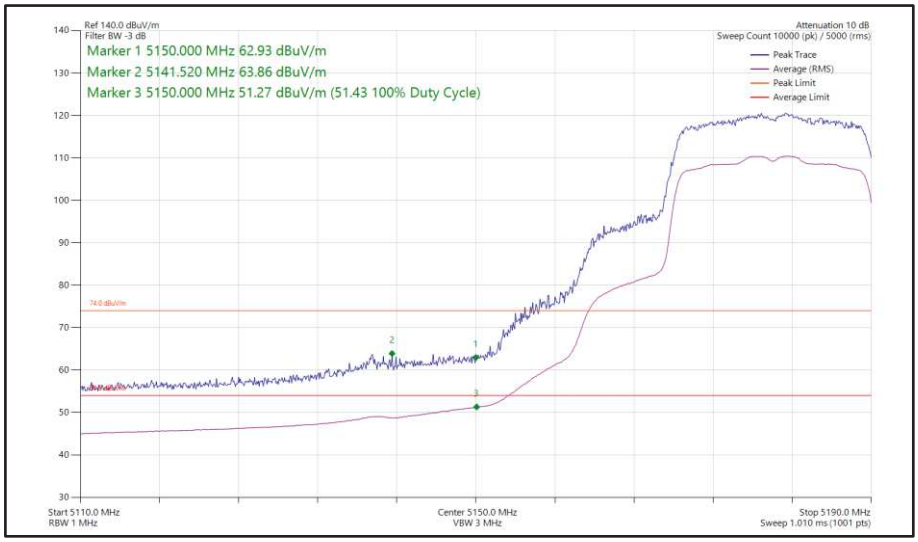

Figure 5 - 802.11ax HE20, SU, SISO, Core 0 - 5180 MHz
Band Edge Frequency 5150 MHz

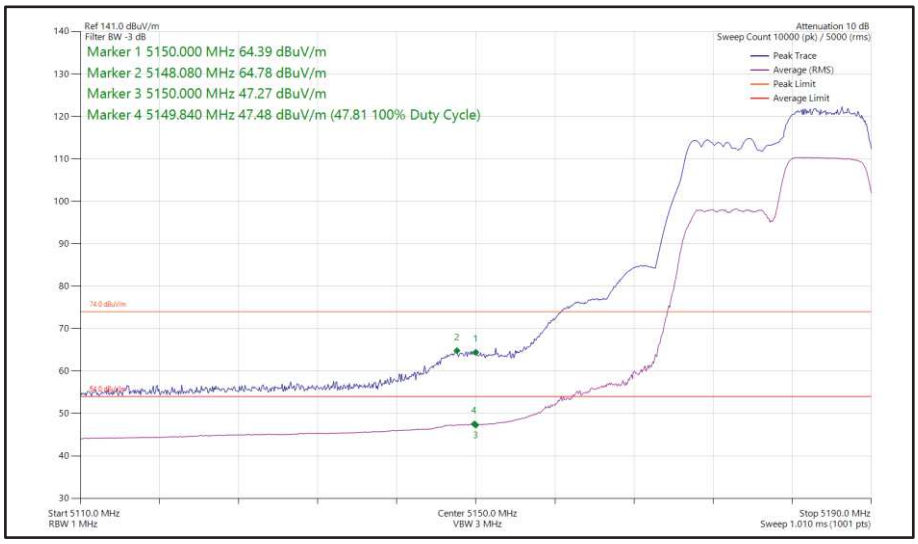

Figure 6 - 802.11ax HE20, RU 106-54, SISO, Core 0 - 5180 MHz
Band Edge Frequency 5150 MHz

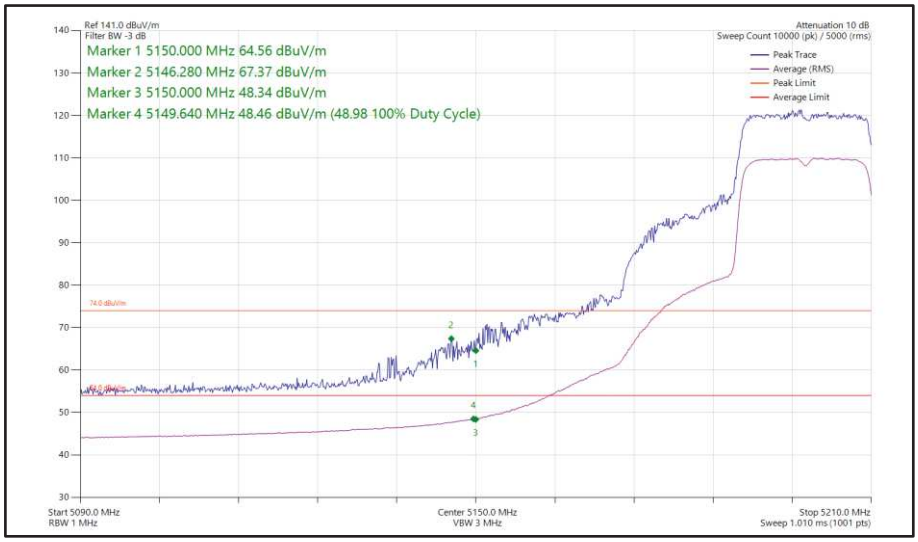

Figure 7 - 802.11ax HE20, SU, SISO, Core 0 - 5200 MHz
Band Edge Frequency 5150 MHz

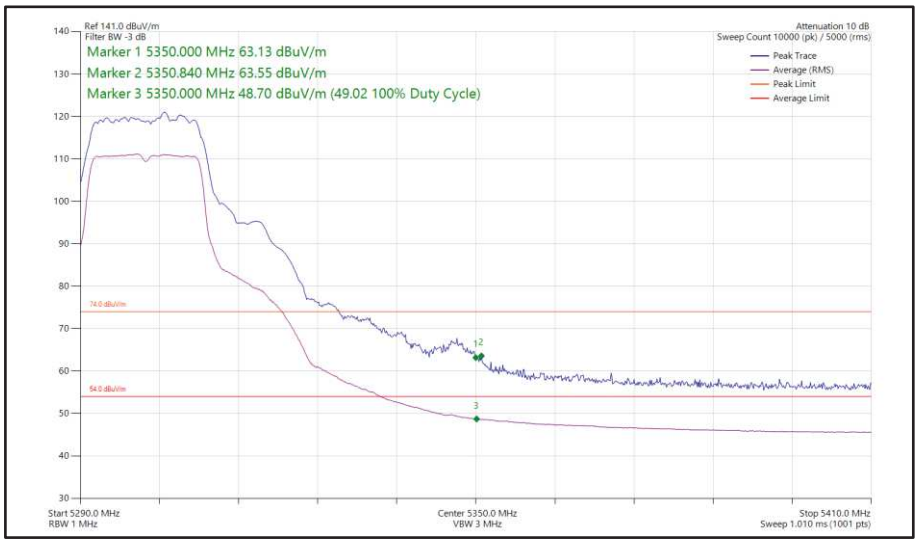

Figure 8 - 802.11a, SISO, Core 0 - 5300 MHz
Band Edge Frequency 5350 MHz

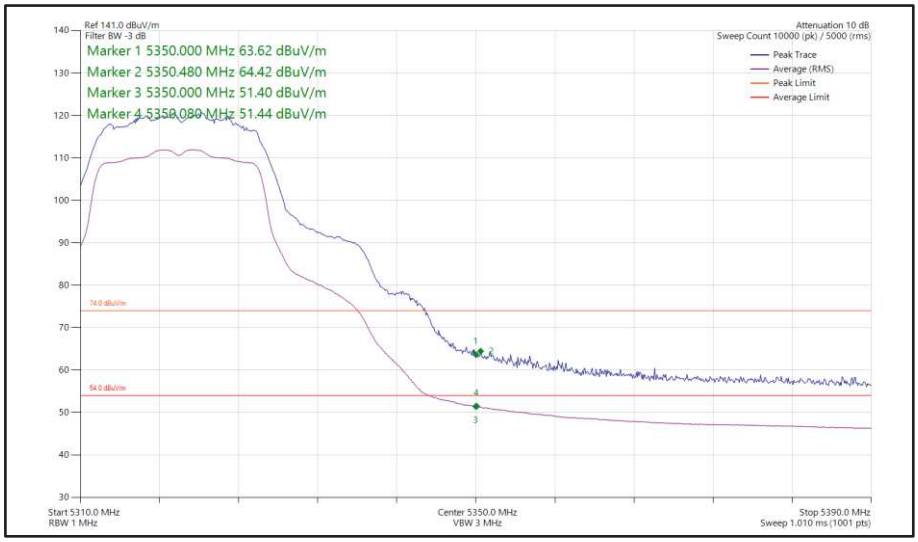

Figure 9 - 802.11a, SISO, Core 0 - 5320 MHz
Band Edge Frequency 5350 MHz

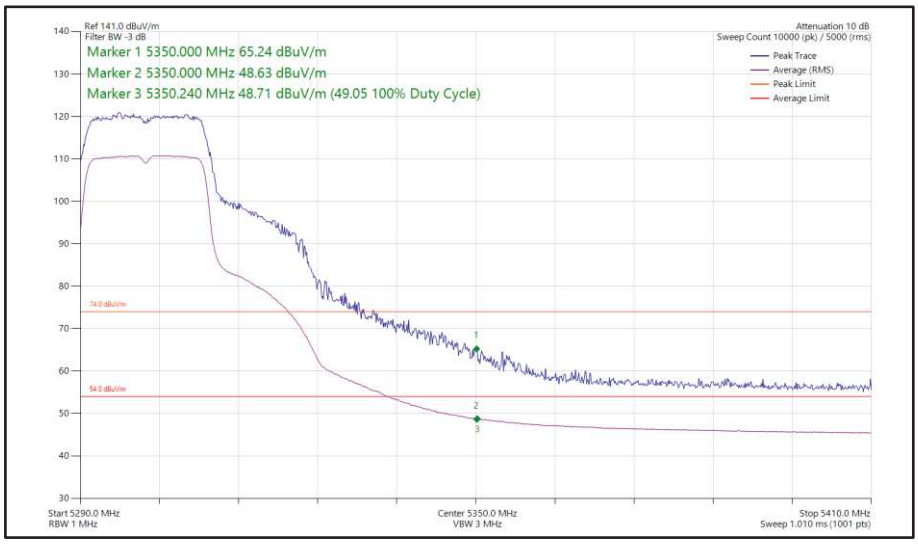

Figure 10 - 802.11n HT20, SISO, Core 0 - 5300 MHz
Band Edge Frequency 5350 MHz

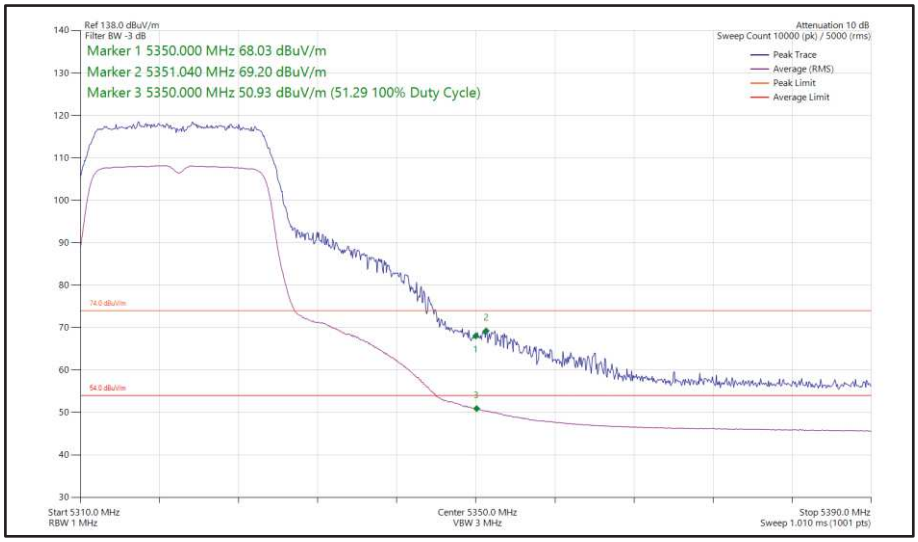

Figure 11 - 802.11n HT20, SISO, Core 0 - 5320 MHz
Band Edge Frequency 5350 MHz

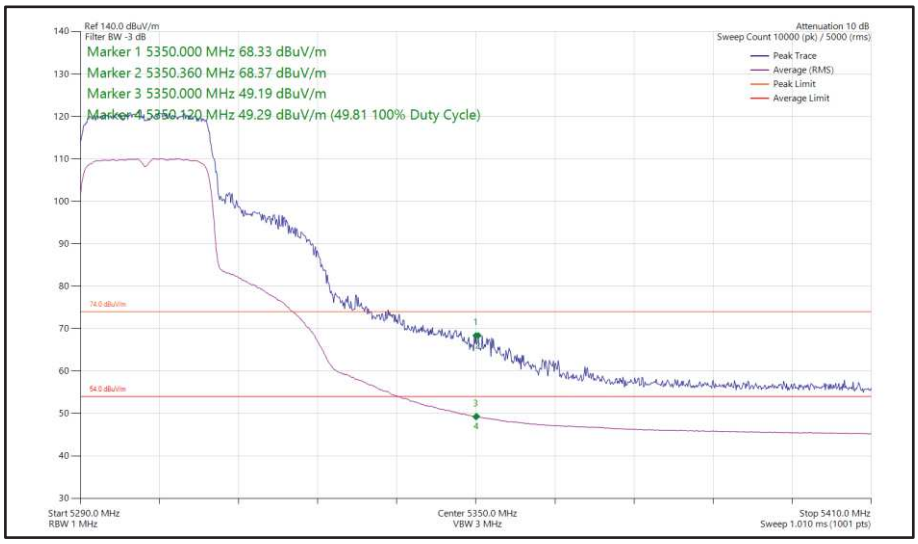

Figure 12 - 802.11ax HE20, SU, SISO, Core 0 - 5300 MHz
Band Edge Frequency 5350 MHz

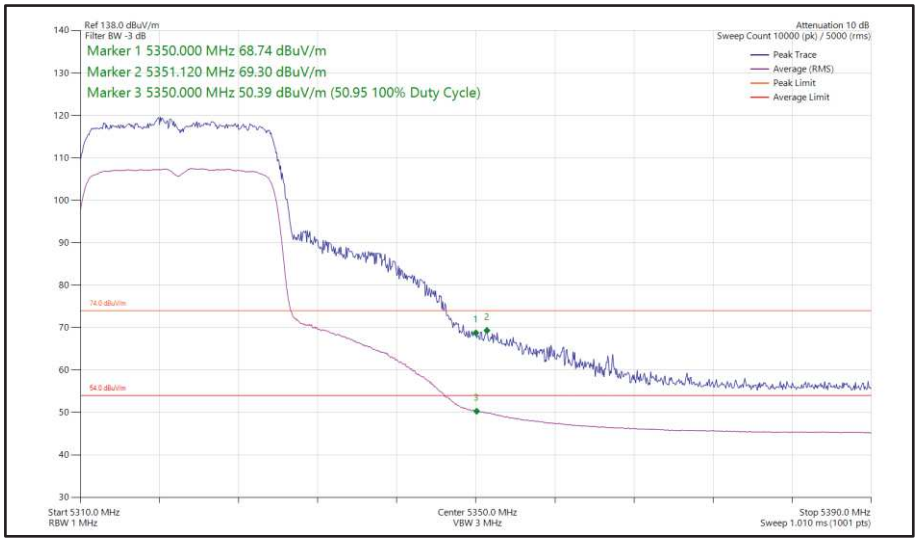

Figure 13 - 802.11ax HE20, SU, SISO, Core 0 - 5320 MHz Band Edge Frequency 5350 MHz

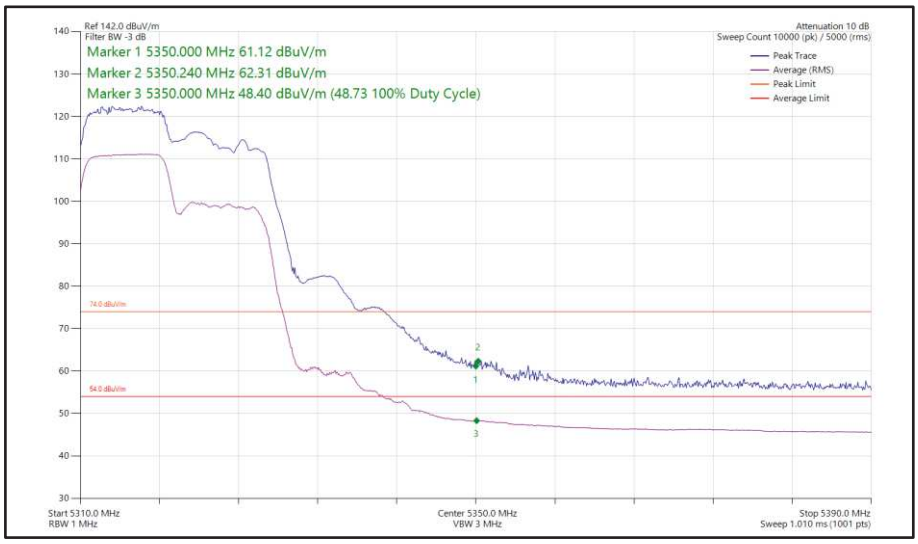

Figure 14 - 802.11ax HE20, RU 106-53, SISO, Core 0 - 5320 MHz Band Edge Frequency 5350 MHz

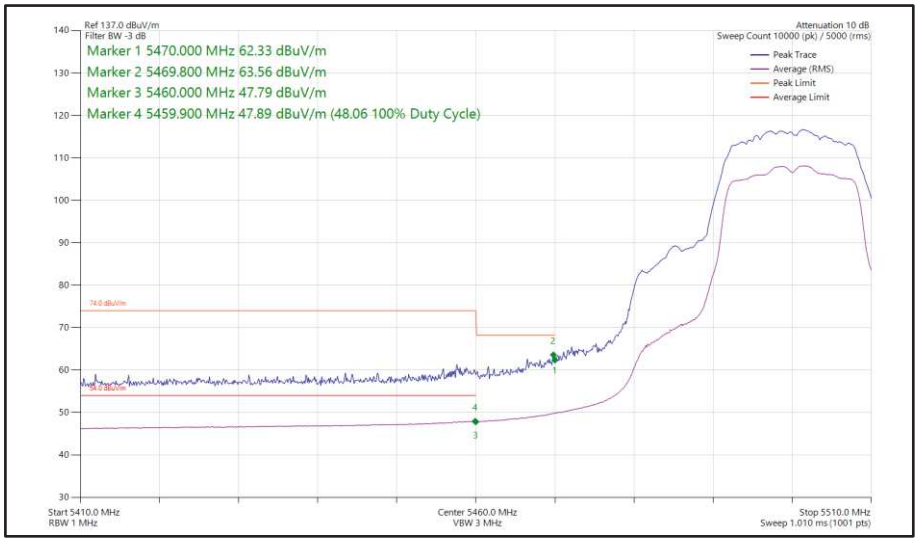

Figure 15 - 802.11a, SISO, Core 0 - 5500 MHz Band Edge Frequency 5460 MHz

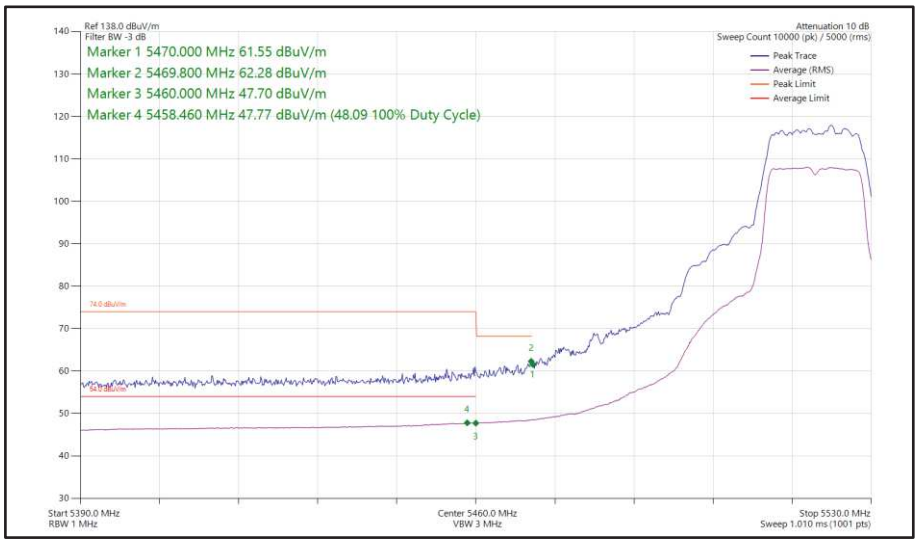

Figure 16 - 802.11a, SISO, Core 0 - 5520 MHz Band Edge Frequency 5460 MHz

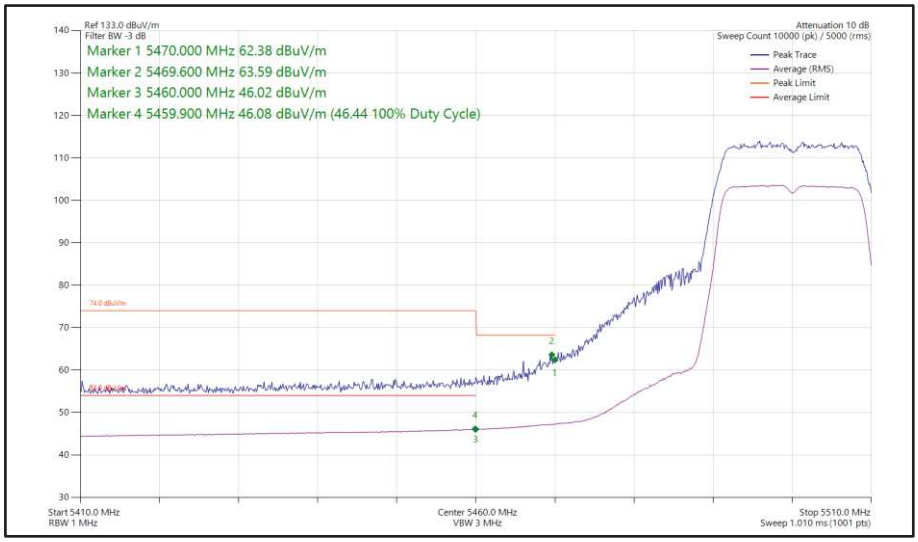

Figure 17 - 802.11n HT20, SISO, Core 0 - 5500 MHz Band Edge Frequency 5460 MHz

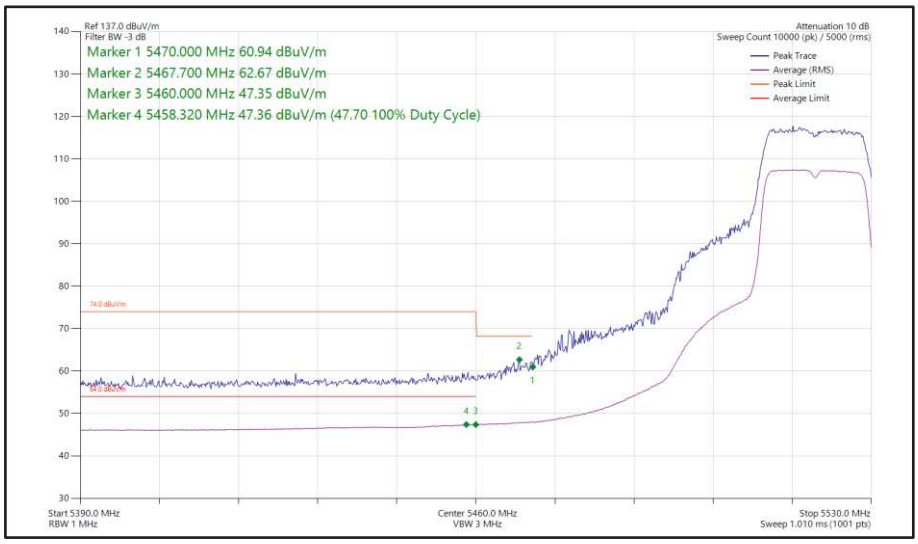

Figure 18 - 802.11n HT20, SISO, Core 0 - 5520 MHz Band Edge Frequency 5460 MHz

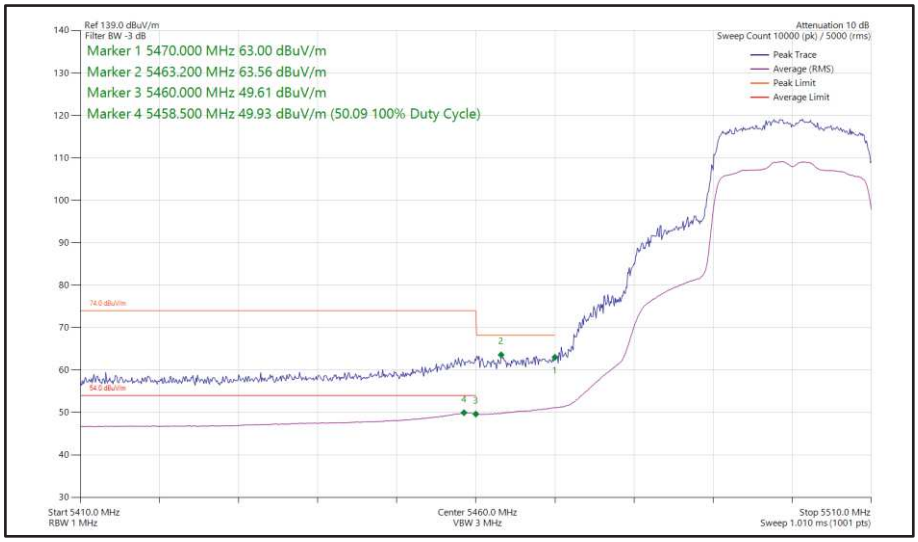

Figure 19 - 802.11ax HE20, SU, SISO, Core 0 - 5500 MHz Band Edge Frequency 5460 MHz

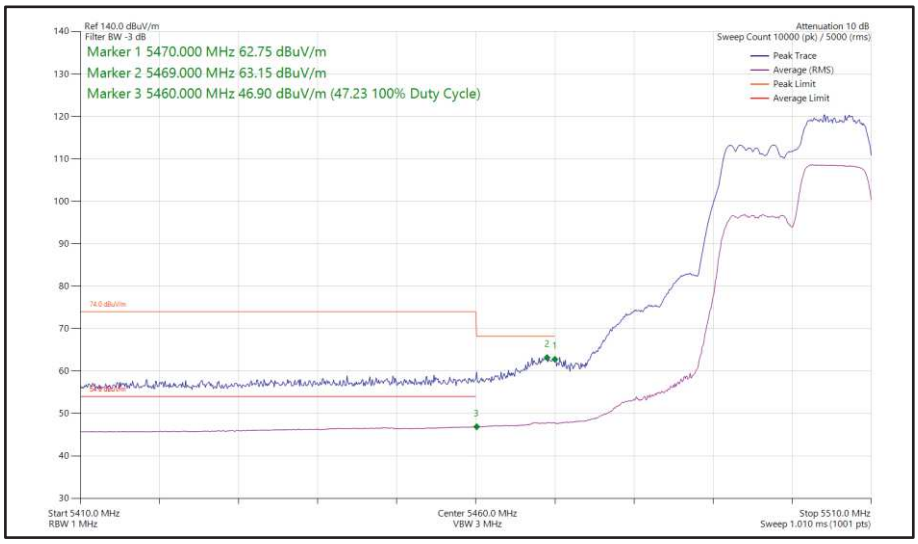

Figure 20 - 802.11ax HE20, RU 106-54, SISO, Core 0 - 5500 MHz Band Edge Frequency 5460 MHz

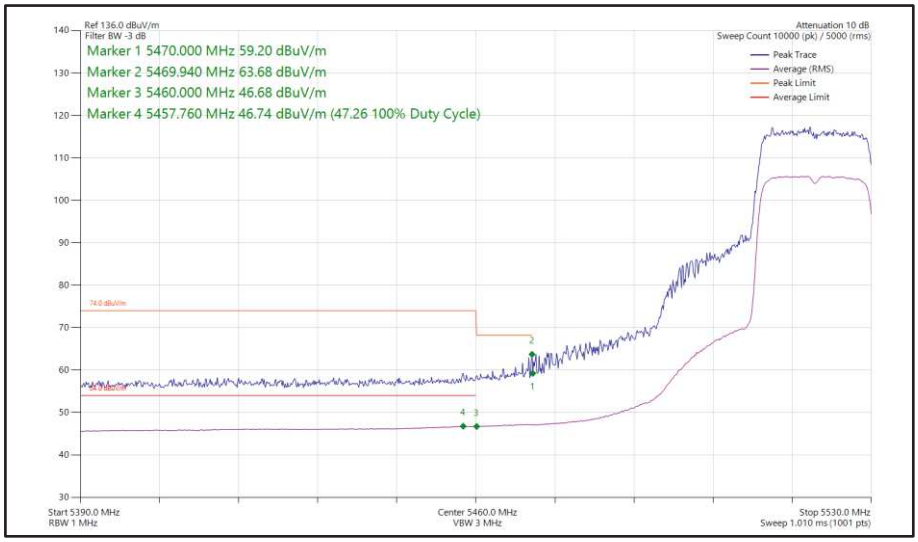

Figure 21 - 802.11ax HE20, SU, SISO, Core 0 - 5520 MHz
Band Edge Frequency 5460 MHz

20 MHz Bandwidth - Core 1 (SISO)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11a	54 Mbps	-	-	5180	5150	66.64	51.36
802.11a	54 Mbps	-	-	5200	5150	61.62	47.89
802.11n HT20	MCS7	-	-	5180	5150	69.30	49.55
802.11n HT20	MCS7	-	-	5200	5150	62.38	47.79
802.11ax HE20	MCS11x1	SU	-	5180	5150	68.88	50.35
802.11ax HE20	MCS11x1	106	53	5180	5150	62.23	46.48
802.11ax HE20	MCS11x1	SU	-	5200	5150	66.61	48.22
802.11a	54 Mbps	-	-	5300	5350	62.31	49.02
802.11a	54 Mbps	-	-	5320	5350	66.61	51.41
802.11n HT20	MCS7	-	-	5300	5350	66.50	49.44
802.11n HT20	MCS7	-	-	5320	5350	69.47	51.30
802.11ax HE20	MCS11x1	SU	-	5300	5350	67.41	49.49
802.11ax HE20	MCS11x1	SU	-	5320	5350	69.48	49.76
802.11ax HE20	MCS11x1	106	53	5320	5350	65.69	49.12
802.11a	54 Mbps	-	-	5500	5460	63.61	47.36
802.11a	54 Mbps	-	-	5520	5460	63.11	48.29
802.11n HT20	MCS7	-	-	5500	5460	63.09	46.60
802.11n HT20	MCS7	-	-	5520	5460	63.43	47.85
802.11ax HE20	MCS4x1	SU	-	5500	5460	63.47	48.54
802.11ax HE20	MCS11x1	106	53	5500	5460	63.43	47.55
802.11ax HE20	MCS4x1	SU	-	5520	5460	63.67	47.49

Table 7 - SISO Restricted Band Edge Results

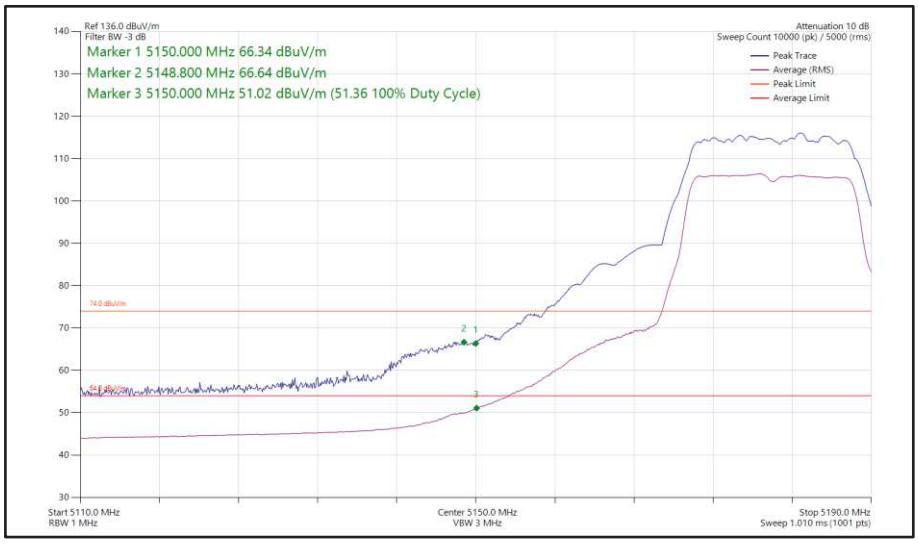

Figure 22 - 802.11a, SISO, Core 1 - 5180 MHz
Band Edge Frequency 5150 MHz

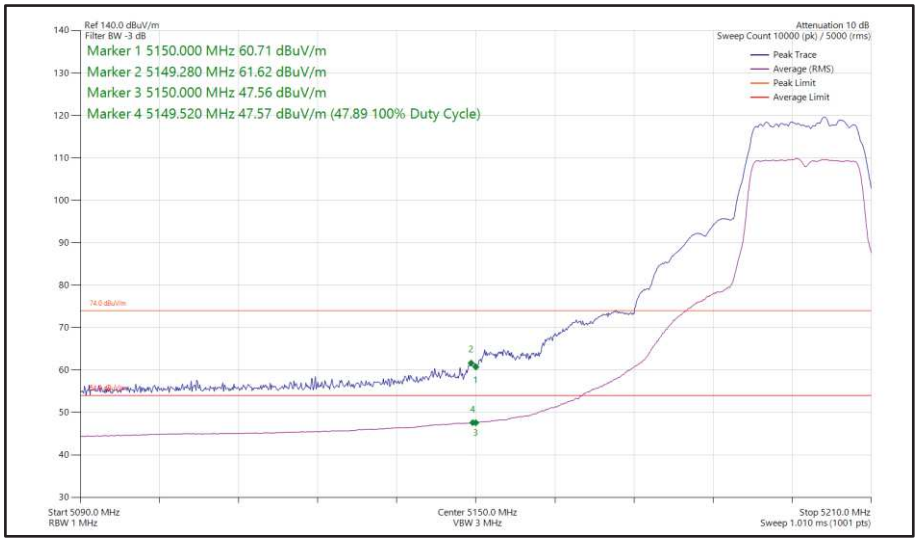

Figure 23 - 802.11a, SISO, Core 1 - 5200 MHz
Band Edge Frequency 5150 MHz

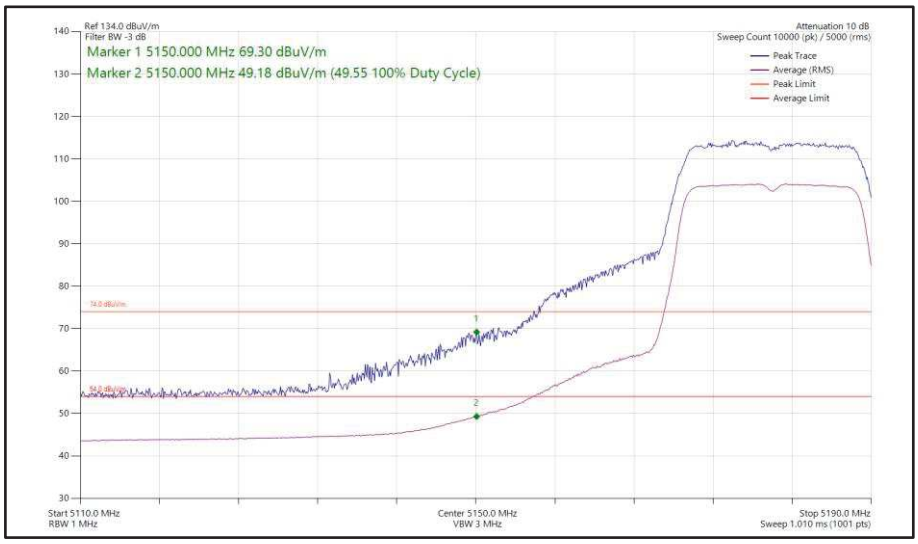

Figure 24 - 802.11n HT20, SISO, Core 1 - 5180 MHz
Band Edge Frequency 5150 MHz

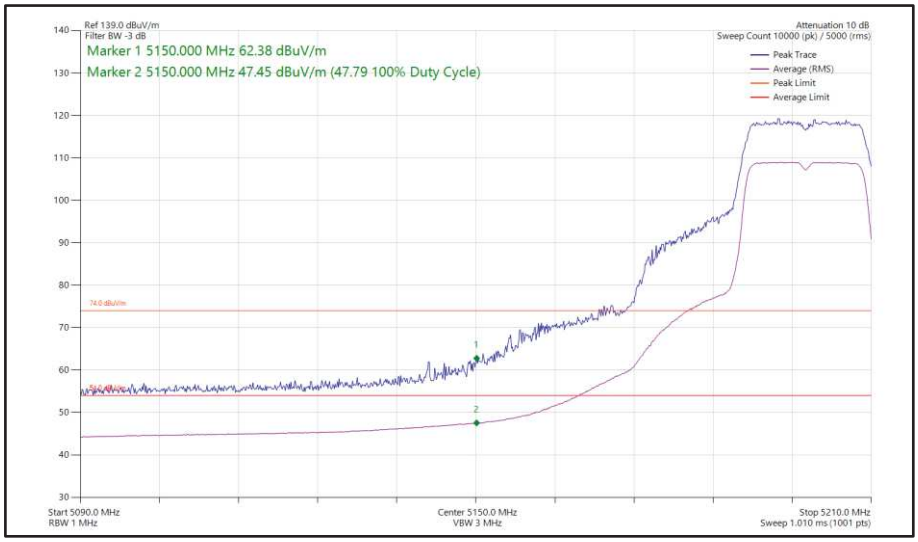

Figure 25 - 802.11n HT20, SISO, Core 1 - 5200 MHz
Band Edge Frequency 5150 MHz

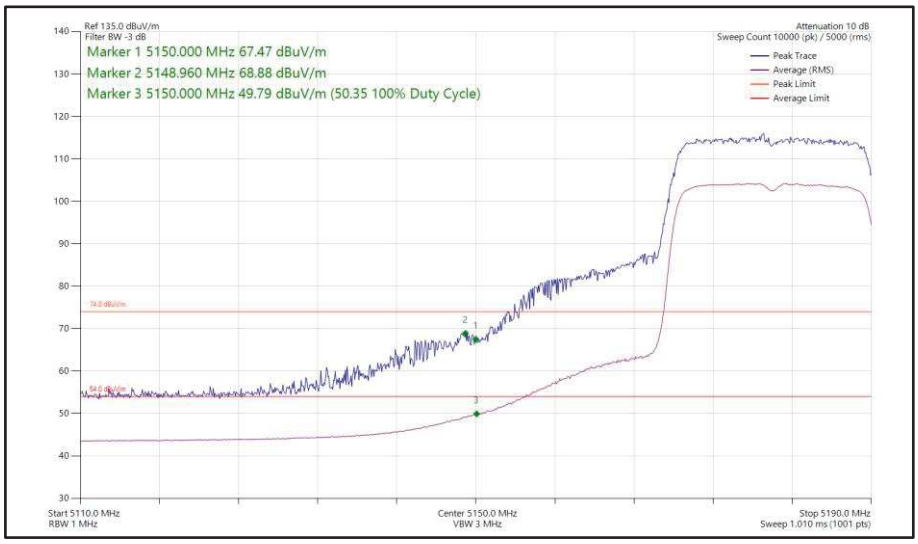

Figure 26 - 802.11ax HE20, SU, SISO, Core 1 - 5180 MHz
Band Edge Frequency 5150 MHz

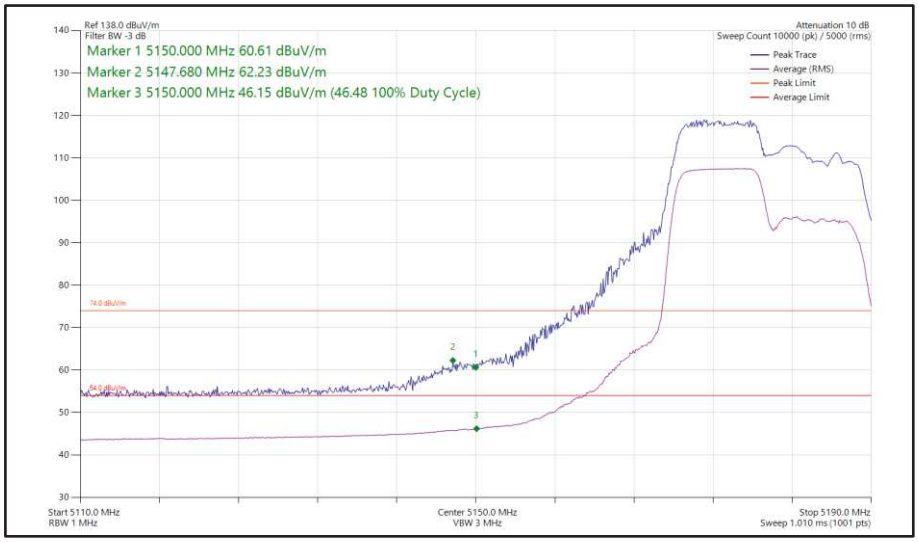

Figure 27 - 802.11ax HE20, RU 106-53, SISO, Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

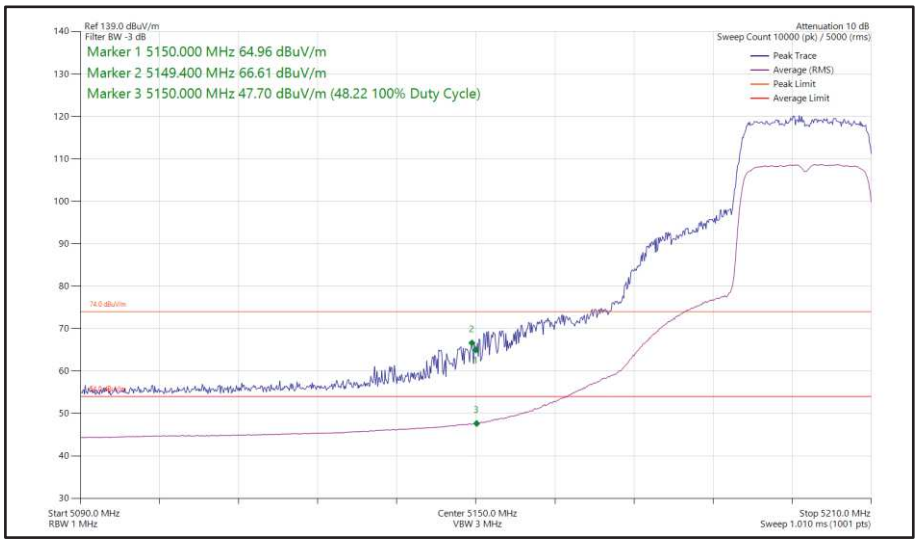

Figure 28 - 802.11ax HE20, SU, SISO, Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

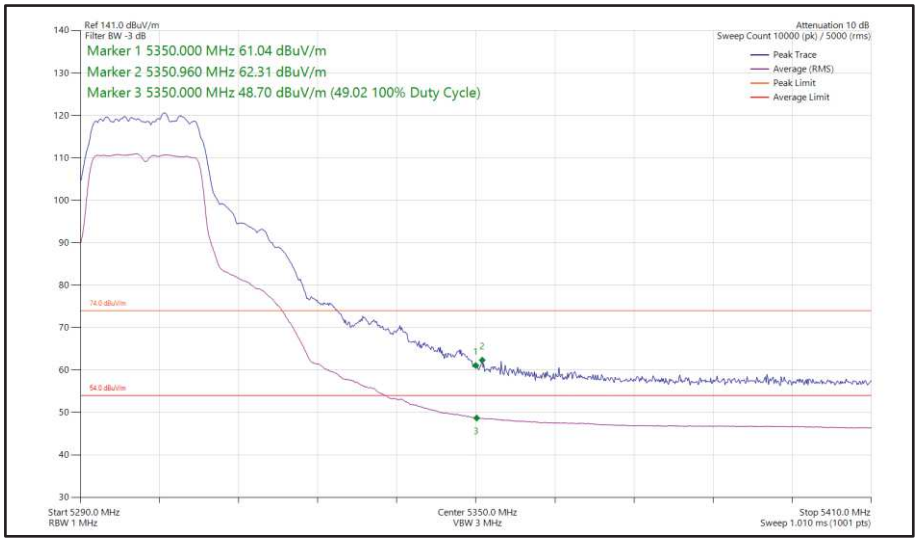

Figure 29 - 802.11a, SISO, Core 1 - 5300 MHz
Band Edge Frequency 5350 MHz

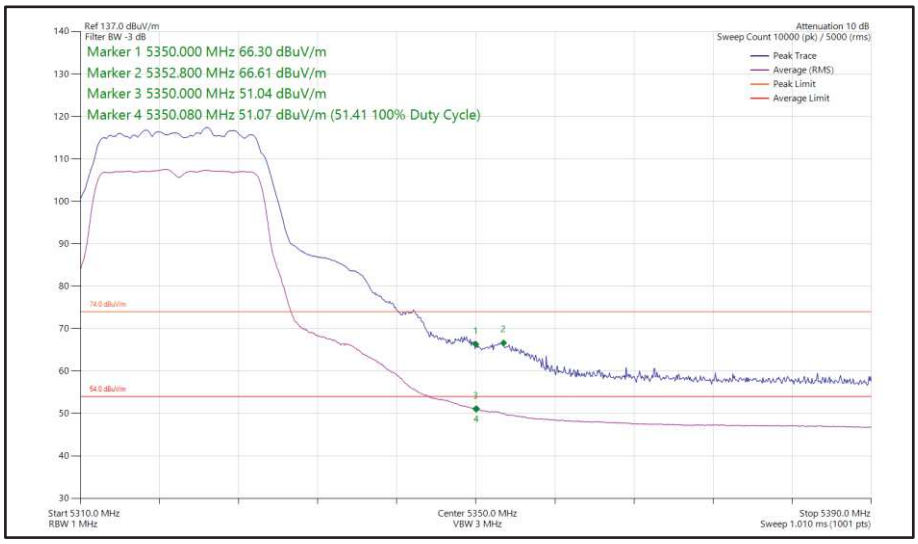

Figure 30 - 802.11a, SISO, Core 1 - 5320 MHz
Band Edge Frequency 5350 MHz

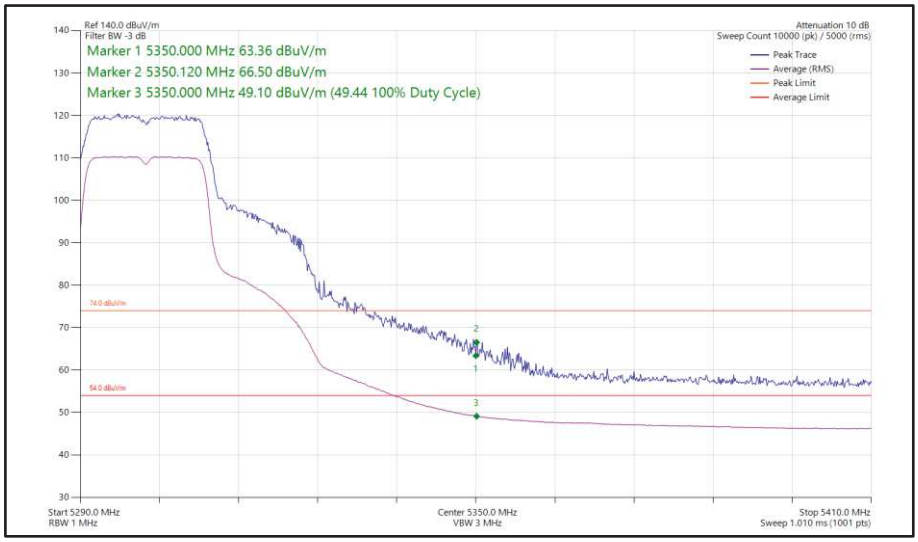

Figure 31 - 802.11n HT20, SISO, Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

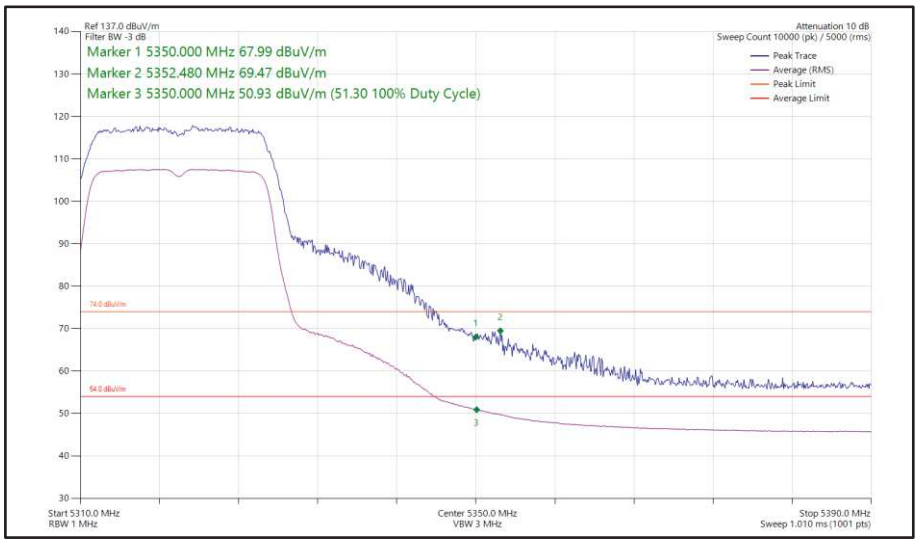

Figure 32 - 802.11n HT20, SISO, Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

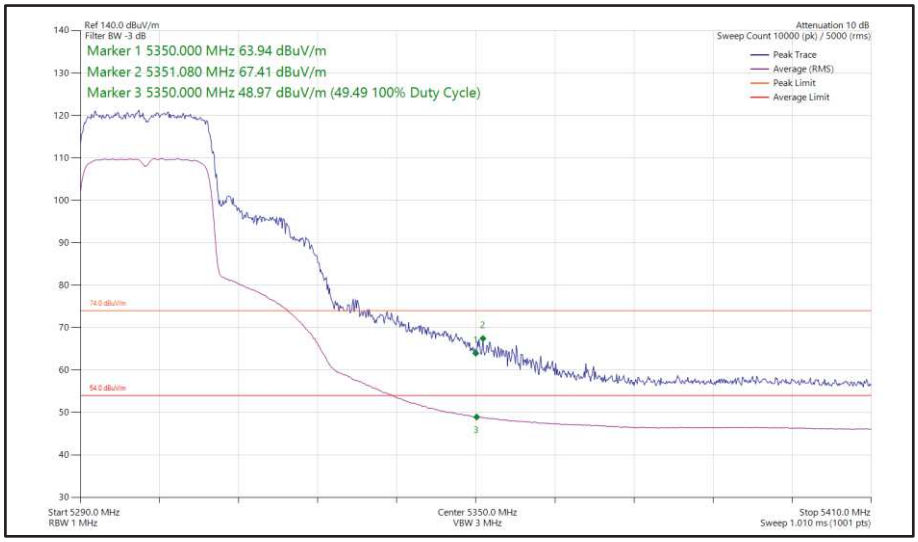

Figure 33 - 802.11ax HE20, SU, SISO, Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

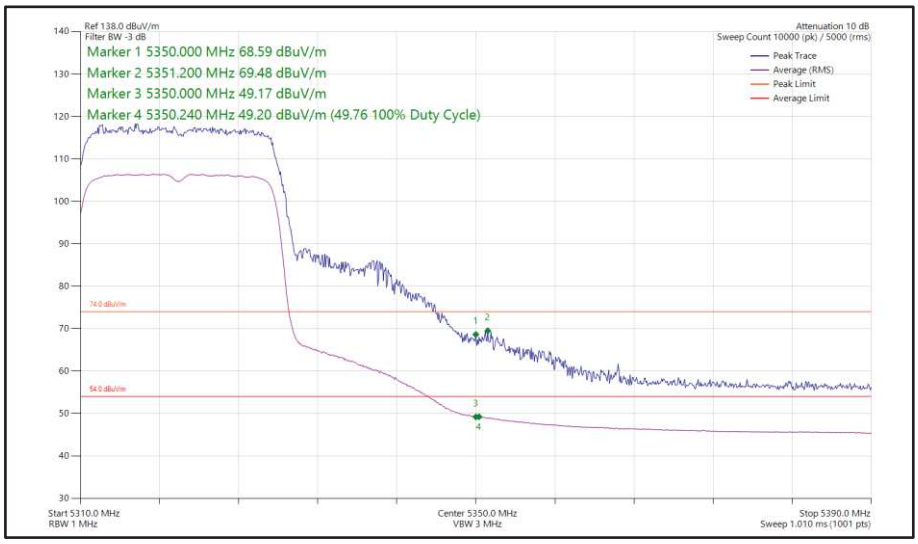

Figure 34 - 802.11ax HE20, SU, SISO, Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

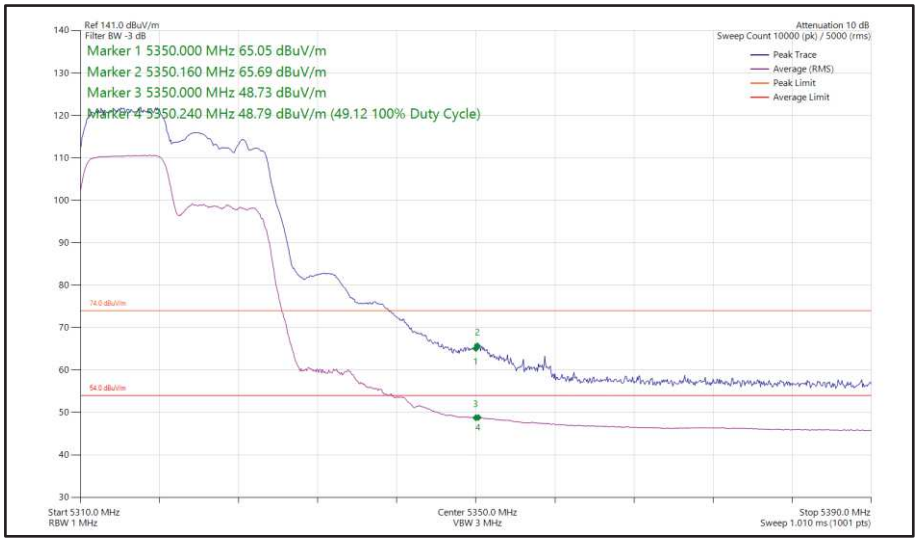

Figure 35 - 802.11ax HE20, RU 106-53, SISO, Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

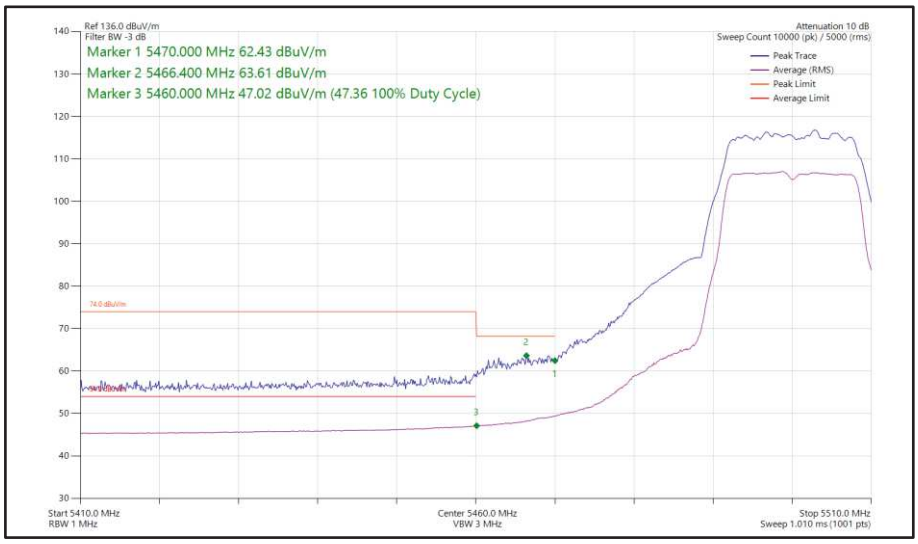

Figure 36 - 802.11a, SISO, Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

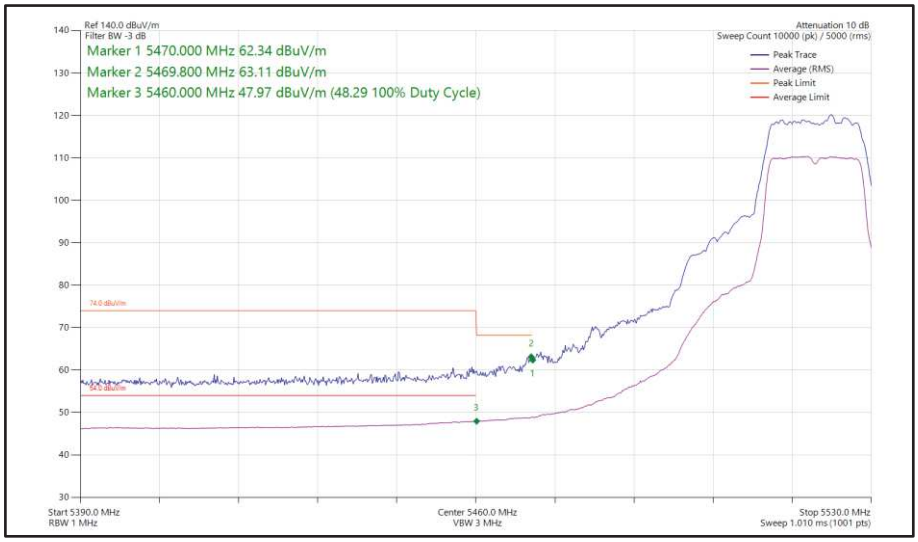

Figure 37 - 802.11a, SISO, Core 1 - 5520 MHz
Band Edge Frequency 5460 MHz

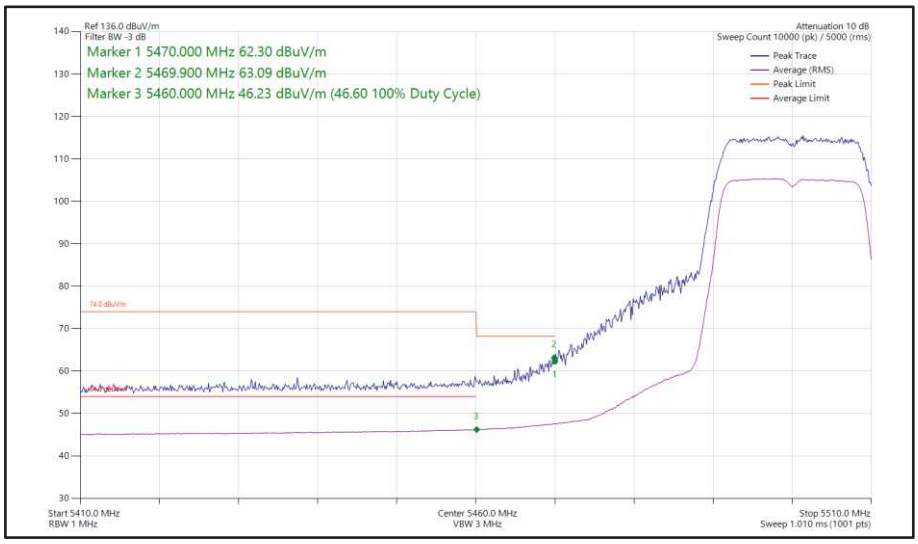

Figure 38 - 802.11n HT20, SISO, Core 1 - 5500 MHz
Band Edge Frequency 5460 MHz

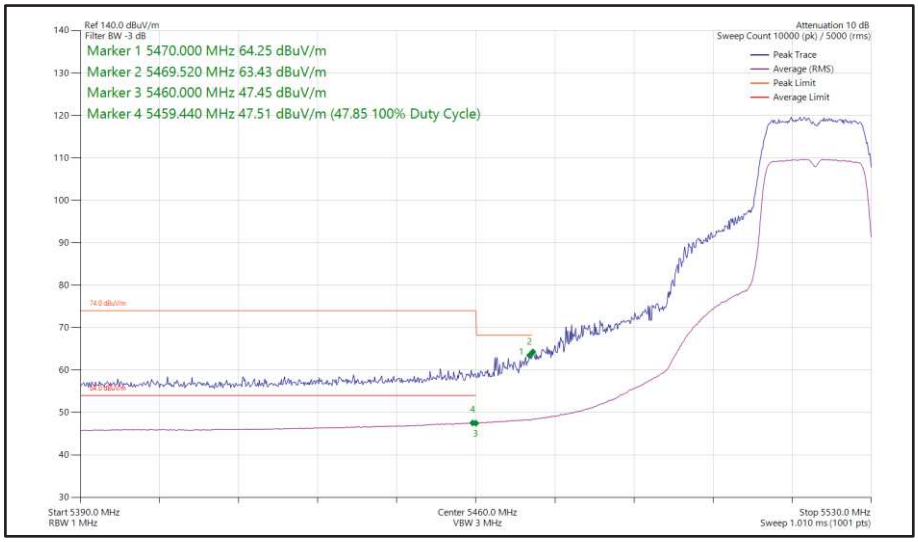

Figure 39 - 802.11n HT20, SISO, Core 1 - 5520 MHz
Band Edge Frequency 5460 MHz

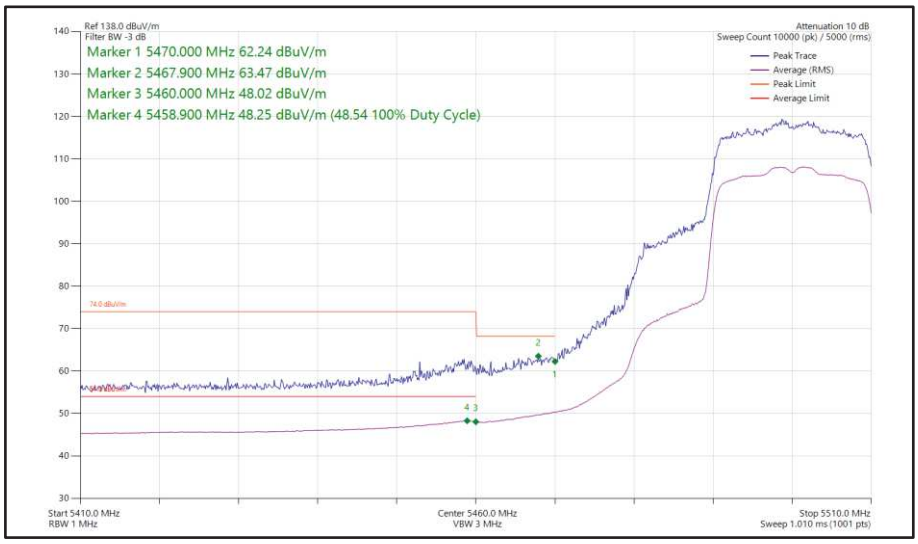

Figure 40 - 802.11ax HE20, SU, SISO, Core 1 - 5500 MHz
Band Edge Frequency 5460 MHz

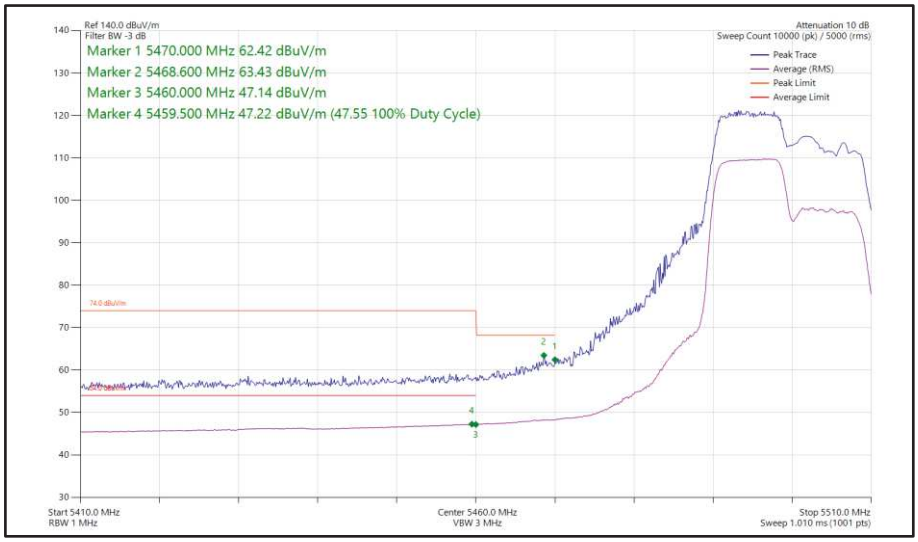

Figure 41 - 802.11ax HE20, RU 106-53, SISO, Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

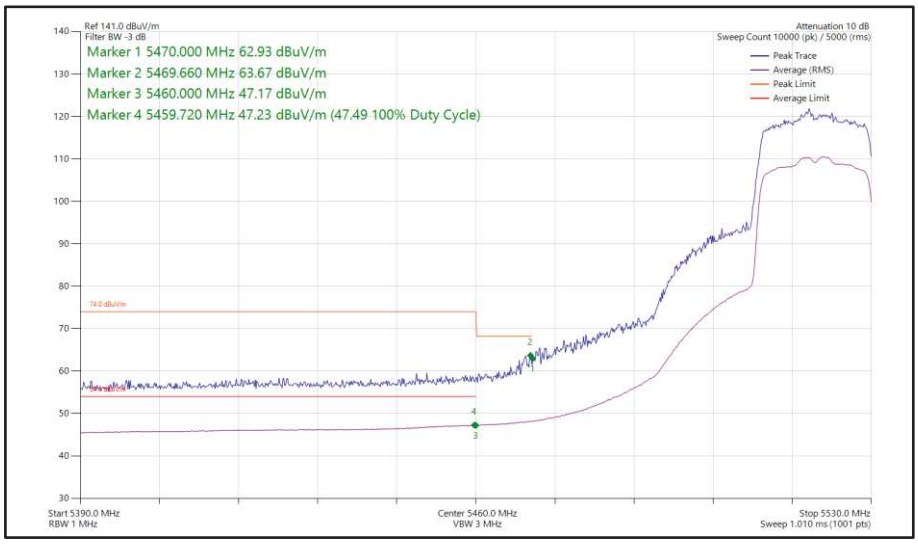

Figure 42 - 802.11ax HE20, SU, SISO, Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

20 MHz Bandwidth - Core 0 + Core 1 (CDD)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT20	MCS4	-	-	5180	5150	64.57	51.31
802.11n HT20	MCS7	-	-	5200	5150	64.82	49.00
802.11ax HE20	MCS4x1	SU	-	5180	5150	64.61	51.34
802.11ax HE20	MCS11x1	106	53	5180	5150	62.67	49.18
802.11ax HE20	MCS11x1	SU	-	5200	5150	69.23	49.66
802.11n HT20	MCS7	-	-	5300	5350	67.48	50.62
802.11n HT20	MCS7	-	-	5320	5350	69.16	51.46
802.11ax HE20	MCS2x1	SU	-	5300	5350	65.03	51.30
802.11ax HE20	MCS4x1	SU	-	5320	5350	65.12	51.40
802.11ax HE20	MCS11x1	106	54	5320	5350	65.78	51.11
802.11n HT20	MCS4	-	-	5500	5460	63.55	49.40
802.11n HT20	MCS7	-	-	5520	5460	63.27	48.70
802.11ax HE20	MCS11x1	SU	-	5500	5460	63.59	47.90
802.11ax HE20	MCS11x1	106	54	5500	5460	63.32	48.24
802.11ax HE20	MCS4x1	SU	-	5520	5460	63.40	48.88

Table 8 - CDD Restricted Band Edge Results

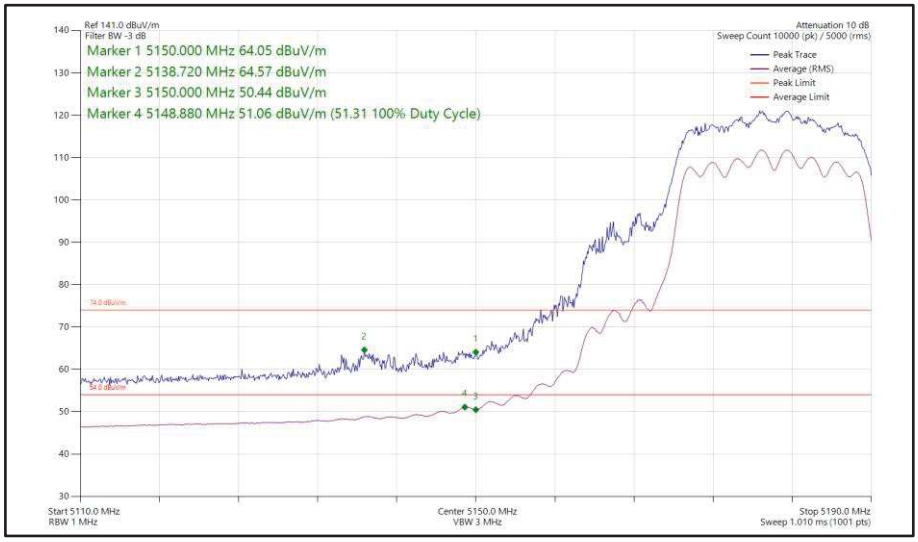

Figure 43 - 802.11n HT20, CDD, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

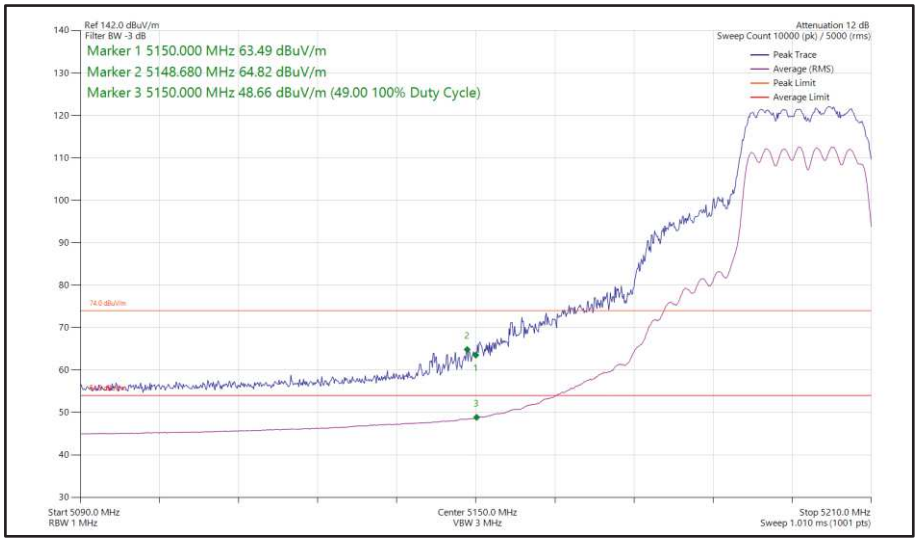

Figure 44 - 802.11n HT20, CDD, Core 0 + Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

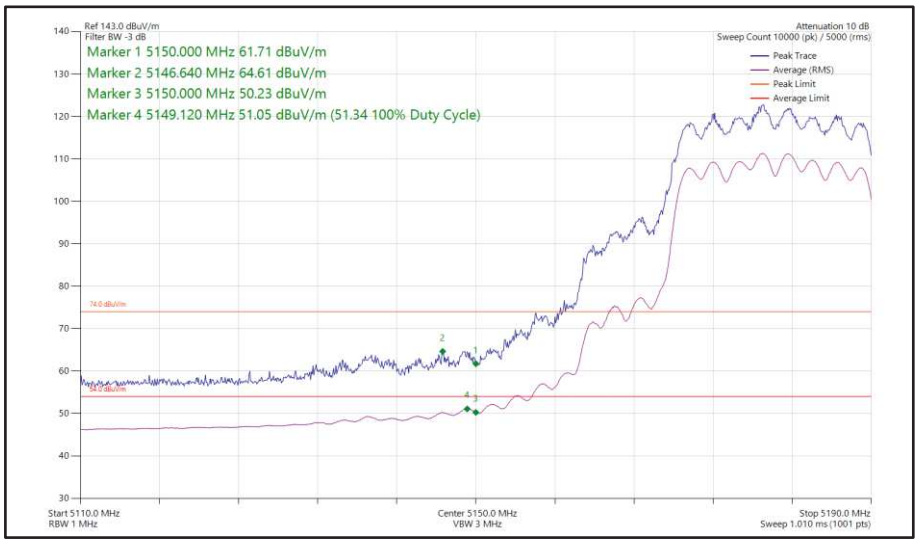

Figure 45 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

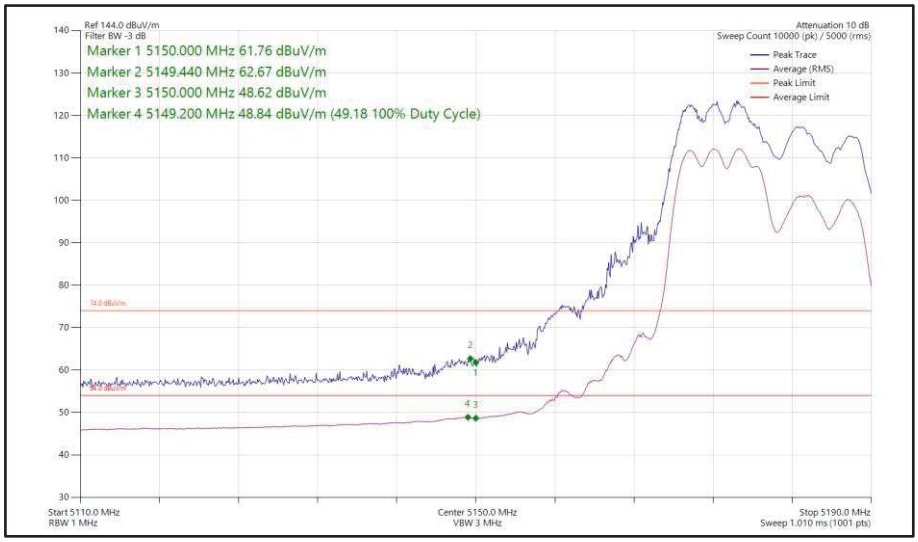

Figure 46 - 802.11ax HE20, RU 106-53, CDD, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

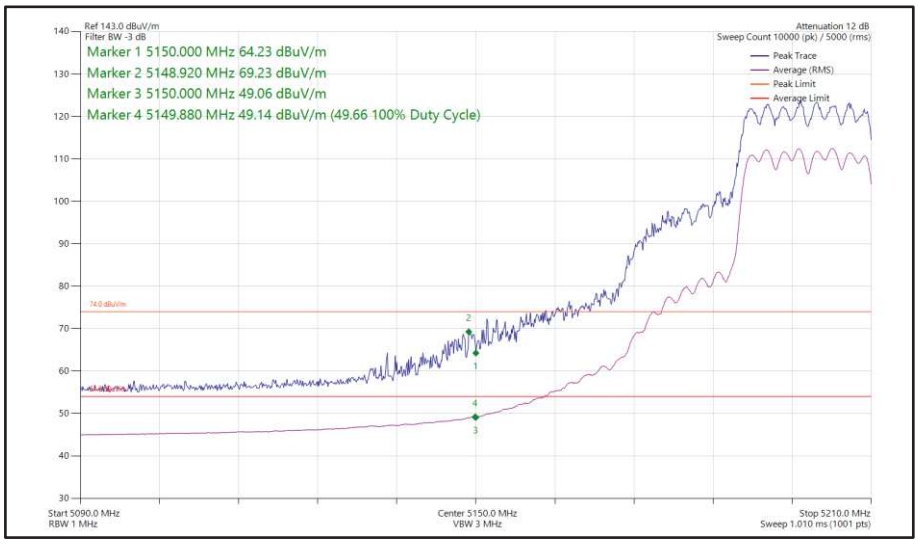

Figure 47 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

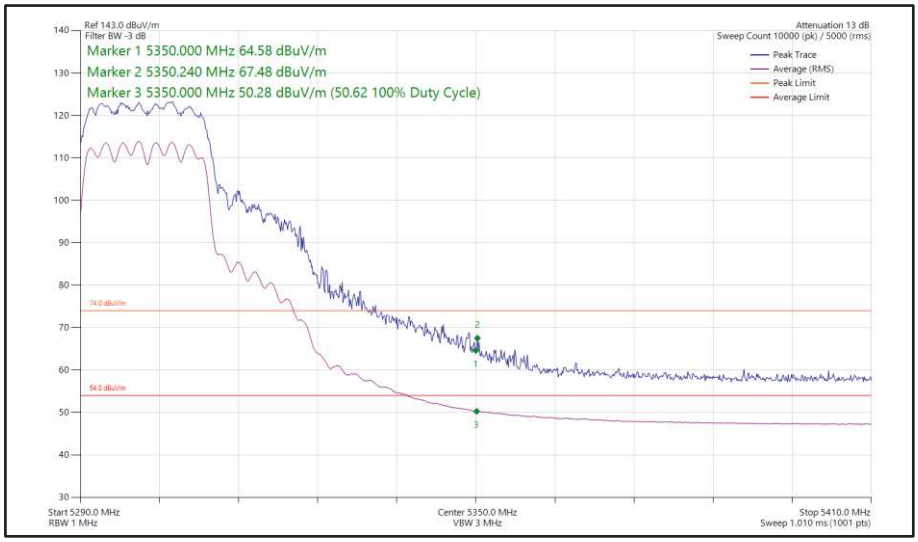

Figure 48 - 802.11n HT20, CDD, Core 0 + Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

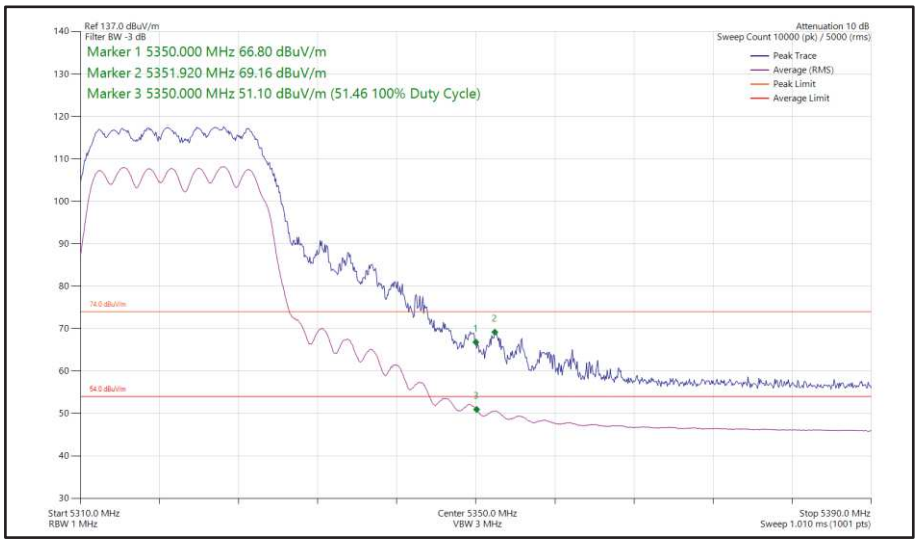

Figure 49 - 802.11n HT20, CDD, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

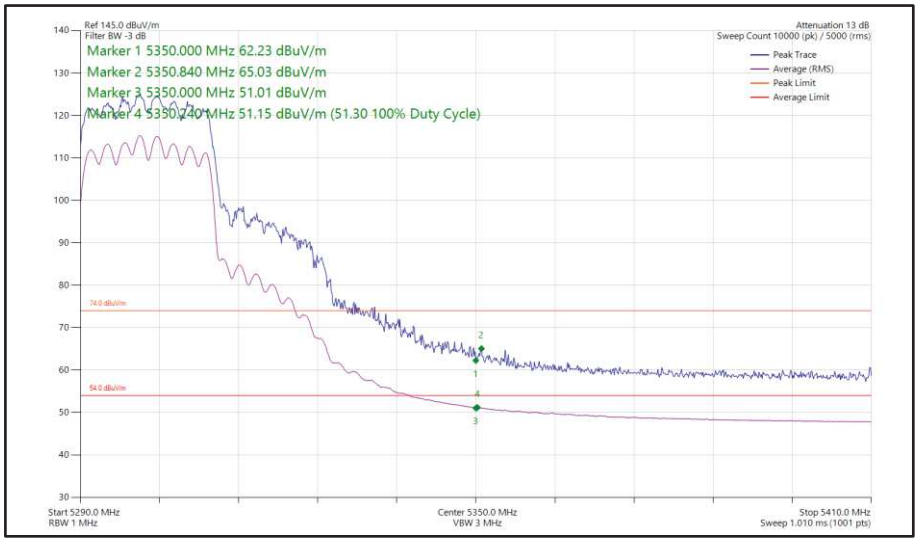

Figure 50 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

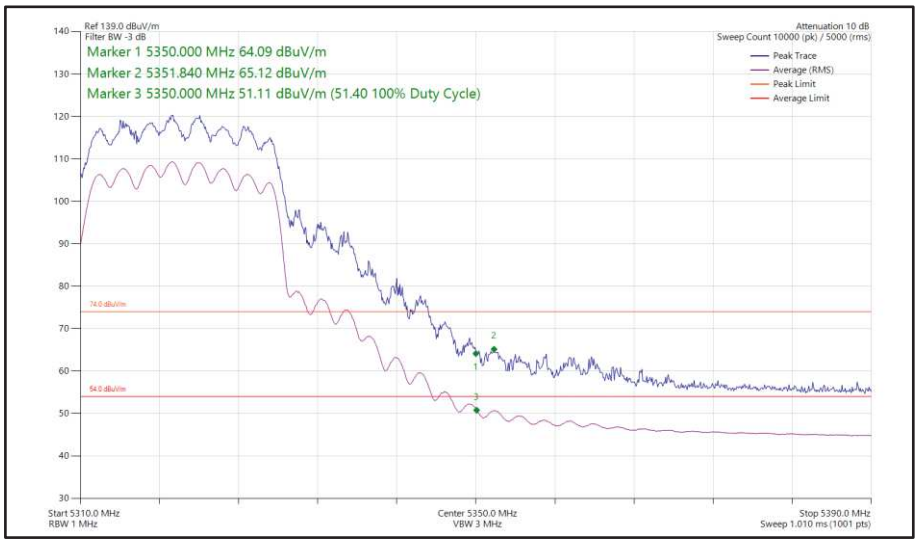

Figure 51 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

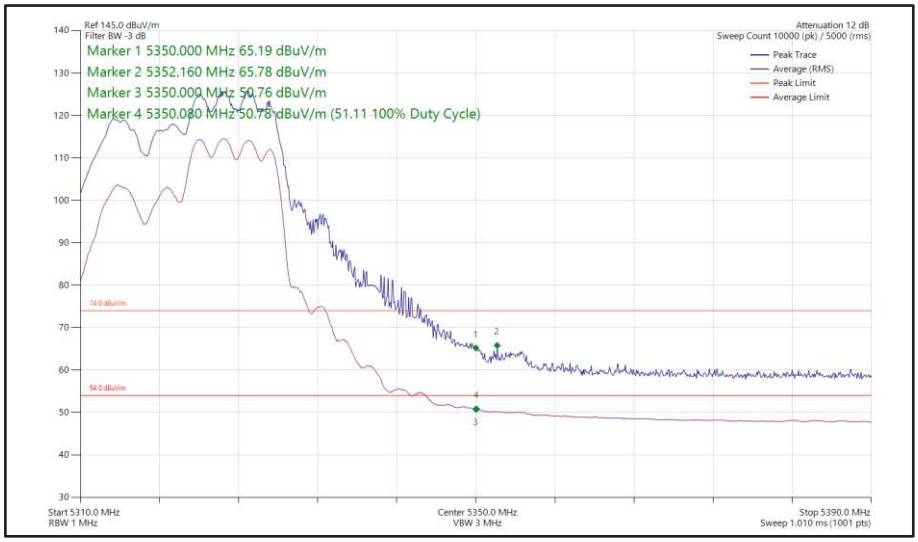

Figure 52 - 802.11ax HE20, RU 106-54, CDD, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

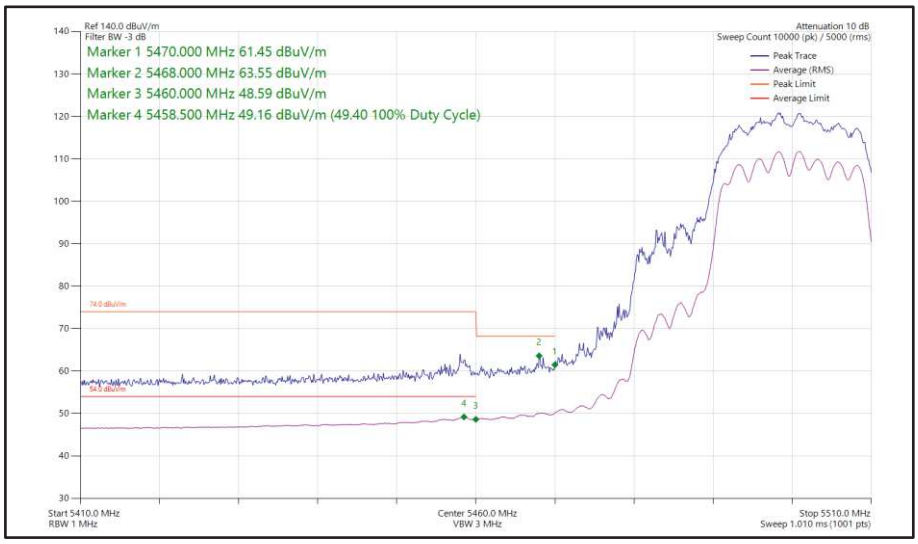

Figure 53 - 802.11n HT20, CDD, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

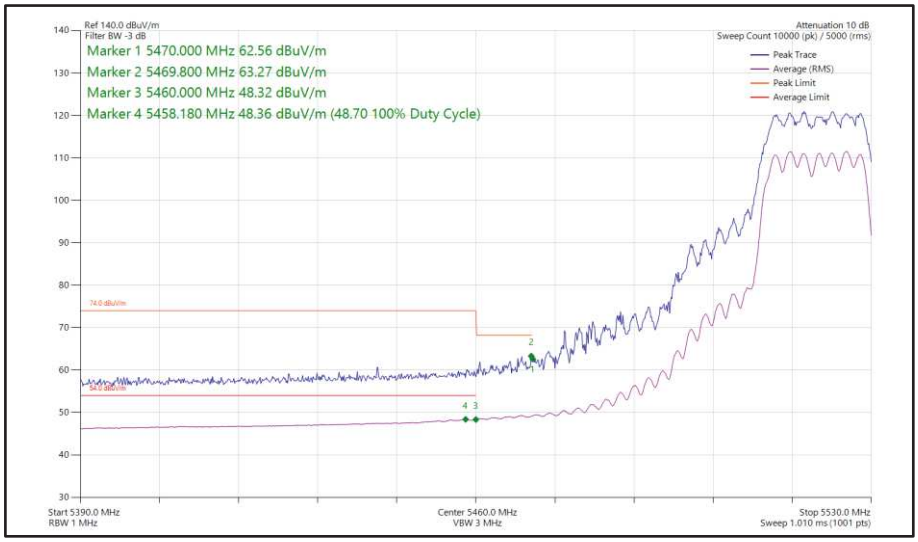

Figure 54 - 802.11n HT20, CDD, Core 0 + Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

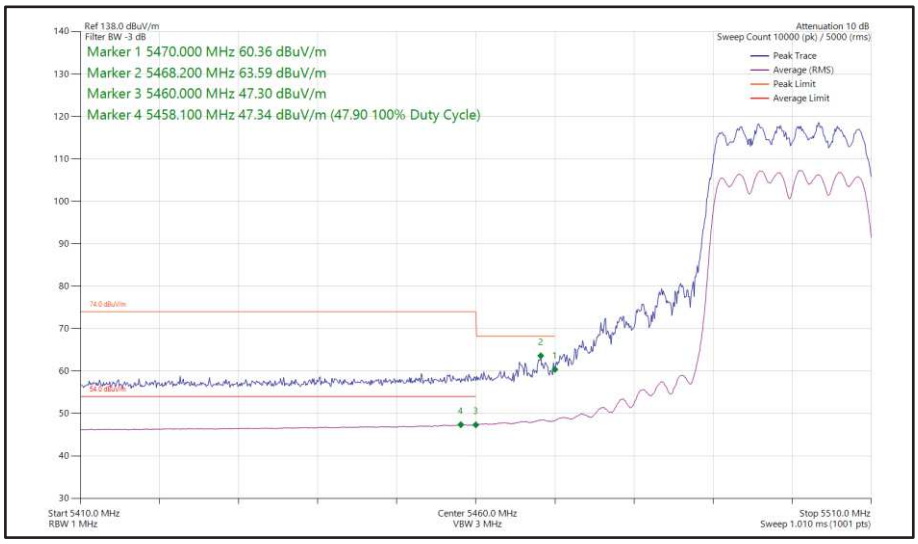

Figure 55 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

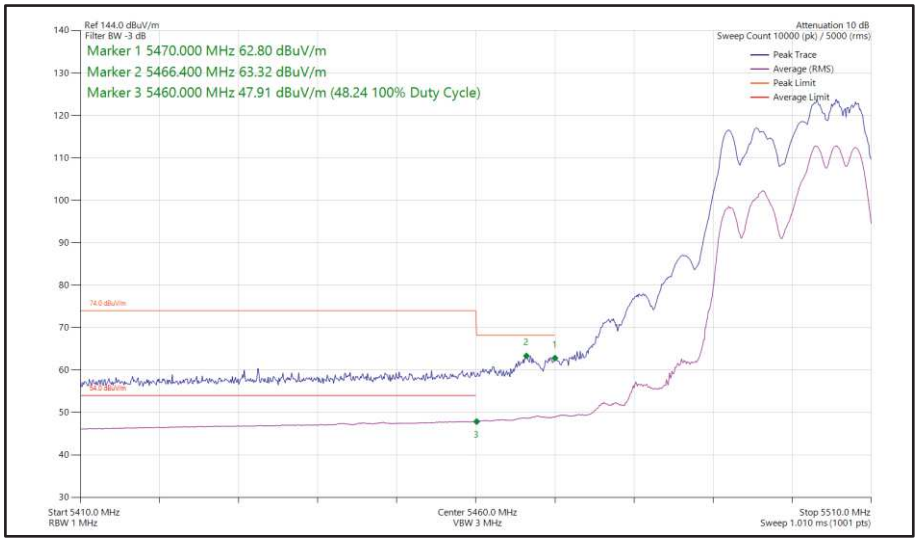

Figure 56 - 802.11ax HE20, RU 106-54, CDD, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

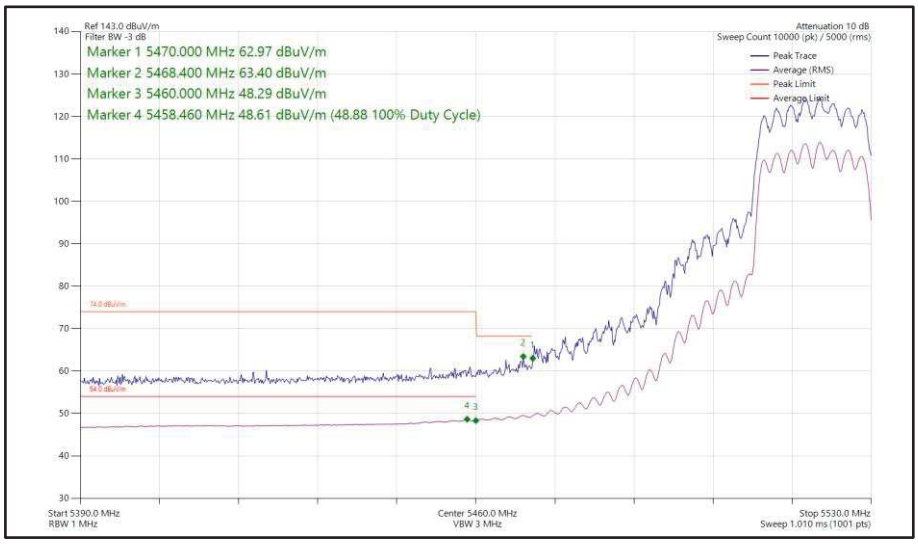

Figure 57 - 802.11ax HE20, SU, CDD, Core 0 + Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

20 MHz Bandwidth - Core 0 + Core 1 (SDM)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT20	MCS15	-	-	5180	5150	67.87	50.97
802.11n HT20	MCS12	-	-	5200	5150	60.49	48.82
802.11ax HE20	MCS2x2	SU	-	5180	5150	63.19	51.26
802.11ax HE20	MCS11x2	106	53	5180	5150	62.25	47.79
802.11ax HE20	MCS11x2	SU	-	5200	5150	68.45	50.73
802.11n HT20	MCS15	-	-	5300	5350	64.67	50.58
802.11n HT20	MCS15	-	-	5320	5350	68.08	51.46
802.11ax HE20	MCS11x2	SU	-	5300	5350	67.45	50.63
802.11ax HE20	MCS2x2	SU	-	5320	5350	64.89	51.46
802.11ax HE20	MCS11x2	106	54	5320	5350	65.54	49.60
802.11n HT20	MCS10	-	-	5500	5460	63.53	50.13
802.11n HT20	MCS15	-	-	5520	5460	63.16	48.92
802.11ax HE20	MCS4x2	SU	-	5500	5460	63.28	50.03
802.11ax HE20	MCS11x2	106	54	5500	5460	63.58	48.20
802.11ax HE20	MCS11x2	SU	-	5520	5460	63.64	48.34

Table 9 - SDM Restricted Band Edge Results

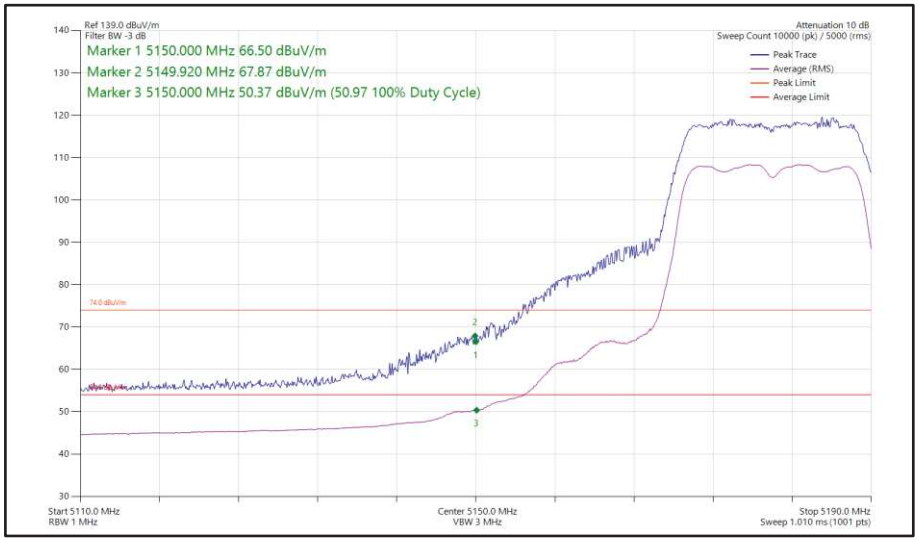

Figure 58 - 802.11n HT20, SDM, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

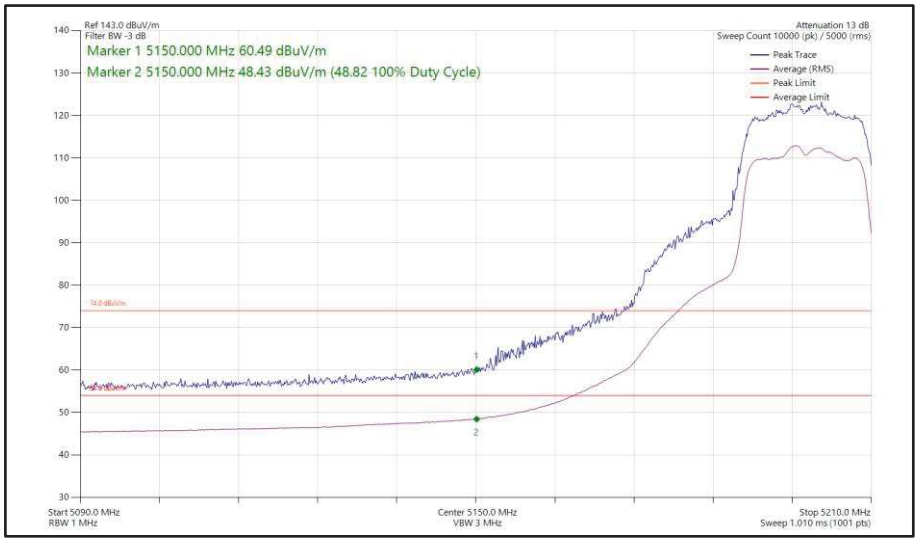

Figure 59 - 802.11n HT20, SDM, Core 0 + Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

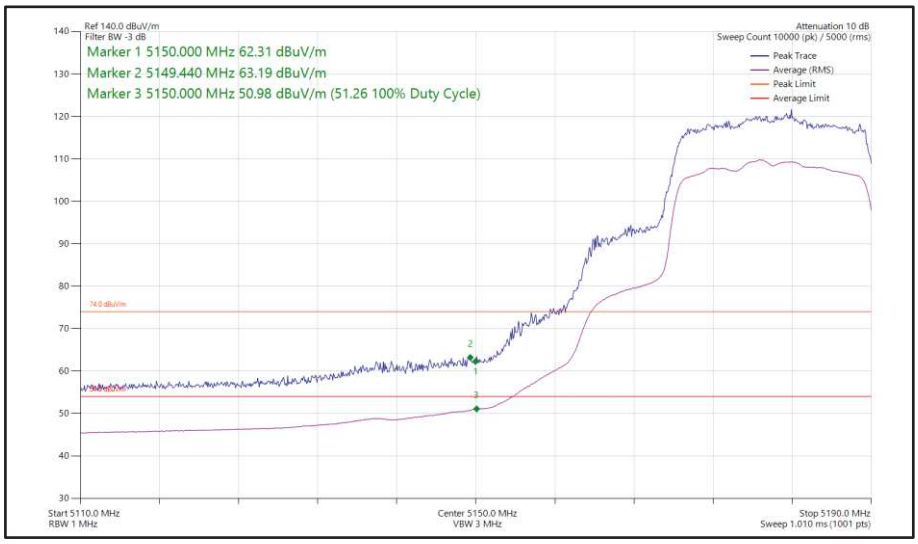

Figure 60 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

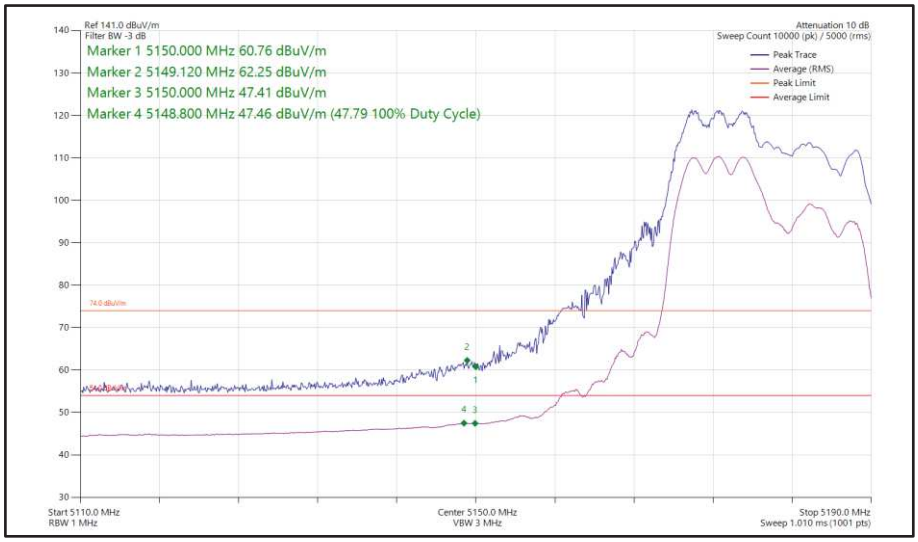

Figure 61 - 802.11ax HE20, RU 106-53, SDM, Core 0 + Core 1 – 5180 MHz Band Edge Frequency 5150 MHz

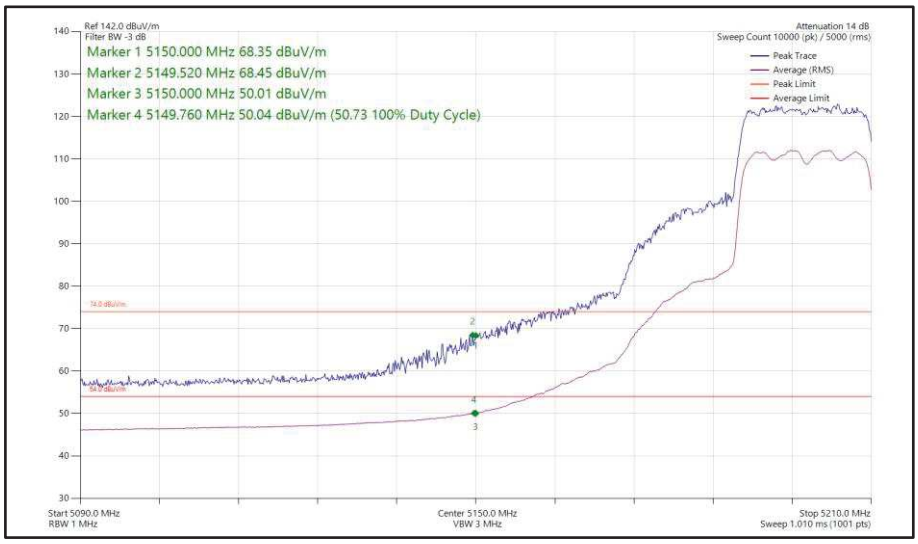

Figure 62 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

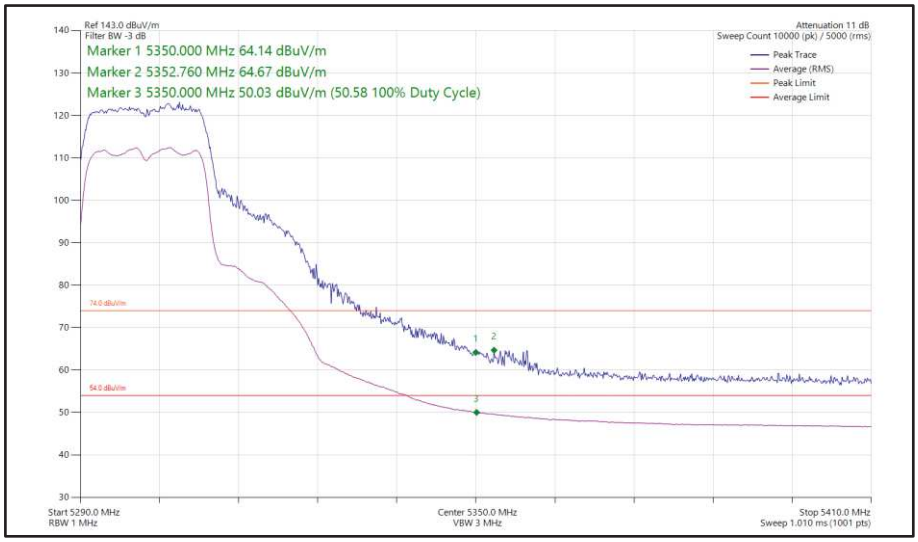

Figure 63 - 802.11n HT20, SDM, Core 0 + Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

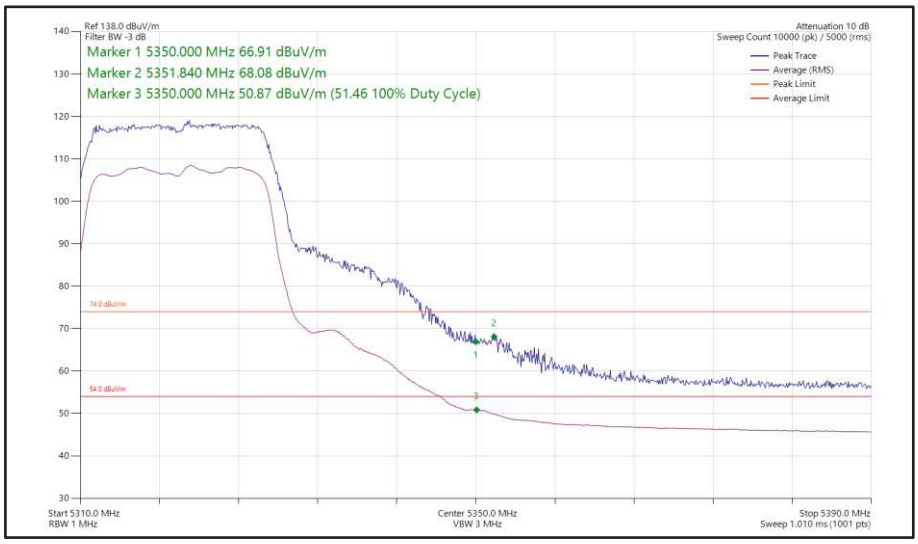

Figure 64 - 802.11n HT20, SDM, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

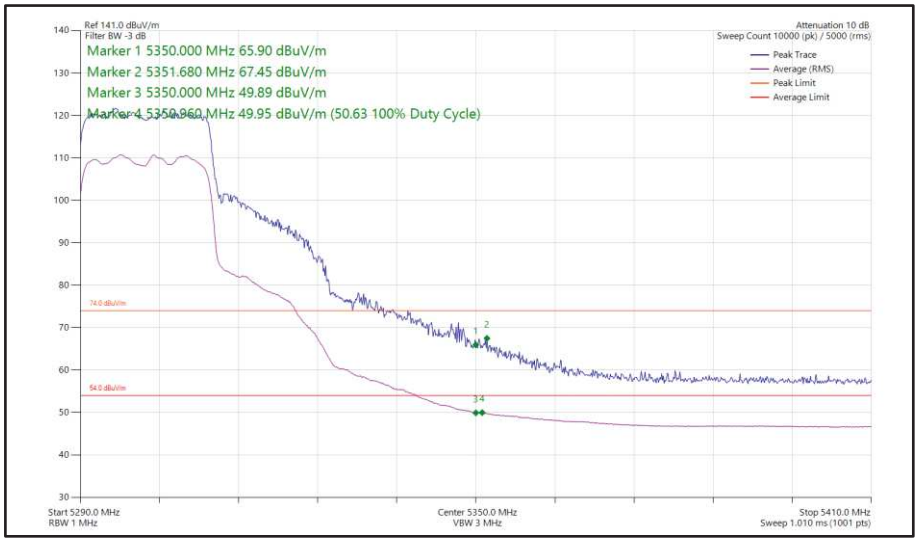

Figure 65 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

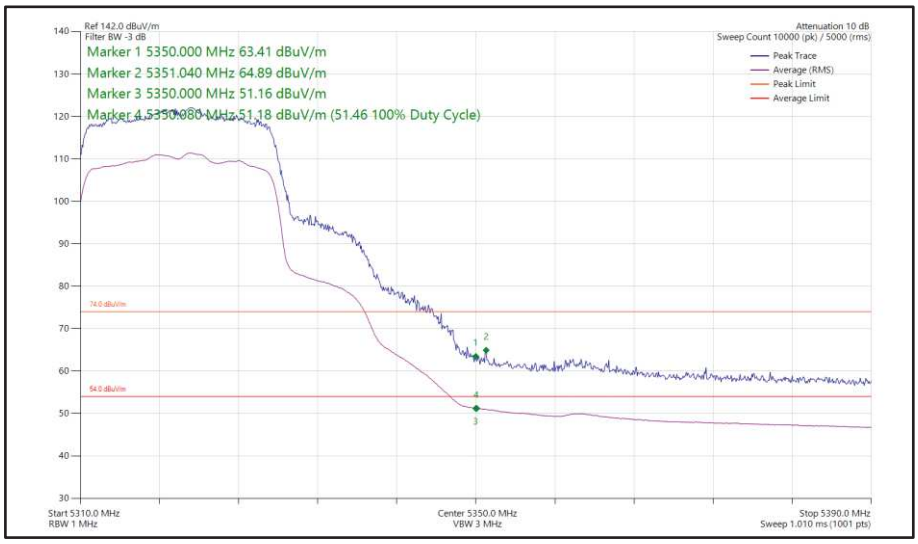

Figure 66 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

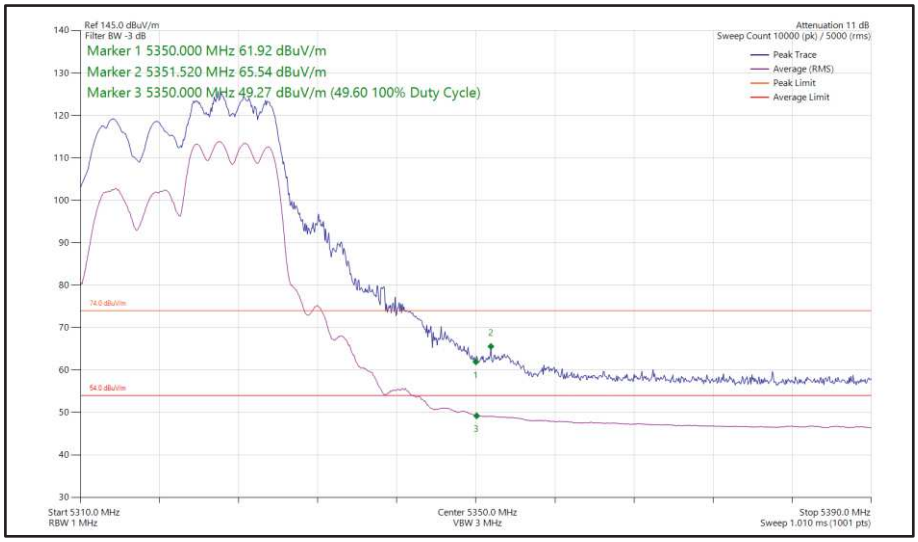

Figure 67 - 802.11ax HE20, RU 106-54, SDM, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

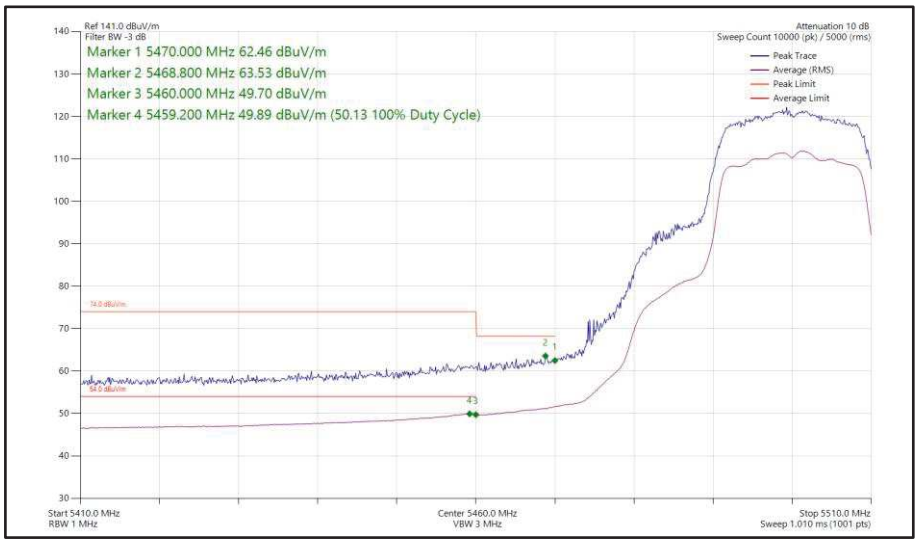

Figure 68 - 802.11n HT20, SDM, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

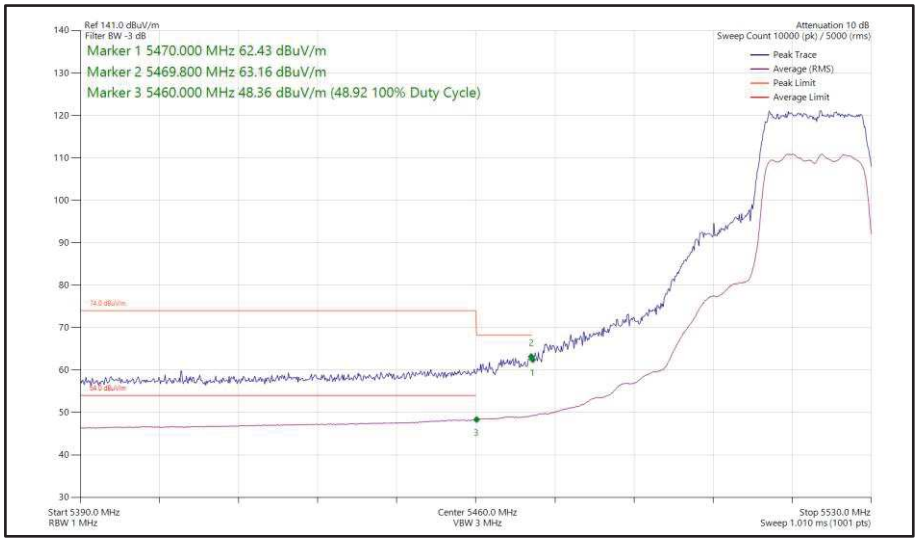

Figure 69 - 802.11n HT20, SDM, Core 0 + Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

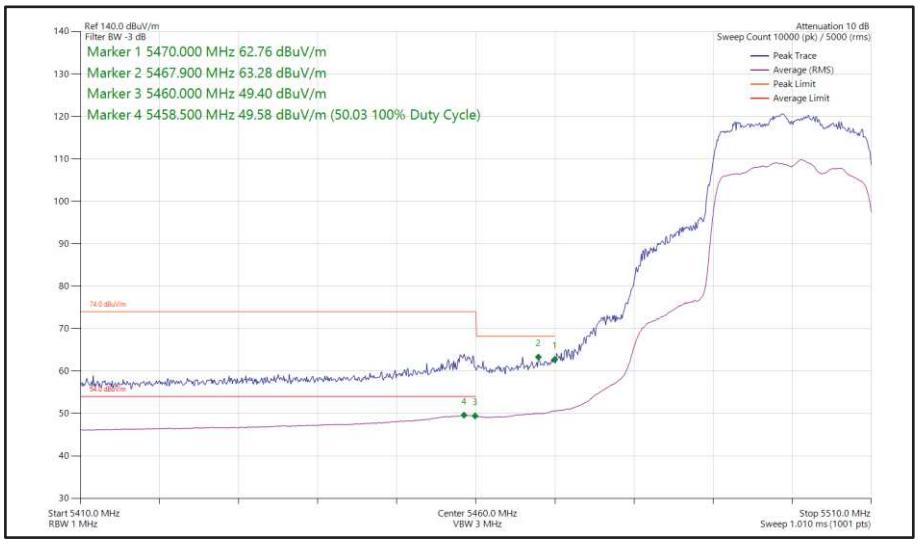

Figure 70 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

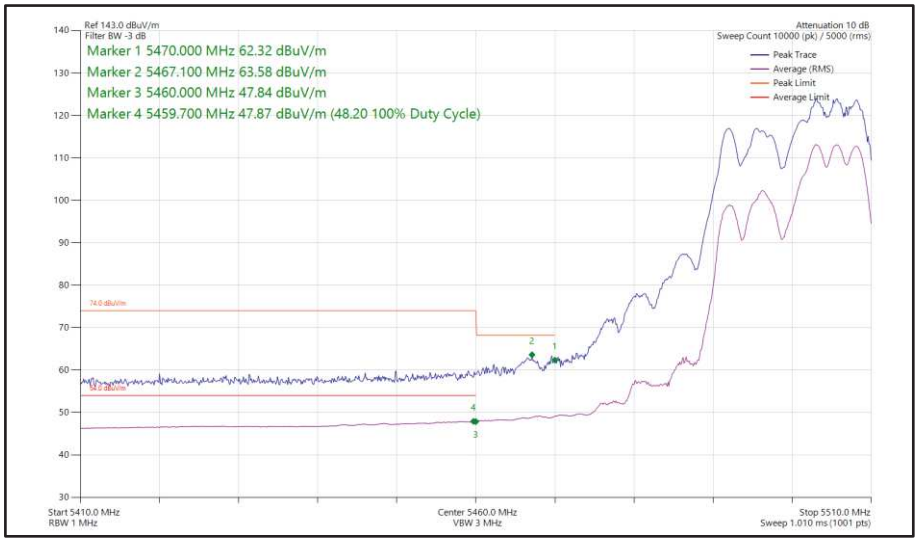

Figure 71 - 802.11ax HE20, RU 106-54, SDM, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

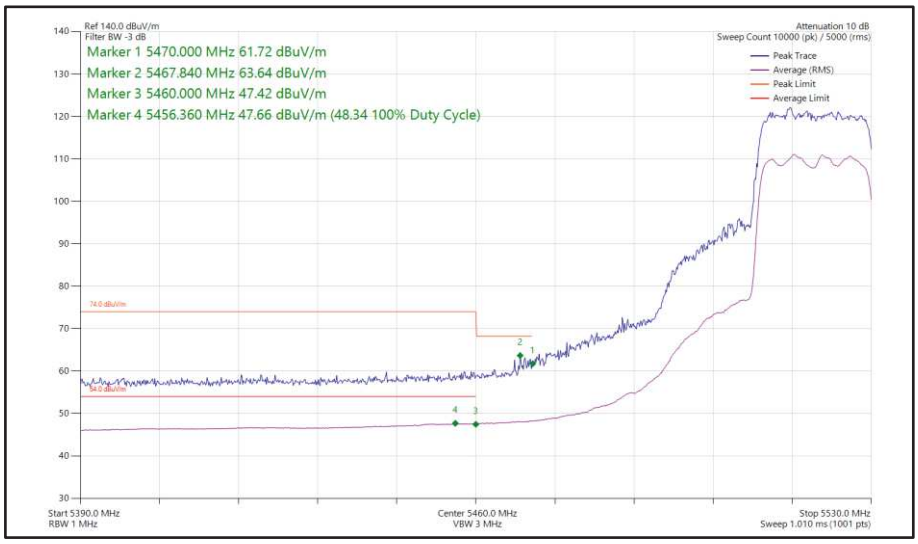

Figure 72 - 802.11ax HE20, SU, SDM, Core 0 + Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

20 MHz Bandwidth - Core 0 + Core 1 (TxBF)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11ac VHT20	MCS7x1	-	-	5180	5150	68.75	51.27
802.11ac VHT20	MCS7x1	-	-	5200	5150	66.52	49.84
802.11ac VHT20	MCS2x1	-	-	5300	5350	61.14	48.74
802.11ac VHT20	MCS4x1	-	-	5320	5350	64.38	51.26
802.11ac VHT20	MCS2x1	-	-	5500	5460	63.60	48.69
802.11ac VHT20	MCS7x1	-	-	5520	5460	60.13	47.93

Table 10 - TxBF Restricted Band Edge Results

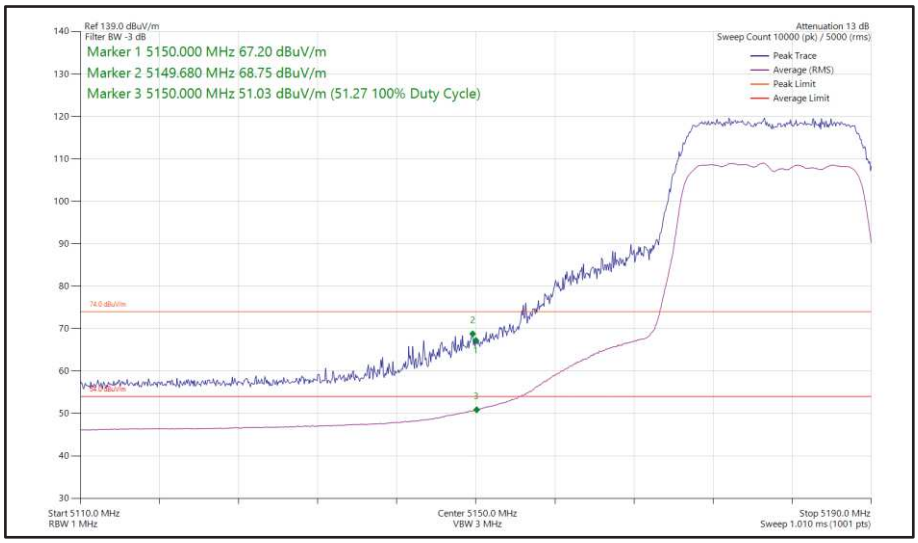

Figure 73 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5180 MHz Band Edge Frequency 5150 MHz

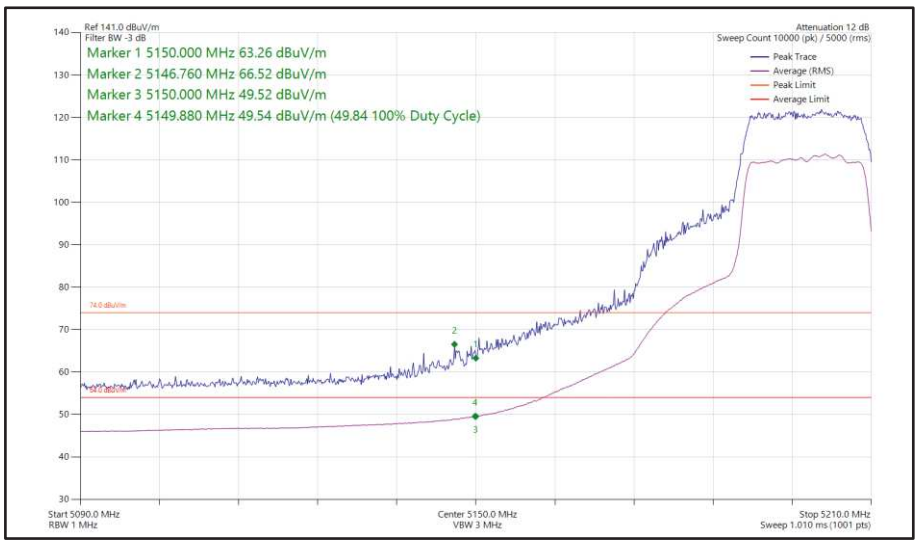

Figure 74 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5200 MHz Band Edge Frequency 5150 MHz

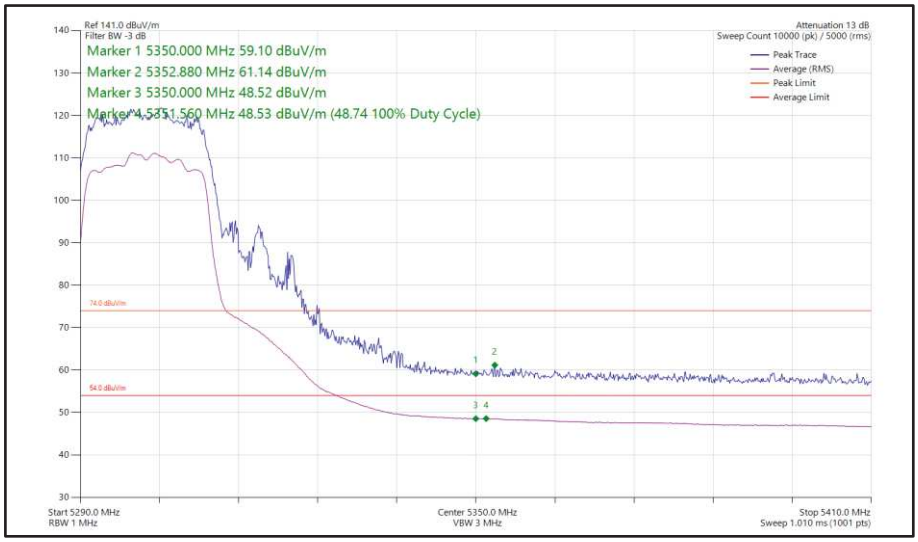

Figure 75 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5300 MHz Band Edge Frequency 5350 MHz

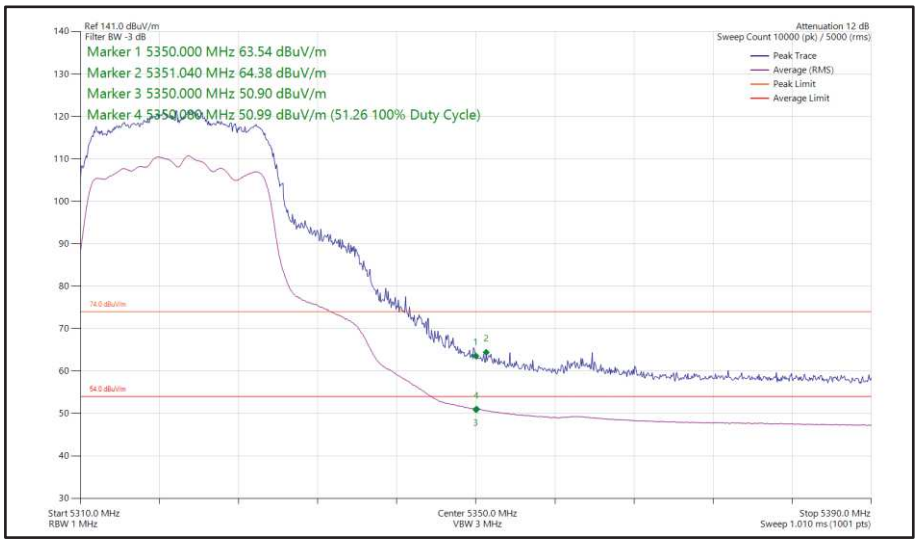

Figure 76 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5320 MHz Band Edge Frequency 5350 MHz

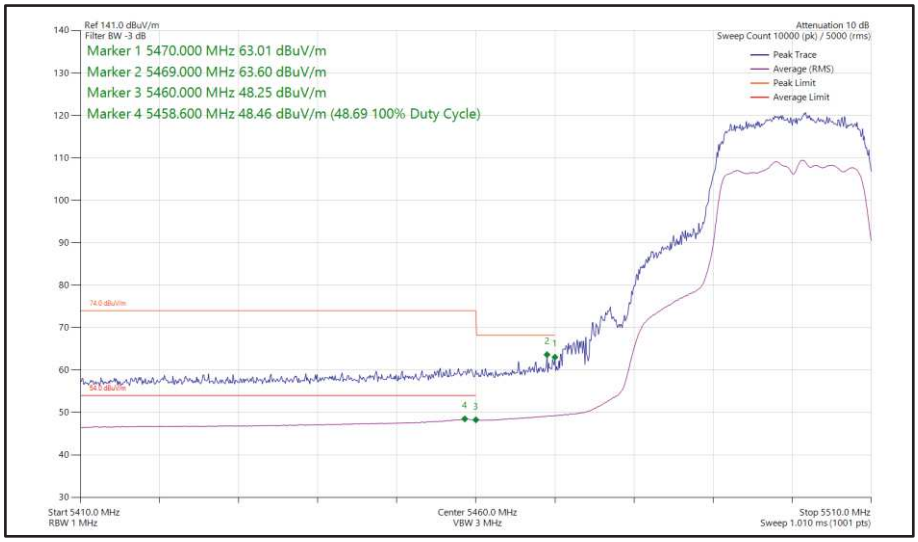

Figure 77 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5500 MHz Band Edge Frequency 5460 MHz

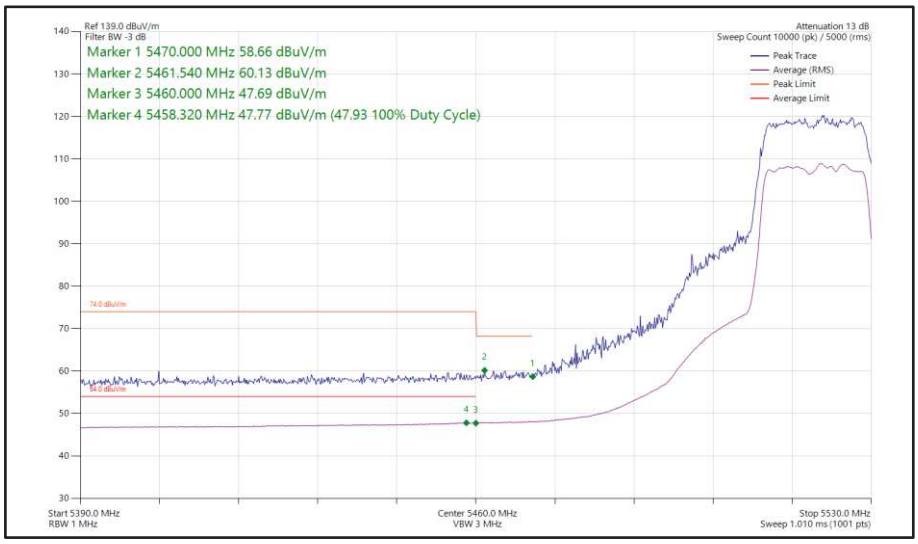

Figure 78 - 802.11ac VHT20, TxBF, Core 0 + Core 1 - 5520 MHz Band Edge Frequency 5460 MHz

40 MHz Bandwidth - Core 0 (SISO)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT40	MCS7	-	-	5190	5150	69.18	49.26
802.11n HT40	MCS7	-	-	5230	5150	66.75	50.89
802.11ax HE40	MCS4x1	SU	-	5190	5150	64.66	51.47
802.11ax HE40	MCS11x1	106	53	5190	5150	67.90	47.12
802.11ax HE40	MCS11x1	SU	-	5230	5150	67.66	50.93
802.11n HT40	MCS7	-	-	5270	5350	66.98	51.17
802.11n HT40	MCS2	-	-	5310	5350	64.20	51.20
802.11ax HE40	MCS11x1	SU	-	5270	5350	67.37	51.15
802.11ax HE40	MCS4x1	SU	-	5310	5350	64.03	51.28
802.11ax HE40	MCS11x1	52	37	5310	5350	69.31	49.14
802.11n HT40	MCS4	-	-	5510	5460	63.65	47.09
802.11n HT40	MCS7	-	-	5550	5460	63.16	47.25
802.11ax HE40	MCS2x1	SU	-	5510	5460	63.65	47.89
802.11ax HE40	MCS11x1	106	53	5510	5460	62.77	46.64
802.11ax HE40	MCS11x1	SU	-	5550	5460	63.03	46.97

Table 11 - SISO Restricted Band Edge Results

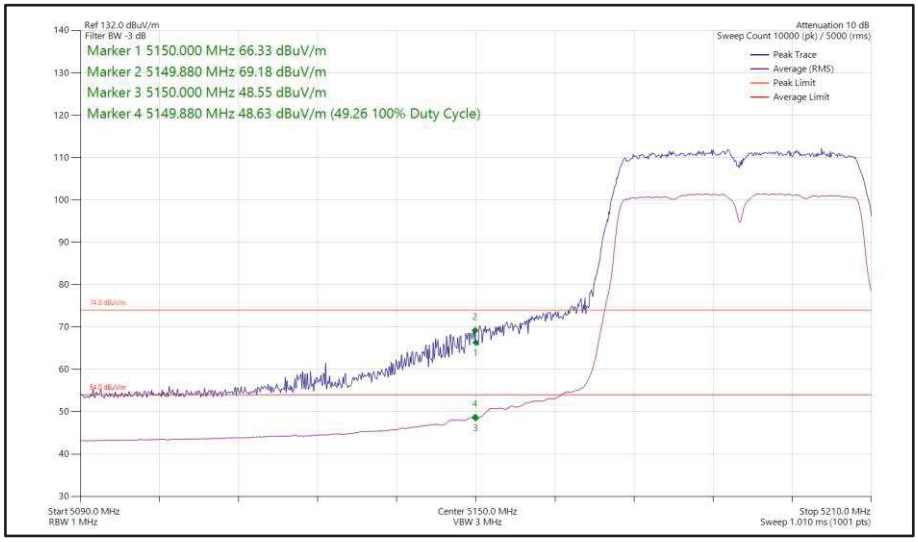

Figure 79 - 802.11n HT40, SISO, Core 0 - 5190 MHz Band Edge Frequency 5150 MHz

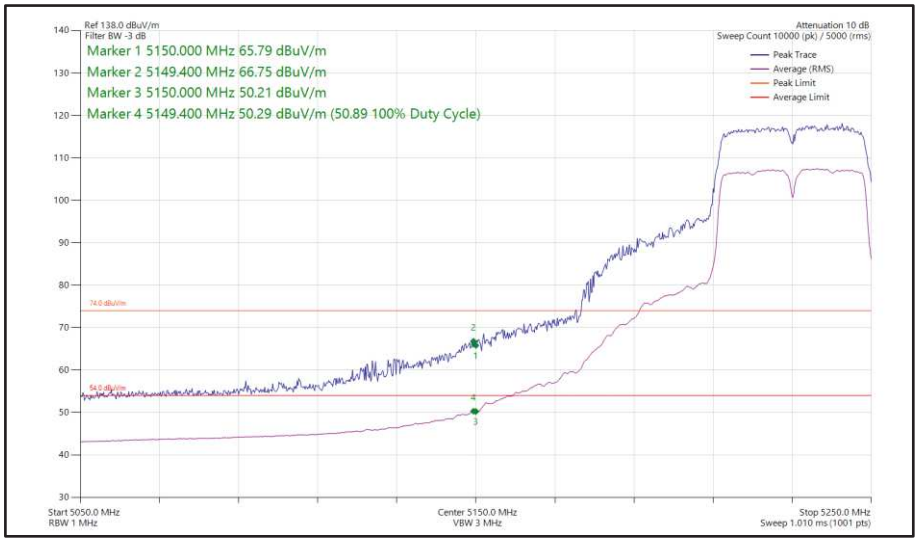

Figure 80 - 802.11n HT40, SISO, Core 0 - 5230 MHz
Band Edge Frequency 5150 MHz

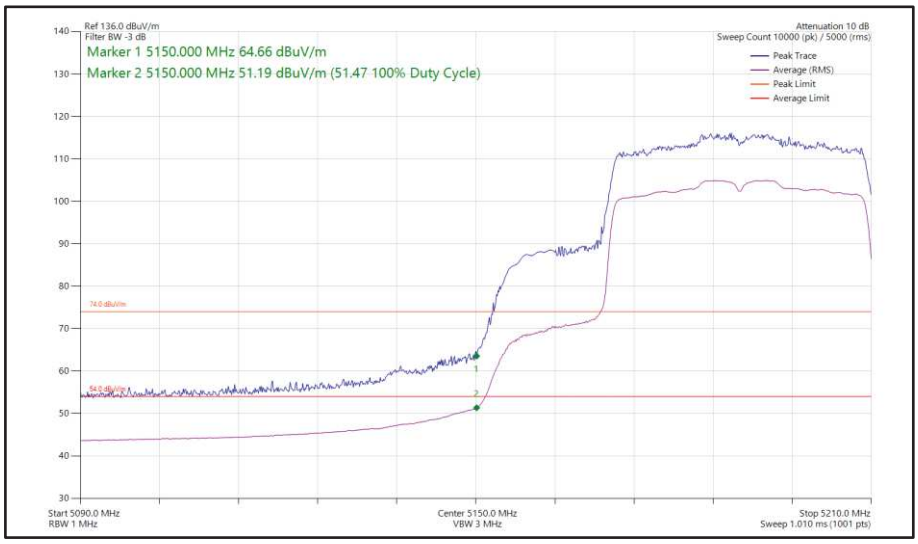

Figure 81 - 802.11ax HE40, SU, SISO, Core 0 - 5190 MHz
Band Edge Frequency 5150 MHz

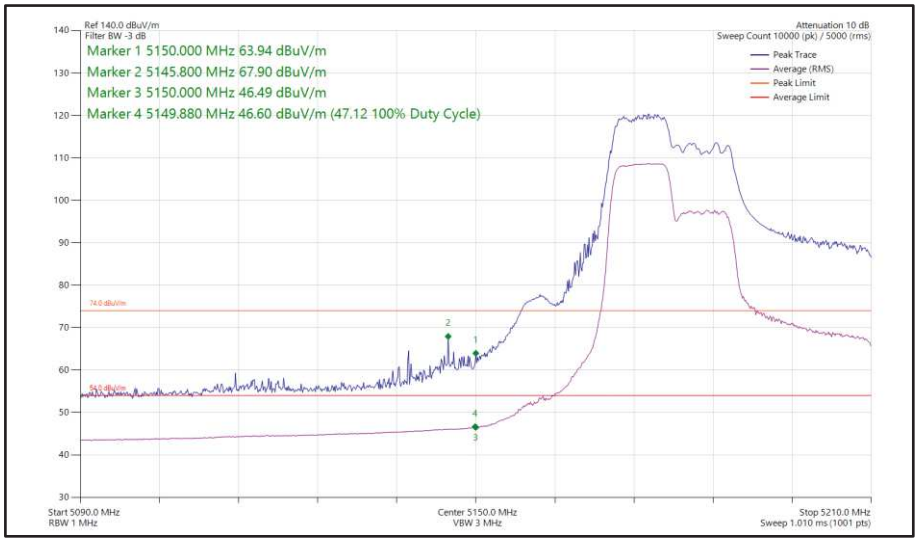

Figure 82 - 802.11ax HE40, RU 106-53, SISO, Core 0 - 5190 MHz Band Edge Frequency 5150 MHz

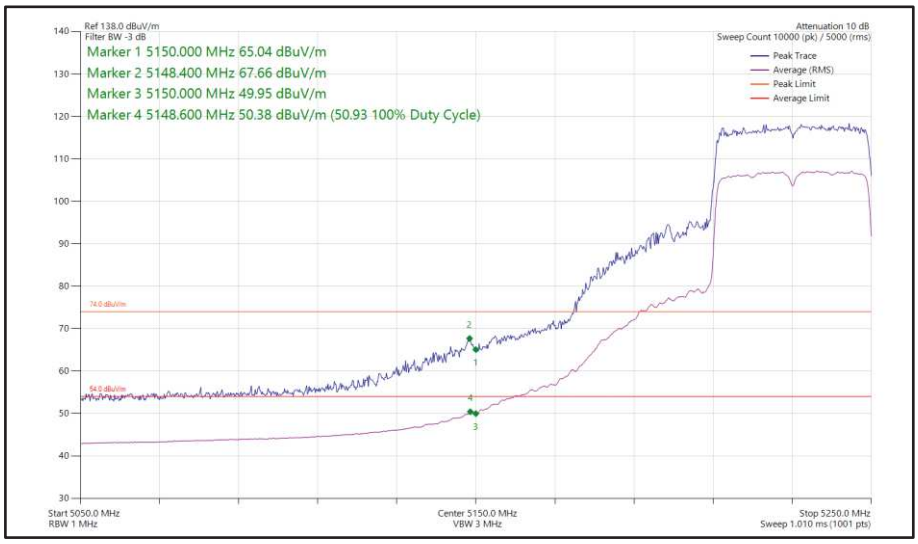

Figure 83 - 802.11ax HE40, SU, SISO, Core 0 - 5230 MHz Band Edge Frequency 5150 MHz

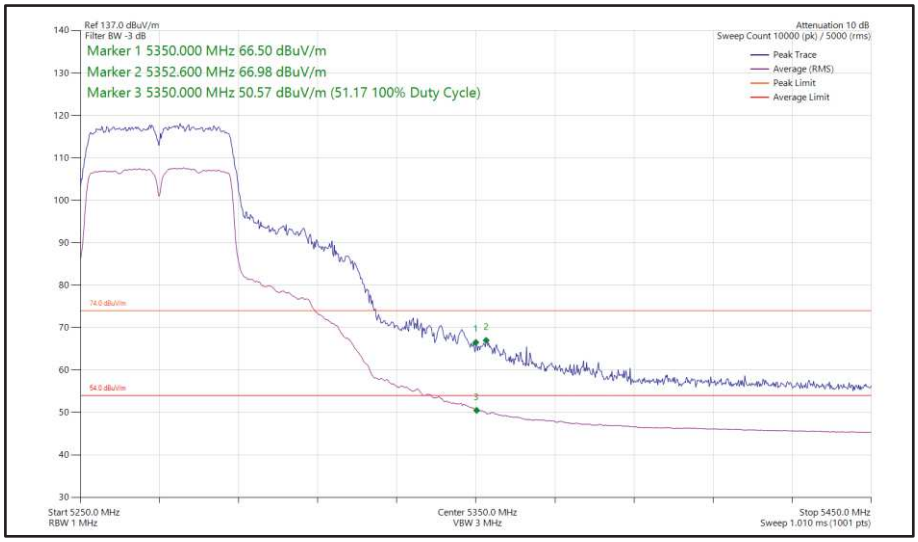

Figure 84 - 802.11n HT40, SISO, Core 0 - 5270 MHz Band Edge Frequency 5350 MHz

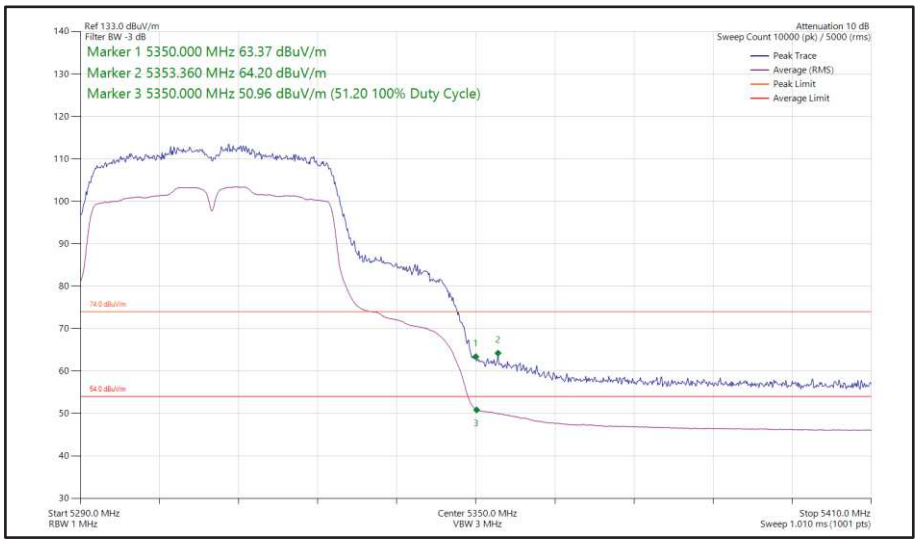

Figure 85 - 802.11n HT40, SISO, Core 0 - 5310 MHz Band Edge Frequency 5350 MHz

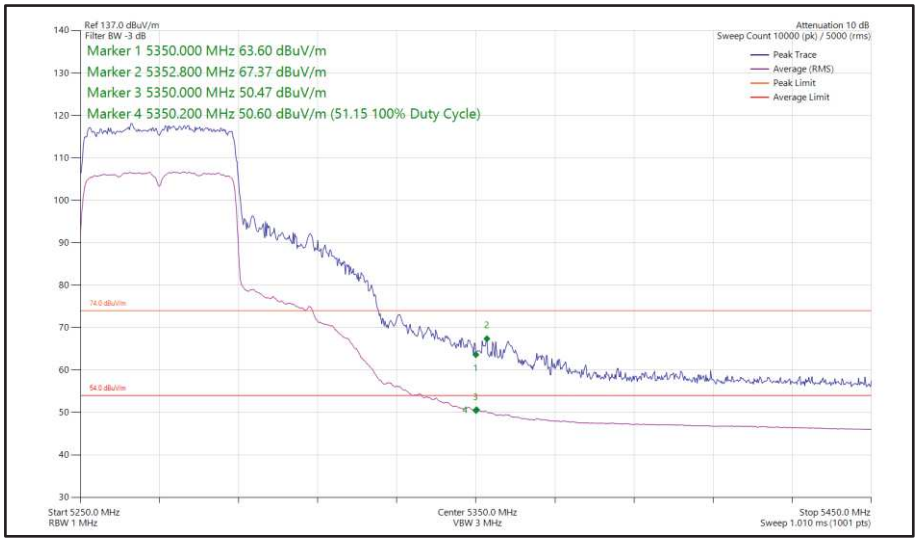

Figure 86 - 802.11ax HE40, SU, SISO, Core 0 - 5270 MHz Band Edge Frequency 5350 MHz

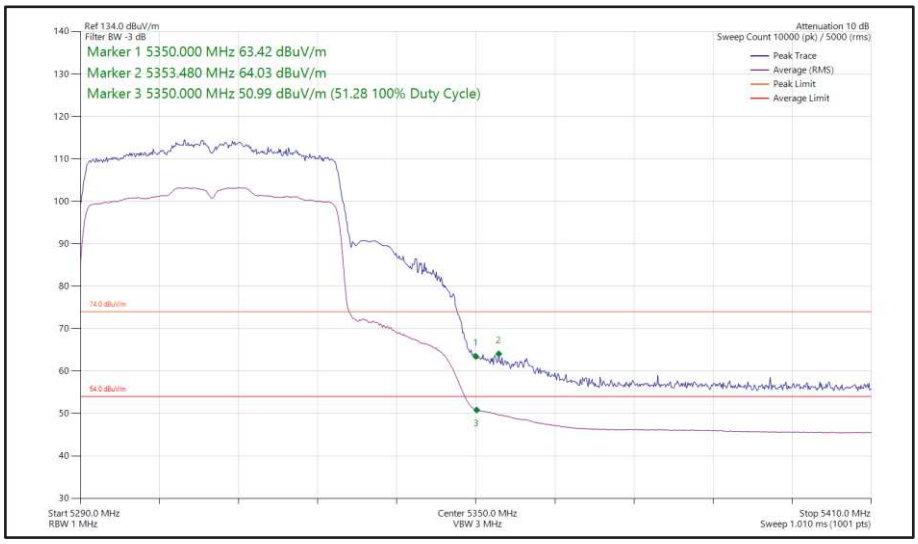

Figure 87 - 802.11ax HE40, SU, SISO, Core 0 - 5310 MHz Band Edge Frequency 5350 MHz

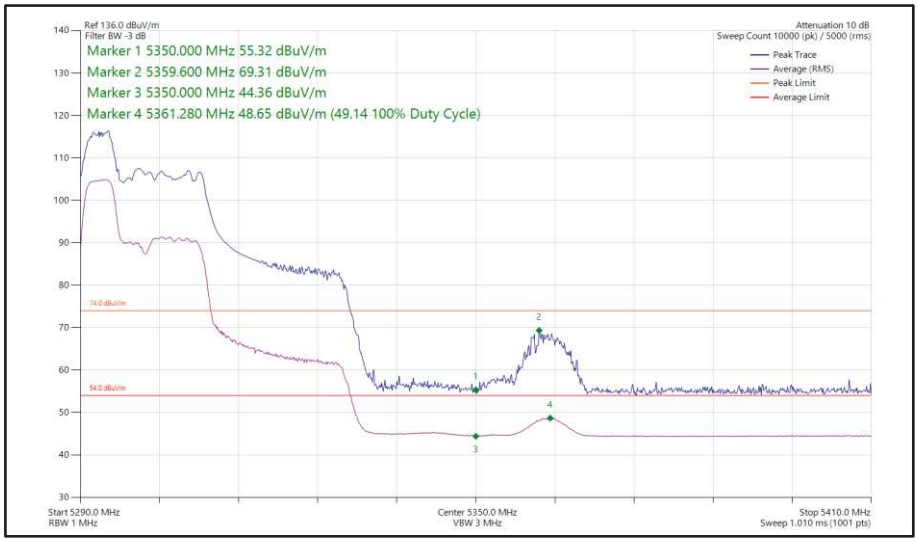

Figure 88 - 802.11ax HE40, RU 52-37, SISO, Core 0 - 5310 MHz Band Edge Frequency 5350 MHz

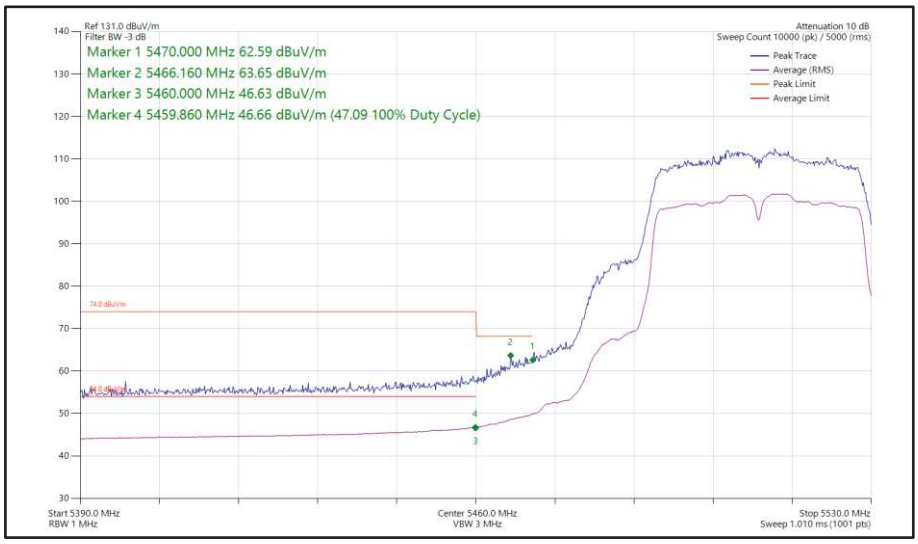

Figure 89 - 802.11n HT40, SISO, Core 0 - 5510 MHz Band Edge Frequency 5460 MHz

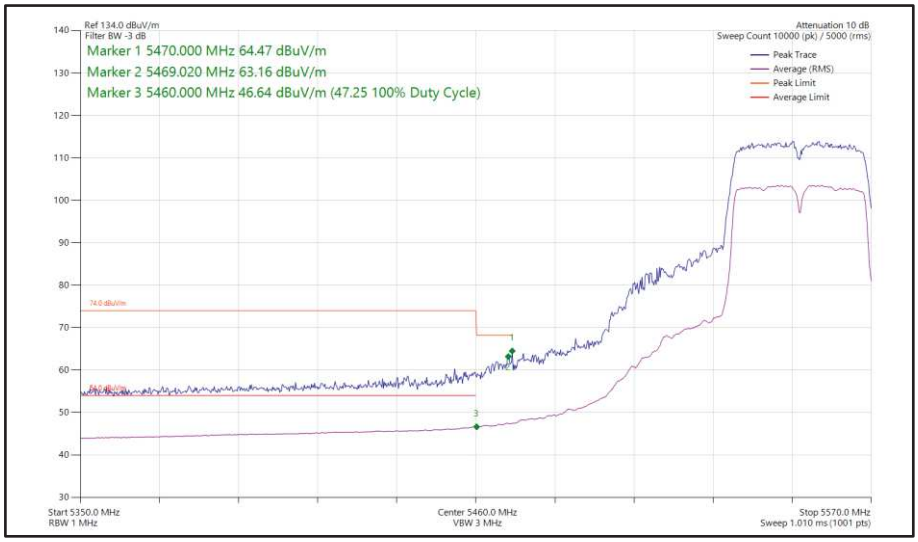

Figure 90 - 802.11n HT40, SISO, Core 0 - 5550 MHz Band Edge Frequency 5460 MHz

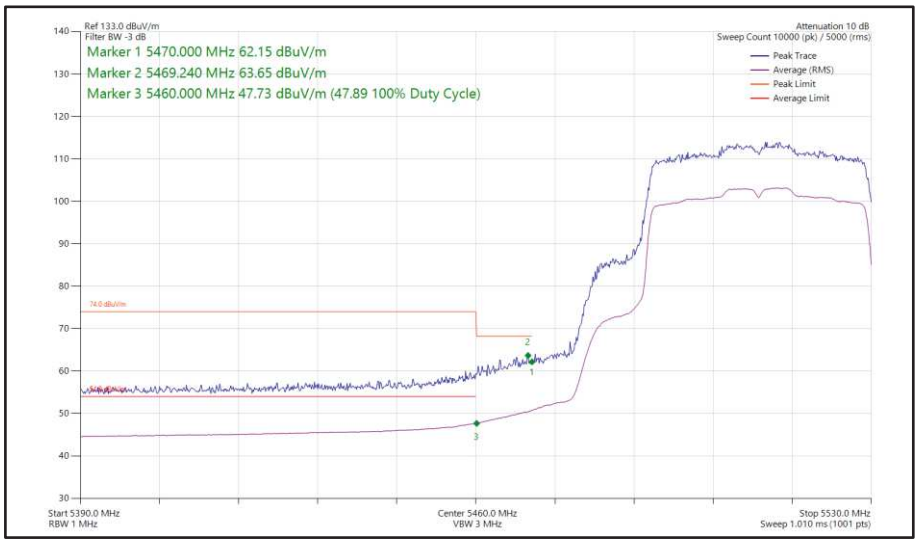

Figure 91 - 802.11ax HE40, SU, SISO, Core 0 - 5510 MHz Band Edge Frequency 5460 MHz

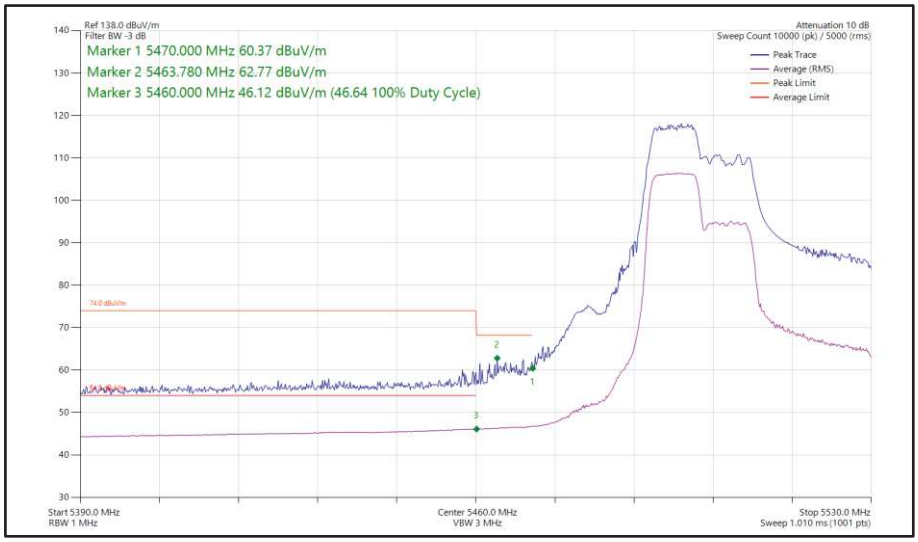

Figure 92 - 802.11ax HE40, RU 106-53, SISO, Core 0 - 5510 MHz Band Edge Frequency 5460 MHz

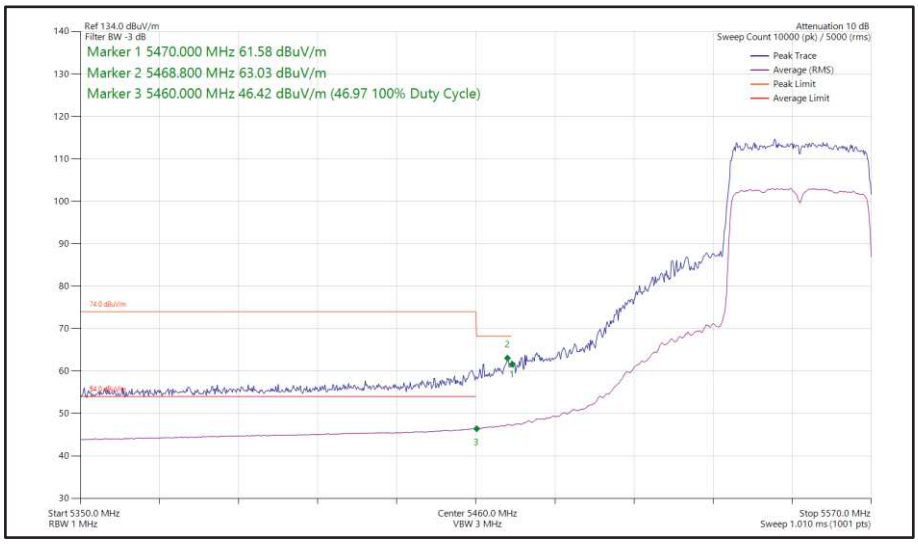

Figure 93 - 802.11ax HE40, SU, SISO, Core 0 - 5550 MHz Band Edge Frequency 5460 MHz

40 MHz Bandwidth - Core 1 (SISO)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT40	MCS2	-	-	5190	5150	63.06	51.03
802.11n HT40	MCS7	-	-	5230	5150	67.37	50.82
802.11ax HE40	MCS4x1	SU	-	5190	5150	63.67	51.42
802.11ax HE40	MCS11x1	106	53	5190	5150	67.22	47.67
802.11ax HE40	MCS11x1	SU	-	5230	5150	67.87	51.19
802.11n HT40	MCS7	-	-	5270	5350	67.26	51.42
802.11n HT40	MCS7	-	-	5310	5350	69.41	50.65
802.11ax HE40	MCS4x1	SU	-	5270	5350	65.92	51.06
802.11ax HE40	MCS2x1	SU	-	5310	5350	64.16	51.50
802.11ax HE40	MCS11x1	52	44	5310	5350	69.38	46.75
802.11n HT40	MCS4	-	-	5510	5460	63.32	47.87
802.11n HT40	MCS7	-	-	5550	5460	62.95	47.27
802.11ax HE40	MCS2x1	SU	-	5510	5460	63.55	48.36
802.11ax HE40	MCS11x1	106	53	5510	5460	63.53	47.19
802.11ax HE40	MCS11x1	SU	-	5550	5460	63.20	47.35

Table 12 - SISO Restricted Band Edge Results

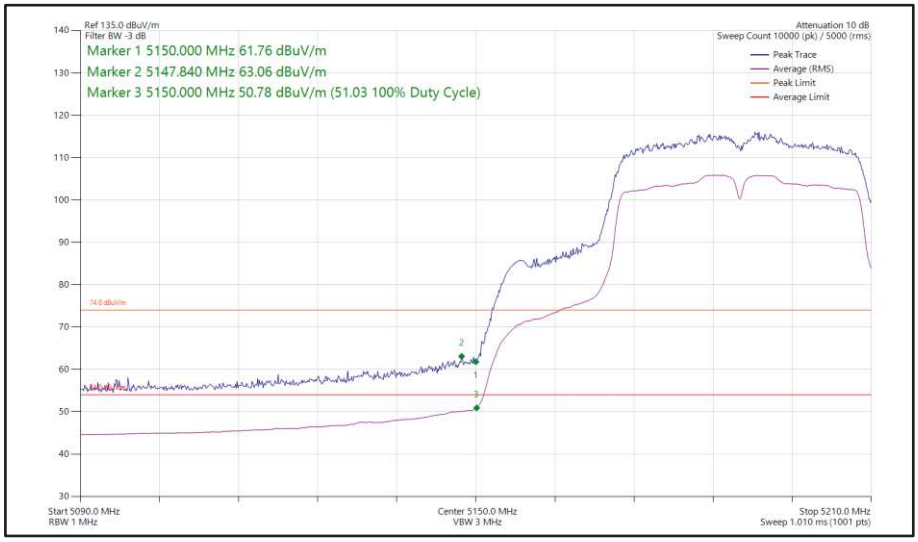

Figure 94 - 802.11n HT40, SISO, Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

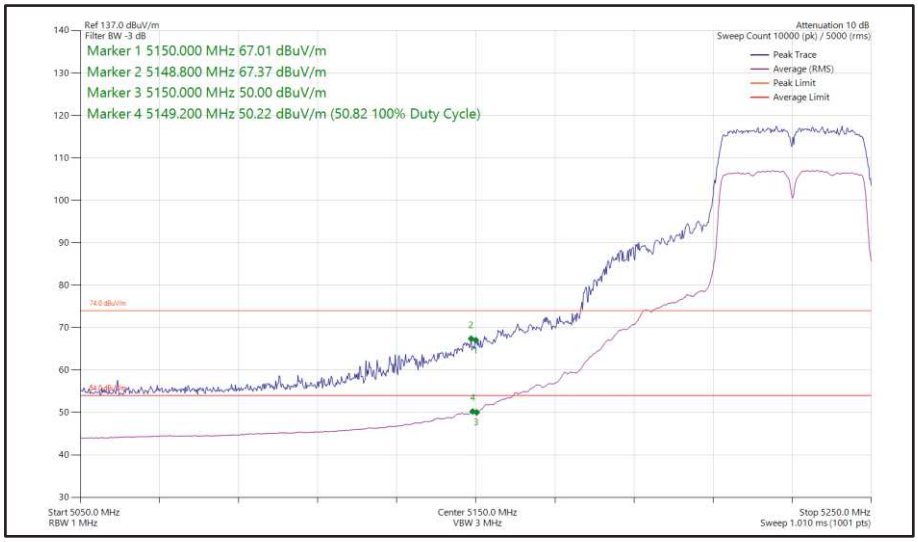

Figure 95 - 802.11n HT40, SISO, Core 1 - 5230 MHz
Band Edge Frequency 5150 MHz

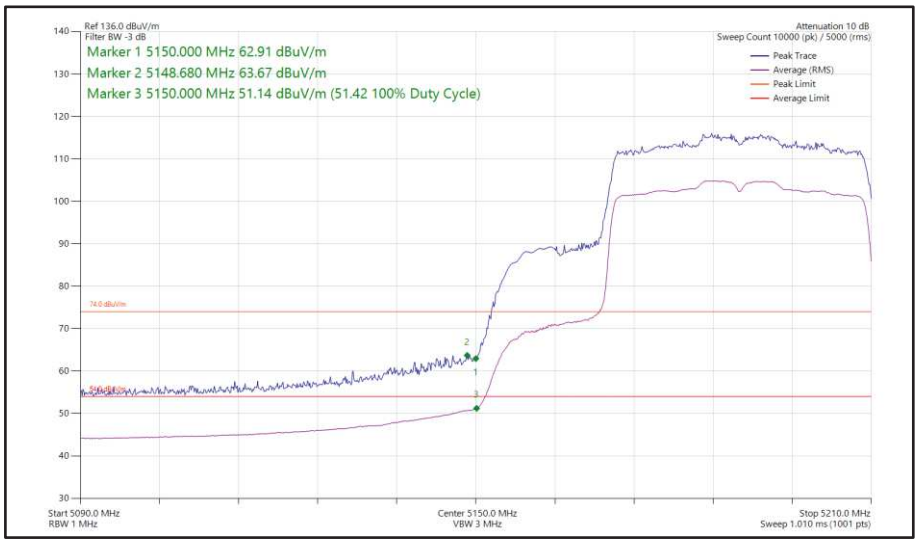

Figure 96 - 802.11ax HE40, SU, SISO, Core 1 - 5190 MHz
Band Edge Frequency 5150 MHz

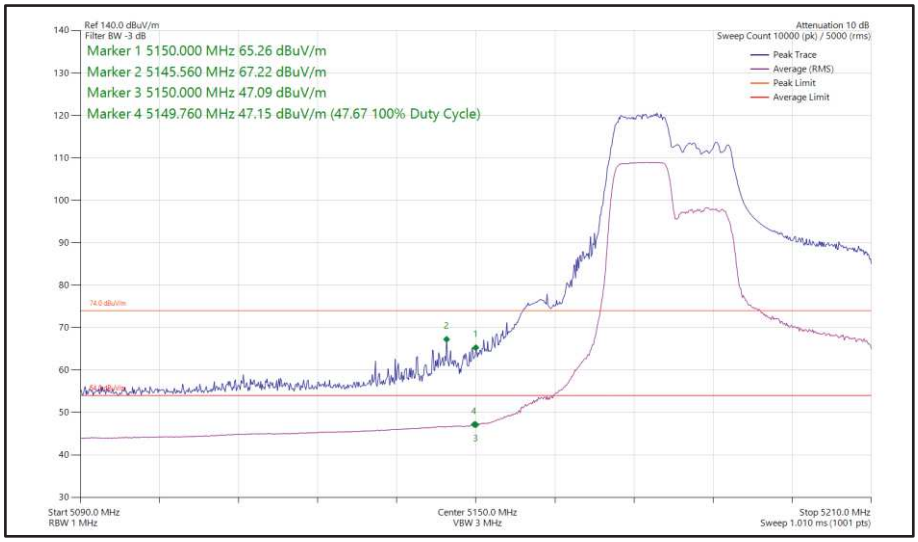

Figure 97 - 802.11ax HE40, RU 106-53, SISO, Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

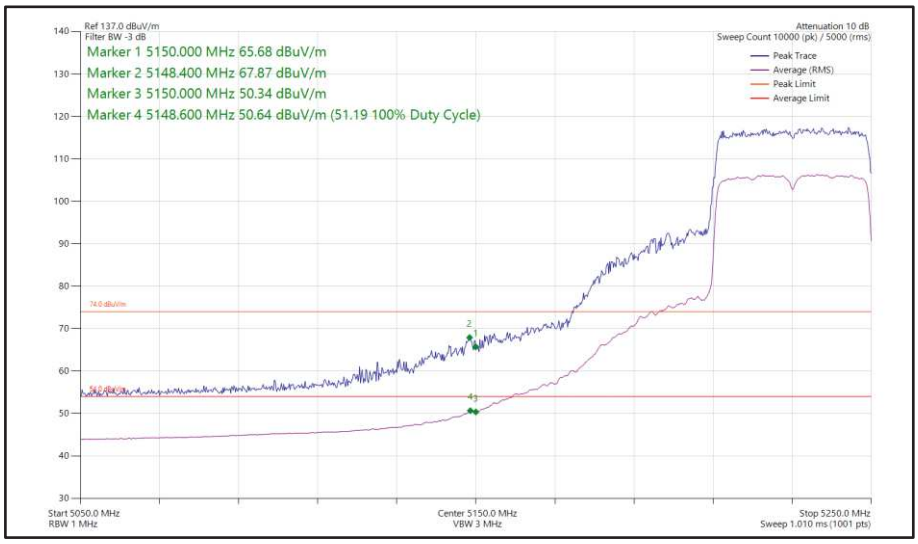

Figure 98 - 802.11ax HE40, SU, SISO, Core 1 - 5230 MHz Band Edge Frequency 5150 MHz

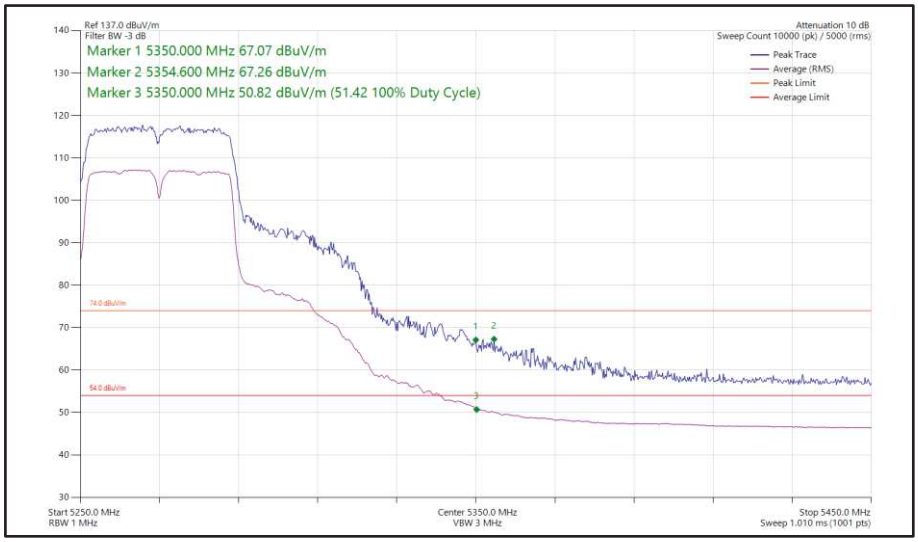

Figure 99 - 802.11n HT40, SISO, Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

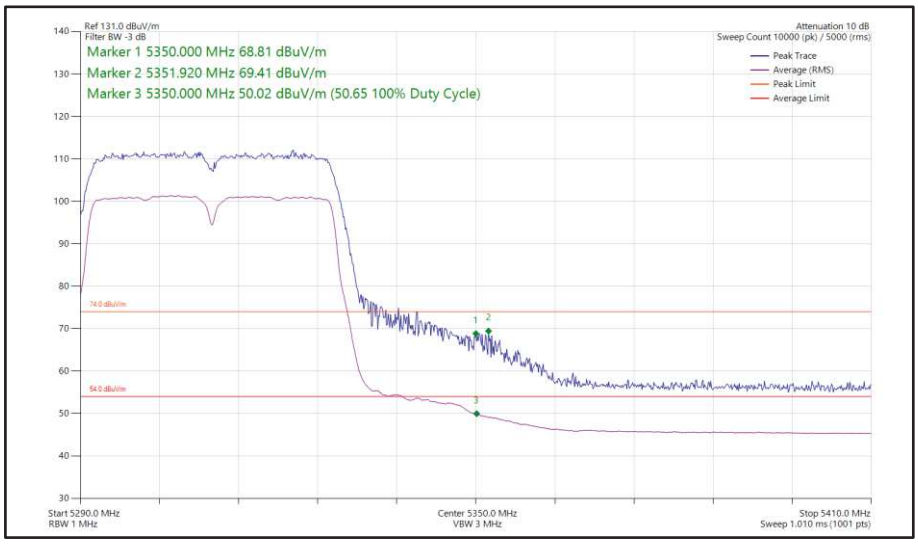

Figure 100 - 802.11n HT40, SISO, Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

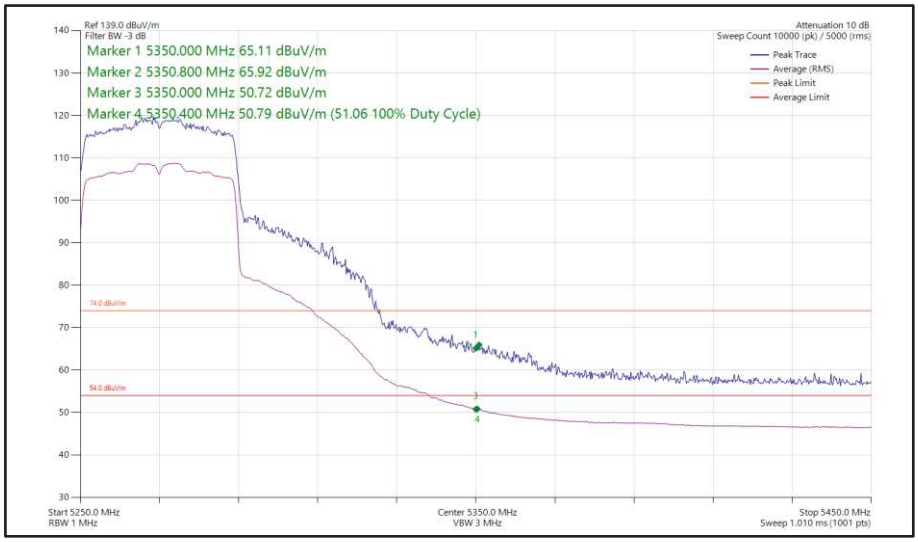

Figure 101 - 802.11ax HE40, SU, SISO, Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

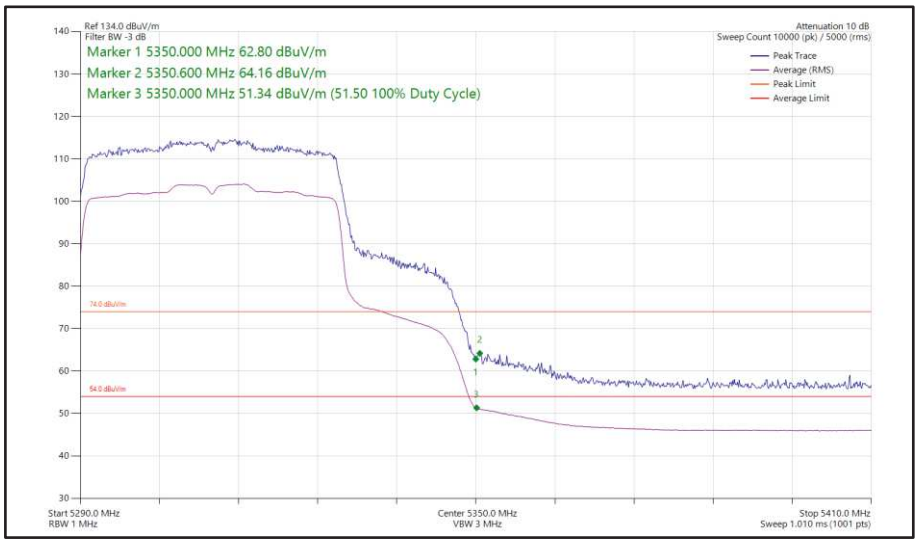

Figure 102 - 802.11ax HE40, SU, SISO, Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

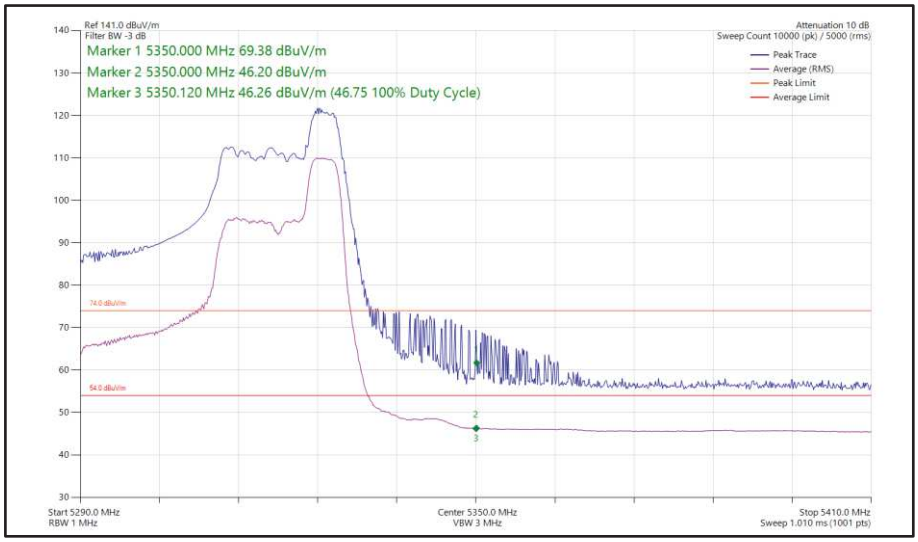

Figure 103 - 802.11ax HE40, RU 52-44, SISO, Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

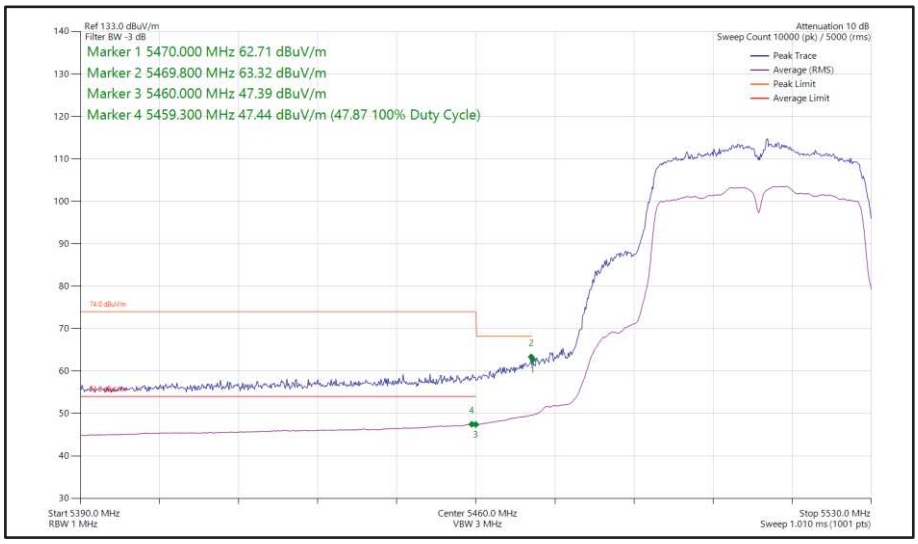

Figure 104 - 802.11n HT40, SISO, Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

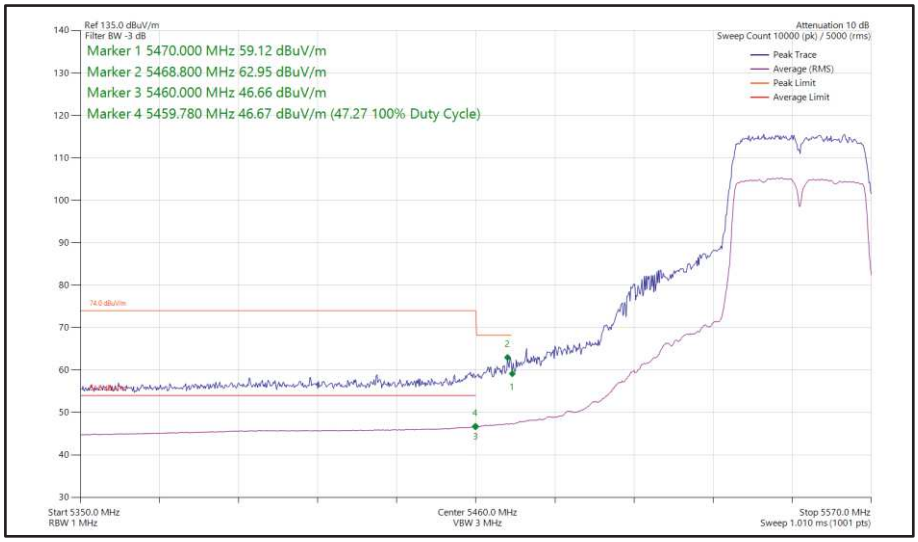

Figure 105 - 802.11n HT40, SISO, Core 1 - 5550 MHz Band Edge Frequency 5460 MHz

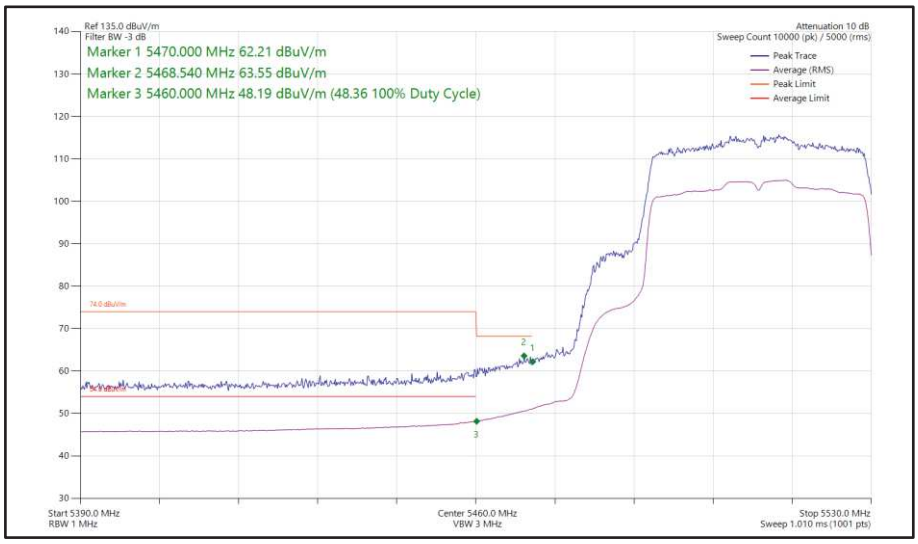

Figure 106 - 802.11ax HE40, SU, SISO, Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

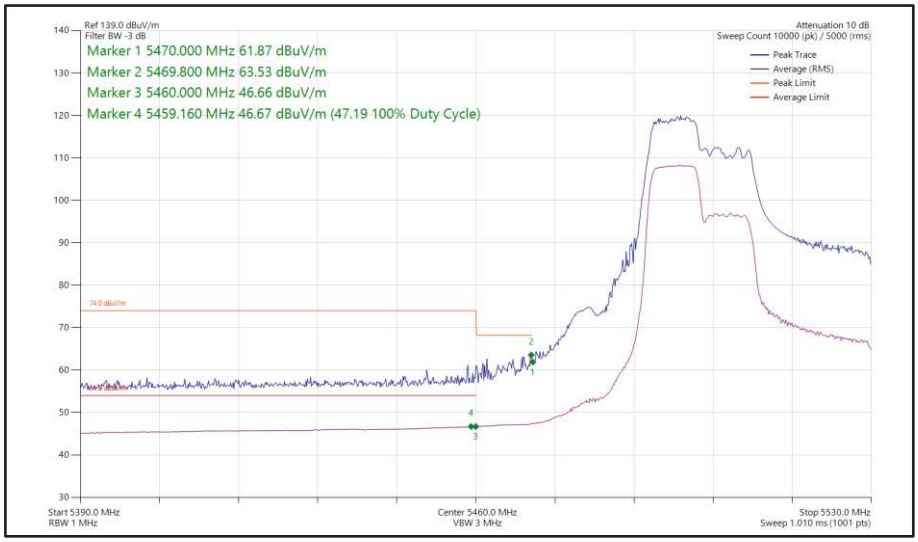

Figure 107 - 802.11ax HE40, RU 106-53, SISO, Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

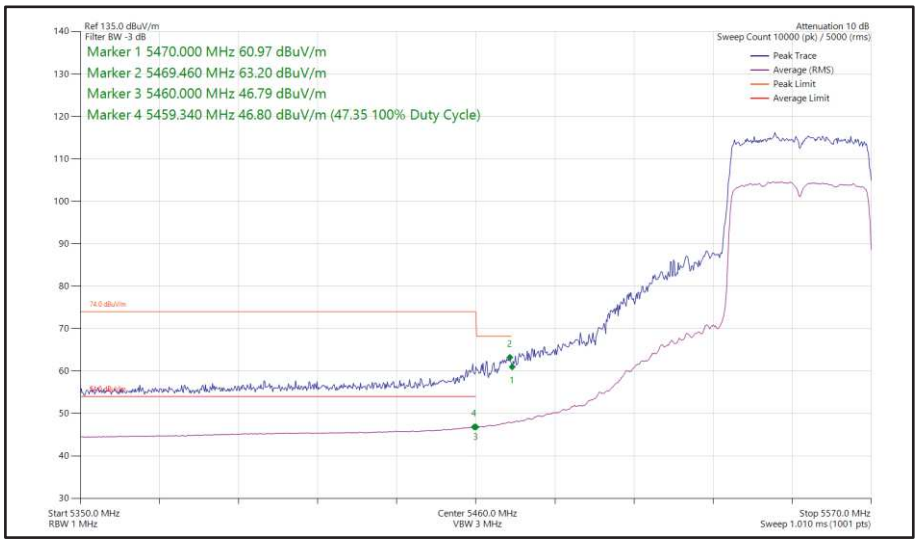

Figure 108 - 802.11ax HE40, SU, SISO, Core 1 - 5550 MHz Band Edge Frequency 5460 MHz

40 MHz Bandwidth - Core 0 + Core 1 (CDD)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT40	MCS2	-	-	5190	5150	63.29	51.33
802.11n HT40	MCS4	-	-	5230	5150	66.18	51.14
802.11ax HE40	MCS11x1	SU	-	5190	5150	69.25	51.30
802.11ax HE40	MCS11x1	106	56	5190	5150	62.82	50.67
802.11ax HE40	MCS11x1	SU	-	5230	5150	66.95	51.10
802.11n HT40	MCS4	-	-	5270	5350	66.06	51.36
802.11n HT40	MCS2	-	-	5310	5350	64.10	51.36
802.11ax HE40	MCS4x1	SU	-	5270	5350	66.17	51.34
802.11ax HE40	MCS4x1	SU	-	5310	5350	64.81	51.41
802.11ax HE40	MCS11x1	106	53	5310	5350	69.03	51.47
802.11n HT40	MCS7	-	-	5510	5460	63.57	47.16
802.11n HT40	MCS7	-	-	5550	5460	63.36	48.37
802.11ax HE40	MCS4x1	SU	-	5510	5460	63.66	49.25
802.11ax HE40	MCS11x1	106	56	5510	5460	63.62	49.74
802.11ax HE40	MCS11x1	SU	-	5550	5460	63.62	48.33

Table 13 - CDD Restricted Band Edge Results

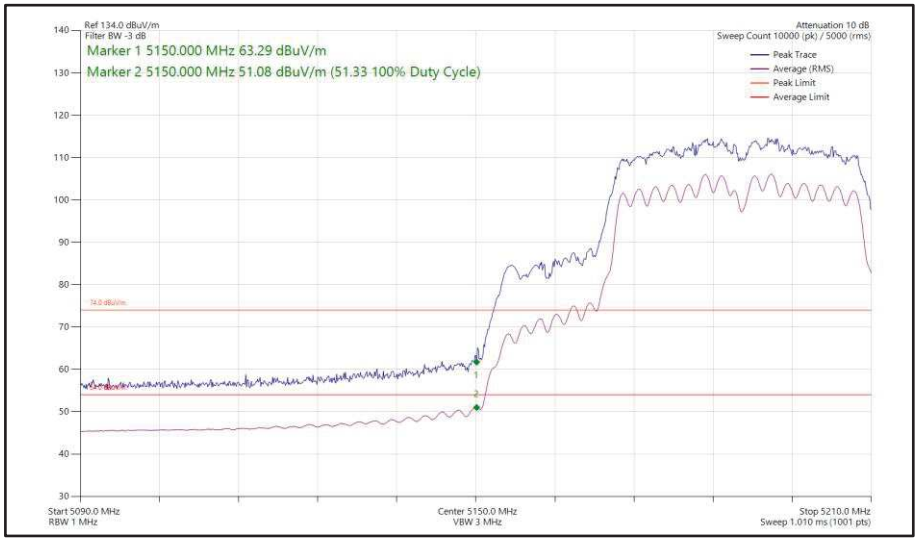

Figure 109 - 802.11n HT40, CDD, Core 0 + Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

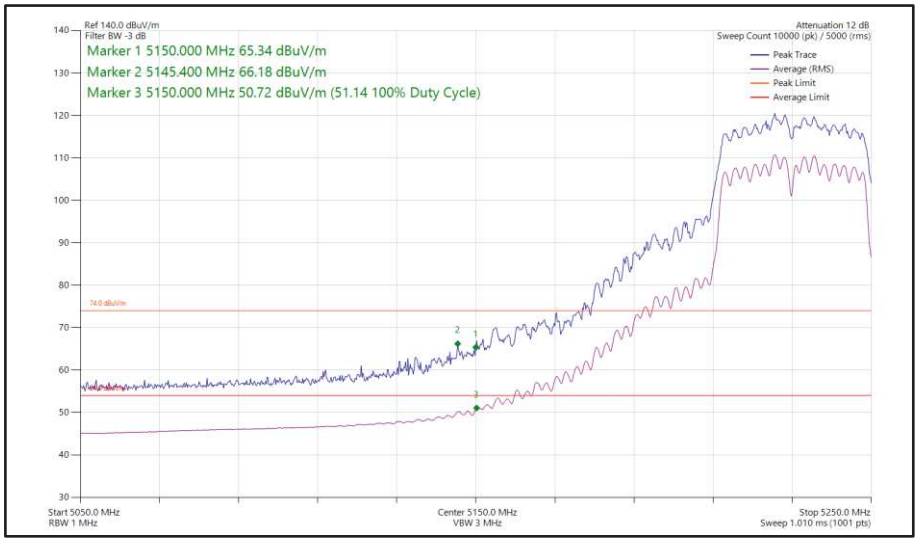

Figure 110 - 802.11n HT40, CDD, Core 0 + Core 1 - 5230 MHz
Band Edge Frequency 5150 MHz

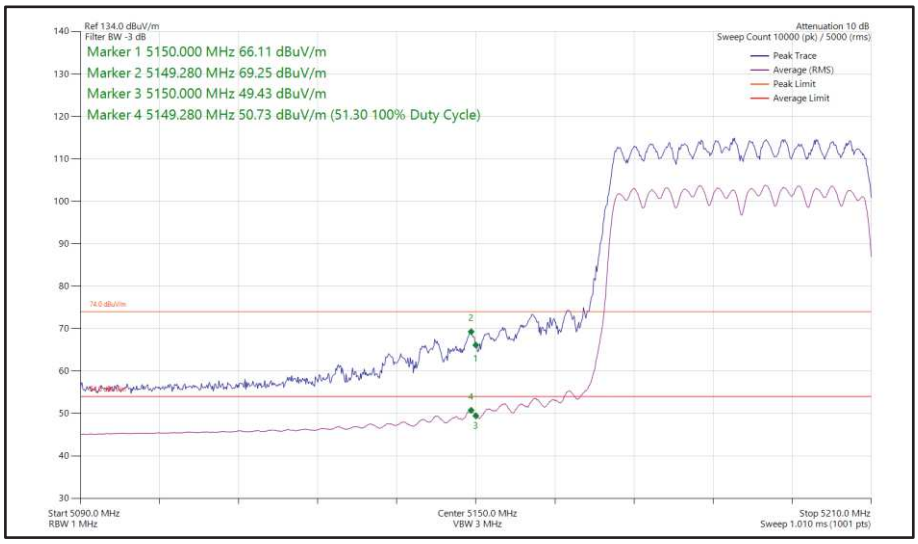

Figure 111 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5190 MHz
Band Edge Frequency 5150 MHz

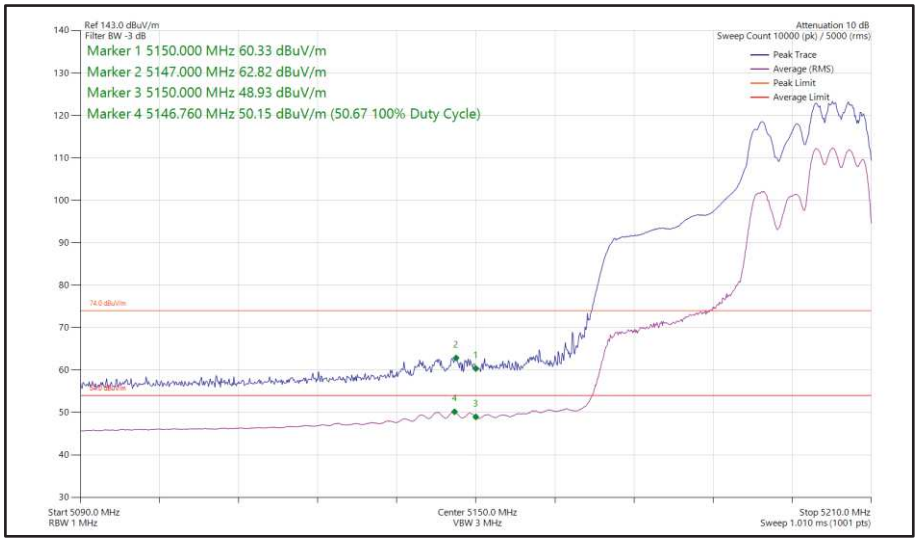

Figure 112 - 802.11ax HE40, RU 106-56, CDD, Core 0 + Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

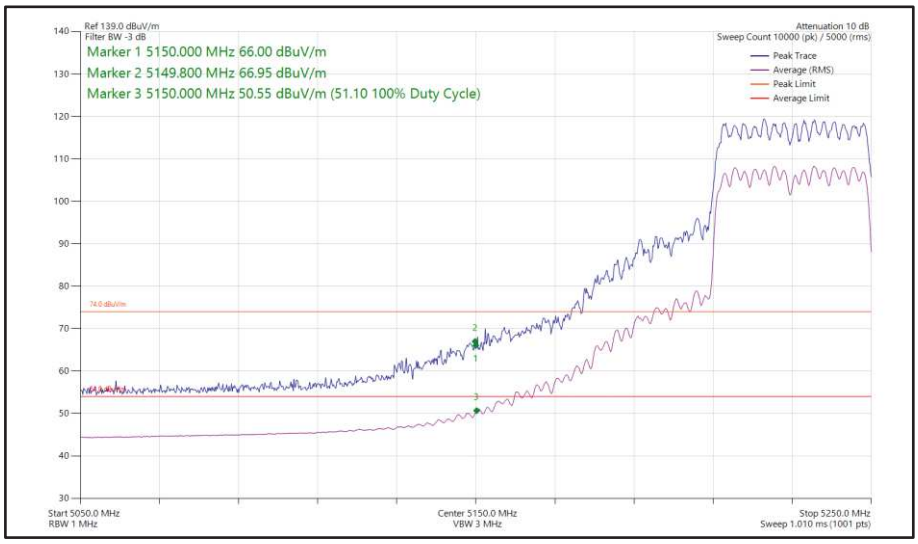

Figure 113 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5230 MHz Band Edge Frequency 5150 MHz

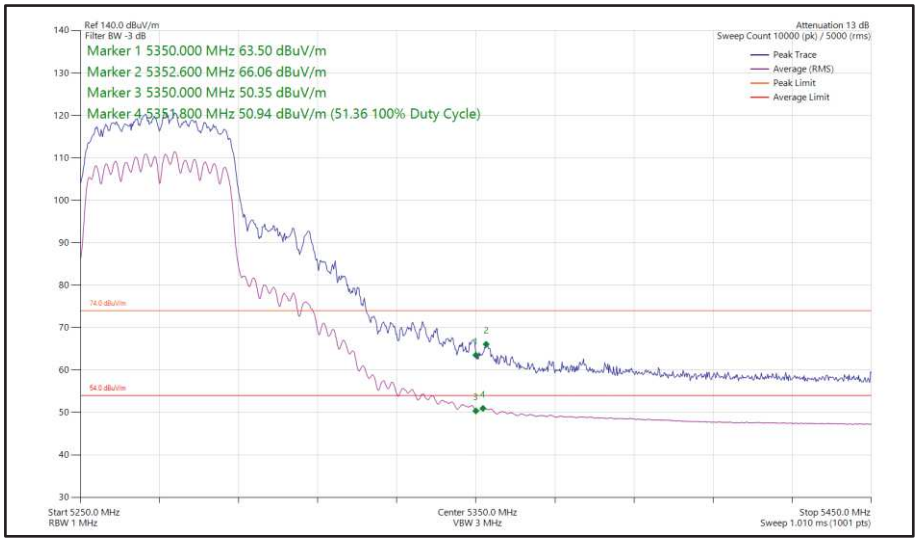

Figure 114 - 802.11n HT40, CDD, Core 0 + Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

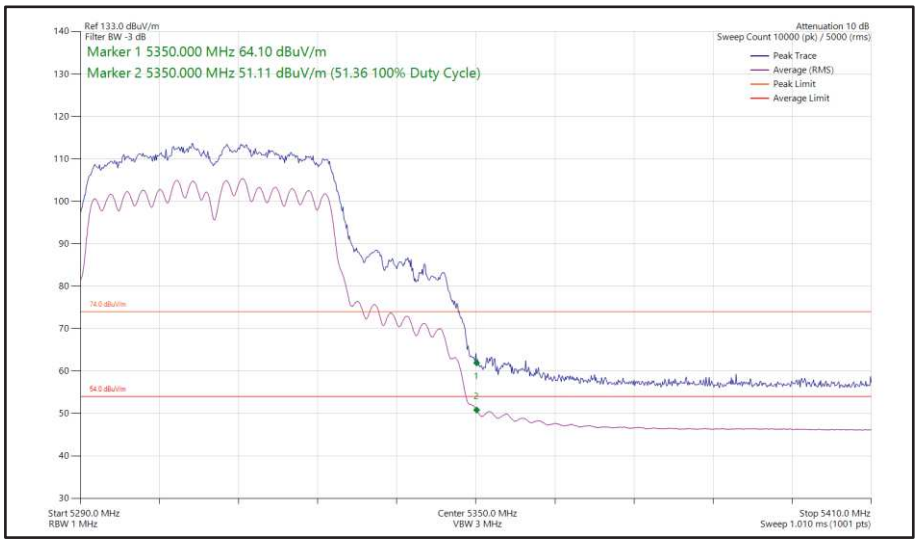

Figure 115 - 802.11n HT40, CDD, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

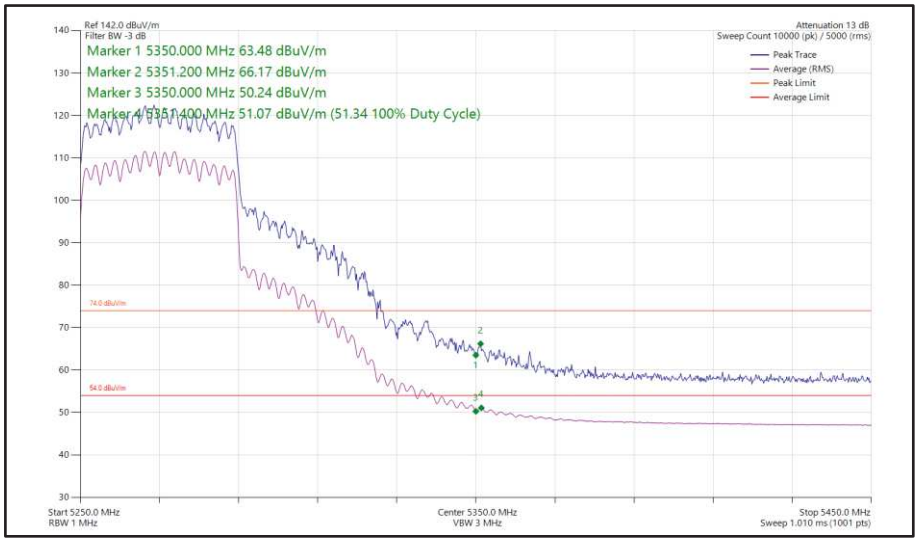

Figure 116 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

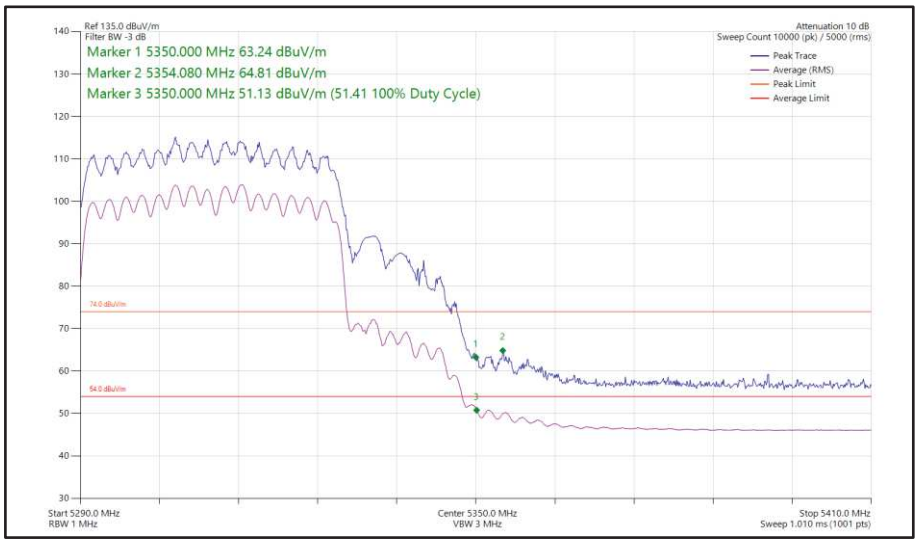

Figure 117 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

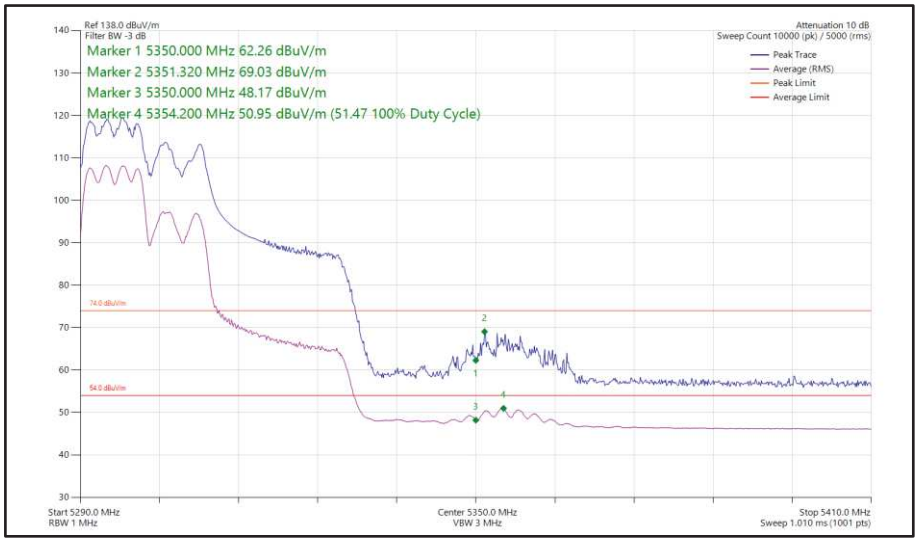

Figure 118 - 802.11ax HE40, RU 106-53, CDD, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

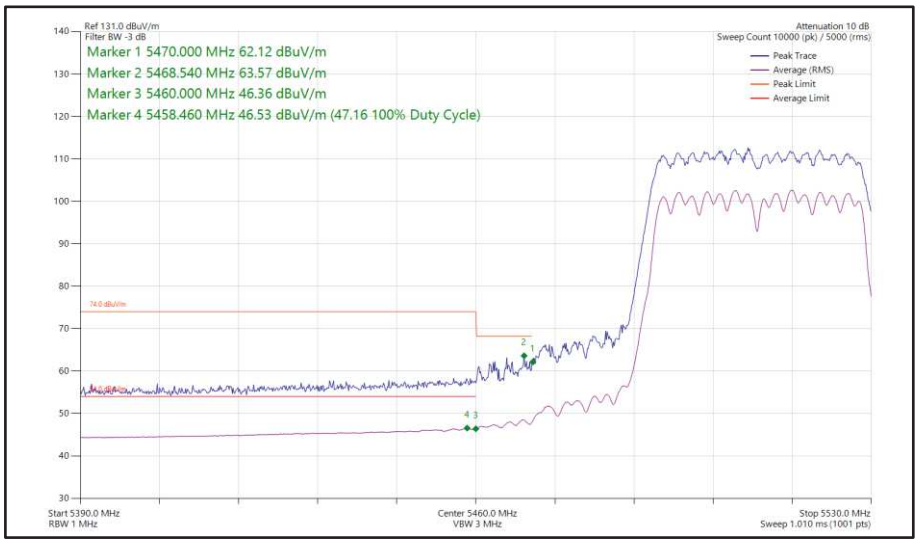

Figure 119 - 802.11n HT40, CDD, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

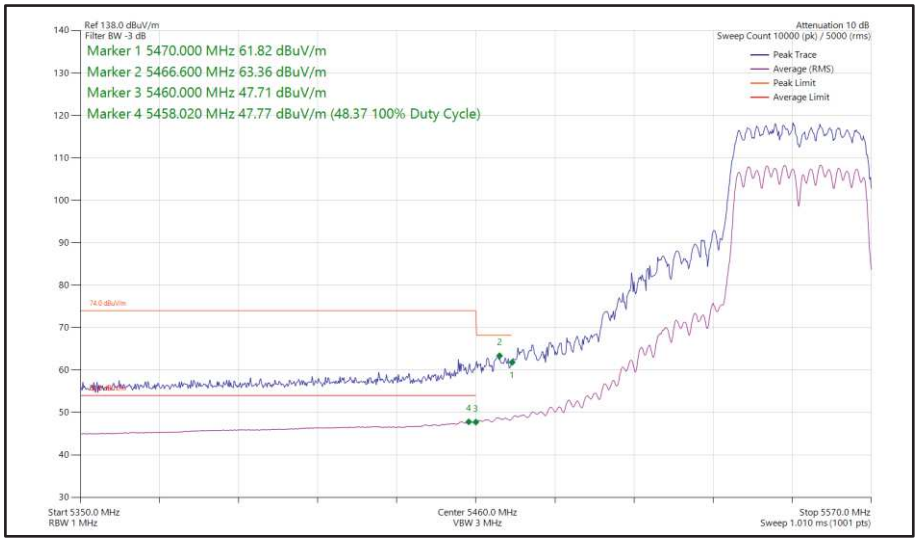

Figure 120 - 802.11n HT40, CDD, Core 0 + Core 1 - 5550 MHz Band Edge Frequency 5460 MHz

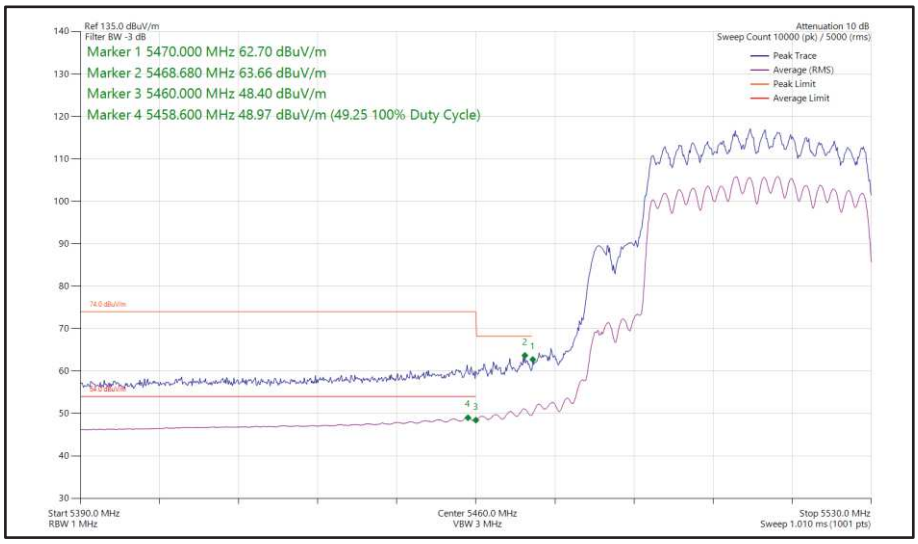

Figure 121 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

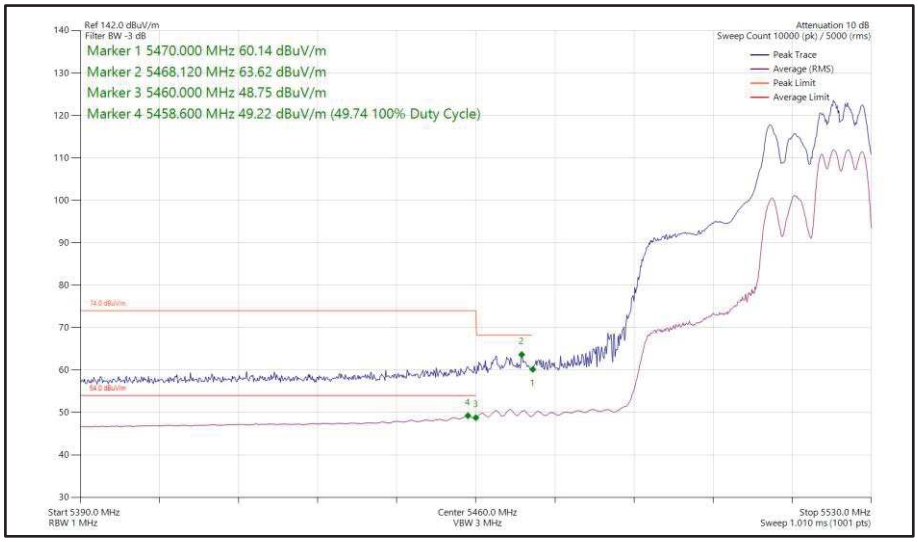

Figure 122 - 802.11ax HE40, RU 106-56, CDD, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

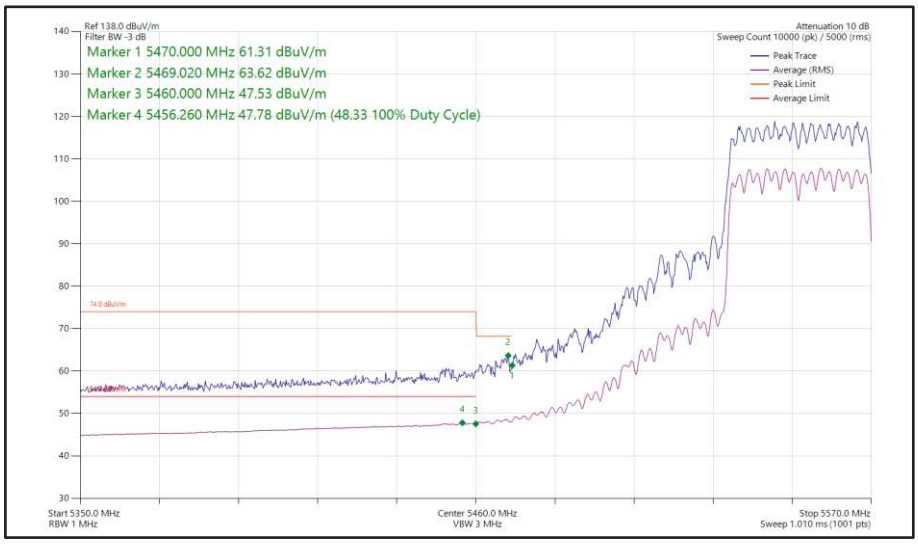

Figure 123 - 802.11ax HE40, SU, CDD, Core 0 + Core 1 - 5550 MHz Band Edge Frequency 5460 MHz

40 MHz Bandwidth - Core 0 + Core 1 (SDM)

Mode	Data Rate/ MCS	Resource Size	Resource Index	TX Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBuV/m)
802.11n HT40	MCS15	-	-	5190	5150	68.70	51.03
802.11n HT40	MCS15	-	-	5230	5150	65.41	51.23
802.11ax HE40	MCS11x2	SU	-	5190	5150	69.27	50.26
802.11ax HE40	MCS11x2	106	56	5190	5150	63.23	50.05
802.11ax HE40	MCS4x2	SU	-	5230	5150	65.58	51.47
802.11n HT40	MCS10	-	-	5270	5350	64.21	51.12
802.11n HT40	MCS15	-	-	5310	5350	66.83	50.93
802.11ax HE40	MCS11x2	SU	-	5270	5350	67.52	51.45
802.11ax HE40	MCS4x2	SU	-	5310	5350	63.34	51.32
802.11ax HE40	MCS11x2	52	44	5310	5350	69.38	48.00
802.11n HT40	MCS10	-	-	5510	5460	63.55	48.65
802.11n HT40	MCS10	-	-	5550	5460	63.48	49.94
802.11ax HE40	MCS11x2	SU	-	5510	5460	63.57	47.62
802.11ax HE40	MCS11x2	106	53	5510	5460	63.46	47.91
802.11ax HE40	MCS4x2	SU	-	5550	5460	63.53	48.32

Table 14 - SDM Restricted Band Edge Results

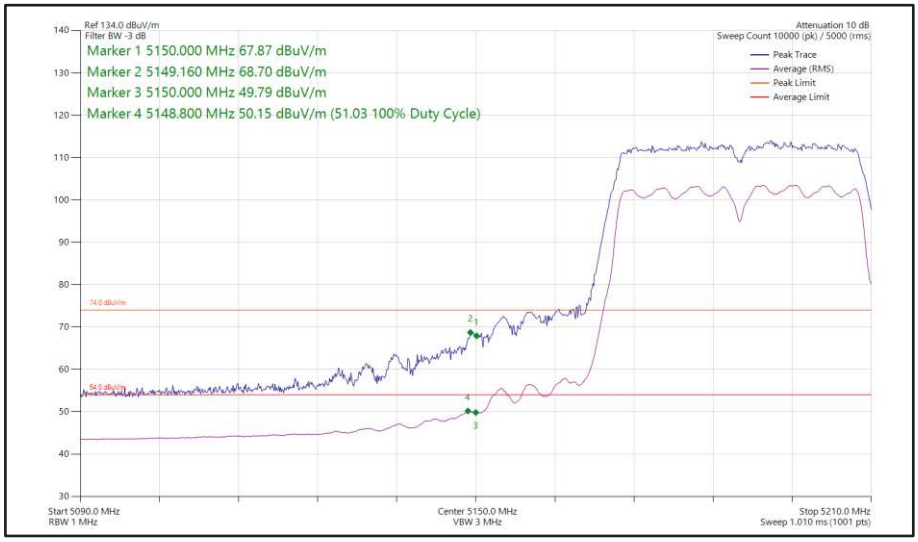

Figure 124 - 802.11n HT40, SDM, Core 0 + Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

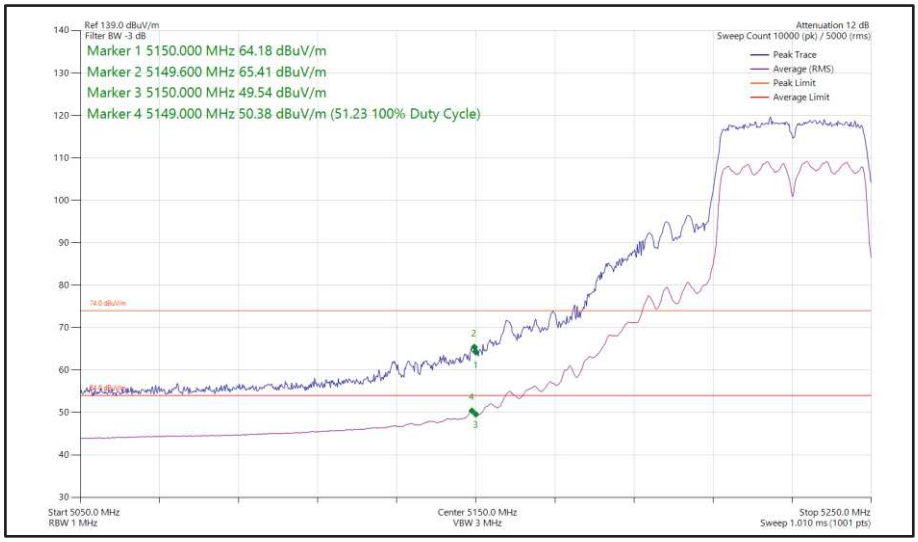

Figure 125 - 802.11n HT40, SDM, Core 0 + Core 1 - 5230 MHz Band Edge Frequency 5150 MHz

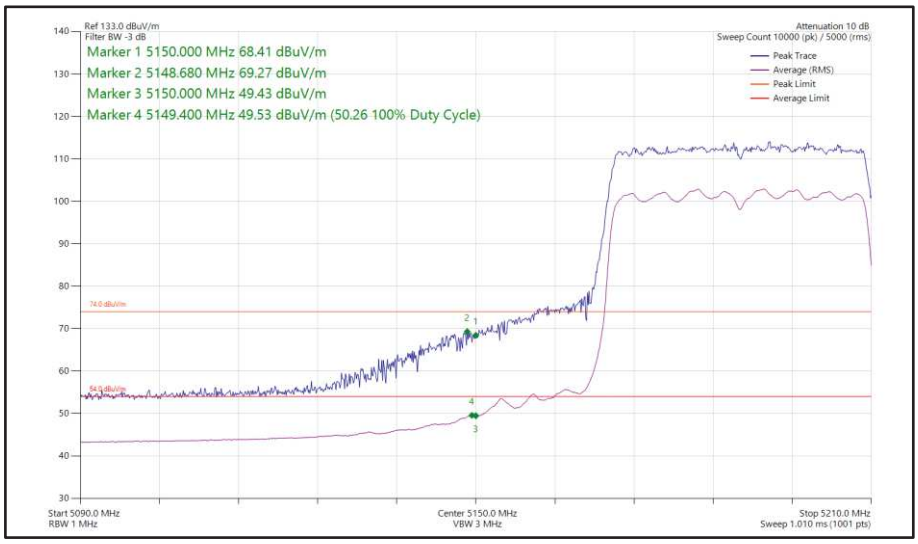

Figure 126 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

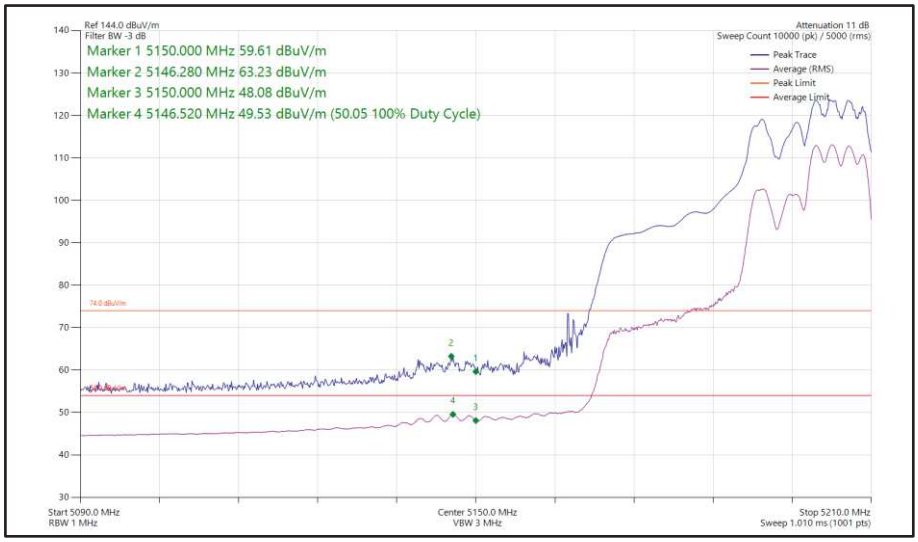

Figure 127 - 802.11ax HE40, RU 106-56, SDM, Core 0 + Core 1 - 5190 MHz Band Edge Frequency 5150 MHz

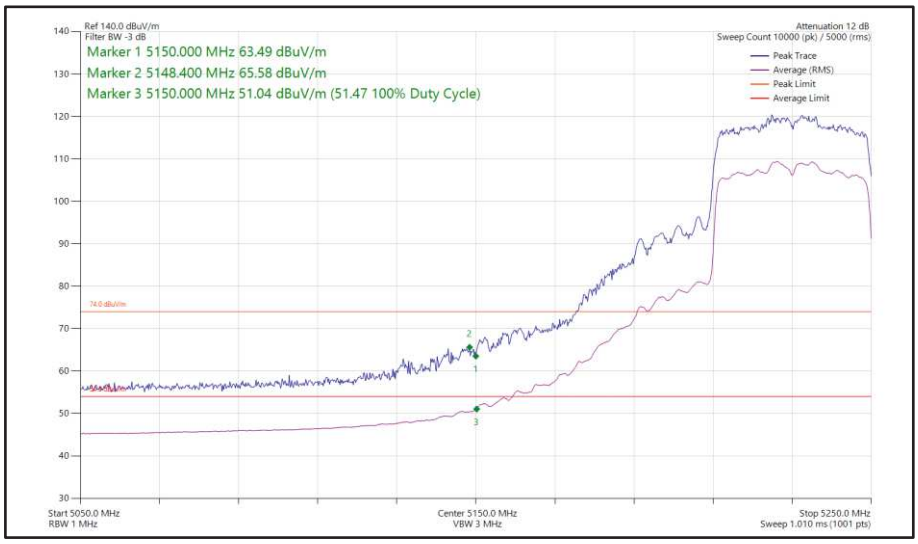

Figure 128 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5230 MHz Band Edge Frequency 5150 MHz

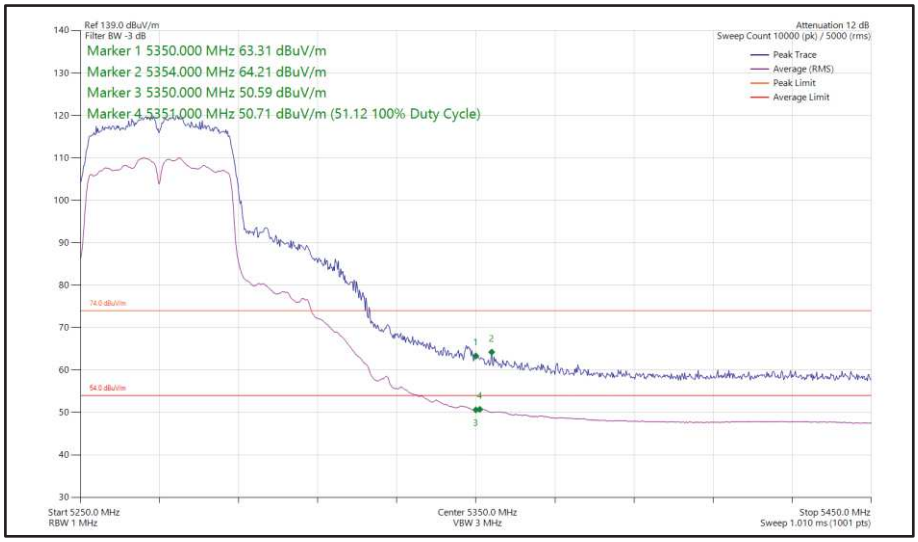

Figure 129 - 802.11n HT40, SDM, Core 0 + Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

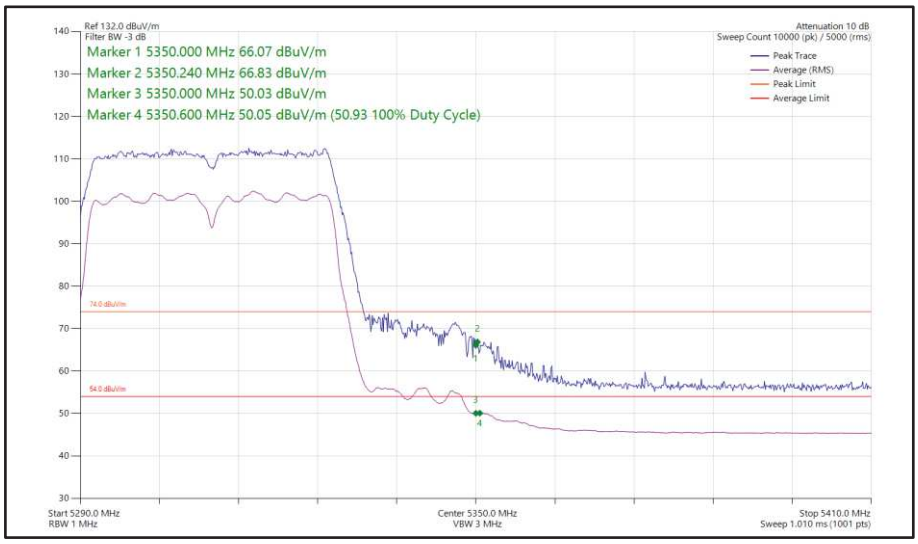

Figure 130 - 802.11n HT40, SDM, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

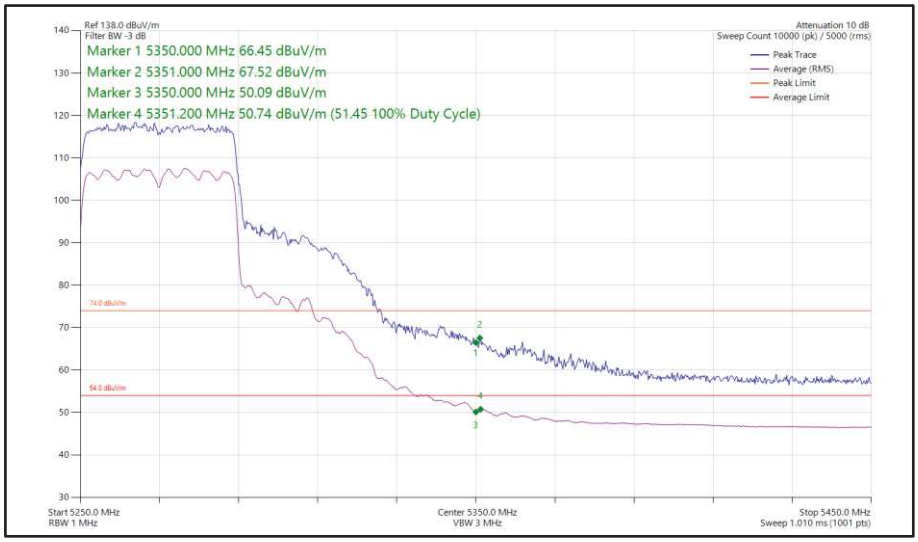

Figure 131 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5270 MHz Band Edge Frequency 5350 MHz

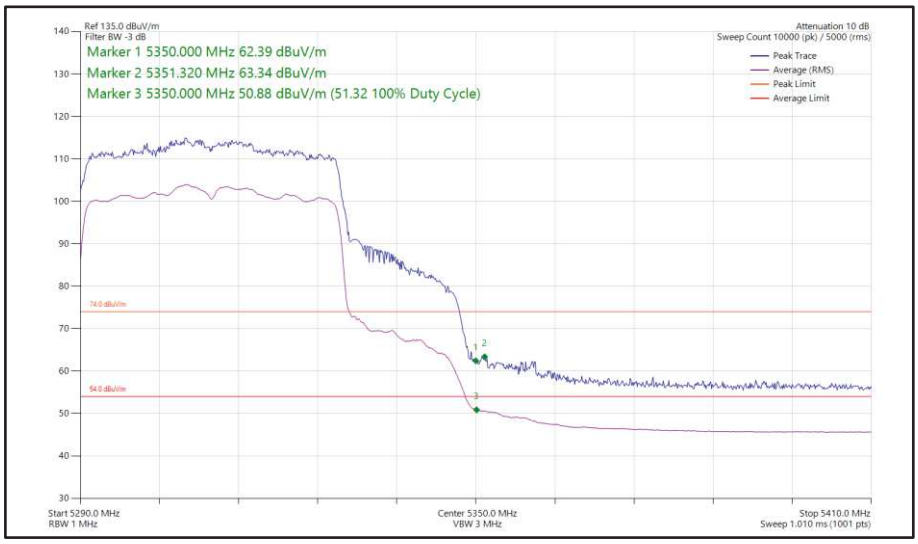

Figure 132 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

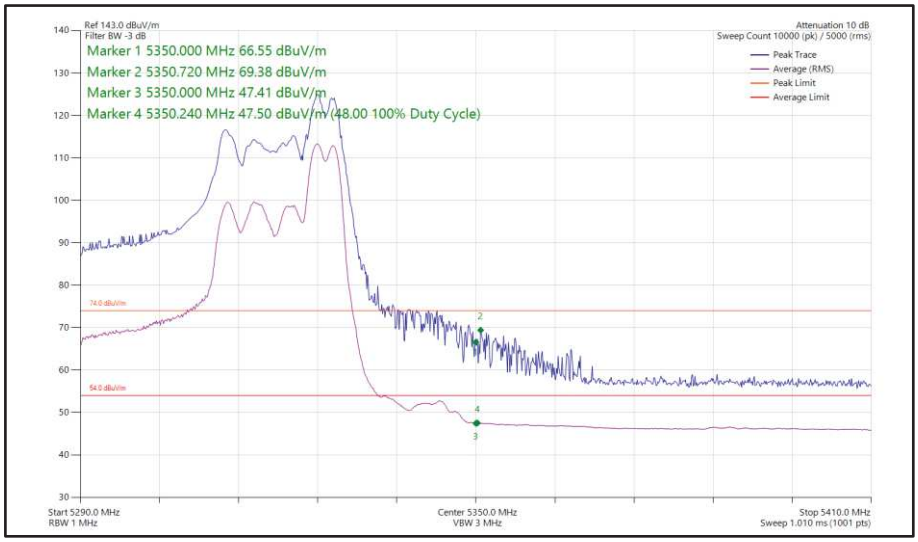

Figure 133 - 802.11ax HE40, RU 52-44, SDM, Core 0 + Core 1 - 5310 MHz Band Edge Frequency 5350 MHz

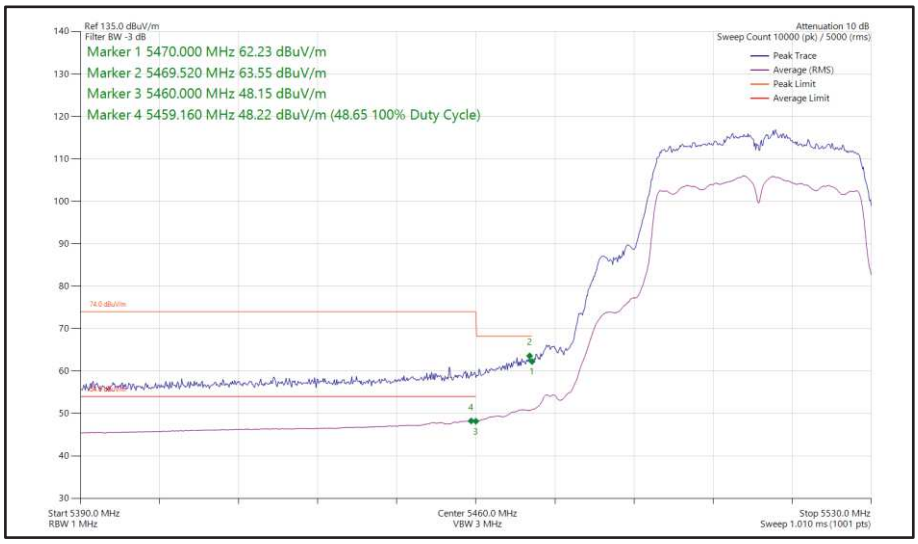

Figure 134 - 802.11n HT40, SDM, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

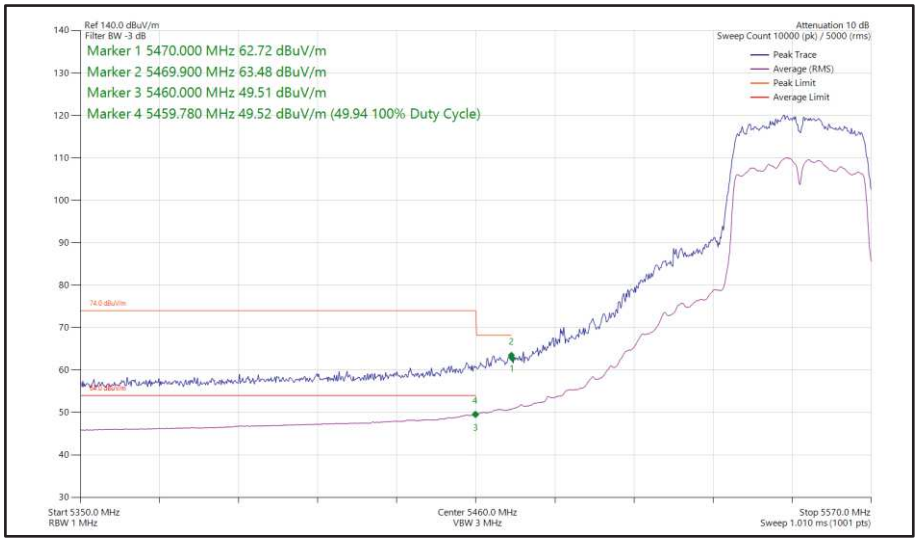

Figure 135 - 802.11n HT40, SDM, Core 0 + Core 1 - 5550 MHz Band Edge Frequency 5460 MHz

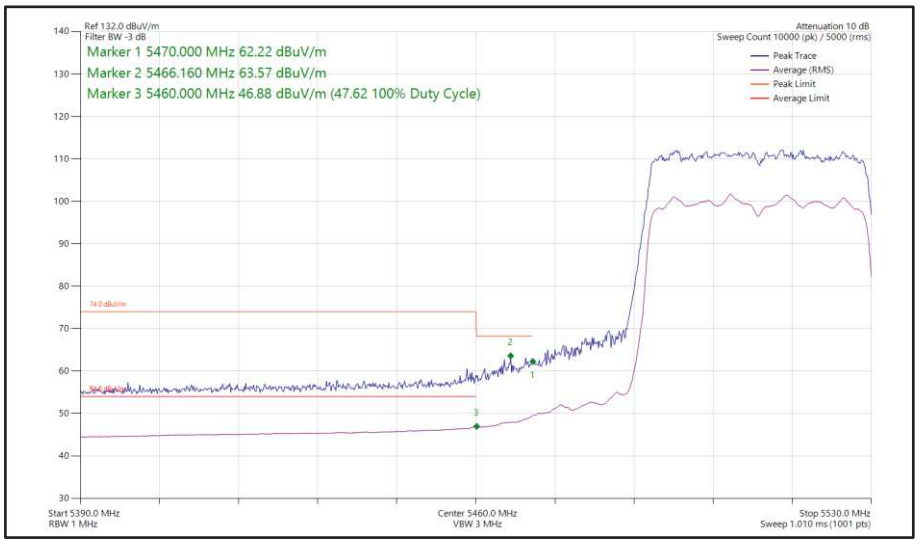

Figure 136 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

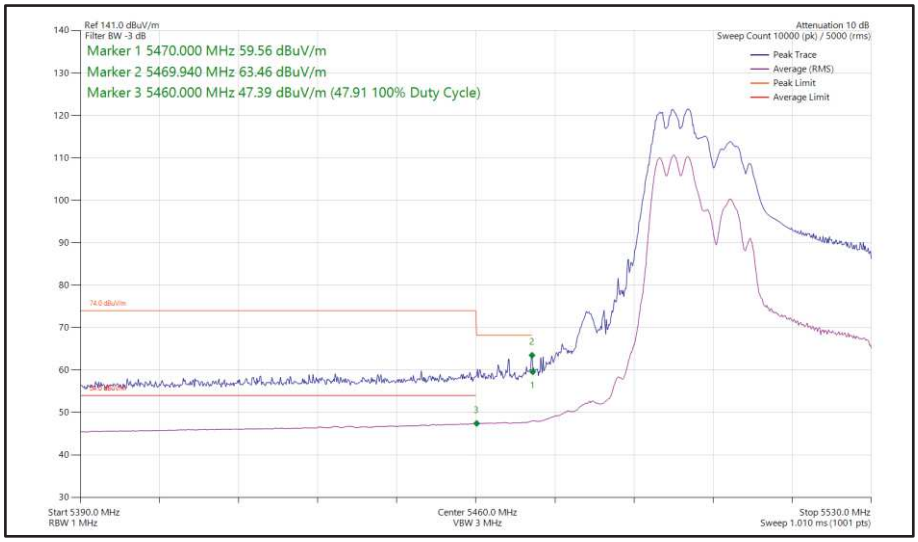

Figure 137 - 802.11ax HE40, RU 106-53, SDM, Core 0 + Core 1 - 5510 MHz Band Edge Frequency 5460 MHz

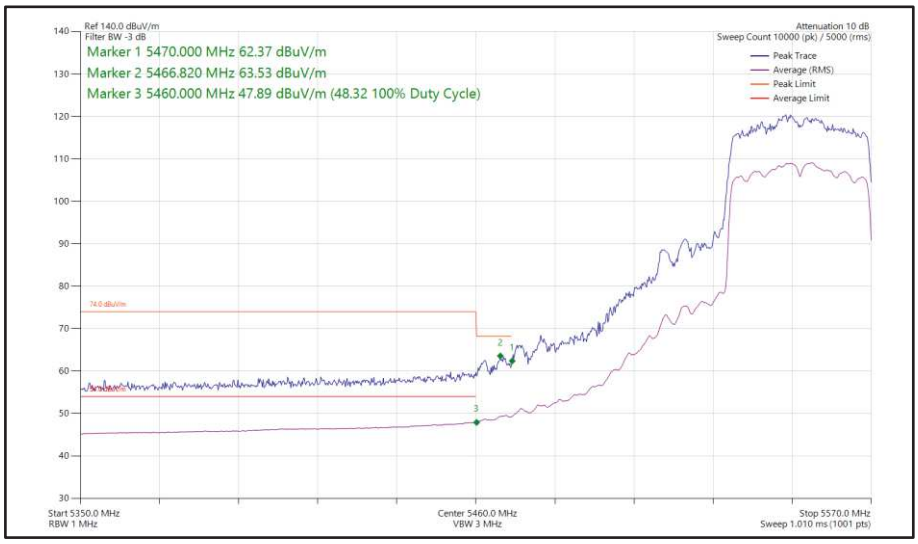

Figure 138 - 802.11ax HE40, SU, SDM, Core 0 + Core 1 - 5550 MHz Band Edge Frequency 5460 MHz