



CERTIFICATION TEST REPORT

Report Number: R12935938-E10

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

Model : 1868

FCC ID : C3K1868

IC : 3048A-1868

EUT Description : Portable Computing Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E (Except DFS)
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:
2019-09-16

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REPORT REVISION HISTORY

Ver.	Issue Date	Revisions	Revised By
1	2019-08-30	Initial Issue	Brian T. Kiewra
2	2019-09-10	Added AC power adaptor to support equipment. Added justification for waiving SISO testing to Section 5.6 Added model similarity explanation to Section 5.1 Revised 802.11ax HE40 SU and 484T RU65 99% BW results in Section 8.2.	Brian T. Kiewra
3	2019-09-16	Added "Scope of Report" as Section 4. Revised radiated emissions reduction statement in Section 6.3.	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: 1868

SERIAL NUMBER: See Section 5.5

DATE TESTED: 2019-07-07 to 2019-09-10

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	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 endorsement by NVLAP, NIST, or any agency of the U.S. government.

Approved & Released
For UL LLC By:



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Prepared By:



Brian T. Kiewra
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UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 789033 D02 v02r01, ANSI C63.10-2013, FCC 06-96, RSS-GEN Issue 5, and RSS-247 Issue 2.

This report pertains to the 802.11ax mode requirements of EUT 1868.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27590, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
☐ Chamber A RTP	☒ North Chamber
☐ Chamber C RTP	☒ South Chamber

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

4. SCOPE OF REPORT

This test report covers the radiated emissions and antenna port conducted emissions for model 1868 for 5.8 GHz 802.11ax HE20, HE40, HE80, and HE160. Antenna port conducted emissions data in this report is leveraged by model 1867. For model 1867, radiated emissions can be found in UL report number R12922855-E10. For model 1868, AC mains line conducted emissions and worst-case radiated emissions can be found in UL report number R12935938-E11.

For the antenna port conducted emissions portion of this report, the worst-case antenna gain across both models was used to represent a worst-case scenario. Both models will be implemented with the same power.

Models 1867 and 1868 are electrically and RF equivalent as they use the same motherboard, radio module and on-board RF components. Both models share a common WiFi and BT power table. The radio-related firmware and driver versions are the same for the two models. The peak antenna gains are in the antenna gain section of the report. Antenna port conducted emissions measurements are done on model 1868 (FCC ID: C3K1868, IC: 3048A-1868) and the data is leveraged for model 1867 (FCC ID: C3K1867, IC: 3048A-1867). Highest antenna gain across the two models in each band has been considered while doing the conducted emissions measurements. Separate radiated & SAR measurements are done on each model.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. 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

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	2.00%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
RF output power, radiated (SAC)	4.52 dB
Power Spectral Density, conducted	2.47 dB
All emissions, radiated	5.17 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Portable Computing Device that contains 802.11 a/ac/ax/b/g/n 20/40/80/160MHz 2x2 dual band and BT/BLE radios.

Models 1867 and 1868 are electrically and RF equivalent as they use the same motherboard, radio module and on-board RF components. Both models share a common WiFi and BT power table. The radio-related firmware and driver versions are the same for the two models. The peak antenna gains are in the antenna gain section of the report. Antenna port conducted emissions measurements are done on model 1868 (FCC ID: C3K1868, IC: 3048A-1868) and the data is leveraged for model 1867 (FCC ID: C3K1867, IC: 3048A-1867). Highest antenna gain across the two models in each band has been considered while doing the conducted emissions measurements. Separate radiated & SAR measurements are done on each model.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 2TX			
5745-5825	802.11ax HE20 OFDMA, 52-Tones	21.60	144.54
5755-5795	802.11ax HE40 OFDMA, 106-Tones	21.98	157.76
5775	802.11ax HE80 OFDMA, 242-Tones	22.07	161.06

6.3. TEST REDUCTIONS CASES

99% bandwidth:

- The narrowest (a representative RU) and widest modes were tested.

6dB bandwidth:

- The narrowest (a representative RU) and widest modes were tested.

Power measurements:

- All tones were tested for each bandwidth.
- Low, middle, and high RU allocation were tested.

Power spectral density:

- All tones were tested for each bandwidth.
- Low, middle, and high RU allocation were tested.

Radiated band edge:

- All tones and bandwidths were tested.
- The RU allocations closest to the band edge was tested to cover all other RU allocations.

Radiated and conducted spurious emissions:

- For 5.8GHz band, multiple modes were investigated and for final measurements HE20 26T was used. The output power for this mode was set to a power setting that represented both the highest output power and highest PSD across all production power settings for all bandwidth / RU configurations.

6.4. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	Antenna Type	Peak Gain (dBi) Chain 0 (Right)	Peak Gain (dBi) Chain 1 (Left)
Model 1867			
2.4 to 2.48	PIFA	0.7	2.6
5.15 to 5.25		4.9	4.4
5.25 to 5.35		6.1	5.0
5.47 to 5.72		7.2	5.5
5.725 to 5.85		9.4	5.6
Model 1868			
2.4 to 2.48	PIFA	0.4	1.0
5.15 to 5.25		3.6	2.2
5.25 to 5.35		5.2	3.5
5.47 to 5.72		6.4	4.7
5.725 to 5.85		7.8	4.5

The 5 GHz WLAN radio utilizes Chain 0 and chain 1.

NOTE: Antenna 1 = Chain 0

Antenna 2 = Chain 1

Using antenna gains from model 1867 as worst-case since the conducted data is being leveraged by model 1867.

6.5. SOFTWARE AND FIRMWARE

EUT	Serial Number	DRTU Version	OS Version	BT Driver Version	WiFi Driver Version	EUT's Power Supply (s/n)
R-557-1868-FCC-CONDUCTED-02	005210692757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P01P9596
R-557-1868-FCC-CONDUCTED-03	005216792757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P03GE596
R-557-1868-FCC-RADIATED-10	013886292757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P02KC596
R-557-1868-FCC-RADIATED-11	013891692757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P01S7596

6.6. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emissions were performed in worst-case test report R12935938-E11.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The EUT has one intended orientations, X; therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates as provided by the client were:

802.11ax HE20mode: MCS0 NSS2
802.11ax HE40mode: MCS0 NSS2
802.11ax HE80mode: MCS0 NSS2

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

MIMO and SISO power are same setting per chain, therefore MIMO mode tested as worst-case to cover SISO mode.

6.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
USB Hub	J5 Create	JCA374	AY2A1904000477 / AY6A1903004261	N/A
Earbuds	Sony	MDR-EX14AP	Non-Serialized	N/A
AC Adaptor	Microsoft	1706	0D130P02KC596	N/A
USB Flash Drive	Kingston	Data Traveler G4	Non-Serialized	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	<3m	None
2	USB-A	1	USB-A	USB	<3m	None
3	USB-C	1	USB-C	USB	<3m	None
4	Aux	1	Aux	Aux	<3m	None

TEST SETUP

The test utility software was located on the EUT during the tests and was used to exercised the radios.

SETUP DIAGRAMS

Please refer to 12935938-EP1 for setup diagrams

7. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North 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	2019-03-22	2020-03-22
Gain-Loss Chains					
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-15	2020-03-15
Receiver & Software					
SA0026	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-19
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

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.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South 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	2019-04-22	2020-04-22
Gain-Loss Chains					
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-13	2020-03-13
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2019-02-28	2020-02-28
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

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.

Test Equipment Used – Antenna Port Conducted Testing (Morrisville)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027	PXA Signal Analyzer	Keysight Technologies	MY54490254	2019-05-15	2020-05-15
s/n 160938893	Environmental Meter	Fisher Scientific	14-650-118	2019-06-17	2020-06-17
224604-002	Coaxial Testing Cable	Uti-flex	UFA147A-0-0180-200200	NA	NA
Antenna Port	Antenna Port Software	Antenna	Version 10.0.1	NA	NA
126431 (PRE0128068)	RF Power Meter	Anritsu	ML2495A	2019-04-30	2020-04-30
126430 (PRE0128067)	Pulse Power Sensor, 300MHz to 40GHz	Anritsu	MA2411B	2019-04-30	2020-04-30
PWM001 (PRE0136343)	RF Power Meter	Keysight Technologies	N1912A	2019-06-14	2020-06-14
PWS001 (PRE0137347)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2019-05-06	2020-05-06
T177	PSA Signal Analyzer	Keysight Technologies	E4446A	2019-04-22	2020-04-22
HI0090	Environmental Meter	Fisher Scientific	17-E670X-80-1	2019-06-17	2020-06-17
Antenna Port	Antenna Port Software	Antenna	Version 10.0.1	NA	NA

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.

8. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 789033 D02 v02r01, Section II B.

6 dB Emission BW: KDB 789033 D02 v02r01, Section II C.2

99% Occupied BW: KDB 789033 D02 v02r01, Section II D.

Conducted Output Power: KDB 789033 D02 v02r01, Section II E.3.b (Method PM-G)

Power Spectral Density: KDB 789033 D02 v02r01, Section II F

Unwanted emissions in restricted bands: KDB 789033 D02 v02r01, Section II G.3, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v02r01, Section II G.3 and G.5.

9. ANTENNA PORT TEST RESULTS FOR 11ax 5.8 GHz

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

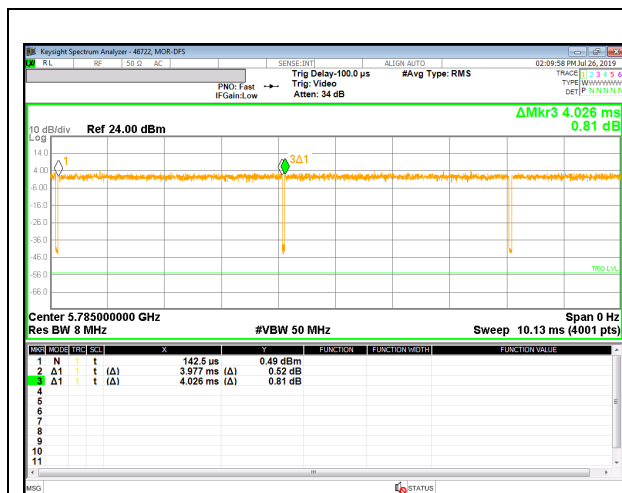
PROCEDURE

789033 D02 Zero-Span Spectrum Analyzer Method.

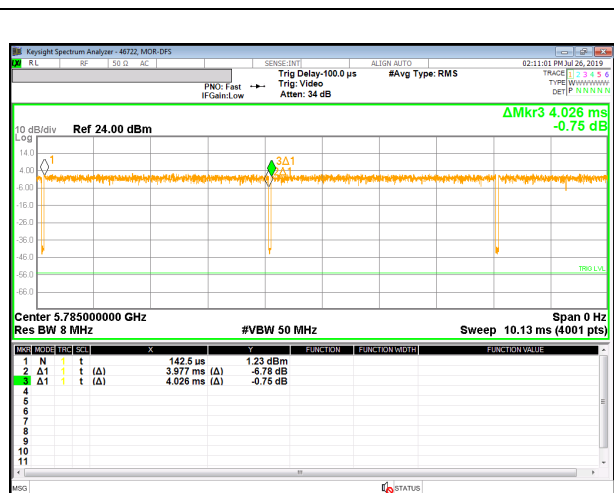
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11ax HE20 OFDMA, SU	3.967	4.013	0.989	98.85%	0.00	0.010
802.11ax HE20 OFDMA, RU size 242T	3.977	4.026	0.988	98.78%	0.00	0.010
802.11ax HE20 OFDMA, RU size 106T	3.977	4.026	0.988	98.78%	0.00	0.010
802.11ax HE20 OFDMA, RU size 52T	3.977	4.026	0.988	98.78%	0.00	0.010
802.11ax HE20 OFDMA, RU size 26T	3.977	4.026	0.988	98.78%	0.00	0.010
802.11ax HE40 OFDMA, SU	3.968	4.015	0.988	98.83%	0.00	0.010
802.11ax HE40 OFDMA, RU size 484T	3.975	4.025	0.988	98.76%	0.00	0.010
802.11ax HE40 OFDMA, RU size 242T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE40 OFDMA, RU size 106T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE40 OFDMA, RU size 52T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE40 OFDMA, RU size 26T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE80 OFDMA, SU	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE80 OFDMA, RU size 996T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE80 OFDMA, RU size 484T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE80 OFDMA, RU size 242T	3.978	4.027	0.988	98.78%	0.00	0.010
802.11ax HE80 OFDMA, RU size 106T	3.978	4.030	0.987	98.71%	0.00	0.010
802.11ax HE80 OFDMA, RU size 52T	3.978	4.030	0.987	98.71%	0.00	0.010
802.11ax HE80 OFDMA, RU size 26T	3.978	4.030	0.987	98.71%	0.00	0.010

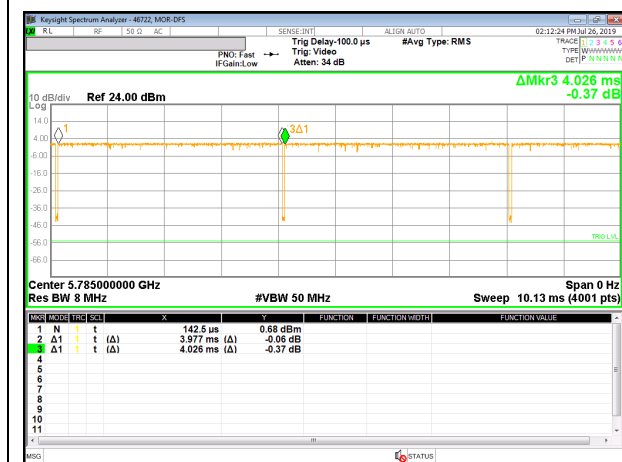
DUTY CYCLE PLOTS



802.11ax HE20 OFDMA, RU size 242T MODE



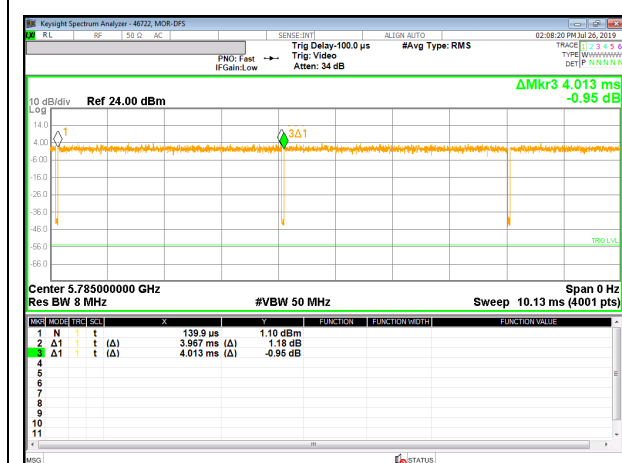
802.11ax HE20 OFDMA, RU size 106T MODE



802.11ax HE20 OFDMA, RU size 52T MODE

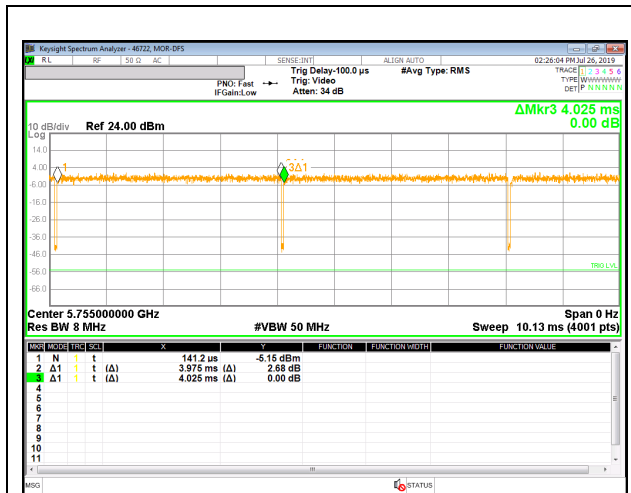


802.11ax HE20 OFDMA, RU size 26T MODE

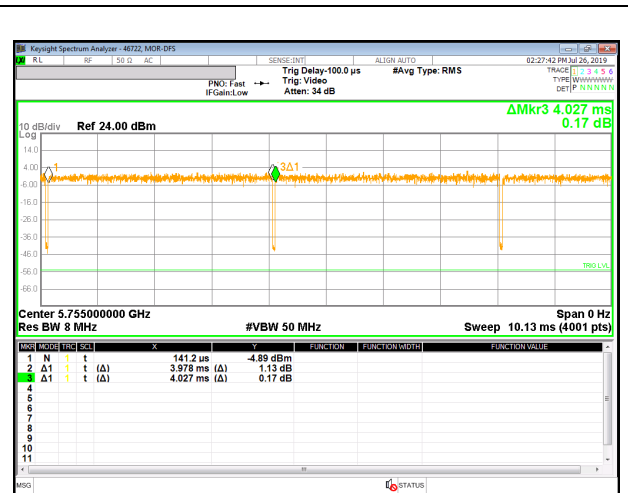


802.11ax HE20 OFDMA, SU MODE

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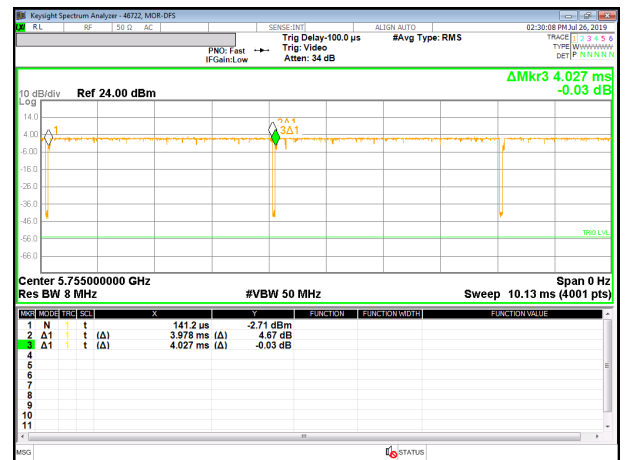
802.11ax HE40 OFDMA, RU size 484T MODE



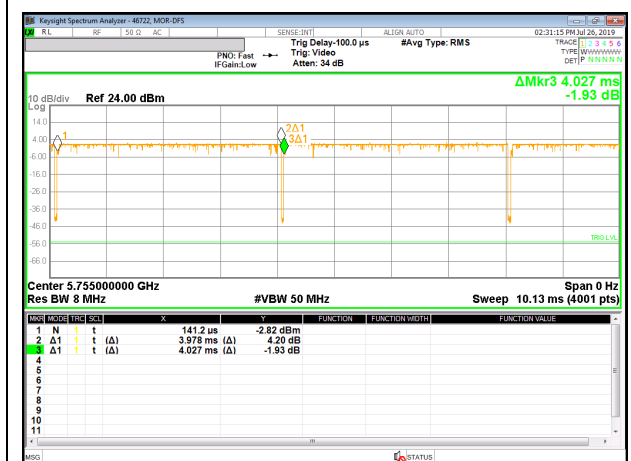
802.11ax HE40 OFDMA, RU size 242T MODE



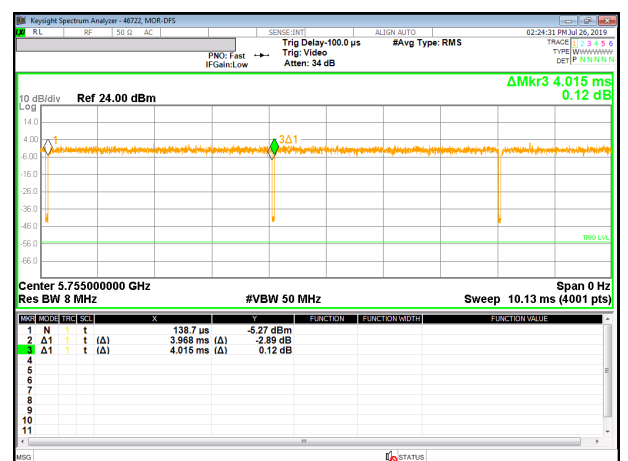
802.11ax HE40 OFDMA, RU size 106T MODE



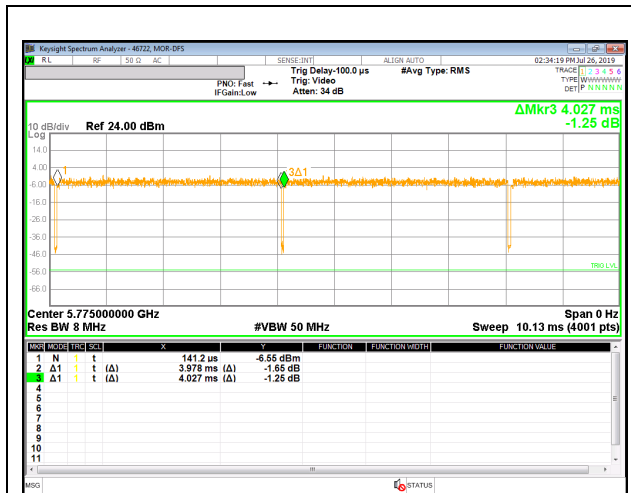
802.11ax HE40 OFDMA, RU size 52T MODE



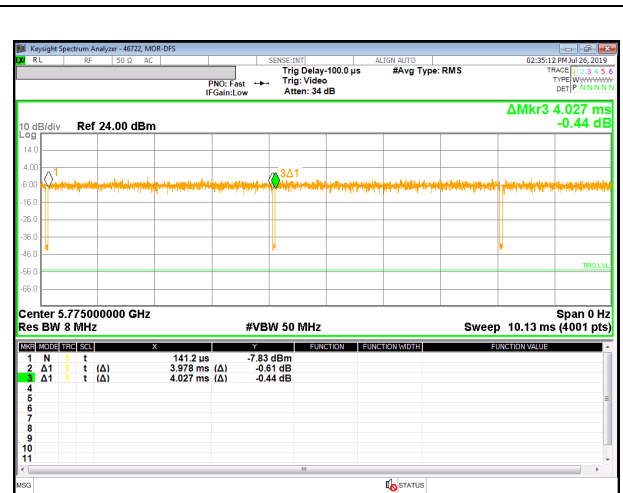
802.11ax HE40 OFDMA, RU size 26T MODE



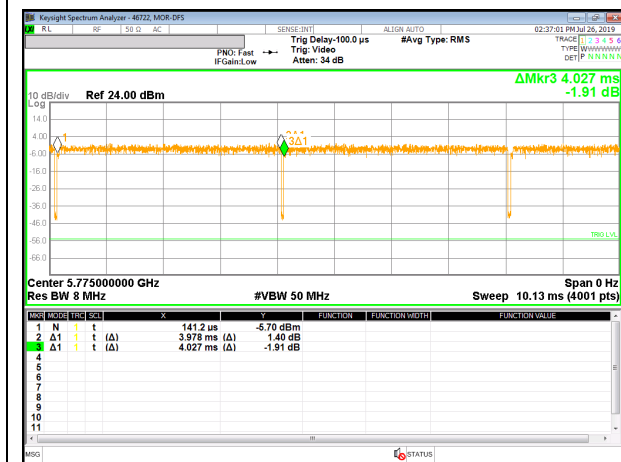
802.11ax HE40 OFDMA, SU



802.11ax HE80 OFDMA, RU size 996T MODE



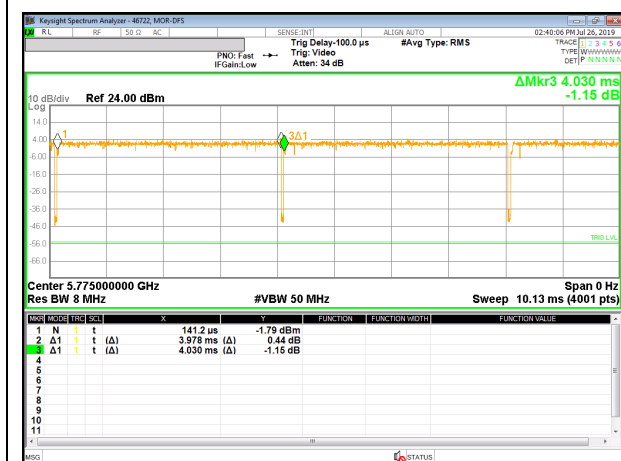
802.11ax HE80 OFDMA, RU size 484T MODE



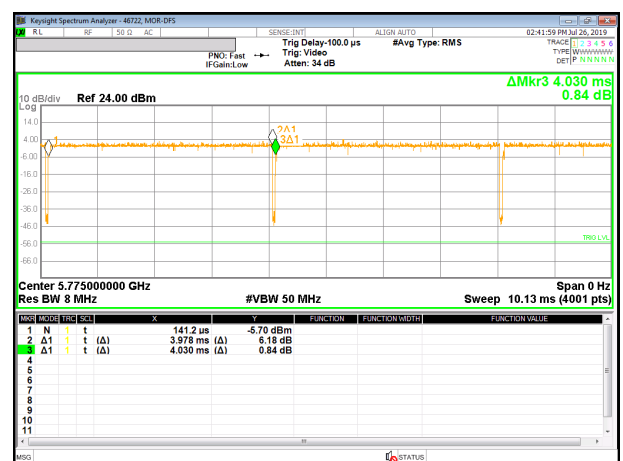
802.11ax HE80 OFDMA, RU size 242T MODE



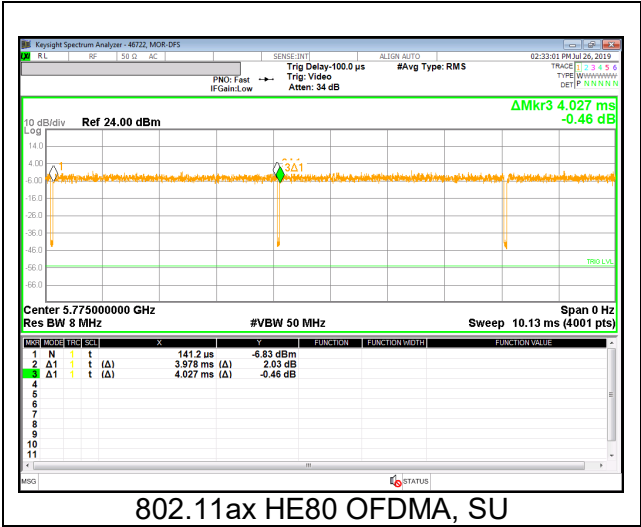
802.11ax HE80 OFDMA, RU size 106T MODE



802.11ax HE80 OFDMA, RU size 52T MODE



802.11ax HE80 OFDMA, RU size 26T MODE



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9.2. 99% BANDWIDTH

LIMITS

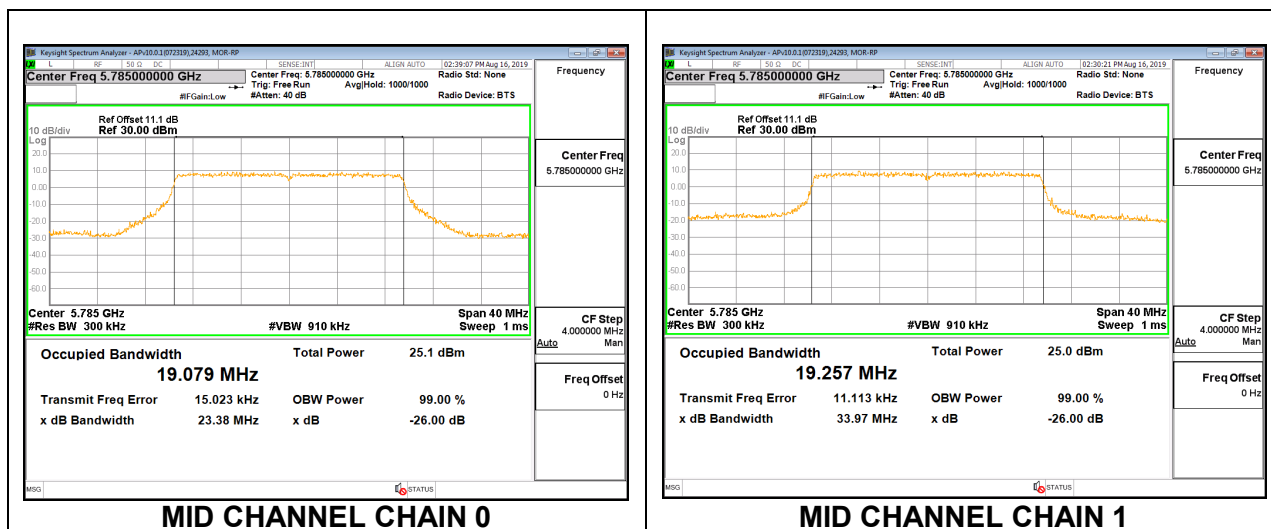
None; for reporting purposes only.

9.2.1. 802.11ax HE20 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Low	5745	19.109	19.104
Mid	5785	19.079	19.257
High	5825	19.138	19.216

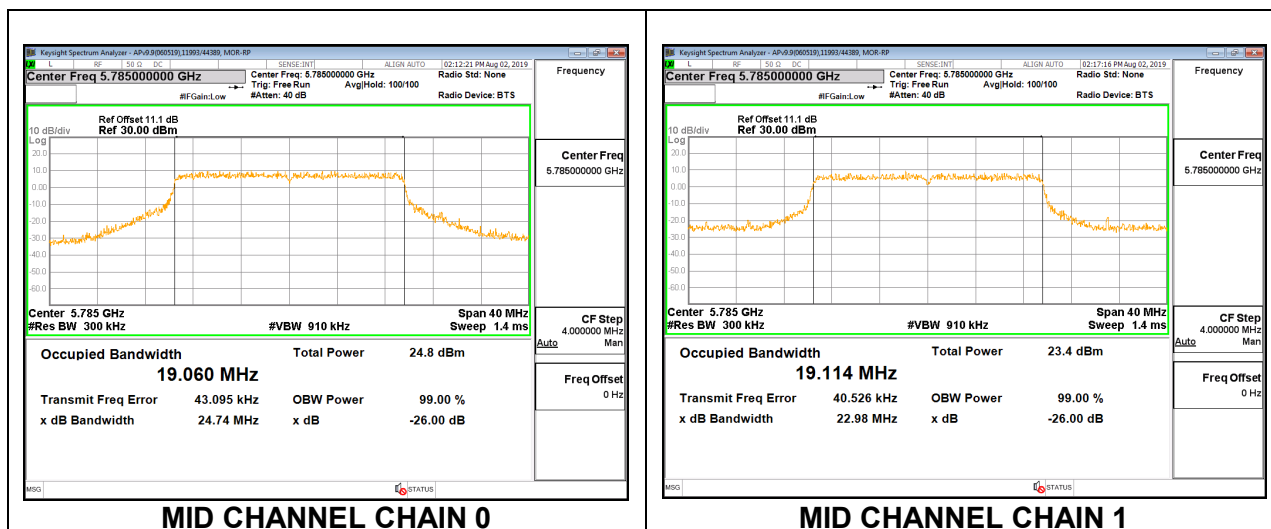
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Low	5745	19.148	19.062
Mid	5785	19.060	19.114
High	5825	19.156	19.103

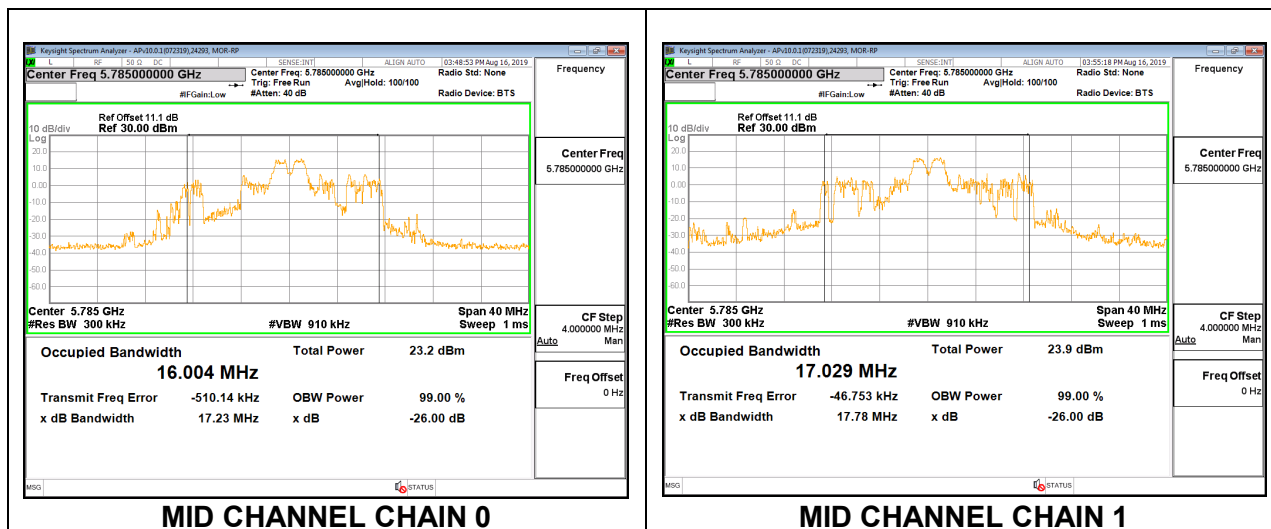
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 26-Tones, RU Index 4

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Low	5745	16.038	17.138
Mid	5785	16.004	17.029
High	5825	16.048	16.499

MID CHANNEL

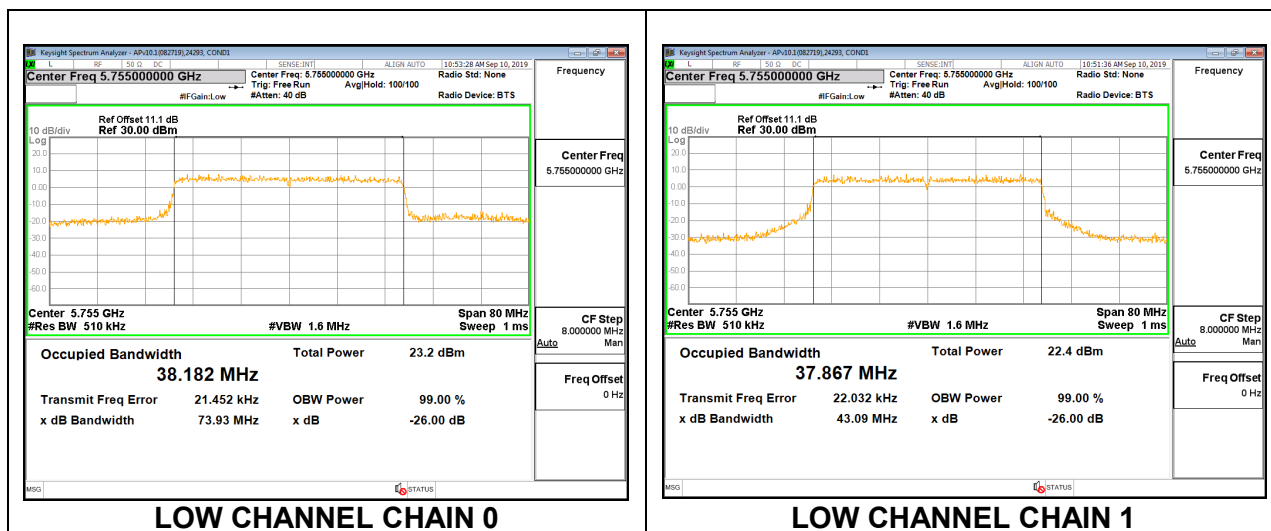


9.2.2. 802.11ax HE40 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Low	5755	38.182	37.867
High	5795	37.919	38.350

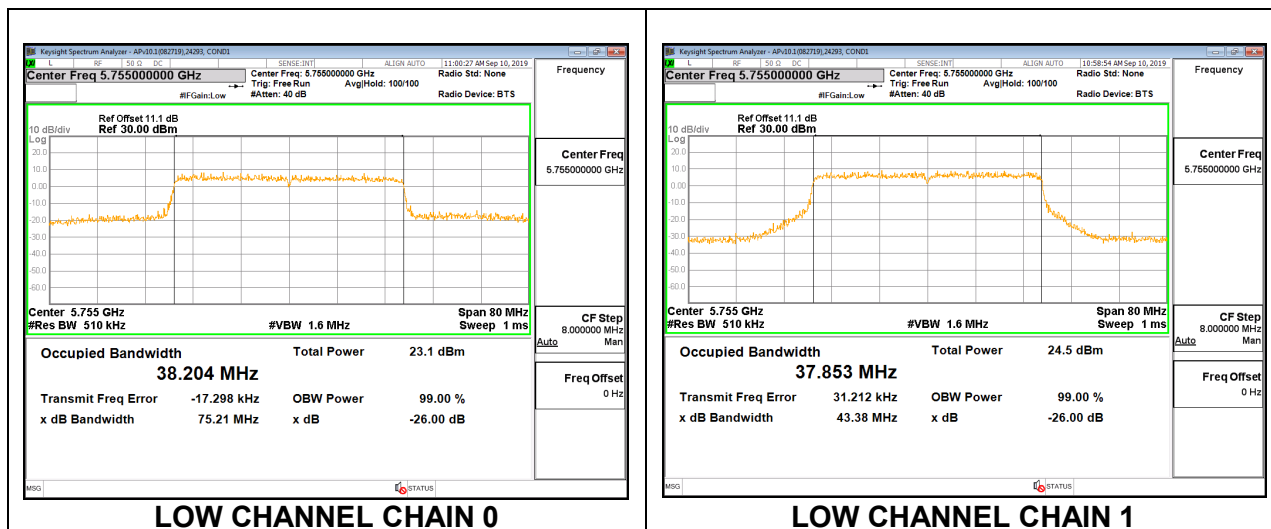
LOW CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 484-Tones, RU Index 65

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Low	5755	38.204	37.853
High	5795	37.916	38.067

LOW CHANNEL

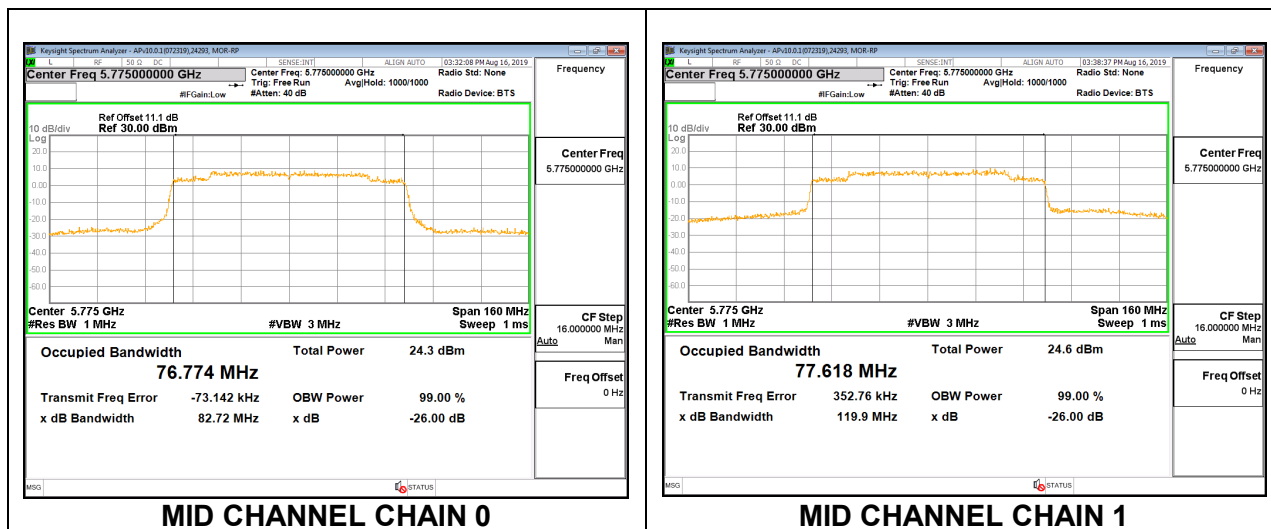


9.2.3. 802.11ax HE80 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Mid	5775	76.77	77.62

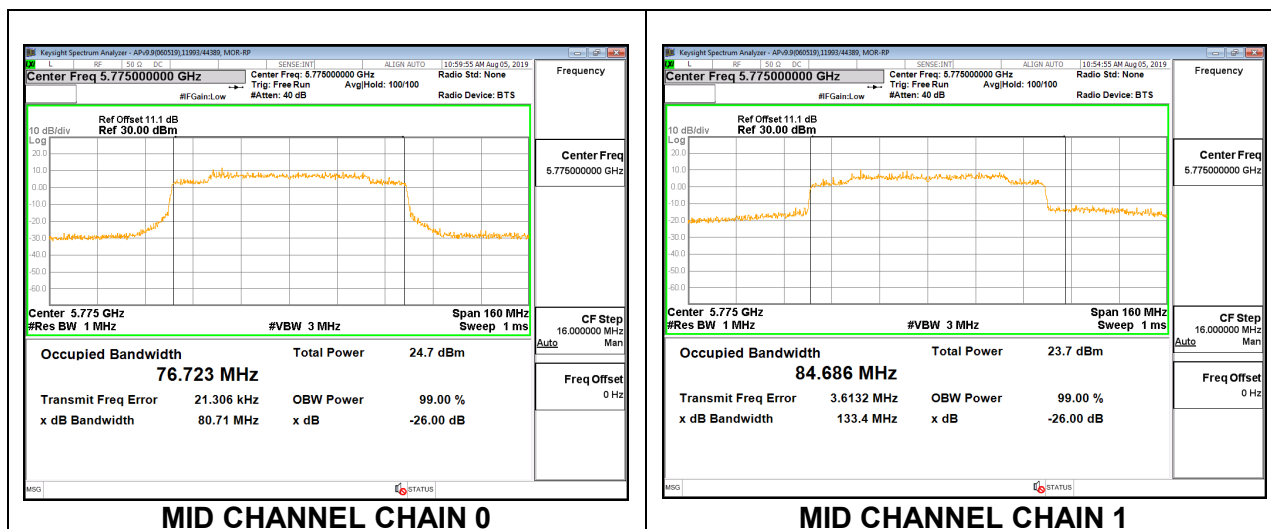
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 996-Tones, RU Index 67

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)
Mid	5775	76.723	84.686

MID CHANNEL



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)
RSS-247 6.2.4.1

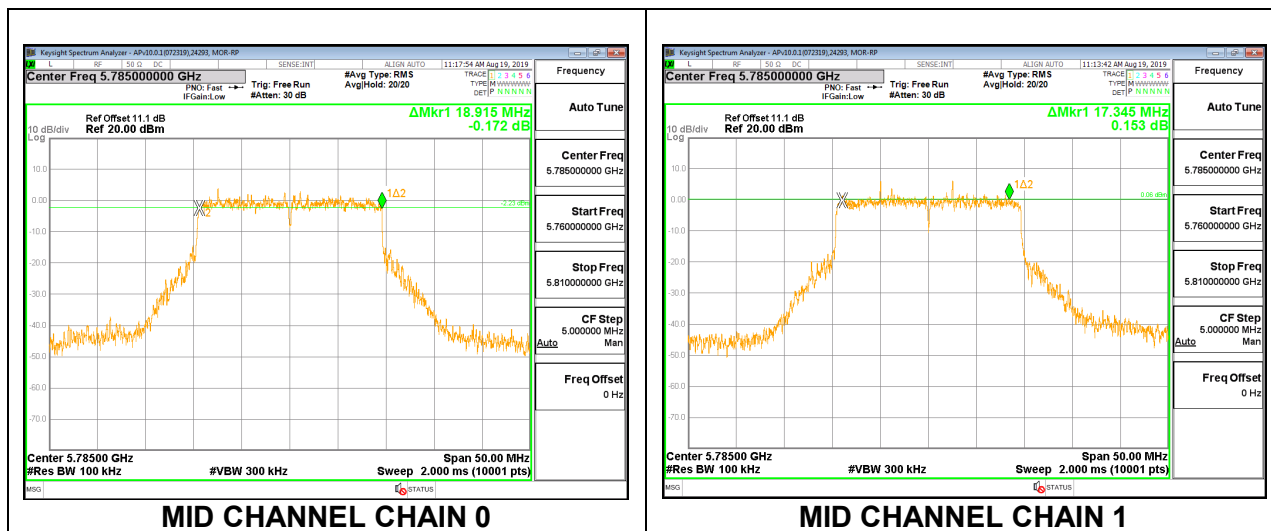
The minimum 6 dB bandwidth shall be at least 500 kHz.

9.3.1. 802.11ax HE20 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	19.080	18.440	0.5
Mid	5785	18.915	17.345	0.5
High	5825	19.110	19.025	0.5
144	5720	4.526	4.636	0.5

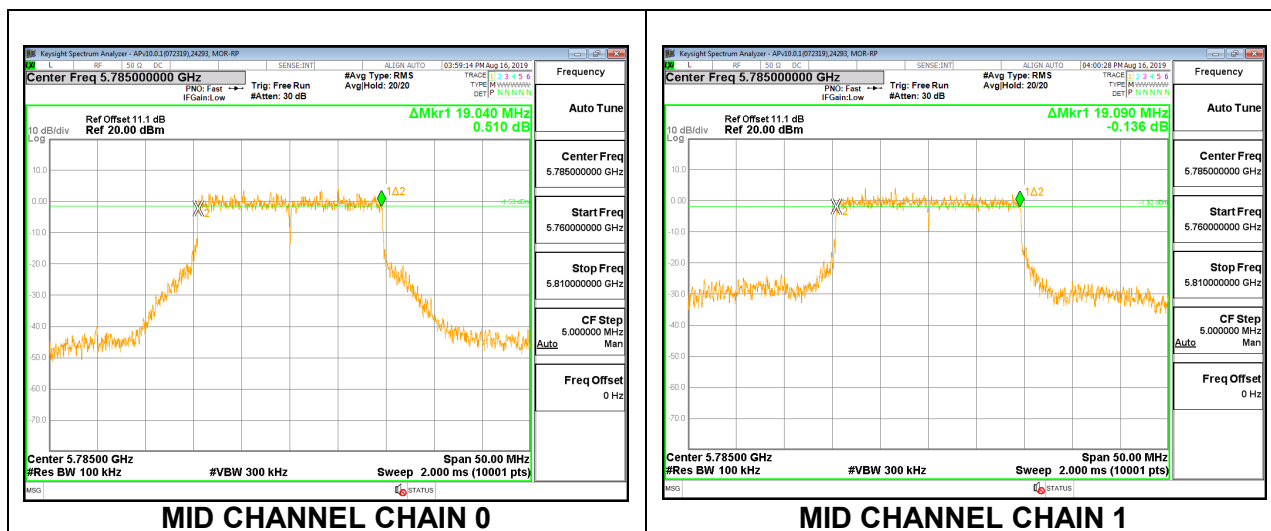
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 242-Tones, RU Index 61

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	19.030	18.985	0.5
Mid	5785	19.040	19.090	0.5
High	5825	18.765	19.070	0.5
144	5720	4.495	4.562	0.5

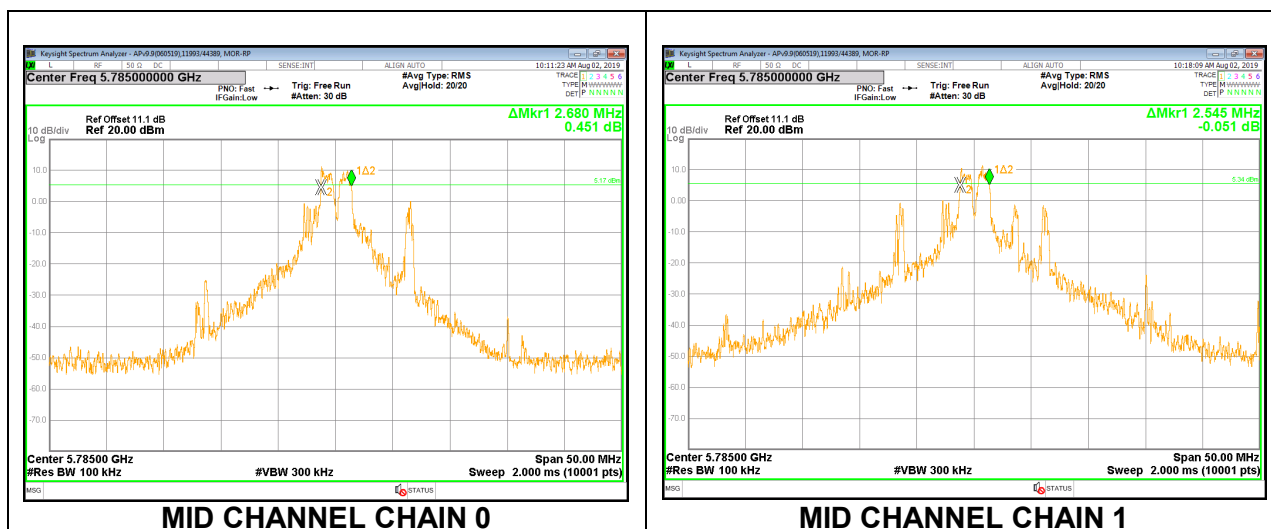
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 26-Tones, RU Index 4

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	2.580	2.605	0.5
Mid	5785	2.680	2.545	0.5
High	5825	2.520	2.570	0.5

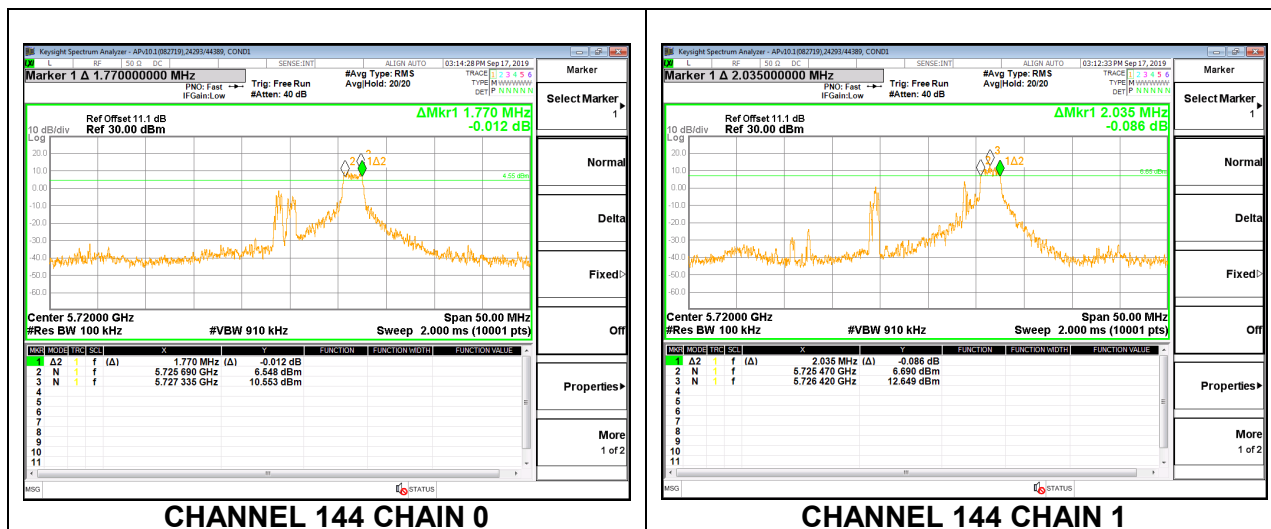
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 26-Tones, RU Index 7 Straddle Channel

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
144	5720	1.770	2.035	0.5

CHANNEL 144

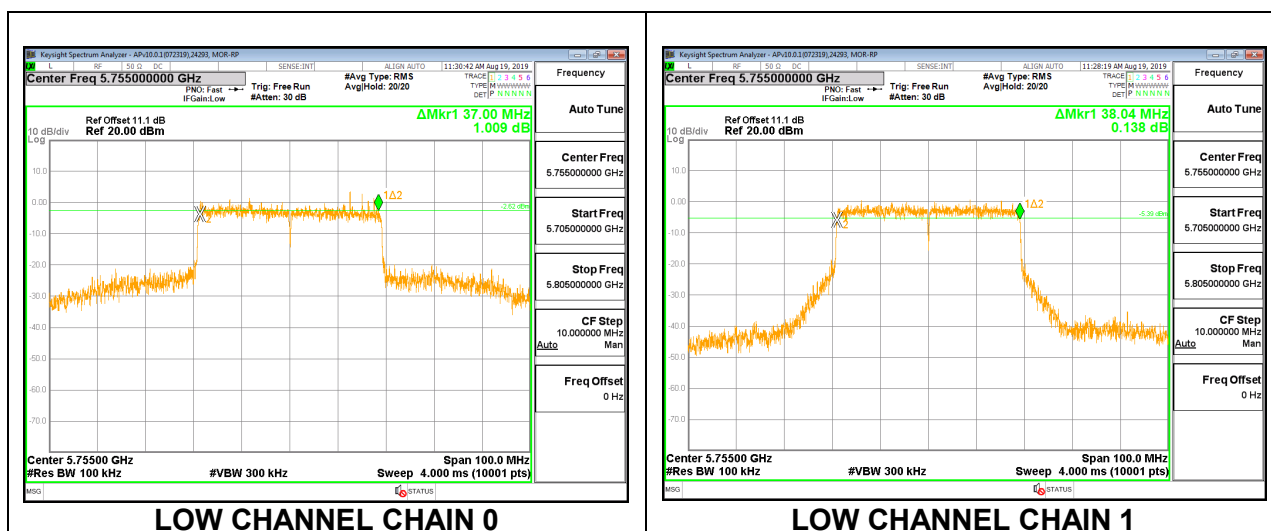


9.3.2. 802.11ax HE40 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5755	37.000	38.040	0.5
High	5795	37.210	37.220	0.5
142	5710	4.080	4.120	0.5

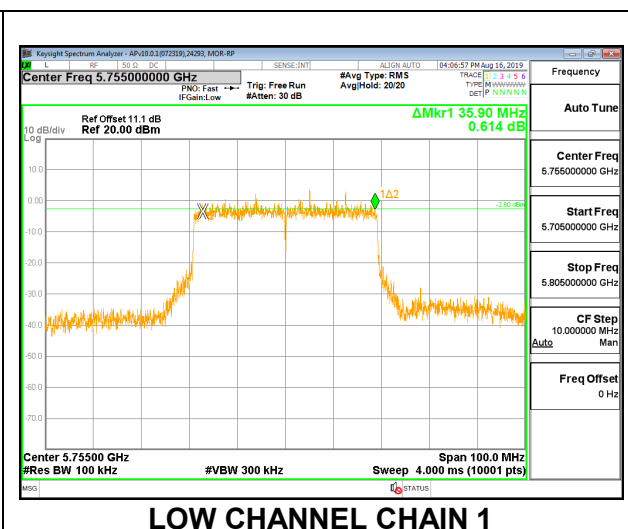
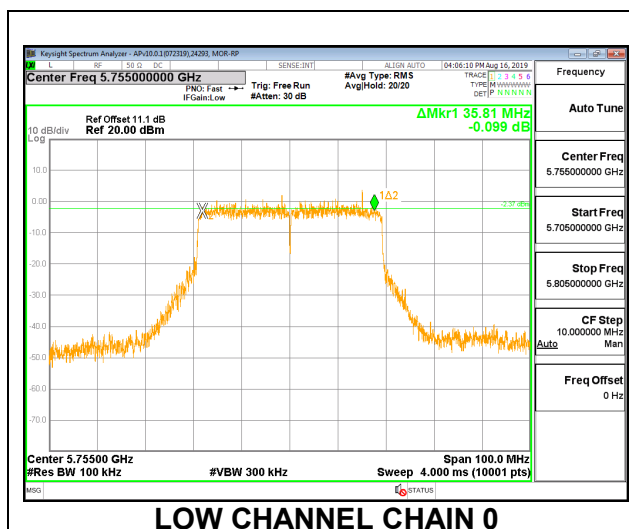
LOW CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 484-Tones, RU Index 65

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5755	35.81	35.90	0.5
High	5795	36.27	35.93	0.5
142	5710	3.650	4.100	0.5

LOW CHANNEL

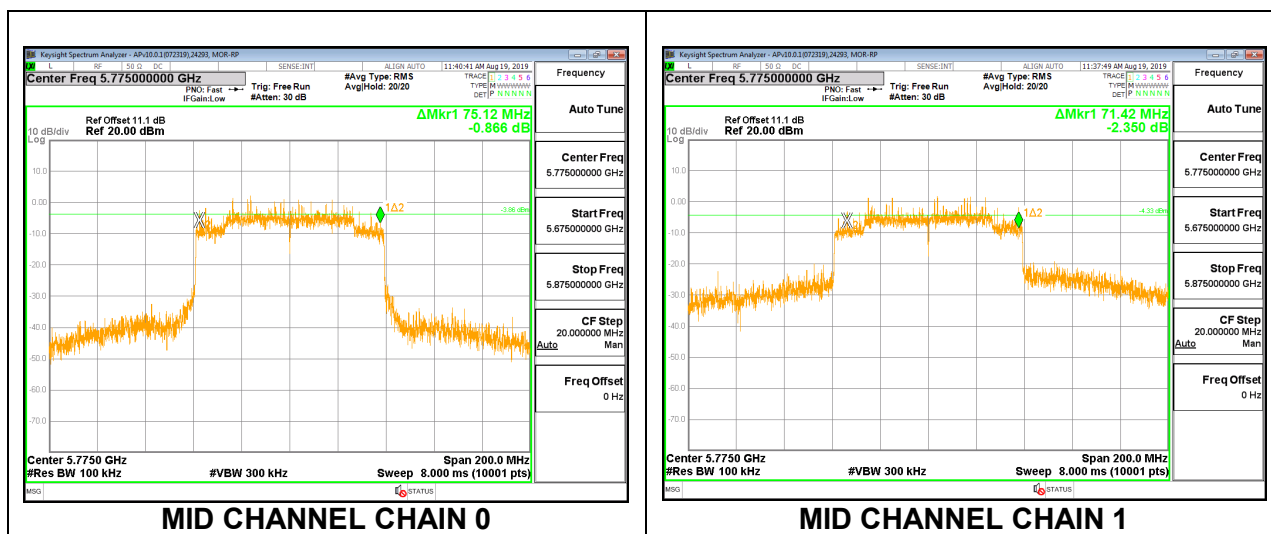


9.3.3. 802.11ax HE80 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Mid	5775	75.120	71.420	0.5
138	5690	4.080	4.080	0.5

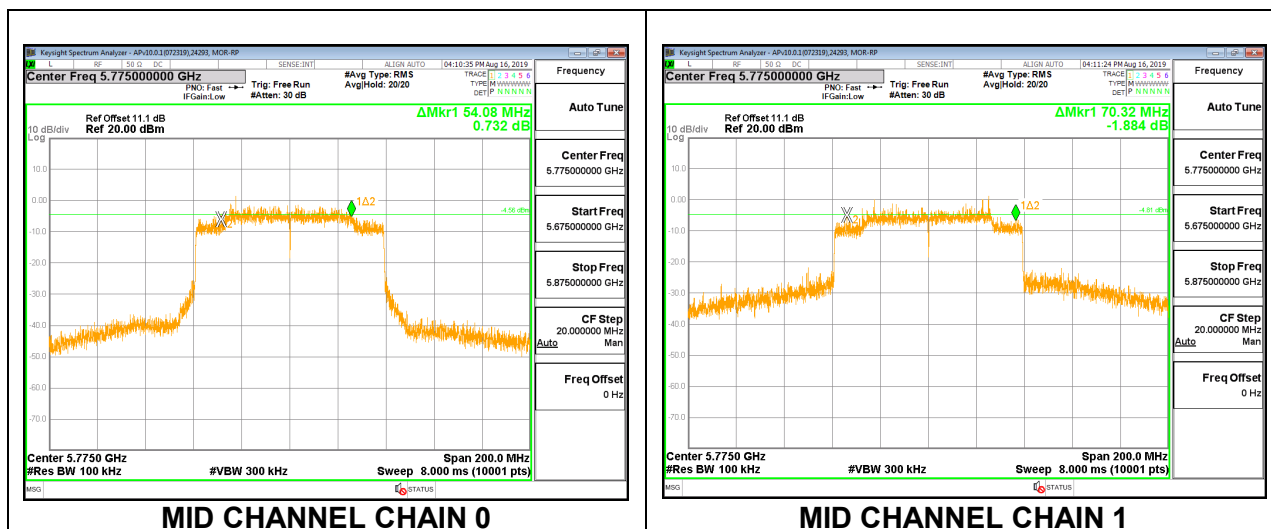
MID CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE –996-Tones, RU Index 67

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Mid	5775	54.080	70.320	0.5
138	5690	4.120	4.120	0.5

MID CHANNEL



9.4. OUTPUT POWER AND PSD

LIMITS

FCC §15.407

Band 5.15–5.25 GHz

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Bands 5.25-5.35 GHz and 5.47-5.725 GHz

The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Band 5.725-5.85 GHz

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

RSS-247

Band 5.15-5.25 GHz

The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Band 5.25-5.35 GHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Bands 5.47-5.6 GHz and 5.65-5.725 GHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Band 5.725-5.85 GHz

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

TEST PROCEDURE

The measurement method used for output power is KDB 789033 D02 v02r01, Section E.3.b (Method PM-G).

The measurement method used for power spectral density is KDB 789033 D02 v02r01, Section F.

DIRECTIONAL ANTENNA GAIN

For 2 TX:

Tx chains are uncorrelated for power and PSD due to the device supporting SDM in all MIMO modes. The directional gains are as follows:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
9.4	5.6	7.90

9.4.1. 802.11ax HE20 MODE IN THE 5.8 GHz BAND

2TX Antenna 1 + Antenna 2 SU MODE

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10
144	5720	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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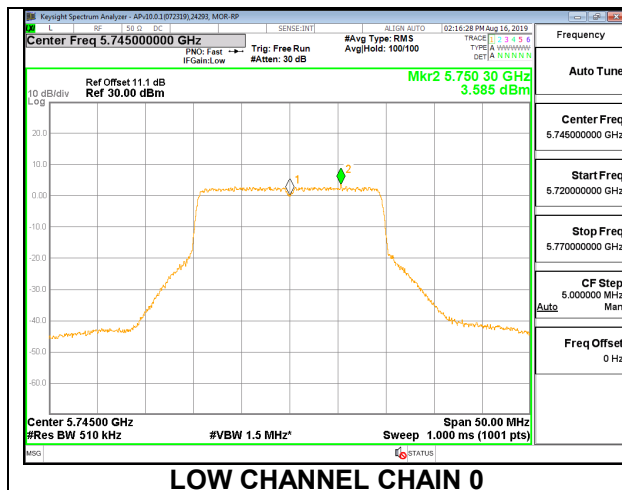
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.21	18.16	21.20	28.10	-6.90
Mid	5785	18.22	18.18	21.21	28.10	-6.89
High	5825	18.13	18.24	21.20	28.10	-6.90
144	5720	15.40	15.34	18.38	28.10	-9.72

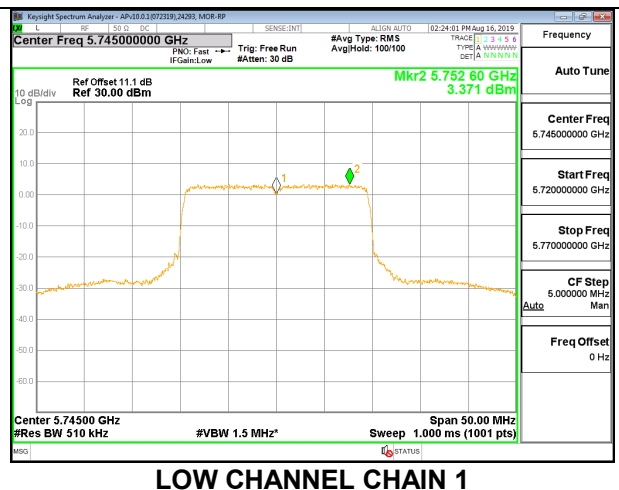
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	3.585	3.371	6.49	28.10	-21.61
Mid	5785	3.480	3.258	6.38	28.10	-21.72
High	5825	3.187	3.109	6.16	28.10	-21.94
144	5720	4.39	4.21	7.31	28.10	-20.79

LOW CHANNEL

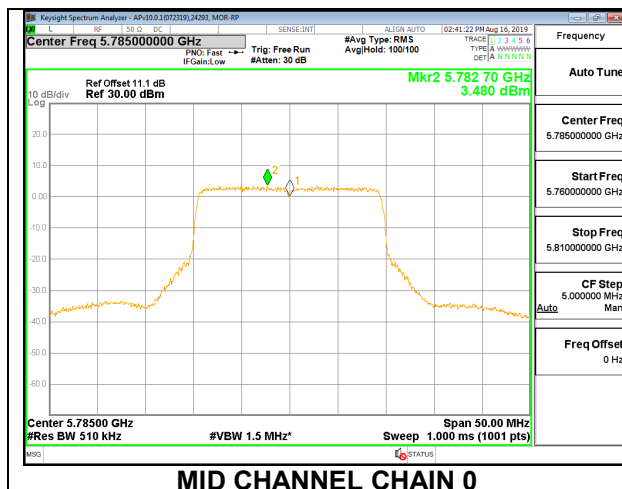


LOW CHANNEL CHAIN 0

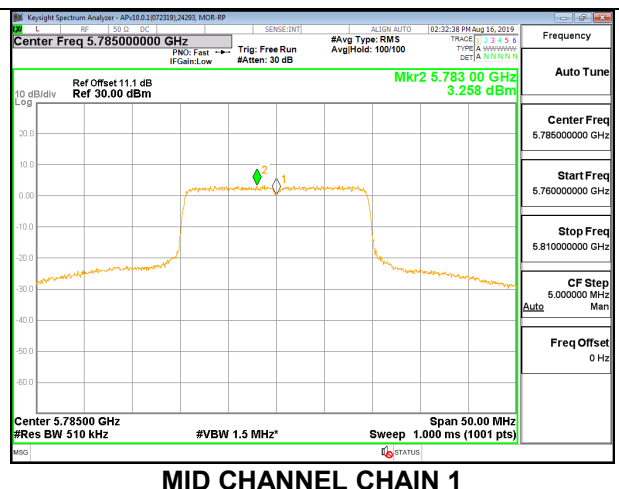


LOW CHANNEL CHAIN 1

MID CHANNEL

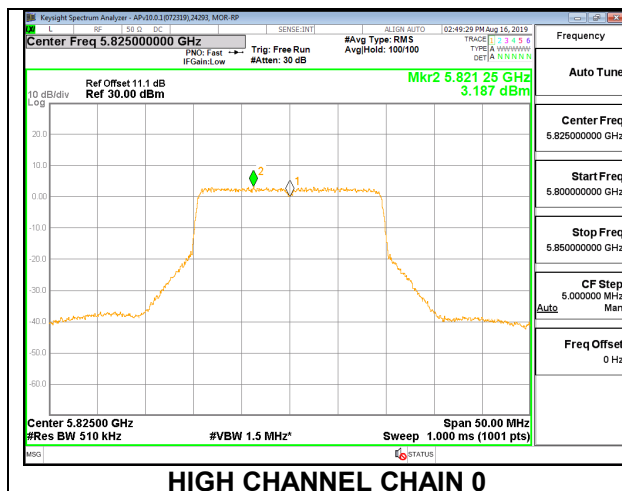


MID CHANNEL CHAIN 0

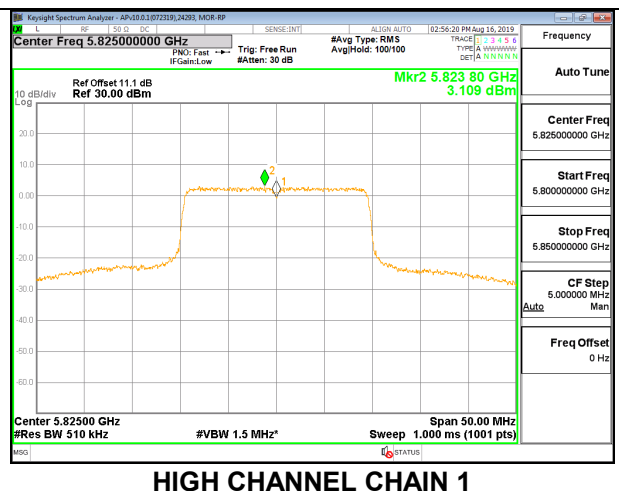


MID CHANNEL CHAIN 1

HIGH CHANNEL

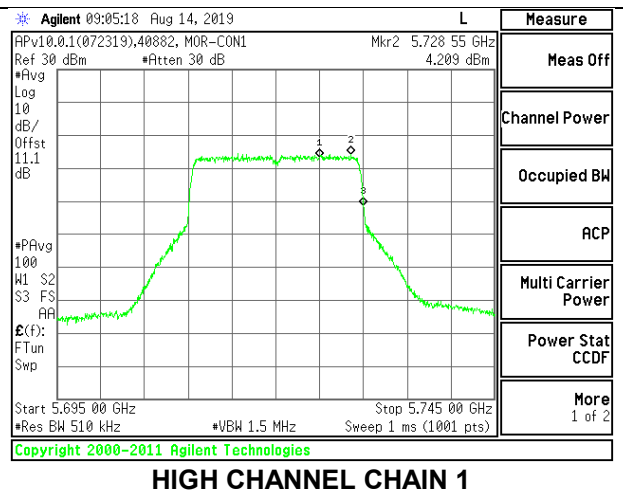
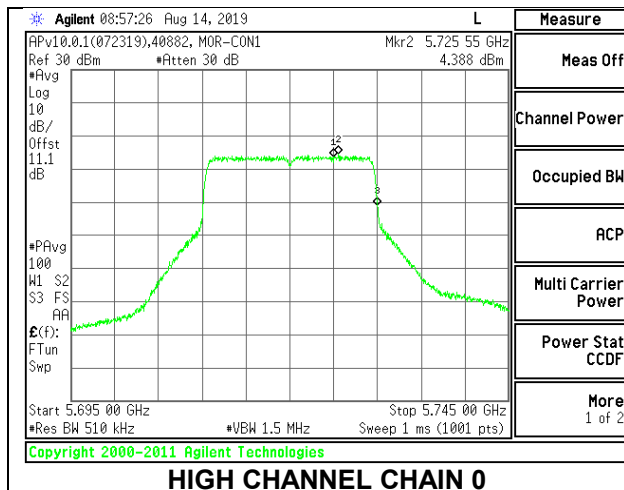


HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

CHANNEL 144



2TX Antenna 1 + Antenna 2 OFDMA MODE – 242-Tones, RU Index 61

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10
144	5720	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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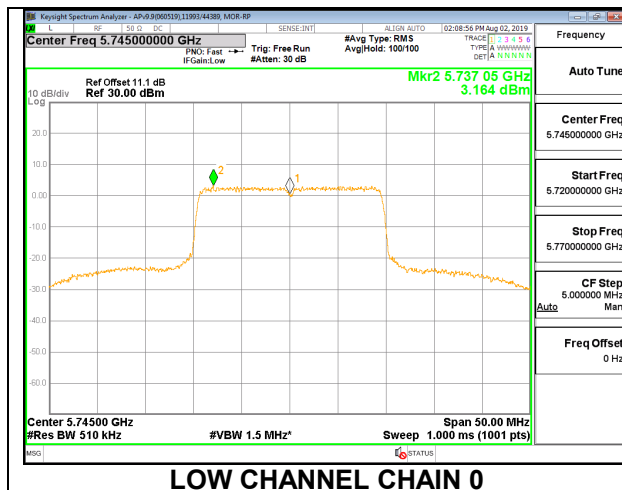
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.14	18.20	21.18	28.10	-6.92
Mid	5785	18.23	18.16	21.21	28.10	-6.89
High	5825	18.17	18.41	21.30	28.10	-6.80
144	5720	15.76	15.90	18.84	28.10	-9.26

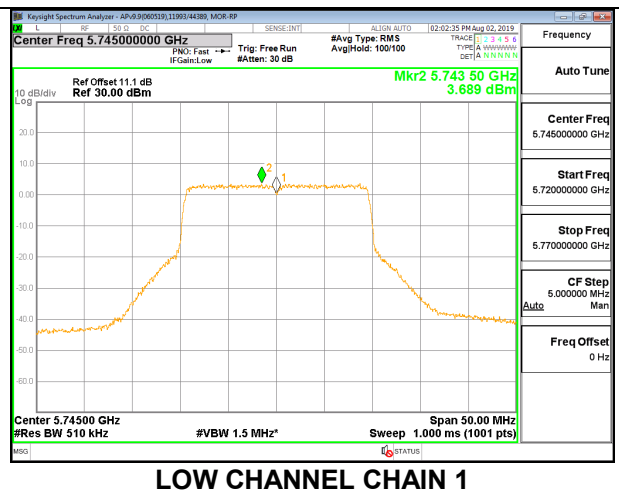
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	3.164	3.689	6.44	28.10	-21.66
Mid	5785	4.174	2.739	6.53	28.10	-21.57
High	5825	3.171	3.903	6.56	28.10	-21.54
144	5720	4.105	4.087	7.11	28.10	-20.99

LOW CHANNEL

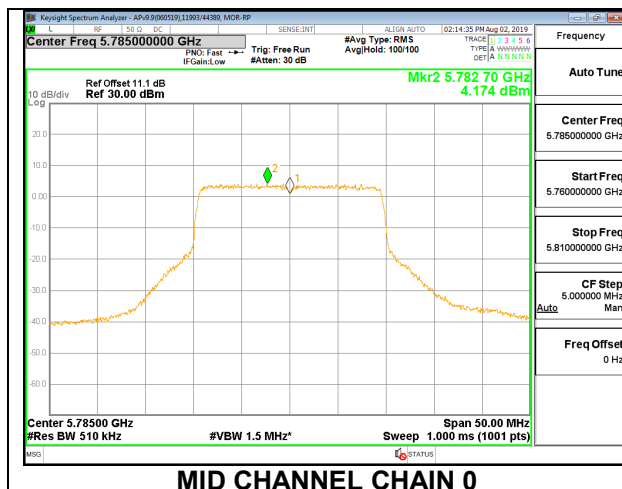


LOW CHANNEL CHAIN 0

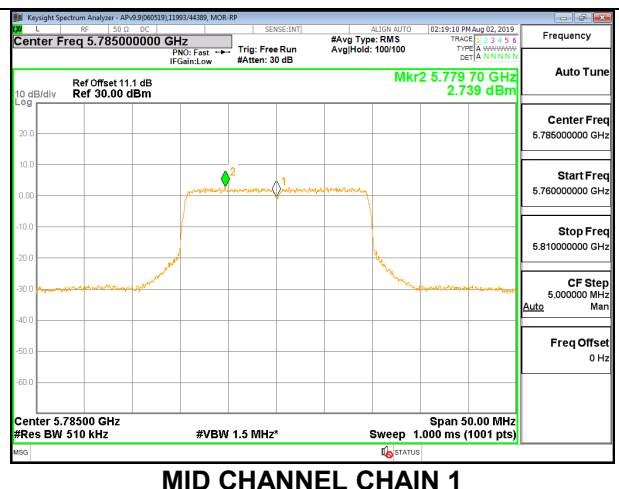


LOW CHANNEL CHAIN 1

MID CHANNEL

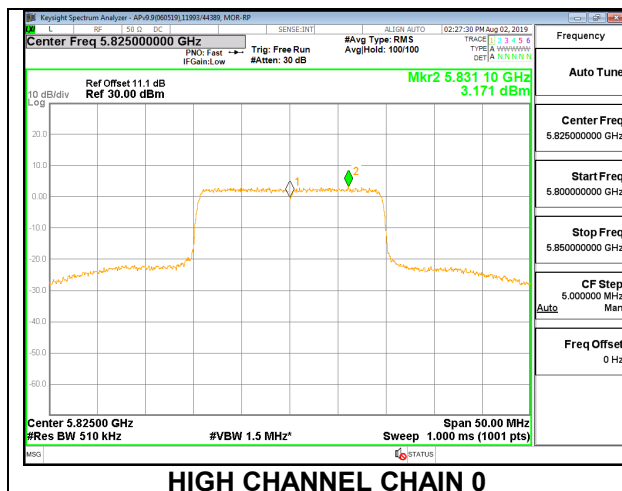


MID CHANNEL CHAIN 0

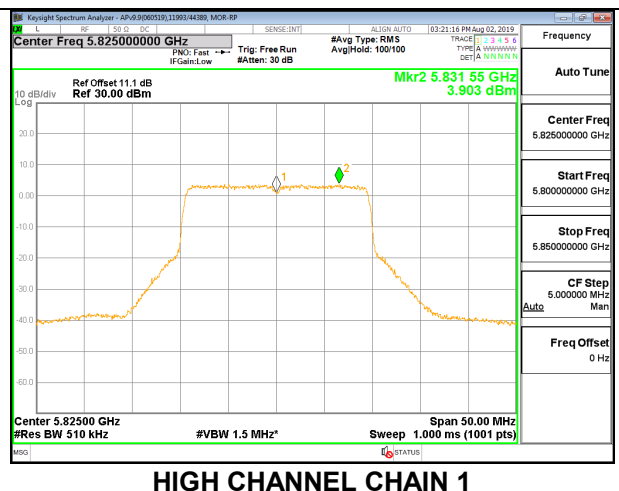


MID CHANNEL CHAIN 1

HIGH CHANNEL

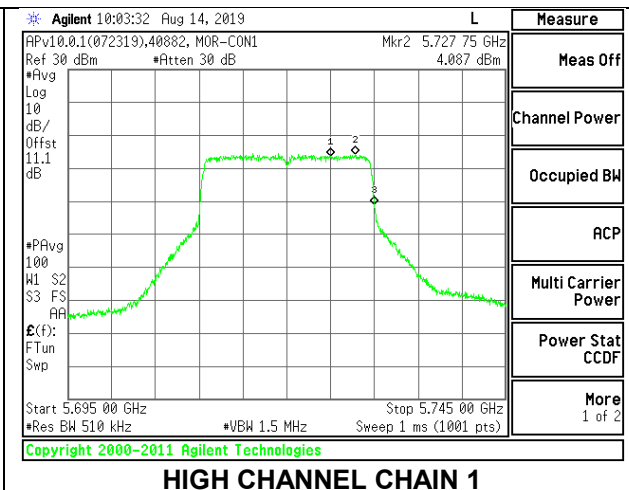
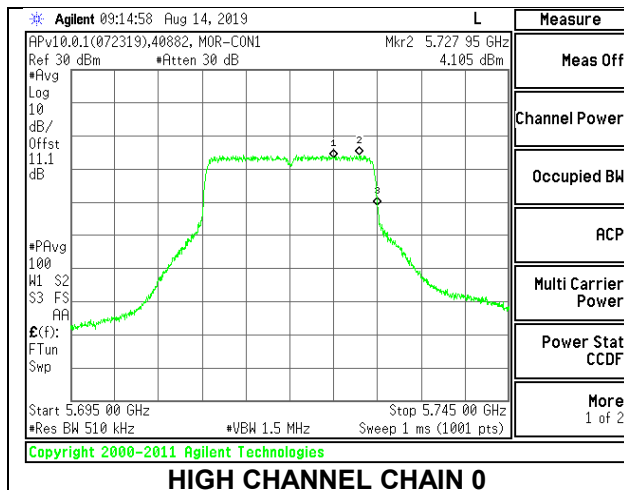


HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

CHANNEL 144



2TX Antenna 1 + Antenna 2 OFDMA MODE – 106-Tones, RU Index 53

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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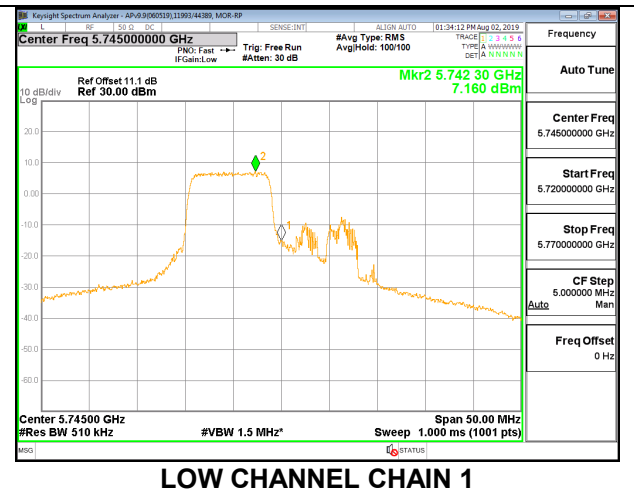
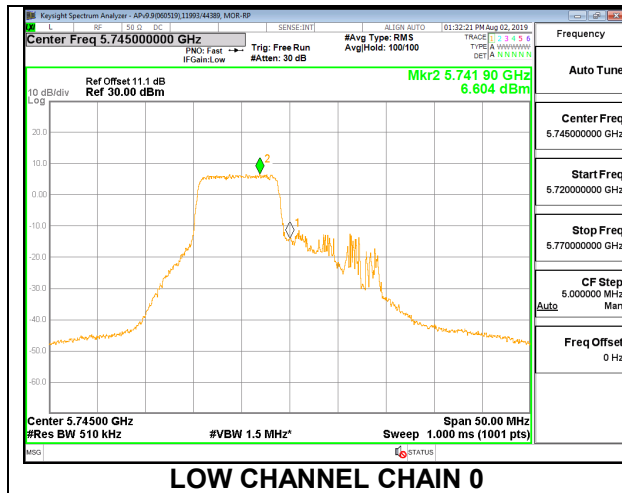
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.20	18.43	21.33	28.10	-6.77
Mid	5785	18.30	18.49	21.41	28.10	-6.69
High	5825	18.22	18.59	21.42	28.10	-6.68

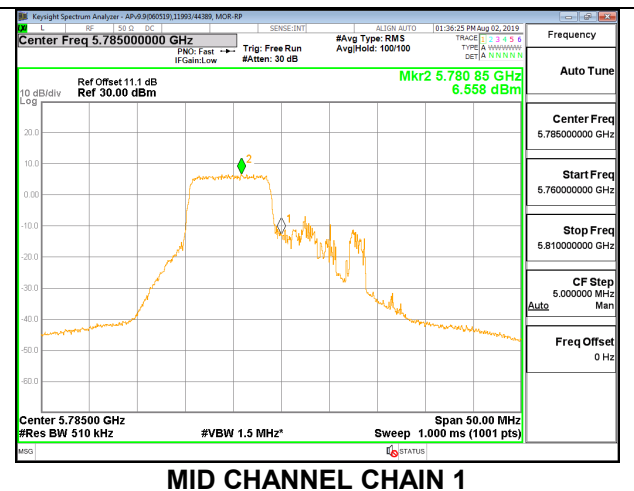
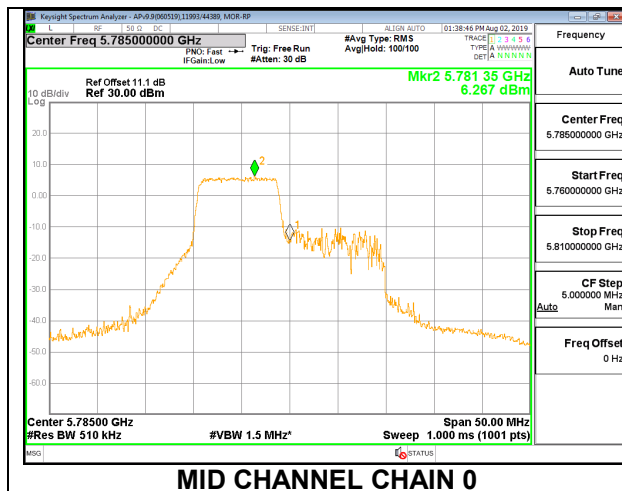
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	6.604	7.160	9.90	28.10	-18.20
Mid	5785	6.267	6.558	9.43	28.10	-18.67
High	5825	6.173	7.239	9.75	28.10	-18.35

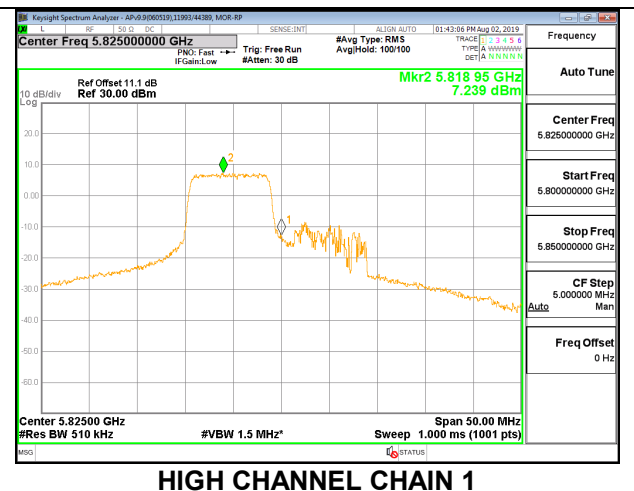
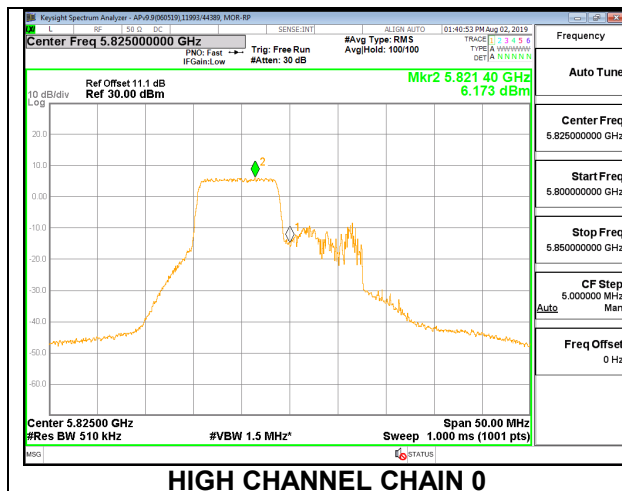
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 106-Tones, RU Index 54

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10
144	5720	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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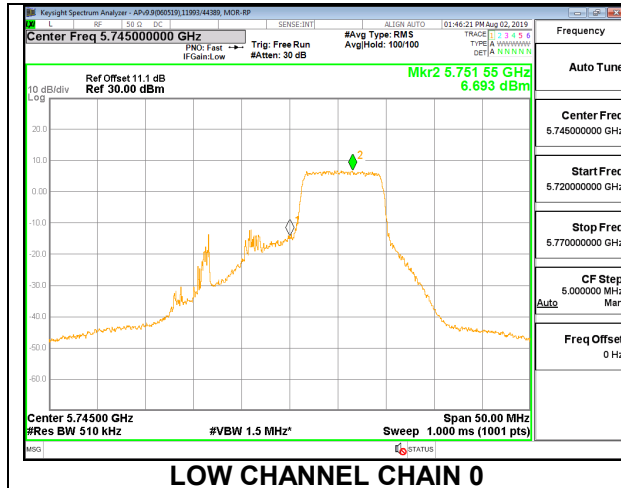
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.19	18.45	21.33	28.10	-6.77
Mid	5785	18.25	18.45	21.36	28.10	-6.74
High	5825	18.19	18.60	21.41	28.10	-6.69
144	5720	15.30	15.21	18.27	28.10	-9.83

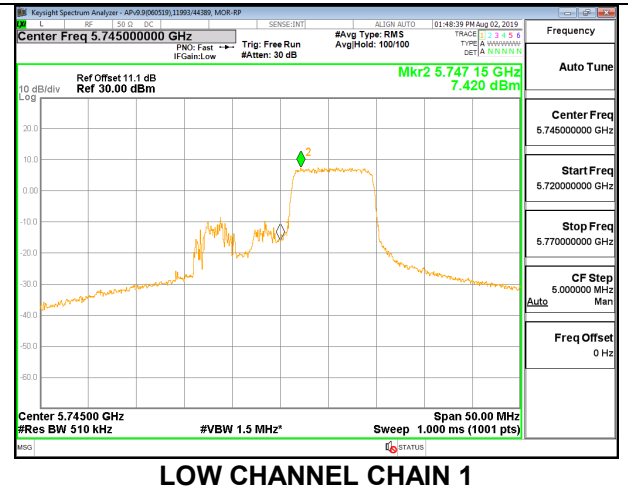
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	6.693	7.420	10.08	28.10	-18.02
Mid	5785	7.675	7.255	10.48	28.10	-17.62
High	5825	7.085	7.132	10.12	28.10	-17.98
144	5720	-0.172	-0.559	2.65	28.10	-25.45

LOW CHANNEL

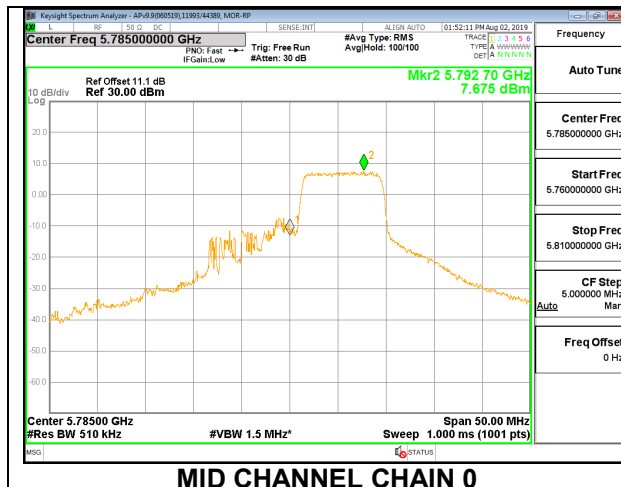


LOW CHANNEL CHAIN 0

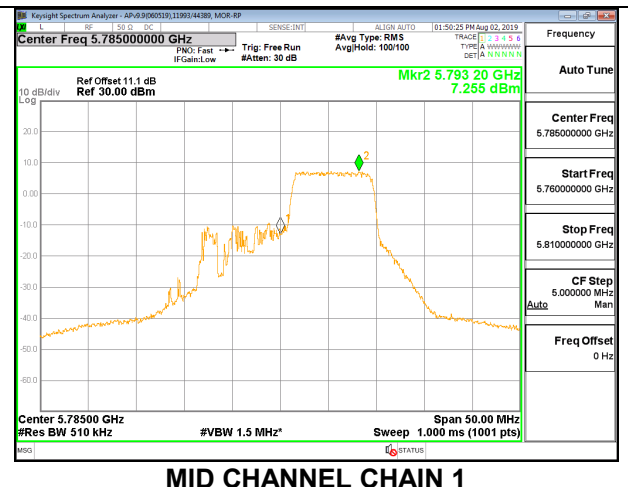


LOW CHANNEL CHAIN 1

MID CHANNEL

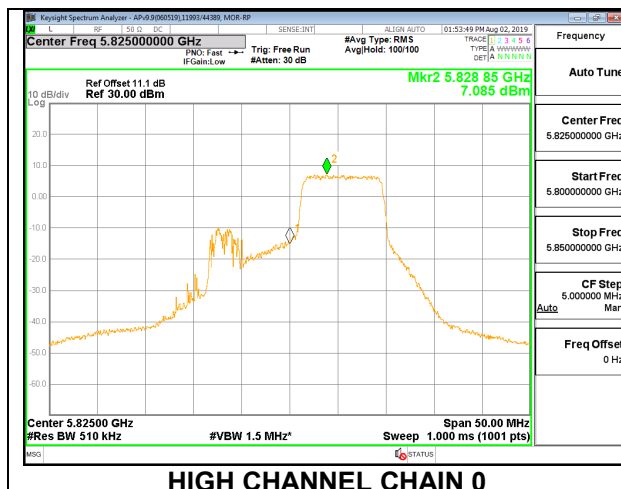


MID CHANNEL CHAIN 0

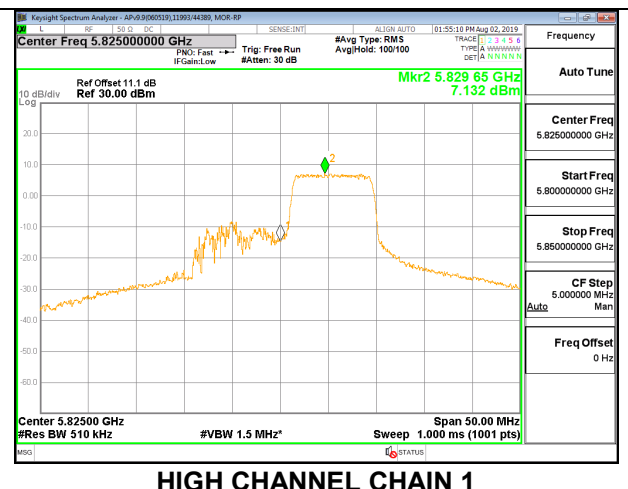


MID CHANNEL CHAIN 1

HIGH CHANNEL

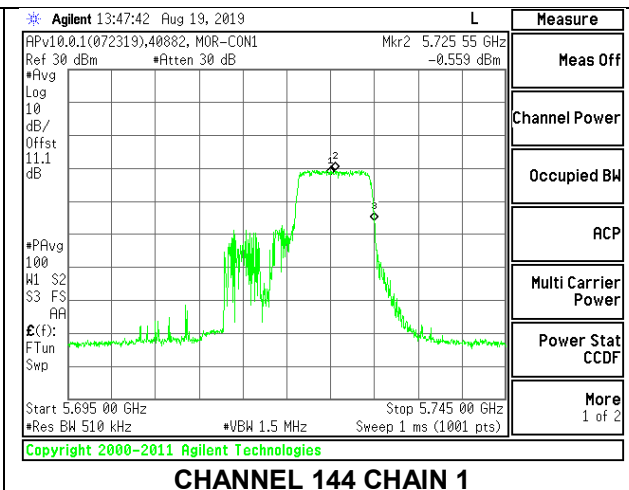
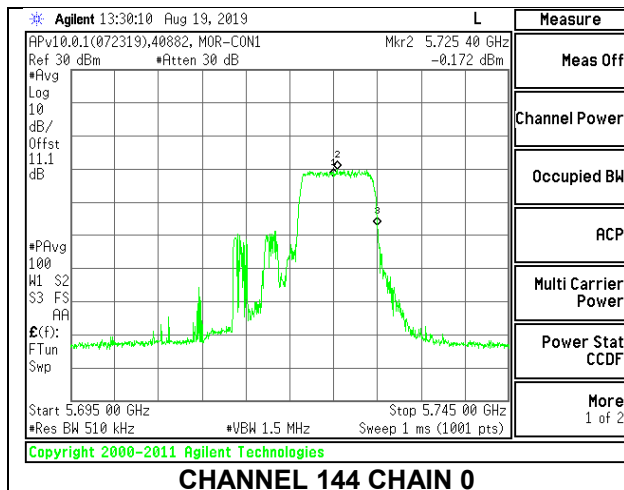


HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

CHANNEL 144



2TX Antenna 1 + Antenna 2 OFDMA MODE – 52-Tones, RU Index 37

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.27	18.23	21.26	28.10	-6.84
Mid	5785	18.33	18.30	21.33	28.10	-6.77
High	5825	18.20	18.48	21.35	28.10	-6.75

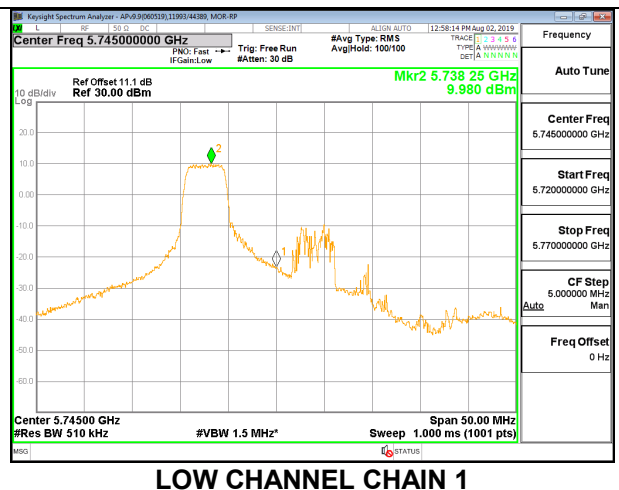
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	9.290	9.980	12.66	28.10	-15.44
Mid	5785	9.410	10.150	12.81	28.10	-15.29
High	5825	9.417	9.975	12.72	28.10	-15.38

LOW CHANNEL

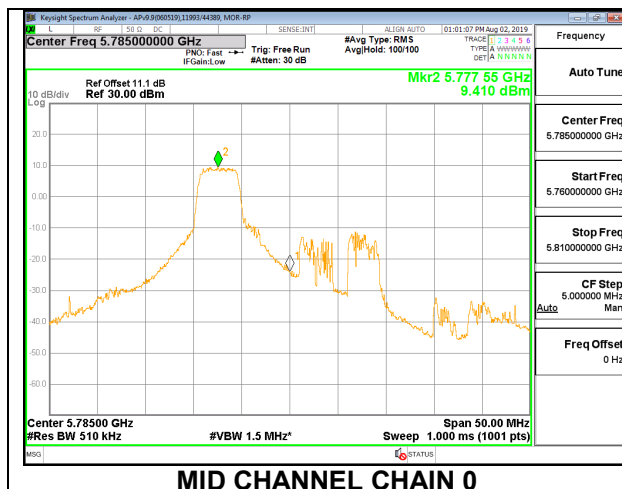


LOW CHANNEL CHAIN 0

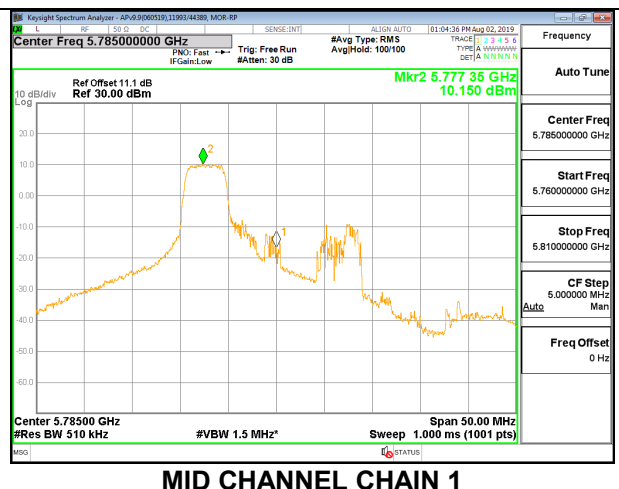


LOW CHANNEL CHAIN 1

MID CHANNEL

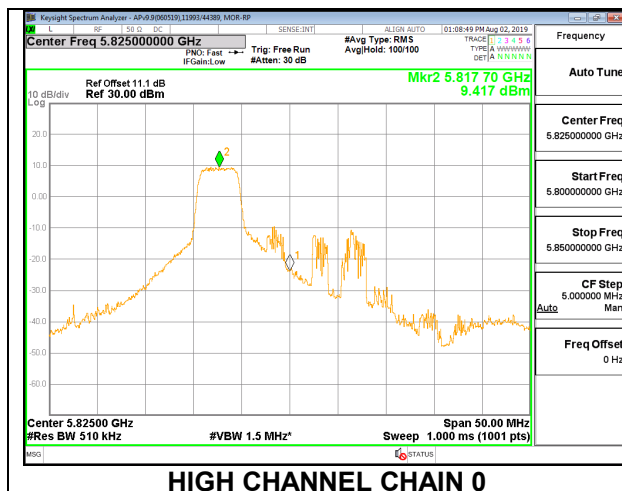


MID CHANNEL CHAIN 0

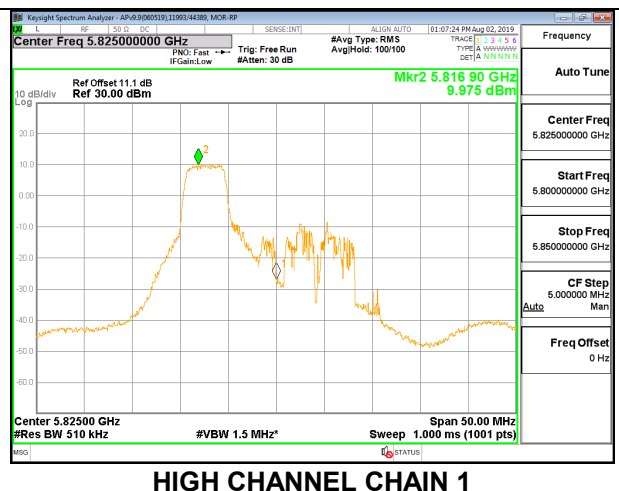


MID CHANNEL CHAIN 1

HIGH CHANNEL



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

2TX Antenna 1 + Antenna 2 OFDMA MODE – 52-Tones, RU Index 38

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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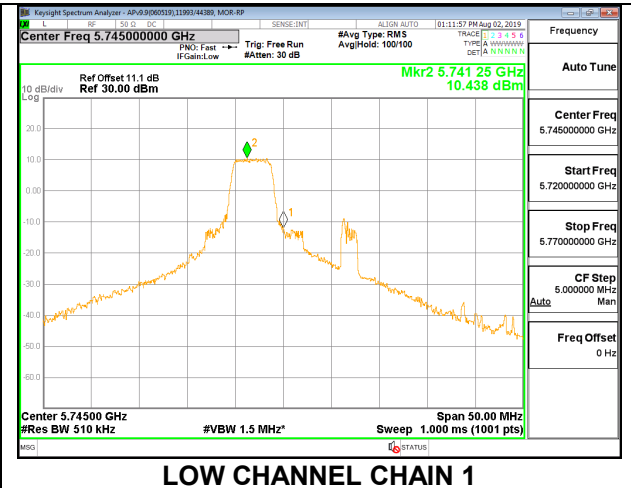
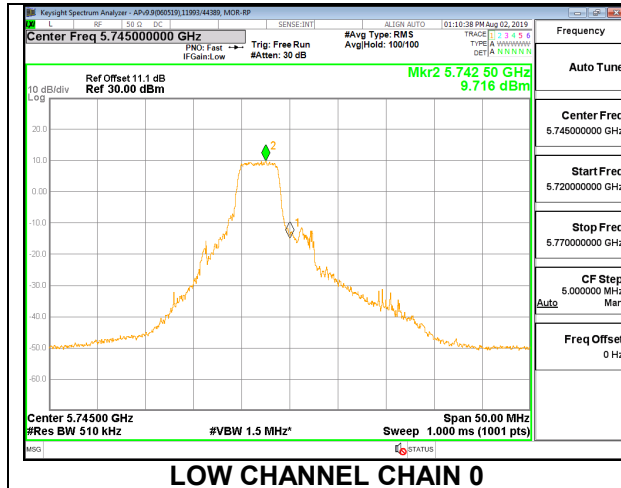
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.43	18.58	21.52	28.10	-6.58
Mid	5785	18.45	18.47	21.47	28.10	-6.63
High	5825	18.44	18.73	21.60	28.10	-6.50

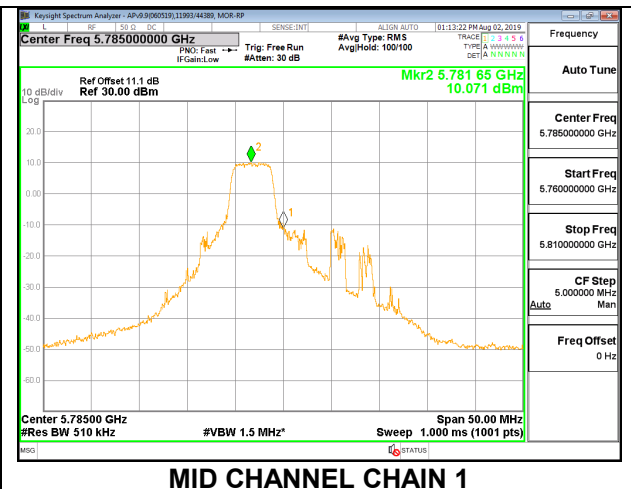
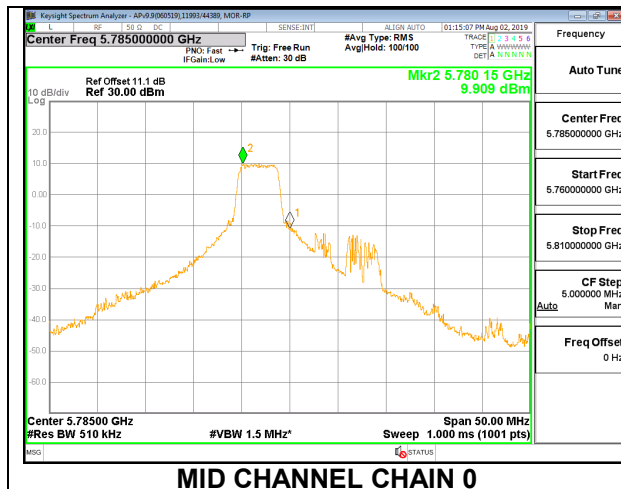
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	9.716	10.438	13.10	28.10	-15.00
Mid	5785	9.909	10.071	13.00	28.10	-15.10
High	5825	9.699	10.690	13.23	28.10	-14.87

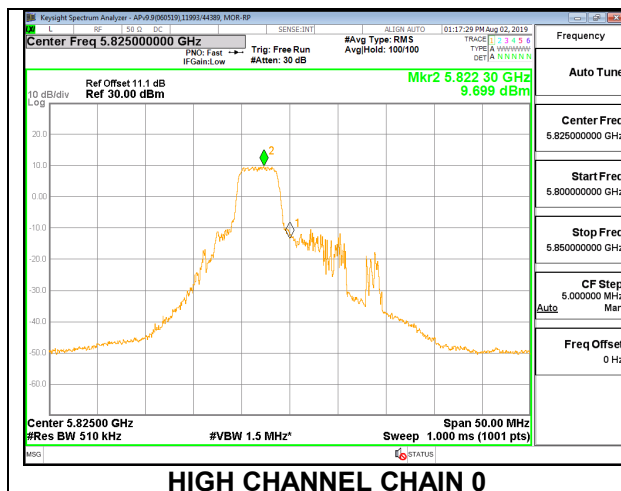
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



2TX Antenna 1 + Antenna 2 OFDMA MODE – 52-Tones, RU Index 40

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10
144	5720	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.23	18.40	21.33	28.10	-6.77
Mid	5785	18.28	18.33	21.32	28.10	-6.78
High	5825	18.23	18.41	21.33	28.10	-6.77
144	5720	11.72	11.88	14.81	28.10	-13.29

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	9.701	10.488	13.12	28.10	-14.98
Mid	5785	9.587	10.339	12.99	28.10	-15.11
High	5825	9.253	9.847	12.57	28.10	-15.53
144	5720	4.14	4.11	7.13	28.10	-20.97

LOW CHANNEL

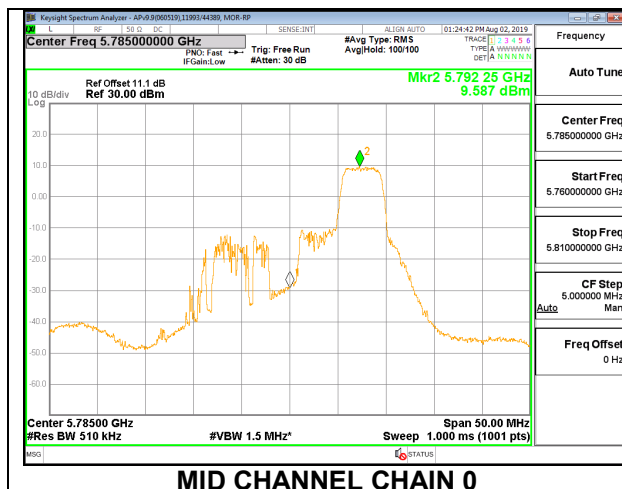


LOW CHANNEL CHAIN 0

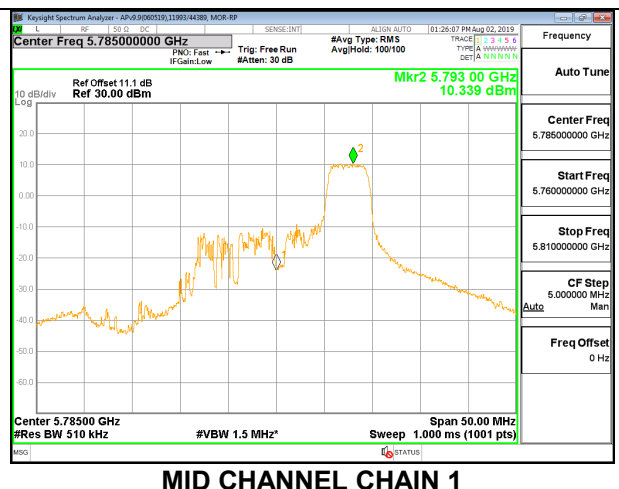


LOW CHANNEL CHAIN 1

MID CHANNEL

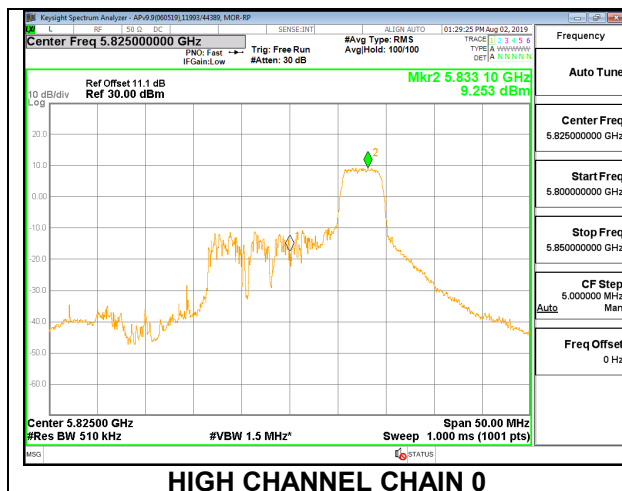


MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

HIGH CHANNEL

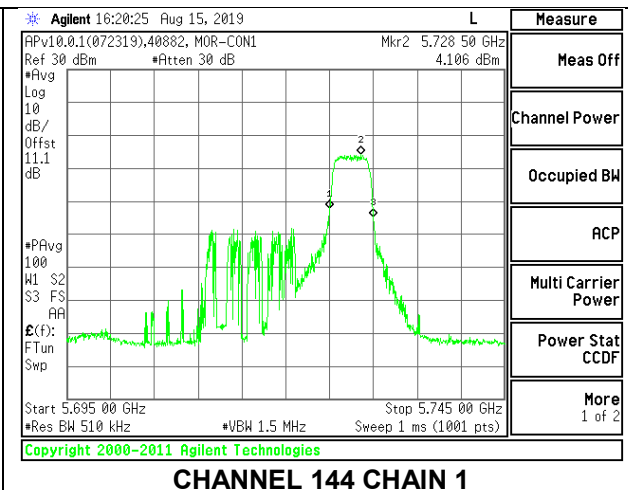
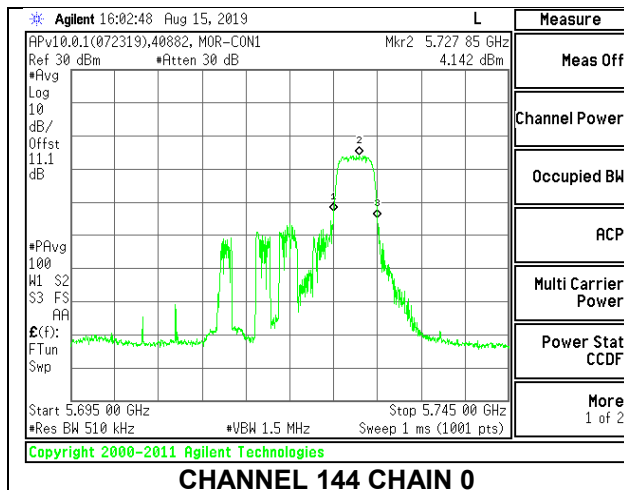


HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

CHANNEL 144



2TX Antenna 1 + Antenna 2 OFDMA MODE – 26-Tones, RU Index 0

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain For Power (dBi)	Directional Gain For PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm/ 1MHz)
Low	5745	7.90	7.90	28.10	28.10
Mid	5785	7.90	7.90	28.10	28.10
High	5825	7.90	7.90	28.10	28.10

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	18.06	18.00	21.04	28.10	-7.06
Mid	5785	18.02	18.03	21.04	28.10	-7.06
High	5825	17.85	18.20	21.04	28.10	-7.06

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm/ 500kHz)	Chain 1 Meas PSD (dBm/ 500kHz)	Total Corr'd PSD (dBm/ 500kHz)	PSD Limit (dBm/ 500kHz)	PSD Margin (dB)
Low	5745	11.923	11.961	14.95	28.10	-13.15
Mid	5785	12.670	12.377	15.54	28.10	-12.56
High	5825	11.154	11.752	14.47	28.10	-13.63