FCC Part 15E
Measurement and Test Report

For

Shenzhen RF-Link Technology Co.,Ltd

Bldg56A,6/F,Baotian Rd3, Xixiang Town,Baoan District, ShenZhen, China

FCC ID: 2AGQ3-8821

FCC Rule(s):	FCC Part 15.407
Product Description:	WIFI+BT module
Tested Model:	RL-EM02G-8821CE
Report No.:	WTH20H03010817W-4
Sample Receipt Date:	2020-03-17
Tested Date:	2020-03-17 to 2020-04-08
Issued Date:	2020-04-08
Tested By:	Jason Su/ Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

Shenzhen SEM Test Technology Co., Ltd.
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C.（518101）
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

TABLE OF CONTENTS

Report version

Version No.	Date of issue	Description
Rev.00	2020-04-08	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Shenzhen RF-Link Technology Co.,Ltd
Address of applicant:	Bldg56A,6/F,Baotian Rd3, Xixiang Town,Baoan District, ShenZhen, China
Manufacturer:	Shenzhen RF-Link Technology Co.,Ltd
Address of manufacturer:	Bldg56A,6/F,Baotian Rd3, Xixiang Town,Baoan District, ShenZhen, China

General Description of EUT	
Product Name:	WIFI+BT module
Brand Name:	RF-LINK
Model No.:	RL-EM02G-8821CE
Adding Model(s):	/
Rated Voltage:	DC 3.3V
Battery Capacity:	/
Power Adapter:	/
Software Version:	/
Hardware Version:	/
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11a, 802.11n(HT20), 802.11n(HT40), 802.11ac(HT20), 802.11ac(HT40), 802.11ac(VHT80)
Frequency Range:	5150-5250MHz, 5725-5850MHz
RF Output Power:	10.52dBm (Conducted)
Type of Modulation:	BPSK, QPSK,16QAM,64QAM, 256QAM
Quantity of Channels:	15
Type of Antenna:	Integral Antenna
Antenna Gain:	2dBi

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.407: General technical requirements.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
KDB789033 D02 v02r01: GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, KDB789033 D02 v02r01
The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Table for parameters of Test Software setting

Enter "3646631+=" into the calculator to enter the engineer mode, you can start to test. During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Mode	Test Frequency (MHz)												
	NCB: 20MHz												
	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720	5745	5785	5825
802.11a 6Mbps	10	10	10	/	/	/	/	/	/	/	10	10	10
802.11n/ ac-HT20 MCS0	10	10	10	/	/	/	/	/	/	/	10	10	10
Mode	NCB: 40MHz												
	5190	5230	5270	5310	5510	5550	5670	5710	5755	5795			
802.11n/ac-HT40 MCS0	10	10	/	/	/	/	/	/	10	10			
Mode	NCB: 80MHz												
	5210		5290		5530		5610		5690		5775		
802.11ac-VHT80 MCS0	10		/		/		/		/		10		

1.5 EUT Operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under Android were executed.

1.6 Test Facility

Address of the test laboratory

Laboratory: Shenzhen SEM Test Technology Co., Ltd.

Address: 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C. (518101）

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintain ed in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11a	5180MHz,5220MHz,5240MHz, 5745MHz, 5785MHz,5825MHz
TM2	802.11n-HT20	5180MHz,5220MHz,5240MHz, 5745MHz, 5785MHz,5825MHz
TM3	802.11n-HT40	5190MHz,5230MHz,5755MHz,5795MHz
TM4	802.11ac-VH80	5210MHz, 5775 MHz

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	50~55 %.
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2019-04-30	2020-04-29
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2019-04-30	2020-04-29
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2019-04-30	2020-04-29
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2019-04-30	2020-04-29
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2019-04-30	2020-04-29
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2019-05-05	2021-05-04
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2019-04-30	2020-04-29
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2019-04-30	2020-04-29
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2019-04-30	2020-04-29
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2019-04-30	2020-04-29
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2019-04-30	2020-04-29
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2019-04-30	2020-04-29
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2019-04-30	2020-04-29
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2019-04-30	2020-04-29
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2019-04-30	2020-04-29
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2019-03-18	2020-03-17
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2020-03-18	2021-03-17
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2020-03-18	2021-03-17
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2020-03-18	2021-03-17
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2020-03-18	2021-03-17
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2020-03-18	2021-03-17

Software List			
Description	**Manufacturer**	**Model**	**Version**
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203; §15.405	Antenna Requirement	Compliant
§15.207; §15.407(b)(6)	Conducted Emission	Compliant
§15.407(a)(1),(2)	Power Spectral Density	Compliant
§15.407(e)	Emission Bandwidth and Occupied Bandwidth	Compliant
§15.407(a)(1),(2)	Maximum Conducted Output Power	Compliant
§15.407(b)(1),(2),(3),(4)	Undesirable emission	Compliant
§15.205; §15.407(b)(1),(2),(3)	Radiated Emission	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.407(h)	Dynamic Frequency Selection (DFS)	Compliant

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to §1.1307 and §2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the MPE Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

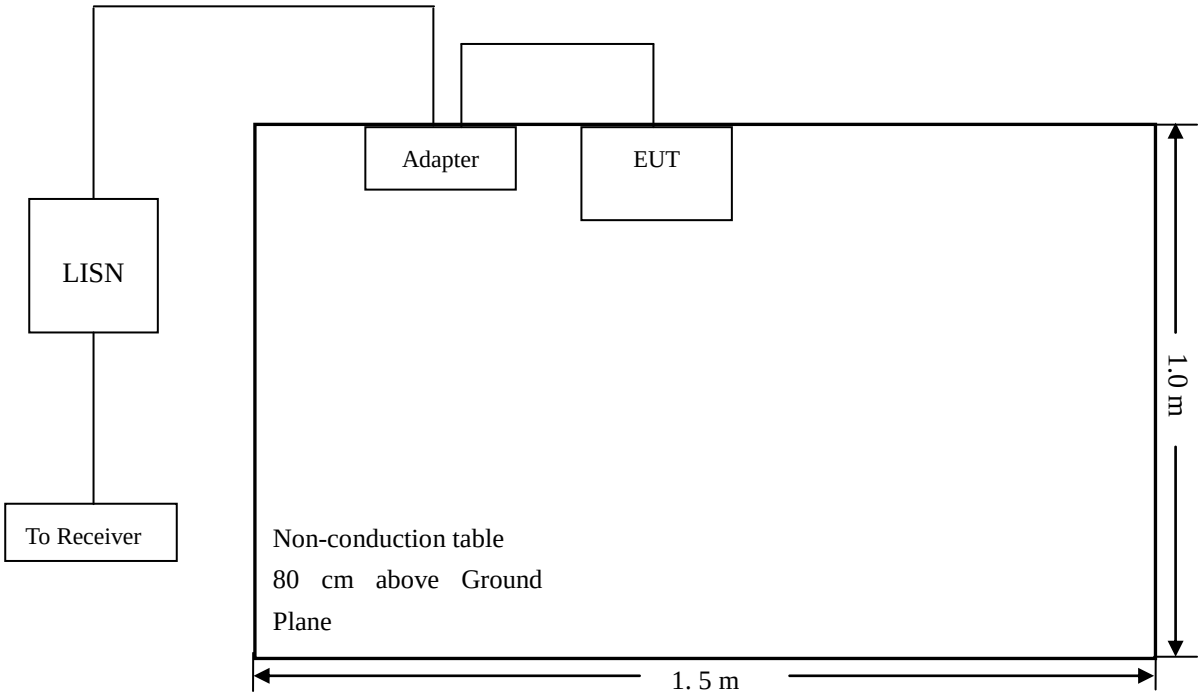
This product has an integral antenna, fulfill the requirement of this section.

5. Conducted Emissions

5.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

5.2 Basic Test Setup Block Diagram



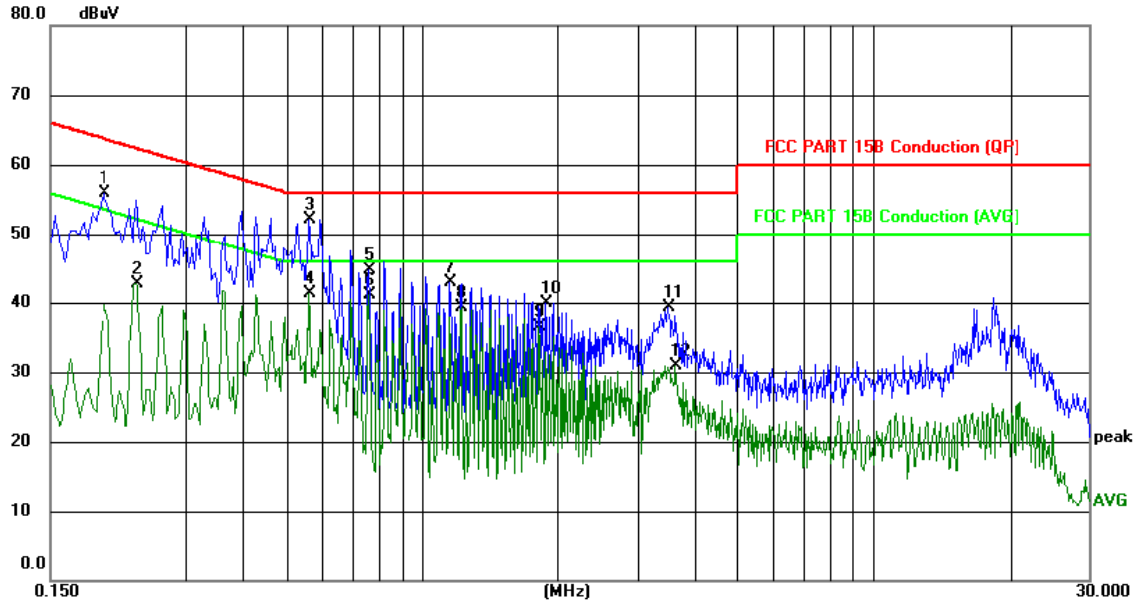
5.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

5.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



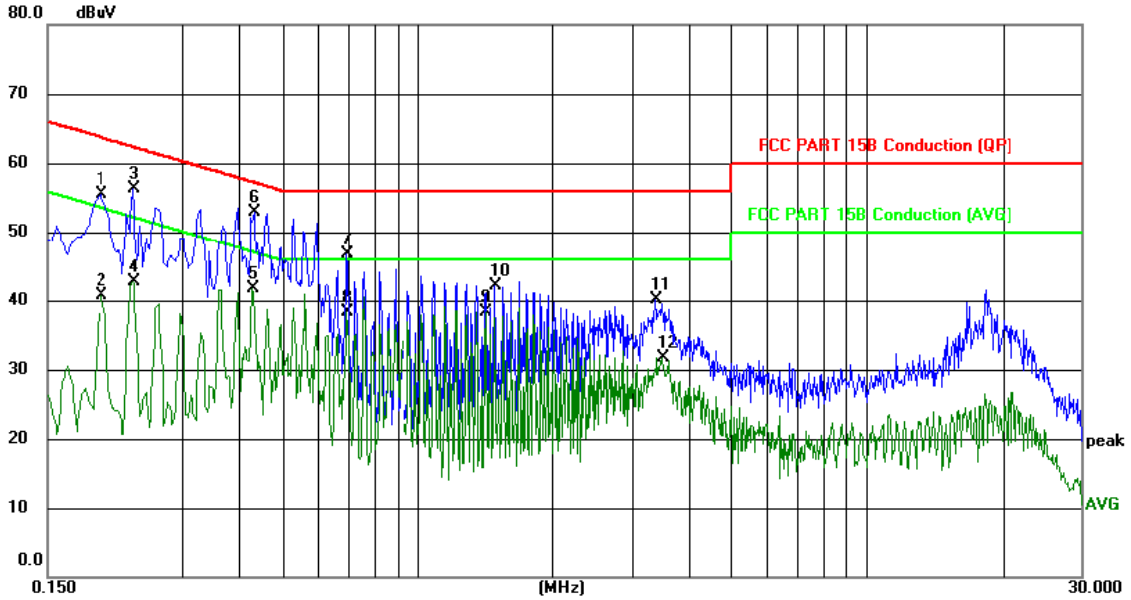
Site
Limit: FCC PART 15B Conduction (QP)
EUT:
M/N: RL-EM02G-8821CE
Mode: ON
Note:

Phase: N
Power: AC230V/50Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1980	45.97	9.94	55.91	63.69	-7.78	QP	
2		0.2340	32.76	9.97	42.73	52.31	-9.58	AVG	
3	*	0.5620	42.20	9.91	52.11	56.00	-3.89	QP	
4		0.5620	31.41	9.91	41.32	46.00	-4.68	AVG	
5		0.7620	34.76	10.00	44.76	56.00	-11.24	QP	
6		0.7620	31.08	10.00	41.08	46.00	-4.92	AVG	
7		1.1580	32.96	9.91	42.87	56.00	-13.13	QP	
8		1.2260	29.31	9.96	39.27	46.00	-6.73	AVG	
9		1.8180	26.41	10.14	36.55	46.00	-9.45	AVG	
10		1.8860	29.85	10.09	39.94	56.00	-16.06	QP	
11		3.5060	28.87	10.38	39.25	56.00	-16.75	QP	
12		3.6380	20.54	10.33	30.87	46.00	-15.13	AVG	

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



Site
Limit: FCC PART 15B Conduction (QP)
EUT:
M/N: RL-EM02G-8821CE
Mode: ON
Note:

Phase: *L1*
Power: AC230V/50Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1980	45.61	9.94	55.55	63.69	-8.14	QP	
2		0.1980	30.73	9.94	40.67	53.69	-13.02	AVG	
3		0.2340	46.24	9.97	56.21	62.31	-6.10	QP	
4		0.2340	32.79	9.97	42.76	52.31	-9.55	AVG	
5		0.4300	31.76	9.85	41.61	47.25	-5.64	AVG	
6	*	0.4340	42.96	9.85	52.81	57.18	-4.37	QP	
7		0.6940	36.68	9.98	46.66	56.00	-9.34	QP	
8		0.6940	28.42	9.98	38.40	46.00	-7.60	AVG	
9		1.4220	28.11	10.27	38.38	46.00	-7.62	AVG	
10		1.4900	31.74	10.39	42.13	56.00	-13.87	QP	
11		3.3780	29.66	10.41	40.07	56.00	-15.93	QP	
12		3.5060	21.36	10.38	31.74	46.00	-14.26	AVG	

6. Power Spectral Density

6.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

6.2 Test Procedure

According to 789033 D02 v02r01 General UNII Test Procedures New Rules v02, the following is the measurement procedure.
For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500kHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW=100 kHZ is available on nearly all spectrum analyzers.

6.3 Summary of Test Results/Plots

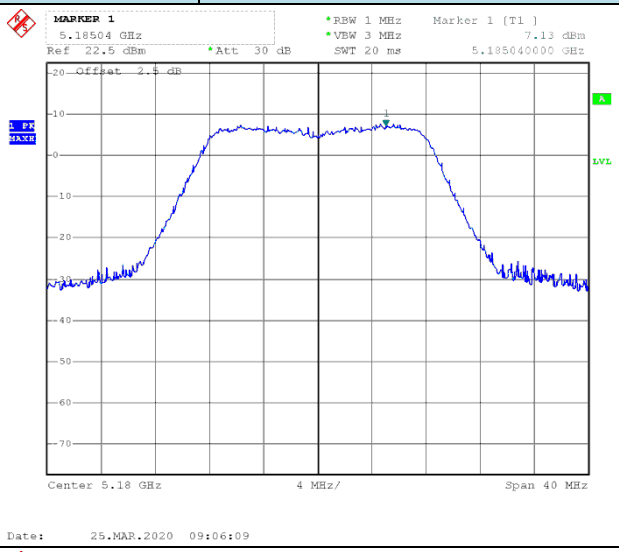
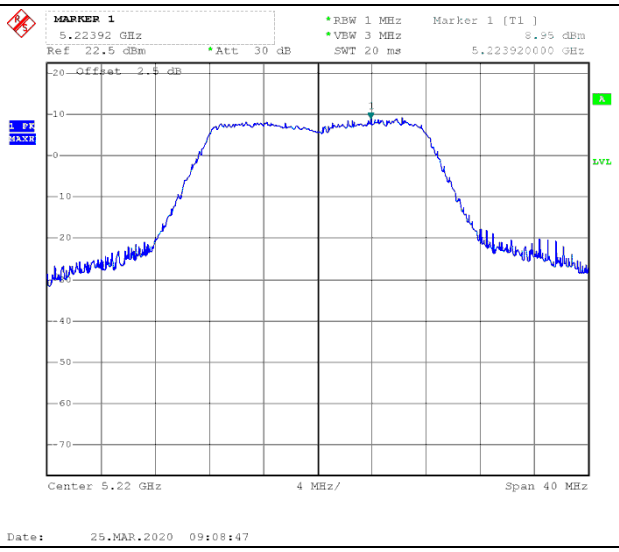
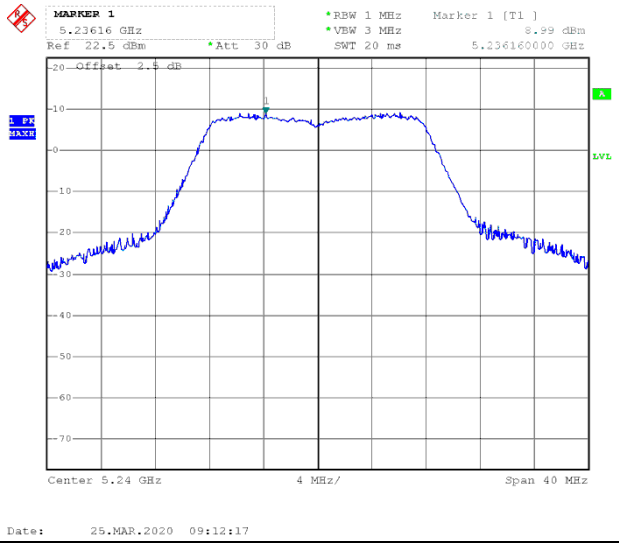
5150-5250MHz

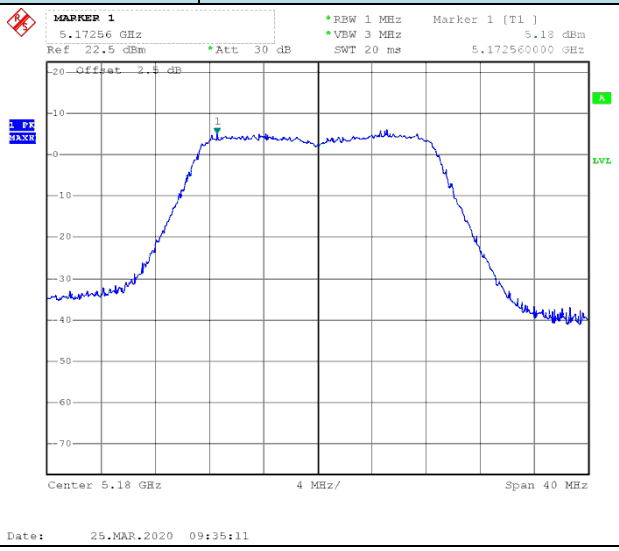
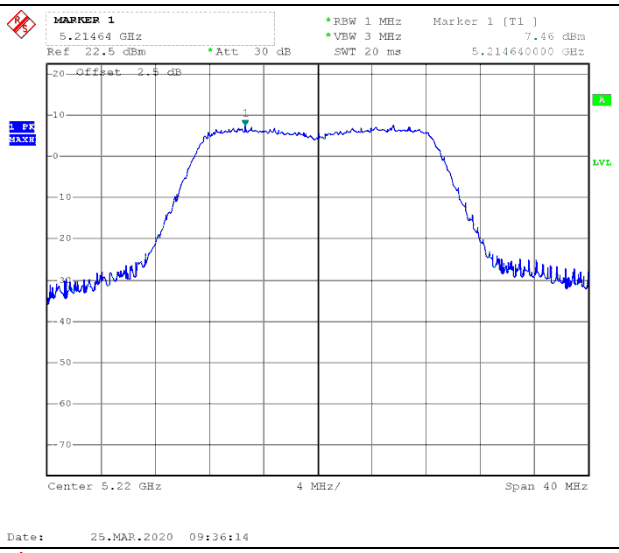
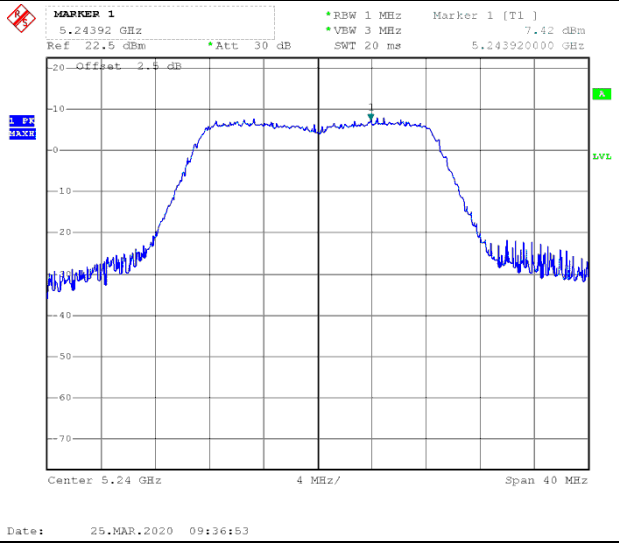
Operating mode	Test Channel	Power Spectral Density dBm/MHz	Limit (dBm/MHz)
802.11a	5180	7.13	10
	5220	8.95	10
	5240	8.99	10
802.11n-HT20	5180	5.18	10
	5220	7.42	10
	5240	7.42	10
802.11n-HT40	5190	1.87	10
	5230	4.86	10
802.11ac-HT20	5180	4.35	10
	5200	6.15	10
	5240	7.17	10
802.11ac-HT40	5190	1.46	10
	5230	2.02	10
802.11ac-HT80	5210	-1.35	10

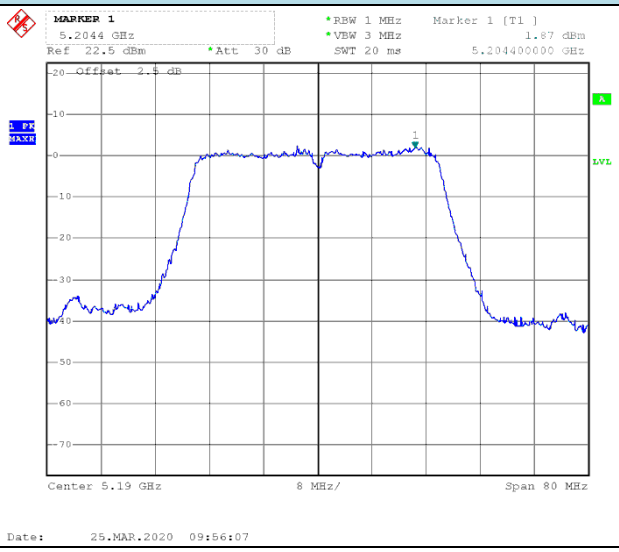
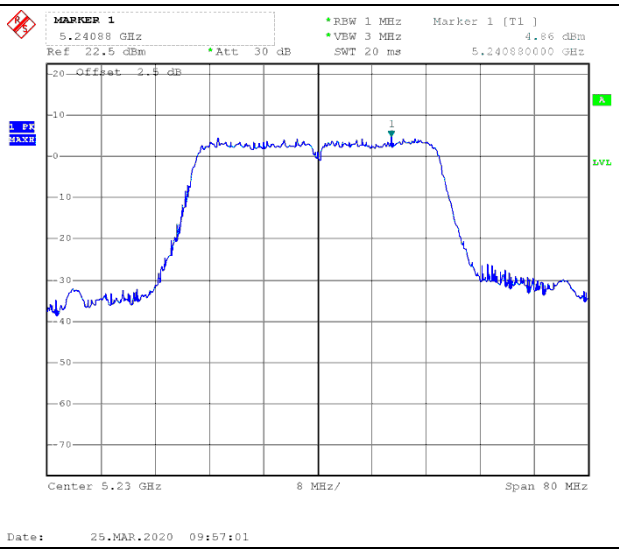
5725-5850MHz

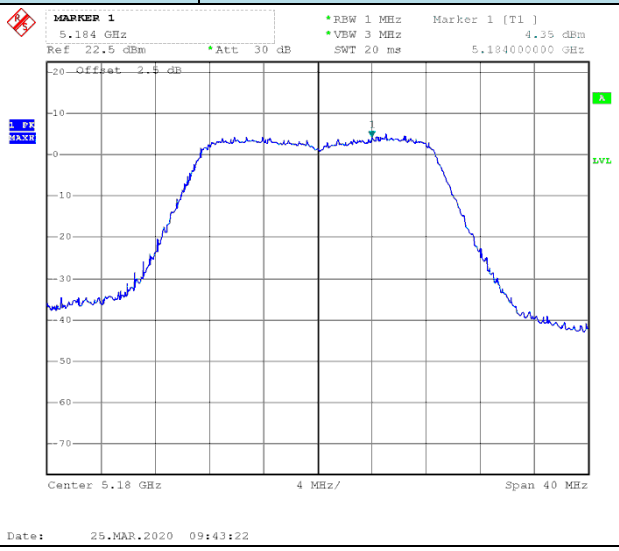
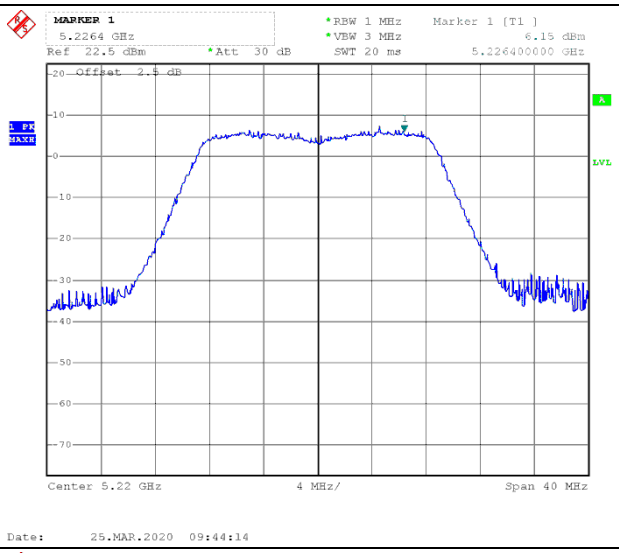
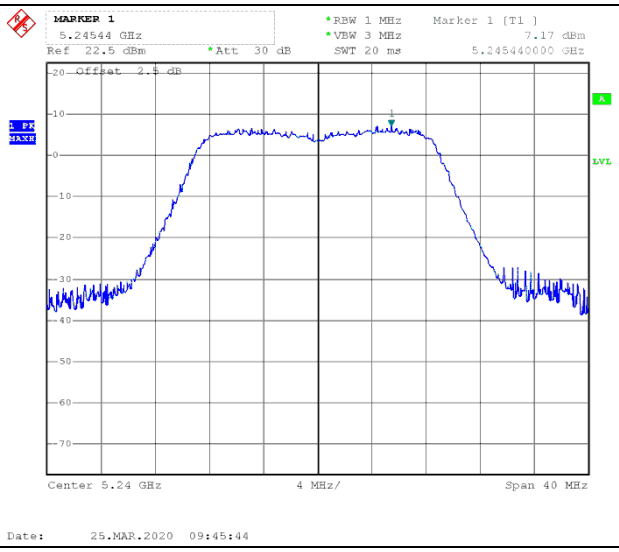
U-NII-3: 5725-5850MHz					
Operating mode	Test Channel	Power Spectral Density dBm/1000kHz	Factor	Power Spectral Density* dBm/500kHz	Limit dBm/500kHz
802.11a	5745	7.62	-3.01	4.61	30
	5785	8.16	-3.01	5.15	30
	5825	7.82	-3.01	4.81	30
802.11n-HT20	5745	7.45	-3.01	4.44	30
	5785	7.28	-3.01	4.27	30
	5825	6.64	-3.01	3.63	30
802.11n-HT40	5755	4.29	-3.01	1.28	30
	5795	4.28	-3.01	1.27	30
802.11ac-HT20	5745	5.73	-3.01	2.72	30
	5785	7.19	-3.01	4.18	30
	5825	6.19	-3.01	3.18	30
802.11ac-HT40	5755	2.23	-3.01	-0.78	30
	5795	1.86	-3.01	-1.15	30
802.11ac-HT80	5775	-1.69	-3.01	-4.7	30
*Note: Maximum PSD=PSD(dBm/1000kHz)+10log(500kHz/1000kHz)=-3.01					

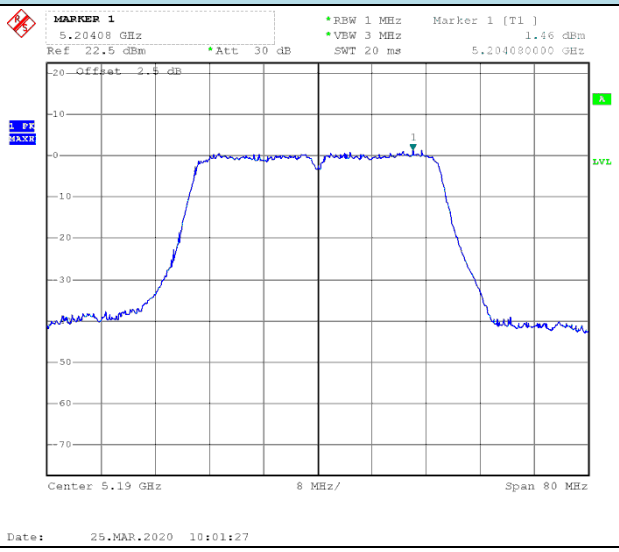
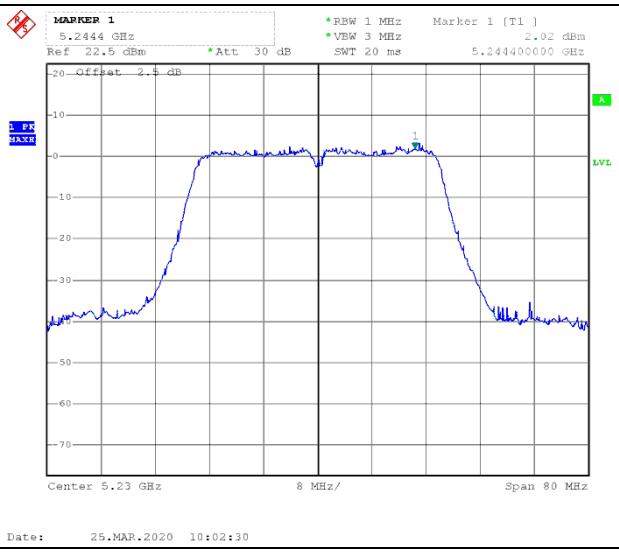
➢ 5150-5250MHz

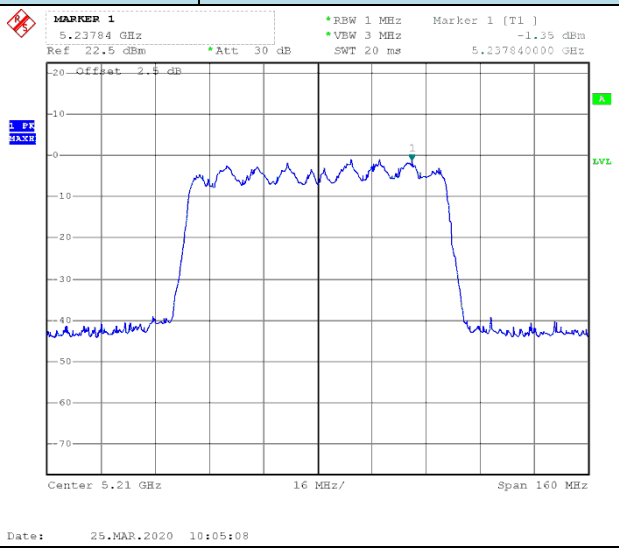
Mode:	**802.11a**
5180MHz	
5220MHz	
5240MHz	

Mode:	802.11n-HT20
5180MHz	
5220MHz	
5240MHz	

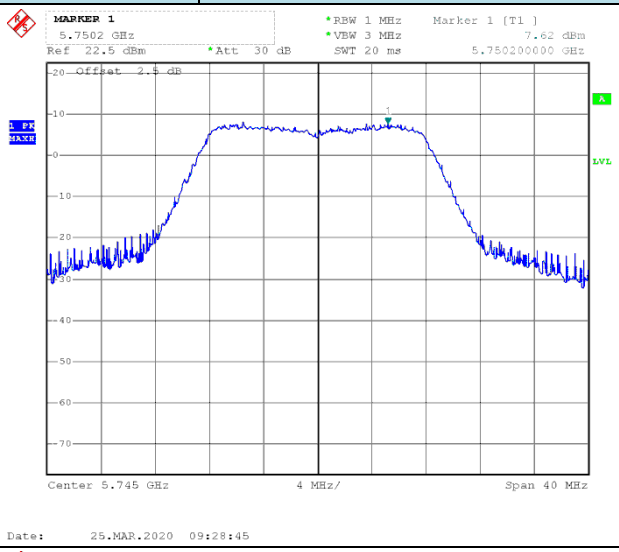
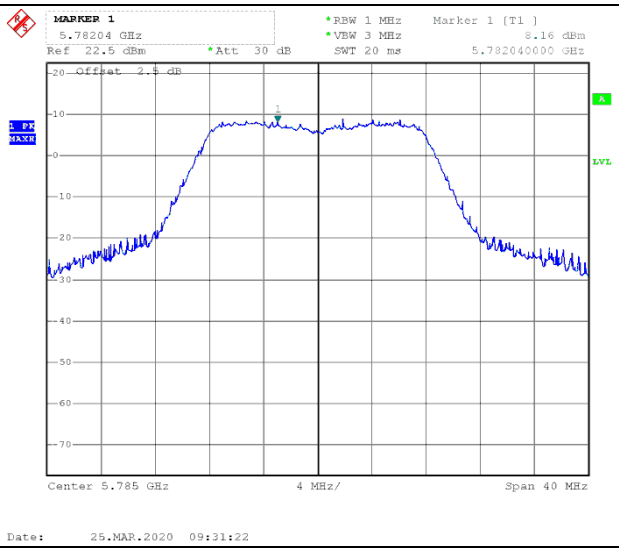
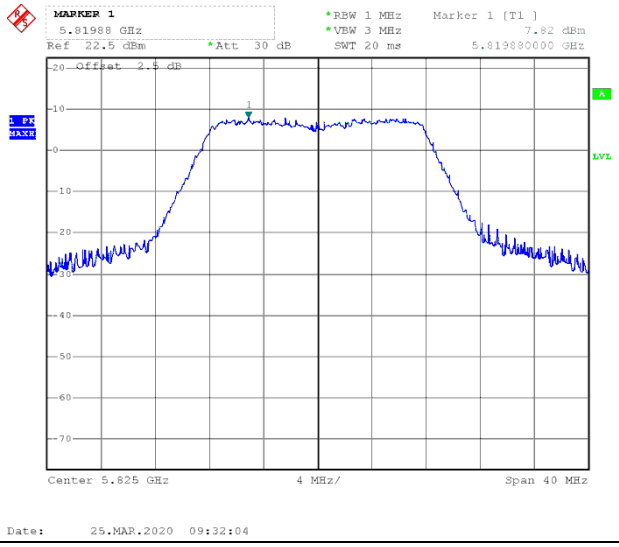
Mode:	802.11n-HT40
5190 MHz	
5230 MHz	

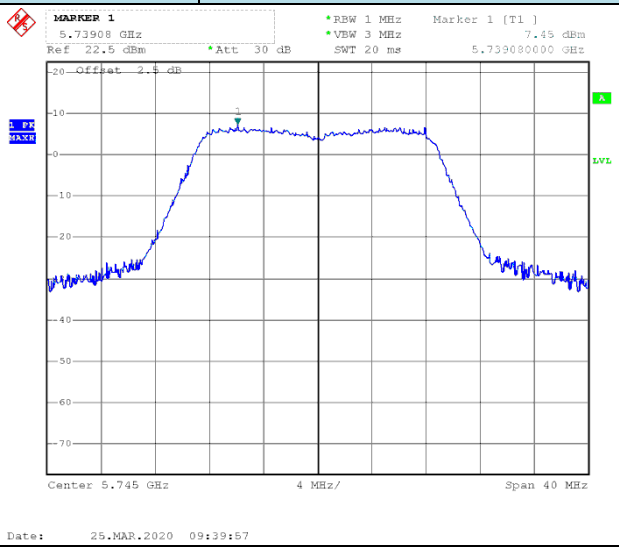
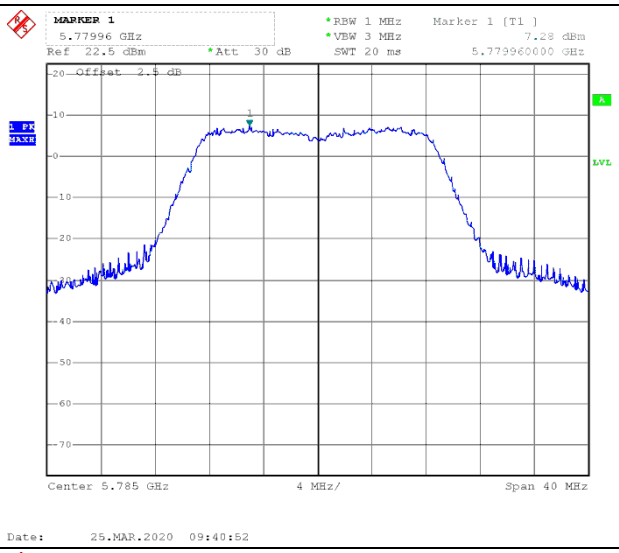
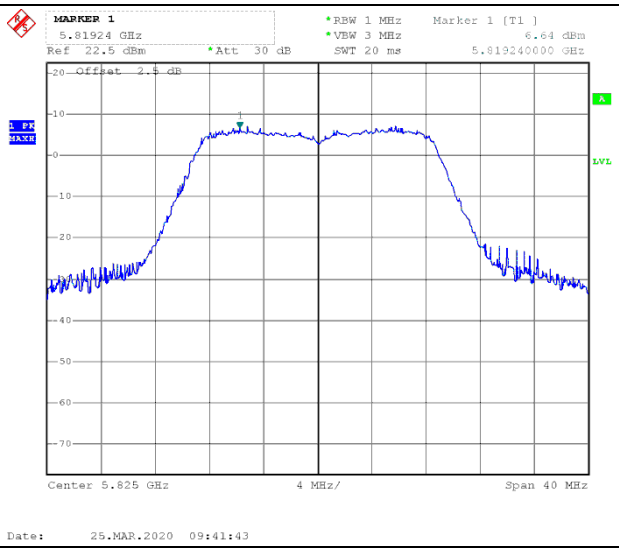
Mode:	802.11ac-HT20
5180MHz	
5220MHz	
5240MHz	

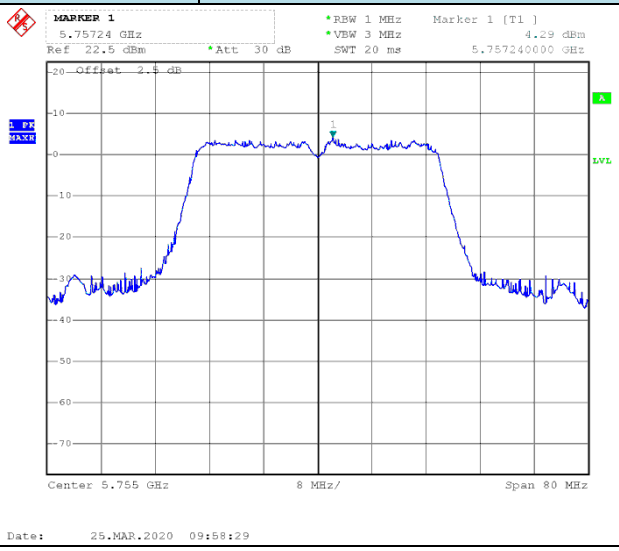
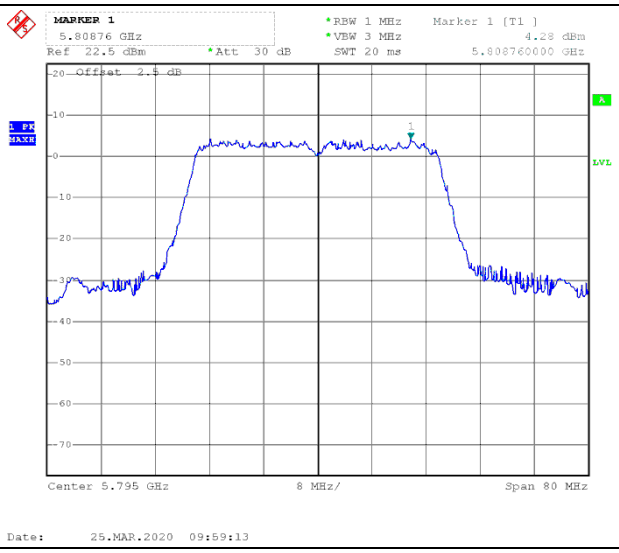
Mode:	802.11ac-HT40
5190 MHz	
5230 MHz	

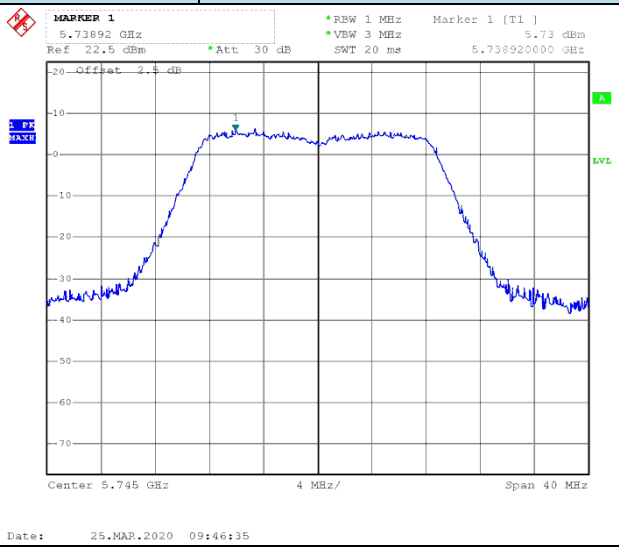
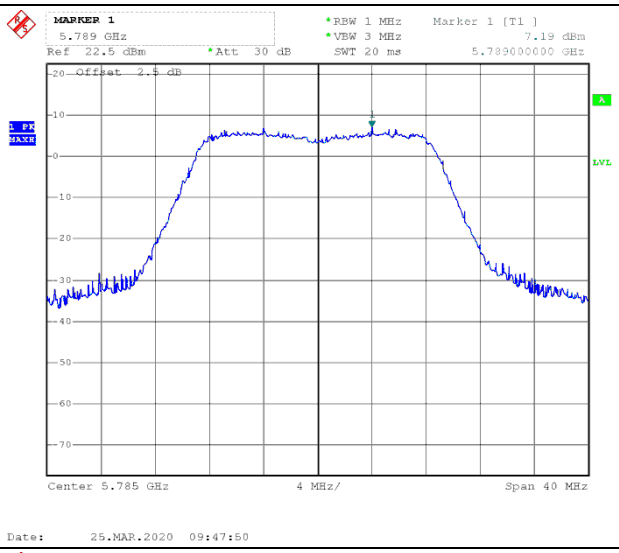
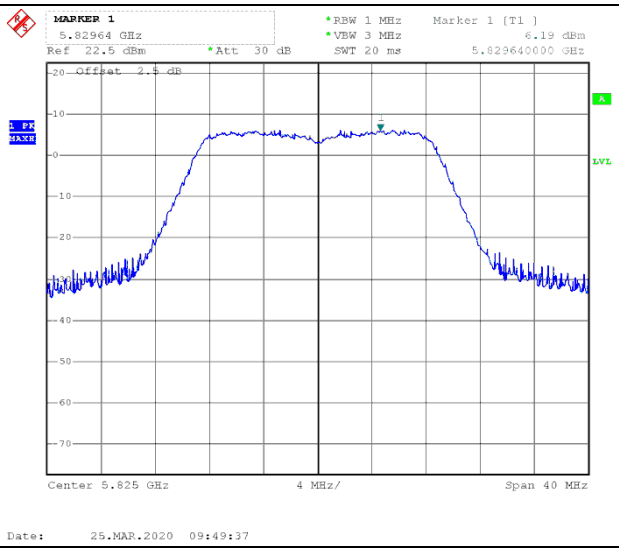
Mode:	**802.11ac VHT80**
5210MHz	

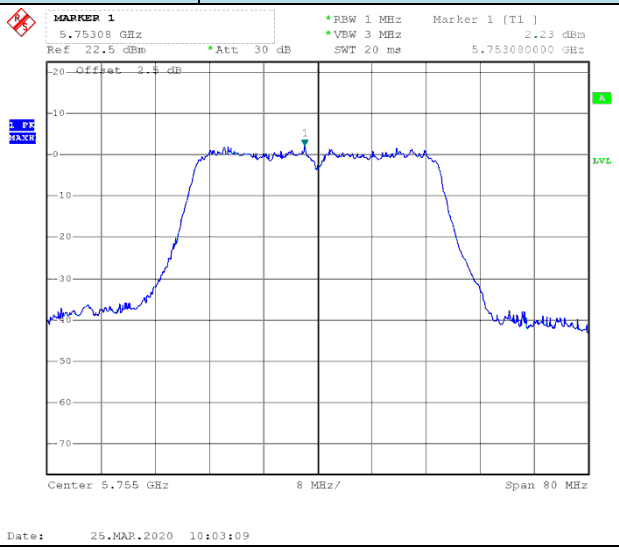
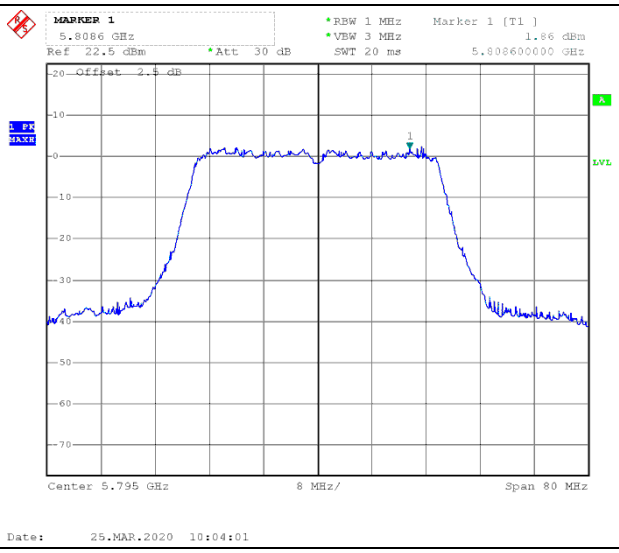
➢ 5725-5850MHz

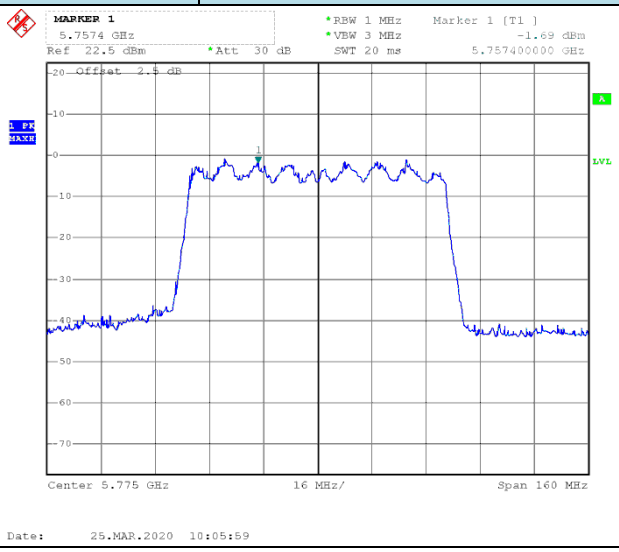
Mode:	802.11a
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11n-HT20
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11n-HT40
5755 MHz	
5795 MHz	

Mode:	802.11ac-HT20
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11ac-HT40
5755 MHz	
5795 MHz	

Mode:	802.11ac VH80
5775 MHz	

7. Emission Bandwidth and Occupied Bandwidth

7.1 Standard Applicable

According to 15.407(a) and (e):

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

7.2 Test Procedure

According to 789033 D02 v02r0r section C&D, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare

this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth
The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 v02r01 General UNII Test Procedures New Rules v01 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

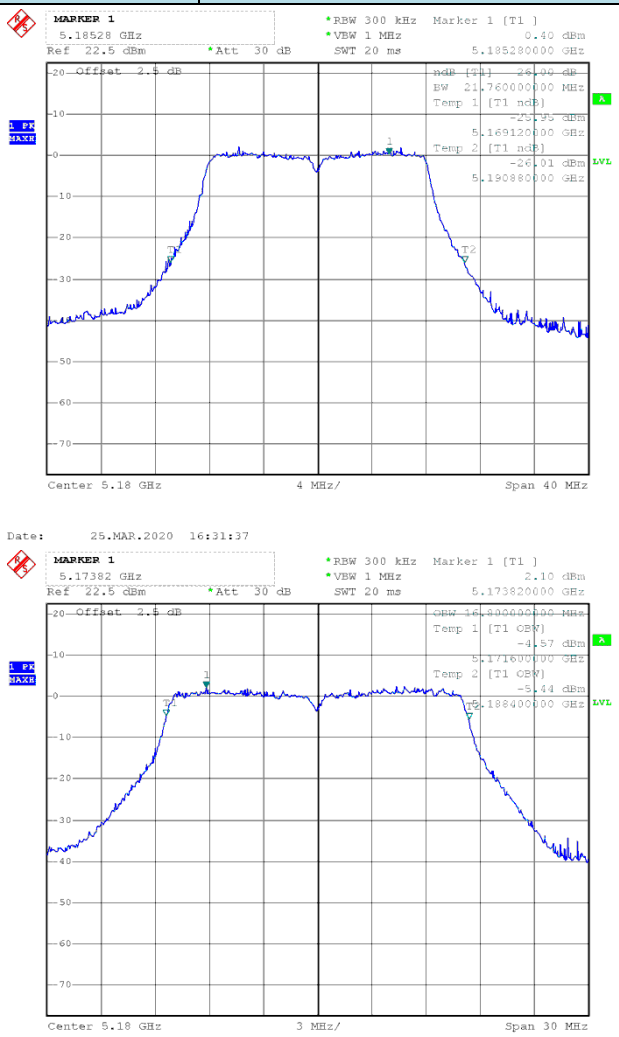
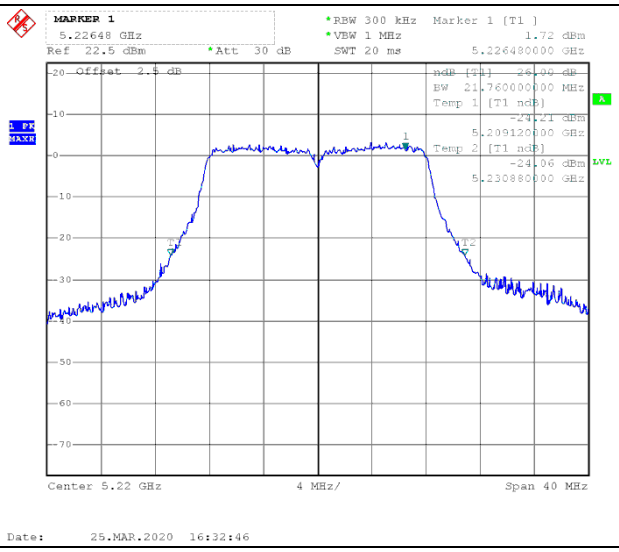
The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 * RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

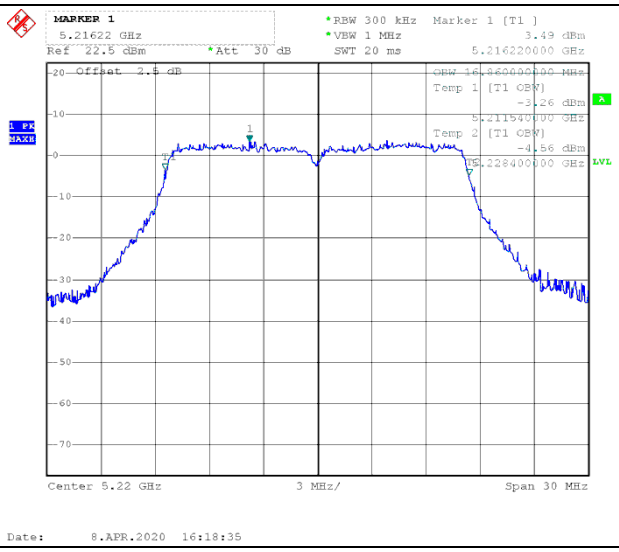
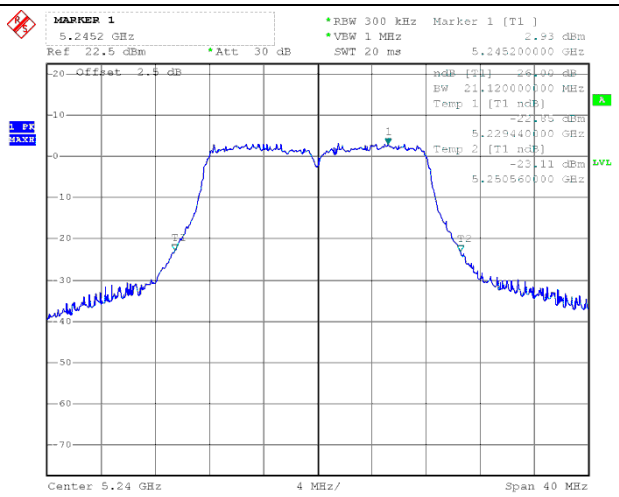
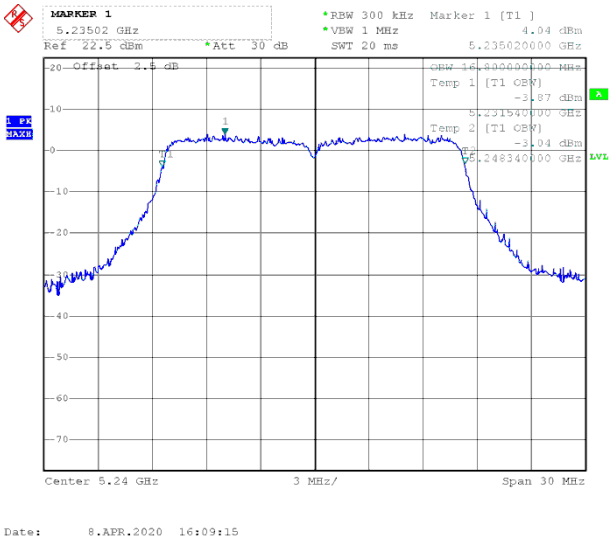
7.3 Summary of Test Results/Plots

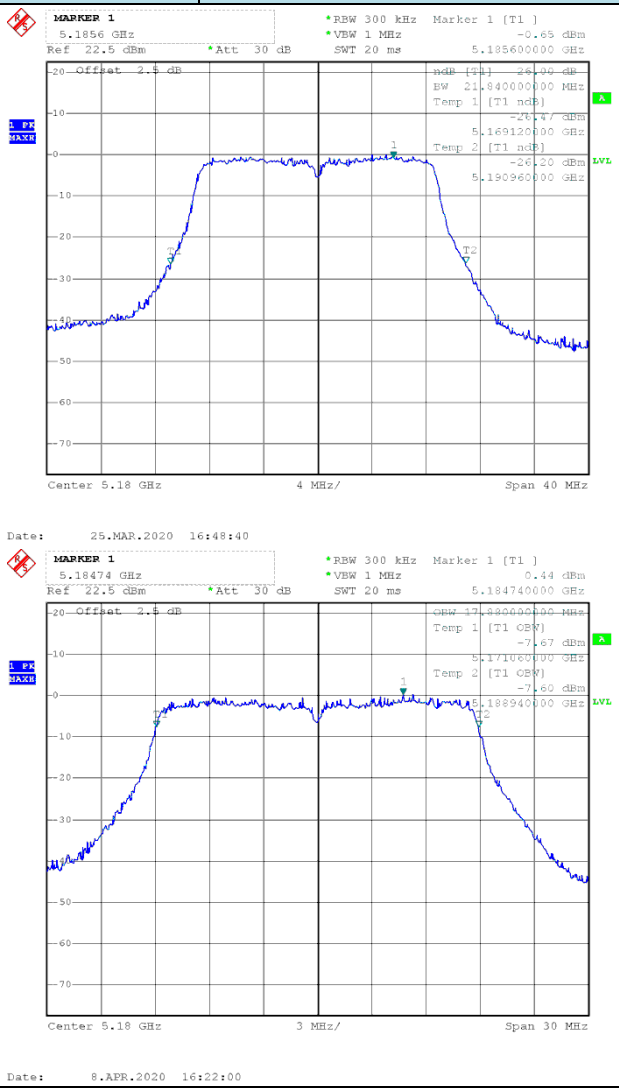
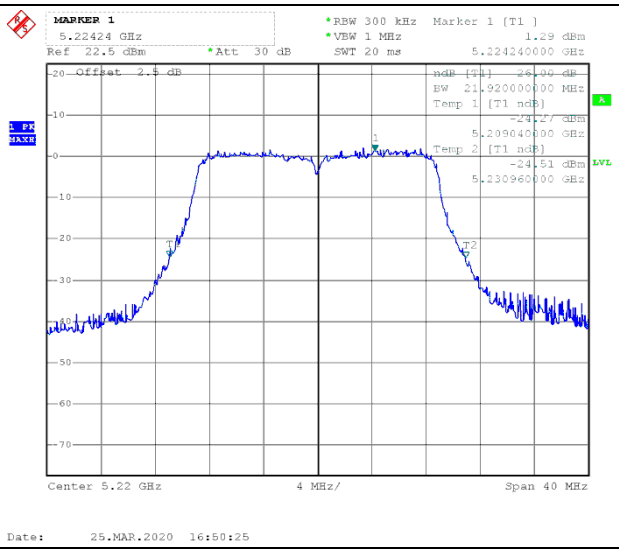
	U-NII-1: 5150-5250MHz			
Test Mode	**Test Channel MHz**	**26 dB Bandwidth MHz**	**99% Bandwidth MHz**	**Limit MHz**
802.11a	5180	21.76	16.80	Pass
	5220	21.76	16.86	Pass
	5240	21.12	16.80	Pass
802.11n-HT20	5180	21.84	17.88	Pass
	5220	21.82	17.88	Pass
	5240	22.00	17.94	Pass
802.11n-HT40	5190	43.68	36.84	Pass
	5230	43.36	36.84	Pass
802.11ac-HT20	5180	21.84	17.88	Pass
	5220	21.52	17.82	Pass
	5240	21.84	17.88	Pass
802.11ac-HT40	5190	44.00	36.84	Pass
	5230	43.20	36.84	Pass
802.11ac-VHT80	5210	81.92	75.36	Pass

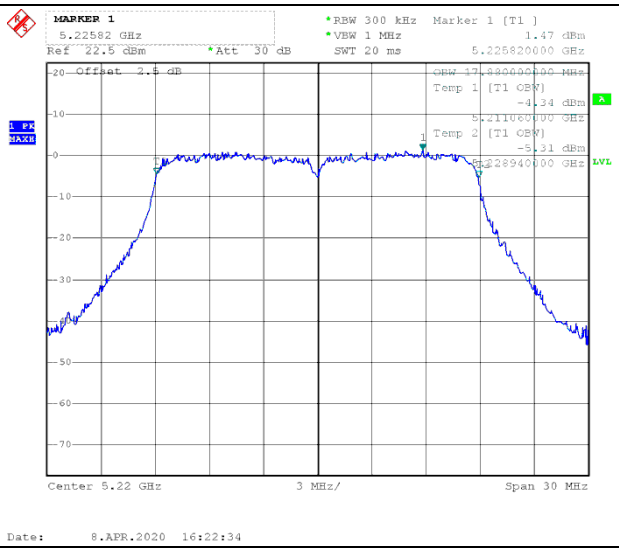
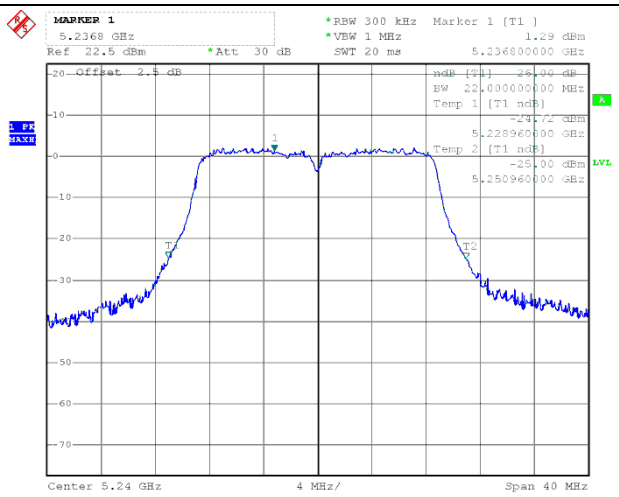
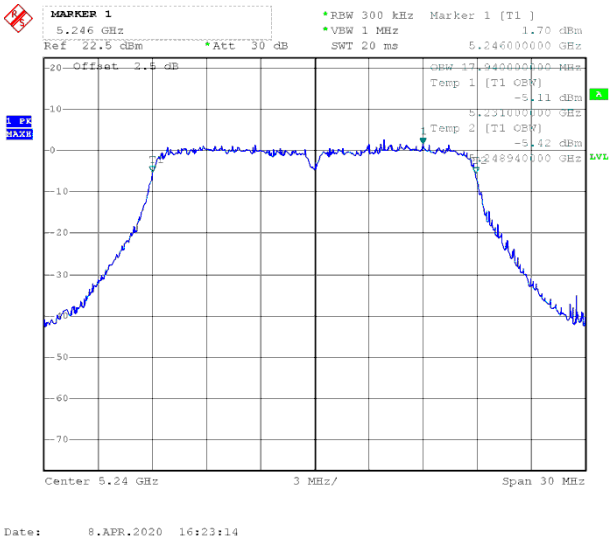
U-NII-3: 5725-5850MHz				
Test Mode	**Test Channel MHz**	**6 dB Bandwidth MHz**	**99% Bandwidth MHz**	**Limit MHz**
802.11a	5745	16.80	16.80	≥500
	5785	16.64	16.86	≥500
	5825	16.80	16.86	≥500
802.11n-HT20	5745	18.08	17.88	≥500
	5785	18.00	17.88	≥500
	5825	17.84	17.82	≥500
802.11n-HT40	5755	36.96	36.86	≥500
	5795	36.80	36.84	≥500
802.11ac-HT20	5745	17.92	17.88	Pass
	5785	17.92	17.88	Pass
	5825	17.92	17.88	Pass
802.11ac-HT40	5755	36.80	36.84	Pass
	5795	36.96	36.84	Pass
802.11ac-VHT80	5775	75.84	75.36	Pass

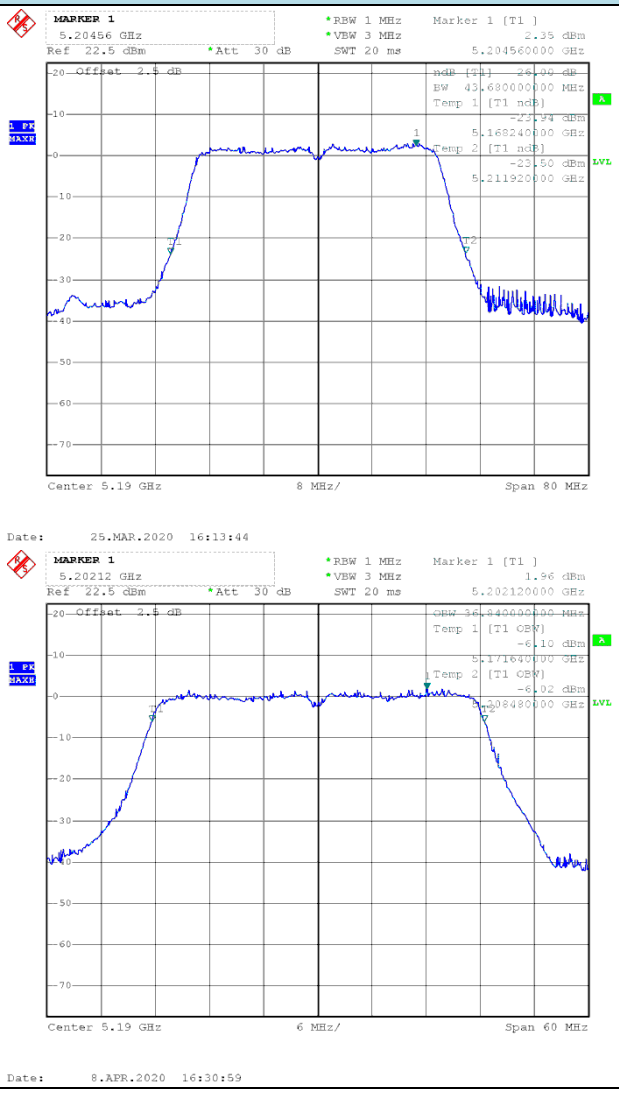
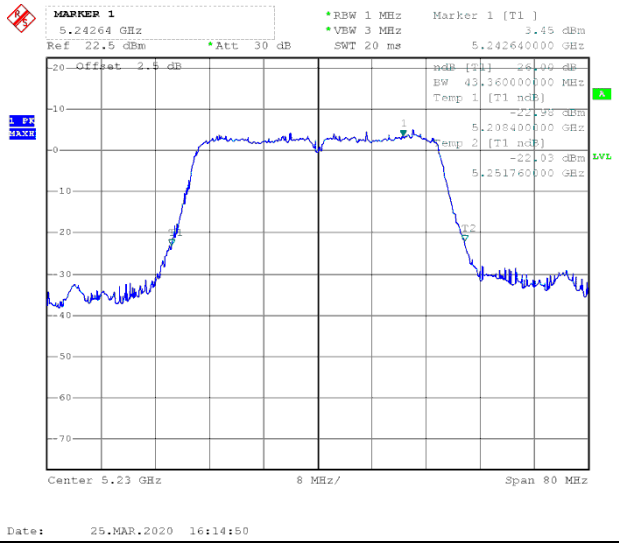
➢ 5150-5250MHz

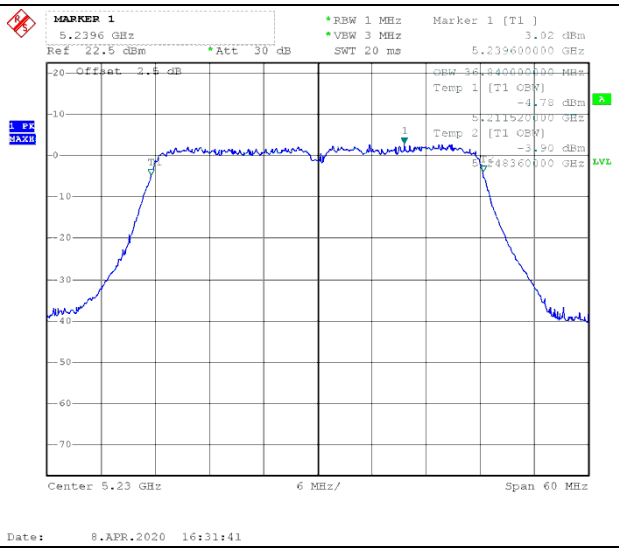
Mode:	**802.11a**
5180MHz	
5220MHz	

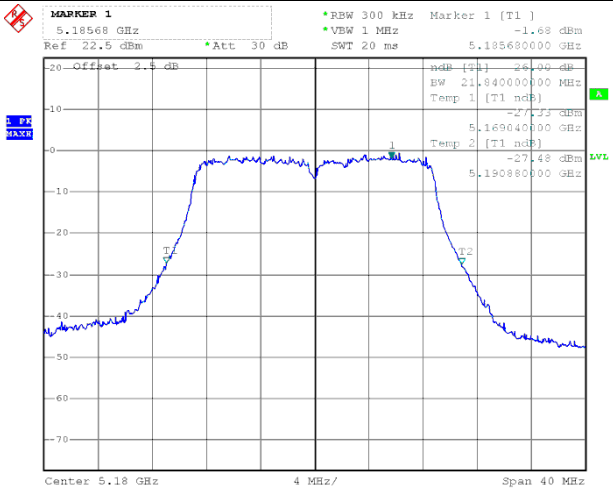
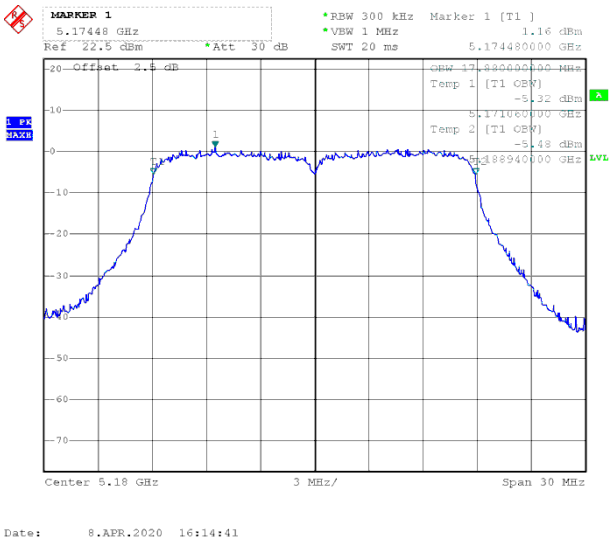
	 MARKER 1 5.21622 GHz Ref 22.5 dBm *Att 30 dB *RBW 300 kHz *VBW 1 MHz SWT 20 ms Marker 1 [T1] 3.49 dBm 5.216220000 GHz Offset 2.5 dB OBW 16.860000000 MHz Temp 1 [T1 OBW] -3.26 dBm 5.211540000 GHz Temp 2 [T1 OBW] -4.56 dBm 5.228400000 GHz Center 5.22 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:18:35
5240MHz	 MARKER 1 5.2452 GHz Ref 22.5 dBm *Att 30 dB *RBW 300 kHz *VBW 1 MHz SWT 20 ms Marker 1 [T1] 2.93 dBm 5.245200000 GHz Offset 2.5 dB ndB [T1] 26.00 dB EW 21.120000000 MHz Temp 1 [T1 ndB] -22.85 dBm 5.229440000 GHz Temp 2 [T1 ndB] -23.11 dBm 5.250560000 GHz Center 5.24 GHz 4 MHz/ Span 40 MHz Date: 25.MAR.2020 16:35:22  MARKER 1 5.23502 GHz Ref 22.5 dBm *Att 30 dB *RBW 300 kHz *VBW 1 MHz SWT 20 ms Marker 1 [T1] 4.04 dBm 5.235020000 GHz Offset 2.5 dB OBW 16.800000000 MHz Temp 1 [T1 OBW] -3.87 dBm 5.231540000 GHz Temp 2 [T1 OBW] -3.04 dBm 5.248340000 GHz Center 5.24 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:09:15

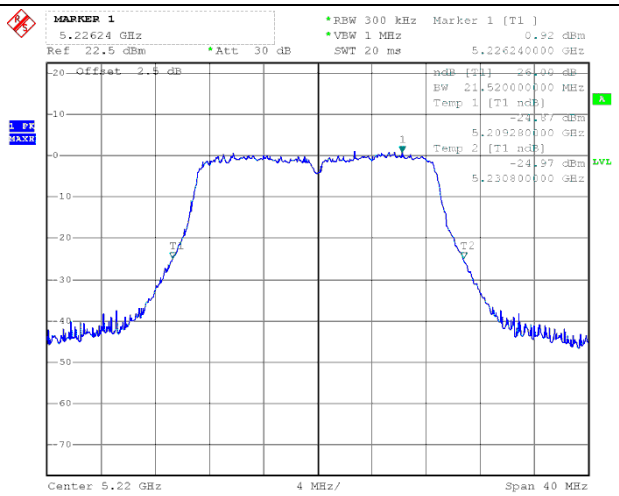
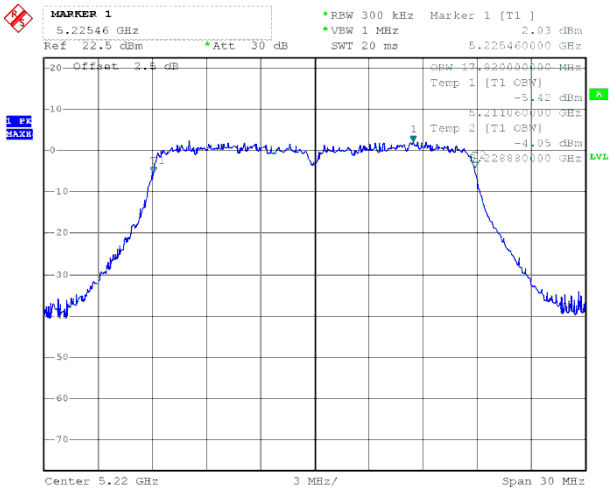
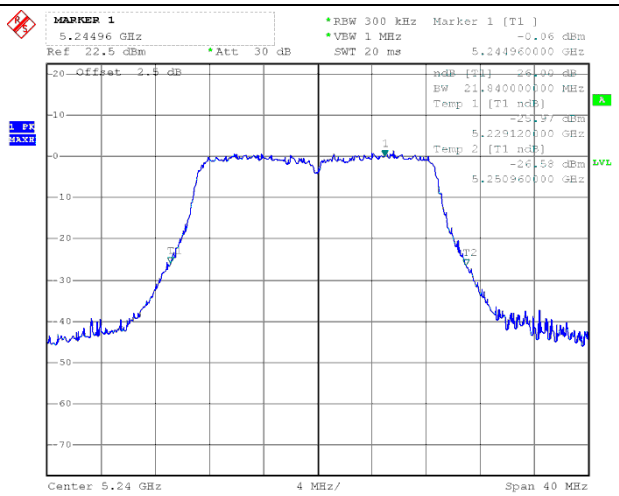
Mode:	802.11n-HT20
5180MHz	
5220MHz	

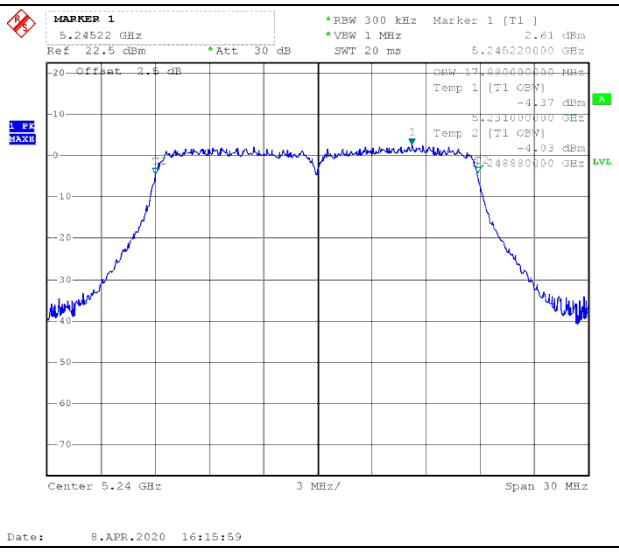
	 MARKER 1 5.22582 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 1.47 dBm 5.225820000 GHz Offset 2.5 dB OBW 17.880000000 MHz Temp 1 [T1 OBW] -4.34 dBm 5.211060000 GHz Temp 2 [T1 OBW] -5.31 dBm 5.228940000 GHz Center 5.22 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:22:34
5240MHz	 MARKER 1 5.2368 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 1.29 dBm 5.236800000 GHz Offset 2.5 dB ndB [T1] 26.99 dB EBW 22.000000000 MHz Temp 1 [T1 ndB] -24.72 dBm 5.228960000 GHz Temp 2 [T1 ndB] -25.00 dBm 5.250960000 GHz Center 5.24 GHz 4 MHz/ Span 40 MHz Date: 25.MAR.2020 16:52:19  MARKER 1 5.246 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 1.70 dBm 5.246000000 GHz Offset 2.5 dB OBW 17.940000000 MHz Temp 1 [T1 OBW] -5.11 dBm 5.231000000 GHz Temp 2 [T1 OBW] -5.42 dBm 5.248940000 GHz Center 5.24 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:23:14

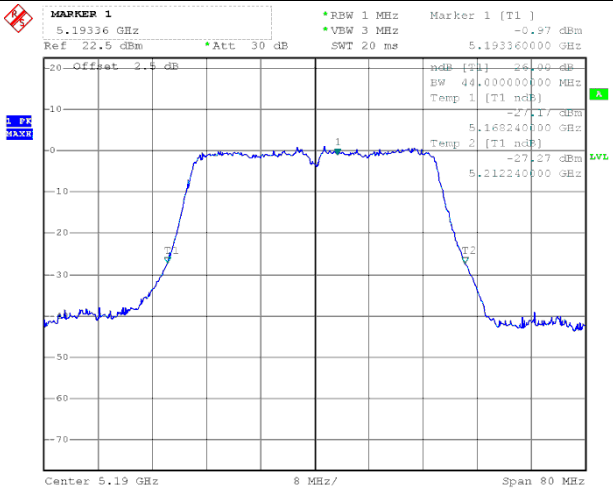
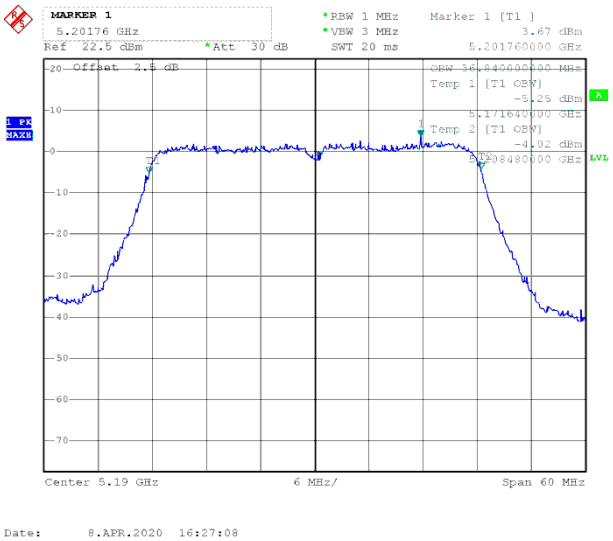
Mode:	802.11n-HT40
5190 MHz	
5230 MHz	

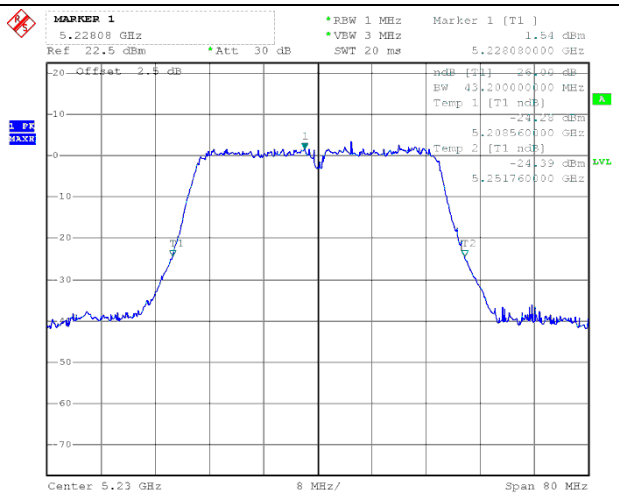
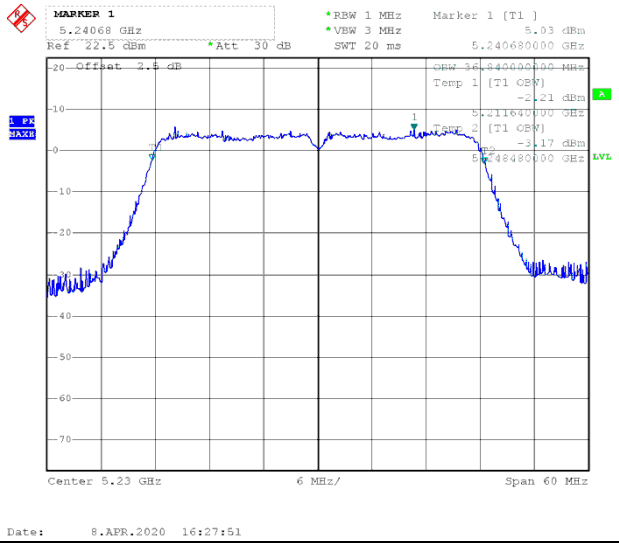
	

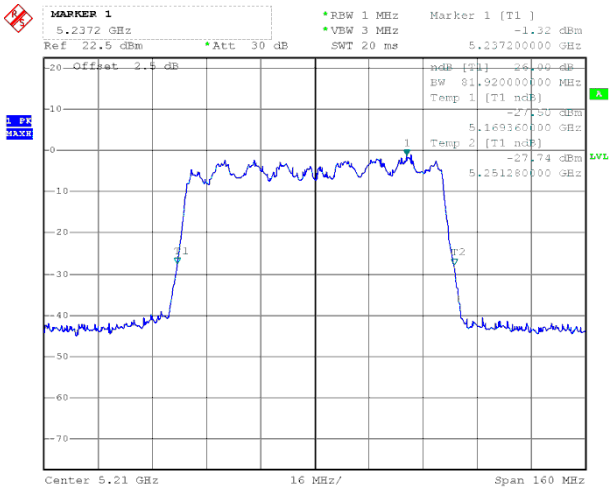
Mode:	**802.11ac-HT20**
5180MHz	 

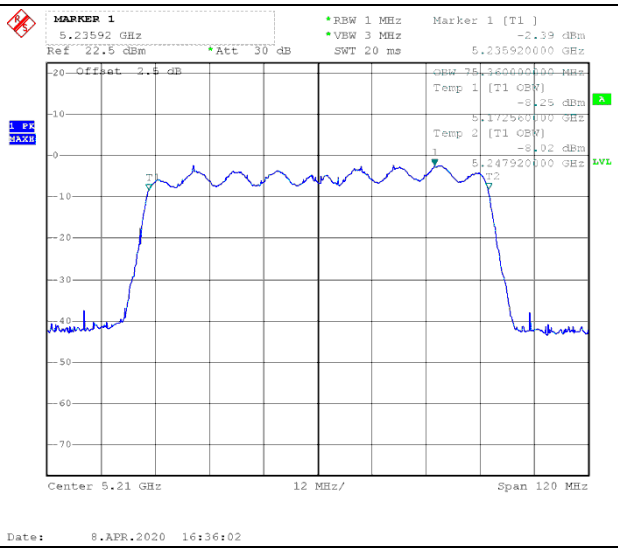
5220MHz	 Date: 25.MAR.2020 16:42:02  Date: 8.APR.2020 16:17:42
5240MHz	 Date: 25.MAR.2020 16:43:12

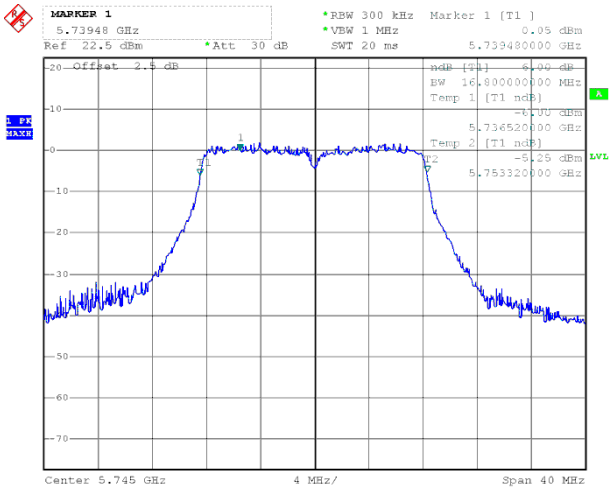
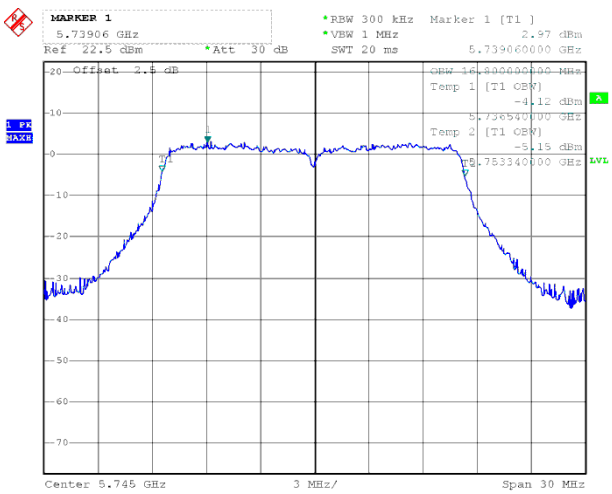
Mode:	**802.11ac-HT40**
5190 MHz	 

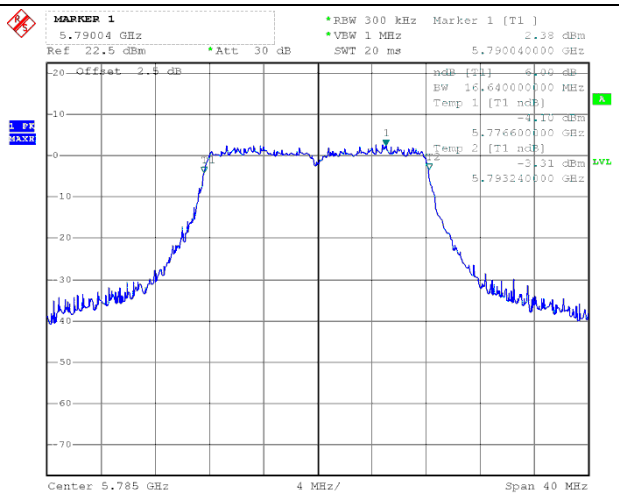
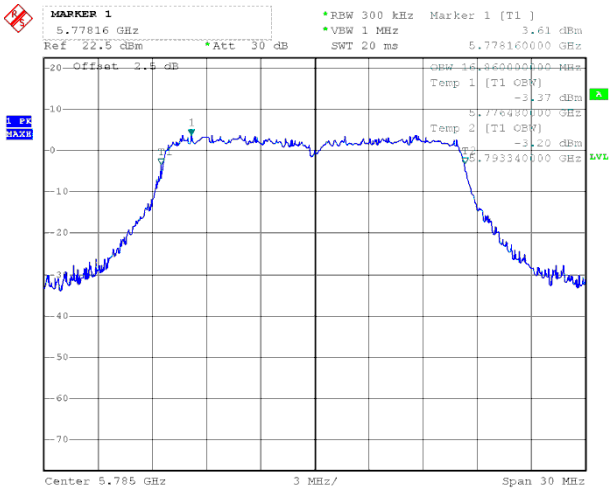
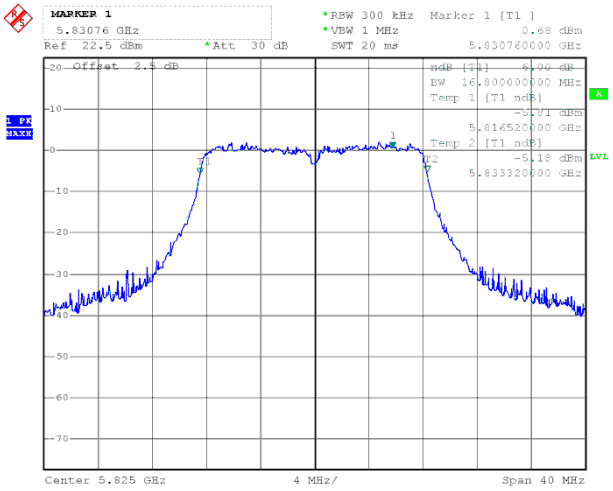
5230 MHz	 

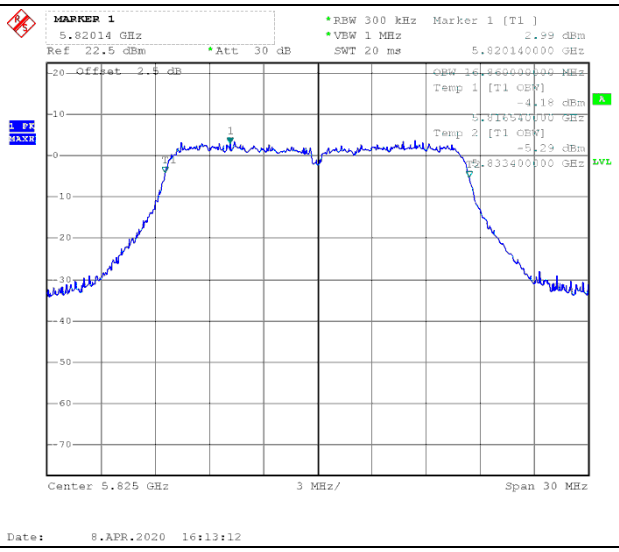
Mode:	**802.11ac VHT80**
5210MHz	

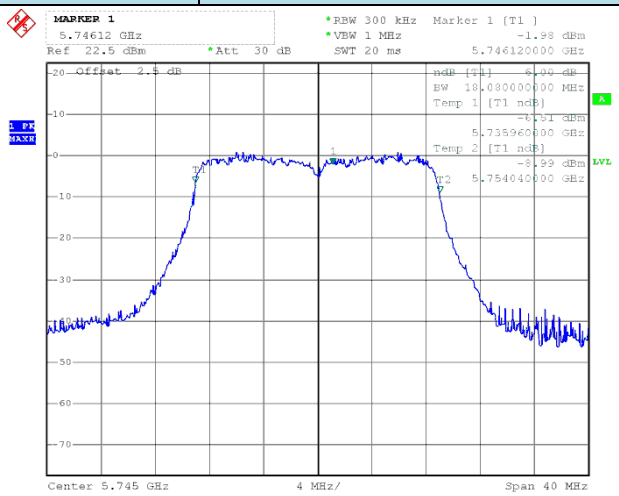
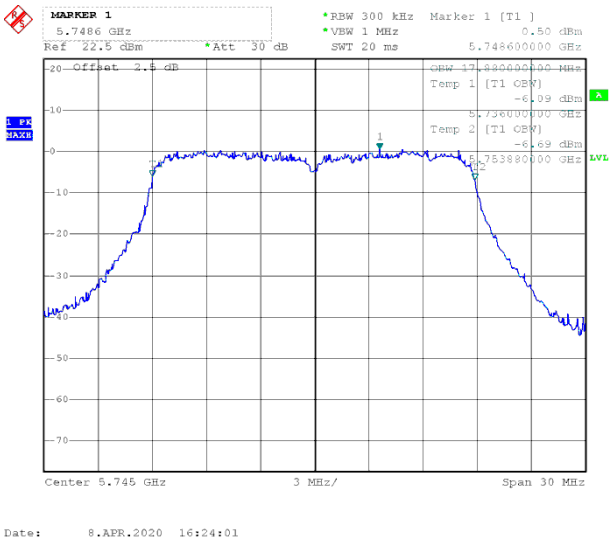
	

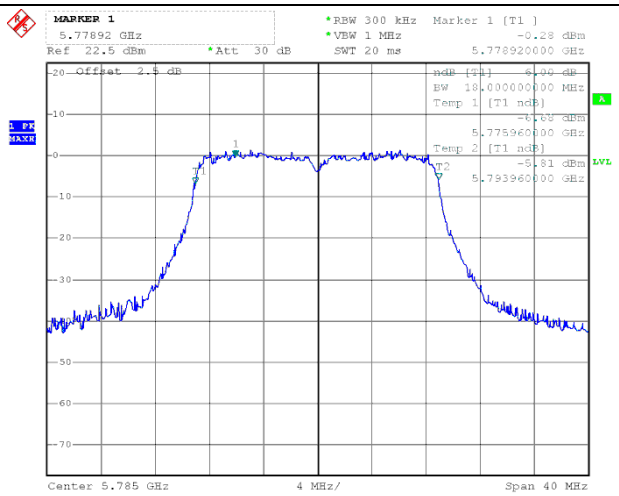
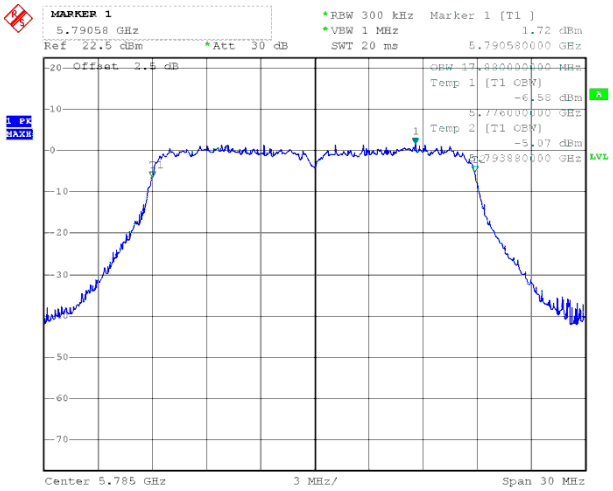
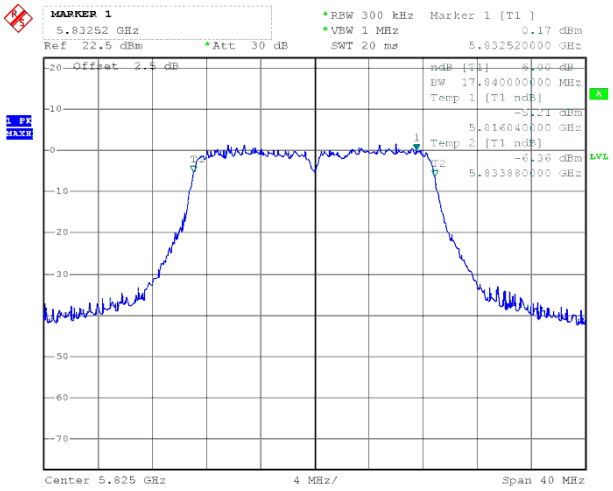
➢ 5725-5850MHz

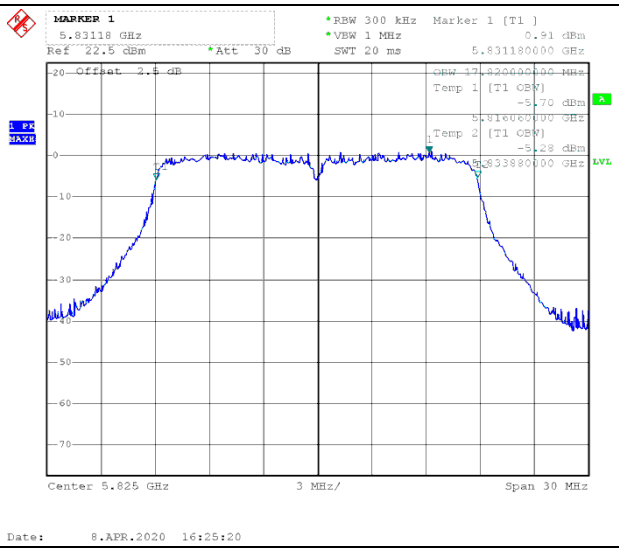
Mode:	**802.11a**
5745MHz	 

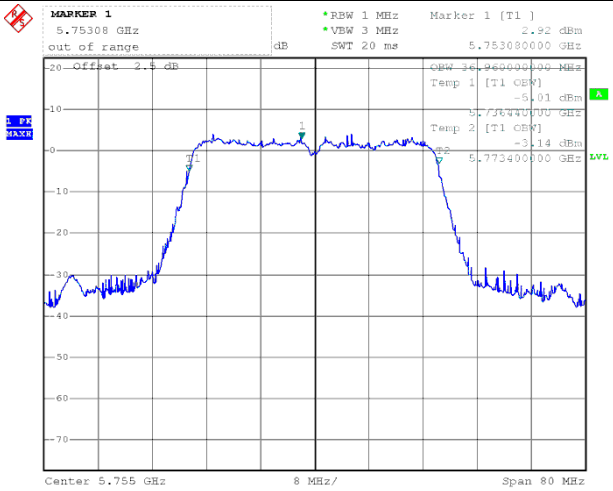
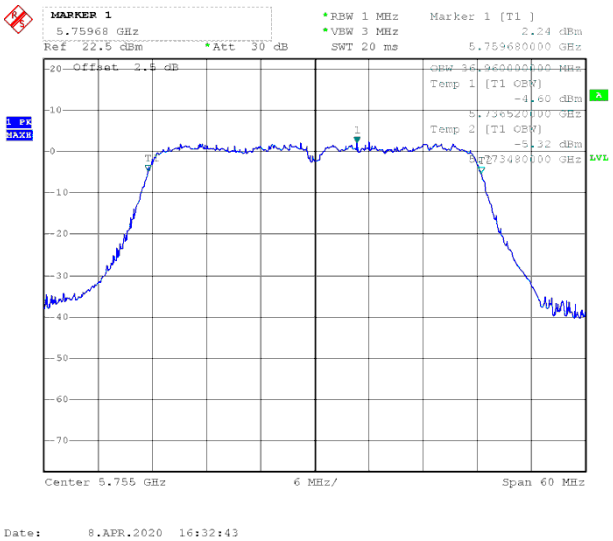
5785MHz	 Date: 25.MAR.2020 16:37:29  Date: 8.APR.2020 16:12:09
5825MHz	 Date: 25.MAR.2020 16:38:45

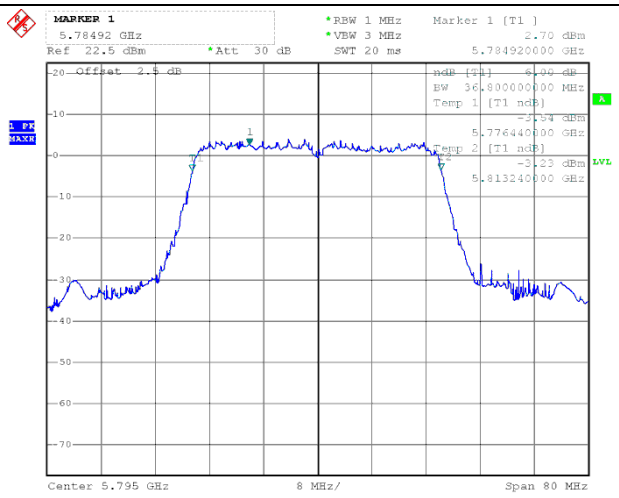
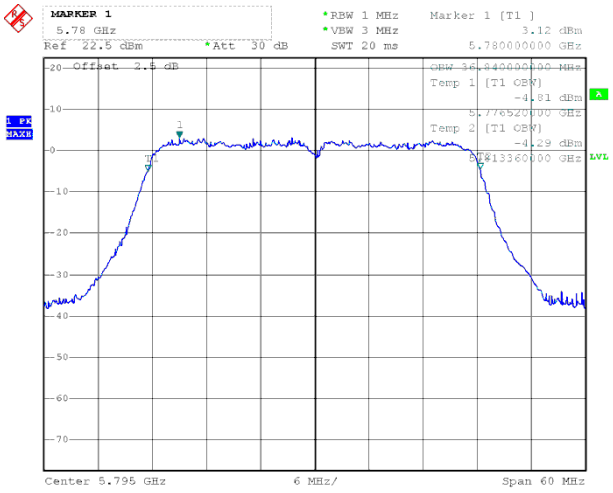
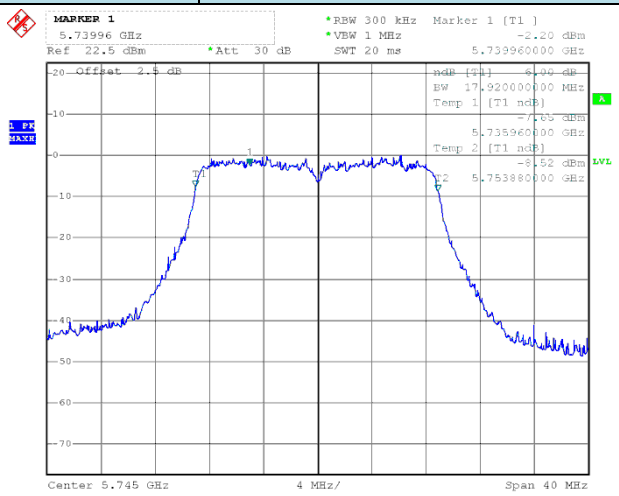
	

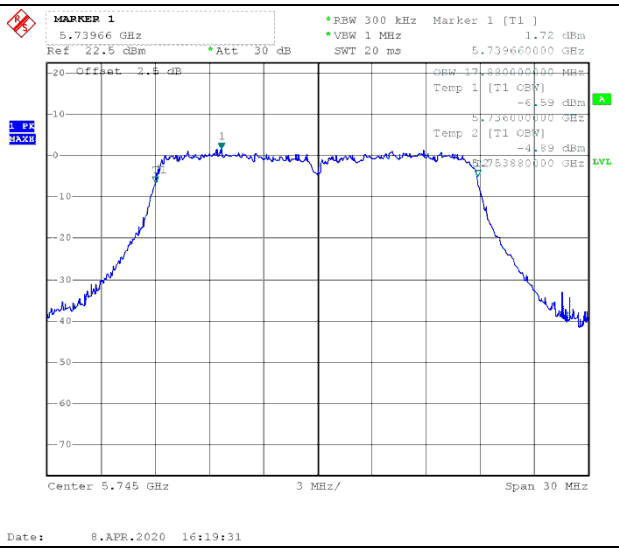
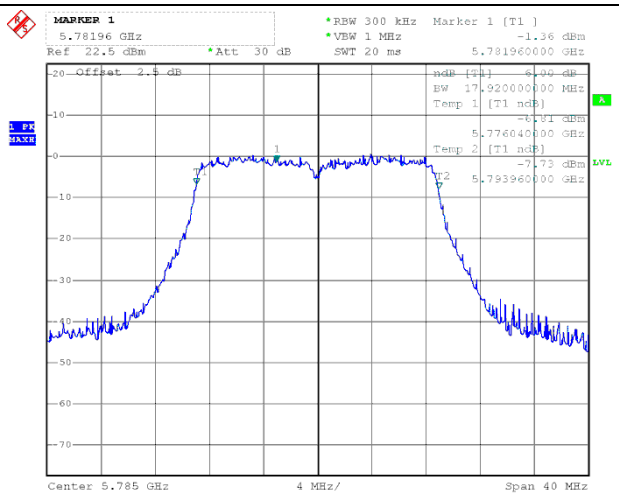
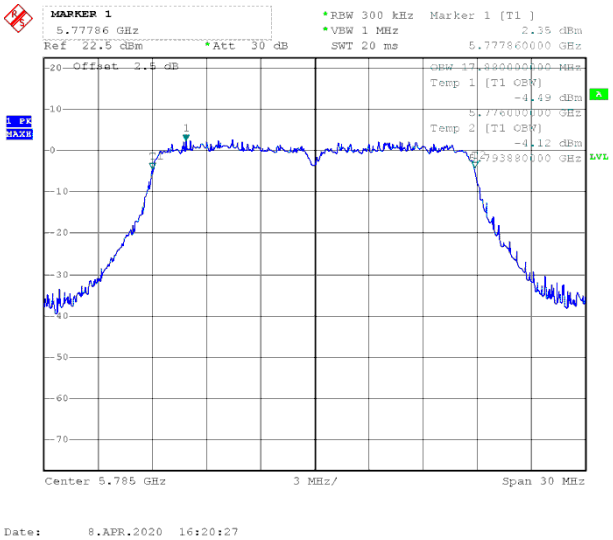
Mode:	**802.11n-HT20**
5745MHz	 

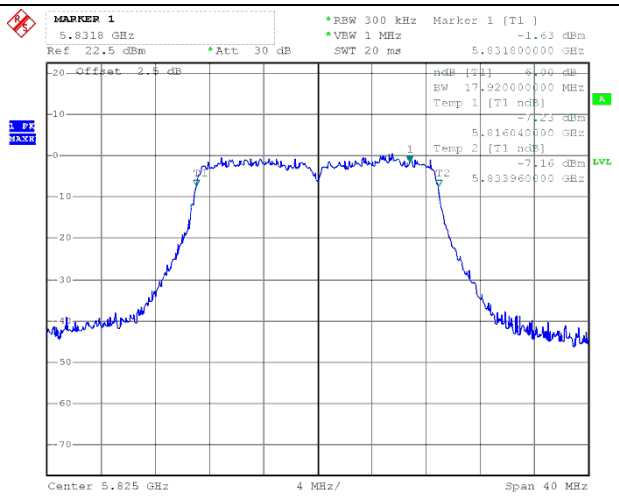
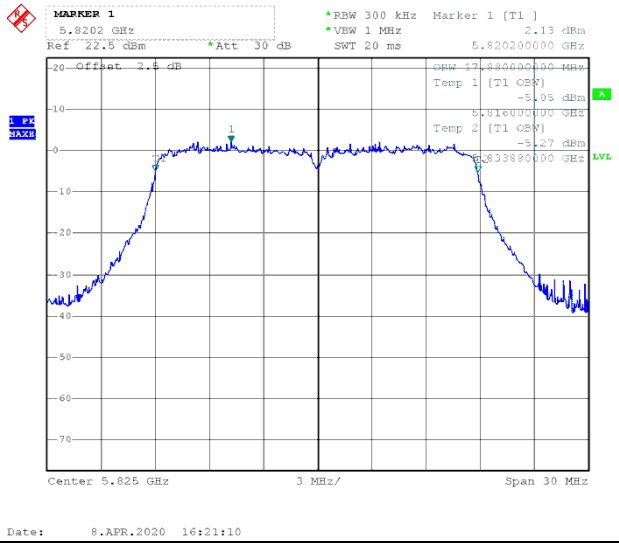
5785MHz	 Date: 25.MAR.2020 16:54:25  Date: 8.APR.2020 16:24:42
5825MHz	 Date: 25.MAR.2020 16:55:41

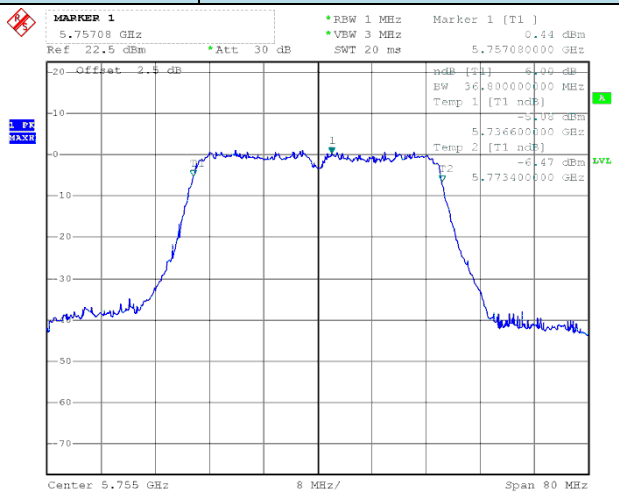
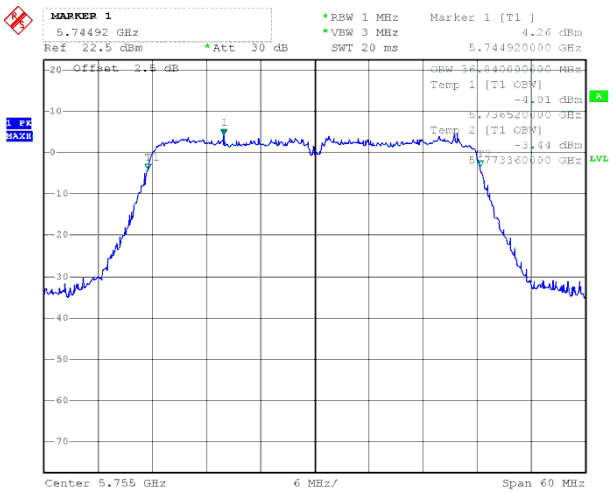
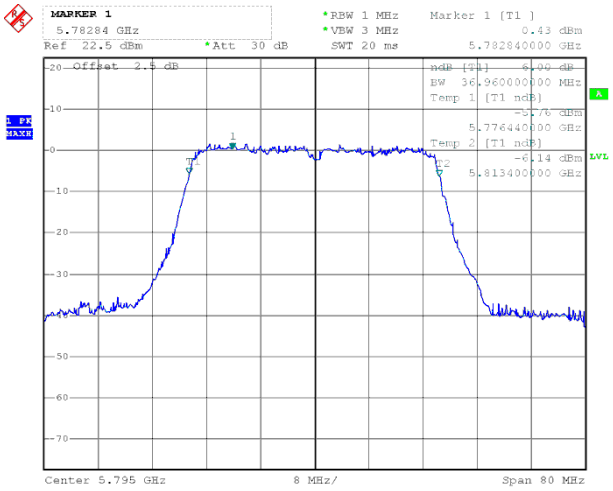
	

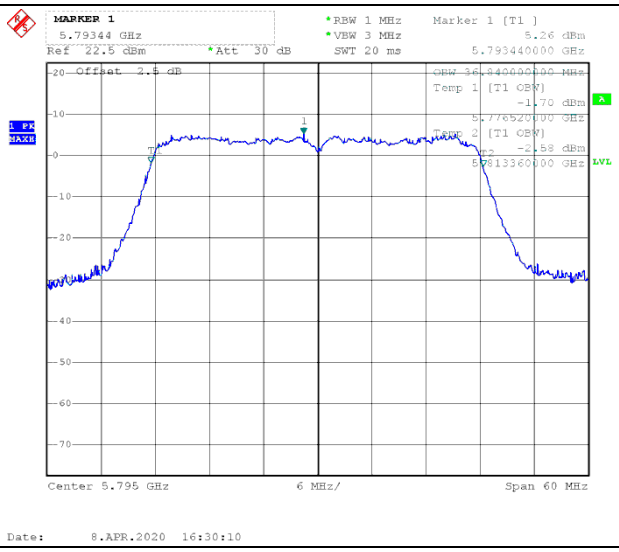
Mode:	**802.11n-HT40**
5755 MHz	 

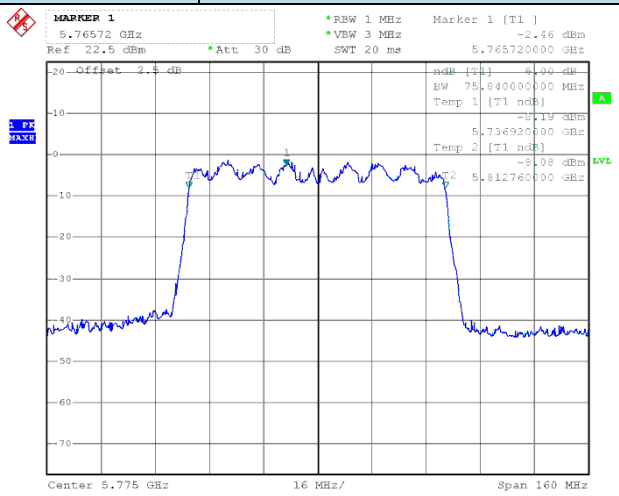
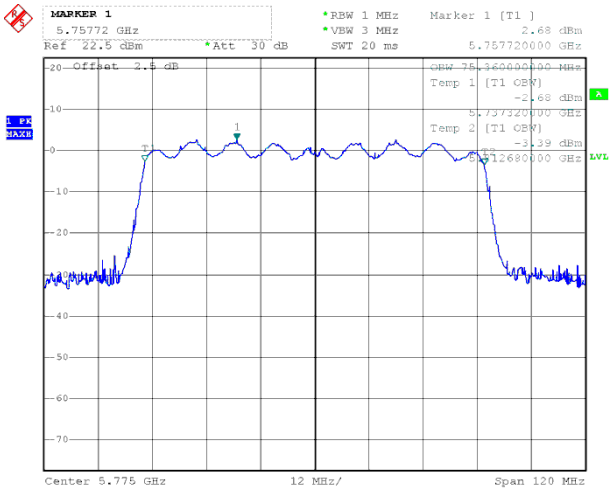
5795 MHz	 
Mode:	**802.11ac-HT20**
5745MHz	

	 MARKER 1 5.73966 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 1.72 dBm 5.739660000 GHz Offset 2.5 dB OBW 17.880000000 MHz Temp 1 [T1 OBW] -6.59 dBm 5.736000000 GHz Temp 2 [T1 OBW] -4.89 dBm 5.753880000 GHz Center 5.745 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:19:31
5785MHz	 MARKER 1 5.78196 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] -1.36 dBm 5.781960000 GHz Offset 2.5 dB ndB [T1] 6.00 dB EBW 17.920000000 MHz Temp 1 [T1 ndB] -6.91 dBm 5.776040000 GHz Temp 2 [T1 ndB] -7.73 dBm 5.793960000 GHz Center 5.785 GHz 4 MHz/ Span 40 MHz Date: 25.MAR.2020 16:45:11  MARKER 1 5.77786 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 2.35 dBm 5.777860000 GHz Offset 2.5 dB OBW 17.880000000 MHz Temp 1 [T1 OBW] -4.49 dBm 5.776000000 GHz Temp 2 [T1 OBW] -4.12 dBm 5.793880000 GHz Center 5.785 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:20:27

5825MHz	 MARKER 1 5.8318 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] -1.63 dBm 5.831800000 GHz Offset 2.5 dB ndB [T1] 6.00 dB BW 17.920000000 MHz Temp 1 [T1 ndB] -7.23 dBm 5.816040000 GHz Temp 2 [T1 ndB] -7.16 dBm 5.833960000 GHz Center 5.825 GHz 4 MHz/ Span 40 MHz Date: 25.MAR.2020 16:46:24  MARKER 1 5.8202 GHz Ref 22.5 dBm Att 30 dB RBW 300 kHz VBW 1 MHz SWT 20 ms Marker 1 [T1] 2.13 dBm 5.820200000 GHz Offset 2.5 dB OBW 17.880000000 MHz Temp 1 [T1 OBW] -5.05 dBm 5.816000000 GHz Temp 2 [T1 OBW] -5.27 dBm 5.833880000 GHz Center 5.825 GHz 3 MHz/ Span 30 MHz Date: 8.APR.2020 16:21:10

Mode:	802.11ac-HT40
5755 MHz	 Date: 25.MAR.2020 16:21:16  Date: 8.APR.2020 16:29:01
5795 MHz	 Date: 25.MAR.2020 16:20:21

Mode:	**802.11ac VHT80**
5775 MHz	 

8. Maximum Conducted Output Power

8.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

8.2 Test Procedure

According to KDB789033 D02 v02r01 section E, the following is the measurement procedure.

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(ii) Set RBW = 1 MHz.
(iii) Set VBW ≥ 3 MHz.
(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

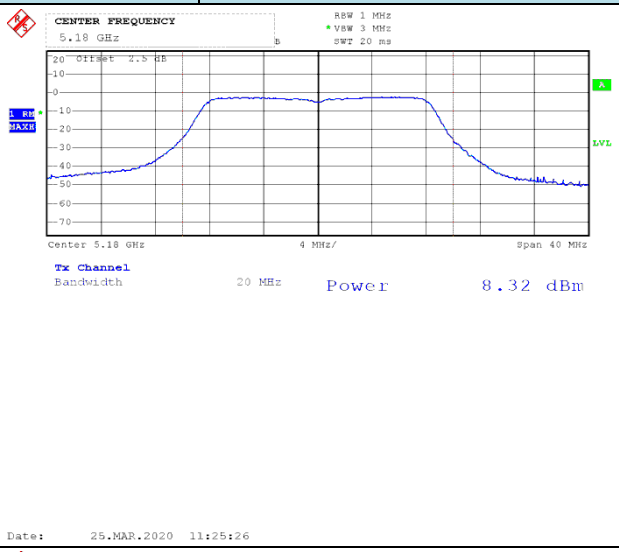
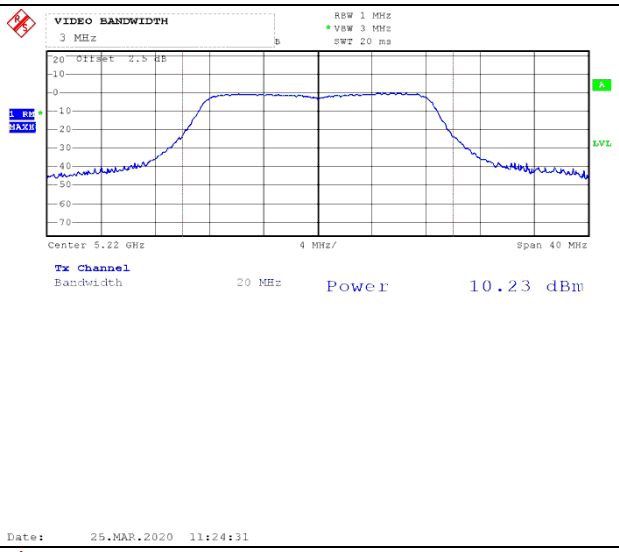
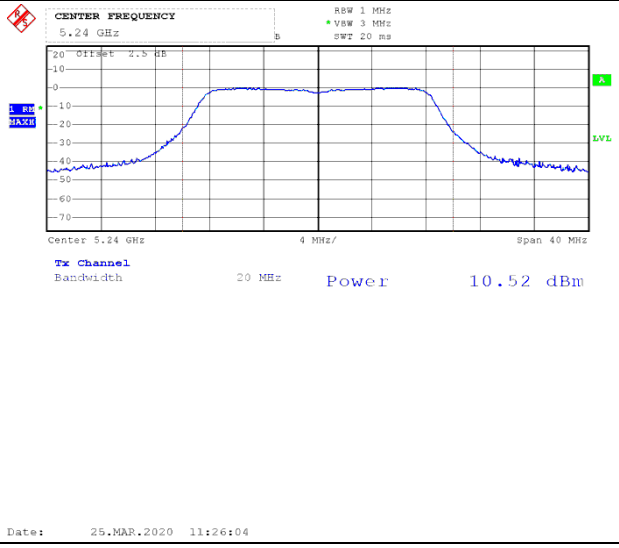
(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

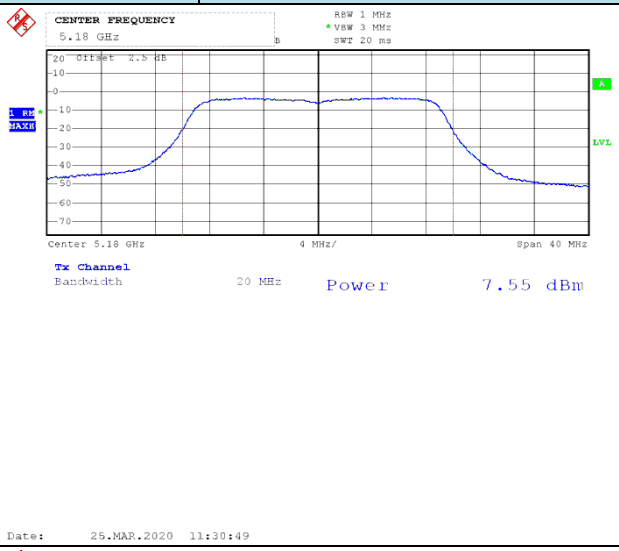
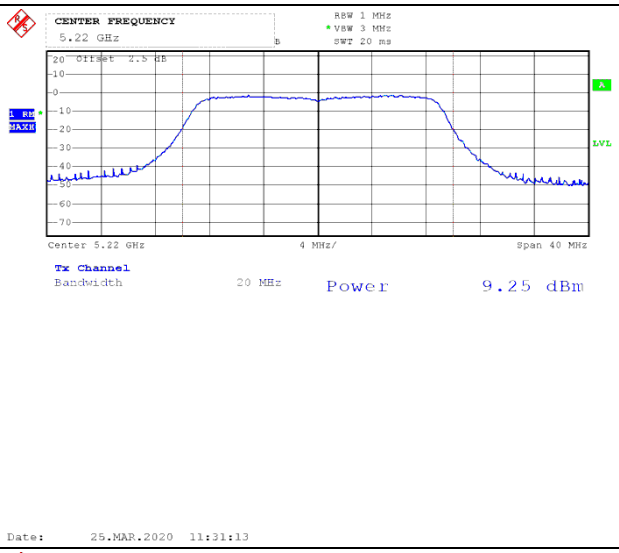
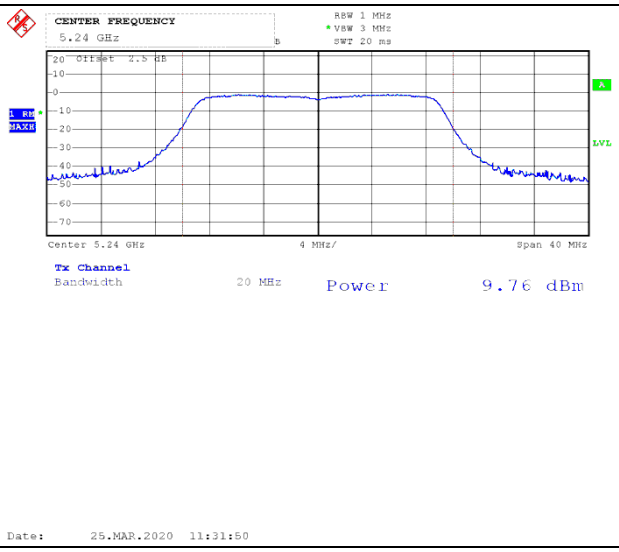
8.3 Summary of Test Results/Plots

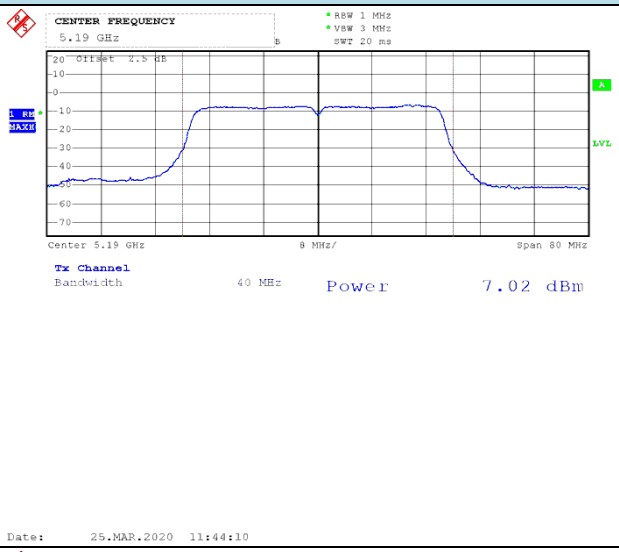
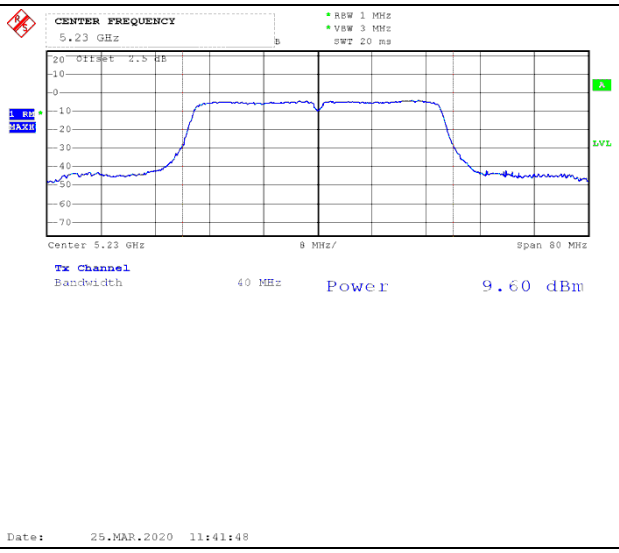
U-NII-1:5150-5250MHz				
Test mode	Frequency MHz	Output Power dBm	Output Power mW	Limit mW
802.11a	5180	8.32	6.79	250
	5200	10.23	10.54	250
	5240	10.52	11.27	250
802.11n-HT20	5180	7.55	5.69	250
	5200	9.25	8.41	250
	5240	9.76	9.46	250
802.11n-HT40	5190	7.02	5.04	250
	5230	9.60	9.12	250
802.11ac-HT20	5180	6.62	4.59	250
	5200	8.35	6.84	250
	5240	8.69	7.40	250
802.11ac-HT40	5190	6.11	4.08	250
	5230	7.47	5.58	250
802.11ac-VHT80	5210	5.92	3.91	250

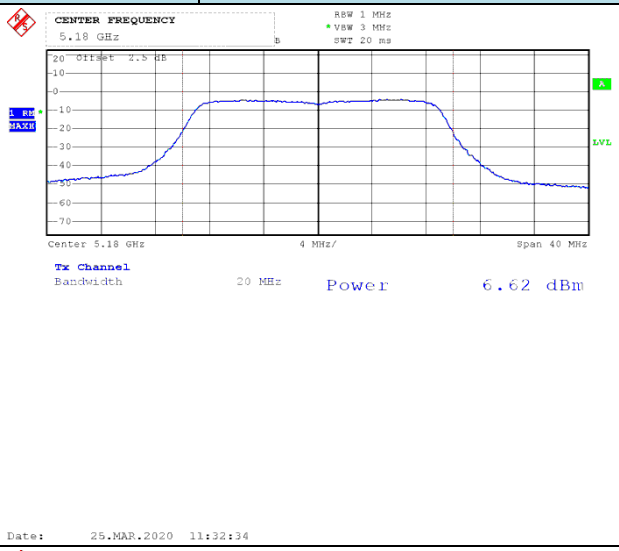
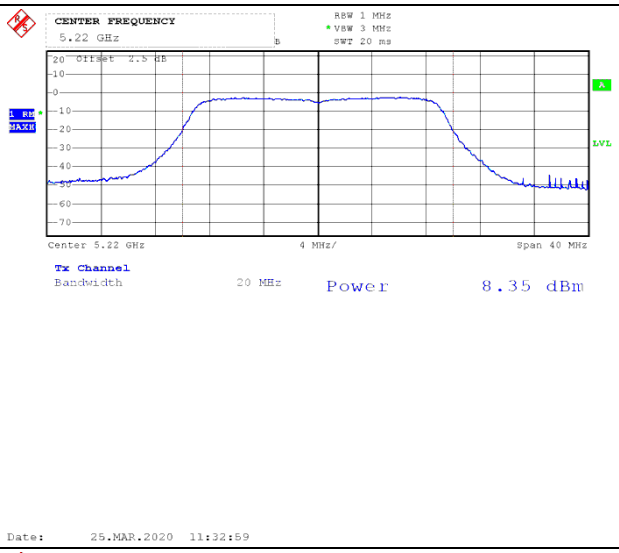
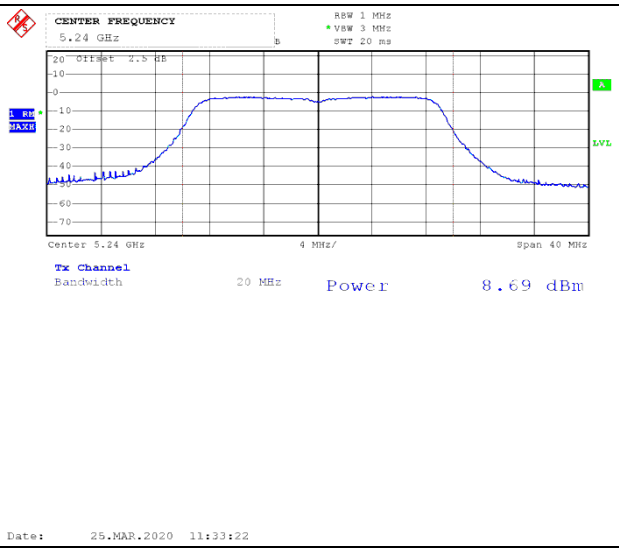
U-NII-3: 5725-5850MHz				
Test mode	Frequency MHz	Output Power dBm	Output Power mW	Limit mW
802.11a	5745	9.57	9.06	1000
	5785	10.20	10.47	1000
	5825	9.79	9.53	1000
802.11n-HT20	5745	8.53	7.13	1000
	5785	9.15	8.22	1000
	5825	8.88	7.73	1000
802.11n-HT40	5755	8.67	7.36	1000
	5795	9.10	8.13	1000
802.11ac-HT20	5745	7.93	6.21	1000
	5785	8.52	7.11	1000
	5825	8.01	6.32	1000
802.11ac-HT40	5755	6.39	4.36	1000
	5795	7.09	5.12	1000
802.11ac-VHT80	5775	6.11	4.08	1000

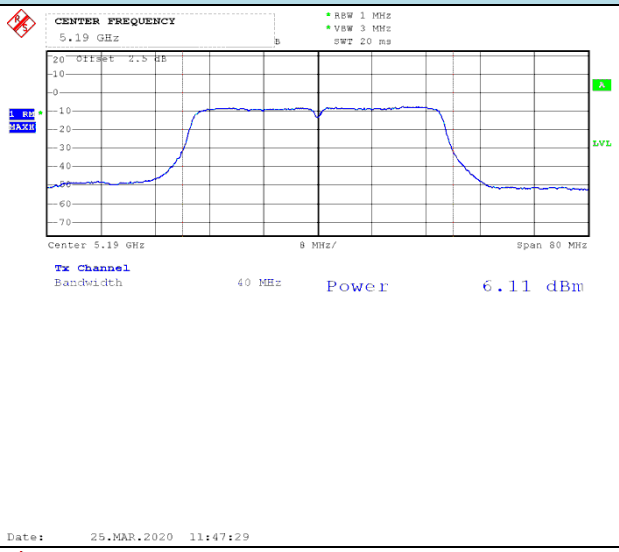
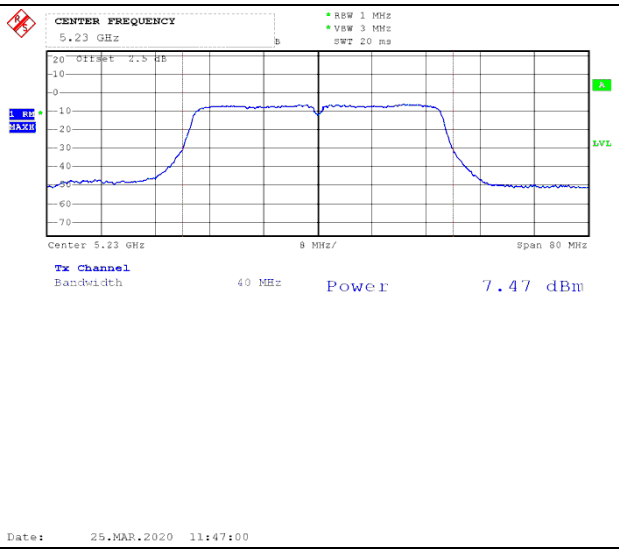
➢ 5150-5250MHz

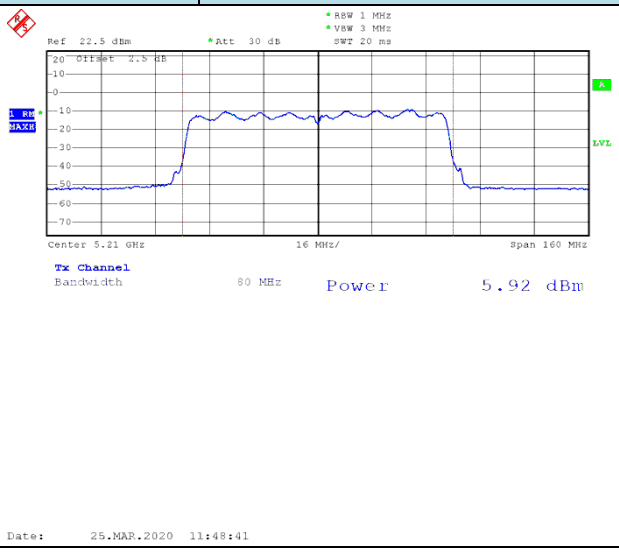
Mode:	**802.11a**
5180MHz	
5220MHz	
5240MHz	

Mode:	802.11n-HT20
5180MHz	
5220MHz	
5240MHz	

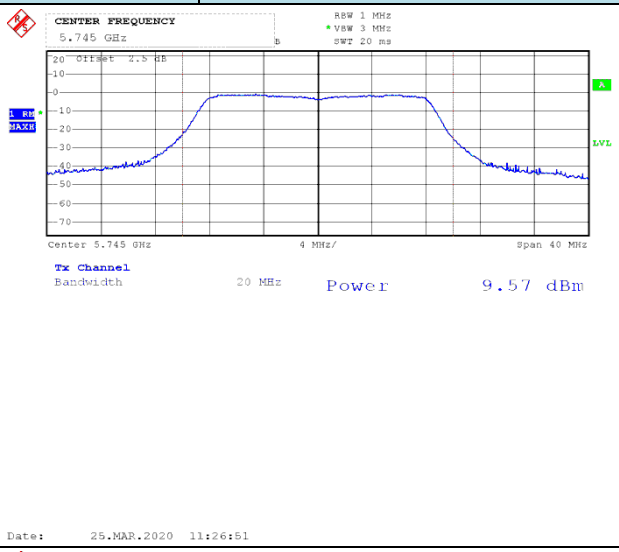
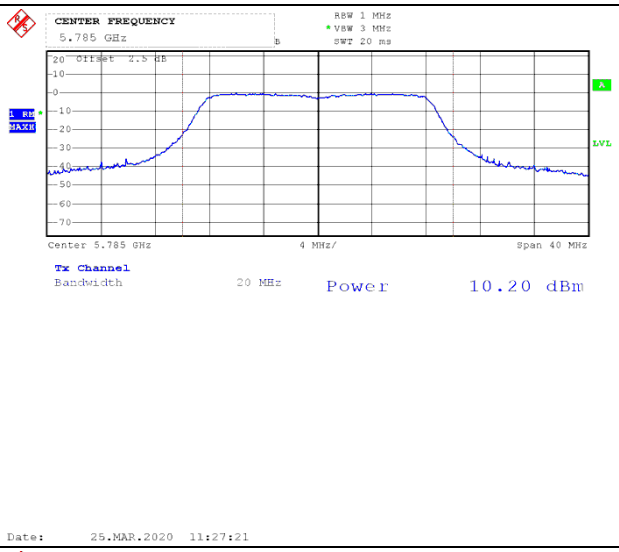
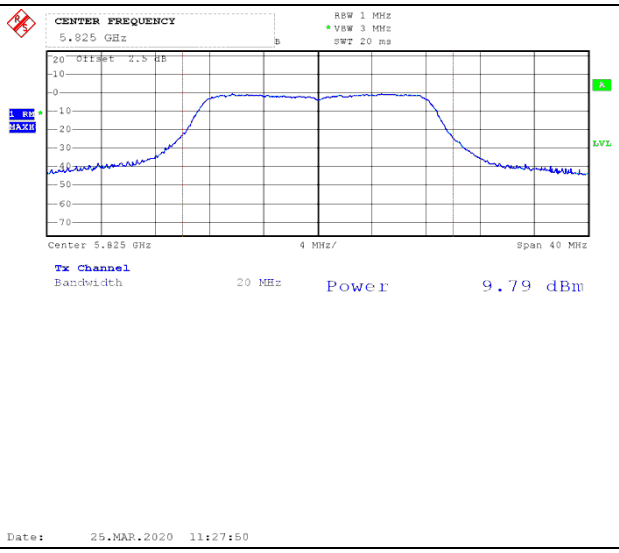
Mode:	802.11n-HT40
5190 MHz	
5230 MHz	

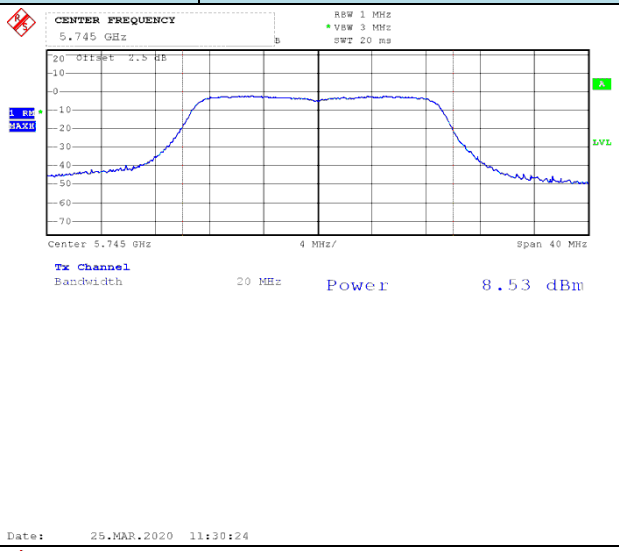
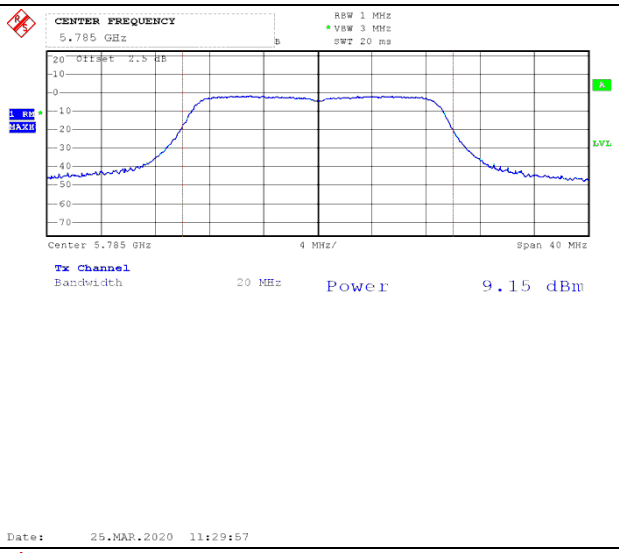
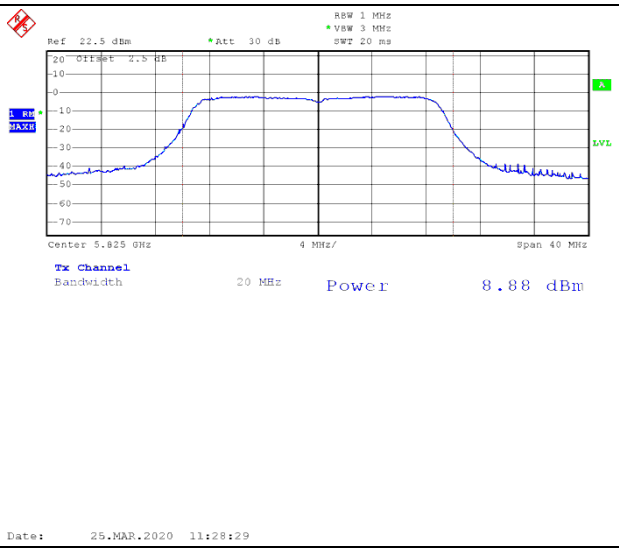
Mode:	802.11ac-HT20
5180MHz	
5220MHz	
5240MHz	

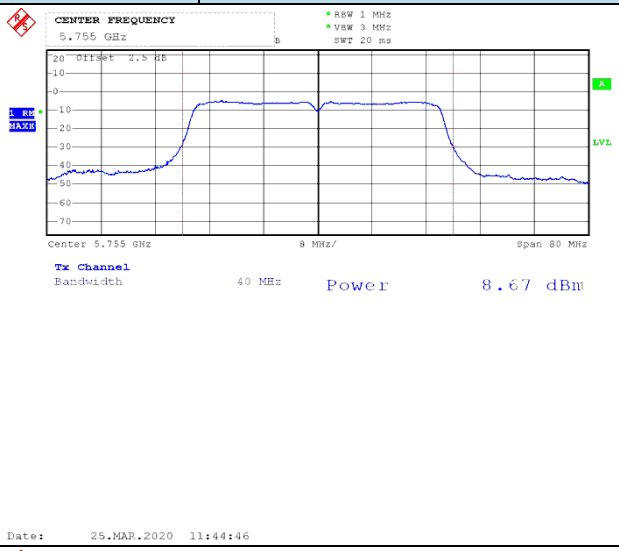
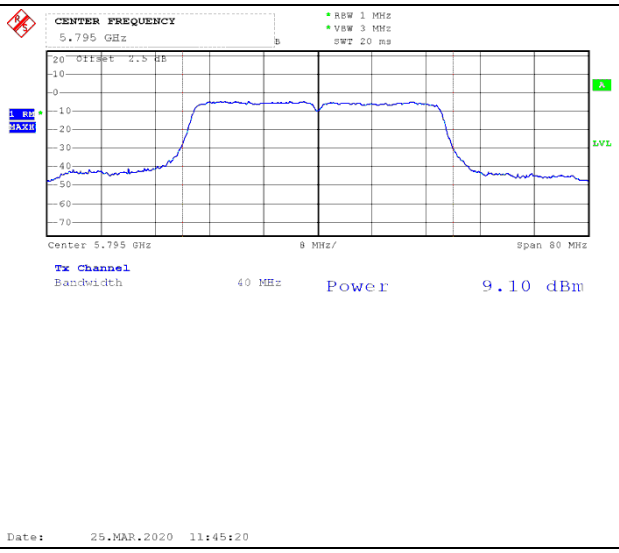
Mode:	802.11ac-HT40
5190 MHz	
5230 MHz	

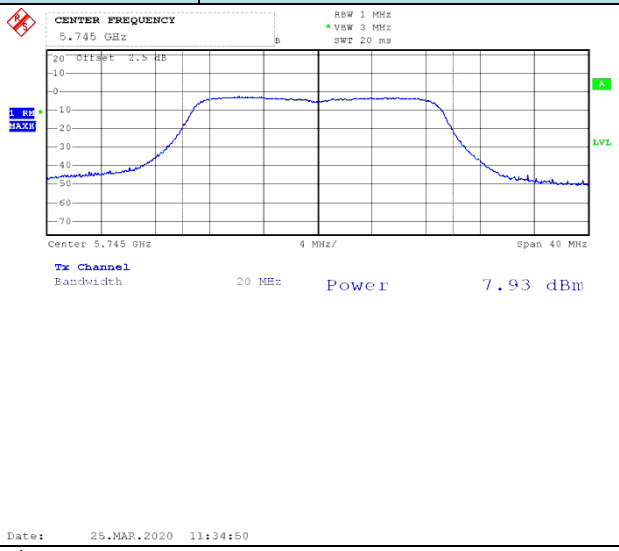
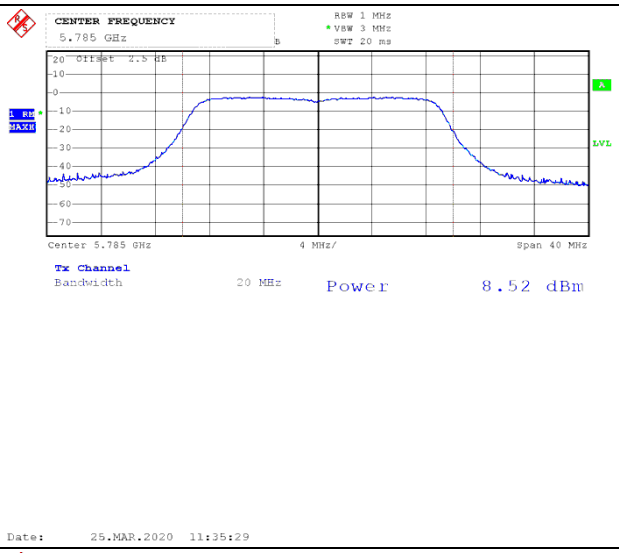
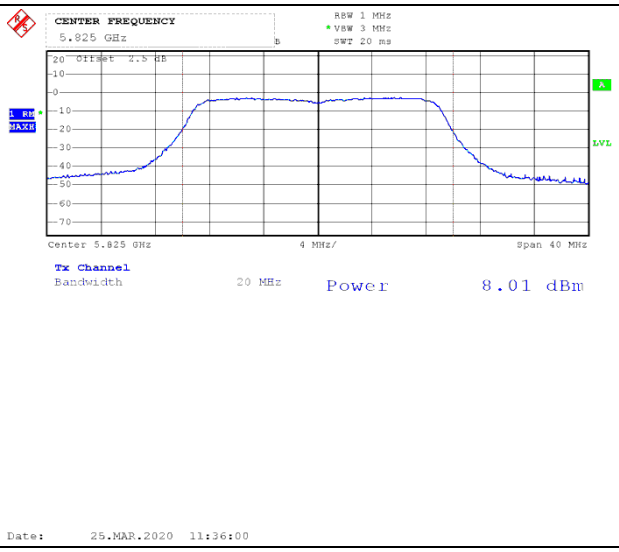
Mode:	**802.11ac VH80**
5210MHz	

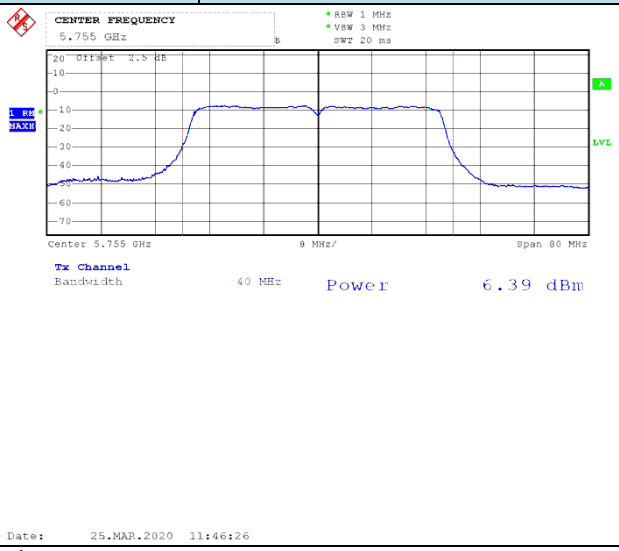
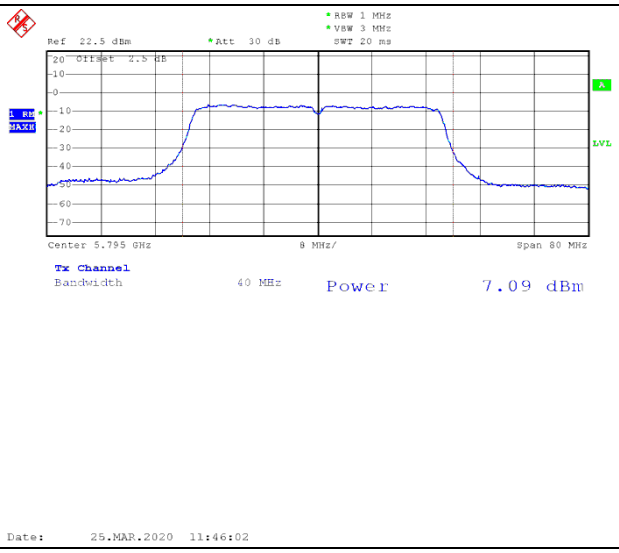
➢ 5725-5850MHz

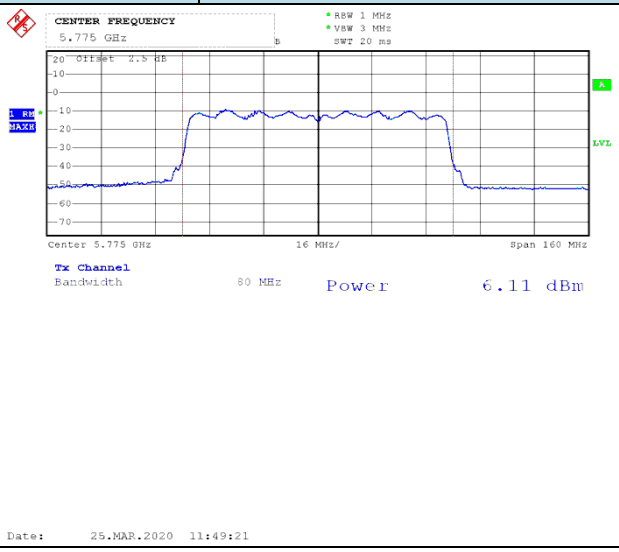
Mode:	**802.11a**
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11n-HT20
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11n-HT40
5755 MHz	
5795 MHz	

Mode:	802.11ac-HT20
5745MHz	
5785MHz	
5825MHz	

Mode:	802.11ac-HT40
5755 MHz	
5795 MHz	

Mode:	802.11ac VHT80
5775 MHz	

9. Radiated Spurious Emissions

9.1 Standard Applicable

According to §15.407(b), undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

According to §15.407(b)(6), Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

According to §15.407(b)(7), The provisions of §15.205 apply to intentional radiators operating under this section.

789033 D02 v02r01 General UNII Test Procedures New Rules v01

If radiated measurements are performed, field strength is then converted to EIRP as follows:

EIRP = ((E*d)^2) / 30

where:

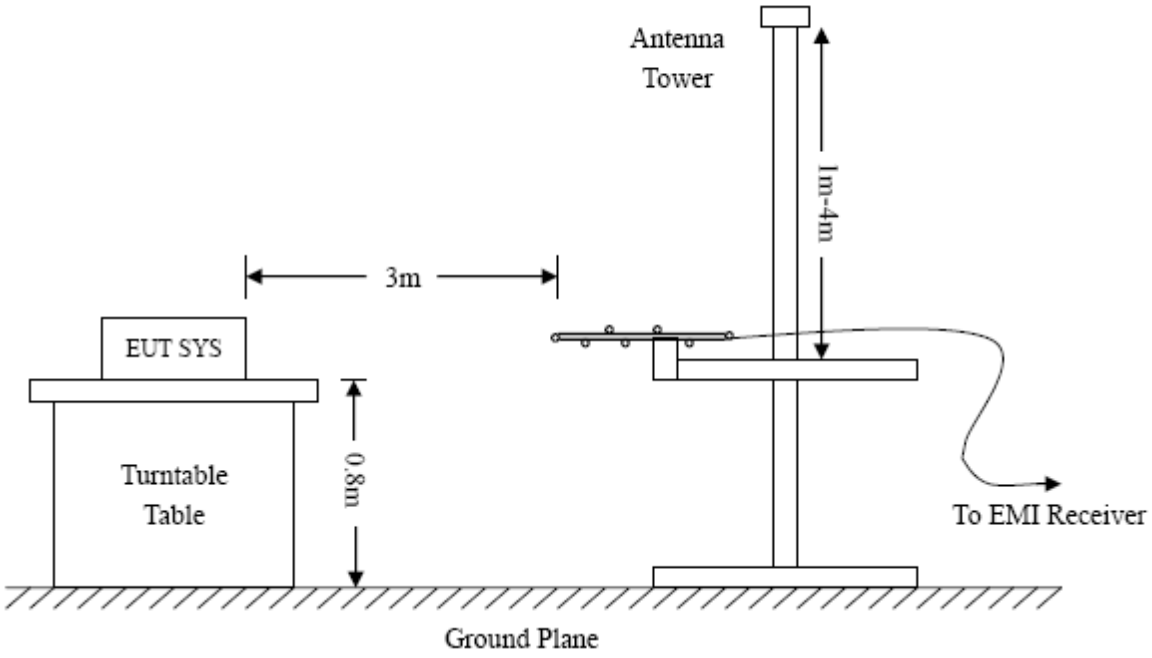
- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotropically radiated power in watts.

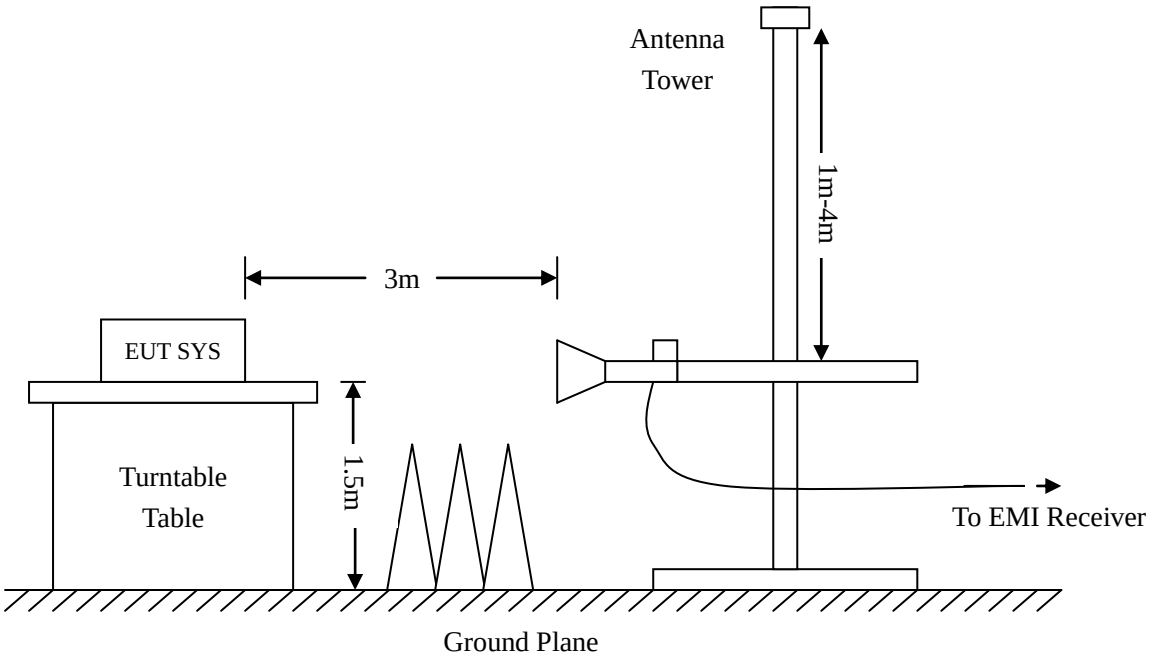
9.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.407(b)(6) and FCC Part 15.209 Limit..

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.


Antenna
Tower
1m-4m
3m
EUT SYS
Turntable
Table
0.8m
To EMI Receiver
Ground Plane


Antenna
Tower
1m-4m
3m
EUT SYS
Turntable
Table
1.5m
To EMI Receiver
Ground Plane

9.3 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:
RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:
RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

9.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15 Limit

9.5 Summary of Test Results/Plots

Note:

1. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

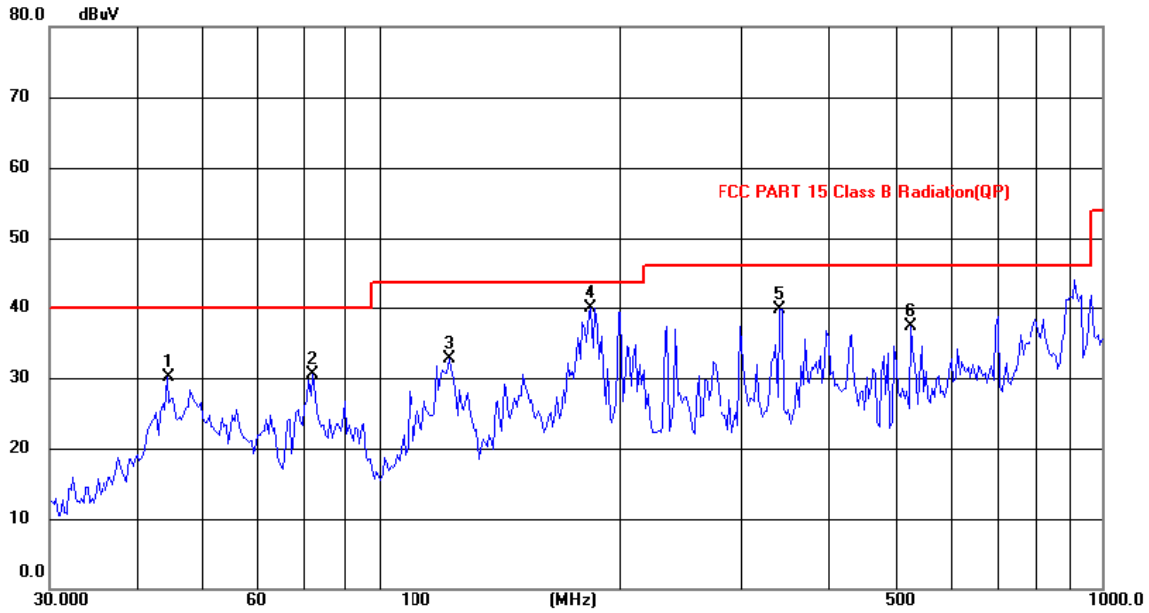
2. Below 1 GHz, Have pre-scan all modulation mode, found the 802.11a modulation Low channel which it was worst case, so only the worst case's data on the test report.

3. Above 1 GHz, Have pre-scan all modulation mode, found the 802.11a modulation which it was worst case, so only the worst case's data on the test report

- Spurious Emission From 30 MHz to 1 GHz
- 5150-5250MHz

802.11a

Test Channel	5180MHz(Worst case)	Polarity:	Horizontal



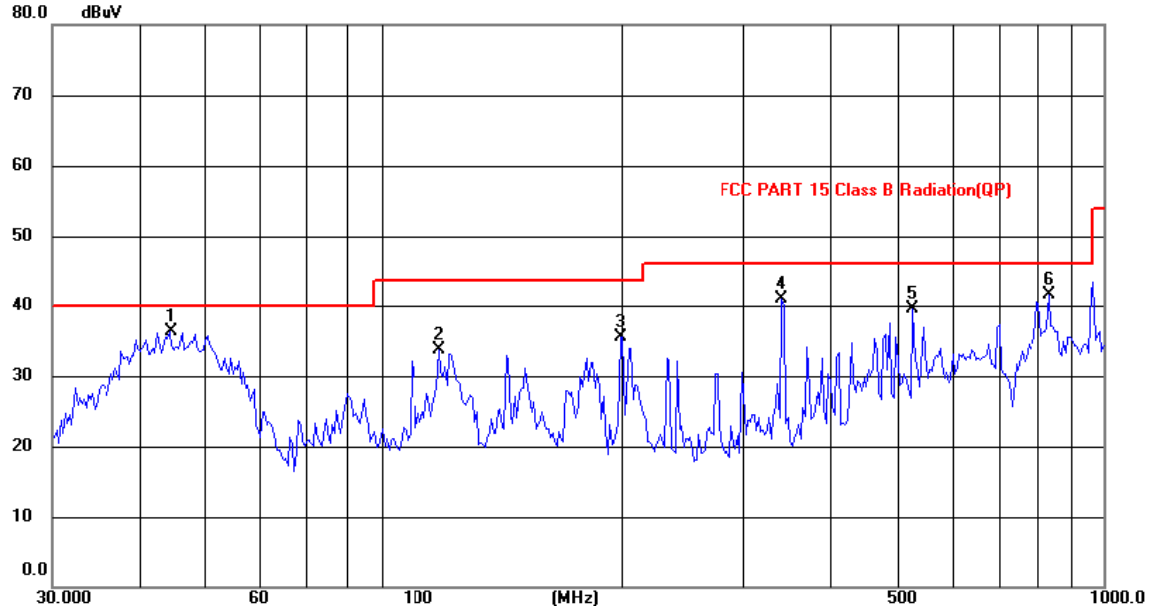
Site
Limit: FCC PART 15 Class B Radiation(QP)
EUT:
M/N: RL-EM02G-8821CE
Mode:
Note: a-5180M

Polarization: *Horizontal*
Power: AC230V/50Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		44.4308	43.93	-13.88	30.05	40.00	-9.95	peak	
2		72.0843	48.74	-18.15	30.59	40.00	-9.41	peak	
3		113.7143	48.95	-16.18	32.77	43.50	-10.73	peak	
4	*	181.9202	56.73	-16.75	39.98	43.50	-3.52	peak	
5		341.9787	51.35	-11.62	39.73	46.00	-6.27	peak	
6		528.2458	45.39	-8.13	37.26	46.00	-8.74	peak	

802.11a			
Test Channel	5180MHz(Worst case)	Polarity:	Vertical



Site
Limit: FCC PART 15 Class B Radiation(QP)
EUT:
M/N: RL-EM02G-8821CE
Mode:
Note: a-5180M

Polarization: *Vertical*
Power: AC230V/50Hz

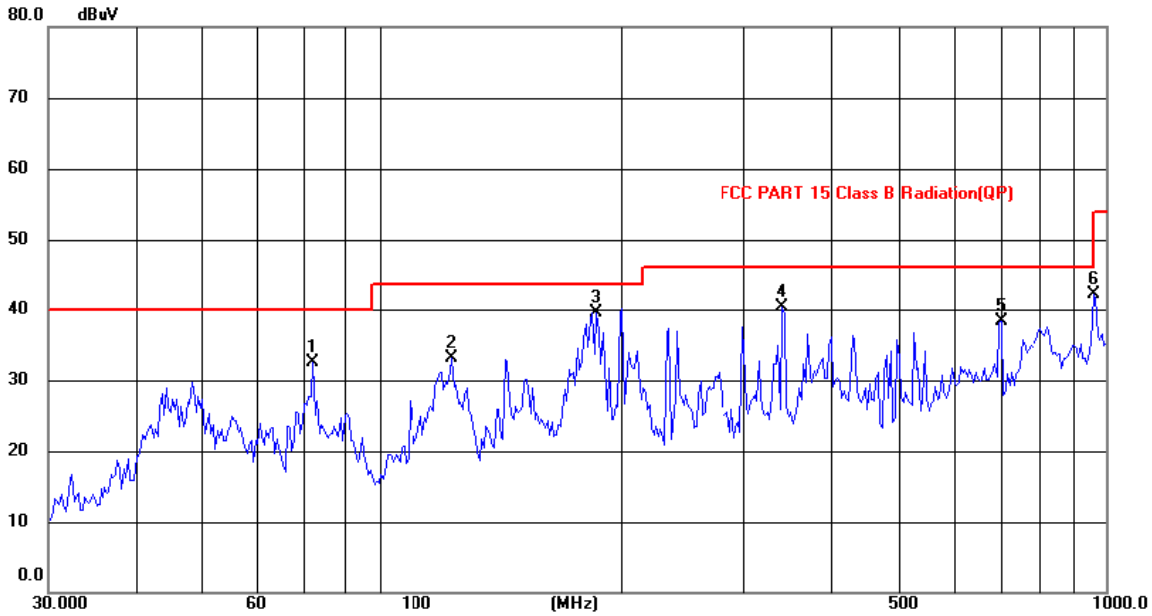
Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	44.4308	50.06	-13.78	36.28	40.00	-3.72	peak	
2		109.0286	49.87	-16.21	33.66	43.50	-9.84	peak	
3		199.2855	51.20	-15.67	35.53	43.50	-7.97	peak	
4		341.9787	52.90	-11.96	40.94	46.00	-5.06	peak	
5		528.2458	47.56	-7.97	39.59	46.00	-6.41	peak	
6		833.3171	43.53	-2.07	41.46	46.00	-4.54	peak	

➢ 5725-5850MHz

802.11a

Test Channel	5745MHz(worst case)	Polarity:	Horizontal



Site
Limit: FCC PART 15 Class B Radiation(QP)
EUT:
M/N: RL-EM02G-8821CE
Mode:
Note: a-5745M

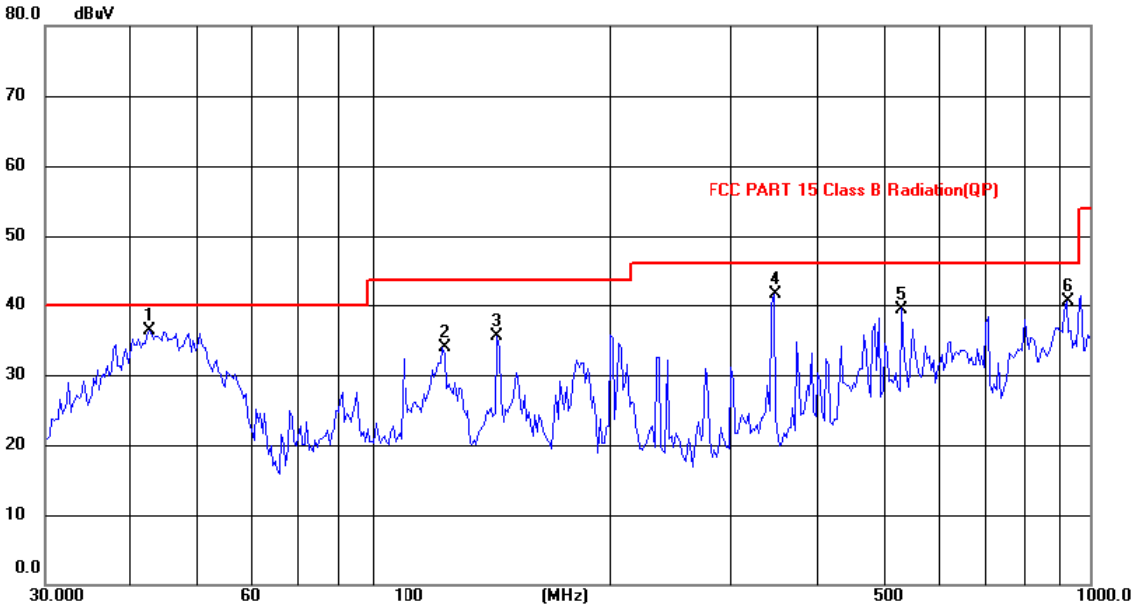
Polarization: *Horizontal*
Power: AC230V/50Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		72.0843	50.59	-18.15	32.44	40.00	-7.56	peak	
2		114.5146	49.45	-16.33	33.12	43.50	-10.38	peak	
3		184.4898	55.96	-16.50	39.46	43.50	-4.04	peak	
4		341.9786	51.94	-11.62	40.32	46.00	-5.68	peak	
5		704.2261	42.66	-4.31	38.35	46.00	-7.65	peak	
6	*	958.7943	44.44	-2.28	42.16	46.00	-3.84	peak	

802.11a

Test Channel	5745MHz(worst case)	Polarity:	Vertical



Site
Limit: FCC PART 15 Class B Radiation(QP)
EUT:
M/N: RL-EM02G-8821CE
Mode:
Note: a-5745M

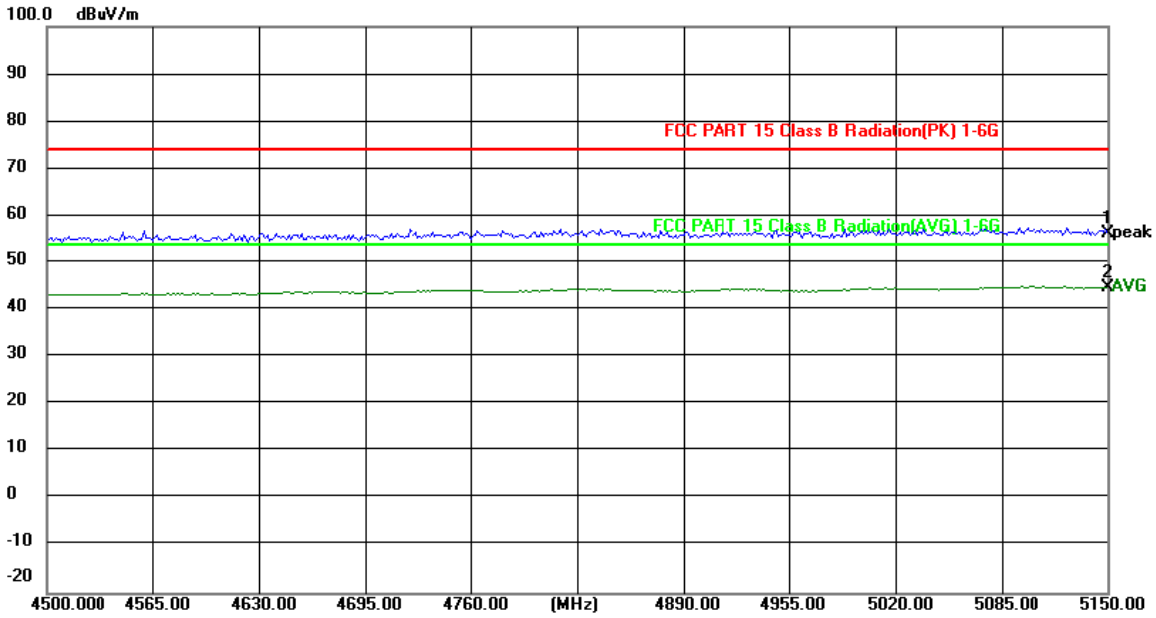
Polarization: *Vertical*
Power: AC230V/50Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	42.6299	50.30	-14.06	36.24	40.00	-3.76	peak	
2		114.0184	50.82	-16.83	33.99	43.50	-9.51	peak	
3		136.8747	53.70	-18.25	35.45	43.50	-8.05	peak	
4		346.0740	53.36	-11.89	41.47	46.00	-4.53	peak	
5		531.2910	47.31	-7.91	39.40	46.00	-6.60	peak	
6		925.6132	41.17	-0.60	40.57	46.00	-5.43	peak	

➢ Spurious Emission above 1GHz

802.11a- Restricted Bandedge			
Test Channel	band 5.15-5.25GHz	Polarity:	Vertical(worst case)



Site
Limit: FCC PART 15 Class B Radiation(PK) 1-6G
EUT:
M/N: RL-EM02G-8821CE
Mode:
Note: a-5180M

Polarization: *Vertical*
Power: DC 3.3V

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		5150.000	43.28	12.98	56.26	73.90	-17.64	peak	
2	*	5150.000	31.62	12.98	44.60	53.90	-9.30	AVG	

Note: The Restricted Bandedge was tested in Horizontal /Vertical and the worst case position data was reported.

- For the frequency band 5.15-5.25GHz, 5.725-5.850GHz (802.11a)
- Harmonics And Spurious Emissions

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5180MHz)							
10360	57.80	7.11	64.91	74.00	-9.09	H	PK
15540	37.98	8.22	46.20	54.00	-7.80	H	AV
10360	60.34	7.11	67.45	74.00	-6.55	V	PK
15540	38.99	8.22	47.21	54.00	-6.79	V	AV
Middle Channel (5220MHz)							
10440	58.05	7.22	65.27	74.00	-8.73	H	PK
15660	34.74	8.67	43.41	54.00	-10.59	H	AV
10440	57.84	7.22	65.06	74.00	-8.94	V	PK
15660	37.38	8.67	46.05	54.00	-7.95	V	AV
High Channel (5240MHz)							
10480	56.50	7.69	64.19	74.00	-9.81	H	PK
15720	38.86	8.93	47.79	54.00	-6.21	H	AV
10480	60.48	7.69	68.17	74.00	-5.83	V	PK
15720	38.58	8.93	47.51	54.00	-6.49	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5745MHz)							
11490	56.12	9.45	65.57	74.00	-8.43	H	PK
17235	36.37	10.36	46.73	54.00	-7.27	H	AV
11490	56.04	9.45	65.49	74.00	-8.51	V	PK
17235	36.25	10.36	46.61	54.00	-7.39	V	AV
Middle Channel (5785MHz)							
11570	56.75	9.62	66.37	74.00	-7.63	H	PK
17355	36.74	10.67	47.41	54.00	-6.59	H	AV
11570	56.46	9.62	66.08	74.00	-7.92	V	PK
17355	35.48	10.67	46.15	54.00	-7.85	V	AV
High Channel (5825MHz)							
11650	57.01	9.84	66.85	74.00	-7.15	H	PK
17475	34.01	10.95	44.96	54.00	-9.04	H	AV
11650	56.33	9.84	66.17	74.00	-7.83	V	PK
17475	36.55	10.95	47.50	54.00	-6.50	V	AV

➢ Out of Band edge for 5150-5250MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-45.61	-27
Highest	Above 5350	-54.32	-27
Note: the data just list the worst cases			

➢ Out of Band edge for 5725-5850MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5715	-46.36	-27
	5715 to 5725	-39.32	-17
Highest	5850 to 5860	-42.36	-17
	Above 5860	-41.36	-27
Note: the data just list the worst cases			

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

10. Frequency Stability

10.1 Standard Applicable

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

10.2 Test Procedure

According to §2.1055, the following test procedure was performed.
The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.
The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode.

10.3 Summary of Test Results/Plots

U-NII-1:5150-5250MHz worst case at 802.11a middle channel				
Voltage(%)	Power(VDC)	TEMP(℃)	Freq.Dev(Hz)	Deviation
100%	3.3	-30	126	0.0242
100%		-20	97	0.0187
100%		-10	174	0.0335
100%		0	97	0.0187
100%		+10	103	0.0198
100%		+20	184	0.0354
100%		+30	141	0.0271
100%		+40	120	0.0231
100%		+50	165	0.0317
Low power	3.0	+20	125	0.0240
High power	3.6	+20	147	0.0283

U-NII-1:5725-5850MHz worst case at 802.11a middle channel				
Voltage(%)	Power(VDC)	TEMP(℃)	Freq.Dev(Hz)	Deviation
100%	3.3	-30	102	0.0176
100%		-20	121	0.0209
100%		-10	141	0.0244
100%		0	124	0.0214
100%		+10	102	0.0176
100%		+20	114	0.0197
100%		+30	127	0.0220
100%		+40	101	0.0175
100%		+50	135	0.0233
Low power	3.0	+20	172	0.0297
High power	3.6	+20	141	0.0244

******* END OF REPORT *******