

# 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

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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

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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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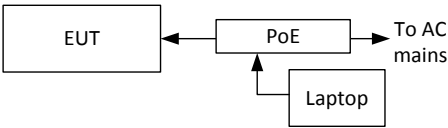


Figure 3.6-1: Setup diagram

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

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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 (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

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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.

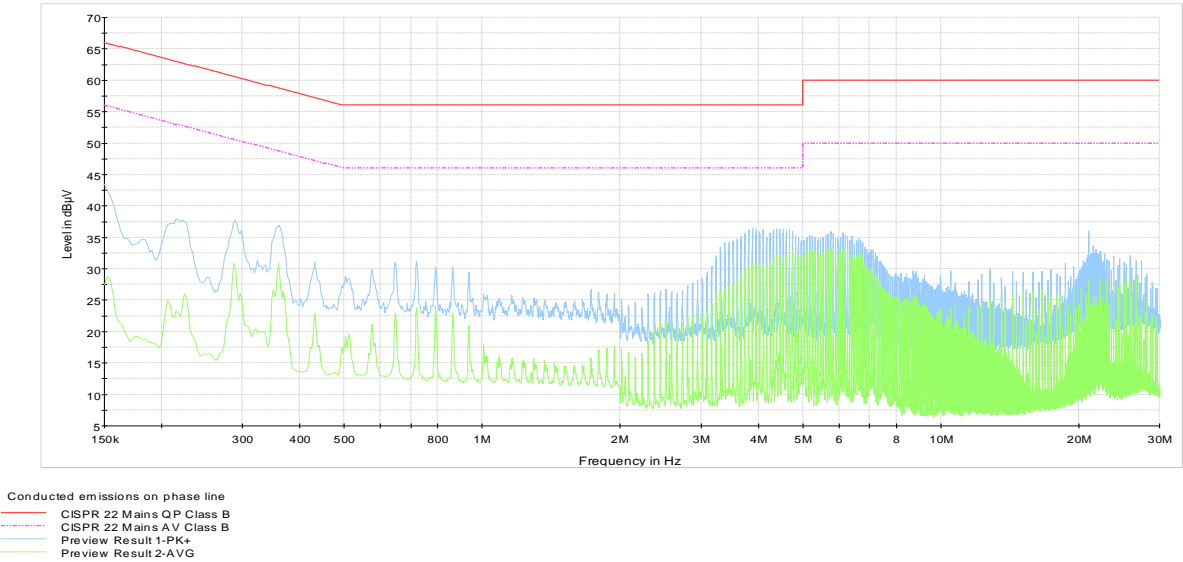
Receiver settings for preview measurements:

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

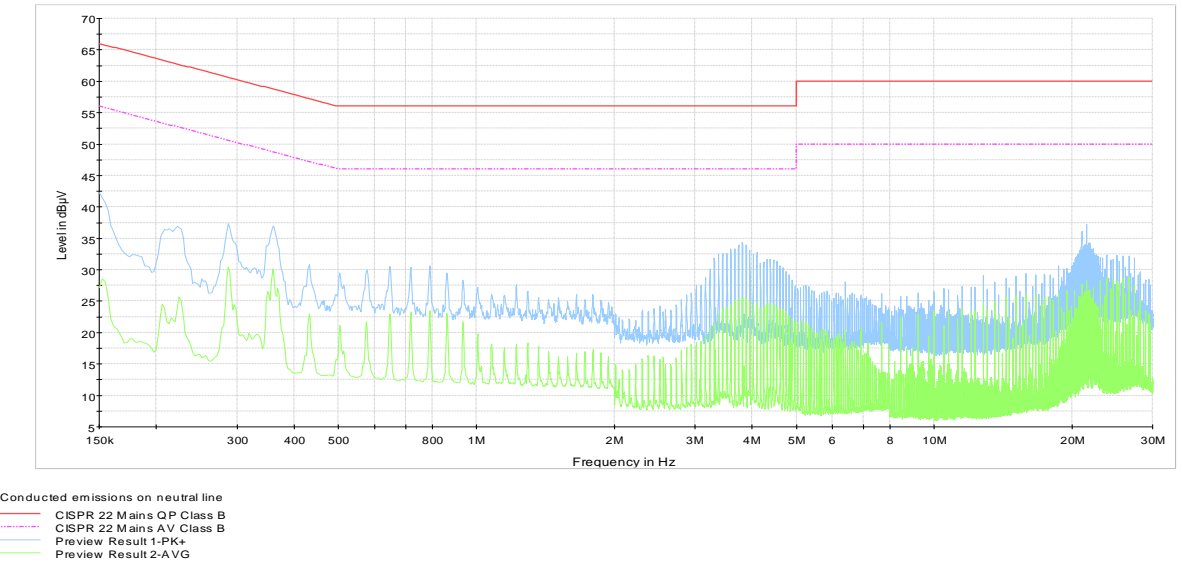
Receiver settings for final measurements:

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

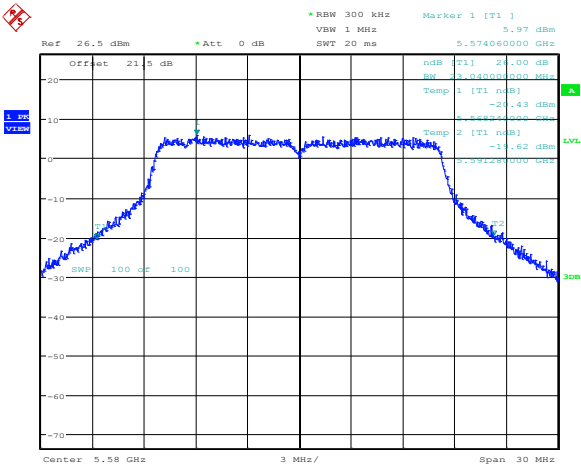
**Table 8.2-1: 26 dB bandwidth results**

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.

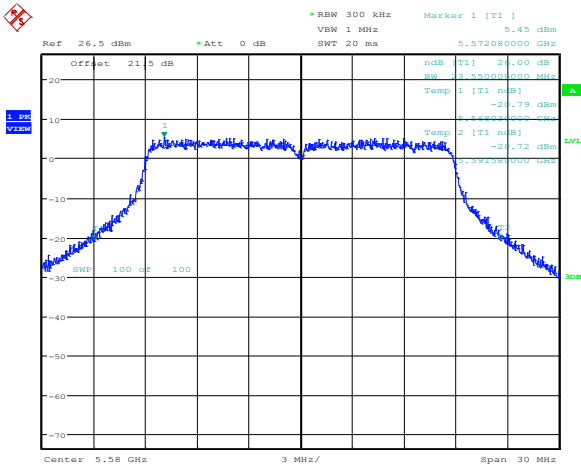


8.2.4 Test data, continued



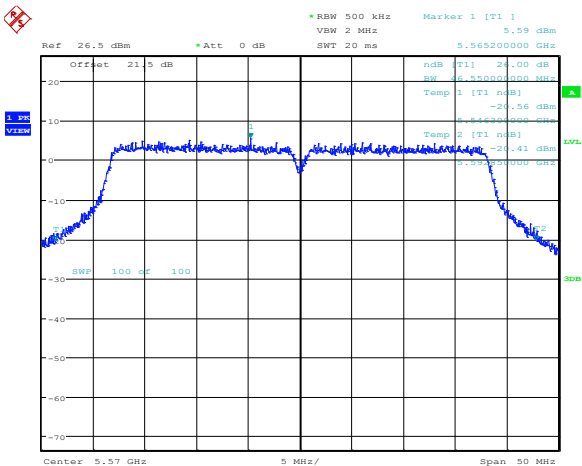
Date: 4.JUL.2013 14:26:03

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:

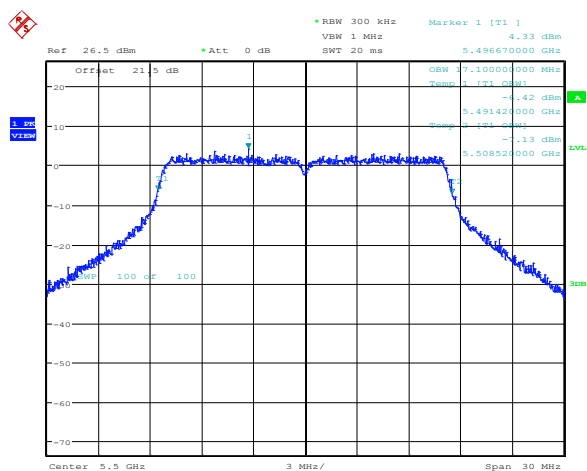
Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥ 3 × RBW
Frequency span:	30 MHz for 20 MHz channel; 50 MHz for 40 MHz channel
Detector mode:	Peak
Trace mode:	Max Hold

### 8.3.4 Test data

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

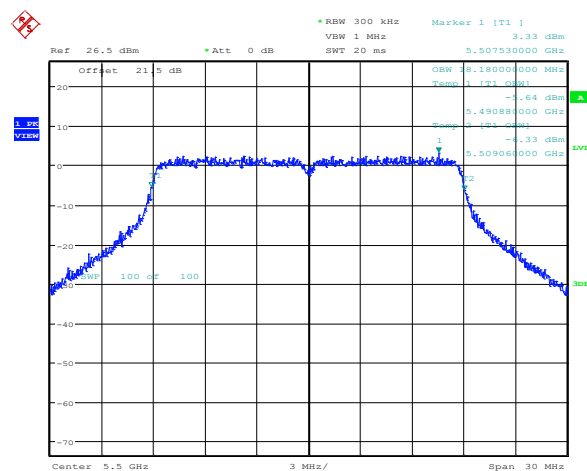
Modulation	99 % bandwidth, MHz
802.11a	17.10
802.11n HT20	18.18
802.11n HT40	37.10

#### 8.3.4 Test data, continued



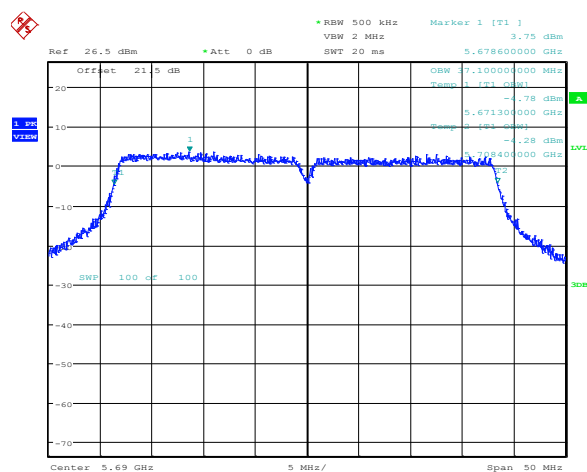
Date: 4.JUL.2013 14:53:00

**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: $11 + 10 \times \log_{10}(23.28) - (9.7 - 6) = 20.97 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$ For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (9.7 - 6) = 21.07 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$ For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (9.7 - 6) = 24.14 \text{ dBm} > 20.30 \text{ dBm} = 24 - (9.7 - 6)$ 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: $11 + 10 \times \log_{10}(23.28) - (11.5 - 6) = 19.17 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$ For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (11.5 - 6) = 19.27 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$ For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (11.5 - 6) = 22.34 \text{ dBm} > 18.50 \text{ dBm} = 24 - (11.5 - 6)$ 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: $11 + 10 \times \log_{10}(23.28) - (12 - 6) = 18.67 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$ For 802.11n HT20: $11 + 10 \times \log_{10}(23.85) - (12 - 6) = 18.77 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$ For 802.11n HT40: $11 + 10 \times \log_{10}(48.30) - (12 - 6) = 21.84 \text{ dBm} > 18 \text{ dBm} = 24 - (12 - 6)$ 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

#### 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



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## 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

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8.4.4 Test data, continued

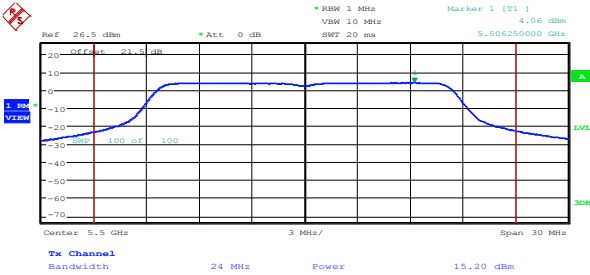


Figure 8.4-1: Output power and PSD on 802.11a, sample plot

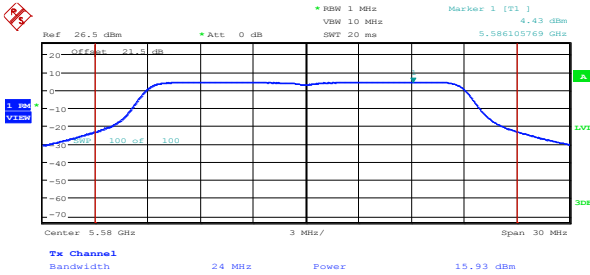


Figure 8.4-2: Output power and PSD on 802.11n HT20, sample plot

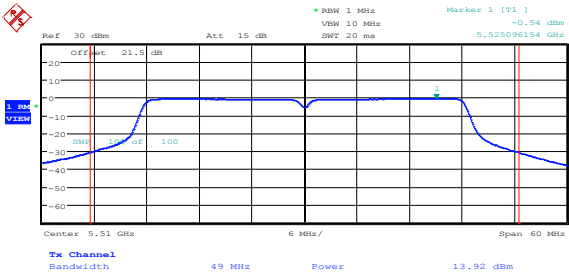


Figure 8.4-3: Output power and PSD on 802.11n HT40, sample plot

## 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, MHz	Field strength of emissions		Measurement distance, 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

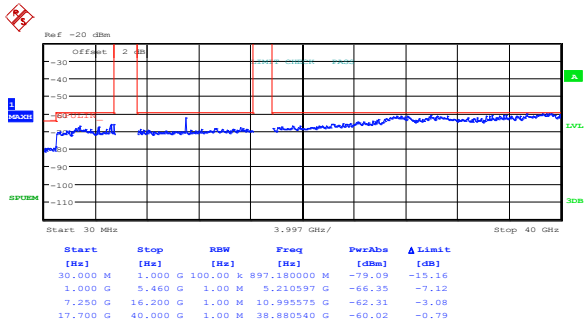


Figure 8.5-1: Peak spurious emissions within restricted bands at low channel, 802.11a, cho

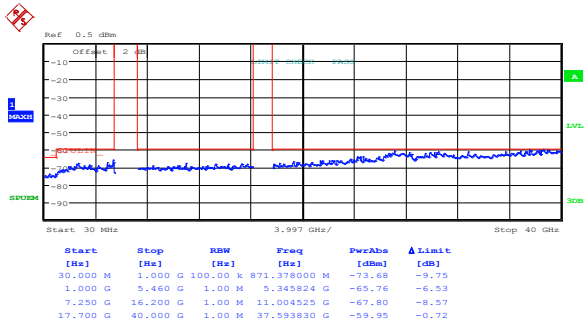


Figure 8.5-2: Peak spurious emissions within restricted bands at low channel, 802.11a, ch1

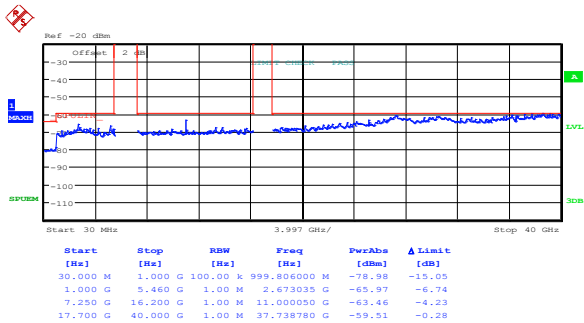


Figure 8.5-3: Peak spurious emissions within restricted bands at low channel, 802.11n HT20, cho

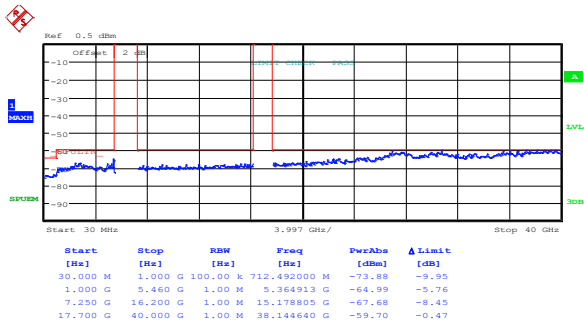


Figure 8.5-4: Peak spurious emissions within restricted bands at low channel, 802.11n HT20, ch1

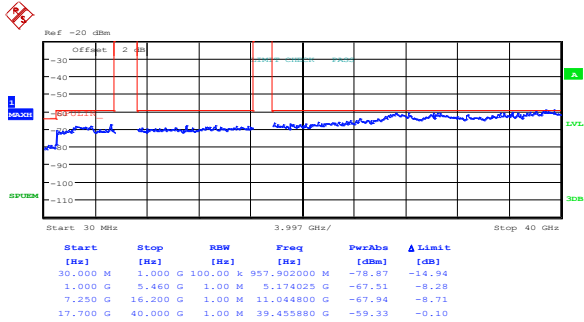


Figure 8.5-5: Peak spurious emissions within restricted bands at low channel, 802.11n HT40, cho

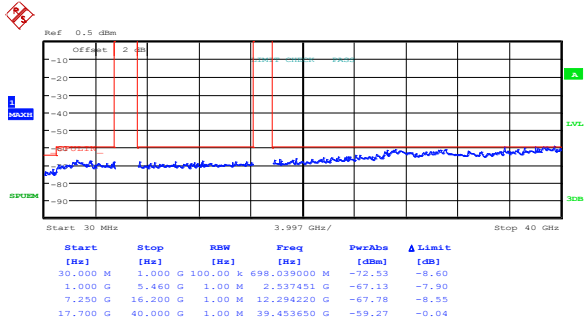


Figure 8.5-6: Peak spurious emissions within restricted bands at low channel, 802.11n HT40, ch1

8.5.4 Test data, continued

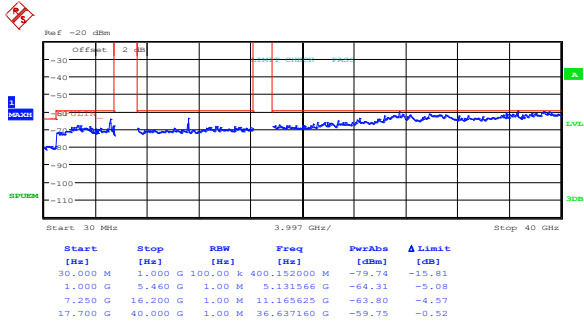


Figure 8.5-7: Peak spurious emissions within restricted bands at mid channel, 802.11a, cho

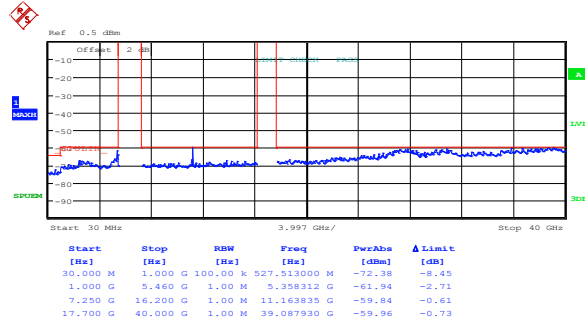


Figure 8.5-8: Peak spurious emissions within restricted bands at mid channel, 802.11a, ch1

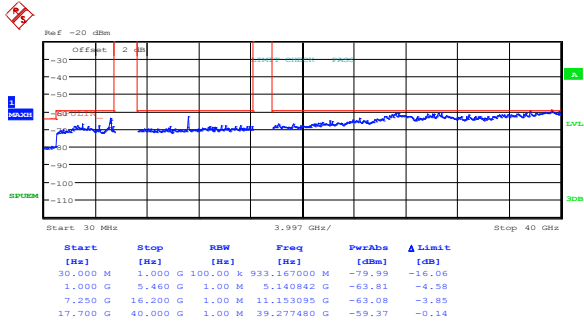


Figure 8.5-9: Peak spurious emissions within restricted bands at mid channel, 802.11n HT20, cho

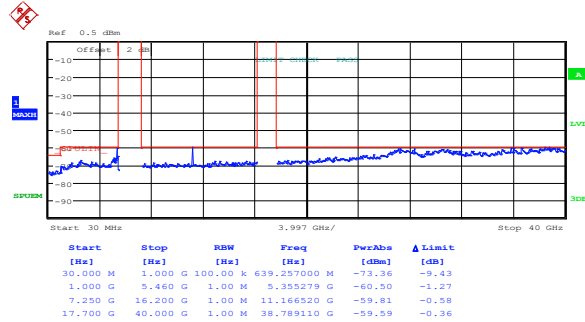


Figure 8.5-10: Peak spurious emissions within restricted bands at mid channel, 802.11n HT20, ch1

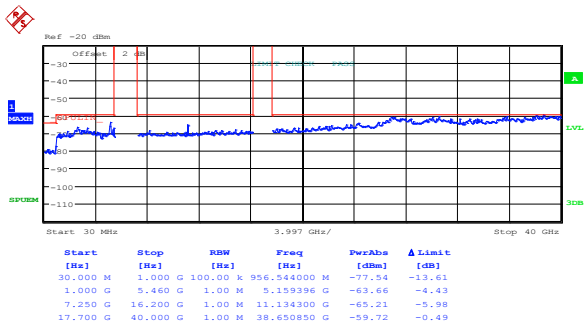


Figure 8.5-11: Peak spurious emissions within restricted bands at mid channel, 802.11n HT40, cho

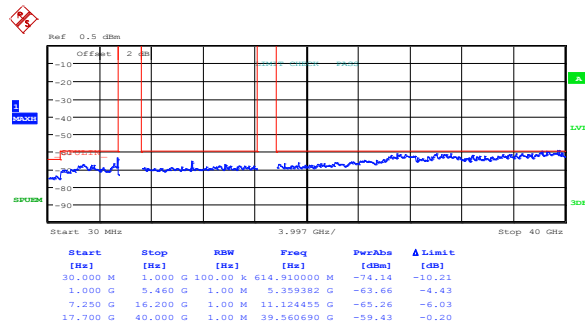


Figure 8.5-12: Peak spurious emissions within restricted bands at mid channel, 802.11n HT40, ch1



## 8.5.4 Test data, continued

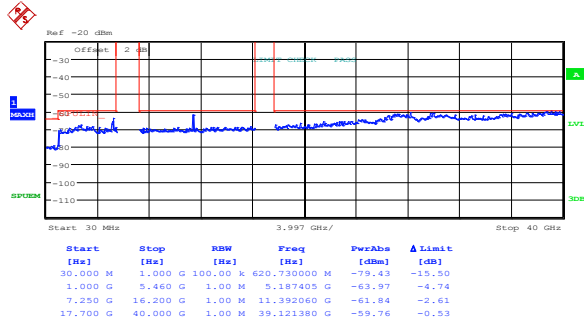


Figure 8.5-13: Peak spurious emissions within restricted bands at high channel, 802.11a, cho

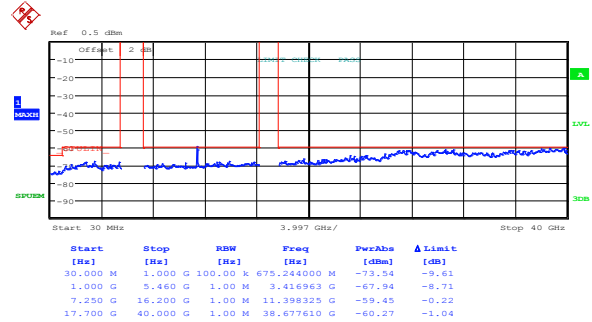


Figure 8.5-14: Peak spurious emissions within restricted bands at high channel, 802.11a, ch1

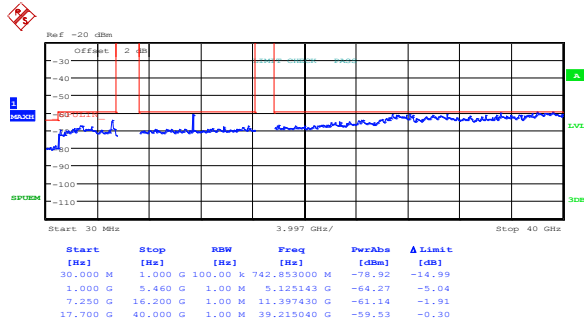


Figure 8.5-15: Peak spurious emissions within restricted bands at high channel, 802.11n HT20, cho

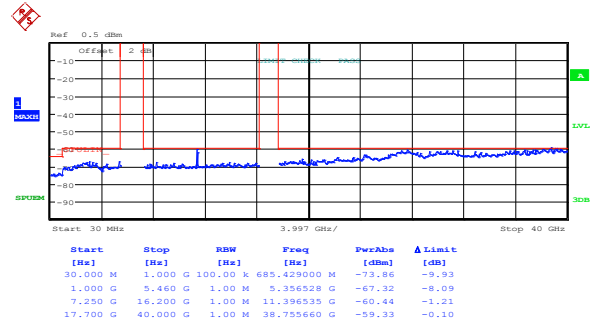


Figure 8.5-16: Peak spurious emissions within restricted bands at high channel, 802.11n HT20, ch1

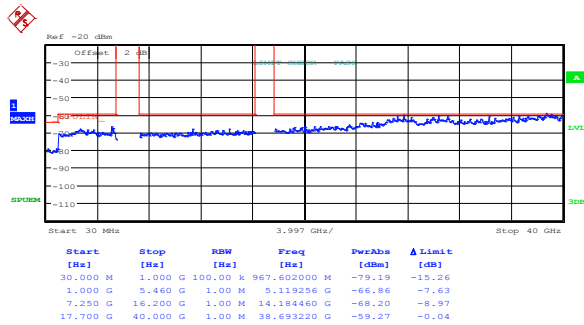


Figure 8.5-17: Peak spurious emissions within restricted bands at high channel, 802.11n HT40, cho

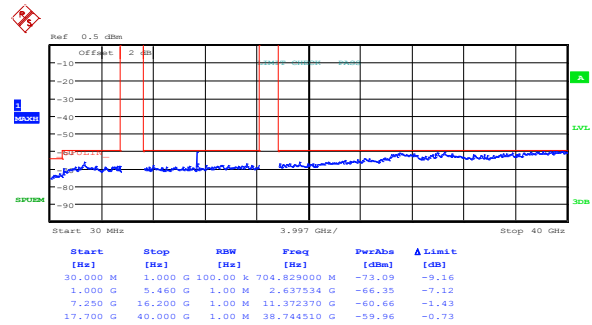


Figure 8.5-18: Peak spurious emissions within restricted bands at high channel, 802.11n HT40, ch1

## 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

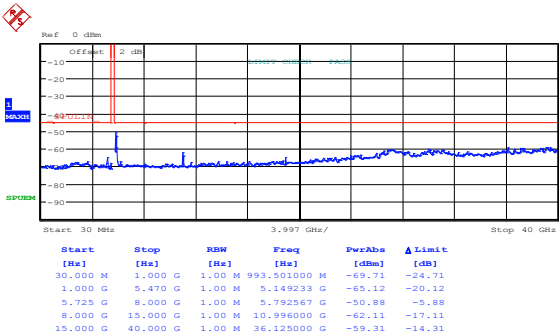


Figure 8.5-19: Peak spurious emissions outside restricted bands at low channel, 802.11a, cho

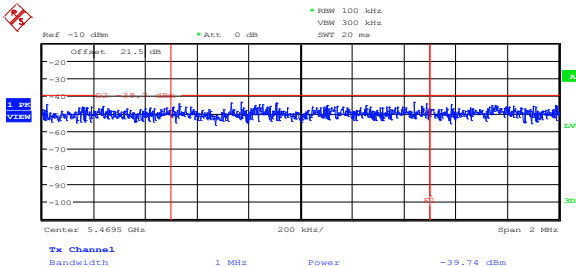


Figure 8.5-20: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 6.7 dBi antenna, cho

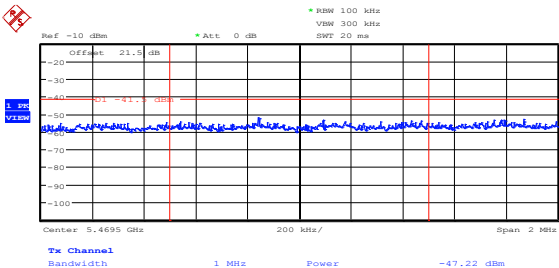


Figure 8.5-21: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 11.5 dBi antenna, cho

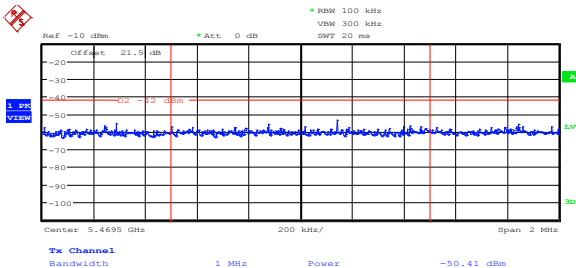


Figure 8.5-22: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 12 dBi antenna, cho

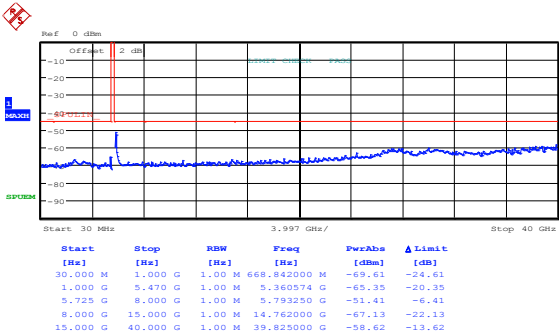


Figure 8.5-23: Peak spurious emissions outside restricted bands at low channel, 802.11a, ch1

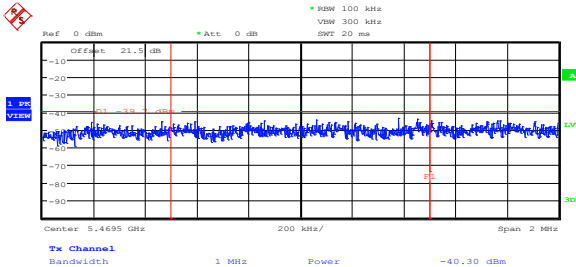


Figure 8.5-24: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued

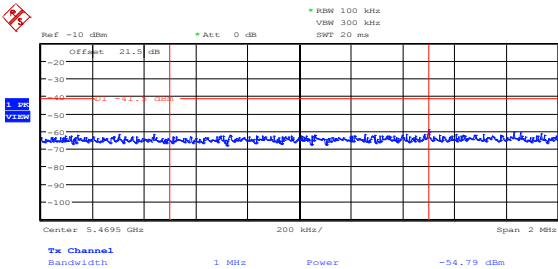


Figure 8.5-25: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 11.5 dBi antenna, ch1

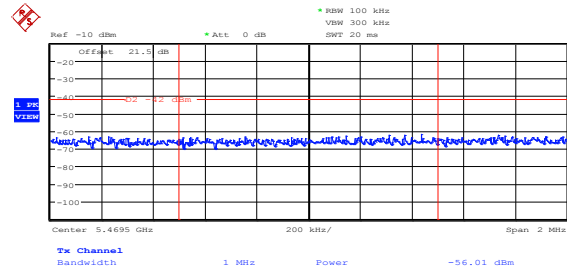


Figure 8.5-26: Lower band edge emission at 5.47 GHz on low channel, 802.11a, 12 dBi antenna, ch1

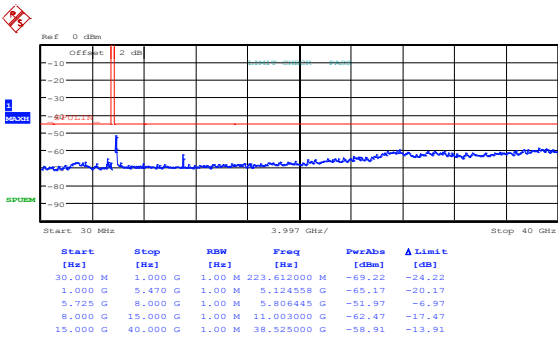


Figure 8.5-27: Peak spurious emissions outside restricted bands at low channel, 802.11n HT20, cho

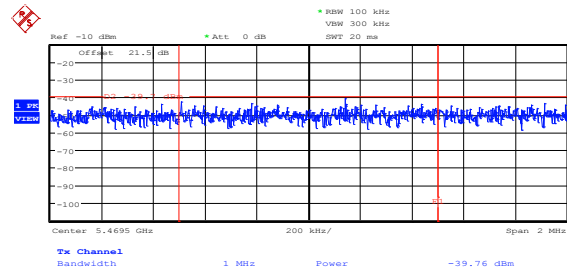


Figure 8.5-28: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 6.7 dBi antenna, cho

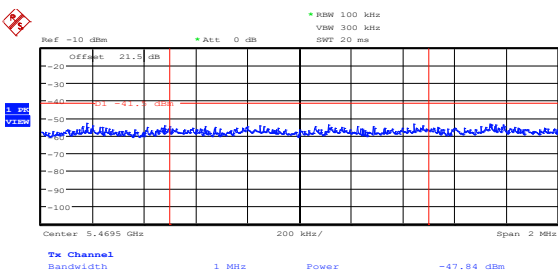


Figure 8.5-29: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 11.5 dBi antenna, cho

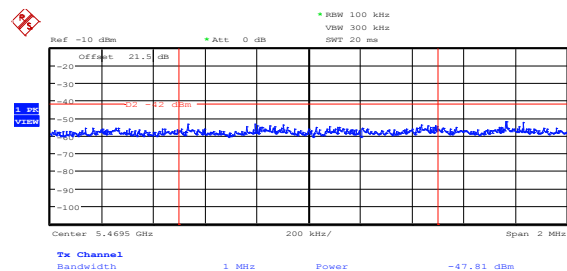


Figure 8.5-30: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 12 dBi antenna, cho

8.5.4 Test data, continued

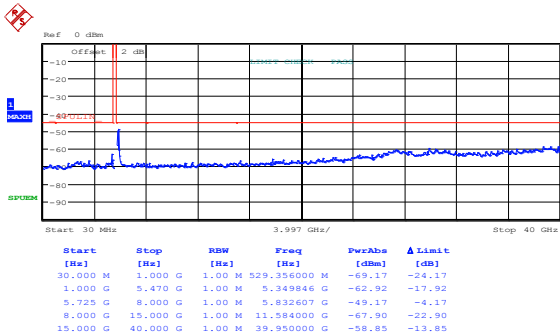


Figure 8.5-31: Peak spurious emissions outside restricted bands at low channel, 802.11n HT20, ch1

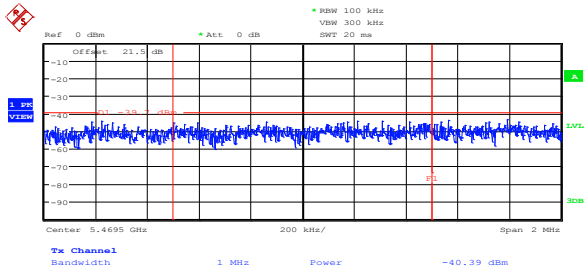


Figure 8.5-32: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 6.7 dBi antenna, ch1

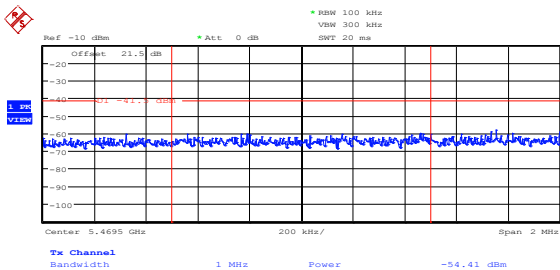


Figure 8.5-33: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 11.5 dBi antenna, ch1

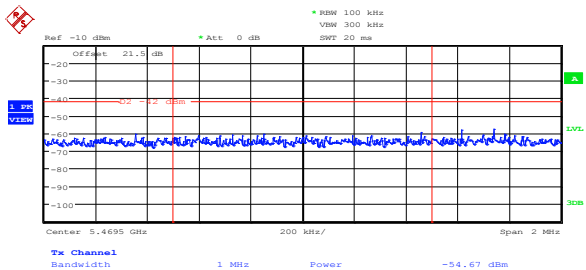


Figure 8.5-34: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT20, 12 dBi antenna, ch1

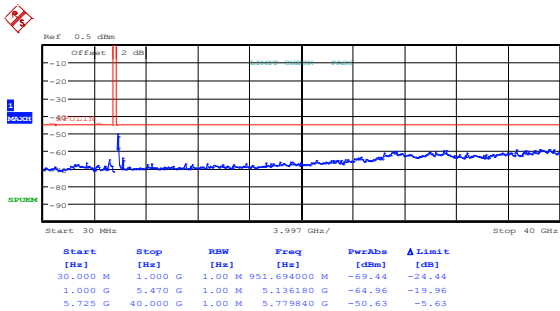


Figure 8.5-35: Peak spurious emissions outside restricted bands at low channel, 802.11n HT40, cho

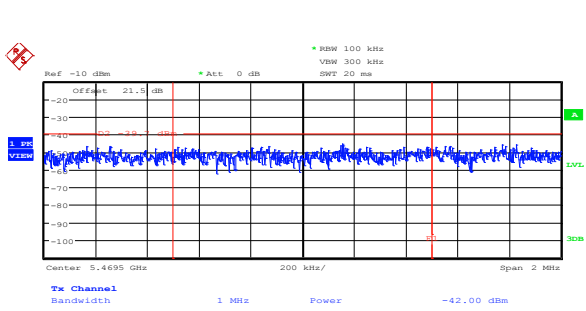


Figure 8.5-36: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

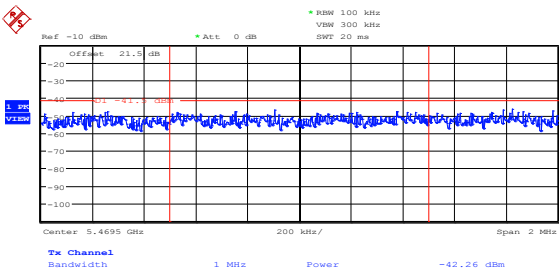


Figure 8.5-37: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 11.5 dBi antenna, cho

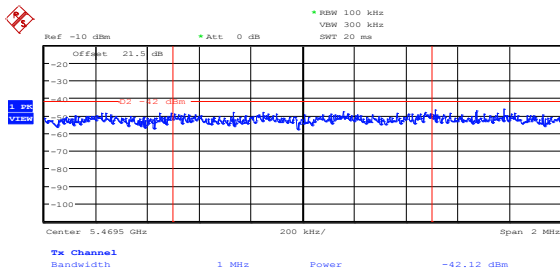


Figure 8.5-38: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 12 dBi antenna, cho

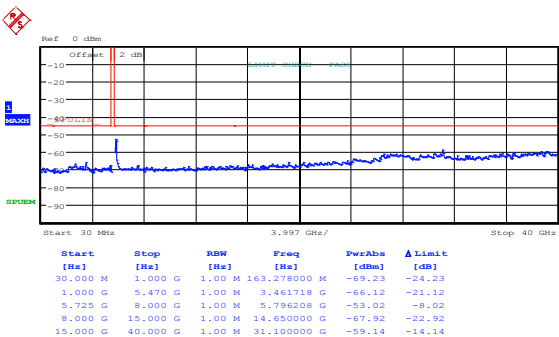


Figure 8.5-39: Peak spurious emissions outside restricted bands at low channel, 802.11n HT40, ch1

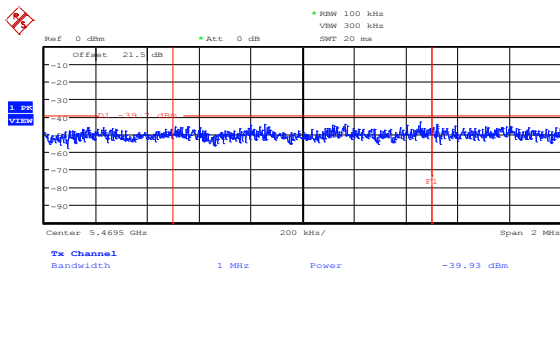


Figure 8.5-40: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 6.7 dBi antenna, ch1

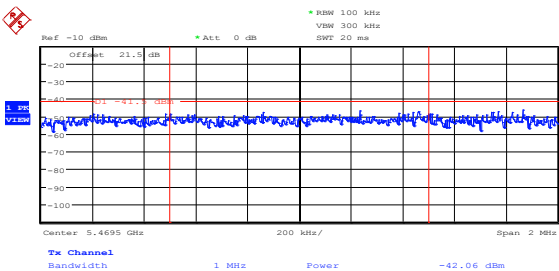


Figure 8.5-41: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 11.5 dBi antenna, ch1

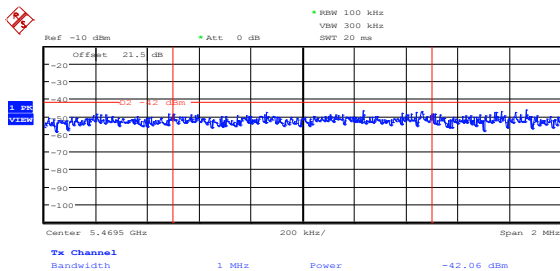


Figure 8.5-42: Lower band edge emission at 5.47 GHz on low channel, 802.11n HT40, 12 dBi antenna, ch1



8.5.4 Test data, continued

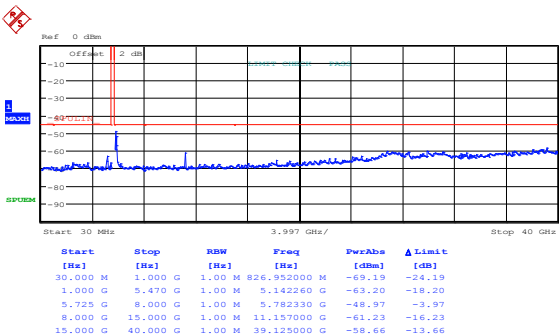


Figure 8.5-43: Peak spurious emissions outside restricted bands at mid channel, 802.11a, cho

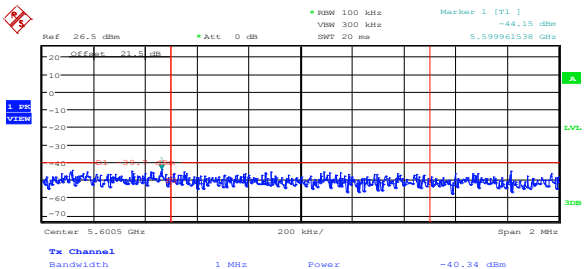


Figure 8.5-44: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 6.7 dBi antenna, cho

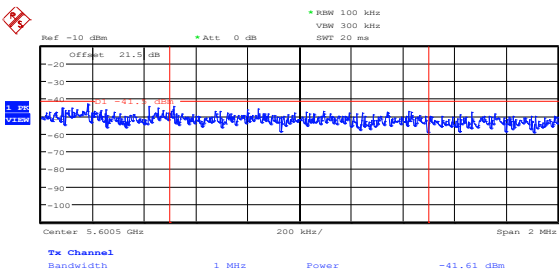


Figure 8.5-45: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 11.5 dBi antenna, cho

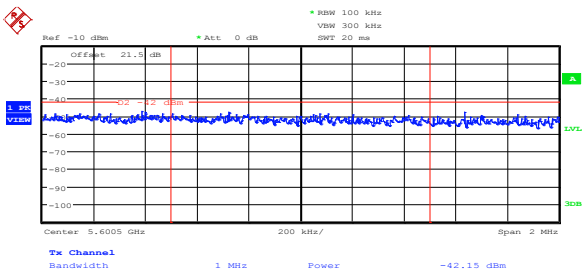


Figure 8.5-46: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 12 dBi antenna, cho

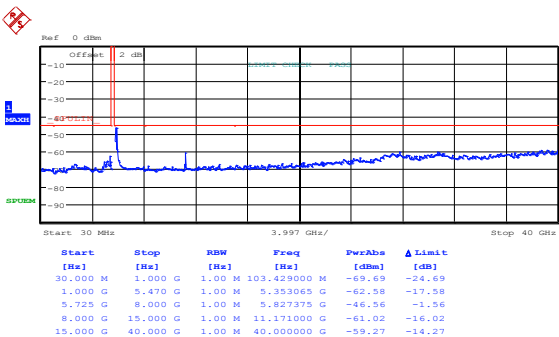


Figure 8.5-47: Peak spurious emissions outside restricted bands at mid channel, 802.11a, ch1

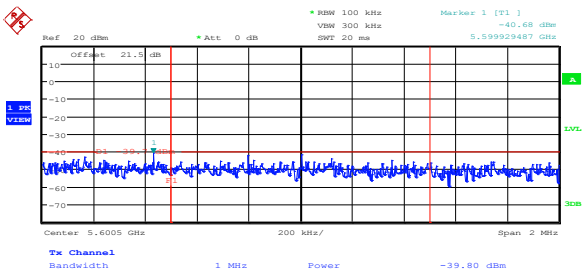
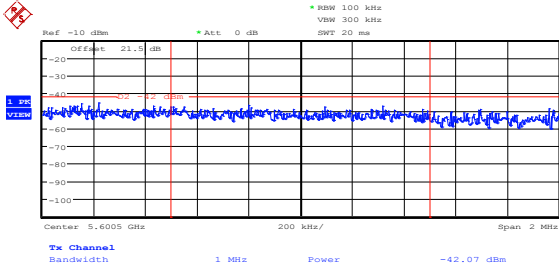
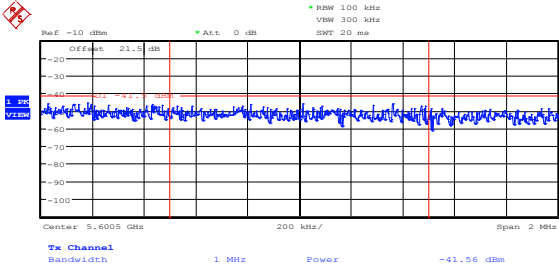
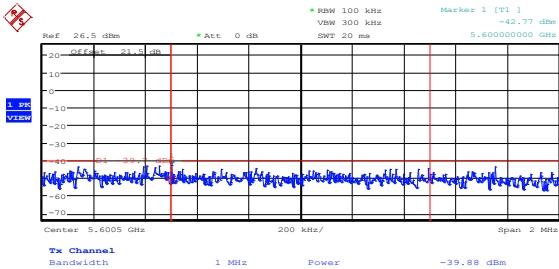
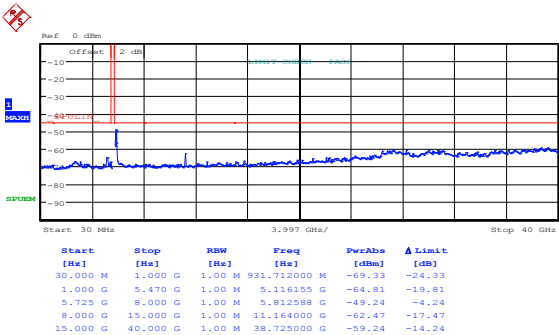
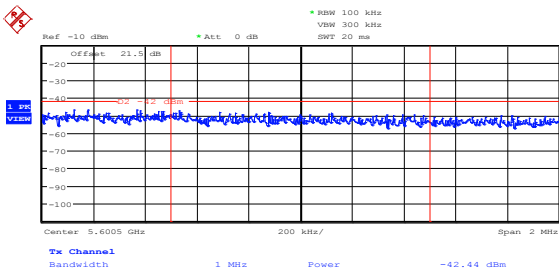
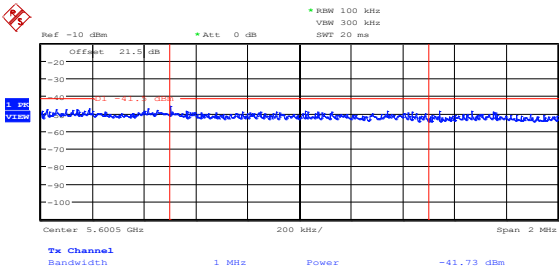


Figure 8.5-48: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued



8.5.4 Test data, continued

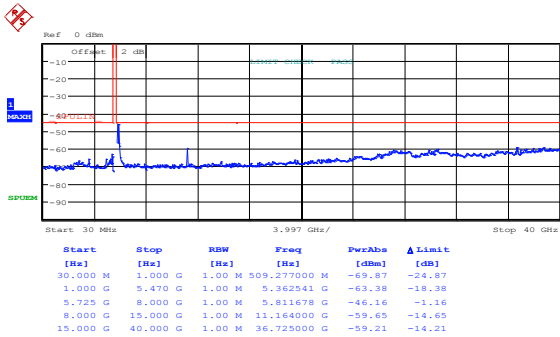


Figure 8.5-55: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT20, ch1

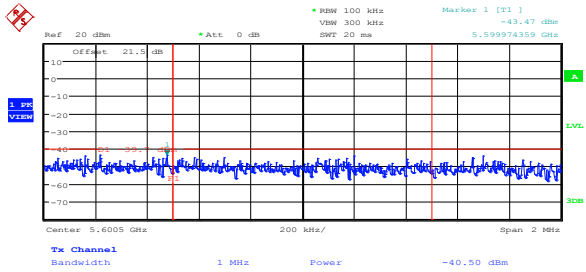


Figure 8.5-56: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 6.7 dBi antenna, ch1

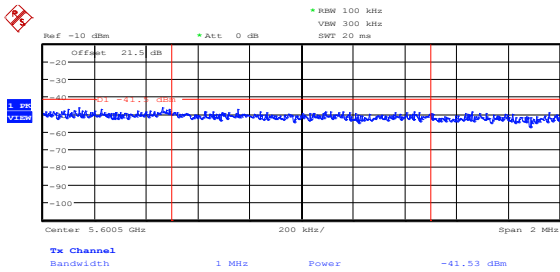


Figure 8.5-57: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 11.5 dBi antenna, ch1

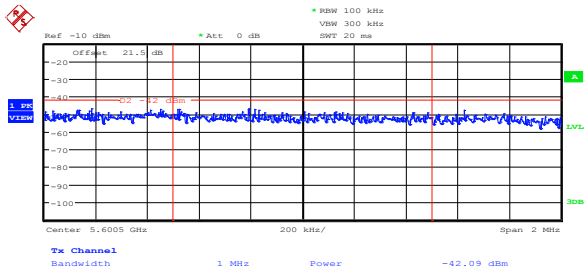


Figure 8.5-58: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT20, 12 dBi antenna, ch1

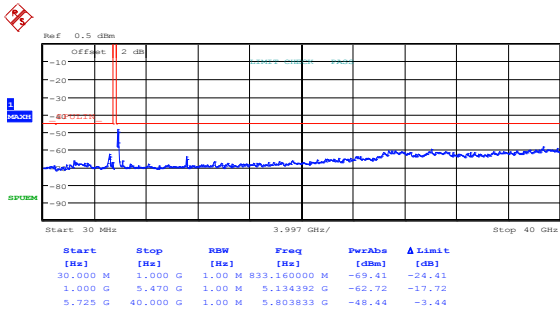


Figure 8.5-59: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT40, cho

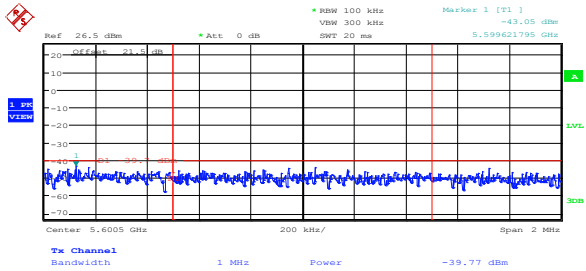


Figure 8.5-60: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

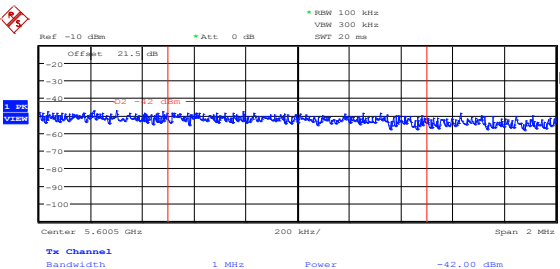
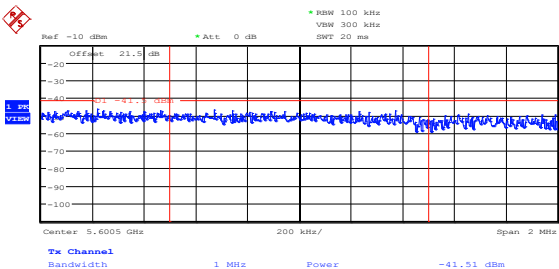


Figure 8.5-61: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 11.5 dBi antenna, cho

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

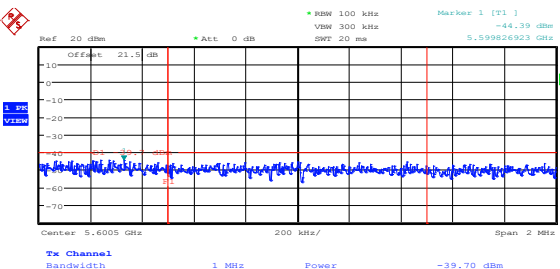
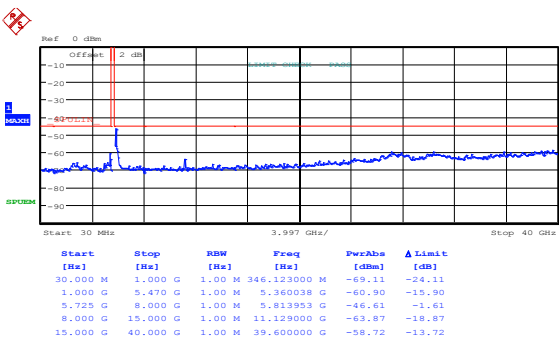


Figure 8.5-63: Peak spurious emissions outside restricted bands at mid channel, 802.11n HT40, ch1

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

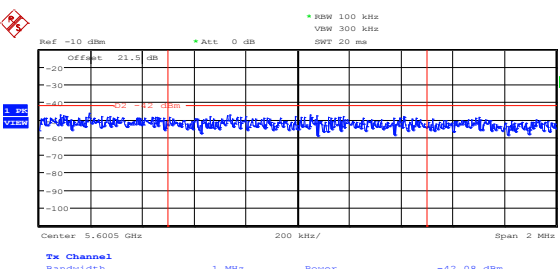
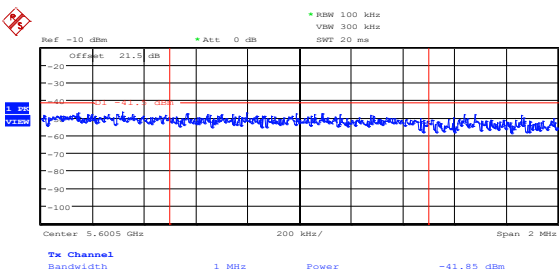


Figure 8.5-65: Upper band edge emission of the first frequency block at 5.6 GHz on mid channel, 802.11n HT40, 11.5 dBi antenna, ch1

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

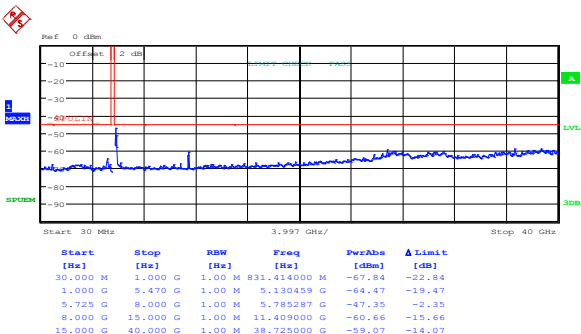


Figure 8.5-67: Peak spurious emissions outside restricted bands at high channel, 802.11a, cho

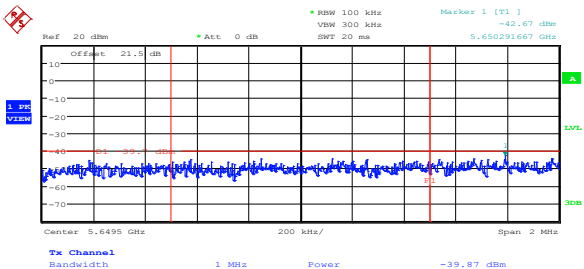


Figure 8.5-68: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 6.7 dBi antenna, cho

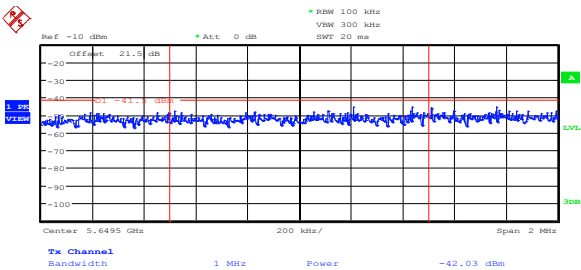


Figure 8.5-69: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 11.5 dBi antenna, cho

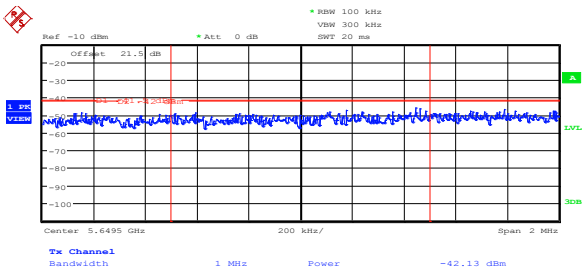


Figure 8.5-70: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 12 dBi antenna, cho

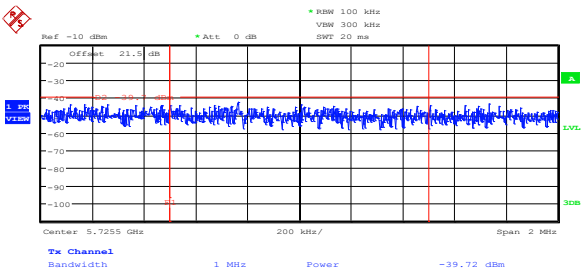


Figure 8.5-71: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 6.7 dBi antenna, cho

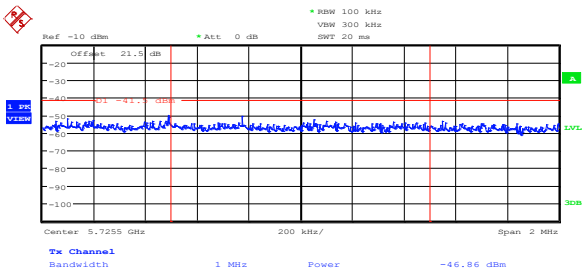


Figure 8.5-72: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 11.5 dBi antenna, cho

8.5.4 Test data, continued

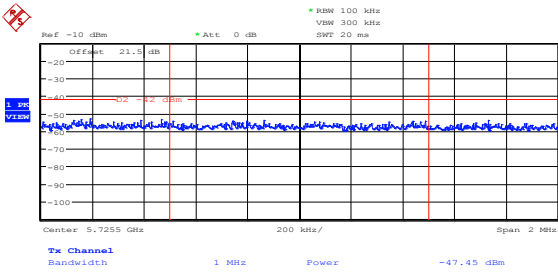


Figure 8.5-73: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 12 dBi antenna, cho

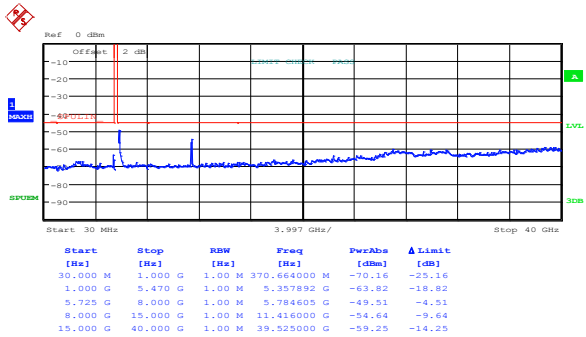


Figure 8.5-74: Peak spurious emissions outside restricted bands at high channel, 802.11a, ch1

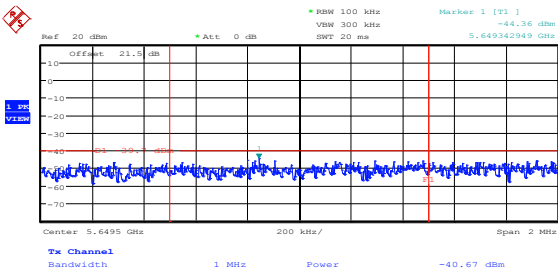


Figure 8.5-75: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 6.7 dBi antenna, ch1

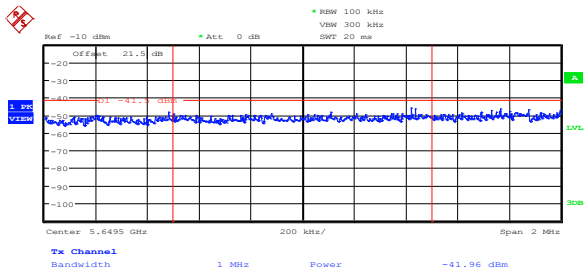


Figure 8.5-76: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 11.5 dBi antenna, ch1

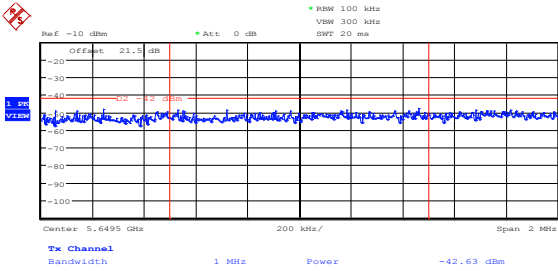


Figure 8.5-77: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11a, 12 dBi antenna, ch1

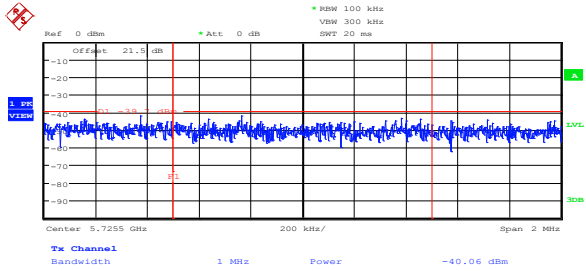


Figure 8.5-78: Upper band edge emission at 5.725 GHz on high channel, 802.11a, 6.7 dBi antenna, ch1

8.5.4 Test data, continued

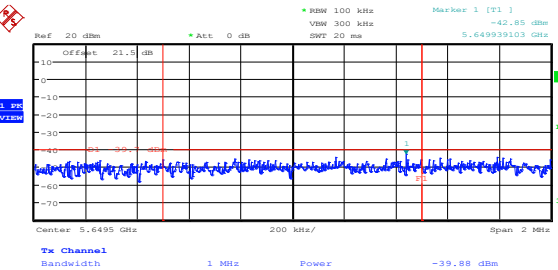
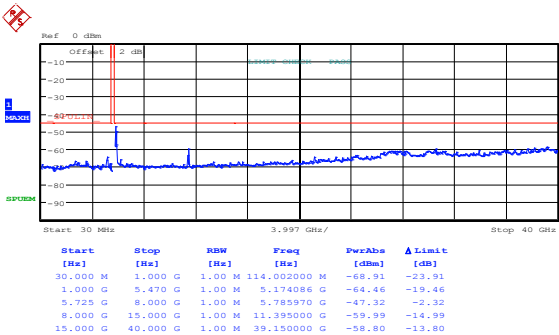
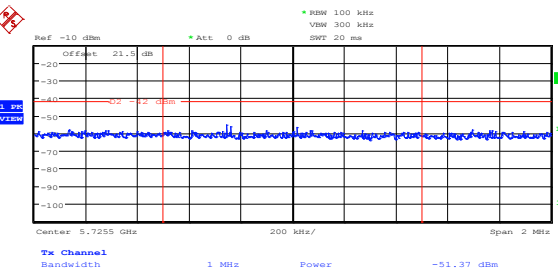
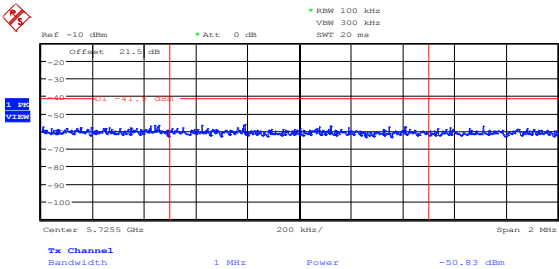
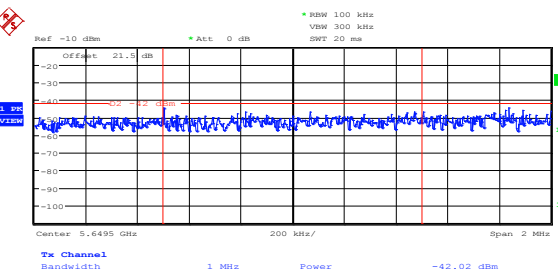
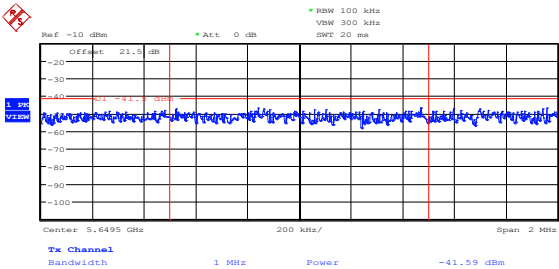


Figure 8.5-82: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 6.7 dBi antenna, cho



8.5.4 Test data, continued

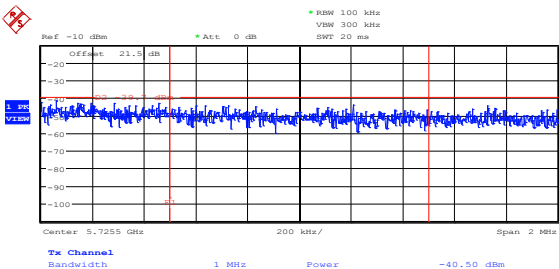


Figure 8.5-85: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 6.7 dBi antenna, cho

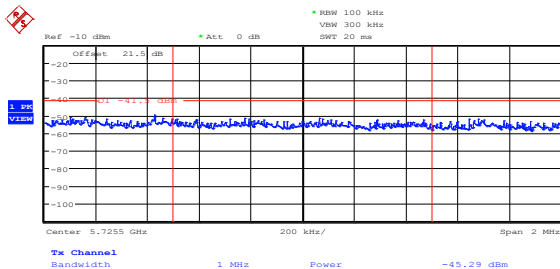


Figure 8.5-86: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 11.5 dBi antenna, cho

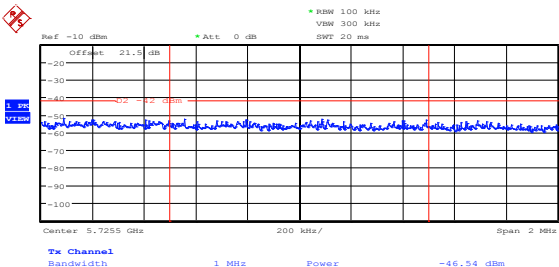


Figure 8.5-87: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 12 dBi antenna, cho

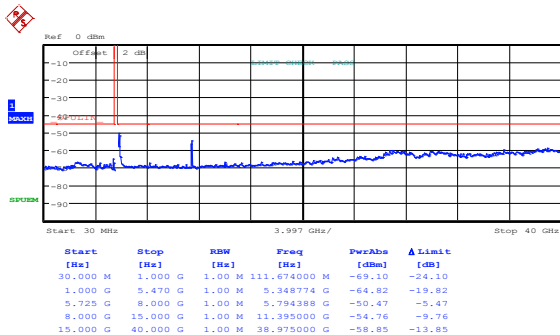


Figure 8.5-88: Peak spurious emissions outside restricted bands at high channel, 802.11n HT20, ch1

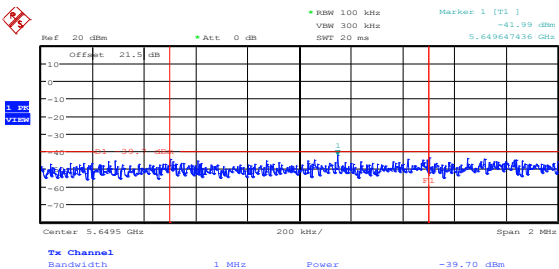


Figure 8.5-89: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 6.7 dBi antenna, ch1

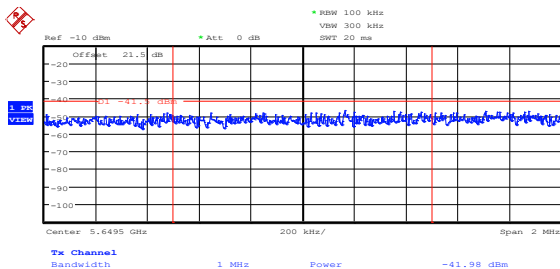


Figure 8.5-90: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 11.5 dBi antenna, ch1



8.5.4 Test data, continued

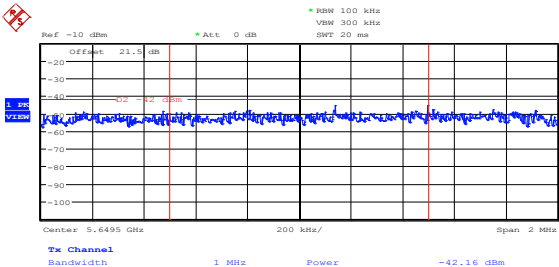


Figure 8.5-91: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT20, 12 dBi antenna, ch1

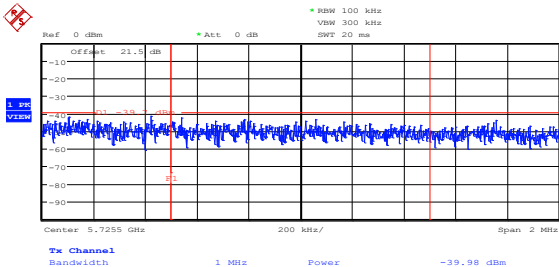


Figure 8.5-92: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 6.7 dBi antenna, ch1

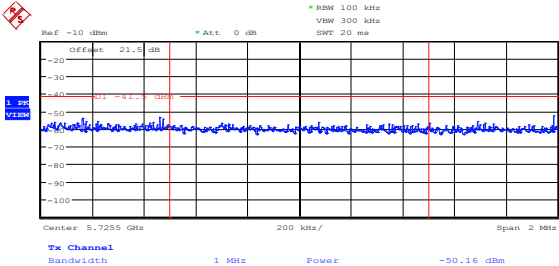


Figure 8.5-93: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 11.5 dBi antenna, ch1

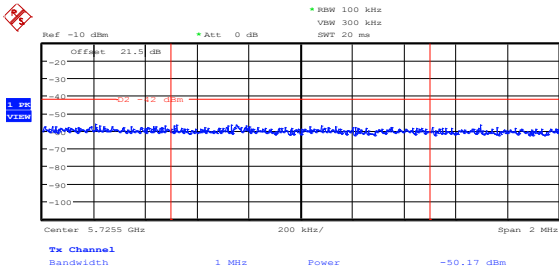


Figure 8.5-94: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT20, 12 dBi antenna, ch1

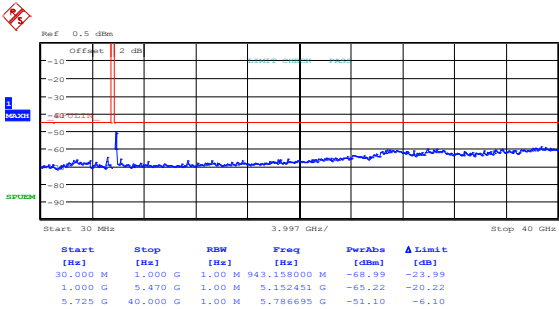


Figure 8.5-95: Peak spurious emissions outside restricted bands at high channel, 802.11n HT40, cho

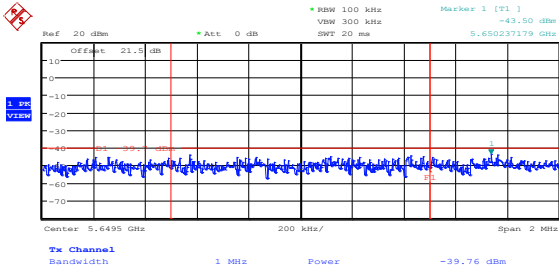


Figure 8.5-96: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 6.7 dBi antenna, cho

8.5.4 Test data, continued

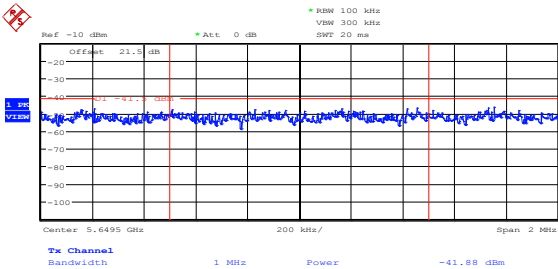


Figure 8.5-97: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 11.5 dBi antenna, cho

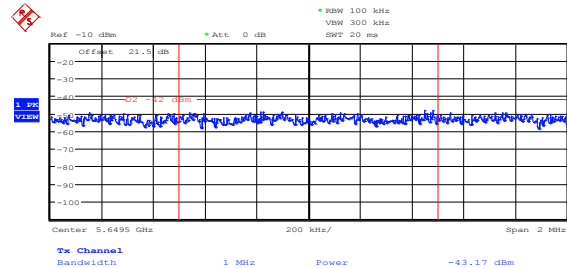


Figure 8.5-98: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 12 dBi antenna, cho

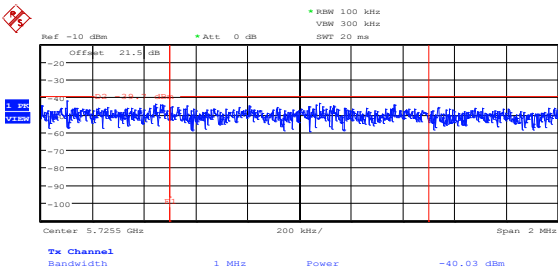


Figure 8.5-99: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 6.7 dBi antenna, cho

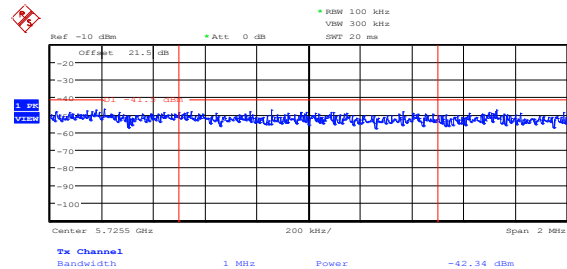


Figure 8.5-100: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 11.5 dBi antenna, cho

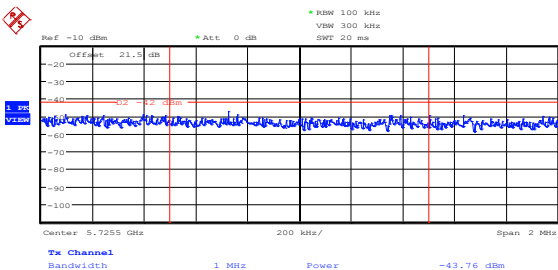


Figure 8.5-101: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 12 dBi antenna, cho

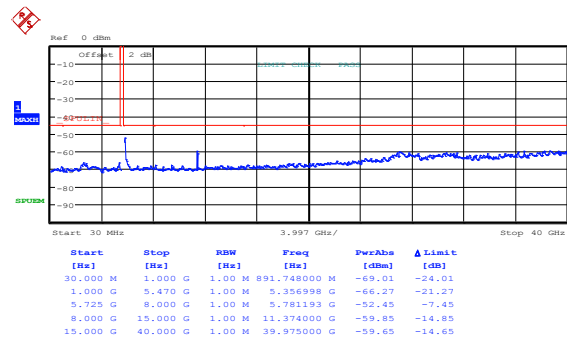


Figure 8.5-102: Peak spurious emissions outside restricted bands at high channel, 802.11n HT40, ch1

## 8.5.4 Test data, continued

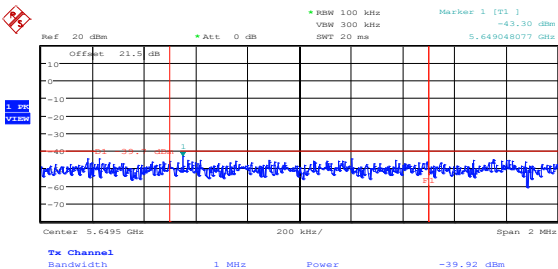


Figure 8.5-103: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 6.7 dBi antenna, ch1

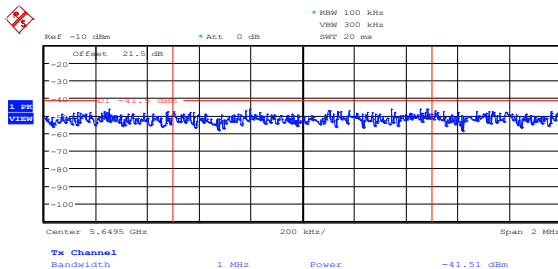


Figure 8.5-104: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 11.5 dBi antenna, ch1

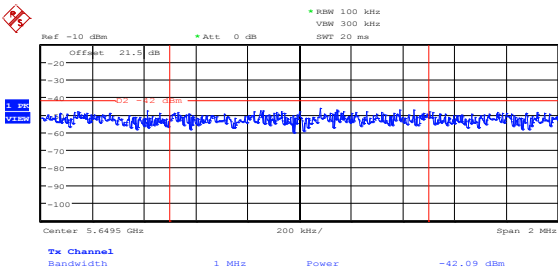


Figure 8.5-105: Lower band edge emission of the second frequency block at 5.65 GHz, 802.11n HT40, 12 dBi antenna, ch1

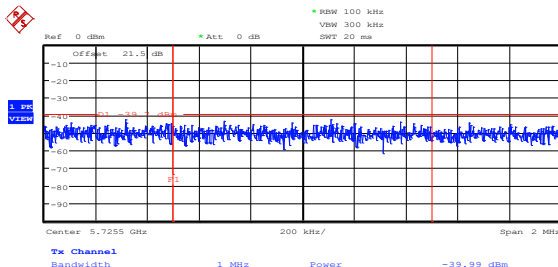


Figure 8.5-106: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 6.7 dBi antenna, ch1

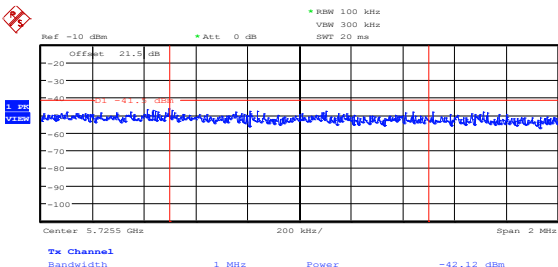


Figure 8.5-107: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 11.5 dBi antenna, ch1

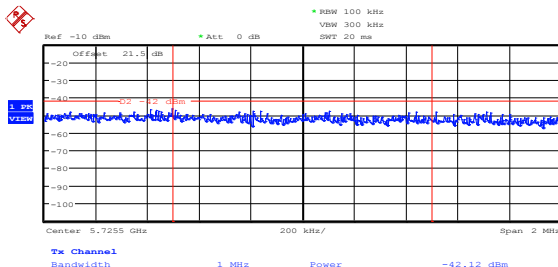


Figure 8.5-108: Upper band edge emission at 5.725 GHz on high channel, 802.11n HT40, 12 dBi antenna, ch1

## 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

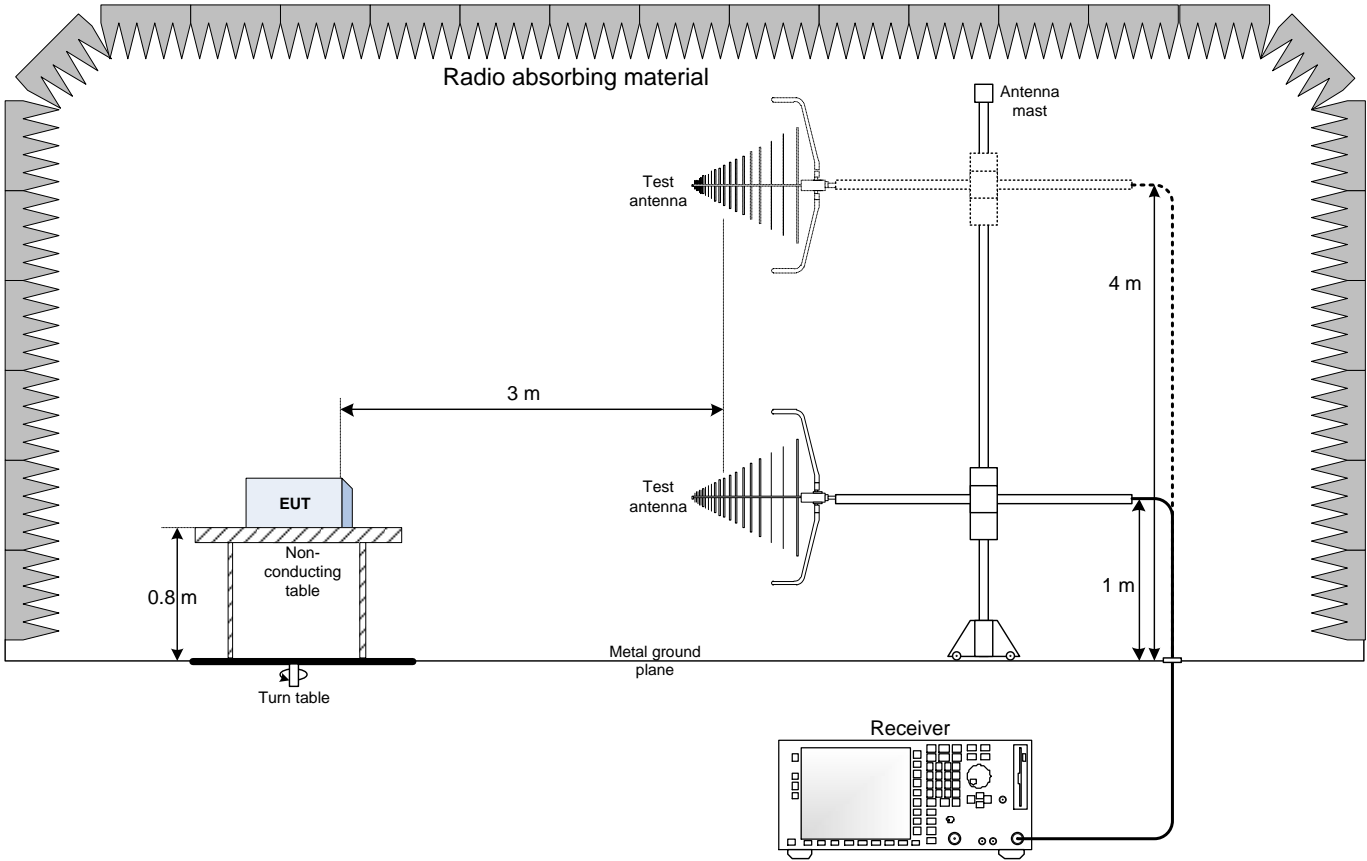
*Table 8.7-3: IC PSD-to-average calculations results*

Modulation	Frequency, MHz	PSD result, dBm/MHz	Average result, 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

