

# Test report

**261299-12TRFWL**

Date of issue: September 29, 2014

Applicant:

**Ericsson WiFi Inc.**

Product:

**Wi-Fi Access Point**

Model:

**AP 511x**

Model variants:

**AP 5115, AP 5116, AP 5117, AP 5118, AP 5119**

FCC ID:

**RAR80085008**

IC Registration number:

**4674A-40085008**

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart E, §15.407**  
Unlicensed National Information Infrastructure Devices
- ◆ **RSS-210, Issue 8, December 2010, Annex 9**  
Local Area Network Devices

#### 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:        | September 29, 2014                                                                  |
| Signature:   |  |

#### 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

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### 1.1 Applicant and manufacturer

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|                 |                    |
|-----------------|--------------------|
| Company name    | Ericsson WiFi Inc. |
| Address         | 6300 Legacy Drive  |
| City            | Plano              |
| Province/State  | TX                 |
| Postal/Zip code | 75024              |
| Country         | USA                |

### 1.2 Test specifications

---

|                                              |                                                        |
|----------------------------------------------|--------------------------------------------------------|
| FCC 47 CFR Part 15, Subpart E, Clause 15.407 | Unlicensed National Information Infrastructure Devices |
| RSS-210, Issue 8, December 2010, Annex 9     | Local Area Network Devices                             |

### 1.3 Test methods

---

|                                                                         |                                                                                                                                                                      |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 789033 D01 General UNII Test Procedures Old Rules v01r03 (June 6, 2014) | Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E                                               |
| 662911 D01 Multiple Transmitter Output v02                              | Emissions testing of transmitters with multiple outputs in the same band (MIMO)                                                                                      |
| 662911 D02 MIMO with Cross Polarized Antenna v01                        | Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna                                                         |
| 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

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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

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None

### 1.6 Test report revision history

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| 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 <sup>1</sup> |
| §15.203    | Antenna requirement       | Pass              |

Notes: <sup>1</sup>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

### 2.2 FCC Part 15 Subpart E, test results

| Part          | Test description                                                | Verdict                 |
|---------------|-----------------------------------------------------------------|-------------------------|
| §15.403(i)    | Emission bandwidth                                              | Not applicable          |
| §15.407(a)(1) | 5.15–5.25 GHz band power and density limits                     | Not applicable          |
| §15.407(a)(2) | 5.25–5.35 GHz and 5.47–5.725 GHz bands power and density limits | Pass                    |
| §15.407(a)(3) | 5.725–5.825 GHz band power and density limits                   | Not applicable          |
| §15.407(a)(6) | Peak excursion                                                  | Pass                    |
| §15.407(b)(1) | 5.15–5.25 GHz band undesired emission limits                    | Not applicable          |
| §15.407(b)(2) | 5.25–5.35 GHz band undesired emission limits                    | Not applicable          |
| §15.407(b)(3) | 5.47–5.725 GHz band undesired emission limits                   | Pass                    |
| §15.407(b)(4) | 5.725–5.825 GHz band undesired emission limits                  | Not applicable          |
| §15.407(b)(6) | Unwanted emissions below 1 GHz                                  | Pass                    |
| §15.407(b)(7) | Radiated emissions within restricted bands                      | Pass                    |
| §15.407(e)    | 5.15–5.25 GHz band operational restriction                      | Not applicable          |
| §15.407(g)    | Frequency stability                                             | Pass                    |
| §15.407(h)(1) | Transmit power control (TPC)                                    | Pass                    |
| §15.407(h)(2) | Dynamic Frequency Selection (DFS)                               | Not tested <sup>1</sup> |

Note: <sup>1</sup>The DFS requirements were not tested at Nemko Canada. It is up to applicant to fulfill the DFS requirements.

### 2.3 RSS-Gen, Issue 3, test results

| Part  | Test description                                       | Verdict        |
|-------|--------------------------------------------------------|----------------|
| 4.6.1 | Occupied bandwidth                                     | Pass           |
| 6.1   | Receiver spurious emissions limits (radiated)          | Not applicable |
| 6.2   | Receiver spurious emissions limits (antenna conducted) | Not applicable |
| 7.2.4 | AC power lines conducted emission limits               | Pass           |

Notes: <sup>1</sup>According to Notice 2012-DRS0126 (from January 2012) section 2.2 of RSS-Gen, Issue 3 has been revised. 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                 |
|----------|---------------------------------------------------------------------------------------------------------------------|-------------------------|
| A9.2     | Transmitter power, e.i.r.p., TPC <sup>1</sup> and spectral power density limits                                     |                         |
| A9.2 (1) | 5150–5250 MHz band                                                                                                  | Not applicable          |
| A9.2 (2) | 5250–5350 MHz band                                                                                                  | Not applicable          |
| A9.2 (3) | 5470–5600 MHz and 5650–5725 MHz bands                                                                               | Pass                    |
| A9.2 (4) | 5725–5825 MHz band                                                                                                  | Not applicable          |
| A9.2     | Out-of-band emission limits                                                                                         |                         |
| A9.2 (1) | 5150–5250 MHz band                                                                                                  | Not applicable          |
| A9.2 (2) | 5250–5350 MHz band                                                                                                  | Not applicable          |
| A9.2 (3) | 5470–5600 MHz and 5650–5725 MHz bands                                                                               | Pass                    |
| A9.2 (4) | 5725–5825 MHz band                                                                                                  | Not applicable          |
| A9.3     | Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz | Not tested <sup>3</sup> |
| A9.4     | Other Requirements for all bands                                                                                    |                         |
| A9.4 (1) | Digital modulation                                                                                                  | Pass <sup>2</sup>       |
| A9.4 (2) | PSD to average power ratio                                                                                          | Pass                    |
| A9.4 (3) | Test frequencies                                                                                                    | Pass                    |
| A9.4 (4) | Discontinuation of transmission                                                                                     | Not tested <sup>3</sup> |

Notes: <sup>1</sup> Transmit Power Control (TPC) requirement is applicable only for 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz bands

<sup>2</sup> The EUT uses digital modulations, such as: 802.11a, 802.11n HT20 and 802.11n HT40

<sup>3</sup> It is up to applicant to fulfill the DFS and requirement of discontinuation of the transmission in case of absence of information to transmit

## Section 3. Equipment under test (EUT) details

### 3.1 Sample information

|                        |               |
|------------------------|---------------|
| Receipt date           | June 18, 2013 |
| Nemko sample ID number | 1             |

### 3.2 EUT information

|                |                                                                           |
|----------------|---------------------------------------------------------------------------|
| Product name   | Wi-Fi Access Point                                                        |
| Model          | AP 511x                                                                   |
| Model variants | Please refer to the table 3.3–1 below for complete list of model variants |
| Serial number  | 201352811810                                                              |

### 3.3 Technical information

|                           |                                                                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating band            | 5470–5725 MHz                                                                                                                                                 |
| Operating sub-bands       | 5470–5600 MHz and 5650–5725 MHz                                                                                                                               |
| Operating frequencies     | 5500–5580 MHz and 5670–5700 MHz (20 MHz channel) and 5510–5570 MHz and 5690 MHz (40 MHz channel)                                                              |
| Modulation type           | 802.11a/n                                                                                                                                                     |
| Occupied bandwidth (99 %) | 17.10 MHz (802.11a); 18.18 MHz (802.11n HT20); 37.10 MHz (802.11n HT40)                                                                                       |
| Emission designator       | W7D                                                                                                                                                           |
| Power requirements        | 48 V <sub>DC</sub> via PoE at 120 V <sub>AC</sub> , 60 Hz or direct AC mains connection to 120 V <sub>AC</sub> , 60 Hz                                        |
| Antenna information       | The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. For the antenna configurations please refer to Table 3.3–1 below. |

**Table 3.3–1: Product model variants**

| Product | Powering | Antenna type                               | Antenna gain, dBi |
|---------|----------|--------------------------------------------|-------------------|
| AP 5115 | AC       | Two internal, omnidirectional              | 6.7               |
| AP 5116 | AC       | Two internal, directional, cross polarized | 11.5              |
| AP 5117 | AC       | Two external, directional, cross polarized | 11.5              |
| AP 5118 | AC       | Two internal, directional, cross polarized | 11.5              |
| AP 5119 | AC       | Two internal, directional, cross polarized | 12.0              |

Note: cross polarized antennas are such as one of the transmitter's outputs is a 90-degree phase-shifted replica of the other and the phase centers of the two antennas are co-located.

### 3.4 Product description and theory of operation

The EUT is device designed to operate in the 2.4 GHz band, and 5 GHz 2×2 MIMO ISM and UNII bands. There are two independent radio units. This report covers only the 5.6 GHz UNII band radio.

### 3.5 EUT exercise details

The EUT was controlled to transmit at desired frequency and modulation from laptop using Art GUI software and telnet session.

3.6 EUT setup diagram

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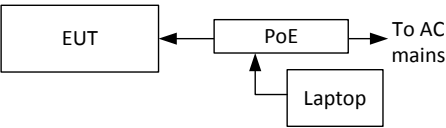


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

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Table 3.7-1: EUT sub assemblies

| Description | Brand name                   | Model/Part number | Serial number     |
|-------------|------------------------------|-------------------|-------------------|
| Laptop      | Toshiba                      | Satellite         | Asset number: 441 |
| PoE adapter | Cincon Electronics Co., Ltd. | TRG60A-POE-L      | RD Sample 4 1127  |

**Section 4. Engineering considerations**

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**4.1 Modifications incorporated in the EUT**

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

**4.2 Technical judgment**

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None

**4.3 Deviations from laboratory tests procedures**

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No deviations were made from laboratory procedures.

# Section 5. Test conditions

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## 5.1 Atmospheric conditions

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|                   |               |
|-------------------|---------------|
| 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

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### 6.1 Uncertainty of measurement

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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. 09/14  |
| Flush mount turntable      | Sunol            | FM2022       | FA002082  | —         | NCR         |
| Controller                 | Sunol            | SC104V       | FA002060  | —         | NCR         |
| Antenna mast               | Sunol            | TLT2         | FA002061  | —         | NCR         |
| Power supply               | California Inst. | 3001I        | FA001021  | 1 year    | May 20/14   |
| Receiver/spectrum analyzer | Rohde & Schwarz  | ESU 26       | FA002043  | 1 year    | May 30/14   |
| Spectrum analyzer          | Rohde & Schwarz  | FSU          | FA001877  | 1 year    | Jan 06/14   |
| Bilog antenna              | Sunol            | JB3          | FA002108  | 1 year    | Feb. 21/14  |
| Horn antenna #1            | EMCO             | 3115         | FA000649  | 1 year    | Mar. 25/14  |
| 1–18 GHz pre-amplifier     | JCA              | JCA118-503   | FA002091  | 1 year    | June 21/14  |
| Temperature chamber        | Thermotron       | SM-16C       | FA001030  | 1 year    | NCR         |
| Horn antenna 18–40 GHz     | EMCO             | 3116         | FA001847  | 1 year    | Sept. 06/13 |
| 26–40 GHz pre-amplifier    | Narda            | DBL-2640N610 | FA001556  | —         | 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 7.2.4 AC power line conducted emissions limits

#### 8.1.1 Definitions and limits

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC definitions | 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 $\mu$ H/50 $\Omega$ 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 definitions  | <p>The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.</p> <p>Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is 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 the table below. The tighter limit applies at the frequency range boundaries.</p> <p>The conducted emissions shall be measured with a 50 <math>\Omega</math>/50 <math>\mu</math>H line impedance stabilization network (LISN).</p> |

**Table 8.1-1: Conducted emissions limit**

| Frequency of emission<br>(MHz) | Conducted limit (dB $\mu$ 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.

#### 8.1.2 Test summary

|               |                 |                   |           |
|---------------|-----------------|-------------------|-----------|
| Test date     | June 19, 2013   | Temperature       | 24 °C     |
| Test engineer | Andrey Adelberg | Air pressure      | 1008 mbar |
| Verdict       | Pass            | Relative humidity | 30 %      |

### 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.

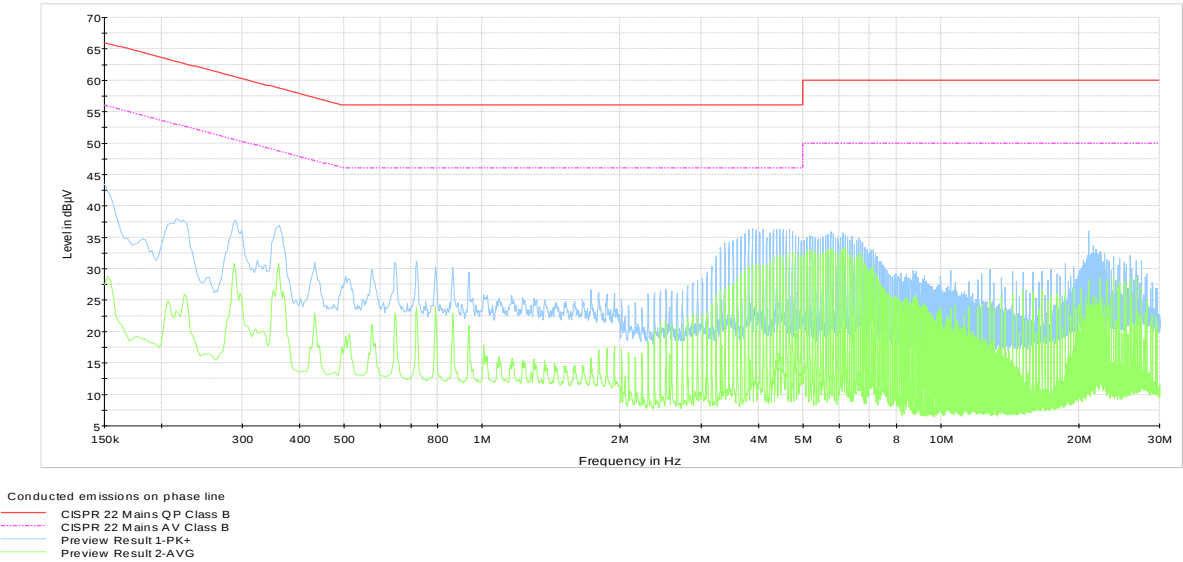
Receiver settings for preview measurements:

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

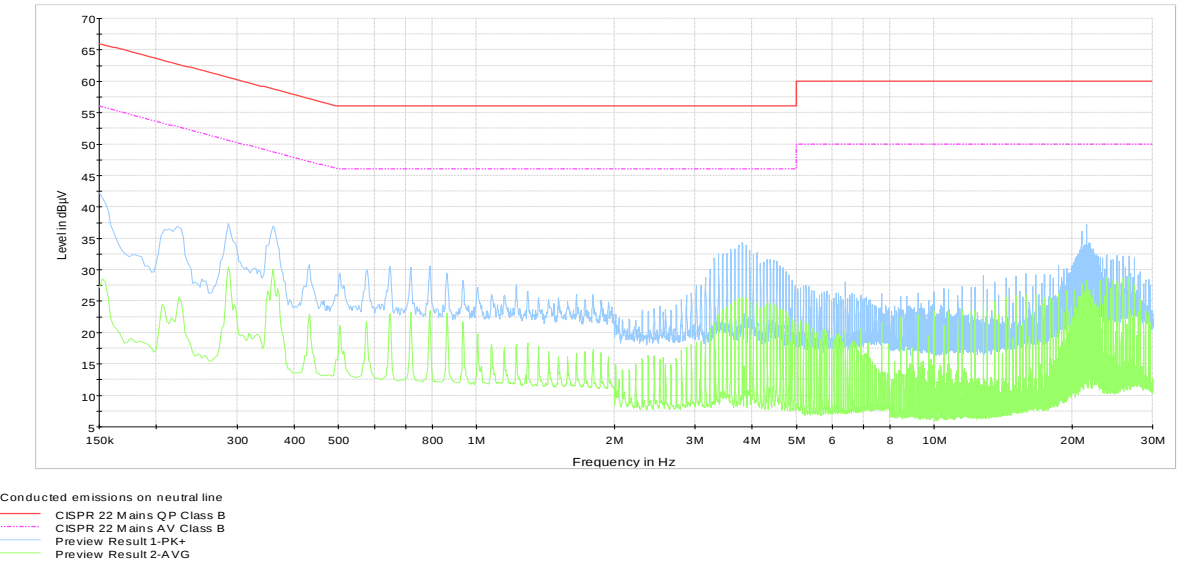
Receiver settings for final measurements:

|                       |                        |
|-----------------------|------------------------|
| 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



Plot 8.1-1: Conducted emissions on phase line



Plot 8.1-2: Conducted emissions on neutral line

## 8.2 FCC 15.403(i) Emission bandwidth

### 8.2.1 Definitions and limits

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

### 8.2.2 Test summary

|                |                 |                    |           |
|----------------|-----------------|--------------------|-----------|
| Test date:     | July 4, 2013    | Temperature:       | 22 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1006 mbar |
| Verdict:       | Pass            | Relative humidity: | 32 %      |

### 8.2.3 Observations, settings and special notes

Spectrum analyser settings:

|                       |                                                          |
|-----------------------|----------------------------------------------------------|
| Resolution bandwidth: | ≥ 1 % of emission BW                                     |
| Video bandwidth:      | ≥ 3 × RBW                                                |
| Frequency span:       | 30 MHz (for 20 MHz channel); 50 MHz (for 40 MHz channel) |
| Detector mode:        | Peak                                                     |
| Trace mode:           | Max Hold                                                 |

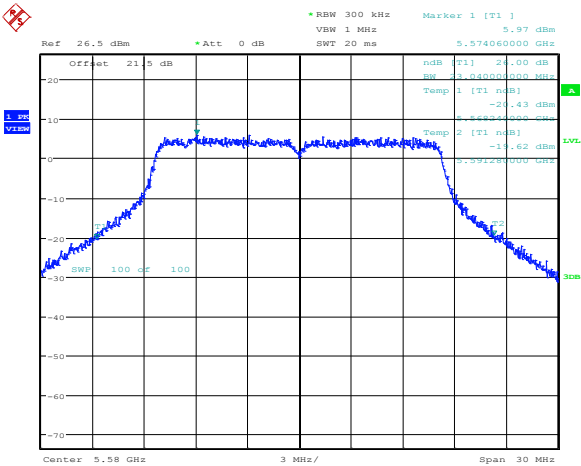
### 8.2.4 Test data

**Table 8.2-1: 26 dB bandwidth results**

| Antenna chain | Modulation   | Frequency, MHz | 26 dB bandwidth, MHz |
|---------------|--------------|----------------|----------------------|
| ch0           | 802.11a      | 5500           | 22.71                |
|               |              | 5580           | 23.04                |
|               |              | 5700           | 23.28                |
|               | 802.11n HT20 | 5500           | 23.49                |
|               |              | 5580           | 23.55                |
|               |              | 5700           | 23.85                |
|               | 802.11n HT40 | 5510           | 47.80                |
|               |              | 5570           | 46.55                |
|               |              | 5690           | 47.55                |
|               | ch1          | 802.11a        | 5500                 |
| 5580          |              |                | 22.80                |
| 5700          |              |                | 22.80                |
| 802.11n HT20  |              | 5500           | 23.85                |
|               |              | 5580           | 23.64                |
|               |              | 5700           | 23.25                |
| 802.11n HT40  |              | 5510           | 47.60                |
|               |              | 5570           | 47.05                |
|               |              | 5690           | 48.30                |

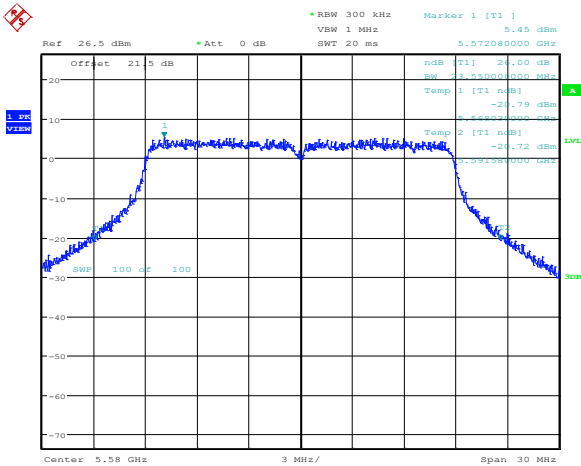
Maximum 26 dB BW for 802.11a is 23.28 MHz, for 802.11n HT20 is 23.85 MHz and for 802.11n HT40 is 48.30 MHz.

8.2.4 Test data, continued



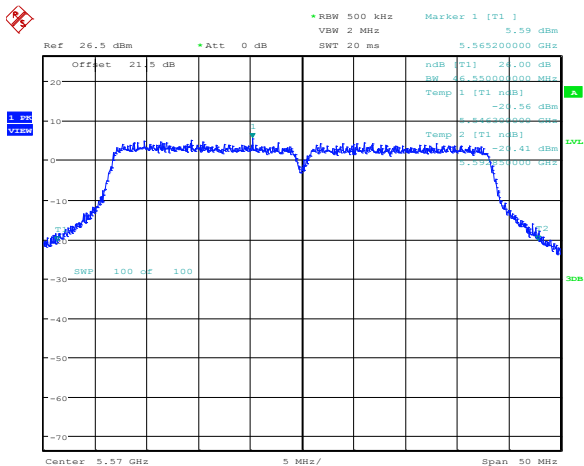
Date: 4.JUL.2013 14:26:03

Figure 8.2-1: 26 dB bandwidth on 802.11a, sample plot



Date: 4.JUL.2013 14:27:48

Figure 8.2-2: 26 dB bandwidth on 802.11n HT20, sample plot



Date: 4.JUL.2013 14:28:49

Figure 8.2-3: 26 dB bandwidth on 802.11n HT40, sample plot

## 8.3 RSS-Gen 4.6.1 Occupied bandwidth

### 8.3.1 Definitions and limits

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

### 8.3.2 Test summary

|                |                 |                    |           |
|----------------|-----------------|--------------------|-----------|
| Test date:     | July 4, 2013    | Temperature:       | 22 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1006 mbar |
| Verdict:       | Pass            | Relative humidity: | 34 %      |

### 8.3.3 Observations, settings and special notes

Spectrum analyser settings:

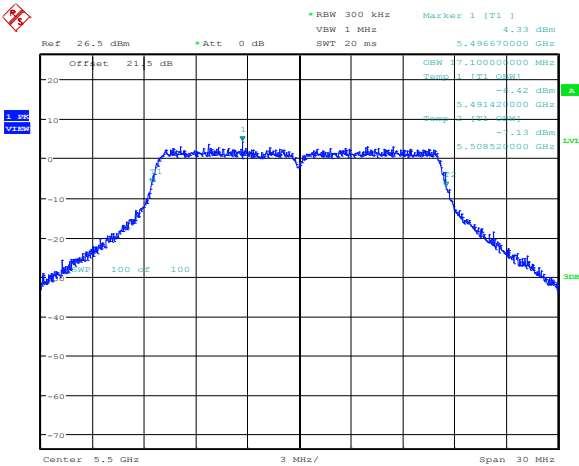
|                       |                                                      |
|-----------------------|------------------------------------------------------|
| Resolution bandwidth: | ≥ 1 % of span                                        |
| Video bandwidth:      | ≥ 3 × RBW                                            |
| Frequency span:       | 30 MHz for 20 MHz channel; 50 MHz for 40 MHz channel |
| Detector mode:        | Peak                                                 |
| Trace mode:           | Max Hold                                             |

### 8.3.4 Test data

**Table 8.3-1: 99 % bandwidth results**

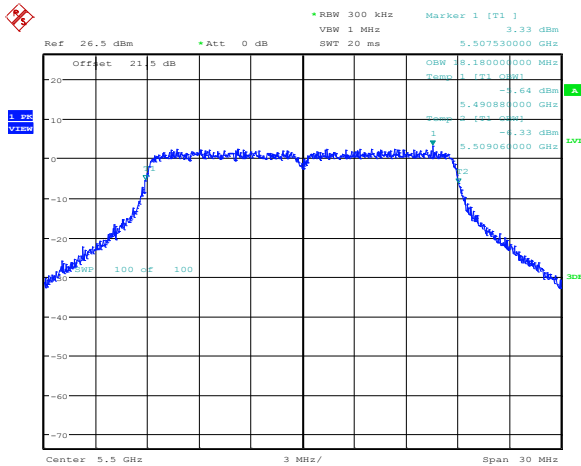
| Modulation   | 99 % bandwidth, MHz |
|--------------|---------------------|
| 802.11a      | 17.10               |
| 802.11n HT20 | 18.18               |
| 802.11n HT40 | 37.10               |

### 8.3.4 Test data, continued



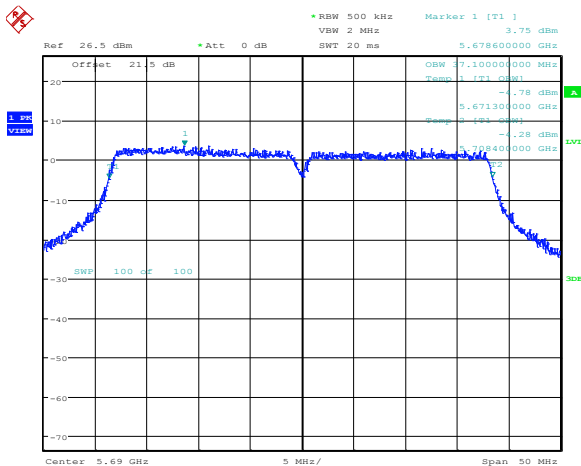
Date: 4.JUL.2013 14:53:00

Figure 8.3-1: 99 % bandwidth on 802.11a, sample plot



Date: 4.JUL.2013 14:54:00

Figure 8.3-2: 99 % bandwidth on 802.11n HT20, sample plot



Date: 4.JUL.2013 14:48:05

Figure 8.3-3: 99 % bandwidth on 802.11n HT40, sample plot

## 8.4 FCC 15.407(a)(2) and RSS-210 A9.2(3) 5.47–5.725 GHz band output power, EIRP and spectral density limits

### 8.4.1 Definitions and limits

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC definitions | <p>For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (24 dBm) or <math>11 \text{ dBm} + 10 \log_{10}(B)</math>, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> <p>The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the above definitions for the emission in question.</p> <p>The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.</p> <p>(h)(1) Transmit power control (TPC). U-NII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW (27 dBm).</p> |
|                 | <p>The maximum conducted output power shall not exceed 250 mW (24 dBm) or <math>11 + 10 \times \log_{10}(B)</math>, dBm, whichever power is less. The power spectral density shall not exceed 11 dBm in any 1 MHz band. The maximum e.i.r.p. shall not exceed 1 W (30 dBm) or <math>17 + 10 \times \log_{10}(B)</math>, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. Note that devices with a maximum e.i.r.p. greater than 500 mW (27 dBm) shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W (30 dBm).</p> <p>Note: For the band 5600–5650 MHz, no operation is permitted. Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 8.4.2 Test summary

|                |                 |                    |           |
|----------------|-----------------|--------------------|-----------|
| Test date:     | July 15, 2013   | Temperature:       | 22 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1006 mbar |
| Verdict:       | Pass            | Relative humidity: | 32 %      |

### 8.4.3 Observations, settings and special notes

The output power test was performed according to 789033 D01 General UNII Test Procedures Old Rules v01r03 section E) 2) b) Method SA-1: trace averaging with the EUT transmitting at full power throughout each sweep. Spectrum analyzer settings were as follows:

|                      |                                 |
|----------------------|---------------------------------|
| Span                 | ≥26 dB BW                       |
| Resolution bandwidth | 1 MHz                           |
| Video bandwidth      | 10 MHz                          |
| Sweep time           | Auto                            |
| Detector             | RMS                             |
| Sweep mode           | Power averaging over 100 traces |

The PPSD test was performed according to 789033 D01 General UNII Test Procedures section F.

Combined average output power was calculated as follows:  $P_{combined} = 10 \times \log_{10} \left( (10^{P_{cho}/10}) + (10^{P_{ch1}/10}) \right)$

EIRP was calculated as follows:  $EIRP = P_{combined} + \text{antenna gain}$

Combined PPSD was calculated as follows:  $PPSD_{combined} = 10 \times \log_{10} \left( (10^{PPSD_{cho}/10}) + (10^{PPSD_{ch1}/10}) \right)$

Directional gain for MIMO Correlated  $2 \times 2$  (CDD/TXBF) with 6.7 dBi antenna = 6.7 dBi +  $10 \times \log_{10}(N)$  dB = 6.7 dBi + 3 dB = 9.7 dBi, where “N” is number of antennae.

Directional gain for MIMO Uncorrelated (cross polarized)  $2 \times 2$  = 11.5 dBi.

Directional gain for MIMO Uncorrelated (cross polarized)  $2 \times 2$  = 12 dBi.

The 26 dB measured bandwidth for 802.11a was 23.28 MHz, for 802.11n HT20 was 23.85 MHz and for 802.11n HT40 was 48.30 MHz.

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.7 dBi antenna FCC output power limits calculations  | For 802.11a: $11 + 10 \times \log_{10}(23.28) - (9.7 - 6) = 20.97 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$<br>For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (9.7 - 6) = 21.07 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$<br>For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (9.7 - 6) = 24.14 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$<br>FCC PPSD limit was calculated as follows: $11 - (9.7 - 6) = 7.3 \text{ dBm/MHz}$        |
| 11.5 dBi antenna FCC output power limits calculations | For 802.11a: $11 + 10 \times \log_{10}(23.28) - (11.5 - 6) = 19.17 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$<br>For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (11.5 - 6) = 19.27 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$<br>For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (11.5 - 6) = 22.34 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$<br>FCC PPSD limit was calculated as follows: $11 - (11.5 - 6) = 5.5 \text{ dBm/MHz}$ |
| 12 dBi antenna FCC output power limits calculations   | For 802.11a: $11 + 10 \times \log_{10}(23.28) - (12 - 6) = 18.67 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$<br>For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (12 - 6) = 18.77 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$<br>For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (12 - 6) = 21.84 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$<br>FCC PPSD limit was calculated as follows: $11 - (12 - 6) = 5 \text{ dBm/MHz}$                          |

The 99 % measured occupied bandwidth for 802.11a was 17.10 MHz, for 802.11n HT20 was 18.18 MHz and for 802.11n HT40 was 37.10 MHz.

The IC output power limits were calculated as follows:

|                  |                                                                        |
|------------------|------------------------------------------------------------------------|
| For 802.11a      | $11 + 10 \times \log_{10}(17.10) = 23.33 \text{ dBm} < 24 \text{ dBm}$ |
| For 802.11n HT20 | $11 + 10 \times \log_{10}(18.18) = 23.60 \text{ dBm} < 24 \text{ dBm}$ |
| For 802.11n HT40 | $11 + 10 \times \log_{10}(37.10) = 26.69 \text{ dBm} > 24 \text{ dBm}$ |

## Section 8

## Test name

## Specification

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FCC 15.407(a)(2) and RSS-210 A9.2(3) 5.47–5.725 GHz band output power, EIRP and spectral density limits

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## 8.4.4 Test data

**Table 8.4-1:** Output power measurements, FCC results for MIMO 2 × 2, 6.7 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined | Limit |            |
| 802.11a      | 5500           | 15.20                               | 15.55  | 18.39    | 20.30 | 1.91       |
|              | 5580           | 15.09                               | 15.43  | 18.27    | 20.30 | 2.03       |
|              | 5700           | 15.31                               | 15.24  | 18.29    | 20.30 | 2.01       |
| 802.11n HT20 | 5500           | 15.43                               | 15.99  | 18.73    | 20.30 | 1.57       |
|              | 5580           | 15.53                               | 15.93  | 18.74    | 20.30 | 1.56       |
|              | 5700           | 14.93                               | 15.46  | 18.21    | 20.30 | 2.09       |
| 802.11n HT40 | 5510           | 11.71                               | 13.92  | 15.96    | 20.30 | 4.34       |
|              | 5570           | 17.06                               | 16.98  | 20.03    | 20.30 | 0.27       |
|              | 5690           | 11.33                               | 13.52  | 15.57    | 20.30 | 4.73       |

**Table 8.4-2:** PPSD measurements, FCC results for MIMO 2 × 2, 6.7 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Peak Power Spectral Density (PPSD), dBm/MHz |        |          | PPSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------------|--------|----------|---------------------|------------|
|              |                | On ch0                                               | On ch1 | Combined |                     |            |
| 802.11a      | 5500           | 4.06                                                 | 4.25   | 7.17     | 7.30                | 0.13       |
|              | 5580           | 4.02                                                 | 4.22   | 7.13     | 7.30                | 0.17       |
|              | 5700           | 4.08                                                 | 4.13   | 7.12     | 7.30                | 0.18       |
| 802.11n HT20 | 5500           | 3.98                                                 | 4.42   | 7.22     | 7.30                | 0.08       |
|              | 5580           | 4.14                                                 | 4.43   | 7.30     | 7.30                | 0.00       |
|              | 5700           | 3.36                                                 | 4.09   | 6.75     | 7.30                | 0.55       |
| 802.11n HT40 | 5510           | -2.55                                                | -0.54  | 1.58     | 7.30                | 5.72       |
|              | 5570           | 2.71                                                 | 2.43   | 5.58     | 7.30                | 1.72       |
|              | 5690           | -3.09                                                | -0.63  | 1.32     | 7.30                | 5.98       |

**Table 8.4-3:** Output power measurements, FCC results for MIMO 2 × 2, 11.5 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined | Limit |            |
| 802.11a      | 5500           | 13.43                               | 13.40  | 16.43    | 18.50 | 2.07       |
|              | 5580           | 13.21                               | 14.00  | 16.63    | 18.50 | 1.87       |
|              | 5700           | 13.63                               | 13.34  | 16.50    | 18.50 | 2.00       |
| 802.11n HT20 | 5500           | 13.87                               | 13.82  | 16.86    | 18.50 | 1.64       |
|              | 5580           | 13.68                               | 14.05  | 16.88    | 18.50 | 1.62       |
|              | 5700           | 13.95                               | 13.88  | 16.93    | 18.50 | 1.57       |
| 802.11n HT40 | 5510           | 13.63                               | 13.77  | 16.71    | 18.50 | 1.79       |
|              | 5570           | 13.95                               | 14.22  | 17.10    | 18.50 | 1.40       |
|              | 5690           | 13.80                               | 13.97  | 16.90    | 18.50 | 1.60       |

#### 8.4.4 Test data, continued

**Table 8.4-4:** PPSD measurements, FCC results for MIMO 2 × 2, 11.5 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Peak Power Spectral Density (PPSD), dBm/MHz |        |          | PPSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------------|--------|----------|---------------------|------------|
|              |                | On ch0                                               | On ch1 | Combined |                     |            |
| 802.11a      | 5500           | 2.39                                                 | 2.22   | 5.32     | 5.50                | 0.18       |
|              | 5580           | 2.21                                                 | 2.72   | 5.48     | 5.50                | 0.02       |
|              | 5700           | 2.49                                                 | 2.25   | 5.38     | 5.50                | 0.12       |
| 802.11n HT20 | 5500           | 2.51                                                 | 2.39   | 5.46     | 5.50                | 0.04       |
|              | 5580           | 2.36                                                 | 2.49   | 5.44     | 5.50                | 0.06       |
|              | 5700           | 2.43                                                 | 2.45   | 5.45     | 5.50                | 0.05       |
| 802.11n HT40 | 5510           | 2.27                                                 | 2.26   | 5.28     | 5.50                | 0.22       |
|              | 5570           | 2.46                                                 | 2.40   | 5.44     | 5.50                | 0.06       |
|              | 5690           | 2.25                                                 | 2.67   | 5.48     | 5.50                | 0.02       |

**Table 8.4-5:** Output power measurements, FCC results for MIMO 2 × 2, 12 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          | Limit | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined |       |            |
| 802.11a      | 5500           | 12.97                               | 12.93  | 15.96    | 18.00 | 2.04       |
|              | 5580           | 12.71                               | 13.01  | 15.87    | 18.00 | 2.13       |
|              | 5700           | 13.20                               | 12.88  | 16.05    | 18.00 | 1.95       |
| 802.11n HT20 | 5500           | 13.32                               | 13.34  | 16.34    | 18.00 | 1.66       |
|              | 5580           | 13.19                               | 13.55  | 16.38    | 18.00 | 1.62       |
|              | 5700           | 13.40                               | 13.36  | 16.39    | 18.00 | 1.61       |
| 802.11n HT40 | 5510           | 13.18                               | 13.32  | 16.26    | 18.00 | 1.74       |
|              | 5570           | 13.44                               | 13.70  | 16.58    | 18.00 | 1.42       |
|              | 5690           | 13.38                               | 13.39  | 16.40    | 18.00 | 1.60       |

**Table 8.4-6:** PPSD measurements, FCC results for MIMO 2 × 2, 12 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Peak Power Spectral Density (PPSD), dBm/MHz |        |          | PPSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------------|--------|----------|---------------------|------------|
|              |                | On ch0                                               | On ch1 | Combined |                     |            |
| 802.11a      | 5500           | 1.94                                                 | 1.74   | 4.85     | 5.00                | 0.15       |
|              | 5580           | 1.71                                                 | 1.72   | 4.73     | 5.00                | 0.27       |
|              | 5700           | 1.97                                                 | 1.81   | 4.90     | 5.00                | 0.10       |
| 802.11n HT20 | 5500           | 1.99                                                 | 1.82   | 4.92     | 5.00                | 0.08       |
|              | 5580           | 1.91                                                 | 2.00   | 4.97     | 5.00                | 0.03       |
|              | 5700           | 1.91                                                 | 1.92   | 4.93     | 5.00                | 0.07       |
| 802.11n HT40 | 5510           | 1.78                                                 | 1.82   | 4.81     | 5.00                | 0.19       |
|              | 5570           | 1.98                                                 | 1.89   | 4.95     | 5.00                | 0.05       |
|              | 5690           | 1.85                                                 | 2.07   | 4.97     | 5.00                | 0.03       |

## Section 8

## Test name

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FCC 15.407(a)(2) and RSS-210 A9.2(3) 5.47–5.725 GHz band output power, EIRP and spectral density limits

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## 8.4.4 Test data, continued

Table 8.4-7: Output power measurements and EIRP calculations results for IC with 6.7 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          |       | Margin, dB | Total antenna gain, dBi | EIRP, dBm  |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|-------------------------|------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined | Limit |            |                         | Calculated | Limit |            |
| 802.11a      | 5500           | 16.74                               | 16.48  | 19.62    | 23.33 | 3.71       | 9.70                    | 29.32      | 29.33 | 0.01       |
|              | 5580           | 12.54                               | 15.36  | 17.19    | 23.33 | 6.14       | 9.70                    | 26.89      | 29.33 | 2.44       |
|              | 5700           | 16.09                               | 16.18  | 19.15    | 23.33 | 4.18       | 9.70                    | 28.85      | 29.33 | 0.48       |
| 802.11n HT20 | 5500           | 16.84                               | 16.74  | 19.80    | 23.60 | 3.80       | 9.70                    | 29.50      | 29.60 | 0.10       |
|              | 5580           | 12.57                               | 14.12  | 16.42    | 23.60 | 7.18       | 9.70                    | 26.12      | 29.60 | 3.48       |
|              | 5700           | 15.60                               | 15.49  | 18.56    | 23.60 | 5.04       | 9.70                    | 28.26      | 29.60 | 1.34       |
| 802.11n HT40 | 5510           | 11.61                               | 13.52  | 15.68    | 24.00 | 8.32       | 9.70                    | 25.38      | 30.00 | 4.62       |
|              | 5570           | 9.81                                | 10.00  | 12.92    | 24.00 | 11.08      | 9.70                    | 22.62      | 30.00 | 7.38       |
|              | 5690           | 11.54                               | 12.73  | 15.19    | 24.00 | 8.81       | 9.70                    | 24.89      | 30.00 | 5.11       |

Table 8.4-8: Output power measurements and EIRP calculations results for IC with 11.5 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          |       | Margin, dB | Antenna gain, dBi | EIRP, dBm  |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|-------------------|------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined | Limit |            |                   | Calculated | Limit |            |
| 802.11a      | 5500           | 13.92                               | 13.89  | 16.91    | 23.33 | 6.42       | 11.50             | 28.41      | 29.33 | 0.92       |
|              | 5580           | 13.70                               | 14.49  | 17.12    | 23.33 | 6.21       | 11.50             | 28.62      | 29.33 | 0.71       |
|              | 5700           | 14.12                               | 13.83  | 16.99    | 23.33 | 6.34       | 11.50             | 28.49      | 29.33 | 0.84       |
| 802.11n HT20 | 5500           | 14.36                               | 14.31  | 17.34    | 23.60 | 6.26       | 11.50             | 28.84      | 29.60 | 0.76       |
|              | 5580           | 14.17                               | 14.54  | 17.37    | 23.60 | 6.23       | 11.50             | 28.87      | 29.60 | 0.73       |
|              | 5700           | 14.44                               | 14.86  | 17.66    | 23.60 | 5.94       | 11.50             | 29.16      | 29.60 | 0.44       |
| 802.11n HT40 | 5510           | 13.67                               | 13.32  | 16.51    | 24.00 | 7.49       | 11.50             | 28.01      | 30.00 | 1.99       |
|              | 5570           | 8.49                                | 8.20   | 11.36    | 24.00 | 12.64      | 11.50             | 22.86      | 30.00 | 7.14       |
|              | 5690           | 13.38                               | 13.88  | 16.65    | 24.00 | 7.35       | 11.50             | 28.15      | 30.00 | 1.85       |

Table 8.4-9: Output power measurements and EIRP calculations results for IC with 12 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          |       | Margin, dB | Antenna gain, dBi | EIRP, dBm  |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------|------------|-------------------|------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined | Limit |            |                   | Calculated | Limit |            |
| 802.11a      | 5500           | 13.43                               | 13.40  | 16.43    | 23.33 | 6.90       | 12.00             | 28.43      | 29.33 | 0.90       |
|              | 5580           | 13.21                               | 14.00  | 16.63    | 23.33 | 6.70       | 12.00             | 28.63      | 29.33 | 0.70       |
|              | 5700           | 13.63                               | 13.34  | 16.50    | 23.33 | 6.83       | 12.00             | 28.50      | 29.33 | 0.83       |
| 802.11n HT20 | 5500           | 13.87                               | 13.82  | 16.86    | 23.60 | 6.74       | 12.00             | 28.86      | 29.60 | 0.74       |
|              | 5580           | 13.68                               | 14.05  | 16.88    | 23.60 | 6.72       | 12.00             | 28.88      | 29.60 | 0.72       |
|              | 5700           | 13.95                               | 13.88  | 16.93    | 23.60 | 6.67       | 12.00             | 28.93      | 29.60 | 0.67       |
| 802.11n HT40 | 5510           | 13.18                               | 13.32  | 16.26    | 24.00 | 7.74       | 12.00             | 28.26      | 30.00 | 1.74       |
|              | 5570           | 8.00                                | 7.71   | 10.87    | 24.00 | 13.13      | 12.00             | 22.87      | 30.00 | 7.13       |
|              | 5690           | 13.38                               | 13.39  | 16.40    | 24.00 | 7.60       | 12.00             | 28.40      | 30.00 | 1.60       |

#### 8.4.4 Test data, continued

**Table 8.4-10:** PSD measurements results for IC with 6.7 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Power Spectral Density (PSD), dBm/MHz |        |          | PSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------|--------|----------|--------------------|------------|
|              |                | On ch0                                         | On ch1 | Combined |                    |            |
| 802.11a      | 5500           | 5.55                                           | 5.23   | 8.40     | 11.00              | 2.60       |
|              | 5580           | 1.46                                           | 4.21   | 6.06     | 11.00              | 4.94       |
|              | 5700           | 4.86                                           | 5.11   | 8.00     | 11.00              | 3.00       |
| 802.11n HT20 | 5500           | 5.41                                           | 5.17   | 8.30     | 11.00              | 2.70       |
|              | 5580           | 1.18                                           | 2.63   | 4.98     | 11.00              | 6.02       |
|              | 5700           | 4.05                                           | 4.10   | 7.09     | 11.00              | 3.91       |
| 802.11n HT40 | 5510           | -2.75                                          | -1.00  | 1.22     | 11.00              | 9.78       |
|              | 5570           | -4.46                                          | -4.30  | -1.37    | 11.00              | 12.37      |
|              | 5690           | -2.95                                          | -1.33  | 0.95     | 11.00              | 10.05      |

**Table 8.4-11:** PSD measurements results for IC with 11.5 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Power Spectral Density (PSD), dBm/MHz |        |          | PSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------|--------|----------|--------------------|------------|
|              |                | On ch0                                         | On ch1 | Combined |                    |            |
| 802.11a      | 5500           | 2.88                                           | 2.71   | 5.80     | 11.00              | 5.20       |
|              | 5580           | 2.70                                           | 3.21   | 5.97     | 11.00              | 5.03       |
|              | 5700           | 2.98                                           | 2.74   | 5.87     | 11.00              | 5.13       |
| 802.11n HT20 | 5500           | 3.00                                           | 2.88   | 5.95     | 11.00              | 5.05       |
|              | 5580           | 2.85                                           | 2.98   | 5.92     | 11.00              | 5.08       |
|              | 5700           | 2.92                                           | 3.43   | 6.19     | 11.00              | 4.81       |
| 802.11n HT40 | 5510           | -1.45                                          | 0.52   | 2.66     | 11.00              | 8.34       |
|              | 5570           | 0.95                                           | 1.18   | 4.08     | 11.00              | 6.92       |
|              | 5690           | -2.73                                          | 1.33   | 2.77     | 11.00              | 8.23       |

**Table 8.4-12:** PSD measurements results for IC with 12 dBi antenna configuration

| Modulation   | Frequency, MHz | Measured Power Spectral Density (PSD), dBm/MHz |        |          | PSD limit, dBm/MHz | Margin, dB |
|--------------|----------------|------------------------------------------------|--------|----------|--------------------|------------|
|              |                | On ch0                                         | On ch1 | Combined |                    |            |
| 802.11a      | 5500           | 2.39                                           | 2.22   | 5.32     | 11.00              | 5.68       |
|              | 5580           | 2.21                                           | 2.72   | 5.48     | 11.00              | 5.52       |
|              | 5700           | 2.49                                           | 2.25   | 5.38     | 11.00              | 5.62       |
| 802.11n HT20 | 5500           | 2.51                                           | 2.39   | 5.46     | 11.00              | 5.54       |
|              | 5580           | 2.36                                           | 2.49   | 5.44     | 11.00              | 5.56       |
|              | 5700           | 2.43                                           | 2.45   | 5.45     | 11.00              | 5.55       |
| 802.11n HT40 | 5510           | -1.94                                          | 0.52   | 2.47     | 11.00              | 8.53       |
|              | 5570           | 0.46                                           | 0.69   | 3.59     | 11.00              | 7.41       |
|              | 5690           | -2.73                                          | 0.84   | 2.42     | 11.00              | 8.58       |

#### 8.4.4 Test data, continued

**Table 8.4-13:** TPC EIRP measurements results for 6.7 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          | Total antenna gain, dBi | TPC EIRP, dBm |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------------------------|---------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined |                         | Calculated    | Limit |            |
| 802.11a      | 5500           | 0.84                                | 1.54   | 4.21     | 9.70                    | 13.91         | 24.00 | 10.09      |
|              | 5580           | 2.39                                | 3.15   | 5.80     | 9.70                    | 15.50         | 24.00 | 8.50       |
|              | 5700           | 1.92                                | 3.16   | 5.59     | 9.70                    | 15.29         | 24.00 | 8.71       |
| 802.11n HT20 | 5500           | 0.81                                | 1.54   | 4.20     | 9.70                    | 13.90         | 24.00 | 10.10      |
|              | 5580           | 2.38                                | 3.09   | 5.76     | 9.70                    | 15.46         | 24.00 | 8.54       |
|              | 5700           | 1.91                                | 3.31   | 5.68     | 9.70                    | 15.38         | 24.00 | 8.62       |
| 802.11n HT40 | 5510           | 1.65                                | 1.79   | 4.73     | 9.70                    | 14.43         | 24.00 | 9.57       |
|              | 5570           | 2.62                                | 3.10   | 5.88     | 9.70                    | 15.58         | 24.00 | 8.42       |
|              | 5690           | 1.95                                | 3.14   | 5.60     | 9.70                    | 15.30         | 24.00 | 8.70       |

**Table 8.4-14:** TPC EIRP measurements results for 11.5 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          | Total antenna gain, dBi | TPC EIRP, dBm |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------------------------|---------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined |                         | Calculated    | Limit |            |
| 802.11a      | 5500           | 0.84                                | 1.54   | 4.21     | 11.50                   | 15.71         | 24.00 | 8.29       |
|              | 5580           | 2.39                                | 3.15   | 5.80     | 11.50                   | 17.30         | 24.00 | 6.70       |
|              | 5700           | 1.92                                | 3.16   | 5.59     | 11.50                   | 17.09         | 24.00 | 6.91       |
| 802.11n HT20 | 5500           | 0.81                                | 1.54   | 4.20     | 11.50                   | 15.70         | 24.00 | 8.30       |
|              | 5580           | 2.38                                | 3.09   | 5.76     | 11.50                   | 17.26         | 24.00 | 6.74       |
|              | 5700           | 1.91                                | 3.31   | 5.68     | 11.50                   | 17.18         | 24.00 | 6.82       |
| 802.11n HT40 | 5510           | 1.65                                | 1.79   | 4.73     | 11.50                   | 16.23         | 24.00 | 7.77       |
|              | 5570           | 2.62                                | 3.10   | 5.88     | 11.50                   | 17.38         | 24.00 | 6.62       |
|              | 5690           | 1.95                                | 3.14   | 5.60     | 11.50                   | 17.10         | 24.00 | 6.90       |

**Table 8.4-15:** TPC EIRP measurements results for 12 dBi antenna configuration

| Modulation   | Frequency, MHz | Conducted average output power, dBm |        |          | Total antenna gain, dBi | TPC EIRP, dBm |       | Margin, dB |
|--------------|----------------|-------------------------------------|--------|----------|-------------------------|---------------|-------|------------|
|              |                | On ch0                              | On ch1 | Combined |                         | Calculated    | Limit |            |
| 802.11a      | 5500           | 0.84                                | 1.54   | 4.21     | 12.00                   | 16.21         | 24.00 | 7.79       |
|              | 5580           | 2.39                                | 3.15   | 5.80     | 12.00                   | 17.80         | 24.00 | 6.20       |
|              | 5700           | 1.92                                | 3.16   | 5.59     | 12.00                   | 17.59         | 24.00 | 6.41       |
| 802.11n HT20 | 5500           | 0.81                                | 1.54   | 4.20     | 12.00                   | 16.20         | 24.00 | 7.80       |
|              | 5580           | 2.38                                | 3.09   | 5.76     | 12.00                   | 17.76         | 24.00 | 6.24       |
|              | 5700           | 1.91                                | 3.31   | 5.68     | 12.00                   | 17.68         | 24.00 | 6.32       |
| 802.11n HT40 | 5510           | 1.65                                | 1.79   | 4.73     | 12.00                   | 16.73         | 24.00 | 7.27       |
|              | 5570           | 2.62                                | 3.10   | 5.88     | 12.00                   | 17.88         | 24.00 | 6.12       |
|              | 5690           | 1.95                                | 3.14   | 5.60     | 12.00                   | 17.60         | 24.00 | 6.40       |



8.4.4 Test data, continued

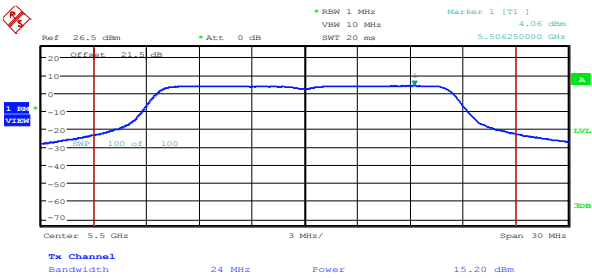


Figure 8.4-1: Output power and PSD on 802.11a, sample plot

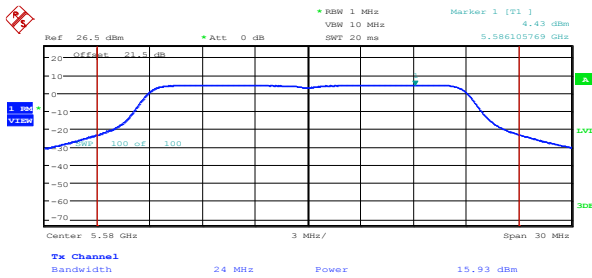


Figure 8.4-2: Output power and PSD on 802.11n HT20, sample plot

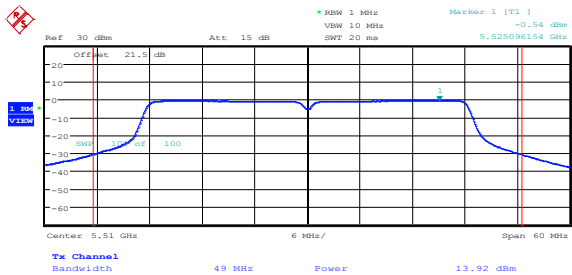


Figure 8.4-3: Output power and PSD on 802.11n HT40, sample plot

## 8.5 FCC 15.407(b) and RSS-210 A9.2(3) Spurious (out-of-band) emissions

### 8.5.1 Definitions and limits

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC definitions | <p>(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz.</p> <p>(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.</p> <p>(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.</p> <p>(7) The provisions of § 15.205 apply to intentional radiators operating under this section.</p> <p>(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.</p>                                                              |
| IC definitions  | <p>Emissions outside the band 5470–5725 MHz shall not exceed –27 dBm/MHz e.i.r.p.</p> <p>RSS-Gen 7.2.2 Emissions falling within restricted frequency bands</p> <p>Restricted bands, identified in below, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:</p> <p>(a) fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of below;</p> <p>(b) unwanted emissions falling into restricted bands of below shall comply with the limits specified in RSS-Gen;</p> <p>(c) unwanted emissions not falling within restricted frequency bands shall either comply with the limits specified in the applicable RSS, or with those specified in RSS-Gen.</p> |

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

| Frequency,<br>MHz | Field strength of emissions |                                 | Measurement distance,<br>m |
|-------------------|-----------------------------|---------------------------------|----------------------------|
|                   | µV/m                        | dBµV/m                          |                            |
| 0.009–0.490       | 2400/F                      | $67.6 - 20 \times \log_{10}(F)$ | 300                        |
| 0.490–1.705       | 24000/F                     | $87.6 - 20 \times \log_{10}(F)$ | 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

## 8.5.1 Definitions and limits, continued

**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 this table and above 38.6 GHz are designated for low-power license-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:     | July 8, 2013    | Temperature:       | 22 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1003 mbar |
| Verdict:       | Pass            | Relative humidity: | 33 %      |

### 8.5.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 40 GHz.

EUT was set to transmit with 100 % duty cycle.

Radiated measurements were performed at a distance of 3 m, the EUT was transmitting on both MIMO chains simultaneously. Radiated emissions were performed while both antenna connectors were terminated with 50  $\Omega$  load.

**No radiated emissions falling within restricted bands above system noise floor were detected.**

**All radiated emissions outside restricted bands were below both the average and peak limits of 15.209 therefore it is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit as per paragraph H)2)c)i) of 789033 D01 General UNII Test Procedures Old Rules v01r03.**

Directional gain for MIMO Correlated  $2 \times 2$  (CDD/TXBF) with 6.7 dBi antenna = 6.7 dBi +  $10 \times \log_{10}(N)$  dB = 6.7 dBi + 3 dB = 9.7 dBi, where "N" is number of antennae. Directional gain for MIMO Uncorrelated (cross polarized)  $2 \times 2$  = 11.5 dBi. Directional gain for MIMO Uncorrelated (cross polarized)  $2 \times 2$  = 12 dBi.

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

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

Average limit line for measurements within restricted bands below 1 GHz was set as follows:

|                       |                                                                    |
|-----------------------|--------------------------------------------------------------------|
| For 6.7 dBi antenna:  | 54 dB $\mu$ V/m – 95.23 dB – 9.7 dBi – 4.7 dB – 3 dB = –58.63 dBm  |
| For 11.5 dBi antenna: | 54 dB $\mu$ V/m – 95.23 dB – 11.5 dBi – 4.7 dB – 3 dB = –60.43 dBm |
| For 12 dBi antenna:   | 54 dB $\mu$ V/m – 95.23 dB – 12.0 dBi – 4.7 dB – 3 dB = –60.93 dBm |

Note: 3 dB is a multiple antenna ports compensation:  $10 \times \log_{10}(2)$  and 4.7 dB is a ground reflection factor

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

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

Average limit line for measurements within restricted bands above 1 GHz was set as follows:

|                       |                                                               |
|-----------------------|---------------------------------------------------------------|
| For 6.7 dBi antenna:  | 54 dB $\mu$ V/m – 95.23 dB – 9.7 dBi – 3 dB = –53.93 dBm/MHz  |
| For 11.5 dBi antenna: | 54 dB $\mu$ V/m – 95.23 dB – 11.5 dBi – 3 dB = –55.73 dBm/MHz |
| For 12 dBi antenna:   | 54 dB $\mu$ V/m – 95.23 dB – 12.0 dBi – 3 dB = –56.23 dBm/MHz |

Note: 3 dB is a multiple antenna ports compensation:  $10 \times \log_{10}(2)$

Spectrum analyser settings for average\* conducted measurements within restricted bands above 1 GHz for frequencies:

|                             |               |
|-----------------------------|---------------|
| Resolution bandwidth:       | 1 MHz         |
| Video bandwidth:            | 10 MHz        |
| Detector mode:              | RMS           |
| Trace mode:                 | Power average |
| Number of averaging traces: | 100           |

Note: \* if peak results were above the average limit. Peak limit is 20 dB higher than the average limit

Spectrum analyser settings for peak conducted measurements outside restricted bands:

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

The limit for conducted emissions measurements outside restricted bands was set as follows:

|                       |                                                |
|-----------------------|------------------------------------------------|
| For 6.7 dBi antenna:  | –27 dBm/MHz – 3 dB – 9.7 dBi = –39.70 dBm/MHz  |
| For 11.5 dBi antenna: | –27 dBm/MHz – 3 dB – 11.5 dBi = –41.50 dBm/MHz |
| For 12 dBi antenna:   | –27 dBm/MHz – 3 dB – 12.0 dBi = –42.00 dBm/MHz |

Note: 3 dB is a multiple antenna ports compensation:  $10 \times \log_{10}(2)$

8.5.4 Test data

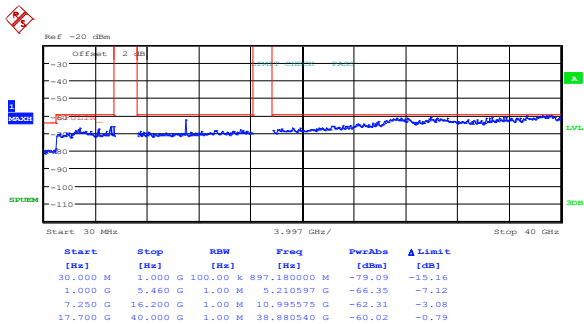


Figure 8.5-1: Peak spurious emissions within restricted bands at low channel, 802.11a, cho

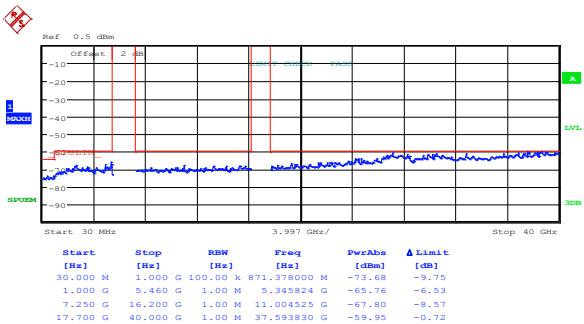


Figure 8.5-2: Peak spurious emissions within restricted bands at low channel, 802.11a, ch1

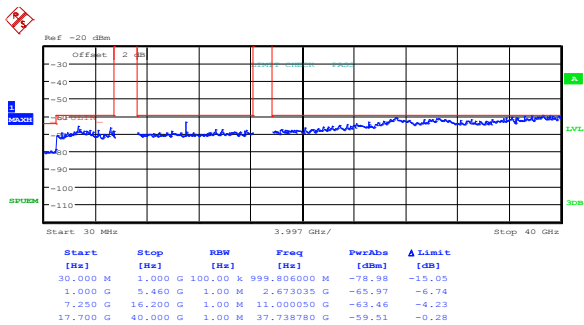


Figure 8.5-3: Peak spurious emissions within restricted bands at low channel, 802.11n HT20, cho

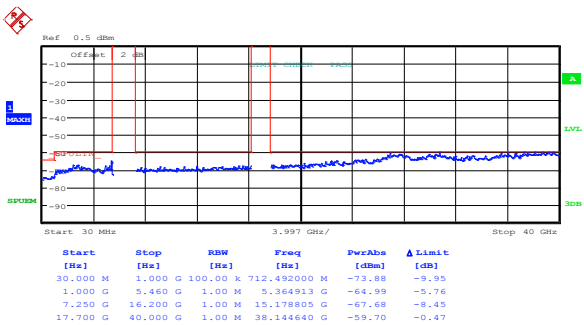


Figure 8.5-4: Peak spurious emissions within restricted bands at low channel, 802.11n HT20, ch1

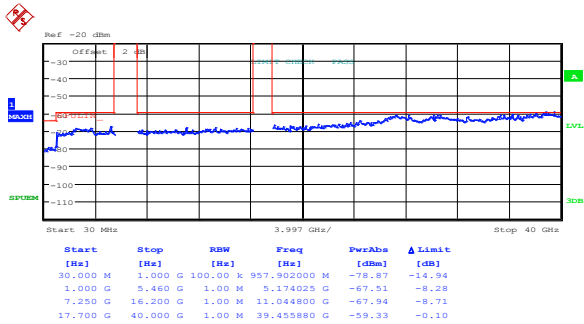


Figure 8.5-5: Peak spurious emissions within restricted bands at low channel, 802.11n HT40, cho

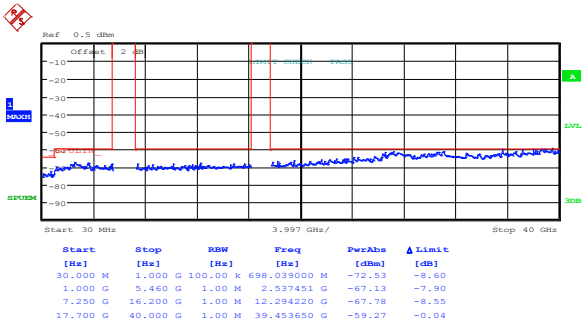


Figure 8.5-6: Peak spurious emissions within restricted bands at low channel, 802.11n HT40, ch1

8.5.4 Test data, continued

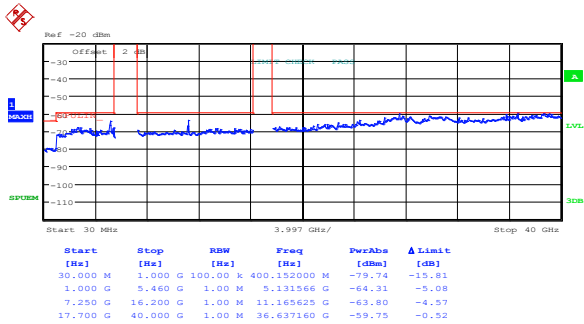


Figure 8.5-7: Peak spurious emissions within restricted bands at mid channel, 802.11a, cho

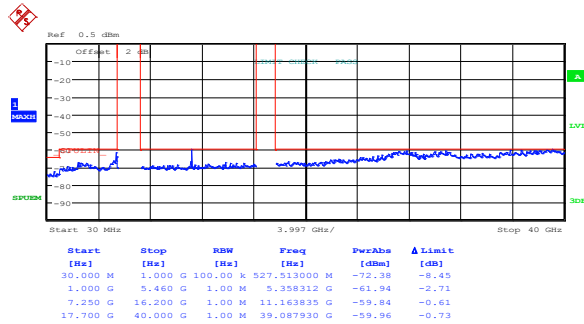


Figure 8.5-8: Peak spurious emissions within restricted bands at mid channel, 802.11a, ch1

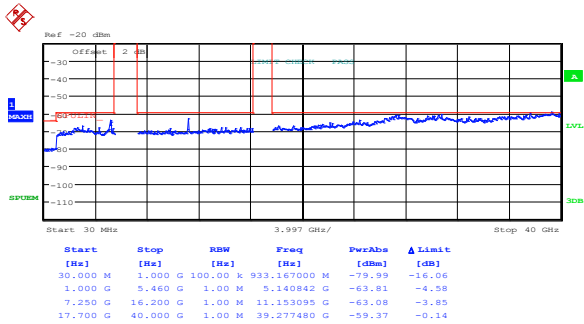


Figure 8.5-9: Peak spurious emissions within restricted bands at mid channel, 802.11n HT20, cho

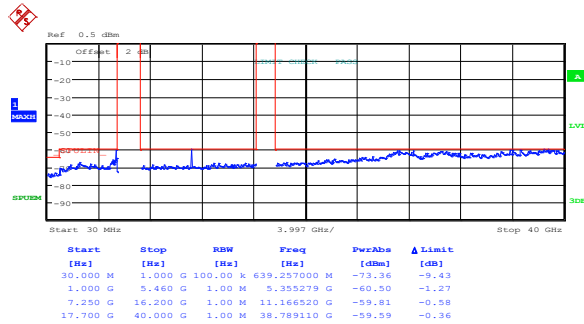


Figure 8.5-10: Peak spurious emissions within restricted bands at mid channel, 802.11n HT20, ch1

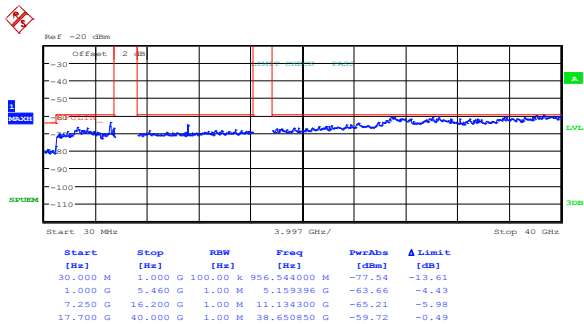


Figure 8.5-11: Peak spurious emissions within restricted bands at mid channel, 802.11n HT40, cho

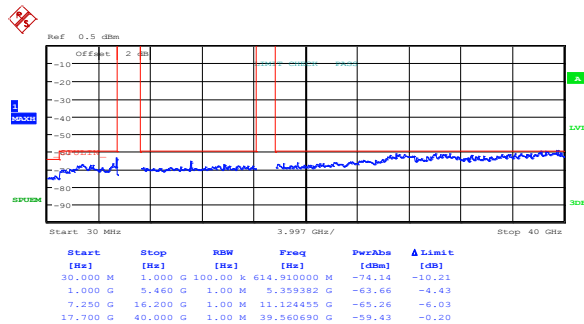


Figure 8.5-12: Peak spurious emissions within restricted bands at mid channel, 802.11n HT40, ch1

## 8.5.4 Test data, continued

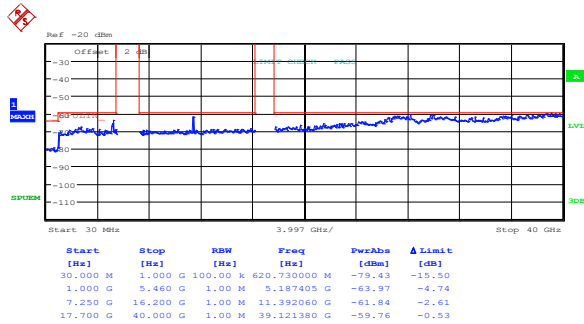


Figure 8.5-13: Peak spurious emissions within restricted bands at high channel, 802.11a, cho

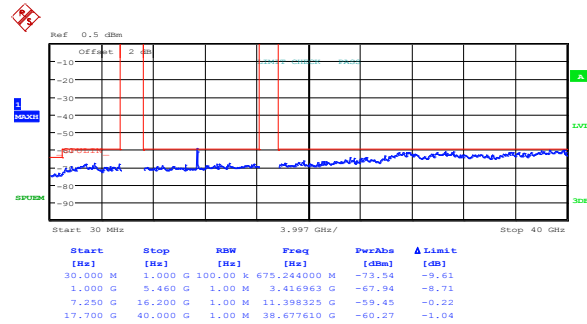


Figure 8.5-14: Peak spurious emissions within restricted bands at high channel, 802.11a, ch1

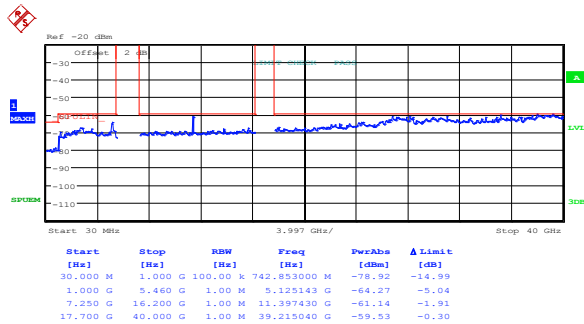


Figure 8.5-15: Peak spurious emissions within restricted bands at high channel, 802.11n HT20, cho

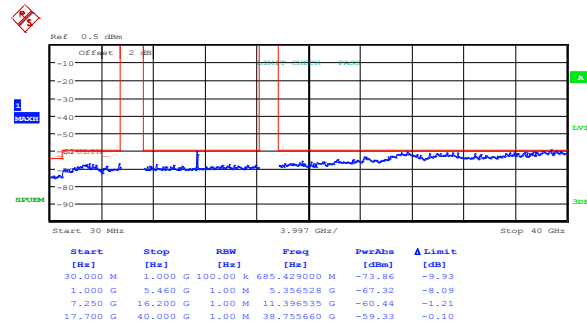


Figure 8.5-16: Peak spurious emissions within restricted bands at high channel, 802.11n HT20, ch1

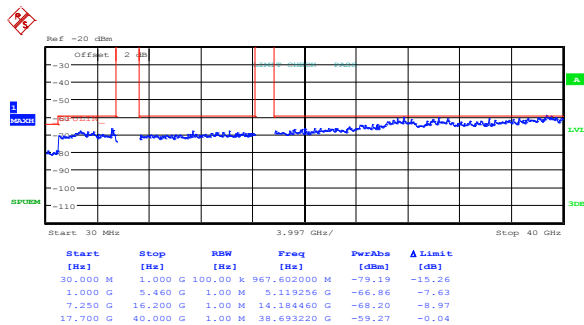


Figure 8.5-17: Peak spurious emissions within restricted bands at high channel, 802.11n HT40, cho

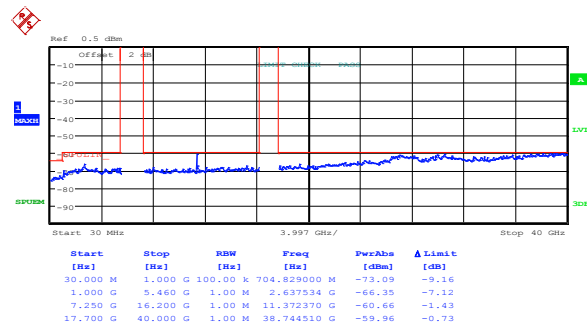


Figure 8.5-18: Peak spurious emissions within restricted bands at high channel, 802.11n HT40, ch1

## 8.5.4 Test data, continued

**Table 8.5-4:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 6.7 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -43.38          | -33.93 | 9.45       | -53.96             | -53.93 | 0.03       |
| Low     | 11000.00       | -62.31          | -33.93 | 28.38      | -72.89             | -53.93 | 18.96      |
| Mid     | 11160.00       | -63.80          | -33.93 | 29.87      | -74.38             | -53.93 | 20.45      |
| High    | 11140.00       | -61.84          | -33.93 | 27.91      | -72.42             | -53.93 | 18.49      |

**Table 8.5-5:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 6.7 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -43.44          | -33.93 | 9.51       | -53.94             | -53.93 | 0.01       |
| Mid     | 11160.00       | -63.08          | -33.93 | 29.15      | -73.58             | -53.93 | 19.65      |
| High    | 11140.00       | -61.14          | -33.93 | 27.21      | -71.64             | -53.93 | 17.71      |

**Table 8.5-6:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 6.7 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -44.47          | -33.93 | 10.54      | -54.18             | -53.93 | 0.25       |
| Low     | 11490.00       | -63.46          | -33.93 | 29.53      | -73.17             | -53.93 | 19.24      |
| Mid     | 11140.00       | -65.21          | -33.93 | 31.28      | -74.92             | -53.93 | 20.99      |

**Table 8.5-7:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 6.7 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -48.03          | -33.93 | 14.10      | -54.00             | -53.93 | 0.07       |
| Mid     | 11160.00       | -59.84          | -33.93 | 25.91      | -65.81             | -53.93 | 11.88      |
| High    | 11140.00       | -59.45          | -33.93 | 25.52      | -65.42             | -53.93 | 11.49      |

**Table 8.5-8:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 6.7 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -46.83          | -33.93 | 12.90      | -54.73             | -53.93 | 0.80       |
| Mid     | 11160.00       | -59.81          | -33.93 | 25.88      | -67.71             | -53.93 | 13.78      |
| High    | 11140.00       | -60.44          | -33.93 | 26.51      | -68.34             | -53.93 | 14.41      |

**Table 8.5-9:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 6.7 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -48.65          | -33.93 | 14.72      | -55.15             | -53.93 | 1.22       |
| Mid     | 11140.00       | -65.26          | -33.93 | 31.33      | -71.76             | -53.93 | 17.83      |
| High    | 11380.00       | -60.66          | -33.93 | 26.73      | -67.16             | -53.93 | 13.23      |

## 8.5.4 Test data, continued

**Table 8.5-10:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 11.5 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -48.86          | -35.73 | 13.13      | -59.05             | -55.73 | 3.32       |
| Low     | 11000.00       | -64.08          | -35.73 | 28.35      | -74.27             | -55.73 | 18.54      |
| Mid     | 11160.00       | -65.68          | -35.73 | 29.95      | -75.87             | -55.73 | 20.14      |
| High    | 11140.00       | -63.52          | -35.73 | 27.79      | -73.71             | -55.73 | 17.98      |

**Table 8.5-11:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 11.5 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -48.52          | -35.73 | 12.79      | -58.98             | -55.73 | 3.25       |
| Mid     | 11160.00       | -64.93          | -35.73 | 29.20      | -75.39             | -55.73 | 19.66      |
| High    | 11140.00       | -62.12          | -35.73 | 26.39      | -72.58             | -55.73 | 16.85      |

**Table 8.5-12:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 11.5 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -48.94          | -35.73 | 13.21      | -58.87             | -55.73 | 3.14       |
| Low     | 11490.00       | -61.54          | -35.73 | 25.81      | -71.47             | -55.73 | 15.74      |
| Mid     | 11140.00       | -68.32          | -35.73 | 32.59      | -78.25             | -55.73 | 22.52      |

**Table 8.5-13:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 11.5 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -55.74          | -35.73 | 20.01      | -58.84             | -55.73 | 3.11       |
| Mid     | 11160.00       | -61.27          | -35.73 | 25.54      | -64.37             | -55.73 | 8.64       |
| High    | 11140.00       | -61.35          | -35.73 | 25.62      | -64.45             | -55.73 | 8.72       |

**Table 8.5-14:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 11.5 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -55.23          | -35.73 | 19.50      | -59.57             | -55.73 | 3.84       |
| Mid     | 11160.00       | -61.69          | -35.73 | 25.96      | -66.03             | -55.73 | 10.30      |
| High    | 11140.00       | -62.02          | -35.73 | 26.29      | -66.36             | -55.73 | 10.63      |

**Table 8.5-15:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 11.5 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -56.00          | -35.73 | 20.27      | -58.79             | -55.73 | 3.06       |
| Mid     | 11140.00       | -68.02          | -35.73 | 32.29      | -70.81             | -55.73 | 15.08      |
| High    | 11380.00       | -60.21          | -35.73 | 24.48      | -63.00             | -55.73 | 7.27       |

## 8.5.4 Test data, continued

**Table 8.5-16:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 12 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -49.73          | -36.23 | 13.50      | -59.34             | -56.23 | 3.11       |
| Low     | 11000.00       | -64.60          | -36.23 | 28.37      | -74.21             | -56.23 | 17.98      |
| Mid     | 11160.00       | -66.22          | -36.23 | 29.99      | -75.83             | -56.23 | 19.60      |
| High    | 11140.00       | -64.09          | -36.23 | 27.86      | -73.70             | -56.23 | 17.47      |

**Table 8.5-17:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 12 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -49.13          | -36.23 | 12.90      | -59.30             | -56.23 | 3.07       |
| Mid     | 11160.00       | -65.47          | -36.23 | 29.24      | -75.64             | -56.23 | 19.41      |
| High    | 11140.00       | -62.69          | -36.23 | 26.46      | -72.86             | -56.23 | 16.63      |

**Table 8.5-18:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 12 dBi antenna at cho.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -49.60          | -36.23 | 13.37      | -59.64             | -56.23 | 3.41       |
| Low     | 11490.00       | -62.08          | -36.23 | 25.85      | -72.12             | -56.23 | 15.89      |
| Mid     | 11140.00       | -68.89          | -36.23 | 32.66      | -78.93             | -56.23 | 22.70      |

**Table 8.5-19:** Conducted spurious emissions within restricted bands. Results for 802.11a and MIMO 2 × 2 with 12 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -56.08          | -36.23 | 19.85      | -59.95             | -56.23 | 3.72       |
| Mid     | 11160.00       | -61.81          | -36.23 | 25.58      | -65.68             | -56.23 | 9.45       |
| High    | 11140.00       | -61.92          | -36.23 | 25.69      | -65.79             | -56.23 | 9.56       |

**Table 8.5-20:** Conducted spurious emissions within restricted bands. Results for 802.11n HT20 and MIMO 2 × 2 with 12 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -51.89          | -36.23 | 15.66      | -59.76             | -56.23 | 3.53       |
| Mid     | 11160.00       | -62.23          | -36.23 | 26.00      | -70.10             | -56.23 | 13.87      |
| High    | 11140.00       | -62.59          | -36.23 | 26.36      | -70.46             | -56.23 | 14.23      |

**Table 8.5-21:** Conducted spurious emissions within restricted bands. Results for 802.11n HT40 and MIMO 2 × 2 with 12 dBi antenna at ch1.

| Channel | Frequency, MHz | Peak power, dBm |        | Margin, dB | Average power, dBm |        | Margin, dB |
|---------|----------------|-----------------|--------|------------|--------------------|--------|------------|
|         |                | Measured        | Limit  |            | Measured           | Limit  |            |
| Low     | 5460.00        | -56.40          | -36.23 | 20.17      | -59.48             | -56.23 | 3.25       |
| Mid     | 11140.00       | -68.56          | -36.23 | 32.33      | -71.64             | -56.23 | 15.41      |
| High    | 11380.00       | -60.78          | -36.23 | 24.55      | -63.86             | -56.23 | 7.63       |

8.5.4 Test data, continued

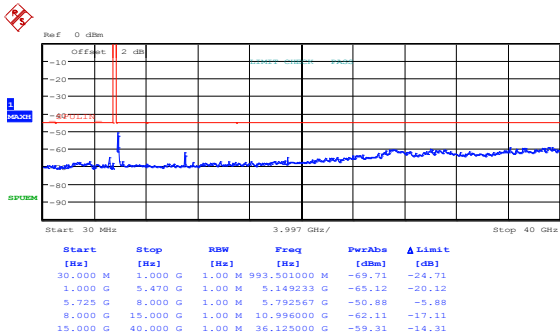


Figure 8.5-19: Peak spurious emissions outside restricted bands at low channel, 802.11a, cho

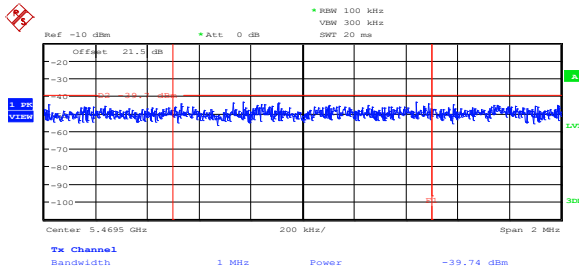


Figure 8.5-20: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 6.7 dBi antenna, cho

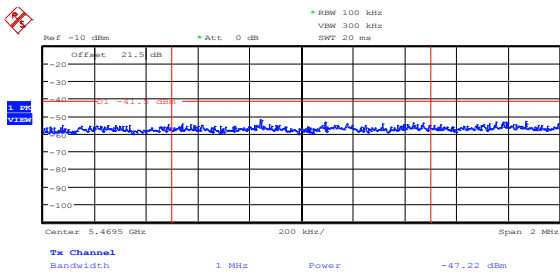


Figure 8.5-21: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 11.5 dBi antenna, cho

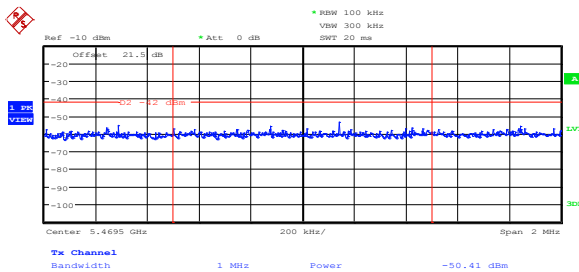


Figure 8.5-22: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 12 dBi antenna, cho

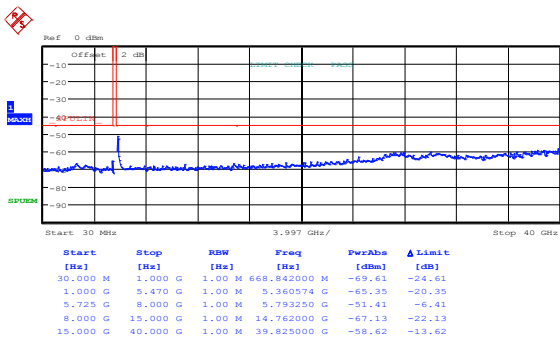


Figure 8.5-23: Peak spurious emissions outside restricted bands at low channel, 802.11a, ch1

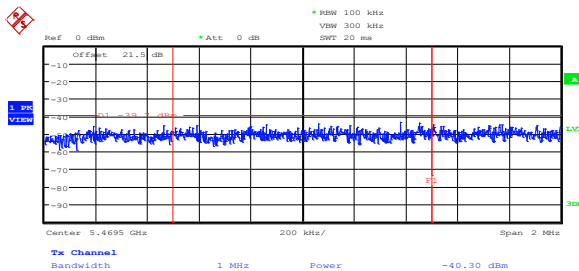


Figure 8.5-24: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued

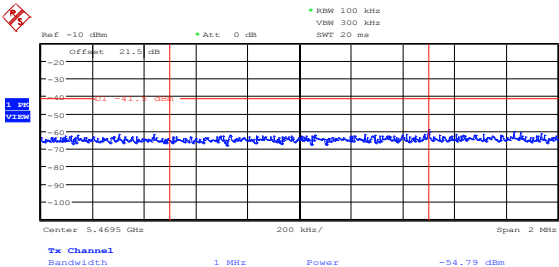


Figure 8.5-25: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 11.5 dBi antenna, ch1

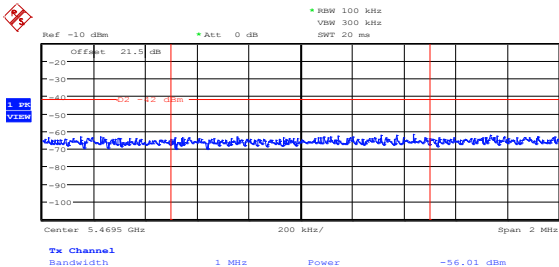


Figure 8.5-26: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 12 dBi antenna, ch1

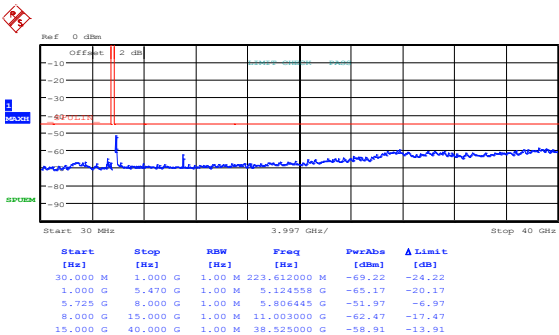


Figure 8.5-27: Peak spurious emissions outside restricted bands at low channel, 802.11n HT20, cho

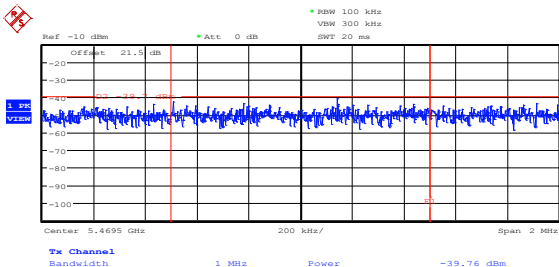


Figure 8.5-28: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 6.7 dBi antenna, cho

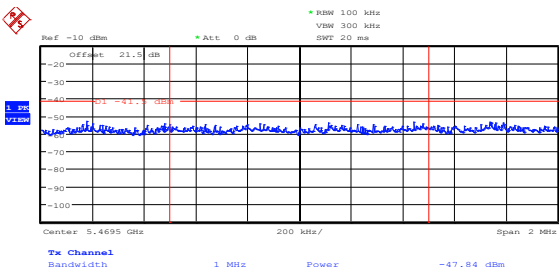


Figure 8.5-29: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 11.5 dBi antenna, cho

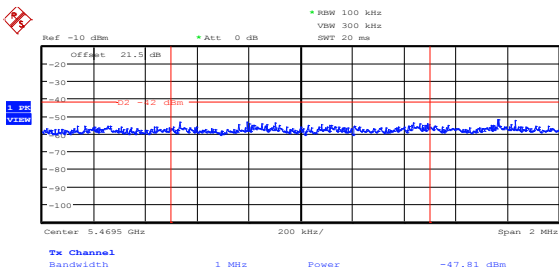


Figure 8.5-30: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 12 dBi antenna, cho

8.5.4 Test data, continued

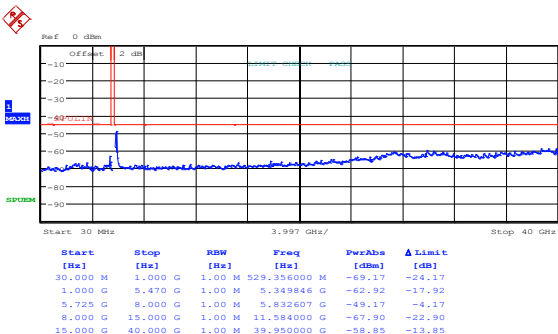


Figure 8.5-31: Peak spurious emissions outside restricted bands at low channel, 802.11n HT20, ch1

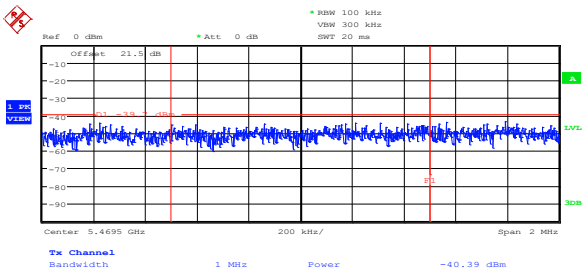


Figure 8.5-32: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 6.7 dBi antenna, ch1

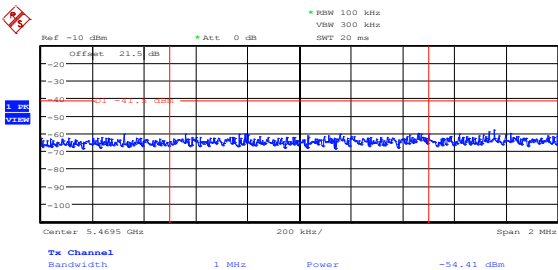


Figure 8.5-33: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 11.5 dBi antenna, ch1

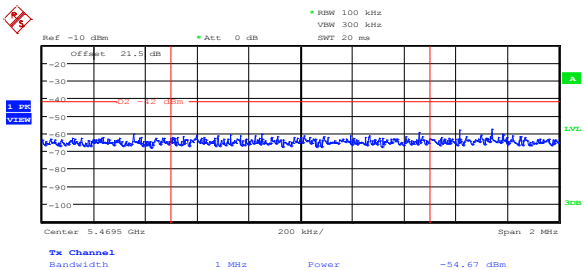


Figure 8.5-34: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 12 dBi antenna, ch1

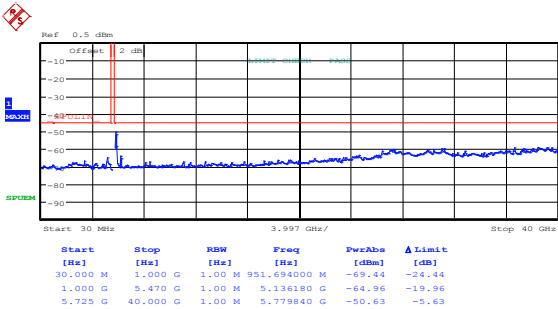


Figure 8.5-35: Peak spurious emissions outside restricted bands at low channel, 802.11n HT40, cho

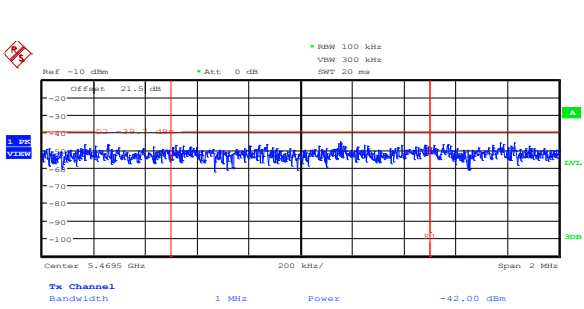


Figure 8.5-36: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

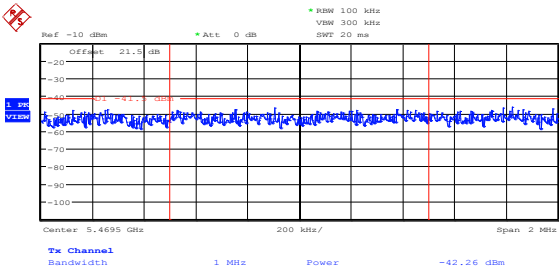


Figure 8.5-37: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 11.5 dBi antenna, cho

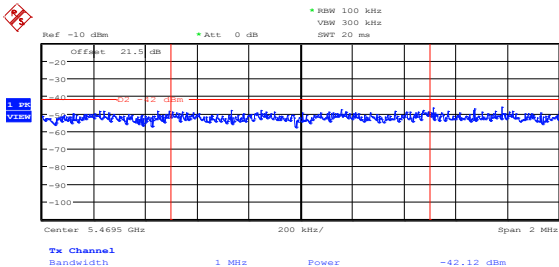


Figure 8.5-38: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 12 dBi antenna, cho

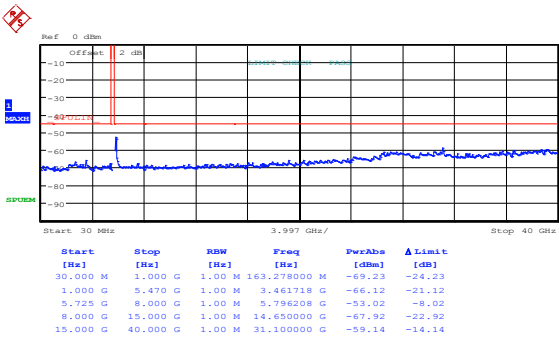


Figure 8.5-39: Peak spurious emissions outside restricted bands at low channel, 802.11n HT40, ch1

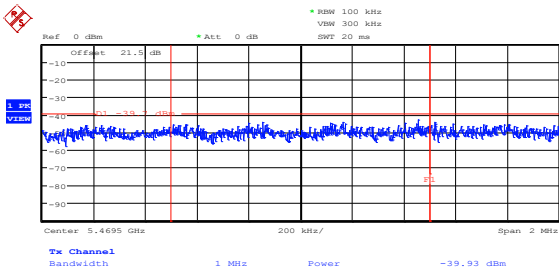


Figure 8.5-40: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 6.7 dBi antenna, ch1

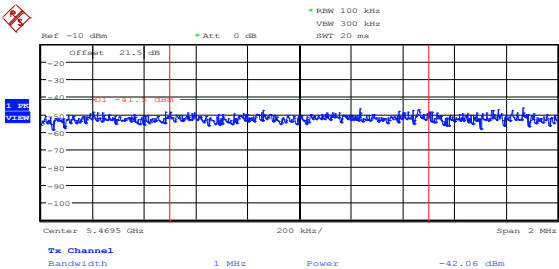


Figure 8.5-41: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 11.5 dBi antenna, ch1

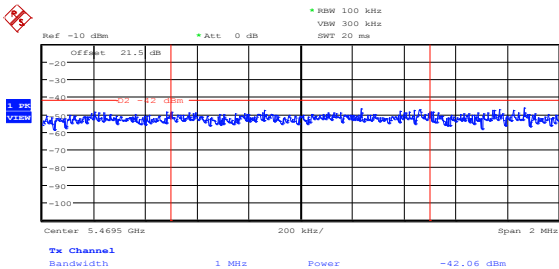


Figure 8.5-42: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 12 dBi antenna, ch1

8.5.4 Test data, continued

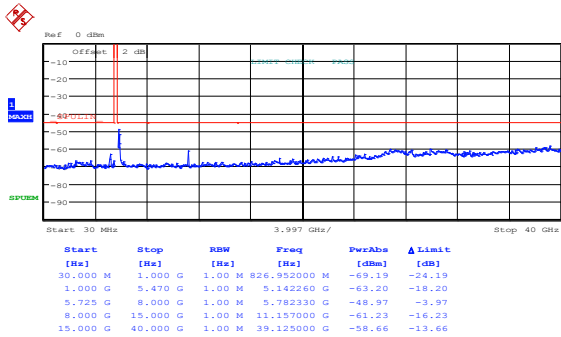


Figure 8.5-43: Peak spurious emissions outside restricted bands at mid channel, 802.11a, cho

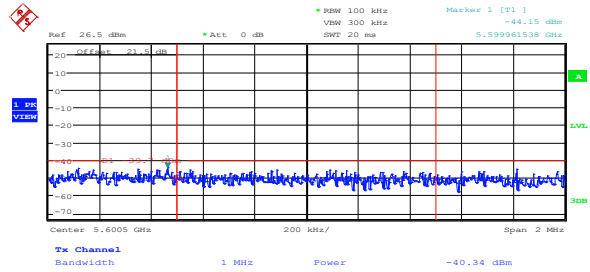


Figure 8.5-44: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 6.7 dBi antenna, cho

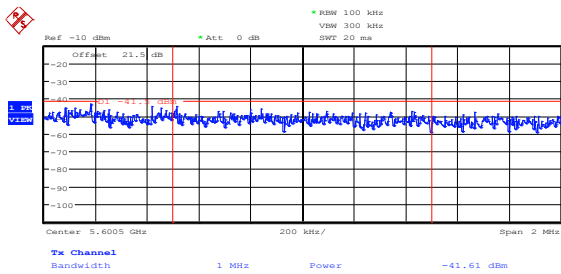


Figure 8.5-45: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 11.5 dBi antenna, cho

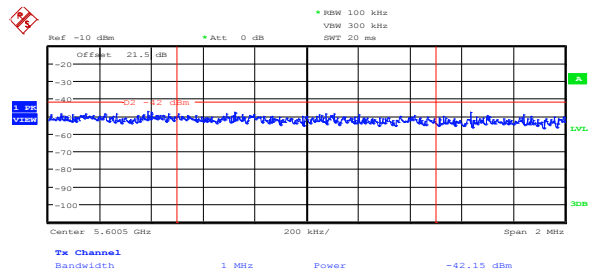


Figure 8.5-46: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 12 dBi antenna, cho

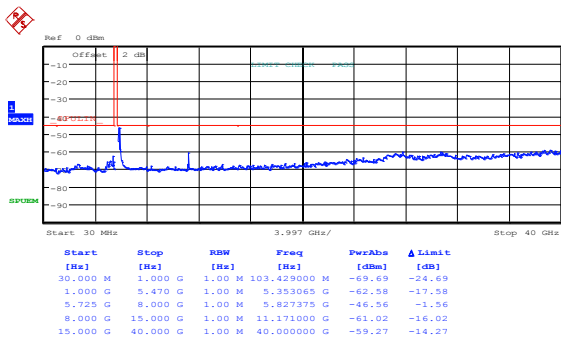


Figure 8.5-47: Peak spurious emissions outside restricted bands at mid channel, 802.11a, ch1

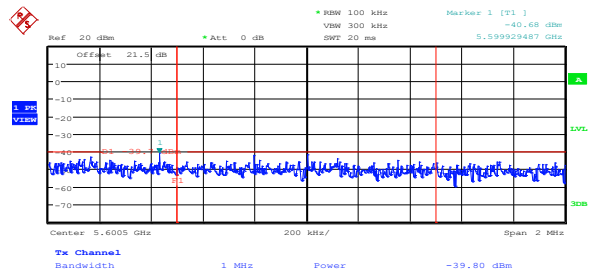


Figure 8.5-48: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued

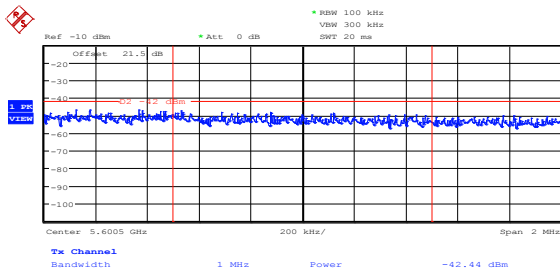
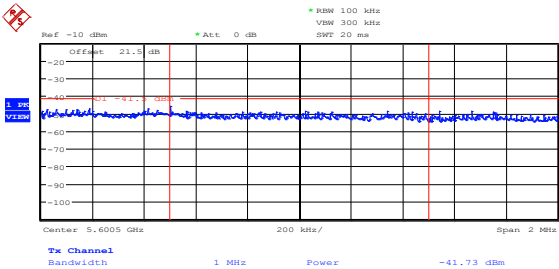


Figure 8.5-49: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 11.5 dBi antenna, ch1

Figure 8.5-50: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 12 dBi antenna, ch1

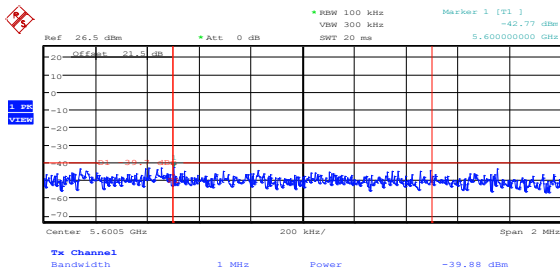
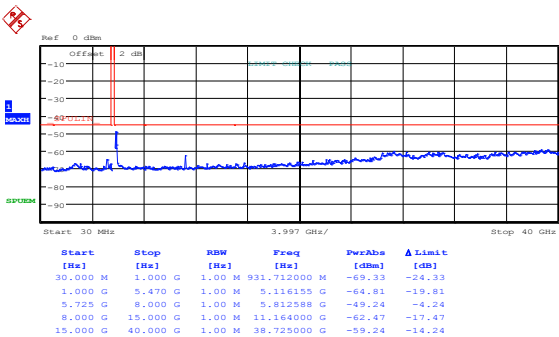


Figure 8.5-52: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 6.7 dBi antenna, cho

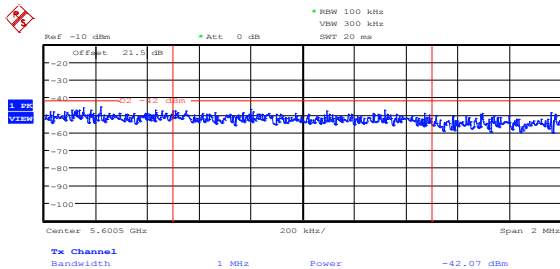
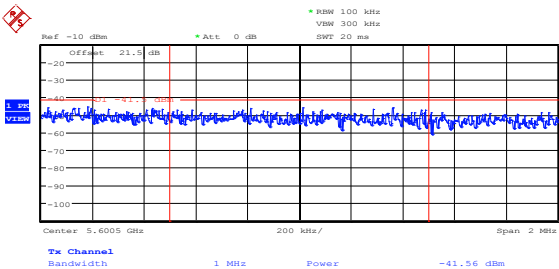


Figure 8.5-53: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 11.5 dBi antenna, cho

Figure 8.5-54: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 12 dBi antenna, cho

8.5.4 Test data, continued

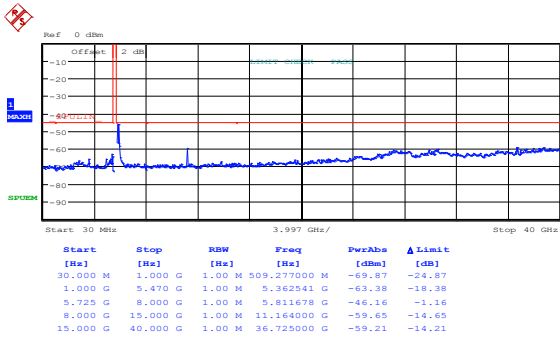


Figure 8.5-55: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT20, ch1

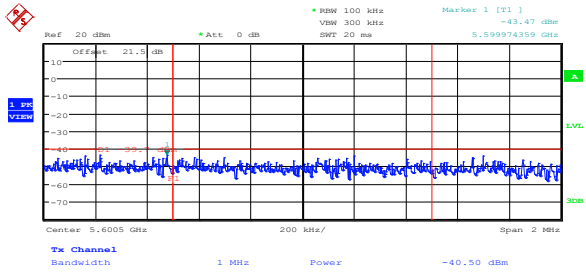


Figure 8.5-56: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 6.7 dBi antenna, ch1

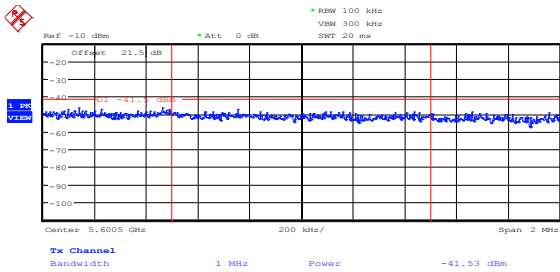


Figure 8.5-57: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 11.5 dBi antenna, ch1

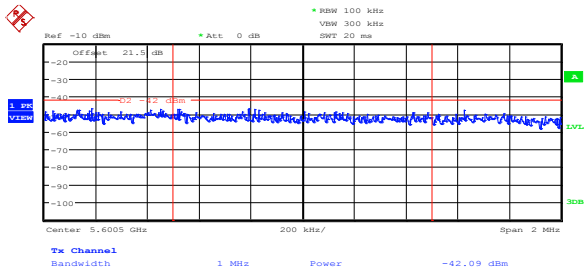


Figure 8.5-58: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 12 dBi antenna, ch1

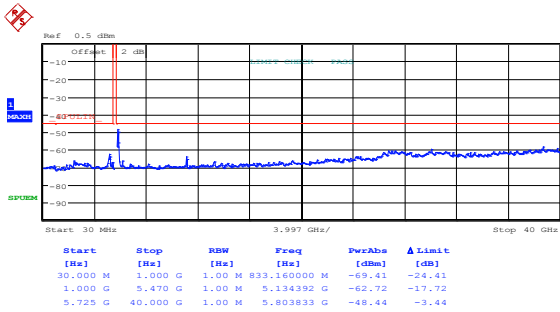


Figure 8.5-59: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT40, cho

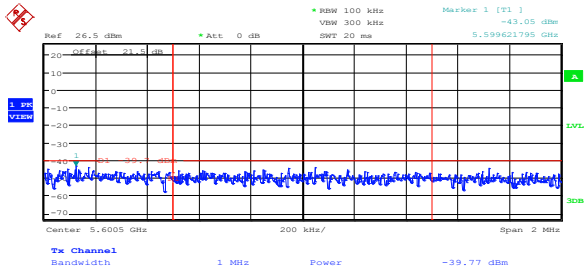


Figure 8.5-60: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

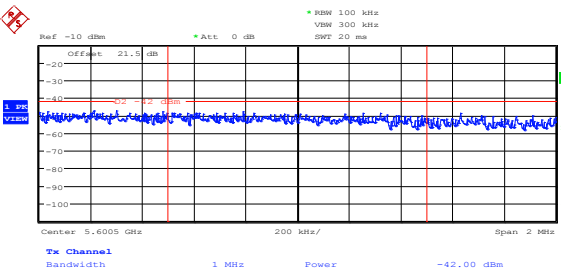
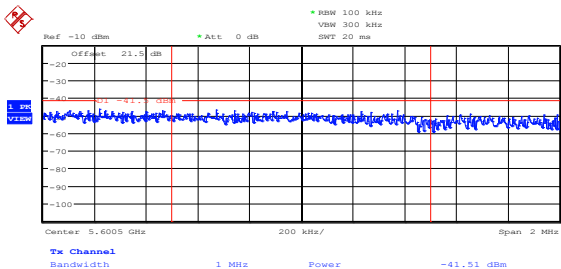


Figure 8.5-61: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 11.5 dBi antenna, cho

Figure 8.5-62: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 12 dBi antenna, cho

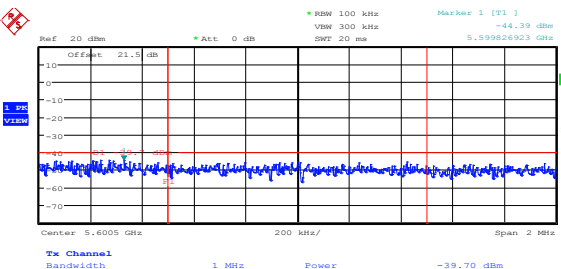
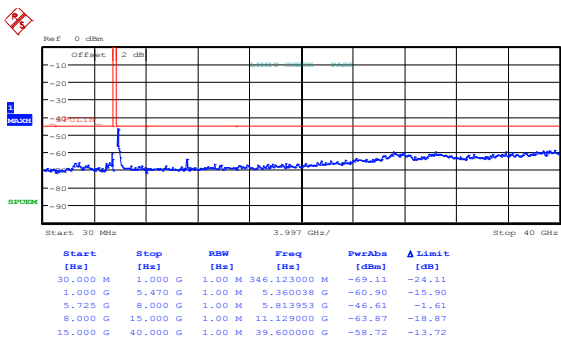


Figure 8.5-63: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT40, ch1

Figure 8.5-64: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 6.7 dBi antenna, ch1

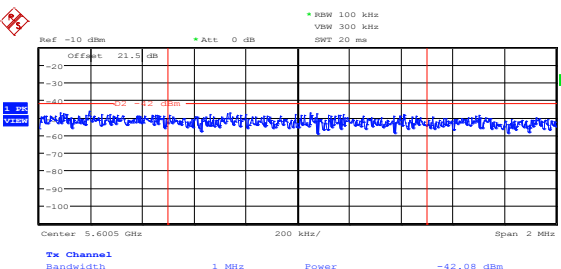
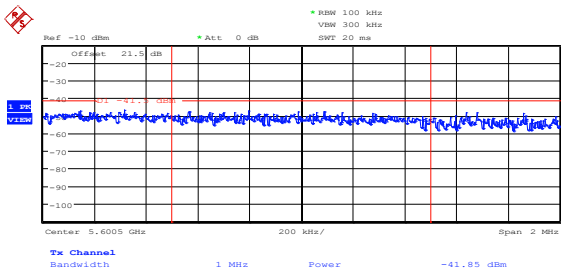


Figure 8.5-65: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 11.5 dBi antenna, ch1

Figure 8.5-66: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 12 dBi antenna, ch1

8.5.4 Test data, continued

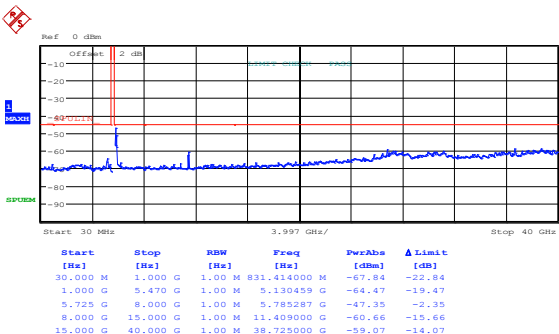


Figure 8.5-67: Peak spurious emissions outside restricted bands at high channel, 802.11a, cho

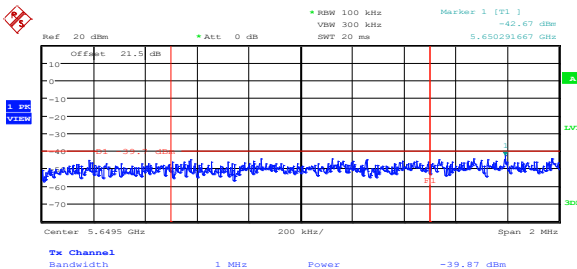


Figure 8.5-68: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 6.7 dBi antenna, cho

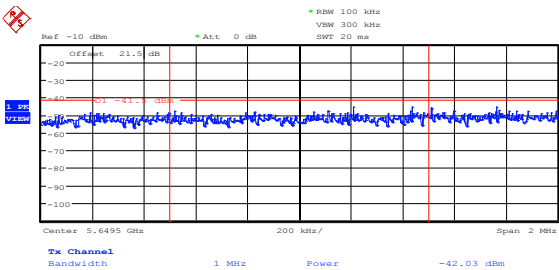


Figure 8.5-69: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 11.5 dBi antenna, cho

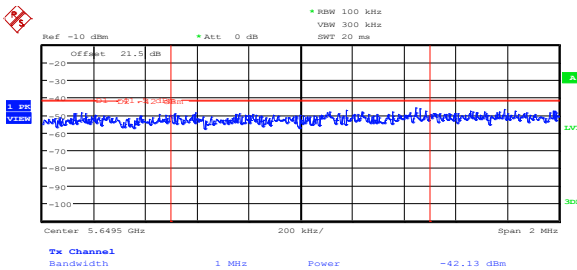


Figure 8.5-70: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 12 dBi antenna, cho

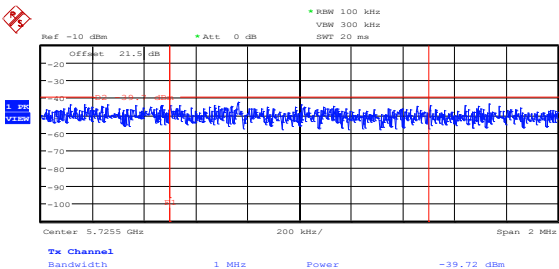


Figure 8.5-71: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 6.7 dBi antenna, cho

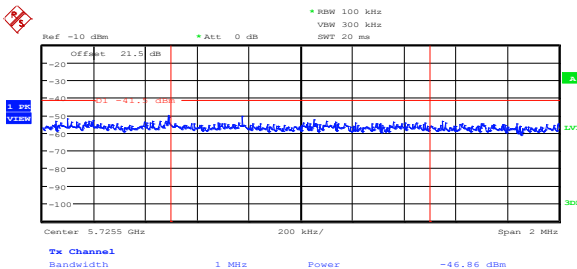


Figure 8.5-72: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 11.5 dBi antenna, cho

8.5.4 Test data, continued

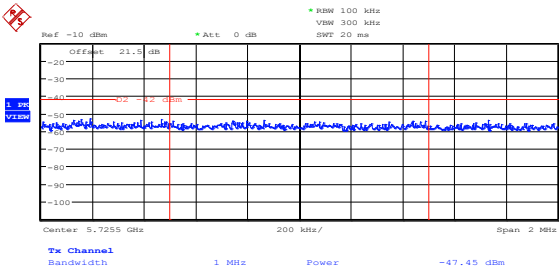


Figure 8.5-73: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 12 dBi antenna, cho

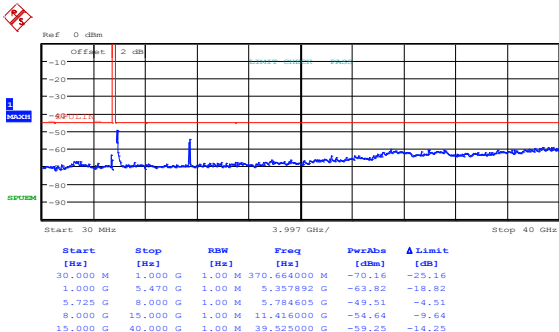


Figure 8.5-74: Peak spurious emissions outside restricted bands at high channel, 802.11a, ch1

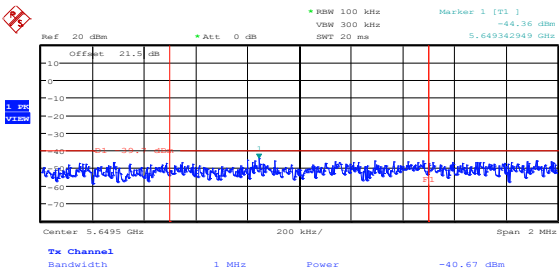


Figure 8.5-75: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 6.7 dBi antenna, ch1

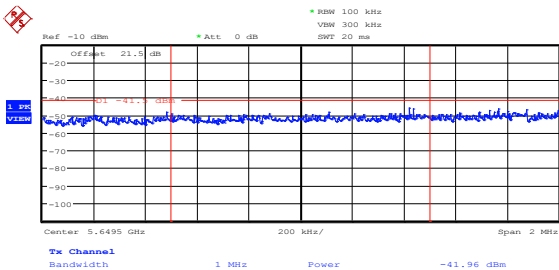


Figure 8.5-76: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 11.5 dBi antenna, ch1

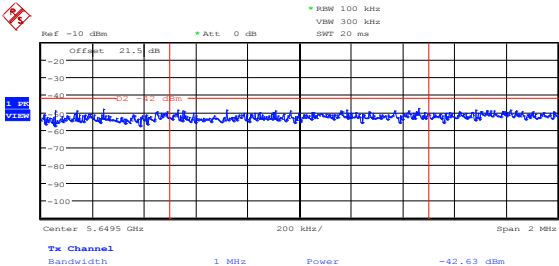


Figure 8.5-77: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 12 dBi antenna, ch1

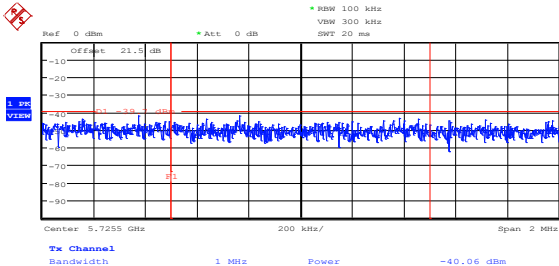


Figure 8.5-78: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued

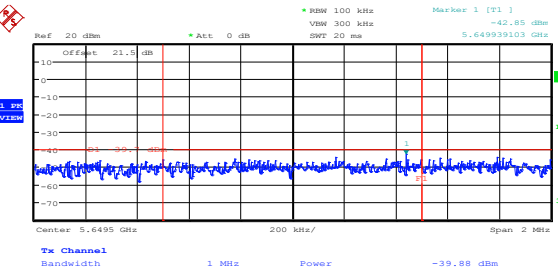
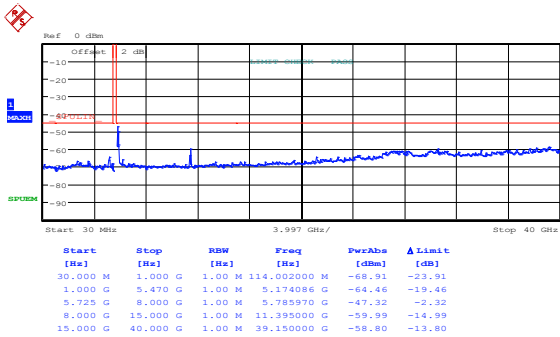
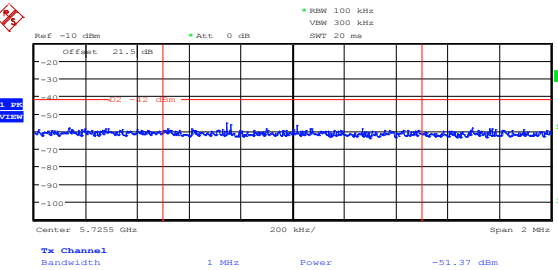
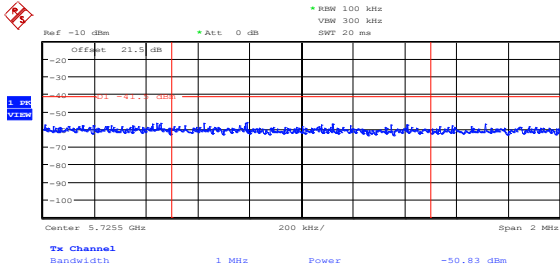
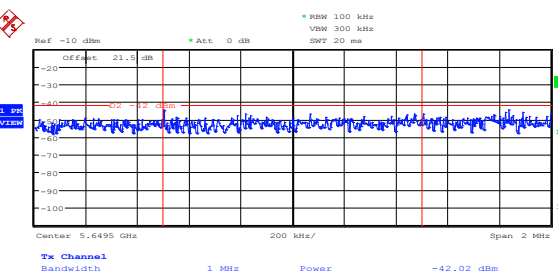
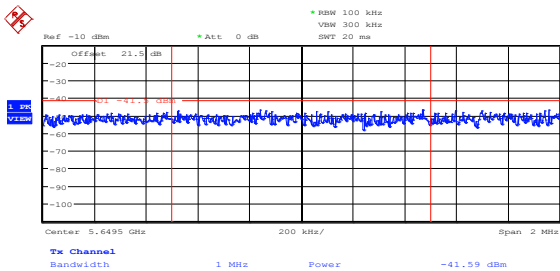


Figure 8.5-82: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 6.7 dBi antenna, cho



8.5.4 Test data, continued

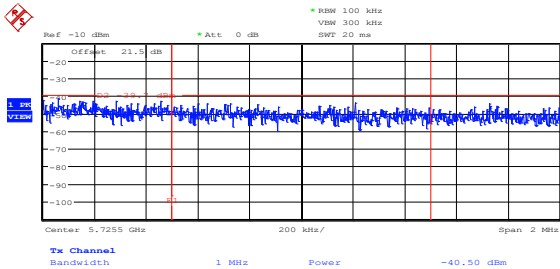


Figure 8.5-85: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 6.7 dBi antenna, cho

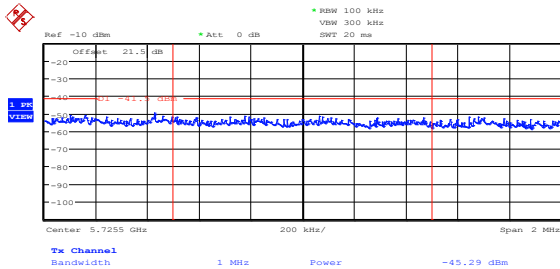


Figure 8.5-86: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 11.5 dBi antenna, cho

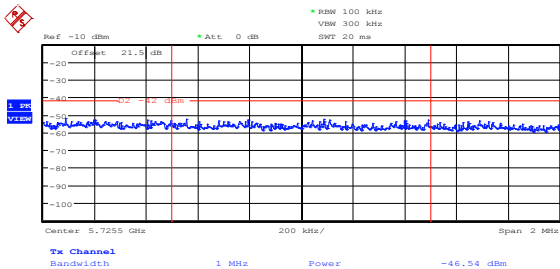


Figure 8.5-87: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 12 dBi antenna, cho

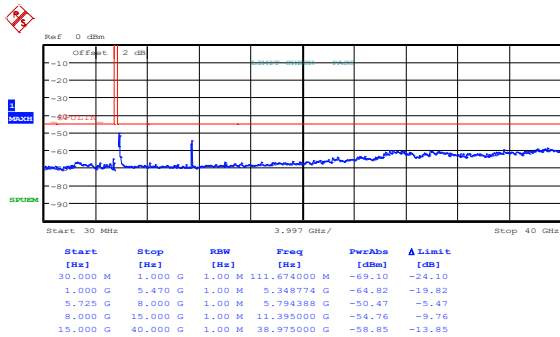


Figure 8.5-88: Peak spurious emissions outside restricted bands at high channel, 802.11n HT20, ch1

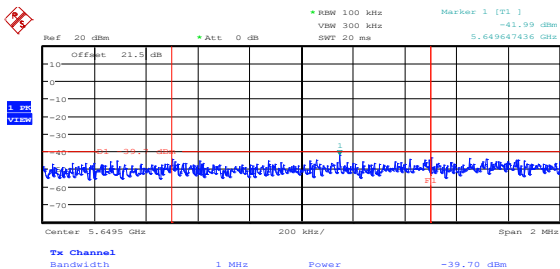


Figure 8.5-89: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 6.7 dBi antenna, ch1

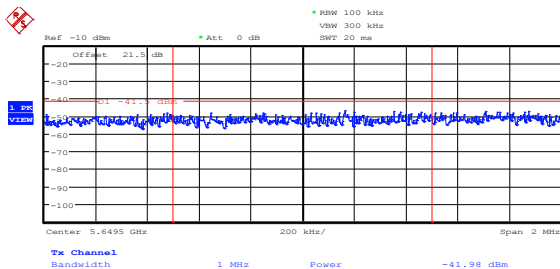


Figure 8.5-90: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 11.5 dBi antenna, ch1

8.5.4 Test data, continued

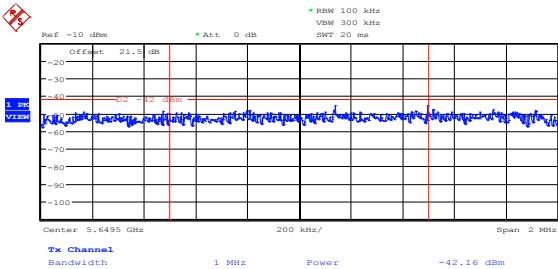


Figure 8.5-91: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 12 dBi antenna, ch1

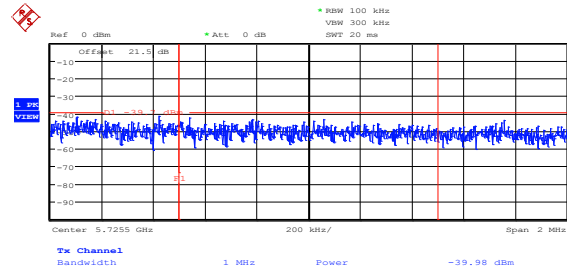


Figure 8.5-92: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 6.7 dBi antenna, ch1

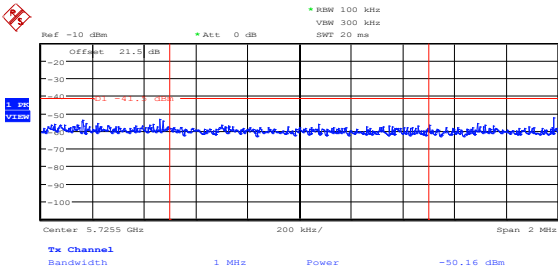


Figure 8.5-93: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 11.5 dBi antenna, ch1

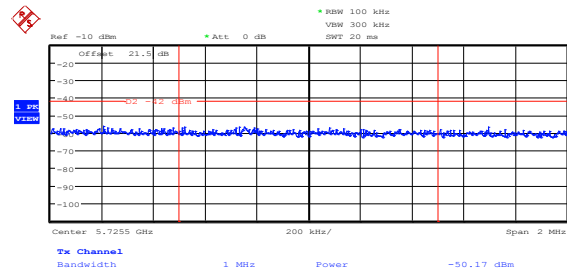


Figure 8.5-94: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 12 dBi antenna, ch1

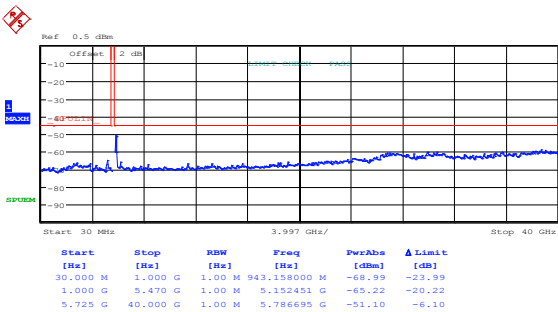


Figure 8.5-95: Peak spurious emissions outside restricted bands at high channel, 802.11n HT40, cho

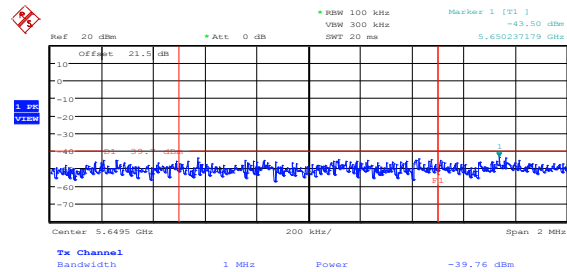


Figure 8.5-96: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

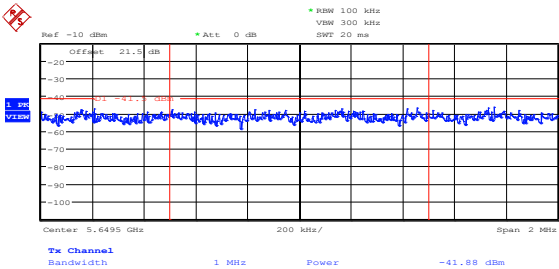


Figure 8.5-97: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 11.5 dBi antenna, cho

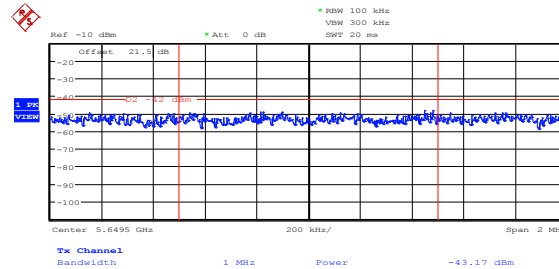


Figure 8.5-98: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 12 dBi antenna, cho

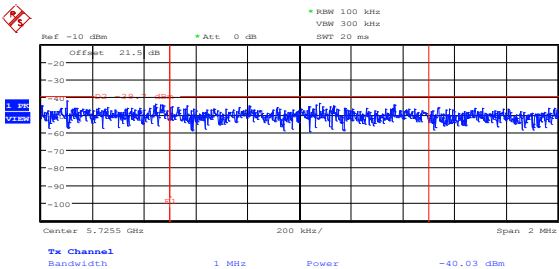


Figure 8.5-99: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 6.7 dBi antenna, cho

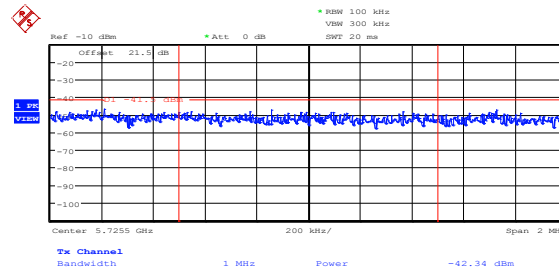


Figure 8.5-100: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 11.5 dBi antenna, cho

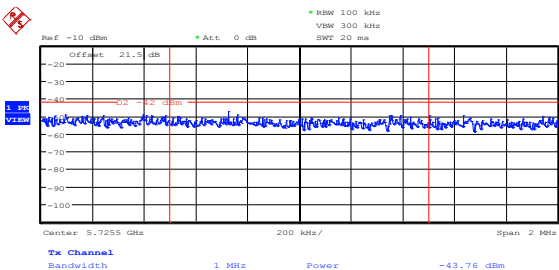


Figure 8.5-101: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 12 dBi antenna, cho

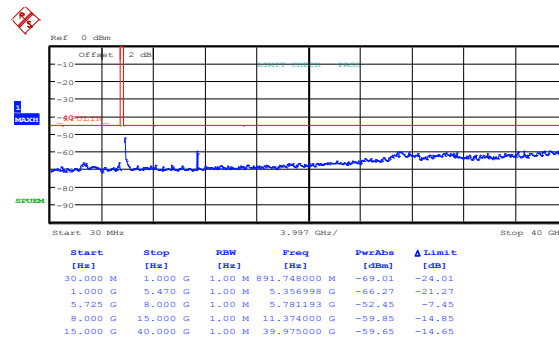


Figure 8.5-102: Peak spurious emissions outside restricted bands at high channel, 802.11n HT40, ch1

8.5.4 Test data, continued

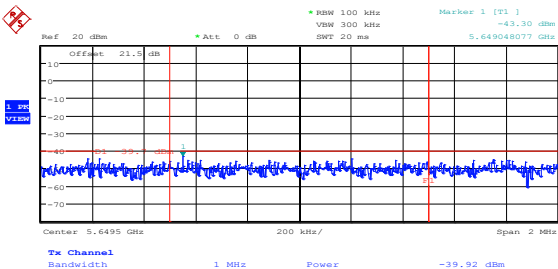


Figure 8.5-103: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 6.7 dBi antenna, ch1

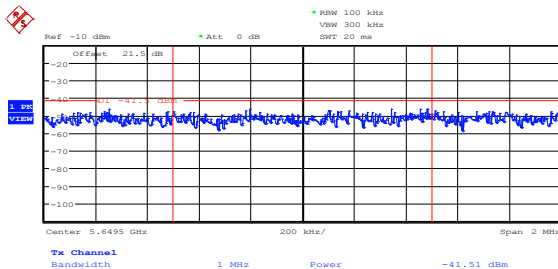


Figure 8.5-104: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 11.5 dBi antenna, ch1

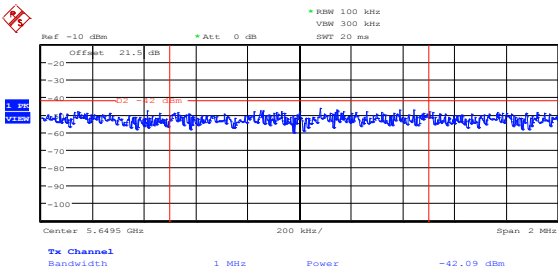


Figure 8.5-105: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 12 dBi antenna, ch1

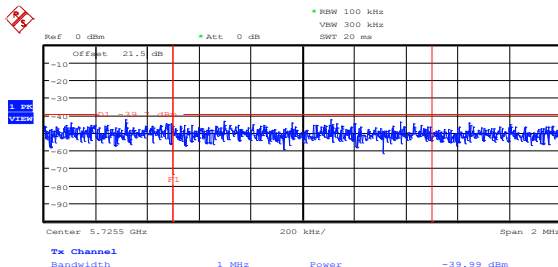


Figure 8.5-106: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 6.7 dBi antenna, ch1

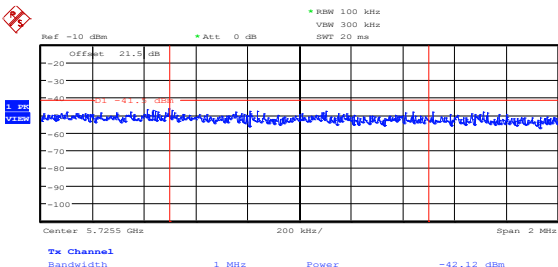


Figure 8.5-107: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 11.5 dBi antenna, ch1

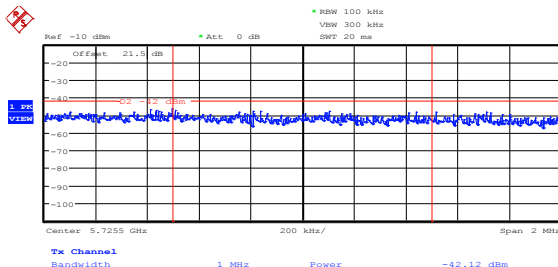


Figure 8.5-108: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 12 dBi antenna, ch1

## 8.6 FCC 15.407(g) Frequency stability

### 8.6.1 Definitions and limits

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 8.6.2 Test summary

|                |                 |                    |           |
|----------------|-----------------|--------------------|-----------|
| Test date:     | July 15, 2013   | Temperature:       | 23 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1003 mbar |
| Verdict:       | Pass            | Relative humidity: | 36 %      |

### 8.6.3 Observations, settings and special notes

Spectrum analyser settings:

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

### 8.6.4 Test data

**Table 8.6-1: Frequency drift measurement**

| Test conditions | Frequency, GHz | Drift, Hz        |
|-----------------|----------------|------------------|
| +50 °C, Nominal | 5.499965170    | -1708            |
| +40 °C, Nominal | 5.499964119    | -657             |
| +30 °C, Nominal | 5.499963754    | -292             |
| +20 °C, +15 %   | 5.499963512    | -50              |
| +20 °C, Nominal | 5.499963462    | <i>Reference</i> |
| +20 °C, -15 %   | 5.499963324    | 138              |
| +10 °C, Nominal | 5.499963078    | 384              |
| 0 °C, Nominal   | 5.499963002    | 460              |
| -10 °C, Nominal | 5.499962955    | 507              |
| -20 °C, Nominal | 5.499962872    | 590              |
| -30 °C, Nominal | 5.499962766    | 696              |

#### 8.6.4 Test data, continued

**Table 8.6-2: Lower band edge drift calculation**

| Modulation   | -26 dBc lower cross point, GHz | Max negative drift, Hz | Drifted lower cross point, GHz | Band edge, GHz | Margin, MHz |
|--------------|--------------------------------|------------------------|--------------------------------|----------------|-------------|
| 802.11a      | 5.489471154                    | 1708                   | 5.48946945                     | 5.47           | 0.01946945  |
| 802.11n HT20 | 5.488846154                    | 1708                   | 5.48884445                     | 5.47           | 0.01884445  |
| 802.11n HT40 | 5.486583333                    | 1708                   | 5.48658163                     | 5.47           | 0.01658162  |

Notes: Drifted lower cross point = -26 dBc lower cross point – max negative drift.

**Table 8.6-3: Upper band edge drift calculation**

| Modulation   | -26 dBc upper cross point, GHz | Max positive drift, Hz | Drifted upper cross point, GHz | Band edge, GHz | Margin, MHz |
|--------------|--------------------------------|------------------------|--------------------------------|----------------|-------------|
| 802.11a      | 5.710432692                    | 698                    | 5.71043339                     | 5.725          | 0.01456661  |
| 802.11n HT20 | 5.710913462                    | 698                    | 5.71091416                     | 5.725          | 0.01408584  |
| 802.11n HT40 | 5.710993590                    | 698                    | 5.710994288                    | 5.725          | 0.01400571  |

Notes: Drifted upper cross point = -26 dBc upper cross point + max positive drift.

## 8.7 FCC 15.407(a)(6) and RSS-210 A9.4(2) Peak excursion and PSD-to-average ratio

### 8.7.1 Definitions and limits

|                |                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC definition | (6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less. |
| IC definition  | Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average (10 log <sub>10</sub> (B)) value by more than 3 dB, the permissible power spectral density shall be reduced by the excess amount.            |

### 8.7.2 Test summary

|                |                 |                    |           |
|----------------|-----------------|--------------------|-----------|
| Test date:     | July 15, 2013   | Temperature:       | 24 °C     |
| Test engineer: | Andrey Adelberg | Air pressure:      | 1003 mbar |
| Verdict:       | Pass            | Relative humidity: | 34 %      |

### 8.7.3 Observations, settings and special notes

FCC test was performed using method described in 789033 D01 General UNII Test Procedures Old Rules v01r03 under section G.

For power spectral density and average power results please refer to Section 8.4 of this document

Note: Ratio is calculated as follows: Peak max-hold value – PPSD value.

### 8.7.4 Test data

**Table 8.7-1:** FCC peak excursion measurements results for cho

| Modulation   | Frequency, MHz | Peak max-hold measurement, dBm | PPSD measurement, dBm/MHz | Peak excursion, dB |       |        |
|--------------|----------------|--------------------------------|---------------------------|--------------------|-------|--------|
|              |                |                                |                           | Ratio              | Limit | Margin |
| 802.11a      | 5500           | 24.62                          | 15.20                     | 9.42               | 13.00 | 3.58   |
|              | 5580           | 24.21                          | 15.09                     | 9.12               | 13.00 | 3.88   |
|              | 5700           | 24.34                          | 15.31                     | 9.03               | 13.00 | 3.97   |
| 802.11n HT20 | 5500           | 24.55                          | 15.43                     | 9.12               | 13.00 | 3.88   |
|              | 5580           | 24.63                          | 15.53                     | 9.10               | 13.00 | 3.90   |
|              | 5700           | 24.30                          | 14.93                     | 9.37               | 13.00 | 3.63   |
| 802.11n HT40 | 5510           | 20.92                          | 11.71                     | 9.21               | 13.00 | 3.79   |
|              | 5570           | 26.22                          | 17.06                     | 9.16               | 13.00 | 3.84   |
|              | 5690           | 20.61                          | 11.33                     | 9.28               | 13.00 | 3.72   |

**Table 8.7-2:** FCC peak excursion measurements results for ch1

| Modulation   | Frequency, MHz | Peak max-hold measurement, dBm | PPSD measurement, dBm/MHz | Peak excursion, dB |       |        |
|--------------|----------------|--------------------------------|---------------------------|--------------------|-------|--------|
|              |                |                                |                           | Ratio              | Limit | Margin |
| 802.11a      | 5500           | 24.48                          | 15.55                     | 8.93               | 13.00 | 4.07   |
|              | 5580           | 24.57                          | 15.43                     | 9.14               | 13.00 | 3.86   |
|              | 5700           | 24.21                          | 15.24                     | 8.97               | 13.00 | 4.03   |
| 802.11n HT20 | 5500           | 24.94                          | 15.99                     | 8.95               | 13.00 | 4.05   |
|              | 5580           | 25.03                          | 15.93                     | 9.10               | 13.00 | 3.90   |
|              | 5700           | 24.69                          | 15.46                     | 9.23               | 13.00 | 3.77   |
| 802.11n HT40 | 5510           | 22.56                          | 13.92                     | 8.64               | 13.00 | 4.36   |
|              | 5570           | 26.08                          | 16.98                     | 9.10               | 13.00 | 3.90   |
|              | 5690           | 22.84                          | 13.52                     | 9.32               | 13.00 | 3.68   |



#### 8.7.4 Test data, continued

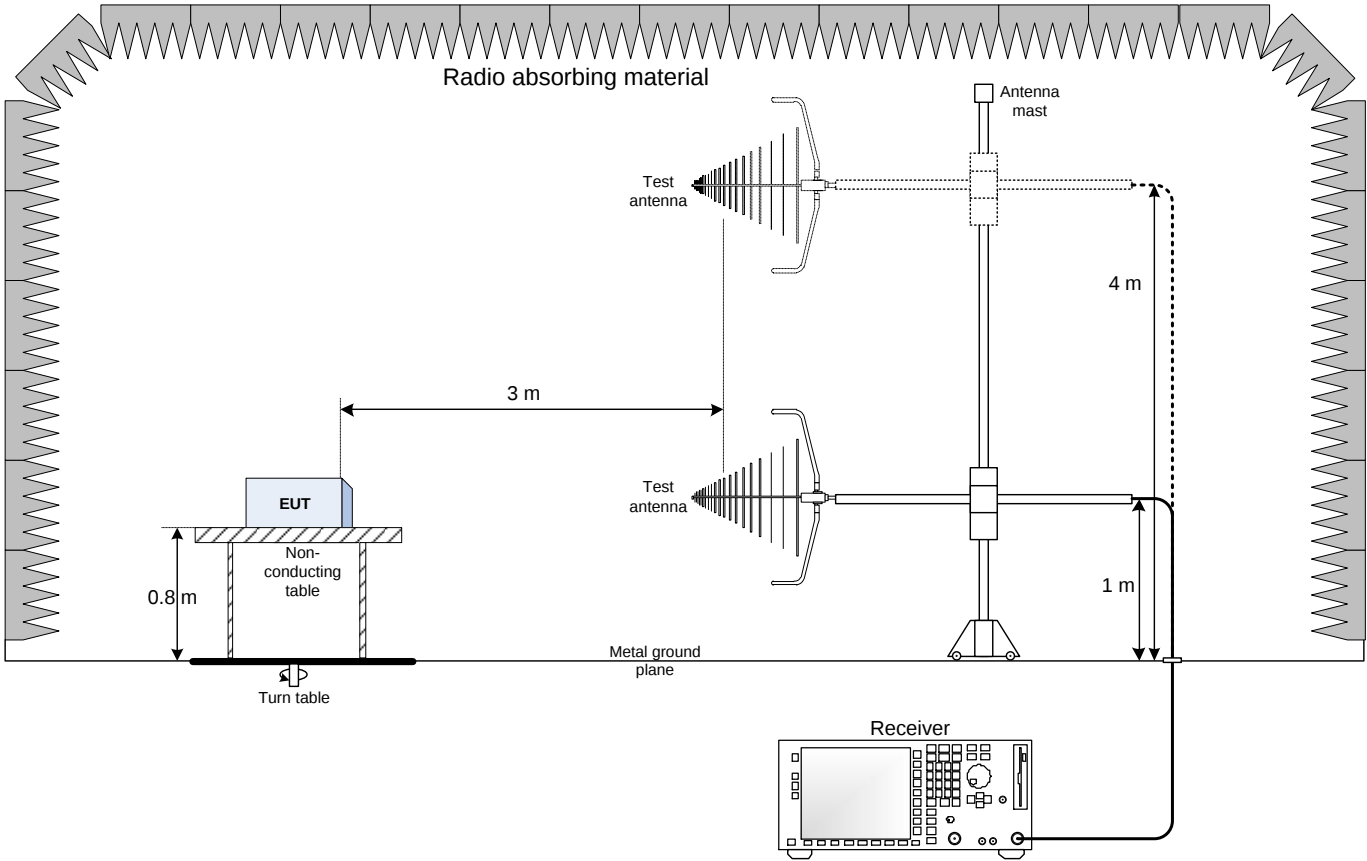
**Table 8.7-3:** IC PSD-to-average calculations results

| Modulation   | Frequency,<br>MHz | PSD result,<br>dBm/MHz | Average result,<br>dBm | PSD to average, dB |       |        |
|--------------|-------------------|------------------------|------------------------|--------------------|-------|--------|
|              |                   |                        |                        | Ratio              | Limit | Margin |
| 802.11a      | 5500              | 8.40                   | 19.62                  | -11.22             | 3.00  | 14.22  |
|              | 5580              | 6.06                   | 17.19                  | -11.13             | 3.00  | 14.13  |
|              | 5700              | 8.00                   | 19.15                  | -11.15             | 3.00  | 14.15  |
| 802.11n HT20 | 5500              | 8.30                   | 19.80                  | -11.50             | 3.00  | 14.50  |
|              | 5580              | 4.98                   | 16.42                  | -11.45             | 3.00  | 14.45  |
|              | 5700              | 7.09                   | 18.56                  | -11.47             | 3.00  | 14.47  |
|              | 5510              | 1.22                   | 15.68                  | -14.46             | 3.00  | 17.46  |
| 802.11n HT40 | 5570              | -1.37                  | 12.92                  | -14.29             | 3.00  | 17.29  |
|              | 5690              | 0.95                   | 15.19                  | -14.24             | 3.00  | 17.24  |

Note: Ratio is calculated as follows: PSD result – Average result.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up

