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Test report

250684-1TRFWL

Date of issue: April 7, 2014

Applicant:

BLiNQ Wireless Inc.

Product:

RF module for Hub and RBM

Model:

RD-5800

FCC ID: ROR00000003

IC Registration number: 10794A-00000003

Specifications:

- FCC 47 CFR Part 15 Subpart E, §15.407
  Unlicensed National Information Infrastructure Devises
- 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:	April 7, 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.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant

Company name:	BLiNQ Wireless Inc.
Address:	400 March Road, Suite 240
City:	Ottawa
Province/State:	ON
Postal/Zip code:	K2K 3H4
Country:	Canada

1.2 Manufacturer

Company name:	Lloyd Douglas Solutions
Address:	130 Iber Road
City:	Ottawa
Province/State:	ON
Postal/Zip code:	K2S 1E9
Country:	Canada

1.3 Test specifications

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

1.4 Test methods

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E	789033 D01 General UNII Test Procedures v01r03 (April 8, 2013)
Emissions testing of transmitters with multiple outputs in the same band (MIMO)	662911 D01 Multiple Transmitter Output v02 (October 31, 2013)
Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna	662911 D02 MIMO with Cross Polarized Antenna v01 (November 25, 2011)
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

1.5 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See “Summary of test results” for full details.

1.6 Exclusions

None

1.7 Test report revision history

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

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

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

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

[2]The Antennas are located within the enclosure of EUT and not user accessible.

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[1]	Not applicable
§15.407(a)(2)	5.25–5.35 GHz and 5.47–5.725 GHz bands power and density limits	Not applicable
§15.407(a)(3)	5.725–5.825 GHz band power and density limits	Pass
§15.407(a)(6)	Peak excursion	Not applicable
§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	Not applicable
§15.407(b)(4)	5.725–5.825 GHz band undesired emission limits	Pass
§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)	Not applicable[1]
§15.407(h)(2)	Dynamic Frequency Selection (DFS)	Not applicable[1]

Notes: [1]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands

2.3 RSS-Gen, Issue 3, test results

Part	Test description	Verdict
4.6.1	Occupied bandwidth	Pass
4.7	Transmitter frequency stability	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: [1]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[1] 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	Not applicable
A9.2 (4)	5725–5825 MHz band	Pass
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	Not applicable
A9.2 (4)	5725–5825 MHz band	Pass
A9.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not applicable
A9.4	Other Requirements for all bands	
A9.4 (1)	Digital modulation	Pass
A9.4 (2)	PSD to average power ratio	Pass
A9.4 (3)	Test frequencies	Pass
A9.4 (4)	Discontinuation of transmission	Not tested[3]

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

[2] The EUT uses digital modulations, such as: QPSK to 256-QAM

[3] It is up to applicant to fulfill the 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	January 2, 2014
Nemko sample ID number	1

3.2 EUT information

Approval type	Split modular approval
Model	RD-5800
End product variants	HX-1200 (Hub), RX-1200 (Remote Backhaul Module or RBM)
Serial number	A131206024

3.3 Technical information

Operating band	5725–5825 MHz
Operating frequency	5740–5810 MHz
Modulation type	OFDM using QPSK, 16-QAM, 64-QAM and 256-QAM modulations
Channel bandwidth	20 MHz
Occupied bandwidth (99 %)	18.37 MHz
Emission designator	W7D
Power requirements	48 V_{DC} via 120 V_{AC}, 60 Hz power supply
MIMO type	2 × 2 with completely uncorrelated type of signal
Antenna information	Hub antenna: Plasma Antennas, Cross-polarized MN: SP-4642, 17 dBi gain RBM antenna: Phoenix Antenna Systems, Cross-polarized MN: 4900-5900-S-14-42-DS-T+5-Blinq, 13 dBi gain The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is a RF module that will be installed within BLiNQ Networks X-1200 systems.
The BLiNQ Networks X-1200 system operates in the sub 6 GHz licensed frequency bands and is designed for Non-Line-of-Sight (NLOS) operation by incorporating advanced Physical Layer (PHY) and Media Access Control (MAC) layer algorithms and techniques.
Hub Module (HM): A sector controller that controls several Remote Backhaul Modules (RBMs). Hub Modules feature 4 RF connectors for an external user defined sectored antenna. Remote Backhaul Module (RBM): A subscriber unit that is installed outdoors on customer premises, including public infrastructure assets such as light and utility poles in mobile backhaul applications. RBMs feature an integrated antenna.
The X-1200 system delivers 8 b/s/Hz spectral efficiency. The system is designed for use in multiple applications that includes mobile backhaul, optical fibre cable extension and corporate and enterprise data backhaul services by providing over 200 Mbps of throughput in a 20 MHz channel.

3.5 EUT exercise details

The EUT was controlled from laptop via Ethernet using Putty telnet session.

3.6 EUT setup diagram

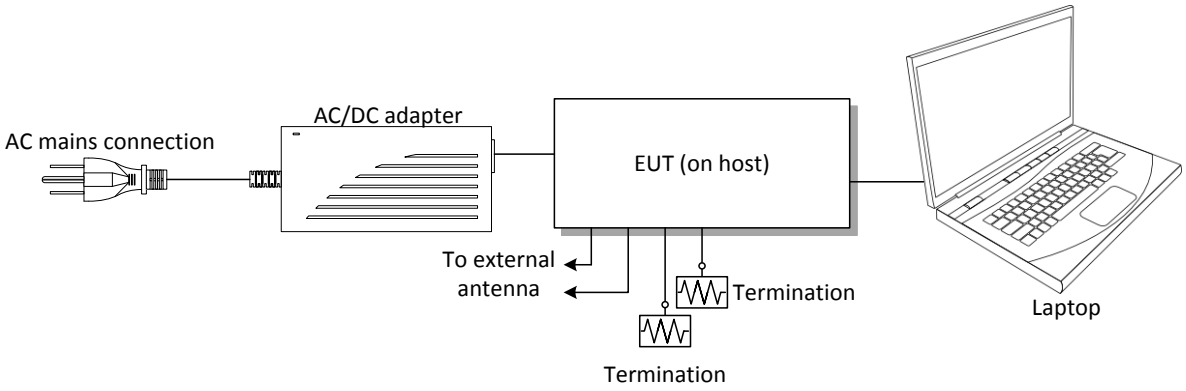


Figure 3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
Power supply	Mean Well	CLG-100-48	RB07131940
Laptop	Dell Latitude	D630C	FA002364

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

EUT uses OFDM using QPSK, 16-QAM, 64-QAM and 256-QAM modulations. The testing was done at the minimum and the maximum rates only to cover the whole range. Not distinguishable difference was observed at the 16-QAM and 64-QAM modulations.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

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

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

5.2 Power supply range

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

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

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

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/14
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Power source	California Instruments	3001i	FA001021	1 year	June 04/14
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Oct. 24/14
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Feb. 21/14
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Jan. 16/14
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Feb. 21/14
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	2 year	Sept. 06/14
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	June 21/14
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Oct. 28/14
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR
Multimeter	Fluke	16	FA001831	1 year	Jan. 30/14

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

IC:
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.

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 Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 Ω/50 µH line impedance stabilization network (LISN).

Table 8.1-1: *Conducted emissions limit*

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

Note: * - Decreases with the logarithm of the frequency.

8.1.2 Test summary

Test date:	January 9, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1035 mbar
Verdict:	Pass	Relative humidity:	31 %

8.1.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

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

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

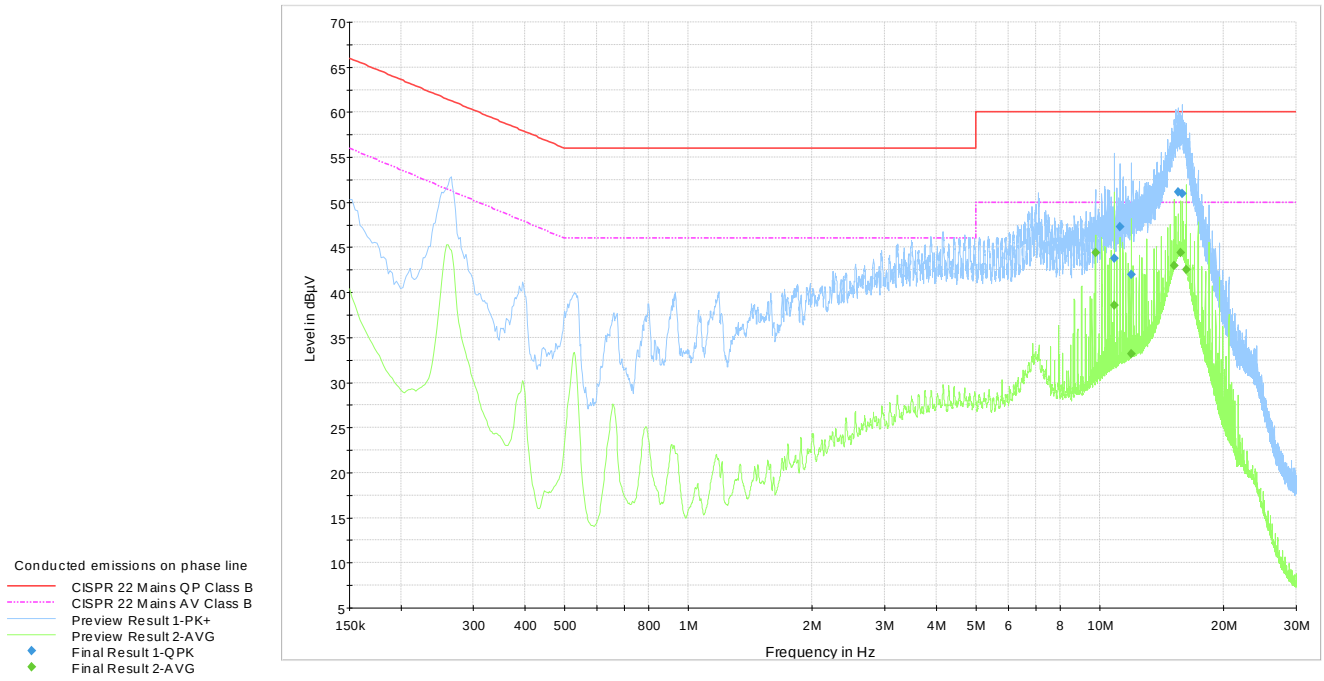
Receiver settings for preview measurements:

Resolution bandwidth:	9 kHz
Video bandwidth:	30 kHz
Detector mode:	Peak and Average
Trace mode:	Max Hold
Measurement time:	100 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*

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

Frequency, MHz	Q-Peak result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
10.823500	43.8	1000.0	9	On	10.3	16.2	60.0
11.188000	47.3	1000.0	9	On	10.4	12.7	60.0
11.903500	42.0	1000.0	9	On	10.4	18.0	60.0
15.485500	51.1	1000.0	9	On	10.5	8.9	60.0
15.877000	51.0	1000.0	9	On	10.5	9.0	60.0

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

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
9.746250	44.4	1000.0	9	On	10.3	5.6	50.0
10.823500	38.5	1000.0	9	On	10.3	11.5	50.0
11.905750	33.2	1000.0	9	On	10.4	16.8	50.0
15.152500	42.9	1000.0	9	On	10.5	7.1	50.0
15.692500	44.4	1000.0	9	On	10.5	5.6	50.0
16.237000	42.5	1000.0	9	On	10.5	7.5	50.0

8.1.4 Test data, continued

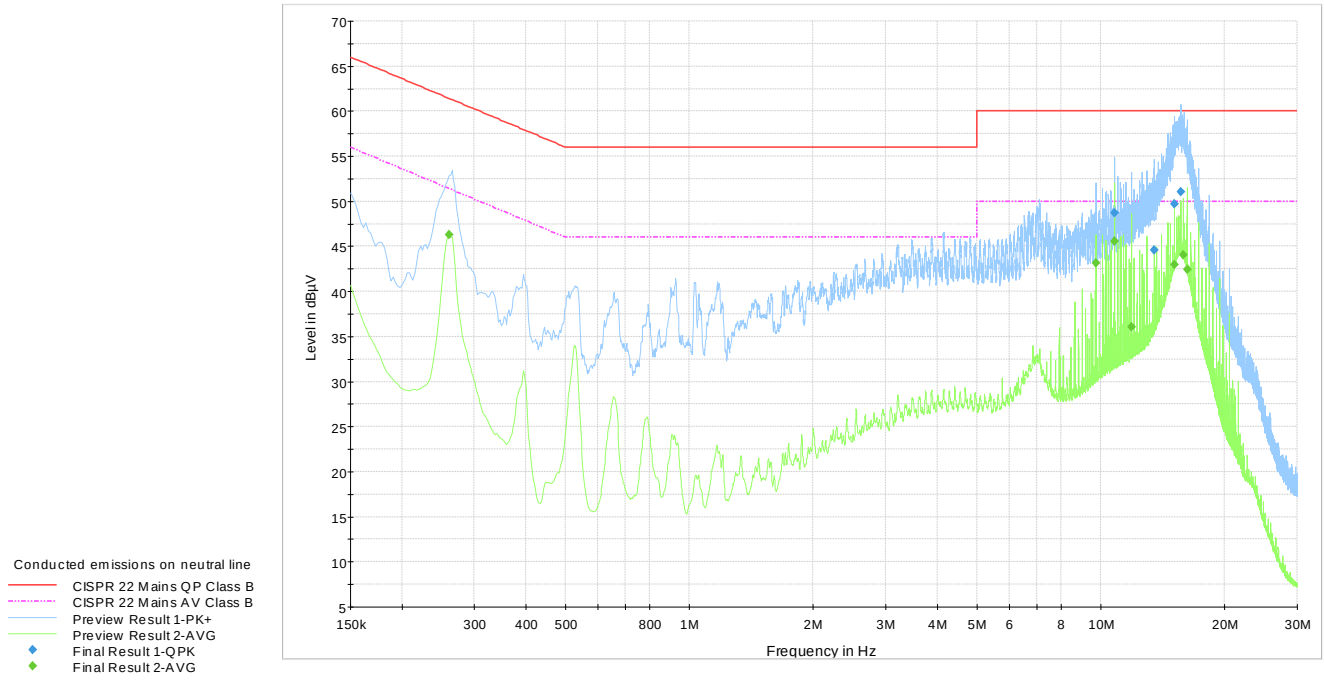


Figure 8.1-2: *Conducted emissions on neutral line*

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

Frequency, MHz	Q-Peak result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
10.787500	48.7	1000.0	9	On	10.4	11.3	60.0
13.487500	44.6	1000.0	9	On	10.5	15.4	60.0
15.105250	49.7	1000.0	9	On	10.6	10.3	60.0
15.643000	51.0	1000.0	9	On	10.6	9.0	60.0

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

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Correction, dB	Margin, dB	Limit, dBµV
0.260250	46.3	1000.0	9	On	9.7	5.2	51.4
9.714750	43.1	1000.0	9	On	10.3	6.9	50.0
10.787500	45.6	1000.0	9	On	10.4	4.4	50.0
11.867500	36.0	1000.0	9	On	10.5	14.0	50.0
15.105250	42.9	1000.0	9	On	10.6	7.1	50.0
15.820750	44.1	1000.0	9	On	10.6	5.9	50.0
16.183000	42.5	1000.0	9	On	10.6	7.5	50.0

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:	January 3, 2014	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
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data

Table 8.2-1: *26 dB bandwidth results*

Chain	Modulation	Frequency	26 dB bandwidth, MHz
ch 0	QPSK	5740	20.19
		5775	20.19
		5810	20.19
	256-QAM	5740	20.19
		5775	20.19
		5810	20.19
ch 1	QPSK	5740	20.19
		5775	20.19
		5810	20.19
	256-QAM	5740	20.19
		5775	20.19
		5810	20.19

8.2.4 Test data, continued

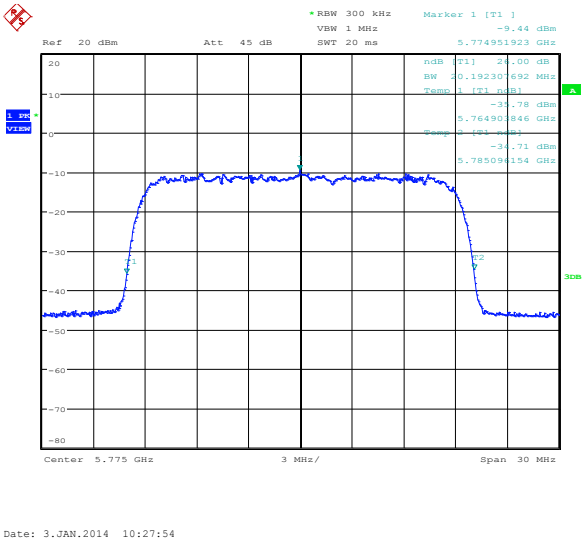


Figure 8.2-1: *26 dB bandwidth on QPSK, sample plot*

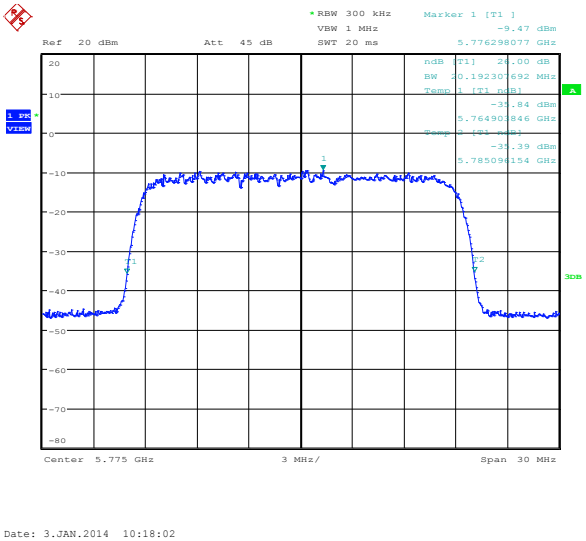


Figure 8.2-2: *26 dB bandwidth on 256-QAM, sample plot*

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:	January 3, 2014	Temperature:	22 °C
Test engineer:	Andrey Adelberg	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	32 %

8.3.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥3 × RBW
Frequency span:	30 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

Table 8.3-1: *99 % bandwidth results*

Chain	Modulation	Frequency	99 % bandwidth, MHz
ch 0	QPSK	5740	18.37
		5775	18.37
		5810	18.37
	256-QAM	5740	18.37
		5775	18.37
		5810	18.37
ch 1	QPSK	5740	18.37
		5775	18.37
		5810	18.37
	256-QAM	5740	18.37
		5775	18.37
		5810	18.37

8.3.4 Test data, continued

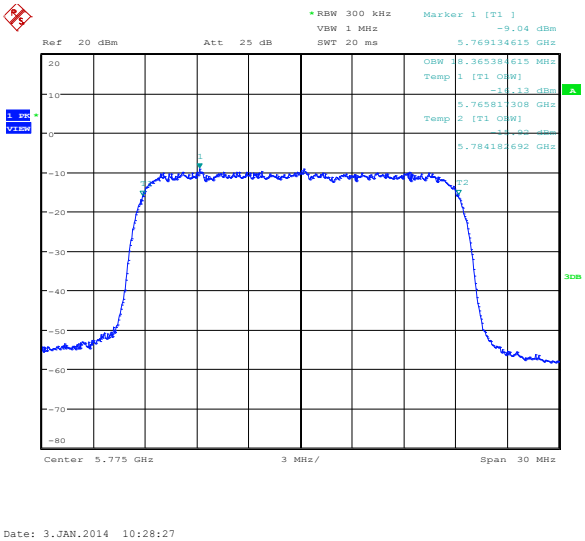


Figure 8.3-1: *99 % bandwidth on QPSK, sample plot*

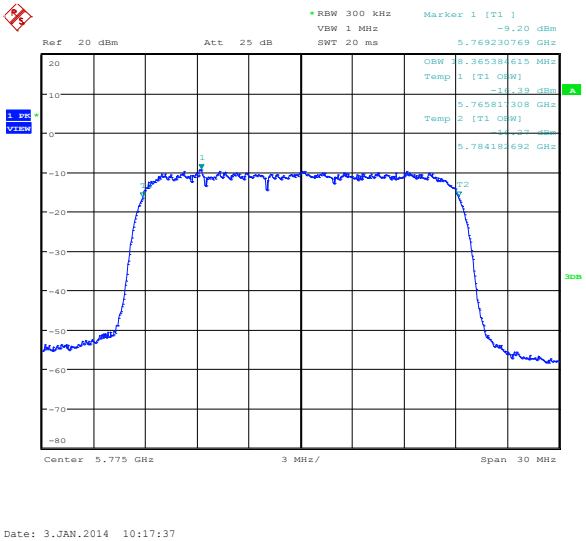


Figure 8.3-2: *99 % bandwidth on 256-QAM, sample plot*

8.4 FCC 15.407(a)(3) and RSS-210 A9.2(4) 5.725–5.825 GHz band output power, EIRP and spectral density limits

8.4.1 Definitions and limits

FCC:
For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W (30 dBm) or 17 dBm + 10 $\log_{10}$ B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

IC:
The maximum conducted output power shall not exceed 1 W (30 dBm) or 17 + 10 $\log_{10}$ B, dBm, whichever power is less. The power spectral density shall not exceed 17 dBm in any 1 MHz band. The maximum e.i.r.p. shall not exceed 4 W (36 dBm) or 23 + 10 $\log_{10}$ B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
Fixed point-to-point systems for this band are permitted to have an e.i.r.p. greater than 4 W (36 dBm) provided that the higher e.i.r.p. is achieved by employing higher gain antennas, but not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding 4 W e.i.r.p. However, remote stations of point-to-multipoint systems shall be permitted to operate at greater than 4 W e.i.r.p. under the same conditions as for point-to-point systems.

8.4.2 Test summary

Test date:	January 3, 2014	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 test was performed according to 789033 D01 General UNII Test Procedures section E) 3) a) Method PM: maximum conducted (average) output power using wideband RF average power meter with a thermocouple detector.
Combined average output power was calculated as follows: $P_{combined} = 10 \times log_{10}\left(\left(10^{P_{ch0}/10}\right) + \left(10^{P_{ch1}/10}\right)\right)$
EIRP was calculated as follows: $EIRP = P_{combined} + antenna\ gain$
Combined PPSD was calculated as follows: $PPSD_{combined} = 10 \times log_{10}\left(\left(10^{PSD_{ch0}/10}\right) + \left(10^{PSD_{ch1}/10}\right)\right)$
Directional gain for cross-polarized MIMO 2 × 2 with completely uncorrelated signal for Hub is 17 dBi – 1 dB (cable loss) = 16 dBi and for RBM is 13 dBi – 2 dB (cable loss) – 1 dB (switch-card loss) = 10 dBi. No summation of gain is needed for cross-polarized antennas as per manufacturer's definition of the cross-polarized MIMO type.

The 26 dB measured bandwidth was 20.19 MHz.
FCC output power limit for Hub was calculated as follows: 17 + 10 × Log_{10} (20.19) – (16 – 6) = 20.05 dBm > **20 dBm** = 30 –(16 – 6)
FCC output power limit for RBM was calculated as follows: 17 + 10 × Log_{10} (20.19) – (10 – 6) = 26.05 dBm > **26 dBm** = 30 –(10 – 6)
FCC PPSD limit was calculated as follows: for Hub: 17 – (16 – 6) = 7 dBm/MHz, for RBM: 17 – (10 – 6) = 13 dBm/MHz

The 99 % measured occupied bandwidth was 18.37 MHz.
IC output power limit was calculated as follows: 17 + 10 × Log_{10} (18.37) = **29.64 dBm** < 30 dBm
EIRP limit was calculated as conducted output power limit + 6 dB.

8.4.4 Test data

Table 8.4-1: *Output power measurements and EIRP calculations results as per FCC for Hub*

Modulation	Frequency, MHz	Conducted output power, dBm			Power limit, dBm	Margin, dB
		On ch0	On ch1	Combined		
QPSK	5740	15.05	15.40	18.24	20.00	1.76
	5775	15.94	14.78	18.41	20.00	1.59
	5810	15.28	15.54	18.42	20.00	1.58
256-QAM	5740	16.11	15.55	18.85	20.00	1.15
	5775	15.75	14.90	18.36	20.00	1.64
	5810	15.22	15.75	18.50	20.00	1.50

Table 8.4-2: *PPSD measurements results as per FCC for Hub*

Modulation	Frequency, MHz	Measured Peak Power Spectral Density (PPSD)			PPSD limit, dBm/MHz	Margin, dB
		On ch0, dBm/Hz	On ch1, dBm/Hz	Combined, dBm/MHz		
QPSK	5740	-56.97	-56.33	6.37	7.00	0.63
	5775	-56.14	-57.02	6.45	7.00	0.55
	5810	-56.71	-56.20	6.56	7.00	0.44
256-QAM	5740	-55.90	-56.21	6.96	7.00	0.04
	5775	-56.33	-56.87	6.42	7.00	0.58
	5810	-56.82	-56.04	6.60	7.00	0.40

Note: dBm/MHz = dBm/Hz + 60 dB

Table 8.4-3: *Output power measurements and EIRP calculations results as per FCC for RBM*

Modulation	Frequency, MHz	Conducted output power, dBm			Power limit, dBm	Margin, dB
		On ch0	On ch1	Combined		
QPSK	5740	21.39	20.93	24.18	26.00	1.82
	5775	21.21	21.14	24.19	26.00	1.81
	5810	21.36	21.23	24.31	26.00	1.69
256-QAM	5740	22.27	20.71	24.57	26.00	1.43
	5775	21.84	21.01	24.46	26.00	1.54
	5810	22.09	20.75	24.48	26.00	1.52

Table 8.4-4: *PPSD measurements results as per FCC for RBM*

Modulation	Frequency, MHz	Measured Peak Power Spectral Density (PPSD)			PPSD limit, dBm/MHz	Margin, dB
		On ch0, dBm/Hz	On ch1, dBm/Hz	Combined, dBm/MHz		
QPSK	5740	-50.63	-50.87	12.26	13.00	0.74
	5775	-50.85	-50.67	12.25	13.00	0.75
	5810	-50.67	-50.48	12.44	13.00	0.56
256-QAM	5740	-49.73	-50.99	12.70	13.00	0.30
	5775	-50.18	-50.74	12.56	13.00	0.44
	5810	-49.93	-50.96	12.60	13.00	0.40

Note: dBm/MHz = dBm/Hz + 60 dB

8.4.4 Test data, continued

Table 8.4-5: *Output power measurements and EIRP calculations results as per IC for Hub*

Modulation	Frequency, MHz	Conducted output power, dBm			Power limit, dBm	Margin, dB	Antenna gain, dBi	Equivalent Isotropically Radiated Power, dBm		
		On ch0	On ch1	Combined				Calculated	Limit	Margin*
QPSK	5740	15.05	15.40	18.24	29.64	11.40	16.00	34.24	35.64	1.40
	5775	15.94	14.78	18.41	29.64	11.23	16.00	34.41	35.64	1.23
	5810	15.28	15.54	18.42	29.64	11.22	16.00	34.42	35.64	1.22
256-QAM	5740	16.11	15.55	18.85	29.64	10.79	16.00	34.85	35.64	0.79
	5775	15.75	14.90	18.36	29.64	11.28	16.00	34.36	35.64	1.28
	5810	15.22	15.75	18.50	29.64	11.14	16.00	34.50	35.64	1.14

Notes: * - Margin obtained in dB units

Table 8.4-6: *PSD measurements results as per IC for Hub*

Modulation	Frequency, MHz	Measured Power Spectral Density (PSD)			PSD limit, dBm/MHz	Margin, dB
		On ch0, dBm/Hz	On ch1, dBm/Hz	Combined, dBm/MHz		
QPSK	5740	-56.97	-56.33	6.37	17.00	10.63
	5775	-56.14	-57.02	6.45	17.00	10.55
	5810	-56.71	-56.20	6.56	17.00	10.44
256-QAM	5740	-55.90	-56.21	6.96	17.00	10.04
	5775	-56.33	-56.87	6.42	17.00	10.58
	5810	-56.82	-56.04	6.60	17.00	10.40

Note: dBm/MHz = dBm/Hz + 60 dB

Table 8.4-7: *Output power measurements and EIRP calculations results as per IC for RBM*

Modulation	Frequency, MHz	Conducted output power, dBm			Power limit, dBm	Margin, dB	Antenna gain, dBi	Equivalent Isotropically Radiated Power, dBm		
		On ch0	On ch1	Combined				Calculated	Limit	Margin*
QPSK	5740	21.39	20.93	24.18	29.64	5.46	10.00	34.18	35.64	1.46
	5775	21.21	21.14	24.19	29.64	5.45	10.00	34.19	35.64	1.45
	5810	21.36	21.23	24.31	29.64	5.33	10.00	34.31	35.64	1.33
256-QAM	5740	22.27	20.71	24.57	29.64	5.07	10.00	34.57	35.64	1.07
	5775	21.84	21.01	24.46	29.64	5.18	10.00	34.46	35.64	1.18
	5810	22.09	20.75	24.48	29.64	5.16	10.00	34.48	35.64	1.16

Notes: * - Margin obtained in dB units

Table 8.4-8: *PSD measurements results as per IC for RBM*

Modulation	Frequency, MHz	Measured Power Spectral Density (PSD)			PSD limit, dBm/MHz	Margin, dB
		On ch0, dBm/Hz	On ch1, dBm/Hz	Combined, dBm/MHz		
QPSK	5740	-50.63	-50.87	12.26	17.00	4.74
	5775	-50.85	-50.67	12.25	17.00	4.75
	5810	-50.67	-50.48	12.44	17.00	4.56
256-QAM	5740	-49.73	-50.99	12.70	17.00	4.30
	5775	-50.18	-50.74	12.56	17.00	4.44
	5810	-49.93	-50.96	12.60	17.00	4.40

Note: dBm/MHz = dBm/Hz + 60 dB

8.4.4 Test data, continued

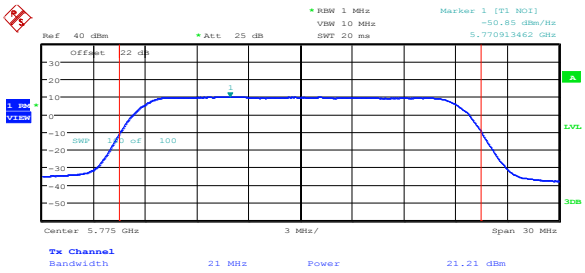


Figure 8.4-1: *Sample plot for power and spectral density for QPSK*

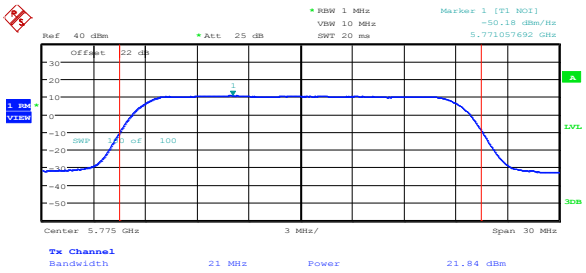


Figure 8.4-2: *Sample plot for power and spectral density for 256-QAM*

8.5 FCC 15.407(b) and RSS-210 A9.2(4) Spurious (out-of-band) emissions

8.5.1 Definitions and limits

FCC:
(4) For transmitters operating in the 5725–5825 MHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of −27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
(7) The provisions of § 15.205 apply to intentional radiators operating under this section.
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.
IC:
For the band 5725–5825 MHz, emissions within the frequency range from the band edges to 10 MHz above or below the band edges shall not exceed −17 dBm/MHz e.i.r.p. For frequencies more than 10 MHz above or below the band edges, emissions shall not exceed −27 dBm/MHz.

RSS-Gen 7.2.2 Emissions falling within restricted frequency bands
Restricted bands, identified in Table 8.5-2, 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:
(a) fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of below;
(b) unwanted emissions falling into restricted bands of below shall comply with the limits specified in RSS-Gen;
(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.

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

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

Notes: * - Applicable only to FCC requirements
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 Table 8.5-2 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:	January 7, 2014	Temperature:	21 °C
Test engineer:	Andrey Adelberg	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	31 %

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 Ω load. No radiated spurious emissions less than 10 dB below the limit were detected. Conducted emissions measurements outside and within restricted bands were performed on each individual MIMO chain. All plots were taken with peak detector, and where the peak result was above the average limit (indicated with red font), tabular data was provided to show compliance with both peak and average limits.

Spectrum analyser 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 for Hub was calculated as follows: 54 dBµV/m – 95.23 dB – 16 dBi − 4.7 dB – 3 dB = −64.93 dBm
Average limit for RBM was calculated as follows: 54 dBµV/m – 95.23 dB – 10 dBi − 4.7 dB – 3 dB = −58.93 dBm
where 3 dB is a multiple antenna ports compensation: $10 \times \log_{10}(2) = 3$ dB

Spectrum analyser 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 for Hub was calculated as follows: 54 dBµV/m – 95.23 dB – 16 dBi − 3 dB = −60.23 dBm
Average limit for RBM was calculated as follows: 54 dBµV/m – 95.23 dB – 10 dBi − 3 dB = −54.23 dBm
where 3 dB is a multiple antenna ports compensation: $10 \times \log_{10}(2) = 3$ dB

Spectrum analyser for average conducted measurements within restricted bands above 1 GHz for frequencies where peak results were above the average limit:

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

Peak limit is 20 dB higher than the average limit: for Hub: −60.23 dBm + 20 dB = −40.23 dBm and for RBM: −54.23 dBm + 20 dB = −34.23 dBm

Spectrum analyser 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 Hub was calculated as follows: −27 dBm/MHz –3 dB – 16 dBi = −46 dBm/MHz
The limit for RBM was calculated as follows: −27 dBm/MHz –3 dB – 10 dBi = −40 dBm/MHz
The limit within the frequency range from the band edges to 10 MHz above or below the band edges was calculated as follows
−17 dBm/MHz –3 dB – 16 dBi = −36 dBm/MHz (for Hub) and −17 dBm/MHz –3 dB – 10 dBi = −30 dBm/MHz (for RBM).
where 3 dB is a multiple antenna ports compensation: $10 \times \log_{10}(2) = 3$ dB

8.5.4 Test data

Table 8.5-4: *Spurious emissions within restricted bands results as per for Hub*

Chain	Modulation	Channel	Frequency, MHz	Peak, dBm	Peak limit, dBm	Peak margin, dB	Average, dBm	Average limit, dBm	Average margin, dB
ch0	QPSK	Low	5122	-50.04	-40.23	9.81	-60.43	-60.23	0.20
		High	5039	-49.42	-40.23	9.19	-60.66	-60.23	0.43
	256-QAM	Low	5138	-49.67	-40.23	9.44	-60.79	-60.23	0.56
		High	5118	-50.38	-40.23	10.15	-61.46	-60.23	1.23
ch1	QPSK	Low	4984	-50.70	-40.23	10.47	-61.98	-60.23	1.75
		High	5138	-50.61	-40.23	10.38	-61.72	-60.23	1.49
	256-QAM	Low	5138	-50.49	-40.23	10.26	-61.56	-60.23	1.33
		High	5087	-52.04	-40.23	11.81	-61.43	-60.23	1.20

Note: highest radiated emission equivalent is 53.80 dBµV/m at 3 m distance at ch0 QPSK low channel at the 5122 MHz.

Table 8.5-5: *Spurious emissions within restricted bands results as per for RBM*

Chain	Modulation	Channel	Frequency, MHz	Peak, dBm	Peak limit, dBm	Peak margin, dB	Average, dBm	Average limit, dBm	Average margin, dB
ch0	QPSK	Low	5102	-49.66	-34.23	15.43	-58.55	-54.23	4.32
			5377	-49.98	-34.23	15.75	-58.87	-54.23	4.64
		High	5135	-50.10	-34.23	15.87	-58.99	-54.23	4.76
			5352	-51.10	-34.23	16.87	-59.44	-54.23	5.21
	256-QAM	Low	5123	-49.31	-34.23	15.08	-58.02	-54.23	3.79
			5375	-50.35	-34.23	16.12	-59.37	-54.23	5.14
		High	5086	-49.25	-34.23	15.02	-58.05	-54.23	3.82
			5351	-50.84	-34.23	16.61	-59.73	-54.23	5.50
ch1	QPSK	Low	4918	-51.13	-34.23	16.90	-60.02	-54.23	5.79
			5390	-52.12	-34.23	17.89	-58.88	-54.23	4.65
		High	5003	-50.33	-34.23	16.10	-61.19	-54.23	6.96
			5386	-51.93	-34.23	17.70	-60.77	-54.23	6.54
	256-QAM	Low	4977	-51.73	-34.23	17.50	-60.84	-54.23	6.61
			5384	-52.94	-34.23	18.71	-62.02	-54.23	7.79
		High	5111	-51.07	-34.23	16.84	-59.18	-54.23	4.95
			5354	-51.87	-34.23	17.64	-60.21	-54.23	5.98

8.5.4 Test data, continued

Table 8.5-6: *Spurious emissions at the band edges for Hub*

Chain	Modulation	Channel	Frequency, MHz	Peak level, dBm/MHz	Limit, dBm/MHz	Margin, dB
ch0	QPSK	Low	5715	-46.13	-46.00	0.13
			5725	-37.35	-36.00	1.35
		High	5825	-36.43	-36.00	0.43
			5835	-47.45	-46.00	1.45
	256-QAM	Low	5715	-46.02	-46.00	0.02
			5725	-38.56	-36.00	2.56
		High	5825	-37.97	-36.00	1.97
			5835	-46.93	-46.00	0.93
ch1	QPSK	Low	5715	-46.30	-46.00	0.30
			5725	-36.54	-36.00	0.54
		High	5825	-38.82	-36.00	2.82
			5835	-48.96	-46.00	2.96
	256-QAM	Low	5715	-46.73	-46.00	0.73
			5725	-37.34	-36.00	1.34
		High	5825	-38.96	-36.00	2.96
			5835	-47.09	-46.00	1.09

Table 8.5-7: *Spurious emissions at the band edges for RBM*

Chain	Modulation	Channel	Frequency, MHz	Peak level, dBm/MHz	Limit, dBm/MHz	Margin, dB
ch0	QPSK	Low	5715	-40.64	-40.00	0.64
			5725	-31.52	-30.00	1.52
		High	5825	-30.31	-30.00	0.31
			5835	-44.33	-40.00	4.33
	256-QAM	Low	5715	-41.93	-40.00	1.93
			5725	-31.36	-30.00	1.36
		High	5825	-30.33	-30.00	0.33
			5835	-42.86	-40.00	2.86
ch1	QPSK	Low	5715	-41.61	-40.00	1.61
			5725	-30.06	-30.00	0.06
		High	5825	-30.15	-30.00	0.15
			5835	-42.20	-40.00	2.20
	256-QAM	Low	5715	-40.25	-40.00	0.25
			5725	-33.50	-30.00	3.50
		High	5825	-31.21	-30.00	1.21
			5835	-42.19	-40.00	2.19

8.5.4 Test data, continued

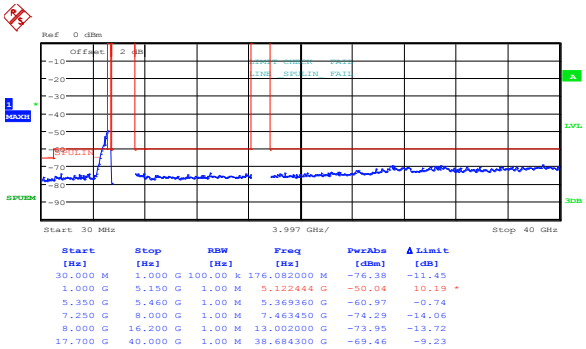


Figure 8.5-1: *Conducted spurious emissions within restricted bands, QPSK, low channel, ch0, Hub*

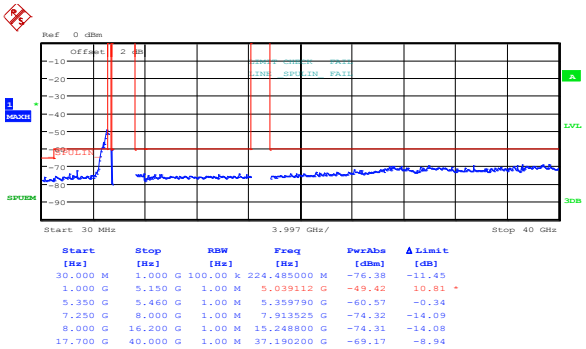


Figure 8.5-2: *Conducted spurious emissions within restricted bands, QPSK, high channel, ch0, Hub*

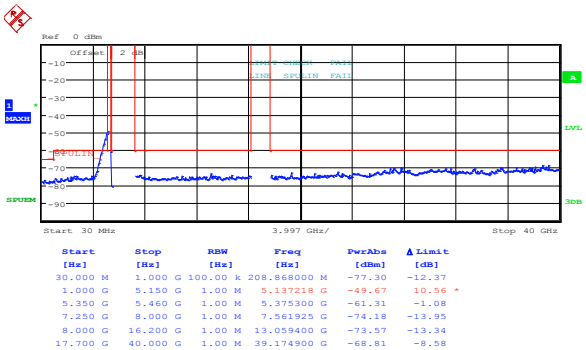


Figure 8.5-3: *Conducted spurious emissions within restricted bands, 256-QAM, low channel, ch0, Hub*

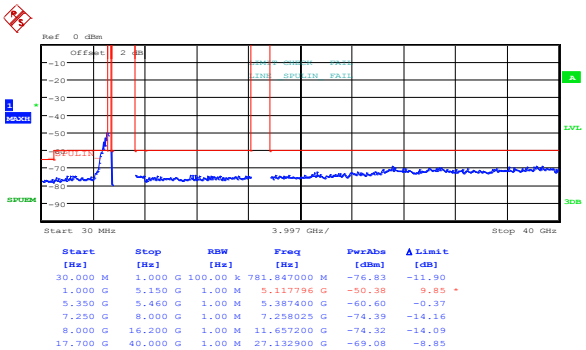


Figure 8.5-4: *Conducted spurious emissions within restricted bands, 256-QAM, high channel, ch0, Hub*

8.5.4 Test data, continued

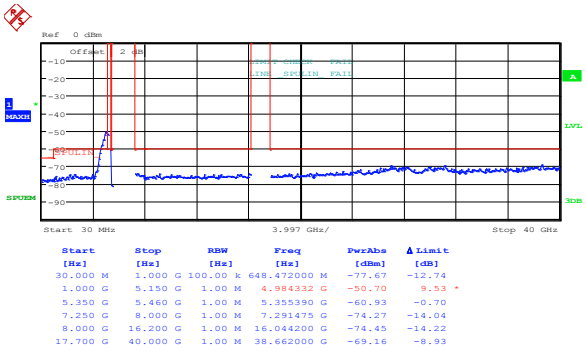


Figure 8.5-5: *Conducted spurious emissions within restricted bands, QPSK, low channel, ch1, Hub*

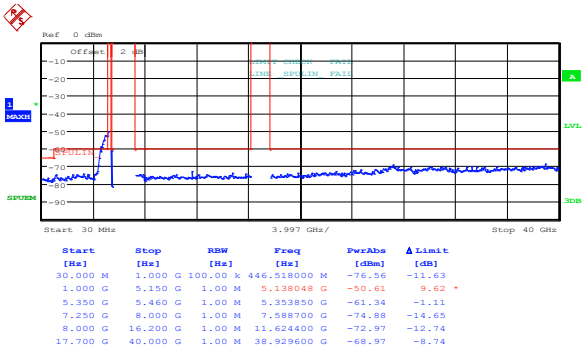


Figure 8.5-6: *Conducted spurious emissions within restricted bands, QPSK, high channel, ch1, Hub*

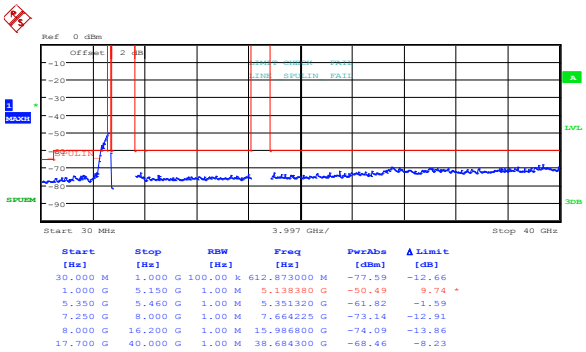


Figure 8.5-7: *Conducted spurious emissions within restricted bands, 256-QAM, low channel, ch1, Hub*

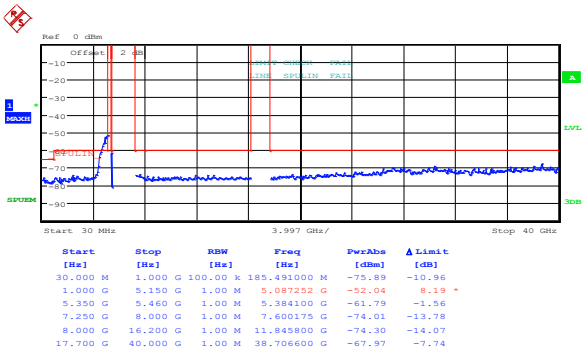


Figure 8.5-8: *Conducted spurious emissions within restricted bands, 256-QAM, high channel, ch1, Hub*

8.5.4 Test data, continued

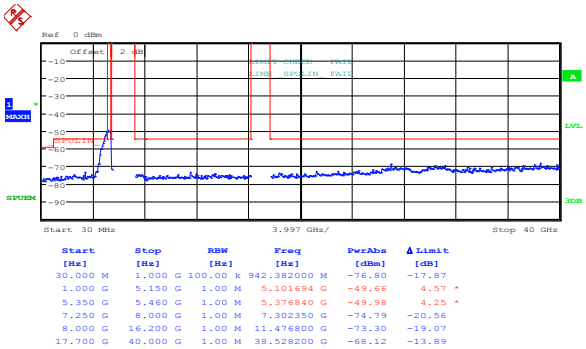


Figure 8.5-9: *Conducted spurious emissions within restricted bands, QPSK, low channel, cho, RBM*

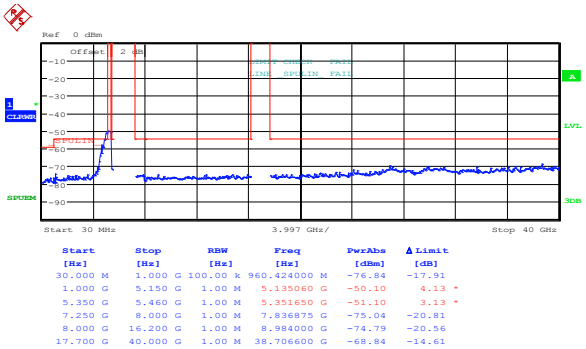


Figure 8.5-10: *Conducted spurious emissions within restricted bands, QPSK, high channel, cho, RBM*

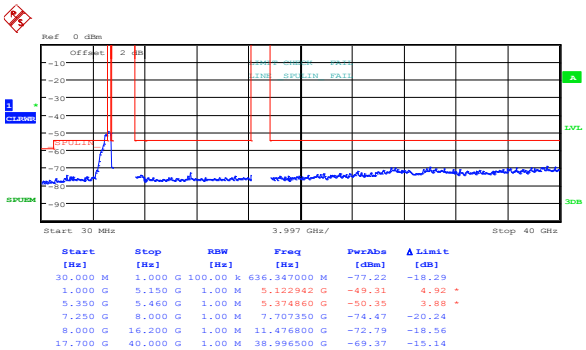


Figure 8.5-11: *Conducted spurious emissions within restricted bands, 256-QAM, low channel, cho, RBM*

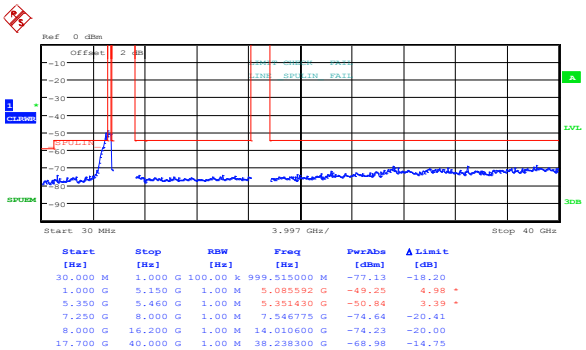
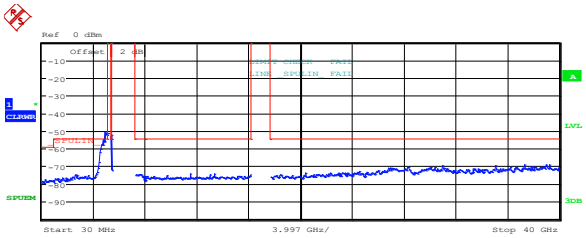


Figure 8.5-12: *Conducted spurious emissions within restricted bands, 256-QAM, high channel, cho, RBM*

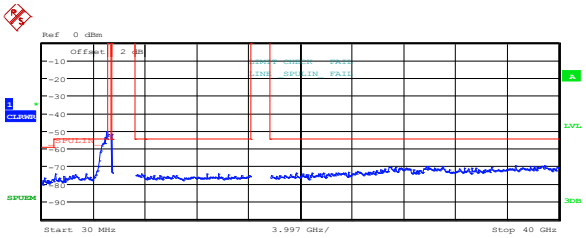
8.5.4 Test data, continued



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	274.440000 M	-77.70	-18.77
1.000 G	5.150 G	1.00 M	4.918264 G	-51.13	3.10 *
5.350 G	5.460 G	1.00 M	5.389710 G	-52.12	2.11 *
7.250 G	8.000 G	1.00 M	7.313900 G	-74.66	-20.43
8.000 G	16.200 G	1.00 M	11.476800 G	-74.21	-19.98
17.700 G	40.000 G	1.00 M	37.257100 G	-69.11	-14.88

Date: 8.JAN.2014 10:17:57

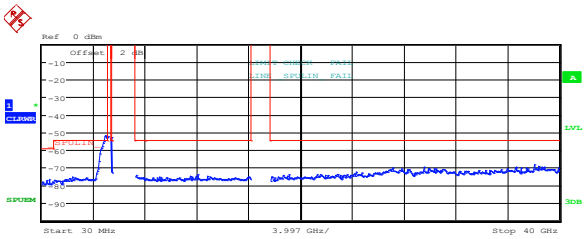
Figure 8.5-13: *Conducted spurious emissions within restricted bands, QPSK, low channel, ch1, RBM*



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	252.130000 M	-76.67	-17.74
1.000 G	5.150 G	1.00 M	5.002924 G	-50.33	3.90 *
5.350 G	5.460 G	1.00 M	5.386080 G	-51.93	2.30 *
7.250 G	8.000 G	1.00 M	7.691675 G	-74.54	-20.31
8.000 G	16.200 G	1.00 M	13.682600 G	-74.38	-20.15
17.700 G	40.000 G	1.00 M	38.907300 G	-69.63	-15.40

Date: 8.JAN.2014 10:16:35

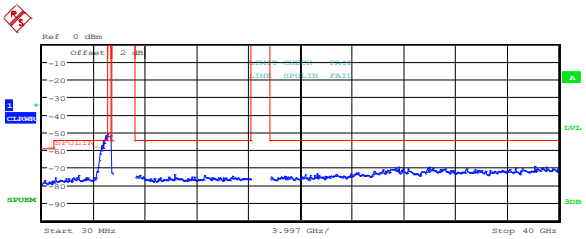
Figure 8.5-14: *Conducted spurious emissions within restricted bands, QPSK, high channel, ch1, RBM*



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	622.282000 M	-76.54	-17.61
1.000 G	5.150 G	1.00 M	4.976862 G	-51.73	2.50 *
5.350 G	5.460 G	1.00 M	5.383770 G	-52.94	1.29 *
7.250 G	8.000 G	1.00 M	7.330775 G	-74.27	-20.04
8.000 G	16.200 G	1.00 M	12.075400 G	-74.01	-19.78
17.700 G	40.000 G	1.00 M	38.082200 G	-68.53	-14.30

Date: 8.JAN.2014 10:11:29

Figure 8.5-15: *Conducted spurious emissions within restricted bands, 256-QAM, low channel, ch1, RBM*



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
30.000 M	1.000 G	100.00 k	239.908000 M	-77.14	-18.21
1.000 G	5.150 G	1.00 M	5.110492 G	-51.07	3.16 *
5.350 G	5.460 G	1.00 M	5.353520 G	-51.87	2.36 *
7.250 G	8.000 G	1.00 M	7.558475 G	-74.46	-20.23
8.000 G	16.200 G	1.00 M	10.255000 G	-73.79	-19.56
17.700 G	40.000 G	1.00 M	38.149100 G	-69.25	-15.02

Date: 8.JAN.2014 10:14:35

Figure 8.5-16: *Conducted spurious emissions within restricted bands, 256-QAM, high channel, ch1, RBM*

8.5.4 Test data, continued

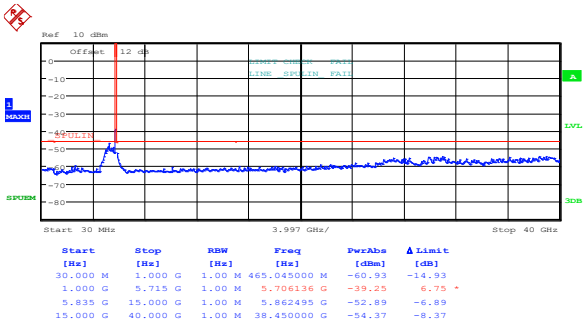


Figure 8.5-17: *Conducted spurious emissions outside restricted bands, QPSK, low channel, cho, Hub*

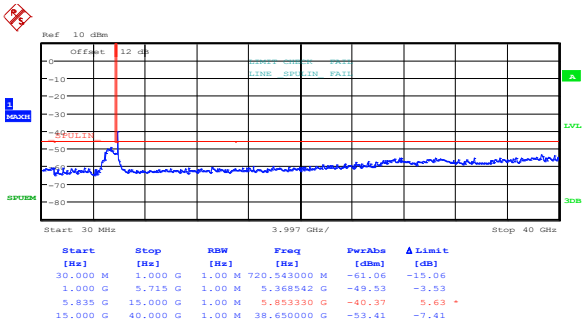


Figure 8.5-18: *Conducted spurious emissions outside restricted bands, QPSK, high channel, cho, Hub*

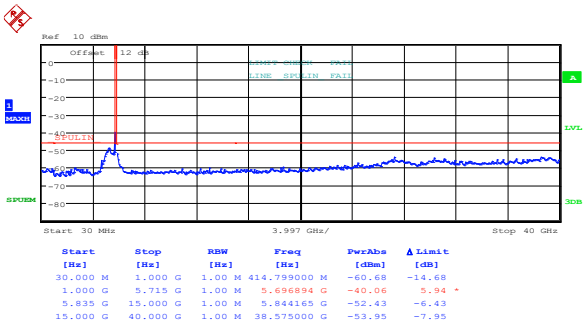


Figure 8.5-19: *Conducted spurious emissions outside restricted bands, 256-QAM, low channel, cho, Hub*

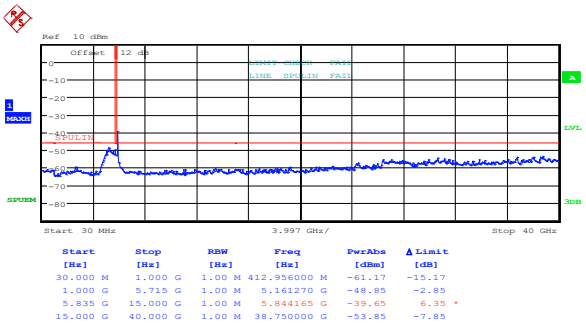


Figure 8.5-20: *Conducted spurious emissions outside restricted bands, 256-QAM, high channel, cho, Hub*

8.5.4 Test data, continued

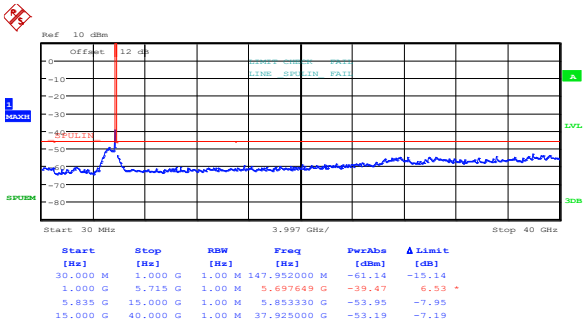


Figure 8.5-21: *Conducted spurious emissions outside restricted bands, QPSK, low channel, ch1, Hub*

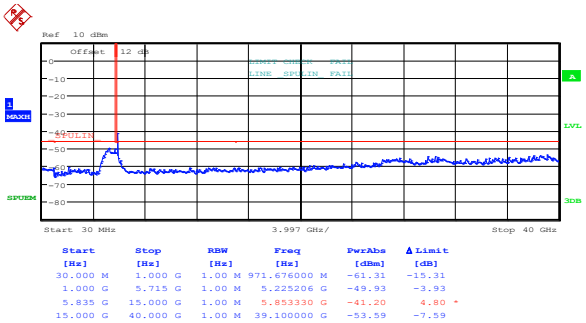


Figure 8.5-22: *Conducted spurious emissions outside restricted bands, QPSK, high channel, ch1, Hub*

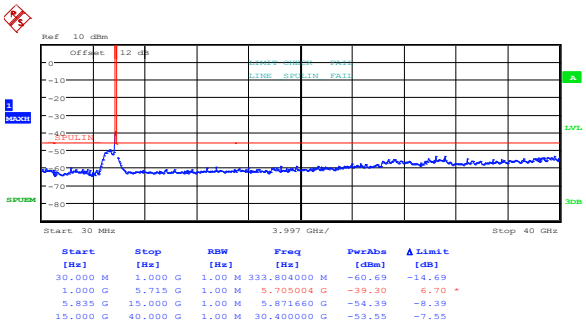


Figure 8.5-23: *Conducted spurious emissions outside restricted bands, 256-QAM, low channel, ch1, Hub*

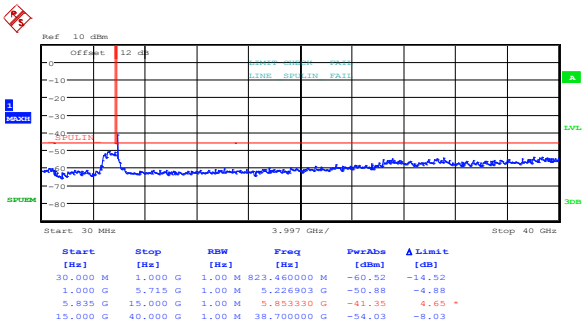


Figure 8.5-24: *Conducted spurious emissions outside restricted bands, 256-QAM, high channel, ch1, Hub*

8.5.4 Test data, continued

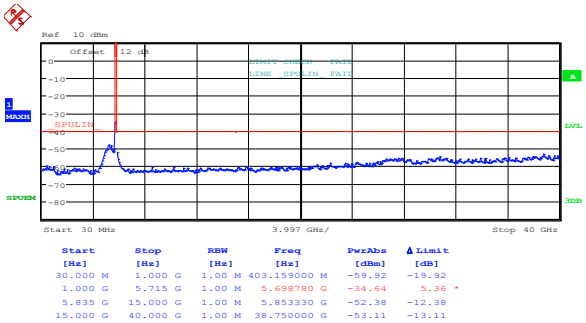


Figure 8.5-25: *Conducted spurious emissions outside restricted bands, QPSK, low channel, cho, RBM*

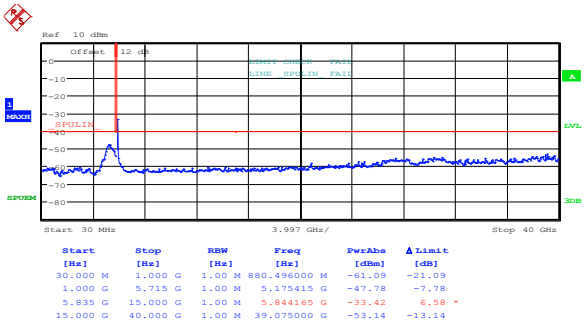


Figure 8.5-26: *Conducted spurious emissions outside restricted bands, QPSK, high channel, cho, RBM*

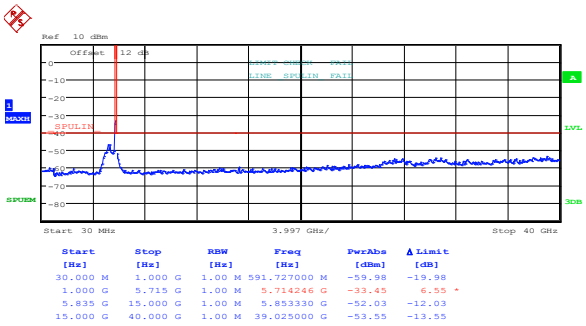


Figure 8.5-27: *Conducted spurious emissions outside restricted bands, 256-QAM, low channel, cho, RBM*

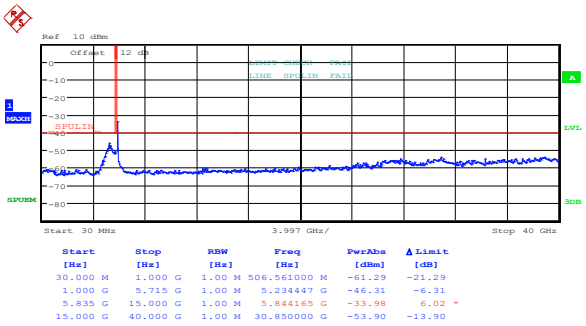


Figure 8.5-28: *Conducted spurious emissions outside restricted bands, 256-QAM, high channel, cho, RBM*

8.5.4 Test data, continued

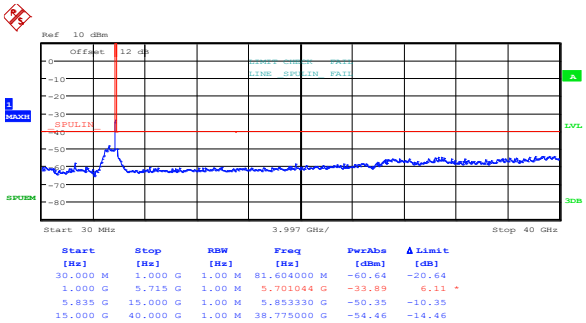


Figure 8.5-29: *Conducted spurious emissions outside restricted bands, QPSK, low channel, ch1, RBM*

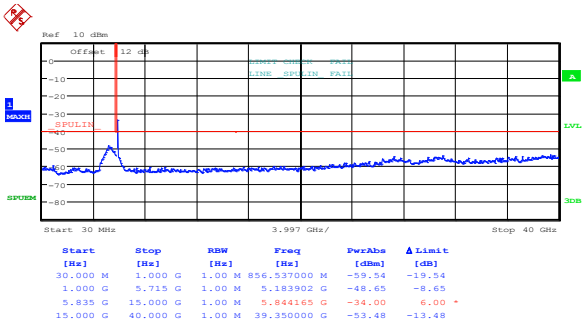


Figure 8.5-30: *Conducted spurious emissions outside restricted bands, QPSK, high channel, ch1, RBM*

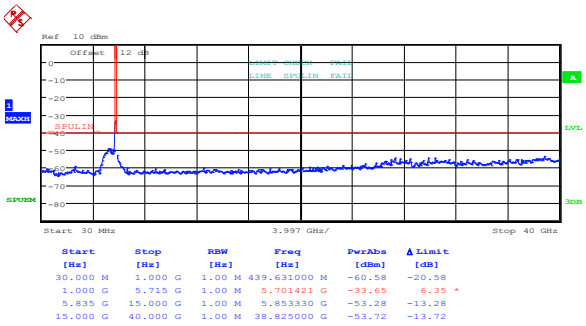


Figure 8.5-31: *Conducted spurious emissions outside restricted bands, 256-QAM, low channel, ch1, RBM*

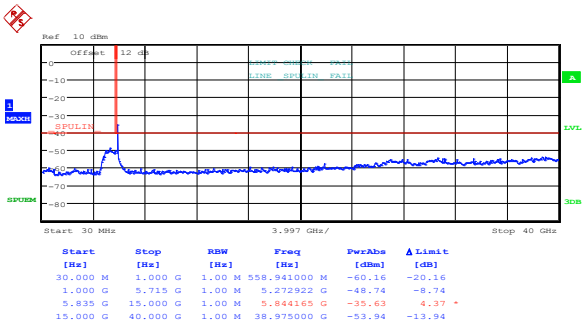


Figure 8.5-32: *Conducted spurious emissions outside restricted bands, 256-QAM, high channel, ch1, RBM*

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:	January 9, 2014	Temperature:	21 °C
Test engineer:	Andrey Adelberg	Air pressure:	1035 mbar
Verdict:	Pass	Relative humidity:	32 %

8.6.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
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	5.80999387	1001
+40 °C, Nominal	5.80999354	667
+30 °C, Nominal	5.80999293	59
+20 °C, +15 %	5.80999290	30
+20 °C, Nominal	5.80999287	*Reference*
+20 °C, −15 %	5.80999287	-3
+10 °C, Nominal	5.80999288	14
0 °C, Nominal	5.80999295	77
−10 °C, Nominal	5.80999339	519
−20 °C, Nominal	5.80999467	1799
−30 °C, Nominal	5.80999598	3108

8.6.4 Test data, continued

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

−26 dBc lower cross point, GHz	Max negative drift, Hz	Drifted lower cross point, GHz	Band edge, GHz	Margin, MHz
5.7250038	3	5.72500384	5.725	0.003843

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

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

−26 dBc upper cross point, GHz	Max positive drift, Hz	Drifted upper cross point, GHz	Band edge, GHz	Margin, MHz
5.8249962	3108	5.82499926	5.825	0.000738

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:
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 in Section 8.4 of this document) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.
IC:
Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average ($10 \times \log_{10}$ (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:	January 8, 2014	Temperature:	21 °C
Test engineer:	Andrey Adelberg	Air pressure:	1003 mbar
Verdict:	Pass	Relative humidity:	30 %

8.7.3 Observations, settings and special notes

FCC test was performed using method described in 789033 D01 General UNII Test Procedures v01r03 under sections G.
For PPSD and Average results please refer to Section 8.4 of this document

8.7.4 Test data

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

Modulation	Frequency, MHz	Peak max-hold measurement, dBm	PPSD measurement, dBm/MHz	Ratio of peak excursion, dB	Peak excursion limit, dB	Margin, dB
QPSK	5740	20.42	9.37	11.05	13.00	1.95
	5775	19.63	9.15	10.48	13.00	2.52
	5810	19.69	9.33	10.36	13.00	2.64
256-QAM	5740	20.45	10.27	10.18	13.00	2.82
	5775	19.77	9.82	9.95	13.00	3.05
	5810	19.74	10.07	9.67	13.00	3.33

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

8.7.4 Test data, continued

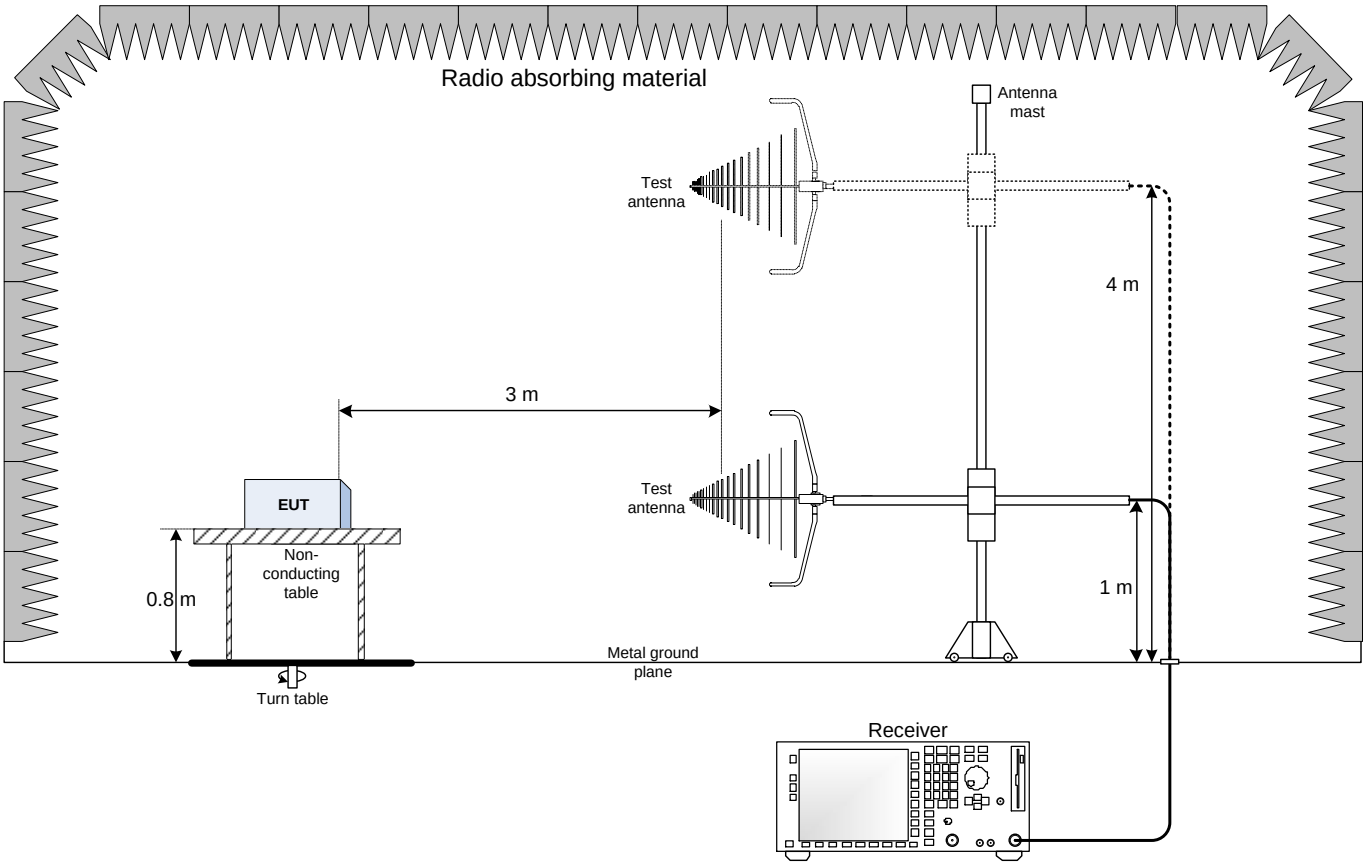
Table 8.7-2: *IC PSD-to-average calculations results*

Modulation	Frequency, MHz	PSD result, dBm/MHz	Average result, dBm	PSD to average, dB		
				Ratio	Limit	Margin
QPSK	5740	9.37	21.39	-12.02	3.00	15.02
	5775	9.15	21.21	-12.06	3.00	15.06
	5810	9.33	21.36	-12.03	3.00	15.03
256-QAM	5740	10.27	22.27	-12.00	3.00	15.00
	5775	9.82	21.84	-12.02	3.00	15.02
	5810	10.07	22.09	-12.02	3.00	15.02

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