



**CFR 47 FCC PART 15 SUBPART E
ISED RSS-247 ISSUE 2**

TEST REPORT

For

Square Terminal

MODEL NUMBER: SPD2-01-A

FCC ID: 2AF3K-SPD2

IC: 21827-SPD2

REPORT NUMBER: 4789331395-9

ISSUE DATE: June 2, 2020

Prepared for

**Square, Inc. (FCC)
1455 Market St, Suite 600, San Francisco, California, United States 94103**

**Square Canada, Inc. (ISED)
5000 Yonge Street, Suite 1501; Toronto, ON, M2N7E9 Canada**

Prepared by

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake
Hi-Tech Development Zone Dongguan, People's Republic of China
Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com**



Revision History

Rev.	Issue Date	Revisions	Revised By
V0	06/02/2020	Initial Issue	



Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6dB/26dB Bandwidth	FCC 15.407 (a)&(e) RSS-247 Clause 6.2	PASS
2	99% Occupied Bandwidth	RSS-Gen Clause 6.6	PASS
3	Maximum Conducted Output Power	FCC 15.407 (a) RSS-247 Clause 6.2	PASS
4	Power Spectral Density	FCC 15.407 (a) RSS-247 Clause 6.2	PASS
5	Radiated Bandedge and Spurious Emission	FCC 15.407 (b) FCC 15.209 FCC 15.205 RSS-247 Clause 6.2 RSS-GEN Clause 8.9	PASS
6	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	PASS
7	Frequency Stability	FCC 15.407 (g)	PASS
8	Dynamic Frequency Selection	FCC 15.407 (h) RSS-247 Clause 6.3	PASS
9	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	PASS
Note: 1. This test report is only published to and used by the applicant, and it is not for evidence purpose in China. 2. The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 15 SUBPART E >> ISED RSS-247 > when <Accuracy Method> decision rule is applied.			



TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	6
2. TEST METHODOLOGY	8
3. FACILITIES AND ACCREDITATION	8
4. CALIBRATION AND UNCERTAINTY	9
4.1. MEASURING INSTRUMENT CALIBRATION	9
4.2. MEASUREMENT UNCERTAINTY.....	9
5. EQUIPMENT UNDER TEST	10
5.1. DESCRIPTION OF EUT	10
5.2. MAXIMUM EIRP	11
5.3. CHANNEL LIST	12
5.4. THE WORSE CASE POWER SETTING PARAMETER.....	14
5.5. THE WORSE CASE CONFIGURATIONS	16
5.6. DESCRIPTION OF AVAILABLE ANTENNAS	17
5.7. DESCRIPTION OF TEST SETUP.....	18
6. MEASURING INSTRUMENT AND SOFTWARE USED	19
7. ANTENNA PORT TEST RESULTS.....	21
7.1. ON TIME AND DUTY CYCLE.....	21
7.2. 6/26/99% dB BANDWIDTH.....	23
7.2.1. 802.11a 20 MODE	25
7.2.2. 802.11ac VHT20 MODE	30
7.2.3. 802.11ac VHT40 MODE	35
7.2.4. 802.11ac VHT80 MODE	40
7.3. MAXIMUM CONDUCTED OUTPUT POWER.....	44
7.3.1. UNII-1 BAND	46
7.3.2. UNII-2A BAND	47
7.3.3. UNII-2C BAND.....	48
7.3.4. UNII-3 BAND	49
7.4. POWER SPECTRAL DENSITY	50
7.4.1. 802.11a 20 MODE	52
7.4.2. 802.11ac VHT20 MODE	56
7.4.3. 802.11ac VHT40 MODE	64
7.4.4. 802.11ac VHT80 MODE	70
8. RADIATED TEST RESULTS.....	74
8.1. 802.11a 20 MODE	80
8.1.1. UNII-1 BAND	80
8.1.2. UNII-2A BAND	96



8.1.3.	UNII-2C BAND.....	112
8.1.4.	UNII-3 BAND	130
8.2.	802.11ac VHT20 MODE	146
8.2.1.	UNII-1 BAND	146
8.2.2.	UNII-2A BAND	162
8.2.3.	UNII-2C BAND.....	178
8.2.4.	UNII-3 BAND	196
8.3.	802.11ac VHT40 MODE	212
8.3.1.	UNII-1 BAND	212
8.3.2.	UNII-2A BAND	224
8.3.3.	UNII-2C BAND.....	236
8.3.1.	UNII-3 BAND	254
8.4.	802.11ac VHT80 MODE	266
8.4.1.	UNII-1 BAND	266
8.4.2.	UNII-2A BAND	274
8.4.3.	UNII-2C BAND.....	282
8.4.4.	UNII-3 BAND	296
8.5.	SPURIOUS EMISSIONS 18~26GHz	302
8.5.1.	802.11a 20 MOD	302
8.6.	SPURIOUS EMISSIONS 26~40GHz	304
8.6.1.	802.11a 20 MODE	304
8.7.	SPURIOUS EMISSIONS 30M ~ 1 GHz	306
8.7.1.	802.11a 20 MODE	306
8.8.	SPURIOUS EMISSIONS BELOW 30M.....	308
8.8.1.	802.11a 20 MODE	308
9.	AC POWER LINE CONDUCTED EMISSIONS	311
9.1.	802.11a 20 MODE	312
10.	FREQUENCY STABILITY.....	314
11.	DYNAMIC FREQUENCY SELECTION	316
12.	ANTENNA REQUIREMENTS	321



1. ATTESTATION OF TEST RESULTS

FCC

Applicant Information

Company Name: Square, Inc.
Address: 1455 Market St, Suite 600, San Francisco, California, United States 94103

ISED

Applicant Information

Company Name: Square Canada, Inc.
Address: 5000 Yonge Street, Suite 1501; Toronto, ON, M2N7E9 Canada

FCC

Manufacturer Information

Company Name: Square, Inc.
Address: 1455 Market St, Suite 600, San Francisco, California, United States 94103

ISED

Manufacturer Information

Company Name: Square Canada, Inc.
Address: 5000 Yonge Street, Suite 1501; Toronto, ON, M2N7E9 Canada

EUT Description

EUT Name: Square Terminal
Model for Canada: SPD2-01-A
Model for US: SPD2-01
Sample Status: Normal
Sample ID: 2809002
Sample Received date: Jan 13, 2020
Date Tested: Jan 13~ May 21, 2020



APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 FCC PART 15 SUBPART E	PASS
ISED RSS-247 Issue 2	PASS
ISED RSS-GEN Issue 5	PASS

Prepared By:

Kebo Zhang
Project Engineer

Checked By:

Shawn Wen
Laboratory Leader

Approved By:

Stephen Guo
Laboratory Manager



2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, CFR 47 FCC Part 2, CFR 47 FCC Part 15, KDB 789033 D02 v02r01, RSS-GEN Issue 5, RSS-247 Issue 2, KDB414788 D01 Radiated Test Site v01, KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 and KDB 905462 D03 UNII clients without radar detection New Rules v01r02. KDB 905462 D04 Operational Modes for DFS Testing New Rules v01

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. FCC (FCC Designation No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules ISED(Company No.: 21320) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320. VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011
---------------------------	---

Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OFS.



4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	3.62dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.00dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.78dB (1GHz-18GHz)
	5.23dB (18GHz-26GHz)
	5.64dB (26GHz-40GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	



5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name	Square Terminal		
Model for Canada	SPD2-01-A		
Model for US	SPD2-01		
Radio Technology	IEEE802.11a 20 IEEE802.11n HT20/n HT40 IEEE802.11ac VHT20/VHT40/VHT80		
Operation frequency	UNII-1/UNII-2A/UNII-2C/UNII-3		
Modulation	OFDM(BPSK,QPSK,16QAM,64QAM, 256QAM only for 11 ac mode)		
Rating:	Power Adapter	Input	100~240V,50/60Hz,1.4A
		Output	5V dc,3.0A; 9V dc,3.0A; 15V dc,3.0A; 20V dc,3.0A
Battery:	7.2Vdc, 3135mAh		



5.2. MAXIMUM EIRP

UNII-1 BAND

IEE Std.	Frequency (MHz)	Max Power (dBm)	Max EIRP (dBm)
802.11a 20	5150-5250	13.00	19.30
802.11n HT20	5150-5250	11.49	19.32
802.11n HT40	5150-5250	13.27	21.10
802.11ac VHT20	5150-5250	11.71	19.55
802.11ac VHT40	5150-5250	13.63	21.47
802.11ac VHT80	5150-5250	13.23	21.07

UNII-2A BAND

IEE Std.	Frequency (MHz)	Max Power (dBm)
802.11a 20	5250-5350	14.11
802.11n HT20	5250-5350	16.88
802.11n HT40	5250-5350	15.98
802.11ac VHT20	5250-5350	16.90
802.11ac VHT40	5250-5350	16.05
802.11ac VHT80	5250-5350	11.41

UNII-2C BAND

IEE Std.	Frequency (MHz)	Max Power (dBm)
802.11a 20	5470-5725	16.02
802.11n HT20	5470-5725	16.96
802.11n HT40	5470-5725	18.58
802.11ac VHT20	5470-5725	17.02
802.11ac VHT40	5470-5725	19.06
802.11ac VHT80	5470-5725	19.01

UNII-3 BAND

IEE Std. 802.11	Frequency (MHz)	Max Power (dBm)
802.11a 20	5725-5850	15.82
802.11n HT20	5725-5850	18.44
802.11n HT40	5725-5850	18.30
802.11ac VHT20	5725-5850	18.50
802.11ac VHT40	5725-5850	18.45
802.11ac VHT80	5725-5850	18.39

**5.3. CHANNEL LIST**

20 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	36	5180
	40	5200
	44	5220
	48	5240
UNII-2A	52	5260
	56	5280
	60	5300
	64	5320
UNII-2C	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	132	5660
	136	5680
	140	5700
UNII-3	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

40 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	38	5190
	46	5230
UNII-2	54	5270
	62	5310
UNII-2C	102	5510
	110	5550
	134	5670
UNII-3	151	5755
	159	5795



80 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	42	5210
UNII-2A	58	5290
UNII-2C	106	5530
	122	5610
UNII-3	155	5775

**5.4. THE WORSE CASE POWER SETTING PARAMETER**

The Worse Case Power Setting Parameter	
Test Software	QRCT

UNII-1

Mode	Rate	Channel	Software Setting Value	
			ANT1	ANT2
11a	6M	36	13	13
		40	13.5	13.5
		48	14	14
11n HT20	MCS0	36	8.5	8.5
		40	9	9
		48	9.5	9.5
11n HT40	MCS0	38	10	10
		46	11	11
11ac VHT20	MCS0	36	8.5	8.5
		40	9	9
		48	9.5	9.5
11ac VHT40	MCS0	38	10	10
		46	11	11
11ac VHT80	MCS0	42	11	11

UNII-2A

Mode	Rate	Channel	Software Setting Value	
			ANT1	ANT2
11a	6M	52	15	15
		60	15	15
		64	15	15
11n HT20	MCS0	52	15	15
		60	15.5	15.5
		64	15	15
11n HT40	MCS0	54	14	14
		62	12	12
11ac VHT20	MCS0	52	15	15
		60	15	15
		64	15	15
11ac VHT40	MCS0	54	14	14
		62	12	12
11ac VHT80	MCS0	58	10	10



UNII-2C

Mode	Rate	Channel	Software Setting Value	
			ANT1	ANT2
11a	6M	100	15	15
		120	15	15
		140	15	15
11n HT20	MCS0	100	14	14
		120	13	13
		140	13	13
11n HT40	MCS0	102	12	12
		118	15	15
		134	14.5	14.5
11ac VHT20	MCS0	100	14	14
		120	13.5	13.5
		140	13.5	13.5
11ac VHT40	MCS0	102	12	12
		118	15	15
		134	15	15
11ac VHT80	MCS0	106	11	11
		122	15	15

UNII-3

Mode	Rate	Channel	Software Setting Value	
			ANT1	ANT2
11a	6M	149	18	18
		157	18	18
		165	18	18
11n HT20	MCS0	149	17	17
		157	17	17
		165	17	17
11n HT40	MCS0	151	17	17
		159	17	17
11ac VHT20	MCS0	149	17	17
		157	17	17
		165	17	17
11ac VHT40	MCS0	151	17	17
		159	17	17
11ac VHT80	MCS0	155	17	17

Note: For the test software setting values were provided by the customer, They are used to control power to meet the maximum declared power level.



5.5. THE WORSE CASE CONFIGURATIONS

For SISO modes, there are two transmission antennas. The antenna used in any given time can be either ANTENNA 1 or ANTENNA 2. The output power measurement for SISO modes on both antennas are reported.

For 2TX MIMO modes, ANTENNA 1 and ANTENNA 2, used at the same time.

SISO mode and MIMO mode have the same power setting, so only the worst-case MIMO mode will be record in the report.

Worst-case data rates as provided by the client were:

802.11a mode: 6 Mbps

802.11n HT20 mode: MCS0

802.11n HT40 mode: MCS0

802.11ac VHT20 mode: MCS0

802.11ac VHT40 mode: MCS0

802.11ac VHT80 mode: MCS0

802.11ac VHT20 and VHT40 mode are different from 802.11nHT20 and HT40 only in control messages, so for these 4 modes, only 802.11ac VHT20 and 802.11ac VHT40 worst case power modes data are recorded in the report .

802.11ac VHT20/VHT40 SISO mode and MIMO mode have the same power setting, so only the worst case power mode(MIMO) will be record in the report.

802.11a support SISO mode, two antenna have the same power setting, so only the worst case power data for antenna 1 are recorded in the report.



5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna No.	Frequency Band	Antenna Type	Max Antenna Gain (dBi)	Directional Gain (dBi)
1	UNII1	PIFA	6.30	7.84
2	UNII1	PIFA	3.05	
1	UNII-2A	PIFA	6.04	7.90
2	UNII-2A	PIFA	3.57	
1	UNII-2C	PIFA	5.68	7.49
2	UNII-2C	PIFA	3.09	
1	UNII3	PIFA	5.28	7.38
2	UNII3	PIFA	3.36	

Note: Directional gain= $10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$ dBi
 N_{ANT} : Antenna numbers

IEE Std. 802.11	Transmit and Receive Mode	Description
802.11a	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
802.11n HT20	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
802.11n HT40	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
802.11ac VHT20	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
802.11ac VHT40	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
802.11ac VHT80	☒ 2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.

Note:

1. Only 802.11a does not support MIMO mode
3. BT&WLAN 2.4G & WLAN 5G can't transmit simultaneously. (declared by client)

Note: The value of the antenna gain was declared by customer.



5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	Laptop	Lenovo	TP00094A	/

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	TYPE C	/	1.0	/

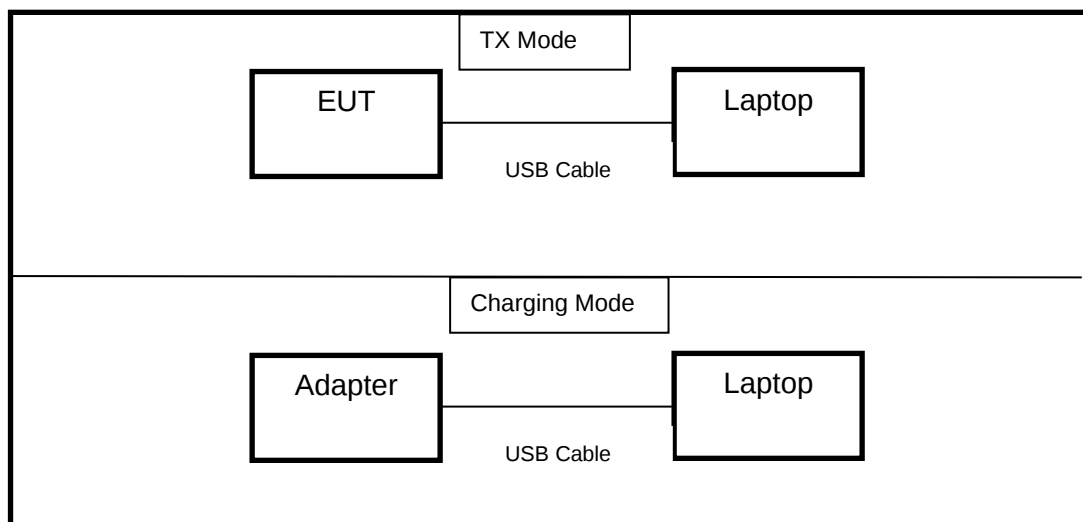
ACCESSORIES

Item	Accessory	Brand Name	Model Name	Description
1	Power Adapter	/	SWD4-01	Input: 100-240V ~ 50/60Hz 1.4A Output: 5V dc,3.0A; 9V dc, 3.0A; 15V dc,3.0A; 20V dc,3.0A

TEST SETUP

The EUT can work in an engineer mode with software.

SETUP DIAGRAM FOR TESTS



**6. MEASURING INSTRUMENT AND SOFTWARE USED**

Conducted Emissions										
Instrument										
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.				
☒	EMI Test Receiver	R&S	ESR3	101961	Dec.05,2019	Dec.05,2020				
☒	Two-Line V-Network	R&S	ENV216	101983	Dec.05,2019	Dec.05,2020				
☒	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Dec.05,2019	Dec.05,2020				
Software										
Used	Description		Manufacturer	Name	Version					
☒	Test Software for Conducted disturbance		Farad	EZ-EMC	Ver. UL-3A1					
Radiated Emissions										
Instrument										
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.				
☒	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.06,2019	Dec.06,2020				
☒	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Sep.17, 2018	Sep.17, 2021				
☒	Preamplifier	HP	8447D	2944A09099	Dec.05,2019	Dec.05,2020				
☒	EMI Measurement Receiver	R&S	ESR26	101377	Dec.05,2019	Dec.05,2020				
☒	Horn Antenna	TDK	HRN-0118	130939	Sep.17, 2018	Sep.17, 2021				
☒	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Aug.11, 2018	Aug.11, 2021				
☒	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.05,2019	Dec.05,2020				
☒	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.05,2019	Dec.05,2020				
☒	Preamplifier	TDK	PA-02-3	TRS-308-00002	Dec.05,2019	Dec.05,2020				
☒	Loop antenna	Schwarzbeck	1519B	00008	Jan.07, 2019	Jan.07, 2022				
☒	Band Reject Filter	Wainwright	WRCJV12-5695-5725-5850-5880-40SS	4	Dec.05,2019	Dec.05,2020				
☒	Band Reject Filter	Wainwright	WRCJV20-5120-5150-5350-5380-60SS	2	Dec.05,2019	Dec.05,2020				
☒	Band Reject Filter	Wainwright	WRCJV20-5440-5470-5725-5755-60SS	1	Dec.05,2019	Dec.05,2020				



☒	High Pass Filter	Wainwright	WHKX10-5850-6500-1800-40SS	4	Dec.05,2019	Dec.05,2020
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Radiated disturbance		Farad	EZ-EMC		Ver. UL-3A1
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.06,2019	Dec.06,2020
☒	Power sensor, Power Meter	R&S	OSP120	100921	Dec.06,2019	Dec.06,2020



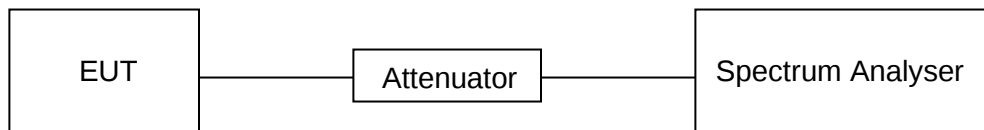
7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only

TEST SETUP



TEST ENVIRONMENT

Temperature	25.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	DC7.2V

RESULTS

Mode	ON Time (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (KHz)	Final setting For VBW (KHz)
802.11a 20	2.05	2.15	0.95	95%	0.21	0.49	1
802.11n HT20	1.93	2.02	0.96	96%	0.20	0.52	1
802.11 ac VHT20	1.93	2.03	0.95	95%	0.22	0.52	1
802.11n HT40	0.95	1.045	0.91	91%	0.41	1.05	2
802.11 ac VHT40	0.95	1.035	0.92	92%	0.37	1.05	2
802.11 ac VHT80	0.462	0.558	0.83	83%	0.82	2.16	3

Note:

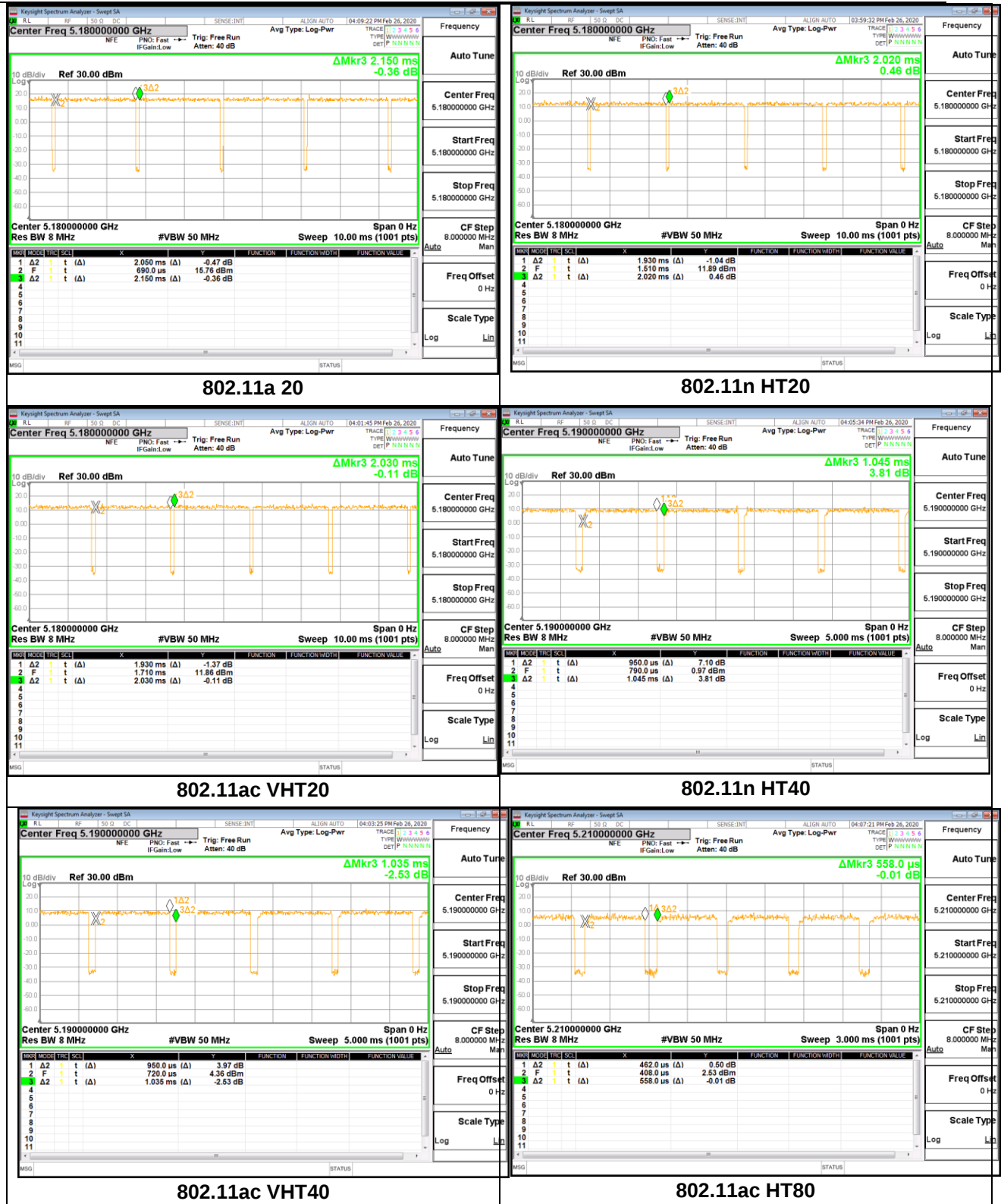
Duty Cycle Correction Factor=10log (1/x).

Where: x is Duty Cycle (Linear)

Where: T is On Time

If that calculated VBW is not available on the analyzer then the next higher value should be used.

Antenna 1 and Antenna 2 has the same duty cycle, only Antenna 1 data show here.





7.2. 6/26/99% dB BANDWIDTH

LIMITS

CFR 47 FCC Part15, Subpart E ISED RSS-247		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	26 dB Bandwidth	5150-5250
	26 dB Bandwidth	5250-5350
	26 dB Bandwidth	For FCC:5470-5725 For IC:5470-5600 5650-5725
	Minimum 500kHz 6dB Bandwidth	5725-5850

ISED RSS-247		
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.

TEST PROCEDURE

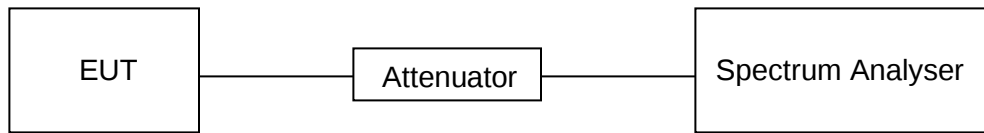
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth: RBW=100kHz For 26dB Bandwidth: approximately 1% of the emission bandwidth. For 99dB Bandwidth: approximately 1%~5% of the emission bandwidth.
VBW	For 6dB Bandwidth : VBW=300kHz For 26dB Bandwidth : >3RBW For 99%dB Bandwidth : >3RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and 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 6dB/26dB&99% Occupied Bandwidth relative to the maximum level measured in the fundamental emission.



TEST SETUP



TEST ENVIRONMENT

Temperature	25.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	DC7.2V

RESULTS

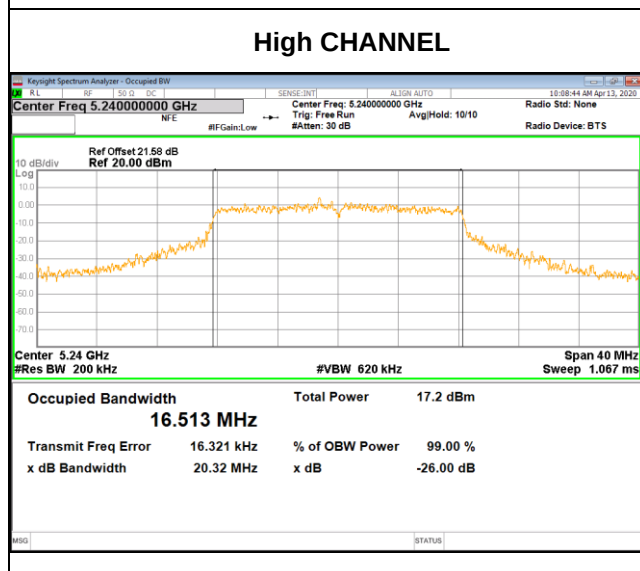
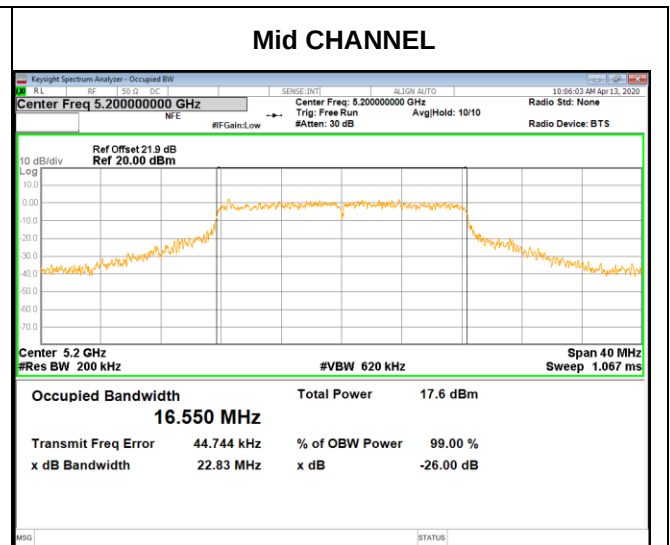
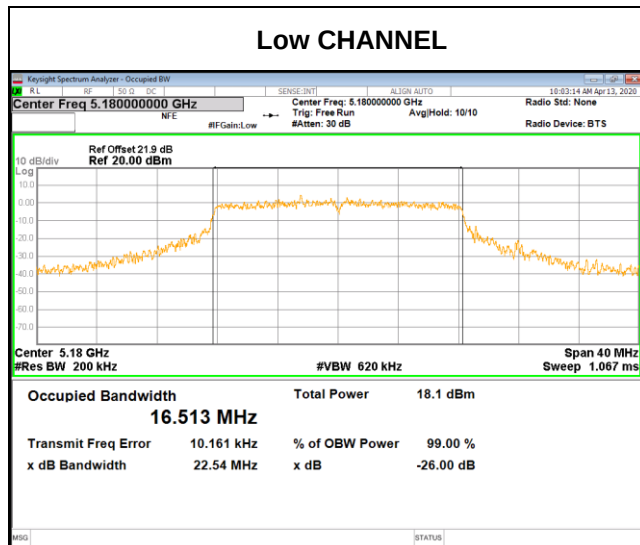


7.2.1. 802.11a 20 MODE

ANT1 WORST CASE

UNII-1 BAND

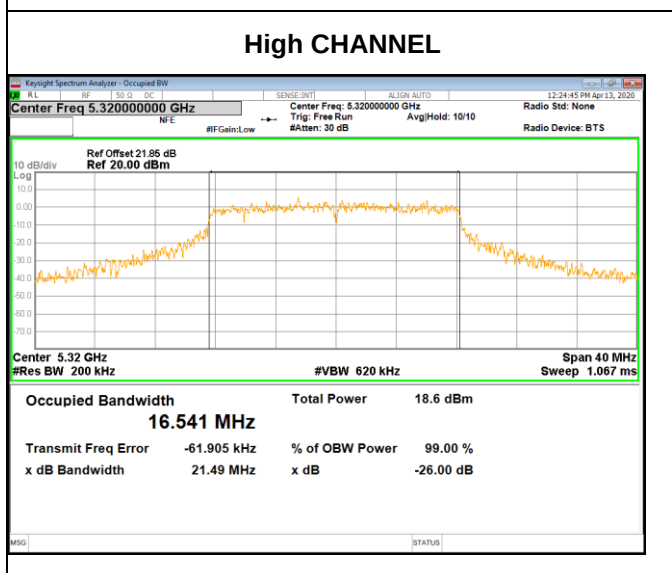
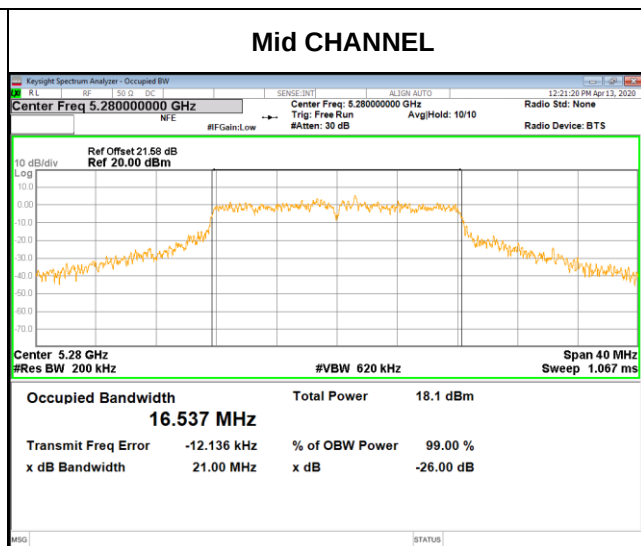
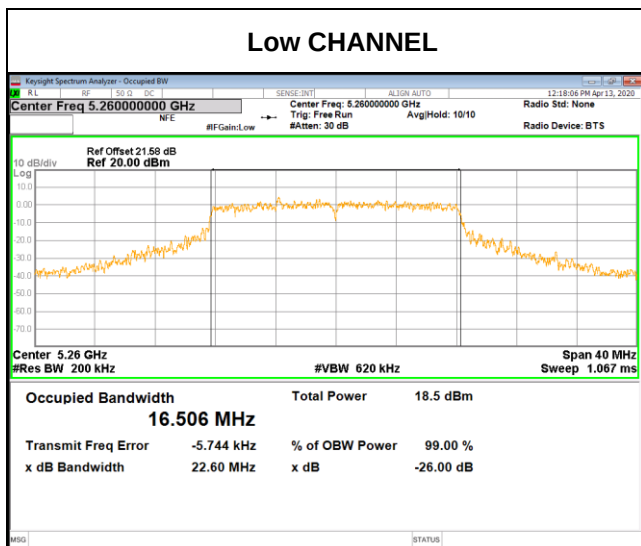
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5180	22.54	16.513
Mid	5200	22.83	16.550
High	5240	20.32	16.513





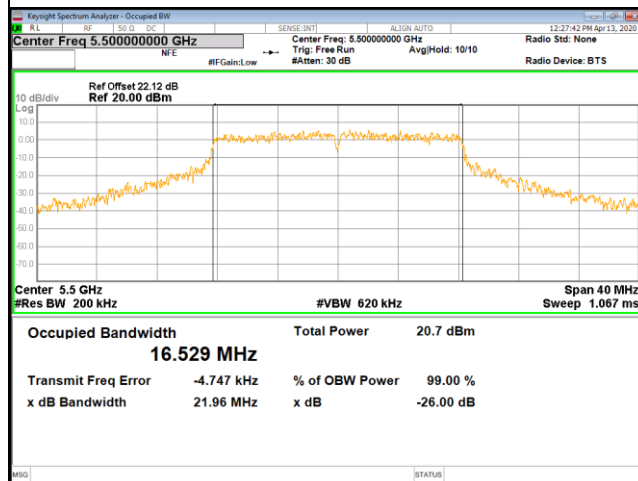
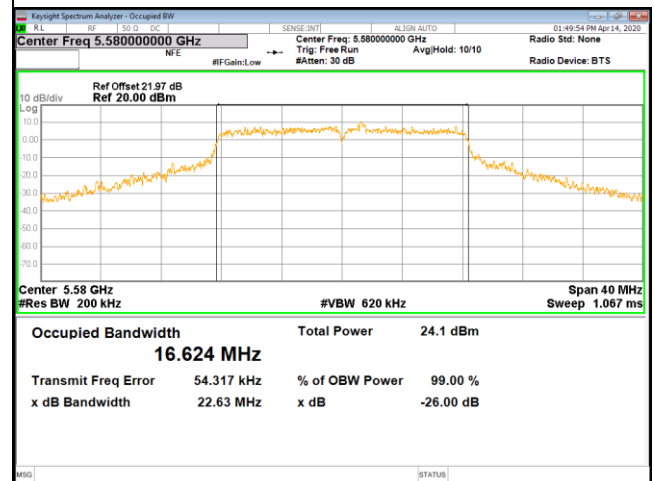
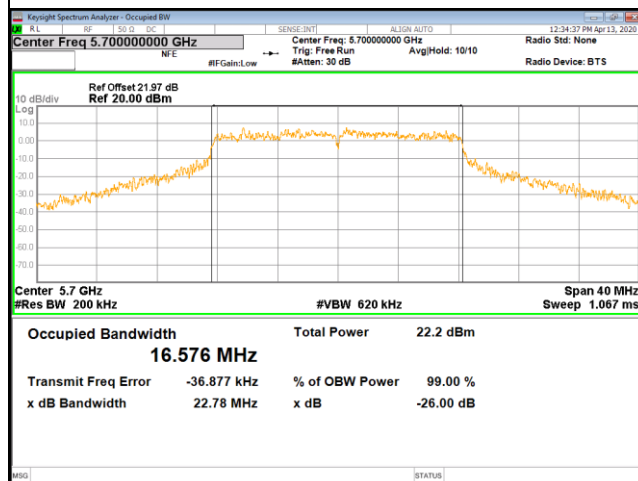
UNII-2A BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5260	22.60	16.506
Mid	5300	21.00	16.537
High	5320	21.49	16.541



**UNII-2C BAND**

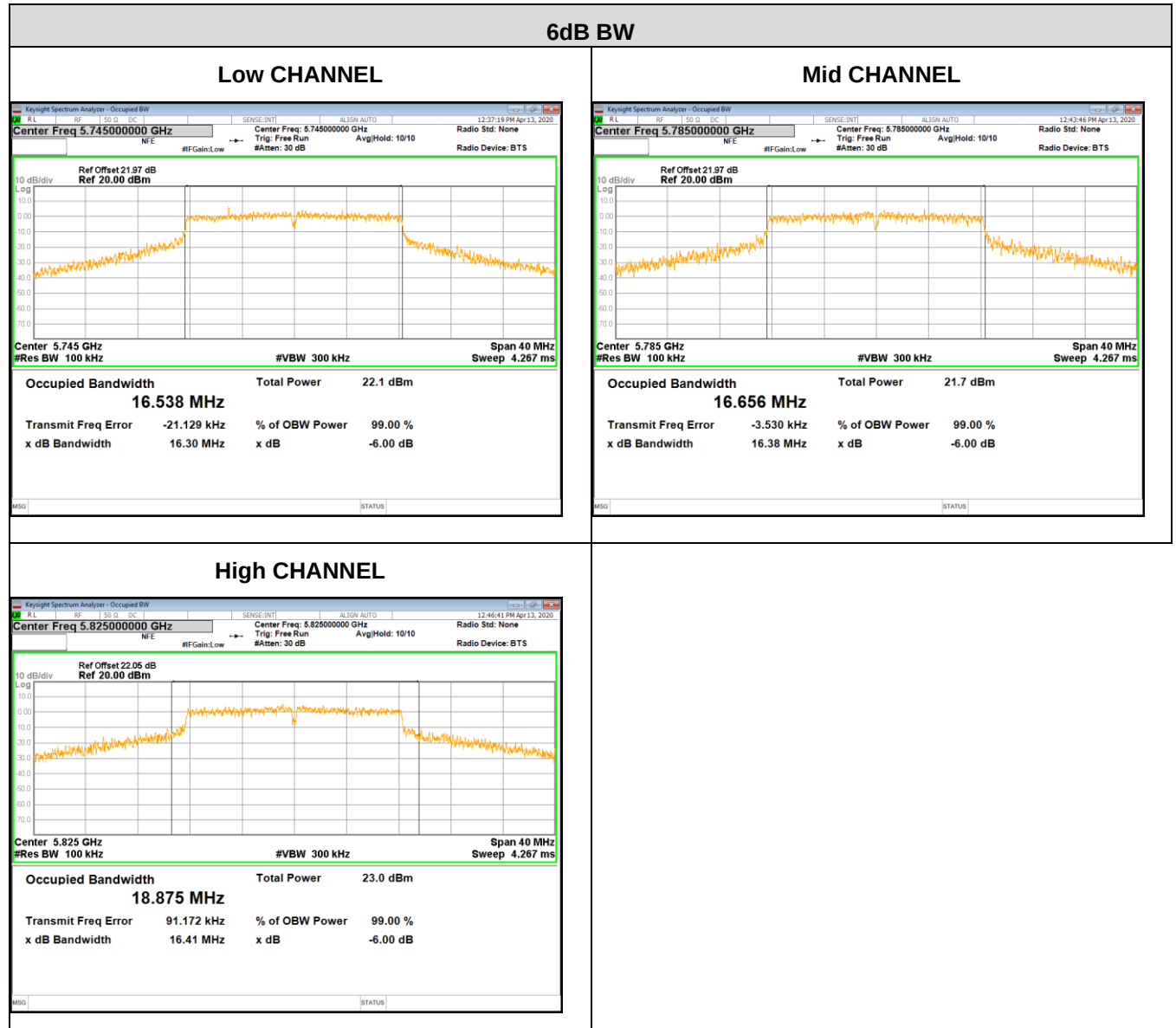
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5500	21.96	16.529
Mid	5580	22.63	16.624
High	5700	22.78	16.576

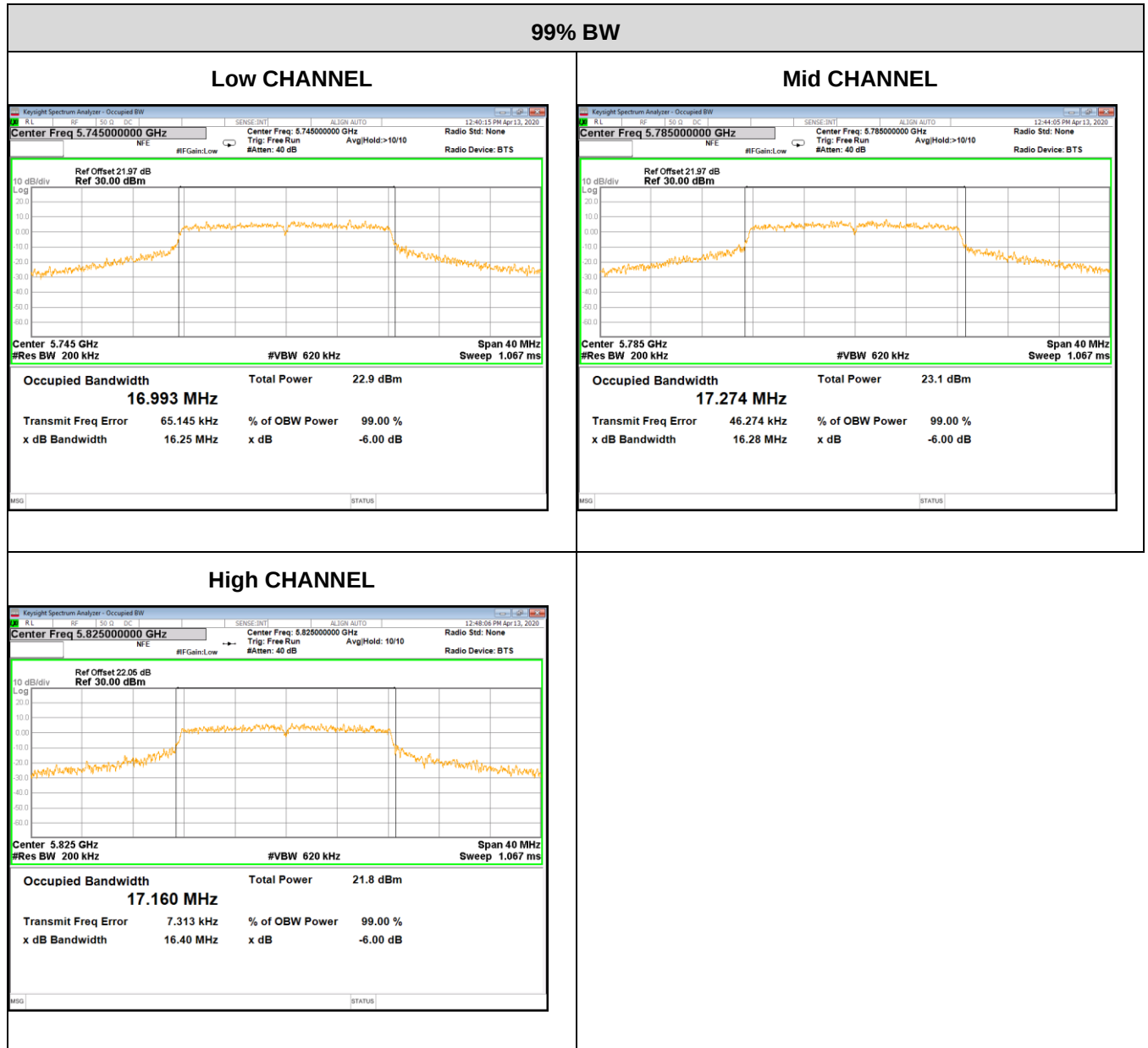
Low CHANNEL**Mid CHANNEL****High CHANNEL**



UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	Limit For 6dB BW (KHz)	Result
Low	5745	16.63	16.993	500	PASS
Mid	5785	16.38	17.274	500	PASS
High	5825	16.41	17.160	500	PASS





Note: All the modes and antenna ports had been tested, only the worst data recorded in the report.



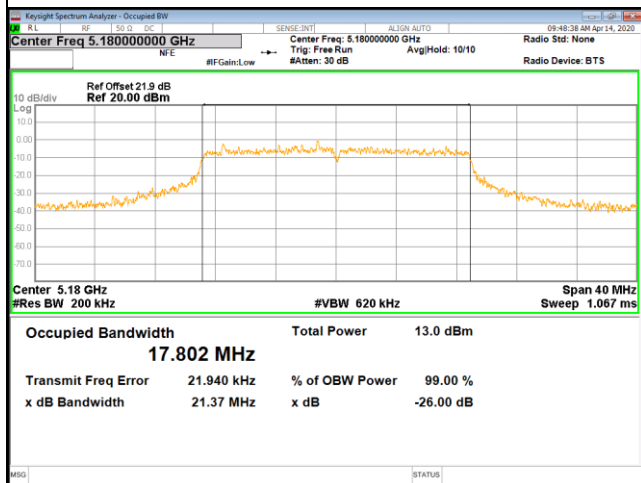
7.2.2. 802.11ac VHT20 MODE

ANT1 WORST CASE

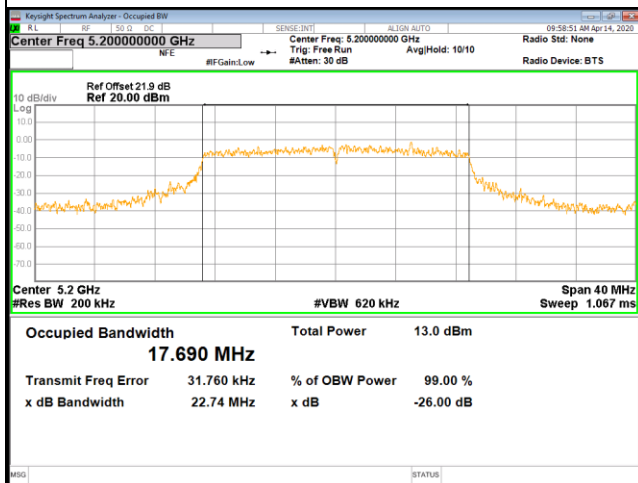
UNII-1 BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5180	21.37	17.802
Mid	5200	22.74	17.690
High	5240	22.75	17.674

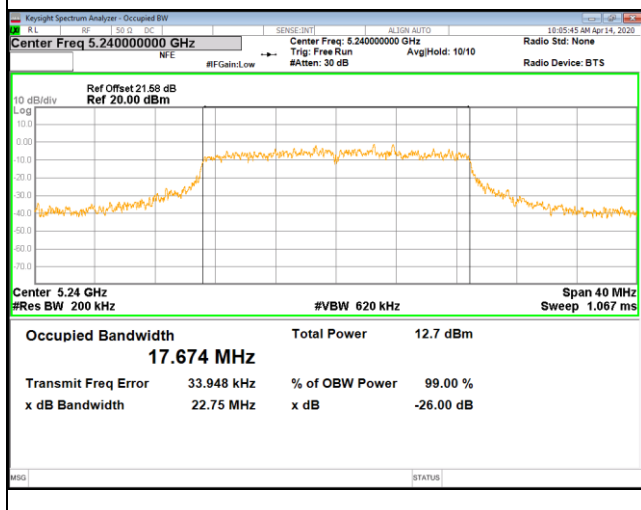
Low CHANNEL



Mid CHANNEL



High CHANNEL





UNII-2A BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5260	23.42	17.755
Mid	5300	22.76	17.675
High	5320	22.62	17.721

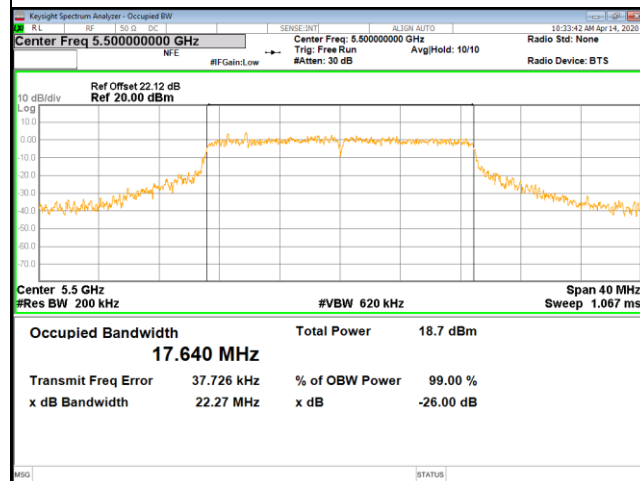




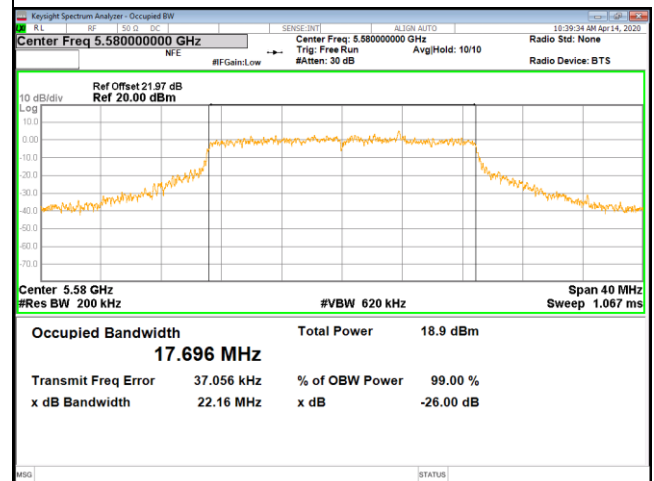
UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5500	22.27	17.640
Mid	5580	22.16	17.696
High	5700	22.11	17.715

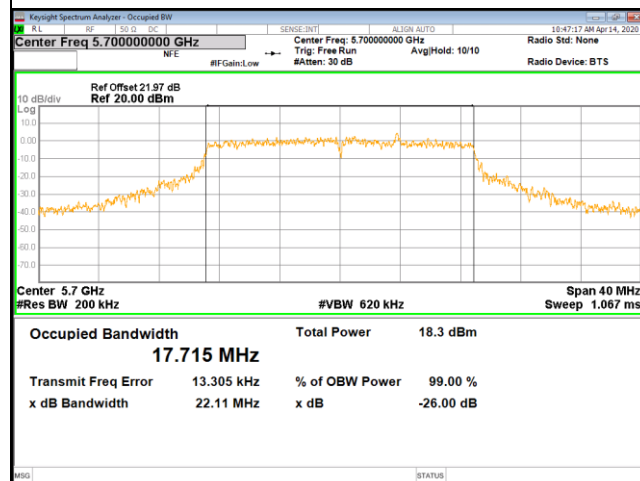
Low CHANNEL



Mid CHANNEL



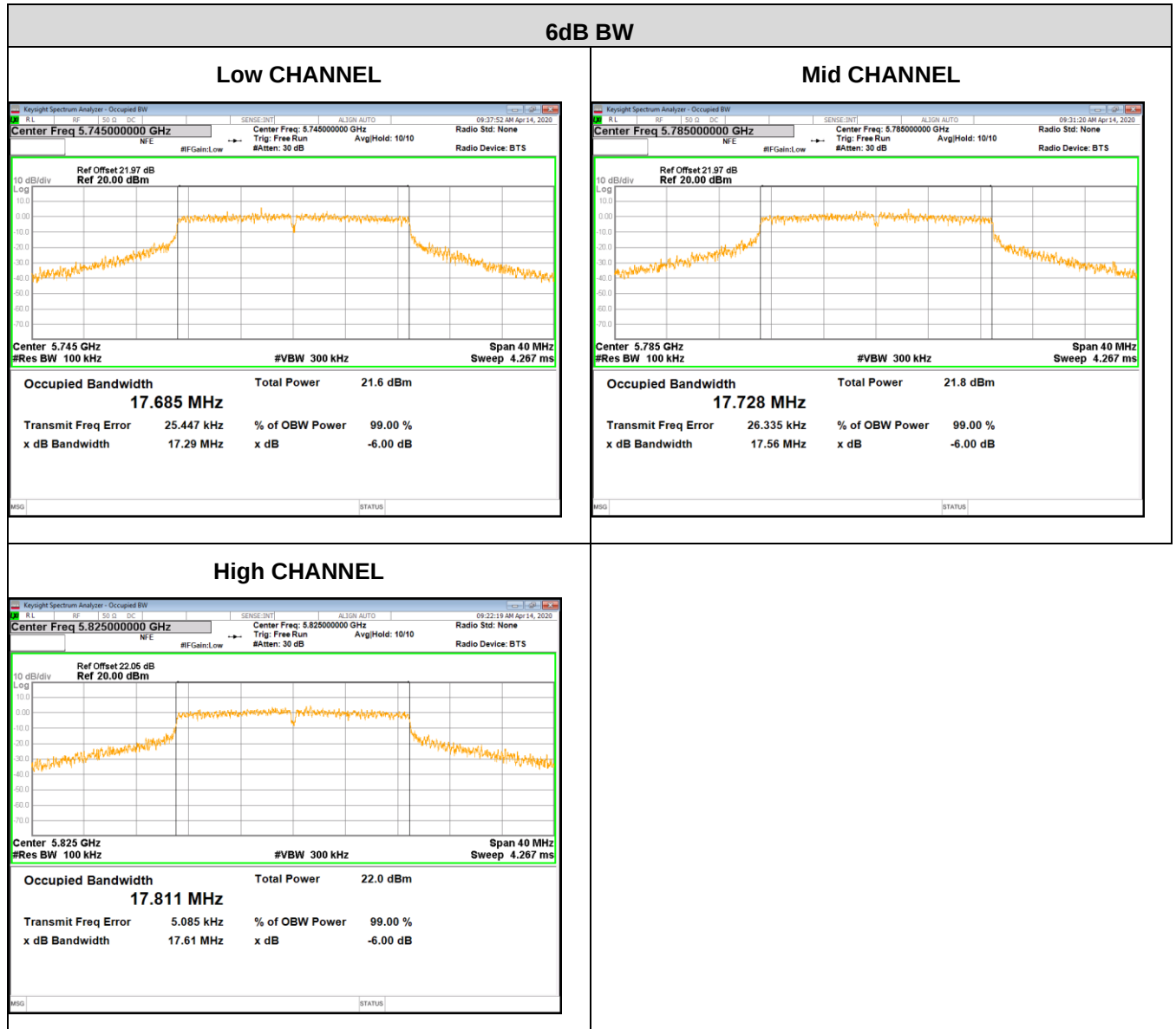
High CHANNEL

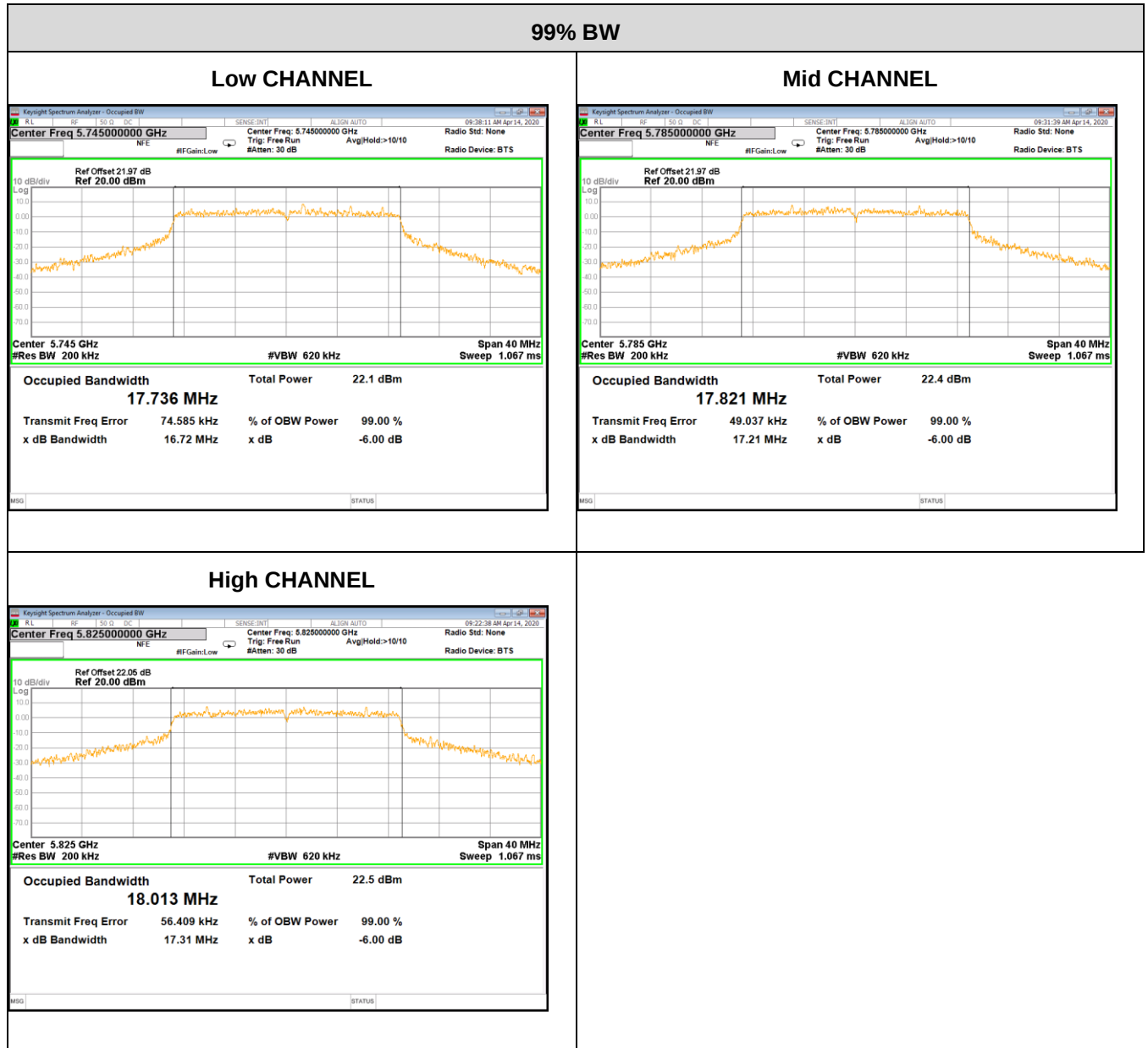




UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	Limit For 6dB BW (KHz)	Result
Low	5745	17.29	17.736	500	PASS
Mid	5785	17.56	17.821	500	PASS
High	5825	17.61	18.013	500	PASS





Note: All the modes and antenna ports had been tested, only the worst data recorded in the report.



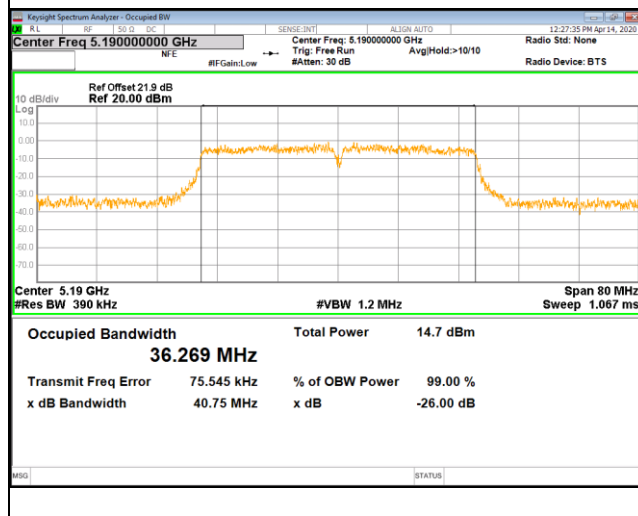
7.2.3. 802.11ac VHT40 MODE

ANT1 WORST CASE

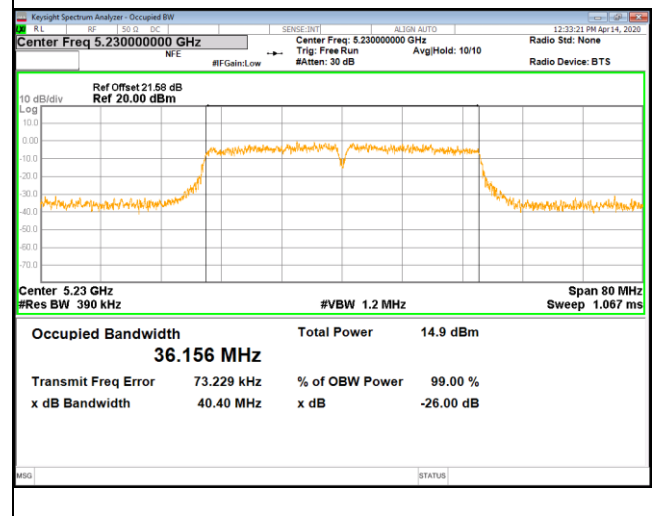
UNII-1 BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5190	40.75	36.269
High	5230	40.40	36.156

Low CHANNEL



High CHANNEL

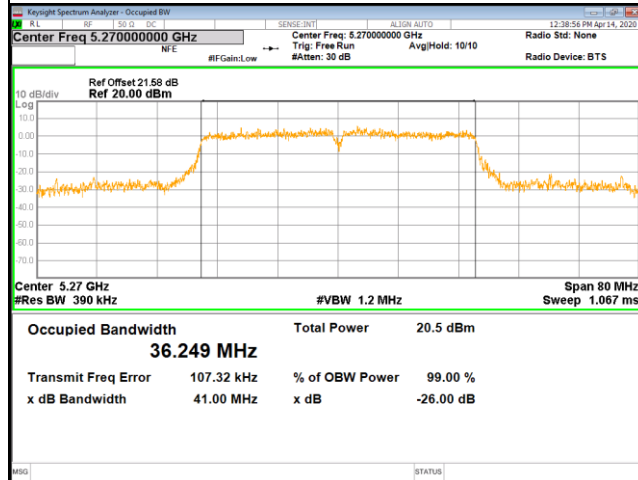




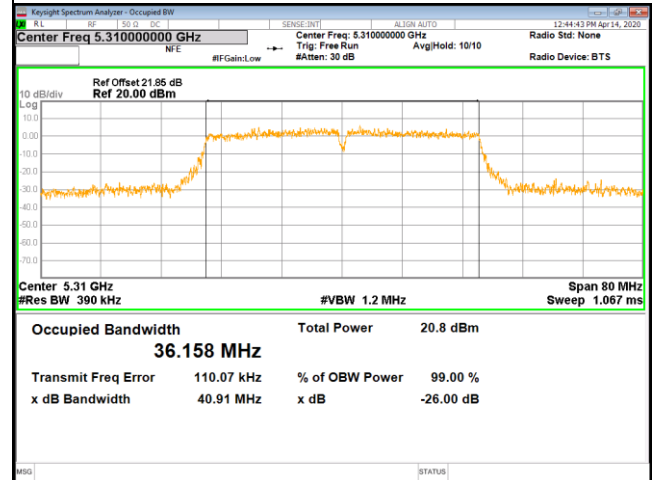
UNII-2A BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5270	41.00	36.249
High	5310	40.91	36.158

Low CHANNEL



High CHANNEL

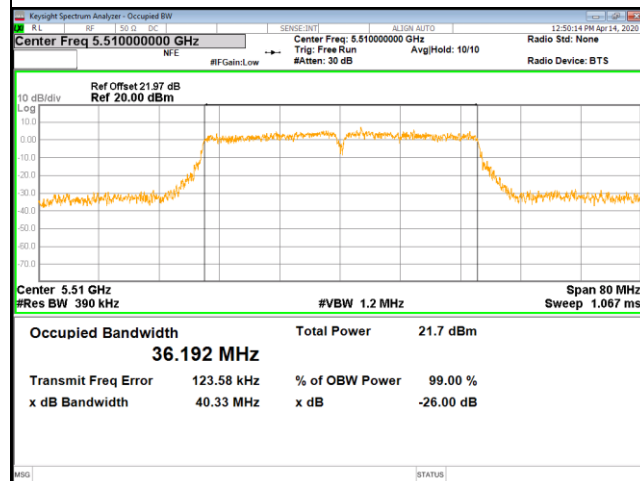




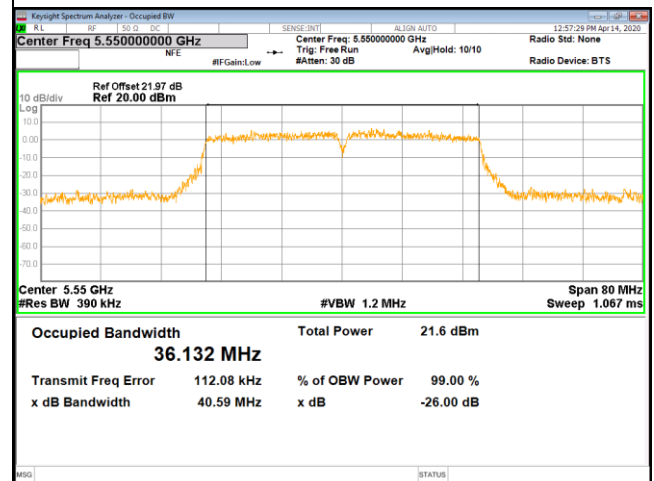
UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5510	40.33	36.192
Mid	5550	40.59	36.132
High	5670	40.40	36.182

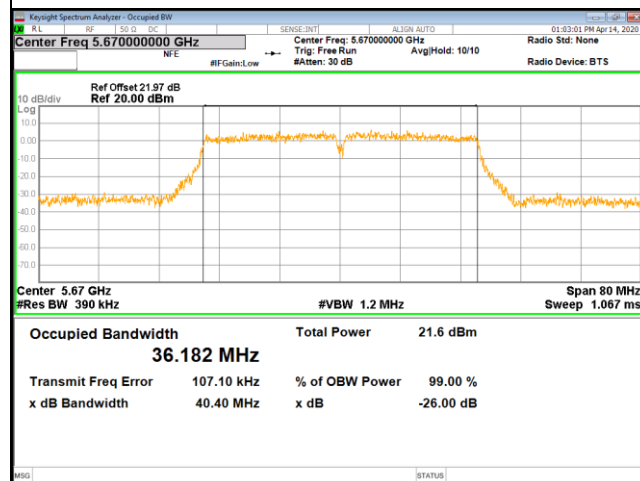
Low CHANNEL



Mid CHANNEL



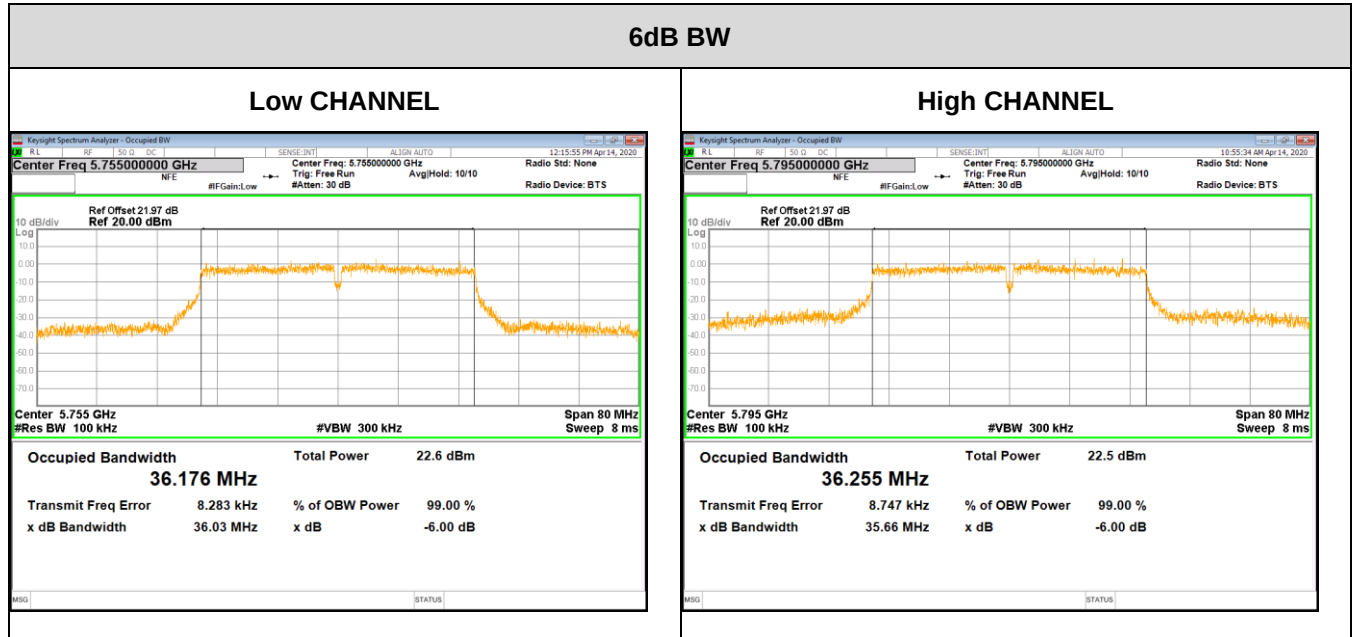
High CHANNEL

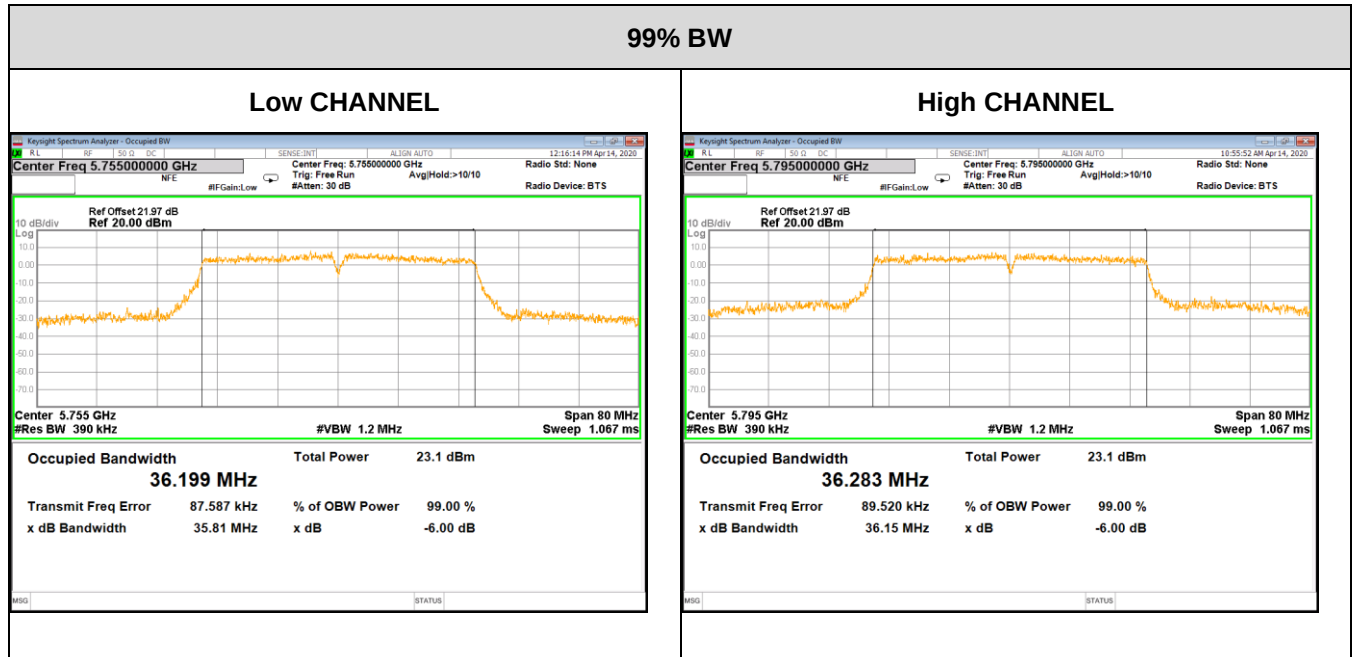




UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	Limit (KHz)	Result
Low	5755	36.03	36.199	500	PASS
High	5795	35.66	36.283	500	PASS





Note: All the modes and antenna ports had been tested, only the worst data recorded in the report.

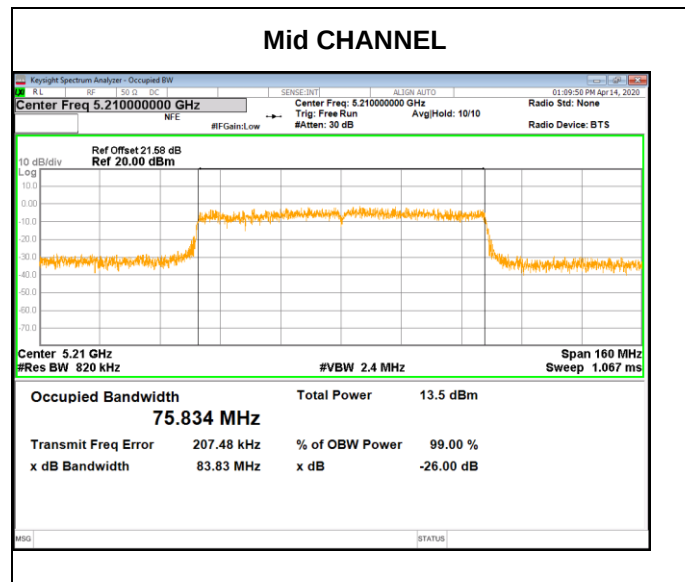


7.2.4. 802.11ac VHT80 MODE

ANT1 WORST CASE

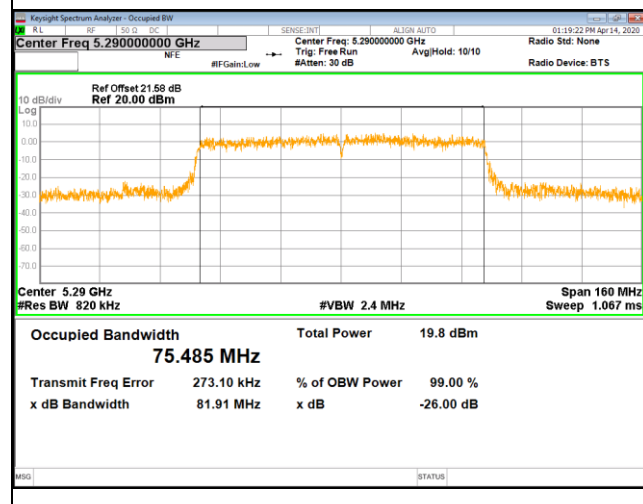
UNII-1 BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Mid	5210	83.83	75.834



**UNII-2A BAND**

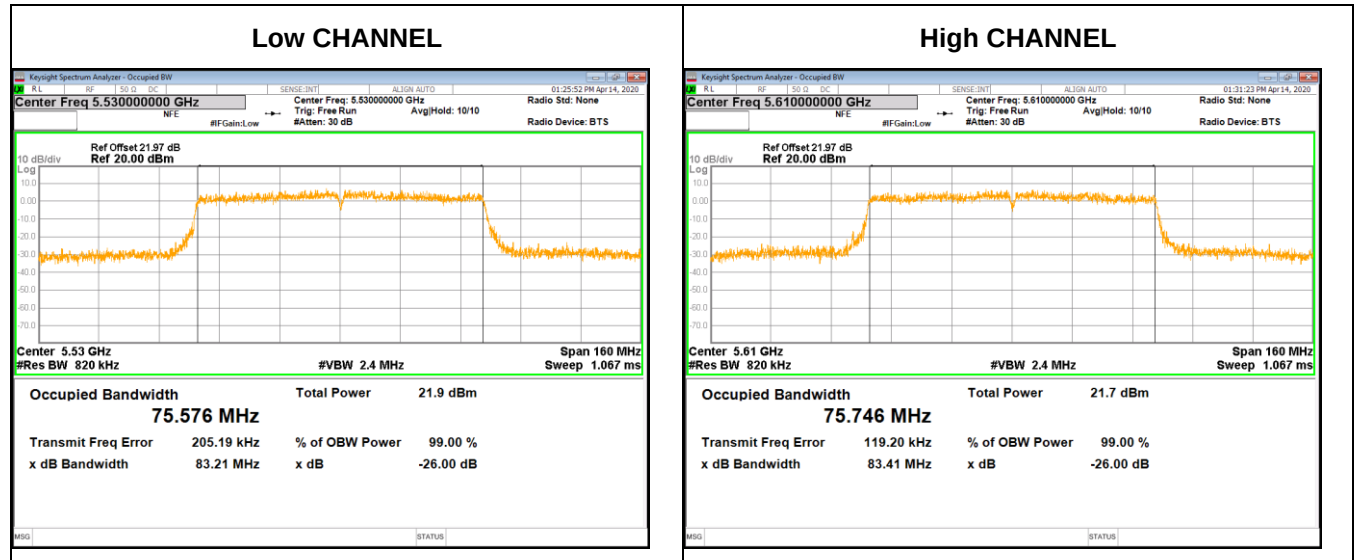
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Mid	5290	81.91	75.485

Mid CHANNEL



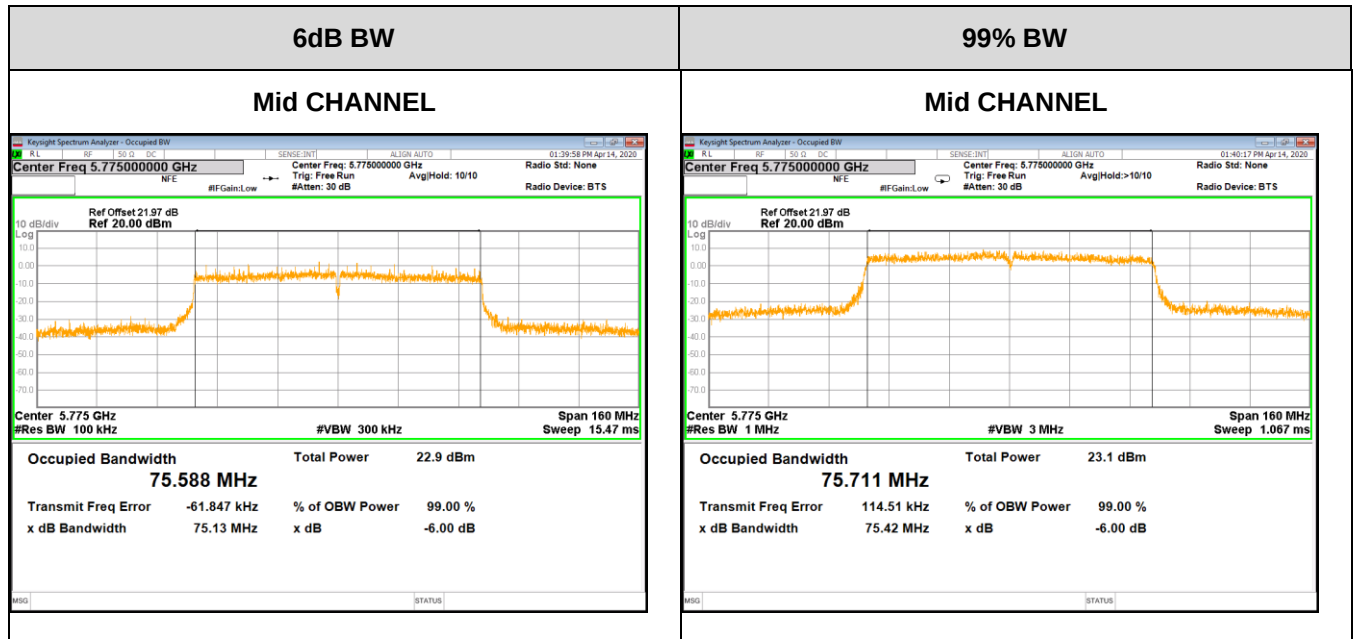
UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5530	83.21	75.576
High	5610	83.41	75.746



**UNII-3 BAND**

Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	Limit For 6dB BW (KHz)	Result
Mid	5775	75.13	75.711	500	PASS



Note: All the modes and antenna ports had been tested, only the worst data recorded in the report.



7.3. MAXIMUM CONDUCTED OUTPUT POWER

LIMITS

CFR 47 FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	For FCC client devices:250mW (24dBm)	5150-5250
	Not exceed the lesser of 250 mW or 11 dBm + 10 log B whichever is less where B is the 26 dB emission bandwidth in megahertz	5250-5350
	Not exceed the lesser of 250 mW or 11 dBm + 10 log B whichever is less where B is the 26 dB emission bandwidth in megahertz	5470-5725
	1 Watt (30dBm)	5725-5850

ISED RSS-247		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	Maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log ₁₀ B, dBm, whichever is less where B is the 99% emission bandwidth in megahertz	5150-5250
	Not exceed 250 mW or 11 + 10 log ₁₀ B, where B is the 99% emission bandwidth in megahertz	5250-5350
	Not exceed 250 mW or 11 + 10 log ₁₀ B, where B is the 99% emission bandwidth in megahertz	5470-5600 5650-5725
	1 Watt (30dBm)	5725-5850

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



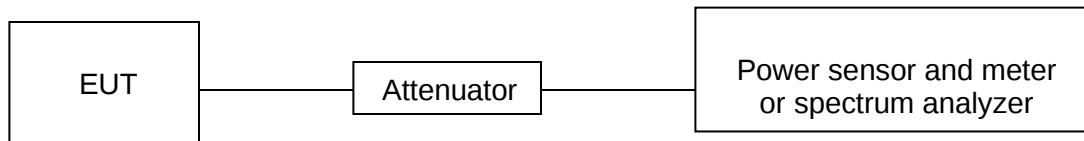
TEST PROCEDURE

Refer to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Connect the EUT to the a broadband average RF power meter, the power meter shall have a video bandwidth that is greater than or equal to the bandwidth and shall utilize a fast-responding diode detector.

Straddle channel power is measured using PXA spectrum analyzer.

TEST SETUP



TEST ENVIRONMENT

Temperature	25.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	DC7.2V

**RESULTS****7.3.1. UNII-1 BAND**

Mode	Frequency (MHz)	CONDUCTED POWER (dBm)		Total (dBm)	FCC Limit (dBm)	EIRP (dBm)		Total (dBm)	ISED EIRP Limit (dBm)	Result
		ANT1	ANT2			ANT1	ANT2			
802.11a20	5180	13.00	13.06	/	24	19.30	16.11	/	22.2	PASS
	5200	12.86	12.86	/	24	19.16	15.91	/	22.2	PASS
	5240	12.86	12.84	/	24	19.16	15.89	/	22.2	PASS
802.11n HT20	5180	8.68	8.22	11.47	22.2	/	/	19.30	22.5	PASS
	5200	8.40	8.55	11.49	22.2	/	/	19.32	22.5	PASS
	5240	8.38	8.11	11.26	22.2	/	/	19.09	22.5	PASS
802.11ac VHT20	5180	8.28	8.29	11.30	22.2	/	/	19.13	22.5	PASS
	5200	8.70	8.70	11.71	22.2	/	/	19.55	22.5	PASS
	5240	8.37	8.37	11.38	22.2	/	/	19.22	22.5	PASS
802.11n HT40	5190	10.19	10.00	13.11	22.2	/	/	20.94	23	PASS
	5230	10.31	10.20	13.27	22.2	/	/	21.10	23	PASS
802.11ac VHT40	5190	10.22	10.73	13.49	22.2	/	/	21.33	23	PASS
	5230	10.39	10.84	13.63	22.2	/	/	21.47	23	PASS
802.11ac VHT80	5210	10.02	10.41	13.23	22.2	/	/	21.07	23	PASS

Note: 1. Conducted Power=Meas. Level+ Correction Factor

2. For SISO Mode: EIRP=conducted Power + Antenna Gain,

For MIMO Mode: EIRP=conducted Power + Directional Gain.

3. The test results have already included the duty cycle correction factor. About correction Factor please refer to section 7.1



7.3.2. UNII-2A BAND

Mode	Frequency (MHz)	CONDUCTED POWER (dBm)		Total (dBm)	CONDUCTED POWER (dBm)	ISED Limit (dBm)	Result
		ANT1	ANT2				
802.11a20	5260	13.36	13.59	/	24	23.2	PASS
	5300	14.04	13.82	/	24	23.2	PASS
	5320	13.85	14.11	/	24	23.2	PASS
802.11n HT20	5260	13.16	13.45	16.32	22.1	23.5	PASS
	5300	13.78	13.96	16.88	22.1	23.5	PASS
	5320	13.66	13.89	16.79	22.1	23.5	PASS
802.11ac VHT20	5260	13.19	13.47	16.34	22.1	23.5	PASS
	5300	13.85	13.83	16.85	22.1	23.5	PASS
	5320	13.73	14.05	16.90	22.1	23.5	PASS
802.11n HT40	5270	12.95	12.99	15.98	22.1	24	PASS
	5310	10.58	10.97	13.79	22.1	24	PASS
802.11ac VHT40	5270	12.98	13.10	16.05	22.1	24	PASS
	5310	10.96	10.59	13.79	22.1	24	PASS
802.11ac VHT80	5290	8.38	8.41	11.41	22.1	24	PASS

Note: 1. Conducted Power = Meas. Level + Correction Factor

2. The test results have already included the duty cycle correction factor. About correction Factor please refer to section 7.1

**7.3.3. UNII-2C BAND**

Mode	Frequency (MHz)	CONDUCTED POWER (dBm)		Total (dBm)	FCC Limit (dBm)	ISED Limit (dBm)	Result
		ANT1	ANT2				
802.11a20	5500	15.35	15.48	/	24	23.2	PASS
	5580	15.94	16.02	/	24	23.2	PASS
	5700	16.10	16.02	/	24	23.2	PASS
802.11n HT20	5500	13.75	14.14	16.96	22.5	23.5	PASS
	5580	13.77	13.16	16.49	22.5	23.5	PASS
	5700	13.41	13.97	16.71	22.5	23.5	PASS
802.11ac VHT20	5500	14.11	13.90	17.02	22.5	23.5	PASS
	5580	14.28	13.65	16.99	22.5	23.5	PASS
	5700	13.99	13.59	16.80	22.5	23.5	PASS
802.11n HT40	5510	12.20	12.40	15.31	22.5	24	PASS
	5590	15.88	15.22	18.57	22.5	24	PASS
	5670	15.62	15.51	18.58	22.5	24	PASS
802.11ac VHT40	5510	12.48	12.33	15.42	22.5	24	PASS
	5590	15.89	15.52	18.72	22.5	24	PASS
	5670	16.07	16.02	19.06	22.5	24	PASS
802.11ac VHT80	5530	11.36	11.38	14.38	22.5	24	PASS
	5610	15.92	16.07	19.01	22.5	24	PASS

Note: 1. Conducted Power=Meas. Level+ Correction Factor

2. The test results have already included the duty cycle correction factor. About correction Factor please refer to section 7.1



7.3.4. UNII-3 BAND

Mode	Frequency (MHz)	CONDUCTED POWER (dBm)		Total (dBm)	Limit (dBm)	Result
		ANT1	ANT2			
802.11a20	5745	15.21	15.14	/	30	PASS
	5785	15.34	15.35	/	30	PASS
	5825	15.82	15.51	/	30	PASS
802.11n HT20	5745	15.03	14.92	17.99	28.6	PASS
	5785	15.21	15.20	18.22	28.6	PASS
	5825	15.49	15.37	18.44	28.6	PASS
802.11ac VHT20	5745	15.14	15.02	18.09	28.6	PASS
	5785	15.23	15.32	18.29	28.6	PASS
	5825	15.50	15.48	18.50	28.6	PASS
802.11n HT40	5755	14.83	14.83	17.84	28.6	PASS
	5795	15.23	15.35	18.30	28.6	PASS
802.11ac VHT40	5755	15.38	14.93	18.17	28.6	PASS
	5795	15.49	15.38	18.45	28.6	PASS
802.11ac VHT80	5775	15.48	15.28	18.39	28.6	PASS

Note: 1. Conducted Power=Meas. Level+ Correction Factor

2. The test results have already included the duty cycle correction factor. About correction Factor please refer to section 7.1



7.4. POWER SPECTRAL DENSITY

LIMITS

CFR 47 FCC Part15, Subpart E ISED RSS-247		
Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	For FCC: Other than Mobile and portable:17dBm/MHz Mobile and portable:11dBm/MHz	5150-5250
	For RSS: e.i.r.p. 10dBm/MHz	
	11dBm/MHz	5250-5350
	11dBm/MHz	For FCC:5470-5725 For IC:5470-5600 5650-5725
	30dBm/500kHz	5725-5850
Note: 1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.		

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

For U-NII-1, U-NII-2A and U-NII-2C band:

Center Frequency	The center frequency of the channel under test
Detector	RMS
RBW	1MHz
VBW	$\geq 3 \times \text{RBW}$
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

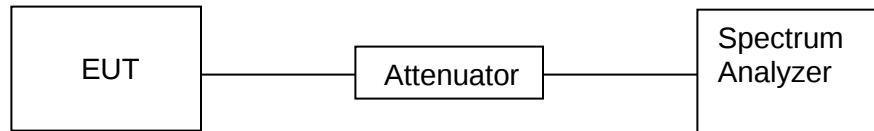
For U-NII-3:

Center Frequency	The center frequency of the channel under test
Detector	RMS
RBW	500kHz
VBW	$\geq 3 \times \text{RBW}$
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto



Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

TEST SETUP



TEST ENVIRONMENT

Temperature	25.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	DC7.2V

RESULTS



7.4.1. 802.11a 20 MODE

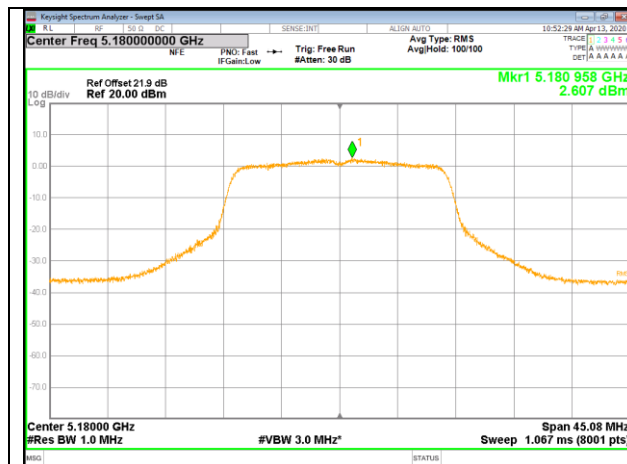
UNII-1 BAND

WORST CASE FOR ANT1

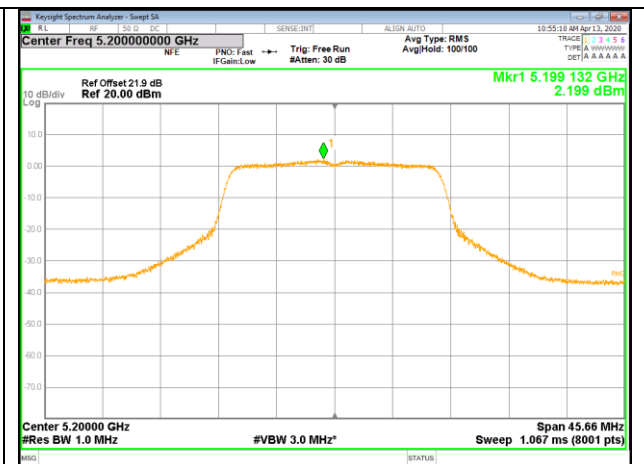
Test Channel	Frequency (MHz)	ANT	DCCF (dB)	PSD Result (dBm/MHz)	FCC Limit (dBm/MHz)	EIRP Result (dBm/MHz)	ISED EIRP Limit (dBm/MHz)
Low	5180	1	0.21	2.607	11	9.117	10
Mid	5200	1	0.21	2.199		8.709	
High	5240	1	0.21	2.162		8.672	

Note:

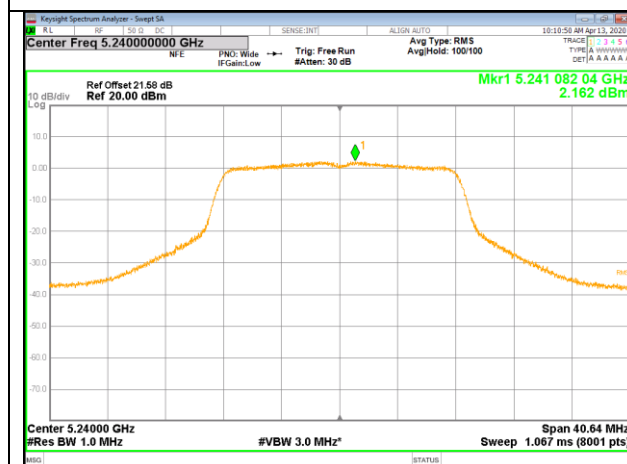
1. For test plots, it does not include the duty cycle correction factor.
2. PSD result=Test plots result+ Duty Cycle Correction Factor
3. The test results have already included the duty cycle correction factor. About correction Factor please refer to section 7.1.



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL