

TEST REPORT

of

FCC Part 15 Subpart E §15.407

FCC ID: BEJIGCJ1PHE

Equipment Under Test : Car AVN
Model Name : IGCJ1PHE
Applicant : LG Electronics USA
Manufacturer : LG Electronics USA
Date of Receipt : 2018.09.21
Date of Test(s) : 2018.09.22 ~ 2019.05.13
Date of Issue : 2019.05.14

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Nancy Park

Date:

2019.05.14

Technical
Manager:



Jungmin Yang

Date:

2019.05.14

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RTT5041-19(2019.04.24)(1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

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1. General Information

1.1. Testing Laboratory

- SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
 - 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
 - Designation number: KR0150

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1.2. Details of Applicant

Applicant : LG Electronics USA
 Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632
 Contact Person : Han, Kyung-su
 Phone No. : +2 201 472 2623

1.3. Details of Manufacturer

Company : LG Electronics Inc.
 Address : 10, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796

1.4. Description of EUT

Kind of Product	Car AVN	
Model Name	IGCJ1PHE	
Power Supply	DC 12 V	
Frequency Range	5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20), 5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40), 5 210 MHz (Band 1: 11ac_VHT80), 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20), 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40), 5 775 MHz (Band 3: 11ac_VHT80)	
Modulation Technique	OFDM	
Number of Channels	4 channel (Band 1: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80)	
Antenna Type	External antenna	
Antenna Gain	ANT 1	5 150 MHz ~ 5 250 MHz: 5 dB i, 5 725 MHz ~ 5 850 MHz: 5 dB i
	ANT 2	5 150 MHz ~ 5 250 MHz: 5 dB i, 5 725 MHz ~ 5 850 MHz: 5 dB i

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	Annual	Jul. 03, 2019
Signal Generator	R&S	SMBV100A	255834	Jun. 15, 2018	Annual	Jun. 15, 2019
Spectrum Analyzer	R&S	FSV30	103210	Dec. 05, 2018	Annual	Dec. 05, 2019
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 21, 2018	Annual	Sep. 21, 2019
Spectrum Analyzer	Agilent	N9030A	US51350132	Sep. 21, 2018	Annual	Sep. 21, 2019
Power Meter	Anritsu	ML2495A	1223004	Jun. 12, 2018	Annual	Jun. 12, 2019
Power Sensor	Anritsu	MA2411B	1207272	Jun. 12, 2018	Annual	Jun. 12, 2019
Attenuator	MCLI	FAS-23-20	23834	Jun. 12, 2018	Annual	Jun. 12, 2019
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-2	Feb. 19, 2019	Annual	Feb. 19, 2020
High Pass Filter	Wainwright Instrument GmbH	WHKX6.0/18G-10SS	51	Jun. 11, 2018	Annual	Jun. 11, 2019
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	May 27, 2018	Annual	May 27, 2019
DC Power Supply	R&S	HMP2020	019258024	Nov. 06, 2018	Annual	Nov. 06, 2019
Preamplifier	H.P.	8447F	2944A03909	Aug. 07, 2018	Annual	Aug. 07, 2019
Preamplifier	Agilent	8449B	3008A01932	Feb. 22, 2019	Annual	Feb. 22, 2020
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 13, 2018	Annual	May 13, 2019
Loop Antenna	R&S	HFH2-Z2	100118	Jun. 12, 2017	Biennial	Jun. 12, 2019
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Mar. 26, 2018	Biennial	Mar. 26, 2020
Horn Antenna	R&S	HF906	100326	Feb. 14, 2018	Biennial	Feb. 14, 2020
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	BBHA9170431	Sep. 10, 2018	Biennial	Sep. 10, 2020
Test Receiver	R&S	ESU26	100109	Jan. 31, 2019	Annual	Jan. 31, 2020
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jan. 04, 2019	Semi-annual	Jul. 04, 2019
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jan. 04, 2019	Semi-annual	Jul. 04, 2019
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 01/20	Feb. 28, 2019	Semi-annual	Aug. 28, 2019

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1.6. Summary of Test Result

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart E		
Section	Test Item(s)	Result
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(4)	Transmitter Radiated Spurious Emissions	Complied
15.407(a)	26 dB Bandwidth & 99 % Bandwidth	Complied
15.407(e)	6 dB Bandwidth	Complied
15.407(a)(1) 15.407(a)(3)	Maximum Conducted Output Power	Complied
15.407(a)(1) 15.407(a)(3)	Peak Power Spectral Density	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 General UNII Test Procedures New Rules v02r01 were used in the measurement of the DUT.

1.8. Sample Calculation

Where relevant, the following sample calculation is provided:

1.8.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.8.2. Radiation Test

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB)

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1.9. Measurement Uncertainty

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

Parameter	Uncertainty
RF Output Power	± 0.34 dB
Occupied Bandwidth	± 9.66 kHz
Power Spectral Density	± 0.41 dB
Conducted Spurious Emission	± 0.76 dB
Radiated Emission, 9 kHz to 30 MHz	± 3.59 dB
Radiated Emission, below 1 GHz	± 5.88 dB
Radiated Emission, above 1 GHz	± 5.94 dB

Uncertainty figures are valid to a confidence level of 95 %.

1.10. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013754	2019.04.24	Initial
1	F690501/RF-RTL013754-1	2019.05.14	Added measurement uncertainty of RF conducted test and bandwidth test result of which antenna

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1.11. Duty Cycle of EUT

Regarding to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, B, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below
 Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value, Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

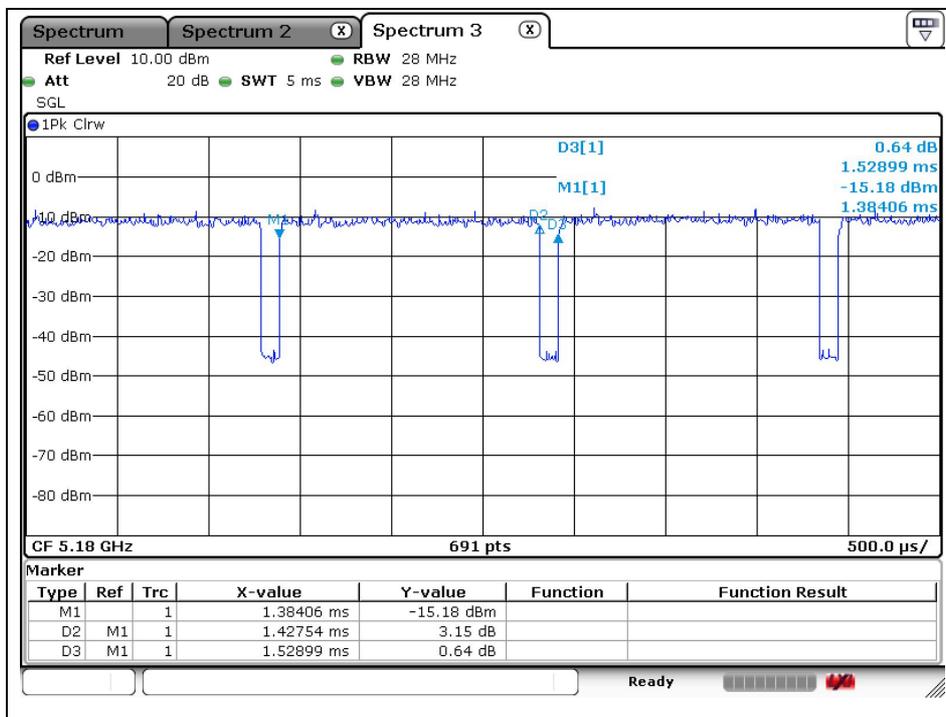
Mode	Data Rate (Mbps)	Duty Cycle (%)	Correction factor (dB)
11a	6	93.36	0.30
11n_HT20	MCS0	92.93	0.32
11n_HT40	MCS0	86.74	0.62
11ac_VHT80	MCS0	76.67	1.15

Remark;

1. As measured duty cycles of EUT, all of mode and data rate keep constant period and are converted to log scale (power averaging) to compensate correction factor to result of average test items.
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (dB) = 10 log (1 / Duty cycle)

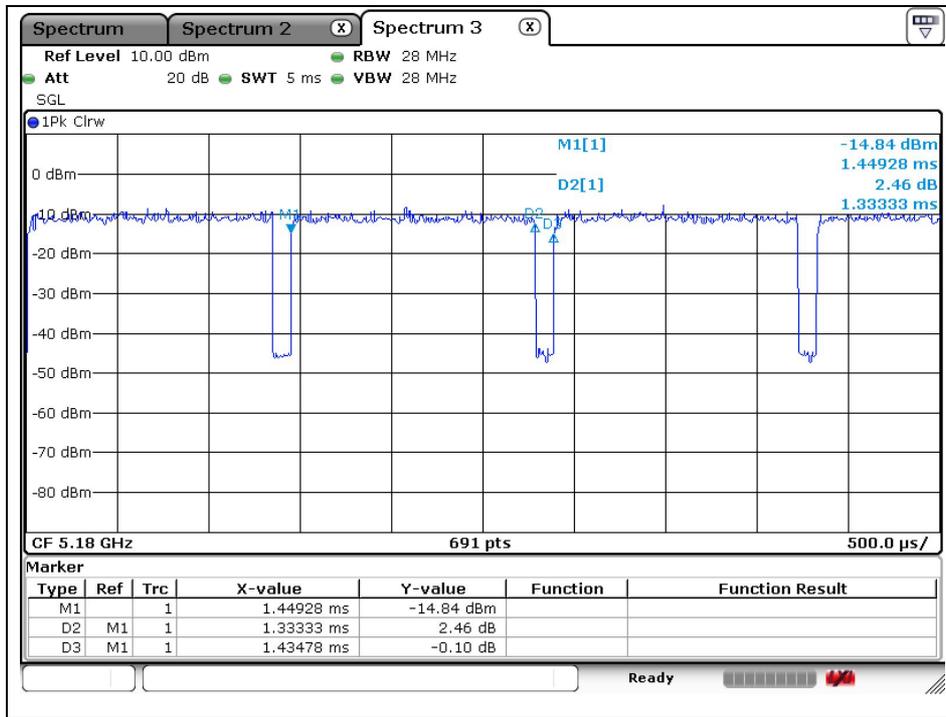
- Test plots

802.11a

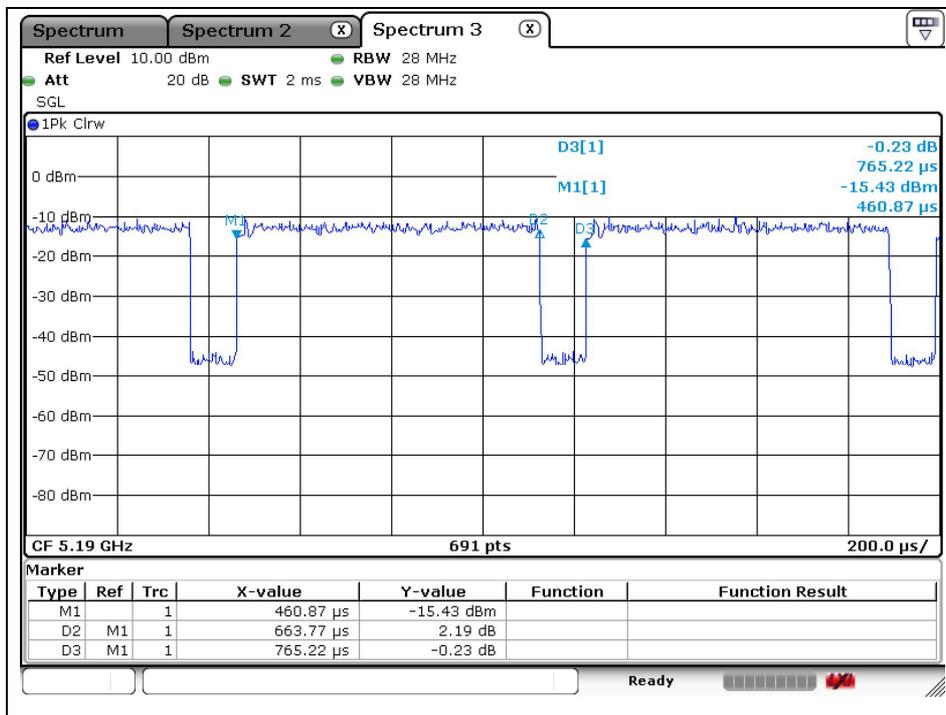


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802.11n_HT20

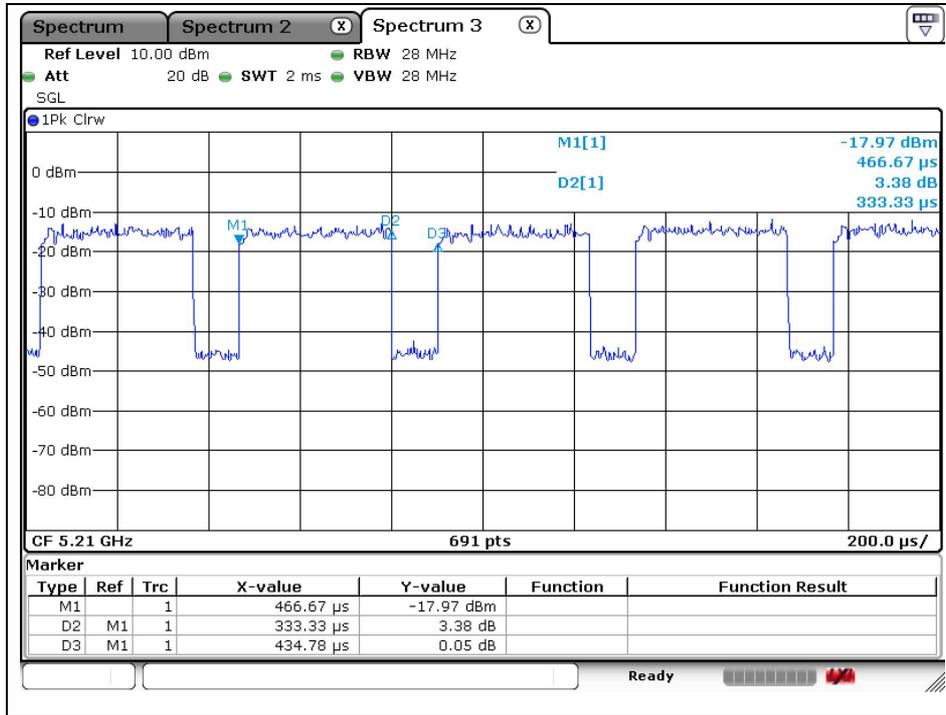


802.11n_HT40



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802.11ac_VHT80



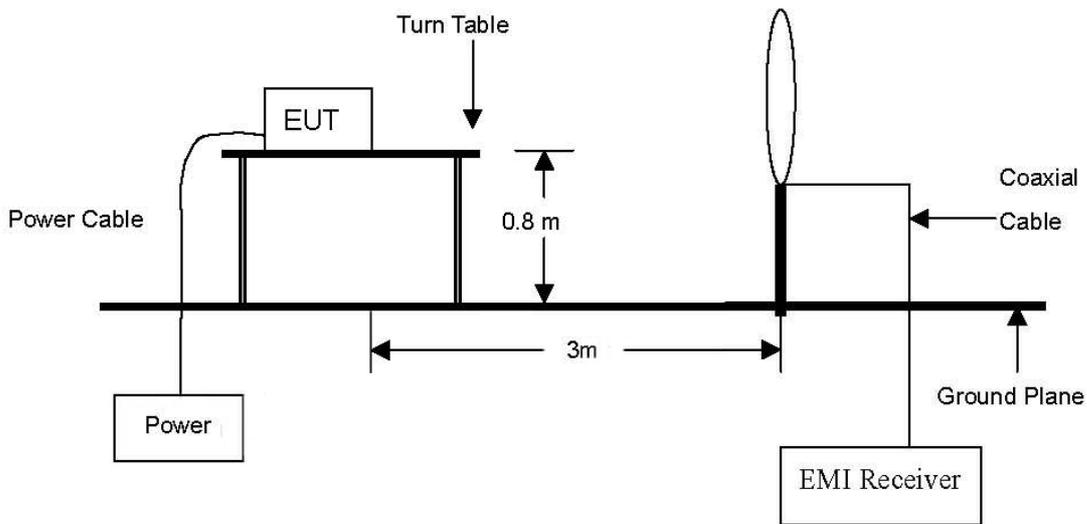
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2. Transmitter Radiated Spurious Emissions

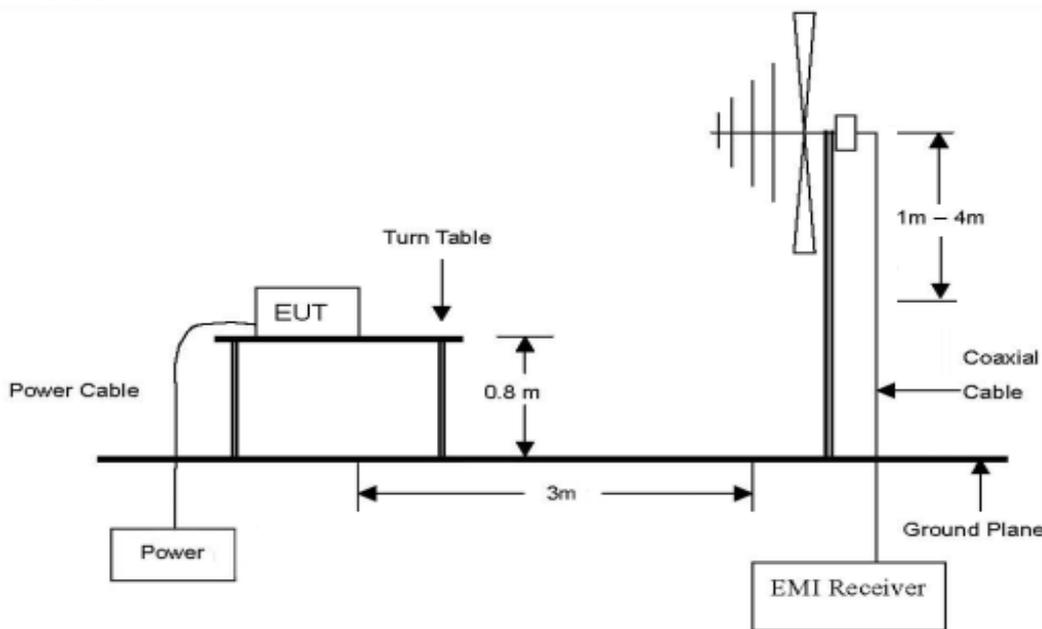
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz emissions.

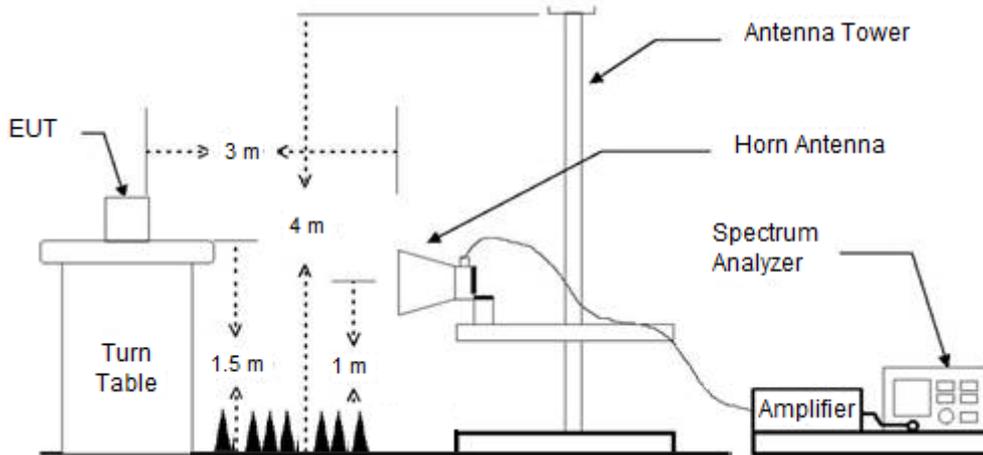


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



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The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



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2.2. Limit

According to § 15.407(b)

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

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

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

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (Meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

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2.3. Test Procedures

Radiated spurious emissions from the EUT were measured according to the dictates in section G of KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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Note;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

- II.G.4. Unwanted emissions measurements below 1 GHz.

Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

- II.G.5. Unwanted maximum emissions measurements above 1 GHz.

Peak emission levels are measured by setting the analyzer as follows:

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = Peak, Sweep time = auto, Trace mode = Max hold.

- II.G.6. Average unwanted emissions measurements above 1 GHz.

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = power averaging (rms), Averaging type = power averaging (rms), Sweep time = auto, Perform a trace average of at least 100 traces. If the transmission is continuous, if the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 % duty cycle, at least 200 traces shall be averaged.

If tests are performed with the EUT transmitting at a duty cycle less than 98 %, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle. The correction factor is computed as follows:

- If power averaging (rms) mode was used in II.G.6.c)(iv), the correction factor is $10 \log(1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50 %, then 3 dB must be added to the measured emission levels.

- To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes (X, Y, Z). Worst orthogonal plan of EUT is **X – axis** during radiation test.

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2.4. Test result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission below 1 000 MHz

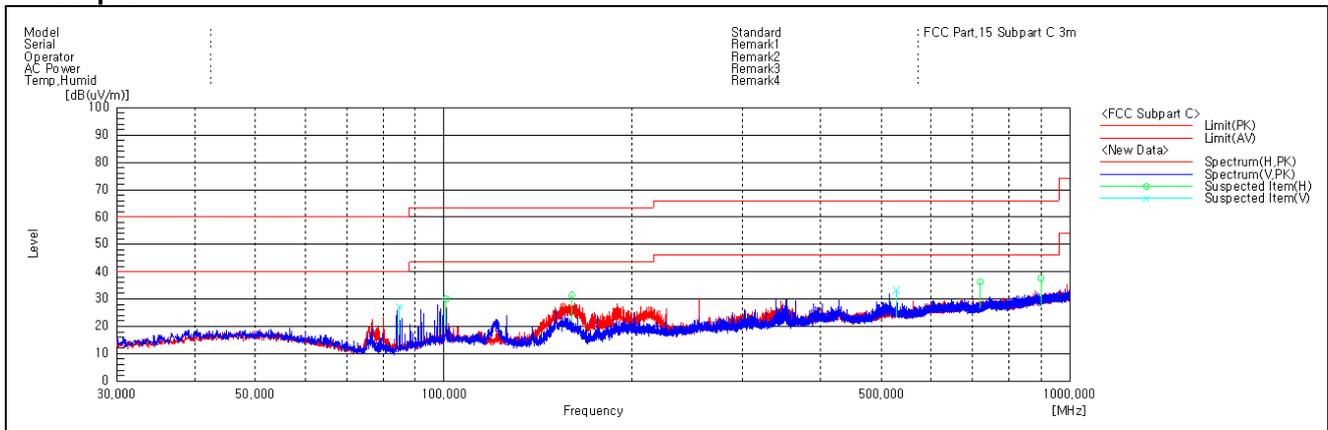
The frequency spectrum from 9 kHz to 1 000 MHz was investigated. All reading values are peak values.

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBµV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)
32.34	38.60	Peak	V	11.72	-26.91	23.41	40.00	16.59
77.09	43.00	Peak	H	7.49	-25.83	24.66	40.00	15.34
159.98	46.70	Peak	H	8.70	-24.20	31.20	43.50	12.30
528.34	39.00	Peak	V	17.80	-22.41	34.39	46.00	11.61
719.90	37.30	Peak	V	20.00	-22.44	34.86	46.00	11.14
900.01	38.90	Peak	H	22.30	-22.03	39.17	46.00	6.83

Remark;

- Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
- Reported spurious emissions are in **11ac VHT80 (Band 3) / MCS0 / Middle channel**, as worst case among other modes.
- Radiated spurious emission measurement as below.
(Actual = Reading + AF + AMP + CL)
- According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

- Test plot



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2.4.2. Radiated Spurious Emission above 1 000 MHz

OFDM: 802.11a (6 Mbps) Band 1_ANT 1+ANT 2

A. Low Channel (5 180 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	44.57	Peak	H	31.80	-23.20	-	53.17	74.00	20.83
*4 500.00	34.52	Average	H	31.80	-23.20	0.30	43.42	54.00	10.58
*4 809.00	46.72	Peak	H	32.45	-22.74	-	56.43	74.00	17.57
*4 580.25	35.27	Average	H	31.70	-23.04	0.30	44.23	54.00	9.77
*5 150.00	44.06	Peak	H	33.30	-22.57	-	54.79	74.00	19.21
*5 150.00	34.33	Average	H	33.30	-22.57	0.30	45.36	54.00	8.64

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 220 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 240 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11a (6 Mbps) Band 3_ANT 1+ANT 2

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 635.96	45.98	Peak	H	33.70	-21.83		57.85	68.23	10.38
5 691.14	45.79	Peak	H	33.86	-21.58		58.07	98.67	40.60
5 704.47	46.00	Peak	H	33.90	-21.54		58.36	106.48	48.12
5 724.00	44.46	Peak	H	33.90	-21.61		56.75	119.95	63.20

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 852.24	45.28	Peak	H	34.01	-21.40		57.89	117.12	59.23
5 862.14	45.48	Peak	H	34.07	-21.34		58.21	108.83	50.62
5 895.97	45.72	Peak	H	34.28	-21.10		58.90	89.71	30.81
5 961.31	46.25	Peak	H	34.40	-21.18		59.47	68.36	8.89

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11n_HT20 (MCS0) Band 1_ANT 1+ANT 2

A. Low Channel (5 180 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	45.38	Peak	H	31.80	-23.20	-	53.98	74.00	20.02
*4 500.00	34.31	Average	H	31.80	-23.20	0.32	43.23	54.00	10.77
*4 552.50	47.36	Peak	H	31.70	-23.13	-	55.93	74.00	18.07
*4 632.00	35.32	Average	H	31.83	-22.83	0.32	44.64	54.00	9.36
*5 150.00	45.23	Peak	H	33.30	-22.57	-	55.96	74.00	18.04
*5 150.00	34.27	Average	H	33.30	-22.57	0.32	45.32	54.00	8.68

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 220 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 240 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11n_HT20 (MCS0) Band 3_ANT 1+ANT 2

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 611.01	45.69	Peak	H	33.70	-21.75		57.64	68.23	10.59
5 695.79	46.14	Peak	H	33.88	-21.55		58.47	102.11	43.64
5 713.93	45.26	Peak	H	33.90	-21.57		57.59	109.13	51.54
5 721.21	44.98	Peak	H	33.90	-21.60		57.28	113.59	56.31

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 850.00	44.68	Peak	H	34.00	-21.43		57.25	122.23	64.98
5 860.66	44.70	Peak	H	34.06	-21.35		57.41	109.24	51.83
5 904.55	45.29	Peak	H	34.31	-21.08		58.52	83.36	24.84
5 950.25	45.60	Peak	H	34.40	-21.18		58.82	68.23	9.41

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11n_HT40 (MCS0) Band 1_ANT 1+ANT 2

A. Low Channel (5 190 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	44.57	Peak	H	31.80	-23.20	-	53.17	74.00	20.83
*4 500.00	34.92	Average	H	31.80	-23.20	0.62	44.14	54.00	9.86
*4 662.75	46.80	Peak	H	31.95	-22.85	-	55.90	74.00	18.10
*4 710.75	34.93	Average	H	32.12	-22.87	0.62	44.80	54.00	9.20
*5 150.00	44.12	Peak	H	33.30	-22.57	-	54.85	74.00	19.15
*5 150.00	34.26	Average	H	33.30	-22.57	0.62	45.61	54.00	8.39

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 230 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11n_HT40 (MCS0) Band 3_ANT 1+ANT 2

A. Low Channel (5 755 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 631.50	44.85	Peak	H	33.70	-21.81		56.74	68.23	11.49
5 659.58	44.77	Peak	H	33.74	-21.79		56.72	75.32	18.60
5 706.56	44.89	Peak	H	33.90	-21.54		57.25	107.06	49.81
5 720.00	44.02	Peak	H	33.90	-21.60		56.32	110.83	54.51

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 795 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 853.42	44.95	Peak	H	34.02	-21.40		57.57	114.43	56.86
5 871.32	44.43	Peak	H	34.13	-21.27		57.29	106.26	48.97
5 918.08	46.19	Peak	H	34.34	-21.11		59.42	73.35	13.93
5 946.36	44.45	Peak	H	34.39	-21.18		57.66	68.23	10.57

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11ac_VHT80 (MCS0) Band 1_ANT 1+ANT 2

A. Low Channel (5 210 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	44.08	Peak	H	31.80	-23.20	-	52.68	74.00	21.32
*4 500.00	34.85	Average	H	31.80	-23.20	1.15	44.60	54.00	9.40
*4 729.47	46.03	Peak	H	32.16	-22.84	-	55.35	74.00	18.65
*4 593.75	35.27	Average	H	31.70	-22.98	1.15	45.14	54.00	8.86
*5 150.00	44.31	Peak	H	33.30	-22.57	-	55.04	74.00	18.96
*5 150.00	34.12	Average	H	33.30	-22.57	1.15	46.00	54.00	8.00

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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OFDM: 802.11ac_VHT80 (MCS0) Band 3_ANT 1+ANT 2

A. Middle Channel (5 775 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 647.16	45.23	Peak	H	33.70	-21.86		57.07	68.23	11.16
5 667.32	45.80	Peak	H	33.77	-21.74		57.83	81.04	23.21
5 713.04	45.08	Peak	H	33.90	-21.57		57.41	108.88	51.47
5 720.00	44.06	Peak	H	33.90	-21.60		56.36	110.83	54.47
5 850.50	45.27	Peak	H	34.00	-21.42		57.85	121.09	63.24
5 872.67	44.62	Peak	H	34.14	-21.26		57.50	105.88	48.38
5 914.25	45.67	Peak	H	34.33	-21.10		58.90	76.18	17.28
5 936.01	45.67	Peak	H	34.37	-21.16		58.88	68.23	9.35

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Remark;

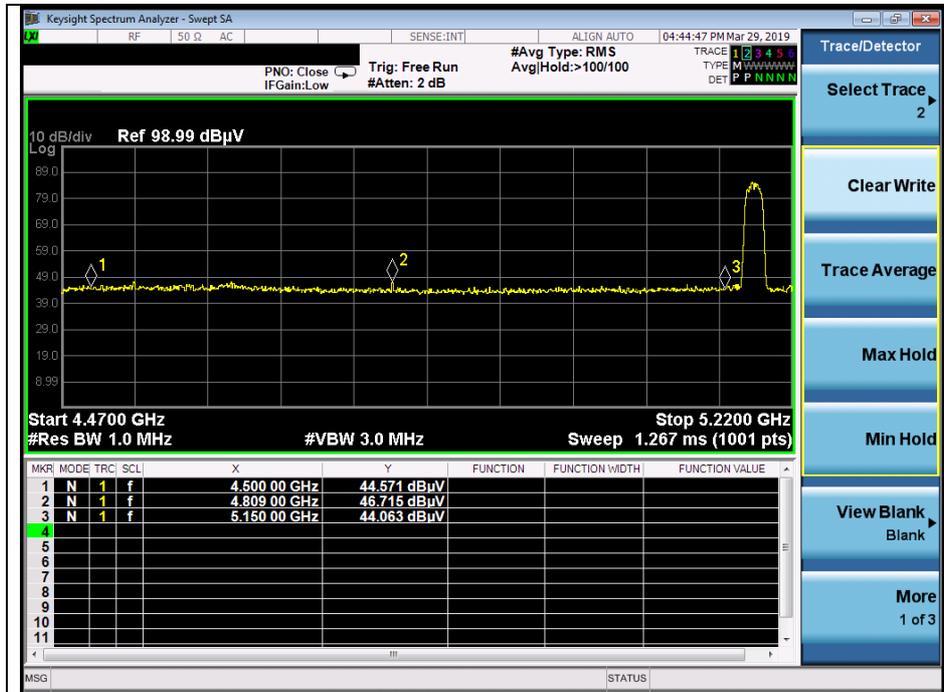
1. "*" means the restricted band.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak / average detector mode if frequency was in restricted band. Otherwise the frequency was out of restricted band, only peak detector should be used.
3. Actual = Reading + AF + AMP + CL + (DF)
4. If frequency was out of restricted band, the calculation method for peak limit is same as below.
 $68.23 \text{ dB}\mu\text{V/m} = \text{EIRP} - 20 \log(d) + 104.77 = -27 - 20 \log(3) + 104.77$
5. In case of the emissions within $\pm 75 \text{ MHz}$ from band edge of band 3, limit should be adjusted to emission mask of 15.407(4)(i).
6. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 dB.
7. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

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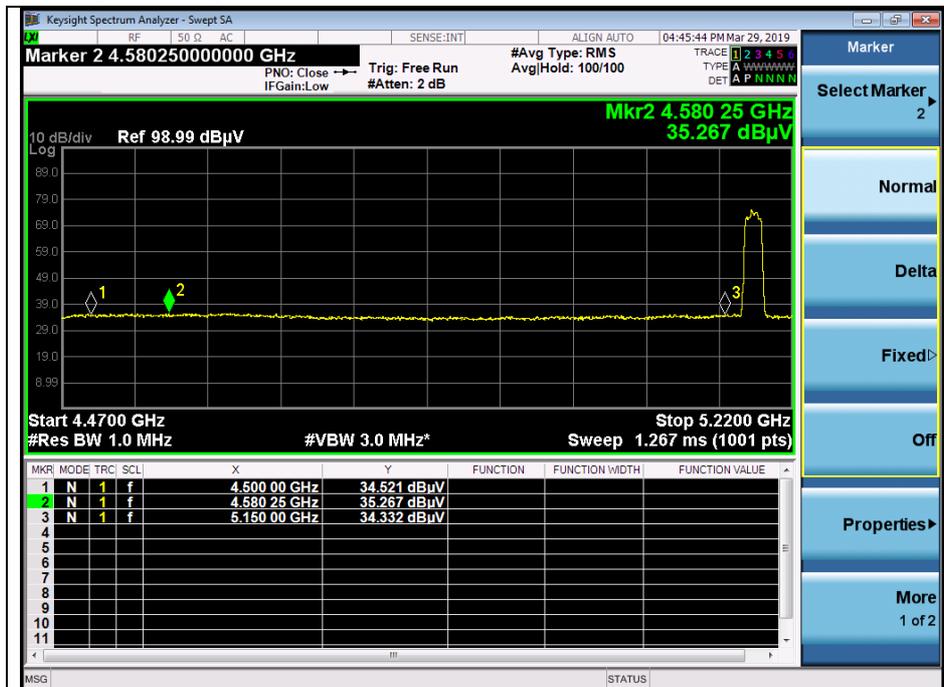
- Test plots

OFDM: 802.11a (6 Mbps)_ANT 1+ANT 2

Low channel Band edge (Peak) - Band 1



Low channel Band edge (Average) - Band 1

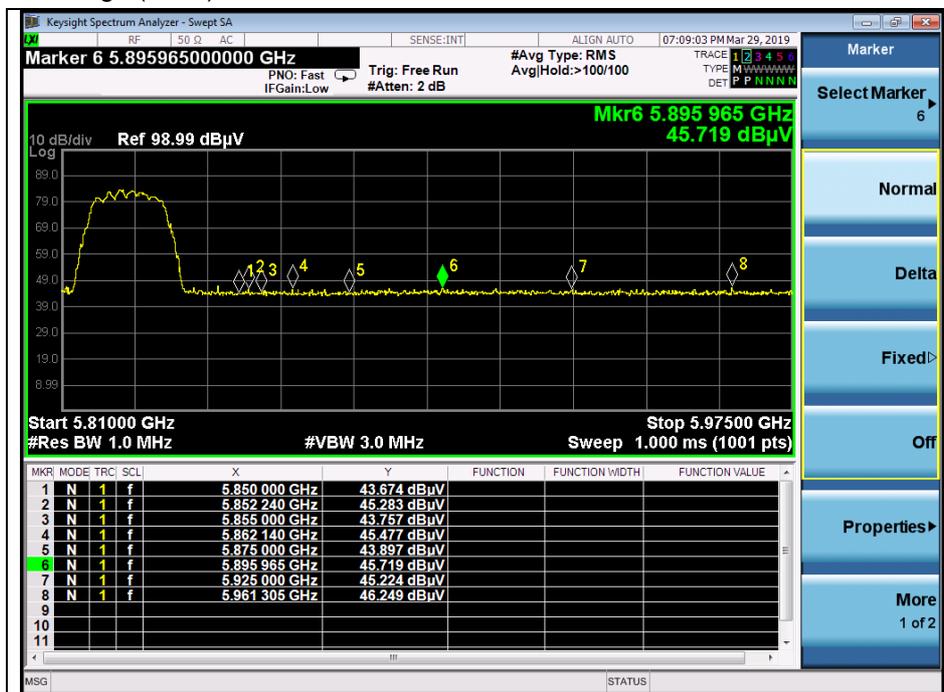


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Low channel Band edge (Peak) - Band 3



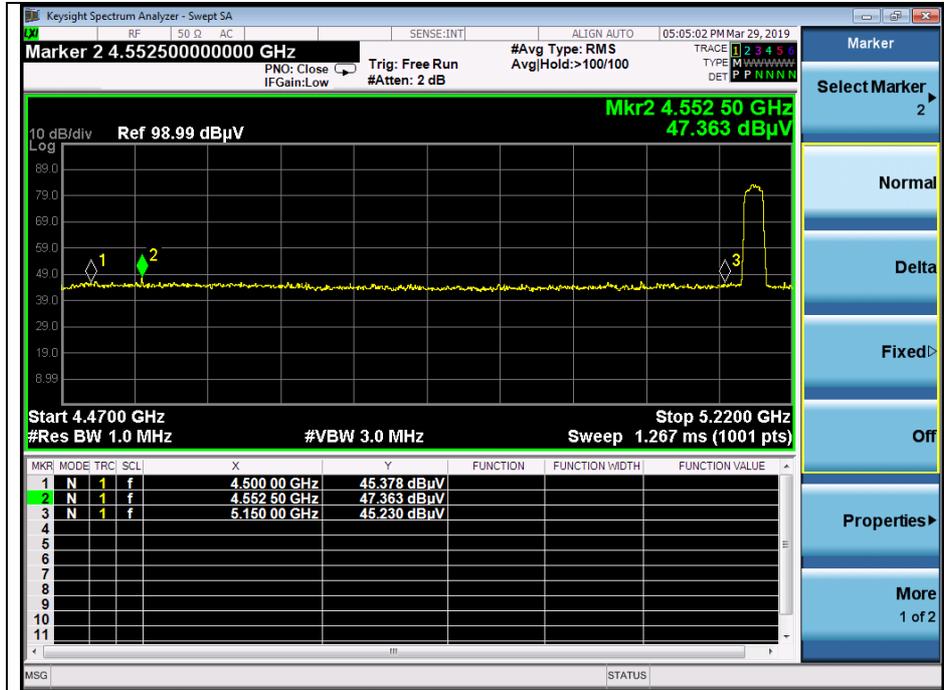
High channel Band edge (Peak) - Band 3



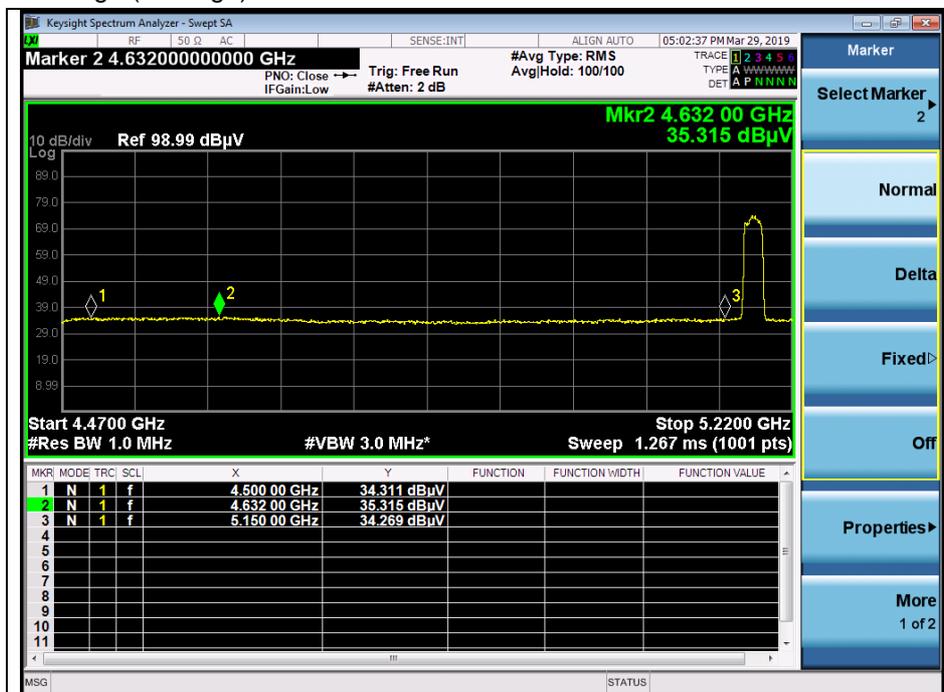
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OFDM: 802.11n_HT20 (MCS0)_ANT 1+ANT 2

Low channel Band edge (Peak) - Band 1

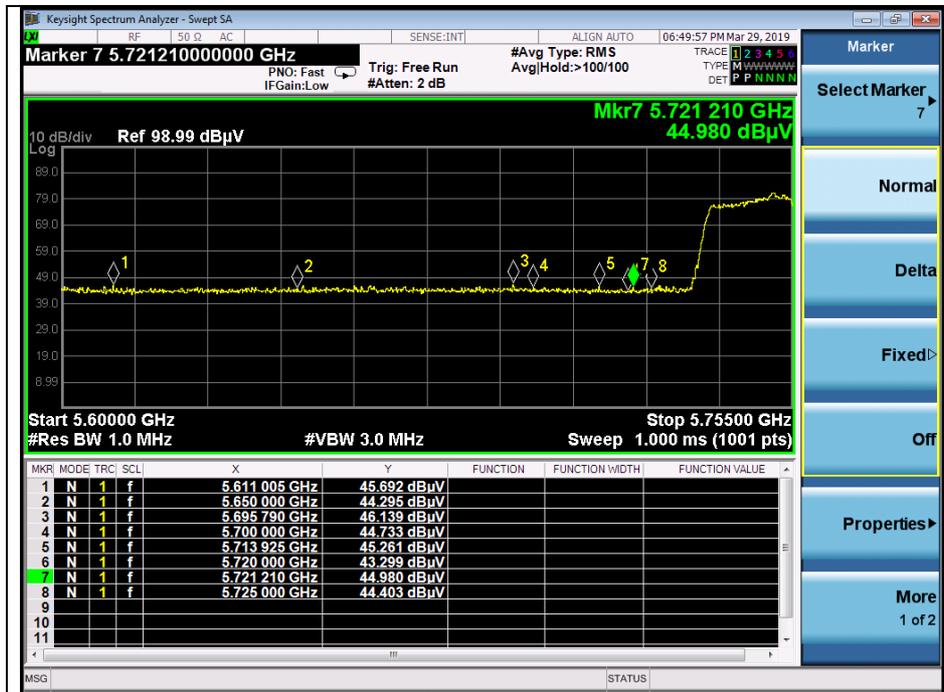


Low channel Band edge (Average) - Band 1

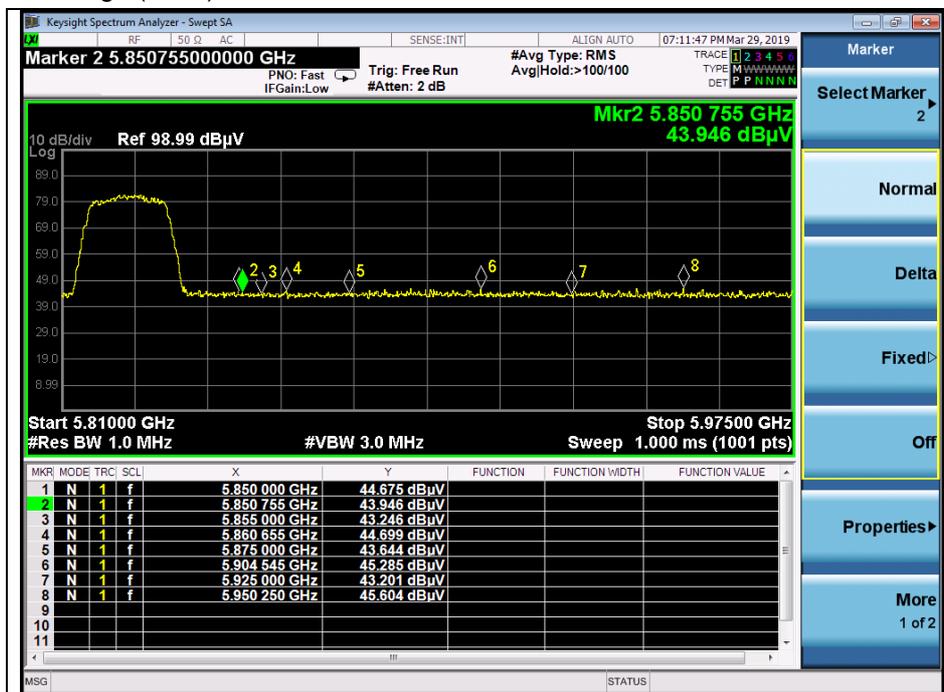


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Low channel Band edge (Peak) - Band 3



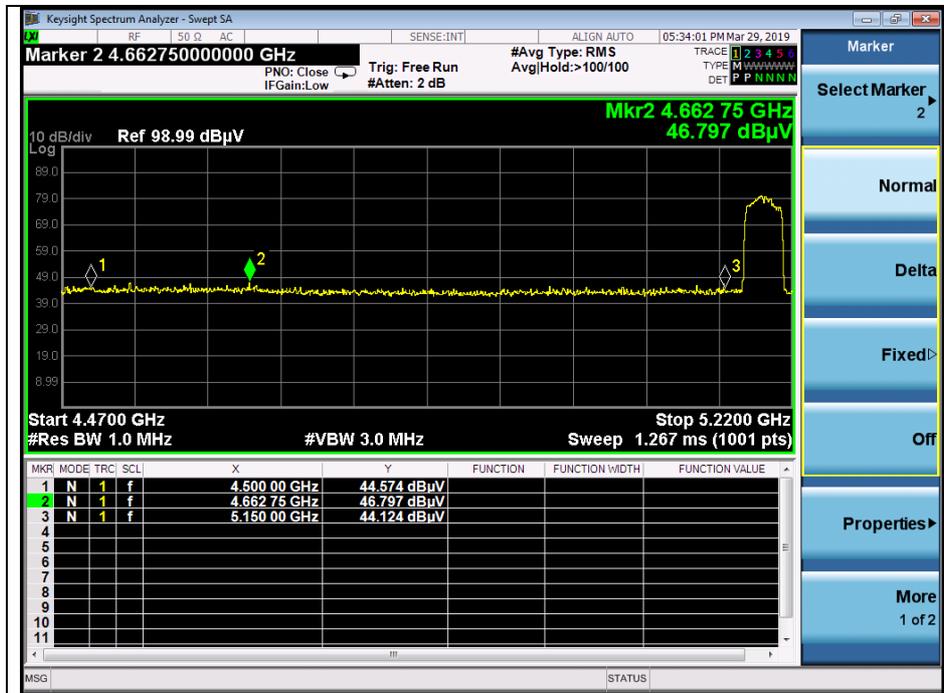
High channel Band edge (Peak) - Band 3



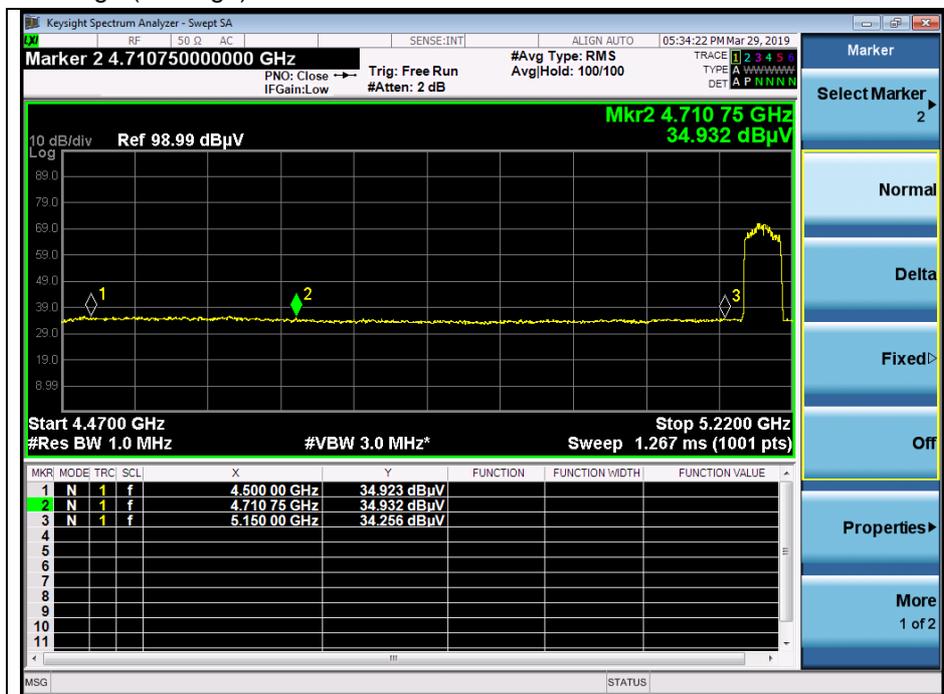
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OFDM: 802.11n_HT40 (MCS0)_ANT 1+ANT 2

Low channel Band edge (Peak) - Band 1

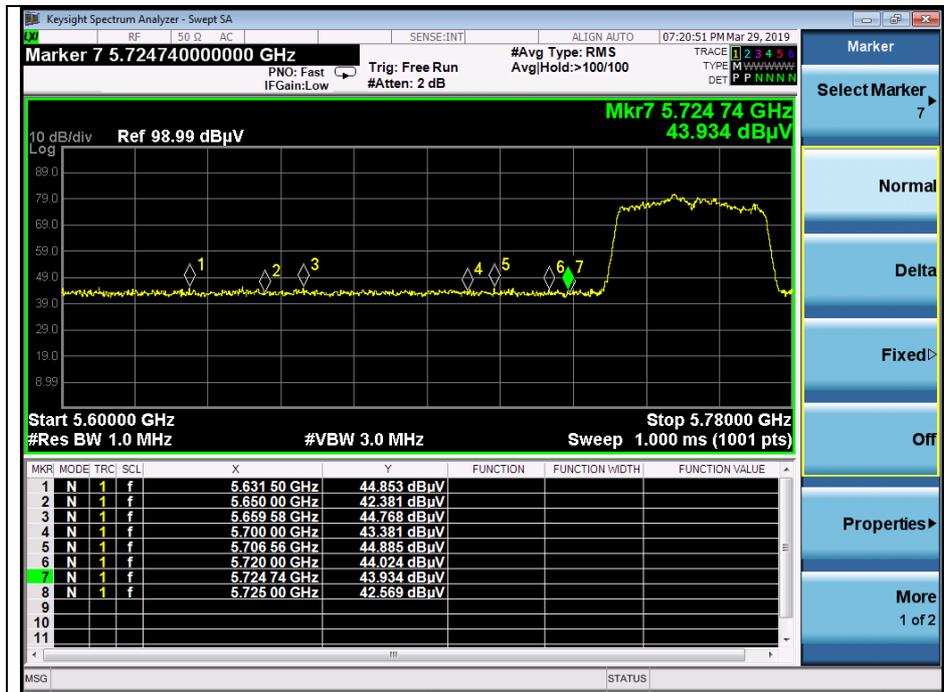


Low channel Band edge (Average) - Band 1



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Low channel Band edge (Peak) - Band 3



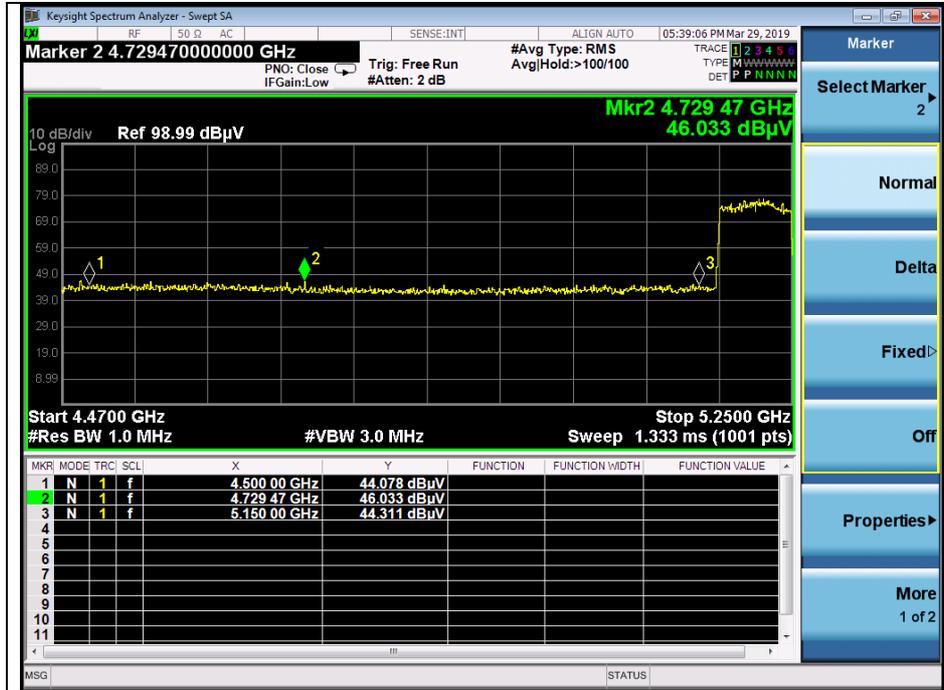
High channel Band edge (Peak) - Band 3



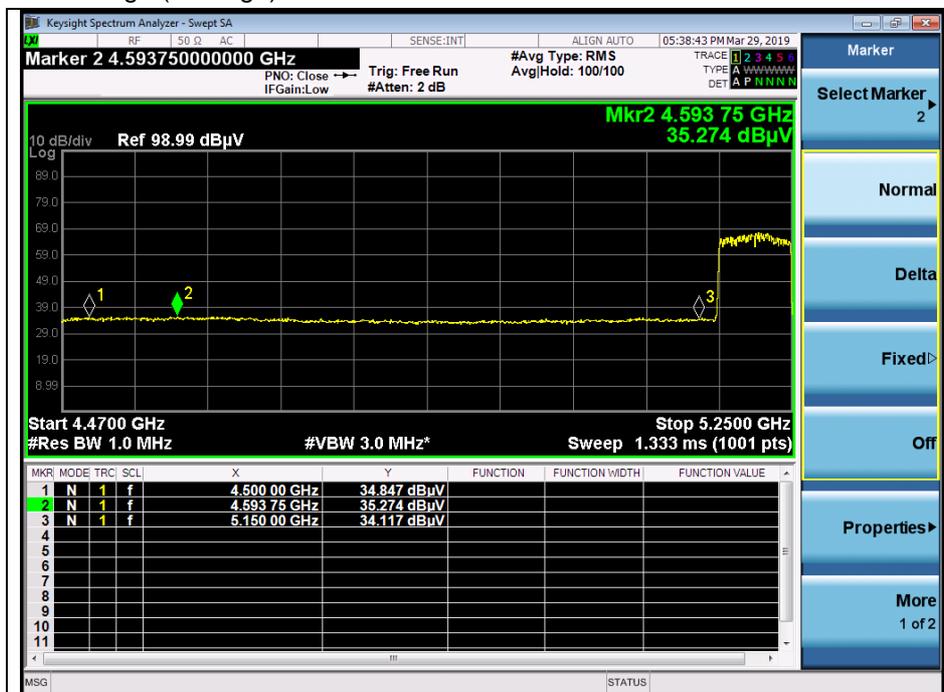
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OFDM: 802.11ac_VHT80 (MCS0)_ANT 1+ANT 2

Middle channel Band edge (Peak) - Band 1

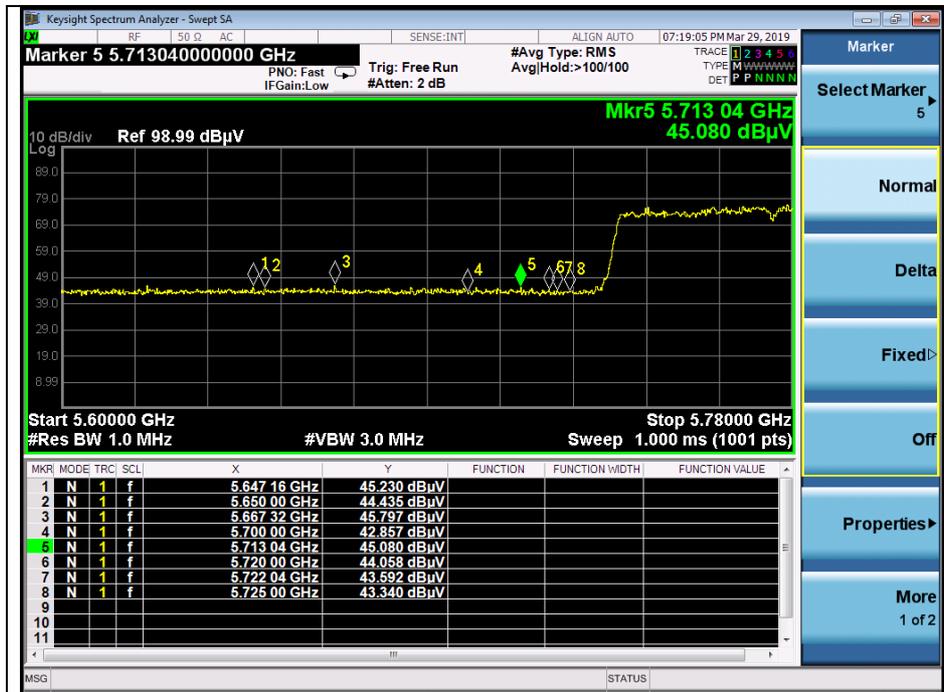


Middle channel Band edge (Average) - Band 1



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Low channel Band edge (Peak) - Band 3



High channel Band edge (Peak) - Band 3



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3. 26 dB Bandwidth & 99 % Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purpose only.

3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

3.3.1. 26 dB Bandwidth

1. This measurement settings are specified in section C.1 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW: approximately 1 % of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. 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 %.

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3.3.2. 99 % Bandwidth

1. This measurement settings are specified in section D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5 % of the OBW.
5. Set VBW \geq 3 x RBW.
6. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
7. Use the 99 % power bandwidth function of the instrument (if available).
8. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % occupied bandwidth is the difference between these two frequencies.

In the result,

- DFS requirements are not applicable in the 5 150 MHz - 5 250 MHz.

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RTT5041-19(2019.04.24)(1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

3.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	
					ANT 1	ANT 2
11a	U-NII 1	5 180	36	6	20.955	21.245
		5 220	44		21.476	21.013
		5 240	48		21.506	21.187
	U-NII 3	5 745	149		21.708	21.129
		5 785	157		21.534	21.245
		5 825	165		21.708	21.187

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	
					ANT 1	ANT 2
11n_HT20	U-NII 1	5 180	36	MCS0	21.360	21.476
		5 220	44		21.737	21.476
		5 240	48		22.026	21.245
	U-NII 3	5 745	149		23.039	21.303
		5 785	157		21.766	21.418
		5 825	165		22.402	21.418

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	
					ANT 1	ANT 2
11n_HT40	U-NII 1	5 190	38	MCS0	39.410	39.942
		5 230	46		40.190	40.174
	U-NII 3	5 755	151		39.860	40.174
		5 795	159		39.650	40.174

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	
					ANT 1	ANT 2
11ac_VHT80	U-NII 1	5 210	42	MCS0	82.520	81.737
	U-NII 3	5 775	155		81.270	81.968

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	99% Bandwidth (MHz)	
					ANT 1	ANT 2
11a	U-NII 1	5 240	48	6	16.961	17.019
11n_HT20		5 240	48	MCS0	17.829	18.177
11n_HT40		5 230	46	MCS0	36.585	36.700
11ac_VHT80		5 210	42	MCS0	75.716	75.948

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- Test plots

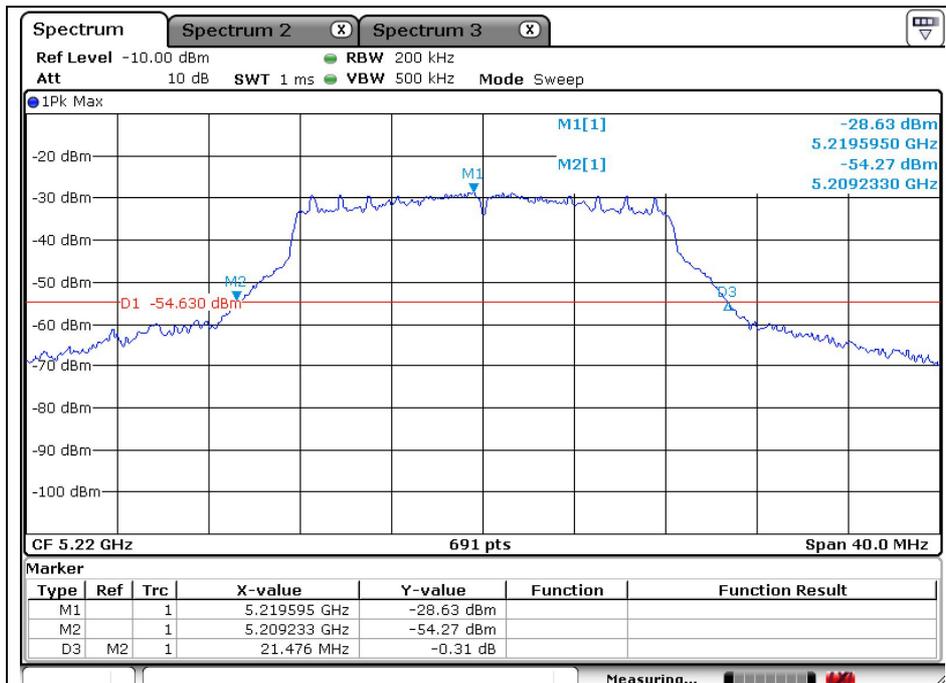
26 dB Bandwidth

802.11a (Band 1)_ANT 1

Low Channel (5 180 MHz)

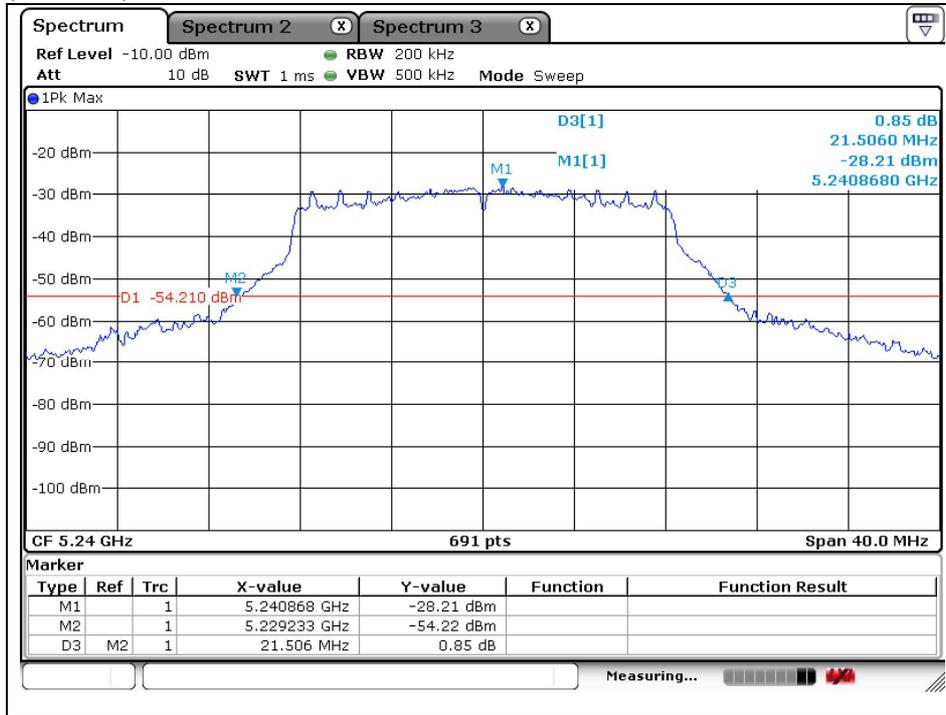


Middle Channel (5 220 MHz)



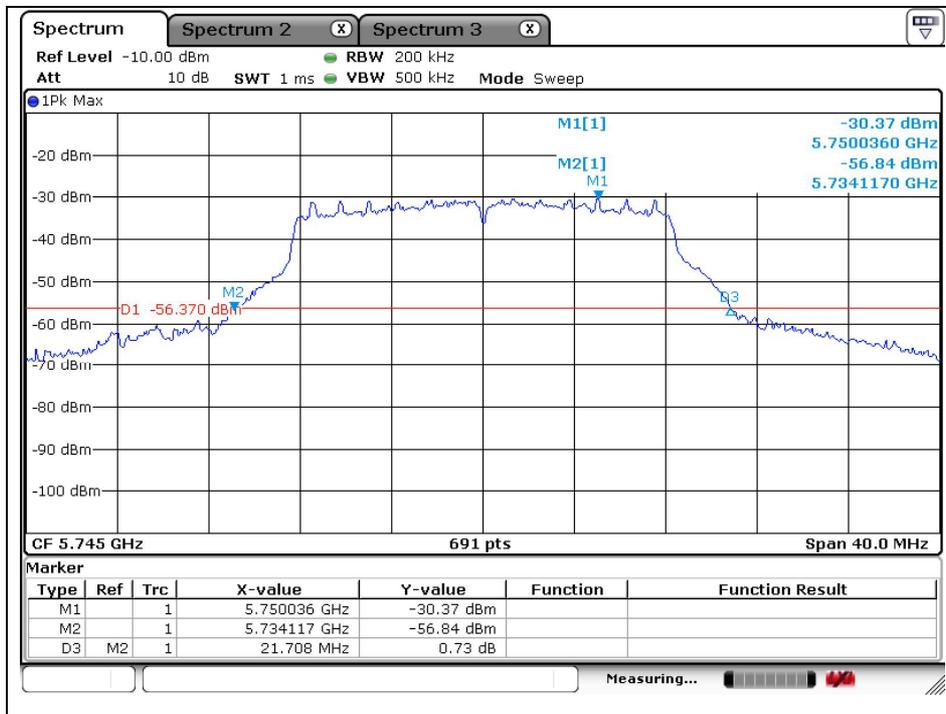
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

High Channel (5 240 MHz)



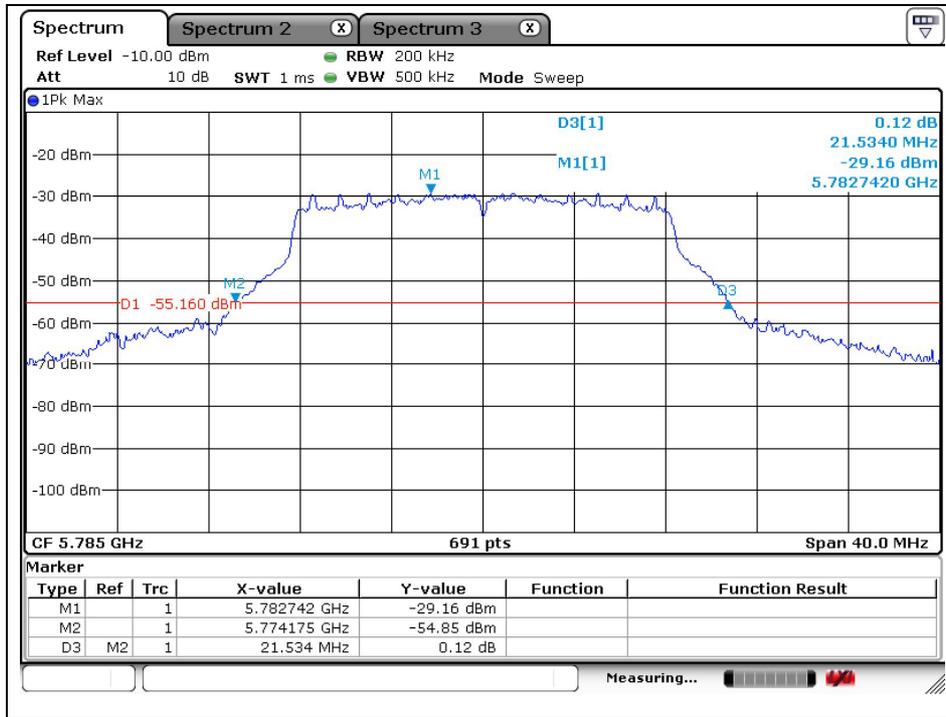
802.11a (Band 3)_ANT 1

Low Channel (5 745 MHz)

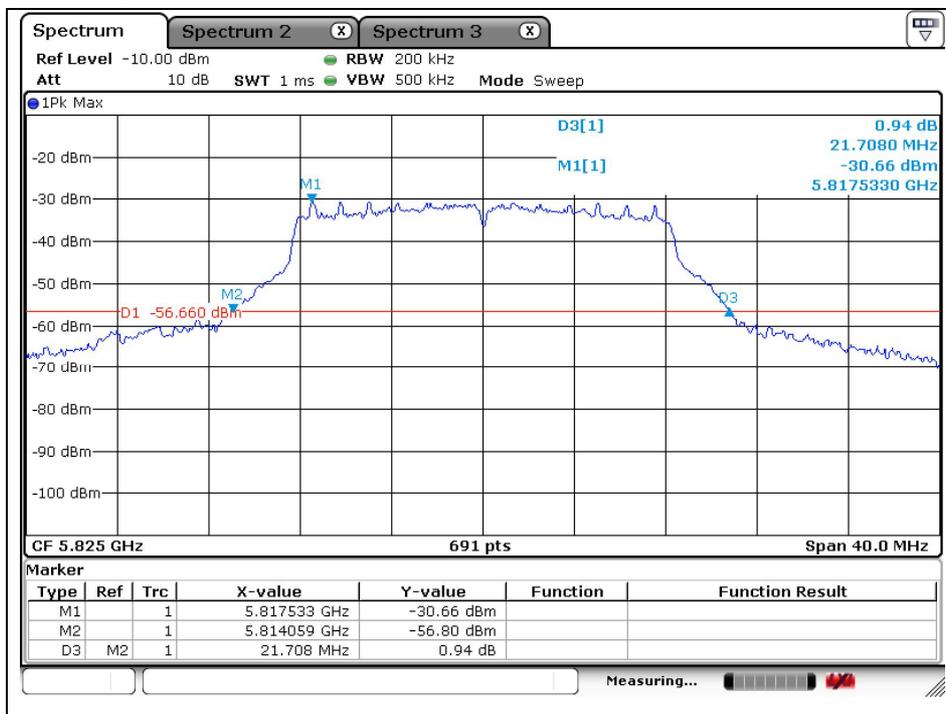


The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

Middle Channel (5 785 MHz)



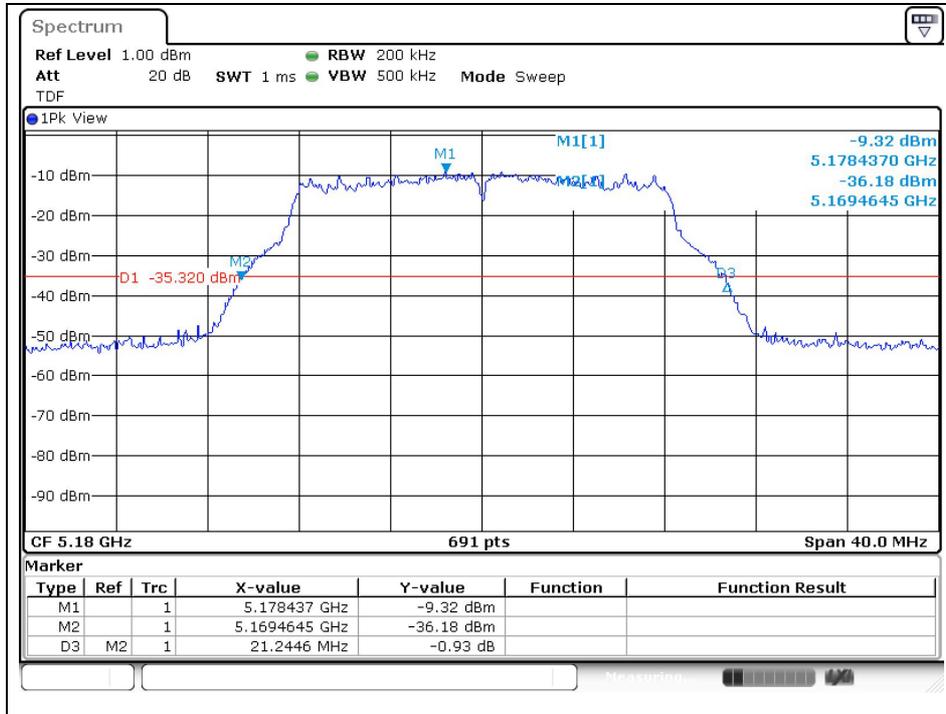
High Channel (5 825 MHz)



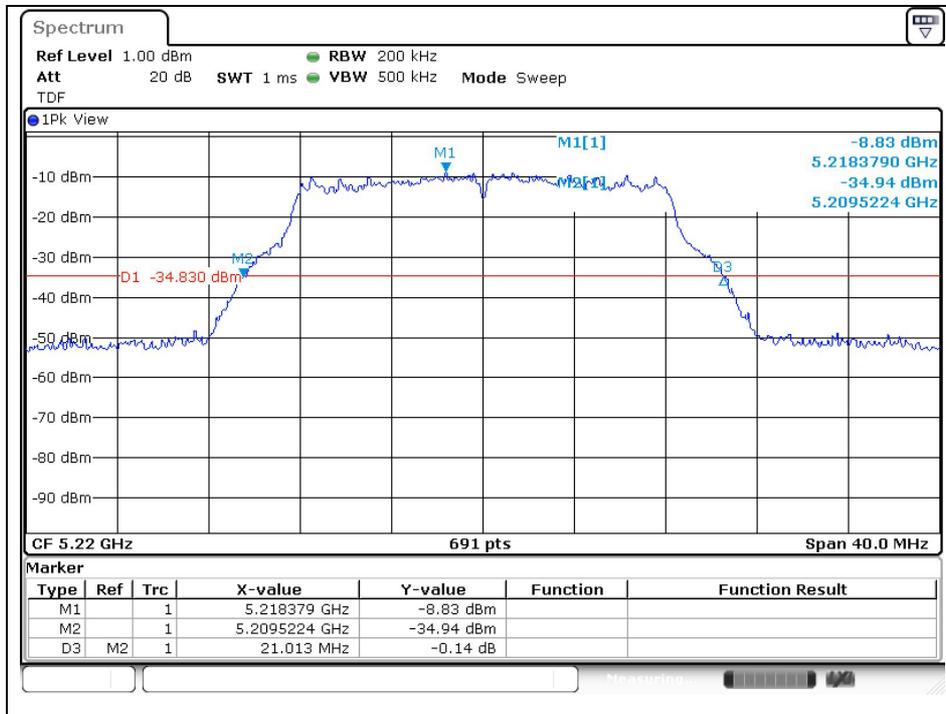
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802.11a (Band 1)_ANT 2

Low Channel (5 180 MHz)



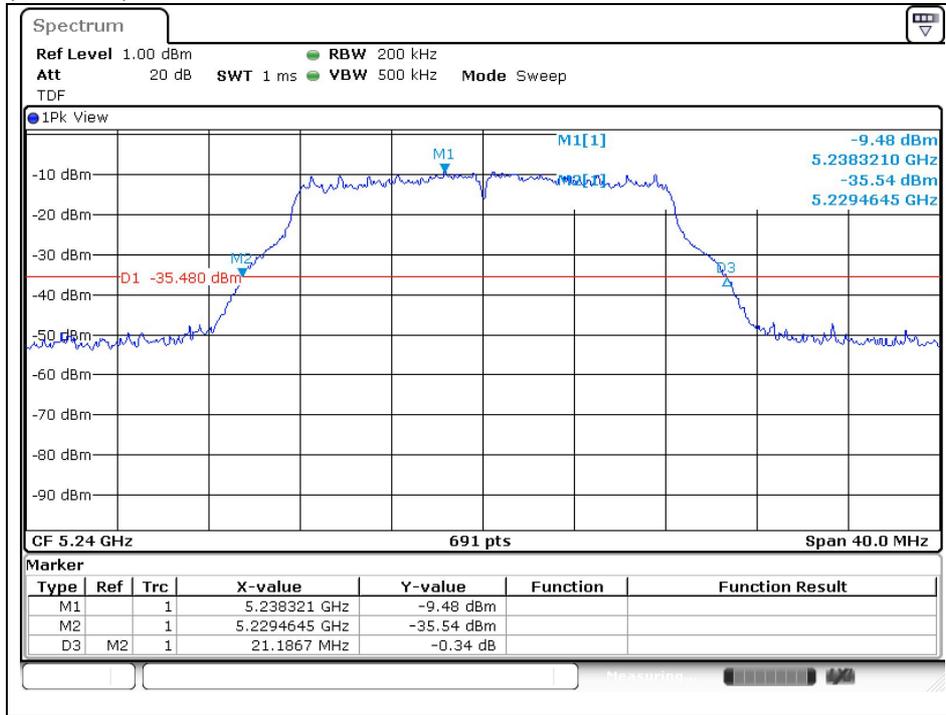
Middle Channel (5 220 MHz)



The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

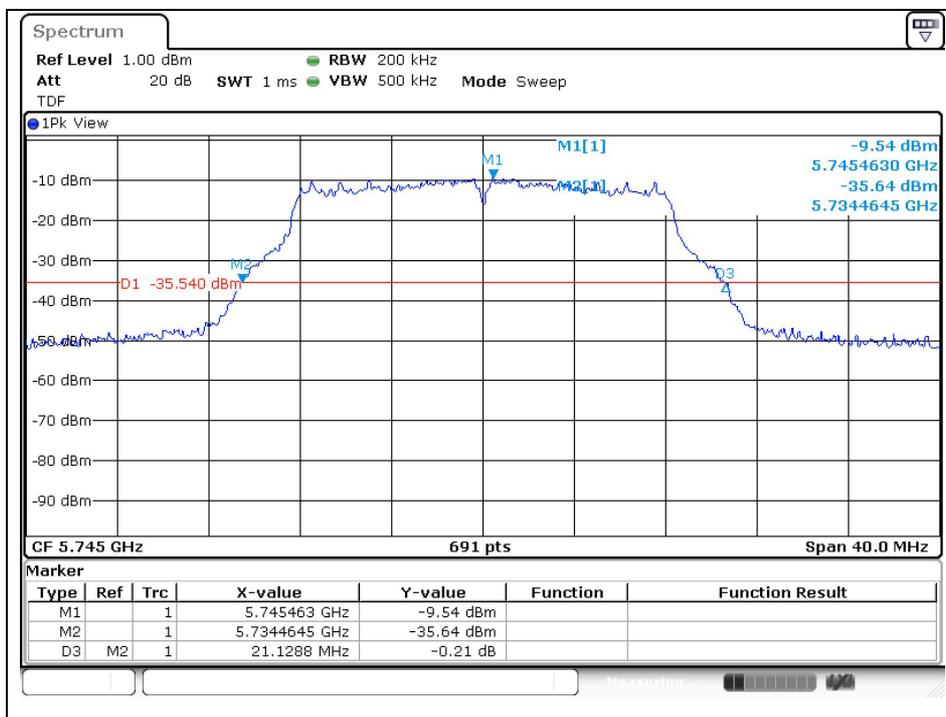
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

High Channel (5 240 MHz)



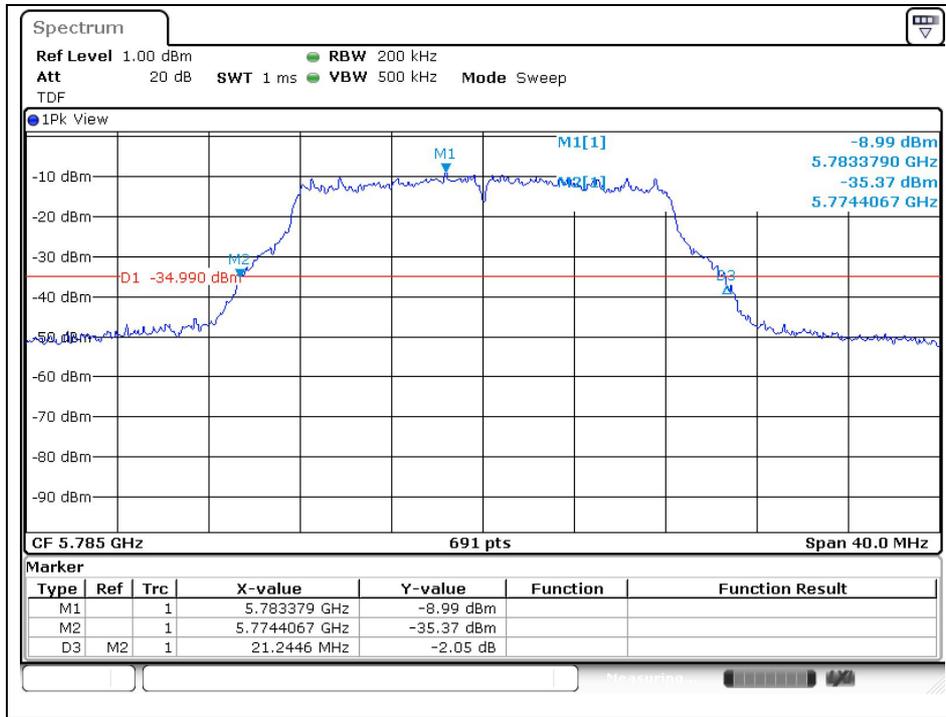
802.11a (Band 3)_ANT 2

Low Channel (5 745 MHz)

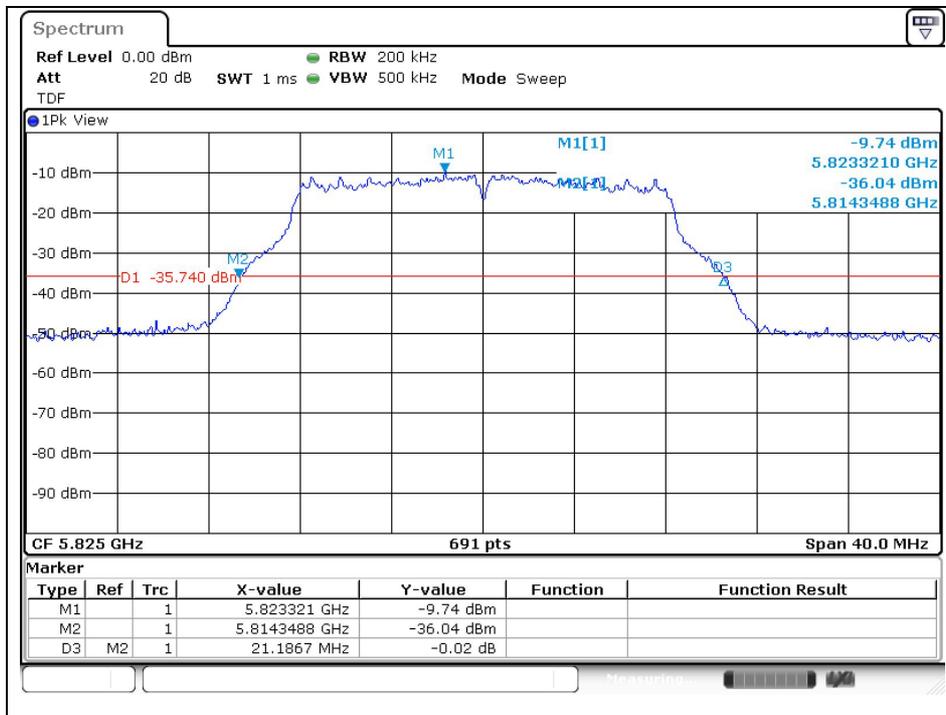


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Middle Channel (5 785 MHz)



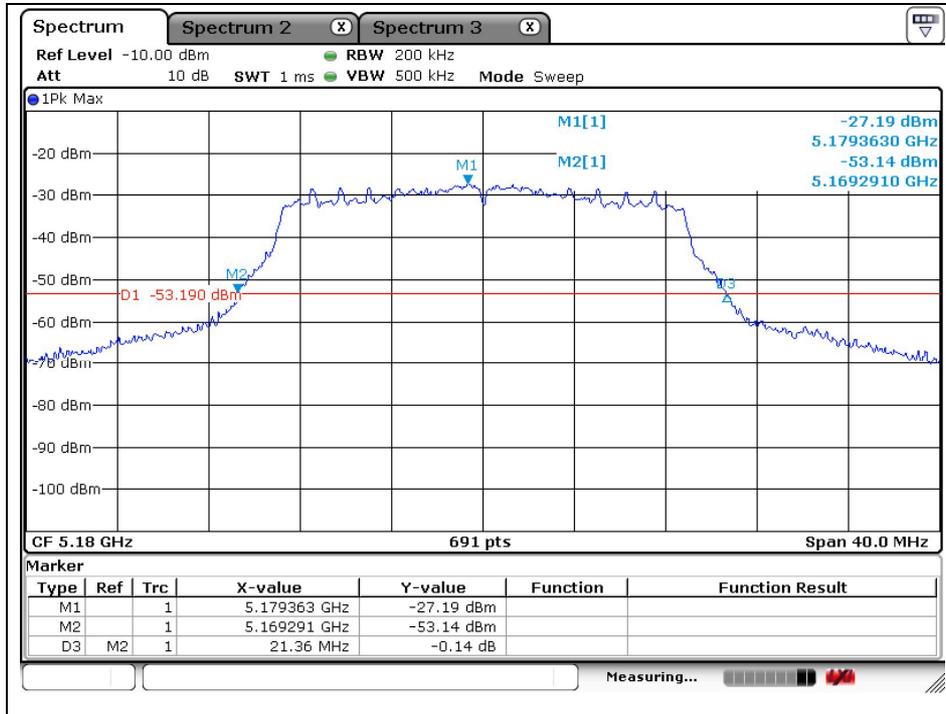
High Channel (5 825 MHz)



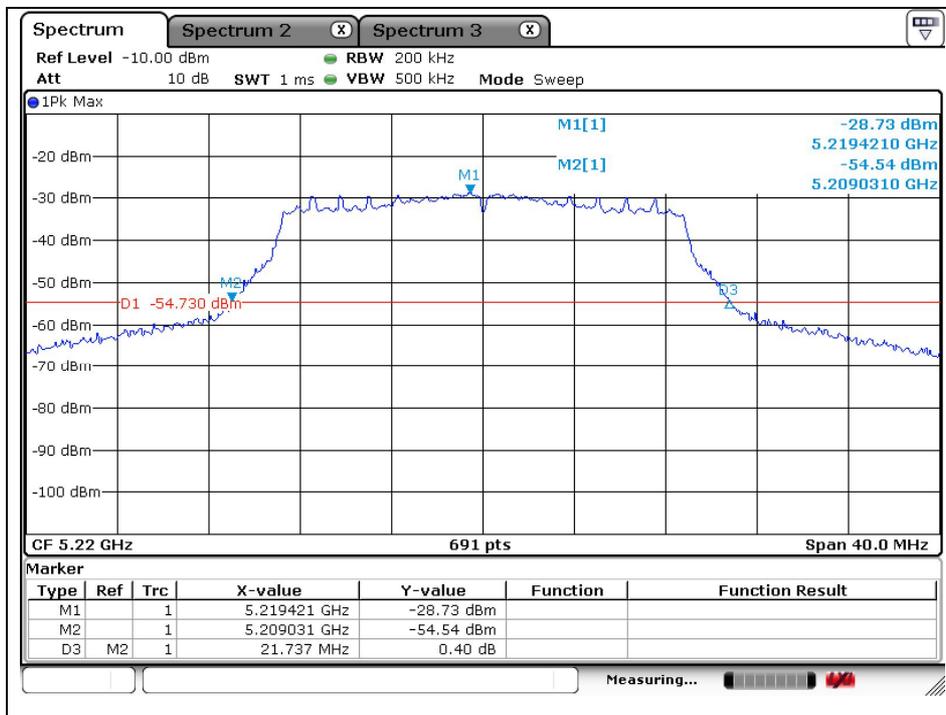
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802.11n_HT20 (Band 1)_ANT 1

Low Channel (5 180 MHz)

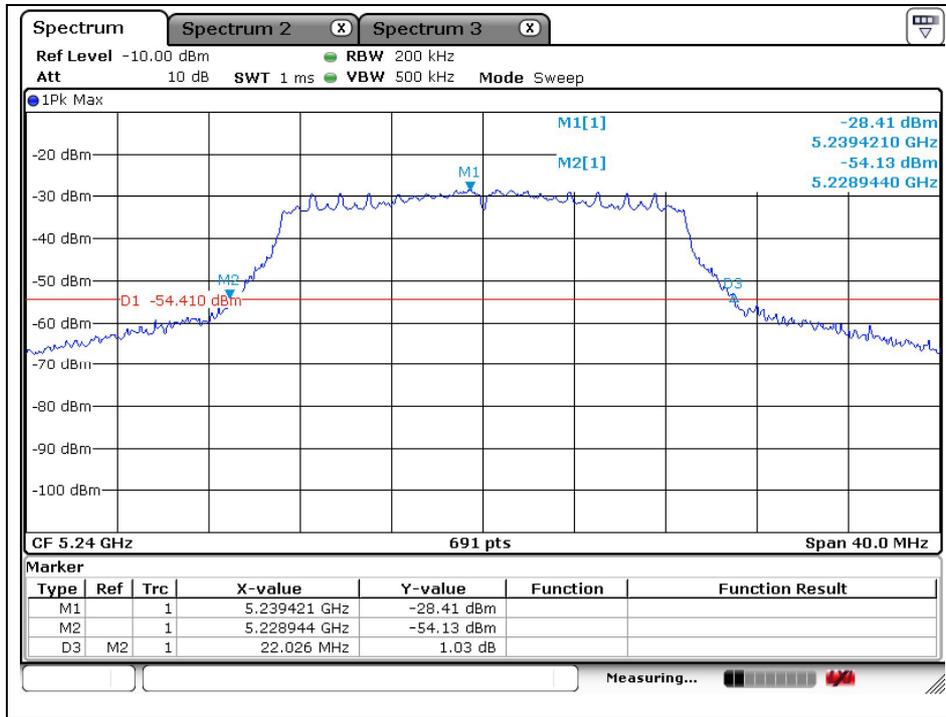


Middle Channel (5 220 MHz)



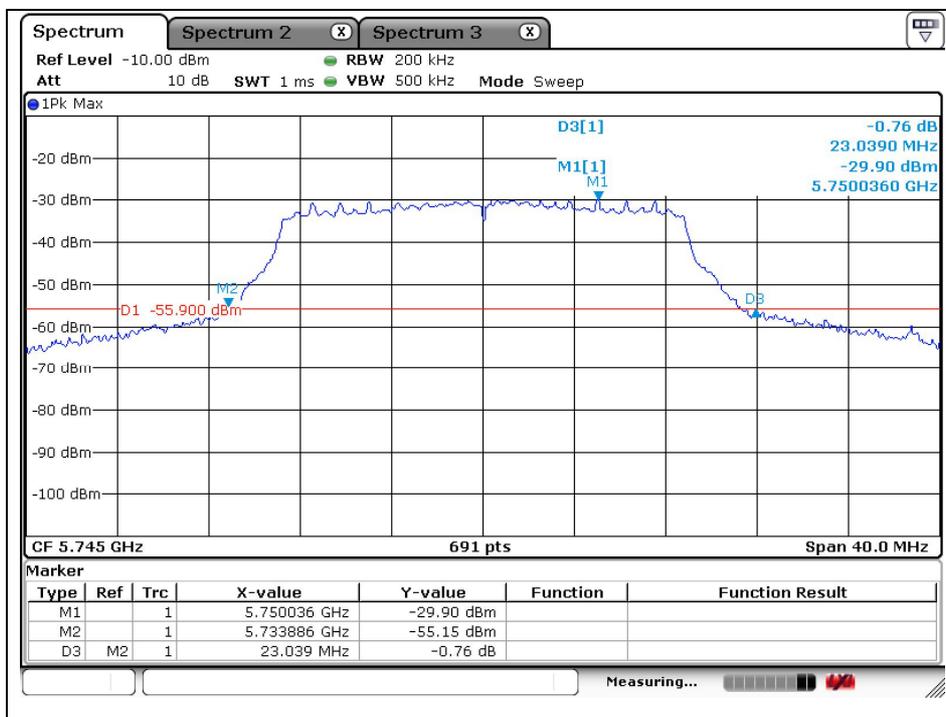
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

High Channel (5 240 MHz)



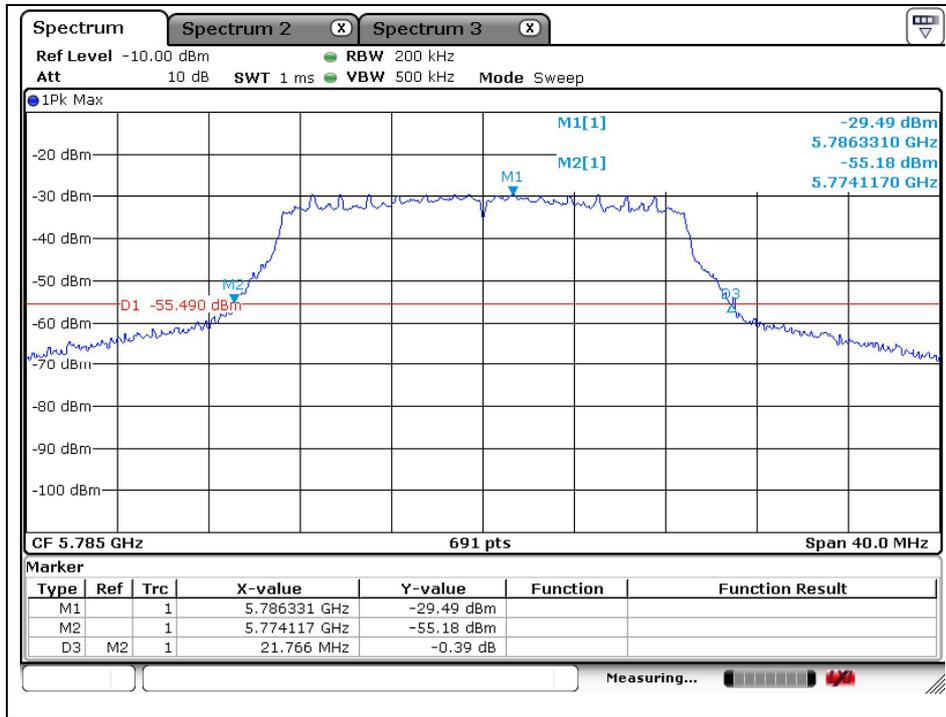
802.11n_HT20 (Band 3)_ANT 1

Low Channel (5 745 MHz)

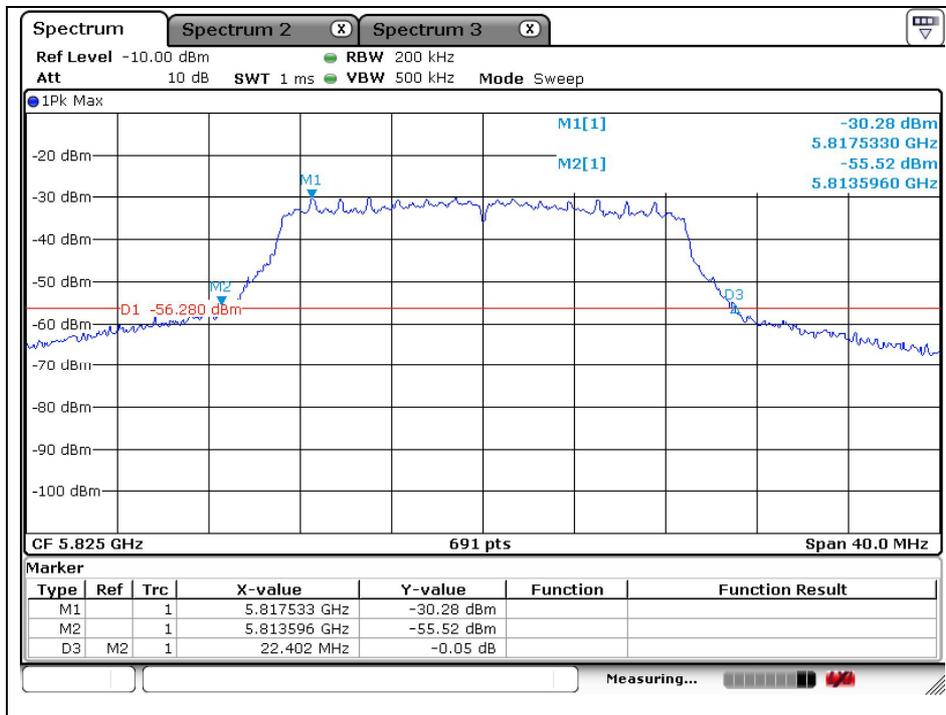


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Middle Channel (5 785 MHz)



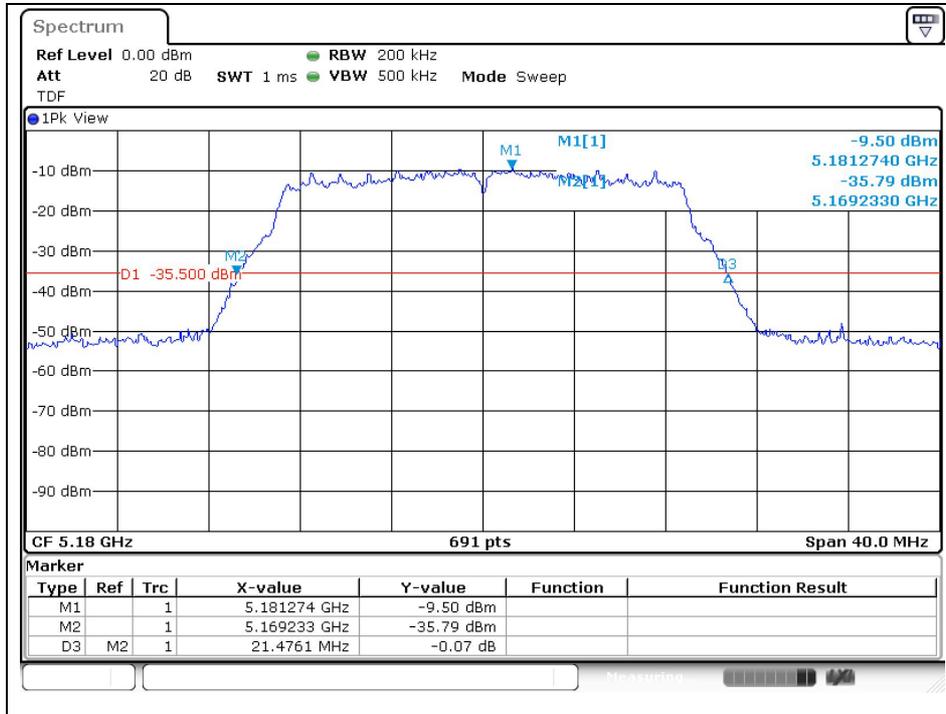
High Channel (5 825 MHz)



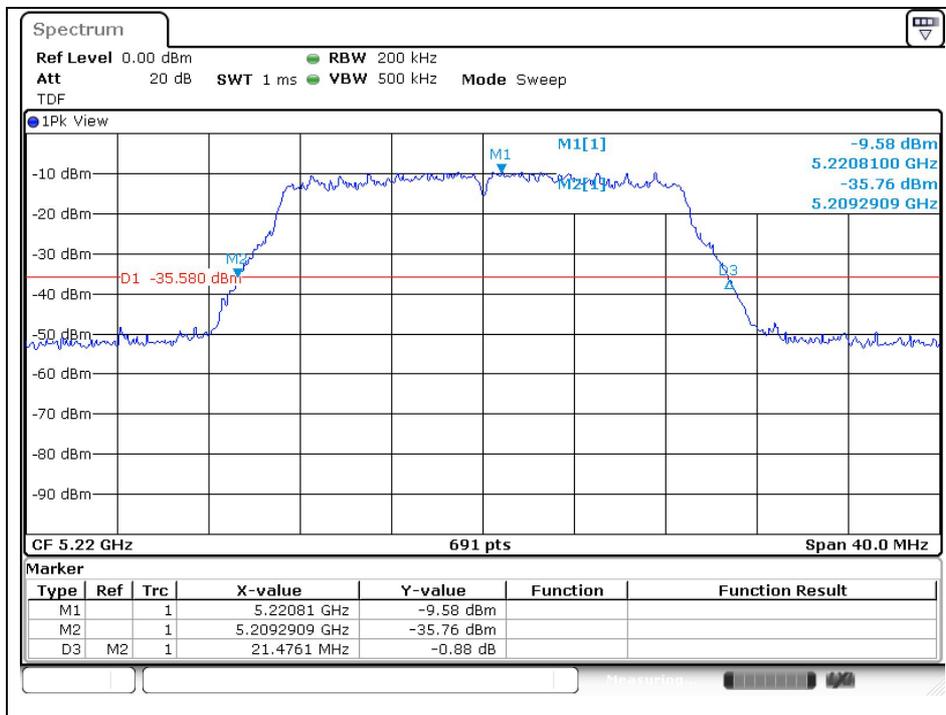
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802.11n_HT20 (Band 1)_ANT 2

Low Channel (5 180 MHz)

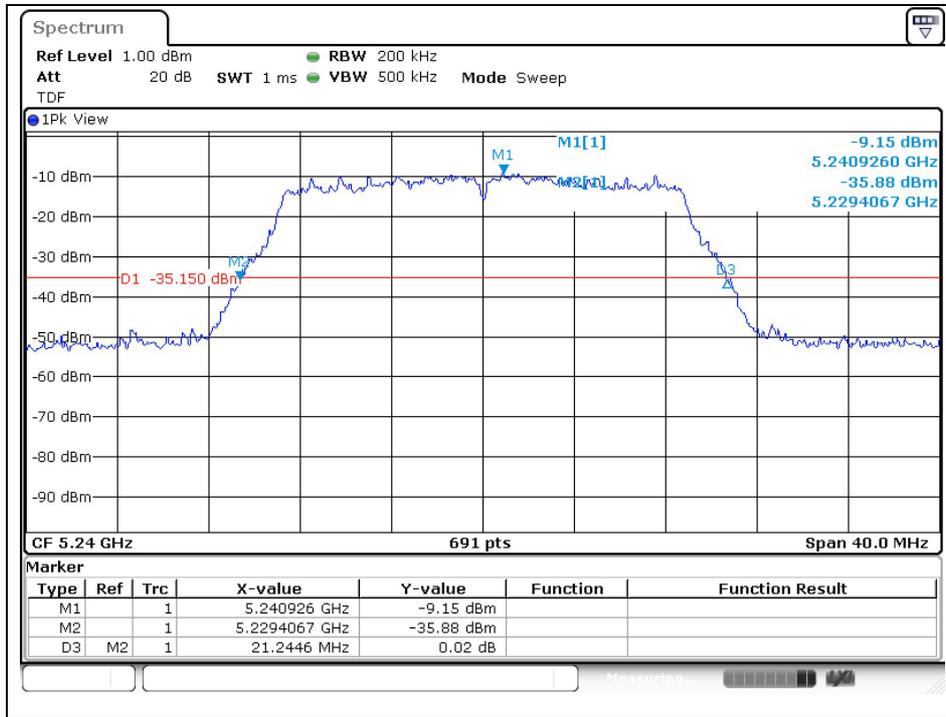


Middle Channel (5 220 MHz)



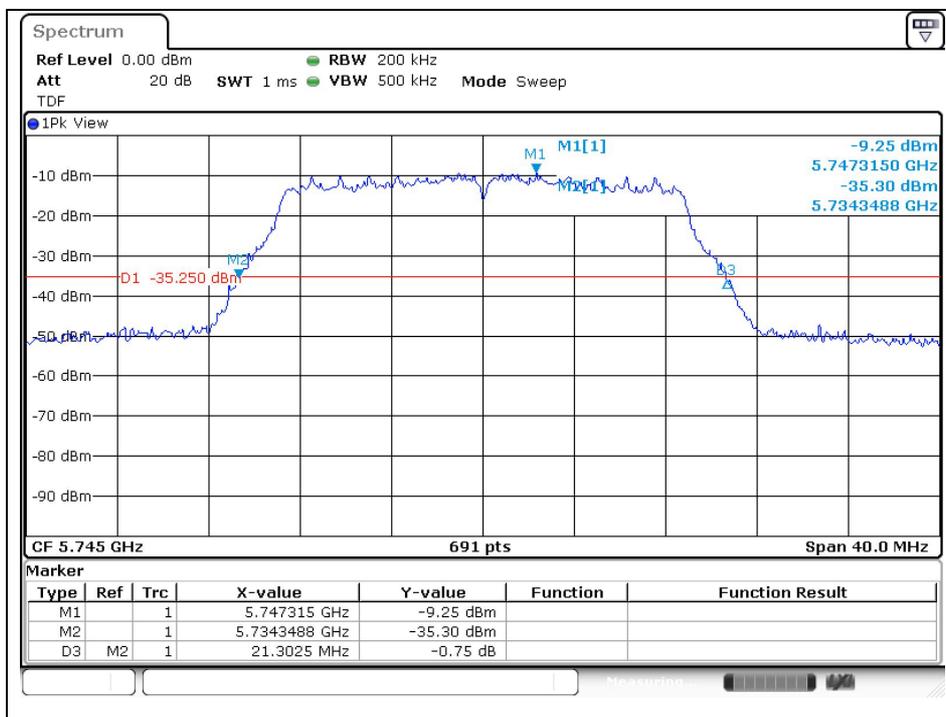
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High Channel (5 240 MHz)



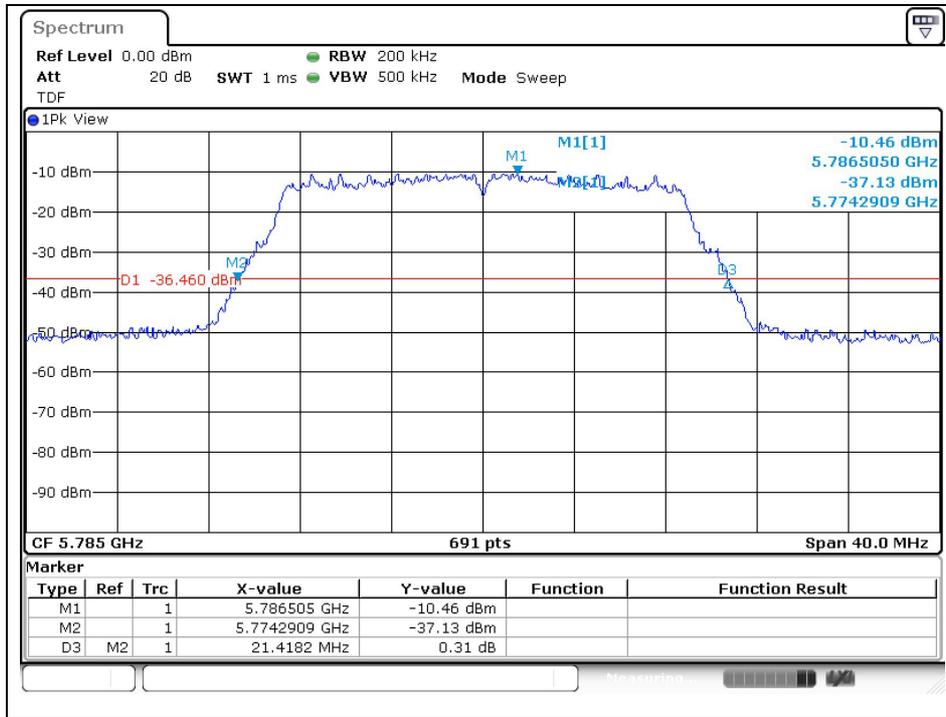
802.11n_HT20 (Band 3)_ANT 2

Low Channel (5 745 MHz)

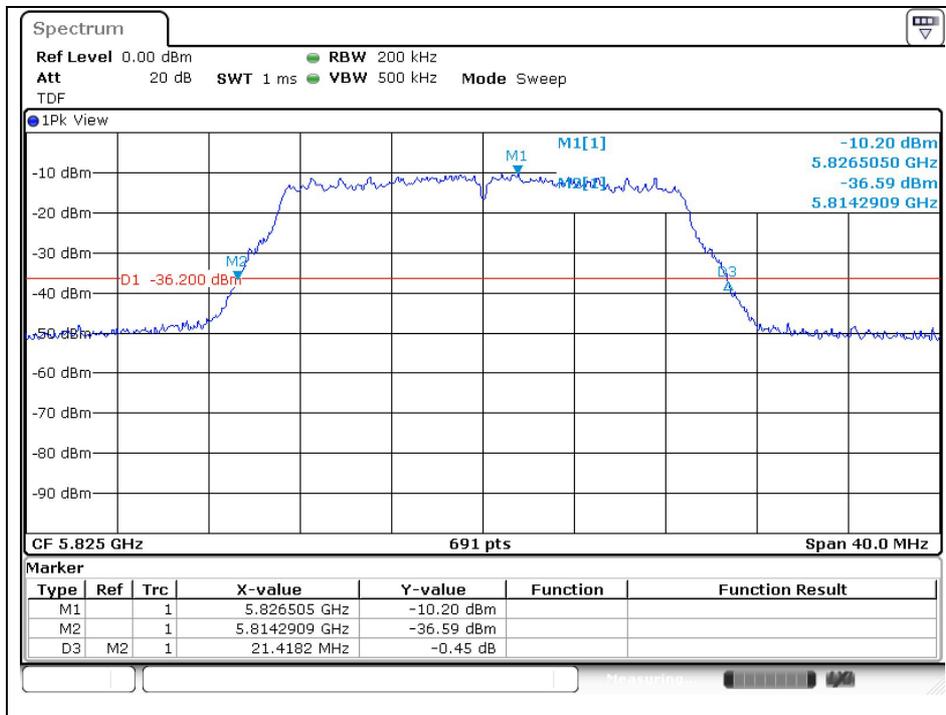


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Middle Channel (5 785 MHz)



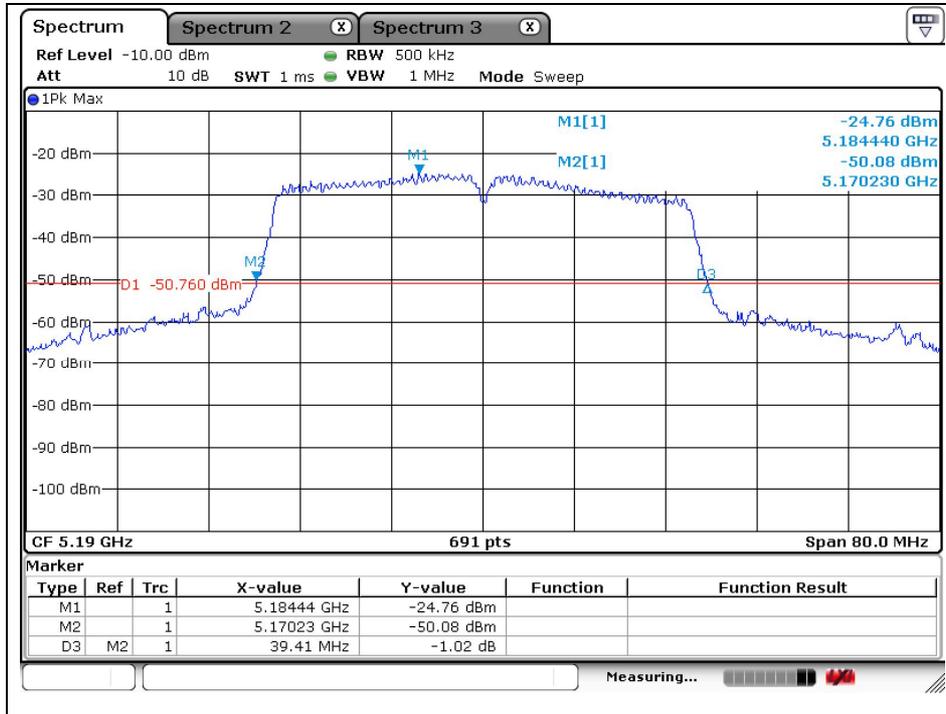
High Channel (5 825 MHz)



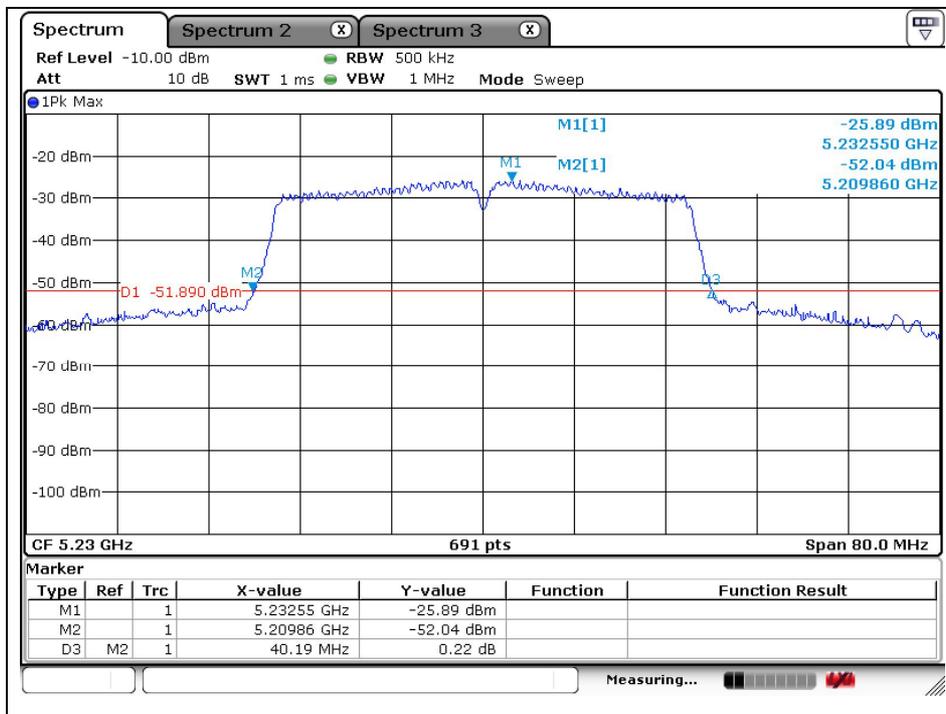
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802.11n_HT40 (Band 1)_ANT 1

Low Channel (5 190 MHz)



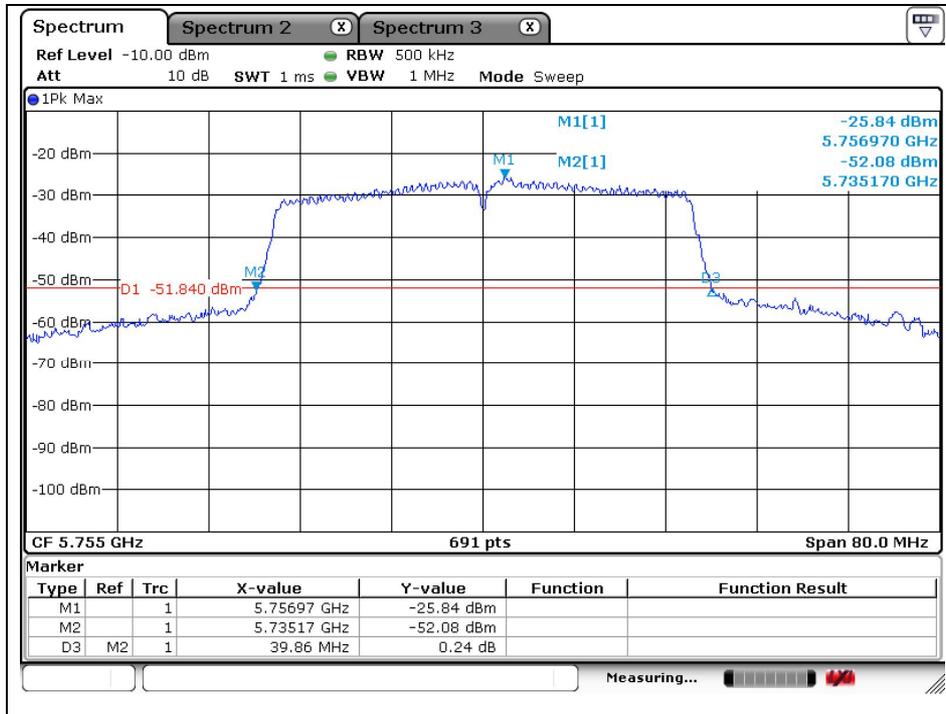
High Channel (5 230 MHz)



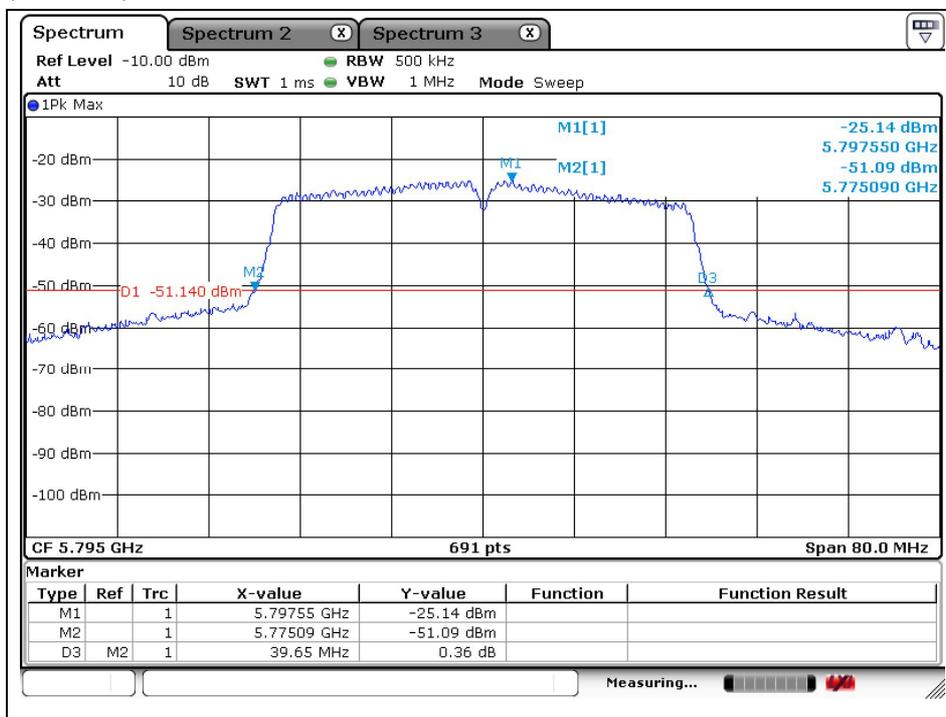
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

802.11n_HT40 (Band 3)_ANT 1

Low Channel (5 755 MHz)



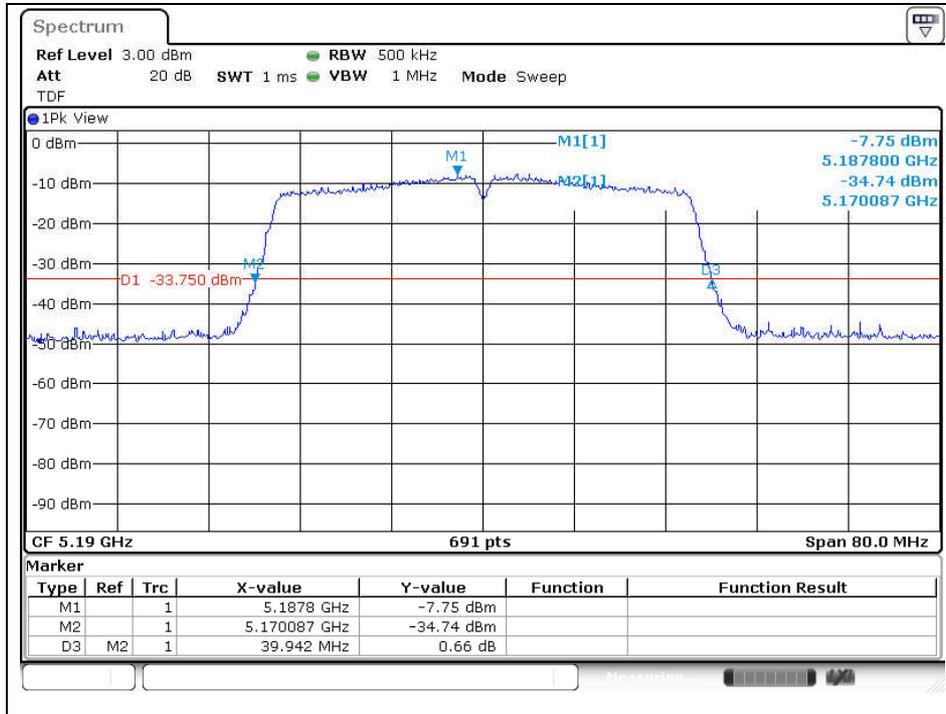
High Channel (5 795 MHz)



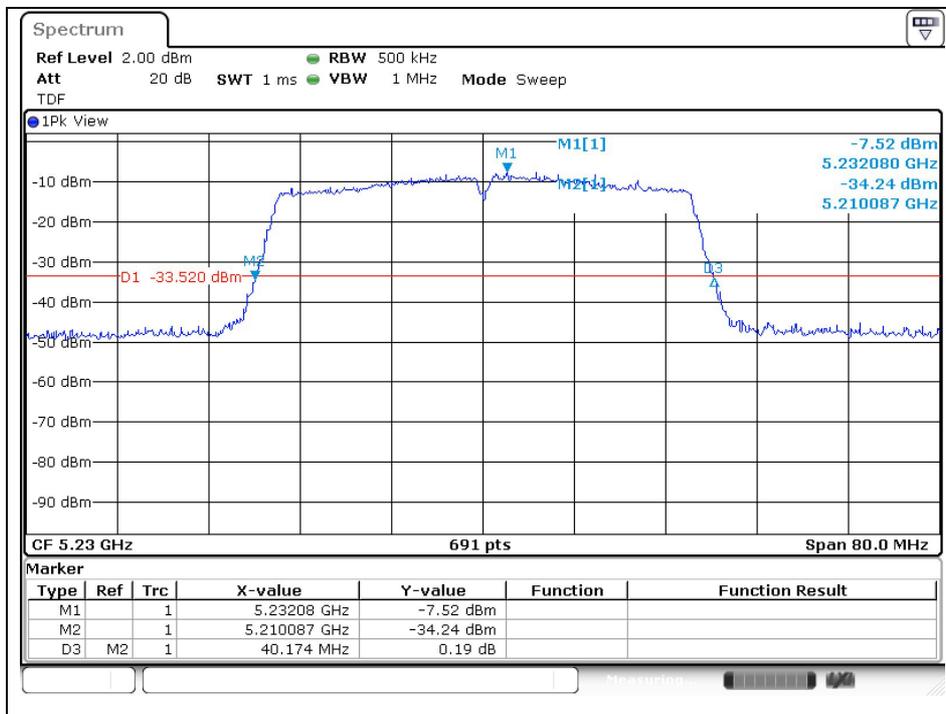
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802.11n_HT40 (Band 1)_ANT 2

Low Channel (5 190 MHz)



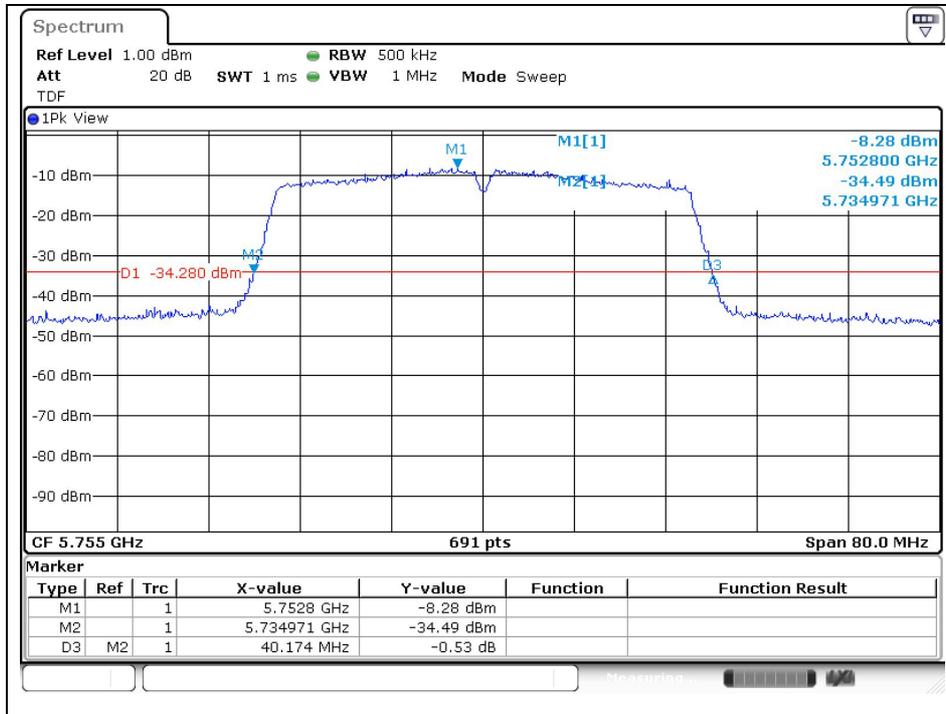
High Channel (5 230 MHz)



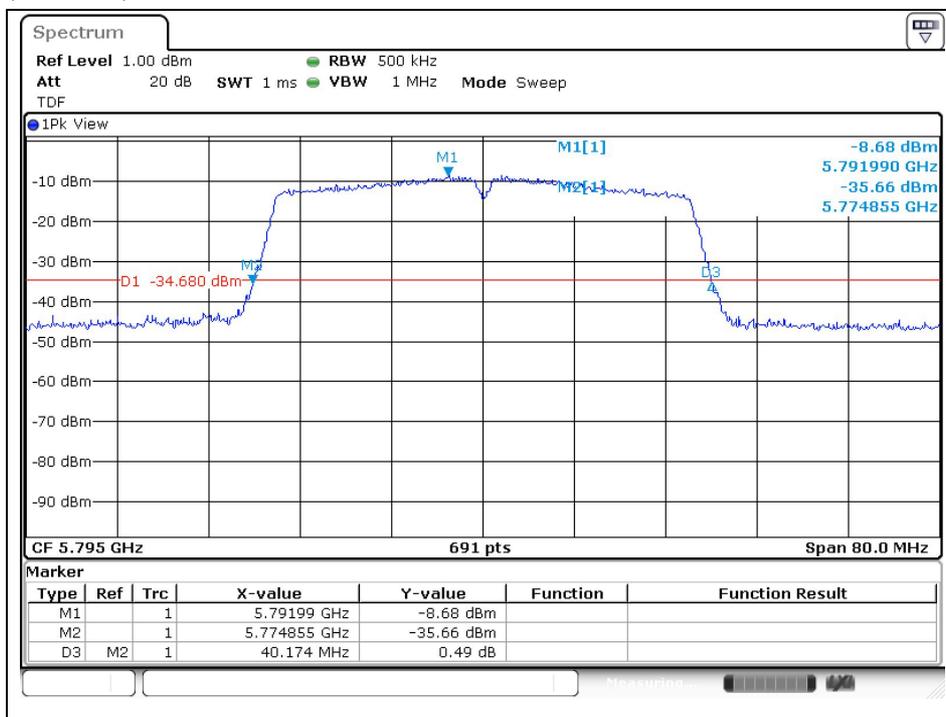
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802.11n_HT40 (Band 3)_ANT 2

Low Channel (5 755 MHz)



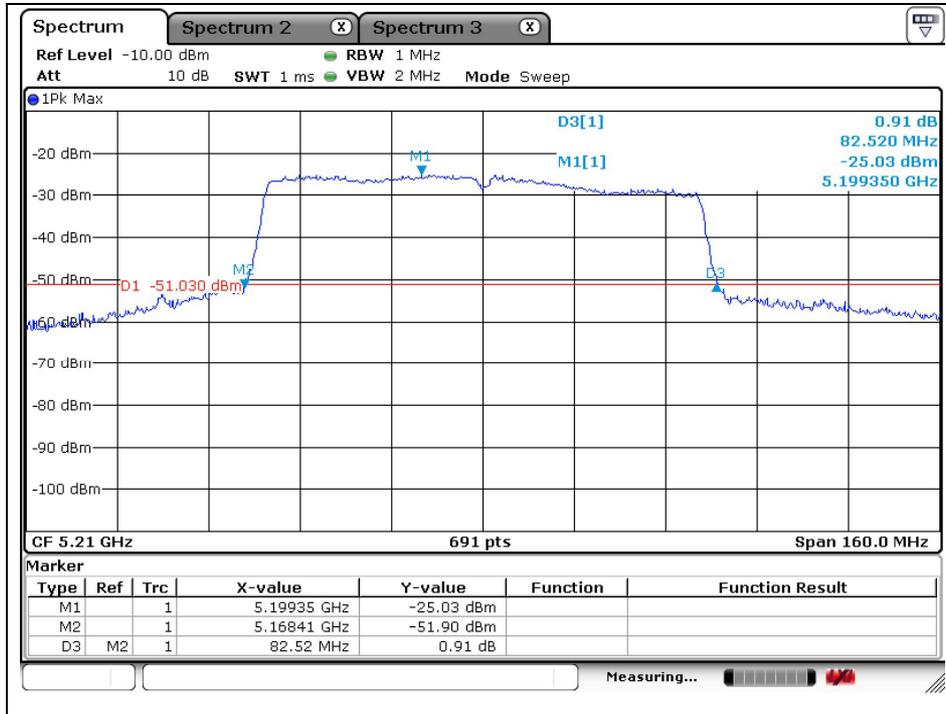
High Channel (5 795 MHz)



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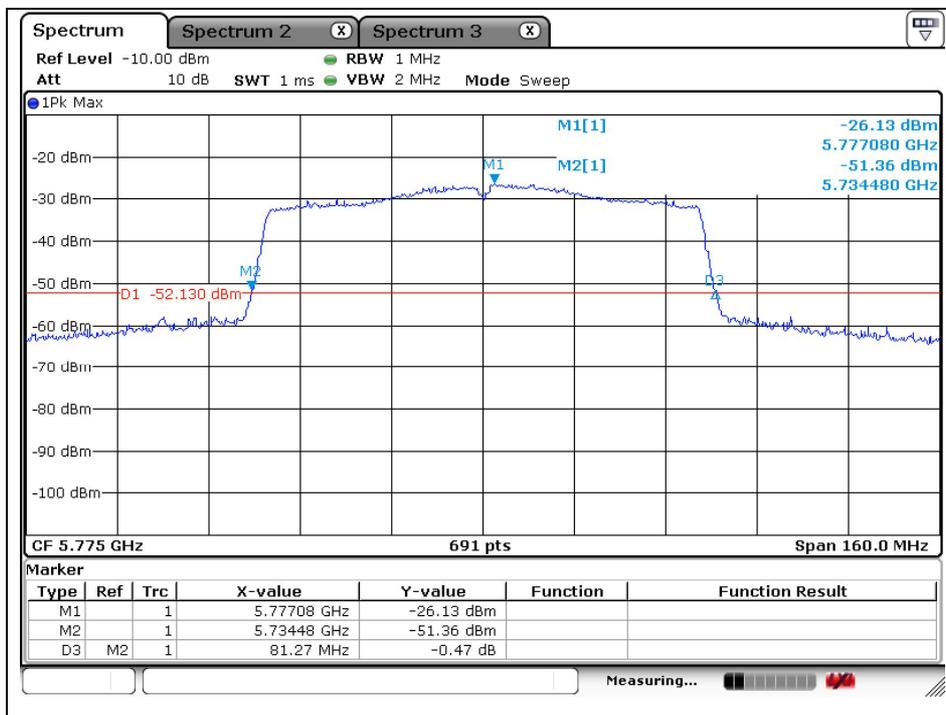
802.11ac_VHT80 (Band 1)_ANT 1

Middle Channel (5 210 MHz)



802.11ac_VHT80 (Band 3)_ANT 1

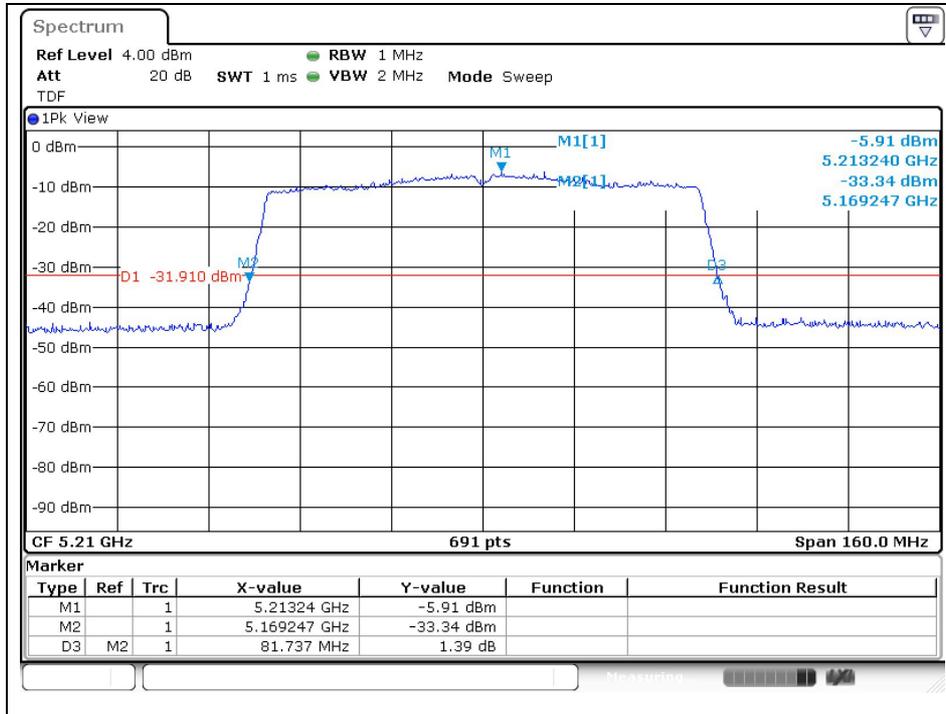
Middle Channel (5 775 MHz)



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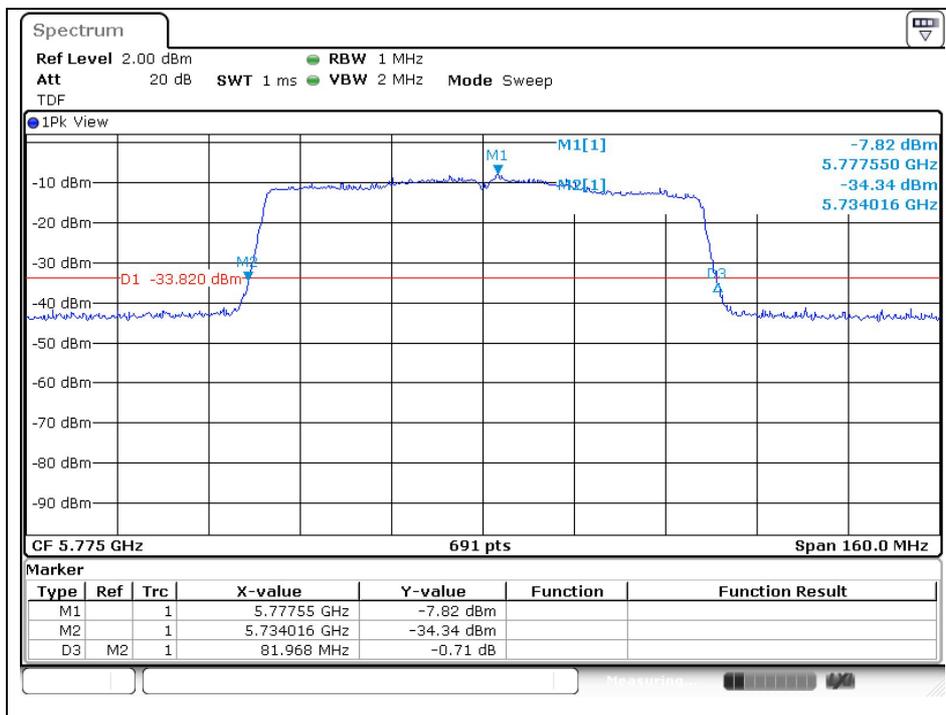
802.11ac_VHT80 (Band 1)_ANT 2

Middle Channel (5 210 MHz)



802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel (5 775 MHz)



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