

Test report

273439-1TRFWL

Date of issue: January 6, 2015

Applicant:

Seagate Technology LLC

Product:

Wireless External Hard Disk Drive

Model:

1AYBA5

FCC ID:

ZC9001AYBA5

IC Registration number:


9580A-1AYBA5

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart C, §15.247**
Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz
- ◆ **RSS-210, Issue 8, December 2010, Annex 8**
Frequency Hopping and Digital Modulation Systems Operating in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz Bands

Test location

| | |
|--------------|--|
| Company name | Nemko Canada Inc. |
| Address: | 303 River Road |
| City | Ottawa |
| Province | Ontario |
| Postal code | K1V 1H2 |
| Country | Canada |
| Telephone | +1 613 737 9680 |
| Facsimile | +1 613 737 9691 |
| Toll free | +1 800 563 6336 |
| Website | www.nemko.com |
| Site number | FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber) |

| | |
|---------------------------|---|
| Tested by | Andrey Adelberg, Senior Wireless/EMC Specialist |
| Reviewed by | Kevin Rose, Wireless/EMC Specialist |
| Date | January 6, 2015 |
| Signature of the reviewer |  |

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

| | |
|-----------------|------------------------|
| Company name | Seagate Technology LLC |
| Address | 10200 S. De Anza Blvd |
| City | Cupertino |
| Province/State | CA |
| Postal/Zip code | 95014 |
| Country | USA |

1.2 Test specifications

| | |
|--|---|
| FCC 47 CFR Part 15, Subpart C, Clause 15.247 | Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz |
| RSS-210, Issue 8 Annex 8, December 2010 | Frequency Hopping and Digital Modulation Systems Operating in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz Bands |

1.3 Test methods

| | |
|--|--|
| 558074 D01 Meas Guidance v03r02 (June 5, 2014) | Guidance for compliance measurements on DTS operating under 15.247 |
| ANSI C64.3 v 2003 | American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

| Revision # | Details of changes made to test report |
|------------|--|
| TRF | Original report issued |

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

| Part | Test description | Verdict |
|------------|---------------------------|-------------------|
| §15.207(a) | Conducted limits | Pass |
| §15.31(e) | Variation of power source | Pass ¹ |
| §15.203 | Antenna requirement | Pass ² |

Notes: ¹ Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

² The Antenna is located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiators test results

| Part | Test description | Verdict |
|--------------------|--|----------------|
| §15.247(a)(1)(i) | Frequency hopping systems operating in the 902–928 MHz band | Not applicable |
| §15.247(a)(1)(ii) | Frequency hopping systems operating in the 5725–5850 MHz band | Not applicable |
| §15.247(a)(1)(iii) | Frequency hopping systems operating in the 2400–2483.5 MHz band | Not applicable |
| §15.247(a)(2) | Minimum 6 dB bandwidth for systems using digital modulation techniques | Pass |
| §15.247(b)(1) | Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band | Not applicable |
| §15.247(b)(2) | Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band | Not applicable |
| §15.247(b)(3) | Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands | Pass |
| §15.247(c)(1) | Fixed point-to-point operation with directional antenna gains greater than 6 dBi | Not applicable |
| §15.247(c)(2) | Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams | Not applicable |
| §15.247(d) | Spurious emissions | Pass |
| §15.247(e) | Power spectral density for digitally modulated devices | Pass |
| §15.247(f) | Time of occupancy for hybrid systems | Not applicable |

2.3 IC RSS-GEN, Issue 4, test results

| Part | Test description | Verdict |
|-------|--|----------------|
| 6.6 | Occupied bandwidth | Pass |
| 7.1.2 | Receiver radiated emission limits | Not applicable |
| 7.1.3 | Receiver conducted emission limits | Not applicable |
| 8.8 | Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus | Pass |

Notes: ¹ According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.4 IC RSS-210, Issue 8, test results

| Part | Test description | Verdict |
|----------|--|----------------|
| A8.1 | Frequency hopping systems | |
| A8.1 (a) | Bandwidth of a frequency hopping channel | Not applicable |
| A8.1 (b) | Minimum channel spacing for frequency hopping systems | Not applicable |
| A8.1 (c) | Frequency hopping systems operating in the 902–928 MHz band | Not applicable |
| A8.1 (d) | Frequency hopping systems operating in the 2400–2483.5 MHz band | Not applicable |
| A8.1 (e) | Frequency hopping systems operating in the 5725–5850 MHz band | Not applicable |
| A8.2 | Digital modulation systems | |
| A8.2 (a) | Minimum 6 dB bandwidth | Pass |
| A8.2 (b) | Maximum power spectral density | Pass |
| A8.3 | Hybrid systems | |
| A8.3 (1) | Digital modulation turned off | Not applicable |
| A8.3 (2) | Frequency hopping turned off | Not applicable |
| A8.4 | Transmitter output power and e.i.r.p. requirements | |
| A8.4 (1) | Frequency hopping systems operating in the 902–928 MHz band | Not applicable |
| A8.4 (2) | Frequency hopping systems operating in the 2400–2483.5 MHz band | Not applicable |
| A8.4 (3) | Frequency hopping systems operating in the 5725–5850 MHz | Not applicable |
| A8.4 (4) | Systems employing digital modulation techniques | Pass |
| A8.4 (5) | Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band | Not applicable |
| A8.4 (6) | Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams | Not applicable |
| A8.5 | Out-of-band emissions | Pass |

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

| | |
|------------------------|-------------------|
| Receipt date | November 11, 2014 |
| Nemko sample ID number | 2 |

3.2 EUT information

| | |
|---------------|---|
| Product name | Wireless External Hard Disk Drive |
| Model | 1AYBA5 |
| Trade marks |  |
| Serial number | NA30500R |

3.3 Technical information

| | |
|---|---|
| Company number | 9580A |
| Model number | 1AYBA5 |
| Manufacturer | Seagate Technology LLC |
| Tested to Radio Standards Specification | RSS-210 A8 |
| Open Area Test Site Industry Canada # | 2040A |
| Frequency band | 2400–2483.5 MHz |
| Frequency range (or fixed frequency) | 2412–2462 MHz |
| RF power | 0.0344 W EIRP (15.37 dBm) |
| Field strength (at what distance) | N/A |
| Occupied bandwidth (99 % BW) | 802.11b: 13.99 MHz; 802.11g: 16.97 MHz; 802.11n: 18.03 MHz |
| Type of modulation | 802.11b/g/n |
| Emission designator (TRC-43) | W7D |
| Transmitter spurious (worst case) | 53.28 dB μ V/m @ 3 m at 2390 MHz |
| Receiver spurious (worst case) | N/A |
| Power requirements | 3.7 V _{DC} from internal battery or 5 V _{DC} via USB from host PC with 120 V _{AC} , 60 Hz |
| Antenna information | Unicon Technologies Corporation. 3.2 x 1.6 x 0.5 (mm) WiFi/Bluetooth Ceramic Chip Antenna (AA055A), PN: H2U34W1H1Z0100, 2.5 dBi gain The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. |

3.4 Product description and theory of operation

EUT is an external hard drive with wireless 802.11b/g/n transmitter using 2.4 GHz ISM band Wi-Fi communication

3.5 EUT exercise details

EUT was connected to UART interface board and was controlled via test computer using TeraTerm session

3.6 EUT setup diagram

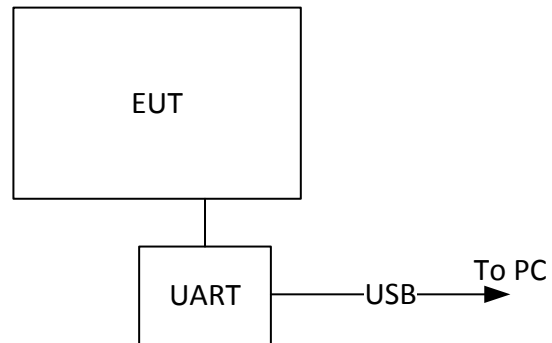


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

| Description | Brand name | Model/Part number | Serial number |
|----------------------|---------------|-------------------|---------------|
| UART interface board | – | – | – |
| PC / Laptop | Dell Latitude | D630C | FA002359 |

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

| | |
|-------------------|---------------|
| Temperature | 15–30 °C |
| Relative humidity | 20–75 % |
| Air pressure | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of $K=2$ with 95% certainty.

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

| Equipment | Manufacturer | Model no. | Asset no. | Cal cycle | Next cal. |
|-----------------------------|------------------------|--------------|-----------|-----------|------------|
| 3 m EMI test chamber | TDK | SAC-3 | FA002047 | 1 year | Mar. 18/15 |
| Flush mount turntable | Sunol | FM2022 | FA002082 | — | NCR |
| Controller | Sunol | SC104V | FA002060 | — | NCR |
| Antenna mast | Sunol | TLT2 | FA002061 | — | NCR |
| Power source | California Instruments | 3001i | FA001021 | 1 year | June 27/15 |
| Receiver/spectrum analyzer | Rohde & Schwarz | ESU 26 | FA002043 | 1 year | Dec. 23/14 |
| Spectrum analyzer | Rohde & Schwarz | FSU | FA001877 | 1 year | Jan. 27/15 |
| Bilog antenna (20–3000 MHz) | Sunol | JB3 | FA002108 | 1 year | Mar. 12/15 |
| Horn antenna (1–18 GHz) | EMCO | 3115 | FA000825 | 1 year | Mar. 10/15 |
| Pre-amplifier (1–18 GHz) | JCA | JCA118-503 | FA002091 | 1 year | June 23/15 |
| Horn antenna 18–26.5 GHz | Electro-metrics | SH-50/60-1 | FA000479 | — | VOU |
| 18–26 GHz pre-amplifier | Narda | BBS-1826N612 | FA001550 | — | VOU |

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

8.1.1 Definitions and limits

FCC:

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 Ω 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.

IC:

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which 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 table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 8.1-1: Conducted emissions limit

| 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 |

Note: * - Decreases with the logarithm of the frequency.
 ** - A linear average detector is required.

8.1.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 13, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1004 mbar |
| Verdict | Pass | Relative humidity | 32 % |

8.1.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

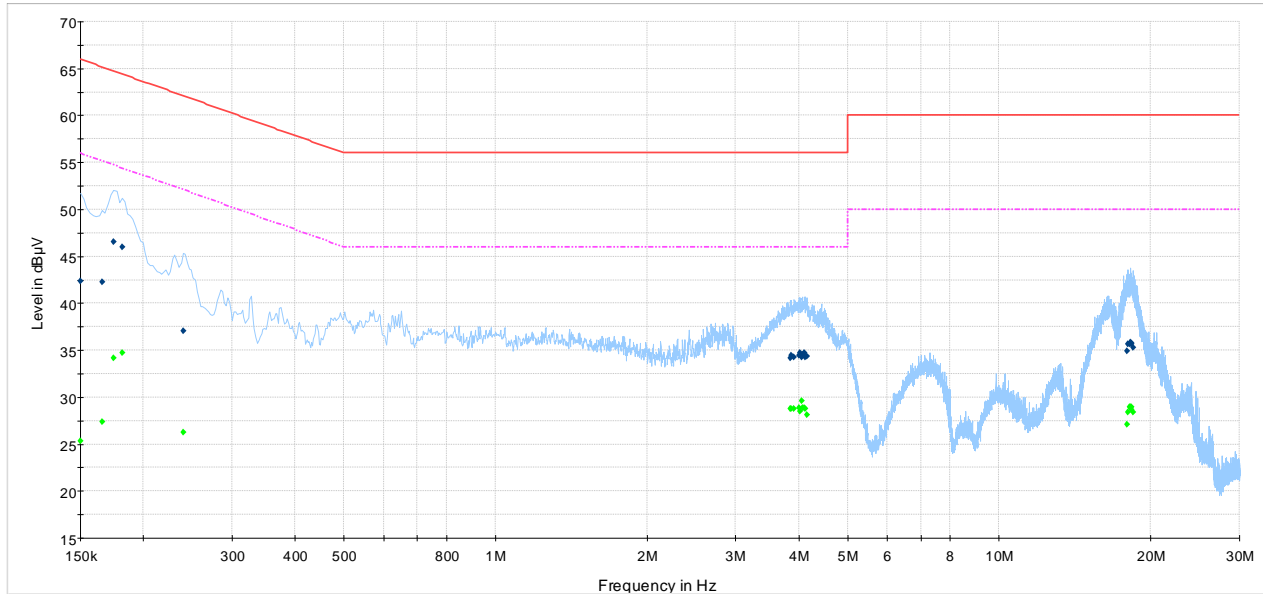
Receiver settings for preview measurements:

| | |
|----------------------|------------------|
| Resolution bandwidth | 9 kHz |
| Video bandwidth | 30 kHz |
| Detector mode | Peak and Average |
| Trace mode | Max Hold |
| Measurement time | 1000 ms |

Receiver settings for final measurements:

| | |
|----------------------|------------------------|
| Resolution bandwidth | 9 kHz |
| Video bandwidth | 30 kHz |
| Detector mode | Quasi-Peak and Average |
| Trace mode | Max Hold |
| Measurement time | 1000 ms |

8.1.4 Test data



Conducted emissions on phase line
 — CISPR 22 Mains QP Class B
 - - - CISPR 22 Mains AV Class B
 — Preview Result 1-PK+
 ◆ Final Result 1-Q-PK
 ◆ Final Result 2-AVG

Plot 8.1-1: Conducted emissions on phase line

Table 8.1-2: Quasi-Peak conducted emissions results on phase line

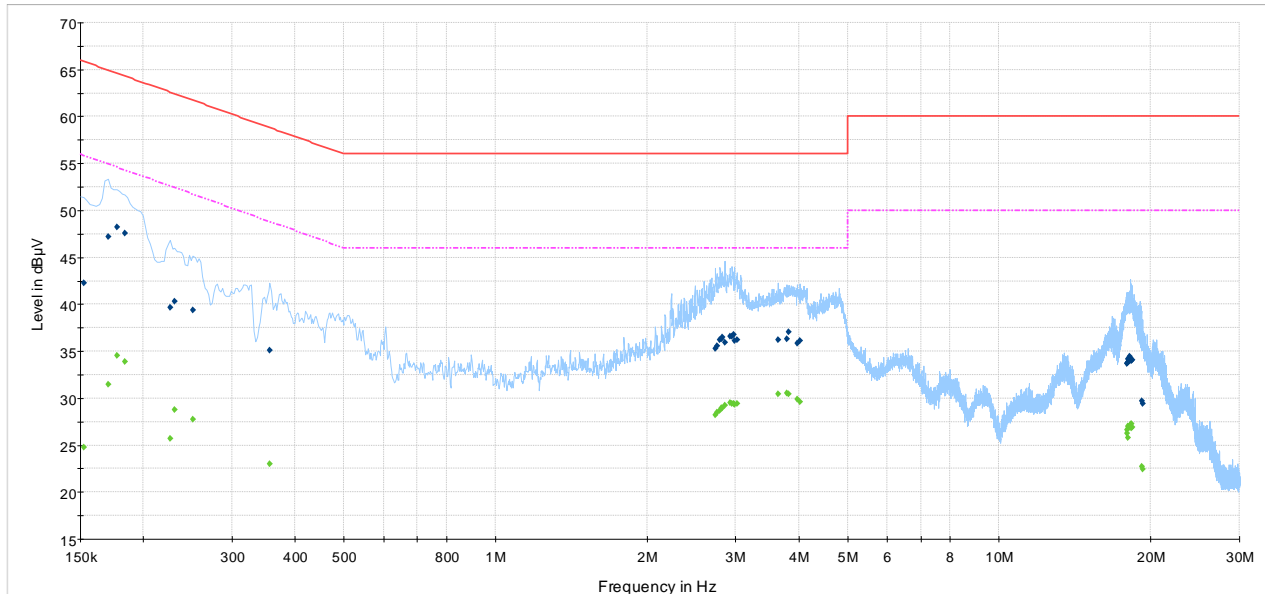
| Frequency, MHz | Q-Peak result, dBµV | Meas. Time, ms | Bandwidth, kHz | Filter | Correction, dB | Margin, dB | Limit, dBµV |
|----------------|---------------------|----------------|----------------|--------|----------------|------------|-------------|
| 0.174750 | 46.5 | 1000.0 | 9 | On | 10.3 | 18.2 | 64.7 |
| 0.181500 | 46.0 | 1000.0 | 9 | On | 10.2 | 18.4 | 64.4 |
| 4.111250 | 34.8 | 1000.0 | 9 | On | 10.1 | 21.2 | 56.0 |
| 4.019000 | 34.7 | 1000.0 | 9 | On | 10.1 | 21.3 | 56.0 |
| 4.064000 | 34.6 | 1000.0 | 9 | On | 10.1 | 21.4 | 56.0 |
| 3.866000 | 34.5 | 1000.0 | 9 | On | 10.1 | 21.5 | 56.0 |

Note: 43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-3: Average conducted emissions results on phase line

| Frequency, MHz | Average result, dBµV | Meas. Time, ms | Bandwidth, kHz | Filter | Correction, dB | Margin, dB | Limit, dBµV |
|----------------|----------------------|----------------|----------------|--------|----------------|------------|-------------|
| 4.059500 | 29.7 | 1000.0 | 9 | On | 10.1 | 16.3 | 46.0 |
| 4.111250 | 28.9 | 1000.0 | 9 | On | 10.1 | 17.1 | 46.0 |
| 3.854750 | 28.8 | 1000.0 | 9 | On | 10.1 | 17.2 | 46.0 |
| 3.866000 | 28.8 | 1000.0 | 9 | On | 10.1 | 17.2 | 46.0 |
| 3.917750 | 28.8 | 1000.0 | 9 | On | 10.1 | 17.2 | 46.0 |
| 4.010000 | 28.8 | 1000.0 | 9 | On | 10.1 | 17.2 | 46.0 |

Note: 43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)



Conducted emissions on neutral line
 — CISPR 22 Mains QP Class B
 - - - CISPR 22 Mains AV Class B
 — Preview Result 1-PK+
 ◆ Final Result 1-Q PK
 ◆ Final Result 2-AVG

Plot 8.1-2: Conducted emissions on neutral line

Table 8.1-4: Quasi-Peak conducted emissions results on neutral line

| Frequency, MHz | Q-Peak result, dBµV | Meas. Time, ms | Bandwidth, kHz | Filter | Correction, dB | Margin, dB | Limit, dBµV |
|----------------|---------------------|----------------|----------------|--------|----------------|------------|-------------|
| 0.177000 | 48.3 | 1000.0 | 9 | On | 10.3 | 16.4 | 64.6 |
| 0.183750 | 47.6 | 1000.0 | 9 | On | 10.2 | 16.7 | 64.3 |
| 0.170250 | 47.2 | 1000.0 | 9 | On | 10.3 | 17.8 | 64.9 |
| 3.814250 | 37.0 | 1000.0 | 9 | On | 10.1 | 19.0 | 56.0 |
| 2.975000 | 36.8 | 1000.0 | 9 | On | 10.0 | 19.2 | 56.0 |
| 2.925500 | 36.6 | 1000.0 | 9 | On | 10.0 | 19.4 | 56.0 |

Table 8.1-5: Average conducted emissions results on neutral line

| Frequency, MHz | Average result, dBµV | Meas. Time, ms | Bandwidth, kHz | Filter | Correction, dB | Margin, dB | Limit, dBµV |
|----------------|----------------------|----------------|----------------|--------|----------------|------------|-------------|
| 3.787250 | 30.5 | 1000.0 | 9 | On | 10.1 | 15.5 | 46.0 |
| 3.636500 | 30.4 | 1000.0 | 9 | On | 10.0 | 15.6 | 46.0 |
| 3.814250 | 30.4 | 1000.0 | 9 | On | 10.1 | 15.6 | 46.0 |
| 3.974000 | 29.9 | 1000.0 | 9 | On | 10.1 | 16.1 | 46.0 |
| 4.028000 | 29.6 | 1000.0 | 9 | On | 10.1 | 16.4 | 46.0 |
| 2.925500 | 29.5 | 1000.0 | 9 | On | 10.0 | 16.5 | 46.0 |

8.2 FCC 15.247(a)(2) and RSS-210 A8.2(a) Minimum 6 dB bandwidth for systems using digital modulation techniques

8.2.1 Definitions and limits

FCC and IC:

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
- (2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 14, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1006 mbar |
| Verdict | Pass | Relative humidity | 31 % |

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

| | |
|----------------------|----------|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | ≥3 × RBW |
| Frequency span | 30 MHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

8.2.4 Test data

Table 8.2-1: 6 dB bandwidth measurement results

| Modulation | Frequency, MHz | 6 dB bandwidth (max rate), MHz | 6 dB bandwidth (min rate), MHz | Minimum limit, MHz | Margin, MHz |
|------------|----------------|--------------------------------|--------------------------------|--------------------|-------------|
| 802.11b | 2412 | 10.15 | 10.07 | 0.50 | 9.57 |
| | 2437 | 10.20 | 10.04 | 0.50 | 9.54 |
| | 2462 | 10.20 | 11.07 | 0.50 | 9.70 |
| 802.11g | 2412 | 16.42 | 16.47 | 0.50 | 15.92 |
| | 2437 | 16.41 | 16.52 | 0.50 | 15.91 |
| | 2462 | 16.26 | 16.54 | 0.50 | 15.76 |
| 802.11n | 2412 | 17.53 | 17.58 | 0.50 | 17.03 |
| | 2437 | 17.52 | 17.62 | 0.50 | 17.02 |
| | 2462 | 17.51 | 17.63 | 0.50 | 17.01 |

Note: The margin was calculated as follows: minimum [6 dB BW (max rate), 6 dB BW (max rate)] – Limit

Section 8

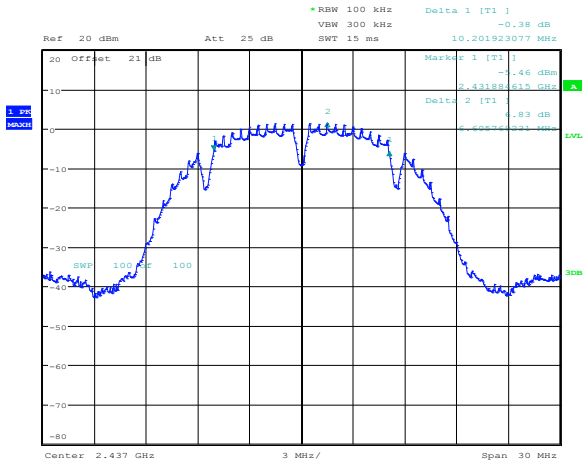
Test name

Specification

Testing data

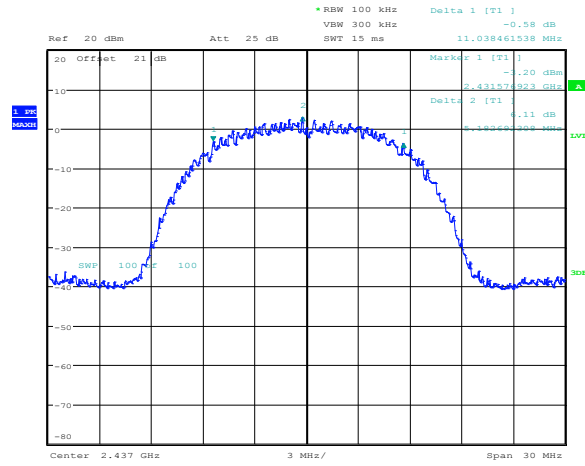
FCC 15.247(a)(2) and RSS-210 A8.2(a) Minimum 6 dB bandwidth for systems using digital modulation techniques

FCC 15 Subpart C and RSS-210, Issue 8



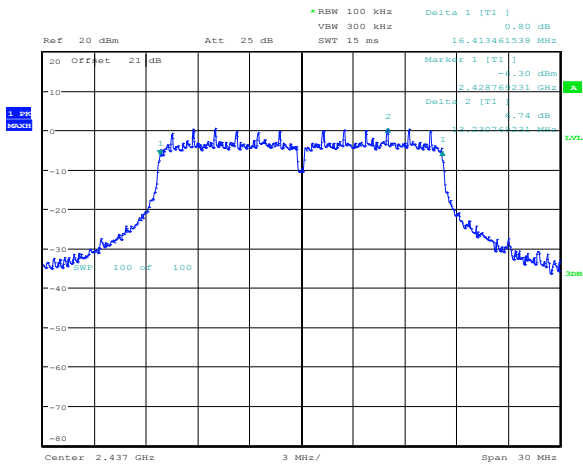
Date: 14.NOV.2014 10:30:06

Figure 8.2-1: 6 dB bandwidth on 802.11b at min rate, sample plot



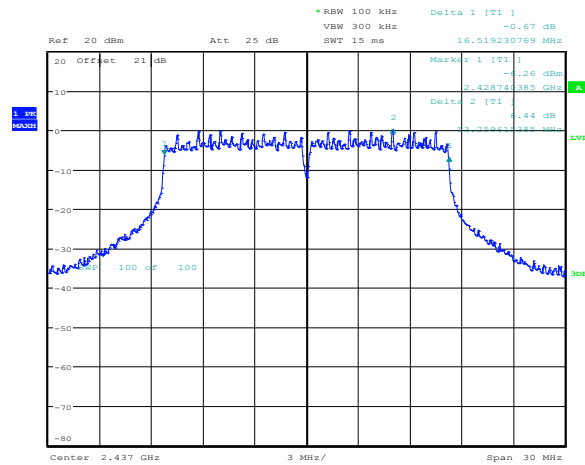
Date: 14.NOV.2014 10:32:15

Figure 8.2-2: 6 dB bandwidth on 802.11b at max rate, sample plot



Date: 14.NOV.2014 10:24:41

Figure 8.2-3: 6 dB bandwidth on 802.11g at min rate, sample plot



Date: 14.NOV.2014 10:27:05

Figure 8.2-4: 6 dB bandwidth on 802.11g at max rate, sample plot

Section 8

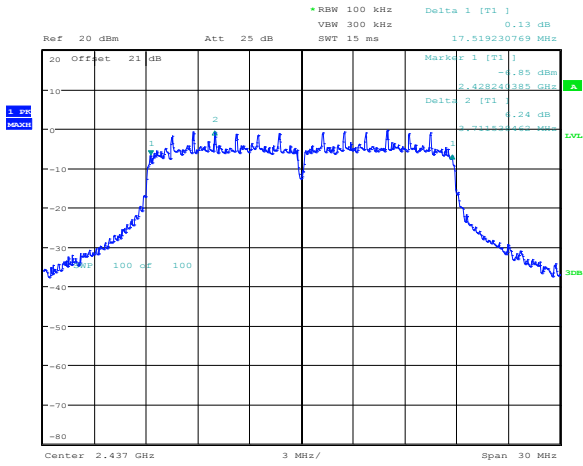
Test name

Specification

Testing data

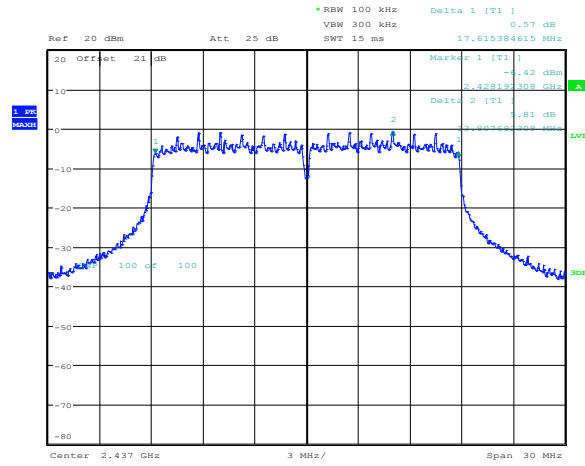
FCC 15.247(a)(2) and RSS-210 A8.2(a) Minimum 6 dB bandwidth for systems using digital modulation techniques

FCC 15 Subpart C and RSS-210, Issue 8



Date: 14.NOV.2014 10:22:22

Figure 8.2-5: 6 dB bandwidth on 802.11n at min rate, sample plot



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Figure 8.2-6: 6 dB bandwidth on 802.11n at max rate, sample plot

8.3 RSS-Gen 6.6 Occupied bandwidth

8.3.1 Definitions and limits

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

8.3.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 13, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1004 mbar |
| Verdict | Pass | Relative humidity | 32 % |

8.3.3 Observations, settings and special notes

Spectrum analyser settings:

| | |
|----------------------|----------|
| Resolution bandwidth | 300 kHz |
| Video bandwidth | ≥3 × RBW |
| Detector mode | Peak |
| Trace mode | Max Hold |

8.3.4 Test data

Table 8.3-1: 99 % bandwidth results

| Modulation | Frequency, MHz | 99 % bandwidth (min rate), MHz | 99 % bandwidth (max rate), MHz |
|------------|----------------|--------------------------------|--------------------------------|
| 802.11b | 2412 | 13.99 | 13.65 |
| | 2437 | 13.99 | 13.75 |
| | 2462 | 13.99 | 13.70 |
| 802.11g | 2412 | 16.97 | 16.78 |
| | 2437 | 16.92 | 16.83 |
| | 2462 | 16.92 | 16.83 |
| 802.11n | 2412 | 18.03 | 17.88 |
| | 2437 | 18.03 | 17.93 |
| | 2462 | 18.03 | 17.93 |

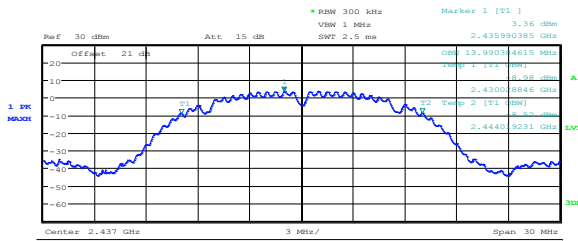


Figure 8.3-1: 99 % bandwidth on 802.11b, min rate, sample plot

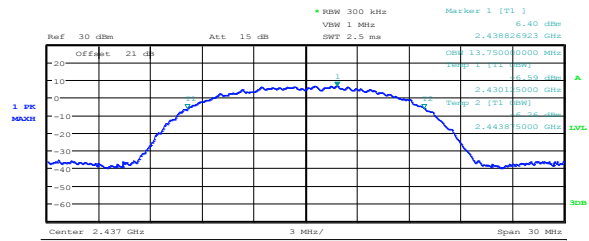


Figure 8.3-2: 99 % bandwidth on 802.11b, max rate, sample plot

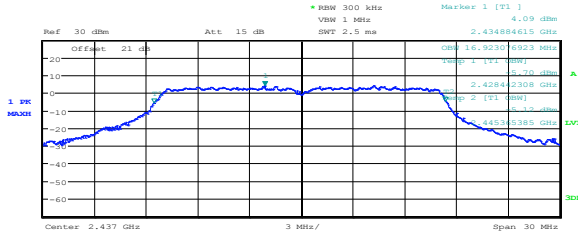


Figure 8.3-3: 99 % bandwidth on 802.11g, min rate, sample plot

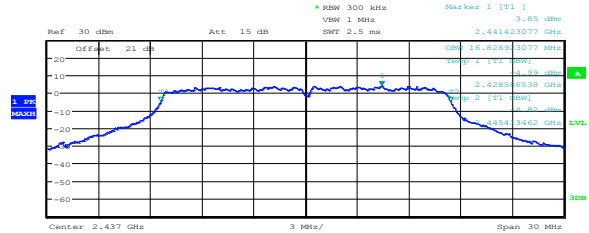


Figure 8.3-4: 99 % bandwidth on 802.11g, max rate, sample plot

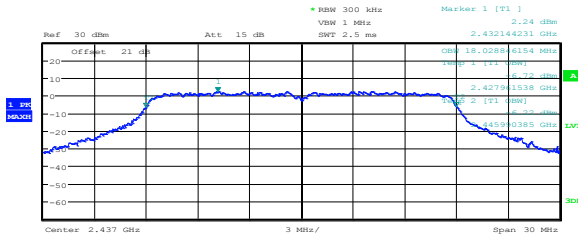


Figure 8.3-5: 99 % bandwidth on 802.11n, min rate, sample plot

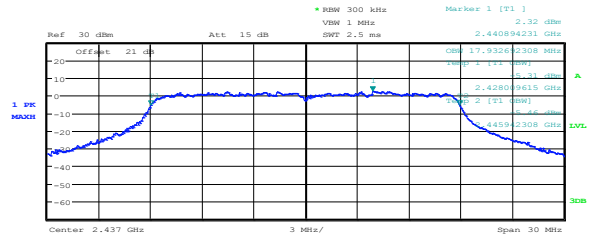


Figure 8.3-6: 99 % bandwidth on 802.11n, max rate, sample plot

8.4 FCC 15.247(b) and RSS-210 A8.4 (4) Transmitter output power and e.i.r.p. requirements

8.4.1 Definitions and limits

FCC:

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- (3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 W (30 dBm). 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.
 - (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.
 - (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

- (c) Operation with directional antenna gains greater than 6 dBi.
- (2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:
 - (i) Different information must be transmitted to each receiver.
 - (ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:
 - (A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or staff having the highest gain.

IC:

A8.4 (4) Transmitter Output Power and e.i.r.p. Requirements for systems employing digital modulation techniques operating in the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands

For systems employing digital modulation techniques operating in the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power (see RSS-Gen).

8.4.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 13, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1004 mbar |
| Verdict | Pass | Relative humidity | 32 % |



8.4.3 Observations, settings and special notes

The test was performed according to DTS guidelines section 9.2.2.2 Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep). Spectrum analyzer settings were:

| | |
|----------------------|--|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 10 MHz |
| Detector mode | RMS |
| Trace mode | Power averaging over 100 sweeps |
| Power integration BW | 20 MHz |
| Sweep trigger | Gated trigger set to enable triggering only on full power pulses |

8.4.4 Test data

Table 8.4-1: Output power measurements results at minimum data rate

| Modulation | Frequency, MHz | Conducted output power, dBm | | Margin, dB | Antenna gain, dBi | EIRP, dBm | EIRP limit, dBm | EIRP margin, dB |
|------------|----------------|-----------------------------|-------|------------|-------------------|-----------|-----------------|-----------------|
| | | Measured | Limit | | | | | |
| 802.11b | 2412 | 12.87 | 30.00 | 17.13 | 2.50 | 15.37 | 36.00 | 20.63 |
| | 2437 | 11.80 | 30.00 | 18.20 | 2.50 | 14.30 | 36.00 | 21.70 |
| | 2462 | 11.67 | 30.00 | 18.33 | 2.50 | 14.17 | 36.00 | 21.83 |
| 802.11g | 2412 | 11.57 | 30.00 | 18.43 | 2.50 | 14.07 | 36.00 | 21.93 |
| | 2437 | 11.61 | 30.00 | 18.39 | 2.50 | 14.11 | 36.00 | 21.89 |
| | 2462 | 11.48 | 30.00 | 18.52 | 2.50 | 13.98 | 36.00 | 22.02 |
| 802.11n | 2412 | 10.99 | 30.00 | 19.01 | 2.50 | 13.49 | 36.00 | 22.51 |
| | 2437 | 10.61 | 30.00 | 19.39 | 2.50 | 13.11 | 36.00 | 22.89 |
| | 2462 | 10.46 | 30.00 | 19.54 | 2.50 | 12.96 | 36.00 | 23.04 |

Table 8.4-2: Output power measurements results at maximum data rate

| Modulation | Frequency, MHz | Conducted output power, dBm | | Margin, dB | Antenna gain, dBi | EIRP, dBm | EIRP limit, dBm | EIRP margin, dB |
|------------|----------------|-----------------------------|-------|------------|-------------------|-----------|-----------------|-----------------|
| | | Measured | Limit | | | | | |
| 802.11b | 2412 | 12.55 | 30.00 | 17.45 | 2.50 | 15.05 | 36.00 | 20.95 |
| | 2437 | 11.82 | 30.00 | 18.18 | 2.50 | 14.32 | 36.00 | 21.68 |
| | 2462 | 11.73 | 30.00 | 18.27 | 2.50 | 14.23 | 36.00 | 21.77 |
| 802.11g | 2412 | 11.64 | 30.00 | 18.36 | 2.50 | 14.14 | 36.00 | 21.86 |
| | 2437 | 11.30 | 30.00 | 18.70 | 2.50 | 13.80 | 36.00 | 22.20 |
| | 2462 | 11.13 | 30.00 | 18.87 | 2.50 | 13.63 | 36.00 | 22.37 |
| 802.11n | 2412 | 10.73 | 30.00 | 19.27 | 2.50 | 13.23 | 36.00 | 22.77 |
| | 2437 | 10.36 | 30.00 | 19.64 | 2.50 | 12.86 | 36.00 | 23.14 |
| | 2462 | 10.17 | 30.00 | 19.83 | 2.50 | 12.67 | 36.00 | 23.33 |

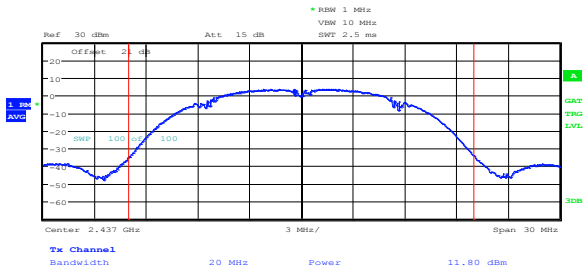


Figure 8.4-1: Output power on 802.11b, min rate, sample plot

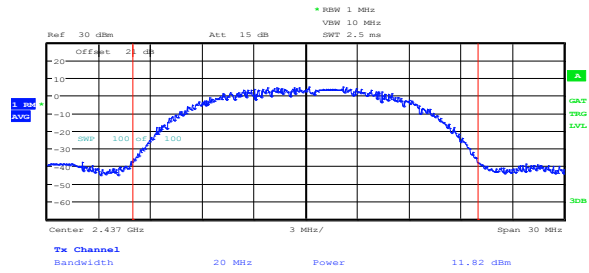


Figure 8.4-2: Output power on 802.11b, max rate, sample plot

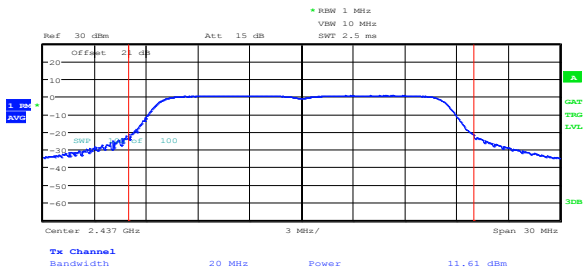


Figure 8.4-3: Output power on 802.11g, min rate, sample plot

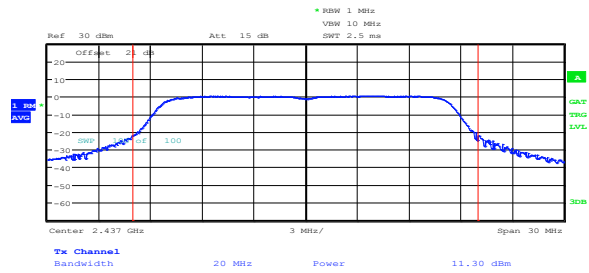


Figure 8.4-4: Output power on 802.11g, max rate, sample plot

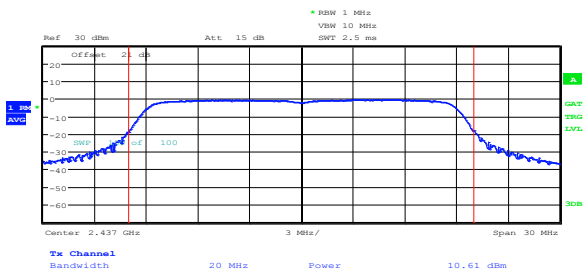


Figure 8.4-5: Output power on 802.11n, min rate, sample plot

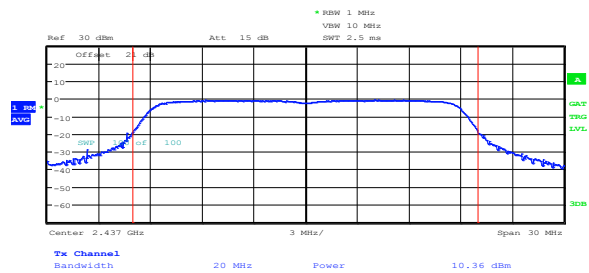


Figure 8.4-6: Output power on 802.11n, max rate, sample plot

8.5 FCC 15.247(d) and RSS-210 A8.5 Spurious (out-of-band) emissions

8.5.1 Definitions and limits

FCC:

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)).

IC:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

Table 8.5-1: FCC §15.209 and RSS-Gen – Radiated emission limits

| Frequency, MHz | Field strength of emissions | | Measurement distance, m |
|-------------------|-----------------------------|-----------------------------------|-------------------------|
| | µV/m | dBµV/m | |
| 0.009–0.490 | 2400/F | 67.6 – 20 × log ₁₀ (F) | 300 |
| 0.490–1.705 | 24000/F | 87.6 – 20 × log ₁₀ (F) | 30 |
| 1.705–30.0 | 30 | 29.5 | 30 |
| 30–88 | 100 | 40.0 | 3 |
| 88–216 | 150 | 43.5 | 3 |
| 216–960 | 200 | 46.0 | 3 |
| above 960 | 500 | 54.0 | 3 |

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.5-2: IC restricted frequency bands

| MHz | MHz | MHz | GHz |
|-----------------|---------------------|---------------|-------------|
| 0.090–0.110 | 12.51975–12.52025 | 399.9–410 | 5.35–5.46 |
| 2.1735–2.1905 | 12.57675–12.57725 | 608–614 | 7.25–7.75 |
| 3.020–3.026 | 13.36–13.41 | 960–1427 | 8.025–8.5 |
| 4.125–4.128 | 16.42–16.423 | 1435–1626.5 | 9.0–9.2 |
| 4.17725–4.17775 | 16.69475–16.69525 | 1645.5–1646.5 | 9.3–9.5 |
| 4.20725–4.20775 | 16.80425–16.80475 | 1660–1710 | 10.6–12.7 |
| 5.677–5.683 | 25.5–25.67 | 1718.8–1722.2 | 13.25–13.4 |
| 6.215–6.218 | 37.5–38.25 | 2200–2300 | 14.47–14.5 |
| 6.26775–6.26825 | 73–74.6 | 2310–2390 | 15.35–16.2 |
| 6.31175–6.31225 | 74.8–75.2 | 2655–2900 | 17.7–21.4 |
| 8.291–8.294 | 108–138 | 3260–3267 | 22.01–23.12 |
| 8.362–8.366 | 156.52475–156.52525 | 3332–3339 | 23.6–24.0 |
| 8.37625–8.38675 | 156.7–156.9 | 3345.8–3358 | 31.2–31.8 |
| 8.41425–8.41475 | 240–285 | 3500–4400 | 36.43–36.5 |
| 12.29–12.293 | 322–335.4 | 4500–5150 | Above 38.6 |

Note: Certain frequency bands listed in Table 8.5-2 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.5-3: FCC restricted frequency bands

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110 | 16.42–16.423 | 399.9–410 | 4.5–5.15 |
| 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 | 2690–2900 | 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 | Above 38.6 |
| 13.36–13.41 | | | |

8.5.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 14, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1006 mbar |
| Verdict | Pass | Relative humidity | 31 % |

8.5.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.

Cabinet radiation measurements were performed at a distance of 3 m with antenna port terminated with 50 Ωload. All modulations were tested, only highest emissions reported. All other results were more than 10–15 dB below the limit

Since fundamental power was tested using average method, the conducted spurious emissions limit is –30 dBc/100 kHz

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

| | |
|----------------------|----------|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | 300 kHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

| | |
|----------------------|----------|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 MHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

| | |
|----------------------|----------|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 10 Hz |
| Detector mode | Peak |
| Trace mode | Max Hold |

Section 8 Testing data
Test name FCC 15.247(d) and RSS-210 A8.5 Spurious (out-of-band) emissions
Specification FCC Part 15 Subpart C and RSS-210, Issue 8



Calculation of the conducted spurious emissions limits for emissions within restricted bands.
 Average limit: $54 \text{ dB}\mu\text{V/m} - 95.23 \text{ dB} - 2.50 \text{ dBi} = -43.73 \text{ dBm}$
 Peak limit: $74 \text{ dB}\mu\text{V/m} - 95.23 \text{ dB} - 2.50 \text{ dBi} = -23.73 \text{ dBm}$

Spectrum analyser settings for conducted spurious emissions measurements:

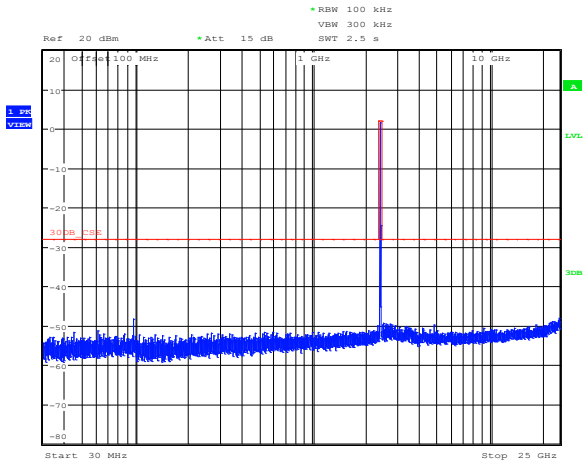
| | |
|----------------------|----------|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | 300 kHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

8.5.4 Test data

Table 8.5-4: Radiated field strength measurement results

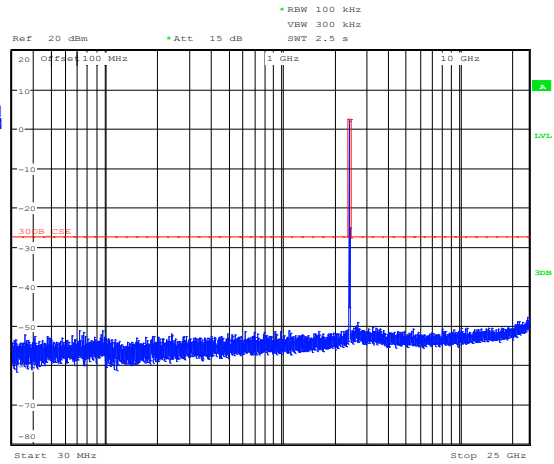
| Channel | Frequency, MHz | Peak Field strength, dB $\mu\text{V/m}$ | | Margin, dB | Average Field strength, dB $\mu\text{V/m}$ | | Margin, dB |
|---------|----------------|---|-------|------------|--|-------|------------|
| | | Measured | Limit | | Measured | Limit | |
| Low | 2390.0 | 66.28 | 74.00 | 7.72 | 53.28 | 54.00 | 0.72 |
| High | 2483.5 | 67.20 | 74.00 | 6.80 | 50.99 | 54.00 | 3.01 |

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.



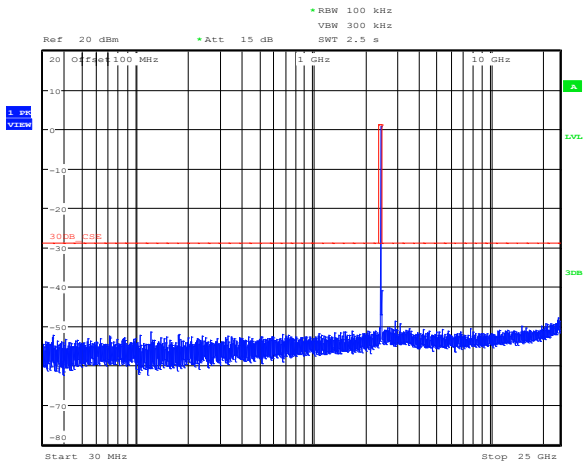
Date: 14.NOV.2014 11:18:59

Figure 8.5-1: Conducted spurious emissions outside restricted bands for 802.11b, low channel at minimum rate



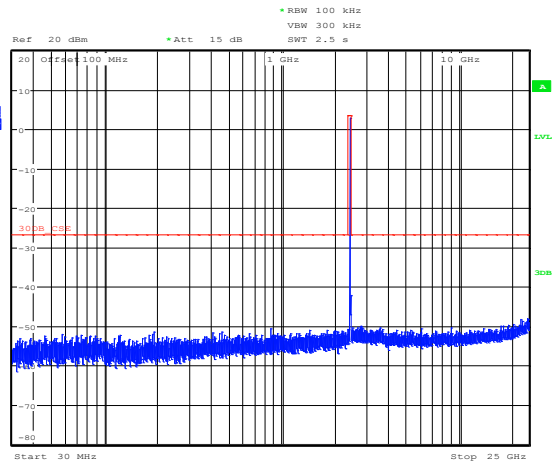
Date: 14.NOV.2014 11:25:12

Figure 8.5-2: Conducted spurious emissions outside restricted bands for 802.11b, low channel at maximum rate



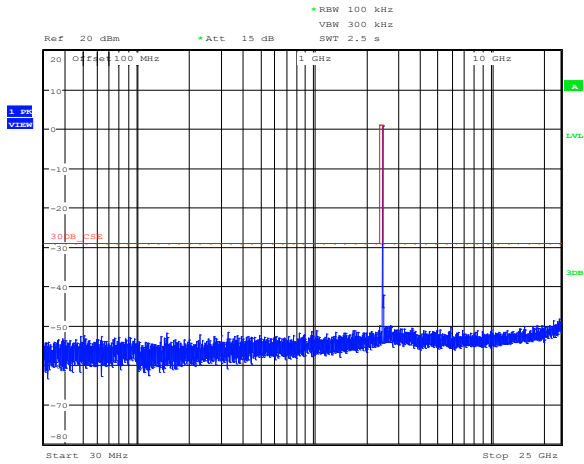
Date: 14.NOV.2014 11:20:02

Figure 8.5-3: Conducted spurious emissions outside restricted bands for 802.11b, mid channel at minimum rate



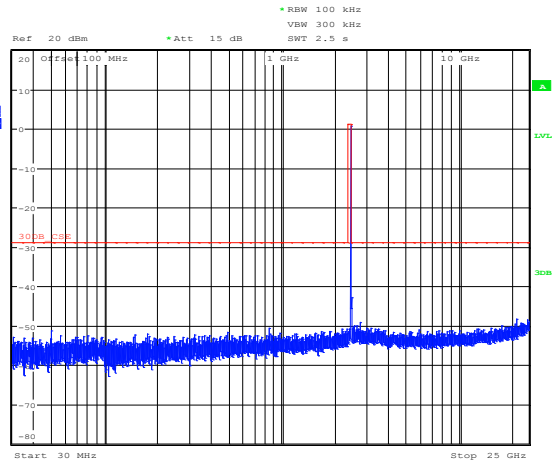
Date: 14.NOV.2014 11:26:23

Figure 8.5-4: Conducted spurious emissions outside restricted bands for 802.11b, mid channel at maximum rate



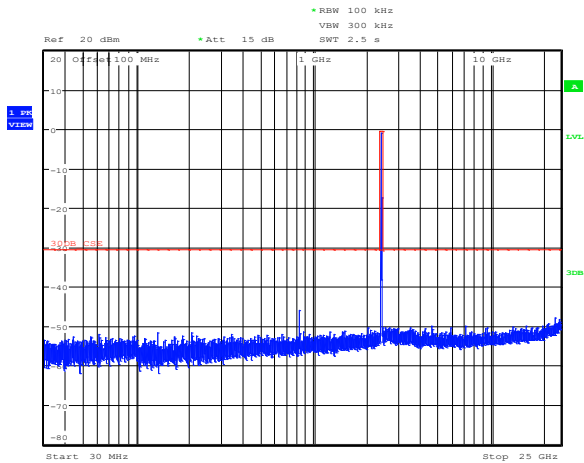
Date: 14.NOV.2014 11:22:33

Figure 8.5-5: Conducted spurious emissions outside restricted bands for 802.11b, high channel at minimum rate



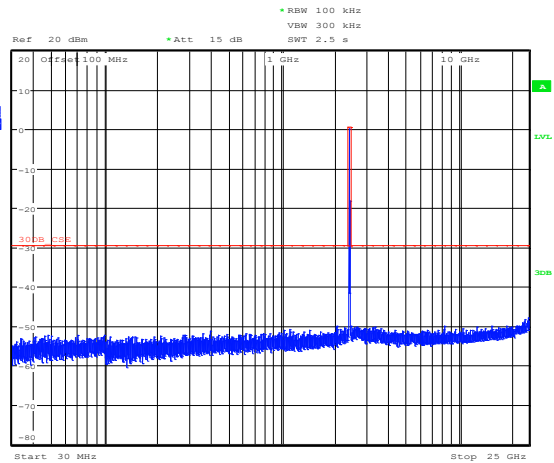
Date: 14.NOV.2014 11:27:18

Figure 8.5-6: Conducted spurious emissions outside restricted bands for 802.11b, high channel at maximum rate



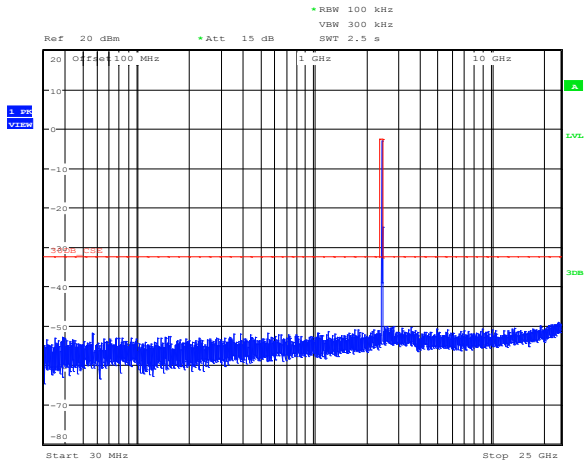
Date: 14.NOV.2014 11:10:22

Figure 8.5-7: Conducted spurious emissions outside restricted bands for 802.11g, low channel at minimum rate



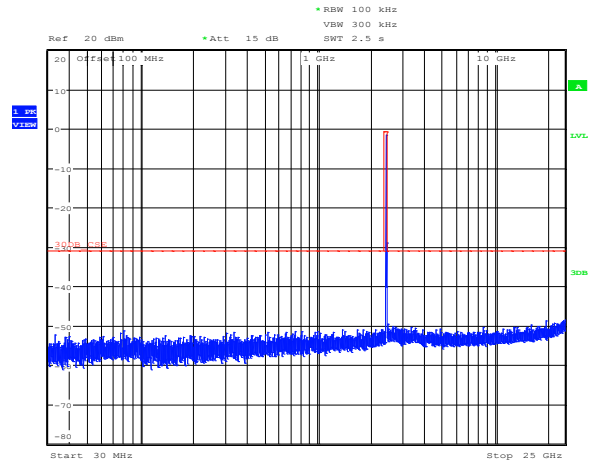
Date: 14.NOV.2014 11:13:30

Figure 8.5-8: Conducted spurious emissions outside restricted bands for 802.11g, low channel at maximum rate



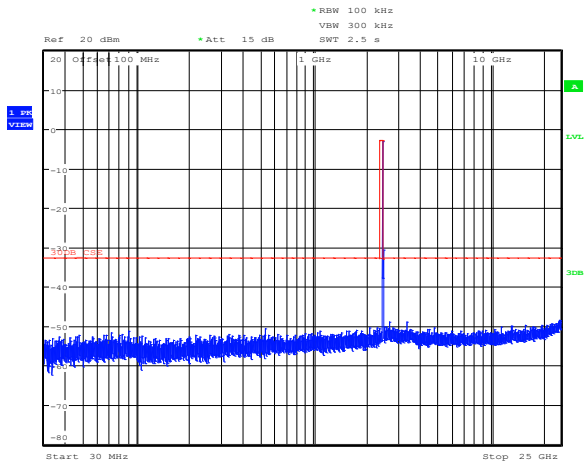
Date: 14.NOV.2014 11:11:06

Figure 8.5-9: Conducted spurious emissions outside restricted bands for 802.11g, mid channel at minimum rate



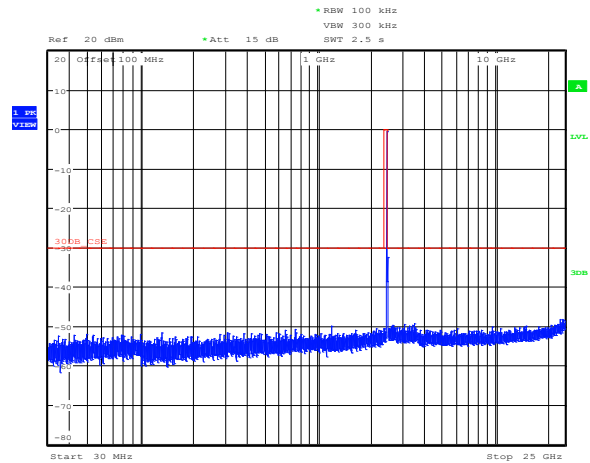
Date: 14.NOV.2014 11:16:05

Figure 8.5-10: Conducted spurious emissions outside restricted bands for 802.11g, mid channel at maximum rate



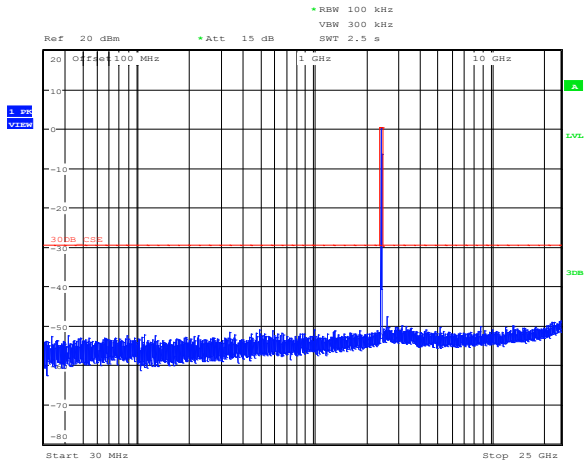
Date: 14.NOV.2014 11:12:06

Figure 8.5-11: Conducted spurious emissions outside restricted bands for 802.11g, high channel at minimum rate



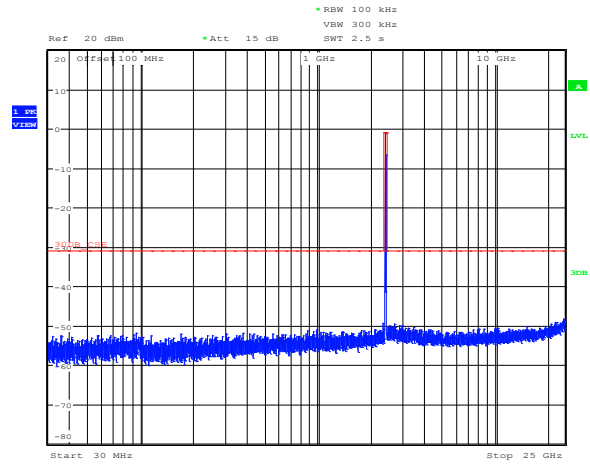
Date: 14.NOV.2014 11:17:20

Figure 8.5-12: Conducted spurious emissions outside restricted bands for 802.11g, high channel at maximum rate



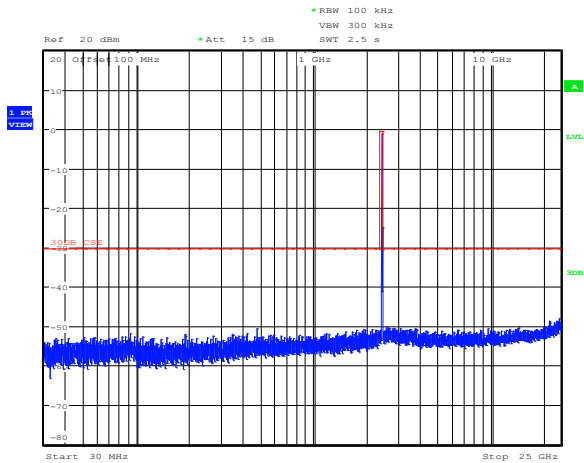
Date: 14.NOV.2014 11:05:40

Figure 8.5-13: Conducted spurious emissions outside restricted bands for 802.11n, low channel at minimum rate



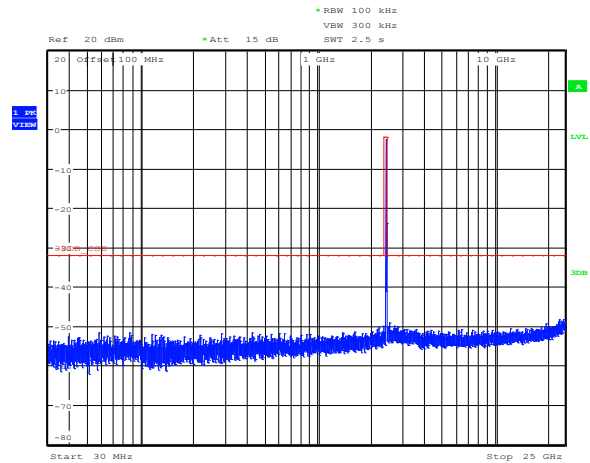
Date: 14.NOV.2014 11:02:57

Figure 8.5-14: Conducted spurious emissions outside restricted bands for 802.11n, low channel at maximum rate



Date: 14.NOV.2014 11:06:28

Figure 8.5-15: Conducted spurious emissions outside restricted bands for 802.11n, mid channel at minimum rate

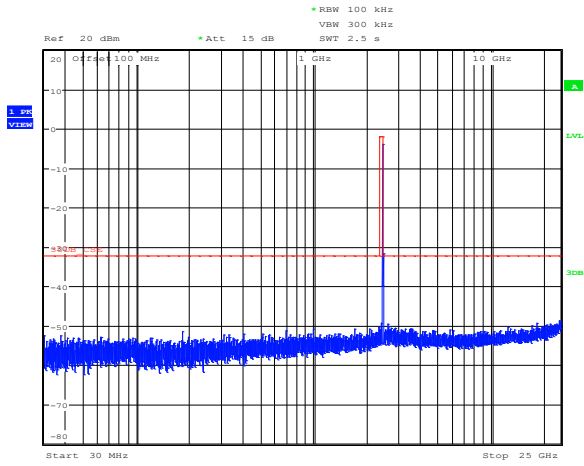


Date: 14.NOV.2014 11:04:00

Figure 8.5-16: Conducted spurious emissions outside restricted bands for 802.11n, mid channel at maximum rate

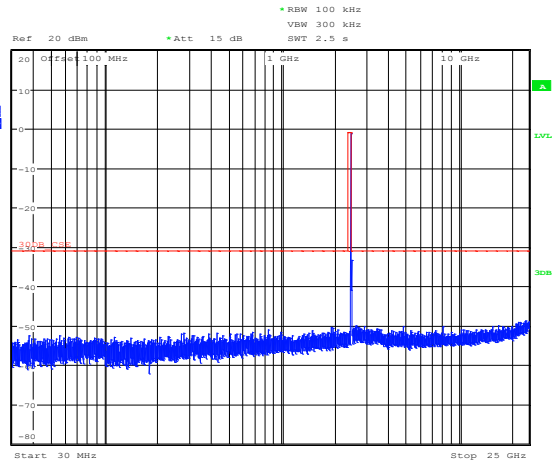
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Date: 14.NOV.2014 11:08:30

Figure 8.5-17: Conducted spurious emissions outside restricted bands for 802.11n, high channel at minimum rate



Date: 14.NOV.2014 11:04:50

Figure 8.5-18: Conducted spurious emissions outside restricted bands for 802.11n, high channel at maximum rate

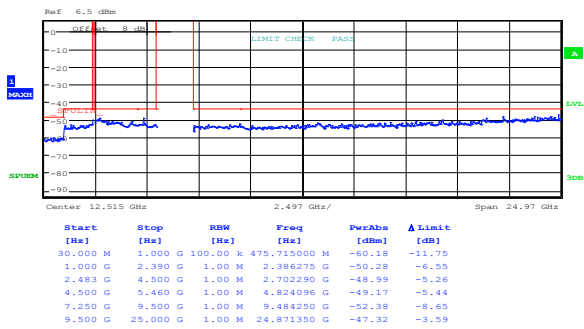


Figure 8.5-19: Conducted peak spurious emissions within restricted bands for 802.11b, low channel at minimum rate

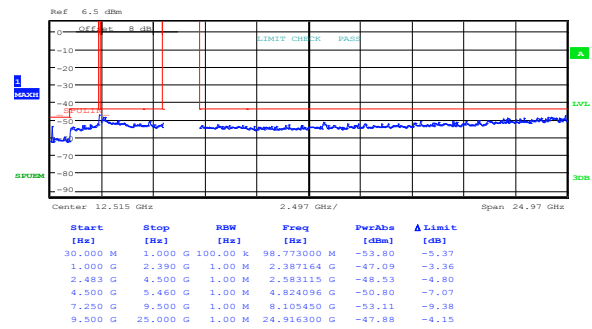


Figure 8.5-20: Conducted peak spurious emissions within restricted bands for 802.11b, low channel at maximum rate

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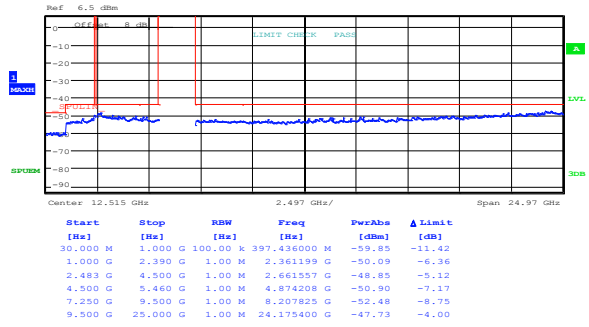


Figure 8.5-21: Conducted peak spurious emissions within restricted bands for 802.11b, mid channel at minimum rate

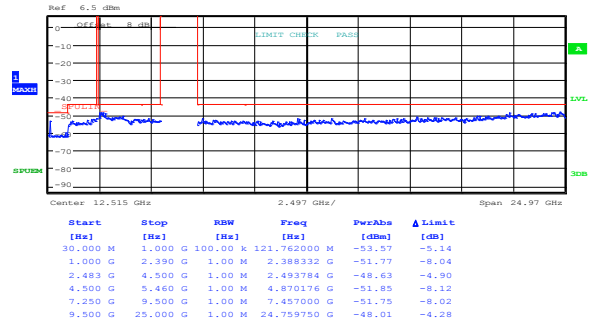


Figure 8.5-22: Conducted peak spurious emissions within restricted bands for 802.11b, mid channel at maximum rate

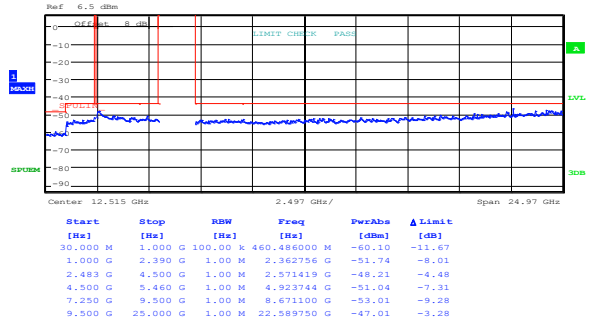


Figure 8.5-23: Conducted peak spurious emissions within restricted bands for 802.11b, high channel at minimum rate

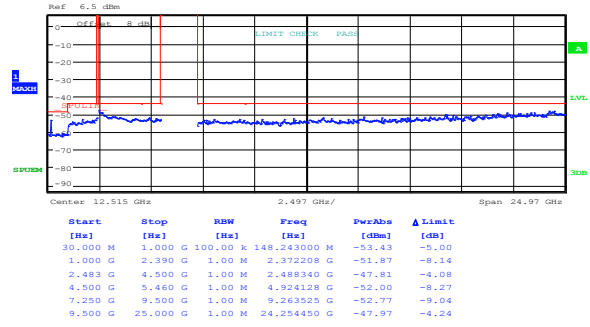


Figure 8.5-24: Conducted peak spurious emissions within restricted bands for 802.11b, high channel at maximum rate

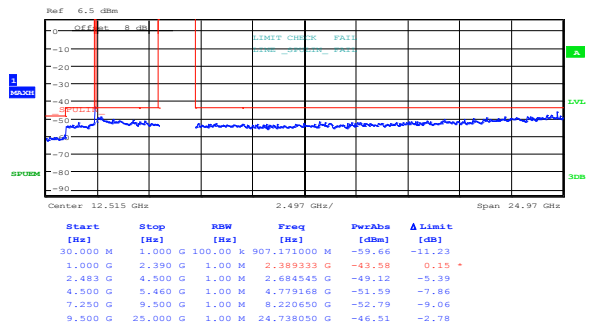


Figure 8.5-25: Conducted peak spurious emissions within restricted bands for 802.11g, low channel at minimum rate

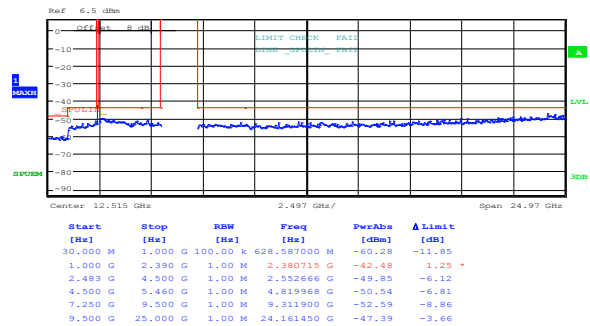


Figure 8.5-26: Conducted peak spurious emissions within restricted bands for 802.11g, low channel at maximum rate

Note: band edge measurements were tested separately. Please refer to the plots below.

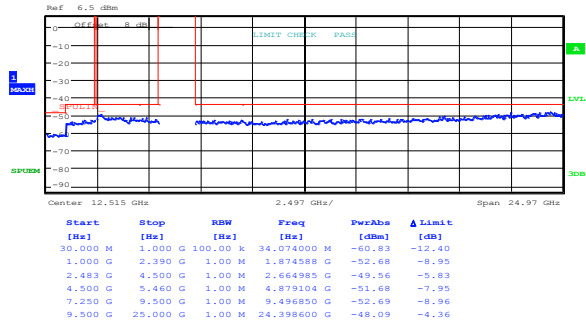


Figure 8.5-27: Conducted peak spurious emissions within restricted bands for 802.11g, mid channel at minimum rate

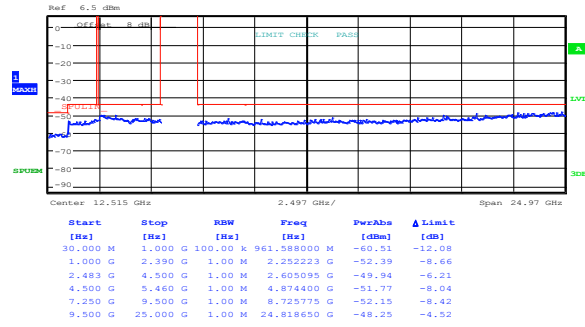


Figure 8.5-28: Conducted peak spurious emissions within restricted bands for 802.11g, mid channel at maximum rate

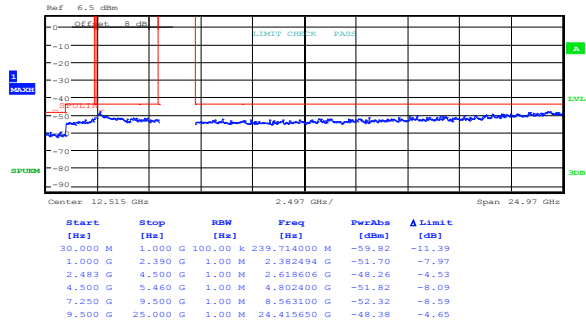


Figure 8.5-29: Conducted peak spurious emissions within restricted bands for 802.11g, high channel at minimum rate

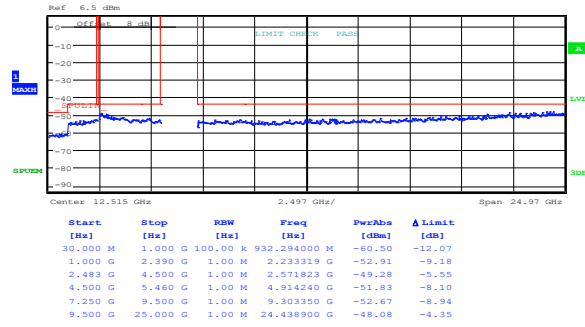


Figure 8.5-30: Conducted peak spurious emissions within restricted bands for 802.11g, high channel at maximum rate

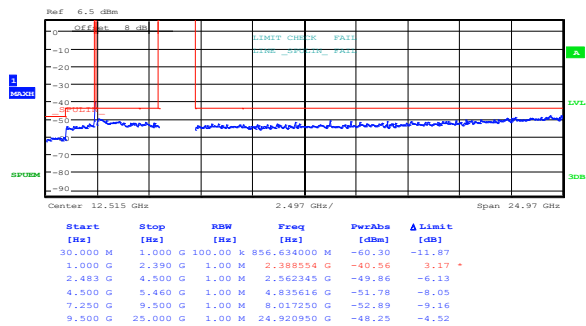


Figure 8.5-31: Conducted peak spurious emissions within restricted bands for 802.11n, low channel at minimum rate

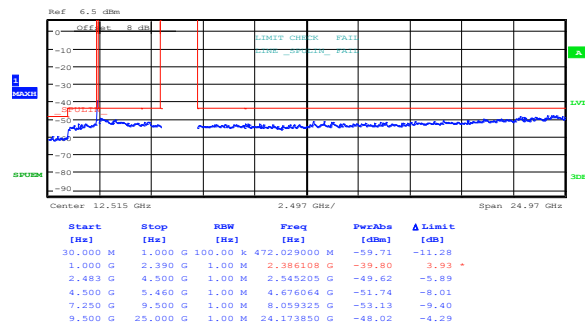


Figure 8.5-32: Conducted peak spurious emissions within restricted bands for 802.11n, low channel at maximum rate

Note: band edge measurements were tested separately. Please refer to the plots below.

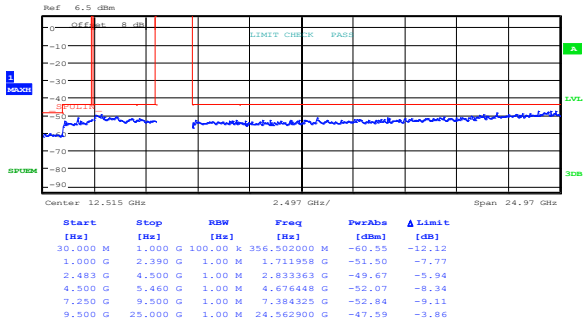


Figure 8.5-33: Conducted peak spurious emissions within restricted bands for 802.11n, mid channel at minimum rate

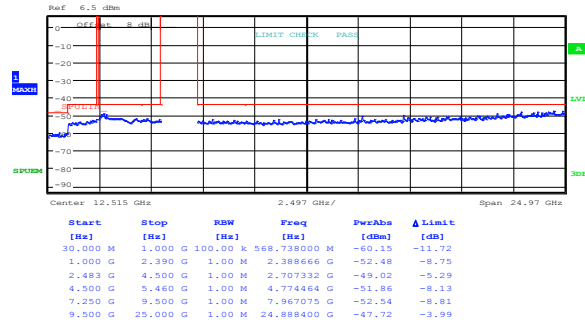


Figure 8.5-34: Conducted peak spurious emissions within restricted bands for 802.11n, mid channel at maximum rate



Figure 8.5-35: Conducted peak spurious emissions within restricted bands for 802.11n, high channel at minimum rate

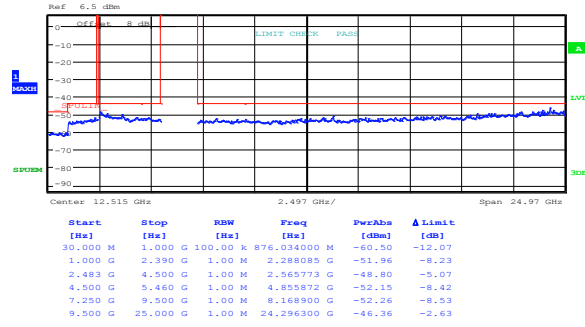


Figure 8.5-36: Conducted peak spurious emissions within restricted bands for 802.11n, high channel at maximum rate

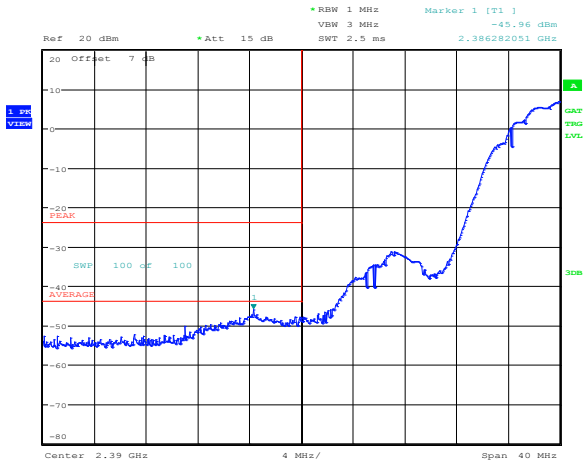


Figure 8.5-37: Conducted peak lower band edge emission for 802.11b at minimum rate

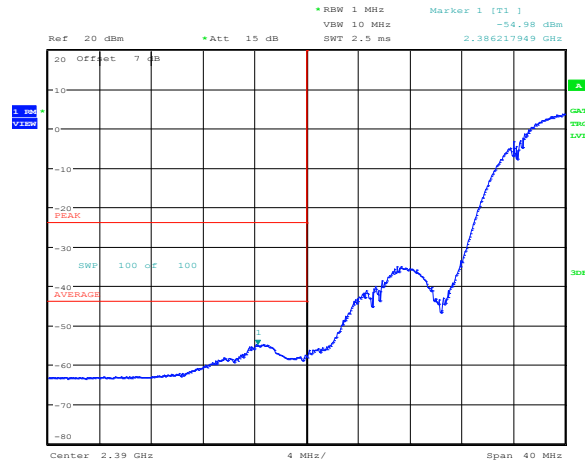
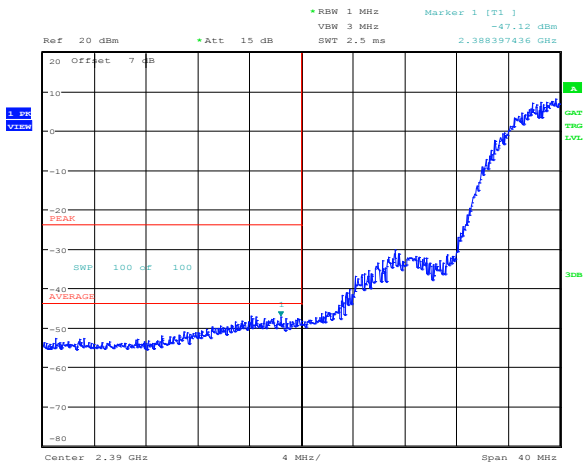


Figure 8.5-38: Conducted average lower band edge emission for 802.11b at minimum rate

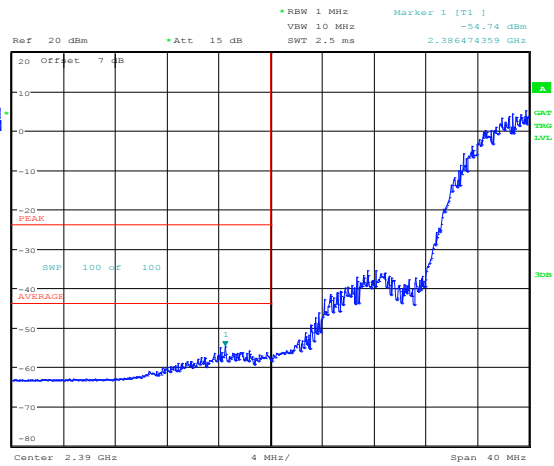
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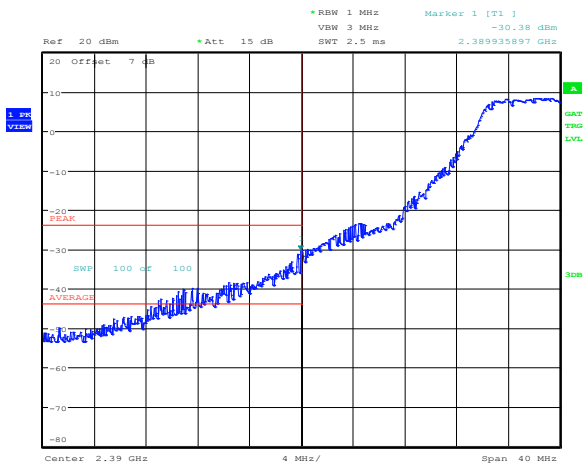
Date: 14.NOV.2014 14:30:05

Figure 8.5-39: Conducted peak lower band edge emission for 802.11b at maximum rate



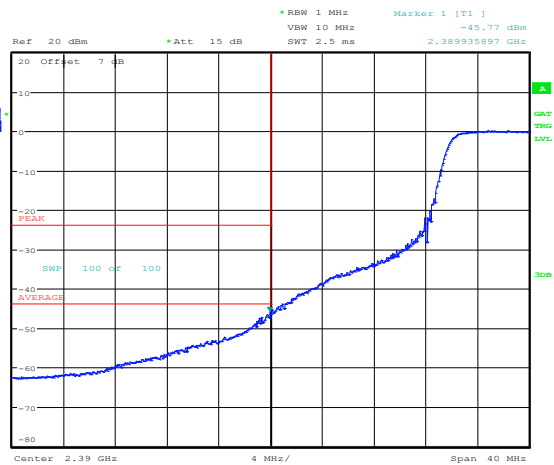
Date: 14.NOV.2014 14:30:27

Figure 8.5-40: Conducted average lower band edge emission for 802.11b at maximum rate



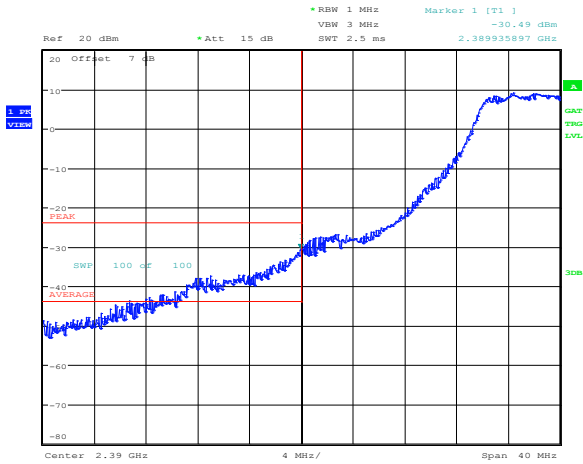
Date: 14.NOV.2014 14:32:12

Figure 8.5-41: Conducted peak lower band edge emission for 802.11g at minimum rate



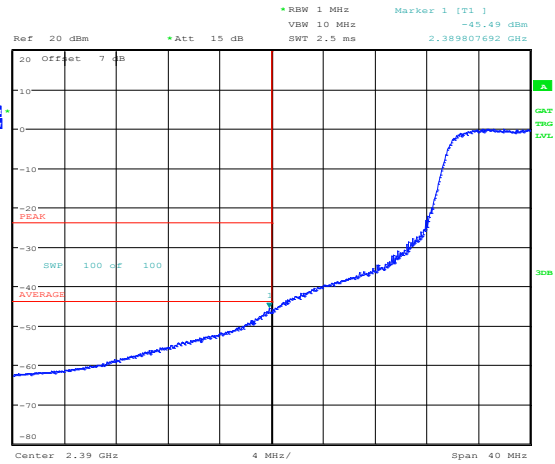
Date: 14.NOV.2014 14:32:53

Figure 8.5-42: Conducted average lower band edge emission for 802.11g at minimum rate



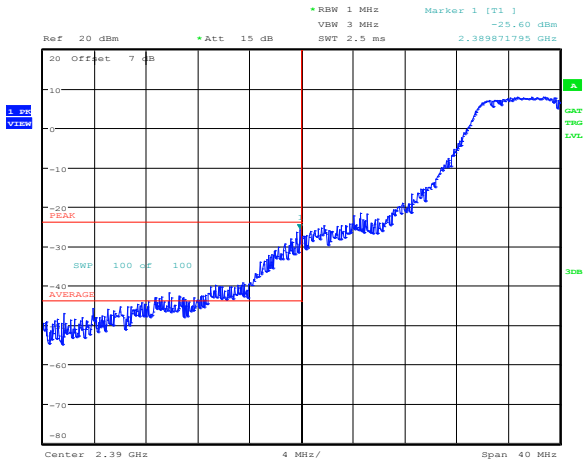
Date: 14.NOV.2014 14:34:00

Figure 8.5-43: Conducted peak lower band edge emission for 802.11g at maximum rate



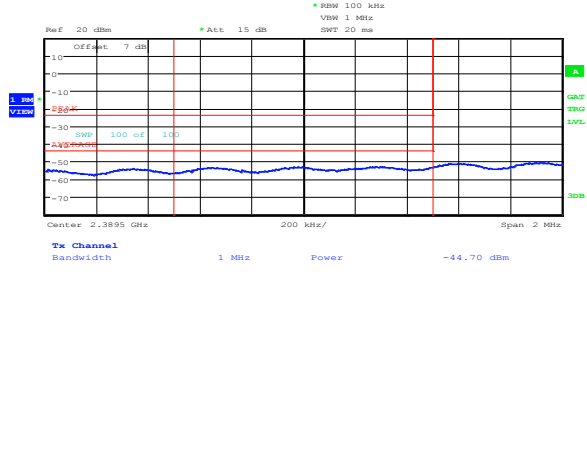
Date: 14.NOV.2014 14:33:40

Figure 8.5-44: Conducted average lower band edge emission for 802.11g at maximum rate



Date: 14.NOV.2014 14:34:34

Figure 8.5-45: Conducted peak lower band edge emission for 802.11n at minimum rate

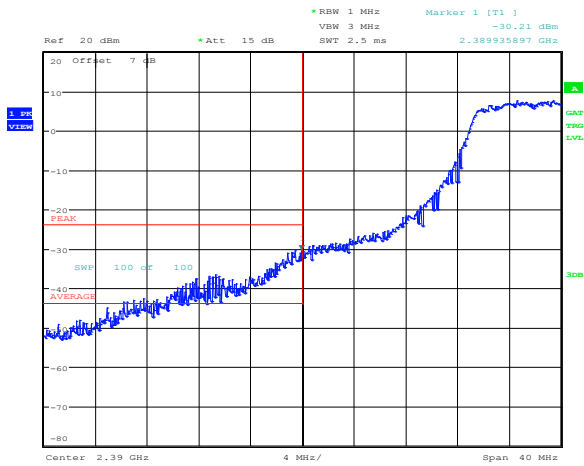


Date: 14.NOV.2014 14:36:50

Figure 8.5-46: Conducted average lower band edge emission for 802.11n at minimum rate

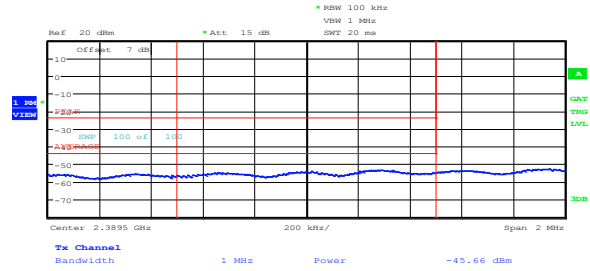
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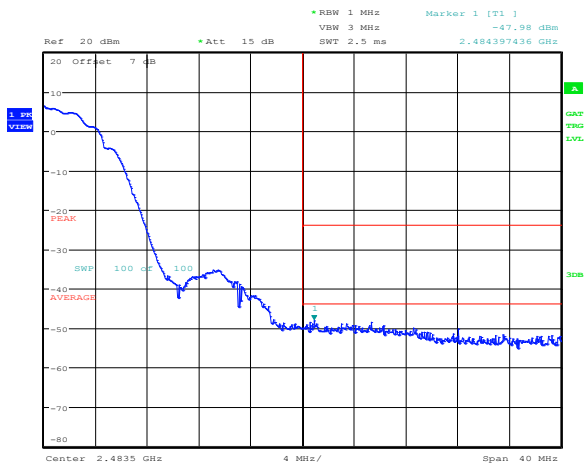
Date: 14.NOV.2014 14:39:16

Figure 8.5-47: Conducted peak lower band edge emission for 802.11n at maximum rate



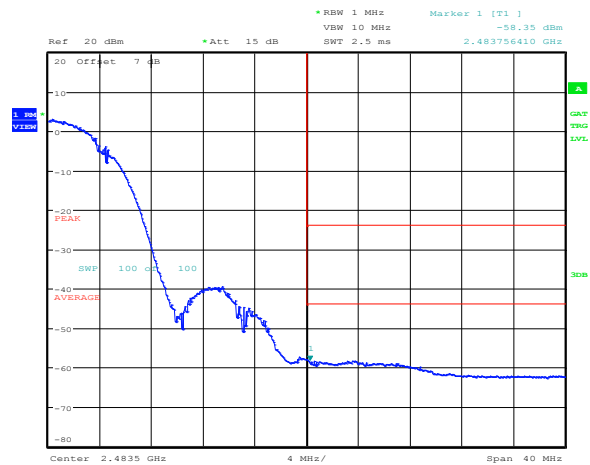
Date: 14.NOV.2014 14:37:57

Figure 8.5-48: Conducted average lower band edge emission for 802.11n at maximum rate



Date: 14.NOV.2014 14:28:06

Figure 8.5-49: Conducted peak upper band edge emission for 802.11b at minimum rate

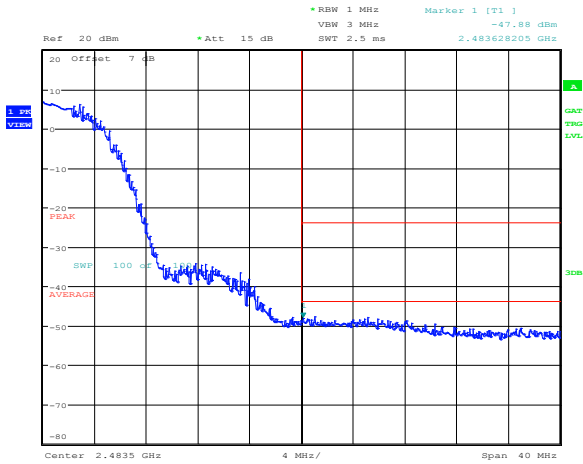


Date: 14.NOV.2014 14:28:29

Figure 8.5-50: Conducted average upper band edge emission for 802.11b at minimum rate

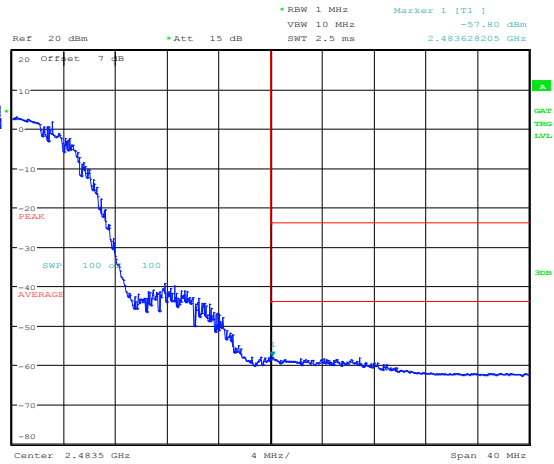
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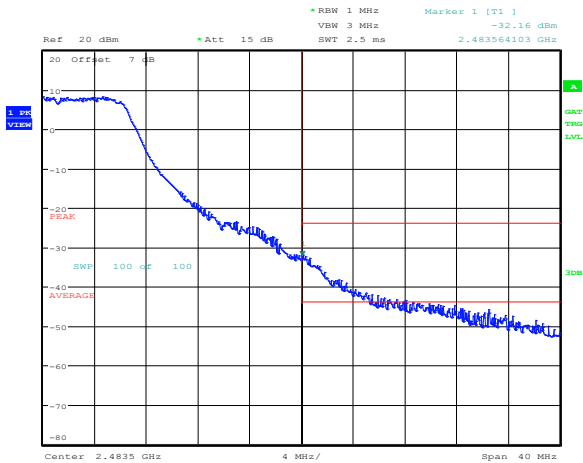
Date: 14.NOV.2014 14:29:30

Figure 8.5-51: Conducted peak upper band edge emission for 802.11b at maximum rate



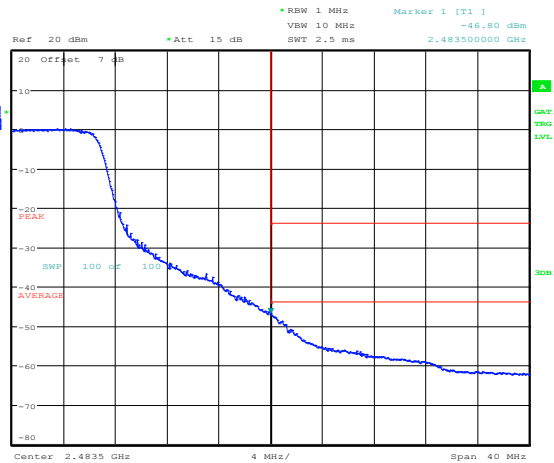
Date: 14.NOV.2014 14:29:13

Figure 8.5-52: Conducted average upper band edge emission for 802.11b at maximum rate



Date: 14.NOV.2014 14:24:34

Figure 8.5-53: Conducted peak upper band edge emission for 802.11g at minimum rate

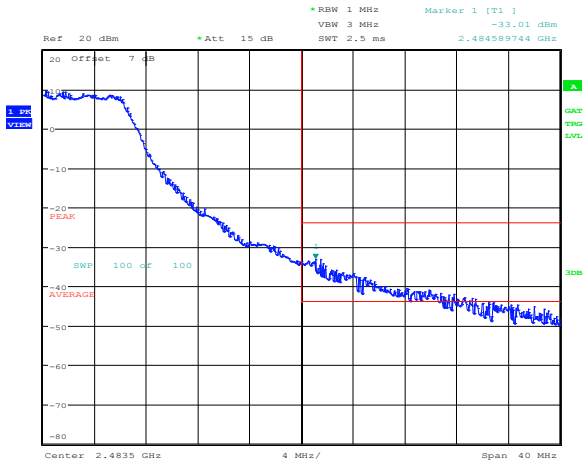


Date: 14.NOV.2014 14:25:31

Figure 8.5-54: Conducted average upper band edge emission for 802.11g at minimum rate

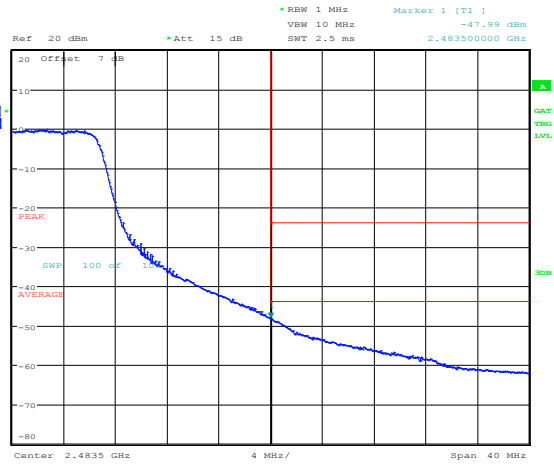
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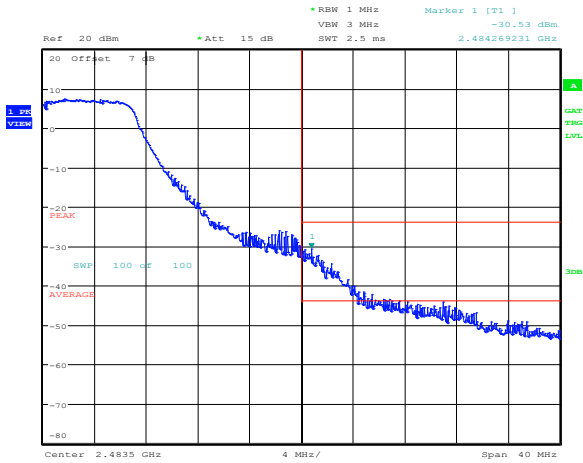
Date: 14.NOV.2014 14:27:00

Figure 8.5-55: Conducted peak upper band edge emission for 802.11g at maximum rate



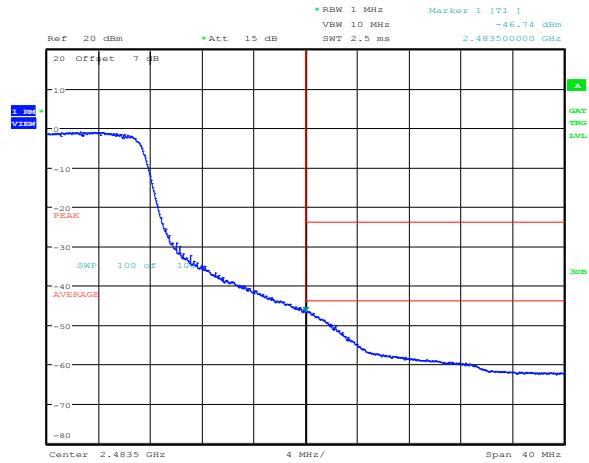
Date: 14.NOV.2014 14:26:32

Figure 8.5-56: Conducted average upper band edge emission for 802.11g at maximum rate



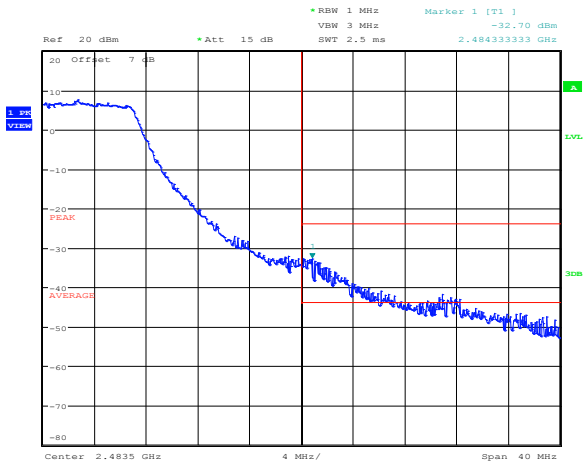
Date: 14.NOV.2014 14:23:48

Figure 8.5-57: Conducted peak upper band edge emission for 802.11n at minimum rate



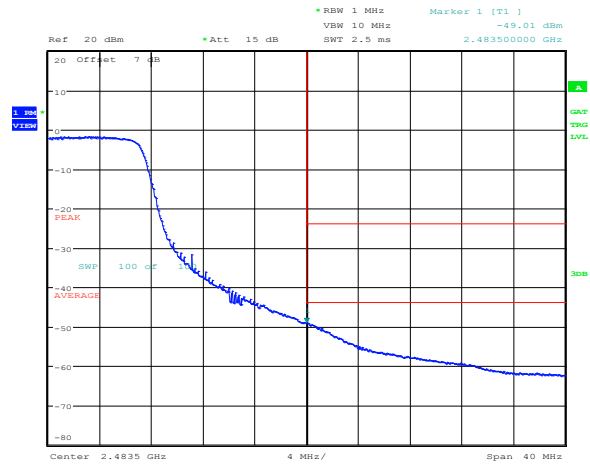
Date: 14.NOV.2014 14:23:20

Figure 8.5-58: Conducted average upper band edge emission for 802.11n at minimum rate



Date: 14.NOV.2014 12:06:23

Figure 8.5-59: Conducted peak upper band edge emission for 802.11n at maximum rate



Date: 14.NOV.2014 12:15:13

Figure 8.5-60: Conducted average upper band edge emission for 802.11n at maximum rate

8.6 FCC 15.247(e) and RSS-210 A8.2(b) Power spectral density for digitally modulated devices

8.6.1 Definitions and limits

FCC:
 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.

IC:
 The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration. This power spectral density shall be determined in accordance with the provisions of Section A8.4(4); (i.e. the power spectral density shall be determined using the same method for determining the conducted output power).

8.6.2 Test summary

| | | | |
|---------------|-------------------|-------------------|-----------|
| Test date | November 13, 2014 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1004 mbar |
| Verdict | Pass | Relative humidity | 32 % |

8.6.3 Observations, settings and special notes

The output power was tested using peak detector, therefore PSD test was performed using method described in section 10.3 AVGPS-1 (averaging with the EUT transmitting at full power throughout each sweep). Spectrum analyser settings:

| | |
|----------------------|--|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | 1 MHz |
| Frequency span | 20 MHz for 802.11b and 30 MHz for 802.11g/n |
| Detector mode | RMS |
| Trace mode | Power averaging over 100 sweeps |
| Sweep trigger | Gated trigger set to enable triggering only on full power pulses |

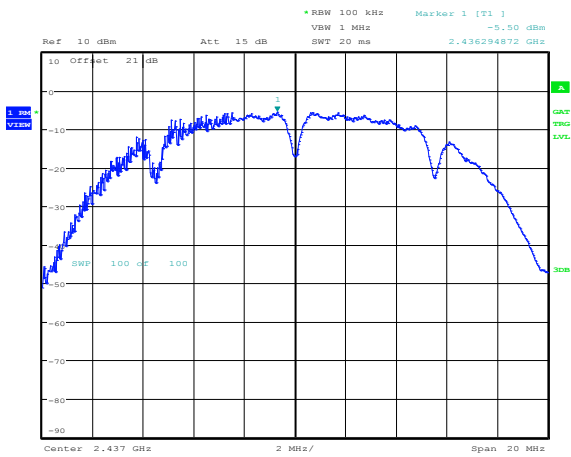
8.6.4 Test data

Table 8.6-1: PSD measurements results for minimum data rate

| Modulation | Frequency, MHz | PSD, dBm/100 kHz | PSD limit, dBm/3 kHz | Margin, dB |
|------------|----------------|------------------|----------------------|------------|
| 802.11b | 2412 | -4.81 | 8.00 | 12.81 |
| | 2437 | -5.50 | 8.00 | 13.50 |
| | 2462 | -4.78 | 8.00 | 12.78 |
| 802.11g | 2412 | -8.73 | 8.00 | 16.73 |
| | 2437 | -8.38 | 8.00 | 16.38 |
| | 2462 | -8.49 | 8.00 | 16.49 |
| 802.11n | 2412 | -9.28 | 8.00 | 17.28 |
| | 2437 | -8.53 | 8.00 | 16.53 |
| | 2462 | -9.31 | 8.00 | 17.31 |

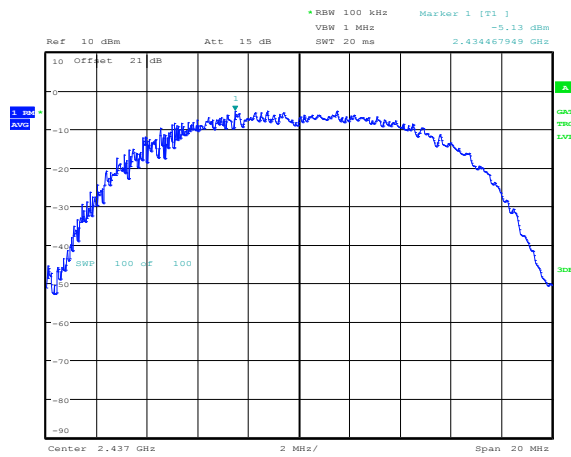
Table 8.6-2: PSD measurements results for maximum data rate

| Modulation | Frequency, MHz | PSD, dBm/100 kHz | PSD limit, dBm/3 kHz | Margin, dB |
|------------|----------------|------------------|----------------------|------------|
| 802.11b | 2412 | -2.96 | 8.00 | 10.96 |
| | 2437 | -5.13 | 8.00 | 13.13 |
| | 2462 | -5.21 | 8.00 | 13.21 |
| 802.11g | 2412 | -8.22 | 8.00 | 16.22 |
| | 2437 | -8.93 | 8.00 | 16.93 |
| | 2462 | -9.21 | 8.00 | 17.21 |
| 802.11n | 2412 | -9.68 | 8.00 | 17.68 |
| | 2437 | -9.63 | 8.00 | 17.63 |
| | 2462 | -9.93 | 8.00 | 17.93 |



Date: 13.NOV.2014 15:51:54

Figure 8.6-1: PSD sample plot on 802.11b at minimum rate

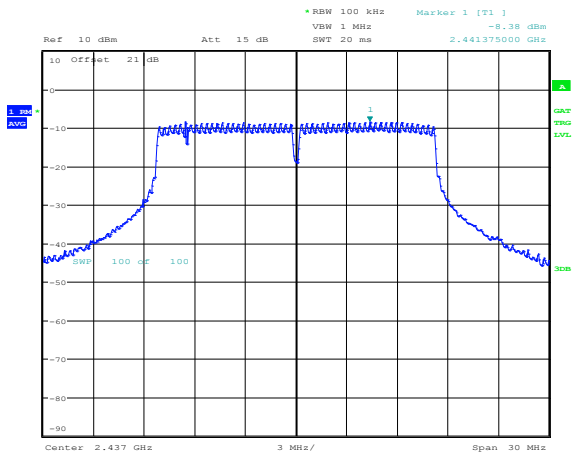


Date: 13.NOV.2014 15:53:24

Figure 8.6-2: PSD sample plot on 802.11b at maximum rate

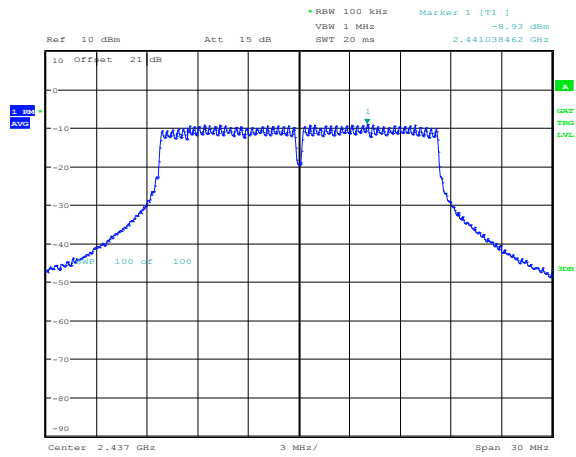
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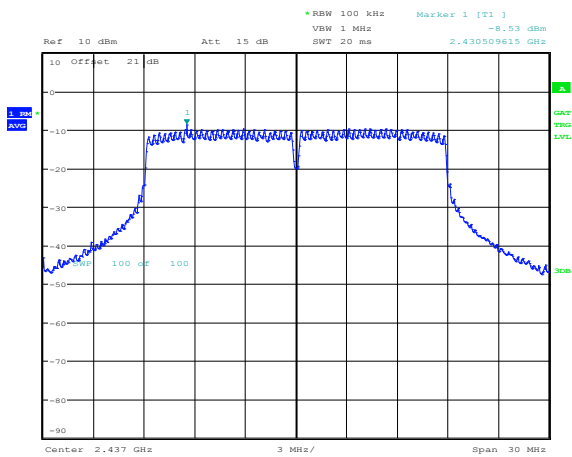
Date: 13.NOV.2014 15:55:04

Figure 8.6-3: PSD sample plot on 802.11g at minimum rate



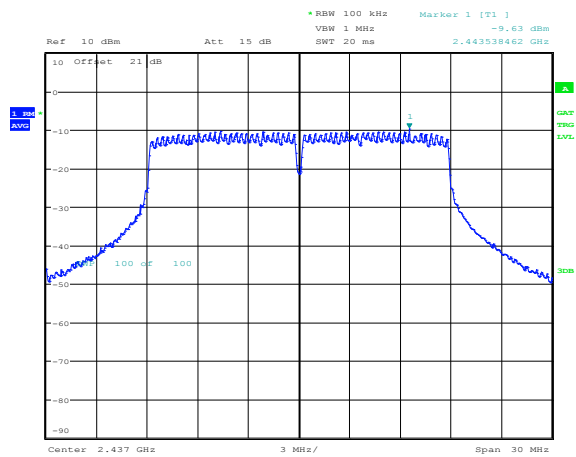
Date: 13.NOV.2014 15:57:01

Figure 8.6-4: PSD sample plot on 802.11g at maximum rate



Date: 13.NOV.2014 15:58:36

Figure 8.6-5: PSD sample plot on 802.11n at minimum rate

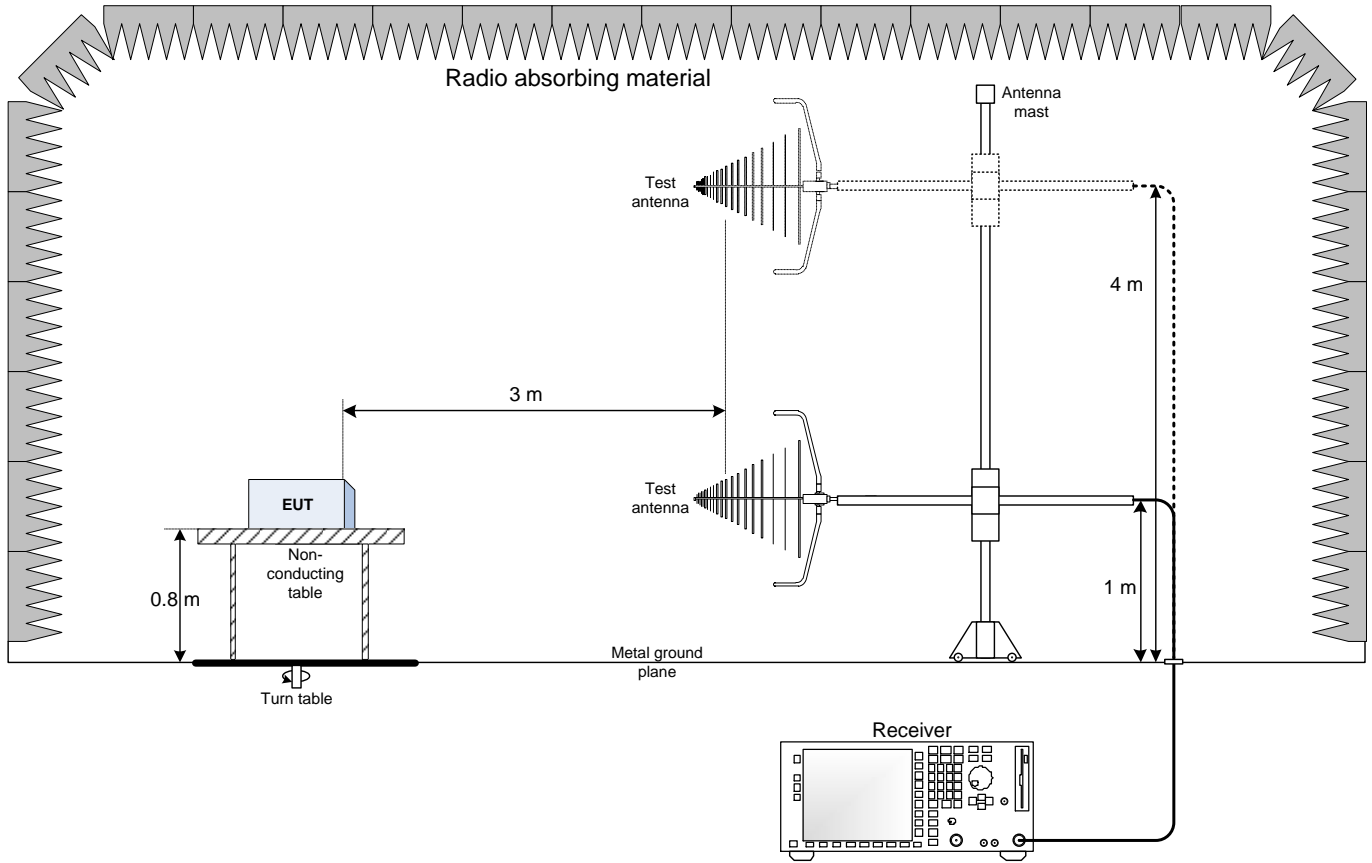


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Figure 8.6-6: PSD sample plot on 802.11n at maximum rate

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up

