RF TEST REPORT for UNII device
No. 150801405SHA-003

Applicant	:	Hansong(Nanjing) Technology Ltd 8th Kangping Road, Jiangning Economy&Technology Development Zone, Nanjing, 211106, China
Manufacturer	:	Hansong(Nanjing) Technology Ltd 8th Kangping Road, Jiangning Economy&Technology Development Zone, Nanjing, 211106, China
Product Name	:	Airplay Speaker
Type/Model	:	Crescendo X

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2014): Radio Frequency Devices

ANSI C63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices

Date of issue: Dec 18, 2015

Prepared by:

Wade Zhang (*Project Engineer*)

Reviewed by:

Daniel Zhao (*Reviewer*)

Description of Test Facility

Name:	Intertek Testing Services Limited Shanghai
Address:	Building No.86, 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
FCC Registration Number:	236597
IC Assigned Code:	2042B-1
Name of contact:	Jonny Jing
Tel:	+86 21 61278271
Fax:	+86 21 54262353

Content

SUMMARY 1
DESCRIPTION OF TEST FACILITY 2
1. GENERAL INFORMATION 4
1.1 Applicant Information 4
1.2 Identification of the EUT 4
1.3 Technical specification 5
2. TEST SPECIFICATION 6
2.1 Instrument list 6
2.2 Test Standard 6
2.3 Mode of operation during the test / Test peripherals used 7
2.4 Test Summary 9
3. MAXIMUM CONDUCTED OUTPUT POWER 10
3.1 Test limit 10
3.2 Test Configuration 11
3.3 Test procedure and test setup 11
3.4 Test protocol 12
4. POWER SPECTRAL DENSITY 14
4.1 Test limit 14
4.2 Test Configuration 14
4.3 Test procedure and test setup 15
4.4 Test Protocol 16
5. MINIMUM 6DB BANDWIDTH 53
5.1 Limit 53
5.2 Test Configuration 53
5.3 Test Procedure and test setup 53
5.4 Test Protocol 54
6. RADIATED EMISSION 63
6.1 Test limit 63
6.2 Test Configuration 64
6.3 Test procedure and test setup 65
6.4 Test protocol 66
7. POWER LINE CONDUCTED EMISSION 75
7.1 Limit 75
7.2 Test configuration 75
7.3 Test procedure and test set up 76
7.4 Test protocol 77
8. 26 DB BANDWIDTH & EMISSION BANDWIDTH (99%) 79
8.1 Test limit 79
8.2 Test Configuration 79
8.3 Test procedure and test setup 79
8.4 Test protocol 81

1. General Information

1.1 Applicant Information

Applicant	:	Hansong(Nanjing) Technology Ltd 8th Kangping Road, Jiangning Economy&Technology Development Zone, Nanjing, 211106, China
Name of contact	:	Anya Sun
Tel	:	0086-025-66604242
Fax	:	0086-025-66612098
Manufacturer	:	Hansong(Nanjing) Technology Ltd 8th Kangping Road, Jiangning Economy&Technology Development Zone, Nanjing, 211106, China

1.2 Identification of the EUT

Product Name	:	Airplay Speaker
Type/model	:	Crescendo X
FCC ID	:	XCO-CRESCENDOX
IC	:	7756A-CRESCENDOX

1.3 Technical specification

Operation Frequency Band	:	5150 ~ 5250MHz; 5250 ~ 5350MHz; 5470 ~ 5725MHz; 5725 ~ 5850MHz
Type of Modulation	:	OFDM(BPSK,QPSK,16QAM,64QAM)
EUT Modes of Modulation	:	802.11a; 802.11n HT20, 802.11n HT40
Channel Number	:	For 5150 ~ 5250MHz band: Channel 36 - 48 For 5250 ~ 5350MHz Band: Channel 52 - 64; For 5470 ~ 5725MHz Band: Channel 100 - 140; For 5725 ~ 5850MHz band: Channel 149 - 165 (No transmission among 5600-5650MHz)
Description of EUT	:	The EUT is an Airplay Speaker which supports WIFI and BT function, and it has only one model, and has two antennas.We tested it and listed the WIFI 5GHz result in this report.
Port identification	:	AC Input *1 RJ45*1 USB*1 AUX In*1 Sub Out*1
Antenna	:	FPC antenna with peak gain 4.2dBi (RC12WFI0237A1)
Rating	:	100-240V ~ 50/60Hz 70W
Declared Temperature range	:	0°C ~ 50°C
Category of EUT	:	Class B
EUT type	:	☒ Table top ☐ Floor standing
Sample received date	:	2015.09.28
Sample Identification No	:	*0150928-36-001*
Date of test	:	2015.09.28 ~ 2015.11.13

2. Test Specification

2.1 Instrument list

Selected	Instrument	EC no.	Model	Valid until date
☒	Semi anechoic chamber	EC 3048	-	2016-5-10
☒	EMI test receiver	EC 3045	ESIB26	2016-10-18
☒	Broadband antenna	EC 4206	CBL 6112D	2016-4-26
☒	Horn antenna	EC 3049	HF906	2016-4-26
☒	Pre-amplifier	EC 5262	pre-amp 18	2016-5-24
☒	Pre-amplifier	EC 4792-2	TPA0118-40	2016-4-9
☒	High Pass Filter	EC 4797-1	WHKX 1.0/15G-10SS	2016-1-7
☒	High Pass Filter	EC 4797-2	WHKX 2.8/18G-12SS	2016-1-7
☒	High Pass Filter	EC 4797-3	WHKX 7.0/1.8G-8SS	2016-1-7
☒	Band Reject Filter	EC 4797-4	WRCGV2400/2483/10SS	2016-1-7
☒	Fully anechoic chamber	EC 3047	-	2016-5-10
☒	PXA Signal Analyzer	EC5338	N9030A	2016-11-16
☒	Test Receiver	EC 4501	ESCI 7	2016-1-13
☒	Power sensor/Power meter	EC4318	N1911A/N1921A	2016-4-19
☒	Power sensor	EC5338-1	U2021XA	2016-10-1
☒	MXG Analog Signal Generator	EC5338-2	N5181A	2016-11-5
☒	MXG Vector Signal Generator	EC5338-1	N51812B	2015-12-29

2.2 Test Standard

47CFR Part 15 (2014): Radio Frequency Devices

ANSI C63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices

RSS-247 Issue 1 (May 2015): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 4 (December 2014): General Requirements for Compliance of Radio Apparatus

KDB 789033 D02 General UNII Test Procedures New Rules v01

2.3 Mode of operation during the test / Test peripherals used

While testing transmitting mode of EUT, the engineering mode was applied and continuously transmission was applied.

The test setting software and command is offered by the manufactory.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, the pre-scan for all data rates in each modulation and bands was tested, and the worst case was found and used in all test cases.

The lowest, middle and highest channel were tested as representatives.

Freq. Band	Modulation	Lowest(MHz)	Middle(MHz)	Highest(MHz)
5150~5250MHz	802.11a	5180	5200	5240
	802.11n HT20	5180	5200	5240
	802.11n HT40	5190	/	5230
5250~5350MHz	802.11a	5260	5300	5320
	802.11n HT20	5260	5300	5320
	802.11n HT40	5270	/	5310
5470~5725 MHz	802.11a	5500	5580	5700
	802.11n HT20	5500	5580	5700
	802.11n HT40	5510	5550	5670
5725~5850MHz	802.11a	5745	5785	5825
	802.11n HT20	5745	5785	5825
	802.11n HT40	5755	/	5795

Test peripherals used:

Item No	Description	Band and Model	S/No
1	Laptop computer	HP ProBook 6470b	NA
2	RS-232 cable	1.8m Unshieling	NA
Note: The accessories are used for configuration only and not used during test.			

Data rate VS Power

The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

After this pre-scan, we choose the following table of the data rata as the worst case.

Freq. Band	Modulation	Worst case data rate
5150~5250MHz 5250~5350MHz; 5470~5725MHz; 5725~5850MHz	802.11a	6Mbps
	802.11n HT20	MCS0
	802.11n HT40	MCS0

Duty cycle:

Duty cycle	Duty cycle(x)	Duty cycle factor（dB）
802.11a	1.00	0.00
802.11n20	1.00	0.00
802.11n40	1.00	0.00

2.4 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	RESULT
Maximum Conducted Output Power	15.407(a)	Pass
Power spectral density	15.407(a)	Pass
Minimum 6dB Bandwidth	15.407(e)	Pass
Radiated emission	15.407 (b) 15.205, 15.209	Pass
Power line conducted emission	15.207	Pass
26 dB Bandwidth & Emission Bandwidth (99%)	15.403(i)	Tested

3. Maximum Conducted Output Power

Test result: Pass

3.1 Test limit

☐ For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

☐ For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

☐ For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

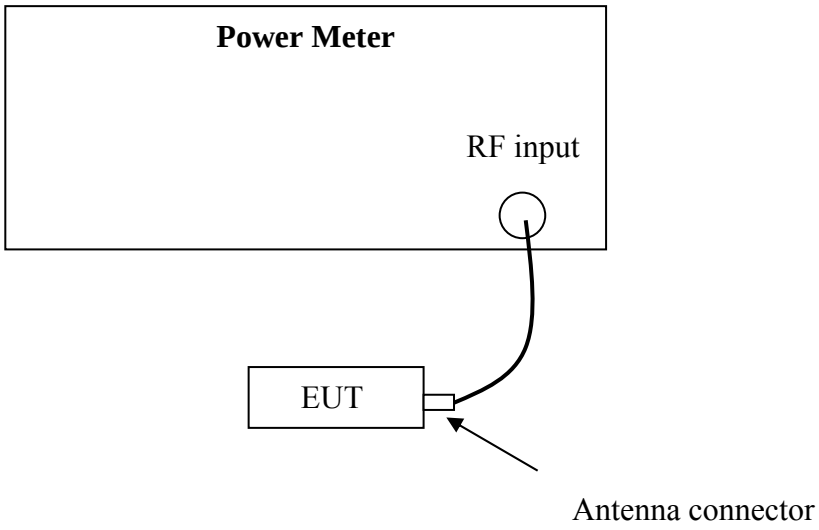
☒ For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

☒ For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

☒ For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

3.2 Test Configuration



3.3 Test procedure and test setup

The power output per FCC §15.407(a) was measured from the antenna port of the EUT according to the measurement method refer to KDB 789033D02 v01: Method PM.

3.4 Test protocol

Temperature : 25 °C

Relative Humidity : 55 %

U-NII-1 Band Conducted Power:

Mode	Frequency (MHz)	Reading (dBm)		Total Power (mw)	Total Power (dBm)	Limit (dBm)	Margin (dB)
		Port 0	Port 1				
802.11a	5180	9.50	9.38	17.58	12.45	24.00	11.55
	5200	9.56	9.55	18.05	12.57	24.00	11.43
	5240	9.63	9.36	17.81	12.51	24.00	11.49
802.11n20	5180	10.11	10.32	21.02	13.23	24.00	10.77
	5200	10.23	10.12	20.82	13.19	24.00	10.81
	5240	10.18	10.25	21.02	13.23	24.00	10.77
802.11n40	5190	9.31	9.38	17.20	12.36	24.00	11.64
	5230	9.35	9.34	17.20	12.36	24.00	11.64

U-NII-2A Band Conducted Power:

Power limit calculation:

Frequency range (MHz)	Mode	26dB bandwidth (MHz)	11+10log B (dBm)	Power Limit (dBm)
5250 - 5350	802.11a	19.93	24.00	24.00
	802.11n20	20.46	24.11	24.00
	802.11n40	41.61	27.19	24.00

Mode	Frequency (MHz)	Reading (dBm)		Total Power (mw)	Total Power (dBm)	Limit (dBm)	Margin (dB)
		Port 0	Port 1				
802.11a	5260	9.43	9.39	17.46	12.42	24.00	11.57
	5300	9.49	9.55	17.91	12.53	24.00	11.47
	5320	9.77	9.68	18.77	12.74	24.00	11.26
802.11n20	5260	10.45	10.53	22.39	13.50	24.00	10.50
	5300	10.25	10.37	21.48	13.32	24.00	10.68
	5320	10.58	10.26	22.05	13.43	24.00	10.57
802.11n40	5270	9.59	9.68	18.39	12.65	24.00	11.35
	5310	9.66	9.74	18.67	12.71	24.00	11.29

U-NII-2C Band Conducted Power:

Power limit calculation:

Frequency range (MHz)	Mode	26dB bandwidth (MHz)	11+10log B (dBm)	Power Limit (dBm)
5470 - 5725	802.11a	19.97	24.00	24.00
	802.11n20	20.37	24.09	24.00
	802.11n40	41.67	27.20	24.00

Mode	Frequency (MHz)	Reading (dBm)		Total Power (mw)	Total Power (dBm)	Limit (dBm)	Margin (dB)
		Port 0	Port 1				
802.11a	5500	10.52	9.35	19.88	12.98	24.00	11.02
	5580	10.21	8.93	18.31	12.63	24.00	11.37
	5700	9.43	8.45	15.77	11.98	24.00	12.02
802.11n20	5500	10.56	9.59	20.48	13.11	24.00	10.89
	5580	10.28	9.32	19.22	12.84	24.00	11.16
	5700	9.47	8.28	15.58	11.93	24.00	12.07
802.11n40	5510	10.78	9.75	21.41	13.31	24.00	10.69
	5550	10.29	9.36	19.32	12.86	24.00	11.14
	5670	9.48	8.68	16.25	12.11	24.00	11.89

U-NII-3 Band Conducted Power:

Mode	Frequency (MHz)	Reading (dBm)		Total Power (mw)	Total Power (dBm)	Limit (dBm)	Margin (dB)
		Port 0	Port 1				
802.11a	5745	9.66	9.76	18.71	12.72	30.00	17.28
	5785	9.59	9.42	17.85	12.52	30.00	17.48
	5825	9.73	9.55	18.41	12.65	30.00	17.35
802.11n20	5745	10.23	10.34	21.36	13.30	30.00	16.70
	5785	10.54	10.89	23.60	13.73	30.00	16.27
	5825	10.49	10.34	22.01	13.43	30.00	16.57
802.11n40	5755	9.55	9.64	18.22	12.61	30.00	17.39
	5795	9.34	9.39	17.28	12.38	30.00	17.62

4. Power spectral density

Test result: **Pass**

4.1 Test limit

☐ For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

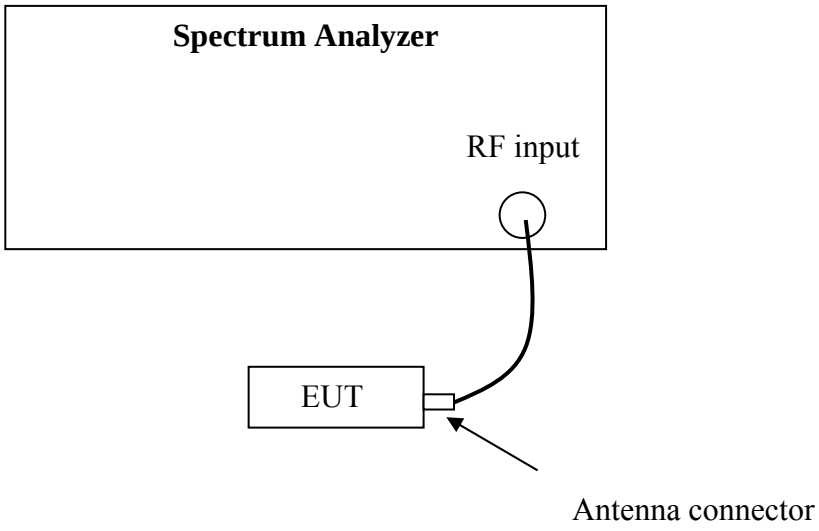
☐ For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

☒ For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

☒ For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

☒ For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

4.2 Test Configuration



4.3 Test procedure and test setup

The power spectral density per FCC §15.407(a) was measured from the antenna port of the EUT according to the measurement method refer to KDB 789033D02 v01: section F.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3. Make the following adjustments to the peak value of the spectrum, if applicable: a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4. The result is the Maximum PSD over 1 MHz reference bandwidth.

5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (*i.e.,* 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply: a) Set RBW ≥ 1/*T*, where *T* is defined in section II.B.l.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

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

4.4 Test Protocol

Temperature : 25 °C

Relative Humidity : 55 %

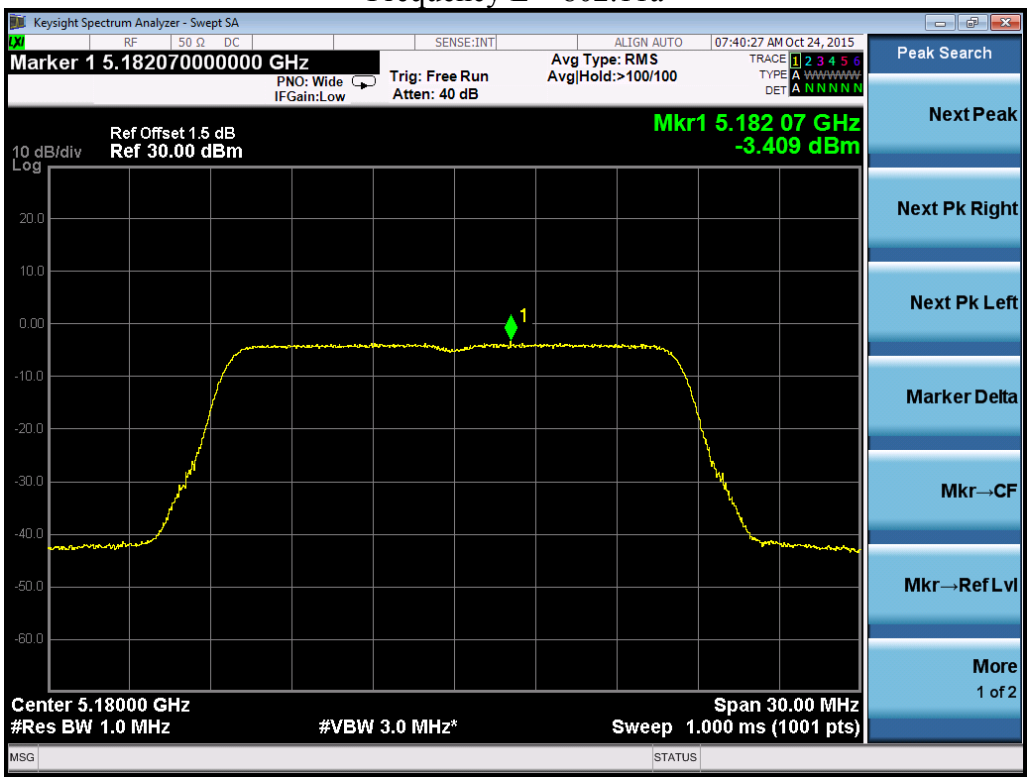
U-NII-1 Band:

Mode	Frequency (MHz)	Reading (dBm/MHz)		Total PSD (mw/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
		Port0	Port 1				
802.11a	5180	-3.409	-3.733	0.88	-0.56	11.00	11.56
	5200	-3.722	-3.736	0.85	-0.72	11.00	11.72
	5240	-3.232	-3.581	0.91	-0.39	11.00	11.39
802.11n20	5180	-4.207	-4.201	0.76	-1.19	11.00	12.19
	5200	-4.043	-4.167	0.78	-1.09	11.00	12.09
	5240	-3.698	-3.963	0.83	-0.82	11.00	11.82
802.11n40	5190	-6.571	-6.357	0.45	-3.45	11.00	14.45
	5230	-6.612	-6.831	0.43	-3.71	11.00	14.71

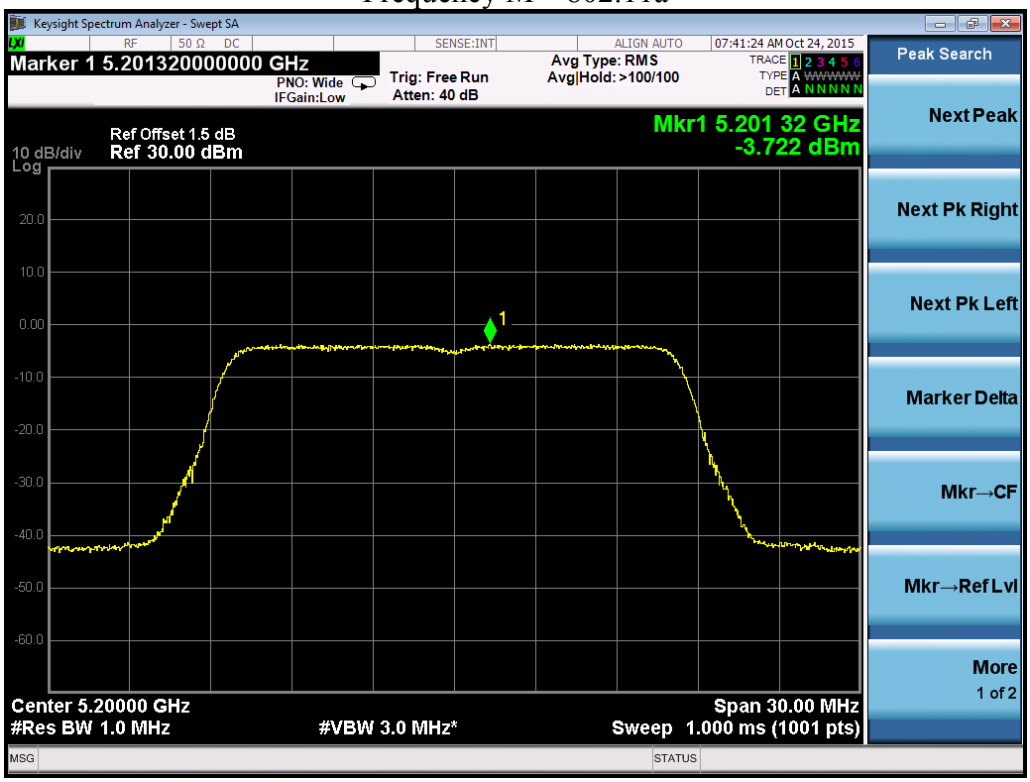
Test Plots as bellow:

Port 1

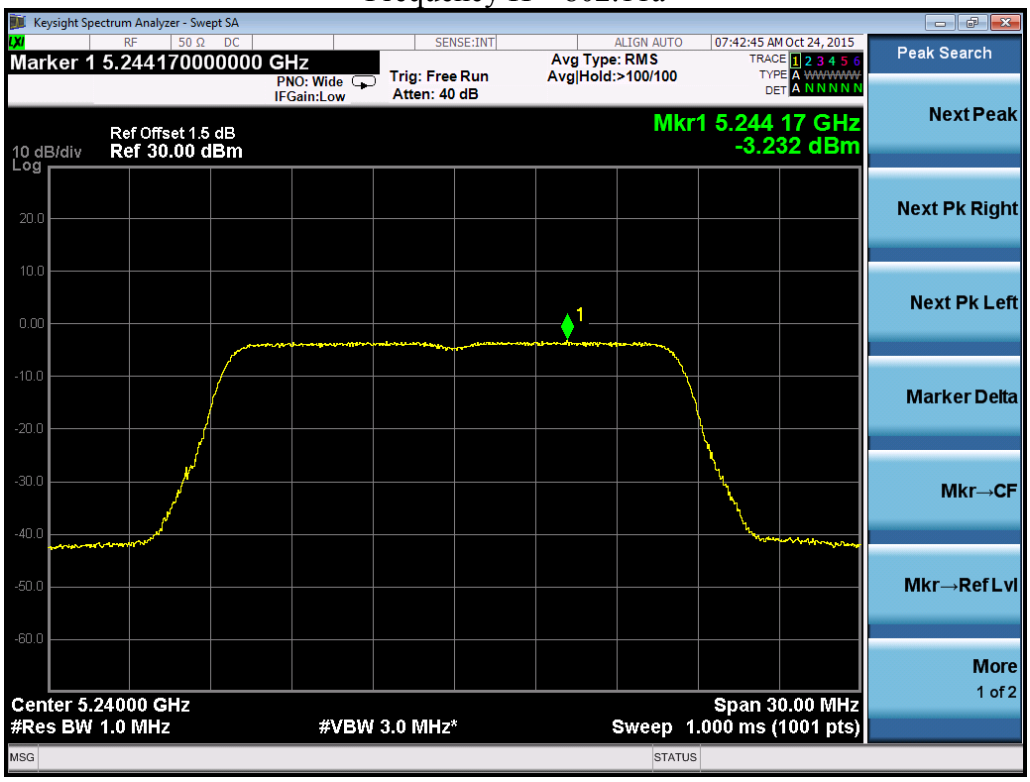
Frequency L – 802.11a



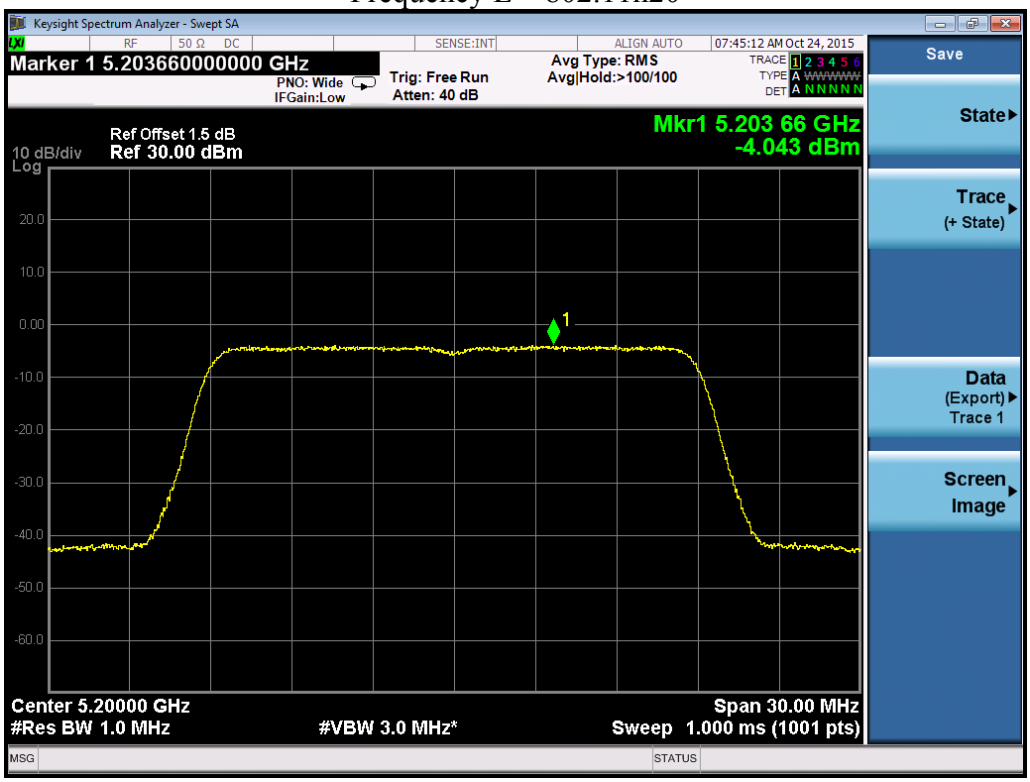
Frequency M – 802.11a



Frequency H – 802.11a



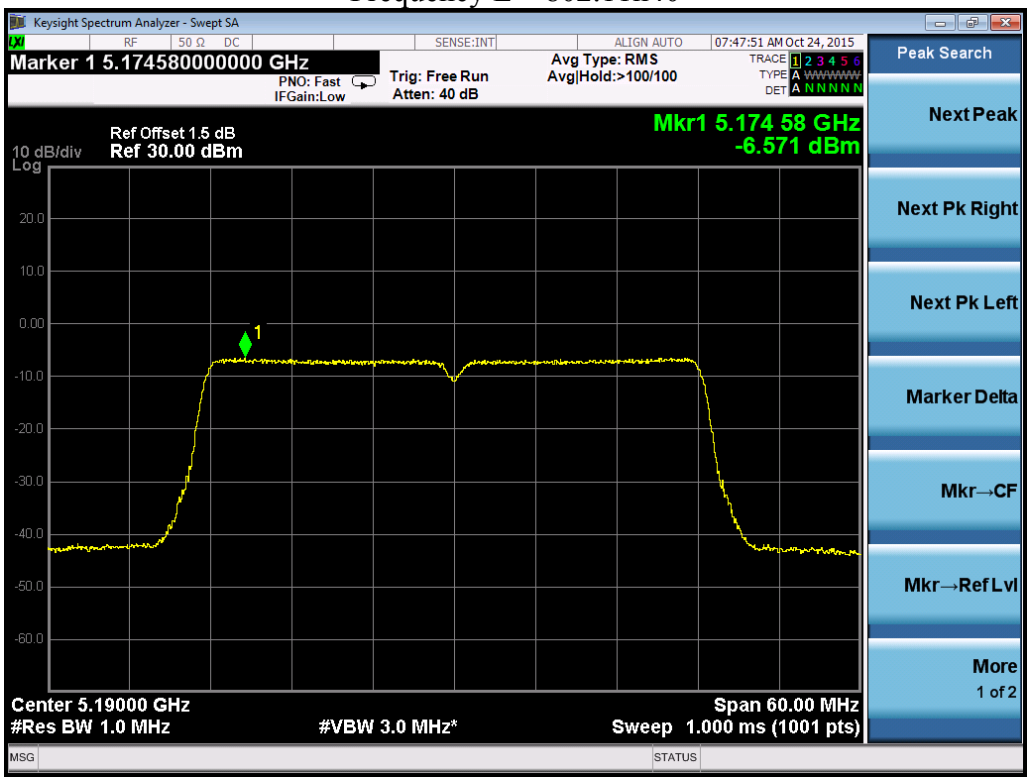
Frequency L – 802.11n20



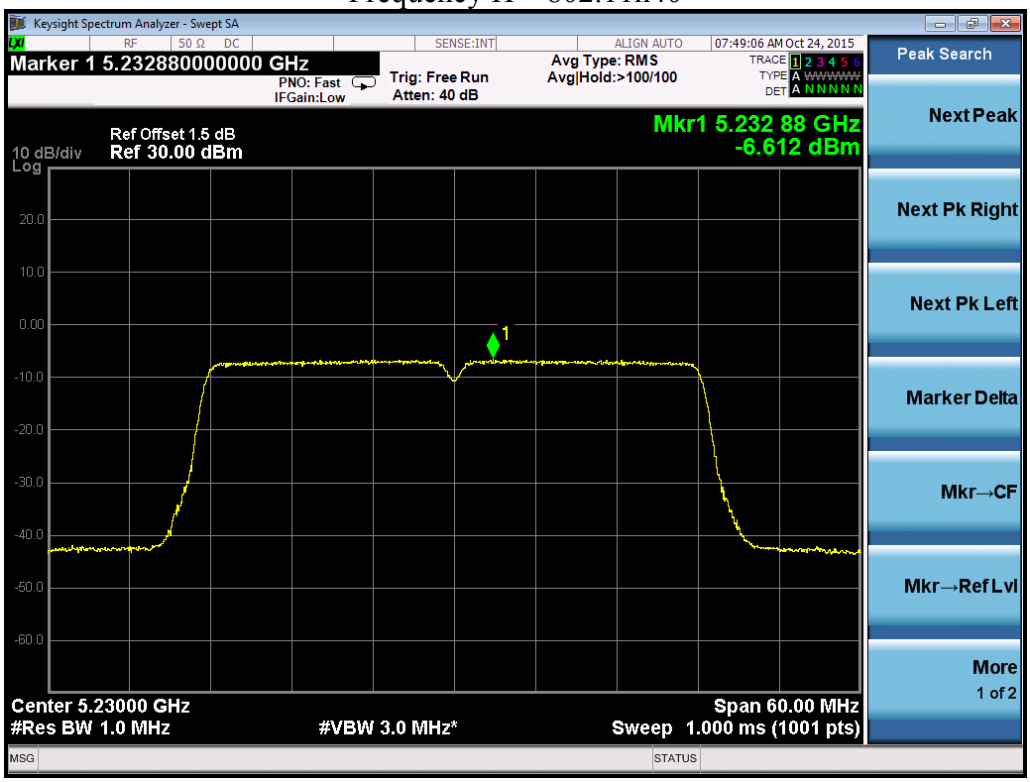
Frequency M – 802.11n20

Frequency H – 802.11n20

Frequency L – 802.11n40

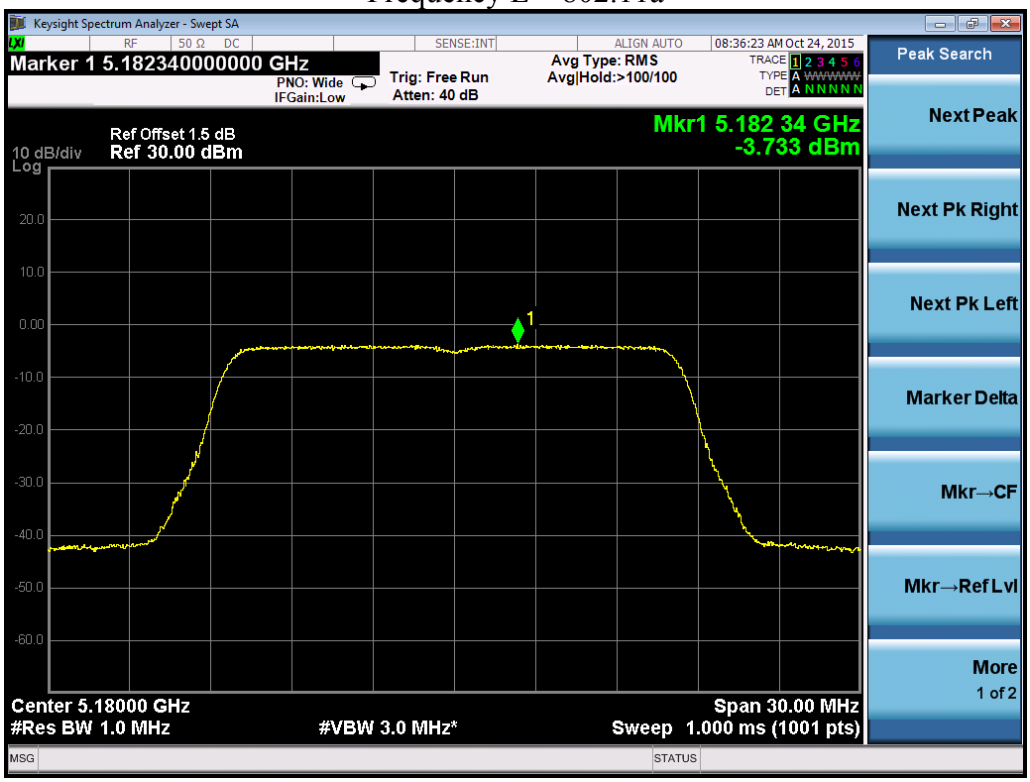


Frequency H – 802.11n40

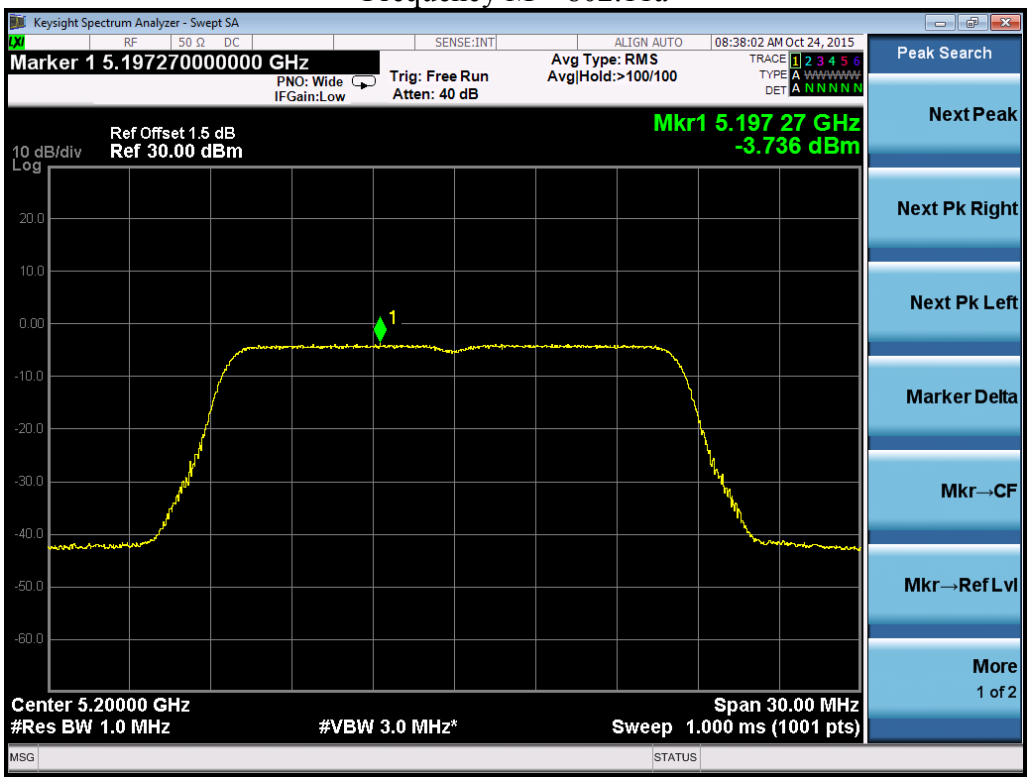


Port 2

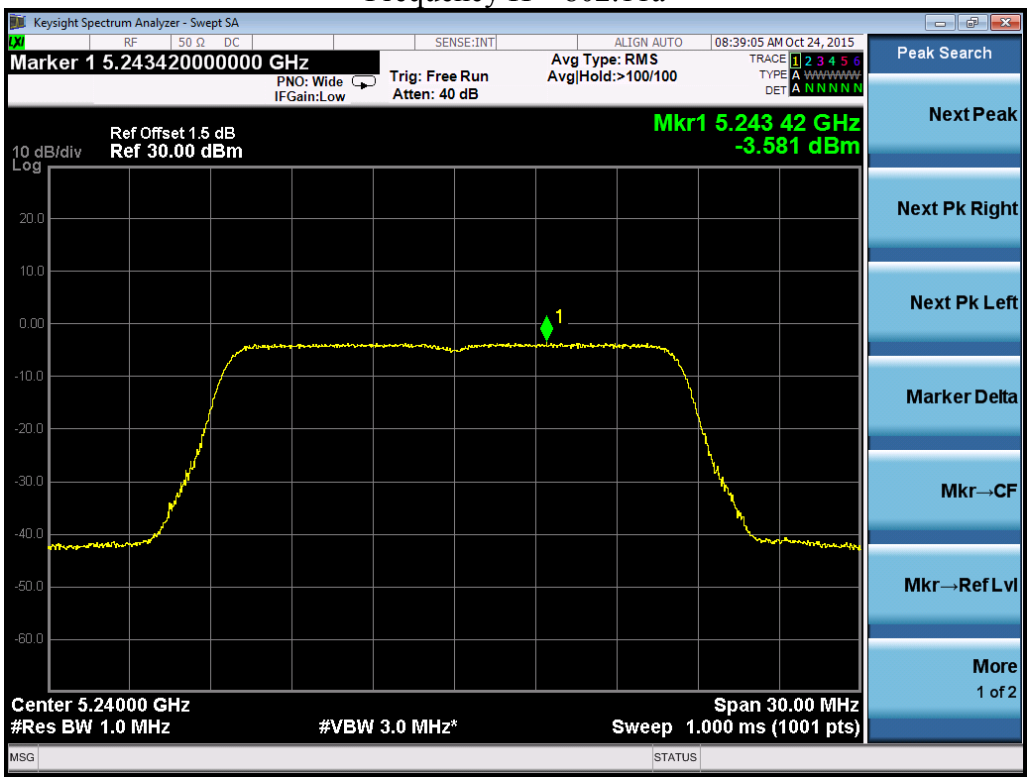
Frequency L – 802.11a



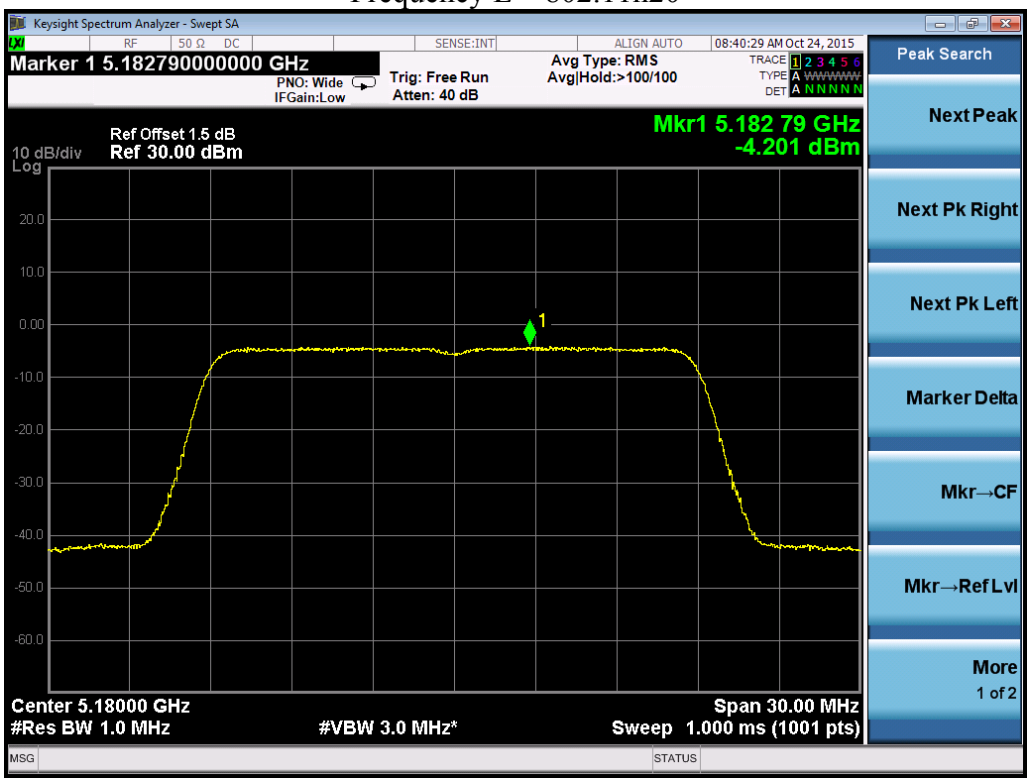
Frequency M – 802.11a



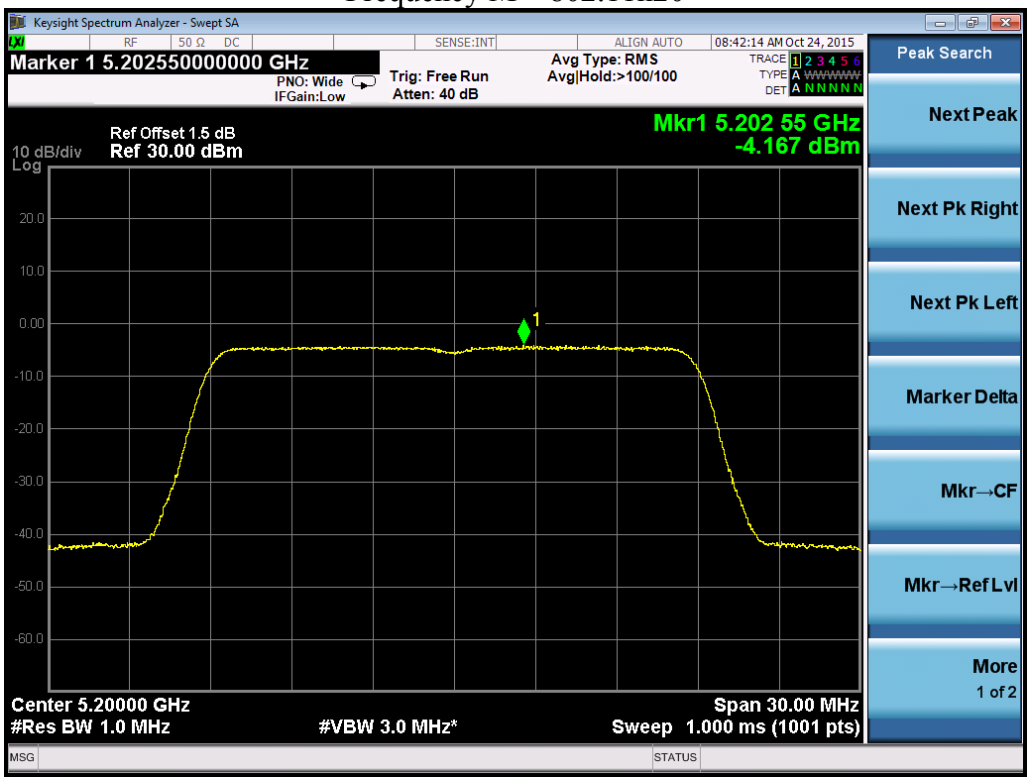
Frequency H – 802.11a



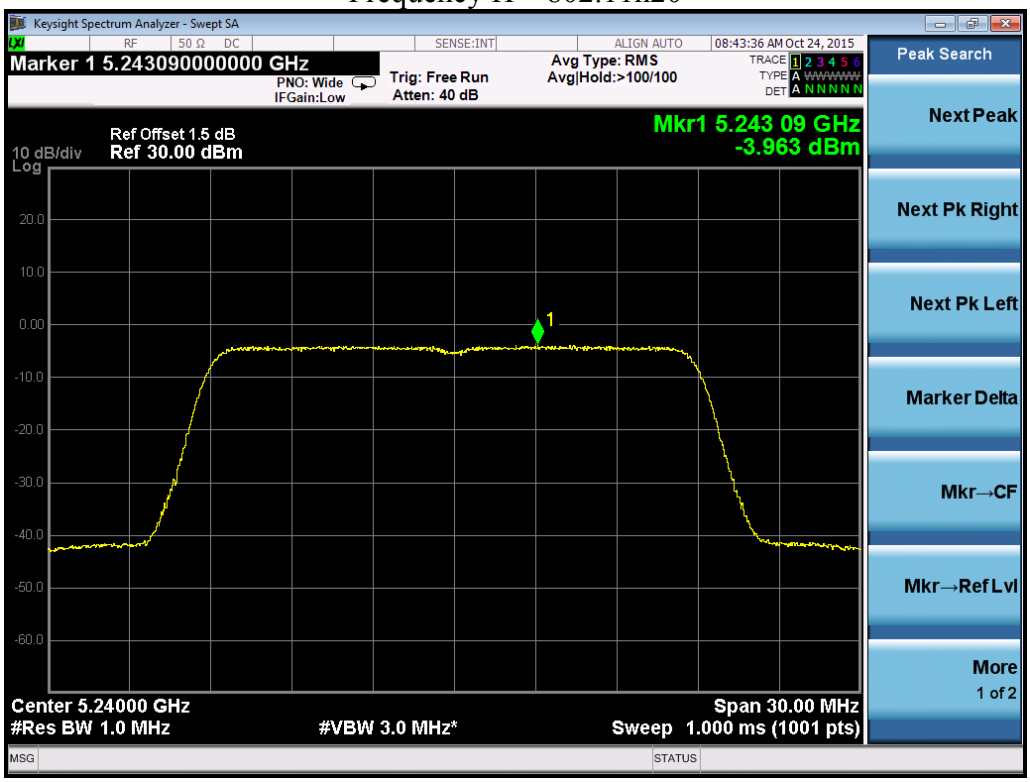
Frequency L – 802.11n20



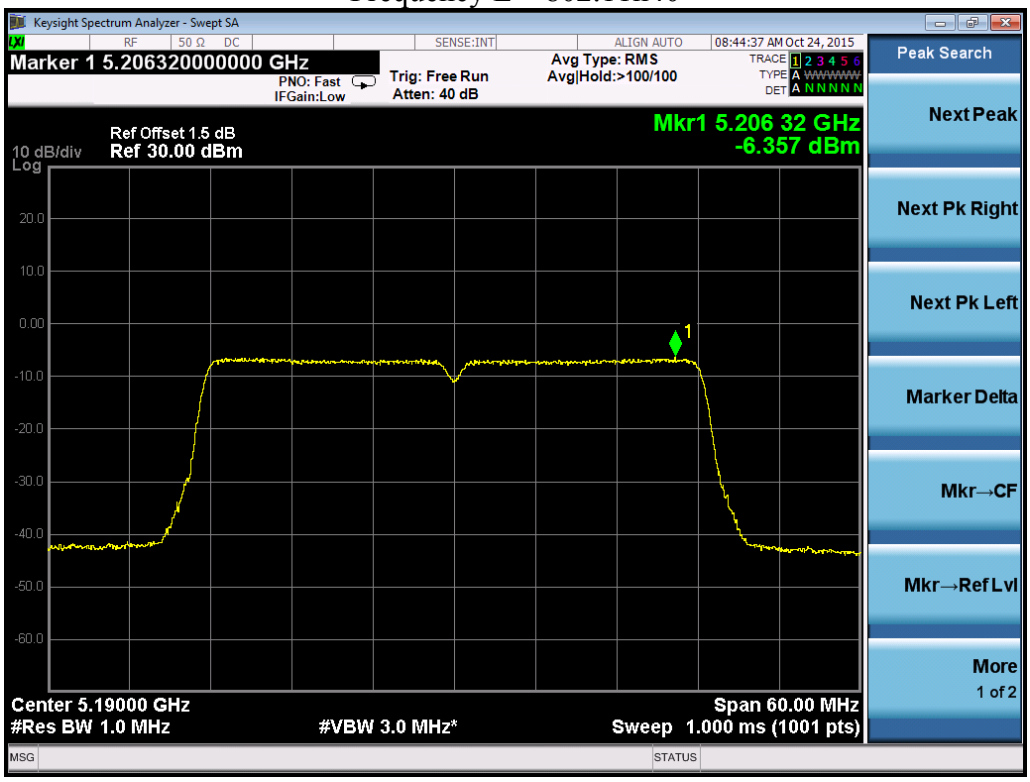
Frequency M – 802.11n20



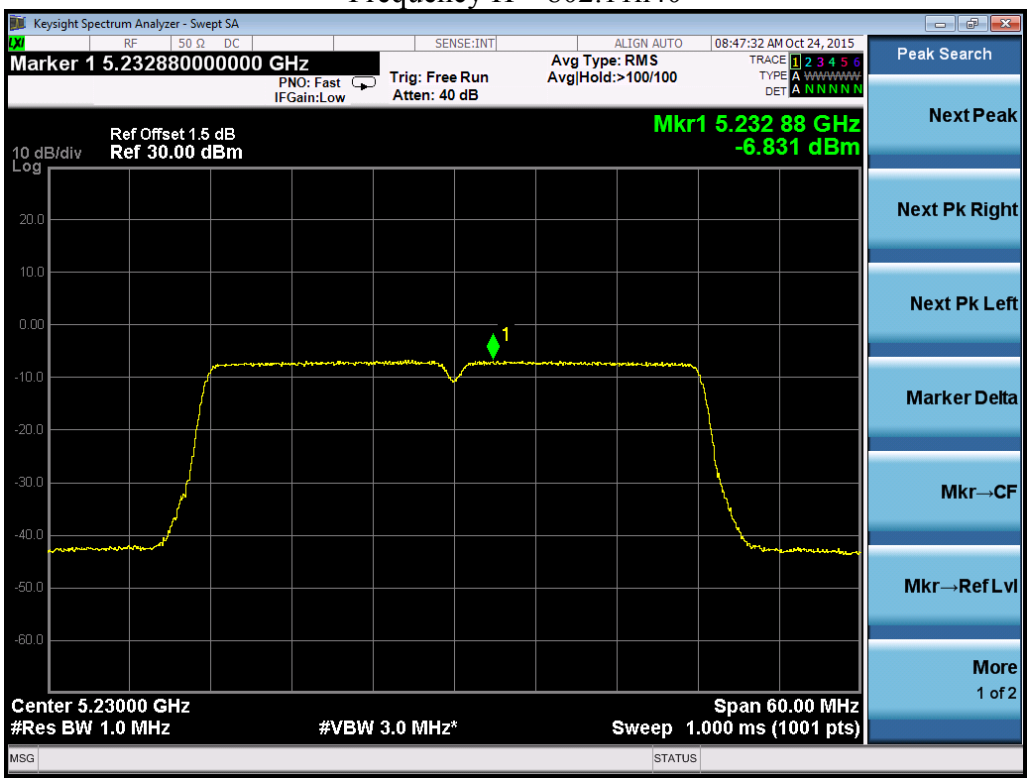
Frequency H – 802.11n20



Frequency L – 802.11n40



Frequency H – 802.11n40



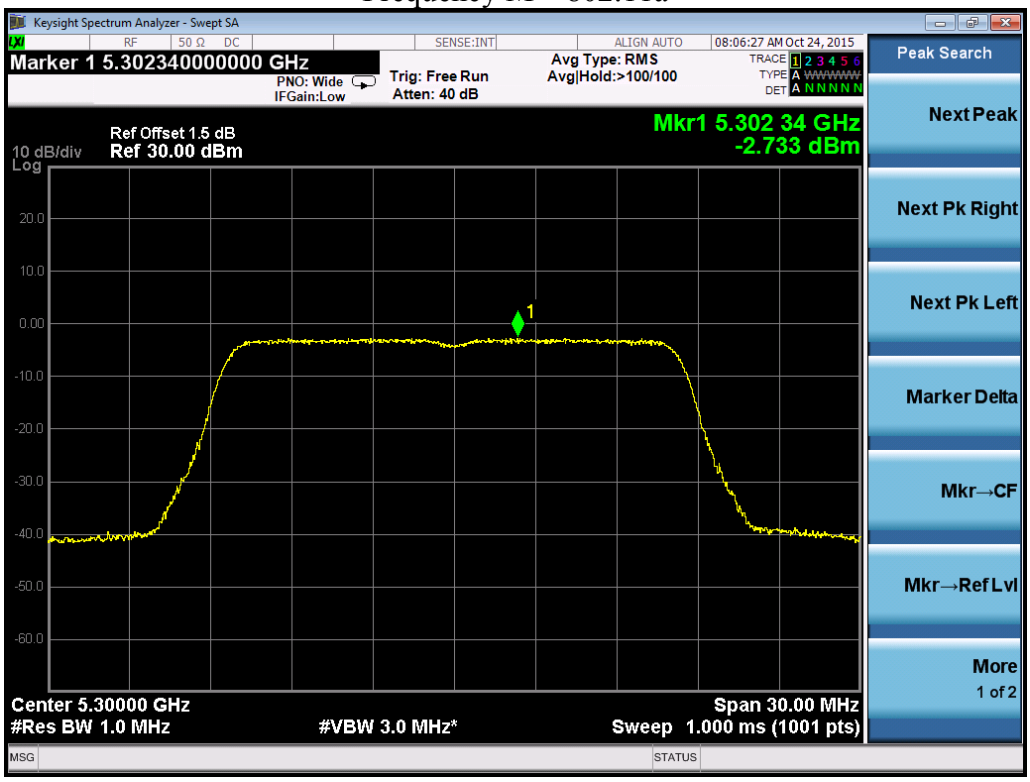
U-NII-2A Band:

Mode	Frequency (MHz)	Reading (dBm/MHz)		Total PSD (mw/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
		Port0	Port 1				
802.11a	5260	-3.447	-3.581	0.89	-0.50	11.00	11.50
	5300	-2.733	-2.823	1.06	0.23	11.00	10.77
	5320	-2.566	-2.978	1.06	0.24	11.00	10.76
802.11n20	5260	-3.676	-3.821	0.84	-0.74	11.00	11.74
	5300	-3.033	-3.241	0.97	-0.13	11.00	11.13
	5320	-2.766	-3.111	1.02	0.08	11.00	10.92
802.11n40	5270	-6.333	-6.472	0.46	-3.39	11.00	14.39
	5310	-6.115	-6.244	0.48	-3.17	11.00	14.17

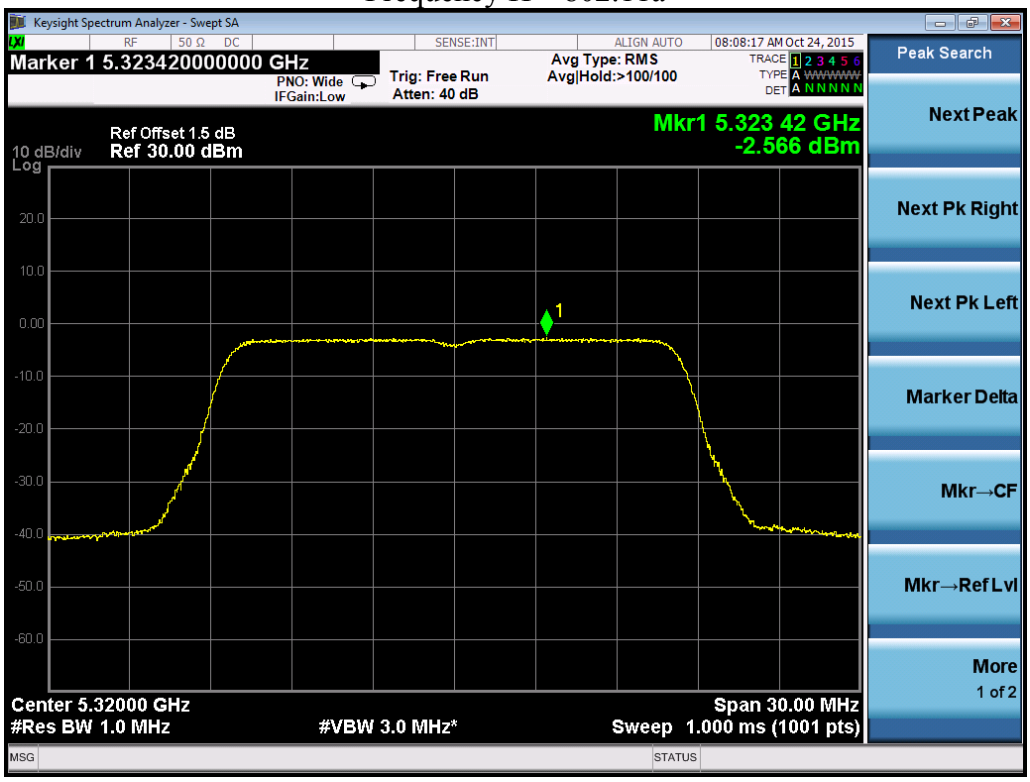
Test Plots as bellow:

Port 1
Frequency L – 802.11a

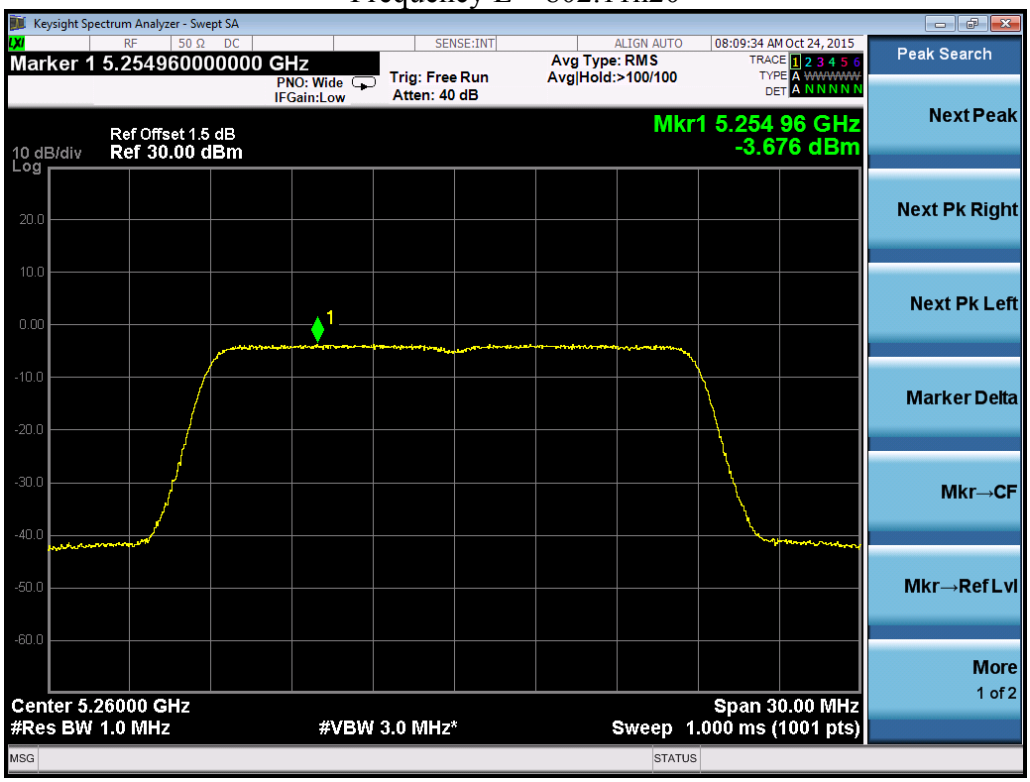
Frequency M – 802.11a



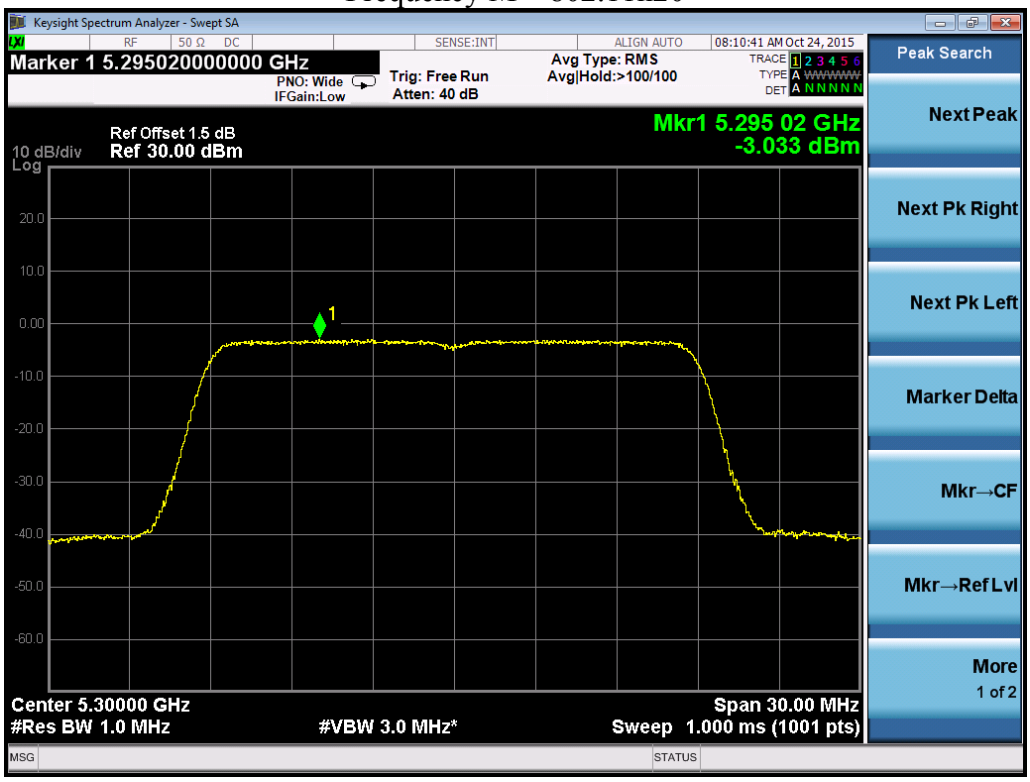
Frequency H – 802.11a



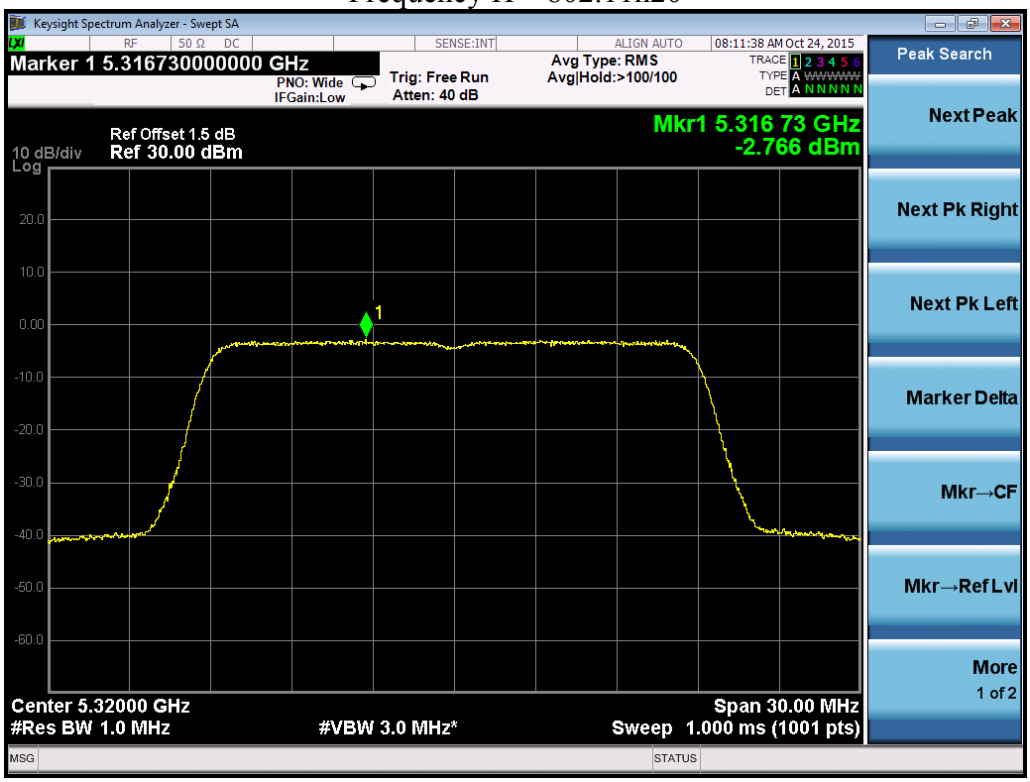
Frequency L – 802.11n20



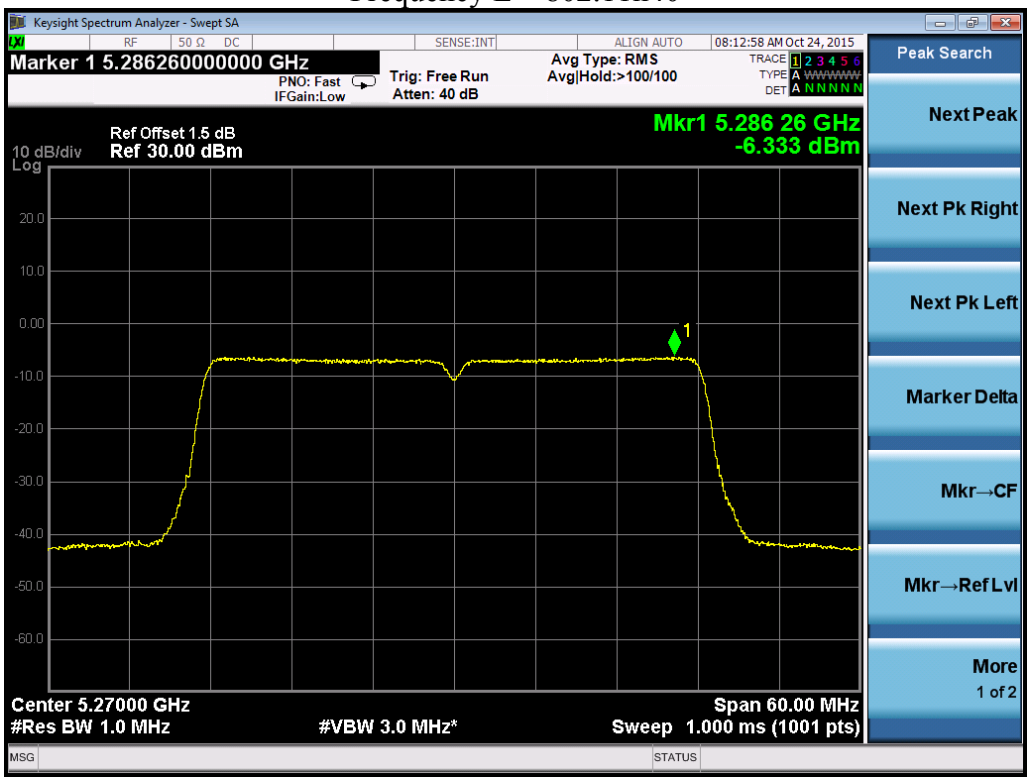
Frequency M – 802.11n20



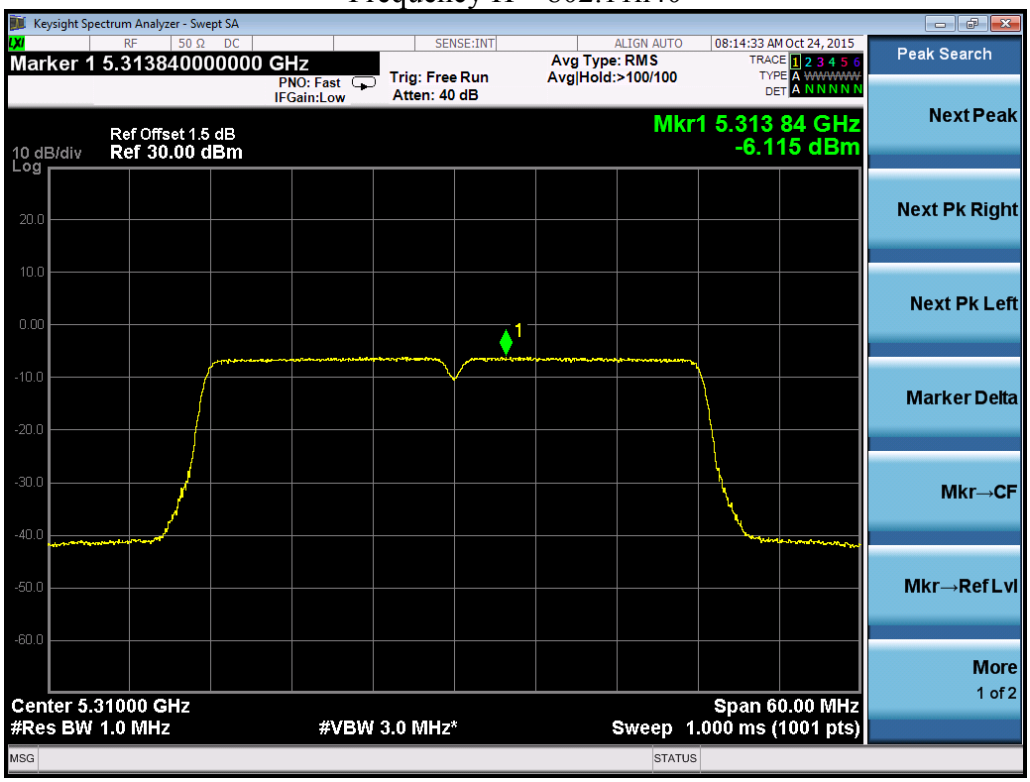
Frequency H – 802.11n20



Frequency L – 802.11n40

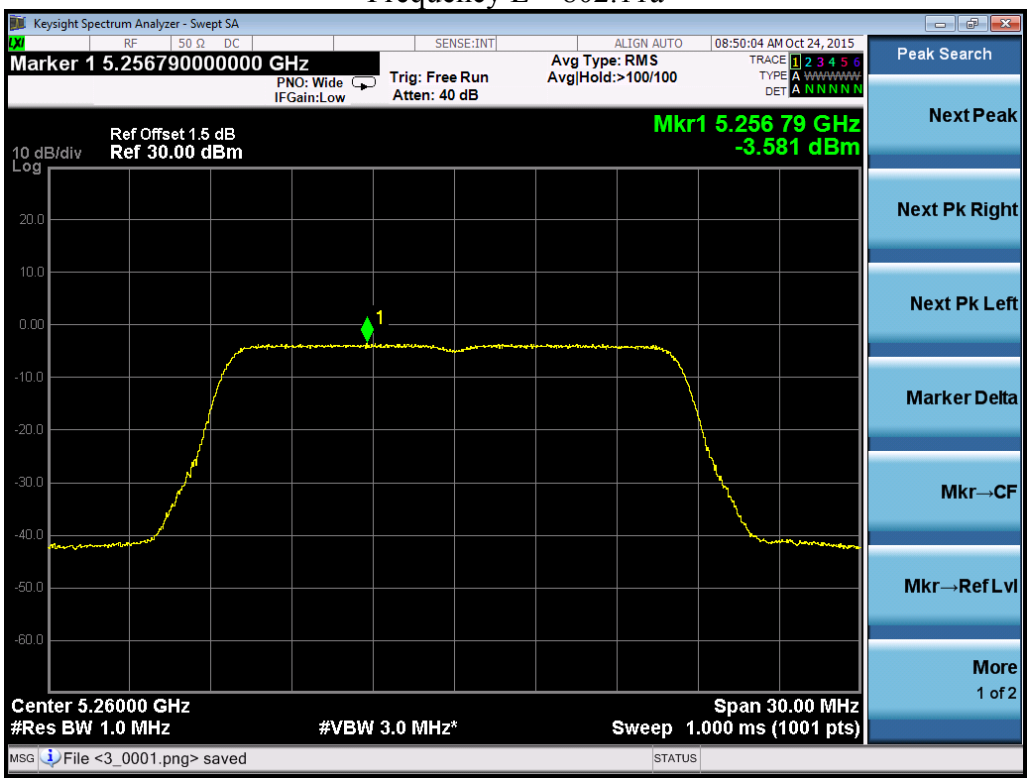


Frequency H – 802.11n40

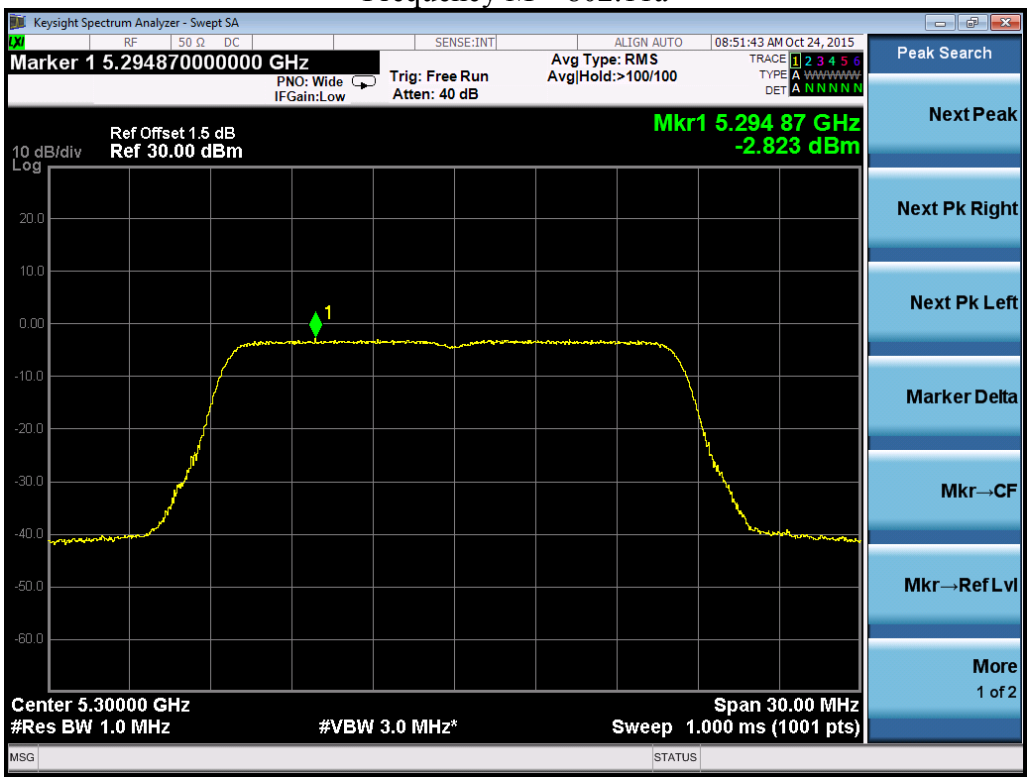


Port 2

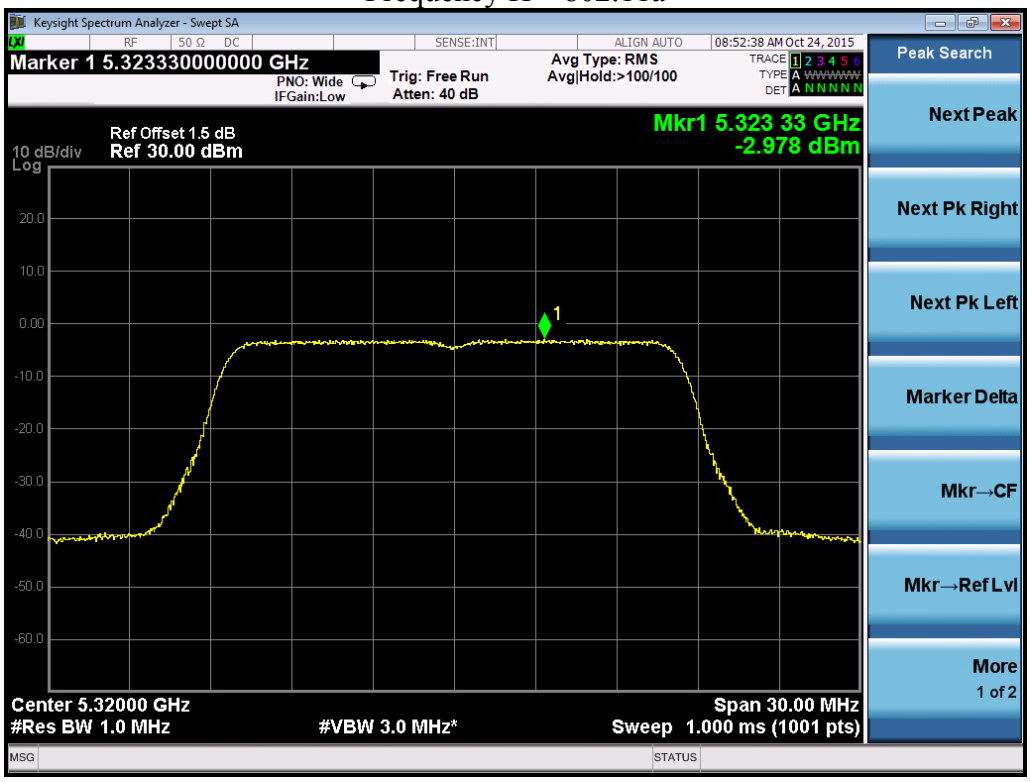
Frequency L – 802.11a



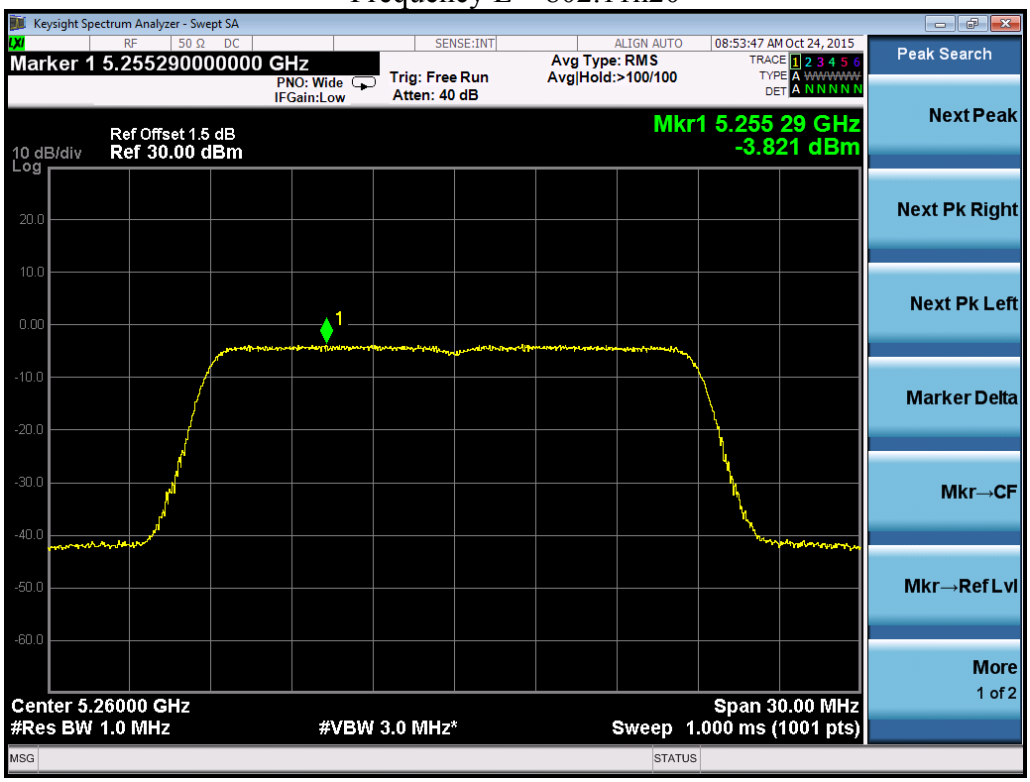
Frequency M – 802.11a



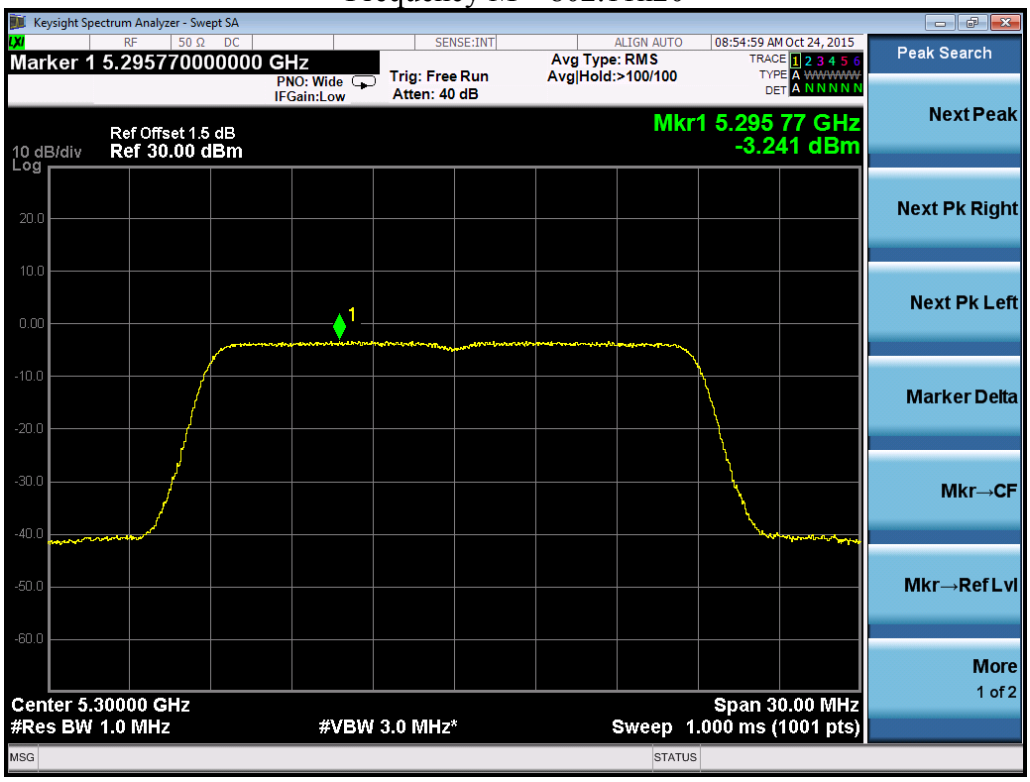
Frequency H – 802.11a



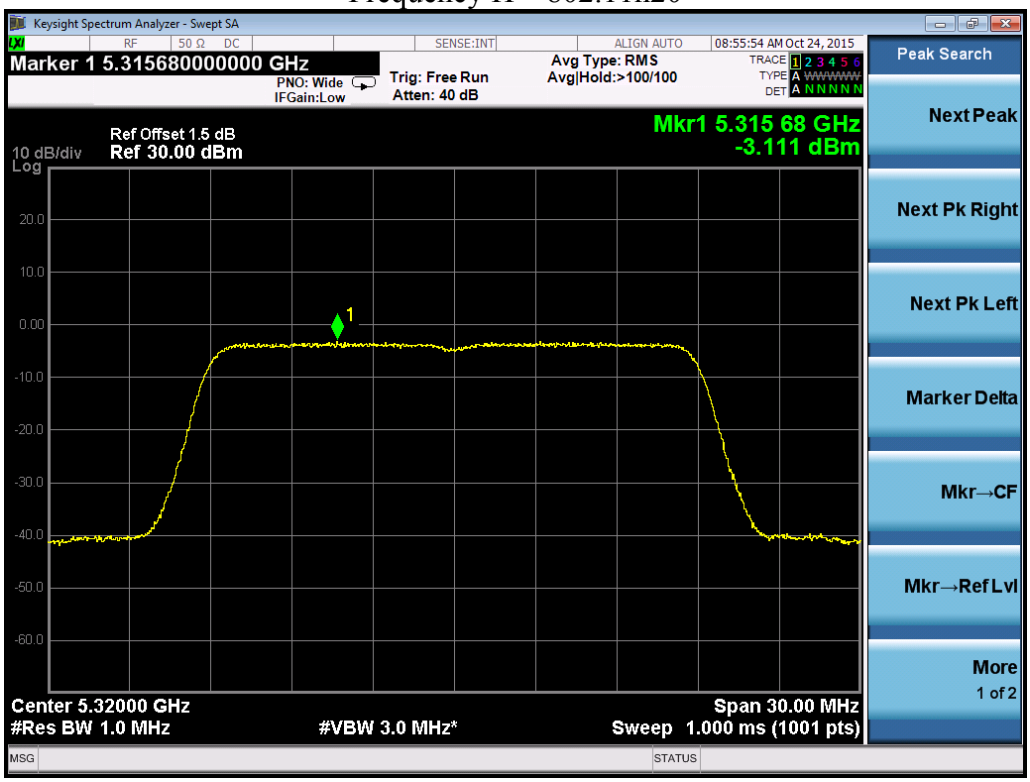
Frequency L – 802.11n20



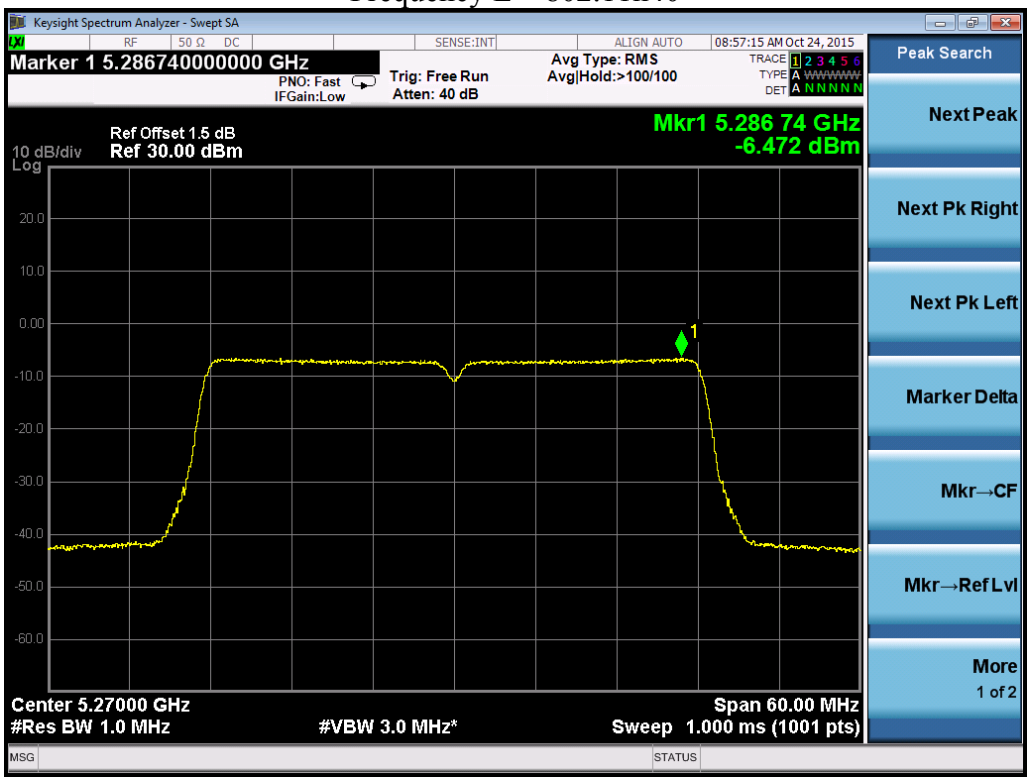
Frequency M – 802.11n20



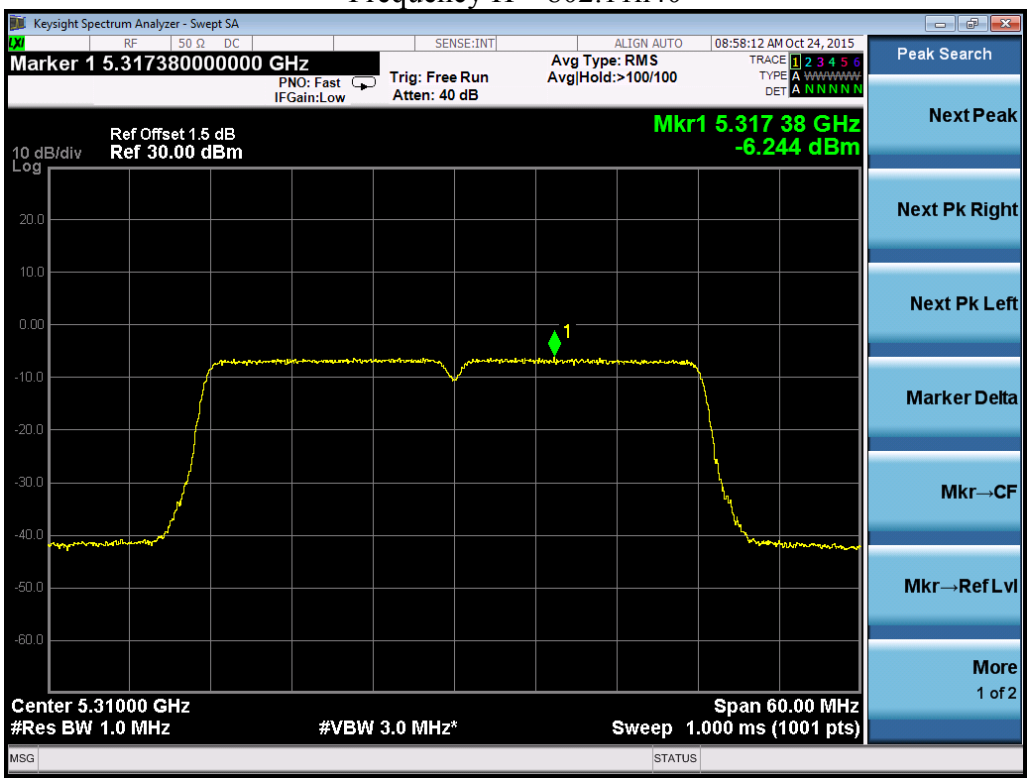
Frequency H – 802.11n20



Frequency L – 802.11n40



Frequency H – 802.11n40

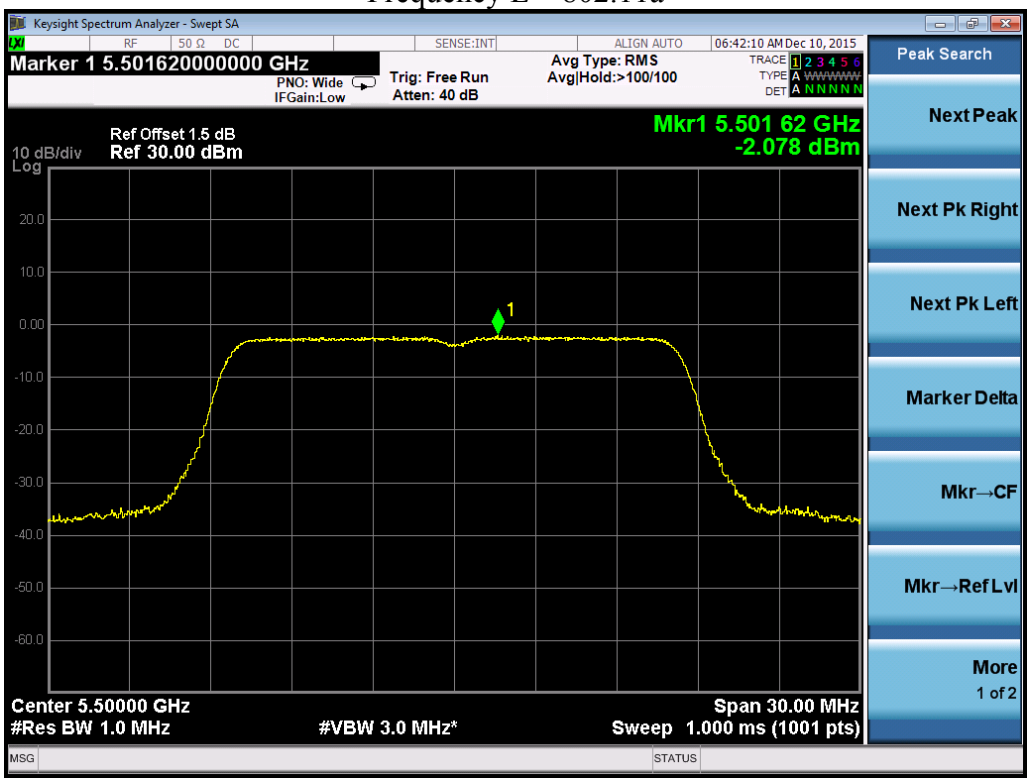


U-NII-2C Band:

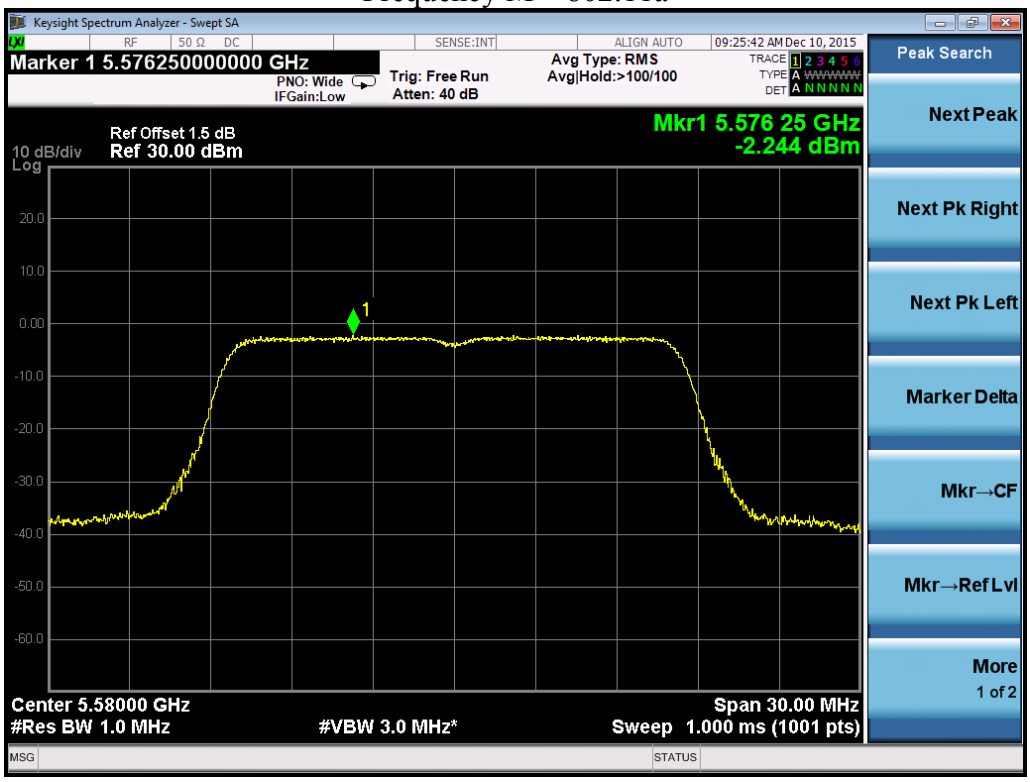
Mode	Frequency (MHz)	Reading (dBm/MHz)		Total PSD (mw/MHz)	Total PSD (dBm/MHz)	FCC limits (dBm/MHz)	Margin (dB)
		Port 0	Port 1				
802.11a	5500	-2.078	-2.438	1.19	0.76	11.00	10.24
	5580	-2.244	-5.099	0.91	-0.43	11.00	11.43
	5700	-5.972	-3.986	0.65	-1.86	11.00	12.86
802.11n20	5500	-3.574	-2.653	0.98	-0.08	11.00	11.08
	5580	-2.759	-2.537	1.09	0.36	11.00	10.64
	5700	-5.794	-4.295	0.64	-1.97	11.00	12.97
802.11n40	5510	-6.407	-5.371	0.52	-2.85	11.00	13.85
	5550	-4.643	-3.023	0.84	-0.75	11.00	11.75
	5670	-8.621	-6.969	0.34	-4.71	11.00	15.71

Test Plots as bellow:

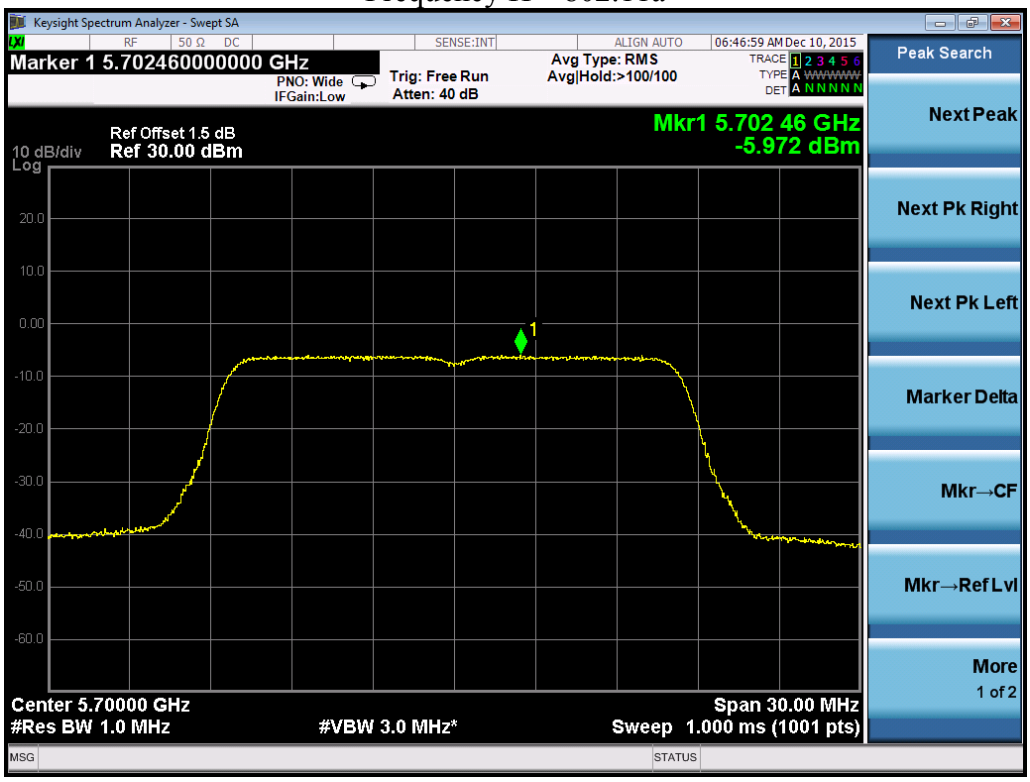
Port 1
Frequency L – 802.11a



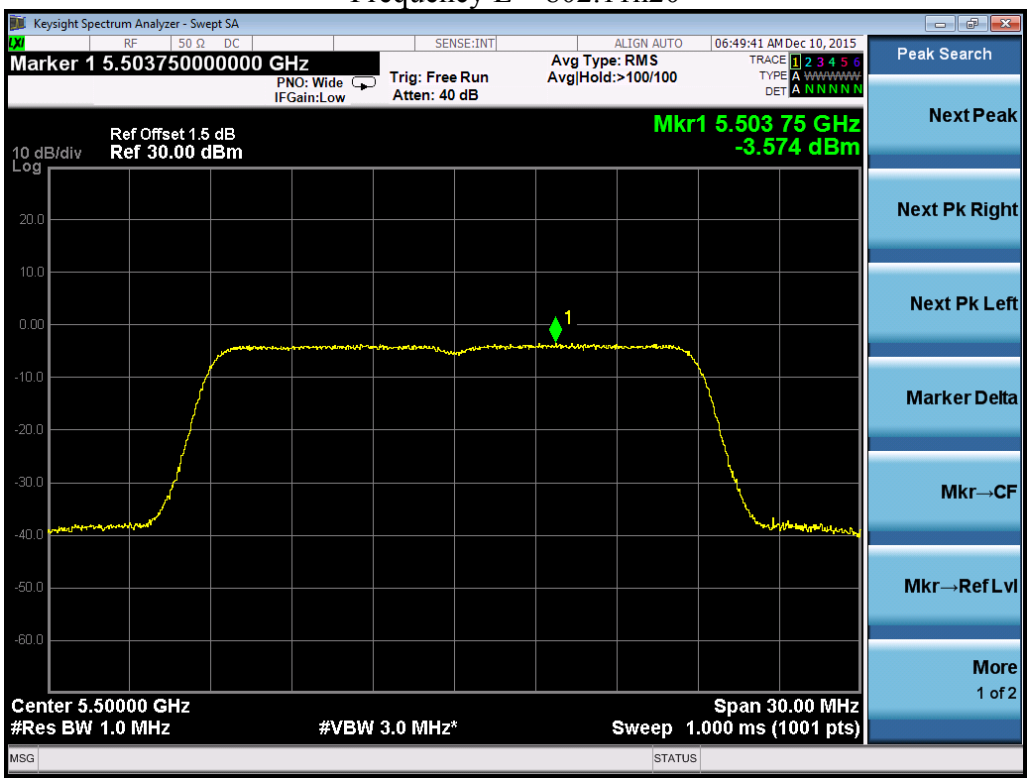
Frequency M – 802.11a



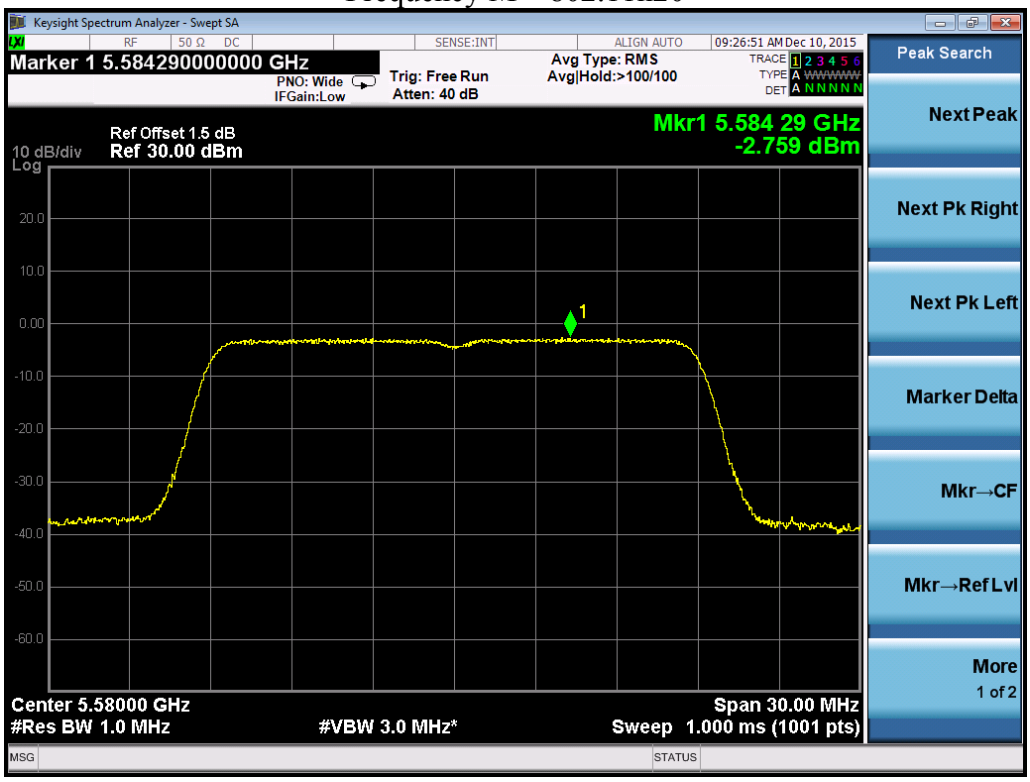
Frequency H – 802.11a



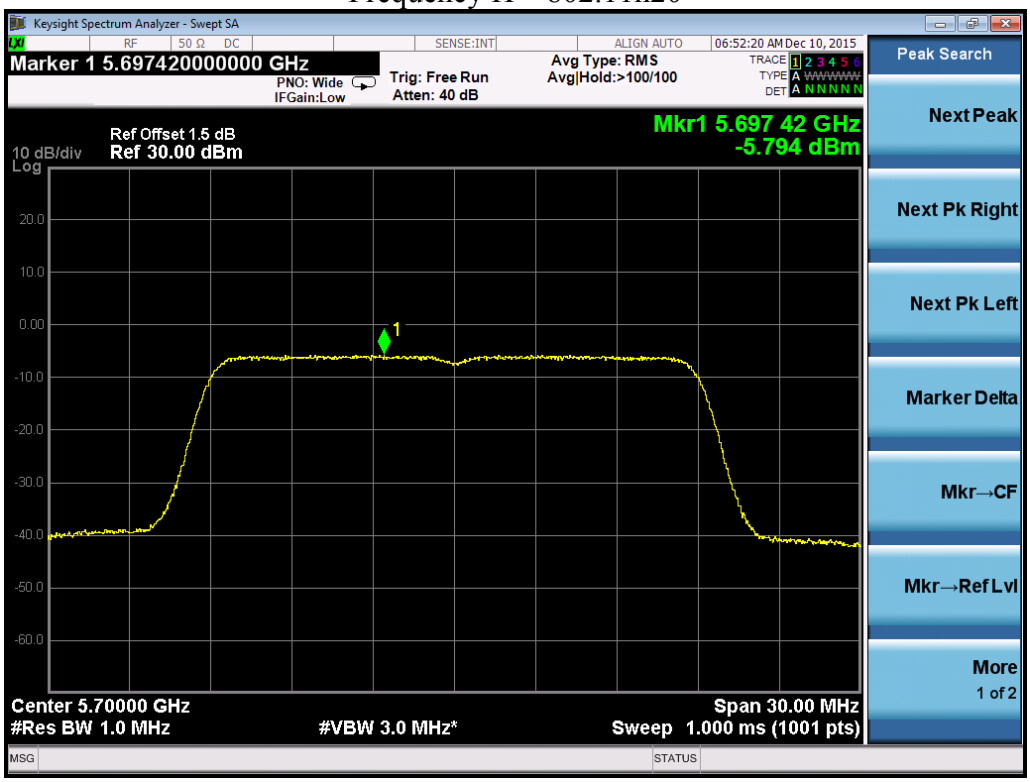
Frequency L – 802.11n20



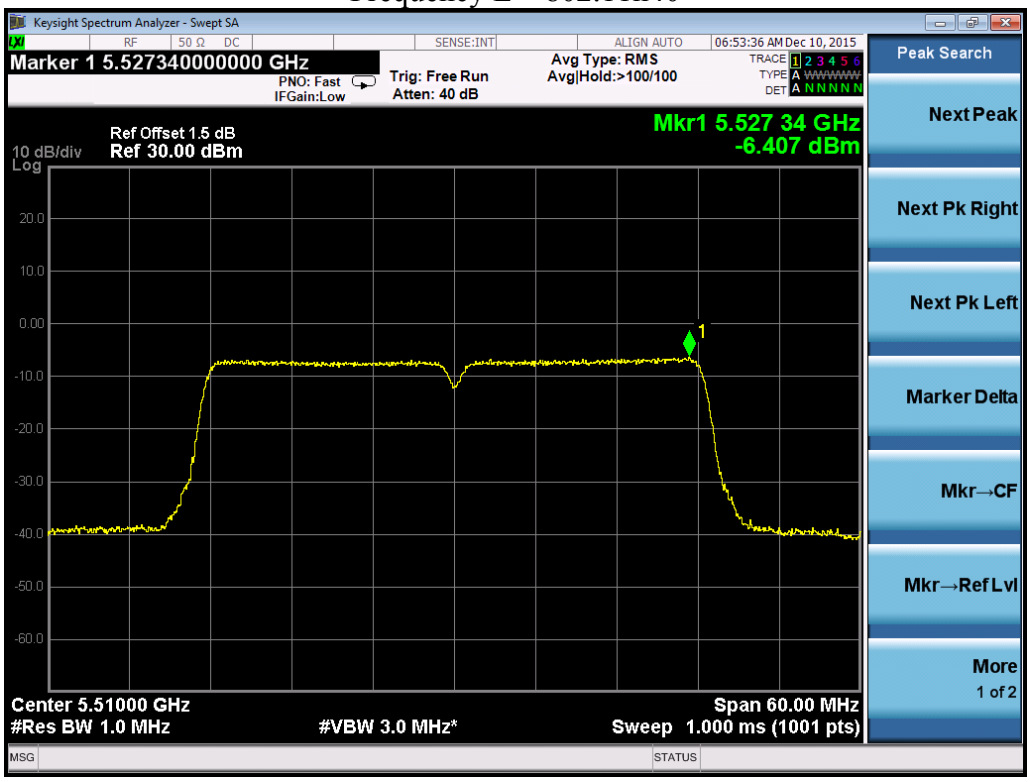
Frequency M – 802.11n20



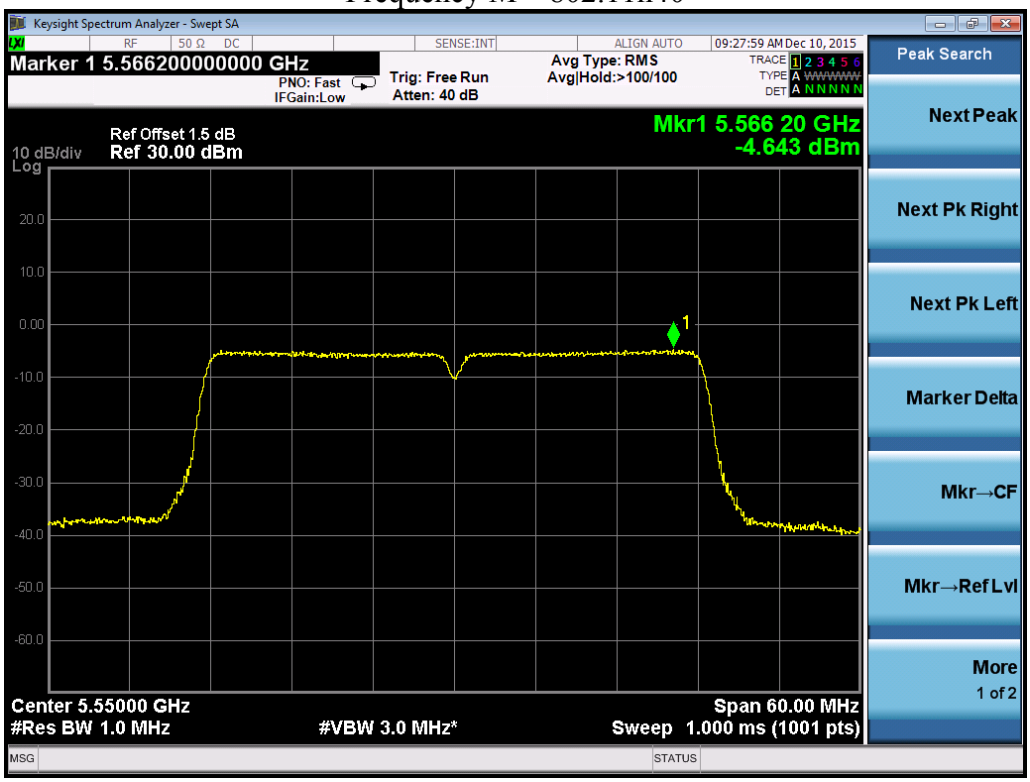
Frequency H – 802.11n20



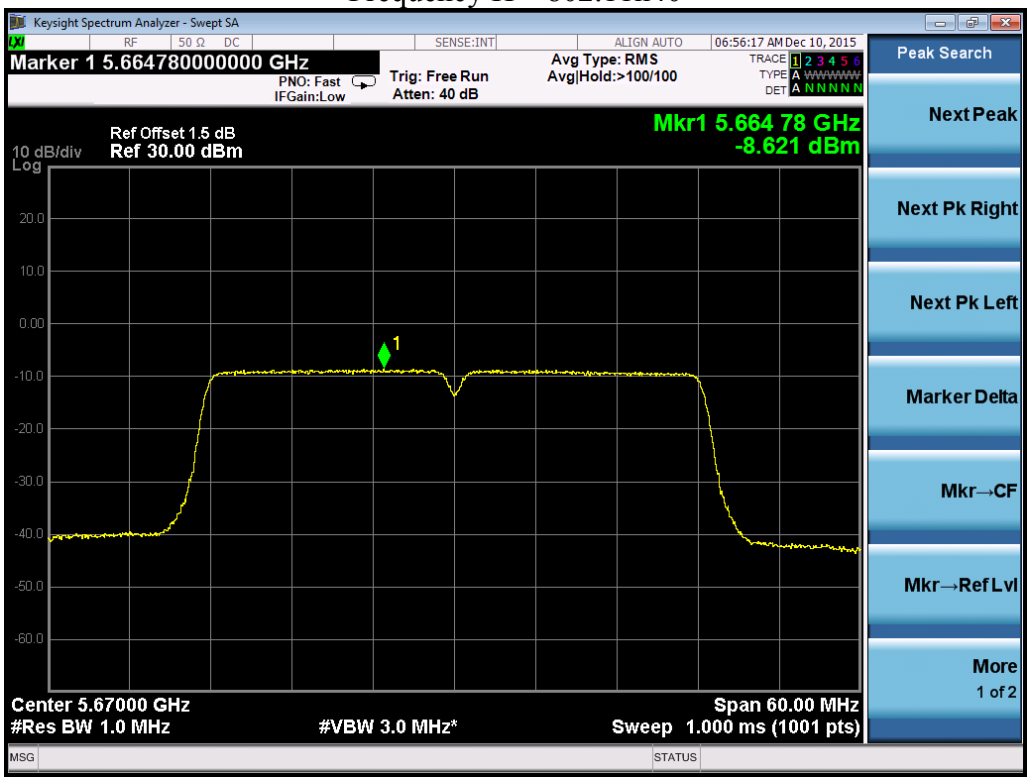
Frequency L – 802.11n40



Frequency M – 802.11n40

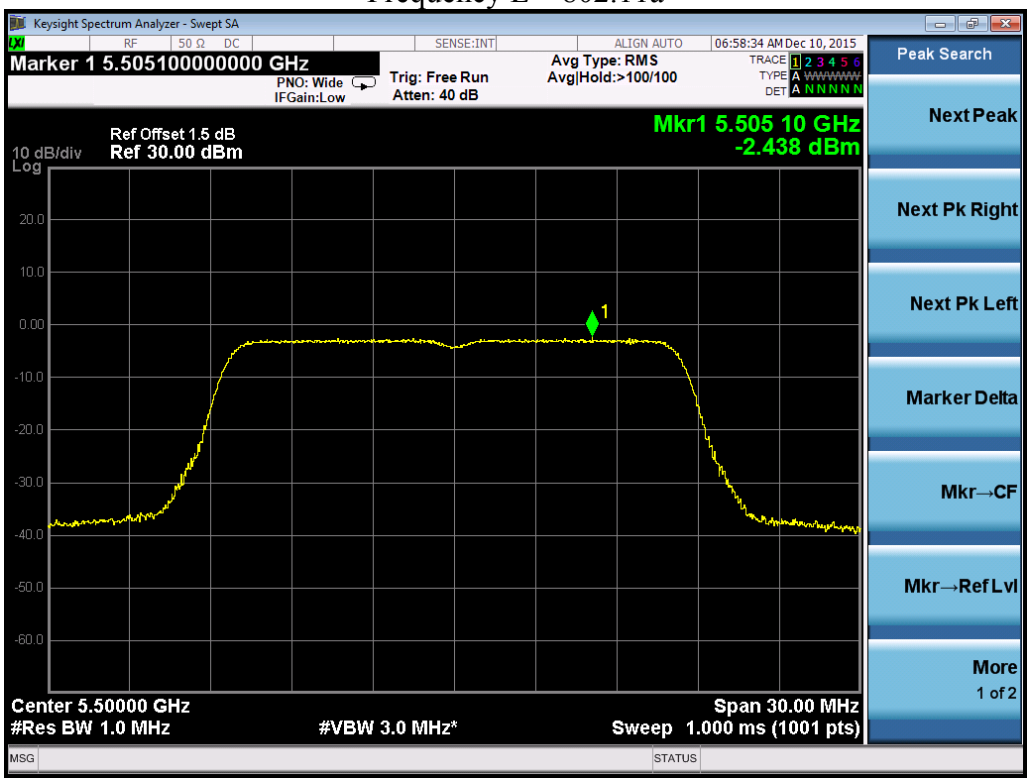


Frequency H – 802.11n40

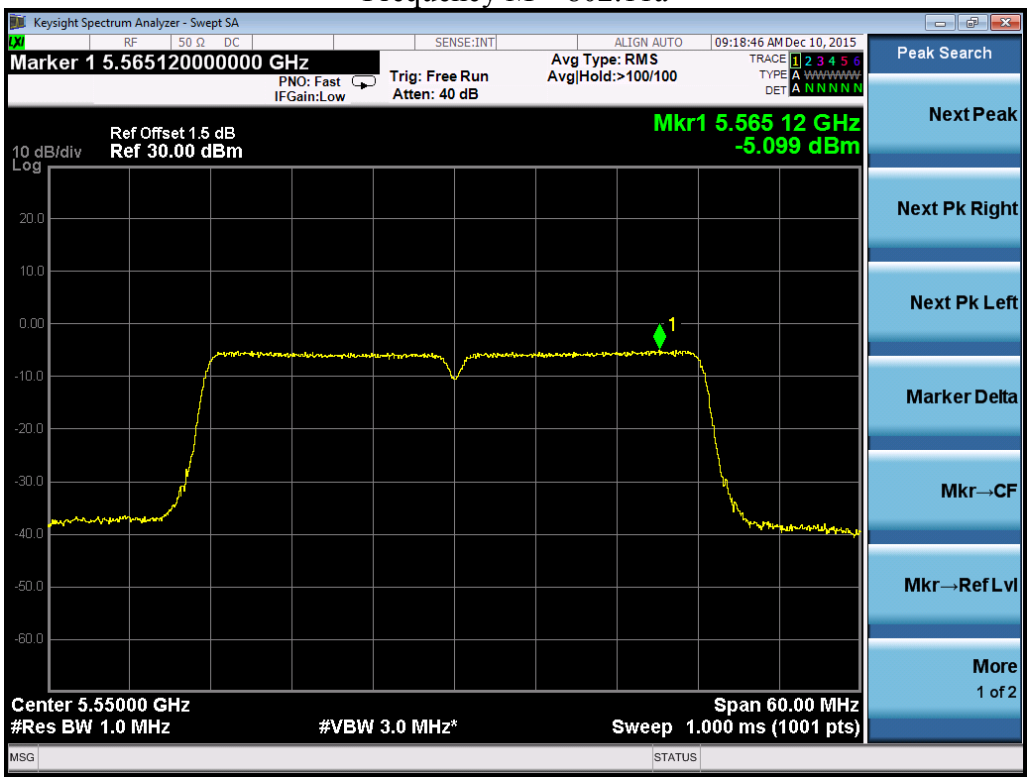


Port 2

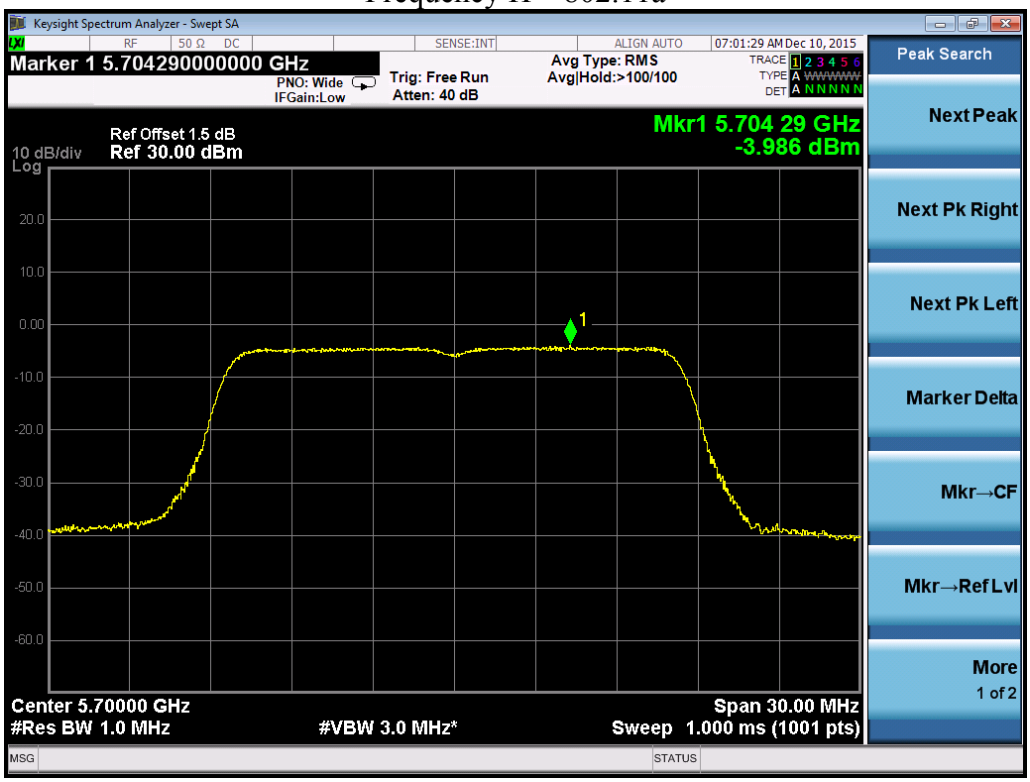
Frequency L – 802.11a



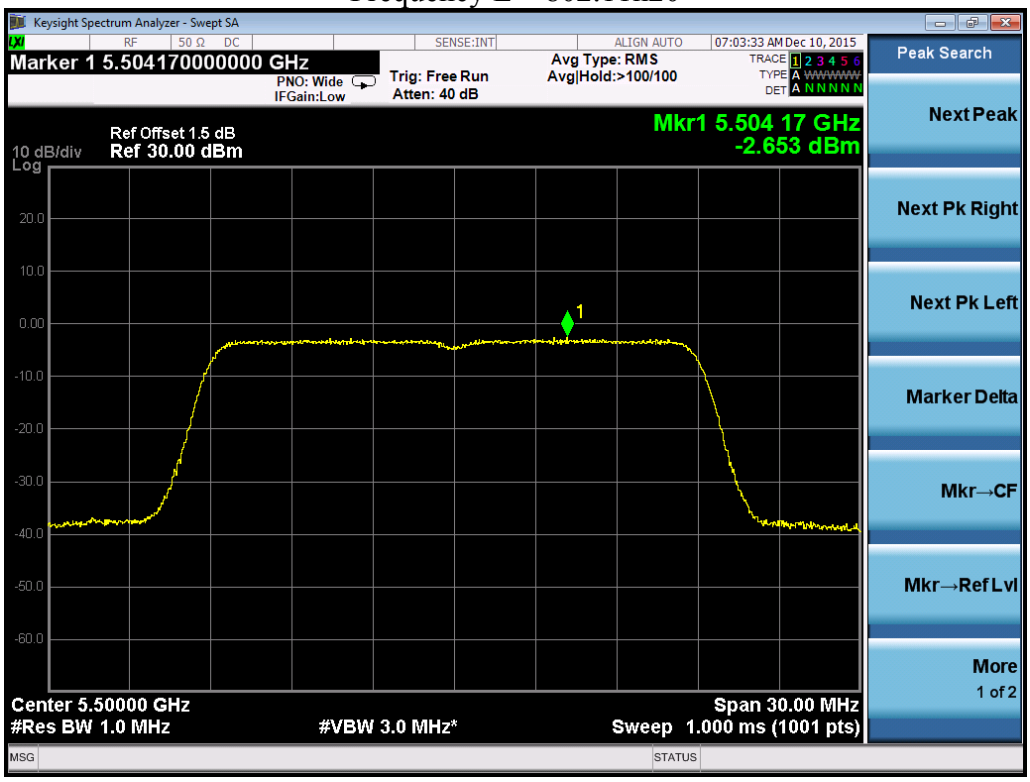
Frequency M – 802.11a



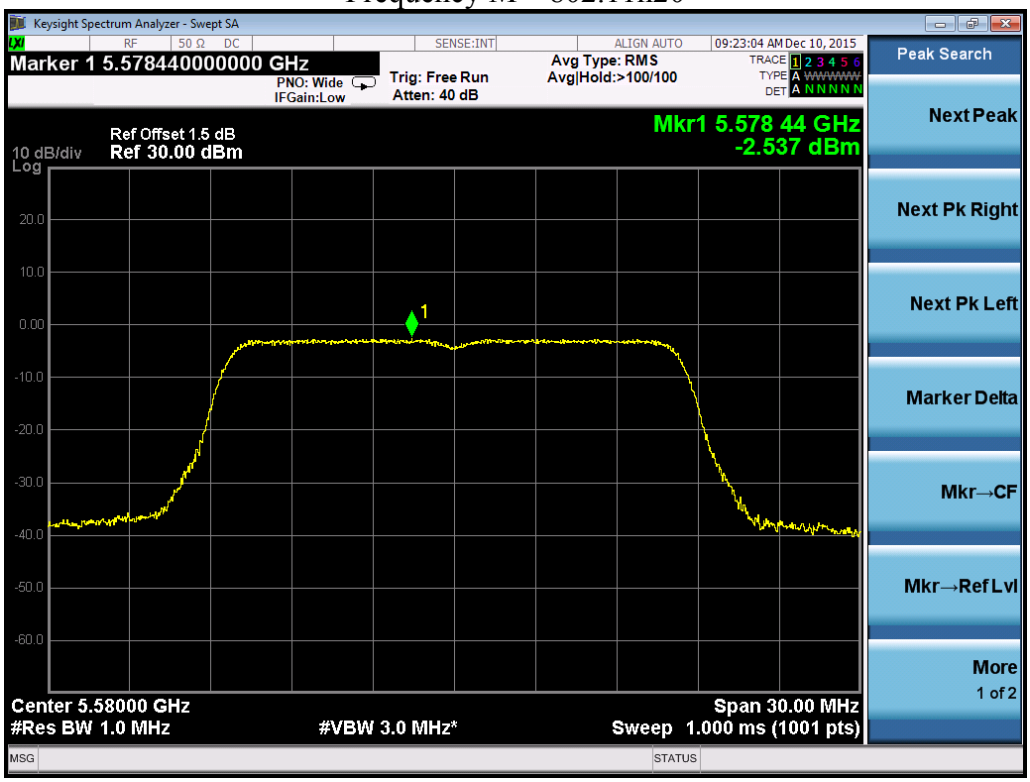
Frequency H – 802.11a



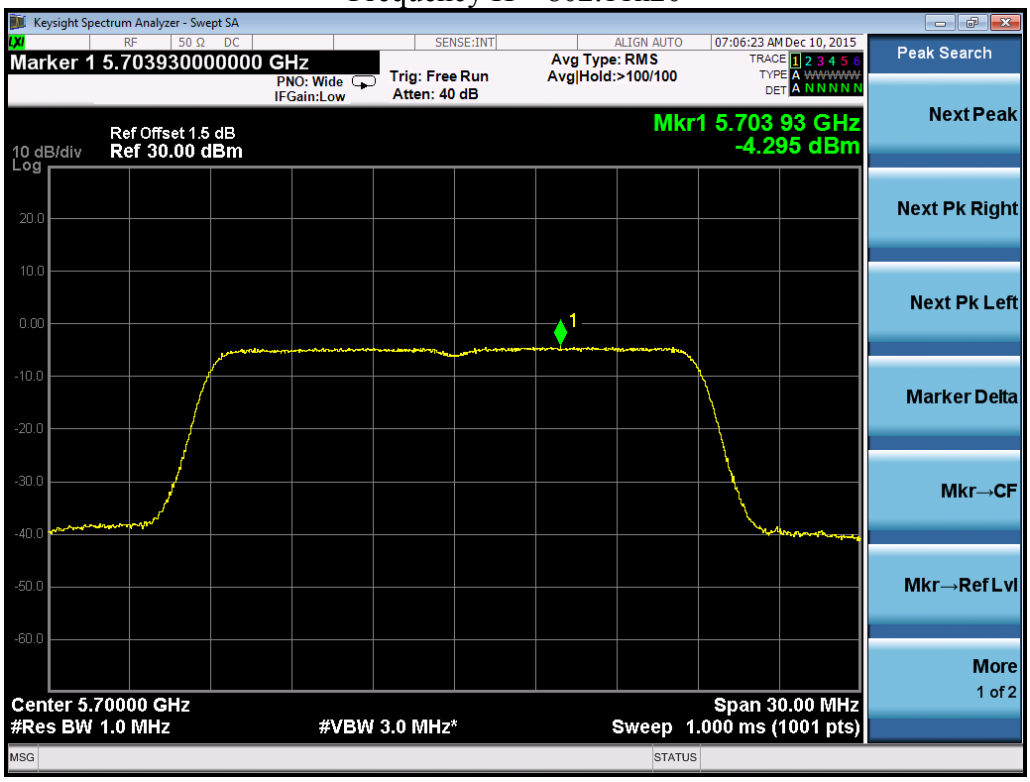
Frequency L – 802.11n20



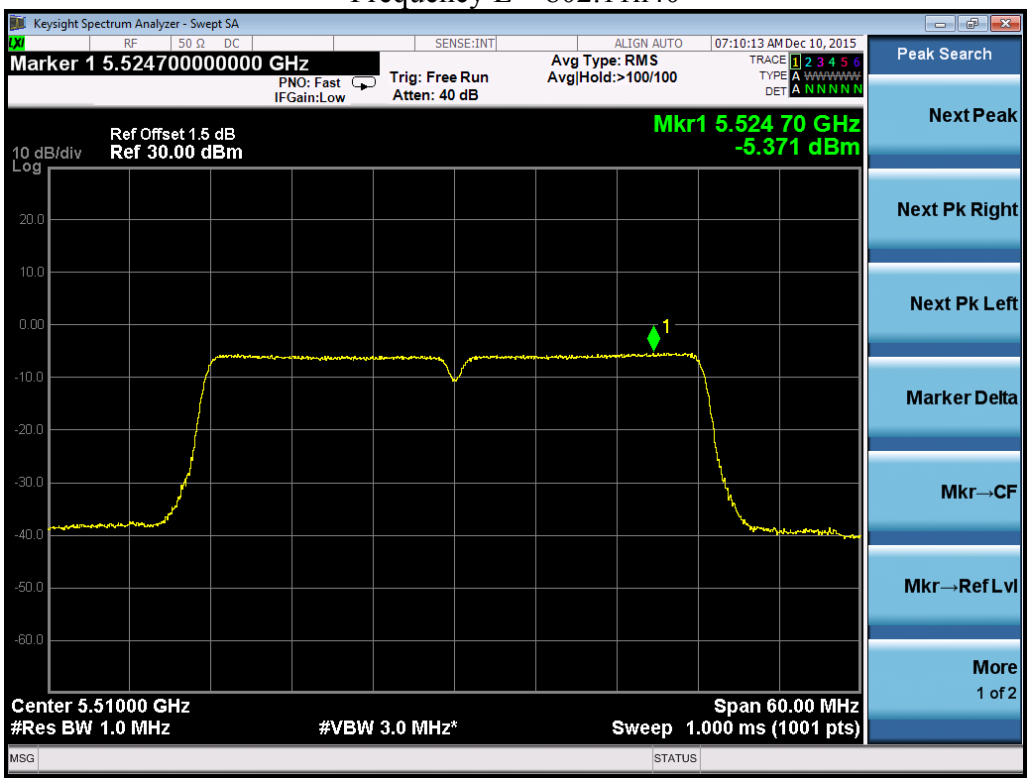
Frequency M – 802.11n20



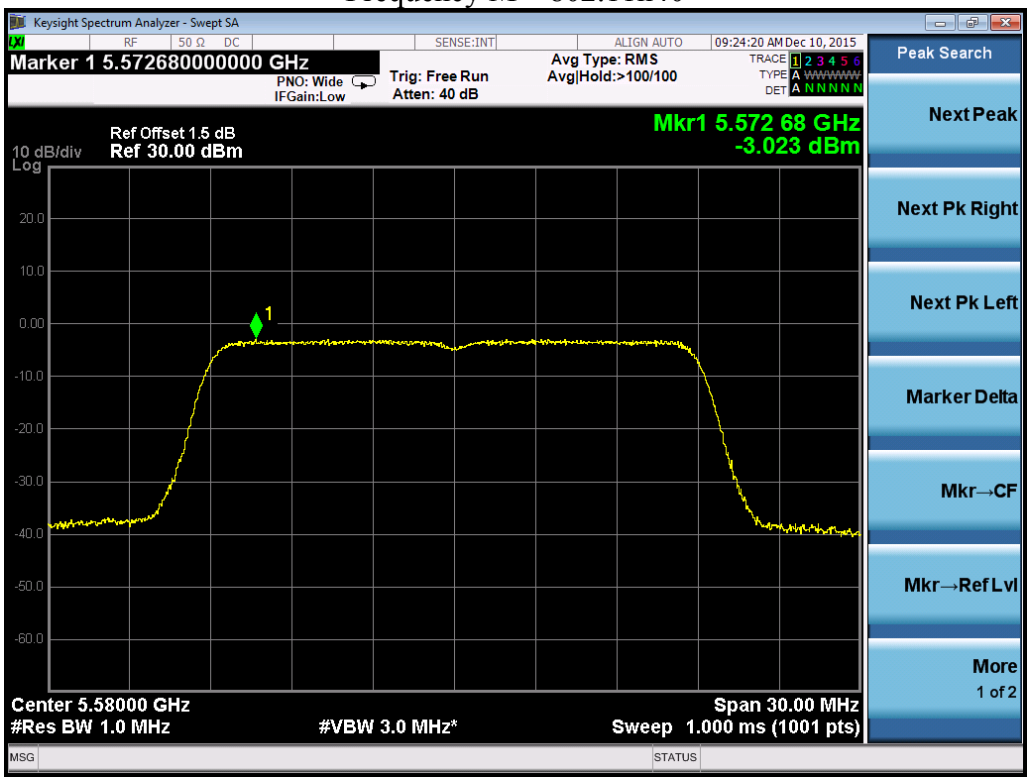
Frequency H – 802.11n20



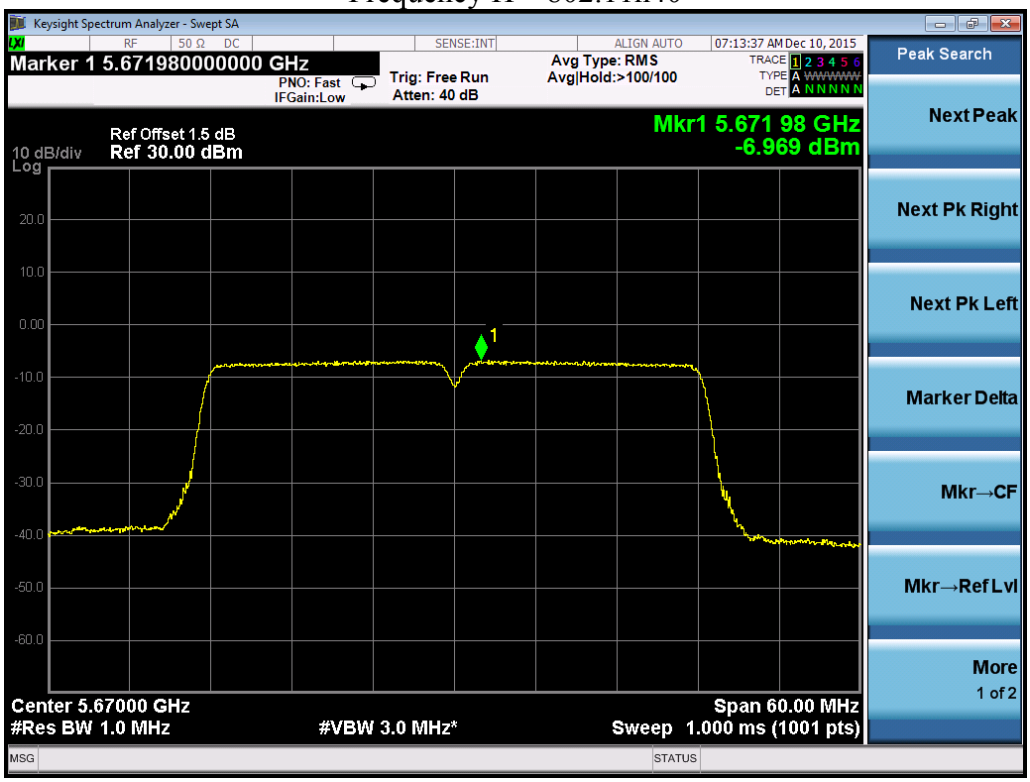
Frequency L – 802.11n40



Frequency M – 802.11n40



Frequency H – 802.11n40



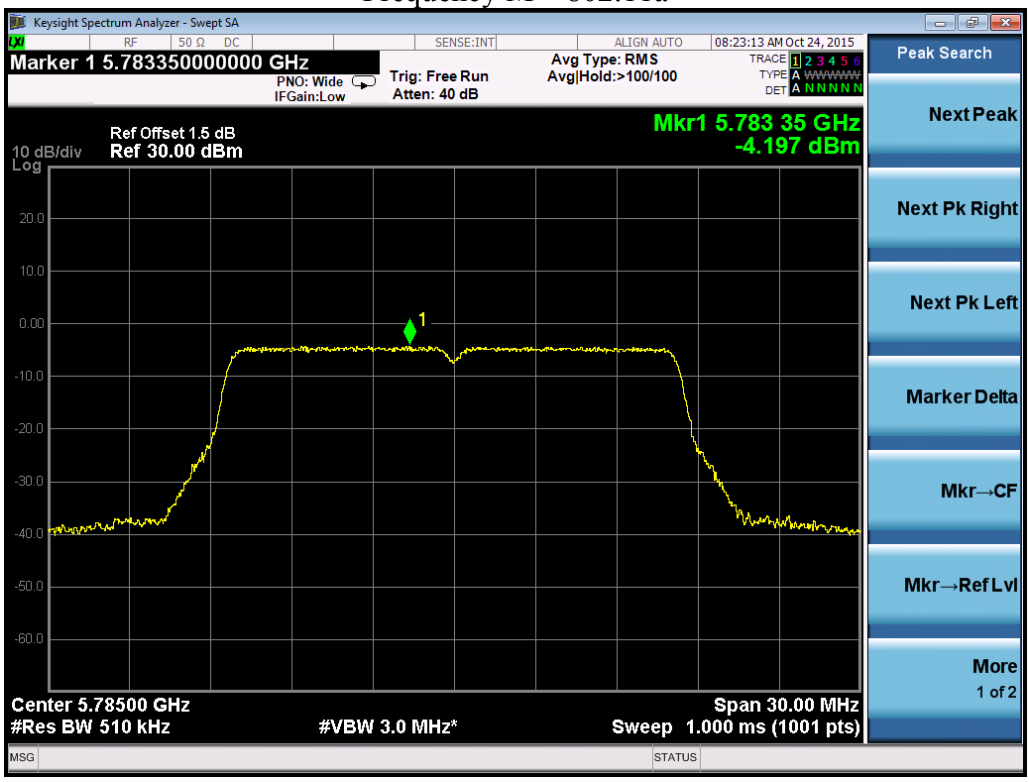
U-NII-3 Band:

Mode	Frequency (MHz)	Reading (dBm/MHz)		Total PSD (mw/500K Hz)	Total PSD (dBm/500K Hz)	Limit (dBm/500K Hz)	Margin (dB)
		Port0	Port 1				
802.11a	5745	-3.122	-2.902	1.00	0.00	30.00	30.00
	5785	-4.197	-4.135	0.77	-1.16	30.00	31.16
	5825	-5.277	-4.754	0.63	-2.00	30.00	32.00
802.11n20	5745	-3.427	-3.149	0.94	-0.28	30.00	30.28
	5785	-4.609	-4.530	0.70	-1.56	30.00	31.56
	5825	-5.436	-5.527	0.57	-2.47	30.00	32.47
802.11n40	5755	-5.979	-5.736	0.52	-2.85	30.00	32.85
	5795	-7.152	-7.123	0.39	-4.13	30.00	34.13

Test Plots as bellow:

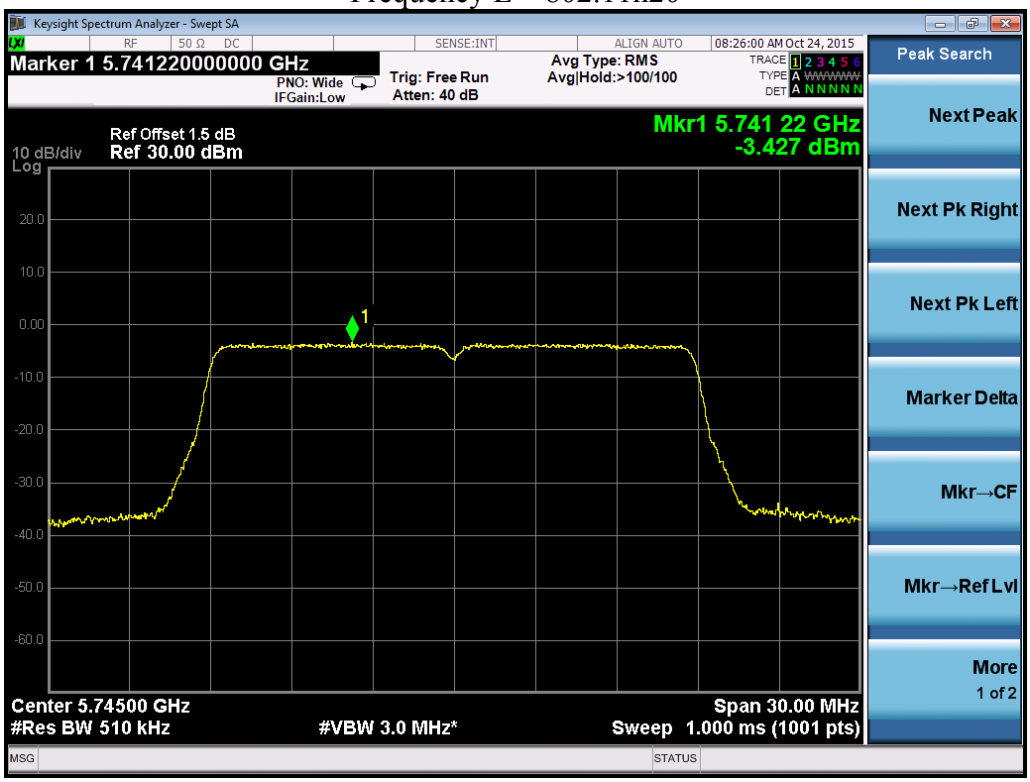
Port 1
Frequency L – 802.11a

Frequency M – 802.11a

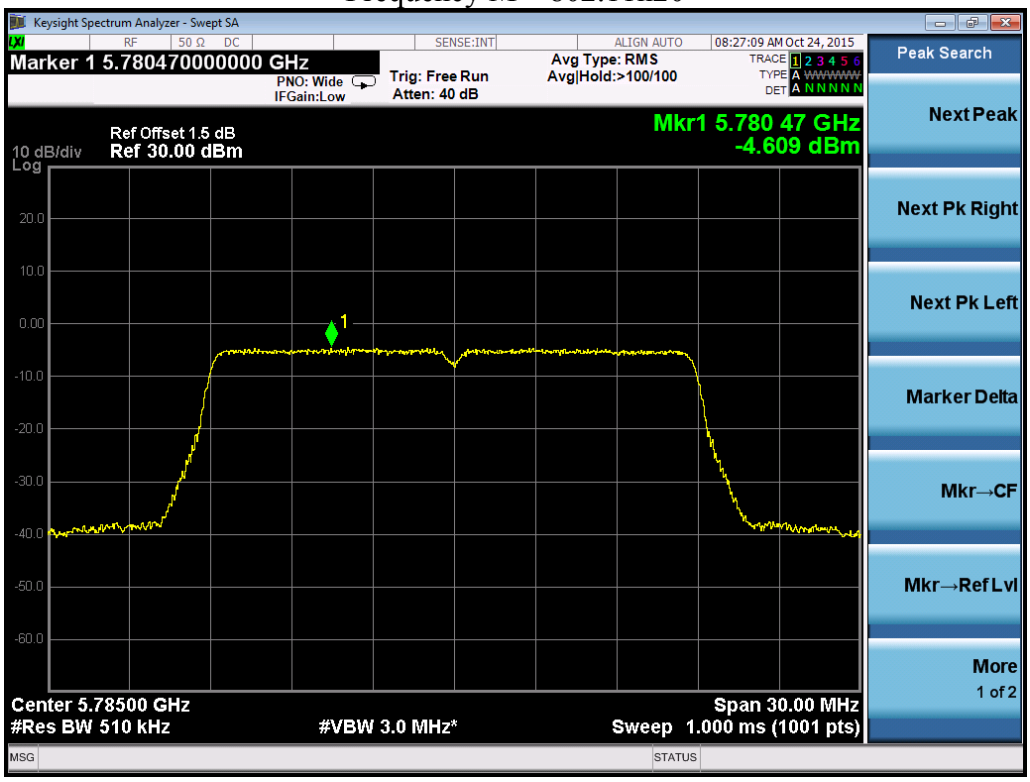


Frequency H – 802.11a

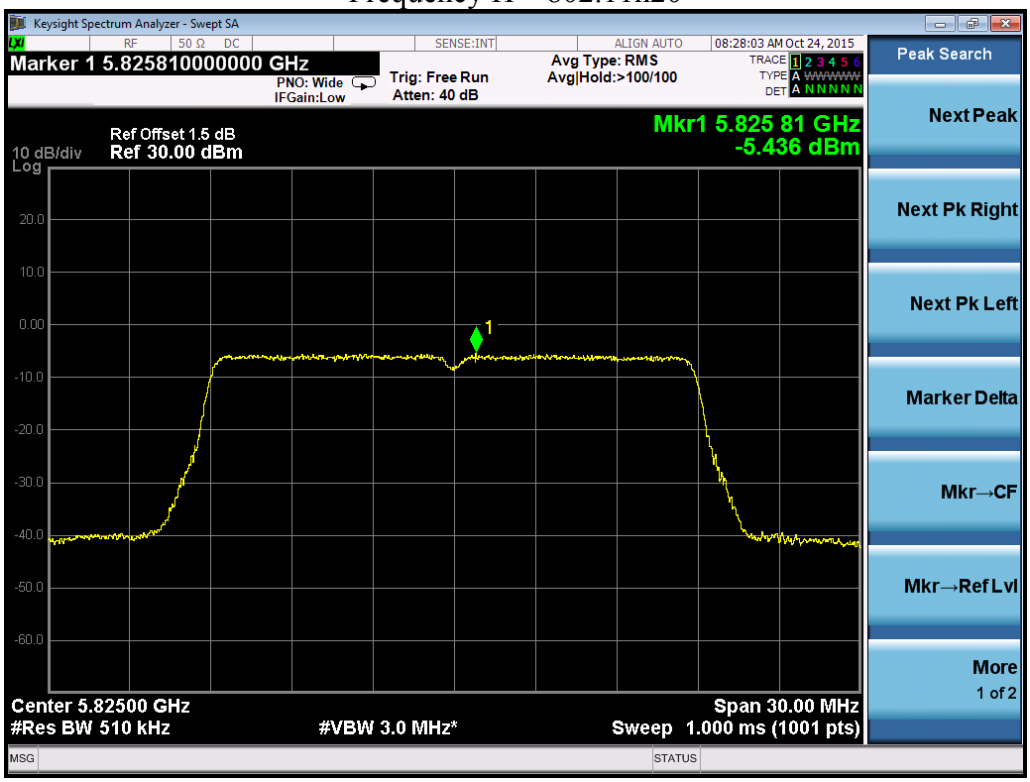
Frequency L – 802.11n20



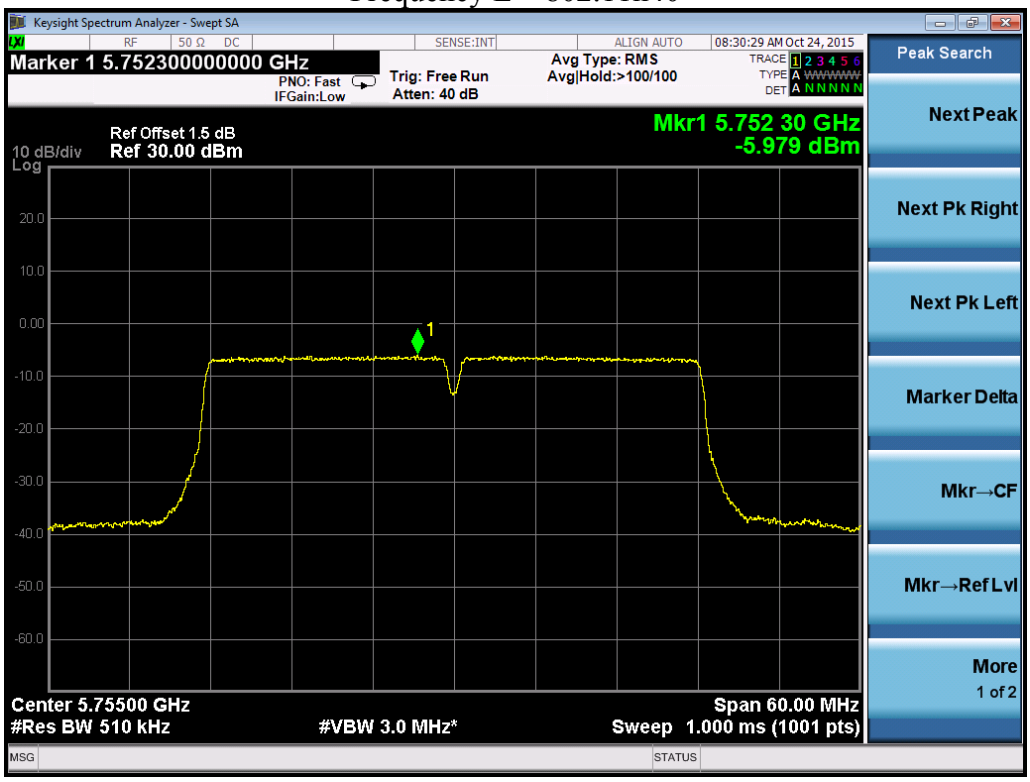
Frequency M – 802.11n20



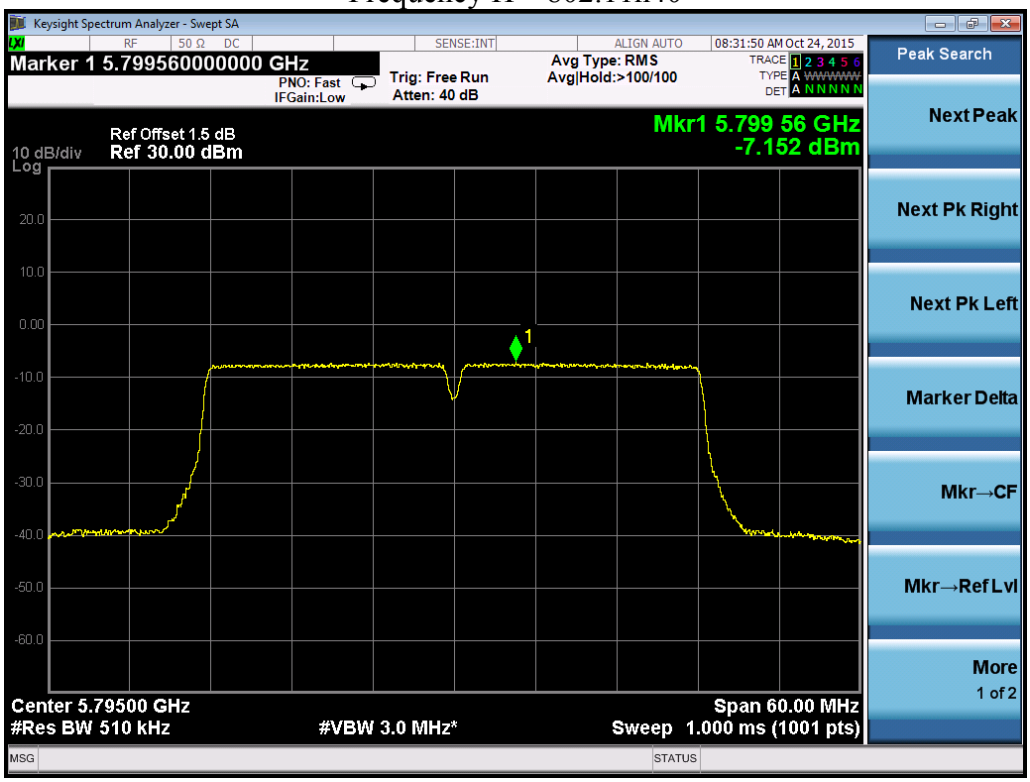
Frequency H – 802.11n20



Frequency L – 802.11n40



Frequency H – 802.11n40

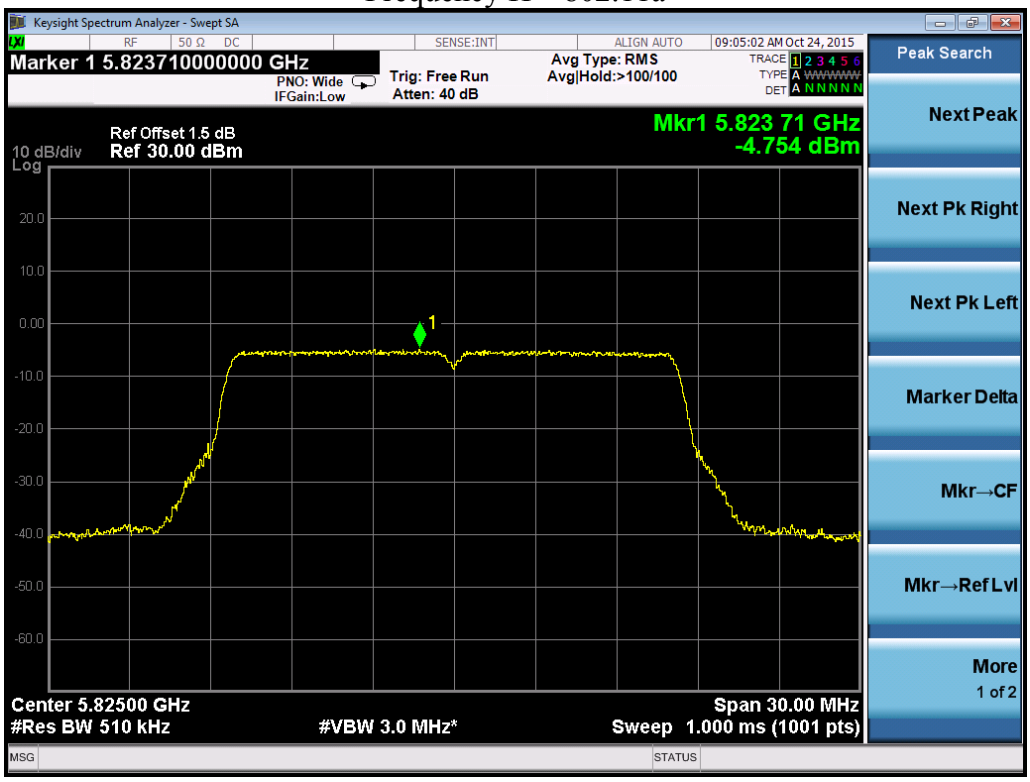


Port 2

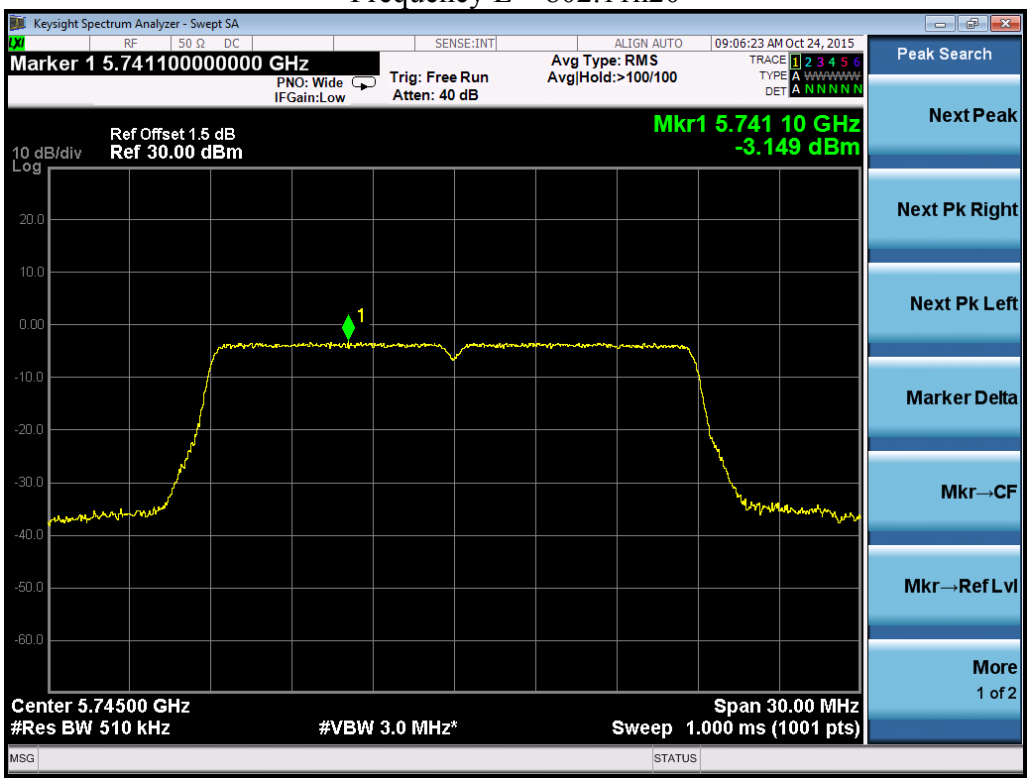
Frequency L – 802.11a

Frequency M – 802.11a

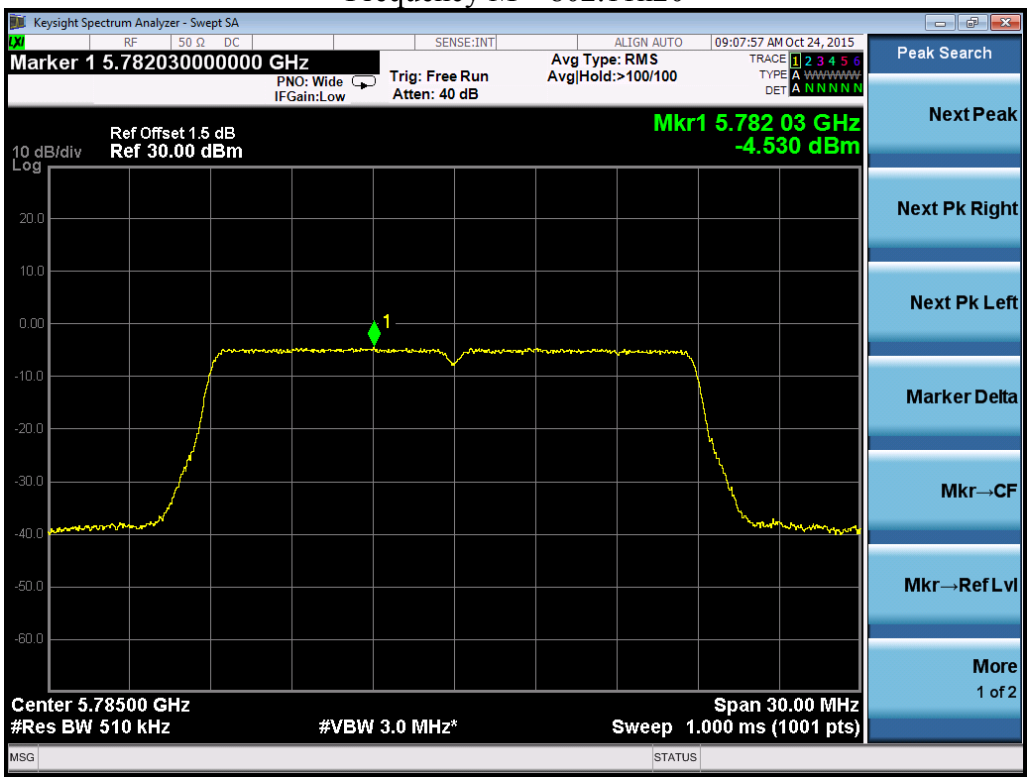
Frequency H – 802.11a



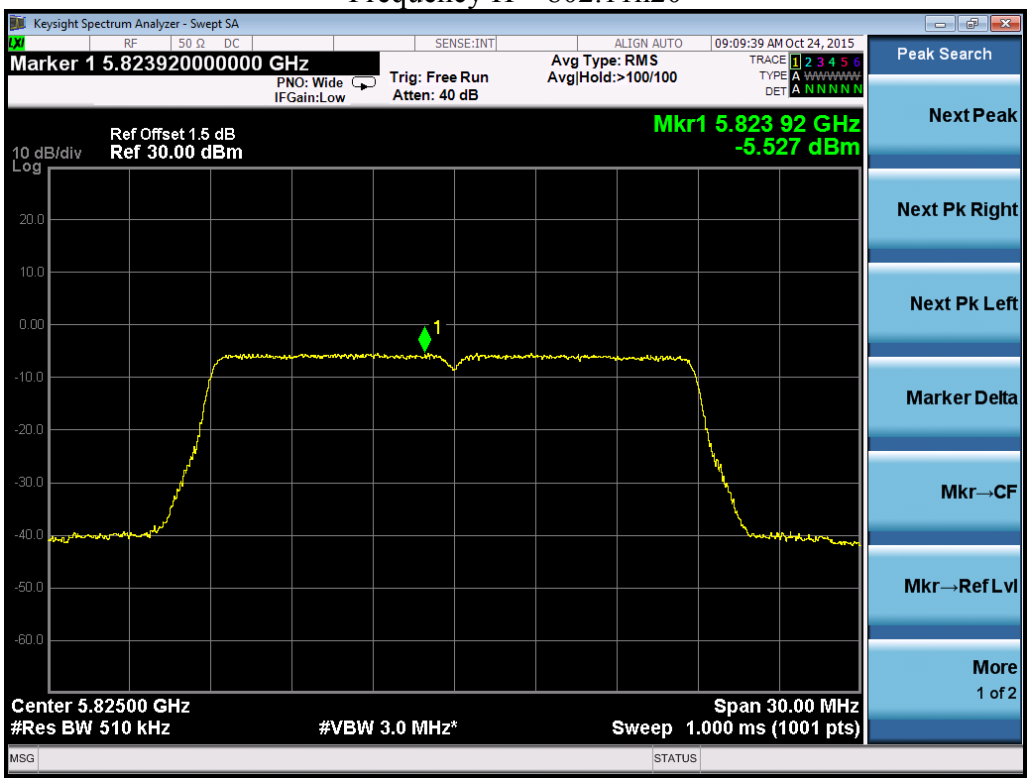
Frequency L – 802.11n20



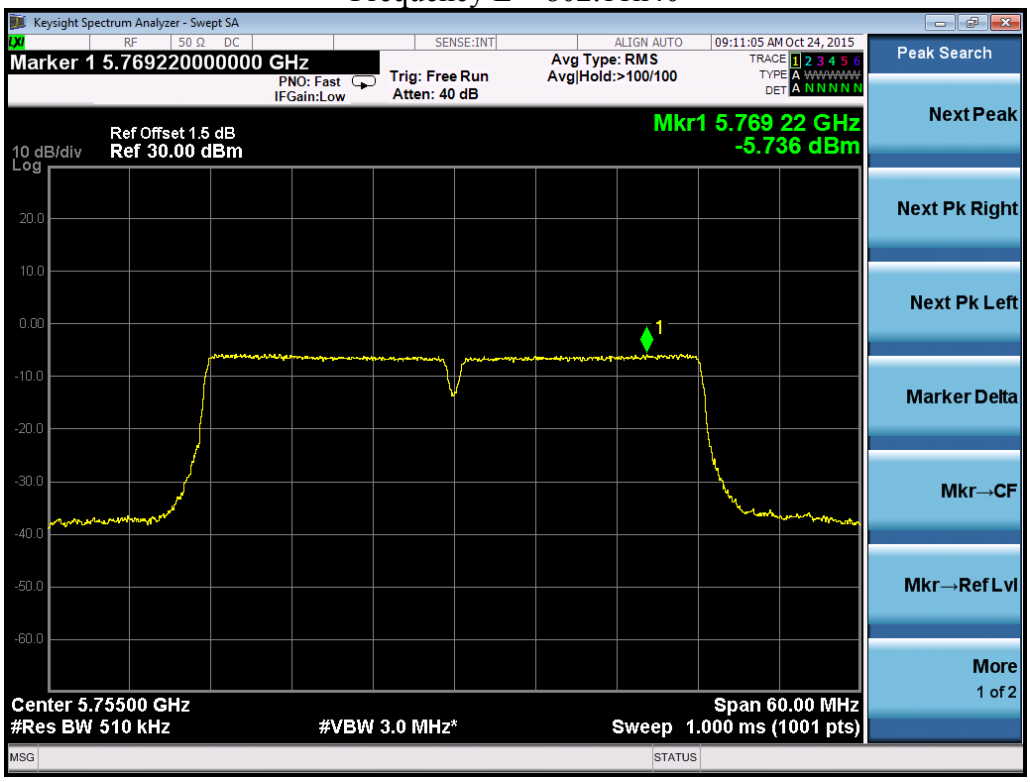
Frequency M – 802.11n20



Frequency H – 802.11n20



Frequency L – 802.11n40



Frequency H – 802.11n40