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FCC RADIO TEST REPORT

Applicant's company	**ASUSTeK COMPUTER INC.**
Applicant Address	4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan
FCC ID	**MSQ-RTAC68UV2**
Manufacturer's company (1)	**Compal Networking (KunShan) Co., LTD.**
Manufacturer Address	No. 520, Nabbang Rd., Economic & Technical Development Zone Kunshan, Jiangsu Province China
Manufacturer's company (2)	**Askey Technology (Jiangsu) Ltd.**
Manufacturer Address	1388, Jiao Tong Road, Wujiang Economic Technological Development Area, Jiang Su Province, P.R.C

Product Name	Wireless-AC1900 Dual Band Gigabit Router
Brand Name	ASUS
Model No.	RT-AC68U, RT-AC68R, RT-AC68W, RT-AC68P, TM-AC1900, RT-AC1900, RT-AC68U V2, RT-AC1900P
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5725 ~ 5850 MHz
Received Date	Apr. 09, 2016
Final Test Date	Apr. 26, 2016
Submission Type	Class II Change

Statement

Test result included is for the IEEE 802.11n and IEEE 802.11a/ac of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013**, **47 CFR FCC Part 15 Subpart E, KDB789033 D02 v01r02, KDB662911 D01 v02r01, KDB644545 D03 v01, ET Docket No. 13–49; FCC 16–24.**

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3D0426-09	Rev. 01	Initial issue of report	Apr. 29, 2016

1. VERIFICATION OF COMPLIANCE

Product Name	:	Wireless-AC1900 Dual Band Gigabit Router
Brand Name	:	ASUS
Model No.	:	RT-AC68U, RT-AC68R, RT-AC68W, RT-AC68P, TM-AC1900, RT-AC1900, RT-AC68U V2, RT-AC1900P
Applicant	:	ASUSTeK COMPUTER INC.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Apr. 09, 2016 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart E				
Part	**Rule Section**	**Description of Test**	**Result**	**Under Limit**
4.1	15.407(a)	26dB Spectrum Bandwidth and 99% Occupied Bandwidth	Complies	-
4.2	15.407(e)	6dB Spectrum Bandwidth	Complies	-
4.3	15.407(a)	Maximum Conducted Output Power	Complies	1.08 dB
4.4	15.407(a)	Power Spectral Density	Complies	14.80 dB
4.5	15.407(b)	Radiated Emissions	Complies	6.22 dB
4.6	15.407(b)	Radiated Emissions In Non-restricted Frequency Bands	Complies	-
4.7	15.407(g)	Frequency Stability	Complies	-
4.8	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	WLAN (3TX, 3RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	IEEE 802.11a: OFDM IEEE 802.11n/ac: see the below table
Data Modulation	IEEE 802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) IEEE 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	IEEE 802.11a: OFDM (6/9/12/18/24/36/48/54) IEEE 802.11n/ac: see the below table
Frequency Range	5725 ~ 5850 MHz
Channel Number	5 for 20MHz bandwidth ; 2 for 40MHz bandwidth ; 1 for 80MHz bandwidth
Channel Band Width (99%)	For non-beamforming function: IEEE 802.11a: 17.47 MHz IEEE 802.11ac MCS0/Nss1 (VHT20): 18.23 MHz IEEE 802.11ac MCS0/Nss1 (VHT40): 37.92 MHz IEEE 802.11ac MCS0/Nss1 (VHT80): 76.70 MHz For beamforming function: IEEE 802.11ac MCS0/Nss1 (VHT20): 17.97 MHz IEEE 802.11ac MCS0/Nss1 (VHT40): 36.76 MHz IEEE 802.11ac MCS0/Nss1 (VHT80): 75.83 MHz
Maximum Conducted Output Power	For non-beamforming function: IEEE 802.11a: 28.83 dBm IEEE 802.11ac MCS0/Nss1 (VHT20): 28.82 dBm IEEE 802.11ac MCS0/Nss1 (VHT40): 28.91 dBm IEEE 802.11ac MCS0/Nss1 (VHT80): 28.56 dBm For beamforming function: IEEE 802.11ac MCS0/Nss1 (VHT20): 26.19 dBm IEEE 802.11ac MCS0/Nss1 (VHT40): 26.21 dBm IEEE 802.11ac MCS0/Nss1 (VHT80): 26.05 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Communication Mode	☒ IP Based (Load Based)	☐ Frame Based
Beamforming Function	☒ With beamforming	☐ Without beamforming
	The product has beamforming function for 802.11n/ac	
Operate Condition	☒ Indoor	☐ Outdoor

Antenna and Band width

Antenna	Three (TX)		
Band width Mode	20 MHz	40 MHz	80 MHz
IEEE 802.11a	V	X	X
IEEE 802.11n	V	V	X
IEEE 802.11ac	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	3	MCS 0-23
802.11n (HT40)	3	MCS 0-23
802.11ac (VHT20)	3	MCS 0-9/Nss1-3
802.11ac (VHT40)	3	MCS 0-9/Nss1-3
802.11ac (VHT80)	3	MCS 0-9/Nss1-3

Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT supports HT20 and HT40.

Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT supports VHT20, VHT40 and VHT80.

Note 3: Modulation modes consist of below configuration:
HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac

3.2. Accessories

Power	Brand	Model	Rating
Adapter 1	PIE	AD890326	Input: 100-240V ~ 50/60Hz 0.8A Output: 19V, 1.75A
Adapter 2	Delta	ADP-33AW B	Input: 100-240V ~ 1A 50-60Hz Output: 19V, 1.75A
Other			
RJ-45 cable*1: Shielded, 1.5m			

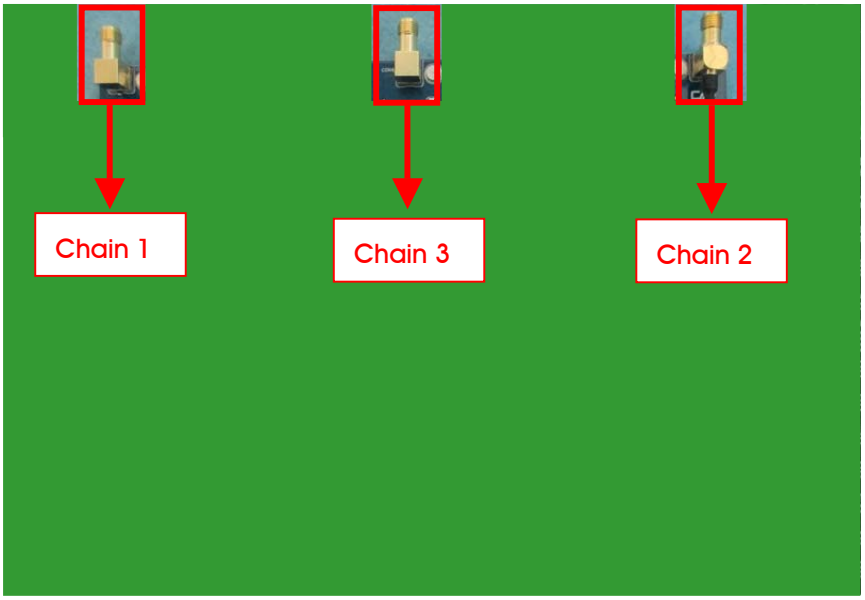
3.3. Table for Filed Antenna

Set	Brand	P/N	Antenna Type	Connector	Gain (dBi)		
					2.4GHz	5GHz Band 1	5GHz Band 4
1	PSA	RFDPA141000SBLB802	Dipole Antenna	Reverse SMA	1.91	4.04	3.94
2	M.gear	C660-510333-A	Dipole Antenna	Reverse SMA	1.51	2.76	3.29
3	PSA	RFDPA161300SBLB803	Dipole Antenna	Reverse SMA	1.61	2.63	3.47

Note: The EUT has three set of antenna and each set has three antennas.

Because above antenna are the same type antennas, only the higher gain antenna "Set 1" was tested.

Chain 1, Chain 2 and Chain 3 could transmit/receive simultaneously.



3.4. Table for Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 151, 159.

For 80MHz bandwidth systems, use Channel 155.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5725~5850 MHz Band 4	149	5745 MHz	157	5785 MHz
	151	5755 MHz	159	5795 MHz
	153	5765 MHz	161	5805 MHz
	155	5775 MHz	165	5825 MHz

3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode		Data Rate	Channel	Chain
Max. Conducted Output Power	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/157/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Power Spectral Density	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/157/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/157/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3

6dB Spectrum Bandwidth Measurement	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/157/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Radiated Emission Above 1GHz	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/157/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Radiated Emissions in non-restricted frequency bands	For non-beamforming function:				
	11a/BPSK	Band 4	6Mbps	149/165	1+2+3
	11ac VHT20	Band 4	MCS0/Nss1	149/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
	For beamforming function:				
	11ac VHT20	Band 4	MCS0/Nss1	149/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Frequency Stability	20 MHz	Band 4	-	157	2
	40 MHz	Band 4	-	151	2
	80 MHz	Band 4	-	155	2

Note: 1. The EUT can only be used at Y axis position.

2.VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.

3.The EUT has non-beamforming function and beamforming function for 802.11n/ac. They were verified for all tests, and all test results were recorded in the report.

3.6. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065				
FAX:	886-3-656-9085				
Test Site No.	**Site Category**	**Location**	**FCC Designation No.**	**IC File No.**	**VCCI Reg. No**
03CH01-CB	SAC	Hsin Chu	TW0006	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

3.7. Table for Multiple Listing

The EUT has eight model names, which are identical to each other in all aspects except for the following table:

Brand Name	Model Name	Description
ASUS	RT-AC68U	All the models are identical; the different model numbers served as marketing strategy.
	RT-AC68R	
	RT-AC68W	
	RT-AC68P	
	TM-AC1900	
	RT-AC1900	
	RT-AC68U V2	
	RT-AC1900P	

From the above models, model: RT-AC68U was selected as representative model for the test and its data was recorded in this report.

3.8. Table for SKU Information

SKU 3 information			
Vendor	**LAN port transformer (Model No.)**	**WAN port transformer (Model No.)**	**Spec**
NET SWAPN(FCE)	FCE_NS773602	FCE_NS771802	DIP 10/100/1000 BASE-T

3.9. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR3D0426-07

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Updating test rule of 5GHz band 4 to "15.407 (b)(4)(ii) of New Rules (ET Docket No. 13–49; FCC 16–24)" from "Old Rules".	1. 26dB Spectrum Bandwidth and 99% Occupied Bandwidth. 2. 6dB Spectrum Bandwidth. 3. Maximum Conducted Output Power. 4. Power Spectral Density. 5. Radiated Emission Above 1GHz 6. Radiated Emissions In Non-restricted Frequency Bands. 7. Frequency Stability.

3.10. Table for Supporting Units

For Test Site No: 03CH01-CB

For non-beamforming function:

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

For beamforming function:

Support Unit	Brand	Model	FCC ID
Notebook*2	DELL	E4300	DoC
WLAN module	Boardcom	BCM943162ZP	QDS-BRCM1075

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

3.11. Table for Parameters of Test Software Setting

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.

For non-beamforming function:

Test Software Version	Mtool 2.0.0.7		
Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	5745 MHz	5785 MHz	5825 MHz
802.11a	93	93	93
802.11ac MCS0/Nss1 VHT20	93	93	93
Mode	NCB: 40MHz		
802.11ac MCS0/Nss1 VHT40	5755 MHz	5795 MHz	
	91	93	
Mode	NCB: 80MHz		
802.11ac MCS0/Nss1 VHT80	5775 MHz		
	92		

For beamforming function:

Test Software Version	Mtool 2.0.0.7		
Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	5745 MHz	5785 MHz	5825 MHz
802.11ac MCS0/Nss1 VHT20	82	82	82
Mode	NCB: 40MHz		
802.11ac MCS0/Nss1 VHT40	5755 MHz	5795 MHz	
	81	81	
Mode	NCB: 80MHz		
802.11ac MCS0/Nss1 VHT80	5775 MHz		
	83		

3.12. EUT Operation during Test

For non-beamforming function:

The EUT was programmed to be in continuously transmitting mode.

For beamforming function:

For Conducted Mode:

The EUT was programmed to be in continuously transmitting mode.

For Radiated Mode:

During the test, the following programs under WIN XP were executed.

The program was executed as follows:

1. During the test, the EUT operation to normal function.
2. Executed command fixed test channel under DOS.
3. Executed "Lantest.exe" to link with the remote workstation to receive and transmit packet by WLAN module and transmit duty cycle no less 98%

3.13. Duty Cycle

For non-beamforming function:

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11a	2.060	2.100	98.10	0.08	0.01
802.11ac MCS0/Nss1 VHT20	1.930	1.960	98.47	0.07	0.01
802.11ac MCS0/Nss1 VHT40	0.950	0.985	96.45	0.16	1.05
802.11ac MCS0/Nss1 VHT80	0.441	0.493	89.45	0.48	2.27

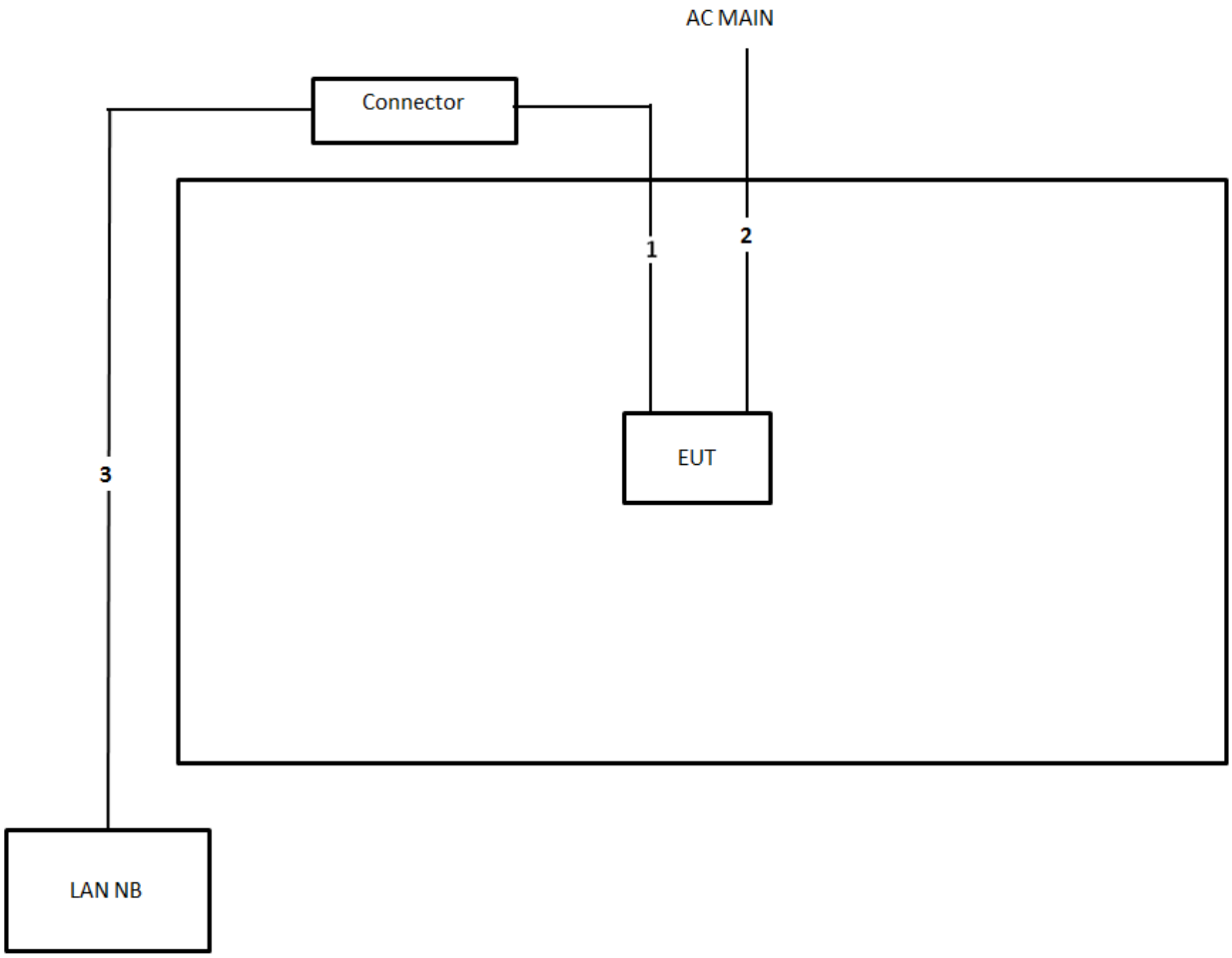
For beamforming function:

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11ac MCS0/Nss1 VHT20	3.725	4.230	88.06	0.55	0.27
802.11ac MCS0/Nss1 VHT40	3.653	4.038	90.47	0.44	0.27
802.11ac MCS0/Nss1 VHT80	5.052	5.482	92.15	0.36	0.20

3.14. Test Configurations

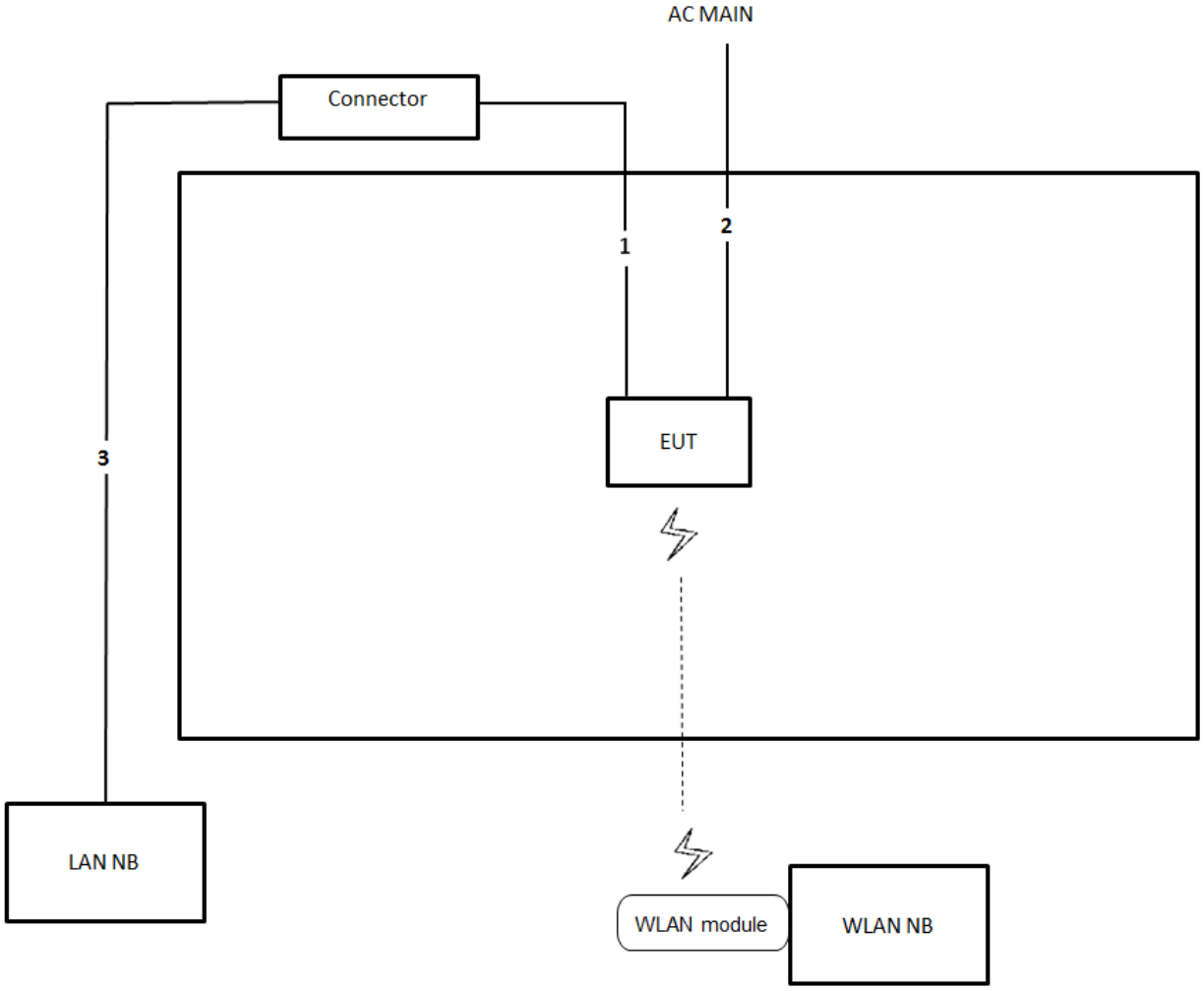
3.14.1. Radiation Emissions Test Configuration

For non-beamforming function:



Item	Connection	Shielded	Length
1	RJ-45 cable	Yes	1.5m
2	Power cable	No	2.2m
3	RJ-45 cable	Yes	10m

For beamforming function:



Item	Connection	Shielded	Length
1	RJ-45 cable	Yes	1.5m
2	Power cable	No	2.2m
3	RJ-45 cable	Yes	10m

4. TEST RESULT

4.1. 26dB Bandwidth and 99% Occupied Bandwidth Measurement

4.1.1. Limit

No restriction limits.

4.1.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

26dB Bandwidth	
Spectrum Parameters	**Setting**
Attenuation	Auto
Span Frequency	> 26dB Bandwidth
RBW	Approximately 1% of the emission bandwidth
VBW	VBW > RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	**Setting**
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold

4.1.3. Test Procedures

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Measure the maximum width of the emission that is 26 dB down from the peak 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%.

4.1.4. Test Setup Layout

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.1.5. Test Deviation

There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.1.7. Test Result of 26dB Bandwidth and 99% Occupied Bandwidth

Temperature	24°C	Humidity	61%
Test Engineer	Peter Wu	Test Function	Non-beamforming function

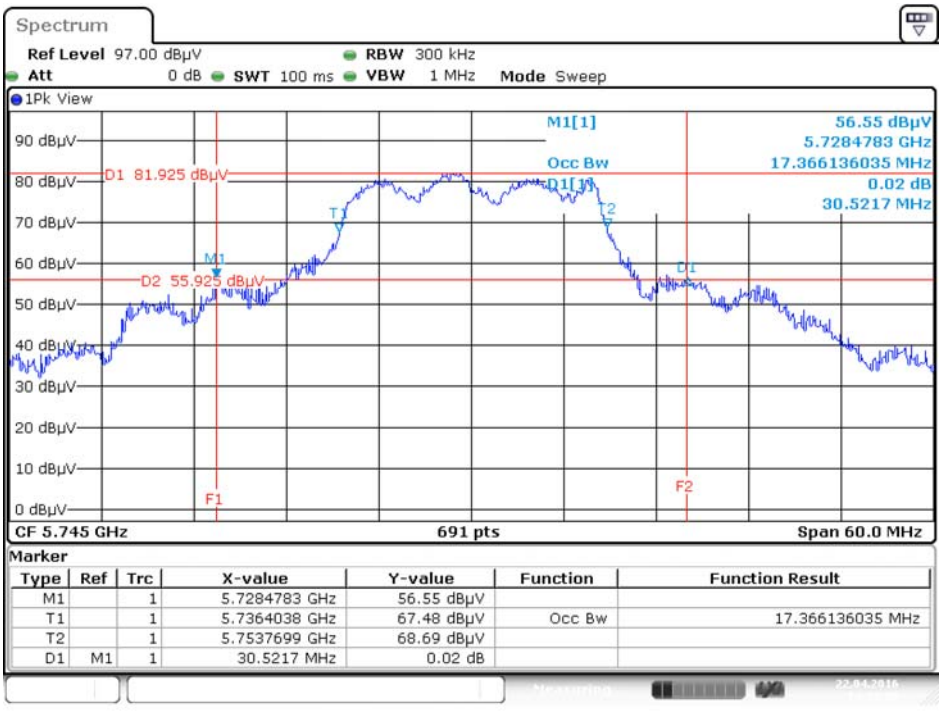
Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745 MHz	30.52	17.37
	5785 MHz	29.65	17.45
	5825 MHz	31.65	17.45
802.11ac MCS0/Nss1 VHT20	5745 MHz	32.87	17.97
	5785 MHz	36.87	18.15
	5825 MHz	36.09	18.23
802.11ac MCS0/Nss1 VHT40	5755 MHz	71.01	37.34
	5795 MHz	81.01	37.92
802.11ac MCS0/Nss1 VHT80	5775 MHz	132.46	76.70

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Function	Beamforming function

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11ac MCS0/Nss1 VHT20	5745 MHz	20.35	17.97
	5785 MHz	20.43	17.89
	5825 MHz	20.52	17.97
802.11ac MCS0/Nss1 VHT40	5755 MHz	40.58	36.76
	5795 MHz	45.94	36.76
802.11ac MCS0/Nss1 VHT80	5775 MHz	82.03	75.83

For non-beamforming function:

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



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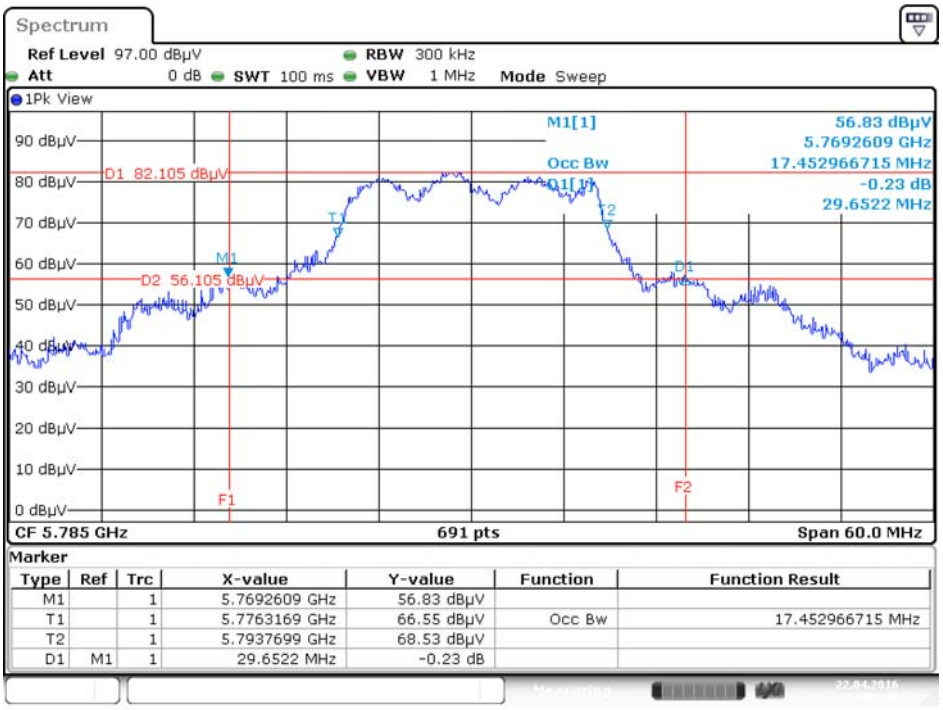
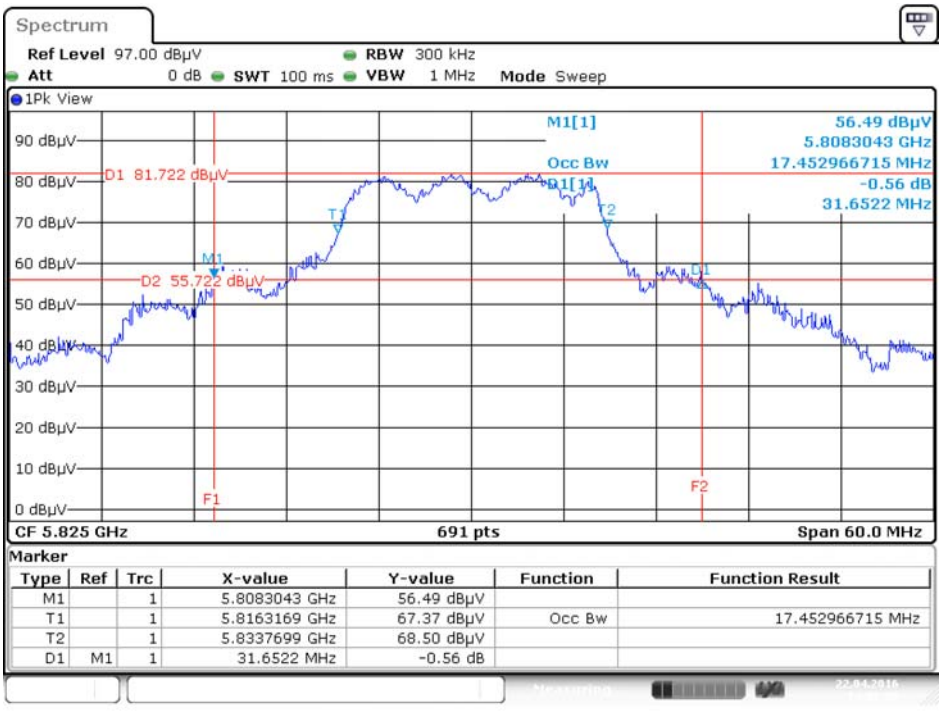
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



Date: 22.APR.2016 14:02:40

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



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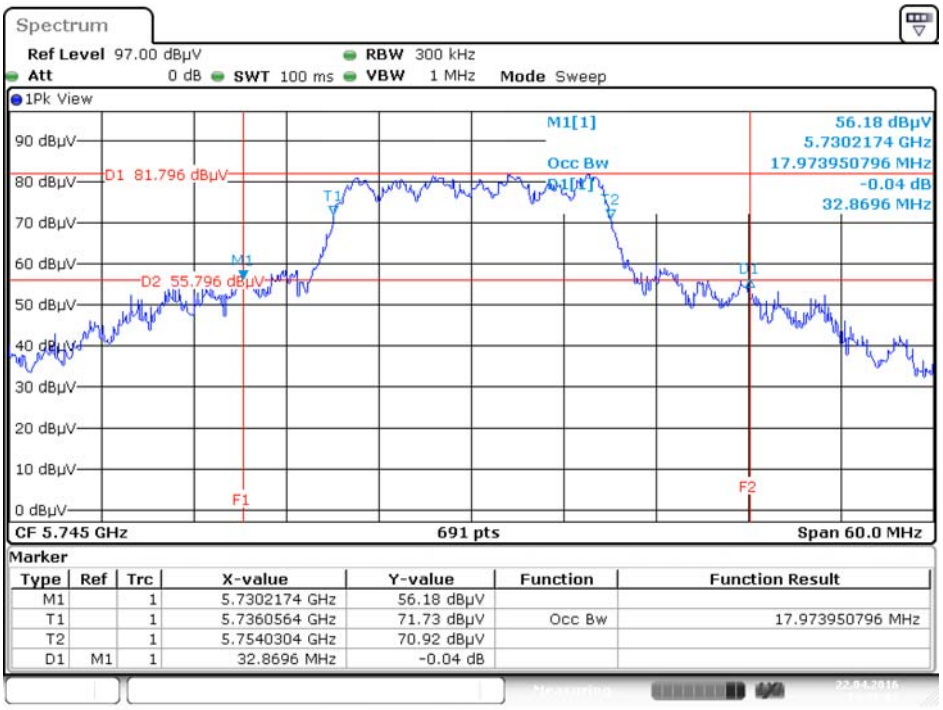
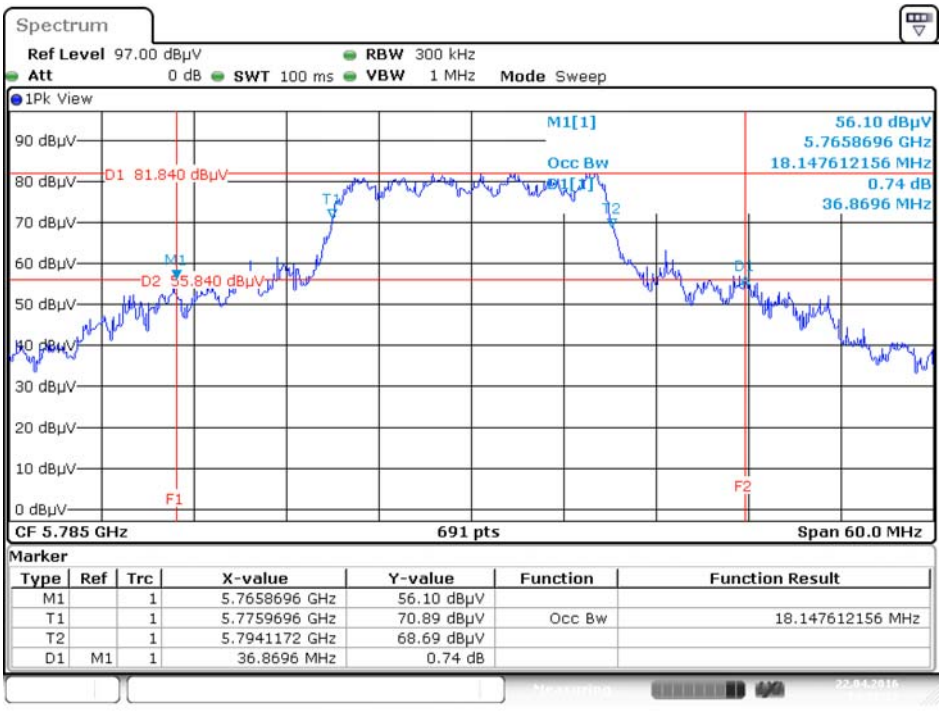
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



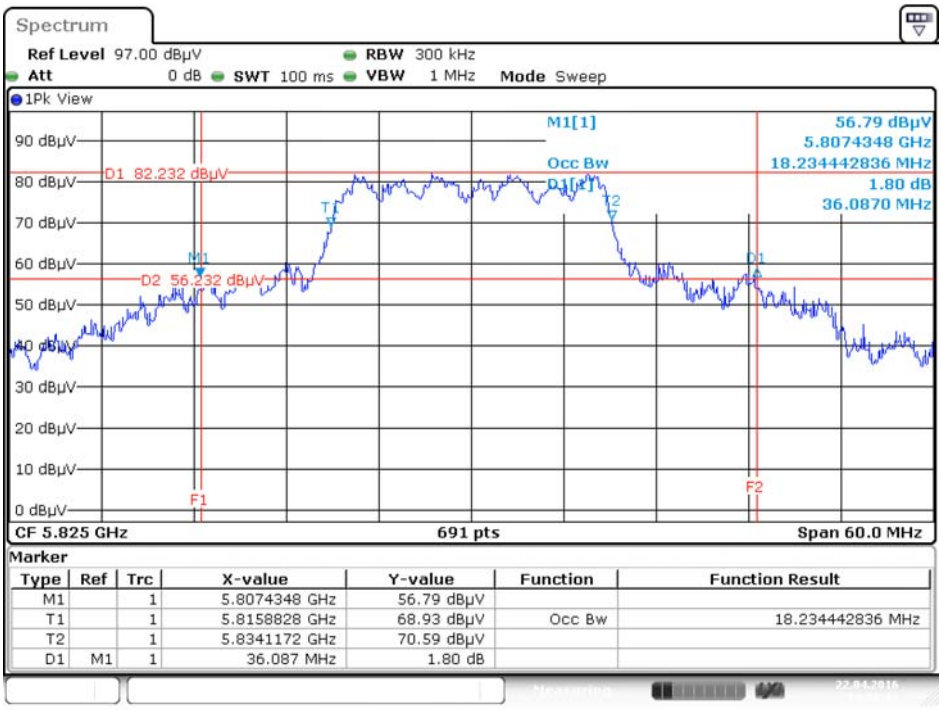
Date: 22.APR.2016 14:01:02

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



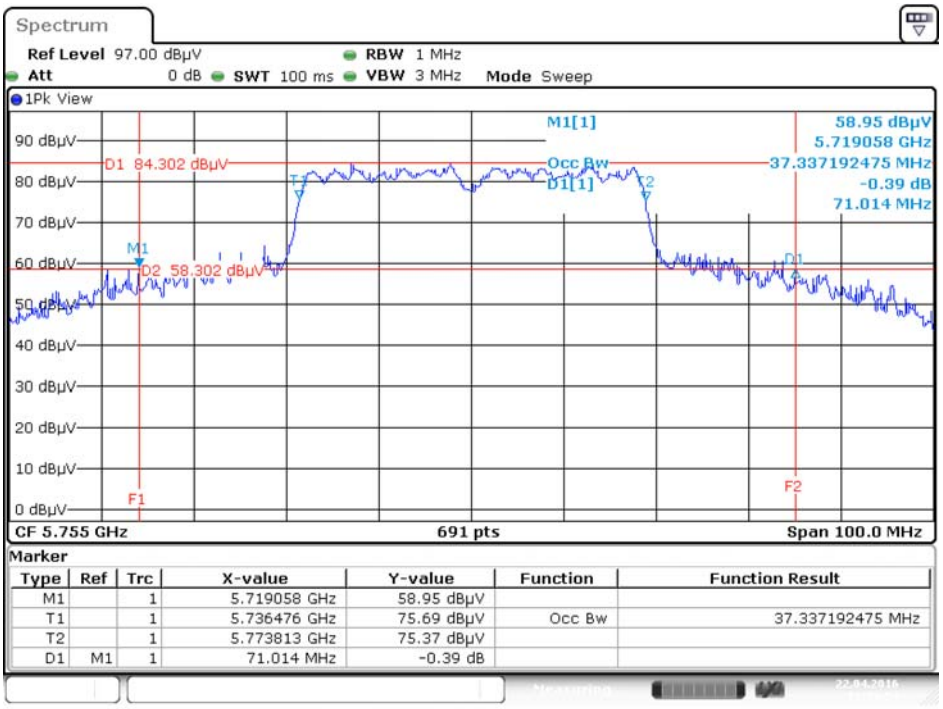
Date: 22.APR.2016 14:01:22

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



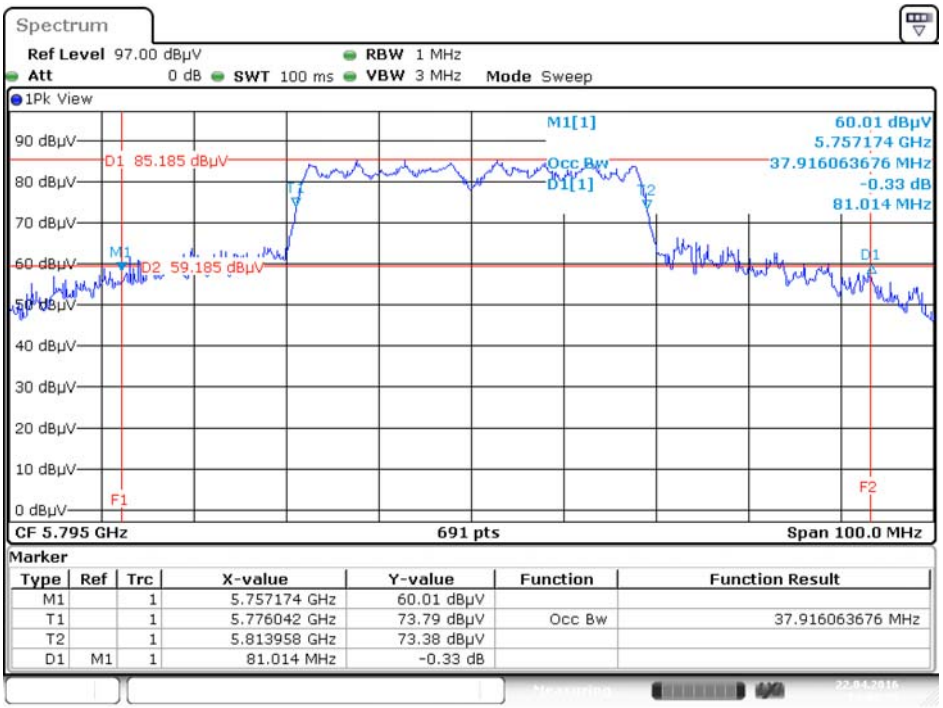
Date: 22.APR.2016 14:01:41

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



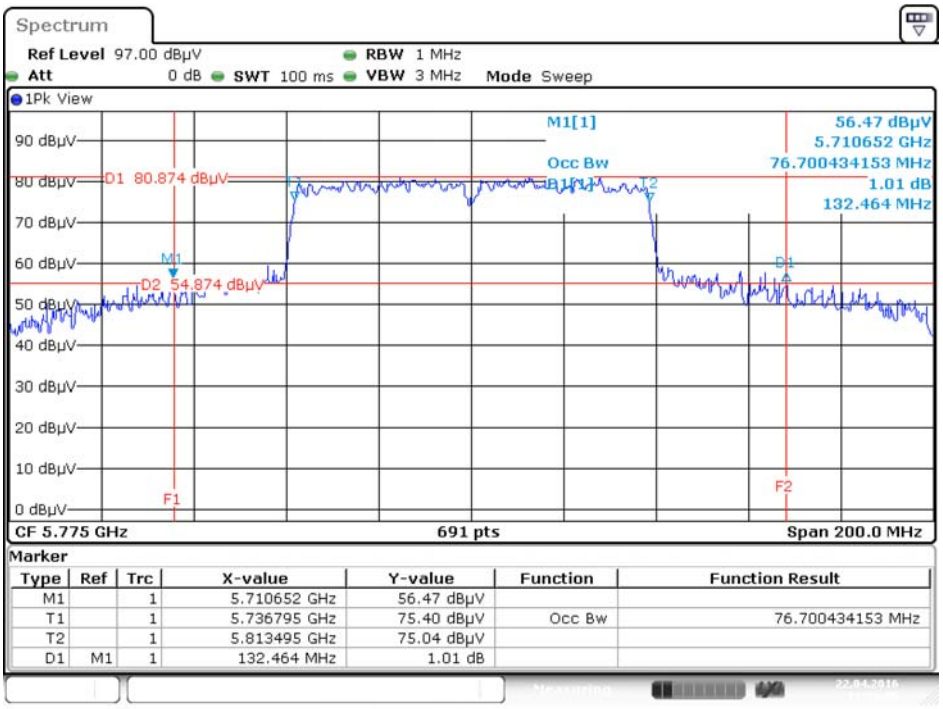
Date: 22.APR.2016 13:59:55

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5795 MHz



Date: 22.APR.2016 14:00:25

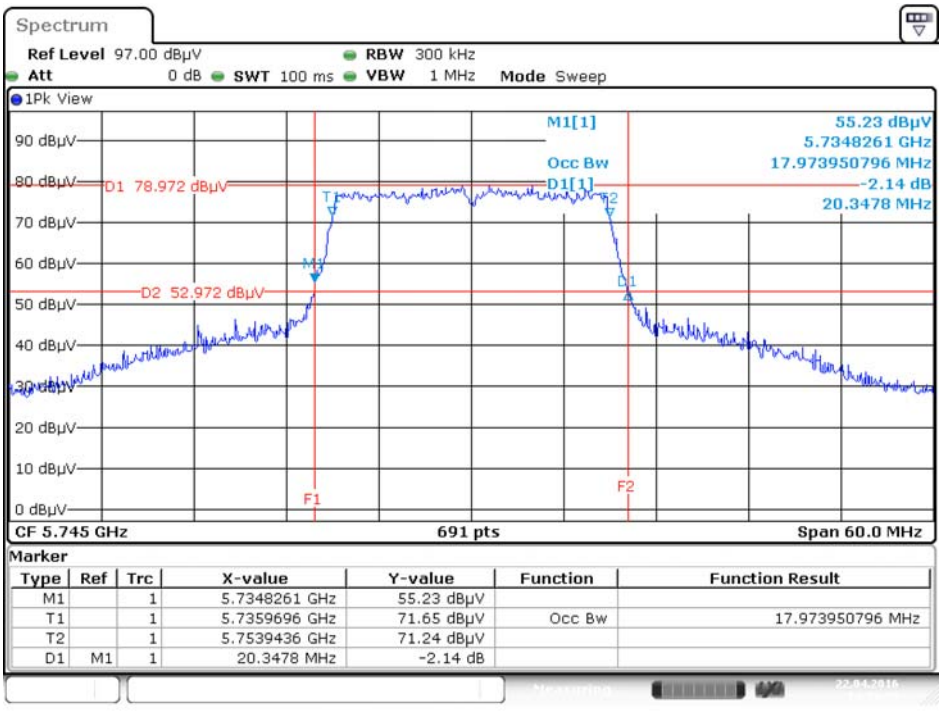
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 22.APR.2016 13:59:05

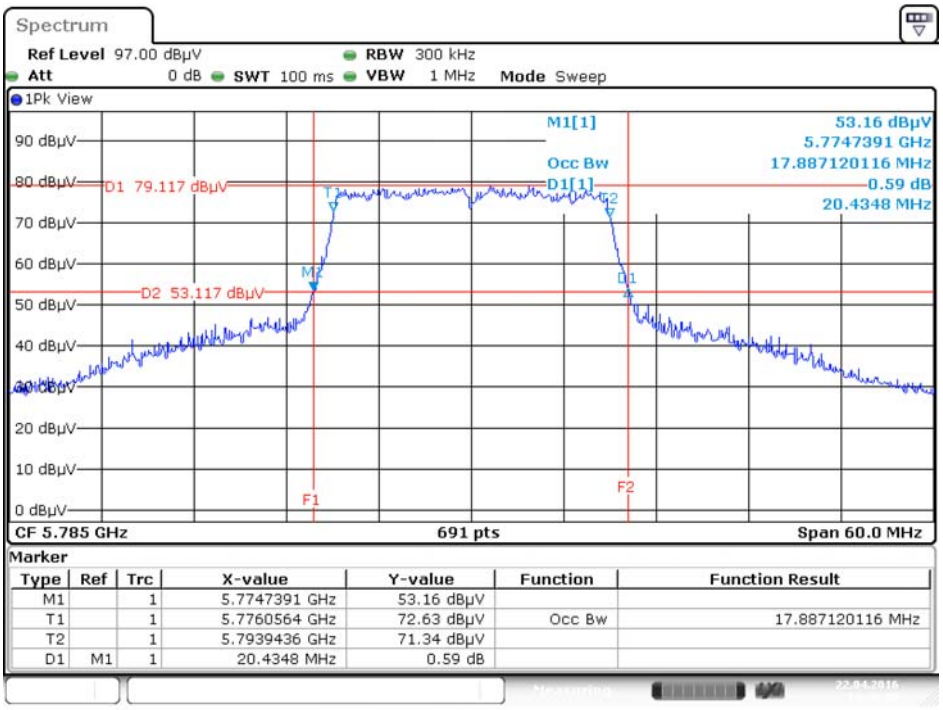
For beamforming function:

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



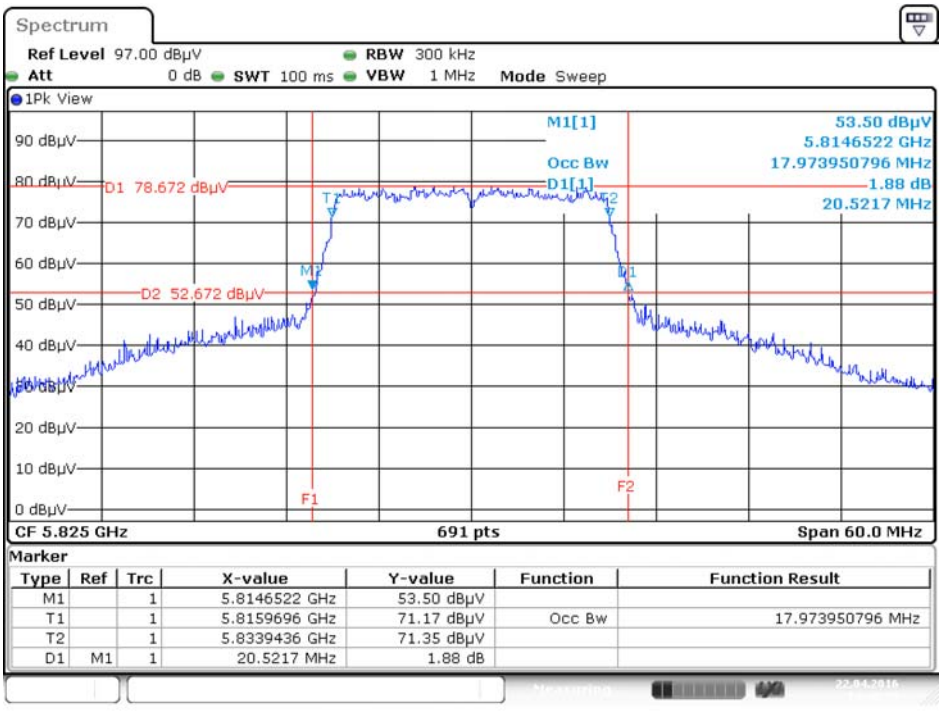
Date: 22.APR.2016 14:39:29

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



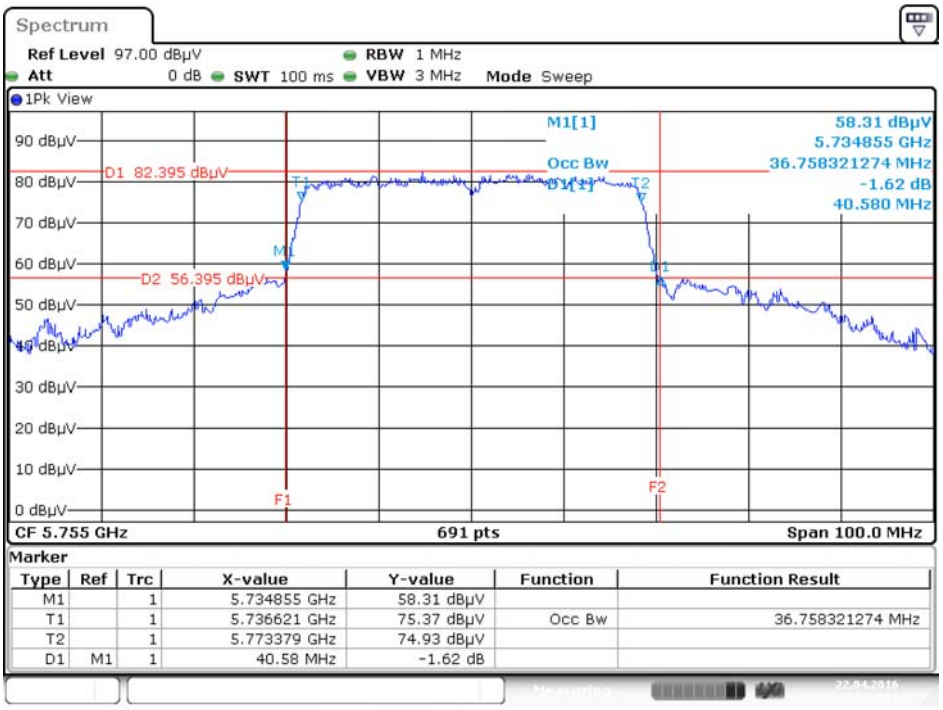
Date: 22.APR.2016 14:40:08

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



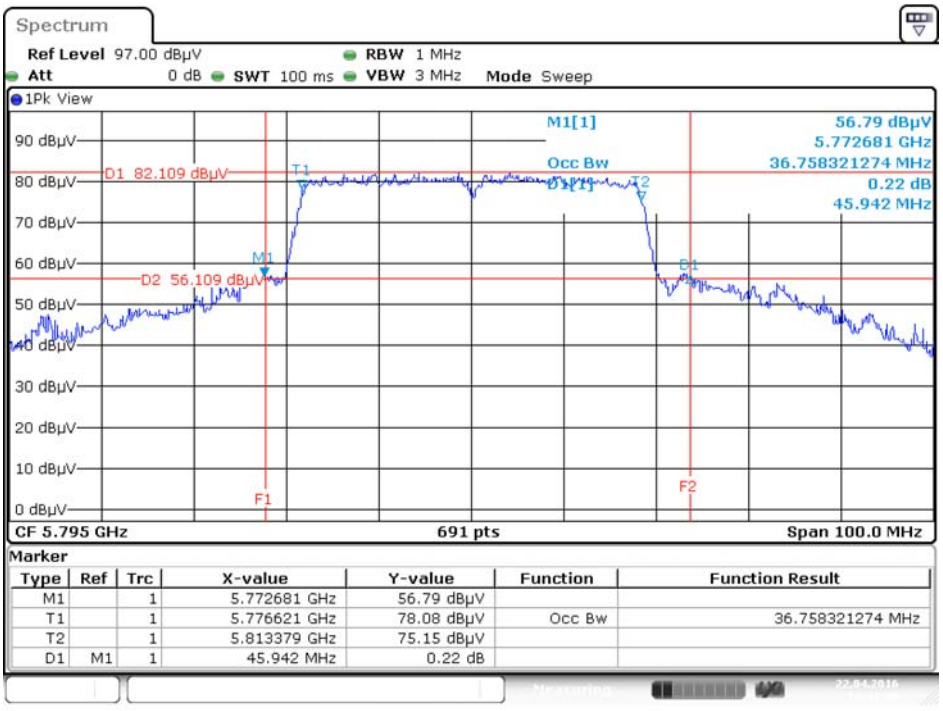
Date: 22.APR.2016 14:40:29

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



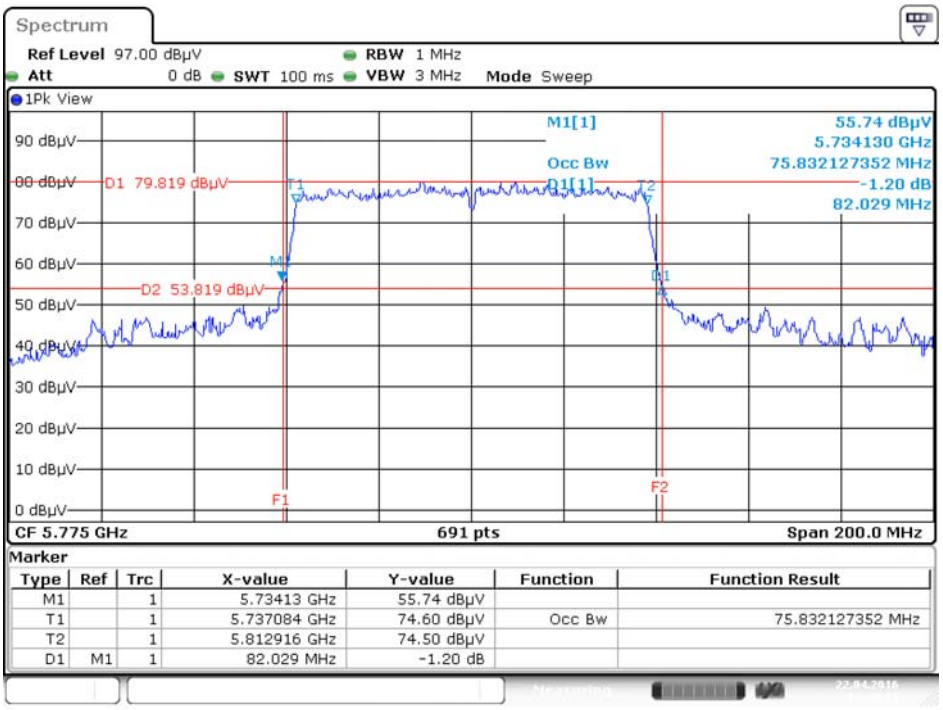
Date: 22.APR.2016 14:41:11

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5795 MHz



Date: 22.APR.2016 14:41:40

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 22.APR.2016 14:45:15

4.2. 6dB Spectrum Bandwidth Measurement

4.2.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

4.2.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

6dB Spectrum Bandwidth	
Spectrum Parameters	**Setting**
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.2.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (C) Emission Bandwidth.
3. Multiple antenna system was performed in accordance with KDB662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. Measured the spectrum width with power higher than 6dB below carrier.

4.2.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Test Result of 6dB Spectrum Bandwidth

Temperature	24°C	Humidity	61%
Test Engineer	Peter Wu	Test Function	Non-beamforming function

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	14.88	500	Complies
	5785 MHz	14.56	500	Complies
	5825 MHz	14.80	500	Complies
802.11ac MCS0/Nss1 VHT20	5745 MHz	17.28	500	Complies
	5785 MHz	17.28	500	Complies
	5825 MHz	17.60	500	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	35.68	500	Complies
	5795 MHz	35.84	500	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	74.80	500	Complies

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Function	Beamforming function

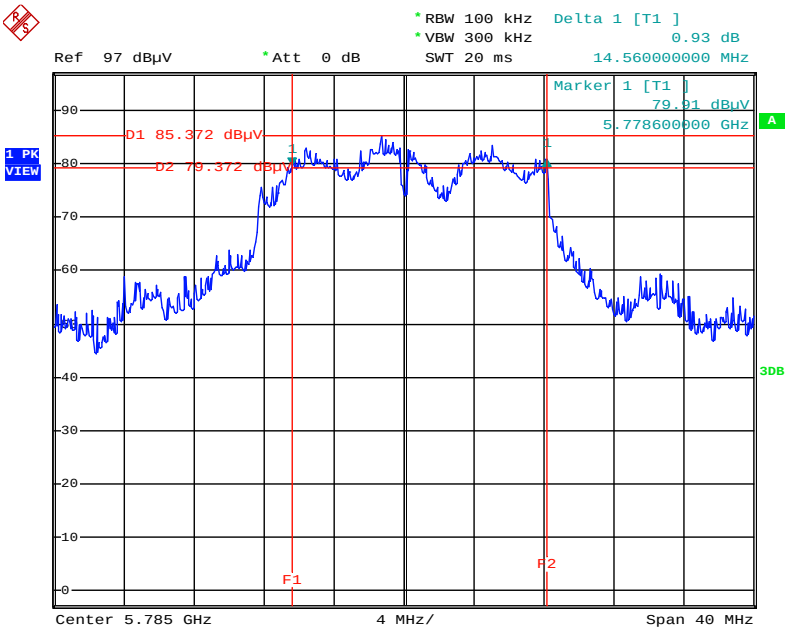
Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11ac MCS0/Nss1 VHT20	5745 MHz	17.60	500	Complies
	5785 MHz	17.60	500	Complies
	5825 MHz	17.60	500	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	36.48	500	Complies
	5795 MHz	36.48	500	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	74.80	500	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

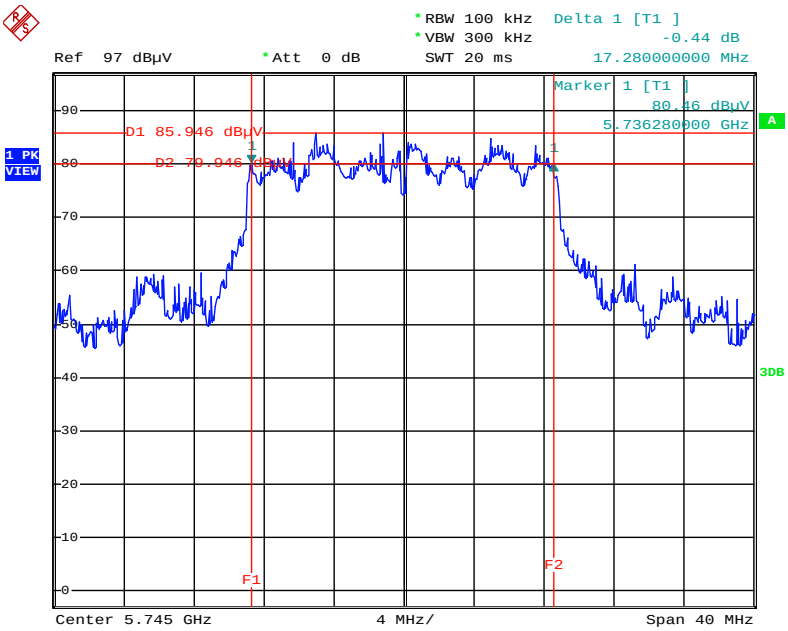
For non-beamforming function:

6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



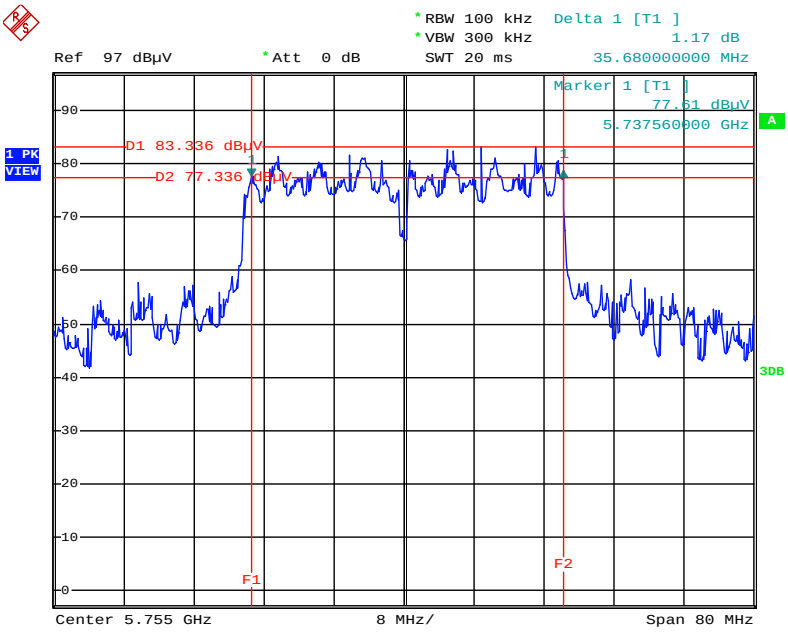
Date: 26.APR.2016 14:32:13

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



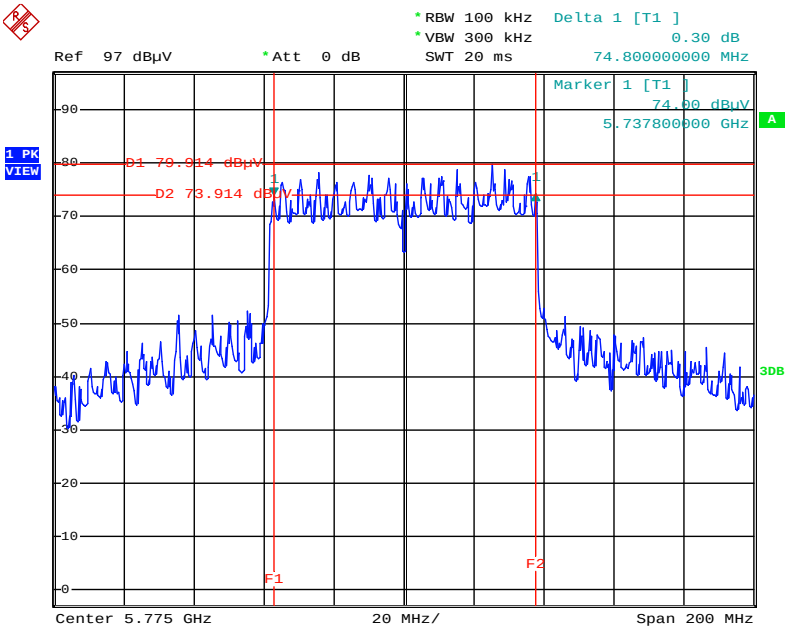
Date: 26.APR.2016 14:32:49

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



Date: 26.APR.2016 14:34:57

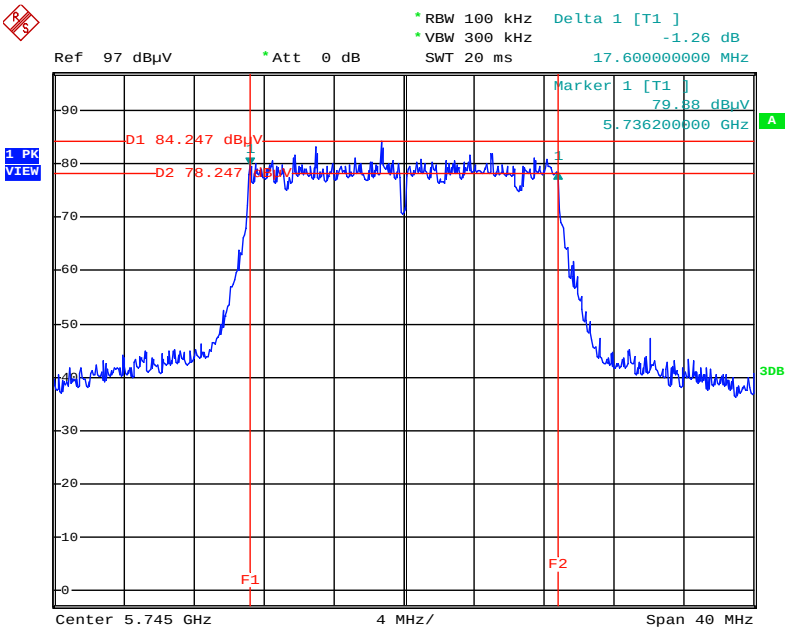
6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 26.APR.2016 14:39:01

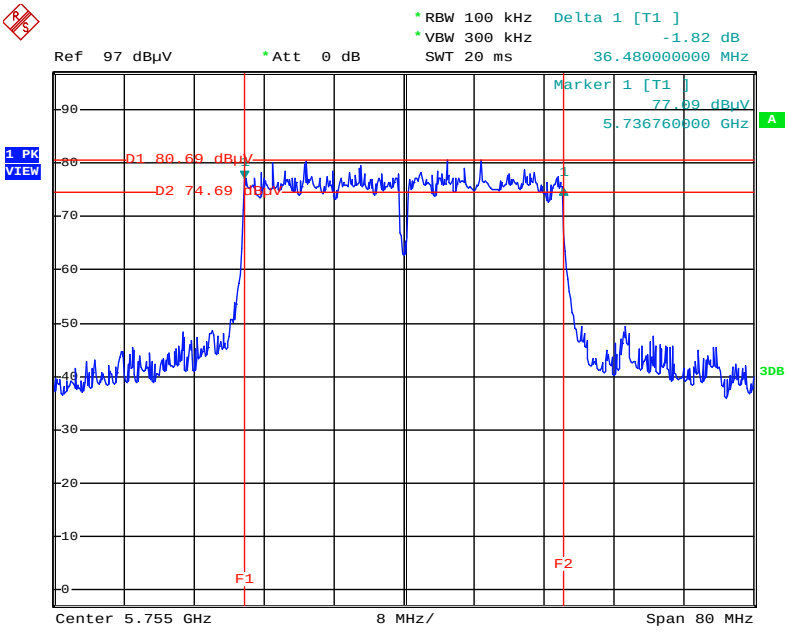
For beamforming function:

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



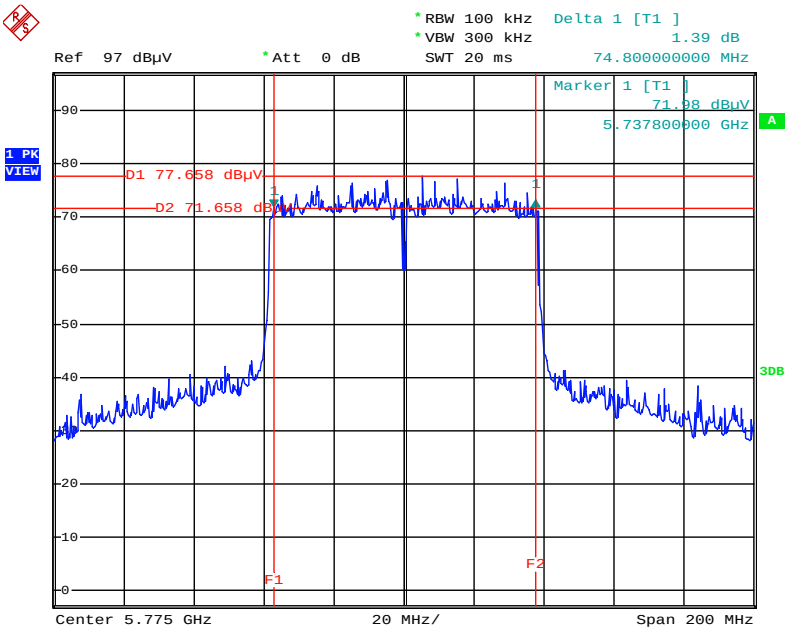
Date: 26.APR.2016 14:46:33

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



Date: 26.APR.2016 14:41:46

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 26.APR.2016 14:41:06

4.3. Maximum Conducted Output Power Measurement

4.3.1. Limit

Frequency Band		Limit
☒	5.725~5.85 GHz	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). If transmitting antennas of directional gain greater than 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.

4.3.2. Measuring Instruments and Setting

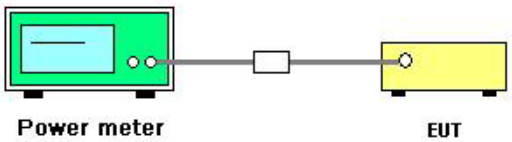
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Detector	AVERAGE

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (E) Maximum conducted output power =>3. Measurement using a Power Meter (PM) =>b) Method PM-G (Measurement using a gated RF average power meter).
3. Multiple antenna systems was performed in accordance with KDB662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. When measuring maximum conducted output power with multiple antenna systems, add every result of the values by mathematic formula.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Maximum Conducted Output Power

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Date	Apr. 22, 2016~Apr. 26, 2016
Test Function	Non-beamforming function		

Mode	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
802.11a	5745 MHz	23.83	24.24	24.04	28.81	30.00	Complies
	5785 MHz	23.91	24.18	24.07	28.83	30.00	Complies
	5825 MHz	23.80	24.16	24.18	28.82	30.00	Complies
802.11ac MCS0/Nss1 VHT20	5745 MHz	23.86	24.14	24.06	28.79	30.00	Complies
	5785 MHz	23.85	24.13	24.16	28.82	30.00	Complies
	5825 MHz	23.76	24.23	24.12	28.81	30.00	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	23.20	23.17	22.63	27.78	30.00	Complies
	5795 MHz	24.06	24.19	24.16	28.91	30.00	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	23.43	23.89	24.02	28.56	30.00	Complies

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Date	Apr. 22, 2016~Apr. 26, 2016
Test Function	Beamforming function		

Mode	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
802.11ac MCS0/Nss1 VHT20	5745 MHz	21.19	21.57	21.48	26.19	27.29	Complies
	5785 MHz	21.09	21.65	21.26	26.11	27.29	Complies
	5825 MHz	21.15	21.41	21.37	26.08	27.29	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	21.28	21.62	21.41	26.21	27.29	Complies
	5795 MHz	21.32	21.53	21.36	26.18	27.29	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	20.91	21.50	21.41	26.05	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm.

4.4. Power Spectral Density Measurement

4.4.1. Limit

The following table is power spectral density limits and decrease power density limit rule refer to section 4.3.1.

Frequency Band		Limit
☒	5.725~5.85 GHz	30 dBm/500kHz

4.4.2. Measuring Instruments and Setting

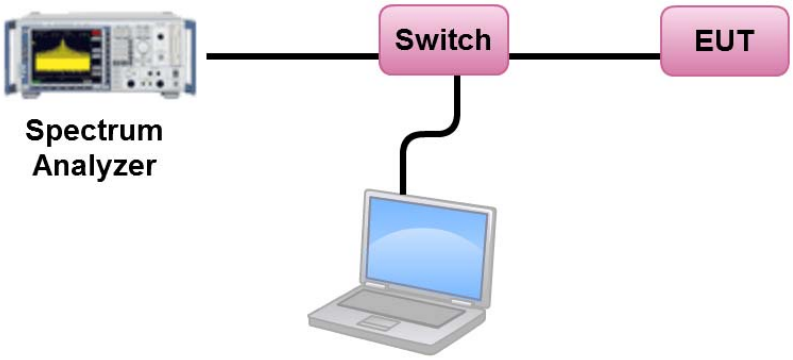
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	1000 kHz
VBW	3000 kHz
Detector	RMS
Trace	AVERAGE
Sweep Time	Auto
Trace Average	100 times
Note: 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.	

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (F) Maximum Power Spectral Density (PSD).
3. Multiple antenna systems was performed in accordance KDB662911 D01 v02r01 in-Band Power Spectral Density (PSD) Measurements and sum the spectra across the outputs.
4. For 5.725~5.85 GHz, the measured result of PSD level must add 10log(500kHz/RBW) and the final result should ≤ 30 dBm.

4.4.4. Test Setup Layout



4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Power Spectral Density

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Date	Apr. 22, 2016~Apr. 26, 2016
Test Function	Non-beamforming function		

Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	15.49	-3.01	12.48	27.29	Complies
157	5785 MHz	15.36	-3.01	12.35	27.29	Complies
165	5825 MHz	15.38	-3.01	12.37	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	15.46	-3.01	12.45	27.29	Complies
157	5785 MHz	15.44	-3.01	12.43	27.29	Complies
165	5825 MHz	15.50	-3.01	12.49	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
151	5755 MHz	11.60	-3.01	8.59	27.29	Complies
159	5795 MHz	12.72	-3.01	9.71	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
155	5775 MHz	9.41	-3.01	6.40	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Date	Apr. 22, 2016~Apr. 26, 2016
Test Function	Beamforming function		

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	12.84	-3.01	9.83	27.29	Complies
157	5785 MHz	12.80	-3.01	9.79	27.29	Complies
165	5825 MHz	12.73	-3.01	9.72	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
151	5755 MHz	10.08	-3.01	7.07	27.29	Complies
159	5795 MHz	10.11	-3.01	7.10	27.29	Complies

Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
155	5775 MHz	6.94	-3.01	3.93	27.29	Complies

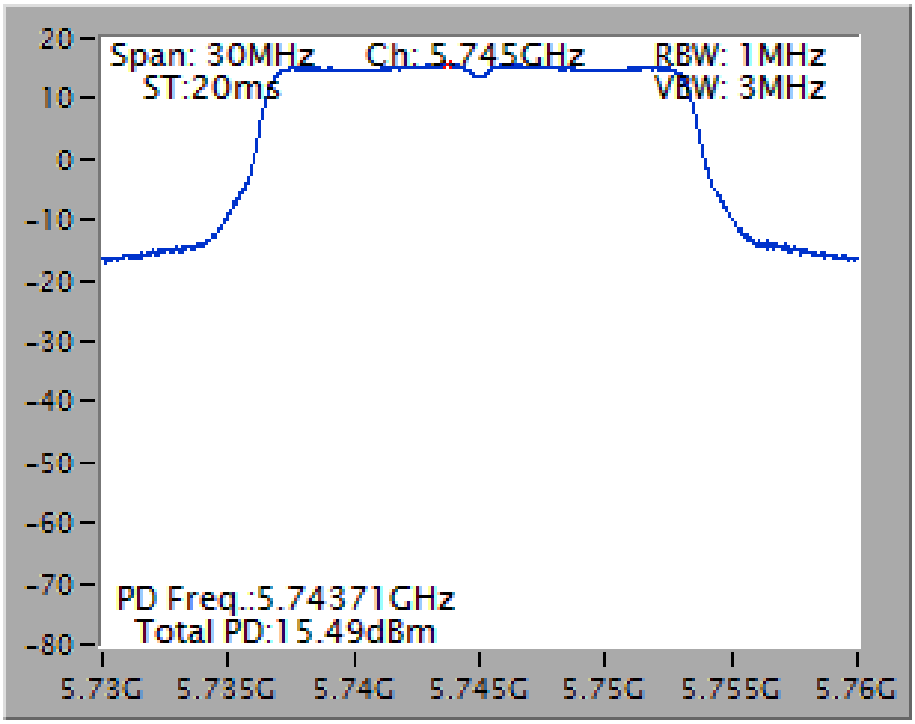
Note: $Directional\,Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.71dBi >6dBi, so limit=30 – (8.71 – 6)=27.29dBm/500kHz.

Note: All the test values were listed in the report.

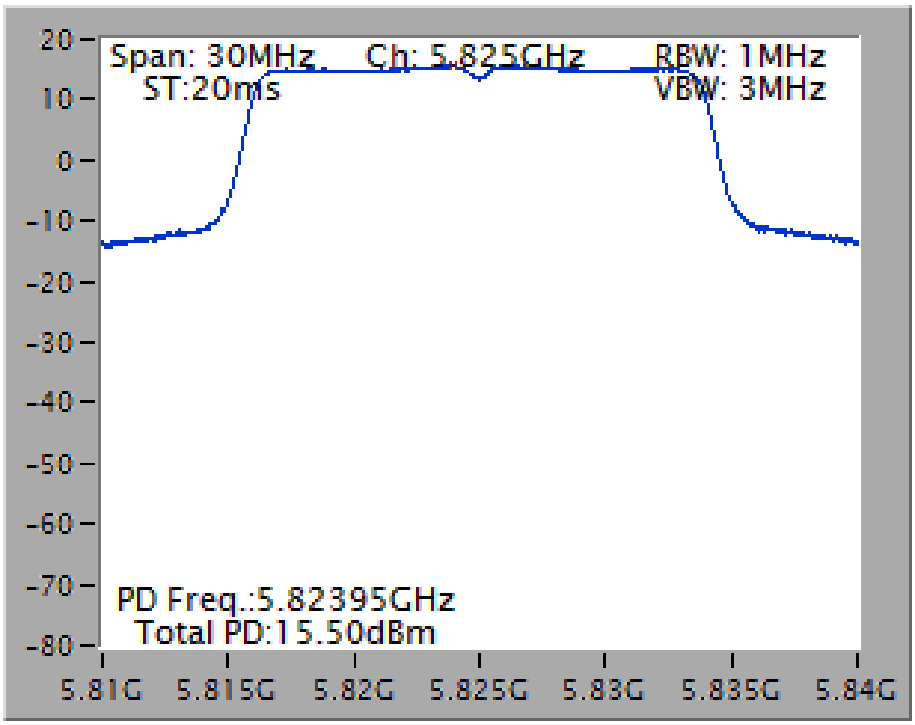
For plots, only the channel with worse result was shown.

For non-beamforming function:

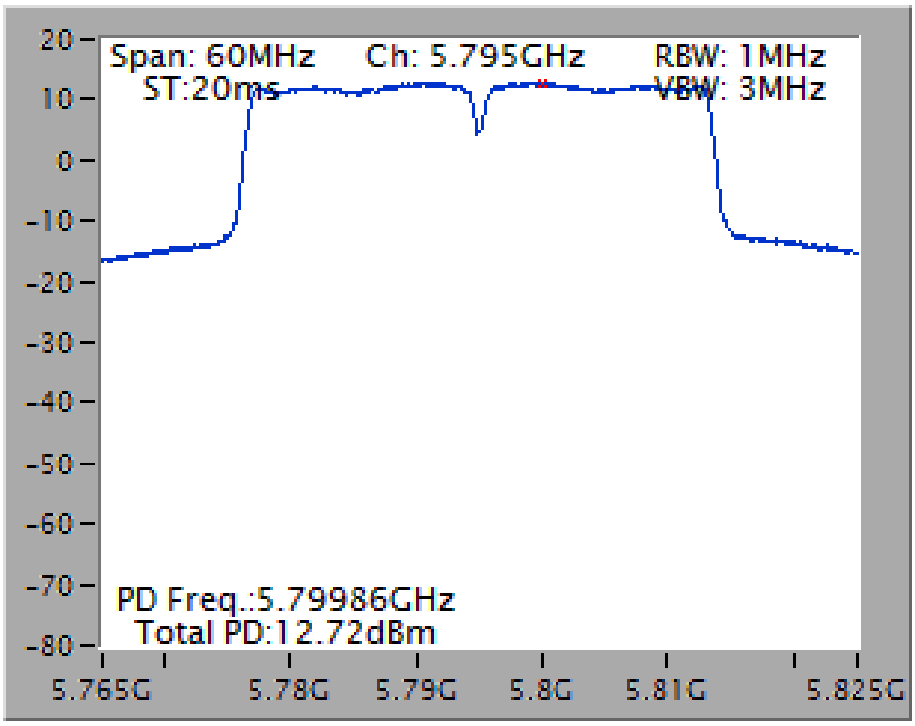
Power Density Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



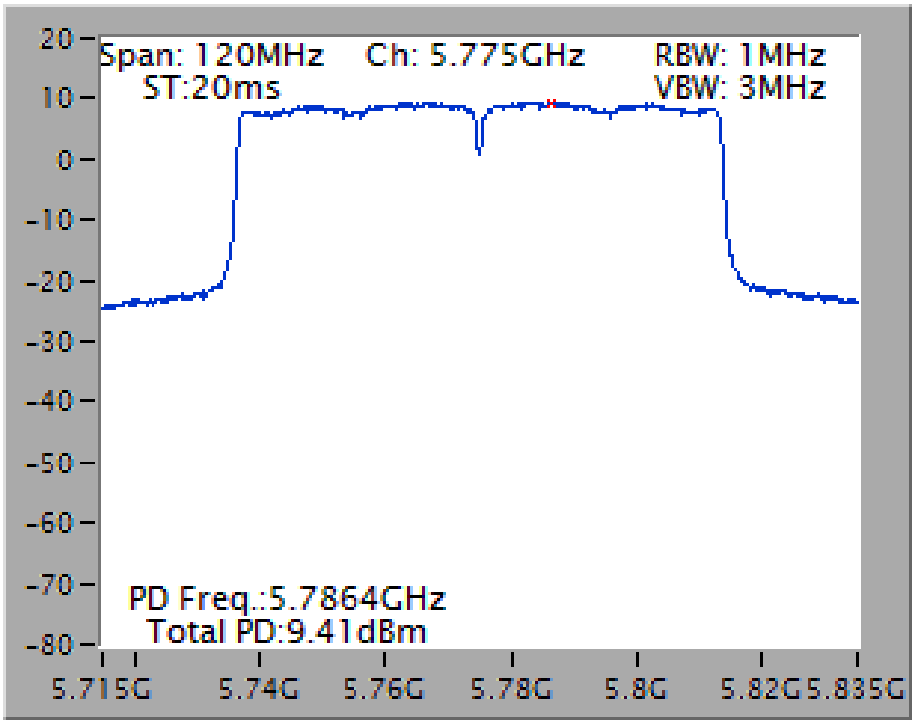
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5795 MHz

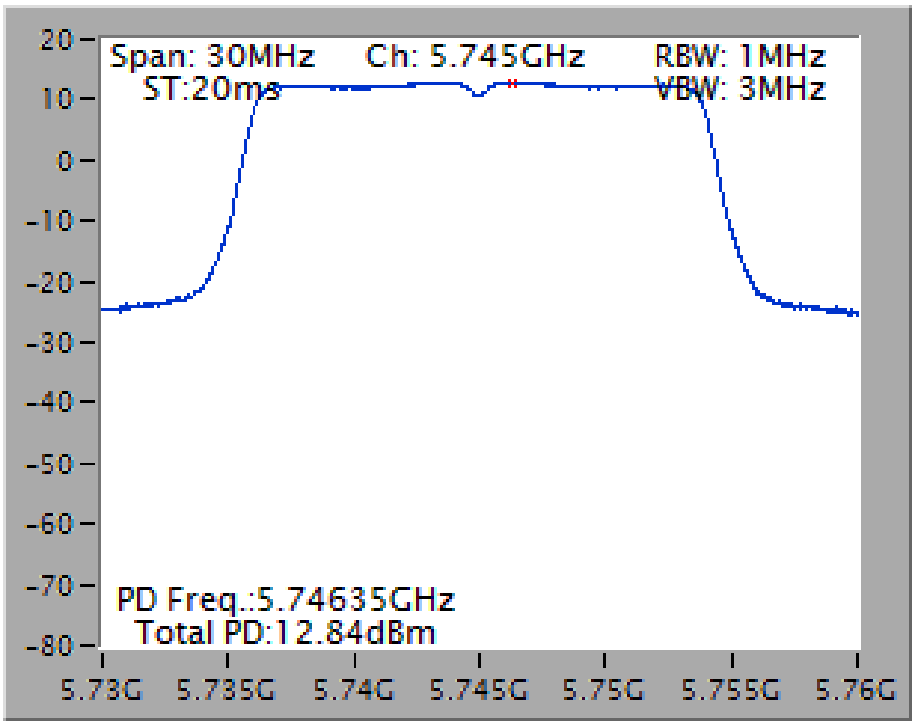


Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz

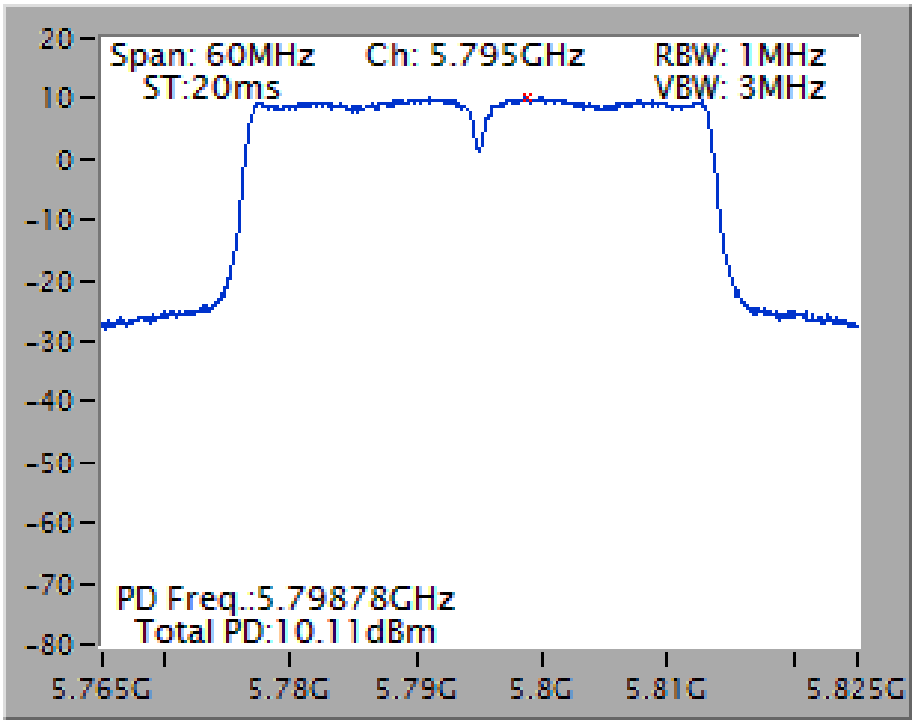


For beamforming function:

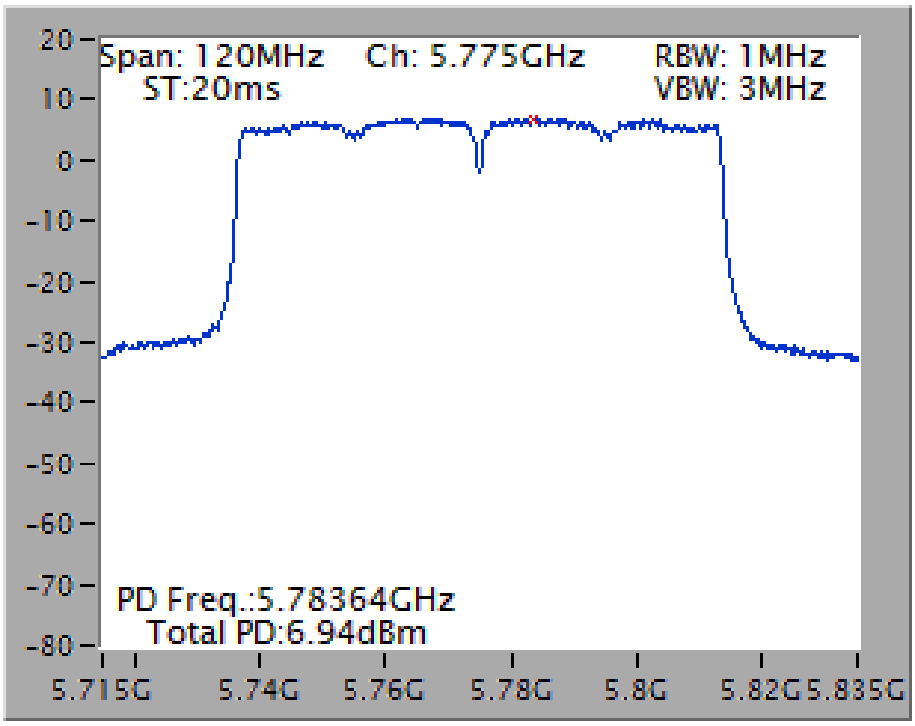
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5795 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



4.5. Radiated Emissions Measurement

4.5.1. Limit

For transmitters operating in the 5.725-5.85 GHz band: Follow 15.407(b)(4)(ii), the emission limits in § 15.247(d), 30dBc in any 100 kHz bandwidth outside the operating frequency band.

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

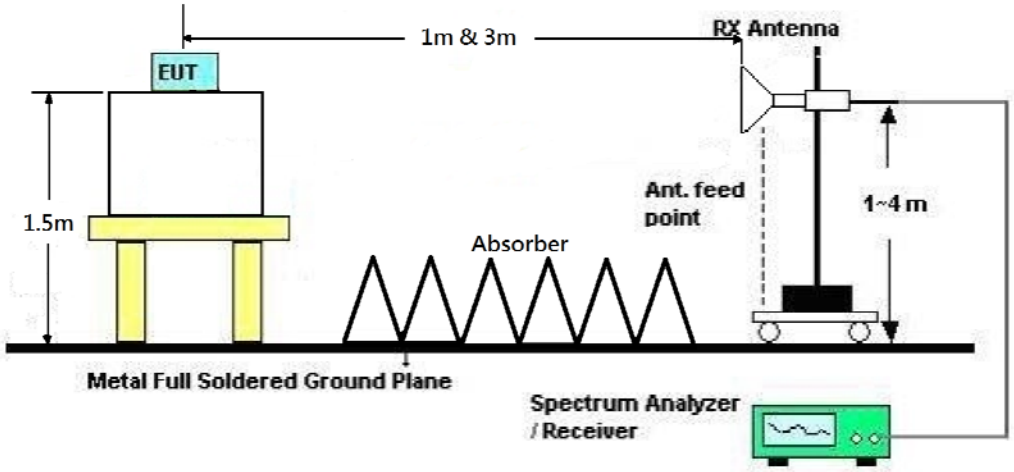
Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.5.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

For non-beamforming function:

The EUT was programmed to be in continuously transmitting mode.

For beamforming function:

The EUT was programmed to be in beamforming transmitting mode.

4.5.7. Results for Radiated Emissions (1GHz~40GHz)

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11a CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11482.88	58.60	74.00	-15.40	42.94	10.74	39.66	34.74	150	63	Peak	HORIZONTAL
2	11491.84	46.18	54.00	-7.82	30.48	10.75	39.70	34.75	150	63	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11486.48	47.58	54.00	-6.42	31.88	10.75	39.70	34.75	157	352	Average	VERTICAL
2	11486.72	59.19	74.00	-14.81	43.49	10.75	39.70	34.75	157	352	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11a CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11571.72	46.04	54.00	-7.96	30.39	10.76	39.65	34.76	147	54	Average	HORIZONTAL
2	11575.16	58.52	74.00	-15.48	42.87	10.76	39.65	34.76	147	54	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11569.92	47.59	54.00	-6.41	31.94	10.76	39.65	34.76	160	4	Average	VERTICAL
2	11570.36	60.77	74.00	-13.23	45.12	10.76	39.65	34.76	160	4	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11a CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11640.84	46.19	54.00	-7.81	30.60	10.77	39.59	34.77	150	58	Average	HORIZONTAL
2	11644.04	59.03	74.00	-14.97	43.44	10.77	39.59	34.77	150	58	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11648.56	59.03	74.00	-14.97	43.44	10.77	39.59	34.77	158	5	Peak	VERTICAL
2	11649.80	47.12	54.00	-6.88	31.53	10.77	39.59	34.77	158	5	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11483.24	45.72	54.00	-8.28	30.06	10.74	39.66	34.74	157	30	Average	HORIZONTAL
2	11485.24	58.78	74.00	-15.22	43.08	10.75	39.70	34.75	157	30	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11483.04	47.70	54.00	-6.30	32.04	10.74	39.66	34.74	171	70	Average	VERTICAL
2	11486.24	59.53	74.00	-14.47	43.83	10.75	39.70	34.75	171	70	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11571.00	46.18	54.00	-7.82	30.53	10.76	39.65	34.76	153	119	Average	HORIZONTAL
2	11576.76	58.94	74.00	-15.06	43.29	10.76	39.65	34.76	153	119	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11573.92	59.33	74.00	-14.67	43.68	10.76	39.65	34.76	142	162	Peak	VERTICAL
2	11574.56	47.12	54.00	-6.88	31.47	10.76	39.65	34.76	142	162	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11640.20	46.05	54.00	-7.95	30.46	10.77	39.59	34.77	164	189	Average	HORIZONTAL
2	11641.80	61.27	74.00	-12.73	45.68	10.77	39.59	34.77	164	189	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11646.32	47.08	54.00	-6.92	31.49	10.77	39.59	34.77	159	142	Average	VERTICAL
2	11653.64	59.81	74.00	-14.19	44.25	10.77	39.57	34.78	159	142	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11516.36	45.59	54.00	-8.41	29.89	10.75	39.70	34.75	142	166	Average	HORIZONTAL
2	11520.00	58.57	74.00	-15.43	42.91	10.75	39.67	34.76	142	166	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11509.04	59.49	74.00	-14.51	43.79	10.75	39.70	34.75	147	111	Peak	VERTICAL
2	11516.52	47.57	54.00	-6.43	31.87	10.75	39.70	34.75	147	111	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11581.96	59.03	74.00	-14.97	43.38	10.76	39.65	34.76	156	46	Peak	HORIZONTAL
2	11591.36	45.87	54.00	-8.13	30.26	10.76	39.62	34.77	156	46	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11589.04	59.25	74.00	-14.75	43.64	10.76	39.62	34.77	160	2	Peak	VERTICAL
2	11589.52	47.30	54.00	-6.70	31.69	10.76	39.62	34.77	160	2	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Non-beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11551.48	57.87	74.00	-16.13	42.22	10.76	39.65	34.76	150	268	Peak	HORIZONTAL
2	11557.20	45.01	54.00	-8.99	29.36	10.76	39.65	34.76	150	268	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11551.20	59.58	74.00	-14.42	43.93	10.76	39.65	34.76	147	322	Peak	VERTICAL
2	11553.72	47.51	54.00	-6.49	31.86	10.76	39.65	34.76	147	322	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11490.12	46.89	54.00	-7.11	31.19	10.75	39.70	34.75	150	357	Average	HORIZONTAL
2	11498.80	58.66	74.00	-15.34	42.96	10.75	39.70	34.75	150	357	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11483.80	60.29	74.00	-13.71	44.59	10.75	39.70	34.75	144	84	Peak	VERTICAL
2	11491.08	47.65	54.00	-6.35	31.95	10.75	39.70	34.75	144	84	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11571.76	44.41	54.00	-9.59	28.76	10.76	39.65	34.76	150	43	Average	HORIZONTAL
2	11573.68	57.23	74.00	-16.77	41.58	10.76	39.65	34.76	150	43	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11568.40	47.08	54.00	-6.92	31.43	10.76	39.65	34.76	162	4	Average	VERTICAL
2	11578.92	59.91	74.00	-14.09	44.26	10.76	39.65	34.76	162	4	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11656.04	44.19	54.00	-9.81	28.63	10.77	39.57	34.78	151	46	Average	HORIZONTAL
2	11656.80	56.97	74.00	-17.03	41.41	10.77	39.57	34.78	151	46	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11648.52	59.69	74.00	-14.31	44.10	10.77	39.59	34.77	143	13	Peak	VERTICAL
2	11651.24	47.14	54.00	-6.86	31.58	10.77	39.57	34.78	143	13	Average	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11513.48	44.60	54.00	-9.40	28.90	10.75	39.70	34.75	150	307	Average	HORIZONTAL
2	11516.24	56.97	74.00	-17.03	41.27	10.75	39.70	34.75	150	307	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11508.04	47.58	54.00	-6.42	31.88	10.75	39.70	34.75	150	339	Average	VERTICAL
2	11515.80	58.82	74.00	-15.18	43.12	10.75	39.70	34.75	150	339	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11586.88	57.56	74.00	-16.44	41.95	10.76	39.62	34.77	134	71	Peak	HORIZONTAL
2	11591.24	44.84	54.00	-9.16	29.23	10.76	39.62	34.77	134	71	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11589.96	47.41	54.00	-6.59	31.80	10.76	39.62	34.77	154	3	Average	VERTICAL
2	11593.12	60.01	74.00	-13.99	44.40	10.76	39.62	34.77	154	3	Peak	VERTICAL

Temperature	24.3°C	Humidity	62%
Test Engineer	Clemens Fang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Apr. 09, 2016	Test Function	Beamforming function

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11543.60	58.20	74.00	-15.80	42.54	10.75	39.67	34.76	166	121	Peak	HORIZONTAL
2	11552.84	45.29	54.00	-8.71	29.64	10.76	39.65	34.76	166	121	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11544.04	47.78	54.00	-6.22	32.12	10.75	39.67	34.76	150	214	Average	VERTICAL
2	11555.24	60.18	74.00	-13.82	44.53	10.76	39.65	34.76	150	214	Peak	VERTICAL

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.6. Radiated Emissions In Non-restricted Frequency Bands Measurement

4.6.1. Limit

For transmitters operating in the 5.725-5.85 GHz band: Follow 15.407(b)(4)(ii), the emission limits in § 15.247(d), 30dBc in any 100 kHz bandwidth outside the operating frequency band.

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for Peak
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

4.6.3. Test Procedures

Test was performed in accordance with Clause 11.11 of ANSI C63.10-2013 and/or in Section 11.0 of KDB Publication 558074.

4.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

For non-beamforming function:

The EUT was programmed to be in continuously transmitting mode.

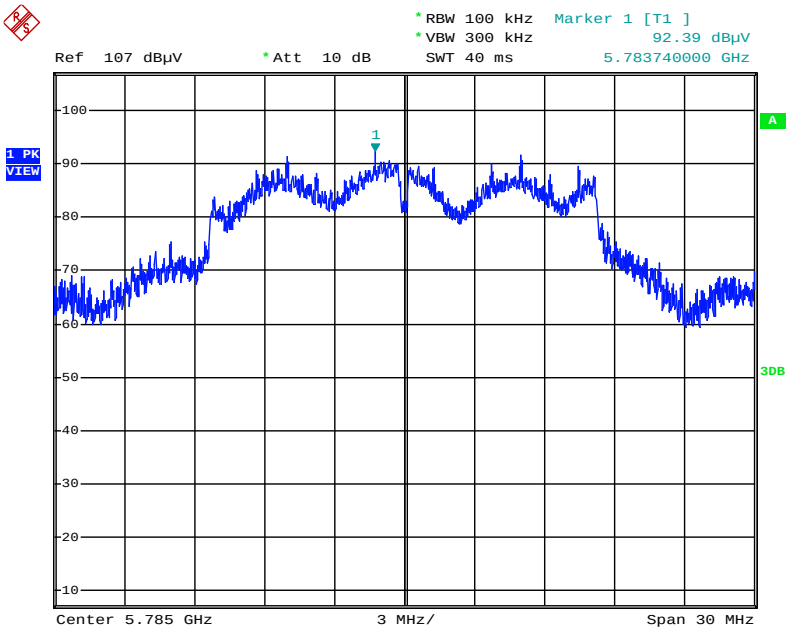
For beamforming function:

The EUT was programmed to be in beamforming transmitting mode.

4.6.7. Test Result of Radiated Emissions in non-restricted frequency bands

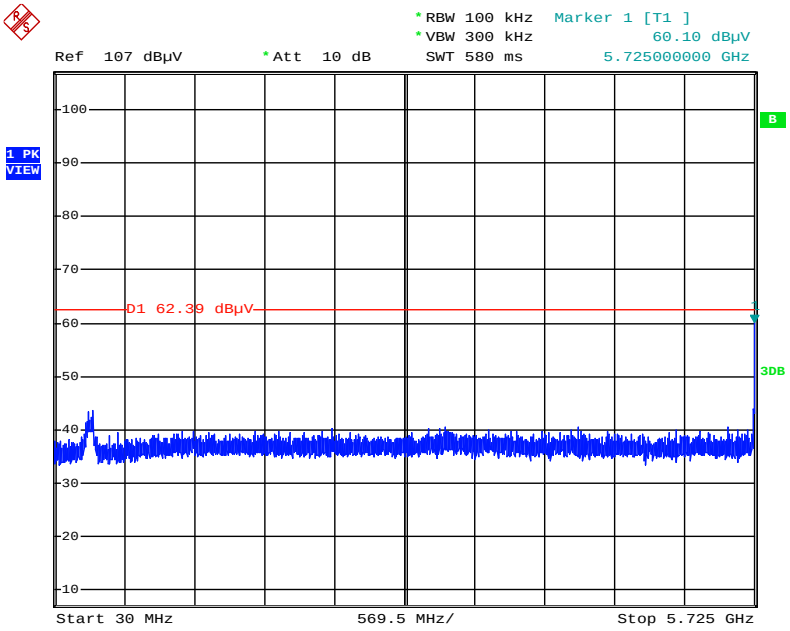
For non-beamforming function:

Plot on Configuration IEEE 802.11a / Reference Level



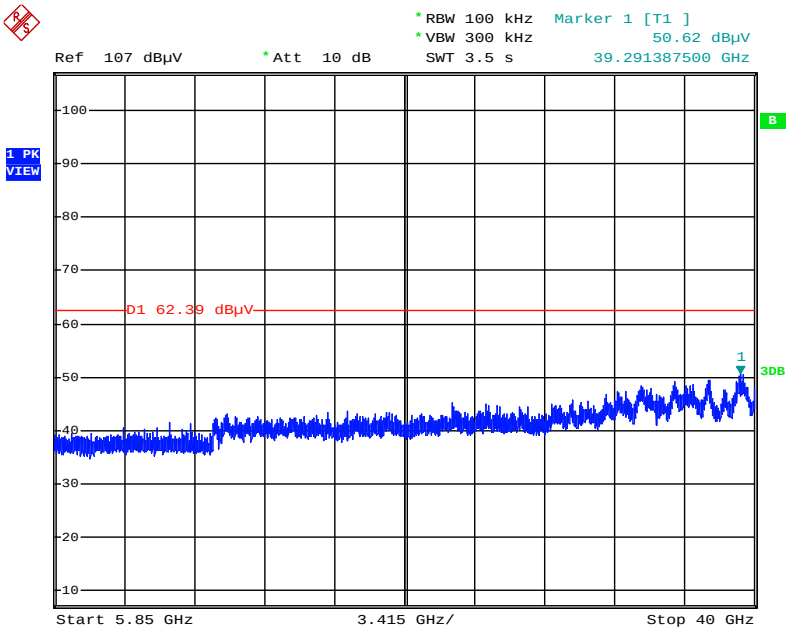
Date: 9.APR.2016 23:41:17

Plot on Configuration IEEE 802.11a / CH 149 / 30MHz~5725MHz (down 30dBc)



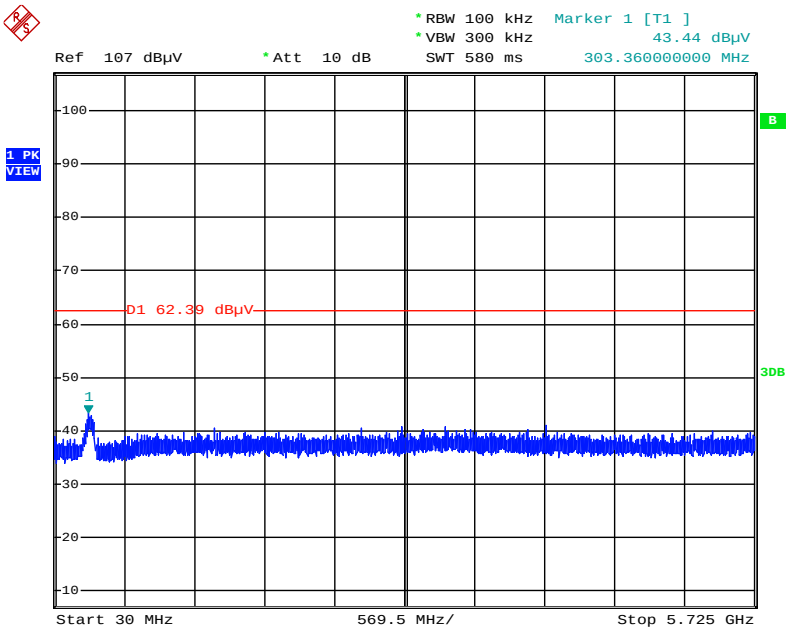
Date: 9.APR.2016 23:42:28

Plot on Configuration IEEE 802.11a / CH 149 / 5850MHz~40000MHz (down 30dBc)



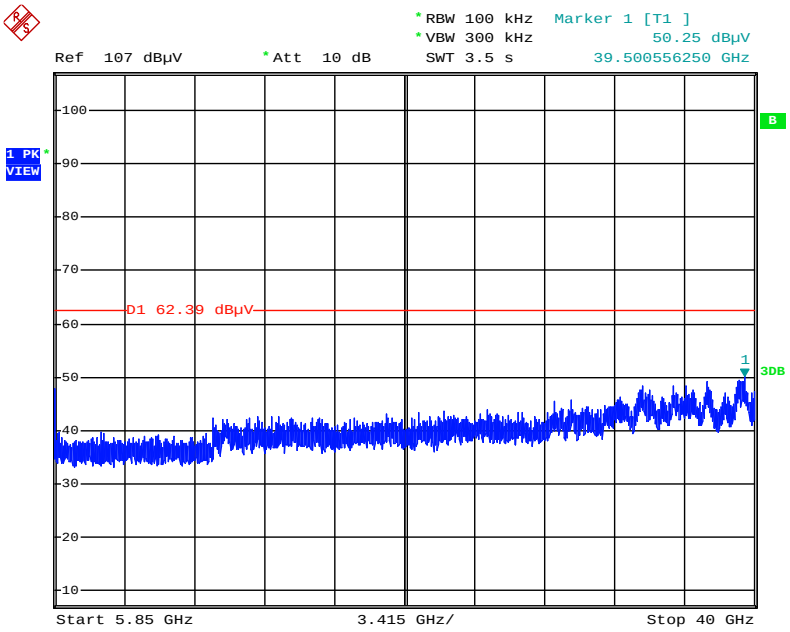
Date: 9.APR.2016 23:43:16

Plot on Configuration IEEE 802.11a / CH 165 / 30MHz~5725MHz (down 30dBc)



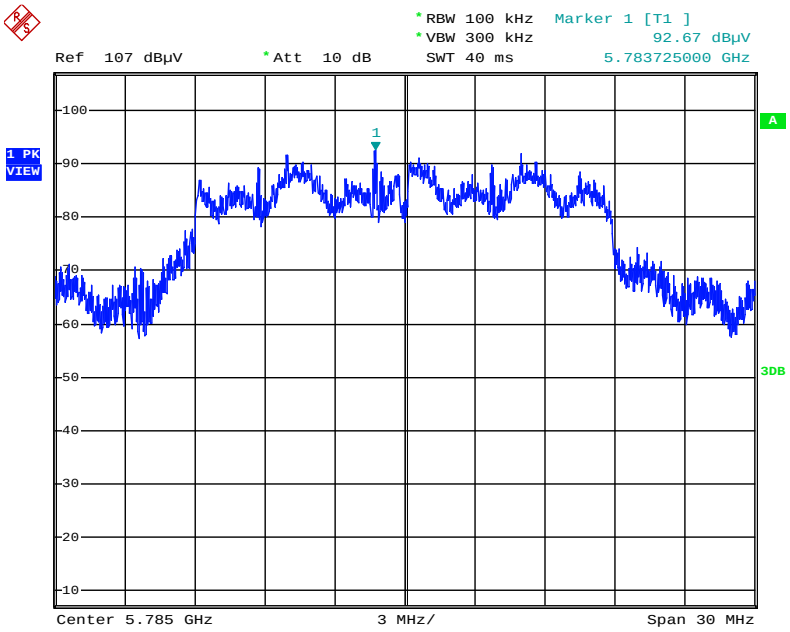
Date: 9.APR.2016 23:45:22

Plot on Configuration IEEE 802.11a / CH 165 / 5850MHz~40000MHz (down 30dBc)



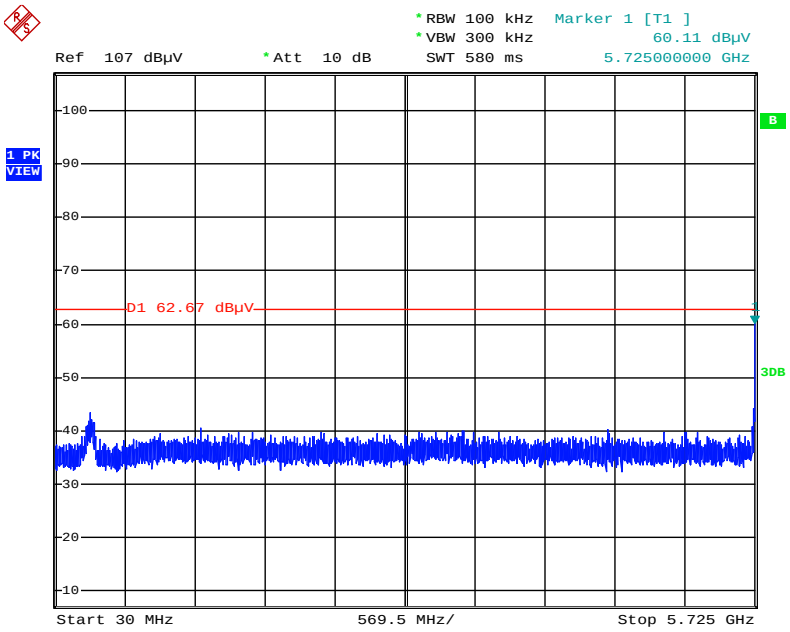
Date: 9.APR.2016 23:44:16

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Reference Level



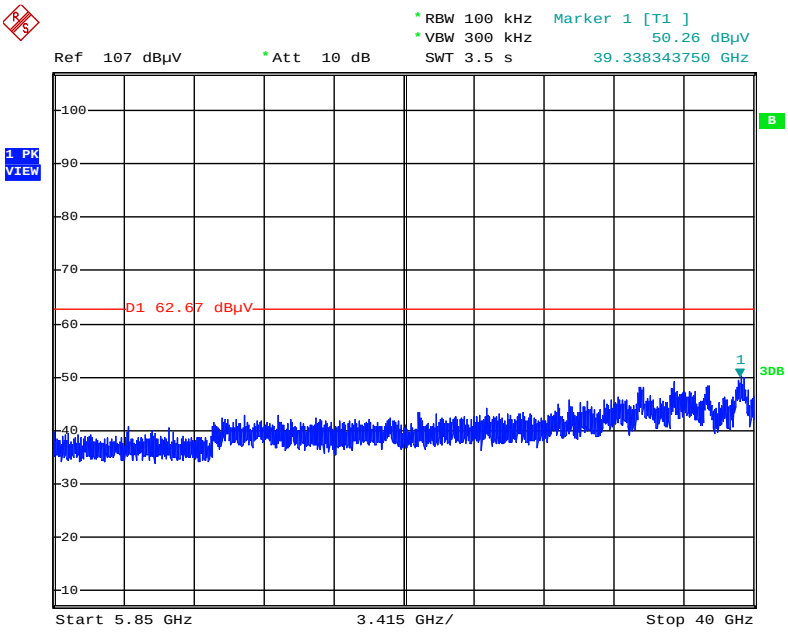
Date: 9.APR.2016 23:36:06

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 30MHz~5725MHz (down 30dBc)



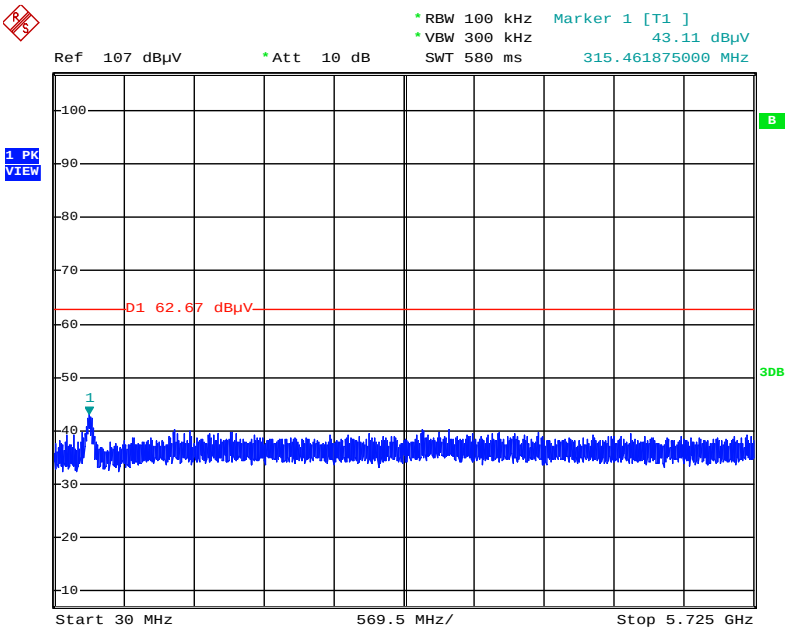
Date: 9.APR.2016 23:36:49

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 5850MHz~40000MHz (down 30dBc)



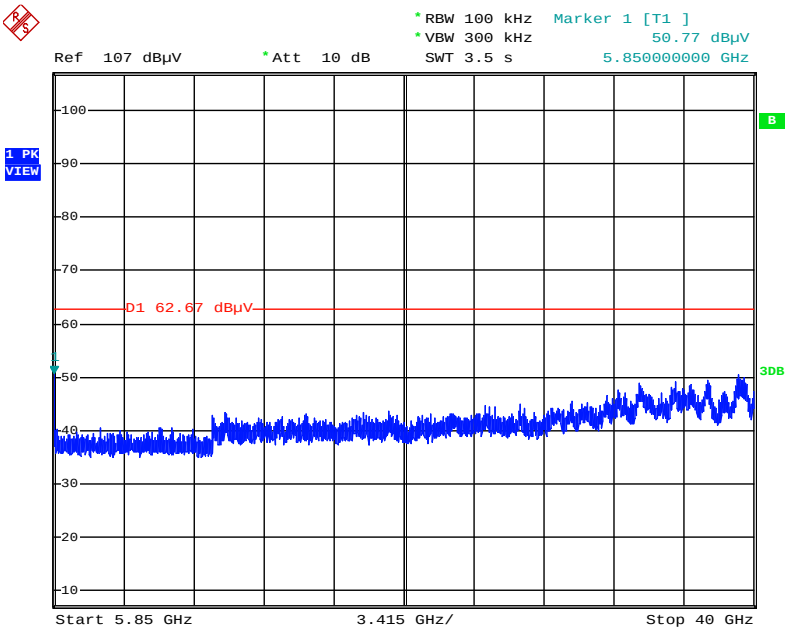
Date: 9.APR.2016 23:37:46

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 30MHz~5725MHz (down 30dBc)



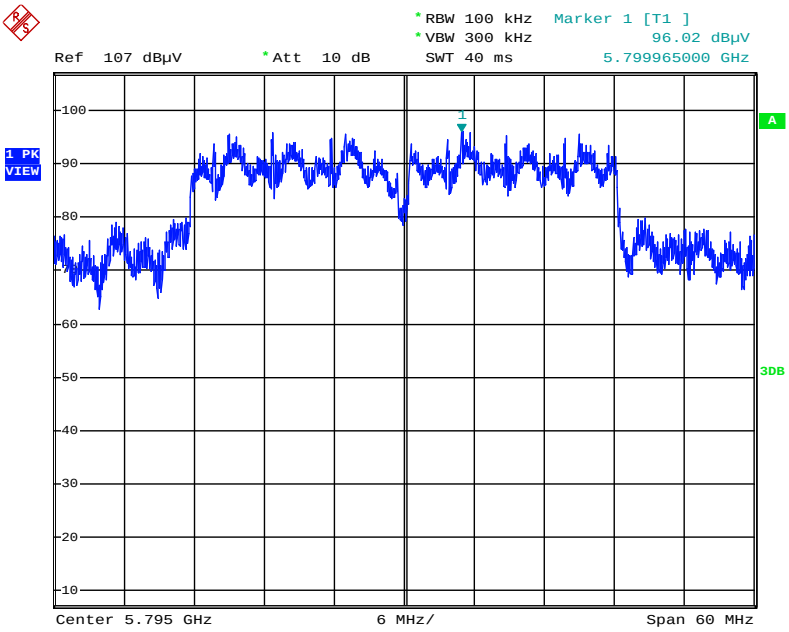
Date: 9.APR.2016 23:39:55

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 5850MHz~40000MHz (down 30dBc)



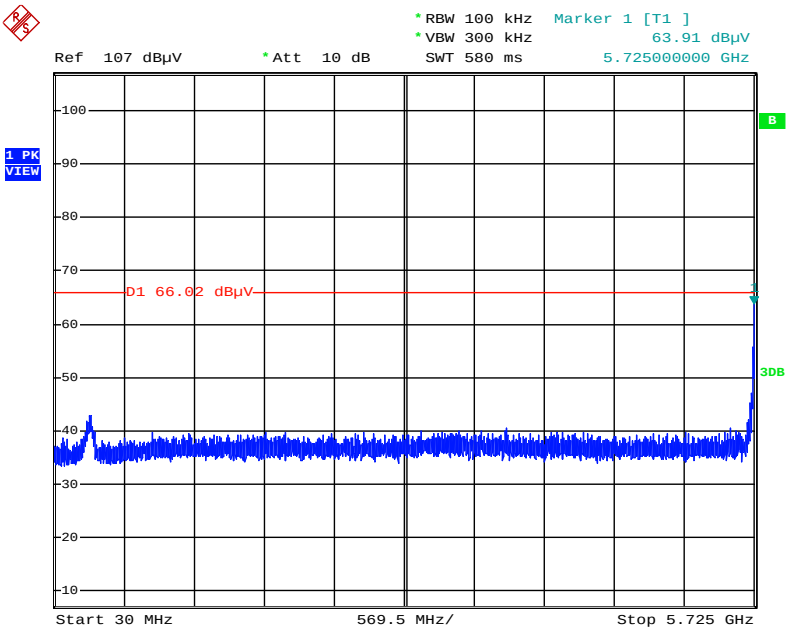
Date: 9.APR.2016 23:39:22

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Reference Level



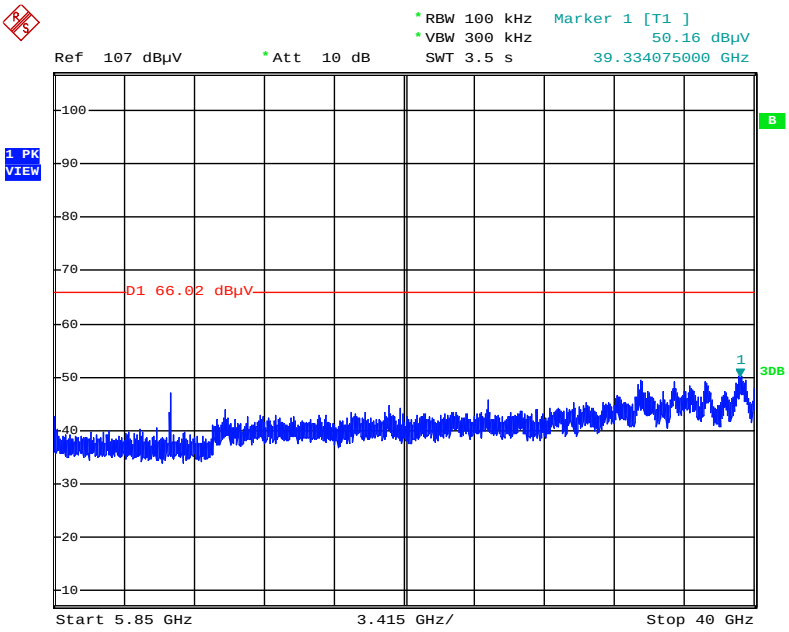
Date: 9.APR.2016 22:44:11

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 30MHz~5725MHz (down 30dBc)



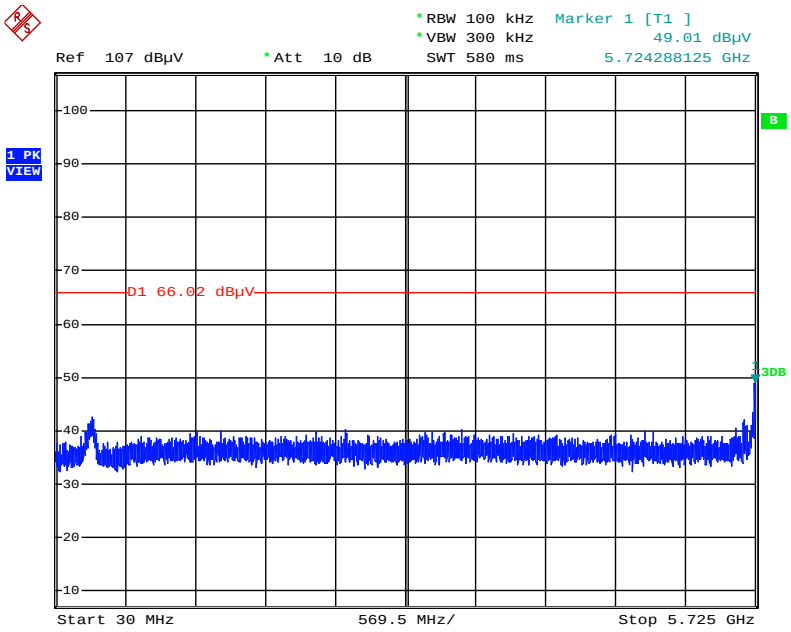
Date: 9.APR.2016 22:46:57

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 5850MHz~40000MHz (down 30dBc)



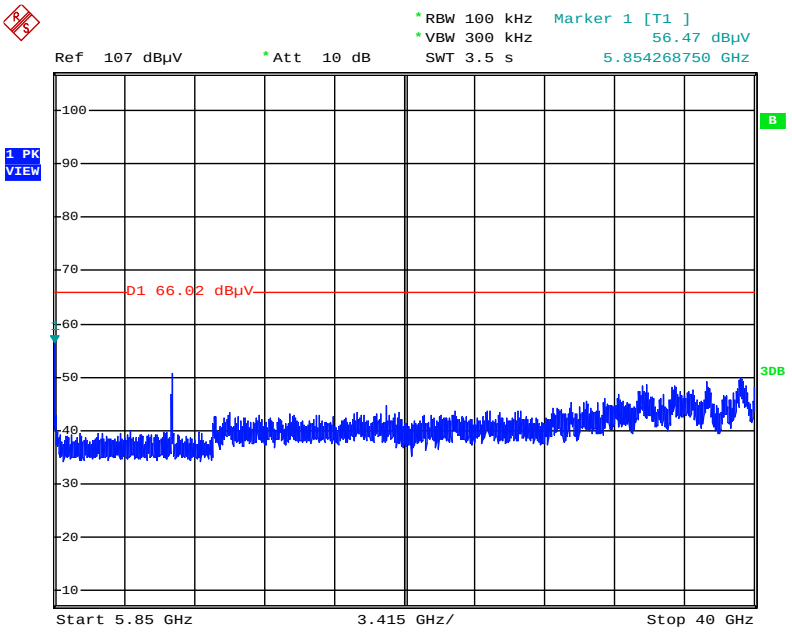
Date: 9.APR.2016 22:47:26

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 30MHz~5725MHz (down 30dBc)



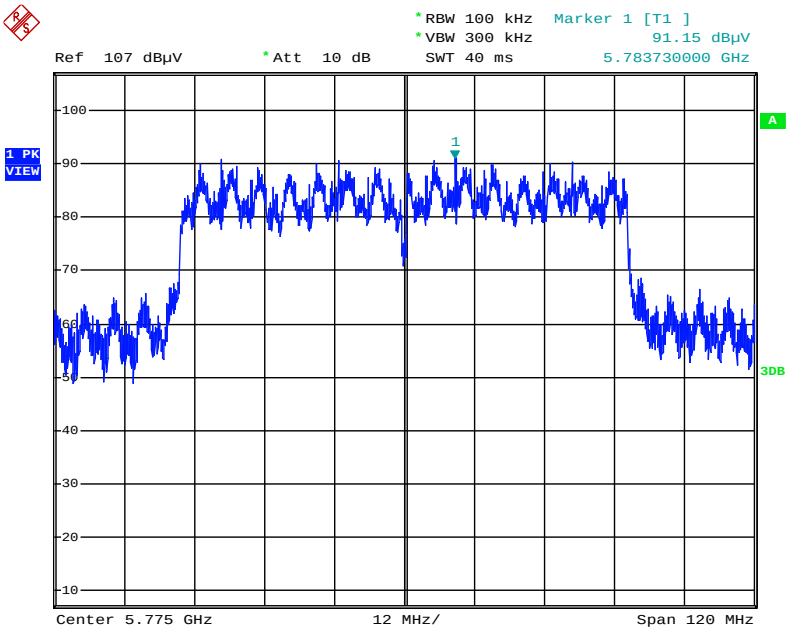
Date: 9.APR.2016 22:45:25

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 5850MHz~40000MHz (down 30dBc)



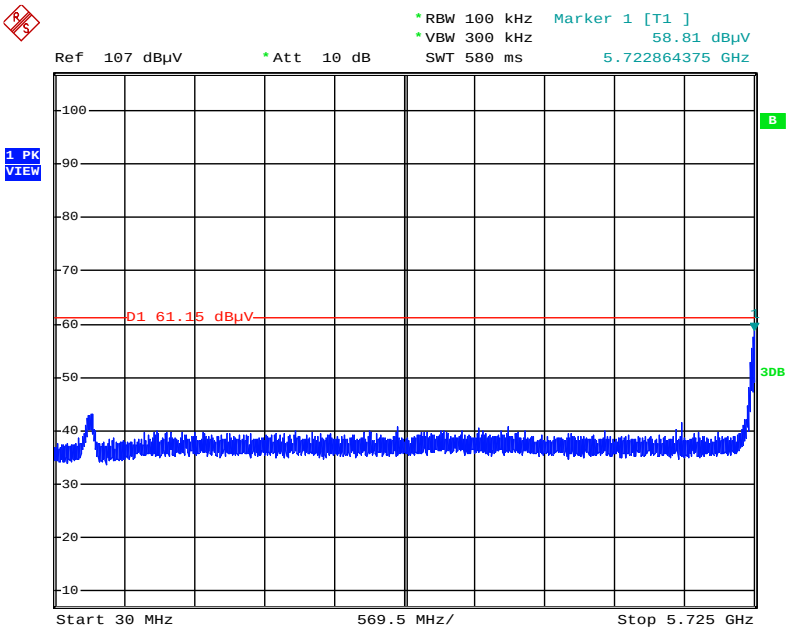
Date: 9.APR.2016 22:44:43

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Reference Level



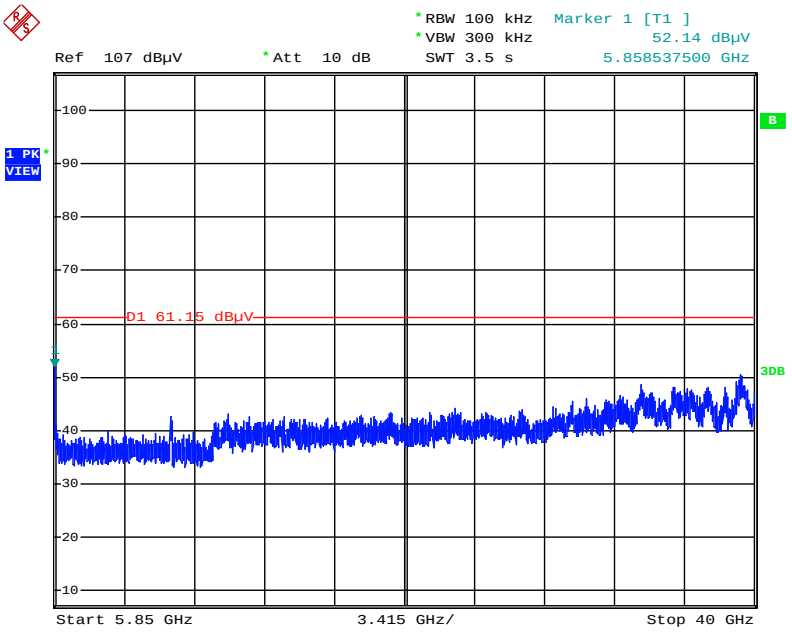
Date: 9.APR.2016 22:37:17

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / CH 155 / 30MHz~5725MHz (down 30dBc)



Date: 9.APR.2016 22:41:53

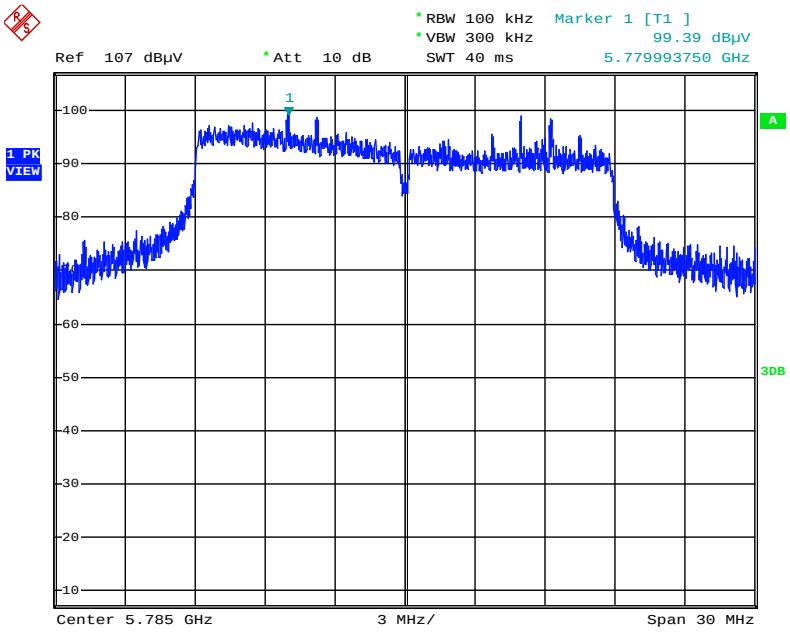
Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / CH 155 / 5850MHz~40000MHz (down 30dBc)



Date: 9.APR.2016 22:43:02

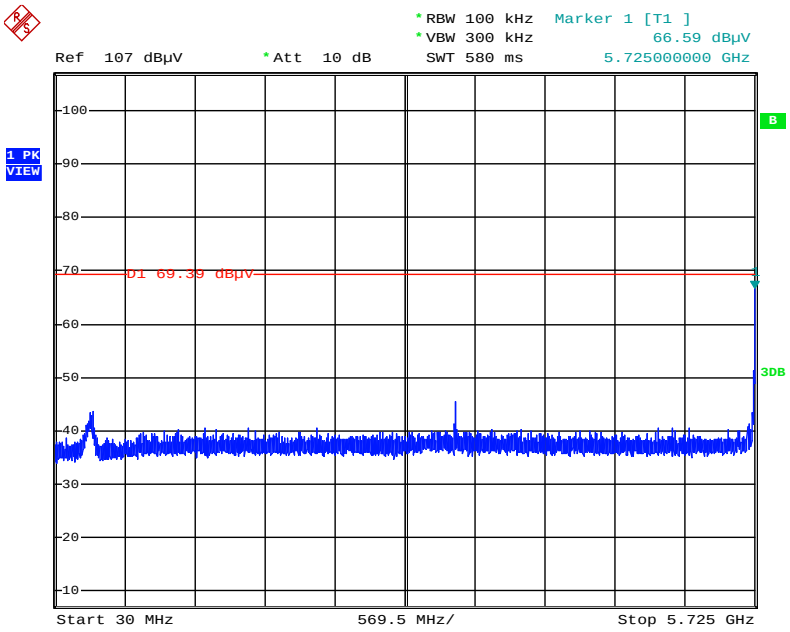
For beamforming function:

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Reference Level



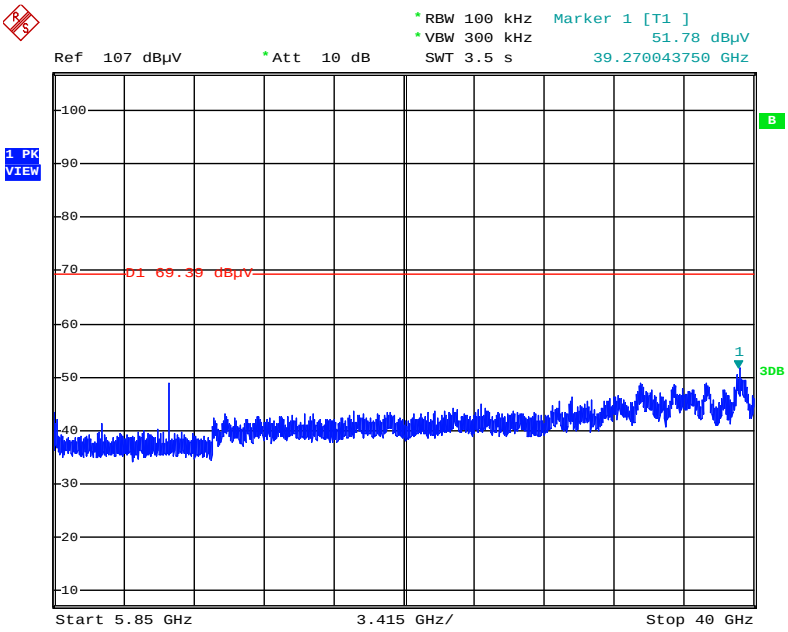
Date: 9.APR.2016 21:48:41

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 30MHz~5725MHz (down 30dBc)



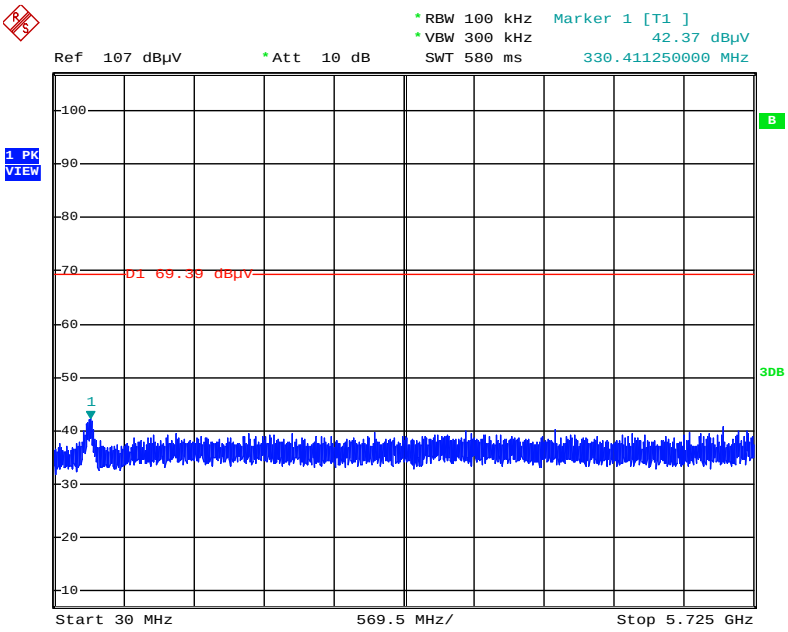
Date: 9.APR.2016 21:51:16

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 149 / 5850MHz~40000MHz (down 30dBc)



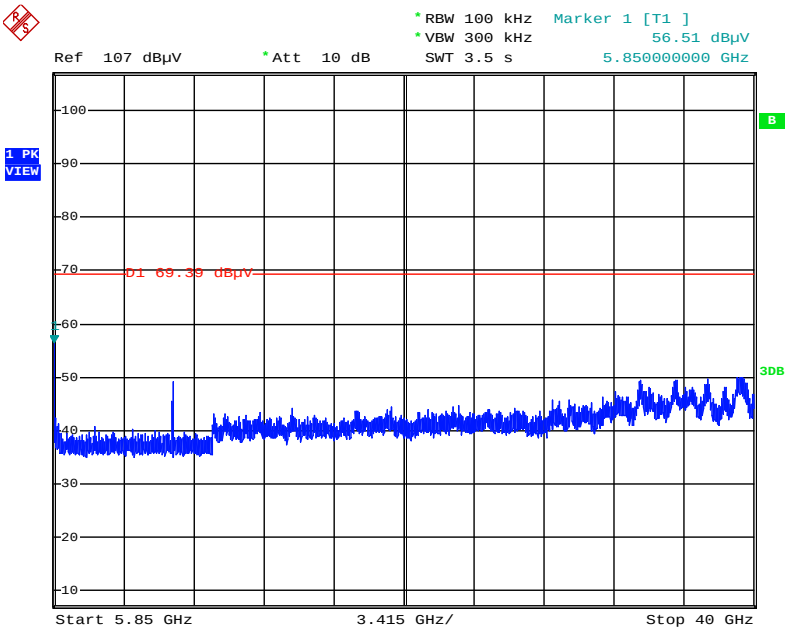
Date: 9.APR.2016 21:52:40

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 30MHz~5725MHz (down 30dBc)



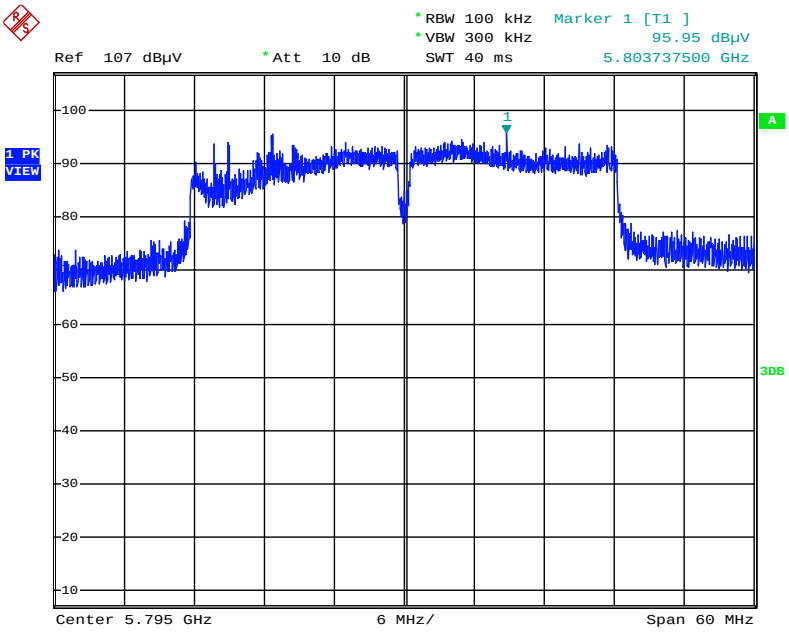
Date: 9.APR.2016 21:54:11

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / CH 165 / 5850MHz~40000MHz (down 30dBc)



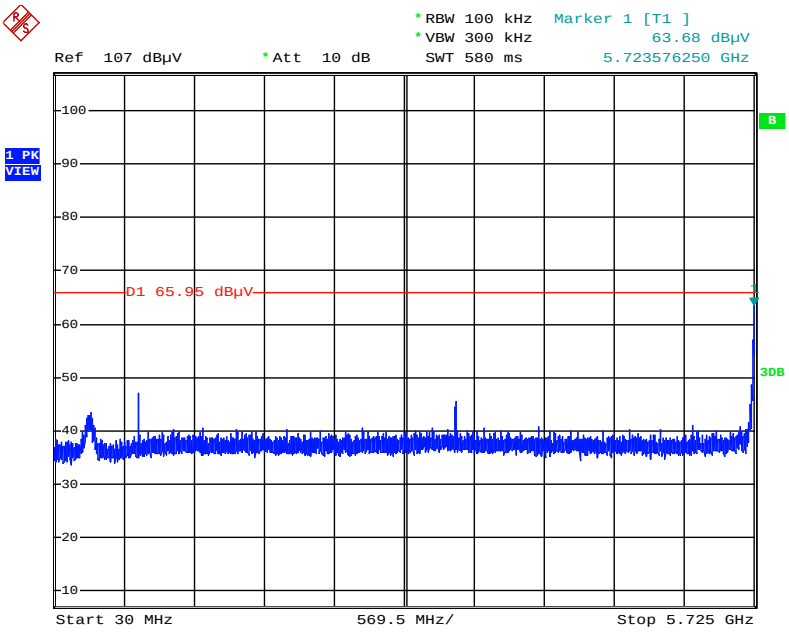
Date: 9.APR.2016 21:53:38

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Reference Level



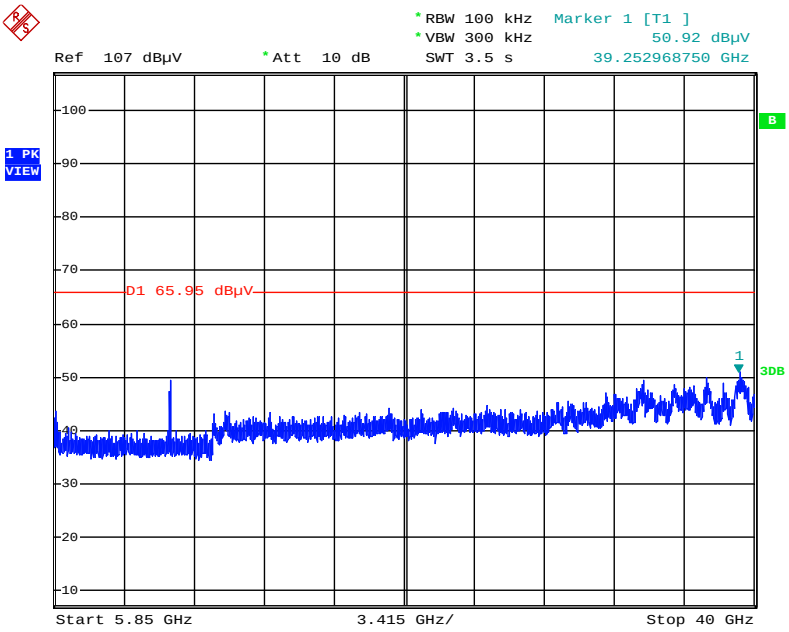
Date: 9.APR.2016 21:37:11

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 30MHz~5725MHz (down 30dBc)



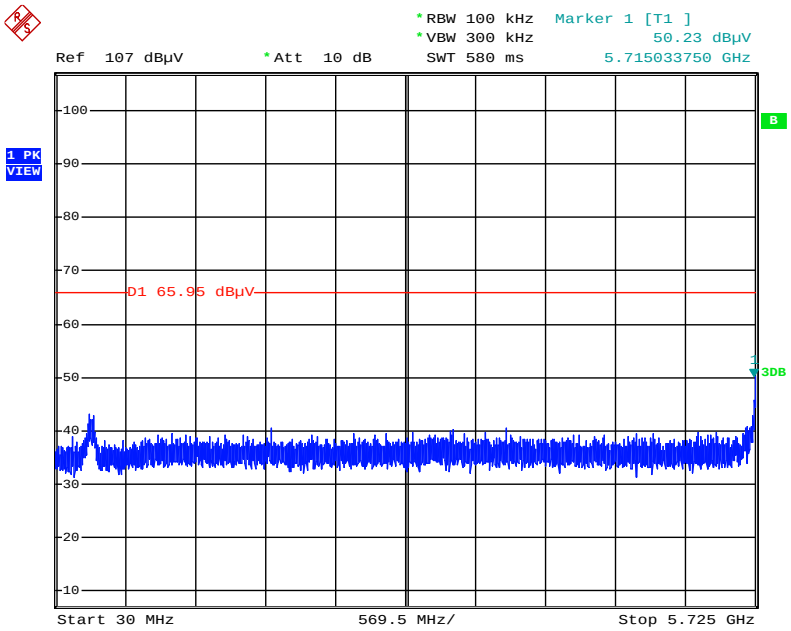
Date: 9.APR.2016 21:43:01

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 151 / 5850MHz~40000MHz (down 30dBc)



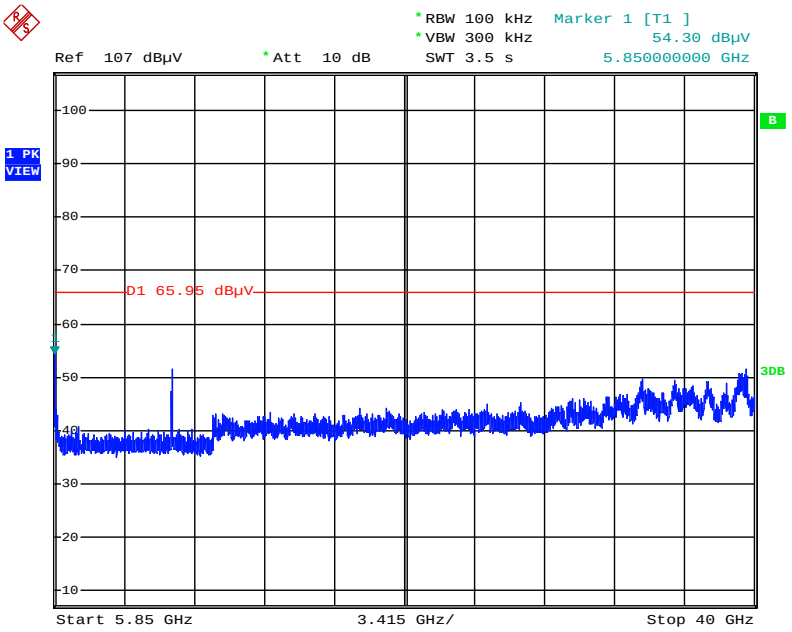
Date: 9.APR.2016 21:44:02

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 30MHz~5725MHz (down 30dBc)



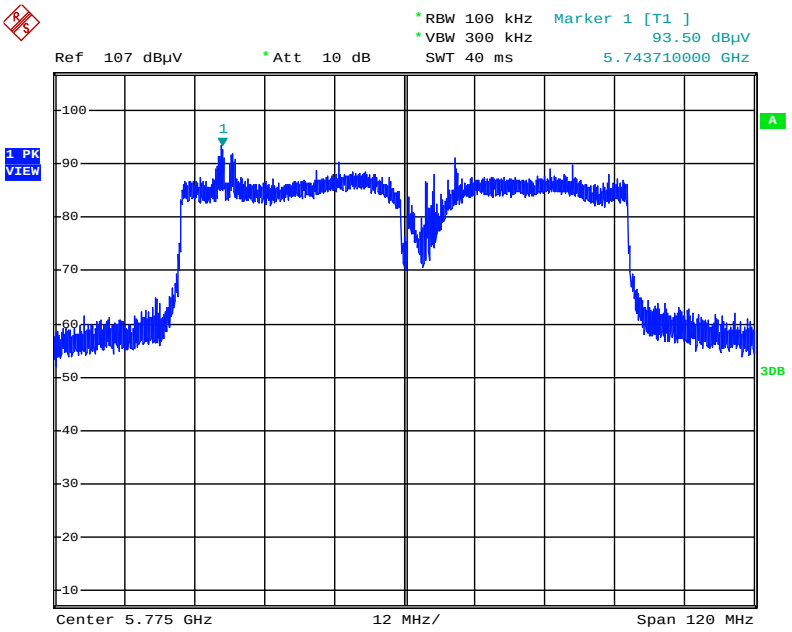
Date: 9.APR.2016 21:39:08

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / CH 159 / 5850MHz~40000MHz (down 30dBc)



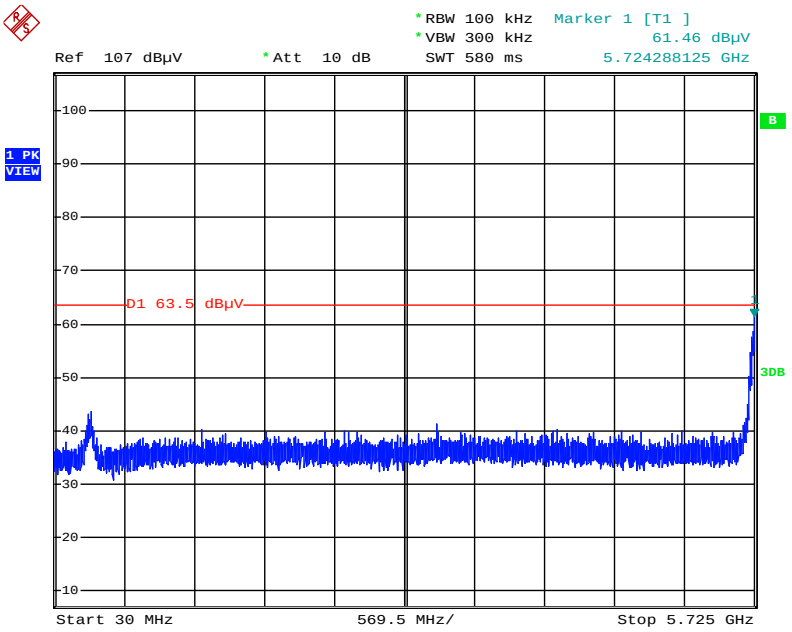
Date: 9.APR.2016 21:38:07

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Reference Level



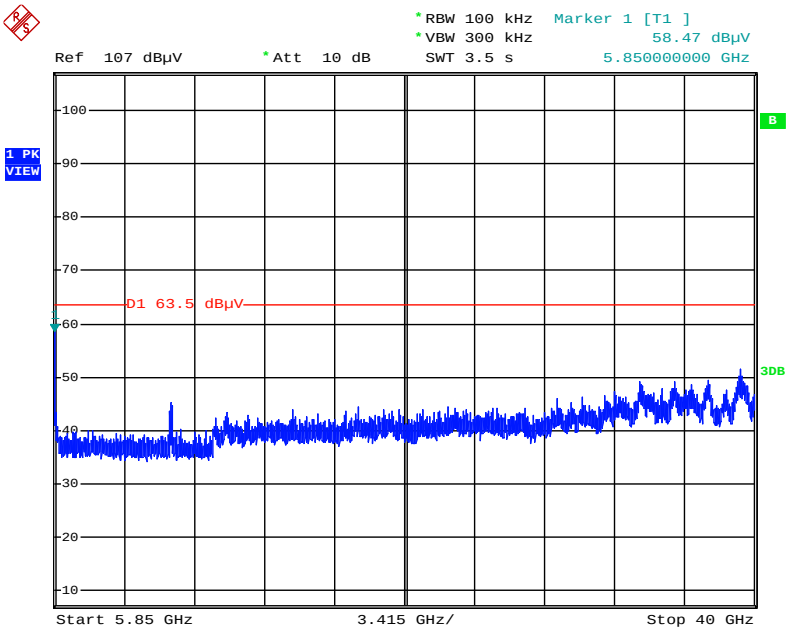
Date: 9.APR.2016 21:30:59

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / CH 155 / 30MHz~5725MHz (down 30dBc)



Date: 9.APR.2016 21:32:09

Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / CH 155 / 5850MHz~40000MHz (down 30dBc)



Date: 9.APR.2016 21:34:43

4.7. Frequency Stability Measurement

4.7.1. Limit

In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

4.7.2. Measuring Instruments and Setting

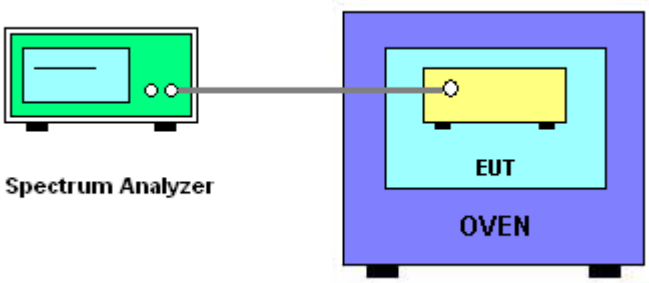
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Sweep Time	Auto

4.7.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 10^6 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
7. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
8. Extreme temperature is -30°C~50°C.

4.7.4. Test Setup Layout



4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously un-modulation transmitting mode.

4.7.7. Test Result of Frequency Stability

Temperature	24℃	Humidity	61%
Test Engineer	Peter Wu	Test Date	Apr. 22, 2016~Apr. 26, 2016

Mode: 20 MHz / Chain 2

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5784.9948	5784.9945	5784.9943	5784.9938
110.00	5784.9947	5784.9939	5784.9937	5784.9935
93.50	5784.9942	5784.9935	5784.9929	5784.9927
Max. Deviation (MHz)	0.0058	0.0065	0.0071	0.0073
Max. Deviation (ppm)	1.00	1.12	1.23	1.26
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(℃)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-30	5785.0015	5785.0001	5784.9983	5784.9960
-20	5784.9999	5784.9986	5784.9969	5784.9945
-10	5784.9984	5784.9972	5784.9956	5784.9937
0	5784.9970	5784.9958	5784.9939	5784.9917
10	5784.9957	5784.9944	5784.9929	5784.9911
20	5784.9945	5784.9932	5784.9916	5784.9897
30	5784.9931	5784.9920	5784.9906	5784.9890
40	5784.9915	5784.9900	5784.9884	5784.9864
50	5784.9898	5784.9886	5784.9871	5784.9844
Max. Deviation (MHz)	0.0102	0.0114	0.0129	0.0156
Max. Deviation (ppm)	1.76	1.97	2.23	2.70
Result	Complies			

Mode: 40 MHz / Chain 2

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5754.9908	5754.9902	5754.9897	5754.9895
110.00	5754.9904	5754.9900	5754.9895	5754.9888
93.50	5754.9896	5754.9889	5754.9885	5754.9877
Max. Deviation (MHz)	0.0104	0.0111	0.0115	0.0123
Max. Deviation (ppm)	1.81	1.93	2.00	2.14
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-30	5754.9982	5754.9968	5754.9950	5754.9927
-20	5754.9966	5754.9953	5754.9936	5754.9912
-10	5754.9951	5754.9939	5754.9923	5754.9904
0	5754.9937	5754.9925	5754.9906	5754.9884
10	5754.9924	5754.9911	5754.9896	5754.9878
20	5754.9912	5754.9899	5754.9883	5754.9864
30	5754.9898	5754.9887	5754.9873	5754.9857
40	5754.9882	5754.9867	5754.9851	5754.9831
50	5754.9865	5754.9853	5754.9838	5754.9811
Max. Deviation (MHz)	0.0135	0.0147	0.0162	0.0189
Max. Deviation (ppm)	2.35	2.55	2.81	3.28
Result	Complies			

Mode: 80 MHz / Chain 2

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5774.9909	5774.9902	5774.9896	5774.9888
110.00	5774.9905	5774.9897	5774.9893	5774.9889
93.50	5774.9903	5774.9897	5774.9894	5774.9892
Max. Deviation (MHz)	0.0097	0.0103	0.0107	0.0112
Max. Deviation (ppm)	1.68	1.78	1.85	1.94
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-30	5774.9991	5774.9977	5774.9959	5774.9936
-20	5774.9975	5774.9962	5774.9945	5774.9921
-10	5774.9960	5774.9948	5774.9932	5774.9913
0	5774.9946	5774.9934	5774.9915	5774.9893
10	5774.9933	5774.9920	5774.9905	5774.9887
20	5774.9921	5774.9908	5774.9892	5774.9873
30	5774.9907	5774.9896	5774.9882	5774.9866
40	5774.9891	5774.9876	5774.9860	5774.9840
50	5774.9874	5774.9862	5774.9847	5774.9820
Max. Deviation (MHz)	0.0126	0.0138	0.0153	0.0180
Max. Deviation (ppm)	2.18	2.39	2.65	3.12
Result	Complies			

4.8. Antenna Requirements

4.8.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.8.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 13, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 09, 2015	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%