

Test Report No:
NIE: 72370RRF.009A1

Partial Test Report

USA FCC Part 15.407, 15.209

(*) Identification of item tested	CIVIC (Central In-Vehicle Infotainment Computer)
(*) Trademark	Bosch
(*) Model and / or type reference	MBCI2LS4PR1
Other identification of the product	FCC ID: 2AUXS-MBCI2LS4PR1
(*) Features	AM/FM/DAB/SIRIUS, GNSS, 2.4/5GHz WLAN, Bluetooth 5.1, Video/Audio etc HW version: D1.1 SW version: E23.3
Applicant	Robert Bosch GmbH Robert-Bosch-Strasse 200 31139, Hildesheim Germany
Test method requested, standard	USA FCC Part 15.407 (10-1-21) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.209 (10-1-21) Edition: Radiated emission limits; general requirements. Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013 ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-10-20
Report template No.	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación) to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with the appropriate scope of accreditation that covers the performed test in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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General Conditions

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a CIVIC Central In-Vehicle Infotainment Computer, including WLAN/ Bluetooth, GPS, AM/FM/DAB receiver.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control No.	Description	Model	Serial No.	Reception
72370C/001	Central In-Vehicle Infotainment Computer	MBCI2LS4PR1	0006101	17/05/2022
72370C/010	Harness	--	--	17/05/2022
72370C/027	BT/WLAN Antenna	--	--	17/05/2022
72370C/028	BT/WLAN Antenna	--	--	17/05/2022
72370C/029	BT/WLAN Antenna	--	--	17/05/2022
72370C/030	BT/WLAN Antenna	--	--	17/05/2022

Auxiliary elements used with the Sample S/01:

Control No.	Description	Model	Serial No.	Reception
72370C/031	FAKRA 4n1 Cable	--	--	17/05/2022
72370C/032	SMA 4n1 Cable	--	--	17/05/2022
72370C/034	FAKRA to SMA Adapter	--	--	17/05/2022
72370C/035	FAKRA to SMA Adapter	--	--	17/05/2022
72370C/036	FAKRA to SMA Adapter	--	--	17/05/2022
72370C/037	FAKRA to SMA Adapter	--	--	17/05/2022
72370C/038	DC Block	--	--	17/05/2022
72370C/039	DC Block	--	--	17/05/2022
72370C/042	DC Block	--	--	17/05/2022
72370C/043	FAKRA to SMA Cable	--	--	17/05/2022
72370C/007	USB Cable	--	--	17/05/2022
72370C/008	USB Adapter	--	--	17/05/2022
72370C/009	Connecting Cable	--	--	17/05/2022

Sample S/01 has undergone the test(s):

The SISO and MIMO tests in the range 1 GHz to 17 GHz indicated in the Appendix A.

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Reception
72370C/180	Central In-Vehicle Infotainment Computer	MBCI2LS4PR1	0006095	26/05/2022
72370C/006	Harness	--	--	17/05/2022
72370C/106	BT/WLAN Antenna	--	--	17/05/2022
72370C/107	BT/WLAN Antenna	--	--	17/05/2022
72370C/108	BT/WLAN Antenna	--	--	17/05/2022
72370C/109	BT/WLAN Antenna	--	--	17/05/2022

Auxiliary elements used with the Sample S/02:

Control N°	Description	Model	Serial N°	Reception
72370C/013	Connecting Cable	--	--	17/05/2022
72370C/019	USB Cable	--	--	17/05/2022
72370C/020	USB Adapter	--	--	17/05/2022
72370C/041	FAKRA to SMA Cable	--	--	17/05/2022
72370C/042	DC Block	--	--	17/05/2022
72370C/064	SMA 4n1 Cable	--	--	17/05/2022
72370C/086	DC Block	--	--	17/05/2022
72370C/087	DC Block	--	--	17/05/2022

Sample S/02 has undergone the test(s):

The SISO and MIMO tests indicated in the Appendix A except in the range 1 GHz to 17 GHz.

Test sample description

Ports.....:	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	Main Connector	2m	☒	☐	☐		
	Most Connector	2m	☒	☐	☐		
	Fakra Quad Connector AM/FM/DAB	-	☒	☒	☐		
	Fakra Single Connector GPS						
	Fakra Quad Connector WLAN/BT	-	☒	☒	☐		
		-	☐	☐	☐		
Supplementary information to the ports.....:	-						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐ AC:		☐	☐	☐	☐	☐

	☒	DC: 9-16V nominal 12 VDC by vehicle battery		
Rated Power..... :	-			
Clock frequencies..... :	-			
Other parameters..... :	-			
Software version..... :	E23.3			
Hardware version..... :	D1.1			
Dimensions in cm (W x H x D) ... :	-			
Mounting position..... :	☐	Table top equipment		
	☐	Wall/Ceiling mounted equipment		
	☐	Floor standing equipment		
	☐	Hand-held equipment		
	☒	Other: Cluster in the car		
Modules/parts..... :	Module/parts of test item		Type	Manufacturer
	-			
	-			
	-			
Accessories (not part of the test item)..... :	Description		Type	Manufacturer
	Antennas			
	HUD			
	SA2 Panel			
	Cameras			
	-			
Documents as provided by the applicant..... :	Description		File name	Issue date
	-			
	-			
	-			

Identification of the client

Robert Bosch GmbH
Robert-Bosch-Strasse 200
31139, Hildesheim, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-06-07
Date (finish)	2022-06-13

Document history

Report number	Date	Description
72370RRF.009	2022-10-18	First release.
72370RRF.009A1	2022-10-20	Second release. Modification of Hardware Version of sample tested and correction of minor typos. This modification of test report cancels and replaces the test report 72370RRF.009.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Alfonso Gutiérrez and José Manuel Jiménez.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber FRANKONIA SAC-3	N/A	N/A
2.	Shielded Room FRANKONIA	N/A	N/A
3.	HYBRID BILOG ANTENNA 30MHz-6GHz ETS LINDGREN 3142E	2021/09	2024/09
4.	RF Preamplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2022/04	2023/04
5.	EMI Test Receiver 2Hz-44GHz ROHDE AND SCHWARZ ESW44	2021/09	2023/09
6.	Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2020/08	2023/08
7.	Pre-amplifier, G>30 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-3A	2021/12	2022/12
8.	EMI Test Receiver 2Hz-44GHz ROHDE AND SCHWARZ ESW44	2021/12	2023/12
9.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
10.	PRE-AMPLIFIER G>30dB 17-40GHz BONN ELEKTRONIK BLMA 1840-4A	2021/09	2022/09
11.	EMI TEST RECEIVER 20Hz-40GHz ROHDE AND SCHWARZ ESU40	2021/11	2023/11
12.	DC Power Supply Agilent Technologies N5770A	N/A	N/A
13.	Digital Multimeter FLUKE 175	2021/11	2022/11
14.	EMC/RF Testing SW ROHDE AND SCHWARZ EMC32	N/A	N/A

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

Common requirements for all Bands:

FCC PART 15		
Requirement – Test case	Verdict	Remark
Transmitter. Duty Cycle	N/A	(1)
Transmitter. 99% Occupied Bandwidth	N/M	(2)
Transmitter. 26 dB Emission Bandwidth (EBW)	N/M	(2)
<u>Supplementary information and remarks:</u> (1) The equipment transmits continuously 100% for all modulations, BW and SISO/MIMO modes. (2) Test not requested.		

U-NII-1: 5.15 GHz – 5.25 GHz Band:

FCC PART 15			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a)(1)(iv)	Transmitter Maximum Conducted Output Power	N/M	(1)
FCC 15.407 (a)(1)(iv)	Transmitter Maximum Power Spectral Density	N/M	(1)
FCC 15.407 (b)(1)	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (b)(1)	Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) Test not requested.			

U-NII-3: 5.725 GHz – 5.85 GHz Band:

FCC PART 15			
Requirement – Test case		Verdict	Remark
FCC 15.407 (e)	6 dB Bandwidth	N/M	(1)
FCC 15.407 (a)(3)(i)	Transmitter Maximum Conducted Output Power	N/M	(1)
FCC 15.407 (a)(3)(i)	Transmitter Maximum Power Spectral Density	N/M	(1)
FCC 15.407 (b)(4)	Transmitter Out of Band Radiated Emissions and Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) Test not requested.			

Appendix A: Tests results for the U-NII-1: 5.15 GHz – 5.25 GHz Band

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TEST CONDITIONS

(*) Declared by the Client.

POWER SUPPLY (*):

Vnominal: 12 Vdc
Type of Power Supply: External DC (Vehicle Battery).

ANTENNA (*):

Type of Antennas: External.

TEST FREQUENCIES (*):

Band U-NII-1:

Technology Tested:	WLAN (IEEE 802.11 a20 / n2040 / ac204080 / ax204080 2x2)	
Modes:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO, or MIMO with CDD)	
	802.11n HT20: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11n HT40: MCS0 to MCS23 (1 or 2 spatial stream with either SISO or 2 chain MIMO CDD)	
	802.11ac VHT20: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT40: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ac VHT80: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ax HE20: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ax HE40: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
	802.11ax HE80: MCS0 to MCS9 (1 or 2 spatial stream) (SISO, or MIMO with CDD without TxBF)	
Setting of cores / ports:	Chain 0, Chain 1, Chain 0 & 1	
Beamforming:	No.	
Frequency Range:	5150 - 5250 MHz	
Operating Channel Bandwidth:	20 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Low (36)	5180
	44	5220
	High (48)	5240
Operating Channel Bandwidth:	40 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Low (38)	5190
	High (46)	5230
Operating Channel Bandwidth:	80 MHz	
Transmission Channels:	Channels	Channel Frequency (MHz)
	Single (42)	5210

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode on the lowest and highest channels at the rated power for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a document containing the setup instructions.

The worst-cases for testing were identified for output power and spurious levels at the band edges which were selected based on preliminary testing. They correspond to next data rates:

- 802.11a: 6 Mbps SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11n HT20: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11n HT40: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ac VHT20: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ac VHT40: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ac VHT80: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ax HE20: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ax HE40: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.
- 802.11ax HE80: MCS0 SISO 1Tx on Chain 0 and 1Tx on Chain 1 / MIMO 2Tx on Chain 0 & 1.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) and 1 GHz-18 GHz Double ridge horn antenna is situated at a distance of 3 m and a distance of 1.5 m for the frequency range 17 GHz-40 GHz (18 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

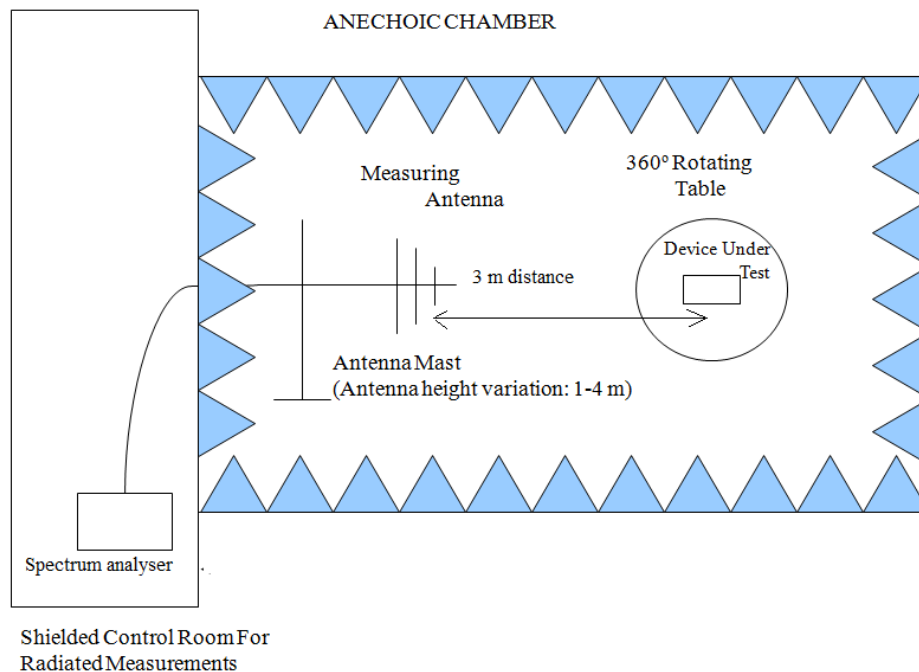
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

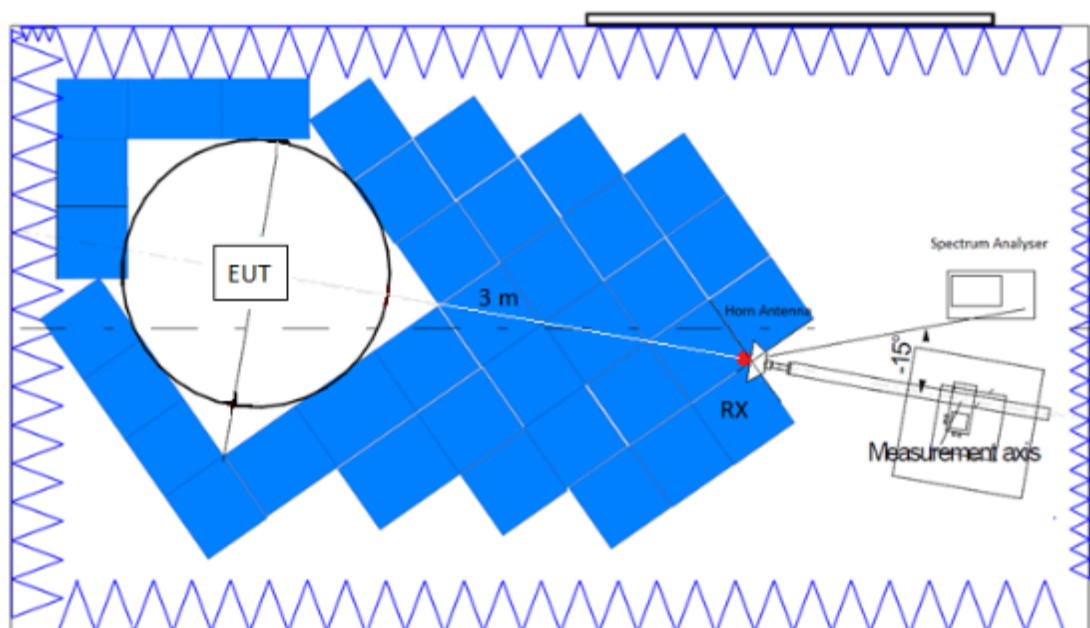
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1MHz / 3MHz for frequencies above 1 GHz.

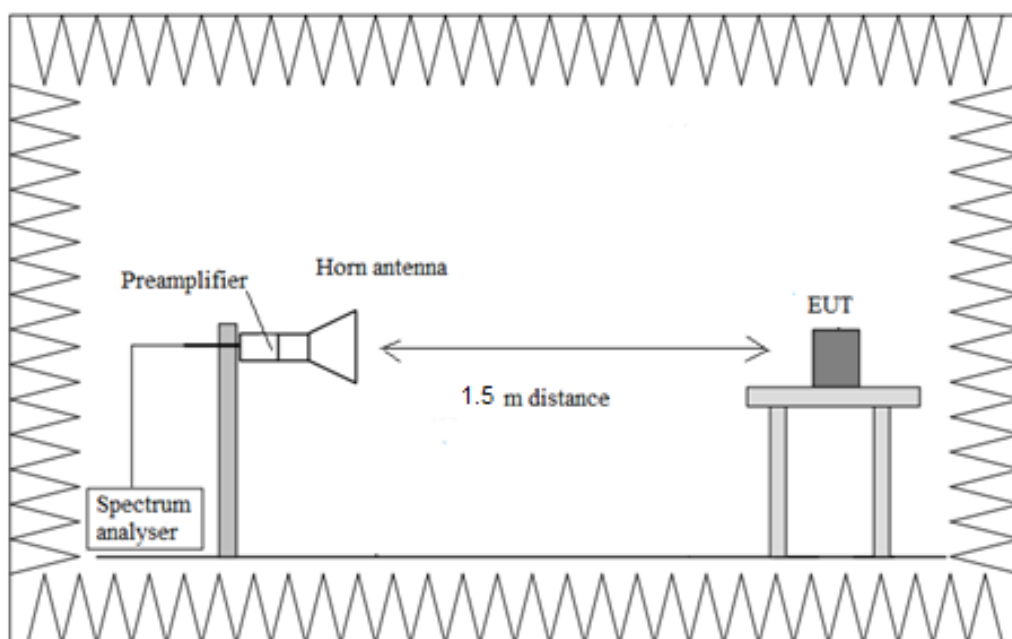
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



FCC 15.407 (b)(1) Transmitter Out of Band Radiated Emissions

SPECIFICATION:

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table, specified when measuring with peak detector function.

RESULTS:

The situation and orientation of the equipment under test were varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 1.5m for the frequency range 17 GHz-40 GHz and a distance of 3m for the frequency range 30 MHz-17 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The worst-case was determined by measuring the e.i.r.p density (radiated). Test performed on the worst-case:

- Preliminary tests determined the worst-case:

SISO Chain 1

Worst-case: 802.11 ax20 (HE20) RU26 offset 0

Frequency range 30 MHz - 1 GHz (SISO Chain 1):

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
875.0215	32.86	H	Quasi-Peak

Measurement Uncertainty (dB) $< \pm 5.1$

Frequency range 1 GHz - 40 GHz (SISO Chain 1):

The results in the next tables show the maximum measured levels in the 1-40 GHz frequency range.

The Low, Middle and High Channels were measured for out-of-band emissions for the worst mode.

Spurious frequencies with peak levels above the average limit (54 dBμV/m at 3 m) are measured with an average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.375	43.21	V	Peak
1687.562	42.67	H	Peak
4890.250	53.56	H	Peak
5068.937	52.27	H	Peak

- MIDDLE CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.187	43.09	V	Peak
3960.250	46.45	V	Peak
4058.875	46.10	V	Peak
5136.250	51.05	H	Peak

- HIGH CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.187	43.02	V	Peak
5074.000	51.53	V	Peak

Measurement uncertainty (dB) $< \pm 4.6$ for $f \geq 1$ GHz up to 17 GHz
 $< \pm 4.89$ for $f \geq 17$ GHz up to 26.5 GHz
 $< \pm 5.14$ for $f \geq 26.5$ GHz up to 40 GHz

Verdict: PASS

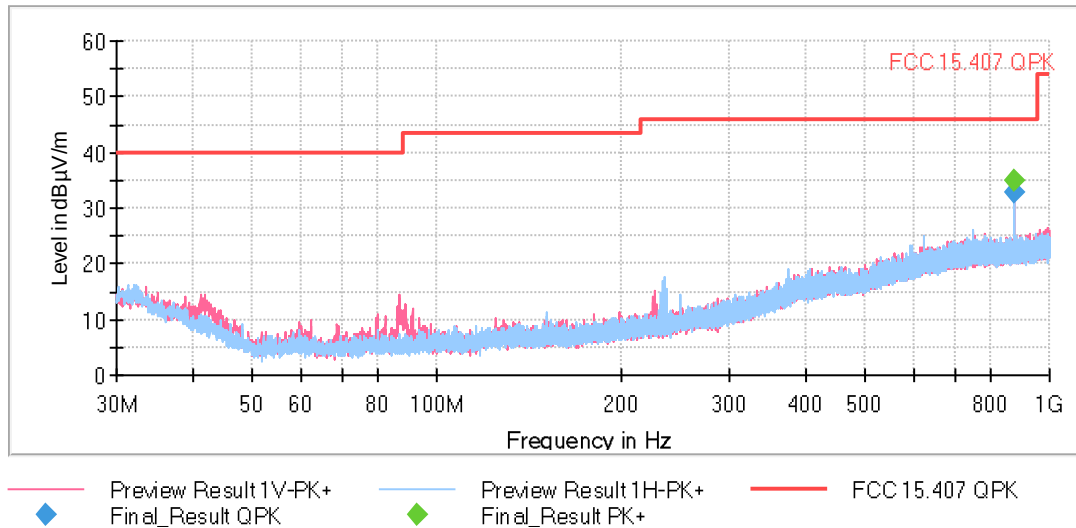
SISO Chain 1:

The setting for each range of frequency is indicated in the following tables:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	30 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 1 GHz – 7 GHz	187.5 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 7 GHz - 17 GHz	312.5 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 17 GHz – 28.5 GHz	383.3 kHz	PK+ ; AVG	1 MHz	0.3 s	0 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 28.5 GHz - 40 GHz	383.3 kHz	PK+ ; AVG	1 MHz	0.3 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz (SISO Chain 1):

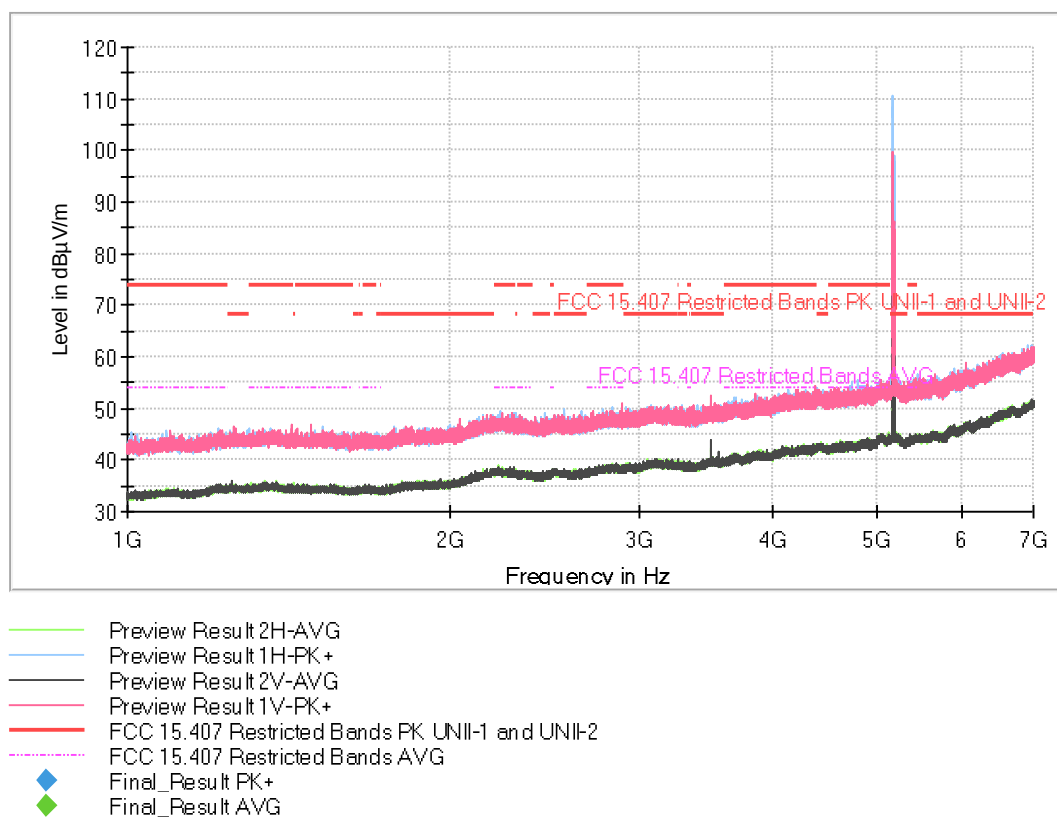
This plot is valid for all the channels.



FREQUENCY RANGE 1 - 7 GHz (SISO Chain 1):

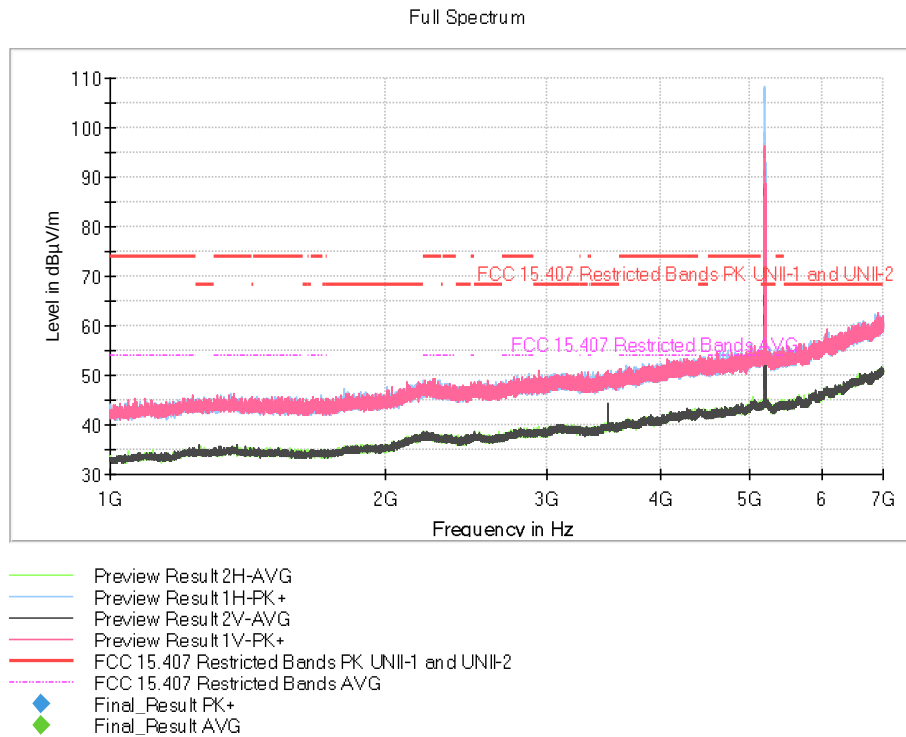
- Low Channel:

Full Spectrum



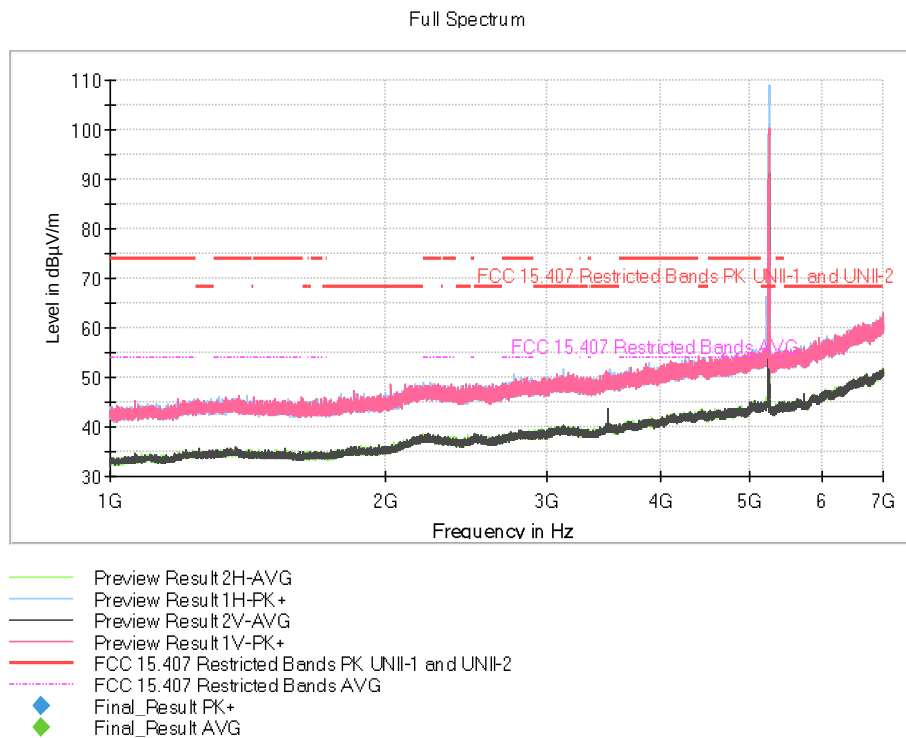
Note: The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



Note: The peak shown in the plot above the limit is the carrier frequency.

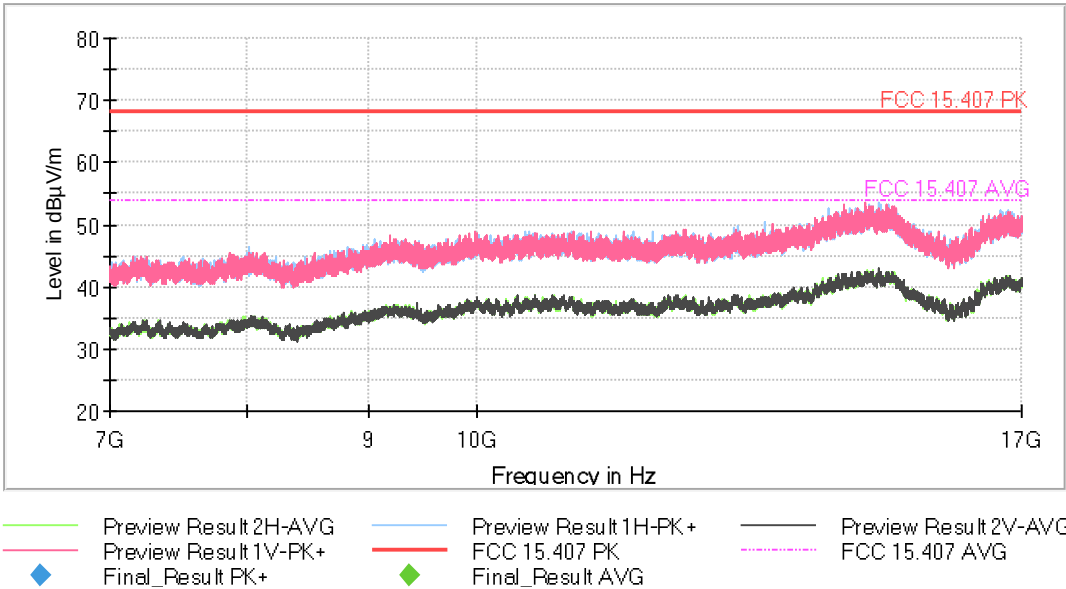
- High Channel:



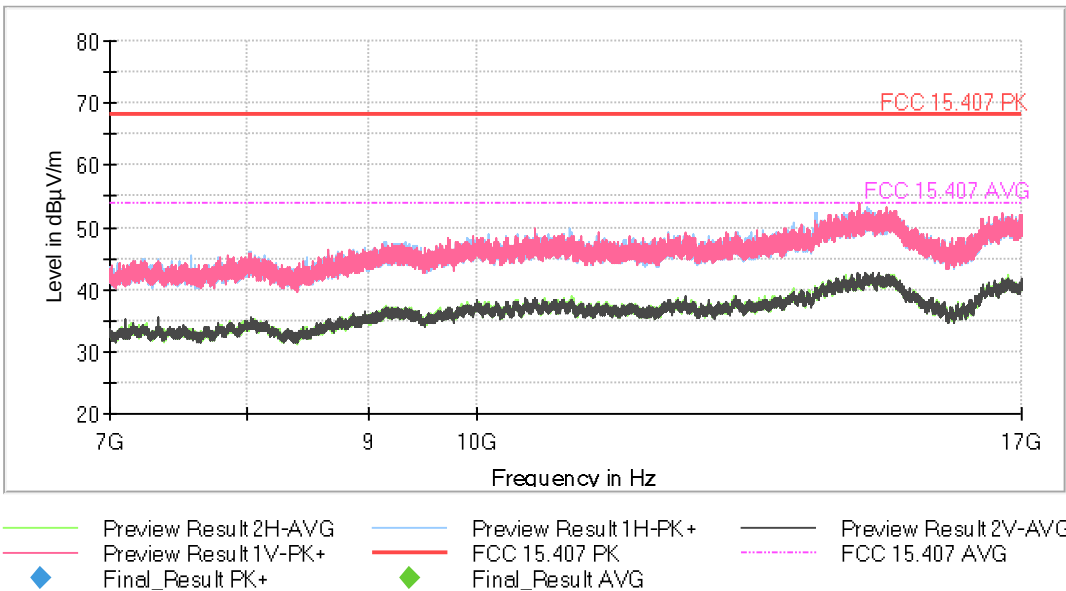
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 7 - 17 GHz (SISO Chain 1):

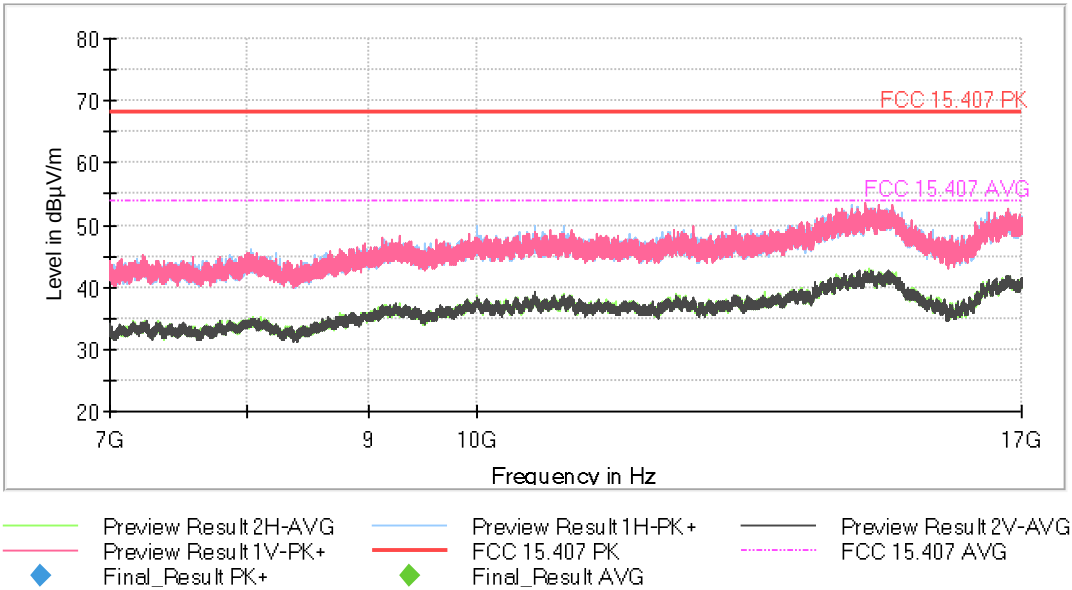
- Low Channel:



- Middle Channel:

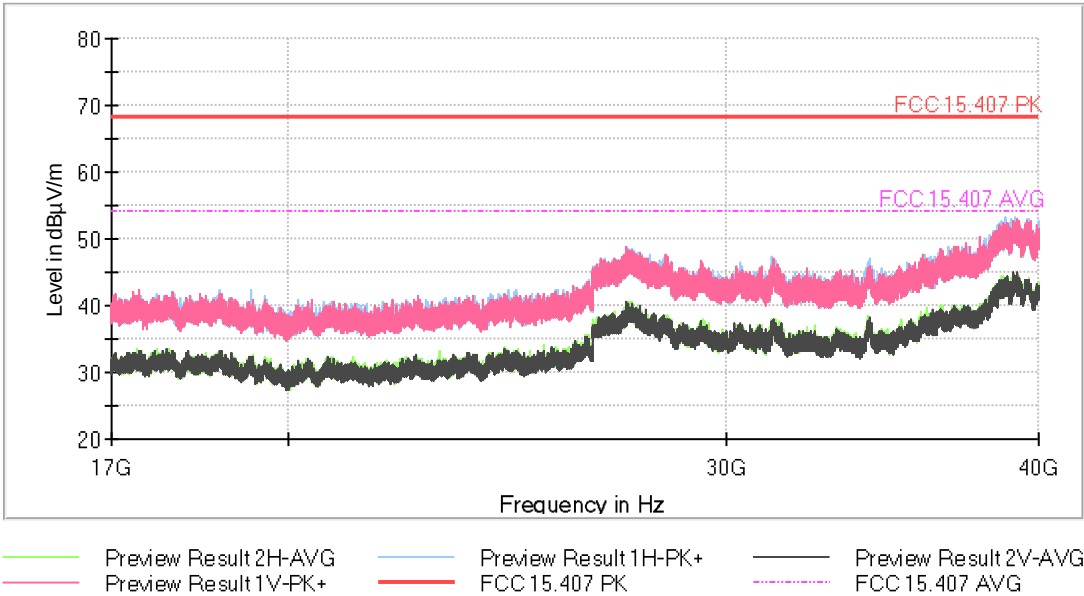


- High Channel:



FREQUENCY RANGE 17 - 40 GHz (SISO Chain 1):

This plot is valid for all the Channels.



MIMO Chain 0 + Chain 1:

- Preliminary tests determined the next worst-case mode:

Worst-case: 802.11 n20 (HT20).

Frequency range 30 MHz - 1 GHz:

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
875.0215	29.86	H	Quasi Peak

Measurement Uncertainty (dB) $< \pm 5.1$

Frequency range 1 - 40 GHz:

The results in the next tables show the maximum measured levels in the 1-40 GHz frequency range.

The Low, Middle and High Channels were measured for out-of-band emissions for the worst mode.

Spurious frequencies with peak levels above the average limit (54 dBμV/m at 3 m) are measured with an average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.300	43.42	V	Peak
1687.100	40.43	H	Peak

- MIDDLE CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.200	43.05	V	Peak
1687.300	40.30	H	Peak

- HIGH CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
1375.600	43.30	V	Peak
1687.500	40.54	H	Peak

Measurement uncertainty (dB) $< \pm 4.6$ for $f \geq 1$ GHz up to 17 GHz
 $< \pm 4.89$ for $f \geq 17$ GHz up to 26.5 GHz
 $< \pm 5.14$ for $f \geq 26.5$ GHz up to 40 GHz

Verdict: PASS

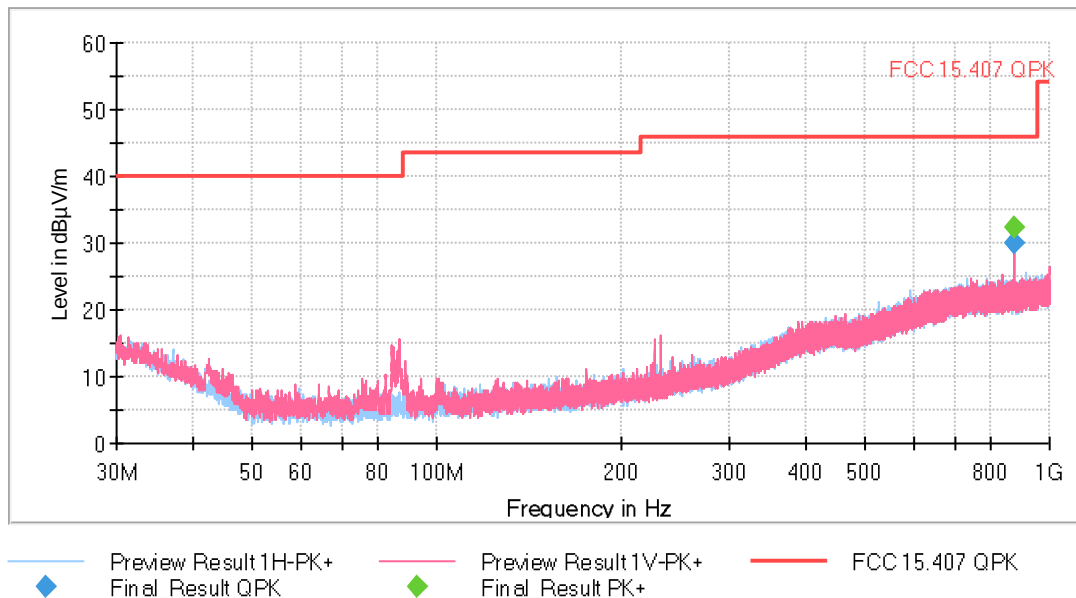
MIMO:

The setting for each range of frequency is indicated in the following tables:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	30 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 1 GHz – 7 GHz	187.5 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 7 GHz - 17 GHz	312.5 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 17 GHz – 28.5 GHz	383.3 kHz	PK+ ; AVG	1 MHz	0.3 s	0 dB
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 28.5 GHz - 40 GHz	383.3 kHz	PK+ ; AVG	1 MHz	0.3 s	0 dB

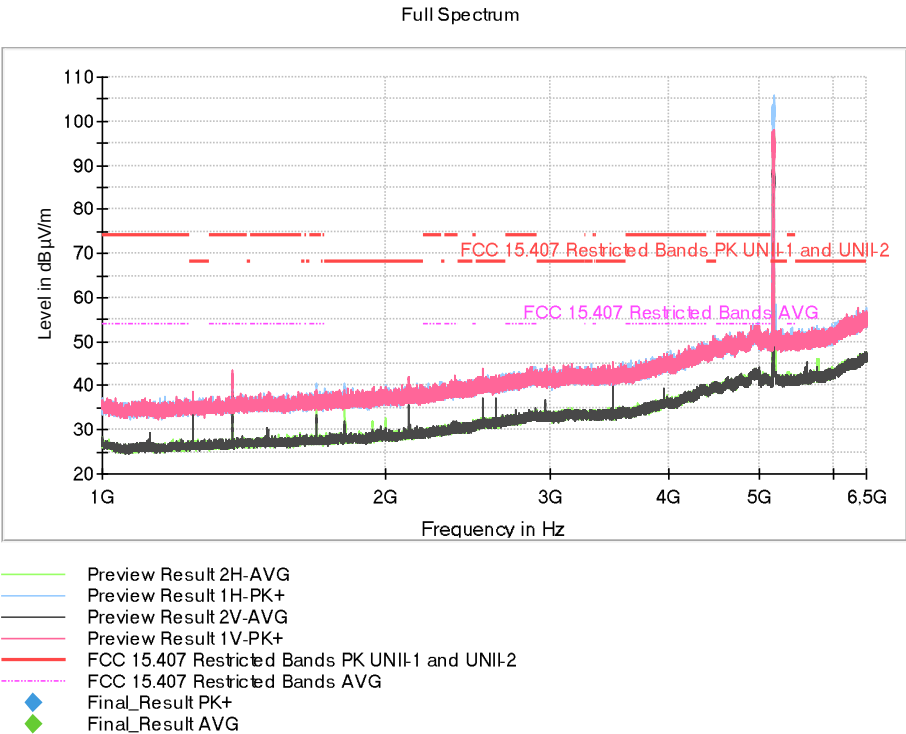
FREQUENCY RANGE 30 MHz - 1 GHz:

This plot is valid for all the Channels.



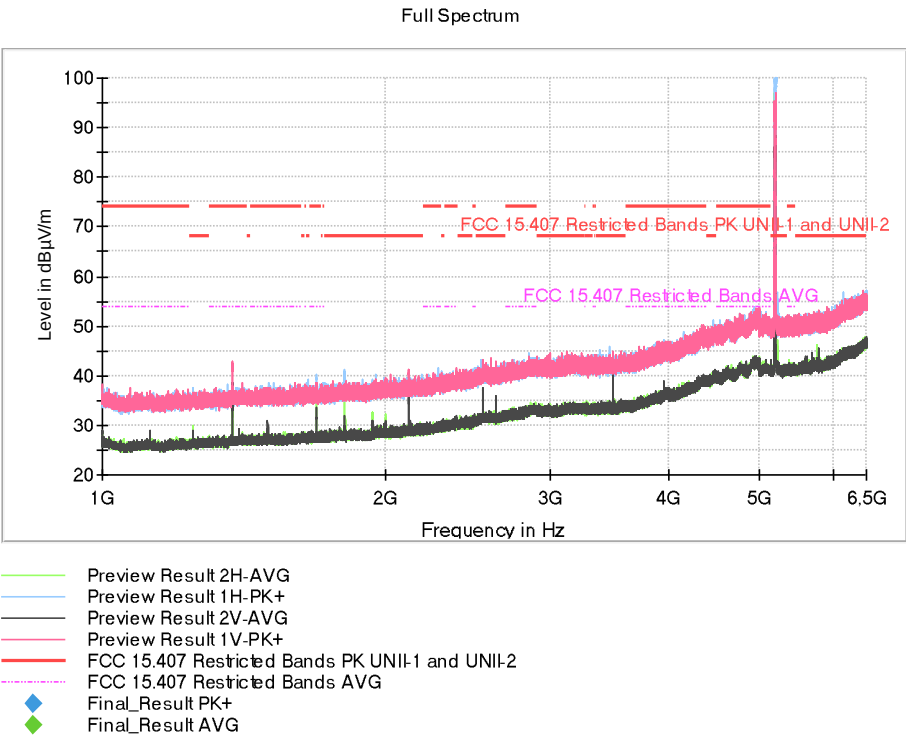
FREQUENCY RANGE 1 – 6.5 GHz (MIMO worst-case):

- Low Channel:



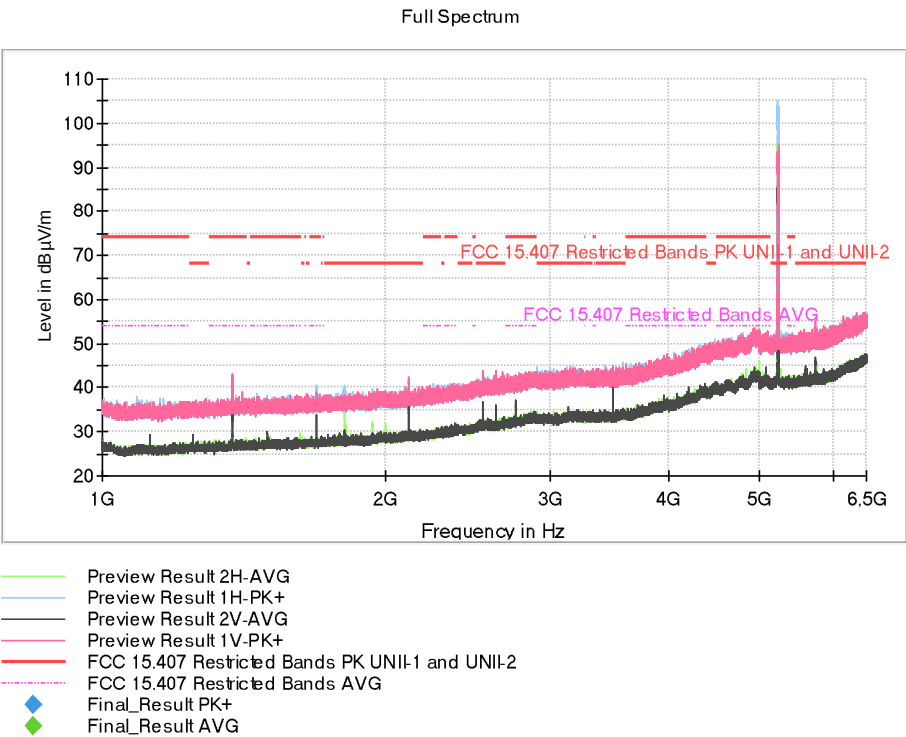
Note: The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



Note: The peak shown in the plot above the limit is the carrier frequency.

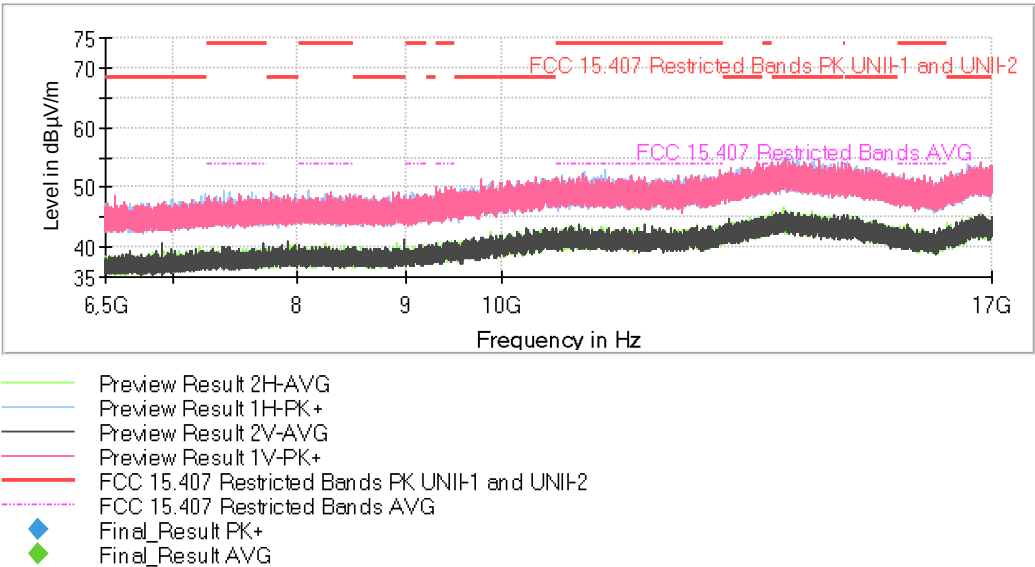
- High Channel:



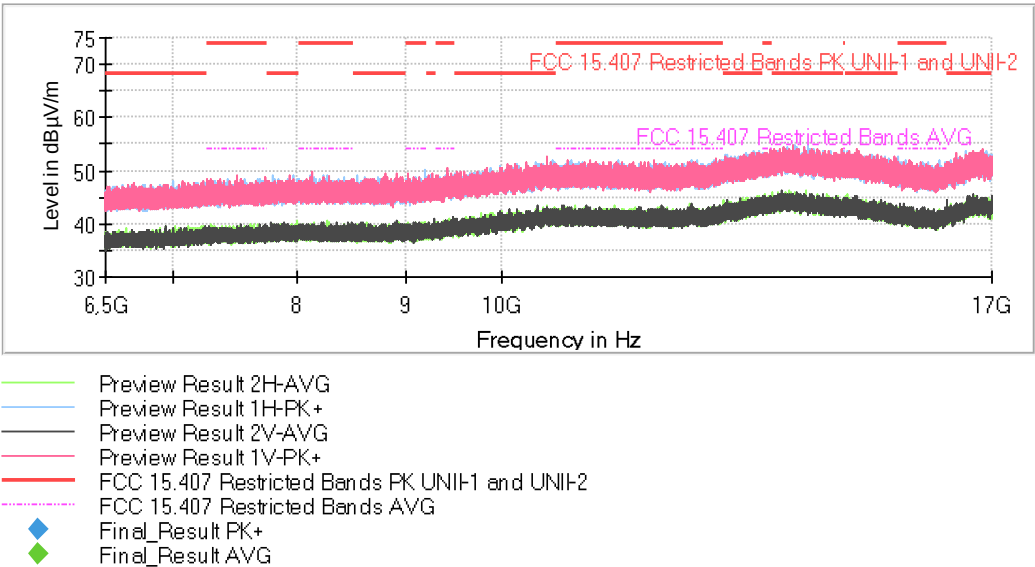
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 6.5 - 17 GHz:

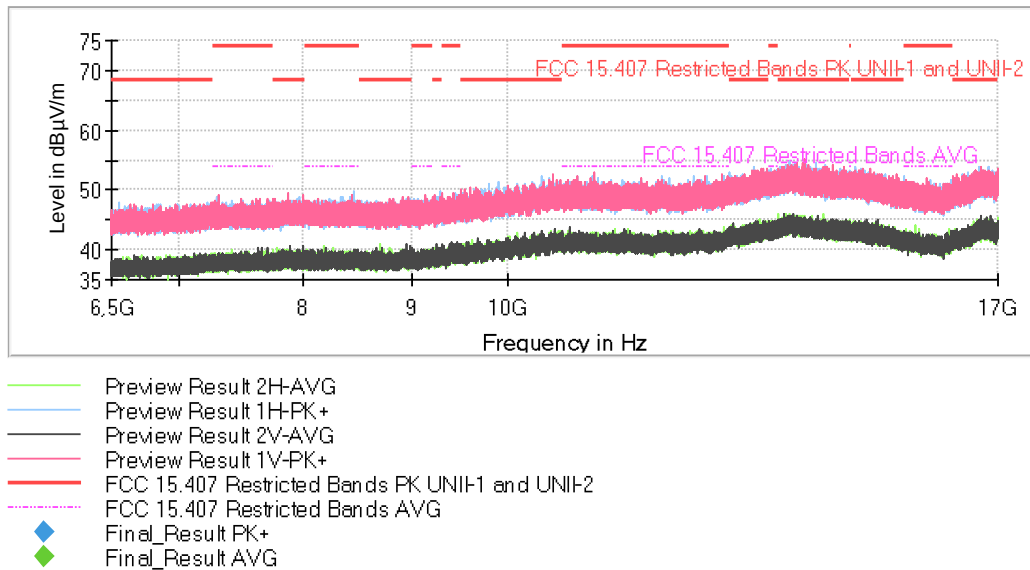
- Low Channel:



- Middle Channel:

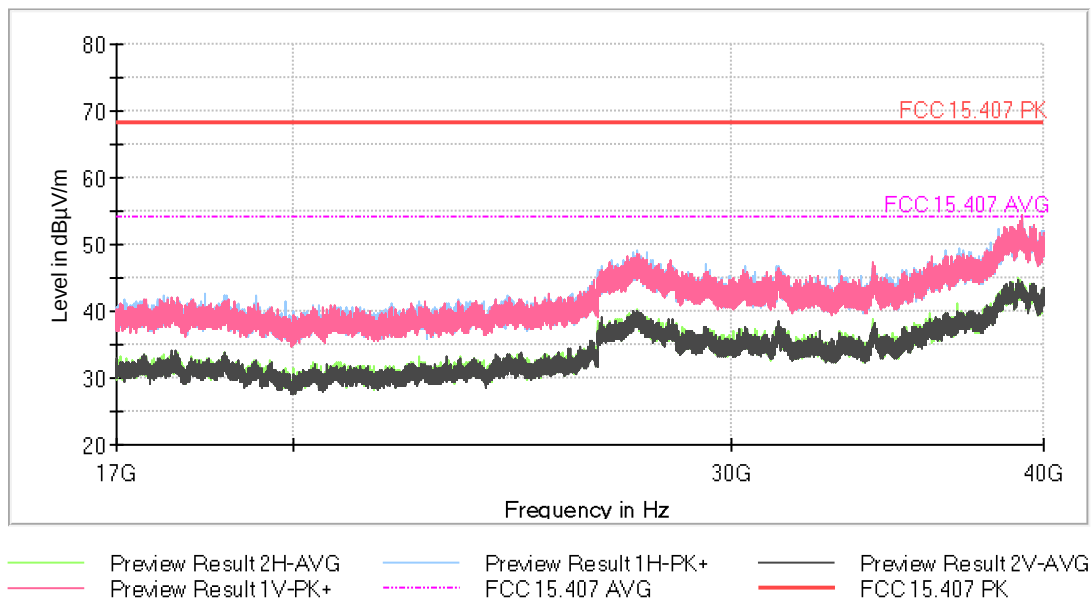


- High Channel:



FREQUENCY RANGE 17 - 40 GHz

This plot is valid for all the Channels.



FCC 15.407 (b)(1) Transmitter Band Edge Radiated Emissions

SPECIFICATION:

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table, specified when measuring with peak detector function.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Measurements were made in both horizontal and vertical planes of polarization.

All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz. There are restricted bands of operation below the band edge at 4.50-5.15 GHz also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply.

Field strength measurements using peak and average detector performed in the restricted bands below 5.15 GHz and above 5.35 GHz.

- Preliminary tests determined the SISO worst-case: Chain 1.

BAND EDGE EMISSIONS: For U-NII-1 band edge spurious emissions inside of the Restricted Bands 4.50-5.15 GHz and 5.35-5.46 GHz.

The Lower Band Edge Channel and the Upper Band Edge Channel were tested for all modes.

SISO worst-case (Chain 1):

- **SISO 802.11 a20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.

- **SISO 802.11 n20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No purious emissions inside the Restricted Band 4.50-5.15 GHz.

- **SISO 802.11 ac20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.

- **SISO 802.11 he20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **SISO 802.11 n40:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **SISO 802.11 ac40:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **SISO 802.11 he40:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **SISO 802.11 ac80:**

- SINGLE CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **SISO 802.11 he80:**

- SINGLE CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

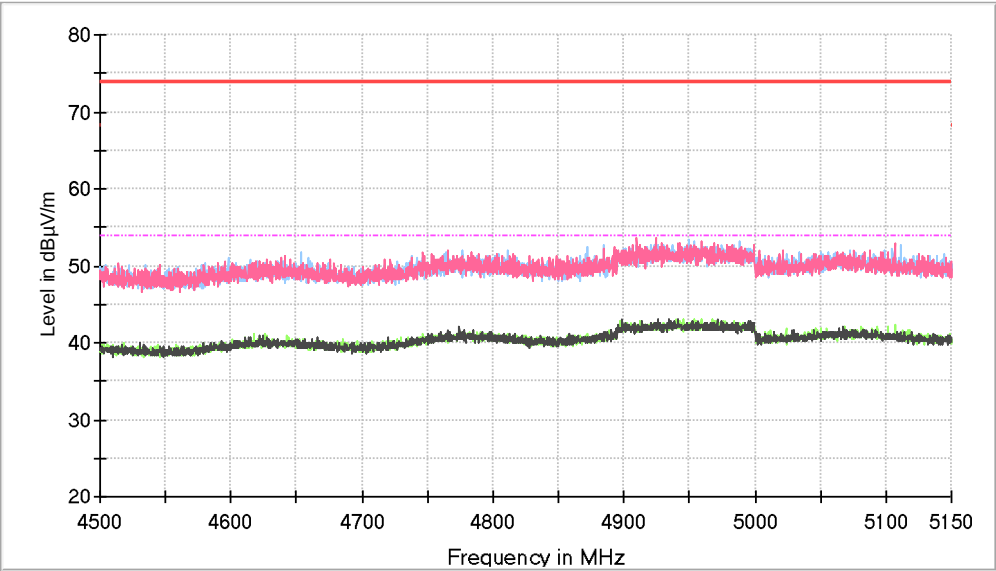
Measurement Uncertainty (dB) $< \pm 4.6$

Verdict: PASS

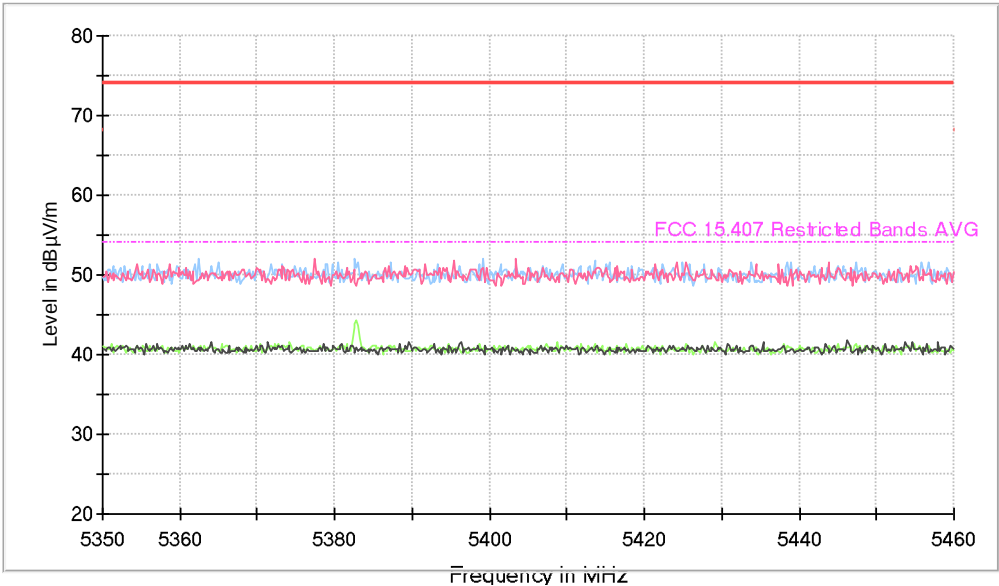
The setting for each range of frequency is indicated in the following tables:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW44] 1 GHz – 7 GHz	187.5 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

- **SISO 802.11 a20 (Chain 1):**
 - Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)

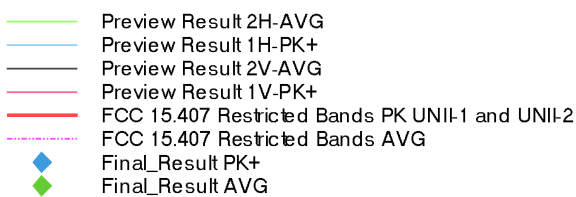
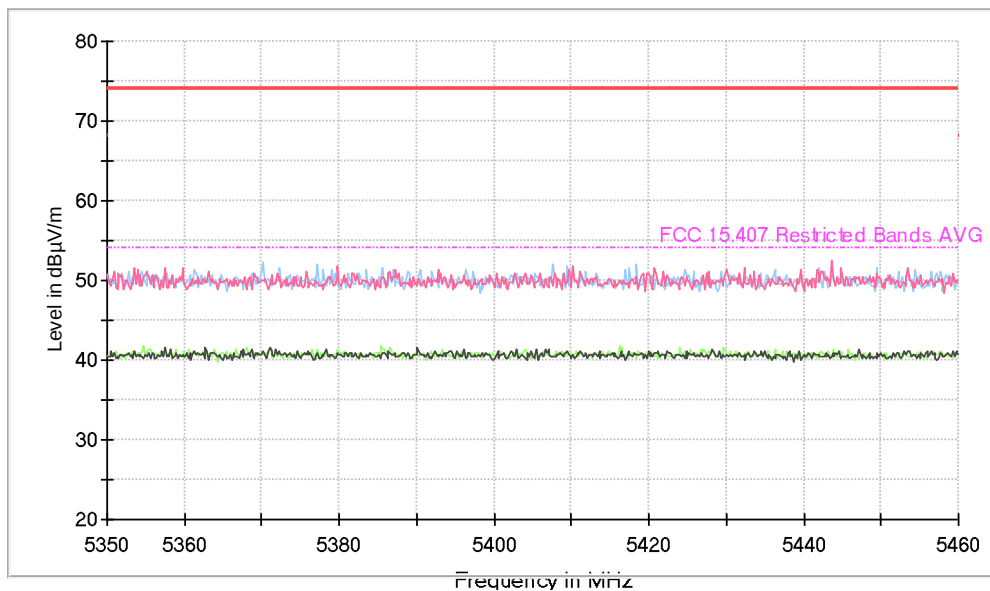
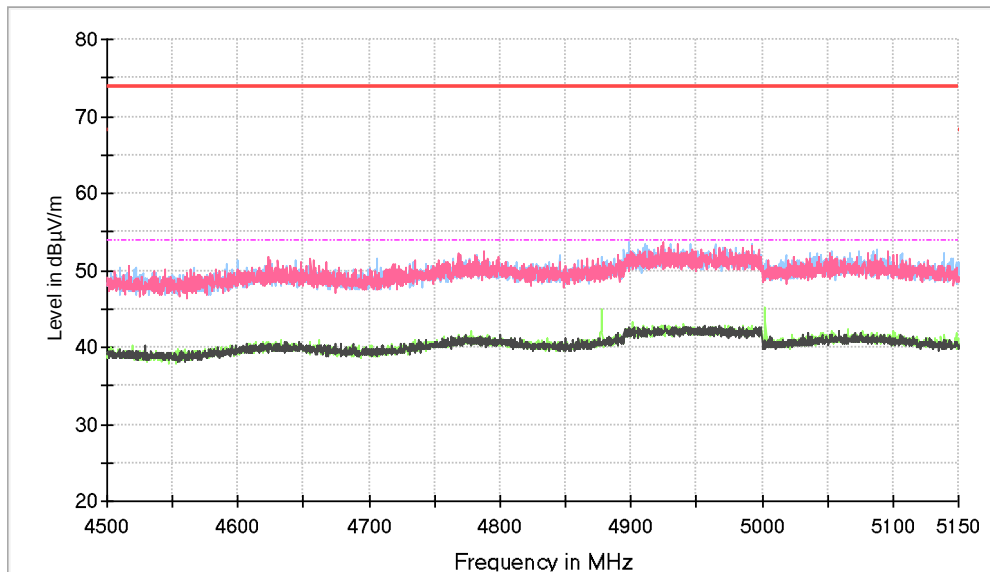


Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

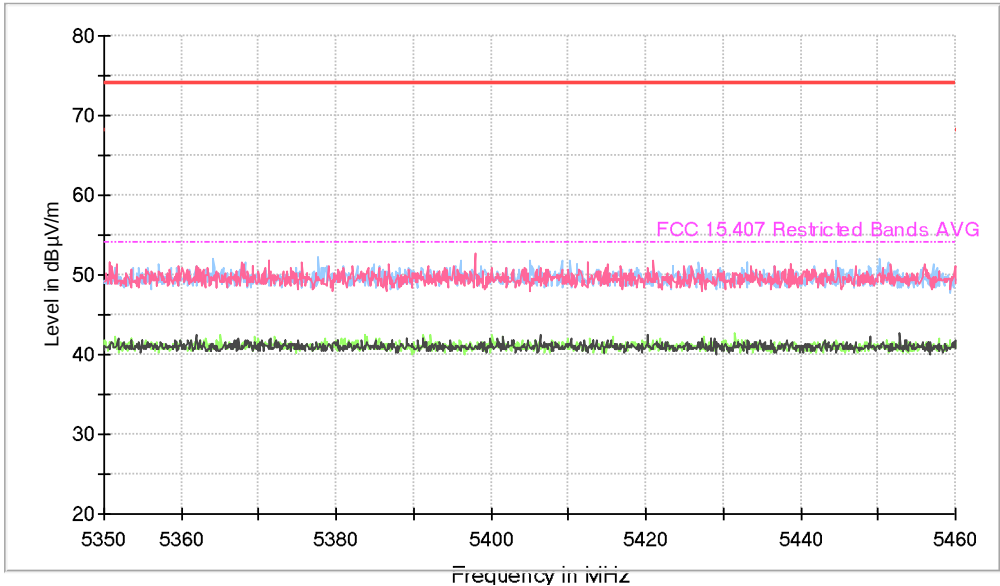
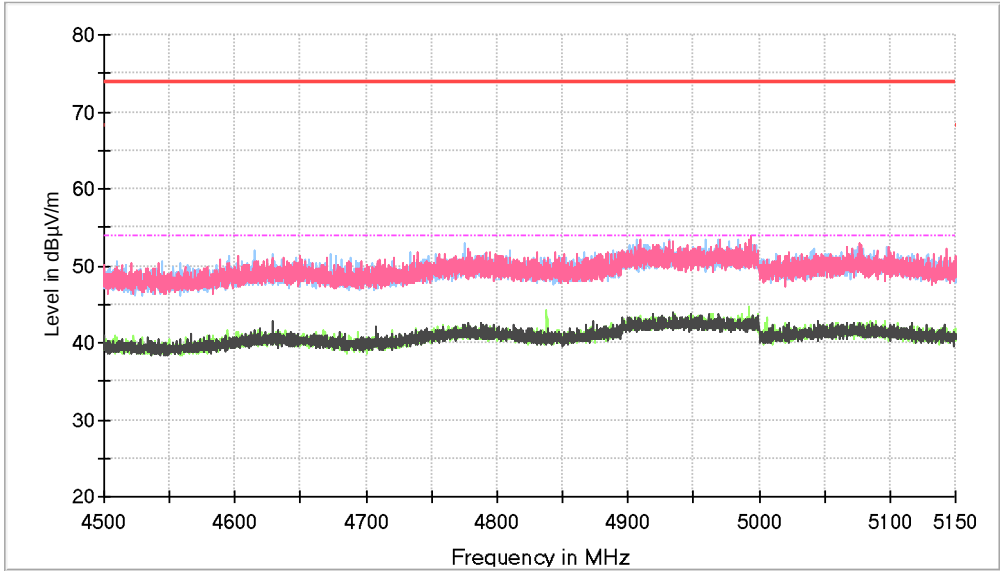


Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

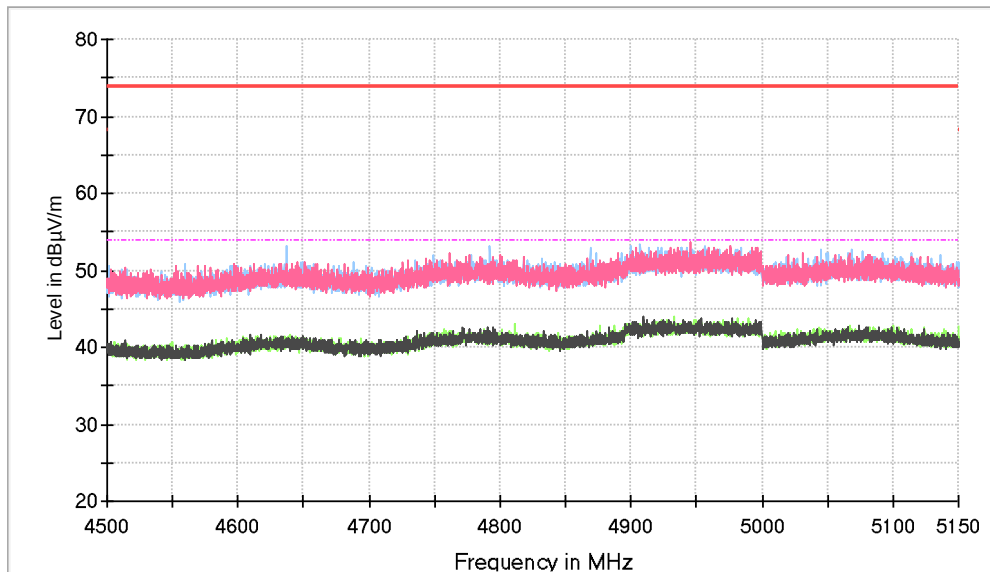
- Lower Band Edge and Upper Band Edge - High Channel (Restricted Bands)



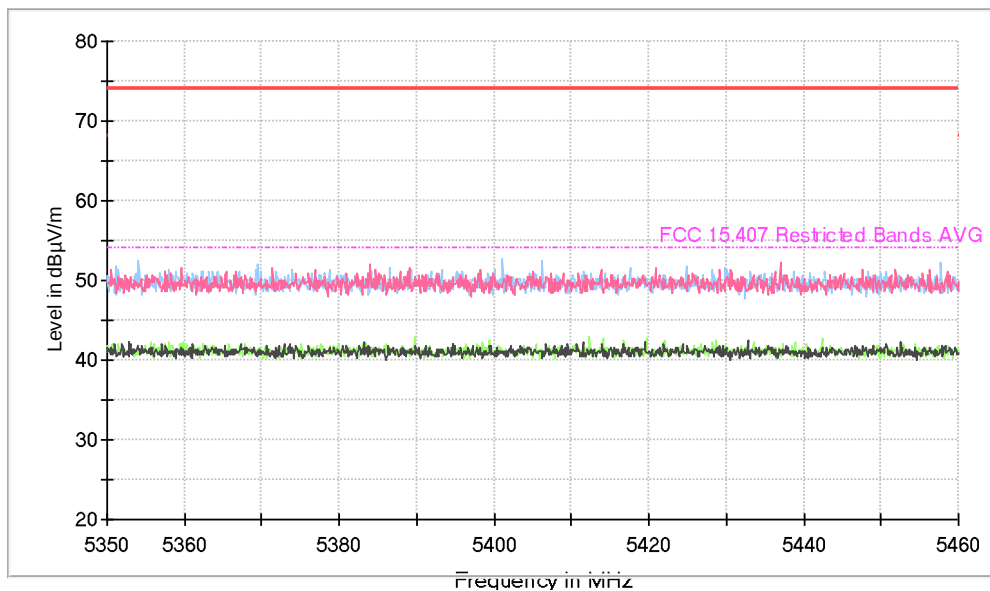
- **SISO 802.11 n20 (Chain 1):**
 - Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)



- Lower Band Edge and Upper Band Edge - High Channel (Restricted Bands)

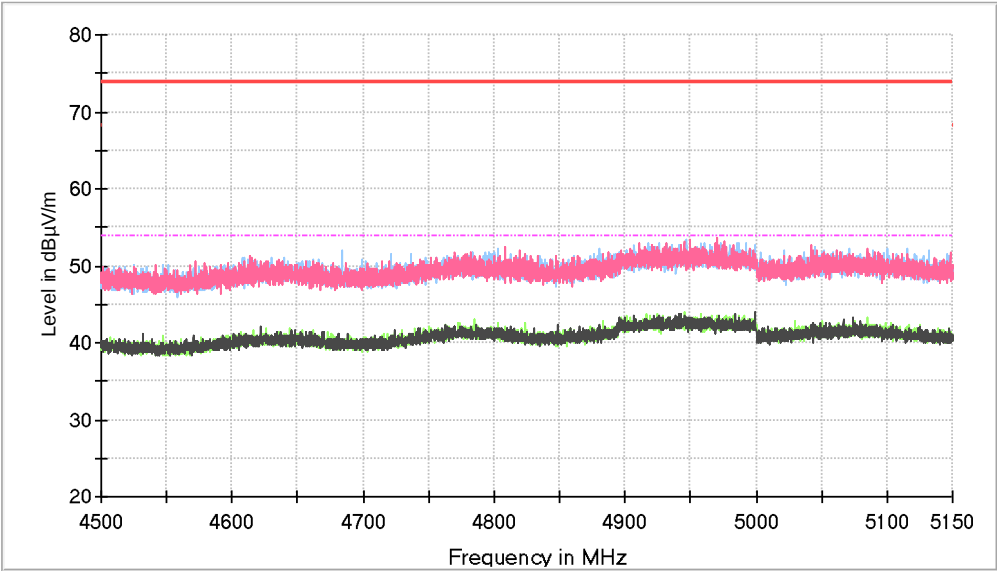


Preview Result 2H-AVG
 Preview Result 1H-PK+
 Preview Result 2V-AVG
 Preview Result 1V-PK+
 FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
 FCC 15.407 Restricted Bands AVG
 Final_Result PK+
 Final_Result AVG

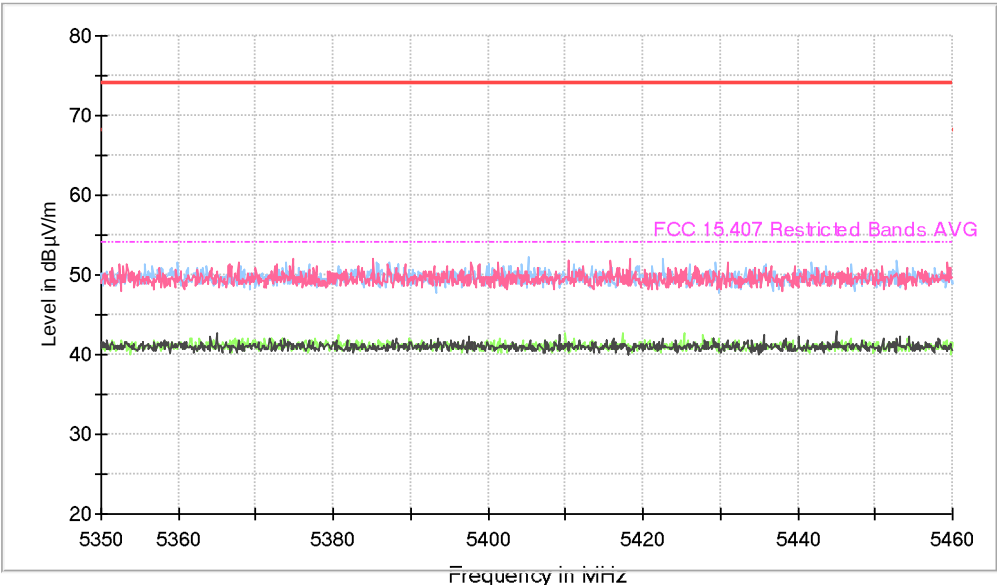


Preview Result 2H-AVG
 Preview Result 1H-PK+
 Preview Result 2V-AVG
 Preview Result 1V-PK+
 FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
 FCC 15.407 Restricted Bands AVG
 Final_Result PK+
 Final_Result AVG

- **SISO 802.11 ac20 (Chain1):**
 - Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)

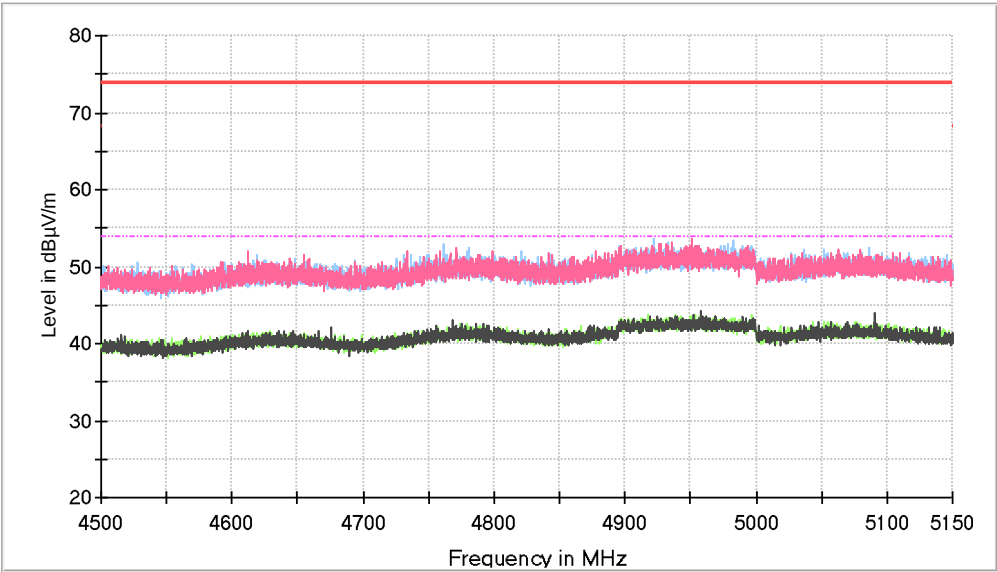


Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

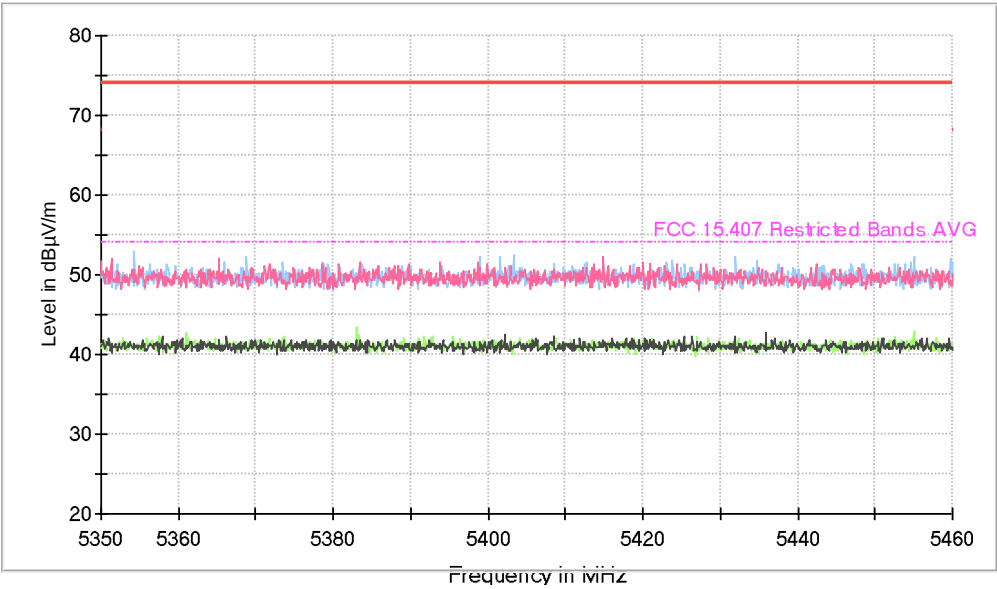


Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

- Lower Band Edge and Upper Band Edge – High Channel (Restricted Bands)



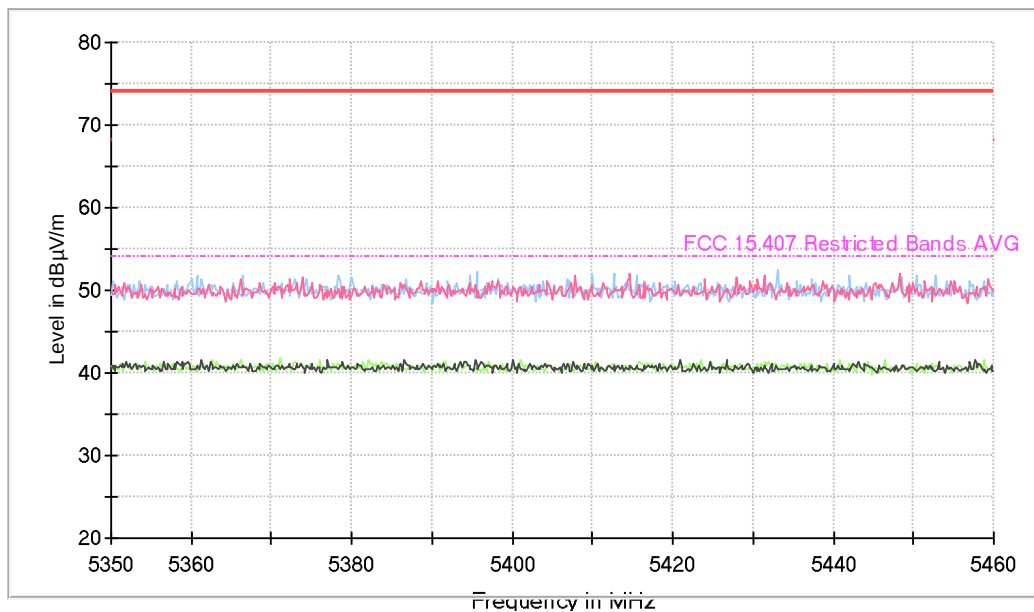
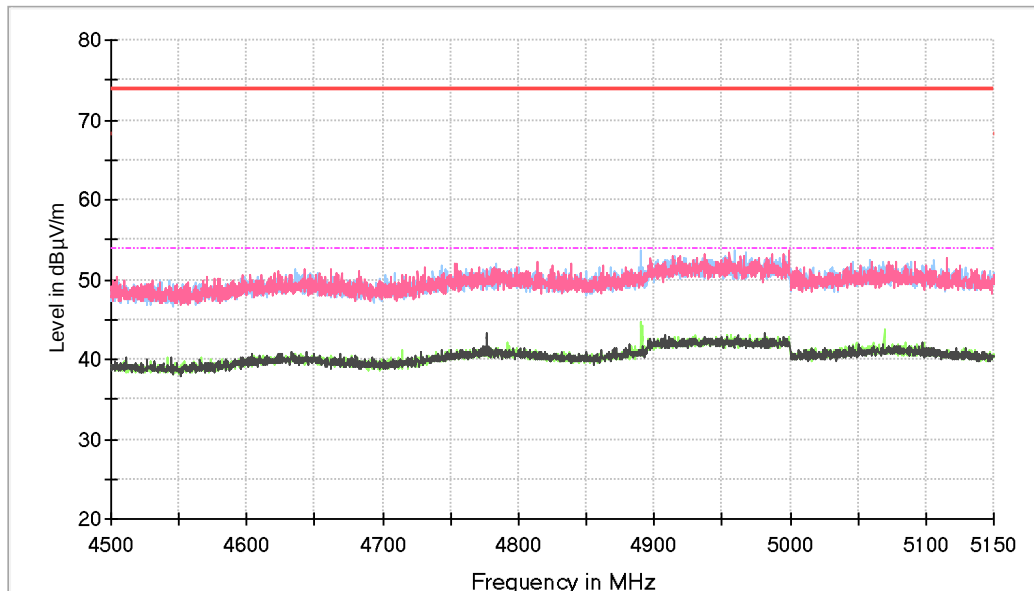
- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
- FCC 15.407 Restricted Bands AVG
- Final_Result PK+
- Final_Result AVG



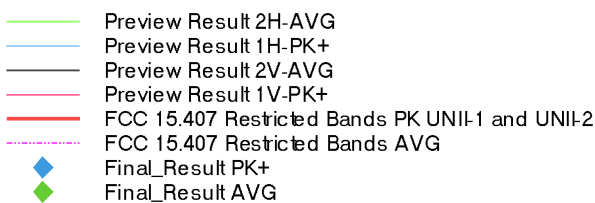
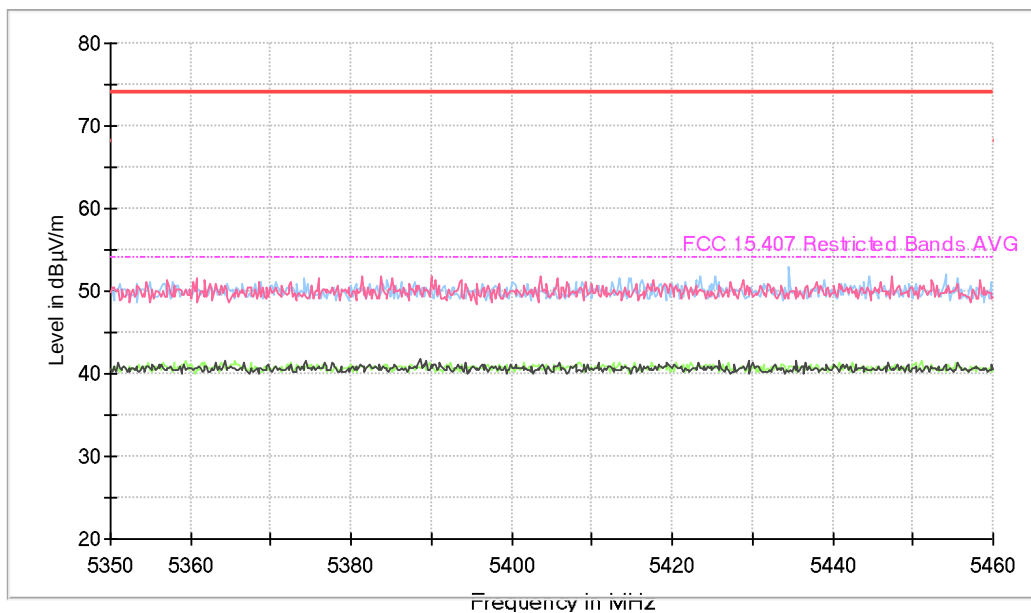
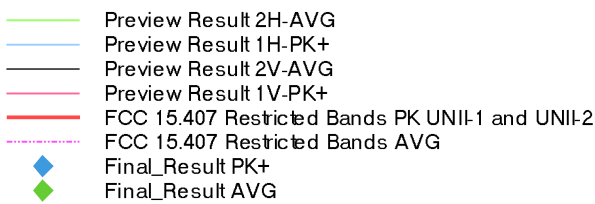
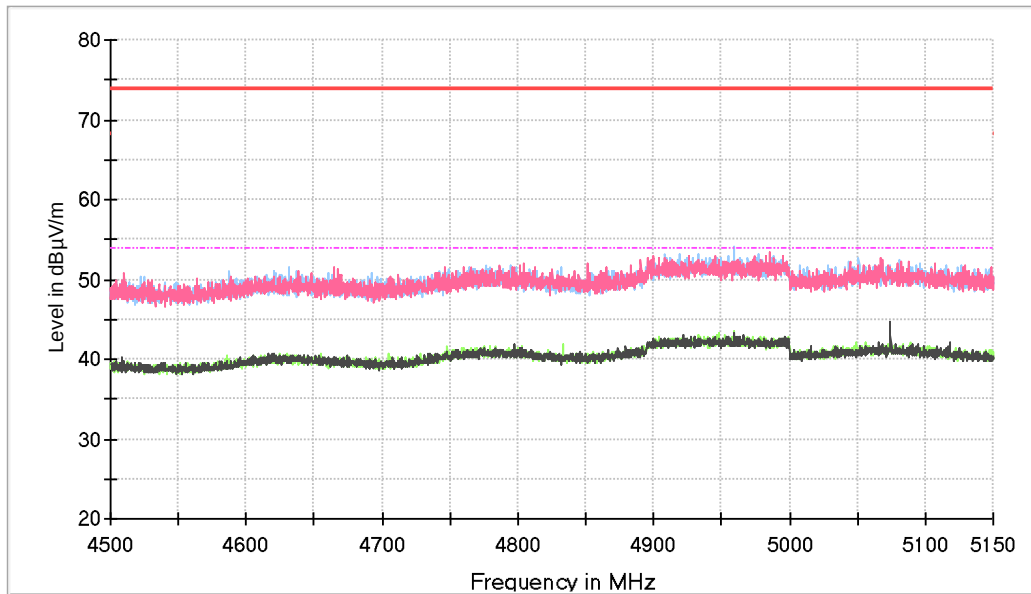
- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
- FCC 15.407 Restricted Bands AVG
- Final_Result PK+
- Final_Result AVG

• **SISO 802.11 he20 SU Full-channel allocation (Chain 1):**

- Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)

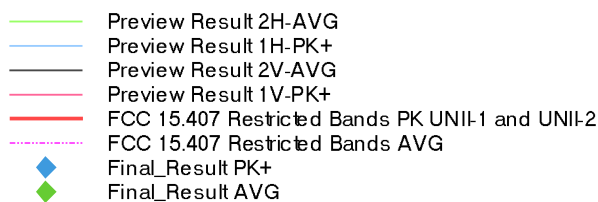
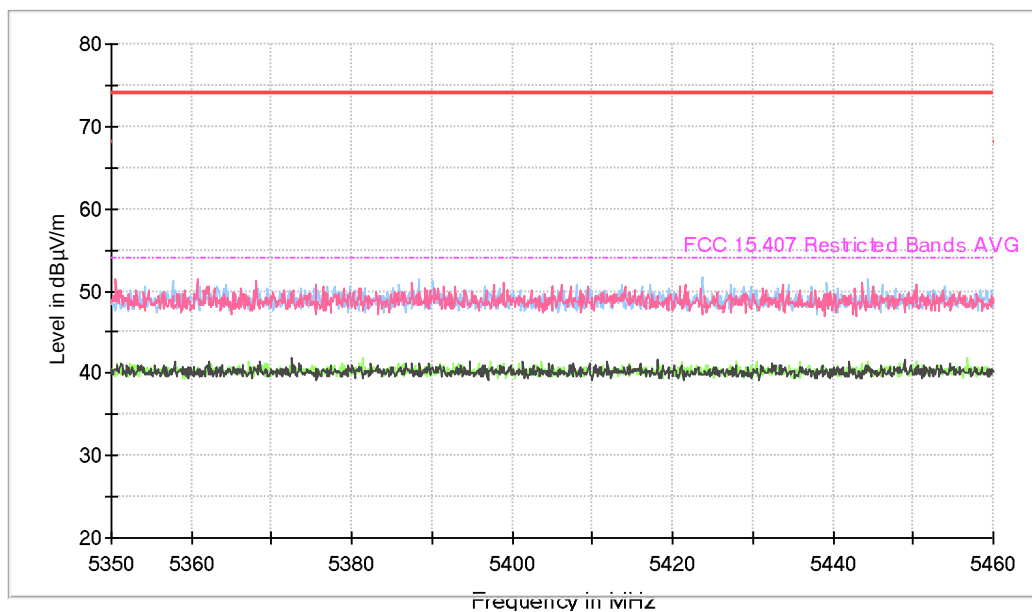
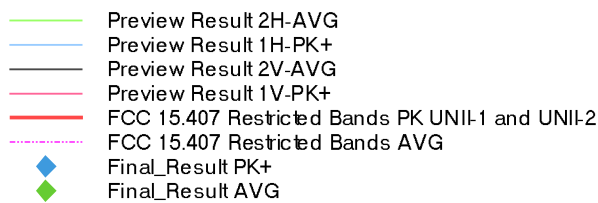
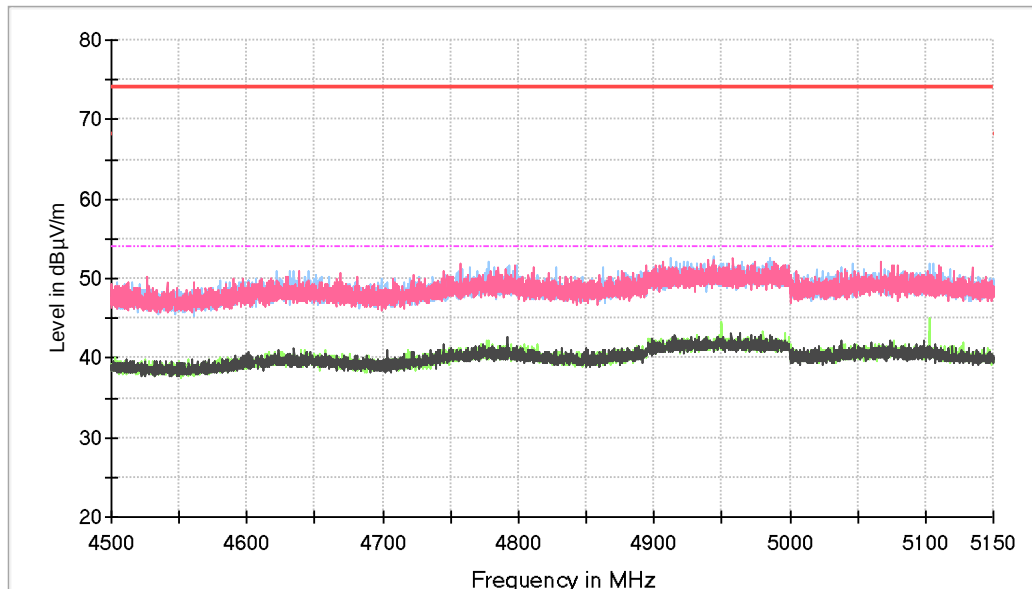


- Lower Band Edge and Upper Band Edge – High Channel (Restricted Bands)

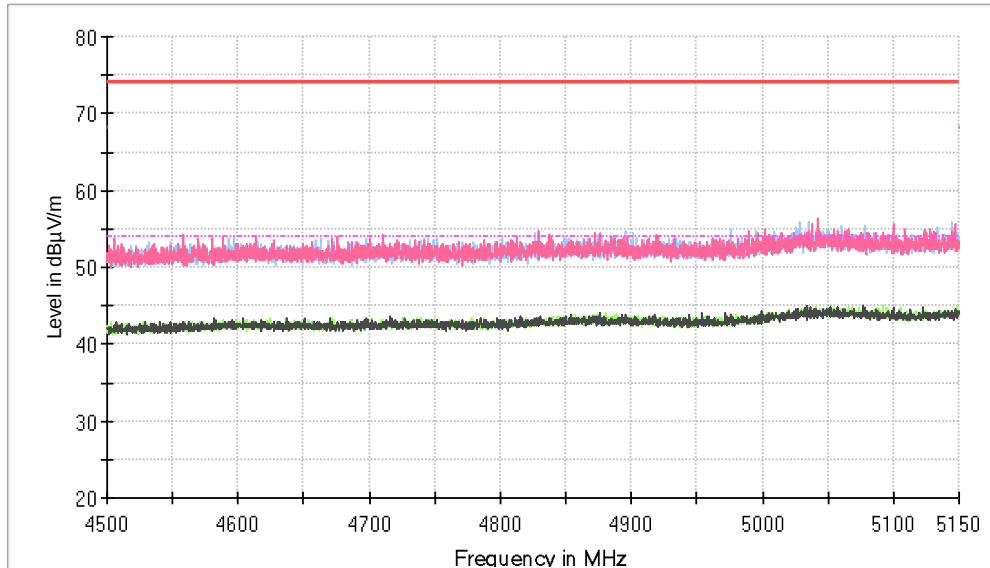


• **SISO 802.11 he40 SU Full-channel allocation (Chain 1):**

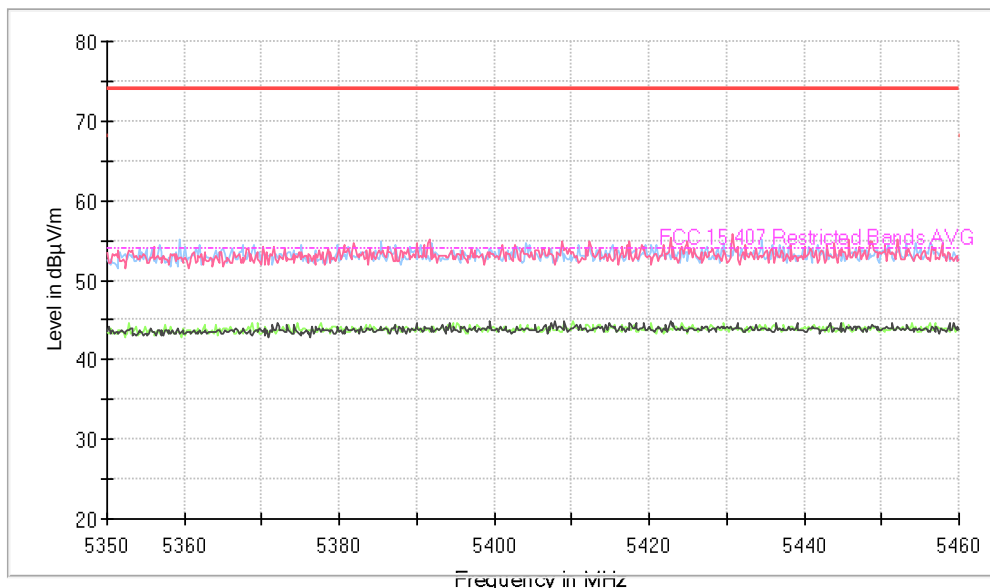
- Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)



- **SISO 802.11 he80 SU Full-channel allocation (Chain 1):**
 - Lower Band Edge and Upper Band Edge – (Restricted Bands)



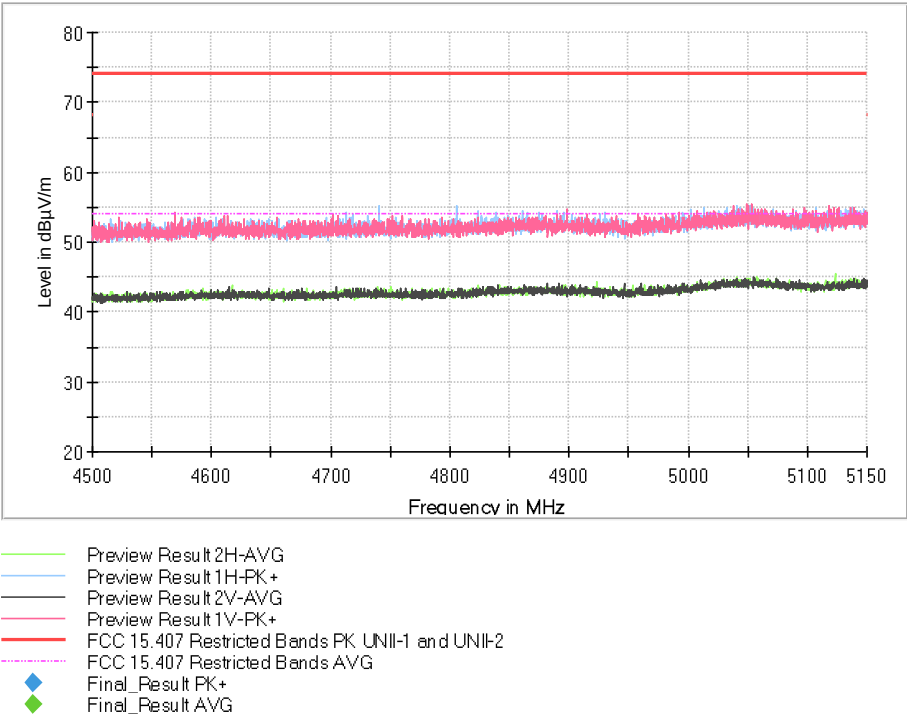
Preview Result 2H-AVG
 Preview Result 1H-PK+
 Preview Result 2V-AVG
 Preview Result 1V-PK+
 FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
 FCC 15.407 Restricted Bands AVG
 Final_Result PK+
 Final_Result AVG



Preview Result 2H-AVG
 Preview Result 1H-PK+
 Preview Result 2V-AVG
 Preview Result 1V-PK+
 FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
 FCC 15.407 Restricted Bands AVG
 Final_Result PK+
 Final_Result AVG

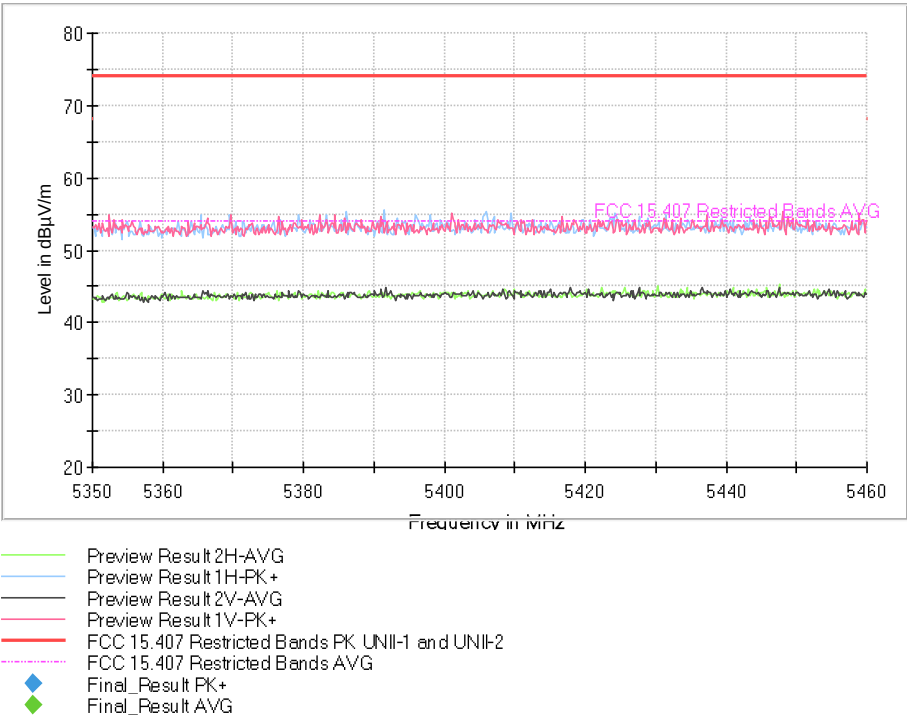
SISO 802.11 he20 RU 26 Offset 0 (Chain 1):

- Lower Band Edge – Low Channel (Restricted Bands)



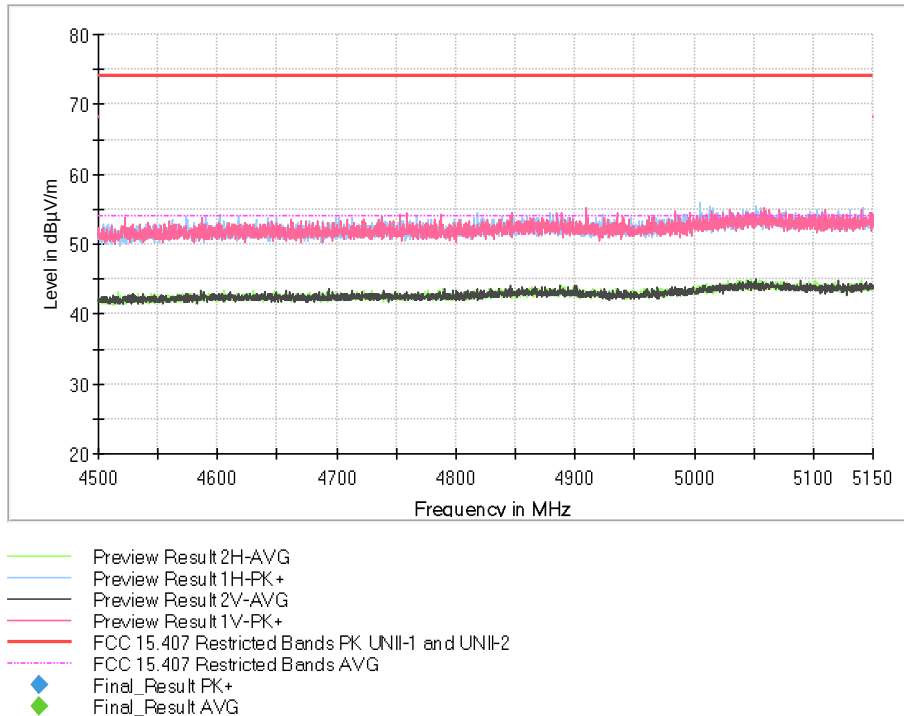
SISO 802.11 he20 RU 26 Offset 8 (Chain 1):

- Upper Band Edge – High Channel (Restricted Bands)



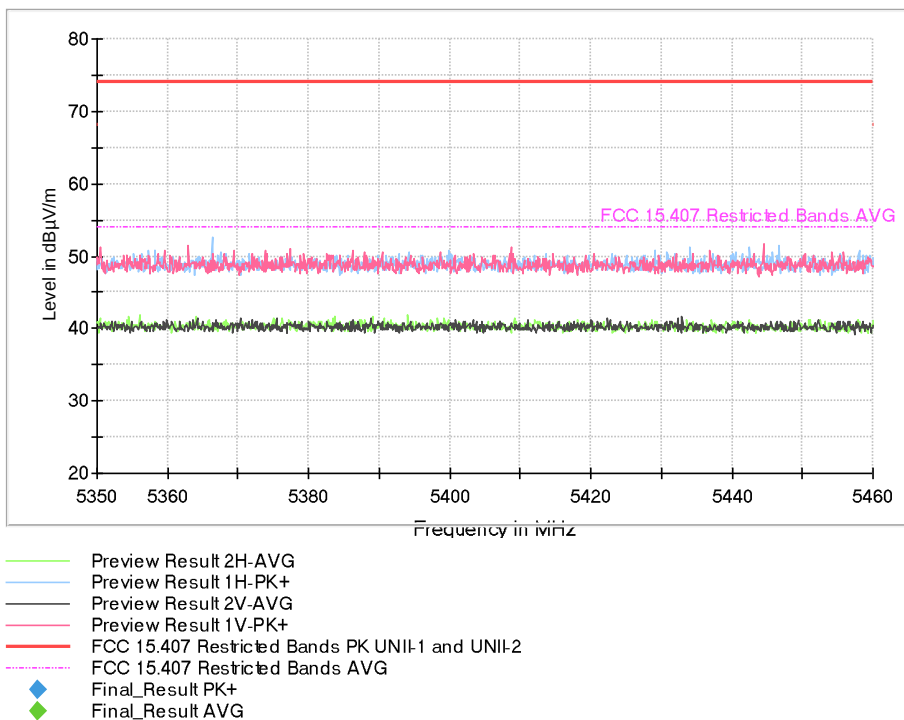
SISO 802.11 he40 RU 26 Offset 0 (Chain 1):

- Lower Band Edge – Low Channel (Restricted Bands)

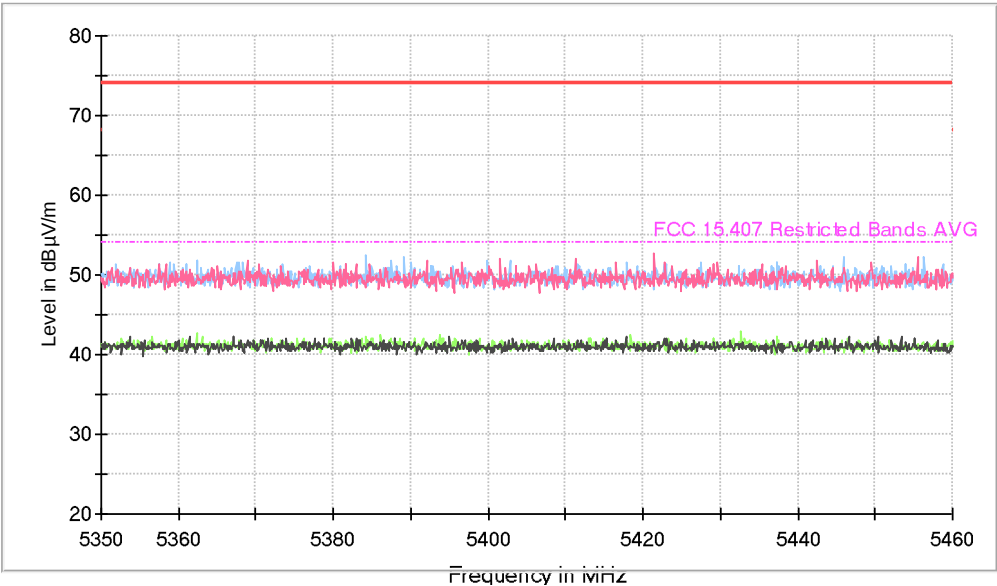
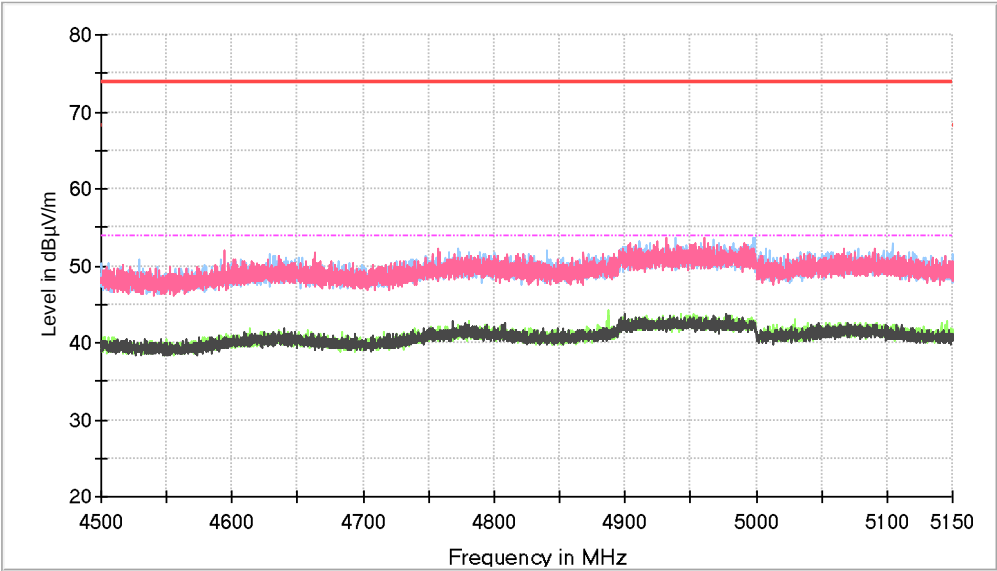


SISO 802.11 he40 RU 26 Offset 17 (Chain 1):

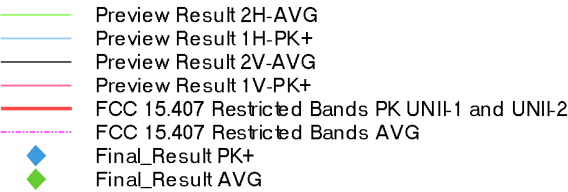
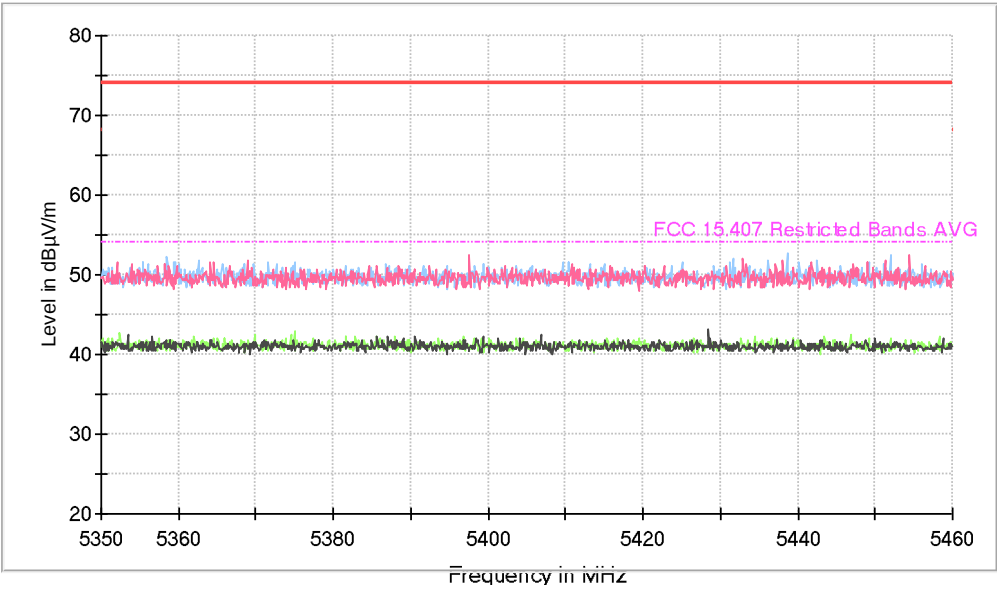
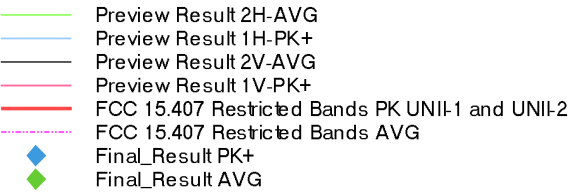
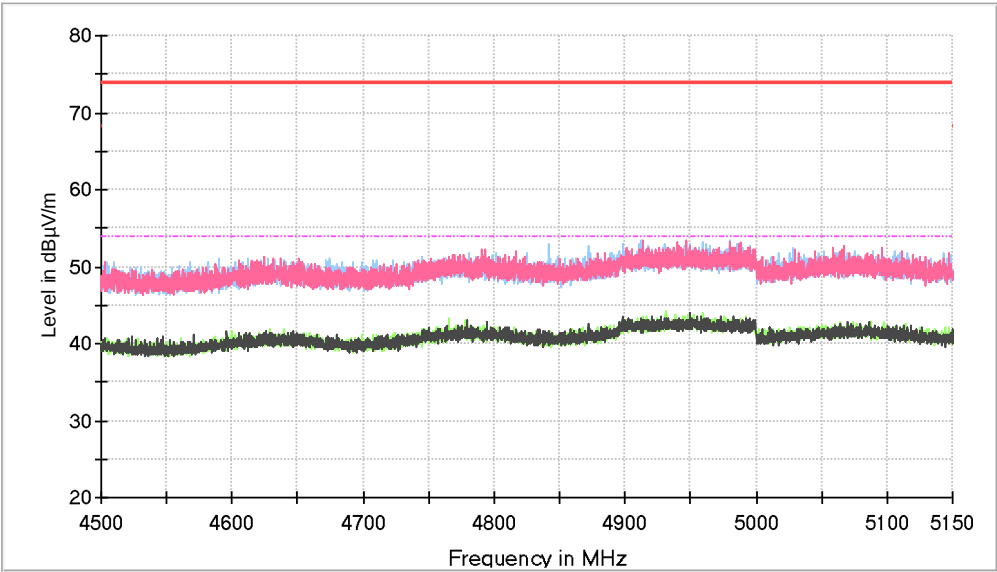
- Upper Band Edge – High Channel (Restricted Bands)



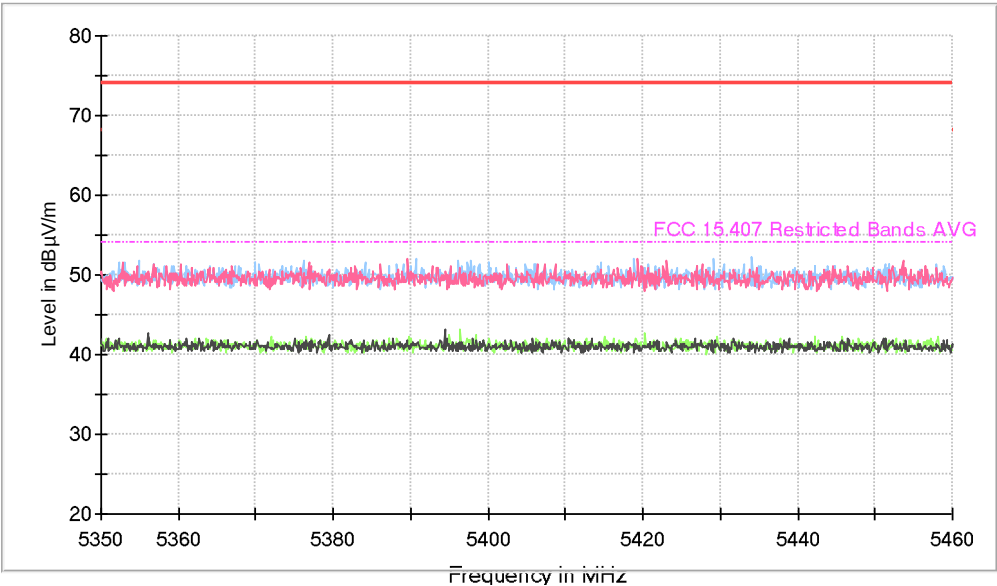
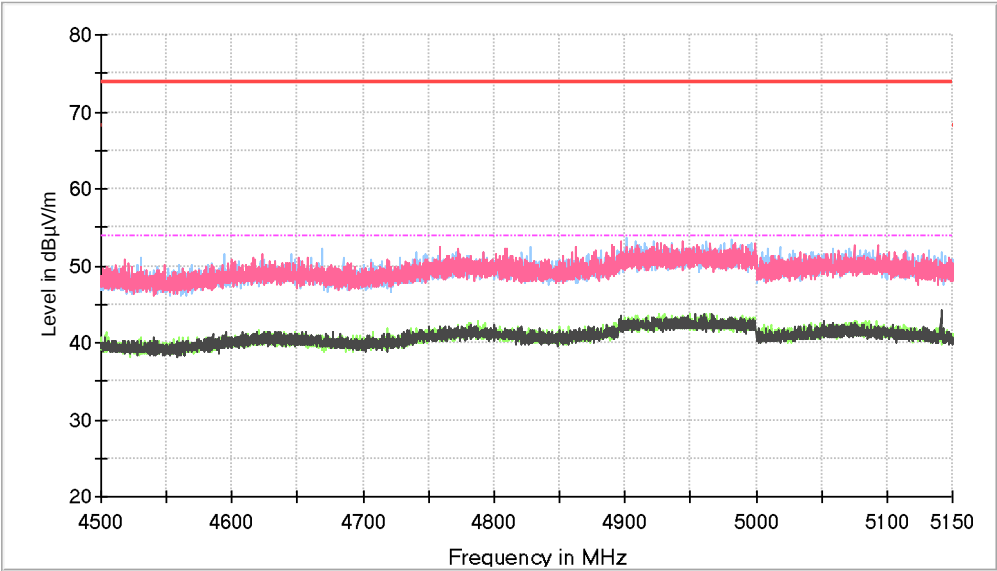
- **SISO 802.11 n40:**
 - Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)



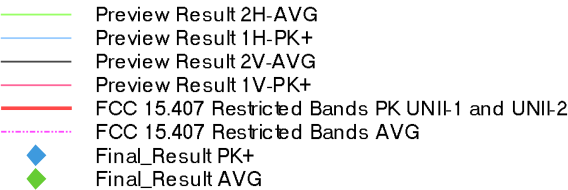
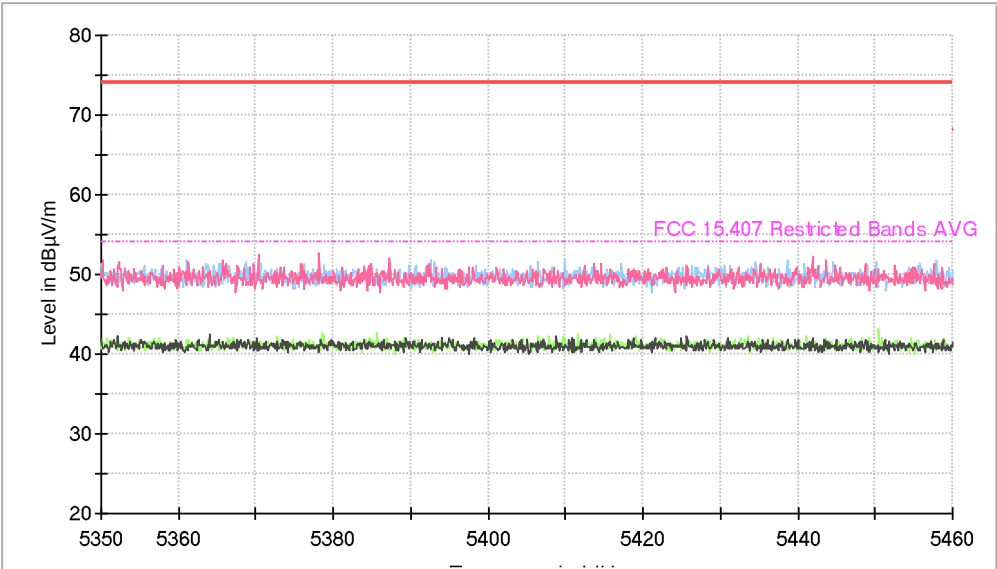
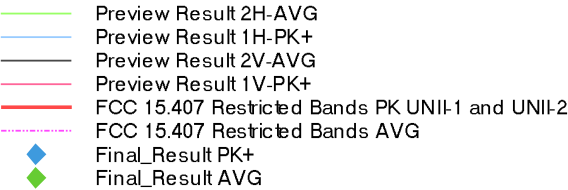
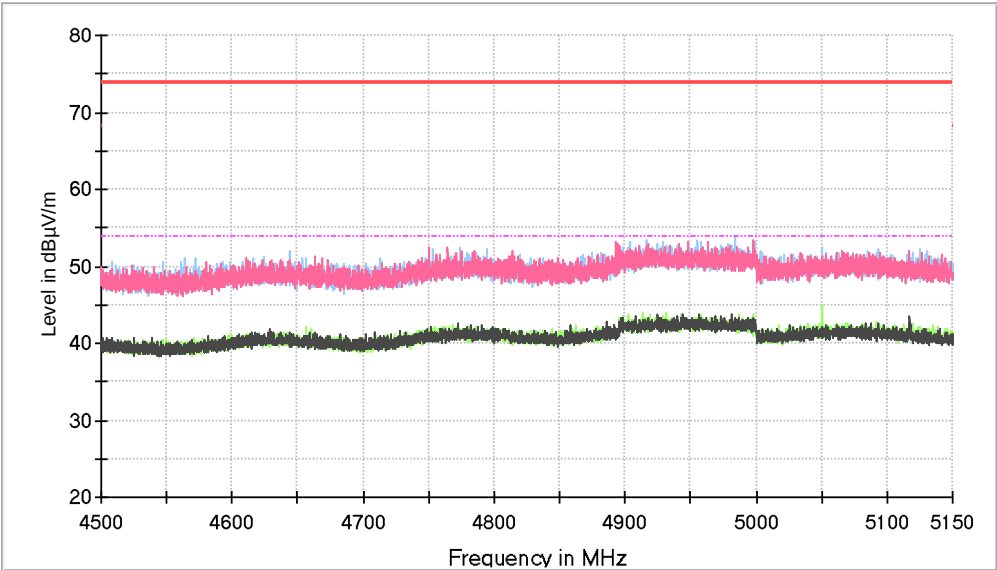
- Lower Band Edge and Upper Band Edge – High Channel (Restricted Bands)



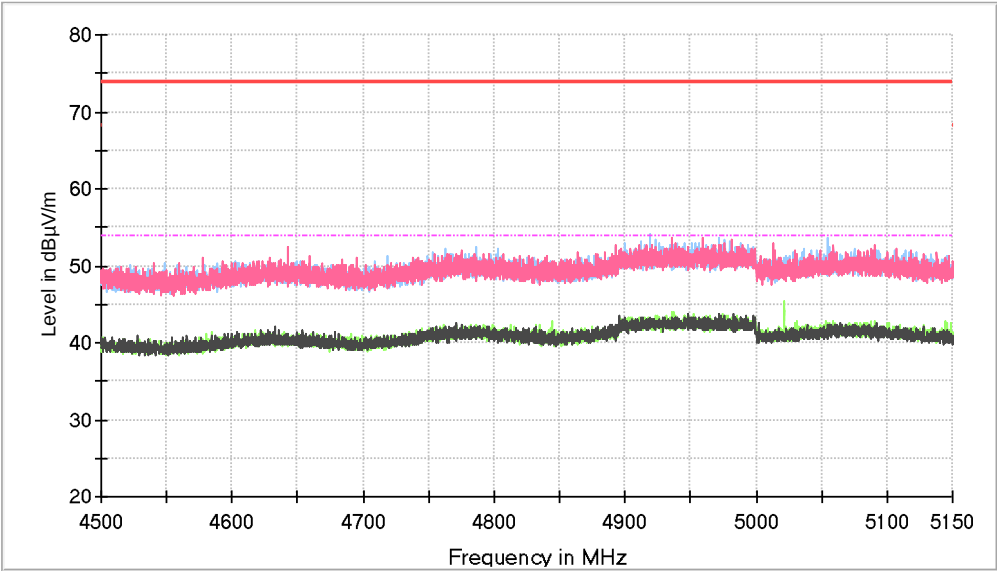
- **SISO 802.11 ac40:**
 - Lower Band Edge and Upper Band Edge – Low Channel (Restricted Bands)



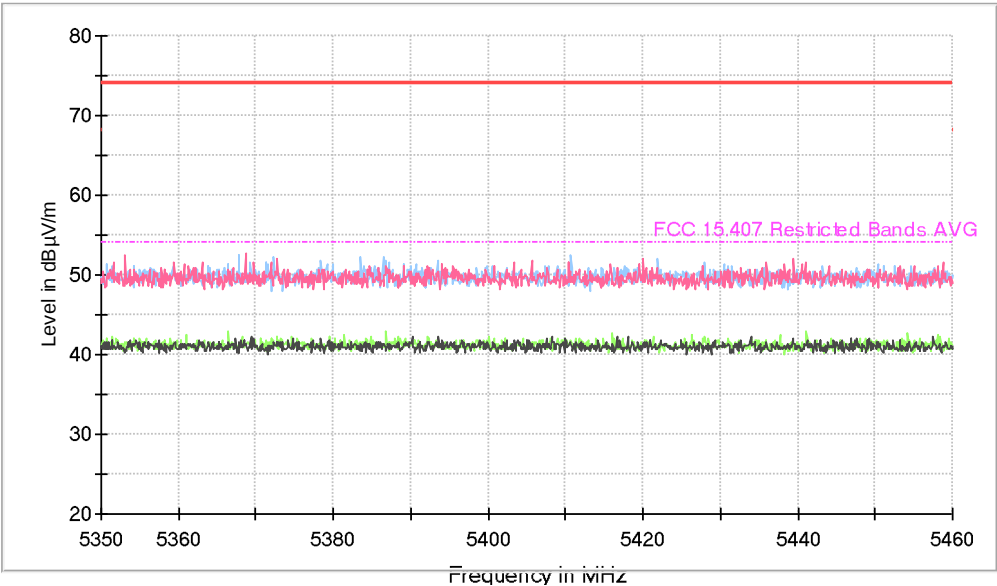
- Lower Band Edge and Upper Band Edge – High Channel (Restricted Bands)



- **SISO 802.11 ac80:**
 - Lower Band Edge and Upper Band Edge – Single Channel (Restricted Bands)



- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
- FCC 15.407 Restricted Bands AVG
- Final_Result PK+
- Final_Result AVG



- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
- FCC 15.407 Restricted Bands AVG
- Final_Result PK+
- Final_Result AVG

MIMO Chain 0 + Chain 1:

- **MIMO 802.11 a20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **MIMO 802.11 n20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- **MIMO 802.11 ac20:**

- LOW CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.

- HIGH CHANNEL:

- Lower Band Edge. No spurious emissions inside the Restricted Band 4.50-5.15 GHz.
- Upper Band Edge. No spurious emissions inside the Restricted Band 5.35-5.46 GHz.