

# RADIO TEST REPORT

No. 1101225-1

## EQUIPMENT UNDER TEST

Equipment: IEEE 802.11b+g WLAN Chipset on a  
reference platform  
Type / model: HDG104  
Manufacturer: H&D Wireless AB  
Tested by request of: H&D Wireless AB

## SUMMARY

The equipment complies with the requirements of the following standards:

47 CFR, Part 15, Subpart B (2010) and Subpart C (2010);

RSS-GEN, Issue 3 (December 2010)  
RSS-210, Issue 8 (December 2010)

Industry Canada listed test facility No. IC 2042G-2

Date of issue: 2011-02-15

Tested by:



Niklas Boström

Approved by:



Stefan Andersson

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## 1. CLIENT INFORMATION

The EUT has been tested by request of

Company: H&D Wireless  
Sjövägen 17  
169 55 Solna  
Sweden

Name of contact: Pär Bergsten

## 2. EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification of the EUT according to the manufacturer/client declaration

Equipment:	IEEE 802.11b+g WLAN Chipset on a reference platform
Type / Model:	HDG104
Brand name:	--
Serial number:	0543
Manufacturer:	H&D Wireless
Rating/Supplying voltage:	3.3 V DC (HDG104 chip) 120 VAC, 60 Hz (Peripheral host computer)
Rating RF output power:	18 dBm
Antenna gain:	max 2 dBi
External antenna connector:	Yes
Operating temperature range:	-20 to +55 °C
Frequency range:	2400 - 2483,5 MHz
Number of channels:	13
Modulation characteristics:	802.11 b/g
Stand by mode supported:	Yes
Low channel = 1	2412 MHz
Mid channel = 7	2442 MHz
High channel = 11	2462 MHz

## 2.2 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT, but not included as part of the EUT.

Equipment	Manufacturer / Type	Serial number
PC	Dell Dimension 5100	--
SD-card	SPB104	0543
PCMCIA-card	SPB479	R2A #28

## 2.3 Modifications during the test

No modifications have been made during the tests.

## 2.4 Additional information about the EUT

The EUT (HDG104) was mounted on a reference SD-card (SPB104). The SD-card was connected to a PCMCIA-card (SPB479) that was connected to a computer.

### 3. TEST SPECIFICATIONS

#### 3.1 Standards

FCC 47 CFR part 15 (2010) Subpart B – Unintentional radiators

FCC 47 CFR part 15 (2010) Subpart C – Intentional Radiators; §15.247 Operation within the bands 902-928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz.

RSS-Gen, Issue 3 (December 2010): General Requirements and Information for the Certification of Radiocommunication Equipment

RSS-210, Issue 8 (December 2010): Low Power Licence-Exempt Radio communication Devices (All Frequency Bands): Category I Equipment.

Measurements methods according to

ANSI C63.4-2009 - Methods of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

and

ANSI C63.10-2009 - Standard for Testing Unlicensed Wireless Devices

#### 3.2 Additions, deviations and exclusions from standards

No other additions, deviations or exclusions have been made from standards.

#### 3.3 Justification

Preliminary testing was performed for all channels and data rates (modulations). After that the highest and lowest data rate for 802.11b (1 and 11 Mbps) and for 802.11g (6 and 54 Mbps) were considered worst case and were selected for final measurements. Radiated measurements were done for the 6Mbps mode since this mode had the highest conducted output power.

#### 3.4 Test set-up

Measurement set-ups for the test of out-of-band spurious emissions test are described in corresponding sections. During other tests the EUT was connected to the spectrum analyzer or peak power meter by cable.

During all tests the EUT was powered with 3.3 V DC from the computer. The computer was powered with 120 V AC, 60 Hz.

#### 3.5 Operating environment

If not additionally specified, the tests were performed under the following environmental conditions:

Air temperature: 20-25 °C  
Relative humidity: 25-40 %

#### 4. TEST SUMMARY

The results in this report apply only to the sample tested.

FCC reference	IC reference	Test	Result	Note
15.247(b)	RSS-210 A8.4 (4)	Peak output power	PASS	
15.247(a)	RSS-210 A8.2 (a)	6 dB Bandwidth	PASS	
15.247(a)	RSS-210 A8.2 (b)	Spectral power density	PASS	
15.247(d)	RSS-210 A8.5	Band edge compliance	PASS	
15.247(d)	RSS-210 A8.5	Out of band spurious emissions, radiated	PASS	
15.247(d)	RSS-210 A8.5	Out of band spurious emissions, conducted	PASS	
15B	RSS-Gen Table 2	Out of band spurious emissions, radiated	PASS	
15B	RSS-Gen Table 4	Conducted emission at AC port	PASS	

NT = Not Tested

NA = Not Applicable

## 5. PEAK OUTPUT POWER

### 5.1 Test equipment

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Power Meter	Rhode & Schwarz	NRVD	8745	2011-07
Peak Power Sensor	Rhode & Schwarz	NRV-Z31	7411	2011-07
Cable	Huber + Suhner	Sucoflex 104	5188	2011-07
RF attenuator	Hewlett Packard	8491A	30088	2011-07

### 5.2 Test protocol

Date of test: 2011-01-27

#### 802.11b, 1 Mbps data rate

Channel (MHz)	Peak power dBm	Limit value (dBm)
2412	18.2	30
2442	16.8	
2462	17.1	

#### 802.11b, 11 Mbps data rate

Channel (MHz)	Peak power dBm	Limit value (dBm)
2412	18.2	30
2442	16.9	
2462	17.1	

#### 802.11g, 6 Mbps data rate

Channel (MHz)	Peak power dBm	Limit value (dBm)
2412	18.6	30
2442	18.9	
2462	18.4	

#### 802.11g, 54 Mbps data rate

Channel (MHz)	Peak power dBm	Limit value (dBm)
2412	18.3	30
2442	18.7	
2462	18.1	

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

Peak output power [dBm] = Power meter reading [dBm] + cable loss [dB] + Attenuator [dB]

## 6. 6 dB BANDWIDTH

### 6.1 Test equipment

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Signal Analyzer	Rhode & Schwarz	FSIQ	12793	2011-07
Cable	Huber + Suhner	Sucoflex 104	5188	2011-07
RF attenuator	Hewlett Packard	8491A	30088	2011-07

### 6.2 Test protocol

Date of test: 2011-01-27

Spectrum analyzer display is corrected for attenuation in the set-up configuration.

#### 802.11b, 1 Mbps data rate

Channel (MHz)	6 dB Bandwidth (MHz)	Plot	Limit value (MHz)
2412	10.281	plot P6.1	> 0.5
2442	10.341	plot P6.2	
2462	10.281	plot P6.3	

#### 802.11b, 11 Mbps data rate

Channel (MHz)	6 dB Bandwidth (MHz)	Plot	Limit value (MHz)
2412	9.800	plot P6.4	> 0.5
2442	9.619	plot P6.5	
2462	10.4008	plot P6.6	

#### 802.11g, 6 Mbps data rate

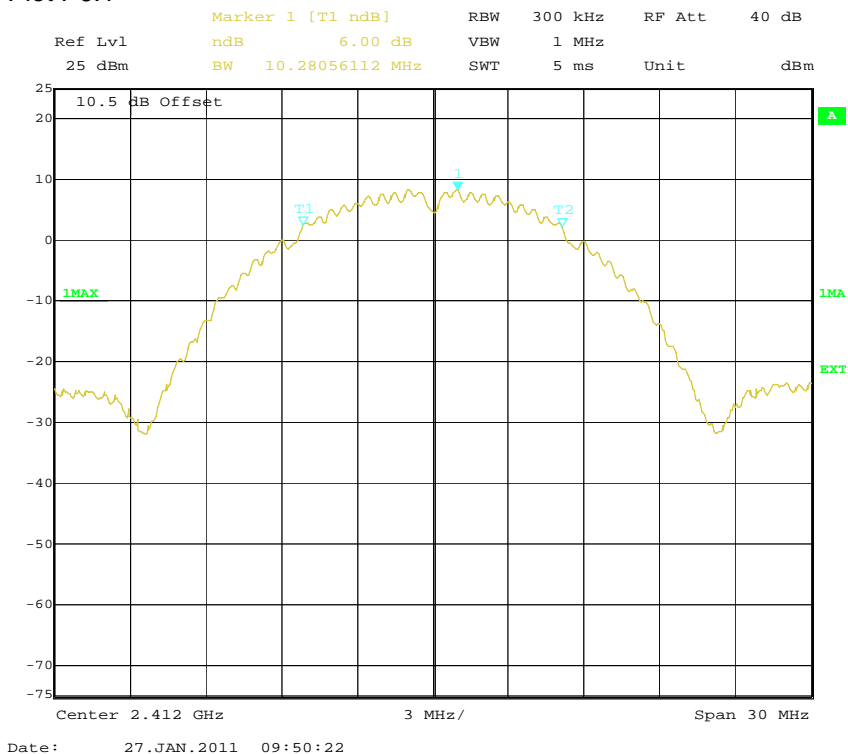
Channel (MHz)	6 dB Bandwidth (MHz)	Plot	Limit value (MHz)
2412	16.653	plot P6.7	> 0.5
2442	16.533	plot P6.8	
2462	16.593	plot P6.9	

#### 802.11g, 54 Mbps data rate

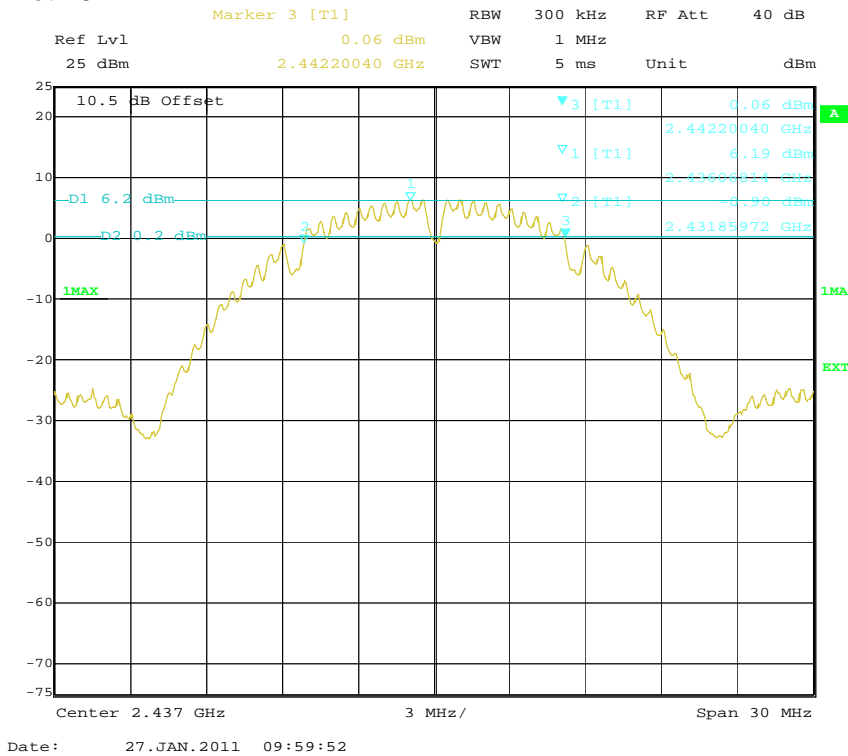
Channel (MHz)	6 dB Bandwidth (MHz)	Plot	Limit value (MHz)
2412	16.653	plot P6.10	> 0.5
2442	16.533	plot P6.11	
2462	16.593	plot P6.12	



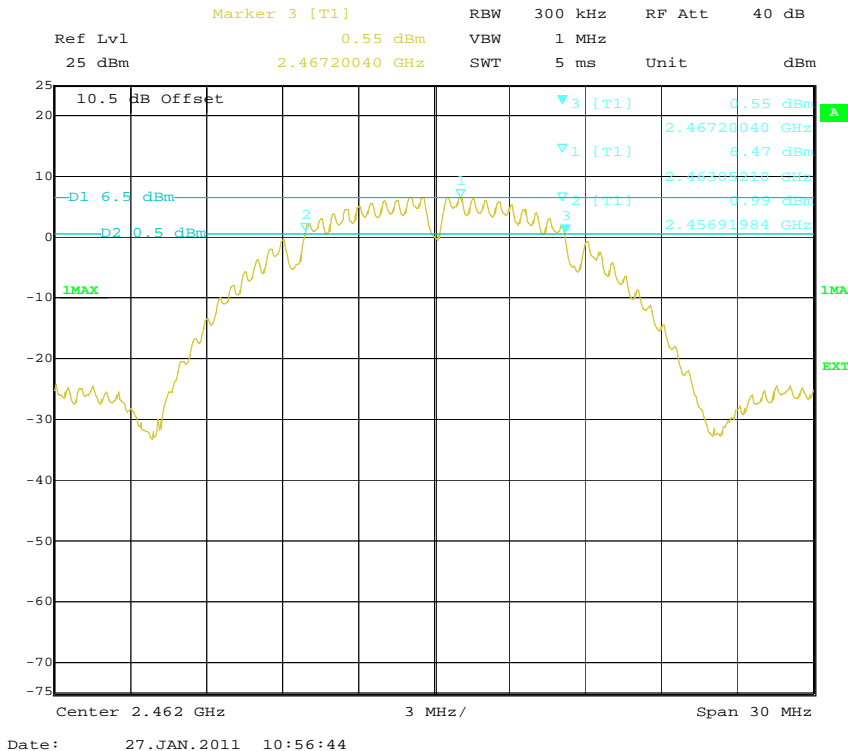
Plot P6.1



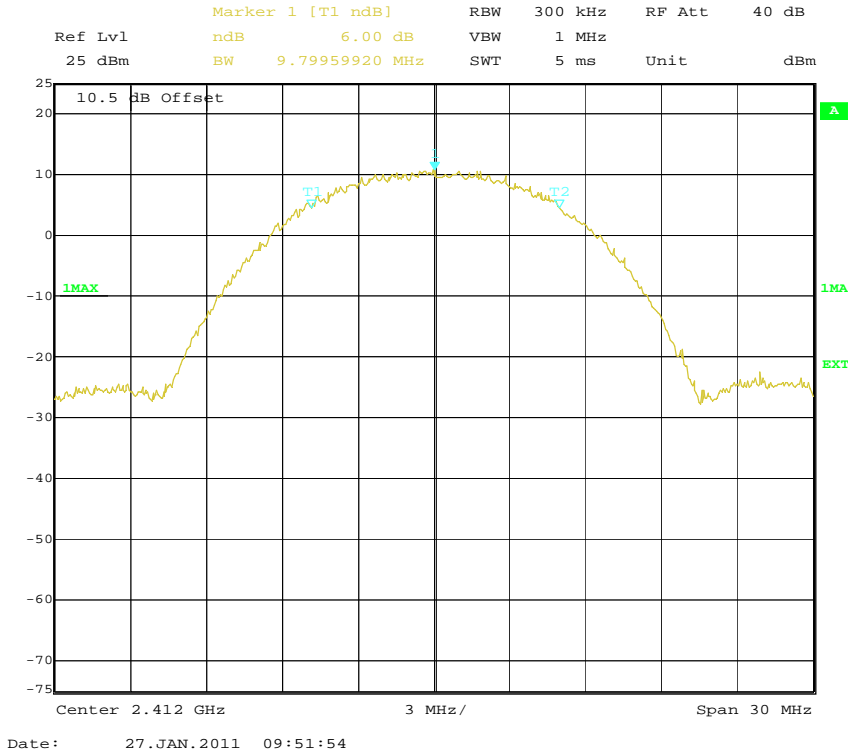
Plot P6.2



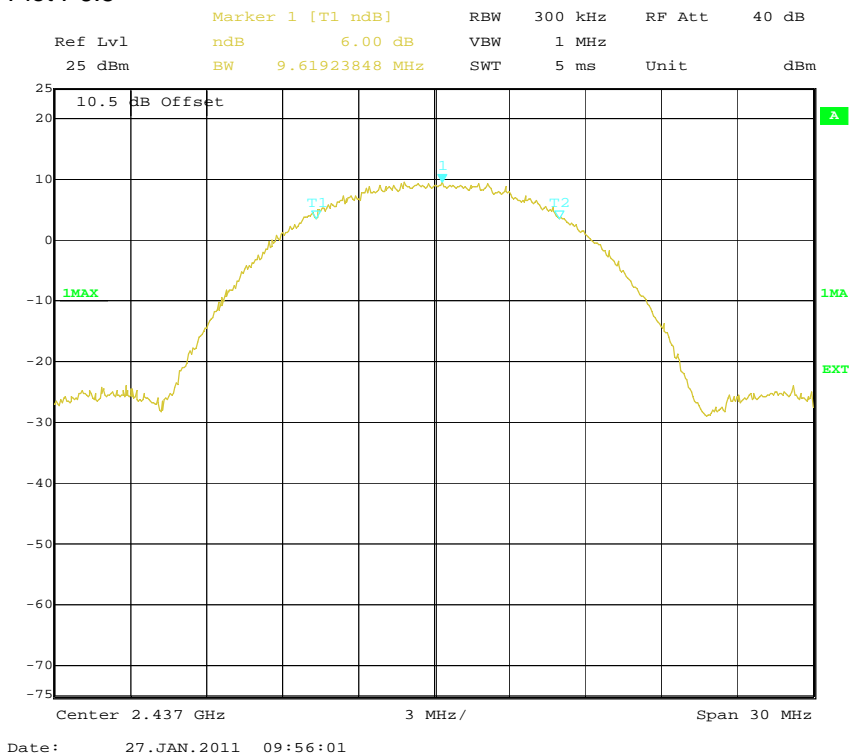
**Plot P6.3**



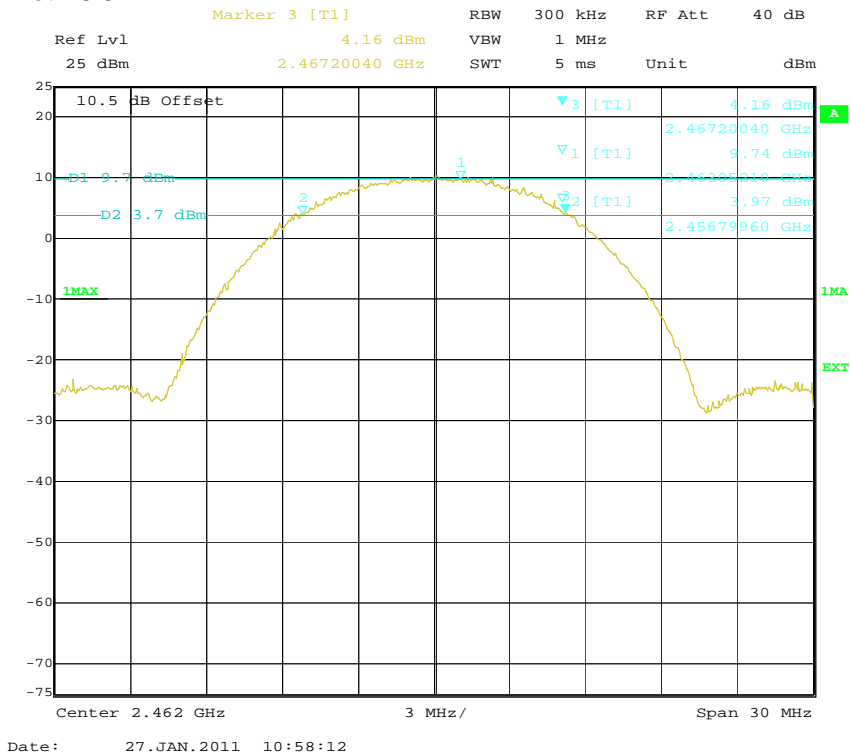
**Plot P6.4**



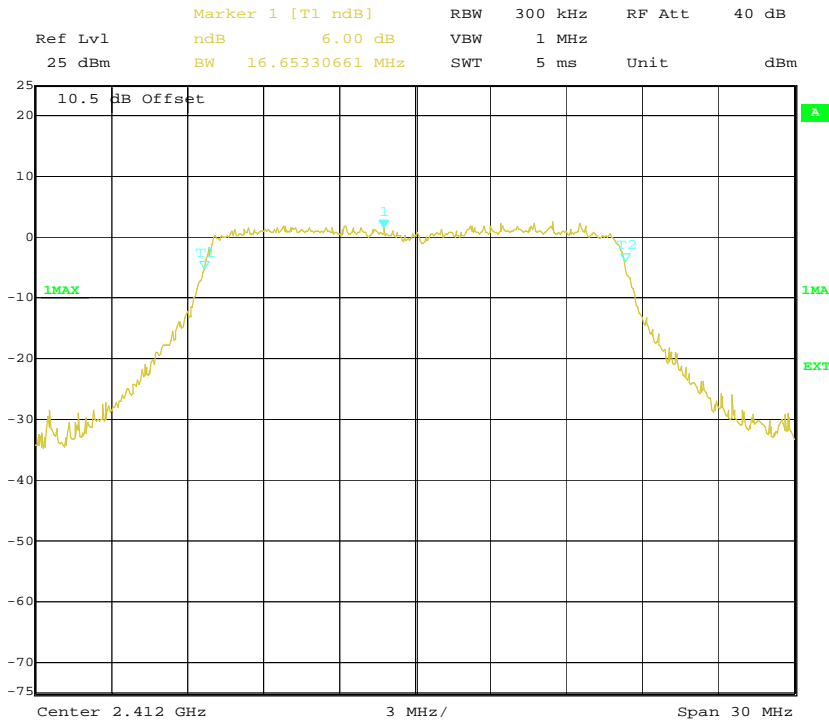
**Plot P6.5**



**Plot P6.6**

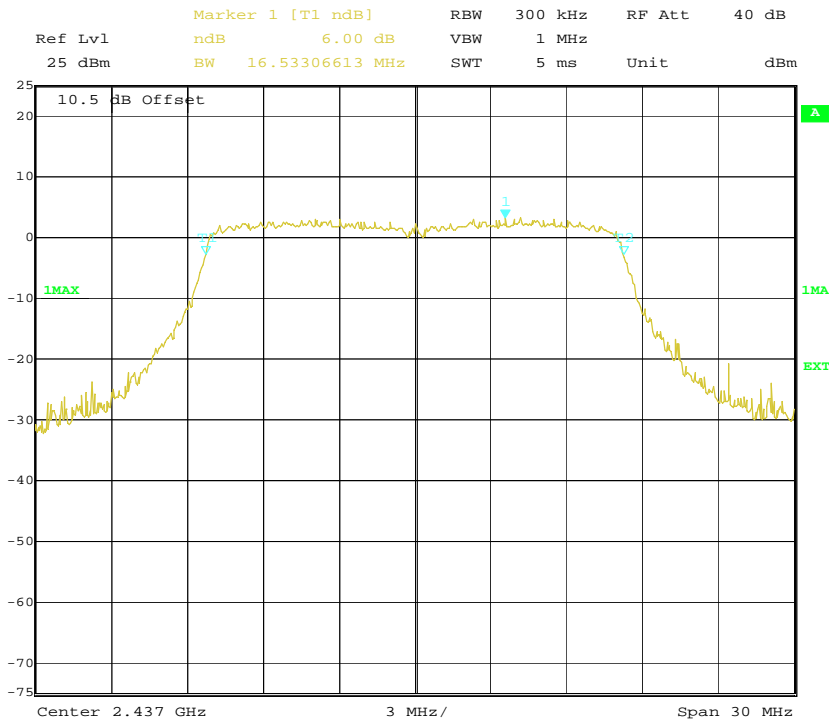


**Plot P6.7**



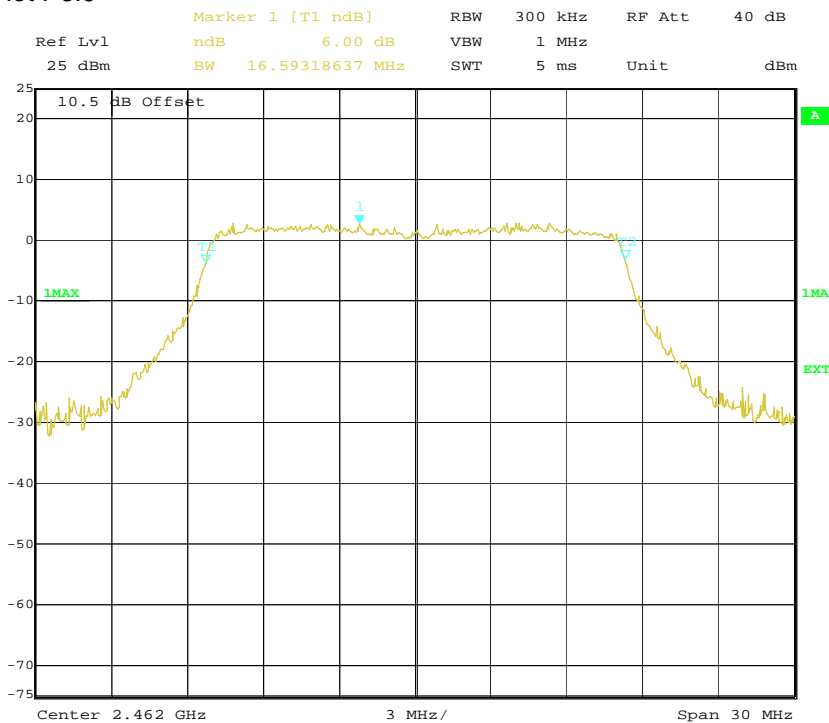
Date: 27.JAN.2011 09:51:19

**Plot P6.8**



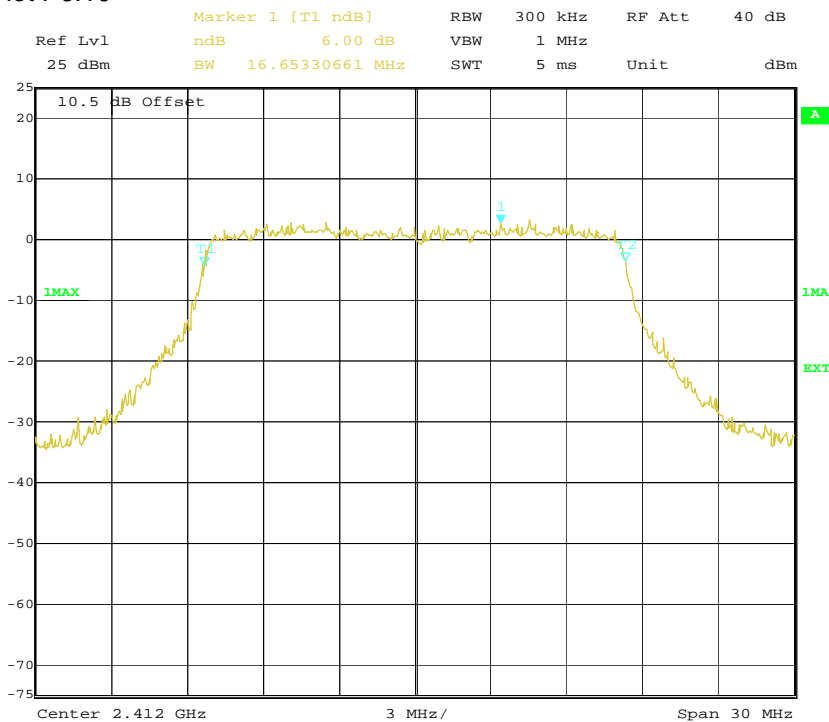
Date: 27.JAN.2011 09:54:11

Plot P6.9



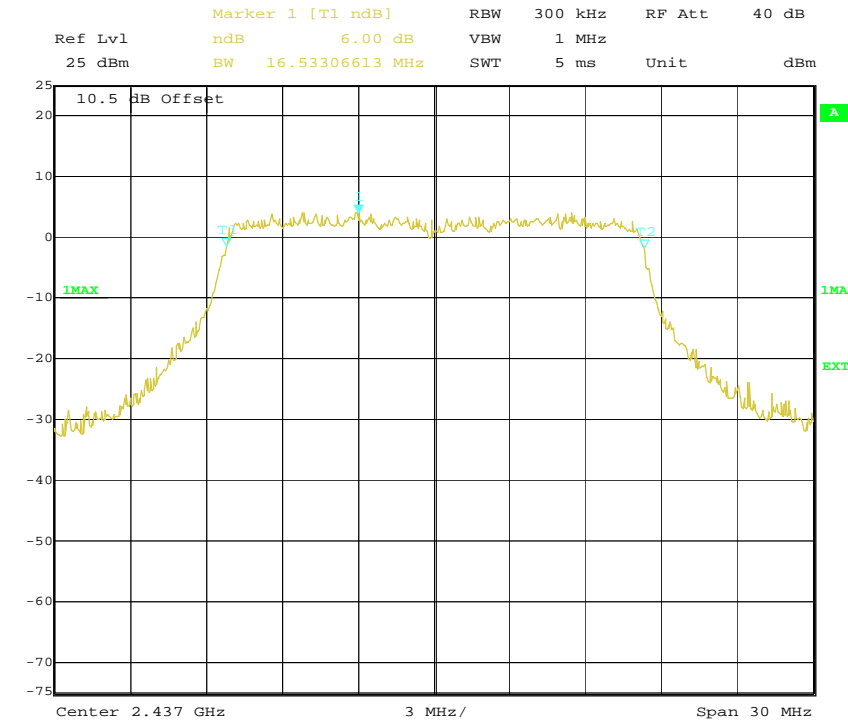
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Plot P6.10



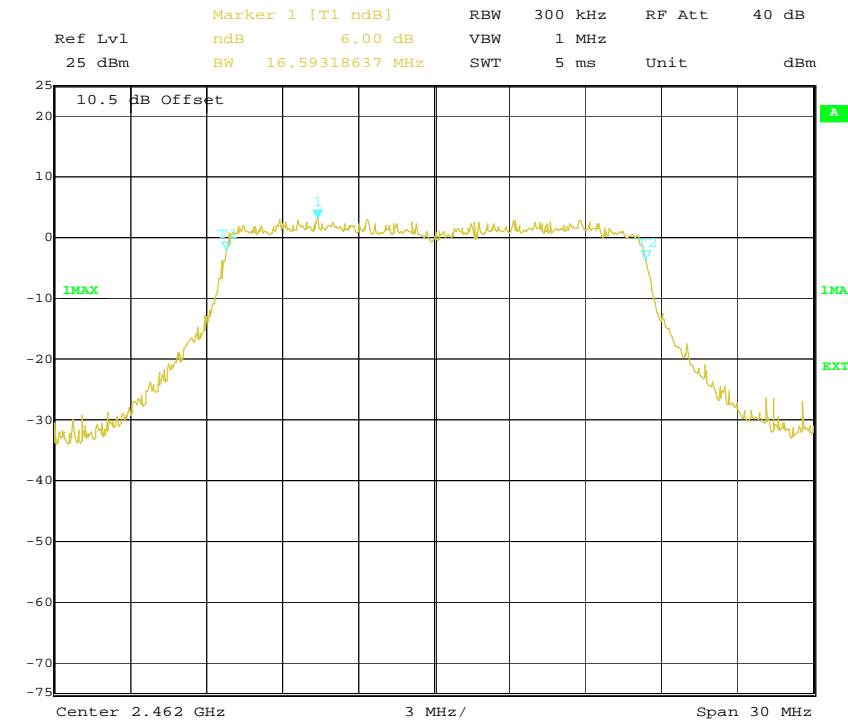
Date: 27.JAN.2011 09:52:46

**Plot P6.11**



Date: 27.JAN.2011 09:53:33

**Plot P6.12**



Date: 27.JAN.2011 11:00:04

**7. BAND EDGE COMPLIANCE, CONDUCTED**

**7.1 Test equipment**

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Signal Analyzer	Rhode & Schwarz	FSIQ	12793	2011-07
Cable	Huber + Suhner	Sucoflex 104	5188	2011-07
RF attenuator	Hewlett Packard	8491A	30088	2011-07

**7.2 Test protocol**

Date of test: 2011-01-27

**802.11b, 1 Mbps data rate**

Channel	Plot	Results	Limit value (dBc)
Low	plot P7.1	PASS	20
High	plot P7.2	PASS	20

**802.11b, 11 Mbps data rate**

Channel	Plot	Results	Limit value (dBc)
Low	plot P7.3	PASS	20
High	plot P7.4	PASS	20

**802.11g, 6 Mbps data rate**

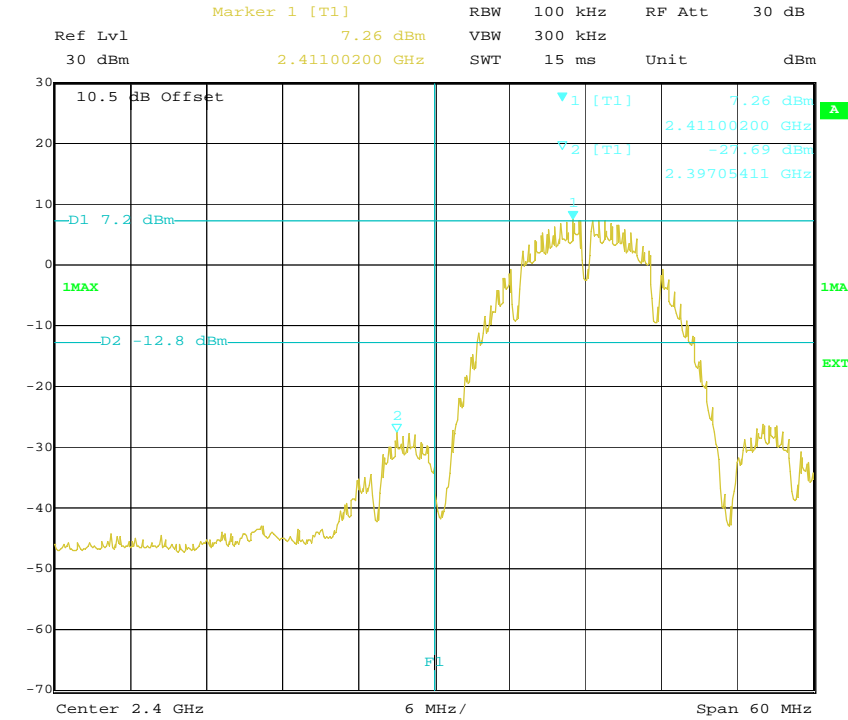
Channel	Plot	Results	Limit value (dBc)
Low	plot P7.5	PASS	20
High	plot P7.6	PASS	20

**802.11g, 54 Mbps data rate**

Channel	Plot	Results	Limit value (dBc)
Low	plot P7.7	PASS	20
High	plot P7.8	PASS	20

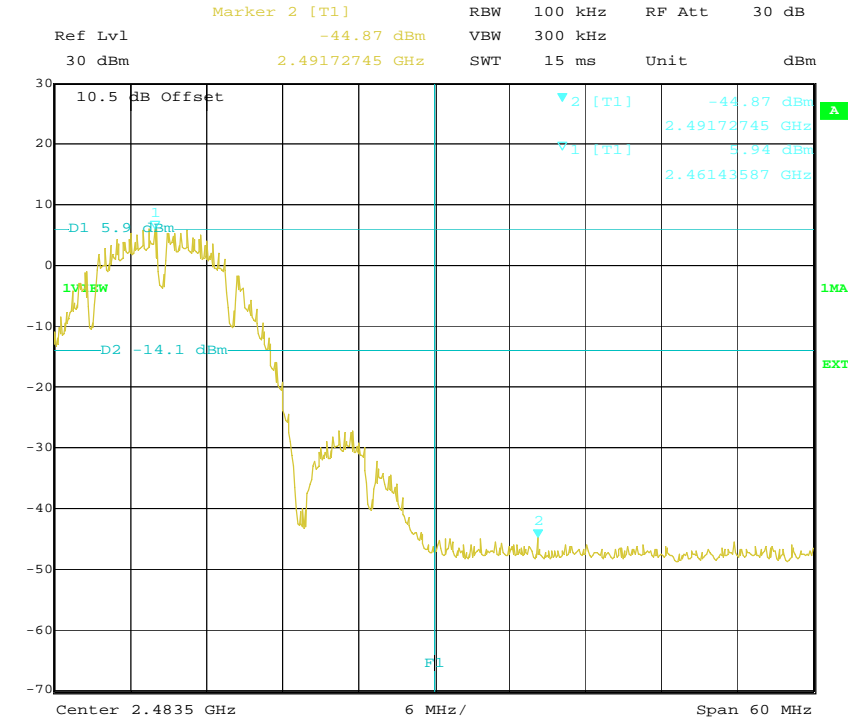
Measurement results are corrected for attenuation in the set-up configuration.

**Plot P7.1**



Date: 27.JAN.2011 16:02:32

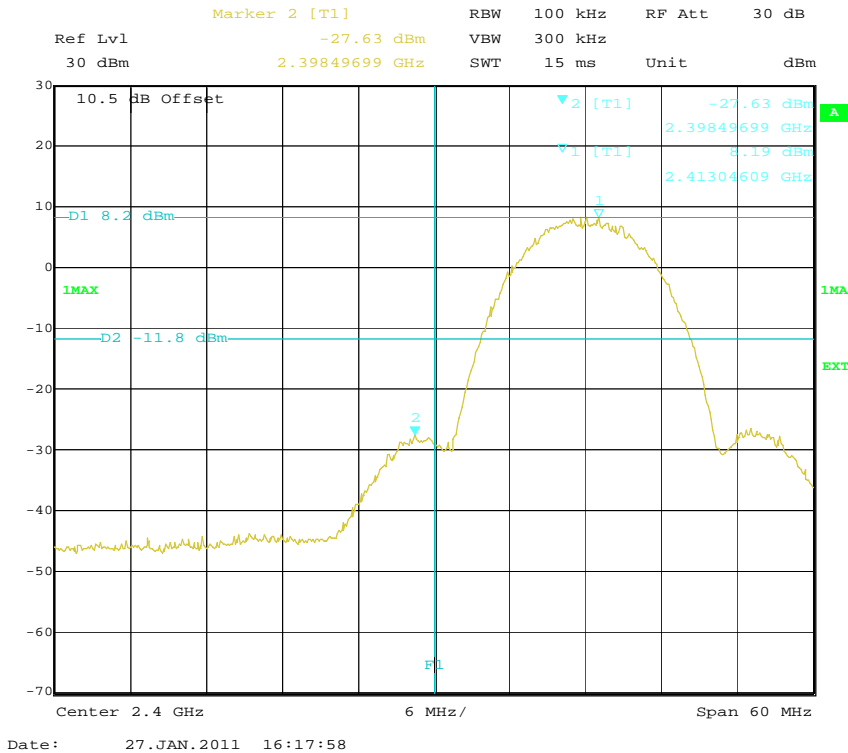
**Plot P7.2**



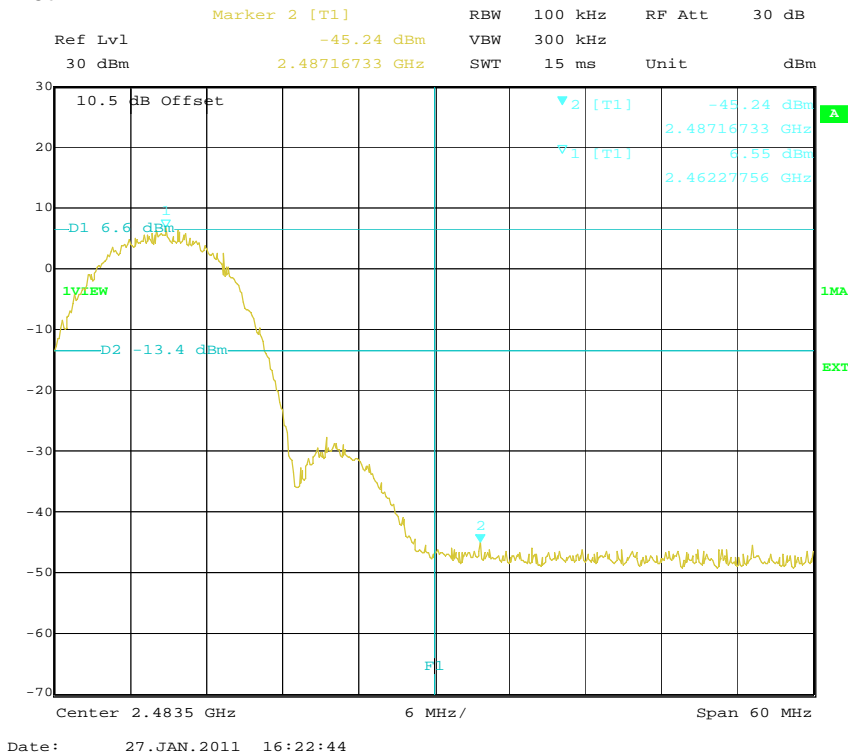
Date: 27.JAN.2011 16:21:16



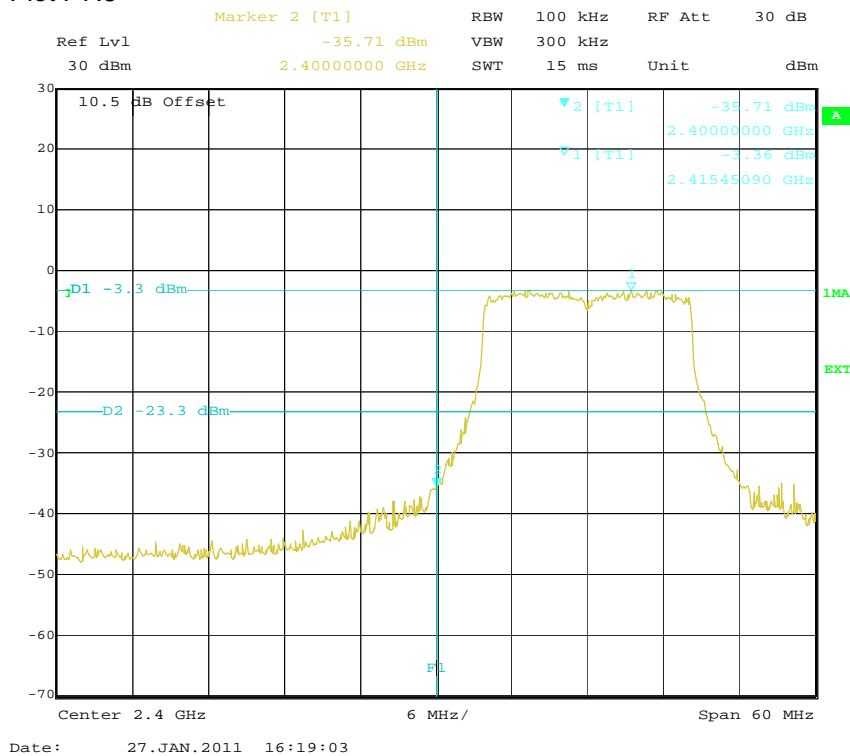
**Plot P7.3**



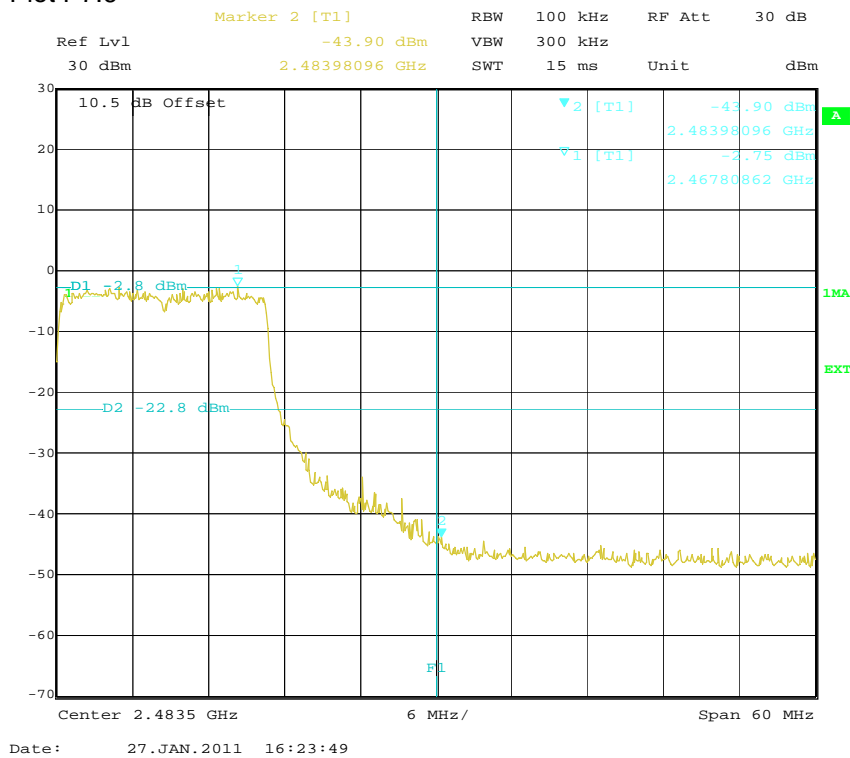
**Plot P7.4**



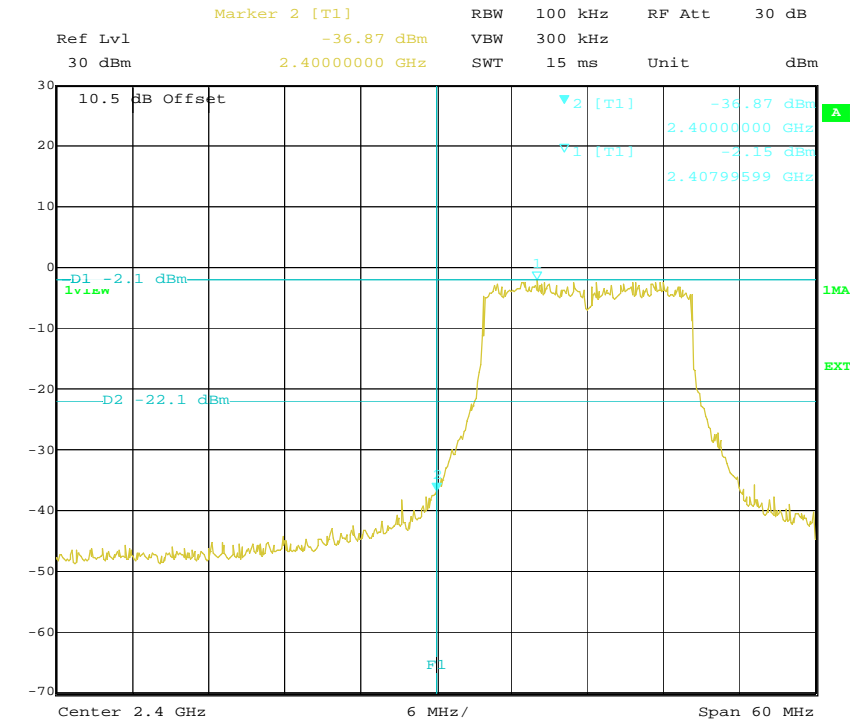
**Plot P7.5**



**Plot P7.6**

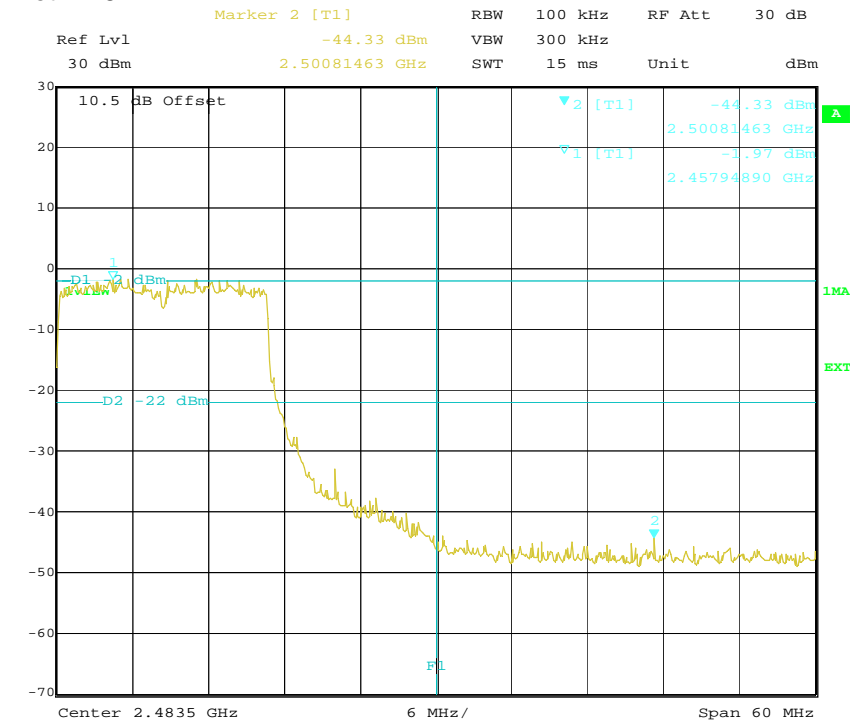


**Plot P7.7**



Date: 27.JAN.2011 16:19:47

**Plot P7.8**



Date: 27.JAN.2011 16:24:58

**8. POWER SPECTRAL DENSITY**

**8.1 Test equipment**

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Signal Analyzer	Rhode & Schwarz	FSIQ	12793	2011-07
Cable	Huber + Suhner	Sucoflex 104	5188	2011-07
RF attenuator	Hewlett Packard	8491A	30088	2011-07

**8.2 Test protocol**

Date of test: 2011-01-27

**802.11b, 1 Mbps data rate**

Channel	Power spectral density (dBm)	Plot	Limit value (dBm)
Low	-6.1	plot P8.1	8
Mid	-7.3	plot P8.2	8
High	-7.1	plot P8.3	8

**802.11b, 11 Mbps data rate**

Channel	Power spectral density (dBm)	Plot	Limit value (dBm)
Low	-6.7	plot P8.4	8
Mid	-7.3	plot P8.5	8
High	-7.5	plot P8.6	8

**802.11g, 6 Mbps data rate**

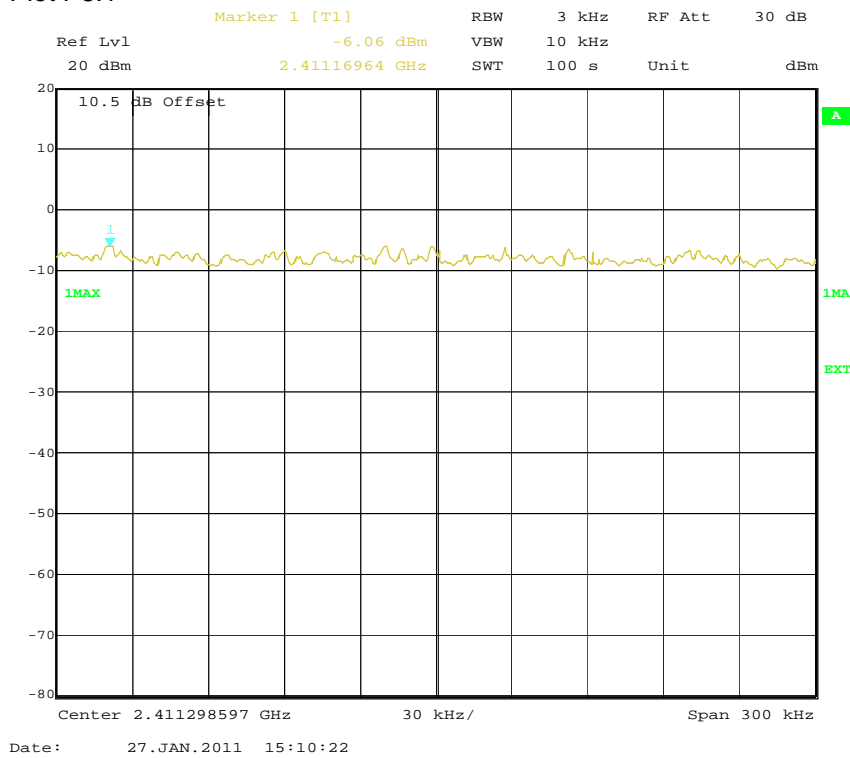
Channel	Power spectral density (dBm)	Plot	Limit value (dBm)
Low	-9.8	plot P8.7	8
Mid	-8.9	plot P8.8	8
High	-9.4	plot P8.9	8

## 802.11g, 54 Mbps data rate

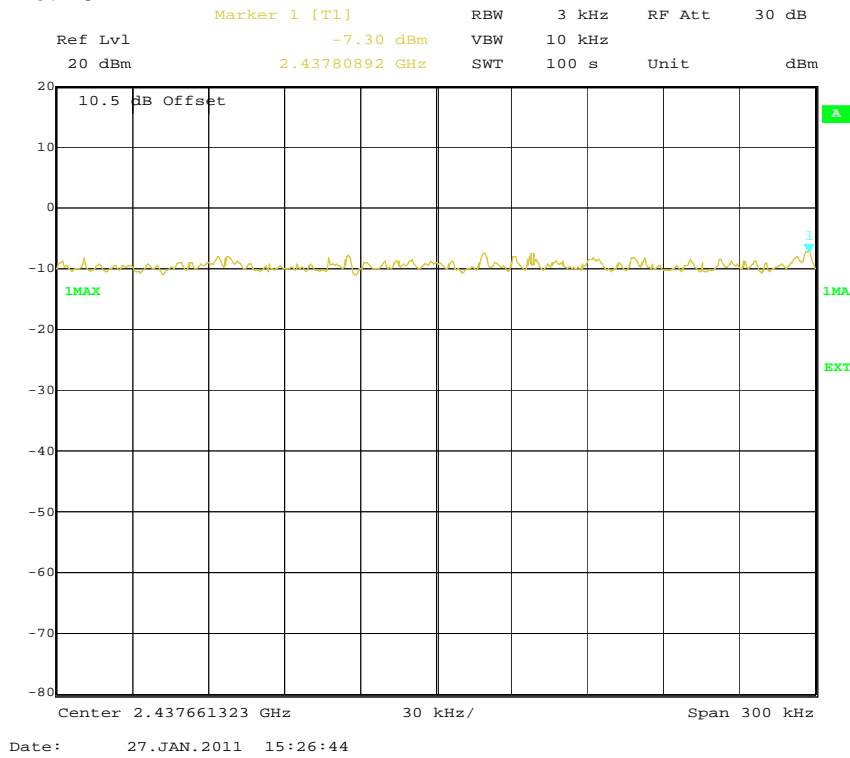
Channel	Power spectral density (dBm)	Plot	Limit value (dBm)
Low	-9.8	plot P8.10	8
Mid	-9.0	plot P8.11	8
High	-9.4	plot P8.12	8

Measurement results are corrected for attenuation in the set-up configuration.

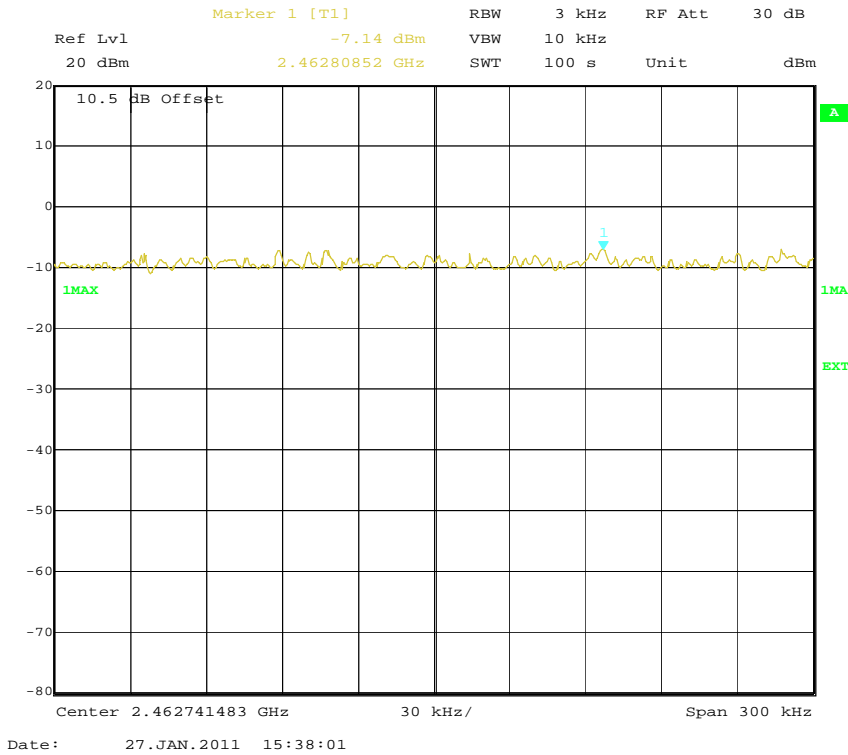
**Plot P8.1**



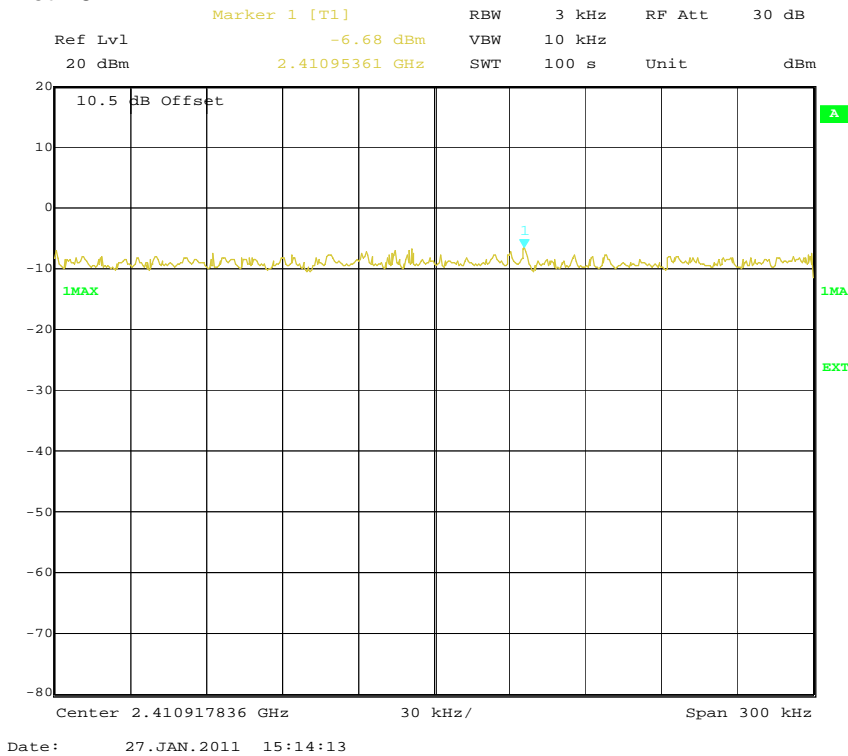
**Plot P8.2**



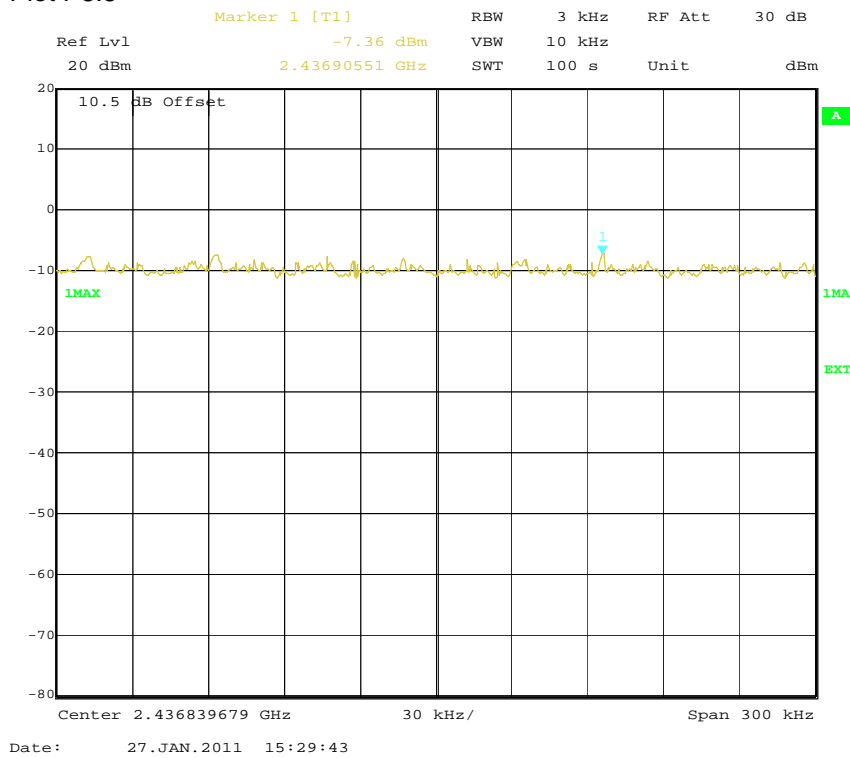
**Plot P8.3**



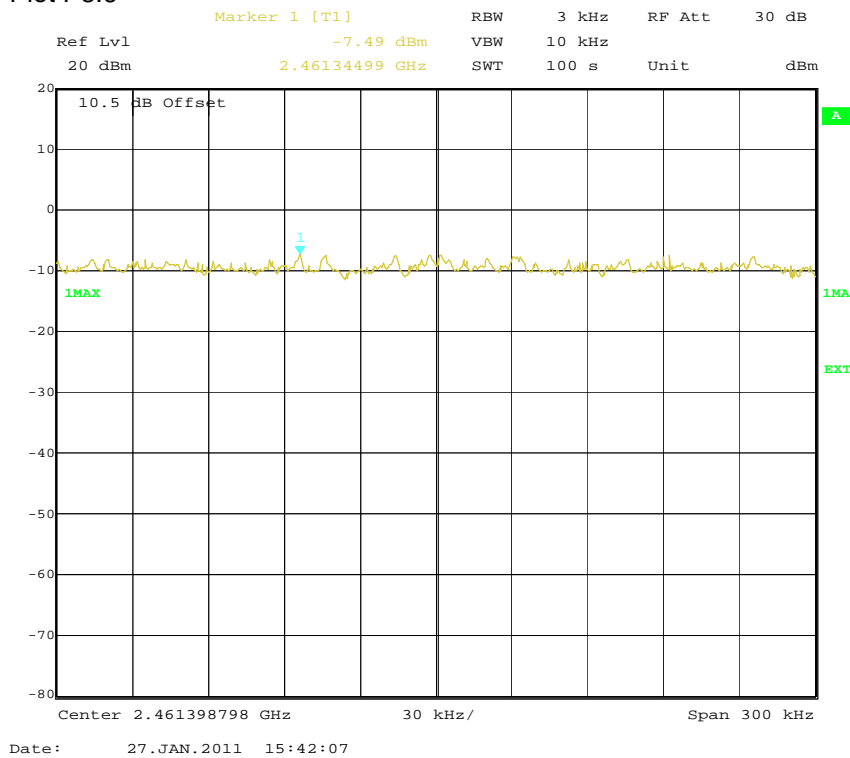
**Plot P8.4**



**Plot P8.5**

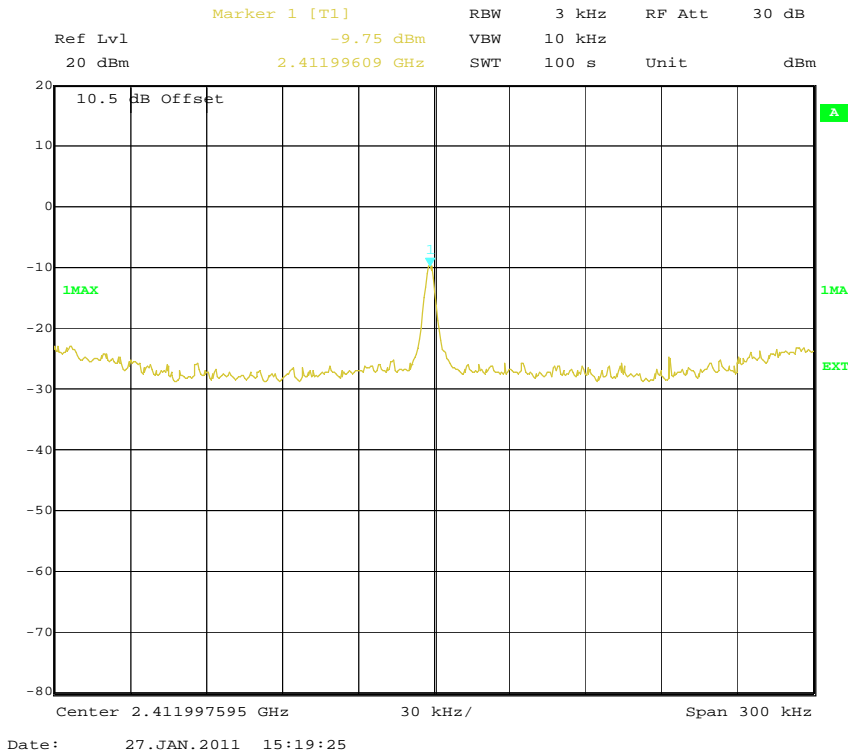


**Plot P8.6**

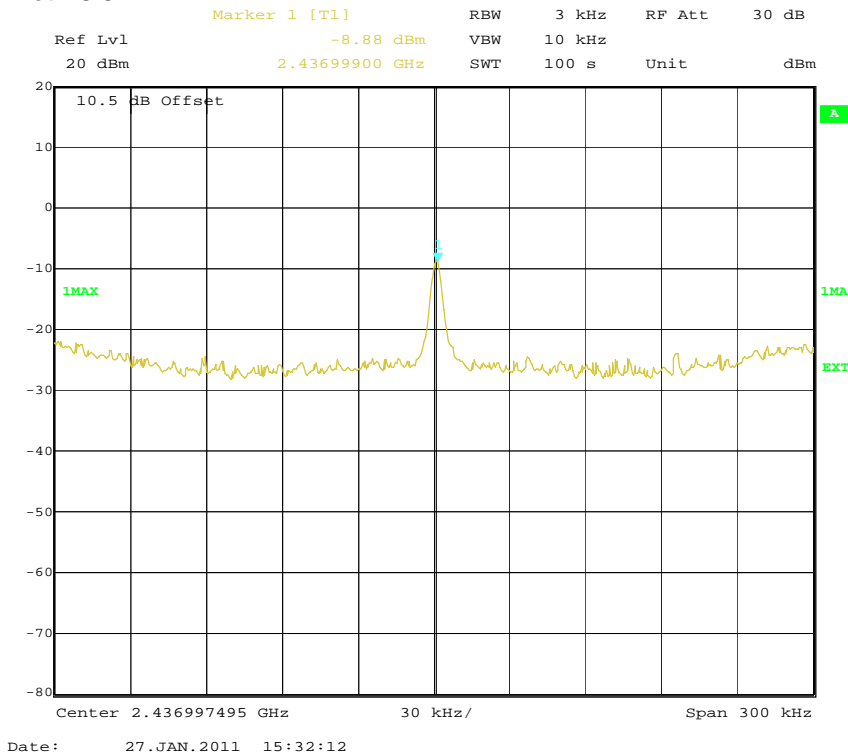




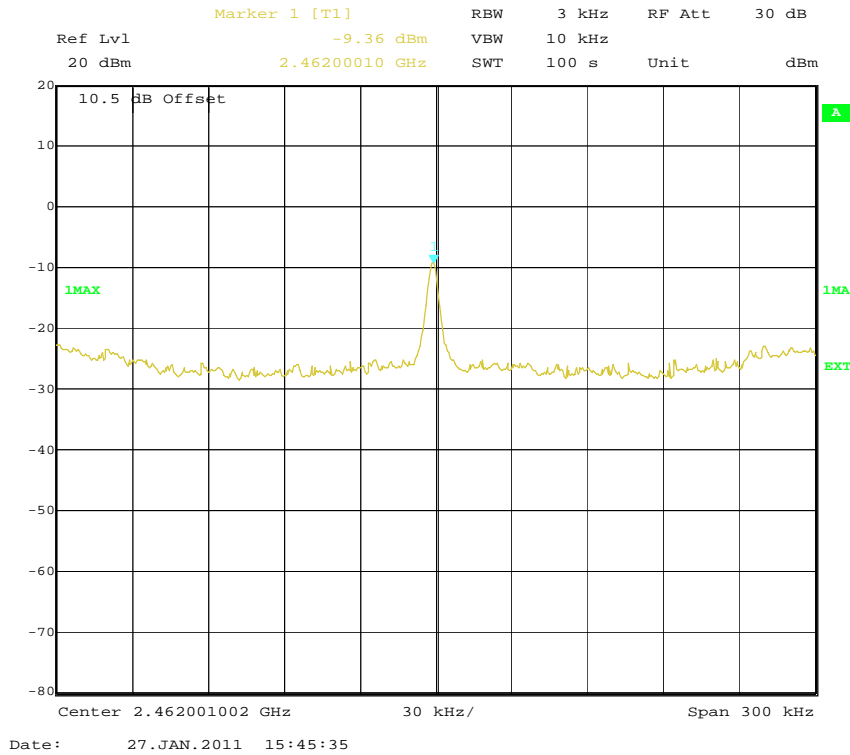
**Plot P8.7**



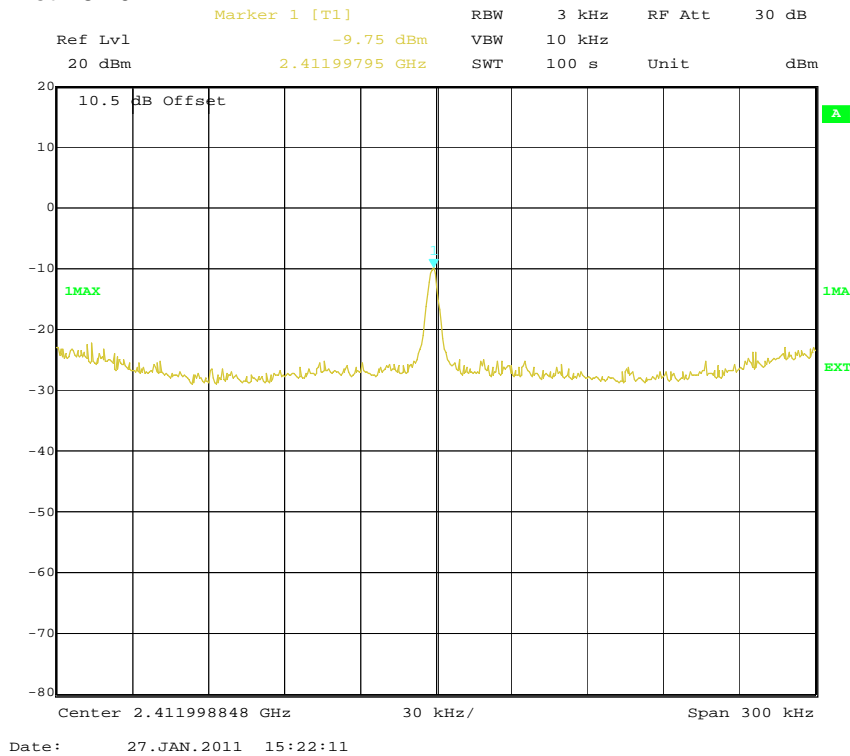
**Plot P8.8**



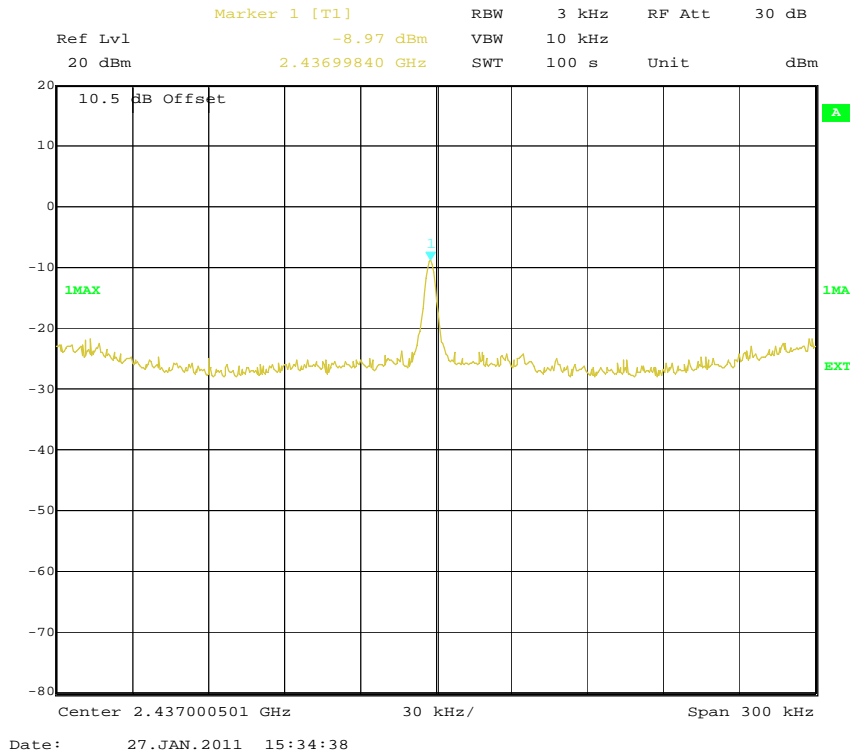
**Plot P8.9**



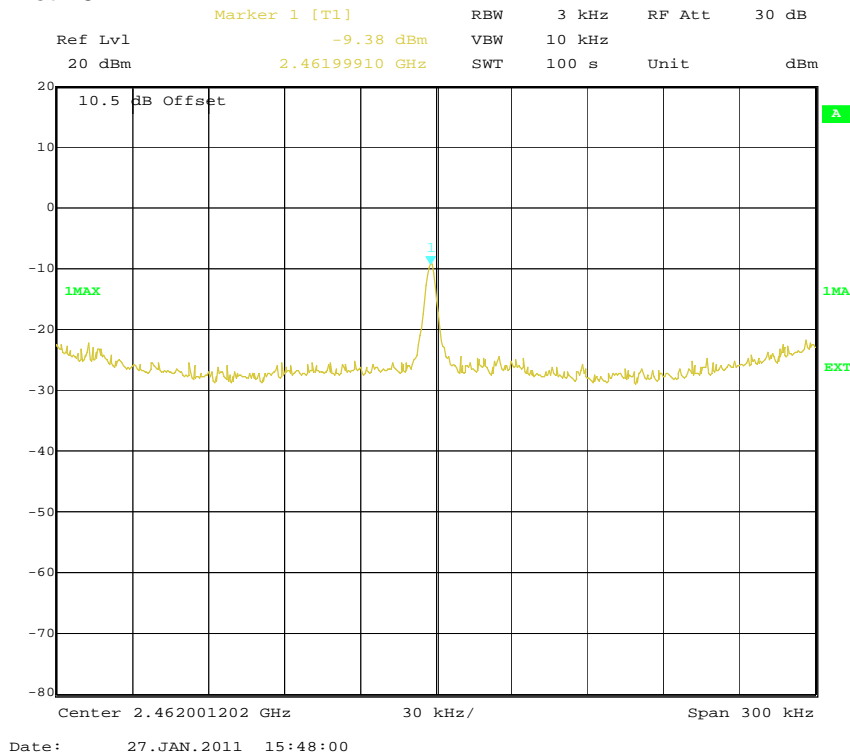
**Plot P8.10**



**Plot P8.11**



**Plot P8.12**



## 9. RADIATED SPURIOUS EMISSIONS

### 9.1 Measurement uncertainty

Radiated disturbance electric field intensity, 30 – 1000 MHz:  $\pm 4,6$  dB

Radiated disturbance electric field intensity, 1000 – 26000 MHz:  $\pm 6,0$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT. Measurement uncertainty is calculated in accordance with EA-4/02-1997. The uncertainty is given with a level of confidence of approximately 95% (k=2).

### 9.2 Test equipment

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
<i>Test site: Semi-anechoic shielded chamber, Stora Hallen</i>			30300	
Software	Rohde & Schwarz	EMC 32		
Measurement receiver	Rohde & Schwarz	ESU 8	12866	2011-06
Measurement receiver	Rohde & Schwarz	ESU 40	13178	2011-07
Antenna, bilog	Chase	CBL6111	8578	2011-09
Preamplifier	Semko	AM1331	7992	2011-07
Cable	Suhner	Sucoflex 104PEA	40035	2011-07
Cable	Suhner	RG214	30224	2011-07
Horn antenna	Rohde & Schwarz	HF907	31245	2013-11
Preamplifier	BONN Elektronik	BLMA 0118-M	31246	2011-07
Cable	Rosenberger	Utiflex FA142A	9747	2011-07
Horn antenna with preamplifier	BONN Elektronik	BLMA 1826-5A	31247	2013-12
Horn antenna with preamplifier	BONN Elektronik	BLMA 2640-5A	31248	2013-12
Cable	Rosenberger	Utiflex FB311A	9748	2011-07
High pass filter	K & L Microwave Inc.	4410-X4500/18000-0	5133	2011-07
Band rejection filter	K & L Microwave Inc.	6N45-2450/T 100-0/0	12389	2011-07

### 9.3 Measurement set-up

#### Test site Semi-anechoic shielded chamber

The radiated disturbance electric field intensity was measured in a semi-anechoic chamber at a distance of 3 m and the EUT was placed on a non-metallic table, 0,8 m above the reference ground plane. The specified test mode was enabled. Test set-up photos are given below.

An overview sweep with peak detection of the electric field intensity was performed with the measurement receiver in max-hold and with the antenna placed 1,5 m above the floor. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

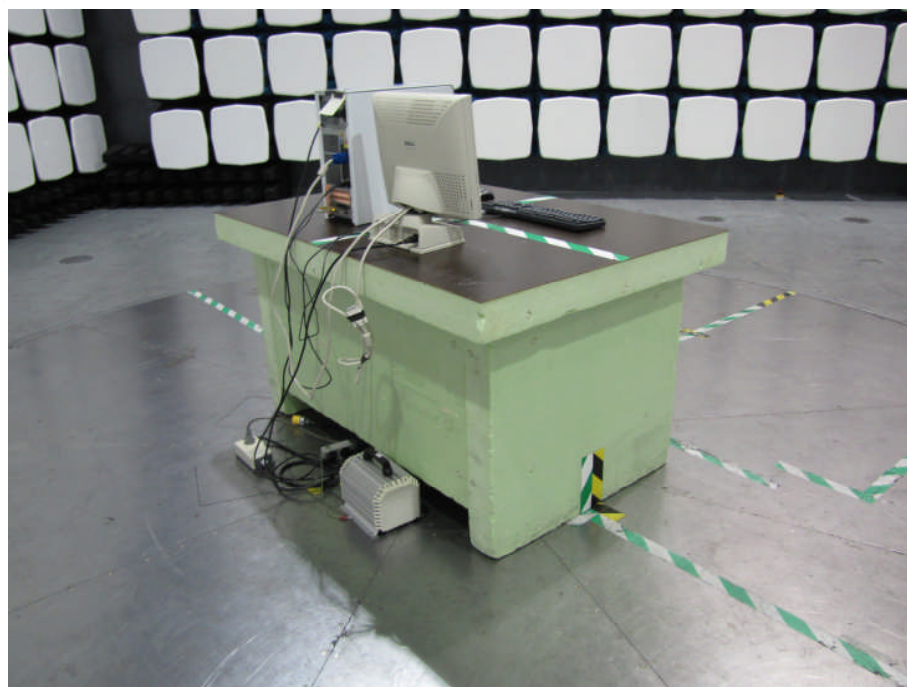
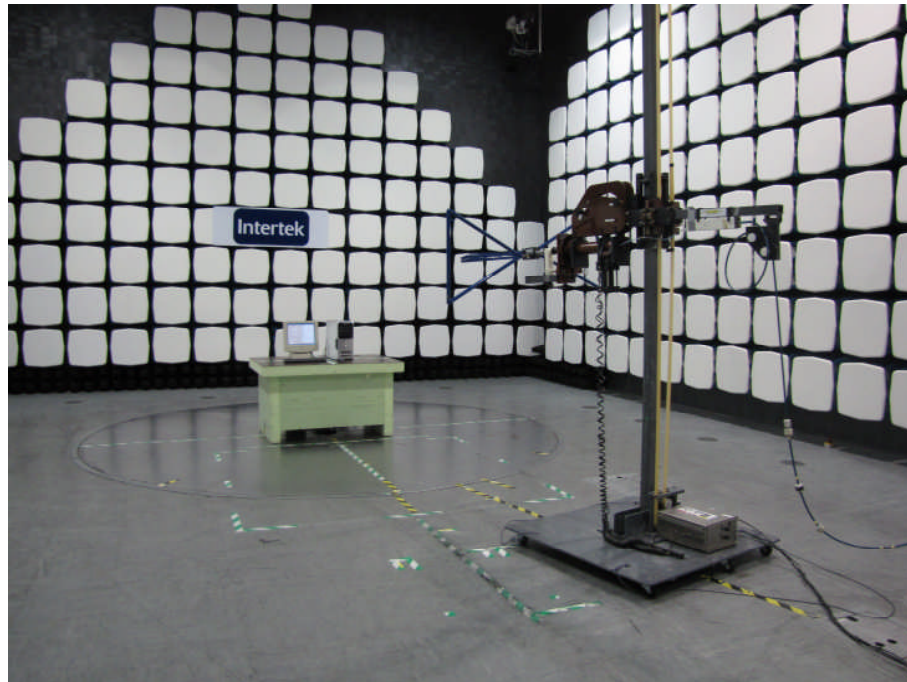
At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with the correct detector(s) were carried out.

The EUT was supplied with 3.3 VDC from the computer during the test.  
The computer was supplied by 120 VAC (60 Hz) during the test.

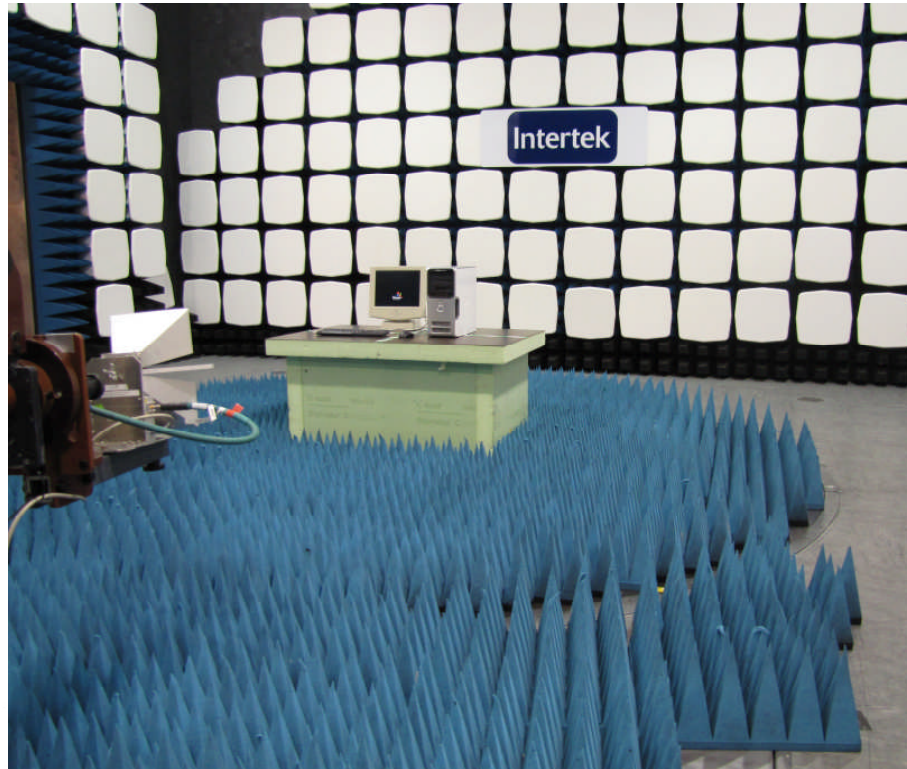
#### Example calculation

Measured level [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]

Test set-up photos 30 -1000 MHz



Test set-up photo above 1 GHz



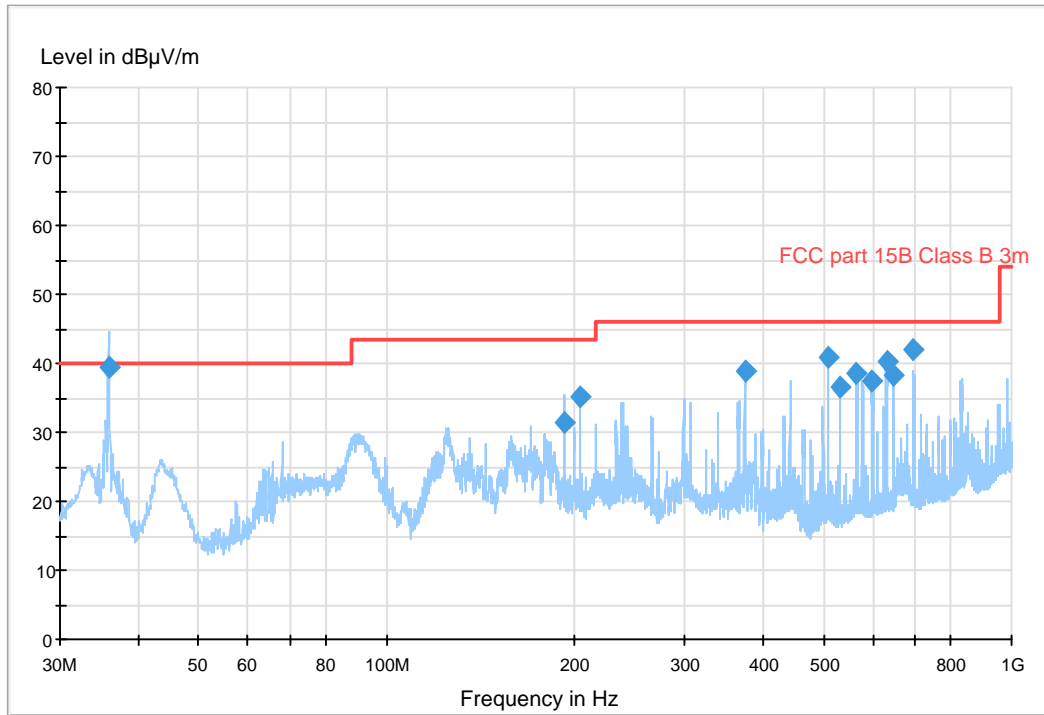
**9.4 Test protocol**

Semi-anechoic shielded chamber

Dates of test 2011-01-05, 2011-01-10 and 2011-01-12

30 – 1000 MHz, max peak at a distance of 3 m on the lowest TX channel, 802.11b, 6 Mbps

FCC 30 - 1000 MHz FCC class B 3m



**Final Result lowest TX channel, 802.11b, 6 Mbps**

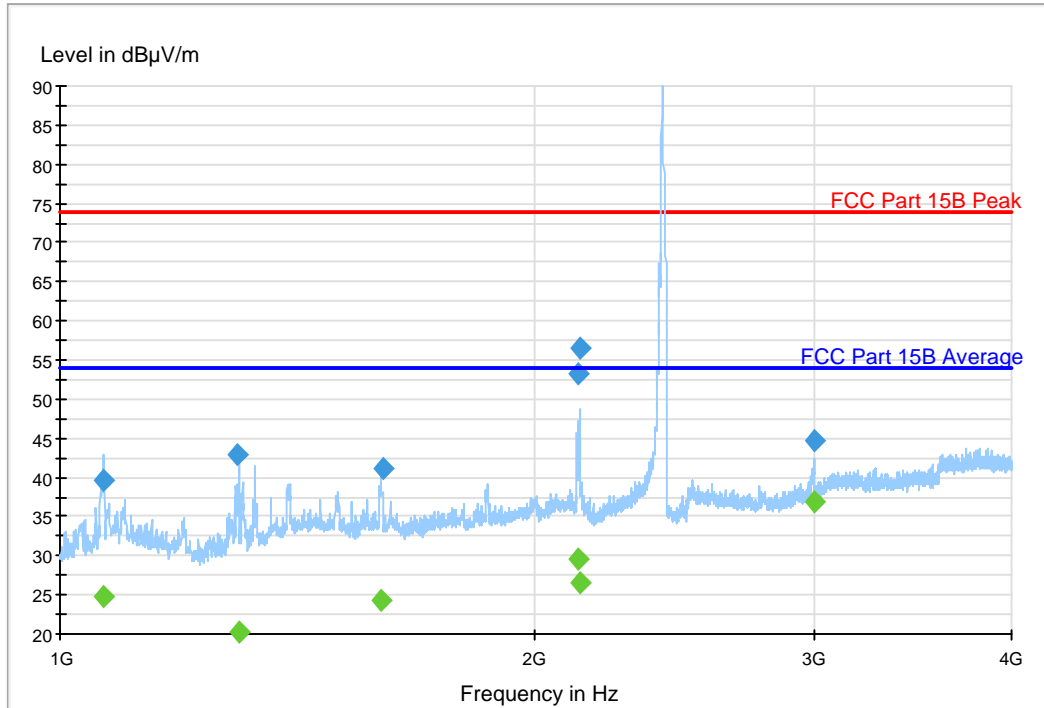
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
35.967800	39.4	120.000	100.0	V	91.0	-17.3	40.0	0.6
192.016800	31.4	120.000	124.0	H	228.0	-22.5	43.5	12.1
203.967800	35.2	120.000	123.0	H	244.0	-21.7	43.5	8.3
373.995000	38.9	120.000	138.0	V	320.0	-15.6	46.0	7.1
510.002600	40.9	120.000	167.0	V	296.0	-10.8	46.0	5.1
533.104800	36.4	120.000	173.0	H	49.0	-10.6	46.0	9.6
564.112800	38.5	120.000	150.0	H	60.0	-8.7	46.0	7.5
597.277200	37.4	120.000	155.0	H	51.0	-8.9	46.0	8.6
632.985600	40.2	120.000	148.0	H	50.0	-8.1	46.0	5.8
645.985600	38.3	120.000	149.0	V	-6.0	-7.8	46.0	7.7
696.800800	42.0	120.000	123.0	H	51.0	-7.2	46.0	4.0

Note None of these emissions are in a restricted band listed in §15.205.



1 – 4 GHz, max peak at a distance of 3 m on the lowest TX channel, 802.11b, 6 Mbps  
Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak lowest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1065.400000	39.5	1000.000	100.0	H	211.0	-17.7	34.5	74.0
1294.800000	43.0	1000.000	136.0	V	28.0	-17.3	31.0	74.0
1599.200000	41.1	1000.000	100.0	H	185.0	-15.0	32.9	74.0
2126.000000	53.2	1000.000	266.0	V	177.0	-13.2	20.8	74.0
2132.000000	56.5	1000.000	143.0	H	49.0	-13.3	17.5	74.0
2999.800000	44.7	1000.000	100.0	H	-16.0	-10.0	29.3	74.0

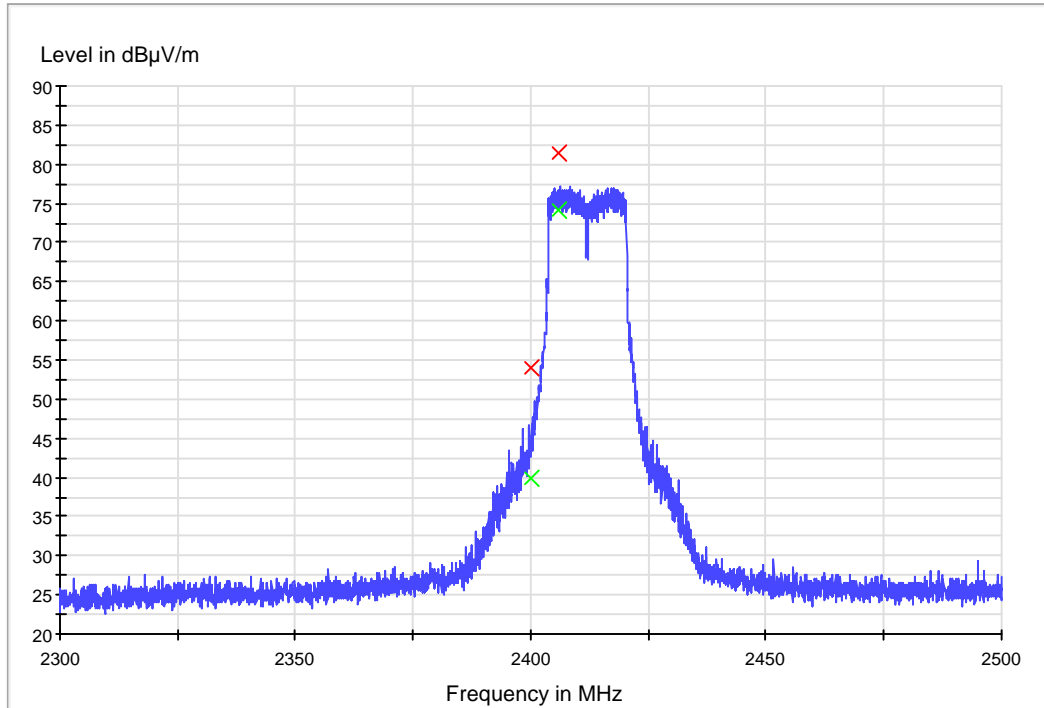
**Final Result Average lowest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1064.400000	24.9	1000.000	177.0	H	187.0	-17.7	29.1	54.0
1297.800000	20.3	1000.000	248.0	V	12.0	-17.2	33.7	54.0
1598.200000	24.2	1000.000	300.0	H	146.0	-15.0	29.8	54.0
2125.000000	29.5	1000.000	136.0	V	173.0	-13.2	24.5	54.0
2132.000000	26.6	1000.000	135.0	H	-5.0	-13.3	27.4	54.0
2999.800000	36.9	1000.000	149.0	H	-34.0	-10.0	17.1	54.0

Note None of these emissions are in a restricted band listed in §15.205.

Emissions at the lower band edge at a distance of 3 m on the lowest TX channel, 802.11b, 6 Mbps

EMI Sweep radiated 2G- 2.5G 3m 100 kHz low sensitivity



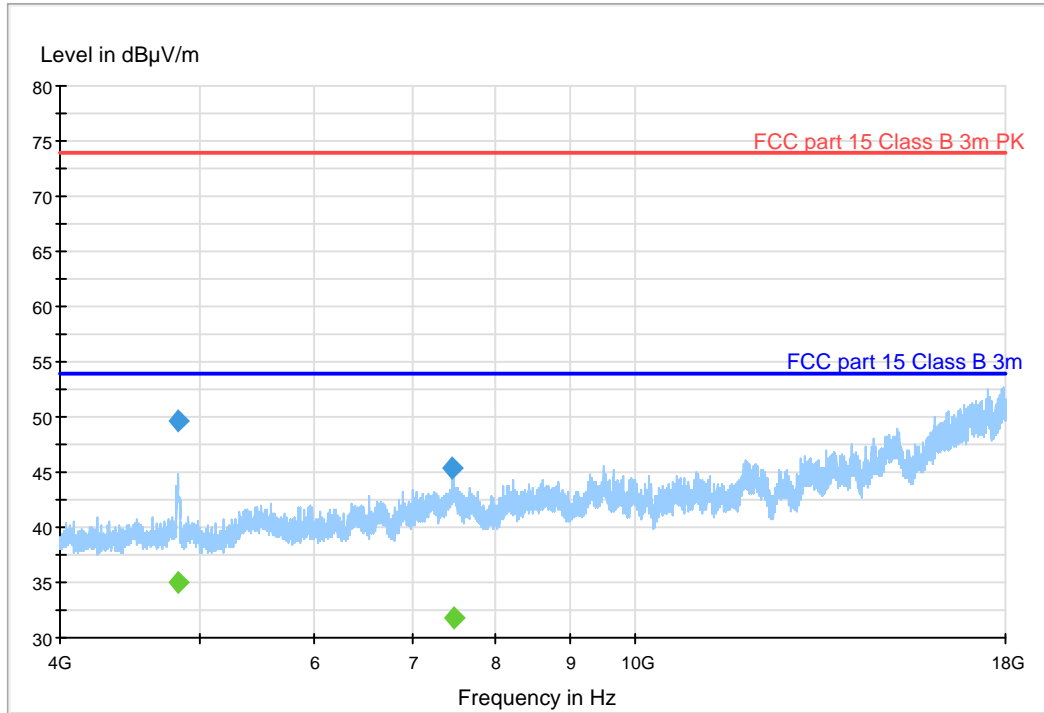
**Result**

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)
2400.000000	54.0	40.0	100.000	210.0	H	196.0	-12.7
2406.000000	81.4	74.0	100.000	200.0	H	196.0	-12.7

The out of band emissions are attenuated by more than 20 dB from the highest emission in the TX band in a 100 kHz measurement bandwidth

4 – 18 GHz, max peak at a distance of 3 m on the lowest TX channel, 802.11b, 6 Mbps  
Emissions below 4 GHz are attenuated by high-pass filter K&L 4410-X4500/18000-0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak lowest TX channel, 802.11b, 6 Mbps**

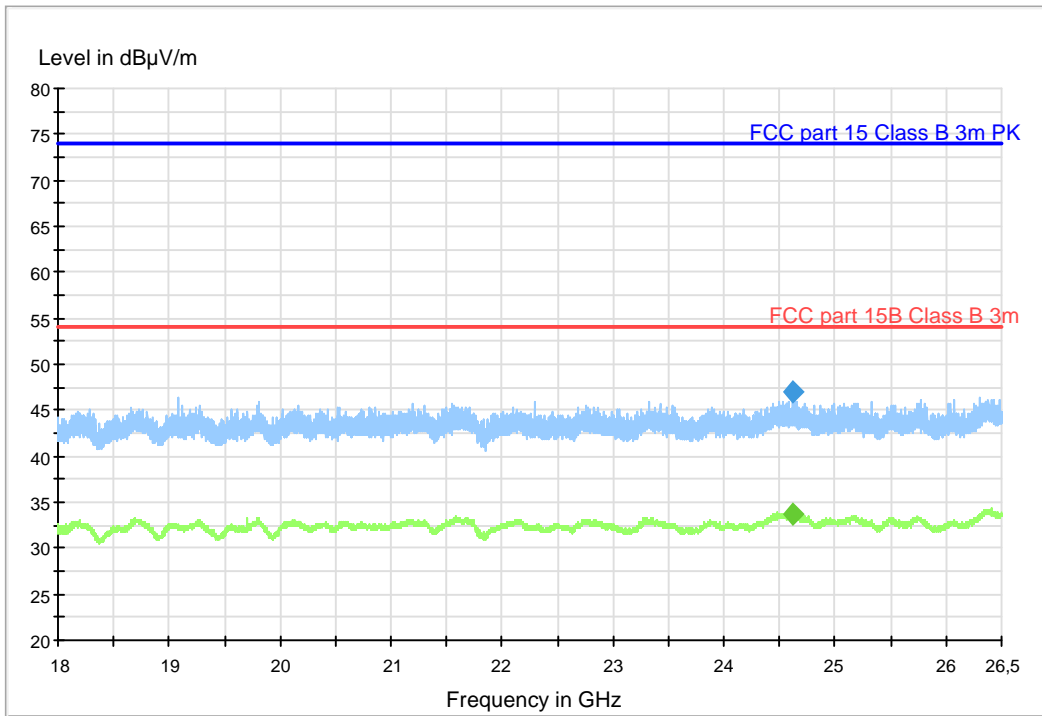
Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4821.600000	49.7	1000.000	174.0	H	171.0	-6.5	24.3	74.0
7468.000000	45.3	1000.000	161.0	H	2.0	-2.6	28.7	74.0

**Final Result Average lowest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4824.600000	35.1	1000.000	169.0	H	177.0	-6.5	18.9	54.0
7476.000000	31.8	1000.000	155.0	H	5.0	-2.6	22.2	54.0

18 – 26 GHz, max peak at a distance of 3 m on the lowest TX channel, 802.11b, 6 Mbps

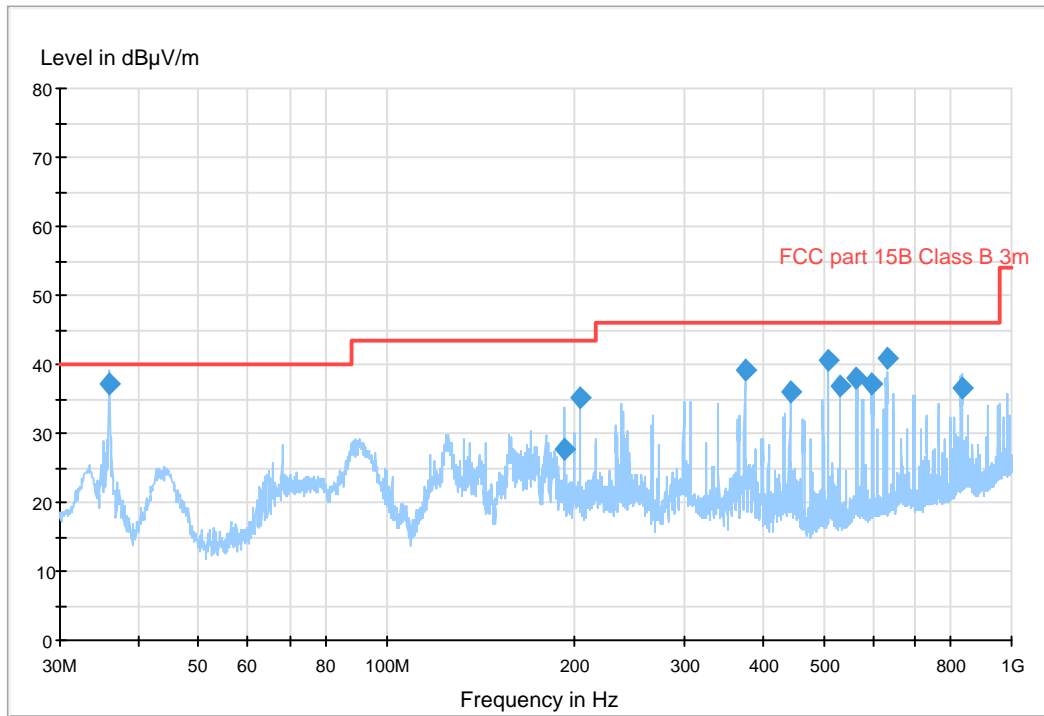
NKB FCC 18 G - 26,5 G class B 3m pre-sweep ESU40



No significant emissions, Noise floor (peak) below 47 dBµV/m.

30 – 1000 MHz, max peak at a distance of 3 m on the middle TX channel, 802.11b, 6 Mbps

FCC 30 - 1000 MHz FCC class B 3m



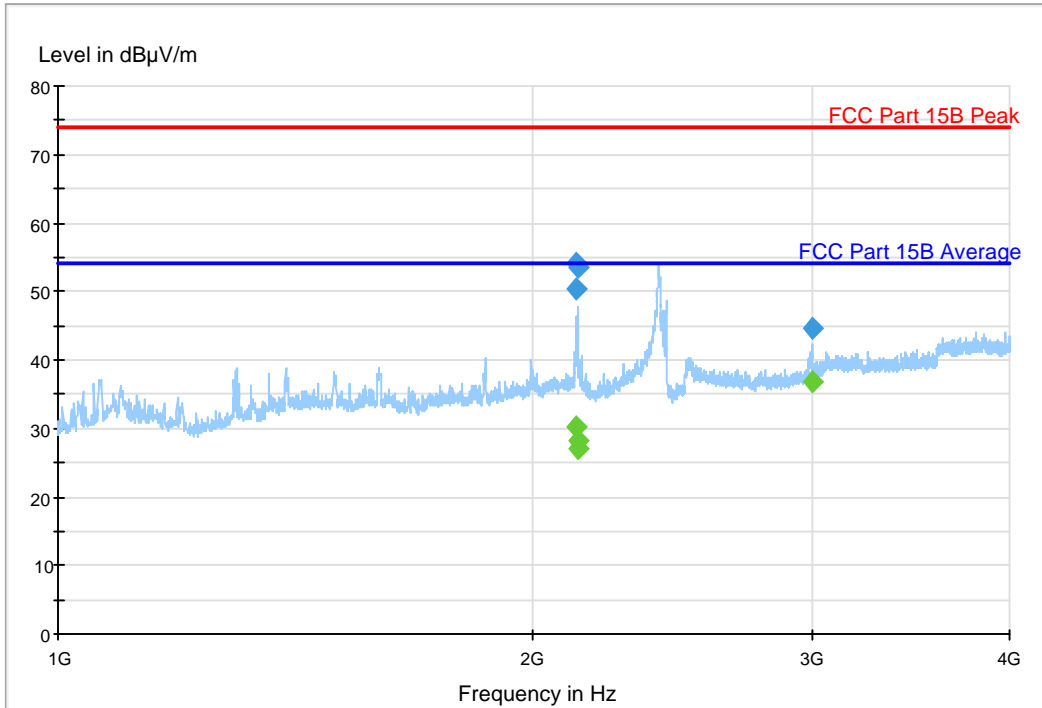
**Final Result middle TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
35.992400	37.0	120.000	100.0	V	143.0	-17.4	40.0	3.0
191.992200	27.6	120.000	100.0	H	192.0	-22.5	43.5	15.9
203.967800	35.2	120.000	100.0	H	247.0	-21.7	43.5	8.3
373.995000	39.3	120.000	124.0	V	322.0	-15.6	46.0	6.7
441.978800	35.9	120.000	161.0	H	332.0	-13.4	46.0	10.1
510.002600	40.7	120.000	149.0	V	284.0	-10.8	46.0	5.3
533.040200	36.8	120.000	159.0	H	47.0	-10.6	46.0	9.2
564.112800	38.0	120.000	144.0	H	58.0	-8.7	46.0	8.0
597.277200	37.1	120.000	142.0	H	49.0	-8.9	46.0	8.9
633.041000	40.7	120.000	119.0	H	52.0	-8.1	46.0	5.3
832.930400	36.5	120.000	156.0	V	9.0	-4.0	46.0	9.5

Note None of these emissions are in a restricted band listed in §15.205.

1 – 4 GHz, max peak at a distance of 3 m on the middle TX channel, 802.11b, 6 Mbps  
Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak middle TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2124.800000	50.5	1000.000	100.0	V	176.0	-13.2	23.5	74.0
2127.600000	54.2	1000.000	181.0	H	171.0	-13.2	19.8	74.0
2130.800000	53.6	1000.000	149.0	H	56.0	-13.3	20.4	74.0
2999.800000	44.6	1000.000	143.0	H	-13.0	-10.0	29.4	74.0

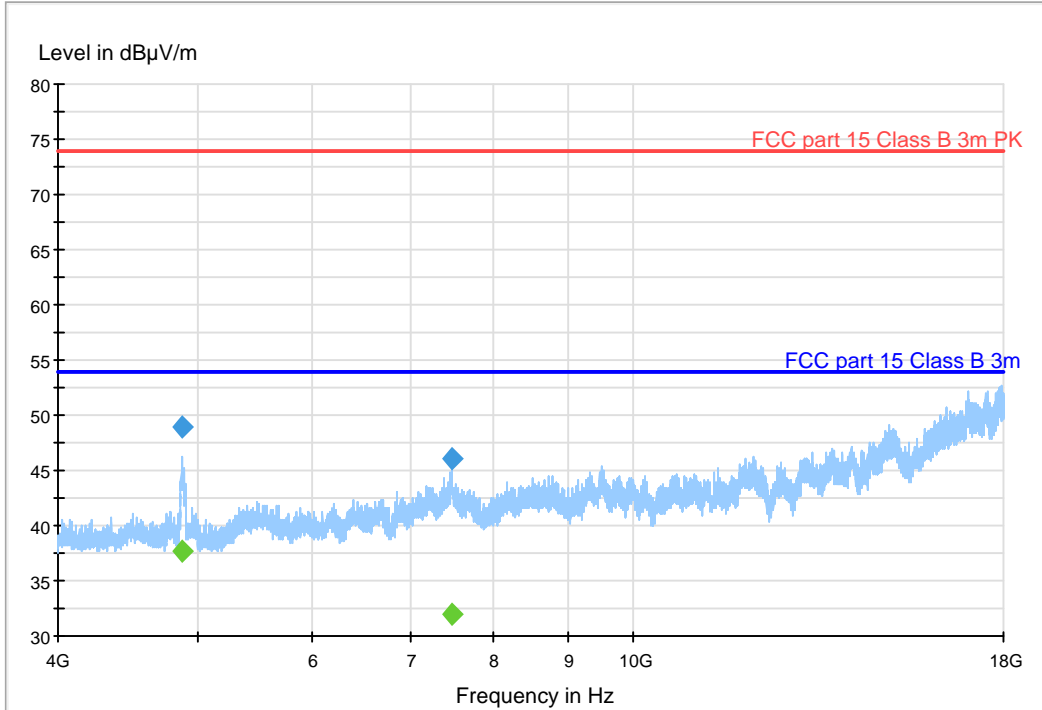
**Final Result Average middle TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2129.800000	30.2	1000.000	143.0	V	175.0	-13.2	23.8	54.0
2132.600000	27.1	1000.000	155.0	H	228.0	-13.3	26.9	54.0
2134.800000	28.2	1000.000	119.0	H	50.0	-13.3	25.8	54.0
2999.800000	36.8	1000.000	142.0	H	-33.0	-10.0	17.2	54.0

Note None of these emissions are in a restricted band listed in §15.205.

4 – 18 GHz, max peak at a distance of 3 m on the middle TX channel, 802.11b, 6 Mbps  
Emissions below 4 GHz are attenuated by high-pass filter K&L 4410-X4500/18000-0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak middle TX channel, 802.11b, 6 Mbps**

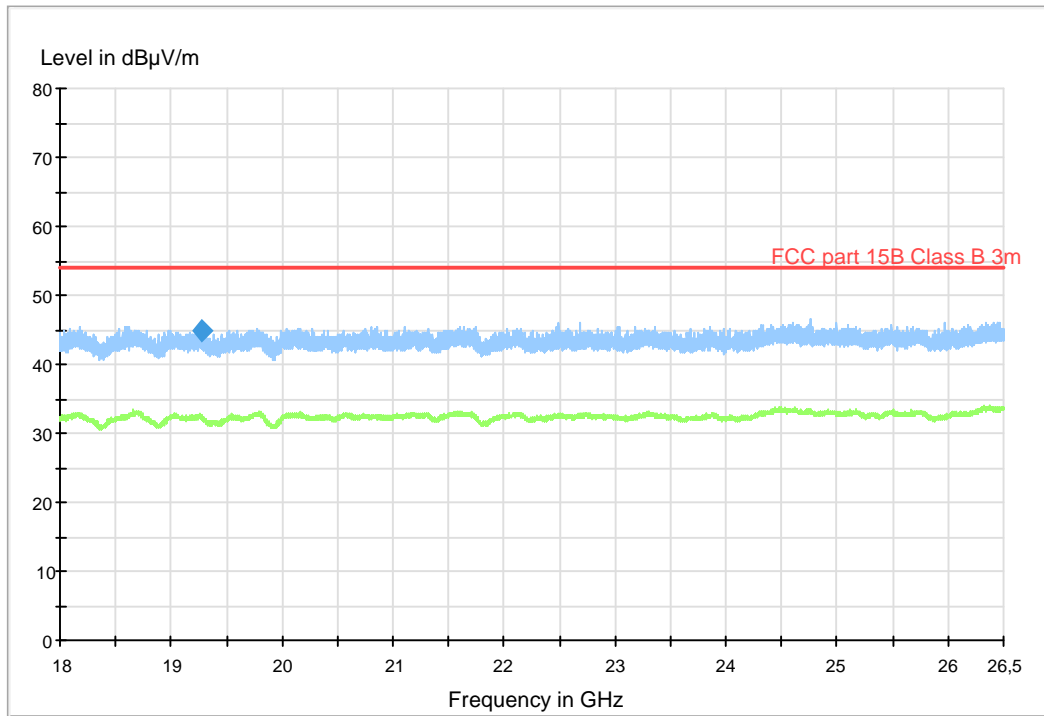
Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4879.200000	48.9	1000.000	136.0	H	181.0	-6.4	25.1	74.0
7482.400000	46.1	1000.000	150.0	H	8.0	-2.6	27.9	74.0

**Final Result Average middle TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4877.200000	37.7	1000.000	192.0	H	147.0	-6.4	16.3	54.0
7485.400000	31.9	1000.000	100.0	H	9.0	-2.6	22.1	54.0

18 – 26 GHz, max peak at a distance of 3 m on the middle TX channel, 802.11b, 6 Mbps

NKB FCC 18 G - 26,5 G class B 3m pre-sweep ESU40

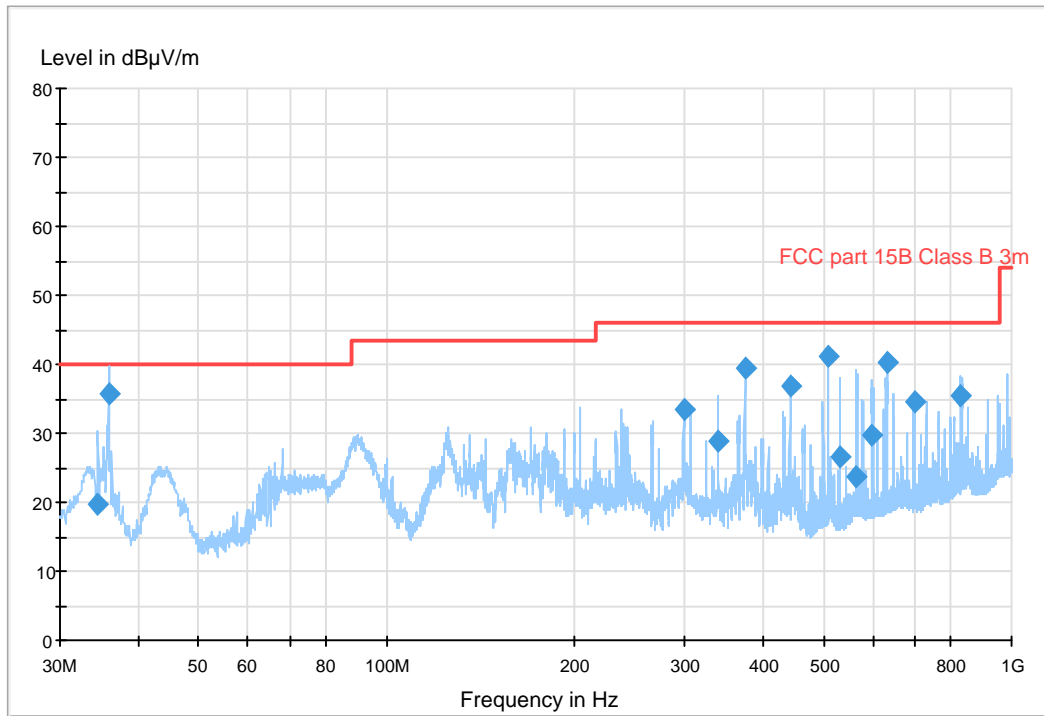


No significant emissions, Noise floor (peak) below 47 dBµV/m.



30 – 1000 MHz, max peak at a distance of 3 m on the highest TX channel, 802.11b, 6 Mbps

FCC 30 - 1000 MHz FCC class B 3m



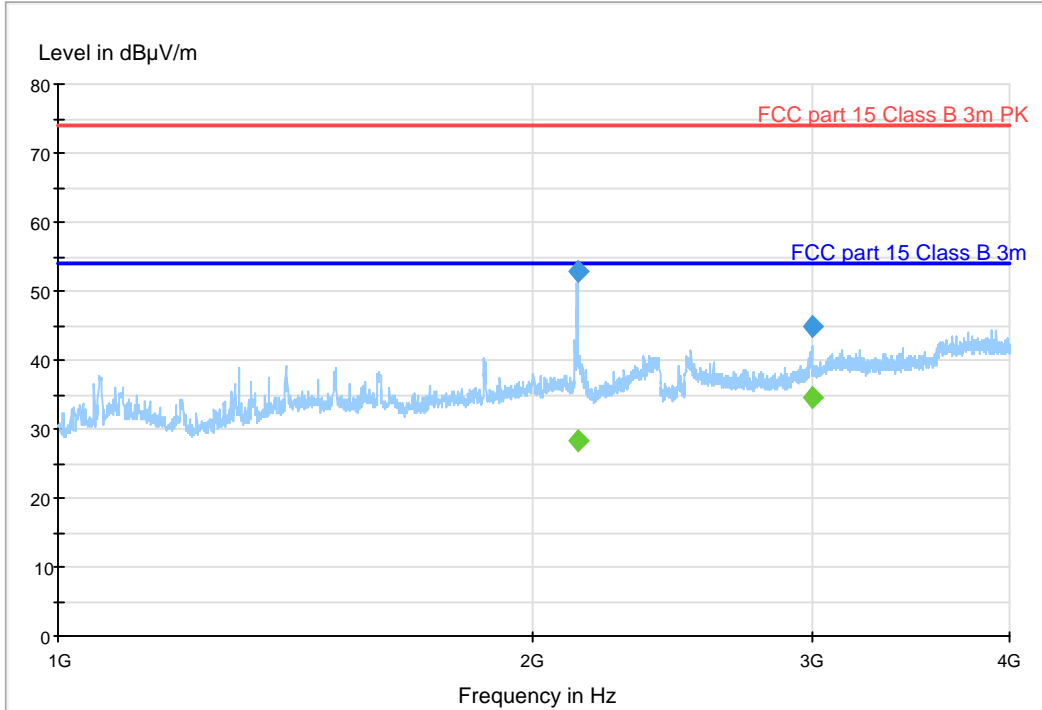
**Final Result highest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
34.457400	19.8	120.000	100.0	V	90.0	-16.7	40.0	20.2
35.983200	35.7	120.000	100.0	V	56.0	-17.3	40.0	4.3
299.834200	33.4	120.000	130.0	V	154.0	-17.0	46.0	12.6
339.960000	28.7	120.000	149.0	V	323.0	-16.1	46.0	17.3
373.995000	39.5	120.000	118.0	V	323.0	-15.6	46.0	6.5
441.994200	37.0	120.000	149.0	H	327.0	-13.4	46.0	9.0
510.002600	41.0	120.000	149.0	V	290.0	-10.8	46.0	5.0
533.064800	26.4	120.000	100.0	H	57.0	-10.6	46.0	19.6
564.112800	23.8	120.000	150.0	H	12.0	-8.7	46.0	22.2
597.277200	29.6	120.000	100.0	H	50.0	-8.9	46.0	16.4
633.041000	40.3	120.000	119.0	H	52.0	-8.1	46.0	5.7
699.652000	34.5	120.000	135.0	V	142.0	-7.2	46.0	11.5
829.576000	35.4	120.000	157.0	V	1.0	-4.0	46.0	10.6

Note None of these emissions are in a restricted band listed in §15.205.

1 – 4 GHz, max peak at a distance of 3 m on the highest TX channel, 802.11b, 6 Mbps  
 Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak highest TX channel, 802.11b, 6 Mbps**

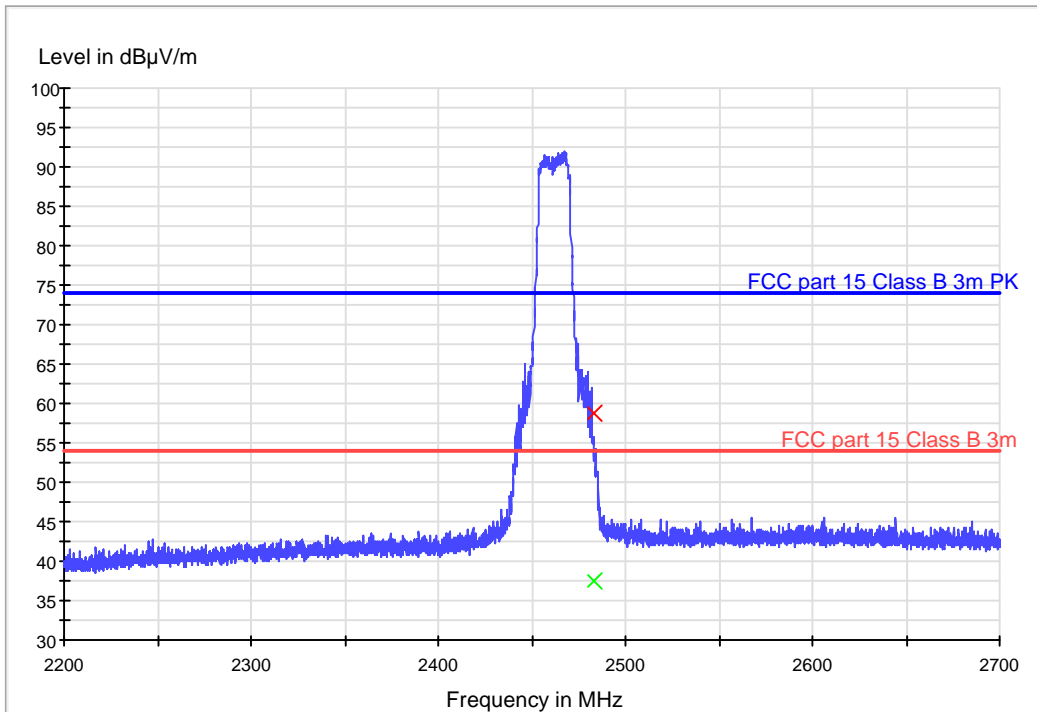
Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2132.200000	52.7	1000.000	231.0	H	56.0	-13.3	21.3	74.0
2999.600000	44.8	1000.000	130.0	H	1.0	-10.0	29.2	74.0

**Final Result Average highest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2132.200000	28.2	1000.000	242.0	H	56.0	-13.3	25.8	54.0
2999.600000	34.7	1000.000	136.0	H	-33.0	-10.0	19.3	54.0

Emissions at the higher band edge at a distance of 3 m on the highest TX channel, 802.11b, 6 Mbps

EMI Sweep radiated 2.2G - 2.7G 3m



**Results Peak at band edge**

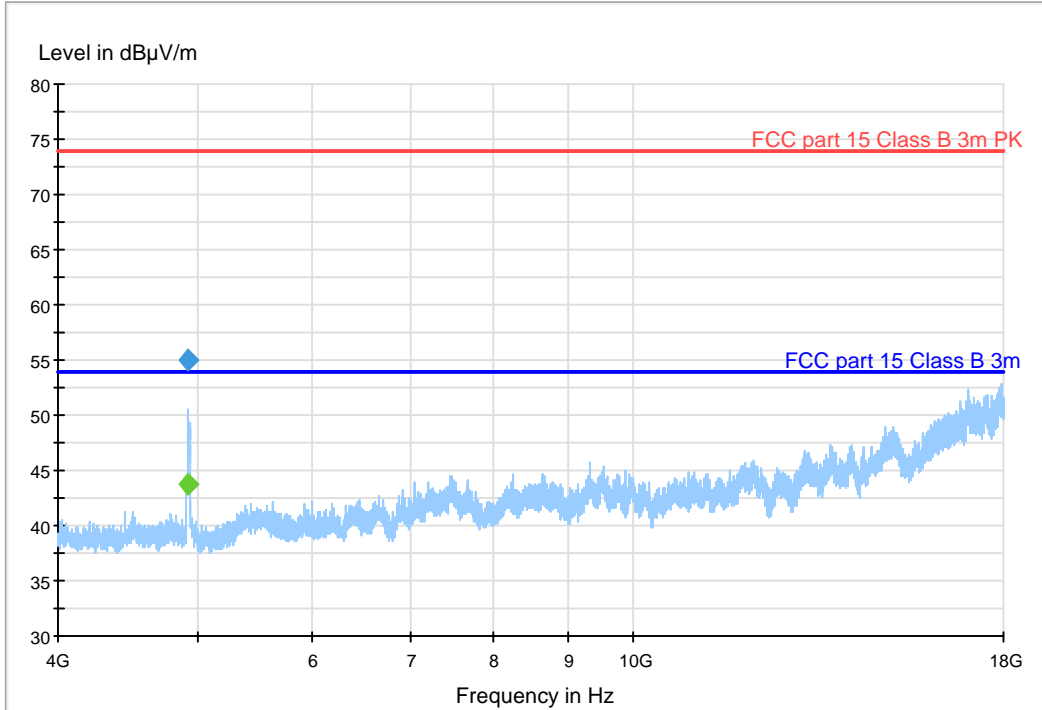
Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	58.8	1000.000	250.0	H	197.0	-12.0	15.2	74.0

**Results Average at band edge**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	37.5	1000.000	250.0	H	197.0	-12.0	16.5	74.0

4 – 18 GHz, max peak at a distance of 3 m on the highest TX channel, 802.11b, 6 Mbps  
 Emissions below 4 GHz are attenuated by high-pass filter K&L 4410-X4500/18000-0

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak highest TX channel, 802.11b, 6 Mbps**

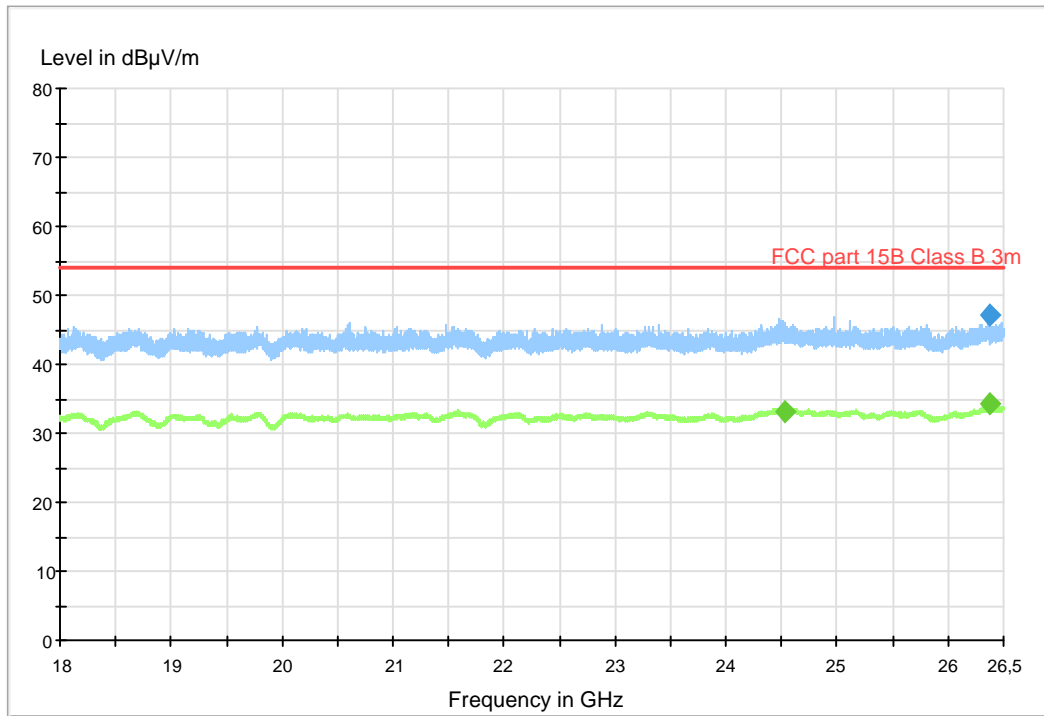
Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4922.200000	55.0	1000.000	180.0	H	185.0	-6.2	19.0	74.0

**Final Result Average highest TX channel, 802.11b, 6 Mbps**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4924.200000	43.7	1000.000	186.0	H	147.0	-6.2	10.3	54.0

18 – 26 GHz, max peak at a distance of 3 m on the highest TX channel, 802.11b, 6 Mbps

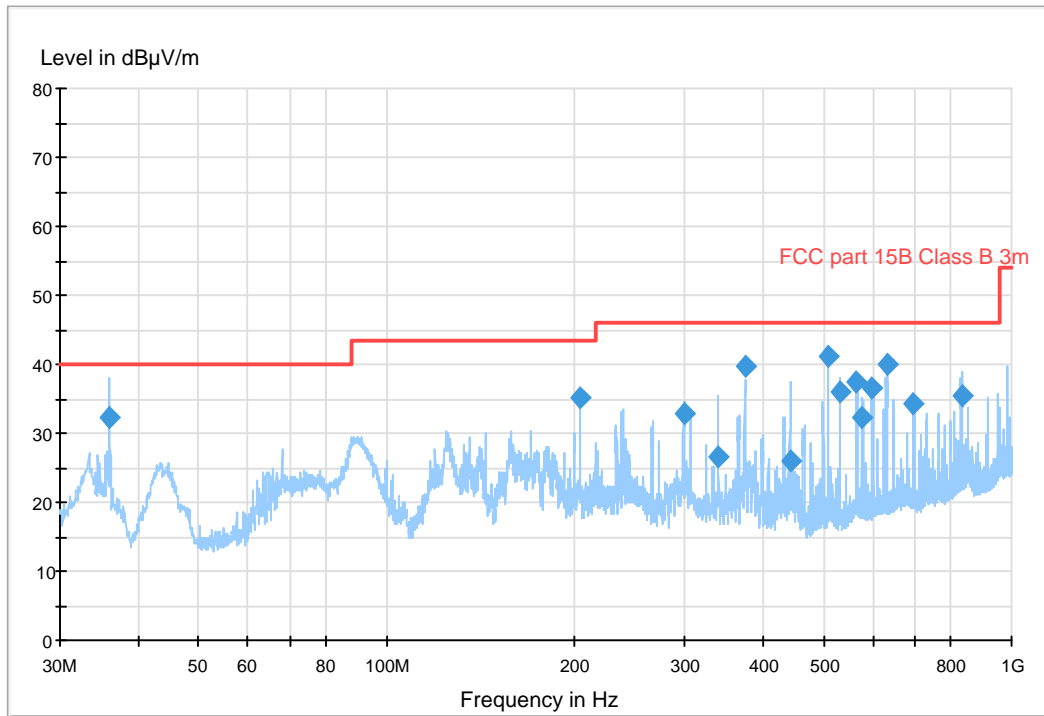
NKB FCC 18 G - 26,5 G class B 3m pre-sweep ESU40



No significant emissions, Noise floor (peak) below 47 dBµV/m.

30 – 1000 MHz, max peak at a distance of 3 m in Rx mode

FCC 30 - 1000 MHz FCC class B 3m

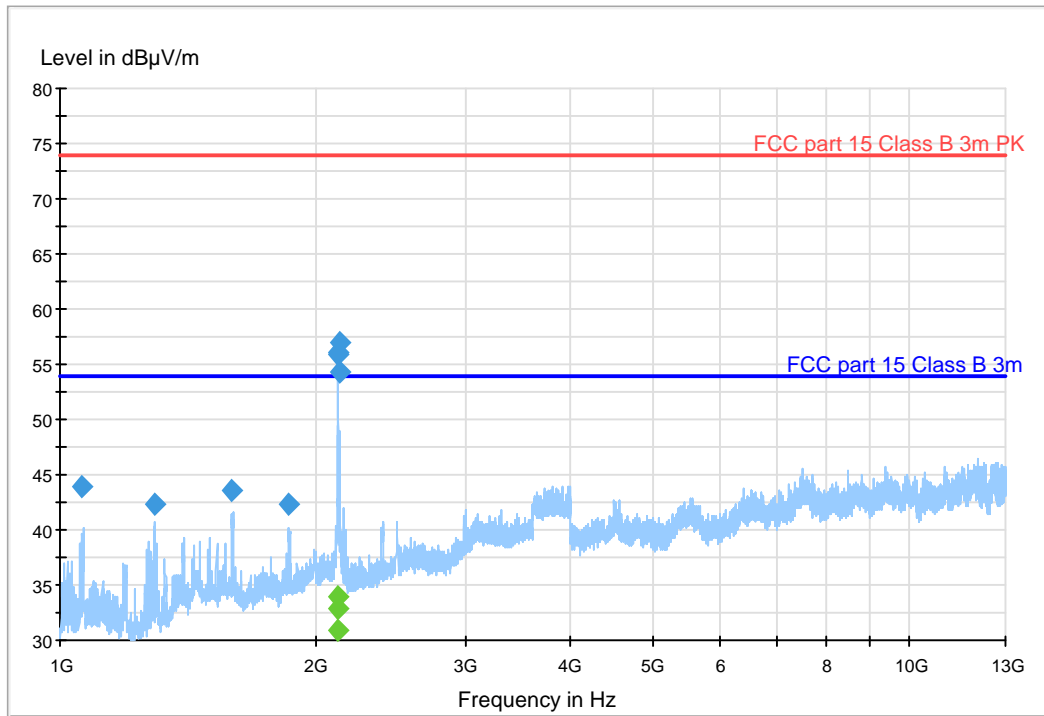


**Final Result Rx mode**

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
35.983200	32.3	120.000	100.0	V	91.0	-17.3	40.0	7.7
203.967800	35.2	120.000	124.0	H	227.0	-21.7	43.5	8.3
298.671400	32.9	120.000	157.0	V	155.0	-17.1	46.0	13.1
339.960000	26.6	120.000	100.0	V	319.0	-16.1	46.0	19.4
373.995000	39.6	120.000	119.0	V	328.0	-15.6	46.0	6.4
441.994200	26.1	120.000	100.0	H	329.0	-13.4	46.0	19.9
510.002600	41.1	120.000	154.0	V	292.0	-10.8	46.0	4.9
533.024800	36.0	120.000	149.0	H	75.0	-10.6	46.0	10.0
564.112800	37.5	120.000	142.0	H	57.0	-8.7	46.0	8.5
578.001800	32.3	120.000	180.0	H	-34.0	-8.8	46.0	13.7
597.252600	36.7	120.000	148.0	H	54.0	-8.9	46.0	9.3
632.985600	40.0	120.000	124.0	H	47.0	-8.1	46.0	6.0
696.840800	34.4	120.000	137.0	V	143.0	-7.2	46.0	11.6
833.050400	35.5	120.000	155.0	V	11.0	-4.0	46.0	10.5

1 – 13 GHz, max peak at a distance of 3 m in the RX mode

NKB FCC 1G - 18 G class B 3m ESU40



**Final Result Peak RX mode**

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1062.000000	43.9	1000.000	170.0	V	4.0	-17.7	30.1	74.0
1294.200000	42.4	1000.000	148.0	V	13.0	-17.3	31.6	74.0
1595.600000	43.6	1000.000	151.0	H	192.0	-15.0	30.4	74.0
1862.800000	42.4	1000.000	100.0	V	36.0	-14.3	31.6	74.0
2126.400000	56.0	1000.000	100.0	V	-29.0	-13.2	18.0	74.0
2128.800000	56.1	1000.000	100.0	V	-5.0	-13.2	17.9	74.0
2131.200000	56.9	1000.000	160.0	V	-3.0	-13.3	17.1	74.0
2133.200000	54.2	1000.000	100.0	V	170.0	-13.3	19.8	74.0

**Final Result Average RX mode**

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1058.000000	25.9	1000.000	163.0	V	12.0	-17.8	28.1	74.0
1292.200000	26.5	1000.000	187.0	V	-8.0	-17.3	27.5	74.0
1597.600000	24.3	1000.000	100.0	H	194.0	-15.0	29.7	74.0
1859.800000	25.5	1000.000	202.0	V	13.0	-14.3	28.5	74.0
2128.400000	32.9	1000.000	116.0	V	-18.0	-13.2	21.1	74.0
2128.800000	34.0	1000.000	100.0	V	-21.0	-13.2	20.0	74.0
2129.200000	30.9	1000.000	100.0	V	177.0	-13.2	23.1	74.0

**10. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT**

**10.1 Measurement uncertainty**

Measurement uncertainty for conducted disturbances at the antenna port  $\pm 3,6$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT. Measurement uncertainty is calculated in accordance with EA-4/02-1997. The uncertainty is given with a level of confidence of approximately 95% (k=2).

**10.2 Test equipment**

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Signal Analyzer	Rhode & Schwarz	FSIQ	12793	2011-07
Cable	Huber + Suhner	Sucoflex 104	5188	2011-07
RF attenuator	Hewlett Packard	8491A	30088	2011-07

**10.3 Test protocol**

Date of test 2011-01-27 and 2011-01-28

802.11b, 1 Mbps data rate

Channel	Plot	Results	Limit value (dBc)
Low	10.1 – 10.3	PASS	20
Middle	10.4 – 10.6	PASS	20
High	10.7 – 10.9	PASS	20

802.11b, 11 Mbps data rate

Channel	Plot	Results	Limit value (dBc)
Low	10.10 – 10.12	PASS	20
Middle	10.13 – 10.15	PASS	20
High	10.16 – 10.18	PASS	20

802.11g, 6 Mbps data rate

Channel	Plot	Results	Limit value (dBc)
Low	10.19 – 10.21	PASS	20
Middle	10.22 – 10.24	PASS	20
High	10.25 – 10.27	PASS	20

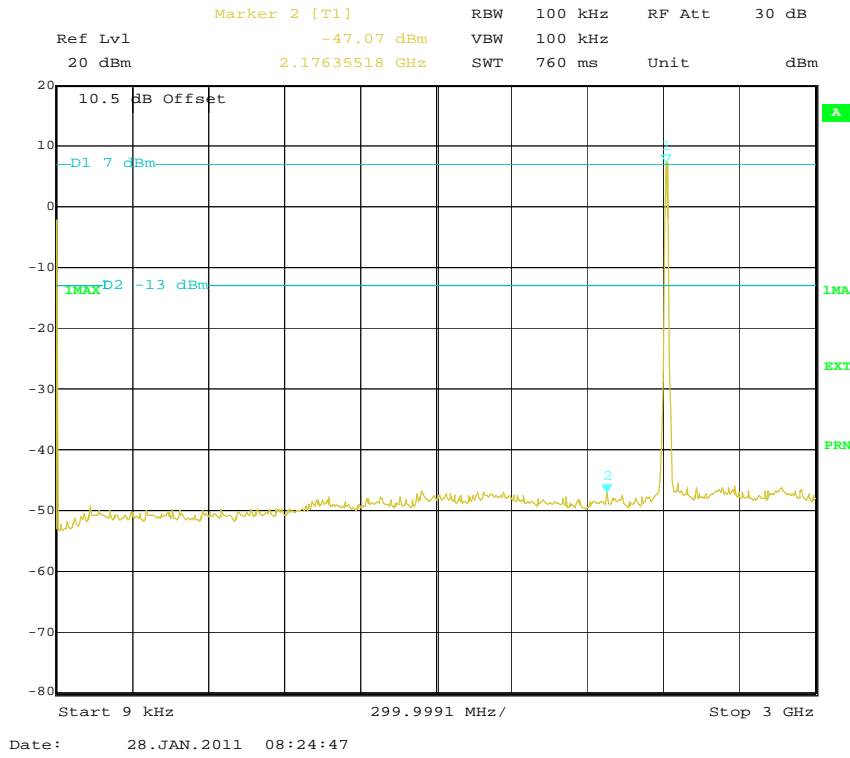


## 802.11g, 54 Mbps data rate

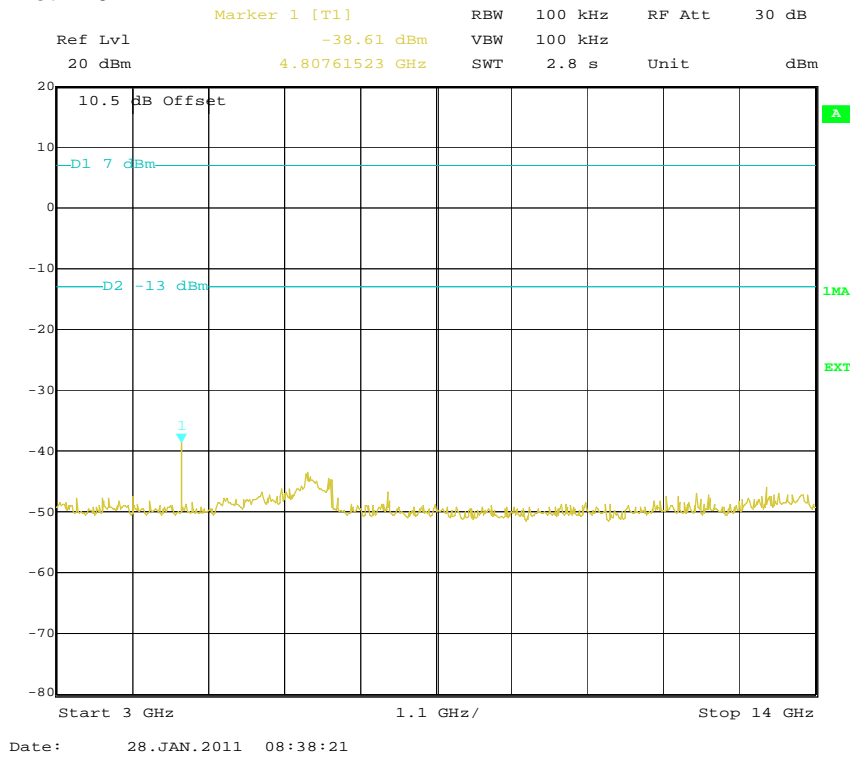
Channel	Plot	Results	Limit value (dBc)
Low	10.28 – 10.30	PASS	20
Middle	10.31 – 10.33	PASS	20
High	10.34 – 10.37	PASS	20

Limit In any 100 kHz bandwidth outside the operating frequency band (2400 – 2483.5 MHz), 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.

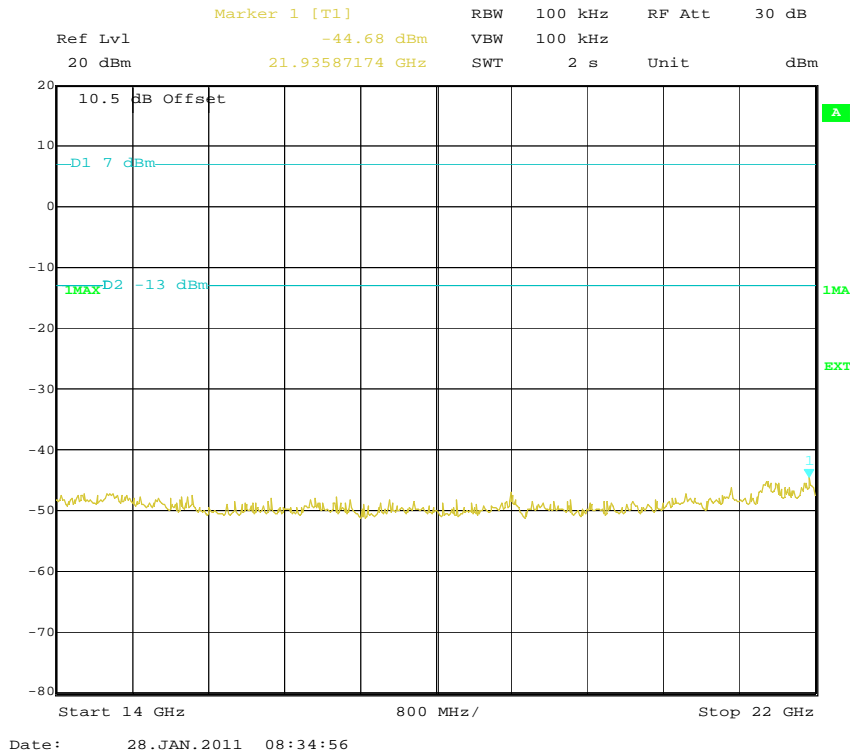
Plot P10.1



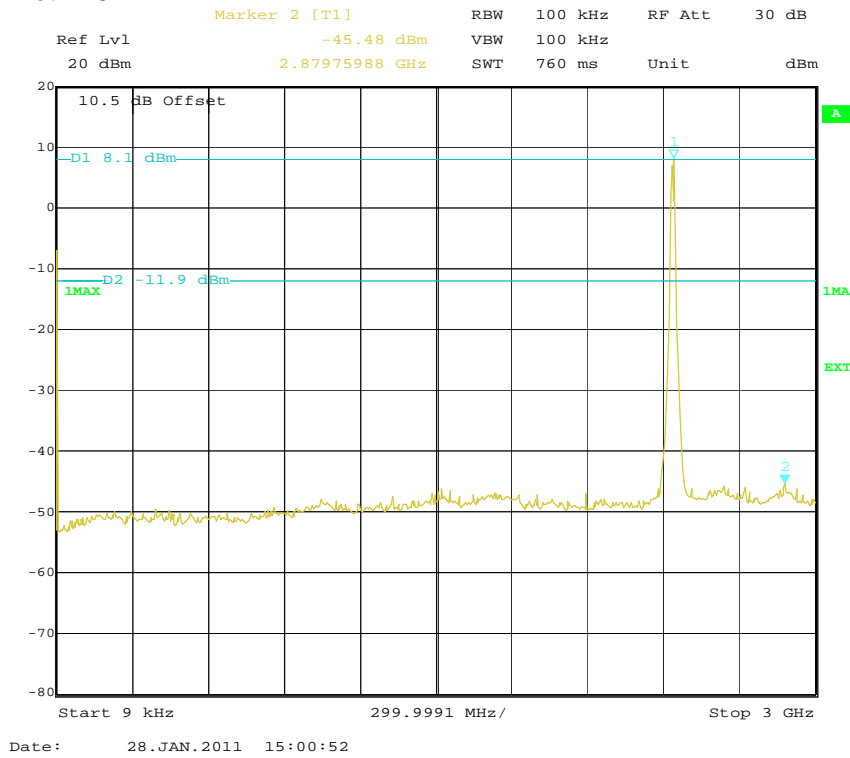
Plot P10.2



**Plot P10.3**



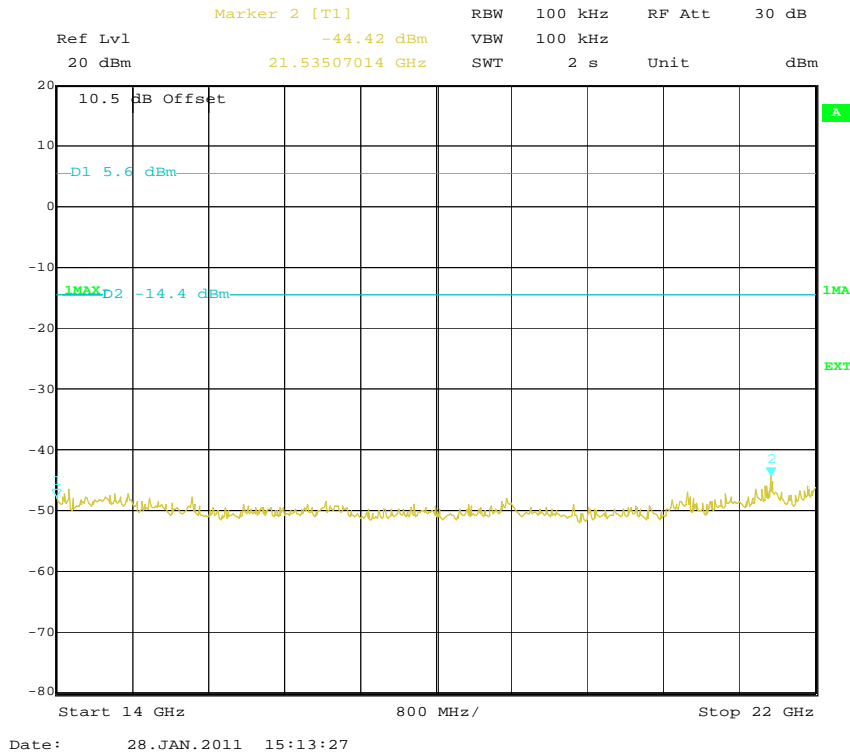
**Plot P10.4**



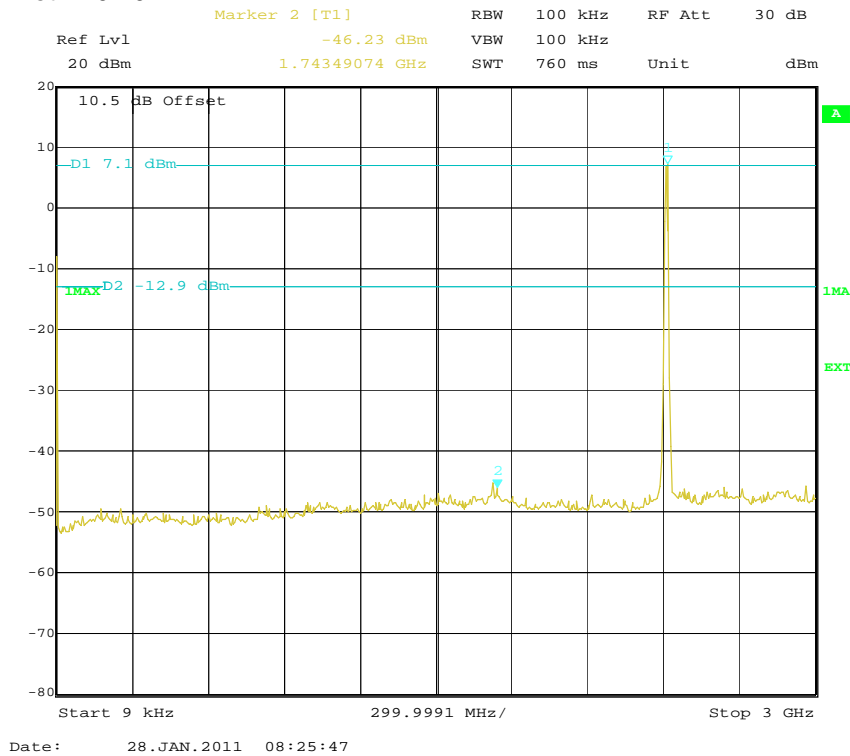




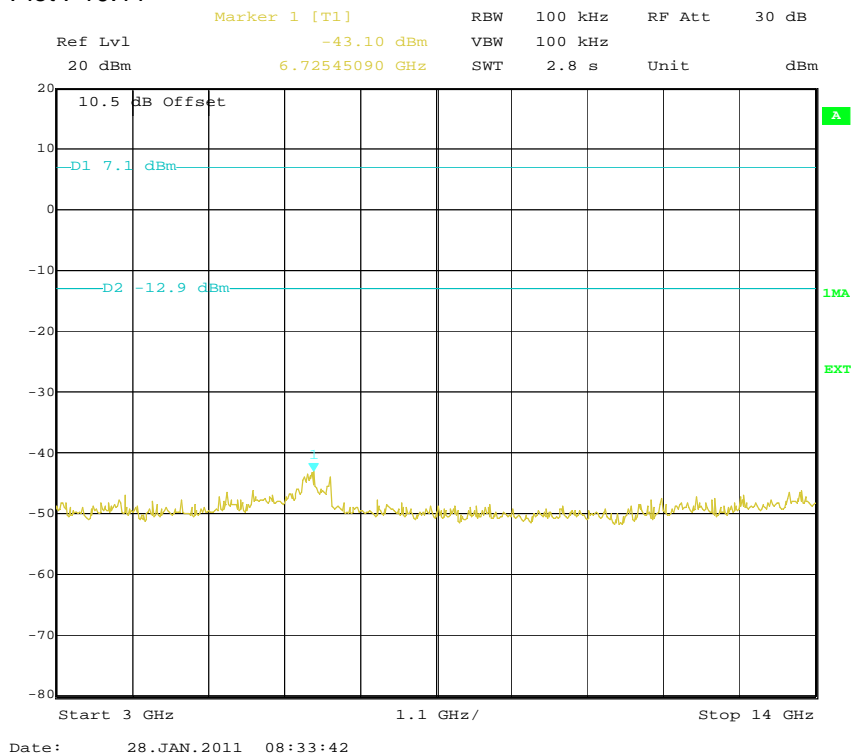
**Plot P10.9**



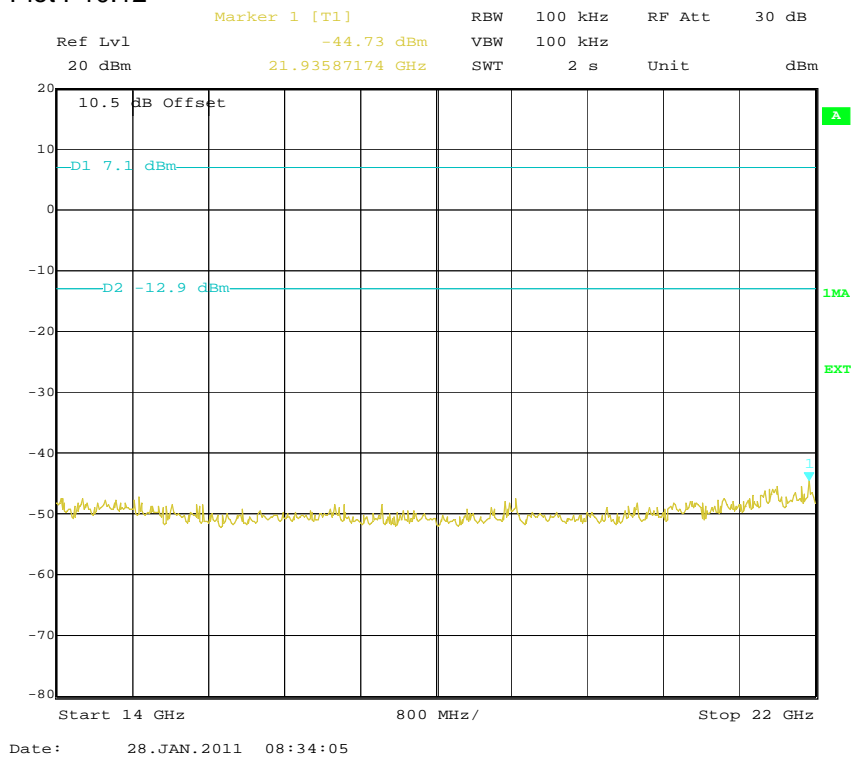
**Plot P10.10**



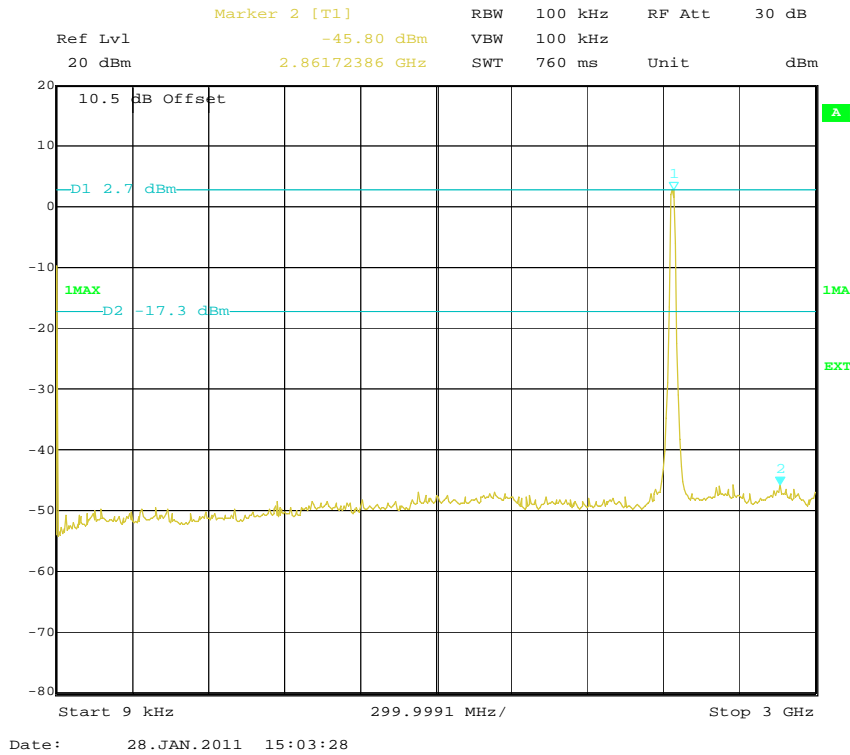
**Plot P10.11**



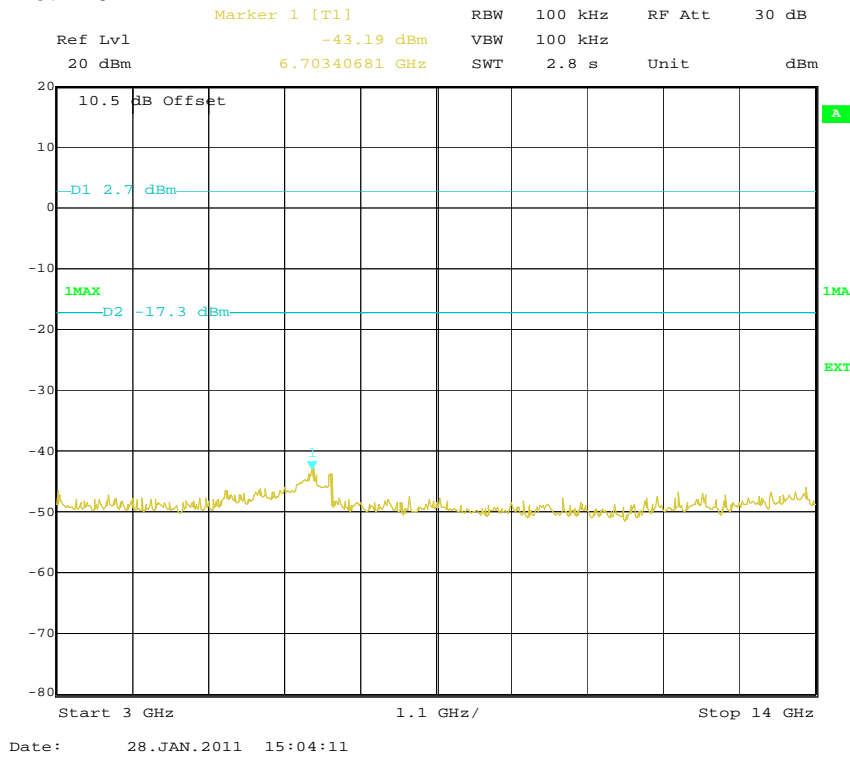
**Plot P10.12**



**Plot P10.13**

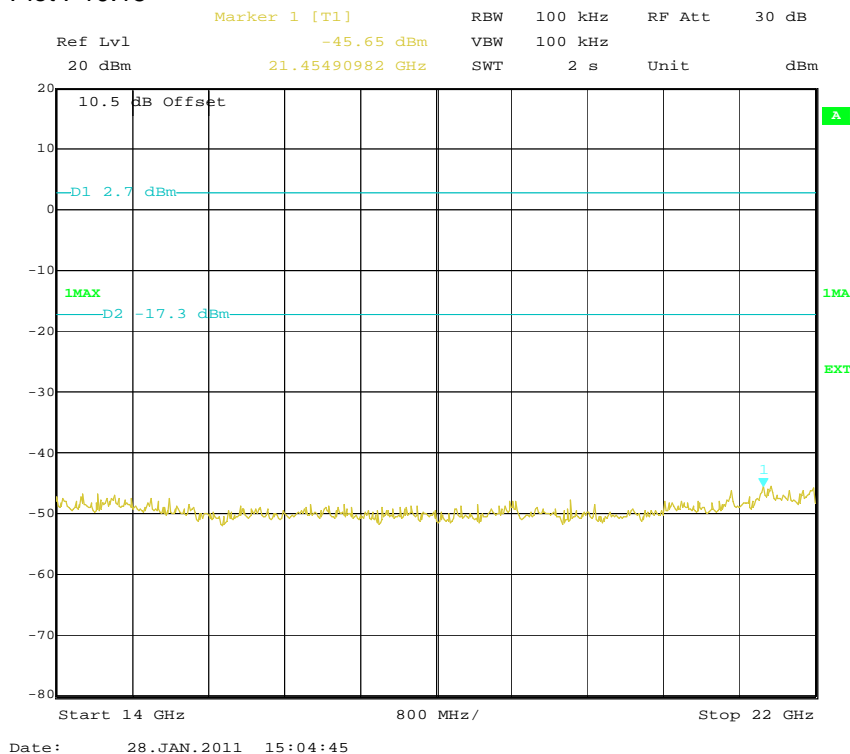


**Plot P10.14**

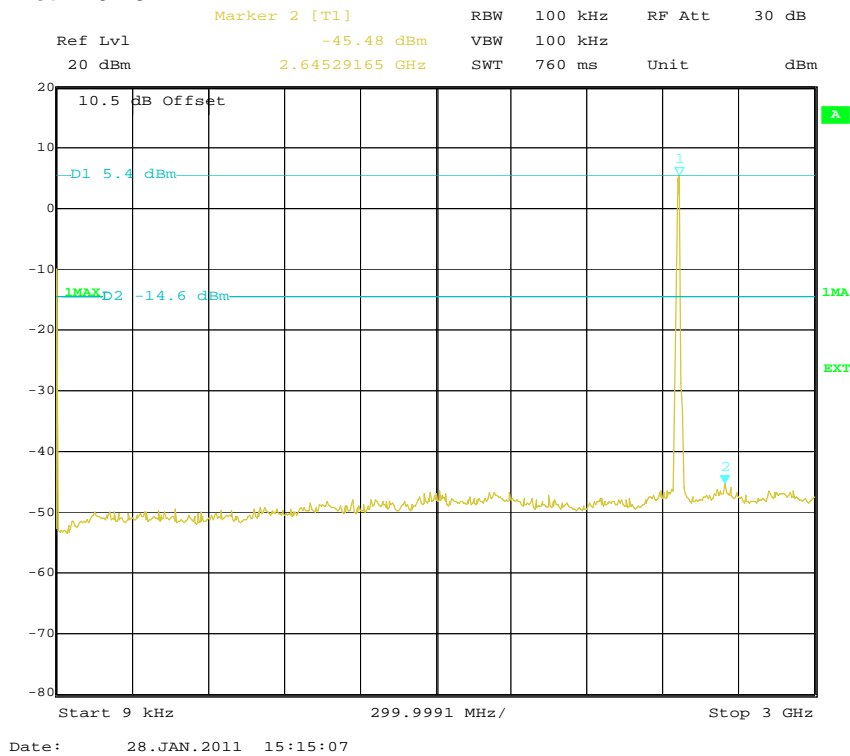




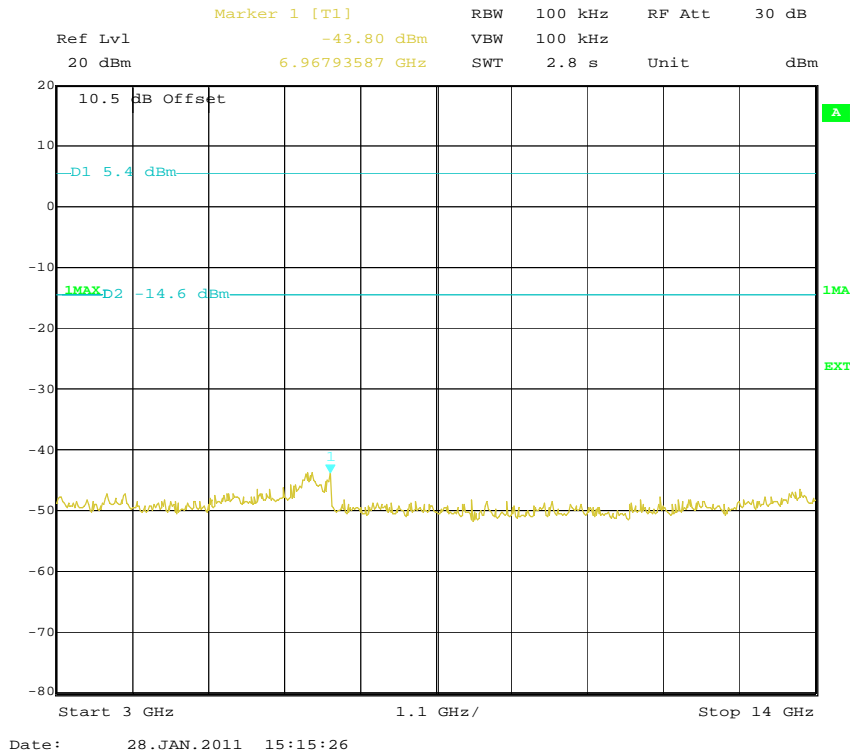
**Plot P10.15**



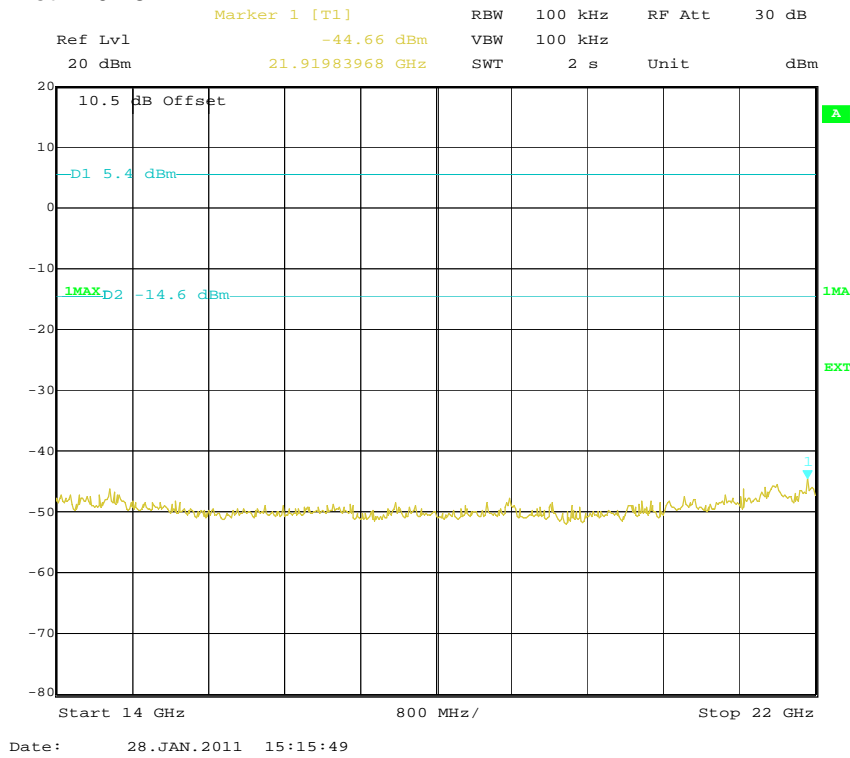
**Plot P10.16**



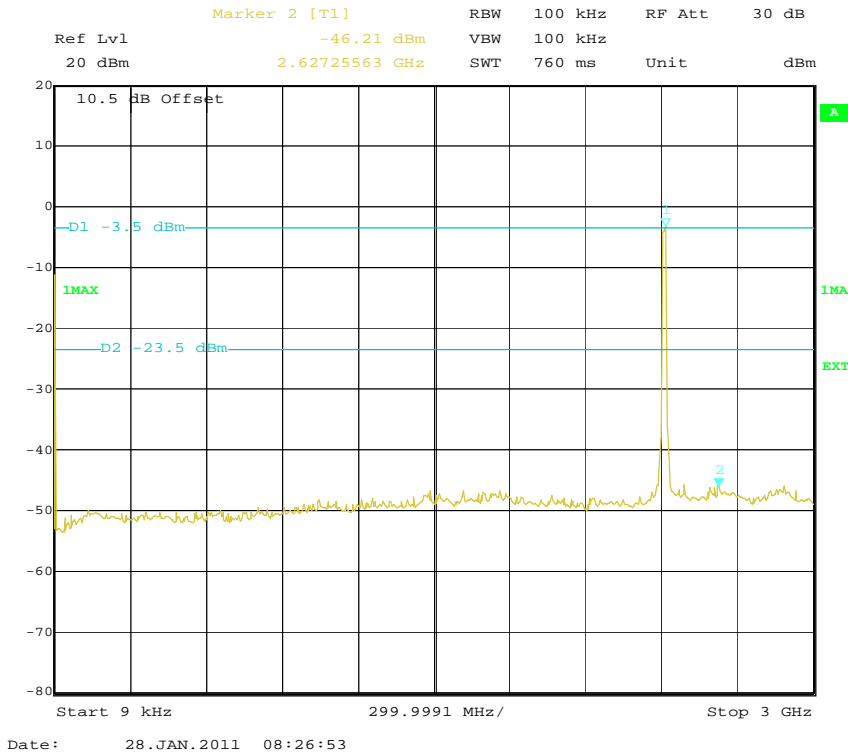
**Plot P10.17**



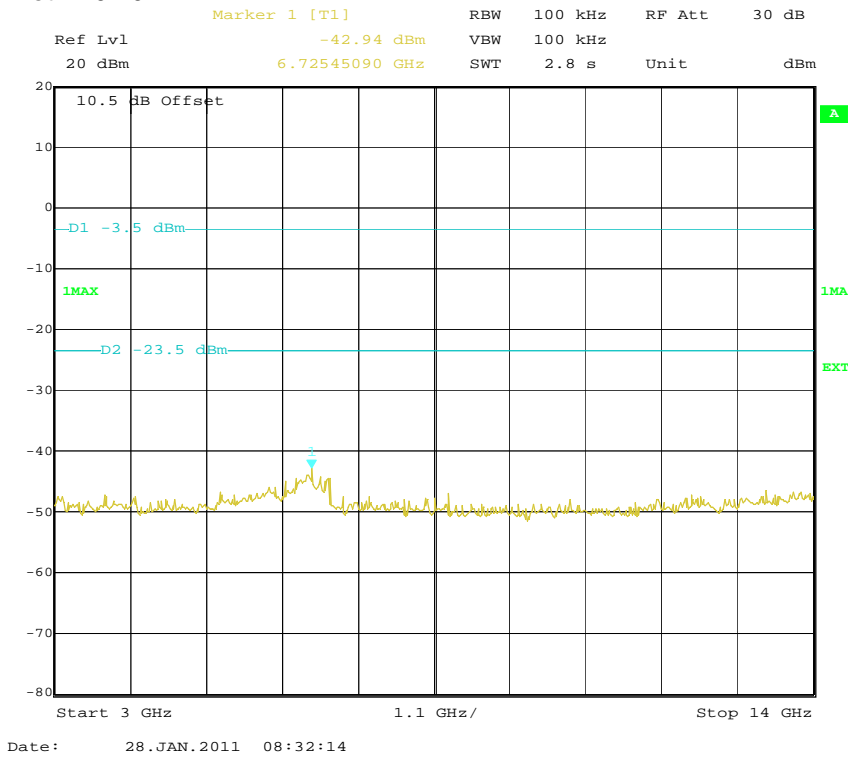
**Plot P10.18**



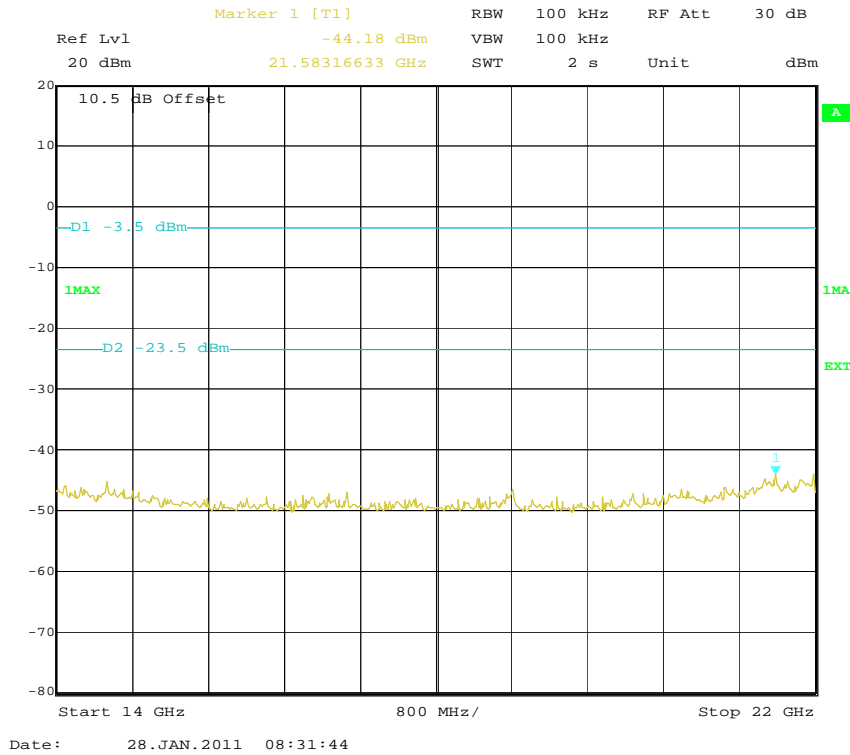
Plot P10.19



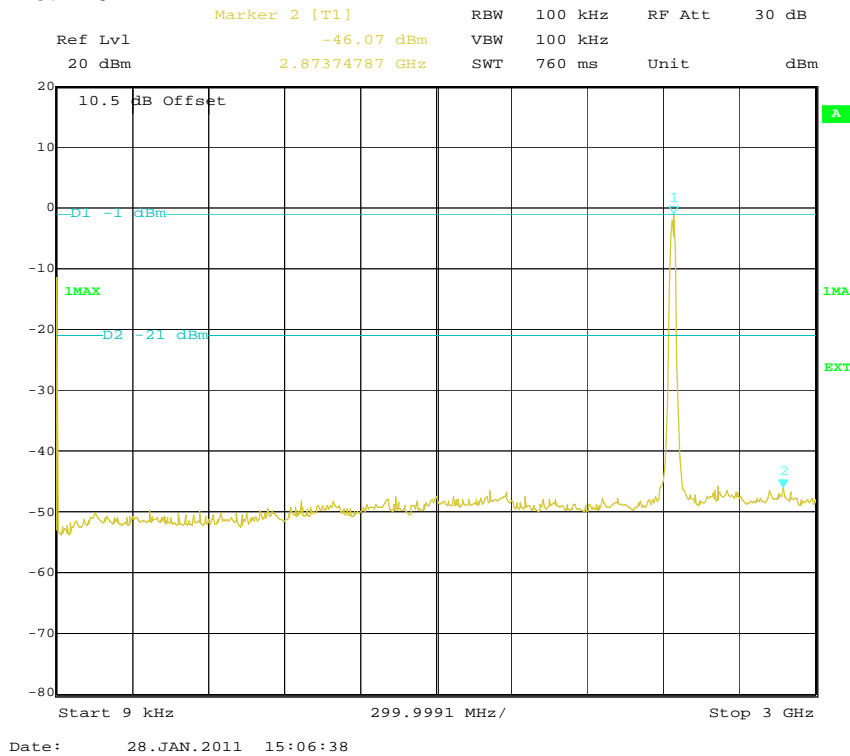
Plot P10.20



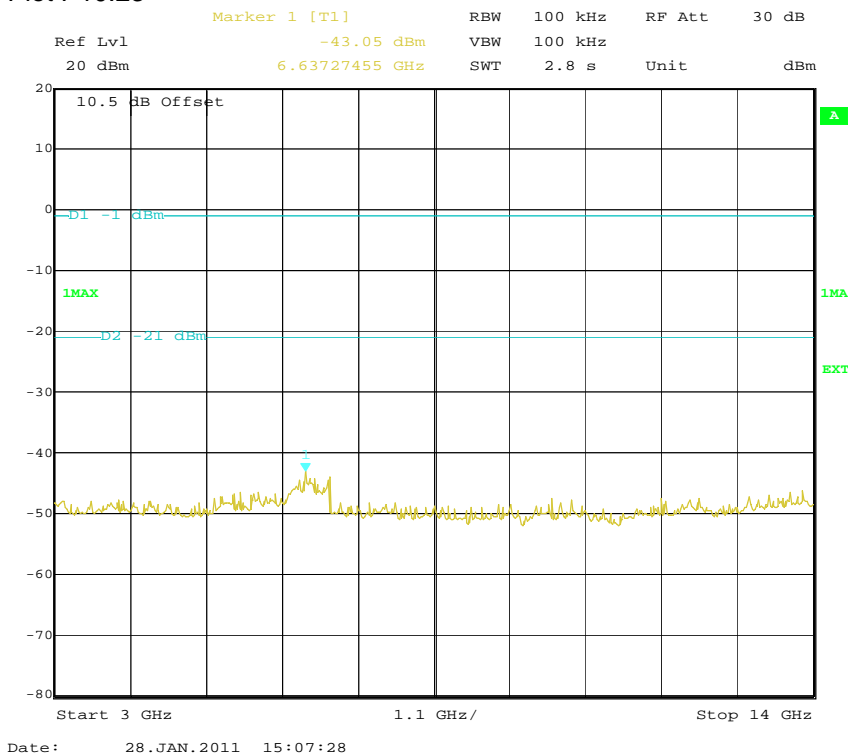
**Plot P10.21**



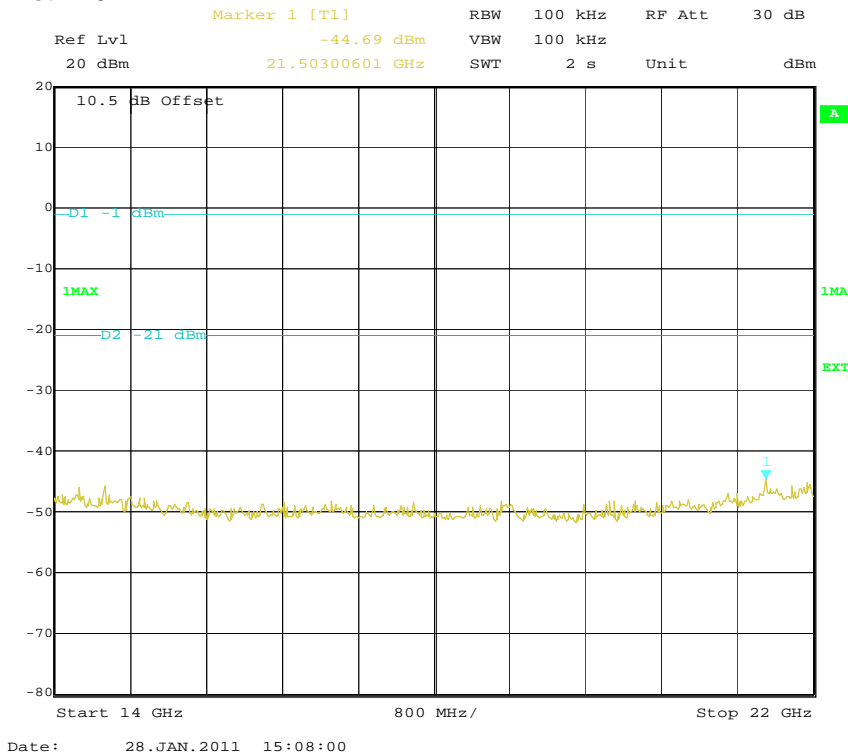
**Plot P10.22**



Plot P10.23

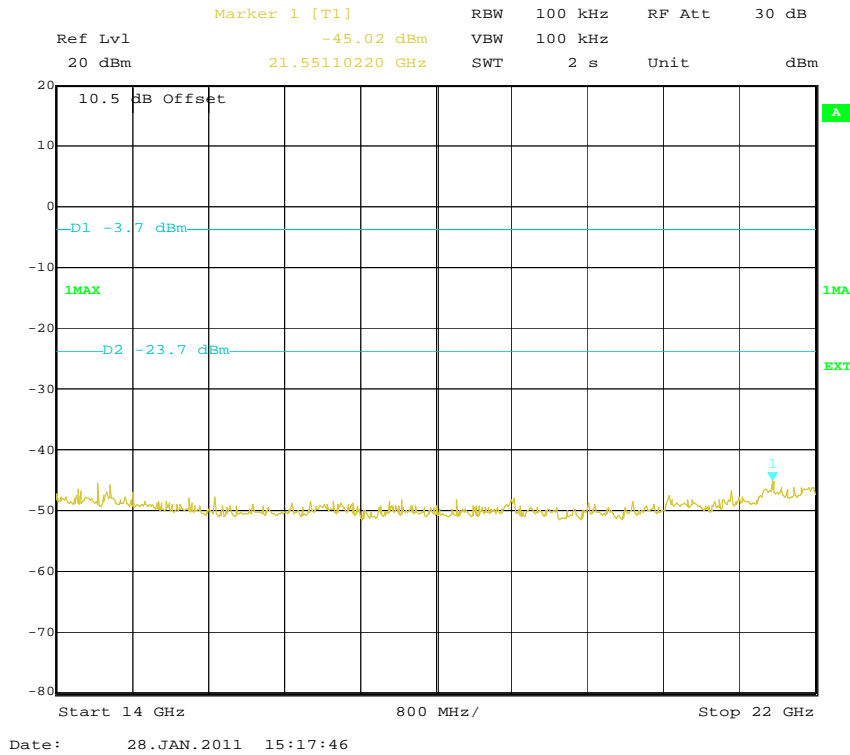


Plot P10.24

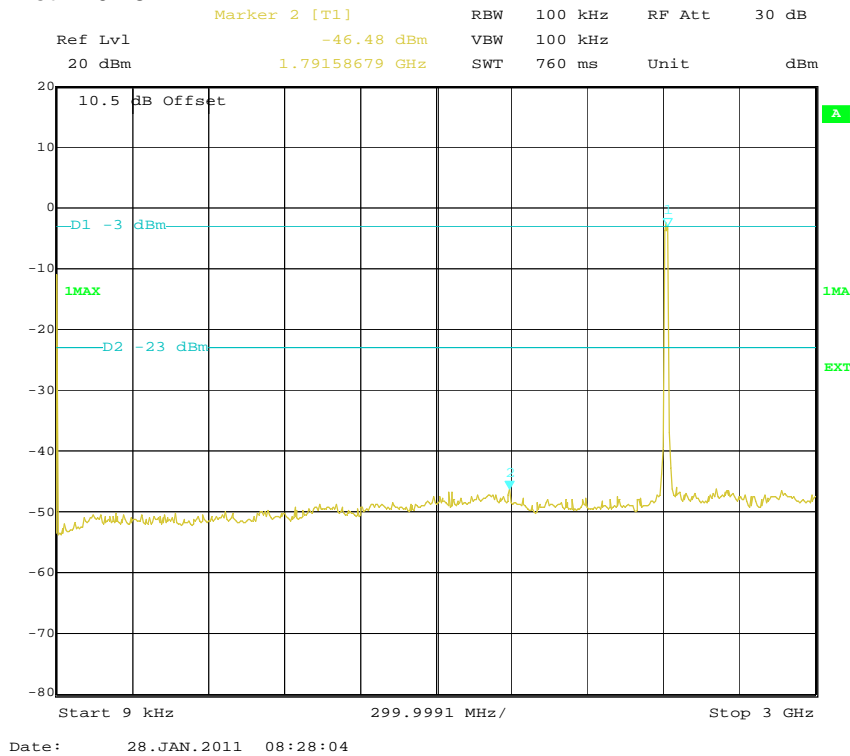




**Plot P10.27**



**Plot P10.28**

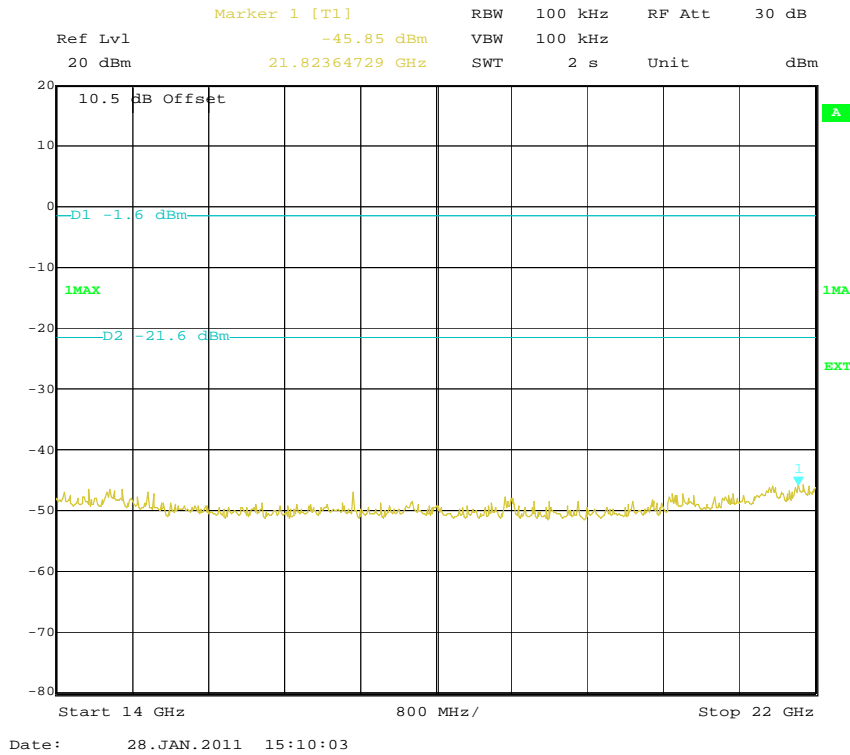




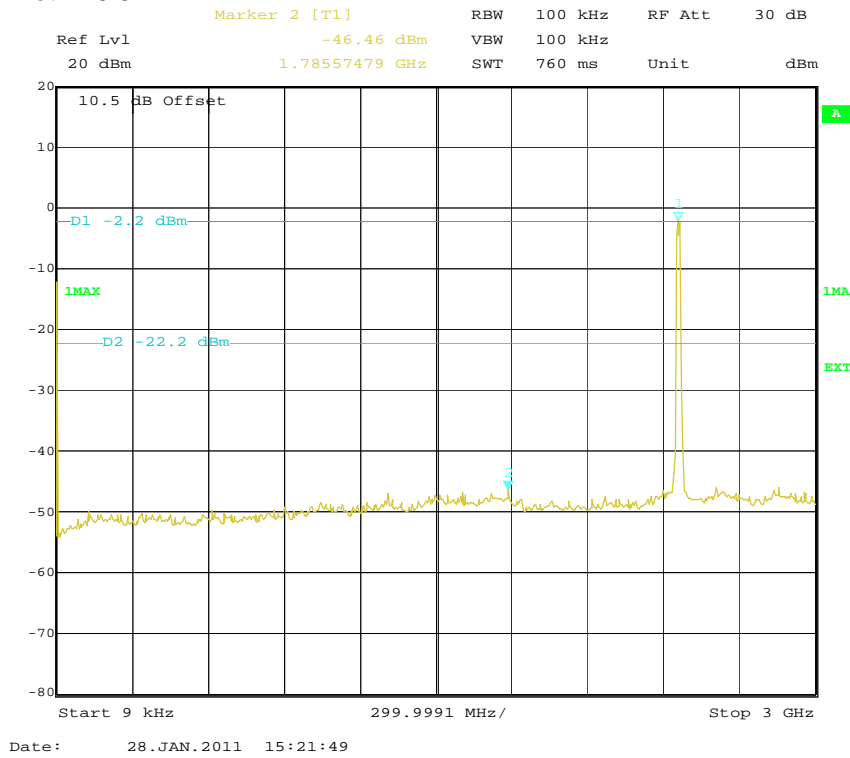




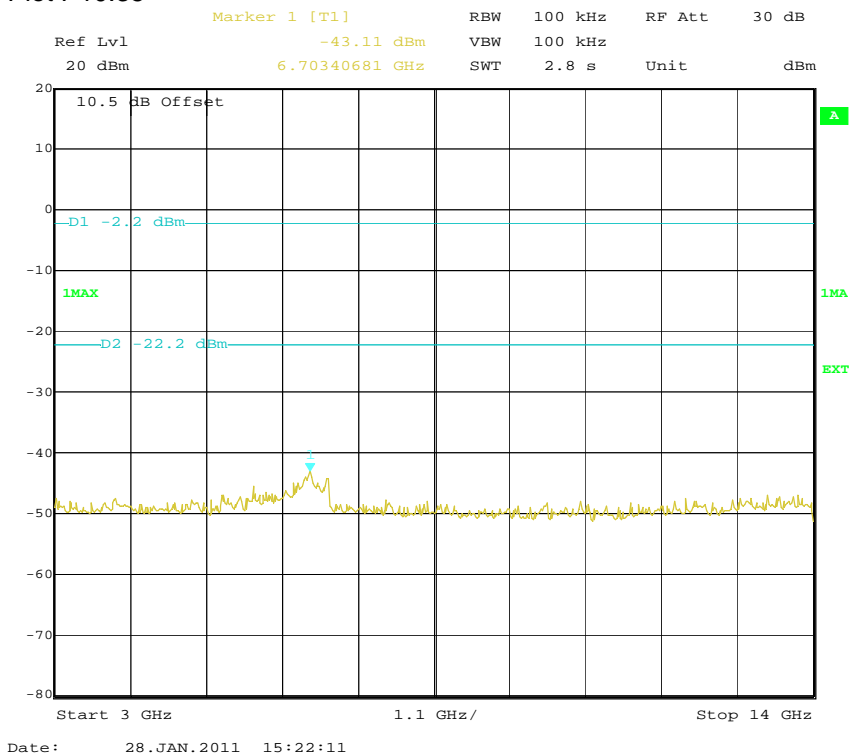
**Plot P10.33**



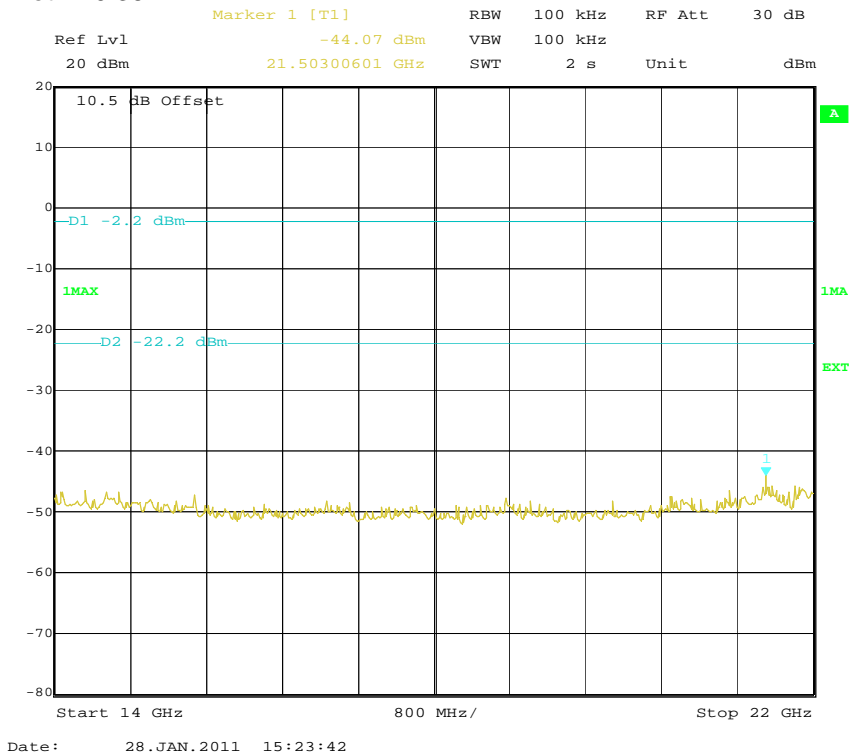
**Plot P10.34**



**Plot P10.35**



**Plot P10.36**



## 11. CONDUCTED DISTURBANCE VOLTAGE IN THE FREQUENCY RANGE 0,15 - 30 MHZ

### 11.1 Measurement uncertainty

Conducted disturbance voltage, quasi-peak detection  $\pm 3.6$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT. Measurement uncertainty is calculated in accordance with EA-4/02-1997. The uncertainty is given with a level of confidence of approximately 95% ( $k=2$ ).

### 11.2 Test equipment

Equipment	Manufacturer	Type	Inv. No.	Calibration due date
Software	Rhode & Schwarz	ES-K1 V1.60		
Measurement Receiver	Rohde & Schwarz	ESHS 30	4946	2011-05
Artificial mains network	Rohde & Schwarz	ESH3-Z5	2727	2011-07

### 11.3 Measurement set-up

During this test the HDG104 module was supplied by the computer and the disturbance was measured on the AC port of the computer.

The mains terminal disturbance voltage was measured with the EUT located 0,8 m above the ground plane and 0,4 m from the vertical ground plane. The EUT was connected to an artificial mains network (AMN). The AMN was placed on the ground plane. Amplitude measurements were performed with a quasi-peak and average detector. The EUT was supplied by 120 VAC (60 Hz) during the test.

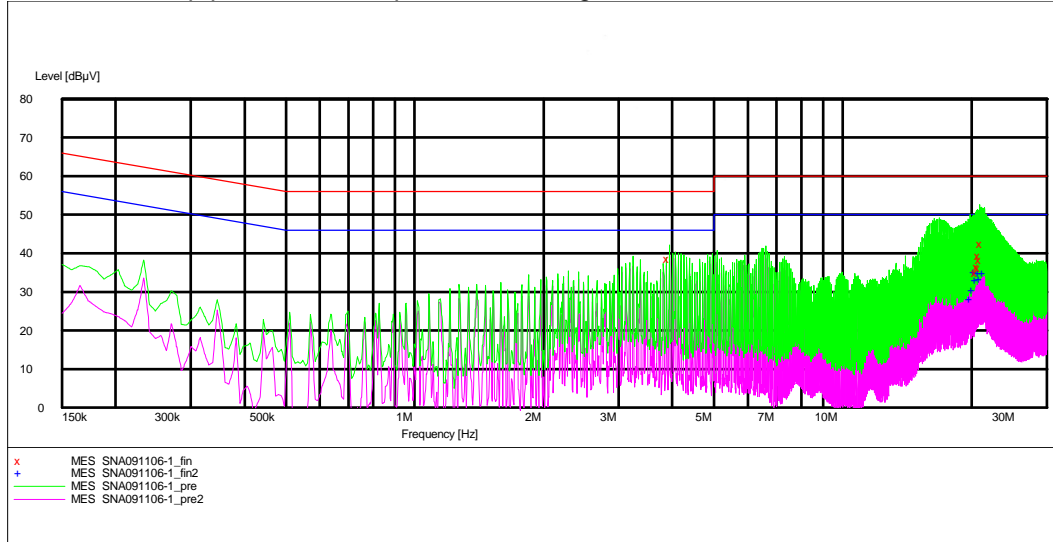
Test set-up photos



**11.4 Test protocol**

Date of test 2009-11-06

Overview sweep performed with peak and average detectors



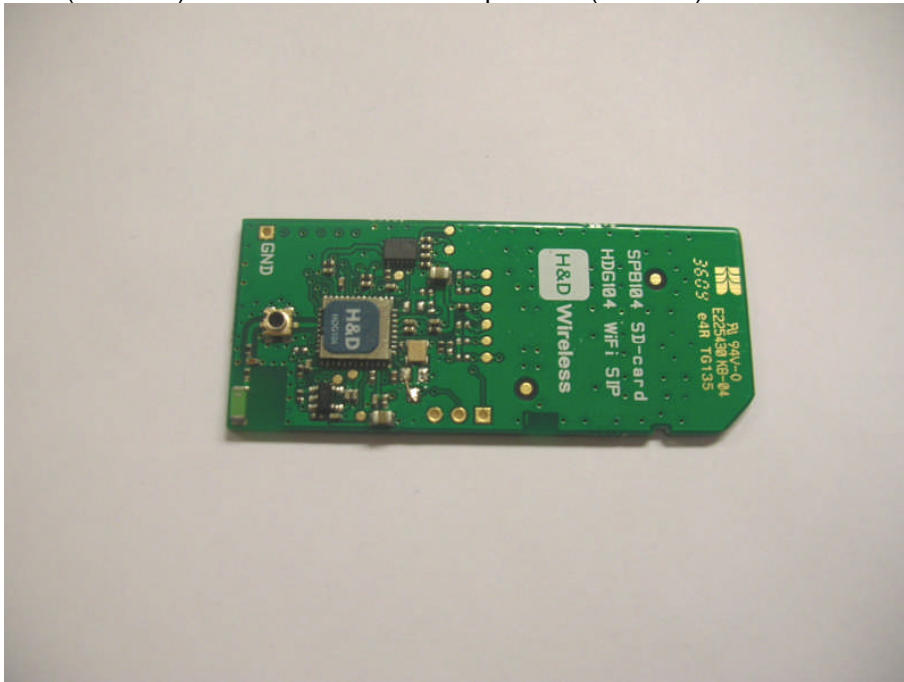
**Data summary**

Frequency /MHz	Quasi-Peak	
	Disturbance Level /dB(µV)	Permitted limit /dB(µV)
3.940	38.6	56.0
20.670	34.8	60.0
20.905	36.6	60.0
21.020	36.3	60.0
21.025	39.4	60.0
21.140	38.4	60.0
21.260	42.3	60.0

Frequency /MHz	Average	
	Disturbance Level /dB(µV)	Permitted limit /dB(µV)
20.095	28.2	50.0
20.330	30.6	50.0
20.565	35.1	50.0
20.680	33.2	50.0
21.030	34.8	50.0
21.145	33.3	50.0
21.495	34.8	50.0

**APPENDIX I – PHOTOS OF THE EUT**

EUT (HDG104) mounted on a reference platform (SPB104)



EUT (HDG104) and SD-card (SPB104) together with PCMCIA-card (SPB479)



EUT, SD-card, PCMCIA-card and computer

