



RADIO TEST REPORT

For

MODEL NO.:1836

FCC ID: C3K1836

IC ID: 3048A-1836

Test Report No. R-TR484-FCCISED-UNII-3

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FCC CFR47 Part 15 Subpart E
Innovation, Science and Economic Development
Canada RSS-247 Issue 2

Prepared by

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TESTING CERT #3472.01

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	5/23/2018	All	All	Version 1.0	Andy Shen
2.0	5/30/2018	4	7	Updated MU Table.	Andy Shen
		8.1	14	Added test site specific details for <30MHz testing.	
		9.6.2	80	Corrected typo on freq range of test.	
		9.6.2	80	Added test setup details for <30MHz testing.	
		9.6.2	80	Removed incorrect references to MIMO mode.	
3.0	06/07/2018	5.6	8	Added section for FW and driver details of the test samples.	Andy Shen

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Test Report Attestation

Microsoft Corporation**Model: 1836****FCC ID: C3K1836****ISED ID: 3048A-1836****Applicable Standards**

Specification	Test Result
FCC CFR47 Rule Parts 15.207, 15.209, 15.407	Pass
Innovation, Science and Economic Development Canada RSS-247 Issue 2, RSS-GEN Issue 5	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces the previously issued report #R-TR484-FCCISED-UNII-2 issued by Microsoft EMC Labs on 5/30/2018.



Written By: Andy Shen
Radio Test Engineer



Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at Microsoft EMC Laboratory,
17760 NE 67th Ct,
Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 3048A-3, 3048A-4

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2014 and other equivalent applicable standards.

Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2014.

ANSI C63.10:2013 and the appropriate KDB test methods were followed.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$. These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

Test item	Uncertainty	Unit
Radiated disturbance (9 kHz to 30 MHz)	5.45	dB
Radiated disturbance (30 MHz to 1 GHz)	5.99	dB
Radiated disturbance (1 GHz to 18 GHz)	5.12	dB
Radiated disturbance (18 GHz to 26.5 GHz)	5.34	dB
Radiated disturbance (26.5 GHz to 40 GHz)	5.08	dB
Conducted Disturbance at Mains Port	3.31	dB
Uncertainty for Conducted Power test	1.277	dB
Uncertainty for Conducted Spurious emission test	2.742	dB
Uncertainty for Bandwidth test	178	kHz
Uncertainty for DC power test	0.05	%
Uncertainty for test site temperature	0.5	°C
Uncertainty for test site Humidity	3	%
Uncertainty for time	0.189	%

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Pamela Galvan
Functional Description of the EUT:	Microsoft Wireless Input Device
Model:	1836
FCC ID:	C3K1836
IC ID:	3048A-1836
Radio under test:	IEEE 802.11a/n supporting 20 MHz Bandwidths 5150- 5250 MHz, 5250-5350 MHz, 5470-5725 MHz and 5725- 5850 MHz.
Modulation(s):	OFDM – BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
EUT Classification:	UNII
Equipment Design State:	Prototype/Production Equivalent
Equipment Condition:	Good

5.1 Test Configurations

Test software “MTK MT7637 QA 0.0.1.63”, “Indium QA tool V1.17 and V1.19” from the module vendor were used to program the EUT to transmit continuously.

This report contains data from the following worst-case modes of operation:

802.11a: 6Mbps, 20MHz BW.

802.11n HT20: MCS0, 20MHz BW.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance, and any deviations required from the EUT are reported.

5.3 Antenna Requirements and Gain Information

The antennas are internal, permanently attached and there are no provisions for connection to an external antenna.

Antenna Gain		
Frequency Band (MHz)	Main Antenna Peak Gain (dBi)	Diversity Antenna Peak Gain (dBi)
UNII Band 1 – 5150 to 5250	6.2	6.7
UNII Band 2a – 5250 to 5350	6.2	6.0
UNII Band 2c – 5470 to 5725	5.9	6.1
UNII Band 3 – 5725 to 5850	5.6	6.4

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed from Mar 22, 2018 to May 23, 2018.

5.6 Test Sample Details

RF Conducted Test Samples:

SN	Internal Lab ID	Design State
02560000893802	R-484-032218-09	EV2

RF Radiated Test Samples:

SN	Internal Lab ID	Design State
0256000447814	R-484-041918-06	DV
0256000517814	R-484-041918-07	DV
0256000597814	R-484-041918-08	DV

Radio FW: 4.5.213.0

Radio Driver Version: WDM Driver v0.0.3.40/ FTDI Driver v2.12.28.0

6 Test Results Summary

Test Description	Applicable Bands (GHz)	FCC CFR 47/ISED Rule Part	Limit	Test Result
26dB Emission Bandwidth	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725	15.407 (a) RSS-247 [6.2.1]	Reporting and Measurement Purposes	NA
99% bandwidth	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725	RSS-247 [6.2]	Reporting and Measurement Purposes	NA
6 dB Bandwidth	5.725 – 5.85	15.407 (e) RSS-247 [6.2.4]	≥ 500kHz	Pass
Output Power	5.15 – 5.25	15.407 (a)(1)(iv)	≤ 250 mW or 10 + 10 log ₁₀ B* whichever is less	Pass
		RSS-247 [6.2.1]	≤ 200 mW or 10 + 10 log ₁₀ B* e.i.r.p whichever is less	Pass
	5.25 – 5.35 5.47 – 5.725	15.407 (a)(2) RSS-247 [6.2]	≤ 250 mW or 11 + 10 log ₁₀ B* whichever is less ≤ 1 W or 17 + 10 log ₁₀ B* e.i.r.p whichever is less	Pass
		5.725 – 5.85	15.407 (a)(3) RSS-247 [6.2]	≤ 1000 mW
Power Spectral Density	5.15 – 5.25	15.407 (a)(1)(iv)	≤ 11dBm/MHz	Pass
		RSS-247 [6.2]	≤ 10dBm/MHz e.i.r.p.	Pass
	5.25 – 5.35 5.47 – 5.725	15.407 (a)(2) RSS-247 [6.2]	≤ 11dBm/MHz	Pass
		5.725 – 5.85	15.407 (a)(3) RSS-247 [6.2]	≤ 30dBm/500kHz
Radiated Spurious Emissions/ Restricted Band Emissions	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725 5.725 – 5.85	15.407 (b), 15.205, 15.209, RSS-Gen [8.9]	FCC CFR 47 15.209 limits RSS-Gen [8.9]	Pass

AC Power Line Conducted Emissions	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725 5.725 – 5.85	15.407 (b), 15.207 RSS-Gen [8.8]	FCC CFR 47 15.207 limits RSS-Gen [8.8]	Pass
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* Note: **B-** FCC references 26dB bandwidth and ISED references 99% bandwidth.

7 Test Equipment List

Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-229	4/9/2019
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-192	4/8/2019
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-248	4/9/2019
Rohde & Schwarz	Signal Analyzer	FSV40	RF-245	4/10/2019
Rohde & Schwarz	Power Meter	NRP2	RF-025	04/19/2018
Agilent	Spectrum Analyzer	N9020A	EMC-054	11/27/2018
Sunol Sciences	Antenna - Broadband Hybrid	JB6	EMC-639	7/17/2018
ETS-Lindgren	Antenna	3117	RF-138	6/13/2018
ETS-Lindgren	Antenna	3117	RF-139	5/22/2018*
ETS-Lindgren	Antenna - Standard Gain Horn	3160-09	RF-179	NA
ETS-Lindgren	Antenna - Standard Gain Horn	3160-10	EMC-601	NA
ETS-Lindgren	Antenna - Passive Loop	6512	EMC-440	8/31/2018
Rohde & Schwarz	Custom Filter Bank+PreAmp	SFUNIT RX	RF-323	NA
Rohde & Schwarz	Custom Filter Bank+PreAmp	SFUNIT RX	RF-324	NA
Rohde & Schwarz	Preamplifier	TS-PR26	RF-199	NA
Rohde & Schwarz	Preamplifier	TS-PR40	RF-258	NA
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-018	NA
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-193	NA
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-249	NA
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-019	NA
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-194	NA
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-250	NA

*This equipment was in calibration when used for testing.

Manufacturer	Description	Model #	Asset #	Calibration Due
Huber & Suhner	RF Cable	SucoFlex 100	RF-350	NA
Huber & Suhner	RF Cable	SucoFlex 106A	RF-599	NA
Huber & Suhner	RF Cable	Sucoflex 102A	RF-269	NA
Madge Tech	THP Monitor	PRHT Temp 2000	EMC-170	09/28/2018
Madge Tech	THP Monitor	PRHT Temp 2000	EMC-680	11/2/2018
Madge Tech	THP Monitor	PRHTemp2000	EMC-681	10/26/2018
MegaPhase	RF Cable	EMC3-N1N1-394	EMC-1037	NA
MegaPhase	RF Cable	EMC3-N1N1-394	EMC-1036	NA
Micro-Coax	RF Cable	UTI Flex	RF-354	NA
Micro-Coax	RF Cable	UTI Flex	RF-359	NA
Micro-Coax	RF Cable	UFB311A-1-0787-50U50U	EMC-351	NA
Murata	RF Cable	MXHQ87WA3000	RF-591	NA
Sucoflex	RF Cable	104PE	RF-430	NA
Teledyne	RF Cable	57500	EMC-1025	NA
Pasternack	RF Cable	PE304-200CM	RF-447	NA
Pasternack	Attenuator	BHBW-S6-2W263+	RF-704	NA
Rohde & Schwarz	Software	EMC-32 V10.01.00	N/A	N/A

Equipment used for Line Conducted Emissions Measurement				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESR3	EMC-669	4/8/2019
Teseq	LISN	NNB 51	EMC-642	7/28/2018
Fluke	Multimeter	87V	EMC-096	10/23/2018
Madge Tech	THP Monitor	PRHTemp2000	EMC-881	7/17/2018
Chroma	AC Power Source	61602	EMC-055	N/A
Micro-Coax	RF Cable	UFA210A-1-1800-50U50U	EMC-367	8/9/2018
ETS-Lindgren	License Dongle	TILE V7.2.5.7	EMC-985	N/A

Note: Items with Calibration Due data marked as N/A are characterized before test, where applicable.

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers are laid out on the ground plane between the receiving antenna and the EUT to meet Site VSWR requirements in accordance with ANSI C63.4:2014.

Testing below 30MHz is also performed in the semi-anechoic chamber. Per KDB 414788, comparison measurements were performed between an open area site and the semi-anechoic chamber and the results from the chamber is higher than those measured from the open area site.

8.1.1 Radiated Measurements in 9 kHz- 30 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A loop antenna is positioned at 3m from the EUT periphery at 1m height from the ground. The turntable is rotated 360 degrees to determine the highest emissions. This is repeated for three orientations of the measurement antenna- parallel, perpendicular and ground-parallel. All possible orientations of the EUT were investigated for emissions and the flat orientation was identified as the worst-case configuration.

8.1.2 Radiated Measurements in 30 MHz - 1000 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both horizontal and vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the flat orientation was identified as the worst-case configuration.

8.1.3 Radiated Measurements above 1GHz

The EUT is positioned on a Turntable at a height of 1.5m. A Linearly polarized antenna is positioned at 3m from the EUT periphery. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The measurement antenna is set at a fixed 1.5m height while the turntable is rotated 360 degrees and the EUT elevation angle is varied from 0 to 150 degrees in 30 degree increments to determine the highest emissions. This is repeated for both horizontal and vertical Polarizations of the Measurement Antenna. Measurements above 18GHz were performed at a 3m distance. Near field scanning is performed to identify frequencies above 1 GHz.

8.2 Test Setup Diagrams

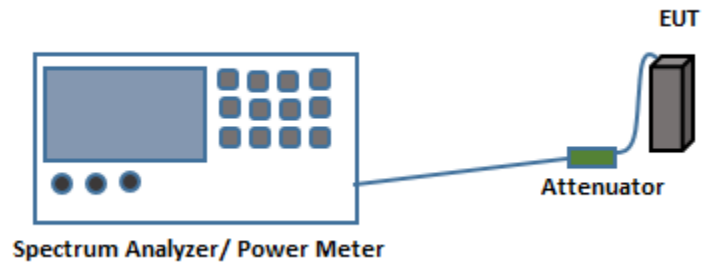


Figure 8-1. Test Setup for Antenna port conducted measurements

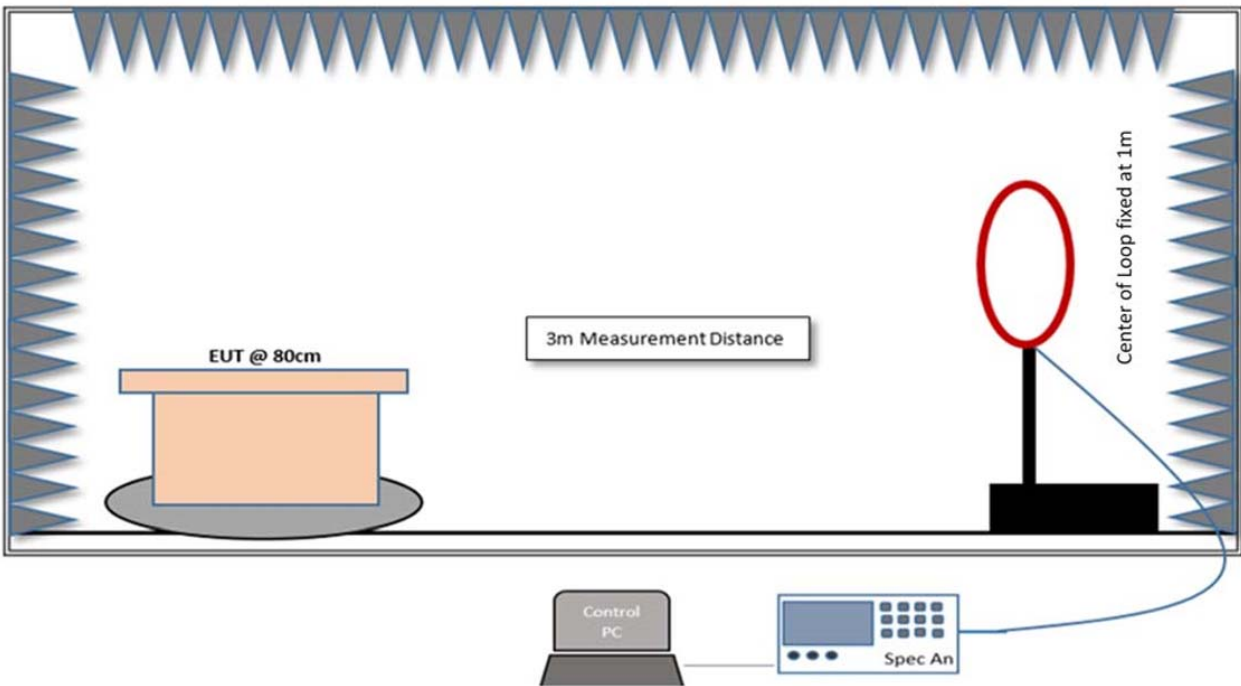


Figure 8-2. Test Setup for Radiated measurements in 9kHz - 30MHz Range

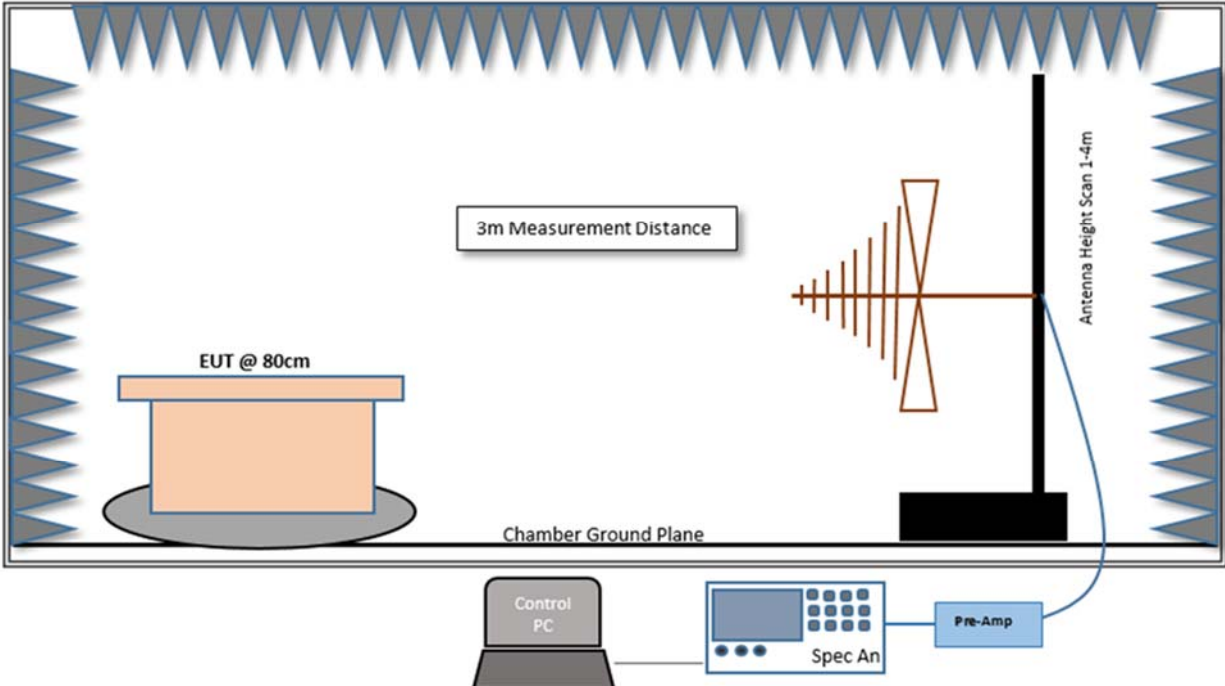


Figure 8-3. Test Setup for Radiated measurements in 30MHz- 1GHz Range

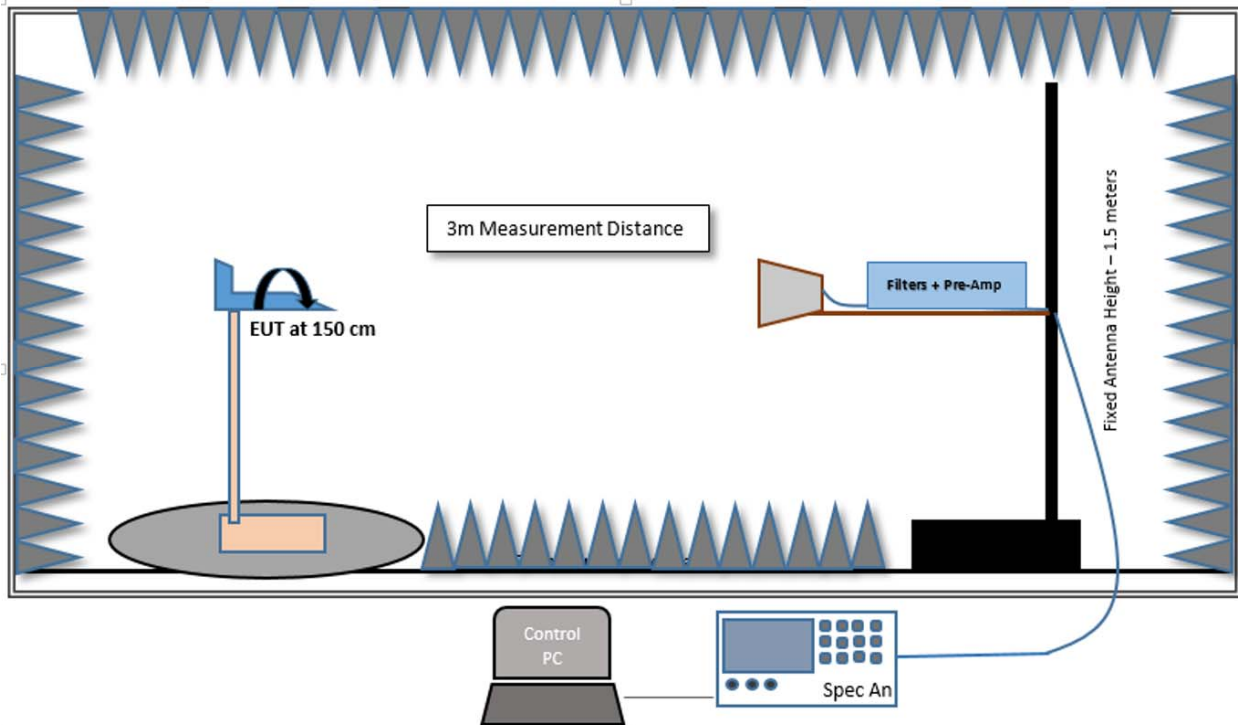


Figure 8-4. Test Setup for Radiated measurements in 1GHz- 18GHz Range

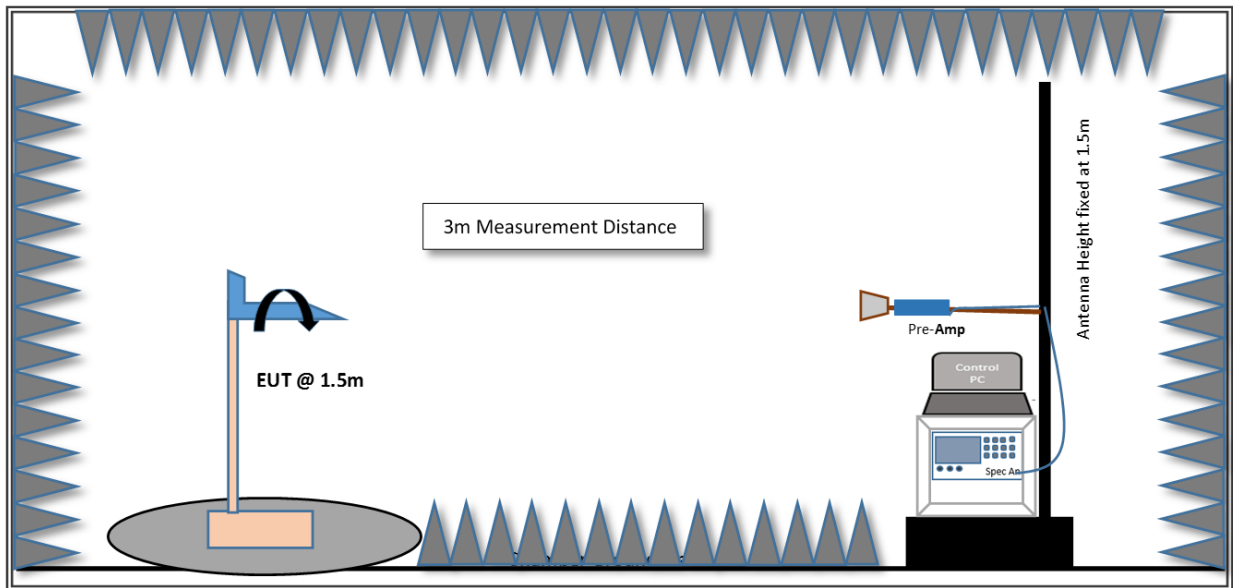


Figure 8-5. Test Setup for Radiated measurements >18GHz

9 Test Results- Conducted

9.1 26-dB Emission Bandwidth

9.1.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)
ISED RSS-247 [6.2.1]

9.1.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r03 and ANSI C63.10:2013.

Spectrum Analyzer settings:

RBW = approximately 1% of the Emissions Bandwidth

VBW \geq 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 26-dB emission bandwidth.

9.1.3 Limits:

Reporting and measurement purposes only.

9.1.4 Test Results:

See Section 9.2.5.

9.2 99% Occupied Bandwidth

9.2.1 Test Requirement:

ISED RSS-247 [6.2]

9.2.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r03 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Set the center frequency to the nominal EUT channel center frequency

Span = 1.5 to 5.0 times the 99% Occupied Bandwidth

RBW = 1% to 5% of the 99% Occupied Bandwidth

VBW \geq 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The built-in functionality of the Spectrum Analyzer is used to measure the 99% Occupied Bandwidth.

9.2.3 Limits:

Reporting and measurement purposes only.

9.2.4 Test Results:

See Section 9.2.5.

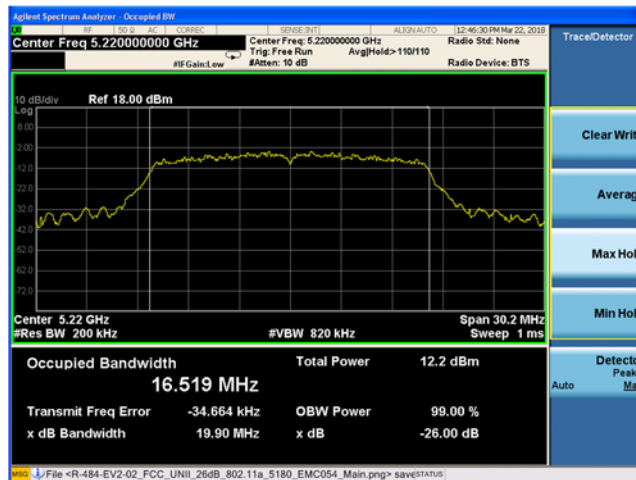
9.2.5 Test Data:

9.2.5.1 Main Antenna 802.11a 26-dB Emission Bandwidth

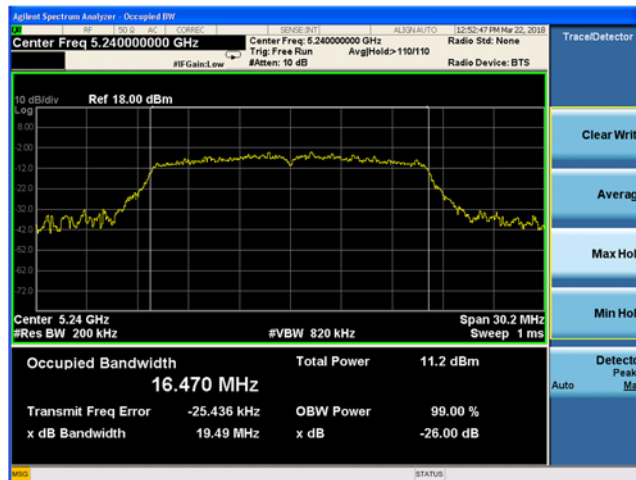
Main antenna 802.11a 26-dB Emission Bandwidth				
Band	Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)	99% Occupied BW (MHz)
UNII-1	36	5180	19.42	16.46
	44	5220	19.90	16.52
	48	5240	19.49	16.47
UNII-2A	52	5260	19.42	16.44
	60	5300	19.53	16.43
	64	5320	19.53	16.47
UNII-2C	100	5500	19.91	16.50
	116	5580	19.45	16.46
	140	5700	19.89	16.45
UNII-3	149	5745	19.47	16.48
	157	5785	19.61	16.47
	165	5825	19.47	16.46



Plot 9-1. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 36)



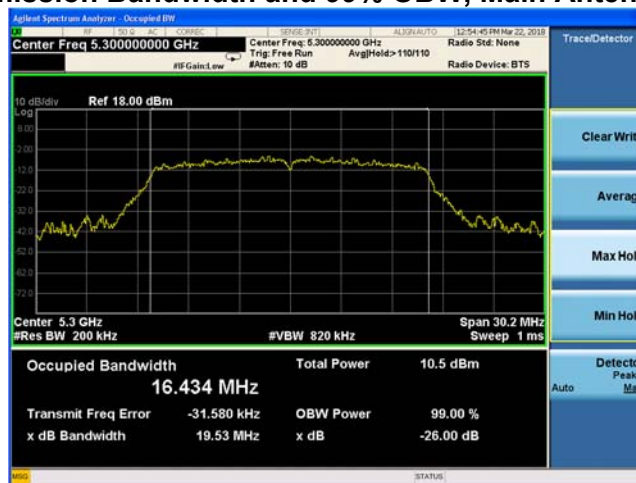
Plot 9-2. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 44)



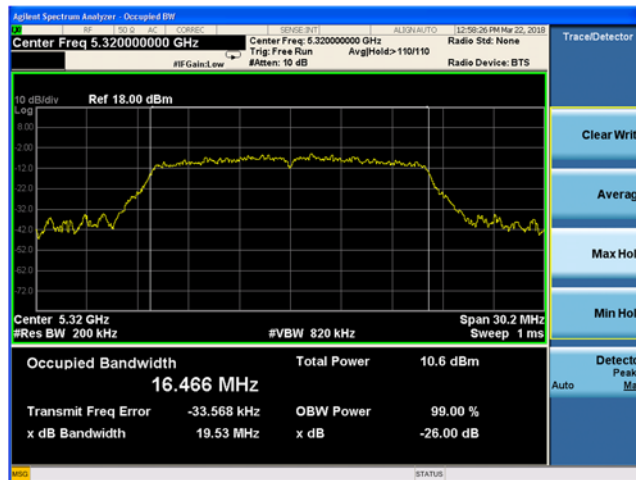
Plot 9-3 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 48)



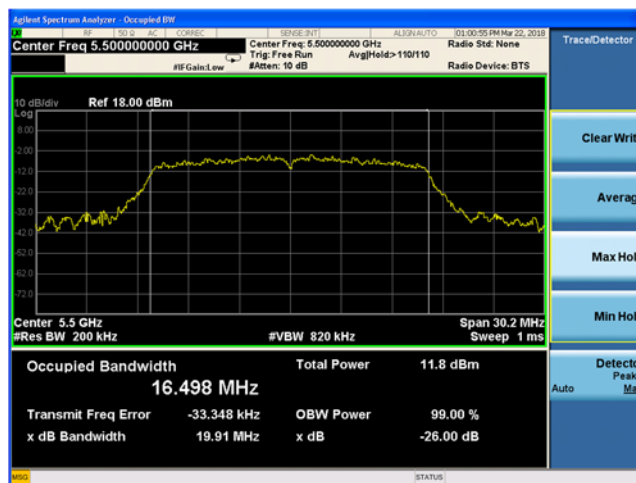
Plot 9-4. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 52)



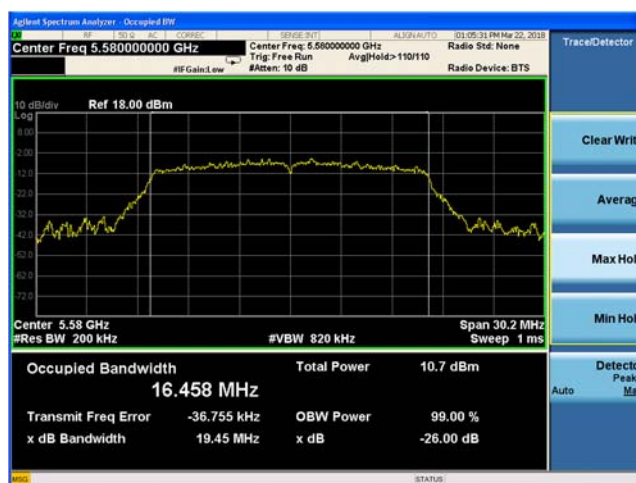
Plot 9-5. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 60)



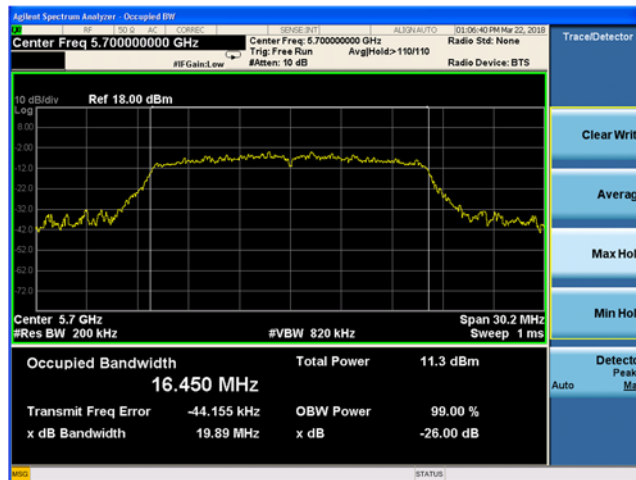
Plot 9-6. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 64)



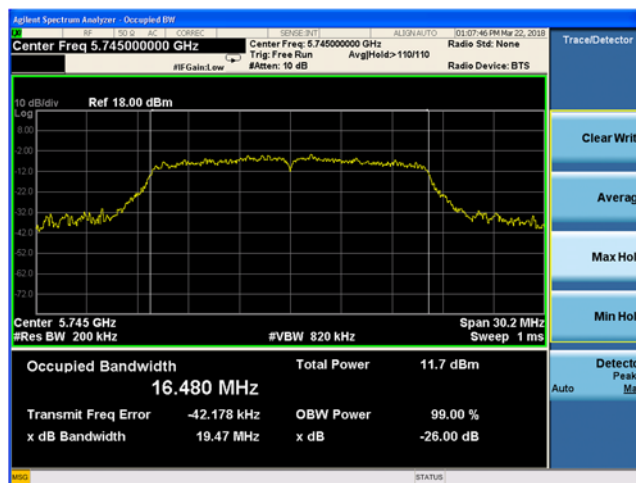
Plot 9-7 . 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 100)



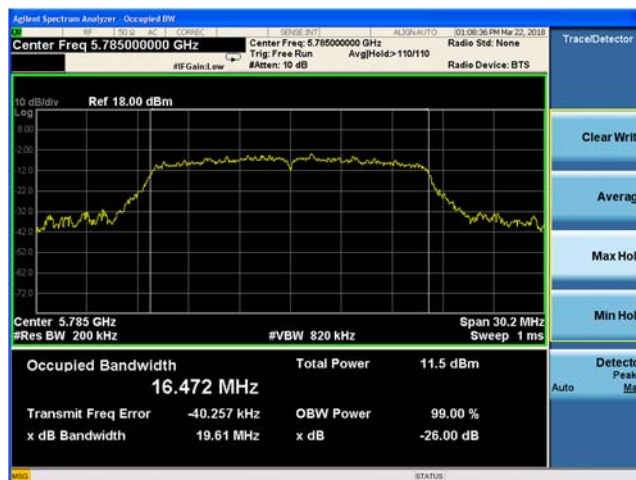
Plot 9-8. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 116)



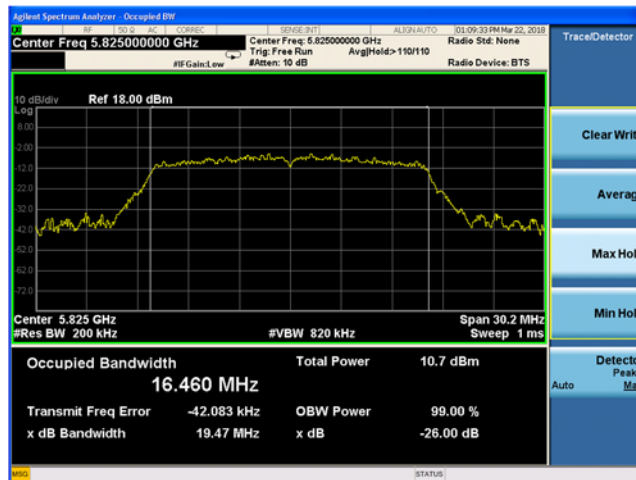
Plot 9-9. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 140)



Plot 9-10. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 149)



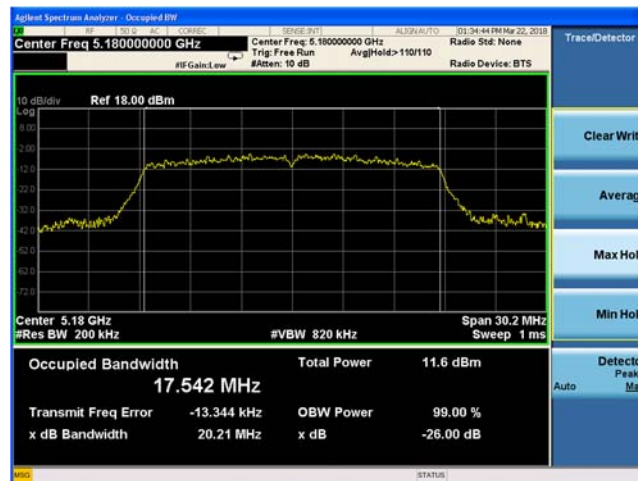
Plot 9-11. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 157)



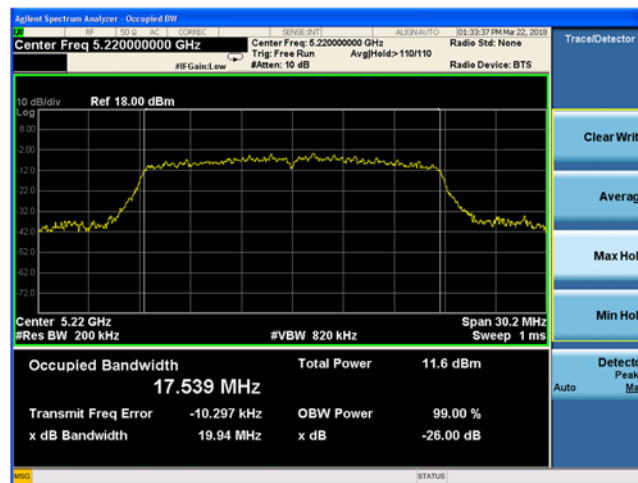
Plot 9-12. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11a (Ch. 165)

9.2.5.2 Main Antenna 802.11n 26-dB Emission Bandwidth

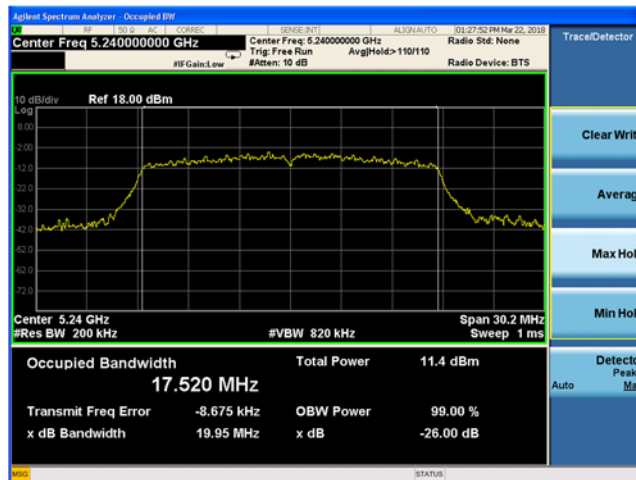
Main antenna 802.11n 26-dB Emission Bandwidth				
Band	Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)	99% Occupied BW (MHz)
UNII-1	36	5180	20.21	17.54
	44	5220	19.94	17.54
	48	5240	19.95	17.52
UNII-2A	52	5260	19.89	17.53
	60	5300	19.93	17.52
	64	5320	19.93	17.51
UNII-2C	100	5500	19.89	17.54
	116	5580	19.94	17.52
	140	5700	19.95	17.52
UNII-3	149	5745	20.05	17.56
	157	5785	19.97	17.56
	165	5825	20.02	17.52



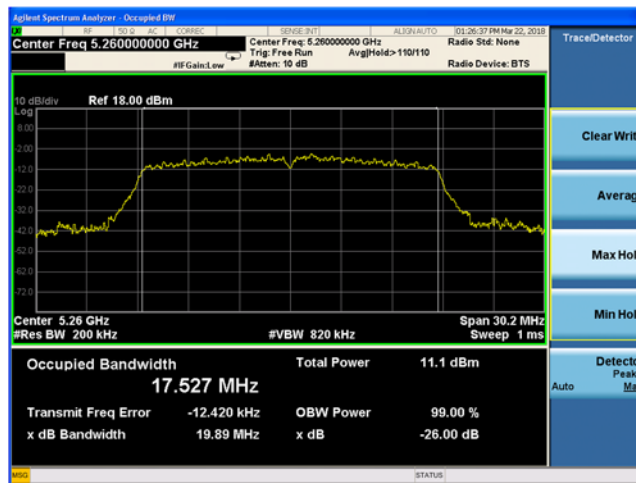
Plot 9-13. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 36)



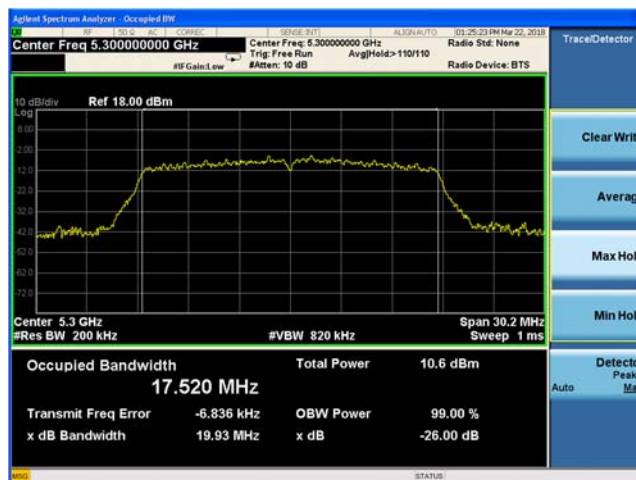
Plot 9-14. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 44)



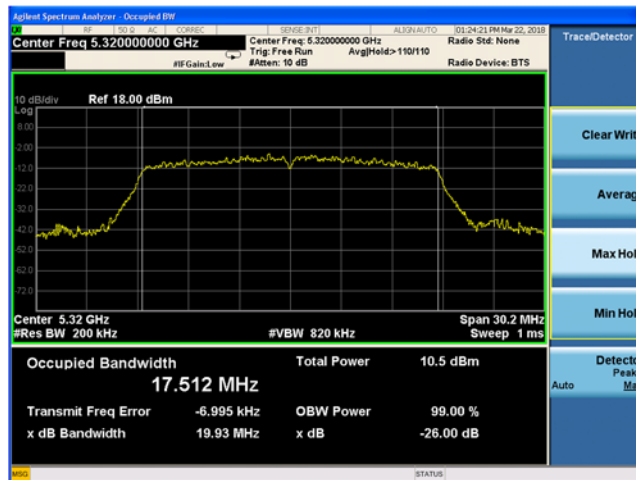
Plot 9-15. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 48)



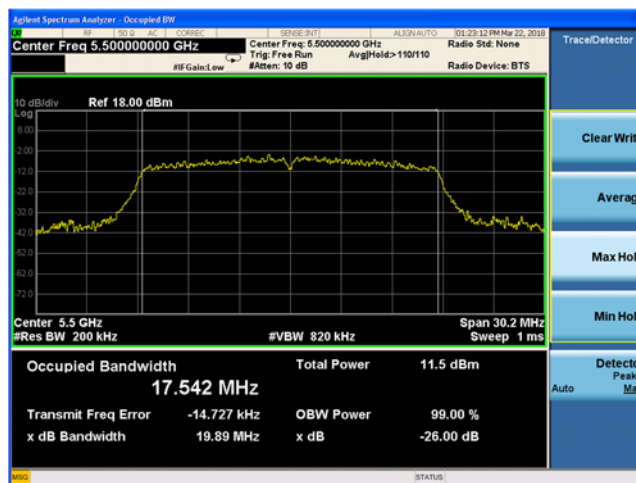
Plot 9-16. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 52)



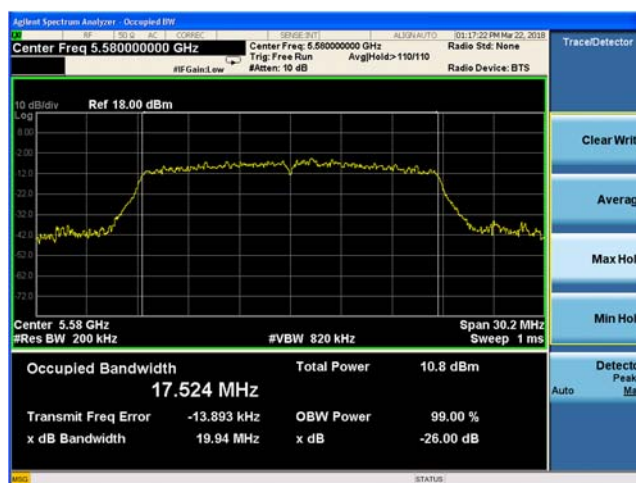
Plot 9-17. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 60)



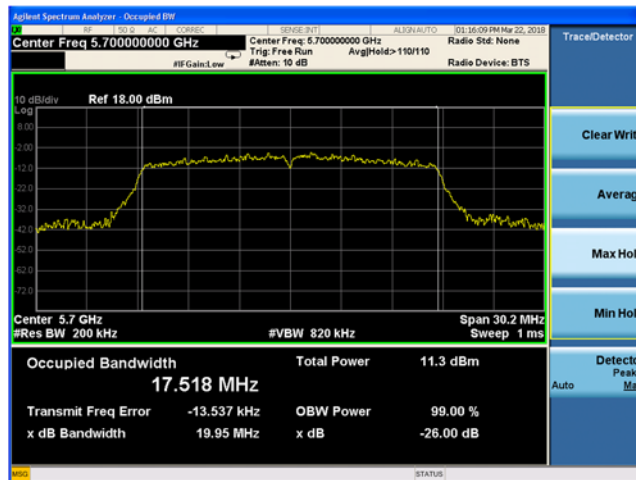
Plot 9-18. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 64)



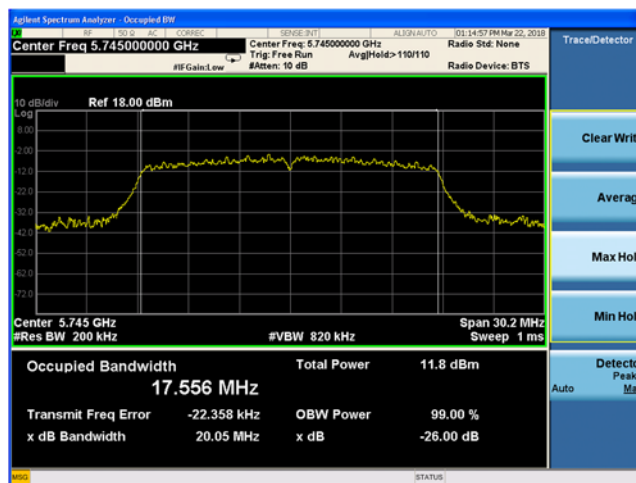
Plot 9-19. 26-dB Emission Bandwidth Chain and 99%, Main Antenna 802.11n (Ch. 100)



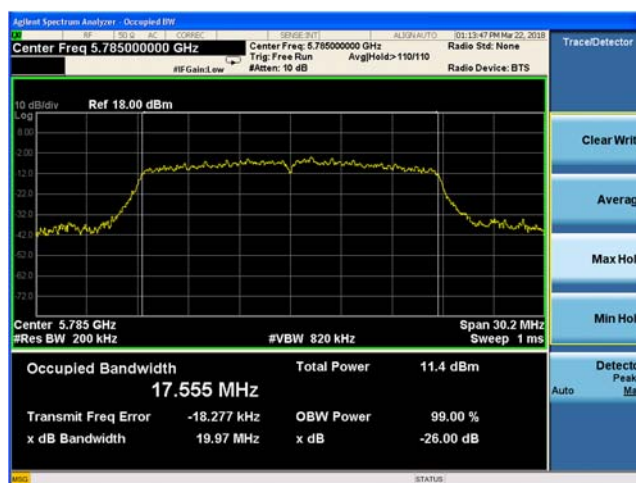
Plot 9-20. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 116)



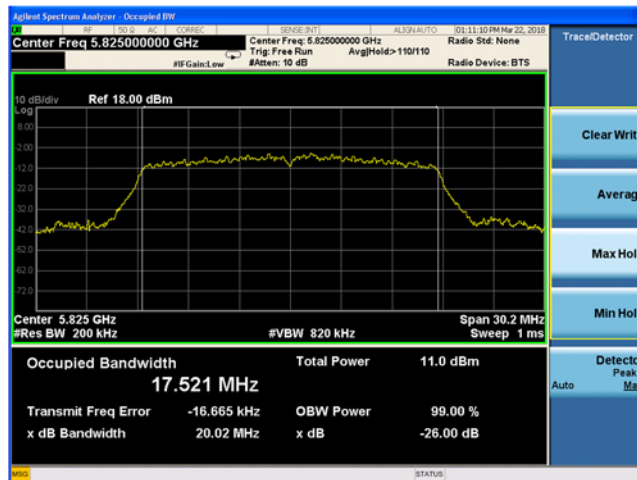
Plot 9-21. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 140)



Plot 9-22. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 149)



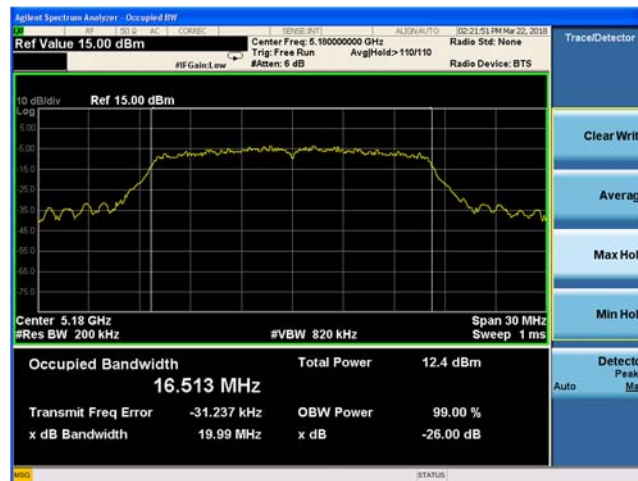
Plot 9-23. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 157)



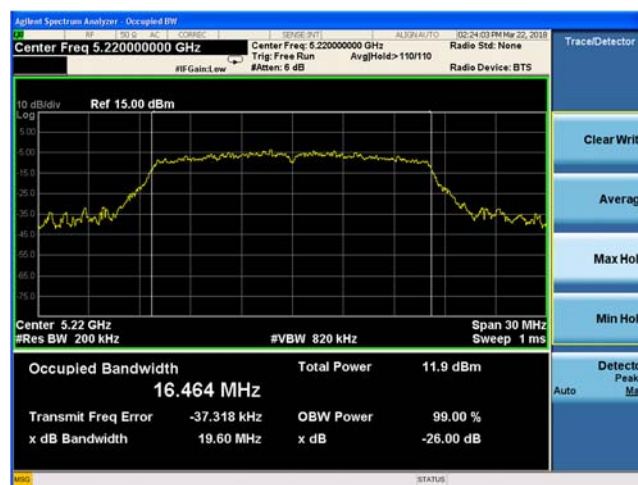
Plot 9-24. 26-dB Emission Bandwidth and 99% OBW, Main Antenna 802.11n (Ch. 165)

9.2.5.3 Diversity Antenna 802.11a HT20 26-dB Emission Bandwidth

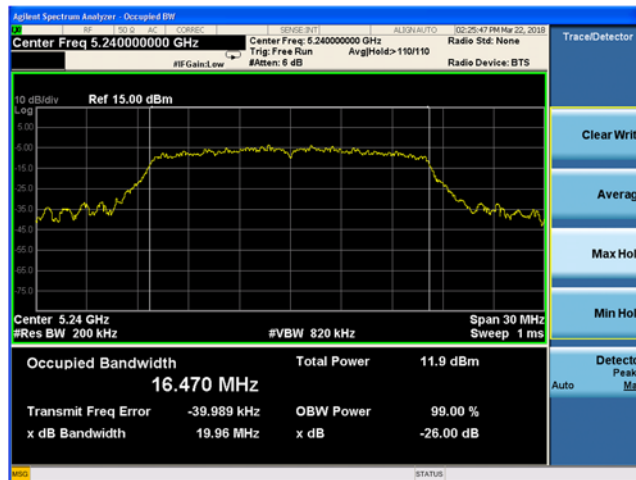
Diversity Antenna 802.11n HT20 26-dB Emission Bandwidth				
Band	Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)	99% Occupied BW (MHz)
UNII-1	36	5180	19.99	16.51
	44	5220	19.60	16.46
	48	5240	19.96	16.47
UNII-2A	52	5260	19.48	16.45
	60	5300	19.58	16.46
	64	5320	19.53	16.47
UNII-2C	100	5500	19.52	16.47
	116	5580	19.65	16.48
	140	5700	19.51	16.46
UNII-3	149	5745	19.54	16.50
	157	5785	19.48	16.49
	165	5825	19.58	16.47



Plot 9-25. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11a HT20 (Ch. 36)



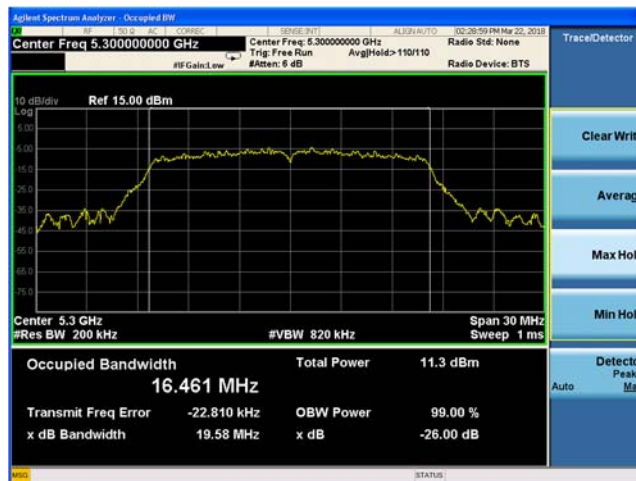
Plot 9-26. 26-dB Emission Bandwidth and 99% OBW, Diversity Antenna 802.11n HT20 (Ch. 44)



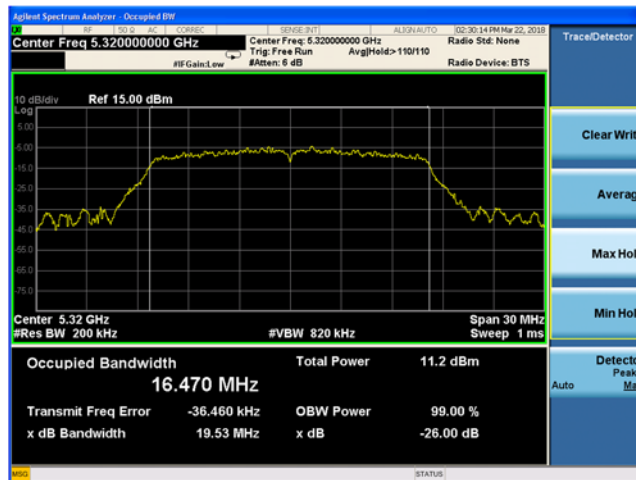
Plot 9-27. 26-dB Emission Bandwidth and 99% OBW, Diversity Antenna 802.11n HT20 (Ch. 48)



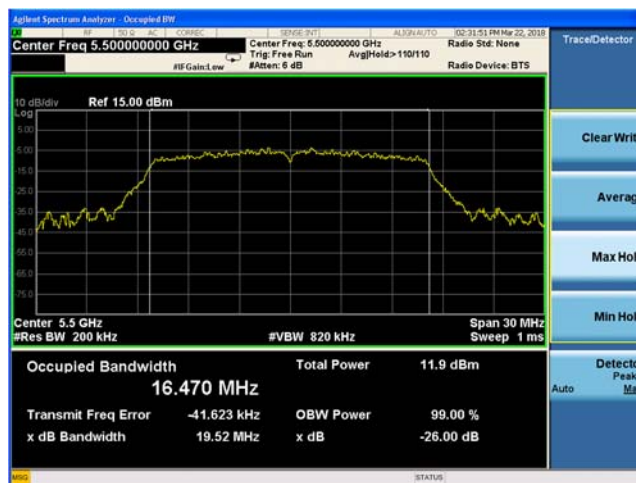
Plot 9-28. 26-dB Emission Bandwidth and 99% OBW, Diversity Antenna 802.11n HT20 (Ch. 52)



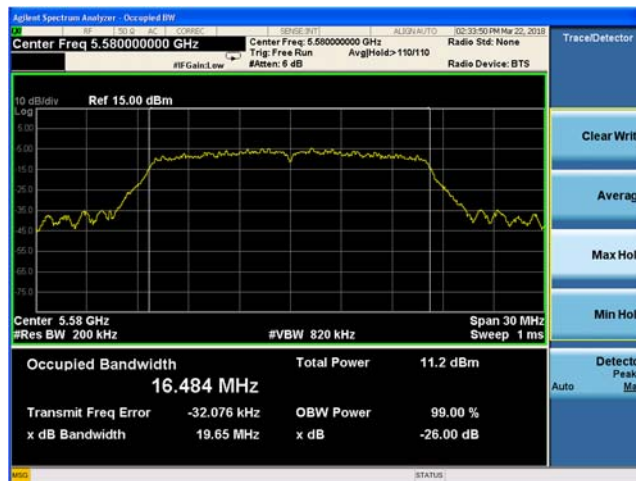
Plot 9-29. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 60)



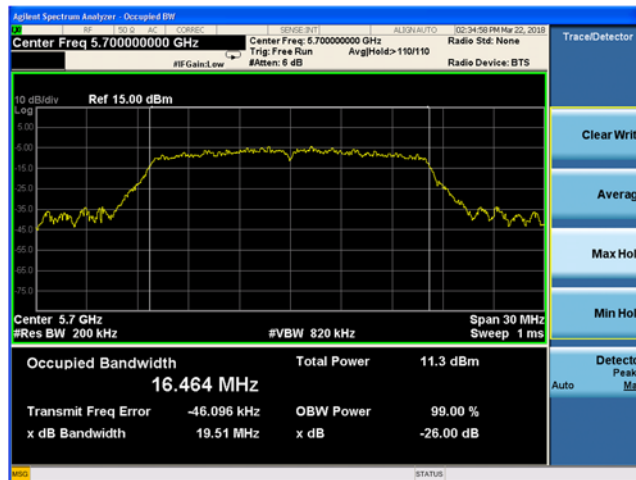
Plot 9-30. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 64)



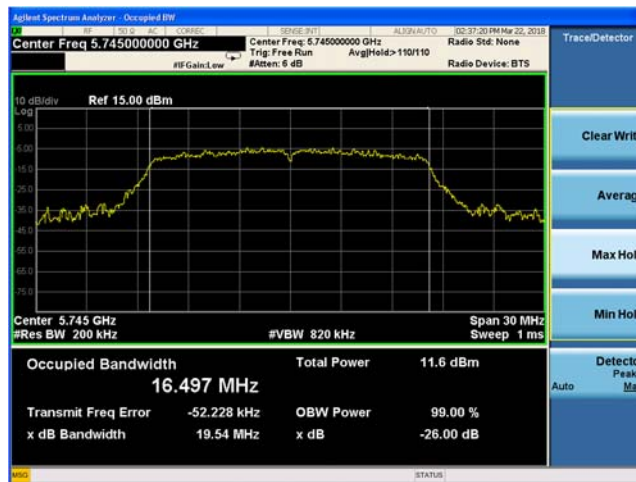
Plot 9-31. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11 HT20 (Ch. 100)



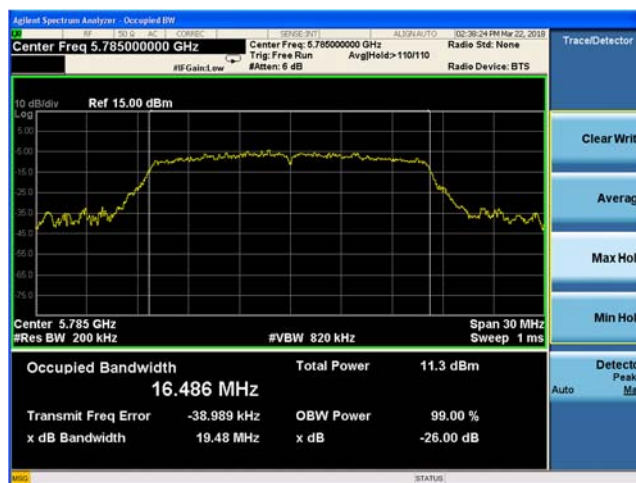
Plot 9-32. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch.116)



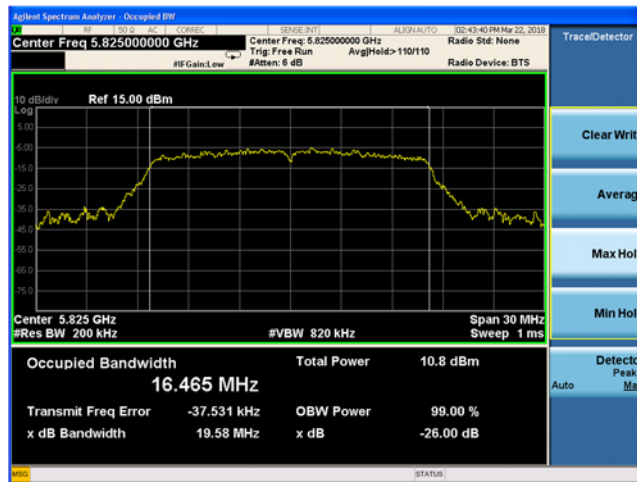
Plot 9-33. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch.140)



Plot 9-34. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch.149)



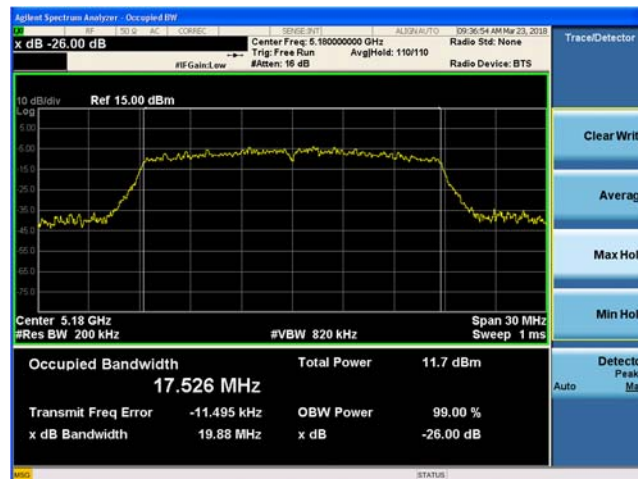
Plot 9-35. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch.157)



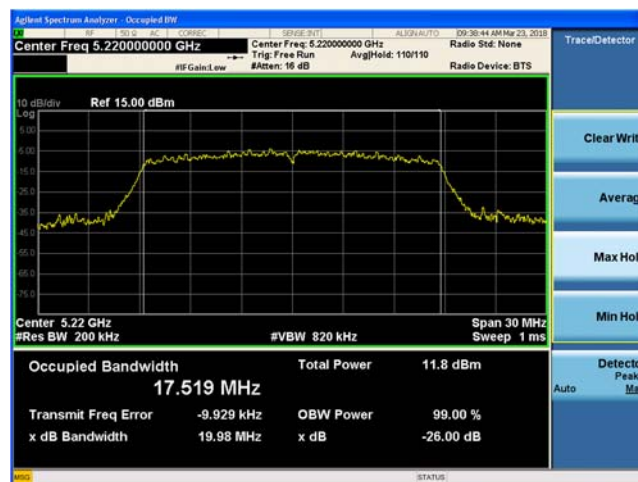
Plot 9-36. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch.165)

9.2.5.4 Diversity Antenna 802.11n HT20 26-dB Emission Bandwidth

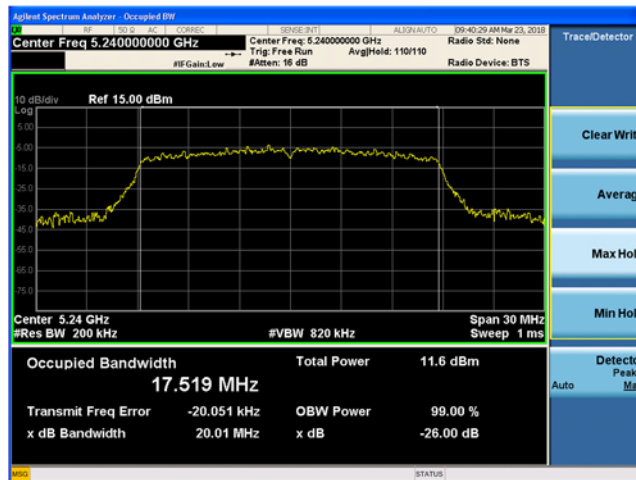
Chain B 802.11n HT20 26-dB Emission Bandwidth				
Band	Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)	99% Occupied BW (MHz)
UNII-1	36	5180	19.88	17.53
	44	5220	19.98	17.52
	48	5240	20.01	17.52
UNII-2A	52	5260	19.90	17.53
	60	5300	19.99	17.53
	64	5320	19.92	17.51
UNII-2C	100	5500	19.92	17.52
	116	5580	19.93	17.51
	140	5700	19.99	17.52
UNII-3	149	5745	19.94	17.54
	157	5785	20.12	17.54
	165	5825	19.99	17.52



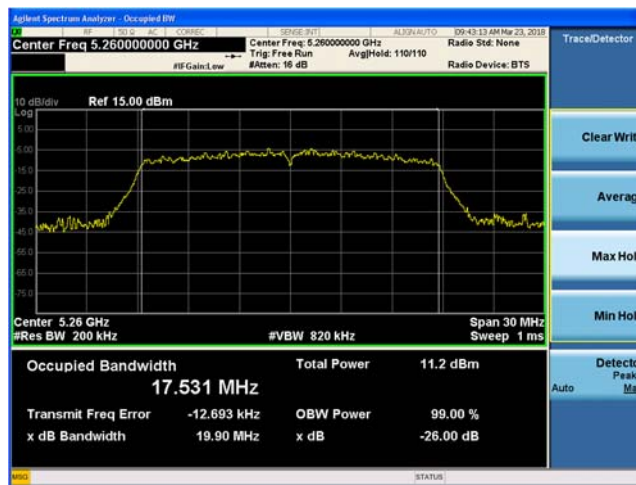
Plot 9-37. 26-dB Emission Bandwidth and 99%OBW, Diversity antenna 802.11n HT20 (Ch.36)



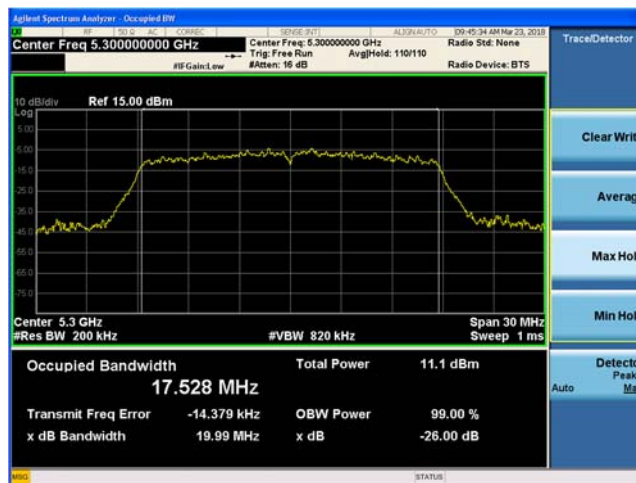
Plot 9-38. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 44)



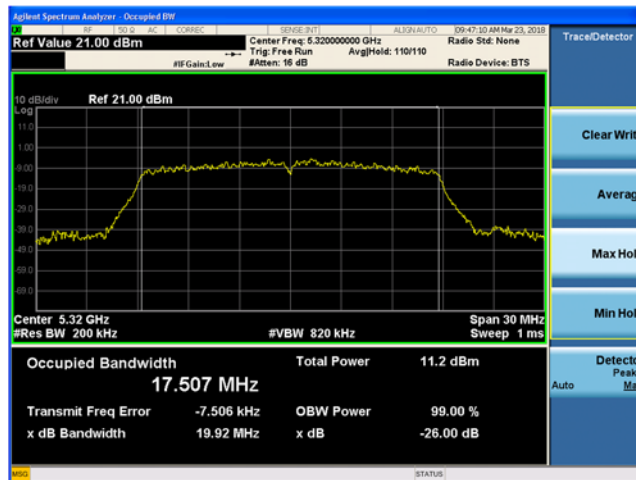
Plot 9-39. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 48)



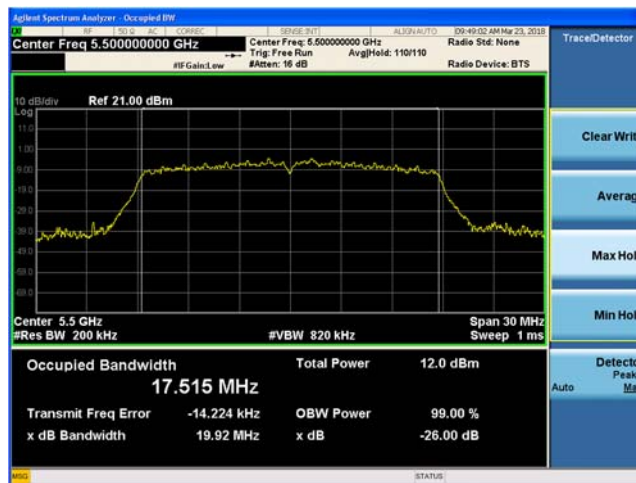
Plot 9-40. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 52)



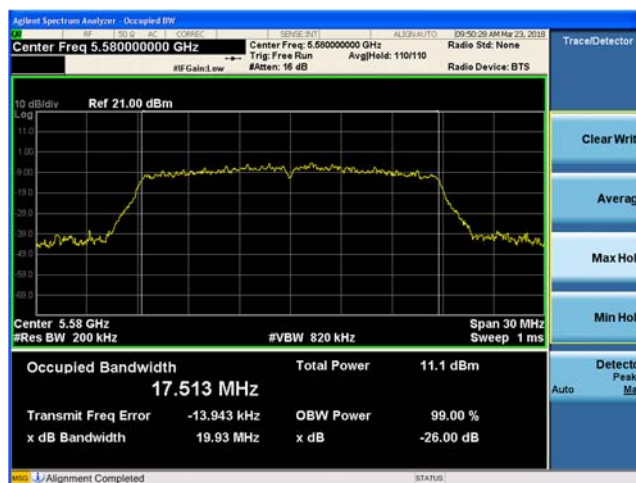
Plot 9-41. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 60)



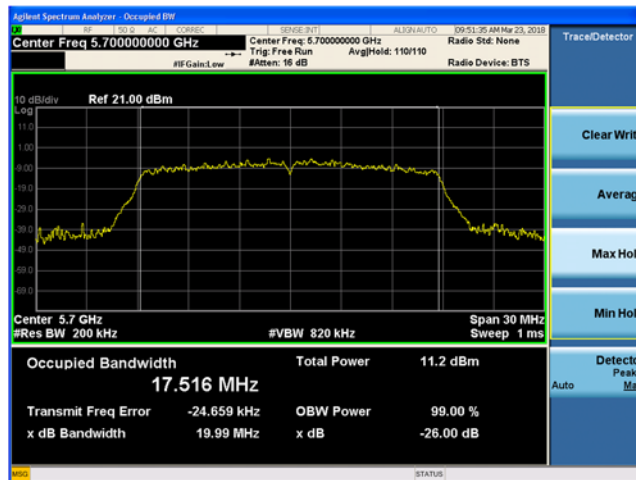
Plot 9-42. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 64)



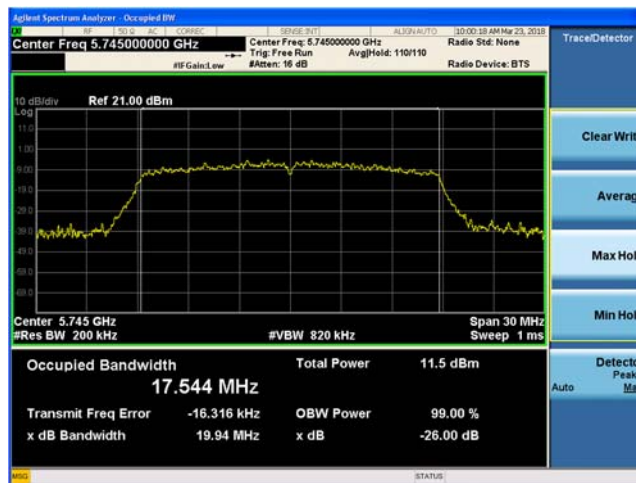
Plot 9-43. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 100)



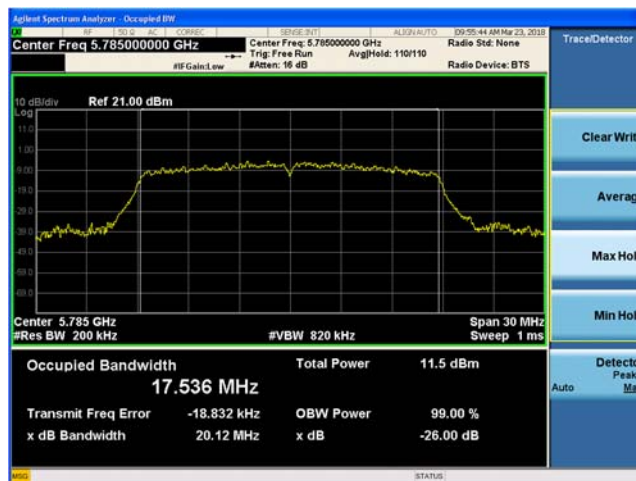
Plot 9-44. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 116)



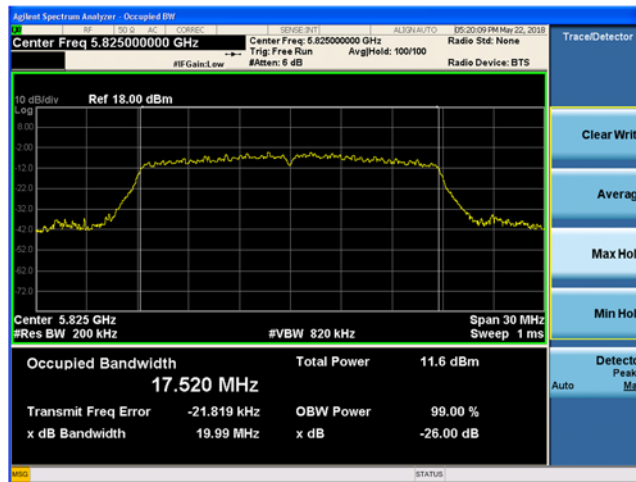
Plot 9-45. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 140)



Plot 9-46. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 149)



Plot 9-47. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 157)



Plot 9-48. 26-dB Emission Bandwidth and 99% OBW, Diversity antenna 802.11n HT20 (Ch. 165)

9.3 6-dB Bandwidth

9.3.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (e)
ISED RSS-247 [6.2.4]

9.3.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r03 and ANSI C63.10:2013.

Spectrum Analyzer settings:

RBW = 100 kHz

VBW \geq 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 6-dB bandwidth.

9.3.3 Limits:

The 6-dB Bandwidth shall be \geq 500 kHz.

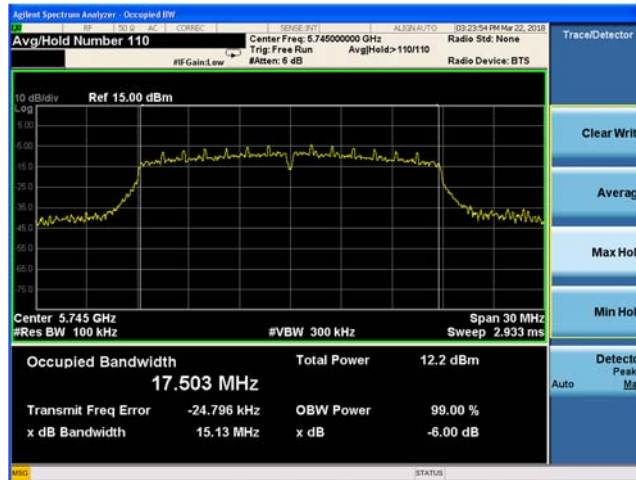
9.3.4 Test Results:

Pass

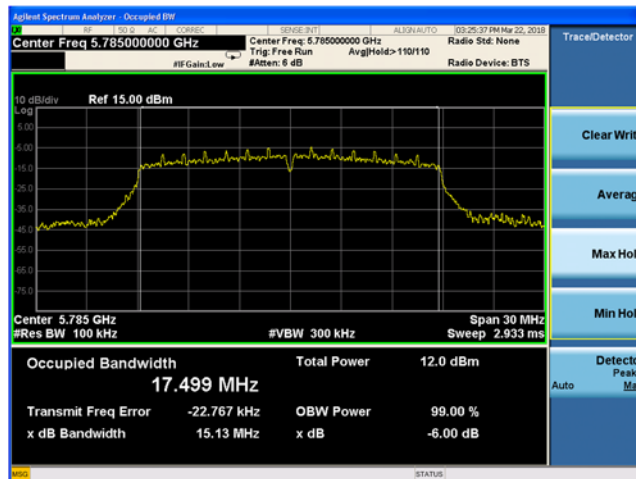
9.3.5 Test Data:

9.3.5.1 Main Antenna 802.11a 6-dB Bandwidth

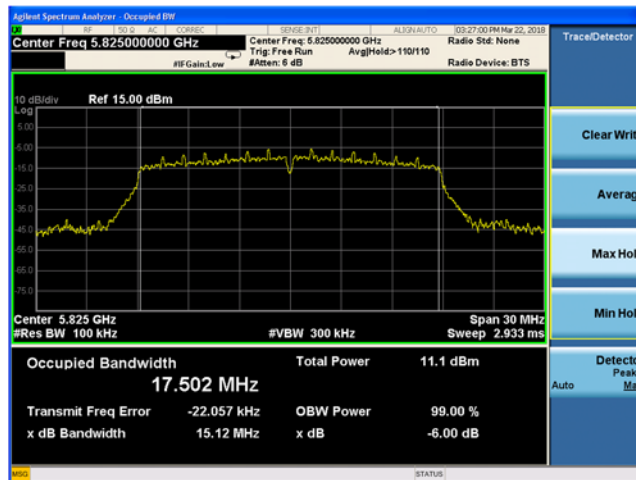
Main Antenna 802.11a 6-dB Bandwidth		
Channel No.	Frequency (MHz)	6-dB Bandwidth (MHz)
149	5745	15.13
157	5785	15.13
165	5825	15.12



Plot 9-49. 6-dB Bandwidth, Main antenna 802.11a (Ch. 149)



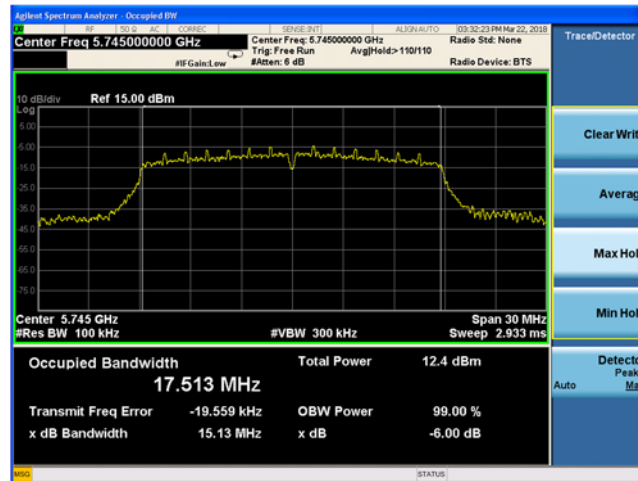
Plot 9-50. 6-dB Bandwidth, Main antenna 802.11a (Ch. 157)



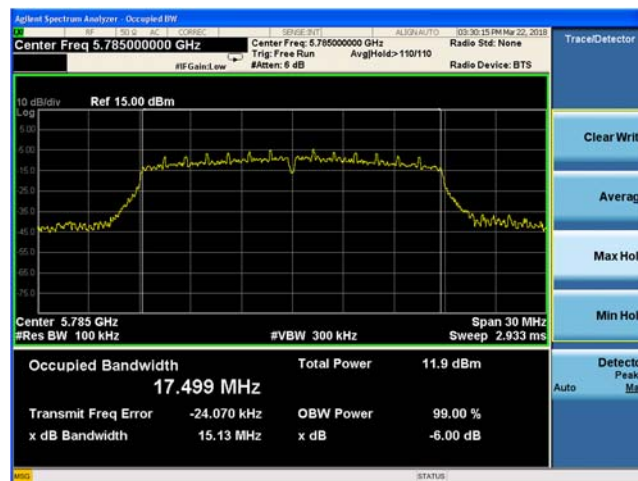
Plot 9-51. 6-dB Bandwidth, Main antenna 802.11a (Ch. 165)

9.3.5.2 Main Antenna 802.11n 6-dB Bandwidth

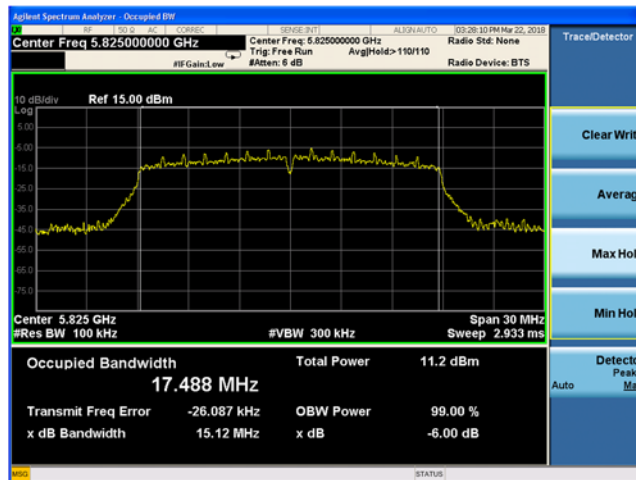
Main Antenna 802.11a 6-dB Bandwidth		
Channel No.	Frequency (MHz)	6-dB Bandwidth (MHz)
149	5745	15.13
157	5785	15.13
165	5825	15.12



Plot 9-52. 6-dB Bandwidth, Main antenna 802.11n (Ch. 149)



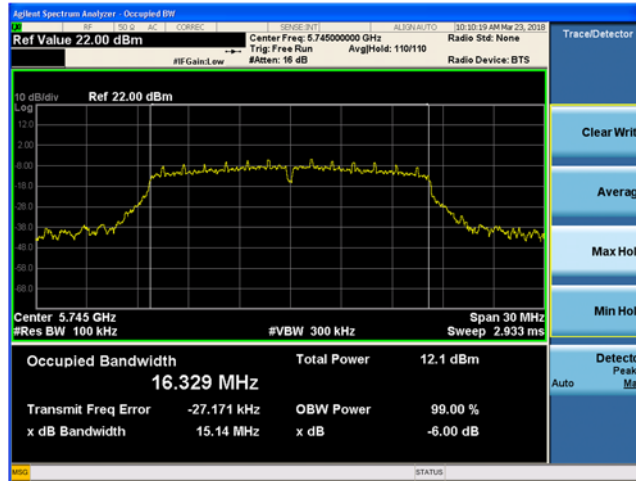
Plot 9-53. 6-dB Bandwidth, Main antenna 802.11n (Ch. 157)



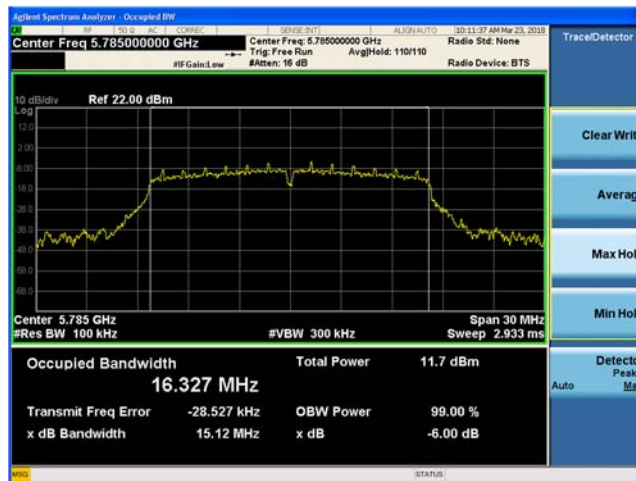
Plot 9-54. 6-dB Bandwidth, Main antenna 802.11n (Ch. 165)

9.3.5.3 Diversity Antenna 802.11a HT20 6-dB Bandwidth

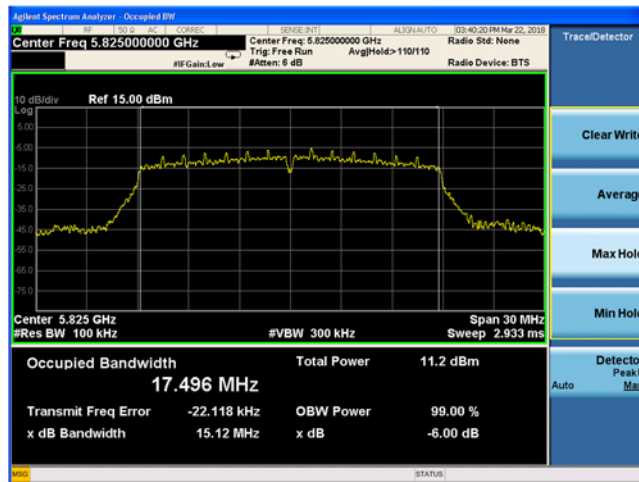
Chain A 802.11n HT20 6-dB Bandwidth		
Channel No.	Frequency (MHz)	6-dB Bandwidth (MHz)
149	5745	15.14
157	5785	15.12
165	5825	15.12



Plot 9-55. 6-dB Bandwidth, Diversity antenna 802.11a HT20 (Ch. 149)



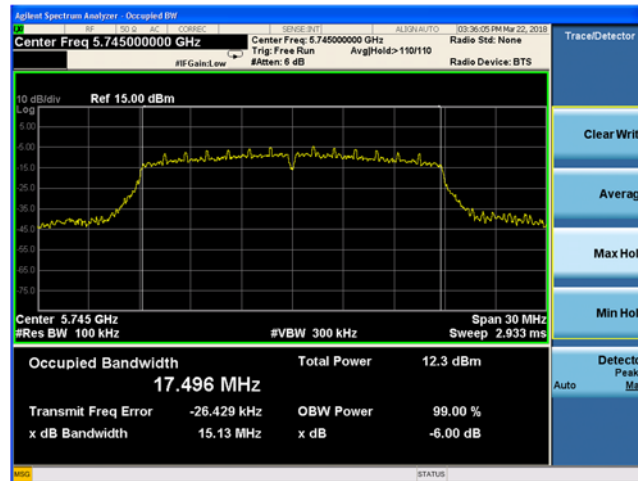
Plot 9-56. 6-dB Bandwidth, Diversity antenna 802.11a HT20 (Ch. 157)



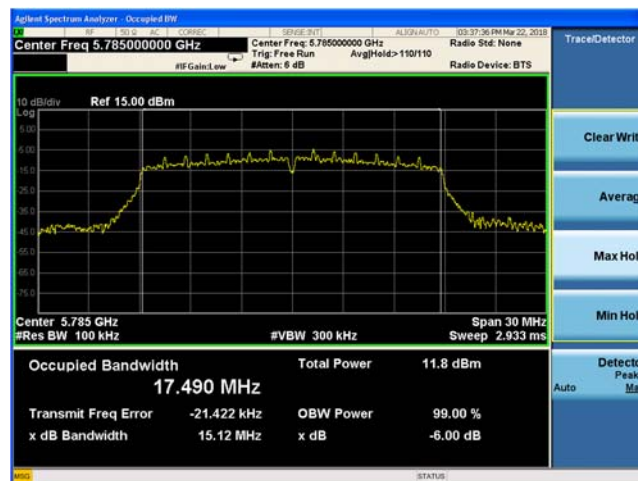
Plot 9-57. 6-dB Bandwidth, Diversity antenna 802.11a HT20 (Ch. 165)

9.3.5.4 Diversity Antenna 802.11n HT20 6-dB Bandwidth

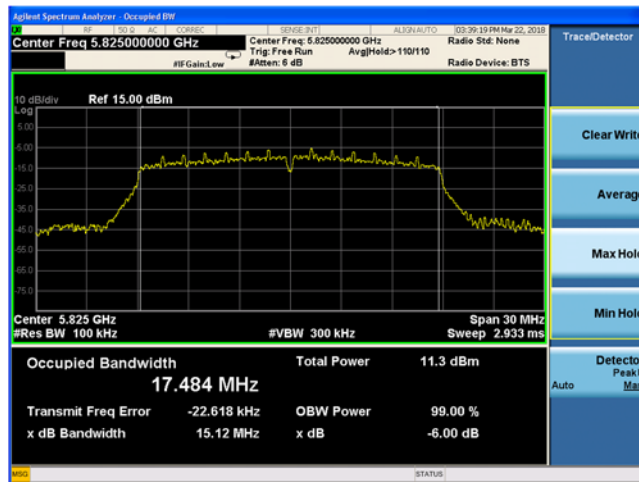
Chain B 802.11n HT20 6-dB Bandwidth		
Channel No.	Frequency (MHz)	6-dB Bandwidth (MHz)
149	5745	15.13
157	5785	15.12
165	5825	15.12



Plot 9-58. 6-dB Bandwidth, Diversity Antenna 802.11n HT20 (Ch. 157)



Plot 9-59. 6-dB Bandwidth, Diversity Antenna 802.11n HT20 (Ch. 157)



Plot 9-60. 6-dB Bandwidth, Diversity Antenna 802.11n HT20 (Ch. 165)

9.4 Maximum Conducted Output Power

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)
ISED RSS-247 [6.2]

9.4.2 Test Method:

Measurements were performed according to the procedures defined in KDBs 789033- General UNII Test Procedures New Rules v01r03, 662911 D01 Multiple Transmitter Output v02r01, and ANSI C63.10 2013.

Spectrum Analyzer settings:

Average Power:

RBW= 1 MHz

VBW= 3 MHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 * \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth.

Use the band power measurement function to integrate the power over the 26-dB Emission Bandwidth or 99% Occupied Bandwidth.

9.4.3 Limits:

15.407: The maximum conducted output power shall not exceed the limits given the following table for antennas that do not exceed a directional gain > 6dBi:

Band of Operation (MHz)	15.407 Limit
5150 – 5250	24 dBm
5250 – 5350	24dBm or 11 dBm + 10 log (B) ⁽¹⁾
5470 – 5725	24dBm or 11 dBm + 10 log (B) ⁽¹⁾
5725 – 5825	30 dBm

Note(1): B is the 26-dB Emission bandwidth of signal in MHz.

RSS-247: The maximum conducted output power and/or EIRP shall not exceed the limits given the following table:

Band of Operation (MHz)	RSS-247 Conducted Output Power Limit	RSS-247 E.I.R.P Limit
5150 – 5250	--	23 dBm or 10 + 10 log (B) ⁽¹⁾
5250 – 5350	24 dBm or 11 + 10 log (B) ⁽¹⁾	30 dBm or 17 + 10 log (B) ⁽¹⁾
5470 – 5725	24 dBm or 11 + 10 log (B) ⁽¹⁾	30 dBm or 17 + 10 log (B) ⁽¹⁾
5725 – 5825	30 dBm	--

Note(1): B is the 99% Occupied Bandwidth of the signal in MHz.

9.4.4 Test Results:

Pass. See Section 9.5.5 for test data.

9.5 Power Spectral Density

9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)
ISED RSS-247 [6.2]

9.5.2 Test Method:

Measurements were performed according to the procedures defined in KDBs 789033- General UNII Test Procedures New Rules v01r03, 662911 D01 Multiple Transmitter Output v02r01, and ANSI C63.10 2013.

Spectrum Analyzer settings for devices operating in the bands 5.15 – 5.25 GHz, 5.25 – 5.35GHz, and 5.47 – 5.725GHz:

RBW= 1 MHz

VBW= 3 MHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 * \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth. Use the peak marker function to identify the Maximum Power Spectral Density

Spectrum Analyzer settings for devices operating in the bands 5.725 – 5.85 GHz:

RBW= 100 kHz

VBW= 300 kHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 * \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth. Use the peak marker function to identify the Maximum Power Spectral Density

Offset is added if measurements are performed using a reduced resolution bandwidth 100 kHz, add $10 * \log(500\text{KHz} / \text{RBW USED})$ to the measured result.

9.5.3 Limits:

15.407: The Maximum Power Spectral Density shall not exceed the limits given the following table for antennas that do not exceed a directional gain > 6dBi:

Band of Operation (MHz)	15.407 Limits
5150 – 5250	11dBm/MHz
5250 – 5350	11dBm/MHz
5470 – 5725	11dBm/MHz
5725 – 5825	30dBm/500kHz

Band of Operation (MHz)	RSS-247 Limits
5150 – 5250	10dBm/MHz e.i.r.p.
5250 – 5350	11dBm/MHz*
5470 – 5725	11dBm/MHz*
5725 – 5825	30dBm/500kHz

For antenna gains >6dBi, the conducted PSD limits are reduced by the amount it exceeds 6dBi.

9.5.4 Test Results:

Pass.

9.5.5 Test Data

9.5.5.1 Main Antenna 802.11a Maximum Conducted Output Power

Main antenna 802.11a Maximum Conducted Output Power								
Chan. No.	Freq. (MHz)	Average Power (dBm)	Duty cycle correction factor (dBm)	Total Power (dBm)	15.407 Limit (dBm)	RSS-247 Limit (dBm)	15.407 Margin (dB)	RSS-247 Margin (dB)
36	5180	7.95	0.21	8.16	23.80	--	-15.64	--
44	5220	7.87	0.21	8.08	23.80	--	-15.72	--
48	5240	7.89	0.21	8.10	23.80	--	-15.70	--
52	5260	7.98	0.21	8.19	23.68	22.96	-15.49	-14.77
60	5300	8.07	0.21	8.28	23.71	22.96	-15.43	-14.68
64	5320	8.04	0.21	8.25	23.71	22.97	-15.46	-14.72
100	5500	7.81	0.21	8.02	23.99	23.17	-15.97	-15.15
116	5580	7.92	0.21	8.13	23.89	23.16	-15.76	-15.03
140	5700	8.17	0.21	8.38	23.99	23.16	-15.61	-14.78
149	5745	7.90	0.21	8.11	30.00	30.00	-21.89	-21.89
157	5785	8.15	0.21	8.36	30.00	30.00	-21.64	-21.64
165	5825	8.01	0.21	8.22	30.00	30.00	-21.78	-21.78

Main antenna 802.11a E.I.R.P						
Channel No.	Frequency (MHz)	Total Power (dBm)	Antenna Gain (dBi)	E.I.R.P (dBm)	RSS-247 E.I.R.P Limit (dBm)	RSS-247 E.I.R.P. Margin (dB)
36	5180	8.16	6.20	14.36	21.96	-7.60
44	5220	8.08	6.20	14.28	21.98	-7.70
48	5240	8.10	6.20	14.30	21.97	-7.67
52	5260	8.19	6.20	14.39	28.96	-14.57
60	5300	8.28	6.20	14.48	28.96	-14.48
64	5320	8.25	6.20	14.45	28.97	-14.52
100	5500	8.02	5.90	13.92	29.17	-15.25
116	5580	8.13	5.90	14.03	29.16	-15.13
140	5700	8.38	5.90	14.28	29.16	-14.88
149	5745	8.11	5.60	13.71	--	--
157	5785	8.36	5.60	13.96	--	--
165	5825	8.22	5.60	13.82	--	--

9.5.5.2 Main Antenna 802.11a Maximum Power Spectral Density

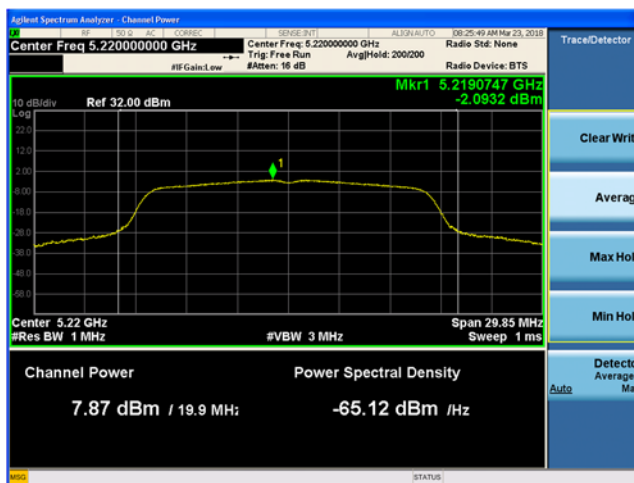
UNII-1 Main antenna 802.11a Maximum Power Spectral Density/MHz										
Chan. No.	Freq. (MHz)	Measured PSD/MHz (dBm)	Duty Cycle corr. factor (dBm)	Total PSD $\frac{dBm}{MHz}$	Total Ant. Gain (dBi)	Total EIRP PSD $\frac{dBm}{MHz}$	15.407 Limit $\frac{dBm}{MHz}$	RSS-247 EIRP PSD Limit $\frac{dBm}{MHz}$	15.407 Margin (dB)	RSS-247 Margin (dB)
36	5180	-2.20	0.21	-1.99	6.20	4.21	10.80	10.00	-12.79	-5.79
44	5220	-2.09	0.21	-1.88	6.20	4.32	10.80	10.00	-12.68	-5.68
48	5240	-2.21	0.21	-2.00	6.20	4.20	10.80	10.00	-12.80	-5.80

UNII-2A and UNII-2C main antenna 802.11a Maximum Power Spectral Density/MHz								
Channel No.	Frequency (MHz)	Measured PSD/MHz (dBm)	Duty cycle correction factor (dBm)	Total PSD $\frac{dBm}{MHz}$	15.407 Limit $\frac{dBm}{MHz}$	RSS-247 Limit $\frac{dBm}{MHz}$	15.407 Margin (dB)	RSS-247 Margin (dB)
52	5260	-2.04	0.21	-1.83	10.80	11.00	-12.63	-12.83
60	5300	-2.03	0.21	-1.82	10.80	11.00	-12.62	-12.82
64	5320	-2.12	0.21	-1.91	10.80	11.00	-12.71	-12.91
100	5500	-2.24	0.21	-2.03	11.00	11.00	-13.03	-13.03
116	5580	-2.17	0.21	-1.96	11.00	11.00	-12.96	-12.96
140	5700	-2.00	0.21	-1.79	11.00	11.00	-12.79	-12.79

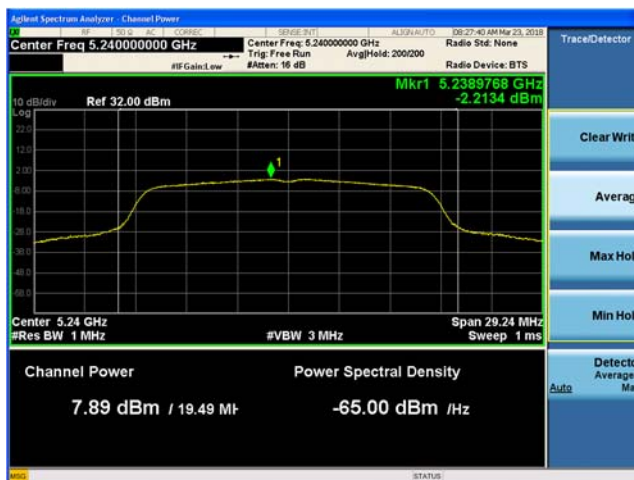
UNII-3 main antenna 802.11a Maximum Power Spectral Density/500kHz								
Chan. No.	Freq. (MHz)	Measured PSD/500kHz (dBm)	Duty cycle correction factor (dBm)	Total PSD $\frac{dBm}{500 kHz}$	15.407 Limit $\frac{dBm}{500 kHz}$	RSS-247 Limit $\frac{dBm}{500 kHz}$	15.407 Margin (dB)	RSS-247 Margin (dB)
149	5745	-4.32	0.21	-4.11	30.00	30.00	-34.11	-34.11
157	5785	-3.73	0.21	-3.52	30.00	30.00	-33.52	-33.52
165	5825	-4.17	0.21	-3.96	30.00	30.00	-34.11	-34.11



Plot 9-61. Maximum Conducted Output Power and PSD, Main antenna 802.11a (Ch. 36)



Plot 9-62. Maximum Conducted Output Power and PSD, Main antenna 802.11a (Ch. 44)



Plot 9-63. Maximum Conducted Output Power and PSD, Main antenna 802.11a (Ch. 48)