

TEST REPORT

of

FCC Part 15 Subpart E §15.407

FCC ID: 2ADXS-WFM50-SFP2501

Equipment Under Test : Wifi module
Model Name : WFM50-SFP2501
Applicant : I&C Technology Co., Ltd.
Manufacturer : I&C Technology Co., Ltd.
Date of Test(s) : 2016.04.28 ~ 2016.06.28
Date of Issue : 2016.06.29

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

Tested By:



Jinhyoung Cho

Date:

2016.06.29

Approved By:



Hyunchae You

Date:

2016.06.29

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RTT5041-20(2015.10.01)(3)

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)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 688 0901

FAX : +82 31 688 0921

1.2. Details of applicant

Applicant : I&C Technology Co., Ltd.

Address : I&C Building, 24, Pangyo-ro 255beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, 13486, Korea

Contact Person : Lee, Gil-Ju

Phone No. : +82 31 696 3452

1.3. Description of EUT

Kind of Product	Wifi module
Model Name	WFM50-SFP2501
Power Supply	DC 3.60 V
Frequency Range	2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20), 5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20), 5 260 MHz ~ 5 320 MHz (Band 2A: 11a/n_HT20), 5 500 MHz ~ 5 720 MHz (Band 2C: 11a/n_HT20)
Modulation Technique	DSSS, OFDM
Number of Channels	11 channels (11b/g/n_HT20), 5 channels (Band 3: 11a/n_HT20), 4 channels (Band 1: 11a/n_HT20), 4 channels (Band 2A: 11a/n_HT20), 9 channels (Band 2C: 11a/n_HT20)
Antenna Type	PCB antenna
Antenna Gain	2 412 MHz ~ 2 462 MHz: 1.98 dB i, 5 180 MHz ~ 5 320 MHz: 3.50 dB i, 5 500 MHz ~ 5 720 MHz: 3.34 dB i, 5 745 MHz ~ 5 825 MHz: 3.01 dB i

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1.4. Declaration by the manufacturer

- The EUT is a slave without radar detection and TPC.
- EUT is not supported TDWR(5.6-5.65 GHz) band.

1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 13, 2015	Annual	Jul. 13, 2016
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 24, 2015	Annual	Sep. 24, 2016
Spectrum Analyzer	R&S	FSV30	103102	Jun. 08, 2016	Annual	Jun. 08, 2017
Attenuator	AEROFLEX / INMET	18N-20 dB	4	Mar. 25, 2016	Annual	Mar. 25, 2017
High Pass Filter	Wainwright Instrument GmbH	WHKX6.0/18G-10SS	51	Jun. 18, 2016	Annual	Jun. 18, 2017
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	Jun. 18, 2016	Annual	Jun. 18, 2017
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-2	Feb. 29, 2016	Annual	Feb. 29, 2017
Power Sensor	R&S	NRP-Z81	100669	Feb. 29, 2016	Annual	Feb. 29, 2017
DC Power Supply	Agilent	U8002A	MY54110041	Sep. 23, 2015	Annual	Sep. 23, 2016
Preamplifier	H.P.	8447F	2944A03909	Aug. 27, 2015	Annual	Aug. 27, 2016
Preamplifier	R&S	SCU-18	10117	Apr. 07, 2016	Annual	Apr. 07, 2017
Preamplifier	TESTEK	TK-PA1840H	130016	Sep. 29, 2015	Annual	Sep. 29, 2016
Loop Antenna	R&S	HFH2-Z2	100118	Jun. 04, 2015	Biennial	Jun. 04, 2017
Trilog Broadband Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Jun. 18, 2015	Biennial	Jun. 18, 2017
Horn Antenna	R&S	HF906	100326	Feb. 01, 2016	Biennial	Feb. 01, 2018
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9170	BBHA9170223	Sep. 01, 2014	Biennial	Sep. 01, 2016
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Test Receiver	R&S	ESU26	100109	Mar. 07, 2016	Annual	Mar. 07, 2017
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.
Two-Line V-Network	R&S	ENV216	100190	Dec. 21, 2015	Annual	Dec. 21, 2016
Test Receiver	R&S	ESCI 7	100911	Dec. 22, 2015	Annual	Dec. 22, 2016
Shield Room	SY Corporation	L x W x H (6.5 m x 3.5 m x 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

► Support equipment

Description	Manufacturer	Model	Serial Number / FCC ID
N/A	-	-	-

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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		
Standard section	Test Item	Result
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3) 15.407(b)(4)	Transmitter radiated spurious emissions	Complied
15.407(a)	26 dB Bandwidth & 99 % Occupied Bandwidth	Complied
15.407(e)	6 dB Bandwidth	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	Maximum Conducted Output Power	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	Peak power spectral density	Complied
15.207	AC Power Line Conducted Emissions	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), the guidance provided in KDB 789033_D02 v01r02 and KDB 644545_D03 v01 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 (dB)

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1.9. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL009890	2016.06.01	Initial
1	F690501/RF-RTL009890-1	2016.06.20	Updated from ANSI C63.10-2009 to ANSI C63.10-2013 and Added test plots for Tx RSE in section 2
2	F690501/RF-RTL009890-2	2016.06.29	Retested several band edge

1.10. Duty Cycle of EUT

Regarding to KDB 789033_D02 v01r02, II.B, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below;

Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value, Set VBW \geq 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							
	6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
11a								
Duty Cycle (%)	99	99	99	98	98	96	96	94
Correction factor (dB)	0.04	0.04	0.04	0.09	0.09	0.18	0.18	0.27
11n_HT20	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Duty Cycle (%)	99	98	98	97	96	96	95	95
Correction factor (dB)	0.04	0.09	0.09	0.13	0.18	0.18	0.22	0.22

Remark:

- 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.
- Duty cycle (%) = (Tx on time / Tx on + off time) x 100
- Correction factor (dB) = 10 log (1 / duty cycle)

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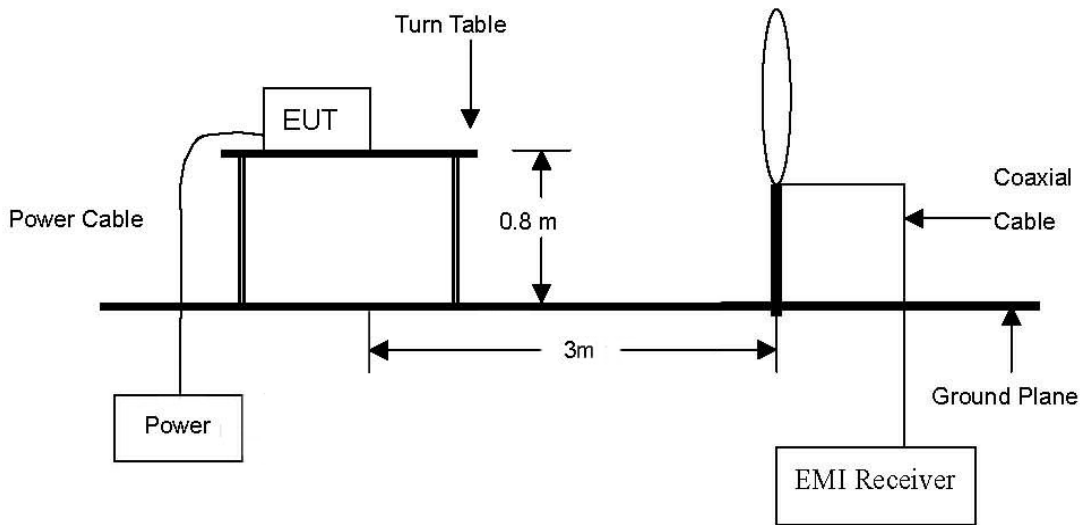
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2. Transmitter radiated spurious emissions

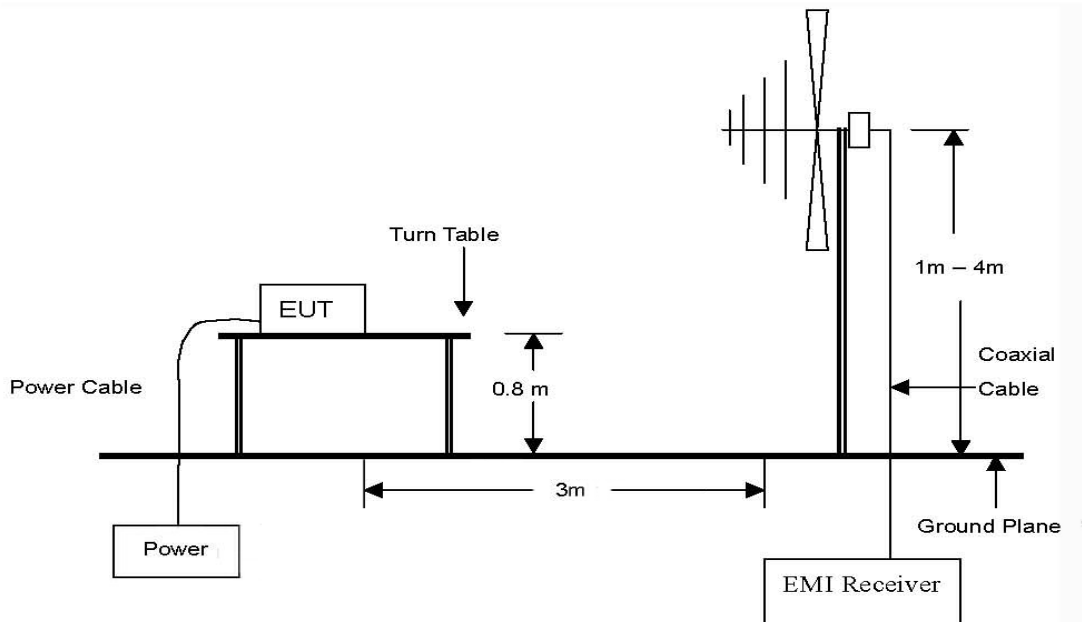
2.1. Test setup

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.

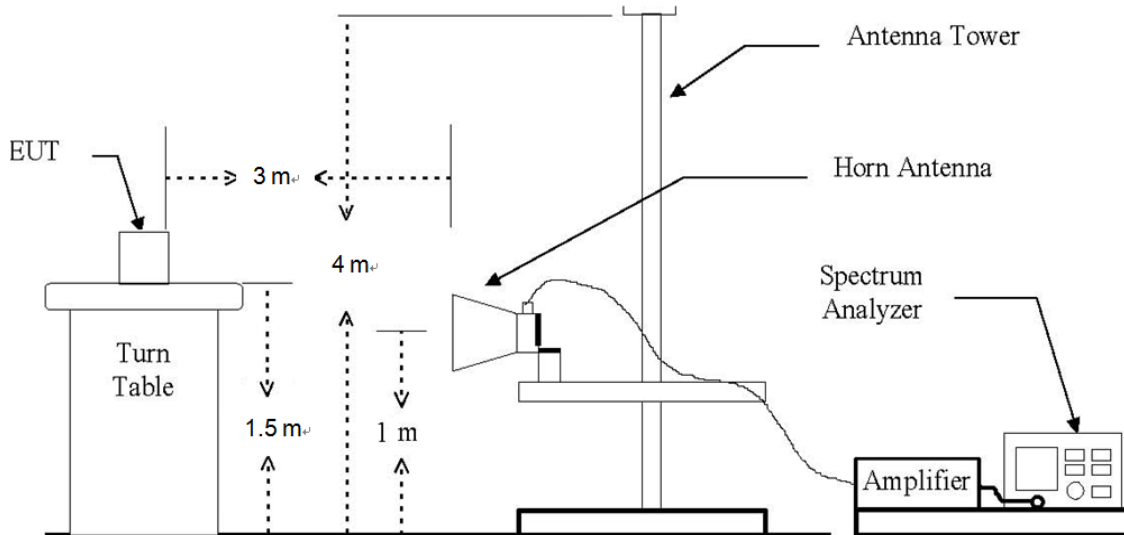


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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

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.

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

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dB m/MHz.

For transmitters operating in the 5.725-5.85 GHz band: 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)	Distance (Meters)	Field Strength (dBμV/m)	Field Strength (μV/m)
0.009 - 0.490	300	20 log (2 400/F(kHz))	2 400/F(kHz)
0.490 - 1.705	30	20 log (24 000/F(kHz))	24 000/F(kHz)
1.705 - 30.0	30	29.54	30
30 - 88	3	40.0	100**
88 - 216	3	43.5	150**
216 - 960	3	46.0	200**
Above 960	3	54.0	500

**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 v01r02 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 meters 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 Trilog broadband 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.

- The measurements for below 1 GHz refer to section II.G.4.
Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.
- The measurements for above 1 GHz refer to section II.G.5.
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
- The measurements for above 1 GHz refer to section II.G.6.
Average emission levels are measured by setting the analyzer as follows:
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 step (iv) above, 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 **Y – 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

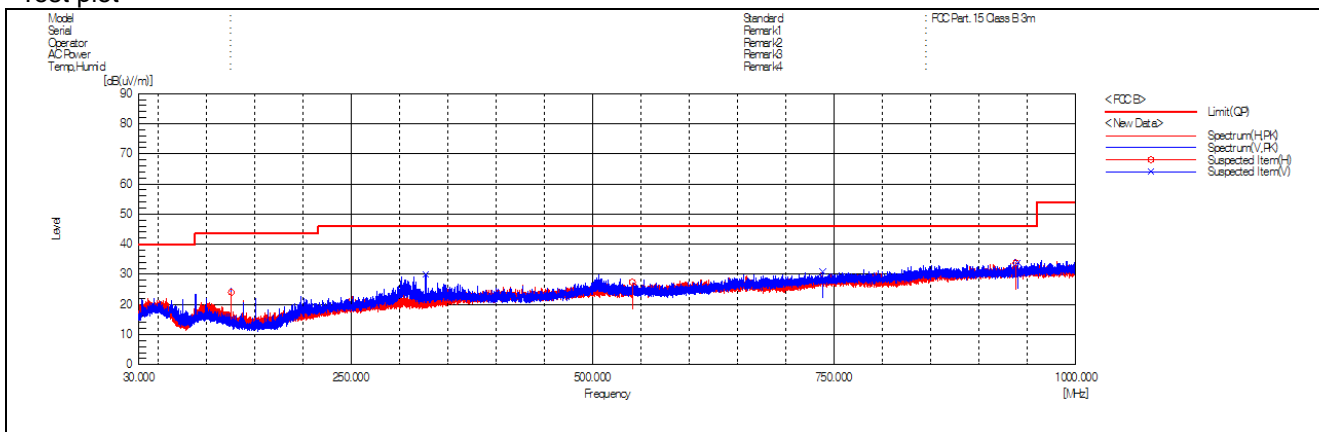
The frequency spectrum from 9 kHz to 1 000 MHz was investigated. All reading values are peak values.

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)
125.87	39.50	Peak	H	10.91	-26.29	24.12	43.50	19.38
327.14	39.20	Peak	V	15.85	-25.07	29.98	46.00	16.02
540.99	34.50	Peak	H	18.68	-25.64	27.54	46.00	18.46
738.18	33.70	Peak	V	22.28	-25.12	30.86	46.00	15.14
938.20	34.20	Peak	H	23.41	-23.94	33.67	46.00	12.33
940.39	34.00	Peak	V	23.77	-23.93	33.84	46.00	12.16

Remark:

- Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
- Reported spurious emissions are in **11a (Band 2A) / 6 Mbps / Low 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

802.11a (Band 1)_6 Mbps

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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	18.22	Peak	H	31.84	7.54	-	57.60	74.00	16.40
*4 500.00	7.96	Average	H	31.84	7.54	-	47.34	54.00	6.66
*5 044.51	21.74	Peak	H	33.24	7.94	-	62.92	74.00	11.08
*5 044.51	9.54	Average	H	33.24	7.94	-	50.72	54.00	3.28
*5 150.00	19.05	Peak	H	33.38	8.11	-	60.54	74.00	13.46
*5 150.00	9.52	Average	H	33.38	8.11	-	51.01	54.00	2.99

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 361.34	37.69	Peak	H	37.67	-26.04	-	49.32	68.23	18.91
Above 10 400.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 200 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 399.33	37.96	Peak	H	37.69	-26.13	-	49.52	68.23	18.71
Above 10 400.00	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)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 480.23	37.58	Peak	H	37.73	-26.29	-	49.02	68.23	19.21
Above 10 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 2A)_6 Mbps

A. Low Channel (5 260 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 520.84	37.43	Peak	H	37.75	-26.37	-	48.81	68.23	19.42
Above 10 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 280 MHz)

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

C. High Channel (5 320 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	17.47	Peak	H	33.66	8.27	-	59.40	74.00	14.60
*5 350.00	8.15	Average	H	33.66	8.27	-	50.08	54.00	3.92
*5 406.17	18.90	Peak	H	33.73	8.58	-	61.21	74.00	12.79
*5 358.83	8.34	Average	H	33.67	8.33	-	50.34	54.00	3.66
*5 460.00	16.95	Peak	H	33.81	8.29	-	59.05	74.00	14.95
*5 460.00	7.43	Average	H	33.81	8.29	-	49.53	54.00	4.47

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*10 639.56	36.89	Peak	H	37.83	-26.51	-	48.21	74.00	25.79
*10 638.53	25.62	Average	H	37.83	-26.51	-	36.94	54.00	17.06
Above 10 700.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 2C)_6 Mbps

A. Low Channel (5 500 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	17.13	Peak	H	33.66	8.27	-	59.06	74.00	14.94
*5 350.00	7.73	Average	H	33.66	8.27	-	49.66	54.00	4.34
*5 458.55	19.09	Peak	H	33.80	8.29	-	61.18	74.00	12.82
*5 385.83	8.28	Average	H	33.70	8.52	-	50.50	54.00	3.50
*5 460.00	17.23	Peak	H	33.81	8.29	-	59.33	74.00	14.67
*5 460.00	7.50	Average	H	33.81	8.29	-	49.60	54.00	4.40

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 001.15	37.29	Peak	H	38.08	-27.55	-	47.82	74.00	26.18
*10 997.83	25.89	Average	H	38.08	-27.53	-	36.44	54.00	17.56
Above 11 100.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 580 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 160.97	35.95	Peak	H	38.20	-27.07	-	47.08	74.00	26.92
*11 158.86	25.16	Average	H	38.20	-27.09	-	36.27	54.00	17.73
Above 11 200.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 720 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 441.39	36.13	Peak	H	38.41	-25.92	-	48.62	74.00	25.38
*11 440.15	25.00	Average	H	38.41	-25.91	-	37.50	54.00	16.50
Above 11 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 3)_6 Mbps

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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 650.00	15.55	Peak	H	33.94	8.37	-	57.86	68.23	10.37

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 490.28	37.37	Peak	H	38.44	-26.17	-	49.64	74.00	24.36
*11 490.05	25.76	Average	H	38.44	-26.17	-	38.03	54.00	15.97
Above 11 500.00	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)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 569.96	36.57	Peak	H	38.43	-25.71	-	49.29	74.00	24.71
*11 569.80	24.76	Average	H	38.43	-25.71	-	37.48	54.00	16.52
Above 11 600.00	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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 925.00	15.82	Peak	H	34.43	8.51	-	58.76	68.23	9.47

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 651.89	36.13	Peak	H	38.40	-25.75	-	48.78	74.00	25.22
*11 647.93	24.97	Average	H	38.41	-25.73	-	37.65	54.00	16.35
Above 11 700.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 1)_MCS0

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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*4 500.00	15.24	Peak	H	31.84	7.54	-	54.62	74.00	19.38
*4 500.00	6.05	Average	H	31.84	7.54	-	45.43	54.00	8.57
*5 139.05	18.97	Peak	H	33.37	8.09	-	60.43	74.00	13.57
*5 143.43	8.66	Average	H	33.38	8.10	-	50.14	54.00	3.86
*5 150.00	17.50	Peak	H	33.38	8.11	-	58.99	74.00	15.01
*5 150.00	8.37	Average	H	33.38	8.11	-	49.86	54.00	4.14

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

B. Middle Channel (5 200 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 397.77	37.67	Peak	H	37.69	-26.12	-	49.24	68.23	18.99
Above 10 400.00	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)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 480.48	36.84	Peak	H	37.73	-26.29	-	48.28	68.23	19.95
Above 10 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 2A)_MCS0
A. Low Channel (5 260 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
10 519.67	36.88	Peak	H	37.75	-26.36	-	48.27	68.23	19.96
Above 10 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 280 MHz)

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

C. High Channel (5 320 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	15.58	Peak	H	33.66	8.27	-	57.51	74.00	16.49
*5 350.00	8.01	Average	H	33.66	8.27	-	49.94	54.00	4.06
*5 355.95	18.78	Peak	H	33.66	8.31	-	60.75	74.00	13.25
*5 360.81	8.20	Average	H	33.67	8.35	-	50.22	54.00	3.78
*5 460.00	16.73	Peak	H	33.81	8.29	-	58.83	74.00	15.17
*5 460.00	7.18	Average	H	33.81	8.29	-	49.28	54.00	4.72

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*10 640.09	36.48	Peak	H	37.84	-26.51	-	47.81	74.00	26.19
*10 637.96	25.87	Average	H	37.83	-26.51	-	37.19	54.00	16.81
Above 10 700.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 2C)_MCS0

A. Low Channel (5 500 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	16.39	Peak	H	33.66	8.27	-	58.32	74.00	15.68
*5 350.00	7.43	Average	H	33.66	8.27	-	49.36	54.00	4.64
*5 392.85	19.47	Peak	H	33.71	8.57	-	61.75	74.00	12.25
*5 404.55	8.25	Average	H	33.73	8.59	-	50.57	54.00	3.43
*5 460.00	17.46	Peak	H	33.81	8.29	-	59.56	74.00	14.44
*5 460.00	7.44	Average	H	33.81	8.29	-	49.54	54.00	4.46

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 001.29	37.09	Peak	H	38.08	-27.55	-	47.62	74.00	26.38
*10 998.36	25.78	Average	H	38.08	-27.55	-	36.31	54.00	17.69
Above 11 100.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 580 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 157.64	36.41	Peak	H	38.20	-27.10	-	47.51	74.00	26.49
*11 161.61	25.19	Average	H	38.20	-27.07	-	36.32	54.00	17.68
Above 11 200.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 720 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 438.34	35.97	Peak	H	38.40	-25.91	-	48.46	74.00	25.54
*11 440.27	25.31	Average	H	38.41	-25.91	-	37.81	54.00	16.19
Above 11 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 3)_MCS0
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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 650.00	16.69	Peak	H	33.94	8.37	-	59.00	68.23	9.23

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 488.00	36.92	Peak	H	38.44	-26.17	-	49.19	74.00	24.81
*11 490.04	25.62	Average	H	38.44	-26.17	-	37.89	54.00	16.11
Above 11 500.00	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)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 569.24	36.45	Peak	H	38.43	-25.71	-	49.17	74.00	24.83
*11 569.71	24.74	Average	H	38.43	-25.71	-	37.46	54.00	16.54
Above 11 600.00	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)	CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 925.00	16.81	Peak	H	34.43	8.51	-	59.75	68.23	8.48

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*11 651.42	36.10	Peak	H	38.40	-25.75	-	48.75	74.00	25.25
*11 649.72	25.01	Average	H	38.41	-25.74	-	37.68	54.00	16.32
Above 11 700.00	Not detected	-	-	-	-	-	-	-	-

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Remark:

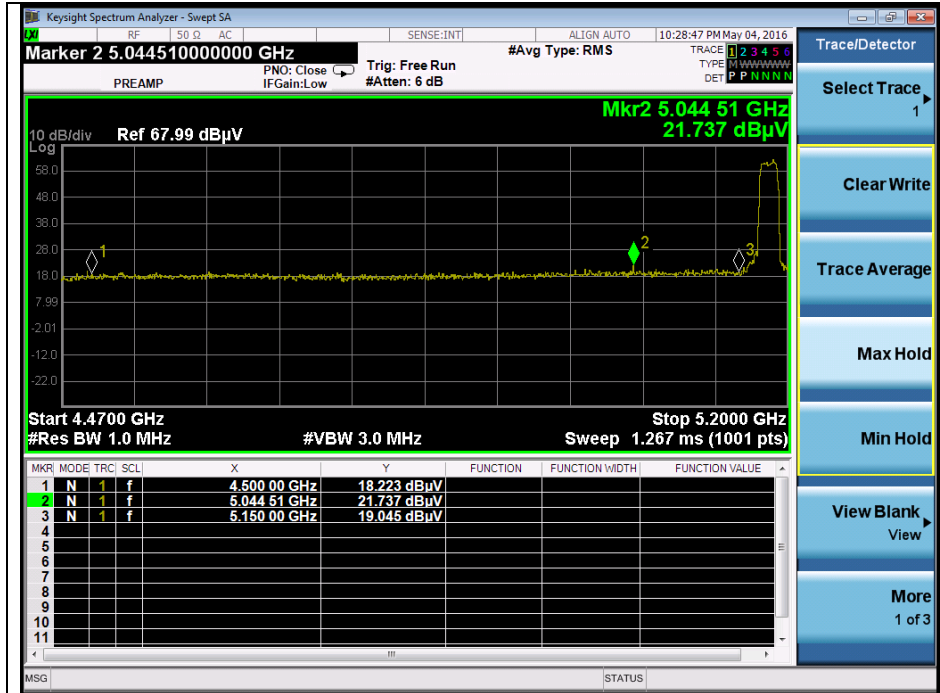
1. "*" means the restricted band.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak / average detector mode if frequency was in restricted band. Otherwise the frequency was out of restricted band, only peak detector should be used.
3. Band edge measurement.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

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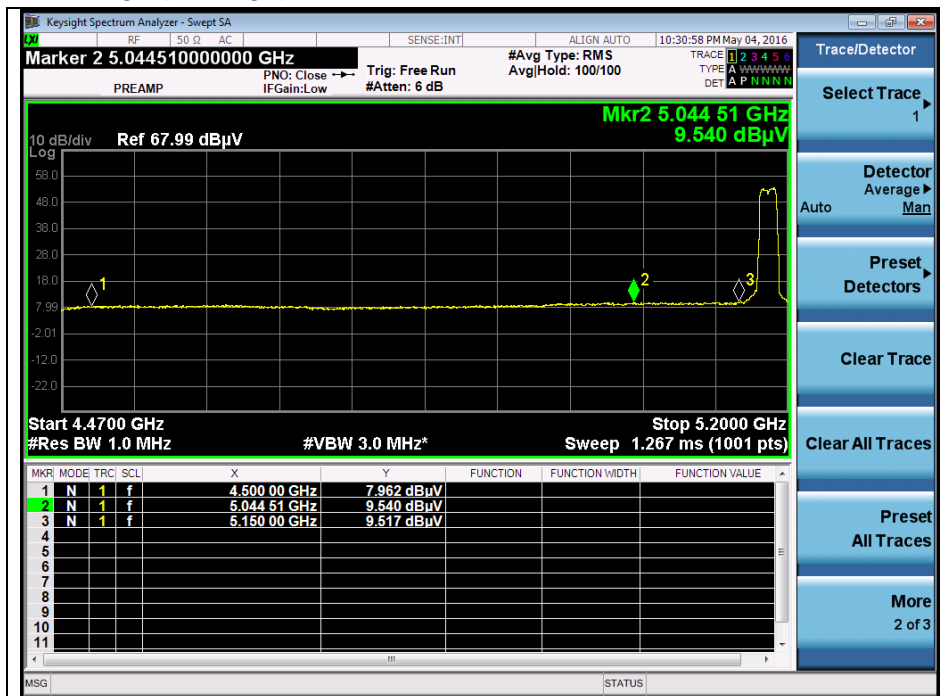
Plots of Spurious Emission

OFDM : 802.11a(6 Mbps)

Low channel Band edge (Peak) - Band 1

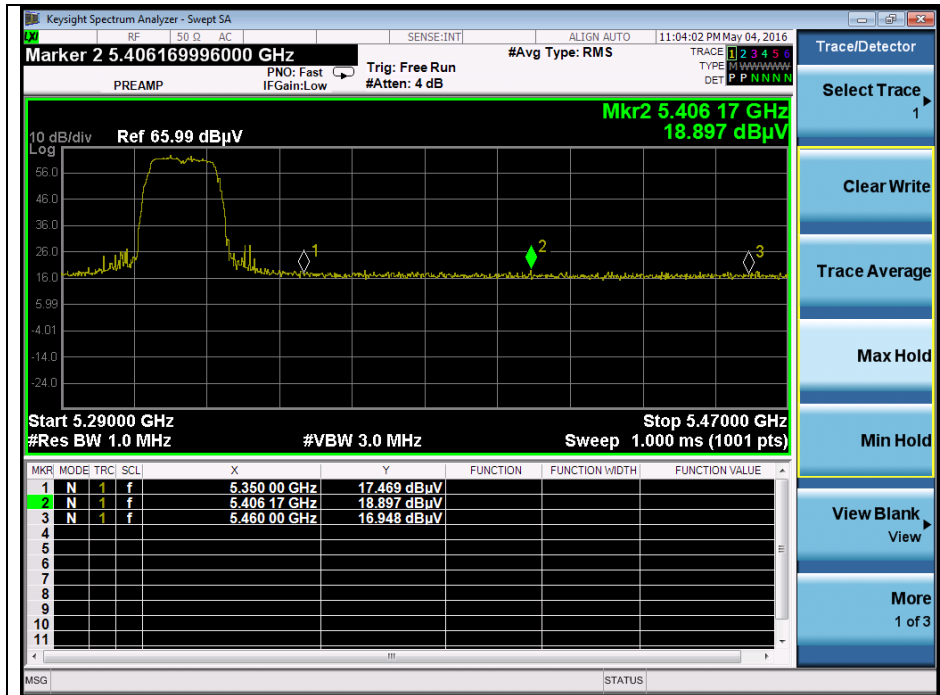


Low channel Band edge (Average) - Band 1

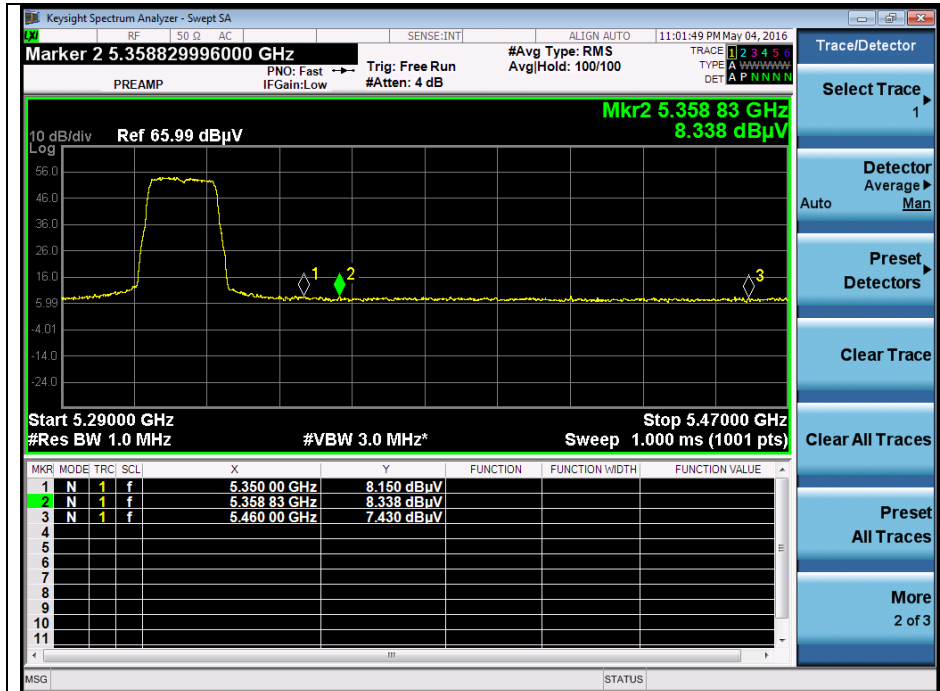


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High channel Band edge (Peak) - Band 2A

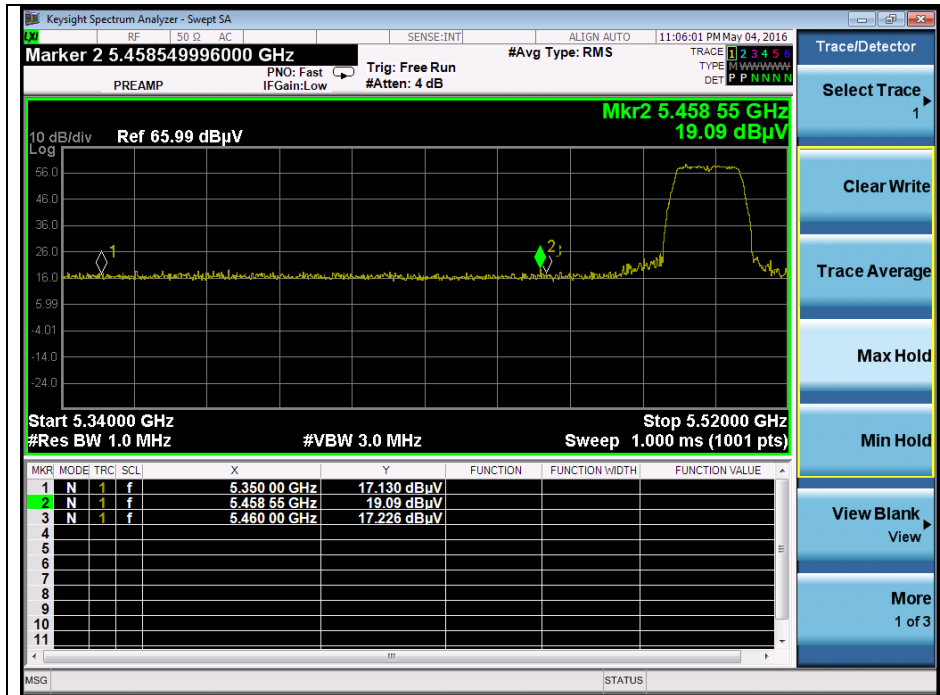


High channel Band edge (Average) - Band 2A

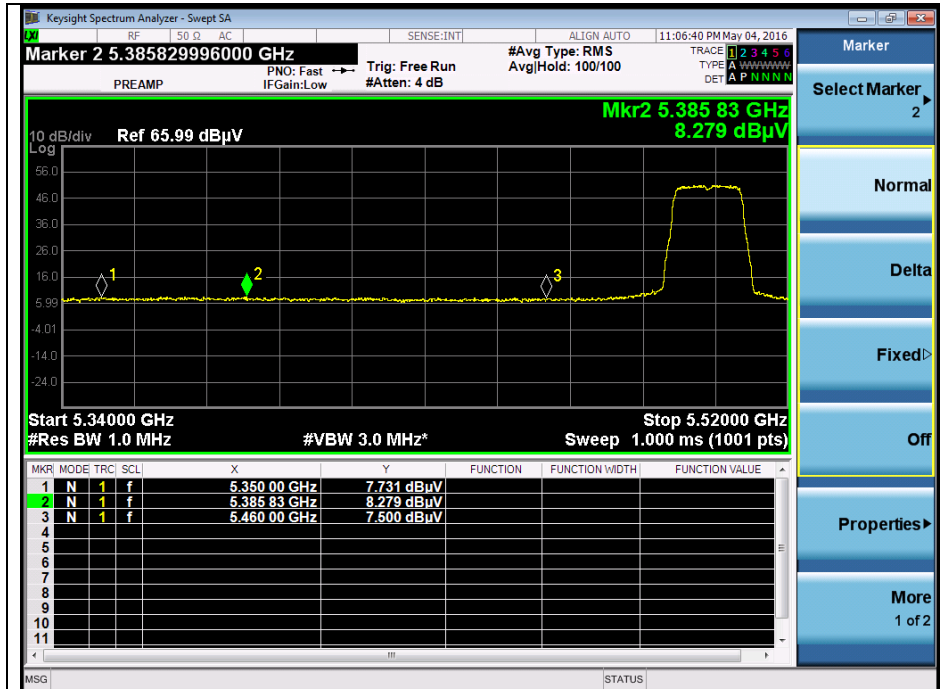


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Low channel Band edge (Peak) - Band 2C

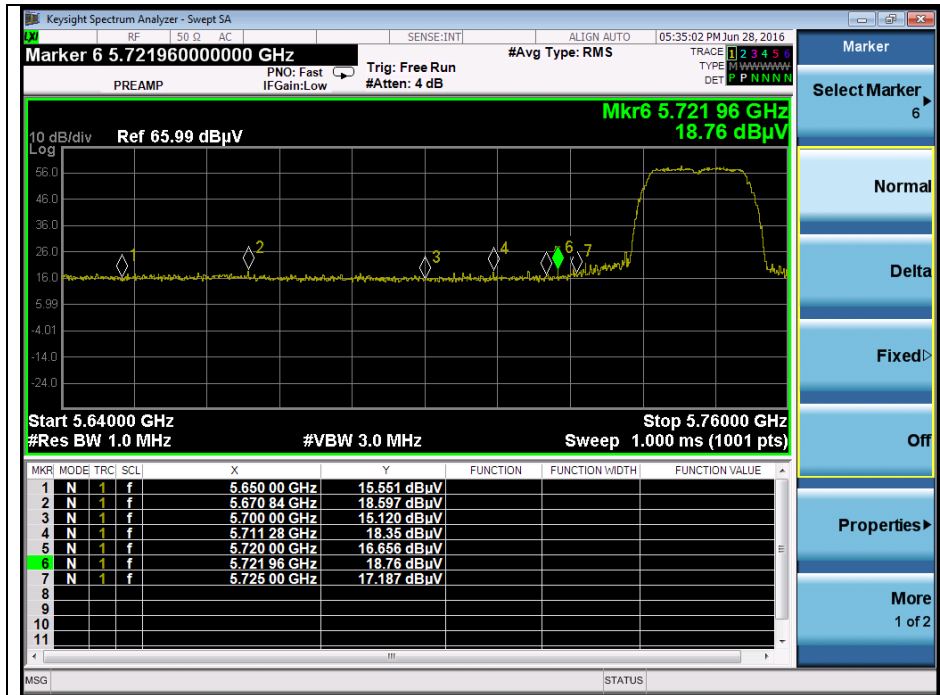


Low channel Band edge (Average) - Band 2C

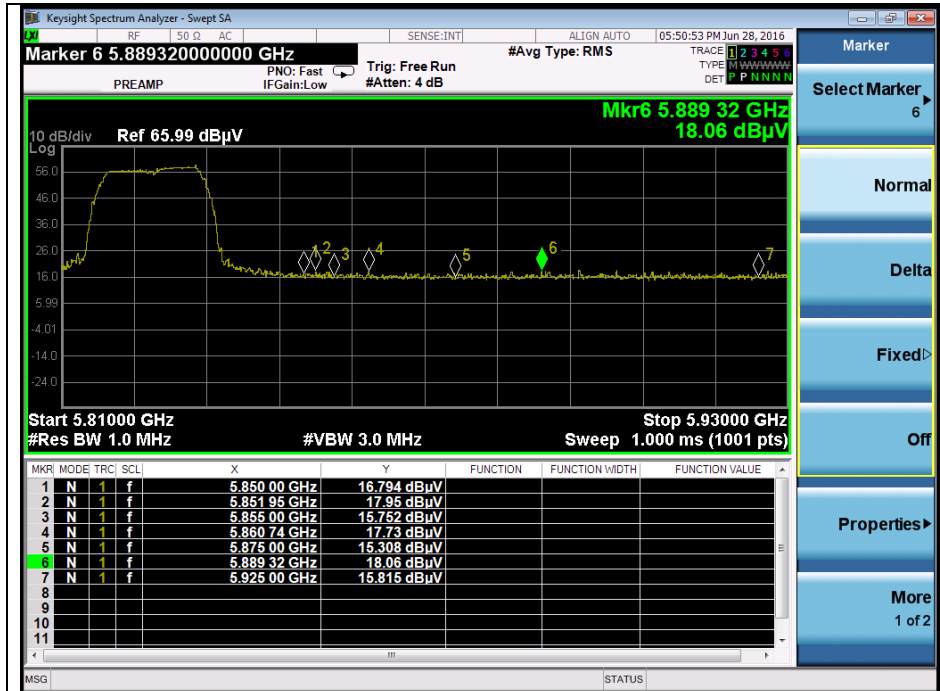


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Low channel Band edge (Peak) - Band 3



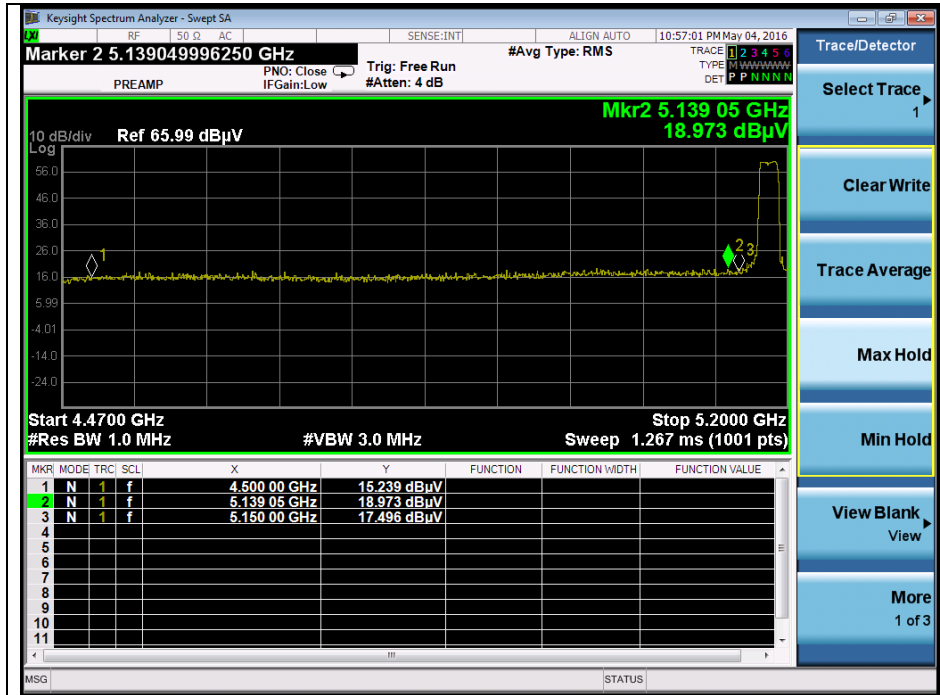
High channel Band edge (Peak) - Band 3



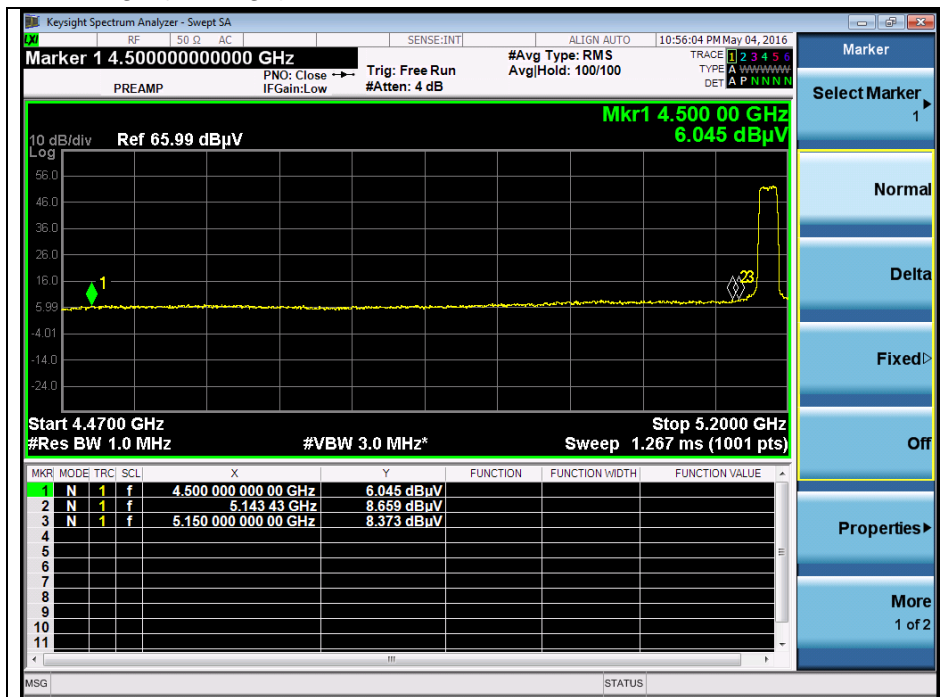
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OFDM : 802.11n_HT20(MCS0)

Low channel Band edge (Peak) - Band 1

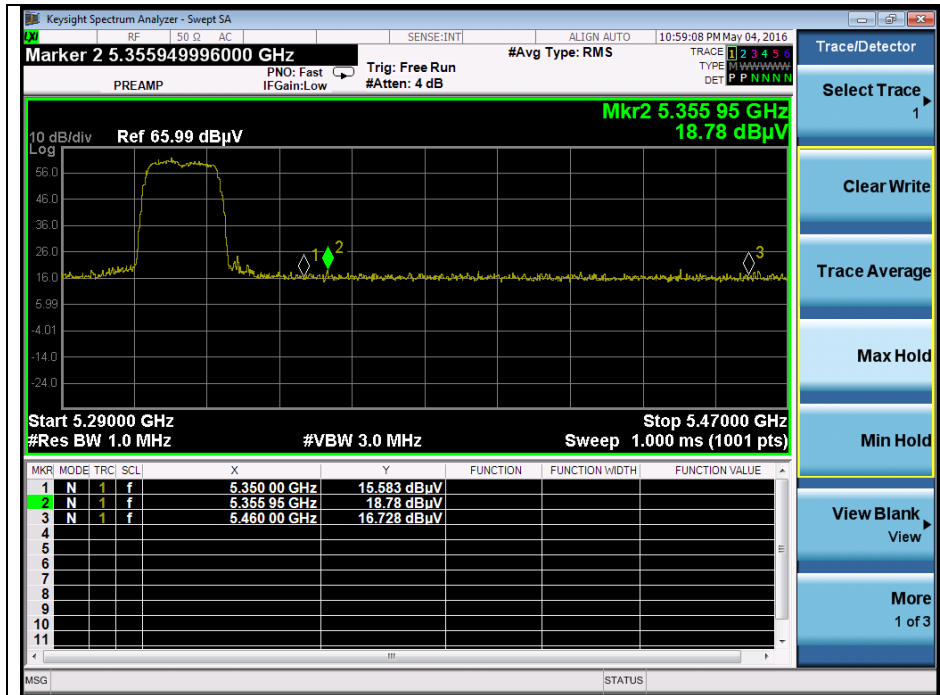


Low channel Band edge (Average) - Band 1

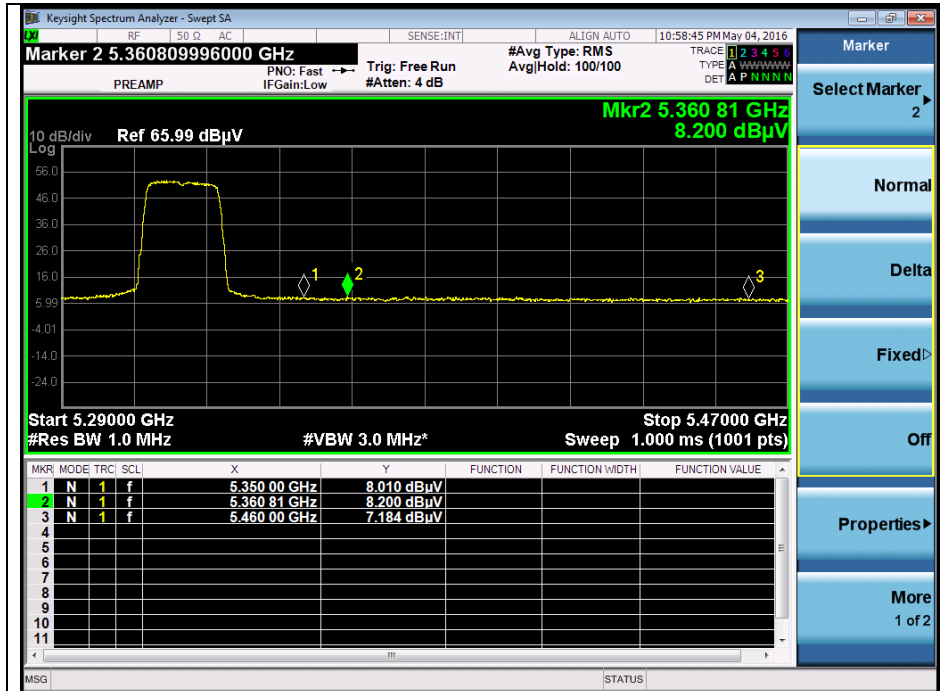


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High channel Band edge (Peak) - Band 2A

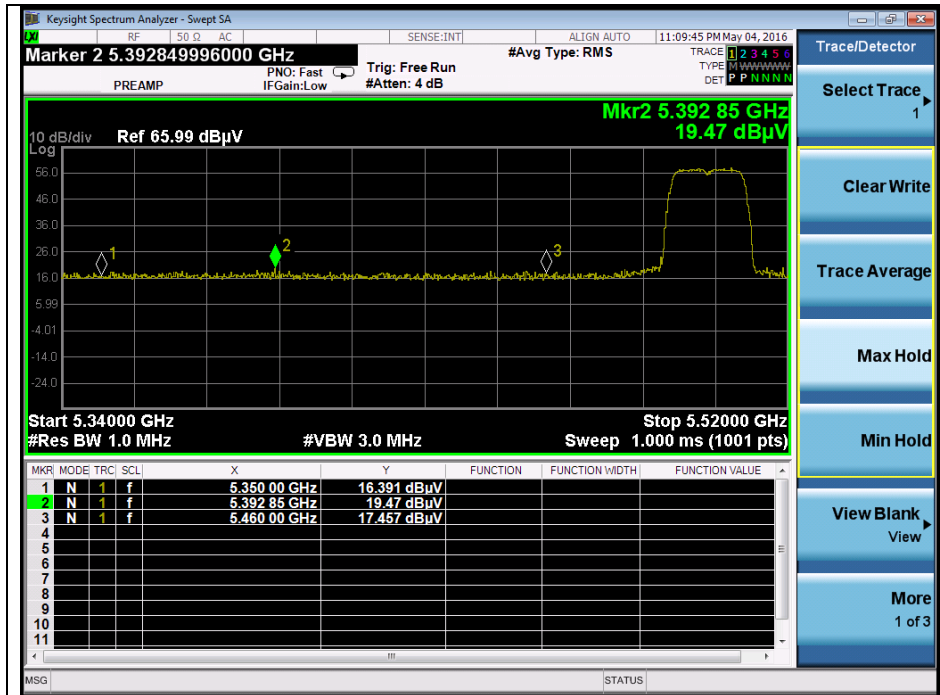


High channel Band edge (Average) - Band 2A

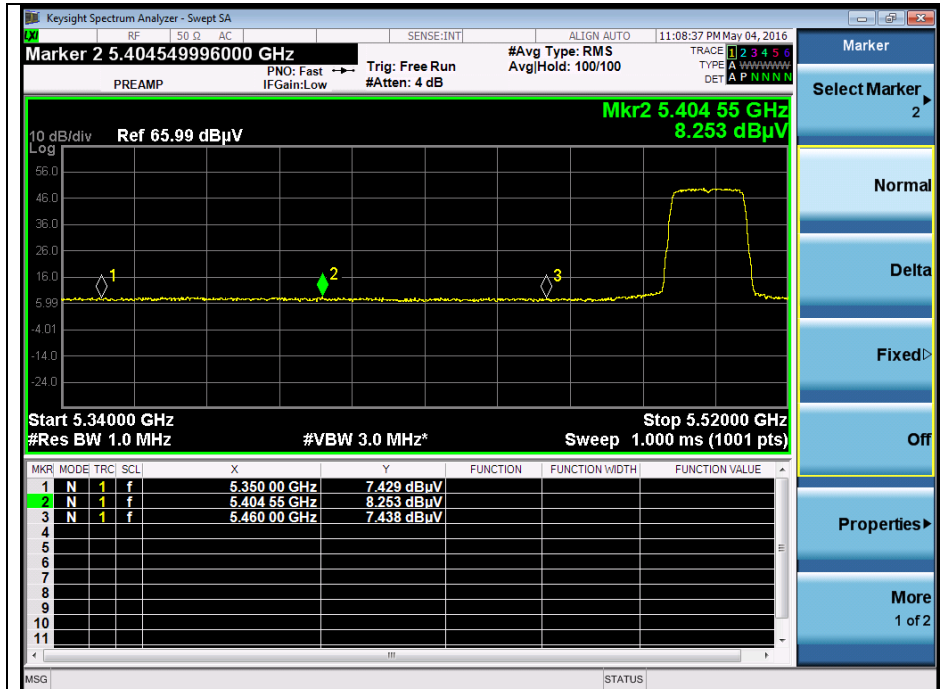


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Low channel Band edge (Peak) - Band 2C

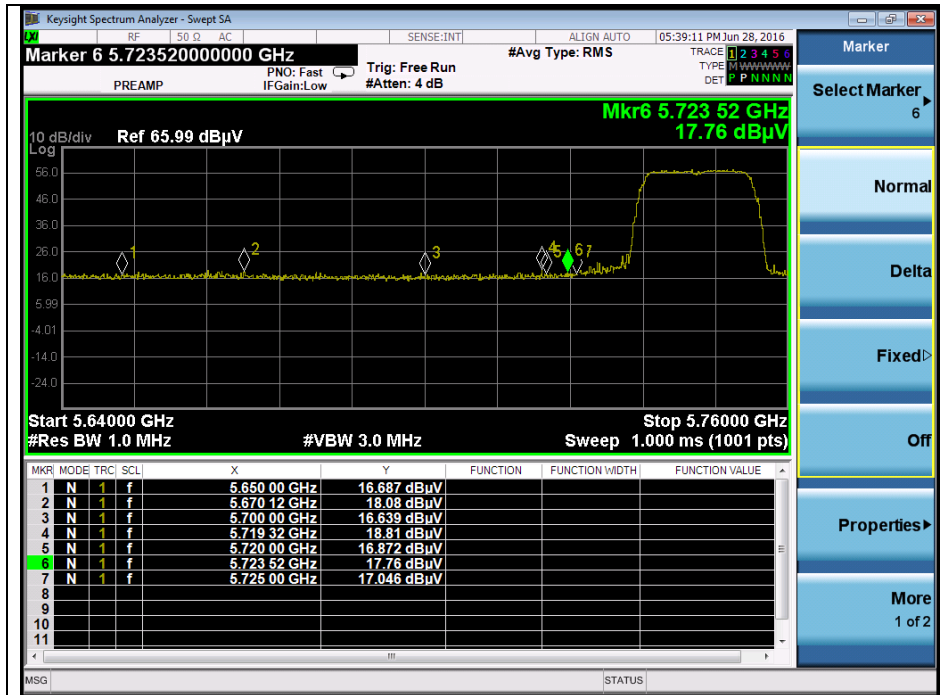


Low channel Band edge (Average) - Band 2C

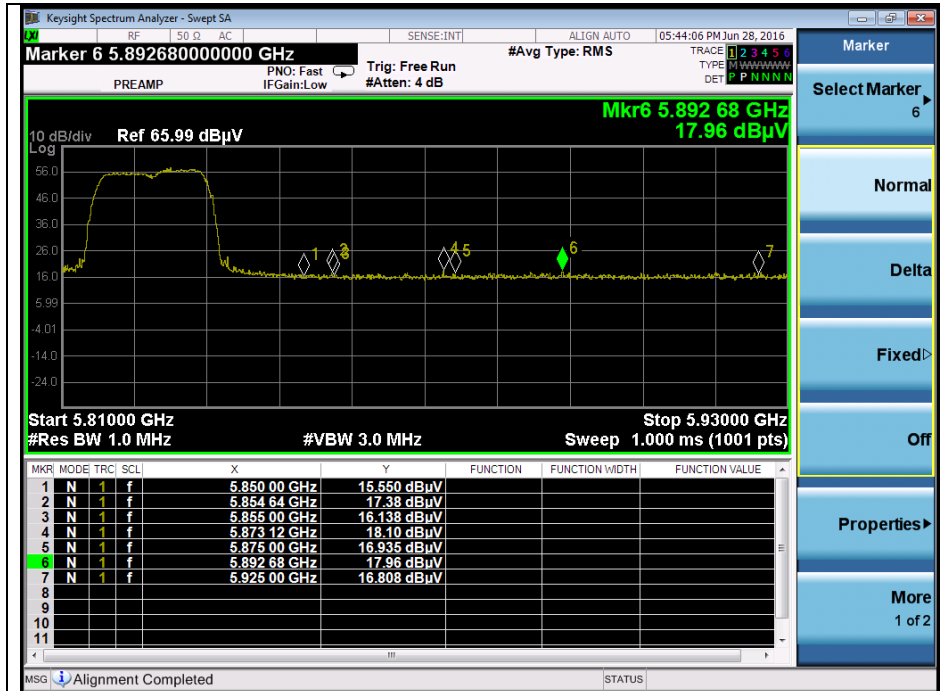


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Low channel Band edge (Peak) - Band 3



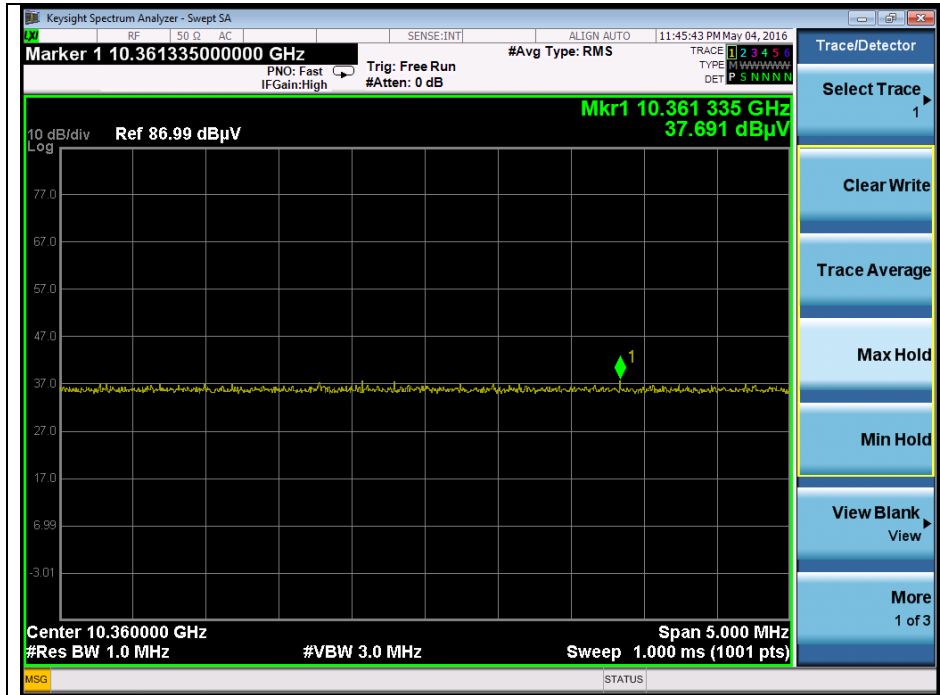
High channel Band edge (Peak) - Band 3



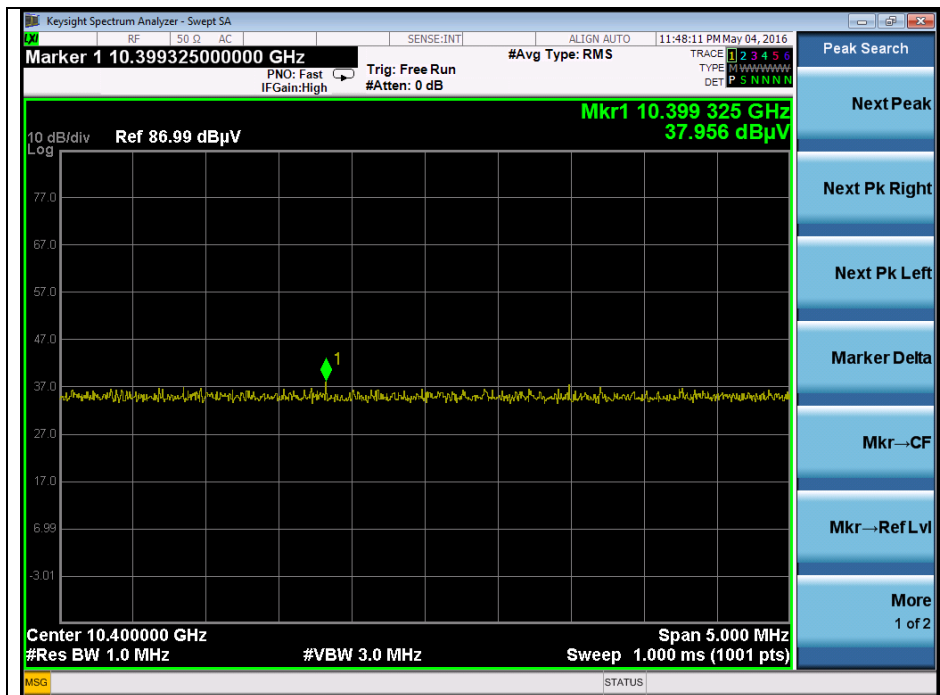
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OFDM : 802.11a(6 Mbps)

Low channel 2nd harmonic (Peak) - Band 1

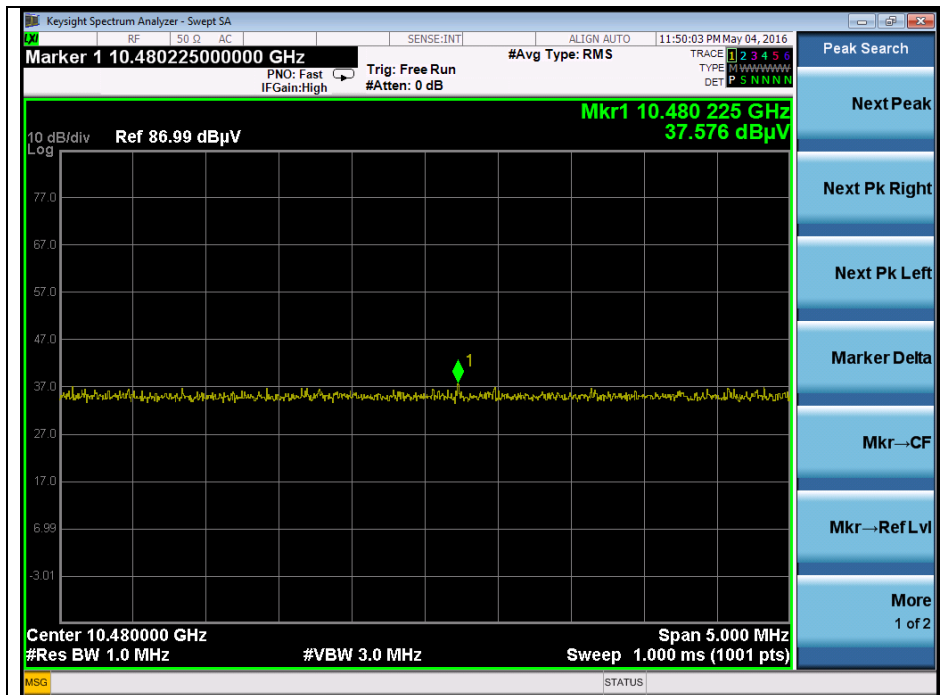


Middle channel 2nd harmonic (Peak) - Band 1

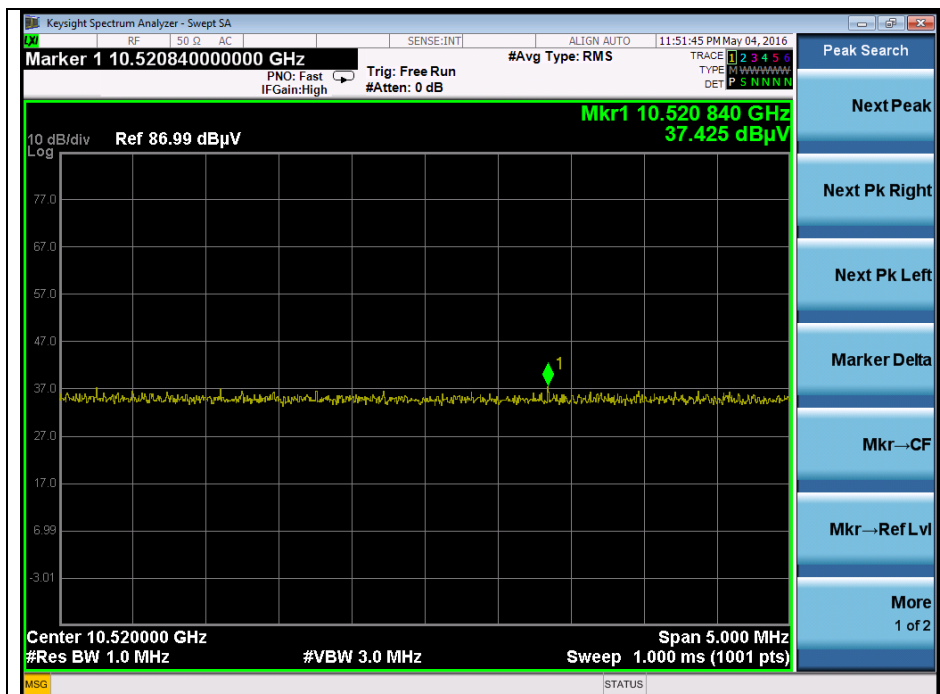


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High channel 2nd harmonic (Peak) - Band 1

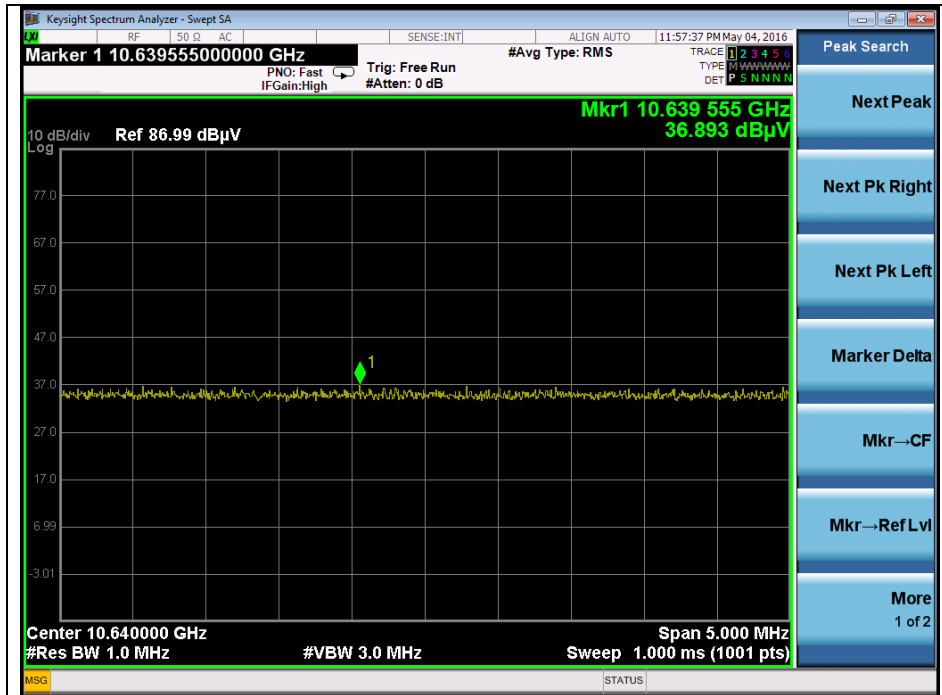


Low channel 2nd harmonic (Peak) - Band 2A

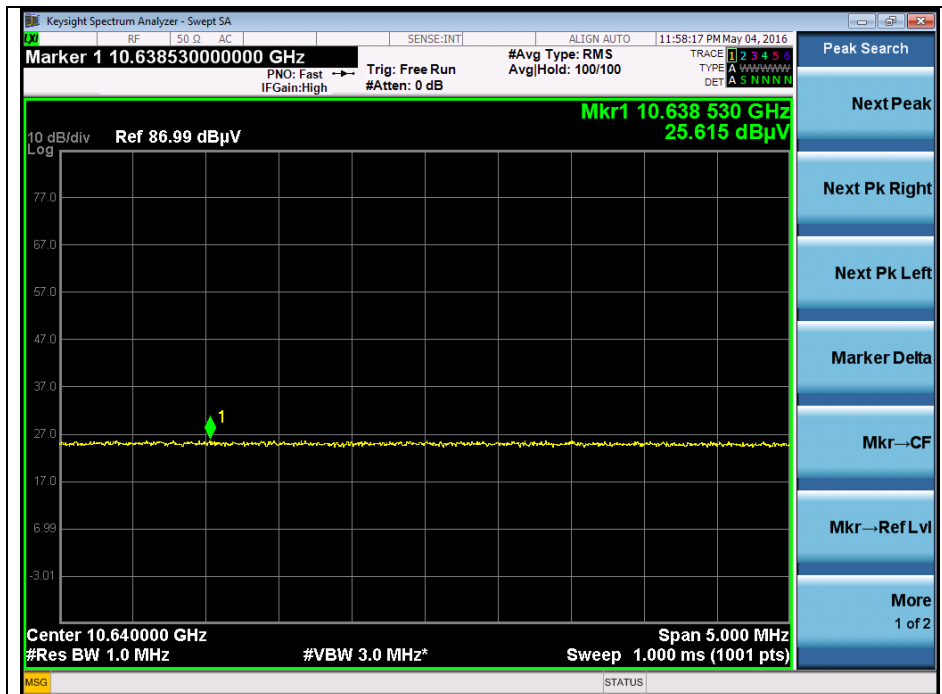


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High channel 2nd harmonic (Peak) - Band 2A

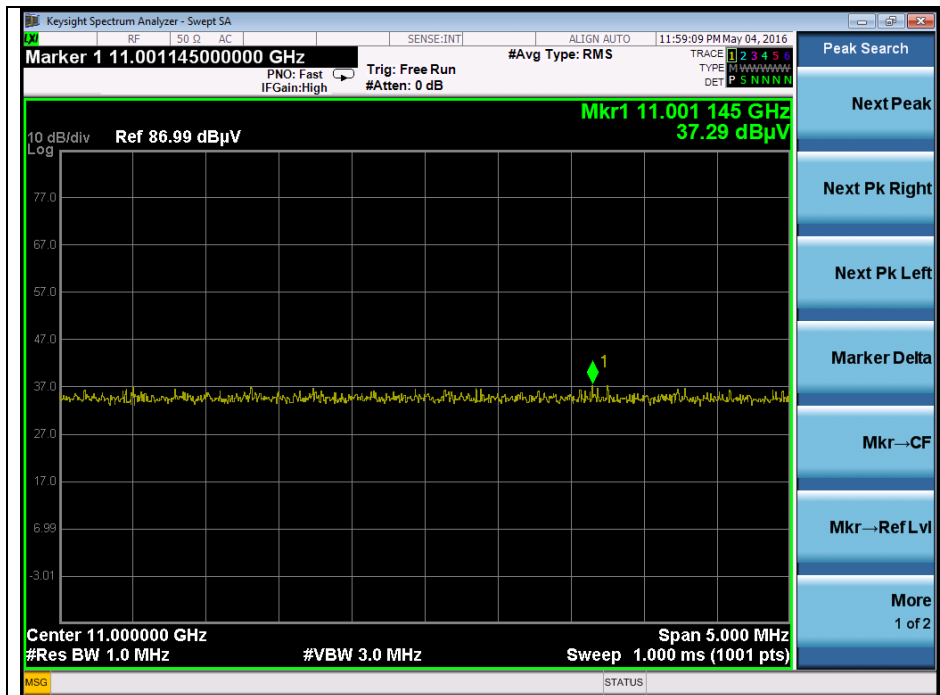


High channel 2nd harmonic (Average) - Band 2A

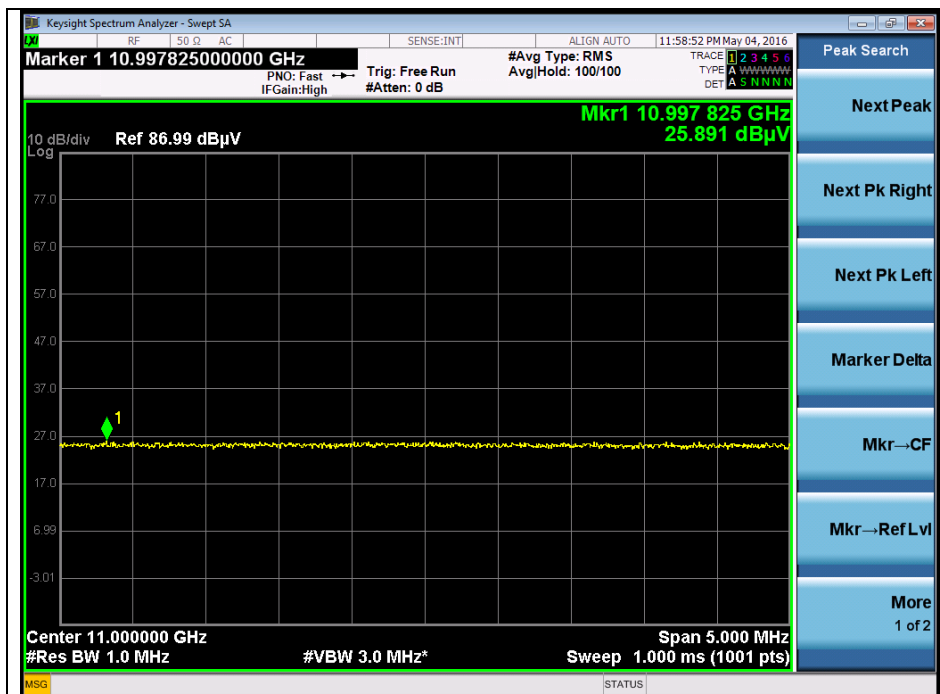


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Low channel 2nd harmonic (Peak) - Band 2C

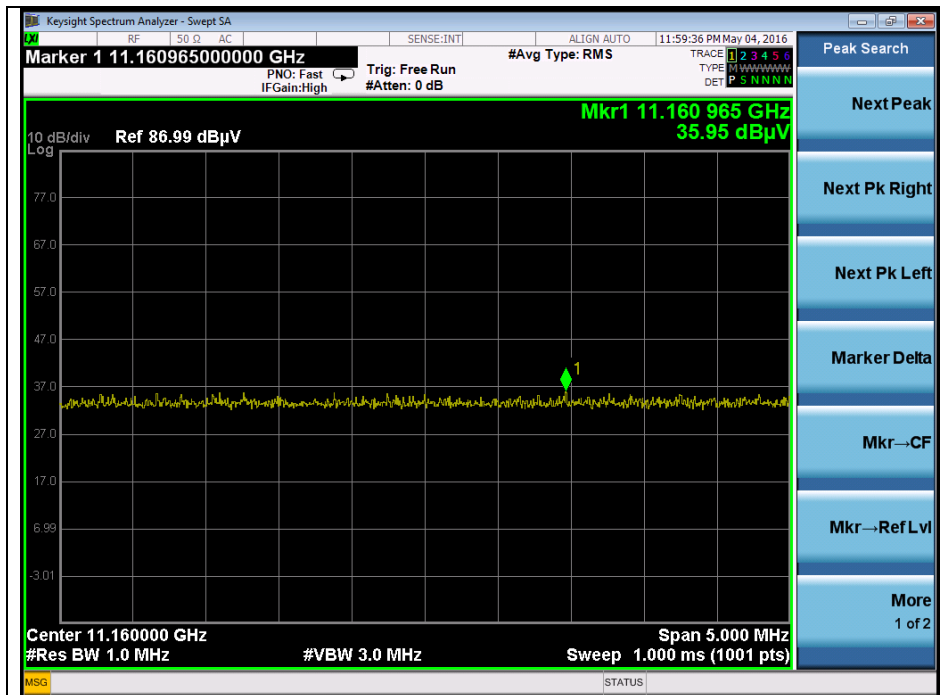


Low channel 2nd harmonic (Average) - Band 2C

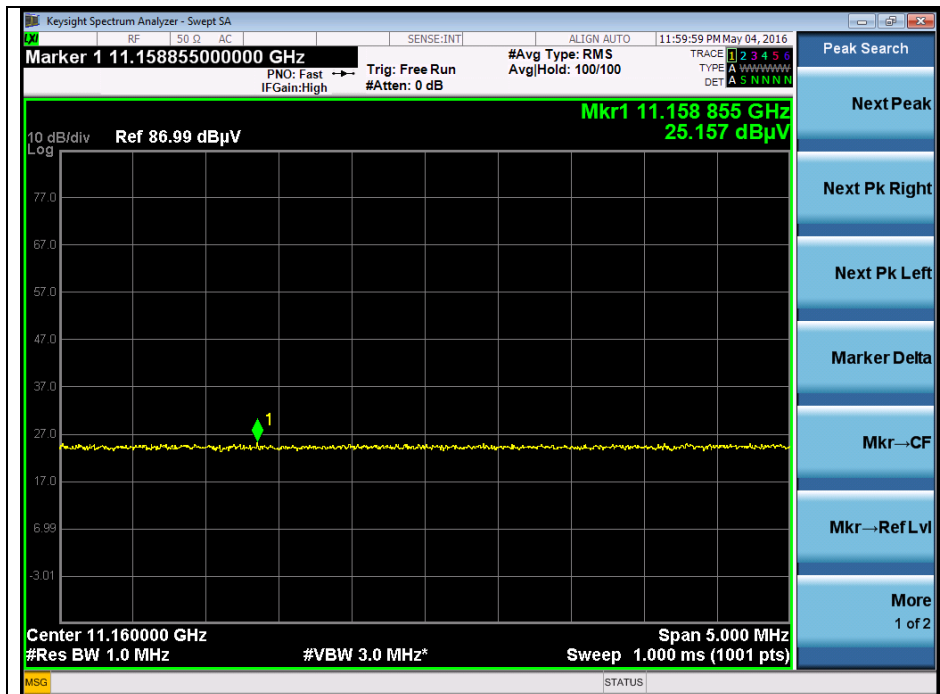


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Middle channel 2nd harmonic (Peak) - Band 2C

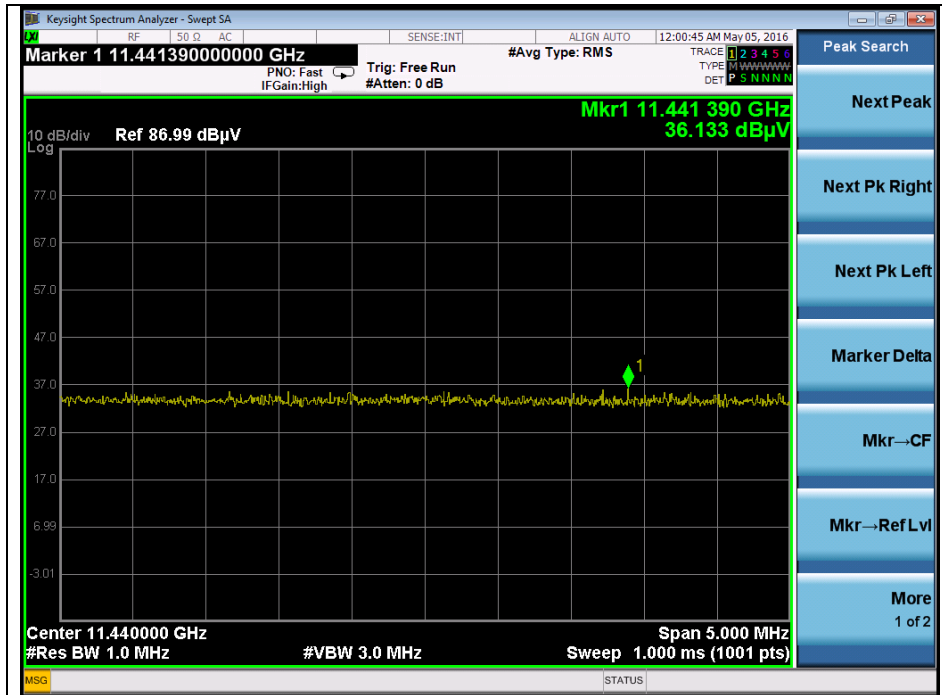


Middle channel 2nd harmonic (Average) - Band 2C



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High channel 2nd harmonic (Peak) - Band 2C

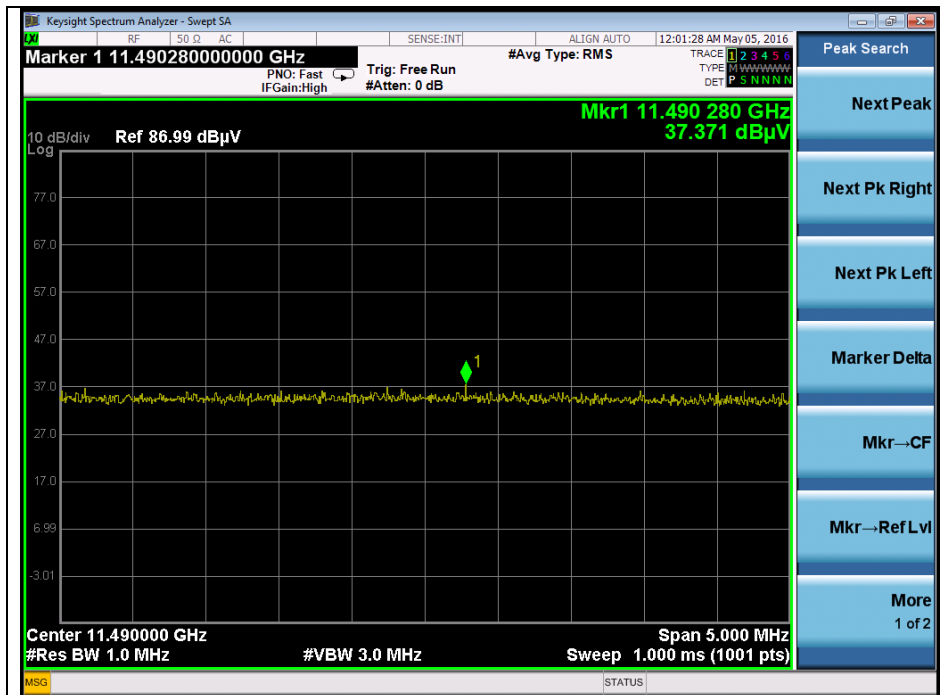


High channel 2nd harmonic (Average) - Band 2C

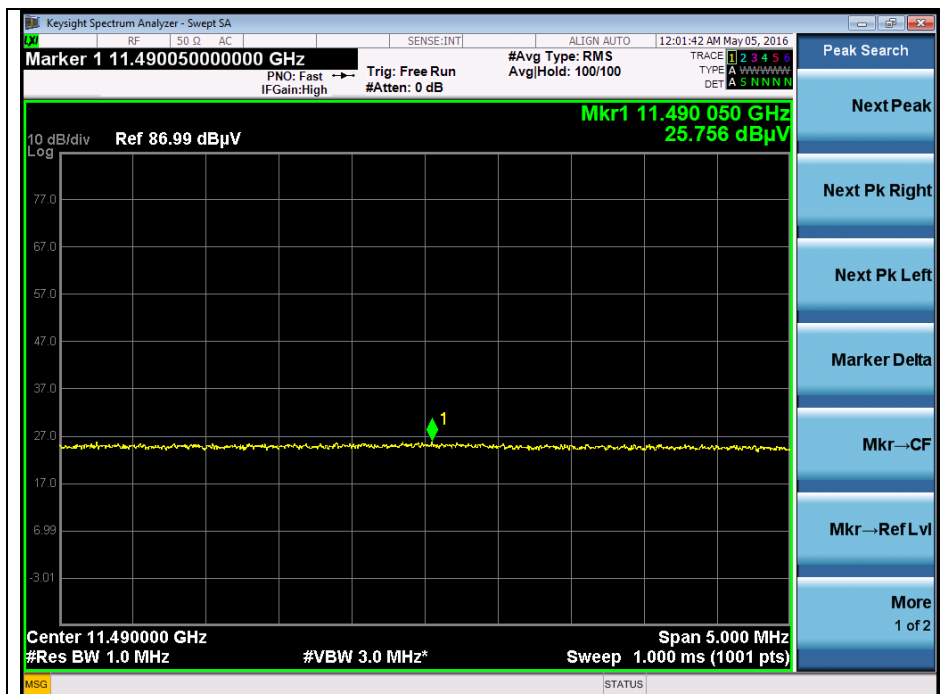


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Low channel 2nd harmonic (Peak) - Band 3

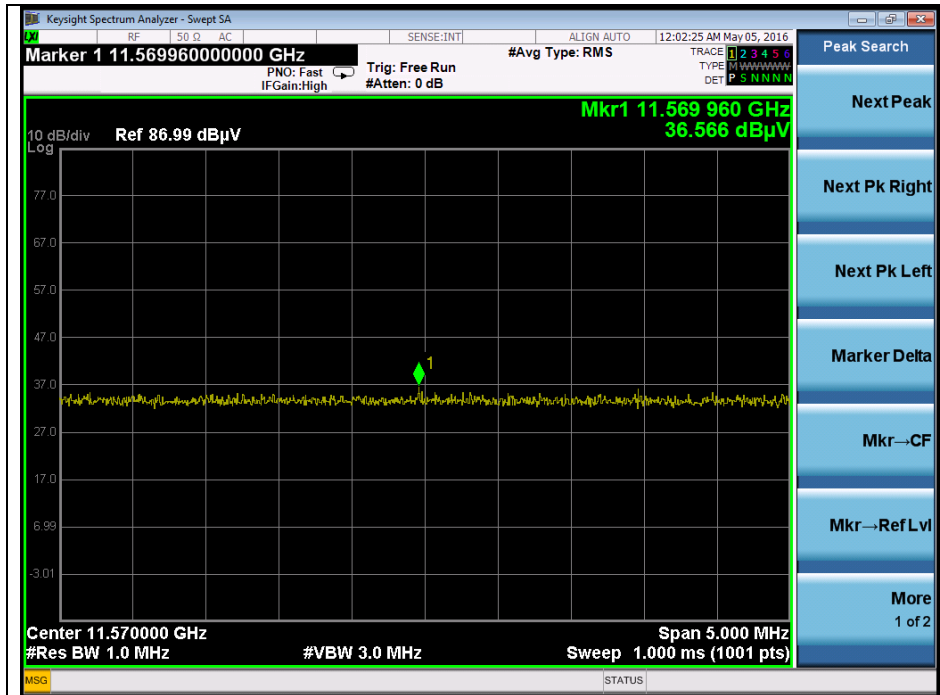


Low channel 2nd harmonic (Average) - Band 3



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Middle channel 2nd harmonic (Peak) - Band 3

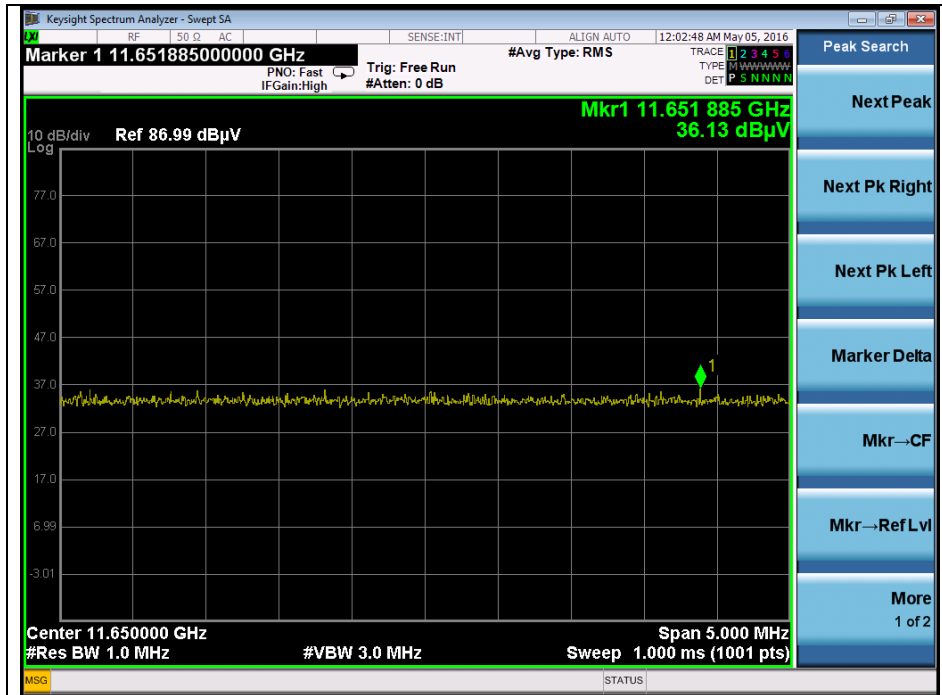


Middle channel 2nd harmonic (Average) - Band 3

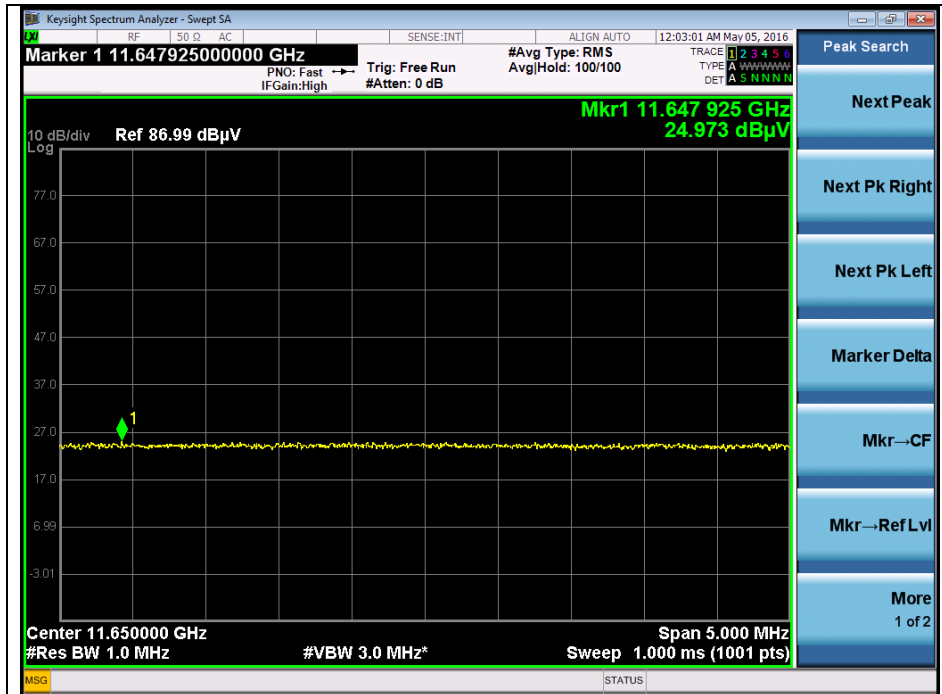


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High channel 2nd harmonic (Peak) - Band 3



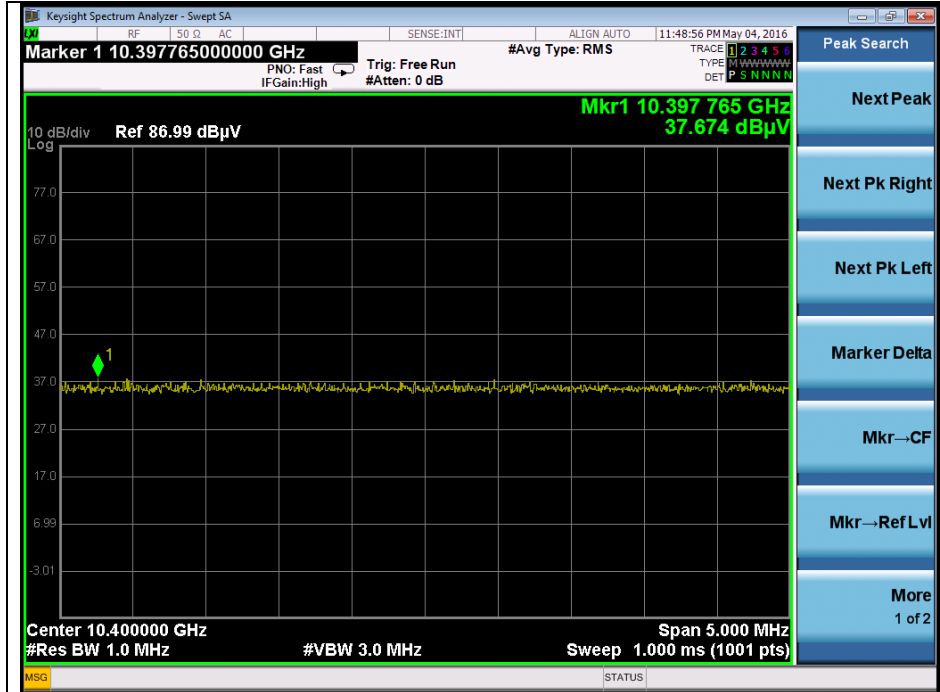
High channel 2nd harmonic (Average) - Band 3



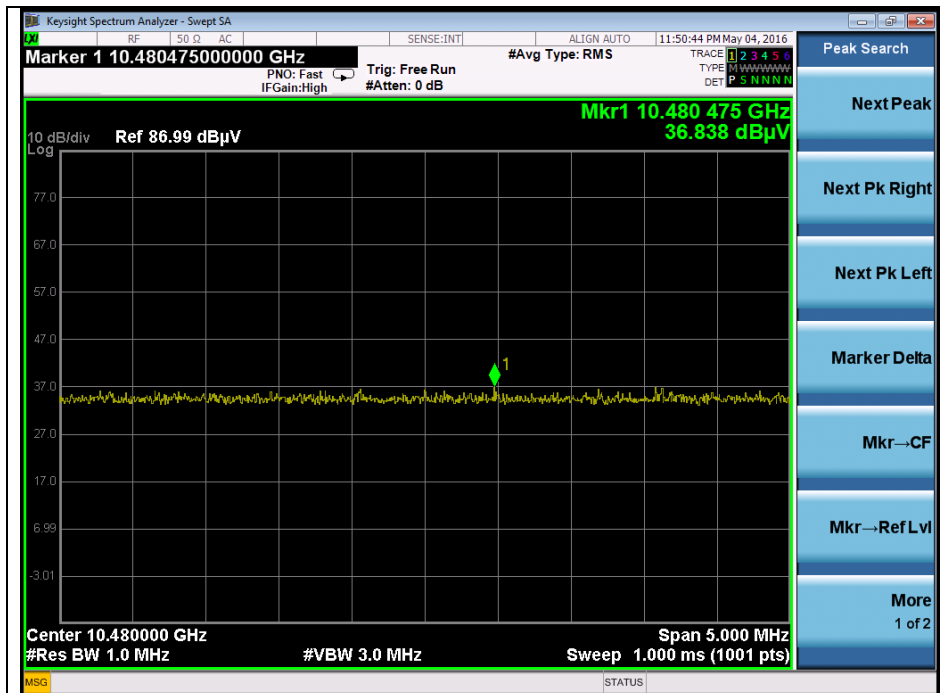
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OFDM : 802.11n_HT20(MCS0)

Middle channel 2nd harmonic (Peak) - Band 1

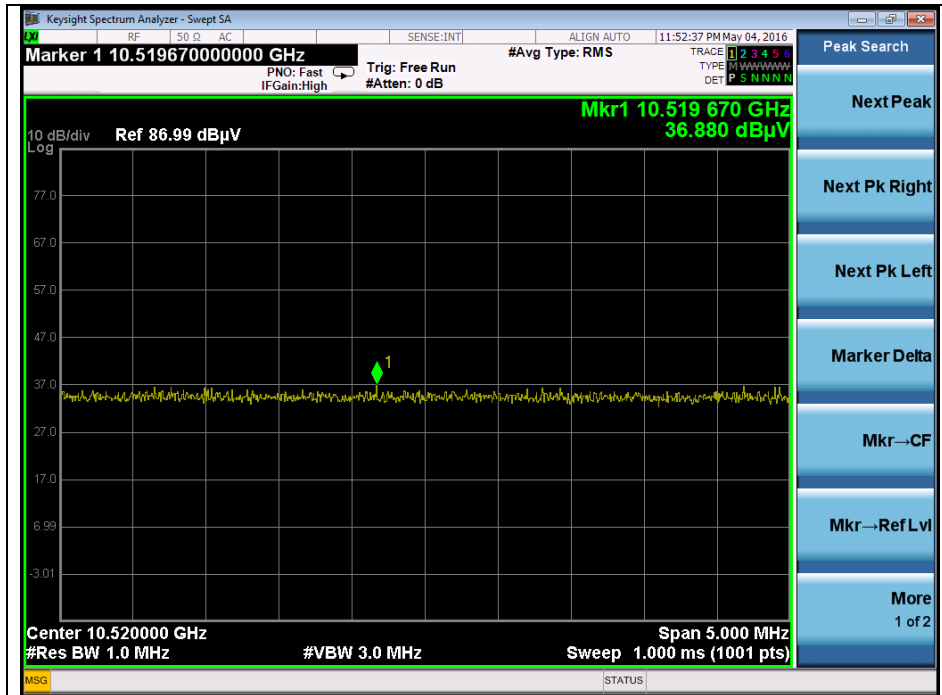


High channel 2nd harmonic (Peak) - Band 1

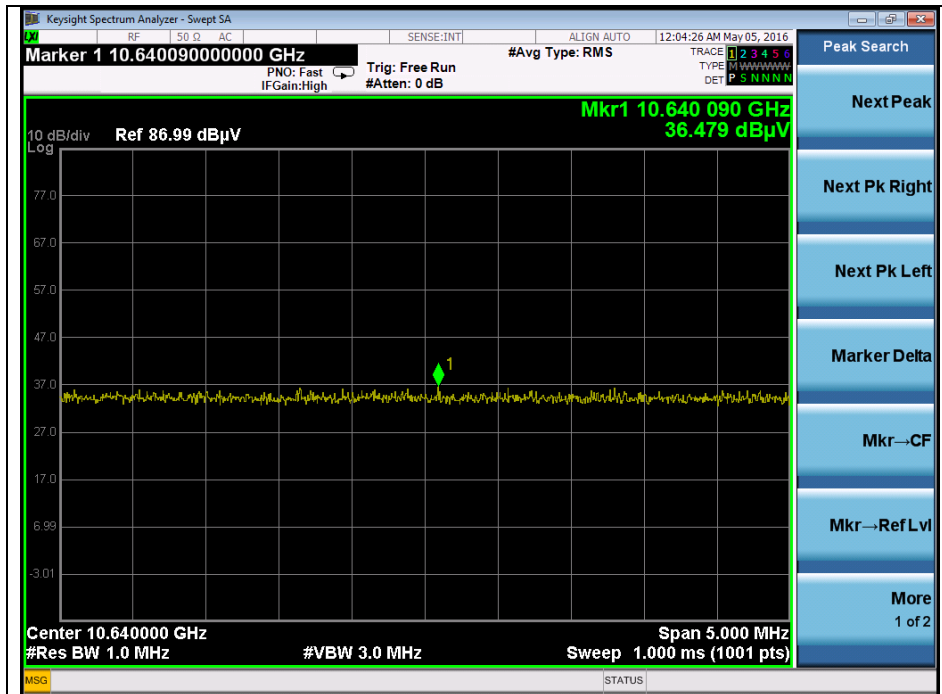


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Low channel 2nd harmonic (Peak) - Band 2A

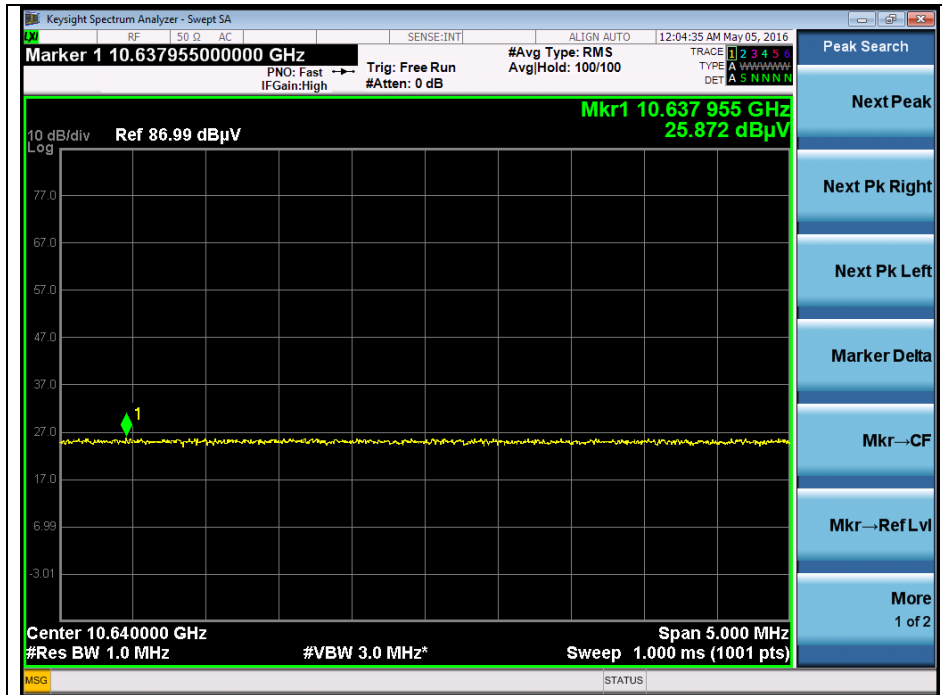


High channel 2nd harmonic (Peak) - Band 2A

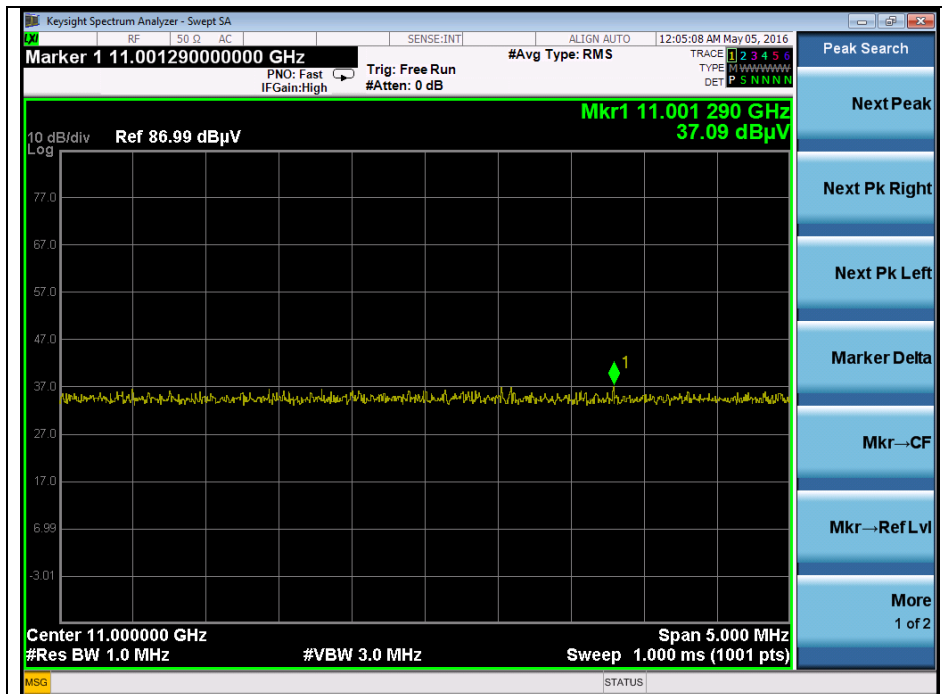


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High channel 2nd harmonic (Average) - Band 2A

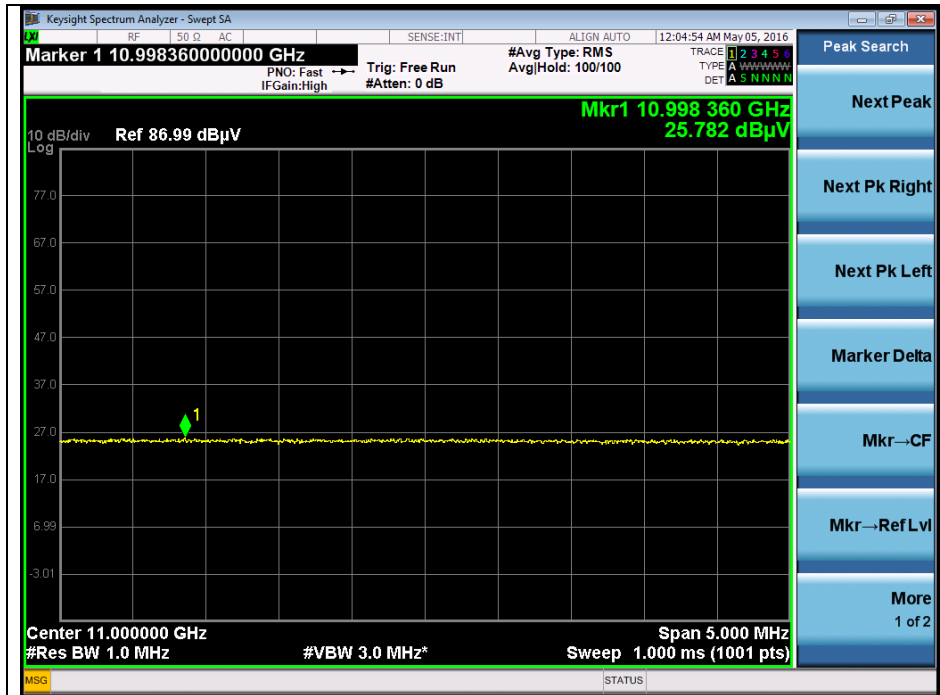


Low channel 2nd harmonic (Peak) - Band 2C

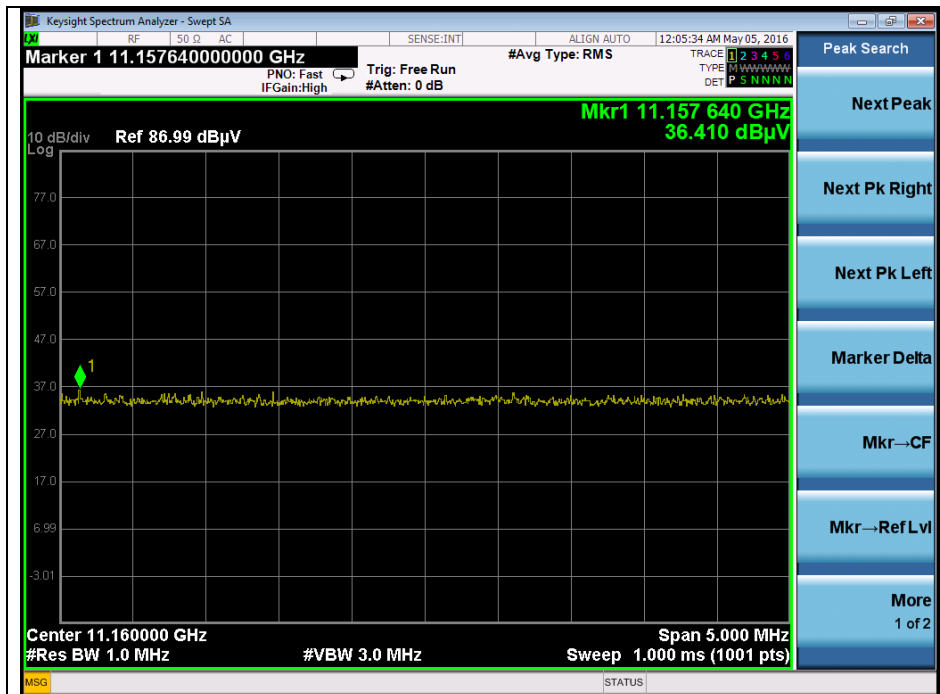


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Low channel 2nd harmonic (Average) - Band 2C

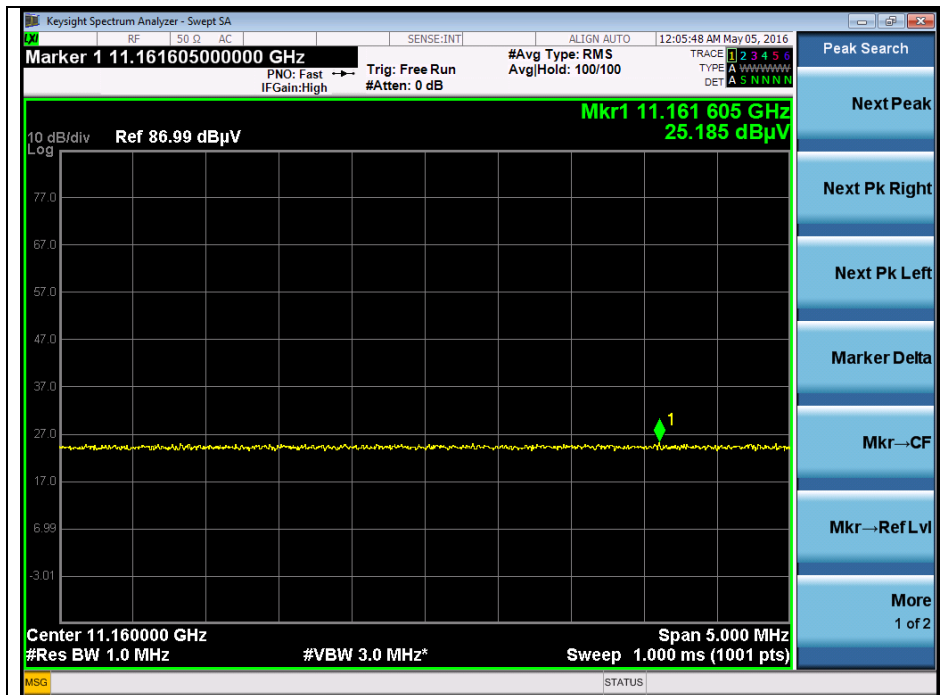


Middle channel 2nd harmonic (peak) - Band 2C

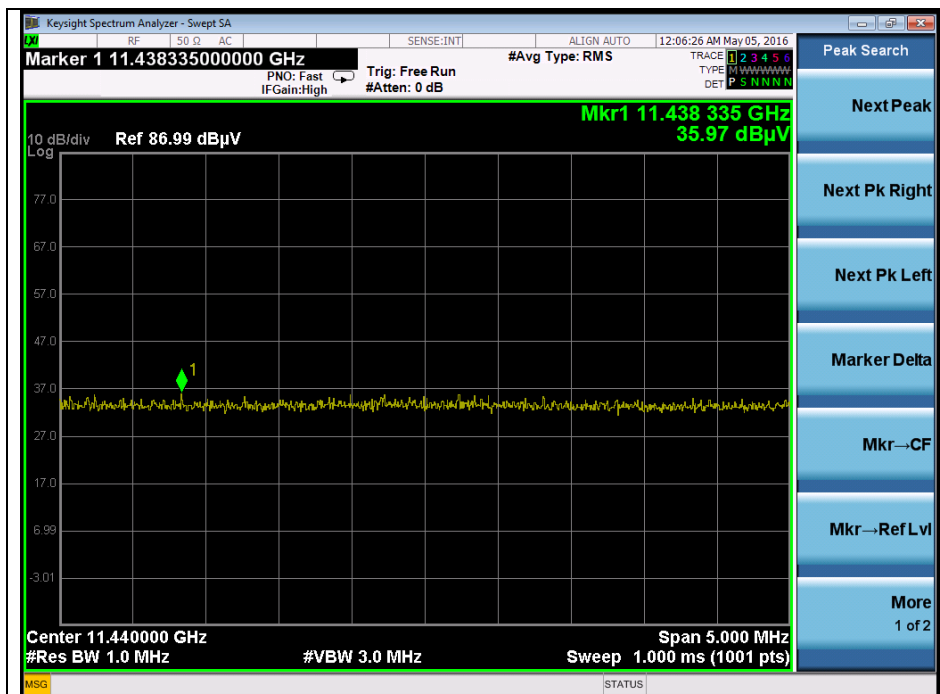


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Middle channel 2nd harmonic (Average) - Band 2C

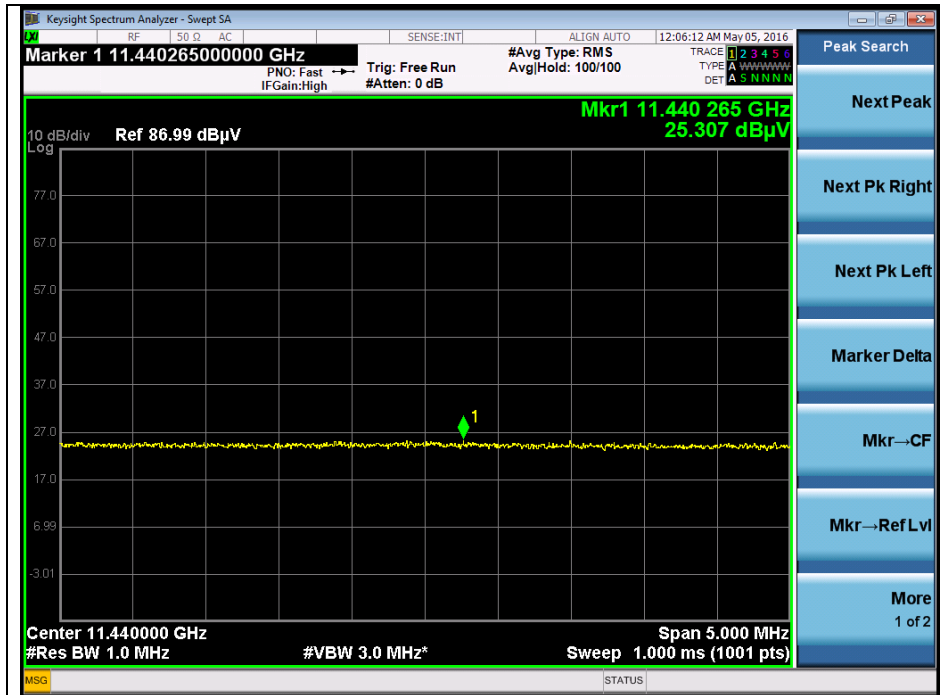


High channel 2nd harmonic (Peak) - Band 2C

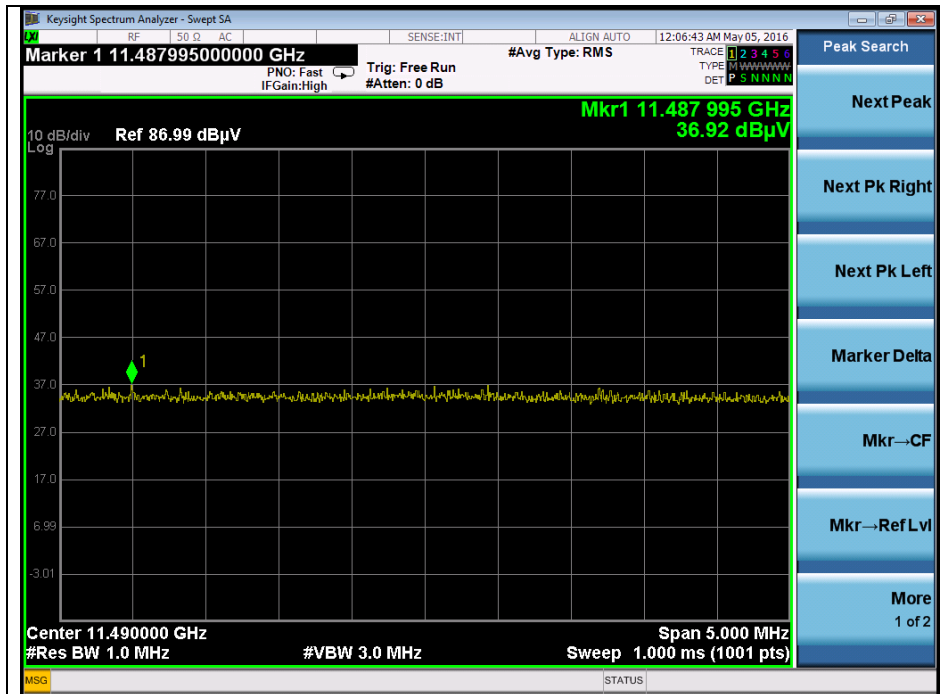


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High channel 2nd harmonic (Average) - Band 2C

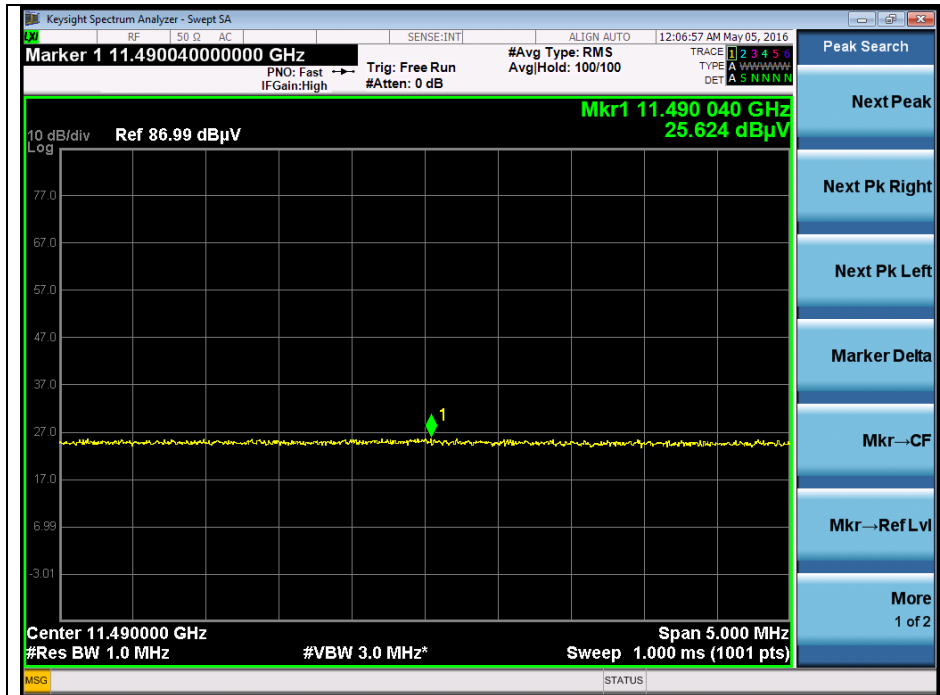


Low channel 2nd harmonic (Peak) - Band 3

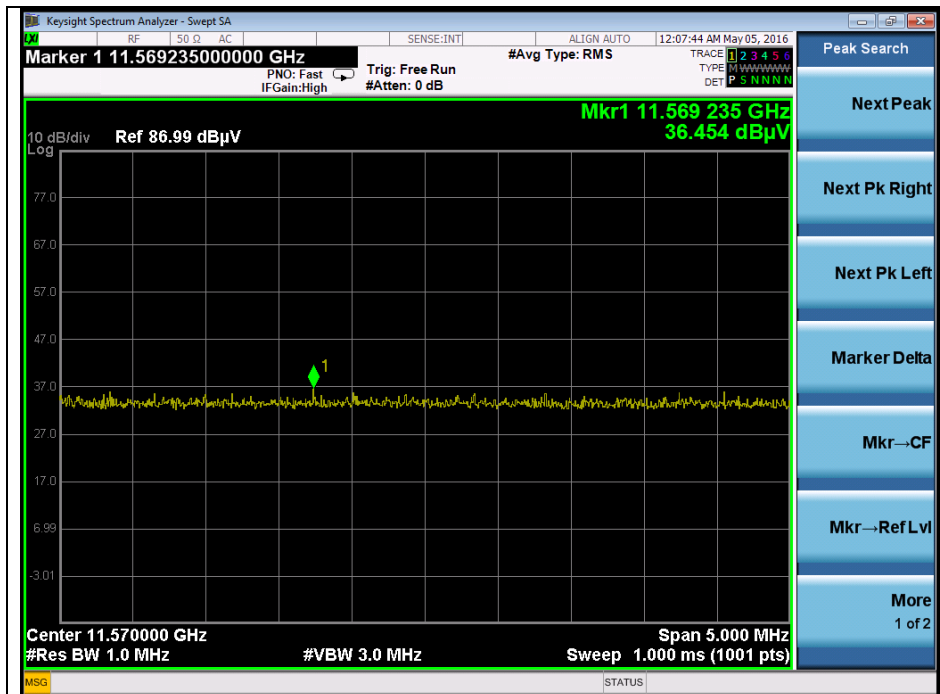


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Low channel 2nd harmonic (Average) - Band 3

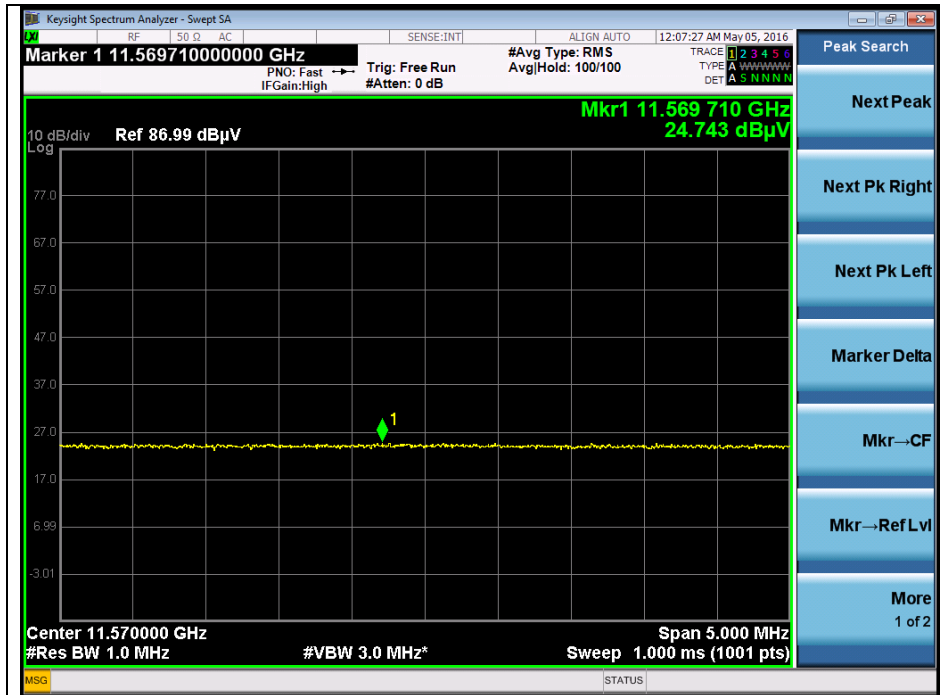


Middle channel 2nd harmonic (peak) - Band 3



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Middle channel 2nd harmonic (Average) - Band 3

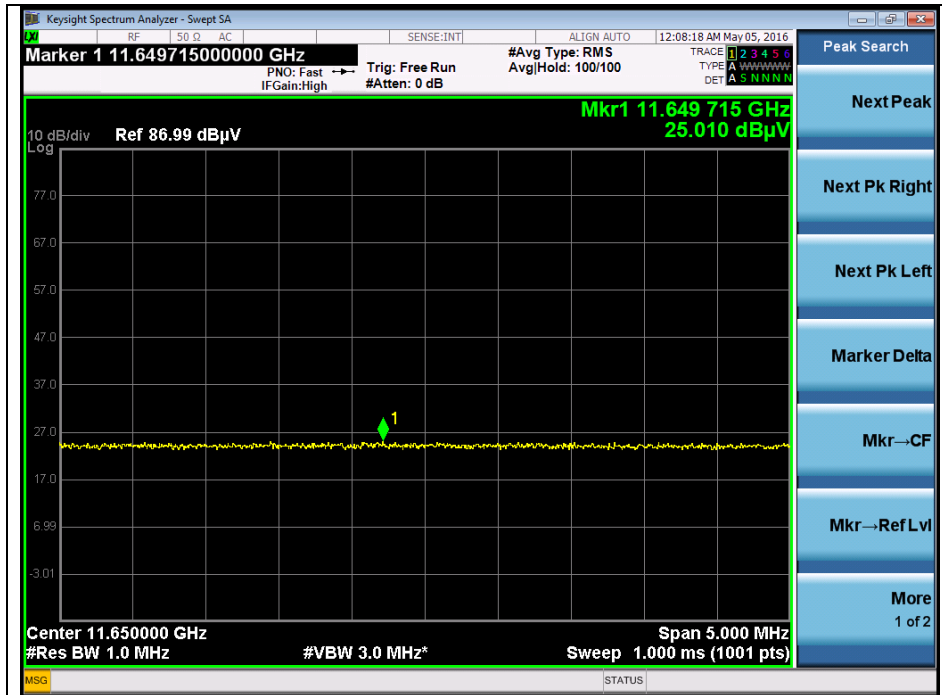


High channel 2nd harmonic (Peak) - Band 3



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High channel 2nd harmonic (Average) - Band 3



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3. 26 dB Bandwidth & 99 % Occupied Bandwidth

3.1. Test setup



3.2. 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.

3.2.1. 26 dB Bandwidth

1. This measurement settings are specified in section C.1 of KDB 789033_D02 v01r02.
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 Maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.
7. In case of band crossing channels 144, the measurement is complied with section D of KDB 644545_D03 v01.

3.2.2. 99 % Bandwidth

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

In the result,

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

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3.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Ch.	Data Rate	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
U-NII 1	11a	5 180	36	6 Mbps	20.42	-
		5 200	40	6 Mbps	20.30	-
		5 240	48	6 Mbps	20.34	17.18
	11n_HT20	5 180	36	MCS0	20.50	-
		5 200	40	MCS0	20.46	-
		5 240	48	MCS0	20.46	18.06
U-NII 2A	11a	5 260	52	6 Mbps	20.40	-
		5 280	56	6 Mbps	20.30	-
		5 320	64	6 Mbps	20.34	-
	11n_HT20	5 260	52	MCS0	20.48	-
		5 280	56	MCS0	20.50	-
		5 320	64	MCS0	20.46	-
U-NII 2C	11a	5 500	100	6 Mbps	20.34	-
		5 580	116	6 Mbps	20.38	-
		5 720	144	6 Mbps	20.30	-
	11n_HT20	5 500	100	MCS0	20.50	-
		5 580	116	MCS0	20.46	-
		5 720	144	MCS0	20.50	-
U-NII 3	11a	5 745	149	6 Mbps	20.34	-
		5 785	157	6 Mbps	20.26	-
		5 825	165	6 Mbps	20.38	-
	11n_HT20	5 745	149	MCS0	20.46	-
		5 785	157	MCS0	20.50	-
		5 825	165	MCS0	20.54	-

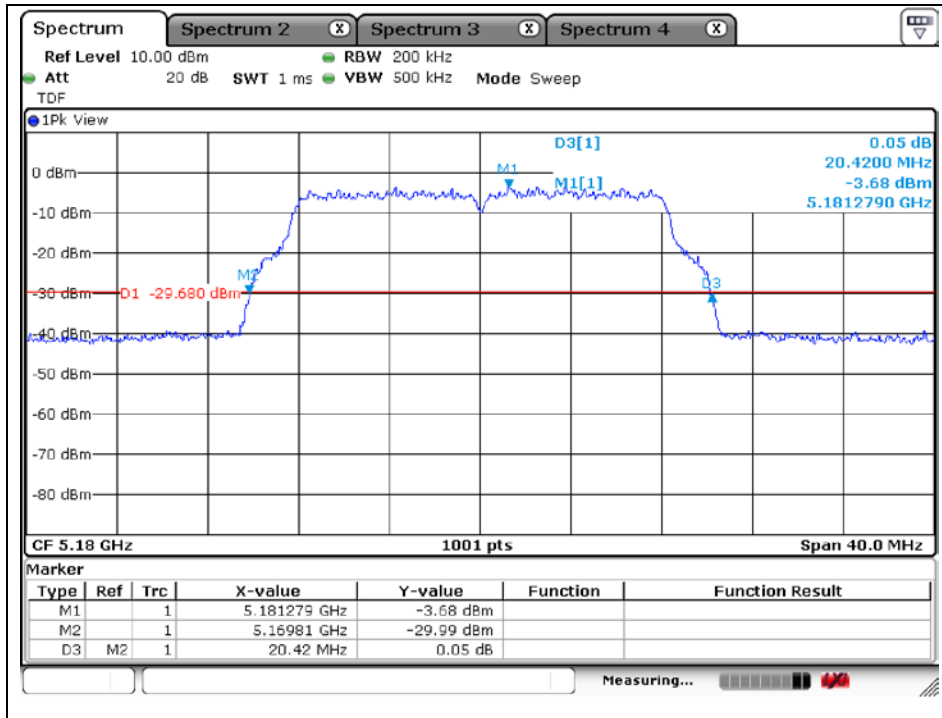
Band	Mode	Frequency (MHz)	Ch.	Data Rate	26 dB Bandwidth (MHz)
U-NII 2C (Band-crossing channel)	11a	5 720	144	6 Mbps	15.19
	11n_HT20	5 720	144	MCS0	15.23

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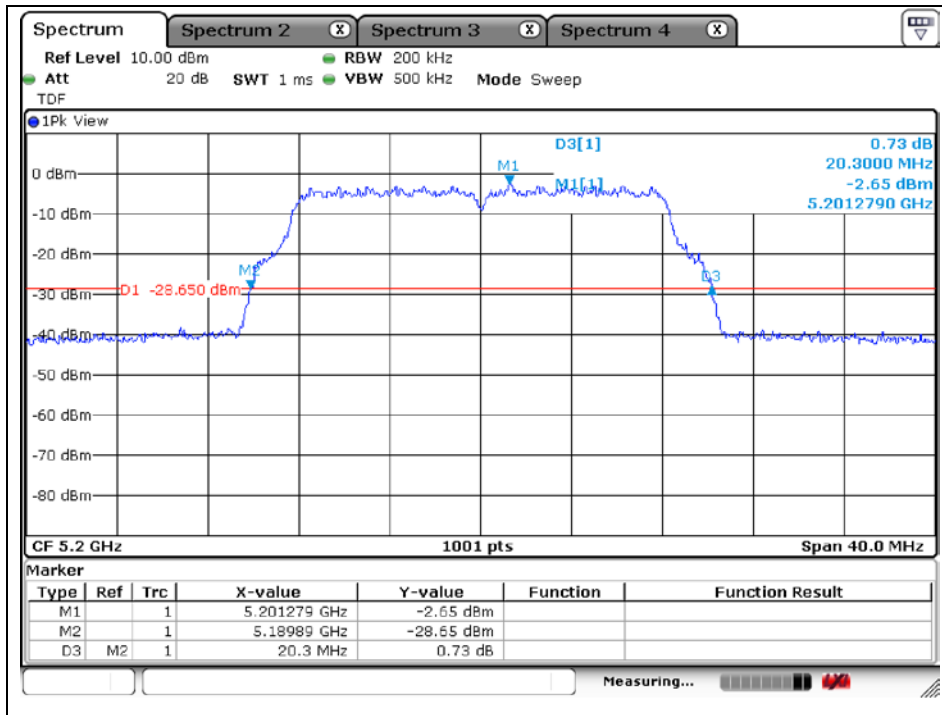
26 dB Bandwidth

802.11a (Band 1)

Low Channel (5 180 MHz)



Middle Channel (5 200 MHz)



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