CERTIFICATION TEST REPORT

Report Number. : 4789247757-E8V2

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

Model : SM-G985F/DS, SM-G985F

FCC ID : A3LSMG985F

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

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

Date Of Issue:
December 17, 2019

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/12/19	Initial issue	Sungeun Lee
V2	12/17/19	Updated to address TCB's question	Sungeun Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT
MODEL NUMBER:	SM-G985F/DS, SM-G985F
SERIAL NUMBER:	R3CM90336DM, R3CM9030DBT, R3CM90FS9RV (CONDUCTED, Original); R3CM9033F1L, R3CM9033H2J, R3CM90FSA4H (RADIATED, Original); R38MA0KHL8H (RADIATED, Spot check);
DATE TESTED:	OCT 22, 2019 – NOV 29, 2019; NOV 15, 2019 – NOV 29, 2019 (Spot check);

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
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Tested By:

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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMG986B NII WLAN(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMG985F shares the same enclosure and circuit board as FCC ID: A3LSMG986B. The WLAN antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG986B remains representative of FCC ID: A3LSMG985F. The test data of FCC ID: A3LSMG986B being submitted for this application to cover WLAN features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated spurious and band edge emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model SM-G986B/DS FCC ID : A3LSMG986B	Spot check model SM-G985F/DS FCC ID : A3LSMG985F	Deviation	Remark
UNII WLAN 802.11 ax (5 GHz)	Band Edge	802.11ax(HE80)_5210_SU_ANT 2	5210 MHz	54.0 dBuV/m	50.51 dBuV/m	47.58 dBuV/m	-2.93 dB	-
	RSE	802.11ax(HE20)_5180_SU_ANT 1	5180 MHz	68.2 dBuV/m	50.59 dBuV/m	52.23 dBuV/m	1.64 dB	2nd Harmonic Noise floor
	Band Edge	802.11ax(HE80)_5210_SU_ALL	5210 MHz	54.0 dBuV/m	50.69 dBuV/m	49.39 dBuV/m	-1.30 dB	-
	RSE	802.11ax(HE20)_5240_SU_ALL	5240 MHz	54.0 dBuV/m	45.35 dBuV/m	46.90 dBuV/m	1.55 dB	-
	Band Edge	802.11ax(HE80)_5290_SU_ANT 2	5290 MHz	54.0 dBuV/m	51.28 dBuV/m	47.07 dBuV/m	-4.21 dB	-
	RSE	802.11ax(HE20)_5300_SU_ANT 1	5300 MHz	54.0 dBuV/m	44.53 dBuV/m	41.98 dBuV/m	-2.55 dB	2nd Harmonic
	Band Edge	802.11ax(HE40)_5310_SU_ALL	5310 MHz	54.0 dBuV/m	50.98 dBuV/m	48.65 dBuV/m	-2.33 dB	-
	RSE	802.11ax(HE20)_5300_SU_ALL	5300 MHz	54.0 dBuV/m	46.77 dBuV/m	45.68 dBuV/m	-1.09 dB	3rd Harmonic
	Band Edge	802.11ax(HE80)_5530_SU_ANT 2	5530 MHz	68.2 dBuV/m	65.55 dBuV/m	63.81 dBuV/m	-1.74 dB	-
	RSE	802.11ax(HE20)_5580_SU_ANT 1	5580 MHz	54.0 dBuV/m	45.81 dBuV/m	42.79 dBuV/m	-3.02 dB	2nd Harmonic
	Band Edge	802.11ax(HE80)_5530_SU_ALL	5530 MHz	54.0 dBuV/m	50.30 dBuV/m	49.86 dBuV/m	-0.44 dB	-
	RSE	802.11ax(HE20)_5500_SU_ALL	5500 MHz	54.0 dBuV/m	46.00 dBuV/m	42.81 dBuV/m	-3.19 dB	2nd Harmonic
	Band Edge	802.11ax(HE80)_5775_SU_ANT 1	5775 MHz	-27.0 dBm	-34.28 dBm	-35.17 dBm	-0.89 dB	Rear side
	RSE	802.11ax(HE20)_5785_SU_ANT 1	5785 MHz	74.0 dBuV/m	57.89 dBuV/m	55.52 dBuV/m	-2.37 dB	3rd Harmonic
	Band Edge	802.11ax(HE80)_5775_SU_ALL	5775 MHz	-27.0 dBm	-34.86 dBm	-34.74 dBm	0.12 dB	Rear side
	RSE	802.11ax(HE40)_5795_SU_ALL	5795 MHz	74.0 dBuV/m	58.38 dBuV/m	56.05 dBuV/m	-2.33 dB	3rd Harmonic

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

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1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMG986B	Original Grant	4789219881-E2	Test Report	4789247757-E2	All
DTS	A3LSMG986B	Original Grant	4789219881-E3 (802.11b/g/n)	Test Report	4789247757-E3 (802.11b/g/n)	All
			4789219881-E4 (802.11ax)	Test Report	4789247757-E4 (802.11ax)	All
			4789219881-E5 Bluetooth LE	Test Report	4789247757-E5 Bluetooth LE	All
DSS	A3LSMG986B	Original Grant	4789219881-E6 (Bluetooth)	Test Report	4789247757-E6 (Bluetooth)	All
NII	A3LSMG986B	Original Grant	4789219881-E7 (802.11a/n/ac)	Test Report	4789247757-E7 (802.11a/n/ac)	All
			4789219881-E8 (802.11ax)	Test Report	4789247757-E8 (802.11ax)	All
DXX	A3LSMG986B	Original Grant	4789219881-E9 (ANT+)	Test Report	4789247757-E9 (ANT+)	All
			4789219881-E10 (NFC)	Test Report	4789247757-E10 (NFC)	All
DCD	A3LSMG986B	Original Grant	4789219881-E11 (WPT)	Test Report	4789247757-E11 (WPT)	All

For this application the data reuse is summarized below for each equipment class:

Equipment Class	Reference FCC ID (Parent)	Application Type	Test Item	Data Re-used
PCE	A3LSMG986B	Original Grant	WWAN	All except SAR (full test), HAC (full test)
DTS	A3LSMG986B	Original Grant	BLE	All
			WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DSS	A3LSMG986B	Original Grant	BT	All except SAR (full test)
NII	A3LSMG986B	Original Grant	WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DXX	A3LSMG986B	Original Grant	ANT+	All
			NFC	All
DCD	A3LSMG986B	Original Grant	WPT	All except RF exposure

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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 558074 D01 DTS Meas Guidance v05r02.
4. ANSI C63.10-2013.
5. KDB 662911 D01 v02r01

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)

28.9 dBuV/m = 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB

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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/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT. This test report addresses the 802.11ax UNII (WLAN) operational mode.

This report covers the Samsung models SM-G985F/DS and SM-G985F.
These models are identical in hardware except SM-G985F has single SIM tray.
With some pre-scan, model SM-G985F/DS was set for spot check test.

WiFi Operating mode

Frequency rage	Mode	Antenna 1	Antenna 2
5GHz (5180 MHz ~ 5825 MHz)	802.11ax(HE20) SISO	TX/RX	TX/RX
	802.11ax(HE20) MIMO	TX/RX	TX/RX
	802.11ax(HE40) SISO	TX/RX	TX/RX
	802.11ax(HE40) MIMO	TX/RX	TX/RX
	802.11ax(HE80) SISO	TX/RX	TX/RX
	802.11ax(HE80) 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**	**A**	**-**	**-**	**A**	**V**
	2	**-**	**A**	**A**	**-**	**V**
	2	A	-	A	-	-
	2	-	A	-	A	-
2.4GHz + 5GHz RSDB & MIMO	3	A	A	A	-	-
	3	A	A	-	A	-
	3	A	-	A	A	-
	3	-	A	A	A	-
2.4GHz + 5GHz RSDB MIMO	**4**	**A**	**A**	**A**	**A**	**V**

Note. A = 13 dBm

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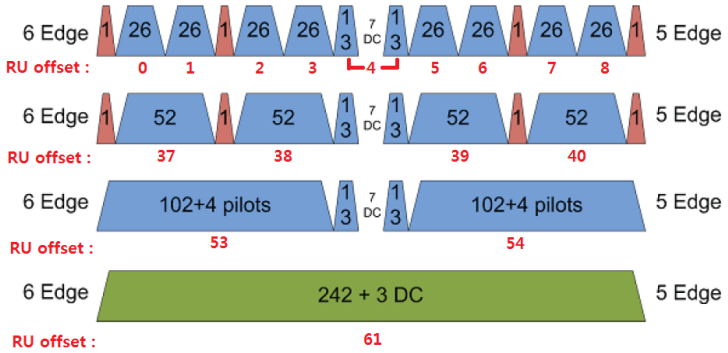
Simultaneous Tx Condition - Bluetooth with 5GHz WLAN (Not RSDB)

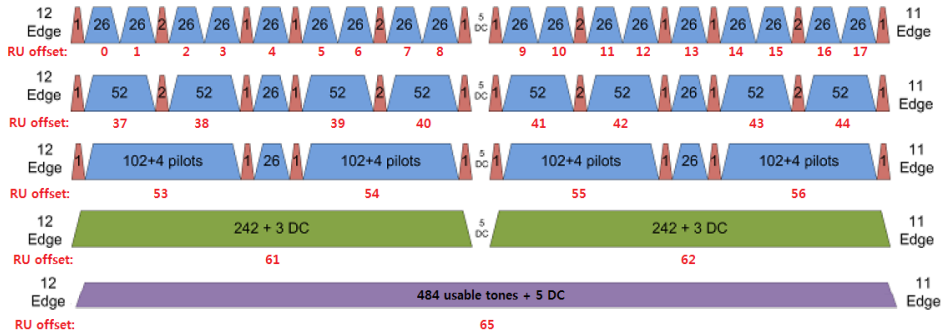
Mode	# of TX	5GHz		2.4GHz Bluetooth	Test Case
		ANT1	ANT2	ANT1	
2.4GHz Bluetooth + 5GHz WLAN (Not RSDB)	2	A	-	B	-
	2	-	A	B	-
	3	**A**	**A**	**B**	**V**

Note1. A = 13 dBm, B = 16.5 dBm

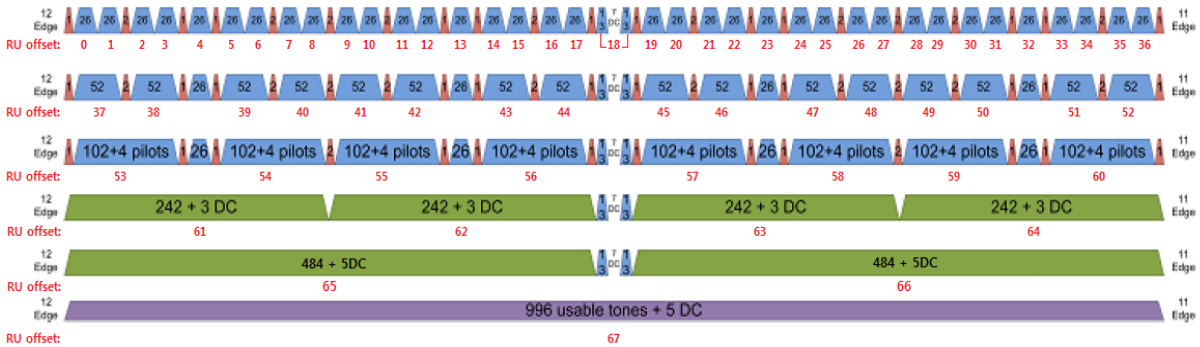
802.11ax RU allocations



- HE 20 Mode -



- HE 40 Mode -



- HE 80 Mode -

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Test RU offset for tones in each modes

Mode	Tones	RU offset
HE20	26T	0
		4
		8
	52T	37
		38
		40
	106T	53
		54
	242T / SU Note 1	61 / -
HE40	26T	0
		9
		17
	52T	37
		41
		44
	106T	53
		54
		56
	242T	61
		62
	484T / SU Note 1	63 / -
HE80	26T	0
		18
		36
	52T	37
		45
		52
	106T	53
		57
		60
	242T	61
		62
		64
	484T	65
		66
	996T / SU Note 1	67 / -

Note 1: Full RU(Resource Unit) 242T mode and SU(Single Unit) mode have no difference in physical waveform. This report has been reported the SU mode with highest output power in SISO and the SU mode with highest output power in MIMO.

Band portion of RU allocation about straddle channels

Mode	Channel	Tones	RU offset	Portion
HE20	Straddle 5720 MHz	26T	6	UNII 2C & UNII 3
		242T / SU	61 / -	
HE40	Straddle 5710 MHz	26T	16	UNII 2C & UNII 3
		484T / SU	65 / -	
HE80	Straddle 5690 MHz	26T	35	UNII 2C & UNII 3
		996T / SU	67 / -	

Note: in case of RU straddle channel, test was performed overlapping RU position.

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5.2. 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]	
		Antenna1	Antenna2	Antenna1	Antenna2
5180 - 5240	802.11ax HE20 SISO	16.67	16.56	46.45	45.29
	802.11ax HE20 MIMO	19.63		91.83	
5190 - 5230	802.11ax HE40 SISO	14.76	14.80	29.92	30.20
	802.11ax HE40 MIMO	17.80		60.26	
5210	802.11ax HE80 SISO	14.62	14.71	28.97	29.58
	802.11ax HE80 MIMO	17.69		58.75	
5260 - 5320	802.11ax HE20 SISO	16.57	16.51	45.39	44.77
	802.11ax HE20 MIMO	19.47		88.51	
5270 - 5310	802.11ax HE40 SISO	14.51	15.38	28.25	34.51
	802.11ax HE40 MIMO	18.54		71.45	
5290	802.11ax HE80 SISO	14.29	14.62	26.85	28.97
	802.11ax HE80 MIMO	17.43		55.34	
5500 - 5720	802.11ax HE20 SISO	14.61	14.72	28.91	29.65
	802.11ax HE20 MIMO	17.63		57.94	
5510 - 5710	802.11ax HE40 SISO	14.72	15.14	29.65	32.66
	802.11ax HE40 MIMO	17.94		62.23	
5530 - 5690	802.11ax HE80 SISO	14.58	14.96	28.71	31.33
	802.11ax HE80 MIMO	16.77		47.53	
5745 - 5825	802.11ax HE20 SISO	15.84	15.61	38.37	36.39
	802.11ax HE20 MIMO	18.75		74.99	
5755 - 5795	802.11ax HE40 SISO	14.95	14.82	31.26	30.34
	802.11ax HE40 MIMO	17.96		62.52	
5775	802.11ax HE80 SISO	14.80	14.42	30.20	27.67
	802.11ax HE80 MIMO	17.67		58.48	

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5.3. 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]	Antenna1 Gain [dBi]	Antenna2 Gain [dBi]	Correlated Chains Directional Gain [dBi]
UNII 1 5150 - 5250	-7.71	-8.78	-5.22
UNII 2A 5250 - 5350	-7.71	-8.78	-5.22
UNII 2C 5470 - 5725	-11.70	-8.89	-7.17
UNII 3 5725 - 5850	-12.00	-8.05	-6.79

“Sub3 WiFi1” and “Sub7 WiFi2” as indicated in antenna specification are written as ANT1 and ANT2 in this report.

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

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

Authorized Frequency Band			
Mode	**Antenna Stream**	**Mode**	**Covered by**
802.11ax HE 20	SISO	802.11ax HE20 RU(242T) 1TX	802.11ax HE20 SU 1TX
	MIMO	802.11ax HE20 RU(242T) 2TX	802.11ax HE20 SU 2TX
802.11ax HE 40	SISO	802.11ax HE40 RU(484T) 1TX	802.11ax HE40 SU 1TX
	MIMO	802.11ax HE40 RU(484T) 2TX	802.11ax HE40 SU 2TX
802.11ax HE 80	SISO	802.11ax HE80 RU(996T) 1TX	802.11ax HE80 SU 1TX
	MIMO	802.11ax HE80 RU(996T) 2TX	802.11ax HE80 SU 2TX

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5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1 GHz 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 1 GHz 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.
For SISO (ANT2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Based on the baseline scan, the worst-case data rates were:
802.11ax HE20 mode: MCS0 1Tx
802.11ax HE20 mode: MCS0 2Tx
802.11ax HE40 mode: MCS0 1Tx
802.11ax HE40 mode: MCS0 2Tx
802.11ax HE80 mode: MCS0 1Tx
802.11ax HE80 mode: MCS0 2Tx

Worst-case selection criteria for test items :

- For the radiated band-edge test, it was tested at SU mode for band-edge.

- For the spurious emissions, it was tested at the bandwidth/RU allocation with actual highest power and bandwidth/RU allocation with actual highest PSD for each bandwidth.

- For the 6dB Bandwidth, it was tested at the RU allocation with lowest tones number for each bandwidth.

Note : All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37M5DX86X1SE3	N/A
Data Cable	SAMSUNG	EP-DG977	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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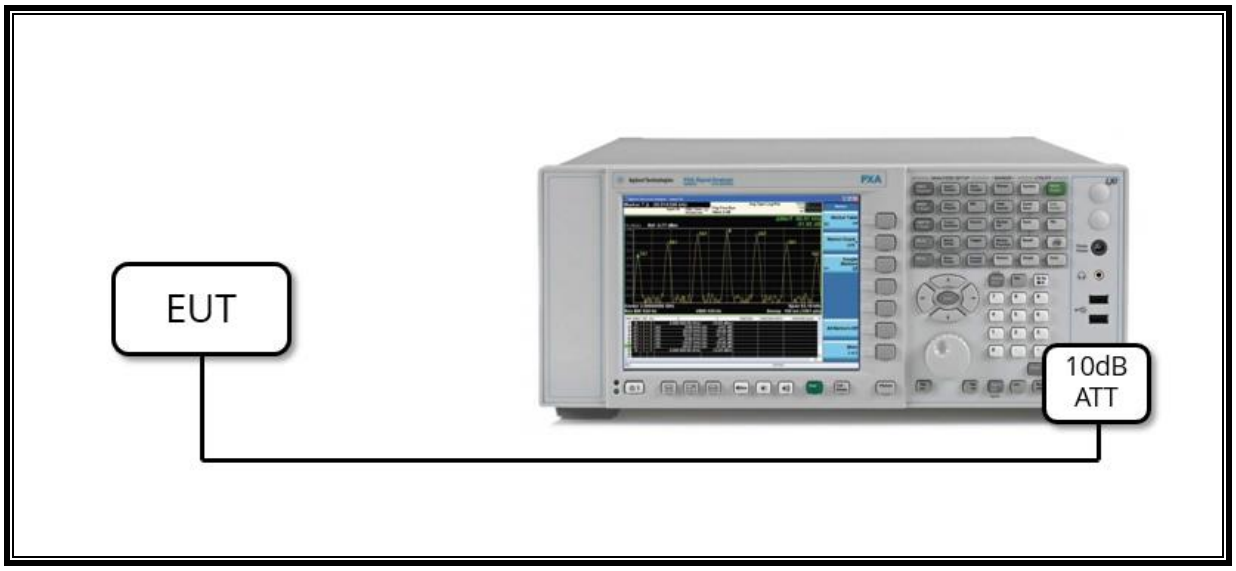
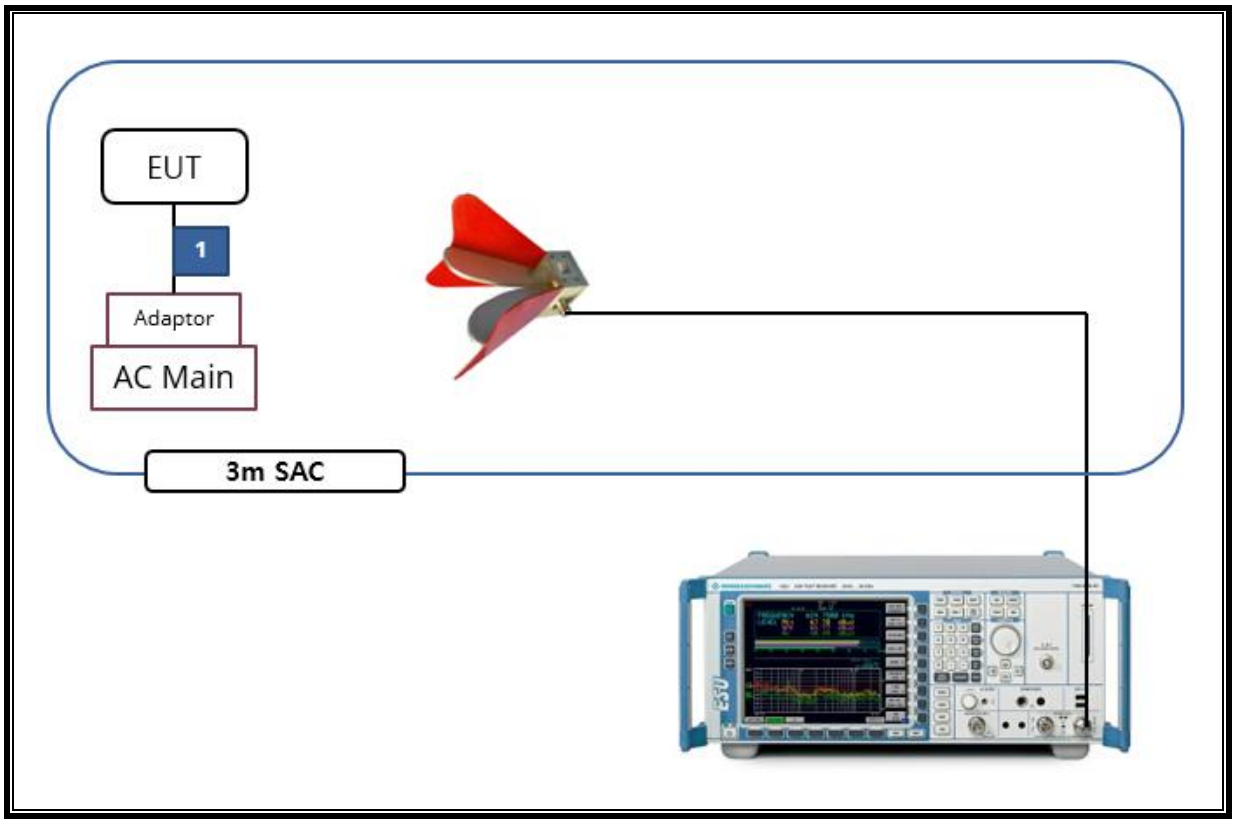
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



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**	**New 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
Antenna, Loop, 9kHz-30MHz				
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 (a)	Emission Bandwidth (26dB Bandwidth)	N/A	Condcuted	N/A
15.407(e)	6dB Band width (5.8Ghz)	500 kHz		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 500 kHz		PASS
15.207 (a)	AC Power Line conducted emissions	Section 10	Radiated	Refer to the UNII 802.11a_n_ac DFS WLAN Test report (No.:4789247757-E7)
15.407 (b) & 15.209	Radiated Spurious Emission	< 54dBuV/m		PASS
15.407 (h)(2)	Dynamic Frequency Selection	N/A	Condcuted	Refer to the UNII 802.11a_n_ac DFS WLAN Test report (No.:4789247757-E7)

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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	Tone	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor [dB]
802.11ax HE20	Single	26T	4.900	4.930	0.99	99.39	0.00
		52T	5.215	5.315	0.98	98.12	0.00
		106T	2.490	2.589	0.96	96.18	0.17
		242T	1.122	1.222	0.92	91.82	0.37
		SU	1.044	1.143	0.91	91.34	0.39
	ALL	26T	5.223	5.322	0.98	98.14	0.00
		52T	2.649	2.749	0.96	96.36	0.16
		106T	1.284	1.384	0.93	92.77	0.33
		242T	0.601	0.701	0.86	85.73	0.67
		SU	0.557	0.656	0.85	84.93	0.71
802.11ax HE40	Single	26T	4.901	4.931	0.99	99.39	0.00
		52T	5.215	5.315	0.98	98.12	0.00
		106T	2.489	2.589	0.96	96.14	0.17
		242T	1.121	1.221	0.92	91.81	0.37
		484T	0.593	0.693	0.86	85.63	0.67
		SU	0.550	0.649	0.85	84.74	0.72
	ALL	26T	5.223	5.323	0.98	98.12	0.00
		52T	2.649	2.749	0.96	96.36	0.16
		106T	1.284	1.384	0.93	92.77	0.33
		242T	0.601	0.701	0.86	85.68	0.67
		484T	0.338	0.437	0.77	77.18	1.12
		SU	0.313	0.412	0.76	76.00	1.19
802.11ax HE80	Single	26T	4.897	4.933	0.99	99.27	0.00
		52T	5.214	5.315	0.98	98.10	0.00
		106T	2.489	2.591	0.96	96.06	0.17
		242T	1.121	1.222	0.92	91.73	0.37
		484T	0.593	0.693	0.86	85.58	0.68
		996T	0.319	0.420	0.76	76.01	1.19
		SU	0.296	0.395	0.75	74.90	1.26
	ALL	26T	5.196	5.296	0.98	98.11	0.00
		52T	2.649	2.751	0.96	96.29	0.16
		106T	1.284	1.385	0.93	92.71	0.33
		242T	0.601	0.701	0.86	85.71	0.67
		484T	0.338	0.438	0.77	77.14	1.13
		996T	0.202	0.302	0.67	66.84	1.75
		SU	0.185	0.284	0.65	65.05	1.87

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 D02 v02r01 Zero-Span Spectrum Analyzer Method.

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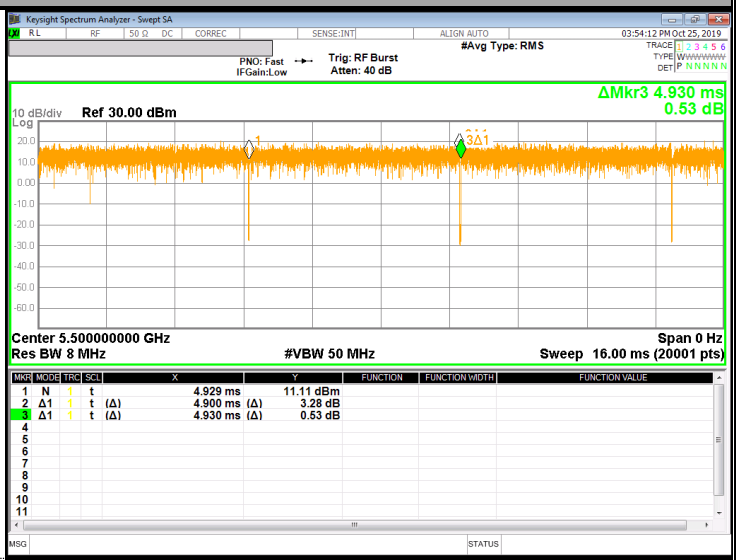
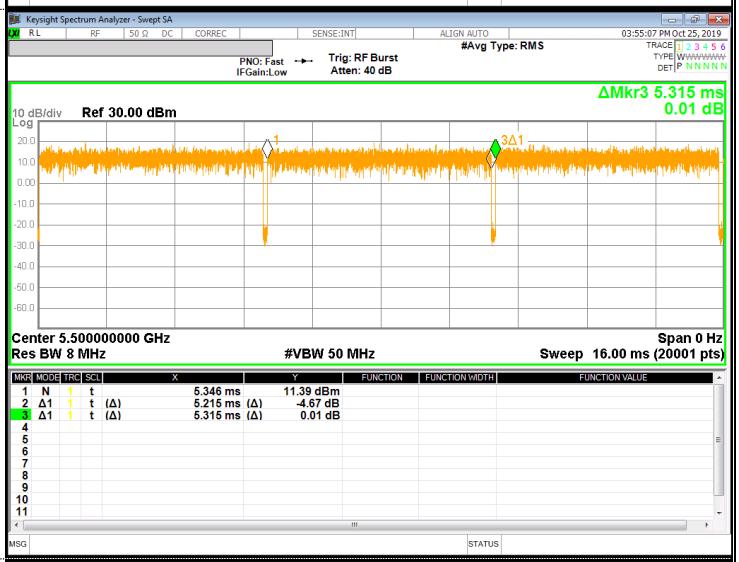
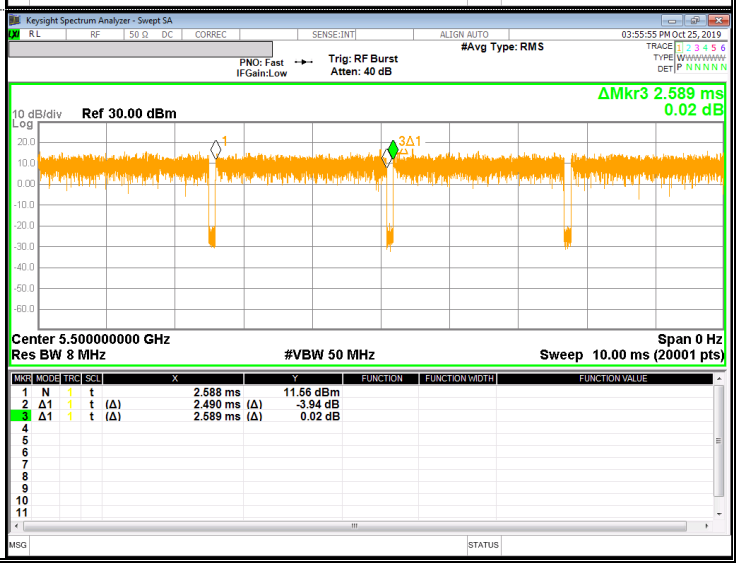
DUTY CYCLE PLOTS

Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE20	Single	26T	
		52T	
		106T	

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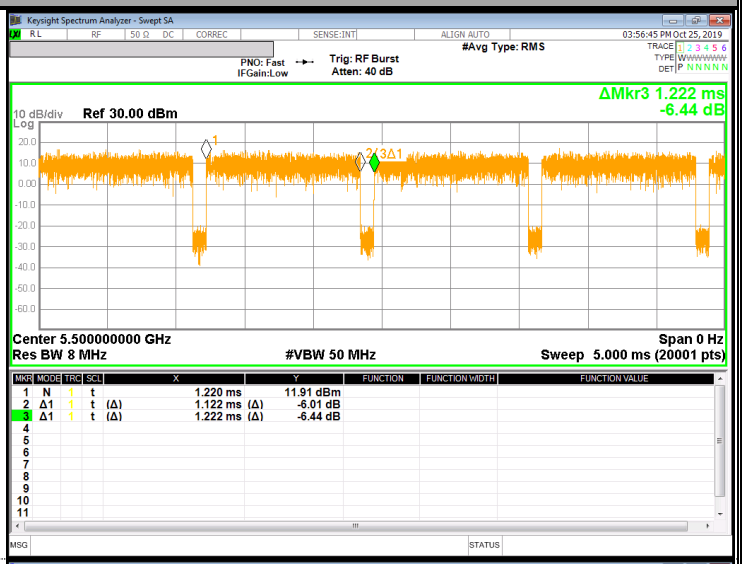
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE20	Single	242T	
		SU	

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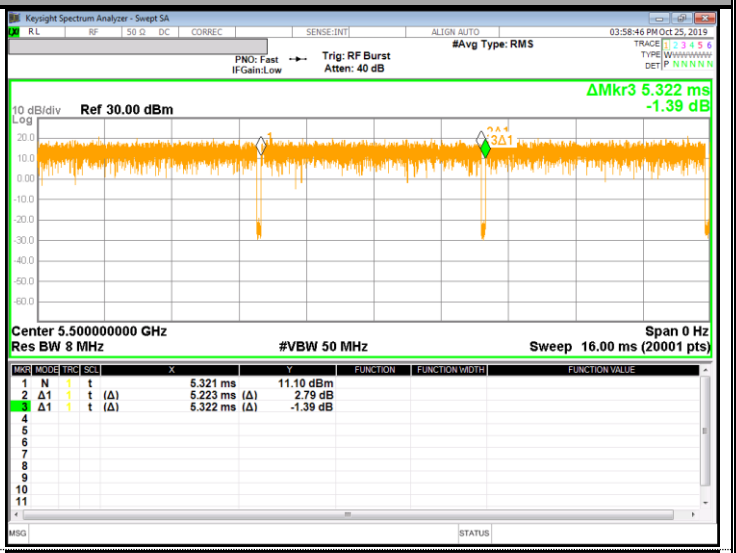
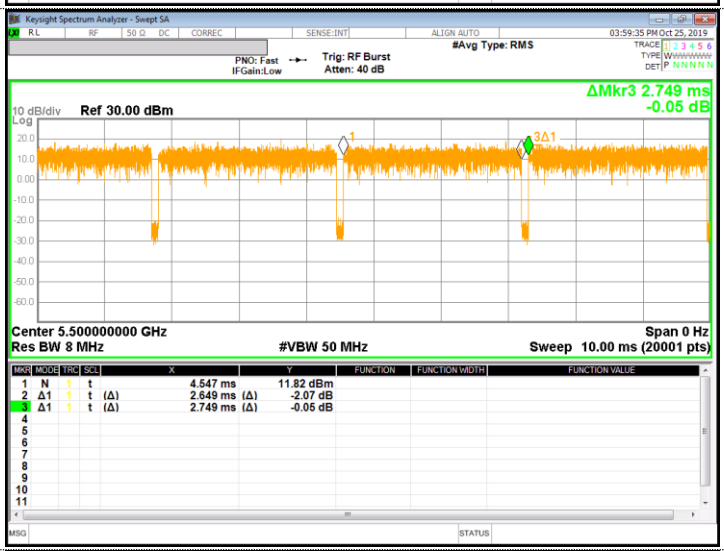
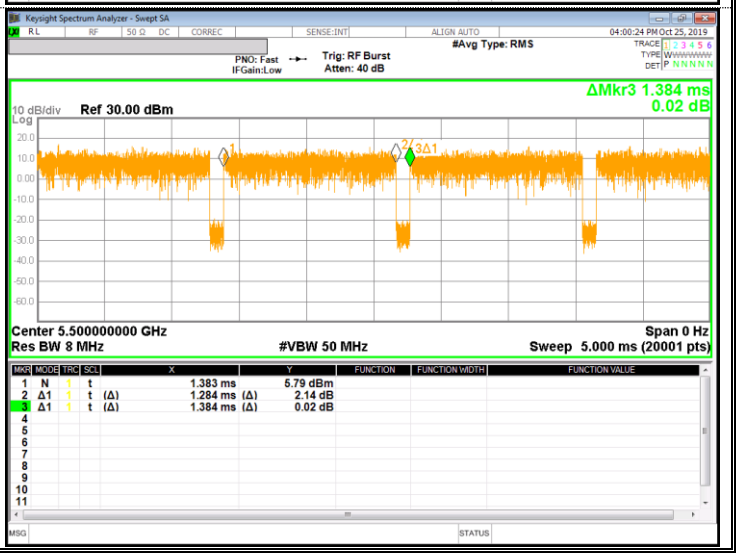
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE20	ALL	26T	
		52T	
		106T	

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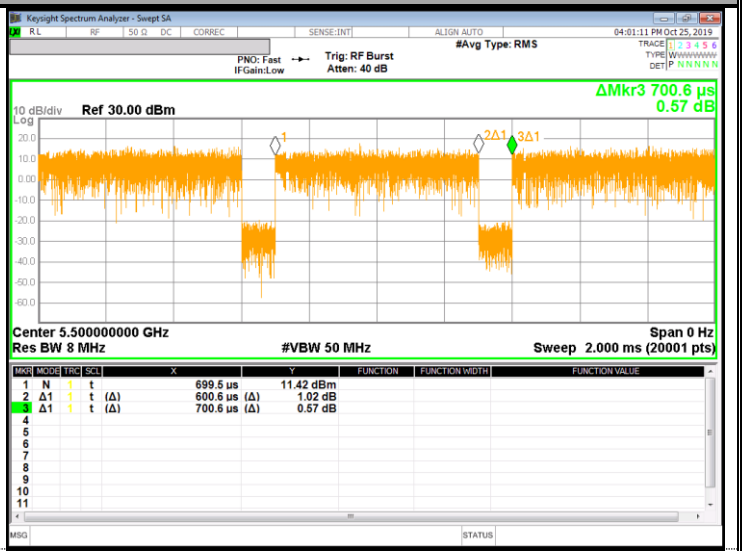
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE20	ALL	242T	
		SU	

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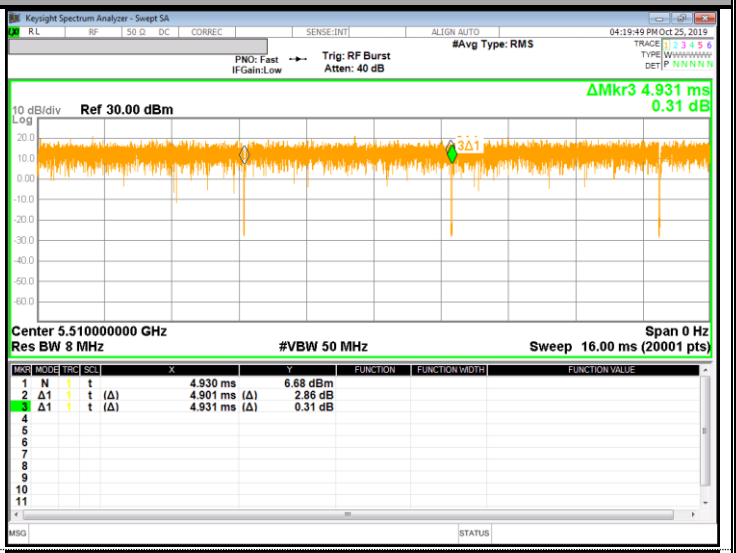
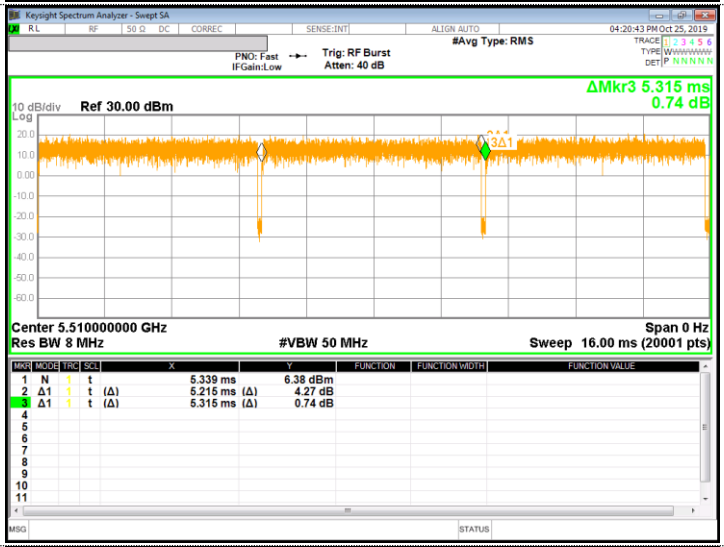
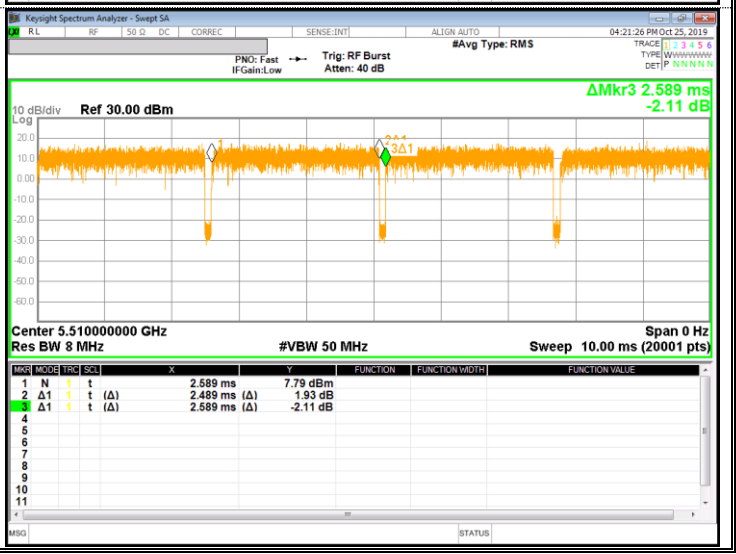
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE40	Single	26T	
		52T	
		106T	

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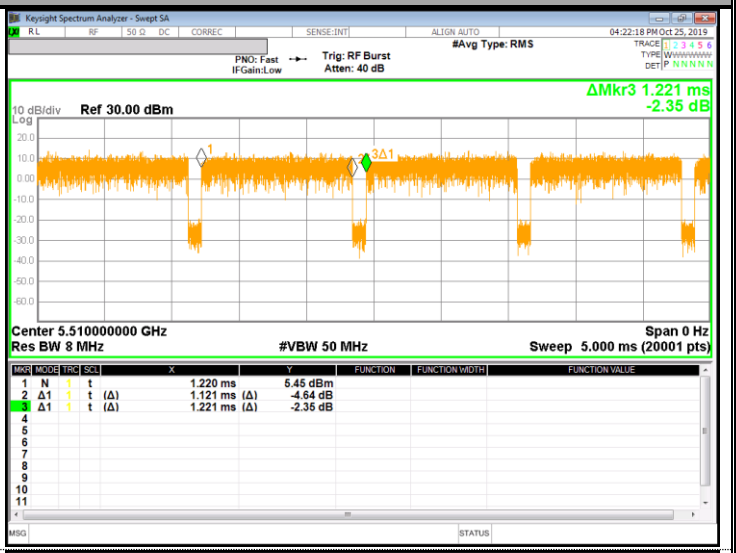
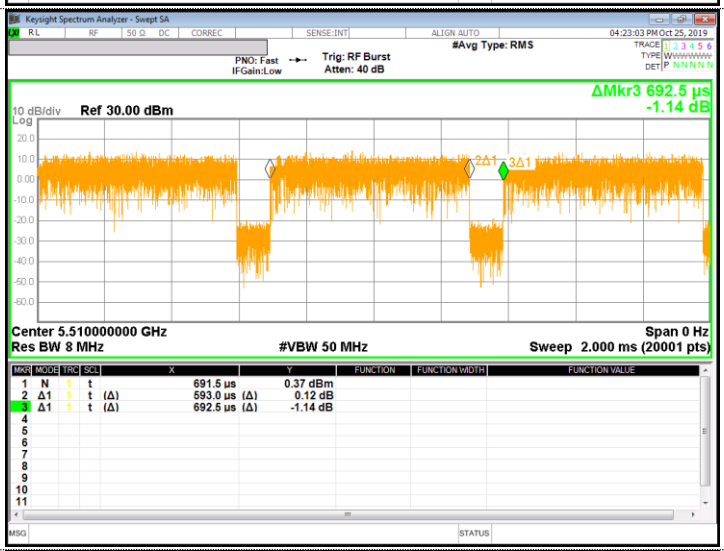
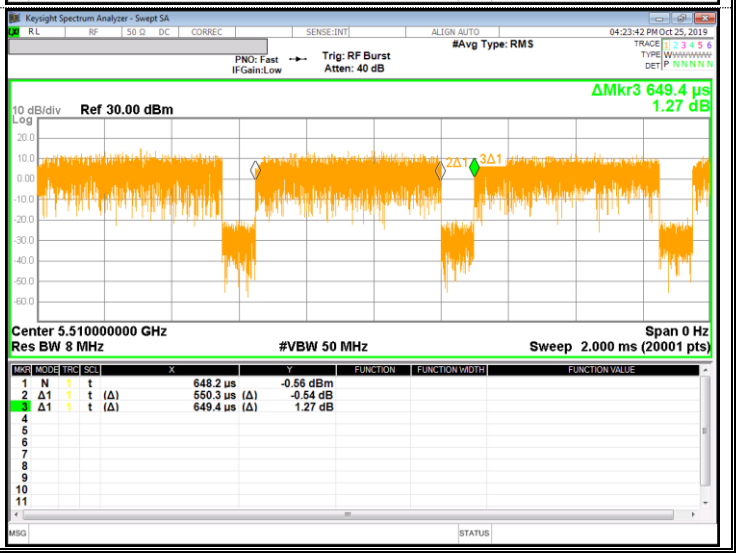
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE40	Single	242T	
		484T	
		SU	

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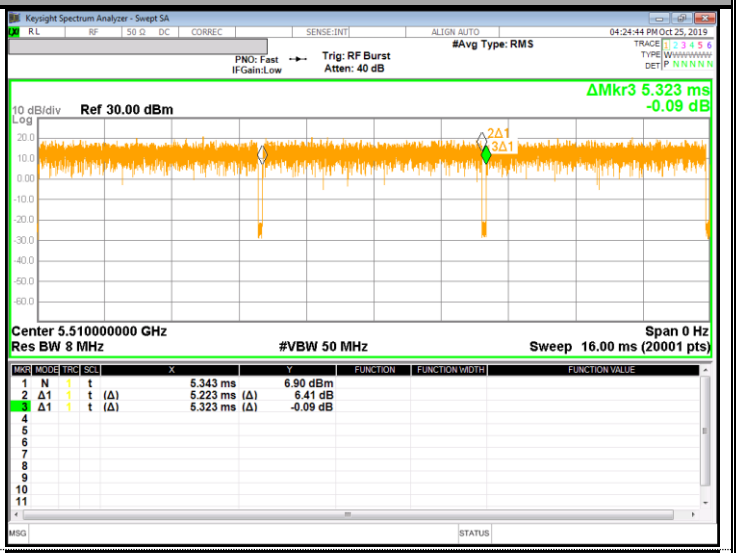
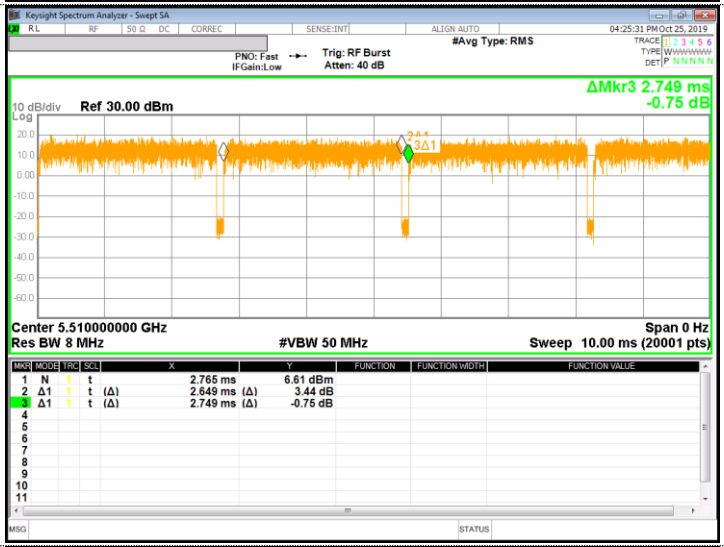
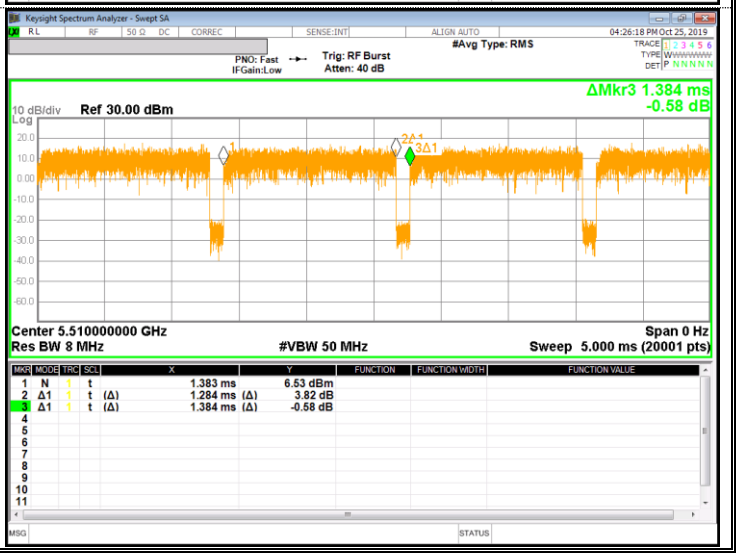
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE40	ALL	26T	
		52T	
		106T	

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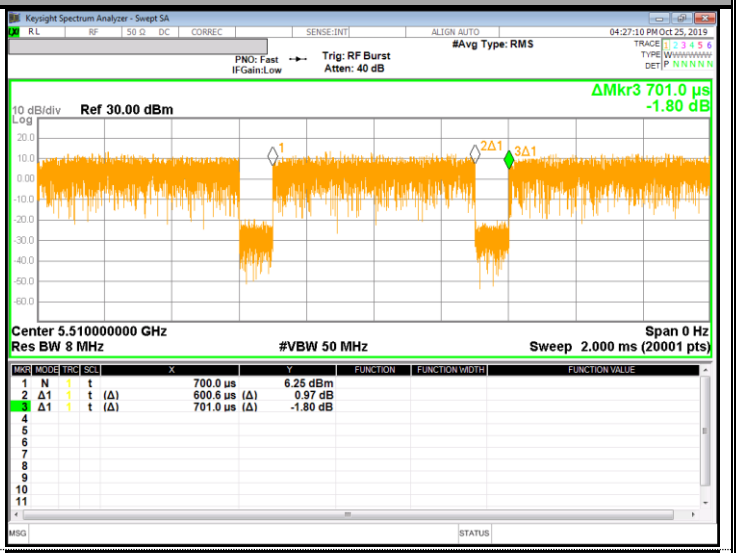
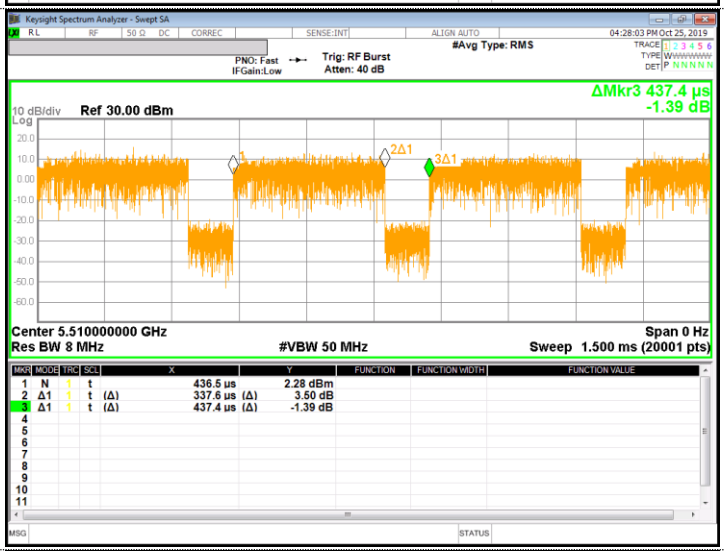
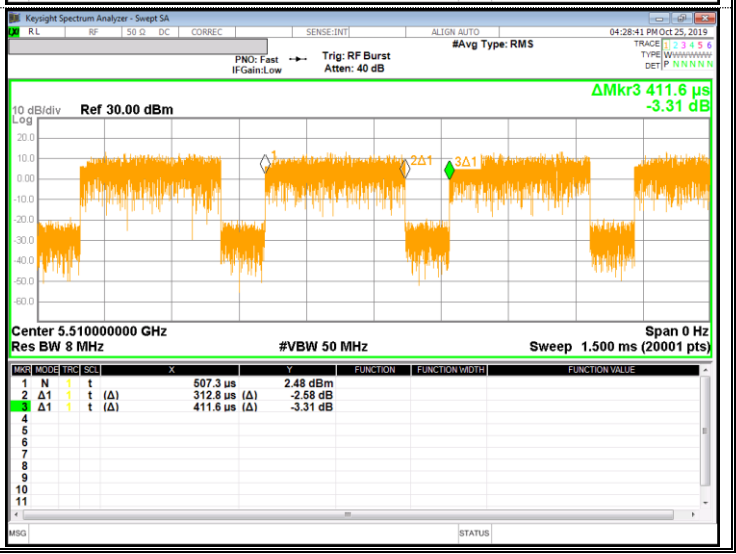
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE40	ALL	242T	
		484T	
		SU	

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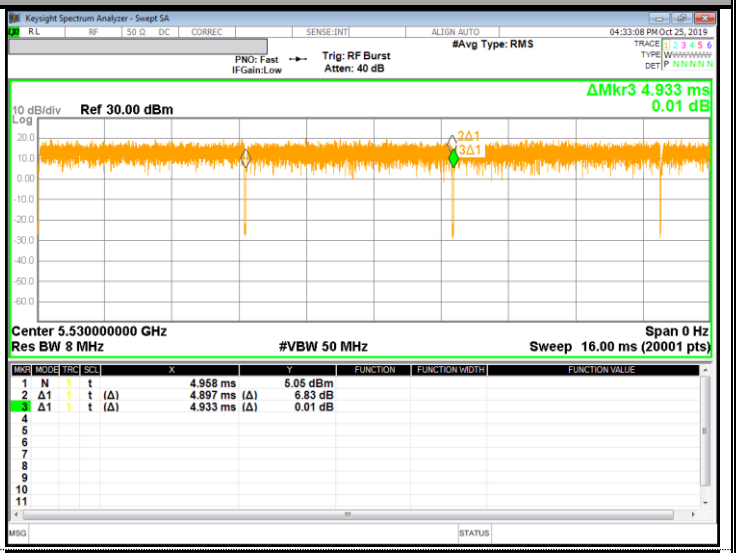
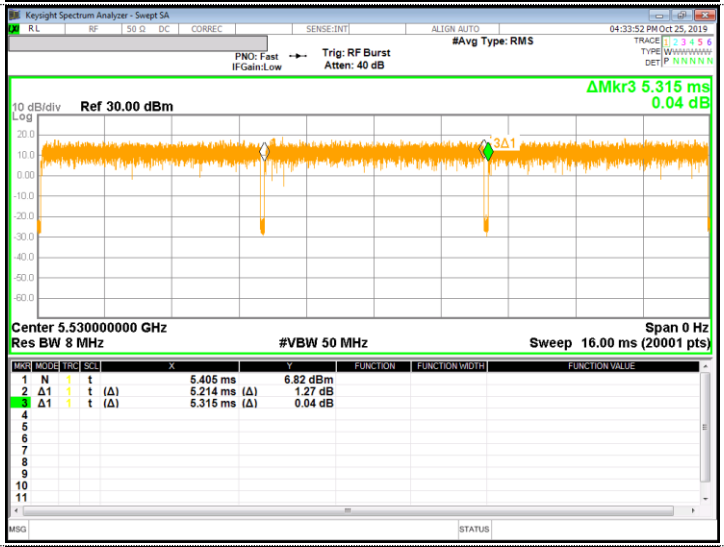
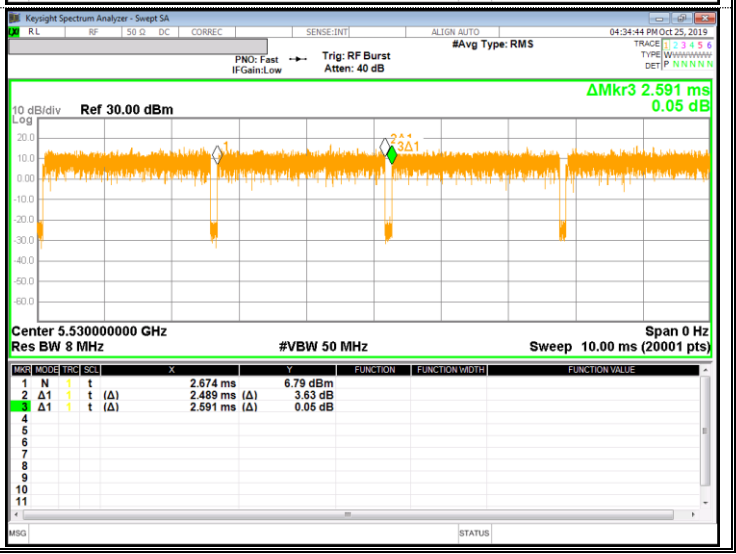
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	Single	26T	
		52T	
		106T	

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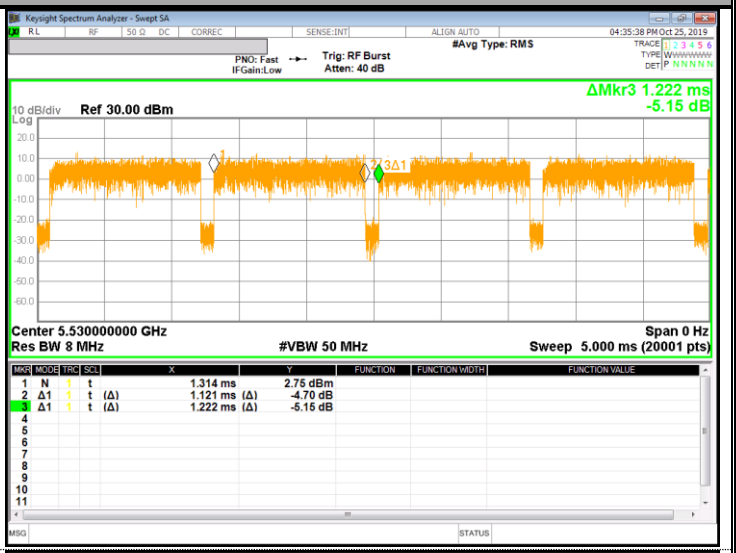
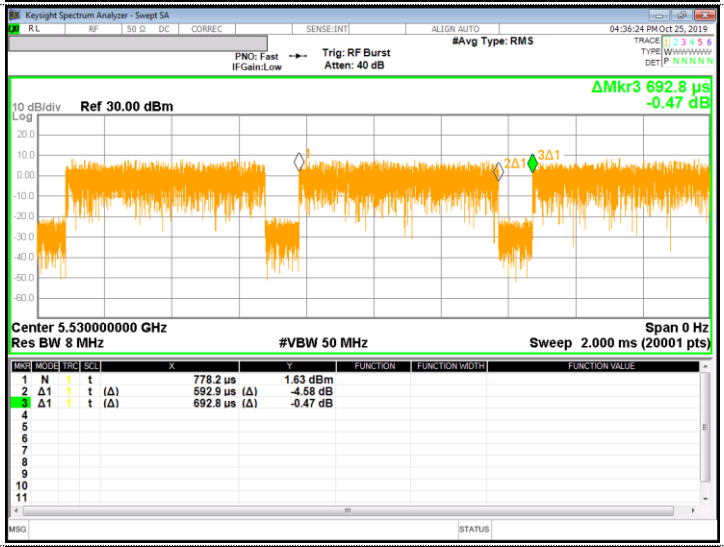
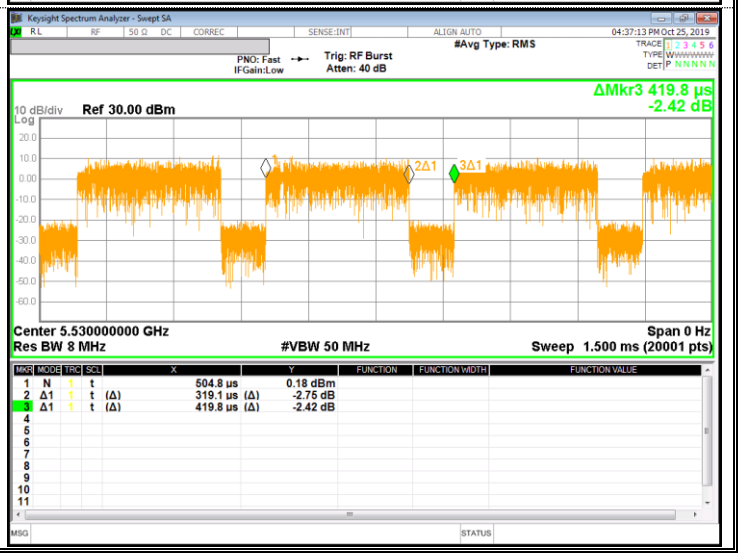
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	Single	242T	
		484T	
		996T	

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Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	Single	SU	

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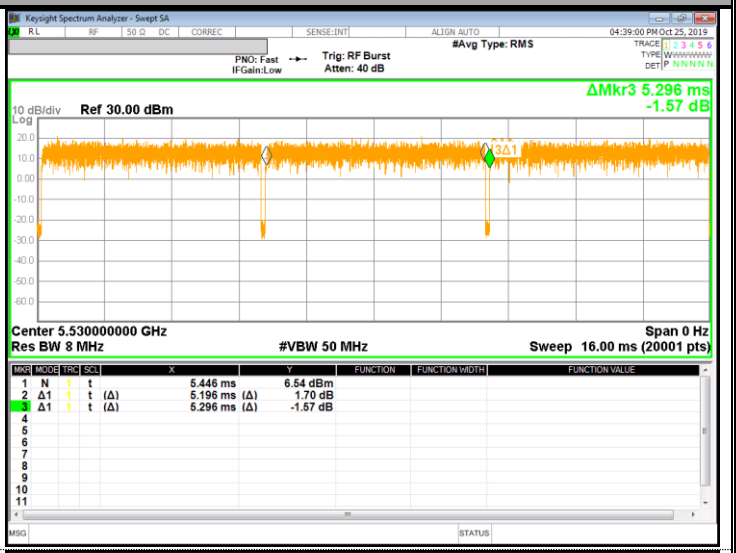
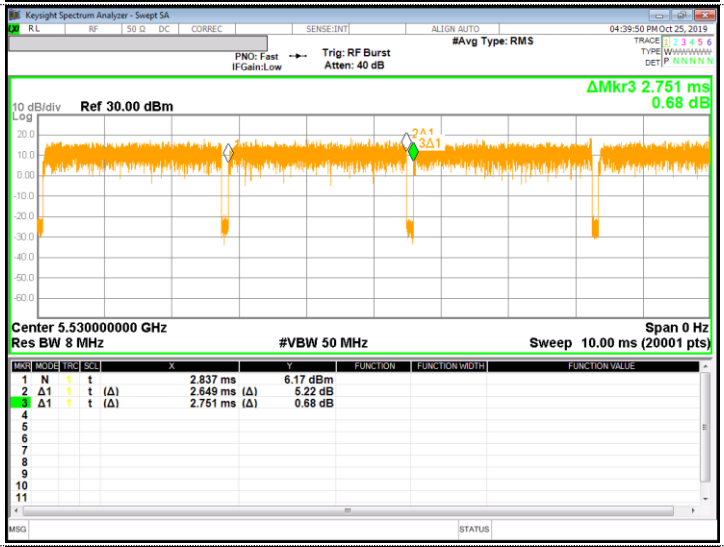
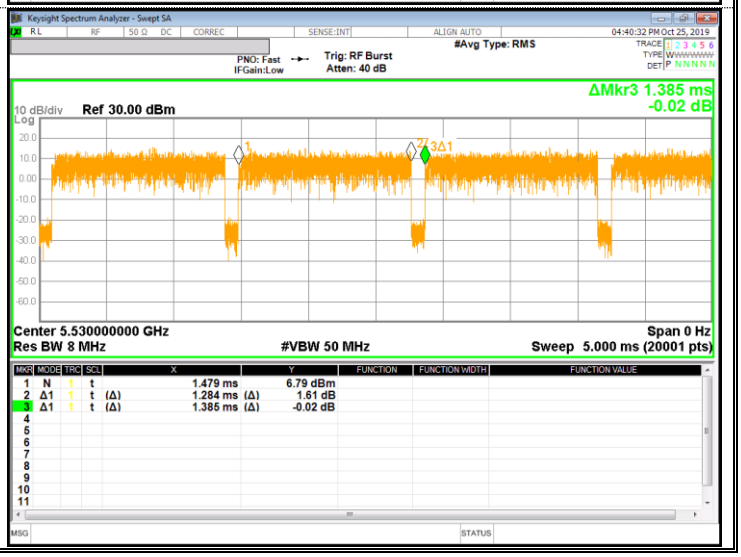
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	ALL	26T	
		52T	
		106T	

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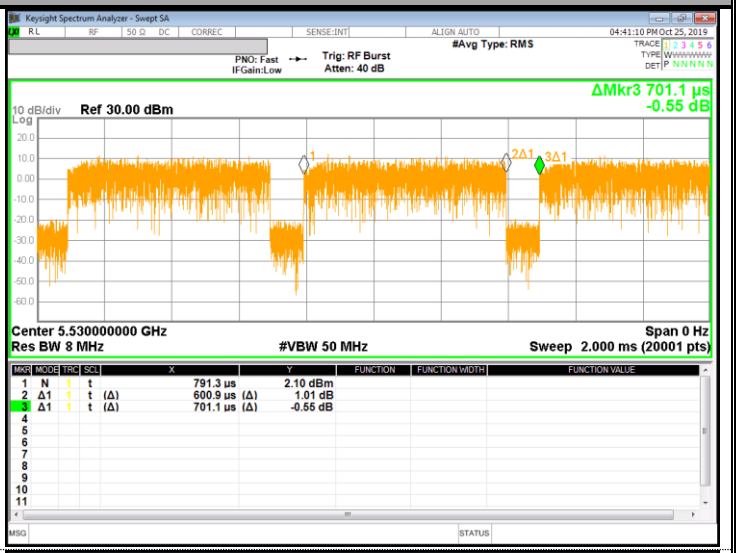
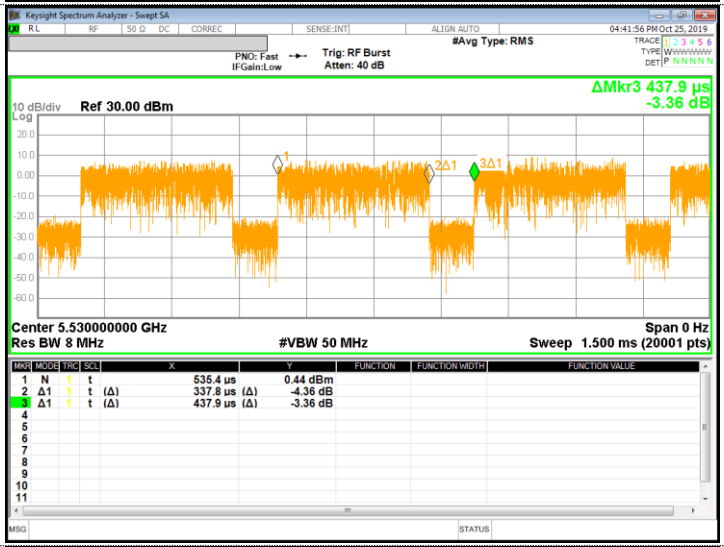
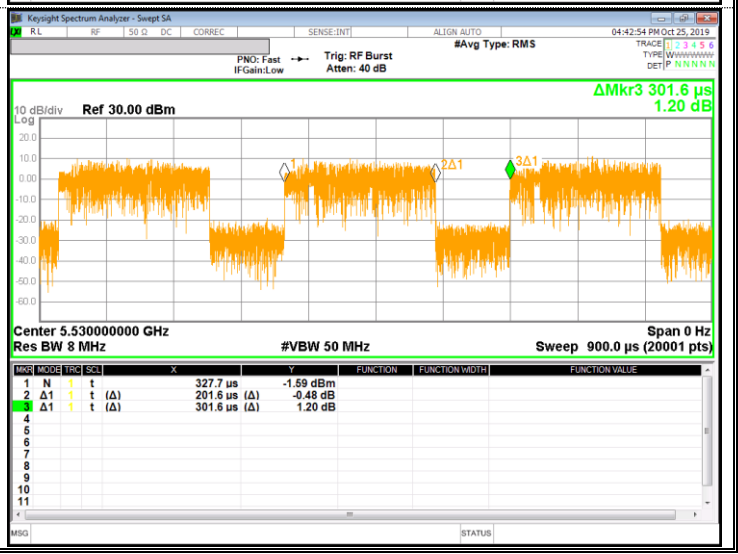
Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	ALL	242T	
		484T	
		996T	

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Mode	ANT	Mode (Tones)	Test Plot
802.11ax HE80	ALL	SU	

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9.2. 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 RU allocation and channels inclueded to straddle band in UNII-2C and UNII-3 Straddle Channel

ex) Marker 2: Lower point of 26 dB bandwidth
Marker 3: Upper point of 26 dB bandwidth
- Turning Frequency : 5725MHz
- Marker 2: 5710 MHz
- Marker 3: 5730 MHz
- 26dB Bandwidth of UNII-2C band Portion
  = (5725 – 5710) = 15 MHz
- 26dB Bandwidth of UNII-3 band Portion
  = (5730 - 5725) = 5 MHz

RESULTS

See the next page.

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9.2.1. 802.11ax 5.2 GHz BAND

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-1	HE20	5180	26T	0	19.62	19.78
				4	18.56	18.96
				8	20.57	20.54
			SU	-	21.39	***21.38***
		5200	26T	0	19.26	20.06
				4	19.12	18.80
				8	20.60	20.46
			SU	-	21.32	21.14
		5240	26T	0	19.86	19.89
				4	19.15	19.24
				8	20.50	20.67
			SU	-	***21.53***	21.26
	HE40	5190	26T	0	18.46	19.70
				9	21.79	23.27
				17	19.93	19.65
			SU	-	***39.74***	***39.68***
		5230	26T	0	20.31	20.06
				9	22.92	22.81
				17	19.64	20.14
			SU	-	39.49	39.59
	HE80	5210	26T	0	20.05	19.79
				18	39.80	39.80
				36	20.97	22.11
			SU	-	***80.70***	***80.03***

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9.2.2. 802.11ax 5.3 GHz BAND

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-2A	HE20	5260	26T	0	19.38	19.46
				4	18.88	18.78
				8	20.36	20.53
			SU	-	***21.66***	21.45
		5300	26T	0	19.87	19.95
				4	18.99	18.66
				8	19.80	20.45
			SU	-	21.43	21.55
		5320	26T	0	20.09	20.01
				4	19.17	19.04
				8	20.68	20.47
			SU	-	21.52	***21.60***
	HE40	5270	26T	0	19.86	19.29
				9	23.32	23.15
				17	20.27	19.75
			SU	-	***39.77***	***39.52***
		5310	26T	0	19.24	19.29
				9	22.94	23.07
				17	20.04	19.66
			SU	-	39.67	39.46
	HE80	5290	26T	0	19.81	21.29
				18	40.26	39.59
				36	21.54	22.59
			SU	-	***80.52***	***80.24***

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9.2.3. 802.11ax 5.5 GHz BAND

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-2C	HE20	5500	26T	0	19.78	20.03
				4	18.87	19.34
				8	20.26	20.52
			SU	-	21.29	21.22
		5580	26T	0	19.97	19.94
				4	19.12	19.15
				8	20.70	20.20
			SU	-	***21.34***	***21.41***
		5700	26T	0	20.03	19.89
				4	18.90	19.20
				8	20.67	20.41
			SU	-	21.27	21.22
	HE40	5510	26T	0	20.05	19.98
				9	22.85	23.39
				17	20.19	20.29
			SU	-	39.55	39.32
		5590	26T	0	20.00	20.10
				9	23.59	23.05
				17	19.99	20.37
			SU	-	***39.86***	39.59
		5670	26T	0	19.94	20.07
				9	22.98	23.14
				17	20.32	20.11
			SU	-	39.78	***39.60***
	HE80	5530	26T	0	19.88	20.48
				18	40.95	40.08
				36	22.59	21.95
			SU	-	***80.68***	80.87
		5610	26T	0	19.66	20.71
				18	39.80	39.05
				36	22.98	22.22
			SU	-	80.46	***81.08***

9.2.4. 802.11ax STRADDLE CHANNEL

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]			
					ANT1		ANT2	
					UNII-2C	UNII-3	UNII-2C	UNII-3
Straddle Channel	HE20	5720	26T	6	14.86	4.05	14.95	4.14
			SU	-	15.88	5.67	15.67	5.87
	HE40	5710	26T	16	15.45	4.22	14.97	4.18
			SU	-	34.95	4.84	34.73	5.07
	HE80	5690	26T	35	16.73	4.81	16.44	4.83
			SU	-	75.05	5.126	75.50	5.58

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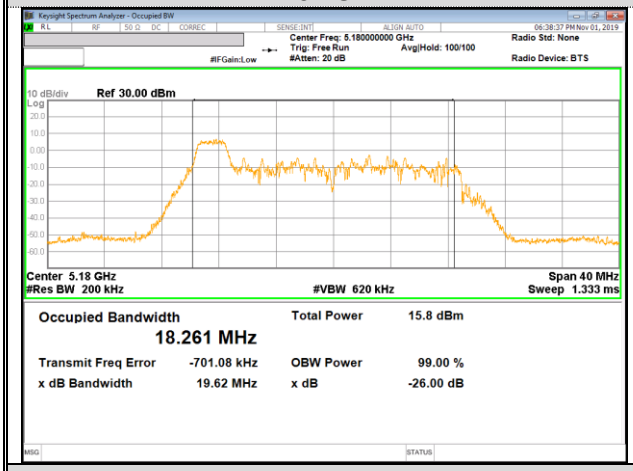
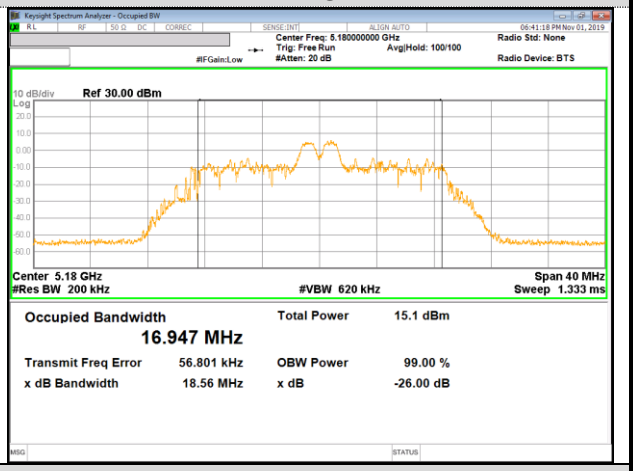
9.2.5. TEST PLOT_802.11ax 5.2 GHz BAND

Band	**UNII-1**
Mode	**HE20**
Frequency	**5180 MHz**
Ant	**1**

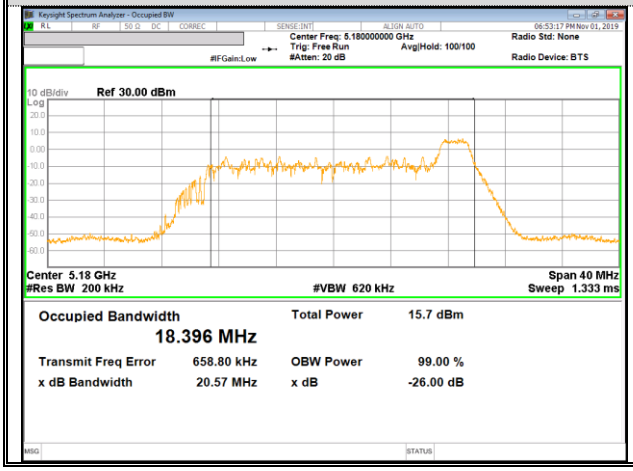
0RU



4RU



8RU



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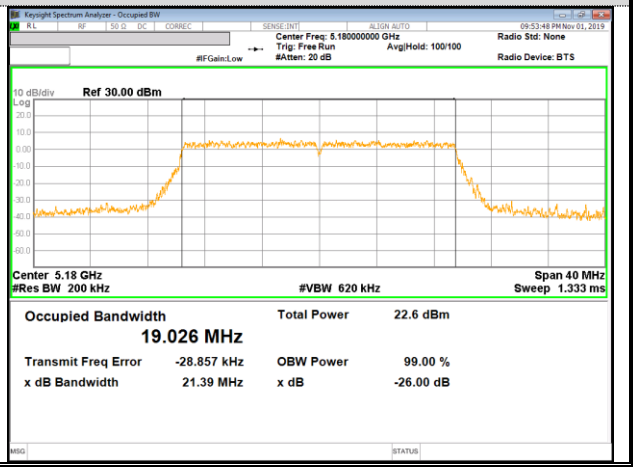

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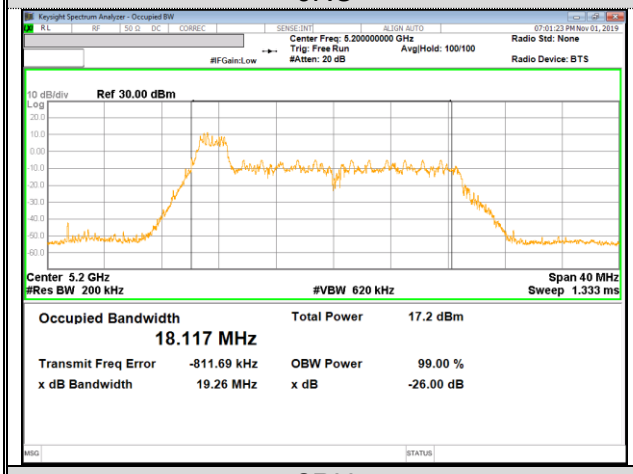
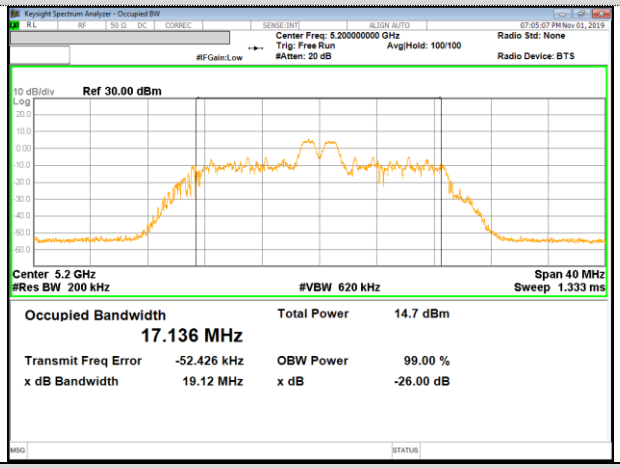
Band	**UNII-1**
Mode	**HE20**
Frequency	**5200 MHz**
Ant	**1**

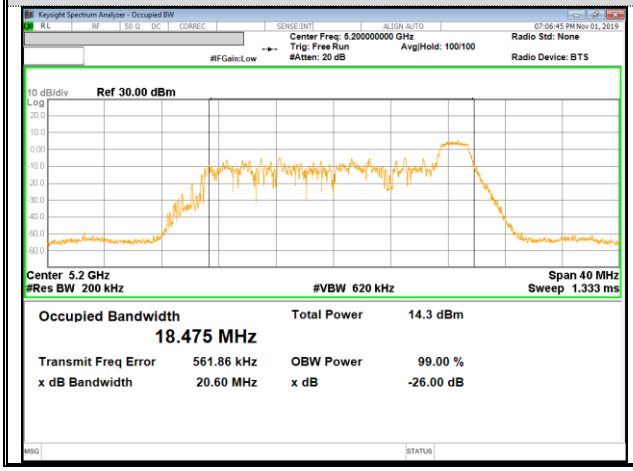
0RU



4RU



8RU



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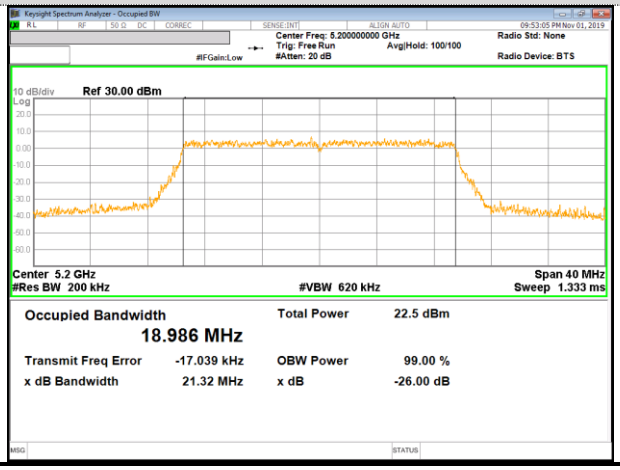

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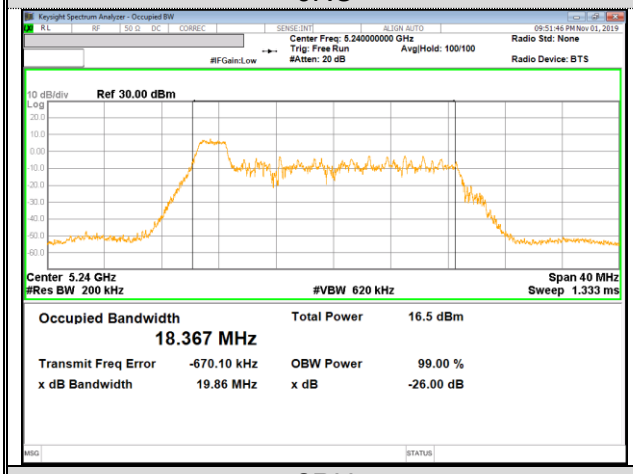
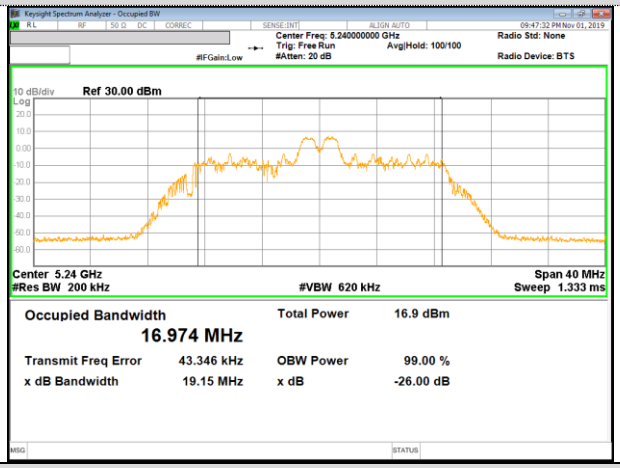
Band	**UNII-1**
Mode	**HE20**
Frequency	**5240 MHz**
Ant	**1**

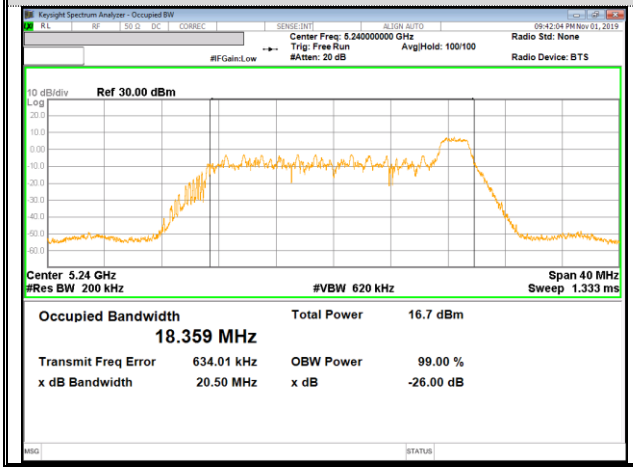
0RU



4RU



8RU



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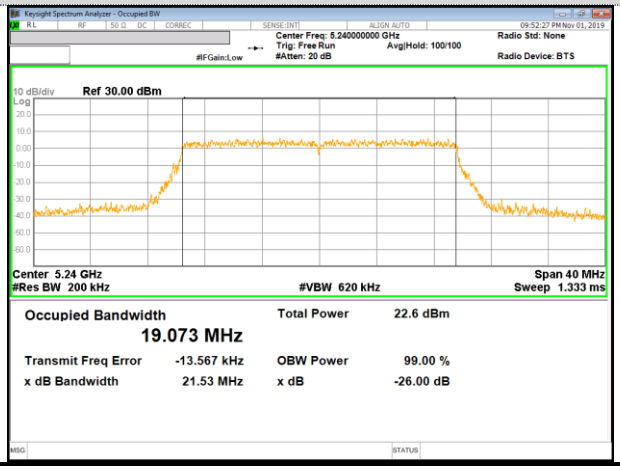

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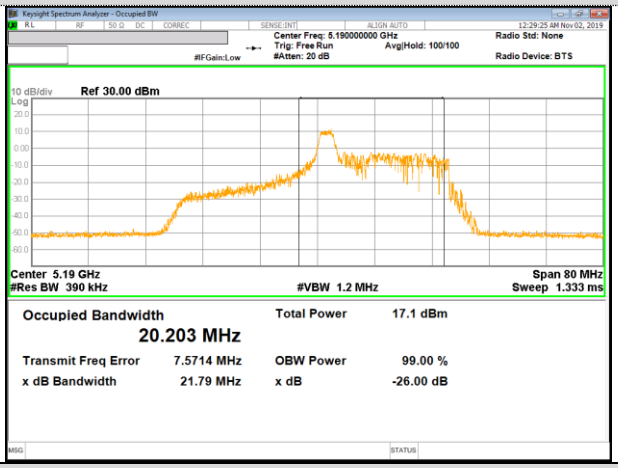
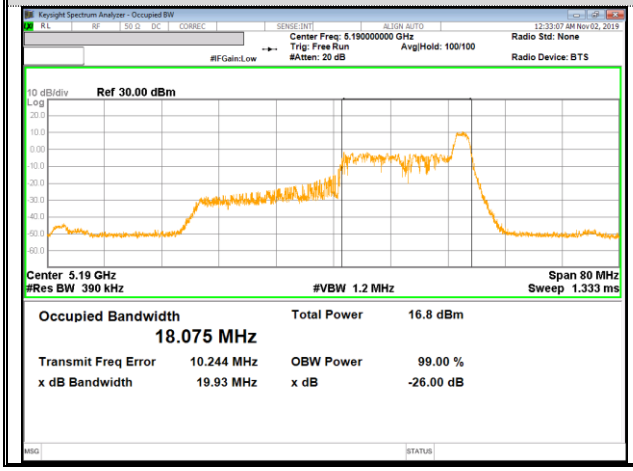
Band	**UNII-1**
Mode	**HE40**
Frequency	**5190 MHz**
Ant	**1**

0RU

9RU



17RU



SU

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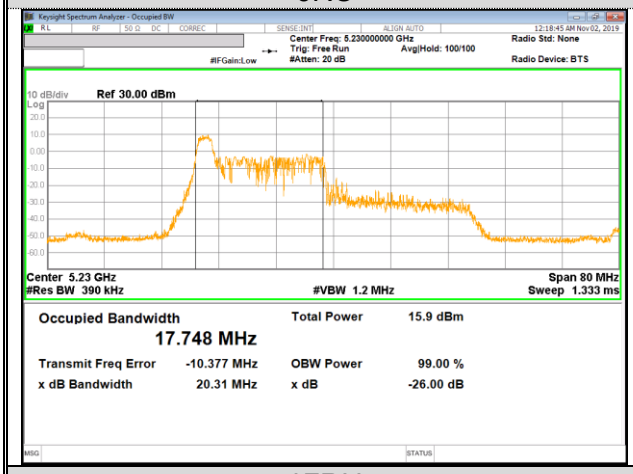
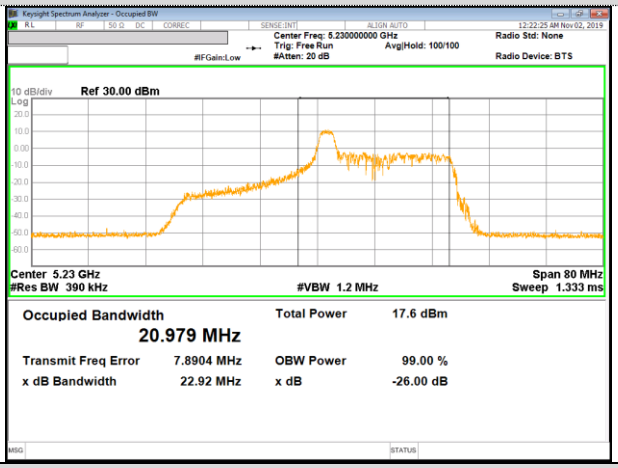
Band	**UNII-1**
Mode	**HE40**
Frequency	**5230 MHz**
Ant	**1**

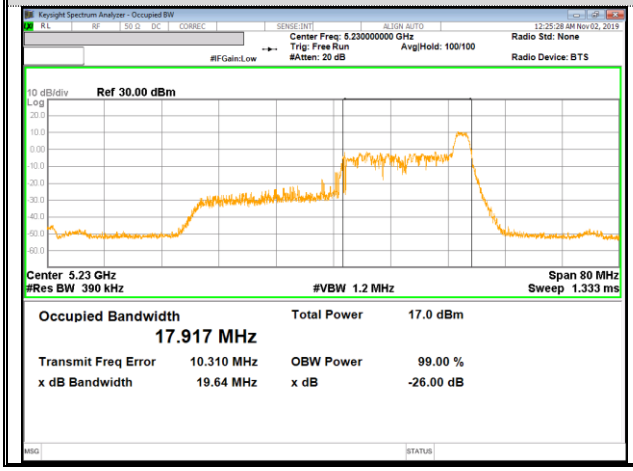
0RU



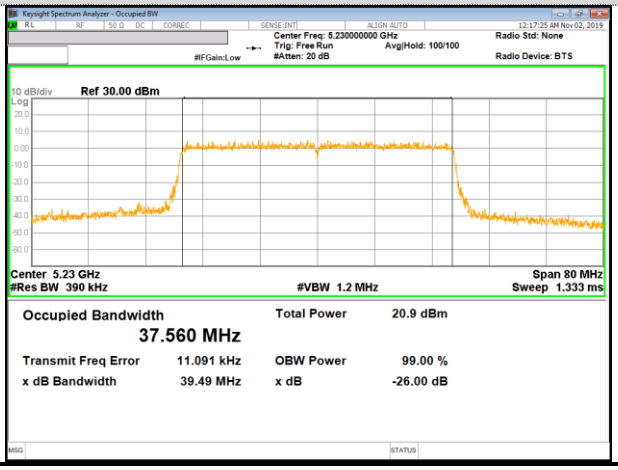
9RU



17RU



SU



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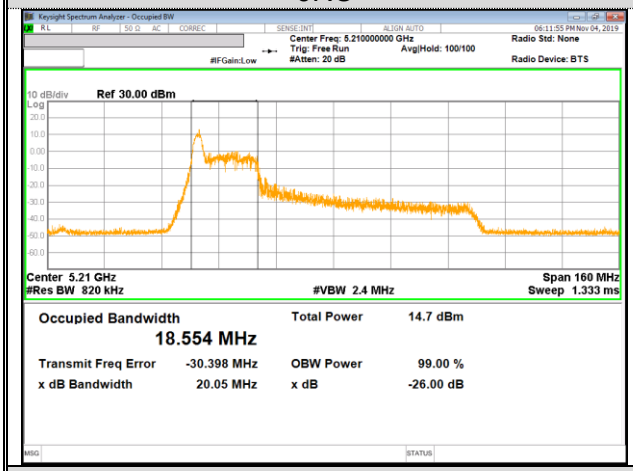
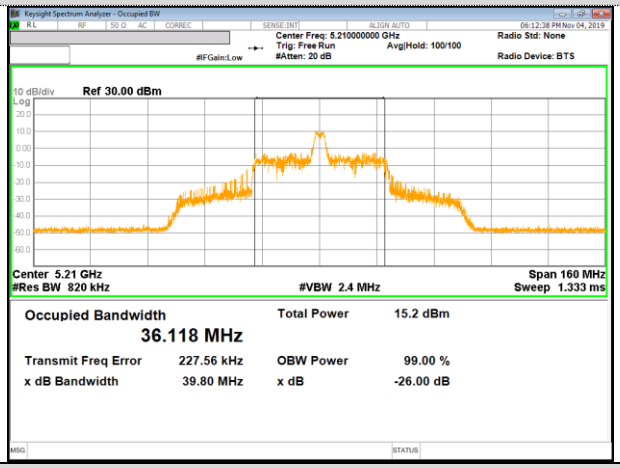
Band	**UNII-1**
Mode	**HE80**
Frequency	**5210 MHz**
Ant	**1**

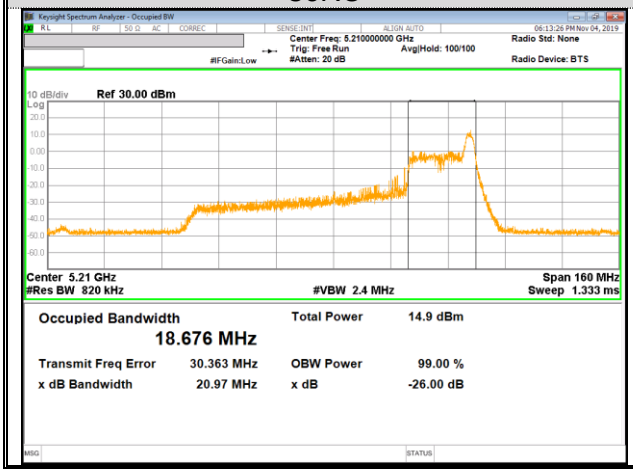
0RU



18RU



36RU



SU

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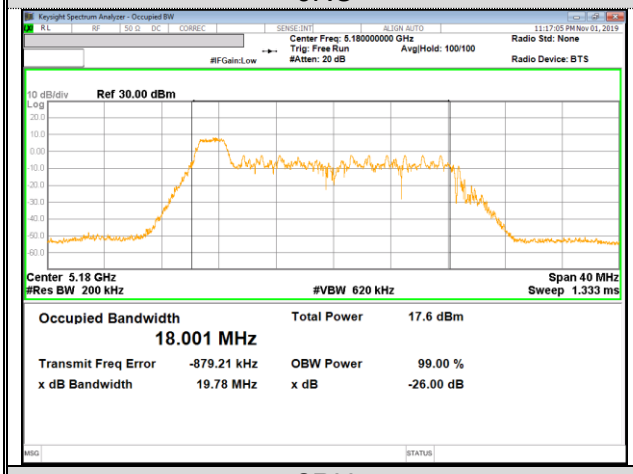
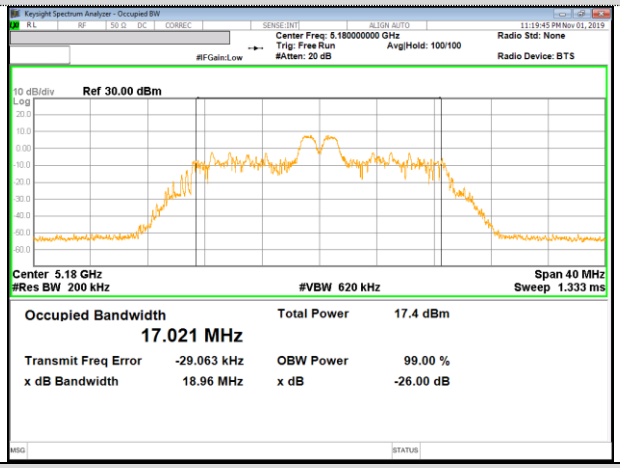
Band	**UNII-1**
Mode	**HE20**
Frequency	**5180 MHz**
Ant	**2**

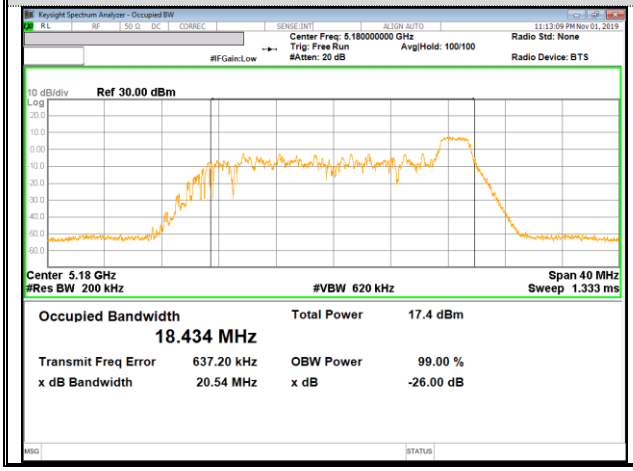
0RU



4RU



8RU



SU

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