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TEST REPORT

ETSI EN 301 893 V2.1.1 (2017-05)

Report Reference No. ..... :	**CTL1906244051-WR04**	
Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	
Tested by: (position+printed name+signature)	Nice Nong (Test Engineer)	
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	

Product Name..... :	Beaglebone AI
Model/Type reference ..... :	Beaglebone AI
List Model(s)..... :	N/A
Trade Mark..... :	N/A
Applicant's name ..... :	**BeagleBoard.org Foundation**
Address of applicant ..... :	4467 Ascot Court Oakland Township, Michigan, US 48306
Test Firm..... :	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm..... :	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification..... :	
Standard..... :	**ETSI EN 301 893 V2.1.1 (2017-05)**
TRF Originator ..... :	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF ..... :	Dated 2011-01
Date of receipt of test item..... :	Jun. 26, 2019
Date of sampling..... :	Jun. 26, 2019
Date of Test Date..... :	Jun. 26, 2019–Jul. 08, 2019
Data of Issue..... :	Jul. 09, 2019
Result..... :	Pass

TEST REPORT

Test Report No. :	CTL1906244051-WR04	Jul. 09, 2019
		Date of issue

Equipment under Test	:	Beaglebone AI
Model /Type	:	Beaglebone AI
Listed Models	:	N/A
Applicant	:	**BeagleBoard.org Foundation**
Address	:	4467 Ascot Court Oakland Township, Michigan, US 48306
Manufacturer	:	**BeagleBoard.org Foundation**
Address	:	4467 Ascot Court Oakland Township, Michigan, US 48306

Test result	Pass *

* In the configuration tested, the EUT complied with the standards specified page 5.

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

** Modified History **

Revision	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2019-07-09	CTL1906244051-WR04	Tracy Qi

Contents

1 TEST SUMMARY

1.1 Test Standards

The tests were performed according to following standards:

ETSI EN 301 893 V2.1.1 (2017-05) – 5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

1.2 Test Description

Technical requirements specifications for transmitter		
Test Item	**ETSI EN 301 893 Sub-Clause**	**Result**
Carrier frequencies	Clause 4.2.1	Pass
Nominal Channel Bandwidth and Occupied Channel Bandwidth	Clause 4.2.2	Pass
RF output power, Transmit Power Control (TPC) and power density	Clause 4.2.3	Pass
Transmitter unwanted emissions	Clause 4.2.4.1 Clause 4.2.4.2	Pass
Receiver spurious emissions	Clause 4.2.5	Pass
Dynamic Frequency Selection (DFS)	Clause 4.2.6	Pass
Adaptivity (Channel Access Mechanism)	Clause 4.2.7	Pass
Receiver Blocking	Clause 4.2.8	Pass
User Access Restrictions	Clause 4.2.9	Pass
Geo-location capability	Clause 4.10	N/A

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1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 399832

Shenzhen CTL Testing 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 maintained in our files. Registration 399832, December 08, 2017.

1.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Occupied Channel Bandwidth	±2%	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Temperature	±1℃	(1)
Humidity	±3%	(1)
DC and low frequency voltages	±1.5%	(1)
Time	±2%	(1)
Duty cycle	±2%	(1)

Note 1: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

2 GENERAL INFORMATION

2.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature	NT: Normal Temperature	25°C
	HT: High Temperature	+55°C
	LT: Low Temperature	-20°C
Voltage	NV: Normal Voltage	5.00V
	HV: High Voltage	5.75V
	LV: Low Voltage	4.25V
Other	Relative Humidity	55 %
	Air Pressure	101 kPa

2.2 General Description of EUT

Product Name:	Beaglebone AI			
Model:	Beaglebone AI			
Power supply:	DC 5.0V			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n 802.11ac	802.11n 802.11ac	802.11ac	N/A
Operation frequency:	5180MHz-5240MHz 5260MHz-5320MHz 5500MHz-5700MHz	5190MHz-5230MHz 5270MHz-5310MHz 5510MHz-5670MHz	5210MHz; 5290MHz; 5530MHz; 5610MHz	N/A
Modulation:	OFDM	OFDM	OFDM	N/A
Channel number:	19	9	4	N/A
Channel separation:	20MHz	40MHz	80MHz	N/A
Antenna type:	Snap antenna			
Antenna gain:	1.5dBi			

Note: For more detailed features description, please refer to the manufacturer’s specifications or the User's Manual

2.3 Description of Test Modes and Test Frequency

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

Mode	Description
802.11a	IEEE 802.11a with data rate of 6Mbps working in SISO mode
802.11n20SISO	IEEE 802.11n20 with data rate MSC0 and 20MHz bandwidth working in SISO mode
802.11n40SISO	IEEE 802.11n40 with data rate MSC0 and 40MHz bandwidth working in SISO mode
802.11ac20 SISO	IEEE 802.11ac20 with data rate MSC0 and 20MHz bandwidth working in SISO mode
802.11ac40 SISO	IEEE 802.11ac40 with data rate MSC0 and 40MHz bandwidth working in SISO mode
802.11ac80 SISO	IEEE 802.11ac80 with data rate MSC0 and 80MHz bandwidth working in SISO mode

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz		80MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
W52 (5150MHz-5250MHz)	36	5180	38	5190	42	5210
	40	5200				
	44	5220	46	5230		
	48	5240				
W53 (5250MHz-5350MHz)	52	5260	54	5270	58	5290
	56	5280				
	60	5300	62	5310		
	64	5320				
W56 (5470MHz-5725MHz)	100	5500	102	5510	106	5530
	104	5520				
	108	5540	110	5550		
	112	5560				
	116	5580	118	5590	122	5610
	120	5600				
	124	5620	126	5630		
	128	5640				
	132	5660	134	5670	--	--
	136	5680			--	--
	140	5700	--	--	--	--

Note: “--“Means no channel(s) available any more.

Test Frequency:

Channel selected for test followed the table defined bellow; refer to ETSI EN 301 893 V2.1.1 clause 5.3.2

Test	Clause	Test channels		
		Lower sub-band (5 150 MHz to 5 350 MHz)		Higher sub-band 5 470 MHz to 5 725 MHz
		5 150 MHz to 5 250 MHz	5 250 MHz to 5 350 MHz	
Centre frequencies	5.4.2	C7 (see note 1)		C8 (see note 1)
Occupied Channel Bandwidth	5.4.3	C7		C8
Power, Power Density	5.4.4	C1	C2	C3, C4
Transmitter unwanted emissions outside the 5 GHz RLAN bands	5.4.5	C7 (see note 1)		C8 (see note 1)
Transmitter unwanted emissions within the 5 GHz RLAN bands	5.4.6	C1	C2	C3, C4
Receiver spurious emissions	5.4.7	C7 (see note 1)		C8 (see note 1)
Transmit Power Control (TPC)	5.4.4	n.a. (see note 2)	C2 (see note 1)	C3, C4 (see note 1)
Dynamic Frequency Selection (DFS)	5.4.8	n.a. (see note 2)	C5	C6 (see note 3)
Adaptivity	5.4.9	C9		
Receiver Blocking	5.4.10	C7		C8

C1, C3: The lowest declared channel for every declared *Nominal Channel Bandwidth* within this band. For the Power Density testing, it is sufficient to only perform this test using the lowest *Nominal Channel Bandwidth*.

C2, C4: The highest declared channel for every declared *Nominal Channel Bandwidth* within this band. For the Power Density testing, it is sufficient to only perform this test using the lowest *Nominal Channel Bandwidth*.

C5, C6: One channel out of the declared channels for this frequency range. If more than one *Nominal Channel Bandwidth* has been declared for this sub-band, testing shall be performed using the lowest and highest *Nominal Channel Bandwidth*.

C7, C8: One channel out of the declared channels for this sub-band. For *Occupied Channel Bandwidth*, testing shall be repeated for every declared *Nominal Channel Bandwidth* within this sub-band.

C9: One channel (in case of single-channel testing) or a group of channels (in case of multi-channel testing) out of the declared channels.

NOTE 1: In case of more than one channel plan has been declared, testing of these specific requirements need only be performed using one of the declared channel plans.

NOTE 2: Testing is not required for *Nominal Channel Bandwidths* that fall completely within the frequency range 5 150 MHz to 5 250 MHz.

NOTE 3: Where the declared channel plan includes channels whose *Nominal Channel Bandwidth* falls completely or partly within the 5 600 MHz to 5 650 MHz band, the tests for the *Channel Availability Check* (and where implemented, for the *Off-Channel CAC)* shall be performed on one of these channels in addition to a channel within the band 5 470 MHz to 5 600 MHz or within the band 5 650 MHz to 5 725 MHz.

2.4 Equipments Used during the Test

Centre frequencies & RF output power & Power density & OCB & TPC & DFS						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Spectrum Analyzer	Agilent	N9020	US46220290	2019/05/24	2020/05/23
2	Signal Generator	Agilent	N5182A	MY47420864	2019/05/24	2020/05/23
3	Signal Generator	Agilent	E4421B	US40051744	2019/05/24	2020/05/23
4	Power Sensor	Agilent	U2021XA	MY5365004	2019/05/24	2020/05/23
5	Power Meter	Agilent	U2531A	TW53323507	2019/05/24	2020/05/23
6	Climate Chamber	ESPEC	EL-10KA	A20120523	2019/05/24	2020/05/23

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	ULTRA-ROADBAND ANTENNA	Sunol Sciences Corp.	JB1	A061713	2019/05/24	2020/05/23
2	Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2019/05/24	2020/05/23
3	EMI Test Receiver	R&S	ESCI	103710	2019/05/24	2020/05/23
4	Controller	EM Electronics	Controller EM 1000	N/A	2019/05/24	2020/05/23
5	Amplifier	Agilent	8349B	3008A02306	2019/05/24	2020/05/23
6	Amplifier	Agilent	8447D	2944A10176	2019/05/24	2020/05/23
7	Temperature/Humidity Meter	Gangxing	CTH-608	02	2019/05/24	2020/05/23
8	High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2019/05/24	2020/05/23
9	High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2019/05/24	2020/05/23
10	RF Cable	HUBER+SUHNER	RG214	N/A	2019/05/24	2020/05/23

The calibration interval is 1 year.

3 TEST ITEM AND RESULTS

3.1 Centre frequencies

Limit

The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range fc ± 20 ppm.

Test Procedure

1. For equipment can operating without modulation
   a Connected The UUT to the spectrum and operated in an unmodulated mode.
   b Set the centre frequency of spectrum to the frequency which UUT operated.
   c Max Hold and waiting the trace stabilized.
   d Search the peak value of the power envelope and noted.
2. For equipment operating with modulation
   a Connected The UUT to the spectrum.
   b Set the centre frequency of spectrum to the frequency which UUT operated.
   c Max Hold and waiting the trace stabilized.
   d Search the peak value of the power envelope and noted.
   e Move the marker in a positive frequency increment until the upper, (relative to the centre frequency), -10 dBc point is reached, note this point as f1.
   f Move the marker in a negative frequency increment until the lower, (relative to the centre frequency), -10 dBc point is reached, note this point as f2.
   g The centre frequency is calculated as (f1 + f2) / 2.
3. These measurements shall be performed under both normal and extreme test conditions.
4. One channel out of the declared channels for each sub-band shall be tested.

Test Results

Test conditions		Test Channel / Frequency	Measured Result (MHz)	Frequency Deviation (ppm)	Limit	Test Result
Voltage (V)	Temperature (℃)					
5.00V	25	CH36/ 5180MHz	5179.955542	-8.57	20 ppm	PASS
5.75V	-20		5179.955635	-8.55		PASS
	+55		5179.955484	-8.58		PASS
5.00V	-20		5179.955698	-8.54		PASS
	+55		5179.954870	-8.70		PASS
5.00V	25	CH100/ 5500MHz	5499.955664	-8.05	20 ppm	PASS
5.75V	-20		5499.955578	-8.09		PASS
	+55		5499.955487	-8.08		PASS
5.00V	-20		5499.955621	-8.07		PASS
	+55		5499.955578	-8.08		PASS

3.2 Nominal Channel Bandwidth and Occupied Channel Bandwidth

Limit

The Nominal Channel Bandwidth for a single Operating Channel shall be 20 MHz.
Alternatively, equipment may implement a lower Nominal Channel Bandwidth with a minimum of 5 MHz, providing they still comply with the Nominal Centre Frequencies defined in clause 4.2.1 (20 MHz raster).
The Occupied Channel Bandwidth shall be between 80 % and 100 % of the Nominal Channel Bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.
The Occupied Channel Bandwidth might change with time/payload.
During a Channel Occupancy Time (COT), equipment may operate temporarily with an Occupied Channel Bandwidth of less than 80 % of its Nominal Channel Bandwidth with a minimum of 2 MHz.

Test Procedure

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

Centre Frequency:	The centre frequency of the channel under test
Resolution Bandwidth:	100 kHz
Video Bandwidth:	300 kHz
Frequency Span:	2 × Nominal Bandwidth (e.g. 40 MHz for a 20 MHz channel)
Sweep time:	> 1 s; for larger Nominal Bandwidths, the sweep time may be increased until a value where the sweep time has no impact on the RMS value of the signal
Detector Mode:	RMS
Trace Mode:	Max Hold

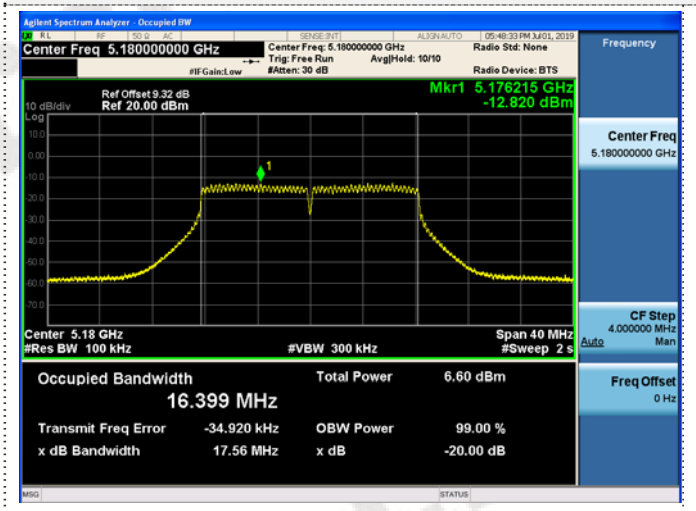
2. When the trace is complete, capture the trace.
3. Find the peak value of the trace and place the analyser marker on this peak.
4. Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.
5. Repeated steps 1 to 3 above in case of simultaneous transmissions in non-adjacent channels.
6. These measurements shall be performed only under normal operating conditions.
7. One channel out of the declared channels for each sub-band shall be tested.

Test Results

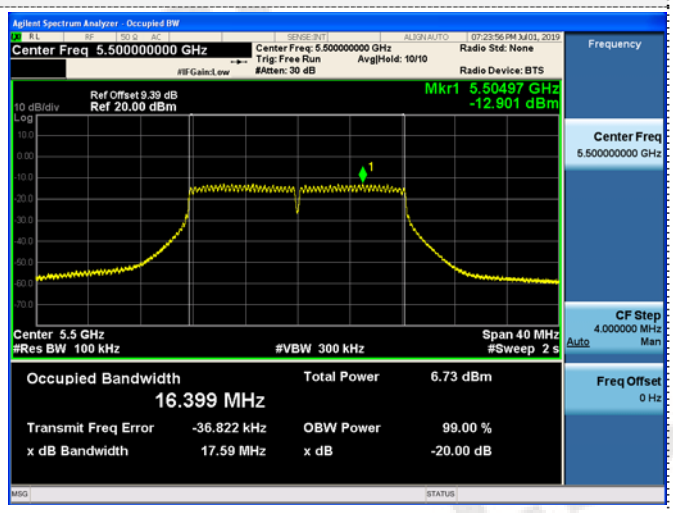
Mode	Channel	Frequency (MHz)	99% bandwidth (MHz)	Result
802.11a	CH36	5180	16.399	Pass
	CH100	5500	16.399	
802.11n20MHz	CH36	5180	17.567	
	CH100	5500	17.564	
802.11n40MHz	CH38	5190	36.104	
	C102	5510	36.073	
802.11ac20MHz	CH36	5180	17.566	
	CH100	5500	17.556	
802.11ac40MHz	CH38	5190	36.106	
	C102	5510	36.062	
802.11ac80MHz	CH42	5210	75.303	
	CH106	5530	75.422	

Test plot as follows:

802.11a

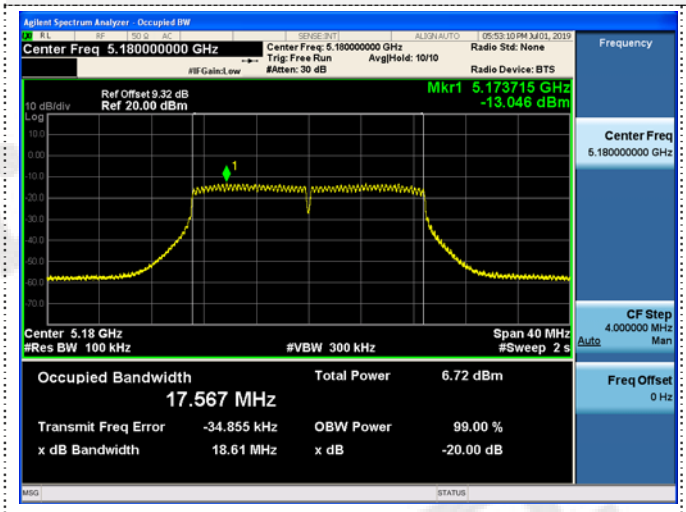


CH36

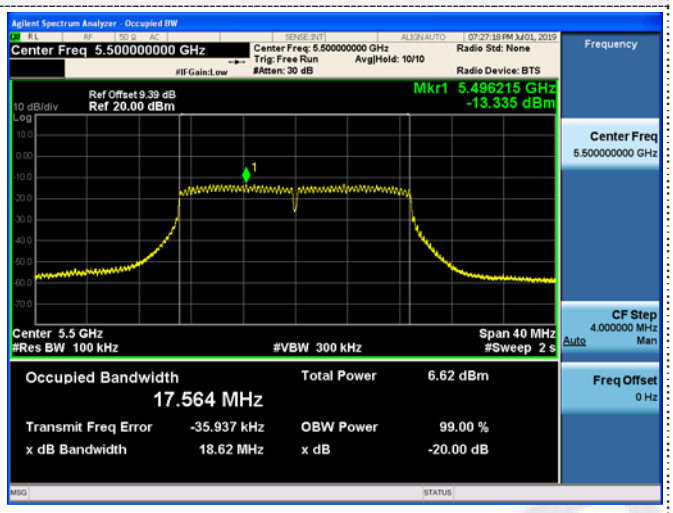


CH100

802.11n20MHz

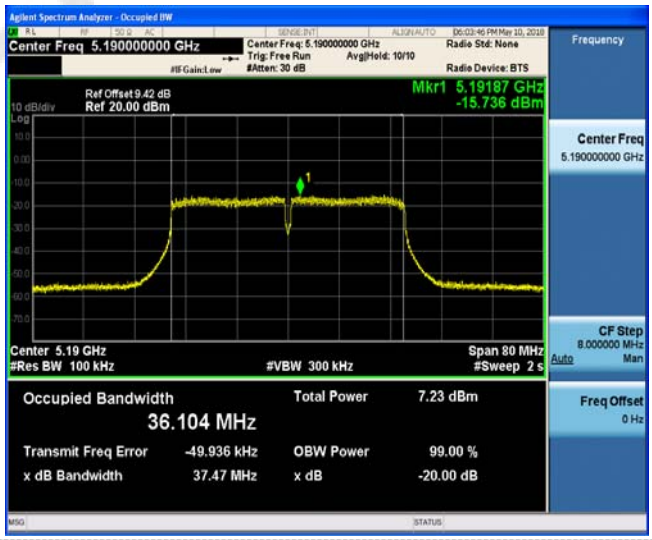


CH36

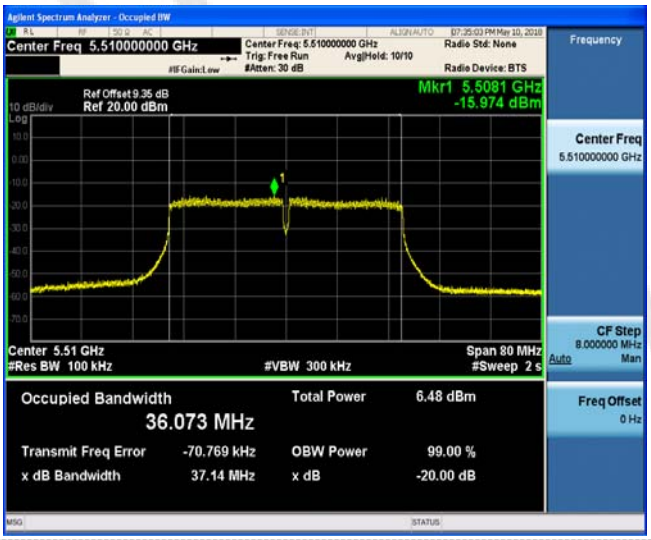


CH100

802.11n40MHz

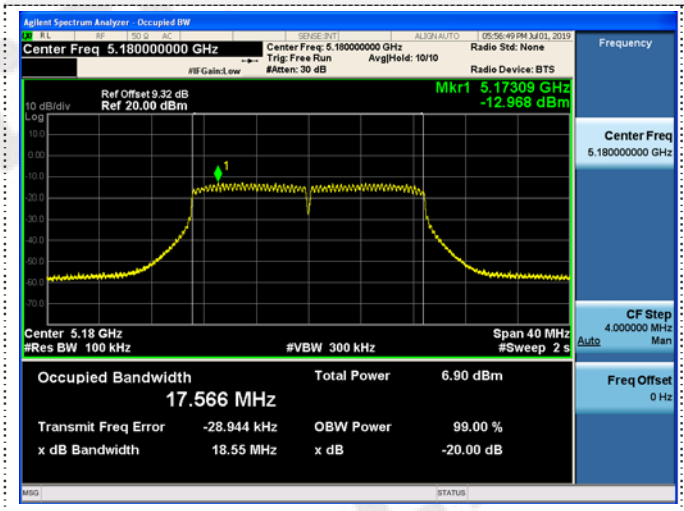


CH38

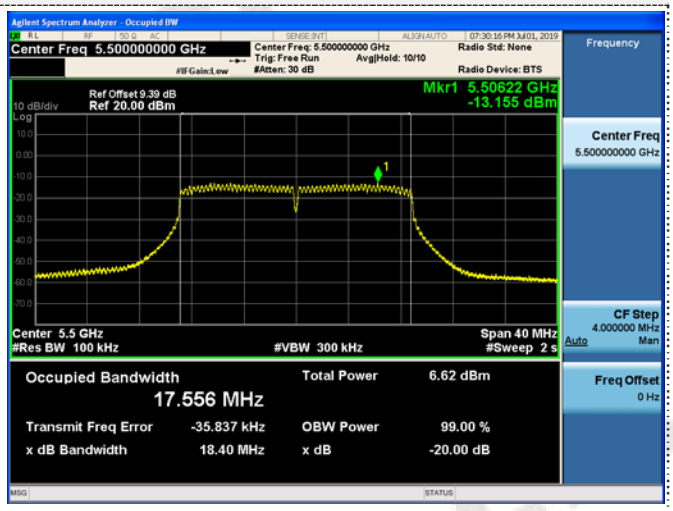


CH102

802.11ac20MHz

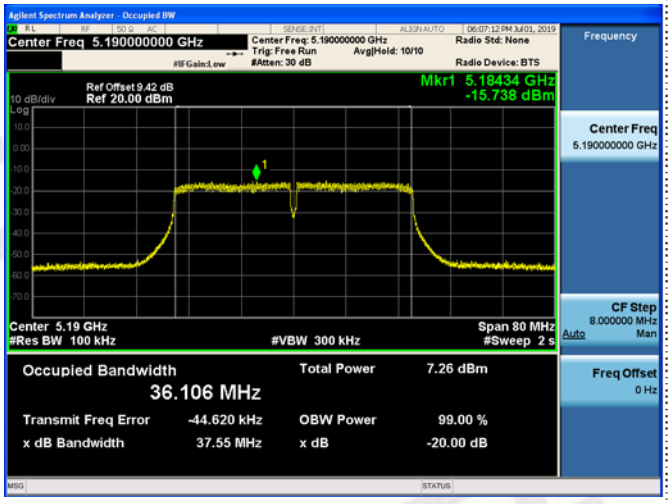


CH36

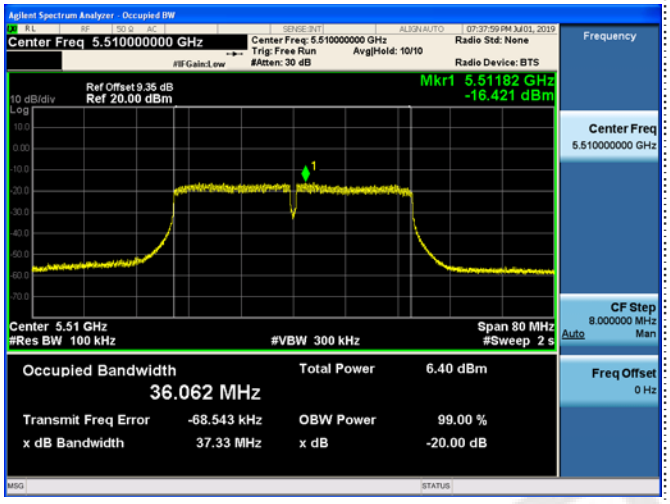


CH100

802.11ac40MHz

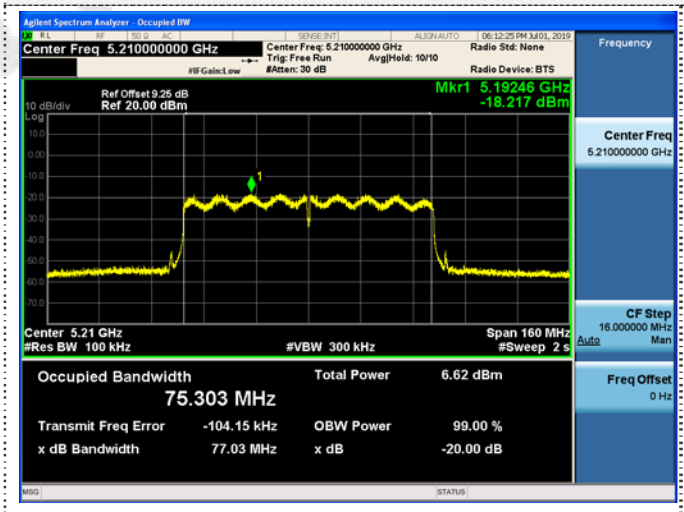


CH38

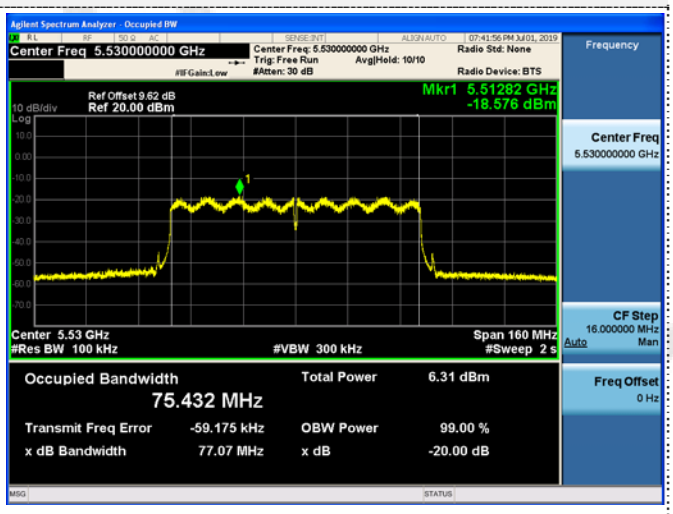


CH102

802.11ac80MHz



CH42



CH106

3.3 RF output power, Transmit Power Control (TPC) and power density

Limit

The limits below are applicable to the system as a whole and in any possible configuration. This means that the antenna gain of the integral or dedicated antenna has to be taken into account as well as the additional (beamforming) gain in case of smart antenna systems (devices with multiple transmit chains).

In case of multiple (adjacent or non-adjacent) channels within the same sub-band, the total RF Output Power of all channels in that sub-band shall not exceed the limits defined in table 2 and table 3.

In case of multiple, non-adjacent channels operating in separate sub-bands, the total RF Output Power in each of the sub-bands shall not exceed the limits defined in table 2 and table 3.

TPC is not required for channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz. For devices with TPC, the RF output power and the Power Density when configured to operate at the highest stated power level (P_H) of the TPC range shall not exceed the levels given in table 2.

Devices are allowed to operate without TPC. See table 2 for the applicable limits that shall apply in this case.

Table 2: Mean e.i.r.p. limits for RF output power and Power Density at the highest power level (P_H)

Frequency range (MHz)	Mean e.i.r.p. limit for P_H (dBm)		Mean e.i.r.p. density limit (dBm/MHz)	
	with TPC	without TPC	with TPC	without TPC
5 150 to 5 350	23	20/23 (see note 1)	10	7/10 (see note 2)
5 470 to 5 725	30 (see note 3)	27 (see note 3)	17 (see note 3)	14 (see note 3)
NOTE 1: The applicable limit is 20 dBm, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 23 dBm.				
NOTE 2: The applicable limit is 7 dBm/MHz, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 10 dBm/MHz.				
NOTE 3: Slave devices without a *Radar Interference Detection* function shall comply with the limits for the frequency range 5 250 MHz to 5 350 MHz.				

For devices using TPC, the RF Output Power during a transmission burst when configured to operate at the lowest stated power level (PL) of the TPC range shall not exceed the levels given in table 3. For devices without TPC, the limits in table 3 do not apply.

Table 3: Mean e.i.r.p. limits for RF Output Power at the lowest power level of the TPC range

Frequency range	Mean e.i.r.p. (dBm) limit for P_L
5 250 MHz to 5 350 MHz	17
5 470 MHz to 5 725 MHz	24 (see note)
NOTE: Slave devices without a *Radar Interference Detection* function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.	

3.3.1 RF output power at the highest power - PH

Test Procedure

1. The UUT shall be configured to operate at:
   - The highest stated transmitter output power level of the TPC range; or
   - The maximum transmitter output power level in case the equipment has no TPC feature.
2. For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment) reference clause 5.4.4.2.1.1.2 of ETSI EN 301 893 V2.1.1 (2017-05)
3. For equipment without continuous transmission capability and operating (or with the capability to operate) in only one sub-band reference clause 5.4.4.2.1.1.3 of ETSI EN 301 893 V2.1.1 (2017-05)
4. For equipment without continuous transmission capability and having simultaneous transmissions in both sub-bands reference clause 5.4.4.2.1.1.4 of ETSI EN 301 893 V2.1.1 (2017-05)
5. These measurements shall be performed under both normal and extreme test conditions.
6. The lowest declared channel for band 5 150 MHz to 5 250 MHz and 5 470 MHz to 5 725 MHz the highest declared channel for band 5 250 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz shall be tested.

Test Results

802.11a							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	36/5180	7.53	1.50	8.53	23	PASS
T_{min}(-20℃)	5.75		7.41	1.50	8.41		
	4.25		7.36	1.50	8.36		
T_{Max}(+55℃)	5.75		7.43	1.50	8.43		
	4.25		7.35	1.50	8.35		
T_{Nor}(25℃)	5.00	64/5320	7.52	1.50	8.52	20	PASS
T_{min}(-20℃)	5.75		7.26	1.50	8.26		
	4.25		7.38	1.50	8.38		
T_{Max}(+55℃)	5.75		7.41	1.50	8.41		
	4.25		7.57	1.50	8.57		
T_{Nor}(25℃)	5.00	100/5500	7.34	1.50	8.34	20	PASS
T_{min}(-20℃)	5.75		7.42	1.50	8.42		
	4.25		7.62	1.50	8.62		
T_{Max}(+55℃)	5.75		7.57	1.50	8.57		
	4.25		7.49	1.50	8.49		
T_{Nor}(25℃)	5.00	140/5700	7.24	1.50	8.24	20	PASS
T_{min}(-20℃)	5.75		7.36	1.50	8.36		
	4.25		7.46	1.50	8.46		
T_{Max}(+55℃)	5.75		7.52	1.50	8.52		
	4.25		7.41	1.50	8.41		

802.11n20MHz							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	36/5180	6.75	1.50	7.75	23	PASS
T_{min}(-20℃)	5.75		6.72	1.50	7.72		
	4.25		6.56	1.50	7.56		
T_{Max}(+55℃)	5.75		6.67	1.50	7.67		
	4.25		6.85	1.50	7.85		
T_{Nor}(25℃)	5.00	64/5320	6.74	1.50	7.74	20	PASS
T_{min}(-20℃)	5.75		6.85	1.50	7.85		
	4.25		6.61	1.50	7.61		
T_{Max}(+55℃)	5.75		6.74	1.50	7.74		
	4.25		6.85	1.50	7.85		
T_{Nor}(25℃)	5.00	100/5500	6.65	1.50	7.65	20	PASS
T_{min}(-20℃)	5.75		6.64	1.50	7.64		
	4.25		6.77	1.50	7.77		
T_{Max}(+55℃)	5.75		6.71	1.50	7.71		
	4.25		6.82	1.50	7.82		
T_{Nor}(25℃)	5.00	140/5700	6.90	1.50	7.90	20	PASS
T_{min}(-20℃)	5.75		6.74	1.50	7.74		
	4.25		6.75	1.50	7.75		
T_{Max}(+55℃)	5.75		6.83	1.50	7.83		
	4.25		6.67	1.50	7.67		

802.11n40MHz							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	38/5190	5.24	1.50	6.24	23	PASS
T_{min}(-20℃)	5.75		5.37	1.50	6.37		
	4.25		5.41	1.50	6.41		
T_{Max}(+55℃)	5.75		5.26	1.50	6.26		
	4.25		5.36	1.50	6.36		
T_{Nor}(25℃)	5.00	62/5310	5.38	1.50	6.38	20	PASS
T_{min}(-20℃)	5.75		5.40	1.50	6.40		
	4.25		5.39	1.50	6.39		
T_{Max}(+55℃)	5.75		5.28	1.50	6.28		
	4.25		5.34	1.50	6.34		
T_{Nor}(25℃)	5.00	102/5510	5.38	1.50	6.38	20	PASS
T_{min}(-20℃)	5.75		5.35	1.50	6.35		
	4.25		5.25	1.50	6.25		
T_{Max}(+55℃)	5.75		5.29	1.50	6.29		
	4.25		5.38	1.50	6.38		
T_{Nor}(25℃)	5.00	134/5670	5.34	1.50	6.34	20	PASS
T_{min}(-20℃)	5.75		5.22	1.50	6.22		
	4.25		5.29	1.50	6.29		
T_{Max}(+55℃)	5.75		5.27	1.50	6.27		
	4.25		5.34	1.50	6.34		

802.11ac20MHz							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	36/5180	7.85	1.50	8.85	23	PASS
T_{min}(-20℃)	5.75		7.69	1.50	8.69		
	4.25		7.48	1.50	8.48		
T_{Max}(+55℃)	5.75		7.58	1.50	8.58		
	4.25		7.66	1.50	8.66		
T_{Nor}(25℃)	5.00	64/5320	7.68	1.50	8.68	20	PASS
T_{min}(-20℃)	5.75		7.59	1.50	8.59		
	4.25		7.62	1.50	8.62		
T_{Max}(+55℃)	5.75		7.45	1.50	8.45		
	4.25		7.58	1.50	8.58		
T_{Nor}(25℃)	5.00	100/5500	7.16	1.50	8.16	20	PASS
T_{min}(-20℃)	5.75		7.56	1.50	8.56		
	4.25		7.63	1.50	8.63		
T_{Max}(+55℃)	5.75		7.28	1.50	8.28		
	4.25		7.69	1.50	8.69		
T_{Nor}(25℃)	5.00	140/5700	7.48	1.50	8.48	20	PASS
T_{min}(-20℃)	5.75		7.28	1.50	8.28		
	4.25		7.65	1.50	8.65		
T_{Max}(+55℃)	5.75		7.39	1.50	8.39		
	4.25		7.54	1.50	8.54		

802.11ac40MHz							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	38/5190	6.25	1.50	7.25	23	PASS
T_{min}(-20℃)	5.75		6.14	1.50	7.14		
	4.25		6.17	1.50	7.17		
T_{Max}(+55℃)	5.75		6.33	1.50	7.33		
	4.25		6.35	1.50	7.35		
T_{Nor}(25℃)	5.00	62/5310	6.29	1.50	7.29	20	PASS
T_{min}(-20℃)	5.75		6.27	1.50	7.27		
	4.25		6.25	1.50	7.25		
T_{Max}(+55℃)	5.75		6.33	1.50	7.33		
	4.25		6.21	1.50	7.21		
T_{Nor}(25℃)	5.00	102/5510	6.28	1.50	7.28	20	PASS
T_{min}(-20℃)	5.75		6.35	1.50	7.35		
	4.25		6.45	1.50	7.45		
T_{Max}(+55℃)	5.75		6.27	1.50	7.27		
	4.25		6.29	1.50	7.29		
T_{Nor}(25℃)	5.00	134/5670	6.31	1.50	7.31	20	PASS
T_{min}(-20℃)	5.75		6.30	1.50	7.30		
	4.25		6.22	1.50	7.22		
T_{Max}(+55℃)	5.75		6.27	1.50	7.27		
	4.25		6.42	1.50	7.42		

802.11ac80MHz							
Test conditions		**Channel/ Frequency**	**Measured power (dBm)**	**Antenna Gain (dBi)**	**e.i.r.p (dBm)**	**Limit (dBm)**	**Result**
Temperature (℃)	**Voltage (V)**						
T_{Nor}(25℃)	5.00	42/5210	5.15	1.50	6.15	23	PASS
T_{min}(-20℃)	5.75		5.25	1.50	6.25		
	4.25		5.13	1.50	6.13		
T_{Max}(+55℃)	5.75		5.20	1.50	6.20		
	4.25		5.19	1.50	6.19		
T_{Nor}(25℃)	5.00	58/5290	5.17	1.50	6.17	20	PASS
T_{min}(-20℃)	5.75		5.15	1.50	6.15		
	4.25		5.16	1.50	6.16		
T_{Max}(+55℃)	5.75		5.13	1.50	6.13		
	4.25		5.18	1.50	6.18		
T_{Nor}(25℃)	5.00	106/5530	5.17	1.50	6.17	20	PASS
T_{min}(-20℃)	5.75		5.22	1.50	6.22		
	4.25		5.16	1.50	6.16		
T_{Max}(+55℃)	5.75		5.19	1.50	6.19		
	4.25		5.21	1.50	6.21		
T_{Nor}(25℃)	5.00	122/5610	5.11	1.50	6.11	20	PASS
T_{min}(-20℃)	5.75		5.15	1.50	6.15		
	4.25		5.14	1.50	6.14		
T_{Max}(+55℃)	5.75		5.13	1.50	6.13		
	4.25		5.18	1.50	6.18		

3.3.2 RF output power at the lowest power level of the TPC range - PL

Test Procedure

1. The UUT shall be configured to operate at the lowest stated transmitter output power level of the TPC range.
2. For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment) reference clause 5.4.4.2.1.2.2 of ETSI EN 301 893 V2.1.1 (2017-05)
3. For equipment without continuous transmission capability and operating (or with the capability to operate) in only one sub-band reference clause 5.4.4.2.1.2.3 of ETSI EN 301 893 V2.1.1 (2017-05)
4. For equipment without continuous transmission capability and having simultaneous transmissions in both sub-bands reference clause 5.4.4.2.1.2.4 of ETSI EN 301 893 V2.1.1 (2017-05)
5. These measurements shall be performed under both normal and extreme test conditions.
6. The lowest declared channel for band 5 150 MHz to 5 250 MHz and 5 470 MHz to 5 725 MHz the highest declared channel for band 5 250 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz shall be tested.
7. This test is only required for equipment with a TPC feature.

Test Results

Not applicable to this device which TPC feature not available.

3.3.3 Power density

Test Procedure

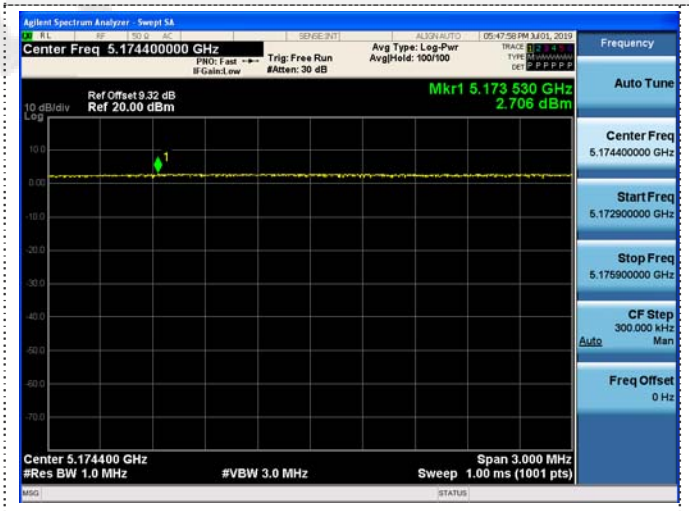
1. The UUT shall be configured to operate at:
   - The highest stated transmitter output power level of the TPC range; or
   - The maximum transmitter output power level in case the equipment has no TPC feature.
2. For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment) reference clause of 5.4.4.2.1.3.2 of ETSI EN 301 893 V2.1.1 (2017-05).
3. For equipment without continuous transmission capability and without the capability to transmit with a constant duty cycle reference clause 5.4.4.2.1.3.3 of ETSI EN 301 893 V2.1.1 (2017-05).
4. These measurements shall only be performed at normal test conditions.
5. The lowest declared channel for band 5 150 MHz to 5 250 MHz and 5 470 MHz to 5 725 MHz the highest declared channel for band 5 250 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz shall be tested.

Test Results

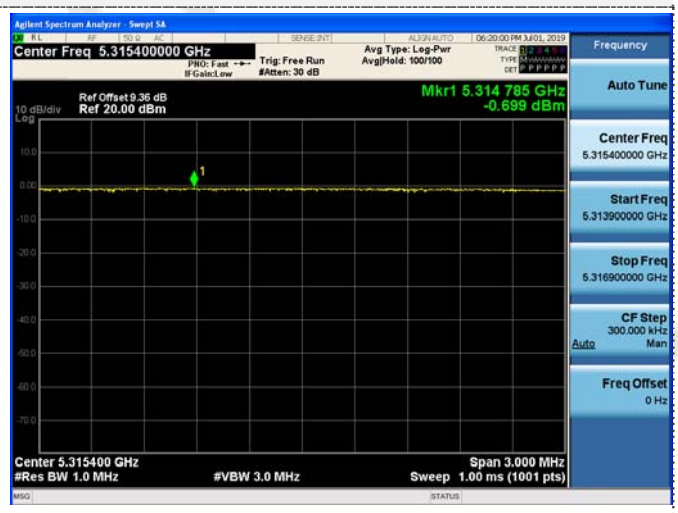
Mode	Channel/ Frequency (MHz)	Measured value (dBm/MHz)	Antenna Gain (dBi)	PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11a	CH36/5180	2.706	1.50	3.806	10	Pass
	CH64/5320	-0.699	1.50	0.301	7	
	CH100/5500	2.962	1.50	3.962	7	
	CH140/5700	2.205	1.50	3.205	7	
802.11n20MHz	CH36/5180	2.845	1.50	3.845	10	Pass
	CH64/5320	-0.641	1.50	0.359	7	
	CH100/5500	2.779	1.50	3.779	7	
	CH140/5700	2.081	1.50	3.081	7	
802.11n40MHz	CH38/5190	0.255	1.50	1.255	10	Pass
	CH62/5310	-2.917	1.50	-1.917	7	
	CH102/5510	-0.450	1.50	0.55	7	
	CH134/5670	-0.617	1.50	0.383	7	
802.11ac20MHz	CH36/5180	4.287	1.50	5.287	10	Pass
	CH64/5320	-0.573	1.50	0.427	7	
	CH100/5500	2.810	1.50	3.81	7	
	CH140/5700	2.161	1.50	3.161	7	
802.11ac40MHz	CH38/5190	0.138	1.50	1.138	10	Pass
	CH62/5310	-3.354	1.50	-2.354	7	
	CH102/5510	-0.518	1.50	0.482	7	
	CH134/5670	-0.859	1.50	0.141	7	
802.11ac80MHz	CH42/5210	-1.006	1.50	-0.006	10	Pass
	CH58/5290	-5.246	1.50	-4.246	7	
	CH106/5530	-2.294	1.50	-1.294	7	
	CH122/5610	-3.302	1.50	-2.302	7	

The test plots as follow:

802.11a

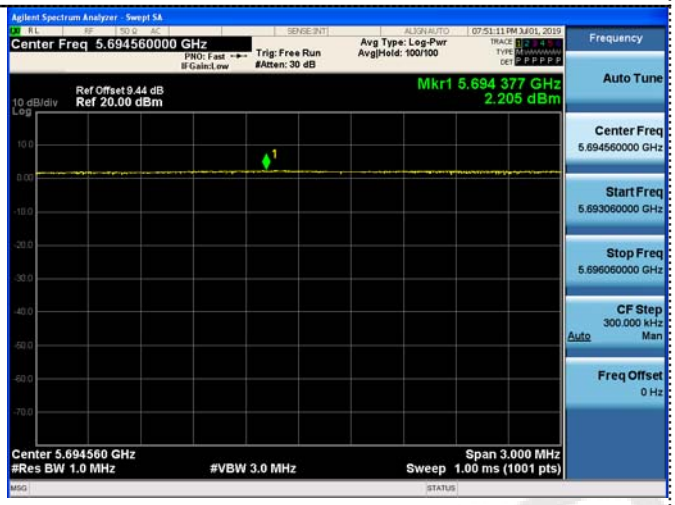


CH36



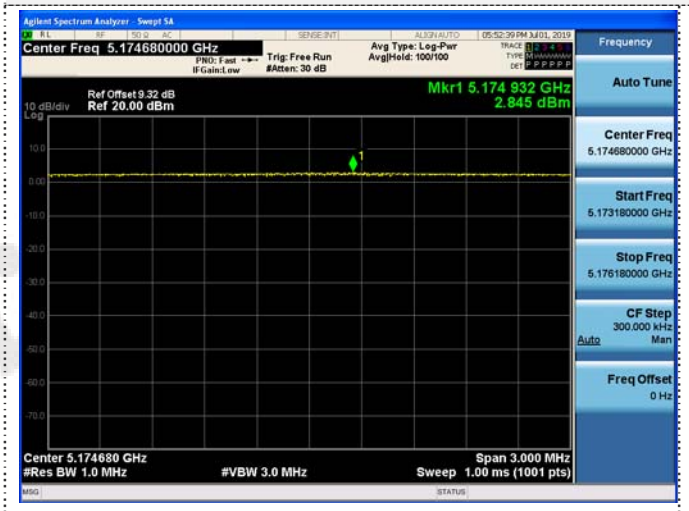
CH64

CH100

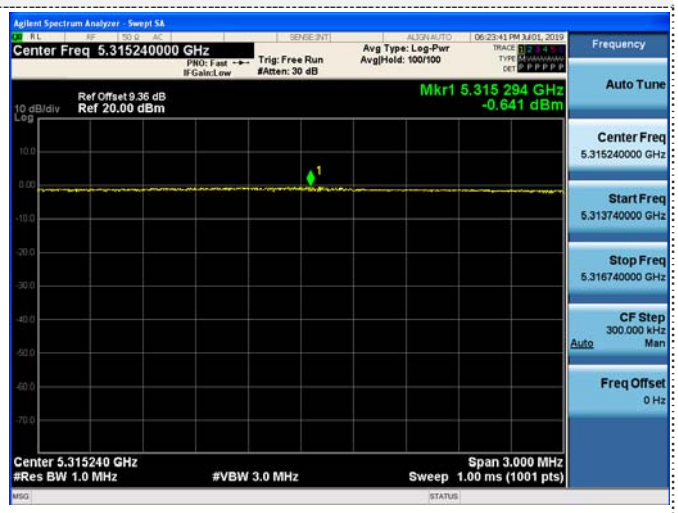


CH140

802.11n20MHz

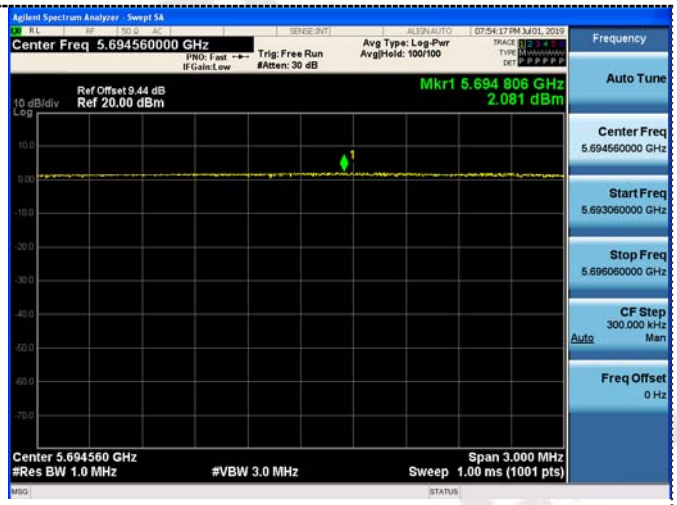


CH36



CH64

CH100



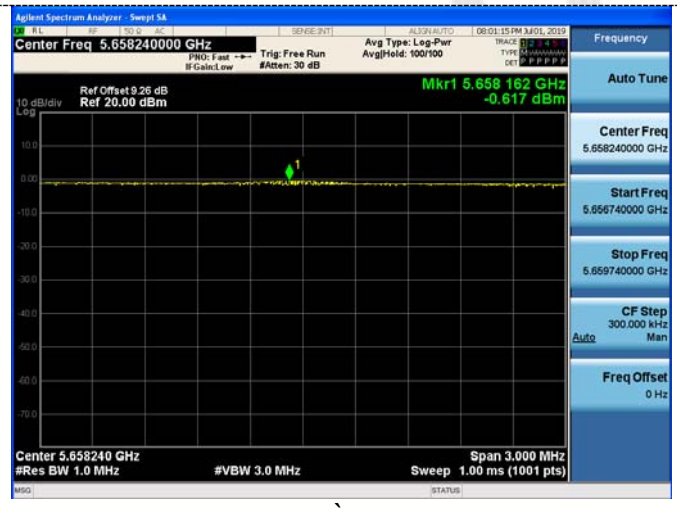
CH140

802.11n40MHz

CH38

CH62

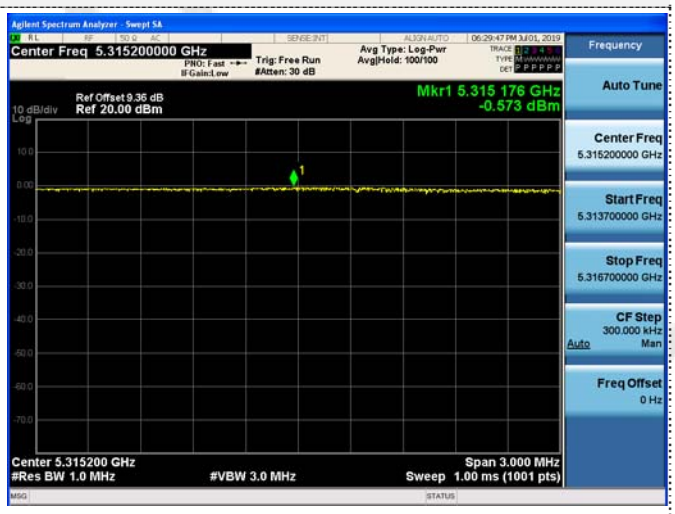
CH102



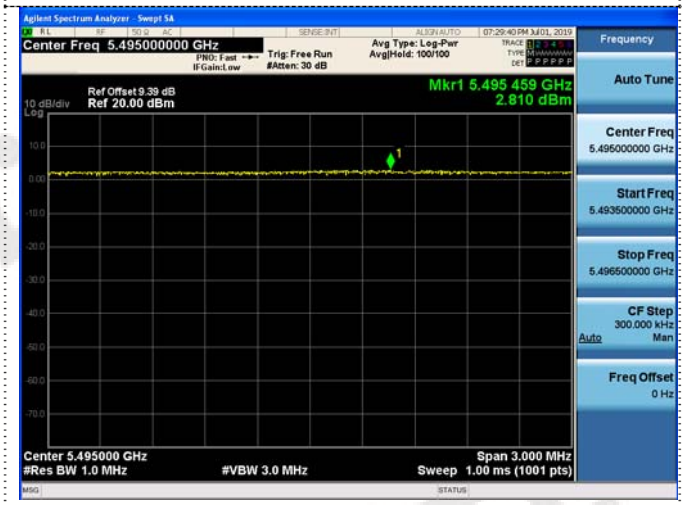
CH134

802.11ac20MHz

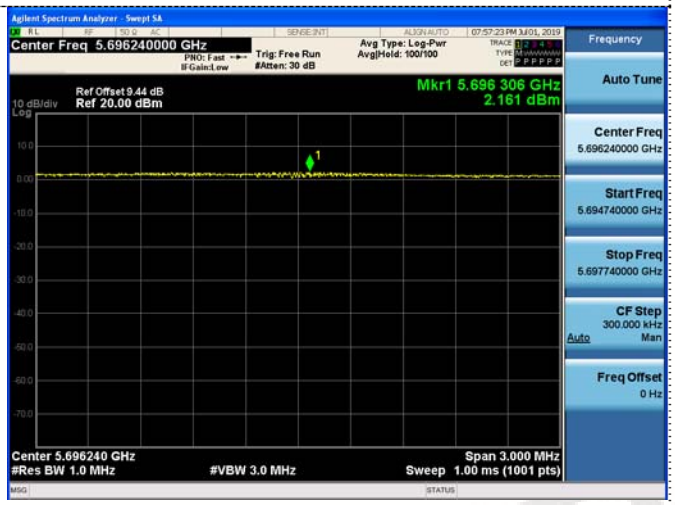
CH36



CH64



CH100



CH140

802.11ac40MHz

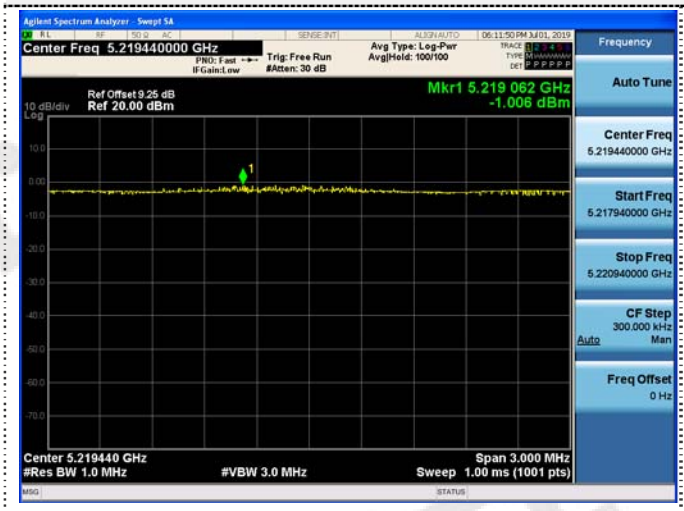
CH38

CH62

CH102

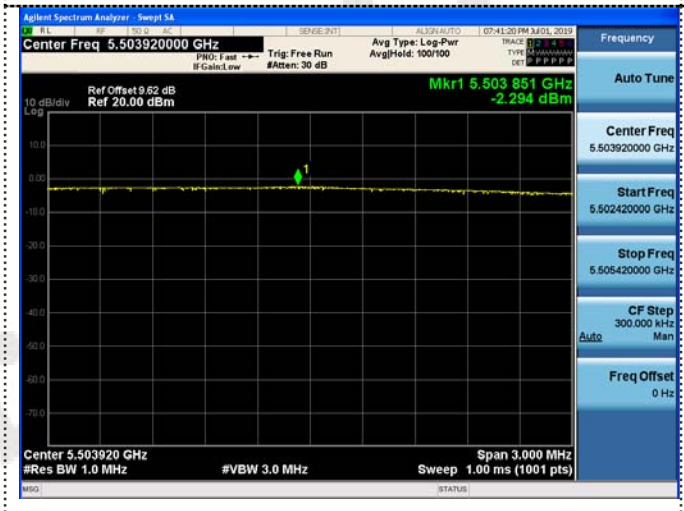
CH134

802.11ac80MHz



CH42

CH58



CH106

CH122

3.4 Transmitter unwanted emissions

3.4.1 Transmitter unwanted emissions outside the 5 GHz RLAN bands

Limit

The level of unwanted emission shall not exceed the limits given in table below:

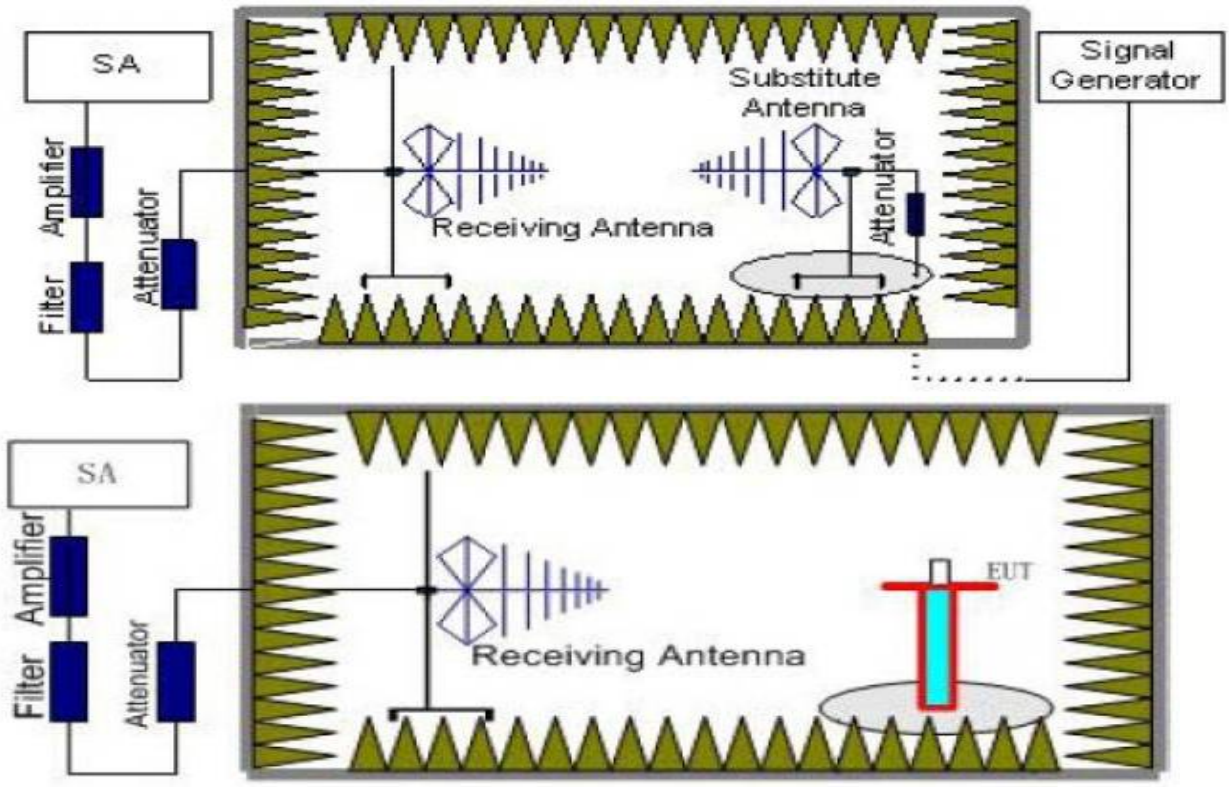
Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 5,15 GHz	-30 dBm	1 MHz
5,35 GHz to 5,47 GHz	-30 dBm	1 MHz
5,725 GHz to 26 GHz	-30 dBm	1 MHz

Test Procedure

1. The measurement procedure follows ETSI EN 301 893 V2.1.1 (2017-05) Sub-clause 5.4.5
2. The measurement shall only be performed at normal test conditions.
3. One channel out of the declared channels for each sub-band shall be tested.

Test Configuration

Effective Radiated Power measurement (30 MHz to 26 GHz)

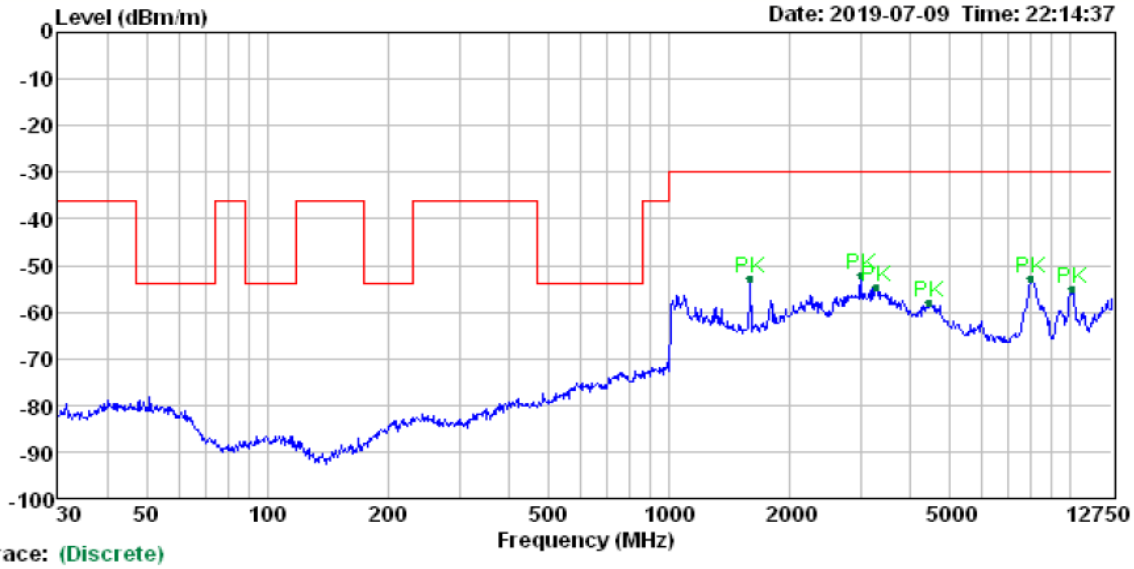


Test Result

Remark: We test all modulation type, and recorded the worst case at 802.11ac20MHz mode.

802.11ac20MHz

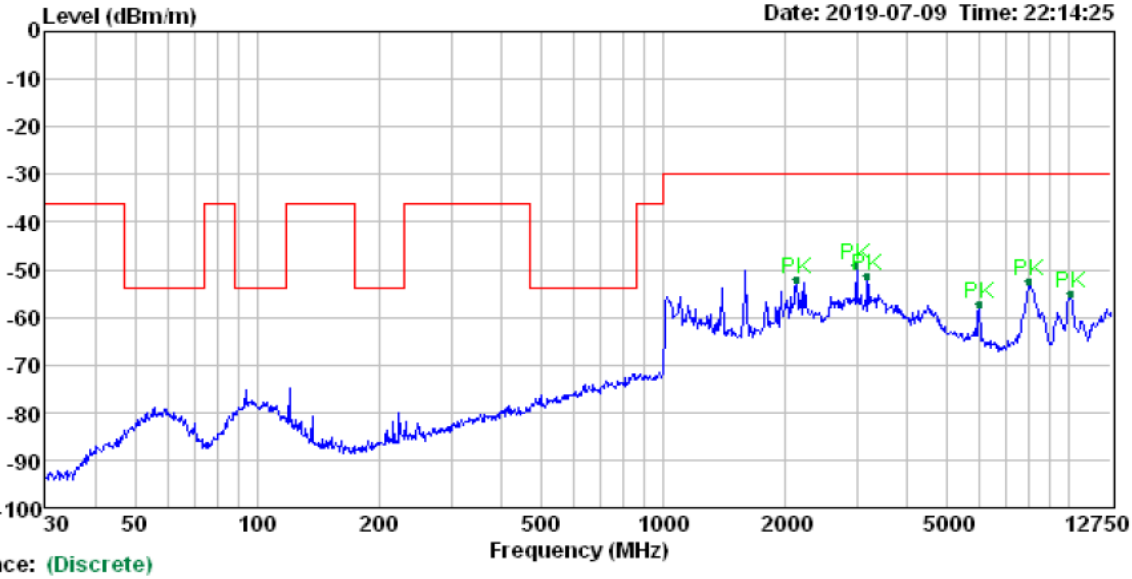
Channel:	*CH36*	*Polarity:*	*Horizontal*



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1599.02	-44.96	-7.90	-52.86	-30.00	22.86	Peak	HORIZONTAL
2	3002.28	-52.58	0.58	-52.00	-30.00	22.00	Peak	HORIZONTAL
3	3274.26	-55.46	0.72	-54.74	-30.00	24.74	Peak	HORIZONTAL
4	4469.42	-58.16	0.41	-57.75	-30.00	27.75	Peak	HORIZONTAL
5	8015.14	-60.93	8.30	-52.63	-30.00	22.63	Peak	HORIZONTAL
6	10083.31	-63.75	8.76	-54.99	-30.00	24.99	Peak	HORIZONTAL

Channel:	*CH36*	*Polarity:*	*Vertical*



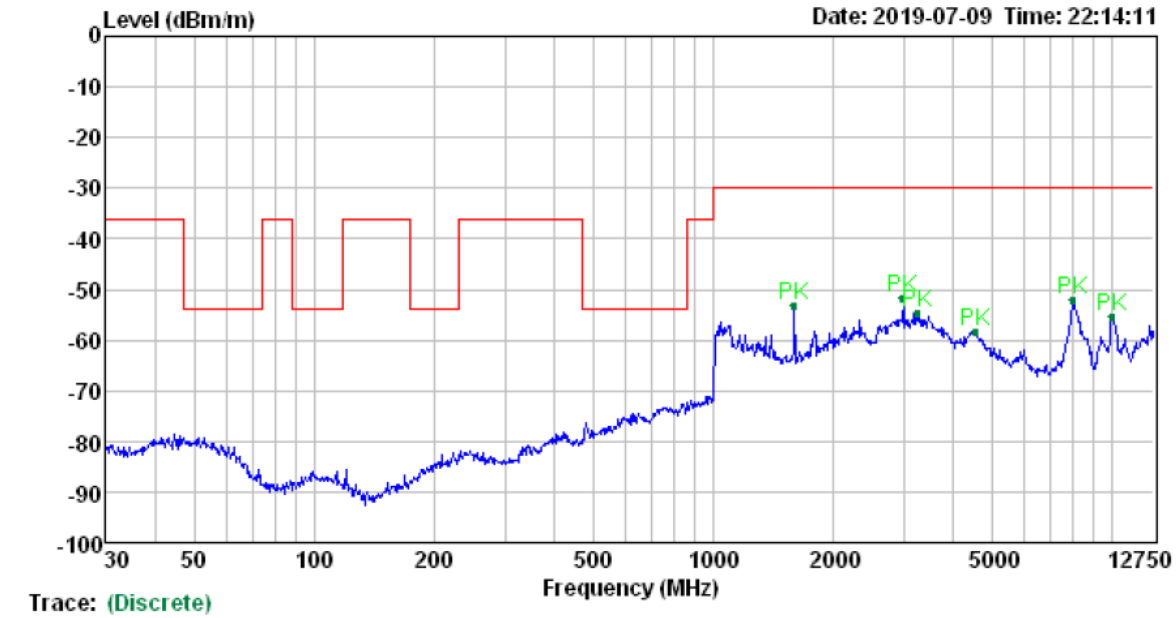
Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	2127.72	-48.40	-3.52	-51.92	-30.00	21.92	Peak	VERTICAL
2	2994.64	-49.79	0.56	-49.23	-30.00	19.23	Peak	VERTICAL
3	3191.80	-52.17	0.73	-51.44	-30.00	21.44	Peak	VERTICAL
4	5992.87	-52.95	-4.10	-57.05	-30.00	27.05	Peak	VERTICAL
5	8015.14	-60.78	8.30	-52.48	-30.00	22.48	Peak	VERTICAL
6	10134.87	-62.85	7.95	-54.90	-30.00	24.90	Peak	VERTICAL

Note: 13GHz-26GHz not recorded for no spurious point have a margin of less than 6 dB with respect to the limits.

802.11ac20MHz

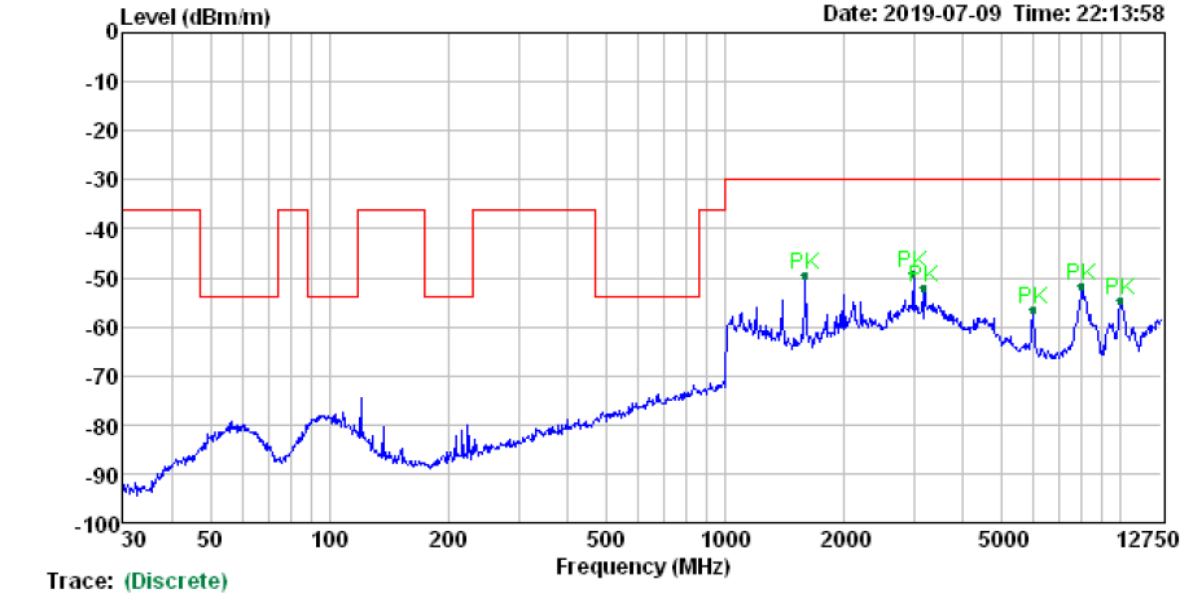
Channel:	CH100	Polarity:	Horizontal



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1594.94	-45.19	-7.92	-53.11	-30.00	23.11	Peak	HORIZONTAL
2	2994.64	-52.34	0.56	-51.78	-30.00	21.78	Peak	HORIZONTAL
3	3265.92	-55.39	0.71	-54.68	-30.00	24.68	Peak	HORIZONTAL
4	4538.34	-58.18	0.00	-58.18	-30.00	28.18	Peak	HORIZONTAL
5	8015.14	-60.51	8.30	-52.21	-30.00	22.21	Peak	HORIZONTAL
6	10006.45	-64.98	9.80	-55.18	-30.00	25.18	Peak	HORIZONTAL

Channel:	CH100	Polarity:	Vertical



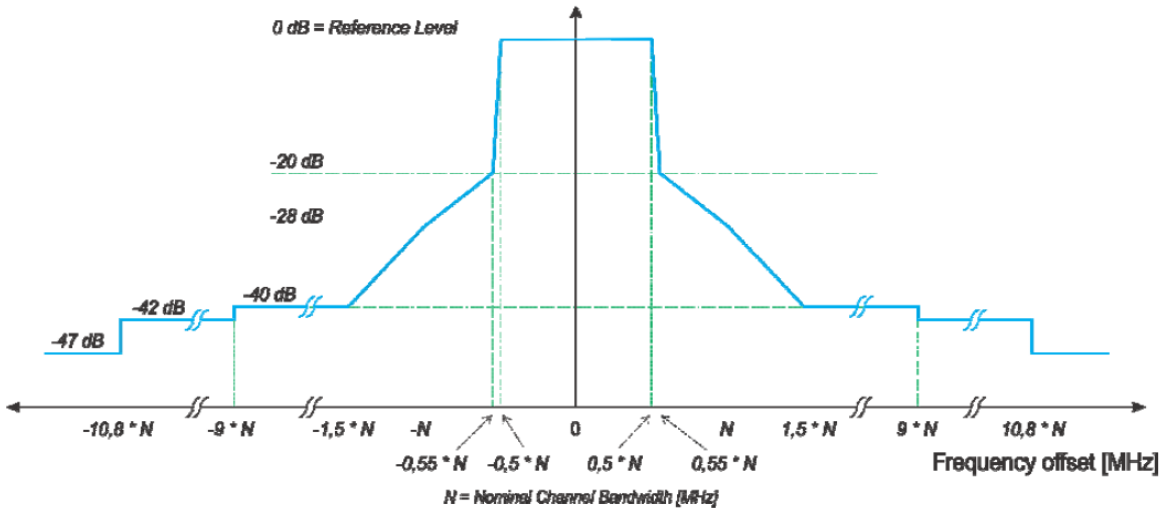
Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	1594.94	-41.41	-7.92	-49.33	-30.00	19.33	Peak	VERTICAL
2	2994.64	-49.67	0.56	-49.11	-30.00	19.11	Peak	VERTICAL
3	3191.80	-52.87	0.73	-52.14	-30.00	22.14	Peak	VERTICAL
4	5992.87	-52.18	-4.10	-56.28	-30.00	26.28	Peak	VERTICAL
5	8015.14	-60.08	8.30	-51.78	-30.00	21.78	Peak	VERTICAL
6	10006.45	-64.26	9.80	-54.46	-30.00	24.46	Peak	VERTICAL

Note: 13GHz-26GHz not recorded for no spurious point have a margin of less than 6 dB with respect to the limits.

3.4.2 Transmitter unwanted emissions within the 5 GHz RLAN bands

Limit



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

Figure 1: Transmit spectral power mask

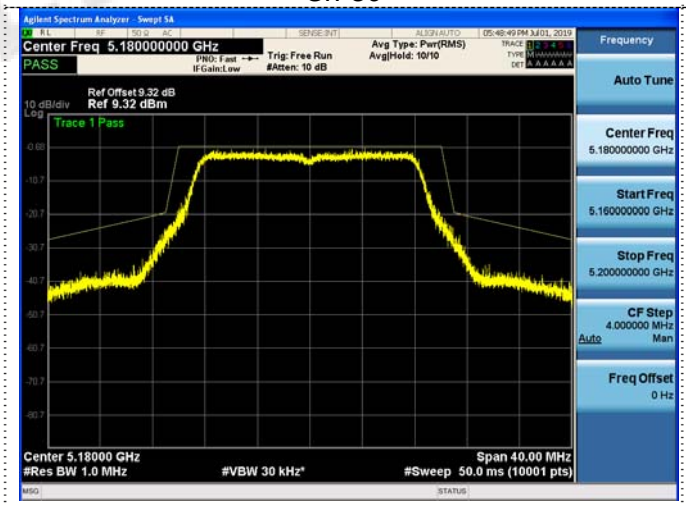
Test Procedure

1. The measurement procedure follows ETSI EN 301 893 V2.1.1 Sub-clause 5.4.6
2. The measurement shall only be performed at normal test conditions.
3. The lowest declared channel for band 5 150 MHz to 5 250 MHz and 5 470 MHz to 5 725 MHz the highest declared channel for band 5 250 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz shall be tested.

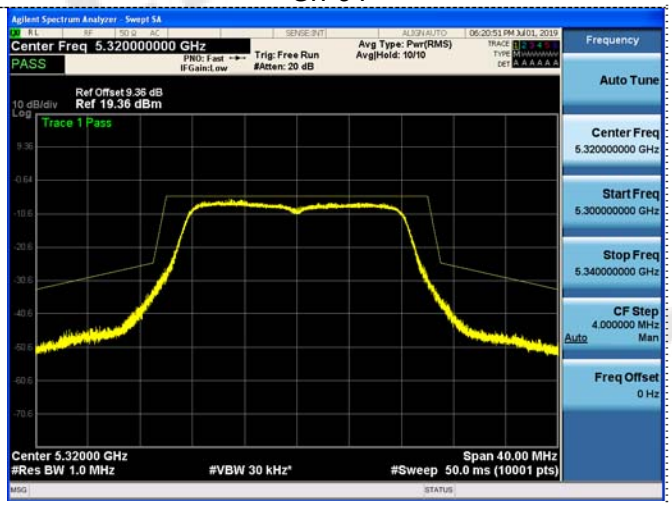
Test Result

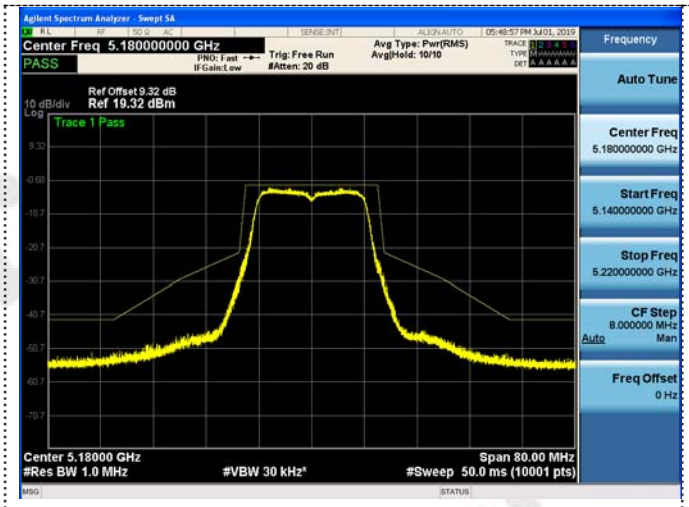
802.11a

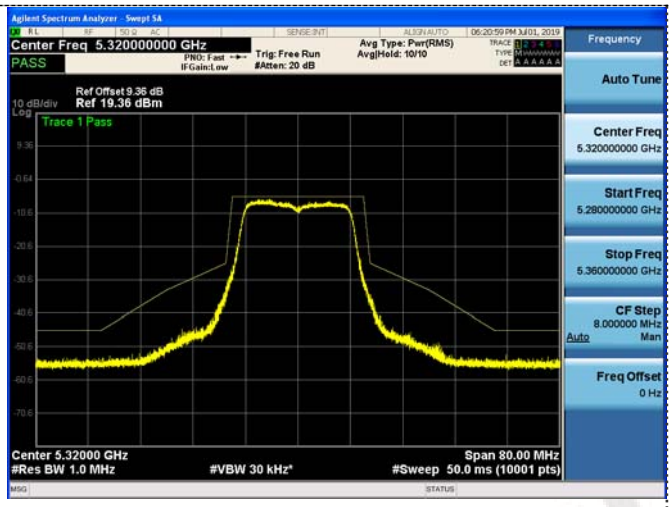
Ch 36

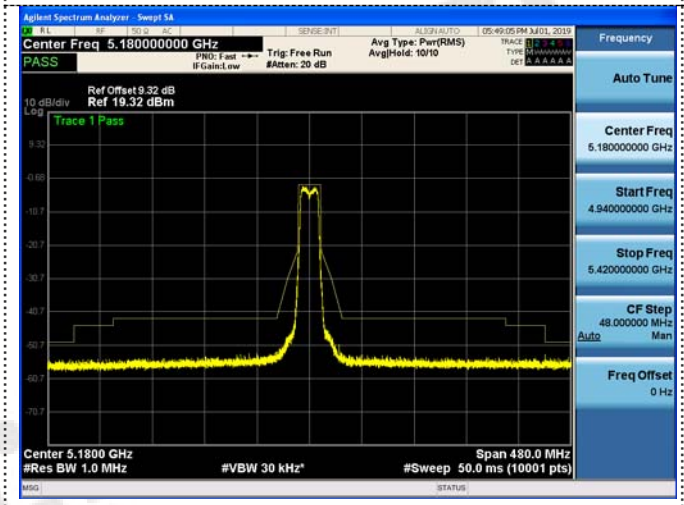


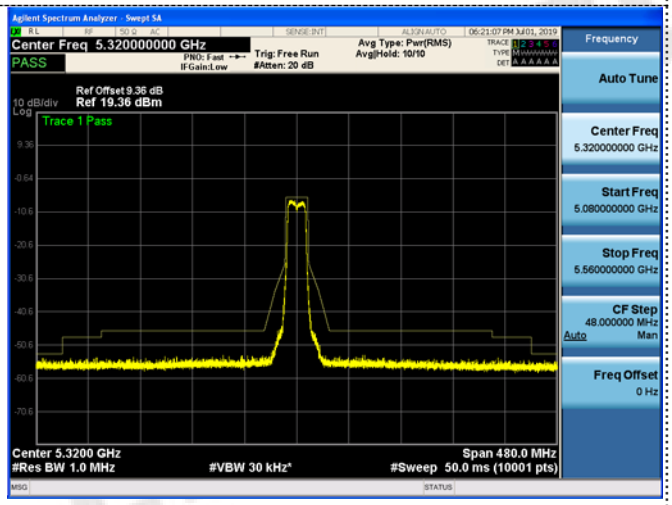
Ch 64





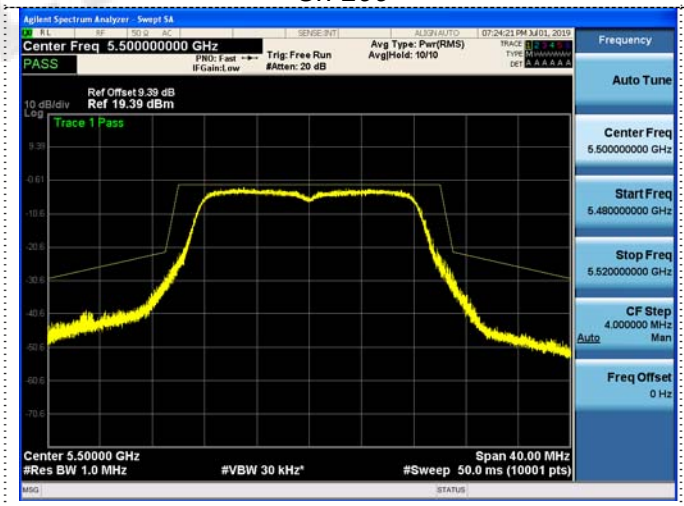




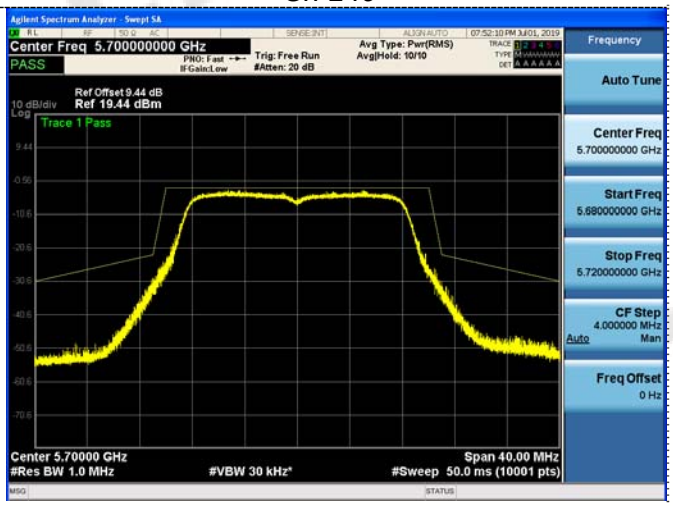


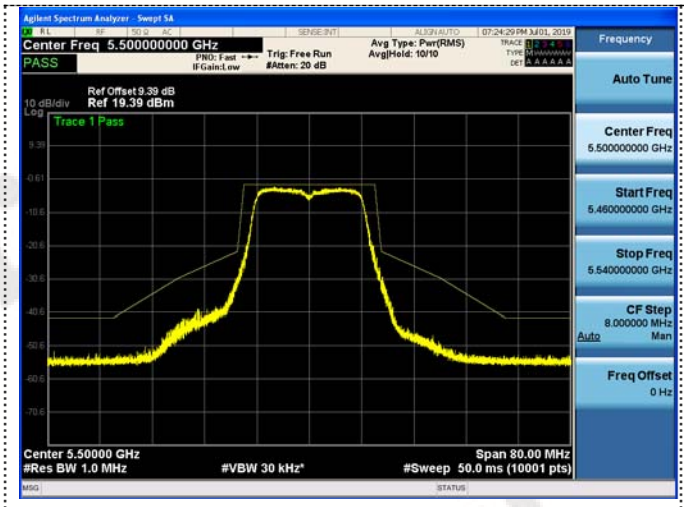
802.11a

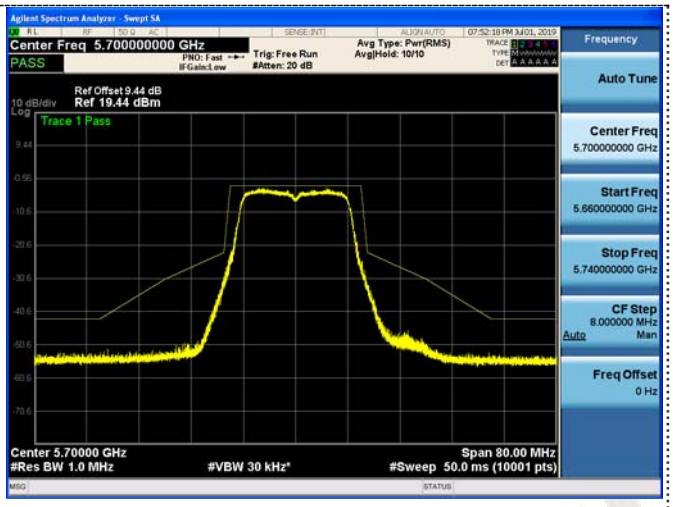
Ch 100

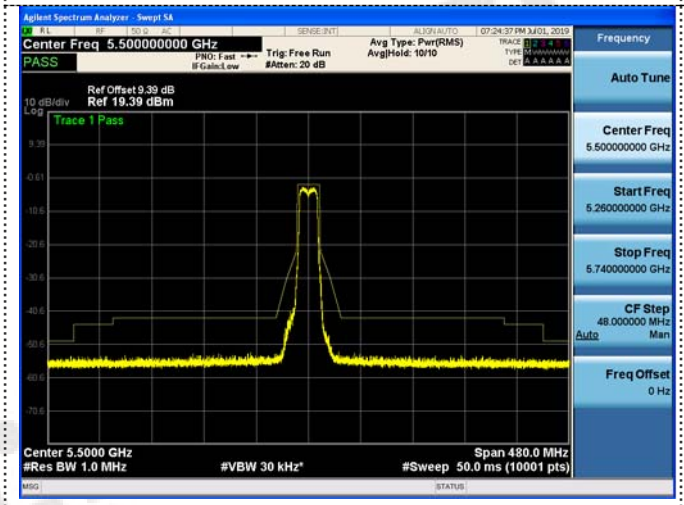


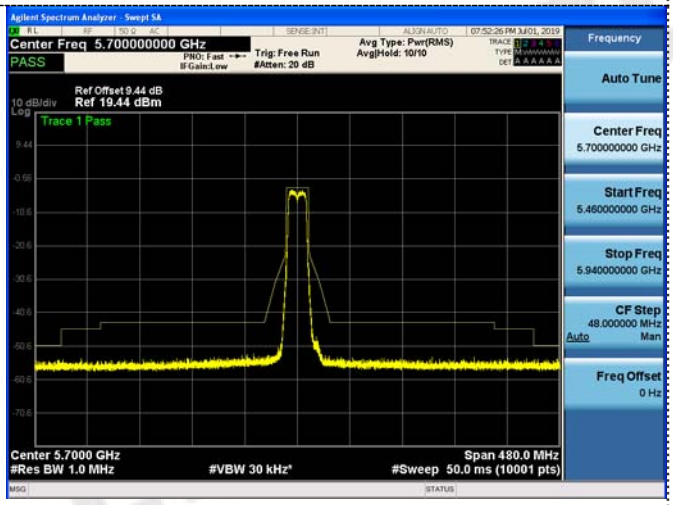
Ch 140





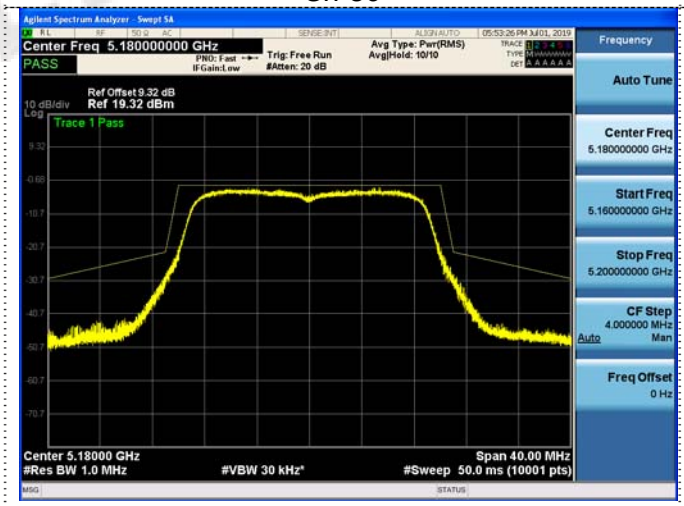




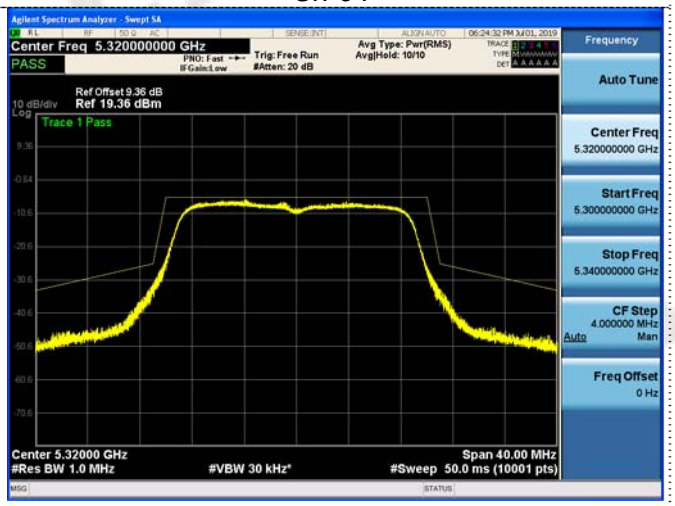


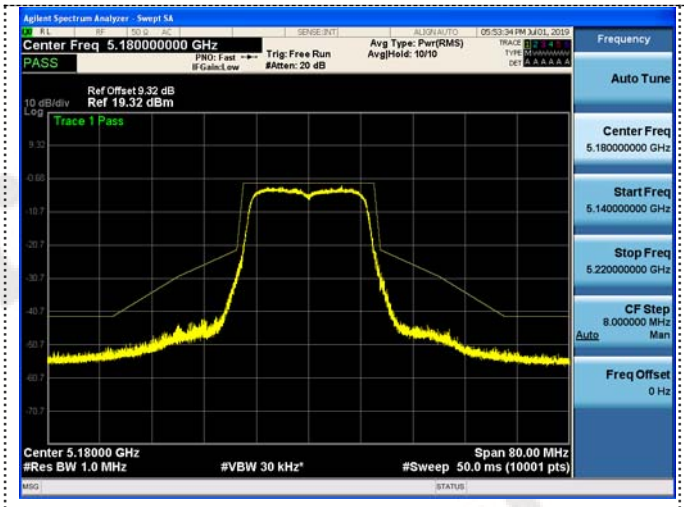
802.11n20MHz

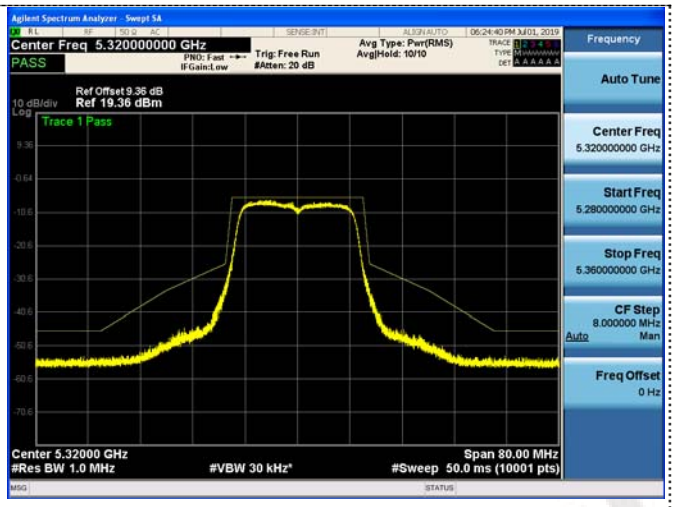
Ch 36

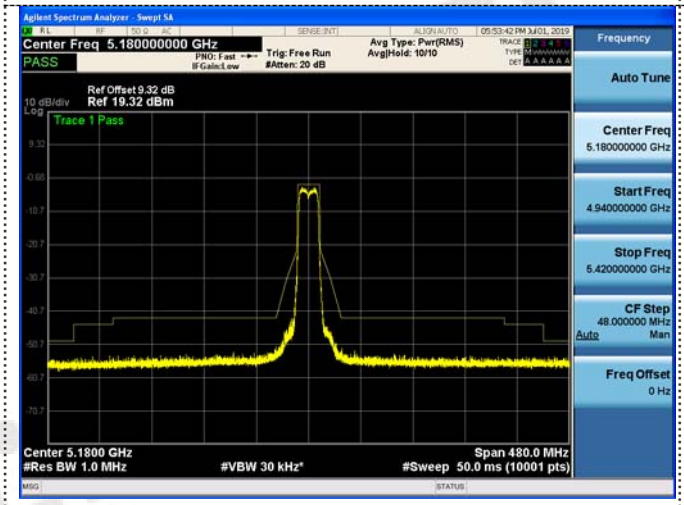


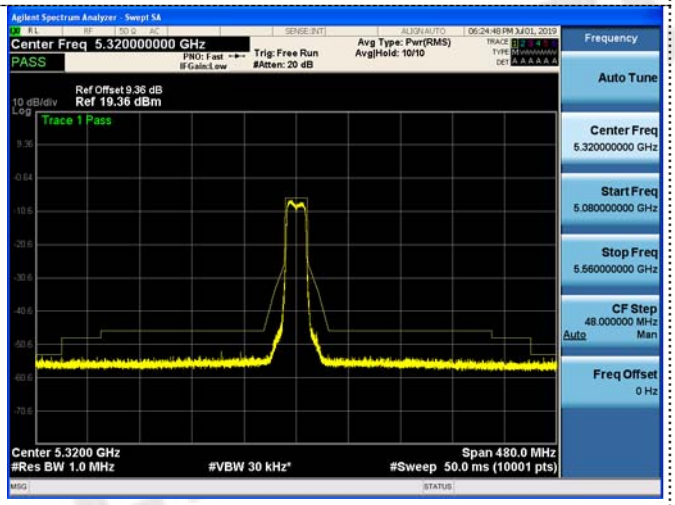
Ch 64





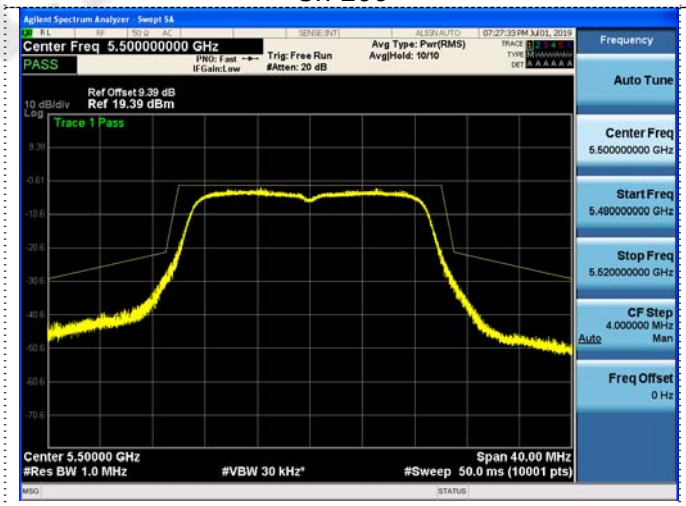




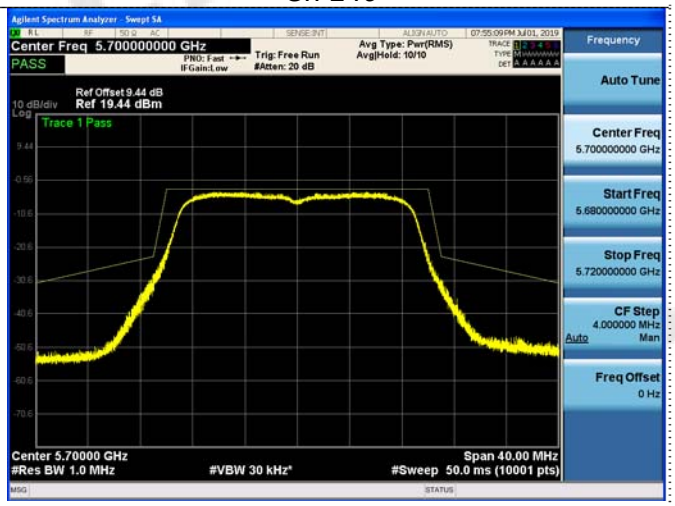


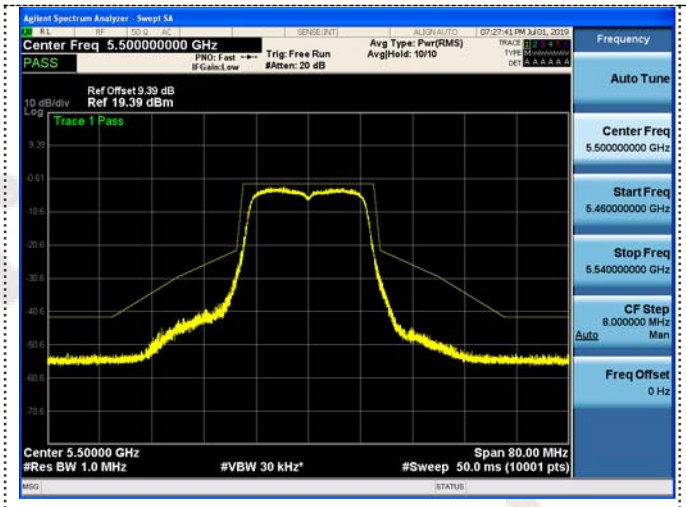
802.11n20MHz

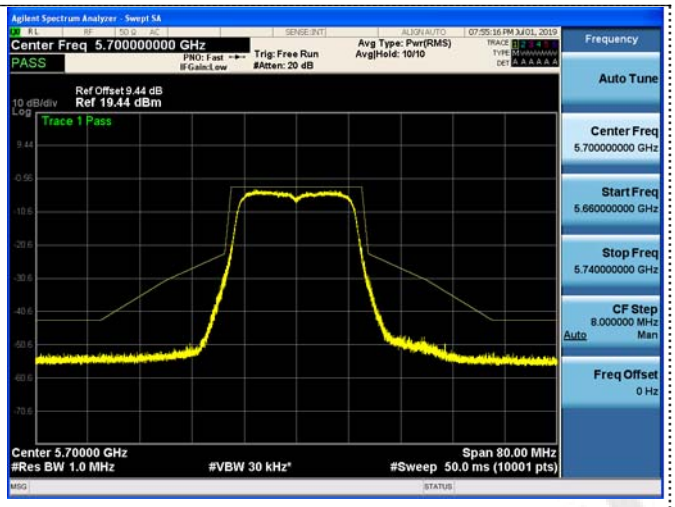
Ch 100

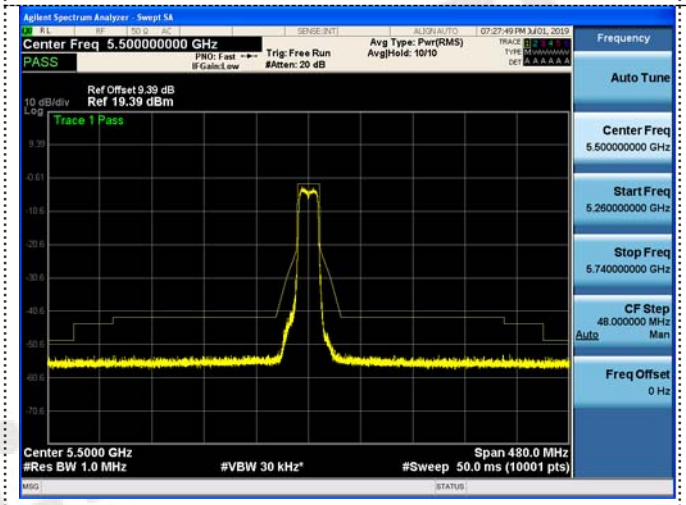


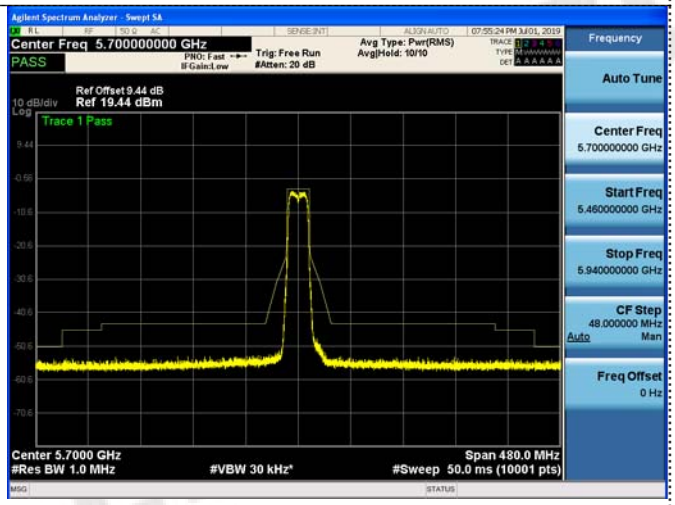
Ch 140





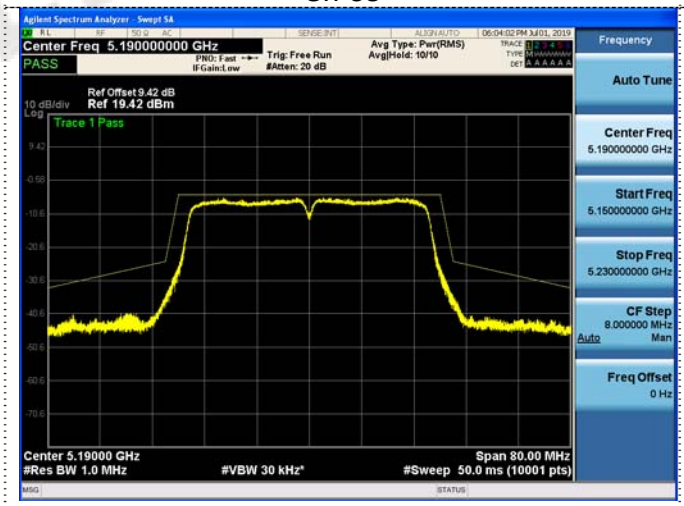




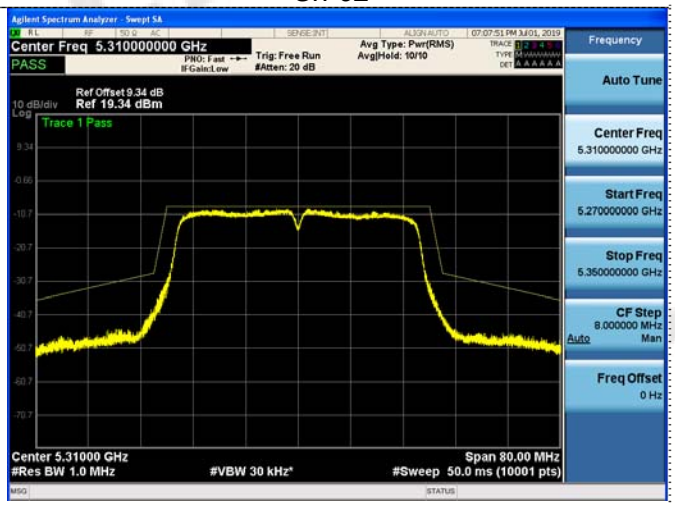


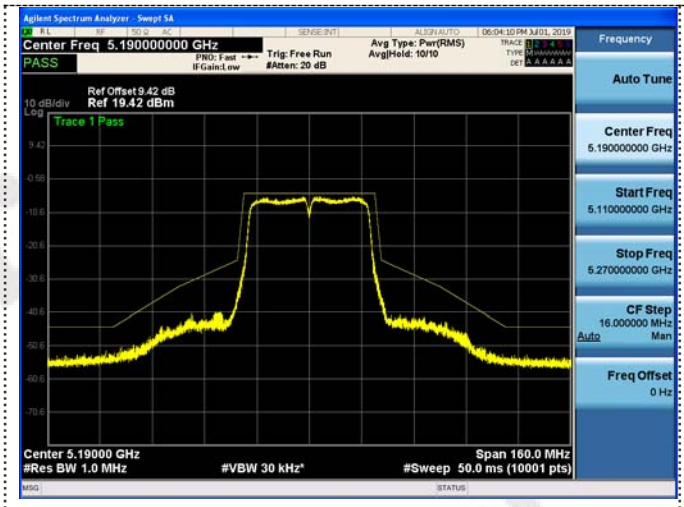
802.11n40MHz

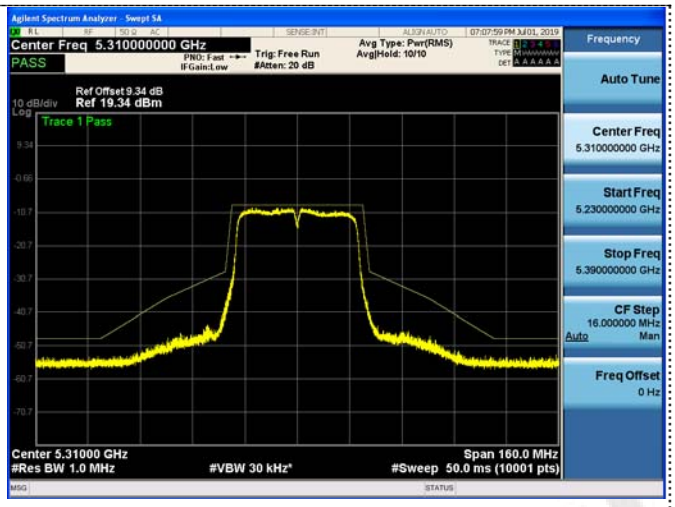
Ch 38

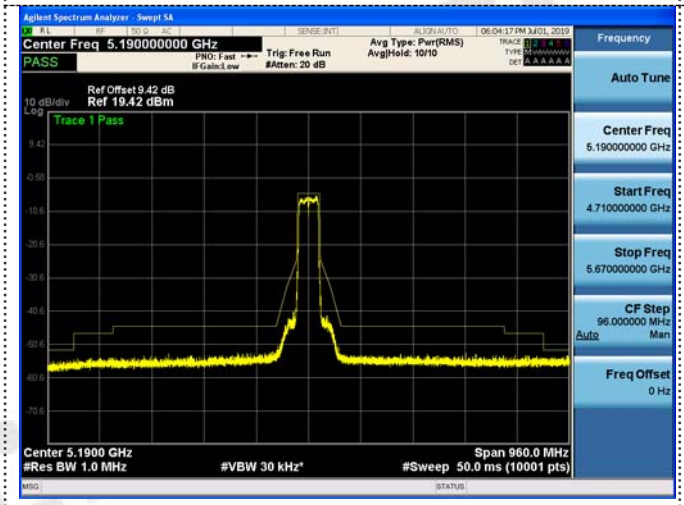


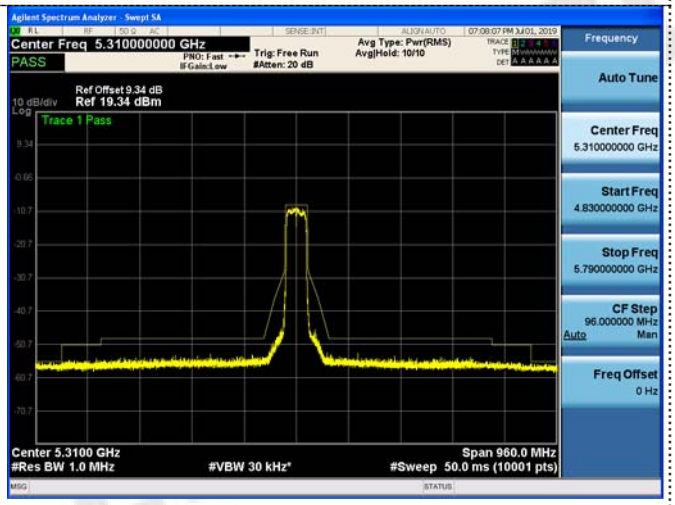
Ch 62





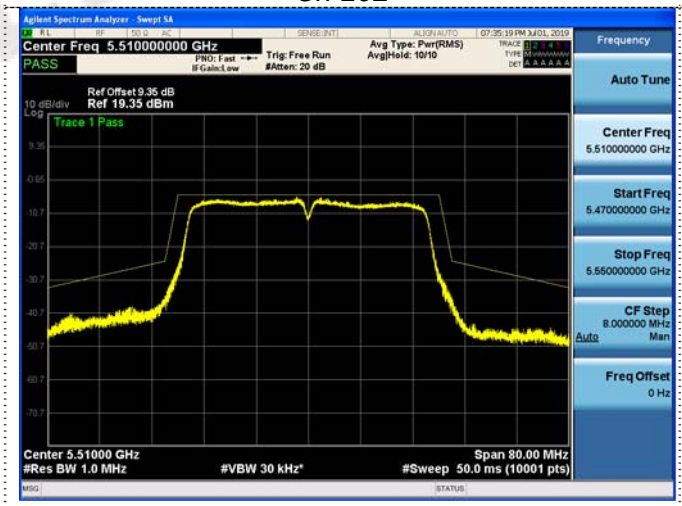




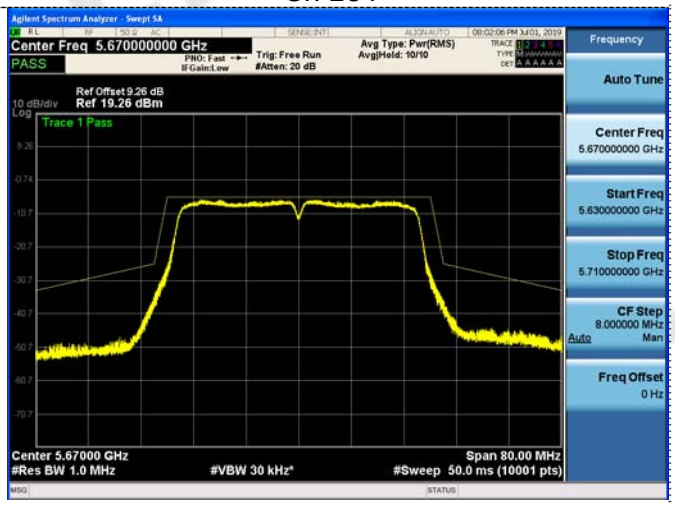


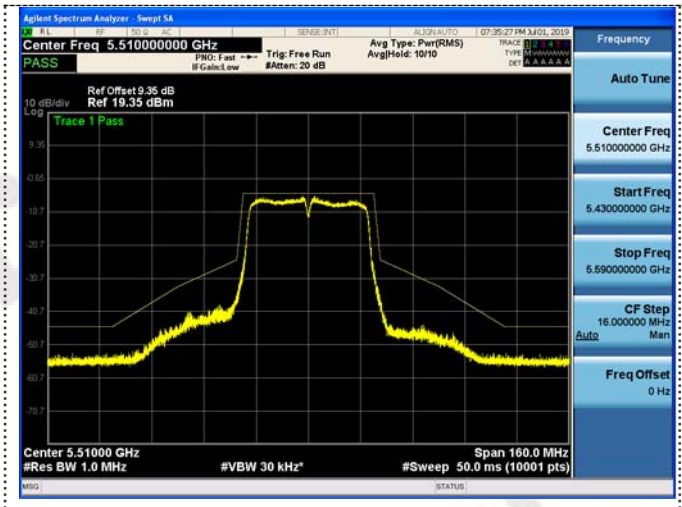
802.11n40MHz

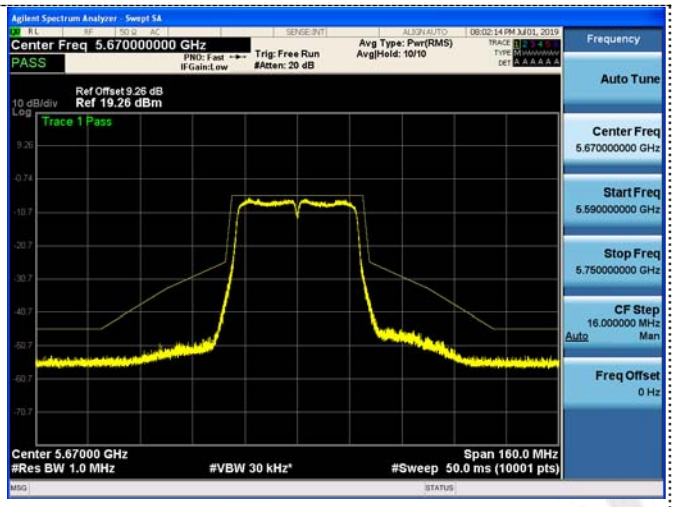
Ch 102

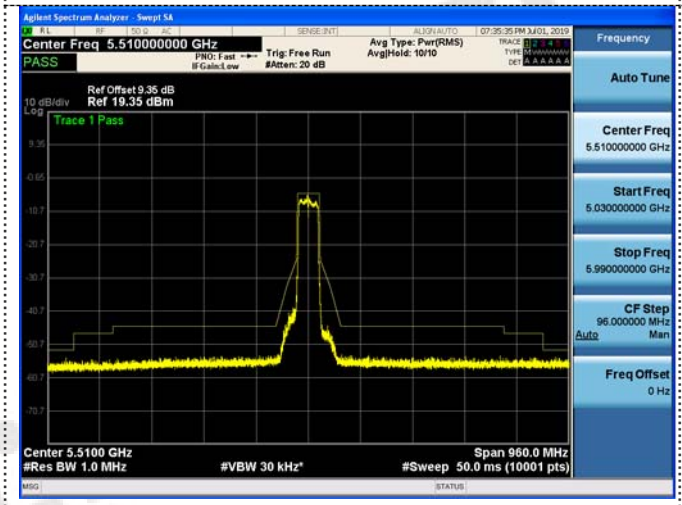


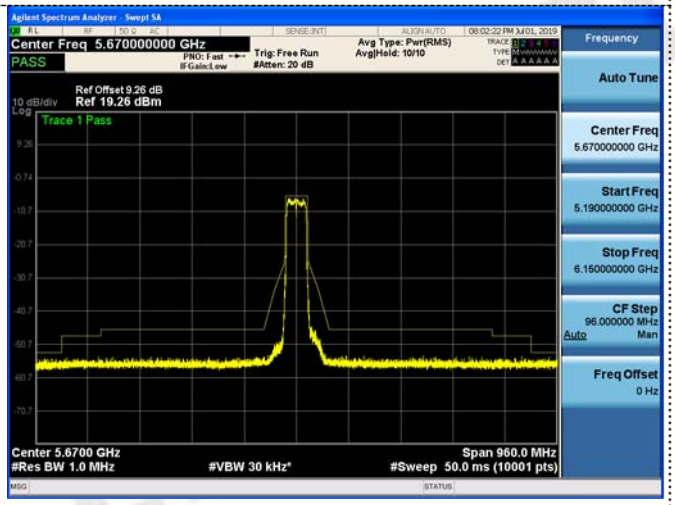
Ch 134





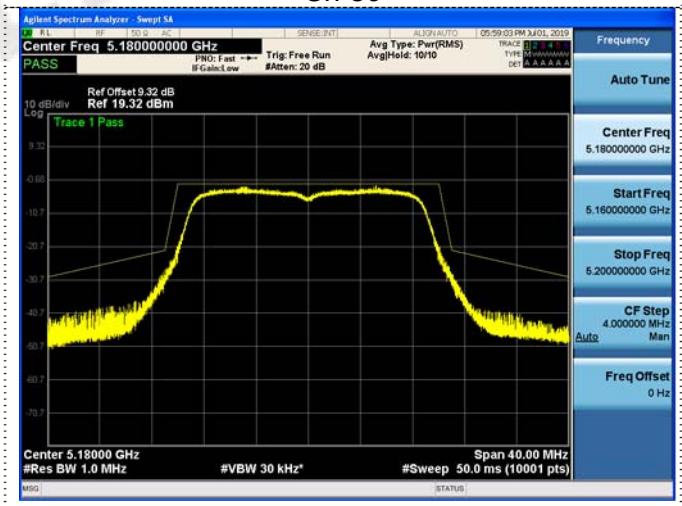




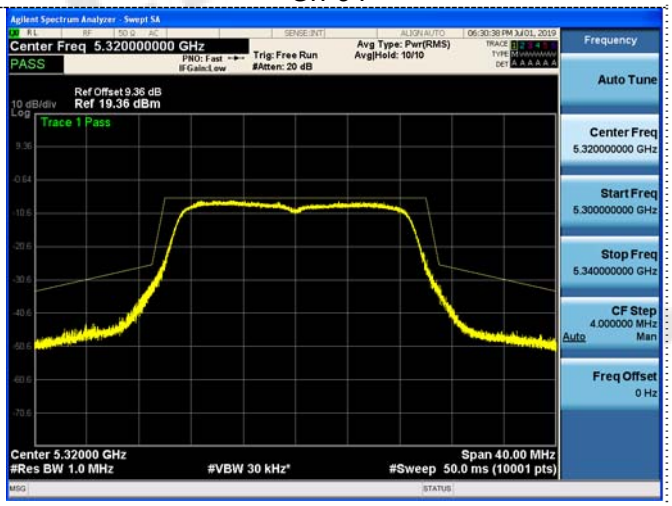


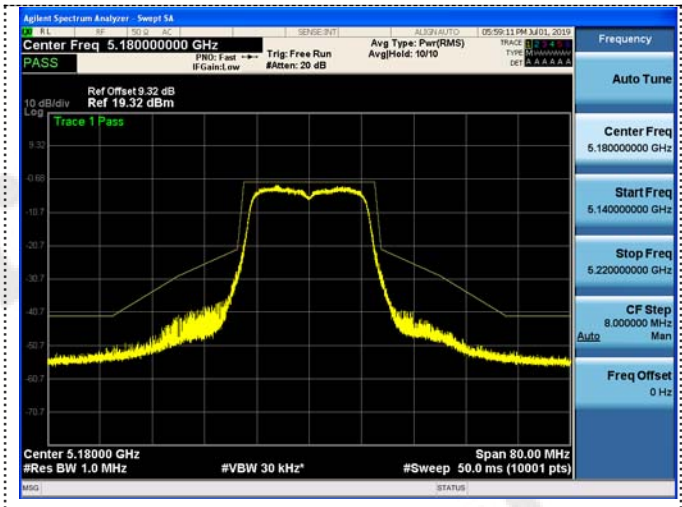
802.11ac20MHz

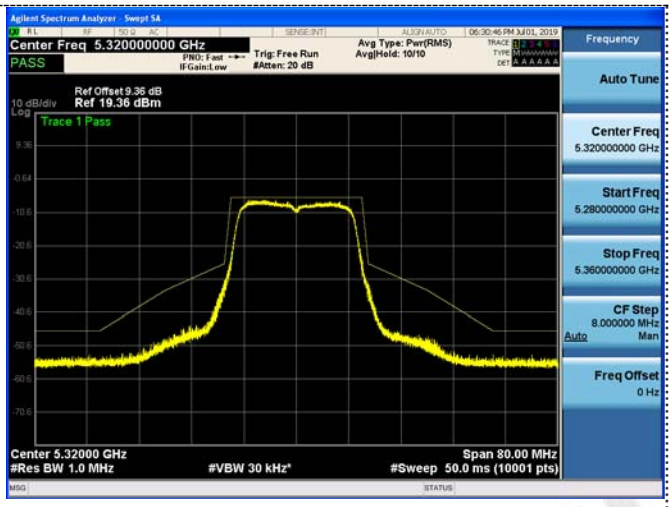
Ch 36

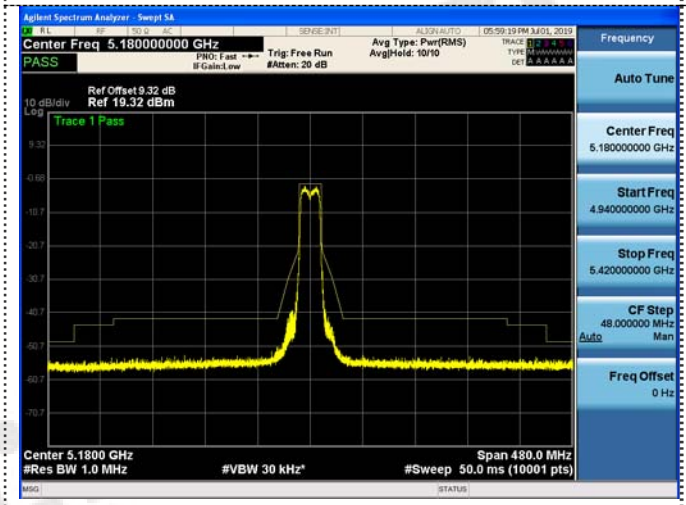


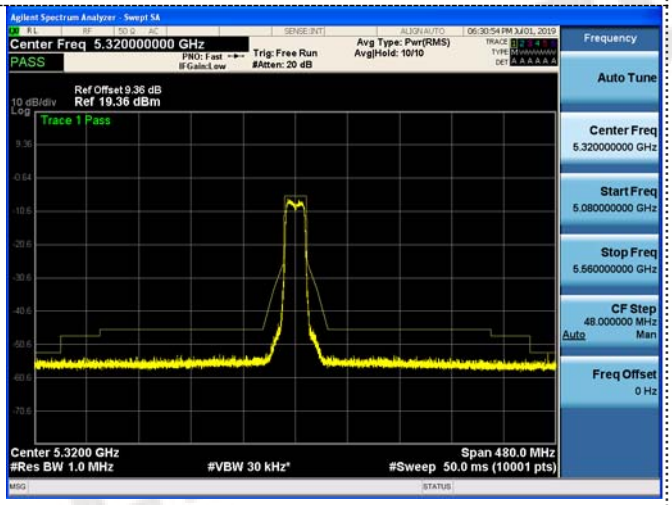
Ch 64





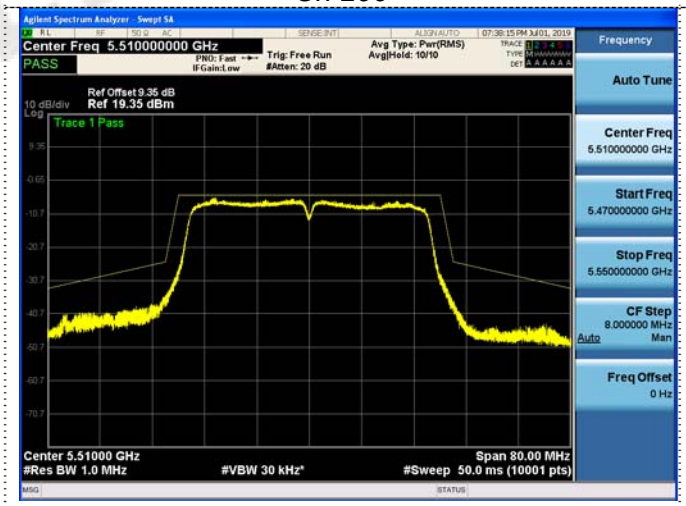




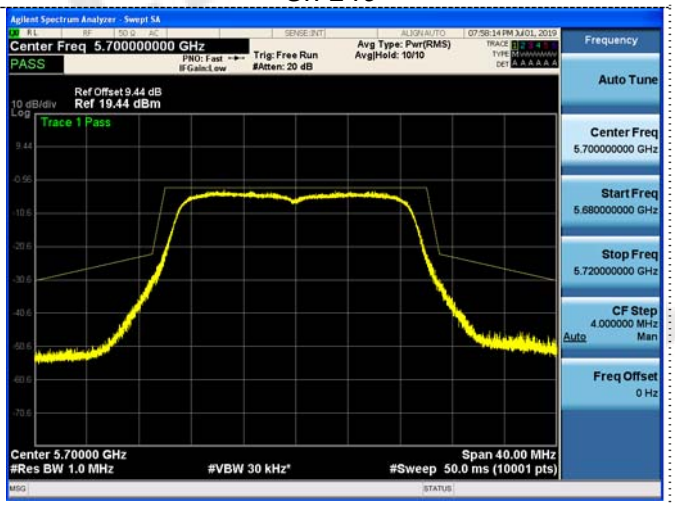


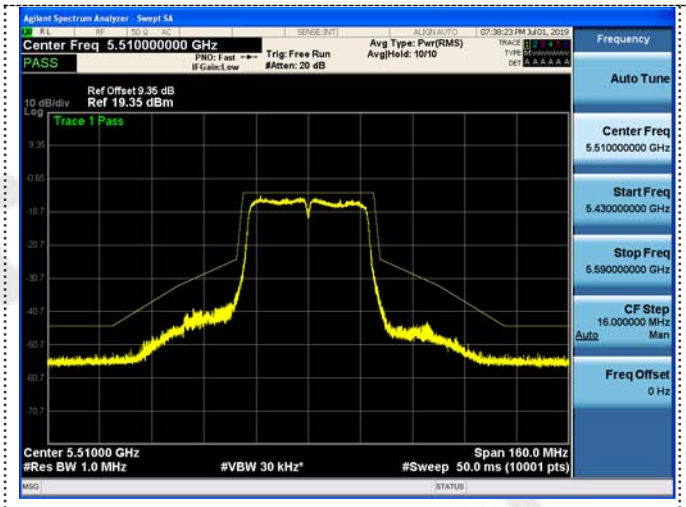
802.11ac20MHz

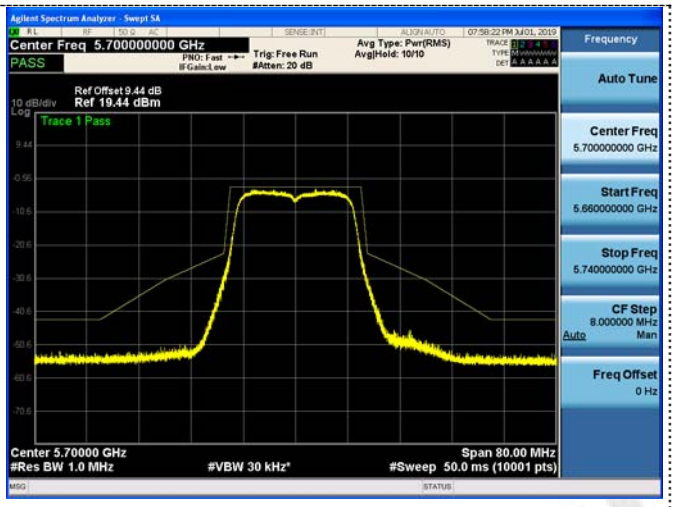
Ch 100

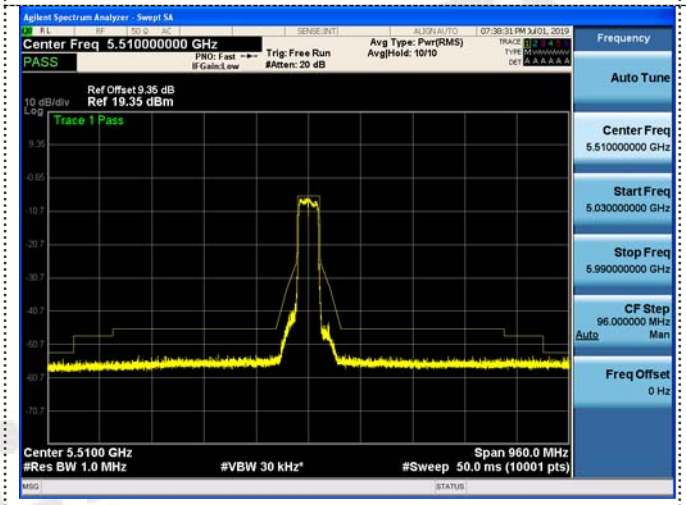


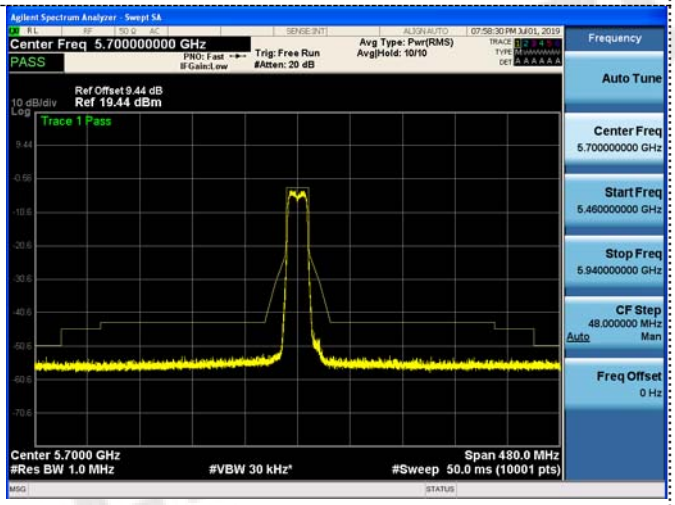
Ch 140





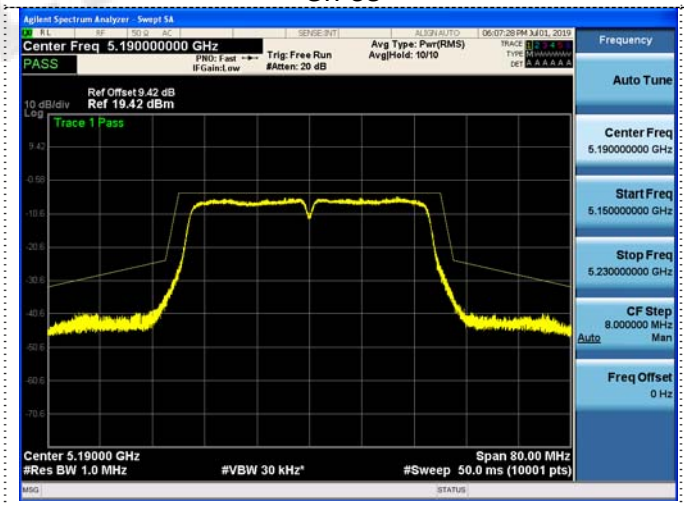




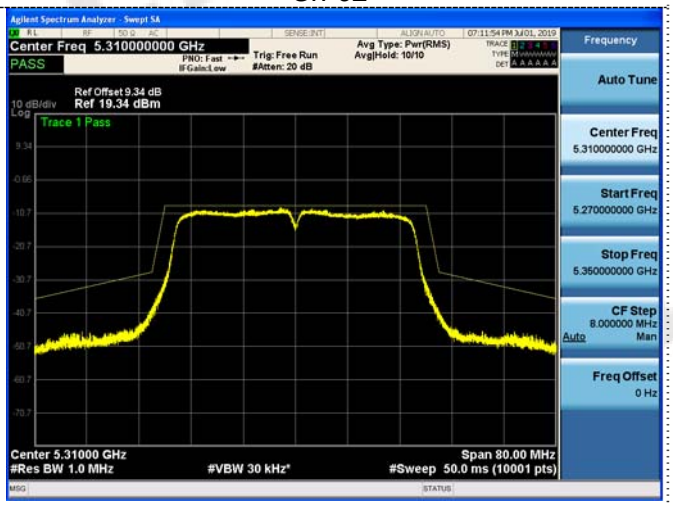


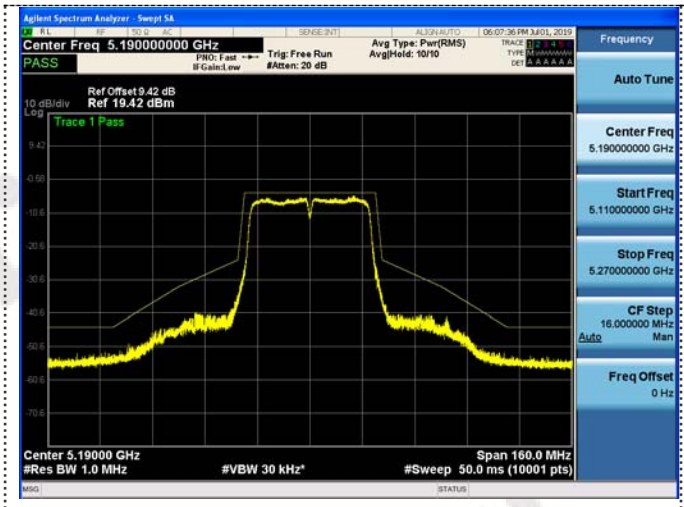
802.11ac40MHz

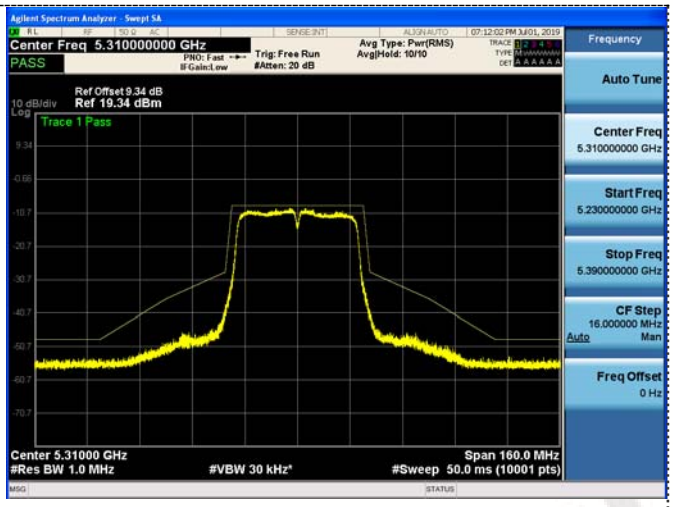
Ch 38

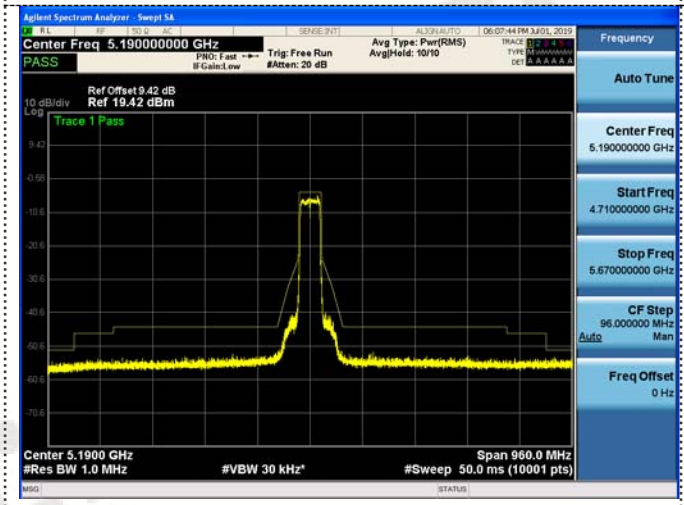


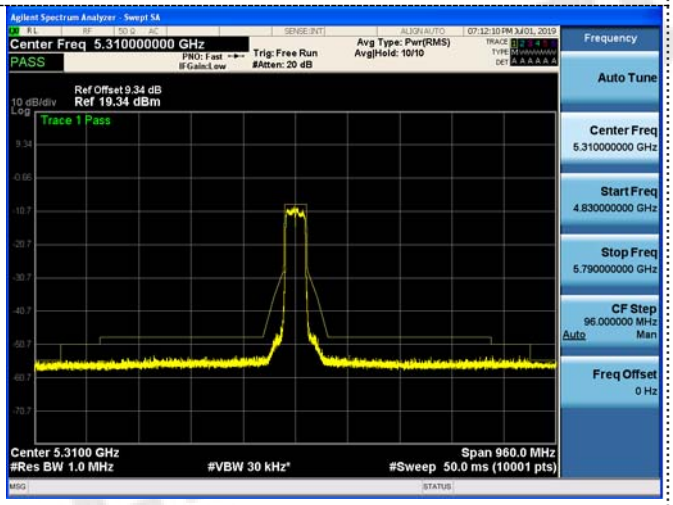
Ch 62





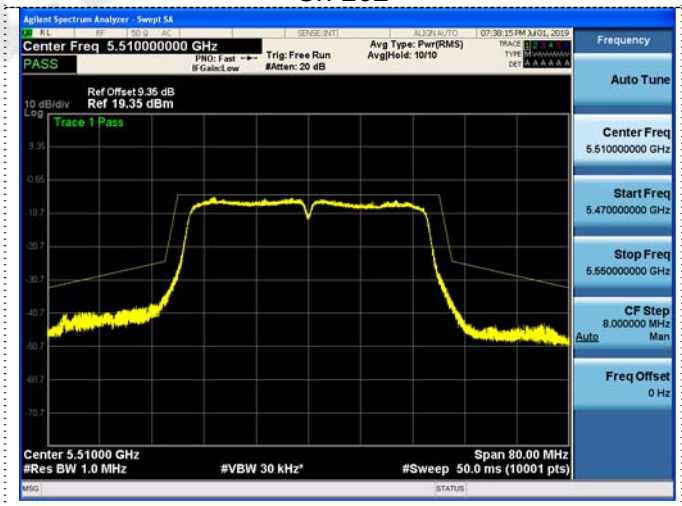




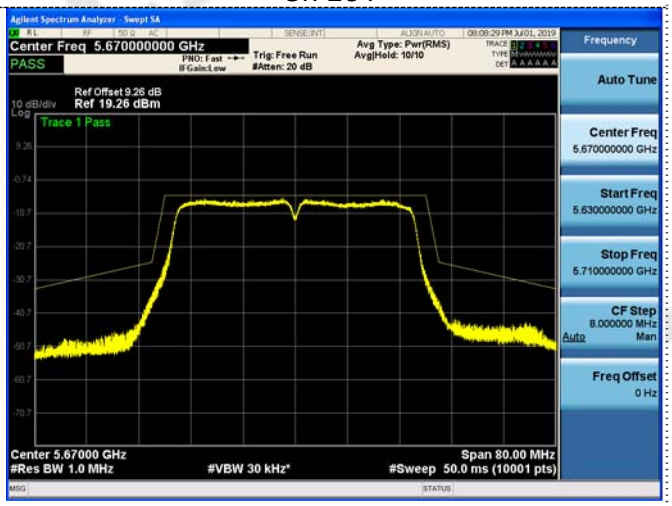


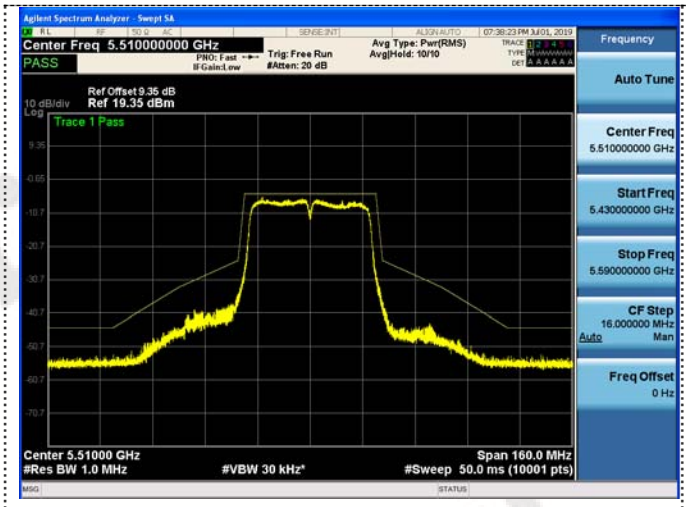
802.11ac40MHz

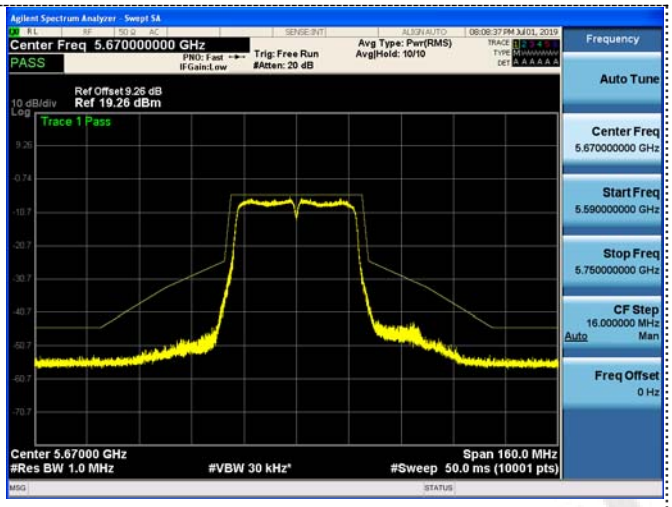
Ch 102

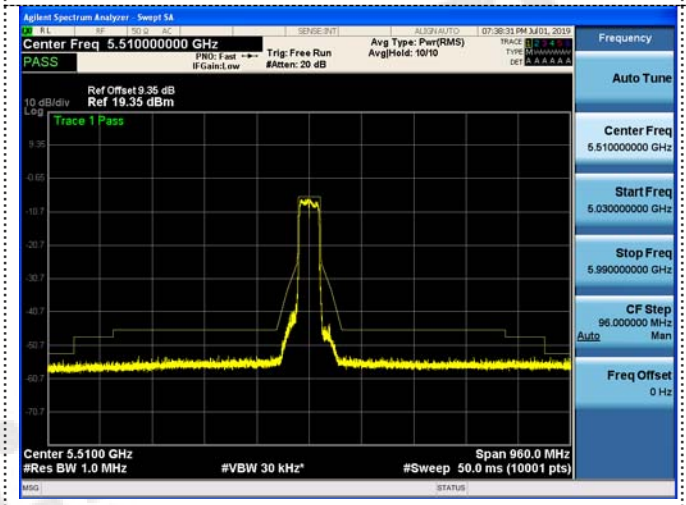


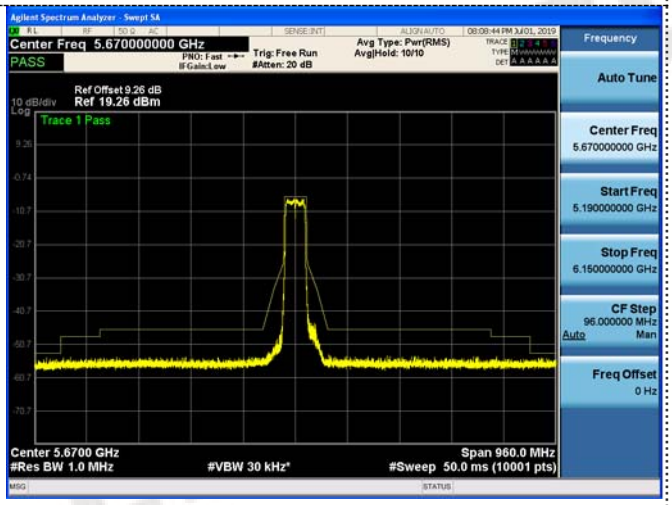
Ch 134





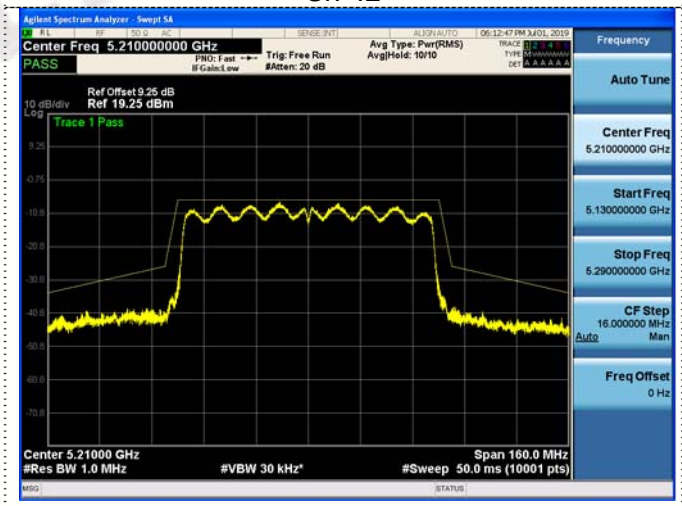




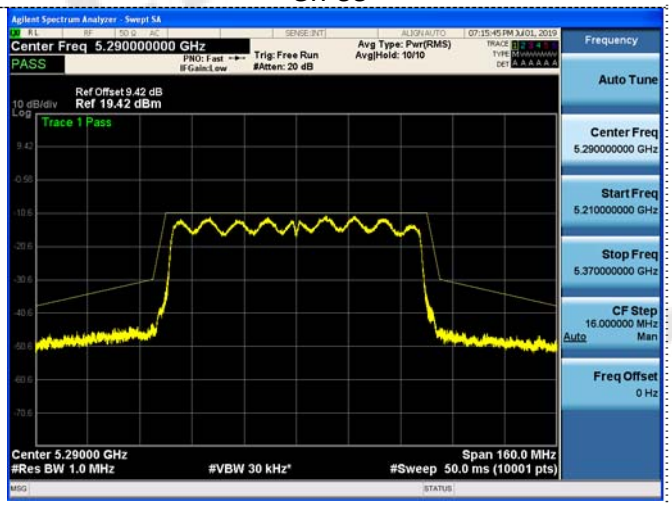


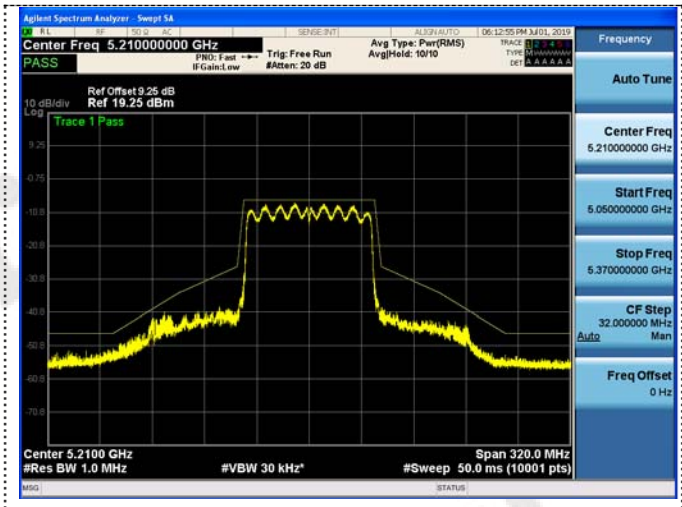
802.11ac80MHz

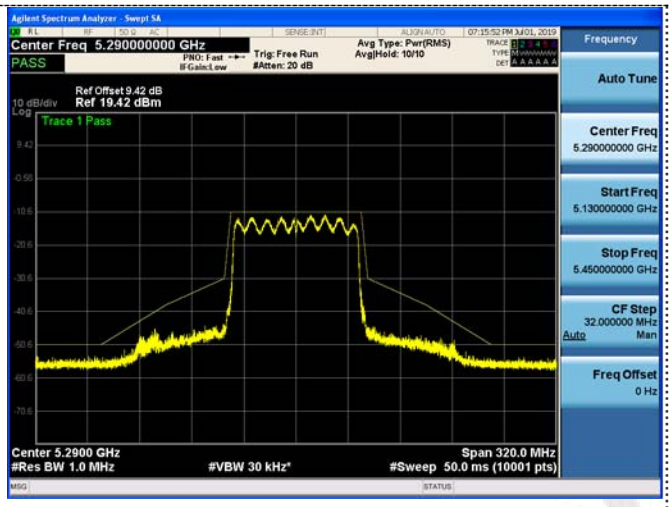
Ch 42

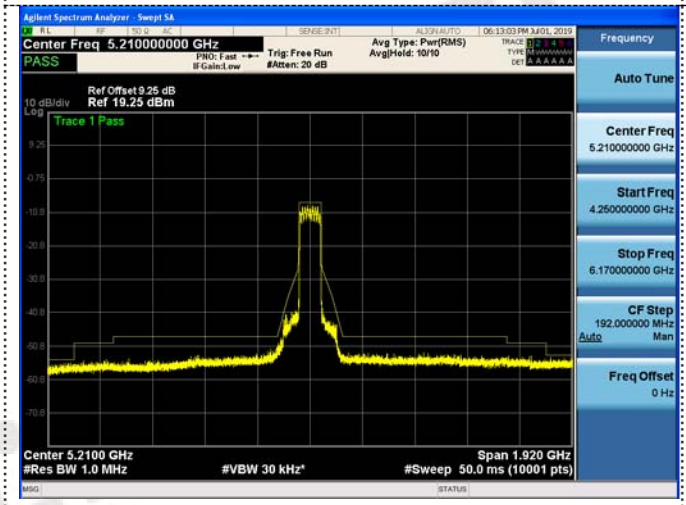


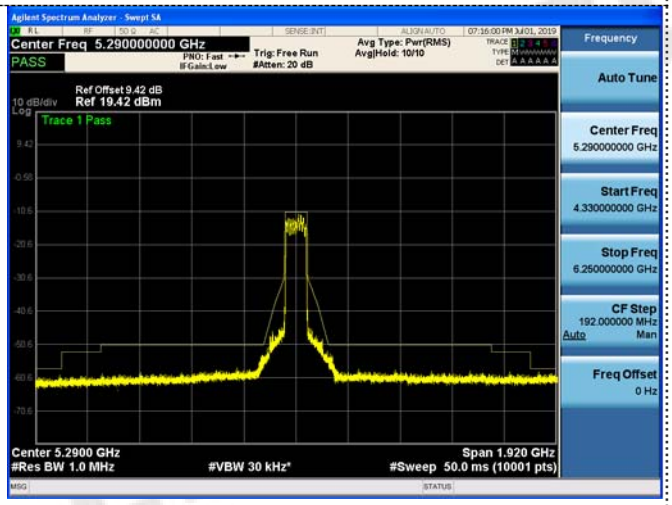
Ch 58





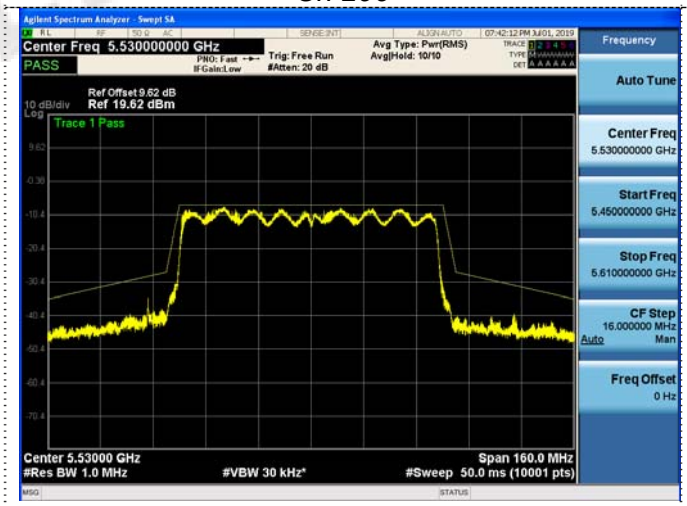




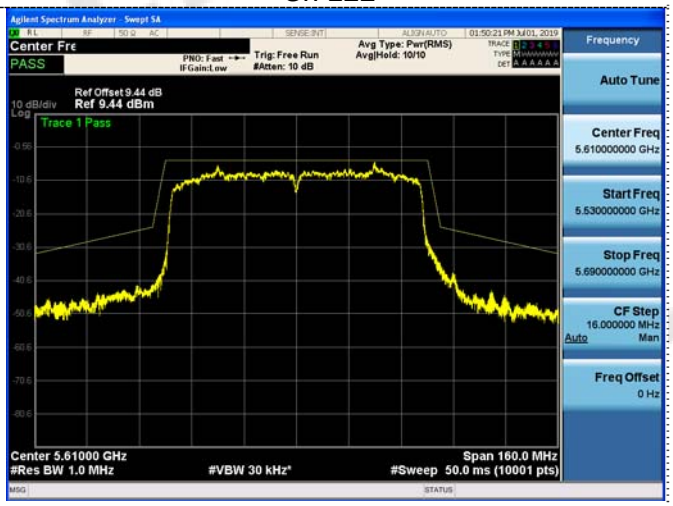


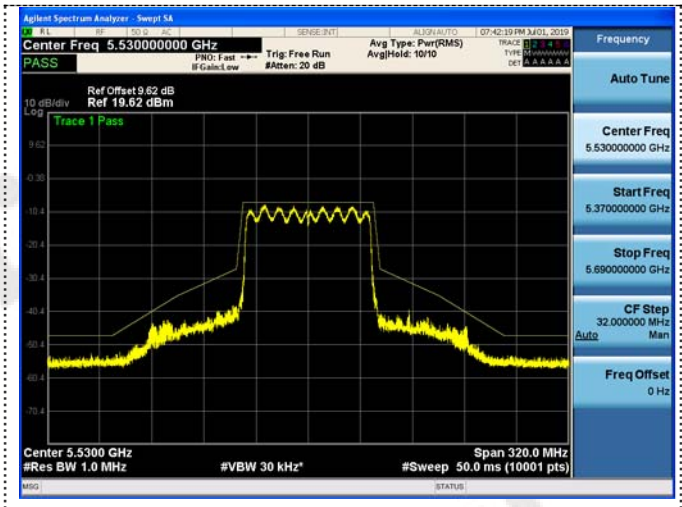
802.11ac80MHz

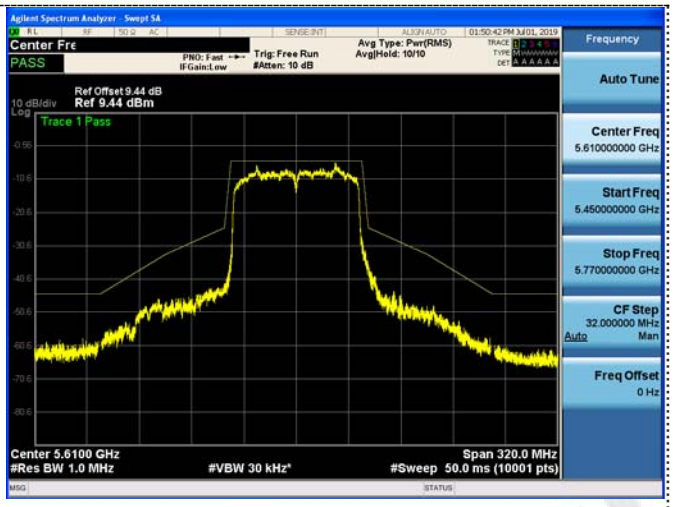
Ch 106

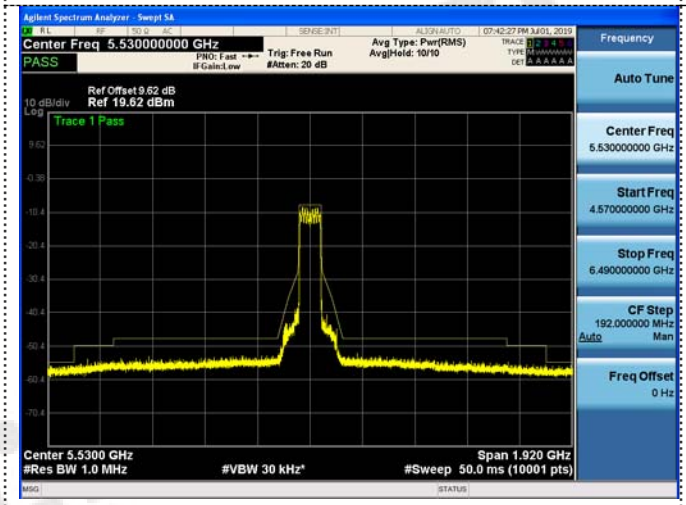


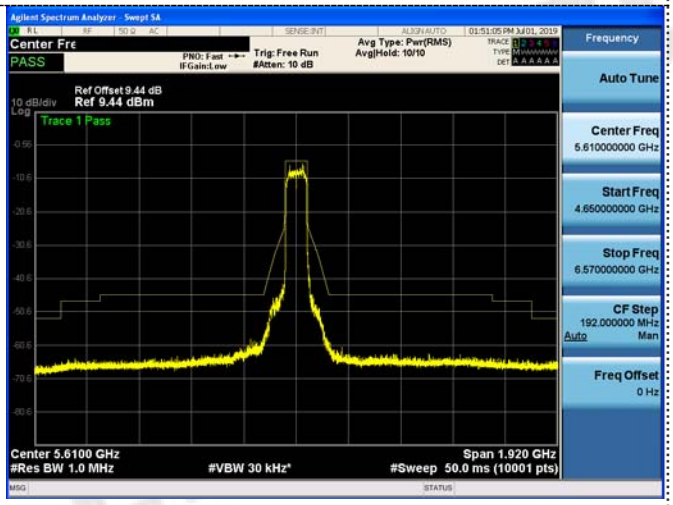
Ch 122











3.5 Receiver spurious emissions

LIMIT

The spurious emissions of the receiver shall not exceed the limits given in table below:

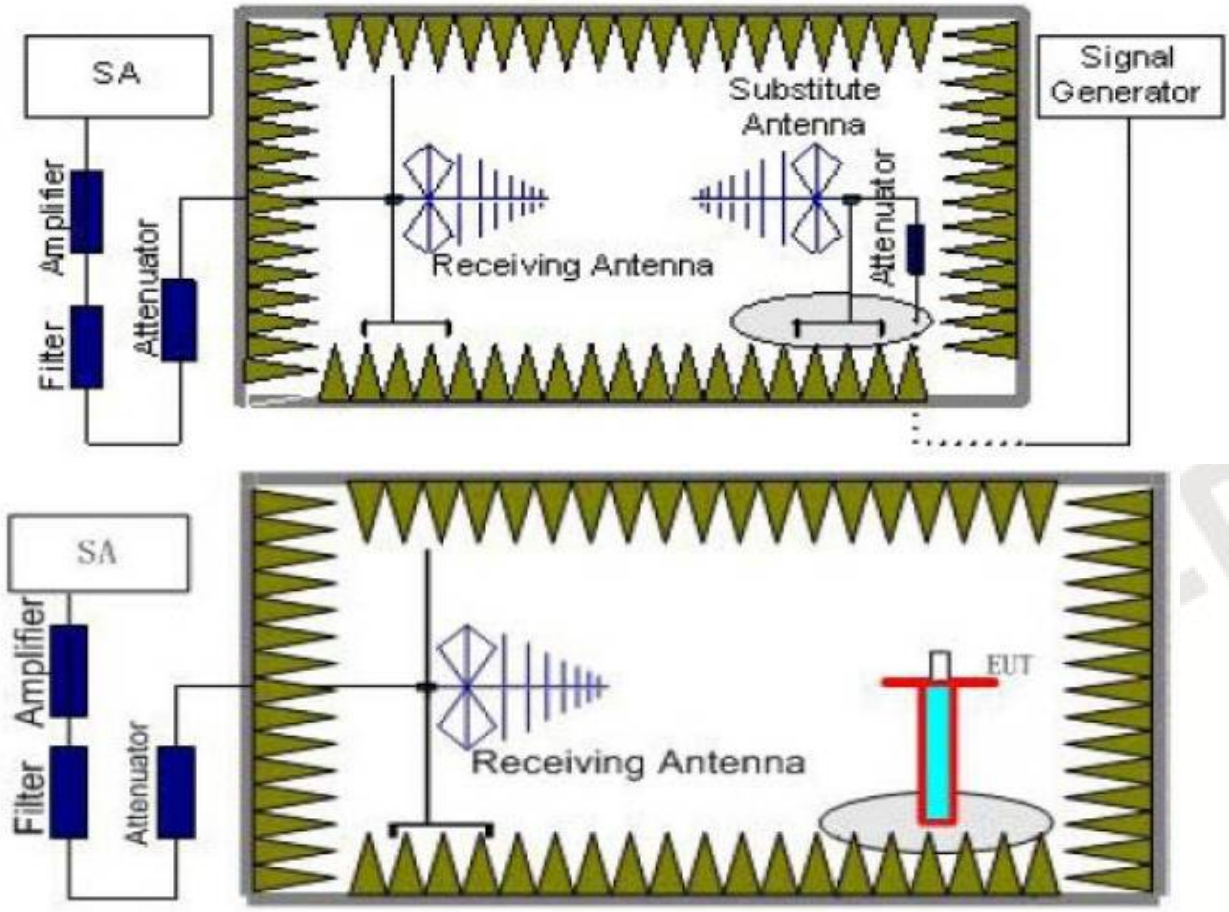
Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 26 GHz	-47 dBm	1 MHz

Test Procedure

1. The measurement procedure follows ETSI EN 301 893 V2.1.1 Sub-clause 5.4.7
2. The measurement shall only be performed at normal test conditions.
3. One channel out of the declared channels for each sub-band shall be tested.

Test Configuration

Effective Radiated Power measurement (30 MHz to 26 GHz)

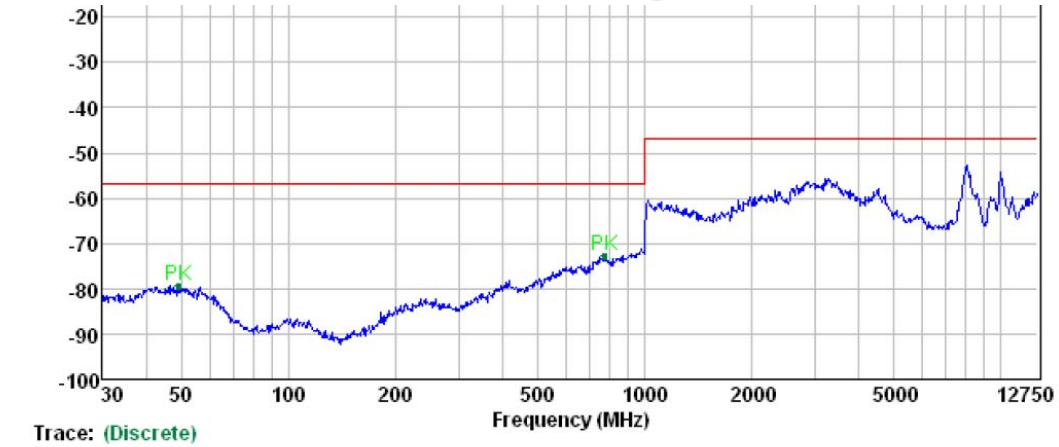


Test Result

Remark: We test all modulation type, and recorded the worst case at 802.11ac 20MHz mode.

802.11ac20MHz

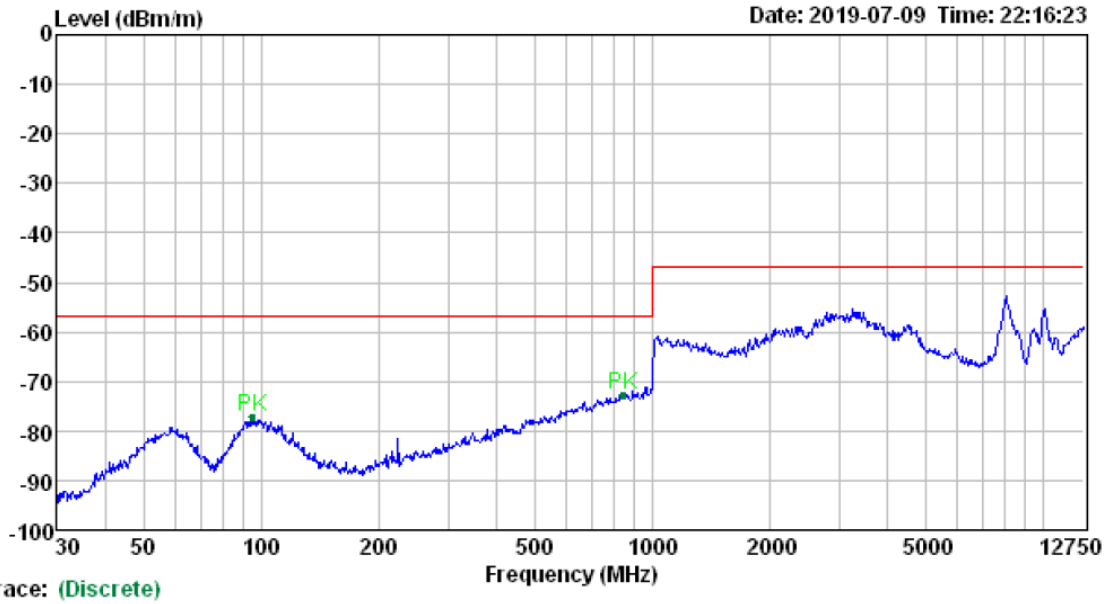
Channel:	*CH36*	*Polarity:*	*Horizontal*



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	49.19	-78.84	-0.53	-79.37	-57.00	22.37	Peak	HORIZONTAL
2	771.45	-78.17	5.41	-72.76	-57.00	15.76	Peak	HORIZONTAL

Channel:	*CH36*	*Polarity:*	*Vertical*



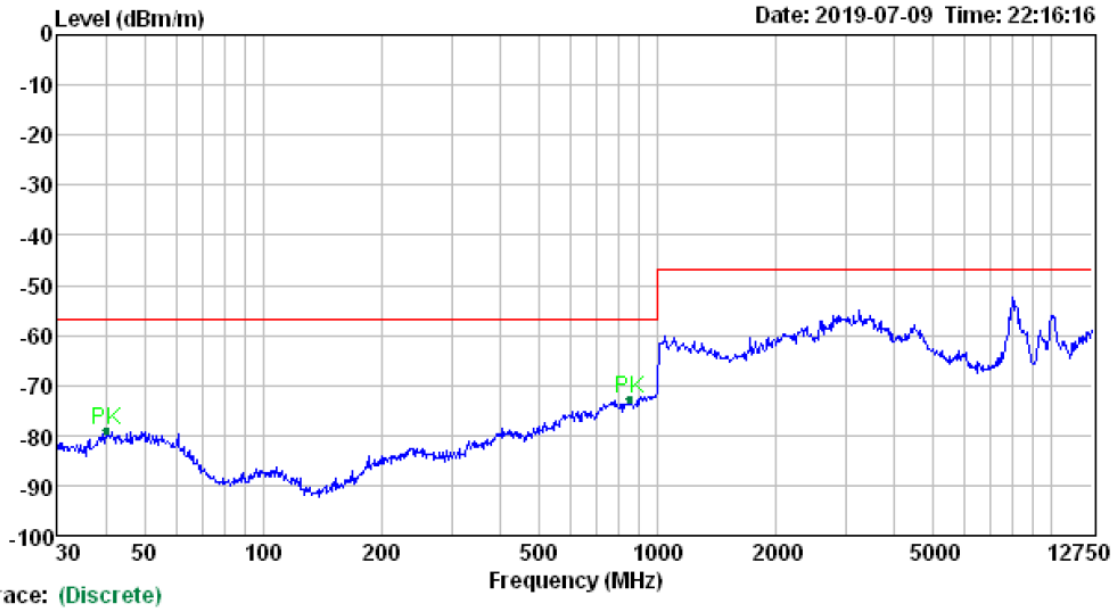
Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	94.43	-77.97	0.71	-77.26	-57.00	20.26	Peak	VERTICAL
2	842.13	-78.38	5.87	-72.51	-57.00	15.51	Peak	VERTICAL

Note: 18GHz-26GHz not recorded for no spurious point have a margin of less than 6 dB with respect to the limits.

802.11ac20MHz

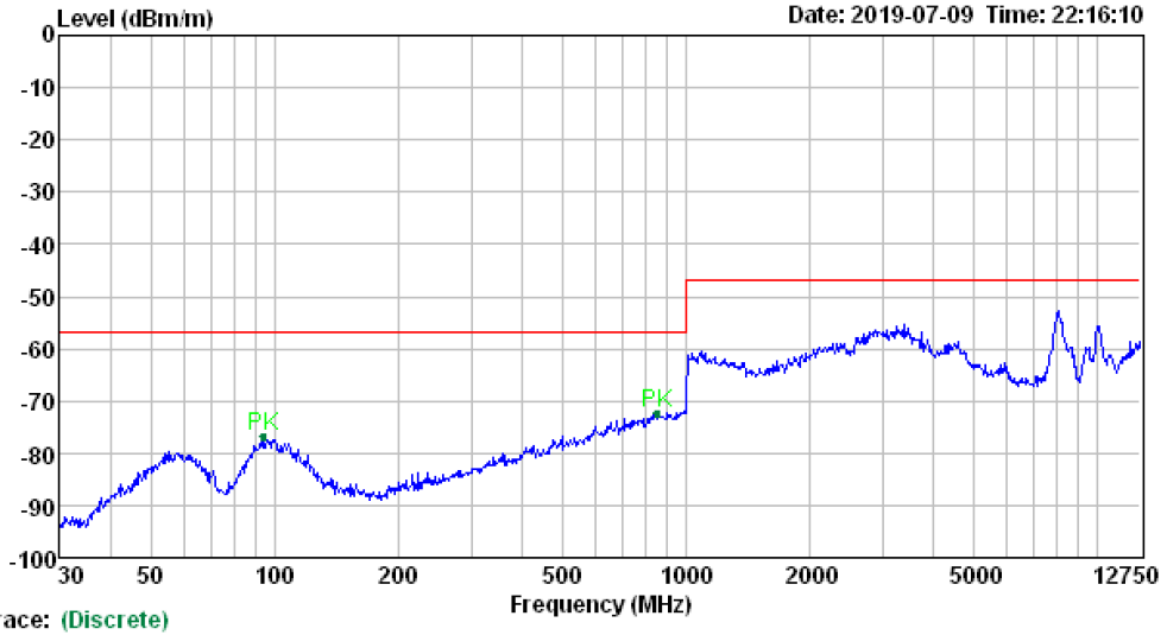
Channel:	*CH100*	*Polarity:*	*Horizontal*



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	39.85	-78.76	-0.22	-78.98	-57.00	21.98	Peak	HORIZONTAL
2	851.04	-78.22	5.50	-72.72	-57.00	15.72	Peak	HORIZONTAL

Channel:	*CH100*	*Polarity:*	*Vertical*



Trace: (Discrete)

Mark	Freq MHz	RD dBm	C.F dB	Result dBm	Limit dBm	Margin dB	Det.	Polarity
1	93.44	-77.31	0.50	-76.81	-57.00	19.81	Peak	VERTICAL
2	848.06	-78.16	5.95	-72.21	-57.00	15.21	Peak	VERTICAL

Note: 18GHz-26GHz not recorded for no spurious point have a margin of less than 6 dB with respect to the limits.

3.6 Dynamic Frequency Selection (DFS)

Applicability

Follow table lists the DFS related technical requirements and their applicability for every operational mode. If the RLAN device is capable of operating in more than one operational mode then every operating mode shall be assessed separately.
DFS mode of operation: From the device, No radar detection function, only close the channel.

Applicability of DFS requirements

Requirement	DFS Operational mode		
	Master	**Slave without radar detection** (see table D.2, note 2)	**Slave with radar detection** (see table D.2, note 2)
Channel Availability Check	Required	Not required	Required (see note 2)
Off-Channel CAC (see note 1)	Required	Not required	Required (see note 2)
In-Service Monitoring	Required	Not required	Required
Channel Shutdown	Required	Required	Required
Non-Occupancy Period	Required	Not required	Required
Uniform Spreading	Required	Not required	Not required
NOTE 1: Where implemented by the manufacturer. NOTE 2: A slave with radar detection is not required to perform a CAC or Off-Channel CAC at initial use of the channel but only after the slave has detected a radar signal on the Operating Channel by In-Service Monitoring.			

DFS parameters

Table D.1: DFS requirement values

Parameter	Value
Channel Availability Check Time	60 s (see note 1)
Minimum Off-Channel CAC Time	6 minutes (see note 2)
Maximum Off-Channel CAC Time	4 hours (see note 2)
Channel Move Time	10 s
Channel Closing Transmission Time	1 s
Non-Occupancy Period	30 minutes
NOTE 1: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the *Channel Availability Check Time* shall be 10 minutes. NOTE 2: For channels whose nominal bandwidth falls completely or partly within the band 5 600 MHz to 5 650 MHz, the *Off-Channel CAC Time* shall be within the range 1 hour to 24 hours.	

Table D.2: Radar Detection Threshold Levels

e.i.r.p. Spectral Density (dBm/MHz)	Value (see note 1 and note 2)
10	-62 dBm
NOTE 1: This is the level at the input of the receiver of an RLAN device with a maximum e.i.r.p. density of 10 dBm/MHz and assuming a 0 dBi receive antenna. For devices employing different e.i.r.p. spectral density and/or a different receive antenna gain G (dBi) the Radar Detection Threshold Level at the receiver input follows the following relationship: DFS Detection Threshold (dBm) = -62 + 10 - e.i.r.p. Spectral Density (dBm/MHz) + G (dBi); however the Radar Detection Threshold Level shall not be less than -64 dBm assuming a 0 dBi receive antenna gain. NOTE 2: Slave devices with a maximum e.i.r.p. of less than 23 dBm do not have to implement radar detection unless these devices are used in fixed outdoor point to point or fixed outdoor point to multipoint applications (see clause 4.2.6.1.3).	

Table D.3: Parameters of the reference DFS test signal

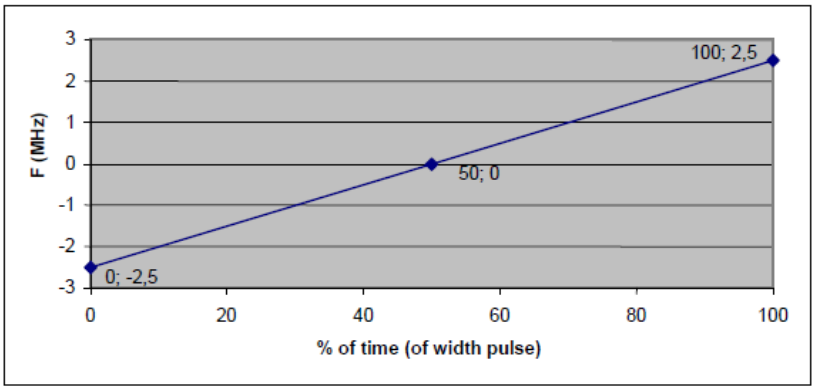
Pulse width W (µs)	Pulse repetition frequency PRF (PPS)	Pulses per burst (PPB)
1	700	18

Table D.4: Parameters of radar test signals

Radar test signal # (see notes 1 to 3)	Pulse width W [µs]		Pulse repetition frequency PRF (PPS)		Number of different PRFs	Pulses per burst for each PRF (PPB) (see note 5)
	Min	Max	Min	Max		
1	0,5	5	200	1 000	1	10 (see note 6)
2	0,5	15	200	1 600	1	15 (see note 6)
3	0,5	15	2 300	4 000	1	25
4	20	30	2 000	4 000	1	20
5	0,5	2	300	400	2/3	10 (see note 6)
6	0,5	2	400	1 200	2/3	15 (see note 6)

NOTE 1: Radar test signals 1 to 4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal 4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a ±2,5 MHz frequency deviation which is described below.



NOTE 3: Radar test signals 5 and 6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal 5, the difference between the PRF values chosen shall be between 20 PPS and 50 PPS. For radar test signal 6, the difference between the PRF values chosen shall be between 80 PPS and 400 PPS. See figure D.3.

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figures D.1, D.3 and D.4.
For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figures D.2 and D.5. See also clauses 4.7.2.2, 5.3.8.2.1.3.1 and 5.3.8.2.1.3.2.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.

NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.

Table D.5: Detection probability

Parameter	Detection Probability (P_d)	
	Channels whose nominal bandwidth falls partly or completely within the 5 600 MHz to 5 650 MHz band	Other channels
CAC, Off-Channel CAC	99,99 %	60 %
In-Service Monitoring	60 %	60 %

NOTE: P_d gives the probability of detection per simulated radar burst and represents a minimum level of detection performance under defined conditions. Therefore P_d does not represent the overall detection probability for any particular radar under real life conditions.

Test set-ups

Set-up A

Set-up A is a set-up whereby the UUT is an RLAN device operating in master mode. Radar test signals are injected into the UUT. This set-up also contains an RLAN device operating in slave mode which is associated with the UUT.

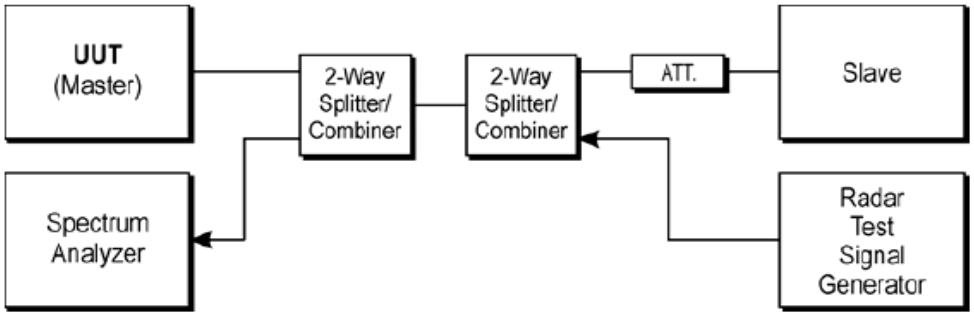


Figure 4: Set-up A

Set-up B

Set-up B is a set-up whereby the UUT is an RLAN device operating in slave mode, with or without Radar Interference Detection function. This set-up also contains an RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device) is associated with the master device.

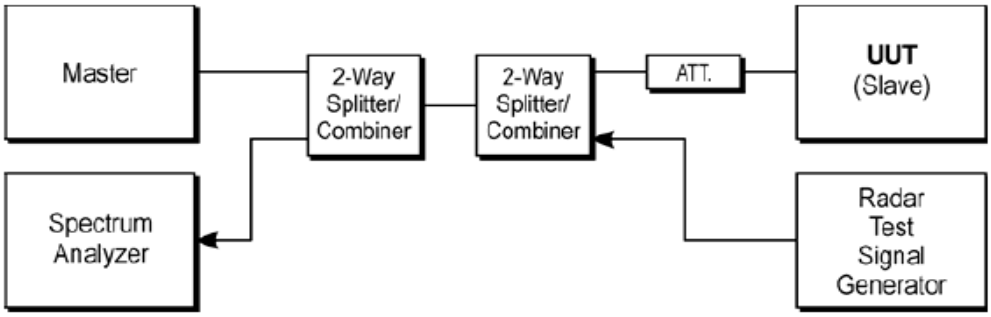


Figure 5: Set-up B

Set-up C

The UUT is an RLAN device operating in slave mode with Radar Interference Detection function. Radar test signals are injected into the slave device. This set-up also contains an RLAN device operating in master mode. The UUT (slave device) is associated with the master device.

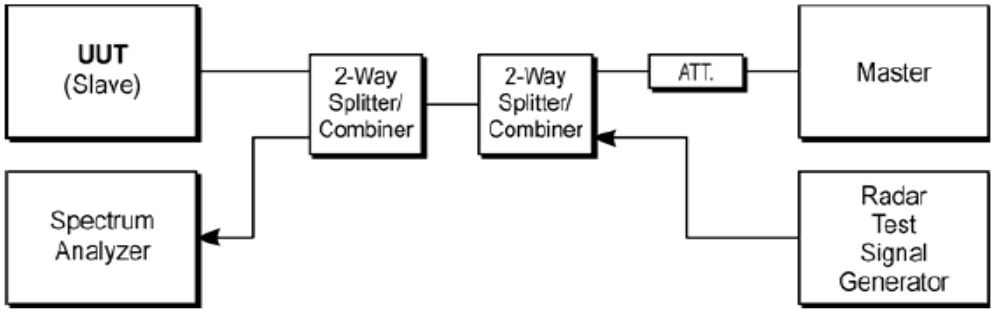


Figure 6: Set-up C

3.6.1 Channel Shutdown

Limit

The Channel Move Time shall not exceed the limit defined in table D.1. The Channel Closing Transmission Time shall not exceed the limit defined in table D.1.

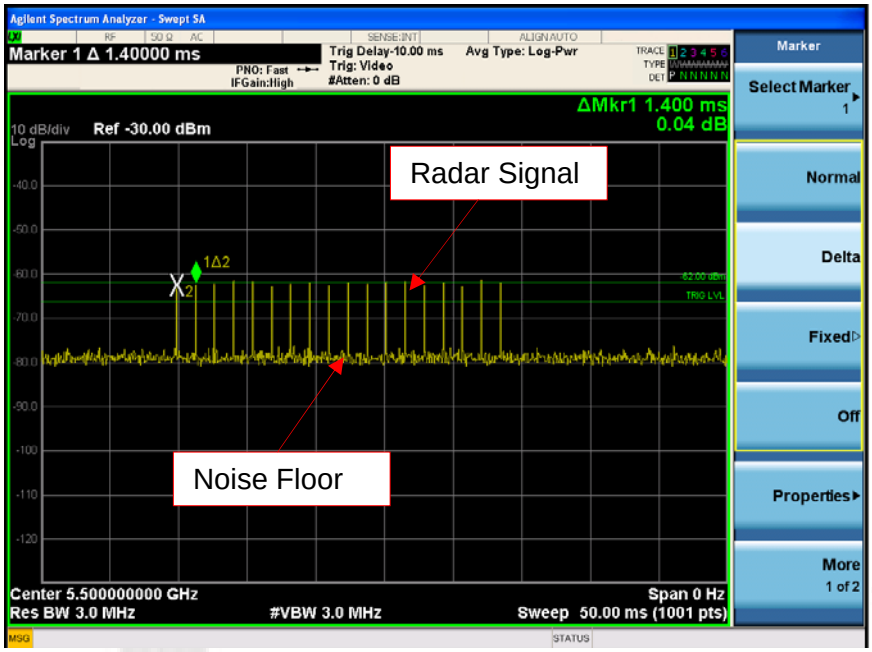
The Non-Occupancy Period shall not be less than the value defined in table D.1.

Test Procedure

1. The measurement procedure follows ETSI EN 300 389 (V1.8.1) Sub-clause 5.3.8.2.1.5
2. The measurement shall only be performed at normal test conditions.
3. One channel out of the declared channels for sub-band 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz. If more than one nominal channel bandwidth has been declared for this sub-band, testing shall be performed using the lowest and highest nominal channel bandwidth.

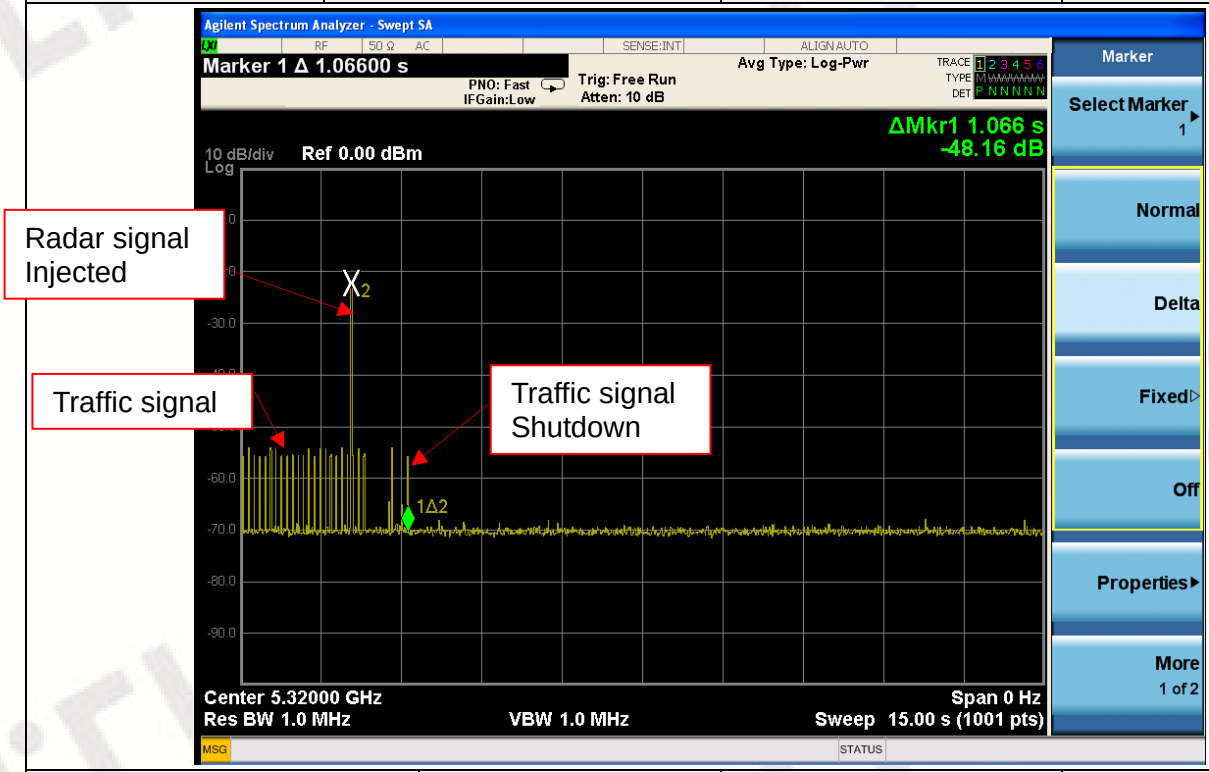
Test Results

Remark: We test all test mode, and recorded the worst case at 802.11ac mode.



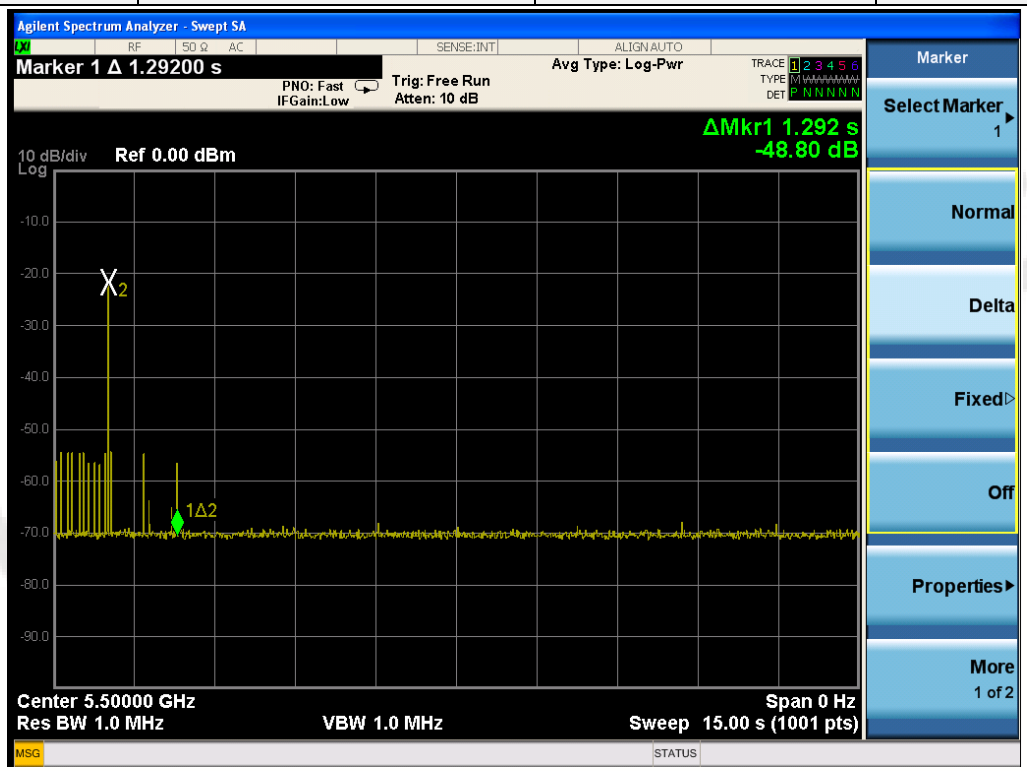
Reference DFS test signal

Mode:	802.11ac (20MHz)	Channel:	64



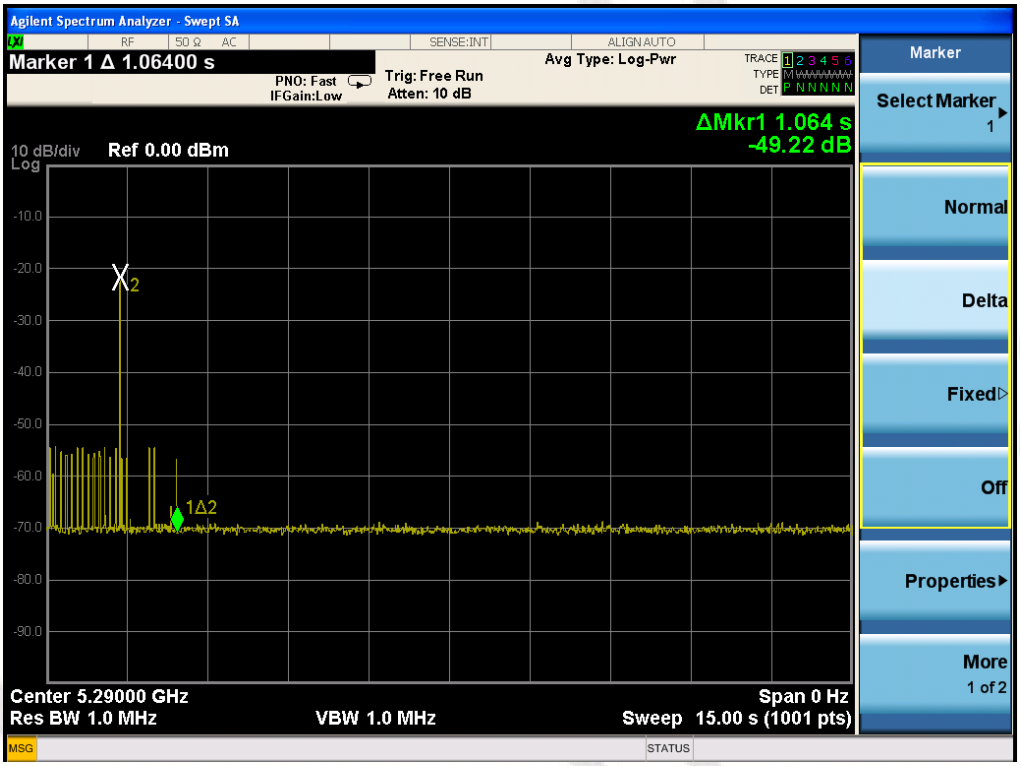
Channel Move Time:	1.066s	Result:	Pass
Transmission Close Time:	397ms		

Mode:	802.11ac (20MHz)	Channel:	100



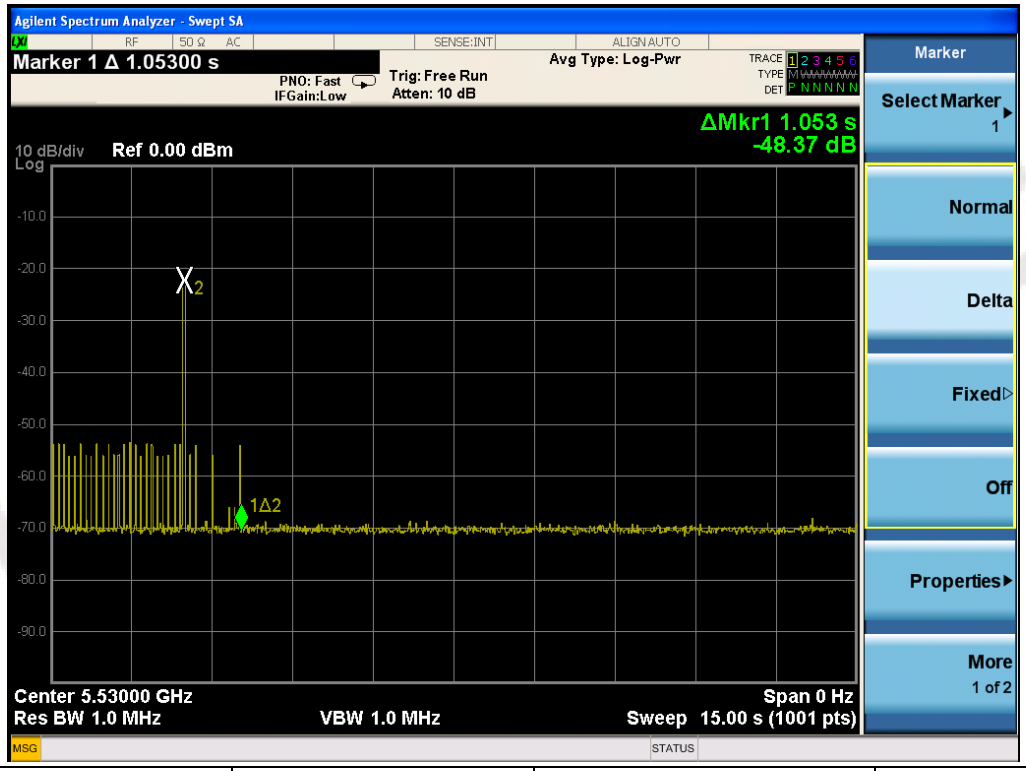
Channel Move Time:	1.292s	Result:	Pass
Transmission Close Time:	96ms		

Mode:	802.11ac (80MHz)	Channel:	58



Channel Move Time:	1.064s	Result:	Pass
Transmission Close Time:	108ms		

Mode:	802.11ac (80MHz)	Channel:	106



Channel Move Time:	1.053s	Result:	Pass
Transmission Close Time:	188ms		

3.7 Adaptivity

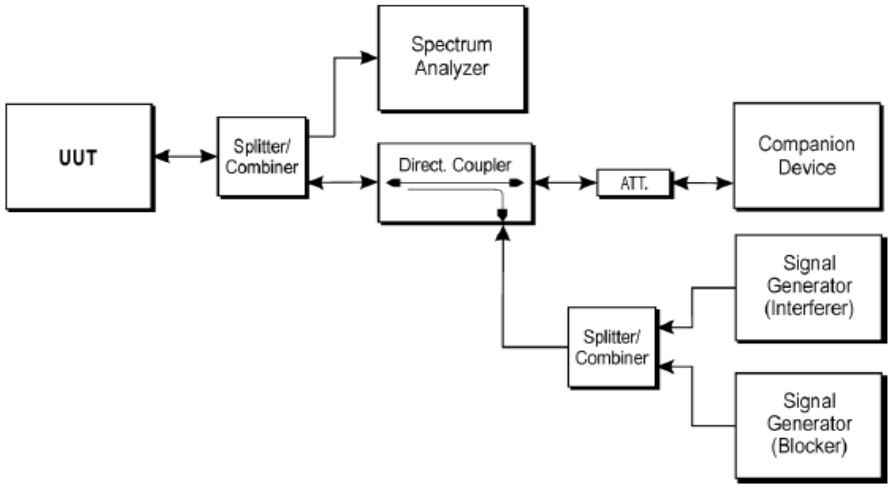
Requirements and limits

When interference signal detected by relevant channel access mechanism UUT used. The UUT should stops transmissions on the current operating channel, apart from Short Control Signaling Transmissions with a maximum duty cycle of 5 % within an observation period of 50 ms,

Test Procedure

1. The measurement procedure follows the clause 5.3.9.2.1 of the ETSI EN 300 893 V1.8.1 (2015-03).
2. The inference signal used shall be a band limited noise signal with a 100 % duty cycle.
3. Testing shall be performed at one channel out of the declared channels for each sub-band and the highest nominal channel bandwidth.

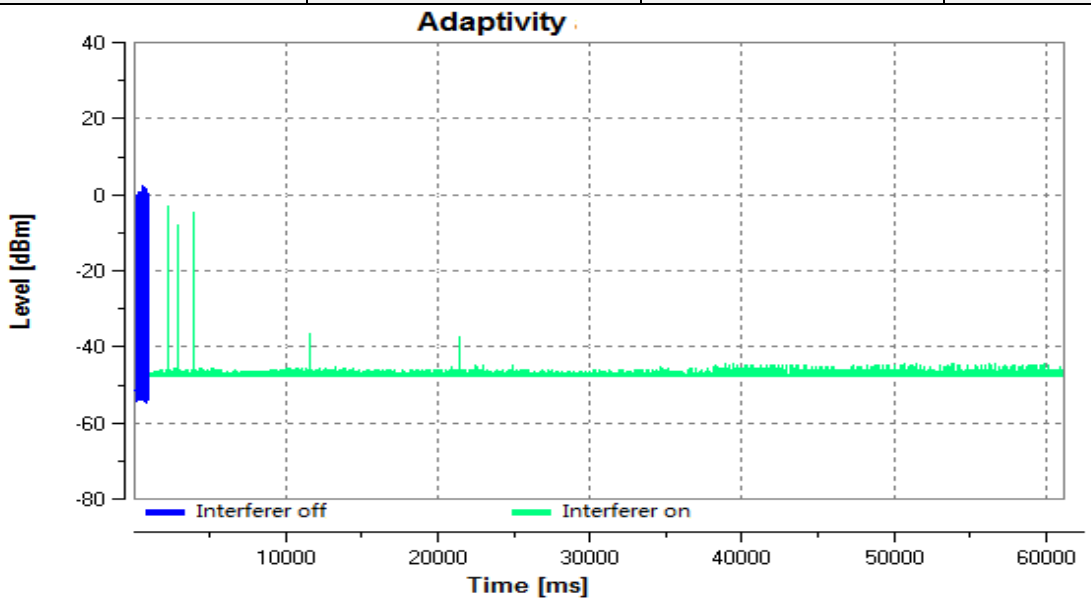
Test Configuration



Test Results

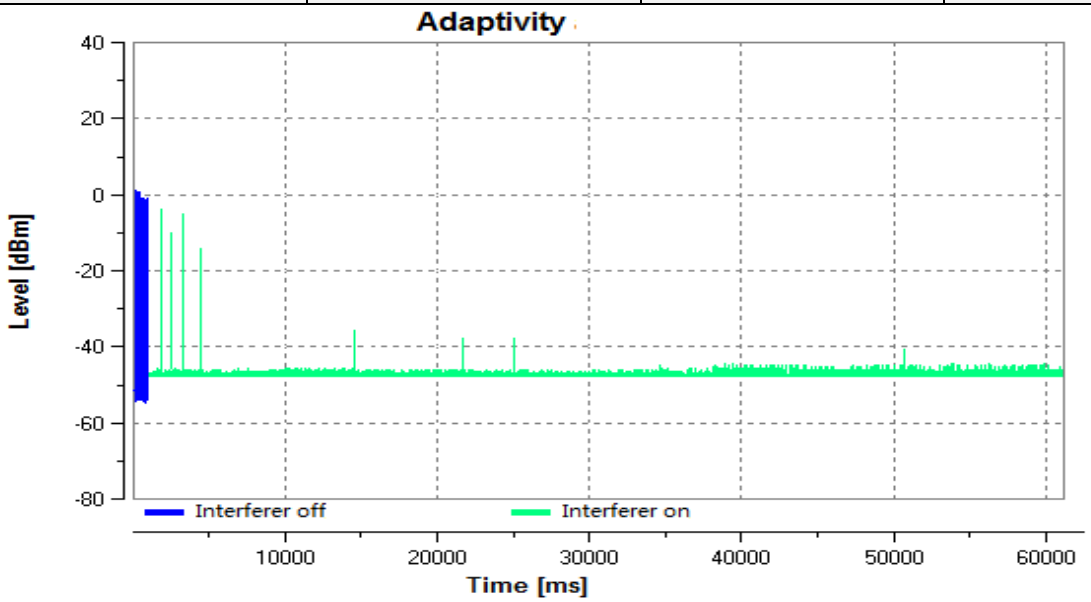
Remark: We test all test modes, and recorded the worst case at 802.11ac80 mode.

Mode:	802.11ac80MHz	Channel:	5290



Step1	**Interferer signal**	COT (ms)	CCA Time(ms)	**Result**	**Comment**
	OFF	2.255	0.668	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Burst observation(ms)**		**Result**	**Comment**
	ON	1.547		PASS	Burst < 5 ms; Short Signaling ok

Mode:	802.11ac80MHz	Channel:	5530



Step1	**Interferer signal**	COT (ms)	CCA Time(ms)	**Result**	**Comment**
	OFF	2.188	0.713	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Burst observation(ms)**		**Result**	**Comment**
	ON	1.944		PASS	Burst < 5 ms; Short Signaling ok

3.8 Receiver Blocking

Limits

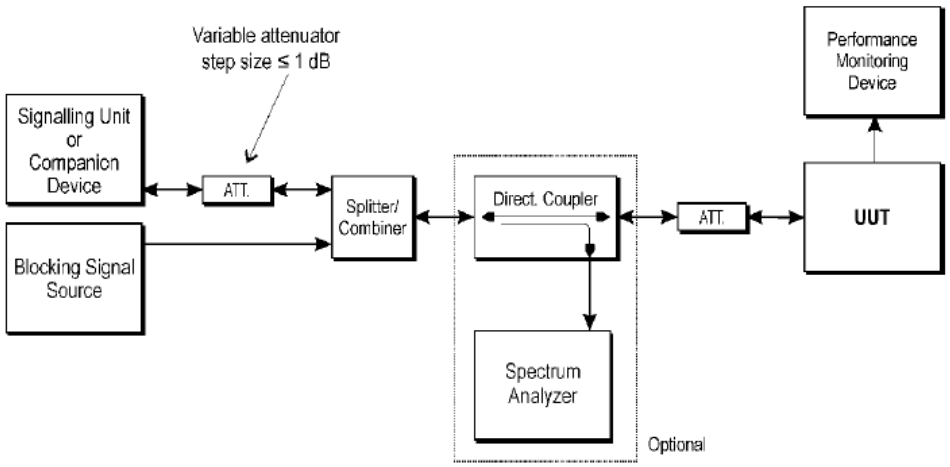
The minimum performance criterion shall be a PER of less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment

While maintaining the minimum performance criteria defined, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined in table below.

Receiver blocking parameters

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)		Type of blocking signal
		Master or Slave with radar detection (see table D.2, note 2)	Slave without radar detection (see table D.2, note 2)	
P_{min} + 6 dB	5 100	-53	-59	CW
P_{min} + 6 dB	4 900 5 000 5 975	-47	-53	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined clause 4.2.8.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.				

Test Configuration



Test Procedure

1. For systems using multiple receive chains only one chain need to be tested. All other receiver inputs shall be terminated.
2. The UUT shall be set to the first operating frequency to be tested (see clause 5.3.2)
3. The blocking signal generator is set to the first frequency as defined in table 9.
4. With the blocking signal generator switched off a communication link is set up between the UUT and the associated companion device using the test setup shown in figure 18. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.2.8.3 is still met. The resulting level for the wanted

signal at the input of the UUT is P_{min}.

This signal level (P_{min}) is increased by 6 dB resulting in a new level (P_{min} + 6 dB) of the wanted signal at the UUT receiver input.

5. The level of the blocking signal at the UUT input is set to the level provided in table 9. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.2.8.3 are met.

   If the performance criteria as specified in clause 4.2.8.3 are met, the level of the blocking signal at the UUT may be further increased (e.g. in steps of 1 dB) until the level whereby the performance criteria as specified in clause 4.2.8.3 are no longer met. The highest level at which the performance criteria are met is recorded in the test report.
6. Repeat step 5 for each remaining combination of frequency and level as specified in table 9.
7. Repeat step 3 to step 6 with the UUT operating at the other operating frequencies at which the blocking test has to be performed. See clause 5.3.2.

Test result

Remark:

1. *The test performed with the combination of the smallest channel bandwidth and the lowest data rate at 802.11a mode according to clause 5.4.10.1 of ETSI EN 301 893 V2.1.1*
2. *With the blocking signal generator switched off, adjust variable attenuator value by 1dB until to communication once cannot maintains. Then replace EUT by a power sensor, measure the power and recorded as $P_{min.}$*

802.11a

Test Frequency (MHz)	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	PER
5180	P_{min} + 6dB	5100	-59	3%
	P_{min} + 6dB	4900	-53	2%
		5000		4%
		5975		3%
5500	P_{min} + 6dB	5100	-59	4%
	P_{min} + 6dB	4900	-53	3%
		5000		4%
		5975		5%

Note: P_{min}=-71dBm

3.9 User Access Restrictions

Requirement

The equipment shall be so constructed that settings (hardware and/or software) related to DFS shall not be accessible to the user if changing those settings result in the equipment no longer being compliant with the DFS requirements.

Method

Default country code is set in the factory and no UI is provided for modification;
There is no downloadable software provided by the manufacturer that can modify critical radio transmitter parameters. All critical parameters are programmed in OTP memory at the factory and cannot be modified or overridden by third parties.

4 EUT TEST PHOTOS

5 PHOTOS OF THE EUT

Please reference to the test report No.: CTL1906244051-WE

*************************THE END*************************