731 Enterprise Drive
Lexington, KY 40510

Telephone: 859-226-1000
Facsimile: 859-226-1040
www.intertek-etlsemko.com

TEST REPORT

Report Number:	**101078559LEX-007**
Project Number:	**G101078559**
Report Issue Date:	**7/13/2013**
Product Name:	**iX101T1 Rugged Tablet**
Model Number:	**iX101T1**
FCCID:	**Q2GWG7550**
ICID:	**4596A-WG7550**
FCC Standards:	**Title 47 CFR Part 15 Subpart E and RSS-210 Issue 8**
Radios Under Test:	**802.11a, 802.11n (HT-20)**

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510

Client:
Xplore Technologies
14000 Summit Dr.
Austin, TX 78728

Report prepared by
Bryan Taylor, Team Leader

Report reviewed by
Jason Centers, Senior Project Engineer

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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.

2 Test Summary

Page	Test full name	FCC Reference	IC Reference	Result
7	Occupied Bandwidth	§ 15.407(a)(1)(2)	A9.2(1)(2)(3)	Pass
19	Peak Conducted Power	§ 15.407(a)(1)(2)	A9.2(1)(2)(3)	Pass
21	Power Spectral Density	§ 15.407(a)(1)(2)	A9.2(1)(2)(3)	Pass
32	Peak Excursion Measurements	§ 15.407(a)(6)	---	Pass
36	Radiated Spurious Emissions (Transmitter)	§ 15.407(b)	A9.2(1)(2)(3)	Pass
44	Frequency Stability	§ 15.407(g)	RSS-Gen (4.7)	Pass
46	Radiated Spurious Emissions (Receiver)	§ 15.109	RSS-Gen (6.1)	Pass
49	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
52	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen (7.1.2)	Pass
53	Dynamic Frequency Selection (DFS)	§ 15.407(h)(2)(iii)(v)	A9.3(b)(iii)(iv)(v)	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Xplore Technologies
Model Number	iX101T1
Serial Number	Test Sample #2
FCC Identifier	Q2GWG7550
IC Identifier	4596A-WG7550
Receive Date	3/20/2013
Test Start Date	3/21/2013
Test End Date	5/15/2013
Device Received Condition	Good
Test Sample Type	Production
Frequency Band / Test Channels	5180 – 5240MHz: 36, 40, 48 5260 – 5320MHz: 52, 60, 64 5500 – 5700MHz: 100, 116, 140
Mode(s) of Operation	802.11a, 802.11n (HT-20)
Modulation Type	OFDM
Duty Cycle	100%
Transmission Control	Test Commands
Antenna Type (15.203)	Internal
Power Supply	115VAC/60Hz (Via AC / DC Power Adapter)

Description of Equipment Under Test
The iX101T1 is a ruggedized tablet PC. This U-NII device operates as a client only device without radar detection using an IP based architecture. The power on time is 3.84s from OFF to ON and to show access points from the WiFi. No information is given to the user about any Radar Waveforms or its parameters.

Antenna Gain Info:
All antennas are PCB / integral to the device and 50 ohm impedance.

Tomcat	WLAN1	With Cable Loss
Freq.[MHz]	Avg.[dBi]	Peak[dBi]
2400	-2.2	2.04
2450	-2.04	2.07
2500	-2.26	2.33
5150	-1.93	3.01
5350	-1.9	2.34
5470	-2.47	2.23
5725	-2.41	1.4
5850	-3.52	0.67

Tomcat	WLAN2	With Cable Loss
Freq.[MHz]	Avg.[dBi]	Peak[dBi]
2400	-3.28	1.71
2450	-2.57	2.74
2500	-3.29	1.72
5150	-1.68	3.72
5350	-1.78	3.61
5470	-2.39	2.94
5725	-1.84	2.98
5850	-2.51	2.28

Highest / Lowest EIRP (Based on Conducted Measurements and the Above Antenna Gains):

5150 – 5250MHz:
Highest: 16.46dBm + 3.72dBi = 20.18dBm (EIRP)
Lowest: 12.12dBm + 3.01dBi = 15.13dBm (EIRP)

5250 – 5350MHz:
Highest: 16.56dBm + 3.61dBi = 20.17dBm (EIRP)
Lowest: 12.23dBm + 2.34dBi = 14.57dBm (EIRP)

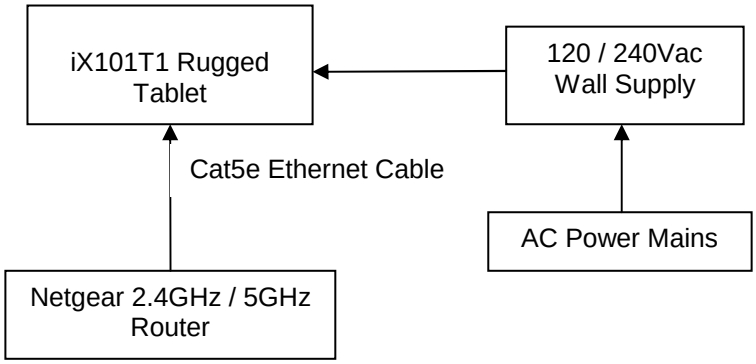
5470 – 5725MHz:
Highest: 17.4dBm + 2.98dBi = 20.38dBm (EIRP)
Lowest: 12.86dBm + 1.4dBi = 14.26dBm (EIRP)

Operating modes of the EUT:

No.	**Descriptions of EUT Exercising**
1	Transmitting 802.11 a or n (HT-20) on low mid or high channels
2	Receive / idle mode

3.1 System setup including cable interconnection details, support equipment and simplified block diagram

3.2 EUT Block Diagram:



3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
120 / 240Vac Power Cable	1m	No	No	120 / 240Vac Wall Supply	Xplore Tablet
Cat5e Ethernet Cable	1m	No	No	Netgear Ethernet / Wi-Fi Router	Xplore Tablet
HDMI Mini Cable	1m	Yes	No	Xplore Tablet	Unterminated
HDMI Cable	1m	Yes	No	Xplore Tablet	Unterminated
Micro USB Cable	1m	Yes	No	Xplore Tablet	Unterminated
USB Cable	1m	Yes	No	USB Mouse	Xplore Tablet

3.4 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Wireless Router	Netgear	WNDR3700v4	311315801CC9
Master Used for DFS Testing (Access Point), FCCID: LDK102054E	Cisco Systems	AIR-AP1131AG-A-K9	FTX1244N25E

4 Occupied Bandwidth

4.1 Test Limits

§ 15.407(a)

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) 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. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 Test Procedure

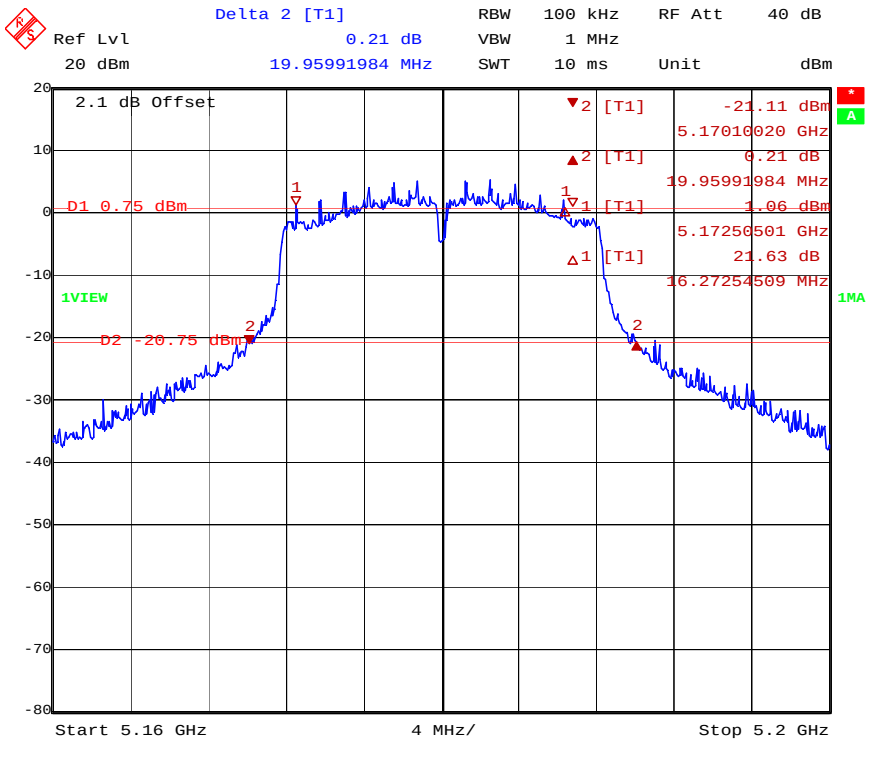
ANSI C63.10: 2009 and KDB Publication No. 789033 D01 v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

4.3 Test Equipment Used:

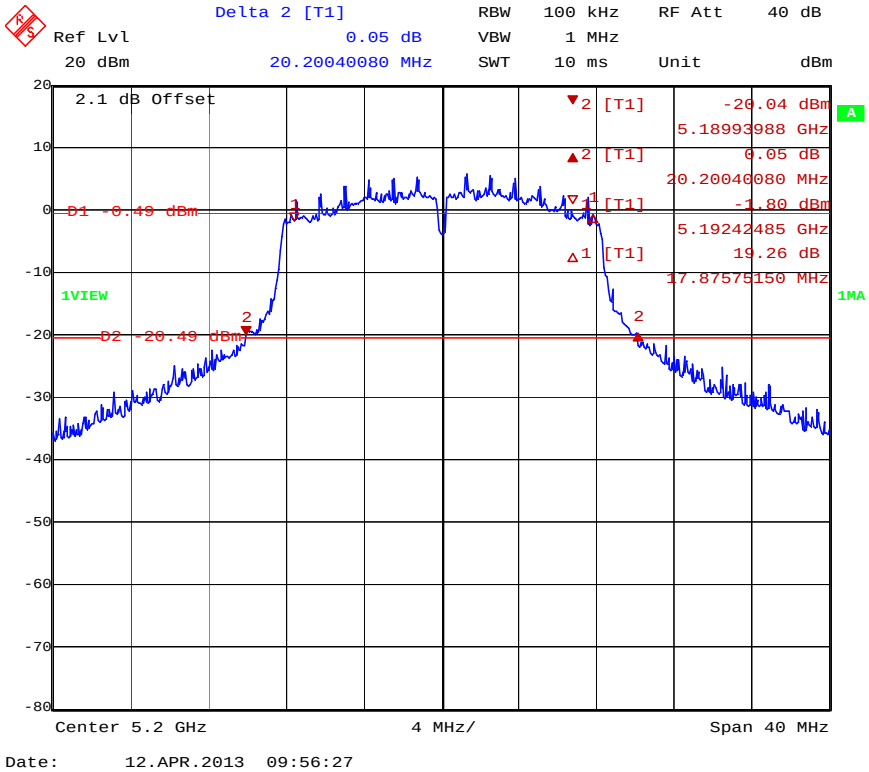
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	11/26/2012	11/26/2013

4.4 Results:

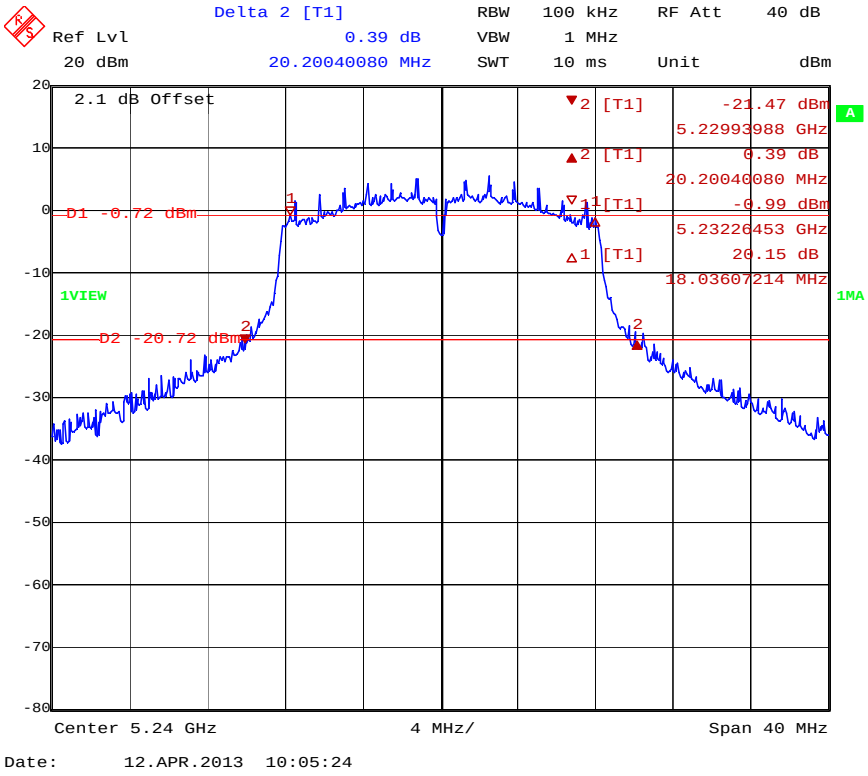
Mode	Channel Number	Frequency (MHz)	26dB Bandwidth (EBW)	6dB Bandwidth	Result
5150 – 5250MHz Band					
802.11a	36	5180	19.95MHz	16.27MHz	Pass
802.11a	40	5200	20.20MHz	17.80MHz	Pass
802.11a	48	5240	20.20MHz	18.03MHz	Pass
802.11n (HT-20)	36	5180	21.00MHz	18.04MHz	Pass
802.11n (HT-20)	40	5200	21.4MHz	18.27MHz	Pass
802.11n (HT-20)	48	5240	21.16MHz	18.81MHz	Pass
5250 – 5350MHz Band					
802.11a	52	5260	20.04MHz	17.73MHz	Pass
802.11a	60	5300	20.76MHz	17.95MHz	Pass
802.11a	64	5320	21.64MHz	18.67MHz	Pass
802.11n (HT-20)	52	5260	20.84MHz	18.11MHz	Pass
802.11n (HT-20)	60	5300	21.64MHz	18.51MHz	Pass
802.11n (HT-20)	64	5320	22.12MHz	18.75MHz	Pass
5470 – 5725MHz Band					
802.11a	100	5500	23.96MHz	19.39MHz	Pass
802.11a	116	5580	23.16MHz	19.47MHz	Pass
802.11a	140	5700	23.88MHz	19.63MHz	Pass
802.11n (HT-20)	100	5500	23.32MHz	19.56MHz	Pass
802.11n (HT-20)	116	5580	23.40MHz	19.07MHz	Pass
802.11n (HT-20)	140	5700	23.32MHz	19.47MHz	Pass



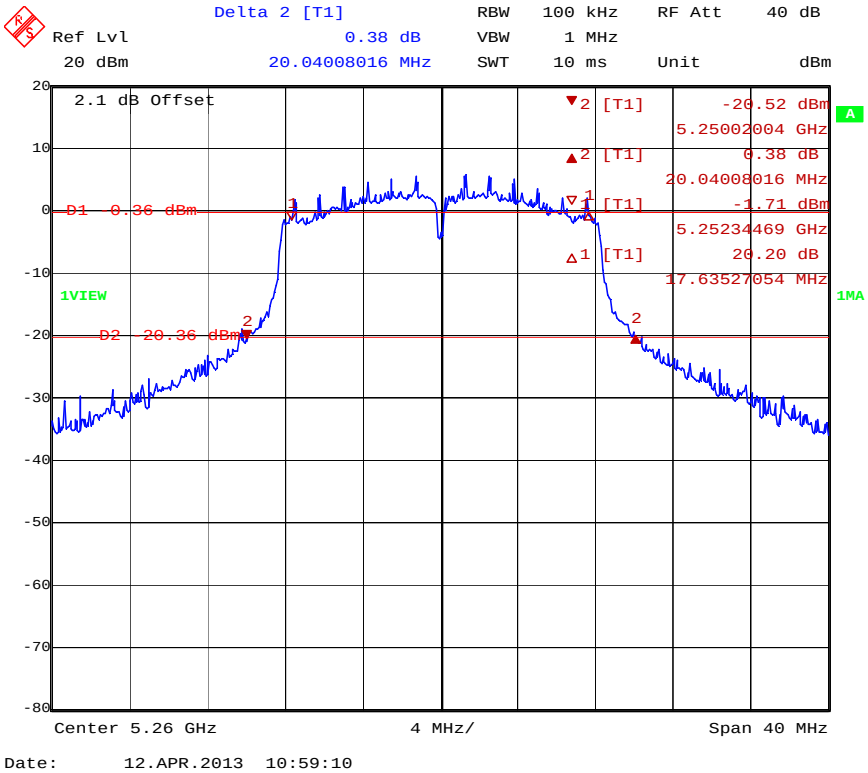
Bandwidth Plot (Channel 36) – 802.11a



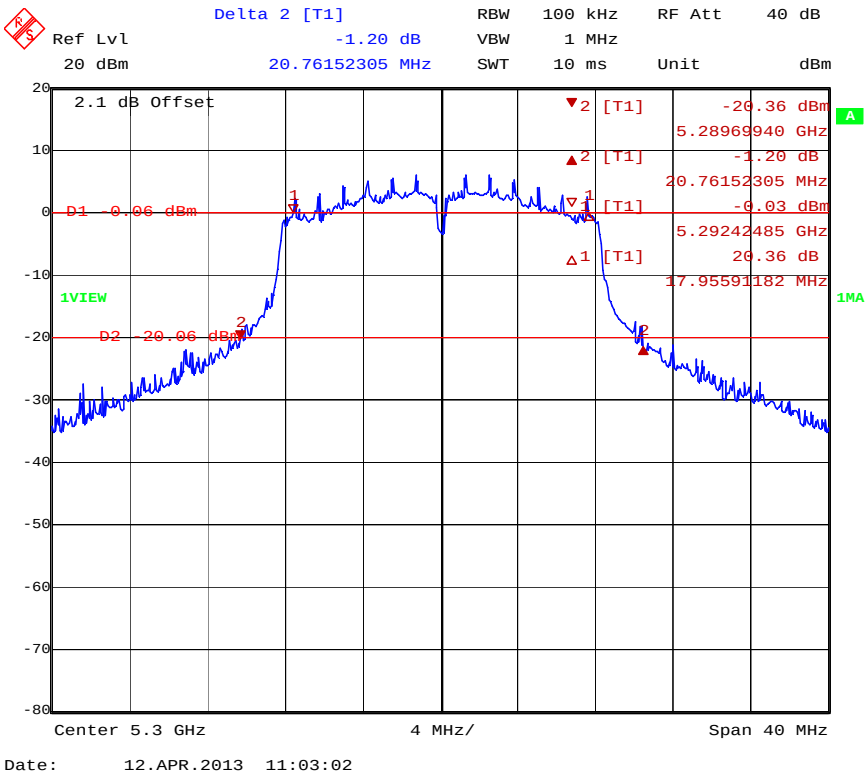
Bandwidth Plot (Channel 40) – 802.11a



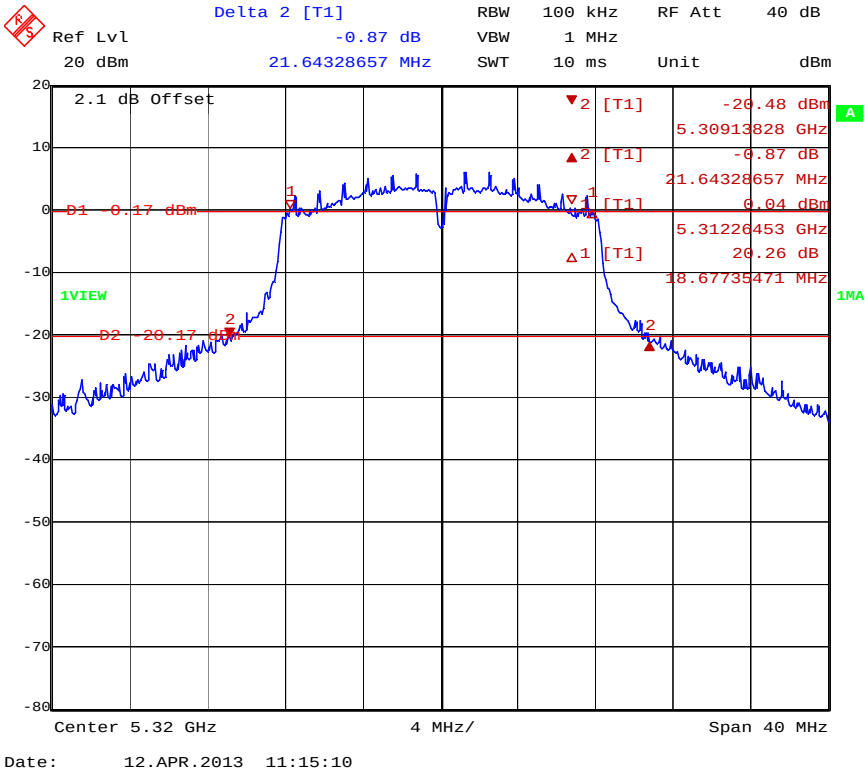
Bandwidth Plot (Channel 48) – 802.11a



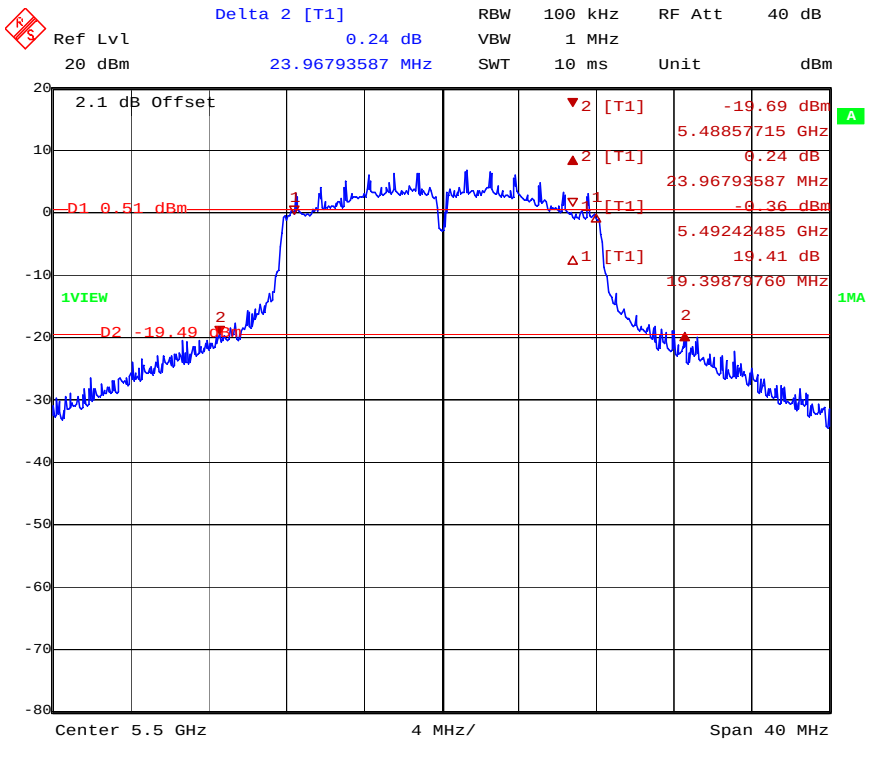
Bandwidth Plot (Channel 52) – 802.11a



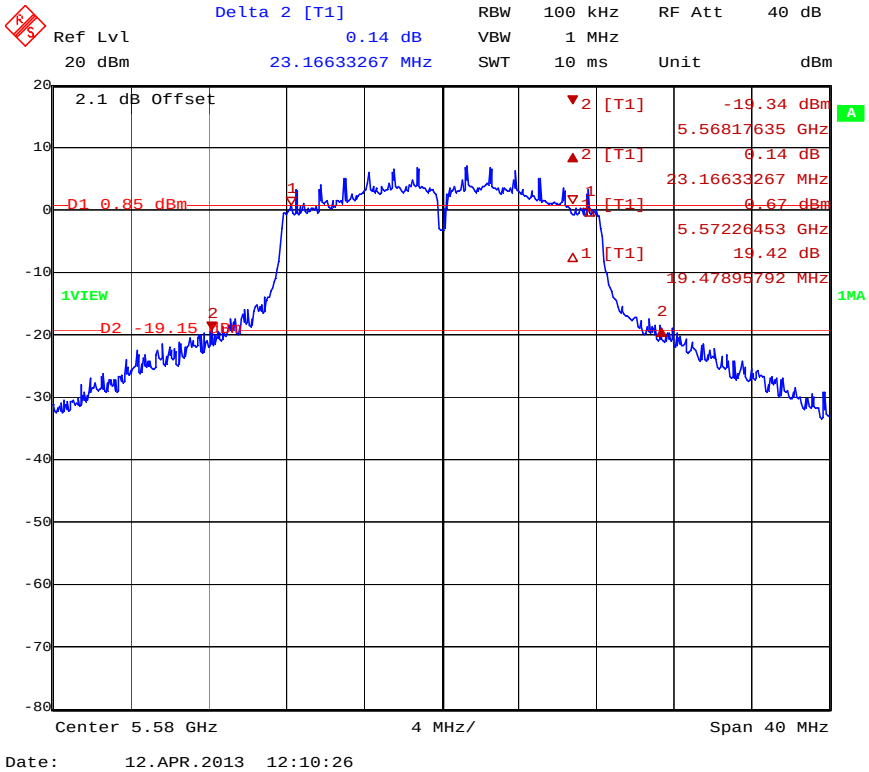
Bandwidth Plot (Channel 60) – 802.11a



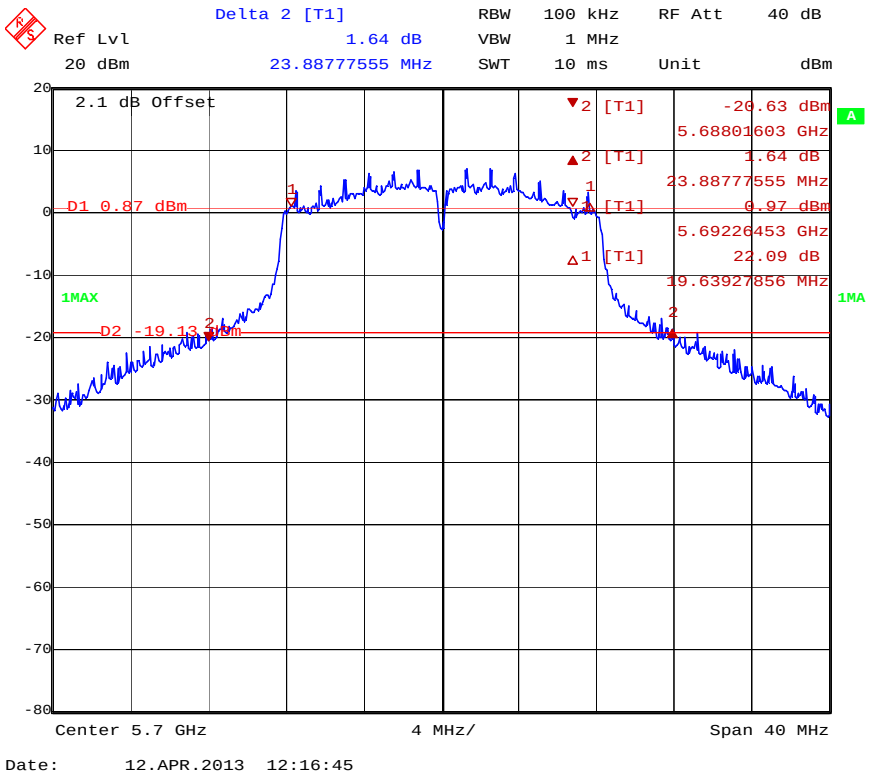
Bandwidth Plot (Channel 64) – 802.11a



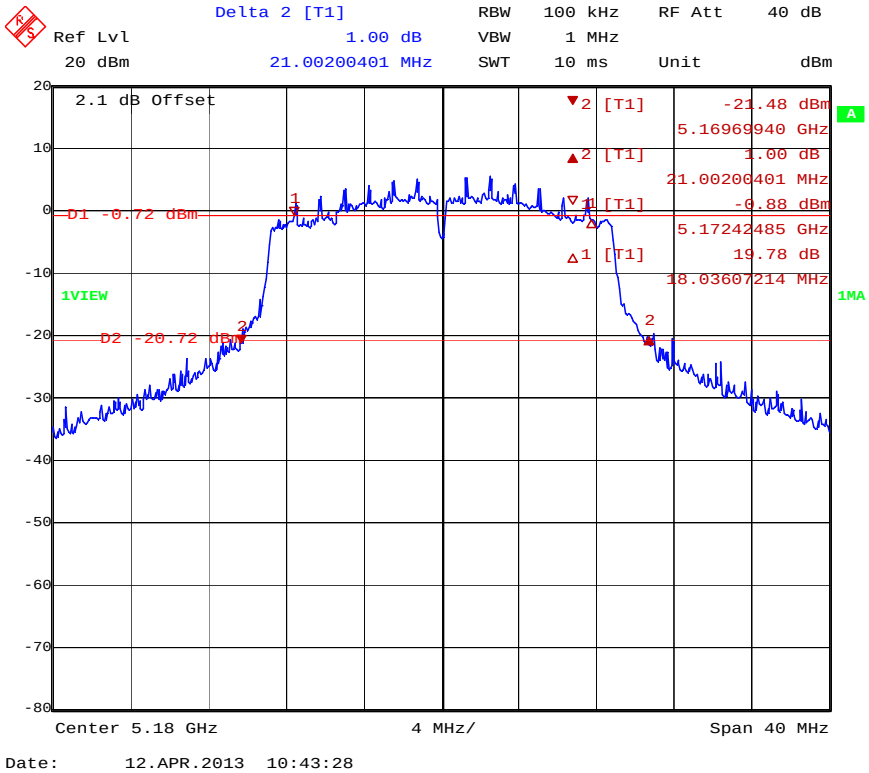
Bandwidth Plot (Channel 100) – 802.11a



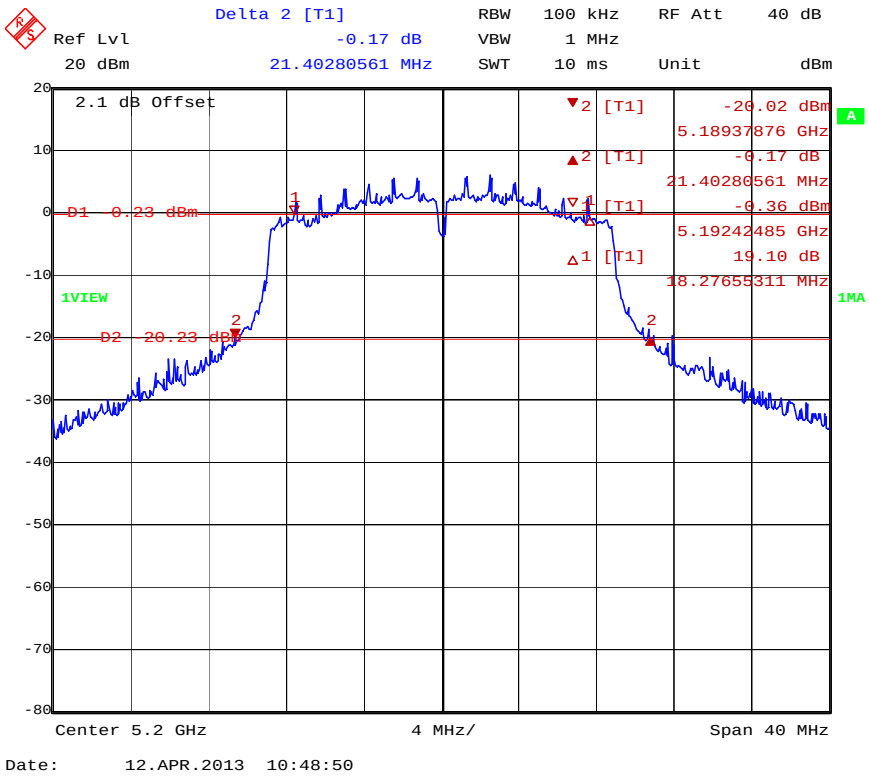
Bandwidth Plot (Channel 116) – 802.11a



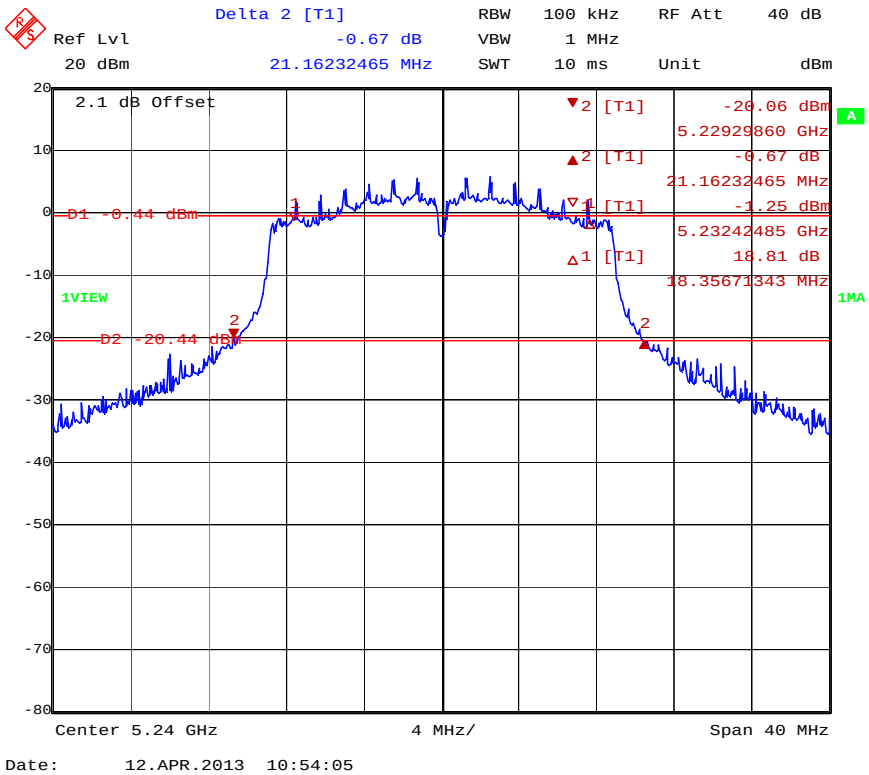
Bandwidth Plot (Channel 140) – 802.11a



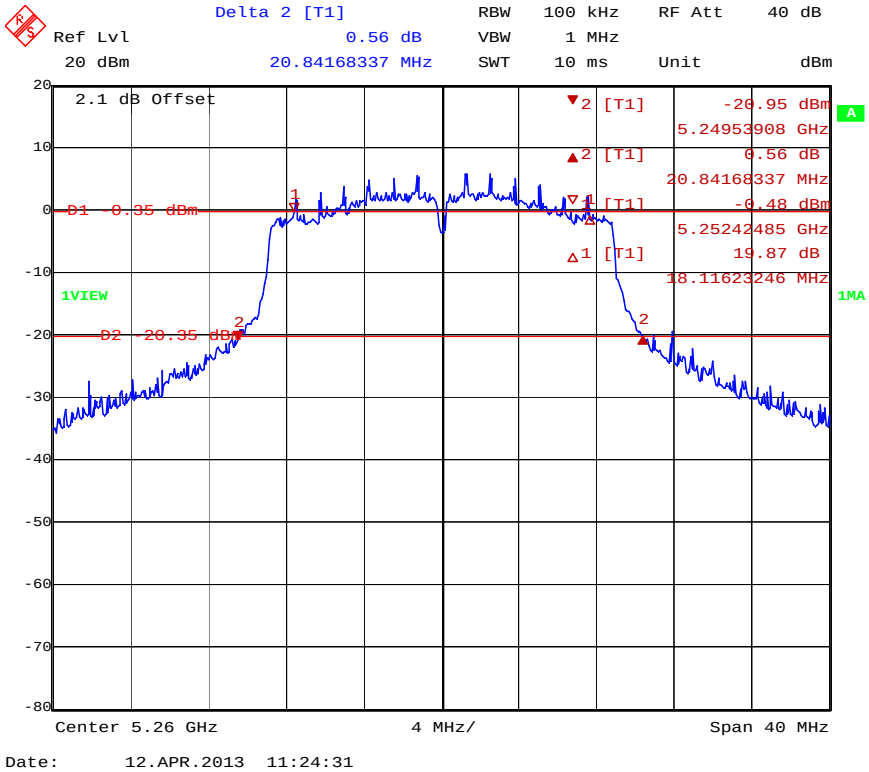
Bandwidth Plot (Channel 36) – 802.11n



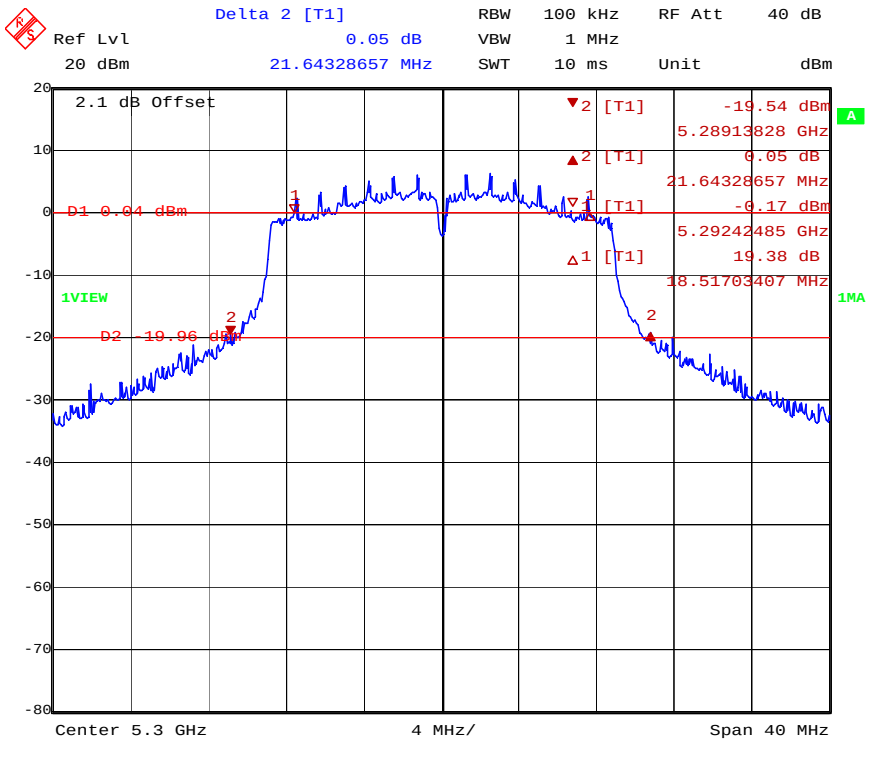
Bandwidth Plot (Channel 40) – 802.11n



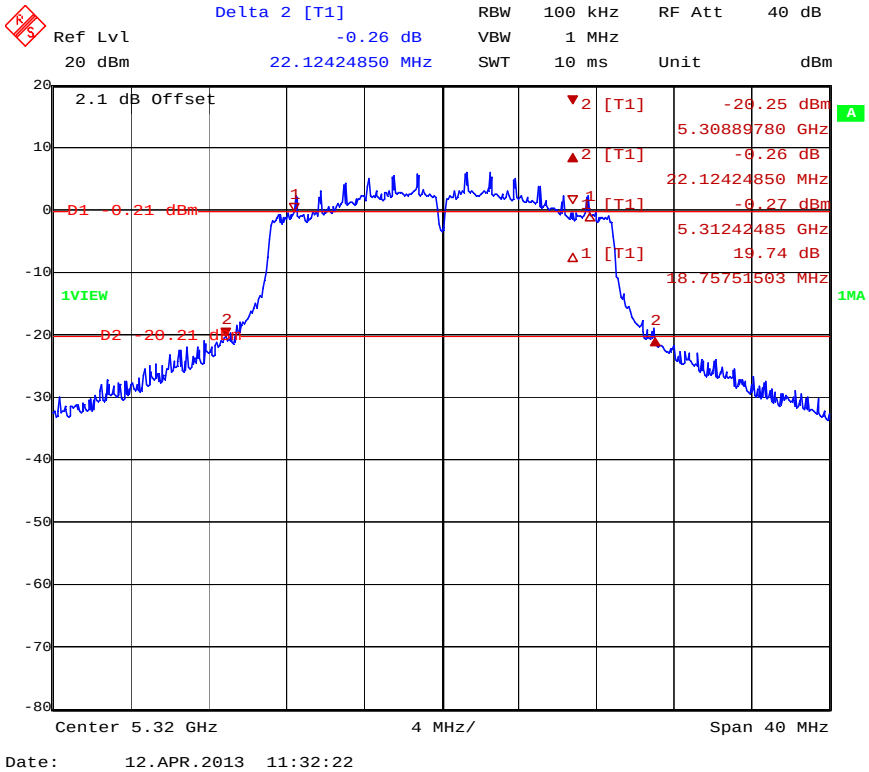
Bandwidth Plot (Channel 48) – 802.11n



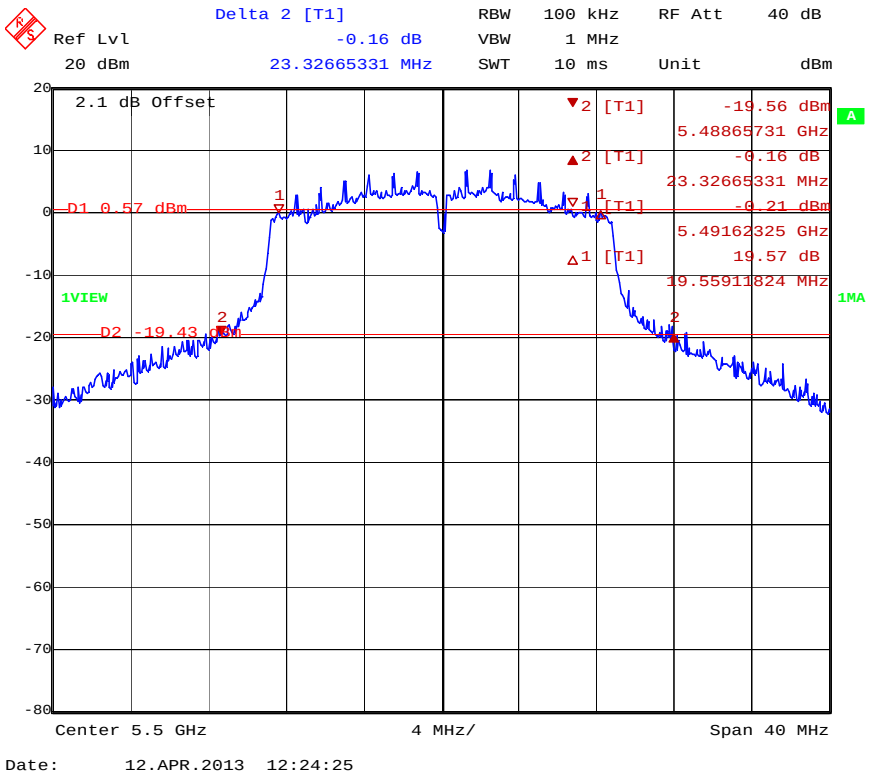
Bandwidth Plot (Channel 52) – 802.11n



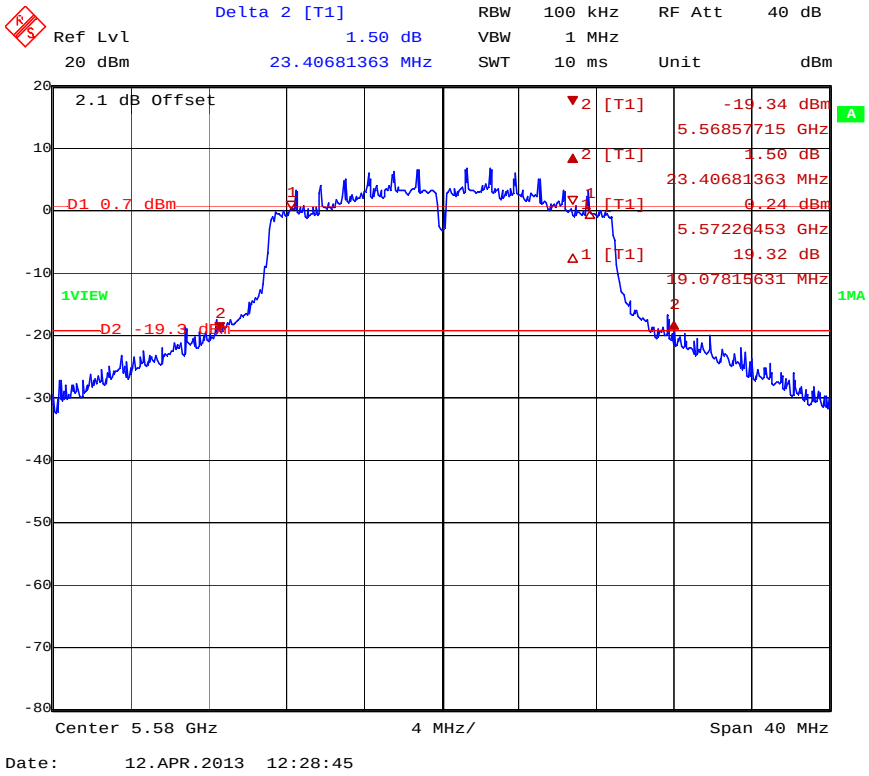
Bandwidth Plot (Channel 60) – 802.11n



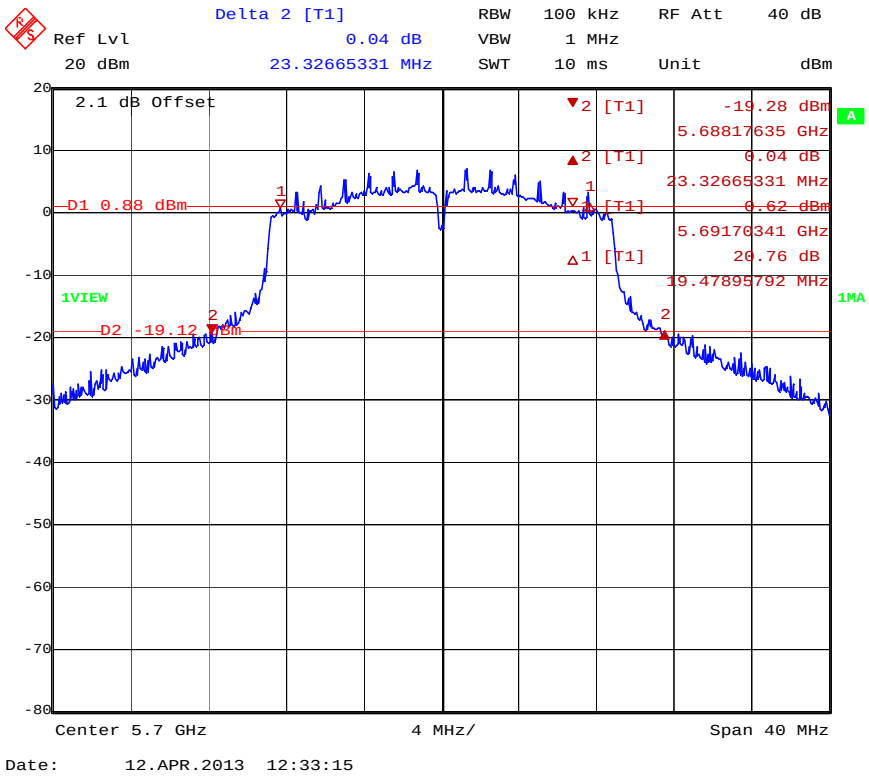
Bandwidth Plot (Channel 64) – 802.11n



Bandwidth Plot (Channel 100) – 802.11n



Bandwidth Plot (Channel 116) – 802.11n



Bandwidth Plot (Channel 140) – 802.11n

5 Peak Conducted Power

5.1 Test Limits

§ 15.407(a)

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) 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. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 789033 D01 v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

The maximum conducted output power was measured using method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)

5.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK30	11/26/2012	11/26/2013

5.4 Results:

The conducted output power measurements shown below are all below the following limits as applicable per frequency band:

5150 – 5250MHz Limit: 17dBm

5250 – 5350MHz Limit: 24dBm

5470 – 5725MHz Limit: 24dBm

Mode	Frequency (MHz)	Channel Number	Conducted Power (dBm) Data Rate (Mbps) 6	9	12	18	24	36	48	54
802.11a	5180	36	15.97	15.9	15.16	15.17	14.58	14.57	12.48	13.29
	5200	40	16.46	16.25	15.45	15.48	14.91	14.77	13.44	13.68
	5220	44	16.36	16.33	16.32	15.5	14.95	14.96	13.68	13.77
	5240	48	16.1	16.13	15.12	15.15	14.76	14.56	13.17	13.3
	5260	52	16.15	16.15	15.47	15.32	14.74	14.87	13.66	13.7
	5280	56	16.44	16.25	15.47	15.42	15	14.97	13.67	13.69
	5300	60	16.56	16.47	15.64	15.65	14.95	15.12	13.76	13.69
	5320	64	16.19	16.25	15.31	15.44	14.86	15.17	13.67	13.4
	5500	100	17.02	16.92	16.21	16.14	15.55	15.48	14.1	14.34
	5520	104	17.03	17.06	16.33	16.2	15.7	15.72	14.27	14.43
	5540	108	17.18	17.16	16.4	16.32	15.9	15.72	14.3	14.3
	5560	112	17.12	17.08	16.28	16.48	16.3	15.86	14.35	14.4
	5580	116	17.4	17.15	16.34	16.46	15.71	15.66	14.39	14.37
	5600	120	17.12	17.2	16.32	16.46	15.77	15.85	14.55	14.5
	5620	124	17.22	17.15	16.32	16.4	16.36	15.87	14.59	14.43
	5640	128	17.09	17.12	16.36	16.23	15.81	15.91	14.62	14.37
	5660	132	17.04	17.18	16.37	16.36	15.77	15.85	14.41	14.46
	5680	136	16.93	17.17	16.39	16.44	16.05	15.9	14.55	14.66
	5700	140	17.38	17.38	16.49	16.34	16.02	15.98	14.65	14.58

Mode	Frequency (MHz)	Channel Number	Conducted Power (dBm) MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n (HT-20)	5180	36	15.64	14.97	14.81	14.47	14.4	13.08	12.99	12.12
	5200	40	16.02	15.15	15.16	14.81	14.74	13.36	13.29	12.52
	5220	44	16.16	15.3	15.04	14.88	14.7	13.4	13.16	12.5
	5240	48	15.94	15.02	14.91	14.57	14.51	13.14	12.96	12.36
	5260	52	15.92	15.11	15.16	14.73	14.46	13.28	13.2	12.23
	5280	56	16.21	15.3	15.27	15.24	14.97	13.42	13.65	12.46
	5300	60	16.22	15.27	15.28	14.81	14.97	13.46	13.56	12.61
	5320	64	16.03	15.37	15.19	14.78	14.59	13.3	13.35	12.37
	5500	100	16.9	16.19	16.02	15.52	15.42	13.96	14	12.86
	5520	104	17.11	16.17	16.09	15.55	15.65	14.05	13.68	13.4
	5540	108	17.17	16.17	16.16	15.68	16.02	14.48	14.31	13.6
	5560	112	17.08	16.2	16.07	15.7	15.99	14.31	14.17	13.42
	5580	116	16.96	15.63	15.92	15.68	15.61	14.7	14.21	13.43
	5600	120	16.96	16.22	16.16	16	15.63	14.35	14.25	13.4
	5620	124	17.14	16.42	16.3	15.91	15.89	14.52	14.56	13.63
	5640	128	17.23	16.2	16.3	15.99	15.87	14.63	14.52	13.67
	5660	132	17.07	16.29	16.22	15.99	15.82	14.48	14.37	13.49
	5680	136	17.12	16.51	16.68	16.06	15.87	14.57	13.89	13.67
	5700	140	17.29	16.46	16.41	16.13	15.97	14.79	14.43	13.73

6 Power Spectral Density

6.1 Test Limits

§ 15.407(a)

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) 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. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 789033 D01 v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

The peak power spectral density was measured using method F and SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)

6.3 Test Equipment Used:

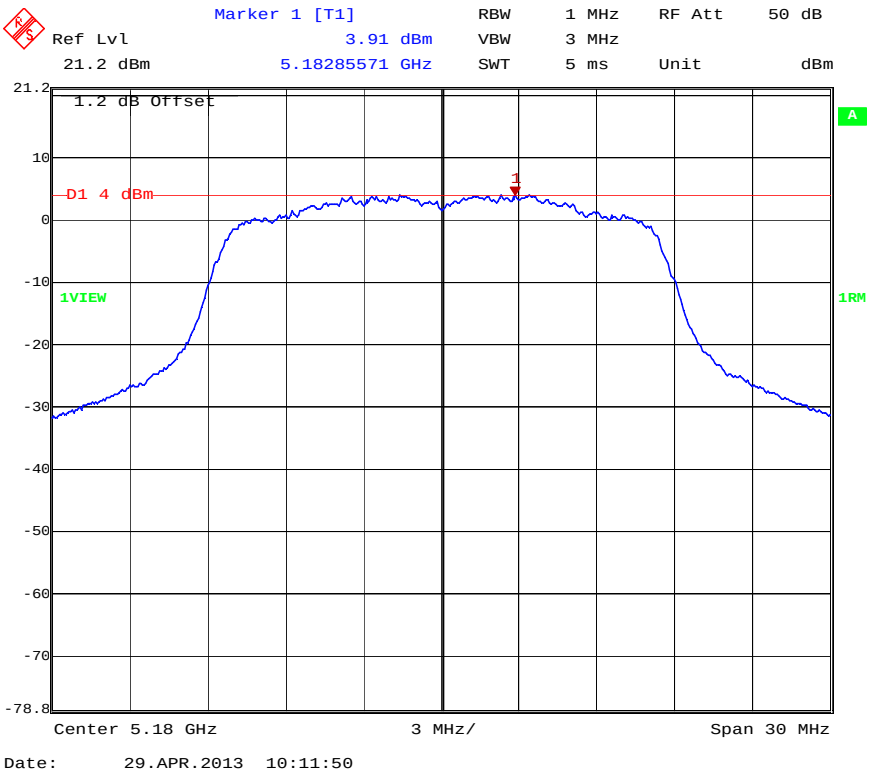
Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Receiver	3746R	Rohde&Schwarz	ESU40	2/13/2013	2/13/2014

6.4 Results:

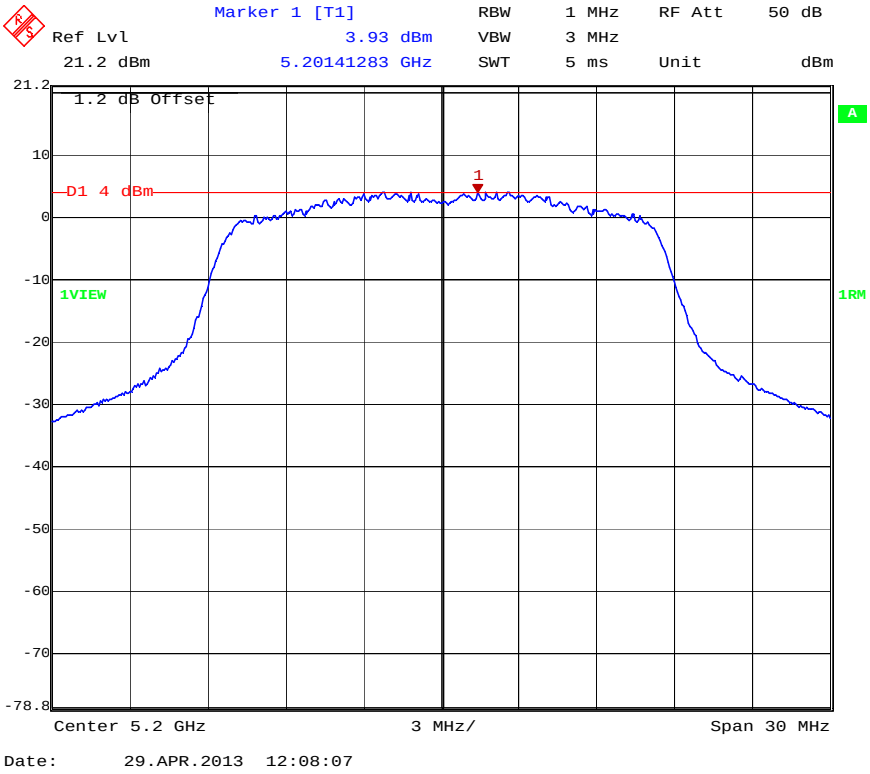
The peak power spectral density measurements all met the relevant limits for the given frequency bands.

Mode	Channel Number	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Result
5150 – 5250MHz Band					
802.11a	36	5180	3.91dBm	4dBm	Pass
802.11a	40	5200	3.93dBm	4dBm	Pass
802.11a	48	5240	3.63dBm	4dBm	Pass
802.11n (HT-20)	36	5180	3.31dBm	4dBm	Pass
802.11n (HT-20)	40	5200	3.60dBm	4dBm	Pass
802.11n (HT-20)	48	5240	2.87dBm	4dBm	Pass
5250 – 5350MHz Band					
802.11a	52	5260	5.64dBm	11dBm	Pass
802.11a	60	5300	5.84dBm	11dBm	Pass
802.11a	64	5320	5.90dBm	11dBm	Pass
802.11n (HT-20)	52	5260	5.27dBm	11dBm	Pass
802.11n (HT-20)	60	5300	5.39dBm	11dBm	Pass
802.11n (HT-20)	64	5320	5.5dBm	11dBm	Pass
5470 – 5725MHz Band					
802.11a	100	5500	6.54dBm	11dBm	Pass
802.11a	116	5580	6.92dBm	11dBm	Pass
802.11a	140	5700	6.66dBm	11dBm	Pass
802.11n (HT-20)	100	5500	6.27dBm	11dBm	Pass
802.11n (HT-20)	116	5580	6.66dBm	11dBm	Pass
802.11n (HT-20)	140	5700	6.43dBm	11dBm	Pass

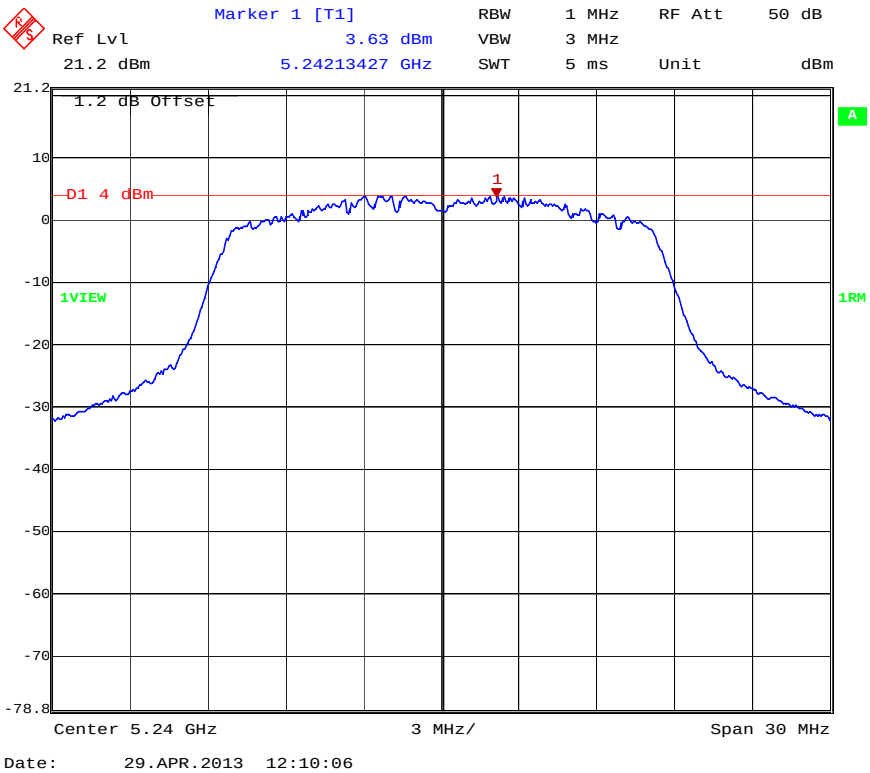
*PSD SA-1 Method



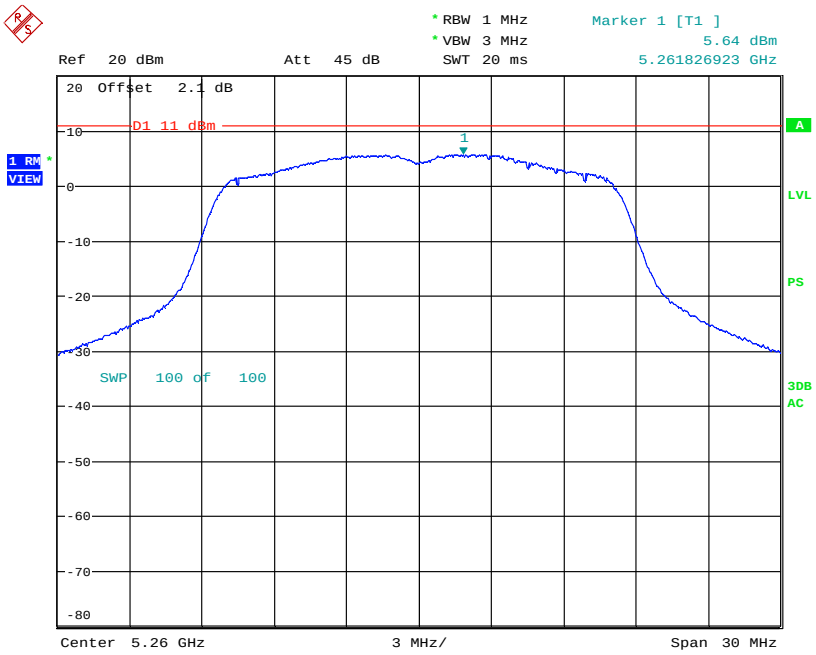
Power Spectral Density (Channel 36) 802.11a



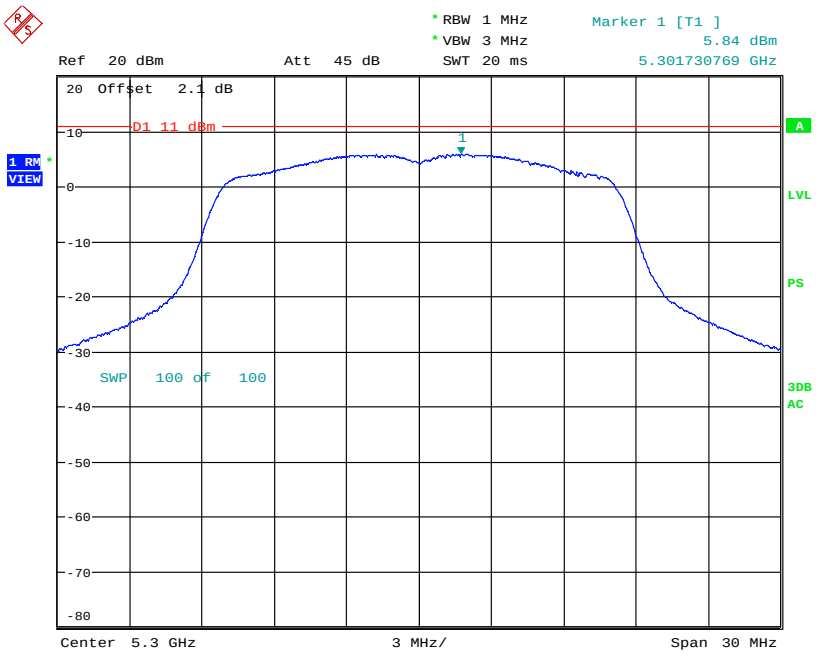
Power Spectral Density (Channel 40) 802.11a



Power Spectral Density (Channel 48) 802.11a



Power Spectral Density (Channel 52) 802.11a



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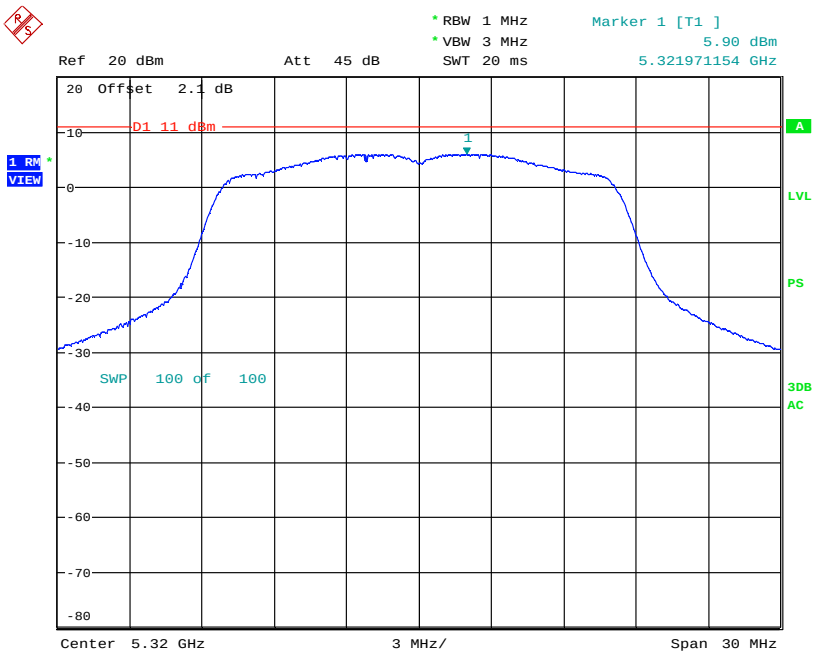
Power Spectral Density (Channel 60) 802.11a



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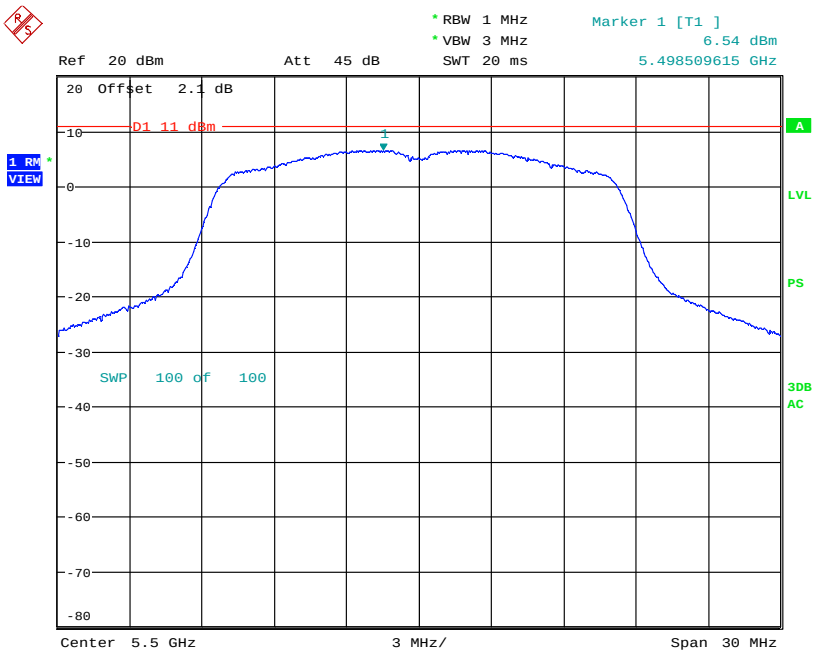
Power Spectral Density (Channel 64) 802.11a



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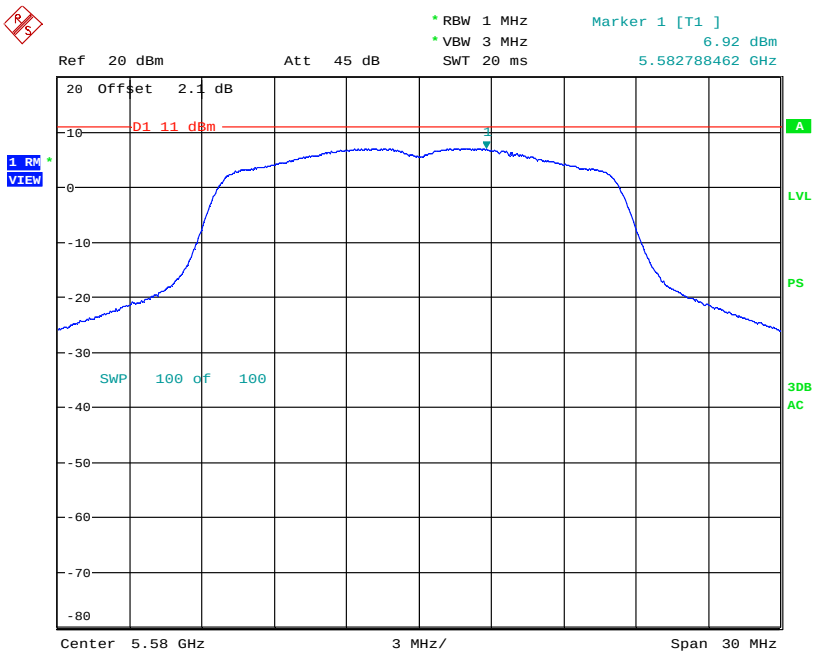
Power Spectral Density (Channel 100) 802.11a



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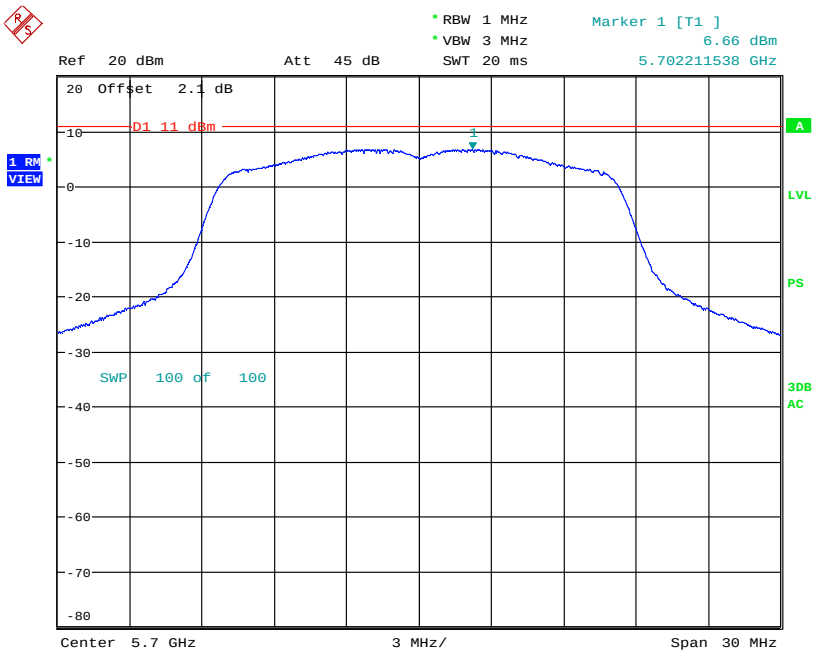
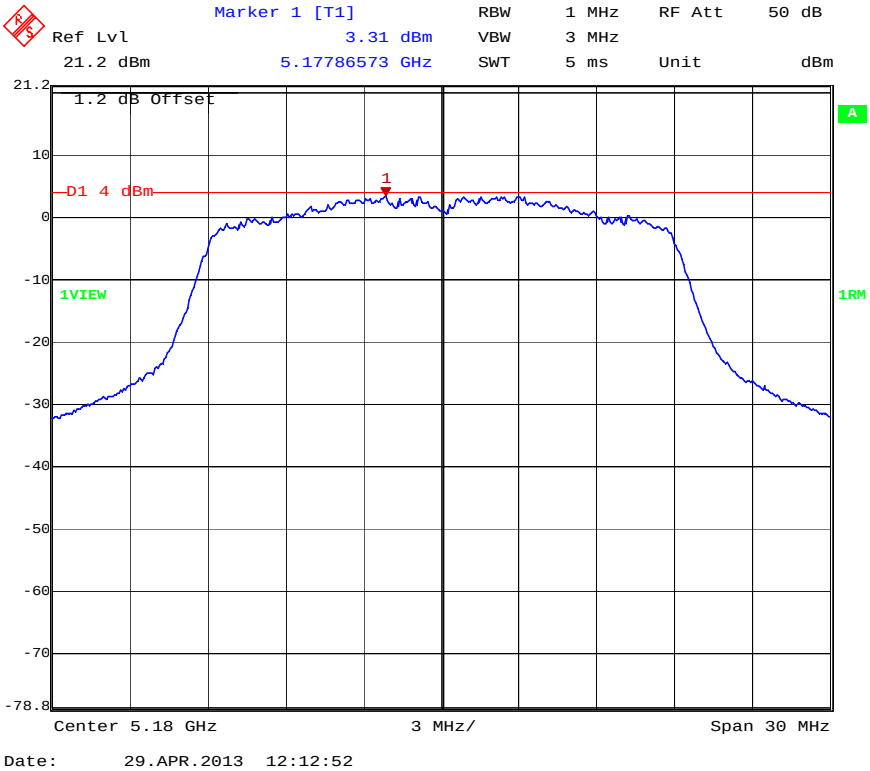
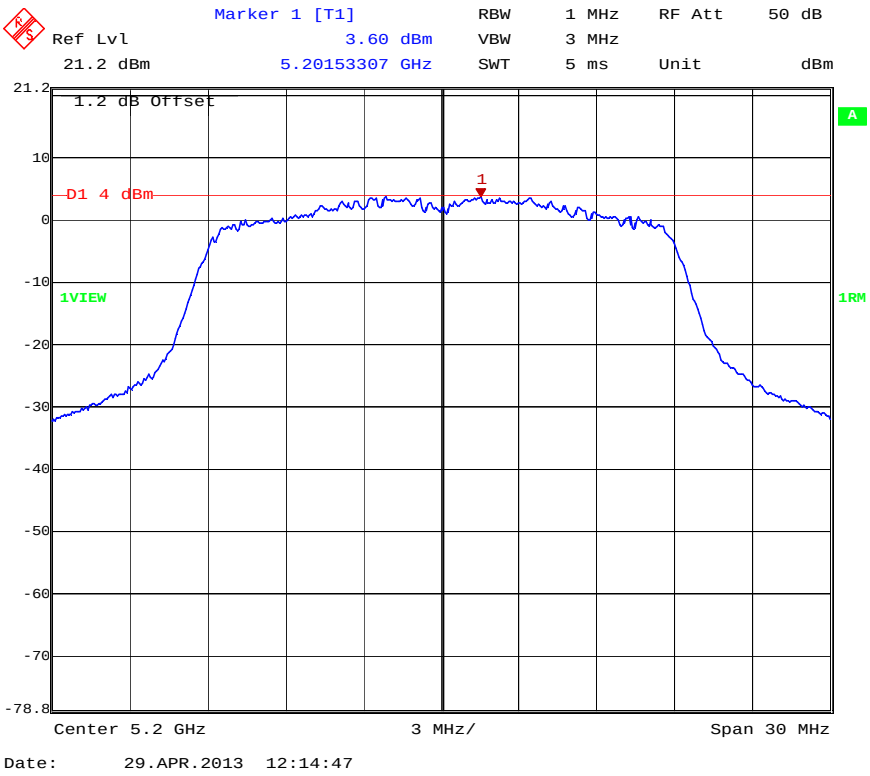
Power Spectral Density (Channel 116) 802.11a



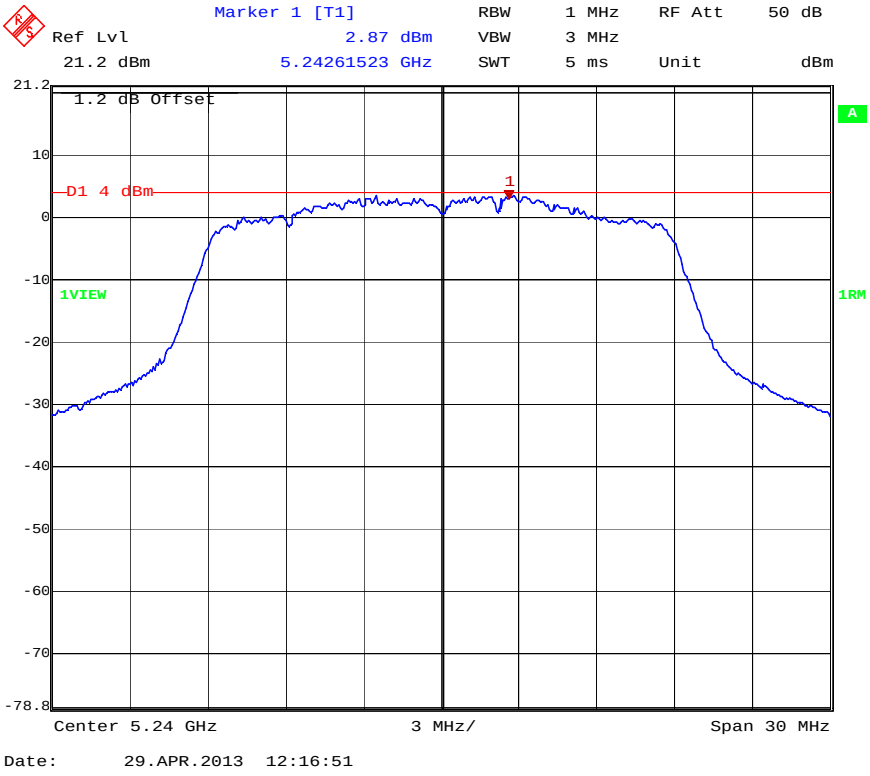
Power Spectral Density (Channel 140) 802.11a



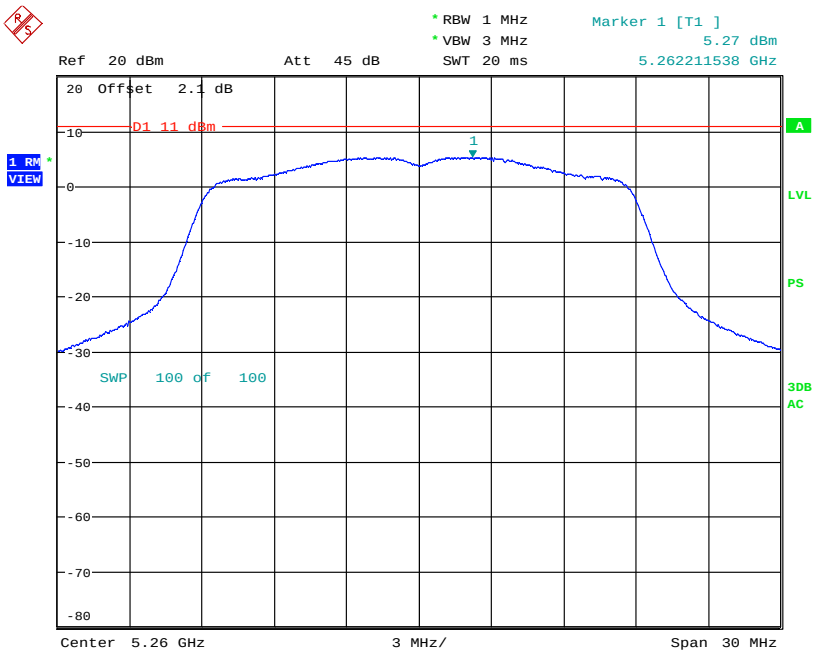
Power Spectral Density (Channel 36) 802.11n



Power Spectral Density (Channel 40) 802.11n



Power Spectral Density (Channel 48) 802.11n



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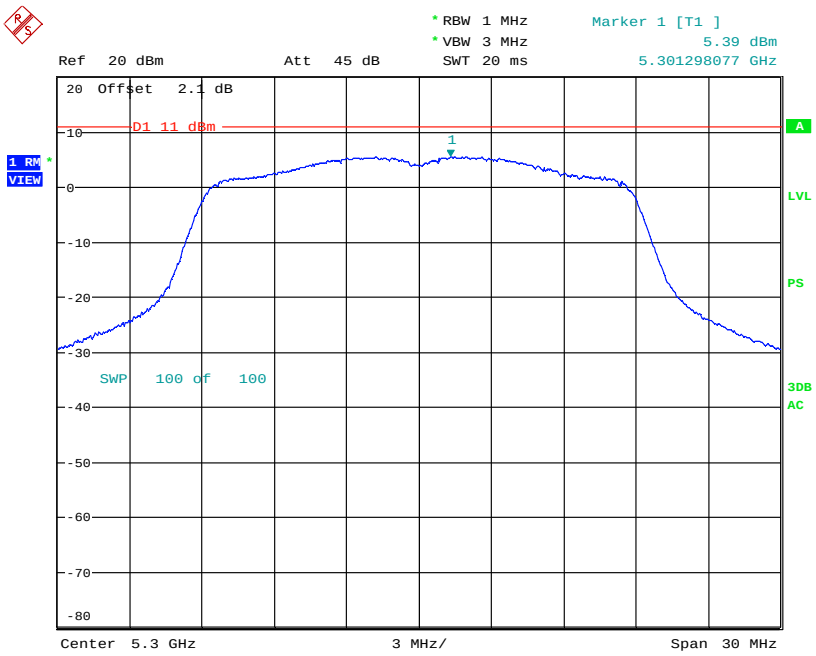
Power Spectral Density (Channel 52) 802.11n



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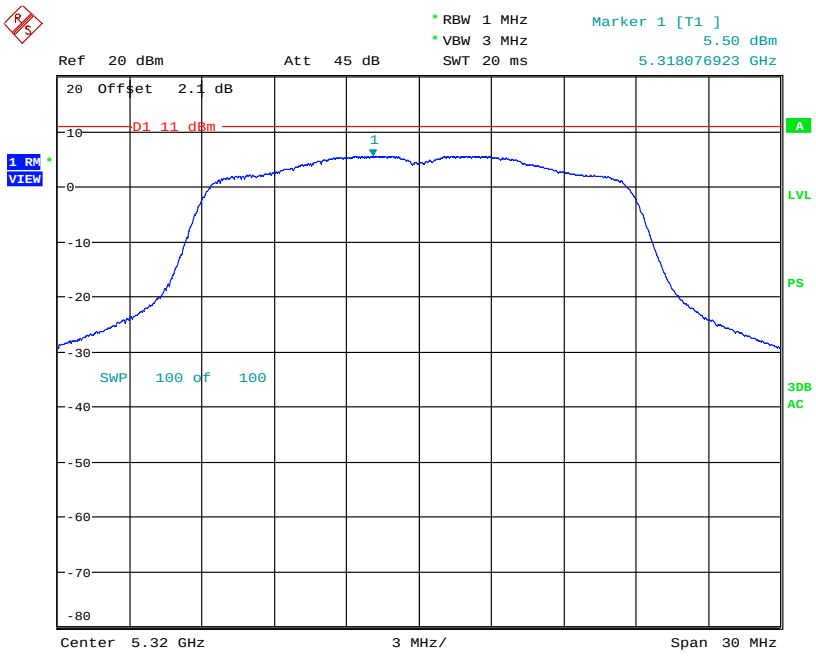
Power Spectral Density (Channel 60) 802.11n



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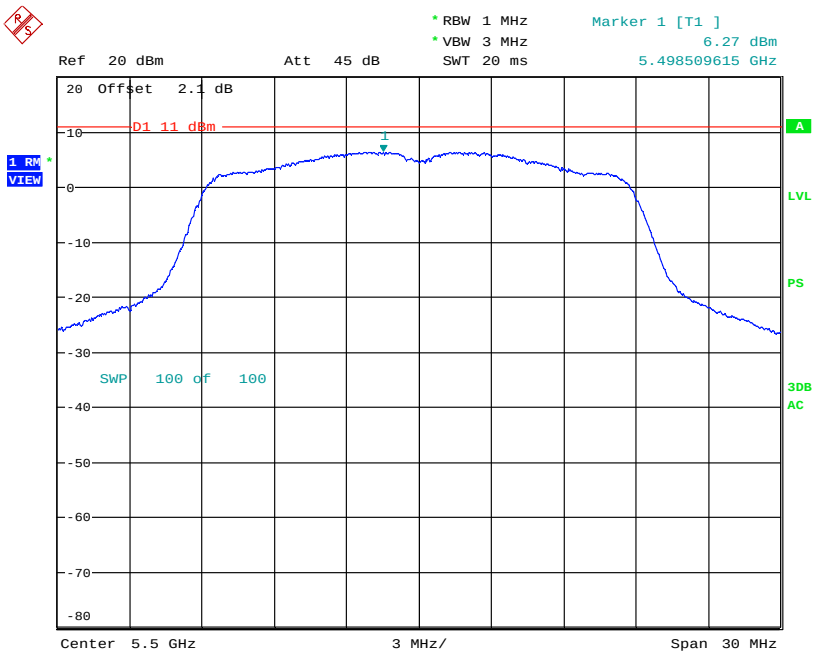
Power Spectral Density (Channel 64) 802.11n



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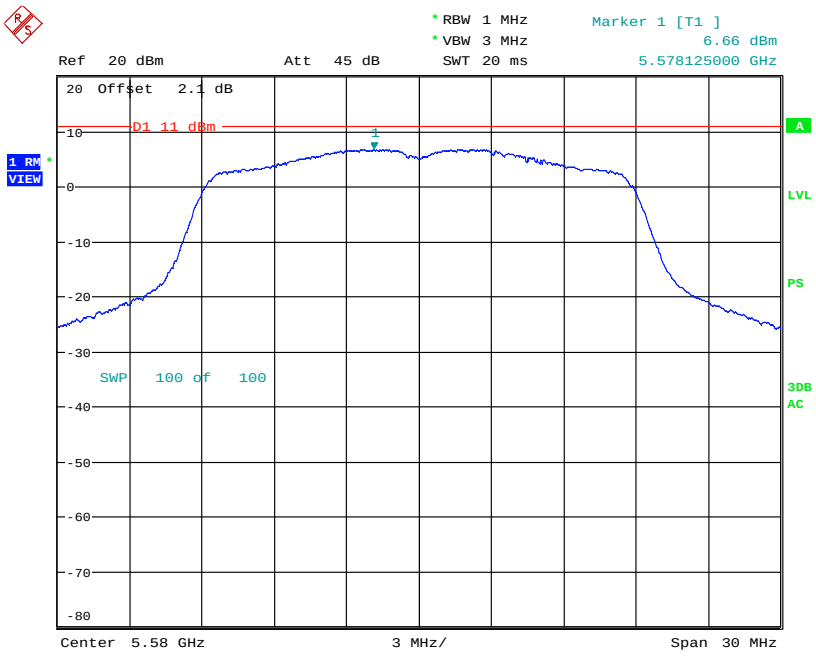
Power Spectral Density (Channel 100) 802.11n



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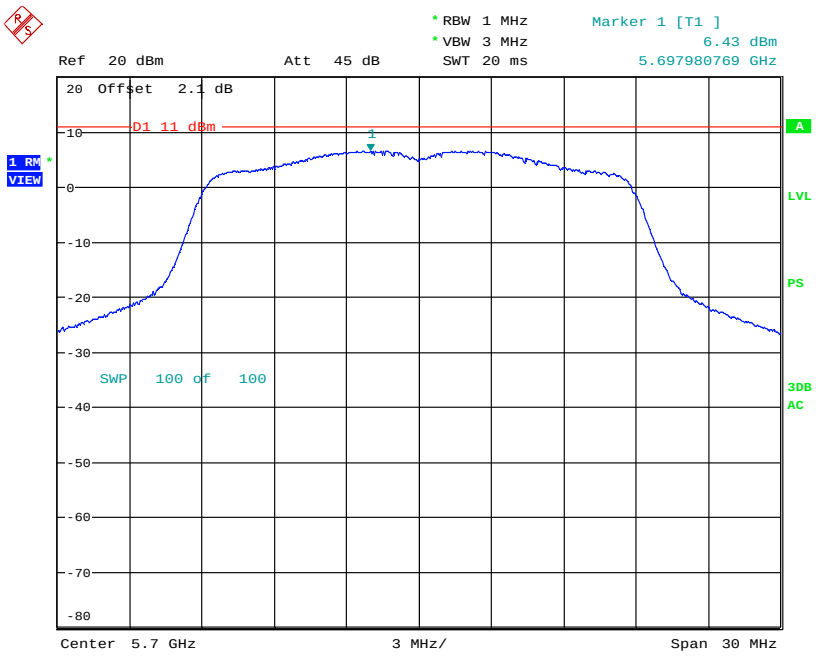
Power Spectral Density (Channel 116) 802.11n



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Power Spectral Density (Channel 140) 802.11n

7 Peak Excursion Measurements

7.1 Test Limits

§ 15.407(a)

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

7.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 789033 D01 v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

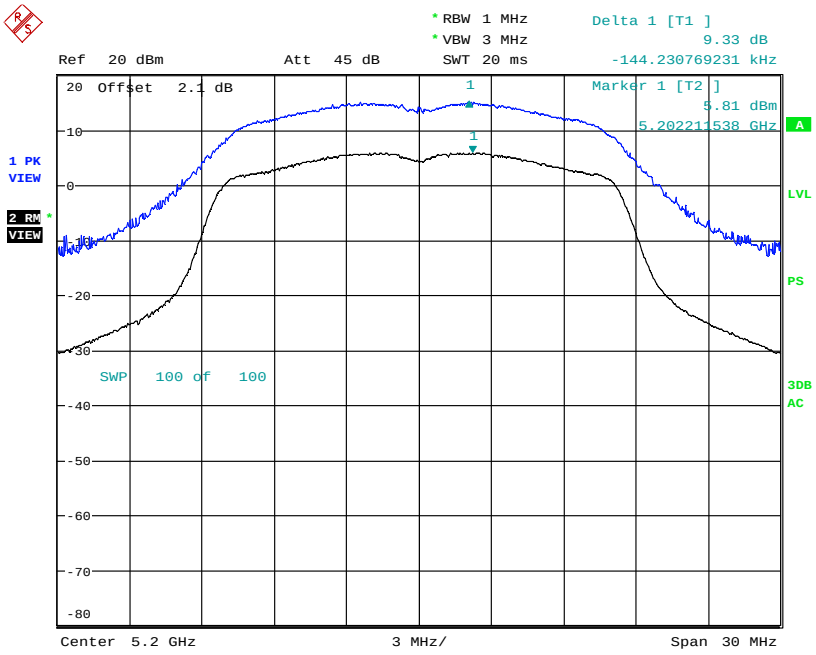
7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Receiver	3746R	Rohde&Schwarz	FSP40	2/13/2013	2/13/2014

7.4 Results:

The following data shows that the peak excursion meets the 13dB limit. The guidance for limiting the number of tests per KDB 789033 D01 v01r03 was followed. Peak excursion measurements were limited to the middle channel of each band in each mode.

Mode	Channel Number	Frequency (MHz)	Peak Excursion Measurement (dB)	Limit (dB)	Result
5150 – 5250MHz Band					
802.11a	40	5200	9.33dB	13dB	Pass
802.11n (HT-20)	40	5200	9.14dB	13dB	Pass
5250 – 5350MHz Band					
802.11a	60	5300	9.21dB	13dB	Pass
802.11n (HT-20)	60	5300	9.01dB	13dB	Pass
5470 – 5725MHz Band					
802.11a	116	5580	9.05dB	13dB	Pass
802.11n (HT-20)	116	5580	9.08dB	13dB	Pass



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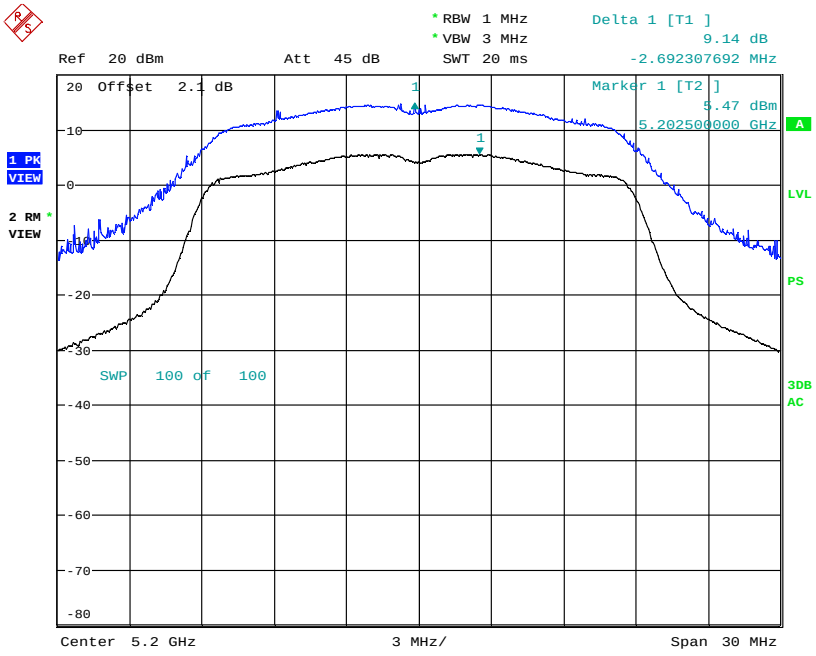
Peak Excursion (Channel 40) 802.11a



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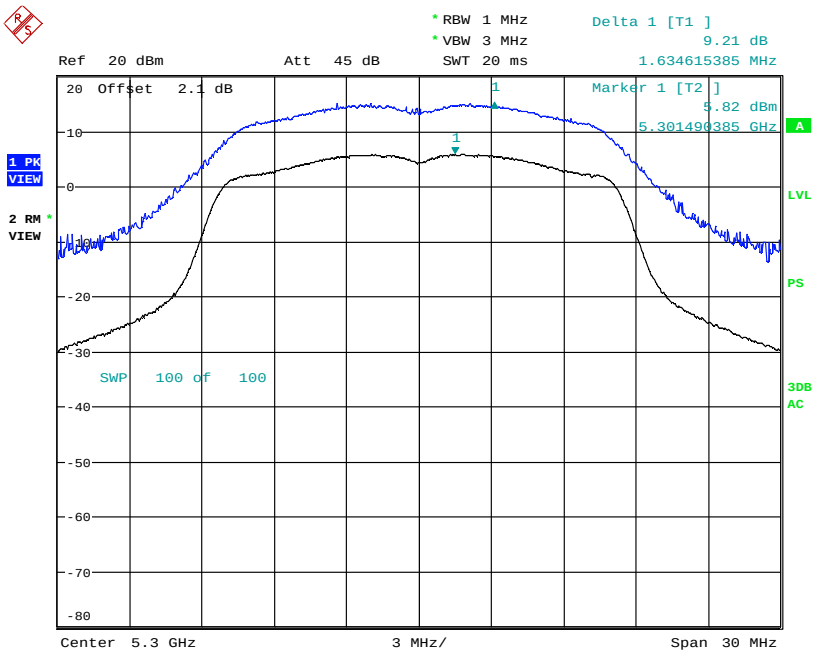
Peak Excursion (Channel 40) 802.11n



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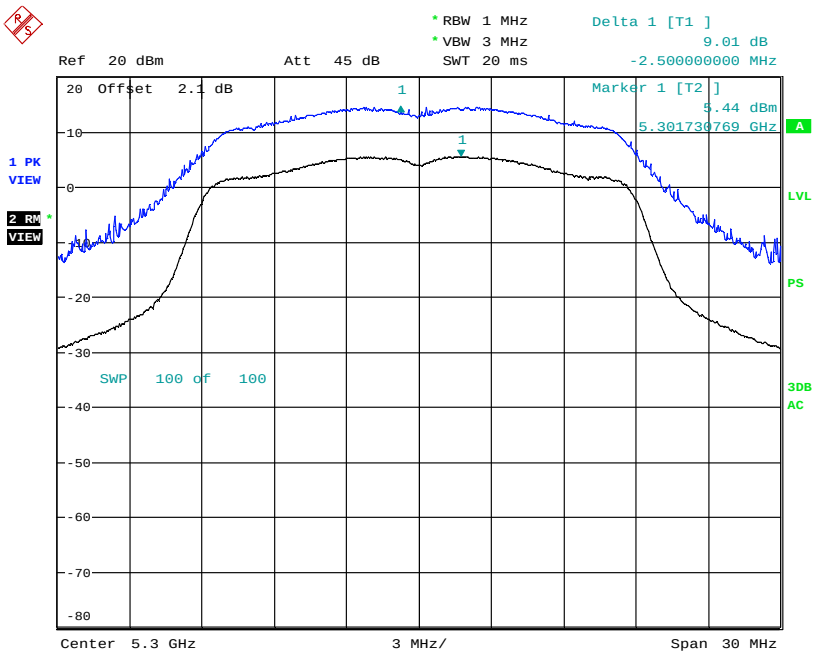
Peak Excursion (Channel 60) 802.11a



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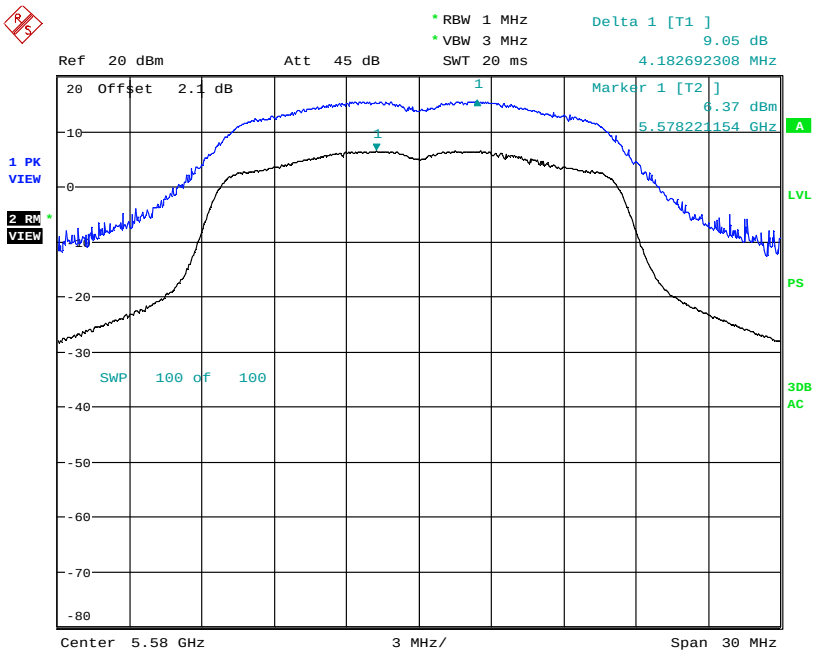
Peak Excursion (Channel 60) 802.11n



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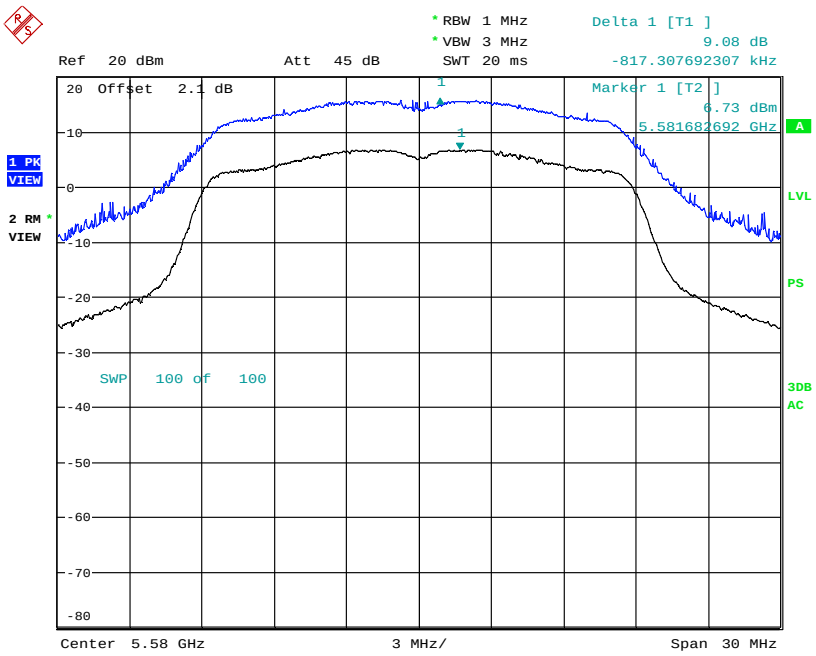
Peak Excursion (Channel 116) 802.11a



Date: 13.APR.2013 00:11:59

Peak Excursion (Channel 116) 802.11n

8 Radiated Spurious Emissions (Transmitter)

8.1 Test Limits

§ 15.407(b):

(b) *Undesirable emission limits:* Except as shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(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 EIRP of -27 dBm/MHz.

(2) 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 EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(3) 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 EIRP of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.

(7) The provisions of § 15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits

Part 15.205(a): Restricted Bands of Operations

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	[2]
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

Part 15.209(a): Field Strength Limits for Restricted Bands of Operation

Frequency (MHz)	Field Strength (microvolts/meter)	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

8.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 789033 D01 v01r03: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E.

8.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:
FS = RA + AF + CF

FS = Field Strength in dBμV/m
RA = Receiver Amplitude in dBμV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBμV/m
Level in μV/m = Common Antilogarithm [(38.78 dBμV/m)/20] = 86.89 μV/m

8.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	987410	Miteq	AFS44-00102000-30-10P-44	9/4/2012	9/4/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
Horn Antenna	6556	ETS	3115	9/13/2012	9/13/2013
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required
High Pass Filter	3986-01 DC0408	Microwave Circuits, Inc.	H3G020G2	Calibrate at Time Of Use	Calibrate at Time Of Use
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK30	11/26/2012	11/26/2013
High Pass Filter	0623	RLC Electronics	F-40-10.0R	Calibrate at Time Of Use	Calibrate at Time Of Use
Horn Antenna	9310-2222	ETS	3116	7/17/2012	7/17/2013
Preamplifier	965178	Miteq	JS418004000	7/24/2012	7/24/2013
Preamplifier	818179	Miteq	JS418004000	7/24/2012	7/24/2013

8.5 Results:

All spurious emissions were attenuated below the -27dBm/MHz (equivalent to 68.3dBuV/m at 3m when measured with a 1MHz RBW). Additionally, all emissions falling within restricted bands of operation and at the band edges were found to be below the limit specified in Part 15.209(a). The spurious emissions listed in the following tables are the worst case emissions. Emissions not reported were at or below the measurement noise floor. The test sample was evaluated on three orthogonal axes since it was a hand held device and could be used in any orientation.

Worst Case Spurious Measurements (5150MHz – 5250MHz)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
36 (5180MHz)	10.36 GHz	V	45.65	37.76	74 / 68.3	54	**Compliant**	802.11a
	15.54 GHz	V	45.727	36.087	74 / 68.3	54	**Compliant**	802.11a
	10.36 GHz	H	45.4	35.91	74 / 68.3	54	**Compliant**	802.11a
	15.54 GHz	H	46.497	36.127	74 / 68.3	54	**Compliant**	802.11a
40 (5200MHz)	10.4 GHz	V	45.762	35.692	74 / 68.3	54	**Compliant**	802.11a
	15.6 GHz	V	45.31	36.02	74 / 68.3	54	**Compliant**	802.11a
	10.4 GHz	H	45.762	36.292	74 / 68.3	54	**Compliant**	802.11a
	15.6 GHz	H	45.82	36.02	74 / 68.3	54	**Compliant**	802.11a
48 (5240MHz)	10.48 GHz	V	46.732	36.192	74 / 68.3	54	**Compliant**	802.11a
	15.72 GHz	V	44.915	36.155	74 / 68.3	54	**Compliant**	802.11a
	10.48 GHz	H	47.372	36.802	74 / 68.3	54	**Compliant**	802.11a
	15.72 GHz	H	45.295	36.215	74 / 68.3	54	**Compliant**	802.11a

802.11a mode

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
36 (5180MHz)	10.36 GHz	V	45.78	37.62	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.54 GHz	V	45.227	36.107	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.36 GHz	H	47.85	36.77	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.54 GHz	H	45.107	36.167	74 / 68.3	54	**Compliant**	802.11n (HT-20)
40 (5200MHz)	10.4 GHz	V	45.262	35.452	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.6 GHz	V	46.2	36.05	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.4 GHz	H	45.512	35.992	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.6 GHz	H	45.44	36.1	74 / 68.3	54	**Compliant**	802.11n (HT-20)
48 (5240MHz)	10.48 GHz	V	48.132	36.282	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.72 GHz	V	46.295	36.165	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.48 GHz	H	47.372	36.802	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.72 GHz	H	45.295	36.215	74 / 68.3	54	**Compliant**	802.11n (HT-20)

802.11n mode

Worst Case Spurious Measurements (5250MHz – 5350MHz)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
52 (5260MHz)	10.52 GHz	V	47.112	36.772	74 / 68.3	54	**Compliant**	802.11a
	15.78 GHz	V	46.448	36.918	74 / 68.3	54	**Compliant**	802.11a
	10.52 GHz	H	47.372	37.272	74 / 68.3	54	**Compliant**	802.11a
	15.78 GHz	H	45.198	36.918	74 / 68.3	54	**Compliant**	802.11a
60 (5300MHz)	10.6 GHz	V	45.526	37.226	74 / 68.3	54	**Compliant**	802.11a
	15.9 GHz	V	45.495	36.545	74 / 68.3	54	**Compliant**	802.11a
	10.6 GHz	H	46.416	37.596	74 / 68.3	54	**Compliant**	802.11a
	15.9 GHz	H	45.495	36.555	74 / 68.3	54	**Compliant**	802.11a
64 (5320MHz)	10.64 GHz	V	46.764	36.794	74 / 68.3	54	**Compliant**	802.11a
	15.96 GHz	V	45.404	36.124	74 / 68.3	54	**Compliant**	802.11a
	10.64 GHz	H	47.014	36.794	74 / 68.3	54	**Compliant**	802.11a
	15.96 GHz	H	46.664	36.174	74 / 68.3	54	**Compliant**	802.11a

802.11a mode

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
52 (5260MHz)	10.52 GHz	V	46.232	36.882	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.78 GHz	V	46.328	36.848	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.52 GHz	H	47.752	37.232	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.78 GHz	H	45.578	36.918	74 / 68.3	54	**Compliant**	802.11n (HT-20)
60 (5300MHz)	10.6 GHz	V	47.046	37.266	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.9 GHz	V	47.395	36.535	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.6 GHz	H	46.416	37.566	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.9 GHz	H	46.245	36.571	74 / 68.3	54	**Compliant**	802.11n (HT-20)
64 (5320MHz)	10.64 GHz	V	45.234	36.794	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.96 GHz	V	45.654	36.134	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	10.64 GHz	H	47.654	36.794	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	15.96 GHz	H	45.904	36.194	74 / 68.3	54	**Compliant**	802.11n (HT-20)

802.11n mode

Worst Case Spurious Measurements (5470MHz – 5725MHz)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
100 (5500MHz)	11.0 GHz	V	46.234	36.824	74 / 68.3	54	**Compliant**	802.11a
	16.5 GHz	V	49.008	37.868	74 / 68.3	54	**Compliant**	802.11a
	11.0 GHz	H	46.354	36.244	74 / 68.3	54	**Compliant**	802.11a
	16.5 GHz	H	46.178	37.788	74 / 68.3	54	**Compliant**	802.11a
116 (5580MHz)	11.16 GHz	V	47.285	37.385	74 / 68.3	54	**Compliant**	802.11a
	16.74 GHz	V	49.935	39.775	74 / 68.3	54	**Compliant**	802.11a
	11.16 GHz	H	46.015	37.135	74 / 68.3	54	**Compliant**	802.11a
	16.74 GHz	H	48.045	39.355	74 / 68.3	54	**Compliant**	802.11a
140 (5700MHz)	11.4 GHz	V	46.043	37.943	74 / 68.3	54	**Compliant**	802.11a
	17.1 GHz	V	53.244	42.384	74 / 68.3	54	**Compliant**	802.11a
	11.4 GHz	H	46.933	36.783	74 / 68.3	54	**Compliant**	802.11a
	17.1 GHz	H	52.484	41.354	74 / 68.3	54	**Compliant**	802.11a

802.11a mode

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
100 (5500MHz)	11.0 GHz	V	46.484	36.784	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	16.5 GHz	V	47.227	37.857	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	11.0 GHz	H	46.104	36.394	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	16.5 GHz	H	47.869	37.789	74 / 68.3	54	**Compliant**	802.11n (HT-20)
116 (5580MHz)	11.16 GHz	V	46.145	37.435	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	16.74 GHz	V	48.295	39.785	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	11.16 GHz	H	47.155	37.195	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	16.74 GHz	H	48.685	39.335	74 / 68.3	54	**Compliant**	802.11n (HT-20)
140 (5700MHz)	11.4 GHz	V	47.313	37.993	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	17.1 GHz	V	51.094	42.444	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	11.4 GHz	H	46.933	36.833	74 / 68.3	54	**Compliant**	802.11n (HT-20)
	17.1 GHz	H	52.484	41.354	74 / 68.3	54	**Compliant**	802.11n (HT-20)

802.11n mode

Worst Case Spurious Measurements (Low and High Restricted Band Edges)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
Ch 36 (5180MHz)	5.15 GHz	V	59.598	49.948	74 / 68.3	54	**Compliant**	802.11a
	5.15 GHz	H	59.187	49.557	74 / 68.3	54	**Compliant**	802.11a
	5.15 GHz	V	58.237	49.857	74 / 68.3	54	**Compliant**	802.11n (20MHz)
	5.15 GHz	H	59.328	49.448	74 / 68.3	54	**Compliant**	802.11n (20MHz)
Ch 100 (5500MHz)	5.46 GHz	V	59.261	51.481	74 / 68.3	54	**Compliant**	802.11a
	5.46 GHz	H	61.162	51.412	74 / 68.3	54	**Compliant**	802.11a
	5.46 GHz	V	61.701	51.421	74 / 68.3	54	**Compliant**	802.11n (20MHz)
	5.46 GHz	H	61.842	51.422	74 / 68.3	54	**Compliant**	802.11n (20MHz)

Low Restricted Band Edge Measurements

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
Ch 64 (5320MHz)	5.35 GHz	V	60.776	50.826	74 / 68.3	54	**Compliant**	802.11a
	5.35 GHz	H	59.286	50.706	74 / 68.3	54	**Compliant**	802.11a
	5.35 GHz	V	60.906	50.866	74 / 68.3	54	**Compliant**	802.11n (20MHz)
	5.35 GHz	H	59.966	50.706	74 / 68.3	54	**Compliant**	802.11n (20MHz)
Ch 140 (5700MHz)	7.25GHz	V	66.3	53.96	74 / 68.3	54	**Compliant**	802.11a
	7.25GHz	H	66.2	53.87	74 / 68.3	54	**Compliant**	802.11a
	7.25GHz	V	66.26	53.88	74 / 68.3	54	**Compliant**	802.11n (20MHz)
	7.25GHz	H	66.1	53.79	74 / 68.3	54	**Compliant**	802.11n (20MHz)

Upper Restricted Band Edge Measurements

9 Frequency Stability

9.1 Test Limits

§ 15.407(g)
(g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

9.2 Test Procedure

The test sample was placed in an environmental chamber, connected directly to a spectrum analyzer (in frequency count mode), and configured to transmit at each center frequency under investigation. The environmental chamber was set to the low extreme, normal, then high extreme temperatures and the frequency was read from the analyzer. The test sample was allowed to stabilize at each temperature point. At nominal temperature the input voltage was varied from minimum to maximum and any change in frequency noted.

9.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	2/13/2013	2/13/2014
Temperature Chamber	2149	Thermotron	SE-1000-5-5	Time of Use	Time of Use
Digital Multimeter	1706	Fluke	87	12/12/2012	12/12/2013
Thermocouple Temperature Sensor	3183	Fluke	53II	4/4/2013	4/4/2014

9.4 Results:

The frequency stability measurements indicate that the emissions are maintained within the band of operation under all conditions of normal operation as specified in the users manual.

Operating Freqeuncy: 5,180,000,000 Hz
Channel: 36
Deviation Limit: 20 ppm
Notes: RBW = 300Hz

Temp (℃)	Measured Freq (Hz)	Freq Error (ppm)
-23	5180015600	3.0115830
20	5179971800	-5.4440154
60	5180030000	5.7915058

Operating Freqeuncy: 5,300,000,000 Hz
Channel: 60
Deviation Limit: 20 ppm
Notes: RBW = 300Hz

Temp (℃)	Measured Freq (Hz)	Freq Error (ppm)
-23	5299990800	-1.7358491
20	5299998200	-0.3396226
60	5300002800	0.5283019

Operating Freqeuncy: 5,500,000,000 Hz
Channel: 100
Deviation Limit: 20 ppm
Notes: RBW = 300Hz

Temp (℃)	Measured Freq (Hz)	Freq Error (ppm)
-23	5500016400	2.9818182
20	5499989600	-1.8909091
60	5500004000	0.7272727

Operating Freqeuncy: 5,560,000,000 Hz
Channel: 112
Deviation Limit: 20 ppm
Notes: RBW = 300Hz

Temp (℃)	Measured Freq (Hz)	Freq Error (ppm)
-23	5560010800	1.9424460
20	5559975600	-4.3884892
60	5560004400	0.7913669

10 Radiated Spurious Emissions (Receiver)

10.1 Test Limits

§ 15.109: Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBuV/m)
30–88	100	40
88–216	150	43.5
216–960	200	46
Above 960	500	54

These limits are identical to those in RSS-GEN

10.2 Test Procedure

ANSI C63.4: 2009

10.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:
FS = RA + AF + CF

FS = Field Strength in dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBµV
AF = 18.52 dB
CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dBµV/m
Level in µV/m = Common Antilogarithm [(38.78 dBµV/m)/20] = 86.89 µV/m

10.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
Horn Antenna	6556	ETS	3115	9/13/2012	9/13/2013
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

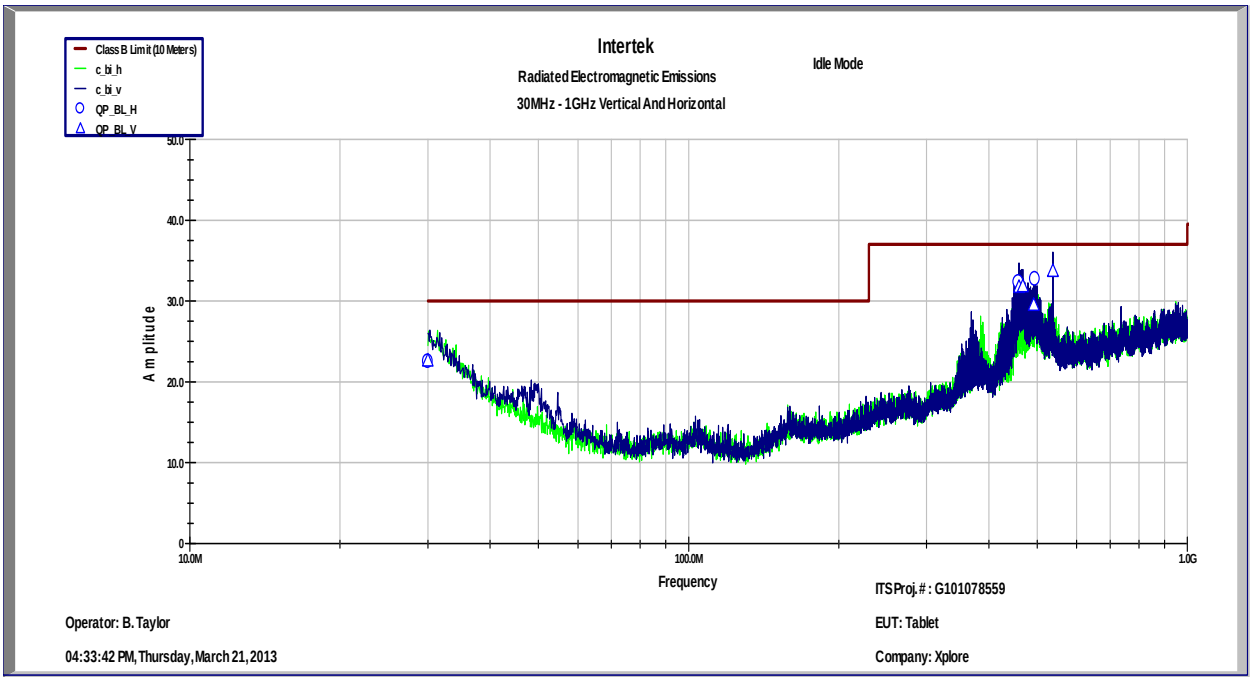
10.5 Results:

All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.109 for a class B digital device and RSS-GEN Section 6.1.

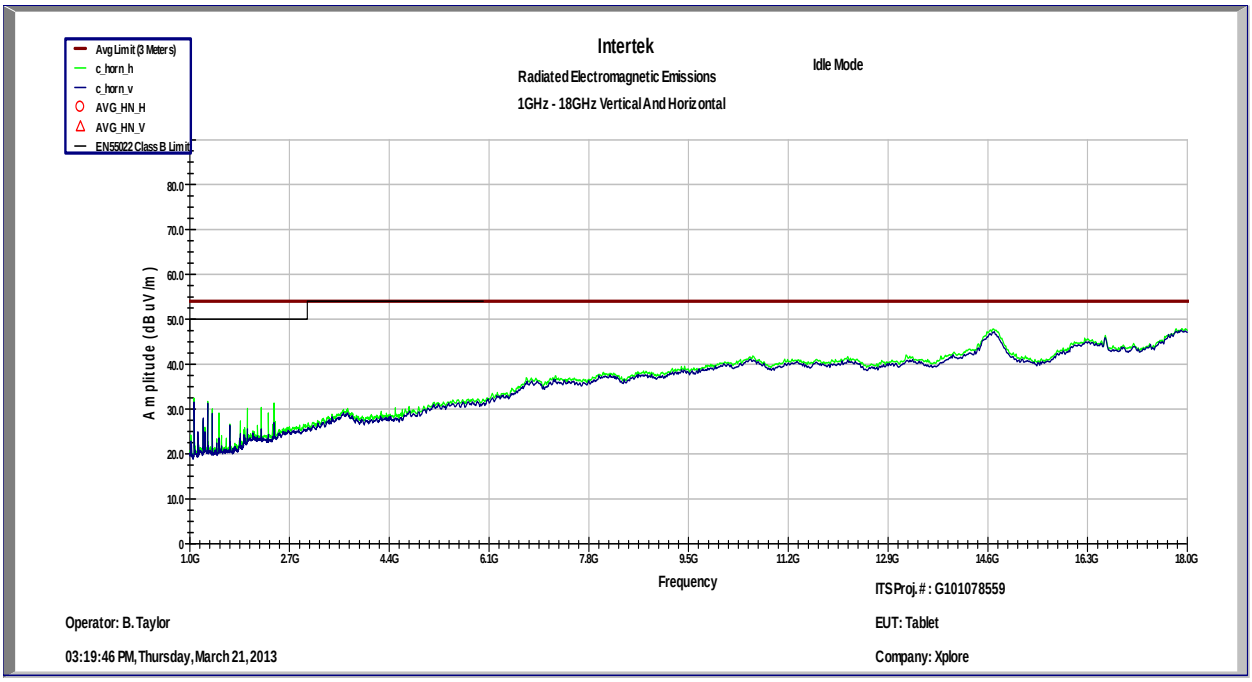
10.6 Test Data:

Radiated Emissions										
Test Engineer:	Bryan Taylor	**Start Date:**	3/21/2013		**End Date:**	3/21/2013				
Temperature:	23.4C	**Humidity:**	38.20%		**Pressure:**	987.8mBar				
Specification:	FCC Part 15 / EN55022				**Test Limit:**	Class B				
Notes:	Idle Mode									
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Frequency	**Polarity (H/V)**	**Raw Reading (dBuV)**	**Cab. (dB)**	**Ant. (dB)**	**Corr. Reading. (dBuV/m)**	**Limit (dBuV/m)**	**Delta (dB)**	**RBW / Detector**	**Test Distance**	**Results**
30.0 MHz	V	19.08	-13.77	17.3	22.61	30	-7.39	120kHz / QP	10m	**Compliant**
459.8 MHz	V	26.49	-11.4	16.62	31.71	37	-5.29	120kHz / QP	10m	**Compliant**
467.9 MHz	V	25.71	-11.36	17.43	31.78	37	-5.22	120kHz / QP	10m	**Compliant**
492.1 MHz	V	22.3	-11.26	18.44	29.48	37	-7.52	120kHz / QP	10m	**Compliant**
537.6 MHz	V	25.96	-10.95	18.69	33.7	37	-3.3	120kHz / QP	10m	**Compliant**
30.0 MHz	H	18.98	-13.77	17.3	22.51	30	-7.49	120kHz / QP	10m	**Compliant**
458.7 MHz	H	27.01	-11.42	16.73	32.32	37	-4.68	120kHz / QP	10m	**Compliant**
494.47 MHz	H	25.48	-11.25	18.49	32.72	37	-4.28	120kHz / QP	10m	**Compliant**
Calculations:					F = C + D + E		H = F - G			

Deviations, Additions, or Exclusions: None



Bilog Prescan



Horn Prescan

11 AC Powerline Conducted Emissions

11.1 Test Limits

§ 15.107(e): Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

11.2 Test Procedure

ANSI C63.4: 2003

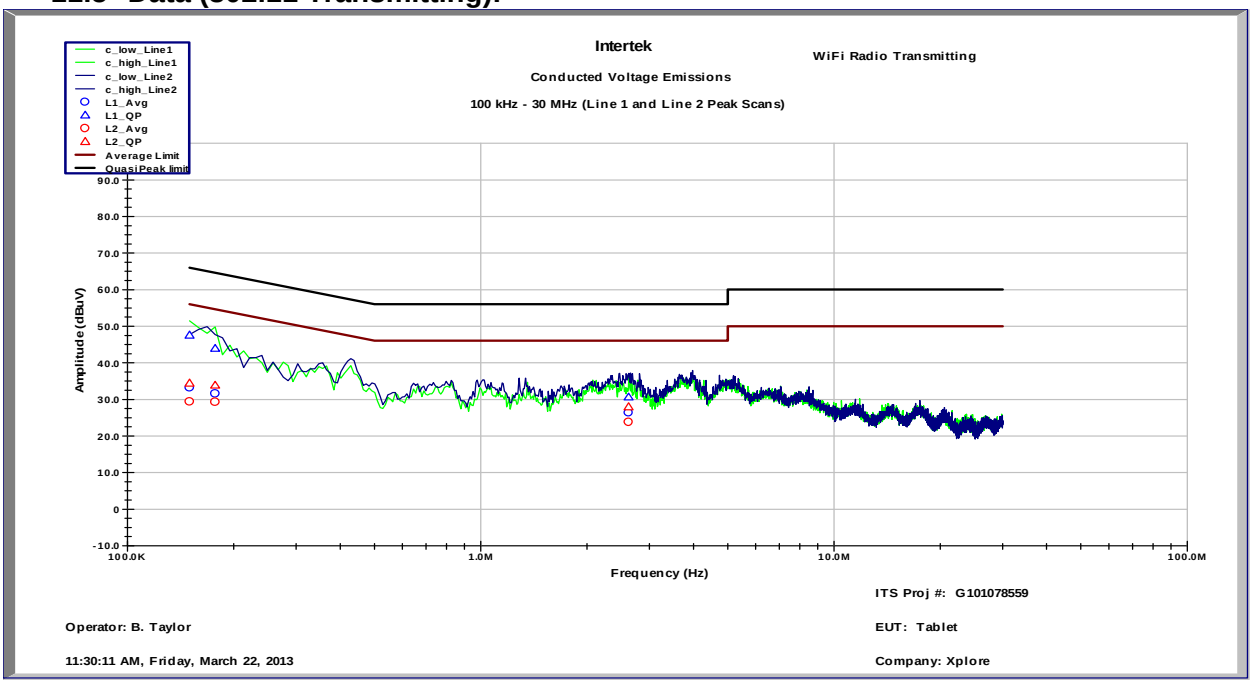
11.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
LISN	3333	Teseq	NNB52	3/11/2013	3/11/2014

11.4 Results:

The sample tested was found to Comply.

11.5 Data (802.11 Transmitting):

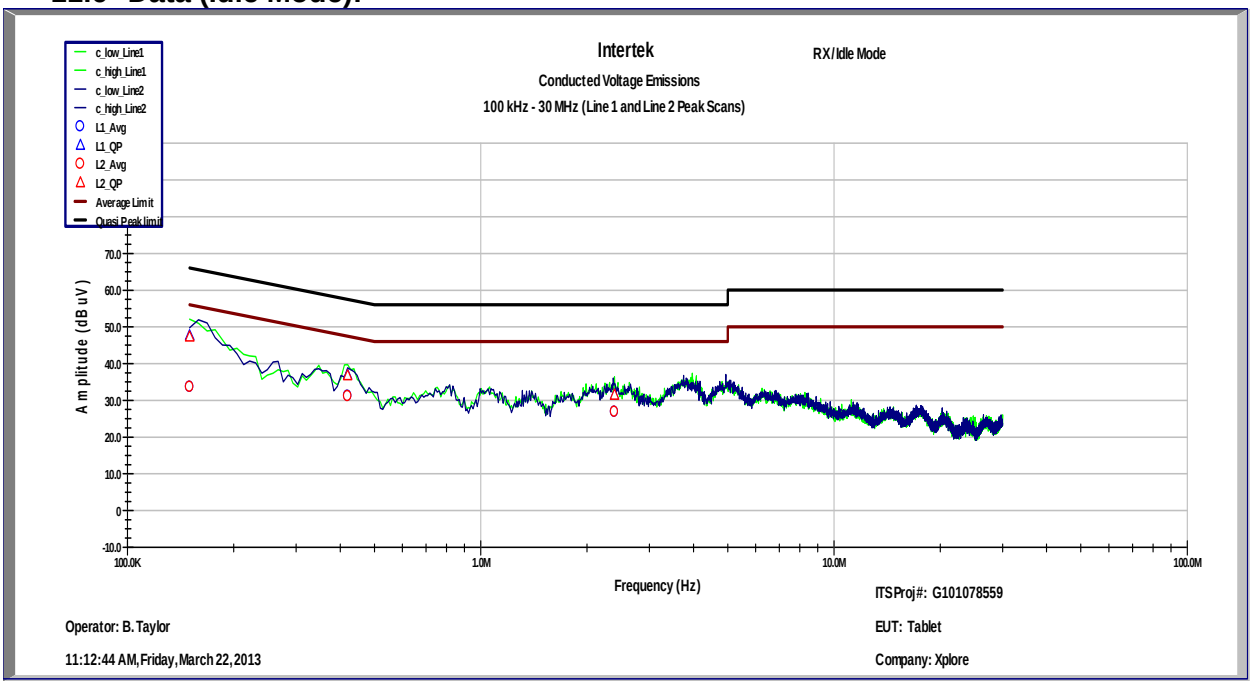


Conducted Voltage Emissions on Power Lines					
Test Engineer:	Bryan Taylor	**Start Date:**	3/21/2013	**End Date:**	3/21/2013
Temperature:	23.4C	**Humidity:**	38.20%	**Pressure:**	987.8mBar
Specification:	FCC Part 15 / EN55022	**Test Limit:**	Class B	**RBW:**	9kHz
Notes:	WiFi Radio Transmitting				

Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Line 1	150.0 KHz	47.54	66	-18.46	33.19	56	-22.81	**Compliant**
Line 1	177.0 KHz	43.9	64.63	-20.73	31.56	54.63	-23.07	**Compliant**
Line 1	2.62 MHz	30.63	56	-25.37	26.37	46	-19.63	**Compliant**
Line 2	150.0 KHz	34.44	66	-31.56	29.37	56	-26.63	**Compliant**
Line 2	177.0 KHz	33.87	64.63	-30.76	29.25	54.63	-25.38	**Compliant**
Line 2	2.62 MHz	27.98	56	-28.02	23.77	46	-22.23	**Compliant**

Deviations, Additions, or Exclusions: None

11.6 Data (Idle Mode):



Conducted Voltage Emissions on Power Lines					
Test Engineer:	Bryan Taylor	**Start Date:**	3/21/2013	**End Date:**	3/21/2013
Temperature:	23.4C	**Humidity:**	38.20%	**Pressure:**	987.8mBar
Specification:	FCC Part 15 / EN55022	**Test Limit:**	Class B	**RBW:**	9kHz
Notes:	Idle Mode				

Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Line 1	150.0 KHz	47.66	66	-18.34	33.64	56	-22.36	**Compliant**
Line 1	420.0 KHz	36.94	57.45	-20.51	31.2	47.45	-16.25	**Compliant**
Line 1	2.391 MHz	31.47	56	-24.53	26.82	46	-19.18	**Compliant**
Line 2	150.0 KHz	47.29	66	-18.71	33.57	56	-22.43	**Compliant**
Line 2	420.0 KHz	36.73	57.45	-20.72	31.1	47.45	-16.35	**Compliant**
Line 2	2.391 MHz	31.47	56	-24.53	26.85	46	-19.15	**Compliant**

Deviations, Additions, or Exclusions: None

12 Antenna Requirement per FCC Part 15.203

12.1 Test Limits

§ 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

12.2 Results:

The sample tested met the antenna requirement. The antenna utilized a U.fl connector for connection to the PCB antenna.

13 Dynamic Frequency Selection (DFS)

13.1 DFS Detection Thresholds for Master or Client Devices with DFS Detection

Maximum Transmit Power	Value
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

13.2 DFS Testing Requirements for Client Devices without DFS Detection

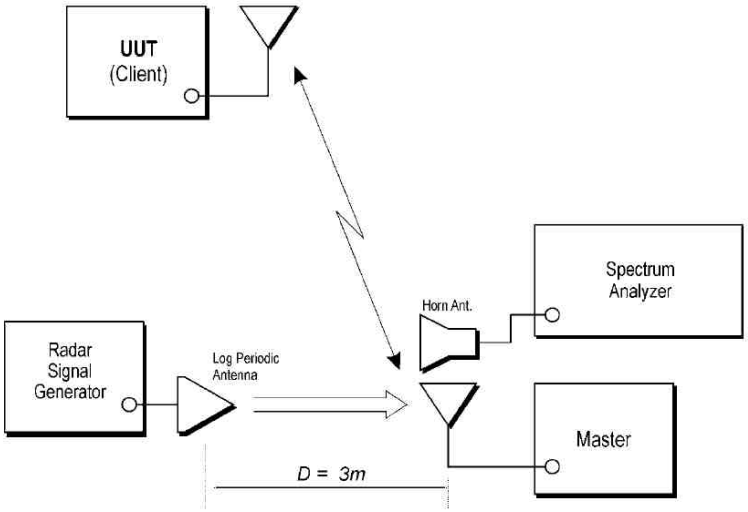
Parameter	Value
Channel Move Time	10 Seconds
Channel Closing Transmission Time	200 mS + an aggregate of 60 mS over remaining 10 Second period.

13.3 Test Waveform

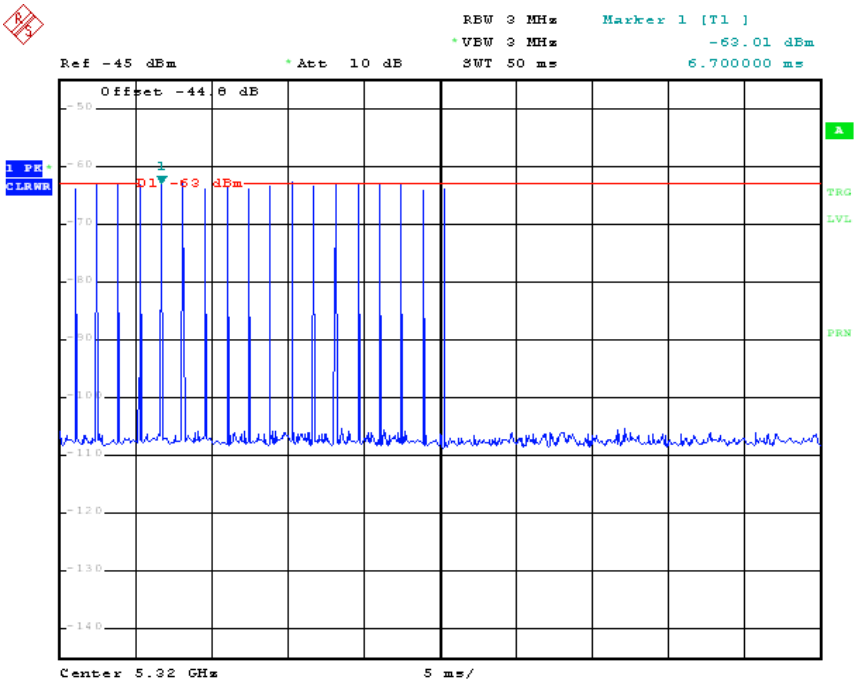
Radar Type	Pulse Width (µsec)	PRI (µsec)
1	1	1428

13.4 DFS Waveform Calibration

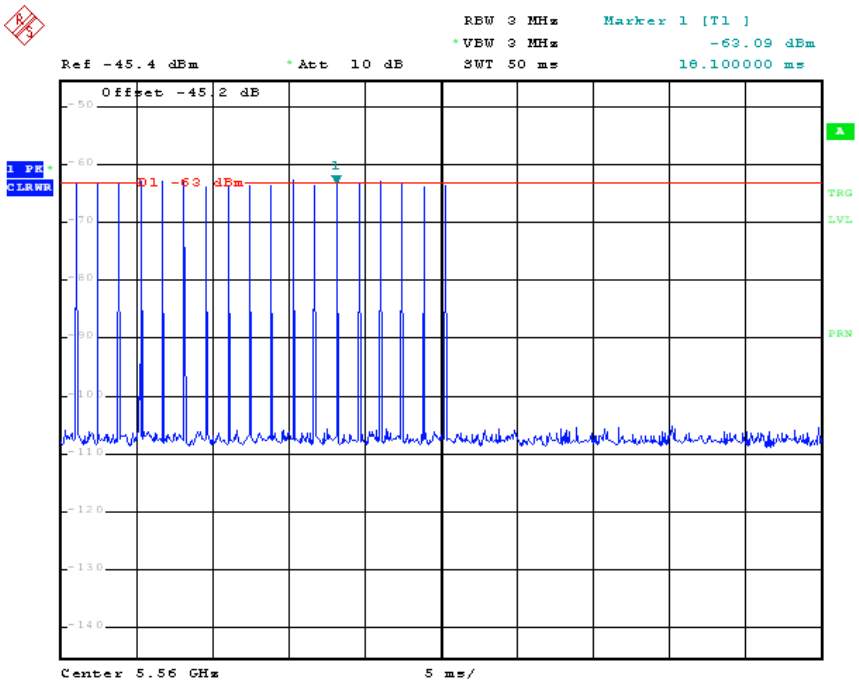
For the DFS signal, horn antenna was attached to a signal generator (RS SMU700A). On the Receive side another horn antenna was attached to a spectrum analyzer with a preamp inline. The spectrum analyzer's resolution bandwidth was set to 3 MHz and the video bandwidth was set to 3 MHz with peak detection. The field was corrected to account for cable loss, antenna gain and preamp. The DFS signal was calibrated to a field strength of -63 dBm. Test wave form 1 was utilized. A block diagram of the calibration setup is shown below.



13.5 Radar Waveform Calibration Plots



Radar Type 1 Calibration 5320MHz



Radar Type 1 Calibration 5560MHz

Computation of the Field Correction Factor

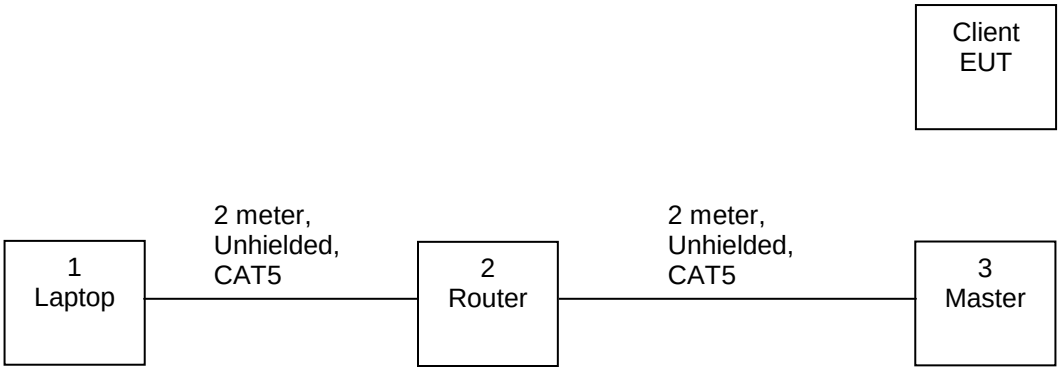
Frequency	System Loss (Preamp and Cable loss)	Antenna Gain	Reference Offset (System Loss – Antenna Gain)
MHz	dB	dBi	dB
5320	- 33.5	11.3	- 44.8
5560	- 34.1	11.1	- 45.2

13.6 DFS Setup & Procedure

A radiated test method was used and the test setup was made as depicted in the diagram below. DFS testing was setup as a client with injection into the master.

The diagram below depicts the setup of the EUT along with associated support equipment.

Block Diagram of the Test Setup



Support Equipment Used for DFS Testing

Item	Description	Model	Serial
1	HP Laptop	EliteBook 8460p	CNU14429SL
2	Netgear Router	WNDR3700v4	3111315801CC9
3	Cisco Systems Access Point FCC ID: LDK102054E	AIR-AP1131AG-A-K9	FTX1244N25E

The Master and Client (EUT) were placed in a semi-anechoic chamber. The simulated radar waveform was transmitted from a horn antenna towards the Master. The signal level of the simulated radar waveform was set 10 dB higher than calibrated level to -53 dBm and was applied to the Master. The horn antenna was connected to the spectrum analyzer and positioned towards the client with the level >10 dB higher than emissions from the Master.

A Rhode & Schwarz Vector Signal Generator with Pulse Sequencer Software was used to generate the DFS radar signals. A Rhode & Schwarz Spectrum Analyzer was used to monitor the transmissions of the Client. The trigger of the spectrum analyzer was aligned with the end of the radar waveform burst from the signal generator.

Channel closing transmission time and channel move time were measured by applying a radar signal to the Master device. The EUT transmissions were observed while Type 1 Radar waveforms were applied. The time between the end of the applied radar waveform and the final transmission on the channel is the channel move time. The channel closing transmission time comprises only those fragments of the channel move time during which the EUT transmits.

The EUT (client without DFS detection) was configured to communicate with a Master wirelessly. The FCC MPEG test file was streamed from the Master to the Client. The EUT was tested with the master device operating in the same band and operating mode.

It was not possible for two client devices to communicate directly with each other while maintaining an association with the master. Therefore, such modes were not evaluated.

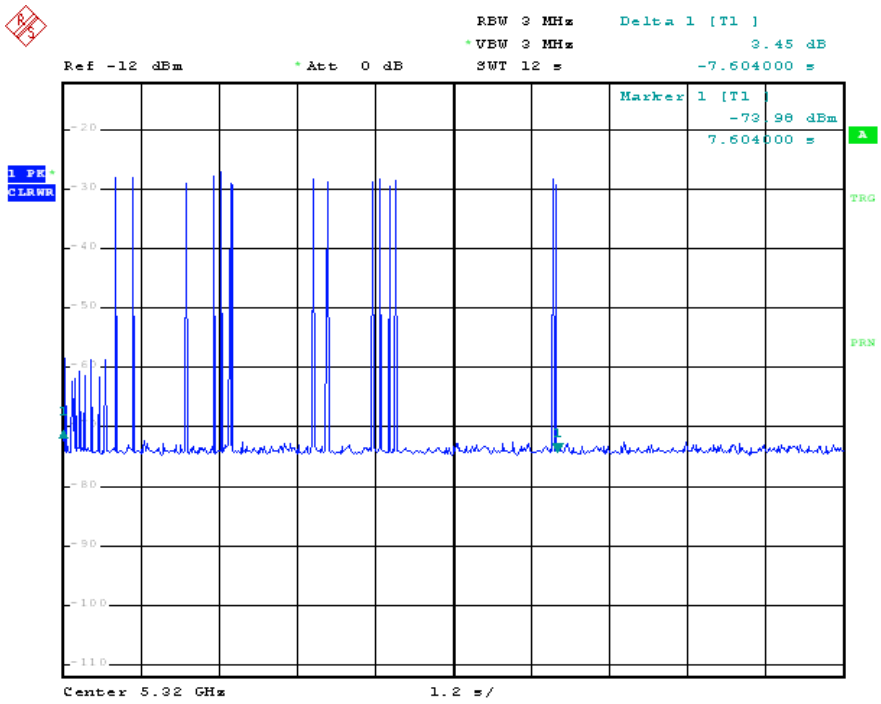
The lower burst amplitude on plots (~ -60 dBm) are traffic communication of the Master device. The highest burst amplitude on plots are (~ -25dBm) are traffic communication of the Slave Device (EUT). The median burst amplitude in plots 3 & 4 is the DFS signal.

13.7 Test Results

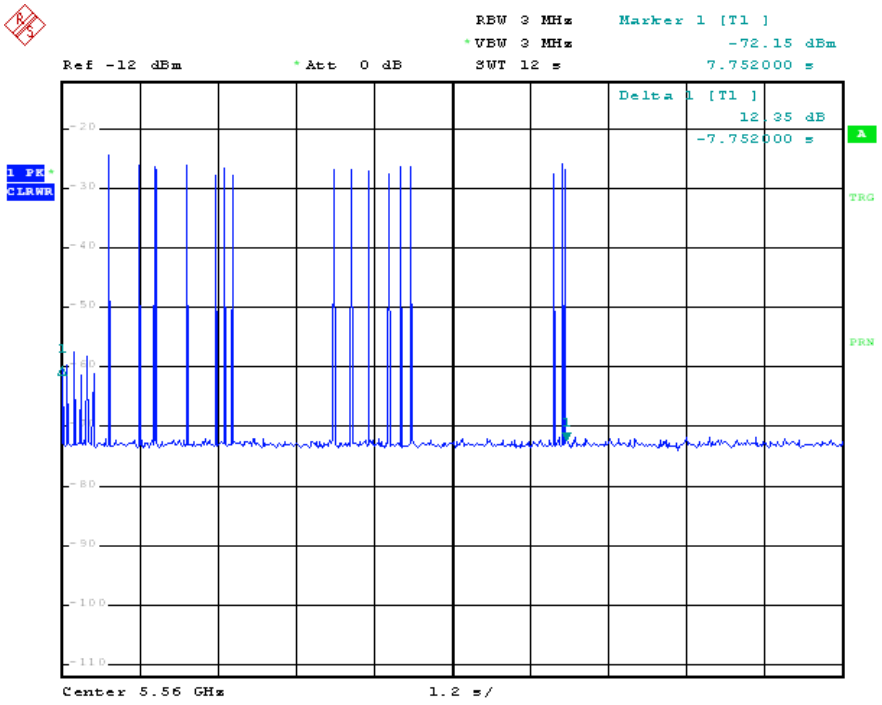
Channel Move Time Test Summary							
Description	**Plot #**	**Radar Type**	**Frequency MHz**	**Number of Beacons Observed**	**Measured Value**	**Limit Requirements**	**Results**
Channel Move Time	1	1	5320	15	7.604s	10s	Pass
Channel Move Time	2	1	5560	18	7.752s	10s	Pass
Channel Closing Transmission Time Test Summary							
Description	**Plot #**	**Radar Type**	**Frequency MHz**	**Number of Beacons Observed**	**Aggregate Measured Value***	**Limit Requirements**	**Results**
Channel Closing Transmission Time	3	1	5260	16	1.058ms	260ms	Pass
Channel Closing Transmission Time	4	1	5540	18	1.191ms	260ms	Pass

Beacon Burst Time		
Description	**Plot #**	**Burst Time**
Burst Time	5	66.144uS

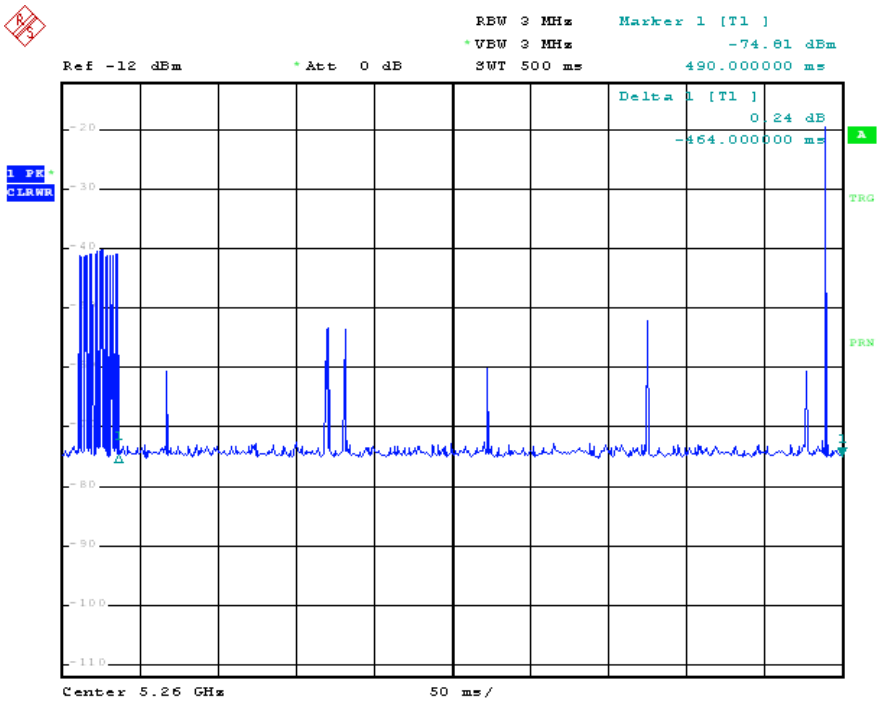
*The Beacons observed in the Channel Move tests were measured for time. The measured value of the beacons in time were then multipled by the number of burst captured during the test then compared to the Limit Requirements for compliance. See plots below.



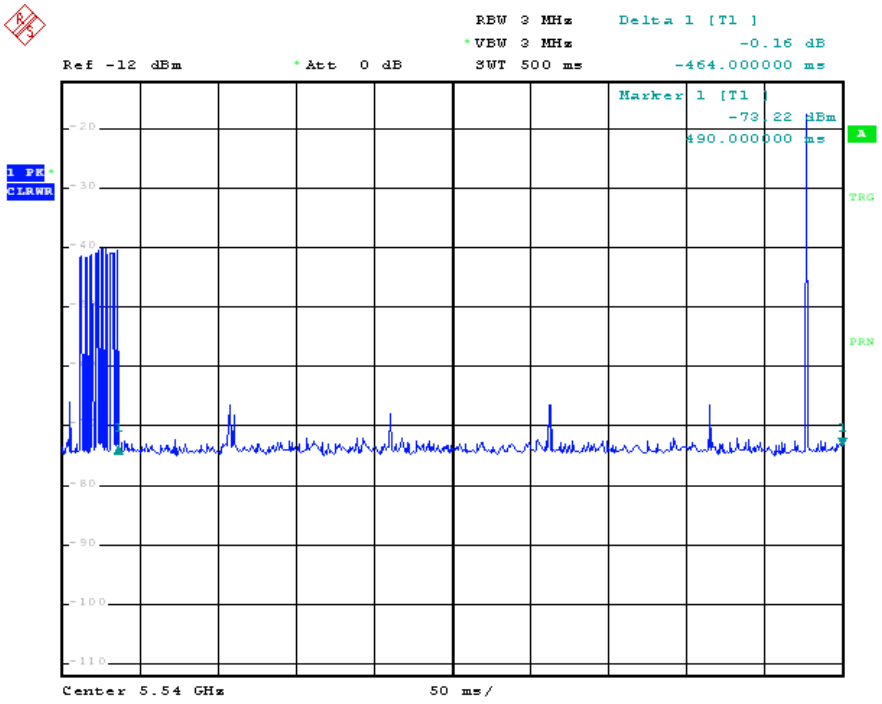
Plot 1: Channel Move Time (CMT), Radar Type 1 @ 5320 MHz



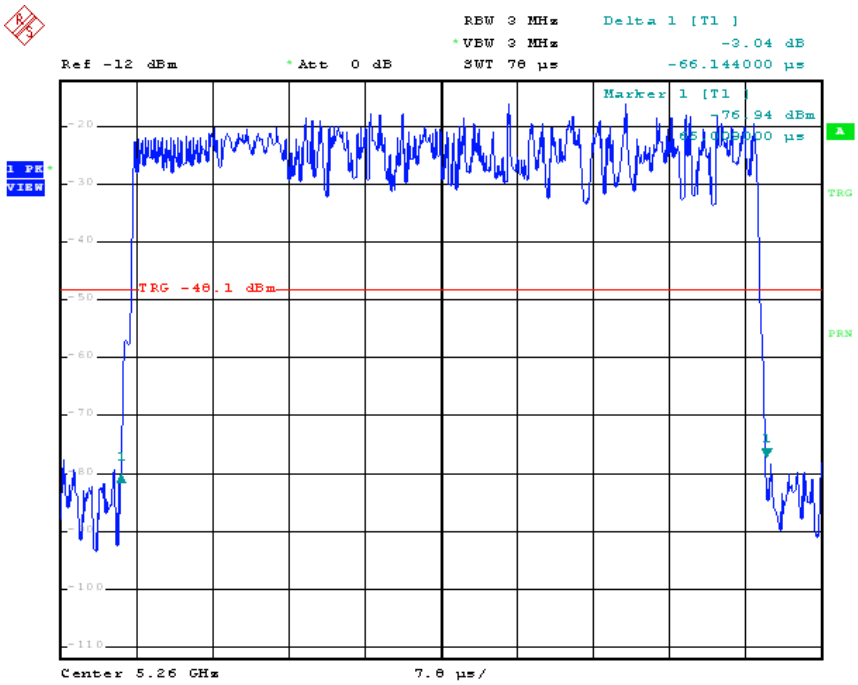
Plot 2: Channel Move Time (CMT), Radar Type 1 @ 5560 MHz



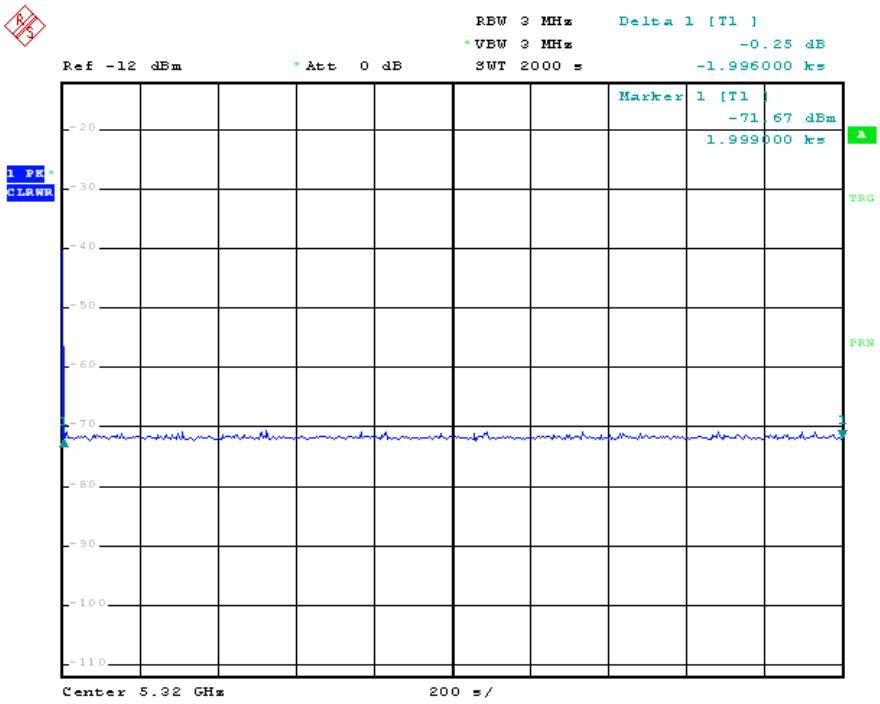
Plot 3: Channel Closing Transmission Time (CCTT), Radar Type 1 @ 5260 MHz



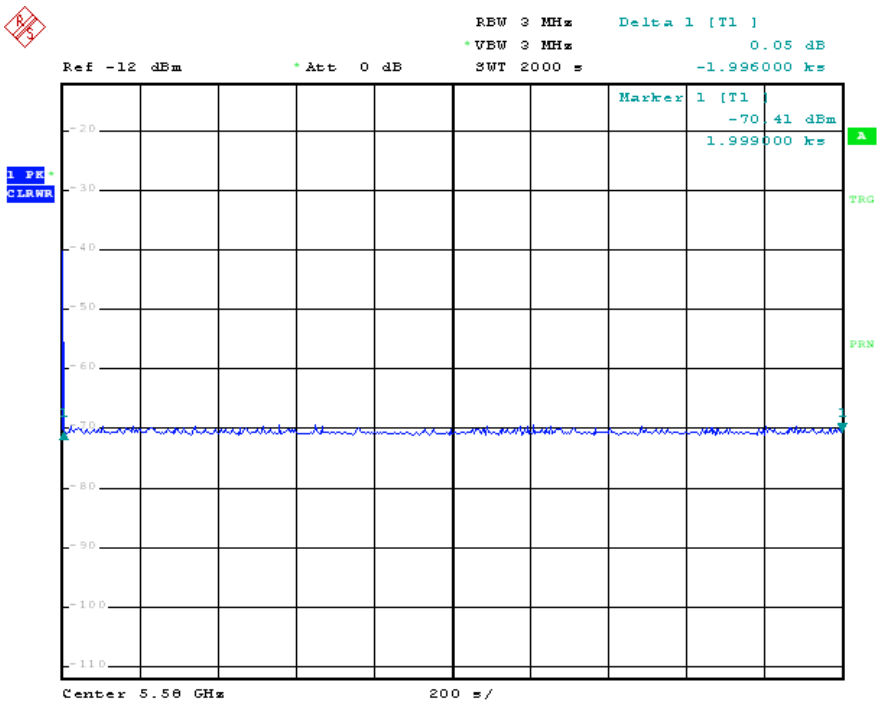
Plot 4: Channel Closing Transmission Time (CCTT), Radar Type 1 @ 5540 MHz



Plot 4: Beacon Burst Time



Plot 5: Un-Occupancy Plot (5320MHz)



Plot 6: Un-Occupancy Plot (5580MHz)

13.8 Test Equipment

Equipment	Manufacturer	Model/Type	Serial Number	Cal Int (Months)	Cal Due
Horn Antenna	ETS Lindgren	3115	9107-3712	12	12/06/2013
Signal Generator	Rohde & Schwarz	SMU200A	102499	12	05/17/2013
Spectrum Analyzer	Rohde and Schwartz	FSP	100030	12	11/13/2013
Horn Antenna	ETS Lindgren	3115	00126795	12	11/15/2013
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	09/10/2013

14 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	±3.9dB	
Radiated emissions, 1 to 18 GHz	±4.2dB	
Radiated emissions, 18 to 40 GHz	±4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	±2.8dB	

15 Revision History

Revision Level	Date	Report Number	Notes
0	7/13/2013	101078559LEX-007	Original Issue
1	10/1/2011	101078559LEX-007	Editorial Corrections