HCT CO.,LTD.

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FCC UNII REPORT

FCC Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
January 04, 2019

Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1901-FC008

FCC ID	**: A3LSOL230-48D**
APPLICANT	**: SAMSUNG Electronics Co., Ltd.**

Model: SOL230-48D

EUT Type: Small cell (SOL230)

Modulation type OFDM

FCC Classification: Unlicensed National Information Infrastructure(UNII)

FCC Rule Part(s): Part 15.407

[Omni]

Band	Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	Ant.0 Power (dBm)	Ant.1 Power (dBm)	Ant.2 Power (dBm)	Ant.3 Power (dBm)	Ant. 0 & 1 & 2 & 3 Power (dBm)
UNII1	802.11a	20	5180 – 5240	15.55	15.64	16.11	15.47	21.69
	802.11n	20	5180 – 5240	15.57	15.55	15.99	15.34	21.63
	802.11n	40	5190 - 5230	15.66	15.59	15.48	15.58	21.59
	802.11ac	20	5180 – 5240	15.64	15.55	15.81	15.36	21.59
	802.11ac	40	5190 - 5230	15.79	15.71	15.60	15.41	21.62
	802.11ac	80	5210	7.52	7.71	7.57	7.54	13.59
UNII2A	802.11a	20	5260 – 5320	14.12	14.19	14.12	14.16	20.10
	802.11n	20	5260 – 5320	14.04	14.09	13.98	14.02	20.05
	802.11n	40	5270 – 5310	15.57	15.42	15.46	15.47	21.50
	802.11ac	20	5260 – 5320	14.10	14.10	13.79	13.97	19.97
	802.11ac	40	5270 – 5310	15.75	15.56	15.50	15.40	21.56
	802.11ac	80	5290	9.44	9.91	9.23	9.48	15.54
UNII2C	802.11a	20	5500 – 5720	14.41	14.54	14.71	14.68	20.60
	802.11n	20	5500 – 5720	14.79	14.76	14.83	14.86	20.82
	802.11n	40	5510 – 5710	15.31	15.17	15.38	15.57	21.36
	802.11ac	20	5500 – 5720	14.90	14.74	14.64	14.81	20.78
	802.11ac	40	5510 – 5710	15.49	15.37	15.46	15.31	21.41
	802.11ac	80	5530 – 5690	15.23	15.44	15.55	15.57	21.43
UNII3	802.11a	20	5745 – 5825	15.57	15.57	15.64	15.85	21.60
	802.11n	20	5745 – 5825	15.51	15.41	15.58	15.65	21.54
	802.11n	40	5755 – 5795	15.51	15.27	15.29	15.60	21.40
	802.11ac	20	5745 – 5825	15.76	15.46	15.35	15.75	21.57
	802.11ac	40	5755 – 5795	15.54	15.43	15.40	15.58	21.49
	802.11ac	80	5775	15.23	15.39	15.28	15.40	21.35

[Directional]

Band	Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	Ant.0 Power (dBm)	Ant.1 Power (dBm)	Ant.2 Power (dBm)	Ant.3 Power (dBm)	Ant. 0 & 1 & 2 & 3 Power (dBm)
UNII1	802.11a	20	5180 – 5240	15.27	15.82	15.39	15.37	21.47
	802.11n	20	5180 – 5240	15.30	15.67	15.23	15.45	21.43
	802.11n	40	5190 - 5230	14.89	15.15	15.28	15.17	21.14
	802.11ac	20	5180 – 5240	15.30	15.22	15.59	15.78	21.50
	802.11ac	40	5190 - 5230	14.89	15.03	15.28	15.22	21.13
	802.11ac	80	5210	8.36	8.61	8.72	8.79	14.64
UNII2A	802.11a	20	5260 – 5320	12.45	12.42	12.60	12.75	18.58
	802.11n	20	5260 – 5320	12.47	12.49	12.52	12.79	18.59
	802.11n	40	5270 – 5310	13.35	13.49	13.17	13.77	19.47
	802.11ac	20	5260 – 5320	12.49	12.44	12.70	12.83	18.64
	802.11ac	40	5270 – 5310	13.33	13.42	13.77	13.73	19.59
	802.11ac	80	5290	6.93	7.02	6.98	7.25	13.07
UNII2C	802.11a	20	5500 – 5720	13.01	12.84	12.97	13.43	19.09
	802.11n	20	5500 – 5720	13.64	13.63	13.58	13.86	19.70
	802.11n	40	5510 – 5710	14.14	13.99	14.38	14.32	20.23
	802.11ac	20	5500 – 5720	13.55	13.55	13.38	13.52	19.51
	802.11ac	40	5510 – 5710	14.08	13.97	14.39	14.37	20.23
	802.11ac	80	5530 – 5690	14.25	14.33	14.43	14.63	20.43
UNII3	802.11a	20	5745 – 5825	15.29	15.26	15.23	15.60	21.36
	802.11n	20	5745 – 5825	15.36	15.11	15.34	15.62	21.38
	802.11n	40	5755 – 5795	14.78	14.71	15.03	15.35	20.99
	802.11ac	20	5745 – 5825	15.36	15.11	15.31	15.60	21.37
	802.11ac	40	5755 – 5795	14.72	14.65	15.05	15.32	20.96
	802.11ac	80	5775	14.91	14.71	15.02	15.25	21.00

Antenna Type	Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	Ant.0 + Ant.2 Power (dBm)	Ant.1 + Ant.3 Power (dBm)	Ant. 0 & 1 & 2 & 3 Power (dBm)
Omni	802.11ac	160	5210 + 5290	14.31	13.24	16.8
	802.11ac	160	5530 + 5610	16.02	16.88	19.47
	802.11ac	160	5210 + 5775	15.78	14.88	18.35
Directional	802.11ac	160	5210 + 5290	14.20	14.77	17.5
	802.11ac	160	5530 + 5610	14.35	15.31	17.85
	802.11ac	160	5210 + 5775	15.35	15.40	18.39

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Fede ral benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Se Wook Park
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1901-FC008	January 04, 2019	- Revised the original report. (Original Report No.: HCT-R-1710-F004) - Revised the Section 8 on page 13 - Revised the Ch62 -> Ch54 on page 58 - Revised the limit and Ant gain in the antenna gain calculation table on page 197, 198, 534 and 535

Table of Contents

1. GENERAL INFORMATION

Applicant: SAMSUNG Electronics Co.,Ltd.

Address: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

FCC ID: A3LSOL230-48D

EUT Type: Small cell (SOL230)

Model: SOL230-48D

Date(s) of Tests: July 20, 2017 ~ October 25, 2017

Place of Tests: HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	SOL230-48D	
EUT Type	Small cell (SOL230)	
Power Supply	DC 48 V	
Frequency Range	TX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A)/ 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A)/ 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A)/ 5530 - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
	160 MHz BW:	5210MHz + 5290MHz / 5530MHz + 5610MHz / 5210MHz + 5775 MHz
	RX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A)/ 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A)/ 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A)/ 5530 - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
	160 MHz BW:	5210MHz + 5290MHz / 5530MHz + 5610MHz / 5210MHz + 5775 MHz
Modulation Type	OFDM(802.11a, 802.11n, 802.11ac)	
Antenna Specification	Antenna type: OMNI Antenna, Directional Antenna Peak Gain : cf. Section 6	

2.1 EUT OPERATING MODE

▣ Operating mode

Mode	Operating Mode	Operating Ant.
802.11a/n/ac	SISO	Ant 0
		Ant 1
		Ant 2
		Ant 3
	MIMO(CDD)	Ant 0 & 1 & 2 & 3

Note : In case of radiation test, we have done all test case. Worst case is MIMO (Ant 0 & 1 & 2 & 3).

3. TEST METHODOLOGY

The measurement procedure described in FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r03 dated August 22, 2016 entitled " Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part15, Subpart E" and ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices' were used in the measurement. For 802.11ac, KDB644545 D03 v01 dated August 14, 2014.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

Conducted Antenna Terminal

See Section from 8.1 to 8.4.(KDB 789033 D02 v01r04)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203, §15.407

"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 antennas of this E.U.T are permanently attached.

* The E.U.T Complies with the requirement of §15.203, §15.407

▣ Directional Gain Calculations

▪ If any transmit signals are correlated with each other (802.11a/n/ac)

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20}+\ldots+10^{GN/20})^2/N]$ dBi

▣ Antenna Gain_Omni

5GHz Band (UNII 1)

Antenna Gain(SISO)	Ant 0	1.2 dBi
	Ant 1	-0.2 dBi
	Ant 2	1.5 dBi
	Ant 3	1.8 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	7.13 dBi

5GHz Band (UNII 2A)

Antenna Gain(SISO)	Ant 0	1.2 dBi
	Ant 1	0.7 dBi
	Ant 2	1.7 dBi
	Ant 3	2.0 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	7.43 dBi

5GHz Band (UNII 2C)

Antenna Gain(SISO)	Ant 0	1.9 dBi
	Ant 1	-0.5 dBi
	Ant 2	0.5 dBi
	Ant 3	2.3 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	7.14 dBi

5GHz Band (UNII 3)

Antenna Gain(SISO)	Ant 0	3.4 dBi
	Ant 1	1.7 dBi
	Ant 2	1.0 dBi
	Ant 3	3.8 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	8.57 dBi

▣ Antenna Gain_Directional

5GHz Band (UNII 1)

Antenna Gain(SISO)	Ant 0	2.5 dBi
	Ant 1	2.8 dBi
	Ant 2	3.1 dBi
	Ant 3	3.7 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	9.06 dBi

5GHz Band (UNII 2A)

Antenna Gain(SISO)	Ant 0	3.4 dBi
	Ant 1	2.8 dBi
	Ant 2	3.8 dBi
	Ant 3	3.6 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	9.43 dBi

5GHz Band (UNII 2C)

Antenna Gain(SISO)	Ant 0	4.0 dBi
	Ant 1	2.4 dBi
	Ant 2	2.5 dBi
	Ant 3	3.7 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	9.20 dBi

5GHz Band (UNII 3)

Antenna Gain(SISO)	Ant 0	5.0 dBi
	Ant 1	2.4 dBi
	Ant 2	3.3 dBi
	Ant 3	4.7 dBi
Antenna Gain(MIMO)	Ant 0 & 1 & 2 & 3	9.93 dBi

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70

8. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407 (for Power Measurement)	N/A	CONDUCTED	PASS
6 dB Bandwidth	§15.407(e)	>500 kHz (5725-5850 MHz)		PASS
Maximum Conducted Output Power	§15.407(a)	< 250 mW (5150-5250 MHz) < 250 mW or 11+10 log log $_{10}$ (BW) dBm (5250-5350 MHz) < 250 mW or 11+10 log log $_{10}$ (BW) dBm (5470-5725 MHz) <1 W (5725-5850 MHz)		PASS
Peak Power Spectral Density	§15.407(a)	<11 dBm/ MHz (5150-5250 MHz) <11 dBm/ MHz (5250-5350 MHz) <11 dBm/ MHz (5470-5725 MHz) <30 dBm/500 kHz(5725-5850 MHz)		PASS
Frequency Stability	§15.407(g)	NA		PASS
AC Conducted Emissions 150 kHz-30 MHz	15.207	<FCC 15.207 limits		N/A
Undesirable Emissions	§15.407(b)	<-27 dBm/MHz EIRP (UNII1, 2A, 2C) <-17 dBm/MHz EIRP within 5715-5725 MHz and 5850-5860 MHz (UNII3) <-27 dBm/MHz EIRP outside 5715-5860 MHz (UNII 3)	RADIATED	PASS
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	15.205, 15.407(b)(5), (6)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS

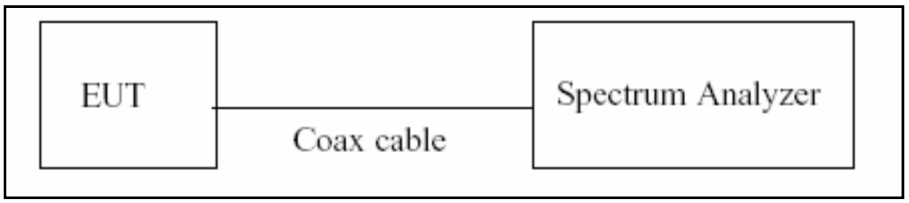
*N/A = Not Tested.

9. TEST RESULT

9.1 DUTY CYCLE

The zero-span mode on a spectrum analyzer or EMI receiver ,if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/*T*, where *T* is defined in section B)1)a), and the number of sweep points across duration *T* exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, (B.2 in KDB 789033 D02 v01r04)
The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)
The zero-span method was used becaure all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

[Omni]

▣ Duty Cycle Factor_Ant 0

Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.067	2.132	0.96951220	0.134
	9	1.385	1.451	0.95454765	0.202
	12	1.044	1.114	0.93750000	0.280
	18	0.704	0.769	0.91457203	0.388
	24	0.532	0.596	0.89244080	0.494
	36	0.364	0.432	0.84168272	0.749
	48	0.276	0.340	0.81364424	0.896
	54	0.249	0.315	0.78994569	1.024
Mode	**MCS INDEX**	**T_{on} (ms)**	**T_{total} (ms)**	**Duty Cycle**	**Duty Cycle Factor (dB)**
802.11n_HT20	MCS 0	5.003	5.064	0.98807156	0.052
	MCS 1	4.983	5.043	0.98802395	0.052
	MCS 2	4.158	4.218	0.98568018	0.063
	MCS 3	4.973	5.033	0.98799999	0.052
	MCS 4	3.333	3.400	0.98019898	0.087
	MCS 5	2.498	2.572	0.97120674	0.127
	MCS 6	2.229	2.296	0.97081716	0.129
	MCS 7	2.010	2.079	0.96681097	0.147
802.11n_HT40	MCS 0	2.427	2.492	0.97378411	0.115
	MCS 1	2.422	2.487	0.97373489	0.116
	MCS 2	2.021	2.091	0.96651791	0.148
	MCS 3	2.413	2.483	0.97180455	0.124
	MCS 4	1.624	1.689	0.96132786	0.171
	MCS 5	1.222	1.288	0.94890511	0.228
	MCS 6	1.094	1.156	0.94579657	0.242
	MCS 7	0.990	1.053	0.94047587	0.267

Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_VHT20	MCS 0	5.013	5.074	0.98809524	0.052
	MCS 1	4.983	5.053	0.98605513	0.061
	MCS 2	4.161	4.235	0.98251115	0.077
	MCS 3	4.976	5.037	0.98796791	0.053
	MCS 4	3.333	3.400	0.98019898	0.087
	MCS 5	2.512	2.572	0.97643976	0.104
	MCS 6	2.233	2.300	0.97087374	0.128
	MCS 7	2.014	2.081	0.96781121	0.142
	MCS 8	1.689	1.749	0.96569468	0.152
802.11ac_ VHT40	MCS 0	2.437	2.503	0.97368684	0.116
	MCS 1	2.422	2.488	0.97352607	0.117
	MCS 2	2.022	2.087	0.96844506	0.139
	MCS 3	2.412	2.478	0.97341379	0.117
	MCS 4	1.625	1.686	0.96370968	0.161
	MCS 5	1.227	1.289	0.95250660	0.211
	MCS 6	1.098	1.159	0.94721408	0.236
	MCS 7	0.993	1.052	0.94396851	0.250
	MCS 8	0.831	0.894	0.92967482	0.317
	MCS 9	0.756	0.820	0.92149530	0.355
802.11ac_ VHT80	MCS 0	1.148	1.206	0.95167804	0.215
	MCS 1	1.137	1.198	0.94926018	0.226
	MCS 2	0.957	1.019	0.93877551	0.274
	MCS 3	1.139	1.199	0.94941933	0.225
	MCS 4	0.771	0.832	0.92708293	0.329
	MCS 5	0.592	0.652	0.90782562	0.420
	MCS 6	0.528	0.589	0.89615379	0.476
	MCS 7	0.481	0.539	0.89075513	0.502
	MCS 8	0.407	0.470	0.86564626	0.627
	MCS 9	0.372	0.433	0.85951941	0.657

▣ Duty Cycle Factor_Ant 1

Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.062	2.131	0.96755877	0.143
	9	1.383	1.449	0.95471709	0.201
	12	1.044	1.114	0.93699515	0.283
	18	0.704	0.770	0.91355140	0.393
	24	0.533	0.595	0.89516129	0.481
	36	0.365	0.433	0.84210526	0.746
	48	0.276	0.340	0.81425664	0.892
	54	0.248	0.314	0.78971985	1.025
Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11n_HT20	MCS 0	5.003	5.074	0.98611045	0.061
	MCS 1	4.983	5.043	0.98802395	0.052
	MCS 2	4.158	4.228	0.98333254	0.073
	MCS 3	4.963	5.033	0.98600132	0.061
	MCS 4	3.326	3.400	0.97821976	0.096
	MCS 5	2.505	2.572	0.97382325	0.115
	MCS 6	2.229	2.303	0.96783481	0.142
	MCS 7	2.014	2.081	0.96781121	0.142
802.11n_HT40	MCS 0	2.427	2.493	0.97357590	0.116
	MCS 1	2.417	2.483	0.97346808	0.117
	MCS 2	2.020	2.088	0.96742671	0.144
	MCS 3	2.414	2.482	0.97260274	0.121
	MCS 4	1.622	1.690	0.95975855	0.178
	MCS 5	1.224	1.287	0.95070176	0.220
	MCS 6	1.093	1.158	0.94324294	0.254
	MCS 7	0.988	1.059	0.93362210	0.298

Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_VHT20	MCS 0	5.013	5.084	0.98613797	0.061
	MCS 1	4.993	5.053	0.98804782	0.052
	MCS 2	4.158	4.218	0.98568018	0.063
	MCS 3	4.973	5.043	0.98602728	0.061
	MCS 4	3.326	3.394	0.98015971	0.087
	MCS 5	2.510	2.568	0.97739387	0.099
	MCS 6	2.233	2.300	0.97087374	0.128
	MCS 7	2.014	2.081	0.96781121	0.142
	MCS 8	1.686	1.749	0.96397942	0.159
802.11ac_ VHT40	MCS 0	2.437	2.498	0.97565926	0.107
	MCS 1	2.427	2.488	0.97556005	0.107
	MCS 2	2.022	2.087	0.96844506	0.139
	MCS 3	2.417	2.483	0.97346808	0.117
	MCS 4	1.622	1.686	0.96169355	0.170
	MCS 5	1.229	1.287	0.95422029	0.204
	MCS 6	1.095	1.158	0.94520276	0.245
	MCS 7	0.993	1.052	0.94396851	0.250
	MCS 8	0.832	0.895	0.92911464	0.319
	MCS 9	0.757	0.814	0.93036291	0.313
802.11ac_ VHT80	MCS 0	1.147	1.206	0.95112243	0.218
	MCS 1	1.140	1.201	0.94905646	0.227
	MCS 2	0.954	1.013	0.94183478	0.260
	MCS 3	1.140	1.201	0.94905646	0.227
	MCS 4	0.771	0.832	0.92643055	0.332
	MCS 5	0.592	0.651	0.90983560	0.410
	MCS 6	0.528	0.588	0.89795918	0.467
	MCS 7	0.480	0.540	0.88888889	0.512
	MCS 8	0.408	0.469	0.87060936	0.602
	MCS 9	0.372	0.432	0.85971878	0.656

▣ Duty Cycle Factor_Ant 2

Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.062	2.127	0.96940575	0.135
	9	1.383	1.451	0.95292132	0.209
	12	1.044	1.114	0.93699515	0.283
	18	0.704	0.770	0.91355140	0.393
	24	0.533	0.595	0.89516129	0.481
	36	0.364	0.444	0.81891892	0.868
	48	0.276	0.344	0.80232558	0.956
	54	0.248	0.315	0.78762555	1.037
Mode	**MCS INDEX**	**T_{on} (ms)**	**T_{total} (ms)**	**Duty Cycle**	**Duty Cycle Factor (dB)**
802.11n_HT20	MCS 0	5.003	5.074	0.98611045	0.061
	MCS 1	4.983	5.043	0.98802395	0.052
	MCS 2	4.147	4.218	0.98329512	0.073
	MCS 3	4.973	5.033	0.98799999	0.052
	MCS 4	3.322	3.392	0.97922752	0.091
	MCS 5	2.503	2.574	0.97243839	0.121
	MCS 6	2.230	2.298	0.97041420	0.130
	MCS 7	2.013	2.081	0.96732026	0.144
802.11n_HT40	MCS 0	2.427	2.493	0.97357590	0.116
	MCS 1	2.422	2.488	0.97352607	0.117
	MCS 2	2.022	2.087	0.96844506	0.139
	MCS 3	2.412	2.483	0.97142592	0.126
	MCS 4	1.622	1.686	0.96169355	0.170
	MCS 5	1.224	1.285	0.95238095	0.212
	MCS 6	1.090	1.156	0.94314014	0.254
	MCS 7	0.988	1.059	0.93362210	0.298

Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_VHT20	MCS 0	5.013	5.084	0.98613797	0.061
	MCS 1	4.983	5.043	0.98802395	0.052
	MCS 2	4.161	4.222	0.98564593	0.063
	MCS 3	4.976	5.043	0.98664755	0.058
	MCS 4	3.333	3.400	0.98019898	0.087
	MCS 5	2.506	2.568	0.97565344	0.107
	MCS 6	2.238	2.300	0.97281694	0.120
	MCS 7	2.019	2.077	0.97204141	0.123
	MCS 8	1.688	1.751	0.96428755	0.158
802.11ac_ VHT40	MCS 0	2.437	2.503	0.97368684	0.116
	MCS 1	2.422	2.488	0.97352607	0.117
	MCS 2	2.023	2.084	0.97063622	0.129
	MCS 3	2.414	2.479	0.97393690	0.115
	MCS 4	1.625	1.686	0.96370968	0.161
	MCS 5	1.227	1.289	0.95250660	0.211
	MCS 6	1.097	1.158	0.94716258	0.236
	MCS 7	0.991	1.052	0.94181301	0.260
	MCS 8	0.833	0.895	0.92979417	0.316
	MCS 9	0.756	0.814	0.92843650	0.322
802.11ac_ VHT80	MCS 0	1.148	1.206	0.95167804	0.215
	MCS 1	1.140	1.203	0.94737105	0.235
	MCS 2	0.955	1.029	0.92857476	0.322
	MCS 3	1.140	1.201	0.94936709	0.226
	MCS 4	0.771	0.834	0.92515590	0.338
	MCS 5	0.591	0.653	0.90450933	0.436
	MCS 6	0.528	0.590	0.89443271	0.485
	MCS 7	0.479	0.538	0.89052687	0.504
	MCS 8	0.407	0.470	0.86506156	0.630
	MCS 9	0.372	0.433	0.85951941	0.657

▣ Duty Cycle Factor_Ant 3

Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.063	2.132	0.96748124	0.144
	9	1.382	1.448	0.95445095	0.202
	12	1.043	1.112	0.93814452	0.277
	18	0.704	0.769	0.91457203	0.388
	24	0.532	0.596	0.89261745	0.493
	36	0.364	0.432	0.84337349	0.740
	48	0.276	0.339	0.81329843	0.898
	54	0.249	0.315	0.79063255	1.020
Mode	**MCS INDEX**	**T_{on} (ms)**	**T_{total} (ms)**	**Duty Cycle**	**Duty Cycle Factor (dB)**
802.11n_HT20	MCS 0	5.003	5.074	0.98611045	0.061
	MCS 1	4.983	5.053	0.98605513	0.061
	MCS 2	4.147	4.218	0.98329512	0.073
	MCS 3	4.973	5.033	0.98799999	0.052
	MCS 4	3.326	3.400	0.97821976	0.096
	MCS 5	2.505	2.572	0.97382325	0.115
	MCS 6	2.229	2.296	0.97081716	0.129
	MCS 7	2.010	2.079	0.96681097	0.147
802.11n_HT40	MCS 0	2.427	2.493	0.97357590	0.116
	MCS 1	2.422	2.488	0.97352607	0.117
	MCS 2	2.022	2.087	0.96844506	0.139
	MCS 3	2.412	2.483	0.97142592	0.126
	MCS 4	1.618	1.686	0.95967742	0.179
	MCS 5	1.224	1.287	0.95070176	0.220
	MCS 6	1.093	1.158	0.94324294	0.254
	MCS 7	0.988	1.059	0.93362210	0.298

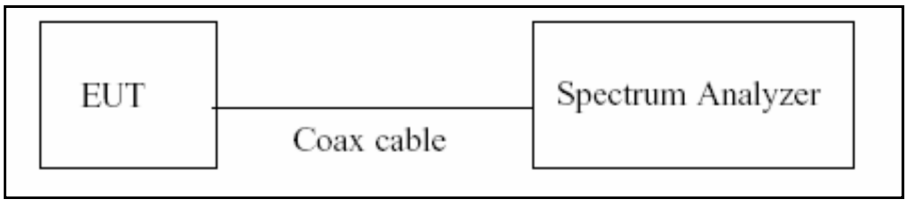
Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_VHT20	MCS 0	5.013	5.074	0.98809524	0.052
	MCS 1	4.983	5.043	0.98802395	0.052
	MCS 2	4.158	4.218	0.98568018	0.063
	MCS 3	4.973	5.043	0.98602728	0.061
	MCS 4	3.333	3.394	0.98214286	0.078
	MCS 5	2.510	2.568	0.97739387	0.099
	MCS 6	2.238	2.300	0.97281694	0.120
	MCS 7	2.019	2.081	0.96995393	0.132
	MCS 8	1.686	1.749	0.96397942	0.159
802.11ac_ VHT40	MCS 0	2.432	2.498	0.97362953	0.116
	MCS 1	2.422	2.488	0.97352607	0.117
	MCS 2	2.023	2.088	0.96905537	0.137
	MCS 3	2.417	2.482	0.97397260	0.115
	MCS 4	1.622	1.680	0.96558704	0.152
	MCS 5	1.229	1.290	0.95254821	0.211
	MCS 6	1.097	1.158	0.94716258	0.236
	MCS 7	0.991	1.052	0.94181301	0.260
	MCS 8	0.833	0.897	0.92820513	0.324
	MCS 9	0.756	0.814	0.92843650	0.322
802.11ac_ VHT80	MCS 0	1.147	1.207	0.95029821	0.221
	MCS 1	1.140	1.200	0.95000000	0.223
	MCS 2	0.958	1.018	0.94103774	0.264
	MCS 3	1.140	1.202	0.94810379	0.231
	MCS 4	0.771	0.832	0.92692308	0.330
	MCS 5	0.592	0.651	0.90909091	0.414
	MCS 6	0.528	0.589	0.89673913	0.473
	MCS 7	0.480	0.550	0.87209302	0.594
	MCS 8	0.407	0.471	0.86425349	0.634
	MCS 9	0.372	0.434	0.85749528	0.668

9.2 EMISSION BANDWIDTH AND MINIMUM EMISSION BANDWIDTH MEASUREMENT

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033 D02 v01r04, at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE (26dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.
The Spectrum Analyzer is set to(C.1 in KDB 789033 D02 v01r04)

1. RBW = approximately 1 % of the emission bandwidth
2. VBW > RBW
3. Detector = Peak
4. Trace mode = max hold
5. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Note : We tested 26 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 26 dB.

▣ TEST PROCEDURE (for the band 5.725-5.85 GHz, 6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to(C.2 in KDB 789033 D02 v01r04)

1. RBW = 100 kHz
2. VBW ≥ 3*RBW
3. Detector = Peak
4. Trace mode = max hold
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points(upper and lower frequencies) that are attenuated by 6 dB relative to the maximum lever measured in the fundamental emission.

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

[Omni]

▣ TEST RESULTS for Ant.0_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	19.58	N/A	Pass
5200	40	19.59	N/A	Pass
5240	48	19.66	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	19.25	N/A	Pass
5300	60	19.52	N/A	Pass
5320	64	19.41	N/A	Pass

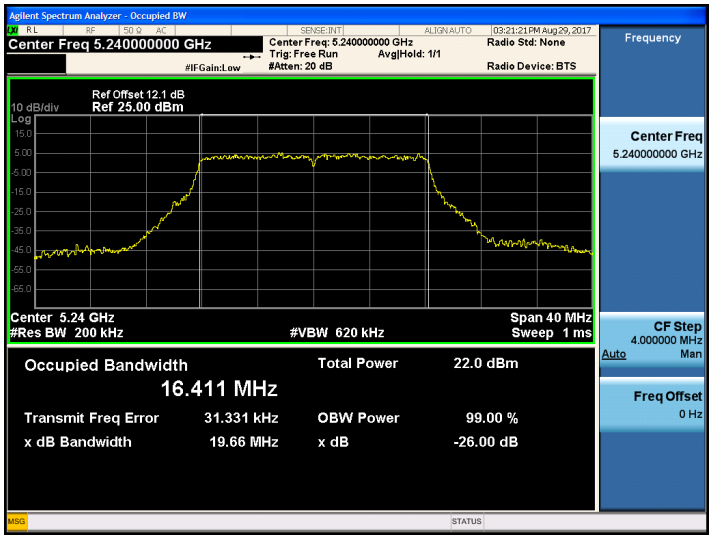
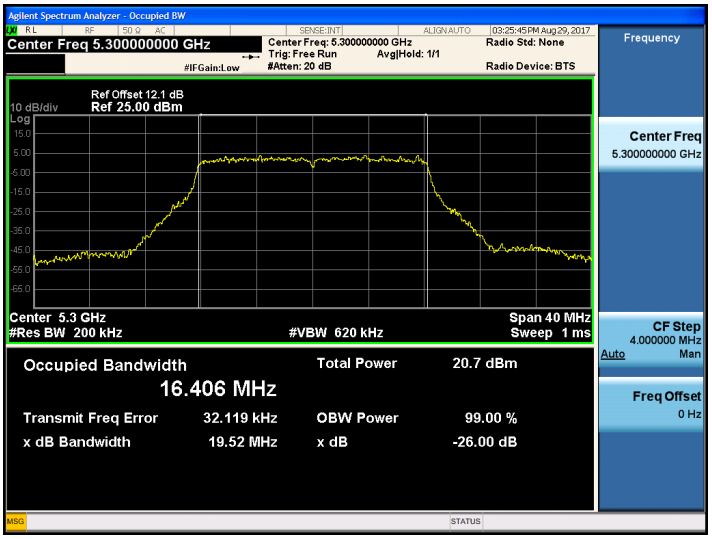
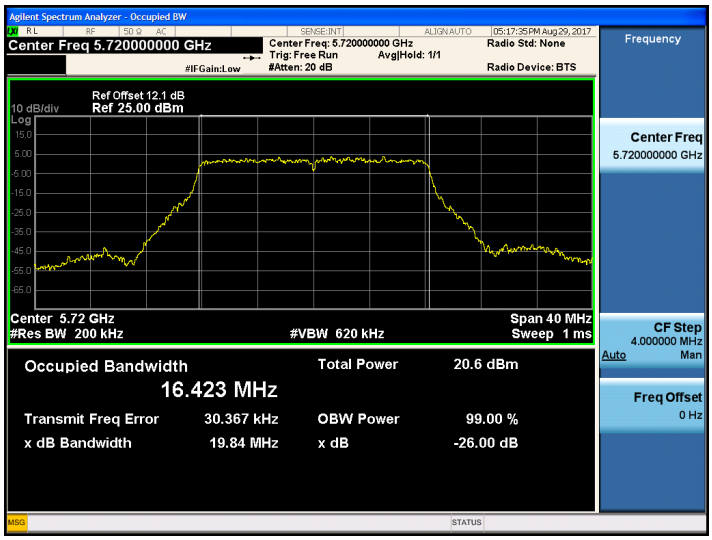
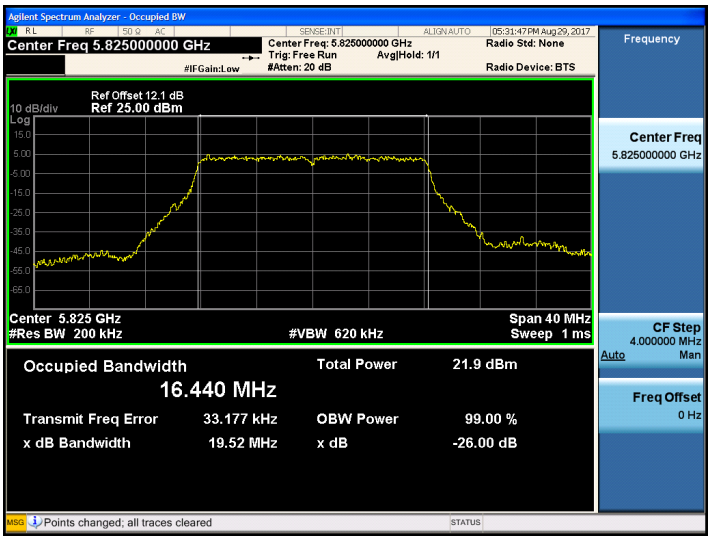
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	19.51	N/A	Pass
5600	120	19.17	N/A	Pass
5720	144	19.84	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	19.28	N/A	Pass
5785	157	19.40	N/A	Pass
5825	165	19.52	N/A	Pass

▣ TEST Plot for Ant.0_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 48)	802.11a UNII 2A BAND 26dB Bandwidth (CH 60)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**
	

Note : In order to simplify the report, attached plots were only the most wide channel.

▣ TEST RESULTS for Ant.1_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	19.43	N/A	Pass
5200	40	19.57	N/A	Pass
5240	48	19.41	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	19.34	N/A	Pass
5300	60	19.52	N/A	Pass
5320	64	19.65	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

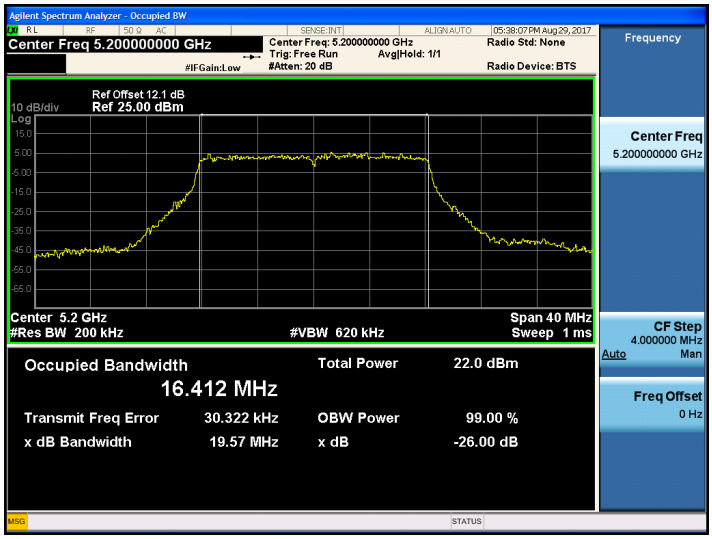
802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	19.22	N/A	Pass
5600	120	19.46	N/A	Pass
5720	144	19.54	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

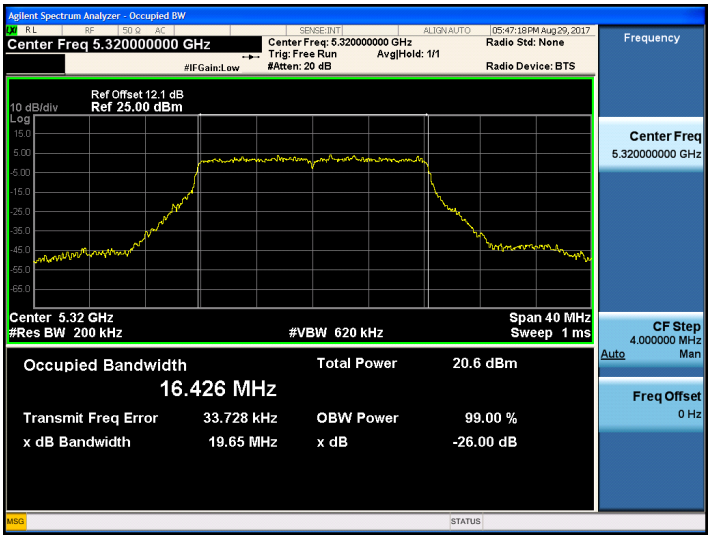
802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	19.21	N/A	Pass
5785	157	19.19	N/A	Pass
5825	165	19.32	N/A	Pass

▣ TEST Plot for Ant.1_802.11a

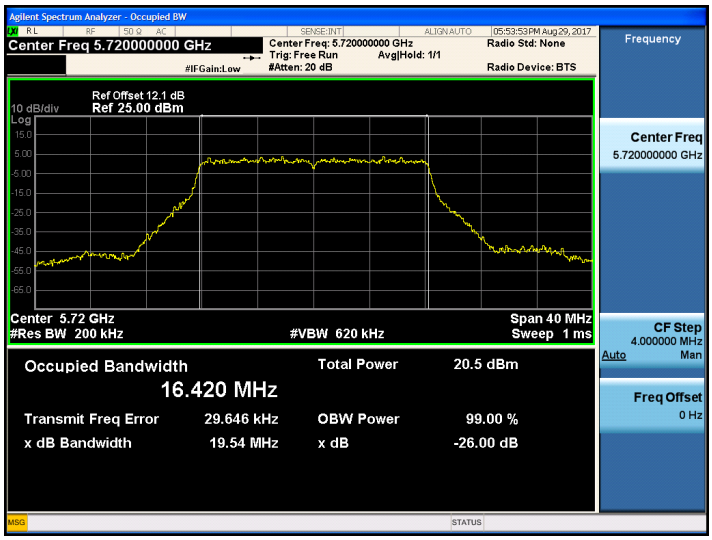
802.11a UNII 1 BAND 26dB Bandwidth (CH40)



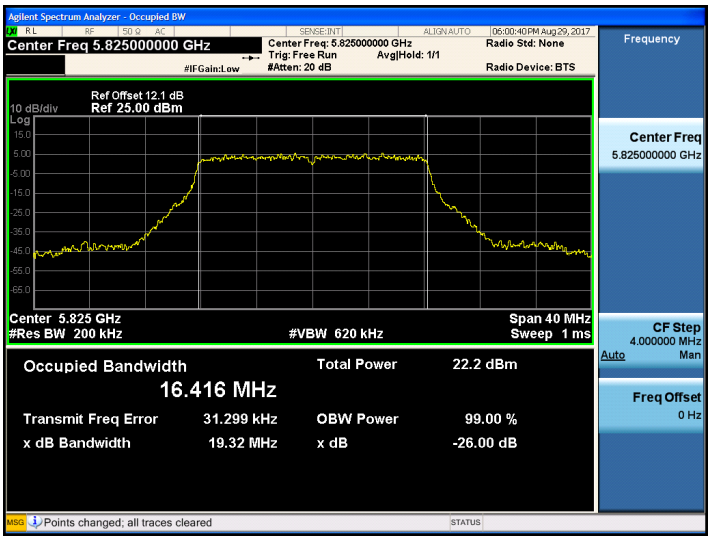
802.11a UNII 2A BAND 26dB Bandwidth (CH 64)



802.11a UNII 2C BAND 26dB Bandwidth (CH144)



802.11a UNII 3 BAND 26dB Bandwidth (CH 165)



Note : In order to simplify the report, attached plots were only the most wide channel.

▣ TEST RESULTS for Ant.2_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	19.08	N/A	Pass
5200	40	19.13	N/A	Pass
5240	48	19.67	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	19.50	N/A	Pass
5300	60	18.98	N/A	Pass
5320	64	19.17	N/A	Pass

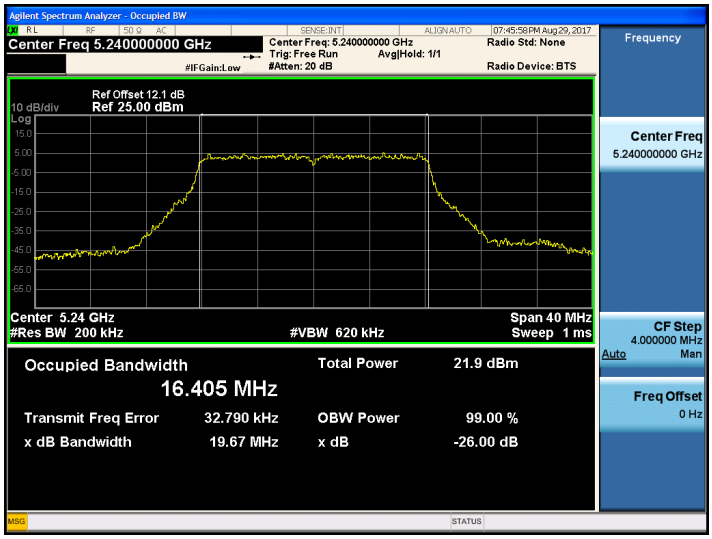
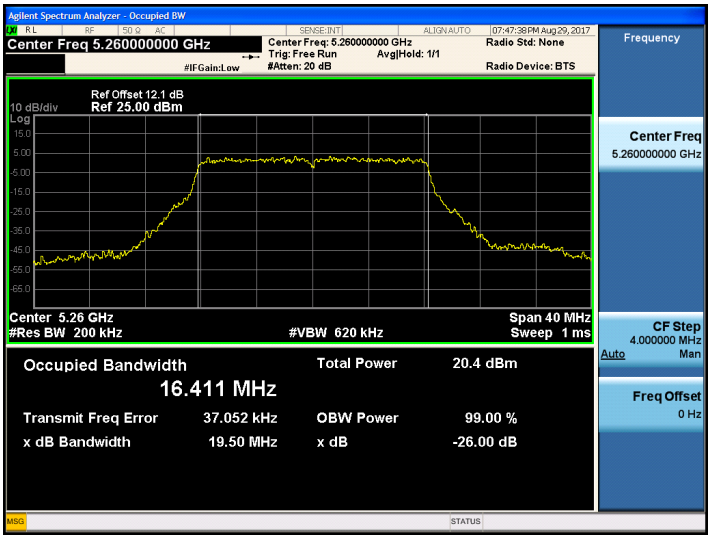
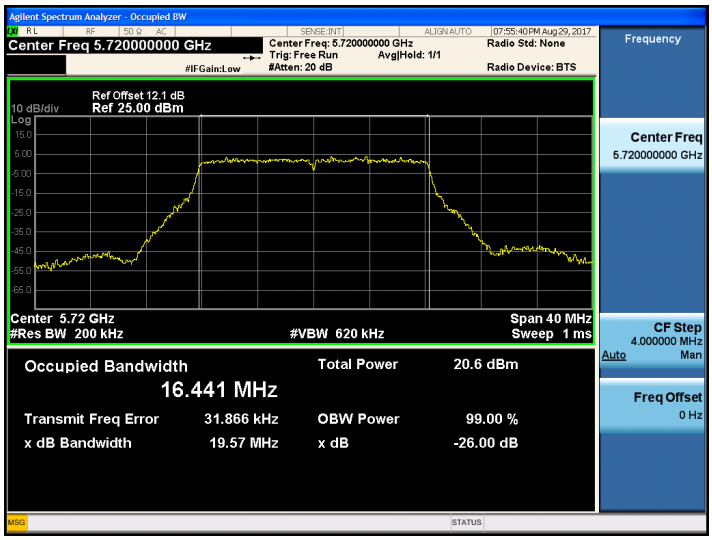
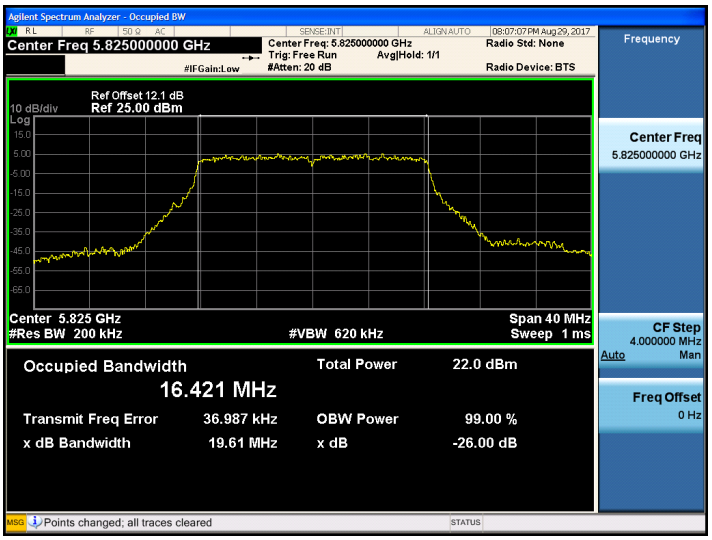
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	19.20	N/A	Pass
5600	120	19.57	N/A	Pass
5720	144	19.57	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	19.24	N/A	Pass
5785	157	19.15	N/A	Pass
5825	165	19.61	N/A	Pass

▣ TEST Plot for Ant.2_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 48)	802.11a UNII 2A BAND 26dB Bandwidth (CH 52)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**
	

Note : In order to simplify the report, attached plots were only the most wide channel.

▣ TEST RESULTS for Ant.3_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	19.17	N/A	Pass
5200	40	19.44	N/A	Pass
5240	48	19.53	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	19.63	N/A	Pass
5300	60	19.28	N/A	Pass
5320	64	18.84	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	19.50	N/A	Pass
5600	120	19.18	N/A	Pass
5720	144	19.36	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	19.19	N/A	Pass
5785	157	19.66	N/A	Pass
5825	165	19.44	N/A	Pass