MEASUREMENT REPORT

FCC PART 15.407 WLAN 802.11a/n/ac

FCC ID:	BKMAE-STI6110
APPLICANT:	SEIKO EPSON CORPORATION
Application Type:	Certification
Product:	Streaming Media Player
Model No.:	STI6110-D101(RoHS)
Brand Name:	EPSON
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:	May 12 ~ June 13, 2019

Reviewed By: (Paddy Chen)

Approved By: (Chenz Ker)

Testing Laboratory
3261

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 herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
1905TW0109-U4	Rev. 01	Initial report	06-18-2019	Valid

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Description Page

§2.1033General Information

Applicant:	SEIKO EPSON CORPORATION
Applicant Address:	3-5, Owa 3-chome, Suwa-shi, Nagano-ken 392-8502 Japan
Manufacturer:	SEIKO EPSON CORPORATION
Manufacturer Address:	3-5, Owa 3-chome, Suwa-shi, Nagano-ken 392-8502 Japan
Test Site:	MRT Technology (Taiwan) Co., Ltd
Test Site Address:	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 153292 and 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.**
- **MRT facility is an IC registered (MRT Reg. No. 21723-1) test laboratory with the site description on file at Industry Canada.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (TAF) under the American Association for Laboratory Accreditation Program (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC, Industry Taiwan, EU and TELEC Rules.**

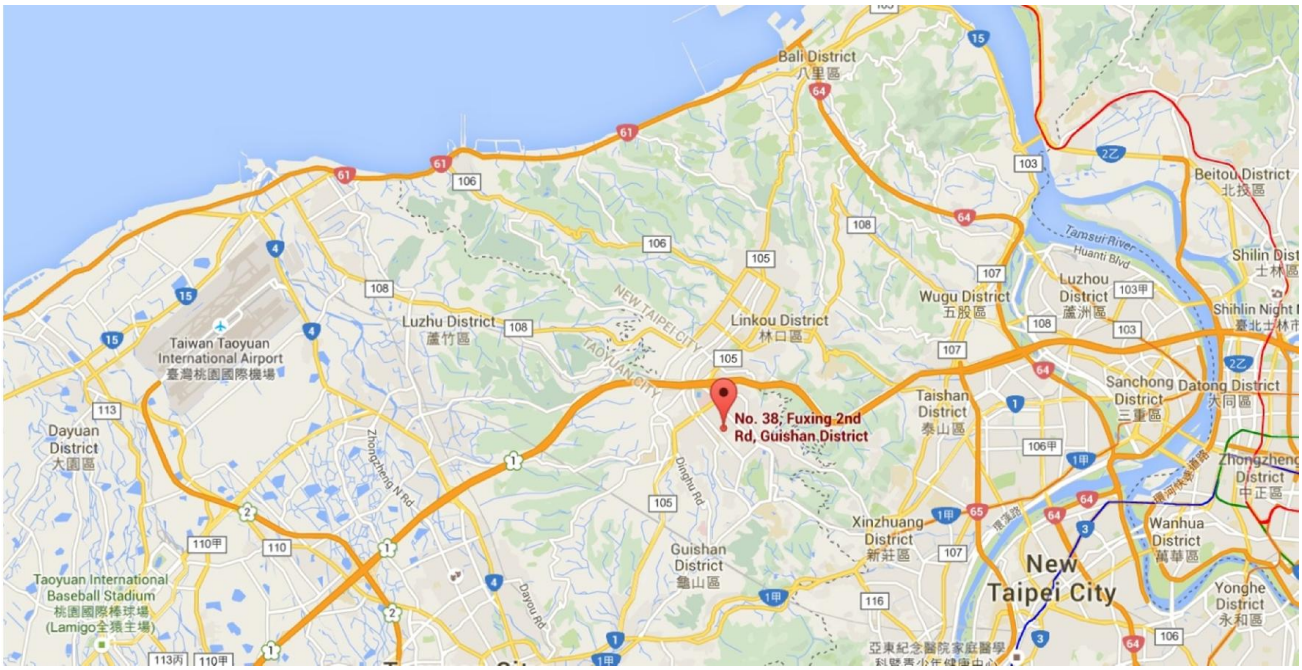
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices includingintentional and/or unintentional radiators for compliance with the technical rules and regulations of the FederalCommunications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	Streaming Media Player
Model No.:	STI6110-D101(RoHS)
Brand Name:	EPSON
Wi-Fi Specification:	802.11a/b/g/n/ac
Bluetooth Specification:	v4.2 dual mode

2.2. Product Specification Subjective to this Report

Frequency Range:	For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 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

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

2.3. 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	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	151	5755 MHz
159	5795 MHz	--	--	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	155	5775 MHz	--	--

2.4. Description of Available Antennas

Antenna Type	Frequency Band (MHz)	T_X Paths	Max Antenna Gain (dBi)	CDD Directional Gain (dBi)	
				For Power	For PSD
Wi-Fi Antenna					
PCB Antenna	2412 ~ 2462	2	1.8	1.8	4.81
	5150 ~ 5250	2	7.1	7.1	10.11
	5725 ~ 5850	2	3.0	3.0	6.01
Bluetooth Antenna					
PCB Antenna	2402 ~ 2480	1	1.6	--	--

Note:

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

For CDD transmissions, directional gain is calculated as follows, $N_{ANT} = 2$, $N_{SS} = 1$.

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

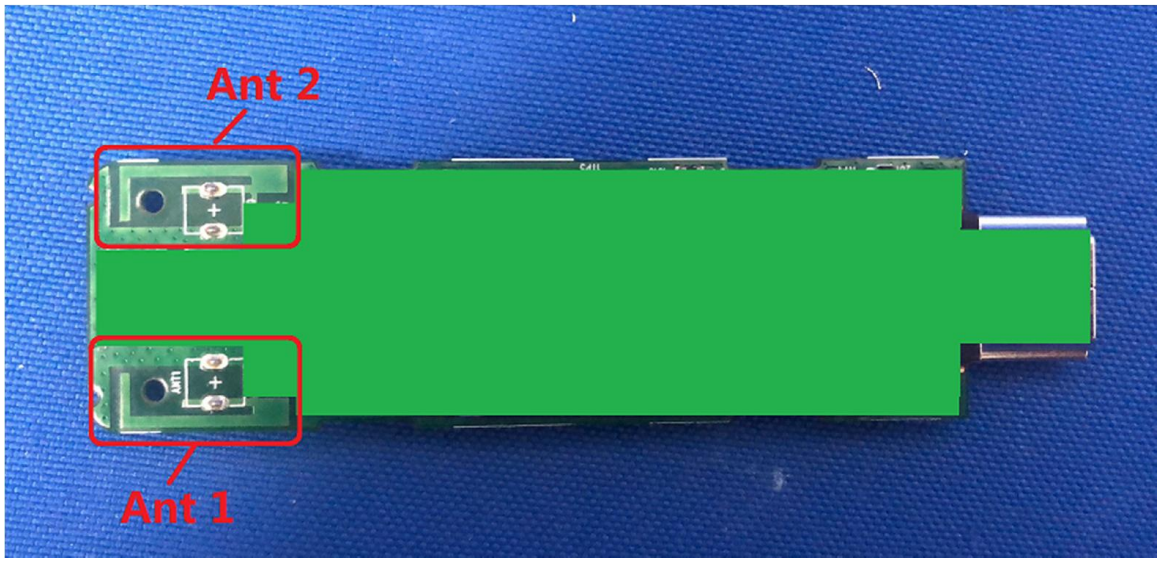
- For power spectral density (PSD) measurements on all devices,

  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;
- For power measurements on IEEE 802.11 devices,

  Array Gain = 0 dB for $N_{ANT} \leq 4$;

2.5. Description of Antenna RF Port

Wi-Fi & Bluetooth Antenna RF Port		
Software Control Port	Ant 1 (Wi-Fi)	Ant 2 (Wi-Fi & Bluetooth)



2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11a (6Mbps)
	Mode 2: Transmit by 802.11n-HT20 (MCS0)
	Mode 3: Transmit by 802.11n-HT40 (MCS0)
	Mode 4: Transmit by 802.11ac-VHT20 (MCS0)
	Mode 5: Transmit by 802.11ac-VHT40 (MCS0)
	Mode 6: Transmit by 802.11ac-VHT80 (MCS0)

2.7. Description of Test Software

The test utility software used during testing was “Ampak RFTestTool”, and the version was VER 5.8.

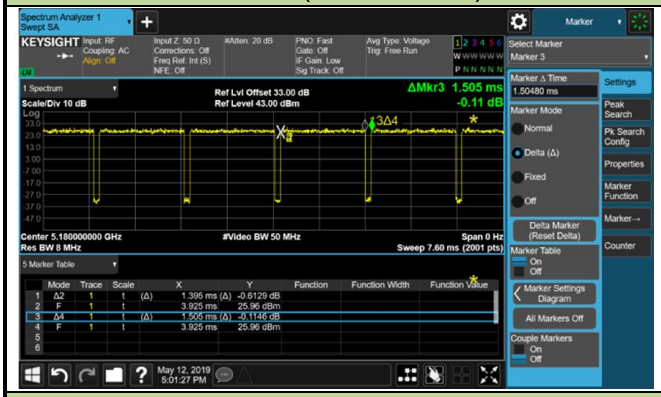
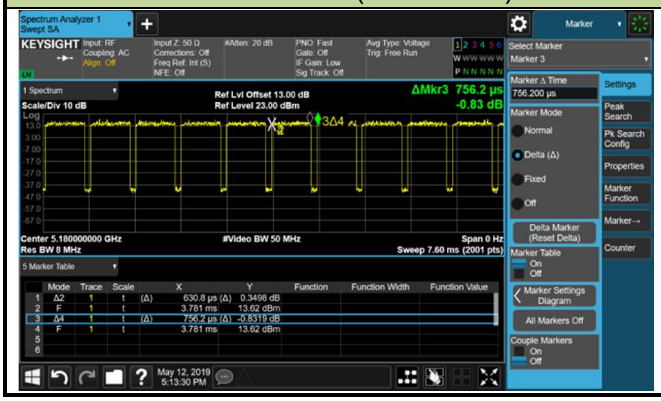
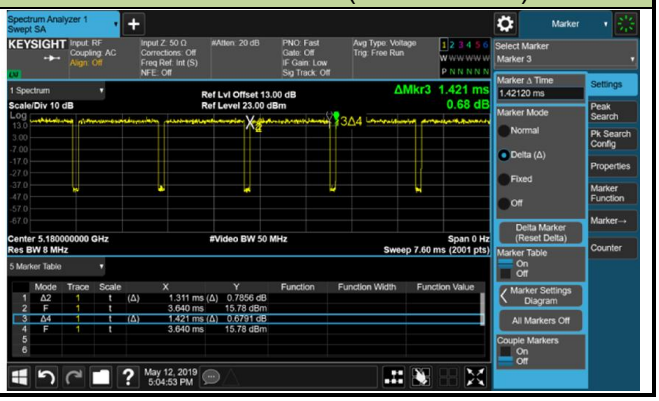
2.8. Device Capabilities

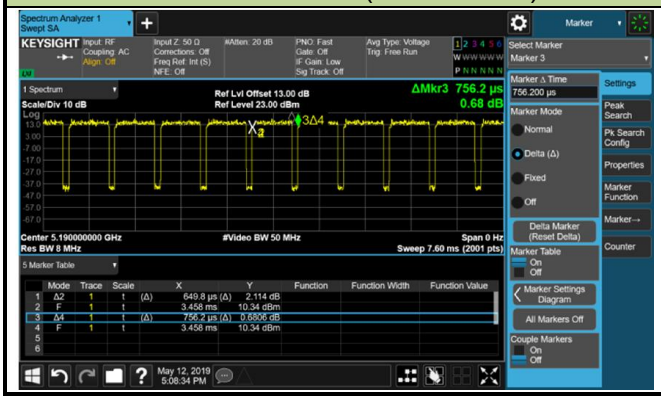
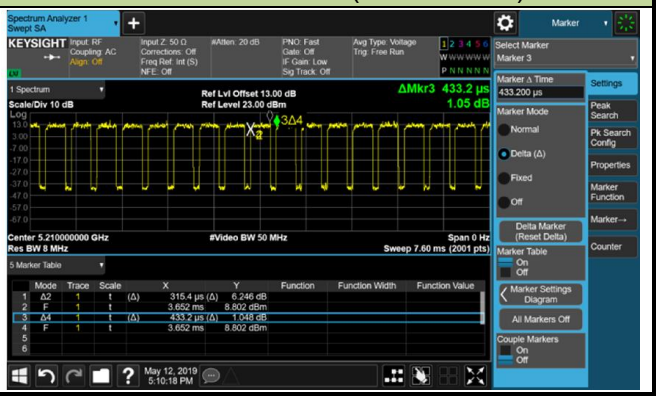
This device contains the following capabilities:

2.4GHz WLAN (DTS), 5GHz WLAN (UNII), Bluetooth v4.2 (DSS / DTS)

Note: 5GHz (NII) operation is possible in 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:

Model No.	Test Mode	Duty Cycle
STI6110-D101(RoHS)	802.11a	92.69%
	802.11n-HT20	91.63%
	802.11n-HT20	83.42%
	802.11ac-VHT20	92.26%
	802.11ac-VHT40	85.93%
	802.11ac-VHT80	72.81%

Duty Cycle (T = Transmission Duration)	
802.11a (T = 1.395ms)	802.11n-HT20 (T = 1.292ms)
	
802.11n-HT40 (T = 830.8s)	802.11ac-VHT20 (T = 1.311ms)
	

802.11ac-VHT40 (T = 649.8us)	802.11ac-VHT80 (T = 315.4us)
	

2.9. Test Configuration

The device was tested per the guidance of KDB 789033 D02v02r01.ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testingand AC line conducted testing.

2.10. EMI Suppression Device(s)/Modifications

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

2.11. 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 pamphletsupplied to the user and be readily visible to the purchaser at the time of purchase. However, when the deviceis 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 andlabel location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed WirelessDevices (ANSI C63.10-2013), and the guidance provided in KDB 789033 D02v02r01 were used in themeasurement of the device**.**

Deviation from measurement procedure…….....None

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, remotecontrolled, 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 tomaximize 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 theresponsible party can be used with the device. The use of a permanently attached antenna or of an antennathat uses a unique coupling to the intentional radiator shall be considered sufficient to comply with theprovisions 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

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2020/03/25
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2020/04/25
8-Wire ISN (T8)	R&S	ENY81	MRTTWA00018	1 year	2020/04/23
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2020/03/25
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2020/05/20

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2020/04/29
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2020/05/22
Broadband Hornantenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2020/04/22
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2020/04/23
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2020/04/24
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2020/04/24
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2020/03/26
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2020/03/25
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2019/07/30
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00010	1 year	2019/06/18
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00032	1 year	2020/05/20

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	1 year	2020/04/22
Wideband Radio Communication Taster	R&S	CMW 500	MRTTWA00041	1 year	2020/01/28
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2019/07/30
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTSUE06457	1 year	2019/07/19
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2020/03/26
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2020/05/20

Software	Version	Function
e3	9.160520a	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 - SR1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: 2.53dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.25dB 1GHz ~ 25GHz: 4.45dB

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	Section 7.2
15.407(e)	6dB Bandwidth	≥ 500kHz		Pass	Section 7.3
15.407(a)(1)(iv), (3)	Maximum Conducted Output Power	Refer to section 7.4		Pass	Section 7.4
15.407(h)(1)	Transmit Power Control	≤ 24 dBm		N/A	Section 7.5
15.407(a)(1)(iv), (3), (5)	Peak Power Spectral Density	Refer to section 7.6		Pass	Section 7.6
15.407(g)	Frequency Stability	± 20 ppm		Pass	Section 7.7
15.407(b)(1), (4)(i)	Undesirable Emissions	Refer to Section 7.8	Radiated	Pass	Section 7.8 & 7.9
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) Test Items “26dB Bandwidth” & “6dB Bandwidth” have been assessed MIMO transmission, and showed the worst test data in this report.
4) “N/A” means that this item is not applicable, and the detail information refers to relevant section.

7.2. 26dB Bandwidth Measurement

7.2.1.Test Limit

N/A

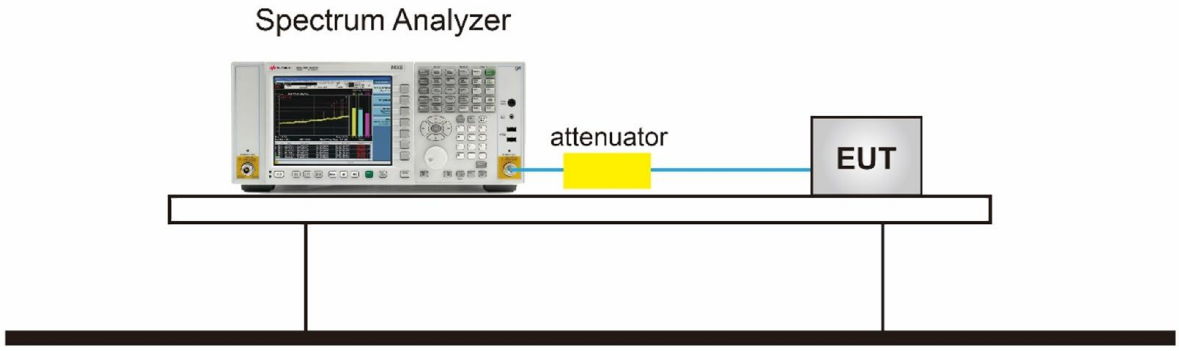
7.2.2.Test Procedure used

KDB 789033 D02v02r01 - Section C.1

7.2.3.Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW ≥ 3×RBW.
4. Detector = Peak.
5. Trace mode = max hold.

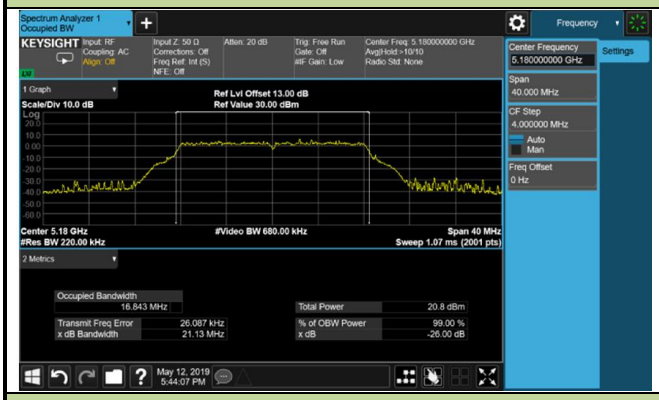
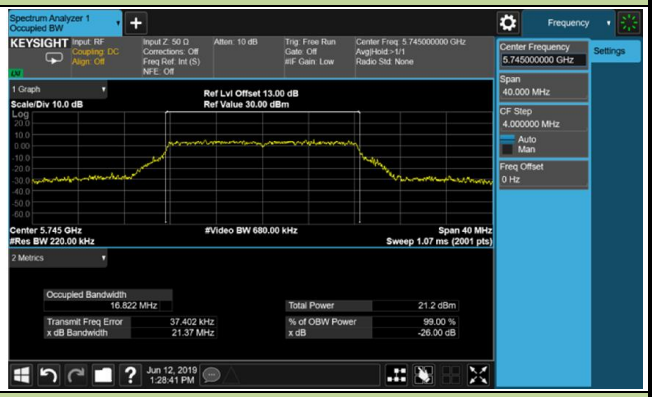
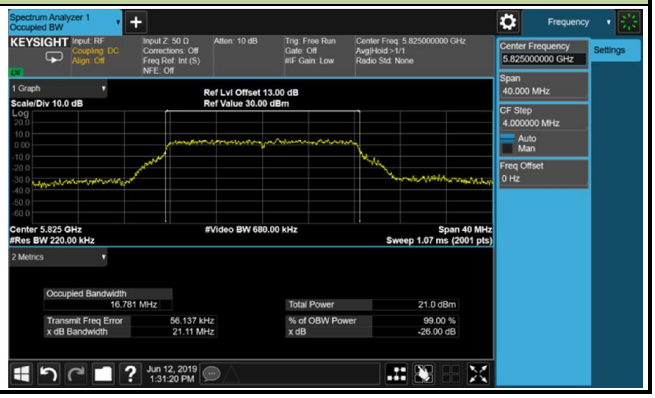
7.2.4.Test Setup

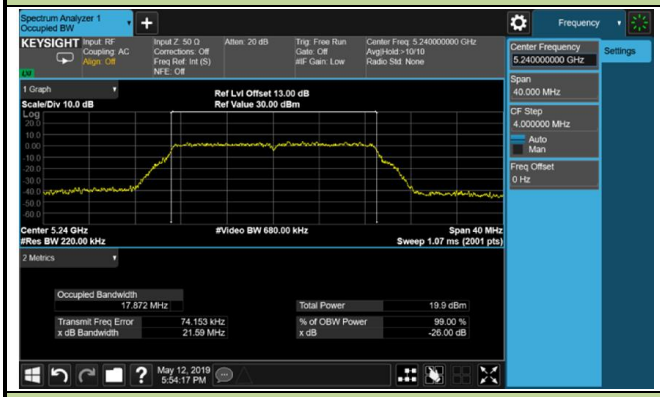
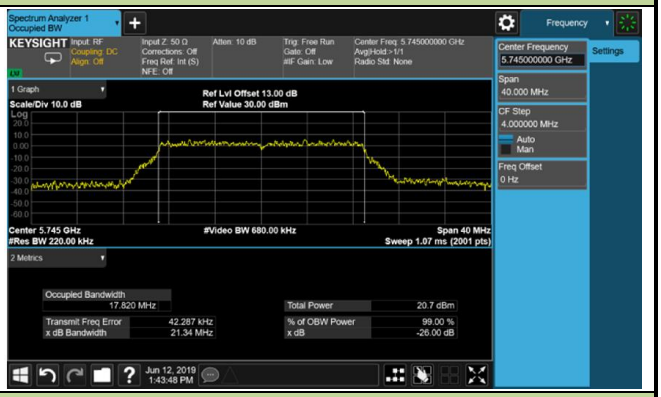
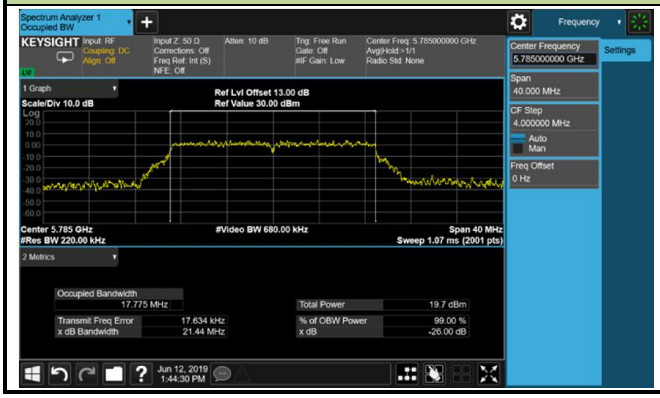
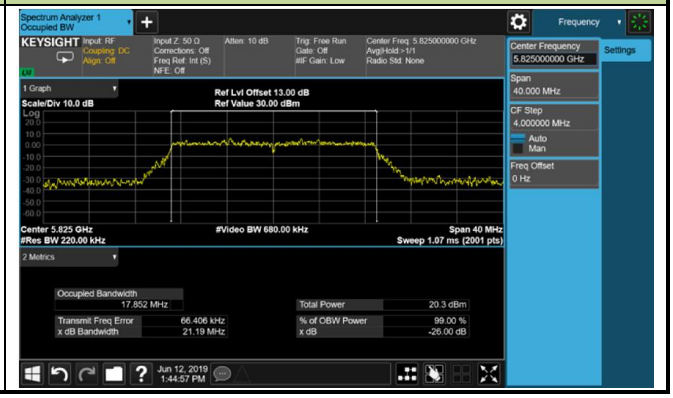


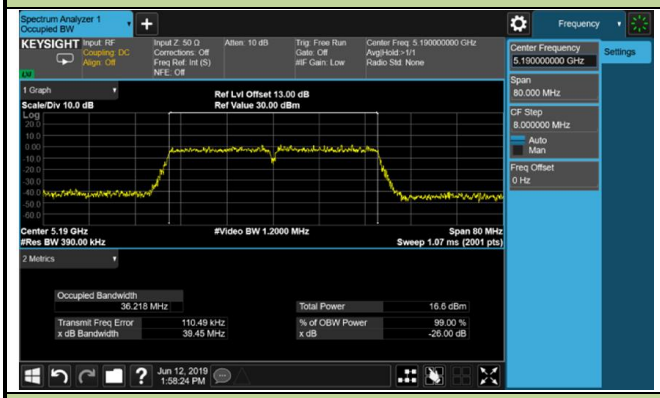
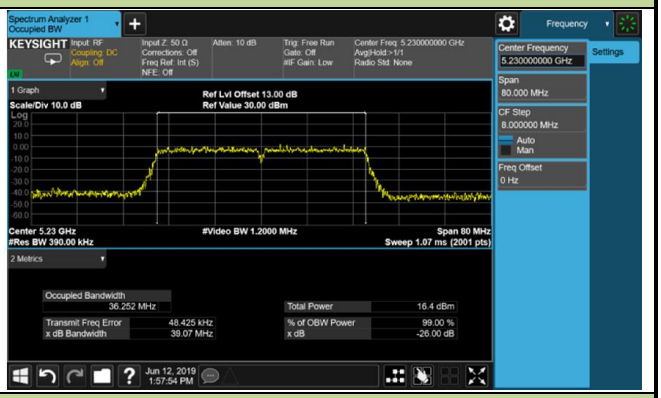
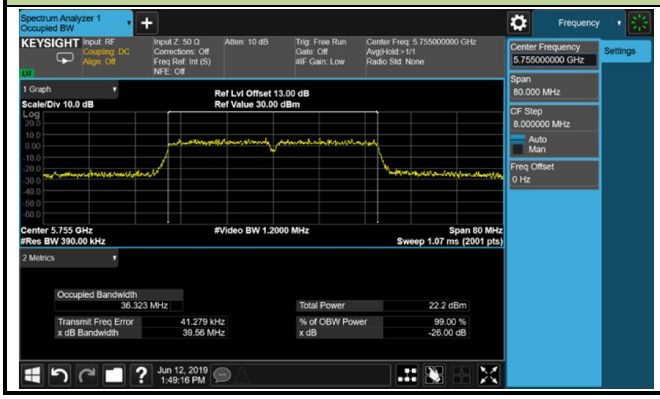
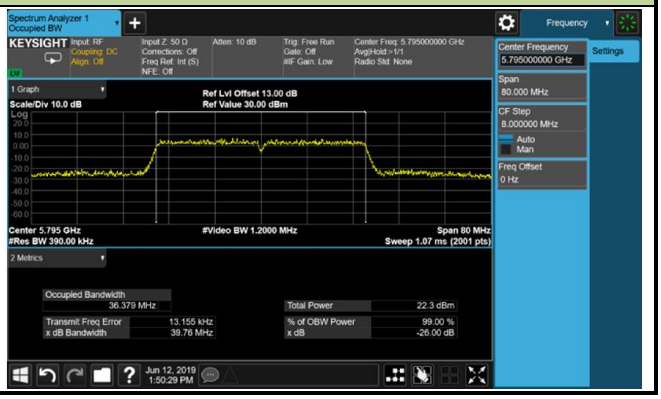
7.2.5.Test Result

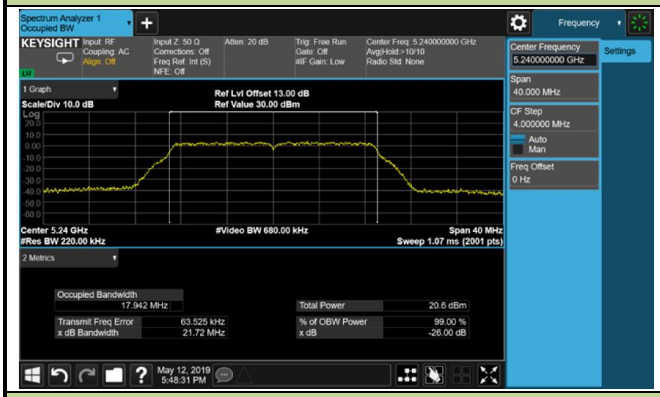
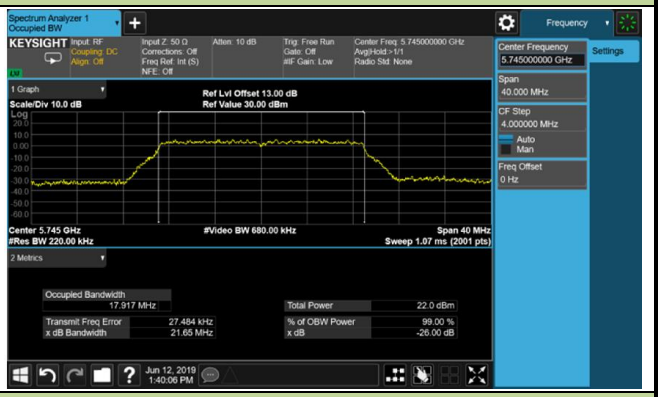
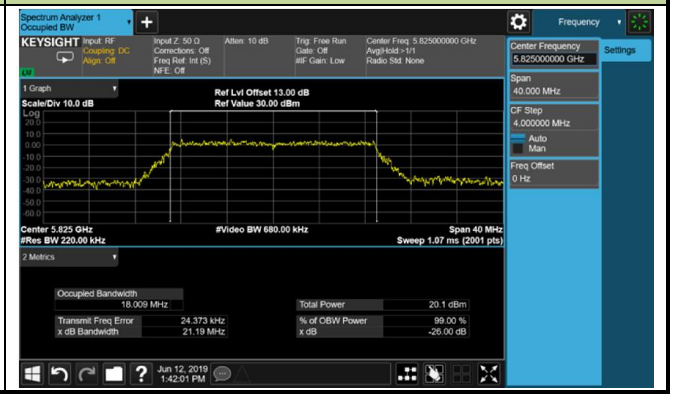
Product	Streaming Media Player	Temperature	24°C
Test Engineer	Kevin Ker	Relative Humidity	56%
Test Site	SR1	Test Date	2019/05/12~ 2019/06/12

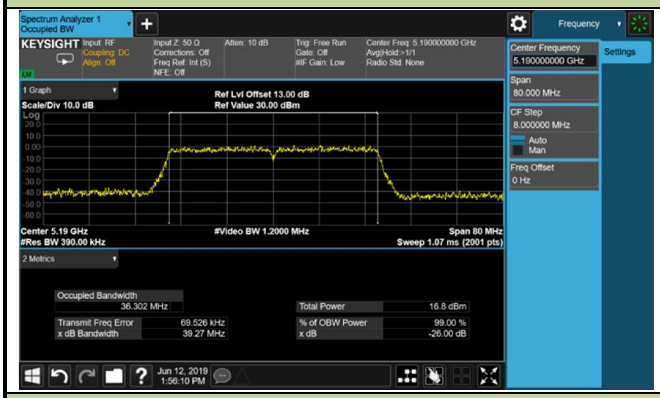
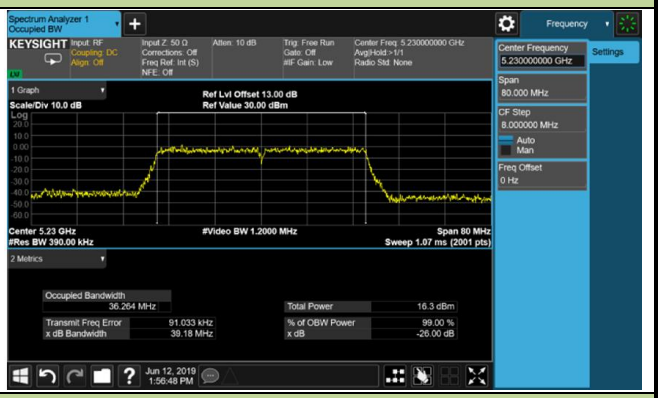
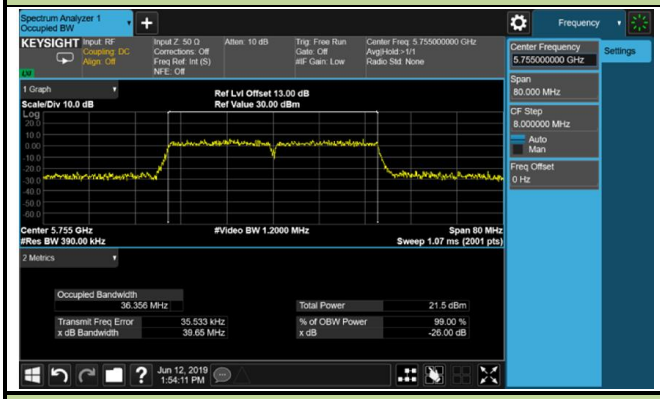
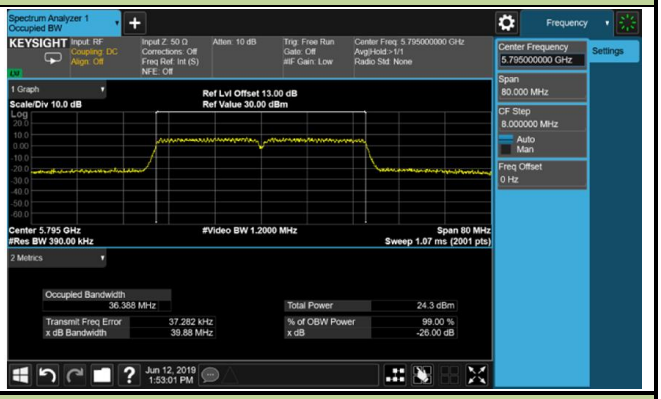
Test Mode	Data Rate/ Mbps	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	6Mbps	36	5180	21.13	16.84
802.11a	6Mbps	44	5220	21.36	16.83
802.11a	6Mbps	48	5240	21.62	16.84
802.11a	6Mbps	149	5745	21.37	16.82
802.11a	6Mbps	157	5785	21.26	16.83
802.11a	6Mbps	165	5825	21.11	16.78
802.11n-HT20	MCS0	36	5180	21.58	17.92
802.11n-HT20	MCS0	44	5220	21.64	17.94
802.11n-HT20	MCS0	48	5240	21.59	17.87
802.11n-HT20	MCS0	149	5745	21.34	17.82
802.11n-HT20	MCS0	157	5785	21.44	17.78
802.11n-HT20	MCS0	165	5825	21.19	17.85
802.11n-HT40	MCS0	38	5190	39.45	36.22
802.11n-HT40	MCS0	46	5230	39.07	36.25
802.11n-HT40	MCS0	151	5755	39.56	36.32
802.11n-HT40	MCS0	159	5795	39.76	36.38
802.11ac-VHT20	MCS0	36	5180	21.77	17.94
802.11ac-VHT20	MCS0	44	5220	21.69	17.94
802.11ac-VHT20	MCS0	48	5240	21.72	17.94
802.11ac-VHT20	MCS0	149	5745	21.65	17.92
802.11ac-VHT20	MCS0	157	5785	21.41	17.95
802.11ac-VHT20	MCS0	165	5825	21.19	18.01
802.11ac-VHT40	MCS0	38	5190	39.27	36.30
802.11ac-VHT40	MCS0	46	5230	39.18	36.26
802.11ac-VHT40	MCS0	151	5755	39.65	36.36
802.11ac-VHT40	MCS0	159	5795	39.88	36.39
802.11ac-VHT80	MCS0	42	5210	80.42	75.56
802.11ac-VHT80	MCS0	155	5775	81.61	75.75

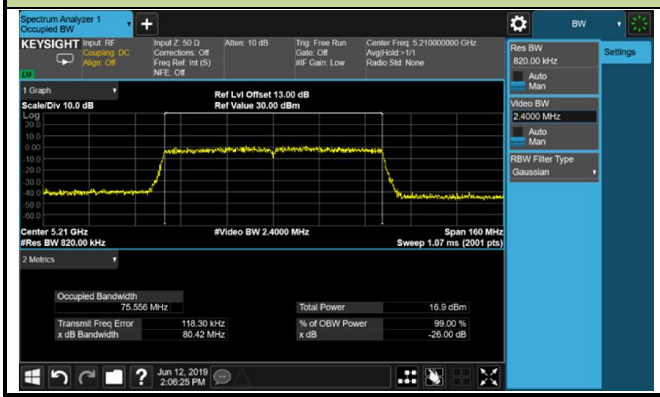
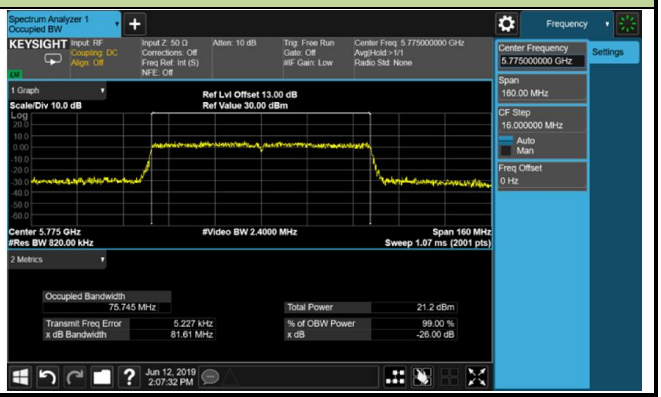
802.11a 26dB Bandwidth & 99% Bandwidth -Ant 1/ Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11n-HT20 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 1 + 2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11n-HT40 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 1 + 2	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 1 + 2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 1 + 2	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth - Ant 1 / Ant 1 + 2	
Channel 42 (5210MHz)	Channel 155 (5775MHz)
	

7.3. 6dB Bandwidth Measurement

7.3.1.Test Limit

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

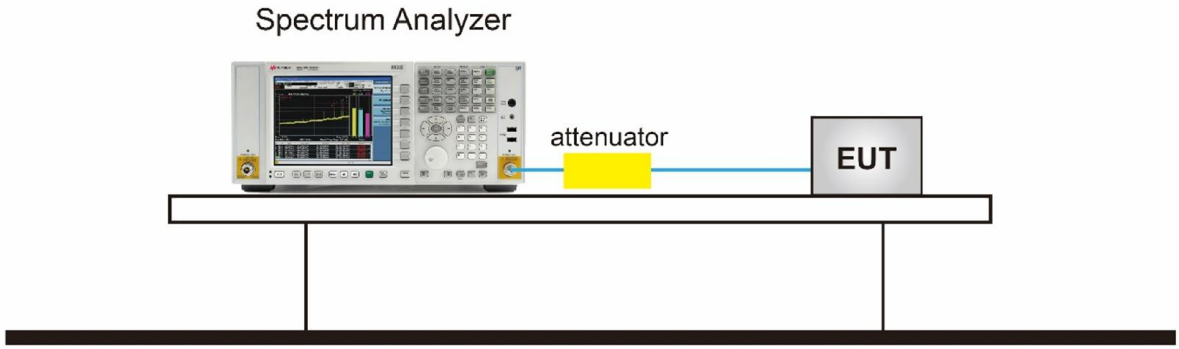
7.3.2.Test Procedure used

KDB 789033 D02v02r01 - Section C.2

7.3.3.Test Setting

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.

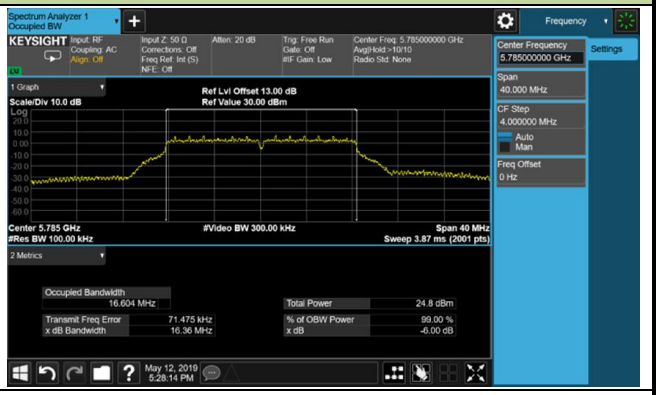
7.3.4.Test Setup

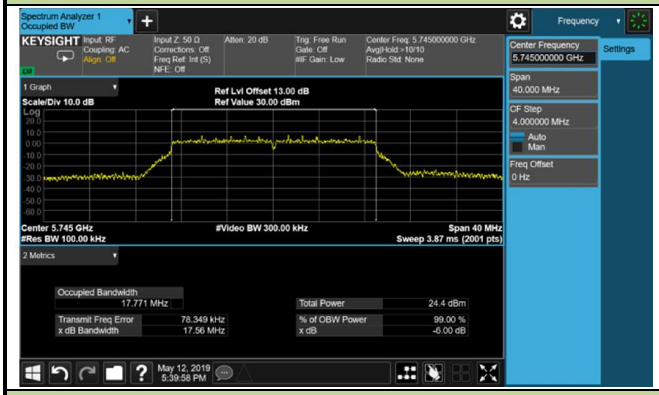
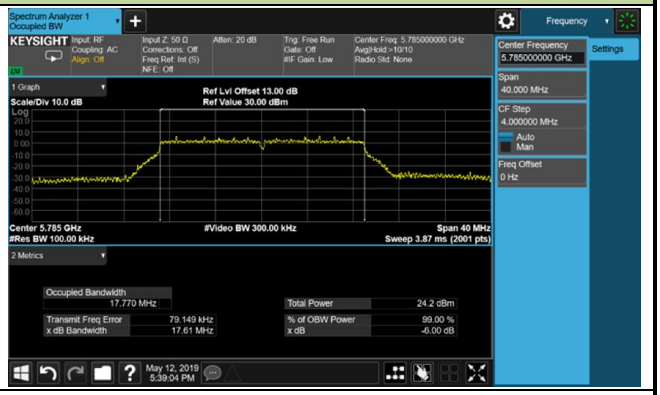


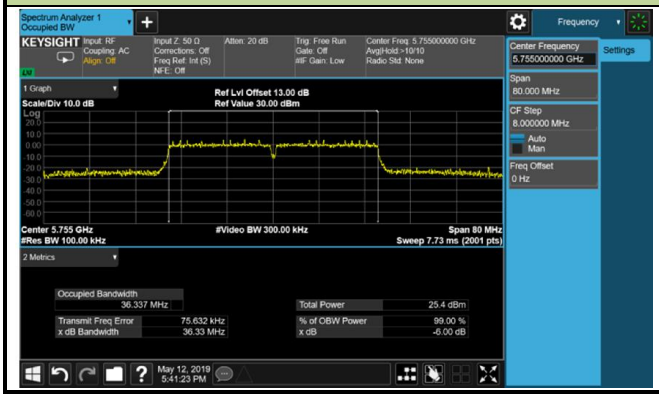
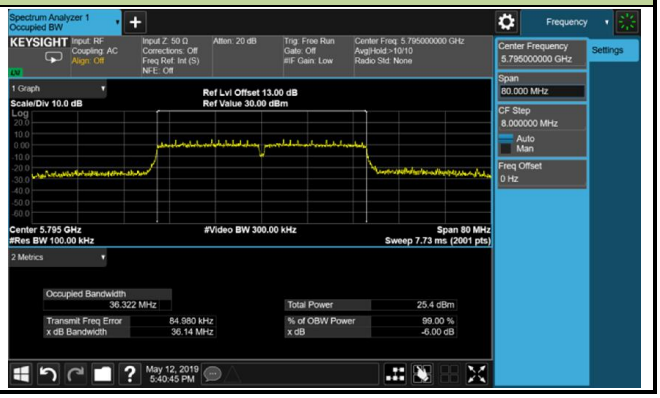
7.3.5.Test Result

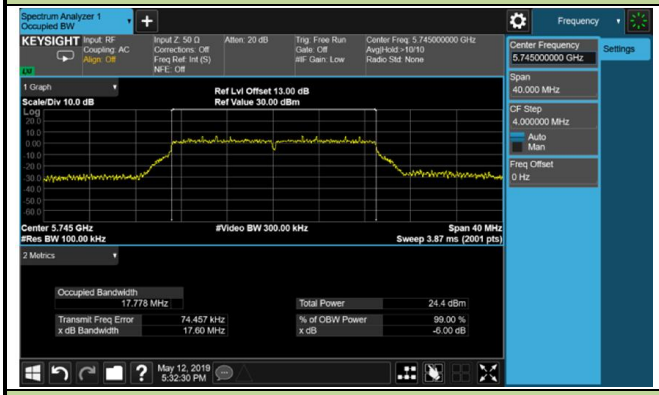
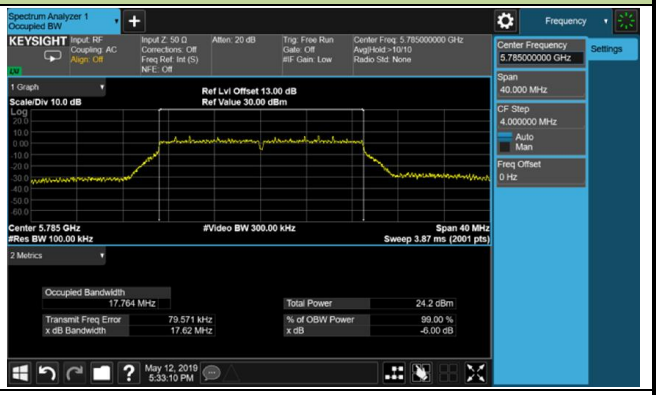
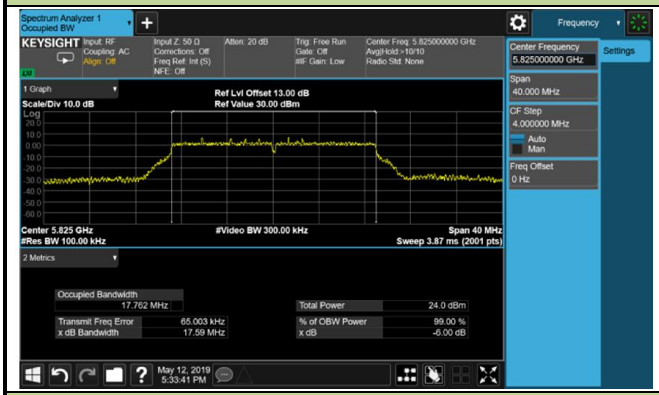
Product	Streaming Media Player	Temperature	24°C
Test Engineer	Kevin Ker	Relative Humidity	56%
Test Site	SR1	Test Date	2019/05/12

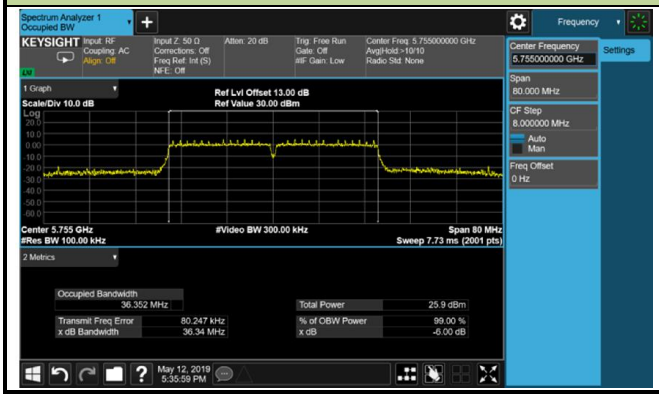
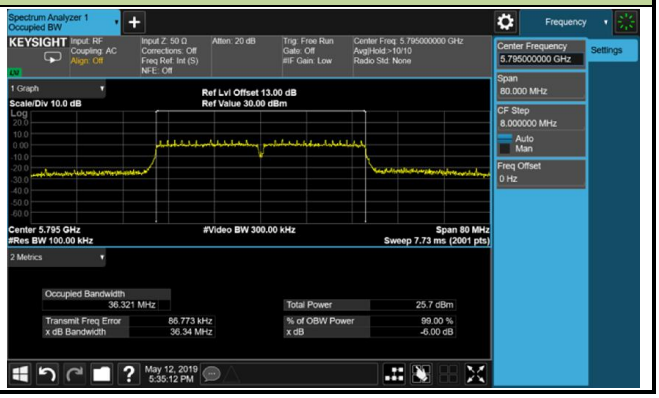
Test Mode	Data Rate/ Mbps	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11a	6Mbps	149	5745	16.39	≥ 0.5	Pass
802.11a	6Mbps	157	5785	16.36	≥ 0.5	Pass
802.11a	6Mbps	165	5825	16.36	≥ 0.5	Pass
802.11n-HT20	MCS0	149	5745	17.56	≥ 0.5	Pass
802.11n-HT20	MCS0	157	5785	17.61	≥ 0.5	Pass
802.11n-HT20	MCS0	165	5825	17.60	≥ 0.5	Pass
802.11n-HT40	MCS0	151	5755	36.33	≥ 0.5	Pass
802.11n-HT40	MCS0	159	5795	36.14	≥ 0.5	Pass
802.11ac-VHT20	MCS0	149	5745	17.60	≥ 0.5	Pass
802.11ac-VHT20	MCS0	157	5785	17.62	≥ 0.5	Pass
802.11ac-VHT20	MCS0	165	5825	17.59	≥ 0.5	Pass
802.11ac-VHT40	MCS0	151	5755	36.34	≥ 0.5	Pass
802.11ac-VHT40	MCS0	159	5795	36.34	≥ 0.5	Pass
802.11ac-VHT80	MCS0	155	5775	75.71	≥ 0.5	Pass

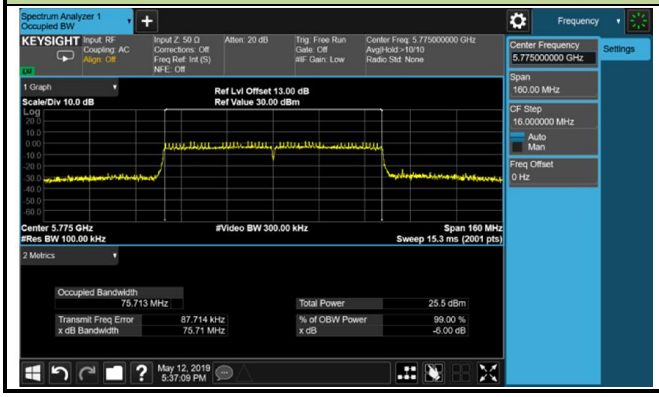
802.11a 6dB Bandwidth- Ant 1 / Ant 1 + 2	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	

802.11n-HT20 6dB Bandwidth- Ant 1 / Ant 1 + 2	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	

802.11n-HT40 6dB Bandwidth - Ant 1 / Ant 1 + 2	
Channel 149 (5755MHz)	Channel 157 (5795MHz)
	

802.11ac-VHT20 6dB Bandwidth - Ant 1 / Ant 1 + 2	
Channel 149 (5745MHz)	Channel 157 (5785MHz)
	
Channel 165 (5825MHz)	
	

802.11ac-VHT40 6dB Bandwidth - Ant 1 / Ant 1 + 2	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT80 6dB Bandwidth - Ant 1 / Ant 1 + 2	
Channel 155 (5775MHz)	
	

7.4. Output Power Measurement

7.4.1.Test Limit

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

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 maximumconducted output power shall be reduced by the amount in dB that the directional gain of theantenna exceeds 6dBi.

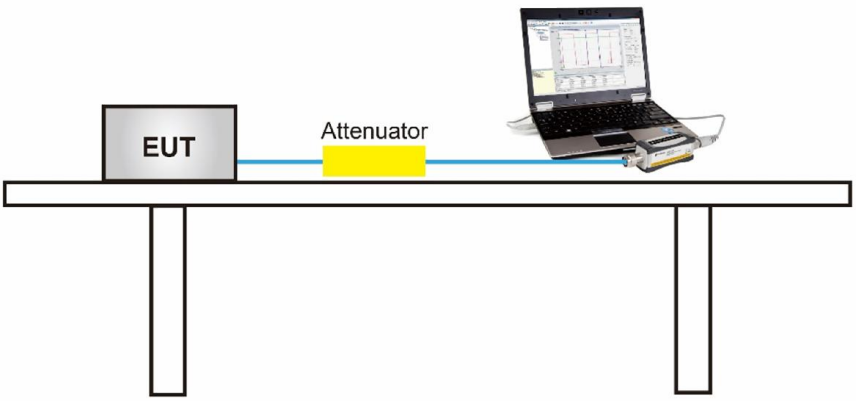
7.4.2.Test Procedure Used

KDB 789033 D02v02r01 - 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.Test Result

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

For Ant 1 / Ant 1 + 2 port:

Test Mode	Bandwidth	Channel	Frequency (MHz)	Data Rate/ Mbps	Average Power (dBm)
802.11a	20	36	5180	6Mbps	9.12
				24Mbps	8.92
				54Mbps	8.35
802.11n	20	36	5180	MCS0	9.14
				MCS3	8.65
				MCS7	8.19
802.11n	40	38	5190	MCS0	11.86
				MCS3	11.30
				MCS7	10.82
802.11ac	20	36	5180	MCS0	9.06
				MCS4	8.71
				MCS8	8.26
802.11ac	40	38	5190	MCS0	11.41
				MCS4	11.03
				MCS9	10.55
802.11ac	80	42	5210	MCS0	12.13
				MCS4	11.60
				MCS9	11.23

Product	Streaming Media Player	Temperature	25°C
Test Engineer	Kevin Ker	Relative Humidity	56%
Test Site	SR1	Test Date	2019/05/12~ 2019/06/13

Test Mode	Data Rate/ Mbps	Channel No.	Freq. (MHz)	Ant 1 Average Power (dBm)	Ant 2 Average Power (dBm)	Total Average Power (dBm)	Average Power Limit (dBm)	Result
11a	6Mbps	36	5180	9.12	9.01	12.08	≤ 28.90	Pass
11a	6Mbps	44	5220	9.14	8.98	12.07	≤ 28.90	Pass
11a	6Mbps	48	5240	9.11	8.70	11.92	≤ 28.90	Pass
11a	6Mbps	149	5745	18.52	17.79	21.18	≤ 30.00	Pass
11a	6Mbps	157	5785	18.53	17.91	21.24	≤ 30.00	Pass
11a	6Mbps	165	5825	18.35	17.82	21.10	≤ 30.00	Pass
11n-HT20	MCS0	36	5180	9.14	8.81	11.99	≤ 28.90	Pass
11n-HT20	MCS0	40	5220	9.05	8.71	11.89	≤ 28.90	Pass
11n-HT20	MCS0	48	5240	8.81	8.91	11.87	≤ 28.90	Pass
11n-HT20	MCS0	149	5745	18.17	17.79	20.99	≤ 30.00	Pass
11n-HT20	MCS0	157	5785	18.39	17.78	21.11	≤ 30.00	Pass
11n-HT20	MCS0	165	5825	18.53	17.77	21.18	≤ 30.00	Pass
11n-HT40	MCS0	38	5190	11.86	11.06	14.49	≤ 28.90	Pass
11n-HT40	MCS0	46	5230	11.79	11.10	14.47	≤ 28.90	Pass
11n-HT40	MCS0	151	5755	19.27	18.60	21.96	≤ 30.00	Pass
11n-HT40	MCS0	159	5795	19.22	18.28	21.79	≤ 30.00	Pass
11ac-VHT20	MCS0	36	5180	9.06	9.01	12.05	≤ 28.90	Pass
11ac-VHT20	MSC0	40	5220	9.07	9.13	12.11	≤ 28.90	Pass
11ac-VHT20	MCS0	48	5240	9.11	8.98	12.06	≤ 28.90	Pass
11ac-VHT20	MSC0	149	5745	18.36	17.71	21.06	≤ 30.00	Pass
11ac-VHT20	MCS0	157	5785	18.29	17.67	21.00	≤ 30.00	Pass
11ac-VHT20	MCS0	165	5825	18.38	17.86	21.14	≤ 30.00	Pass
11ac-VHT40	MCS0	38	5190	11.41	11.14	14.29	≤ 28.90	Pass
11ac-VHT40	MSC0	46	5230	11.51	11.22	14.38	≤ 28.90	Pass
11ac-VHT40	MSC0	151	5755	19.13	18.48	21.83	≤ 30.00	Pass
11ac-VHT40	MCS0	159	5795	19.03	18.41	21.74	≤ 30.00	Pass
11ac-VHT80	MSC0	42	5210	12.13	12.19	15.17	≤ 28.90	Pass
11ac-VHT80	MCS0	155	5775	17.86	17.03	20.48	≤ 30.00	Pass

Note1: The Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 1 Average Power }/10)} + 10^{(\text{Ant 2 Average Power }/10)}\}$.

Note 2: For 5150-5250MHz, the conducted power limit = 30dBm - (7.1dBi - 6dB) = 28.90dBm

Note 3: For 5725-5850MHz, the conducted power limit = 30dBm

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.

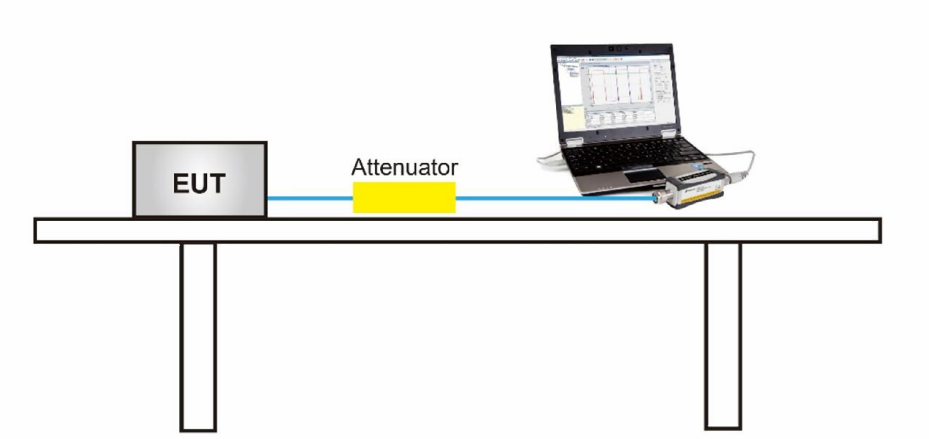
7.5.2.Test Procedure Used

KDB 789033 D02v01- Section E)3)b) 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. The trace was averaged over 100 traces to obtain the final measured average power.

7.5.4.Test Setup



7.5.5.Test Result

A TPC mechanism is not required for systems operating in frequency band 5150 ~ 5250 MHz & 5725 ~ 5850 MHz.

7.6. Power Spectral Density Measurement

7.6.1.Test Limit

For the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 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 theantenna exceeds 6dBi.

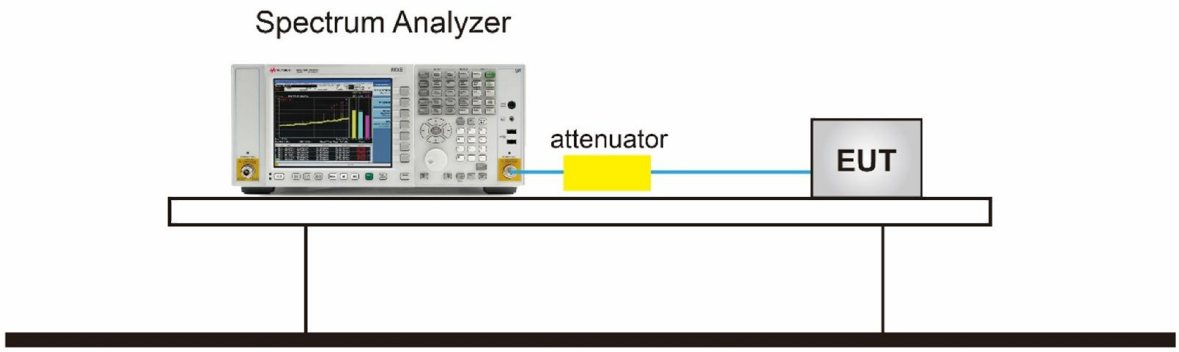
7.6.2.Test Procedure Used

KDB 789033 D02v02r01 - SectionF

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 = 100 kHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. 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.
11. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor 10*log(500kHz/100kHz) = 6.99 dB to the measured result.

7.6.4.Test Setup



7.6.5.Test Result

Product	Streaming Media Player	Temperature	24°C
Test Engineer	Kevin Ker	Relative Humidity	56%
Test Site	SR1	Test Date	2019/05/12 ~ 2019/06/13

For U-NII 1

Test Mode	Data Rate /Mbps	Channel No.	Freq. (MHz)	Ant 1 PSD (dBm/MHz)	Ant 2 PSD (dBm/MHz)	Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/MHz)	Result
11a	6Mbps	36	5180	-3.60	-3.77	92.69	-0.34	≤ 12.89	Pass
11a	6Mbps	44	5220	-3.49	-3.98	92.69	-0.39	≤ 12.89	Pass
11a	6Mbps	48	5240	-3.50	-3.74	92.69	-0.28	≤ 12.89	Pass
11n-HT20	MCS0	36	5180	-3.68	-3.69	91.63	-0.30	≤ 12.89	Pass
11n-HT20	MCS0	44	5220	-3.64	-3.99	91.63	-0.42	≤ 12.89	Pass
11n-HT20	MCS0	48	5240	-3.87	-3.79	91.63	-0.44	≤ 12.89	Pass
11n-HT40	MCS0	38	5190	-3.87	-4.23	83.42	-0.25	≤ 12.89	Pass
11n-HT40	MCS0	46	5230	-3.91	-4.43	83.42	-0.36	≤ 12.89	Pass
11ac-VHT20	MCS0	36	5180	-3.70	-3.85	92.26	-0.41	≤ 12.89	Pass
11ac-VHT20	MCS0	44	5220	-3.83	-3.75	92.26	-0.43	≤ 12.89	Pass
11ac-VHT20	MCS0	48	5240	-3.69	-3.87	92.26	-0.42	≤ 12.89	Pass
11ac-VHT40	MCS0	38	5190	-4.11	-4.17	85.93	-0.47	≤ 12.89	Pass
11ac-VHT40	MCS0	46	5230	-3.86	-4.14	85.93	-0.33	≤ 12.89	Pass
11ac-VHT80	MCS0	42	5210	-6.71	-6.75	72.81	-2.34	≤ 12.89	Pass

Note: When EUT duty cycle ≥ 98%, the total PSD (dBm/MHz) = 10*log $\{10^{(\text{Ant 1 PSD/10})} + 10^{(\text{Ant 2 PSD/10})}\}$ (dBm/MHz).

When EUT duty cycle < 98%, the total PSD (dBm/MHz) = 10*log $\{10^{(\text{Ant 1 PSD/10})} + 10^{(\text{Ant 2 PSD/10})}\}$ (dBm/MHz) + 10*log (1/Duty Cycle).

Note 2: PSD Limit (dBm/MHz) = 17dBm/MHz - (10.11dBi-6dB) = 12.89dBm/MHz

For U-NII 3									
Test Mode	Data Rate/ Mbps	Channel No.	Freq. (MHz)	Ant 1 PSD (dBm/ 100kHz)	Ant 2 PSD (dBm/ 100kHz)	Duty Cycle (%)	Total PSD (dBm/ 500kHz)	Limit (dBm/ 500kHz)	Result
11a	6Mbps	149	5745	-2.76	-3.46	92.69	7.23	≤ 29.99	Pass
11a	6Mbps	157	5785	-2.26	-3.17	92.69	7.64	≤ 29.99	Pass
11a	6Mbps	165	5825	-3.01	-3.53	92.69	7.07	≤ 29.99	Pass
11n-HT20	MCS8	149	5745	-3.03	-3.99	91.63	6.90	≤ 29.99	Pass
11n-HT20	MCS8	157	5785	-3.14	-3.95	91.63	6.85	≤ 29.99	Pass
11n-HT20	MCS8	165	5825	-3.14	-3.87	91.63	6.89	≤ 29.99	Pass
11n-HT40	MCS8	151	5755	-5.06	-5.98	83.42	5.29	≤ 29.99	Pass
11n-HT40	MCS8	159	5795	-5.46	-5.89	83.42	5.12	≤ 29.99	Pass
11ac-VHT20	MCS0	149	5745	-3.16	-3.87	92.26	6.85	≤ 29.99	Pass
11ac-VHT20	MCS0	157	5785	-3.09	-3.77	92.26	6.93	≤ 29.99	Pass
11ac-VHT20	MCS0	165	5825	-3.23	-4.06	92.26	6.72	≤ 29.99	Pass
11ac-VHT40	MCS0	151	5755	-5.03	-5.91	85.93	5.21	≤ 29.99	Pass
11ac-VHT40	MCS0	159	5795	-5.50	-5.79	85.93	5.02	≤ 29.99	Pass
11ac-VHT80	MCS0	155	5775	-9.05	-9.87	72.81	1.94	≤ 29.99	Pass

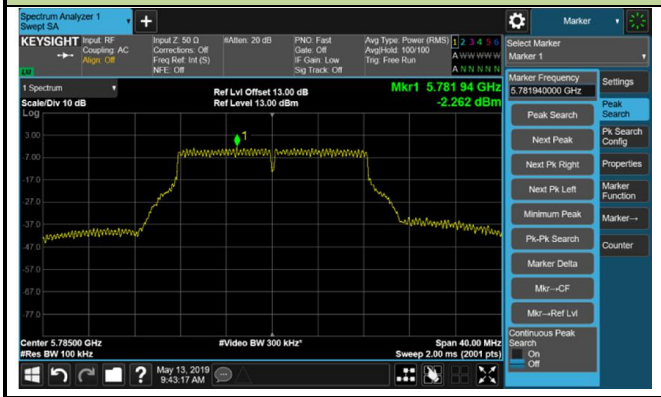
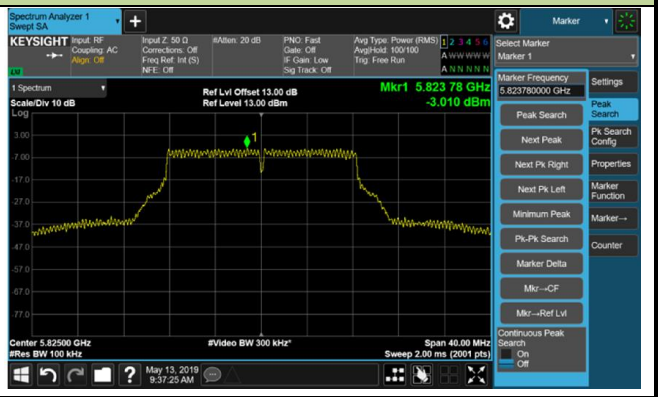
Note 1:

When EUT duty cycle ≥ 98%, the total PSD (dBm/500kHz) = 10*log {$10^{(\text{Ant 1 PSD}/10)}$ + $10^{(\text{Ant 2 PSD}/10)}$} (dBm/100kHz) + Constant Factor (dB).

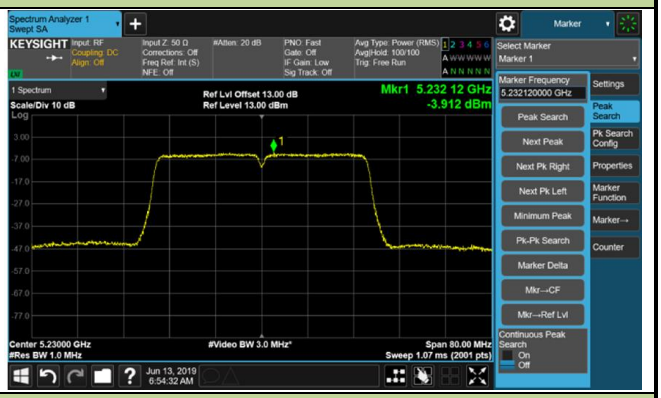
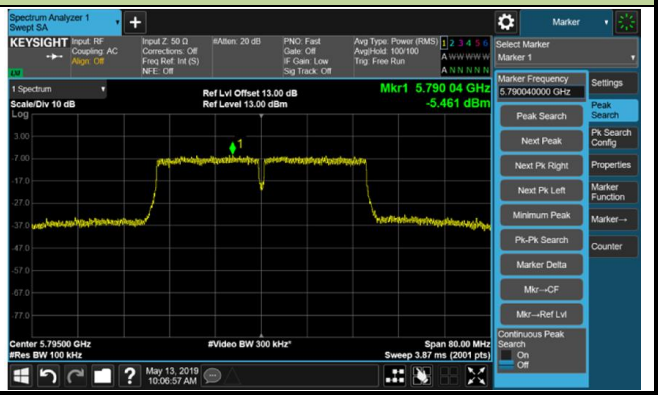
When EUT duty cycle < 98%, the total PSD (dBm/500kHz) = 10*log {$10^{(\text{Ant 1 PSD}/10)}$ + $10^{(\text{Ant 2 PSD}/10)}$} (dBm/100kHz) + Constant Factor (dB) + 10*log (1/Duty Cycle).

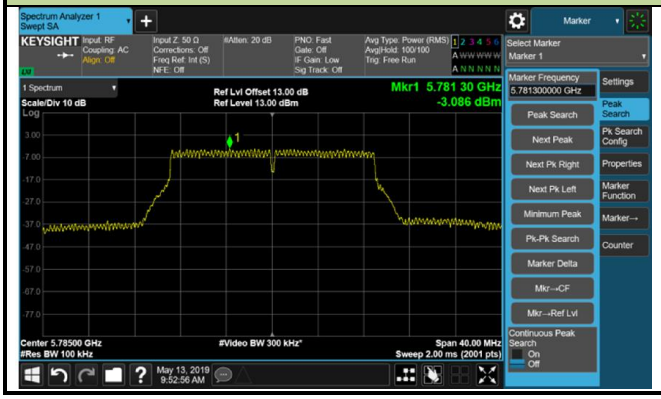
Note 2: Constant Factor (dB) = 6.99dB

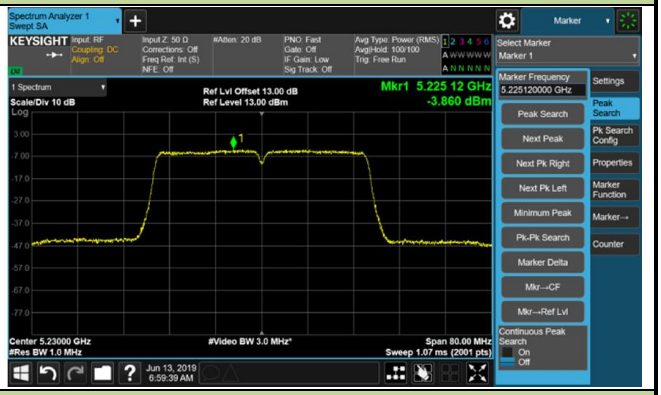
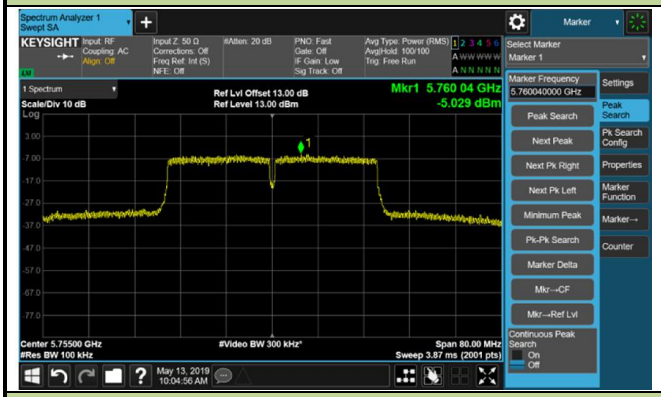
Note 3: PSD Limit (dBm/500kHz) = 30dBm/500kHz - (6.01dBi -6dB) = 29.99dBm/500kHz

802.11a Power Spectral Density - Ant 1 / Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11n-HT20 Power Spectral Density - Ant 1 / Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

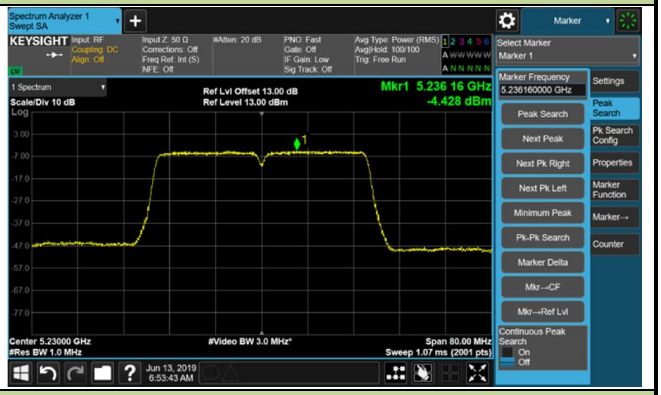
802.11n-HT40 Power Spectral Density - Ant 1 / Ant 1+2	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	

802.11ac-VHT20 Power Spectral Density - Ant 1 / Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11ac-VHT40 Power Spectral Density - Ant 1 / Ant 1+2	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)
	
802.11ac-VHT80 Power Spectral Density - Ant 1 / Ant 1+2	
Channel 42 (5210MHz)	Channel 155 (5775MHz)
	

802.11a Power Spectral Density - Ant 2 / Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11n-HT20 Power Spectral Density - Ant 2 / Ant 1+2	
Channel 36 (5180MHz)	Channel 44 (5220MHz)
	
Channel 48 (5240MHz)	Channel 149 (5745MHz)
	
Channel 157 (5785MHz)	Channel 165 (5825MHz)
	

802.11n-HT40 Power Spectral Density - Ant 2 / Ant 1+2	
Channel 38 (5190MHz)	Channel 46 (5230MHz)
	
Channel 151 (5755MHz)	Channel 159 (5795MHz)