TEST REPORT

Report Number. : R13541206-E4

Applicant	:	Microsoft Corporation One Microsoft Way Redmond, WA 98052-6399 USA
Model	:	1964
FCC ID	:	C3K1964
IC	:	3048A-1964
EUT Description	:	Portable Computing Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5 + A2

Date Of Issue:
2021-07-08

Prepared by:
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400

ACCREDITED
CERT #0751.06

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
v1	2021-05-25	Initial Issue	Niklas Haydon
V2	2021-07-08	Revised power, PSD, and radiated data due to power increase by manufacturer.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Portable Computing Device

MODEL: 1964

SERIAL NUMBER: 0F0002Z211200C (radiated)
0F000AN211200C (radiated)
0F0008Z211200C (radiated)
0F0003K211200C (antenna port conducted)
0F0003W211200C (antenna port conducted)
0F0003V211200C (antenna port conducted)

SAMPLE RECEIPT DATE: 2021-04-12

DATE TESTED: 2021-04-12 to 2021-06-14

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A2	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

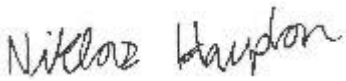
The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or any agency of the U.S. government.

Approved & Released For
UL LLC By:

Brian T. Kiewra
Project Engineer
Consumer Technology Division
UL LLC

Prepared By:



Niklas Haydon
Operations Leader
Consumer Technology Division
UL LLC

Mike Antola
Staff Engineer
Consumer Technology Division
UL LLC

2. TEST RESULTS SUMMARY

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, and KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☒	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
☒	Building: 2800 Perimeter Park Dr Morrisville, NC 27560, U.S.A			

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a portable computing device. This report covers the 2.4 WLAN ax radio in the device.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2.4GHz BAND 802.11 ax MODE 1TX SISO ANT A

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
1TX			
2412 - 2472	802.11ax HE20 SU	23.23	210.38
2412 - 2472	802.11ax HE20 RU size 106T	21.17	130.92
2412 - 2472	802.11ax HE20 RU size 52T	21.26	133.66
2412 - 2472	802.11ax HE20 RU size 26T	19.12	81.66
2422 - 2462	802.11ax HE40 SU	22.93	196.34
2422 - 2462	802.11ax HE40 RU size 242T	23.57	227.51
2422 - 2462	802.11ax HE40 RU size 106T	21.28	134.28
2422 - 2462	802.11ax HE40 RU size 52T	21.27	133.97
2422 - 2462	802.11ax HE40 RU size 26T	19.01	79.62

2.4GHz BAND 802.11 ax MODE 1TX SISO ANT B

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
1TX			
2412 - 2472	802.11ax HE20 SU	23.05	201.84
2412 - 2472	802.11ax HE20 RU size 106T	21.11	129.12
2412 - 2472	802.11ax HE20 RU size 52T	21.18	131.22
2412 - 2472	802.11ax HE20 RU size 26T	18.20	66.07
2422 - 2462	802.11ax HE40 SU	22.48	177.01
2422 - 2462	802.11ax HE40 RU size 242T	22.10	162.18
2422 - 2462	802.11ax HE40 RU size 106T	21.13	129.72
2422 - 2462	802.11ax HE40 RU size 52T	20.25	105.93
2422 - 2462	802.11ax HE40 RU size 26T	17.39	54.83

2.4GHz BAND 802.11 ax MODE 2TX MIMO ANT A + ANT B

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11ax HE20 SU	25.19	330.37
2412 - 2472	802.11ax HE20 RU size 106T	24.03	252.93
2412 - 2472	802.11ax HE20 RU size 52T	22.18	165.20
2412 - 2472	802.11ax HE20 RU size 26T	20.46	111.17
2422 - 2462	802.11ax HE40 SU	25.61	363.92
2422 - 2462	802.11ax HE40 RU size 242T	25.19	330.37
2422 - 2462	802.11ax HE40 RU size 106T	24.04	253.51
2422 - 2462	802.11ax HE40 RU size 52T	22.21	166.34
2422 - 2462	802.11ax HE40 RU size 26T	20.78	119.67

6.3. TEST REDUCTIONS CASES

Preliminary tests were completed that showed that HE20 SU and HE40 SU data can represent HE20 242T and HE40 484T.

6.4. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes two PIFA antennas, with the following gains:

Frequency	Antenna A	Antenna B
2400-2485MHz	3.9dBi	5.5dBi

6.5. SOFTWARE AND FIRMWARE

OS: Windows Build 19041.vb_release 191206-1406
Test tool version 22.35020.0.0-01924
WLAN driver 22.20.0.5
BT driver 22.30.0.4

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6.6. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in the three available configurations (laptop, stage, and tablet). With the EUT in the tablet configuration it was also investigated in three orthogonal orientations (X, Y, Z) modes. It was determined that the laptop configuration was the worst-case configuration orientation; therefore, all final radiated testing was performed with the EUT in the laptop configuration.

All radios that can transmit simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

Worst-case data rates as provided by the client were:
802.11ax HE20 mode: MCS0
802.11ax HE40 mode: MCS0

Output power and average power were performed with the EUT set to the max power setting of each modulation/channel/mode the EUT will be set at:
802.11n HE20 mode, 1Tx Antenna A mode
802.11n HE20 mode, 1Tx Antenna B mode
802.11n HE20 mode, 2Tx, MIMO mode
802.11n HE40 mode, 1Tx Antenna A mode
802.11n HE40 mode, 1Tx Antenna B mode
802.11n HE40 mode, 2Tx, MIMO mode

Frequency Band	Wi-Fi Channels	MIMO – HE20			
		26T	52T	106T	SU
2400 to 2483.5 MHz	1	12	15	17	16
	2	12	15	17	17
	6	12	15	17	17
	10	12	15	17	17
	11	12	15	17	16
	12	5	5	5	13
	13	4	4	4	8.5

Frequency Band	Wi-Fi Channels	MIMO – HE40				
		26T	52T	106T	242T	SU
	3	12	15	17	16	17
	4	12	15	17	17	17
	6	12	15	17	17	17
	8	12	15	17	17	17
	9	12	15	17	16	17
	10	5	5	5	13	17
	11	4	4	4	8.5	17

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Frequency Band	Wi-Fi Channels	SISO Antenna A – HE20			
		26T	52T	106T	SU
2400 to 2483.5 MHz	1	15	17	17	18
	2	15	17	17	-
	6	15	17	17	18
	10	15	17	17	18
	11	15	17	17	17
	12	5	5	5	14
	13	4	4	4	9.5

Frequency Band	Wi-Fi Channels	SISO Antenna A – HE40				
		26T	52T	106T	242T	SU
	3	15	17	17	16	17
	4	15	17	17	17	17
	6	15	17	17	17	17
	8	15	17	17	-	17
	9	15	17	17	17	17
	10	5	5	5	14.5	17
	11	4	4	4	12	17

Frequency Band	Wi-Fi Channels	SISO Antenna B – HE20			
		26T	52T	106T	SU
2400 to 2483.5 MHz	1	13	16	17	18
	2	13	16	17	-
	6	13	16	17	18
	10	13	16	17	18
	11	13	16	17	17
	12	5	5	5	14
	13	4	4	4	9.5

Frequency Band	Wi-Fi Channels	SISO Antenna B – HE40				
		26T	52T	106T	242T	SU
	3	13	16	17	16	17
	4	13	16	17	17	17
	6	13	16	17	17	17
	8	13	16	17	-	17
	9	13	16	17	17	17
	10	5	5	5	14.5	17
	11	4	4	4	12	17

Antenna port conducted emissions outside of output power and average power were performed with the EUT set to the following modes:

802.11n HT20 mode, 2Tx, MIMO with channels 1, 6, and 11 at SISO mid channel power settings and channel 12 and 13 at higher of SISO Ant A and Ant B channel 12 and 13 power settings
802.11n HT40 mode, 2Tx, MIMO with channels 1, 6, and 9 at SISO mid channel power settings and channel 10 and 11 at higher of SISO Ant A and Ant B channel 10 and 11 power settings

Frequency Band	Wi-Fi Channels	MIMO – HE20			
		26T	52T	106T	SU
2400 to 2483.5 MHz	1	15	15	16	18
	6	15	15	16	18
	11	15	15	16	18
	12	5	5	5	14
	13	4	4	4	9.5

Frequency Band	Wi-Fi Channels	MIMO – HE40				
		26T	52T	106T	242T	SU
	3	16	16	16	17	16
	6	16	16	16	17	16
	9	16	16	16	17	16
	10	5	5	5	14.5	13
	11	4	4	4	12	12

Radiated spurious emissions between 1GHz and 18GHz outside of radiated band edge emissions, were performed with the EUT set to transmit on low, middle and high channels on each modulation with the highest power spectral density and then repeated on the highest output mode with the least margin power density emissions scan (with 802.11ax HE40 modes covering 802.11ax HE20 modes):

Frequency Band	Wi-Fi Channels	MIMO – HE40				
		26T	52T	106T	242T	SU
2400-2483.5 MHz	3	12	15	17	-	-
	6	12	15	17	-	-
	11	12	15	17	-	-

Frequency Band	Wi-Fi Channels	SISO ANTENNA A – HE40				
		26T	52T	106T	242T	SU
2400-2483.5 MHz	3	15	17	-	-	-
	6	15	17	-	-	-
	11	15	17	-	-	-

Frequency Band	Wi-Fi Channels	SISO ANTENNA B – HE40				
		26T	52T	106T	242T	SU
2400-2483.5 MHz	3	13	16	-	-	-
	6	15	17	-	-	-
	11	15	17	-	-	-

Radiated band edge emissions were performed with the EUT set to transmit on low and high channels with MIMO covering SISO as MIMO per chain power settings are higher:

Frequency Band	Wi-Fi Channels	MIMO – HE20				
		26T	52T	106T	242T	SU
2400-2483.5 MHz	1	17	17	17	-	17
	11	17	17	17	-	17

Frequency Band	Wi-Fi Channels	MIMO – HE40				
		26T	52T	106T	242T	SU
2400-2483.5 MHz	3	17	17	17	17	17
	9	17	17	17	17	17

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed in UL LLC report R13541206-E3.

6.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
USB Hub	J5create	JCA374	AY2A1904000477	NA
USB Hub	J5create	JCA374	AY3A2010013253	NA
USB Hub	J5create	JCD383	DL3A1903011541	NA
USB Hub	J5create	JCD383	FY5A2010034764	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	Sony	MDR-EX14AP	NA	NA
Earbuds	JVC	HA-FXL	NA	NA
Power Supply	Microsoft	1706	0D130U0HD210C	NA
Power Supply	Microsoft	1706	0D130U0GX310C	N/A
Power Supply	Microsoft	1706	0D130U0HD710C	N/A
Power Supply	Microsoft	1706	0D130U0GU310C	N/A
Power Supply	Microsoft	1706	0D130U0HDL10C	N/A

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Mains	1	12-pin	Mains	<3	Goes to ac/dc adapter
2	USB-C	2	USB-C	USB	<3	None

TEST SETUP

Test software on the EUT exercised the radio card.

SETUP DIAGRAMS

Please refer to R13541206-EP1 for setup diagrams.

7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Subclause 11.6

99% and 6 dB BW: ANSI C63.10 Subclause - 11.8.1 and 6.9.3

Output Power: ANSI C63.10 Subclause - 11.9.1.3 Method PKPM1 Peak-reading power meter
11.9.2.3.2 Method AVGPM-G Gated average power meter

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

General Radiated Spurious Emissions: ANSI C63.10-2013 Sections 6.3-6.6

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0025	Spectrum Analyzer	Agilent	N9030A	2021-04-01	2022-04-01
SA0027	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
PWM004	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-07-31	2021-07-31
PWM002	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
PWS001	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-07-31	2021-07-31
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2021.4.9 2021.4.13	NA	NA

Test Equipment Used - Radiated Disturbance Emissions (E-field) – Chamber C

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0062	HORN Antenna	ETS-Lindgren	3117	2021-02-03	2022-02-03
	Gain-Loss Chains				
C-SAC02	Gain-loss string: 1-18GHz	Various	Various	2021-04-15	2022-04-15
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2020-03-09	2022-03-09
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 21)	NA	NA
	Additional Equipment used				
HI0085	Temp/Humid/Pressure Meter	EXTECH	SD700	2020-04-20	2021-04-30

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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	Gain-Loss Chains				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Additional Equipment used				
ATA174	10dB, DC-18GHz, 5W	Mini-Circuits	BW-N10W5	2020-08-29	2021-08-29
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2020-08-06	2021-08-06

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-03-11	2022-03-11
	Gain-Loss Chains				
C4-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-05-07	2022-05-07
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-09	2022-03-09
SOFTEMI	EMI Software	UL	Version 9.5 (27 May 2021)		
	Additional Equipment used				
ATA176	10dB, DC-18GHz, 5W	Mini-Circuits	BW-N10W5	2020-08-29	2021-08-29
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-28	2021-04-28
	Gain-Loss Chains				
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
ATA176	10dB, DC-18GHz, 5W	Mini-Circuits	BW-N10W5	2020-08-29	2021-08-29

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 D01 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Antenna A

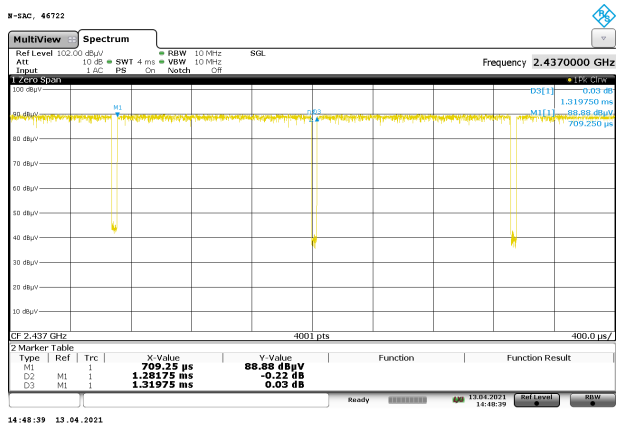
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor Conducted (dB)	Duty Cycle Correction Factor Radiated (dB)
2.4GHz Band						
802.11ax HE20 OFDMA, RU size SU	1.282	1.320	0.971	97.12%	0.13	0.26
802.11ax HE20 OFDMA, RU size 106T	5.474	5.564	0.984	98.38%	0.00	0.00
802.11ax HE20 OFDMA, RU size 52T	5.470	5.560	0.984	98.38%	0.00	0.00
802.11ax HE20 OFDMA, RU size 26T	5.470	5.560	0.984	98.38%	0.00	0.00
802.11ax HE40 OFDMA, RU size SU	1.282	1.327	0.966	96.61%	0.15	0.30
802.11ax HE40 OFDMA, RU size 242T	1.309	1.356	0.965	96.53%	0.15	0.31
802.11ax HE40 OFDMA, RU size 106T	1.308	1.356	0.965	96.46%	0.16	0.31
802.11ax HE40 OFDMA, RU size 52T	1.309	1.356	0.965	96.53%	0.15	0.31
802.11ax HE40 OFDMA, RU size 26T	1.308	1.357	0.964	96.39%	0.16	0.32

Antenna B

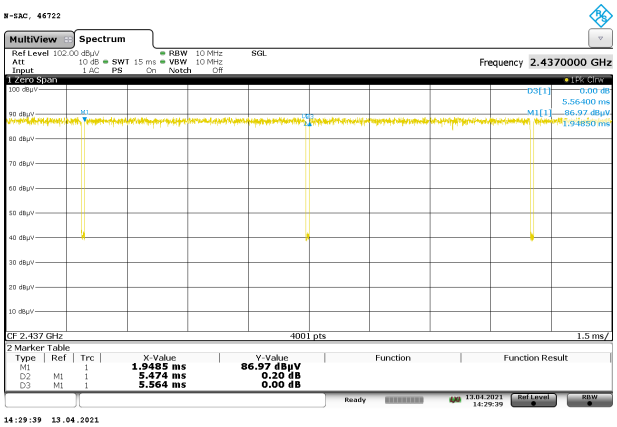
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor Conducted (dB)	Duty Cycle Correction Factor Radiated (dB)
2.4GHz Band						
802.11ax HE20 OFDMA, RU size SU	1.282	1.319	0.972	97.19%	0.12	0.24
802.11ax HE20 OFDMA, RU size 106T	5.470	5.560	0.984	98.38%	0.00	0.00
802.11ax HE20 OFDMA, RU size 52T	5.474	5.564	0.984	98.38%	0.00	0.00
802.11ax HE20 OFDMA, RU size 26T	5.474	5.564	0.984	98.38%	0.00	0.00
802.11ax HE40 OFDMA, RU size SU	1.282	1.326	0.967	96.68%	0.15	0.29
802.11ax HE40 OFDMA, RU size 242T	1.308	1.356	0.965	96.46%	0.16	0.32
802.11ax HE40 OFDMA, RU size 106T	1.308	1.356	0.965	96.46%	0.16	0.32
802.11ax HE40 OFDMA, RU size 52T	1.308	1.356	0.965	96.46%	0.16	0.32
802.11ax HE40 OFDMA, RU size 26T	1.308	1.356	0.965	96.46%	0.16	0.32

DUTY CYCLE PLOTS

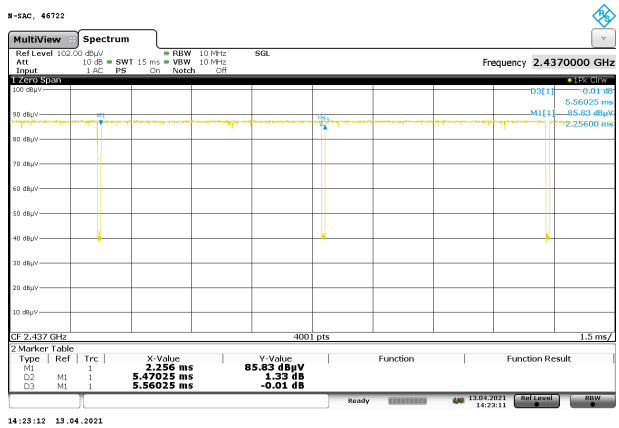
Antenna A



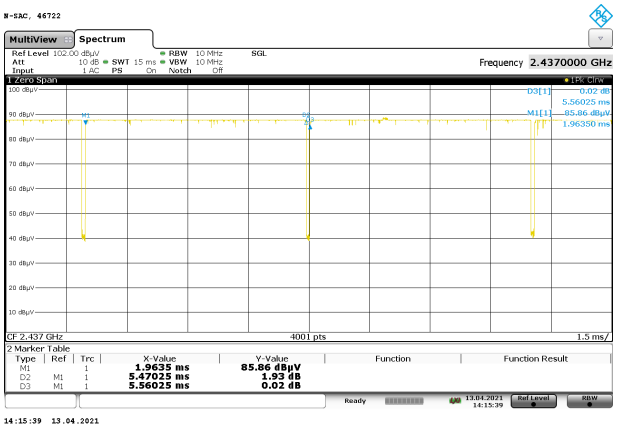
802.11ax HE20 OFDMA, RU index SU MODE



802.11ax HE20 OFDMA, RU index 106T MODE



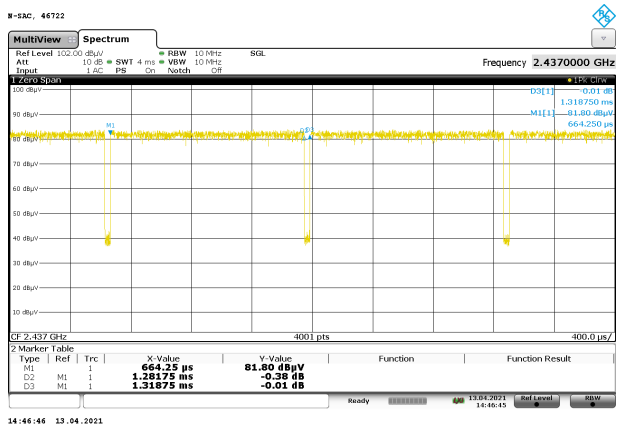
802.11ax HE20 OFDMA, RU index 52T MODE



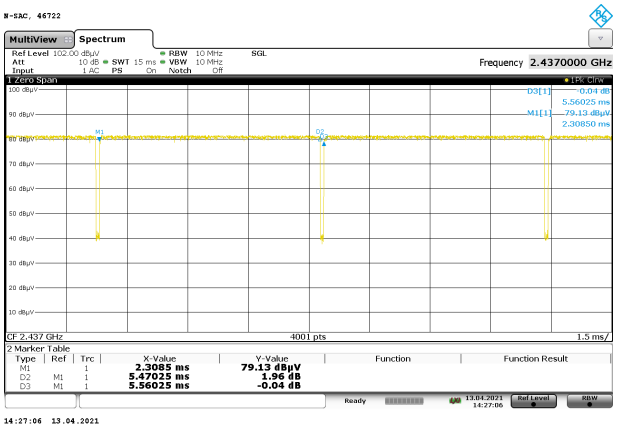
802.11ax HE20 OFDMA, RU index 26T MODE

UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

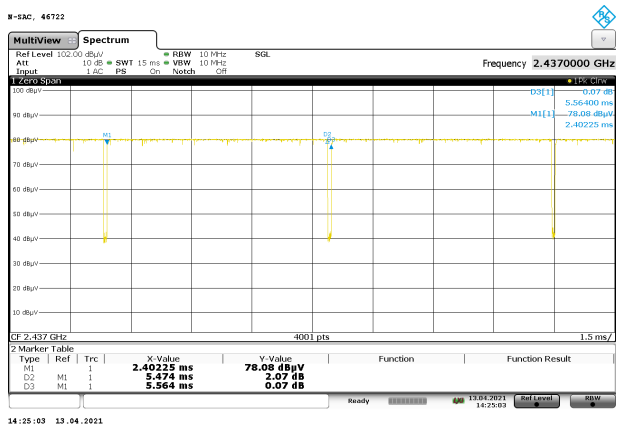
Antenna B



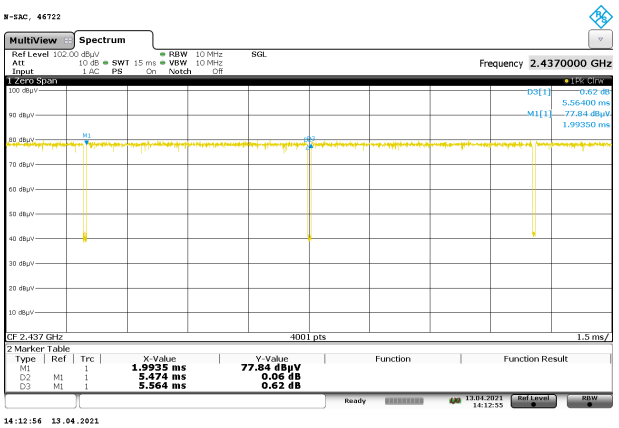
802.11ax HE20 OFDMA, RU index SU MODE



802.11ax HE20 OFDMA, RU index 106T MODE



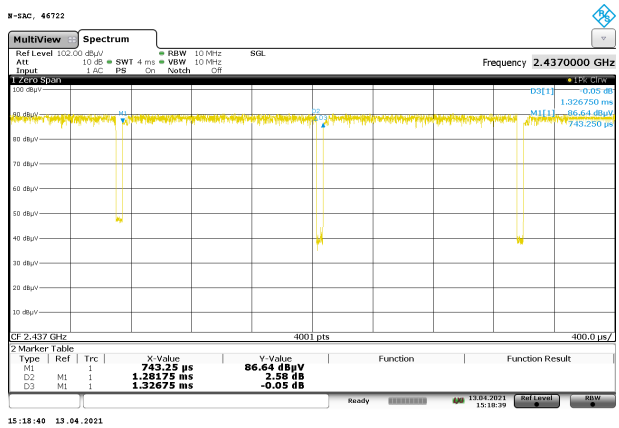
802.11ax HE20 OFDMA, RU index 52T MODE



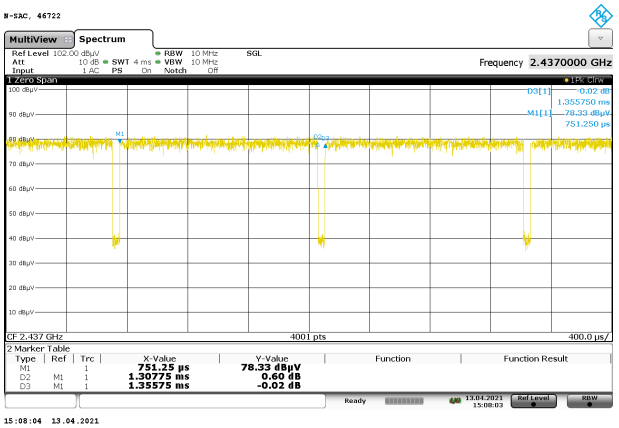
802.11ax HE20 OFDMA, RU index 26T MODE

UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

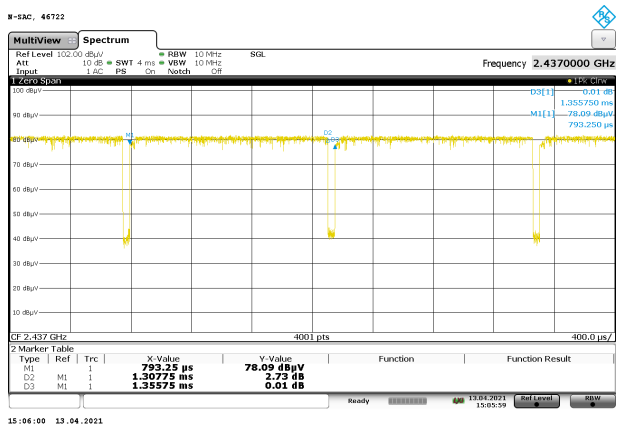
Antenna A



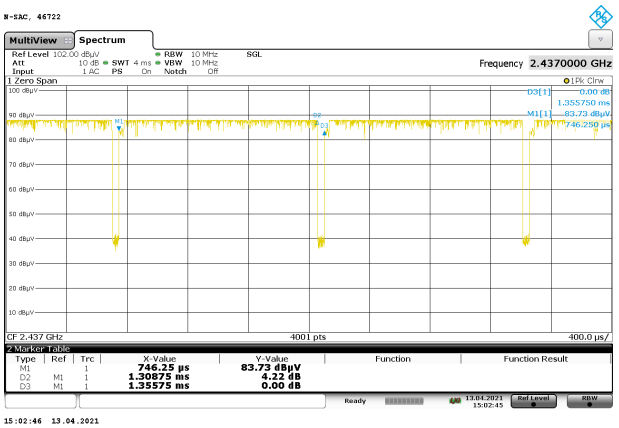
802.11ax HE40 OFDMA, RU index SU MODE



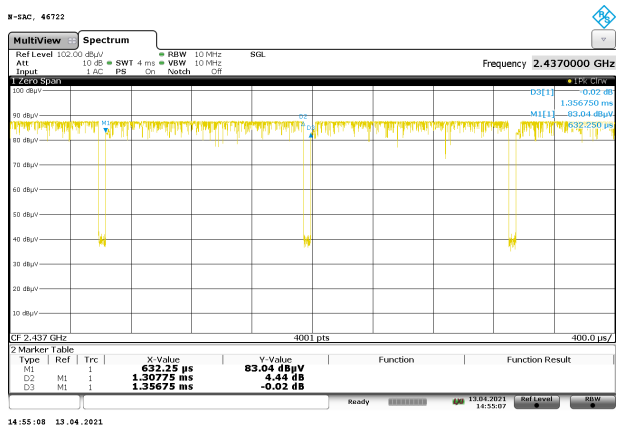
802.11ax HE40 OFDMA, RU index 242T MODE



802.11ax HE40 OFDMA, RU index 106T MODE



802.11ax HE40 OFDMA, RU index 52T MODE



802.11ax HE40 OFDMA, RU index 26T MODE

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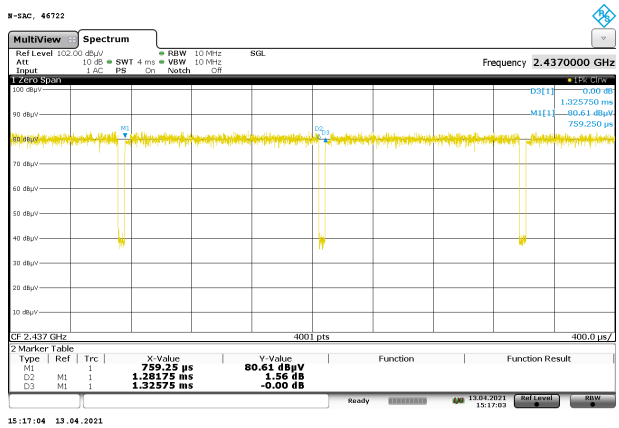
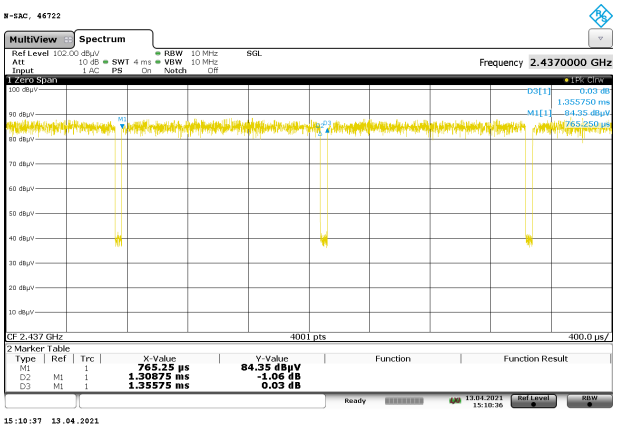
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

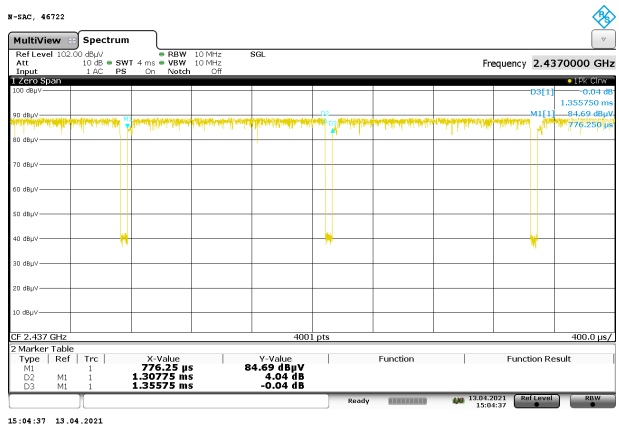
Antenna B



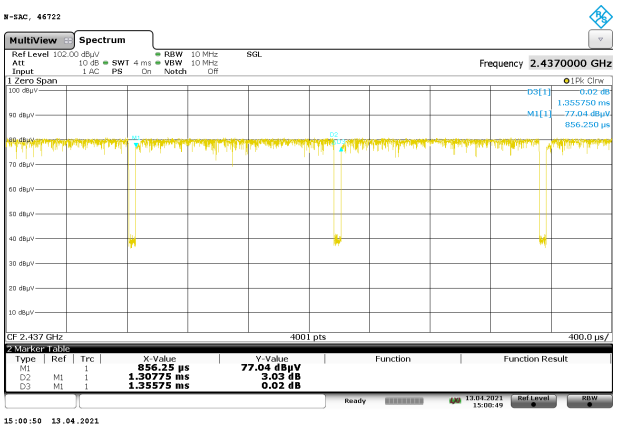
802.11ax HE40 OFDMA, RU index SU MODE



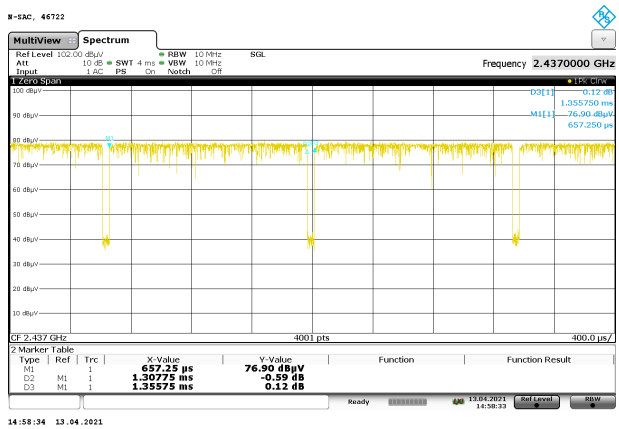
802.11ax HE40 OFDMA, RU index 242T MODE



802.11ax HE40 OFDMA, RU index 106T MODE



802.11ax HE40 OFDMA, RU index 52T MODE



802.11ax HE40 OFDMA, RU index 26T MODE

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9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

ISED RSS-247 Clause 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

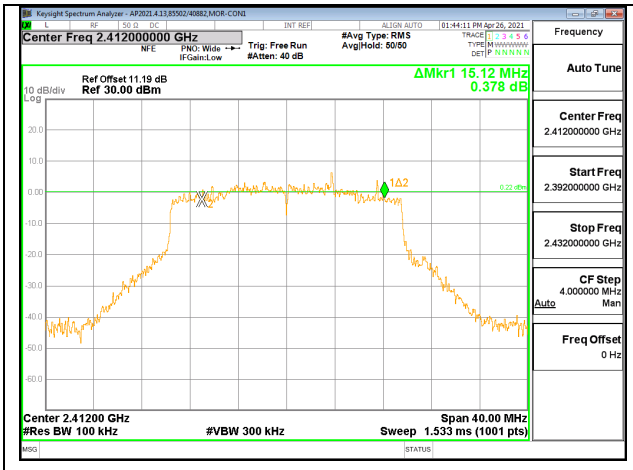
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

9.2.1. 802.11ax HE20 MODE 2TX

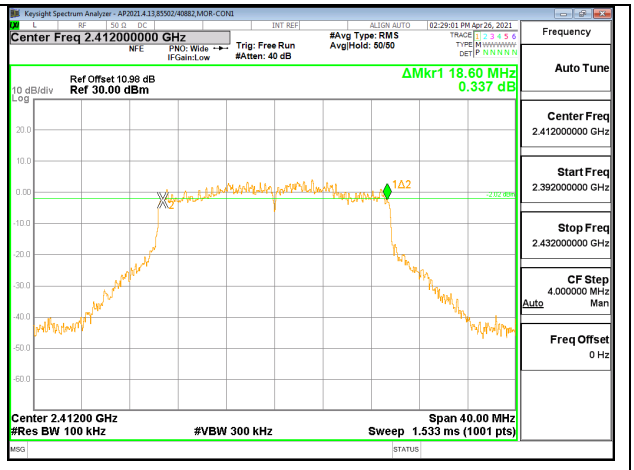
2TX Antenna A + Antenna B OFDMA MODE: SU, Single User

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 1	2412	15.12	18.60	0.5
Mid 6	2437	15.44	14.28	0.5
High 11	2462	12.08	18.52	0.5
High 12	2467	17.84	14.16	0.5
High 13	2472	18.44	18.52	0.5

LOW CHANNEL 1

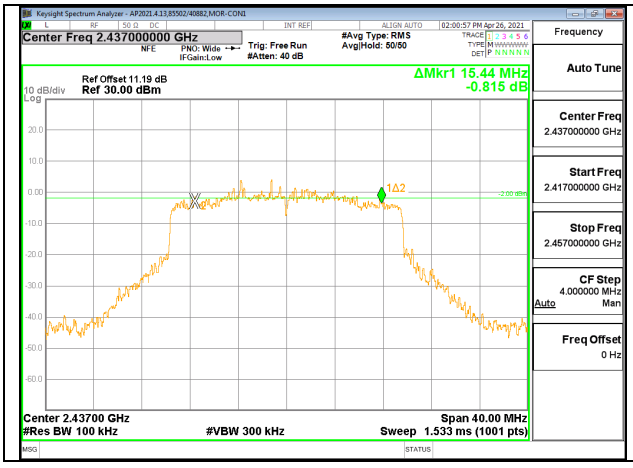


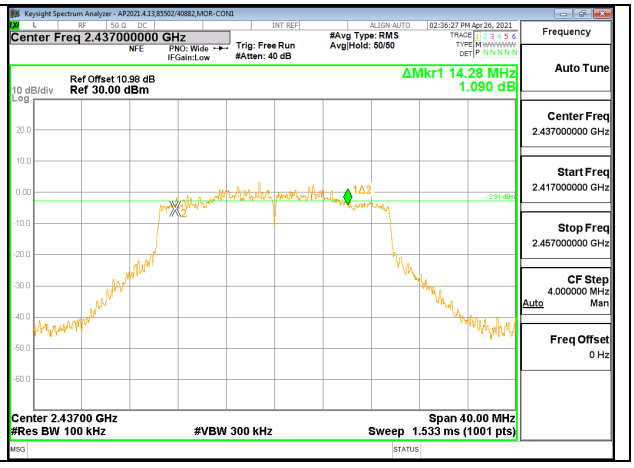
LOW CHANNEL 1 Antenna A



LOW CHANNEL 1 Antenna B

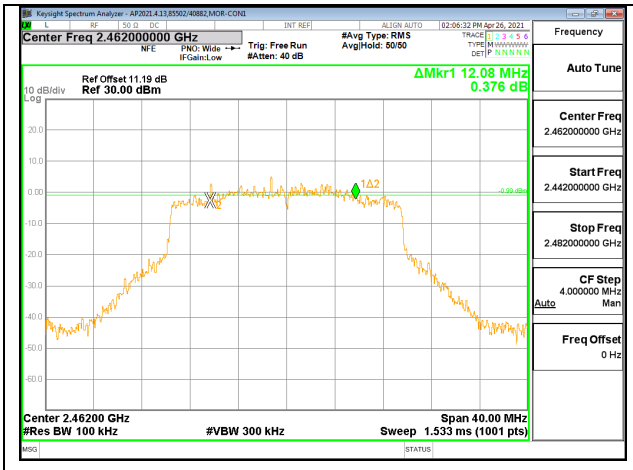
MID CHANNEL 6



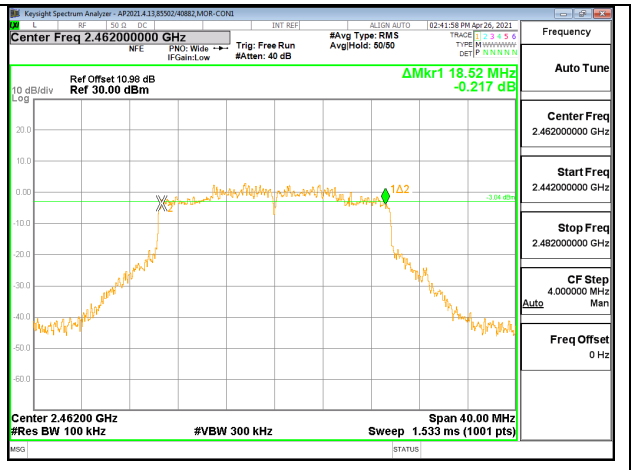


MID CHANNEL 6 Antenna A	MID CHANNEL 6 Antenna B

HIGH CHANNEL 11

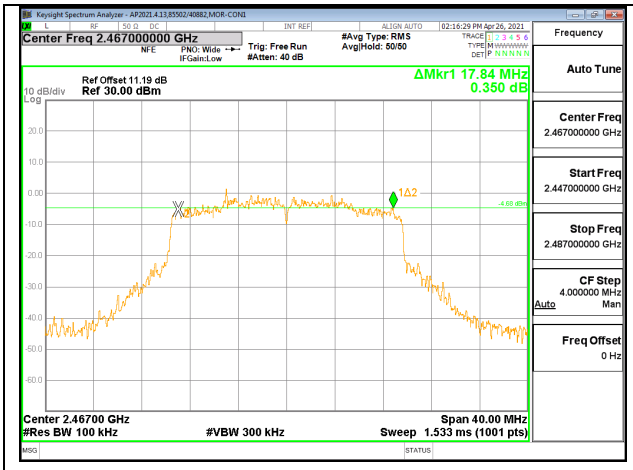


HIGH CHANNEL 11 Antenna A

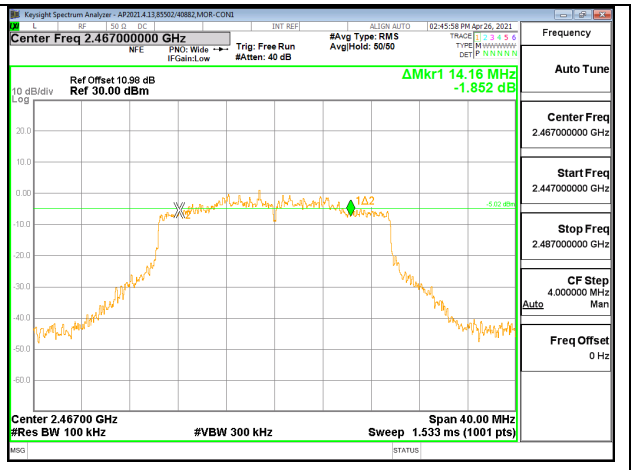


HIGH CHANNEL 11 Antenna B

HIGH CHANNEL 12

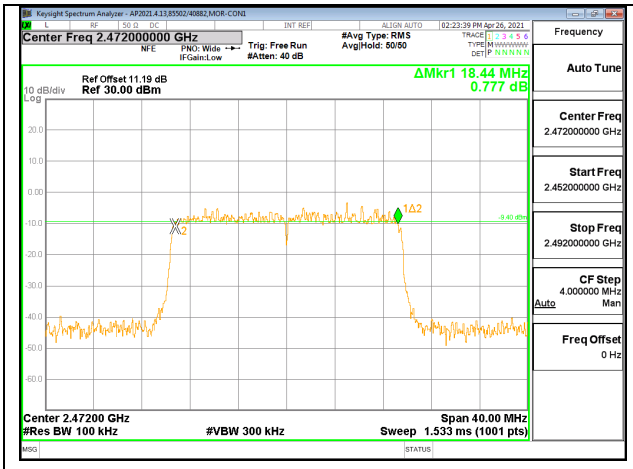


HIGH CHANNEL 12 Antenna A

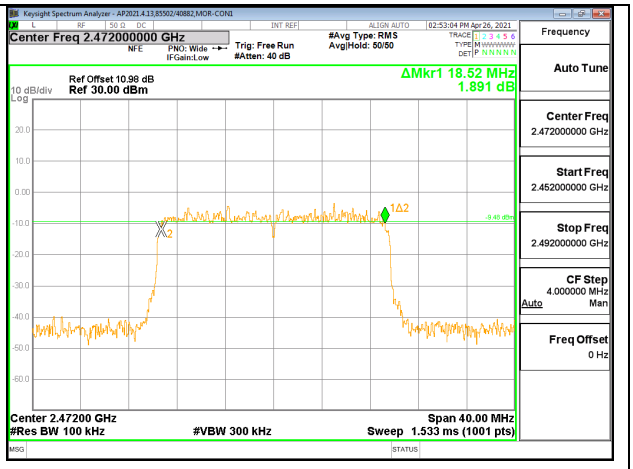


HIGH CHANNEL 12 Antenna B

HIGH CHANNEL 13



HIGH CHANNEL 13 Antenna A



HIGH CHANNEL 13 Antenna B

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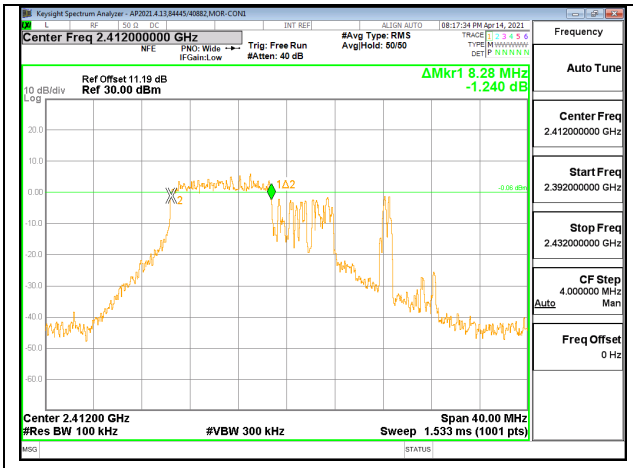
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

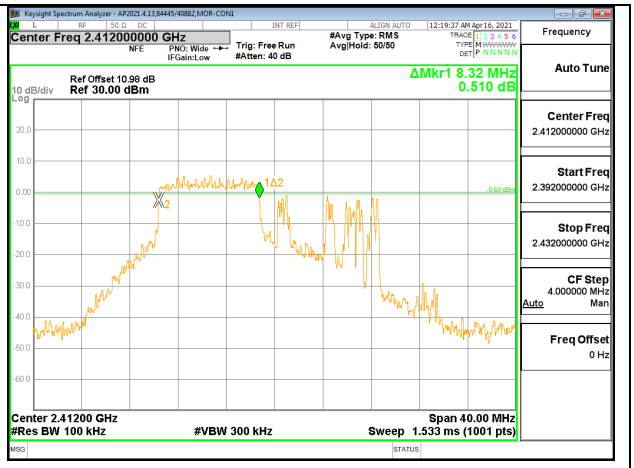
2TX Antenna A + Antenna B OFDMA MODE: 106-Tones, RU Index 53

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 1	2412	8.28	8.32	0.5
Mid 6	2437	8.32	8.36	0.5

LOW CHANNEL 1

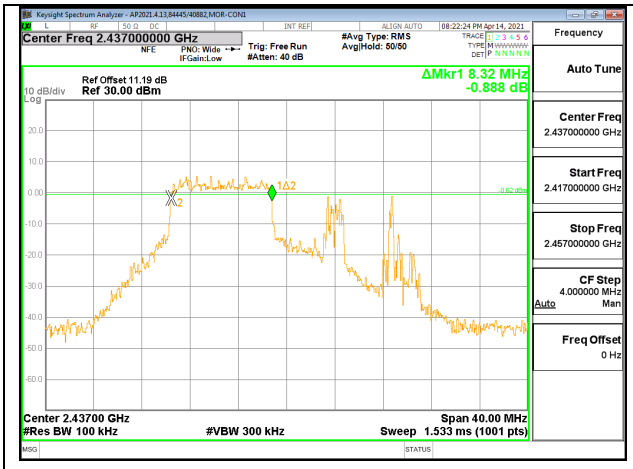


LOW CHANNEL 1 Antenna A

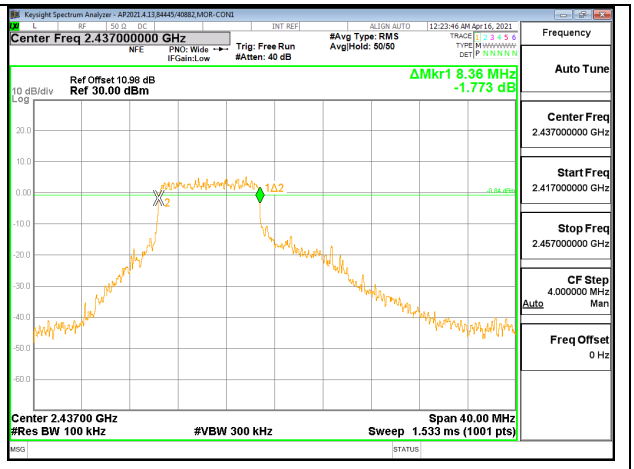


LOW CHANNEL 1 Antenna B

MID CHANNEL 6



MID CHANNEL 6 Antenna A



MID CHANNEL 6 Antenna B

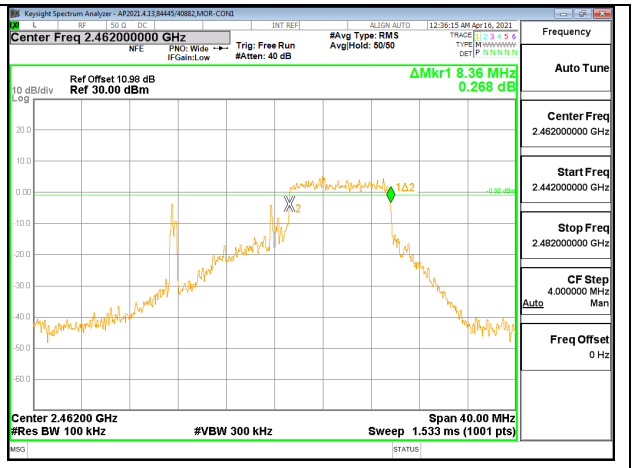
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

2TX Antenna A + Antenna B OFDMA MODE: 106-Tones, RU Index 54

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
High 11	2462	8.48	8.36	0.5
High 12	2467	8.68	8.36	0.5
High 13	2472	8.24	8.12	0.5

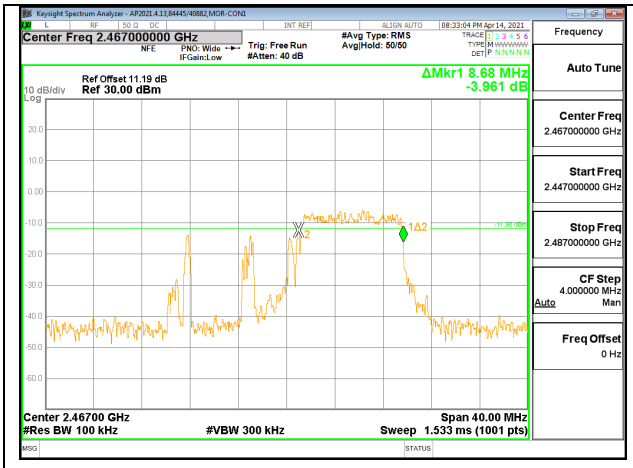
HIGH CHANNEL 11

HIGH CHANNEL 11 Antenna A

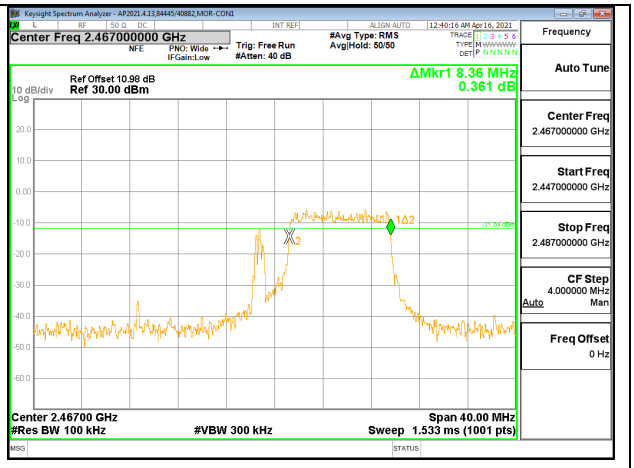


HIGH CHANNEL 11 Antenna B

HIGH CHANNEL 12

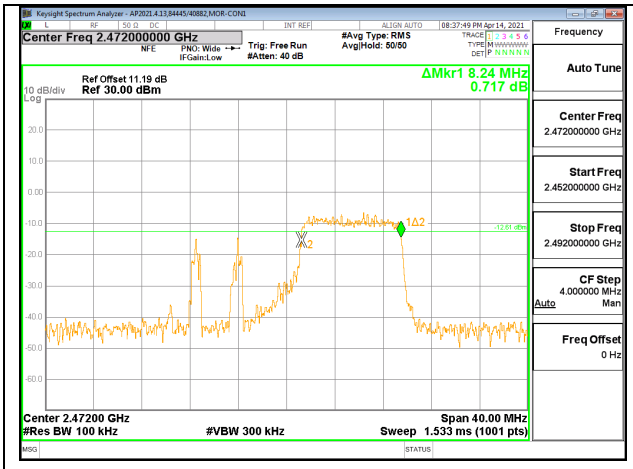


HIGH CHANNEL 12 Antenna A

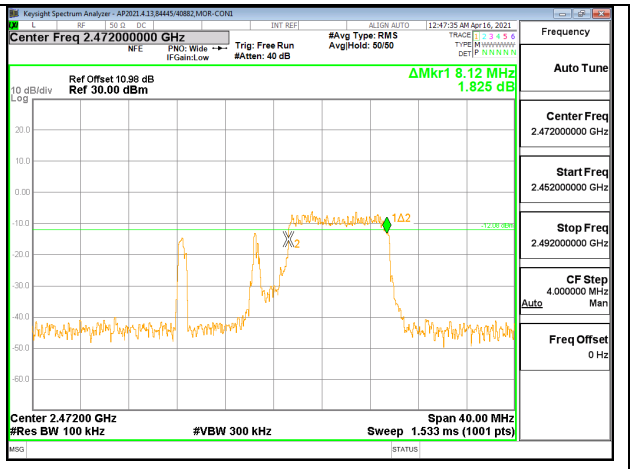


HIGH CHANNEL 12 Antenna B

HIGH CHANNEL 13



HIGH CHANNEL 13 Antenna A

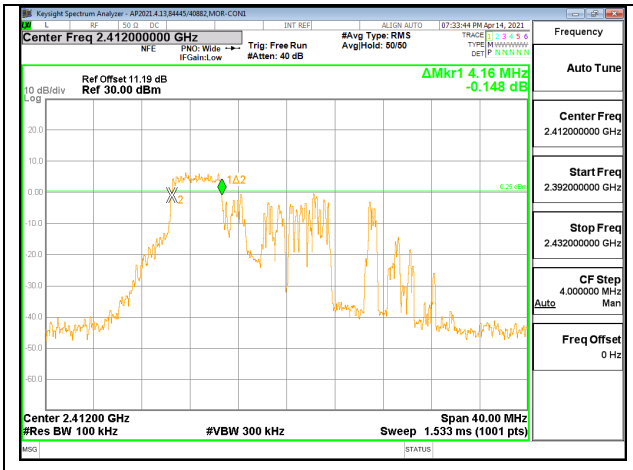


HIGH CHANNEL 13 Antenna B

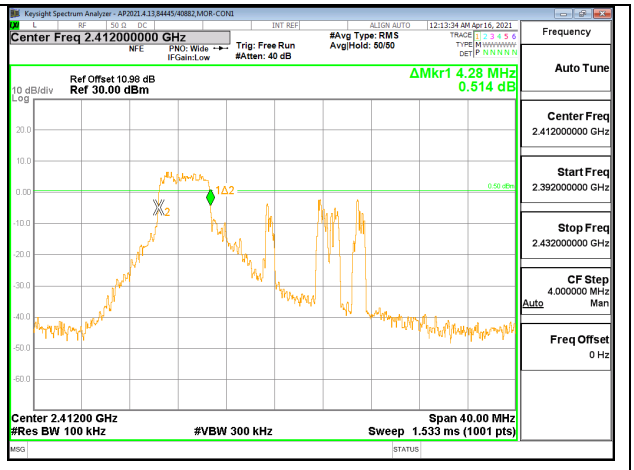
2TX Antenna A + Antenna B OFDMA MODE: 52-Tones, RU Index 37

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 1	2412	4.16	4.28	0.5

LOW CHANNEL 1



LOW CHANNEL 1 Antenna A



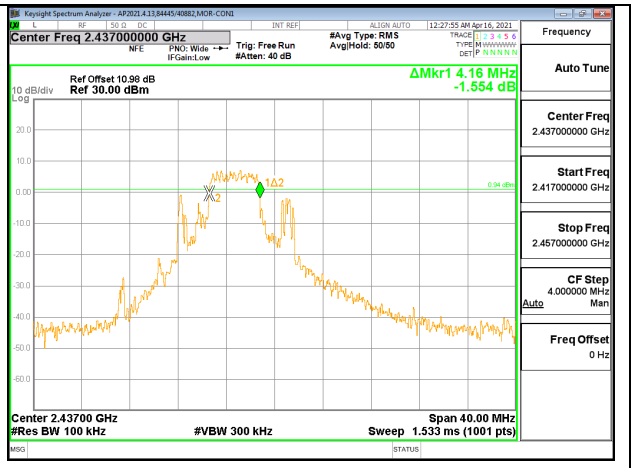
LOW CHANNEL 1 Antenna B

2TX Antenna A + Antenna B OFDMA MODE: 52-Tones, RU Index 38

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Mid 6	2437	4.16	4.16	0.5

MID CHANNEL 6

MID CHANNEL 6 Antenna A



MID CHANNEL 6 Antenna B

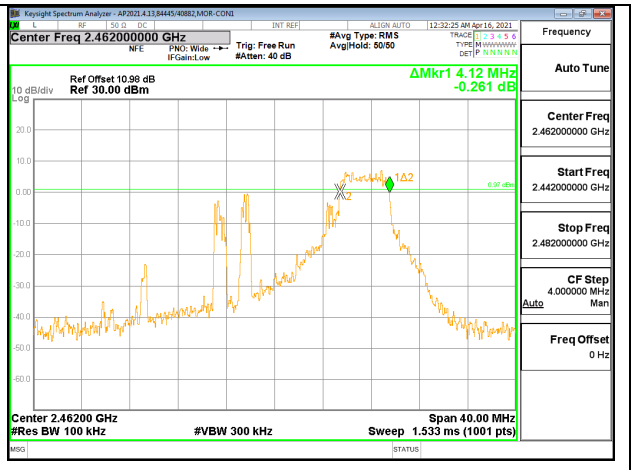
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

2TX Antenna A + Antenna B OFDMA MODE: 52-Tones, RU Index 40

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
High 11	2462	4.12	4.12	0.5
High 12	2467	4.12	4.16	0.5
High 13	2472	4.52	4.04	0.5

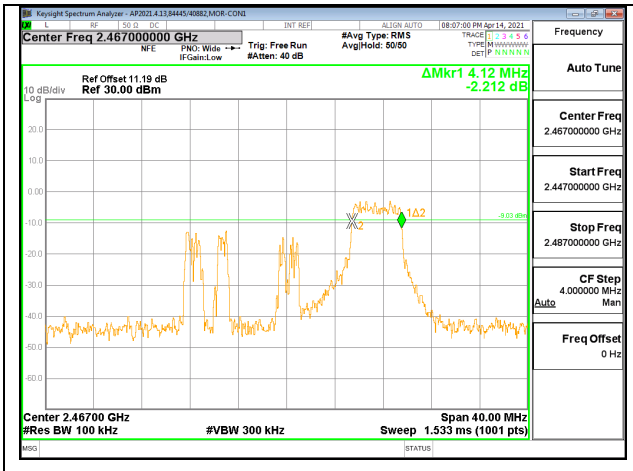
HIGH CHANNEL 11

HIGH CHANNEL 11 Antenna A

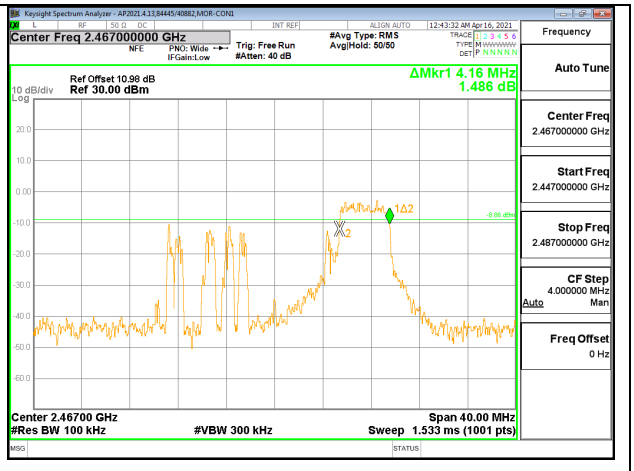


HIGH CHANNEL 11 Antenna B

HIGH CHANNEL 12

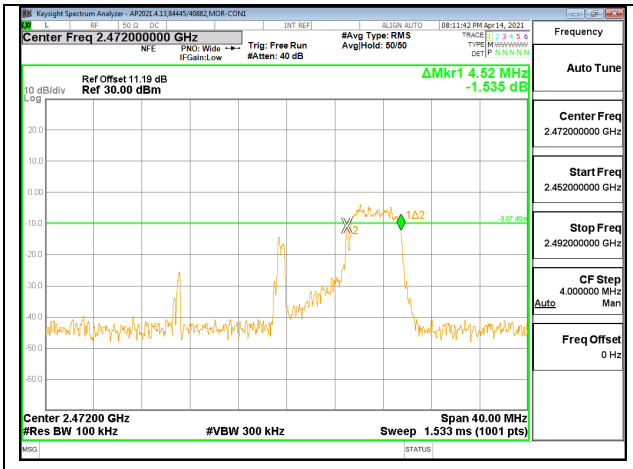


HIGH CHANNEL 12 Antenna A

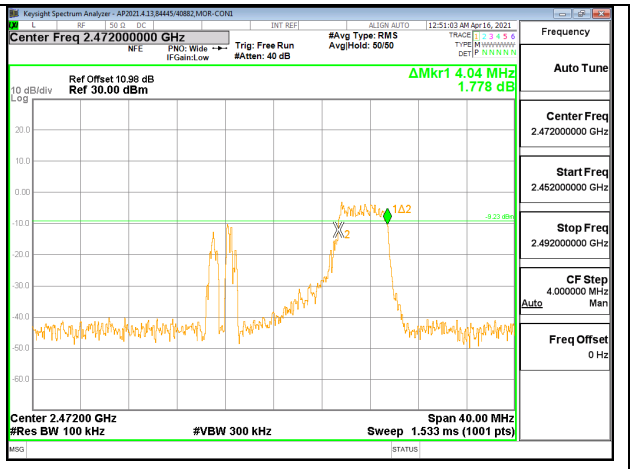


HIGH CHANNEL 12 Antenna B

HIGH CHANNEL 13



HIGH CHANNEL 13 Antenna A

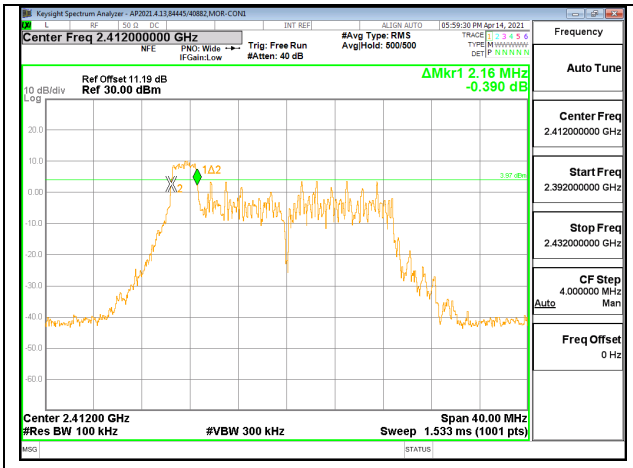


HIGH CHANNEL 13 Antenna B

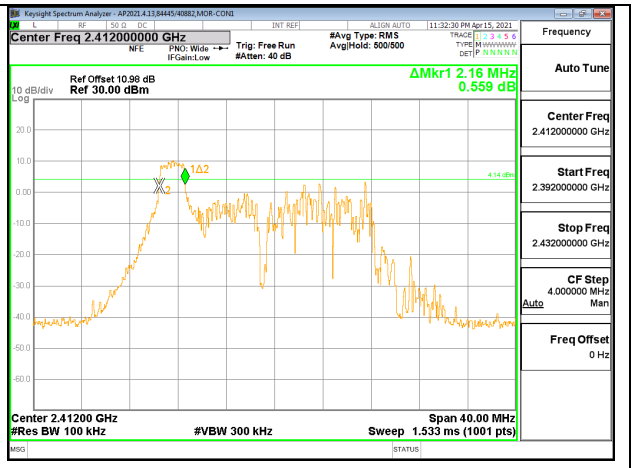
2TX Antenna A + Antenna B OFDMA MODE: 26-Tones, RU Index 0

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 1	2412	2.16	2.16	0.5

LOW CHANNEL 1



LOW CHANNEL 1 Antenna A



LOW CHANNEL 1 Antenna B

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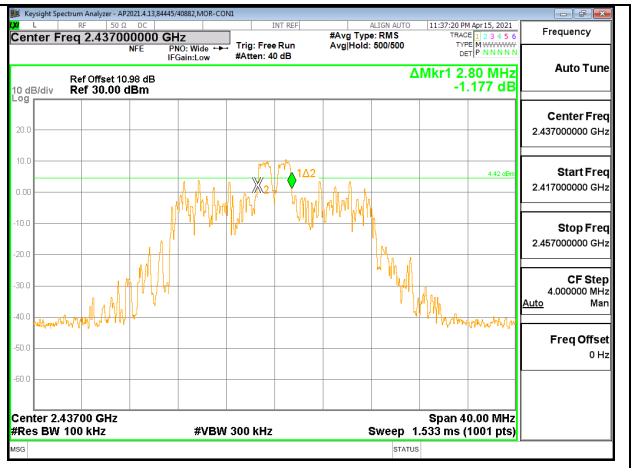
2TX Antenna A + Antenna B OFDMA MODE: 26-Tones, RU Index 4

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Mid 6	2437	2.76	2.80	0.5

MID CHANNEL 6

MID CHANNEL 6 Antenna A

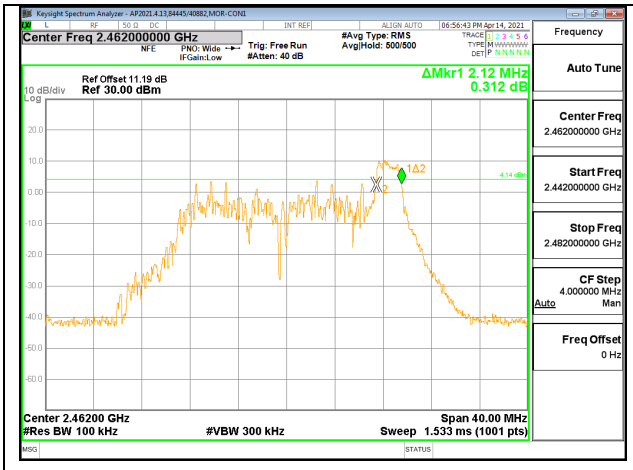


MID CHANNEL 6 Antenna B

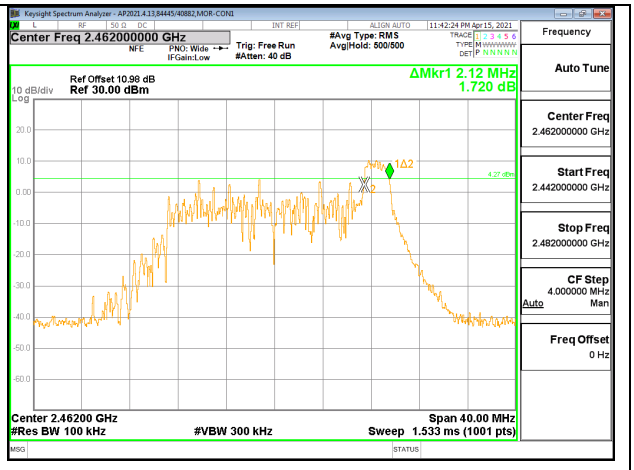
2TX Antenna A + Antenna B OFDMA MODE: 26-Tones, RU Index 8

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
High 11	2462	2.12	2.12	0.5
High 12	2467	2.12	2.16	0.5
High 13	2472	2.08	2.12	0.5

HIGH CHANNEL 11

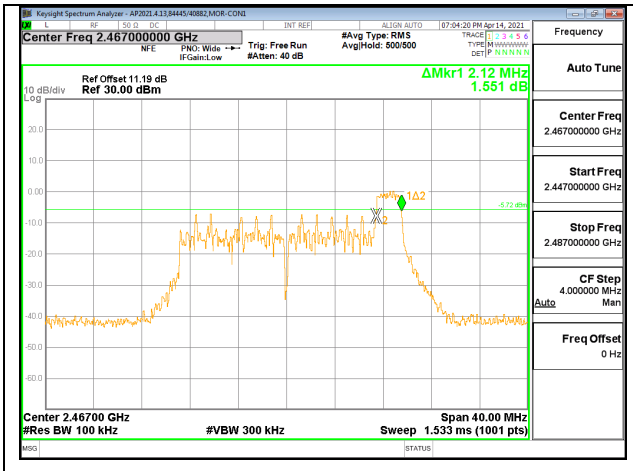


HIGH CHANNEL 11 Antenna A

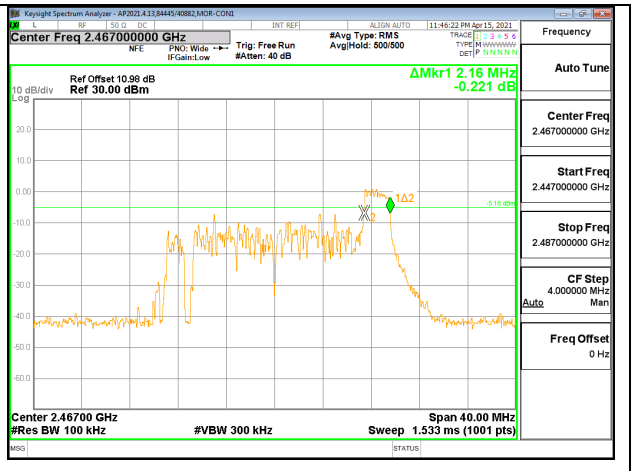


HIGH CHANNEL 11 Antenna B

HIGH CHANNEL 12

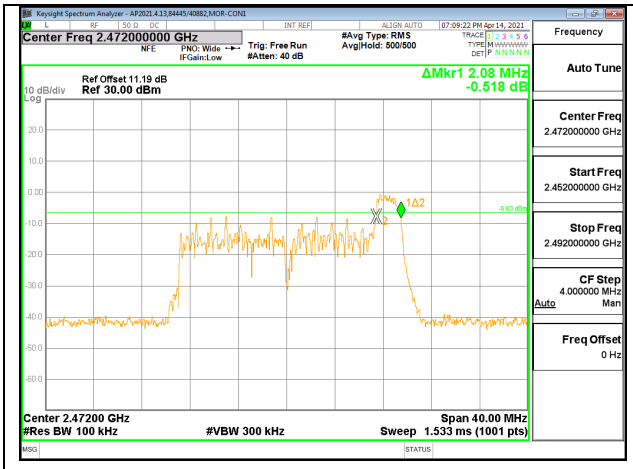


HIGH CHANNEL 12 Antenna A

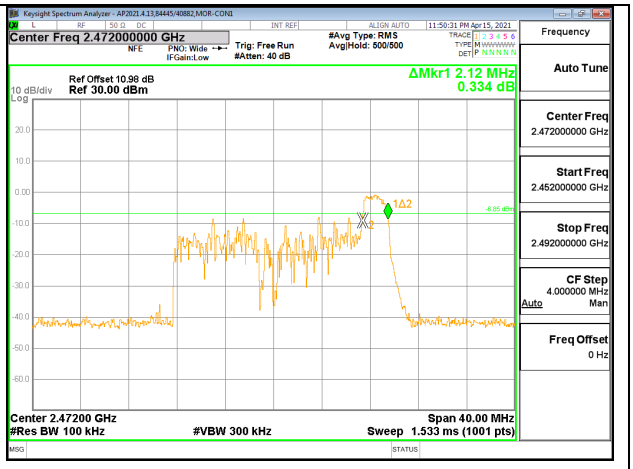


HIGH CHANNEL 12 Antenna B

HIGH CHANNEL 13



HIGH CHANNEL 13 Antenna A



HIGH CHANNEL 13 Antenna B

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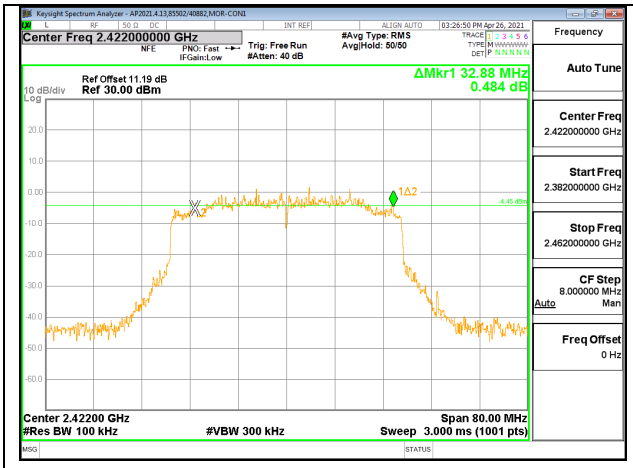
9.2.2. 802.11ax HE40 MODE 2TX

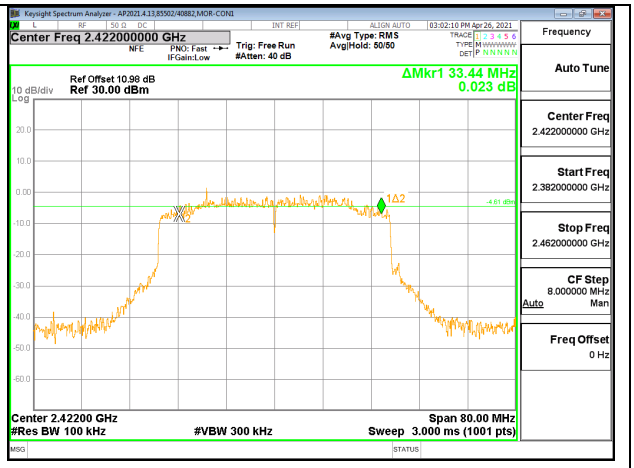
2TX Antenna A + Antenna B OFDMA MODE: SU, Single User

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 3	2422	32.88	33.44	0.5
Mid 6	2437	32.80	29.68	0.5
High 9	2452	36.08	35.44	0.5
High 10	2457	34.48	26.00	0.5
High 11	2462	37.92	37.36	0.5

LOW CHANNEL 3

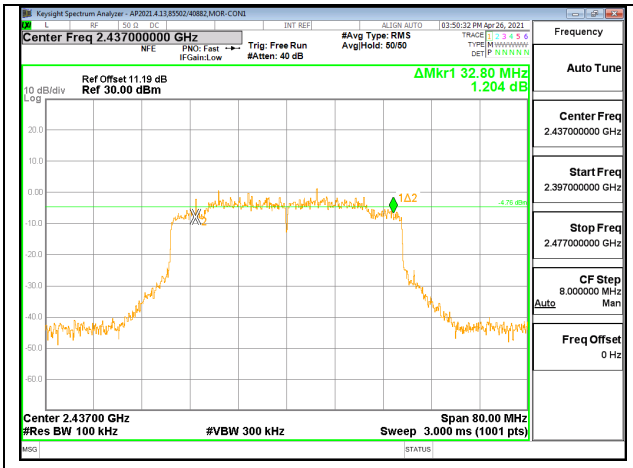


LOW CHANNEL 3 Antenna A

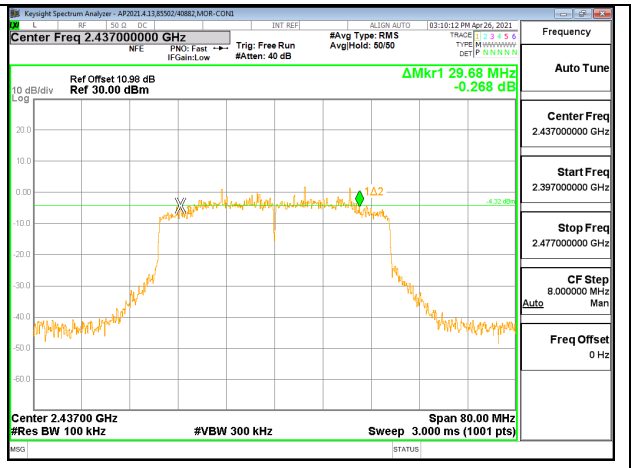


LOW CHANNEL 3 Antenna B

MID CHANNEL 6

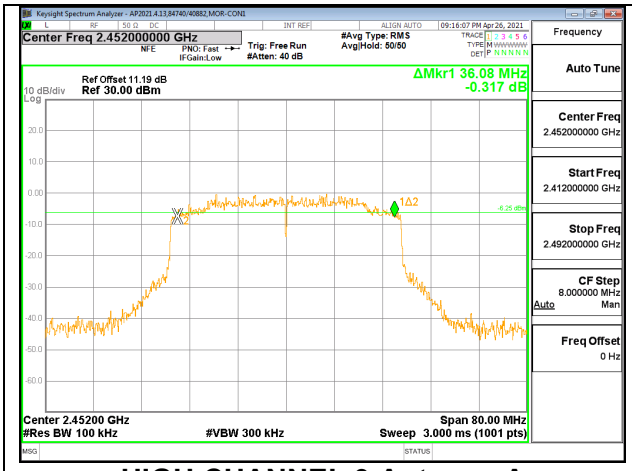


MID CHANNEL 6 Antenna A

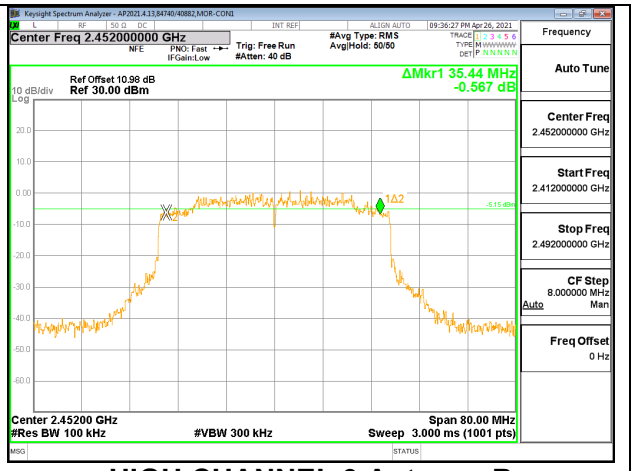


MID CHANNEL 6 Antenna B

HIGH CHANNEL 9

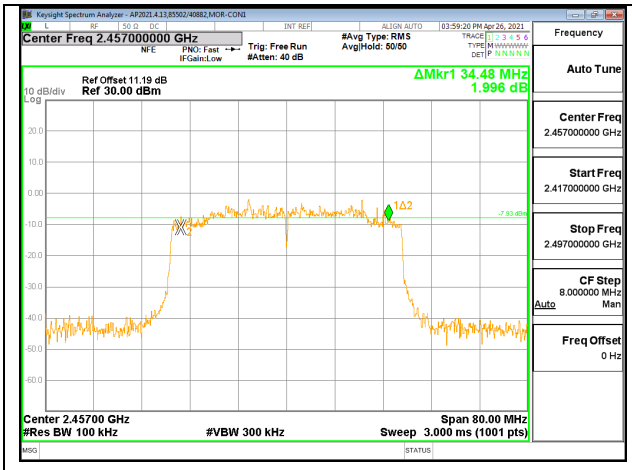


HIGH CHANNEL 9 Antenna A

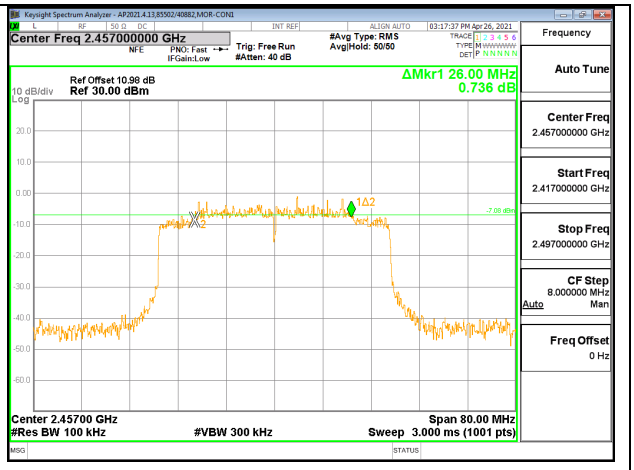


HIGH CHANNEL 9 Antenna B

HIGH CHANNEL 10

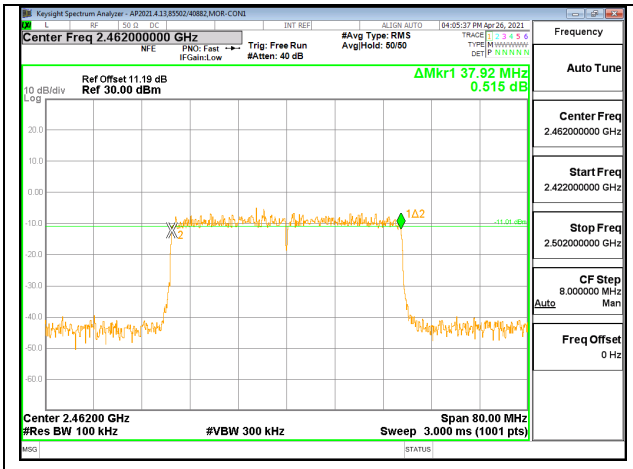


HIGH CHANNEL 10 Antenna A

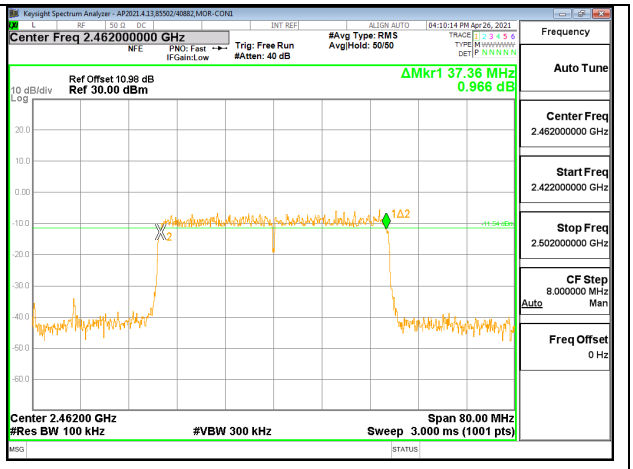


HIGH CHANNEL 10 Antenna B

HIGH CHANNEL 11



HIGH CHANNEL 11 Antenna A

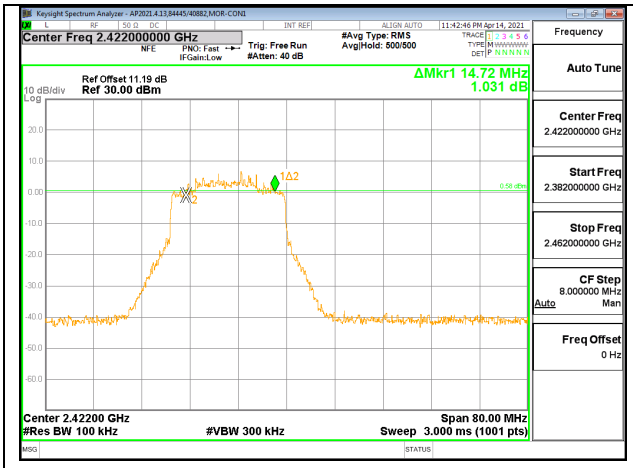


HIGH CHANNEL 11 Antenna B

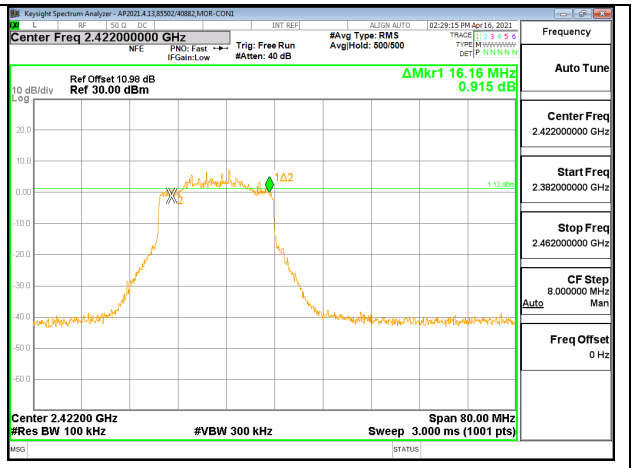
2TX Antenna A + Antenna B OFDMA MODE: 242-Tones, RU Index 61

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 3	2422	14.72	16.16	0.5
Mid 6	2437	17.20	16.80	0.5

LOW CHANNEL 3

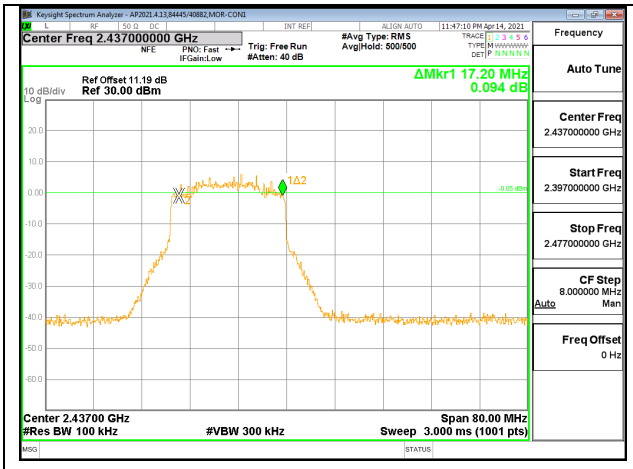


LOW CHANNEL 3 Antenna A

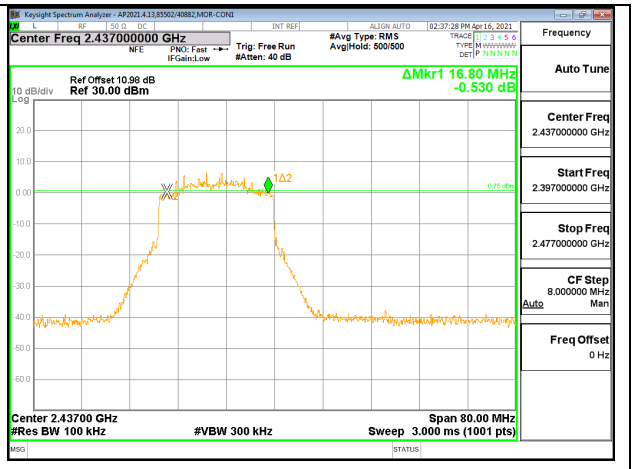


LOW CHANNEL 3 Antenna B

MID CHANNEL 6



MID CHANNEL 6 Antenna A



MID CHANNEL 6 Antenna B

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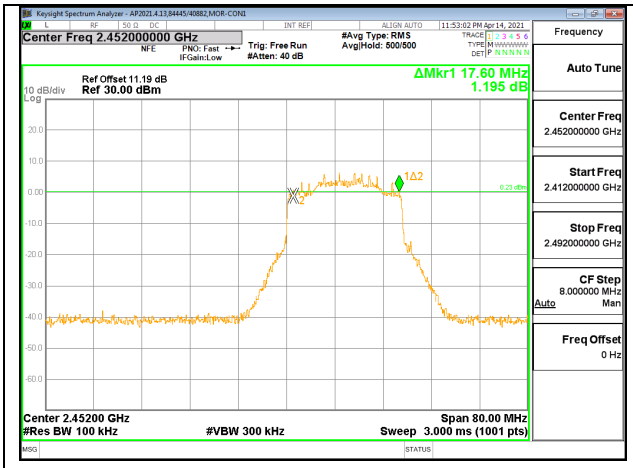
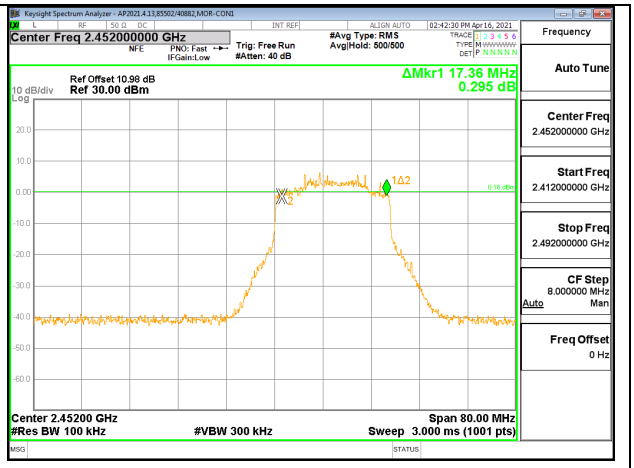
2TX Antenna A + Antenna B OFDMA MODE: 242-Tones, RU Index 62

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
High 9	2452	17.60	17.36	0.5
High 10	2457	17.84	16.24	0.5
High 11	2462	18.64	18.72	0.5

HIGH CHANNEL 9

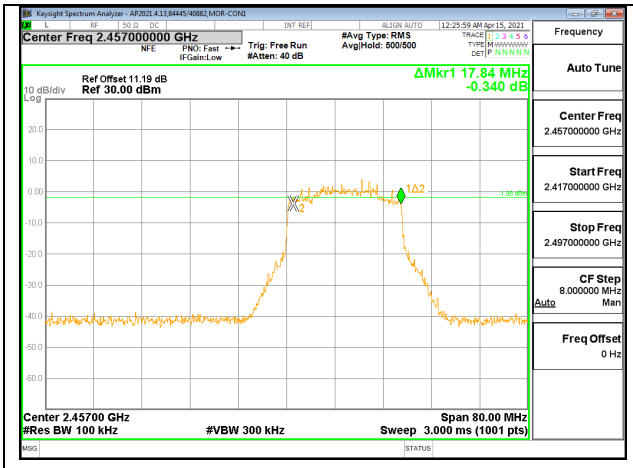


HIGH CHANNEL 9 Antenna A

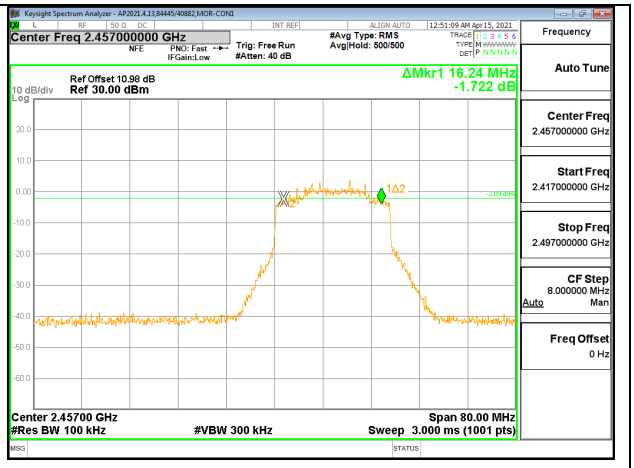


HIGH CHANNEL 9 Antenna B

HIGH CHANNEL 10

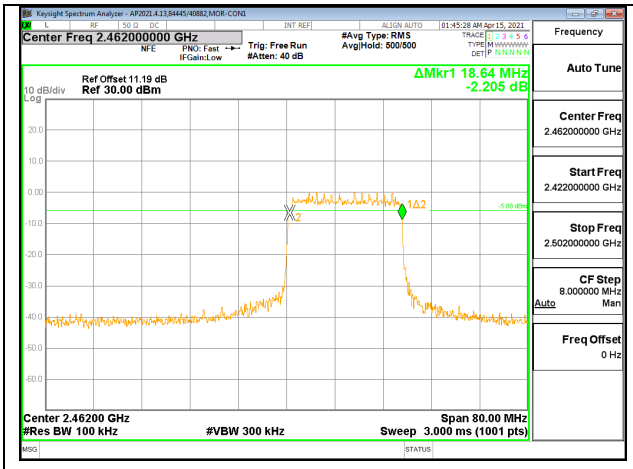


HIGH CHANNEL 10 Antenna A

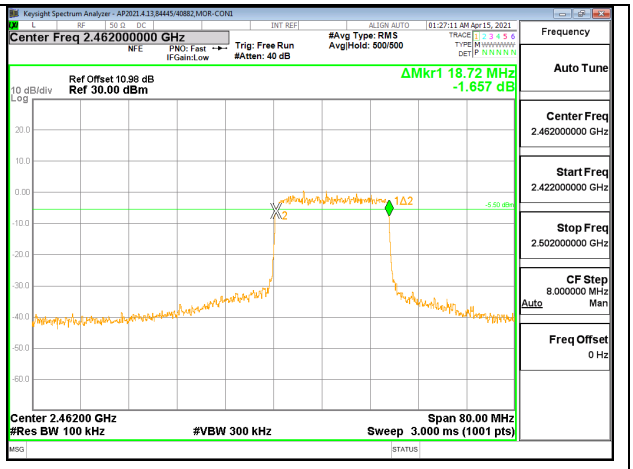


HIGH CHANNEL 10 Antenna B

HIGH CHANNEL 11



HIGH CHANNEL 11 Antenna A



HIGH CHANNEL 11 Antenna B

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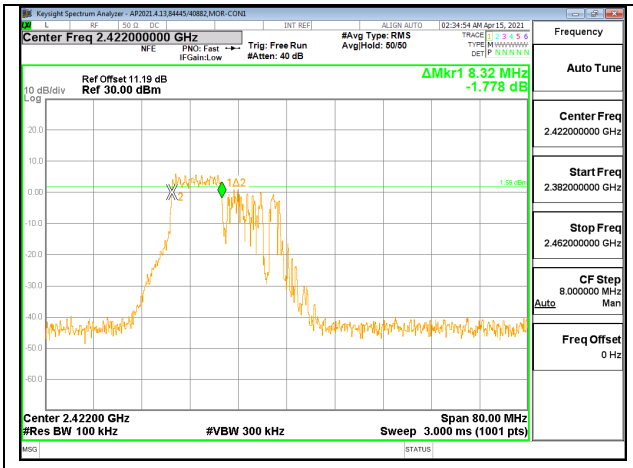
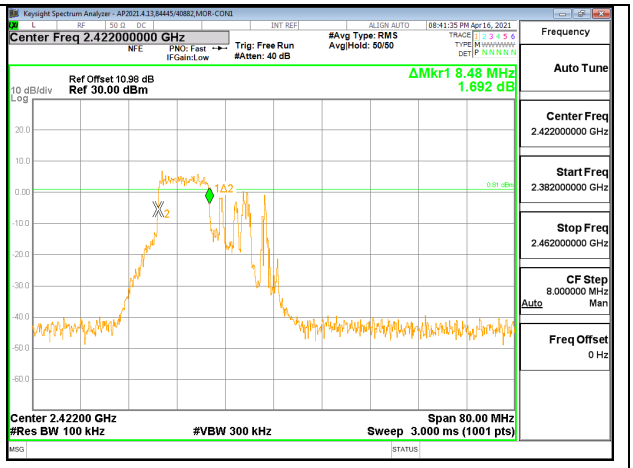
2TX Antenna A + Antenna B OFDMA MODE: 106-Tones, RU Index 53

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 3	2422	8.32	8.48	0.5

LOW CHANNEL 3



LOW CHANNEL 3 Antenna A

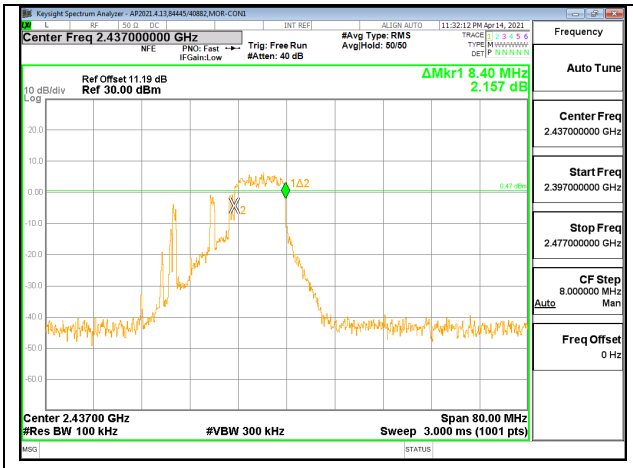


LOW CHANNEL 3 Antenna B

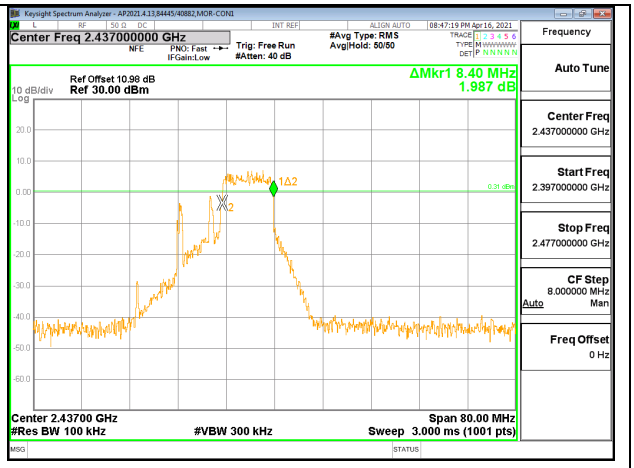
2TX Antenna A + Antenna B OFDMA MODE: 106-Tones, RU Index 54

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Mid 6	2437	8.40	8.40	0.5

MID CHANNEL 6



MID CHANNEL 6 Antenna A

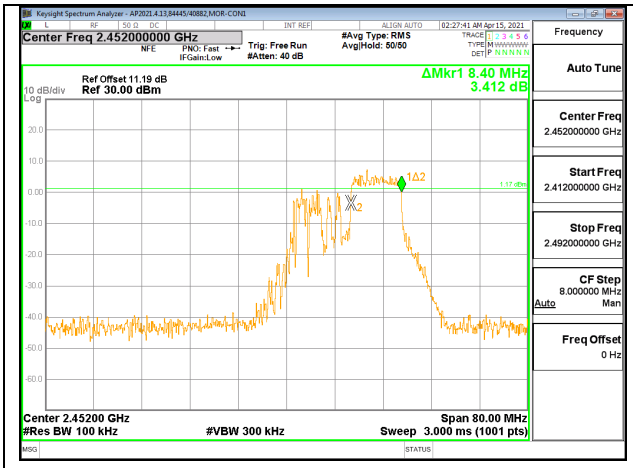


MID CHANNEL 6 Antenna B

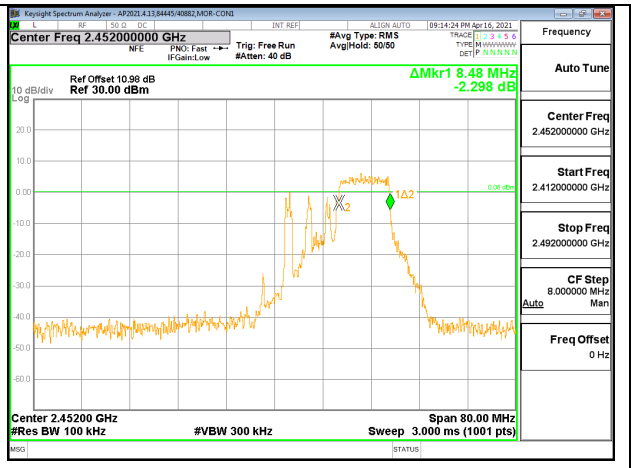
2TX Antenna A + Antenna B OFDMA MODE: 106-Tones, RU Index 56

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
High 9	2452	8.40	8.48	0.5
High 10	2457	8.48	8.48	0.5
High 11	2462	8.32	8.48	0.5

HIGH CHANNEL 9

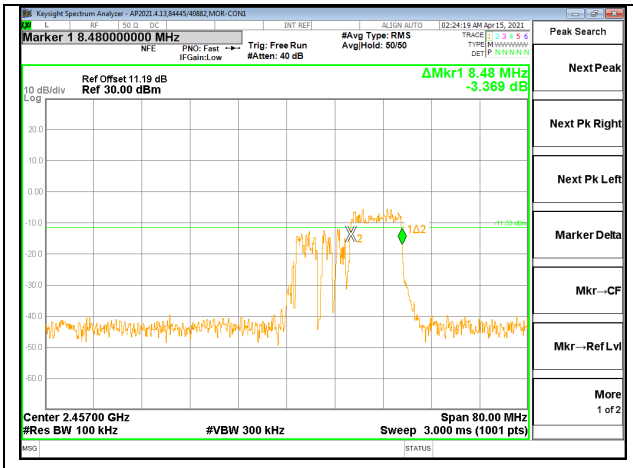


HIGH CHANNEL 9 Antenna A

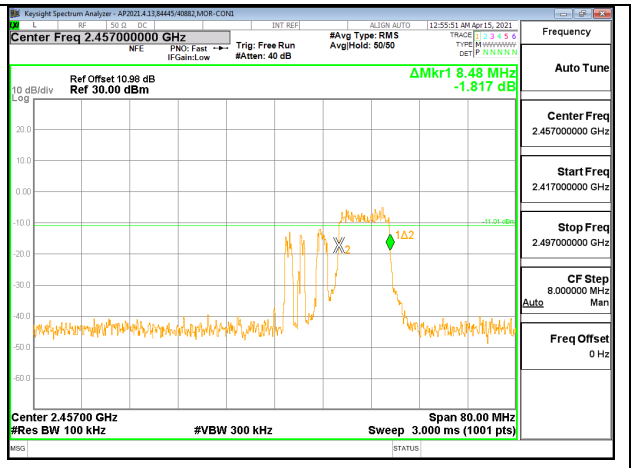


HIGH CHANNEL 9 Antenna B

HIGH CHANNEL 10

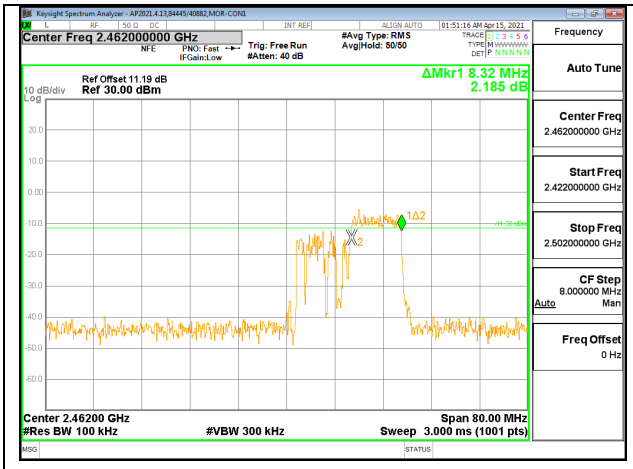


HIGH CHANNEL 10 Antenna A

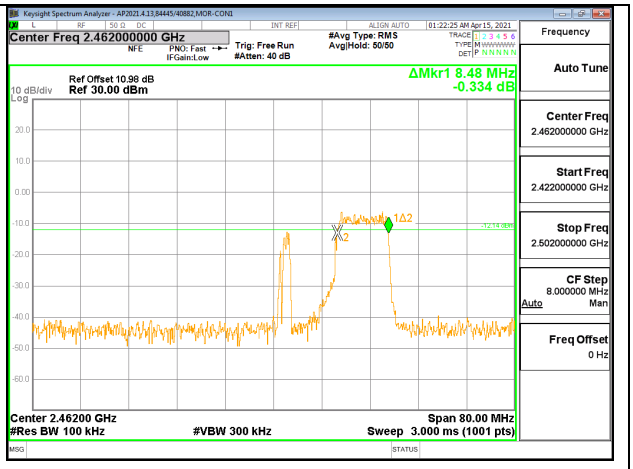


HIGH CHANNEL 10 Antenna B

HIGH CHANNEL 11



HIGH CHANNEL 11 Antenna A

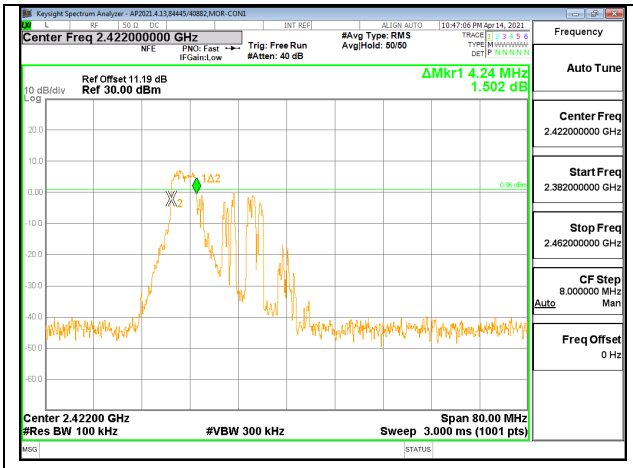


HIGH CHANNEL 11 Antenna B

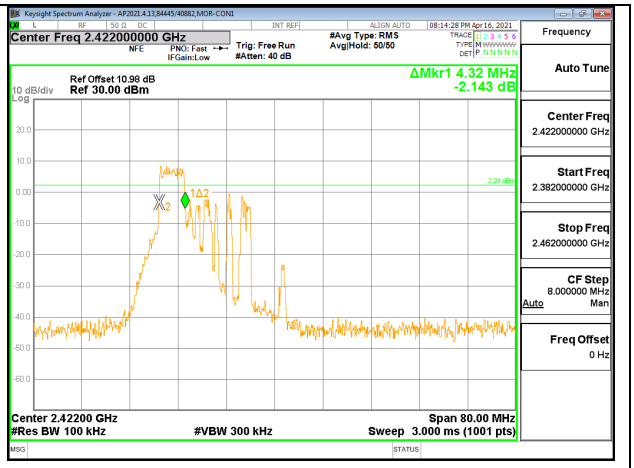
2TX Antenna A + Antenna B OFDMA MODE: 52-Tones, RU Index 37

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Low 3	2422	4.24	4.32	0.5

LOW CHANNEL 3



LOW CHANNEL 3 Antenna A

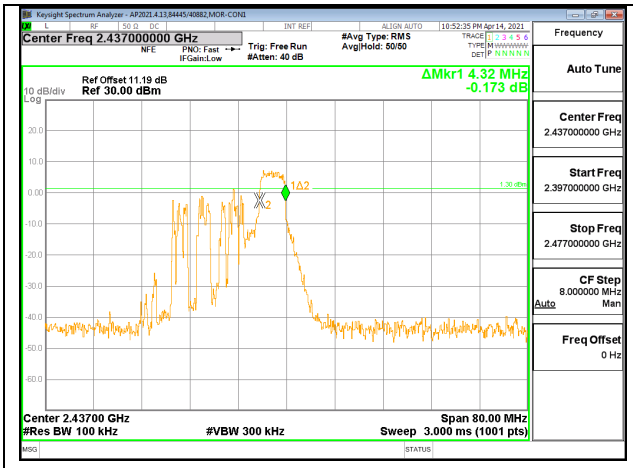


LOW CHANNEL 3 Antenna B

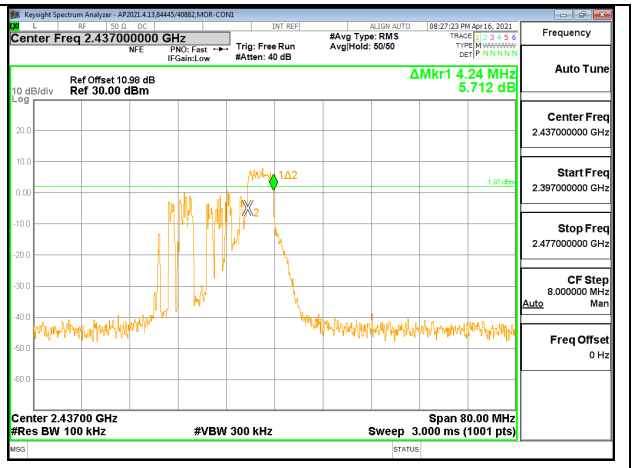
2TX Antenna A + Antenna B OFDMA MODE: 52-Tones, RU Index 40

Channel	Frequency (MHz)	6 dB BW ANT A (MHz)	6 dB BW ANT B (MHz)	Minimum Limit (MHz)
Mid 6	2437	4.32	4.24	0.5

MID CHANNEL 6



MID CHANNEL 6 Antenna A



MID CHANNEL 6 Antenna B