

TEST REPORT

Report Number: 101078559LEX-006
Project Number: G101078559

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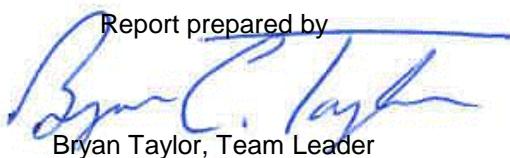
Product Name: iX101T1 Rugged Tablet
Model Number: iX101T1
FCCID: Q2GWG7550
ICID: 4596A-WG7550

Standards: Title 47 CFR Part 15 Subpart C and RSS-210
Issue 8

Radios Under Test: 802.11a and n

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 |
|------|---|-------------------------------------|------------------------------------|--------|
| 6 | Peak Conducted Power | § 15.247(b)(3)(4) | RSS-210 (A8.4) | Pass |
| 7 | Occupied Bandwidth | § 15.247(a)(2) | RSS-210 (A8.2), RSS-GEN (4.6.1) | Pass |
| 12 | Conducted Spurious Emissions | § 15.247(d) | RSS-210 (A8.5) | Pass |
| 21 | Power Spectral Density | § 15.247(e) | RSS-210 (A8.2b) | Pass |
| 25 | Radiated Spurious Emissions (Transmitter) | § 15.247(d), § 15.209, and § 15.205 | RSS-210 (2.2) (A8.5) | Pass |
| 30 | Radiated Spurious Emissions (Receiver) | § 15.109 | RSS-Gen (6.1) | Pass |
| 33 | AC Powerline Conducted Emissions | § 15.107, § 15.207 | RSS-Gen (7.2.4) | Pass |
| 36 | Antenna Requirement per FCC Part 15.203 | § 15.203 | RSS-Gen (7.1.2) | 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 | 4/29/2013 |
| Device Received Condition | Good |
| Test Sample Type | Production |
| Frequency Band | 5725MHz – 5850MHz |
| Mode(s) of Operation | 802.11a, 802.11n (HT-20) |
| Modulation Type | OFDM |
| Duty Cycle | 100% |
| Transmission Control | Test Commands |
| Test Channels | 149, 157, 165 |
| Antenna Type (15.203) | Internal |
| Power Supply | 115VAC/60Hz (Via AC / DC Power Adapter) |

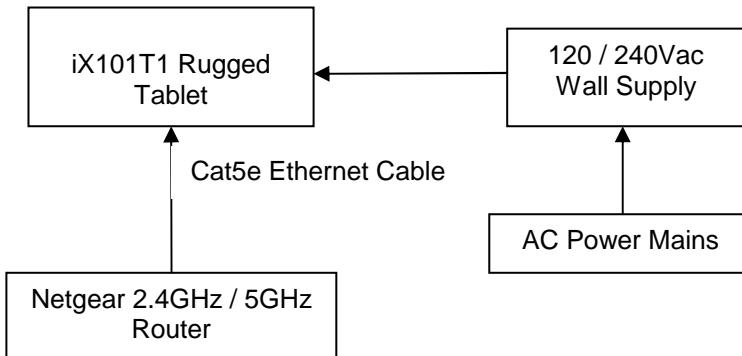
| Description of Equipment Under Test | |
|--|--|
| The iX101T1 is a ruggedized tablet PC. | |

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 |

4 Peak Conducted Power

4.1 Test Limits

§ 15.247(b)(3): For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§ 15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, 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. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247). The peak output power was measured using the channel power function of the spectrum analyzer (8.1.2 Option 2).

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 | Frequency (MHz) | Channel Number | Conducted Power (dBm) | | | | | | | |
|-----------------|-----------------|----------------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
| | | | Data Rate (Mbps) | | | | | | | |
| | | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 802.11a | 5745 | 149 | 24.43 | 24.28 | 23.33 | 23.22 | 22.69 | 22.89 | 21.56 | 21.46 |
| | 5765 | 153 | 24.35 | 24.38 | 23.4 | 23.31 | 22.51 | 22.39 | 21.65 | 21.34 |
| | 5785 | 157 | 24.3 | 24.47 | 23.5 | 23.19 | 22.65 | 22.75 | 21.37 | 21.35 |
| | 5805 | 161 | 24.45 | 24.21 | 23.3 | 23.37 | 22.58 | 22.76 | 21.37 | 21.53 |
| | 5825 | 165 | 24.15 | 24.11 | 23.19 | 23.35 | 22.48 | 22.62 | 21.38 | 21.54 |
| 802.11n (HT-20) | 5745 | 149 | 24.29 | 23.15 | 23.29 | 23.14 | 22.71 | 21.2 | 21.28 | 20.52 |
| | 5765 | 153 | 23.47 | 23.15 | 23.27 | 22.78 | 22.77 | 21.49 | 21.32 | 20.31 |
| | 5785 | 157 | 24.32 | 23.16 | 23.13 | 22.76 | 22.82 | 21.3 | 21.36 | 21.45 |
| | 5805 | 161 | 24.18 | 23.64 | 23.22 | 22.79 | 23.14 | 21.31 | 21.23 | 20.4 |
| | 5825 | 165 | 23.84 | 23.15 | 23.3 | 22.57 | 22.52 | 21.31 | 21.16 | 20.16 |

5 Occupied Bandwidth

5.1 Test Limits

§ 15.247(a)(2): For digital modulation systems, the minimum 6dB bandwidth shall be at least 500kHz.

5.2 Test Procedure

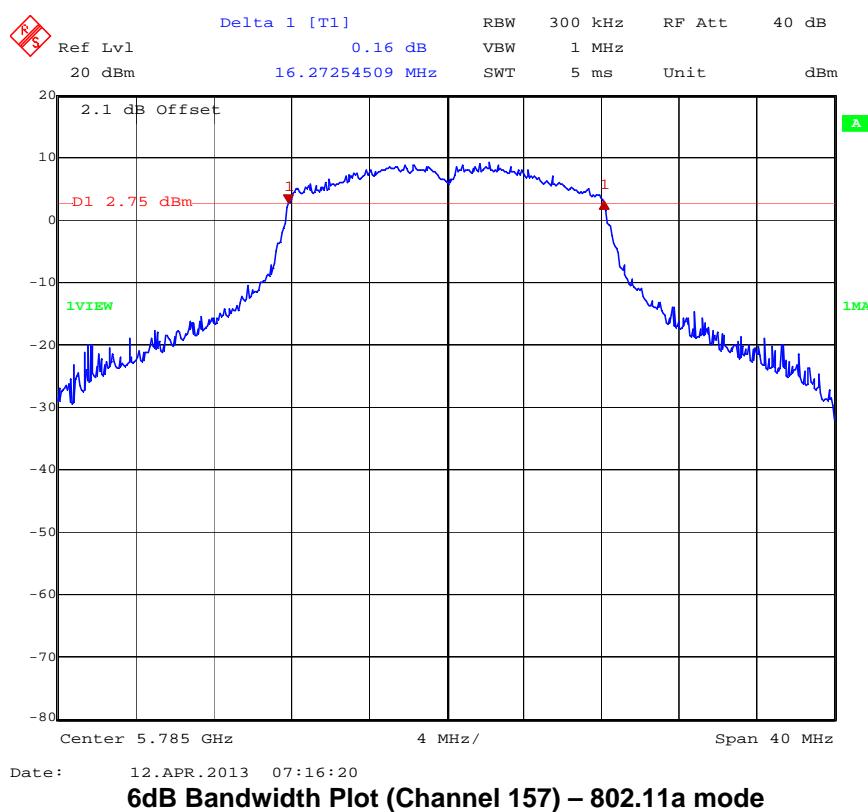
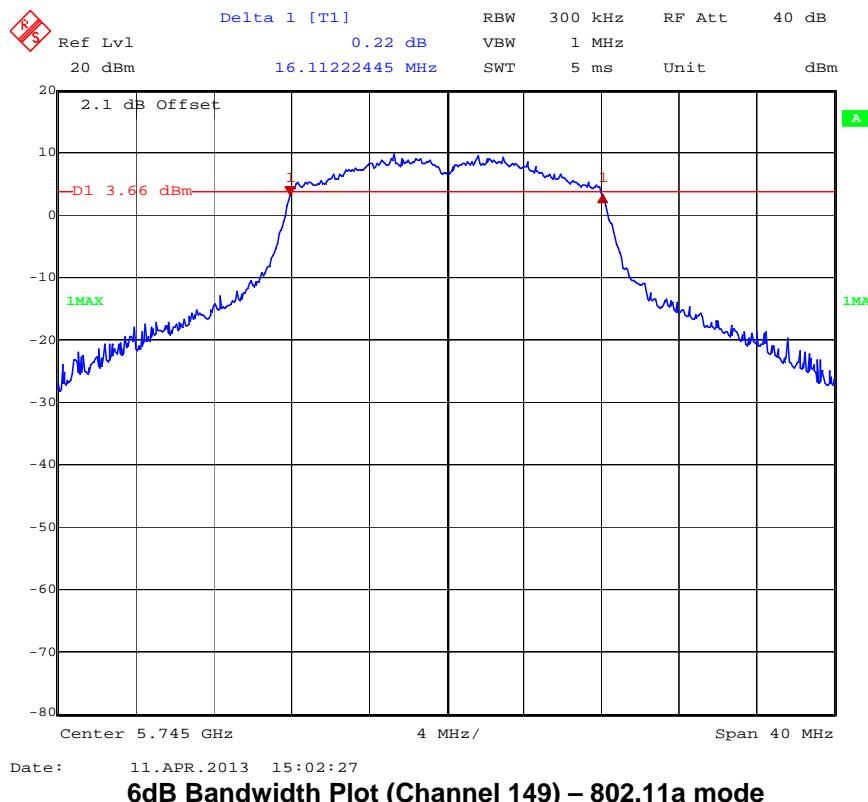
ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

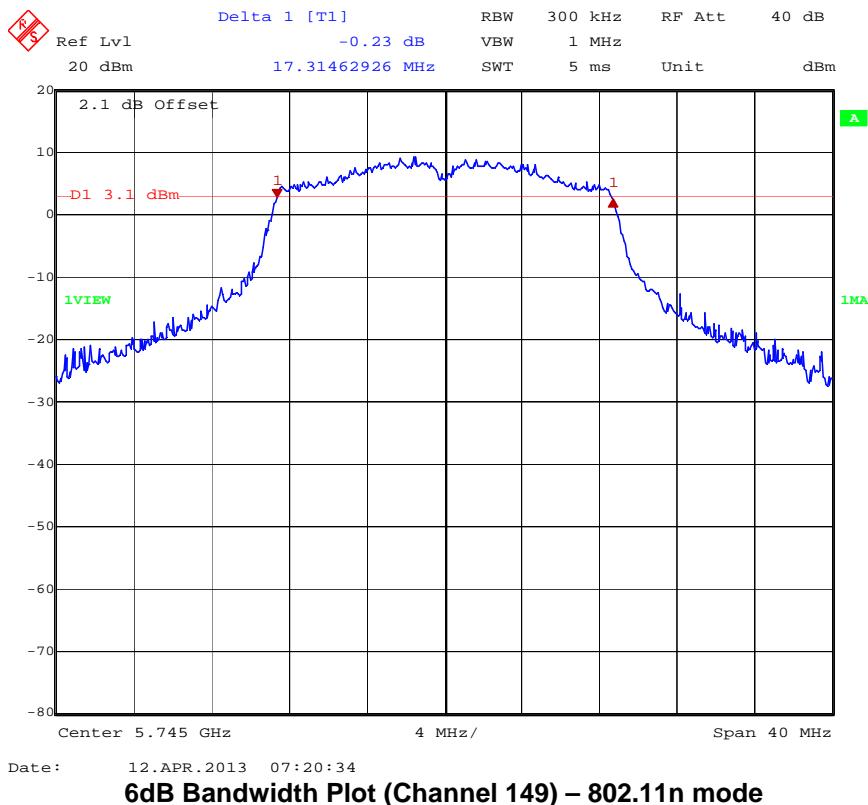
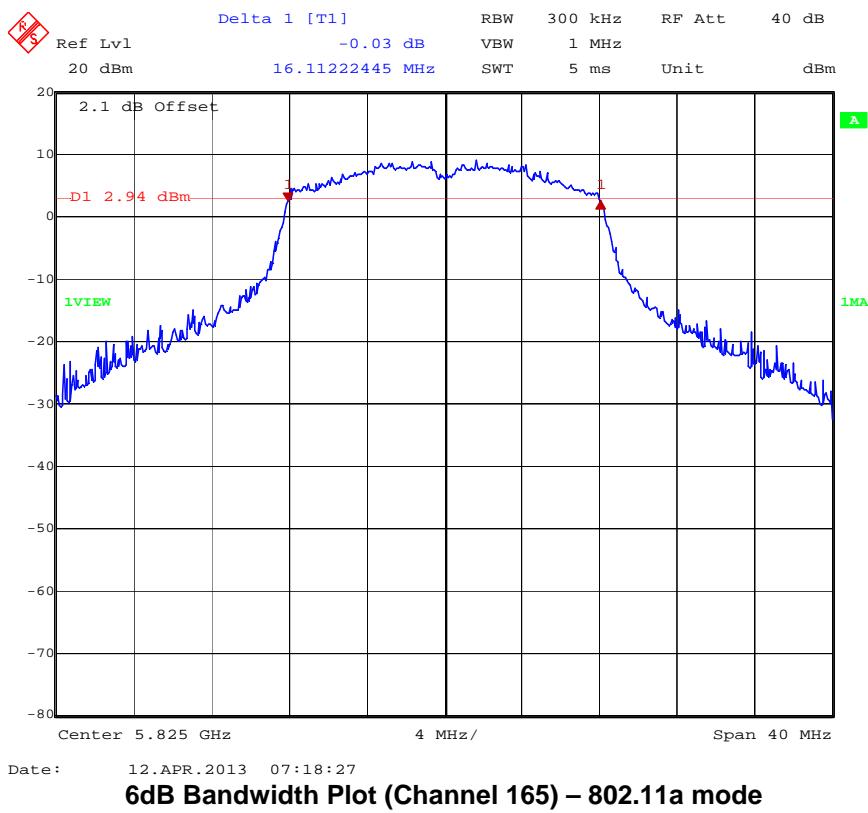
5.3 Test Equipment Used:

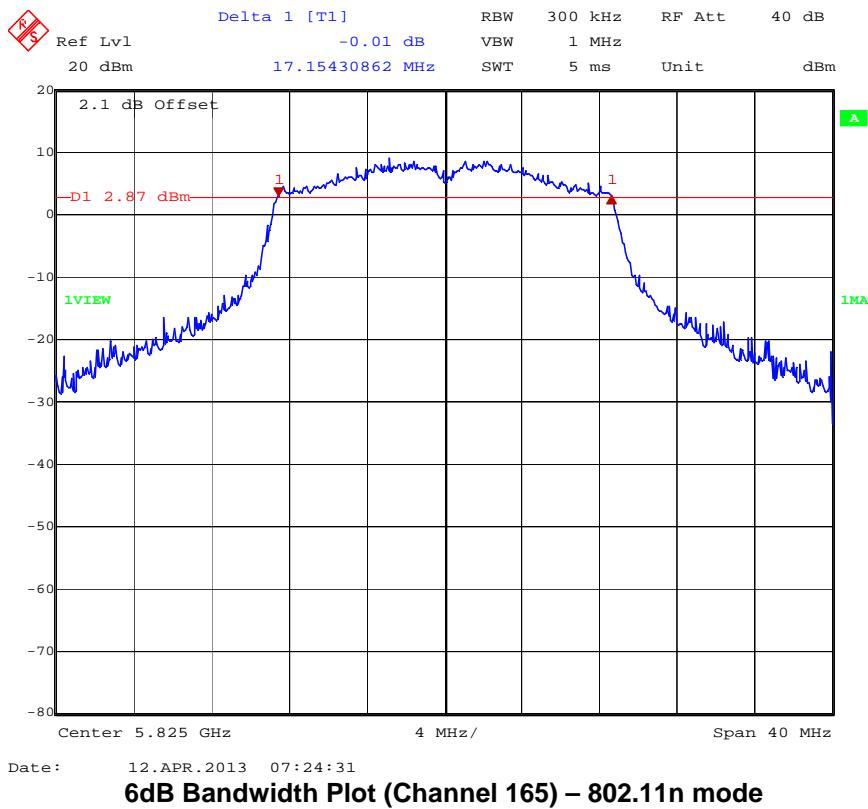
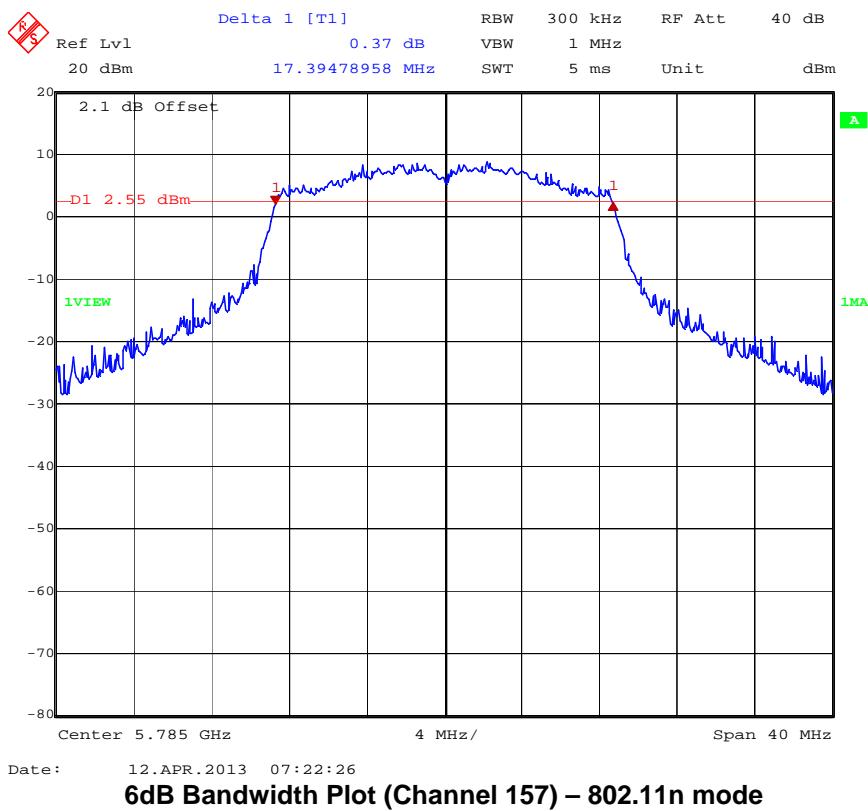
| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|-------------------|---------------|-----------------|--------|------------|------------|
| Spectrum Analyzer | 3720 | Rohde & Schwarz | FSEK30 | 11/26/2012 | 11/26/2013 |

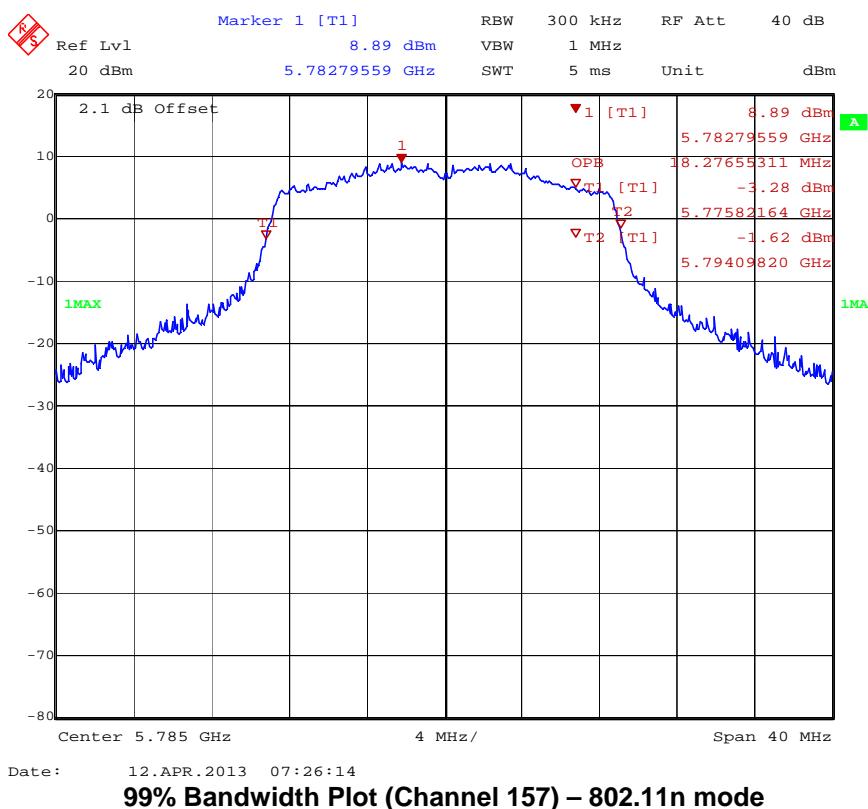
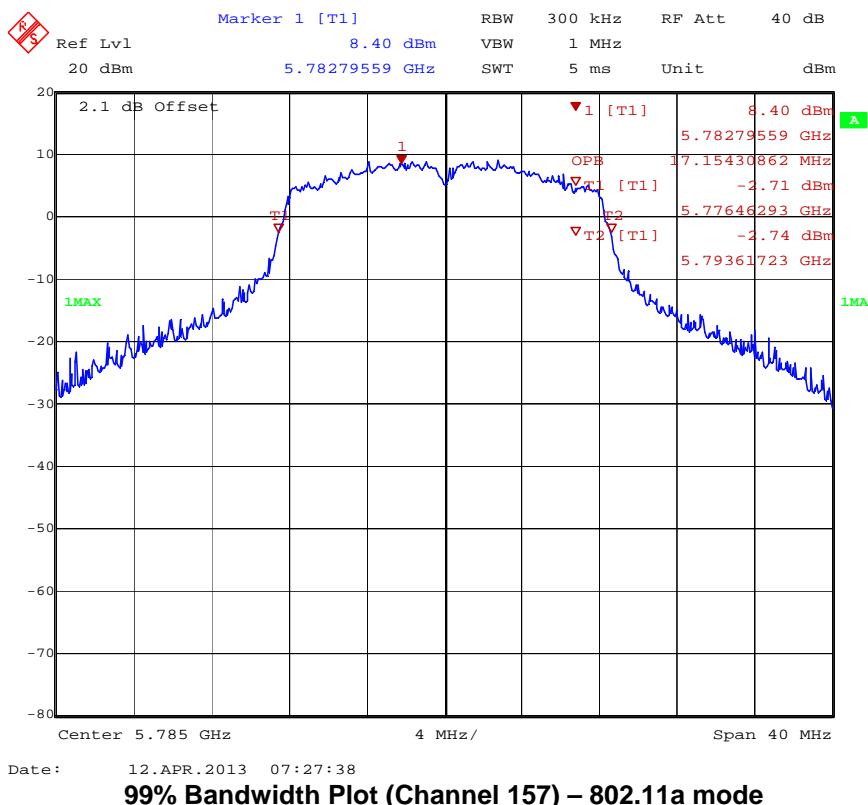
5.4 Results:

| Mode | Channel Number | Frequency (MHz) | 6dB Bandwidth | 99% Power Bandwidth | Result |
|-----------------|----------------|-----------------|---------------|---------------------|--------|
| 802.11a | 149 | 5745 | 16.11MHz | --- | Pass |
| 802.11a | 157 | 5785 | 16.27MHz | 17.15MHz | Pass |
| 802.11a | 165 | 5825 | 16.11MHz | --- | Pass |
| 802.11n (HT-20) | 149 | 5745 | 17.31MHz | --- | Pass |
| 802.11n (HT-20) | 157 | 5785 | 17.39MHz | 18.27MHz | Pass |
| 802.11n (HT-20) | 165 | 5825 | 17.15MHz | --- | Pass |









6 Conducted Spurious Emissions

6.1 Test Limits

§ 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

6.2 Test Procedure

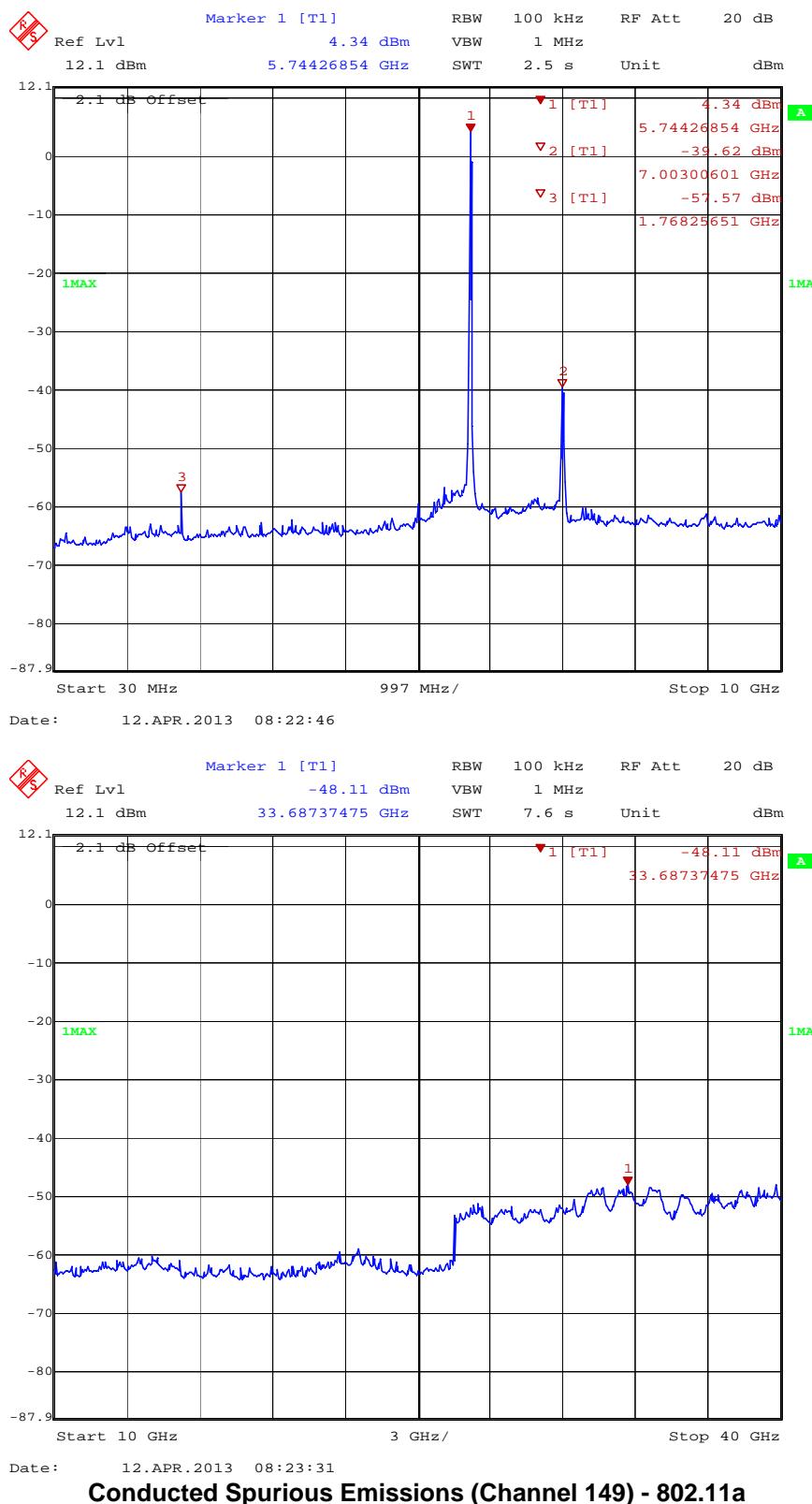
ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

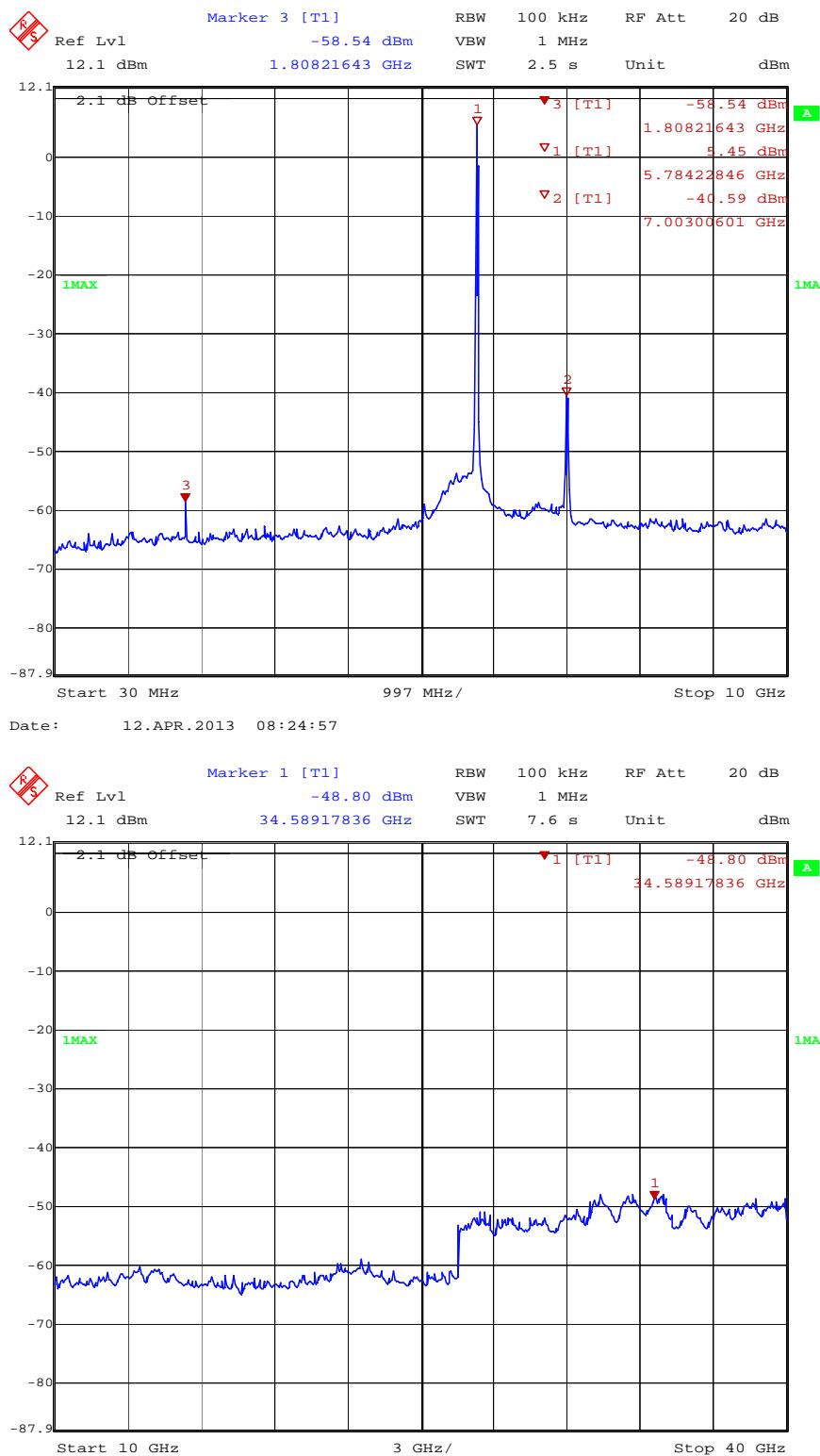
6.3 Test Equipment Used:

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

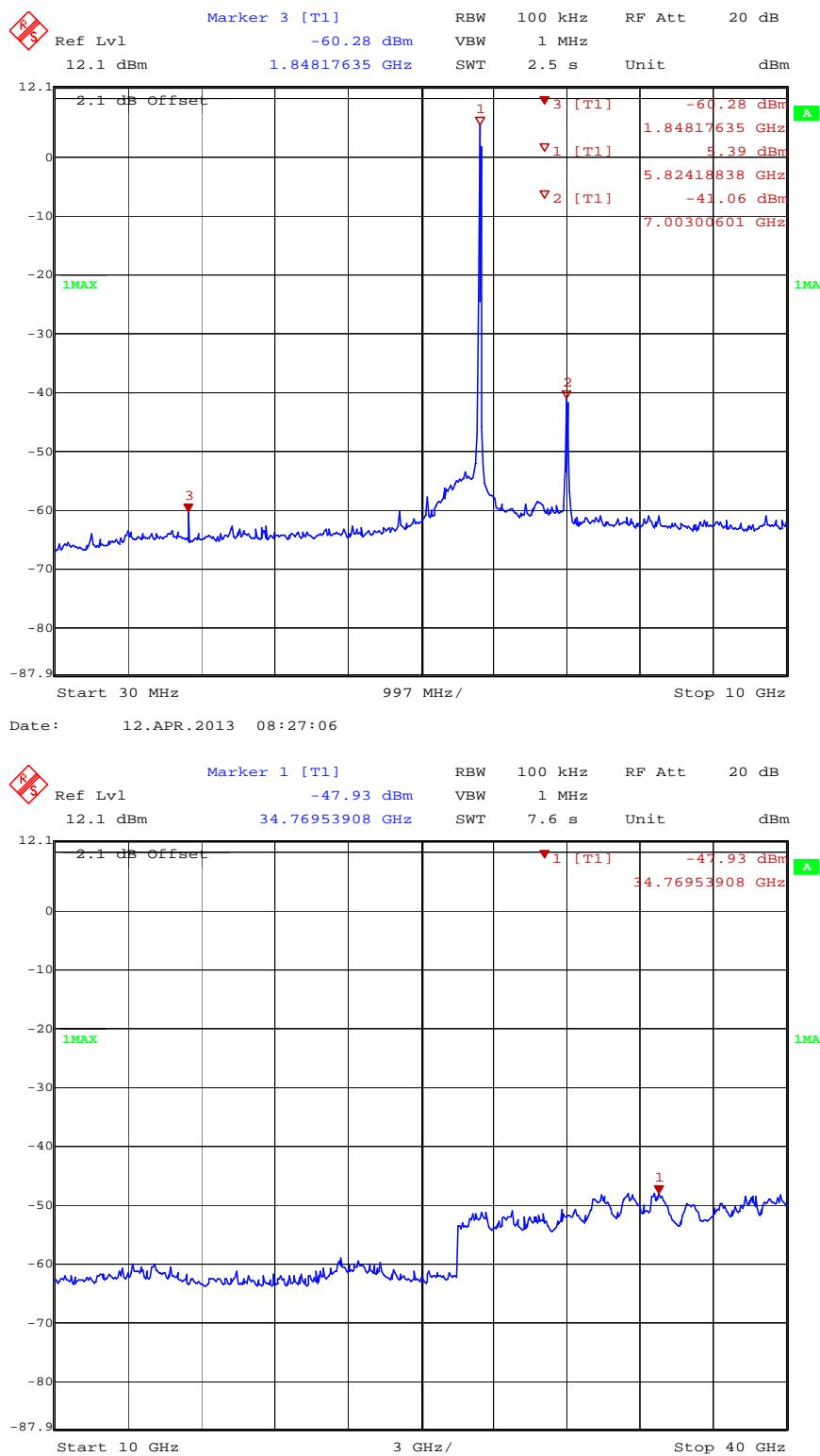
6.4 Results:

The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria.

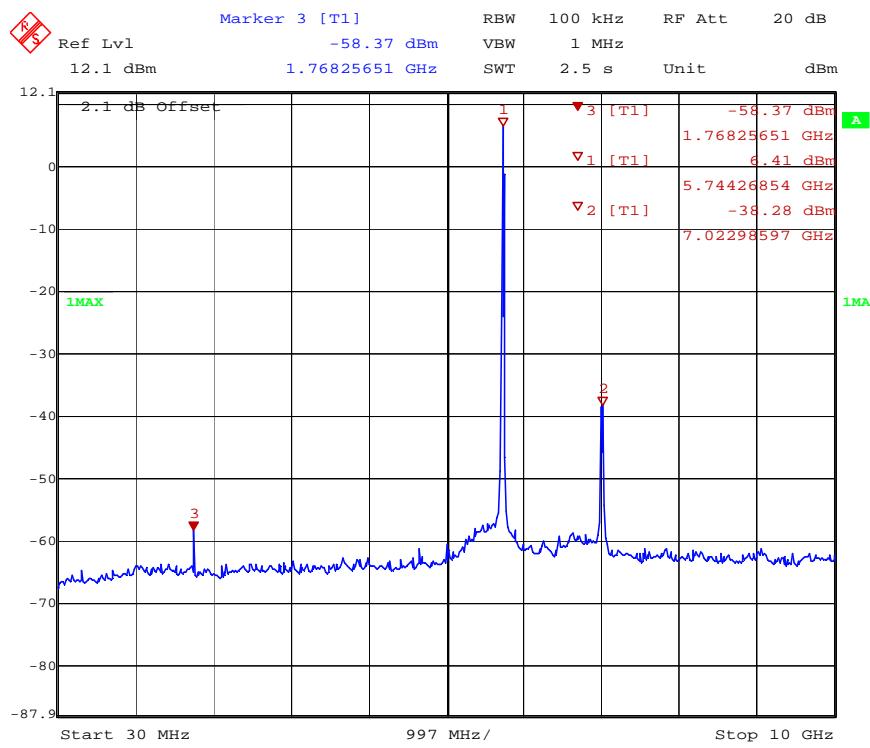




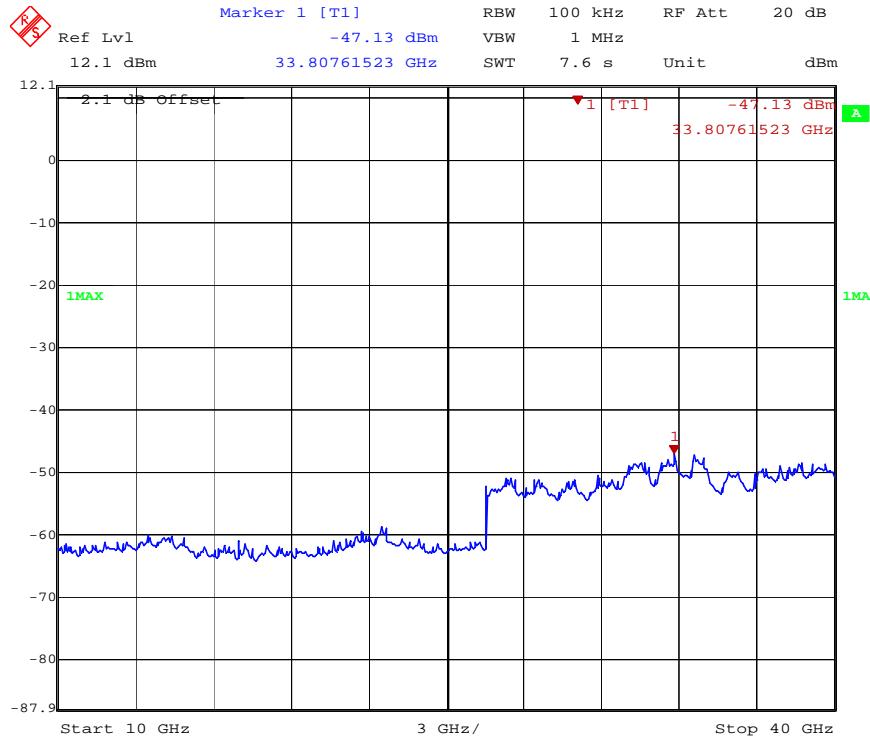
Conducted Spurious Emissions (Channel 157) - 802.11a



Conducted Spurious Emissions (Channel 165) - 802.11a

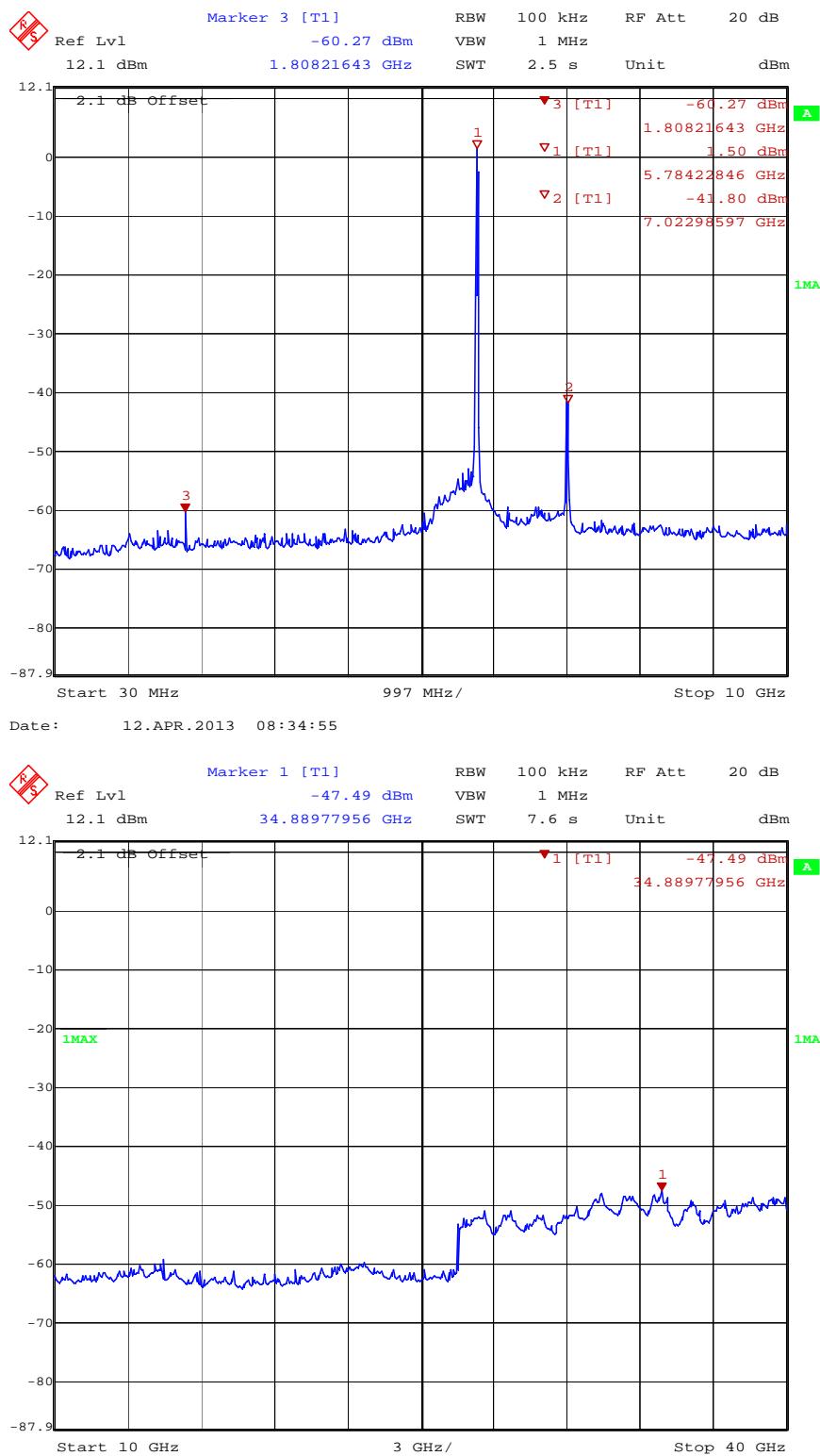


Date: 12.APR.2013 08:31:28



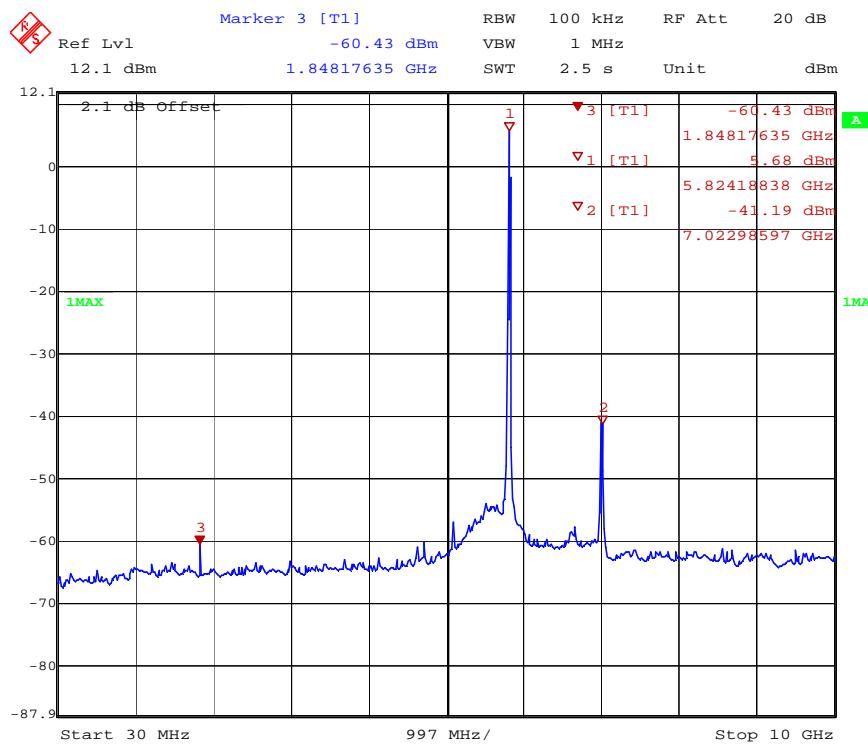
Date: 12.APR.2013 08:32:49

Conducted Spurious Emissions (Channel 149) - 802.11n

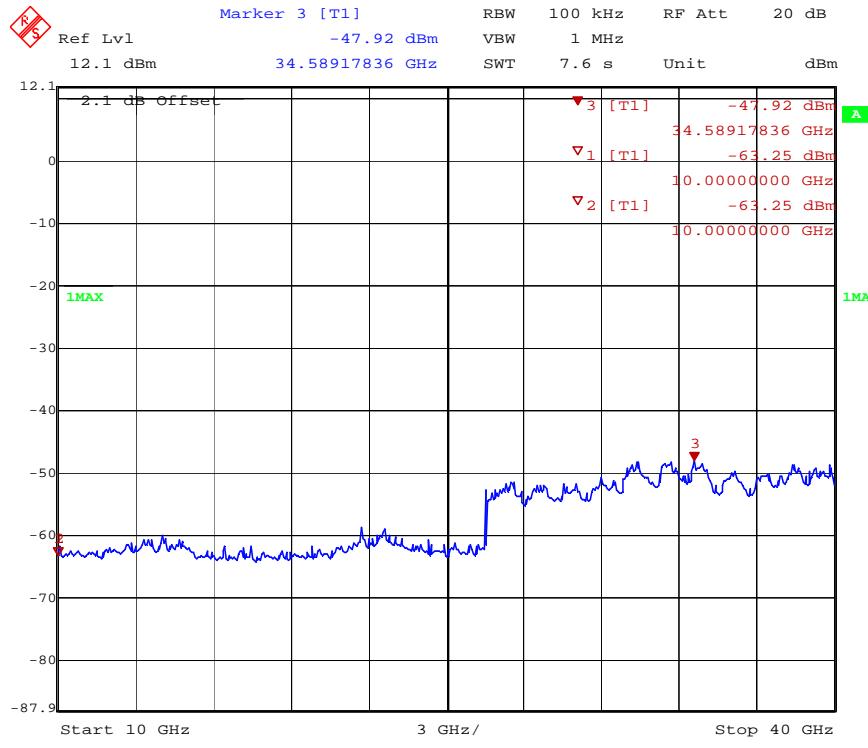


Date: 12.APR.2013 08:34:55

Conducted Spurious Emissions (Channel 157) - 802.11n

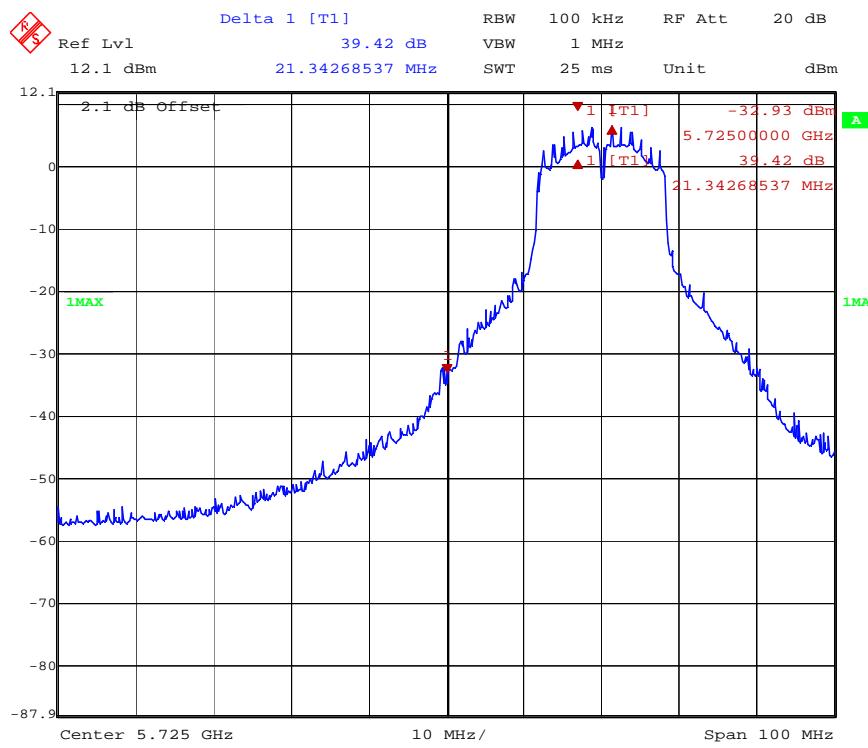


Date: 12.APR.2013 08:35:46

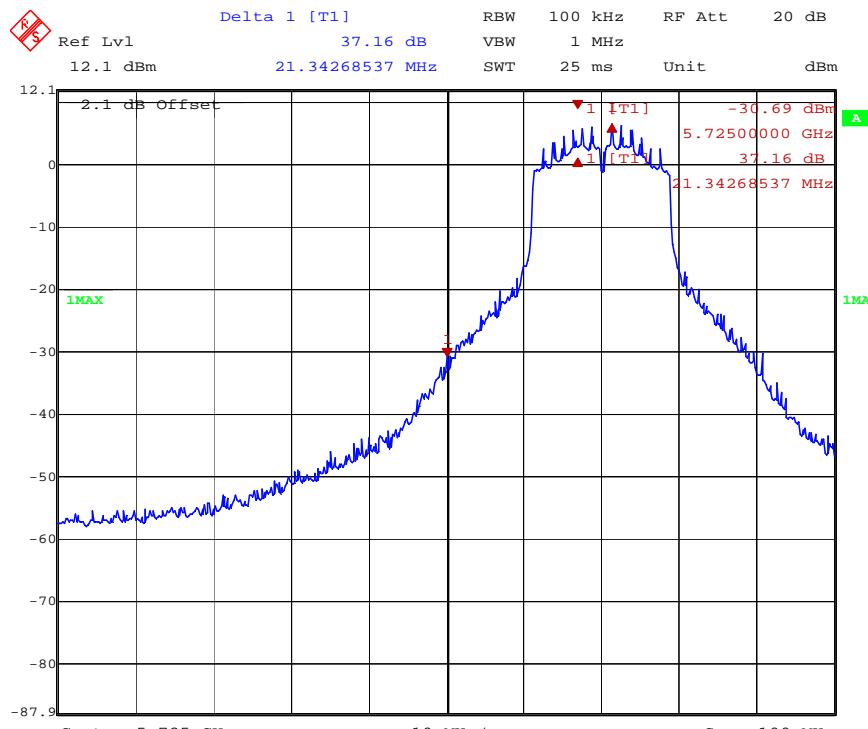


Date: 12.APR.2013 08:36:39

Conducted Spurious Emissions (Channel 165) - 802.11n

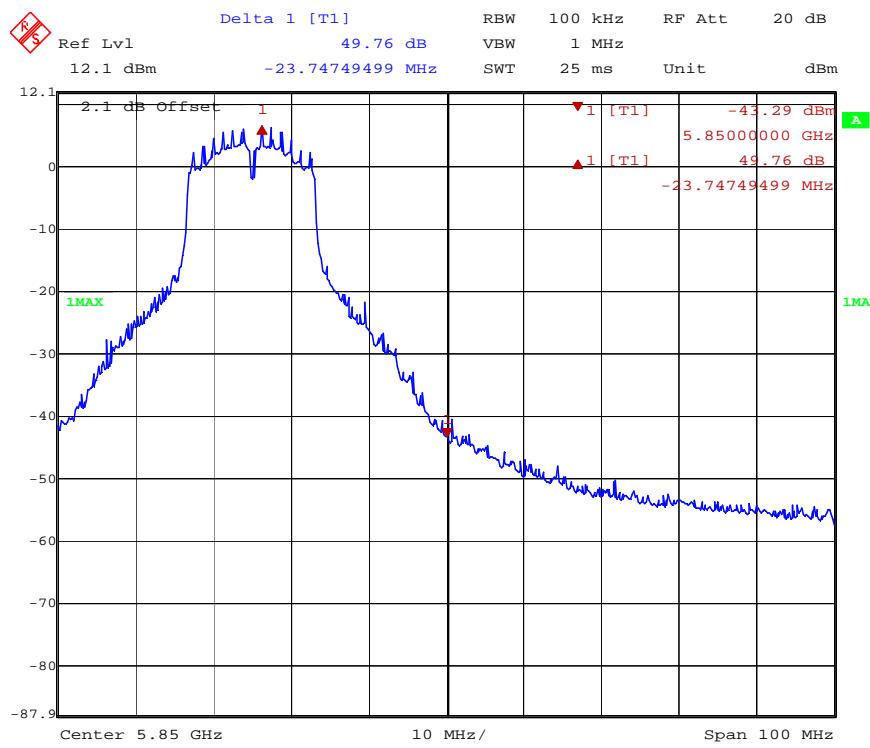


Date: 12.APR.2013 08:56:06

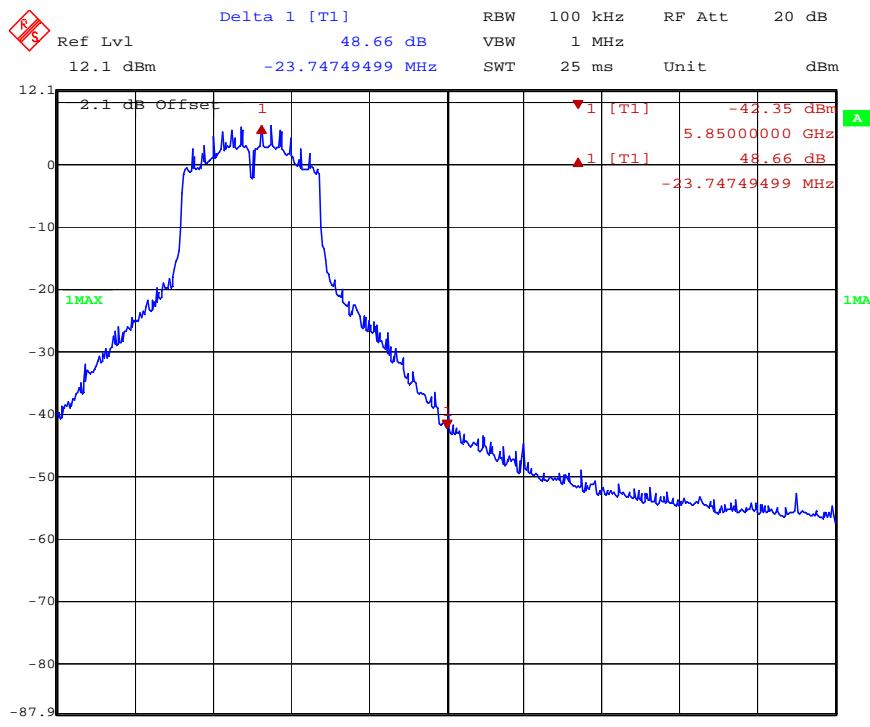
Emissions Close to Band Edge (Channel 149)- 802.11a

Date: 12.APR.2013 08:57:06

Emissions Close to Band Edge (Channel 149)- 802.11n



Date: 12.APR.2013 08:58:25

Emissions Close to Band Edge (Channel 165) - 802.11a

Date: 12.APR.2013 08:59:10

Emissions Close to Band Edge (Channel 165) - 802.11n

7 Power Spectral Density

7.1 Test Limits

§ 15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

7.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

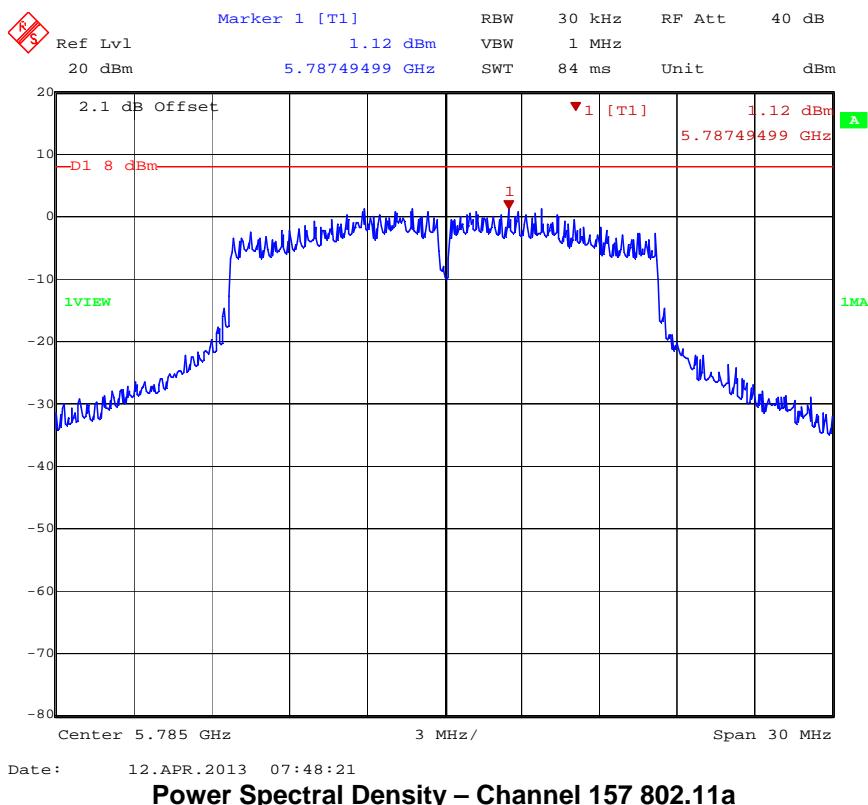
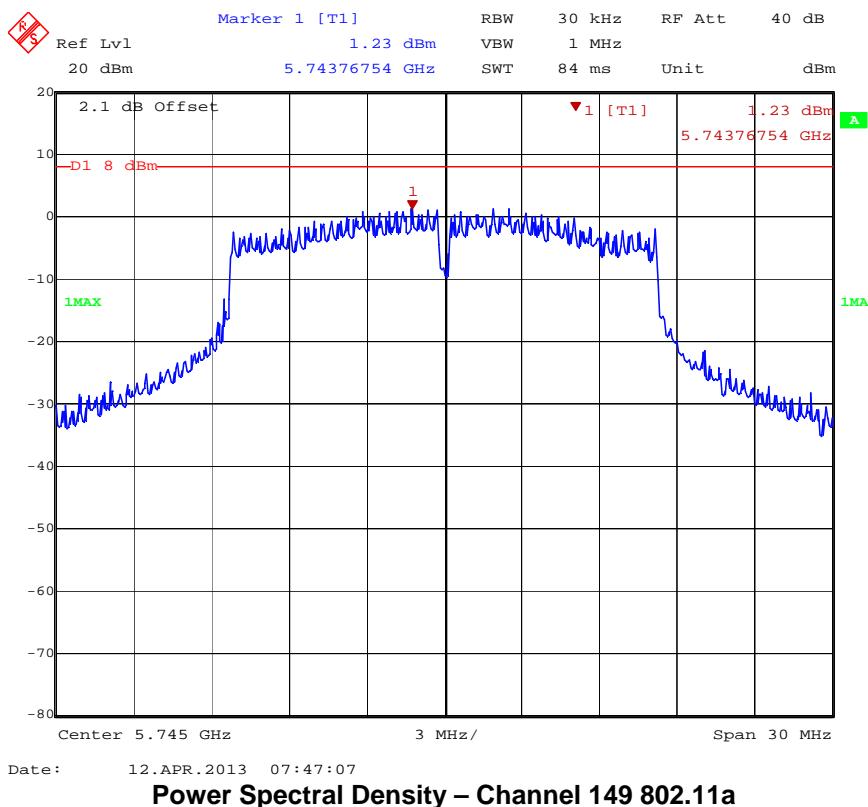
7.3 Test Equipment Used:

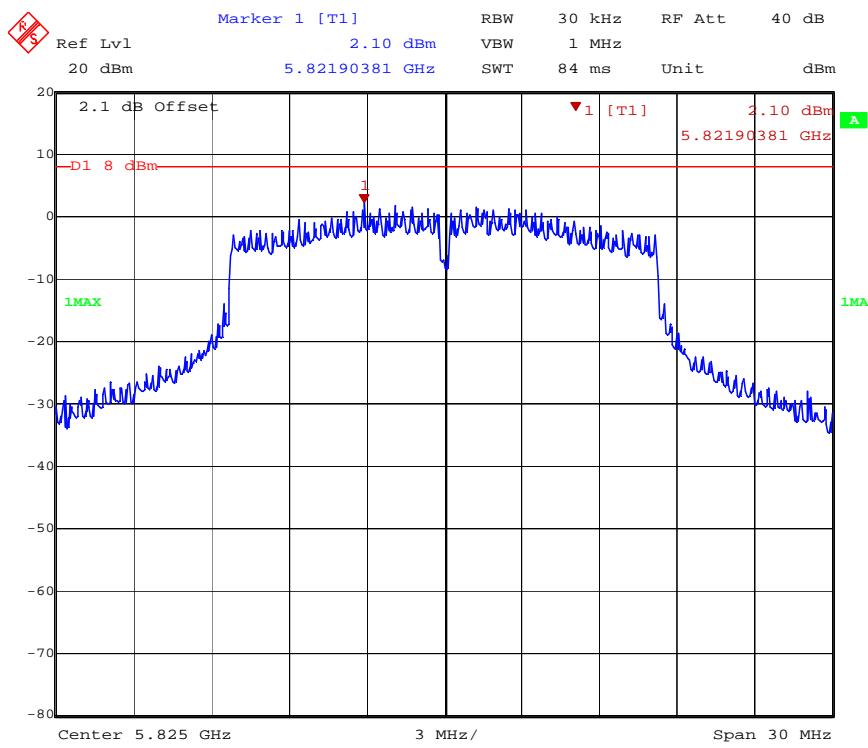
| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|-------------------|---------------|---------------|--------|------------|------------|
| Spectrum Analyzer | 3720 | Rohde&Schwarz | FSEK30 | 11/26/2012 | 11/26/2013 |

7.4 Results:

*PSD Option 1 Method

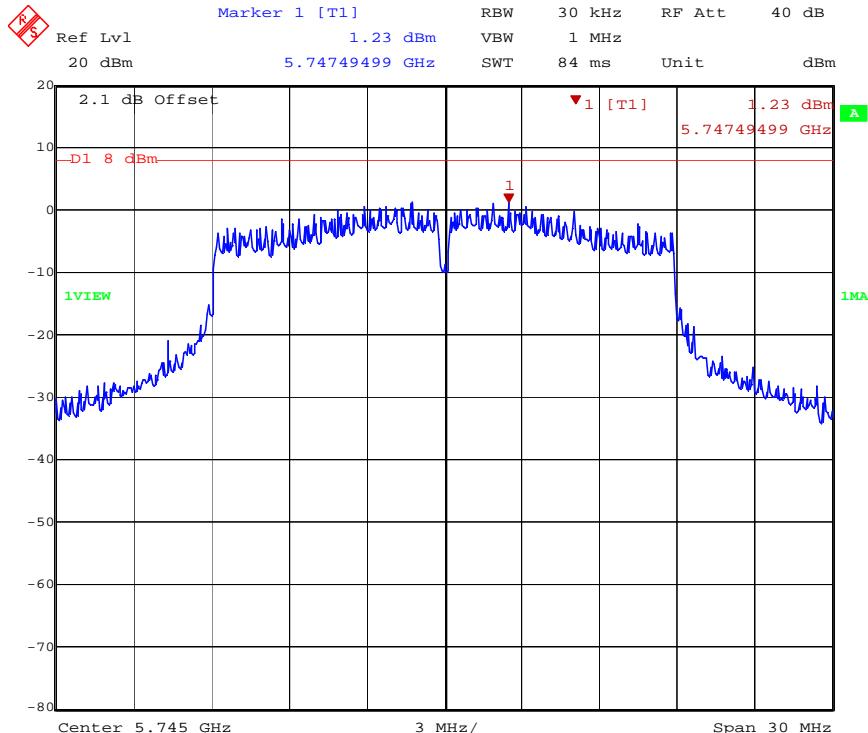
| Mode | Channel Number | Frequency (MHz) | PSD in 3kHz BW (dBm) | Limit (dBm) | Result |
|-----------------|----------------|-----------------|----------------------|-------------|--------|
| 802.11a | 149 | 5745 | 1.23dBm | 8.0 | Pass |
| 802.11a | 157 | 5785 | 1.12dBm | 8.0 | Pass |
| 802.11a | 165 | 5825 | 2.1dBm | 8.0 | Pass |
| 802.11n (HT-20) | 149 | 5745 | 1.23dBm | 8.0 | Pass |
| 802.11n (HT-20) | 157 | 5785 | 1.31dBm | 8.0 | Pass |
| 802.11n (HT-20) | 165 | 5825 | 1.28dBm | 8.0 | Pass |





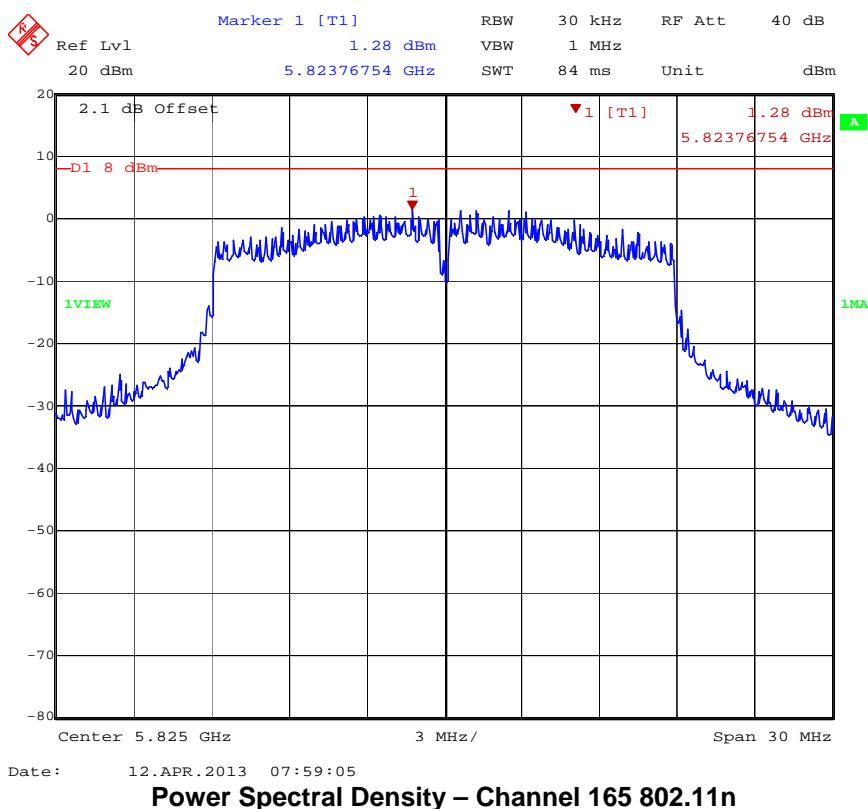
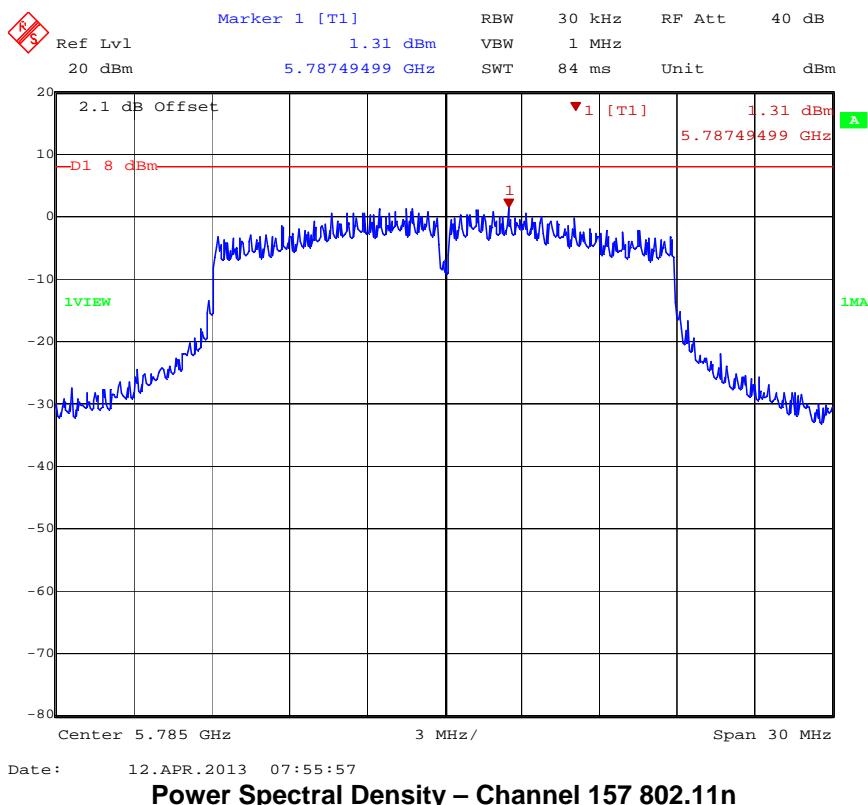
Date: 12.APR.2013 07:52:10

Power Spectral Density – Channel 165 802.11a



Date: 12.APR.2013 07:54:04

Power Spectral Density – Channel 149 802.11n



8 Radiated Spurious Emissions (Transmitter)

8.1 Test Limits

§ 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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 |
| 10.495–0.505 | 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. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

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 dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dB μ V

AF = 18.52 dB

CF = 0.78 dB

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

Level in μ V/m = Common Antilogarithm $[(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$

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 by at least 20dB below the level of the fundamental as required by Part 15.247(d). 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 (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 |
|------------------|--------------------|----------|------------------------------|-----------------------------|---------------------|---------------------|-----------|----------|
| 149 (5745MHz) | 11.49 GHz | V | 43.983 | 34.523 | 74 | 54 | Compliant | 802.11a |
| | 17.235 GHz | V | 49.293 | 40.853 | 74 | 54 | Compliant | 802.11a |
| | 11.49 GHz | H | 44.353 | 34.823 | 74 | 54 | Compliant | 802.11a |
| | 17.235 GHz | H | 50.082 | 40.512 | 74 | 54 | Compliant | 802.11a |
| 157 (5785MHz) | 11.57 GHz | V | 45.672 | 35.152 | 74 | 54 | Compliant | 802.11a |
| | 17.355 GHz | V | 53.097 | 42.617 | 74 | 54 | Compliant | 802.11a |
| | 11.57 GHz | H | 44.032 | 35.442 | 74 | 54 | Compliant | 802.11a |
| | 17.355 GHz | H | 52.847 | 42.637 | 74 | 54 | Compliant | 802.11a |
| 165 (5825MHz) | 11.65 GHz | V | 45.161 | 36.691 | 74 | 54 | Compliant | 802.11a |
| | 17.475 GHz | V | 53.697 | 43.747 | 74 | 54 | Compliant | 802.11a |
| | 11.65 GHz | H | 46.05 | 36.82 | 74 | 54 | Compliant | 802.11a |
| | 17.475 GHz | H | 53.047 | 43.687 | 74 | 54 | Compliant | 802.11a |

802.11a Mode

Worst Case Spurious Measurements (802.11n 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 |
|------------------|--------------------|----------|------------------------------|-----------------------------|---------------------|---------------------|-----------|-----------------|
| 149 (5745MHz) | 11.49 GHz | V | 44.603 | 35.263 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.235 GHz | V | 49.683 | 40.673 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 11.49 GHz | H | 45.753 | 35.533 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.235 GHz | H | 49.953 | 40.803 | 74 | 54 | Compliant | 802.11n (HT-20) |
| 157 (5785MHz) | 11.57 GHz | V | 46.812 | 35.412 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.355 GHz | V | 52.327 | 42.677 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 11.57 GHz | H | 47.582 | 35.592 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.355 GHz | H | 52.197 | 42.687 | 74 | 54 | Compliant | 802.11n (HT-20) |
| 165 (5825MHz) | 11.65 GHz | V | 45.031 | 36.681 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.475 GHz | V | 52.396 | 43.856 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 11.65 GHz | H | 46.81 | 36.93 | 74 | 54 | Compliant | 802.11n (HT-20) |
| | 17.475 GHz | H | 54.077 | 43.767 | 74 | 54 | Compliant | 802.11n (HT-20) |

802.11n Mode (HT-20)

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 149 (5745MHz) | 5.46 GHz | V | 61.32 | 51.38 | 74 | 54 | Compliant | 802.11a |
| | 5.46 GHz | H | 61.24 | 51.24 | 74 | 54 | Compliant | 802.11a |
| | 5.46 GHz | V | 61.58 | 51.46 | 74 | 54 | Compliant | 802.11n (20MHz) |
| | 5.46 GHz | H | 61.49 | 51.51 | 74 | 54 | Compliant | 802.11n (20MHz) |

Low 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 165 (5825MHz) | 7.25GHz | V | 65.78 | 53.79 | 74 | 54 | Compliant | 802.11a |
| | 7.25GHz | H | 66.31 | 53.81 | 74 | 54 | Compliant | 802.11a |
| | 7.25GHz | V | 66.48 | 53.86 | 74 | 54 | Compliant | 802.11n (20MHz) |
| | 7.25GHz | H | 66.21 | 53.9 | 74 | 54 | Compliant | 802.11n (20MHz) |

High Band Edge Measurements

9 Radiated Spurious Emissions (Receiver)

9.1 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 (dB μ V/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

9.2 Test Procedure

ANSI C63.4: 2009

9.3 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 dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dB μ V

AF = 18.52 dB

CF = 0.78 dB

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

Level in μ V/m = Common Antilogarithm $[(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$

9.4 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 |

9.5 Results:

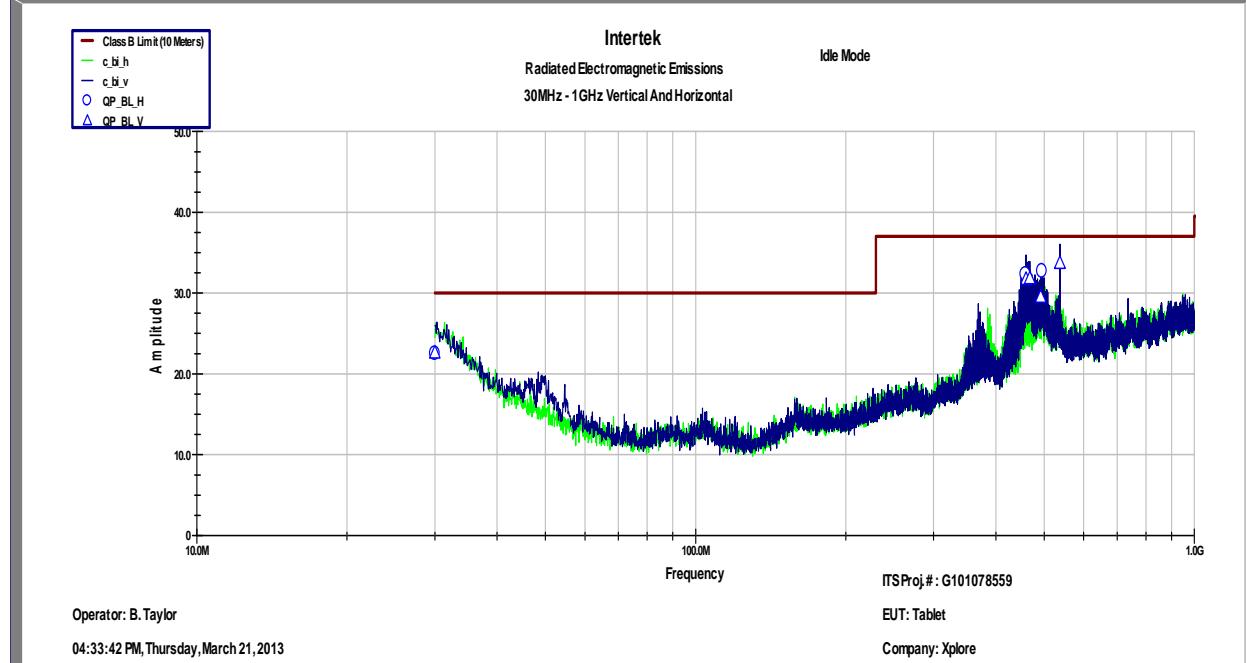
All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.109 for a class B digital device and RSS-GEN Section 6.1.

9.6 Test Data:

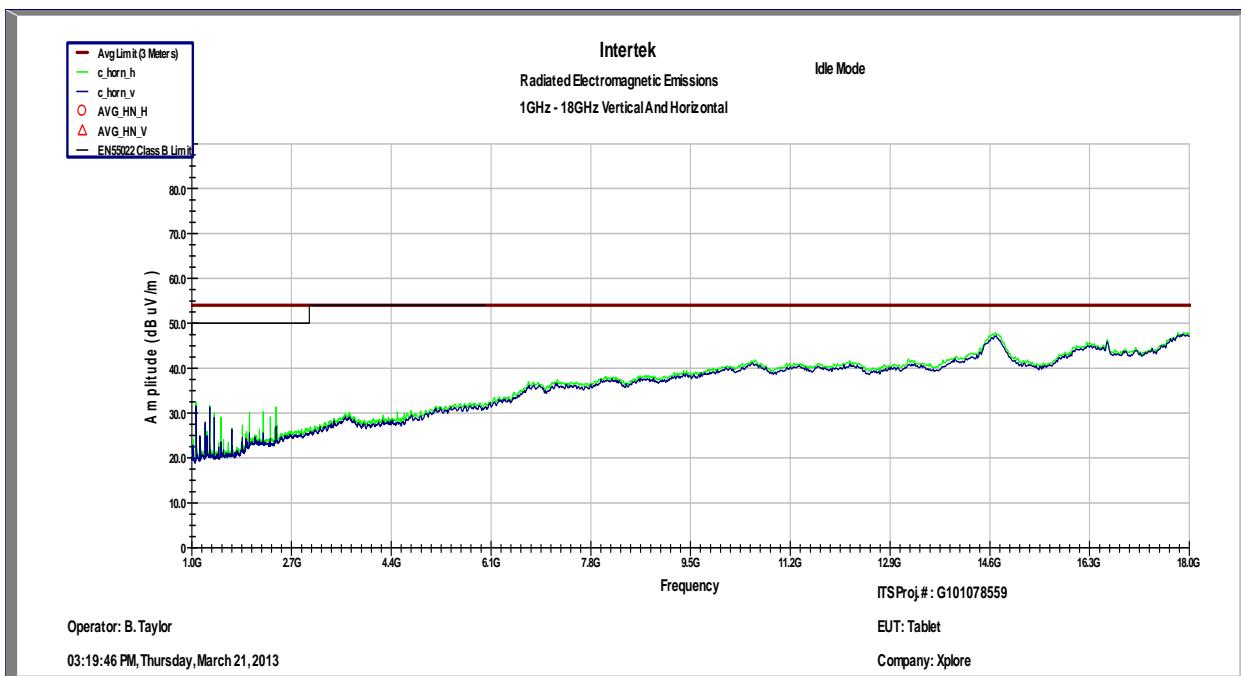
| Radiated Emissions | | | | | | | | | | | |
|--------------------|-----------------------|--------------------|-----------|-----------|-------------------------|----------------|-------------|----------------|---------------|-----------|--|
| Test Engineer: | Bryan Taylor | Start Date: | 3/21/2013 | 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

10 AC Powerline Conducted Emissions

10.1 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 μ H/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 (dB μ V) | |
|--------------------------------|------------------------------|-----------|
| | 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.

10.2 Test Procedure

ANSI C63.4: 2003

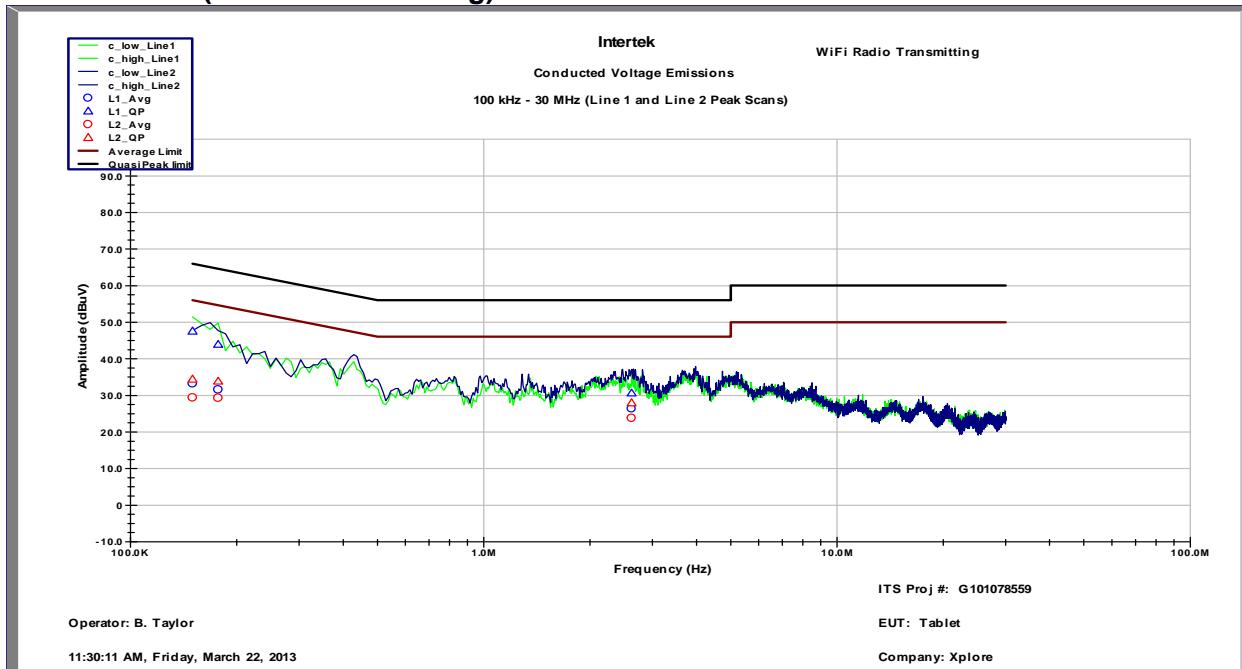
10.3 Test Equipment Used:

| 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 |

10.4 Results:

The sample tested was found to Comply.

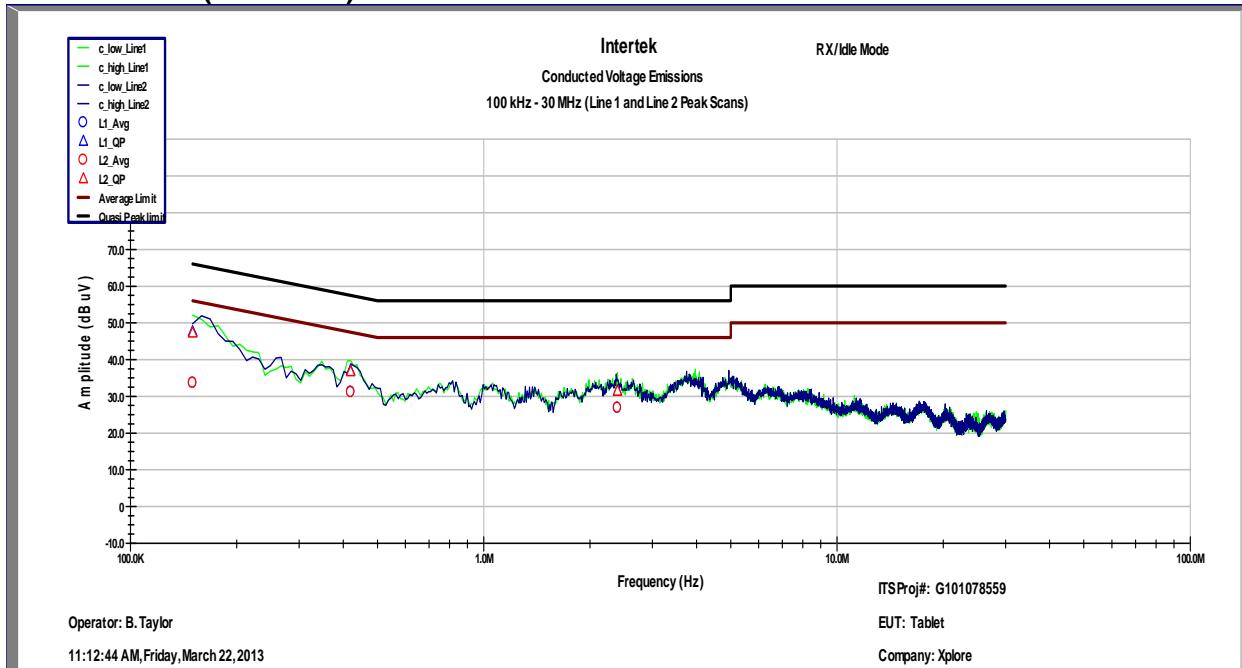
10.5 Data (802.11 Transmitting):



| 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

10.6 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% |
| 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

11 Antenna Requirement per FCC Part 15.203**11.1 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.

11.2 Results:

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

12 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 | <u>+3.9</u> dB | |
| Radiated emissions, 1 to 18 GHz | <u>+4.2</u> dB | |
| Radiated emissions, 18 to 40 GHz | <u>+4.3</u> dB | |
| Power Port Conducted emissions, 150kHz to 30 MHz | <u>+2.8</u> dB | |

13 Revision History

| Revision Level | Date | Report Number | Notes |
|----------------|-----------|------------------|----------------|
| 0 | 6/14/2013 | 101078559LEX-006 | Original Issue |
| | | | |
| | | | |
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