MEASUREMENT REPORT

FCC PART 15.407/ WLAN 802.11a/n/ac

FCC ID:	HD5-CT40PL0N
APPLICANT:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Application Type:	Certification
Product:	Mobile Computer
Model No.:	CT40P-L0N
Brand Name:	Honeywell
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part15 Subpart E (Section 15.407)
Test Procedure(s):	ANSI C63.10-2013, KDB 789033 D02v02r01 KDB 662911 D01v02r01
Test Date:	July 06 ~ 17, 2020

Reviewed By: (Jame Yuan)

Approved By: (Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D02v02r01. Test results reported here in relate only to the item(s) tested.
The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2006RSU069-U4	Rev. 01	Initial Report	07-27-2020	Valid

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General Information

Applicant:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Applicant Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States
Manufacturer:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Manufacturer Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edangRd.,Suzhou, China.

- **MRT facility is an FCC registered (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.**
- **MRT facility is an IC registered (MRT Reg. No.11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LACert. No.3628.01) in EMC, Telecommunications, Radio and SAR testing.**

Accredited Laboratory

A2LA has accredited

MRT TECHNOLOGY (SUZHOU) CO., LTD.

Suzhou, Jiangsu, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Presented this 24th day of July 2018.

President and CEO
For the Accreditation Council
Certificate Number 3628.01
Valid to August 31, 2020

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

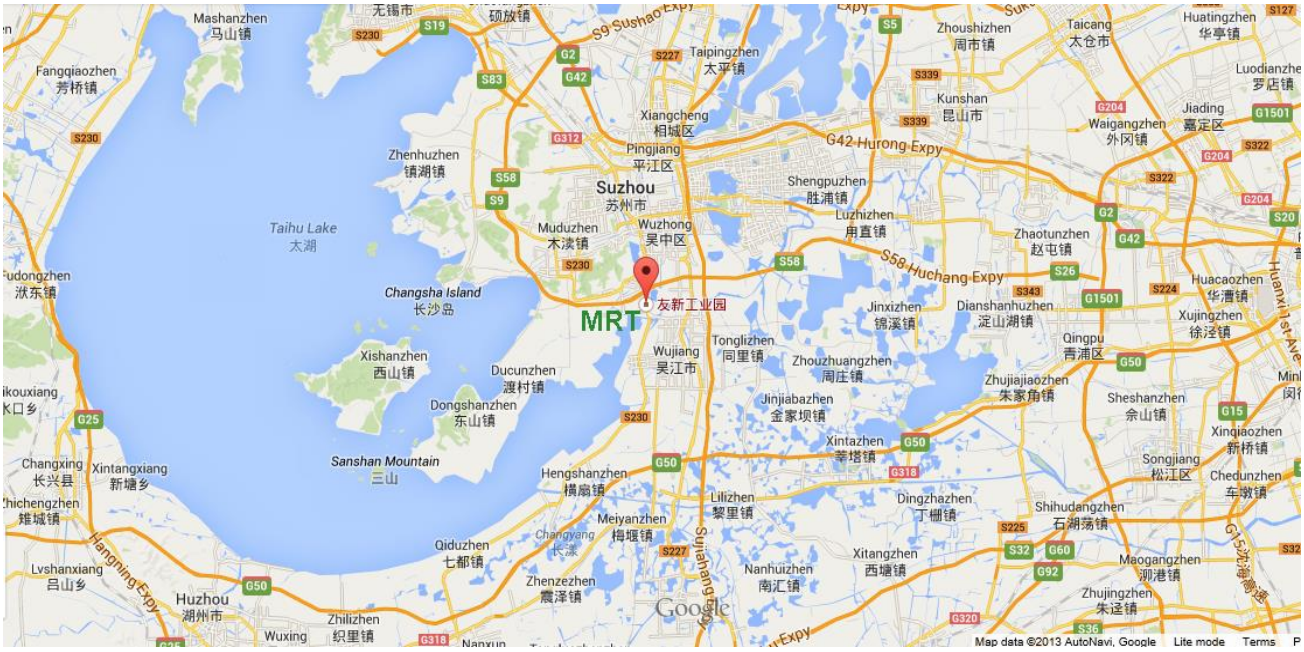
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	Mobile Computer
Model No.	CT40P-L0N
Serial No.	19252B5D57 (Conducted Sample) 20010B217B (Radiated Sample)
Hardware Version	V2.0
Software Version	OS.03.001
Qualcomm Chipset	
Wi-Fi Specification	802.11a/b/g/n/ac
Bluetooth Version	v5.0 dual mode
Antenna Delivery	$2*T_X + 2*R_X$
Nordic Chipset	
Bluetooth Version	v5.1 single mode, LE only
NXP Chipset	
NFC Working Frequency	13.56MHz
Accessories	
USB Adapter	Model No.: ADS-12B-06 05010E Input Power: 100 - 240V ~ 50/60Hz, Max. 0.3A Output Power: 5Vdc 2.0A
Rechargeable Li-ion Battery	Model No.: CT50-BTSC Capacitance: 4020mAh/15.5Wh Rated Voltage: 3.85V

2.2. Product Specification Subjective to this Report

Frequency Range:	For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5260~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz,5270~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz
Type of Modulation:	802.11a/n/ac: OFDM
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps
Maximum Average Output Power:	802.11a: 15.38dBm 802.11ac-VHT20: 15.38dBm 802.11ac-VHT40: 13.46dBm 802.11ac-VHT80:10.09dBm

Note: For other features of this EUT, test report will be issued separately.

2.3. Description of Available Antennas

Antenna Type	Frequency Band(GHz)	Antenna Gain (dBi)		Directional Gain (dBi)	
		Ant 0	Ant 1	For Power	For PSD
FPC Antenna	2.4~2.5	0.60	2.20	2.20	5.21
	5.1~5.725	1.30	1.80	1.80	4.81
	5.725~5.85	3.35	2.48	3.35	6.36

Note 1: SISO mode is only for Ant 0 port.

Note 2: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

2.4. Working Frequencies for this Report

802.11a/n-HT20/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	52	5260 MHz	56	5280 MHz
60	5300 MHz	64	5320 MHz	100	5500 MHz
104	5520 MHz	108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz
128	5640 MHz	132	5660 MHz	136	5680 MHz
140	5700 MHz	144	5720 MHz	149	5745 MHz
153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	--	--	--	--

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz
62	5310 MHz	102	5510 MHz	110	5550 MHz
118	5590 MHz	126	5630 MHz	134	5670 MHz
142	5710 MHz	151	5755 MHz	159	5795 MHz

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530 MHz
122	5610 MHz	138	5690 MHz	155	5775 MHz

2.5. Test Mode

Test Mode	Mode 1: Transmit by 802.11a (6Mbps)
	Mode 2: Transmit by 802.11ac-VHT20 (MCS0)
	Mode 3: Transmit by 802.11ac-VHT40 (MCS0)
	Mode 4: Transmit by 802.11ac-VHT80 (MCS0)

Note: 802.11n and 802.11ac have same modulation type and same power parameter, so we only show 802.11ac test data in report.

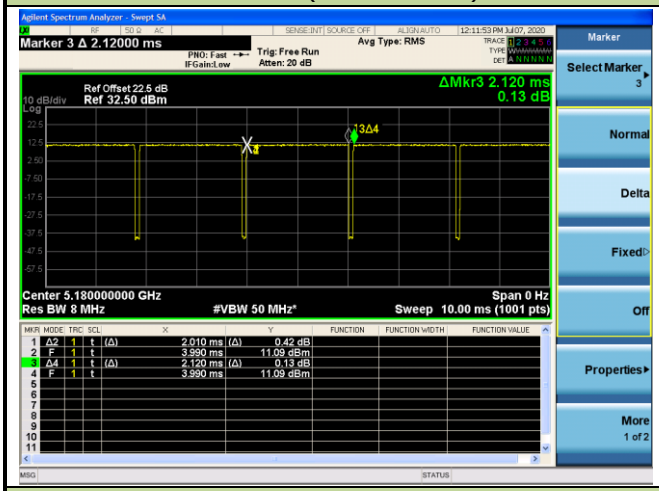
2.6. Duty Cycle

5GHz (NII) operation is possible in 20MHz, 40MHzand 80MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

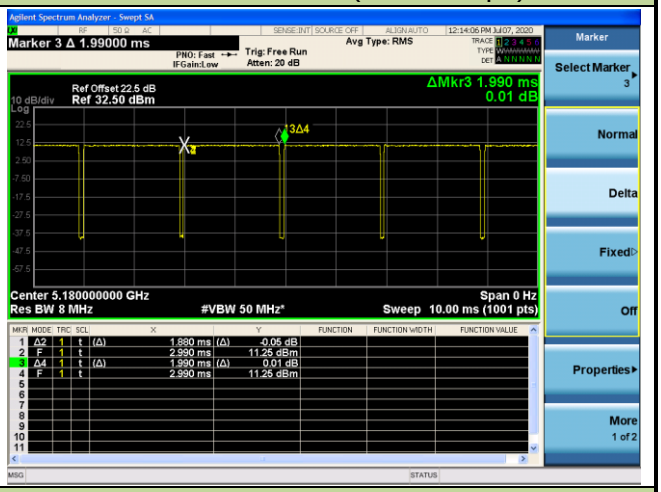
Test Mode	Duty Cycle
802.11a	94.81%
802.11ac-VHT20	94.47%
802.11ac-VHT40	90.24%
802.11ac-VHT80	84.75%

Duty Cycle (T = Transmission Duration)

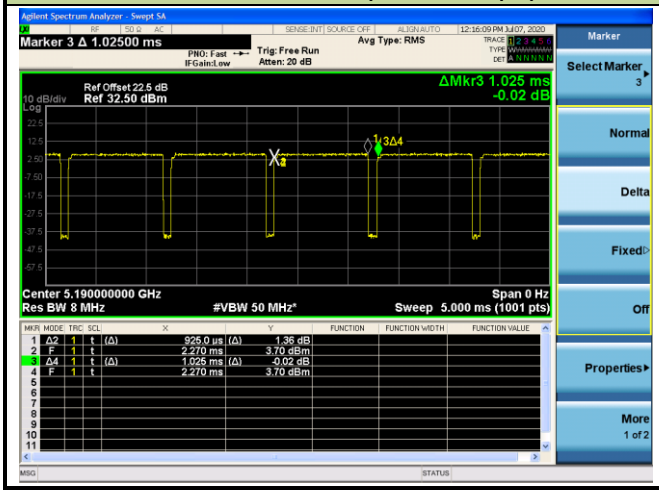
802.11a (T =2.010ms)



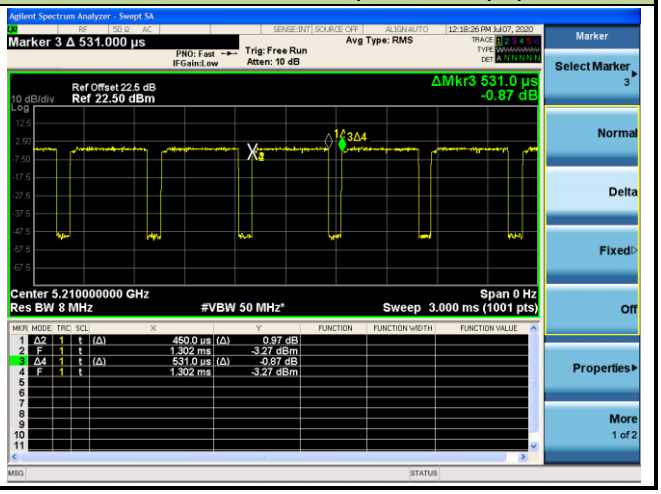
802.11ac-VHT20 (T = 1.880μs)



802.11ac-VHT40 (T = 925.0μs)



802.11ac-VHT80 (T = 450.0μs)



2.7. Description of Test Software

The test utility software used during testing was “QRCT”, and the version was 3.0.268.0.
Power parameter value refers to operation description.

2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

2.10. Test Environment Condition

Ambient Temperature	15°C~35°C
Relative Humidity	20%RH ~75%RH

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 789033 D02v02r01 were used in the measurement.

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"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 antenna of the device is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2021/01/18
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2021/06/11
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2021/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2020/08/08
Shielding Room	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2021/04/03
BroadBand Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/29
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2021/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/29
Broadband CoaxialPreamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2021/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2021/04/14
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2021/07/02
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2021/04/14
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/17
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2021/06/11
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2021/06/11
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2021/06/11
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2021/06/11
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Attenuator	MVE	6dB	MRTSUE06534	1 year	2020/12/12
Attenuator	MVE	10dB	MRTSUE06543	1 year	2020/12/12
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

Software	**Version**	**Function**
EMI Software	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.15dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

7. TEST RESULT

7.1. Summary

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	26dB Bandwidth	N/A	Conducted	Pass	Section7.2
15.407(e)	6dB Bandwidth	≥ 500kHz		Pass	Section 7.3
15.407(a)(1)(iv), (2),(3)	Maximum Conducted Output Power	U-NII-1: ≤250mW U-NII-2: ≤250mWor 11 +10log$_{10}$B U-NII-3: ≤1W		Pass	Section 7.4
15.407(h)(1)	Transmit Power Control	≤24dBm		N/A	Section 7.5
15.407(a)(1)(iv), (2), (3), (5)	Power Spectral Density	U-NII-1&U-NII-2: ≤11dBm/MHz U-NII-3: ≤30dBm/500kHz		Pass	Section 7.6
15.407(g)	Frequency Stability	N/A		Pass	Section 7.7
15.407(b)(1), (2), (3), (4)(i)	Undesirable Emissions	≤ -27dBm/MHz EIRP Detail see section 7.9	Radiated	Pass	Section 7.8 Section7.9
15.205, 15.209 15.407(b)(5), (6), (7)	General Field Strength Limits(Restricted Bands andRadiated Emission Limits)	Emissions in restrictedbands must meet theradiated limits detailed in15.209		Pass	
15.207	AC Conducted Emissions 150kHz-30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.10

Notes:

1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer.The correction table was used to account for the losses of the cables and attenuators used as part ofthe system to connect the EUT to the analyzer at all frequencies of interest.
2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
3) Occupied Bandwidth and Frequency Stability were assessed for SISO mode.
4) “N/A” means that the test item is not applicable, and the details refer to relevant section.

7.2. Emission Bandwidth Measurement

7.2.1.Test Limit

N/A

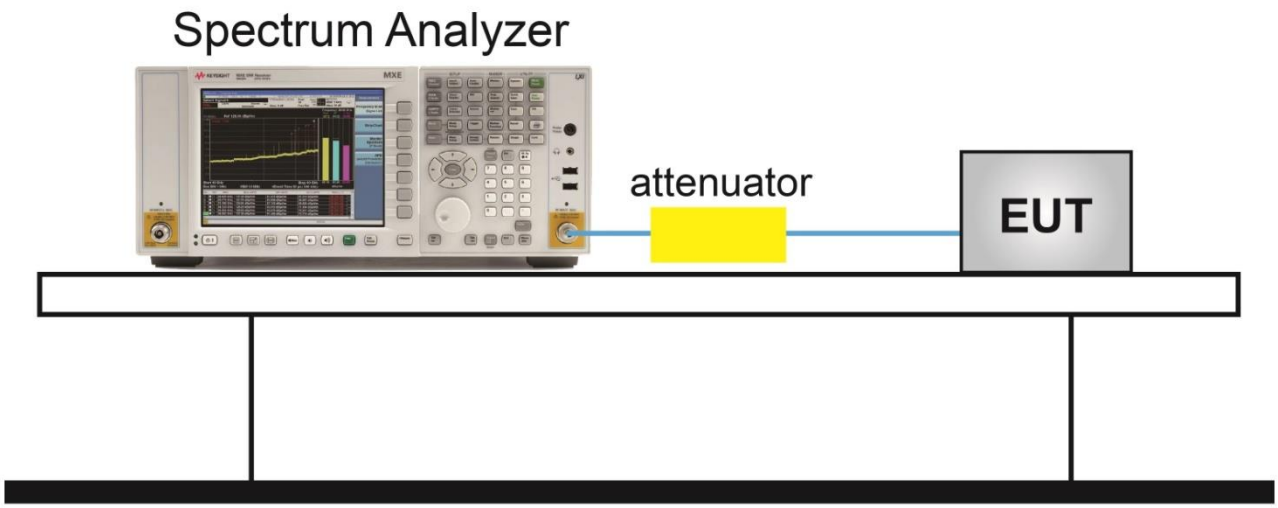
7.2.2.TestProcedureUsed

KDB 789033 D02v02r01 -Section C.1

7.2.3.TestSetting

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the 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%.

7.2.4.Test Setup



7.2.5.Test Result

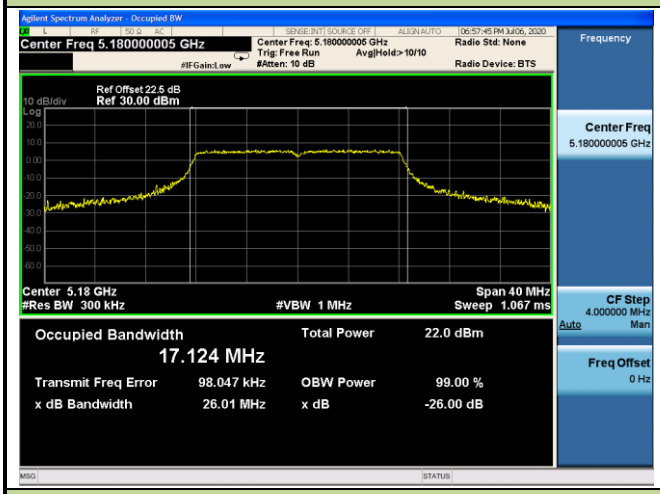
Product	Mobile Computer	Test Engineer	Gordon Qi
Test Site	TR3	Test Date	2020/07/07
Test Mode	SISO - ANT 0		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)
802.11a	6Mbps	36	5180	26.01
802.11a	6Mbps	44	5220	25.84
802.11a	6Mbps	48	5240	25.46
802.11a	6Mbps	52	5260	25.33
802.11a	6Mbps	60	5300	25.49
802.11a	6Mbps	64	5320	23.76
802.11a	6Mbps	100	5500	24.96
802.11a	6Mbps	116	5580	26.55
802.11a	6Mbps	140	5700	28.00
802.11a	6Mbps	144	5720	28.09
802.11a	6Mbps	149	5745	27.81
802.11a	6Mbps	157	5785	26.46
802.11a	6Mbps	165	5825	25.38
802.11ac-VHT20	MCS0	36	5180	27.64
802.11ac-VHT20	MCS0	44	5220	26.50
802.11ac-VHT20	MCS0	48	5240	26.89
802.11ac-VHT20	MCS0	52	5260	27.99
802.11ac-VHT20	MCS0	60	5300	23.51
802.11ac-VHT20	MCS0	64	5320	27.40
802.11ac-VHT20	MCS0	100	5500	28.26
802.11ac-VHT20	MCS0	116	5580	27.64
802.11ac-VHT20	MCS0	140	5700	27.73
802.11ac-VHT20	MCS0	144	5720	29.09
802.11ac-VHT20	MCS0	149	5745	29.70
802.11ac-VHT20	MCS0	157	5785	29.00
802.11ac-VHT20	MCS0	165	5825	27.47

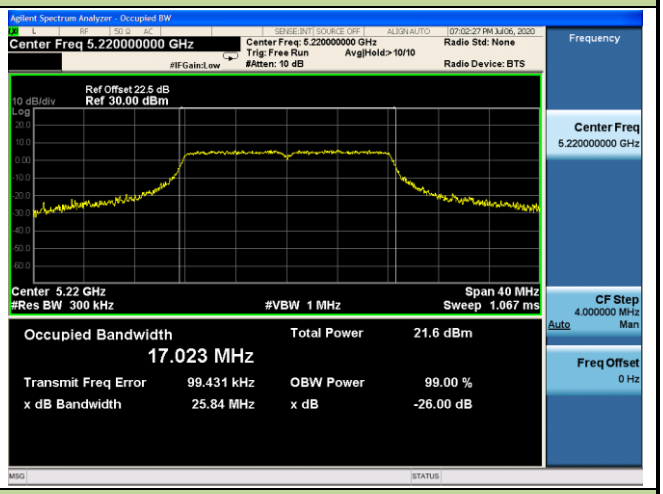
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)
802.11ac-VHT40	MCS0	38	5190	42.74
802.11ac-VHT40	MCS0	46	5230	42.10
802.11ac-VHT40	MCS0	54	5270	41.75
802.11ac-VHT40	MCS0	62	5310	41.96
802.11ac-VHT40	MCS0	102	5510	41.83
802.11ac-VHT40	MCS0	110	5550	42.06
802.11ac-VHT40	MCS0	134	5670	42.41
802.11ac-VHT40	MCS0	142	5710	42.26
802.11ac-VHT40	MCS0	151	5755	42.14
802.11ac-VHT40	MCS0	159	5795	41.83
802.11ac-VHT80	MCS0	42	5210	85.15
802.11ac-VHT80	MCS0	58	5290	84.77
802.11ac-VHT80	MCS0	106	5530	84.87
802.11ac-VHT80	MCS0	122	5610	85.42
802.11ac-VHT80	MCS0	138	5690	86.59
802.11ac-VHT80	MCS0	155	5775	85.12

SISO Mode - 802.11a 26dB Bandwidth

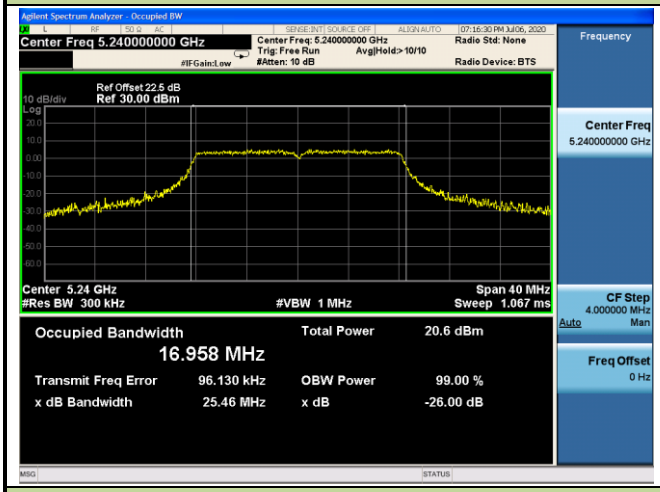
Channel 36 (5180MHz)



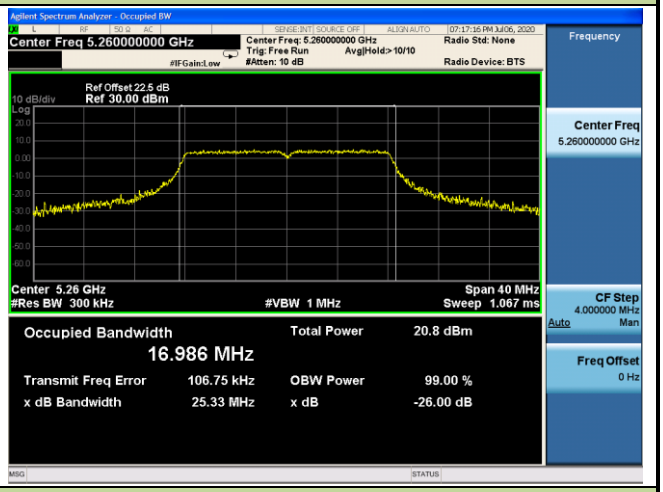
Channel 44 (5220MHz)



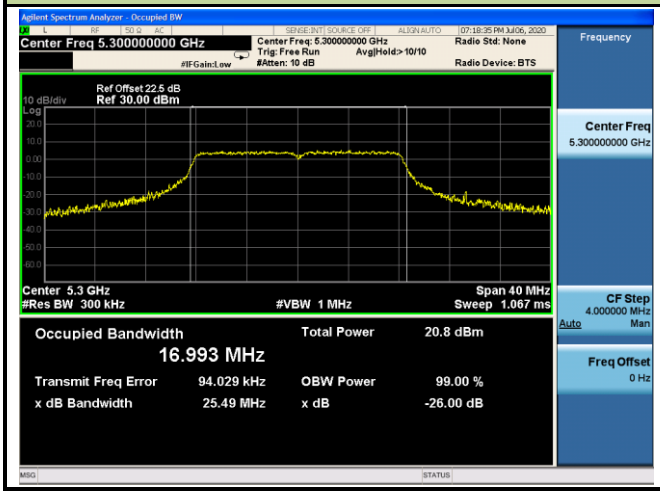
Channel 48 (5240MHz)



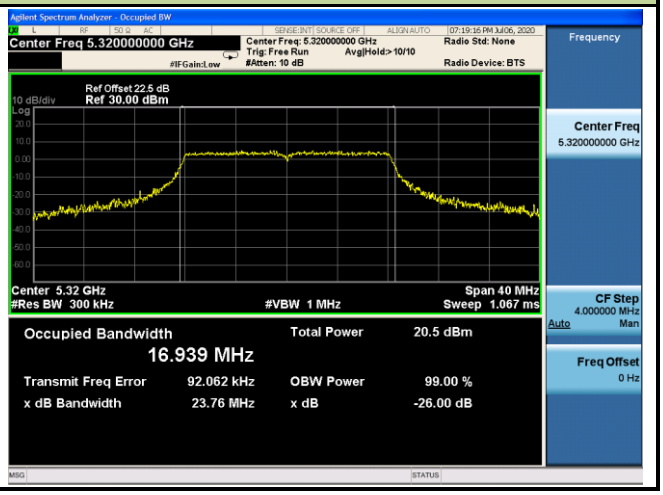
Channel 52 (5260MHz)



Channel 60 (5300MHz)

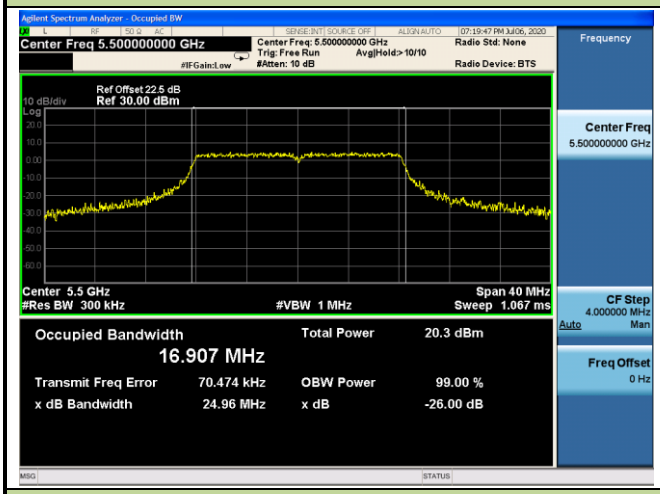


Channel 64 (5320MHz)

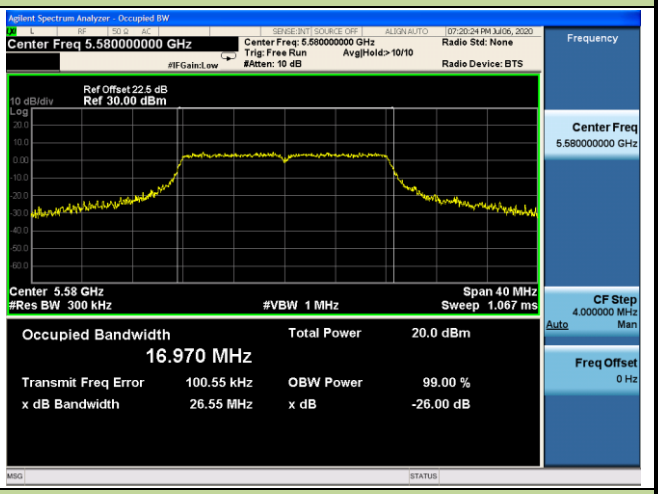


SISO Mode - 802.11a 26dB Bandwidth

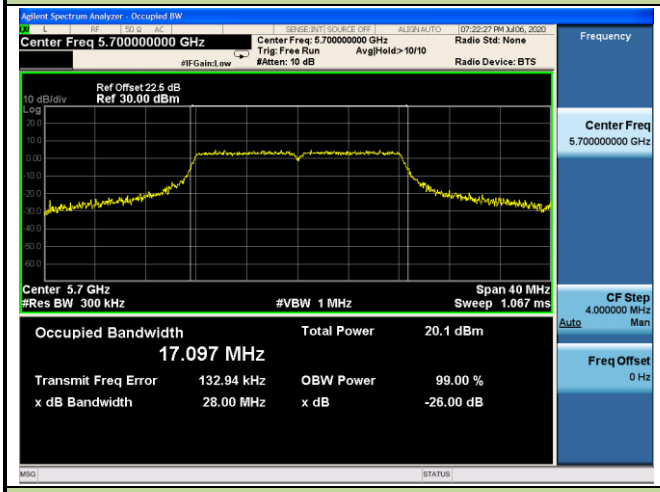
Channel 100 (5500MHz)



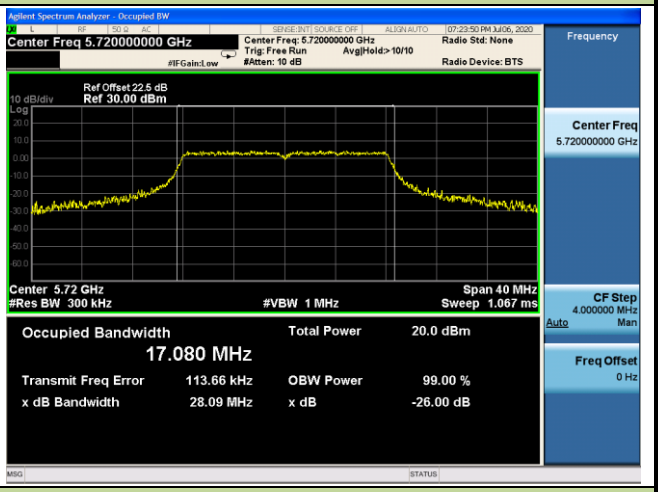
Channel 116 (5580MHz)



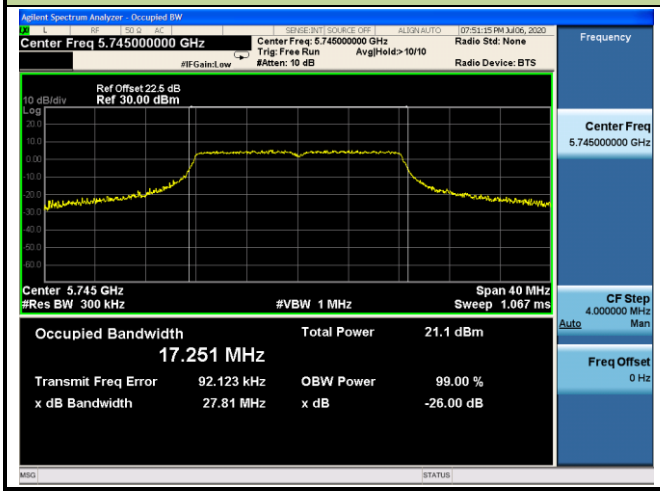
Channel 140 (5700MHz)



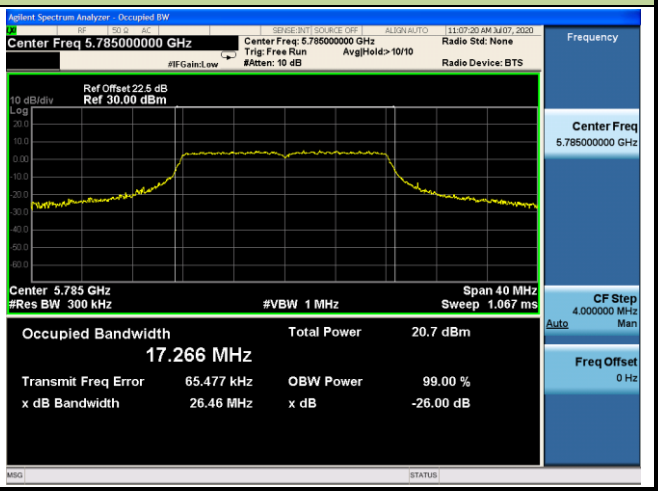
Channel 144 (5720MHz)

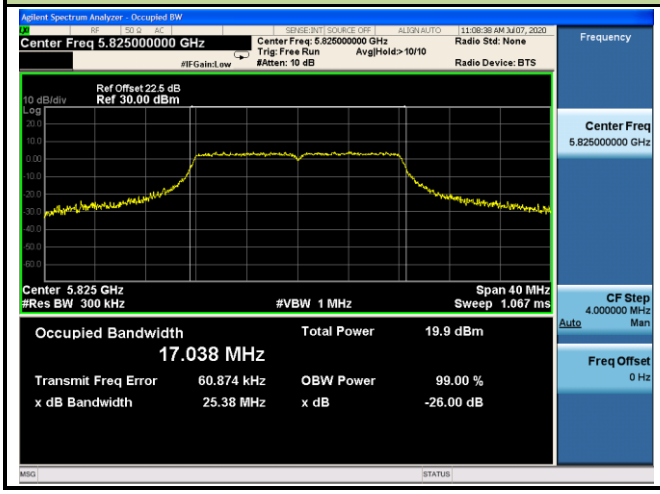


Channel 149 (5745MHz)



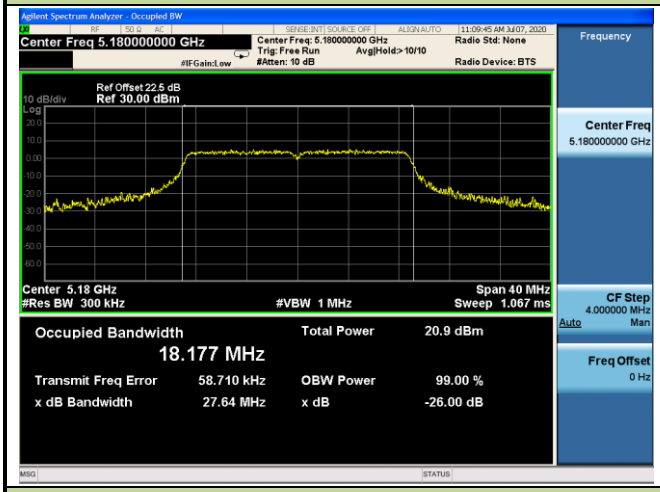
Channel 157 (5785MHz)



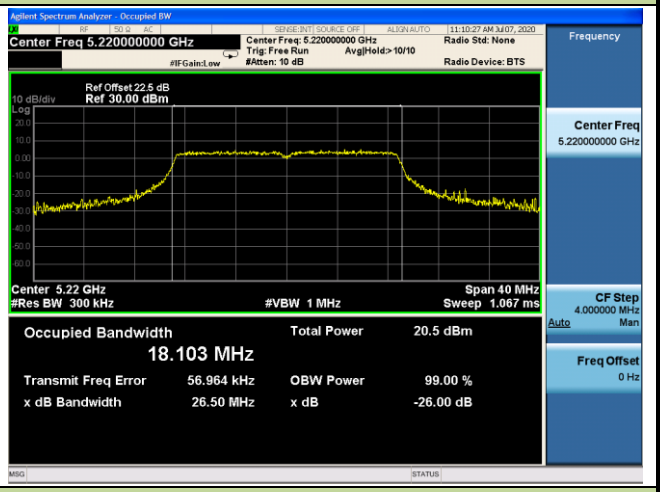
SISO Mode - 802.11a 26dB Bandwidth	
Channel 165 (5825MHz)	
	

SISO Mode - 802.11ac-VHT20 26dB Bandwidth

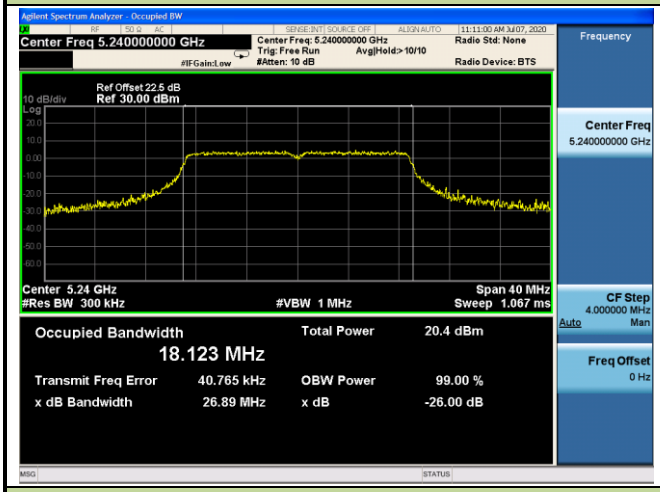
Channel 36 (5180MHz)



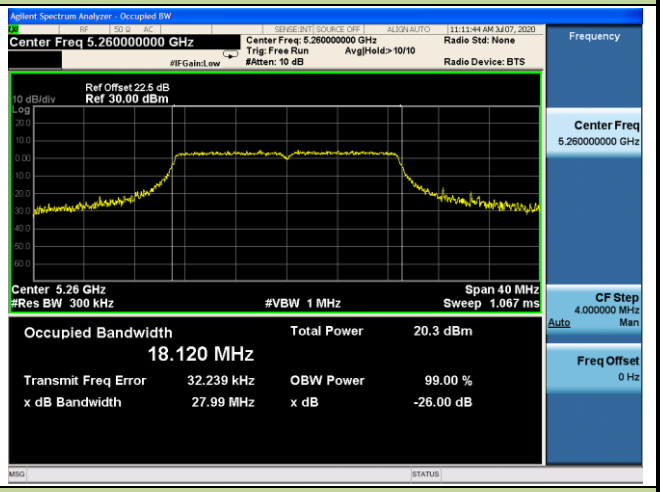
Channel 44 (5220MHz)



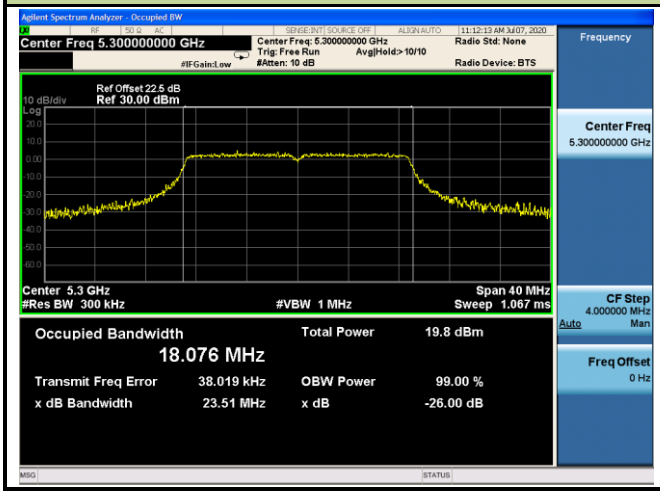
Channel 48 (5240MHz)



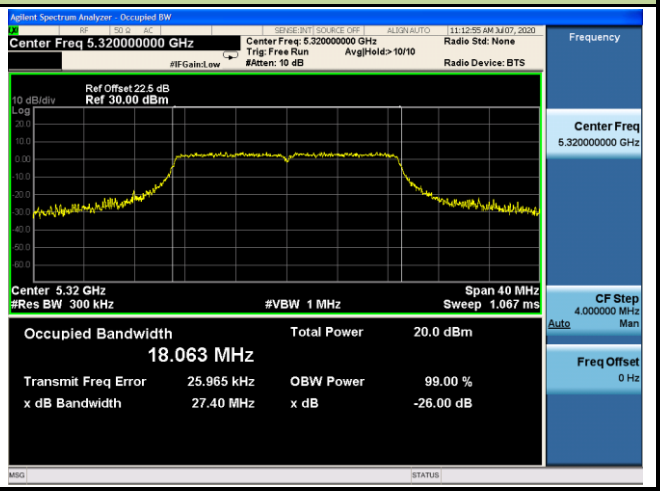
Channel 52 (5260MHz)



Channel 60 (5300MHz)

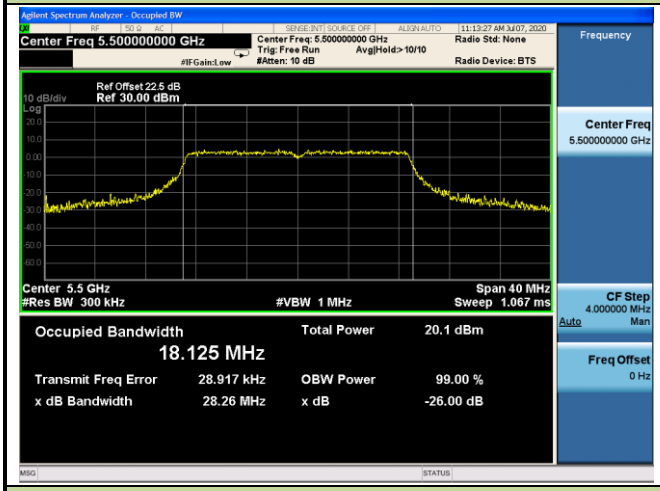


Channel 64 (5320MHz)

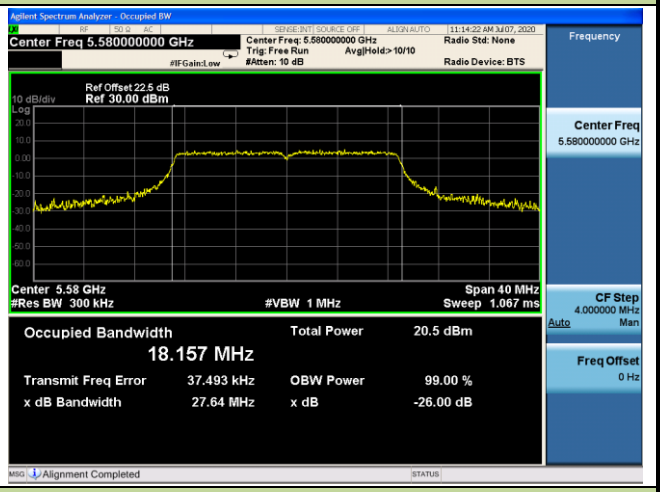


SISO Mode - 802.11ac-VHT20 26dB Bandwidth

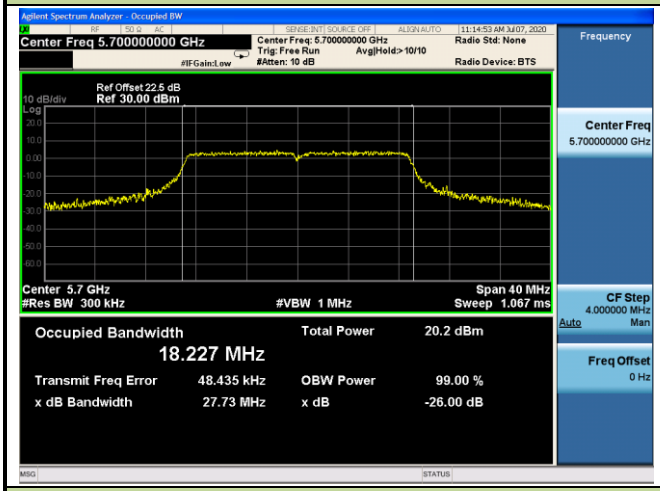
Channel 100 (5500MHz)



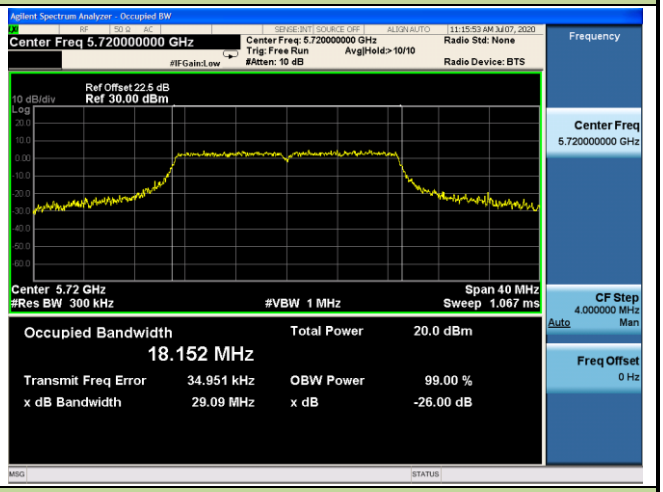
Channel 116 (5580MHz)



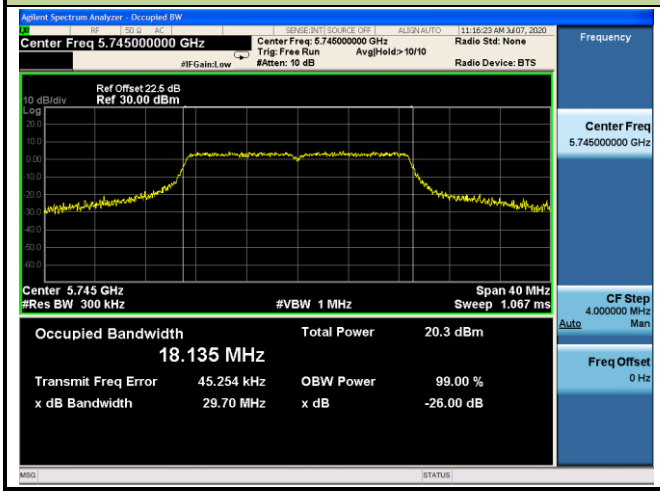
Channel 140 (5700MHz)



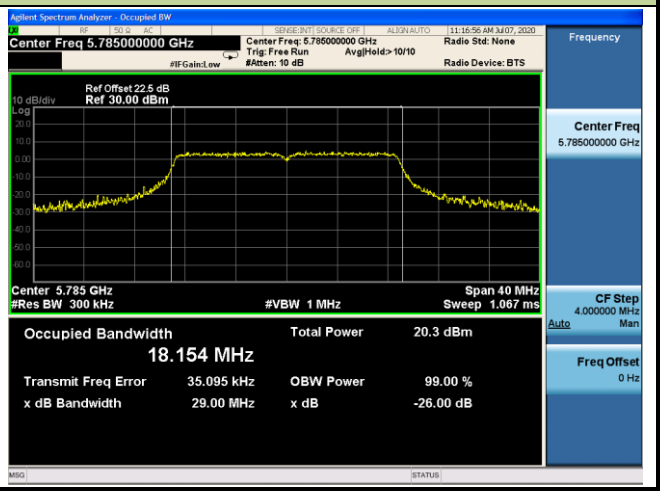
Channel 144 (5720MHz)

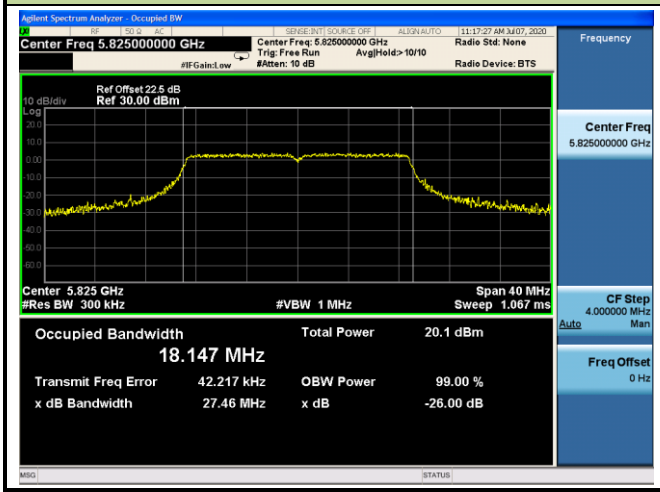


Channel 149 (5745MHz)



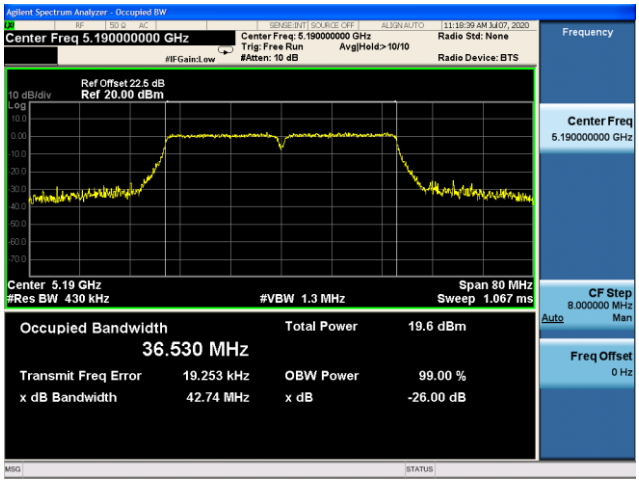
Channel 157 (5785MHz)



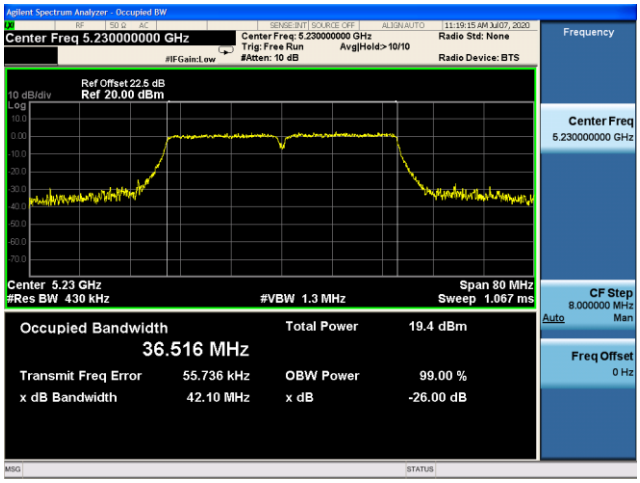
SISO Mode - 802.11ac-VHT20 26dB Bandwidth	
Channel 165 (5825MHz)	
	

SISO Mode - 802.11ac-VHT40 26dB Bandwidth

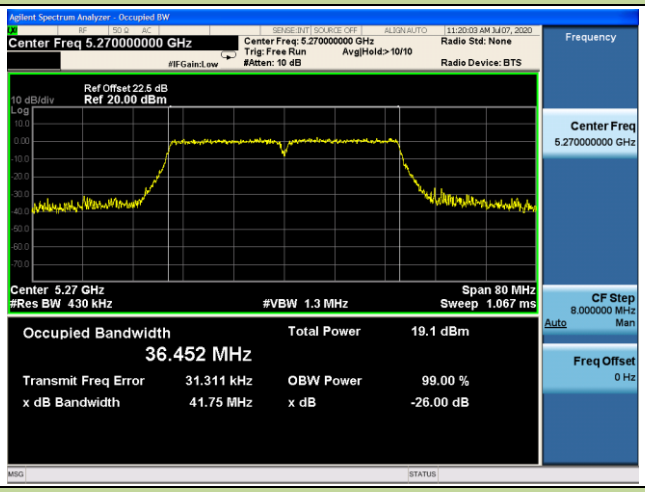
Channel 38 (5190MHz)



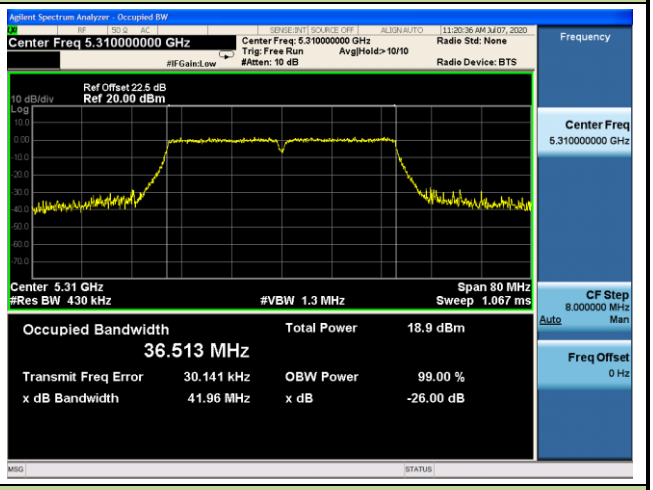
Channel 46 (5230MHz)



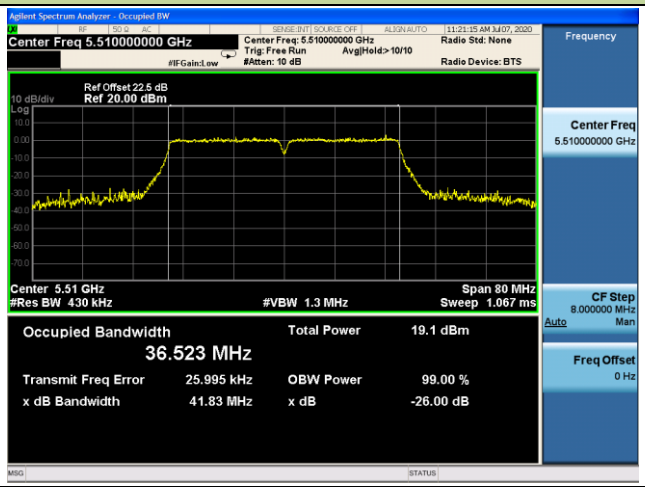
Channel 54 (5270MHz)



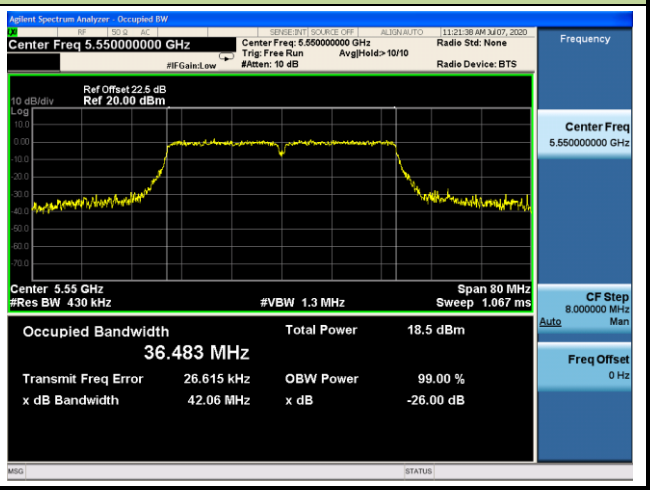
Channel 62 (5310MHz)



Channel 102 (5510MHz)

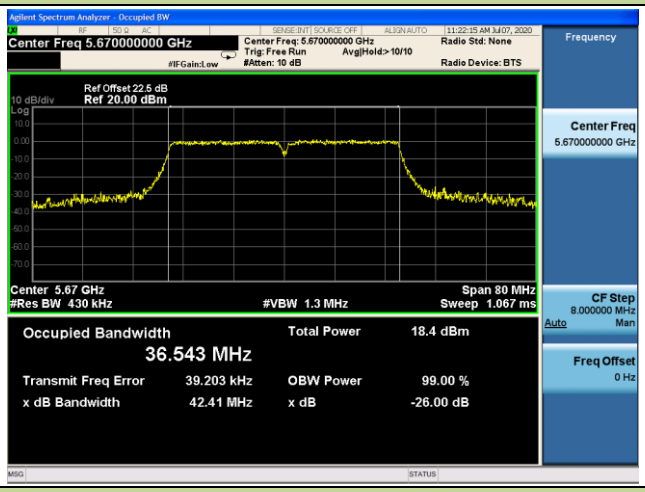


Channel 110 (5550MHz)

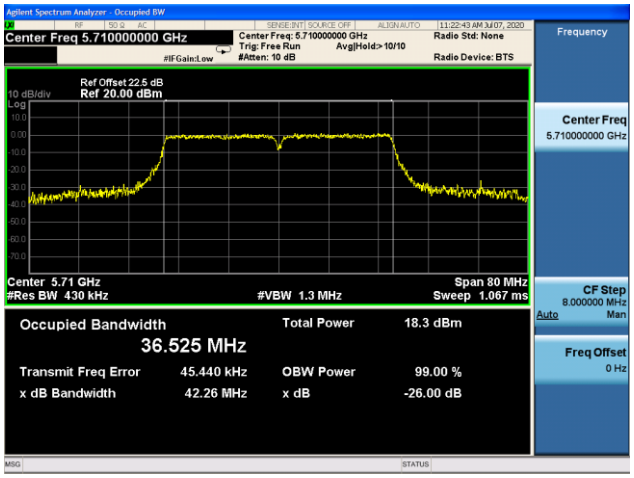


SISO Mode - 802.11ac-VHT40 26dB Bandwidth

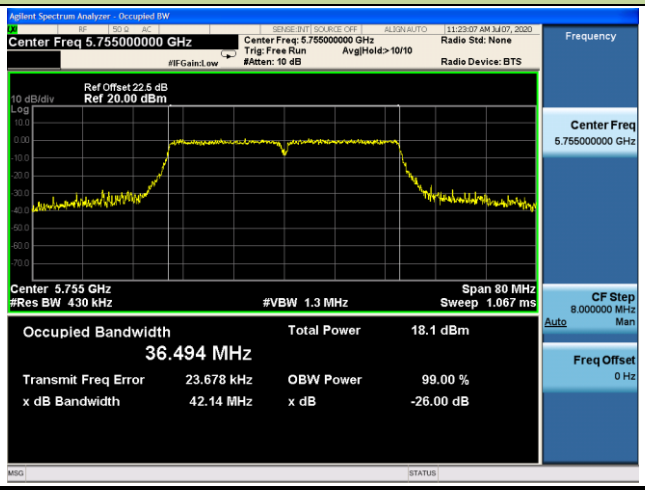
Channel 134 (5670MHz)



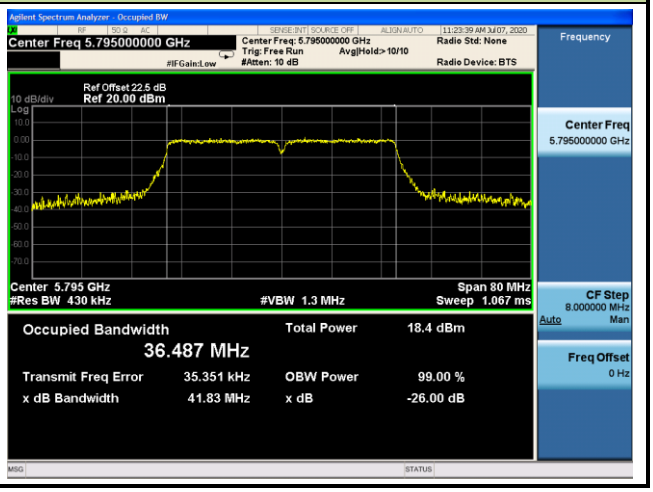
Channel 142 (5710MHz)



Channel 151 (5755MHz)

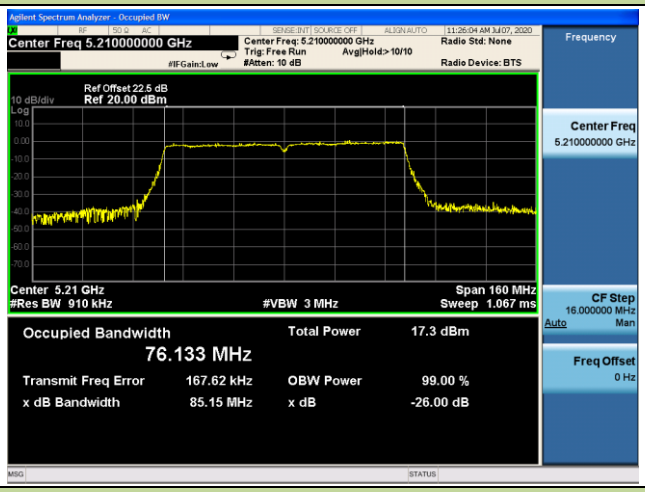


Channel 159 (5795MHz)

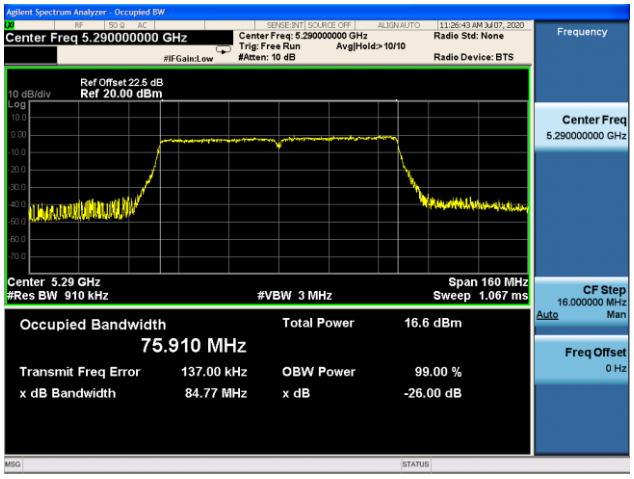


SISO Mode - 802.11ac-VHT80 26dB Bandwidth

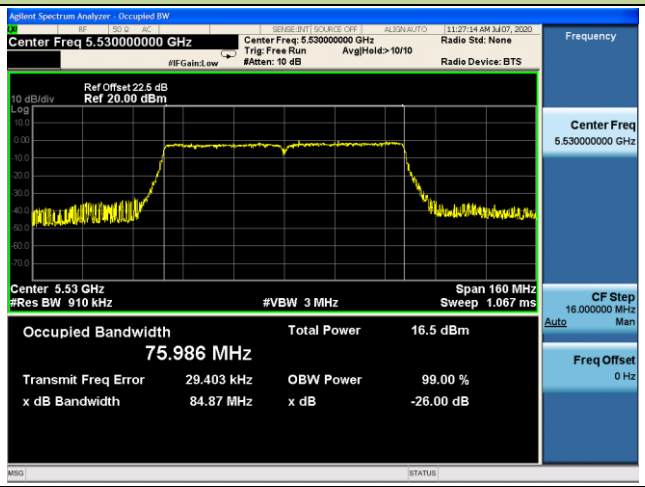
Channel 42 (5210MHz)



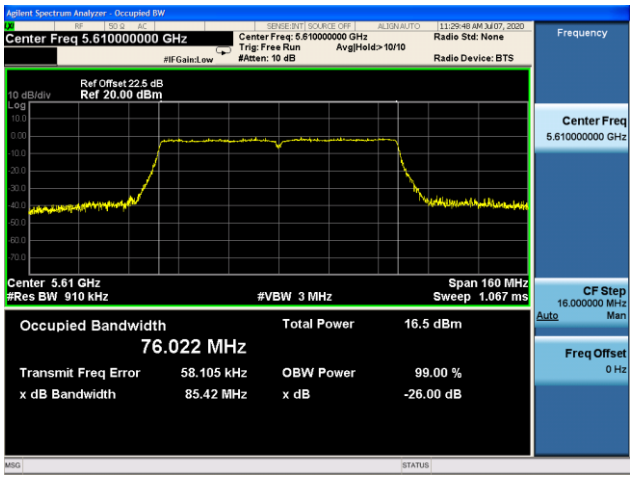
Channel 58 (5290MHz)



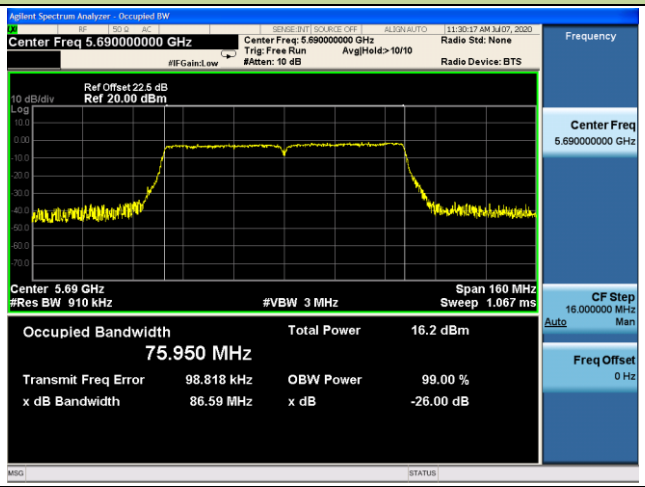
Channel 106 (5530MHz)



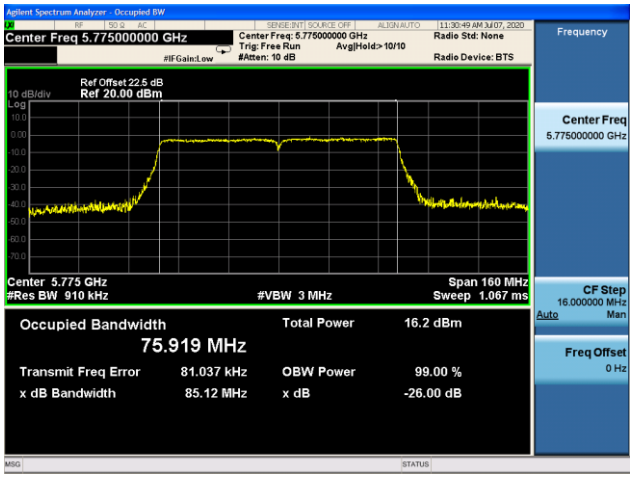
Channel 122 (5610MHz)



Channel 138(5690MHz)



Channel 155 (5775MHz)



7.3. 6dB Bandwidth Measurement

7.3.1.Test Limit

The minimum 6dBbandwidth shall be at least 500 kHz.

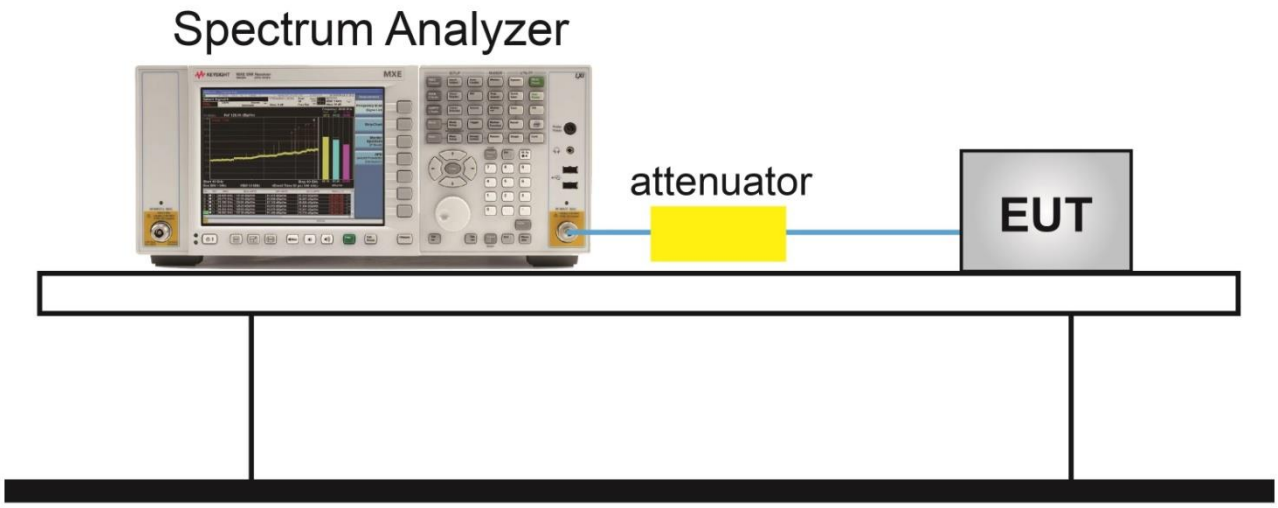
7.3.2.Test Procedure Used

KDB 789033 D02v02r01 - Section C.2

7.3.3.TestSetting

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW≥ 3 × RBW.
4. Detector = Peak.
5. Trace mode = Max hold.
6. Sweep = Auto couple.
7. Allow the trace to stabilize.
8. 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 level measured in the fundamental emission.

7.3.4.Test Setup



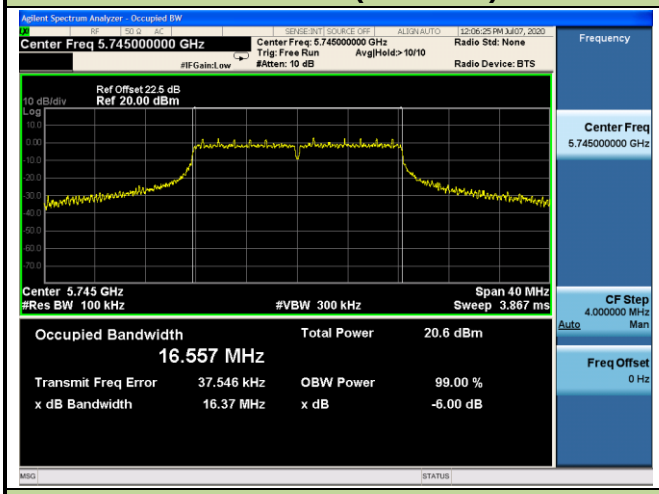
7.3.5.TestResult

Product	Mobile Computer	Test Engineer	Gordon Qi
Test Site	TR3	Test Date	2020/07/07
Test Mode	SISO Mode		

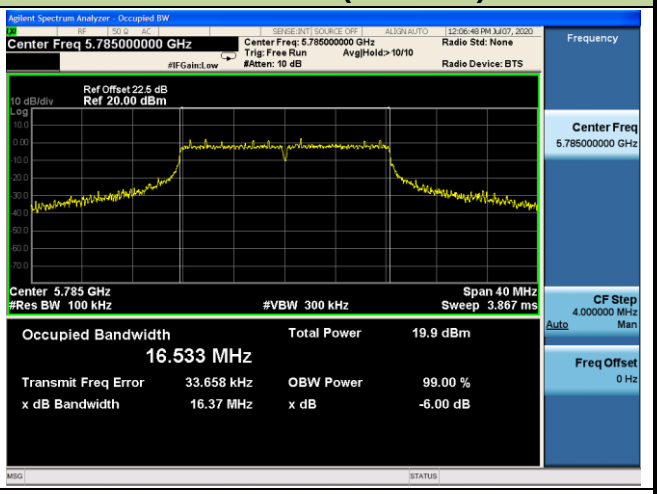
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11a	6Mbps	149	5745	16.37	≥ 0.5	Pass
802.11a	6Mbps	157	5785	16.37	≥ 0.5	Pass
802.11a	6Mbps	165	5825	16.39	≥ 0.5	Pass
802.11ac-VHT20	MCS0	149	5745	17.61	≥ 0.5	Pass
802.11ac-VHT20	MCS0	157	5785	17.61	≥ 0.5	Pass
802.11ac-VHT20	MCS0	165	5825	17.62	≥ 0.5	Pass
802.11ac-VHT40	MCS0	151	5755	36.39	≥ 0.5	Pass
802.11ac-VHT40	MCS0	159	5795	36.37	≥ 0.5	Pass
802.11ac-VHT80	MCS0	155	5775	76.12	≥ 0.5	Pass

SISO Mode - 802.11a 6dB Bandwidth

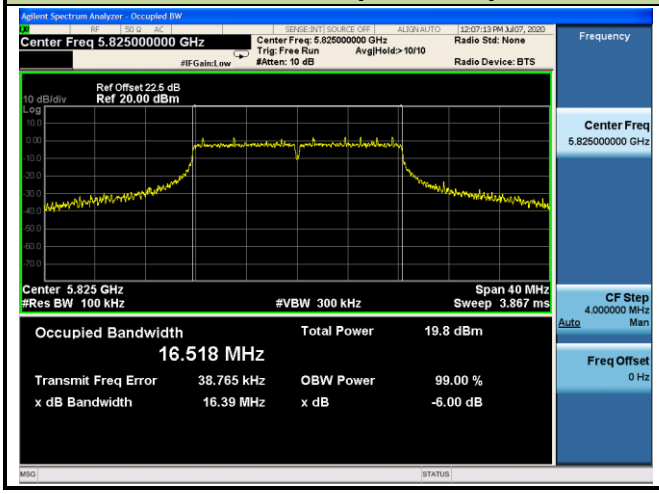
Channel 149 (5745MHz)



Channel 157 (5785MHz)

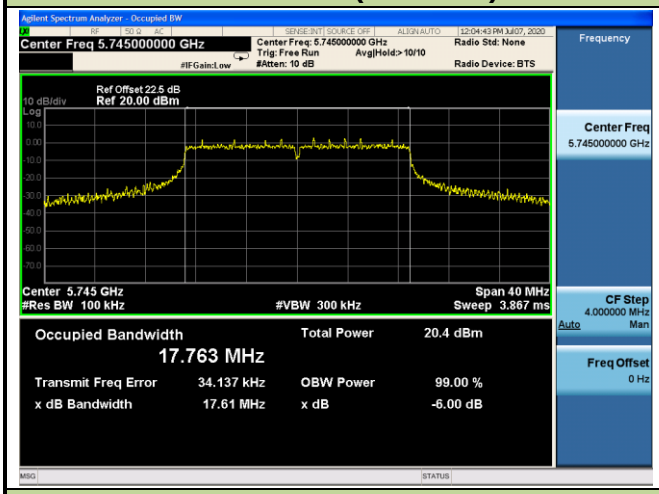


Channel 165 (5825MHz)

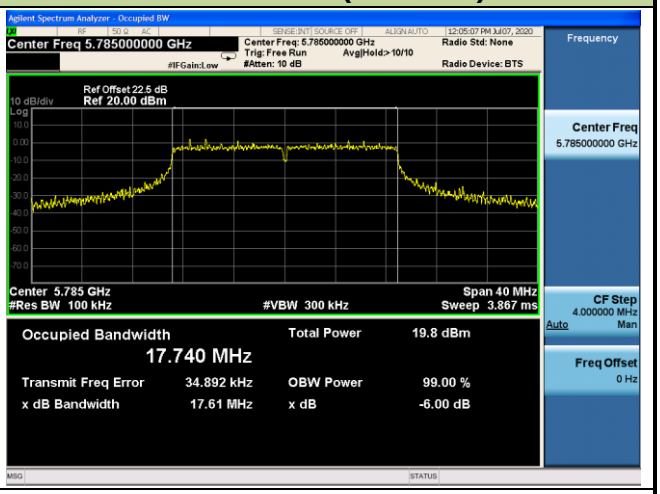


SISO Mode - 802.11ac-VHT20 6dB Bandwidth

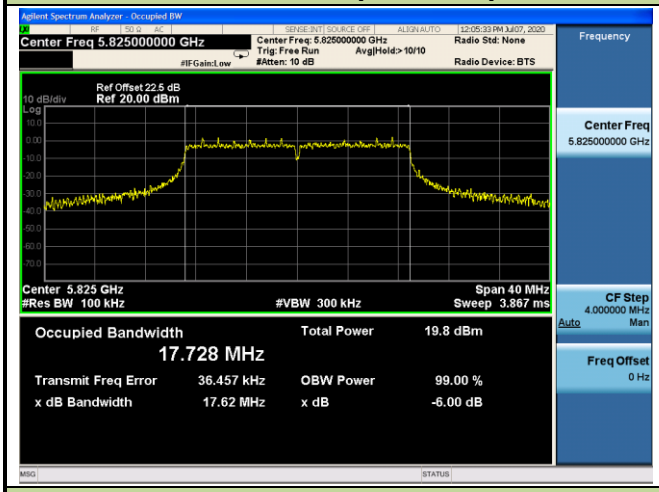
Channel 149 (5745MHz)



Channel 157 (5785MHz)

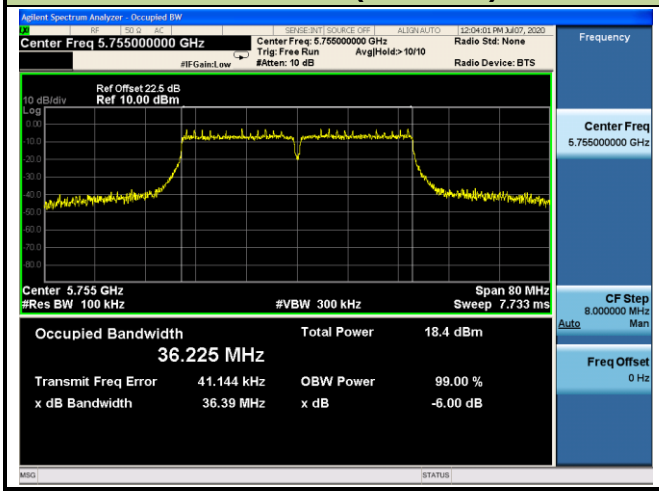


Channel 165 (5825MHz)

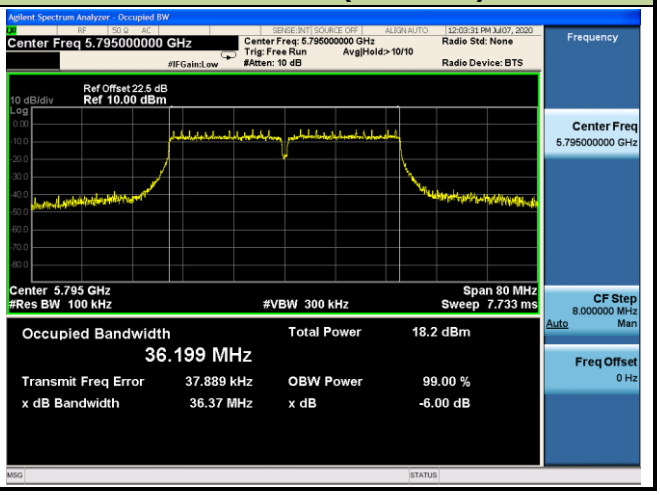


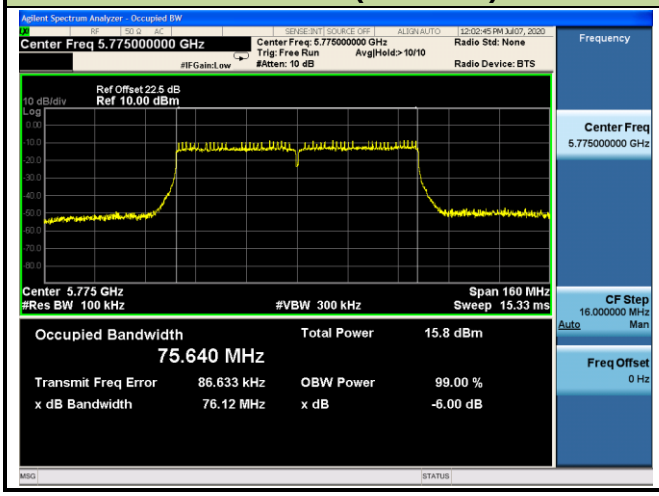
SISO Mode - 802.11ac-VHT40 6dB Bandwidth

Channel 151 (5755MHz)



Channel 159 (5795MHz)



SISO Mode - 802.11ac-VHT80 6dB Bandwidth	
Channel 155 (5775MHz)	
	

7.4. Output Power Measurement

7.4.1.Test Limit

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

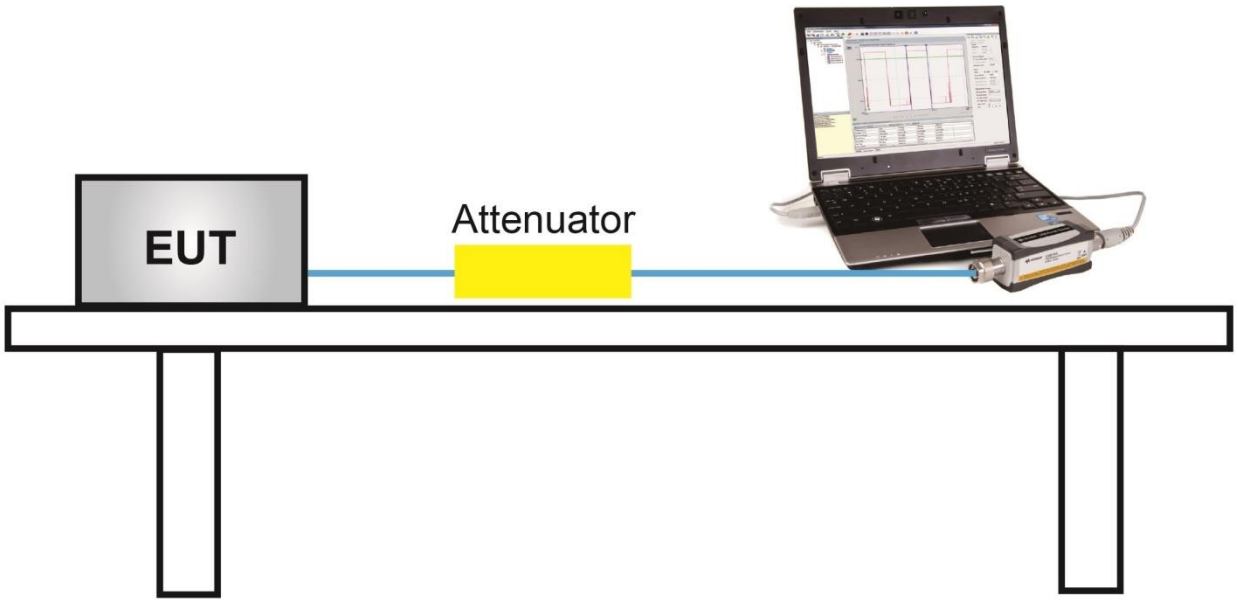
7.4.2.Test Procedure Used

KDB 789033D02v02r01- Section E)3)b) Method PM-G

7.4.3.Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

7.4.4.Test Setup



7.4.5.TestResult

Output power test was verified over all data rates of each mode shown as below table, and then choose the maximum output power (gray marker) for final test of each channel.

Test Mode	Bandwidth	Channel No.	Frequency (MHz)	Data Rate/ MCS	Average Power (dBm)
802.11a	20	36	5180	6Mbps	15.28
				24Mbps	15.20
				54Mbps	15.13
802.11ac	20	36	5180	MCS0	15.21
				MCS4	15.14
				MCS8	15.12
802.11ac	40	38	5190	MCS0	13.34
				MCS4	13.25
				MCS9	13.21
802.11ac	80	42	5210	MCS0	9.52
				MCS4	9.48
				MCS9	9.45

Product	Mobile Computer	Test Engineer	Gordon Qi
Test Site	TR3	Test Date	2020/07/12~2020/07/13
Test Mode	SISO Mode		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)	Average Power Limit (dBm)	Result
11a	6Mbps	36	5180	15.28	≤ 30.00	Pass
11a	6Mbps	44	5220	15.27	≤ 30.00	Pass
11a	6Mbps	48	5240	15.25	≤ 30.00	Pass
11a	6Mbps	52	5260	15.24	≤ 23.98	Pass
11a	6Mbps	60	5300	15.13	≤ 23.98	Pass
11a	6Mbps	64	5320	15.31	≤ 23.98	Pass
11a	6Mbps	100	5500	15.38	≤ 23.98	Pass
11a	6Mbps	116	5580	15.16	≤ 23.98	Pass
11a	6Mbps	140	5700	15.13	≤ 23.98	Pass
11a	6Mbps	144	5720	15.16	≤ 23.98	Pass
11a	6Mbps	149	5745	15.24	≤ 30.00	Pass
11a	6Mbps	157	5785	15.03	≤ 30.00	Pass
11a	6Mbps	165	5825	14.81	≤ 30.00	Pass
11ac-VHT20	MCS0	36	5180	15.21	≤ 30.00	Pass
11ac-VHT20	MCS0	44	5220	15.19	≤ 30.00	Pass
11ac-VHT20	MCS0	48	5240	15.25	≤ 23.98	Pass
11ac-VHT20	MCS0	52	5260	15.22	≤ 23.98	Pass
11ac-VHT20	MCS0	60	5300	15.14	≤ 23.98	Pass
11ac-VHT20	MCS0	64	5320	15.25	≤ 23.98	Pass
11ac-VHT20	MCS0	100	5500	15.27	≤ 23.98	Pass
11ac-VHT20	MCS0	116	5580	15.17	≤ 23.98	Pass
11ac-VHT20	MCS0	140	5700	15.24	≤ 23.98	Pass
11ac-VHT20	MCS0	144	5720	15.18	≤ 23.98	Pass
11ac-VHT20	MCS0	149	5745	15.16	≤ 30.00	Pass
11ac-VHT20	MCS0	157	5785	14.95	≤ 30.00	Pass
11ac-VHT20	MCS0	165	5825	14.78	≤ 30.00	Pass

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)	Average Power Limit (dBm)	Result
11ac-VHT40	MCS0	38	5190	13.34	≤ 30.00	Pass
11ac-VHT40	MCS0	46	5230	13.31	≤ 30.00	Pass
11ac-VHT40	MCS0	54	5270	13.25	≤ 23.98	Pass
11ac-VHT40	MCS0	62	5310	13.13	≤ 23.98	Pass
11ac-VHT40	MCS0	102	5510	13.26	≤ 23.98	Pass
11ac-VHT40	MCS0	110	5550	13.18	≤ 23.98	Pass
11ac-VHT40	MCS0	134	5670	13.37	≤ 23.98	Pass
11ac-VHT40	MCS0	142	5710	13.30	≤ 23.98	Pass
11ac-VHT40	MCS0	151	5755	13.10	≤ 30.00	Pass
11ac-VHT40	MCS0	159	5795	12.84	≤ 30.00	Pass
11ac-VHT80	MCS0	42	5210	9.52	≤ 30.00	Pass
11ac-VHT80	MCS0	58	5290	9.54	≤ 23.98	Pass
11ac-VHT80	MCS0	106	5530	9.74	≤ 23.98	Pass
11ac-VHT80	MCS0	122	5610	9.68	≤ 23.98	Pass
11ac-VHT80	MCS0	138	5690	9.54	≤ 23.98	Pass
11ac-VHT80	MCS0	155	5775	9.51	≤ 30.00	Pass

Product	Mobile Computer	Test Engineer	Gordon Qi
Test Site	TR3	Test Date	2020/07/07~2020/07/10
Test Mode	MIMO Mode		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Average Power (dBm)	Limit (dBm)	Result
				Ant 0	Ant 1			
11ac-VHT20	MCS0	36	5180	11.30	11.98	14.66	≤ 30.00	Pass
11ac-VHT20	MCS0	44	5220	11.39	11.87	14.65	≤ 30.00	Pass
11ac-VHT20	MCS0	48	5240	12.04	12.65	15.37	≤ 30.00	Pass
11ac-VHT20	MCS0	52	5260	11.94	12.58	15.28	≤ 23.98	Pass
11ac-VHT20	MCS0	60	5300	11.98	12.45	15.23	≤ 23.98	Pass
11ac-VHT20	MCS0	64	5320	12.15	12.46	15.32	≤ 23.98	Pass
11ac-VHT20	MCS0	100	5500	12.29	12.35	15.33	≤ 23.98	Pass
11ac-VHT20	MCS0	116	5580	12.03	12.23	15.14	≤ 23.98	Pass
11ac-VHT20	MCS0	140	5700	12.35	12.37	15.37	≤ 23.98	Pass
11ac-VHT20	MCS0	144	5720	12.27	12.23	15.26	≤ 23.98	Pass
11ac-VHT20	MCS0	149	5745	12.22	12.52	15.38	≤ 30.00	Pass
11ac-VHT20	MCS0	157	5785	11.99	12.55	15.29	≤ 30.00	Pass
11ac-VHT20	MCS0	165	5825	11.73	12.68	15.24	≤ 30.00	Pass
11ac-VHT40	MCS0	38	5190	9.45	10.26	12.88	≤ 30.00	Pass
11ac-VHT40	MCS0	46	5230	9.52	9.83	12.69	≤ 30.00	Pass
11ac-VHT40	MCS0	54	5270	9.21	9.78	12.51	≤ 23.98	Pass
11ac-VHT40	MCS0	62	5310	10.11	10.52	13.33	≤ 23.98	Pass
11ac-VHT40	MCS0	102	5510	10.42	10.45	13.45	≤ 23.98	Pass
11ac-VHT40	MCS0	110	5550	10.39	10.51	13.46	≤ 23.98	Pass
11ac-VHT40	MCS0	134	5670	10.42	10.46	13.45	≤ 23.98	Pass
11ac-VHT40	MCS0	142	5710	10.37	10.42	13.41	≤ 23.98	Pass
11ac-VHT40	MCS0	151	5755	10.24	10.39	13.33	≤ 30.00	Pass
11ac-VHT40	MCS0	159	5795	9.98	10.36	13.18	≤ 30.00	Pass
11ac-VHT80	MCS0	42	5210	6.54	7.56	10.09	≤ 30.00	Pass
11ac-VHT80	MCS0	58	5290	6.56	7.49	10.06	≤ 23.98	Pass
11ac-VHT80	MCS0	106	5530	6.61	7.21	9.93	≤ 23.98	Pass
11ac-VHT80	MCS0	122	5610	6.79	6.95	9.88	≤ 23.98	Pass
11ac-VHT80	MCS0	138	5690	6.84	6.93	9.90	≤ 23.98	Pass
11ac-VHT80	MCS0	155	5775	6.82	6.96	9.90	≤ 30.00	Pass

Note: Total Average Power (dBm) = $10*\log\{10^{(\text{ANT 0 Average Power }/10)}+10^{(\text{ANT 1 Average Power }/10)}\}$ (dBm).

7.5. Transmit Power Control

7.5.1.Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

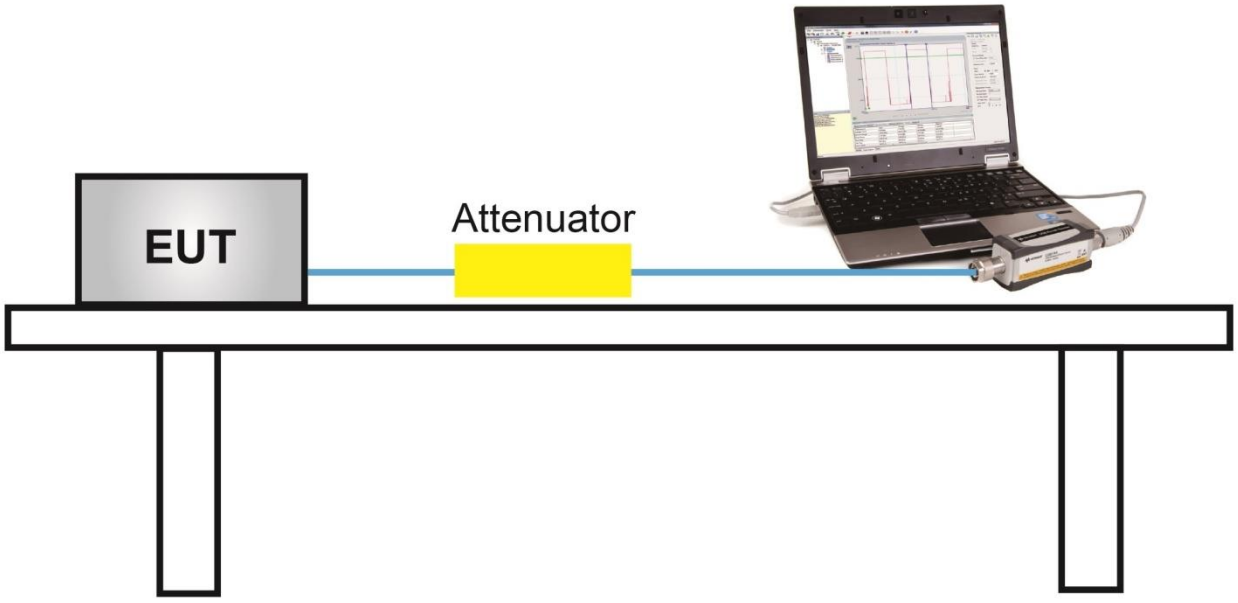
7.5.2.Test Procedure Used

ANSI C63.10-2013- Section 12.3.3.2 Method PM-G

7.5.3.Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

7.5.4.Test Setup



7.5.5.TestResult

A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

7.6. Power Spectral Density Measurement

7.6.1.TestLimit

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

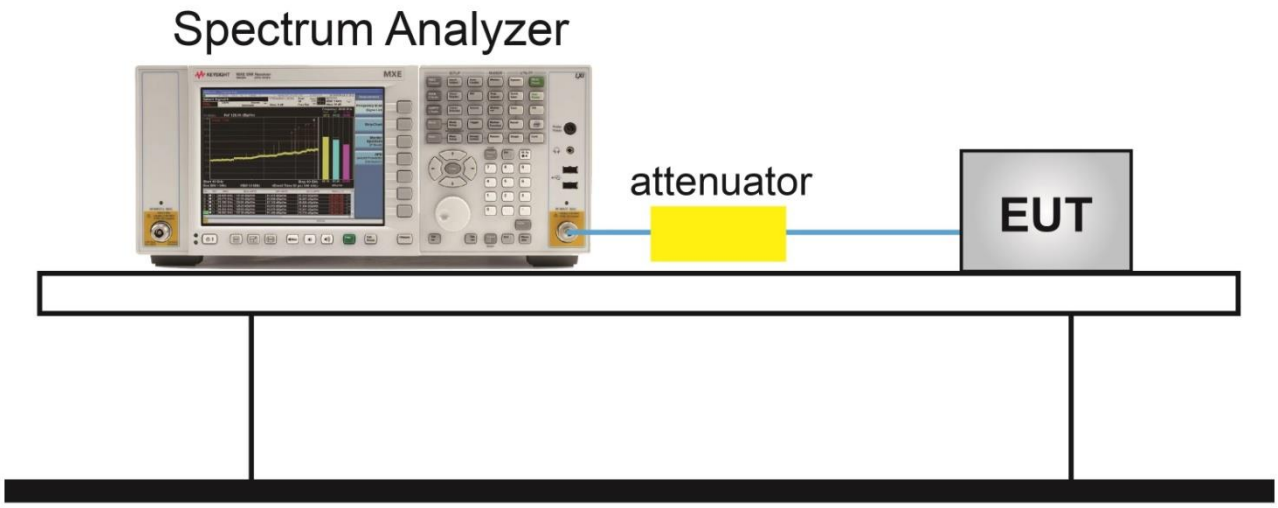
If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

7.6.2.Test Procedure Used

KDB 789033 D02v02r01 - Section F

7.6.3.Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz

   If measurement bandwidth of Maximum PSD is specified in 500 kHz,RBW = 510kHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = Power averaging (Average)
7. Trace average at least 100 traces in power averaging (rms) mode
8. Sweep time = Auto
9. Trigger = Free run
10. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
11. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.

7.6.4.Test Setup