CERTIFICATION TEST REPORT

Report Number. : 4789354138-E7V2

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-G770U1

FCC ID : A3LSMG770U

EUT Description : GSM/CDMA/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac, ANT+ and NFC

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E

Date Of Issue:
March 09, 2020

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	03/03/20	Initial issue	Yeonhee Lim
V1	03/09/20	Updated to address TCB's question	Yeonhee Lim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/CDMA/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac, ANT+ and NFC
MODEL NUMBER:	SM-G770U1
SERIAL NUMBER:	R38MC0CE6KN (CONDUCTED); R38MC0CE28A, R38MC0CE7SR (RADIATED)
DATE TESTED:	JAN 20, 2020 – FEB 13, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Technician
UL Korea, Ltd.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 789033 D02 General UNII Test Procedures New Rules v02r01
4. KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
5. KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02
6. KDB 662911 D01 v02r01
7. ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. 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.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☐ Chamber 3

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4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. SAMPLE CALCULATION

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

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4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/CDMA/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac, ANT+ and NFC. This test report addresses the NII (UNII 802.11a/n/ac) operational mode.

WiFi operating mode

Frequency rage	Mode	ANT1	ANT2
5GHz (5180 MHz ~ 5825 MHz)	802.11a SISO	TX/RX	TX/RX
	802.11a MIMO	TX/RX	TX/RX
	802.11n SISO	TX/RX	TX/RX
	802.11n MIMO	TX/RX	TX/RX
	802.11ac SISO	TX/RX	TX/RX
	802.11ac MIMO	TX/RX	TX/RX

Simultaneous TX Condition

Simultaneous Tx Condition - RSDB

Mode	# of TX	5GHz		2.4GHz		Test Case
		ANT1	ANT2	ANT1	ANT2	
2.4GHz + 5GHz RSDB Only	2	-	-	-	-	-
	2	-	**O**	**O**	-	**O**
	2	-	-	-	-	-
	2	-	-	-	-	-
2.4GHz + 5GHz RSDB & MIMO	3	-	-	-	-	-
	3	-	-	-	-	-
	3	-	-	-	-	-
	3	-	-	-	-	-
2.4GHz + 5GHz RSDB MIMO	4	-	-	-	-	-

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MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted average output power as follows:

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
5180 - 5240	802.11a MIMO	19.98		99.54	
	802.11n(HT20) MIMO	20.04		100.93	
5190 – 5230	802.11n(HT40) MIMO	19.83		96.16	
5210	802.11ac(VHT80) MIMO	16.60		45.71	
5260 - 5320	802.11a MIMO	20.02		100.46	
	802.11n(HT20) MIMO	19.90		97.72	
5270 - 5310	802.11n(HT40) MIMO	19.68		92.90	
5290	802.11ac(VHT80) MIMO	16.80		47.86	
5500 - 5720	802.11a MIMO	20.02		100.46	
	802.11n(HT20) MIMO	20.19		104.47	
5510 - 5710	802.11n(HT40) MIMO	19.86		96.83	
5530 - 5690	802.11ac(VHT80) MIMO	16.58		45.50	
5745 - 5825	802.11a MIMO	20.78		119.67	
	802.11n(HT20) MIMO	20.80		120.23	
5755 - 5795	802.11n(HT40) MIMO	19.85		96.61	
5775	802.11ac(VHT80) MIMO	16.71		46.88	

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5.2. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.

The radio utilizes a internal antenna, with a maximum gain of:

Frequency Band [MHz]	ANT1 Gain [dBi]	ANT2 Gain [dBi]	Correlated Chains Directional Gain [dBi]
UNII 1 5150 - 5250	-7.58	-6.12	-3.81
UNII 2A 5250 - 5350	-7.12	-5.94	-3.50
UNII 2C 5470 - 5725	-6.87	-5.07	-2.91
UNII 3 5725 - 5850	-6.54	-4.55	-2.48

“WiFi1” and “WiFi2” as indicated in antenna specification are written as ANT1 and ANT2 in this report.

5.3. List of test reduction and modes covering other modes:

The output power on covered modes is equal to or less than one referenced.

UNII 1

5150 – 5250 MHz RESTRICTED Frequency Band (Radiated Testing)	
Frequency Range [MHz]	**Mode**
5180 - 5240	802.11a Legacy 1TX / 2TX
5180 - 5240	802.11n HT20 1TX / 2TX
5180 - 5240	802.11ac VHT20 1TX / 2TX
5190 - 5230	802.11n HT40 1TX / 2TX
5190 - 5230	802.11ac VHT40 1TX / 2TX
5210	802.11ac VHT80 1TX / 2TX

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UNII 2A

5250 – 5350 MHz RESTRICTED Frequency Band (Radiated Testing)	
Frequency Range [MHz]	**Mode**
5260 - 5320	802.11a Legacy 1TX / 2TX
5260 - 5320	802.11n HT20 1TX / 2TX
5260 - 5320	802.11ac VHT20 1TX / 2TX
5270 - 5310	802.11n HT40 1TX / 2TX
5270 - 5310	802.11ac VHT40 1TX / 2TX
5290	802.11ac VHT80 1TX / 2TX

UNII 2C

5470 – 5725 MHz RESTRICTED Frequency Band (Radiated Testing)	
Frequency Range [MHz]	**Mode**
5500 - 5720	802.11a Legacy 1TX / 2TX
5500 - 5720	802.11n HT20 1TX / 2TX
5500 - 5720	802.11ac VHT20 1TX / 2TX
5510 - 5710	802.11n HT40 1TX / 2TX
5510 - 5710	802.11ac VHT40 1TX / 2TX
5530 - 5690	802.11ac VHT80 1TX / 2TX

UNII 3

5725 – 5850 MHz RESTRICTED Frequency Band (Radiated Testing)	
Frequency Range [MHz]	**Mode**
5745 - 5825	802.11a Legacy 1TX / 2TX
5745 - 5825	802.11n HT20 1TX / 2TX
5745 - 5825	802.11ac VHT20 1TX / 2TX
5755 - 5795	802.11n HT40 1TX / 2TX
5755 - 5795	802.11ac VHT40 1TX / 2TX
5775	802.11ac VHT80 1TX / 2TX

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5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

For SISO (ANT1), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.
For SISO (ANT2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.
For MIMO, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

Based on the baseline scan, the worst-case data rates were:

802.11a mode: 6 Mbps 1Tx
802.11a mode: 6 Mbps 2Tx
802.11n HT20 mode: MCS0 1Tx
802.11n HT20 mode: MCS0 2Tx
802.11n HT40 mode: MCS0 1Tx
802.11n HT40 mode: MCS0 2Tx
802.11ac VHT80 mode: MCS0 1Tx
802.11ac VHT80 mode: MCS0 2Tx

Depending on spot-check results for 802.11a / n HT20 & HT40 / ac VHT80, MIMO mode is worst case than SISO (ANT1) and SISO (ANT2). So radiation test for 802. 11a / n HT20 & HT40 / ac VHT80 were evaluated at MIMO mode.

Note : All radiated and power line conducted tests were performed connected with charger for evaluation of worst case mode.

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37MAYF19B7DK3	N/A
Data Cable	SAMSUNG	EP-DA705BBE	N/A	N/A

I/O CABLE

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software exercised the EUT to enable NII mode.

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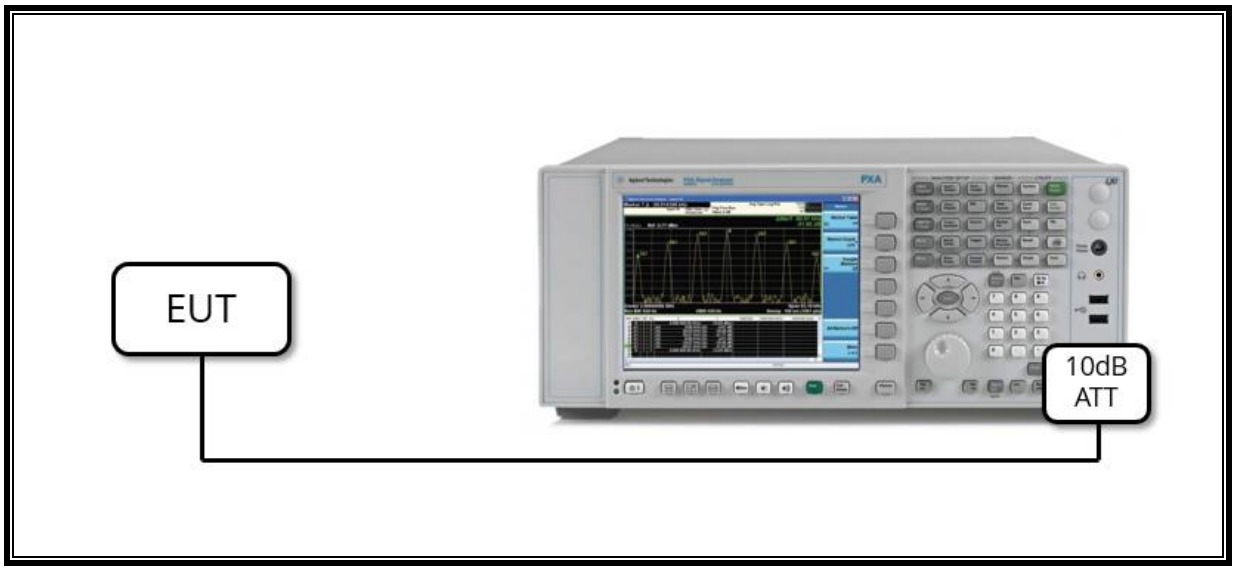
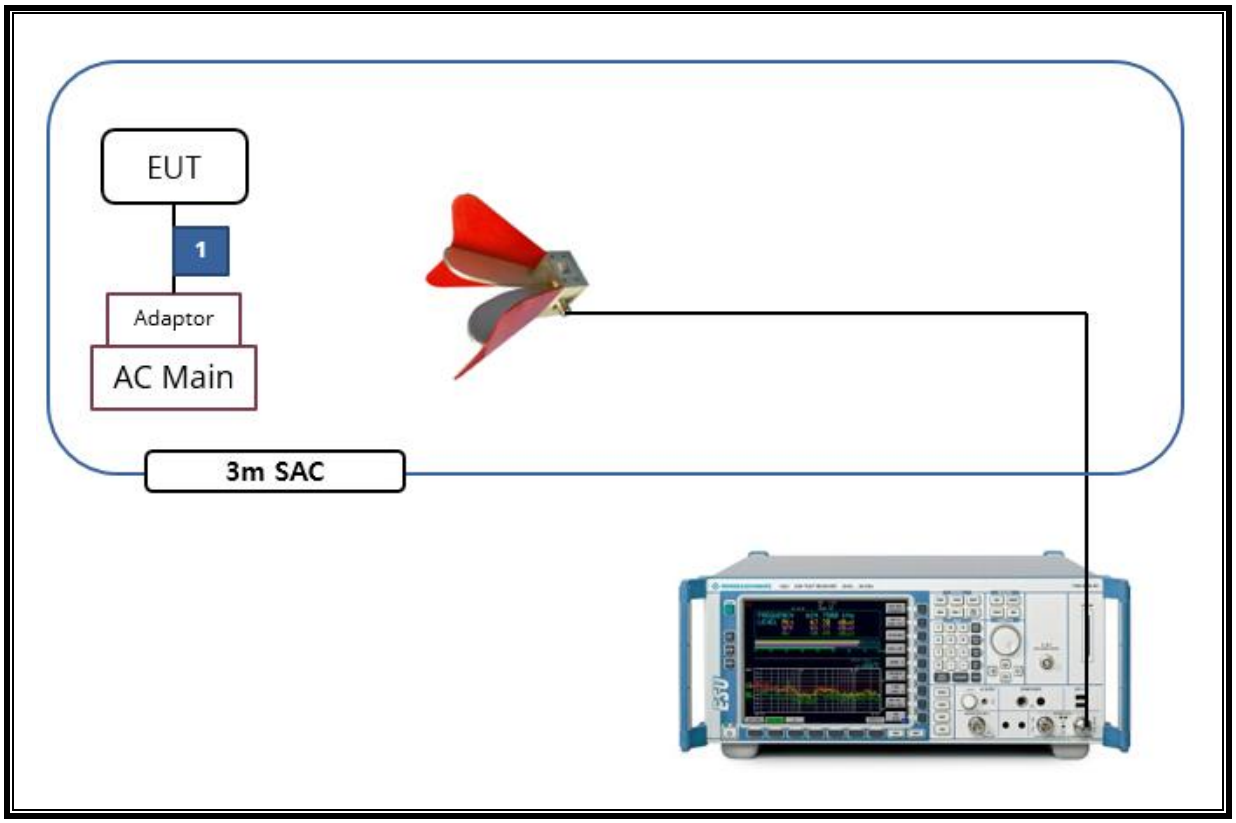
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20
Attenuator	PASTERNACK	PE7004-10	2	08-06-20
Attenuator	PASTERNACK	PE7087-10	A009	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
Termination	WEINSCHEL	M1406A	T01	08-08-20
Attenuator	WEINSCHEL	WA76-30-21	A015	08-08-20
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.407(e)	6dB Band width (5.8GHz)	500kHz	Condcuted	PASS
15.407 (a)(2)	TX Cond. Power 5.15-2.25, 5.25-5.35 & 5.47-5.725	< 24dBm or 11+10Log(26dB BW)		PASS
15.407 (a)(3)	TX Cond. Power 5.725-5.825	< 30dBm		PASS
15.407 (a)(5)	PSD (5.2,5.3,5.5GHz)	<11dBm		PASS
15.407 (a)(5)	PSD (5.8GHz)	30dBm per 500kHz		PASS
15.207 (a)	AC Power Line conducted emissions	Section 10	Radiated	PASS
15.407 (b) & 15.209	Radiated Spurious Emission	< 54dBuV/m		PASS
15.407 (h)(2)	Dynamic Frequency Selection	N/A	Condcuted	PASS

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8. MEASUREMENT METHODS

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

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

26dB Emission BW : KDB 789033 D02 v02r01, Section II.C.1.

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)

Conducted Output Power for Straddle Channel (ch144/142/138 for 20/40/80MHz BW):

KDB 789033 D02 v02r01, Section II.E.2.b(Method SA-1)

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

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

Unwanted emissions in non-restricted bands : KDB 789033 D02 v02r01, Section II.G.3 – II.G.6.

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

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9. REFERENCE MEASUREMENTS RESULTS

9.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ANT	ON Time [msec)	Period [msec]	Duty Cycle X [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]
802.11a	Single	2.796	2.833	0.987	98.7	0.00
802.11n HT20		5.120	5.157	0.993	99.3	0.00
802.11n HT40		2.484	2.520	0.986	98.6	0.00
802.11ac VHT80		2.851	2.889	0.987	98.7	0.00
802.11a	ALL	2.796	2.833	0.987	98.7	0.00
802.11n HT20		5.120	5.157	0.993	99.3	0.00
802.11n HT40		2.484	2.520	0.986	98.6	0.00
802.11ac VHT80		1.452	1.488	0.976	97.6	0.11

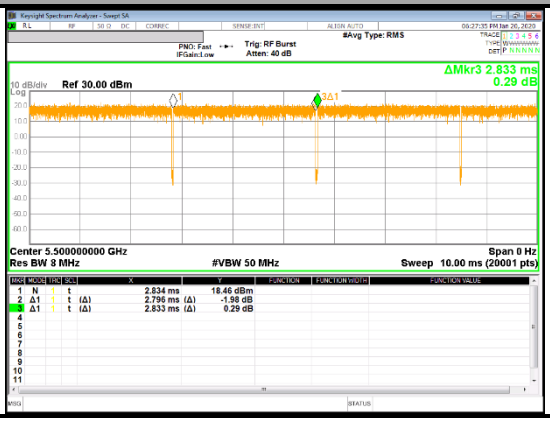
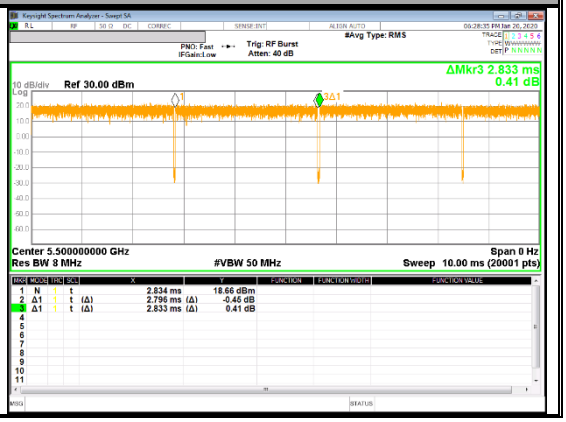
LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 D02 v02r01 Zero-Span Spectrum Analyzer Method.

9.2. DUTY CYCLE PLOTS

Mode	ANT SINGLE	ANT ALL
802.11 a		

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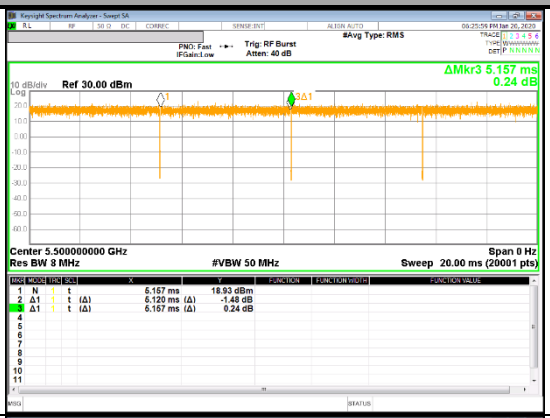
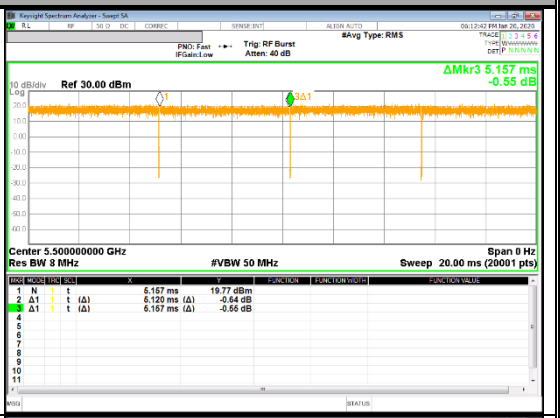
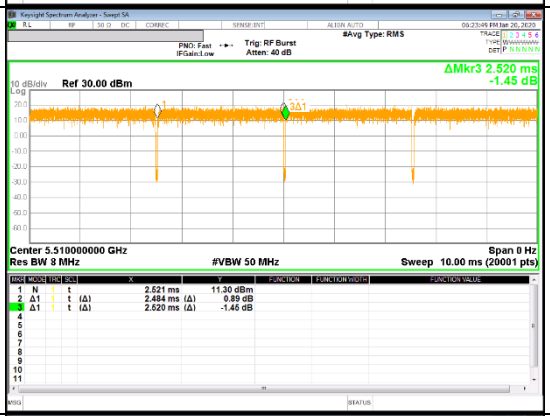
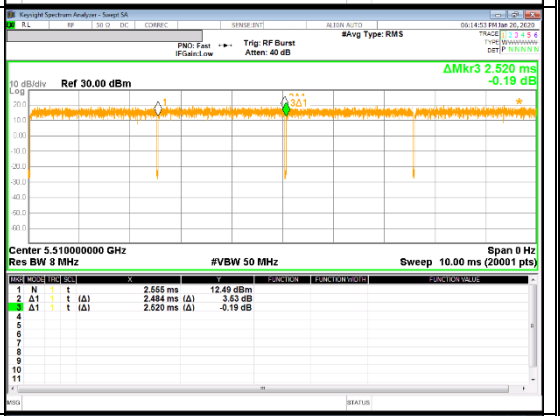
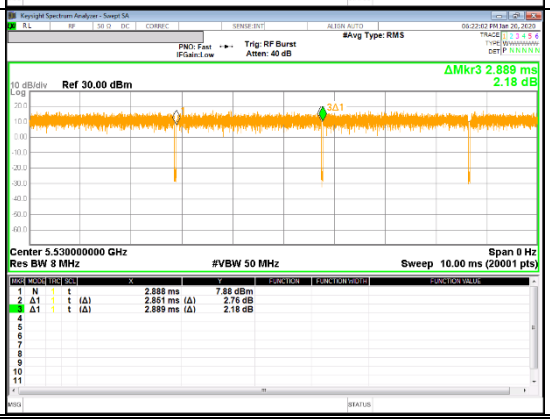
Mode	ANT SINGLE	ANT ALL
802.11 n HT20		
802.11 n HT40		
802.11 ac VHT80		

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9.3. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Reference to 789033 D02 General UNII Test Procedures New Rules v02r01: The transmitter output is connected to a spectrum analyzer with the RBW set to approximately 1% of EBW, the VBW > RBW, peak detector and max hold.

NOTE

- Calculation for 26dB Bandwidth of UNII-2C and UNII-3 Straddle Channel

ex) Fundamental frequency : 5720MHz
  - 26dB BW : 20.58MHz
  - Turning Frequency : 5725MHz
  - 26dB Bandwidth of UNII-2C band Portion
    = (5725 – (5720 - (20.58 / 2)) = 15.29 MHz
  - 26dB Bandwidth of UNII-3 band Portion
    = (5720 + (20.58 / 2) -5725) = 5.29 MHz

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RESULTS

9.3.1. 5.2 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-1	802.11a	Low	5180	20.37	21.98	21.98
		Mid	5200	21.40	20.17	
		High	5240	19.91	21.69	
	802.11n HT20	Low	5180	21.86	22.20	22.20
		Mid	5200	20.66	21.60	
		High	5240	21.96	20.79	
	802.11n HT40	Low	5190	39.96	40.06	40.06
		High	5230	39.53	39.93	
	802.11ac VHT80	Mid	5210	81.50	81.64	81.64

9.3.2. 5.3 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-2A	802.11a	Low	5260	20.99	20.36	21.68
		Mid	5300	20.64	21.14	
		High	5320	21.68	20.19	
	802.11n HT20	Low	5260	21.93	22.27	22.27
		Mid	5300	21.02	20.90	
		High	5320	20.96	20.38	
	802.11n HT40	Low	5270	39.65	39.58	40.09
		High	5310	40.09	39.67	
	802.11ac VHT80	Mid	5290	81.36	81.11	81.36

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9.3.3. 5.5 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-2C	802.11a	Low	5500	20.94	19.53	21.28
		Mid	5580	21.28	20.89	
		High	5700	20.34	20.57	
	802.11n HT20	Low	5500	20.59	22.02	22.02
		Mid	5580	21.74	21.87	
		High	5700	21.06	20.85	
	802.11n HT40	Low	5510	39.99	39.74	40.28
		Mid	5590	39.94	39.55	
		High	5670	40.28	39.82	
	802.11ac VHT80	Low	5530	81.27	82.20	82.20
		High	5610	81.14	81.99	

9.3.4. STRADDLE CHANNEL

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]			
				ANT1		ANT2	
				UNII-2C	UNII-3	UNII-2C	UNII-3
Straddle Channel	802.11a	Straddle	5720	14.83	4.90	15.10	5.70
	802.11n HT20	Straddle	5720	15.23	5.35	16.15	5.72
	802.11n HT40	Straddle	5710	34.48	5.07	34.98	4.95
	802.11ac VHT80	Straddle	5690	75.31	5.48	75.61	5.52

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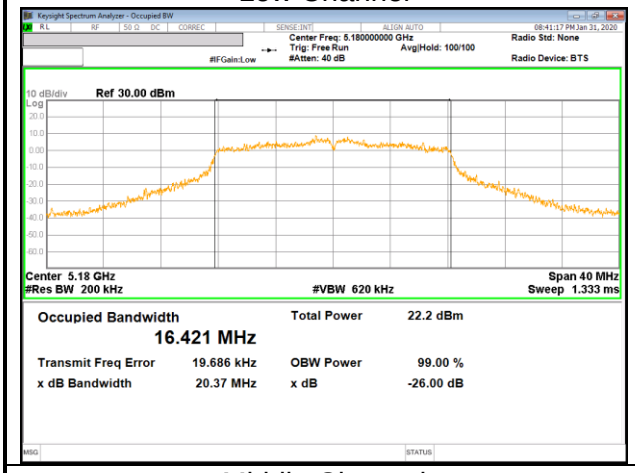
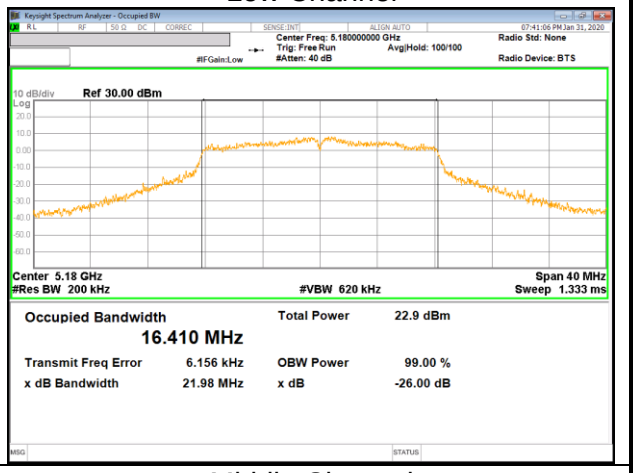
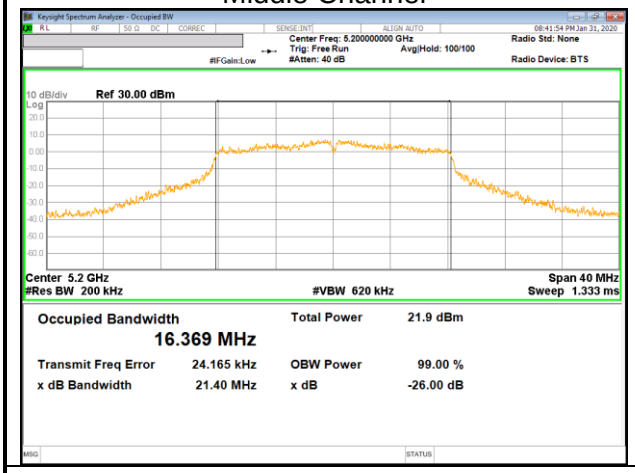
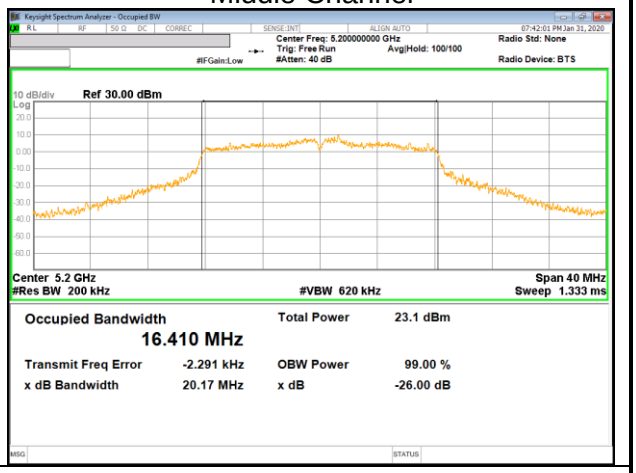
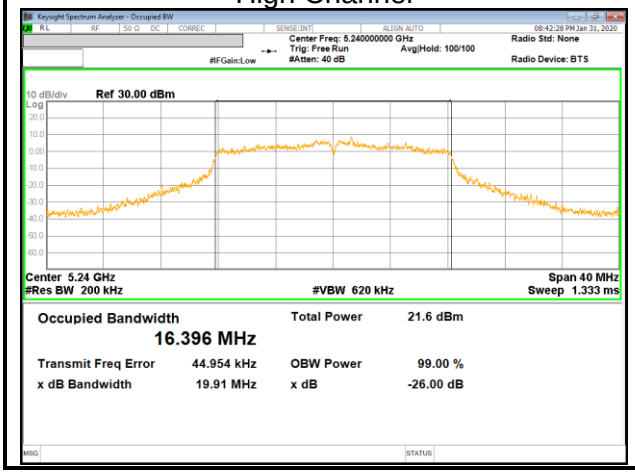
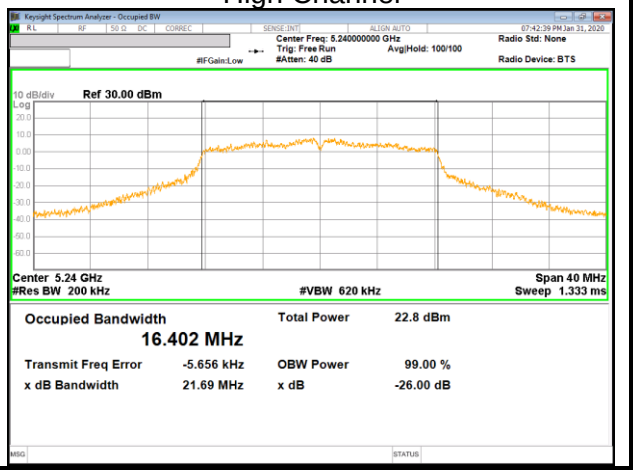
9.3.5. 26 dB BANDWIDTH PLOTS

UNII 5.2 GHz IEEE 802.11a mode

ANT1	ANT2
Low Channel	Low Channel
	
Occupied Bandwidth 16.421 MHz; Total Power 22.2 dBm; Transmit Freq Error 19.686 kHz; OBW Power 99.00 %; x dB Bandwidth 20.37 MHz; x dB -26.00 dB	Occupied Bandwidth 16.410 MHz; Total Power 22.9 dBm; Transmit Freq Error 6.156 kHz; OBW Power 99.00 %; x dB Bandwidth 21.98 MHz; x dB -26.00 dB
Middle Channel	Middle Channel
	
Occupied Bandwidth 16.369 MHz; Total Power 21.9 dBm; Transmit Freq Error 24.165 kHz; OBW Power 99.00 %; x dB Bandwidth 21.40 MHz; x dB -26.00 dB	Occupied Bandwidth 16.410 MHz; Total Power 23.1 dBm; Transmit Freq Error -2.291 kHz; OBW Power 99.00 %; x dB Bandwidth 20.17 MHz; x dB -26.00 dB
High Channel	High Channel
	
Occupied Bandwidth 16.396 MHz; Total Power 21.6 dBm; Transmit Freq Error 44.954 kHz; OBW Power 99.00 %; x dB Bandwidth 19.91 MHz; x dB -26.00 dB	Occupied Bandwidth 16.402 MHz; Total Power 22.8 dBm; Transmit Freq Error -5.656 kHz; OBW Power 99.00 %; x dB Bandwidth 21.69 MHz; x dB -26.00 dB

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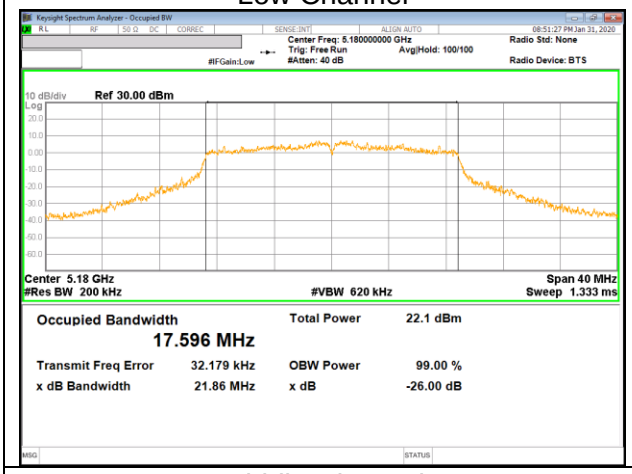
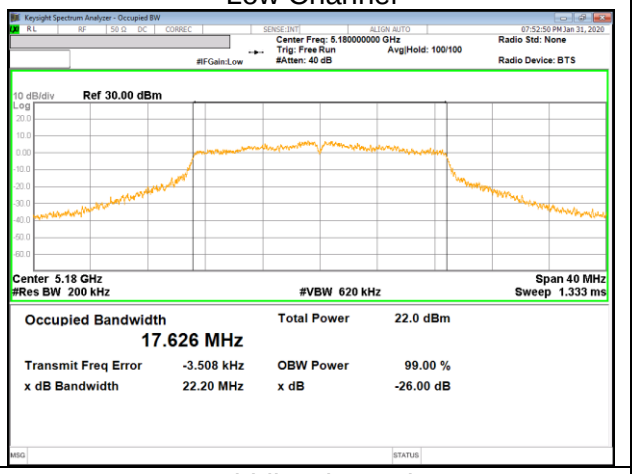
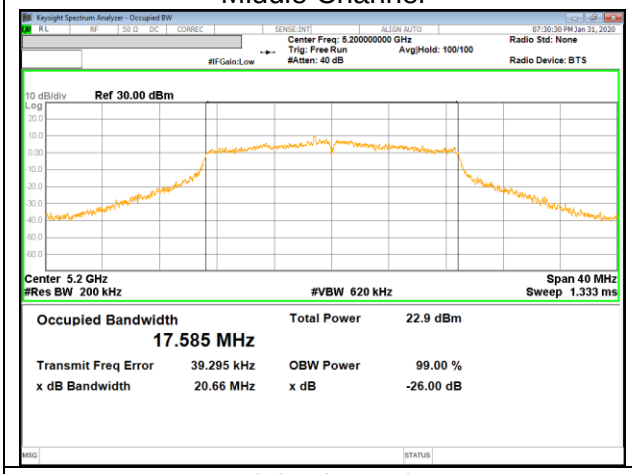
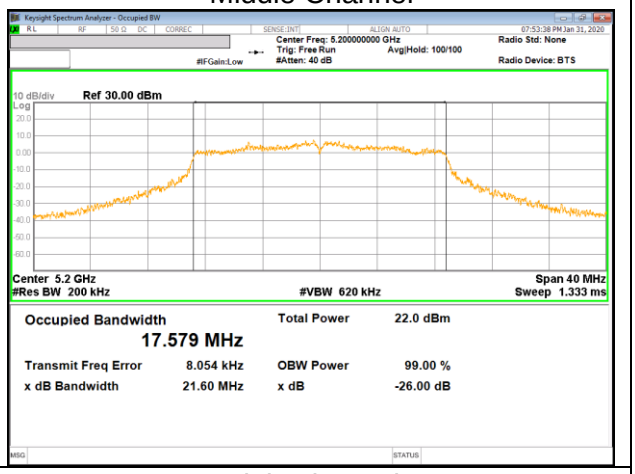
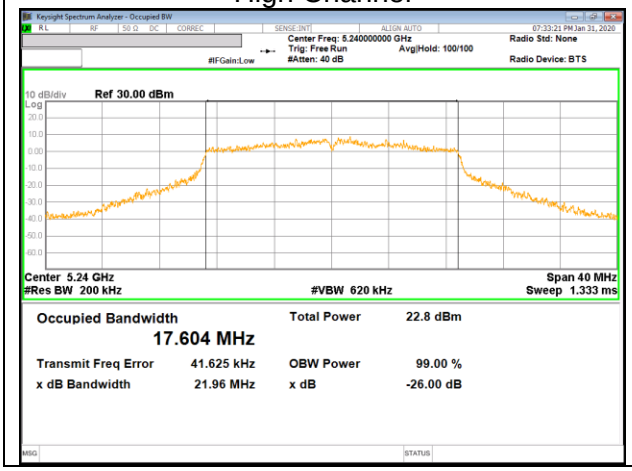
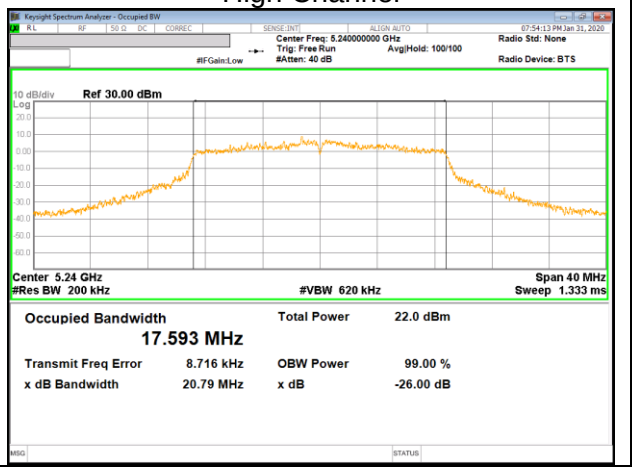
UNII 5.2 GHz IEEE 802.11n HT20 mode

ANT1	ANT2
Low Channel	Low Channel
	
Middle Channel	Middle Channel
	
High Channel	High Channel
	

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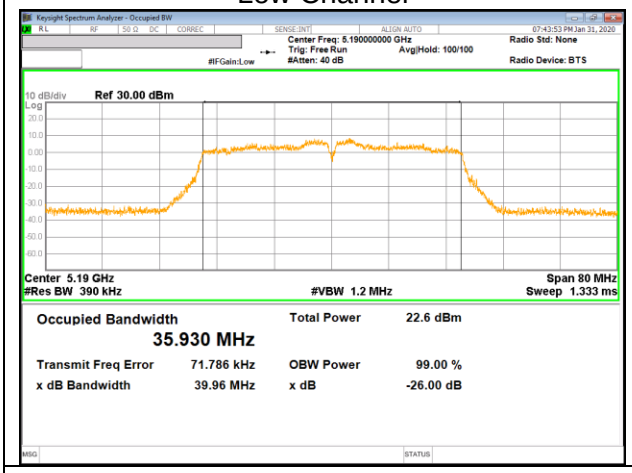
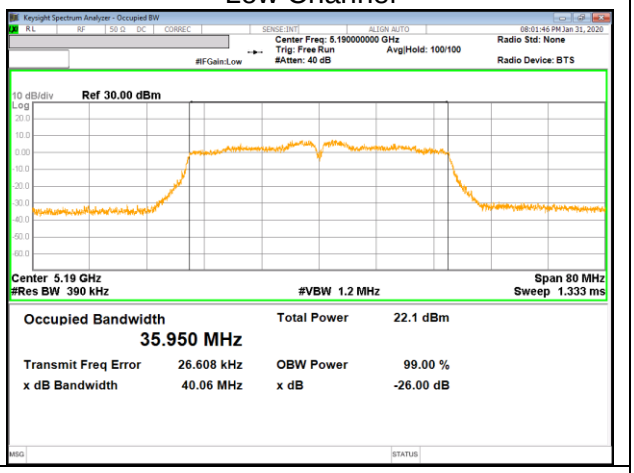
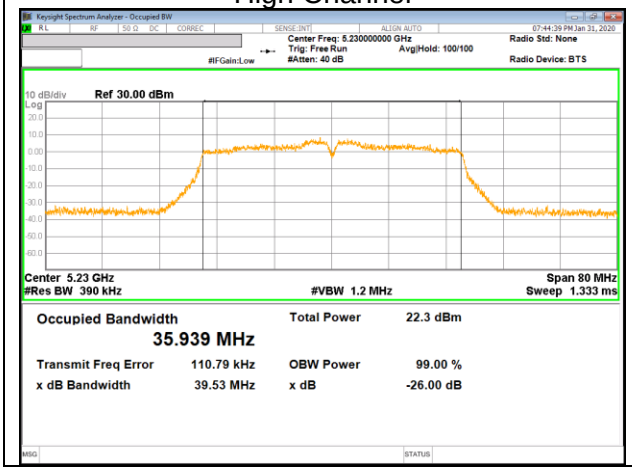
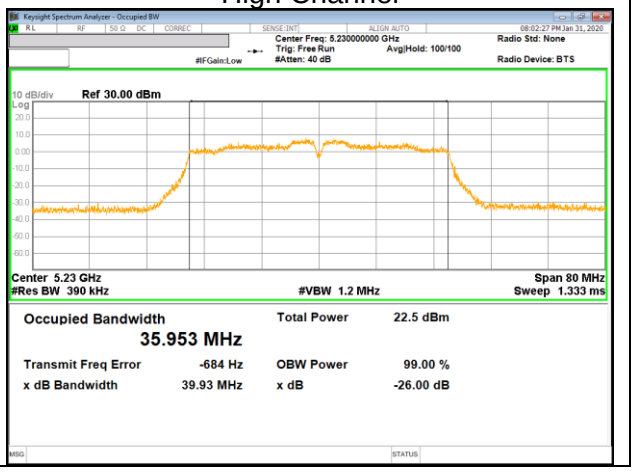
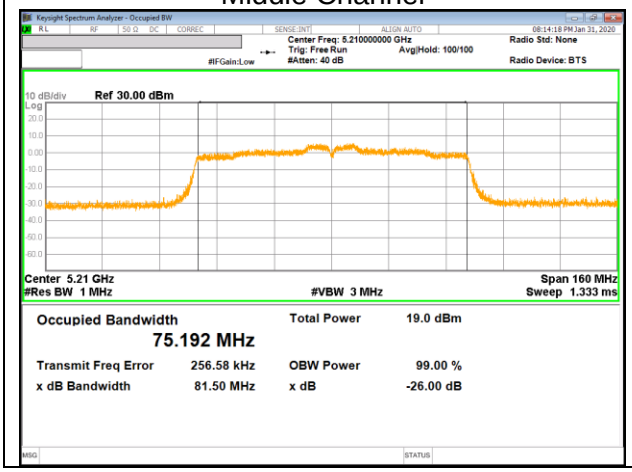
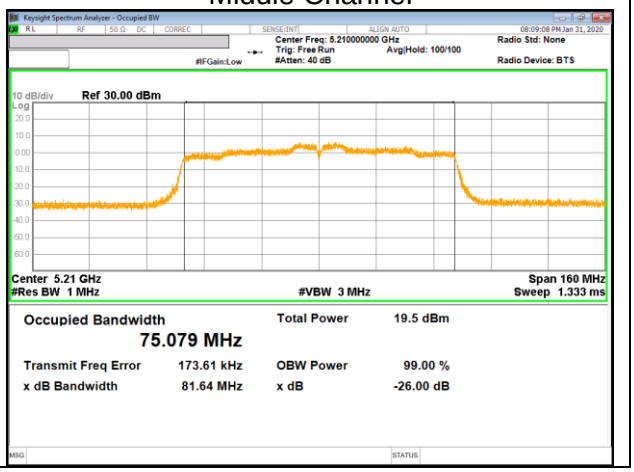
UNII 5.2 GHz IEEE 802.11n HT40 mode

ANT1	ANT2
Low Channel	Low Channel
	
High Channel	High Channel
	

UNII 5.2 GHz IEEE 802.11ac VHT80 mode

ANT1	ANT2
Middle Channel	Middle Channel
	

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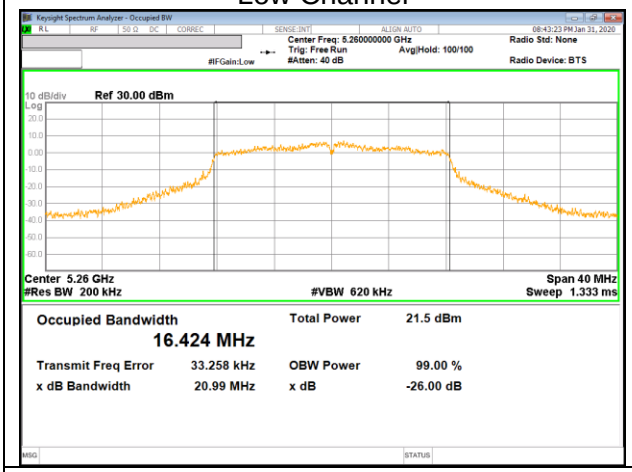
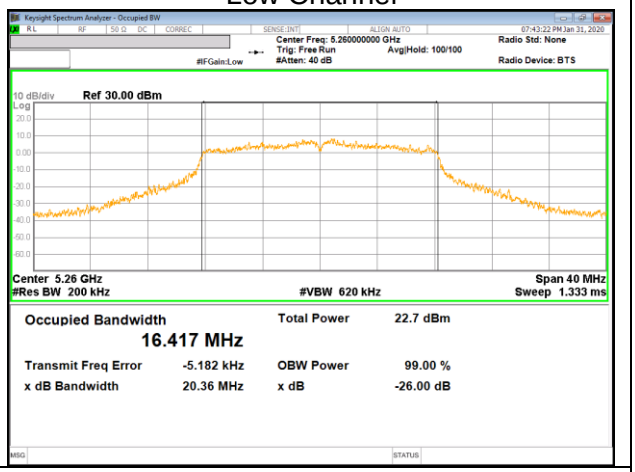
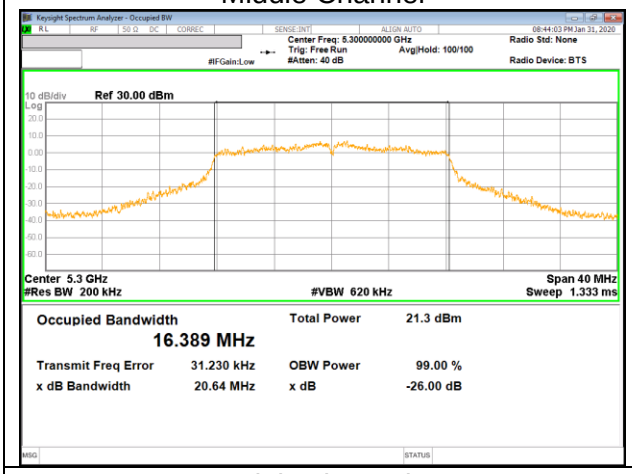
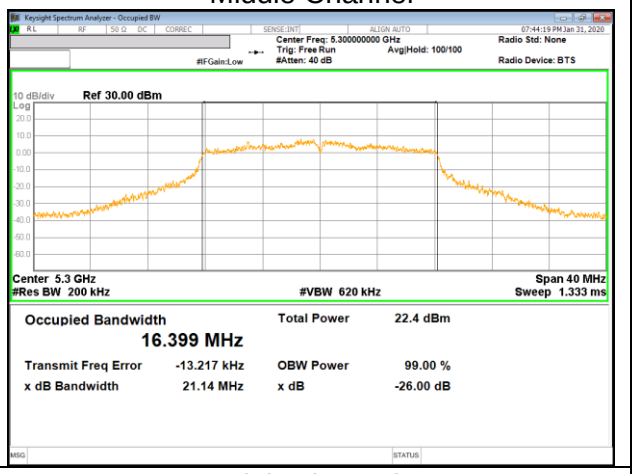
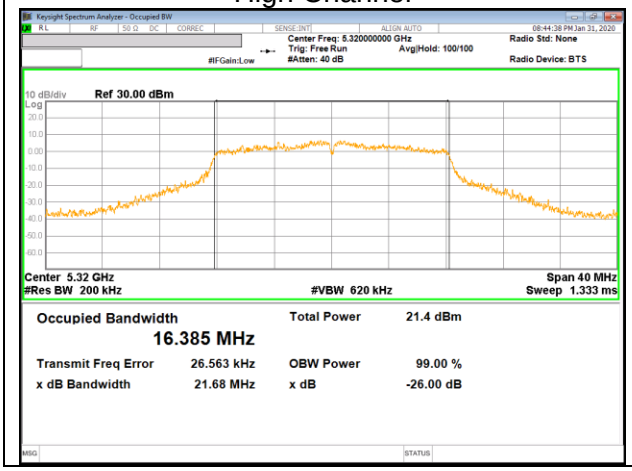
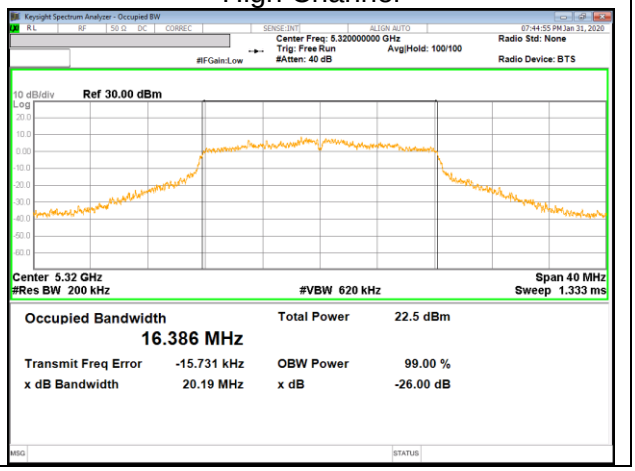
UNII 5.3 GHz IEEE 802.11a mode

ANT1	ANT2
Low Channel	Low Channel
	
Occupied Bandwidth 16.424 MHz; Total Power 21.5 dBm; Transmit Freq Error 33.258 kHz; OBW Power 99.00 %; x dB Bandwidth 20.99 MHz; x dB -26.00 dB	Occupied Bandwidth 16.417 MHz; Total Power 22.7 dBm; Transmit Freq Error -5.182 kHz; OBW Power 99.00 %; x dB Bandwidth 20.36 MHz; x dB -26.00 dB
Middle Channel	Middle Channel
	
Occupied Bandwidth 16.389 MHz; Total Power 21.3 dBm; Transmit Freq Error 31.230 kHz; OBW Power 99.00 %; x dB Bandwidth 20.64 MHz; x dB -26.00 dB	Occupied Bandwidth 16.399 MHz; Total Power 22.4 dBm; Transmit Freq Error -13.217 kHz; OBW Power 99.00 %; x dB Bandwidth 21.14 MHz; x dB -26.00 dB
High Channel	High Channel
	
Occupied Bandwidth 16.385 MHz; Total Power 21.4 dBm; Transmit Freq Error 26.563 kHz; OBW Power 99.00 %; x dB Bandwidth 21.68 MHz; x dB -26.00 dB	Occupied Bandwidth 16.386 MHz; Total Power 22.5 dBm; Transmit Freq Error -15.731 kHz; OBW Power 99.00 %; x dB Bandwidth 20.19 MHz; x dB -26.00 dB

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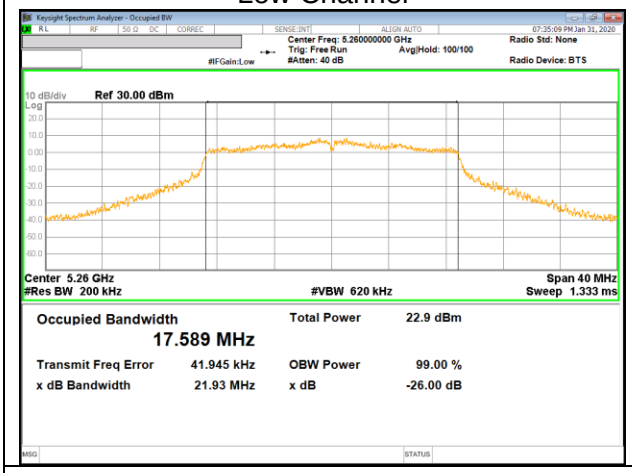
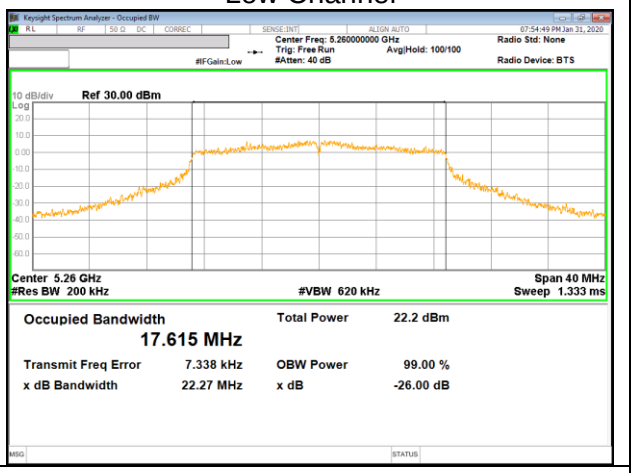
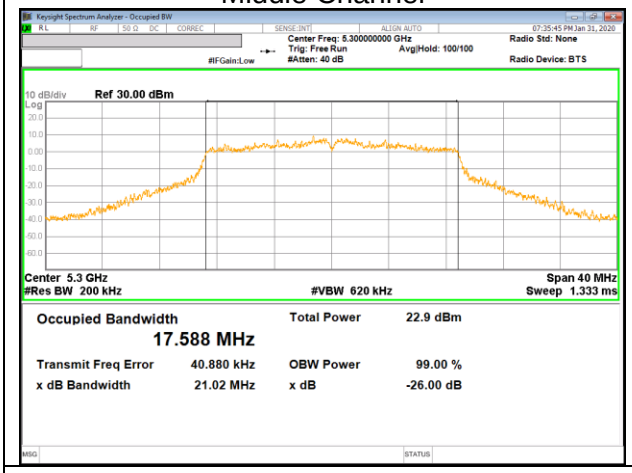
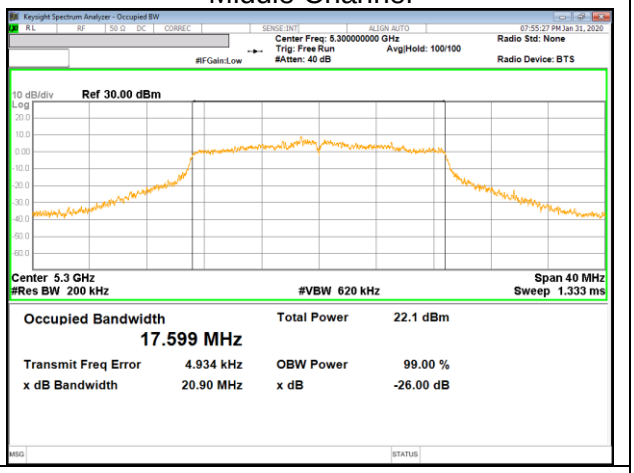
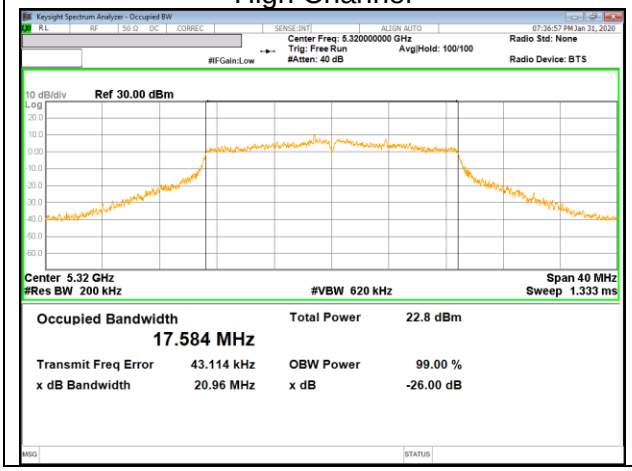
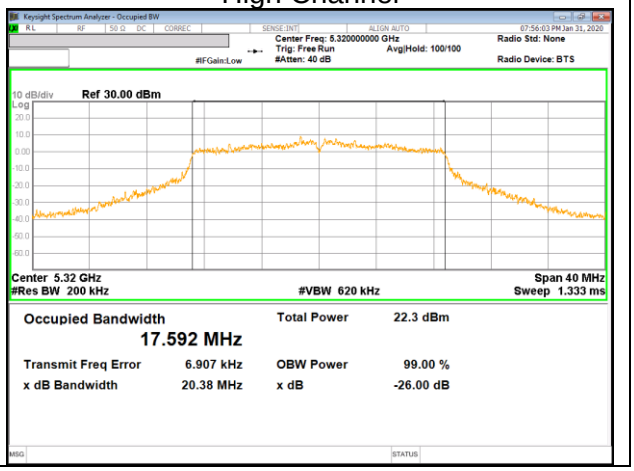
UNII 5.3 GHz IEEE 802.11n HT20 mode

ANT1	ANT2
Low Channel	Low Channel
	
Middle Channel	Middle Channel
	
High Channel	High Channel
	

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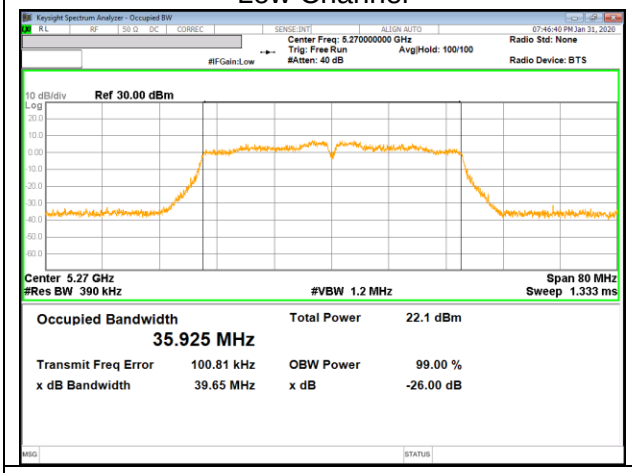
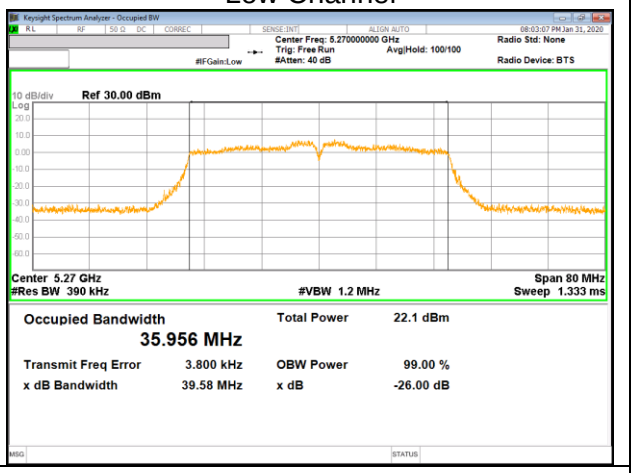
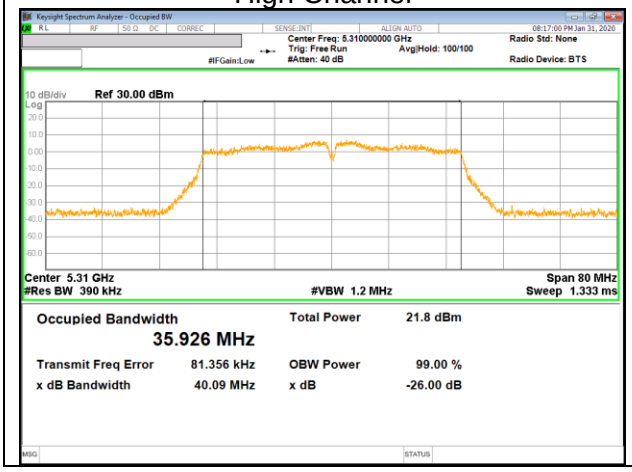
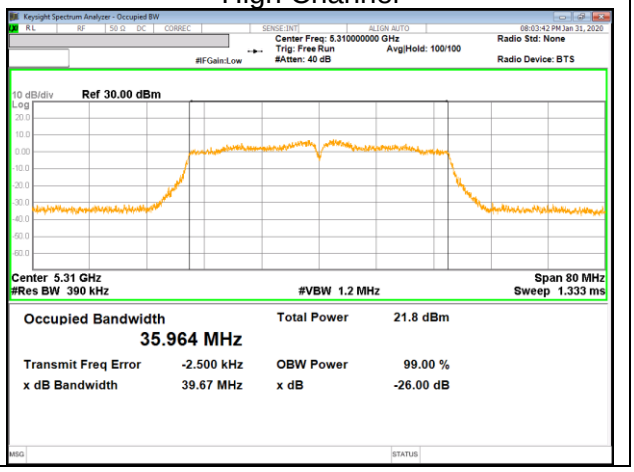
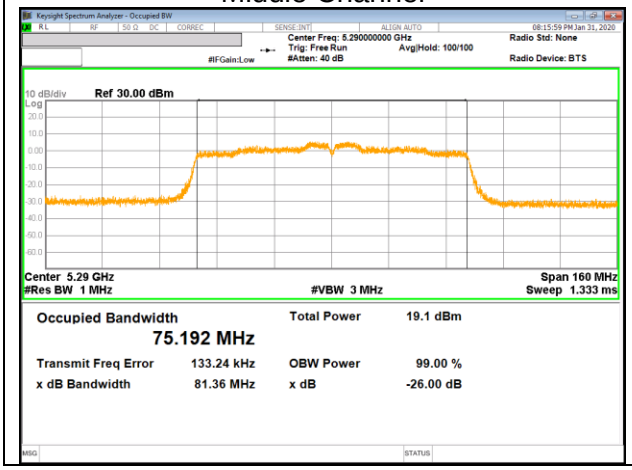
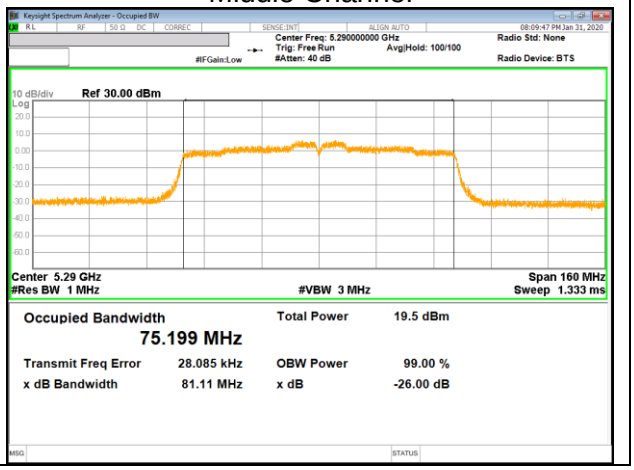
UNII 5.3 GHz IEEE 802.11n HT40 mode

ANT1	ANT2
Low Channel	Low Channel
	
High Channel	High Channel
	

UNII 5.3 GHz IEEE 802.11ac VHT80 mode

ANT1	ANT2
Middle Channel	Middle Channel
	

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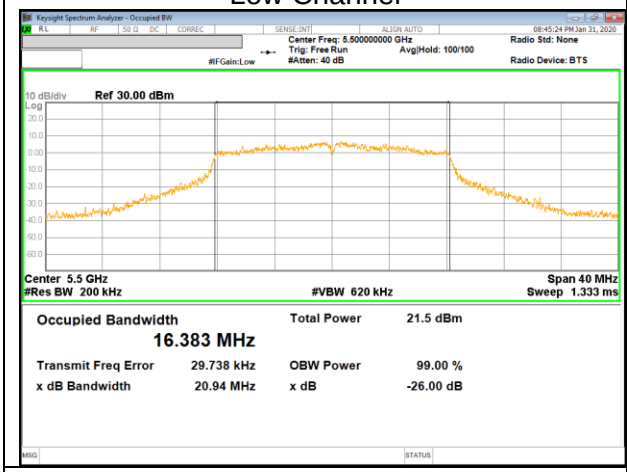
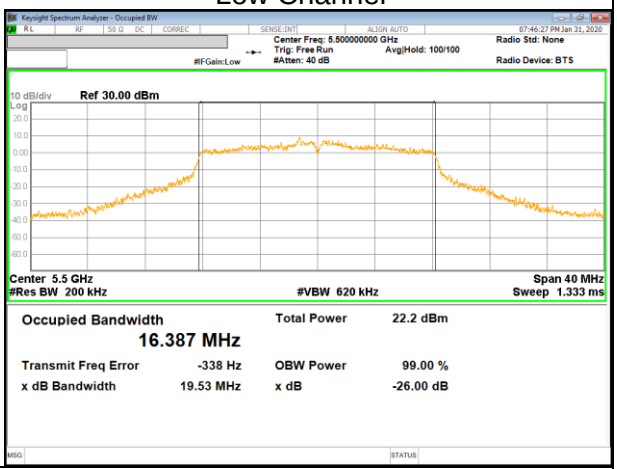
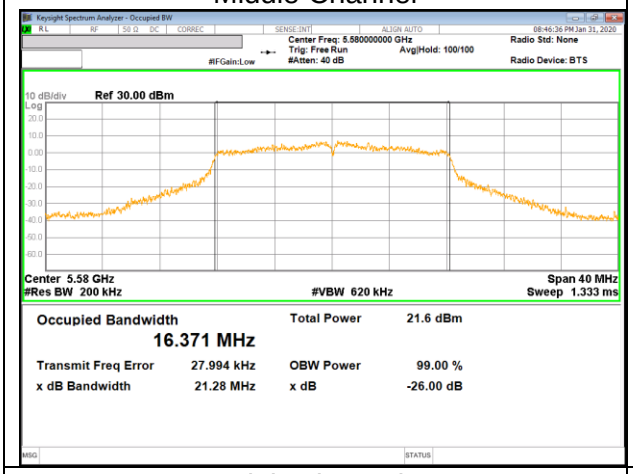
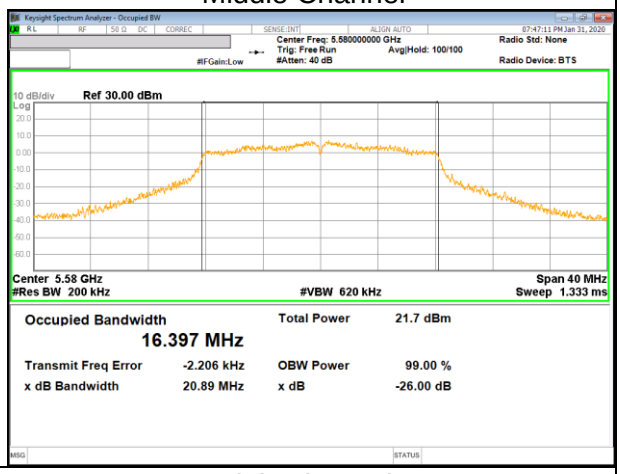
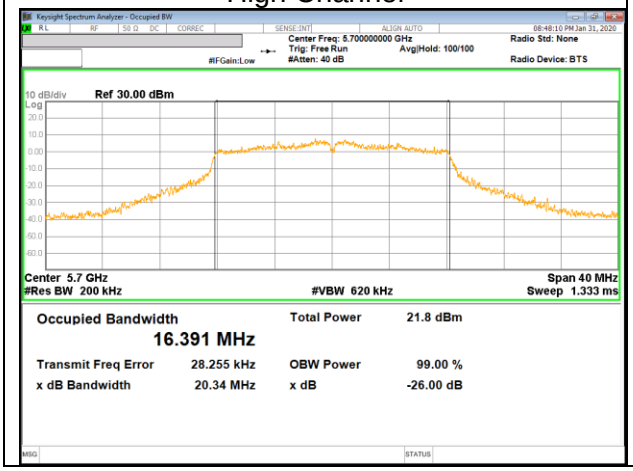
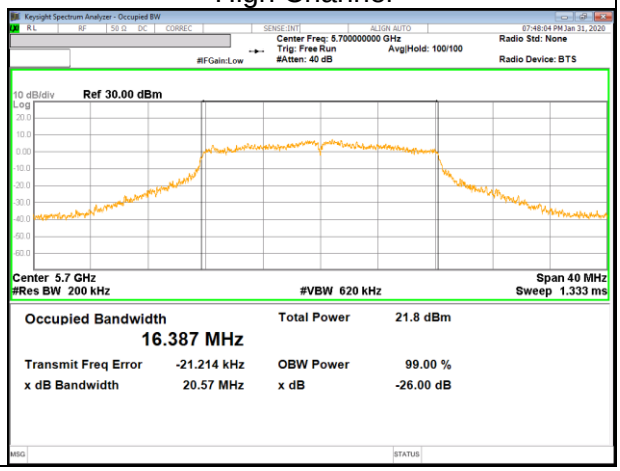
UNII 5.5 GHz IEEE 802.11a mode

ANT1	ANT2
Low Channel	Low Channel
	
Occupied Bandwidth 16.383 MHz; Total Power 21.5 dBm; Transmit Freq Error 29.738 kHz; OBW Power 99.00 %; x dB Bandwidth 20.94 MHz; x dB -26.00 dB	Occupied Bandwidth 16.387 MHz; Total Power 22.2 dBm; Transmit Freq Error -338 Hz; OBW Power 99.00 %; x dB Bandwidth 19.53 MHz; x dB -26.00 dB
Middle Channel	Middle Channel
	
Occupied Bandwidth 16.371 MHz; Total Power 21.6 dBm; Transmit Freq Error 27.994 kHz; OBW Power 99.00 %; x dB Bandwidth 21.28 MHz; x dB -26.00 dB	Occupied Bandwidth 16.397 MHz; Total Power 21.7 dBm; Transmit Freq Error -2.206 kHz; OBW Power 99.00 %; x dB Bandwidth 20.89 MHz; x dB -26.00 dB
High Channel	High Channel
	
Occupied Bandwidth 16.391 MHz; Total Power 21.8 dBm; Transmit Freq Error 28.255 kHz; OBW Power 99.00 %; x dB Bandwidth 20.34 MHz; x dB -26.00 dB	Occupied Bandwidth 16.387 MHz; Total Power 21.8 dBm; Transmit Freq Error -21.214 kHz; OBW Power 99.00 %; x dB Bandwidth 20.57 MHz; x dB -26.00 dB

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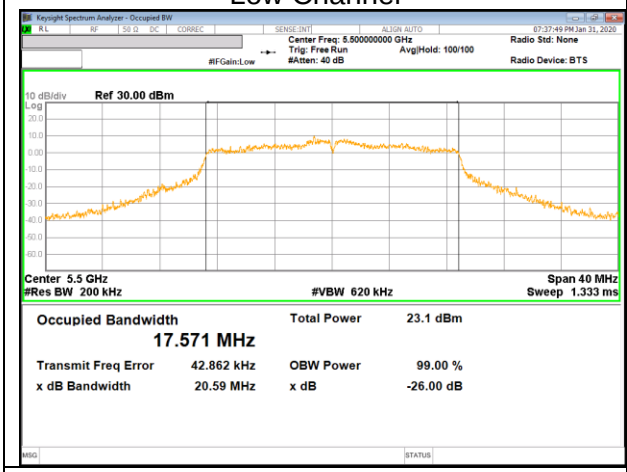
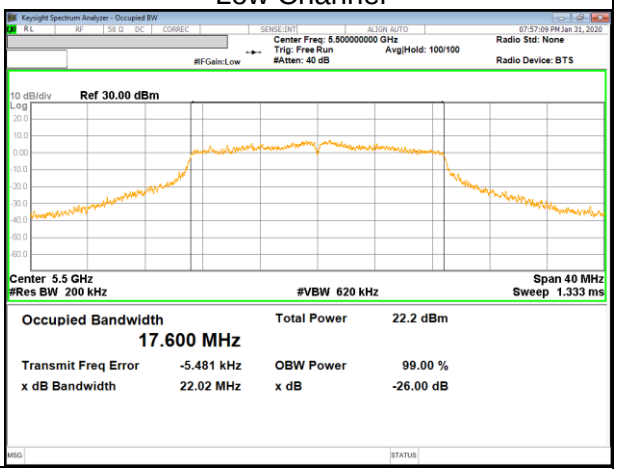
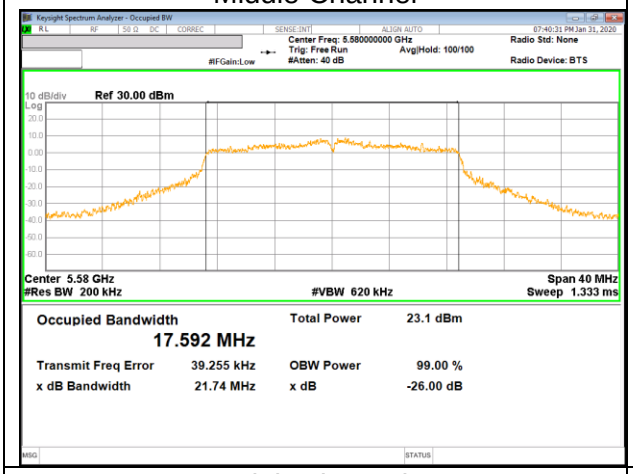
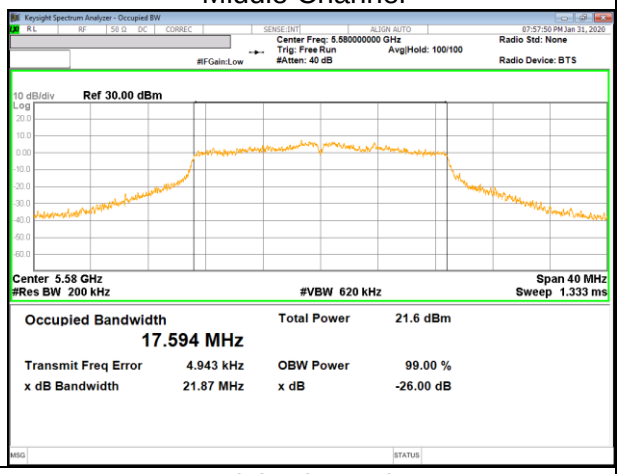
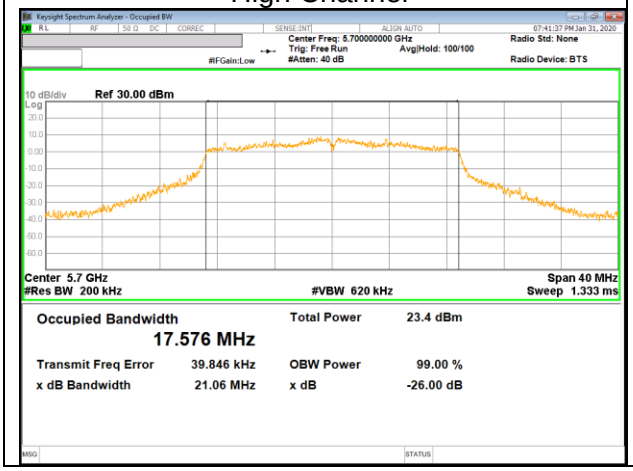
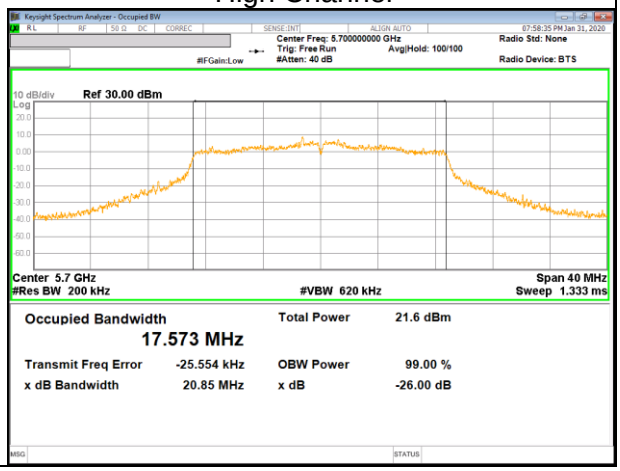
UNII 5.5 GHz IEEE 802.11n HT20 mode

ANT1	ANT2
Low Channel	Low Channel
	
Occupied Bandwidth 17.571 MHz; Total Power 23.1 dBm; Transmit Freq Error 42.862 kHz; OBW Power 99.00 %; x dB Bandwidth 20.59 MHz; x dB -26.00 dB	Occupied Bandwidth 17.600 MHz; Total Power 22.2 dBm; Transmit Freq Error -5.481 kHz; OBW Power 99.00 %; x dB Bandwidth 22.02 MHz; x dB -26.00 dB
Middle Channel	Middle Channel
	
Occupied Bandwidth 17.592 MHz; Total Power 23.1 dBm; Transmit Freq Error 39.255 kHz; OBW Power 99.00 %; x dB Bandwidth 21.74 MHz; x dB -26.00 dB	Occupied Bandwidth 17.594 MHz; Total Power 21.6 dBm; Transmit Freq Error 4.943 kHz; OBW Power 99.00 %; x dB Bandwidth 21.87 MHz; x dB -26.00 dB
High Channel	High Channel
	
Occupied Bandwidth 17.576 MHz; Total Power 23.4 dBm; Transmit Freq Error 39.846 kHz; OBW Power 99.00 %; x dB Bandwidth 21.06 MHz; x dB -26.00 dB	Occupied Bandwidth 17.573 MHz; Total Power 21.6 dBm; Transmit Freq Error -25.554 kHz; OBW Power 99.00 %; x dB Bandwidth 20.85 MHz; x dB -26.00 dB

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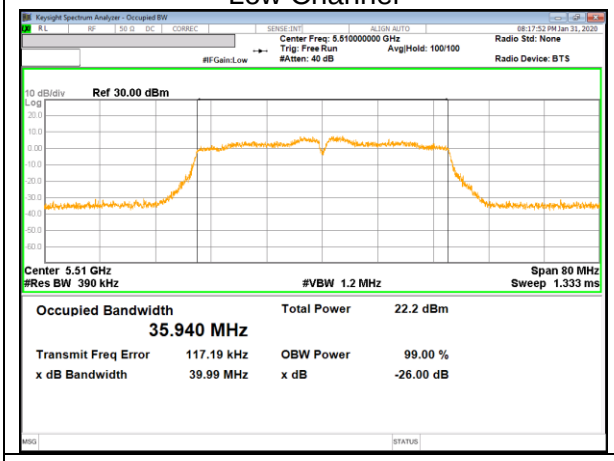
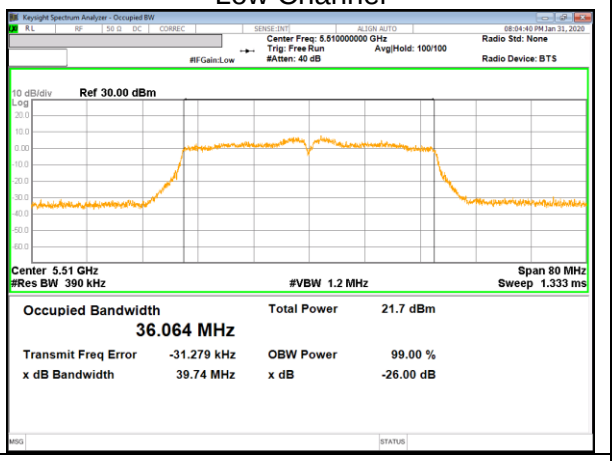
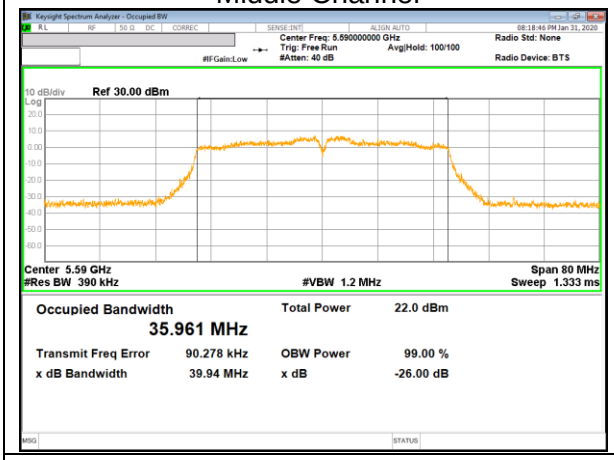
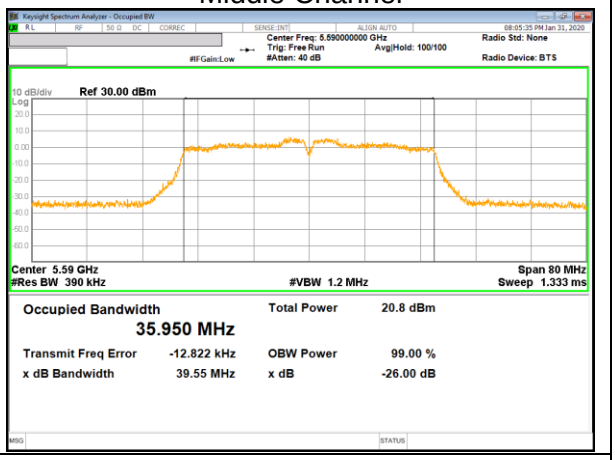
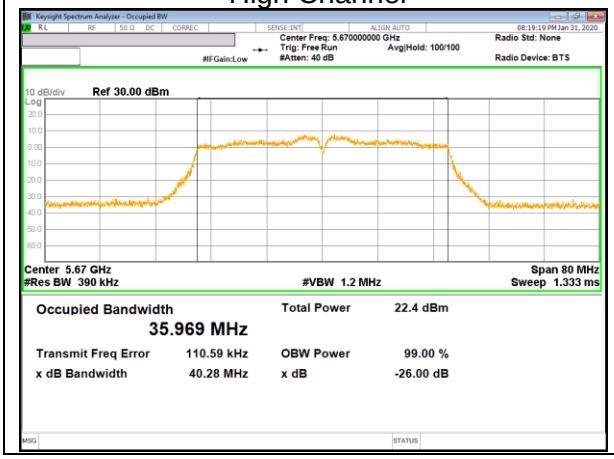
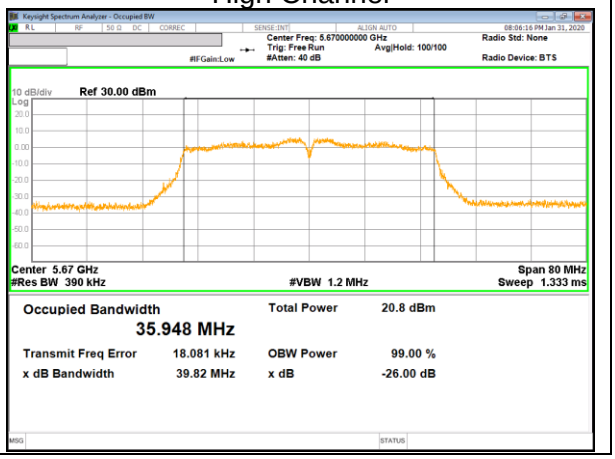
UNII 5.5 GHz IEEE 802.11n HT40 mode

ANT1	ANT2
Low Channel	Low Channel
	
Middle Channel	Middle Channel
	
High Channel	High Channel
	

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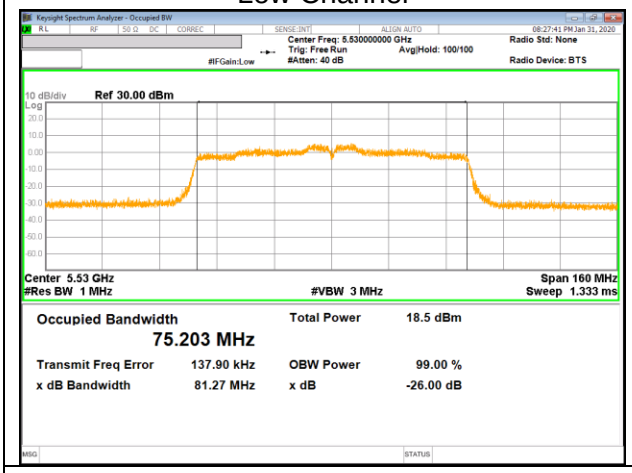
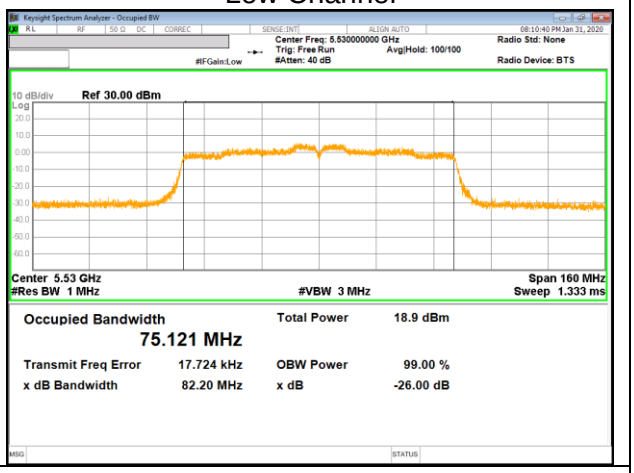
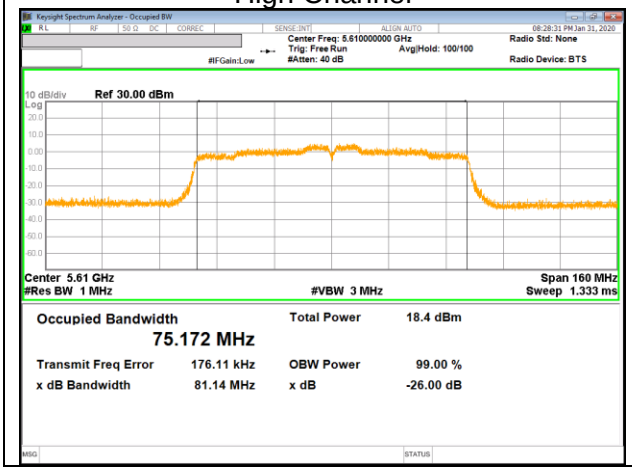
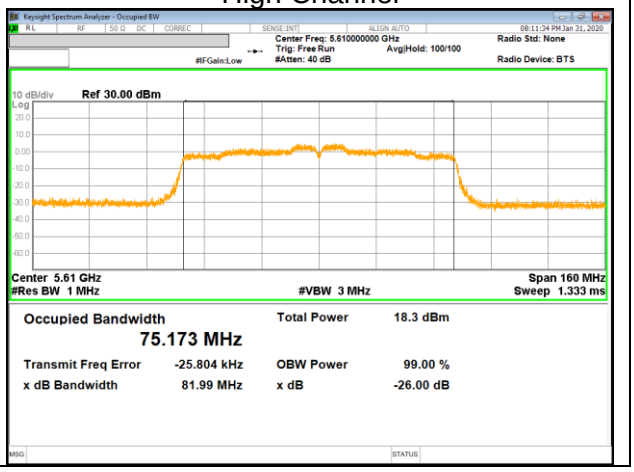
UNII 5.5 GHz IEEE 802.11ac VHT80 mode

ANT1	ANT2
Low Channel	Low Channel
	
High Channel	High Channel
	

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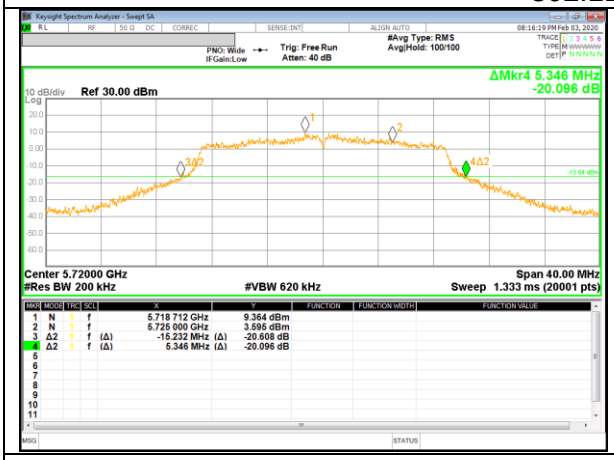
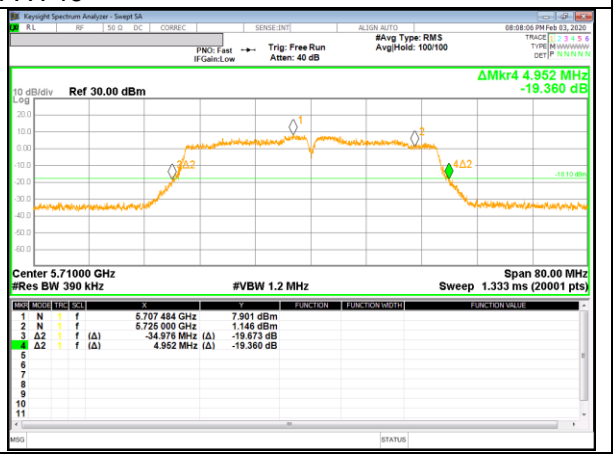
UNII Straddle Channel IEEE 802.11a / n HT20 / n HT40 / ac VHT80 mode

ANT1	ANT2
802.11a	
802.11n HT20	
	
802.11n HT40	
	

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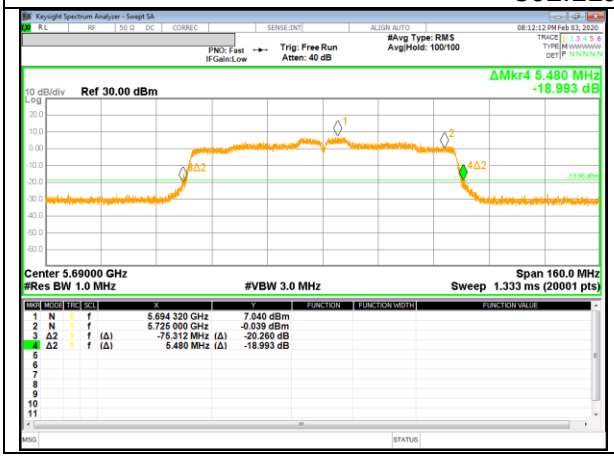
ANT1	ANT2
802.11ac VHT80	
	

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10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.407

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

TEST PROCEDURE

Reference to 789033 D02 General UNII Test Procedures New Rules v02r01: The transmitter output is connected to a spectrum analyzer with the RBW set to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

NOTE

- Calculation for 6dB Bandwidth of UNII-3 Straddle Channel

ex) Fundamental frequency : 5720MHz
  - 6dB BW : 16.350MHz
  - Starting Frequency of UNII-3 band : 5725MHz
  - 6dB Bandwidth of UNII-3 band Portion
    = (5720 + (16.350 / 2) -5725) = 3.175 MHz

RESULTS

10.1.1. 5.8 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	6 dB BW [MHz]		Worst	Minimum Limit [MHz]
				ANT1	ANT2		
UNII-3	802.11a	Low	5745	15.31	10.10	10.10	0.5
		Mid	5785	15.67	13.79		
		High	5825	11.97	11.26		
	802.11n HT20	Low	5745	16.08	17.03	11.31	
		Mid	5785	15.76	11.31		
		High	5825	14.02	15.38		
	802.11n HT40	Low	5755	30.41	34.95	30.27	
		High	5795	33.86	30.27		
	802.11ac VHT80	Middle	5775	50.08	66.30	50.08	

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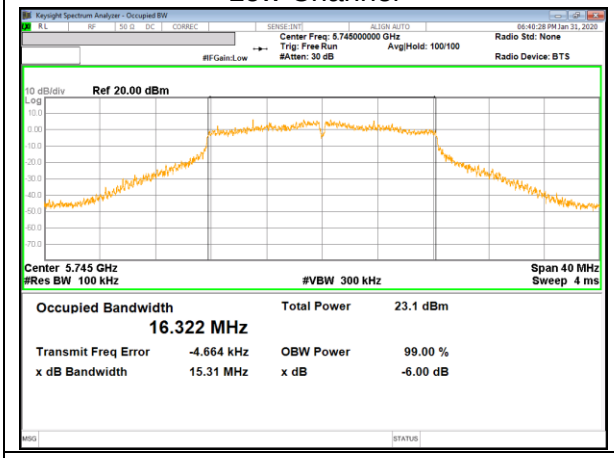
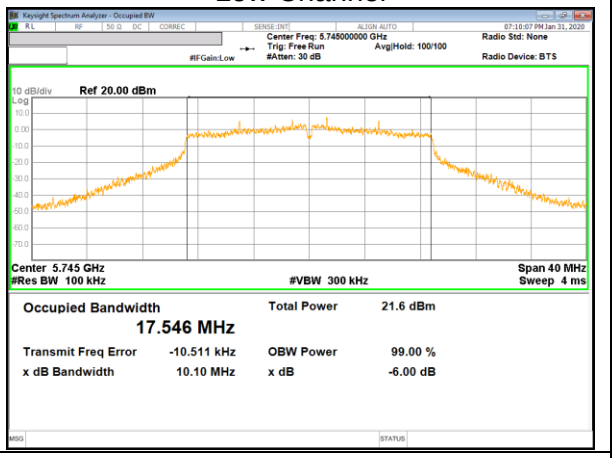
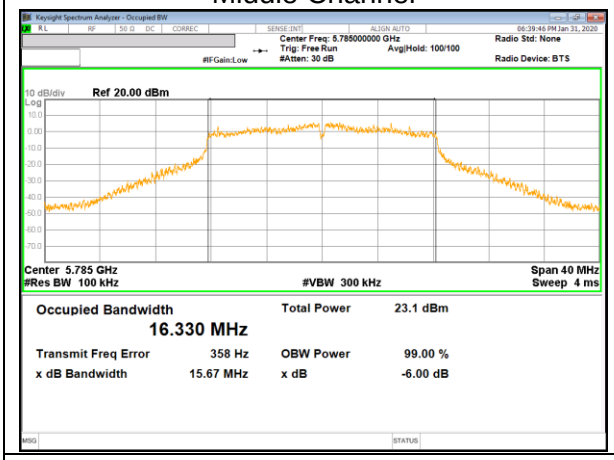
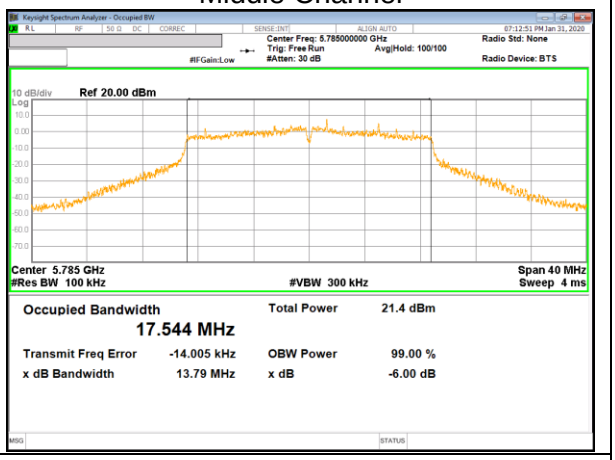
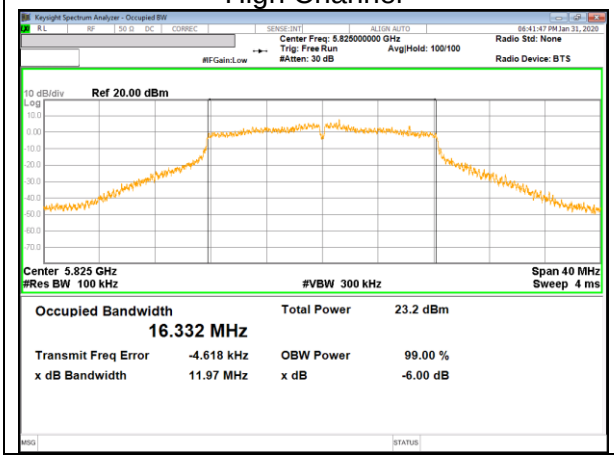
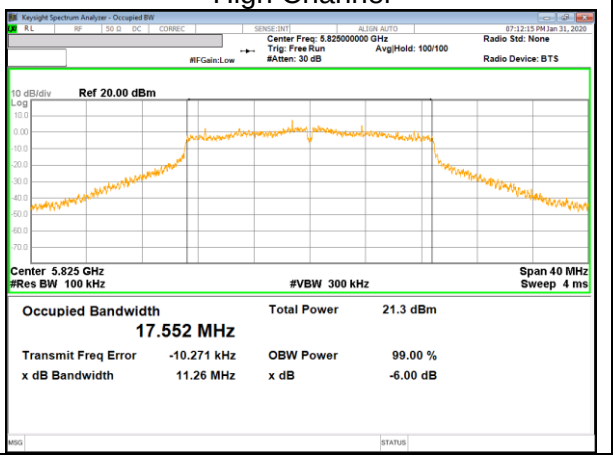
10.1.2. 6 dB BANDWIDTH PLOTS

IEEE 802.11a mode

ANT1	ANT2
Low Channel	Low Channel
	
Occupied Bandwidth 16.322 MHz; Total Power 23.1 dBm; Transmit Freq Error -4.664 kHz; OBW Power 99.00 %; x dB Bandwidth 15.31 MHz; x dB -6.00 dB	Occupied Bandwidth 17.546 MHz; Total Power 21.6 dBm; Transmit Freq Error -10.511 kHz; OBW Power 99.00 %; x dB Bandwidth 10.10 MHz; x dB -6.00 dB
Middle Channel	Middle Channel
	
Occupied Bandwidth 16.330 MHz; Total Power 23.1 dBm; Transmit Freq Error 358 Hz; OBW Power 99.00 %; x dB Bandwidth 15.67 MHz; x dB -6.00 dB	Occupied Bandwidth 17.544 MHz; Total Power 21.4 dBm; Transmit Freq Error -14.005 kHz; OBW Power 99.00 %; x dB Bandwidth 13.79 MHz; x dB -6.00 dB
High Channel	High Channel
	
Occupied Bandwidth 16.332 MHz; Total Power 23.2 dBm; Transmit Freq Error -4.618 kHz; OBW Power 99.00 %; x dB Bandwidth 11.97 MHz; x dB -6.00 dB	Occupied Bandwidth 17.552 MHz; Total Power 21.3 dBm; Transmit Freq Error -10.271 kHz; OBW Power 99.00 %; x dB Bandwidth 11.26 MHz; x dB -6.00 dB

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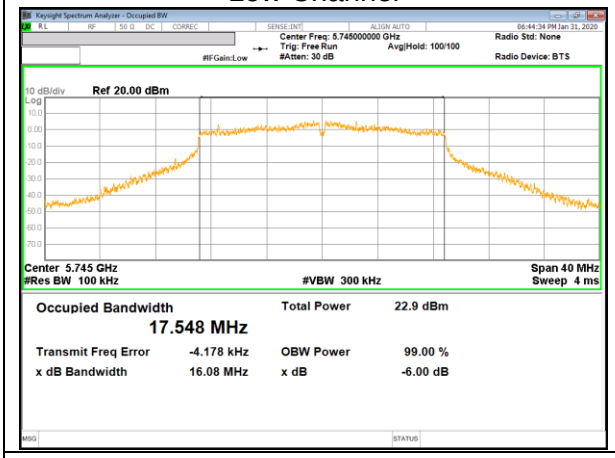
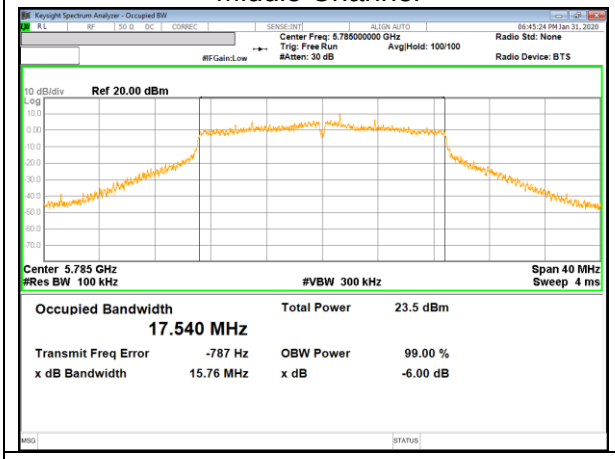
IEEE 802.11n HT20 mode

ANT1

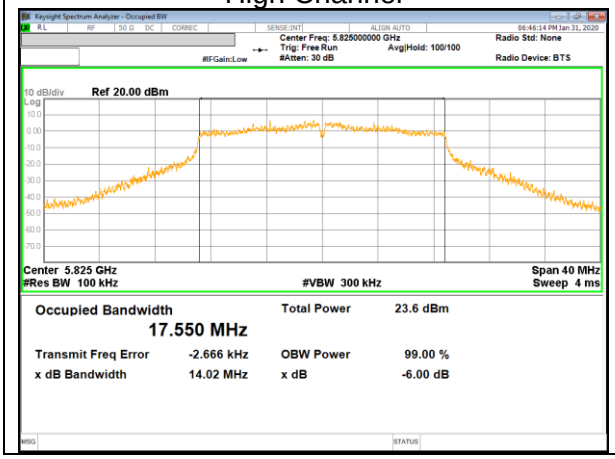
Low Channel



Middle Channel

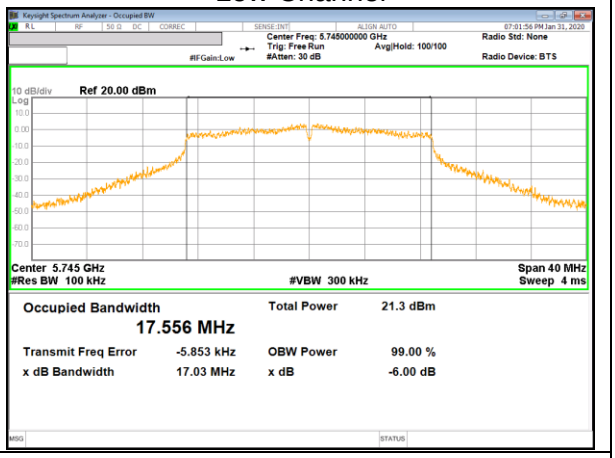


High Channel

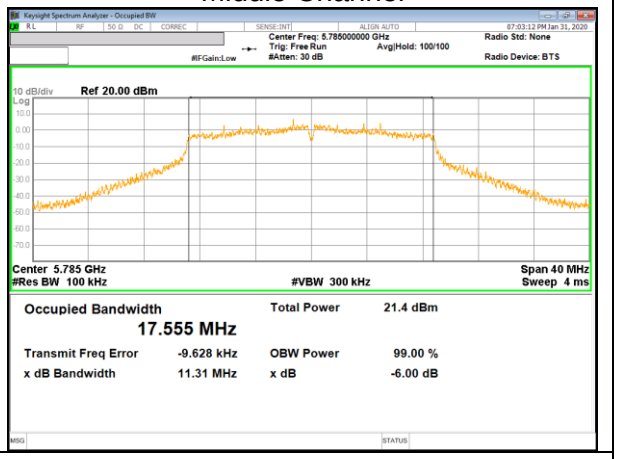


ANT2

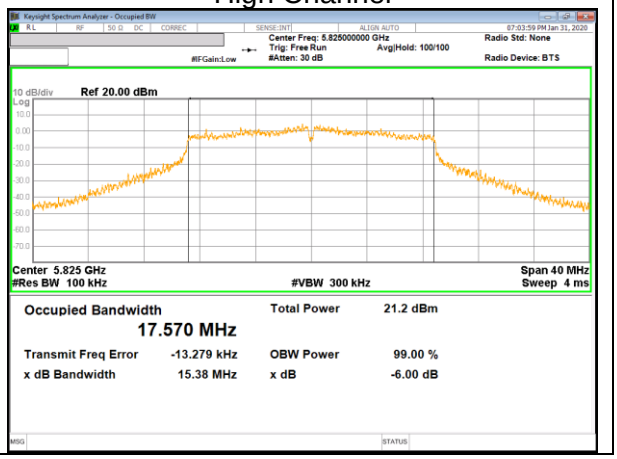
Low Channel



Middle Channel



High Channel



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