

Compliance test report ID **229067-1TRFWL**

Date of issue  
April 26, 2013

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**FCC 47 CFR Part 90 Subpart Y**

Private Land Mobile Services

**RSS-111, Issue 4 January 2012**

Broadband public safety equipment operating in the band 4940–4990 MHz

Applicant **Redline Communications**  
Product **Broad-band wireless infrastructure product**  
Model **RDL-3000-RMC**  
FCC ID **QC8-RDL3000RMC**  
IC Reg. # **4310A-RDL3000RMC**

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Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation



Test location

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FCC test site registration number: 176392 and IC registered site number: 2040A-4 (3 m semi anechoic chamber)

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**Tested by** Andrey Adelberg, Senior Wireless/EMC Specialist

**Reviewed by**  April 26, 2013  

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Kevin Rose, Wireless/EMC Specialist **Date**

Limits of responsibility

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

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

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer

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

### 1.2 Test specifications

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FCC 47 CFR Part 90 Subpart Y	Private Land Mobile Services
RSS-111, Issue 4, January 2012	Broadband public safety equipment operating in the band 4940–4990 MHz

### 1.3 Test methods

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Emissions testing of transmitters with multiple outputs in the same band (MIMO) 662911 D01 Multiple Transmitter Output v01r02 (September 26, 2012)

### 1.4 Statement of compliance

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In the configuration tested, the EUT was found compliant.

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

See "Summary of test results" for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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

## Section 2. Summary of test results

### 2.1 FCC Part 90 Subpart Y, test results

Part	Test description	Verdict
90.1215	Occupied bandwidth	Pass
90.1215	Maximum conducted output power	Pass
90.1215	Power spectrum density	Pass
90.1215	The ratio of the peak excursion	Pass
90.210(m)	Spurious emissions at the antenna terminals	Pass
90.210(m)(6)	Radiated spurious emissions	Pass
90.213	Frequency stability	Pass

Notes: None

### 2.2 RSS-111 Issue 4, test results

Part	Test description	Verdict
5.1	Type of modulation	Pass <sup>1</sup>
5.2	Transmitter frequency stability	Pass
5.3	Transmitter output power and channel bandwidth	Pass
5.4	Transmitter unwanted emissions	Pass
5.5	Receiver spurious emissions	Not applicable <sup>2</sup>

Notes: <sup>1</sup>The EUT utilizes OFDM method of encoding digital modulations such as BPSK, QPSK, 16-QAM and 64-QAM.

<sup>2</sup> According to Notice 2012-DRS0126 (from January 2012) section 2.2 of RSS-Gen, Issue 3 has been revised.

#### 2.2.3 Receivers Excluded from Industry Canada Requirements

Only radiocommunication receivers operating in stand-alone mode within the band 30–960 MHz and scanner receivers are subject to Industry Canada requirements, as described above. All other receivers are excluded from any Industry Canada certification, testing, labelling and reporting requirements.

**The EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver 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-RMC
Serial number	149PC12480006

### 3.3 Technical information

Operating band	4940–4990 MHz
Operating frequencies	5 MHz channel: 4942.5–4987.5 MHz 10 MHz channel: 4945–4985 MHz 20 MHz channel: 4950–4980 MHz
Modulation type	OFDM using 64-QAM, 16-QAM, QPSK and BPSK modulation for sub-carriers
Channel bandwidths	5 MHz, 10 MHz and 20 MHz
Emission designator	W7D
Power requirements	48 V <sub>DC</sub> PoE via 120 V <sub>AC</sub> , 60 Hz
Antennas 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

### 3.4 Product description and theory of operation

The EUT is a 2x2 MIMO point-to-multipoint (PMP) carrier grade broadband wireless infrastructure product, designed to operate in the 4940–4990 MHz bands.

### 3.5 EUT exercise details

The EUT was controlled to transmit at desired frequency and modulation from laptop using web interface at IP address: 192.168.25.2

### 3.6 EUT setup diagram

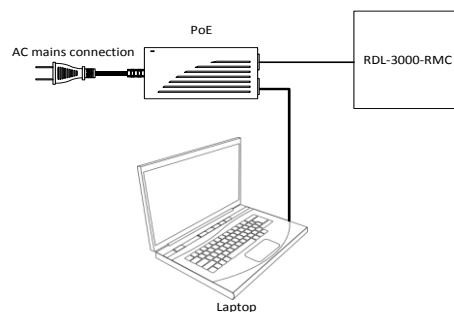


Figure 3.6-1: Setup diagram

### 3.7 EUT sub assemblies

**Table 3.7-1:** EUT sub assemblies

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



## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.



## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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

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

### 5.2 Power supply range

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

## Section 6. Measurement uncertainty

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### 6.1 Uncertainty of measurement

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

## Section 7. Test equipment

### 7.1 Test equipment list

*Table 7.1-1: Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/13
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

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### 8.1 FCC 90.1215 Occupied bandwidth

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#### 8.1.1 Definitions and limits

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The peak power spectral density is measured as 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 one MHz or the 26 dB emission bandwidth of the device whichever is less.

#### 8.1.2 Test summary

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<b>Test date</b>	January 22, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	23 °C	<b>Air pressure</b>	1002 mbar	<b>Relative humidity</b>	33 %

#### 8.1.3 Observations/special notes

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Spectrum analyzer settings:

For 5 MHz and 10 MHz channels: Peak detector with RBW/VBW of 100 kHz/300 kHz

For 20 MHz channel: Peak detector with RBW/VBW of 200 kHz/500 kHz



8.1.4 Test data

**Table 8.1-1: 26 dB bandwidth of 5 MHz channel measurements**

Modulation	Frequency, MHz	26 dB bandwidth, MHz
BPSK	4942.5	4.76
	4965.0	4.76
	4987.5	4.76
QPSK	4942.5	4.76
	4965.0	4.76
	4987.5	4.76
16-QAM	4942.5	4.76
	4965.0	4.76
	4987.5	4.76
64-QAM	4942.5	4.76
	4965.0	4.76
	4987.5	4.76

**Table 8.1-2: 26 dB bandwidth of 10 MHz channel measurements**

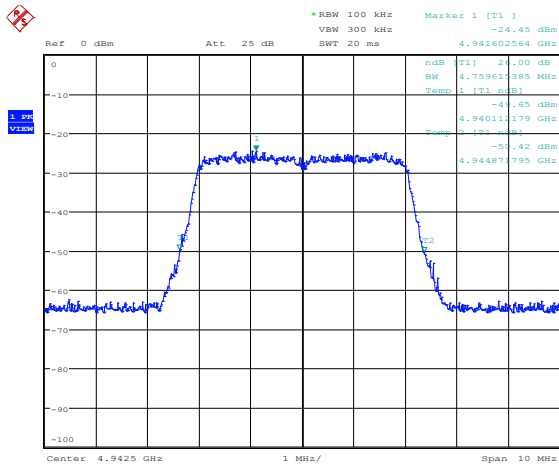
Modulation	Frequency, MHz	26 dB bandwidth, MHz
BPSK	4945.0	9.23
	4965.0	9.23
	4985.0	9.23
QPSK	4945.0	9.23
	4965.0	9.23
	4985.0	9.23
16-QAM	4945.0	9.23
	4965.0	9.23
	4985.0	9.23
64-QAM	4945.0	9.23
	4965.0	9.23
	4985.0	9.23

**Table 8.1-3: 26 dB bandwidth of 20 MHz channel measurements**

Modulation	Frequency, MHz	26 dB bandwidth, MHz
BPSK	4950.0	18.46
	4965.0	18.46
	4980.0	18.46
QPSK	4950.0	18.46
	4965.0	18.46
	4980.0	18.46
16-QAM	4950.0	18.46
	4965.0	18.46
	4980.0	18.46
64-QAM	4950.0	18.46
	4965.0	18.46
	4980.0	18.46

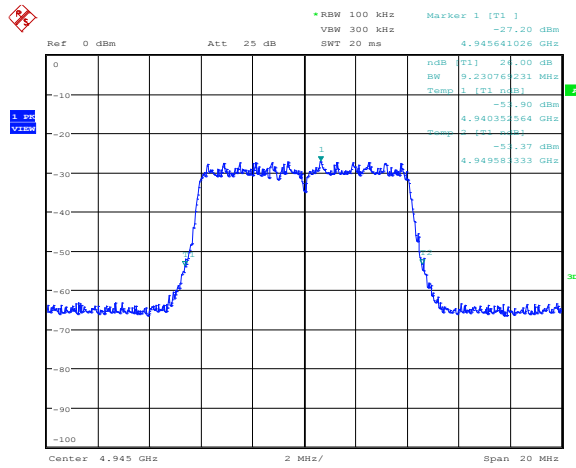
www.nemko.com

8.1.4 Test data, continued



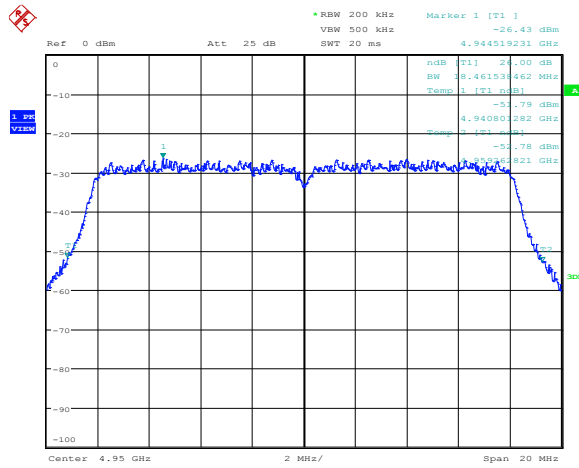
Date: 22.JAN.2013 10:11:55

Figure 8.1-1: Sample plot for 26 dB bandwidth for 5 MHz



Date: 22.JAN.2013 10:10:56

Figure 8.1-2: Sample plot for 26 dB bandwidth for 10 MHz



Date: 22.JAN.2013 10:09:51

Figure 8.1-3: Sample plot for 26 dB bandwidth for 20 MHz

## 8.2 FCC 90.1215 Maximum conducted output power

### 8.2.1 Definitions and limits

The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a)(1) The maximum conducted output power should not exceed the limits in the following table:

**Table 8.2-1: RF output power limits**

Channel Bandwidth, MHz	Low-power transmitter power, dBm	High-power transmitter power, dBm
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

(2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

### 8.2.2 Test summary

<b>Test date</b>	January 25, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1003 mbar	<b>Relative humidity</b>	34 %

### 8.2.3 Observations/special notes

Spectrum analyzer settings:

For 5 MHz channel: RMS detector with RBW/VBW of 5 MHz/10 MHz

For 10 MHz channel: RMS detector with RBW/VBW of 10 MHz/10 MHz

For 20 MHz channel: RMS detector with RBW/VBW of 20 MHz/30 MHz

The power at each antenna port was measured individually and the aggregate power was summed up mathematically using the following formula:

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

Output power limit for 32 dBi antenna gain was reduced by amount in decibels that the directional gain of the antenna exceeds 26 dBi:

For 5 MHz channel: 27 dBm – (32 dBi – 26 dBi) = 21 dBm

For 10 MHz channel: 30 dBm – (32 dBi – 26 dBi) = 24 dBm

For 20 MHz channel: 33 dBm – (32 dBi – 26 dBi) = 27 dBm

8.2.4 Test data

**Table 8.2-2: RF power and EIRP measurement of 5 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	19.20	19.22	22.22	27.00	4.78	10.00	32.22	53.00	20.78
	4965.0	19.80	19.64	22.73	27.00	4.27	10.00	32.73	53.00	20.27
	4987.5	20.13	20.02	23.09	27.00	3.91	10.00	33.09	53.00	19.91
QPSK	4942.5	19.41	19.26	22.35	27.00	4.65	10.00	32.35	53.00	20.65
	4965.0	19.79	19.36	22.59	27.00	4.41	10.00	32.59	53.00	20.41
	4987.5	20.02	19.95	23.00	27.00	4.00	10.00	33.00	53.00	20.00
16-QAM	4942.5	19.38	19.23	22.32	27.00	4.68	10.00	32.32	53.00	20.68
	4965.0	19.92	19.33	22.65	27.00	4.35	10.00	32.65	53.00	20.35
	4987.5	19.99	20.11	23.06	27.00	3.94	10.00	33.06	53.00	19.94
64-QAM	4942.5	19.35	19.03	22.20	27.00	4.80	10.00	32.20	53.00	20.80
	4965.0	20.03	19.53	22.80	27.00	4.20	10.00	32.80	53.00	20.20
	4987.5	20.04	20.22	23.14	27.00	3.86	10.00	33.14	53.00	19.86

**Table 8.2-3: RF power and EIRP measurement of 10 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	19.73	19.13	22.45	30.00	7.55	10.00	32.45	56.00	23.55
	4965.0	20.01	19.59	22.82	30.00	7.18	10.00	32.82	56.00	23.18
	4985.0	20.33	20.13	23.24	30.00	6.76	10.00	33.24	56.00	22.76
QPSK	4945.0	19.58	19.08	22.35	30.00	7.65	10.00	32.35	56.00	23.65
	4965.0	19.81	19.87	22.85	30.00	7.15	10.00	32.85	56.00	23.15
	4985.0	20.41	19.99	23.22	30.00	6.78	10.00	33.22	56.00	22.78
16-QAM	4945.0	19.63	19.08	22.37	30.00	7.63	10.00	32.37	56.00	23.63
	4965.0	19.82	19.90	22.87	30.00	7.13	10.00	32.87	56.00	23.13
	4985.0	20.19	20.00	23.11	30.00	6.89	10.00	33.11	56.00	22.89
64-QAM	4945.0	19.81	19.09	22.48	30.00	7.52	10.00	32.48	56.00	23.52
	4965.0	19.81	19.94	22.89	30.00	7.11	10.00	32.89	56.00	23.11
	4985.0	20.34	20.00	23.18	30.00	6.82	10.00	33.18	56.00	22.82

**Table 8.2-4: RF power and EIRP measurement of 20 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	20.57	20.00	23.30	33.00	9.70	10.00	33.30	59.00	25.70
	4965.0	20.80	20.45	23.64	33.00	9.36	10.00	33.64	59.00	25.36
	4980.0	21.13	20.76	23.96	33.00	9.04	10.00	33.96	59.00	25.04
QPSK	4950.0	20.57	19.98	23.30	33.00	9.70	10.00	33.30	59.00	25.70
	4965.0	20.83	20.53	23.69	33.00	9.31	10.00	33.69	59.00	25.31
	4980.0	21.09	20.75	23.93	33.00	9.07	10.00	33.93	59.00	25.07
16-QAM	4950.0	20.52	20.26	23.40	33.00	9.60	10.00	33.40	59.00	25.60
	4965.0	20.89	20.53	23.72	33.00	9.28	10.00	33.72	59.00	25.28
	4980.0	21.03	20.77	23.91	33.00	9.09	10.00	33.91	59.00	25.09
64-QAM	4950.0	20.51	20.32	23.43	33.00	9.57	10.00	33.43	59.00	25.57
	4965.0	20.93	20.52	23.74	33.00	9.26	10.00	33.74	59.00	25.26
	4980.0	21.08	21.14	24.12	33.00	8.88	10.00	34.12	59.00	24.88



8.2.5 Test data, continued

**Table 8.2-5: RF power and EIRP measurement of 5 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	19.20	19.22	22.22	27.00	4.78	19.00	41.22	53.00	11.78
	4965.0	19.80	19.64	22.73	27.00	4.27	19.00	41.73	53.00	11.27
	4987.5	20.13	20.02	23.09	27.00	3.91	19.00	42.09	53.00	10.91
QPSK	4942.5	19.41	19.26	22.35	27.00	4.65	19.00	41.35	53.00	11.65
	4965.0	19.79	19.36	22.59	27.00	4.41	19.00	41.59	53.00	11.41
	4987.5	20.02	19.95	23.00	27.00	4.00	19.00	42.00	53.00	11.00
16-QAM	4942.5	19.38	19.23	22.32	27.00	4.68	19.00	41.32	53.00	11.68
	4965.0	19.92	19.33	22.65	27.00	4.35	19.00	41.65	53.00	11.35
	4987.5	19.99	20.11	23.06	27.00	3.94	19.00	42.06	53.00	10.94
64-QAM	4942.5	19.35	19.03	22.20	27.00	4.80	19.00	41.20	53.00	11.80
	4965.0	20.03	19.53	22.80	27.00	4.20	19.00	41.80	53.00	11.20
	4987.5	20.04	20.22	23.14	27.00	3.86	19.00	42.14	53.00	10.86

**Table 8.2-6: RF power and EIRP measurement of 10 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	19.73	19.13	22.45	30.00	7.55	19.00	41.45	56.00	14.55
	4965.0	20.01	19.59	22.82	30.00	7.18	19.00	41.82	56.00	14.18
	4985.0	20.33	20.13	23.24	30.00	6.76	19.00	42.24	56.00	13.76
QPSK	4945.0	19.58	19.08	22.35	30.00	7.65	19.00	41.35	56.00	14.65
	4965.0	19.81	19.87	22.85	30.00	7.15	19.00	41.85	56.00	14.15
	4985.0	20.41	19.99	23.22	30.00	6.78	19.00	42.22	56.00	13.78
16-QAM	4945.0	19.63	19.08	22.37	30.00	7.63	19.00	41.37	56.00	14.63
	4965.0	19.82	19.90	22.87	30.00	7.13	19.00	41.87	56.00	14.13
	4985.0	20.19	20.00	23.11	30.00	6.89	19.00	42.11	56.00	13.89
64-QAM	4945.0	19.81	19.09	22.48	30.00	7.52	19.00	41.48	56.00	14.52
	4965.0	19.81	19.94	22.89	30.00	7.11	19.00	41.89	56.00	14.11
	4985.0	20.34	20.00	23.18	30.00	6.82	19.00	42.18	56.00	13.82

**Table 8.2-7: RF power and EIRP measurement of 20 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	20.57	20.00	23.30	33.00	9.70	19.00	42.30	59.00	16.70
	4965.0	20.80	20.45	23.64	33.00	9.36	19.00	42.64	59.00	16.36
	4980.0	21.13	20.76	23.96	33.00	9.04	19.00	42.96	59.00	16.04
QPSK	4950.0	20.57	19.98	23.30	33.00	9.70	19.00	42.30	59.00	16.70
	4965.0	20.83	20.53	23.69	33.00	9.31	19.00	42.69	59.00	16.31
	4980.0	21.09	20.75	23.93	33.00	9.07	19.00	42.93	59.00	16.07
16-QAM	4950.0	20.52	20.26	23.40	33.00	9.60	19.00	42.40	59.00	16.60
	4965.0	20.89	20.53	23.72	33.00	9.28	19.00	42.72	59.00	16.28
	4980.0	21.03	20.77	23.91	33.00	9.09	19.00	42.91	59.00	16.09
64-QAM	4950.0	20.51	20.32	23.43	33.00	9.57	19.00	42.43	59.00	16.57
	4965.0	20.93	20.52	23.74	33.00	9.26	19.00	42.74	59.00	16.26
	4980.0	21.08	21.14	24.12	33.00	8.88	19.00	43.12	59.00	15.88

8.2.4 Test data, continued

**Table 8.2-8:** RF power and EIRP measurement of 5 MHz channel for 32 dBi antenna

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	17.73	18.14	20.95	21.00	0.05	32.00	52.95	53.00	0.05
	4965.0	17.27	17.82	20.56	21.00	0.44	32.00	52.56	53.00	0.44
	4987.5	17.48	17.88	20.69	21.00	0.31	32.00	52.69	53.00	0.31
QPSK	4942.5	17.59	17.75	20.68	21.00	0.32	32.00	52.68	53.00	0.32
	4965.0	17.37	17.79	20.60	21.00	0.40	32.00	52.60	53.00	0.40
	4987.5	17.52	17.87	20.71	21.00	0.29	32.00	52.71	53.00	0.29
16-QAM	4942.5	17.74	17.70	20.73	21.00	0.27	32.00	52.73	53.00	0.27
	4965.0	17.35	17.76	20.57	21.00	0.43	32.00	52.57	53.00	0.43
	4987.5	17.19	17.90	20.57	21.00	0.43	32.00	52.57	53.00	0.43
64-QAM	4942.5	17.82	17.70	20.77	21.00	0.23	32.00	52.77	53.00	0.23
	4965.0	17.22	17.85	20.56	21.00	0.44	32.00	52.56	53.00	0.44
	4987.5	17.17	17.98	20.60	21.00	0.40	32.00	52.60	53.00	0.40

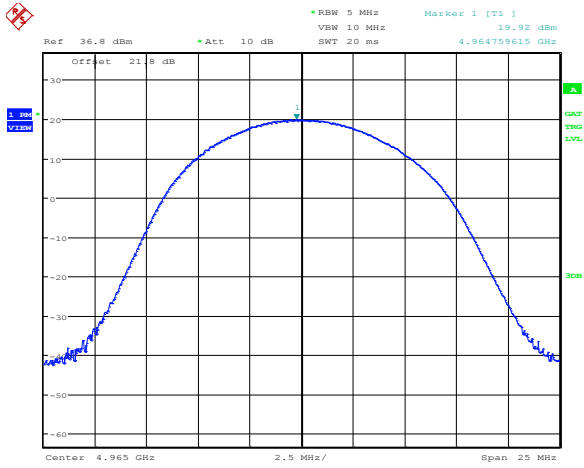
**Table 8.2-9:** RF power and EIRP measurement of 10 MHz channel for 32 dBi antenna

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	19.73	19.13	22.45	24.00	1.55	32.00	54.45	56.00	1.55
	4965.0	20.01	19.59	22.82	24.00	1.18	32.00	54.82	56.00	1.18
	4985.0	20.33	20.13	23.24	24.00	0.76	32.00	55.24	56.00	0.76
QPSK	4945.0	19.58	19.08	22.35	24.00	1.65	32.00	54.35	56.00	1.65
	4965.0	19.81	19.87	22.85	24.00	1.15	32.00	54.85	56.00	1.15
	4985.0	20.41	19.99	23.22	24.00	0.78	32.00	55.22	56.00	0.78
16-QAM	4945.0	19.63	19.08	22.37	24.00	1.63	32.00	54.37	56.00	1.63
	4965.0	19.82	19.90	22.87	24.00	1.13	32.00	54.87	56.00	1.13
	4985.0	20.19	20.00	23.11	24.00	0.89	32.00	55.11	56.00	0.89
64-QAM	4945.0	19.81	19.09	22.48	24.00	1.52	32.00	54.48	56.00	1.52
	4965.0	19.81	19.94	22.89	24.00	1.11	32.00	54.89	56.00	1.11
	4985.0	20.34	20.00	23.18	24.00	0.82	32.00	55.18	56.00	0.82

**Table 8.2-10:** RF power and EIRP measurement of 20 MHz channel for 32 dBi antenna

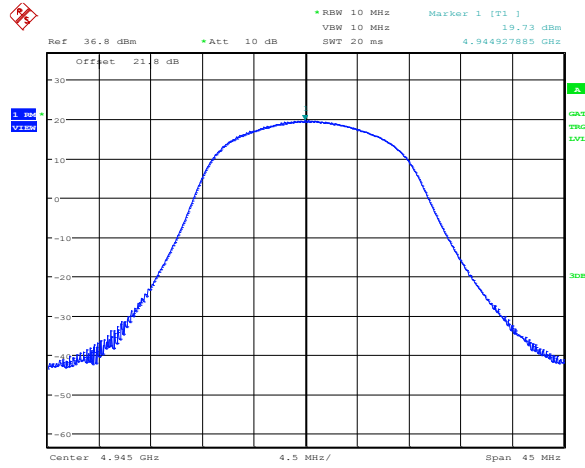
Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	20.57	20.00	23.30	27.00	3.70	32.00	55.30	59.00	3.70
	4965.0	20.80	20.45	23.64	27.00	3.36	32.00	55.64	59.00	3.36
	4980.0	21.13	20.76	23.96	27.00	3.04	32.00	55.96	59.00	3.04
QPSK	4950.0	20.57	19.98	23.30	27.00	3.70	32.00	55.30	59.00	3.70
	4965.0	20.83	20.53	23.69	27.00	3.31	32.00	55.69	59.00	3.31
	4980.0	21.09	20.75	23.93	27.00	3.07	32.00	55.93	59.00	3.07
16-QAM	4950.0	20.52	20.26	23.40	27.00	3.60	32.00	55.40	59.00	3.60
	4965.0	20.89	20.53	23.72	27.00	3.28	32.00	55.72	59.00	3.28
	4980.0	21.03	20.77	23.91	27.00	3.09	32.00	55.91	59.00	3.09
64-QAM	4950.0	20.51	20.32	23.43	27.00	3.57	32.00	55.43	59.00	3.57
	4965.0	20.93	20.52	23.74	27.00	3.26	32.00	55.74	59.00	3.26
	4980.0	21.08	21.14	24.12	27.00	2.88	32.00	56.12	59.00	2.88

### 8.2.4 Test data, continued



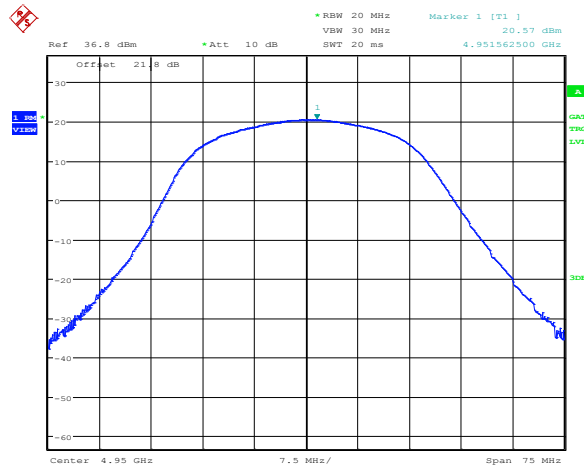
Date: 28.JAN.2013 09:54:38

Figure 8.2-1: Sample plot of power measurement for 5 MHz channel



Date: 28.JAN.2013 10:05:16

Figure 8.2-2: Sample plot of power measurement for 10 MHz channel



Date: 28.JAN.2013 10:16:38

Figure 8.2-3: Sample plot of power measurement for 20 MHz channel

## 8.3 FCC 90.1215 Power spectral density

### 8.3.1 Definitions and limits

2) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

### 8.3.2 Test summary

<b>Test date</b>	January 25, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1004 mbar	<b>Relative humidity</b>	34 %

### 8.3.3 Observations/special notes

Spectrum analyzer settings:

RMS detector with RBW/VBW of 1 MHz/10 MHz

The PSD at each antenna port was measured individually and the aggregate PSD was summed up mathematically using the following formula:

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

Peak power spectral density limit for 32 dBi antenna gain was reduced by amount in decibels that the directional gain of the antenna exceeds 26 dBi:  
 21 dBm/MHz – (32 dBi – 26 dBi) = 15 dBm/MHz

### 8.3.4 Test data

**Table 8.3-1: PSD and PSD EIRP measurement of 5 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	12.15	10.80	14.54	21.00	6.46	10.00	24.54	47.00	22.46
	4965.0	11.47	11.18	14.34	21.00	6.66	10.00	24.34	47.00	22.66
	4987.5	11.49	11.78	14.65	21.00	6.35	10.00	24.65	47.00	22.35
QPSK	4942.5	12.18	10.78	14.55	21.00	6.45	10.00	24.55	47.00	22.45
	4965.0	11.48	11.09	14.30	21.00	6.70	10.00	24.30	47.00	22.70
	4987.5	11.52	11.63	14.59	21.00	6.41	10.00	24.59	47.00	22.41
16-QAM	4942.5	12.09	10.81	14.51	21.00	6.49	10.00	24.51	47.00	22.49
	4965.0	11.43	11.11	14.28	21.00	6.72	10.00	24.28	47.00	22.72
	4987.5	11.71	11.59	14.66	21.00	6.34	10.00	24.66	47.00	22.34
64-QAM	4942.5	12.04	10.90	14.52	21.00	6.48	10.00	24.52	47.00	22.48
	4965.0	11.35	11.08	14.23	21.00	6.77	10.00	24.23	47.00	22.77
	4987.5	11.54	11.60	14.58	21.00	6.42	10.00	24.58	47.00	22.42

**Table 8.3-2: PSD and PSD EIRP measurement of 10 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	12.12	12.25	15.20	21.00	5.80	10.00	25.20	47.00	21.80
	4965.0	12.34	12.18	15.27	21.00	5.73	10.00	25.27	47.00	21.73
	4985.0	12.83	12.62	15.74	21.00	5.26	10.00	25.74	47.00	21.26
QPSK	4945.0	12.18	12.21	15.21	21.00	5.79	10.00	25.21	47.00	21.79
	4965.0	12.65	12.15	15.42	21.00	5.58	10.00	25.42	47.00	21.58
	4985.0	12.80	12.59	15.71	21.00	5.29	10.00	25.71	47.00	21.29
16-QAM	4945.0	12.25	12.18	15.23	21.00	5.77	10.00	25.23	47.00	21.77
	4965.0	12.37	12.20	15.30	21.00	5.70	10.00	25.30	47.00	21.70
	4985.0	13.07	12.56	15.83	21.00	5.17	10.00	25.83	47.00	21.17
64-QAM	4945.0	12.22	12.12	15.18	21.00	5.82	10.00	25.18	47.00	21.82
	4965.0	12.31	12.40	15.37	21.00	5.63	10.00	25.37	47.00	21.63
	4985.0	12.79	12.60	15.71	21.00	5.29	10.00	25.71	47.00	21.29

**Table 8.3-3: PSD and PSD EIRP measurement of 20 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	9.88	9.14	12.54	21.00	8.46	10.00	22.54	47.00	24.46
	4965.0	9.91	9.70	12.82	21.00	8.18	10.00	22.82	47.00	24.18
	4980.0	9.85	9.75	12.81	21.00	8.19	10.00	22.81	47.00	24.19
QPSK	4950.0	9.60	8.99	12.32	21.00	8.68	10.00	22.32	47.00	24.68
	4965.0	9.84	9.54	12.70	21.00	8.30	10.00	22.70	47.00	24.30
	4980.0	9.95	9.75	12.86	21.00	8.14	10.00	22.86	47.00	24.14
16-QAM	4950.0	9.55	9.09	12.34	21.00	8.66	10.00	22.34	47.00	24.66
	4965.0	10.03	9.26	12.67	21.00	8.33	10.00	22.67	47.00	24.33
	4980.0	9.96	9.83	12.91	21.00	8.09	10.00	22.91	47.00	24.09
64-QAM	4950.0	9.67	9.37	12.53	21.00	8.47	10.00	22.53	47.00	24.47
	4965.0	10.02	9.38	12.72	21.00	8.28	10.00	22.72	47.00	24.28
	4980.0	10.24	9.89	13.08	21.00	7.92	10.00	23.08	47.00	23.92

8.3.4 Test data, continued

**Table 8.3-4: PSD and PSD EIRP measurement of 5 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	12.15	10.80	14.54	21.00	6.46	19.00	33.54	47.00	13.46
	4965.0	11.47	11.18	14.34	21.00	6.66	19.00	33.34	47.00	13.66
	4987.5	11.49	11.78	14.65	21.00	6.35	19.00	33.65	47.00	13.35
QPSK	4942.5	12.18	10.78	14.55	21.00	6.45	19.00	33.55	47.00	13.45
	4965.0	11.48	11.09	14.30	21.00	6.70	19.00	33.30	47.00	13.70
	4987.5	11.52	11.63	14.59	21.00	6.41	19.00	33.59	47.00	13.41
16-QAM	4942.5	12.09	10.81	14.51	21.00	6.49	19.00	33.51	47.00	13.49
	4965.0	11.43	11.11	14.28	21.00	6.72	19.00	33.28	47.00	13.72
	4987.5	11.71	11.59	14.66	21.00	6.34	19.00	33.66	47.00	13.34
64-QAM	4942.5	12.04	10.90	14.52	21.00	6.48	19.00	33.52	47.00	13.48
	4965.0	11.35	11.08	14.23	21.00	6.77	19.00	33.23	47.00	13.77
	4987.5	11.54	11.60	14.58	21.00	6.42	19.00	33.58	47.00	13.42

**Table 8.3-5: PSD and PSD EIRP measurement of 10 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	12.12	12.25	15.20	21.00	5.80	19.00	34.20	47.00	12.80
	4965.0	12.34	12.18	15.27	21.00	5.73	19.00	34.27	47.00	12.73
	4985.0	12.83	12.62	15.74	21.00	5.26	19.00	34.74	47.00	12.26
QPSK	4945.0	12.18	12.21	15.21	21.00	5.79	19.00	34.21	47.00	12.79
	4965.0	12.65	12.15	15.42	21.00	5.58	19.00	34.42	47.00	12.58
	4985.0	12.80	12.59	15.71	21.00	5.29	19.00	34.71	47.00	12.29
16-QAM	4945.0	12.25	12.18	15.23	21.00	5.77	19.00	34.23	47.00	12.77
	4965.0	12.37	12.20	15.30	21.00	5.70	19.00	34.30	47.00	12.70
	4985.0	13.07	12.56	15.83	21.00	5.17	19.00	34.83	47.00	12.17
64-QAM	4945.0	12.22	12.12	15.18	21.00	5.82	19.00	34.18	47.00	12.82
	4965.0	12.31	12.40	15.37	21.00	5.63	19.00	34.37	47.00	12.63
	4985.0	12.79	12.60	15.71	21.00	5.29	19.00	34.71	47.00	12.29

**Table 8.3-6: PSD and PSD EIRP measurement of 20 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	9.88	9.14	12.54	21.00	8.46	19.00	31.54	47.00	15.46
	4965.0	9.91	9.70	12.82	21.00	8.18	19.00	31.82	47.00	15.18
	4980.0	9.85	9.75	12.81	21.00	8.19	19.00	31.81	47.00	15.19
QPSK	4950.0	9.60	8.99	12.32	21.00	8.68	19.00	31.32	47.00	15.68
	4965.0	9.84	9.54	12.70	21.00	8.30	19.00	31.70	47.00	15.30
	4980.0	9.95	9.75	12.86	21.00	8.14	19.00	31.86	47.00	15.14
16-QAM	4950.0	9.55	9.09	12.34	21.00	8.66	19.00	31.34	47.00	15.66
	4965.0	10.03	9.26	12.67	21.00	8.33	19.00	31.67	47.00	15.33
	4980.0	9.96	9.83	12.91	21.00	8.09	19.00	31.91	47.00	15.09
64-QAM	4950.0	9.67	9.37	12.53	21.00	8.47	19.00	31.53	47.00	15.47
	4965.0	10.02	9.38	12.72	21.00	8.28	19.00	31.72	47.00	15.28
	4980.0	10.24	9.89	13.08	21.00	7.92	19.00	32.08	47.00	14.92

### 8.3.4 Test data, continued

**Table 8.3-7: PSD and PSD EIRP measurement of 5 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	5.69	5.43	8.57	15.00	6.43	32.00	40.57	47.00	6.43
	4965.0	5.19	5.48	8.35	15.00	6.65	32.00	40.35	47.00	6.65
	4987.5	4.38	5.43	7.95	15.00	7.05	32.00	39.95	47.00	7.05
QPSK	4942.5	5.59	5.48	8.55	15.00	6.45	32.00	40.55	47.00	6.45
	4965.0	5.29	5.29	8.30	15.00	6.70	32.00	40.30	47.00	6.70
	4987.5	4.57	5.38	8.00	15.00	7.00	32.00	40.00	47.00	7.00
16-QAM	4942.5	5.54	5.49	8.53	15.00	6.47	32.00	40.53	47.00	6.47
	4965.0	5.30	5.29	8.31	15.00	6.69	32.00	40.31	47.00	6.69
	4987.5	4.65	5.38	8.04	15.00	6.96	32.00	40.04	47.00	6.96
64-QAM	4942.5	5.49	5.58	8.55	15.00	6.45	32.00	40.55	47.00	6.45
	4965.0	5.43	5.29	8.37	15.00	6.63	32.00	40.37	47.00	6.63
	4987.5	4.54	5.39	8.00	15.00	7.00	32.00	40.00	47.00	7.00

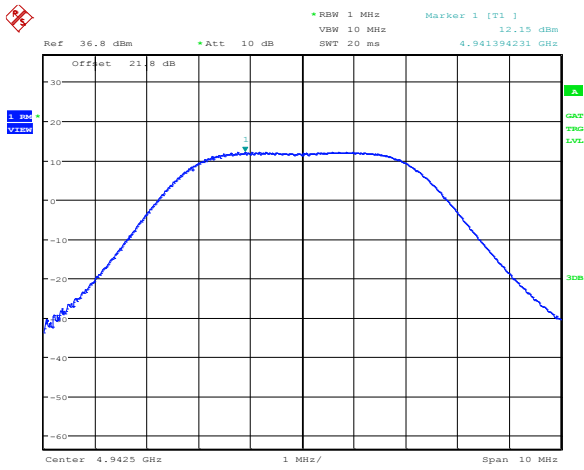
**Table 8.3-8: PSD and PSD EIRP measurement of 10 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	6.33	5.84	9.10	15.00	5.90	32.00	41.10	47.00	5.90
	4965.0	6.60	6.62	9.62	15.00	5.38	32.00	41.62	47.00	5.38
	4985.0	6.03	5.45	8.76	15.00	6.24	32.00	40.76	47.00	6.24
QPSK	4945.0	6.35	5.80	9.09	15.00	5.91	32.00	41.09	47.00	5.91
	4965.0	6.66	6.71	9.70	15.00	5.30	32.00	41.70	47.00	5.30
	4985.0	5.73	5.46	8.61	15.00	6.39	32.00	40.61	47.00	6.39
16-QAM	4945.0	6.42	5.73	9.10	15.00	5.90	32.00	41.10	47.00	5.90
	4965.0	6.53	6.79	9.67	15.00	5.33	32.00	41.67	47.00	5.33
	4985.0	5.53	5.47	8.51	15.00	6.49	32.00	40.51	47.00	6.49
64-QAM	4945.0	6.41	5.69	9.08	15.00	5.92	32.00	41.08	47.00	5.92
	4965.0	6.46	6.81	9.65	15.00	5.35	32.00	41.65	47.00	5.35
	4985.0	5.60	5.46	8.54	15.00	6.46	32.00	40.54	47.00	6.46

**Table 8.3-9: PSD and PSD EIRP measurement of 20 MHz channel for 32 dBi antenna**

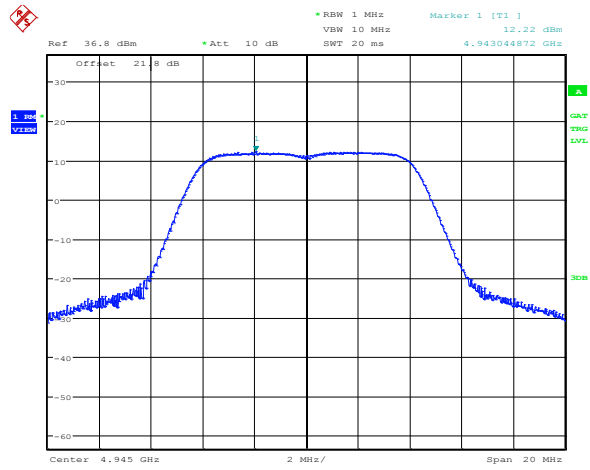
Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	4.52	4.35	7.45	15.00	7.55	32.00	39.45	47.00	7.55
	4965.0	4.83	4.60	7.73	15.00	7.27	32.00	39.73	47.00	7.27
	4980.0	5.36	4.73	8.07	15.00	6.93	32.00	40.07	47.00	6.93
QPSK	4950.0	4.55	4.36	7.47	15.00	7.53	32.00	39.47	47.00	7.53
	4965.0	4.63	4.68	7.67	15.00	7.33	32.00	39.67	47.00	7.33
	4980.0	5.03	4.75	7.90	15.00	7.10	32.00	39.90	47.00	7.10
16-QAM	4950.0	4.61	4.33	7.48	15.00	7.52	32.00	39.48	47.00	7.52
	4965.0	4.85	4.71	7.79	15.00	7.21	32.00	39.79	47.00	7.21
	4980.0	5.03	4.76	7.91	15.00	7.09	32.00	39.91	47.00	7.09
64-QAM	4950.0	4.69	4.31	7.51	15.00	7.49	32.00	39.51	47.00	7.49
	4965.0	4.97	5.00	8.00	15.00	7.00	32.00	40.00	47.00	7.00
	4980.0	4.99	4.87	7.94	15.00	7.06	32.00	39.94	47.00	7.06

### 8.3.4 Test data, continued



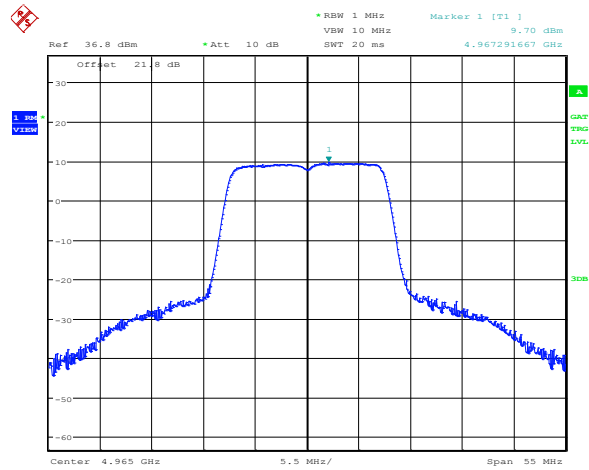
Date: 28.JAN.2013 14:36:27

Figure 8.3-1: Sample plot of PSD measurement for 5 MHz channel



Date: 28.JAN.2013 14:19:23

Figure 8.3-2: Sample plot of PSD measurement for 10 MHz channel



Date: 28.JAN.2013 11:53:03

Figure 8.3-3: Sample plot of PSD measurement for 20 MHz channel



## 8.4 FCC 90.1215 The ratio of peak excursion

### 8.4.1 Definitions and limits

(e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### 8.4.2 Test summary

<b>Test date</b>	January 29, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1002 mbar	<b>Relative humidity</b>	34 %

### 8.4.3 Observations/special notes

Spectrum analyzer settings:  
 Peak (trace 1) and RMS (trace 2) detectors with RBW/VBW of 1 MHz/10 MHz.

### 8.4.4 Test data

*Table 8.4-1: Peak excursion measurement of 5 MHz channel*

Modulation	Frequency, MHz	Excursion, dB	Limit, dB	Margin, dB
BPSK	4942.5	7.60	13.00	5.40
	4965.0	7.46	13.00	5.54
	4987.5	7.35	13.00	5.65
QPSK	4942.5	7.67	13.00	5.33
	4965.0	7.11	13.00	5.89
	4987.5	7.39	13.00	5.61
16-QAM	4942.5	7.75	13.00	5.25
	4965.0	7.02	13.00	5.98
	4987.5	7.54	13.00	5.46
64-QAM	4942.5	7.57	13.00	5.43
	4965.0	7.22	13.00	5.78
	4987.5	7.37	13.00	5.63

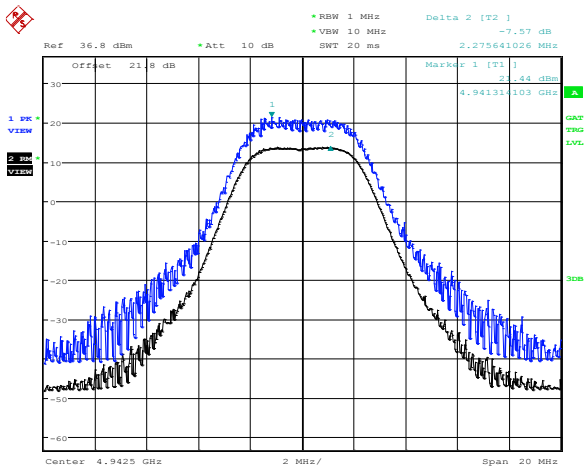
*Table 8.4-2: Peak excursion measurement of 10 MHz channel*

Modulation	Frequency, MHz	Excursion, dB	Limit, dB	Margin, dB
BPSK	4945.0	7.13	13.00	5.87
	4965.0	7.07	13.00	5.93
	4985.0	6.80	13.00	6.20
QPSK	4945.0	7.19	13.00	5.81
	4965.0	7.02	13.00	5.98
	4985.0	6.88	13.00	6.12
16-QAM	4945.0	7.11	13.00	5.89
	4965.0	7.00	13.00	6.00
	4985.0	6.83	13.00	6.17
64-QAM	4945.0	7.30	13.00	5.70
	4965.0	7.06	13.00	5.94
	4985.0	6.89	13.00	6.11

8.4.4 Test data, continued

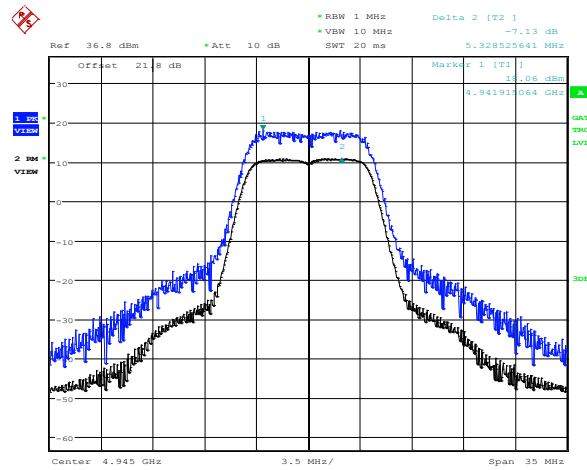
Table 8.4-3: Peak excursion measurement of 20 MHz channel

Modulation	Frequency, MHz	Excursion, dB	Limit, dB	Margin, dB
BPSK	4950.0	7.18	13.00	5.82
	4965.0	7.30	13.00	5.70
	4980.0	7.26	13.00	5.74
QPSK	4950.0	7.00	13.00	6.00
	4965.0	7.14	13.00	5.86
	4980.0	7.18	13.00	5.82
16-QAM	4950.0	7.21	13.00	5.79
	4965.0	7.20	13.00	5.80
	4980.0	7.25	13.00	5.75
64-QAM	4950.0	6.99	13.00	6.01
	4965.0	7.06	13.00	5.94
	4980.0	7.23	13.00	5.77



Date: 29.JAN.2013 15:22:27

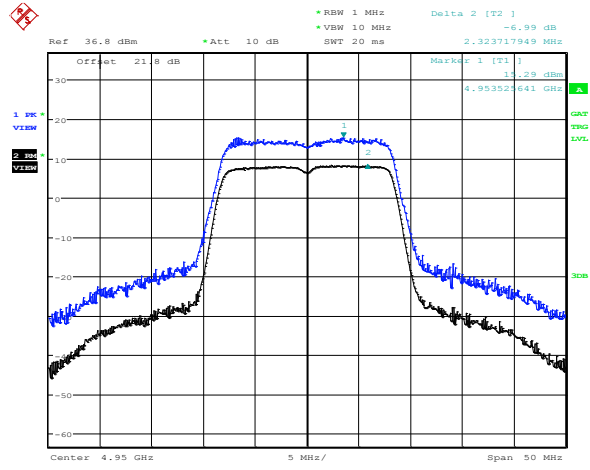
Figure 8.4-1: Sample plot for peak excursion for 5 MHz channel



Date: 29.JAN.2013 13:53:58

Figure 8.4-2: Sample plot for peak excursion for 10 MHz channel

### 8.4.4 Test data, continued



Date: 29.JAN.2013 16:19:57

Figure 8.4-3: Sample plot for peak excursion for 20 MHz channel

## 8.5 RSS-111 Clause 5.3 Transmit output power and channel bandwidth

### 8.5.1 Definitions and limits

Equipment is classified as either a low-power or high-power device according to its maximum transmitted power and its channel bandwidth as described in the section below. The equipment's occupied bandwidth shall not exceed its channel bandwidth. The transmitted power of low-power and high-power devices shall not exceed the maximum limits corresponding to the equipment type given in the following table

**Table 8.5-1: RF output power limits**

Channel Bandwidth, MHz	Low-power transmitter power (P), dBm	High-power transmitter power (P), dBm
1	$P \leq 7$	$7 < P \leq 20$
5	$P \leq 14$	$14 < P \leq 27$
10	$P \leq 17$	$17 < P \leq 30$
15	$P \leq 18.8$	$18.8 < P \leq 31.8$
20	$P \leq 20$	$20 < P \leq 33$

High- and low-power devices are also limited to a maximum power spectral density of 21 dBm/MHz and 8 dBm/MHz respectively. Devices using channel bandwidths other than those listed in Table 8.2 1 are permitted; however, the channel bandwidth shall not exceed 20 MHz and the devices shall comply with the maximum power spectral density limits of 21 dBm/MHz for high-power transmitters and 8 dBm/MHz for low-power transmitters.

For equipment with an antenna system that works with multiple transmitters, with different information transmitted by each transmitter to each receiver, the total power of the device shall be calculated as the sum of the powers from all the transmitters and it shall not be higher than the power limit specified in the above table for high-power devices according to the equipment's channel bandwidth.

For high-power fixed point-to-point and point-to-multipoint operation, a directional gain up to 26 dBi may be used, however if it exceeds 26 dBi, both the peak transmit power and the peak power spectral density should be reduced by the equivalent amount.

### 8.5.2 Test summary

<b>Test date</b>	January 24, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1004 mbar	<b>Relative humidity</b>	32 %

### 8.5.3 Observations/special notes

Spectrum analyzer settings for peak output power:

For 5 MHz channel: Peak detector with RBW/VBW of 5 MHz/10 MHz; For 10 MHz channel: Peak detector with RBW/VBW of 10 MHz/10 MHz

For 20 MHz channel: Peak detector with RBW/VBW of 20 MHz/30 MHz

The power at each antenna port was measured individually and the aggregate power was summed up mathematically using the following formula:

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

Spectrum analyzer settings for peak power spectral density:

Peak detector with RBW/VBW of 1 MHz/10 MHz

The PSD at each antenna port was measured individually and the aggregate power was summed up mathematically using the following formula:

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

Spectrum analyzer settings for 99 % bandwidth:

For 5 and 10 MHz channels: Peak detector with RBW/VBW of 100 kHz/300 kHz; For 20 MHz channel: Peak detector with RBW/VBW of 200 kHz/500 kHz

Output power limit for 32 dBi antenna gain was reduced by amount in decibels that the directional gain of the antenna exceeds 26 dBi:

For 5 MHz channel: 27 dBm – (32 dBi – 26 dBi) = 21 dBm

For 10 MHz channel: 30 dBm – (32 dBi – 26 dBi) = 24 dBm

For 20 MHz channel: 33 dBm – (32 dBi – 26 dBi) = 27 dBm

Peak power spectral density limit for 32 dBi antenna gain was reduced by amount in decibels that the directional gain of the antenna exceeds 26 dBi:

21 dBm/MHz – (32 dBi – 26 dBi) = 15 dBm/MHz

### 8.5.4 Test data

**Table 8.5-2: RF power and EIRP measurement of 5 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	22.81	23.63	26.25	27.00	0.75	10.00	36.25	53.00	16.75
	4965.0	22.77	22.75	25.77	27.00	1.23	10.00	35.77	53.00	17.23
	4987.5	23.16	22.94	26.06	27.00	0.94	10.00	36.06	53.00	16.94
QPSK	4942.5	22.63	23.64	26.17	27.00	0.83	10.00	36.17	53.00	16.83
	4965.0	22.84	22.96	25.91	27.00	1.09	10.00	35.91	53.00	17.09
	4987.5	23.22	23.51	26.38	27.00	0.62	10.00	36.38	53.00	16.62
16-QAM	4942.5	22.78	23.81	26.34	27.00	0.66	10.00	36.34	53.00	16.66
	4965.0	23.19	23.07	26.14	27.00	0.86	10.00	36.14	53.00	16.86
	4987.5	23.17	22.81	26.00	27.00	1.00	10.00	36.00	53.00	17.00
64-QAM	4942.5	22.54	23.78	26.21	27.00	0.79	10.00	36.21	53.00	16.79
	4965.0	23.40	22.72	26.08	27.00	0.92	10.00	36.08	53.00	16.92
	4987.5	23.31	23.10	26.22	27.00	0.78	10.00	36.22	53.00	16.78

**Table 8.5-3: RF power and EIRP measurement of 10 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	26.37	25.87	29.14	30.00	0.86	10.00	39.14	56.00	16.86
	4965.0	26.39	26.38	29.40	30.00	0.60	10.00	39.40	56.00	16.60
	4985.0	25.62	26.20	28.93	30.00	1.07	10.00	38.93	56.00	17.07
QPSK	4945.0	26.32	26.03	29.19	30.00	0.81	10.00	39.19	56.00	16.81
	4965.0	26.41	26.27	29.35	30.00	0.65	10.00	39.35	56.00	16.65
	4985.0	25.51	26.27	28.92	30.00	1.08	10.00	38.92	56.00	17.08
16-QAM	4945.0	26.19	25.81	29.01	30.00	0.99	10.00	39.01	56.00	16.99
	4965.0	26.40	26.23	29.33	30.00	0.67	10.00	39.33	56.00	16.67
	4985.0	25.68	26.24	28.98	30.00	1.02	10.00	38.98	56.00	17.02
64-QAM	4945.0	26.27	26.19	29.24	30.00	0.76	10.00	39.24	56.00	16.76
	4965.0	26.49	26.27	29.39	30.00	0.61	10.00	39.39	56.00	16.61
	4985.0	25.78	26.35	29.08	30.00	0.92	10.00	39.08	56.00	16.92

**Table 8.5-4: RF power and EIRP measurement of 20 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	27.41	27.64	30.54	33.00	2.46	10.00	40.54	59.00	18.46
	4965.0	27.91	27.99	30.96	33.00	2.04	10.00	40.96	59.00	18.04
	4980.0	27.90	27.84	30.88	33.00	2.12	10.00	40.88	59.00	18.12
QPSK	4950.0	27.18	27.50	30.35	33.00	2.65	10.00	40.35	59.00	18.65
	4965.0	27.64	27.57	30.62	33.00	2.38	10.00	40.62	59.00	18.38
	4980.0	28.16	28.32	31.25	33.00	1.75	10.00	41.25	59.00	17.75
16-QAM	4950.0	27.26	27.69	30.49	33.00	2.51	10.00	40.49	59.00	18.51
	4965.0	27.67	27.63	30.66	33.00	2.34	10.00	40.66	59.00	18.34
	4980.0	28.18	28.08	31.14	33.00	1.86	10.00	41.14	59.00	17.86
64-QAM	4950.0	28.04	28.12	31.09	33.00	1.91	10.00	41.09	59.00	17.91
	4965.0	28.12	28.10	31.12	33.00	1.88	10.00	41.12	59.00	17.88
	4980.0	28.07	27.99	31.04	33.00	1.96	10.00	41.04	59.00	17.96

8.5.4 Test data, continued

**Table 8.5-5: RF power and EIRP measurement of 5 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	22.81	23.63	26.25	27.00	0.75	19.00	45.25	53.00	7.75
	4965.0	22.77	22.75	25.77	27.00	1.23	19.00	44.77	53.00	8.23
	4987.5	23.16	22.94	26.06	27.00	0.94	19.00	45.06	53.00	7.94
QPSK	4942.5	22.63	23.64	26.17	27.00	0.83	19.00	45.17	53.00	7.83
	4965.0	22.84	22.96	25.91	27.00	1.09	19.00	44.91	53.00	8.09
	4987.5	23.22	23.51	26.38	27.00	0.62	19.00	45.38	53.00	7.62
16-QAM	4942.5	22.78	23.81	26.34	27.00	0.66	19.00	45.34	53.00	7.66
	4965.0	23.19	23.07	26.14	27.00	0.86	19.00	45.14	53.00	7.86
	4987.5	23.17	22.81	26.00	27.00	1.00	19.00	45.00	53.00	8.00
64-QAM	4942.5	22.54	23.78	26.21	27.00	0.79	19.00	45.21	53.00	7.79
	4965.0	23.40	22.72	26.08	27.00	0.92	19.00	45.08	53.00	7.92
	4987.5	23.31	23.10	26.22	27.00	0.78	19.00	45.22	53.00	7.78

**Table 8.5-6: RF power and EIRP measurement of 10 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	26.37	25.87	29.14	30.00	0.86	19.00	48.14	56.00	7.86
	4965.0	26.39	26.38	29.40	30.00	0.60	19.00	48.40	56.00	7.60
	4985.0	26.93	27.01	29.98	30.00	0.02	19.00	48.98	56.00	7.02
QPSK	4945.0	26.32	26.03	29.19	30.00	0.81	19.00	48.19	56.00	7.81
	4965.0	26.41	26.27	29.35	30.00	0.65	19.00	48.35	56.00	7.65
	4985.0	25.51	26.87	29.25	30.00	0.75	19.00	48.25	56.00	7.75
16-QAM	4945.0	26.19	25.81	29.01	30.00	0.99	19.00	48.01	56.00	7.99
	4965.0	26.40	26.23	29.33	30.00	0.67	19.00	48.33	56.00	7.67
	4985.0	25.68	26.95	29.37	30.00	0.63	19.00	48.37	56.00	7.63
64-QAM	4945.0	26.27	26.19	29.24	30.00	0.76	19.00	48.24	56.00	7.76
	4965.0	26.49	26.27	29.39	30.00	0.61	19.00	48.39	56.00	7.61
	4985.0	25.78	26.35	29.08	30.00	0.92	19.00	48.08	56.00	7.92

**Table 8.5-7: RF power and EIRP measurement of 20 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	27.41	27.64	30.54	33.00	2.46	19.00	49.54	59.00	9.46
	4965.0	27.91	27.99	30.96	33.00	2.04	19.00	49.96	59.00	9.04
	4980.0	27.90	27.84	30.88	33.00	2.12	19.00	49.88	59.00	9.12
QPSK	4950.0	27.18	27.50	30.35	33.00	2.65	19.00	49.35	59.00	9.65
	4965.0	27.64	27.57	30.62	33.00	2.38	19.00	49.62	59.00	9.38
	4980.0	28.16	28.32	31.25	33.00	1.75	19.00	50.25	59.00	8.75
16-QAM	4950.0	27.26	27.69	30.49	33.00	2.51	19.00	49.49	59.00	9.51
	4965.0	27.67	27.63	30.66	33.00	2.34	19.00	49.66	59.00	9.34
	4980.0	28.18	28.08	31.14	33.00	1.86	19.00	50.14	59.00	8.86
64-QAM	4950.0	28.04	28.12	31.09	33.00	1.91	19.00	50.09	59.00	8.91
	4965.0	28.12	28.10	31.12	33.00	1.88	19.00	50.12	59.00	8.88
	4980.0	28.07	27.99	31.04	33.00	1.96	19.00	50.04	59.00	8.96

8.5.4 Test data, continued

**Table 8.5-8: RF power and EIRP measurement of 5 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4942.5	16.90	16.89	19.91	21.00	1.09	32.00	51.91	53.00	1.09
	4965.0	16.94	16.51	19.74	21.00	1.26	32.00	51.74	53.00	1.26
	4987.5	17.35	17.19	20.28	21.00	0.72	32.00	52.28	53.00	0.72
QPSK	4942.5	17.12	16.98	20.06	21.00	0.94	32.00	52.06	53.00	0.94
	4965.0	17.04	16.50	19.79	21.00	1.21	32.00	51.79	53.00	1.21
	4987.5	17.33	17.12	20.24	21.00	0.76	32.00	52.24	53.00	0.76
16-QAM	4942.5	17.00	16.34	19.69	21.00	1.31	32.00	51.69	53.00	1.31
	4965.0	16.73	16.65	19.70	21.00	1.30	32.00	51.70	53.00	1.30
	4987.5	17.54	17.24	20.40	21.00	0.60	32.00	52.40	53.00	0.60
64-QAM	4942.5	16.57	16.38	19.49	21.00	1.51	32.00	51.49	53.00	1.51
	4965.0	16.64	16.81	19.74	21.00	1.26	32.00	51.74	53.00	1.26
	4987.5	17.44	17.08	20.27	21.00	0.73	32.00	52.27	53.00	0.73

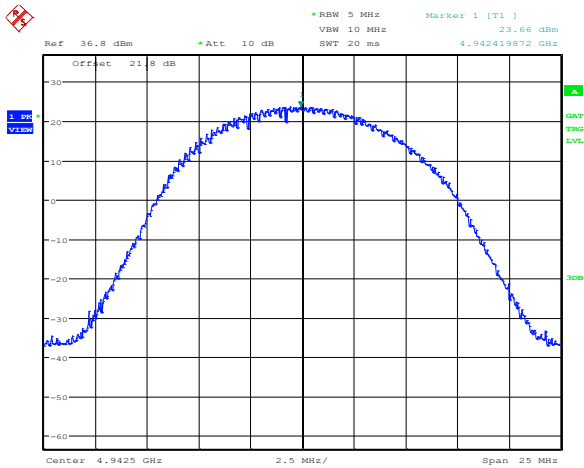
**Table 8.5-9: RF power and EIRP measurement of 10 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4945.0	20.82	20.54	23.69	24.00	0.31	32.00	55.69	56.00	0.31
	4965.0	19.79	20.52	23.18	24.00	0.82	32.00	55.18	56.00	0.82
	4985.0	20.32	20.21	23.28	24.00	0.72	32.00	55.28	56.00	0.72
QPSK	4945.0	20.59	20.48	23.55	24.00	0.45	32.00	55.55	56.00	0.45
	4965.0	19.79	20.84	23.36	24.00	0.64	32.00	55.36	56.00	0.64
	4985.0	20.05	20.33	23.20	24.00	0.80	32.00	55.20	56.00	0.80
16-QAM	4945.0	20.41	20.21	23.32	24.00	0.68	32.00	55.32	56.00	0.68
	4965.0	19.68	20.53	23.14	24.00	0.86	32.00	55.14	56.00	0.86
	4985.0	20.17	20.27	23.23	24.00	0.77	32.00	55.23	56.00	0.77
64-QAM	4945.0	20.37	20.29	23.34	24.00	0.66	32.00	55.34	56.00	0.66
	4965.0	19.80	20.82	23.35	24.00	0.65	32.00	55.35	56.00	0.65
	4985.0	20.20	20.25	23.24	24.00	0.76	32.00	55.24	56.00	0.76

**Table 8.5-10: RF power and EIRP measurement of 20 MHz channel for 32 dBi antenna**

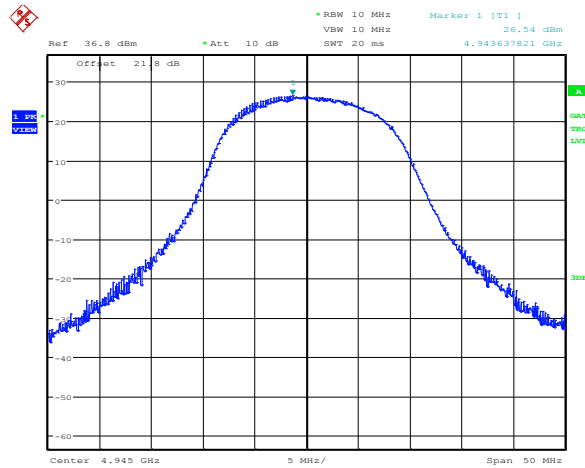
Modulation	Frequency, MHz	Power at ch0, dBm	Power at ch1, dBm	Combined output power, dBm	Output power limit, dBm	Power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
BPSK	4950.0	24.03	23.88	26.97	27.00	0.03	32.00	58.97	59.00	0.03
	4965.0	23.48	23.81	26.66	27.00	0.34	32.00	58.66	59.00	0.34
	4980.0	23.84	23.91	26.89	27.00	0.11	32.00	58.89	59.00	0.11
QPSK	4950.0	23.49	23.67	26.59	27.00	0.41	32.00	58.59	59.00	0.41
	4965.0	23.45	23.74	26.61	27.00	0.39	32.00	58.61	59.00	0.39
	4980.0	23.91	23.95	26.94	27.00	0.06	32.00	58.94	59.00	0.06
16-QAM	4950.0	23.99	23.92	26.97	27.00	0.03	32.00	58.97	59.00	0.03
	4965.0	23.96	23.87	26.93	27.00	0.07	32.00	58.93	59.00	0.07
	4980.0	23.98	23.99	27.00	27.00	0.00	32.00	59.00	59.00	0.00
64-QAM	4950.0	24.08	23.73	26.92	27.00	0.08	32.00	58.92	59.00	0.08
	4965.0	23.99	23.92	26.97	27.00	0.03	32.00	58.97	59.00	0.03
	4980.0	23.98	23.87	26.94	27.00	0.06	32.00	58.94	59.00	0.06

### 8.5.4 Test data, continued



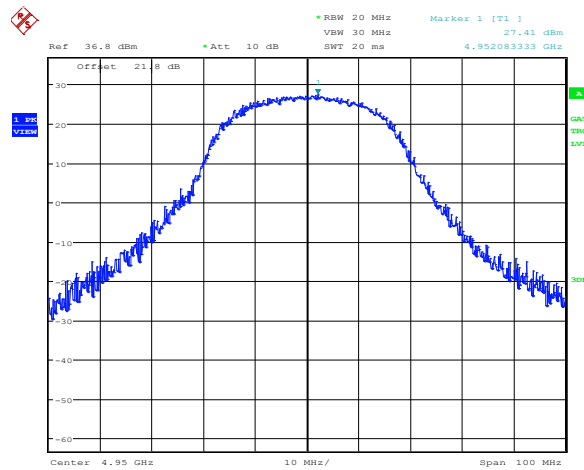
Date: 24.JAN.2013 16:46:16

Figure 8.5-1: Sample plot of power measurement for 5 MHz channel



Date: 24.JAN.2013 14:54:26

Figure 8.5-2: Sample plot of power measurement for 10 MHz channel



Date: 23.JAN.2013 14:58:26

Figure 8.5-3: Sample plot of power measurement for 20 MHz channel

These plots are here to show the test equipment settings and do not represent actual results.



8.5.4 Test data, continued

**Table 8.5-11: PSD and PSD EIRP measurement of 5 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	17.60	18.30	20.97	21.00	0.03	10.00	30.97	47.00	16.03
	4965.0	17.68	17.65	20.68	21.00	0.32	10.00	30.68	47.00	16.32
	4987.5	18.05	17.79	20.93	21.00	0.07	10.00	30.93	47.00	16.07
QPSK	4942.5	17.51	18.20	20.88	21.00	0.12	10.00	30.88	47.00	16.12
	4965.0	17.72	17.60	20.67	21.00	0.33	10.00	30.67	47.00	16.33
	4987.5	18.10	17.74	20.93	21.00	0.07	10.00	30.93	47.00	16.07
16-QAM	4942.5	17.63	18.17	20.92	21.00	0.08	10.00	30.92	47.00	16.08
	4965.0	17.83	17.55	20.70	21.00	0.30	10.00	30.70	47.00	16.30
	4987.5	18.12	17.82	20.98	21.00	0.02	10.00	30.98	47.00	16.02
64-QAM	4942.5	17.70	18.25	20.99	21.00	0.01	10.00	30.99	47.00	16.01
	4965.0	17.85	17.83	20.85	21.00	0.15	10.00	30.85	47.00	16.15
	4987.5	18.00	17.68	20.85	21.00	0.15	10.00	30.85	47.00	16.15

**Table 8.5-12: PSD and PSD EIRP measurement of 10 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	18.18	17.69	20.95	21.00	0.05	10.00	30.95	47.00	16.05
	4965.0	18.18	17.80	21.00	21.00	0.00	10.00	31.00	47.00	16.00
	4985.0	17.60	18.19	20.92	21.00	0.08	10.00	30.92	47.00	16.08
QPSK	4945.0	17.99	17.71	20.86	21.00	0.14	10.00	30.86	47.00	16.14
	4965.0	18.20	17.77	21.00	21.00	0.00	10.00	31.00	47.00	16.00
	4985.0	17.66	18.14	20.92	21.00	0.08	10.00	30.92	47.00	16.08
16-QAM	4945.0	17.95	17.71	20.84	21.00	0.16	10.00	30.84	47.00	16.16
	4965.0	18.19	17.73	20.98	21.00	0.02	10.00	30.98	47.00	16.02
	4985.0	17.65	18.12	20.90	21.00	0.10	10.00	30.90	47.00	16.10
64-QAM	4945.0	17.93	17.77	20.86	21.00	0.14	10.00	30.86	47.00	16.14
	4965.0	18.16	17.80	20.99	21.00	0.01	10.00	30.99	47.00	16.01
	4985.0	17.64	18.25	20.97	21.00	0.03	10.00	30.97	47.00	16.03

**Table 8.5-13: PSD and PSD EIRP measurement of 20 MHz channel for 10 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	16.46	16.09	19.29	21.00	1.71	10.00	29.29	47.00	17.71
	4965.0	16.56	16.94	19.76	21.00	1.24	10.00	29.76	47.00	17.24
	4980.0	17.02	16.70	19.87	21.00	1.13	10.00	29.87	47.00	17.13
QPSK	4950.0	16.51	16.08	19.31	21.00	1.69	10.00	29.31	47.00	17.69
	4965.0	16.59	16.88	19.75	21.00	1.25	10.00	29.75	47.00	17.25
	4980.0	17.25	13.70	18.84	21.00	2.16	10.00	28.84	47.00	18.16
16-QAM	4950.0	16.58	15.96	19.29	21.00	1.71	10.00	29.29	47.00	17.71
	4965.0	16.68	16.91	19.81	21.00	1.19	10.00	29.81	47.00	17.19
	4980.0	17.38	16.71	20.07	21.00	0.93	10.00	30.07	47.00	16.93
64-QAM	4950.0	16.58	16.36	19.48	21.00	1.52	10.00	29.48	47.00	17.52
	4965.0	16.63	16.80	19.73	21.00	1.27	10.00	29.73	47.00	17.27
	4980.0	17.29	16.67	20.00	21.00	1.00	10.00	30.00	47.00	17.00

8.5.4 Test data, continued

**Table 8.5-14: PSD and PSD EIRP measurement of 5 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	17.60	18.30	20.97	21.00	0.03	19.00	39.97	47.00	7.03
	4965.0	17.68	17.65	20.68	21.00	0.32	19.00	39.68	47.00	7.32
	4987.5	18.05	17.79	20.93	21.00	0.07	19.00	39.93	47.00	7.07
QPSK	4942.5	17.51	18.20	20.88	21.00	0.12	19.00	39.88	47.00	7.12
	4965.0	17.72	17.60	20.67	21.00	0.33	19.00	39.67	47.00	7.33
	4987.5	18.10	17.74	20.93	21.00	0.07	19.00	39.93	47.00	7.07
16-QAM	4942.5	17.63	18.17	20.92	21.00	0.08	19.00	39.92	47.00	7.08
	4965.0	17.83	17.55	20.70	21.00	0.30	19.00	39.70	47.00	7.30
	4987.5	18.12	17.82	20.98	21.00	0.02	19.00	39.98	47.00	7.02
64-QAM	4942.5	17.70	18.25	20.99	21.00	0.01	19.00	39.99	47.00	7.01
	4965.0	17.85	17.83	20.85	21.00	0.15	19.00	39.85	47.00	7.15
	4987.5	18.00	17.68	20.85	21.00	0.15	19.00	39.85	47.00	7.15

**Table 8.5-15: PSD and PSD EIRP measurement of 10 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	18.18	17.69	20.95	21.00	0.05	19.00	39.95	47.00	7.05
	4965.0	18.18	17.80	21.00	21.00	0.00	19.00	40.00	47.00	7.00
	4985.0	17.60	18.19	20.92	21.00	0.08	19.00	39.92	47.00	7.08
QPSK	4945.0	17.99	17.71	20.86	21.00	0.14	19.00	39.86	47.00	7.14
	4965.0	18.20	17.77	21.00	21.00	0.00	19.00	40.00	47.00	7.00
	4985.0	17.66	18.14	20.92	21.00	0.08	19.00	39.92	47.00	7.08
16-QAM	4945.0	17.95	17.71	20.84	21.00	0.16	19.00	39.84	47.00	7.16
	4965.0	18.19	17.73	20.98	21.00	0.02	19.00	39.98	47.00	7.02
	4985.0	17.65	18.12	20.90	21.00	0.10	19.00	39.90	47.00	7.10
64-QAM	4945.0	17.93	17.77	20.86	21.00	0.14	19.00	39.86	47.00	7.14
	4965.0	18.16	17.80	20.99	21.00	0.01	19.00	39.99	47.00	7.01
	4985.0	17.64	18.25	20.97	21.00	0.03	19.00	39.97	47.00	7.03

**Table 8.5-16: PSD and PSD EIRP measurement of 20 MHz channel for 19 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	16.46	16.09	19.29	21.00	1.71	19.00	38.29	47.00	8.71
	4965.0	16.56	16.94	19.76	21.00	1.24	19.00	38.76	47.00	8.24
	4980.0	17.02	16.70	19.87	21.00	1.13	19.00	38.87	47.00	8.13
QPSK	4950.0	16.51	16.08	19.31	21.00	1.69	19.00	38.31	47.00	8.69
	4965.0	16.59	16.88	19.75	21.00	1.25	19.00	38.75	47.00	8.25
	4980.0	17.25	13.70	18.84	21.00	2.16	19.00	37.84	47.00	9.16
16-QAM	4950.0	16.58	15.96	19.29	21.00	1.71	19.00	38.29	47.00	8.71
	4965.0	16.68	16.91	19.81	21.00	1.19	19.00	38.81	47.00	8.19
	4980.0	17.38	16.71	20.07	21.00	0.93	19.00	39.07	47.00	7.93
64-QAM	4950.0	16.58	16.36	19.48	21.00	1.52	19.00	38.48	47.00	8.52
	4965.0	16.63	16.80	19.73	21.00	1.27	19.00	38.73	47.00	8.27
	4980.0	17.29	16.67	20.00	21.00	1.00	19.00	39.00	47.00	8.00

8.5.4 Test data, continued

**Table 8.5-17: PSD and PSD EIRP measurement of 5 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4942.5	11.54	11.75	14.66	15.00	0.34	32.00	46.66	47.00	0.34
	4965.0	11.98	11.47	14.74	15.00	0.26	32.00	46.74	47.00	0.26
	4987.5	11.99	11.82	14.92	15.00	0.08	32.00	46.92	47.00	0.08
QPSK	4942.5	11.50	11.68	14.60	15.00	0.40	32.00	46.60	47.00	0.40
	4965.0	11.85	11.49	14.68	15.00	0.32	32.00	46.68	47.00	0.32
	4987.5	11.97	11.83	14.91	15.00	0.09	32.00	46.91	47.00	0.09
16-QAM	4942.5	11.48	11.71	14.61	15.00	0.39	32.00	46.61	47.00	0.39
	4965.0	11.78	11.50	14.65	15.00	0.35	32.00	46.65	47.00	0.35
	4987.5	12.01	11.78	14.91	15.00	0.09	32.00	46.91	47.00	0.09
64-QAM	4942.5	11.49	11.76	14.64	15.00	0.36	32.00	46.64	47.00	0.36
	4965.0	11.52	11.49	14.52	15.00	0.48	32.00	46.52	47.00	0.48
	4987.5	12.06	11.84	14.96	15.00	0.04	32.00	46.96	47.00	0.04

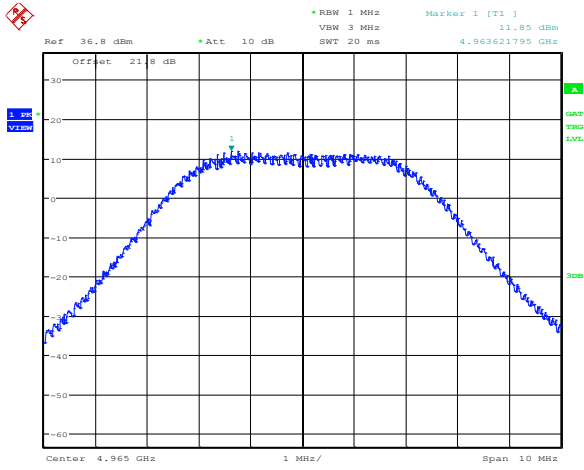
**Table 8.5-18: PSD and PSD EIRP measurement of 10 MHz channel for 32 dBi antenna**

Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4945.0	11.52	11.80	14.67	15.00	0.33	32.00	46.67	47.00	0.33
	4965.0	11.12	12.15	14.68	15.00	0.32	32.00	46.68	47.00	0.32
	4985.0	11.35	12.21	14.81	15.00	0.19	32.00	46.81	47.00	0.19
QPSK	4945.0	11.64	11.98	14.82	15.00	0.18	32.00	46.82	47.00	0.18
	4965.0	11.18	12.07	14.66	15.00	0.34	32.00	46.66	47.00	0.34
	4985.0	11.42	12.19	14.83	15.00	0.17	32.00	46.83	47.00	0.17
16-QAM	4945.0	11.69	11.93	14.82	15.00	0.18	32.00	46.82	47.00	0.18
	4965.0	11.31	12.10	14.73	15.00	0.27	32.00	46.73	47.00	0.27
	4985.0	11.47	12.20	14.86	15.00	0.14	32.00	46.86	47.00	0.14
64-QAM	4945.0	11.72	11.80	14.77	15.00	0.23	32.00	46.77	47.00	0.23
	4965.0	11.25	12.00	14.65	15.00	0.35	32.00	46.65	47.00	0.35
	4985.0	11.58	12.20	14.91	15.00	0.09	32.00	46.91	47.00	0.09

**Table 8.5-19: PSD and PSD EIRP measurement of 20 MHz channel for 32 dBi antenna**

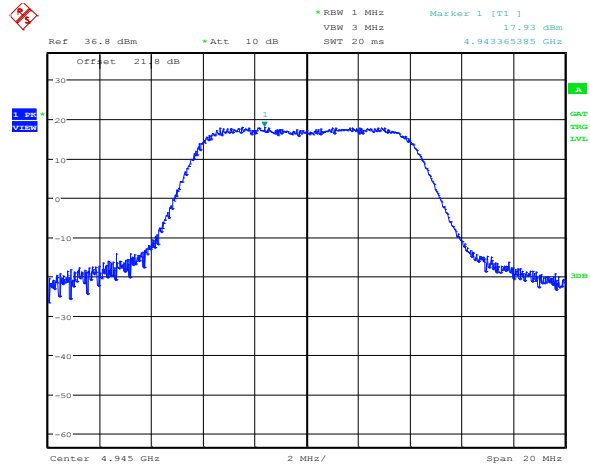
Modulation	Frequency, MHz	PSD at ch0, dBm/MHz	PSD at ch1, dBm/MHz	Combined PSD, dBm/MHz	PSD limit, dBm/MHz	PSD margin, dB	Antenna gain, dBi	PSD EIRP, dBm/MHz	PSD EIRP limit, dBm/MHz	PSD EIRP margin, dB
BPSK	4950.0	11.43	11.41	14.43	15.00	0.57	32.00	46.43	47.00	0.57
	4965.0	11.77	11.44	14.62	15.00	0.38	32.00	46.62	47.00	0.38
	4980.0	12.00	11.86	14.94	15.00	0.06	32.00	46.94	47.00	0.06
QPSK	4950.0	11.45	11.26	14.37	15.00	0.63	32.00	46.37	47.00	0.63
	4965.0	11.79	11.39	14.60	15.00	0.40	32.00	46.60	47.00	0.40
	4980.0	11.95	11.83	14.90	15.00	0.10	32.00	46.90	47.00	0.10
16-QAM	4950.0	11.45	11.31	14.39	15.00	0.61	32.00	46.39	47.00	0.61
	4965.0	11.69	11.62	14.67	15.00	0.33	32.00	46.67	47.00	0.33
	4980.0	11.94	11.88	14.92	15.00	0.08	32.00	46.92	47.00	0.08
64-QAM	4950.0	11.49	11.22	14.37	15.00	0.63	32.00	46.37	47.00	0.63
	4965.0	11.73	11.41	14.58	15.00	0.42	32.00	46.58	47.00	0.42
	4980.0	12.06	11.79	14.94	15.00	0.06	32.00	46.94	47.00	0.06

### 8.5.4 Test data, continued



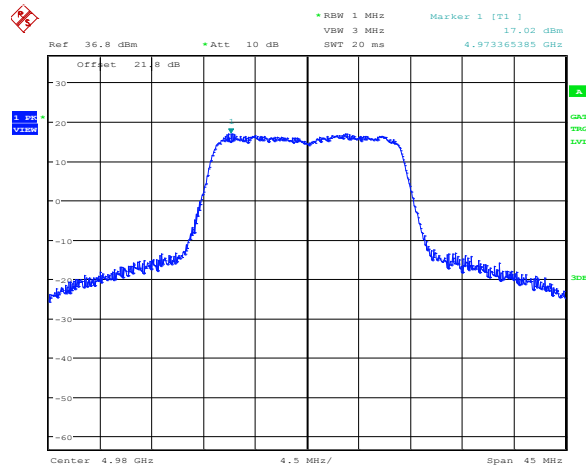
Date: 28.JAN.2013 15:04:19

Figure 8.5-4: Sample plot of PSD measurement for 5 MHz channel



Date: 28.JAN.2013 15:20:32

Figure 8.5-5: Sample plot of PSD measurement for 10 MHz channel



Date: 29.JAN.2013 11:29:51

Figure 8.5-6: Sample plot of PSD measurement for 20 MHz channel

### 8.5.4 Test data, continued

**Table 8.5-20:** 99 % occupied bandwidth of 5 MHz channel measurements

Modulation	Frequency, MHz	99 % occupied bandwidth, MHz
BPSK	4942.5	4.13
	4965.0	4.13
	4987.5	4.13
QPSK	4942.5	4.13
	4965.0	4.13
	4987.5	4.13
16-QAM	4942.5	4.13
	4965.0	4.13
	4987.5	4.13
64-QAM	4942.5	4.13
	4965.0	4.13
	4987.5	4.13

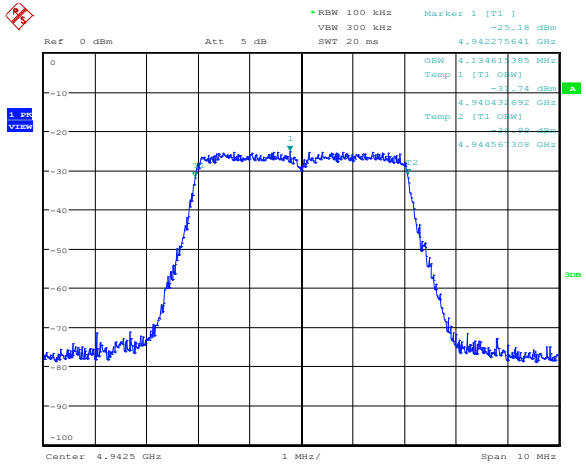
**Table 8.5-21:** 99 % occupied bandwidth of 10 MHz channel measurements

Modulation	Frequency, MHz	99 % occupied bandwidth, MHz
BPSK	4945.0	8.17
	4965.0	8.17
	4985.0	8.17
QPSK	4945.0	8.17
	4965.0	8.17
	4985.0	8.17
16-QAM	4945.0	8.17
	4965.0	8.17
	4985.0	8.17
64-QAM	4945.0	8.17
	4965.0	8.17
	4985.0	8.17

**Table 8.5-22:** 99 % occupied bandwidth of 20 MHz channel measurements

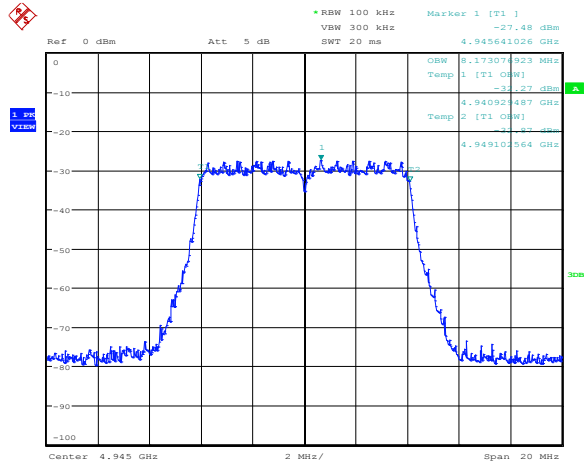
Modulation	Frequency, MHz	99 % occupied bandwidth, MHz
BPSK	4950.0	16.31
	4965.0	16.31
	4980.0	16.31
QPSK	4950.0	16.31
	4965.0	16.31
	4980.0	16.31
16-QAM	4950.0	16.31
	4965.0	16.31
	4980.0	16.31
64-QAM	4950.0	16.31
	4965.0	16.31
	4980.0	16.31

### 8.5.4 Test data, continued



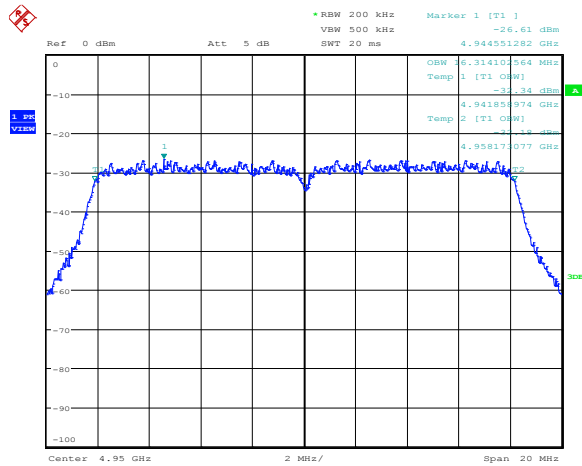
Date: 22.JAN.2013 10:01:45

Figure 8.5-7: Sample plot for 99 % occupied bandwidth for 5 MHz



Date: 22.JAN.2013 10:06:57

Figure 8.5-8: Sample plot for 99 % occupied bandwidth for 10 MHz



Date: 22.JAN.2013 10:08:34

Figure 8.5-9: Sample plot for 99 % occupied bandwidth for 20 MHz

## 8.6 FCC 90.210(m) and RSS-111 Clause 5.4 Transmitter spurious (unwanted) emissions on the antenna terminals

### 8.6.1 Definitions and limits

On any frequency  $f$ , offset from the channel centre frequency  $f_c$  by a separation  $f_d$  (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified in Table 8.3 1. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

**Table 8.6-1: FCC §15.209 and RSS-Gen – Radiated emission limits**

Offset frequency $f_d$ (% of the EUT's channel bandwidth)	Minimum attenuation, dB	
	Low power transmitter	High power transmitter
$0 < f_d \leq 45$	0	0
$45 < f_d \leq 50$	$219 \log (f_d/45)$	$568 \log (f_d/45)$
$50 < f_d \leq 55$	$10 + 242 \log (f_d/50)$	$26 + 145 \log (f_d/50)$
$55 < f_d \leq 100$	$20 + 31 \log (f_d/55)$	$32 + 31 \log (f_d/55)$
$100 < f_d \leq 150$	$28 + 68 \log (f_d/100)$	$40 + 57 \log (f_d/100)$
$f_d > 150$	40	50 or $55 + 10 \log (P)^*$

Notes: Where  $f_d$  (%) =  $((f - f_c) / \text{channel bandwidth} \times 100)$ ; P is transmitter's output power (in watts). \* Whichever is the lesser attenuation.

### 8.6.2 Test summary

<b>Test date</b>	January 22, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1004 mbar	<b>Relative humidity</b>	35 %

### 8.6.3 Observations/special notes

The Spectrum was searched from 30 MHz to the 40 GHz.

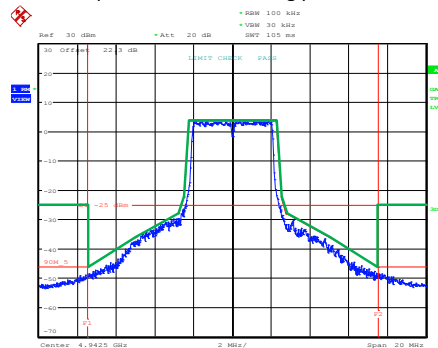
Spectrum analyzer settings for emission mask:

RMS detector with RBW/VBW of 100 kHz/30 kHz for 5 and 10 MHz channels; and 200 kHz/30 kHz for 20 MHz channel

Spectrum analyzer settings for spurious emissions outside the pass band (only the worst case emissions as representative plots are shown):

Peak detector with RBW/VBW of 100 kHz/30 kHz for 5 and 10 MHz channels; and 200 kHz/30 kHz for 20 MHz channel

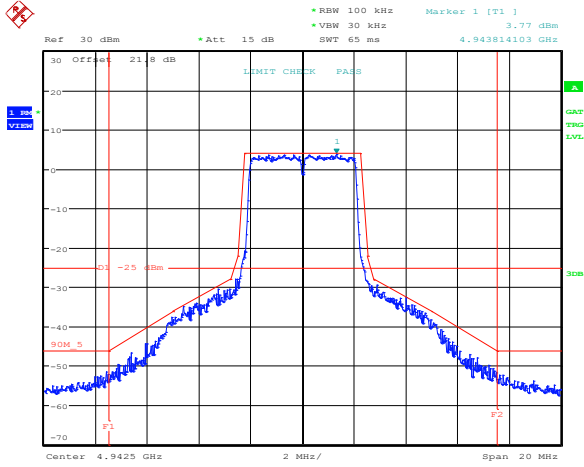
F1 and F2 on the following plots are frequencies indicating 150 % of the authorized bandwidth. From F1 and below and from F2 and above the -25 dBm limit line applies. All emissions shall lie below the green line as depicted on the following plot



Date: 30\_JAN.2012 16:21:02

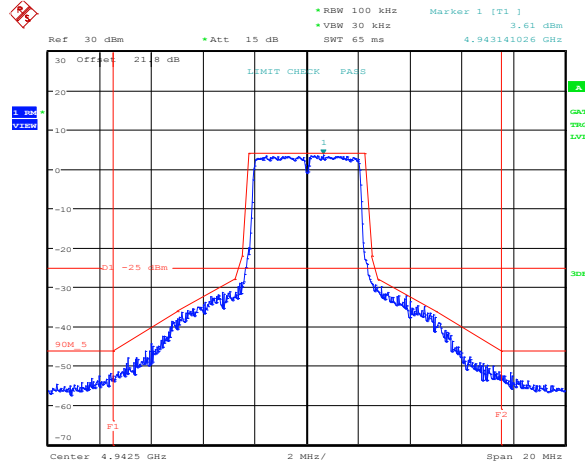
**Figure 8.6-1: Emission mask application example**

### 8.6.4 Test data



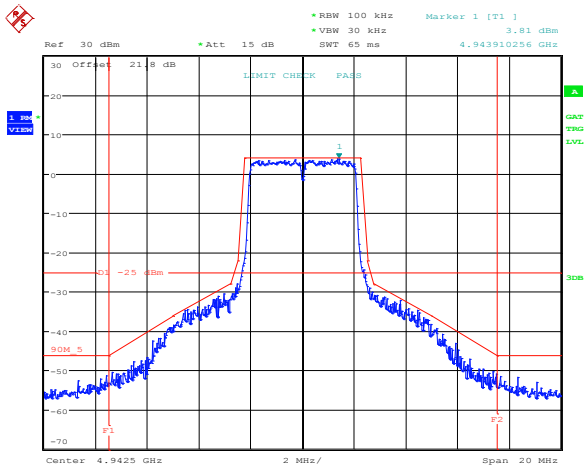
Date: 22.JAN.2013 14:52:10

Figure 8.6-2: Emission mask for 5 MHz channel, antenna port 1, low frequency, BPSK



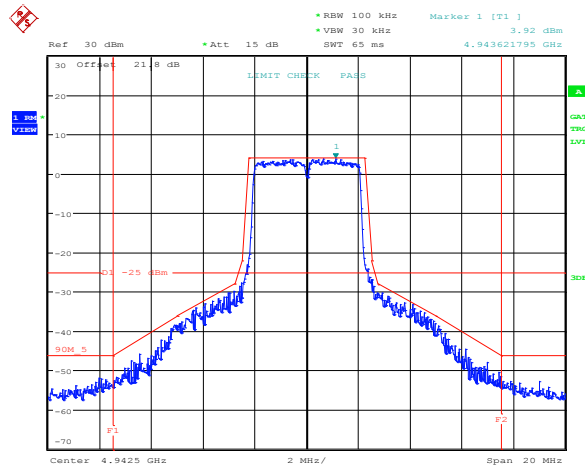
Date: 22.JAN.2013 14:52:33

Figure 8.6-3: Emission mask for 5 MHz channel, antenna port 1, low frequency, QPSK



Date: 22.JAN.2013 14:52:50

Figure 8.6-4: Emission mask for 5 MHz channel, antenna port 1, low frequency, 16-QAM

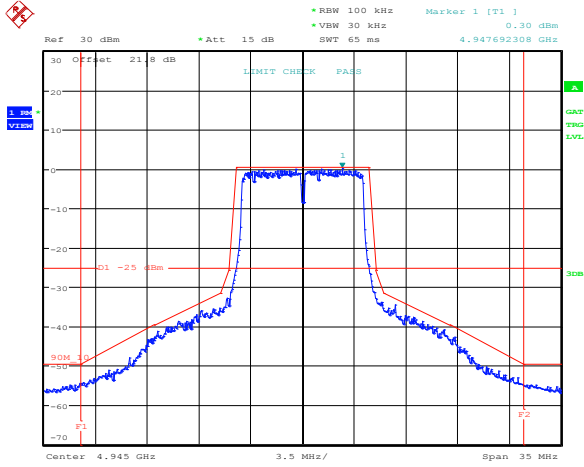


Date: 22.JAN.2013 14:53:12

Figure 8.6-5: Emission mask for 5 MHz channel, antenna port 1, low frequency, 64-QAM

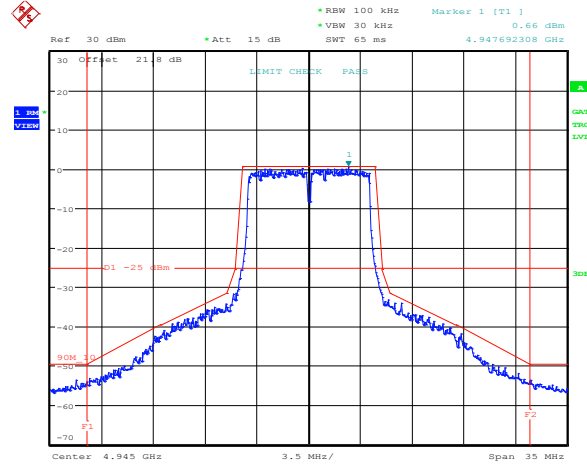


8.6.4 Test data, continued



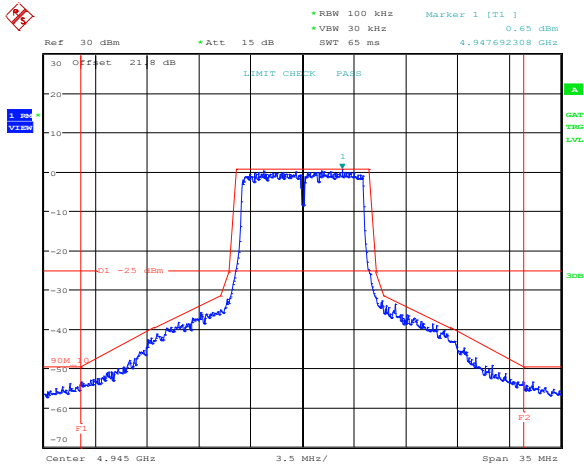
Date: 22.JAN.2013 15:02:48

Figure 8.6-6: Emission mask for 10 MHz channel, antenna port 1, low frequency, BPSK



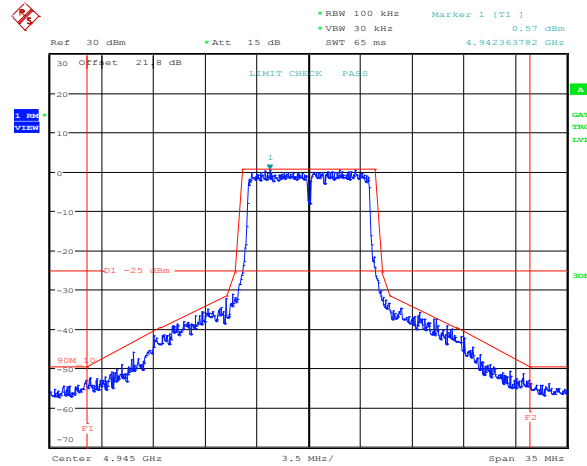
Date: 22.JAN.2013 15:03:50

Figure 8.6-7: Emission mask for 10 MHz channel, antenna port 1, low frequency, QPSK



Date: 22.JAN.2013 15:04:12

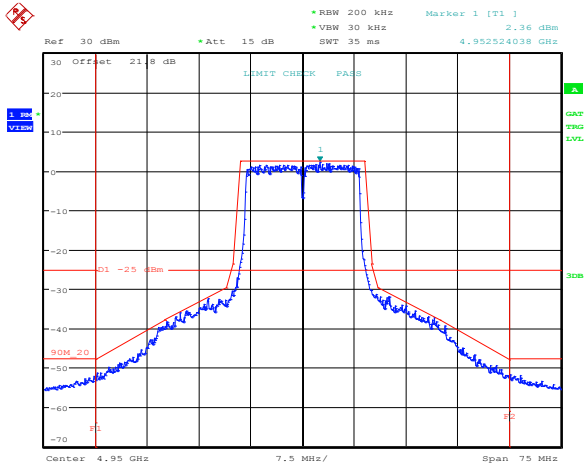
Figure 8.6-8: Emission mask for 10 MHz channel, antenna port 1, low frequency, 16-QAM



Date: 22.JAN.2013 15:04:29

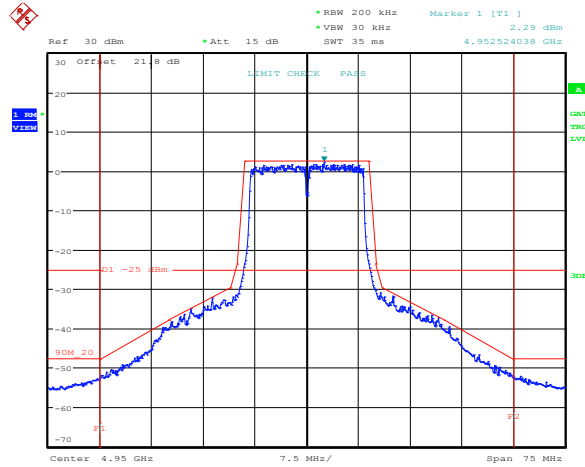
Figure 8.6-9: Emission mask for 10 MHz channel, antenna port 1, low frequency, 64-QAM

8.6.4 Test data, continued



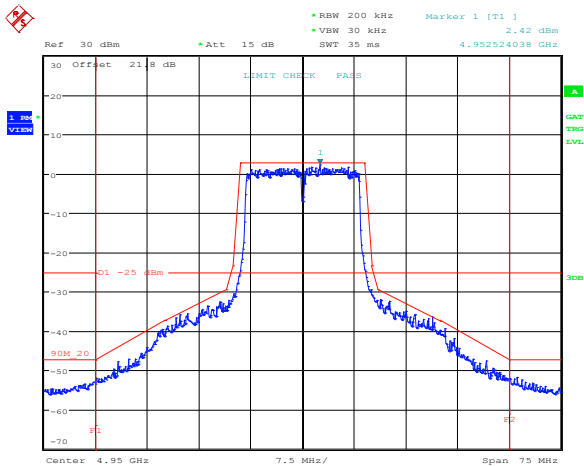
Date: 22.JAN.2013 14:25:49

Figure 8.6-10: Emission mask for 20 MHz channel, antenna port 1, low frequency, BPSK



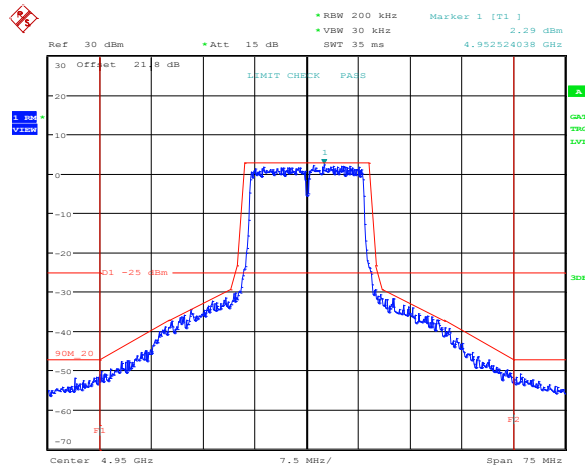
Date: 22.JAN.2013 14:25:23

Figure 8.6-11: Emission mask for 20 MHz channel, antenna port 1, low frequency, QPSK



Date: 22.JAN.2013 14:39:54

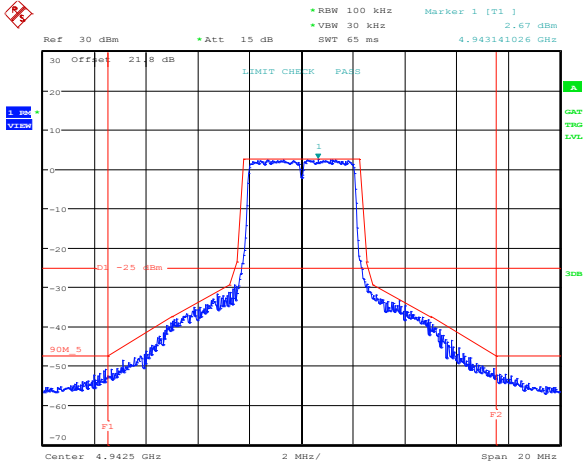
Figure 8.6-12: Emission mask for 20 MHz channel, antenna port 1, low frequency, 16-QAM



Date: 22.JAN.2013 14:39:31

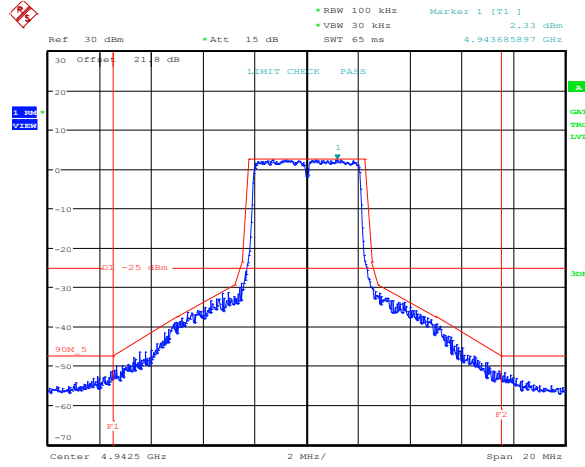
Figure 8.6-13: Emission mask for 20 MHz channel, antenna port 1, low frequency, 64-QAM

8.6.4 Test data, continued



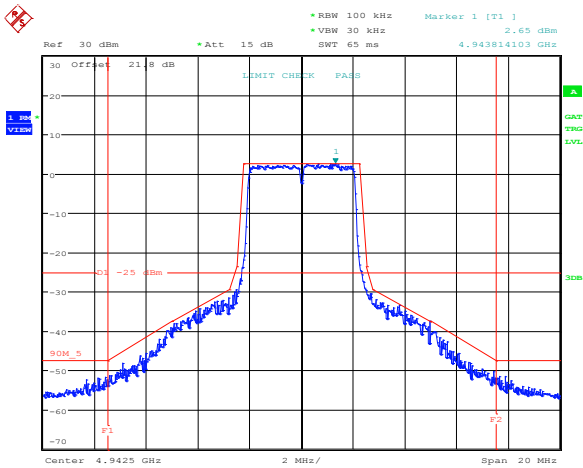
Date: 22.JAN.2013 14:56:02

Figure 8.6-14: Emission mask for 5 MHz channel, antenna port 2, low frequency, BPSK



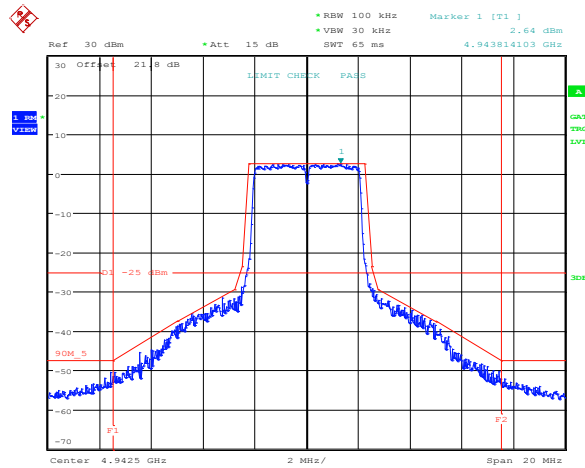
Date: 22.JAN.2013 14:55:40

Figure 8.6-15: Emission mask for 5 MHz channel, antenna port 2, low frequency, QPSK



Date: 22.JAN.2013 14:55:18

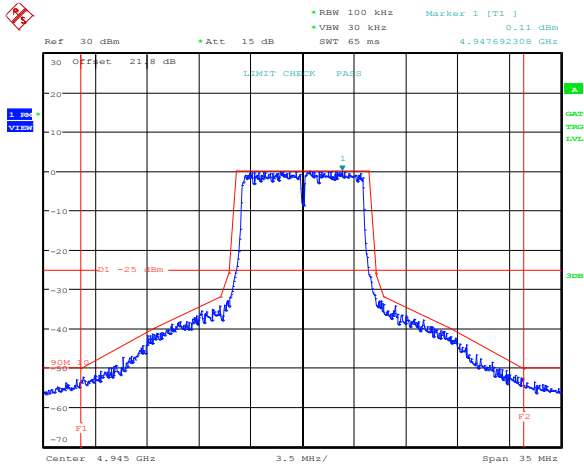
Figure 8.6-16: Emission mask for 5 MHz channel, antenna port 2, low frequency, 16-QAM



Date: 22.JAN.2013 14:54:52

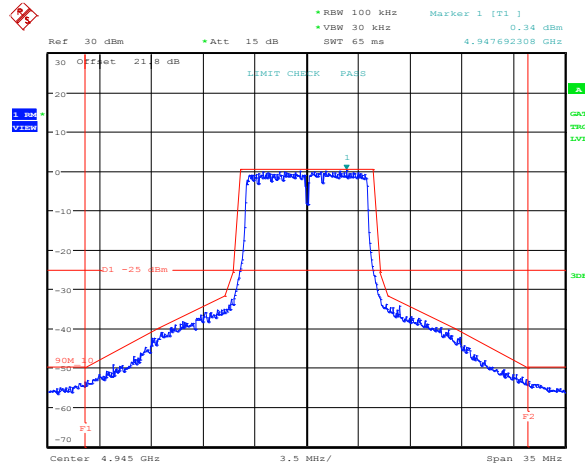
Figure 8.6-17: Emission mask for 5 MHz channel, antenna port 2, low frequency, 64-QAM

### 8.6.4 Test data, continued



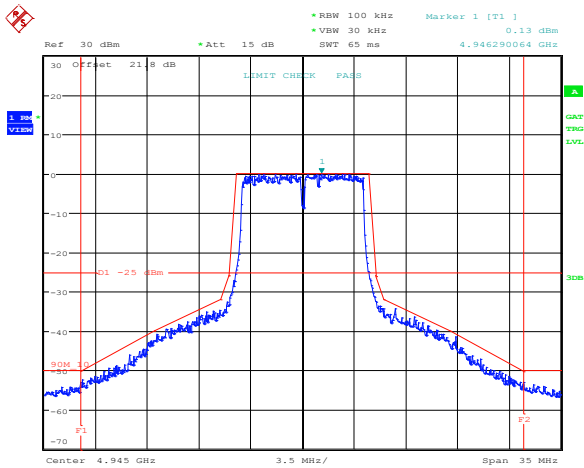
Date: 22.JAN.2013 15:06:32

Figure 8.6-18: Emission mask for 10 MHz channel, antenna port 2, low frequency, BPSK



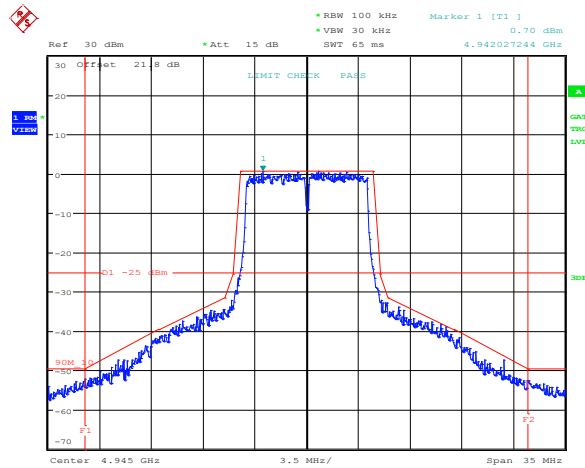
Date: 22.JAN.2013 15:06:03

Figure 8.6-19: Emission mask for 10 MHz channel, antenna port 2, low frequency, QPSK



Date: 22.JAN.2013 15:05:36

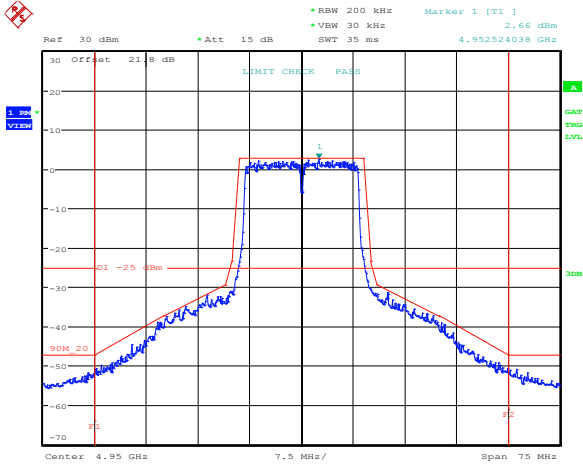
Figure 8.6-20: Emission mask for 10 MHz channel, antenna port 2, low frequency, 16-QAM



Date: 22.JAN.2013 15:05:07

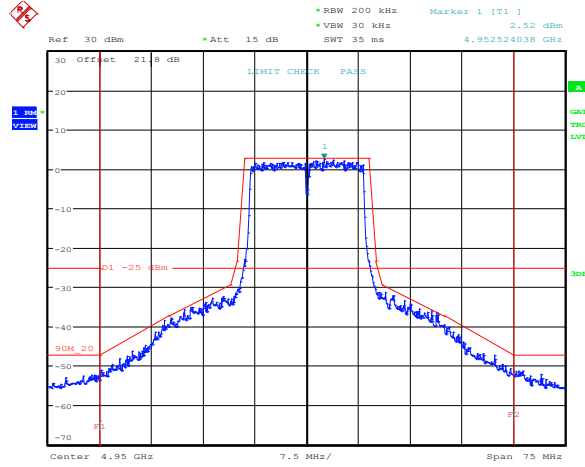
Figure 8.6-21: Emission mask for 10 MHz channel, antenna port 2, low frequency, 64-QAM

### 8.6.4 Test data, continued



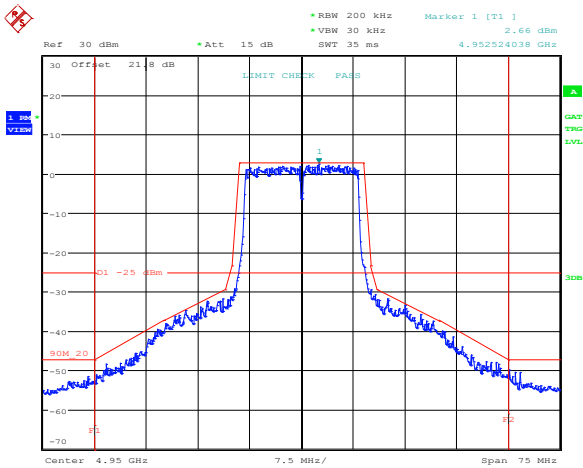
Date: 22.JAN.2013 14:37:13

Figure 8.6-22: Emission mask for 20 MHz channel, antenna port 2, low frequency, BPSK



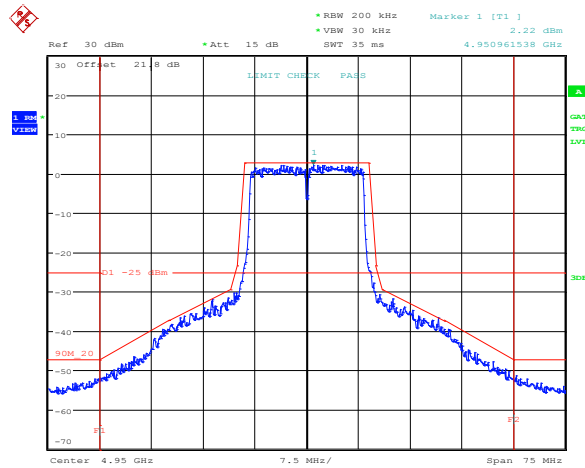
Date: 22.JAN.2013 14:37:43

Figure 8.6-23: Emission mask for 20 MHz channel, antenna port 2, low frequency, QPSK



Date: 22.JAN.2013 14:38:06

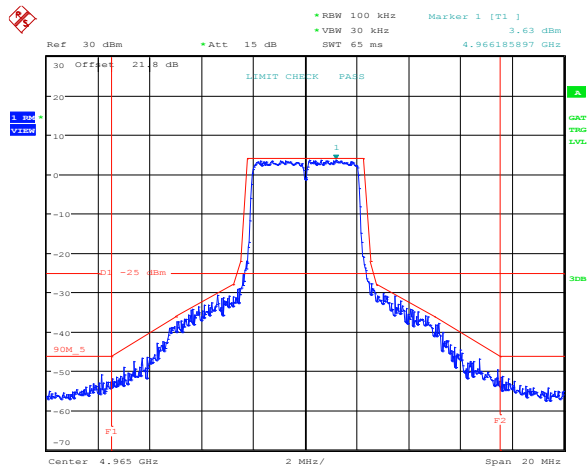
Figure 8.6-24: Emission mask for 20 MHz channel, antenna port 2, low frequency, 16-QAM



Date: 22.JAN.2013 14:38:29

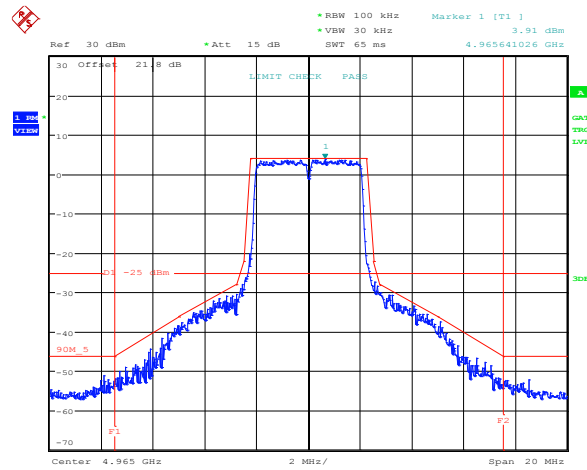
Figure 8.6-25: Emission mask for 20 MHz channel, antenna port 2, low frequency, 64-QAM

8.6.5 Test data, continued



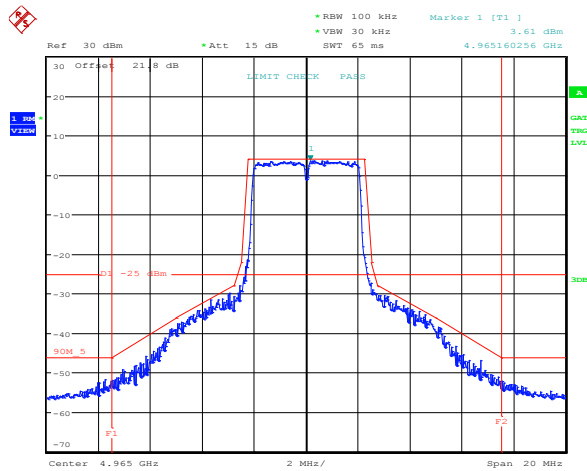
Date: 22.JAN.2013 14:51:11

Figure 8.6-26: Emission mask for 5 MHz channel, antenna port 1, mid frequency, BPSK



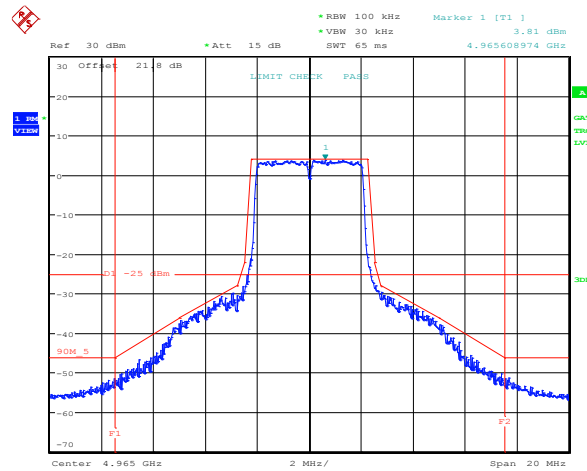
Date: 22.JAN.2013 14:50:45

Figure 8.6-27: Emission mask for 5 MHz channel, antenna port 1, mid frequency, QPSK



Date: 22.JAN.2013 14:50:26

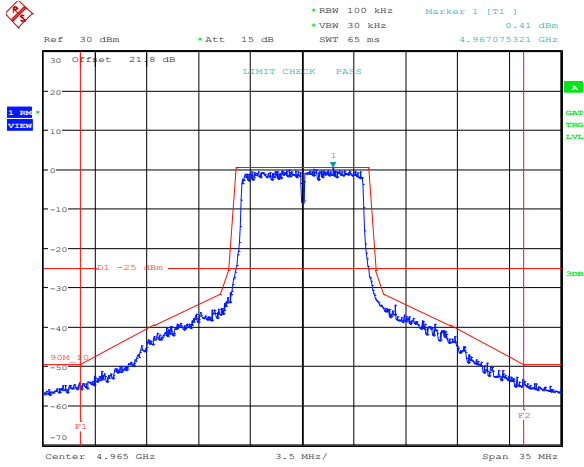
Figure 8.6-28: Emission mask for 5 MHz channel, antenna port 1, mid frequency, 16-QAM



Date: 22.JAN.2013 14:50:02

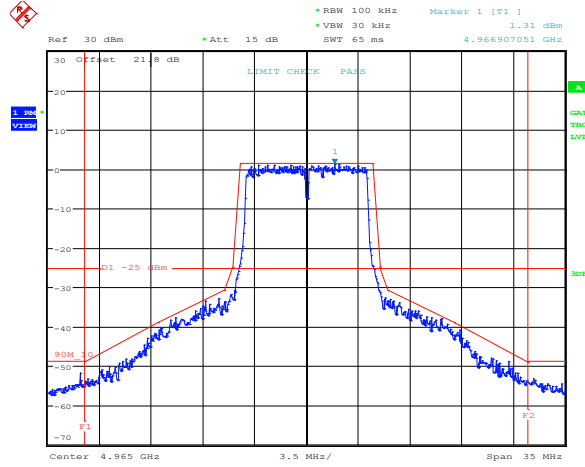
Figure 8.6-29: Emission mask for 5 MHz channel, antenna port 1, mid frequency, 64-QAM

### 8.6.4 Test data, continued



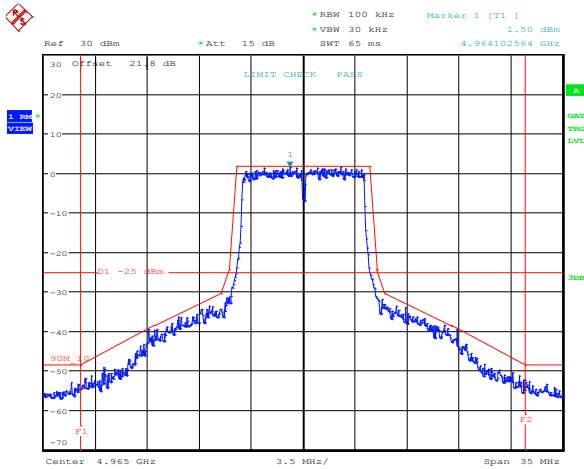
Date: 22.JAN.2013 16:26:09

Figure 8.6-30: Emission mask for 10 MHz channel, antenna port 1, mid frequency, BPSK



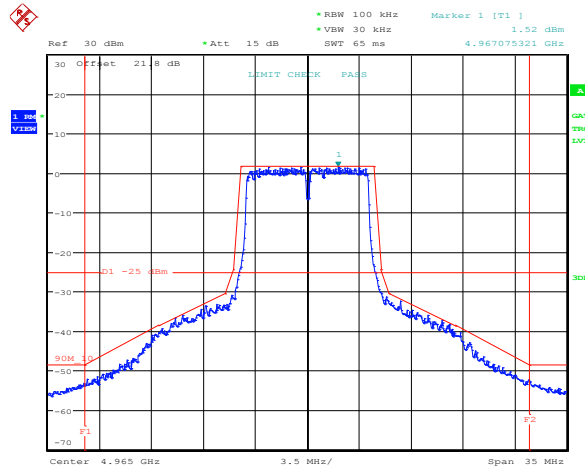
Date: 22.JAN.2013 16:25:41

Figure 8.6-31: Emission mask for 10 MHz channel, antenna port 1, mid frequency, QPSK



Date: 22.JAN.2013 16:25:14

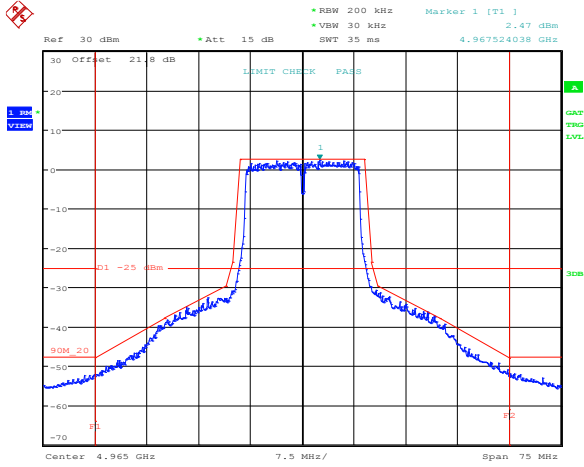
Figure 8.6-32: Emission mask for 10 MHz channel, antenna port 1, mid frequency, 16-QAM



Date: 22.JAN.2013 16:24:46

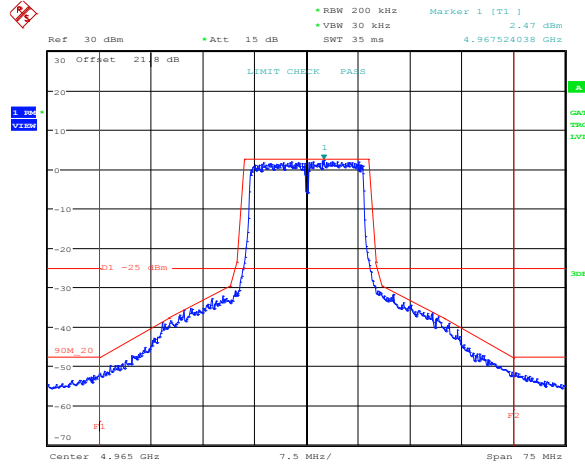
Figure 8.6-33: Emission mask for 10 MHz channel, antenna port 1, mid frequency, 64-QAM

### 8.6.4 Test data, continued



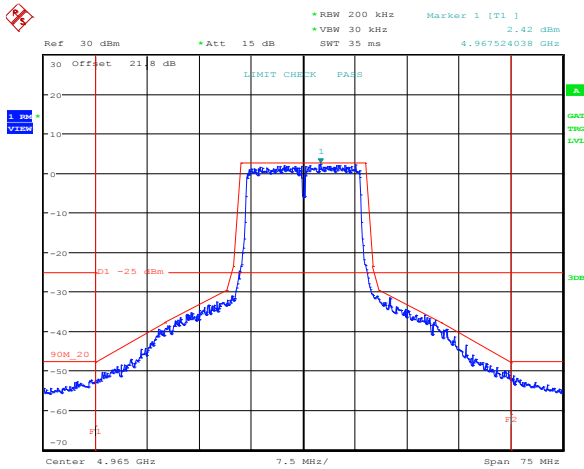
Date: 22.JAN.2013 14:29:06

Figure 8.6-34: Emission mask for 20 MHz channel, antenna port 1, mid frequency, BPSK



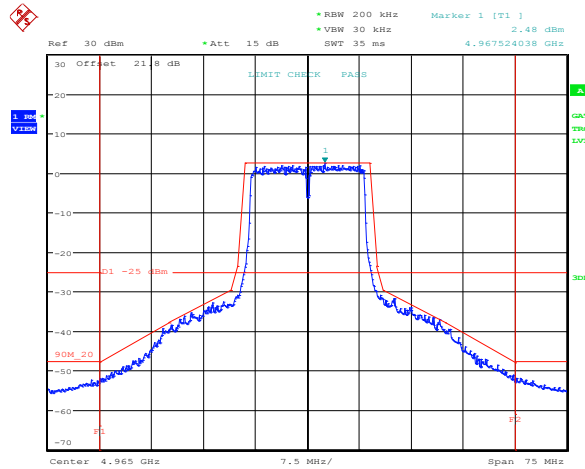
Date: 22.JAN.2013 14:29:28

Figure 8.6-35: Emission mask for 20 MHz channel, antenna port 1, mid frequency, QPSK



Date: 22.JAN.2013 14:29:54

Figure 8.6-36: Emission mask for 20 MHz channel, antenna port 1, mid frequency, 16-QAM

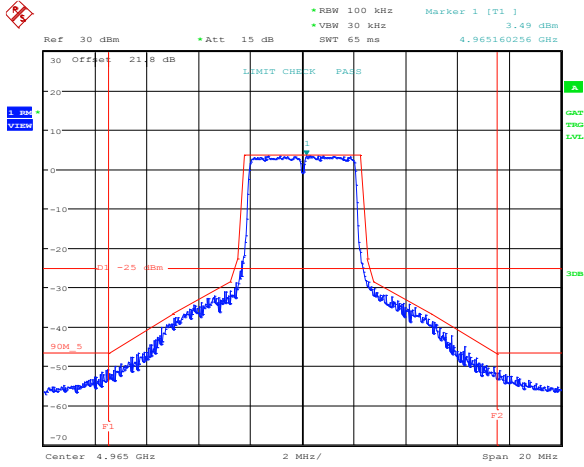


Date: 22.JAN.2013 14:30:17

Figure 8.6-37: Emission mask for 20 MHz channel, antenna port 1, mid frequency, 64-QAM

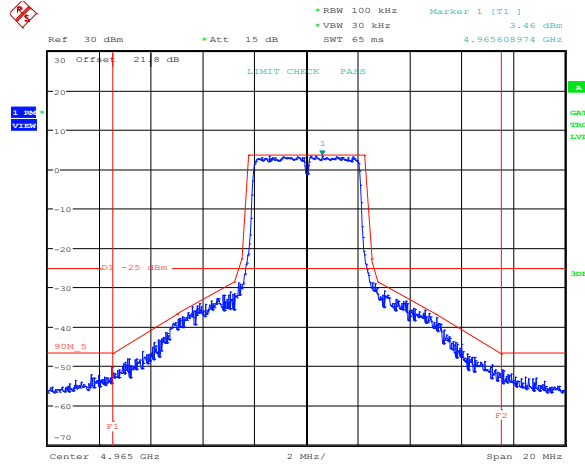


### 8.6.4 Test data, continued



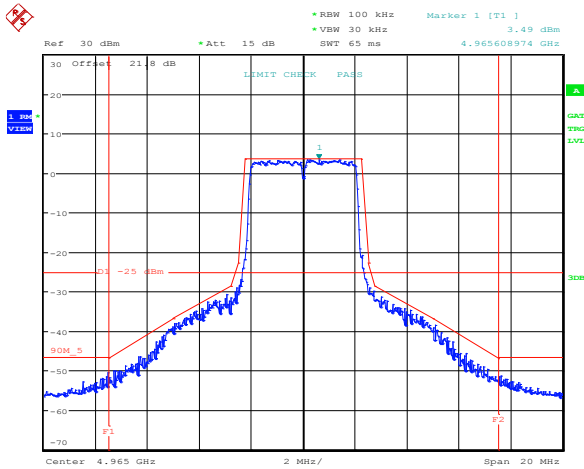
Date: 22.JAN.2013 14:47:53

Figure 8.6-38: Emission mask for 5 MHz channel, antenna port 2, mid frequency, BPSK



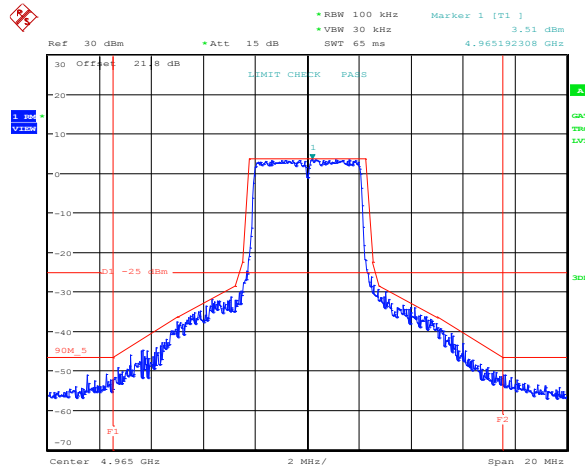
Date: 22.JAN.2013 14:48:23

Figure 8.6-39: Emission mask for 5 MHz channel, antenna port 2, mid frequency, QPSK



Date: 22.JAN.2013 14:48:57

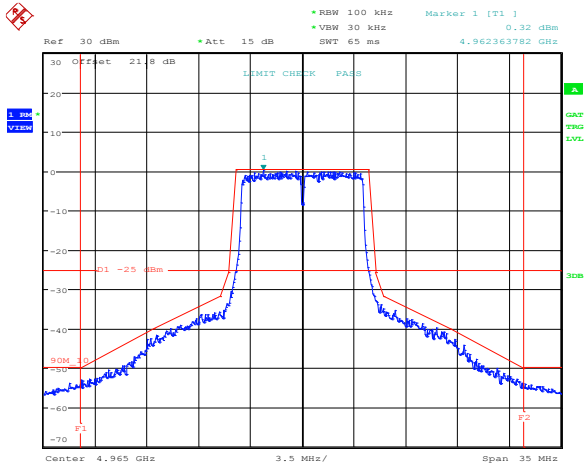
Figure 8.6-40: Emission mask for 5 MHz channel, antenna port 2, mid frequency, 16-QAM



Date: 22.JAN.2013 14:49:26

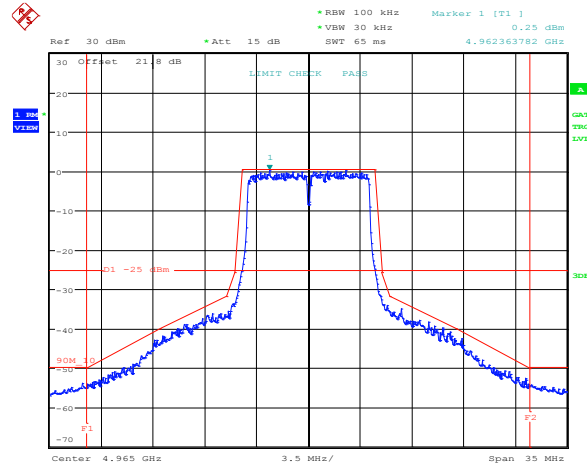
Figure 8.6-41: Emission mask for 5 MHz channel, antenna port 2, mid frequency, 64-QAM

### 8.6.4 Test data, continued



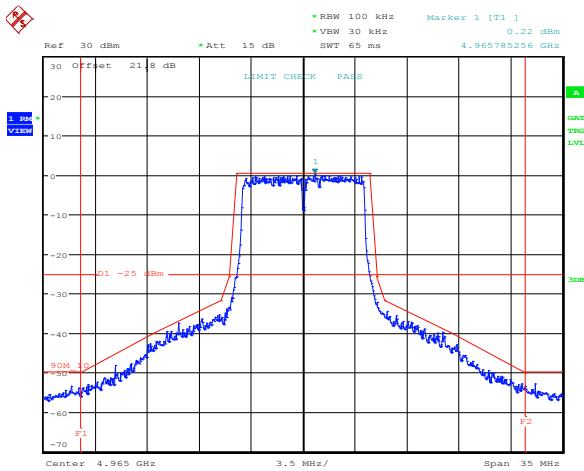
Date: 22.JAN.2013 16:22:43

Figure 8.6-42: Emission mask for 10 MHz channel, antenna port 2, mid frequency, BPSK



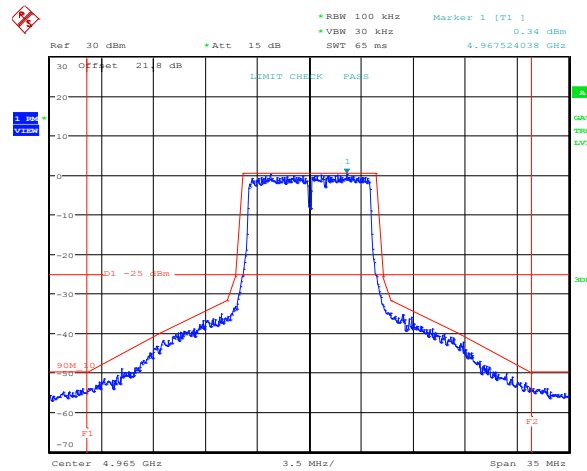
Date: 22.JAN.2013 16:23:11

Figure 8.6-43: Emission mask for 10 MHz channel, antenna port 2, mid frequency, QPSK



Date: 22.JAN.2013 16:23:30

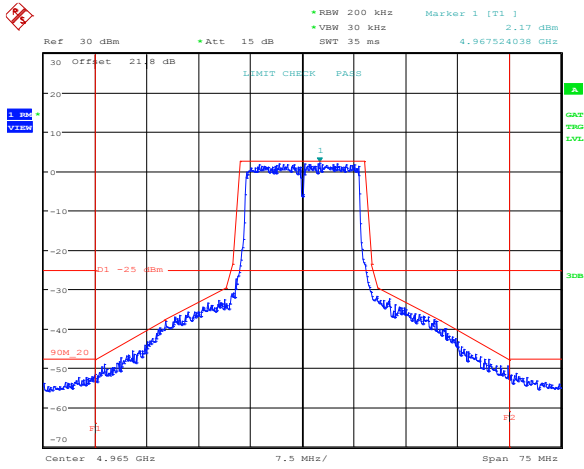
Figure 8.6-44: Emission mask for 10 MHz channel, antenna port 2, mid frequency, 16-QAM



Date: 22.JAN.2013 16:23:51

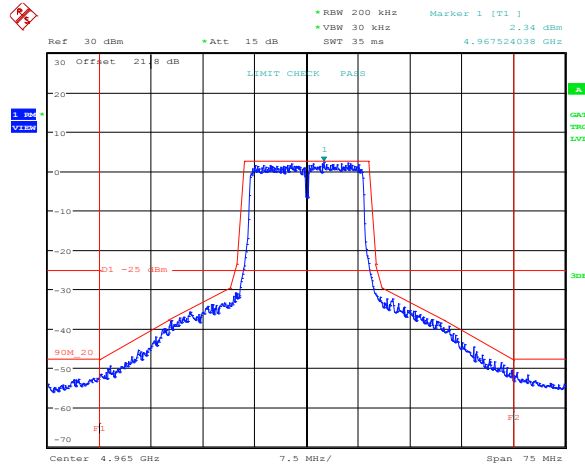
Figure 8.6-45: Emission mask for 10 MHz channel, antenna port 2, mid frequency, 64-QAM

### 8.6.4 Test data, continued



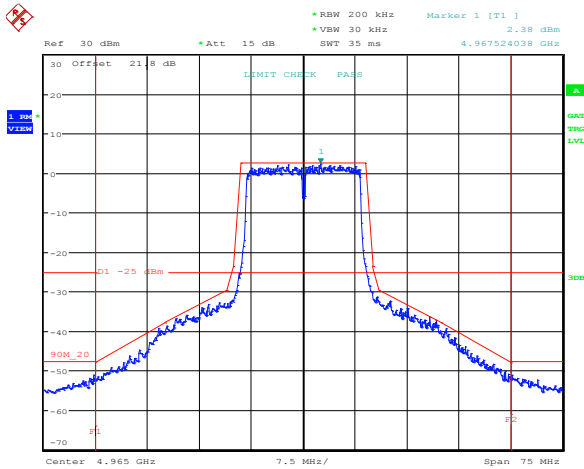
Date: 22.JAN.2013 14:31:44

Figure 8.6-46: Emission mask for 20 MHz channel, antenna port 2, mid frequency, BPSK



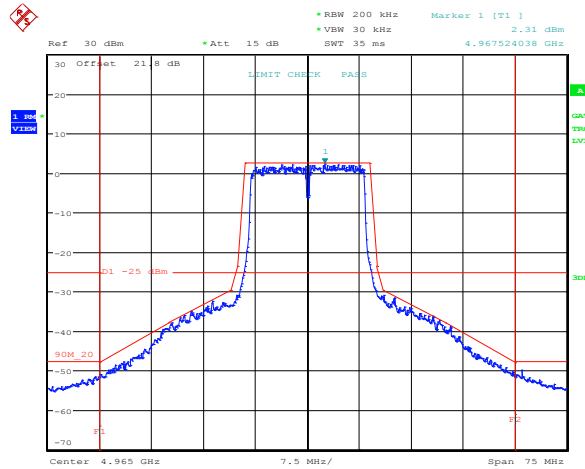
Date: 22.JAN.2013 14:31:27

Figure 8.6-47: Emission mask for 20 MHz channel, antenna port 2, mid frequency, QPSK



Date: 22.JAN.2013 14:31:06

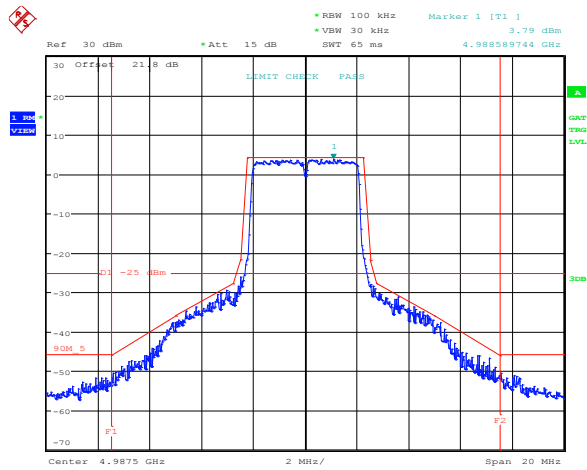
Figure 8.6-48: Emission mask for 20 MHz channel, antenna port 2, mid frequency, 16-QAM



Date: 22.JAN.2013 14:30:40

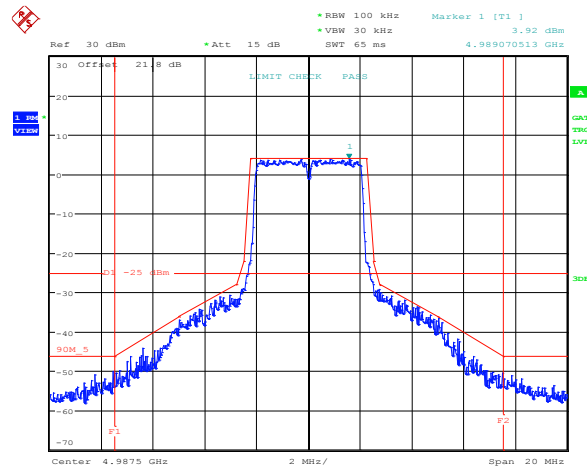
Figure 8.6-49: Emission mask for 20 MHz channel, antenna port 2, mid frequency, 64-QAM

8.6.4 Test data, continued



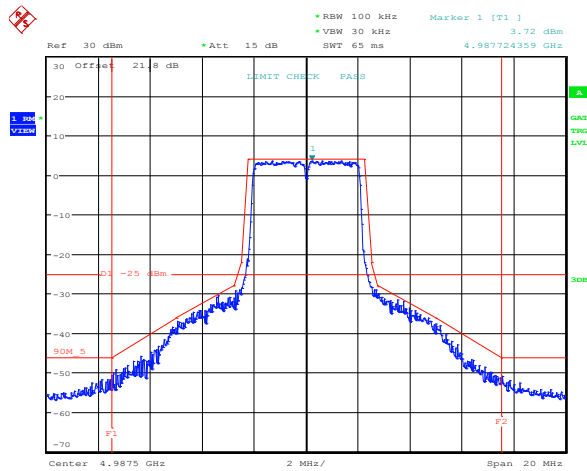
Date: 22.JAN.2013 15:00:39

Figure 8.6-50: Emission mask for 5 MHz channel, antenna port 1, high frequency, BPSK



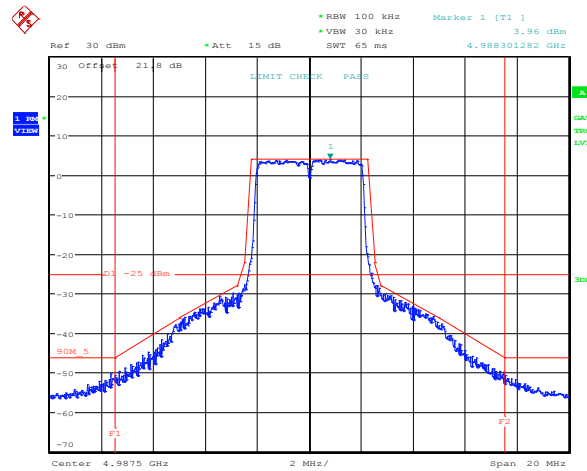
Date: 22.JAN.2013 15:00:00

Figure 8.6-51: Emission mask for 5 MHz channel, antenna port 1, high frequency, QPSK



Date: 22.JAN.2013 14:59:39

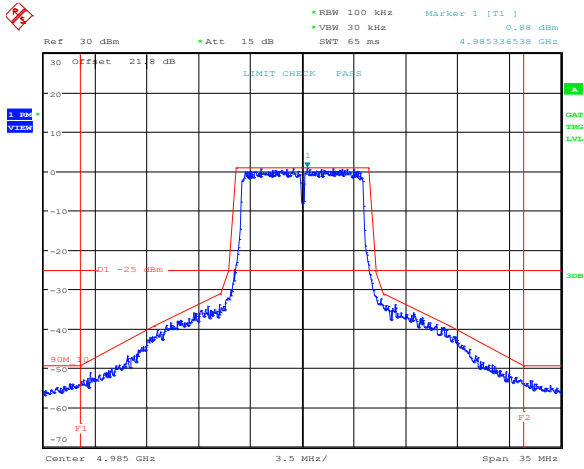
Figure 8.6-52: Emission mask for 5 MHz channel, antenna port 1, high frequency, 16-QAM



Date: 22.JAN.2013 14:59:15

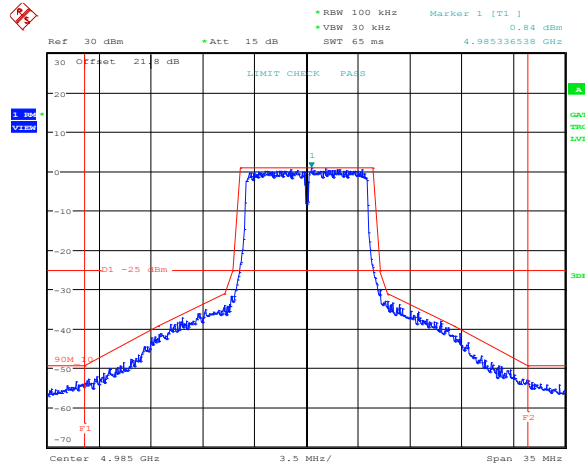
Figure 8.6-53: Emission mask for 5 MHz channel, antenna port 1, high frequency, 64-QAM

### 8.6.4 Test data, continued



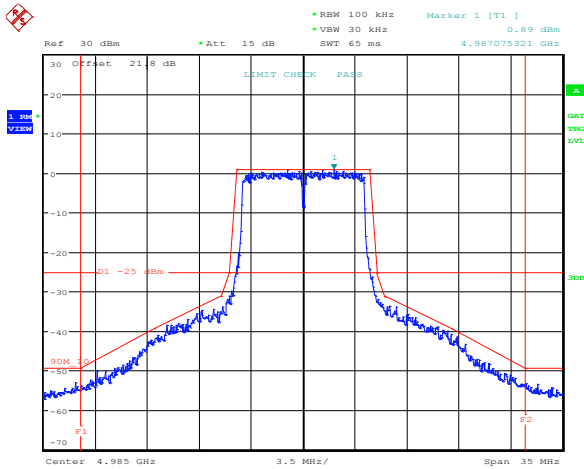
Date: 22.JAN.2013 16:28:02

Figure 8.6-54: Emission mask for 10 MHz channel, antenna port 1, high frequency, BPSK



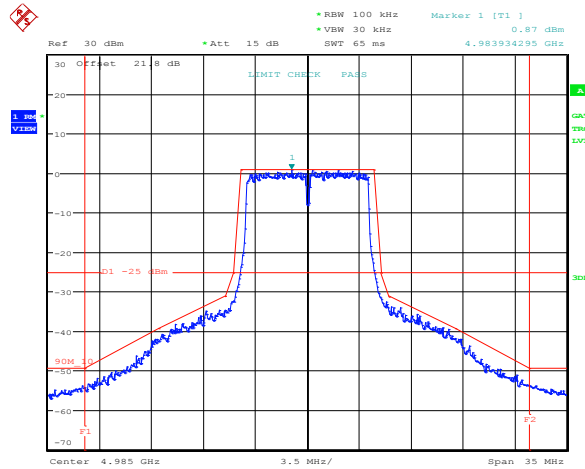
Date: 22.JAN.2013 16:28:36

Figure 8.6-55: Emission mask for 10 MHz channel, antenna port 1, high frequency, QPSK



Date: 22.JAN.2013 16:29:00

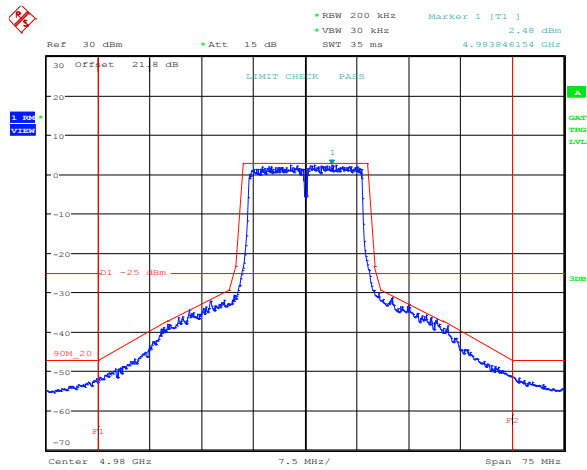
Figure 8.6-56: Emission mask for 10 MHz channel, antenna port 1, high frequency, 16-QAM



Date: 22.JAN.2013 16:29:22

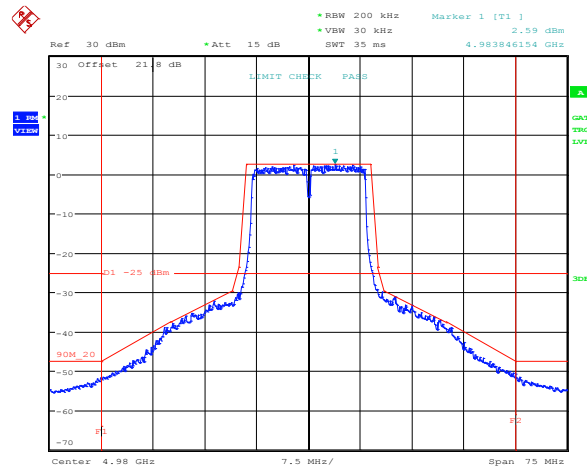
Figure 8.6-57: Emission mask for 10 MHz channel, antenna port 1, high frequency, 64-QAM

8.6.4 Test data, continued



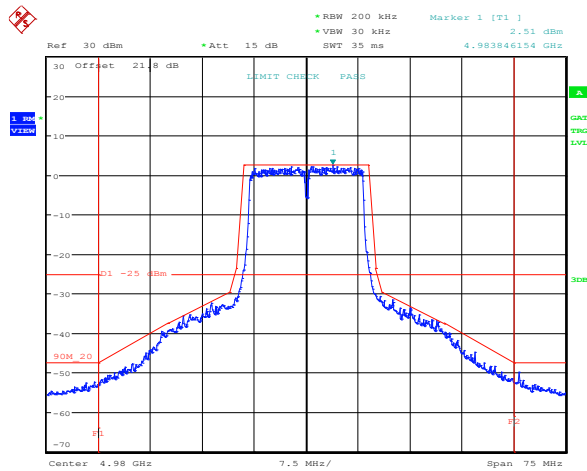
Date: 22.JAN.2013 14:35:55

Figure 8.6-58: Emission mask for 20 MHz channel, antenna port 1, high frequency, BPSK



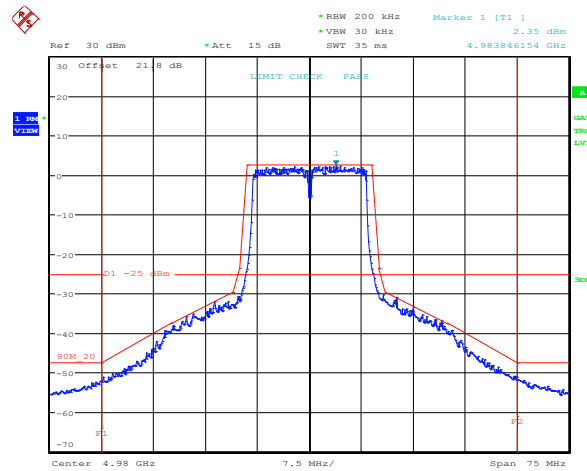
Date: 22.JAN.2013 14:35:25

Figure 8.6-59: Emission mask for 20 MHz channel, antenna port 1, high frequency, QPSK



Date: 22.JAN.2013 14:34:59

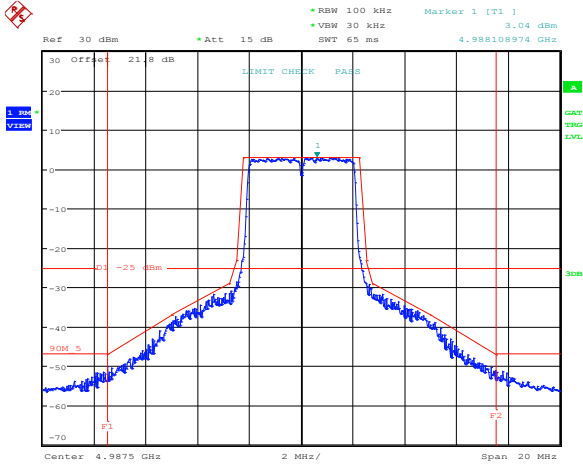
Figure 8.6-60: Emission mask for 20 MHz channel, antenna port 1, high frequency, 16-QAM



Date: 22.JAN.2013 14:34:35

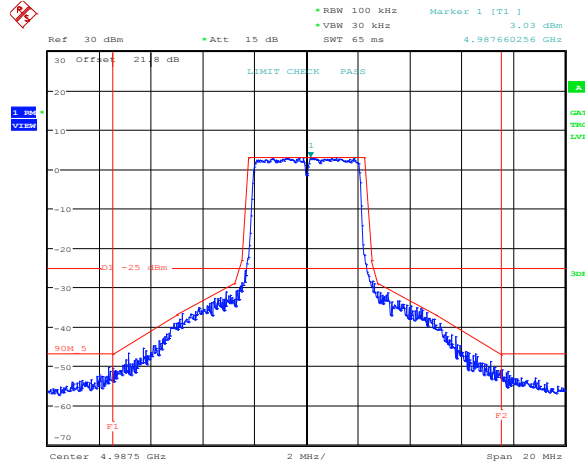
Figure 8.6-61: Emission mask for 20 MHz channel, antenna port 1, high frequency, 64-QAM

8.6.4 Test data, continued



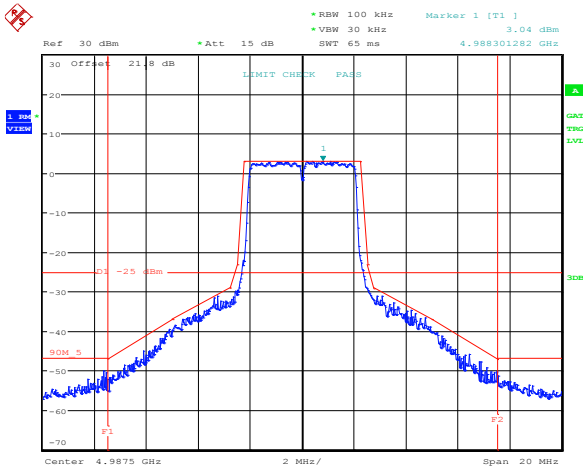
Date: 22.JAN.2013 14:57:12

Figure 8.6-62: Emission mask for 5 MHz channel, antenna port 2, high frequency, BPSK



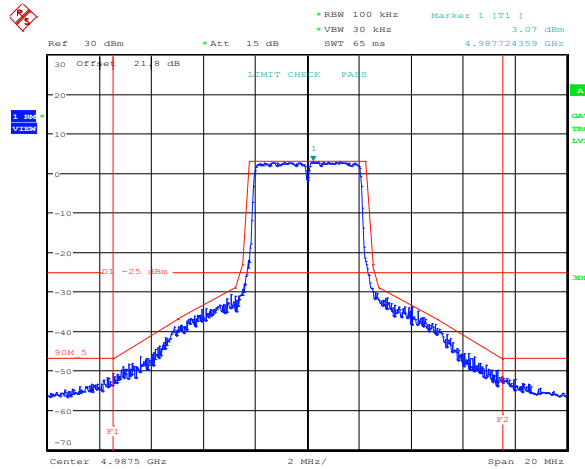
Date: 22.JAN.2013 14:57:35

Figure 8.6-63: Emission mask for 5 MHz channel, antenna port 2, high frequency, QPSK



Date: 22.JAN.2013 14:57:58

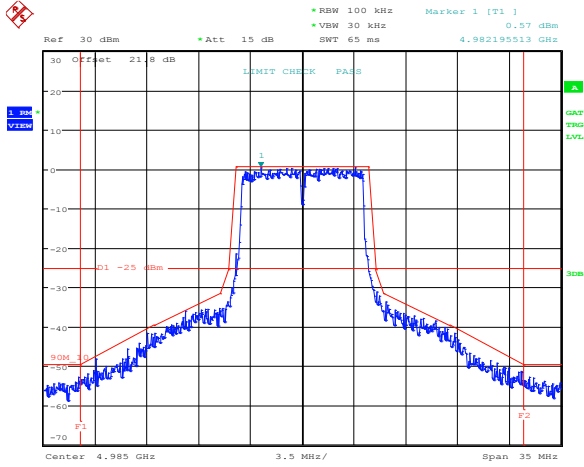
Figure 8.6-64: Emission mask for 5 MHz channel, antenna port 2, high frequency, 16-QAM



Date: 22.JAN.2013 14:58:23

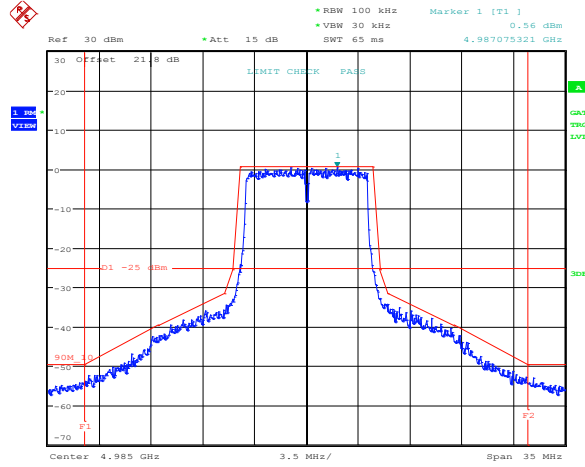
Figure 8.6-65: Emission mask for 5 MHz channel, antenna port 2, high frequency, 64-QAM

### 8.6.4 Test data, continued



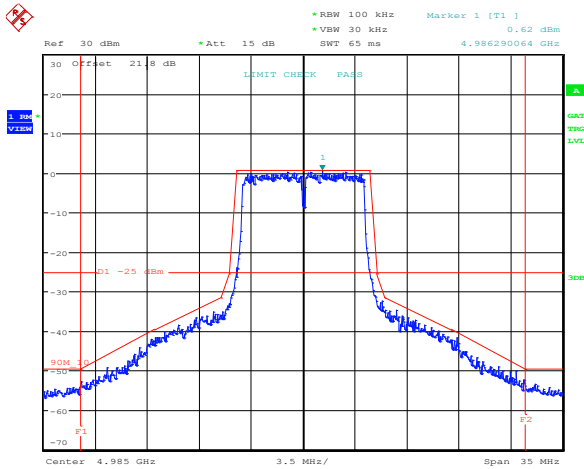
Date: 22.JAN.2013 16:30:57

Figure 8.6-66: Emission mask for 10 MHz channel, antenna port 2, high frequency, BPSK



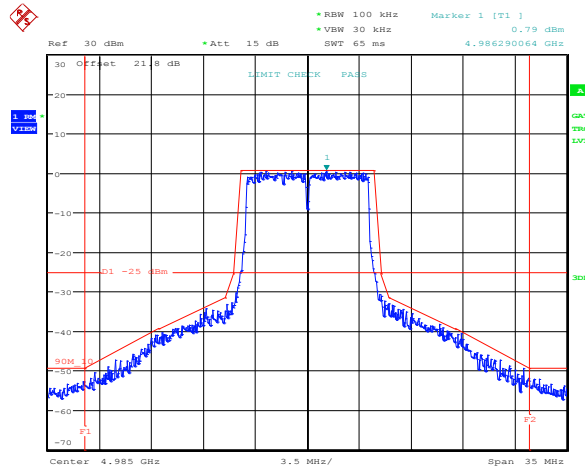
Date: 22.JAN.2013 16:30:39

Figure 8.6-67: Emission mask for 10 MHz channel, antenna port 2, high frequency, QPSK



Date: 22.JAN.2013 16:30:18

Figure 8.6-68: Emission mask for 10 MHz channel, antenna port 2, high frequency, 16-QAM

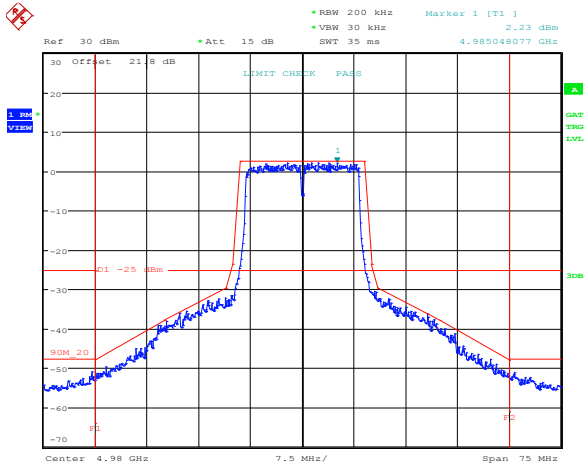


Date: 22.JAN.2013 16:29:50

Figure 8.6-69: Emission mask for 10 MHz channel, antenna port 2, high frequency, 64-QAM

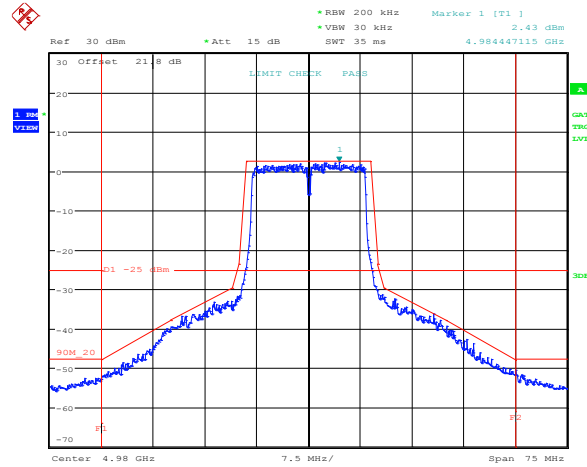


### 8.6.4 Test data, continued



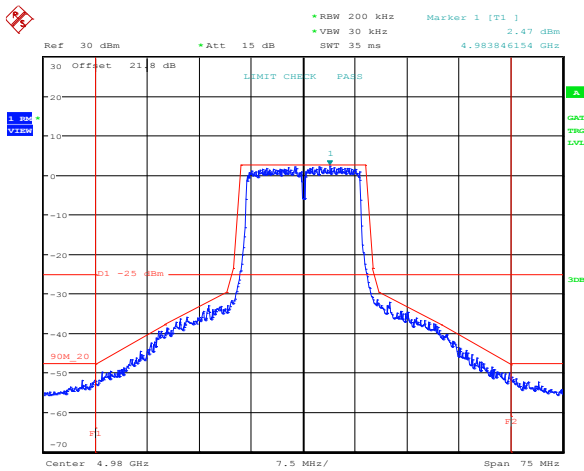
Date: 22.JAN.2013 14:32:50

**Figure 8.6-70:** Emission mask for 20 MHz channel, antenna port 2, high frequency, BPSK



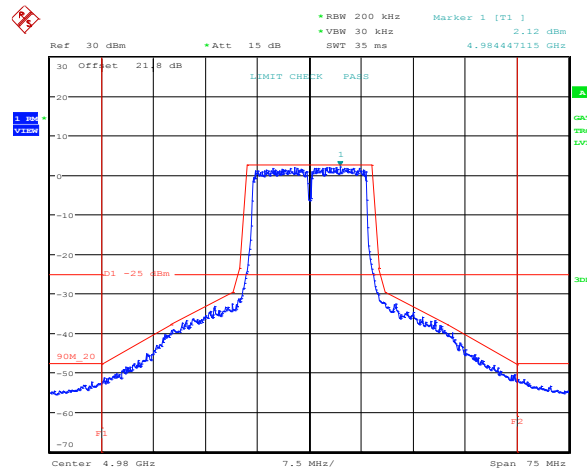
Date: 22.JAN.2013 14:33:15

**Figure 8.6-71:** Emission mask for 20 MHz channel, antenna port 2, high frequency, QPSK



Date: 22.JAN.2013 14:33:36

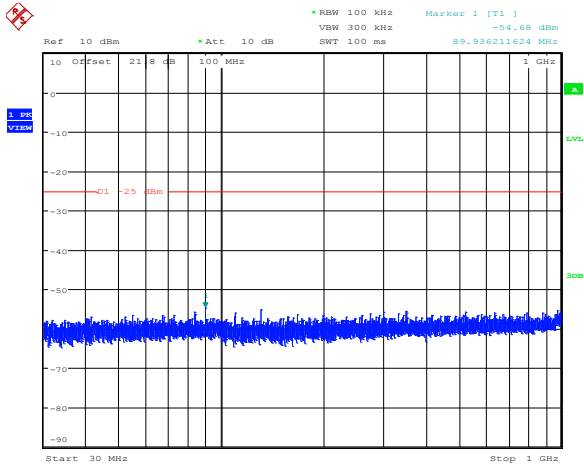
**Figure 8.6-72:** Emission mask for 20 MHz channel, antenna port 2, high frequency, 16-QAM



Date: 22.JAN.2013 14:34:03

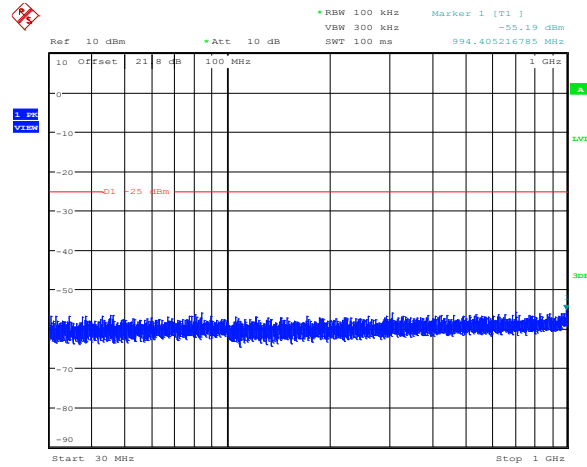
**Figure 8.6-73:** Emission mask for 20 MHz channel, antenna port 2, high frequency, 64-QAM

### 8.6.4 Test data, continued



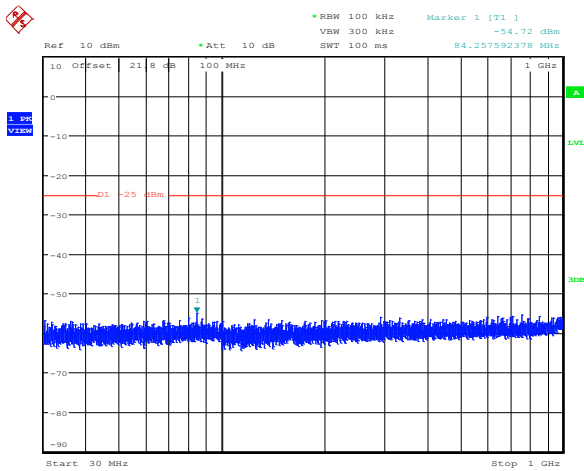
Date: 29.JAN.2013 16:49:56

**Figure 8.6-74:** Spurious emissions sample plot below 1 GHz, antenna port 1, 5 MHz channel, BPSK



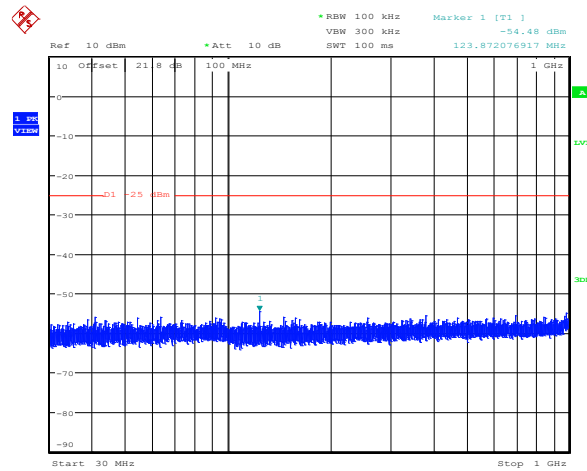
Date: 29.JAN.2013 16:50:43

**Figure 8.6-75:** Spurious emissions sample plot below 1 GHz, antenna port 2, 5 MHz channel, BPSK



Date: 29.JAN.2013 16:59:48

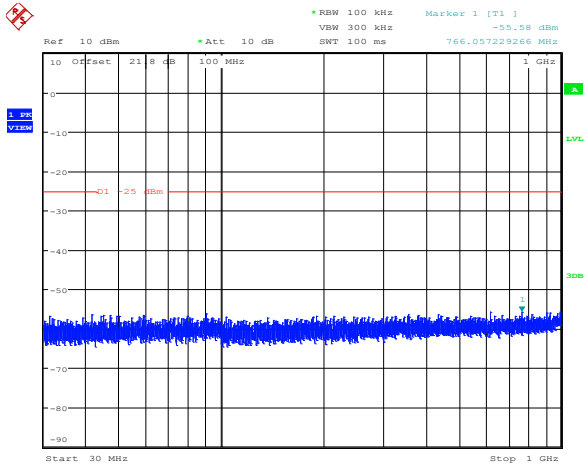
**Figure 8.6-76:** Spurious emissions sample plot below 1 GHz, antenna port 1, 5 MHz channel, 64-QAM



Date: 29.JAN.2013 16:58:52

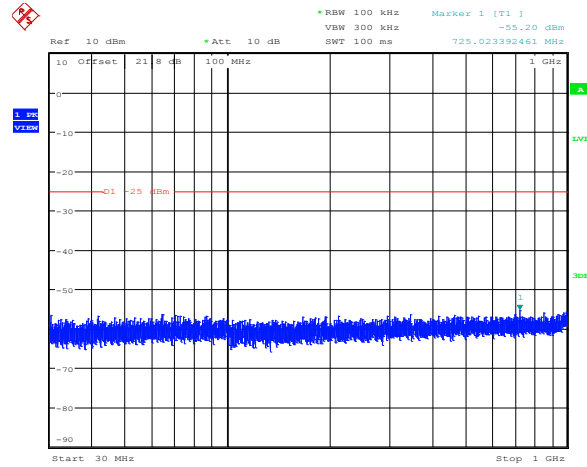
**Figure 8.6-77:** Spurious emissions sample plot below 1 GHz, antenna port 2, 5 MHz channel, 64-QAM

### 8.6.4 Test data, continued



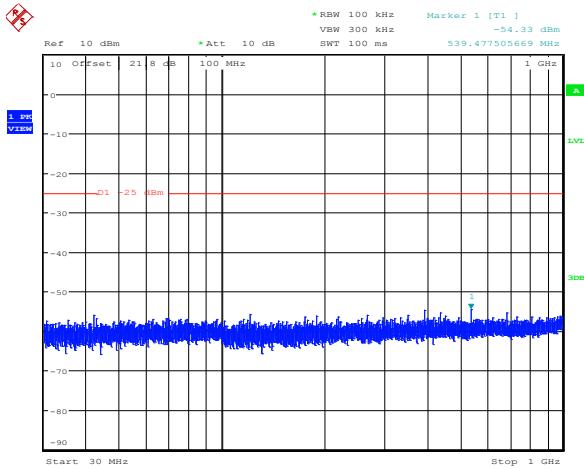
Date: 29.JAN.2013 17:01:42

**Figure 8.6-78:** Spurious emissions sample plot below 1 GHz, antenna port 1, 10 MHz channel, BPSK



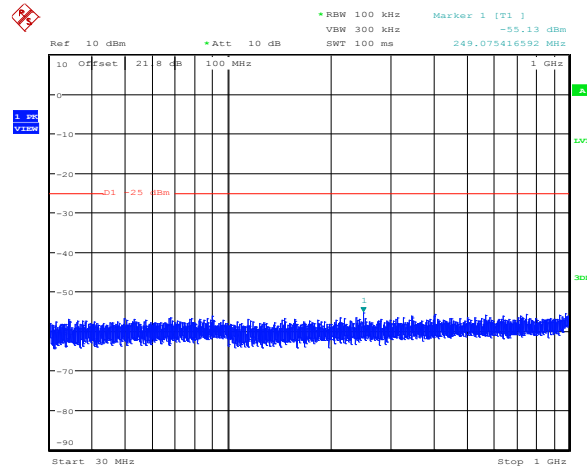
Date: 29.JAN.2013 17:03:04

**Figure 8.6-79:** Spurious emissions sample plot below 1 GHz, antenna port 2, 10 MHz channel, BPSK



Date: 29.JAN.2013 17:02:34

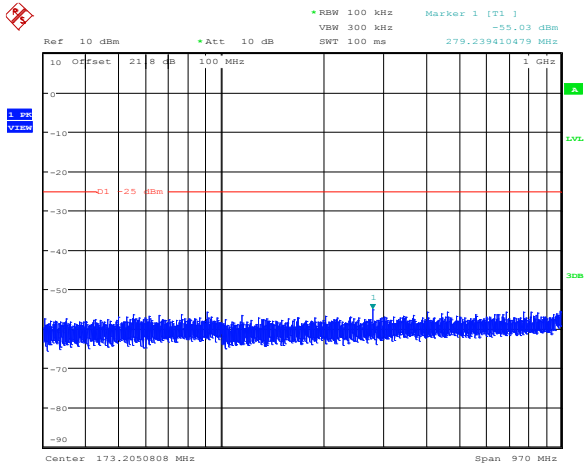
**Figure 8.6-80:** Spurious emissions sample plot below 1 GHz, antenna port 1, 10 MHz channel, 64-QAM



Date: 29.JAN.2013 17:01:06

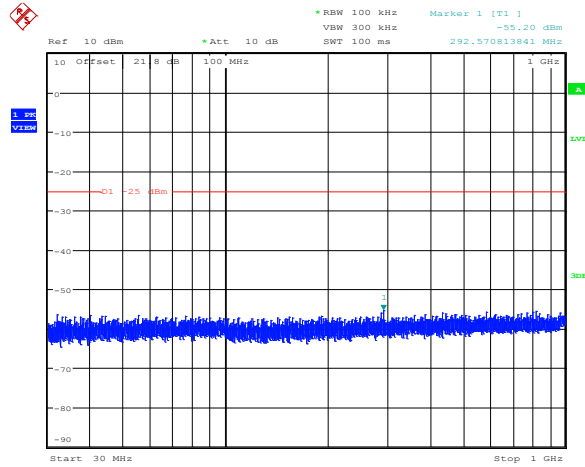
**Figure 8.6-81:** Spurious emissions sample plot below 1 GHz, antenna port 2, 10 MHz channel, 64-QAM

### 8.6.4 Test data, continued



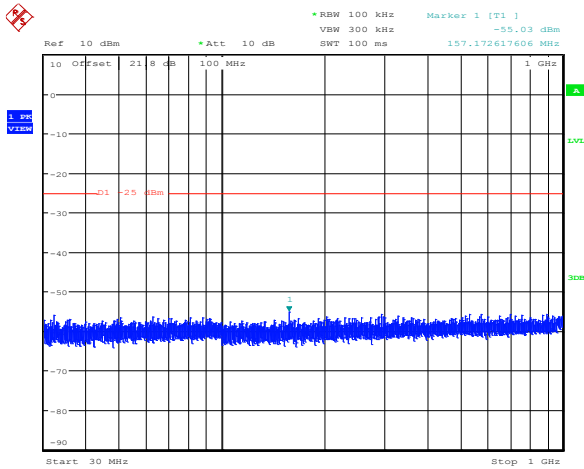
Date: 30.JAN.2013 09:34:46

**Figure 8.6-82:** Spurious emissions sample plot below 1 GHz, antenna port 1, 20 MHz channel, BPSK



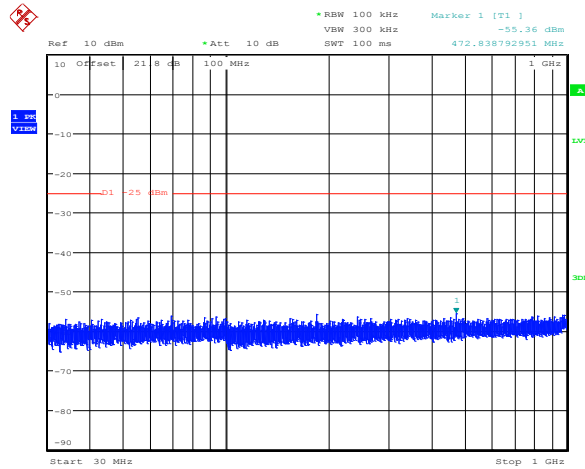
Date: 30.JAN.2013 09:35:18

**Figure 8.6-83:** Spurious emissions sample plot below 1 GHz, antenna port 2, 20 MHz channel, BPSK



Date: 30.JAN.2013 09:35:41

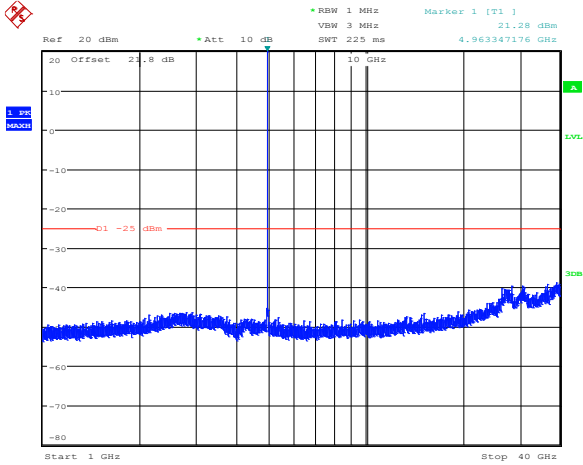
**Figure 8.6-84:** Spurious emissions sample plot below 1 GHz, antenna port 1, 20 MHz channel, 64-QAM



Date: 30.JAN.2013 09:36:47

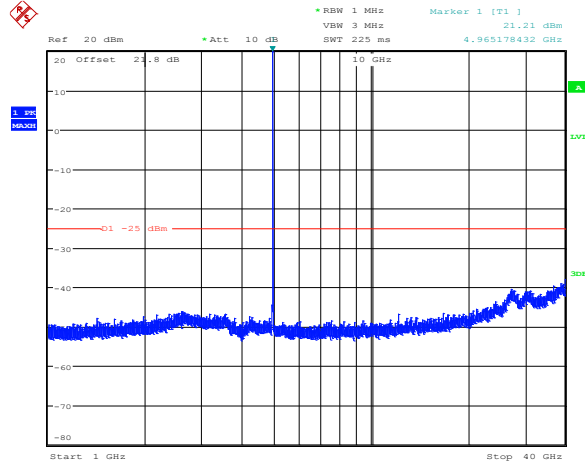
**Figure 8.6-85:** Spurious emissions sample plot below 1 GHz, antenna port 2, 20 MHz channel, 64-QAM

### 8.6.4 Test data, continued



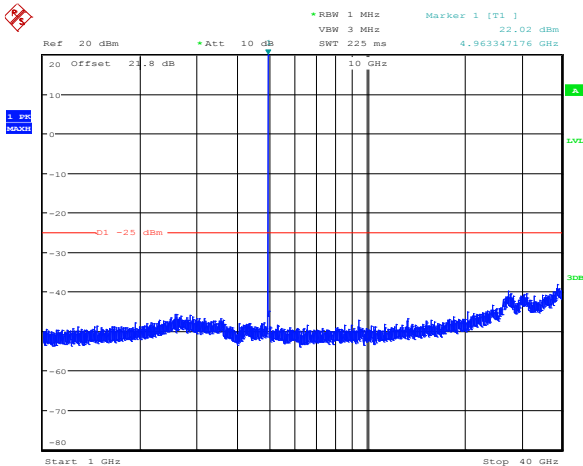
Date: 30.JAN.2013 09:57:55

**Figure 8.6-86:** Spurious emissions sample plot above 1 GHz, antenna port 1, 5 MHz channel, BPSK



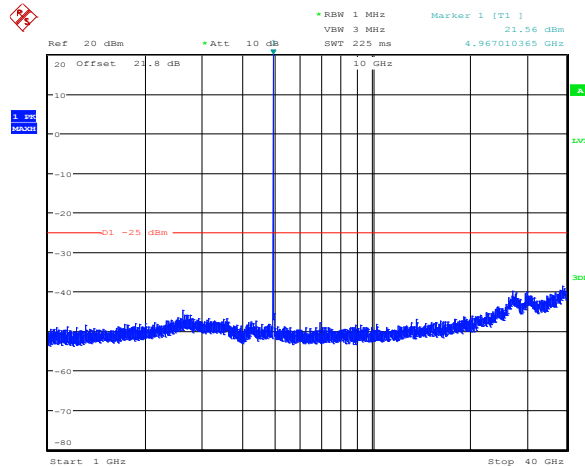
Date: 30.JAN.2013 09:55:05

**Figure 8.6-87:** Spurious emissions sample plot above 1 GHz, antenna port 2, 5 MHz channel, BPSK



Date: 30.JAN.2013 09:57:25

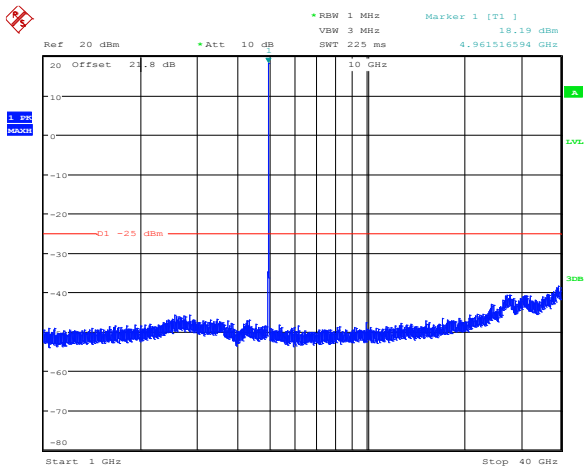
**Figure 8.6-88:** Spurious emissions sample plot above 1 GHz, antenna port 1, 5 MHz channel, 64-QAM



Date: 30.JAN.2013 09:54:28

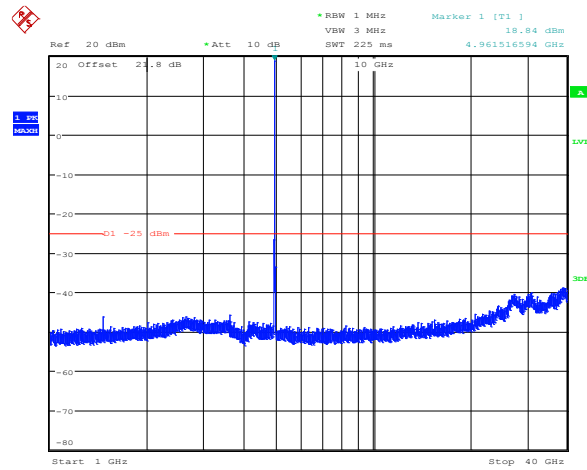
**Figure 8.6-89:** Spurious emissions sample plot above 1 GHz, antenna port 2, 5 MHz channel, 64-QAM

### 8.6.4 Test data, continued



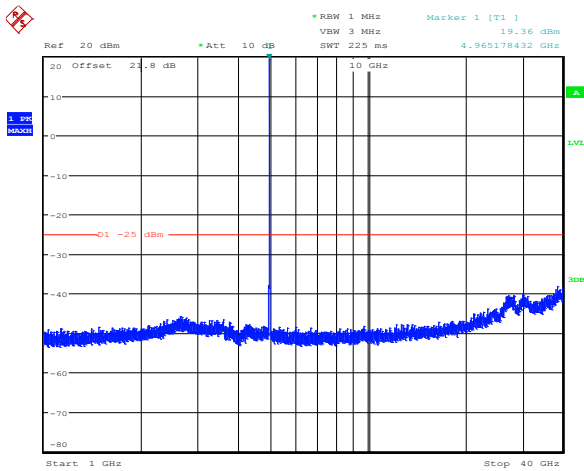
Date: 30.JAN.2013 09:56:19

**Figure 8.6-90:** Spurious emissions sample plot above 1 GHz, antenna port 1, 10 MHz channel, BPSK



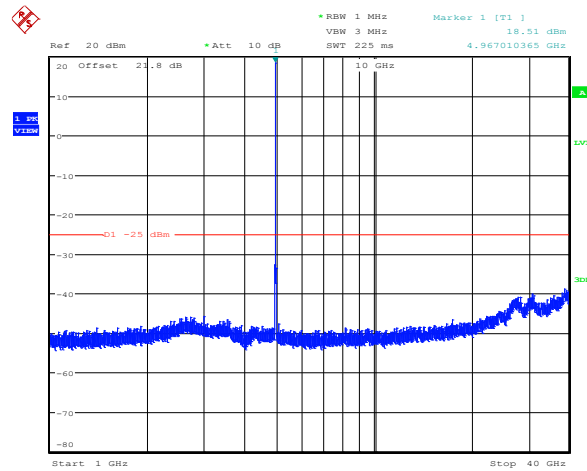
Date: 30.JAN.2013 09:55:42

**Figure 8.6-91:** Spurious emissions sample plot above 1 GHz, antenna port 2, 10 MHz channel, BPSK



Date: 30.JAN.2013 09:56:50

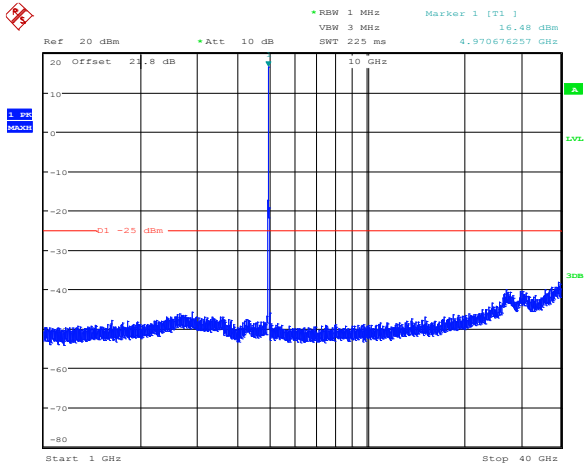
**Figure 8.6-92:** Spurious emissions sample plot above 1 GHz, antenna port 1, 10 MHz channel, 64-QAM



Date: 30.JAN.2013 09:53:50

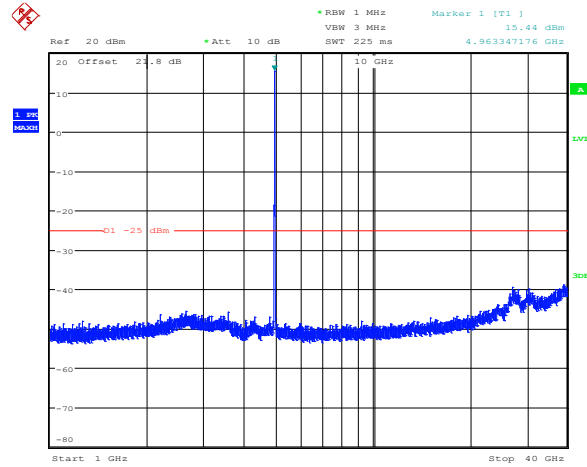
**Figure 8.6-93:** Spurious emissions sample plot above 1 GHz, antenna port 2, 10 MHz channel, 64-QAM

### 8.6.4 Test data, continued



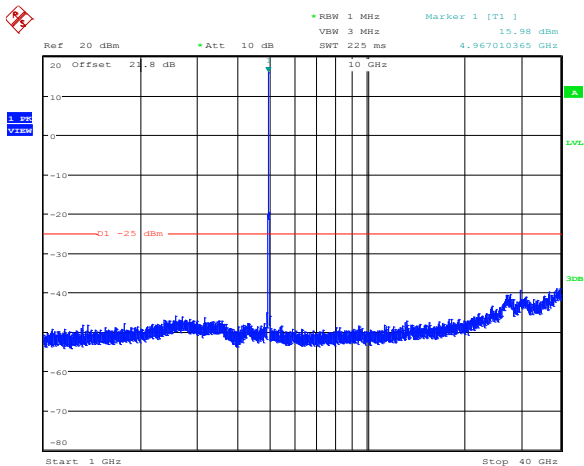
Date: 30.JAN.2013 09:58:28

**Figure 8.6-94:** Spurious emissions sample plot above 1 GHz, antenna port 1, 20 MHz channel, BPSK



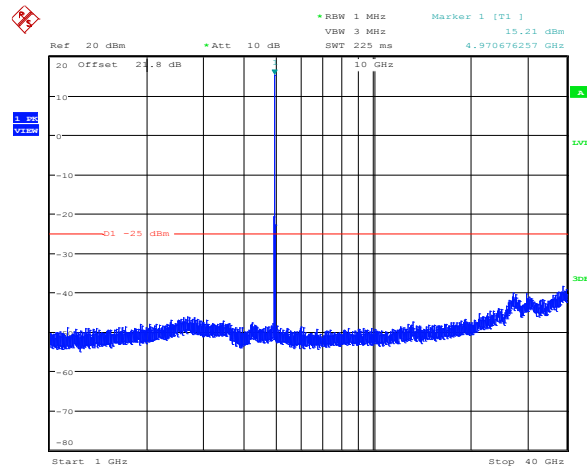
Date: 30.JAN.2013 09:58:58

**Figure 8.6-95:** Spurious emissions sample plot above 1 GHz, antenna port 2, 20 MHz channel, BPSK



Date: 30.JAN.2013 09:45:36

**Figure 8.6-96:** Spurious emissions sample plot above 1 GHz, antenna port 1, 20 MHz channel, 64-QAM



Date: 30.JAN.2013 09:53:05

**Figure 8.6-97:** Spurious emissions sample plot above 1 GHz, antenna port 2, 20 MHz channel, 64-QAM



## 8.7 FCC 90.210(m)(6) and RSS-111 Clause 5.4 Radiated spurious emissions of the transmitter

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### 8.7.1 Definitions and limits

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m) Emission Mask M. For high power transmitters (greater than 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:  
(6) On any frequency removed from the assigned frequency between above 150 % of the authorized bandwidth: 50 dB or  $55 + 10 \log (P)$  dB, whichever is the lesser attenuation.

### 8.7.2 Test summary

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<b>Test date</b>	January 25, 2013	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	22 °C	<b>Air pressure</b>	1003 mbar	<b>Relative humidity</b>	32 %

### 8.7.3 Observations/special notes

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The spectrum was searched from 30 MHz to 40 GHz.

All measurements were performed a 3 m distance.

The pre-scan was performed with spectrum analyzer, using peak detector with 100 kHz RBW for frequencies below 1 GHz and 1 MHz RBW for frequencies above 1 GHz.

The cabinet radiation was performed while antenna ports were terminated with 50 Ω compatible load. The final measurements are to be performed using substitution method.

### 8.7.4 Test data

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No spurious emissions were detected within 20 dB below the limit.





## 8.8 FCC 90.213 and RSS-111 Clause 5.2 Transmitter frequency stability

### 8.8.1 Definitions and limits

FCC:  
 Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.

IC:  
 The applicant shall ensure frequency stability by showing that the occupied bandwidth is maintained within the band of operation when tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

**Table 8.8-1: Minimum frequency stability limits**

Frequency range, MHz	Fixed and base station, ppm	Mobile station over 2 W, ppm	Mobile station less than 2 W, ppm
Below 25	100	100	200
25–50	20	20	50
72–76	5	–	50
150–174	50	5	50
216–220	1.0	–	1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
929–930	1.5	–	–
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450	–	–	–

### 8.8.2 Test summary

<b>Test date</b>	November 1, 2012	<b>Test engineer</b>	Andrey Adelberg	<b>Verdict</b>	Pass
<b>Temperature</b>	24 °C	<b>Air pressure</b>	1003 mbar	<b>Relative humidity</b>	35 %

### 8.8.3 Observations/special notes

Frequency stability was performed on three channels, since there is no specific limit for this frequency range only worst case is presented in the report. RSS-Gen was used as test guidance.

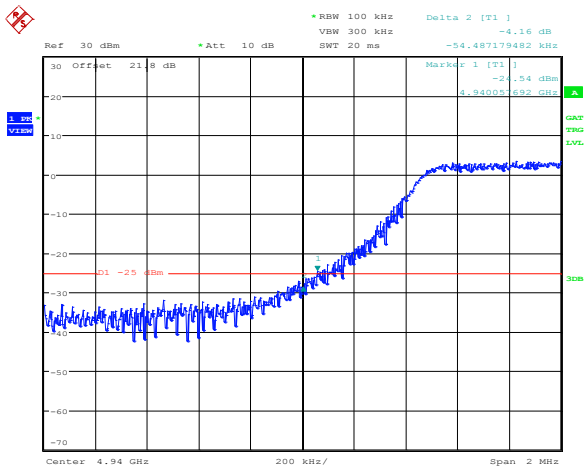
### 8.8.4 Test data

Table 8.8-2: Frequency stability results

Temperature, °C	Voltage	Nominal frequency, GHz	Frequency measured, GHz	Offset, Hz	Offset, ppm
50	Nominal	4.965000000	4.9650159214	-104	-1.19
40	Nominal	4.965000000	4.9650159133	-112	-1.26
30	Nominal	4.965000000	4.9650159005	-125	-1.07
20	Nominal +15 %	4.965000000	4.9650160349	9	-0.45
20	Nominal	4.965000000	4.9650160255		Reference
20	Nominal -15 %	4.965000000	4.9650162003	175	-1.48
10	Nominal	4.965000000	4.9650162169	191	-0.49
0	Nominal	4.965000000	4.9650162278	202	0.76
-10	Nominal	4.965000000	4.9650162455	220	0.36
-20	Nominal	4.965000000	4.9650162323	207	0.68
-30	Nominal	4.965000000	4.9650162197	194	0.36

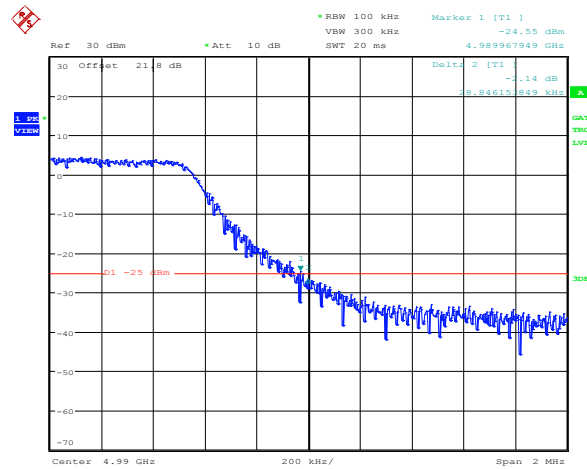
Table 8.8-3: Frequency stability results for IC

Channel BW, MHz	$f_H$ and $f_L$ , Hz	Maximum environmental drift, Hz	Drifted $f_H$ and $f_L$ , Hz	Limit, Hz	Margin, kHz
5	$f_L$ : 4940057692	-125	4940057567	4940000000	57.567
	$f_H$ : 4989967949	220	4989968169	4990000000	31.831
10	$f_L$ : 4940250000	-125	4940249875	4940000000	249.875
	$f_H$ : 4989804487	220	4989804707	4990000000	195.293
20	$f_L$ : 4940136218	-125	4940136093	4940000000	136.093
	$f_H$ : 4989889423	220	4989889643	4990000000	110.357



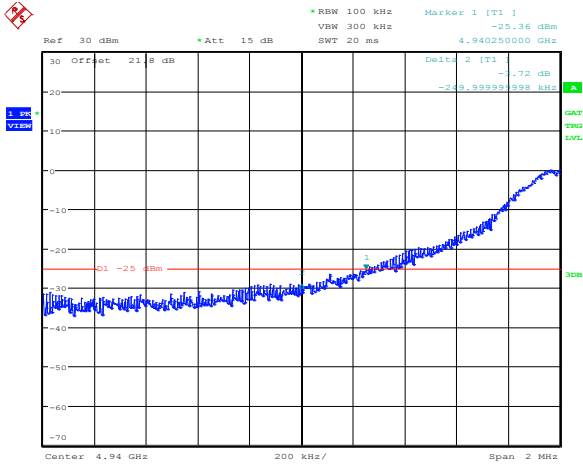
Date: 23.JAN.2013 14:43:54

Figure 8.8-1: Lower band edge for 5 MHz channel, low frequency ( $f_L$ )



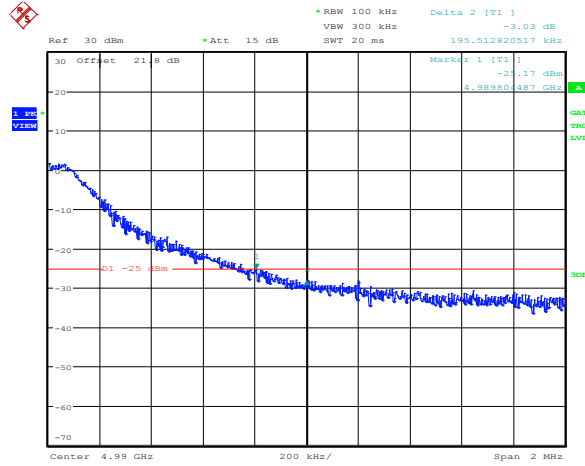
Date: 23.JAN.2013 14:44:43

Figure 8.8-2: Upper band edge for 5 MHz channel, high frequency ( $f_H$ )



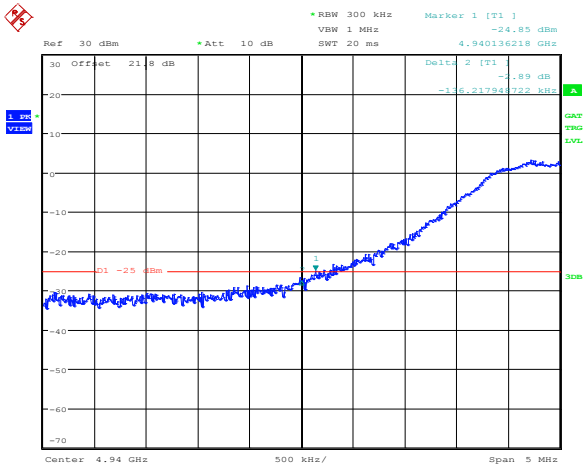
Date: 23.JAN.2013 14:40:53

Figure 8.8-3: Lower band edge for 10 MHz channel, low frequency ( $f_L$ )



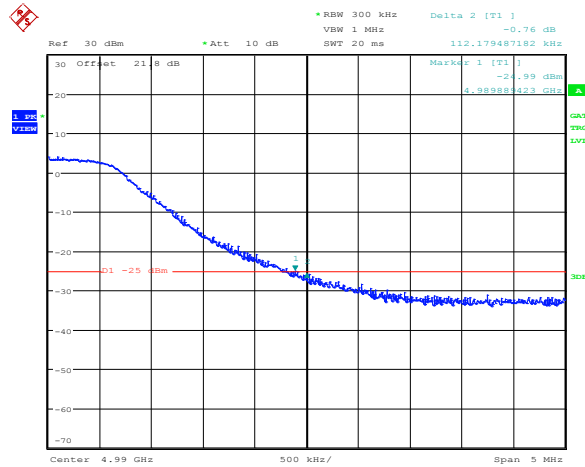
Date: 23.JAN.2013 14:39:41

Figure 8.8-4: Upper band edge for 10 MHz channel, high frequency ( $f_H$ )



Date: 23.JAN.2013 14:48:27

Figure 8.8-5: Lower band edge for 20 MHz channel, low frequency ( $f_L$ )



Date: 23.JAN.2013 14:47:28

Figure 8.8-6: Upper band edge for 20 MHz channel, high frequency ( $f_H$ )

## Section 9. Block diagrams of test set-ups

### 9.1 Radiated emissions set-up

