



FCC TEST REPORT

**Test report
On Behalf of
Shenzhen Yingdakang Technology CO., LTD
For
Wireless Repeater**

**Model No.: DA213WUS, DA213BUS, AC12RP, DWR-C5400R,
DWR-C4510R, W120RP, W121RP**

FCC ID: 2ACSI-DA213WX

Prepared for : Shenzhen Yingdakang Technology CO., LTD
Room 8004, B/51, 2nd Dist ,Shangtang Songzi Park, MinZhi , Longhua ,
Shenzhen, China

Prepared By : Shenzhen HUAKE Testing Technology Co., Ltd.
1F, B2 Building, JunfengZhongchengZhizao Innovation Park, Fuhai Street,
Bao'an District, Shenzhen City, China

Date of Test: Apr. 15, 2020

Date of Report: Apr. 15, 2020 -- Apr. 29, 2020

Report Number: HK2004170655-2E

**TEST RESULT CERTIFICATION**

Applicant's name.....: Shenzhen Yingdakang Technology CO., LTD
Address.....: Room 8004, B/51, 2nd Dist ,Shangtang Songzi Park, MinZhi ,
Longhua , Shenzhen, China

Manufacture's Name: Shenzhen Yingdakang Technology CO., LTD
Address.....: Room 8004, B/51, 2nd Dist ,Shangtang Songzi Park, MinZhi ,
Longhua , Shenzhen, China

Product description

Trade Mark.....: N/A
Product name.....: Wireless Repeater
Model and/or type reference: DA213WUS, DA213BUS, AC12RP, DWR-C5400R, DWR-C4510R,
W120RP, W121RP

Standards: FCC 47 CFR Part 15 Subpart E

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen HUAKE Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen HUAKE Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Date of Test.....:

Date (s) of performance of tests: Apr. 15, 2020

Date of Issue.....: Apr. 15, 2020 -- Apr. 29, 2020

Test Result: **Pass**

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



TABLE OF CONTENTS

1.GENERAL INFORMATION	4
1.1 TEST RESULTS.....	4
1.2 TEST FACILITY	4
1.3 MEASUREMENT EQUIPMENT USED.....	4
1.4 MEASUREMENT UNCERTAINTY	6
2 GENERAL DESCRIPTION.....	7
2.1 EUT DESCRIPTION	7
2.2 DUTY CYCLES	9
2.3 EUT CONFIGURATION.....	9
2.4 DESCRIPTION OF TEST SETUP	9
2.5 GENERAL TEST PROCEDURES.....	10
2.6 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS	10
2.7 DESCRIPTION OF TEST MODES	11
2.8 ANTENNA DESCRIPTION	11
3.SETUP OF EQUIPMENT UNDER TEST	12
3.1SETUP CONFIGURATION OF EUT	12
3.2SUPPORT EQUIPMENT	12
4 TEST REQUIREMENTS AND RESULTS	13
4.126 DB EMISSION BANDWIDTH.....	13
4.2MAXIMUM CONDUCTED OUTPUT POWER	28
4.3BAND EDGES MEASUREMENT	31
4.4POWER SPECTRAL DENSITY	44
4.5FREQUENCY STABILITY MEASUREMENT	73
4.6RADIATED UNDESIRABLE EMISSION.....	78
4.7POWERLINE CONDUCTED EMISSIONS	100
7 Photographs of Test Setup.....	103
8 PHOTOS OF THE EUT	105



1. GENERAL INFORMATION

1.1 TEST RESULTS

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a)	PASS
26dB Emission Bandwidth & 99% Occupied Bandwidth	§15.403(i)	PASS
Power Spectral Density	§15.407(a)	PASS
Band edge	§15.407(b)	PASS
Radiated Emission	§15.407(a)	PASS
Frequency Stability	§15.407(g)	PASS

Note: 1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

1.2 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.3 MEASUREMENT EQUIPMENT USED

The measuring equipment, which was utilized in performing the tests documented here in, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

Conducted Emissions Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	2019-12-26	2020-12-25
Spectrum analyzer	R&S	FSP40	HKE-025	2019-12-26	2020-12-25
Power meter	Agilent	E4419B	HKE-085	2019-12-26	2020-12-25
Power Sensor	Agilent	E9300A	HKE-086	2019-12-26	2020-12-25
Power SPLITTER	Mini-Circuits	ZN2PD-9G	HKE-125	N.C.R	N.C.R
programmable power	Agilent	E3634A	HKE-091	N.C.R	N.C.R
Temperature and humidity	Boyang	HTC-1	HKE-079	2019-12-26	2020-12-25



977 Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	2019-12-26	2020-12-25
Spectrum analyzer	R&S	FSP40	HKE-025	2019-12-26	2020-12-25
Spectrum analyzer	Agilent	N9020A	HKE-089	2019-12-26	2020-12-25
Receiver	R&S	ESCI 7	HKE-010	2019-12-26	2020-12-25
Preamplifier	EMCI	EMC051845SE	HKE-015	2019-12-26	2020-12-25
Preamplifier	Agilent	83051A	HKE-016	2019-12-26	2020-12-25
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2019-12-26	2020-12-25
Horn antenna	Schwarzbeck	9120D	HKE-013	2019-12-26	2020-12-25
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	2019-12-26	2020-12-25
High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	2019-12-26	2020-12-25
Position controller	Taiwan MF	MF7802	HKE-011	N.C.R	N.C.R
Antenna tower	Taiwan MF	CTERG23	HKE-120	N.C.R	N.C.R
Controller	Taiwan MF	CT100	HKE-121	N.C.R	N.C.R
Test Software			EZ-EMC		

Conducted Emission					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Receiver	R&S	ESCI 7	HKE-010	2019-12-26	2020-12-25
LISN	R&S	ENV216	HKE-002	2019-12-26	2020-12-25
LISN	ENV216	R&S	HKE-059	2019-12-26	2020-12-25
ISN	Schwarzbeck	ISN CAT5 8158	HKE-062	2019-12-26	2020-12-25
Test Software	EZ-EMC				

Remark: Each piece of equipment is scheduled for calibration once a year.



1.4 Measurement Uncertainty

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] and shall correspond to an expansion factor(coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95% and 95,45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 6 is based on such expansion factors.

Table6:Maximummeasurementuncertainty

Parameter	UNCERTAINTY
Radio frequency	$\pm 0.8 \times 10^{-7}$
RF power, conducted	0.2054
Maximum frequency deviation:	1.3%
-within 300Hz and 6 kHz of audio frequency	
-within 6 kHz and 25 kHz of audio frequency	0.65 dB
Adjacent channel power	0.2054
Conducted spurious emission of transmitter, valid up to 6 GHz	0.2892
Conducted emission of receivers	+1.2/-1.1 dB
Radiated emission of transmitter, valid up to 6 GHz	± 3.94 dB
Radiated emission of receiver, valid up to 6 GHz	± 3.94 dB
RF level uncertainty for a given BER	± 0.3 dB
Temperature	0.1979
Humidity	± 1 %



2 GENERAL DESCRIPTION

2.1 EUT DESCRIPTION

Equipment	Wireless Repeater			
Model Name	DA213WUS			
Serial No.	DA213BUS, AC12RP, DWR-C5400R, DWR-C4510R, W120RP, W121RP			
Model Difference	All model's the function, software and electric circuit are the same, only model named different. Test sample model: DA213WUS			
Trade Mark	N/A			
FCC ID	2ACSI-DA213WX			
Hardware Version:	V1.6.2			
Software Version:	V1.0			
Frequency Range :	Band	Mode	Operation frequency	Channels
	Band I UNII-I	IEEE802.11 n HT20	5180-5240MHz	4
		IEEE802.11 n HT40	5190-5230MHz	2
		IEEE802.11 ac HT20	5180-5240MHz	4
		IEEE802.11 ac HT40	5190-5230MHz	2
		IEEE802.11 ac HT80	5210MHz	1
	Band II UNII-2A	IEEE802.11 n HT20	5260-5320 MHz	4
		IEEE802.11 n HT40	5270-5310 MHz	2
		IEEE802.11 ac HT20	5260-5320 MHz	4
		IEEE802.11 ac HT40	52770-5310 MHz	2
		IEEE802.11 ac HT80	5290 MHz	1
	Band II UNII-2C	IEEE802.11 n HT20	5500-5720 MHz	12
		IEEE802.11 n HT40	5510-5710 MHz	6
		IEEE802.11 ac HT20	5500-5720 MHz	12
		IEEE802.11 ac HT40	5510-5710 MHz	6
		IEEE802.11 ac HT80	5530-5690 MHz	3
	BAND III	IEEE802.11 n HT20	5745-5825 MHz	5
		IEEE802.11 n HT40	5755-5795 MHz	2
		IEEE802.11 ac HT20	5745-5825 MHz	5
		IEEE802.11 ac HT40	5755-5795 MHz	2
		IEEE802.11 ac HT80	5775 MHz	1
Antenna Type	Internal antenna			
Antenna Gain	Antenna 1: 3dBi Antenna 2: 3dBi MIMO: 6.01dBi			
Power Source	AC 110V 60Hz			

Note: This report only shows band1/2A /2C test data

Through software technology, the product can not transmit 802.11a mode

Data Rate(s) Tested:

6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)
 13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)
 29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390,
 390/433.3 (ac – 80MHz BW)
 13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4Mbps (MIMO n/ac –



20MHz) 156/173Mbps (MIMO ac – 20MHz)
 27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243/270, 270/300Mbps (MIMO n/ac – 40MHz)
 324/360, 360/400Mbps (MIMO ac – 40MHz)
 58.5/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780,
 780/866.7Mbps (MIMO ac – 80MHz)

Frequency of Channels during testing

Band 1		Band 2A		Band 2C		Band 3	
CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)
36	5180	52	5260	100	5500	149	5745
40	5200	56	5280	...	...	...	...
44	5220	60	5300	120	5600	157	5785
48	5240	64	5320	...	...	...	...
				144	5720	165	5825

802.11n / 802.11ac (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)
38	5190	54	5270	102	5510	151	5755
46	5230	62	5310	...	...	159	5795
				118	5590		
				...	...		
				142	5710		

802.11n / 802.11ac (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)	CH.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775
				...	...		
				138	5690		

802.11ac (80MHz BW) Frequency / Channel Operations

Worst Case Configuration: ANT1 transmitting both 2.4GHz mode and 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	ANT1	ANT1
Channel	1	36
Operating Frequency (MHz)	2412	5180
Data Rate (Mbps)	GFSK/1Mbps	MCS0
Mode	2G4 wifi	UNII

Note: The test data for the worst mode of radiation emission has been recorded in the report: HK2004170655-1E

Antenna Description

Frequency [GHz]	Antenna Gain (dBi)	
	ANT1	ANT2
5.150 - 5.250	3	3



5.260 - 5.350	3	3
5.470 - 5.725	3	3
5.745 - 5.850	3	3

2.2 Duty Cycles

5GHz NII operation is possible in 20MHz, and 40MHz, and 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, and detector = peak per the guidance of Section B)2)b) of ANSI C63.10-2013 and KDB 789033 D02 v02r01. 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:

Duty Cycles(%)			
Mode/Band	ANT1	ANT2	MIMO
N(HT20)	98.32	98.36	98.39
N(HT40)	98.24	99.34	98.20
AC(HT20)	99.28	98.56	99.64
AC(HT40)	99.31	98.77	99.37
AC(HT80)	98.22	99.38	98.62

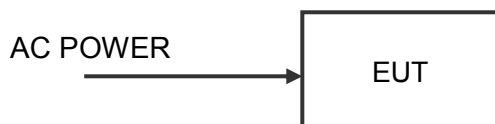
2.3 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

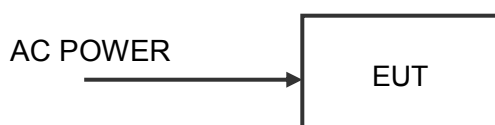
The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement. According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing:



Operation of EUT during Radiation and Above1GHz Radiation testing:





2.5 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turn table, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.3 of ANSI C63.10:2013, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30 MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

Under 1GHz:

The EUT is placed on a turn table, which is 0.8m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

Above 1GHz:

The EUT is placed on a turn table, which is 1.5m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

2.6 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.50 - 5.15
0.495 - 0.505 ⁽¹⁾	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960.0 - 1240	7.25 - 7.75
4.125 - 4.128	25.50 - 25.67	1300 - 1427	8.025 - 8.500
4.17725 - 4.17775	37.50 - 38.25	1435.0 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73.00 - 74.60	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.80 - 75.20	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108.00 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.90 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500.0	17.7 - 21.4
8.37625 - 8.38675	156.70 - 156.90	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.1700	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.20	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358.0	36.43 - 36.5 ⁽²⁾
12.57675 - 12.57725	322.0 - 335.4	3600 - 4400	
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

2.7 DESCRIPTION OF TEST MODES

Description	Modulation Technology	Modulation Type
26dB Bandwidth and 99% bandwidth	OFDM	BPSK
Maximum conducted output power	OFDM	BPSK
Band edges measurement	OFDM	BPSK
Peak Power Spectral Density	OFDM	BPSK
Radiated undesirable emission	OFDM	BPSK
Power line conducted emission	OFDM	BPSK

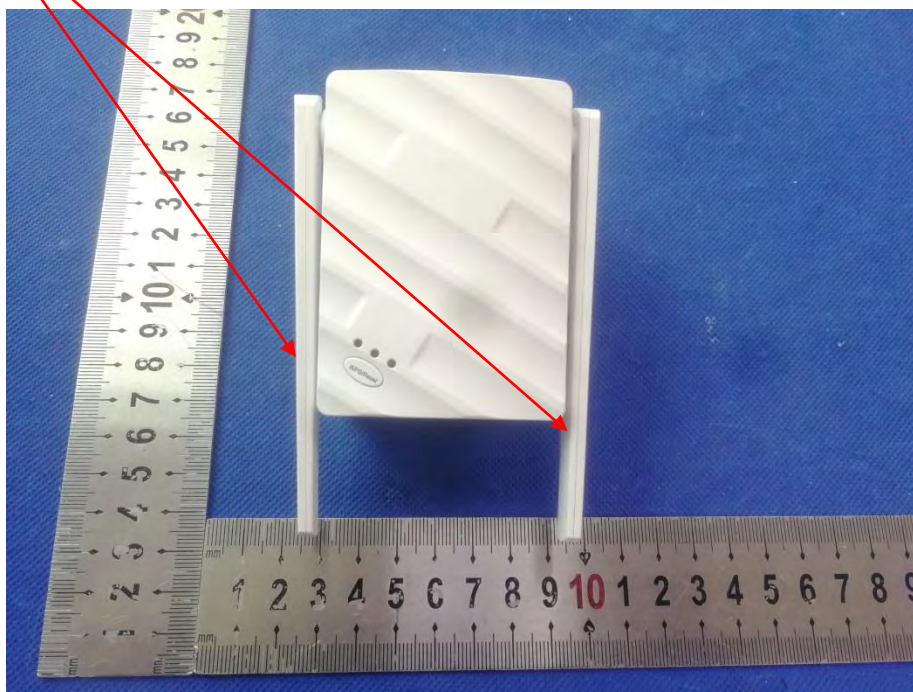
2.8 ANTENNA DESCRIPTION

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 or 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 this EUT is a unique (**Internal Antenna** for WiFi).

* the EUT complies with the requirement of 15.203.

WIFI ANTENNA





3.SETUP OF EQUIPMENT UNDER TEST

3.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

3.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	Certificate
1.	Notebook	DELL	TP00067A	N/A	FCC ID

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



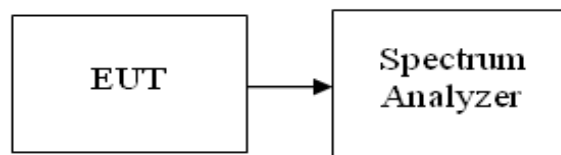
4 TEST REQUIREMENTS AND RESULTS

4.1 26 DB EMISSION BANDWIDTH

LIMIT

According to §15.403(i), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzers RBW = approximately 1% of the emission bandwidth, VBW > RBW, Detector = Peak, Span > 26dB bandwidth, and Sweep = auto, Trace mode = max hold.
4. Measure the maximum width of the emission that is 26dB 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%.
5. Repeat until all the rest channels were investigated.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	26dB Bandwidth [MHz]	
				ANT1	ANT2
BAND 1	n (20MHz)	36	5180	20.29	20.31
		40	5200	20.42	20.28
		48	5240	20.19	20.28
	n (40MHz)	38	5190	40.52	41.09
		46	5230	40.57	40.68
	ac (20MHz)	36	5180	20.90	21.10
		40	5200	20.52	20.99
		48	5240	20.53	20.92
	ac(40MHz)	38	5190	39.82	40.00

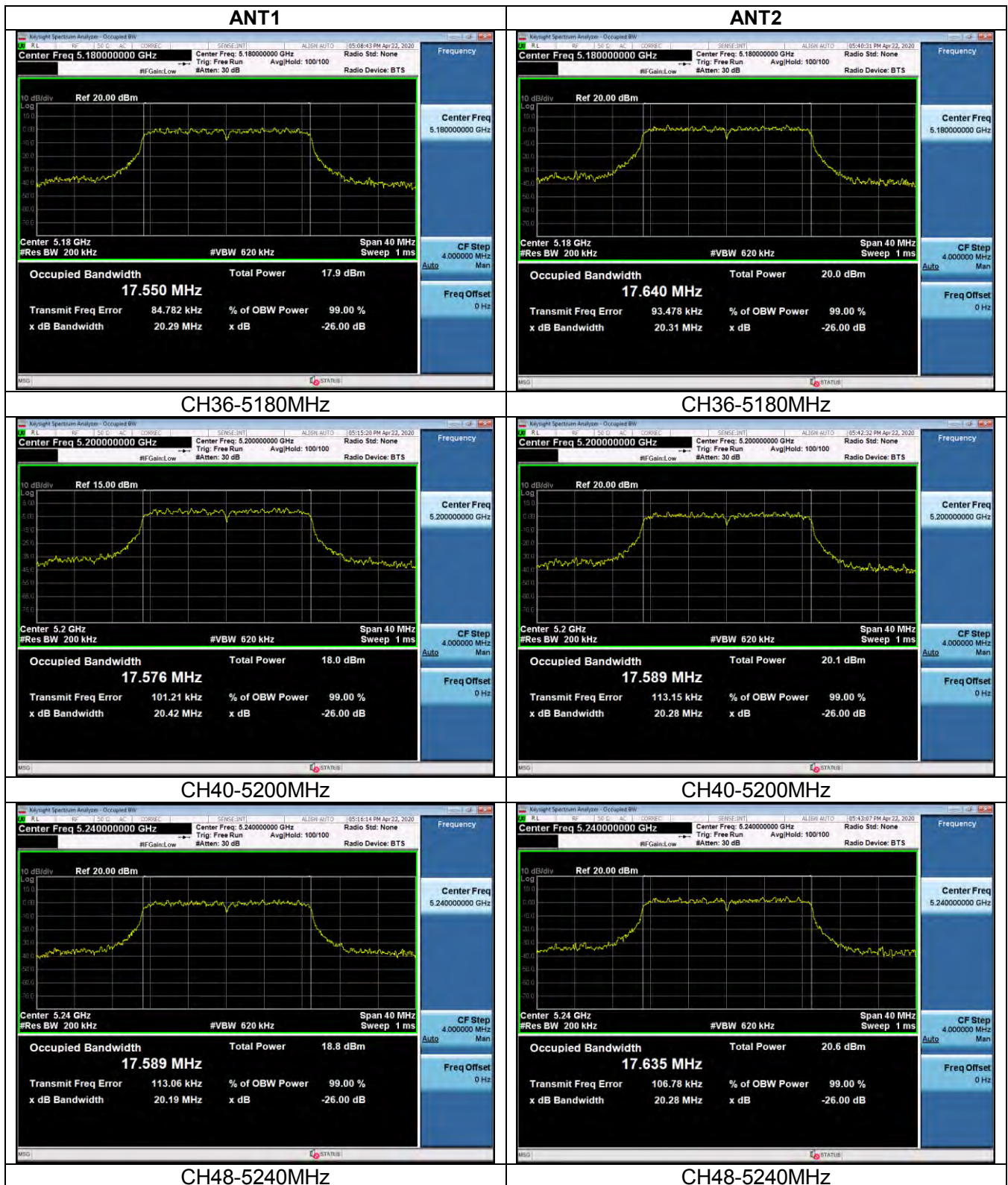


		46	5230	39.75	39.98
	ac(80MHz)	42	5210	82.69	81.87
BAND 2A	n (20MHz)	52	5260	20.12	19.94
		56	5280	20.23	20.02
		64	5320	20.10	19.80
	n (40MHz)	54	5270	54.98	41.10
		62	5310	54.96	41.12
	ac (20MHz)	52	5260	20.50	20.28
		56	5280	20.25	20.46
		64	5320	20.23	20.58
	ac(40MHz)	54	5270	47.64	39.75
		62	5310	47.87	40.00
	ac(80MHz)	58	5290	95.64	82.64
	BAND 2C	n (20MHz)	100	5500	20.33
120			5600	20.04	20.29
144			5720	20.25	20.06
n (40MHz)		102	5510	40.73	40.39
		118	5590	41.28	40.92
		142	5710	52.83	40.17
ac (20MHz)		100	5500	20.54	20.21
		120	5600	20.62	20.19
		144	5720	20.35	20.45
ac(40MHz)		102	5510	40.25	40.24
		118	5590	40.27	40.21
		142	5710	47.55	40.39
ac(80MHz)		106	5530	82.27	80.85
		122	5610	82.50	81.24



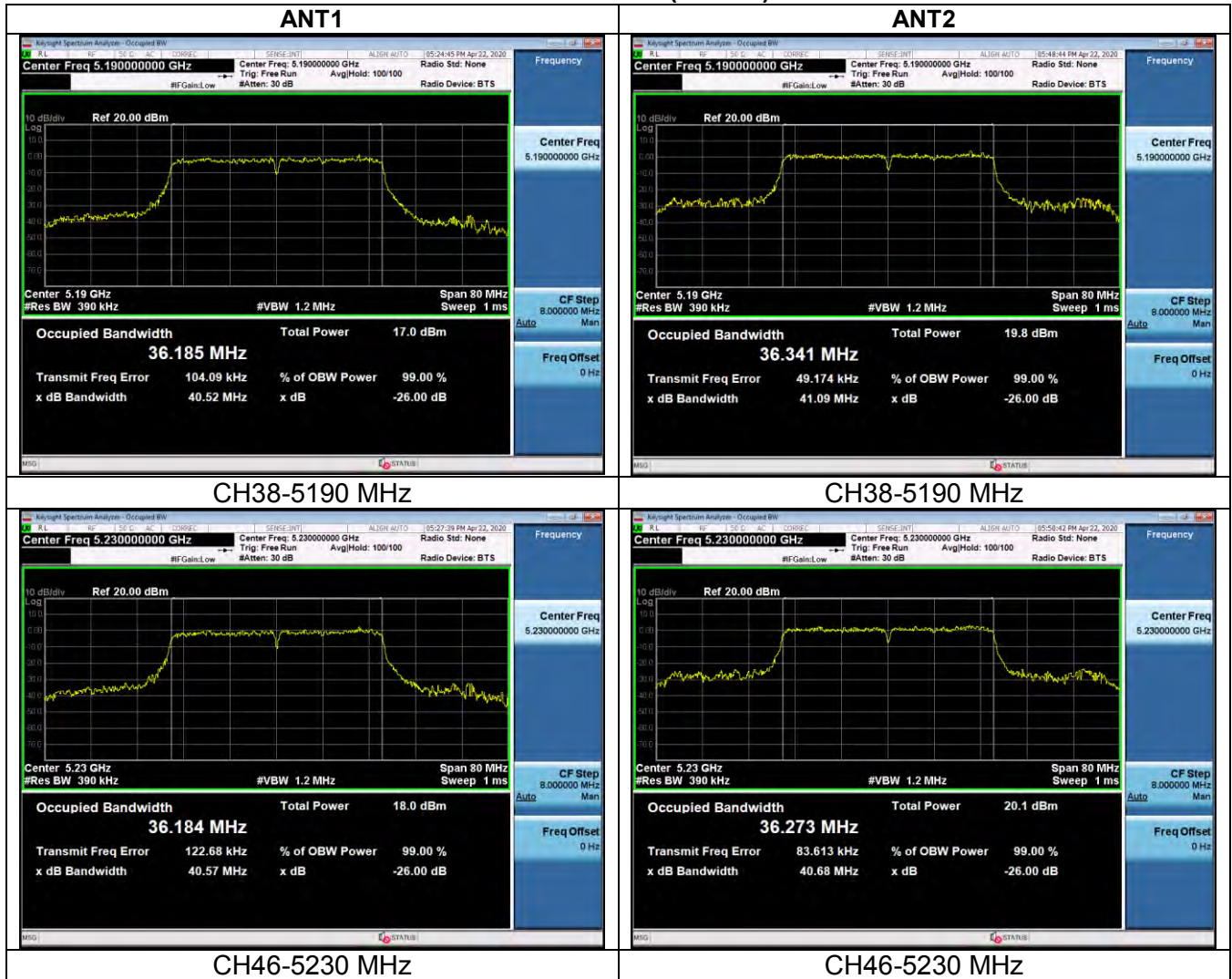
Test plots as follows:

Band 1 -- n (20MHz)



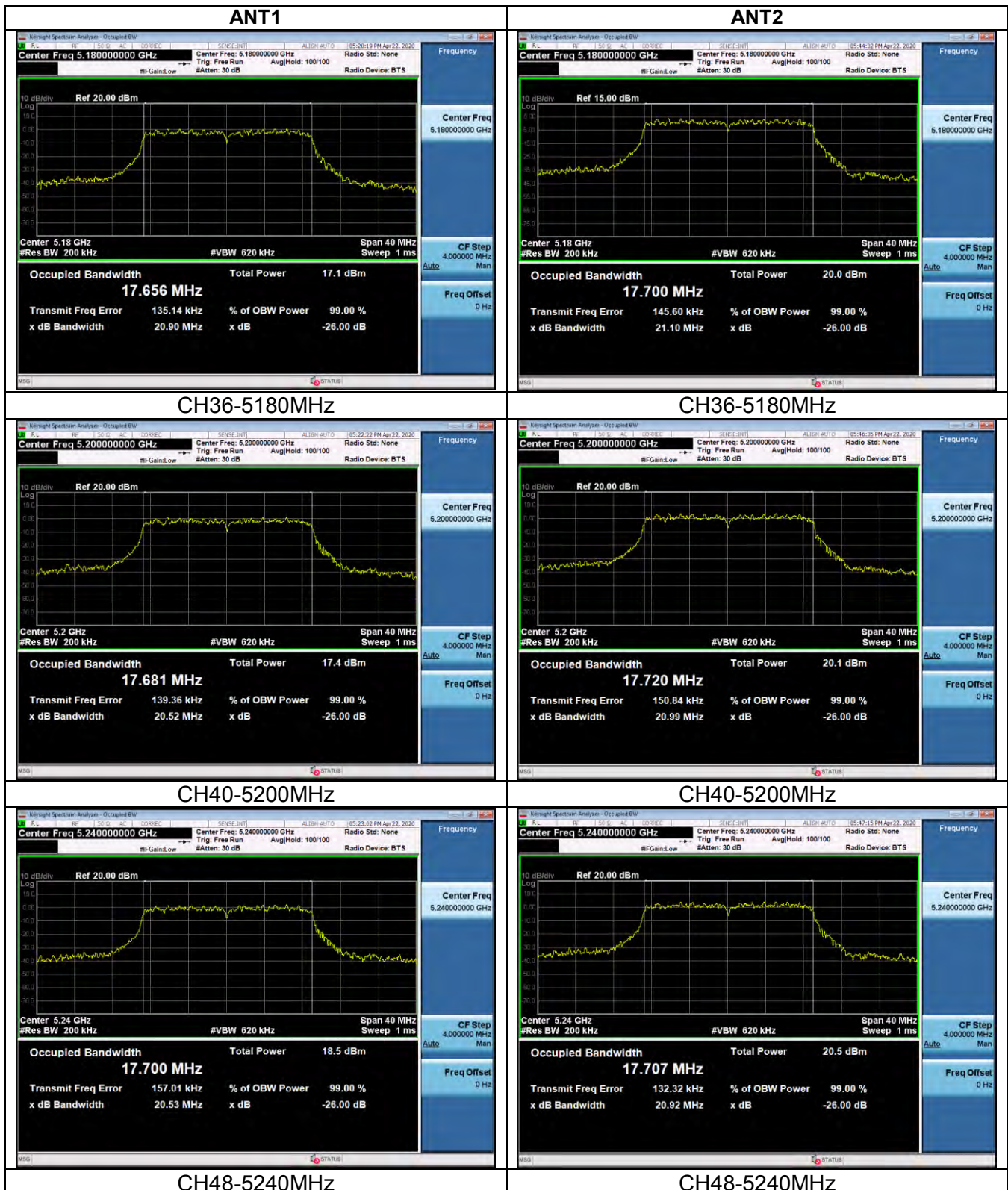


Band 1 -- n (40MHz)



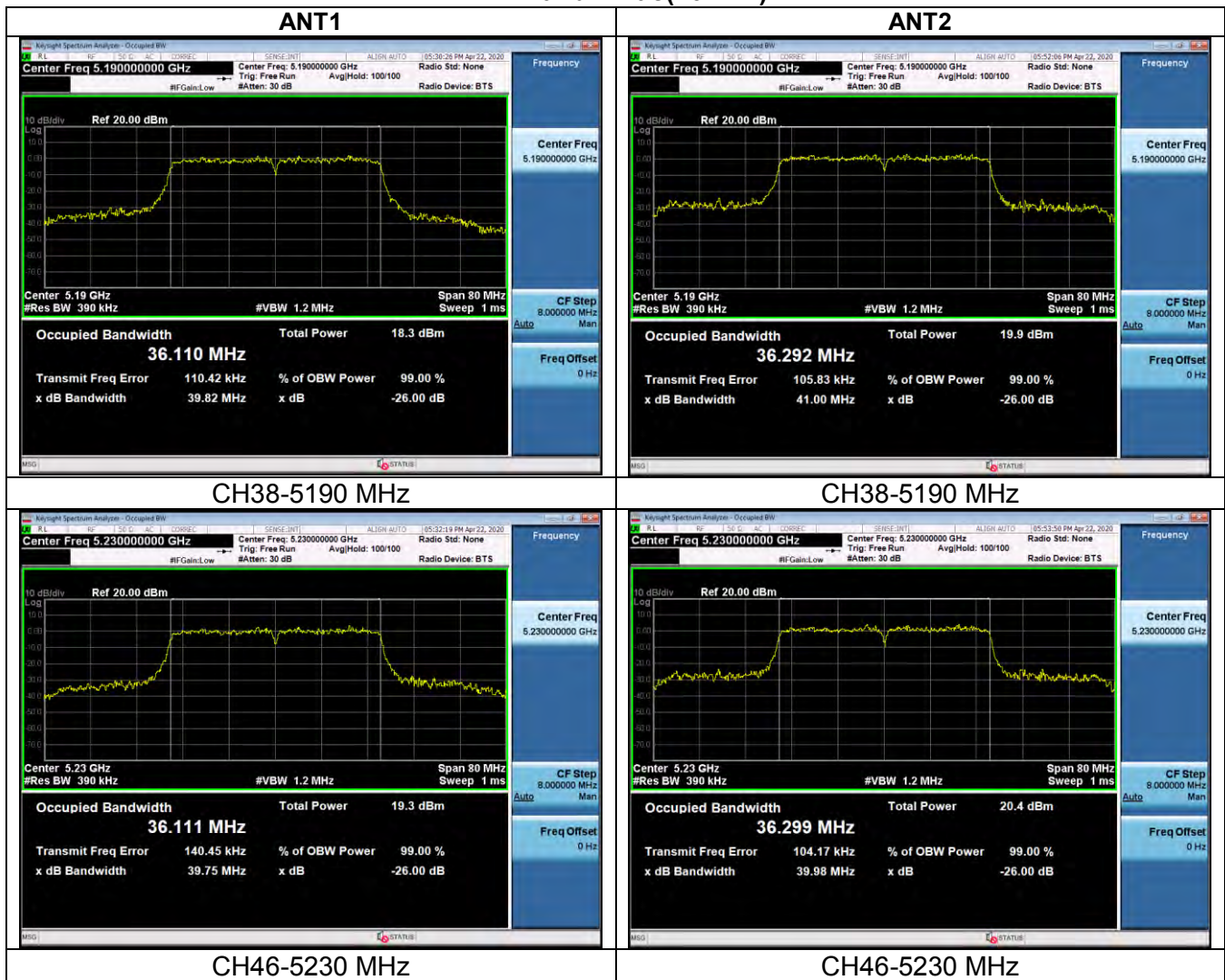


Band 1-- ac (20MHz)

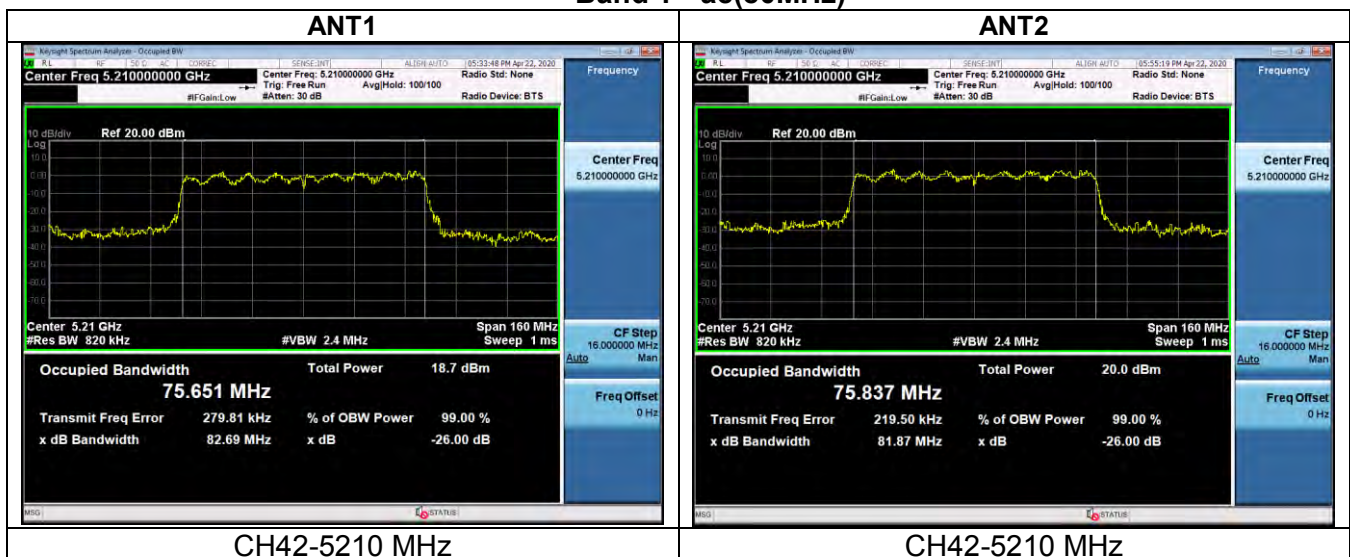




Band 1-- ac(40MHz)

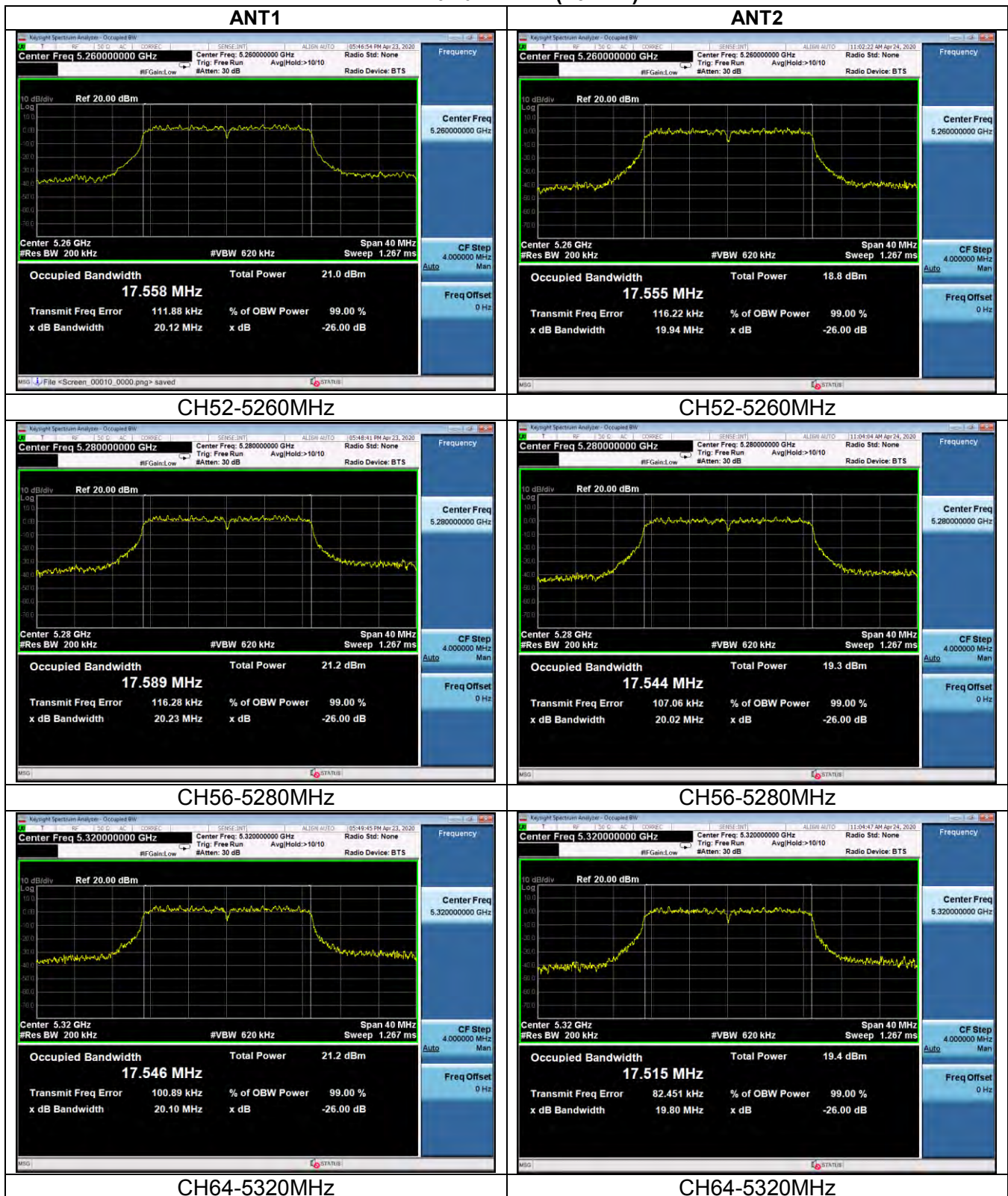


Band 1-- ac(80MHz)



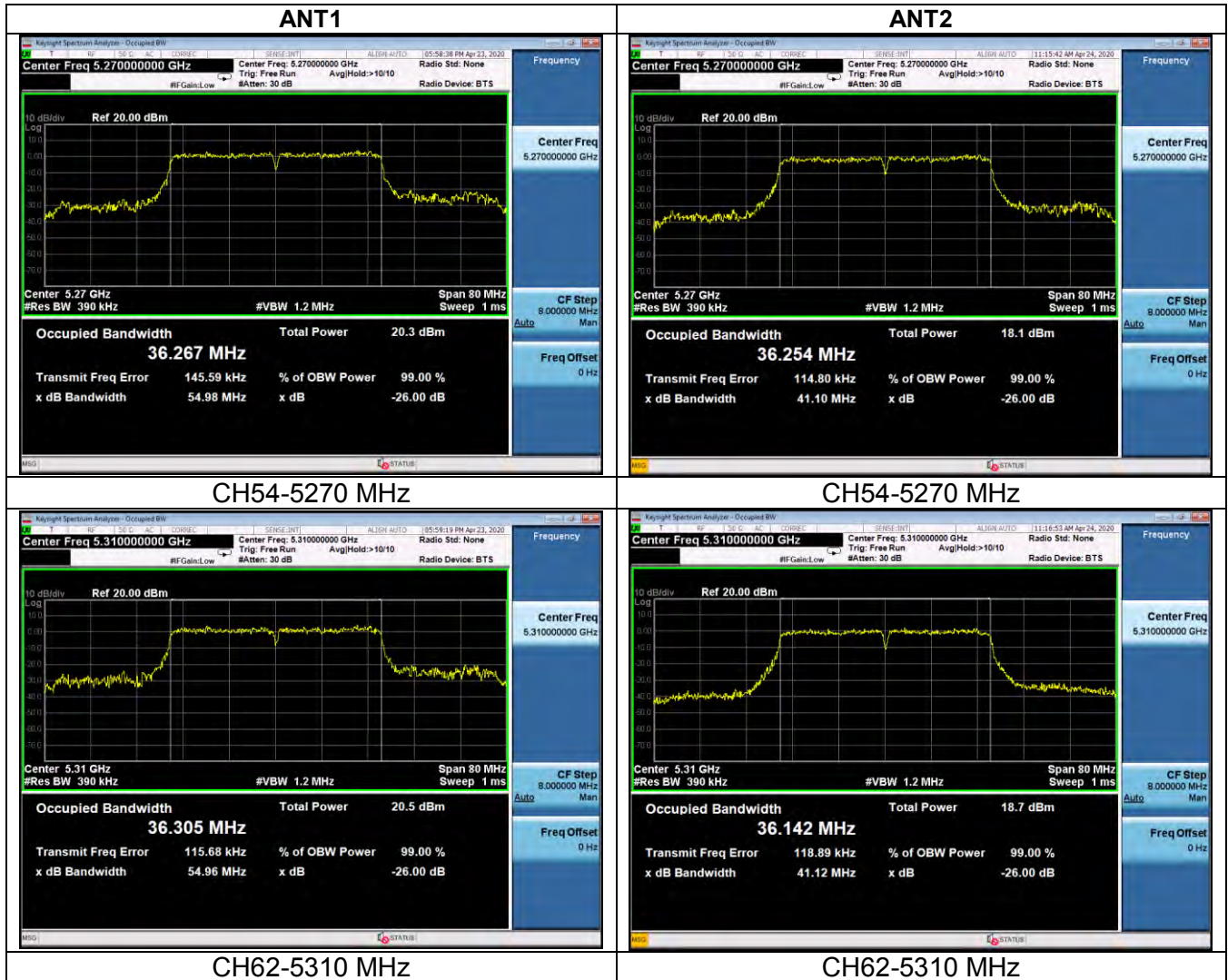


Band 2A -- n (20MHz)



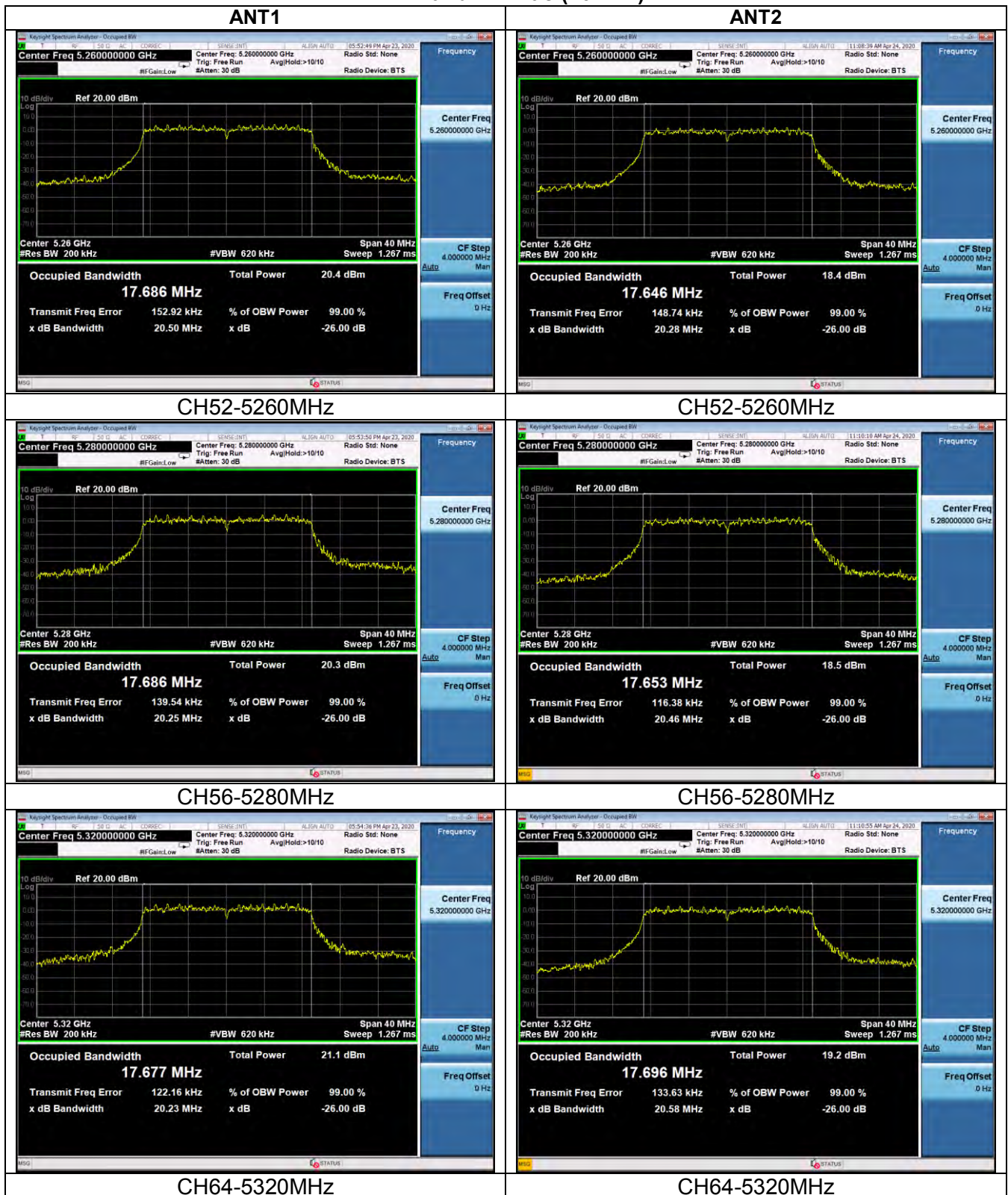


Band 2A -- n (40MHz)



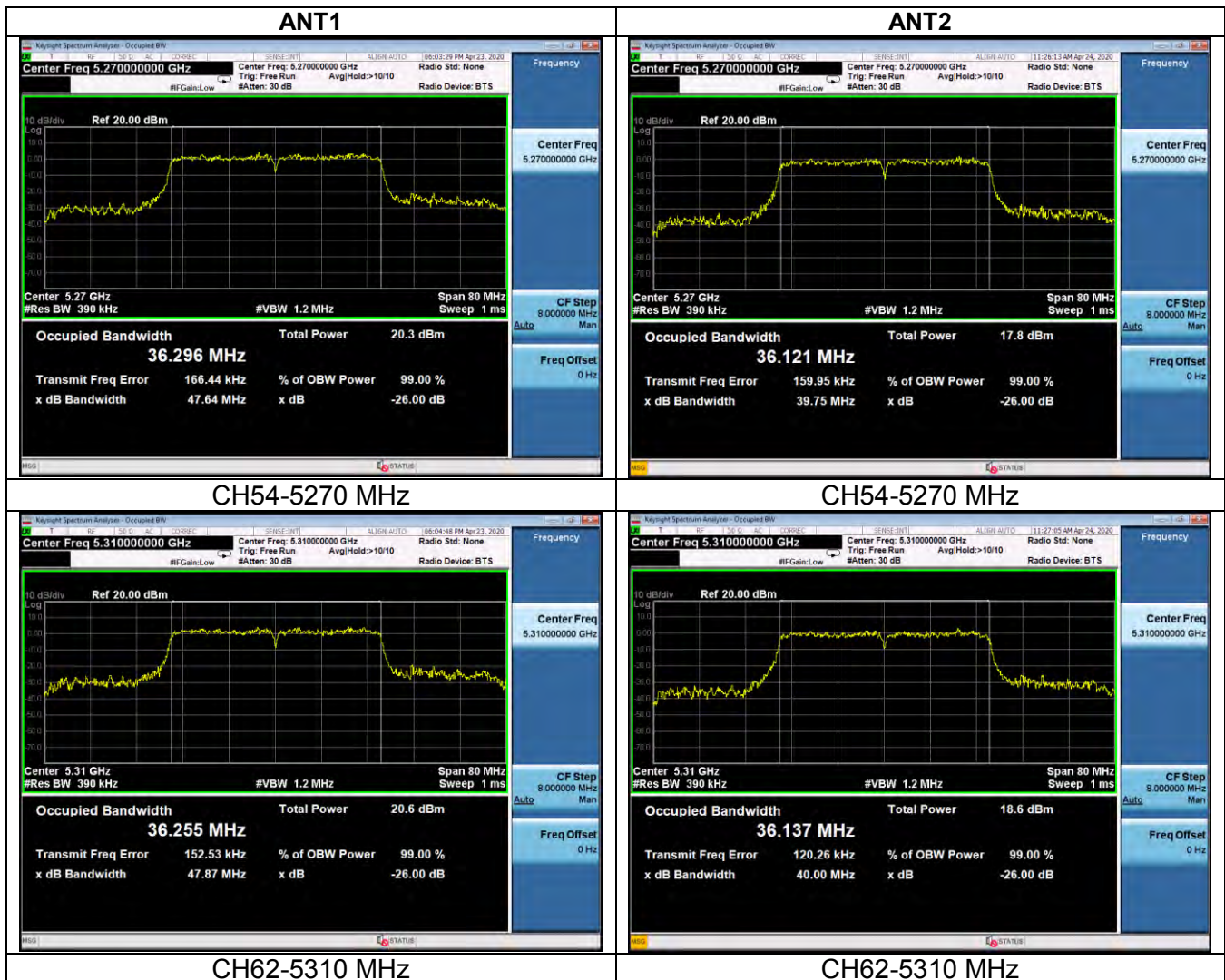


Band 2A -- ac (20MHz)





Band 2A -- ac(40MHz)

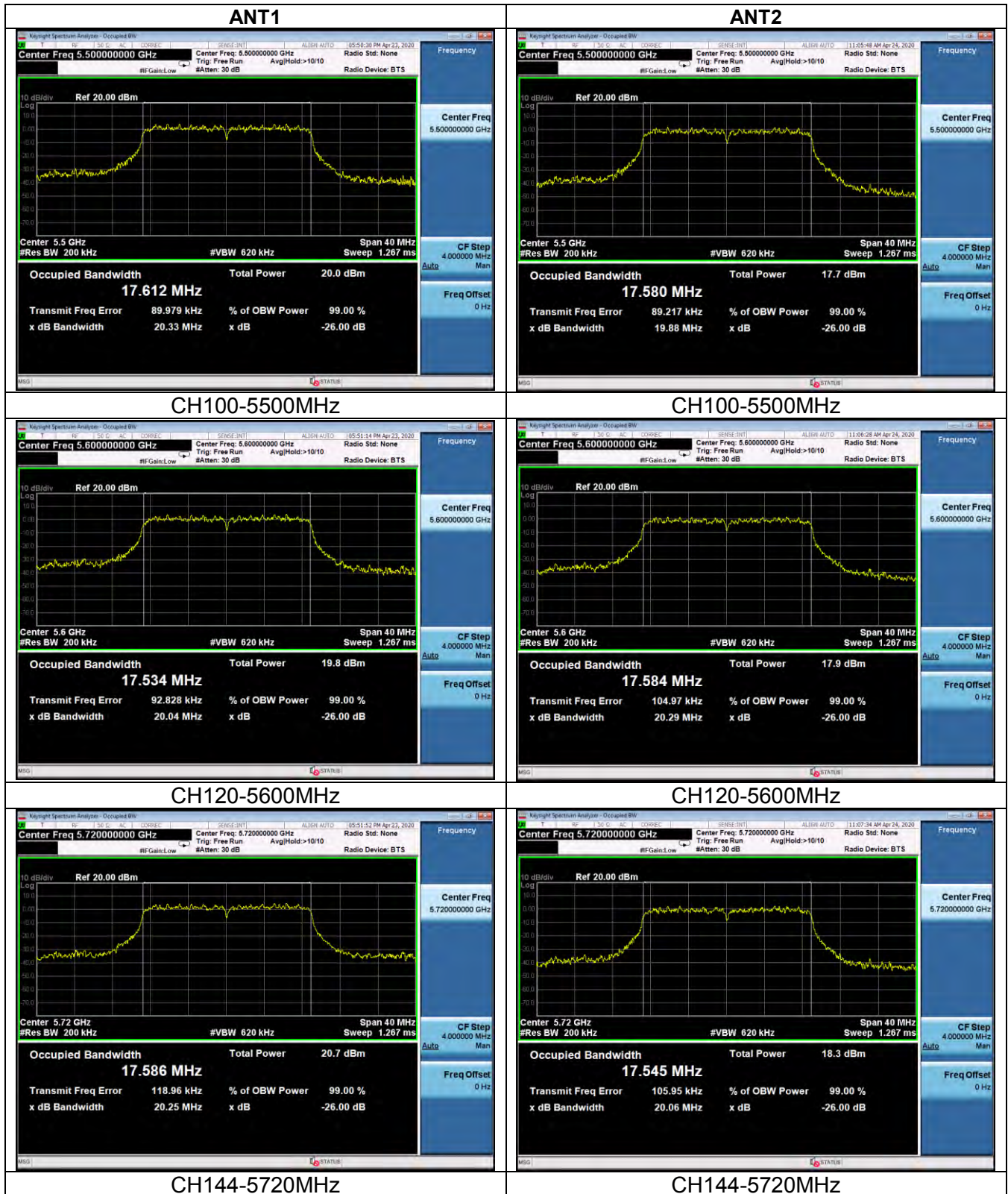


Band 2A -- ac(80MHz)



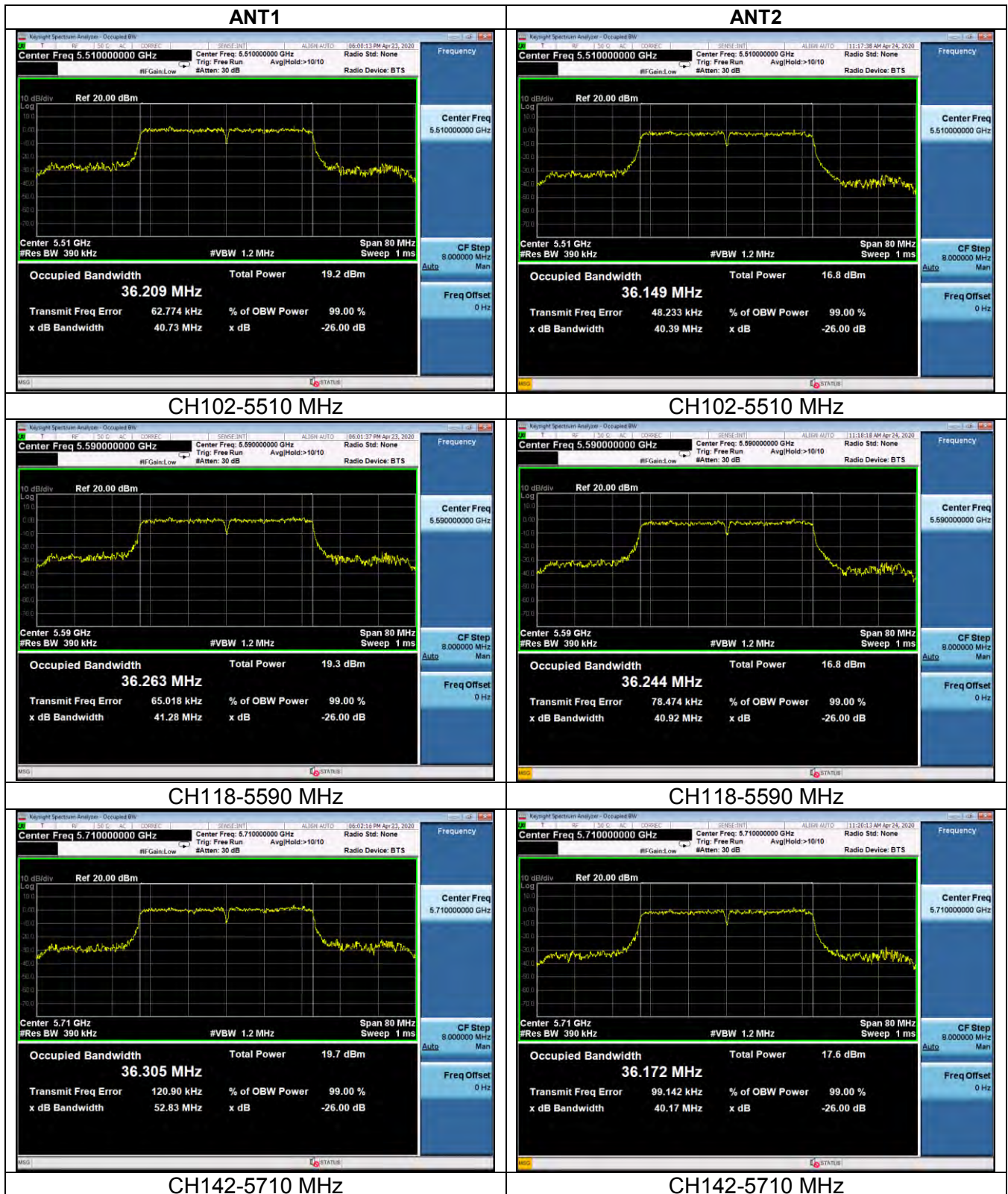


Band 2C -- n (20MHz)



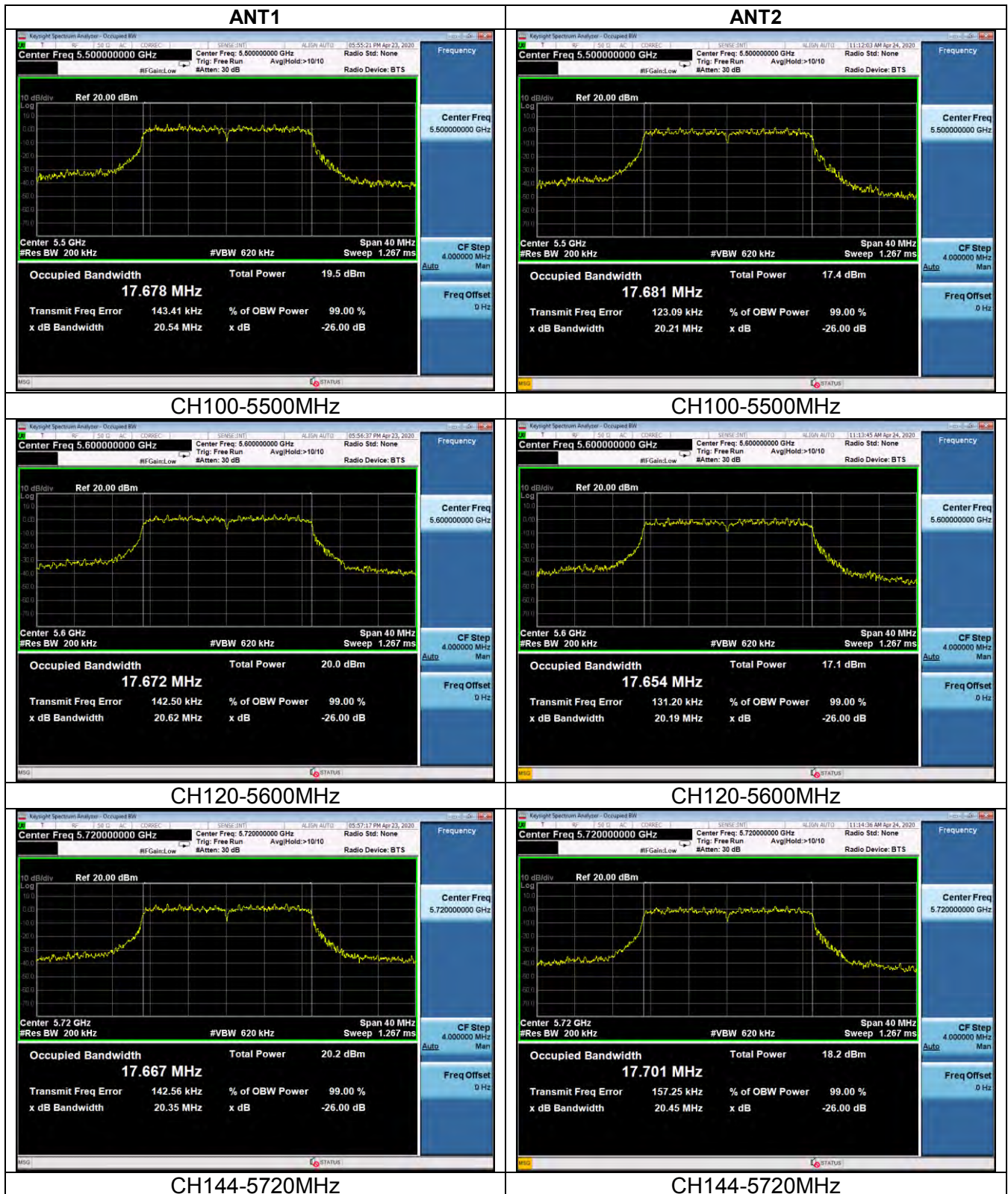


Band 2C --n (40MHz)



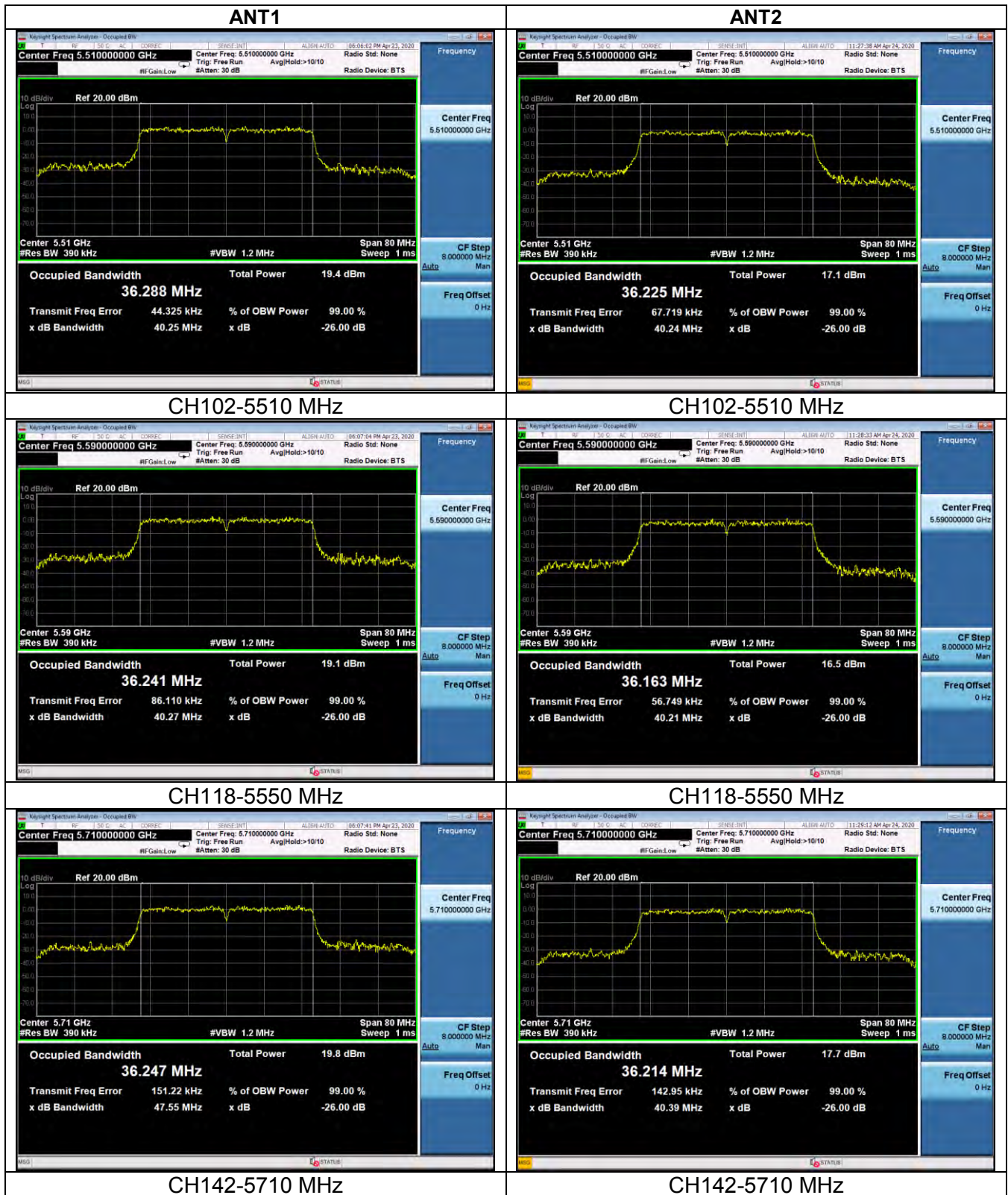


Band 2C -- ac (20MHz)



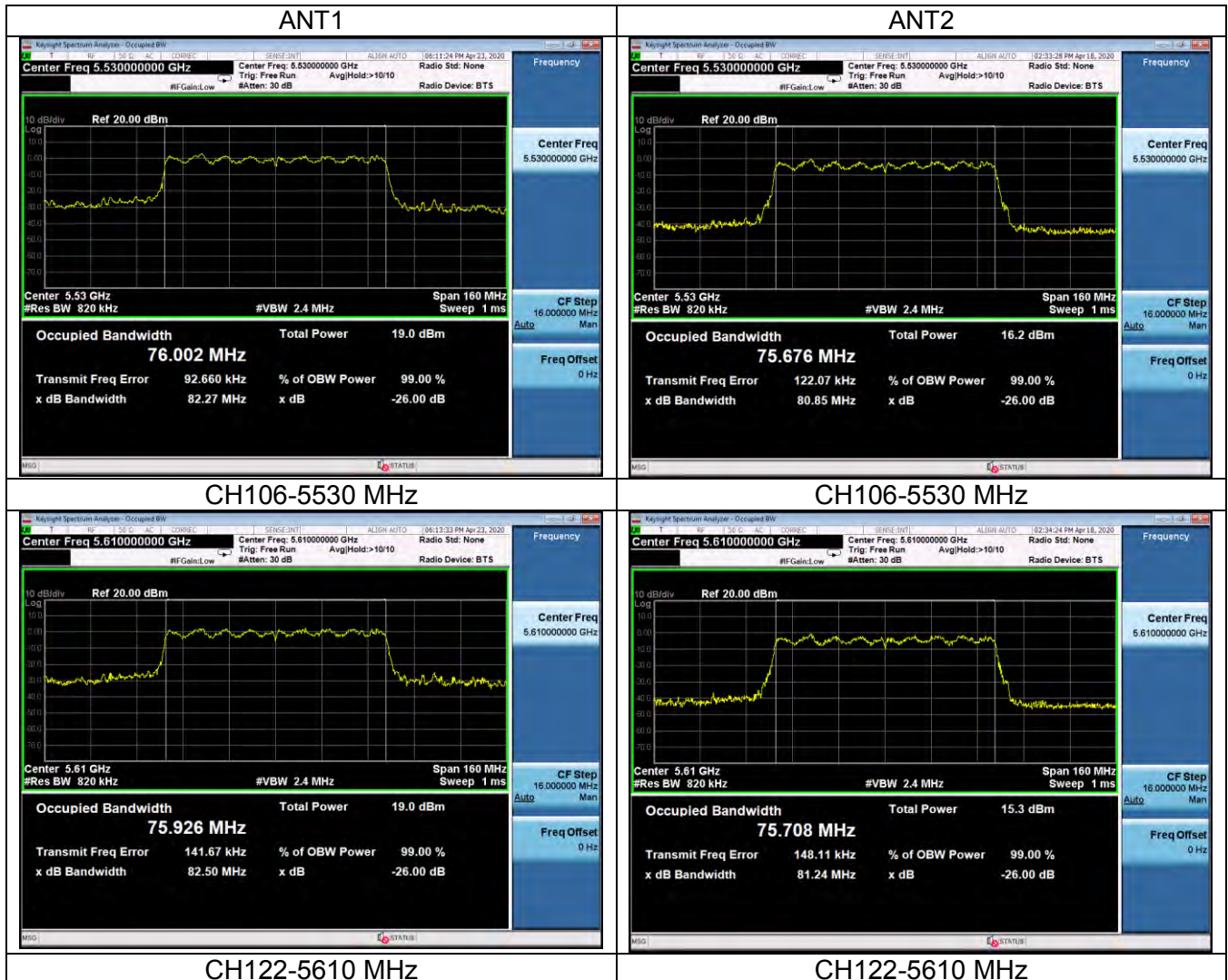


Band 2C -- ac(40MHz)





Band 2C --ac(80MHz)





4.2 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

According to §15.407(a),

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.

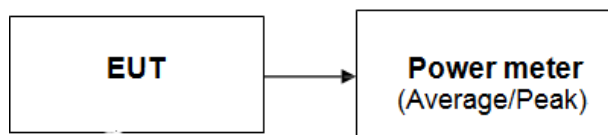
For the 5.25-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or 11dBm $10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

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

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W

The peak power shall not exceed the limit as follow:

TEST CONFIGURATION



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

TEST PROCEDURE

The testing follows Method PM of FCC KDB789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF peak power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	Conducted Power [dBm]		Limit [dBm]
				ANT1	ANT2	
BAND 1	n (20MHz)	36	5180	11.01	12.98	30
		40	5200	11.34	12.03	30
		48	5240	10.54	12.66	30
	n (40MHz)	38	5190	10.04	10.41	30
		46	5230	10.13	10.95	30
	ac (20MHz)	36	5180	10.64	11.18	30
		40	5200	10.14	12.41	30
		48	5240	11.24	12.02	30



	ac(40MHz)	38	5190	9.99	10.10	30
		46	5230	10.08	10.86	30
	ac(80MHz)	42	5210	8.70	8.32	30
BAND 2A	n (20MHz)	52	5260	11.90	12.97	24
		56	5280	11.65	12.75	24
		64	5320	10.24	10.75	24
	n (40MHz)	54	5270	11.70	11.26	24
		62	5310	10.75	9.17	24
	ac (20MHz)	52	5260	10.59	11.29	24
		56	5280	10.47	10.02	24
		64	5320	11.77	10.02	24
	ac(40MHz)	54	5270	9.18	9.08	24
		62	5310	9.36	10.02	24
	ac(80MHz)	58	5290	7.72	7.84	24
BAND 2C	n (20MHz)	100	5500	11.52	12.34	24
		120	5600	12.54	11.62	24
		144	5720	10.24	11.61	24
	n (40MHz)	102	5510	9.04	10.08	24
		118	5590	10.71	11.84	24
		142	5710	10.18	10.88	24
	ac (20MHz)	100	5500	11.14	11.18	24
		120	5600	10.89	11.45	24
		144	5720	9.55	10.27	24
	ac(40MHz)	102	5510	9.18	10.12	24
		118	5590	10.92	9.25	24
		142	5710	9.59	9.47	24
	ac(80MHz)	106	5530	7.72	8.24	24
		122	5610	7.24	8.98	24

**MIMO/CDD Maximum Conducted Output Power Measurements**

BAND	802.11 Mode	Channel No.	Freq. [MHz]	Conducted Power [dBm]		MIMO	Limit [dBm]	Results
				ANT1	ANT2			
BAND 1	n(20MHz)	36	5180	10.85	12.82	14.96	29.99	PASS
		40	5200	11.27	11.96	14.64	29.99	
		48	5240	10.40	12.52	14.60	29.99	
	n(40MHz)	38	5190	9.78	10.15	12.98	29.99	
		46	5230	10.07	10.89	13.51	29.99	
	ac(20MHz)	36	5180	10.36	10.90	13.65	29.99	
		40	5200	9.86	12.13	14.15	29.99	
		48	5240	11.17	11.95	14.59	29.99	
	ac(40MHz)	38	5190	9.96	10.07	13.03	29.99	
		46	5230	9.93	10.71	13.35	29.99	
	ac(80MHz)	42	5210	8.60	8.22	11.42	29.99	
BAND 2A	n (20MHz)	52	5260	11.75	12.82	15.33	23.99	PASS
		56	5280	11.59	12.69	15.19	23.99	
		64	5320	10.00	10.51	13.27	23.99	
	n (40MHz)	54	5270	11.62	11.18	14.42	23.99	
		62	5310	10.71	9.13	13.00	23.99	
	ac(20MHz)	52	5260	10.37	11.07	13.74	23.99	
		56	5280	10.20	9.75	12.99	23.99	
		64	5320	11.74	9.99	13.96	23.99	
	ac(40MHz)	54	5270	9.07	8.97	12.03	23.99	
		62	5310	9.36	10.02	12.71	23.99	
	ac(80MHz)	58	5290	7.61	7.73	10.68	23.99	
BAND 2C	n (20MHz)	100	5500	11.30	12.12	14.74	23.99	PASS
		120	5600	12.34	11.42	14.91	23.99	
		144	5720	9.97	11.34	13.72	23.99	
	n (40MHz)	102	5510	10.83	10.87	13.86	23.99	
		118	5590	10.70	11.83	14.31	23.99	
		142	5710	10.02	10.72	13.39	23.99	
	ac(20MHz)	100	5500	11.08	11.12	14.11	23.99	
		120	5600	10.79	11.35	14.09	23.99	
		144	5720	9.32	10.04	12.71	23.99	
	ac(40MHz)	102	5510	9.05	9.99	12.56	23.99	
		118	5590	10.74	9.07	13.00	23.99	
		142	5710	9.51	9.39	12.46	23.99	
	ac(80MHz)	106	5530	7.58	8.10	10.86	23.99	
		122	5610	7.30	8.12	10.74	23.99	

MIMO LIMIT= LIMIT-(GAIN_{MIMO} - 6)

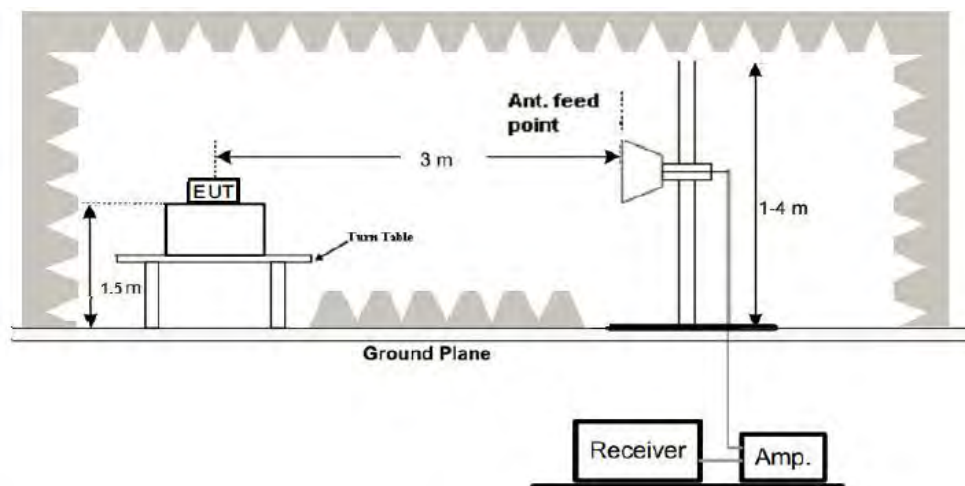
4.3 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(b),

- (1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
- (2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

TEST CONFIGURATION



TESTPROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / Sweep=AUTO

VBW=10Hz, when duty cycle is no less than 98 percent.

VBW $\geq 1/T$, when duty cycle is less than 98 percent, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Mode/Band	Duty Cycles(%)		
	ANT1	ANT2	MIMO
N(HT20)	98.32	98.36	98.39
N(HT40)	98.24	99.34	98.20
AC(HT20)	99.28	98.56	99.64
AC(HT40)	99.31	98.77	99.37
AC(HT80)	98.22	99.38	98.62

TESTRESULTS



Antenna1

Band1--IEEE802.11n(HT20) mode

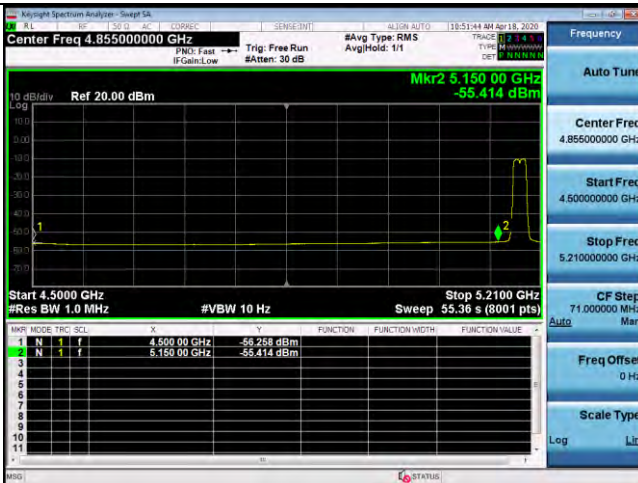


Band1--IEEE802.11n(HT40) mode

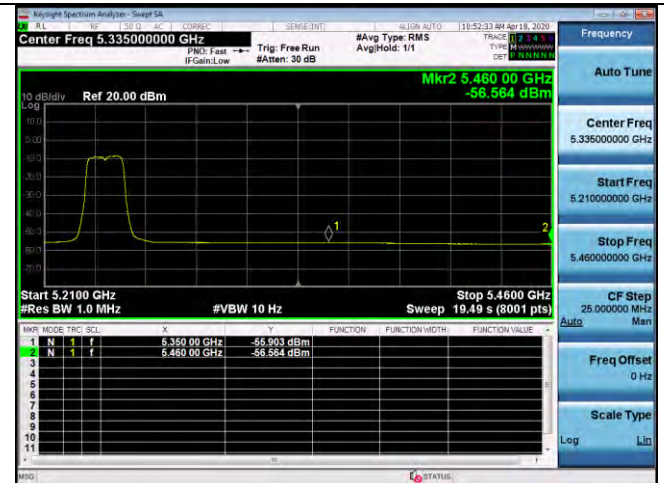




Band1--IEEE802.11ac(HT20) mode

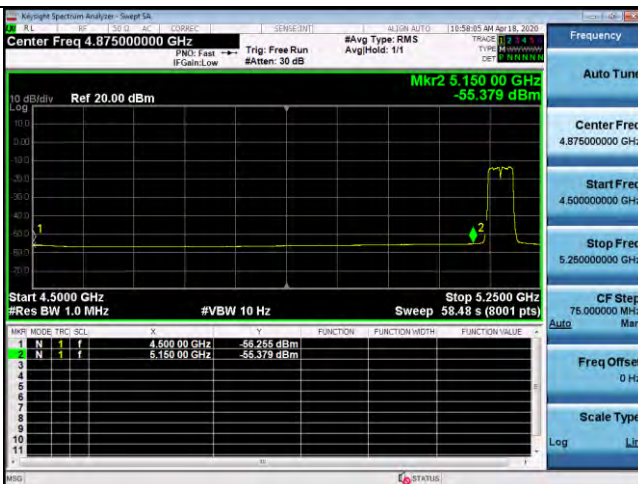


Left--5190 MHz

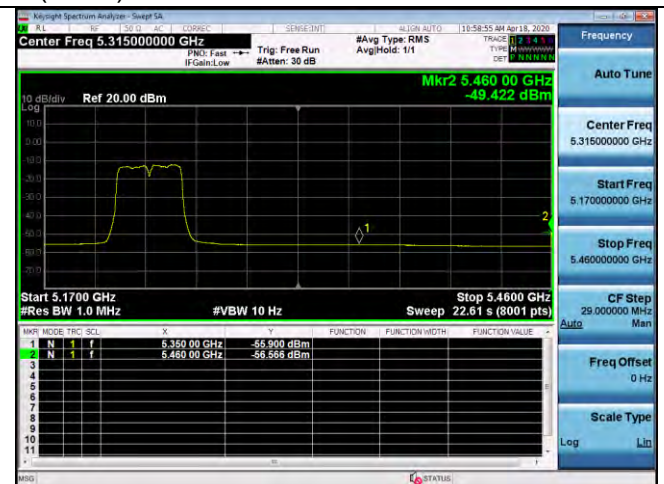


Right--5230 MHz

Band1--IEEE802.11ac(HT40) mode

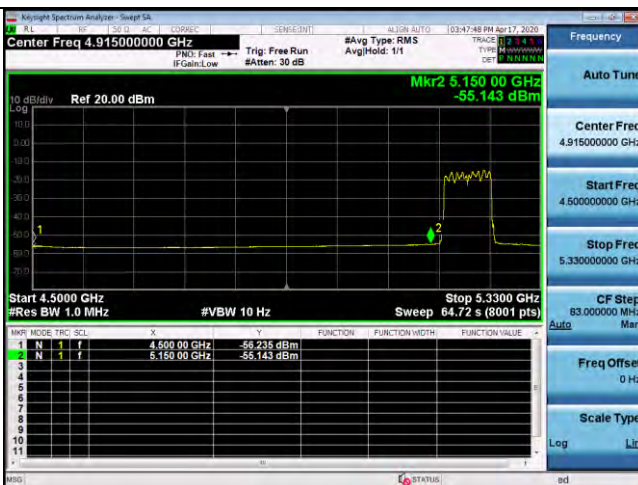


Left--5190 MHz

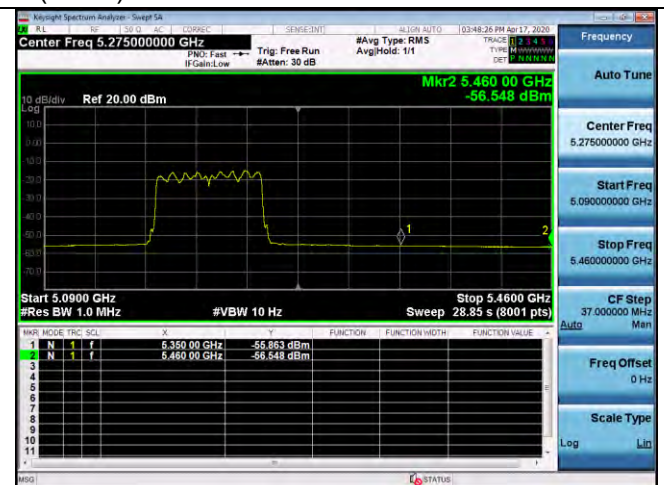


Right--5230 MHz

Band1--IEEE802.11ac(HT80) mode



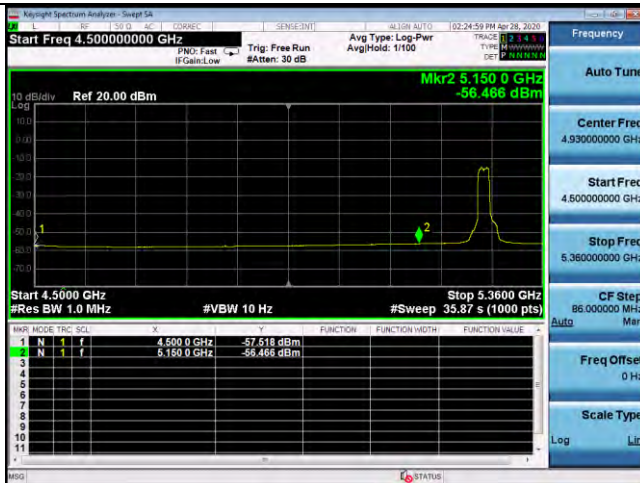
Left--5210 MHz



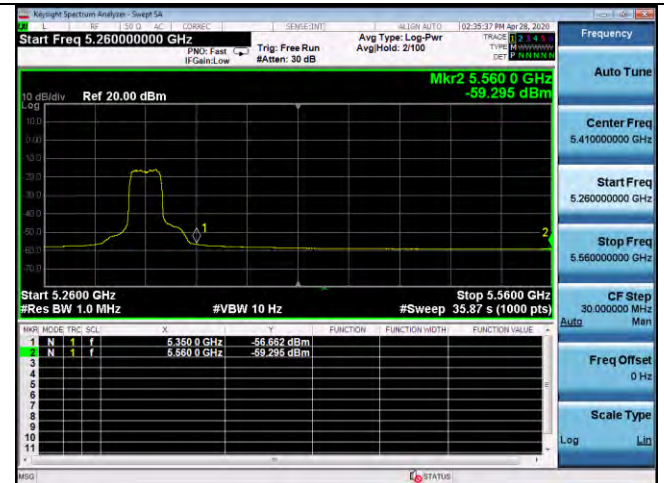
Right--5210 MHz



Band 2A-IEEE802.11n(HT20) mode

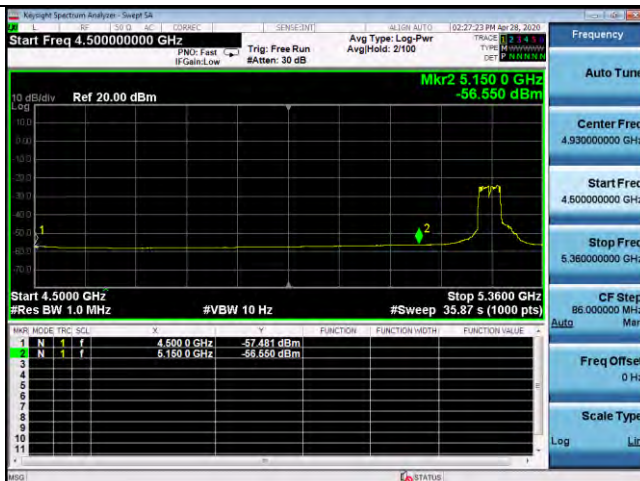


Left--5260 MHz

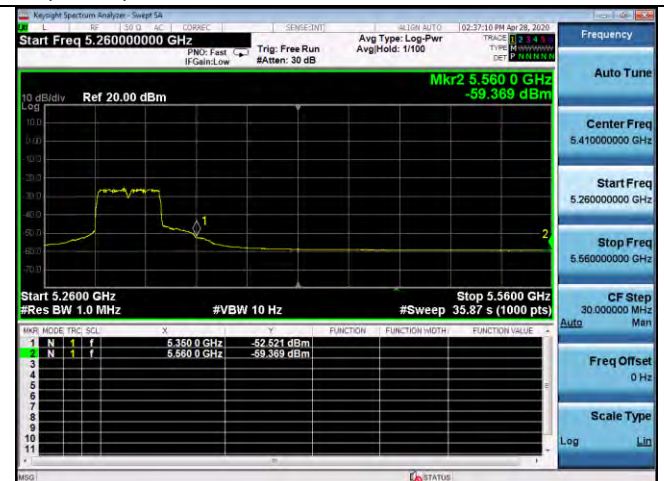


Right--5320 MHz

Band 2A--IEEE802.11n(HT40) mode



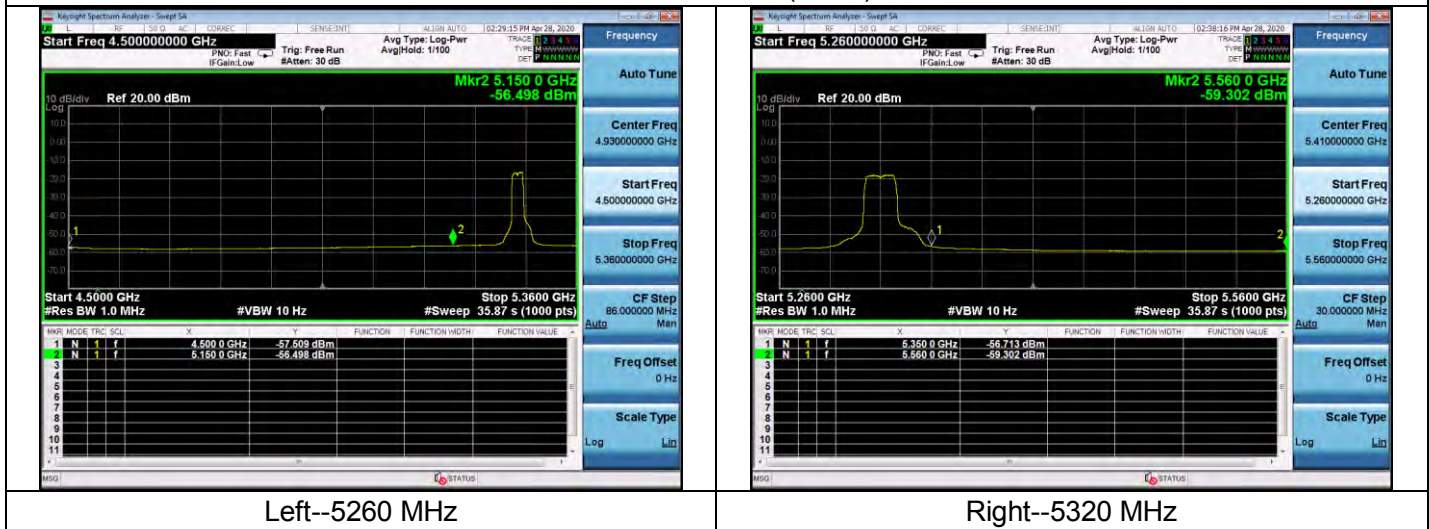
Left--5270 MHz



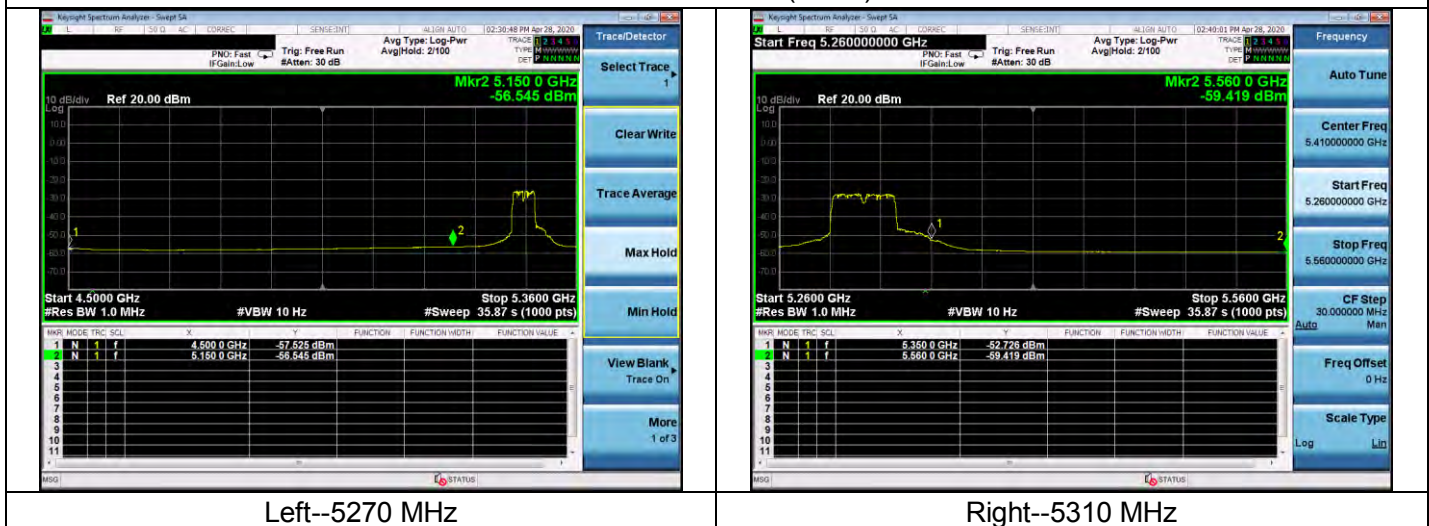
Right--5310 MHz



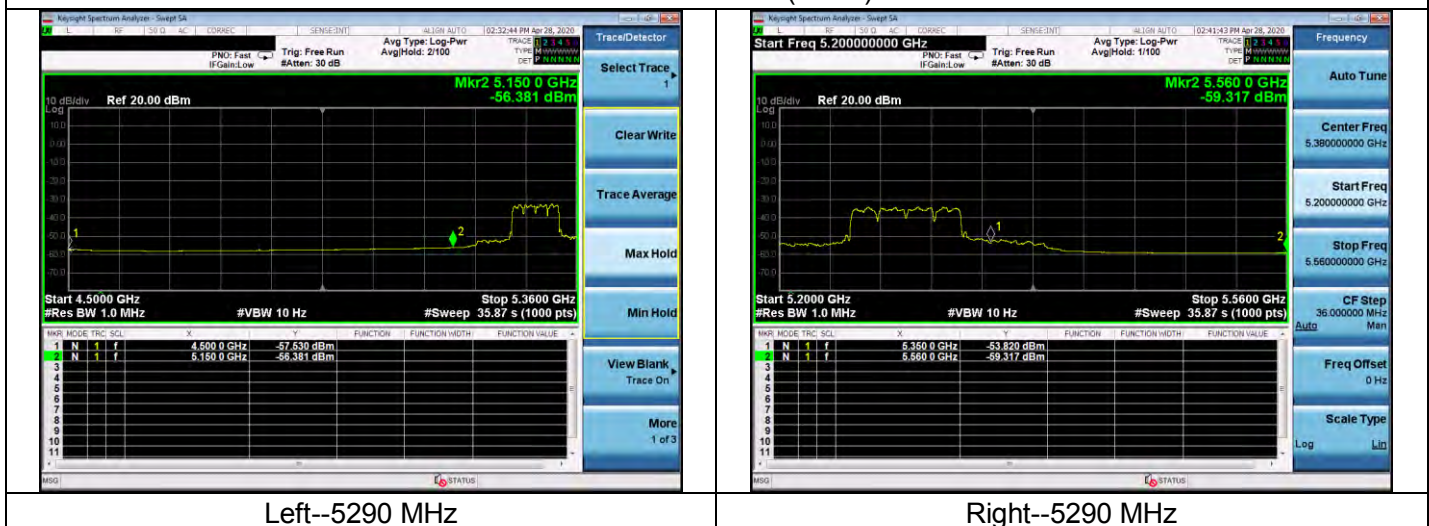
Band 2A--IEEE802.11ac(HT20) mode



Band 2A--IEEE802.11ac(HT40) mode

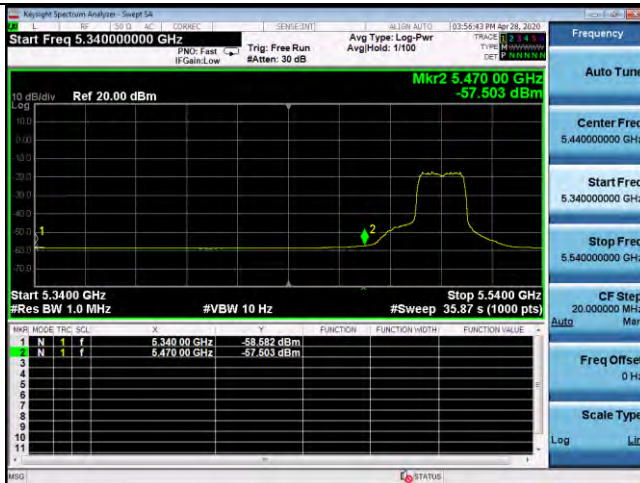


Band 2A--IEEE802.11ac(HT80) mode

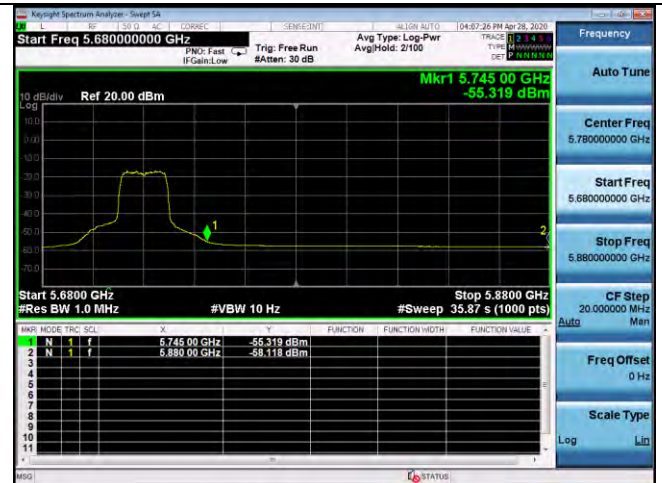




Band 2C--IEEE802.11n(HT20) mode



Left--5500 MHz



Right--5720 MHz

Band 2C--IEEE802.11n(HT40) mode



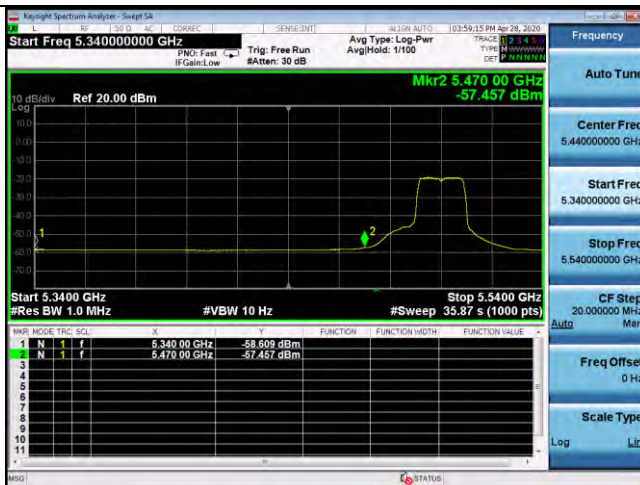
Left--5510 MHz



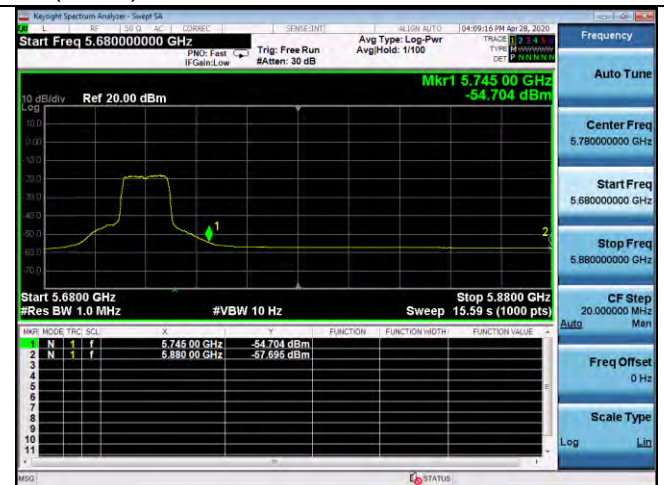
Right--5710 MHz



Band 2C--IEEE802.11ac(HT20) mode



Left--5500 MHz



Right--5720 MHz

Band 2C--IEEE802.11ac(HT40) mode



Left--5510 MHz



Right--5710 MHz

Band 2C--IEEE802.11ac(HT80) mode



Left--5530 MHz

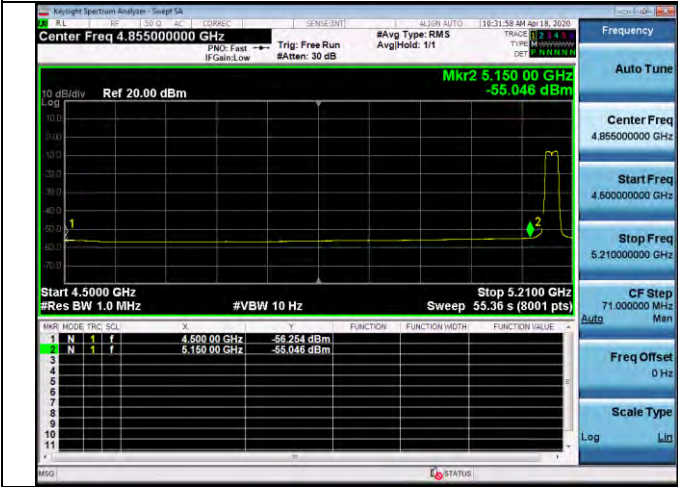


Right--5690 MHz

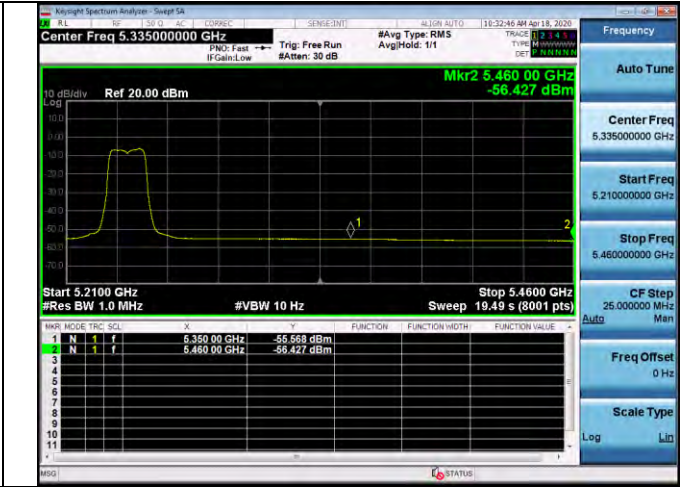


Antenna 2

Band1--IEEE802.11n(HT20) mode

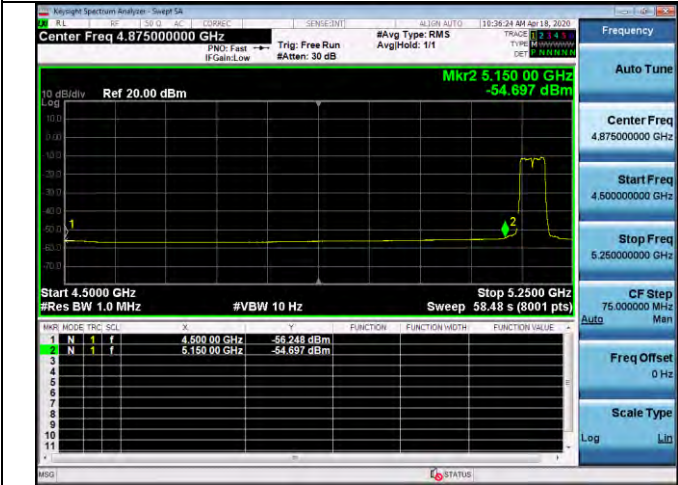


Left--5180 MHz

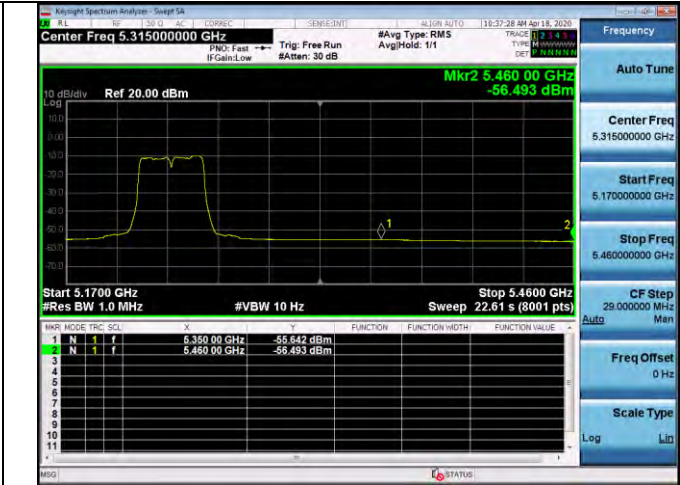


Right--5240 MHz

Band1--IEEE802.11n(HT40) mode



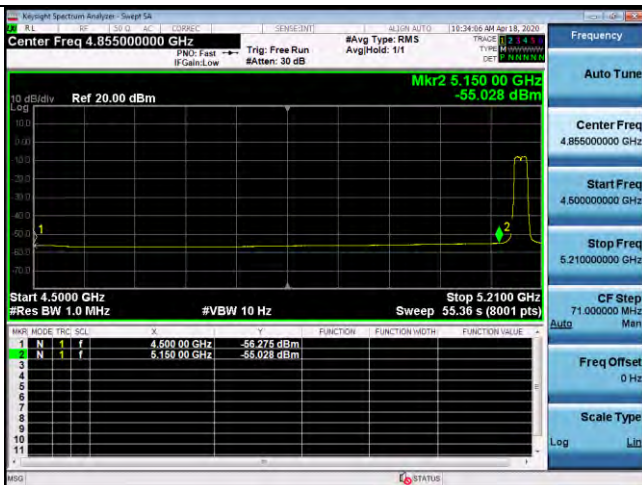
Left--5190 MHz



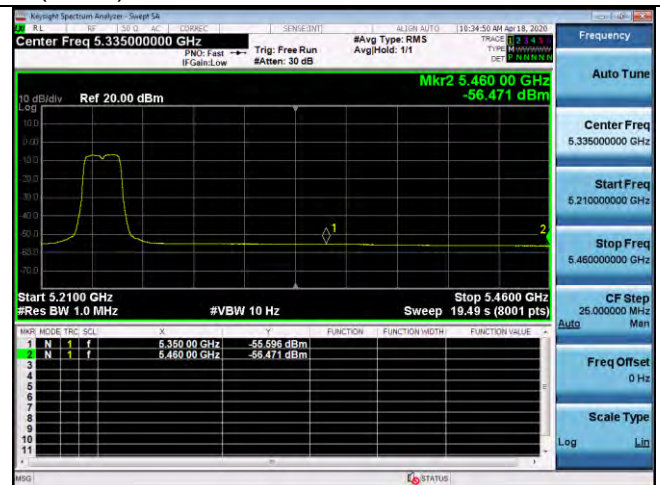
Right--5230 MHz



Band1--IEEE802.11ac(HT20) mode

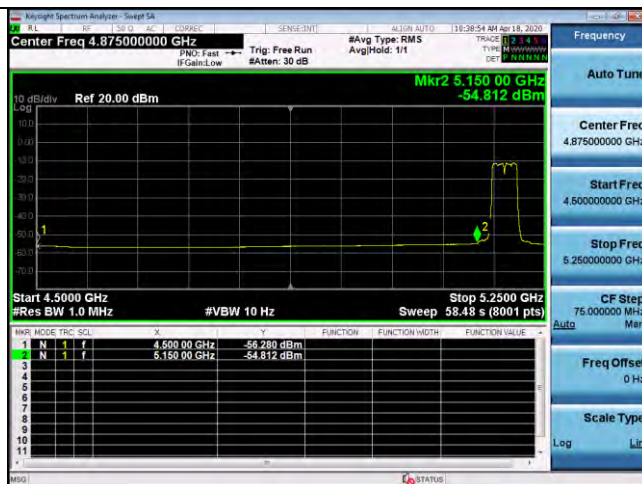


Left--5190 MHz

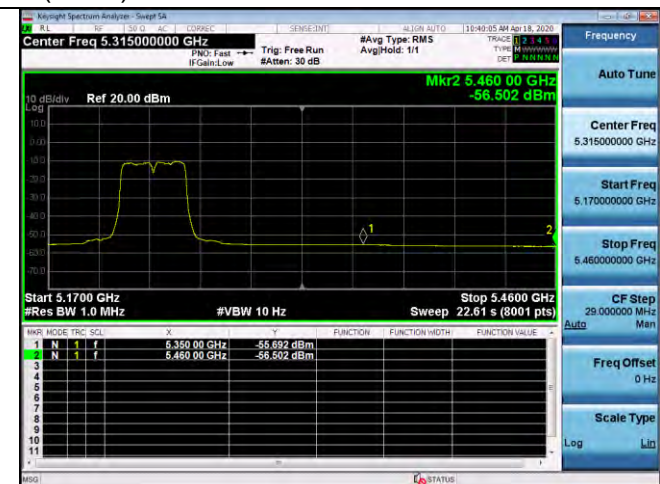


Right--5230 MHz

Band1--IEEE802.11ac(HT40) mode

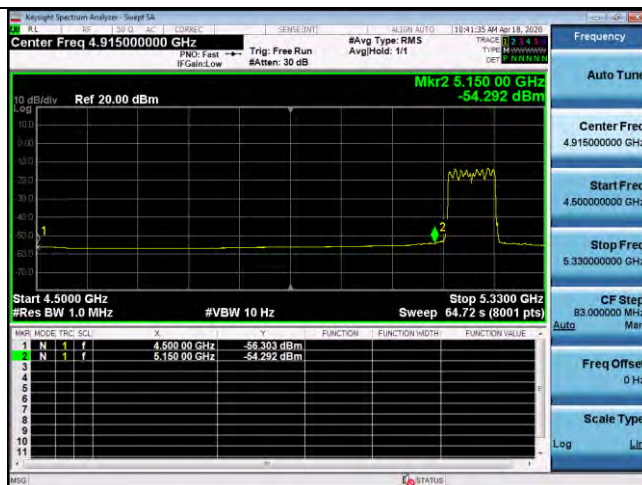


Left--5190 MHz

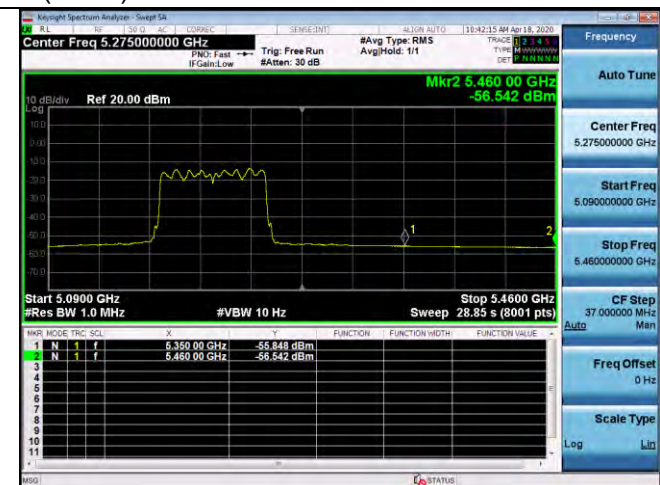


Right--5230 MHz

Band1--IEEE802.11ac(HT80) mode



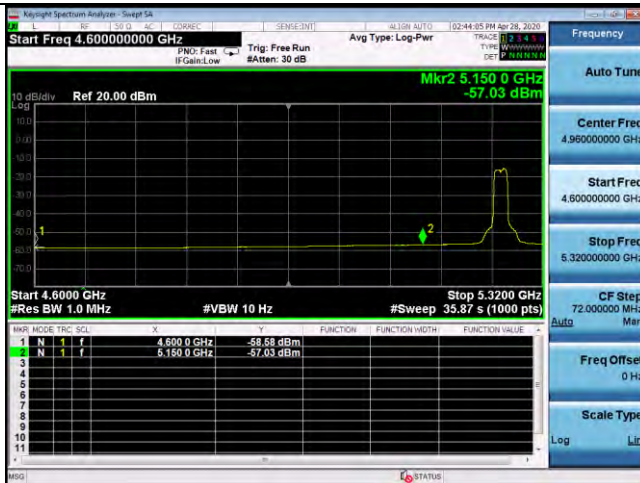
Left--5210 MHz



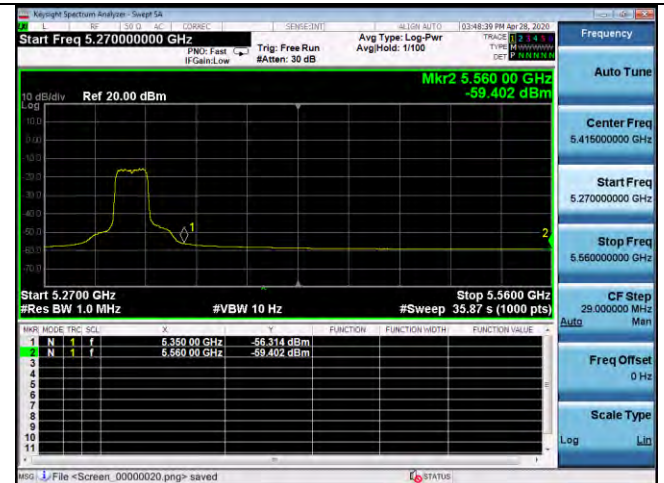
Right--5210 MHz



Band 2A--IEEE802.11n(HT20) mode

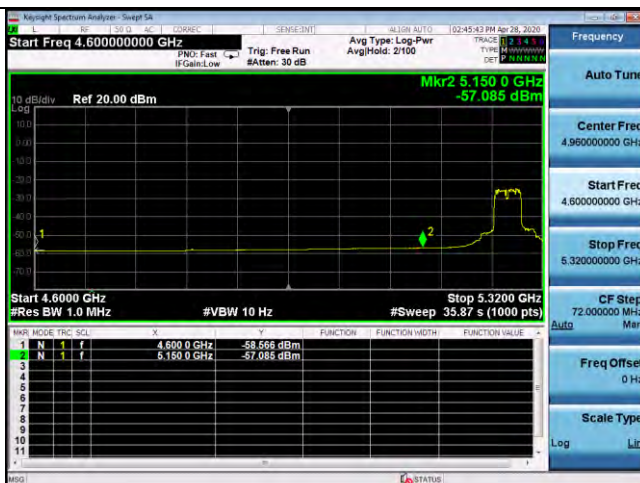


Left--5260 MHz



Right--5320 MHz

Band 2A--IEEE802.11n(HT40) mode



Left--5270 MHz



Right--5310 MHz



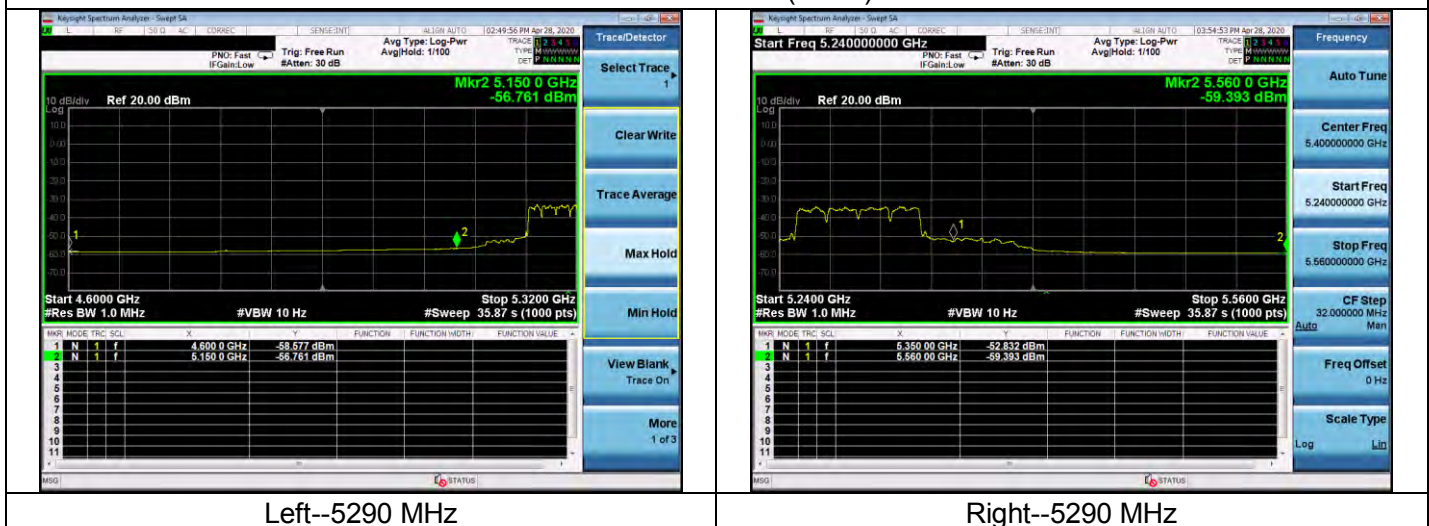
Band 2A--IEEE802.11ac(HT20) mode



Band 2A--IEEE802.11ac(HT40) mode

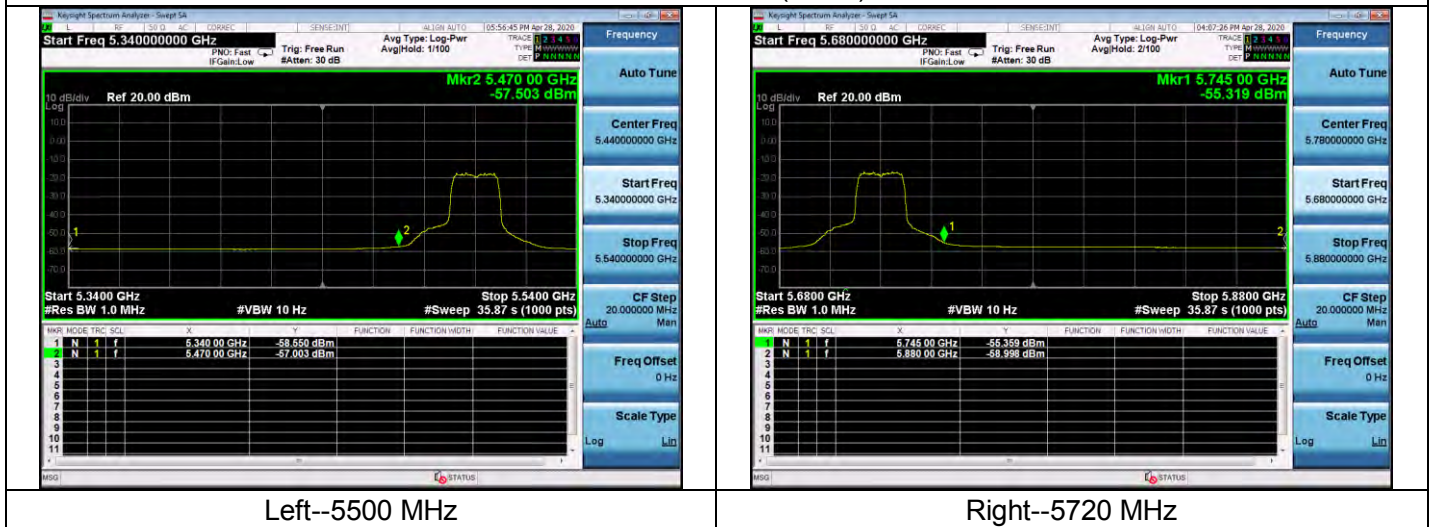


Band 2A--IEEE802.11ac(HT80) mode

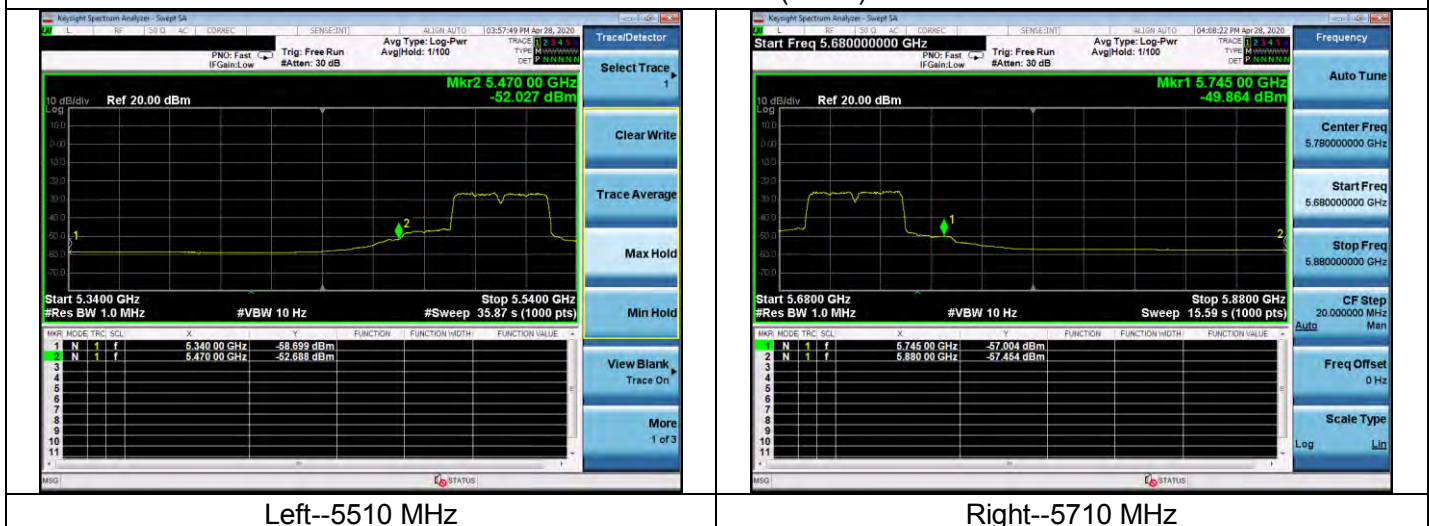




Band 2C--IEEE802.11n(HT20) mode

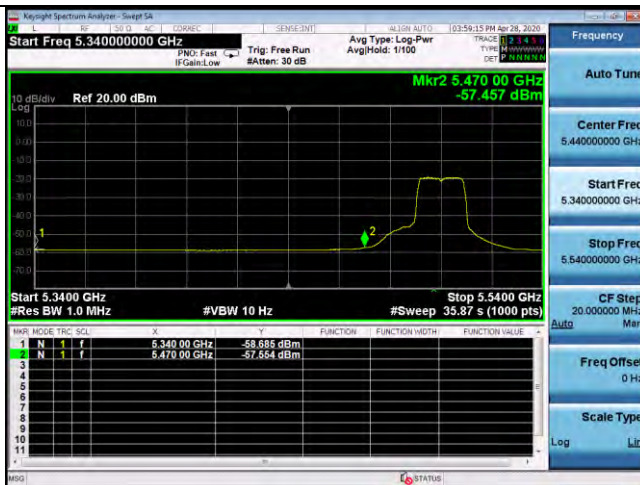


Band 2C--IEEE802.11n(HT40) mode

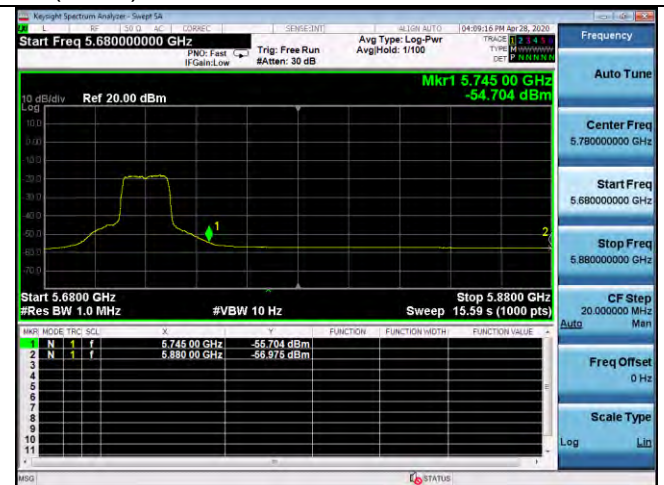




Band 2C--IEEE802.11ac(HT20) mode

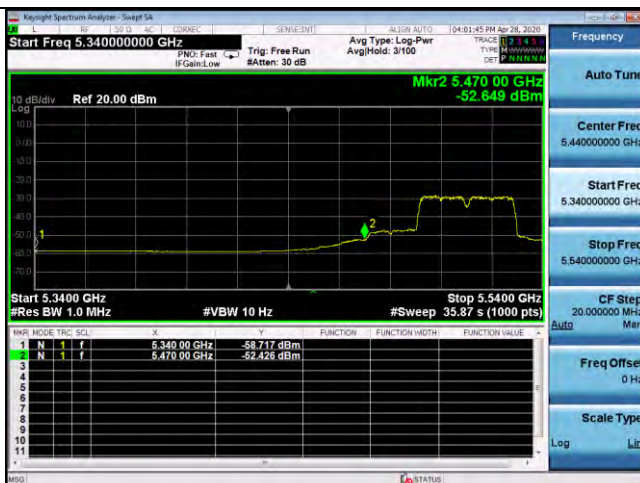


Left--5500 MHz



Right--5720 MHz

Band 2C--IEEE802.11ac(HT40) mode



Left--5510 MHz



Right--5710 MHz

Band 2C--IEEE802.11ac(HT80) mode



Left--5530 MHz



Right--5690 MHz



4.4 POWER SPECTRAL DENSITY

LIMIT

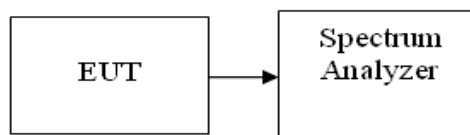
According to §15.407(a),

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

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

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

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span must be greater than 26dB bandwidth, adjust as necessary, Sweep = auto, Detector RMS
3. Record the max. reading.

TEST RESULTS

BAND	802.11 Mode	Channel No.	Frequency [MHz]	Measured Power Spectral Density [dBm/MHz]		Power Spectral Density Limit [dBm/MHz]
				ANT1	ANT2	
BAND 1	n (20MHz)	36	5180	0.020	3.130	17
		40	5200	0.394	3.315	17
		48	5240	1.670	4.105	17
	n (40MHz)	38	5190	-3.060	0.021	17
		46	5230	-2.202	0.311	17
	ac (20MHz)	36	5180	-0.801	2.334	17
		40	5200	-0.329	2.265	17
		48	5240	0.928	3.310	17
	ac(40MHz)	38	5190	-2.834	0.033	17
		46	5230	-1.748	0.619	17
	ac(80MHz)	42	5210	-5.078	-3.025	17

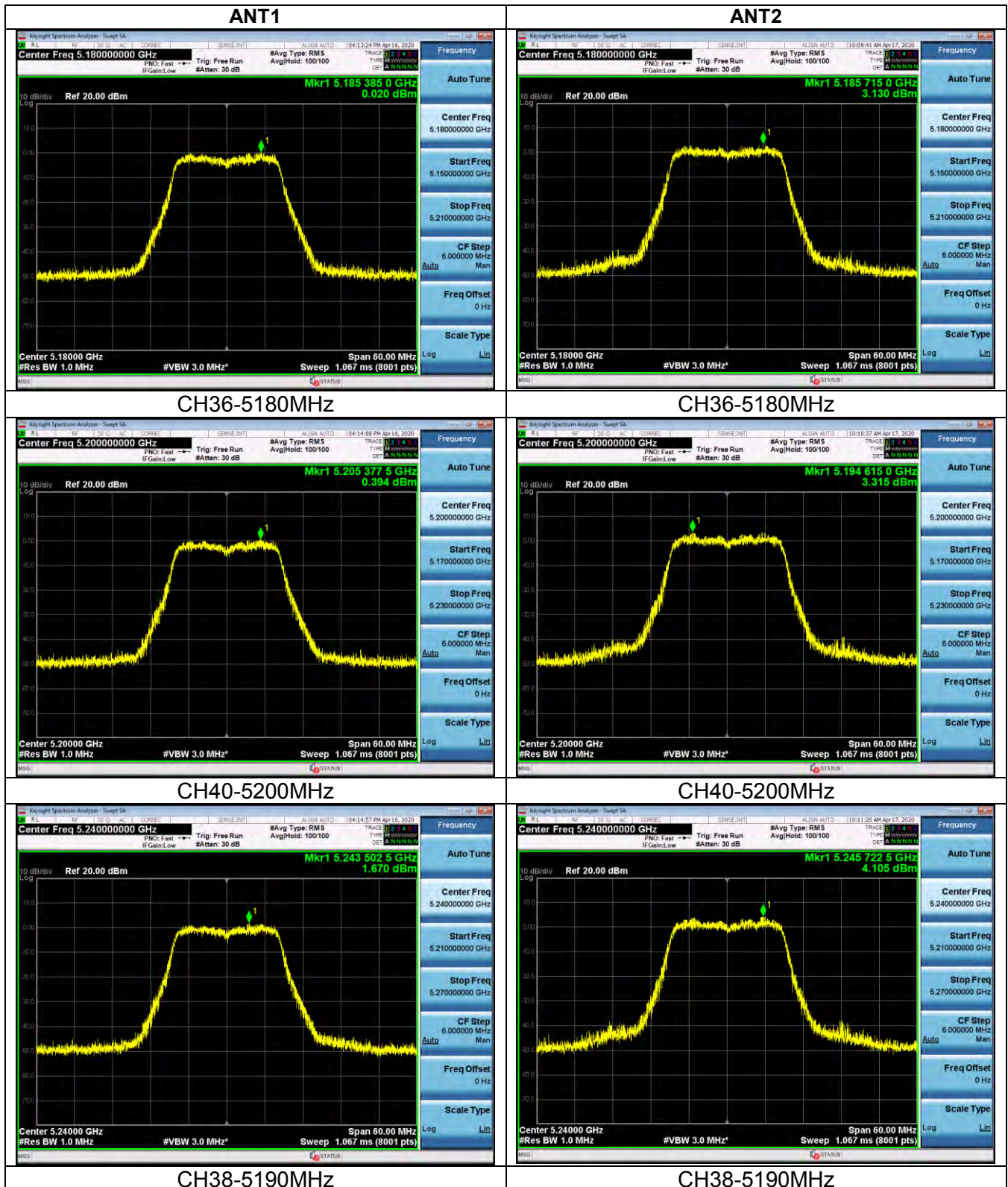


BAND 2A	n (20MHz)	52	5260	2.466	4.681	11
		56	5280	3.240	5.282	11
		64	5320	3.428	5.585	11
	n (40MHz)	54	5270	-0.513	1.595	11
		62	5310	-0.194	1.895	11
	ac (20MHz)	52	5260	3.092	3.686	11
		56	5280	3.920	4.228	11
		64	5320	3.962	4.891	11
	ac(40MHz)	54	5270	-0.424	1.333	11
		62	5310	0.059	2.056	11
	ac(80MHz)	58	5290	-3.954	-1.825	11
BAND 2C	n (20MHz)	100	5500	0.241	3.744	11
		120	5600	1.349	3.822	11
		144	5720	2.692	4.015	11
	n (40MHz)	102	5510	-3.283	-0.530	11
		118	5590	-1.991	-0.001	11
		142	5710	-0.456	0.754	11
	ac (20MHz)	100	5500	0.595	2.718	11
		120	5600	1.950	2.510	11
		144	5720	3.012	3.242	11
	ac(40MHz)	102	5510	-2.709	0.231	11
		118	5590	-1.909	0.111	11
		142	5710	-0.527	0.506	11
	ac(80MHz)	106	5530	-5.759	-2.780	11
		122	5610	-4.753	-3.144	11



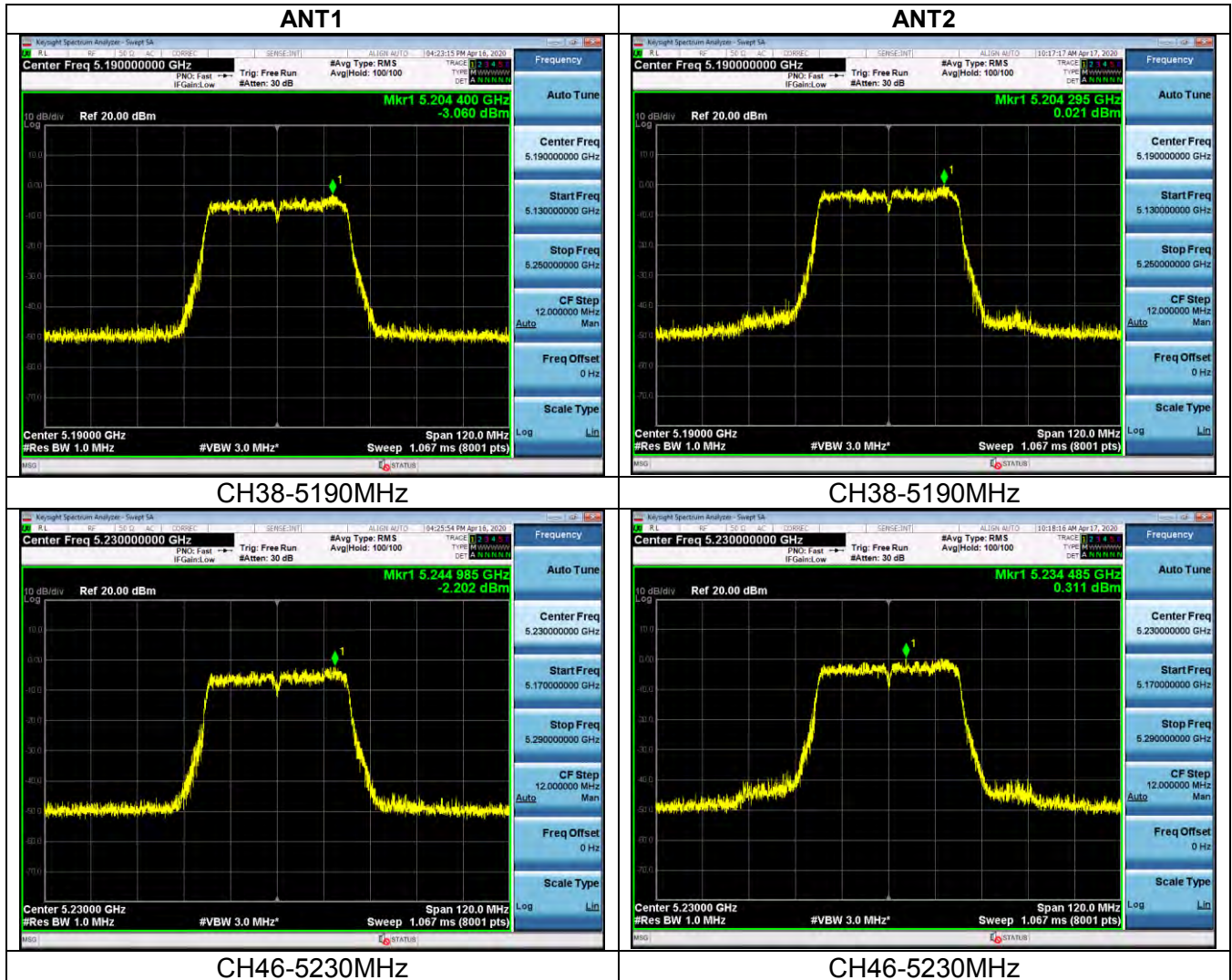
Test plots as follows:

band 1 -- n (20MHz)



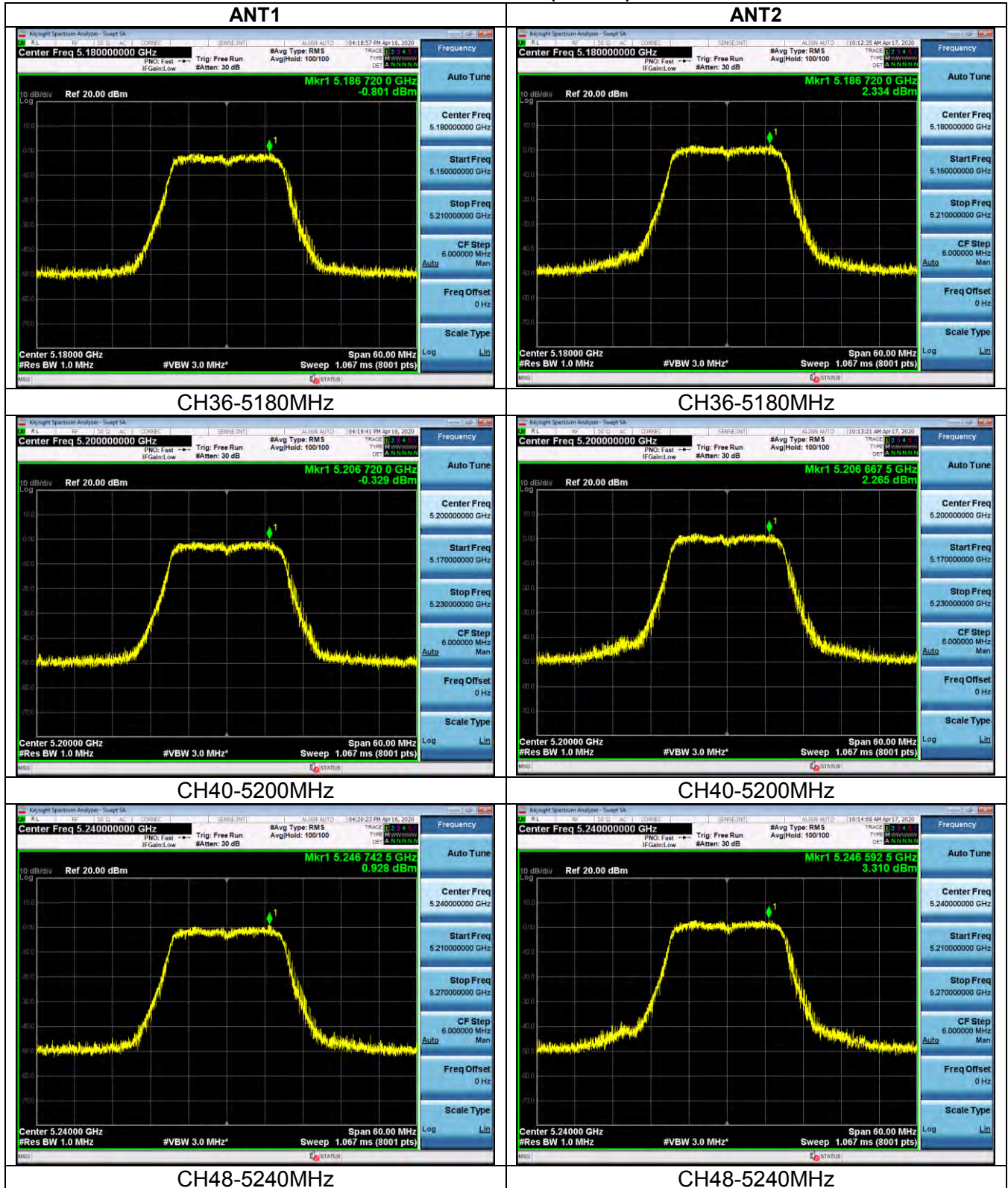


band 1 -- n (40MHz)



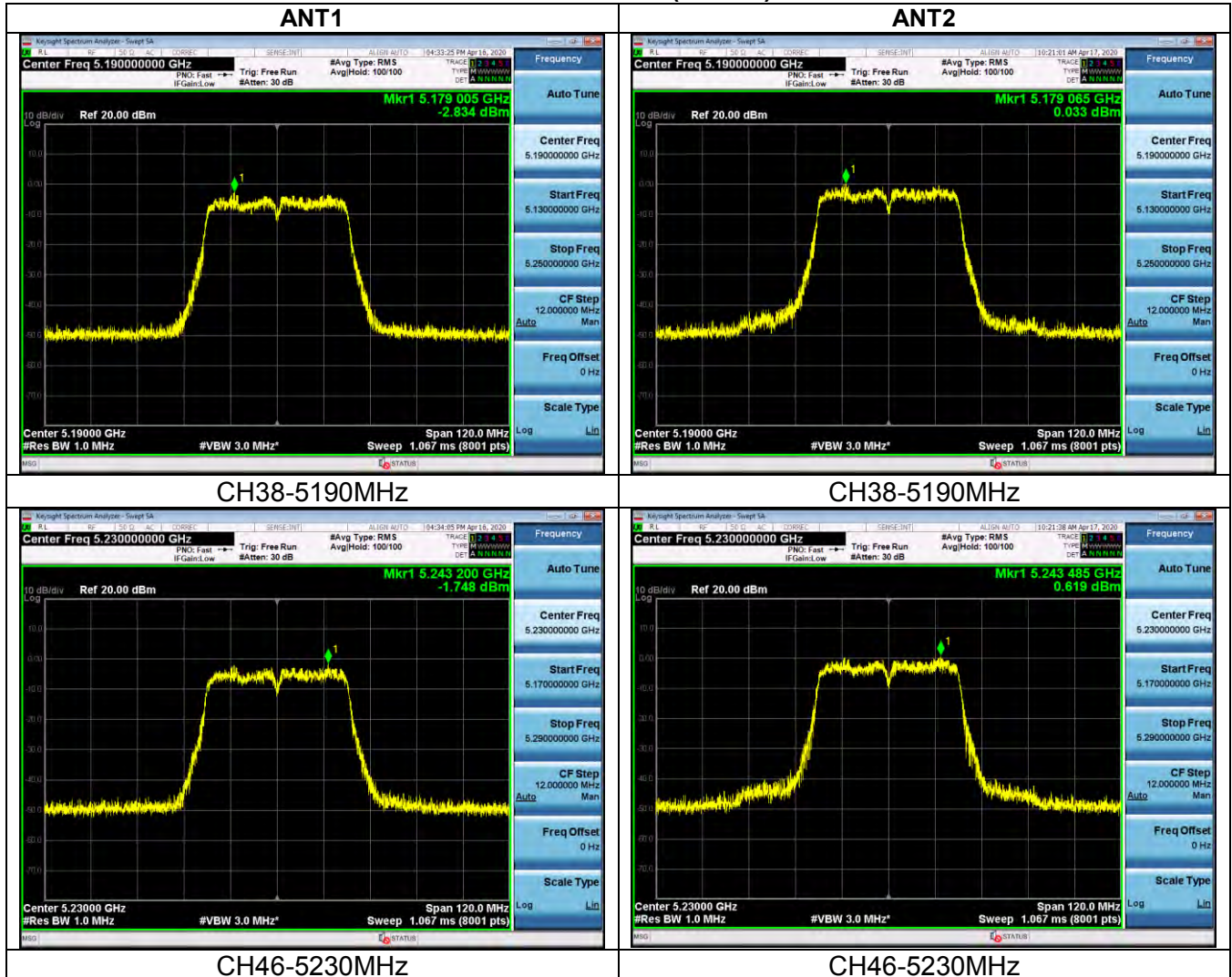


band 1 -- ac(20MHz)

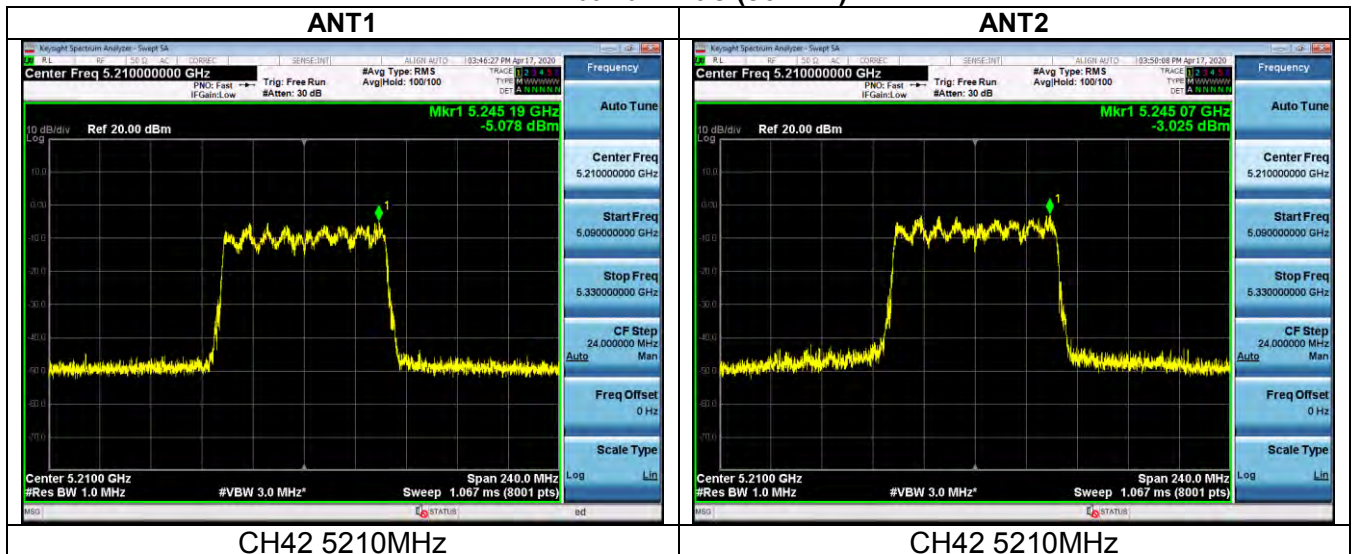




band 1 --ac (40MHz)

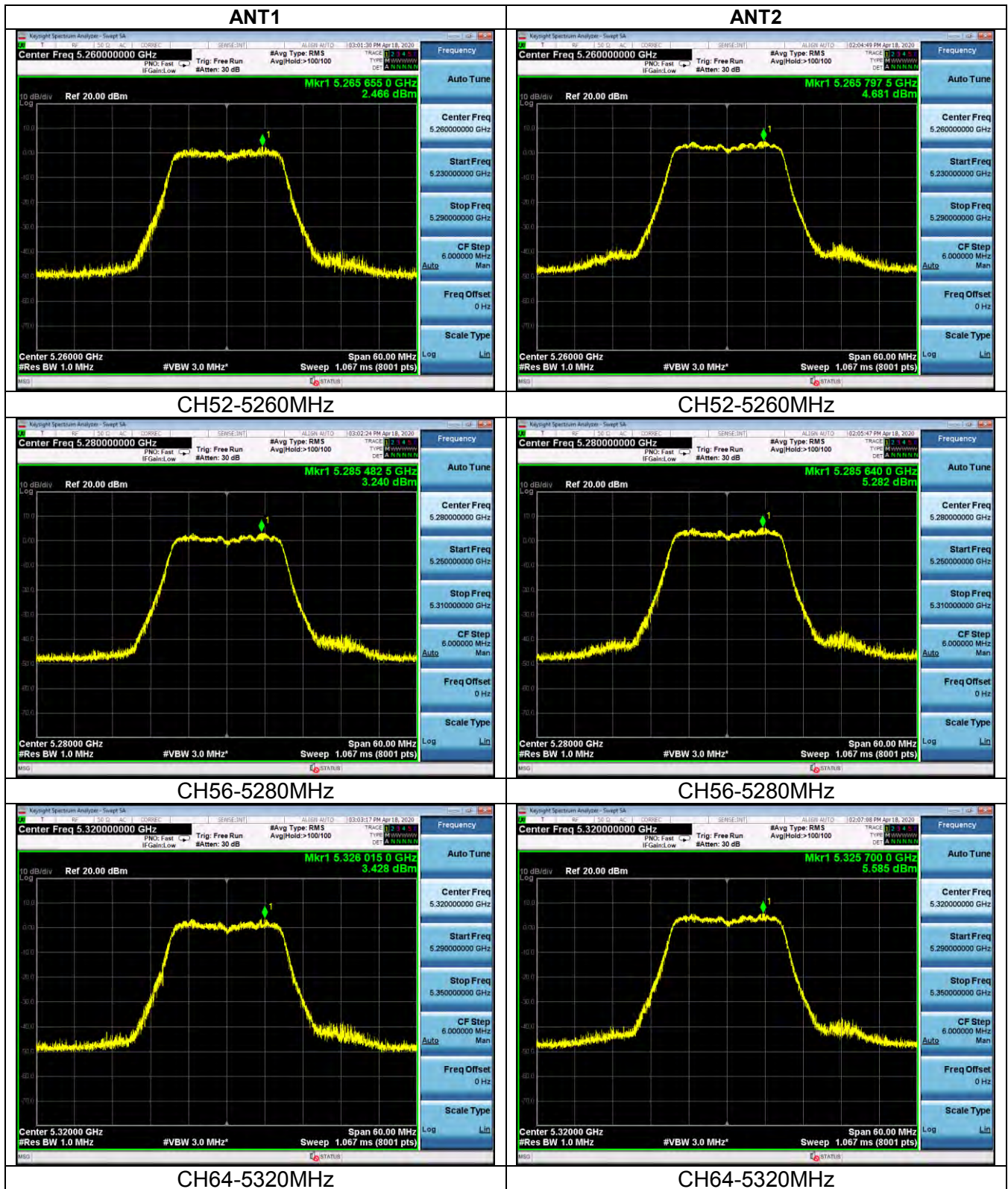


band 1 --ac (80MHz)





band 2A -- n (20MHz)





band 2A -- n (40MHz)

