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Test report

237492-3TRFWL

Date of issue: May 16, 2013

Applicant:

Redline Communications

Product:

Broad-band wireless infrastructure product

Model:

RDL-3000-RMG

FCC ID: QC8-RDL3000RMG

IC Registration number: 4310A-RDL3000RMG

FCC 47 CFR Part 15 Subpart C, §15.407

Unlicensed National Information Infrastructure Devises

RSS-210, Issue 8 Annex 9, December 2010

Local Area Network Devices

Test location

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May 16, 2013

Date

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

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Section 1. Report summary

1.1 Applicant and manufacturer

Redline Communications
302 Town Center Blvd.
Markham, Ontario,
Canada, L3R 0E8

1.2 Test specifications

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

1.3 Test methods

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E	789033 D01 General UNII Test Procedures v01r02 (September 26, 2012)
Emissions testing of transmitters with multiple outputs in the same band (MIMO)	662911 D01 Multiple Transmitter Output v01r02 (September 26, 2012)
AC power-line conducted emission measurements	ANSI C63.4-2009, Clause 7

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

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

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

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

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

[2]The EUT requires professional installation.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Pass
§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	Pass
§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	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)[1]	Not tested

Note: DFS measurements were not tested at Nemko Canada lab. It's up to manufacturer to provide the results for the DFS requirements.

2.3 IC 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: [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 and e.i.r.p. limits	
A9.2 (1)	5150–5250 MHz band	Not applicable
A9.2 (2)	5250–5350 MHz band	Pass
A9.2 (3)	5470–5600 MHz and 5650–5725 MHz bands	Not applicable
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	Pass
A9.2 (3)	5470–5600 MHz and 5650–5725 MHz bands	Not applicable
A9.2 (4)	5725–5825 MHz band	Not applicable
A9.3	Dynamic Frequency Selection (DFS) for devices operating in the 5250–5350 MHz and 5470–5725 MHz bands	Not tested[1]
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[2]
A9.4 (5)	Mobile satellite services	Not applicable

Notes: [1]DFS measurements were not tested at Nemko Canada lab. It's up to manufacturer to provide the results for the DFS requirements.

[2]It's up to applicant to fulfill the discontinuation of transmission requirements.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 21, 2013
Nemko sample ID number	1

3.2 EUT information

Product name	Broad-band wireless infrastructure product
Model	RDL-3000-RMG
Serial number	149PC12480006

3.3 Technical information

Operating band	5250–5350 MHz
Operating frequency	5252.5–5345 MHz (5 MHz channel), 5255–5342.5 MHz (10 MHz channel) and 5260–5337.5 MHz (20 MHz channel)
Modulation type	OFDM using 64-QAM, 16-QAM, QPSK and BPSK modulation for sub-carriers
Channel bandwidths	5, 10 and 20 MHz
Emission designator	W7D
Power requirements	48 V_{DC} PoE via 120 V_{AC}, 60 Hz
Antenna information	19 dBi Dual Polarization/ Dual Slant Subscriber Antenna 4.9–6.1 GHz, Redline 30-00328-50 10 dBi L-COM HG5158DP-10U, L-COM 32 dBi Redline A3FT3204LTPD Parabolic Antenna, 4.9–5.8 GHz, 4 degree, dual polarity The EUT is professionally installed.

3.4 Product description and theory of operation

The EUT is a 2×2 MIMO point-to-multipoint (PMP) carrier grade broadband wireless infrastructure product, designed to operate in the 5250–5350 MHz band.

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

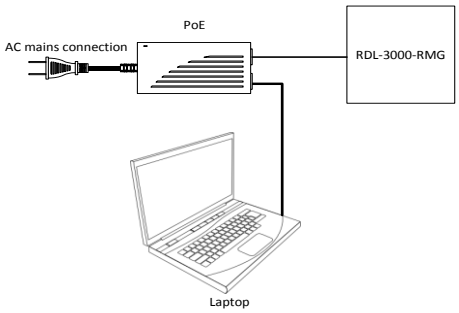


Diagram 3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
PoE	Cincon Electronics Co.	TRG60A-POE-L	1127

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

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

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

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±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. 09/13
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 08/13
Bilog antenna	Sunol	JB3	FA002108	1 year	Feb. 21/14
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 21/14
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	July 03/13
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Jan. 16/14
18–26 GHz pre-amplifier	Narda	BBS-1826N612	FA001550	—	VOU
Horn antenna 18–26.5 GHz	Electro-metrics	SH-50/60-1	FA000479	—	VOU
Horn antenna 26.5–40 GHz	Electro-metrics	SH-50/60-2	FA000485	—	VOU
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR

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 25, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1003 mbar	**Relative humidity**	32 %

8.1.3 Observations/special notes

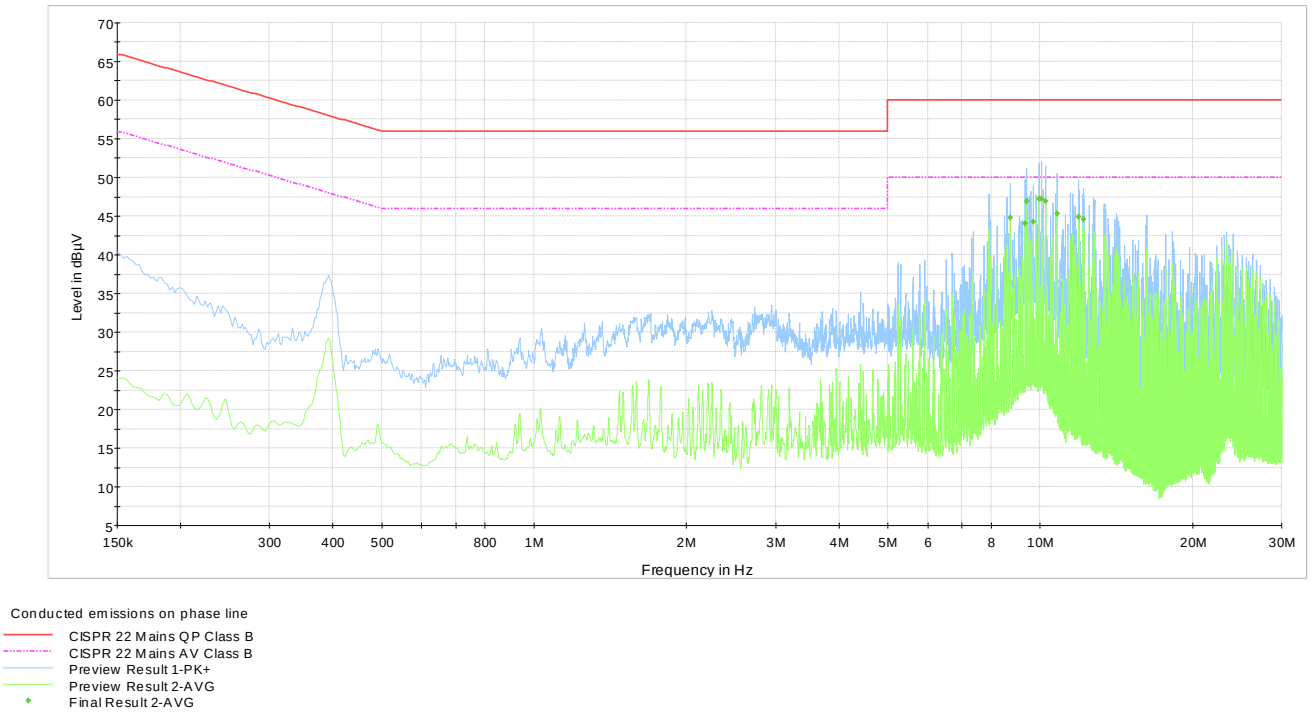
The EUT was set up as tabletop configuration.

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: Peak and Average detector (Max hold), RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms
Receiver settings for final measurements: Q-Peak and Average detector, RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms

8.1.4 Test data

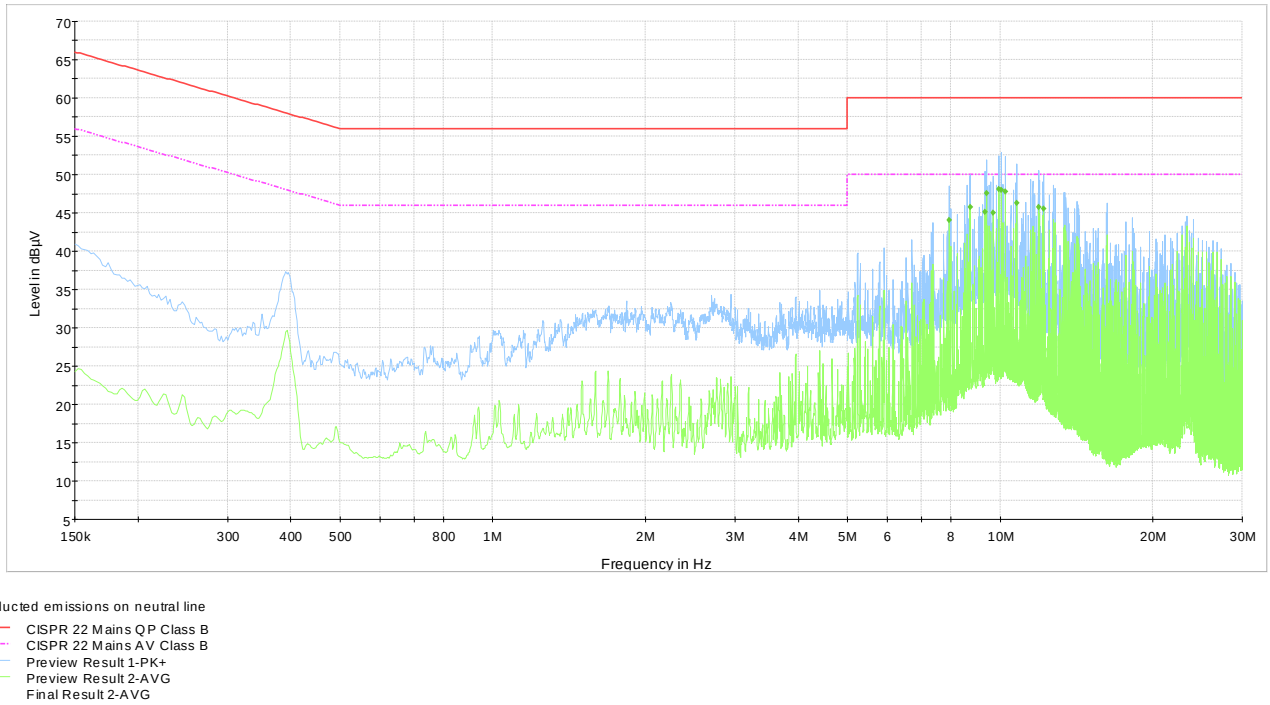


Plot 8.1-1: *Conducted emissions on phase line*

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

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Conductor	Correction, dB	Margin, dB	Limit, dBµV
8.718000	44.8	100	9	On	Phase	10.2	5.2	50.0
9.327750	44.1	100	9	On	Phase	10.2	5.9	50.0
9.388500	46.9	100	9	On	Phase	10.2	3.1	50.0
9.694500	44.3	100	9	On	Phase	10.2	5.7	50.0
9.937500	47.2	100	9	On	Phase	10.3	2.8	50.0
10.060750	47.3	100	9	On	Phase	10.3	2.7	50.0
10.243000	46.9	100	9	On	Phase	10.3	3.1	50.0
10.794250	45.3	100	9	On	Phase	10.3	4.7	50.0
11.892250	44.9	100	9	On	Phase	10.4	5.1	50.0
12.198250	44.6	100	9	On	Phase	10.4	5.4	50.0

8.1.4 Test data, continued



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

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

Frequency, MHz	Average result, dBµV	Meas. Time, ms	Bandwidth, kHz	Filter	Conductor	Correction, dB	Margin, dB	Limit, dBµV
7.923750	44.0	100	9	On	Neutral	10.2	6.0	50.0
8.718000	45.8	100	9	On	Neutral	10.3	4.2	50.0
9.327750	45.2	100	9	On	Neutral	10.3	4.8	50.0
9.388500	47.5	100	9	On	Neutral	10.3	2.5	50.0
9.694500	45.0	100	9	On	Neutral	10.3	5.0	50.0
9.937500	48.1	100	9	On	Neutral	10.3	1.9	50.0
10.060750	48.0	100	9	On	Neutral	10.3	2.0	50.0
10.243000	47.8	100	9	On	Neutral	10.3	2.2	50.0
10.794250	46.3	100	9	On	Neutral	10.4	3.7	50.0
11.892250	45.8	100	9	On	Neutral	10.4	4.2	50.0
12.198250	45.5	100	9	On	Neutral	10.5	4.5	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	February 5, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1004 mbar	**Relative humidity**	32 %

8.2.3 Observations/special notes

Measurements were performed with peak detector using RBW approximately 1 % of the emission BW. VBW was set three times RBW.

8.2.4 Test data

Table 8.2-1: *26 dB bandwidth results for 5 MHz channel*

Frequency, MHz	26 dB bandwidth, MHz
5252.5	4.68
5300.0	4.68
5345.0	4.68

Table 8.2-2: *26 dB bandwidth results for 10 MHz channel*

Frequency, MHz	26 dB bandwidth, MHz
5255.0	9.29
5300.0	9.29
5342.5	9.29

Table 8.2-3: *26 dB bandwidth results for 20 MHz channel*

Frequency, MHz	26 dB bandwidth, MHz
5260.0	18.59
5300.0	18.59
5337.5	18.59

8.2.4 Test data, continued

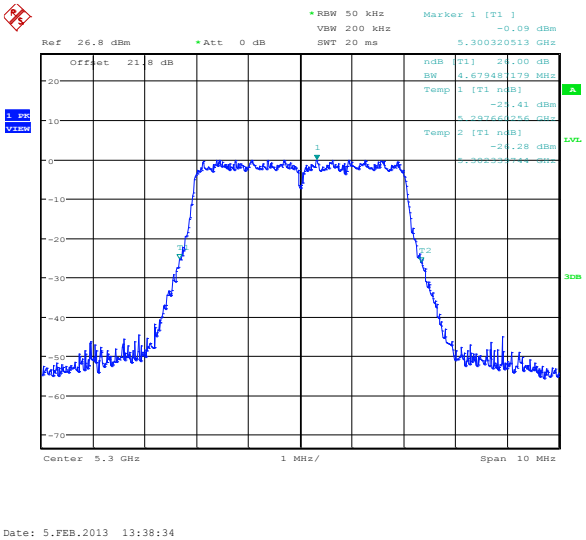


Diagram 8.2-1: *26 dB bandwidth on 5 MHz channel, sample plot*

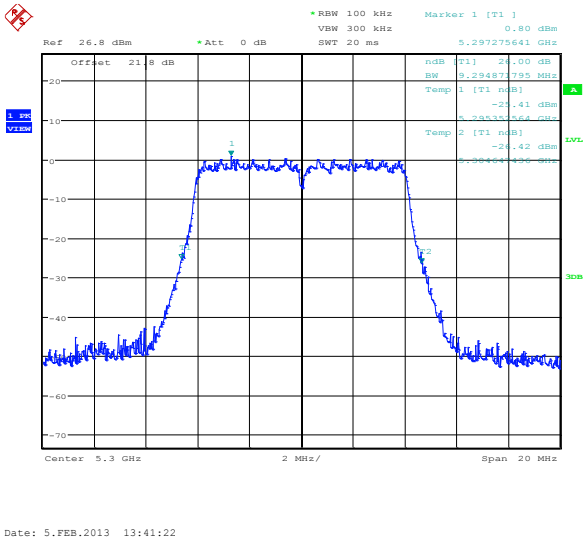


Diagram 8.2-2: *26 dB bandwidth on 10 MHz channel, sample plot*

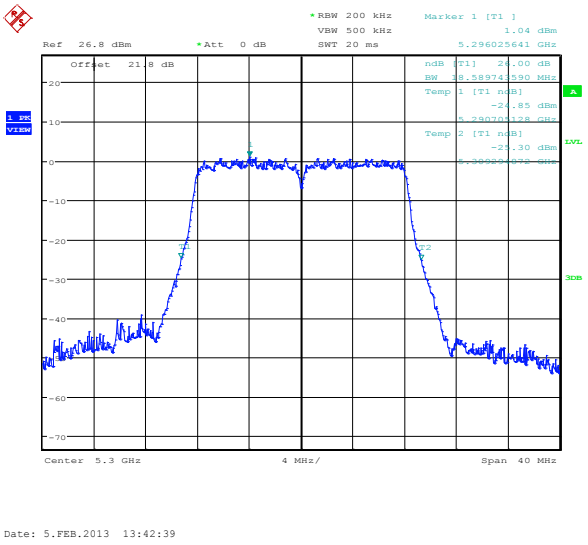


Diagram 8.2-3: *26 dB bandwidth on 20 MHz channel, sample plot*

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	February 5, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1004 mbar	**Relative humidity**	32 %

8.3.3 Observations/special notes

Measurements were performed with peak detector using RBW ≥ 1 % of span; VBW was set three times RBW.

8.3.4 Test data

Table 8.3-1: *99 % bandwidth results for 5 MHz channel*

Frequency, MHz	99 % bandwidth, MHz
5252.5	4.13
5300.0	4.14
5345.0	4.13

Table 8.3-2: *99 % bandwidth results for 10 MHz channel*

Frequency, MHz	99 % bandwidth, MHz
5255.0	8.27
5300.0	8.27
5342.5	8.26

Table 8.3-3: *99 % bandwidth results for 20 MHz channel*

Frequency, MHz	99 % bandwidth, MHz
5260.0	16.43
5300.0	16.44
5337.5	16.44

8.3.4 Test data, continued

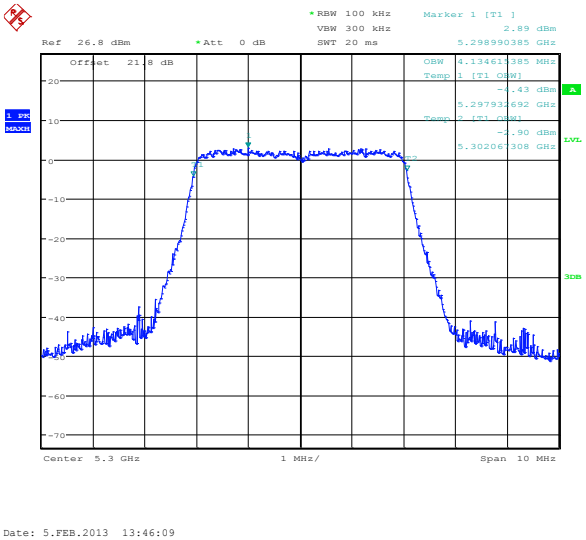


Diagram 8.3-1: *99 % bandwidth on 5 MHz channel, sample plot*

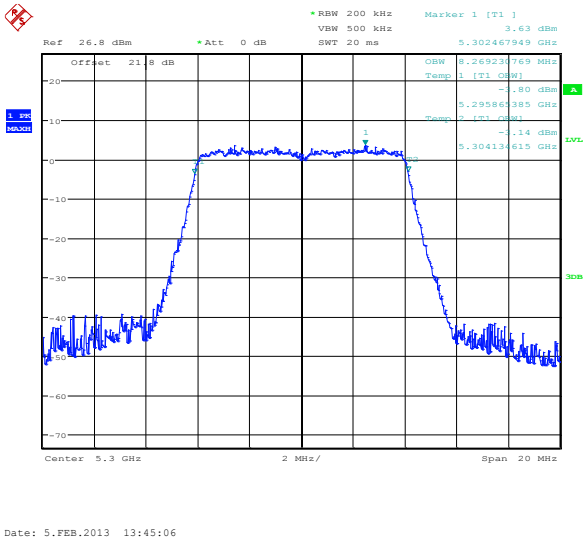


Diagram 8.3-2: *99 % bandwidth on 10 MHz channel, sample plot*

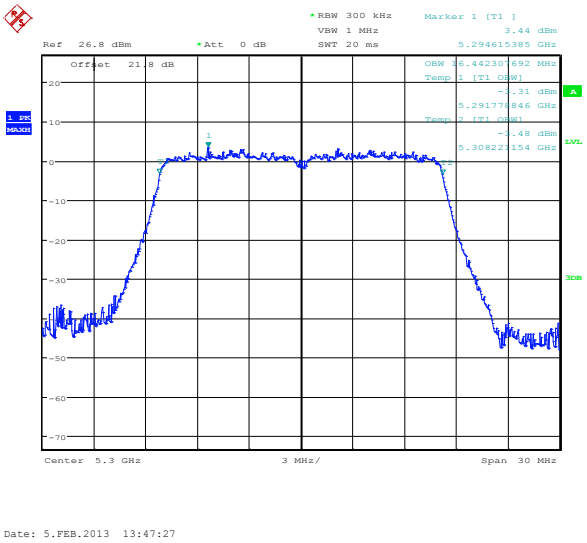


Diagram 8.3-3: *99 % bandwidth on 20 MHz channel, sample plot*

8.4 FCC 15.407(a)(2) and RSS-210 A9.2(2) 5.25–5.35 GHz band output power, EIRP and spectral density limits

8.4.1 Definitions and limits

FCC:

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 11 dBm + 10 $\log_{10}$(B), 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 megahertz 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.

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.

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.

(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).

IC:

The maximum conducted output power shall not exceed 250 mW (24 dBm) or 11 + 10 $\log_{10}$(B), dBm, whichever power is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or 17 + 10 $\log_{10}$(B), 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).

In addition to the above requirements, devices operating in the band 5250–5350 MHz with a maximum e.i.r.p. greater than 200 mW (23 dBm) shall comply with the following e.i.r.p. elevation mask, where θ is the angle above the local horizontal plane (of the Earth) as shown in the table below:

Table 8.4-1: *Elevation mask requirements*

Angle above the local horizontal plane	Maximum EIRP (dBW/MHz)		Maximum EIRP (dBm/MHz)
0º ≤ θ < 8º	−13	−13	17
8º ≤ θ < 40º	−13 − 0.716 (θ–8)	−13 to −36	17 to −6
40º ≤ θ ≤ 45º	−35.9 − 1.22 (θ–40)	−36 to −42	−6 to −12
θ > 45º	−42	−42	−12

8.4.2 Test summary

Test date	February 5, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1004 mbar	**Relative humidity**	32 %

8.4.3 Observations/special notes

The test was performed according to UNII guidelines (789033 D01 General UNII Test Procedures v01r02) section (3)(b) Method SA-1: maximum conducted (average) output power using Spectrum Analyzer with RMS detector.

FCC EBW (26 dB BW) for 5 MHz channel is 4.68 MHz, for 10 MHz channel is 9.29 MHz and for 20 MHz channel is 18.59 MHz.

Output power limit calculation for 10 dBi antenna (FCC):
For 5 MHz channel 11 + 10 × $\log_{10}$ (4.68) dBm – (10 dBi – 6 dBi) = 13.70 dBm;
For 10 MHz channel 11 + 10 × $\log_{10}$ (9.29) dBm – (10 dBi – 6 dBi) = 16.68 dBm
For 20 MHz channel 11 + 10 × $\log_{10}$ (18.59) dBm – (10 dBi – 6 dBi) = 19.68 dBm

Output power limit calculation for 19 dBi antenna (FCC):
For 5 MHz channel 11 + 10 × $\log_{10}$ (4.68) dBm – (19 dBi – 6 dBi) = 4.70 dBm;
For 10 MHz channel 11 + 10 × $\log_{10}$ (9.29) dBm – (19 dBi – 6 dBi) = 7.68 dBm
For 20 MHz channel 11 + 10 × $\log_{10}$ (18.59) dBm – (19 dBi – 6 dBi) = 10.68 dBm

Output power limit calculation for 32 dBi antenna (FCC):
For 5 MHz channel 11 + 10 × $\log_{10}$ (4.68) dBm – (32 dBi – 6 dBi) = −8.30 dBm;
For 10 MHz channel 11 + 10 × $\log_{10}$ (9.29) dBm – (32 dBi – 6 dBi) = −5.32 dBm
For 20 MHz channel 11 + 10 × $\log_{10}$ (18.59) dBm – (32 dBi – 6 dBi) = −2.32 dBm

PSD limit calculation (FCC):
For 10 dBi antenna: 11 dBm/MHz – (10 dBi – 6 dBi) = 7 dBm/MHz
For 19 dBi antenna: 11 dBm/MHz – (19 dBi – 6 dBi) = −2 dBm/MHz
For 32 dBi antenna: 11 dBm/MHz – (32 dBi – 6 dBi) = −15 dBm/MHz

IC EBW (99 % OBW) for 5 MHz channel is 4.14 MHz, for 10 MHz channel is 8.27 MHz and for 20 MHz channel is 16.44 MHz.

Output power limit calculation (IC):
For 5 MHz channel 11 + 10 × $\log_{10}$ (4.14) dBm = 17.17 dBm;
For 10 MHz channel 11 + 10 × $\log_{10}$ (8.27) dBm = 20.18 dBm
For 20 MHz channel 11 + 10 × $\log_{10}$ (16.44) dBm = 23.16 dBm
Note: EIRP limit is 6 dB higher than the output power limit

IC: Maximum EIRP is 22.99 dBm which is less than 23 dBm (200 mW) – no TPC and elevation mask compliance is required

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 PSD was calculated as follows:

$$PSD_{combined} = 10 \times log_{10}\left(\left(10^{PSD_{ch0}/10}\right) + \left(10^{PSD_{ch1}/10}\right)\right)$$

8.4.4 Test data

Table 8.4-2: *Output power measurements and (10 dBi antenna) EIRP calculations results at 5 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5252.5	8.51	7.53	11.06	13.70	2.64
	5300.0	8.45	8.66	11.57	13.70	2.14
	5345.0	7.68	7.51	10.61	13.70	3.10
QPSK	5252.5	8.50	7.55	11.06	13.70	2.64
	5300.0	8.44	8.66	11.56	13.70	2.14
	5345.0	7.62	7.63	10.64	13.70	3.07
16-QAM	5252.5	8.52	7.56	11.08	13.70	2.63
	5300.0	8.46	8.68	11.58	13.70	2.12
	5345.0	7.62	7.77	10.71	13.70	3.00
64-QAM	5252.5	8.44	7.57	11.04	13.70	2.67
	5300.0	8.49	8.68	11.60	13.70	2.11
	5345.0	7.55	7.86	10.72	13.70	2.98

Table 8.4-3: *Output power measurements and (19 dBi antenna) EIRP calculations results at 5 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5252.5	-1.44	-1.38	1.60	4.70	3.10
	5300.0	-0.46	-1.22	2.19	4.70	2.52
	5345.0	-0.50	-1.42	2.07	4.70	2.63
QPSK	5252.5	-1.49	-1.33	1.60	4.70	3.10
	5300.0	-0.50	-1.01	2.26	4.70	2.44
	5345.0	-0.46	-1.38	2.11	4.70	2.59
16-QAM	5252.5	-1.47	-1.30	1.63	4.70	3.08
	5300.0	-0.50	-0.92	2.31	4.70	2.40
	5345.0	-0.49	-1.38	2.10	4.70	2.60
64-QAM	5252.5	-1.50	-1.28	1.62	4.70	3.08
	5300.0	-0.51	-0.84	2.34	4.70	2.36
	5345.0	-0.43	-1.37	2.14	4.70	2.57

Table 8.4-4: *Output power measurements and (32 dBi antenna) EIRP calculations results at 5 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5252.5	-14.50	-14.38	-11.43	-8.30	3.13
	5300.0	-13.47	-13.26	-10.35	-8.30	2.06
	5345.0	-14.34	-14.41	-11.36	-8.30	3.07
QPSK	5252.5	-14.53	-14.25	-11.38	-8.30	3.08
	5300.0	-13.50	-13.25	-10.36	-8.30	2.07
	5345.0	-14.35	-14.40	-11.36	-8.30	3.07
16-QAM	5252.5	-14.51	-14.11	-11.30	-8.30	3.00
	5300.0	-13.44	-13.26	-10.34	-8.30	2.04
	5345.0	-14.38	-14.33	-11.34	-8.30	3.05
64-QAM	5252.5	-14.52	-14.13	-11.31	-8.30	3.01
	5300.0	-13.51	-13.25	-10.37	-8.30	2.07
	5345.0	-14.52	-14.34	-11.42	-8.30	3.12

8.4.4 Test data, continued

Table 8.4-5: *Output power measurements and (10 dBi antenna) EIRP calculations results at 10 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5255.0	10.54	10.49	13.53	16.68	3.16
	5300.0	10.46	10.81	13.65	16.68	3.03
	5342.5	10.69	11.54	14.15	16.68	2.54
QPSK	5255.0	10.50	10.51	13.52	16.68	3.17
	5300.0	10.48	10.80	13.65	16.68	3.03
	5342.5	10.63	11.55	14.12	16.68	2.56
16-QAM	5255.0	10.33	10.55	13.45	16.68	3.23
	5300.0	10.49	10.81	13.66	16.68	3.02
	5342.5	10.62	11.55	14.12	16.68	2.56
64-QAM	5255.0	10.37	10.67	13.53	16.68	3.15
	5300.0	10.54	10.79	13.68	16.68	3.01
	5342.5	10.63	11.55	14.12	16.68	2.56

Table 8.4-6: *Output power measurements and (19 dBi antenna) EIRP calculations results at 10 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5255.0	1.52	1.91	4.73	7.68	2.95
	5300.0	1.58	1.83	4.72	7.68	2.97
	5342.5	2.60	2.77	5.70	7.68	1.99
QPSK	5255.0	1.61	1.89	4.76	7.68	2.92
	5300.0	1.60	1.84	4.73	7.68	2.95
	5342.5	2.61	2.64	5.64	7.68	2.05
16-QAM	5255.0	1.60	1.87	4.75	7.68	2.94
	5300.0	1.57	1.84	4.72	7.68	2.97
	5342.5	2.58	2.53	5.57	7.68	2.12
64-QAM	5255.0	1.61	1.86	4.75	7.68	2.94
	5300.0	1.64	1.85	4.76	7.68	2.93
	5342.5	2.59	2.44	5.53	7.68	2.16

Table 8.4-7: *Output power measurements and (32 dBi antenna) EIRP calculations results at 10 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5255.0	-11.56	-11.33	-8.43	-5.32	3.12
	5300.0	-11.57	-11.08	-8.31	-5.32	2.99
	5342.5	-11.43	-11.50	-8.45	-5.32	3.14
QPSK	5255.0	-11.56	-11.31	-8.42	-5.32	3.11
	5300.0	-11.59	-11.06	-8.31	-5.32	2.99
	5342.5	-11.47	-11.49	-8.47	-5.32	3.15
16-QAM	5255.0	-11.59	-11.31	-8.44	-5.32	3.12
	5300.0	-11.58	-11.07	-8.31	-5.32	2.99
	5342.5	-11.33	-11.45	-8.38	-5.32	3.06
64-QAM	5255.0	-11.60	-11.30	-8.44	-5.32	3.12
	5300.0	-11.51	-11.02	-8.25	-5.32	2.93
	5342.5	-11.27	-11.47	-8.36	-5.32	3.04

8.4.4 Test data, continued

Table 8.4-8: *Output power measurements and (10 dBi antenna) EIRP calculations results at 20 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5260.0	13.86	13.14	16.53	19.69	3.17
	5300.0	13.97	13.15	16.59	19.69	3.10
	5337.5	14.15	14.08	17.13	19.69	2.57
QPSK	5260.0	13.85	13.12	16.51	19.69	3.18
	5300.0	13.95	13.17	16.59	19.69	3.10
	5337.5	14.00	14.10	17.06	19.69	2.63
16-QAM	5260.0	13.84	13.12	16.51	19.69	3.19
	5300.0	13.98	13.21	16.62	19.69	3.07
	5337.5	13.99	14.11	17.06	19.69	2.63
64-QAM	5260.0	13.85	13.16	16.53	19.69	3.16
	5300.0	13.96	13.24	16.63	19.69	3.07
	5337.5	14.12	14.10	17.12	19.69	2.57

Table 8.4-9: *Output power measurements and (19 dBi antenna) EIRP calculations results at 20 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5260.0	4.88	4.09	7.51	10.69	3.18
	5300.0	4.81	4.08	7.47	10.69	3.22
	5337.5	5.02	4.98	8.01	10.69	2.68
QPSK	5260.0	4.85	4.10	7.50	10.69	3.19
	5300.0	4.82	4.27	7.56	10.69	3.13
	5337.5	4.94	4.97	7.97	10.69	2.73
16-QAM	5260.0	4.86	4.08	7.50	10.69	3.19
	5300.0	4.88	4.33	7.62	10.69	3.07
	5337.5	4.97	4.98	7.99	10.69	2.71
64-QAM	5260.0	4.88	4.10	7.52	10.69	3.17
	5300.0	4.87	4.47	7.68	10.69	3.01
	5337.5	4.87	4.98	7.94	10.69	2.76

Table 8.4-10: *Output power measurements and (32 dBi antenna) EIRP calculations results at 20 MHz channel for FCC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB
BPSK	5260.0	-8.30	-8.11	-5.19	-2.31	2.89
	5300.0	-8.56	-8.21	-5.37	-2.31	3.06
	5337.5	-8.01	-8.10	-5.04	-2.31	2.74
QPSK	5260.0	-8.25	-8.15	-5.19	-2.31	2.88
	5300.0	-8.55	-8.21	-5.37	-2.31	3.06
	5337.5	-8.03	-8.09	-5.05	-2.31	2.74
16-QAM	5260.0	-8.29	-8.19	-5.23	-2.31	2.92
	5300.0	-8.59	-8.20	-5.38	-2.31	3.07
	5337.5	-8.02	-8.08	-5.04	-2.31	2.73
64-QAM	5260.0	-8.31	-8.20	-5.24	-2.31	2.94
	5300.0	-8.67	-8.00	-5.31	-2.31	3.00
	5337.5	-8.02	-8.08	-5.04	-2.31	2.73

8.4.4 Test data, continued

Table 8.4-11: *Output power measurements and (10 dBi antenna) EIRP calculations results at 5 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5252.5	10.40	9.47	12.97	17.17	4.20	10.00	22.97	23.17	0.20
	5300.0	10.33	9.45	12.92	17.17	4.25	10.00	22.92	23.17	0.25
	5345.0	10.48	9.27	12.93	17.17	4.24	10.00	22.93	23.17	0.24
QPSK	5252.5	10.42	9.38	12.94	17.17	4.23	10.00	22.94	23.17	0.23
	5300.0	10.41	9.46	12.97	17.17	4.20	10.00	22.97	23.17	0.20
	5345.0	10.48	9.22	12.91	17.17	4.26	10.00	22.91	23.17	0.26
16-QAM	5252.5	10.41	9.41	12.95	17.17	4.22	10.00	22.95	23.17	0.22
	5300.0	10.30	9.48	12.92	17.17	4.25	10.00	22.92	23.17	0.25
	5345.0	10.47	9.26	12.92	17.17	4.25	10.00	22.92	23.17	0.25
64-QAM	5252.5	10.41	9.37	12.93	17.17	4.24	10.00	22.93	23.17	0.24
	5300.0	10.28	9.48	12.91	17.17	4.26	10.00	22.91	23.17	0.26
	5345.0	10.30	9.28	12.83	17.17	4.34	10.00	22.83	23.17	0.34

Table 8.4-12: *Output power measurements and (19 dBi antenna) EIRP calculations results at 5 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5252.5	1.28	0.56	3.95	17.17	13.22	19.00	22.95	23.17	0.22
	5300.0	1.34	0.56	3.98	17.17	13.19	19.00	22.98	23.17	0.19
	5345.0	1.36	0.52	3.97	17.17	13.20	19.00	22.97	23.17	0.20
QPSK	5252.5	1.28	0.55	3.94	17.17	13.23	19.00	22.94	23.17	0.23
	5300.0	1.40	0.52	3.99	17.17	13.18	19.00	22.99	23.17	0.18
	5345.0	1.38	0.51	3.98	17.17	13.19	19.00	22.98	23.17	0.19
16-QAM	5252.5	1.29	0.55	3.95	17.17	13.22	19.00	22.95	23.17	0.22
	5300.0	1.42	0.49	3.99	17.17	13.18	19.00	22.99	23.17	0.18
	5345.0	1.38	0.53	3.99	17.17	13.18	19.00	22.99	23.17	0.18
64-QAM	5252.5	1.25	0.48	3.89	17.17	13.28	19.00	22.89	23.17	0.28
	5300.0	1.41	0.51	3.99	17.17	13.18	19.00	22.99	23.17	0.18
	5345.0	1.37	0.51	3.97	17.17	13.20	19.00	22.97	23.17	0.20

Table 8.4-13: *Output power measurements and (32 dBi antenna) EIRP calculations results at 5 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5252.5	-11.54	-12.56	-9.01	17.17	26.18	32.00	22.99	23.17	0.18
	5300.0	-11.56	-12.63	-9.05	17.17	26.22	32.00	22.95	23.17	0.22
	5345.0	-11.55	-12.69	-9.07	17.17	26.24	32.00	22.93	23.17	0.24
QPSK	5252.5	-11.55	-12.55	-9.01	17.17	26.18	32.00	22.99	23.17	0.18
	5300.0	-11.52	-12.59	-9.01	17.17	26.18	32.00	22.99	23.17	0.18
	5345.0	-11.55	-12.66	-9.06	17.17	26.23	32.00	22.94	23.17	0.23
16-QAM	5252.5	-11.58	-12.54	-9.02	17.17	26.19	32.00	22.98	23.17	0.19
	5300.0	-11.59	-12.68	-9.09	17.17	26.26	32.00	22.91	23.17	0.26
	5345.0	-11.54	-12.65	-9.05	17.17	26.22	32.00	22.95	23.17	0.22
64-QAM	5252.5	-11.57	-12.52	-9.01	17.17	26.18	32.00	22.99	23.17	0.18
	5300.0	-11.57	-12.66	-9.07	17.17	26.24	32.00	22.93	23.17	0.24
	5345.0	-11.51	-12.65	-9.03	17.17	26.20	32.00	22.97	23.17	0.20

8.4.4 Test data, continued

Table 8.4-14: *Output power measurements and (10 dBi antenna) EIRP calculations results at 10 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5255.0	10.37	9.38	12.91	20.18	7.26	10.00	22.91	26.18	3.26
	5300.0	10.36	8.68	12.61	20.18	7.56	10.00	22.61	26.18	3.56
	5342.5	10.48	9.32	12.95	20.18	7.23	10.00	22.95	26.18	3.23
QPSK	5255.0	10.35	9.35	12.89	20.18	7.29	10.00	22.89	26.18	3.29
	5300.0	10.37	8.72	12.63	20.18	7.54	10.00	22.63	26.18	3.54
	5342.5	10.47	9.33	12.95	20.18	7.23	10.00	22.95	26.18	3.23
16-QAM	5255.0	10.36	9.34	12.89	20.18	7.28	10.00	22.89	26.18	3.28
	5300.0	10.44	8.69	12.66	20.18	7.51	10.00	22.66	26.18	3.51
	5342.5	10.50	9.35	12.97	20.18	7.20	10.00	22.97	26.18	3.20
64-QAM	5255.0	10.36	9.36	12.90	20.18	7.28	10.00	22.90	26.18	3.28
	5300.0	10.43	8.79	12.70	20.18	7.48	10.00	22.70	26.18	3.48
	5342.5	10.54	9.32	12.98	20.18	7.19	10.00	22.98	26.18	3.19

Table 8.4-15: *Output power measurements and (19 dBi antenna) EIRP calculations results at 10 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5255.0	0.31	0.64	3.49	20.18	16.69	19.00	22.49	26.18	3.69
	5300.0	0.43	0.81	3.63	20.18	16.54	19.00	22.63	26.18	3.54
	5342.5	1.48	0.33	3.95	20.18	16.22	19.00	22.95	26.18	3.22
QPSK	5255.0	0.33	0.61	3.48	20.18	16.69	19.00	22.48	26.18	3.69
	5300.0	0.41	0.83	3.64	20.18	16.54	19.00	22.64	26.18	3.54
	5342.5	1.44	0.34	3.94	20.18	16.24	19.00	22.94	26.18	3.24
16-QAM	5255.0	0.36	0.63	3.51	20.18	16.67	19.00	22.51	26.18	3.67
	5300.0	0.41	0.83	3.64	20.18	16.54	19.00	22.64	26.18	3.54
	5342.5	1.46	0.34	3.95	20.18	16.23	19.00	22.95	26.18	3.23
64-QAM	5255.0	0.35	0.60	3.49	20.18	16.69	19.00	22.49	26.18	3.69
	5300.0	0.35	0.87	3.63	20.18	16.55	19.00	22.63	26.18	3.55
	5342.5	1.53	0.33	3.98	20.18	16.19	19.00	22.98	26.18	3.19

Table 8.4-16: *Output power measurements and (32 dBi antenna) EIRP calculations results at 10 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5255.0	-11.65	-12.65	-9.11	20.18	29.29	32.00	22.89	26.18	3.29
	5300.0	-11.64	-12.44	-9.01	20.18	29.19	32.00	22.99	26.18	3.19
	5342.5	-12.56	-12.59	-9.56	20.18	29.74	32.00	22.44	26.18	3.74
QPSK	5255.0	-11.60	-12.64	-9.08	20.18	29.25	32.00	22.92	26.18	3.25
	5300.0	-11.65	-12.45	-9.02	20.18	29.20	32.00	22.98	26.18	3.20
	5342.5	-12.51	-12.57	-9.53	20.18	29.70	32.00	22.47	26.18	3.70
16-QAM	5255.0	-11.61	-12.66	-9.09	20.18	29.27	32.00	22.91	26.18	3.27
	5300.0	-11.66	-12.44	-9.02	20.18	29.20	32.00	22.98	26.18	3.20
	5342.5	-12.49	-12.60	-9.53	20.18	29.71	32.00	22.47	26.18	3.71
64-QAM	5255.0	-11.59	-12.62	-9.06	20.18	29.24	32.00	22.94	26.18	3.24
	5300.0	-11.66	-12.43	-9.02	20.18	29.19	32.00	22.98	26.18	3.19
	5342.5	-12.49	-12.62	-9.54	20.18	29.72	32.00	22.46	26.18	3.72

8.4.4 Test data, continued

Table 8.4-17: *Output power measurements and (10 dBi antenna) EIRP calculations results at 20 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5260.0	9.81	9.97	12.90	23.16	10.26	10.00	22.90	29.16	6.26
	5300.0	9.70	10.20	12.97	23.16	10.19	10.00	22.97	29.16	6.19
	5337.5	9.97	9.92	12.96	23.16	10.20	10.00	22.96	29.16	6.20
QPSK	5260.0	9.77	10.00	12.90	23.16	10.26	10.00	22.90	29.16	6.26
	5300.0	9.65	10.16	12.92	23.16	10.24	10.00	22.92	29.16	6.24
	5337.5	9.94	9.92	12.94	23.16	10.22	10.00	22.94	29.16	6.22
16-QAM	5260.0	9.75	9.99	12.88	23.16	10.28	10.00	22.88	29.16	6.28
	5300.0	9.69	10.18	12.95	23.16	10.21	10.00	22.95	29.16	6.21
	5337.5	9.92	9.95	12.95	23.16	10.21	10.00	22.95	29.16	6.21
64-QAM	5260.0	9.73	10.00	12.88	23.16	10.28	10.00	22.88	29.16	6.28
	5300.0	9.76	10.17	12.98	23.16	10.18	10.00	22.98	29.16	6.18
	5337.5	9.92	9.94	12.94	23.16	10.22	10.00	22.94	29.16	6.22

Table 8.4-18: *Output power measurements and (19 dBi antenna) EIRP calculations results at 20 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5260.0	0.62	1.19	3.92	23.16	19.23	19.00	22.92	29.16	6.23
	5300.0	0.70	0.92	3.82	23.16	19.34	19.00	22.82	29.16	6.34
	5337.5	0.93	-0.06	3.47	23.16	19.69	19.00	22.47	29.16	6.69
QPSK	5260.0	0.61	1.18	3.91	23.16	19.24	19.00	22.91	29.16	6.24
	5300.0	0.78	0.93	3.87	23.16	19.29	19.00	22.87	29.16	6.29
	5337.5	0.94	-0.09	3.47	23.16	19.69	19.00	22.47	29.16	6.69
16-QAM	5260.0	0.62	1.10	3.88	23.16	19.28	19.00	22.88	29.16	6.28
	5300.0	0.80	0.94	3.88	23.16	19.28	19.00	22.88	29.16	6.28
	5337.5	1.00	-0.10	3.50	23.16	19.66	19.00	22.50	29.16	6.66
64-QAM	5260.0	0.62	1.02	3.83	23.16	19.32	19.00	22.83	29.16	6.32
	5300.0	0.82	0.93	3.89	23.16	19.27	19.00	22.89	29.16	6.27
	5337.5	0.97	-0.09	3.48	23.16	19.68	19.00	22.48	29.16	6.68

Table 8.4-19: *Output power measurements and (32 dBi antenna) EIRP calculations results at 20 MHz channel for IC*

Modulation	Frequency, MHz	Average power on ch0, dBm	Average power on ch1, dBm	Combined average power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	5260.0	-12.14	-12.02	-9.07	23.16	32.23	32.00	22.93	29.16	6.23
	5300.0	-12.15	-11.91	-9.02	23.16	32.18	32.00	22.98	29.16	6.18
	5337.5	-12.20	-11.91	-9.04	23.16	32.20	32.00	22.96	29.16	6.20
QPSK	5260.0	-12.14	-12.01	-9.06	23.16	32.22	32.00	22.94	29.16	6.22
	5300.0	-12.19	-11.88	-9.02	23.16	32.18	32.00	22.98	29.16	6.18
	5337.5	-12.18	-11.93	-9.04	23.16	32.20	32.00	22.96	29.16	6.20
16-QAM	5260.0	-12.19	-12.00	-9.08	23.16	32.24	32.00	22.92	29.16	6.24
	5300.0	-12.18	-11.96	-9.06	23.16	32.22	32.00	22.94	29.16	6.22
	5337.5	-12.22	-11.96	-9.08	23.16	32.24	32.00	22.92	29.16	6.24
64-QAM	5260.0	-12.22	-12.00	-9.10	23.16	32.26	32.00	22.90	29.16	6.26
	5300.0	-12.21	-11.84	-9.01	23.16	32.17	32.00	22.99	29.16	6.17
	5337.5	-12.19	-11.96	-9.06	23.16	32.22	32.00	22.94	29.16	6.22

8.4.4 Test data, continued

Table 8.4-20: *PSD measurements results for FCC with 10 dBi antenna configuration*

Channel bandwidth, MHz	Frequency, MHz	PSD at ch0, dBm/1 MHz	PSD at ch1, dBm/1 MHz	Combined PSD, dBm/1 MHz	PSD limit, dBm/1 MHz	Margin, dB
5	5252.5	4.29	3.48	6.91	7.00	0.09
	5300.0	3.40	3.77	6.60	7.00	0.40
	5345.0	3.59	3.92	6.77	7.00	0.23
10	5255.0	3.63	3.67	6.66	7.00	0.34
	5300.0	3.70	4.18	6.96	7.00	0.04
	5342.5	3.27	3.94	6.63	7.00	0.37
20	5260.0	4.00	3.26	6.66	7.00	0.34
	2300.0	3.95	3.32	6.66	7.00	0.34
	5337.5	3.50	3.75	6.64	7.00	0.36

Table 8.4-21: *PSD measurements results for FCC with 19 dBi antenna configuration*

Channel bandwidth, MHz	Frequency, MHz	PSD at ch0, dBm/1 MHz	PSD at ch1, dBm/1 MHz	Combined PSD, dBm/1 MHz	PSD limit, dBm/1 MHz	Margin, dB
5	5252.5	-5.41	-5.11	-2.25	-2.00	0.25
	5300.0	-5.41	-5.68	-2.53	-2.00	0.53
	5345.0	-4.62	-5.58	-2.06	-2.00	0.06
10	5255.0	-5.25	-4.94	-2.08	-2.00	0.08
	5300.0	-5.25	-5.05	-2.14	-2.00	0.14
	5342.5	-5.06	-4.99	-2.01	-2.00	0.01
20	5260.0	-5.00	-5.74	-2.34	-2.00	0.34
	2300.0	-5.00	-5.50	-2.23	-2.00	0.23
	5337.5	-5.51	-5.32	-2.40	-2.00	0.40

Table 8.4-22: *PSD measurements results for FCC with 32 dBi antenna configuration*

Channel bandwidth, MHz	Frequency, MHz	PSD at ch0, dBm/1 MHz	PSD at ch1, dBm/1 MHz	Combined PSD, dBm/1 MHz	PSD limit, dBm/1 MHz	Margin, dB
5	5252.5	-18.53	-18.15	-15.33	-15.00	0.33
	5300.0	-18.40	-18.25	-15.31	-15.00	0.31
	5345.0	-18.47	-18.24	-15.34	-15.00	0.34
10	5255.0	-18.58	-18.32	-15.44	-15.00	0.44
	5300.0	-18.49	-17.94	-15.20	-15.00	0.20
	5342.5	-18.74	-18.84	-15.78	-15.00	0.78
20	5260.0	-18.13	-18.05	-15.08	-15.00	0.08
	2300.0	-18.69	-17.95	-15.29	-15.00	0.29
	5337.5	-18.19	-18.50	-15.33	-15.00	0.33

8.4.4 Test data, continued

Table 8.4-23: *PSD measurements results for IC with 10 dBi antenna (max power settings)*

Channel bandwidth, MHz	Frequency, MHz	PSD at ch0, dBm/1 MHz	PSD at ch1, dBm/1 MHz	Combined PSD, dBm/1 MHz	PSD limit, dBm/1 MHz	Margin, dB
5	5252.5	6.49	5.50	9.03	11.00	1.97
	5300.0	5.48	4.72	8.13	11.00	2.87
	5345.0	6.30	5.51	8.93	11.00	2.07
10	5255.0	3.61	2.57	6.13	11.00	4.87
	5300.0	3.77	2.07	6.01	11.00	4.99
	5342.5	2.94	1.72	5.38	11.00	5.62
20	5260.0	-0.07	0.32	3.14	11.00	7.86
	2300.0	-0.03	0.37	3.18	11.00	7.82
	5337.5	-0.22	-0.39	2.71	11.00	8.29

Table 8.4-24: *TPC measurements results for FCC with 10 dBi antenna*

Channel bandwidth, MHz	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined power, dBm	Antenna gain, dBi	TPC EIRP, dBm	TPC EIRP limit, dBm	Margin, dB
5	5252.5	8.44	7.57	11.04	10.00	21.04	24.00	2.96
	5300.0	8.49	8.68	11.60	10.00	21.60	24.00	2.40
	5345.0	7.55	7.86	10.72	10.00	20.72	24.00	3.28
10	5255.0	10.37	10.67	13.53	10.00	23.53	24.00	0.47
	5300.0	10.54	10.79	13.68	10.00	23.68	24.00	0.32
	5342.5	10.63	10.66	13.66	10.00	23.66	24.00	0.34
20	5260.0	10.70	10.44	13.58	10.00	23.58	24.00	0.42
	2300.0	10.90	10.24	13.59	10.00	23.59	24.00	0.41
	5337.5	11.08	10.44	13.78	10.00	23.78	24.00	0.22

Table 8.4-25: *TPC measurements results for FCC with 19 dBi antenna*

Channel bandwidth, MHz	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined power, dBm	Antenna gain, dBi	TPC EIRP, dBm	TPC EIRP limit, dBm	Margin, dB
5	5252.5	-1.50	-1.28	1.62	19.00	20.62	24.00	3.38
	5300.0	-0.51	-0.84	2.34	19.00	21.34	24.00	2.66
	5345.0	-0.43	-1.37	2.14	19.00	21.14	24.00	2.86
10	5255.0	1.61	1.86	4.75	19.00	23.75	24.00	0.25
	5300.0	1.64	1.85	4.76	19.00	23.76	24.00	0.24
	5342.5	1.68	1.73	4.72	19.00	23.72	24.00	0.28
20	5260.0	1.87	2.03	4.96	19.00	23.96	24.00	0.04
	2300.0	1.93	1.26	4.62	19.00	23.62	24.00	0.38
	5337.5	2.00	1.96	4.99	19.00	23.99	24.00	0.01

Table 8.4-26: *TPC measurements results for FCC with 32 dBi antenna*

Channel bandwidth, MHz	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined power, dBm	Antenna gain, dBi	TPC EIRP, dBm	TPC EIRP limit, dBm	Margin, dB
5	5252.5	-14.52	-14.13	-11.31	32.00	20.69	24.00	3.31
	5300.0	-13.51	-13.25	-10.37	32.00	21.63	24.00	2.37
	5345.0	-14.52	-14.34	-11.42	32.00	20.58	24.00	3.42
10	5255.0	-11.60	-11.30	-8.44	32.00	23.56	24.00	0.44
	5300.0	-11.51	-11.02	-8.25	32.00	23.75	24.00	0.25
	5342.5	-11.27	-11.47	-8.36	32.00	23.64	24.00	0.36
20	5260.0	-11.25	-11.45	-8.34	32.00	23.66	24.00	0.34
	2300.0	-11.14	-11.59	-8.35	32.00	23.65	24.00	0.35
	5337.5	-10.98	-11.52	-8.23	32.00	23.77	24.00	0.23

8.4.4 Test data, continued

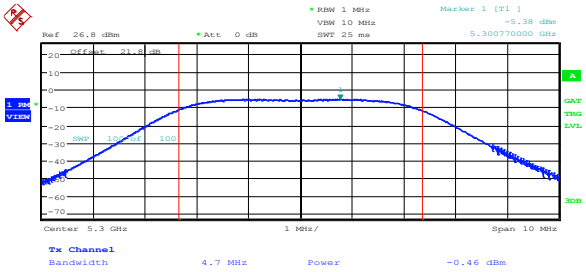


Diagram 8.4-1: *Output power on 5 MHz channel, sample plot*

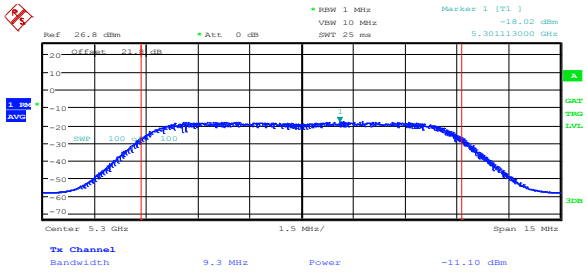


Diagram 8.4-2: *Output power on 10 MHz channel, sample plot*

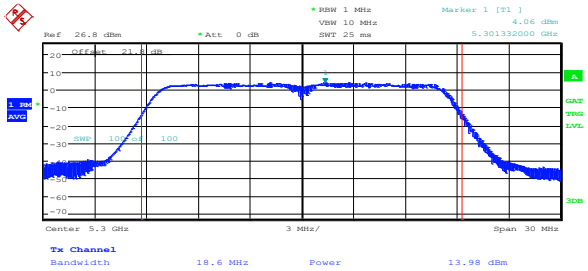


Diagram 8.4-3: *Output power on 20 MHz channel, sample plot*

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

8.5.1 Definitions and limits

FCC:
(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of −27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of −27 dBm/MHz in the 5.15–5.25 GHz band.
(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.
(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:
Emissions outside the band 5250–5350 MHz shall not exceed −27 dBm/MHz e.i.r.p.
The outermost carrier frequencies or channels, as permitted by the design of the equipment, shall be used when measuring unwanted emissions. Such carrier or channel center frequencies are to be indicated in the test report.

RSS-Gen 7.2.2 Emissions falling within restricted frequency bands
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:
(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 µV/m	Field strength of emissions dBµV/m	Measurement distance, 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: 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	399.9–410.0	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	8.025–8.500
4.125–4.128	16.420–16.423	1435.0–1626.5	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	25.50–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.50–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73.0–74.6	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	3345.8–3358.0	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.290–12.293	322.0–335.4	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	16.420–16.423	399.9–410.0	4.50–5.15
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	25.50–25.67	1300–1427	8.025–8.500
4.17725–4.17775	37.50–38.25	1435.0–1626.5	9.0–9.2
4.20725–4.20775	73.0–74.6	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	108.00–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.90–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500.0	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.170	3260–3267	23.6–24.0
12.290–12.293	167.72–173.20	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358.0	36.43–36.5
12.57675–12.57725	322.0–335.4	3600–4400	Above 38.6
13.36–13.41			

8.5.2 Test summary

Test date	February 8, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1003 mbar	**Relative humidity**	32 %

8.5.3 Observations/special notes

The spectrum was searched from 30 MHz to the 40 GHz.
Radiated measurements were performed at a distance of 3 m, the EUT was transmitting on both MIMO chains simultaneously with terminated antenna ports with 50 Ω loads on each antenna port.
Settings for radiated measurements within restricted bands:
For frequencies below 1 GHz, RBW was set to 100 kHz, VBW was 3 times wider than RBW.
Peak detector was used for measurements.
For frequencies above 1 GHz, RBW was set to 1 MHz, VBW was 3 times wider than RBW.
Conducted emissions were performed on each individual MIMO chain and plots were adjusted to include 3 dB (10 × log(total number of chains)) and antenna directional gain.

8.5.4 Test data

Duty cycle/average factor calculations for restricted bands emissions

§15.35(c) permits a duty cycle reduction to the measured field strength (or equivalent power) when pulsed operation is employed. This allowance is only applicable to unwanted emissions that demonstrate the same pulse characteristics as does the fundamental emission (e.g., harmonic emissions). The duty cycle (d.c.) is determined as follows:

For a pulse train ≤ 100 msec:

d.c. = cumulative on time/cumulative off time over the pulse train.

For a pulse train > 100 msec:

d.c. = cumulative on time/100 msec.

See C63.10 for further guidance in determining the applicable duty cycle.

$$Duty cycle / average factor = 20 \times \log_{10}\left(\frac{Tx_{100ms}}{100ms}\right)$$

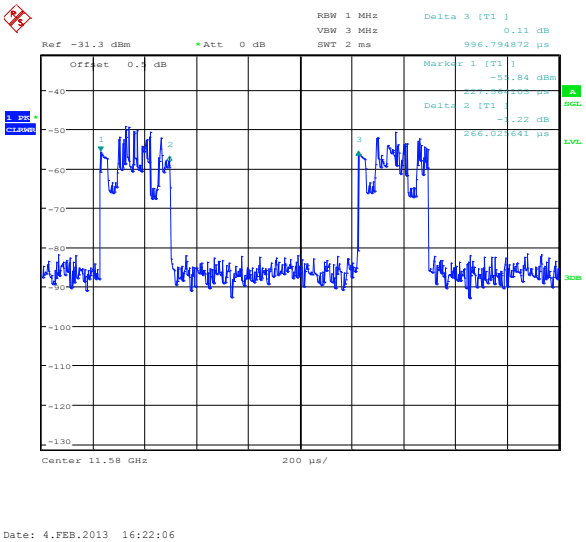


Diagram 8.5-1: *Duty cycle for 5 MHz channel*

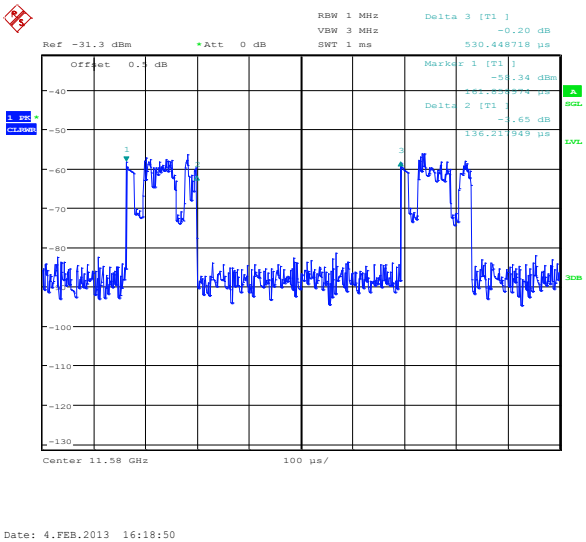


Diagram 8.5-2: *Duty cycle for 10 MHz channel*

8.5.4 Test data, continued

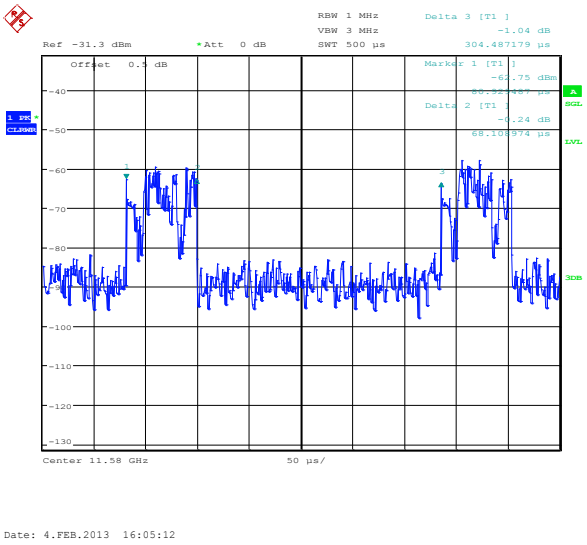


Diagram 8.5-3: *Duty cycle for 20 MHz channel*

Duty cycle correction factor calculations:

For 5 MHz channel

Tx_{ON} is 266.03 µs; Tx_{PERIOD} is 996.80 µs; Duty cycle = 0.27; Correction Factor = $20 \times \text{Log}_{10}$ (0.27) = −11.47 dB

For 10 MHz channel

Tx_{ON} is 136.20 µs; Tx_{PERIOD} is 530.45 µs; Duty cycle = 0.26; Correction Factor = $20 \times \text{Log}_{10}$ (0.26) = −11.81 dB

For 20 MHz channel

Tx_{ON} is 68.11 µs; Tx_{PERIOD} is 304.49 µs; Duty cycle = 0.22; Correction Factor = $20 \times \text{Log}_{10}$ (0.22) = −13.01 dB

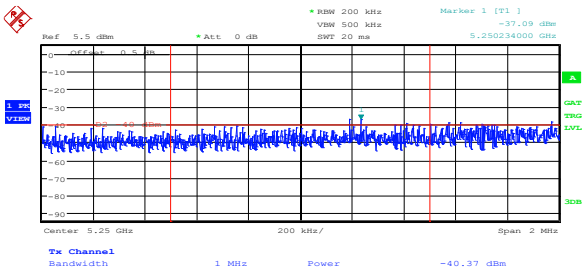


Diagram 8.5-4: *Lower band edge sample plot*

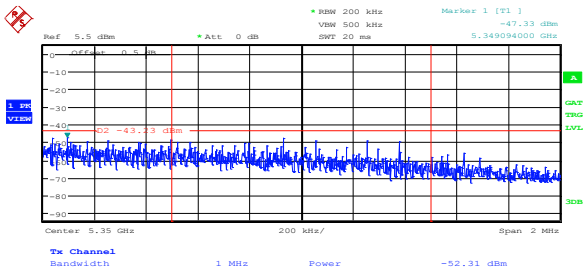


Diagram 8.5-5: *Upper band edge sample plot*

8.5.4 Test data, continued

Table 8.5-4: *Lower band edge emissions results*

Channel bandwidth, MHz	Chain	Frequency, MHz	Level, dBm/MHz	Antenna gain, dBi	Antenna number CF, dB	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
5	0	5250	-40.42	10	3	-27.42	-27.00	0.42
5	1	5250	-40.44	10	3	-27.44	-27.00	0.44
10	0	5250	-40.37	10	3	-27.37	-27.00	0.37
10	1	5250	-41.21	10	3	-28.21	-27.00	1.21
20	0	5250	-40.18	10	3	-27.18	-27.00	0.18
20	1	5250	-40.25	10	3	-27.25	-27.00	0.25
5	0	5250	-49.57	19	3	-27.57	-27.00	0.57
5	1	5250	-49.09	19	3	-27.09	-27.00	0.09
10	0	5250	-49.13	19	3	-27.13	-27.00	0.13
10	1	5250	-49.81	19	3	-27.81	-27.00	0.81
20	0	5250	-49.53	19	3	-27.53	-27.00	0.53
20	1	5250	-49.62	19	3	-27.62	-27.00	0.62
5	0	5250	-67.11	32	3	-32.11	-27.00	5.11
5	1	5250	-64.24	32	3	-29.24	-27.00	2.24
10	0	5250	-64.37	32	3	-29.37	-27.00	2.37
10	1	5250	-64.29	32	3	-29.29	-27.00	2.29
20	0	5250	-64.08	32	3	-29.08	-27.00	2.08
20	1	5250	-64.87	32	3	-29.87	-27.00	2.87

Notes: Antenna number CF is the correction factor to include number of antenna ports ($10 \times \log_{10}(2) = 3$ dB)

Table 8.5-5: *Upper band edge emissions results*

Channel bandwidth, MHz	Chain	Frequency, MHz	Peak Level, dBm/MHz	Antenna gain, dBi	Ant. CF, dB	Peak EIRP, dBm/MHz	Pk EIRP limit equivalent, dBm/MHz	Margin, dB	Duty cycle CF, dB	Avg EIRP, dBm/MHz	Avg EIRP limit equivalent, dBm/MHz	Margin, dB
5	0	5350	-42.95	10.00	3.00	-29.95	-21.23	8.72	-11.47	-41.42	-41.23	0.19
5	1	5350	-43.37	10.00	3.00	-30.37	-21.23	9.14	-11.47	-41.84	-41.23	0.61
10	0	5350	-42.62	10.00	3.00	-29.62	-21.23	8.39	-11.81	-41.43	-41.23	0.20
10	1	5350	-42.89	10.00	3.00	-29.89	-21.23	8.66	-11.81	-41.70	-41.23	0.47
20	0	5350	-41.76	10.00	3.00	-28.76	-21.23	7.53	-13.01	-41.77	-41.23	0.54
20	1	5350	-42.05	10.00	3.00	-29.05	-21.23	7.82	-13.01	-42.06	-41.23	0.83
5	0	5350	-51.76	19.00	3.00	-29.76	-21.23	8.53	-11.47	-41.23	-41.23	0.00
5	1	5350	-52.31	19.00	3.00	-30.31	-21.23	9.08	-11.47	-41.78	-41.23	0.55
10	0	5350	-52.17	19.00	3.00	-30.17	-21.23	8.94	-11.81	-41.98	-41.23	0.75
10	1	5350	-52.39	19.00	3.00	-30.39	-21.23	9.16	-11.81	-42.20	-41.23	0.97
20	0	5350	-50.29	19.00	3.00	-28.29	-21.23	7.06	-13.01	-41.30	-41.23	0.07
20	1	5350	-50.23	19.00	3.00	-28.23	-21.23	7.00	-13.01	-41.24	-41.23	0.01
5	0	5350	-65.79	32.00	3.00	-30.79	-21.23	9.56	-11.47	-42.26	-41.23	1.03
5	1	5350	-65.24	32.00	3.00	-30.24	-21.23	9.01	-11.47	-41.71	-41.23	0.48
10	0	5350	-65.22	32.00	3.00	-30.22	-21.23	8.99	-11.81	-42.03	-41.23	0.80
10	1	5350	-65.47	32.00	3.00	-30.47	-21.23	9.24	-11.81	-42.28	-41.23	1.05
20	0	5350	-63.33	32.00	3.00	-28.33	-21.23	7.10	-13.01	-41.34	-41.23	0.11
20	1	5350	-63.91	32.00	3.00	-28.91	-21.23	7.68	-13.01	-41.92	-41.23	0.69

Notes: Peak EIRP limit equivalent is calculated as follows: 74 dBµV/m – 95.23 dB = −21.23 dBm. Average EIRP limit equivalent is 20 dB below the Peak one. Ant. CF is the correction factor to include number of antenna ports ($10 \times \log_{10}(2) = 3$ dB)

8.5.4 Test data, continued

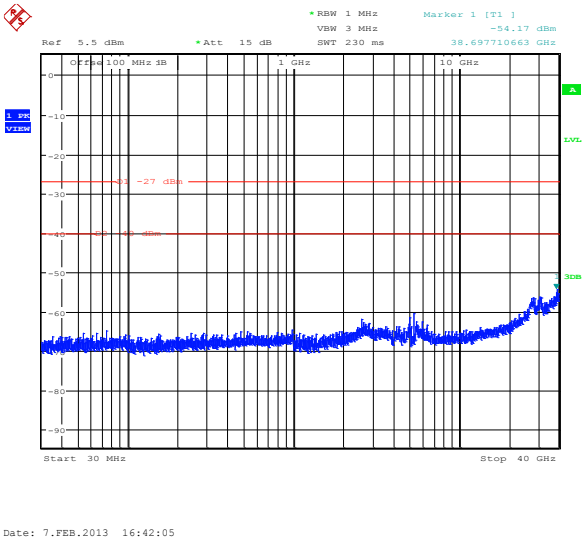


Diagram 8.5-6: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch0, low frequency*

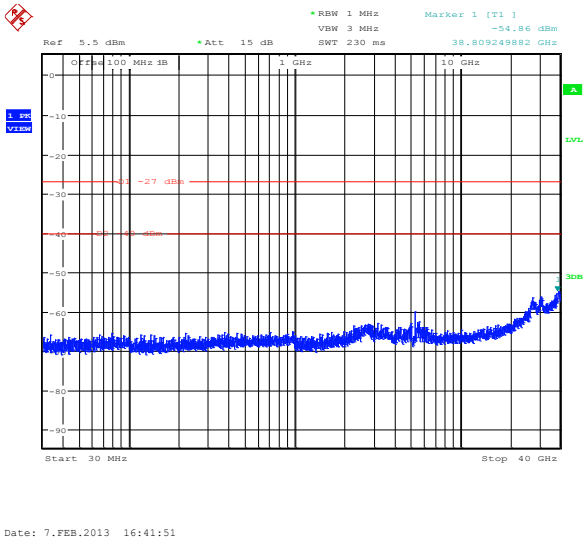


Diagram 8.5-7: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch0, mid frequency*

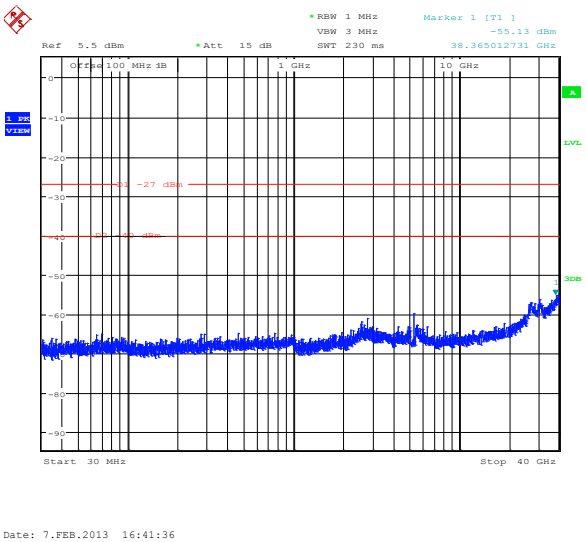


Diagram 8.5-8: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch0, high frequency*

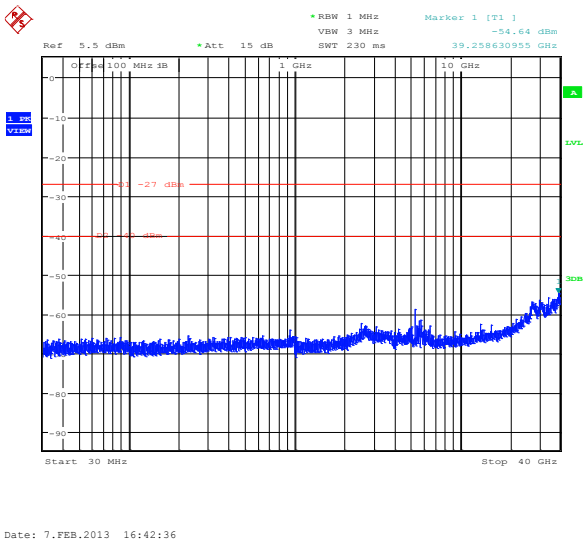


Diagram 8.5-9: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

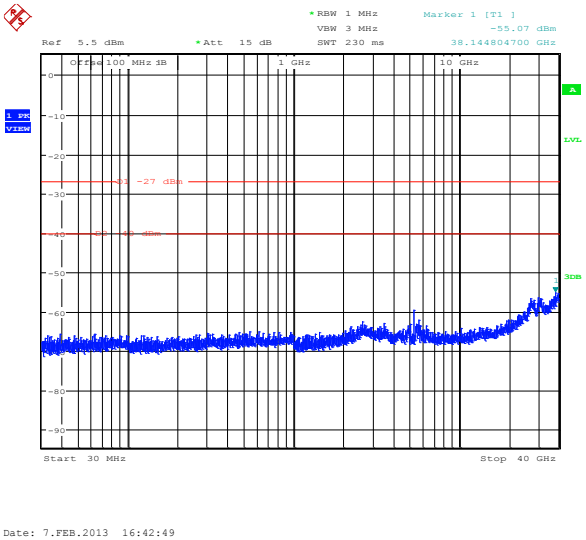


Diagram 8.5-10: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch1, mid frequency*

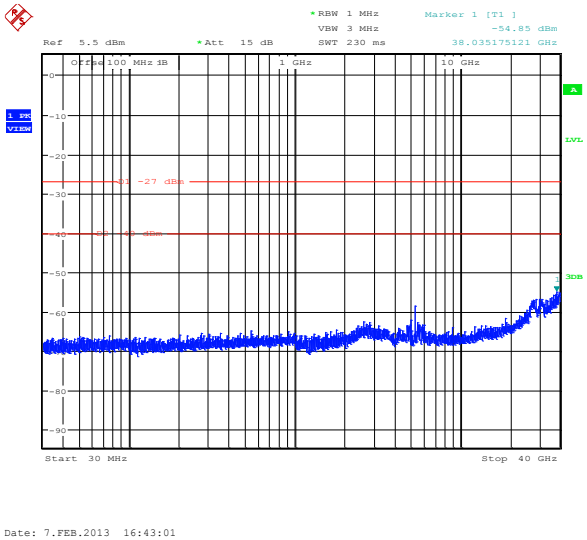


Diagram 8.5-11: *Conducted spurious emissions for FCC,10 dBi antenna, 5 MHz channel, ch1, high frequency*

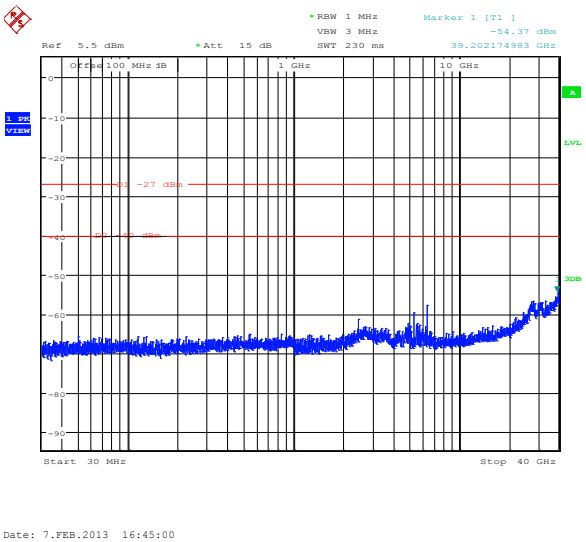


Diagram 8.5-12: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch0, low frequency*

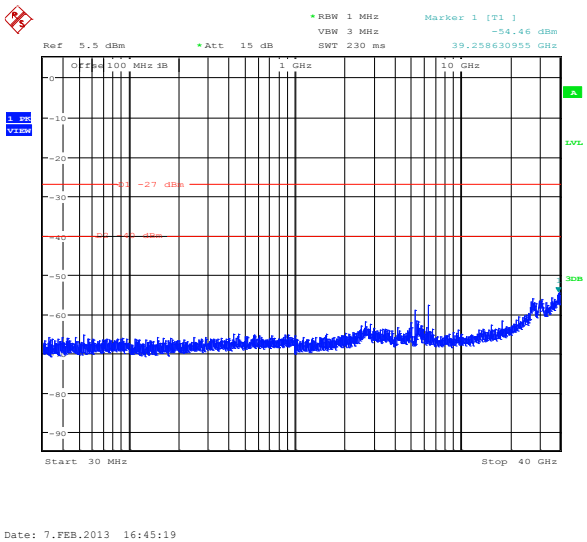


Diagram 8.5-13: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

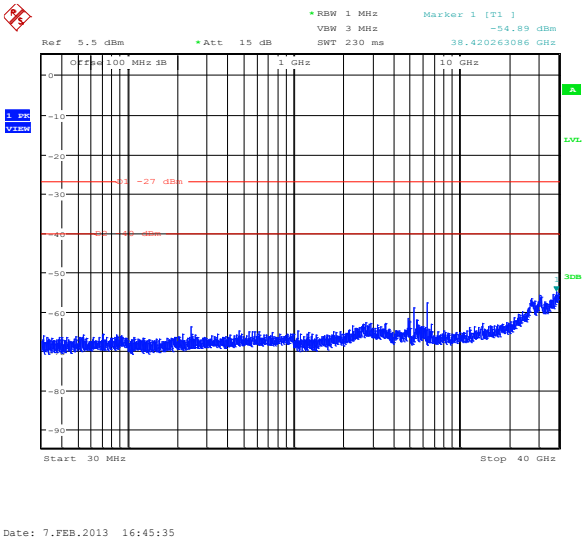


Diagram 8.5-14: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch0, high frequency*

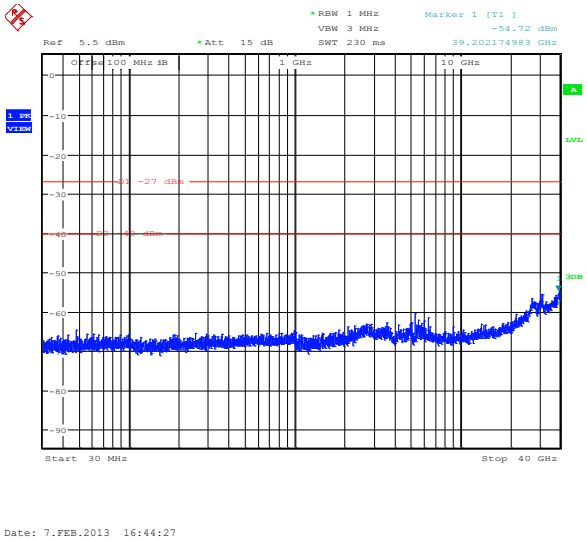


Diagram 8.5-15: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch1, low frequency*

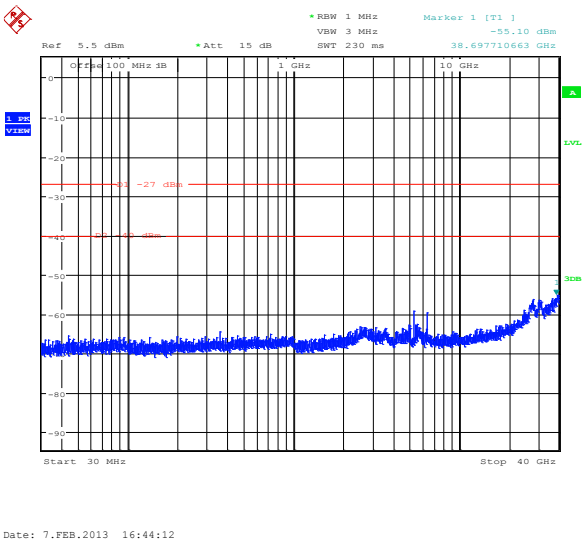


Diagram 8.5-16: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch1, mid frequency*

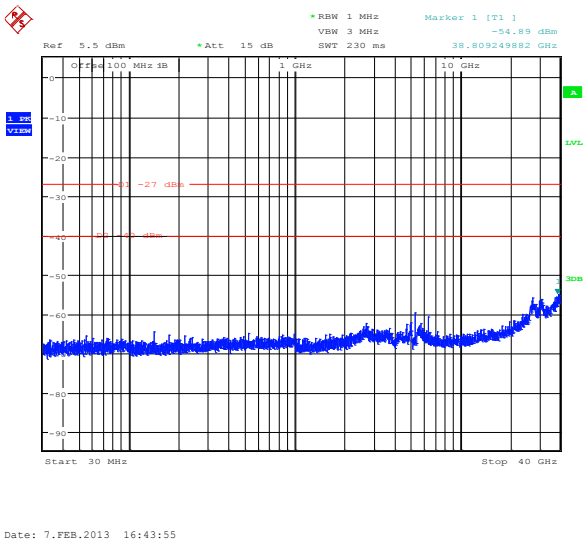


Diagram 8.5-17: *Conducted spurious emissions for FCC,10 dBi antenna, 10 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

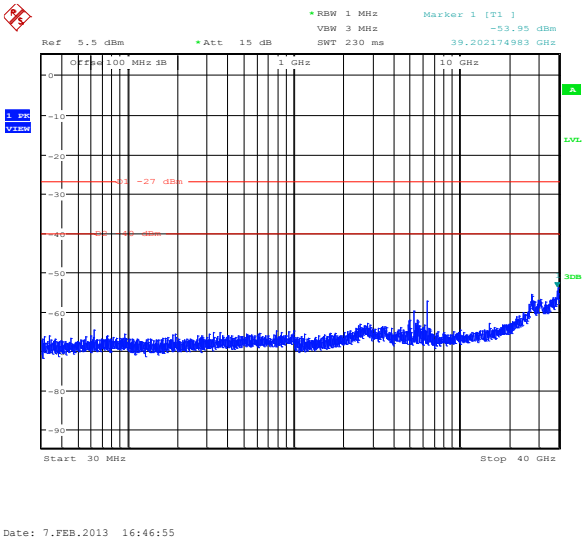


Diagram 8.5-18: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch0, low frequency*

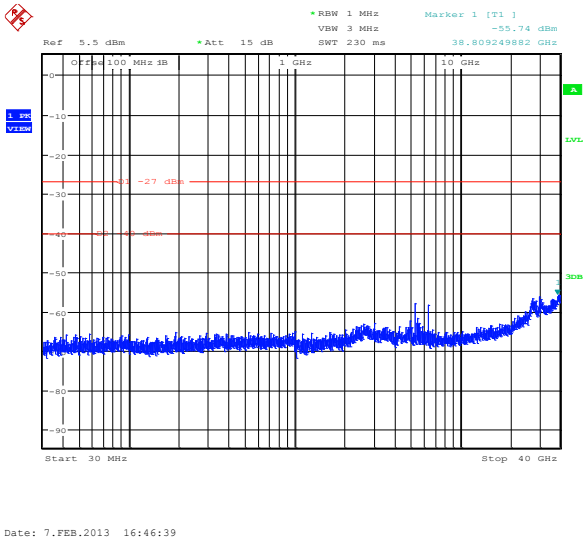


Diagram 8.5-19: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch0, mid frequency*

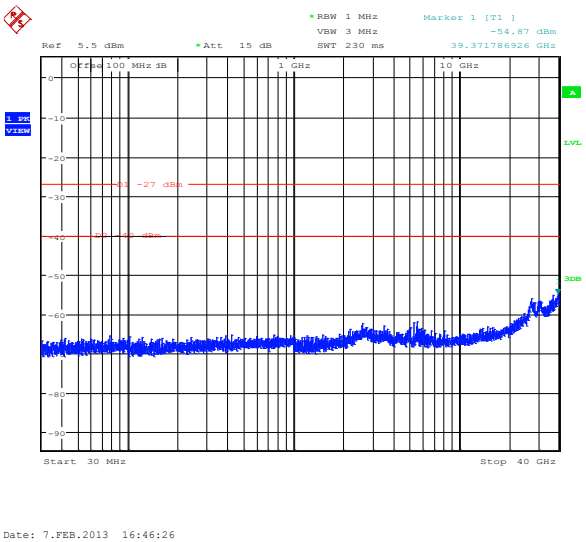


Diagram 8.5-20: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch0, high frequency*

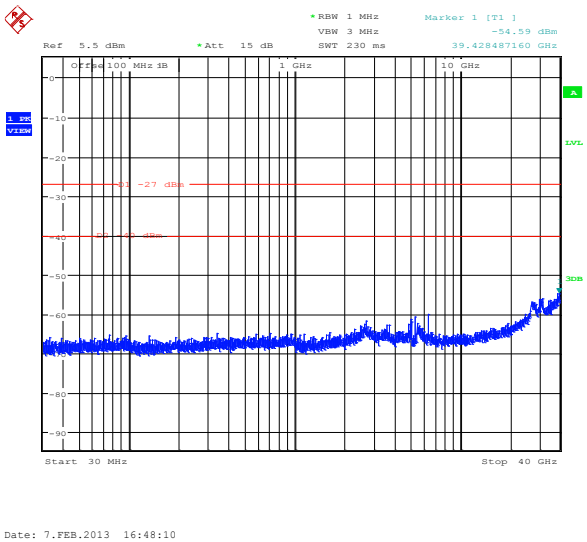


Diagram 8.5-21: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

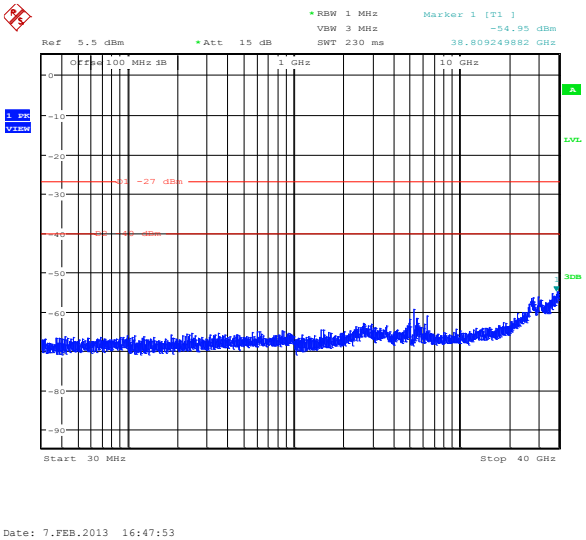


Diagram 8.5-22: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch1, mid frequency*

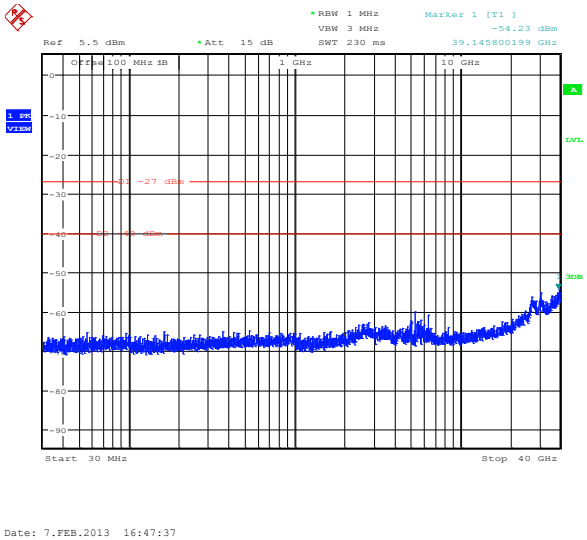


Diagram 8.5-23: *Conducted spurious emissions for FCC,10 dBi antenna, 20 MHz channel, ch1, high frequency*

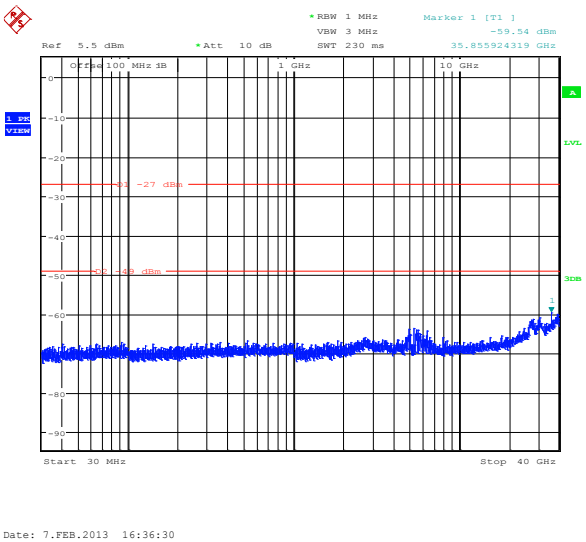


Diagram 8.5-24: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch0, low frequency*

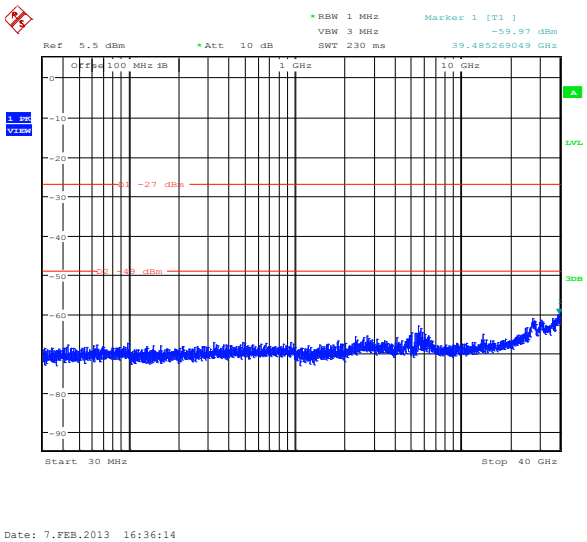


Diagram 8.5-25: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

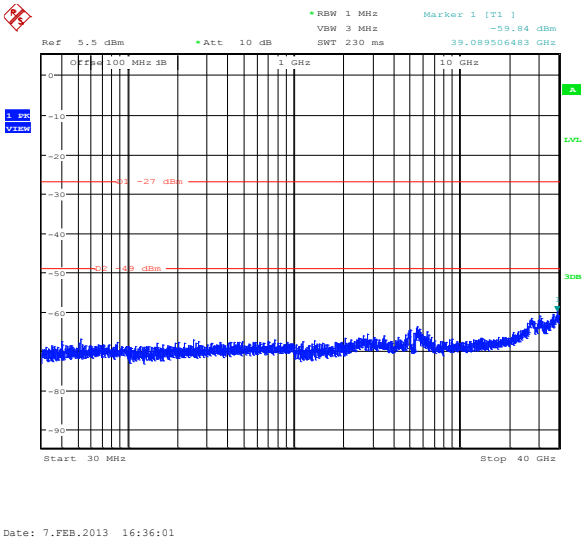


Diagram 8.5-26: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch0, high frequency*

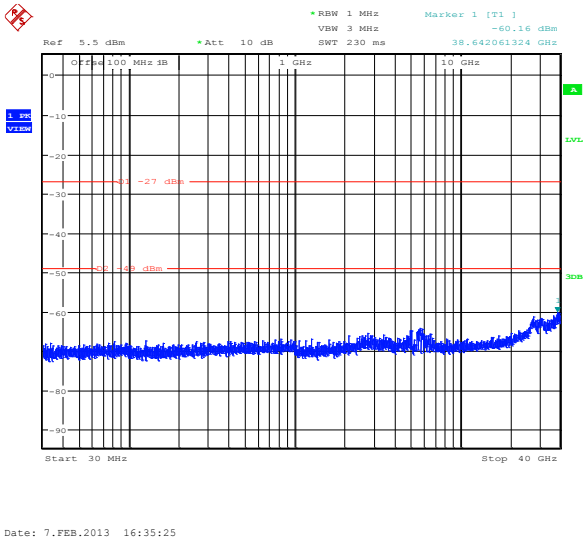


Diagram 8.5-27: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch1, low frequency*

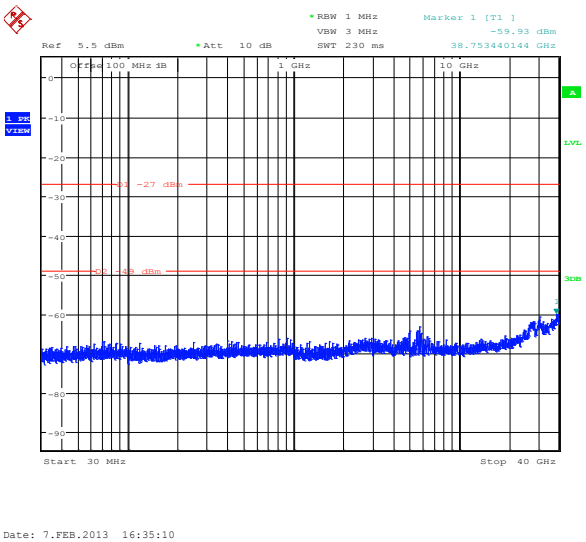


Diagram 8.5-28: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch1, mid frequency*

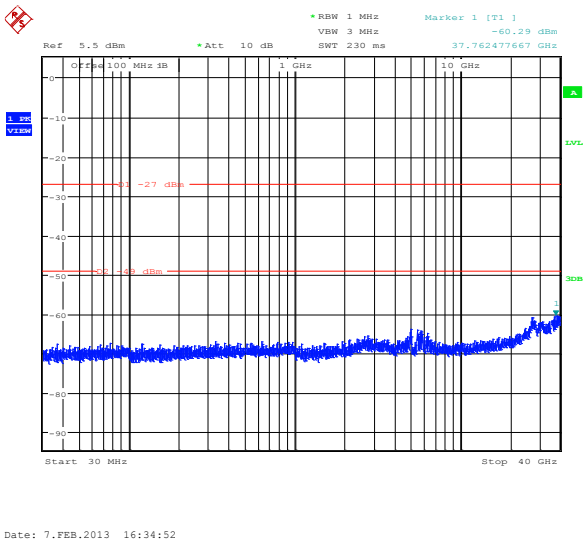


Diagram 8.5-29: *Conducted spurious emissions for FCC,19 dBi antenna, 5 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

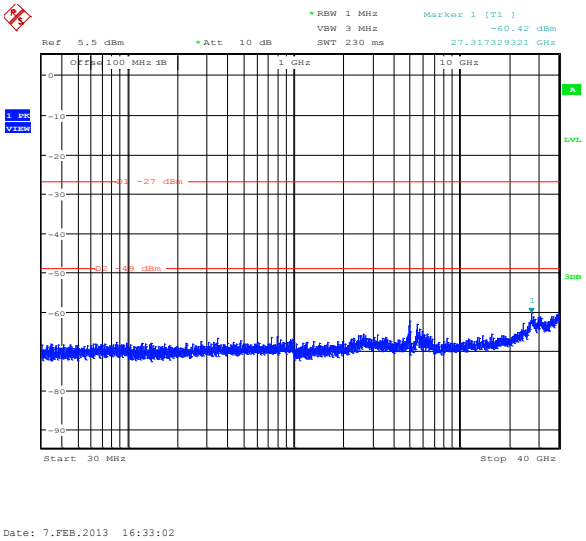


Diagram 8.5-30: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch0, low frequency*

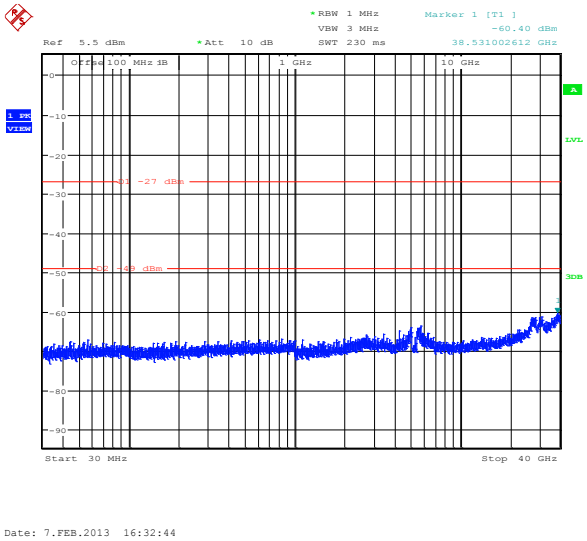


Diagram 8.5-31: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch0, mid frequency*

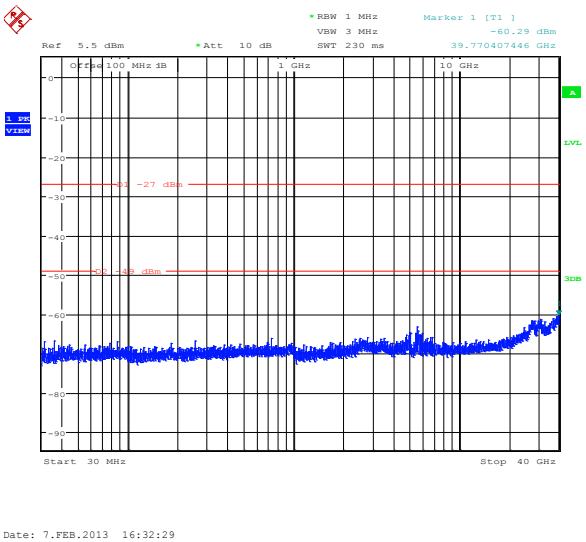


Diagram 8.5-32: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch0, high frequency*

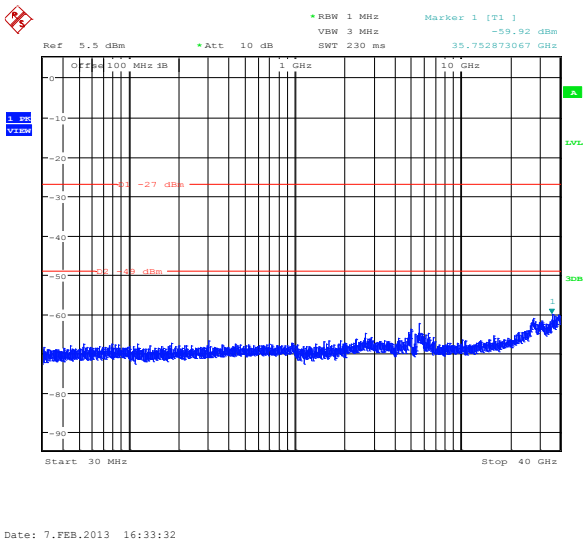


Diagram 8.5-33: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

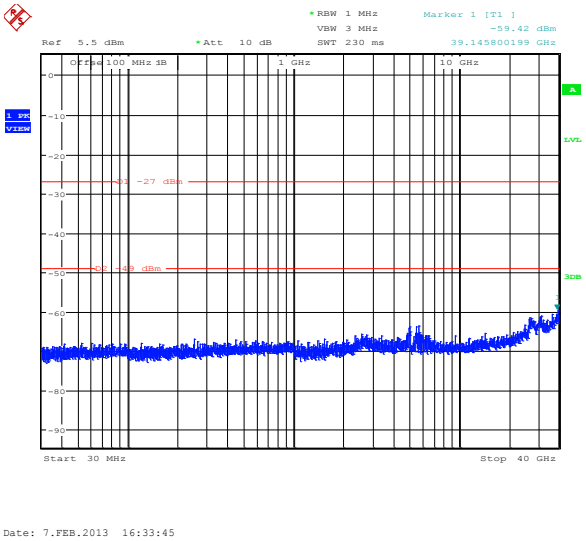


Diagram 8.5-34: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch1, mid frequency*

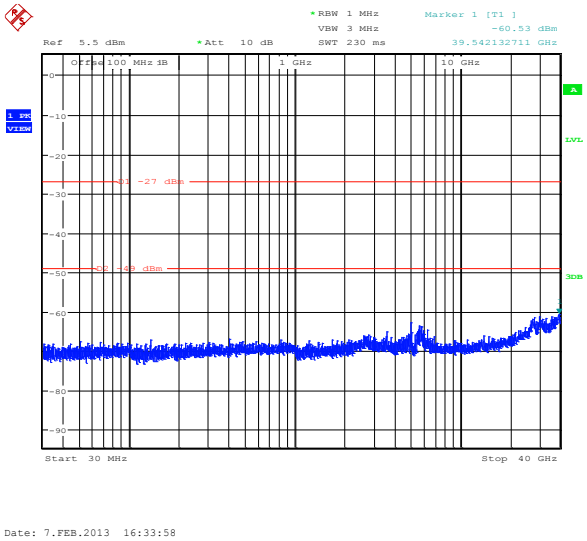


Diagram 8.5-35: *Conducted spurious emissions for FCC,19 dBi antenna, 10 MHz channel, ch1, high frequency*

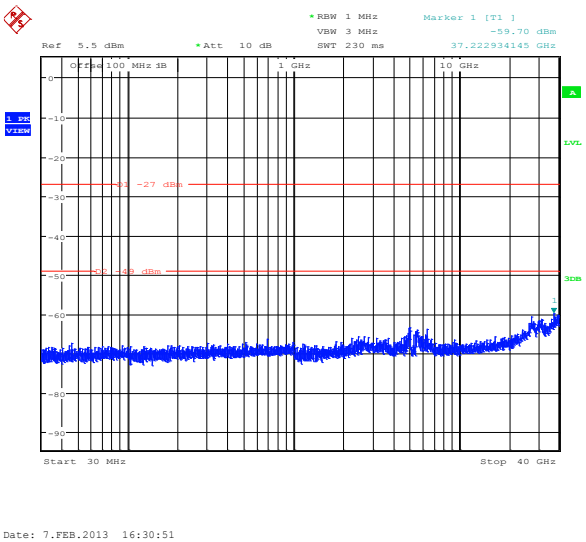


Diagram 8.5-36: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch0, low frequency*

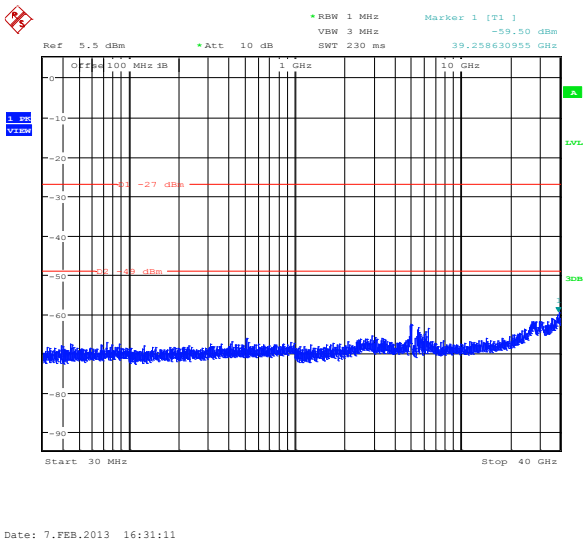


Diagram 8.5-37: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

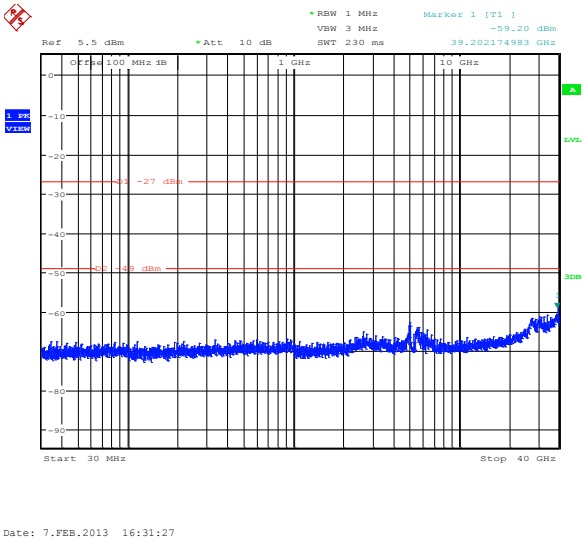


Diagram 8.5-38: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch0, high frequency*

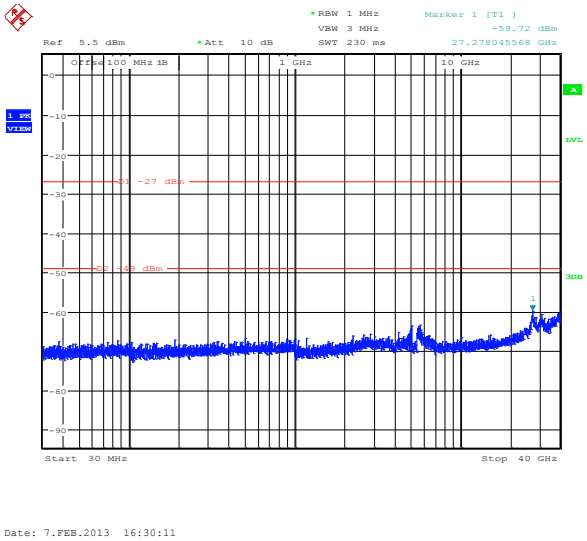


Diagram 8.5-39: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch1, low frequency*

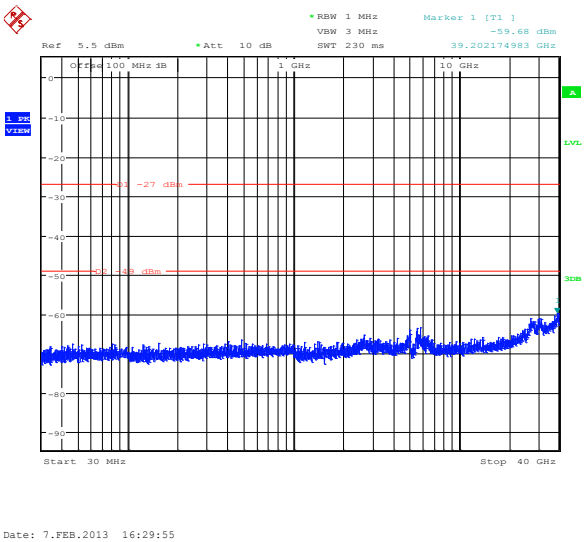


Diagram 8.5-40: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch1, mid frequency*

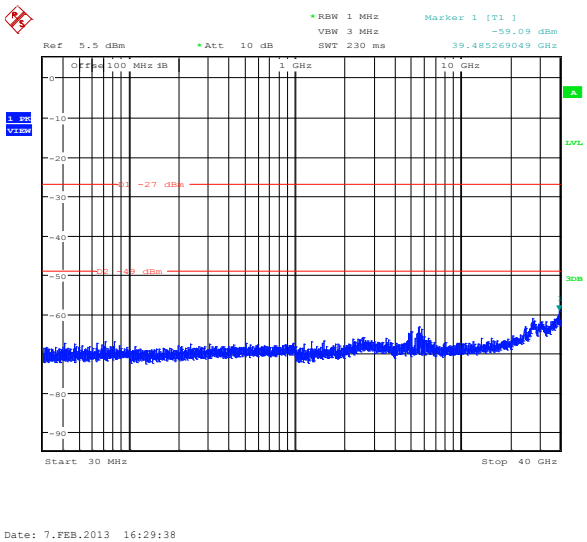


Diagram 8.5-41: *Conducted spurious emissions for FCC,19 dBi antenna, 20 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

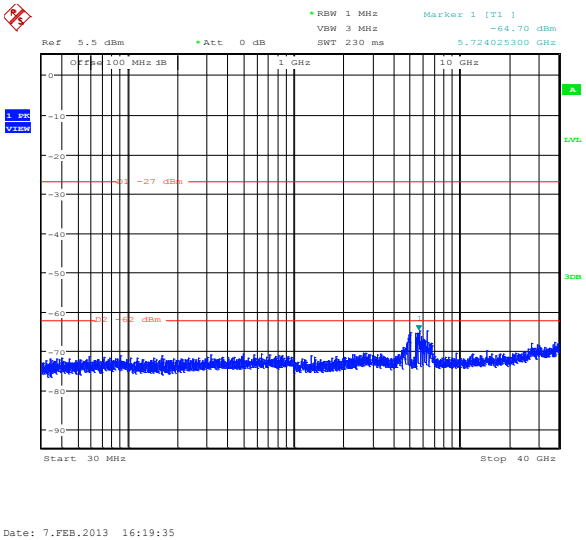


Diagram 8.5-42: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch0, low frequency*

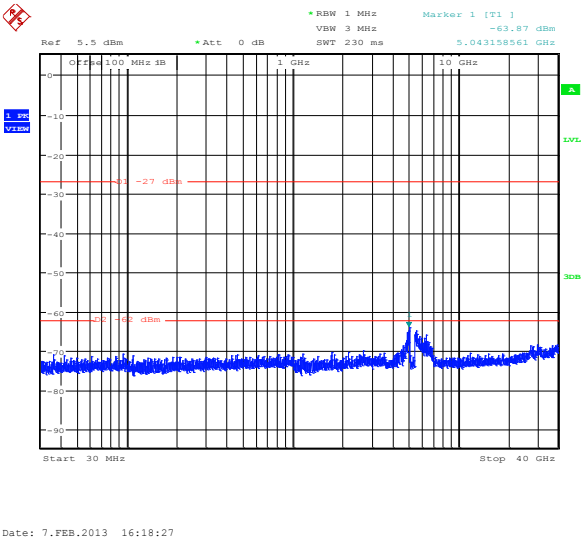


Diagram 8.5-43: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch0, mid frequency*

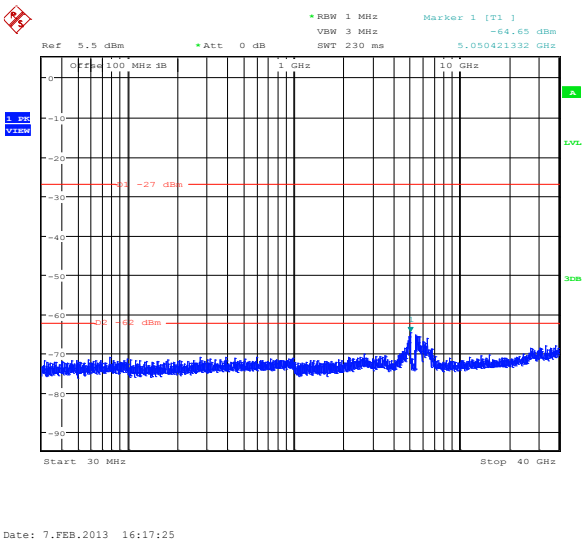


Diagram 8.5-44: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch0, high frequency*

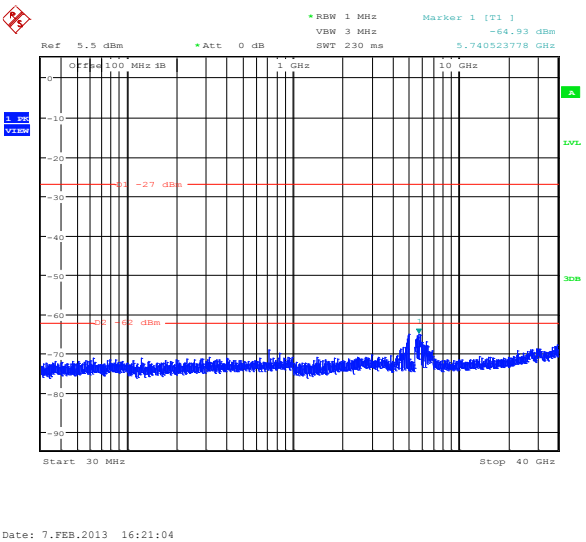


Diagram 8.5-45: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

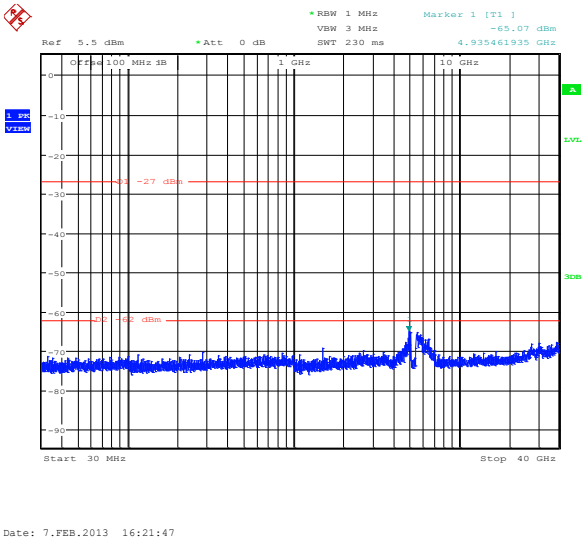


Diagram 8.5-46: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch1, mid frequency*

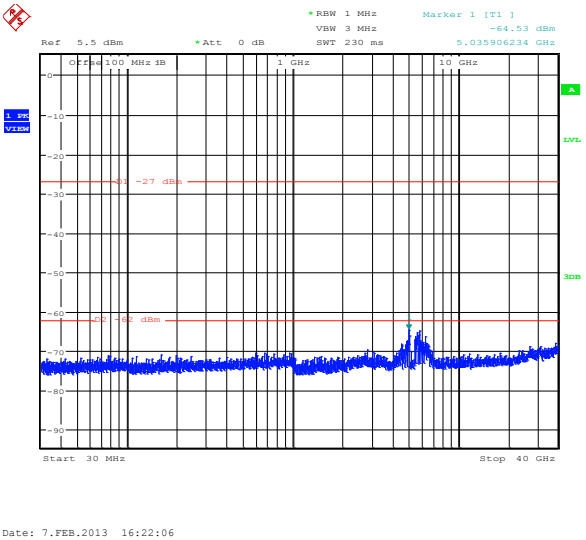


Diagram 8.5-47: *Conducted spurious emissions for FCC,32 dBi antenna, 5 MHz channel, ch1, high frequency*

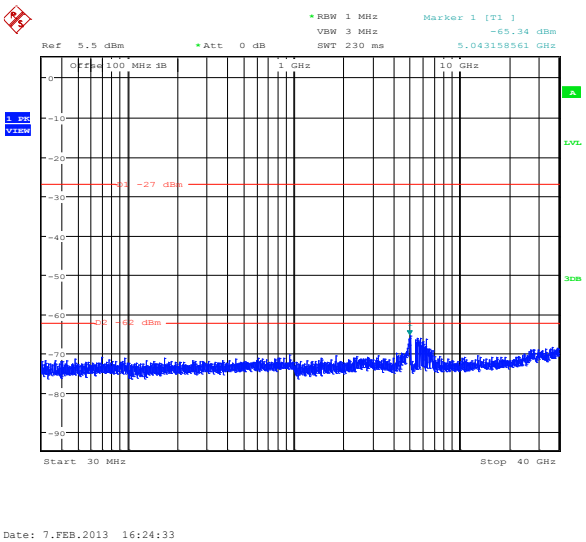


Diagram 8.5-48: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch0, low frequency*

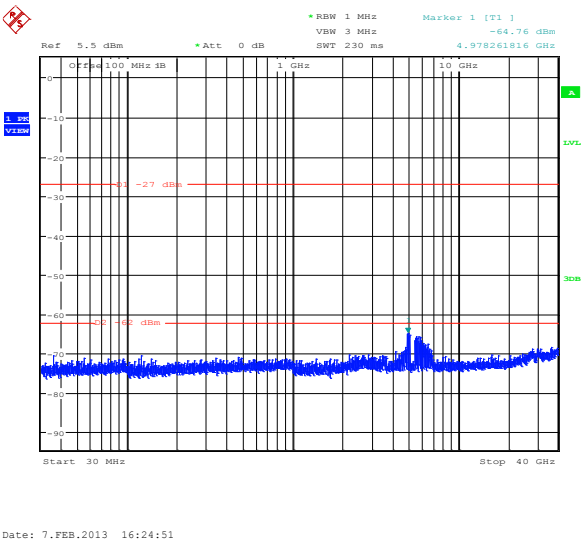


Diagram 8.5-49: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

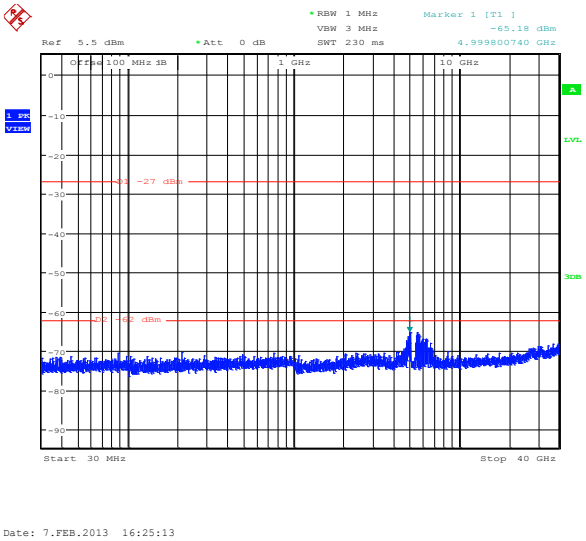


Diagram 8.5-50: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch0, high frequency*

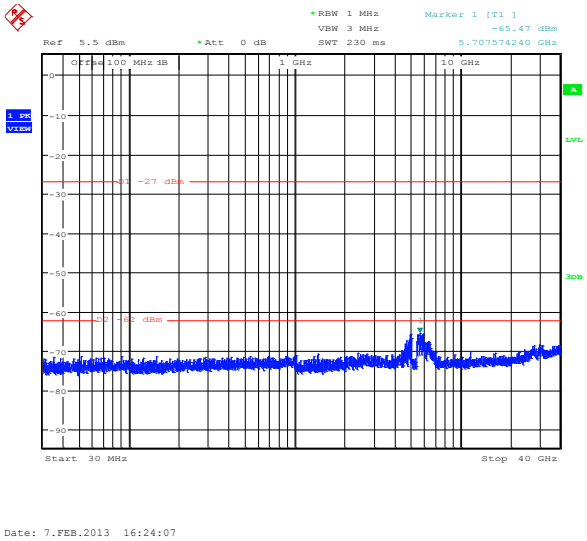


Diagram 8.5-51: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch1, low frequency*

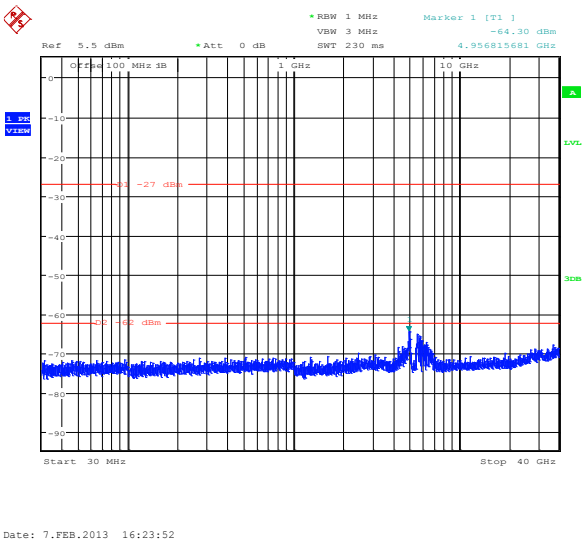


Diagram 8.5-52: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch1, mid frequency*

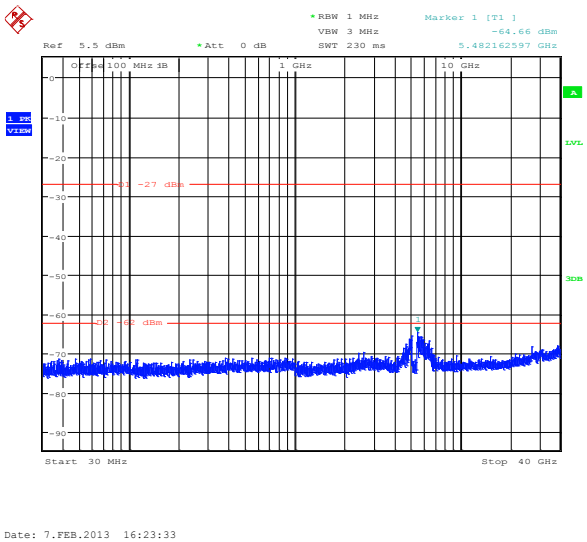


Diagram 8.5-53: *Conducted spurious emissions for FCC,32 dBi antenna, 10 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

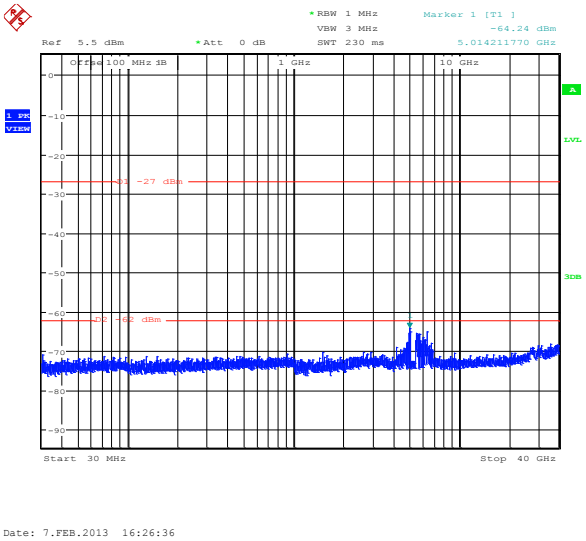


Diagram 8.5-54: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch0, low frequency*

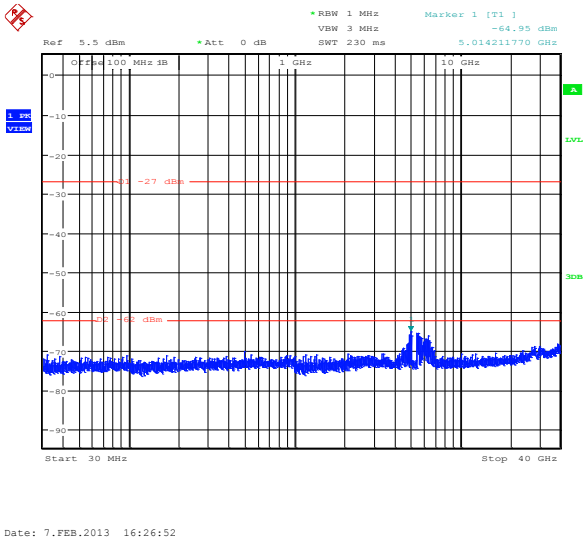


Diagram 8.5-55: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch0, mid frequency*

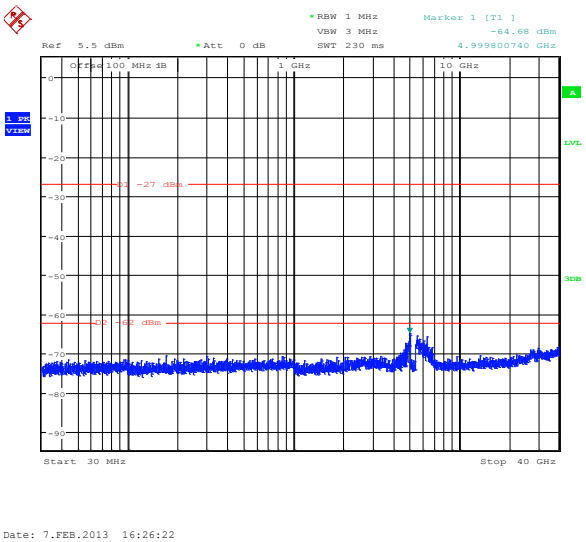


Diagram 8.5-56: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch0, high frequency*

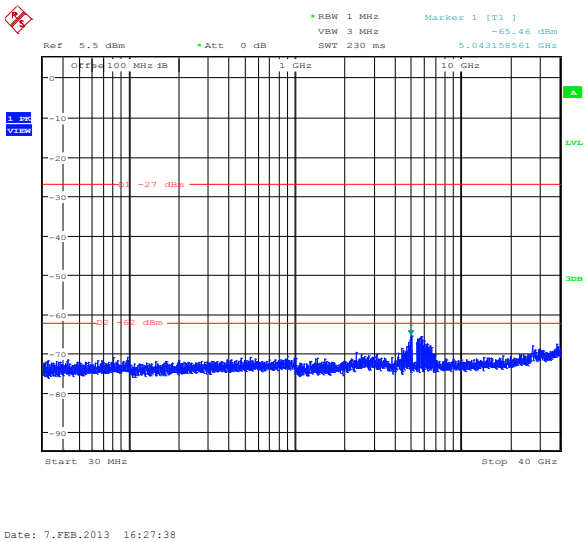


Diagram 8.5-57: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

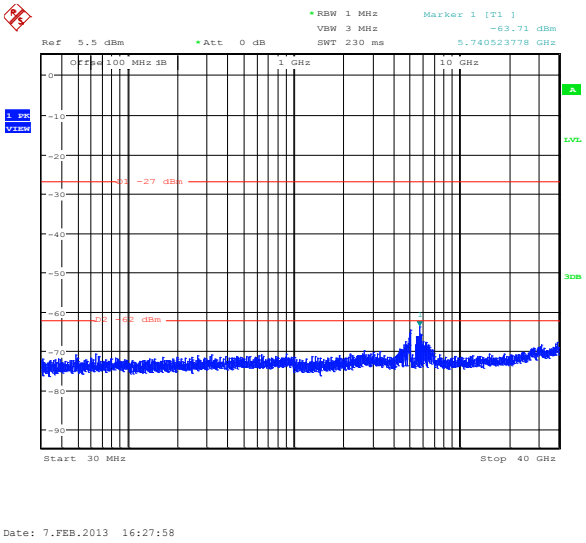


Diagram 8.5-58: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch1, mid frequency*

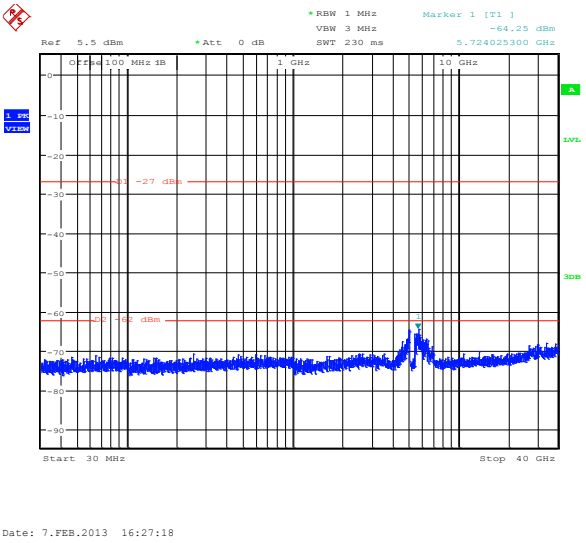


Diagram 8.5-59: *Conducted spurious emissions for FCC,32 dBi antenna, 20 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

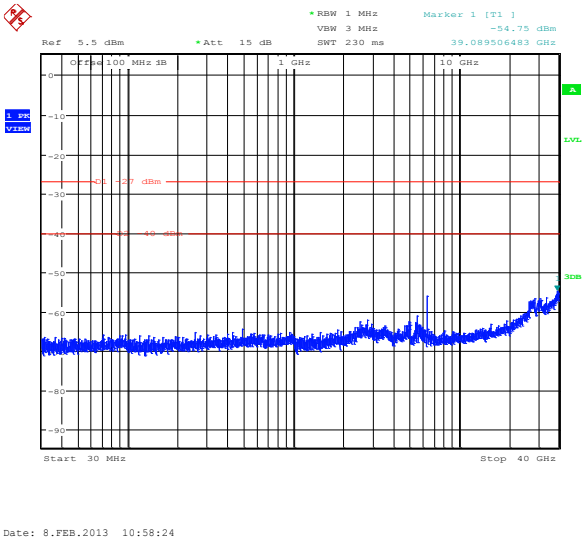


Diagram 8.5-60: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch0, low frequency*

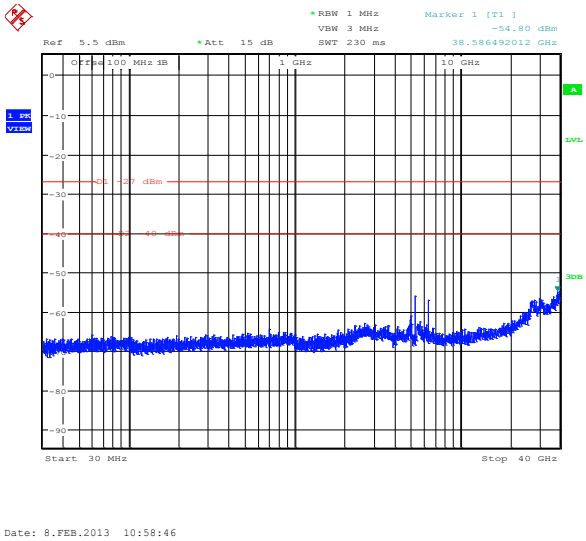


Diagram 8.5-61: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch0, mid frequency*

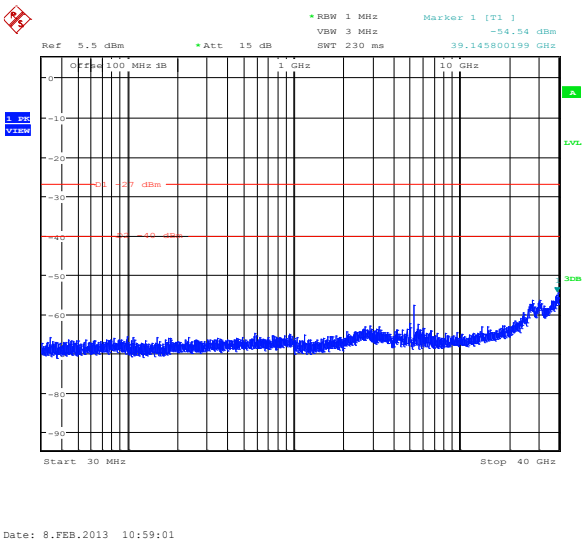


Diagram 8.5-62: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch0, high frequency*

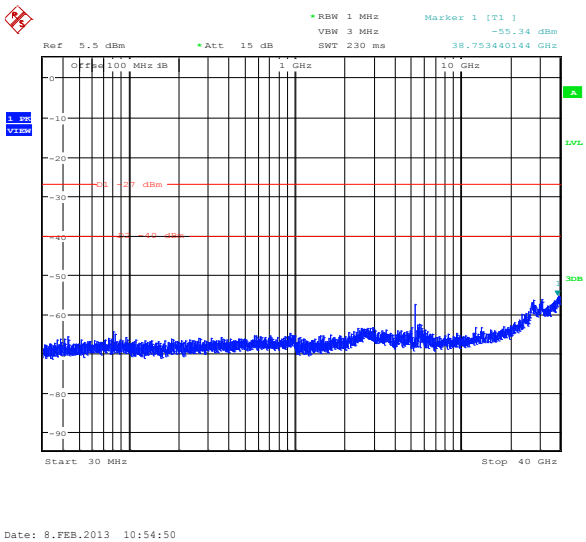


Diagram 8.5-63: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

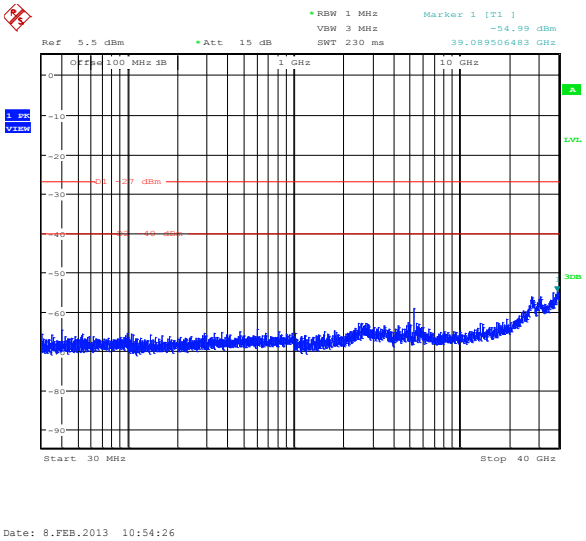


Diagram 8.5-64: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch1, mid frequency*

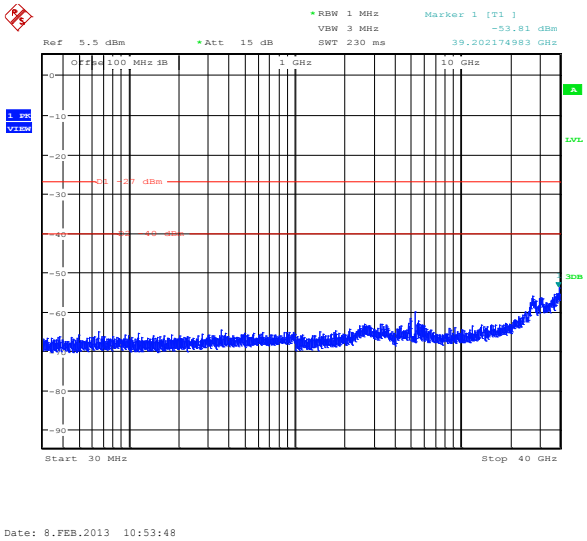


Diagram 8.5-65: *Conducted spurious emissions for IC,10 dBi antenna, 5 MHz channel, ch1, high frequency*

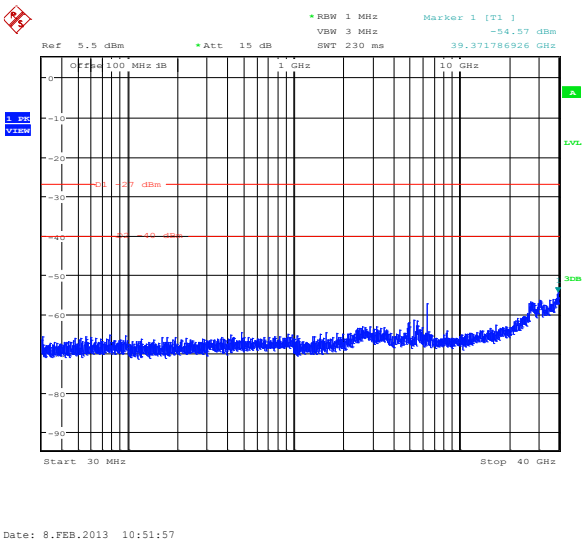


Diagram 8.5-66: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch0, low frequency*

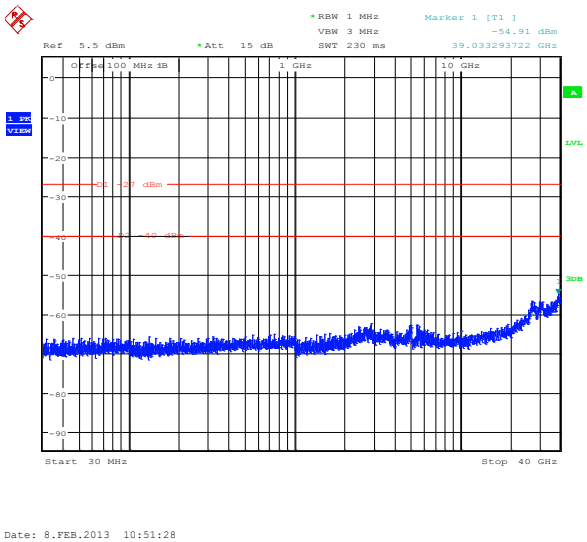


Diagram 8.5-67: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

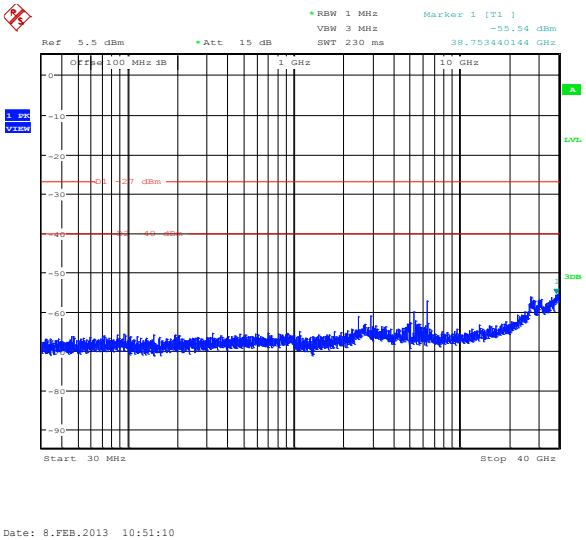


Diagram 8.5-68: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch0, high frequency*

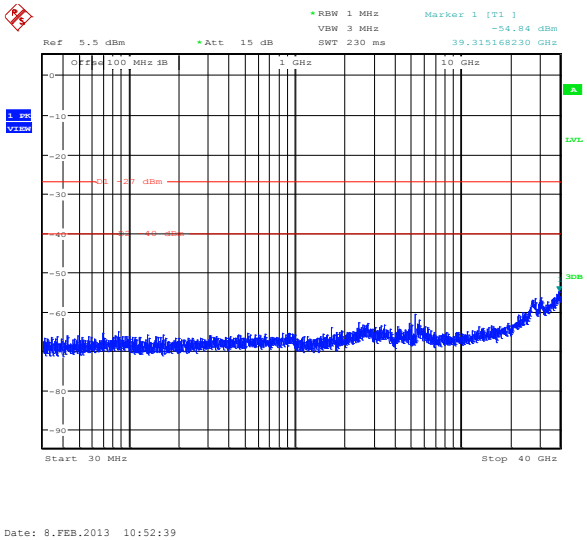


Diagram 8.5-69: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch1, low frequency*

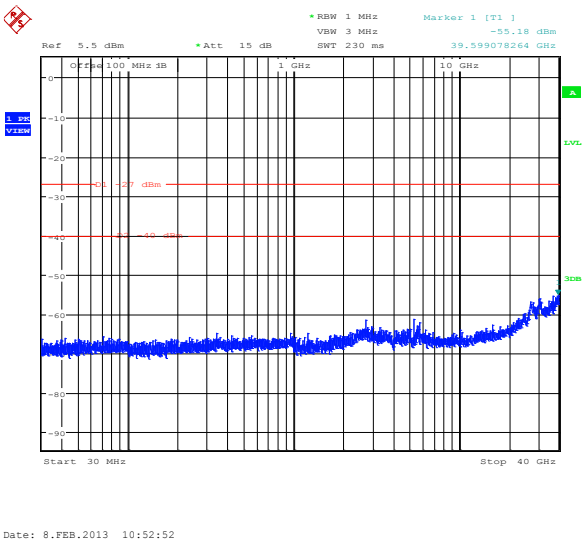


Diagram 8.5-70: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch1, mid frequency*

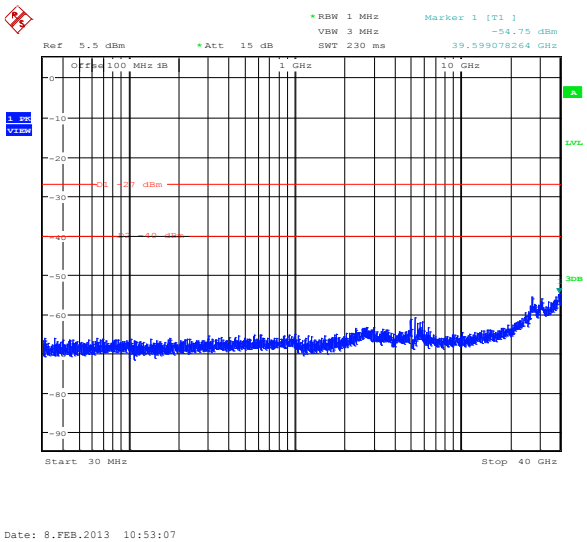


Diagram 8.5-71: *Conducted spurious emissions for IC,10 dBi antenna, 10 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

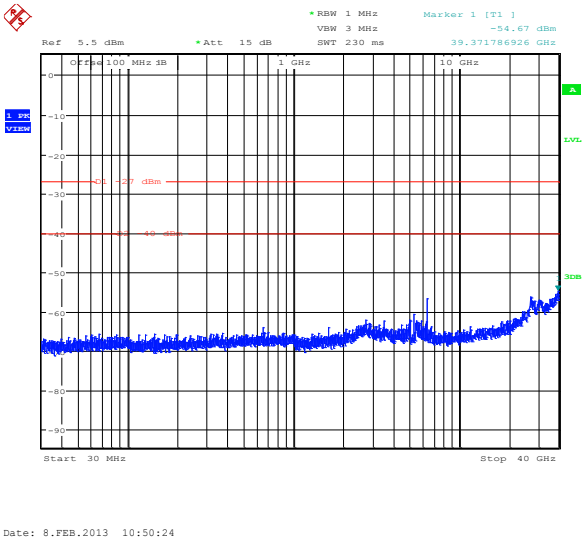


Diagram 8.5-72: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch0, low frequency*

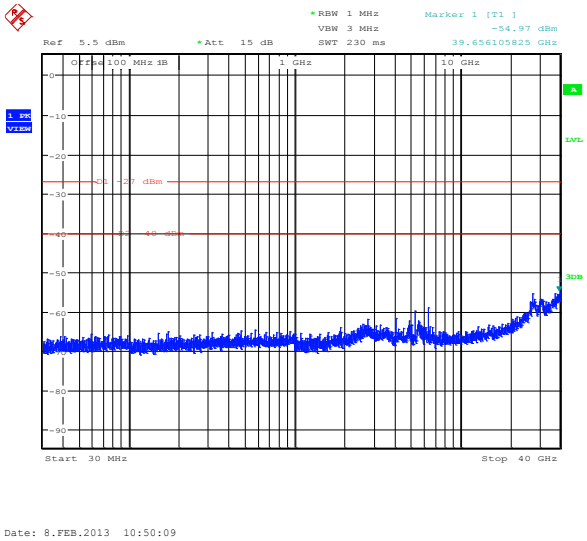


Diagram 8.5-73: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch0, mid frequency*

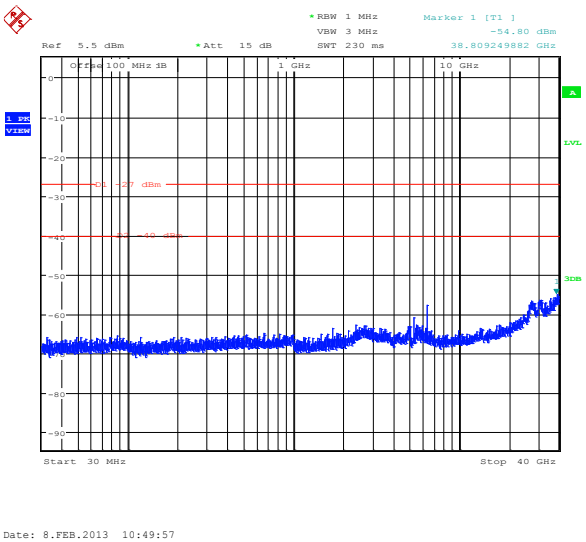


Diagram 8.5-74: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch0, high frequency*

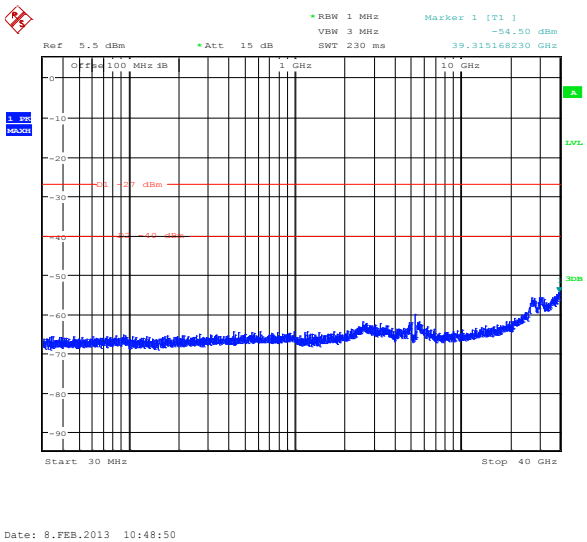


Diagram 8.5-75: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

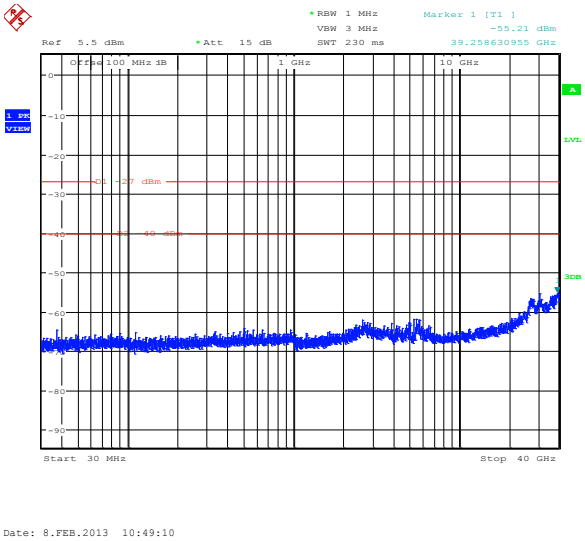


Diagram 8.5-76: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch1, mid frequency*

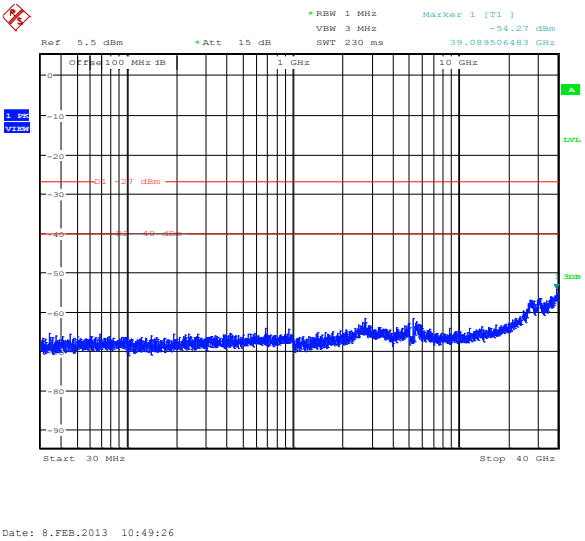


Diagram 8.5-77: *Conducted spurious emissions for IC,10 dBi antenna, 20 MHz channel, ch1, high frequency*

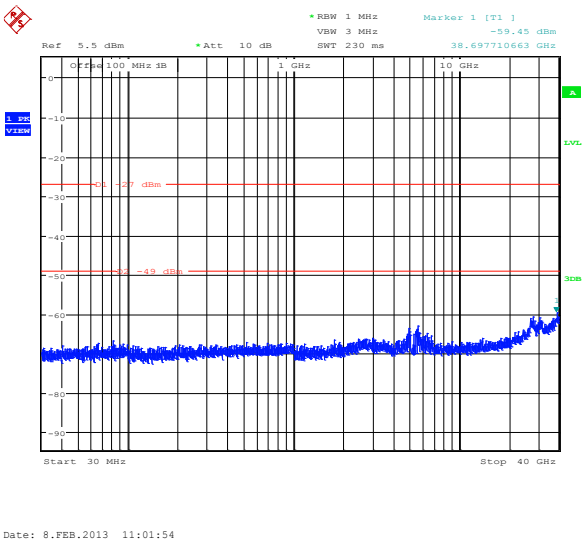


Diagram 8.5-78: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, ch0, low frequency*

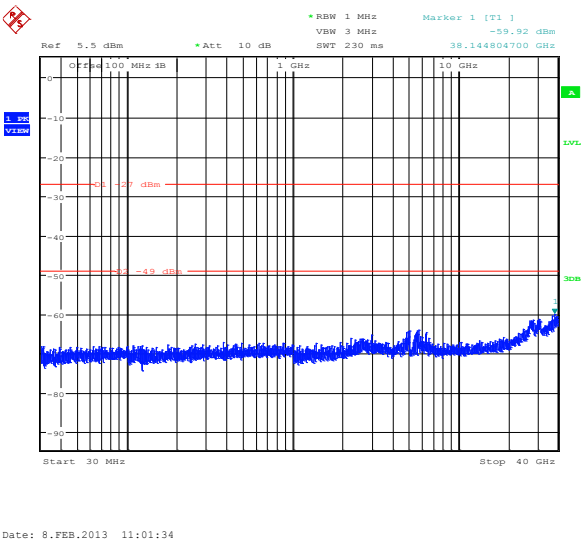


Diagram 8.5-79: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

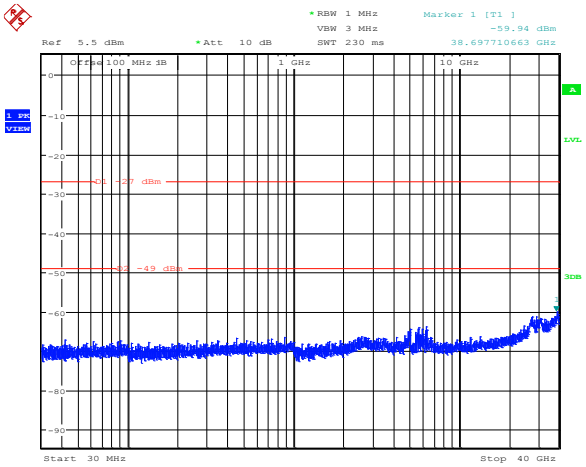


Diagram 8.5-80: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, cho, high frequency*

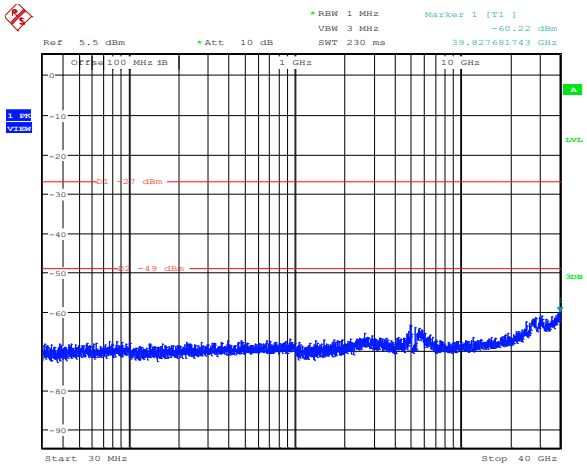


Diagram 8.5-81: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, ch1, low frequency*

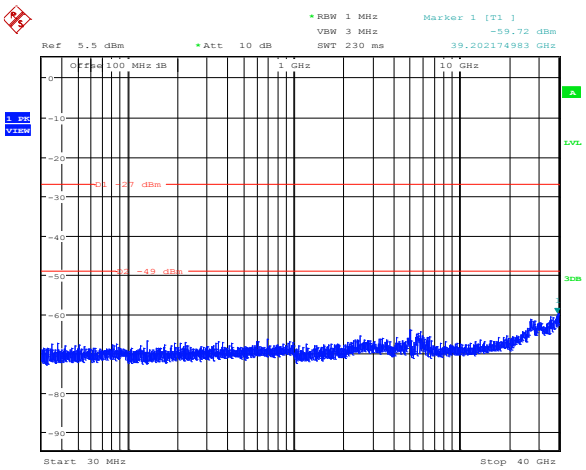


Diagram 8.5-82: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, ch1, mid frequency*

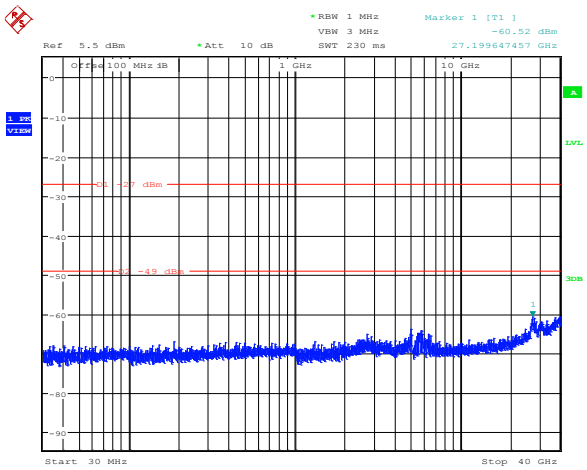


Diagram 8.5-83: *Conducted spurious emissions for IC,19 dBi antenna, 5 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

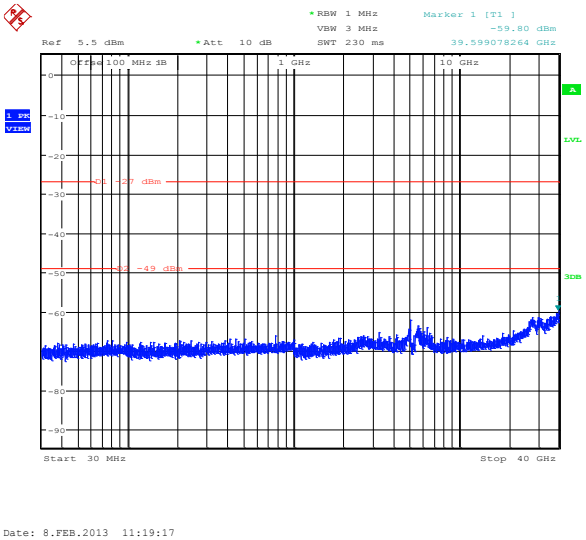


Diagram 8.5-84: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch0, low frequency*

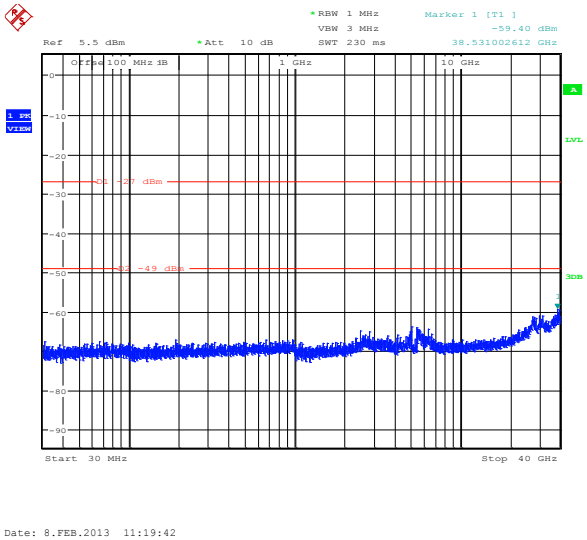


Diagram 8.5-85: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch0, mid frequency*

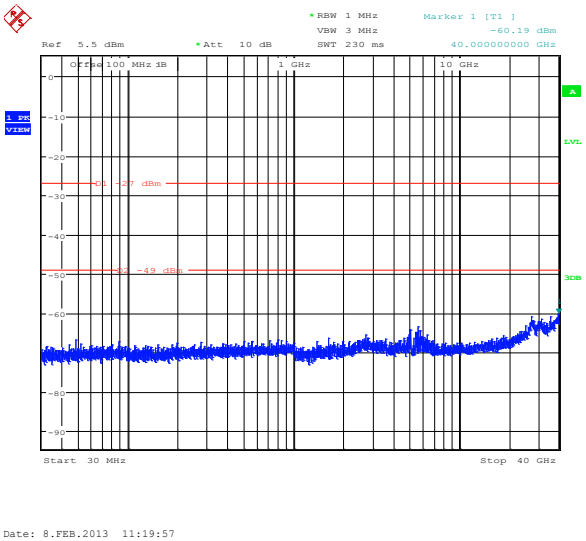


Diagram 8.5-86: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch0, high frequency*

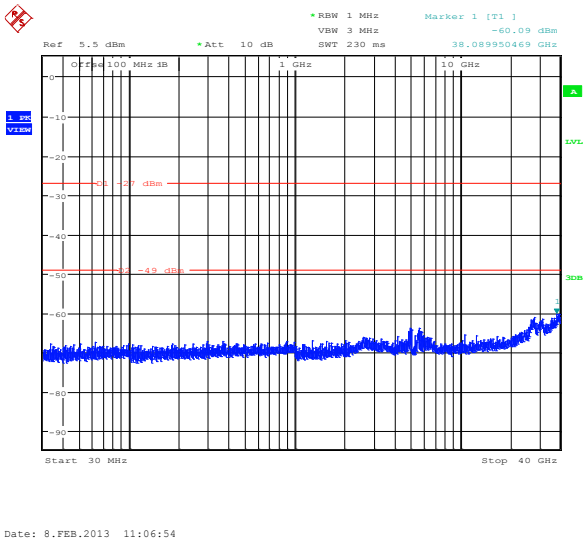


Diagram 8.5-87: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

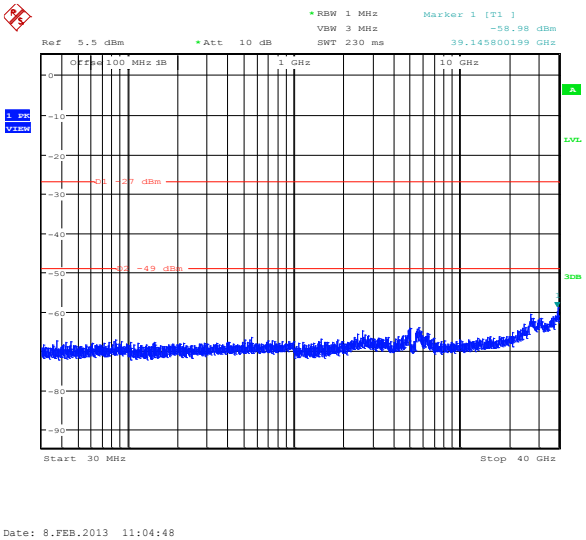


Diagram 8.5-88: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch1, mid frequency*

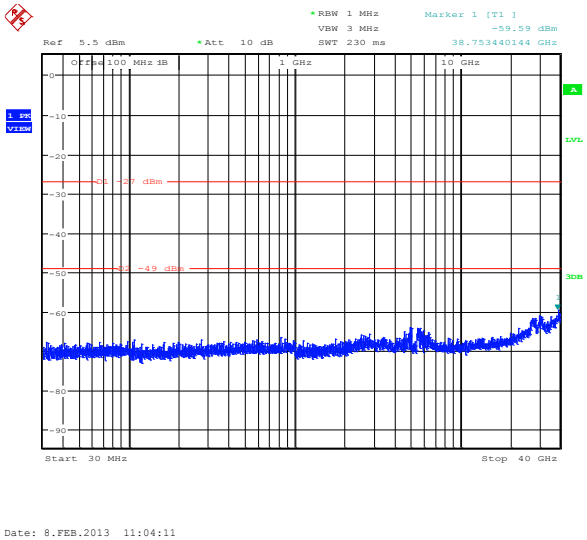


Diagram 8.5-89: *Conducted spurious emissions for IC,19 dBi antenna, 10 MHz channel, ch1, high frequency*

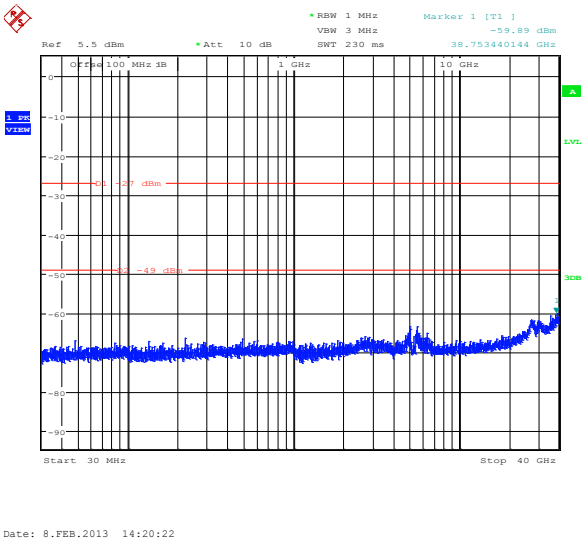


Diagram 8.5-90: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch0, low frequency*

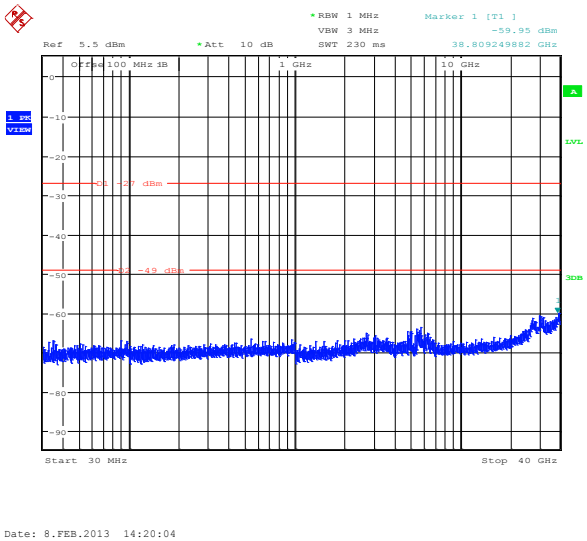


Diagram 8.5-91: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

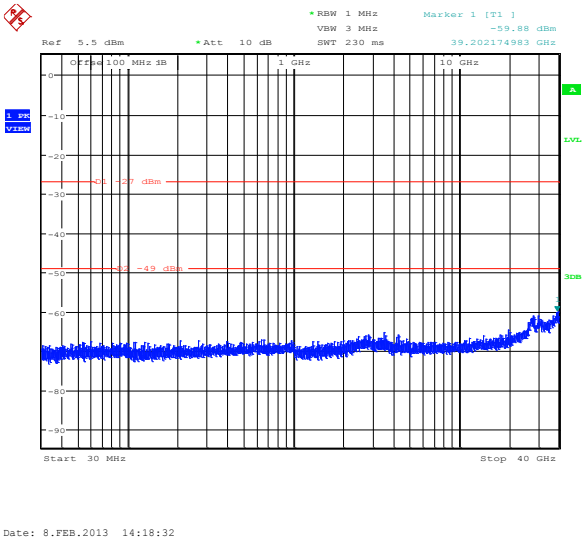


Diagram 8.5-92: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch0, high frequency*

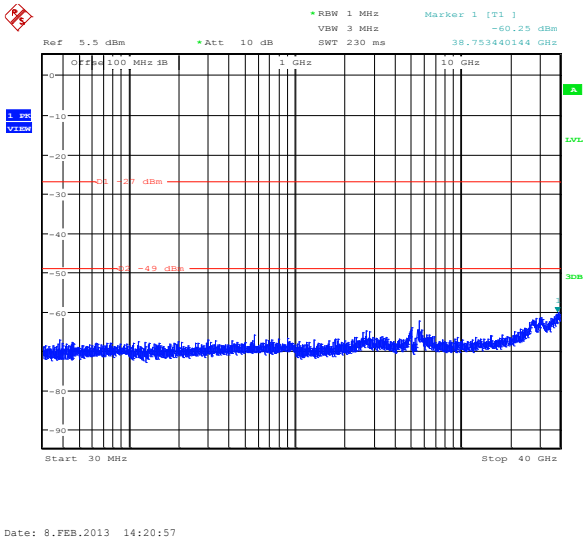


Diagram 8.5-93: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch1, low frequency*

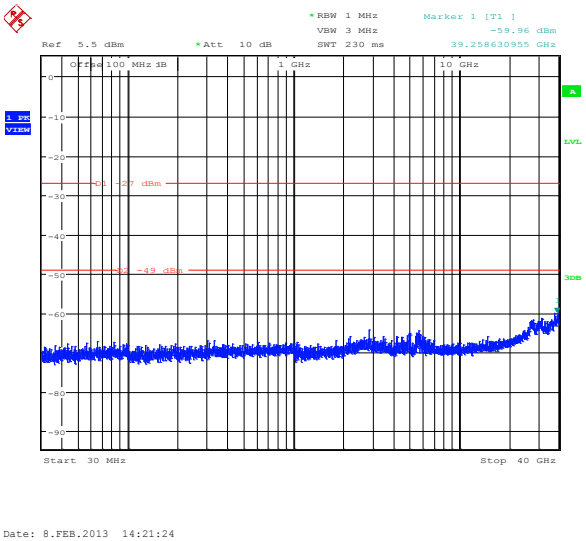


Diagram 8.5-94: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch1, mid frequency*

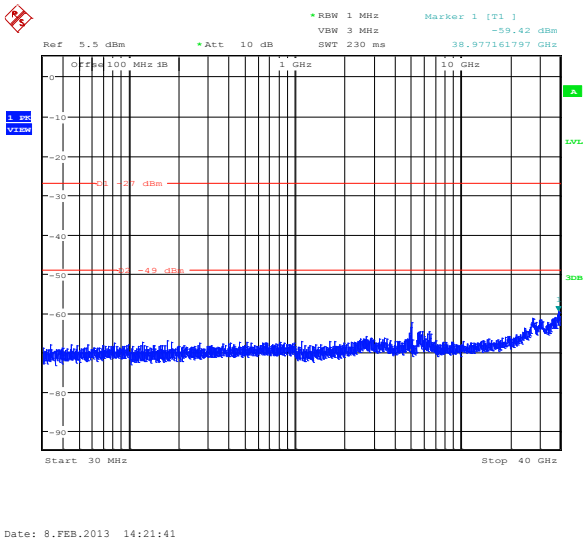


Diagram 8.5-95: *Conducted spurious emissions for IC,19 dBi antenna, 20 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

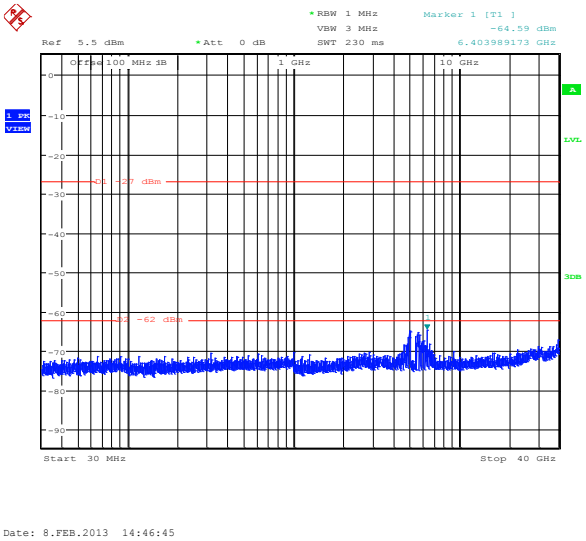


Diagram 8.5-96: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch0, low frequency*

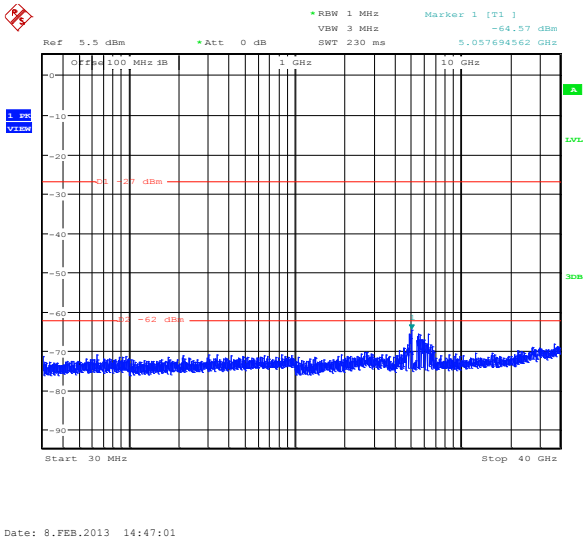


Diagram 8.5-97: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch0, mid frequency*

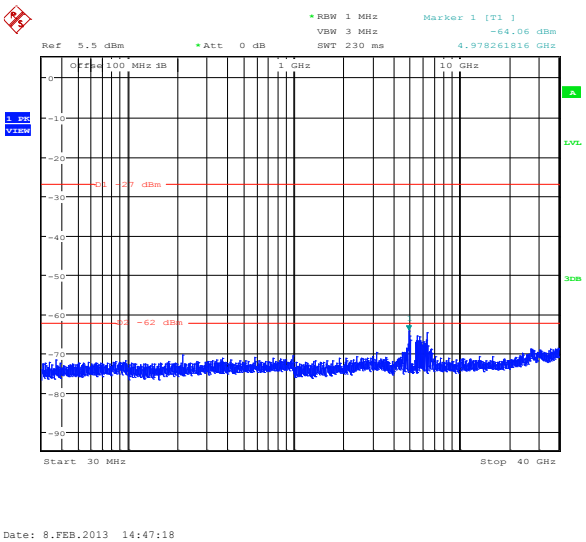


Diagram 8.5-98: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch0, high frequency*

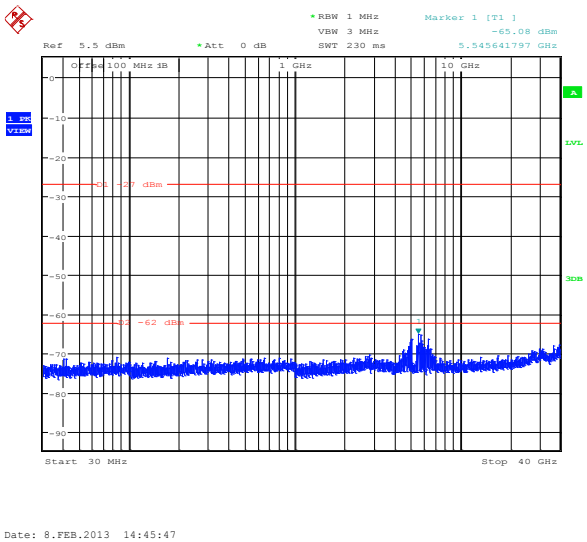


Diagram 8.5-99: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

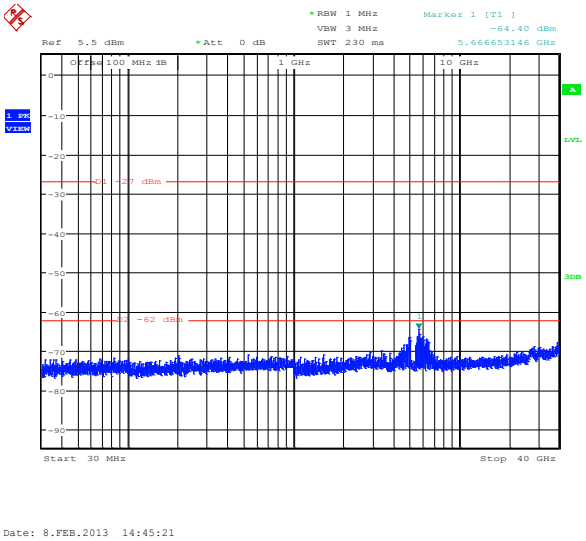


Diagram 8.5-100: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch1, mid frequency*

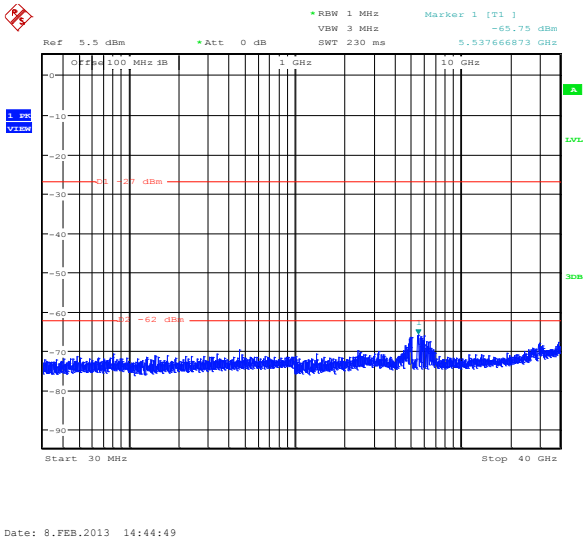


Diagram 8.5-101: *Conducted spurious emissions for IC,32 dBi antenna, 5 MHz channel, ch1, high frequency*

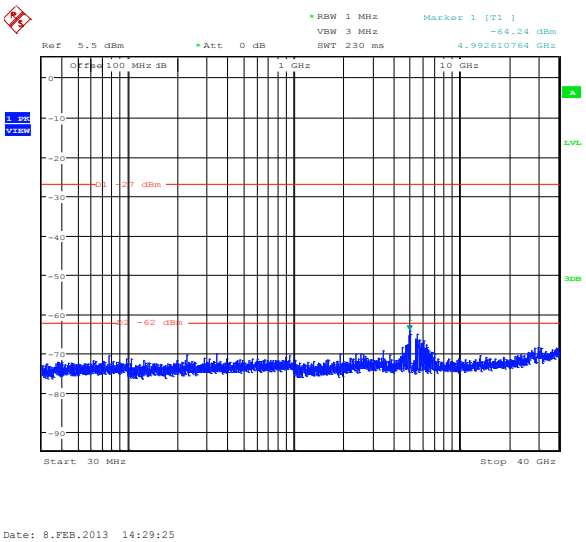


Diagram 8.5-102: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch0, low frequency*

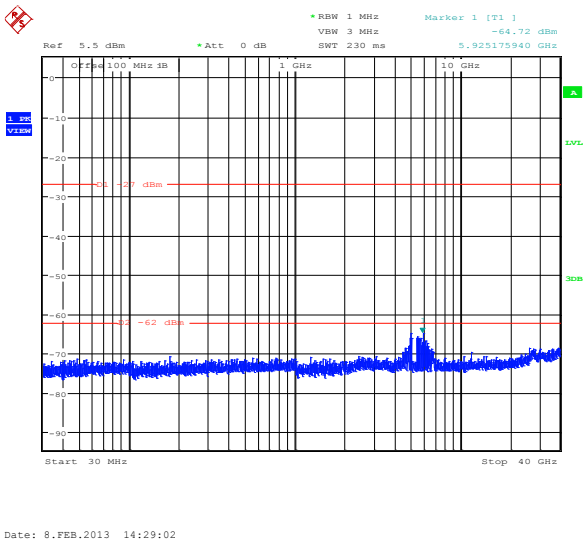


Diagram 8.5-103: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch0, mid frequency*

8.5.4 Test data, continued

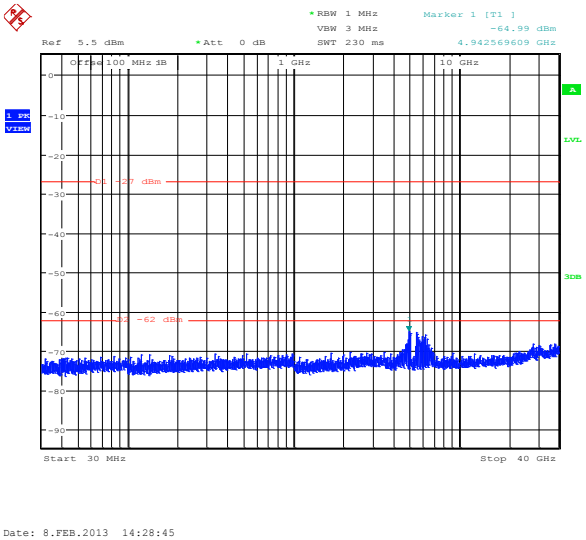


Diagram 8.5-104: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch0, high frequency*

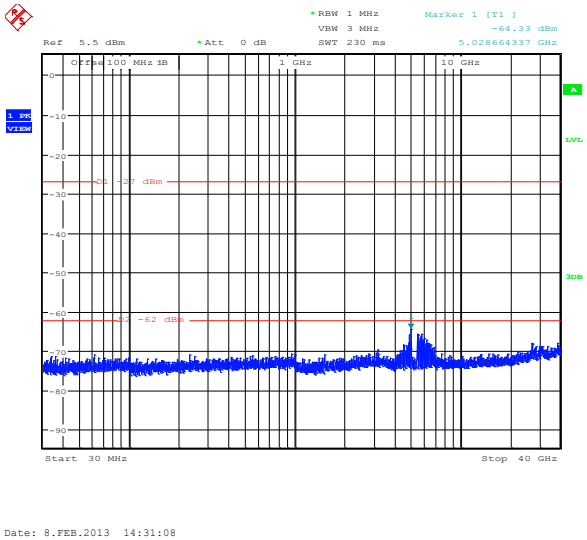


Diagram 8.5-105: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch1, low frequency*

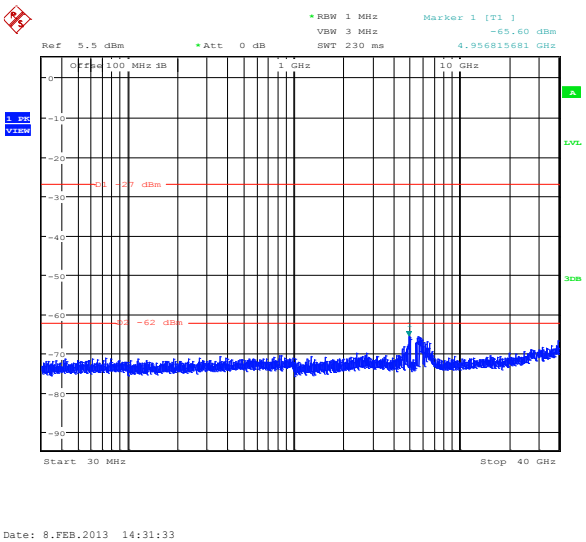


Diagram 8.5-106: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch1, mid frequency*

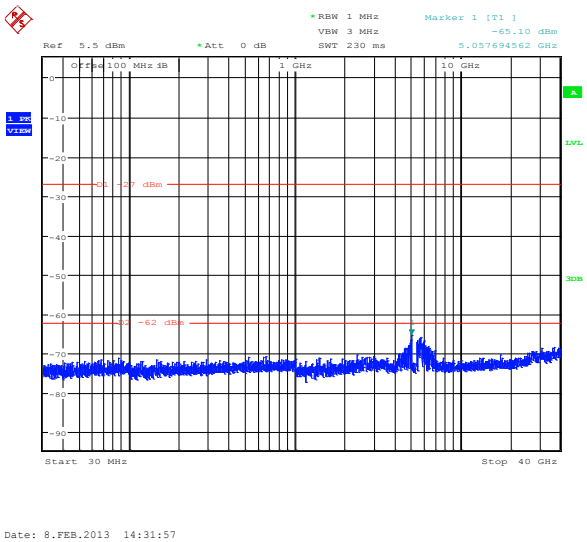


Diagram 8.5-107: *Conducted spurious emissions for IC,32 dBi antenna, 10 MHz channel, ch1, high frequency*

8.5.4 Test data, continued

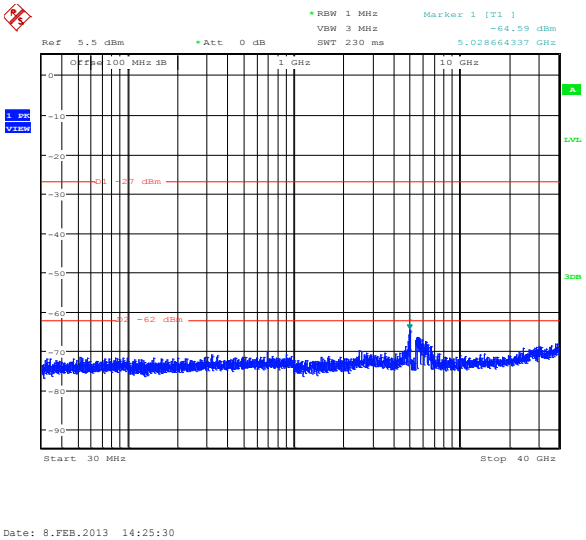


Diagram 8.5-108: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch0, low frequency*

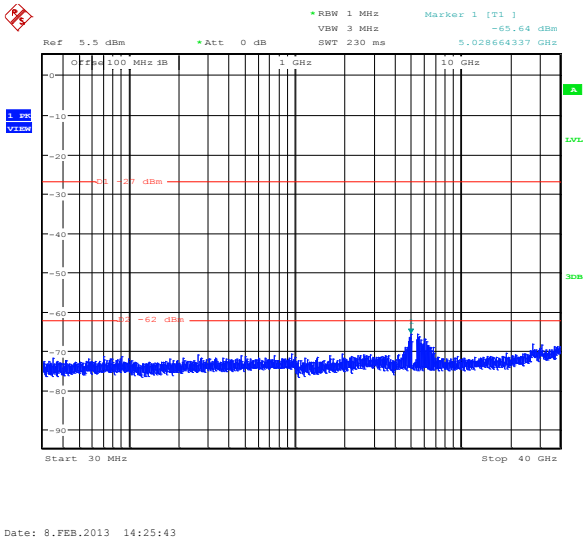


Diagram 8.5-109: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch0, mid frequency*

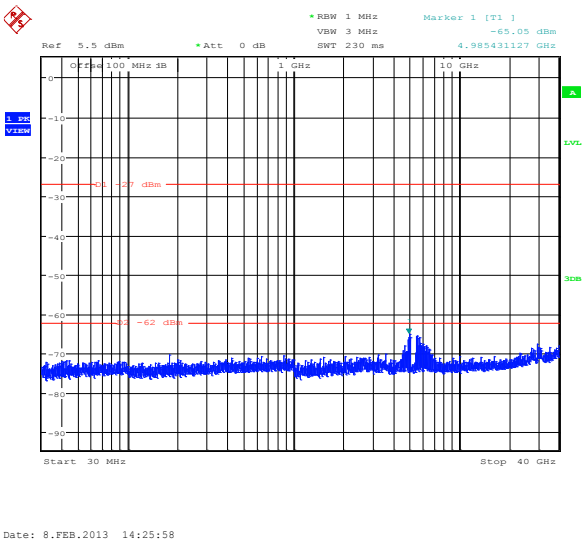


Diagram 8.5-110: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch0, high frequency*

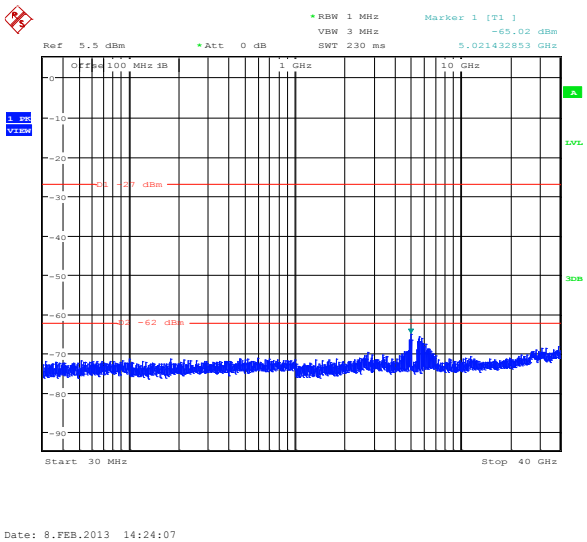


Diagram 8.5-111: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch1, low frequency*

8.5.4 Test data, continued

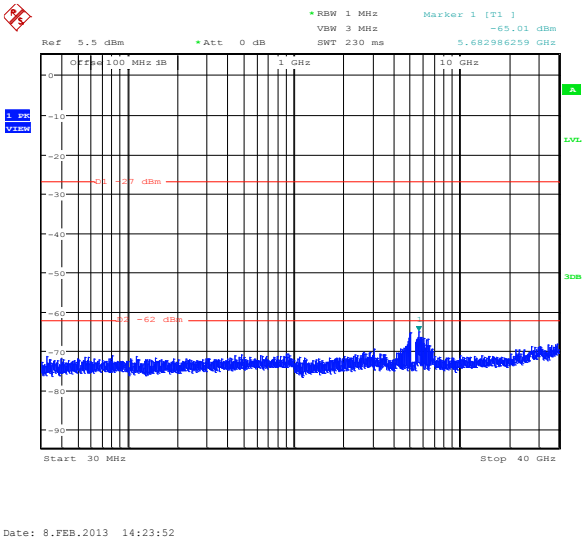


Diagram 8.5-112: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch1, mid frequency*

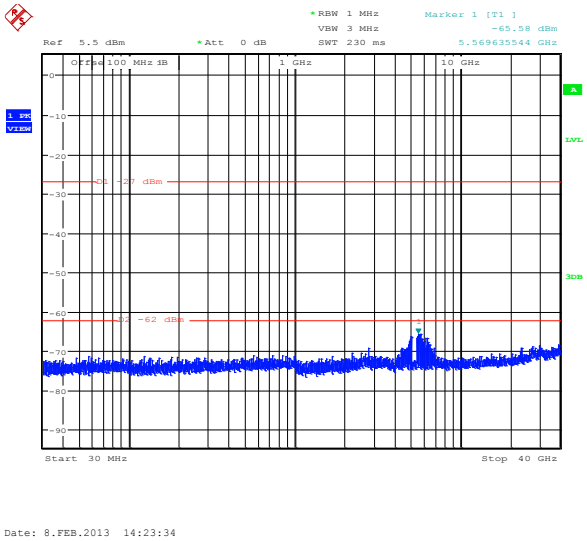


Diagram 8.5-113: *Conducted spurious emissions for IC,32 dBi antenna, 20 MHz channel, ch1, high frequency*

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	February 6, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1002 mbar	**Relative humidity**	33 %

8.6.3 Observations/special notes

The frequency stability test was performed in the −30 to +50 °C temperature range at 5.25–5.35 GHz frequency range. The input voltage was varied ±15 % at the room temperature.

All modulations and both antenna ports were investigated, only the worst-case results were presented.

8.6.4 Test data

Table 8.6-1: *Frequency drift measurement*

Test conditions	Frequency, GHz	Drift, Hz
+50 °C, Nominal	5.299983074	-102
+40 °C, Nominal	5.299983019	-157
+30 °C, Nominal	5.299982915	-261
+20 °C, +15 %	5.299983013	-163
+20 °C, Nominal	5.299983176	*Reference*
+20 °C, −15 %	5.299983179	3
+10 °C, Nominal	5.299983222	46
0 °C, Nominal	5.299983297	121
−10 °C, Nominal	5.299983303	127
−20 °C, Nominal	5.299983300	124
−30 °C, Nominal	5.299983255	79

Table 8.6-2: *Band edge drift calculation*

Channel bandwidth, MHz	−26 dBc lower cross point, GHz	Max negative drift, Hz	Drifted lower cross point, GHz	Band edge, GHz	Margin, MHz
5	5.29766026	-261	5.297659995	5.250000000	47.659995
10	5.2948718	-261	5.294871534	5.250000000	44.871534
20	5.29070513	-261	5.290704867	5.250000000	40.704867
Channel bandwidth, MHz	**−26 dBc upper cross point, GHz**	**Max positive drift, Hz**	**Drifted upper cross point, GHz**	**Band edge, GHz**	**Margin, MHz**
5	5.30233974	127	5.302466744	5.350000000	47.533256
10	5.30464744	127	5.304774436	5.350000000	45.225564
20	5.30929487	127	5.309421872	5.350000000	40.578128

Notes: Drifted lower cross point = −26 dBc lower cross point – max negative drift. 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:
(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:
Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average (10 $\log_{10}$ (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	February 7, 2013	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	1004 mbar	**Relative humidity**	35 %

8.7.3 Observations/special notes

FCC test was performed using method described in 789033 D01 General UNII Test Procedures v01r02 under sections F, E and C.

8.7.4 Test data

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

Channel bandwidth, MHz	Frequency, MHz	Peak PSD result at ch0, dBm/MHz	Peak PSD result at ch1, dBm/MHz	Combined Peak PSD result, dBm/MHz
5	5252.5	14.33	13.54	16.96
	5300.0	14.00	14.57	17.30
	5345.0	13.52	13.34	16.44
10	5255.0	12.75	13.18	15.98
	5300.0	12.45	13.19	15.85
	5342.5	12.82	13.24	16.05
20	5260.0	12.48	11.80	15.16
	2300.0	12.29	12.02	15.17
	5337.5	12.20	12.52	15.37

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

Channel bandwidth, MHz	Frequency, MHz	Peak PSD result, dBm/MHz	Average PSD result, dBm/MHz	Excursion dB	Limit, dB	Margin, dB
5	5252.5	16.96	6.91	10.05	13.00	2.95
	5300.0	17.30	6.60	10.71	13.00	2.29
	5345.0	16.44	6.77	9.67	13.00	3.33
10	5255.0	15.98	6.66	9.32	13.00	3.68
	5300.0	15.85	6.96	8.89	13.00	4.11
	5342.5	16.05	6.63	9.42	13.00	3.58
20	5260.0	15.16	6.66	8.51	13.00	4.49
	2300.0	15.17	6.66	8.51	13.00	4.49
	5337.5	15.37	6.64	8.74	13.00	4.26

Note: Excursion is calculated as follows: Peak power result – Average PSD result.

8.7.4 Test data, continued

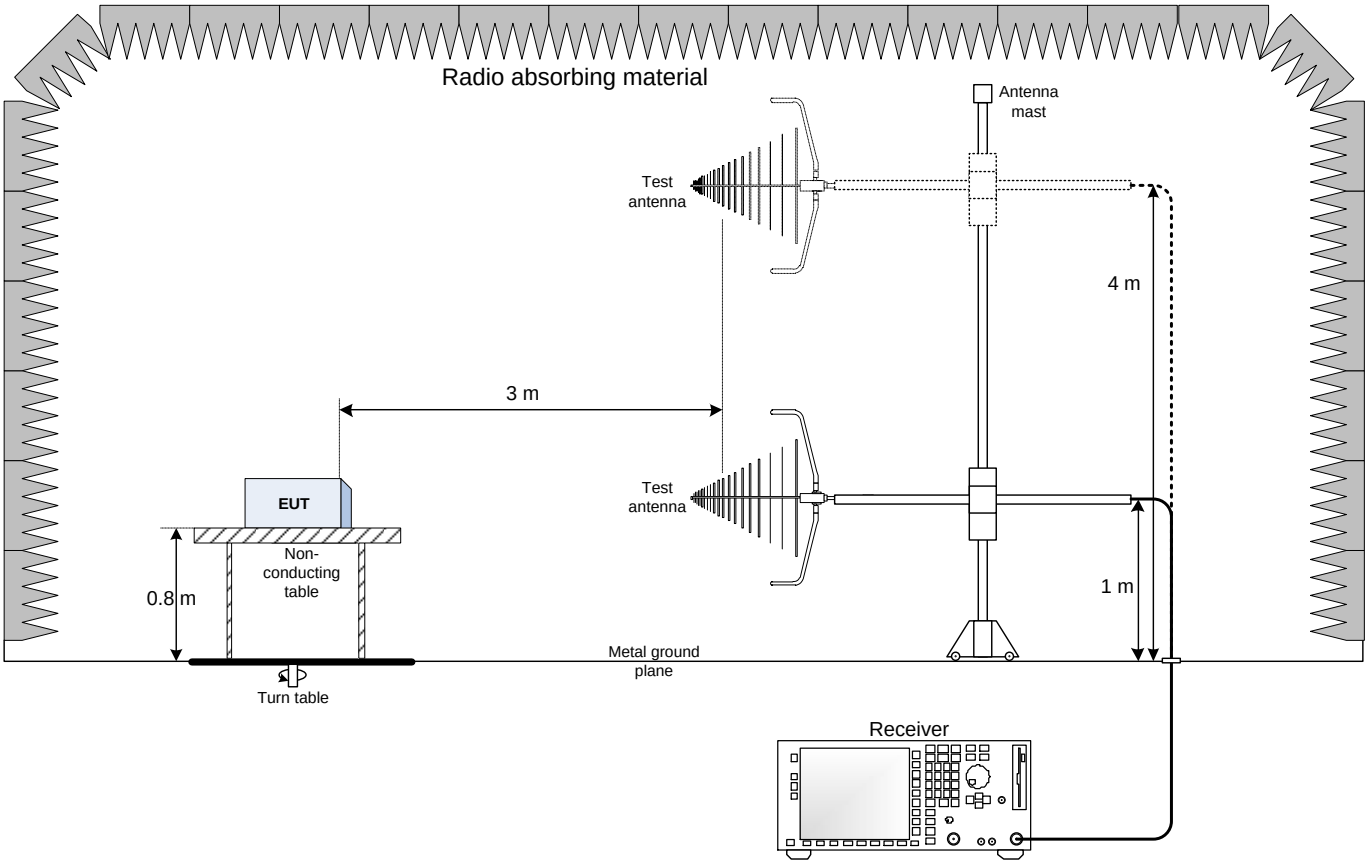
Table 8.7-3: *IC PSD-to-average calculations results*

Channel bandwidth, MHz	Frequency, MHz	PSD result, dBm/MHz	Average result, dBm	Delta dB	Limit, dB	Margin, dB
5	5252.5	9.03	12.97	-3.94	+3.00	6.94
	5300.0	8.13	12.92	-4.80	+3.00	7.80
	5345.0	8.93	12.93	-4.00	+3.00	7.00
10	5255.0	6.13	12.90	-6.77	+3.00	9.77
	5300.0	6.01	12.70	-6.68	+3.00	9.68
	5342.5	5.38	12.98	-7.60	+3.00	10.60
20	5260.0	3.14	12.88	-9.74	+3.00	12.74
	2300.0	3.18	12.98	-9.80	+3.00	12.80
	5337.5	2.71	12.94	-10.23	+3.00	13.23

Note: Delta 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