www.nemko.com

Compliance test report ID **196334-5TRFWL**

Date of issue
March 6, 2012

FCC 47 CFR Part 15 Subpart C, §15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz.

Applicant **Redline Communications**
Product **Broad-band wireless infrastructure product**
Model **RDL-3000-RM**
FCC ID **QC8-RDL3000RM**

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

SCC Accredited LAB
LAB Accrédité CCN

Test location

Nemko Canada Inc.
303 River Road
Ottawa, ON, K1V 1H2
Canada
Test site FCC ID: 176392 (3 m semi anechoic chamber)

Telephone +1 613 737 9680
Facsimile +1 613 737 9691
Toll free +1 800 563 6336
Website www.nemko.com

Tested by Andrey Adelberg, Senior Wireless/EMC Specialist

Reviewed by 

David Duchesne, Senior EMC/Wireless Specialist

March 6, 2012

Date

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Applicant and manufacturer

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

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Chapter 15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz.

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See “Summary of test results” for full details.

1.4 Exclusions

None

1.5 Test report revision history

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

Section 2 Summary of test results

2.1 FCC Part 15 – general requirements, test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass[1]
§15.31(m)	Number of operating frequencies	Pass[2]
§15.203	Antenna requirement	Pass[3]

Notes:
[1] Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed
[2] Since the frequency band was wider than 10 MHz, three channels (1 near top, 1 near middle and 1 near bottom) were selected for the testing.
[3] The antenna used with this EUT is non-detachable.

2.2 FCC Part 15 Subpart C – Intentional Radiators, test results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(b)(4)	Maximum peak output power	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3 Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 17, 2012
Nemko sample ID number	3

3.2 EUT information

Product name	Broad-band wireless infrastructure product
Model	RDL-3000-RM
Serial number	117PC11510007

3.3 Technical information

Operating band	5725–5850 MHz
Operating frequency	5 MHz Channel: 5727.5–5847.5 MHz 10 MHz Channel: 5730–5845 MHz 20 MHz Channel: 5735–5840 MHz
Modulation type	OFDM using 64-QAM, 16-QAM, QPSK and BPSK modulation for sub-carriers
Occupied bandwidth	5, 10 and 20 MHz
Emission designator	W7D
Power requirements	48 V_{DC} PoE via 120 V_{AC}, 60 Hz
Antenna information	Redline 4.9–6.1 GHz Dual Polarization/ Dual Slant Subscriber Antenna, 19 dBi, M/N: 30-00328-00

3.4 Product description and theory of operation

The EUT is a 2×2 MIMO point-to-multipoint (PMP) carrier grade broadband wireless infrastructure product, designed to operate in the 5725–5850 MHz band.

3.5 EUT exercise details

The EUT was in a continuous transmitting mode with random data frames. The modulation, channel bandwidth and channel frequency was changed using a Web-based interface of the Ethernet port.

3.6 EUT setup diagram

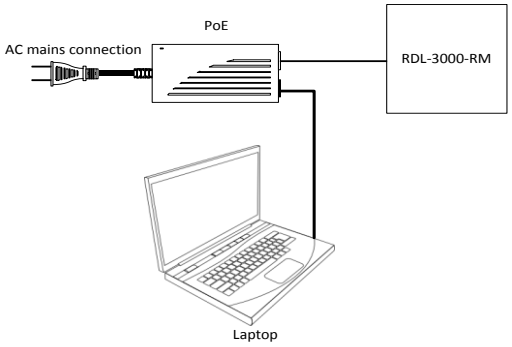


Diagram 3.6-1: Setup diagram

3.7 Support equipment

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

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature: 15–30 °C
Relative humidity: 20–75 %
Air pressure: 86–106 kPa

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

5.2 Power supply range

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

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

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

Section 7 Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/12
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Power Source	California Instruments	5001ix	FA001770	1 year	May 03/12
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	April 27/12
Biconical antenna	Sunol	BC2	FA002078	1 year	Jan. 04/13
Log periodic antenna	Sunol	LP5	FA002077	1 year	Dec. 28/12
Horn antenna #1	EMCO	3115	FA000649	1 year	Mar. 08/12
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	Aug. 15/12
Horn antenna 18–26.5 GHz	Electro-metrics	SH-50/60-1	FA000479	—	VOU
18–26 GHz pre-amplifier	Narda	BBS-1826N612	FA001550	—	VOU
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR
18.0 – 40.0 GHz Horn Antenna	EMCO	3116	FA001847	1 year	May 20/12
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	—	VOU
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Nov. 18/12
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Feb. 09/13
Note: NCR - no calibration required, VOU - verify on use					

Section 8 Testing data

8.1 Clause 15.207(a) Conducted limits

8.1.1 Definitions and limits

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

Table 8.1-1: Conducted emissions limit

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

8.1.2 Test summary

Test date	February 2, 2012	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	1002 mbar	**Relative humidity**	32 %

8.1.3 Observations/special notes

The EUT was set up as tabletop configuration.

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

Receiver/spectrum analyzer settings

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

Measurement details

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement. The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

8.1.4 Test data

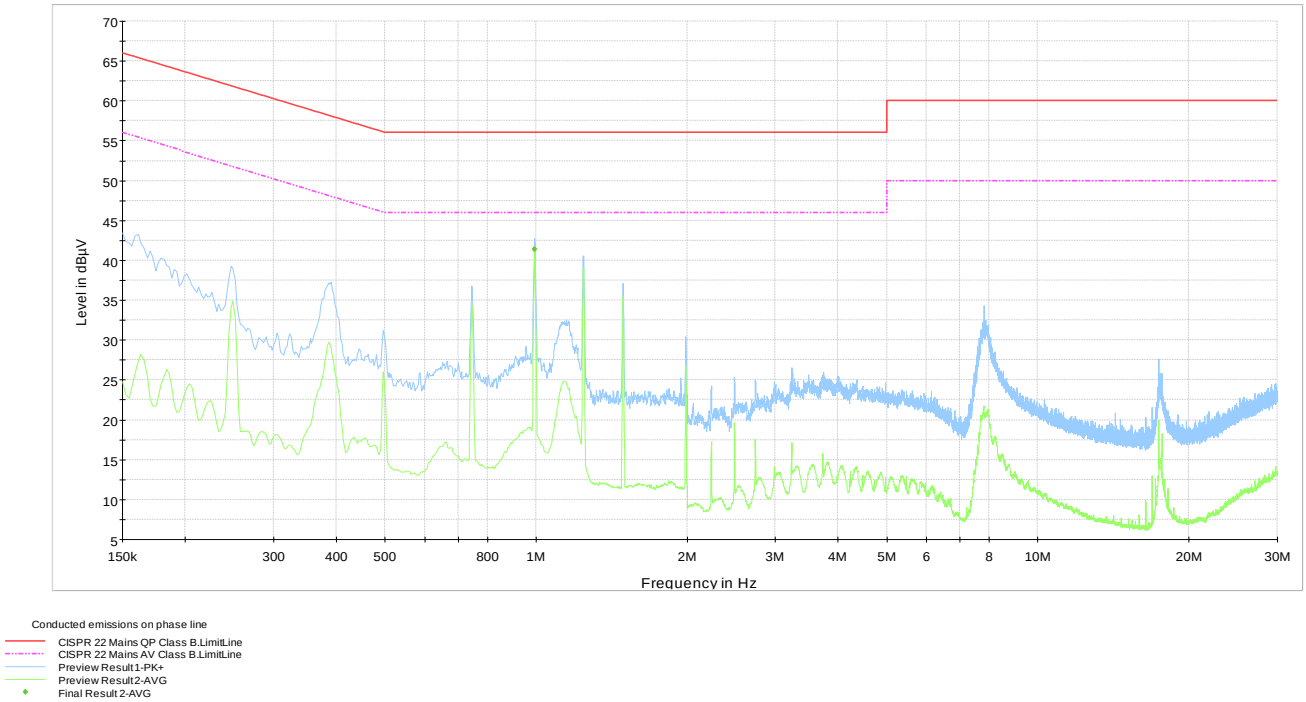
Table 8.1-2: Average conducted emissions results

Frequency (MHz)	Average result (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
0.993750	41.4	100.0	9.000	On	Phase	10.0	4.6	46.0
0.993750	41.9	100.0	9.000	On	Neutral	10.0	4.1	46.0

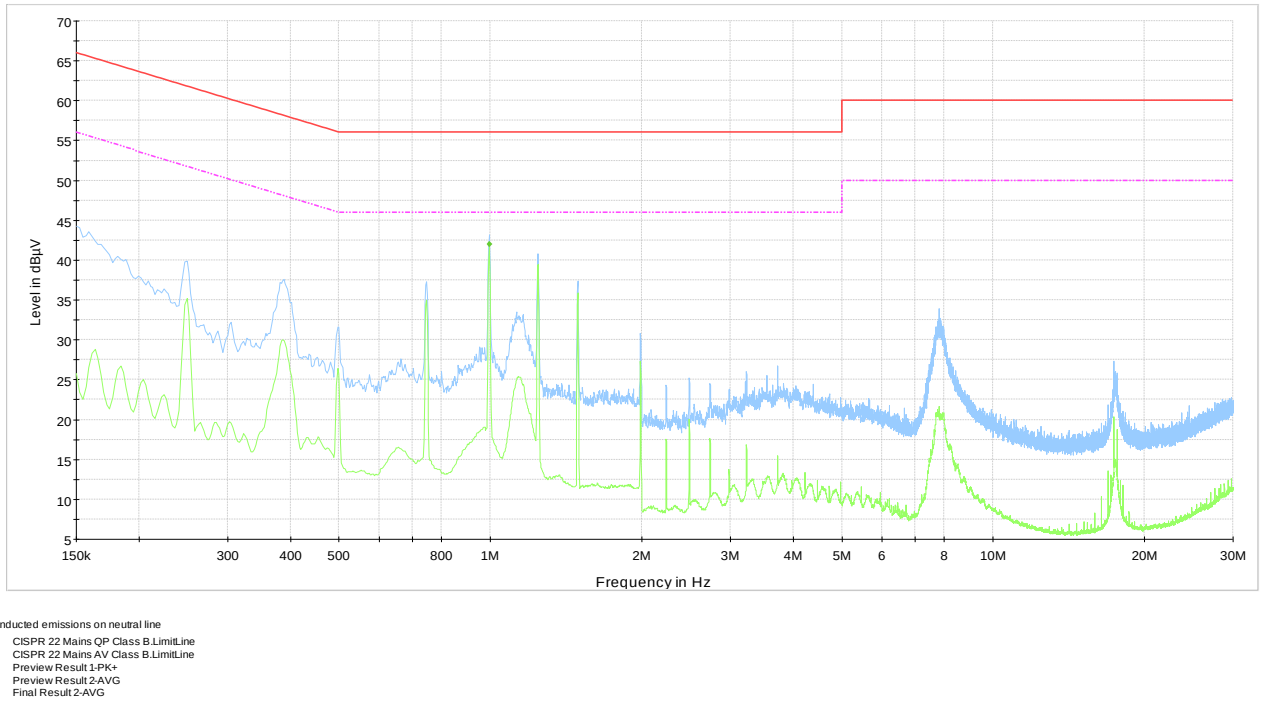
Sample calculation:
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
Result (dBµV) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:
43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.1.4 Test data



Plot 8.1-1: Conducted emissions on phase line



Plot 8.1-2: Conducted emissions on neutral line

8.2 Clause 15.247(a)(2) Minimum 6 dB bandwidth for systems using digital modulation techniques

8.2.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2.2 Test summary

Test date	February 6, 2012	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1001 mbar	**Relative humidity**	31 %

8.2.3 Observations/special notes

5 MHz and 10 MHz channel measurements were performed with peak detector using 100 kHz RBW. VBW was set wider than RBW.
20 MHz channel measurements were performed with peak detector using 200 kHz RBW. VBW was set wider than RBW.
The testing was performed as per DTS test guidance: KDB 558074 D01 DTS Meas Guidance v 01.

8.2.4 Test data

Table 8.2-1: 6 dB bandwidth results for 5 MHz channel

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
5727.5	4.11	> 0.5	3.61
5790.0	4.11	> 0.5	3.61
5847.5	4.10	> 0.5	3.60

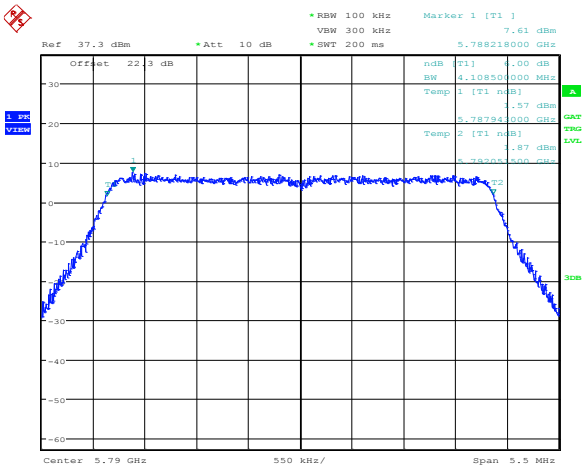
Table 8.2-2: 6 dB bandwidth results for 10 MHz channel

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
5730.0	8.24	> 0.5	7.74
5790.0	8.23	> 0.5	7.73
5845.0	8.23	> 0.5	7.73

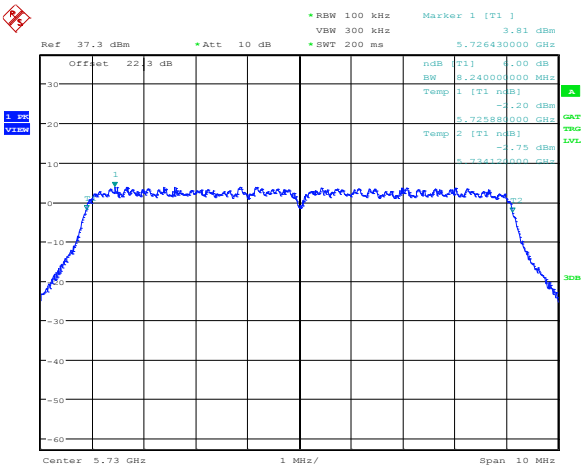
Table 8.2-3: 6 dB bandwidth results for 20 MHz channel

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
5735.0	16.40	> 0.5	15.90
5790.0	16.36	> 0.5	15.86
5840.0	16.38	> 0.5	15.88

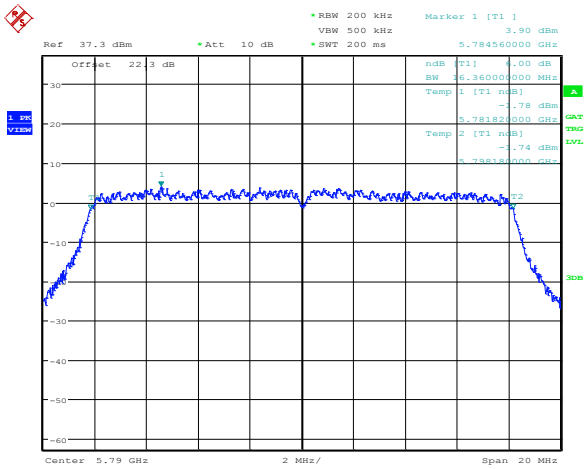
8.2.4 Test data, continued



Plot 8.2-1: Sample plot of 6 dB bandwidth, 5 MHz channel



Plot 8.2-2: Sample plot of 6 dB bandwidth, 10 MHz channel



Plot 8.2-3: Sample plot of 6 dB bandwidth, 20 MHz channel

8.3 Clause 15.247(b) Maximum peak conducted output power

8.3.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

8.3.2 Test summary

Test date	February 3, 2012	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1002 mbar	**Relative humidity**	31 %

8.3.3 Observations/special notes

The power at each antenna port was measured individually and the aggregate power was summed up mathematically.
Measurement procedure AVG2 of 558074 D01 DTS Meas. Guidance v01 was used for average power measurements.
MIMO test guidance as per KDB 662911 D01 Multiple Transmitter Output v01r01.
Directional gain calculations for this device according were performed according to KDB 662911.

8.3.4 Test data

Table 8.3-1: Conducted output power results for 5 MHz channel

Modulation	Frequency (MHz)	Conducted power, port 1 (dBm)	Conducted power, port 2 (dBm)	Combined power (dBm)	Conducted power limit (dBm)	Margin (dB)	Antenna gain (dBi)	EIRP (dBm)	EIRP limit (dBm)	Margin (dBm)
BPSK	5727.5	13.79	13.53	16.67	17.00	0.33	19.00	35.67	36.00	0.33
	5790.0	13.89	13.41	16.67	17.00	0.33	19.00	35.67	36.00	0.33
	5847.5	13.97	13.45	16.73	17.00	0.27	19.00	35.73	36.00	0.27
QPSK	5727.5	13.81	13.50	16.67	17.00	0.33	19.00	35.67	36.00	0.33
	5790.0	13.93	13.35	16.66	17.00	0.34	19.00	35.66	36.00	0.34
	5847.5	13.96	13.48	16.74	17.00	0.26	19.00	35.74	36.00	0.26
16-QAM	5727.5	13.84	13.49	16.68	17.00	0.32	19.00	35.68	36.00	0.32
	5790.0	13.84	13.36	16.62	17.00	0.38	19.00	35.62	36.00	0.38
	5847.5	13.95	13.48	16.73	17.00	0.27	19.00	35.73	36.00	0.27
64-QAM	5727.5	13.94	13.65	16.81	17.00	0.19	19.00	35.81	36.00	0.19
	5790.0	13.91	13.40	16.67	17.00	0.33	19.00	35.67	36.00	0.33
	5847.5	14.21	13.47	16.87	17.00	0.13	19.00	35.87	36.00	0.13

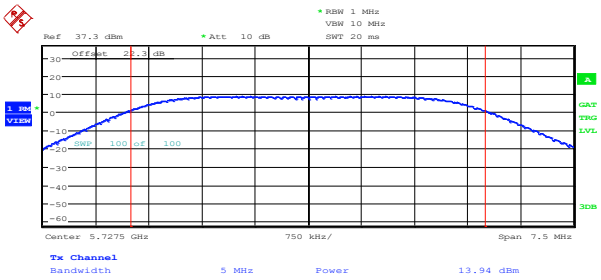
Table 8.3-2: Conducted output power results for 10 MHz channel

Modulation	Frequency (MHz)	Conducted power, port 1 (dBm)	Conducted power, port 2 (dBm)	Combined power (dBm)	Conducted power limit (dBm)	Margin (dB)	Antenna gain (dBi)	EIRP (dBm)	EIRP limit (dBm)	Margin (dBm)
BPSK	5730.0	13.53	13.38	16.47	17.00	0.53	19.00	35.47	36.00	0.53
	5790.0	13.81	13.61	16.72	17.00	0.28	19.00	35.72	36.00	0.28
	5845.0	13.48	13.65	16.58	17.00	0.42	19.00	35.58	36.00	0.42
QPSK	5730.0	13.73	13.51	16.63	17.00	0.37	19.00	35.63	36.00	0.37
	5790.0	13.37	13.55	16.47	17.00	0.53	19.00	35.47	36.00	0.53
	5845.0	13.33	13.57	16.46	17.00	0.54	19.00	35.46	36.00	0.54
16-QAM	5730.0	13.96	13.44	16.72	17.00	0.28	19.00	35.72	36.00	0.28
	5790.0	13.30	13.59	16.46	17.00	0.54	19.00	35.46	36.00	0.54
	5845.0	13.39	13.56	16.49	17.00	0.51	19.00	35.49	36.00	0.51
64-QAM	5730.0	14.26	13.21	16.78	17.00	0.22	19.00	35.78	36.00	0.22
	5790.0	13.12	13.68	16.42	17.00	0.58	19.00	35.42	36.00	0.58
	5845.0	13.33	13.59	16.47	17.00	0.53	19.00	35.47	36.00	0.53

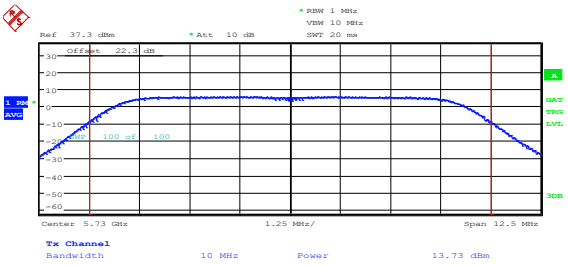
Table 8.3-3: Conducted output power results for 20 MHz channel

Modulation	Frequency (MHz)	Conducted power, port 1 (dBm)	Conducted power, port 2 (dBm)	Combined power (dBm)	Conducted power limit (dBm)	Margin (dB)	Antenna gain (dBi)	EIRP (dBm)	EIRP limit (dBm)	Margin (dBm)
BPSK	5735.0	13.32	13.63	16.49	17.00	0.51	19.00	35.49	36.00	0.51
	5790.0	13.99	13.47	16.75	17.00	0.25	19.00	35.75	36.00	0.25
	5840.0	13.35	13.95	16.67	17.00	0.33	19.00	35.67	36.00	0.33
QPSK	5735.0	13.33	13.61	16.48	17.00	0.52	19.00	35.48	36.00	0.52
	5790.0	14.01	13.53	16.79	17.00	0.21	19.00	35.79	36.00	0.21
	5840.0	13.32	13.79	16.57	17.00	0.43	19.00	35.57	36.00	0.43
16-QAM	5735.0	13.43	13.62	16.54	17.00	0.46	19.00	35.54	36.00	0.46
	5790.0	14.01	13.61	16.82	17.00	0.18	19.00	35.82	36.00	0.18
	5840.0	13.32	13.74	16.55	17.00	0.45	19.00	35.55	36.00	0.45
64-QAM	5735.0	13.62	13.61	16.63	17.00	0.37	19.00	35.63	36.00	0.37
	5790.0	13.99	13.79	16.90	17.00	0.10	19.00	35.90	36.00	0.10
	5840.0	13.29	13.68	16.50	17.00	0.50	19.00	35.50	36.00	0.50

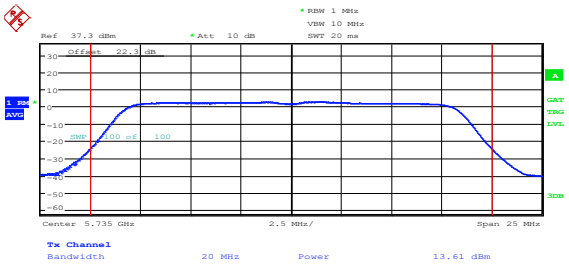
8.3.4 Test data, continued



Plot 8.3-1: Peak output power on low channel



Plot 8.3-2: Peak output power on mid channel



Plot 8.3-3: Peak output power on high channel

8.4 Clause 15.247(d) Spurious emissions

8.4.1 Definitions and limits

15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Table 8.4-1: Restricted bands of operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

Table 8.4-2: §15.209 – Radiated emission limits

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

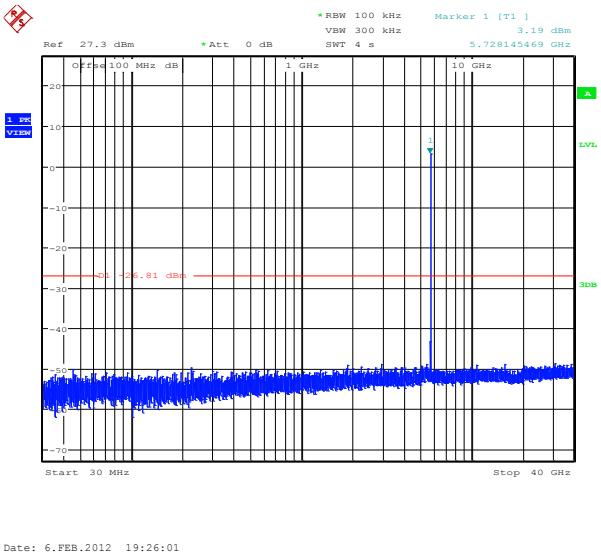
8.4.2 Test summary

Test date	February 6, 2012	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1002 mbar	**Relative humidity**	33 %

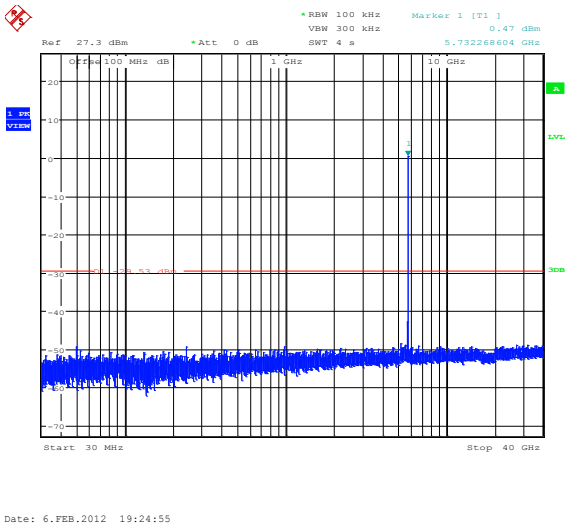
8.4.3 Observations/special notes

- The spectrum was searched from 30 MHz to the 40 GHz.
- All radiated measurements were performed at a distance of 3 m
- All measurements were performed:
- within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results and using peak detector with 1 MHz/10 Hz RBW/VBW for average results.
- Conducted spurious emissions were performed according to 558074 D01 DTS Meas. Guidance v01.
- MIMO test guidance as per KDB 662911 D01 Multiple Transmitter Output v01r01.
- All modulations were investigated; only worst case data was reported.

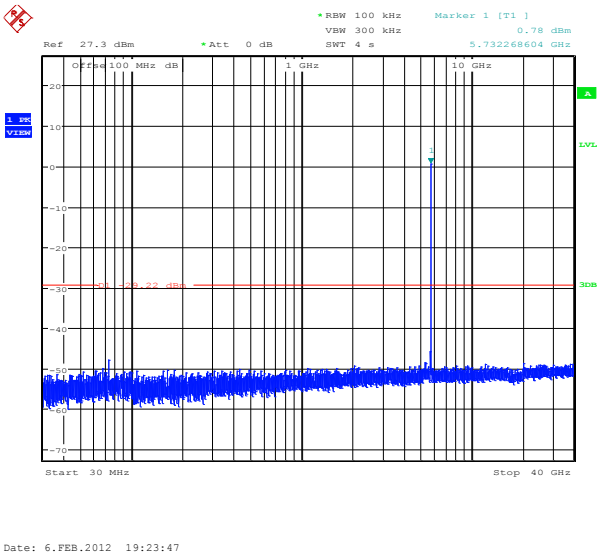
8.4.4 Test data



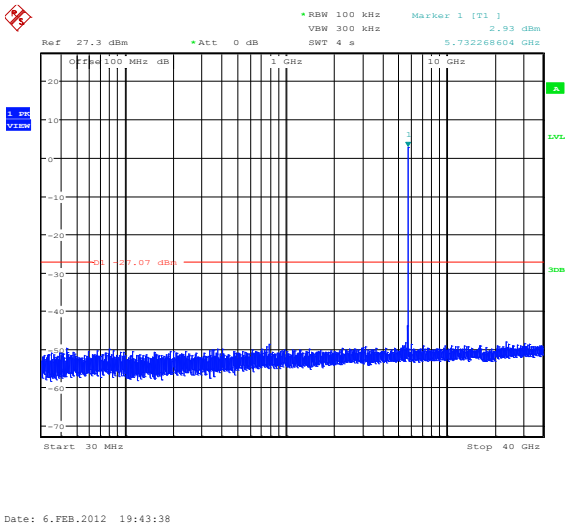
Plot 8.4-1: Conducted spurious emissions at the antenna port 1, 5 MHz channel, low frequency



Plot 8.4-2: Conducted spurious emissions at the antenna port 1, 10 MHz channel, low frequency

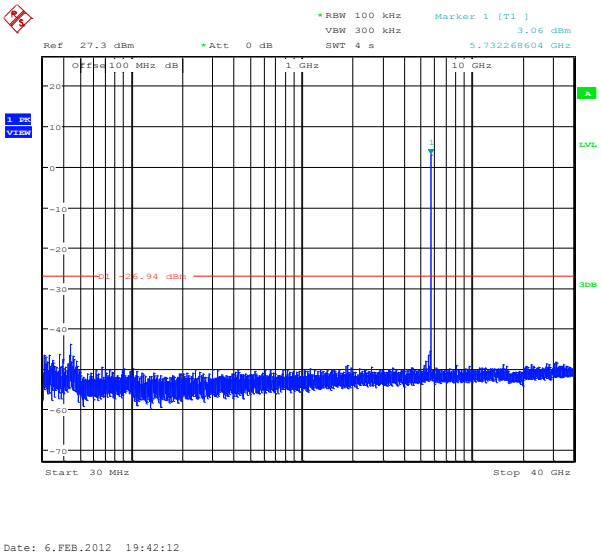


Plot 8.4-3: Conducted spurious emissions at the antenna port 1, 20 MHz channel, low frequency

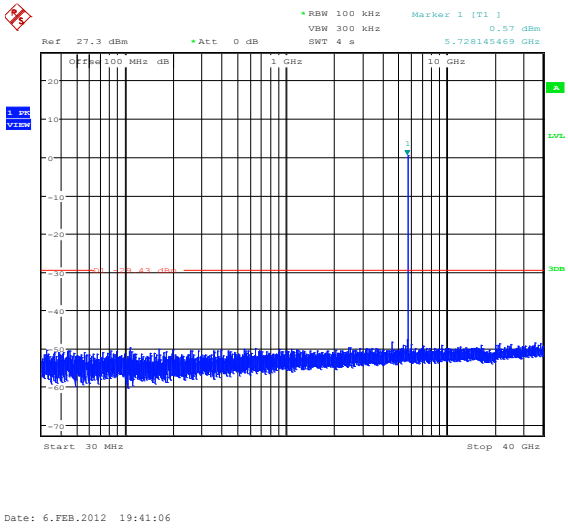


Plot 8.4-4: Conducted spurious emissions at the antenna port 2, 5 MHz channel, low frequency

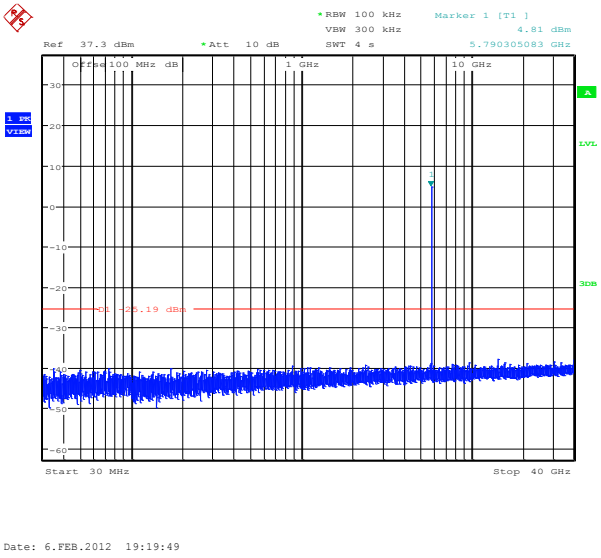
8.4.4 Test data, continued



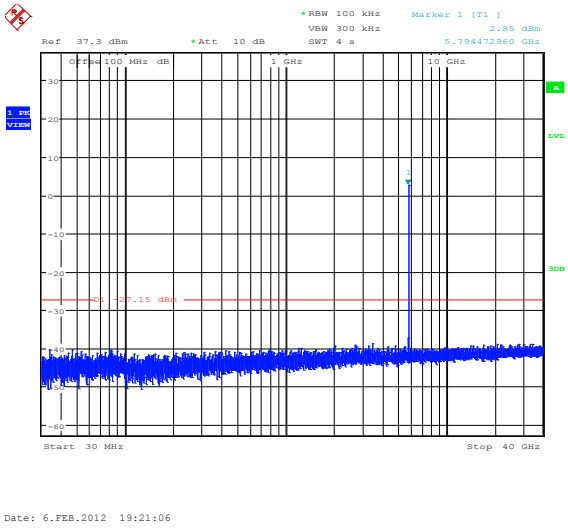
Plot 8.4-5: Conducted spurious emissions at the antenna port 2, 10 MHz channel, low frequency



Plot 8.4-6: Conducted spurious emissions at the antenna port 2, 20 MHz channel, low frequency

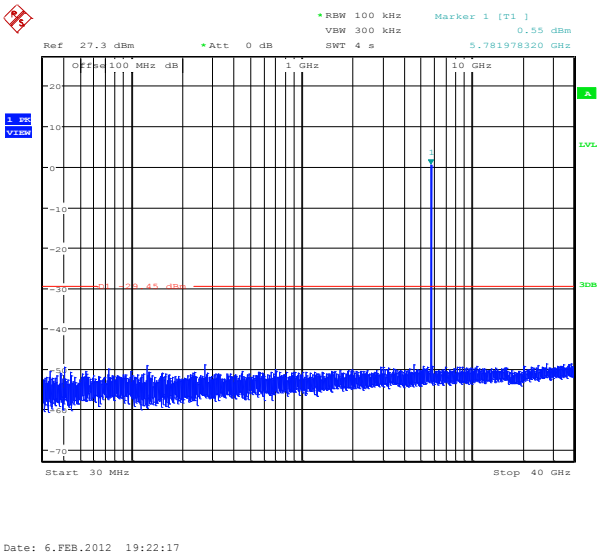


Plot 8.4-7: Conducted spurious emissions at the antenna port 1, 5 MHz channel, mid frequency

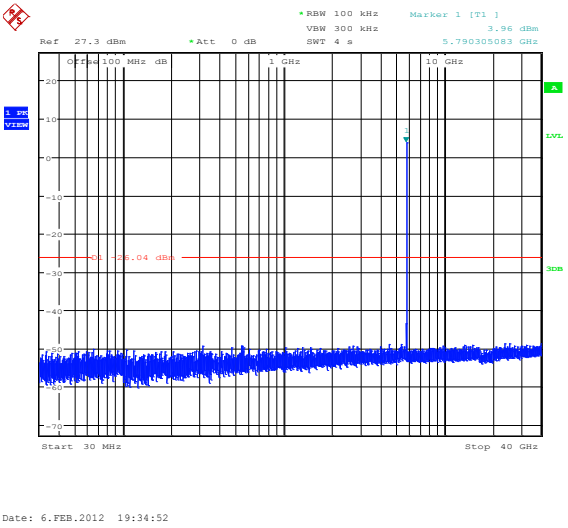


Plot 8.4-8: Conducted spurious emissions at the antenna port 1, 10 MHz channel, mid frequency

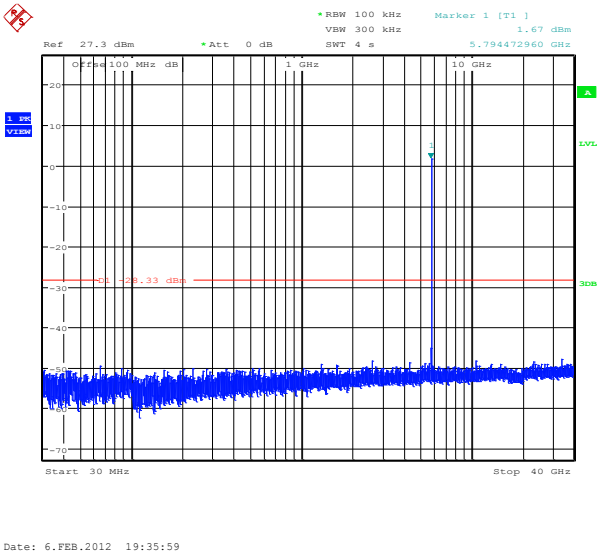
8.4.4 Test data, continued



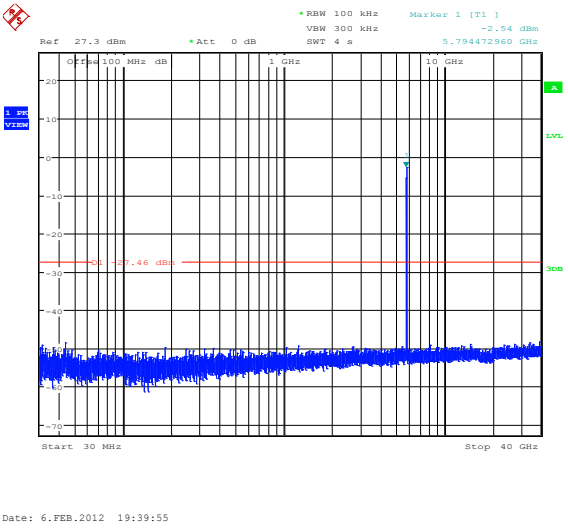
Plot 8.4-9: Conducted spurious emissions at the antenna port 1, 20 MHz channel, mid frequency



Plot 8.4-10: Conducted spurious emissions at the antenna port 2, 5 MHz channel, mid frequency

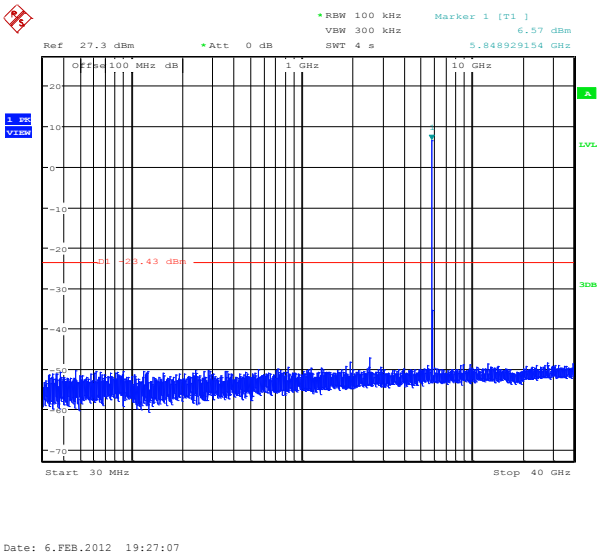


Plot 8.4-11: Conducted spurious emissions at the antenna port 2, 10 MHz channel, mid frequency

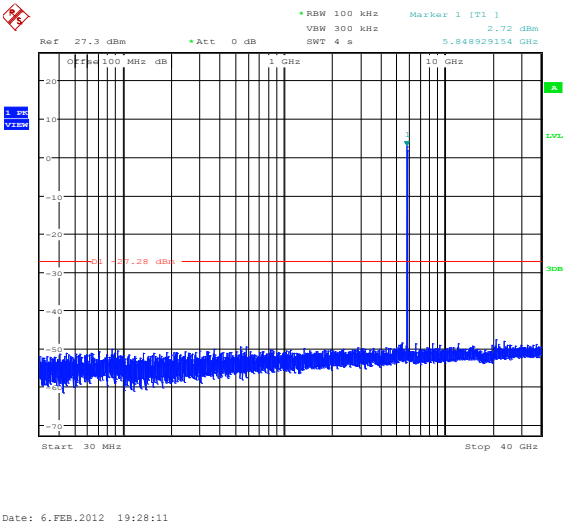


Plot 8.4-12: Conducted spurious emissions at the antenna port 2, 20 MHz channel, mid frequency

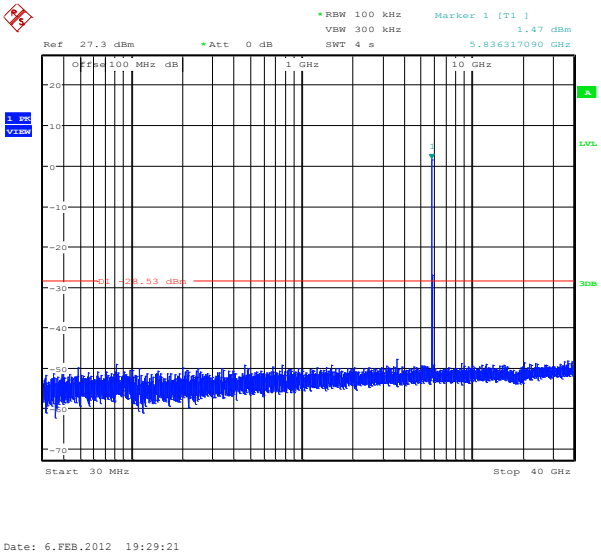
8.4.4 Test data, continued



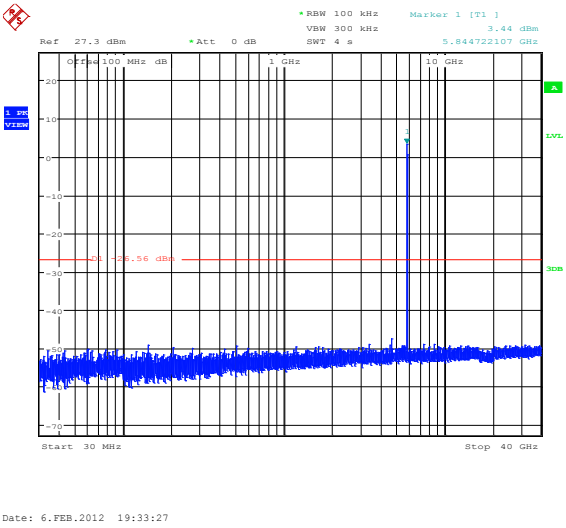
Plot 8.4-13: Conducted spurious emissions at the antenna port 1, 5 MHz channel, high frequency



Plot 8.4-14: Conducted spurious emissions at the antenna port 1, 10 MHz channel, high frequency

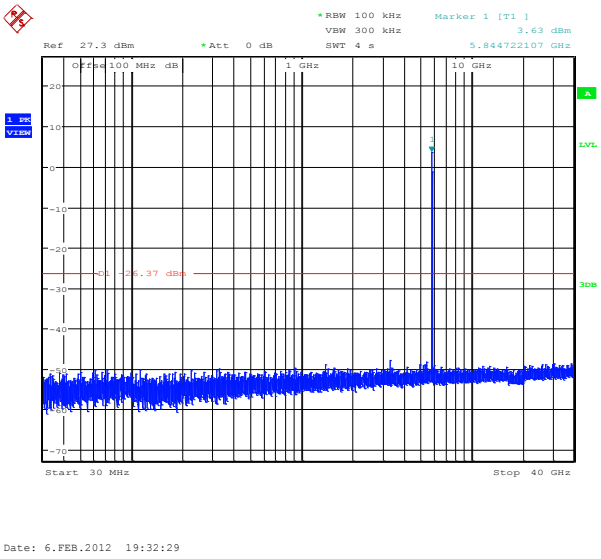


Plot 8.4-15: Conducted spurious emissions at the antenna port 1, 20 MHz channel, high frequency

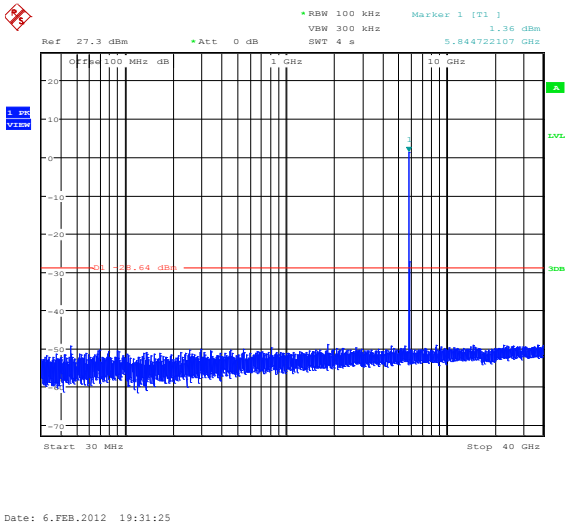


Plot 8.4-16: Conducted spurious emissions at the antenna port 2, 5 MHz channel, high frequency

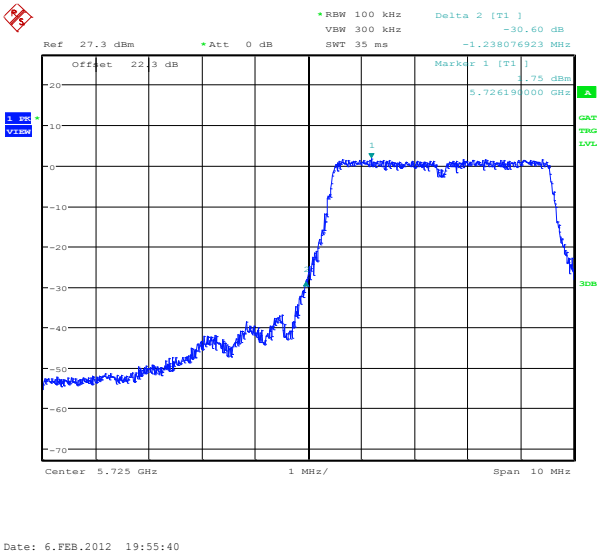
8.4.4 Test data, continued



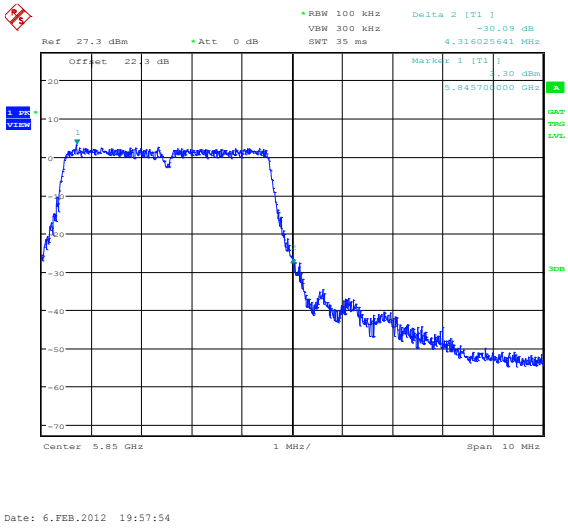
Plot 8.4-17: Conducted spurious emissions at the antenna port 2, 10 MHz channel, high frequency



Plot 8.4-18: Conducted spurious emissions at the antenna port 2, 20 MHz channel, high frequency

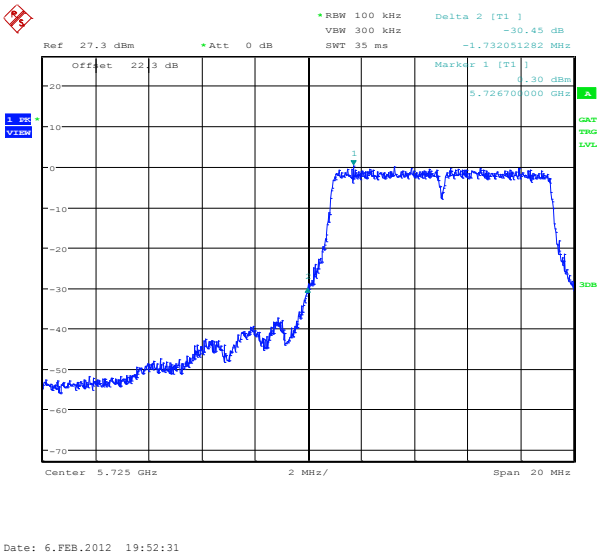


Plot 8.4-19: Conducted lower band edge at the antenna port 1, 5 MHz channel

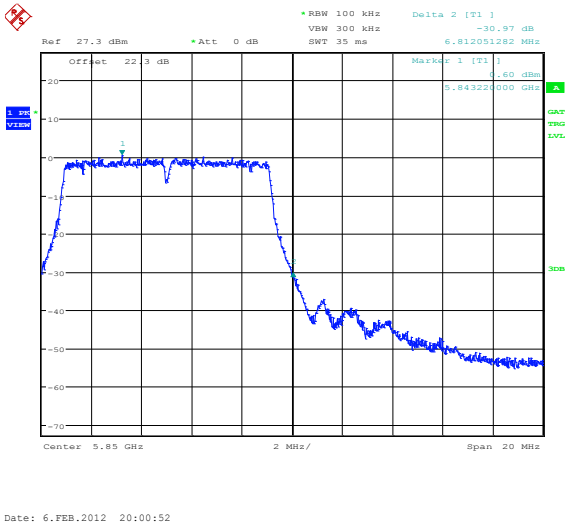


Plot 8.4-20: Conducted upper band edge at the antenna port 1, 5 MHz channel

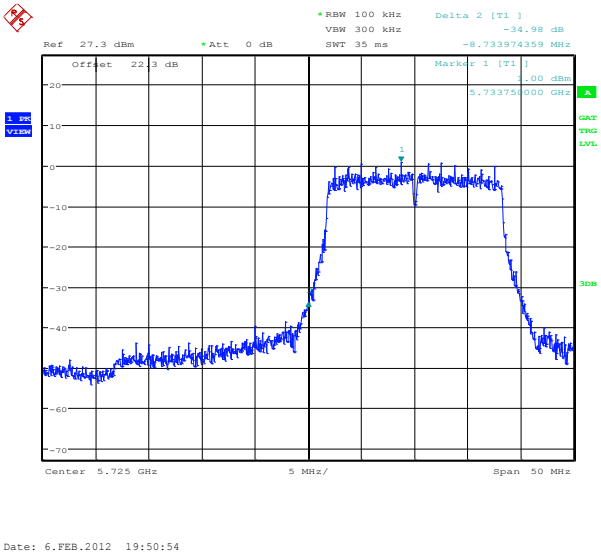
8.4.4 Test data, continued



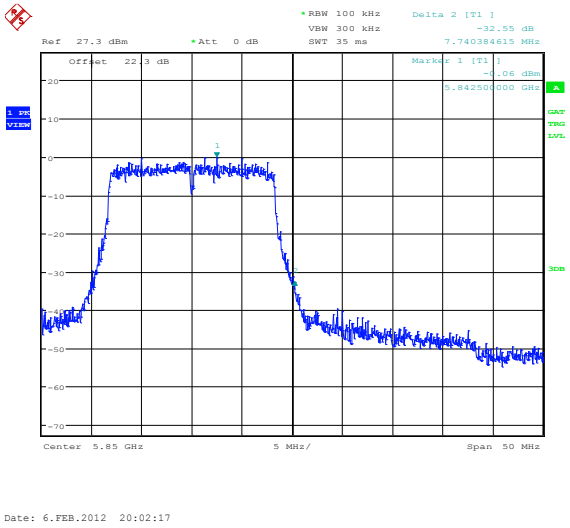
Plot 8.4-21: Conducted lower band edge at the antenna port 1, 10 MHz channel



Plot 8.4-22: Conducted upper band edge at the antenna port 1, 10 MHz channel

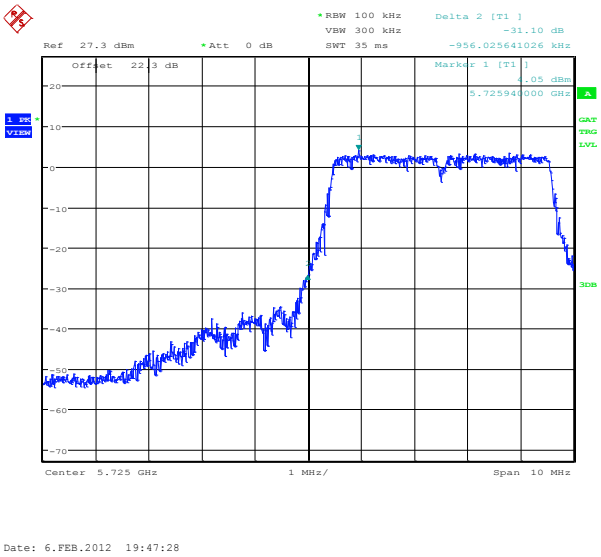


Plot 8.4-23: Conducted lower band edge at the antenna port 1, 20 MHz channel

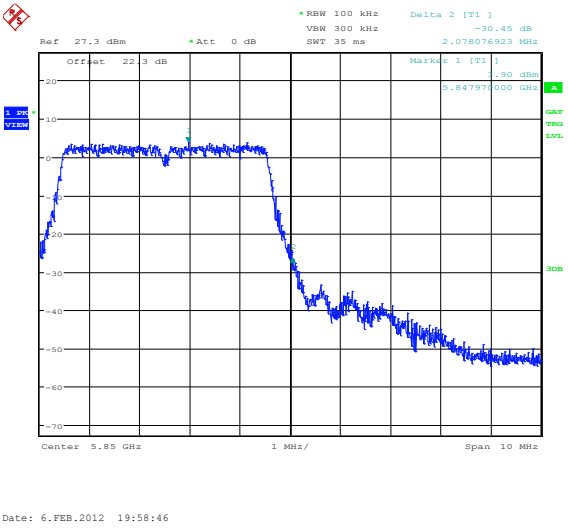


Plot 8.4-24: Conducted upper band edge at the antenna port 1, 20 MHz channel

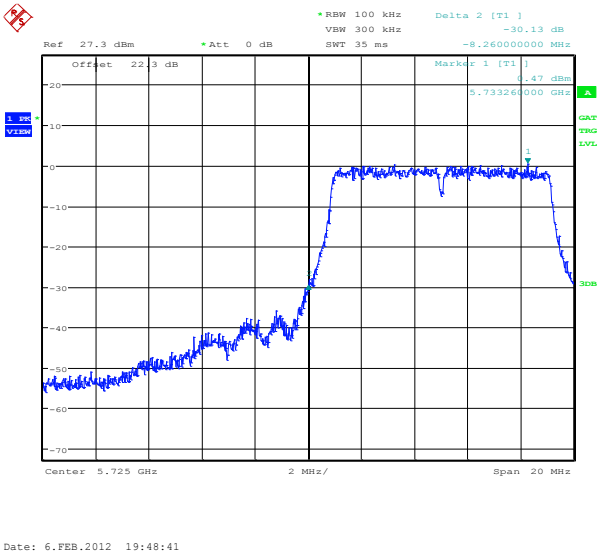
8.4.4 Test data, continued



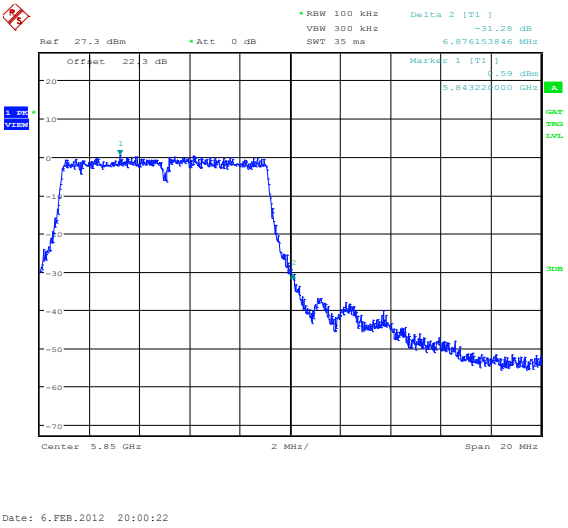
Plot 8.4-25: Conducted lower band edge at the antenna port 2, 5 MHz channel



Plot 8.4-26: Conducted upper band edge at the antenna port 2, 5 MHz channel

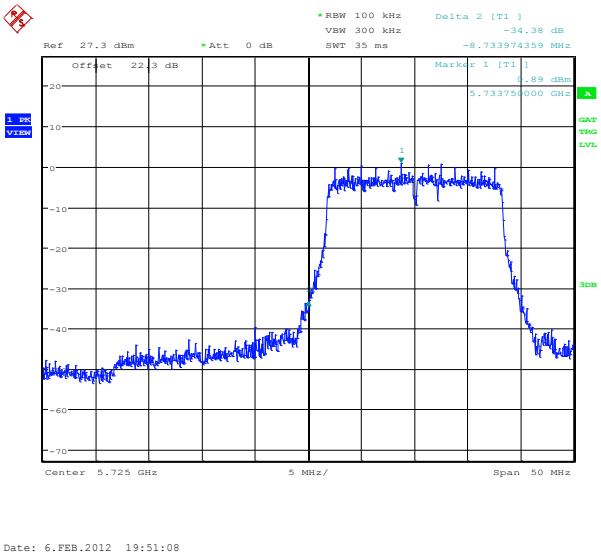


Plot 8.4-27: Conducted lower band edge at the antenna port 2, 10 MHz channel

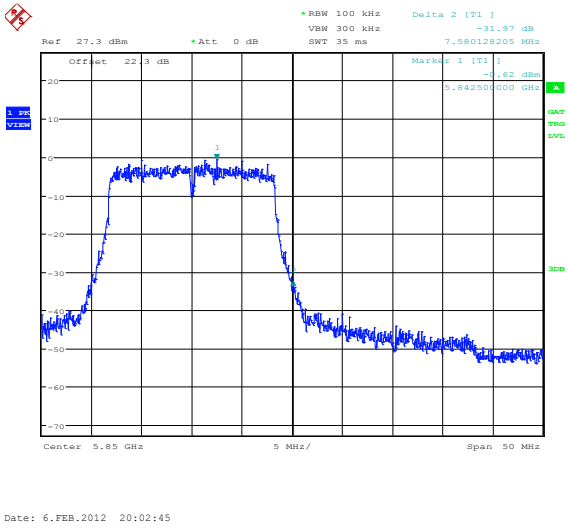


Plot 8.4-28: Conducted upper band edge at the antenna port 2, 10 MHz channel

8.4.4 Test data, continued



Plot 8.4-29: Conducted lower band edge at the antenna port 2, 20 MHz channel



Plot 8.4-30: Conducted upper band edge at the antenna port 2, 20 MHz channel

Table 8.4-3: Radiated spurious emissions results

Frequency, MHz	Detector	RBW, kHz	Polarization	Peak field strength, dBµV/m	Limit, dBµV/m	Margin, dB
265.5	Peak	100	H	40.9	46.0	5.1
Note: No more spurious emissions were detected within 10 dB below the limit.						

8.5 Clause 15.247(e) Power spectral density for digitally modulated devices

8.5.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.5.2 Test summary

Test date	February 6, 2012	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1002 mbar	**Relative humidity**	31 %

8.5.3 Observations/special notes

Measurement procedure AVGPSD of 558074 D01 DTS Meas. Guidance v01 was used for average PSD measurements. Since the measured results are more than 20 dB below the limit, only worst case emissions are reported.
MIMO test guidance as per KDB 662911 D01 Multiple Transmitter Output v01r01.

8.5.4 Test data

Table 8.5-1: PSD results for 5 MHz channel

Frequency (MHz)	PSD at port 1 (dBm/100 kHz)	PSD at port 2 (dBm/100 kHz)	Combined PSD (dBm/100 kHz)	BWCF (dB)	PSD (dBm/3 kHz)	PSD limit (dBm/3 kHz)	Margin (dB)
5727.5	-0.62	-2.09	1.72	-15.20	-13.48	8.00	21.48
5790.0	-0.77	-2.68	1.39	-15.20	-13.81	8.00	21.81
5847.5	-1.24	-2.53	1.17	-15.20	-14.03	8.00	22.03

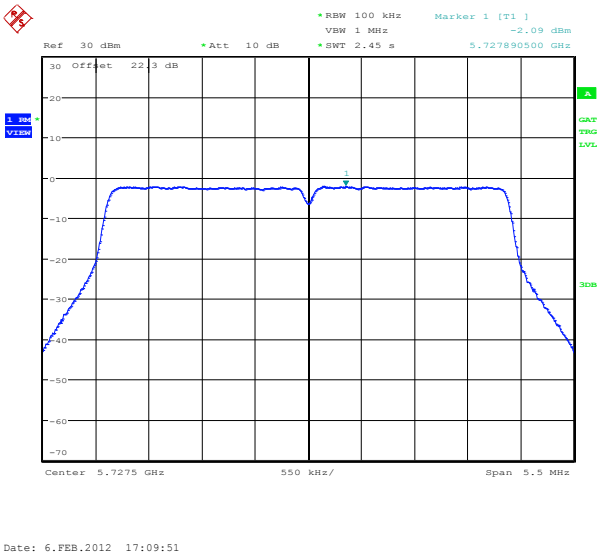
Table 8.5-2: PSD results for 10 MHz channel

Frequency (MHz)	PSD at port 1 (dBm/100 kHz)	PSD at port 2 (dBm/100 kHz)	Combined PSD (dBm/100 kHz)	BWCF (dB)	PSD (dBm/3 kHz)	PSD limit (dBm/3 kHz)	Margin (dB)
5730.0	-3.59	-4.98	-1.22	-15.20	-16.42	8.00	24.42
5790.0	-3.62	-3.57	-0.58	-15.20	-15.78	8.00	23.78
5845.0	-3.53	-4.39	-0.93	-15.20	-16.13	8.00	24.13

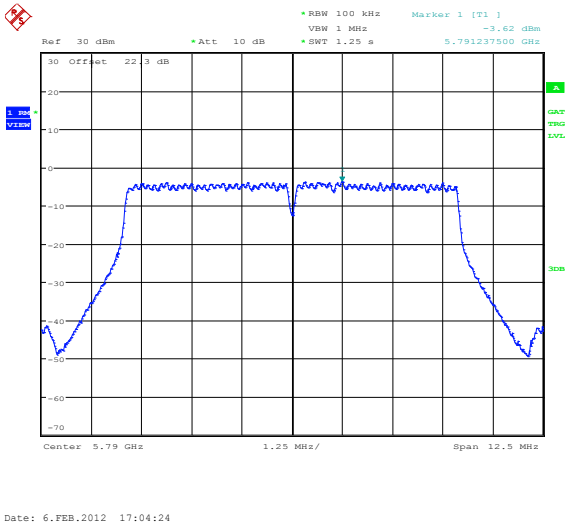
Table 8.5-3: PSD results for 20 MHz channel

Frequency (MHz)	PSD at port 1 (dBm/100 kHz)	PSD at port 2 (dBm/100 kHz)	Combined PSD (dBm/100 kHz)	BWCF (dB)	PSD (dBm/3 kHz)	PSD limit (dBm/3 kHz)	Margin (dB)
5735.0	-4.99	-5.93	-2.42	-15.20	-17.62	8.00	25.62
5790.0	-4.67	-4.93	-1.79	-15.20	-16.99	8.00	24.99
5840.0	-5.38	-6.53	-2.91	-15.20	-18.11	8.00	26.11

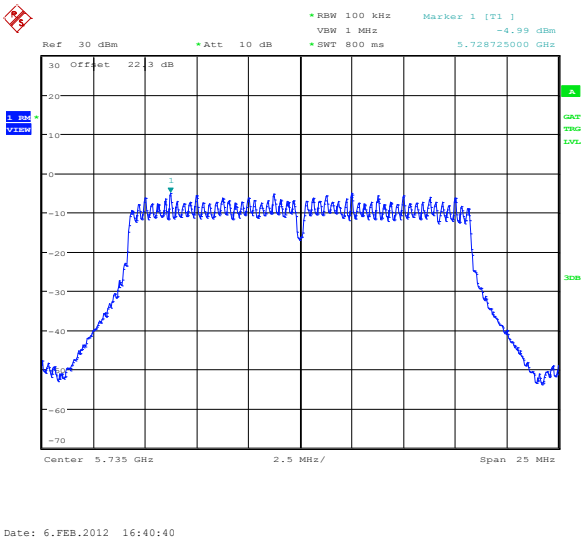
8.5.4 Test data, continued



Plot 8.5-1: Sample plot of PSD for 5 MHz channel



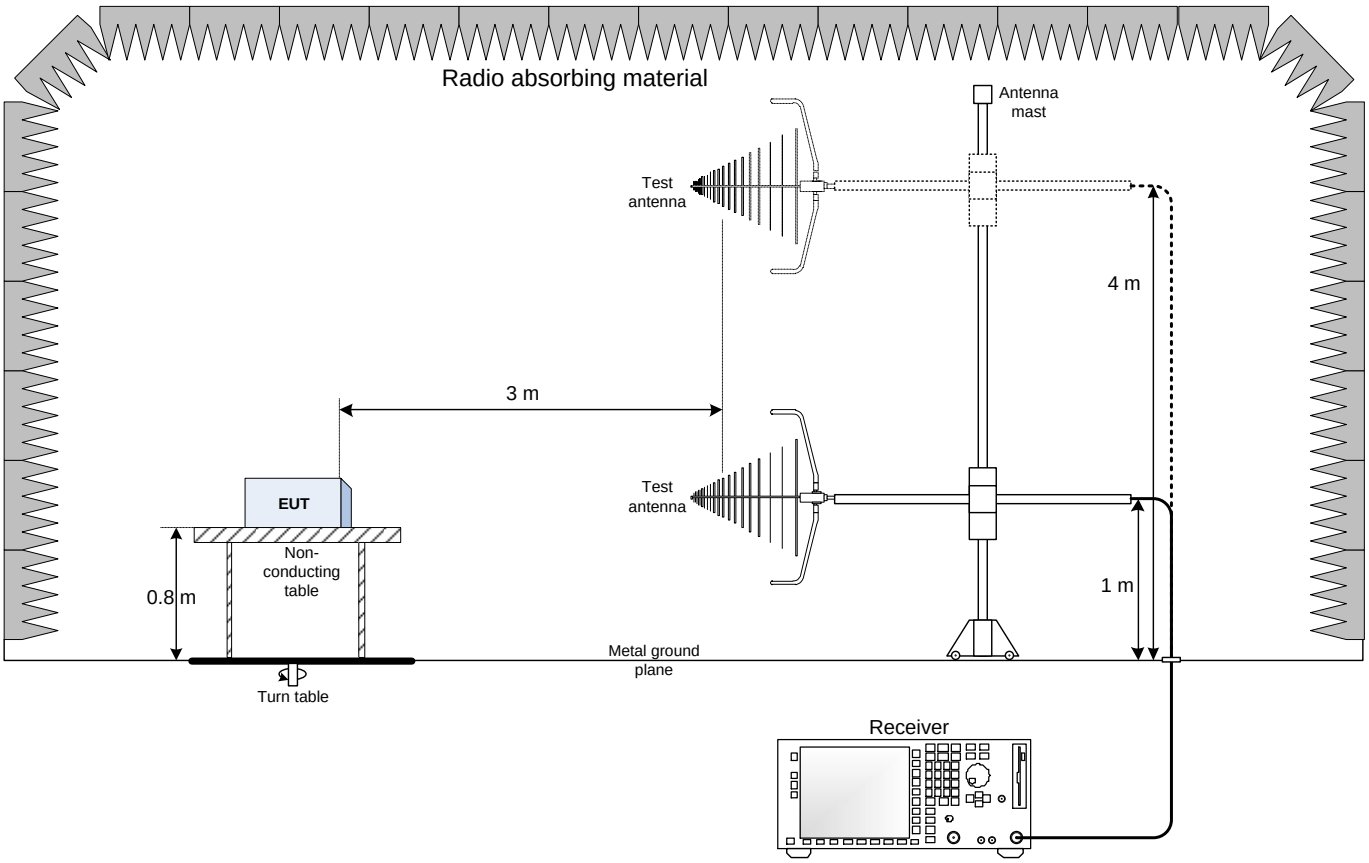
Plot 8.5-2: Sample plot of PSD for 10 MHz channel



Plot 8.5-3: Sample plot of PSD for 20 MHz channel

Section 9 Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up