

Radio test report

20082954300 - rev 1.0

based on:

- FCC Part 15 Subpart C, section 15.247 (10-1-07 Edition)
- IC RSS-210, Issue 7 (June 2007 edition)
- IC RSS-Gen, Issue 2 (June 2007 edition)

Dual band 802.11n Wireless LAN Module
NuTune
MRX2010

Contents

MAIN MODULE.....	4
1 INTRODUCTION	4
2 PRODUCT	5
3 TEST SCHEDULE	5
4 PRODUCT DOCUMENTATION.....	5
5 OBSERVATIONS AND COMMENTS	6
6 MODIFICATIONS TO THE SAMPLE.....	6
7 SUMMARY.....	6
8 CONCLUSIONS.....	7
TEST RESULTS MODULE	8
1.1 Equipment information.....	8
1.2 Channel test frequencies (MHz) and power settings (<i>dBm</i>).....	8
1.3 Test modulation	8
2 EMISSION TESTS BELOW 1 GHz	9
2.1 Power line conducted emissions	9
3 EMISSION TESTS 802.11B	10
3.1 Minimum 6 dB bandwidth.....	10
3.2 Peak power output	11
3.3 Peak power spectral density.....	12
3.4 Attenuation of unwanted emissions.....	13
3.5 Field strength of unwanted emissions in restricted bands	14
3.6 Field strength of unwanted emissions in adjacent restricted bands	15
3.7 Rx spurious emissions	16
4 EMISSION TESTS 802.11G.....	17
4.1 Minimum 6 dB bandwidth.....	17
4.2 Peak power output	18
4.3 Peak power spectral density.....	19
4.4 Attenuation of unwanted emissions.....	20
4.5 Field strength of unwanted emissions in restricted bands	21
4.6 Field strength of unwanted emissions in adjacent restricted bands	22
4.7 Rx spurious emissions	23
5 EMISSION TESTS 802.11N (20 MHz) 2400 – 2483.5 MHz BAND.....	24
5.1 Minimum 6 dB bandwidth.....	24
5.2 Peak power output	25
5.3 Peak power spectral density.....	26
5.4 Attenuation of unwanted emissions (conducted).....	27
5.5 Field strength of unwanted emissions in the non-adjacent restricted bands	28
Field strength of unwanted emissions in the non-adjacent restricted bands (continued)	29
5.6 Field strength of unwanted emissions in adjacent restricted bands	30
5.7 Rx spurious emissions	31
6 EMISSION TESTS 802.11A: 5725 – 5850 MHz BAND.....	32
6.1 Minimum 6 dB bandwidth.....	32
6.2 Peak power output	33
6.3 Peak power spectral density.....	34
6.4 Attenuation of unwanted emissions.....	35
6.5 Field strength of unwanted emissions in restricted bands	36
6.6 Field strength of unwanted emissions in adjacent restricted bands	37
6.7 Rx spurious emissions	38

7	EMISSION TESTS 802.11N (20 MHz) 5725 – 5850 MHz BAND	39
7.1	Minimum 6 dB bandwidth.....	39
7.2	Peak power output	40
7.3	Peak power spectral density.....	41
7.4	Attenuation of unwanted emissions.....	42
7.5	Field strength of unwanted emissions in restricted bands	43
7.6	Field strength of unwanted emissions in adjacent restricted bands	45
7.7	Rx spurious emissions	46
8	EMISSION TESTS 802.11N (40 MHz) 2400 – 2483.5 MHz BAND.....	47
8.1	Minimum 6 dB bandwidth.....	47
8.2	Peak power output	48
8.3	Peak power spectral density.....	49
8.4	Attenuation of unwanted emissions.....	50
8.5	Field strength of unwanted emissions in the non-adjacent restricted bands	51
	Field strength of unwanted emissions in the non-adjacent restricted bands (continued)	52
	Field strength of unwanted emissions in the non-adjacent restricted bands (continued)	53
8.6	Field strength of unwanted emissions in adjacent restricted bands	54
8.7	Rx spurious emissions	55
9	EMISSION TESTS 802.11N (40 MHz) 5725 – 5850 MHz BAND.....	56
9.1	Minimum 6 dB bandwidth.....	56
9.2	Peak power output	57
9.3	Peak power spectral density.....	58
9.4	Attenuation of unwanted emissions.....	59
9.5	Field strength of unwanted emissions in restricted bands	60
9.6	Field strength of unwanted emissions in adjacent restricted bands	61
9.7	Rx spurious emissions	62
10	MAXIMUM PERMISSIBLE EXPOSURE	63
	USED TEST EQUIPMENT MODULE	64
	CROSS REFERENCE TABLE	65
	REVISION HISTORY	66

This report comprises of five modules. The total number of pages is: 66

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication B.V.
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie). The contents of this test report, if reproduced, shall be copied in full, unless special consent in writing for reproduction in part is granted by Telefication. Copyright of this test report is reserved to Telefication.

Ordering party:

Company name : NuTune
Address : High Tech Campus 32 room 2.38
Zipcode : 5656 AE
City/town : Eindhoven
Country : The Netherlands
Date of order : 22 July 2008

2 Product

A sample of the following product was submitted for testing:

Product description : Dual band 802.11n Wireless LAN Module
Manufacturer : NuTune
Trade mark : NuTune
Type designation : MRX2010
FCC ID : WOPMRX2010C2
Hardware version : C2
Serial number : HV.11.2222.01262
Software release : 2.3.5

3 Test schedule

Tests are carried out in accordance with the specification detailed in chapter 7 “Summary” of this report.

Tests are carried out at the following location:

- Telefication, Zevenaar

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18.
The Registration Number is: 282250.

The samples of the product were received on:

- 4 August 2008

Tests are carried out from:

- 7 August to 21 August 2008

4 Product documentation

For production of this report the following product documentation is used:

Description	Date	Identification
Performance specification	07-12-05	MRX2010_description&spec.doc

The above mentioned documentation will be filed at Telefication for a period of 10 years.

5 Observations and comments

The MRX2010 is a LAN transceiver module with IEEE 802.11a/b/g/n capability. It operates in the 2400 – 2483.5 MHz ISM band as well as the 5150 – 5350 MHz, 5470 – 5725 MHz and 5700 – 5850 MHz bands. This report comprises measurements under the provision of section 15.247. Measurement results of the module under the provisions of section 15.407 are recorded in Telefication test report 20082954301.

To control the module during measurements, it was supplied with a host. Normal operational modes were controlled by means of a web interface. Special radio-measurement modes were controlled by means of the METALINK software tool: DUT GUI version 4.52.

All measurements are carried out as conducted tests, except for:

- restricted band measurements,
- receiver spurious emissions.

Output power, power spectral density and bandwidth tests for IEEE 802.11 a/g/n are carried out using a combiner.

All radiated measurements are valid for the vertical polarization direction, except for emissions below 1 GHz, which are measured for both orthogonal directions.

6 Modifications to the sample

No modifications are made to the sample.

7 Summary

The product is intended for use in the following application area(s):

INTENTIONAL RADIATOR OPERATING IN THE 2.4 GHz FREQUENCY BAND
INTENTIONAL RADIATOR OPERATING IN THE 5 GHz FREQUENCY BAND^{*)}

^{*)} The 5 GHz band test results under the provision of section 15.407 are laid down in Telefication test report 20082954301.

The sample is tested according to the following specification(s):

FCC Part 15 Subpart C, section 15.247 (10-01-07 Edition);
IC RSS-210, Issue 7 (June 2007 edition);
IC RSS-Gen, Issue 2 (June 2007 edition).

8 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 7 of this report.

The results of the tests as stated in this report, are exclusively applicable to the product items as identified in this test report. Telefication does not accept any responsibility for the results stated in this test report, with respect to the properties of product items not involved in these tests.

All tests are performed by:

name : P.A. Suringa

function : Senior Engineer Radio/EMC

signature :



Review of test report by:

name : S.J. van Spijker

function : Senior Test Engineer

signature :



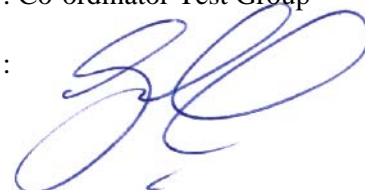
The above conclusions have been verified by the following signatory:

Date : 14 October 2008

name : J.P. van de Poll

function : Co-ordinator Test Group

signature :



Test results module

1.1 Equipment information

Type designation	MRX2010
Type of equipment	WIFI access point
Operating frequency range	2400 – 2483.5 MHz 5150 – 5350 MHz 5470 – 5725 MHz 5725 – 5850 MHz
Possible modulation types	OFDM WITH BPSK, QPSK, 16QAM And 64QAM DBPSK, DQPSK, CCK
Antenna type	External Dual-Band Omni-Directional Antenna
Antenna gain	5.5 dBi @ 5 GHz; 2.5 dBi @ 2.4 – 2.5 GHz

1.2 Channel test frequencies (MHz) and power settings (dBm)

Mode	Ch 1	Ch 3	Ch 6	Ch 9	Ch 11	Ch 149	Ch 151	Ch 157	Ch 159	Ch 165
IEEE 802.11a	--	--	--	--	--	5745 18	--	5785 18	--	5825 18
IEEE 802.11b	2412 20	--	2437 20	--	2462 20	--	--	--	--	--
IEEE 802.11g	2412 18	--	2437 20	--	2462 18	--	--	--	--	--
IEEE 802.11n (20 MHz)	2412 18	--	2437 20	--	2462 18	5745 18	--	5785 18	--	5825 18
IEEE 802.11n (40 MHz)	--	2422 13	2437 20	2452 12	--	--	5755 18	--	5795 18	--

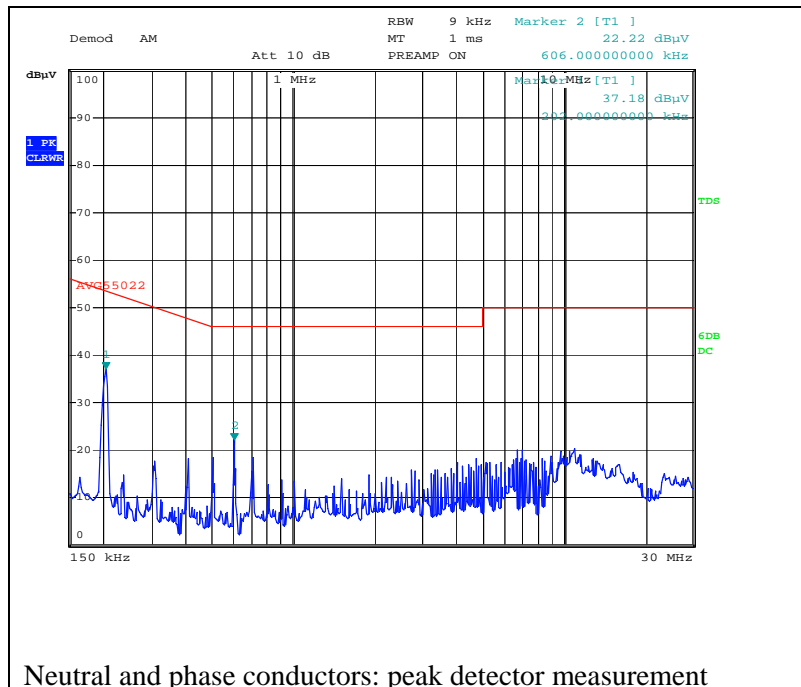
1.3 Test modulation

802.11b	5.5 Mbps Short Preamble
802.11g	QAM64 3/4 Rank1: 54 Mbps
802.11a	QAM64 3/4 Rank1: 54 Mbps
802.11n	QAM64 5/6 Rank1: 135 Mbps

2 Emission tests below 1 GHz

2.1 Power line conducted emissions

Compliance standard : FCC part 15, subpart C, section 15.207
 Method of test : ANSI C63.4-2003, sections 7 & 11.5
 Ambient temperature : 24 °C
 Relative humidity : 50 %
 EUT condition : transmitting



Measurement uncertainty: +3.7/-3.7 dB

3 Emission tests 802.11b

3.1 Minimum 6 dB bandwidth

Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)

Method of test : ANSI C63.4-2003

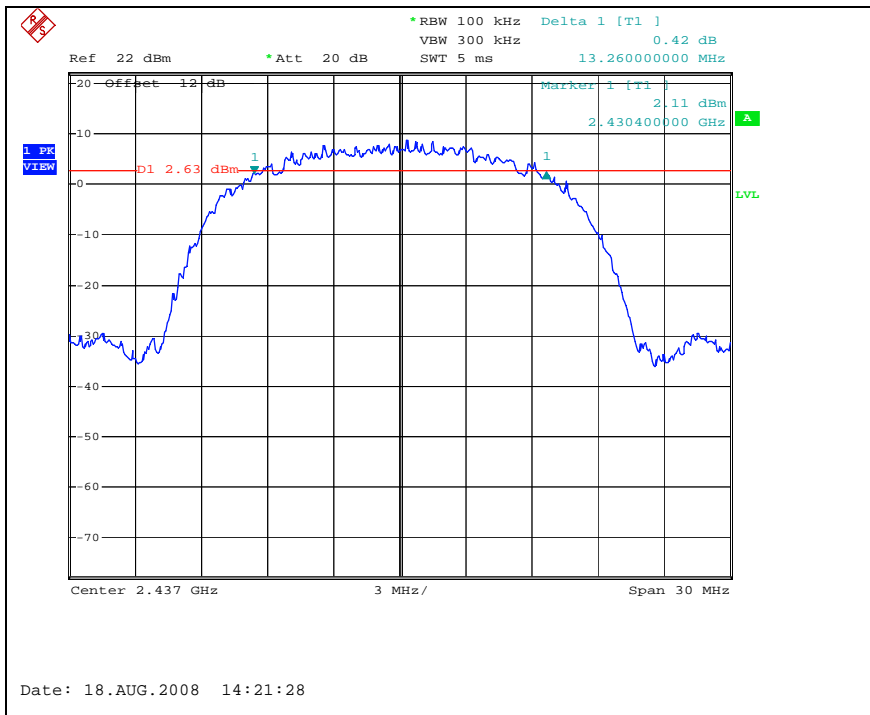
Ambient temperature : 24 °C

Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11
12.9 MHz	13.26 MHz	12.84 MHz

Channel 6 plot



Measurement uncertainty: + 23/- 23 kHz

3.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
19.0 dBm	18.8 dBm	18.5 dBm	Measured. value (conducted)
21.5 dBm E.I.R.P.	21.3 dBm E.I.R.P.	21.0 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ -2.7 dB

3.3 Peak power spectral density

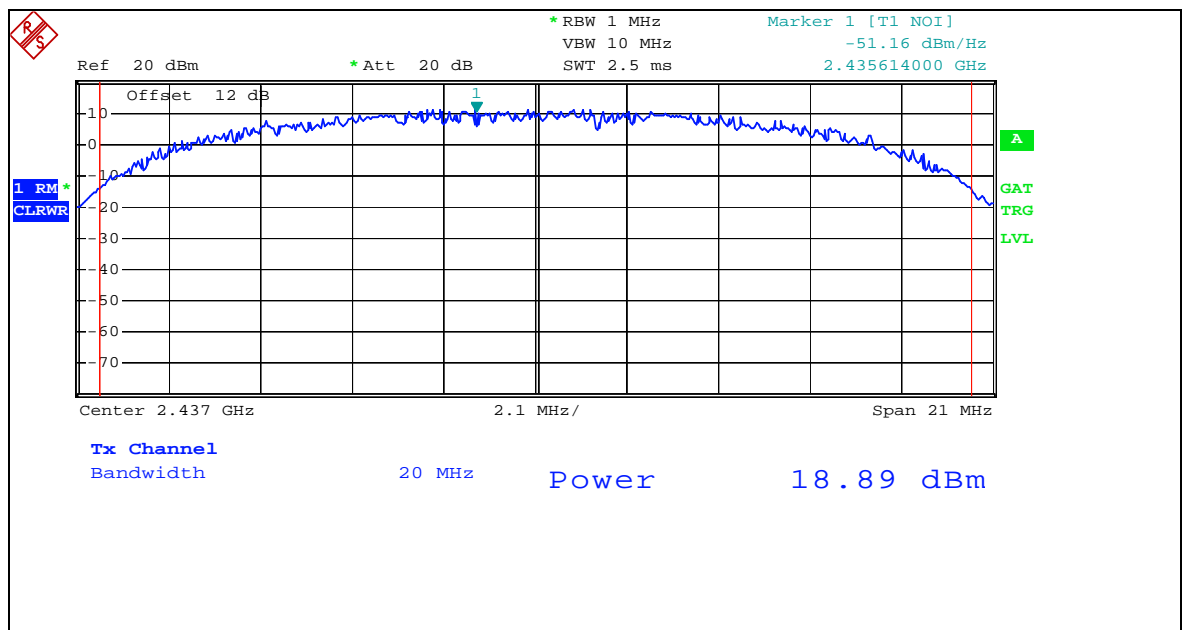
Compliance standard : FCC part 15, subpart C, section 15.247 (e)
 Method of test : FCC KDB Publication No. 558074, PSD Option 1
 Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-16.6 dBm/3 kHz	-16.4 dBm/3 kHz	-16.0 dBm/3 kHz	Measured. value (conducted)
-14.1 dBm/3 kHz E.I.R.P.	-13.9 dBm/3 kHz E.I.R.P.	-13.5 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 6 plot



Measurement uncertainty: + 2.4/ -2.7 dB

3.4 Attenuation of unwanted emissions

Compliance standard	:	FCC part 15, subpart C, section 15.247(d)
Method of test	:	ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2; FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
Ambient temperature	:	24 °C
Relative humidity	:	50 %
Test results	:	

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.4.

3.5 Field strength of unwanted emissions in restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : FCC Public Notice DA 00-705
Ambient temperature : 24 °C
Relative humidity : 50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.5.

3.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : KDB Publication No. 558074
Ambient temperature : 24 °C
Relative humidity : 50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.6.

3.7 Rx spurious emissions

Compliance standard	:	IC RSS-Gen, section 2.3
Method of test	:	IC RSS-Gen, section 4.10 & 7.2.3.1
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (40 MHz) mode, see section 8.7.

4 Emission tests 802.11g

4.1 Minimum 6 dB bandwidth

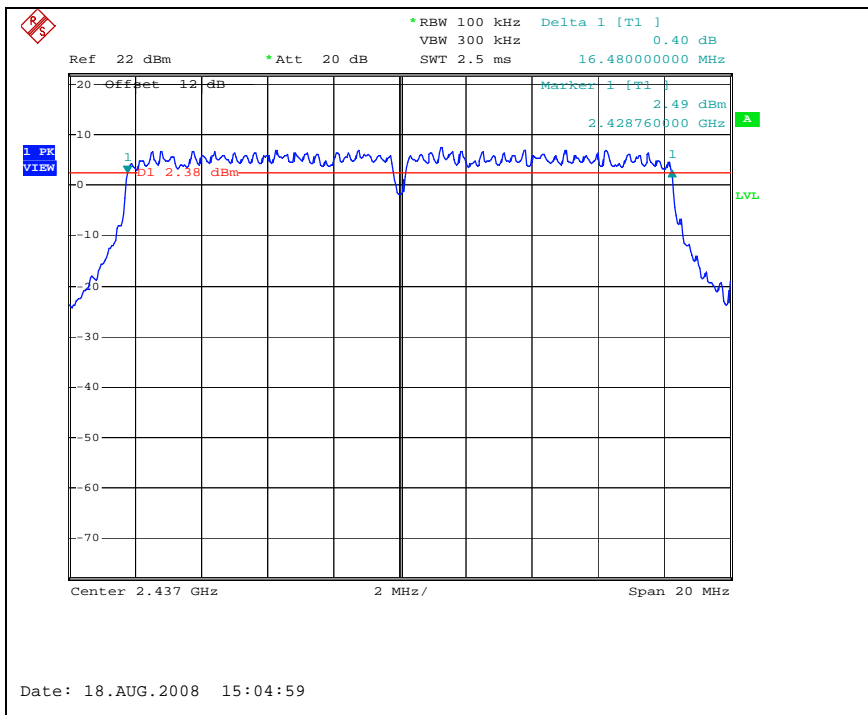
Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11
16.52 MHz	16.56 MHz	16.48 MHz

Channel 6 plot



Measurement uncertainty: + 23/- 23 kHz

4.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
20.5 dBm	21.7 dBm	19.9 dBm	Measured. value (conducted)
23.0 dBm E.I.R.P.	24.2 dBm E.I.R.P.	22.4 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ - 2.7 dB

4.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

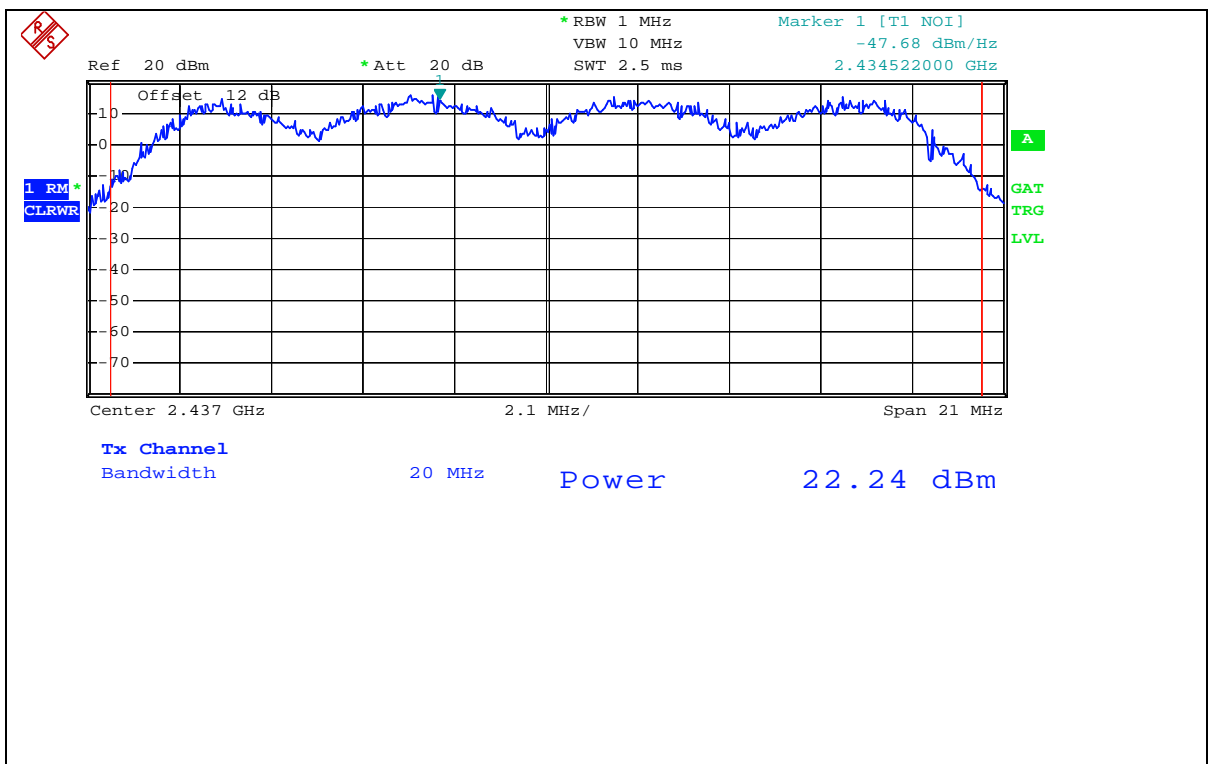
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-13.0 dBm/3 kHz	-12.0 dBm/3 kHz	-15.0 dBm/3 kHz	Measured. value (conducted)
-10.5 dBm/3 kHz E.I.R.P.	-9.5 dBm/3 kHz E.I.R.P.	-12.5 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 6 plot



Measurement uncertainty: + 2.4/ -2.7 dB

4.4 Attenuation of unwanted emissions

Compliance standard : FCC part 15, subpart C, section 15.247 (d)
Method of test : ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2;
FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
Ambient temperature : 24 °C
Relative humidity : 50 %
Test results :

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.4.

4.5 Field strength of unwanted emissions in restricted bands

Compliance standard	:	FCC part 15, subpart C, section 15.205(a)
Method of test	:	KDB Publication No. 558074
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.5.

4.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : KDB Publication No. 558074
Ambient temperature : 24 °C
Relative humidity : 50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.6.

4.7 Rx spurious emissions

Compliance standard	:	IC RSS-Gen, section 2.3
Method of test	:	IC RSS-Gen, section 4.10 & 7.2.3.1
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (40 MHz) mode, see section 8.7.

5 Emission tests 802.11n (20 MHz) 2400 – 2483.5 MHz band

5.1 Minimum 6 dB bandwidth

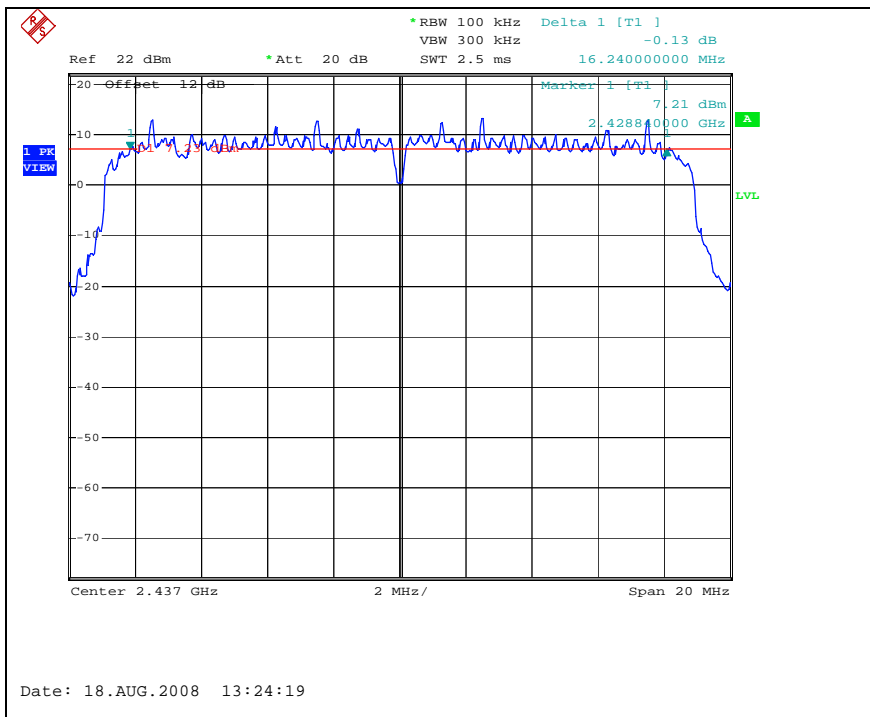
Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11
16.32 MHz	16.24 MHz	16.48 MHz

Channel 6 plot



Measurement uncertainty: + 23/- 23 kHz

5.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
19.7 dBm	21.8 dBm	19.9 dBm	Measured. value (conducted)
22.2 dBm E.I.R.P.	24.3 dBm E.I.R.P.	22.4 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ - 2.7 dB

5.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

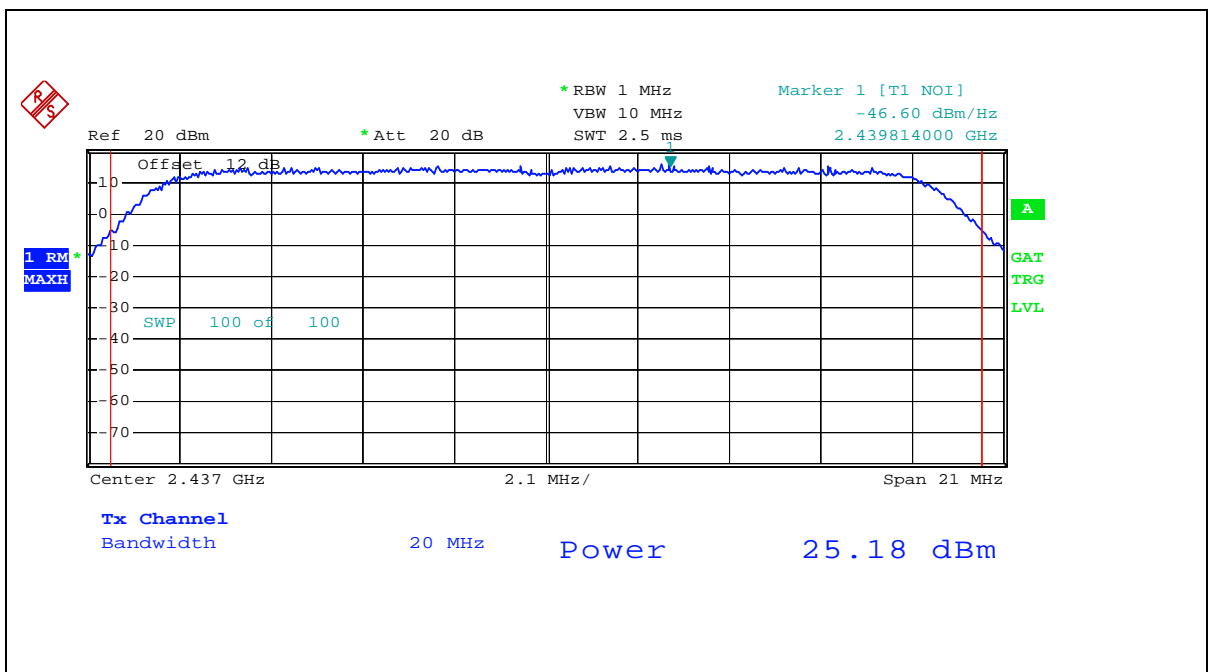
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 1	Channel 6	Channel 11	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-15.0 dBm/3 kHz	-11.7 dBm/3 kHz	-16.0 dBm/3 kHz	Measured. value (conducted)
-12.5 dBm/3 kHz E.I.R.P.	-9.2 dBm/3 kHz E.I.R.P.	-13.5 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 6 plot

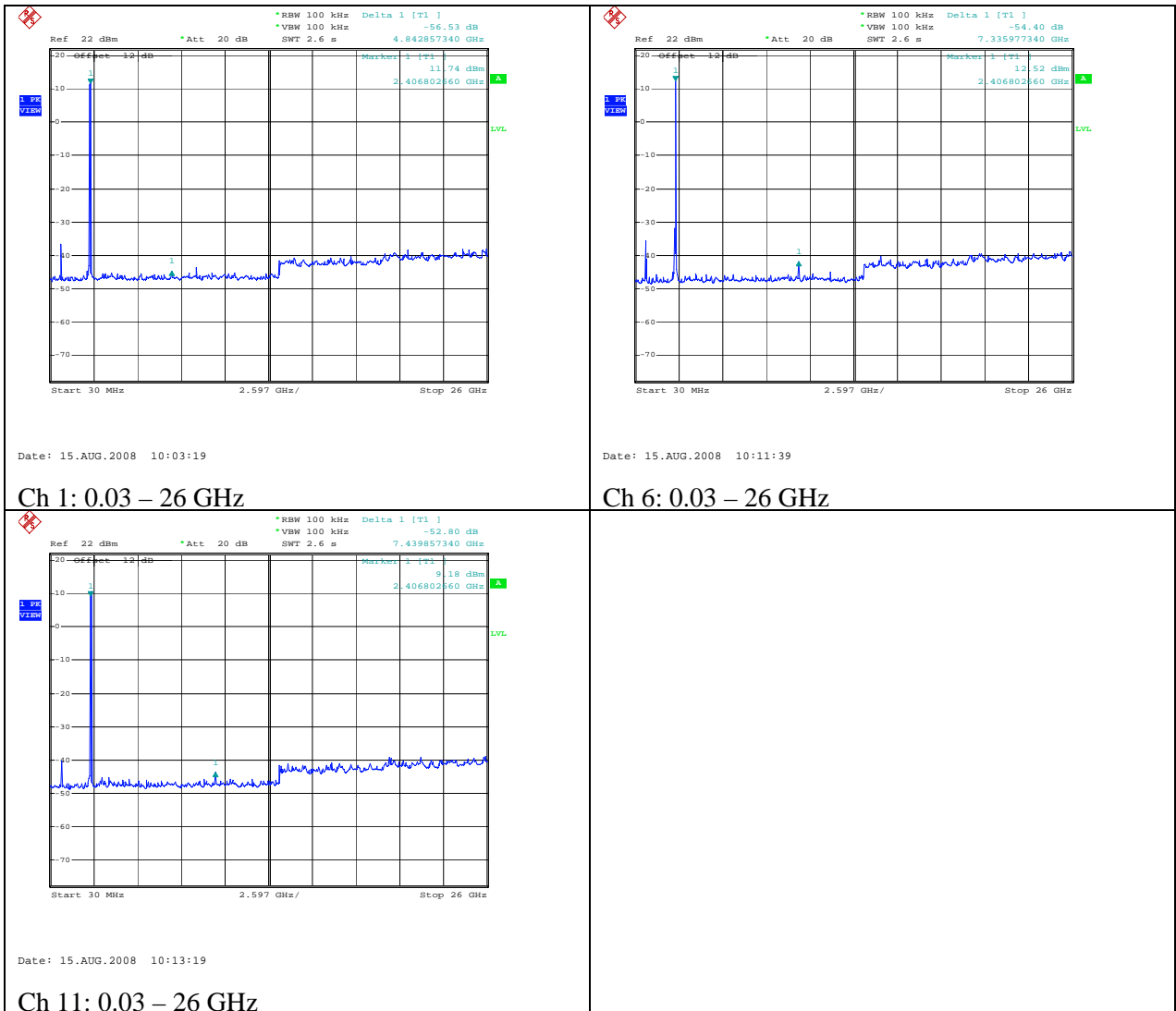


Measurement uncertainty: + 2.4/ -2.7 dB

5.4 Attenuation of unwanted emissions (conducted)

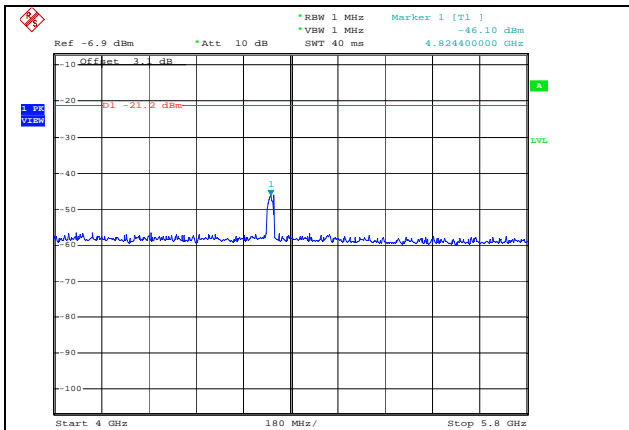
Compliance standard : FCC part 15, subpart C, section 15.247 (d)
 Method of test : ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2;
 FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :



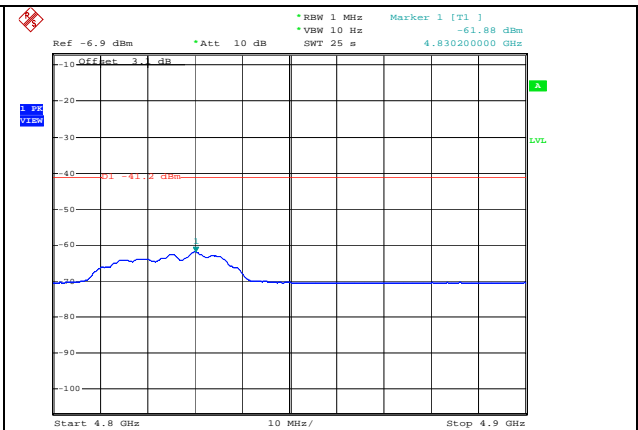
5.5 Field strength of unwanted emissions in the non-adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



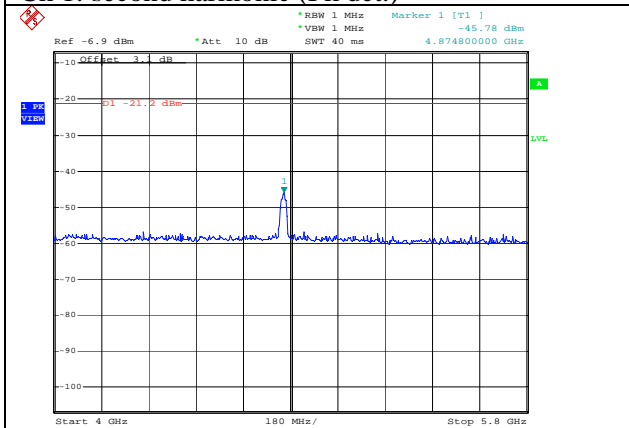
Date: 8.AUG.2008 10:17:06

Ch 1: second harmonic (Pk det.)



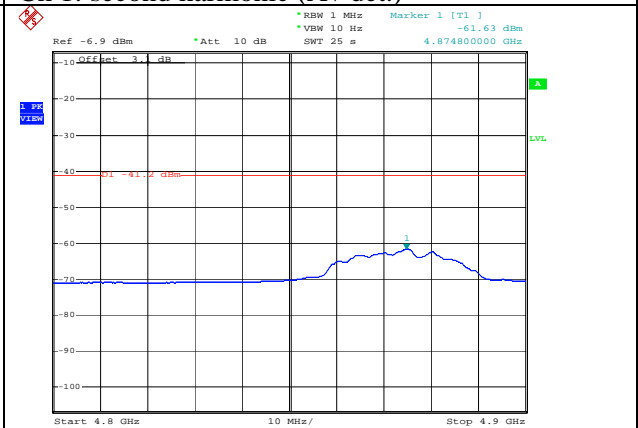
Date: 8.AUG.2008 10:22:28

Ch 1: second harmonic (Av det.)



Date: 8.AUG.2008 10:38:34

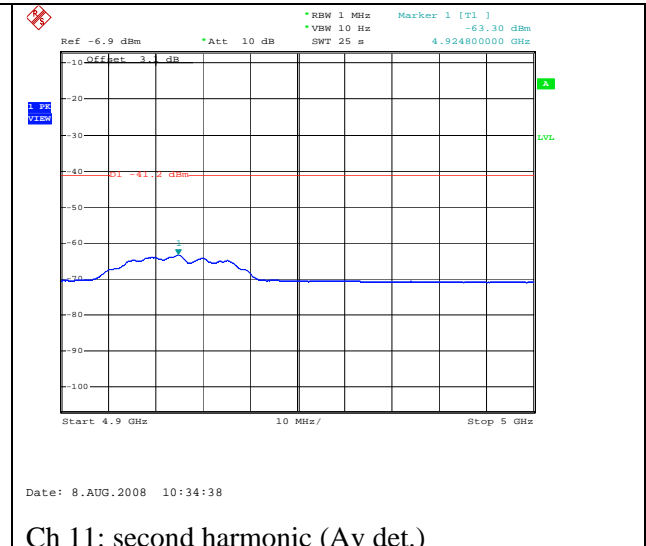
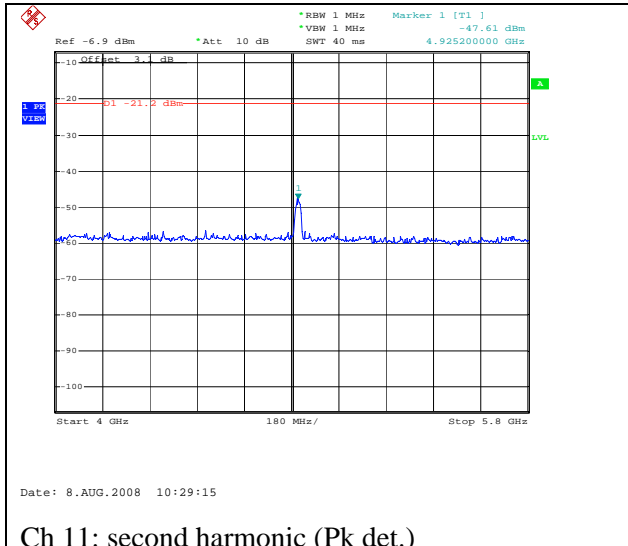
Ch 6: second harmonic (Pk det.)



Date: 8.AUG.2008 10:43:27

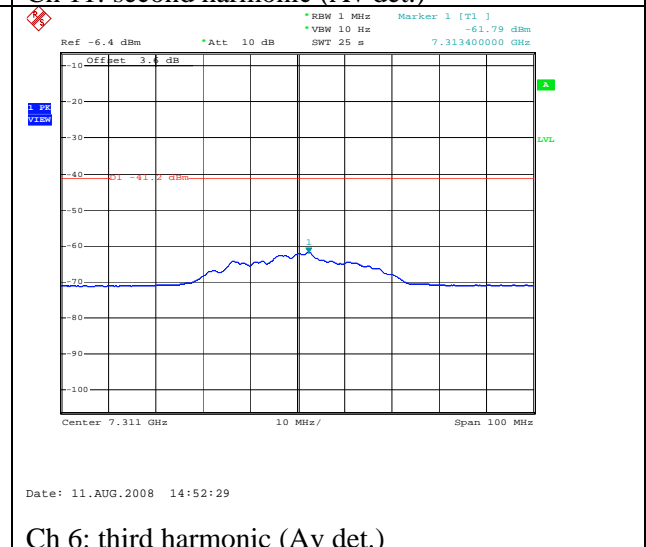
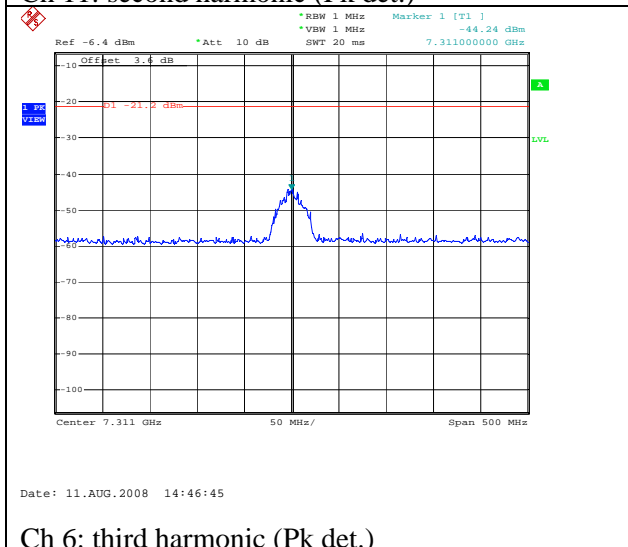
Ch 6: second harmonic (Av det.)

Field strength of unwanted emissions in the non-adjacent restricted bands (continued)



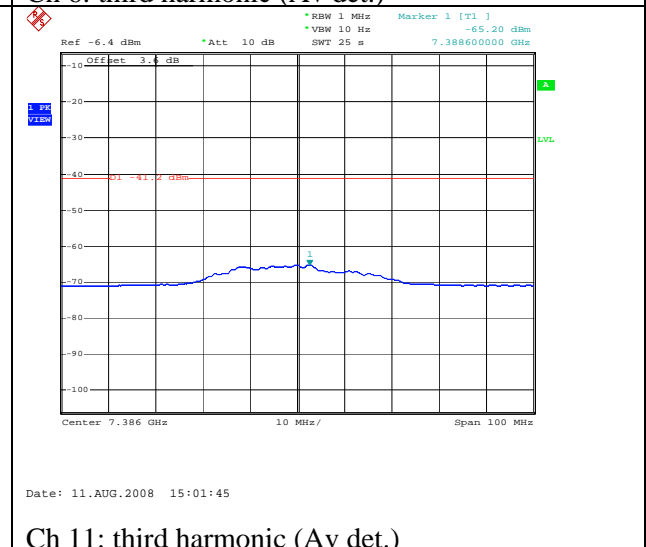
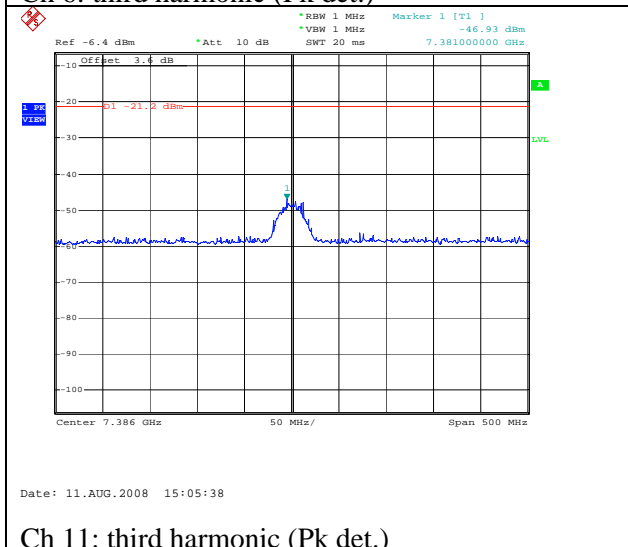
Ch 11: second harmonic (Pk det.)

Ch 11: second harmonic (Av det.)



Ch 6: third harmonic (Pk det.)

Ch 6: third harmonic (Av det.)

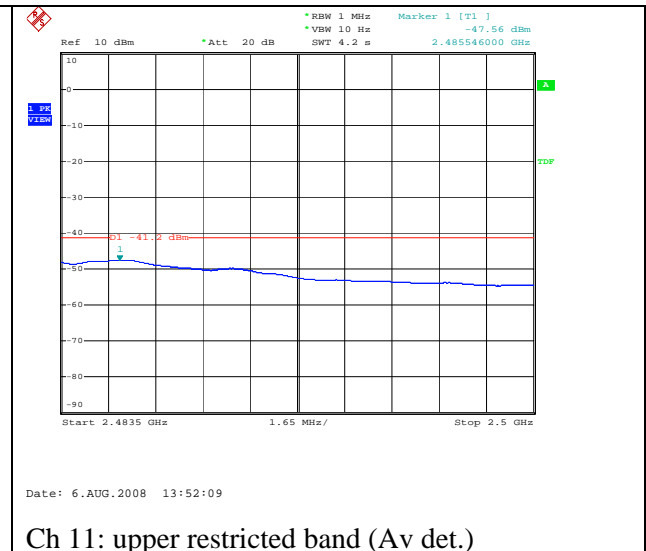
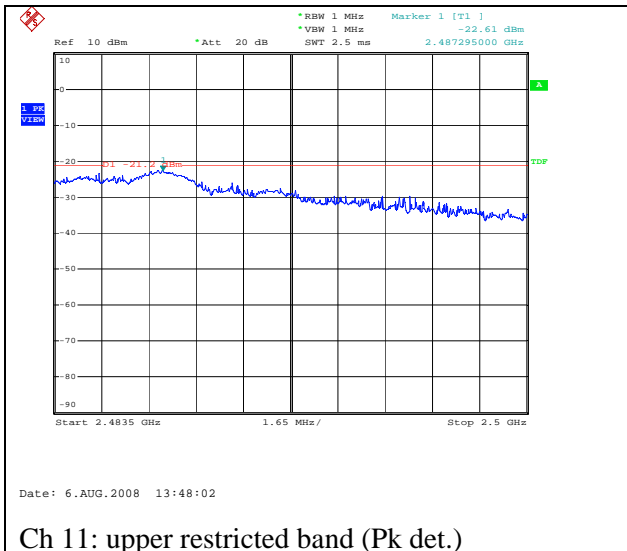
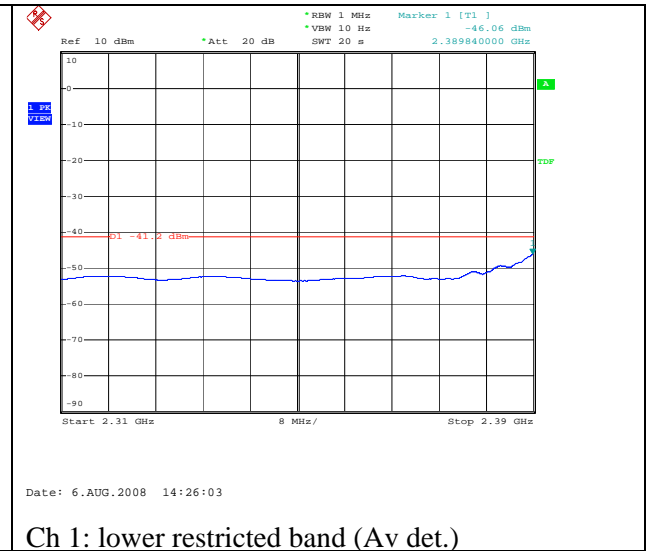
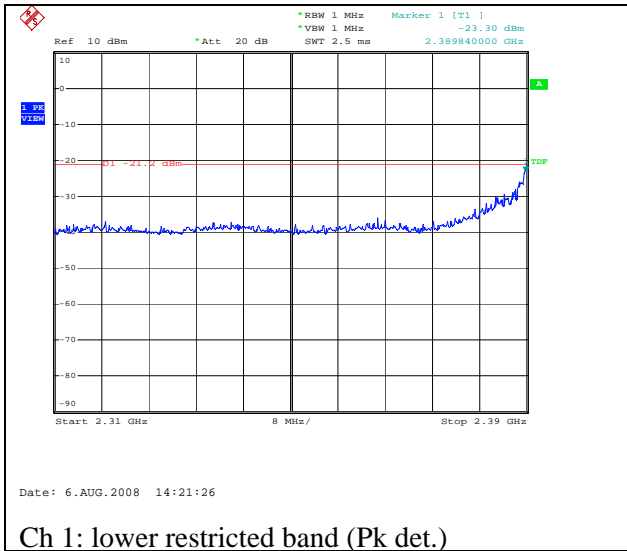


Ch 11: third harmonic (Pk det.)

Ch 11: third harmonic (Av det.)

5.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



5.7 Rx spurious emissions

Compliance standard	:	IC RSS-Gen, section 2.3
Method of test	:	IC RSS-Gen, section 4.10 & 7.2.3.1
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (40 MHz) mode, see section 8.7.

6 Emission tests 802.11a: 5725 – 5850 MHz band

6.1 Minimum 6 dB bandwidth

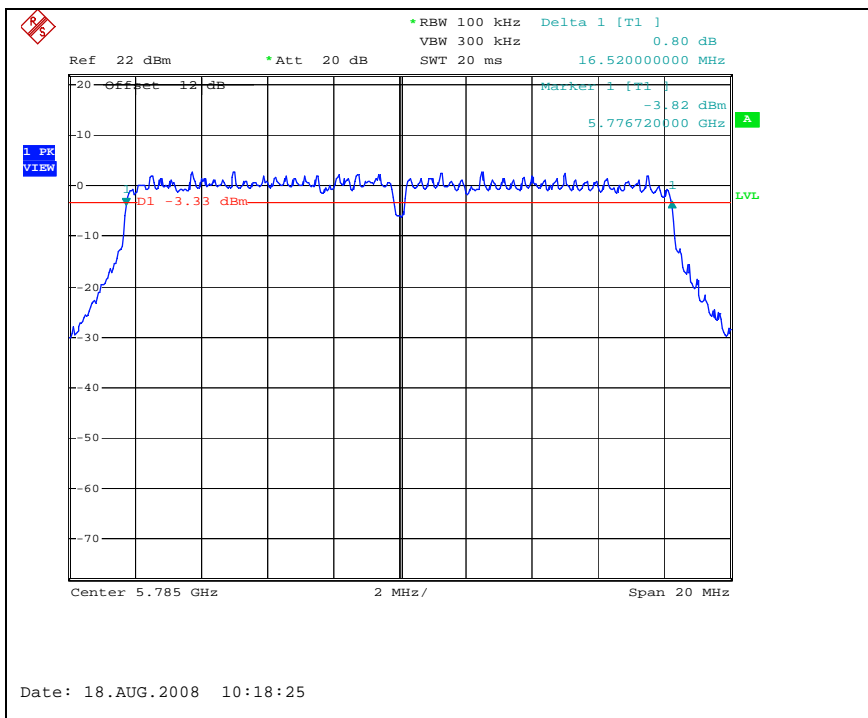
Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165
16.52 MHz	16.52 MHz	16.48 MHz

Channel 157 plot



Measurement uncertainty: + 23/- 23 kHz

6.2 Peak power output

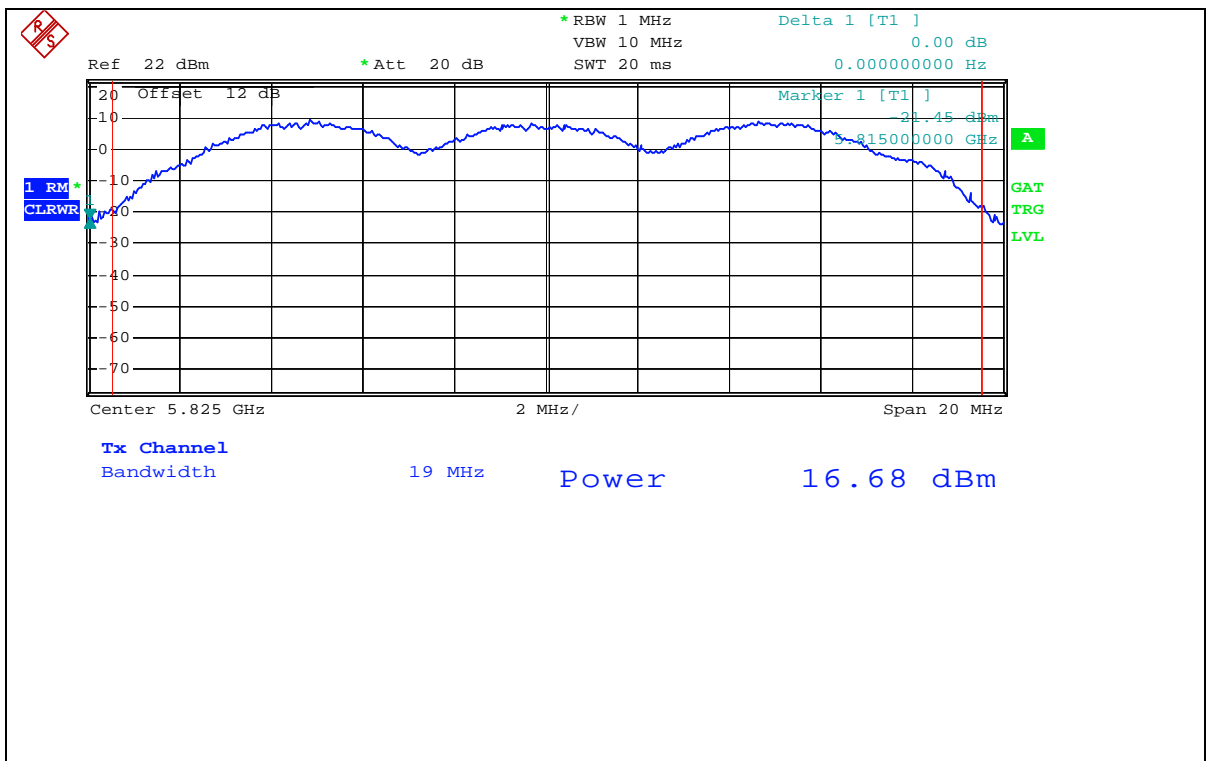
Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
17.5 dBm	17.1 dBm	16.7 dBm	Measured. value (conducted)
23.0 dBm E.I.R.P.	22.6 dBm E.I.R.P.	22.1 dBm E.I.R.P.	Calculated value (radiated)

Channel 165 plot



Measurement uncertainty: + 2.4/ - 2.7 dB

6.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

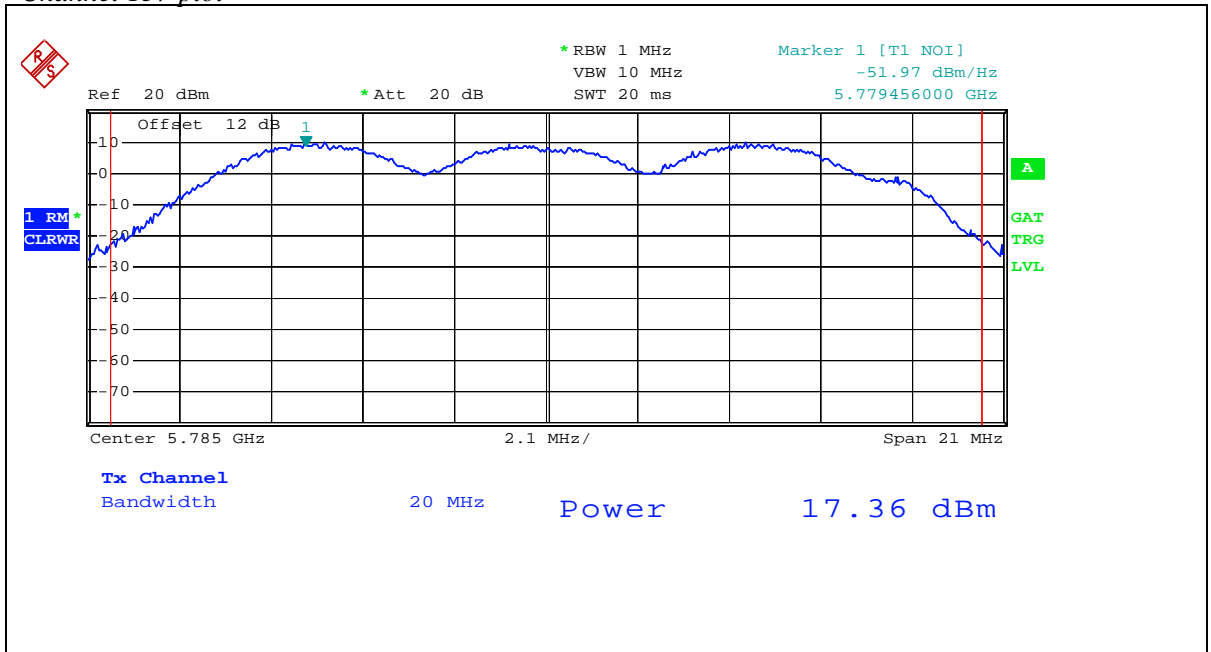
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-16.6 dBm/3 kHz	-17.0 dBm/3 kHz	-17.1 dBm/3 kHz	Measured. value (conducted)
-11.1 dBm/3 kHz E.I.R.P.	-11.5 dBm/3 kHz E.I.R.P.	-11.6 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 157 plot



Measurement uncertainty: + 2.4/ -2.7 dB

6.4 Attenuation of unwanted emissions

Compliance standard : FCC part 15, subpart C, section 15.247 (d)
Method of test : ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2;
FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 7.4.

6.5 Field strength of unwanted emissions in restricted bands

Compliance standard	:	FCC part 15, subpart C, section 15.205(a)
Method of test	:	KDB Publication No. 558074
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 7.5.

6.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : KDB Publication No. 558074(high pass filter used at channel 11 only)
Ambient temperature : 24 °C
Relative humidity : 50 %

Not applicable.

6.7 Rx spurious emissions

Compliance standard	:	IC RSS-Gen, section 2.3
Method of test	:	IC RSS-Gen, section 4.10 & 7.2.3.1
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (40 MHz) mode, see section 9.7.

7 Emission tests 802.11n (20 MHz) 5725 – 5850 MHz band

7.1 Minimum 6 dB bandwidth

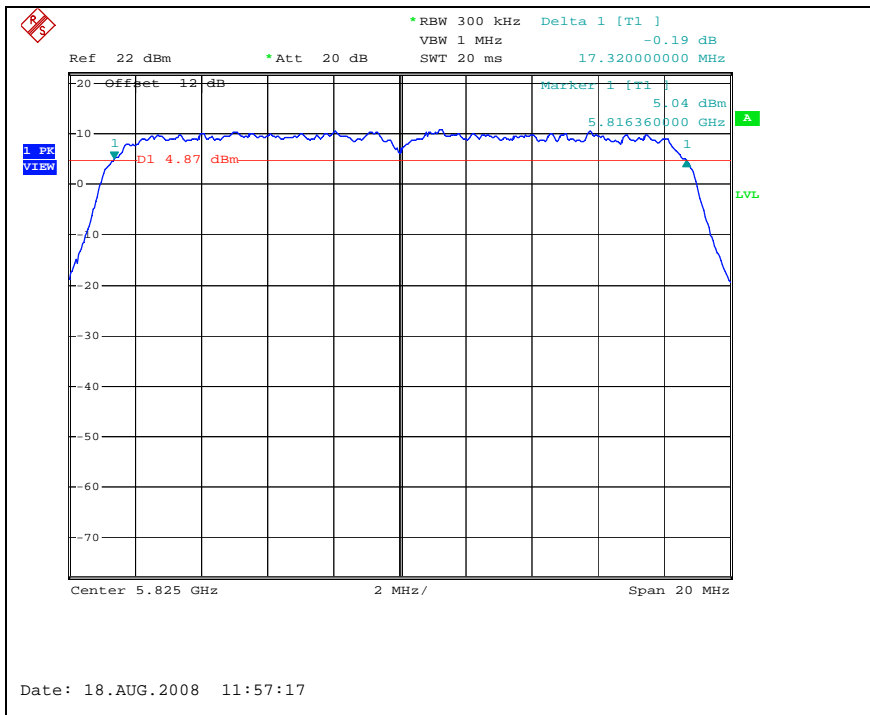
Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165
17.20 MHz	17.24 MHz	17.32 MHz

Channel 165 plot



Measurement uncertainty: + 23/- 23 kHz

7.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
17.7 dBm	17.2 dBm	16.8 dBm	Measured. value (conducted)
23.2 dBm E.I.R.P.	22.7 dBm E.I.R.P.	22.3 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ - 2.7 dB

7.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

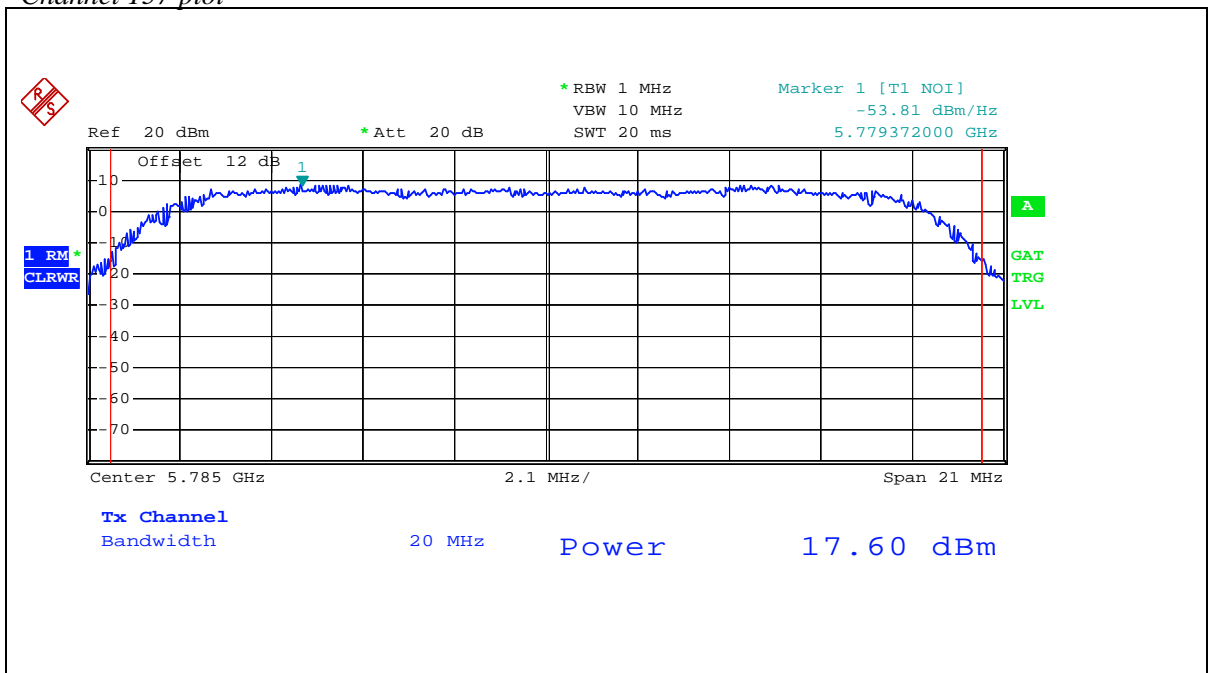
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 157	Channel 165	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-19.1 dBm/3 kHz	-18.8 dBm/3 kHz	-20.0 dBm/3 kHz	Measured. value (conducted)
-13.6 dBm/3 kHz E.I.R.P.	-13.3 dBm/3 kHz E.I.R.P.	-14.5 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 157 plot

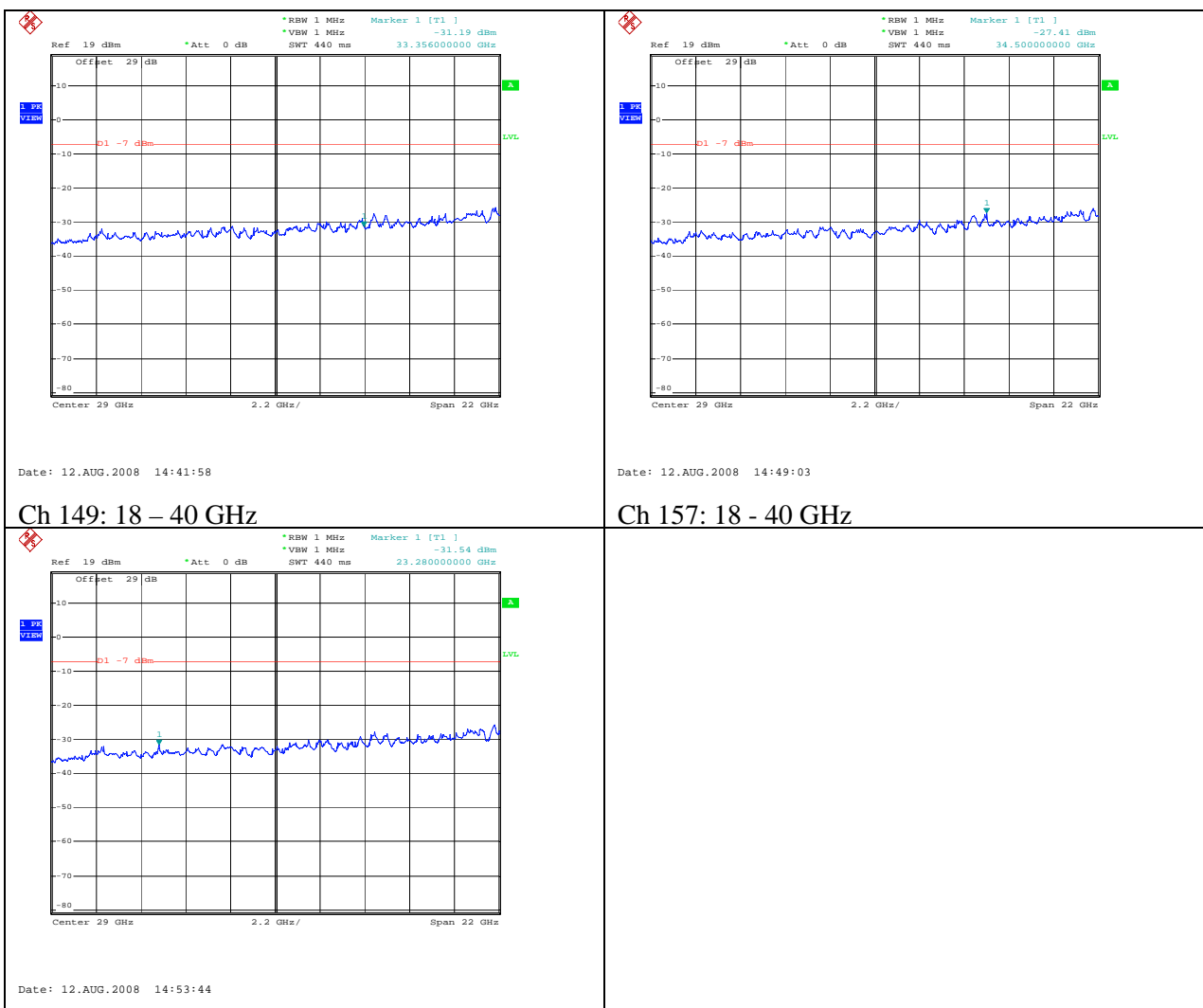


Measurement uncertainty: + 2.4/ -2.7 dB

7.4 Attenuation of unwanted emissions

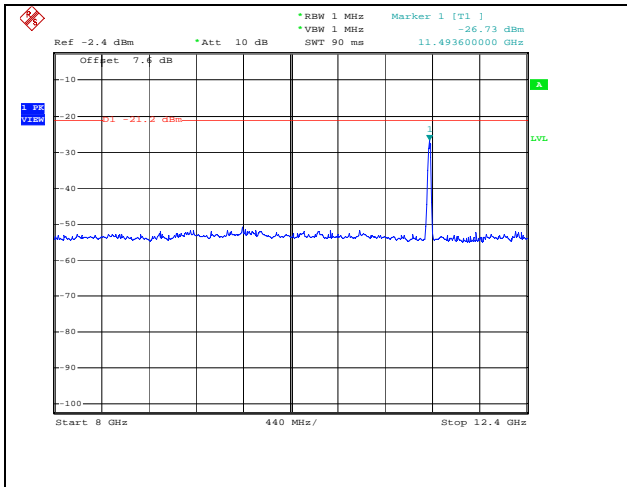
Compliance standard : FCC part 15, subpart C, section 15.247 (d)
 Method of test : ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2;
 FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :



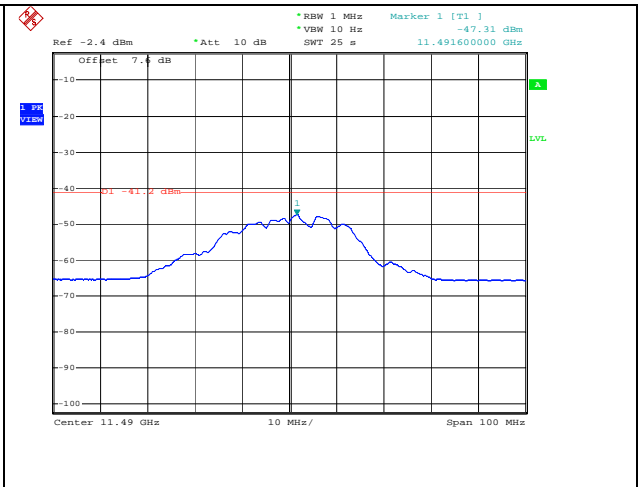
7.5 Field strength of unwanted emissions in restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



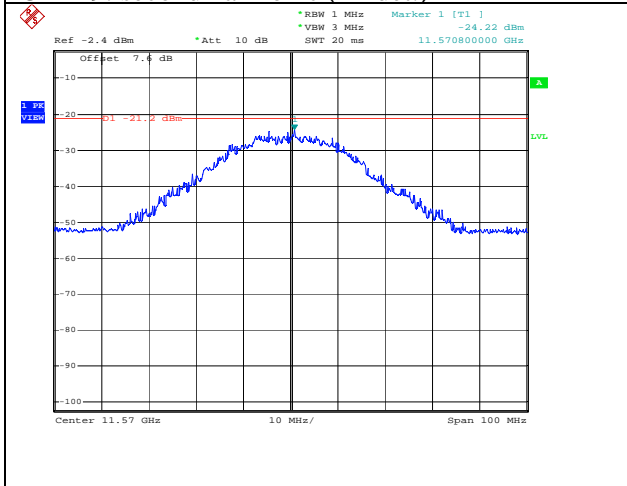
Date: 8.AUG.2008 11:45:36

Ch 149: second harmonic (Pk det.)



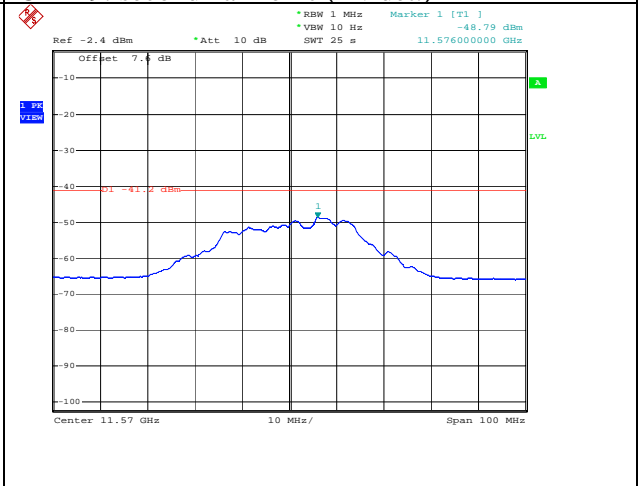
Date: 8.AUG.2008 11:50:35

Ch 149: second harmonic (Av det.)



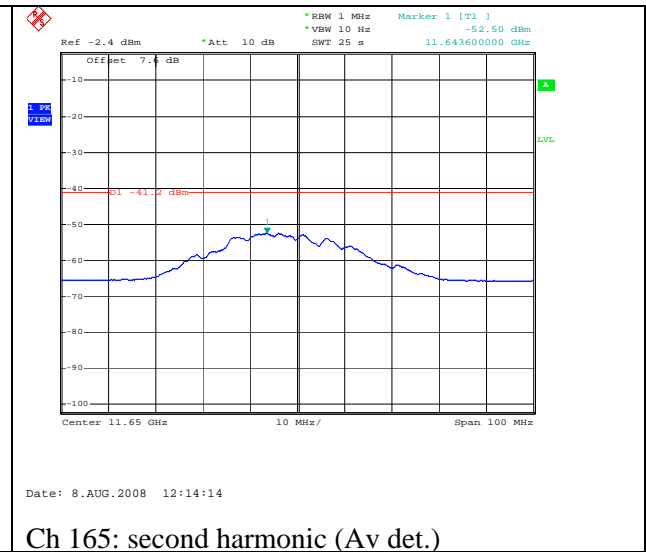
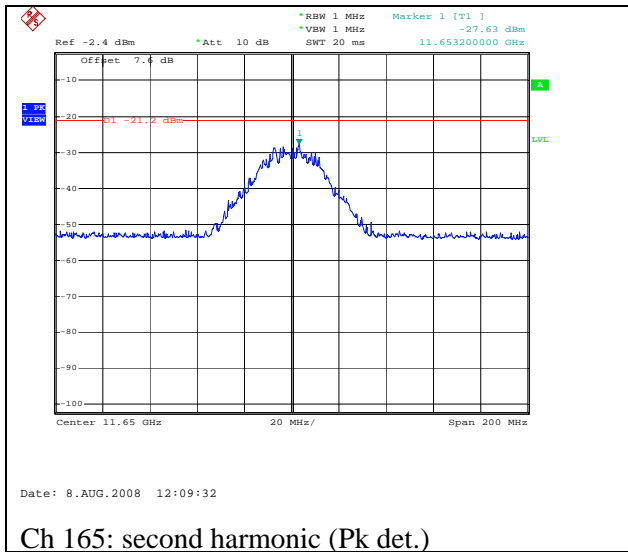
Date: 8.AUG.2008 12:04:36

Ch 157: second harmonic (Pk det.)



Date: 8.AUG.2008 12:01:41

Ch 157: second harmonic (Av det.)



7.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : KDB Publication No. 558074(high pass filter used at channel 11 only)
Ambient temperature : 24 °C
Relative humidity : 50 %

Not applicable.

7.7 Rx spurious emissions

Compliance standard	:	IC RSS-Gen, section 2.3
Method of test	:	IC RSS-Gen, section 4.10 & 7.2.3.1
Ambient temperature	:	24 °C
Relative humidity	:	50 %

Not performed.

This phenomenon is covered with the sample in 802.11n (40 MHz) mode, see section 9.7.

8 Emission tests 802.11n (40 MHz) 2400 – 2483.5 MHz band

8.1 Minimum 6 dB bandwidth

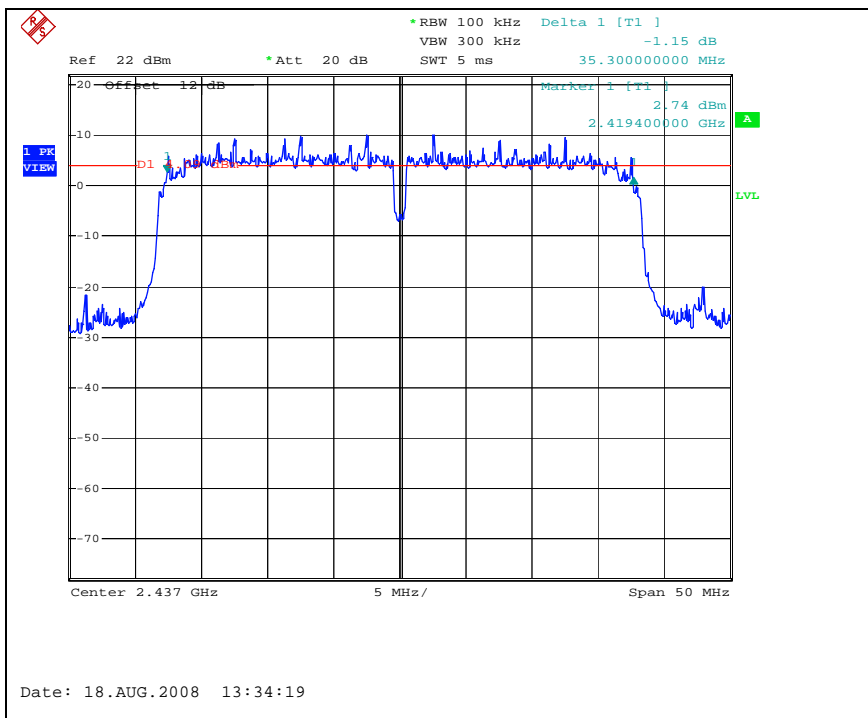
Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 3	Channel 6	Channel 9
35.1 MHz	35.3 MHz	35.1 MHz

Channel 6 plot



Measurement uncertainty: + 23/- 23 kHz

8.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 3	Channel 6	Channel 9	
30 dBm	30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	36 dBm	Limit (radiated)
12.7 dBm	18.7 dBm	11.3 dBm	Measured. value (conducted)
15.2 dBm E.I.R.P.	21.2 dBm E.I.R.P.	13.8 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ - 2.7 dB

8.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

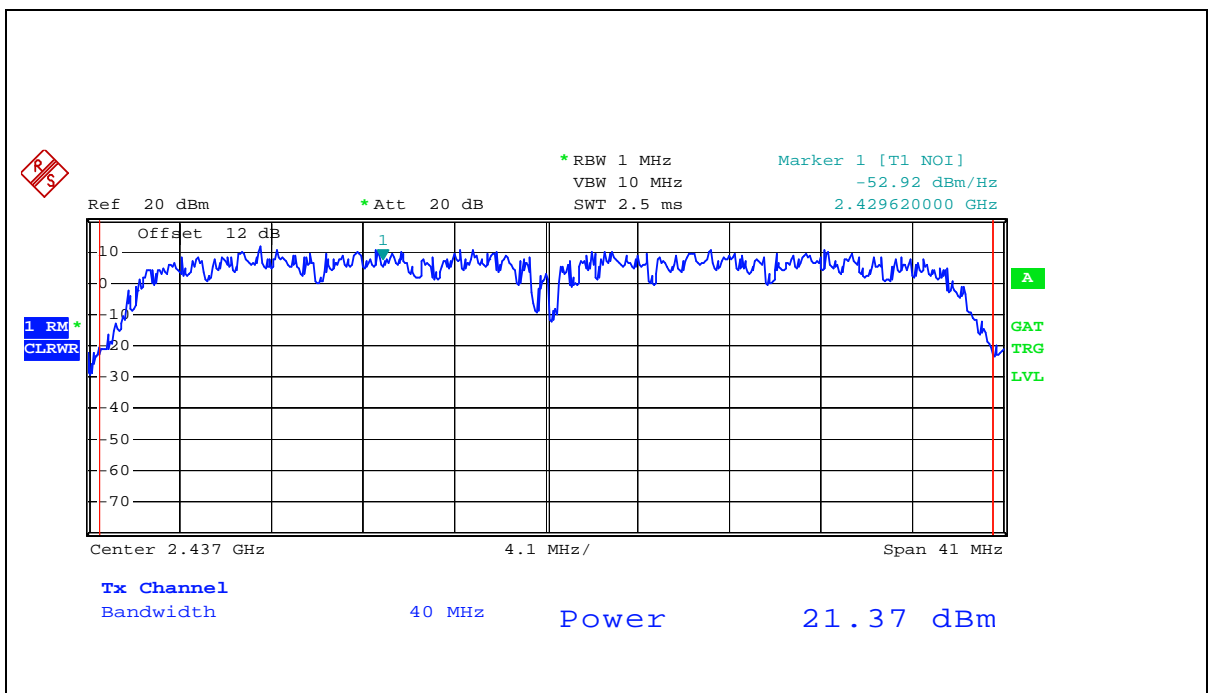
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 3	Channel 6	Channel 9	
8 dBm/3 kHz	8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-23.2 dBm/3 kHz	-18 dBm/3 kHz	-24.8 dBm/3 kHz	Measured. value (conducted)
-20.7 dBm/3 kHz E.I.R.P.	-15.5 dBm/3 kHz E.I.R.P.	-22.3 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 6 plot



Measurement uncertainty: + 2.4/ -2.7 dB

8.4 Attenuation of unwanted emissions

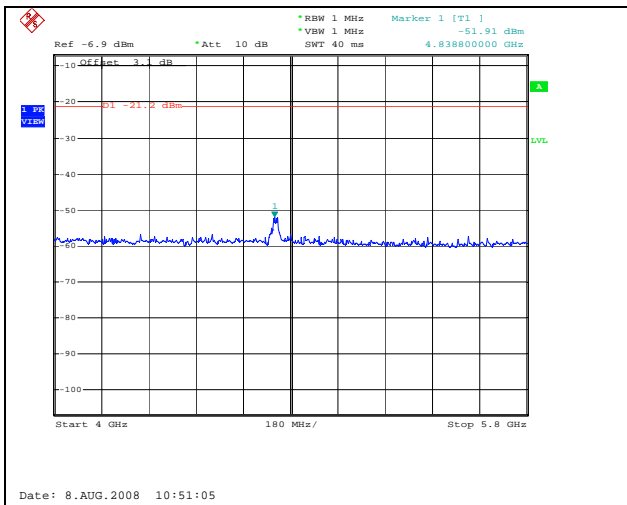
Compliance standard	:	FCC part 15, subpart C, section 15.247 (d)
Method of test	:	ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2; FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
Ambient temperature	:	24 °C
Relative humidity	:	50 %
Test results	:	

Not performed.

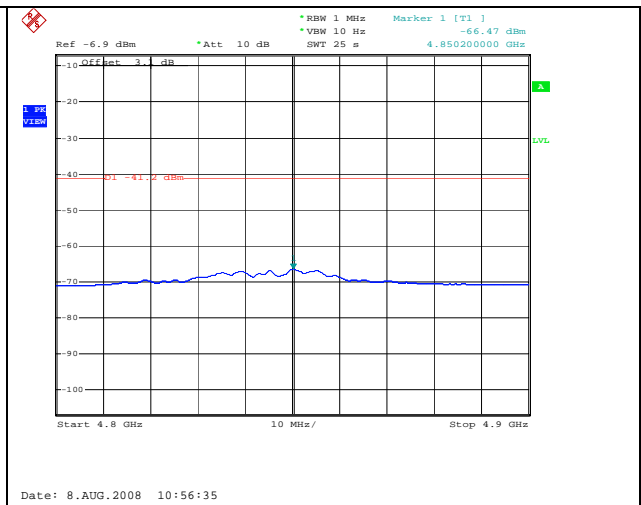
This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 5.4.

8.5 Field strength of unwanted emissions in the non-adjacent restricted bands

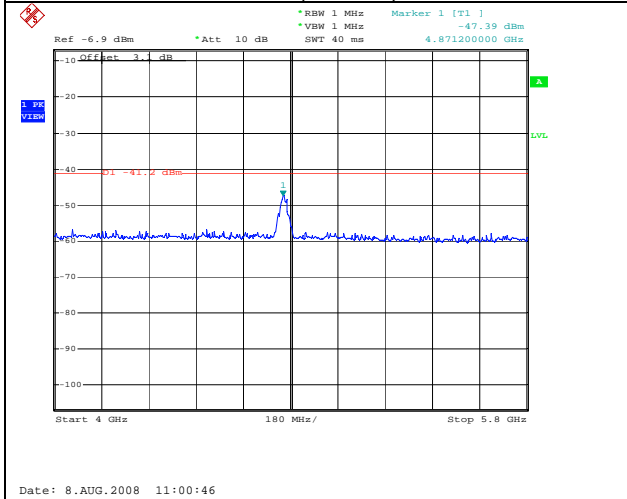
Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



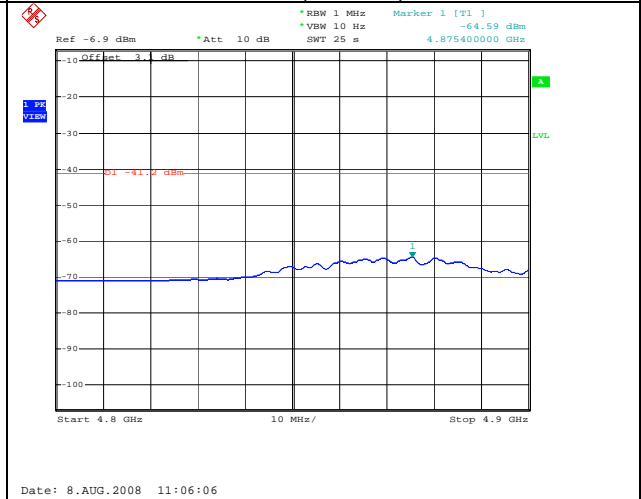
Ch 3: second harmonic (Pk det.)



Ch 3: second harmonic (Av det.)

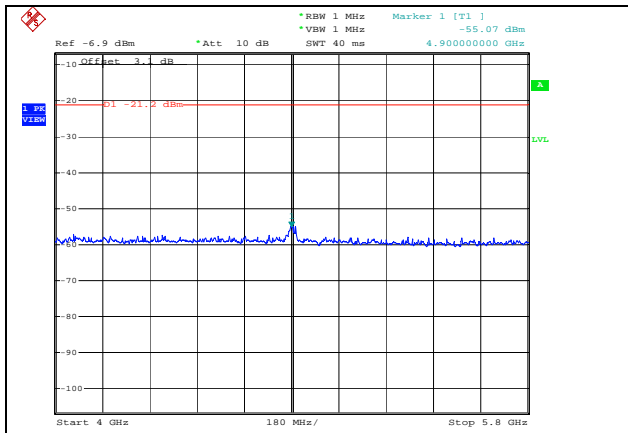


Ch 6: second harmonic (Pk det.)



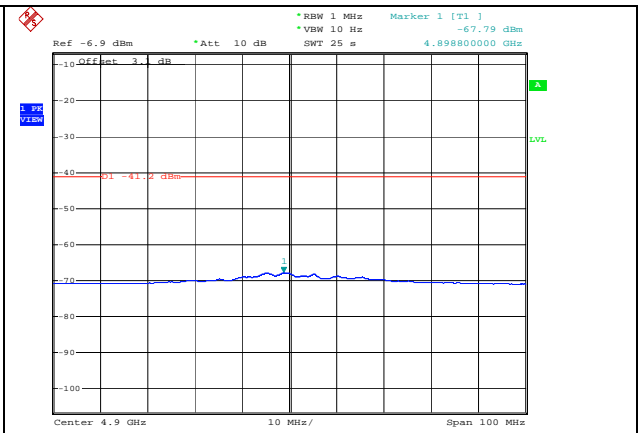
Ch 6: second harmonic (Av det.)

Field strength of unwanted emissions in the non-adjacent restricted bands (continued)



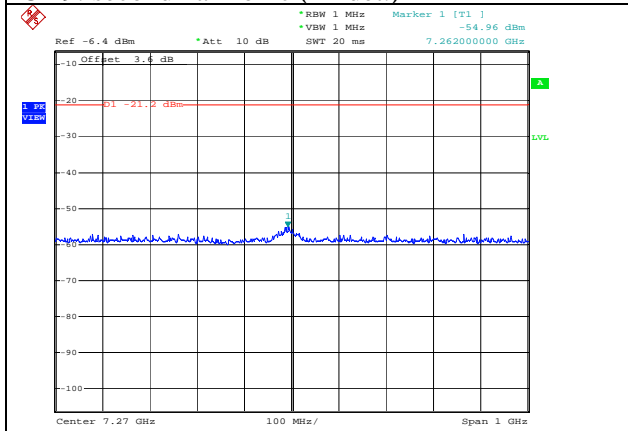
Date: 8.AUG.2008 11:10:22

Ch 9: second harmonic (Pk det.)



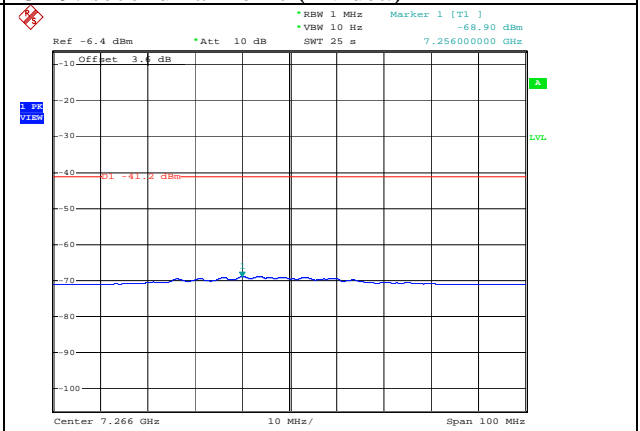
Date: 8.AUG.2008 11:15:12

Ch 9: second harmonic (Av det.)



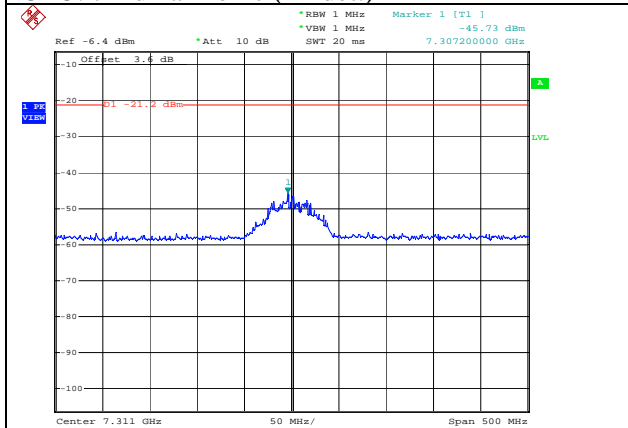
Date: 11.AUG.2008 11:28:55

Ch 3: third harmonic (Pk det.)



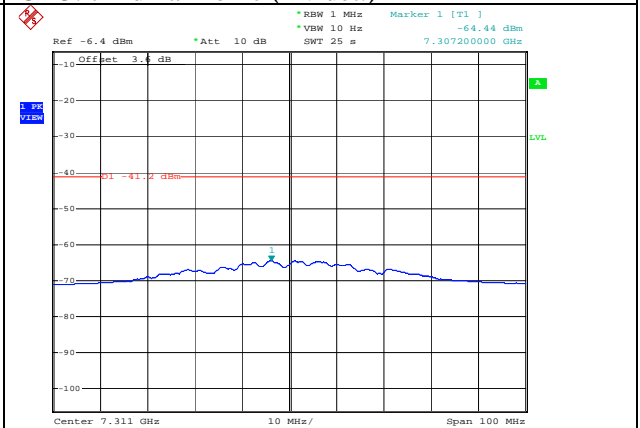
Date: 11.AUG.2008 11:34:47

Ch 3: third harmonic (Av det.)



Date: 11.AUG.2008 13:48:41

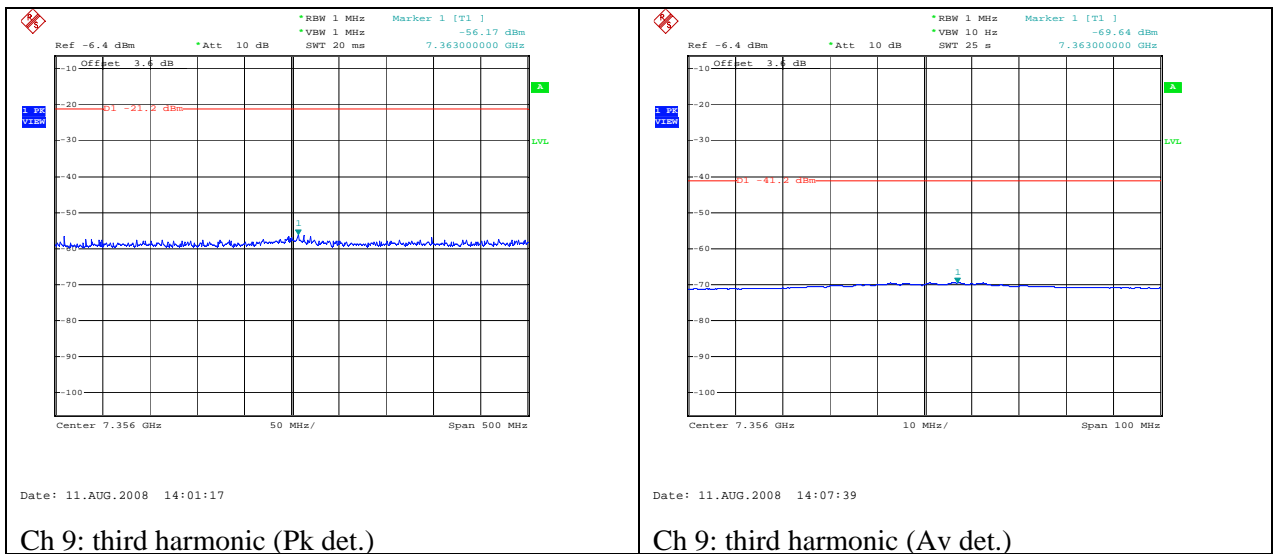
Ch 6: third harmonic (Pk det.)



Date: 11.AUG.2008 13:15:18

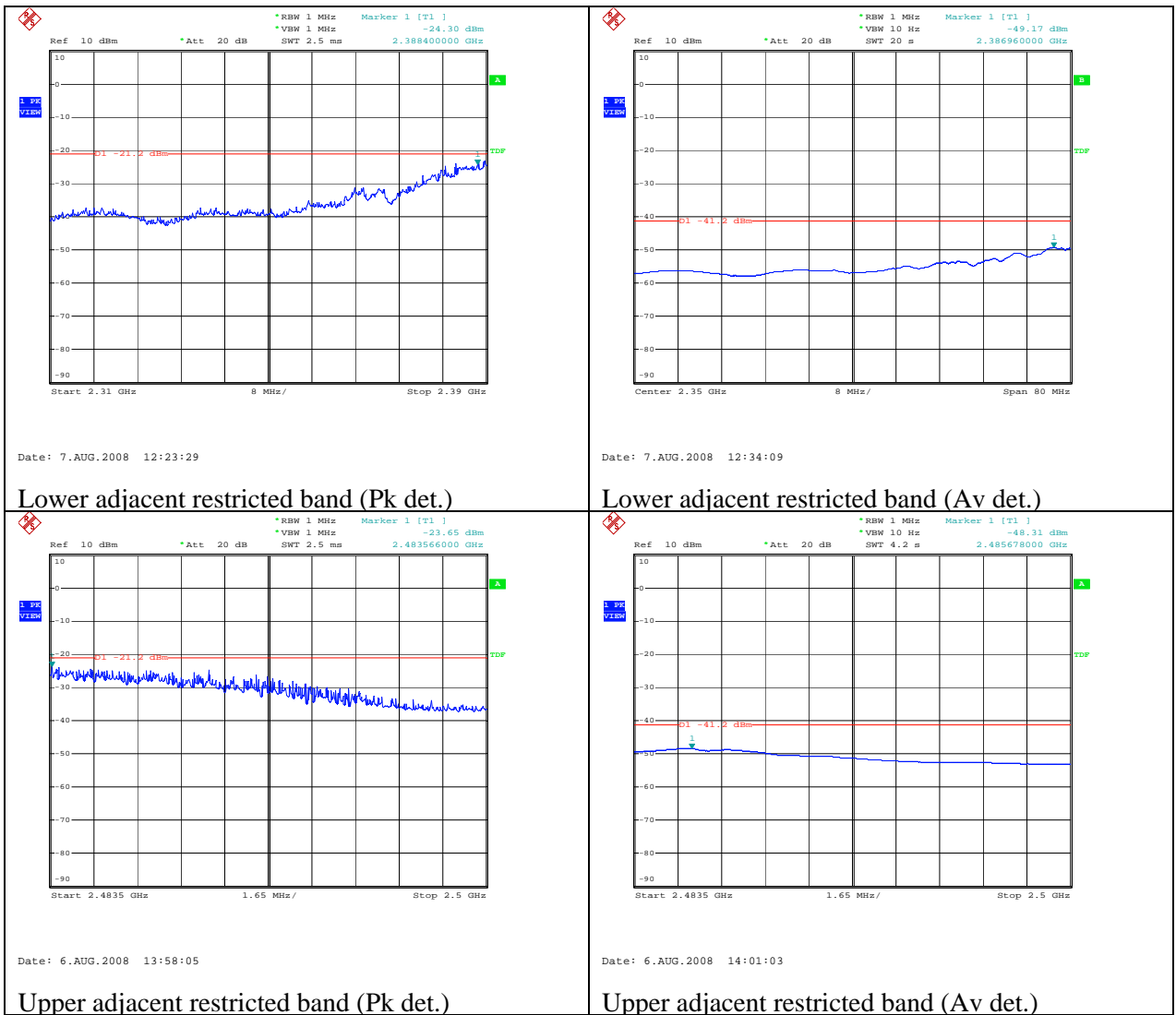
Ch 6: third harmonic (Av det.)

Field strength of unwanted emissions in the non-adjacent restricted bands (continued)



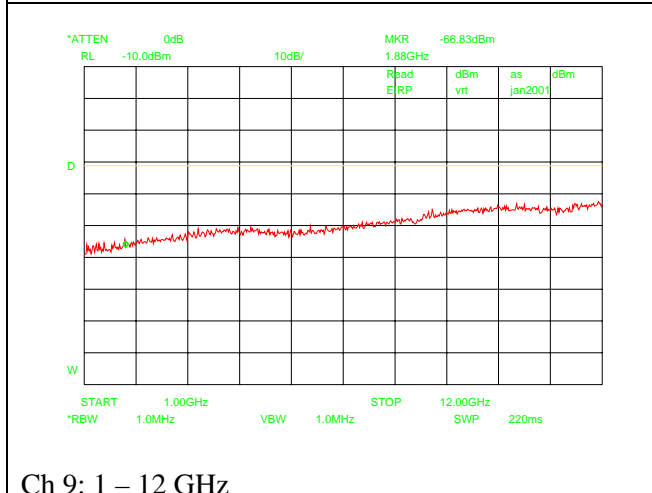
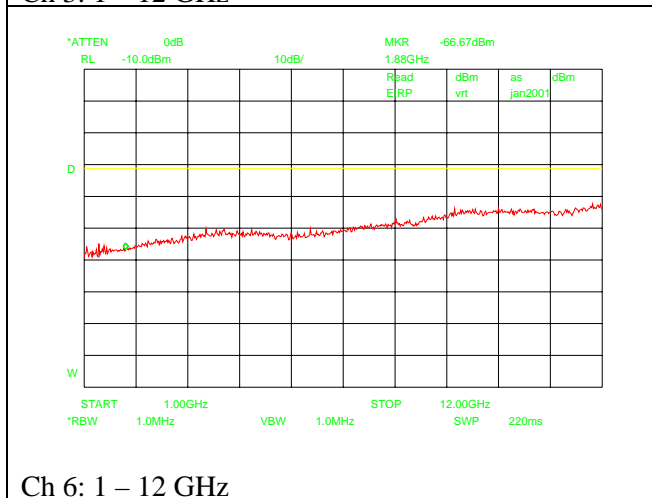
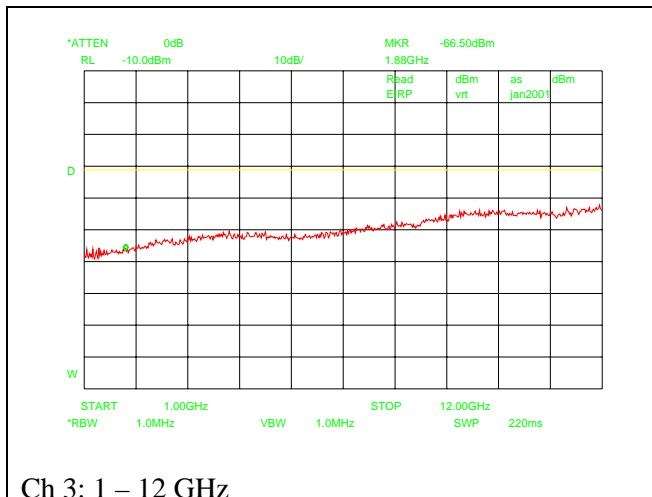
8.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



8.7 Rx spurious emissions

Compliance standard : IC RSS-Gen, section 2.3
 Method of test : IC RSS-Gen, section 4.10 & 7.2.3.1
 Ambient temperature : 24 °C
 Relative humidity : 50 %



9 Emission tests 802.11n (40 MHz) 5725 – 5850 MHz band

9.1 Minimum 6 dB bandwidth

Compliance standard : FCC part 15, subpart C, §15.247 (a)(2)
Method of test : KDB Publication No. 558074

Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 151	Channel 159
35.3 MHz	35.1 MHz

Measurement uncertainty: + 23/- 23 kHz

9.2 Peak power output

Compliance standard : FCC part 15, subpart C, section 15.247 (b)(3)
 Method of test : KDB Publication No. 558074, option 2, method #1

Ambient temperature : 24 °C
 Relative humidity : 50 %

Test results :

Channel 149	Channel 157	
30 dBm	30 dBm	Limit (conducted)
36 dBm	36 dBm	Limit (radiated)
18.9 dBm	18.4 dBm	Measured. value (conducted)
24.2 dBm E.I.R.P.	23.9 dBm E.I.R.P.	Calculated value (radiated)

Measurement uncertainty: + 2.4/ - 2.7 dB

9.3 Peak power spectral density

Compliance standard : FCC part 15, subpart C, section 15.247 (e)
Method of test : KDB Publication No. 558074, PSD Option 1

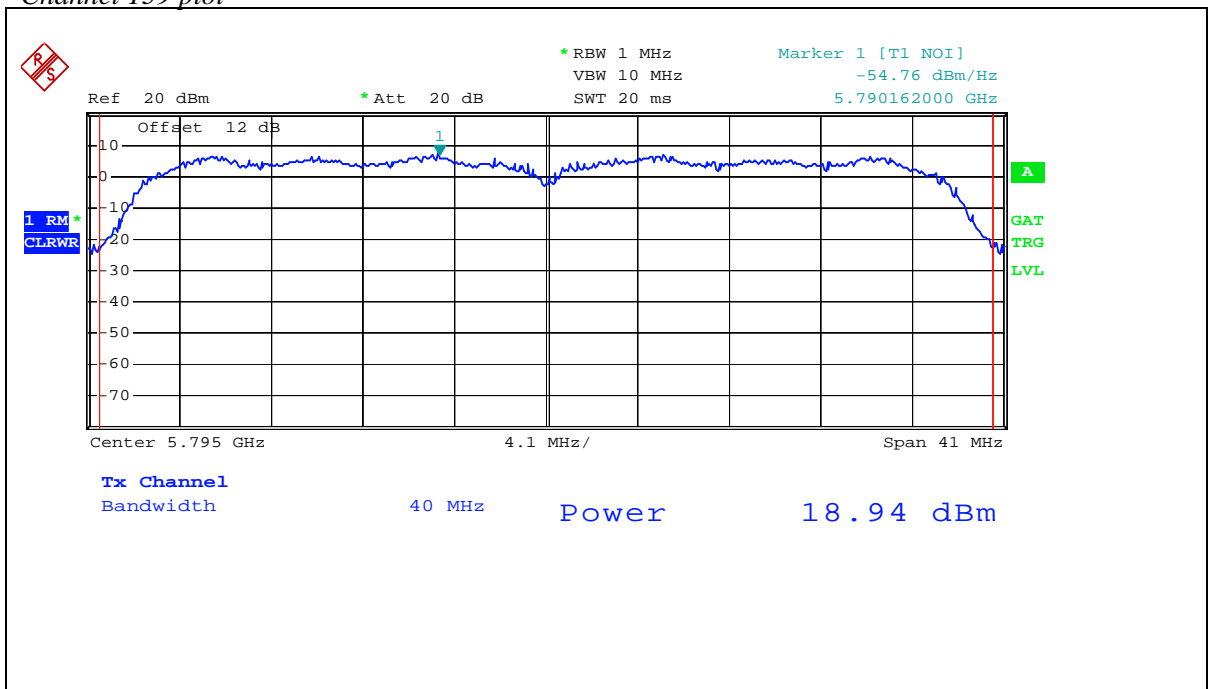
Ambient temperature : 24 °C
Relative humidity : 50 %

Test results :

Channel 149	Channel 159	
8 dBm/3 kHz	8 dBm/3 kHz	Limit (conducted)
14 dBm/3 kHz	14 dBm/3 kHz	Limit (radiated)
-19.7 dBm/3 kHz	-19.8 dBm/3 kHz	Measured. value (conducted)
-14.2 dBm/3 kHz E.I.R.P.	-14.3 dBm/3 kHz E.I.R.P.	Calculated value (radiated)

Following FCC KDB Publication No. 558074, PSD Option 1, the noise power density has been normalized to 1 Hz and corrected to 3 kHz by adding 35 dB (10 log(3000)).

Channel 159 plot



Measurement uncertainty: + 2.4/ -2.7 dB

9.4 Attenuation of unwanted emissions

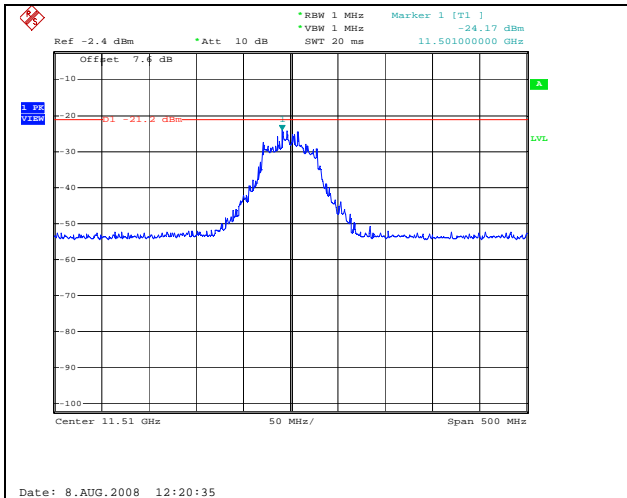
Compliance standard	:	FCC part 15, subpart C, section 15.247 (d)
Method of test	:	ANSI C63.4-2003, sections 5.5, 8.2.3, 8.2.4 & 8.3.1.2; FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
Ambient temperature	:	24 °C
Relative humidity	:	50 %
Test results	:	

Not performed.

This phenomenon is covered with the sample in 802.11n (20 MHz) mode, see section 7.4.

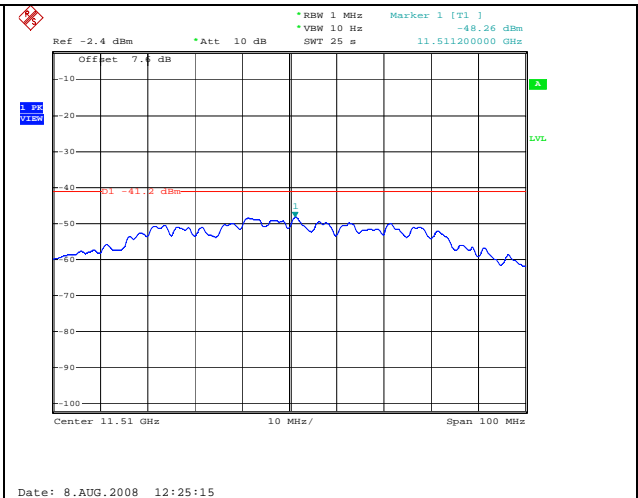
9.5 Field strength of unwanted emissions in restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
 Method of test : KDB Publication No. 558074
 Ambient temperature : 24 °C
 Relative humidity : 50 %



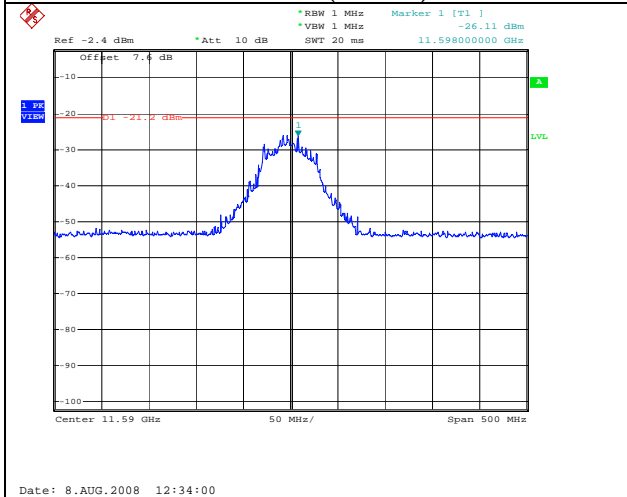
Date: 8.AUG.2008 12:20:35

Ch 151: second harmonic (Pk det.)



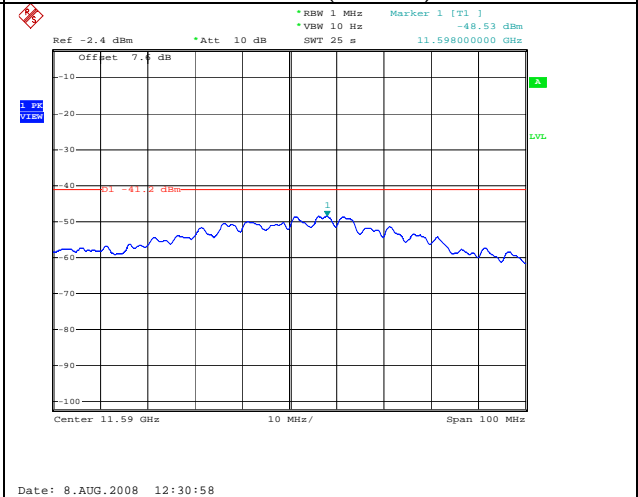
Date: 8.AUG.2008 12:25:15

Ch 151: second harmonic (Av det.)



Date: 8.AUG.2008 12:34:00

Ch 159: second harmonic (Pk det.)



Date: 8.AUG.2008 12:30:58

Ch 159: second harmonic (Av det.)

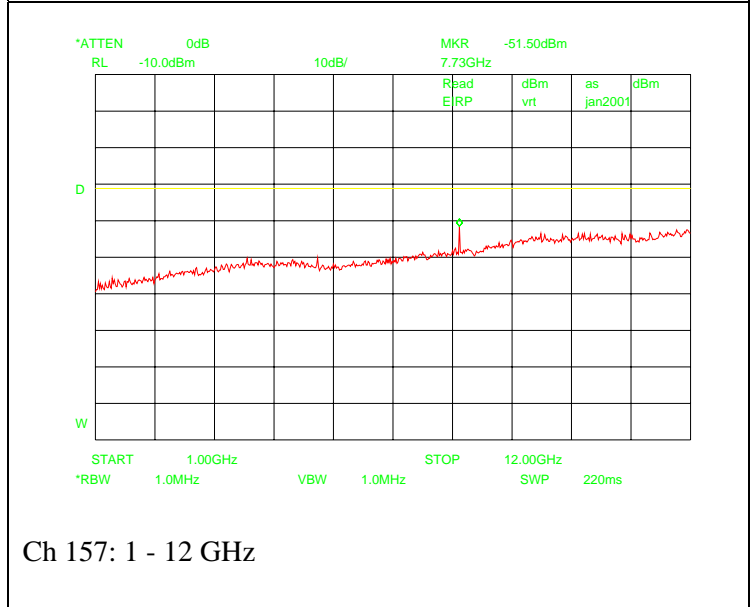
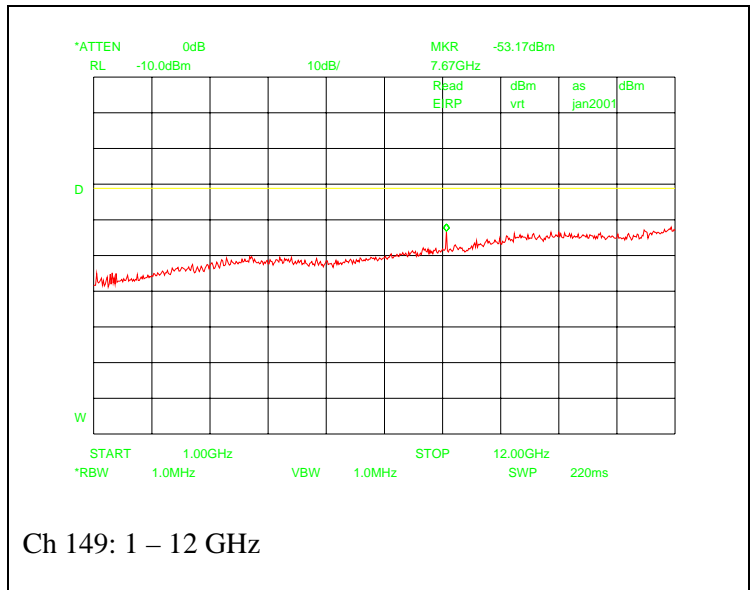
9.6 Field strength of unwanted emissions in adjacent restricted bands

Compliance standard : FCC part 15, subpart C, section 15.205(a)
Method of test : KDB Publication No. 558074
Ambient temperature : 24 °C
Relative humidity : 50 %

Not applicable.

9.7 Rx spurious emissions

Compliance standard : IC RSS-Gen, section 2.3
 Method of test : IC RSS-Gen, section 4.10 & 7.2.3.1
 Ambient temperature : 24 °C
 Relative humidity : 50 %



10 Maximum permissible exposure

Compliance standard : FCC part 1, section 1.1307(b)(1)
IC Safety Code 6, section 2.2.1 (a)

Power density with 100 % reflection:

Mode	Band	MPE Distance (cm)	Output power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)	IC power Density (W/m ²)
802.11a	5.8 GHz	20	17.5	5.5	0.160	1.60
802.11b	2.4 GHz	20	19.0	2.5	0.112	1.12
802.11g	2.4 GHz	20	21.7	2.5	0.208	2.08
802.11n (20 MHz)	2.4 GHz	20	21.8	2.5	0.212	2.12
802.11n (40 MHz)	2.4 GHz	20	18.7	2.5	0.104	1.04
802.11n (20 MHz)	5.8 GHz	20	17.7	5.5	0.168	1.68
802.11n (40 MHz)	5.8 GHz	20	18.9	5.5	0.220	2.20

Power density with 0 % reflection:

Mode	Band	MPE Distance (cm)	Output power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)	IC power Density (W/m ²)
802.11a	5.8 GHz	20	17.5	5.5	0.040	0.40
802.11b	2.4 GHz	20	19.0	2.5	0.028	0.28
802.11g	2.4 GHz	20	21.7	2.5	0.052	0.52
802.11n (20 MHz)	2.4 GHz	20	21.8	2.5	0.053	0.53
802.11n (40 MHz)	2.4 GHz	20	18.7	2.5	0.026	0.26
802.11n (20 MHz)	5.8 GHz	20	17.7	5.5	0.042	0.42
802.11n (40 MHz)	5.8 GHz	20	18.9	5.5	0.055	0.55

Used test equipment module

Description	Telef. ID	Manufacturer	Model
Spectrum Analyzer	TE 00481	Hewlett Packard	HP 8563E
Spectrum Analyzer	TE 11125	Rohde & Schwarz	FSP 40
EMI test receiver	TE 11128	Rohde & Schwarz	ESCI
BiLog antenna	TE 00967	Chase	CBL6112A
Artificial mains network	TE 00208	Rohde & Schwarz	ESH3-Z5
RF Pre-amplifier up to 1000 MHz	TE 00098	Rohde & Schwarz	ESV-Z3
RF Pre-amplifier 1 – 20.0 GHz	TE 00092	Hewlett Packard	HP 8349A
RF Pre-amplifier 1 - 26.5 GHz	TE 00093	Hewlett Packard	HP 8449B
Anechoic chamber	TE 01064	Euroshield	RFD-F-100
Biconilog antenna	TE 00700	Emco	3143
DRG Antenna	TE 00531	Emco	3115
Horn Antenna	TE 00607	Scientific Atlanta	12-12
Horn Antenna	TE 00611	Scientific Atlanta	12-5.8
Horn antenna	TE00610	Scientific Atlanta	12-8.2
Horn antenna	TE00612	Scientific Atlanta	12-3.9
DRG antenna	TE00533	Emco	3116
Pre amplifier	TE11131	Miteq	JS4-18004000
Antenna tower	--	HD	AS 620p
Turntable	--	HD	DS 412
Turntable controller	--	HD	HD 050
Attenuator	TE 00500	Hewlett Packard	HP 8459D
Laptop		Dell	

Cross reference table

Transmitter	
IC RSS-210 Issue 7, Annex 8	FCC 47 CFR Ch. 1 part 15, subpart C (10-1-07 Edition)
A8.2 (a)	§ 15.247 (a) (2)
A8.4 (4)	§ 15.247 (b) (3)
A8.2 (b)	§ 15.247 (e)
A8.5	§ 15.247 (d)
Receiver	
IC RSS-Gen Issue 2	
§ 7.2.3	--
IC RSS-Gen Issue 2	FCC 47 CFR Ch. 1 part 15, subpart C (10-1-07 Edition)
§ 7.2.2	§ 15.207 (a)

Revision history

REVISION	DATE	REMARKS
1.0	14 October 2008	<ul style="list-style-type: none">- Added test modulation / data rate overview on page 8;- Added conducted emissions test results on page 9;- Corrected E.I.R.P. value (CH 1) on page 18;- Corrected E.I.R.P. values on page 24;- Corrected channel reference on page 31;- Added MPE values for 100 % reflection;- Peak power output test results tables completed with limits;- Peak power spectral density test results tables completed with limits;- Corrected several references to the operating band 5725 – 5850 MHz;- FCC registration number added in section 3 of 'Main module'.