

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4856-02-09/07

Date:2008-04-17

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Recognized by the
Federal Communications Commission
Anechoic chamber registration no.: 90462 (FCC)
Anechoic chamber registration no.: IC3463A-1 (IC)
TCB ID: DE 0001



Accredited by the
German Accreditation Council
DAR-Registration Number
DAT-P-176/94-D1



Accredited Bluetooth[®] Test Facility (BQTF)

Test report no. : 2-4856-02-09/07
Applicant : ads-tec GmbH
Type : TT13C4 / TT13W
Test Standard : FCC Part 15.407
RSS 210 Issue 7
FCC ID : T9GTT13C4
IC Cert. No. : 6275A-TT13C4

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1. Administrative data

1.1. Administrative data of the test facility

1.1.1 Identification of the testing laboratory

Company name:	Cetecom ICT Services GmbH
Address:	Untertürkheimerstr. 6-10 D-66117 Saarbruecken Germany
Laboratory accreditation:	DAR-Registration No. DAT-P-176/94-D1 Bluetooth Qualification Test Facility (BQTF)
Responsible for testing laboratory:	Harro Ames, Michael Berg Phone: +49 681 598 0 Fax: +49 681 598 9075 email: info@ict.cetecom.de



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Responsible for testing laboratory
(Harro Ames)

1.1.2 Organizational items

Reference No.:	2-4865-02-09/07
Order No.:	
Responsible for test report and project leader:	Harro Ames, Michael Berg
Receipt of EUT:	2008-02-19
Date(s) of test:	2008-02-19 to 2008-04-17
Date of report:	2008-04-17
Number of report pages:	84
Number of diagram pages (annex):	

Version of template:	1.6



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Responsible for test report
(Michael Berg)

Note:

The test results of this test report relate exclusively to the item tested as specified in this report. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

During the test no hardware and software changes are allowed to be performed at the EUT.

1.1.3 Applicant's details

Applicant's name:	ads-tec GmbH
Address:	Raiffeisenstr. 14 D- 70771 Leinfelden-Echterdingen Germany

Contact person:	Mr. C. Remmert
	Tel: +49 (0)711 45894-286
	Fax: +49 (0)711 45894-994
	email: C.Remmert@ads-tec.de

1.2 Administrative data of manufacturer / member

Manufacturer's name:	- applicant -
Address:	

1.3 Description of the Equipment under test (EUT)

1.3.1 EUT: Type, S/N etc.

Product name	Product ID	Description	S/N serial number	HW hardware status	SW software status
TT13C4 / TT13W		Dual WLAN Client	-	-	-
Frequency Band [MHz]	Type of Modulation	Number of channels	Antenna	Power Supply	Temperature Range
5150 - 5350	OFDM	8	2 internal antennas	External AC power supply	-20°C to +55°C

1.3.2 If RF component testing only, description of additional used HW/SW

	Product name	Product ID	Description	S/N serial number	HW hardware status	SW software status
1						
2						

1.3.3 Additional EUT information

The sample is a client for dualband use. (2.4 and 5 GHz).

Inside the client there is one RF part, able to work on 2.4 and 5 GHz.

In this report we test the frequency range 5150 to 5350 MHz according to FCC15.407

Other frequency ranges are tested in separate reports.

1.3.4 Additional EUT information For IC Canada (appendix 2)

IC Certification Number:	6275A-TT13C4
Model Name:	TT13C4 / TT13W
Manufacturer (complete Adress):	ads-tec GmbH Raiffeisenstr. 14 D-70771 Leinfelden-Echterdingen Germany
Tested to Radio Standards Specification (RSS) No.:	RSS-210 Issue 7
Open Area Test Site Industry Canada Number:	IC 3463A-1
Frequency Range (or fixed frequency) [MHz]:	5180 to 5320 MHz
RF: Power [W] (max):	Rad. EIRP: 169.8 mW Conducted : 104.7 mW
Antenna Type:	Build-in print antennas
Occupied Bandwidth (99% BW) [MHz]:	18.2 MHz
Type of Modulation:	OFDM
Emission Designator (TRC-43):	18M2G7D
Transmitter Spurious (worst case) [dBm]:	-44.2 dBm @ 10360 MHz
Receiver Spurious (worst case) [dBm]:	-49.0 dBm @ 1503 MHz

ATTESTATION: I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all the applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Date: 2008-04-17

Testengineer: Harro Ames

1.3.5 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions
Op. 1		low temperature, low power source conditions
Op. 3		low temperature, high power source conditions
Op. 4		high temperature, low power source conditions
Op. 5		high temperature, high power source conditions

*) EUT operating mode no. is used to simplify the test report.

1.3.6 Extreme conditions testing values

Description	Shortcut	Unit	Value
Nominal Temperature / humidity	T _{nom}	°C / %	22°C / 33%
Low Temperature	T _{low}	°C	-20°C
High Temperature	T _{high}	°C	55°C
Nominal Power Source	V _{nom}	V	115V AC
Low Power Source	V _{low}	V	100V AC
High Power Source	V _{high}	V	130V AC

Type of powersource: External DC power supply delivered by the customer

2 Test standard & summary list of all performed test cases

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC Part 15 §15.407 - CANADA RSS-210	pass	2008-04-17	

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
None	Antenna Gain	Yes			
Range:	5.150 to 5.350 GHz				
§15.407a(3)+(4)	Peak transmit power	Yes			
§15.407a(5)	Peak power spectral density conducted	Yes			
§ 15.407a (6)	Ratio of peak excursion	Yes			
§ 15.407b (3)	Undesirable emissions conducted	Yes			
§ 15.209	Spurious Emission -radiated (TX)	Yes			
§ 15.209	Spurious Emission -radiated (RX)	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	Yes			
§15.407h (iii)	Channel Move Time (DFS requirement for client)	Yes			
§15.407h (iv)	Non-occupancy Period (DFS requirement for client)	Yes			

3 RF measurement testing

3.1 Description of test set-up

3.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas conform with specifications ANSI C63.2-1987 clause 15 and ANSI C63.4-1992 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-1992 clause 4.2.

Antennas conform with ANSI C63.2-1996 item 15.

9 kHz - 150 kHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

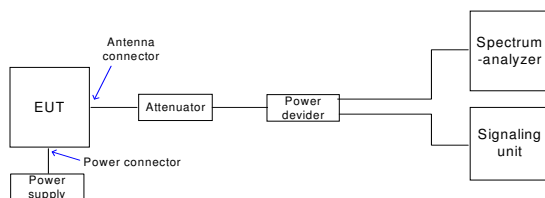
30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

>1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn with lownoise preamp

3.1.2 Conducted measurements (if possible)

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is connected to the spectrum analyzer. The specific losses for signal paths is first checked within a calibration. The measurement readings on the spectrum analyzer is corrected by the specific test set-up loss. The attenuator, power divider, signaling unit and the spectrum analyzer are impedance matched on 50 Ohm.



3.1.3 AC-conducted measurements

We used the dedicated power supply delivered by the customer.

3.2 Referenced Documents

none

3.3 Additional comments

For testing we used a special software tool delivered by the customer. (ART)

3.4 Antenna gain

The antenna gain is calculated by subtracting the conducted from the radiated power.

For the dedicated rod antenna, we calculated max dBi at 5240 MHz.

Frequency range of the sample : 5150 to 5350 MHz

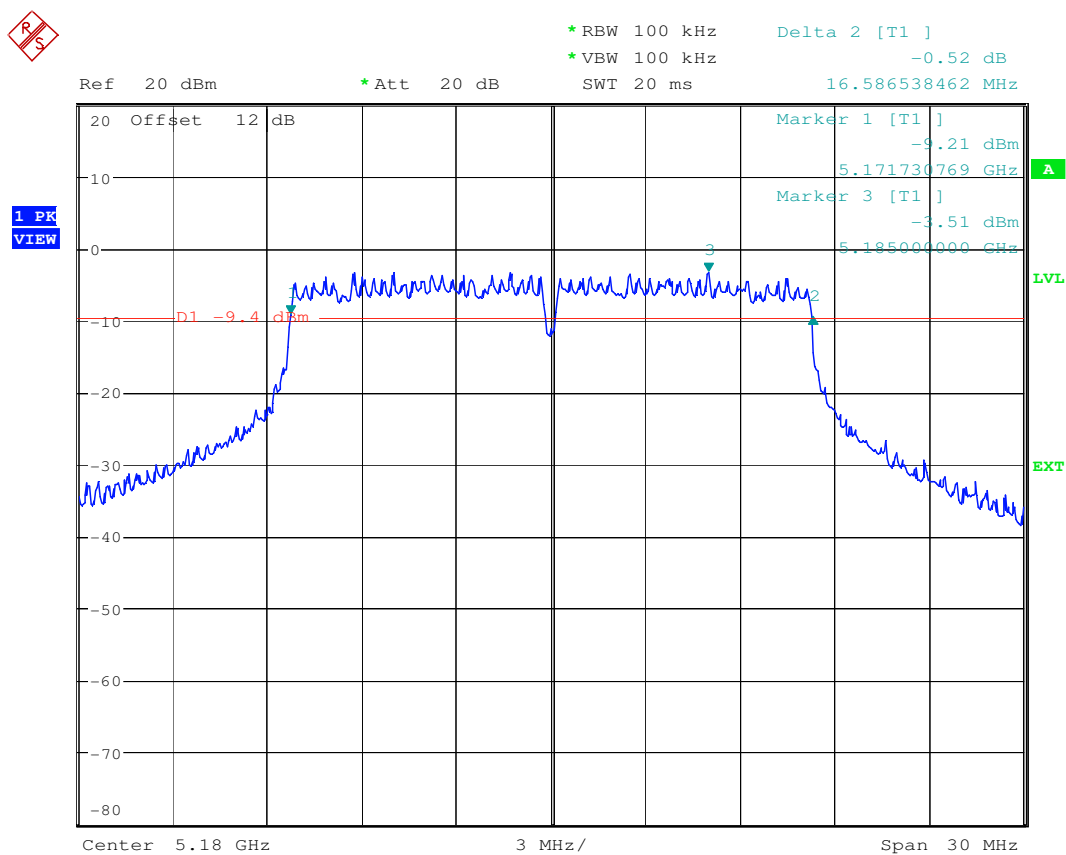
Measurements according to the measurement procedure for U-NII bands (August 2002)

3.5 Transmit Power

§15.407a(1)+(4)

3.5.1 Measurement 1: Emission BW of the sample (6 dB, 20 dB, 26 dB)

Plot 1: 5180 MHz 6 dB BW



Date: 13.MAR.2008 14:01:15

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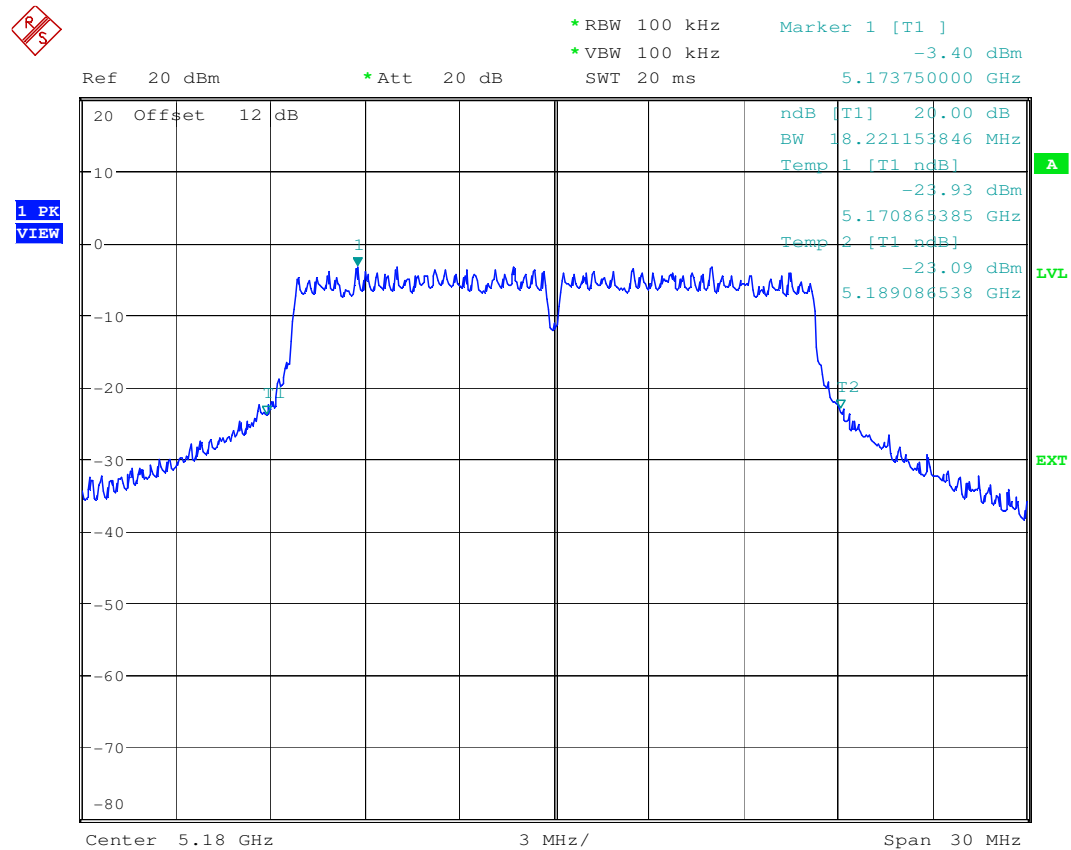


Test report No.: 2-4856-02-09/07

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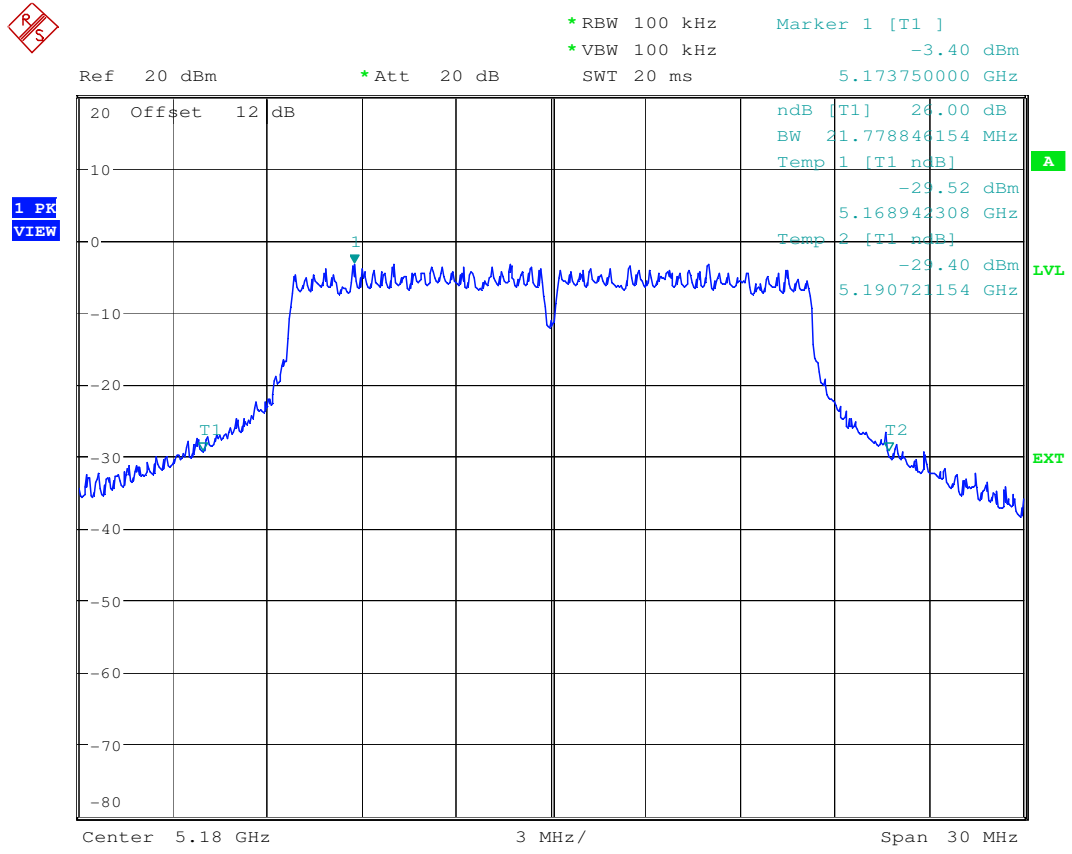
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Plot 2: 5180 MHz 20 dB BW



Date: 13.MAR.2008 13:59:25

Plot 3: 5180 MHz 26 dB BW



Date: 13.MAR.2008 14:00:03

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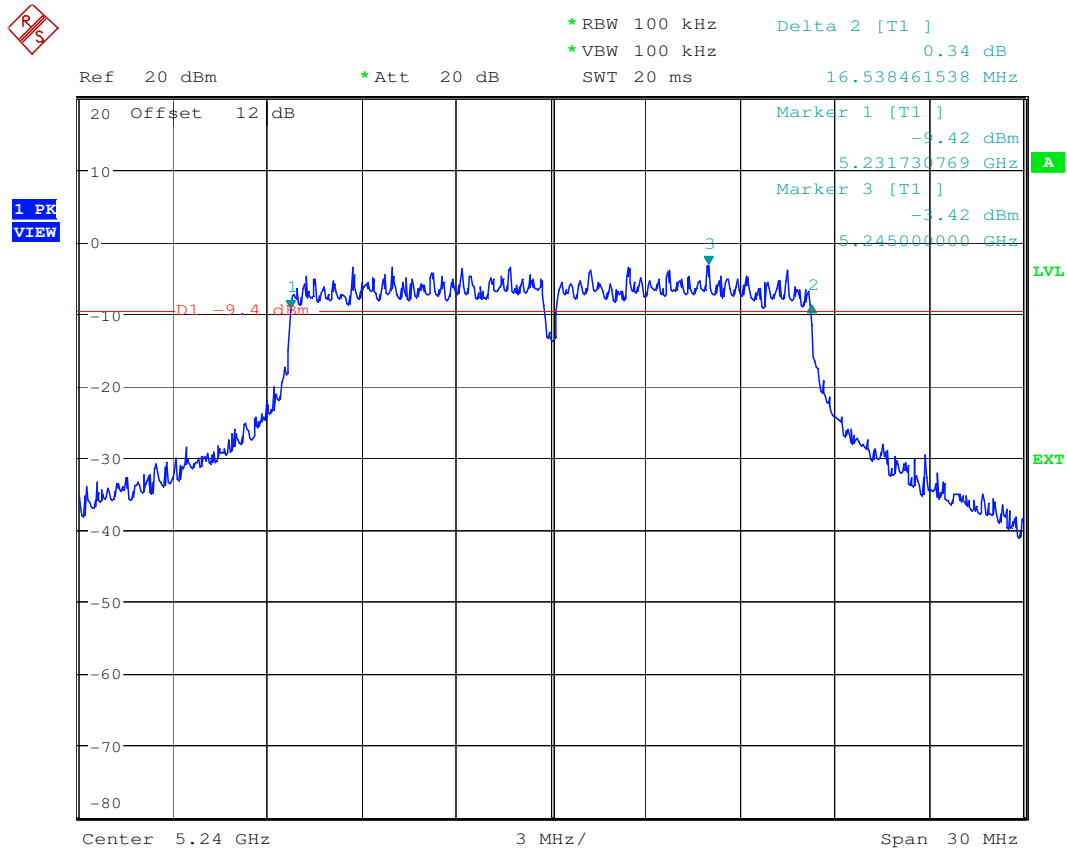


Test report No.: 2-4856-02-09/07

Date:2008-04-17

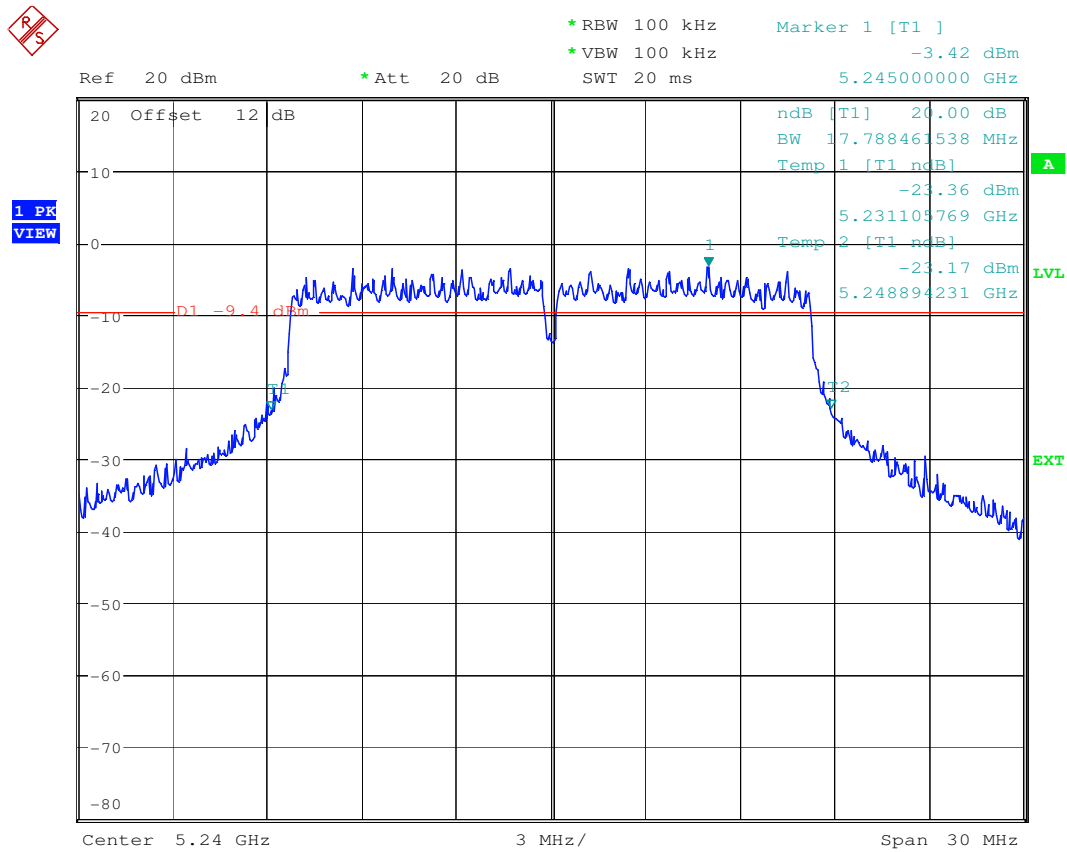
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Plot 4: 5240 MHz 6 dB BW



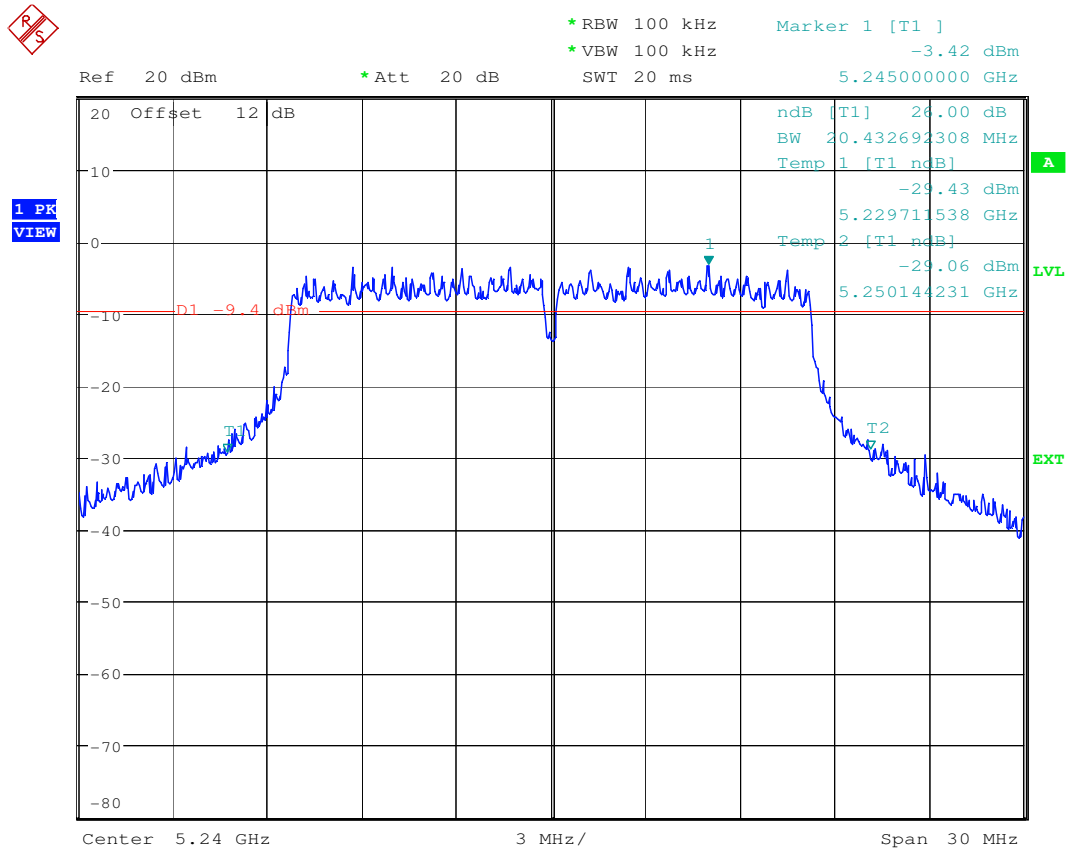
Date: 13.MAR.2008 14:30:43

Plot 5: 5240 MHz 20 dB BW



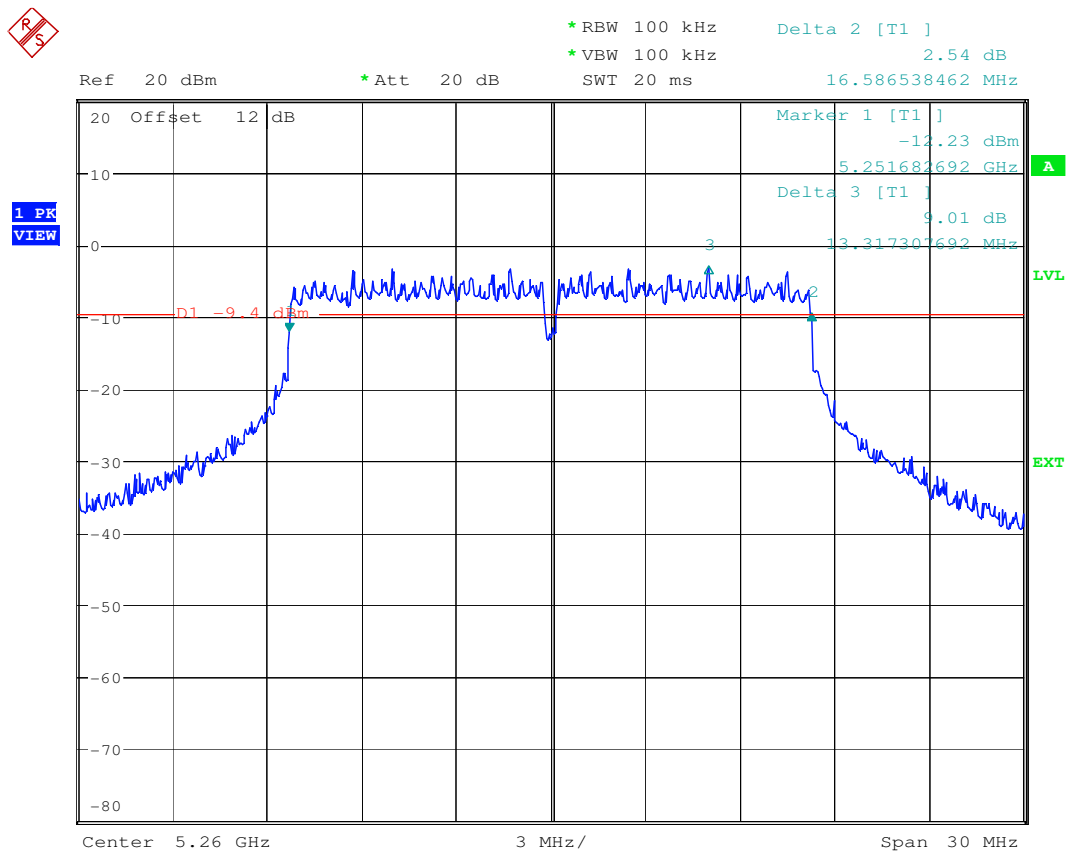
Date: 13.MAR.2008 14:34:10

Plot 6: 5240 MHz 26 dB BW



Date: 13.MAR.2008 14:34:52

Plot 7: 5260 MHz 6 dB BW



Date: 13.MAR.2008 14:49:11

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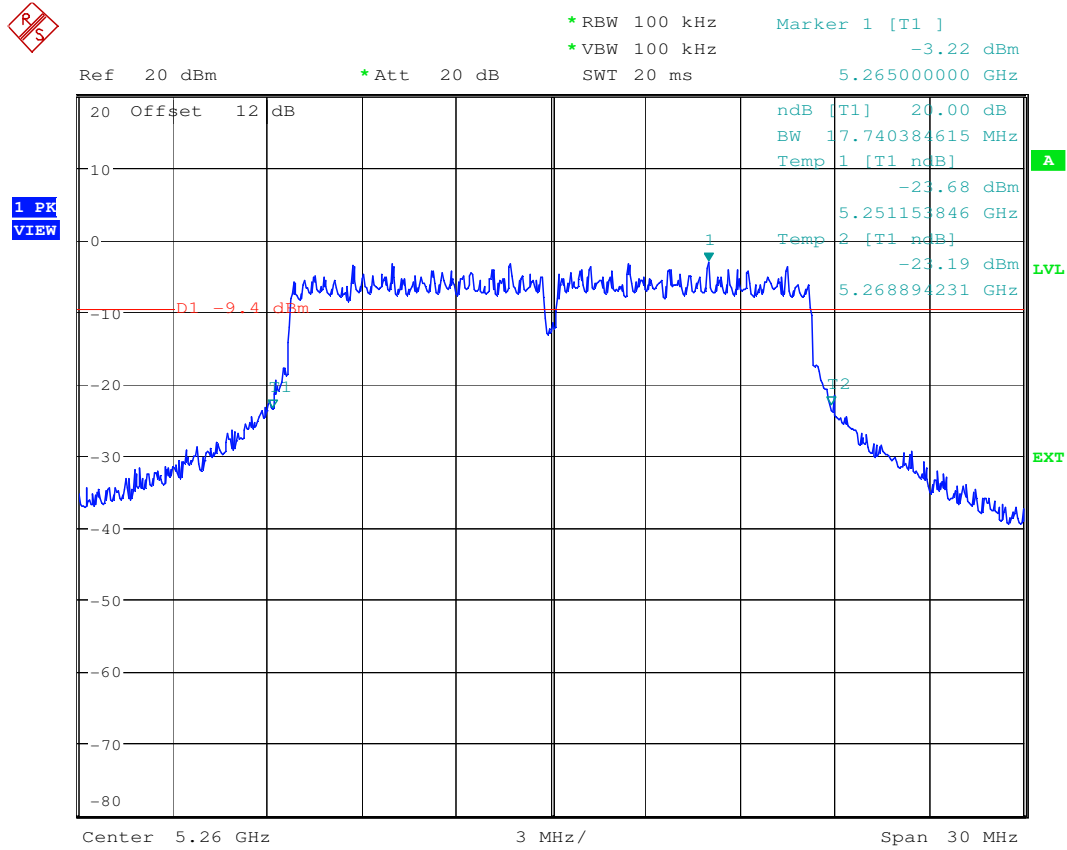


Test report No.: 2-4856-02-09/07

Date:2008-04-17

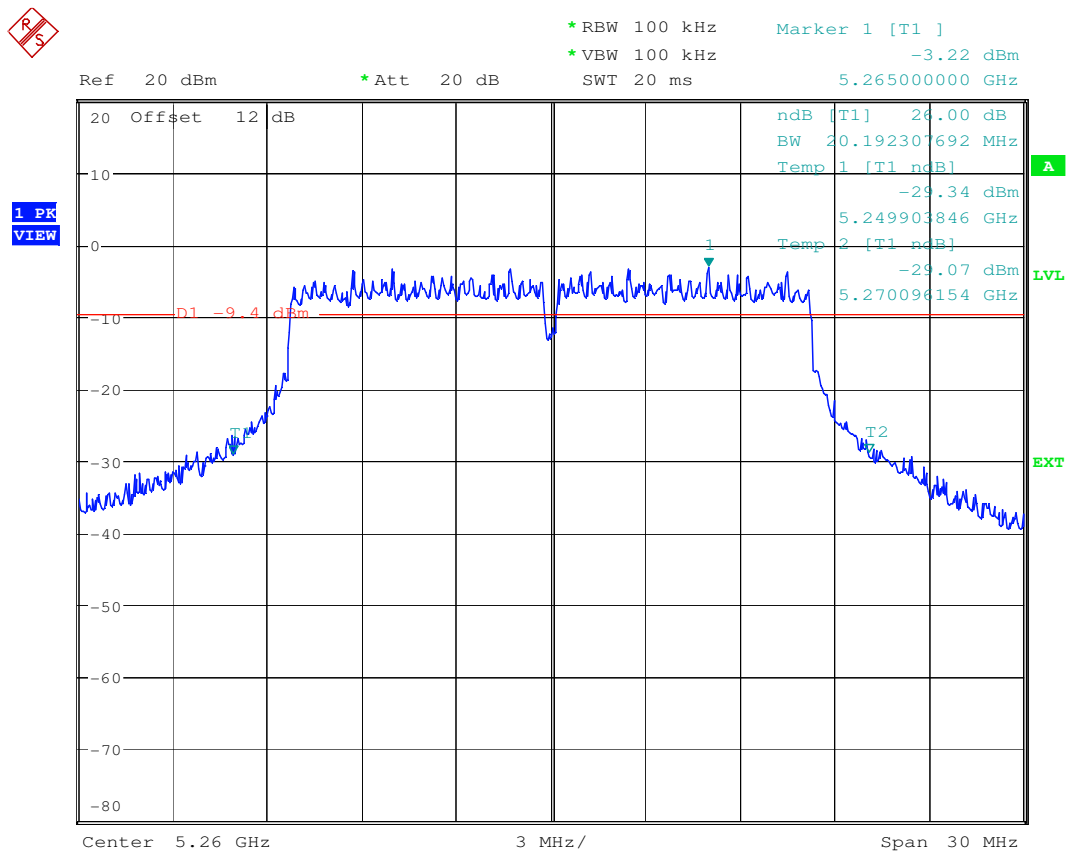
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Plot 8: 5260 MHz 20 dB BW



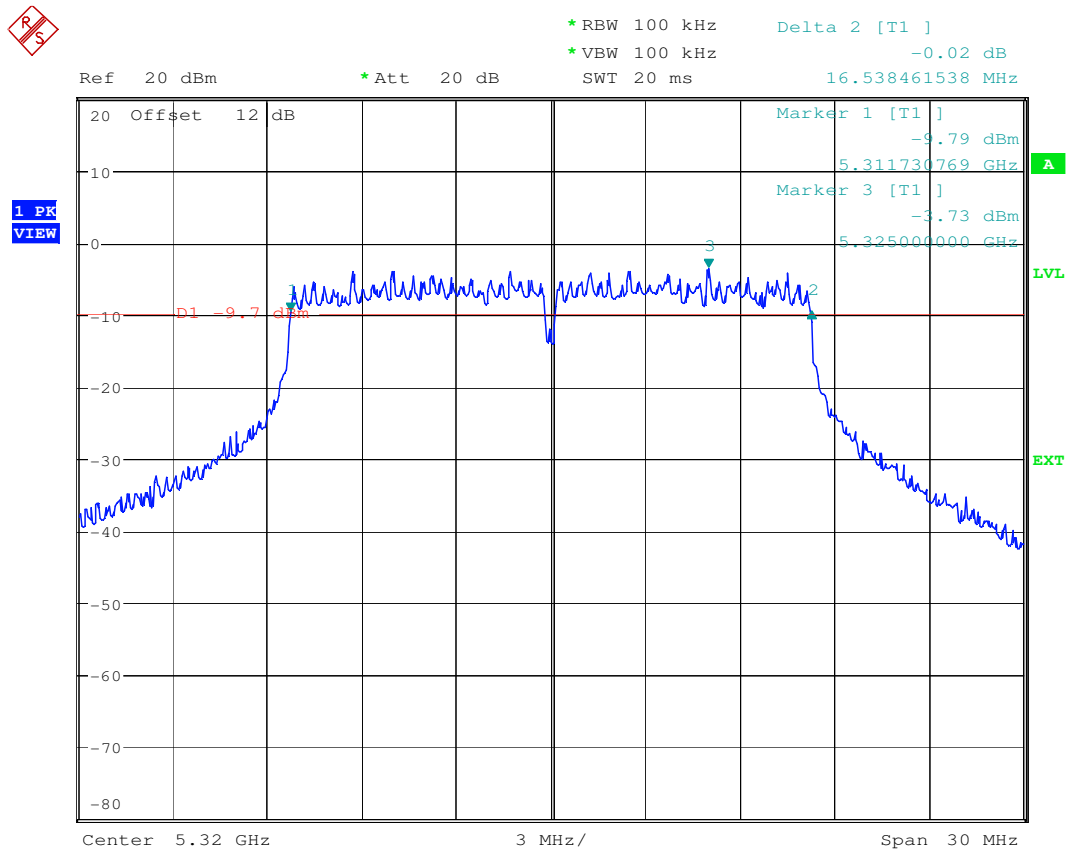
Date: 13.MAR.2008 14:37:00

Plot 9: 5260 MHz 26 dB BW



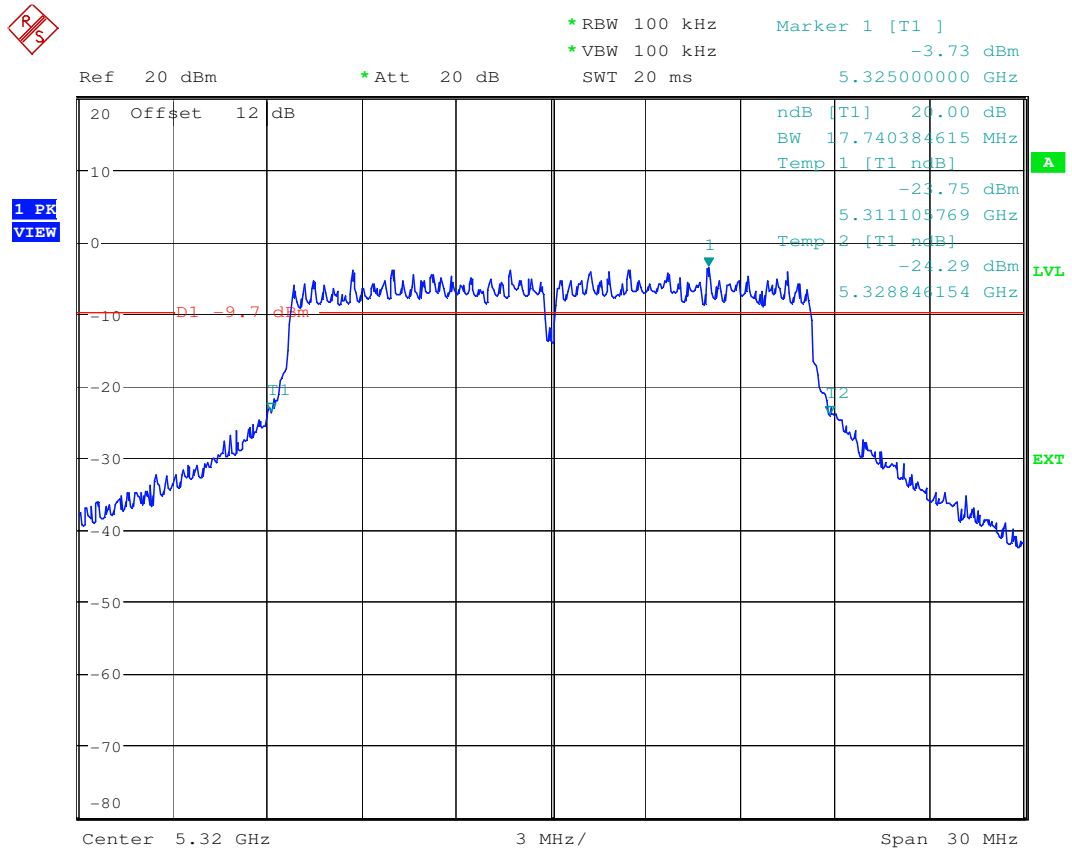
Date: 13.MAR.2008 14:36:39

Plot 10: 5320 MHz 6 dB BW



Date: 13.MAR.2008 14:50:24

Plot 11: 5320 MHz 20 dB BW



Date: 13.MAR.2008 14:51:03

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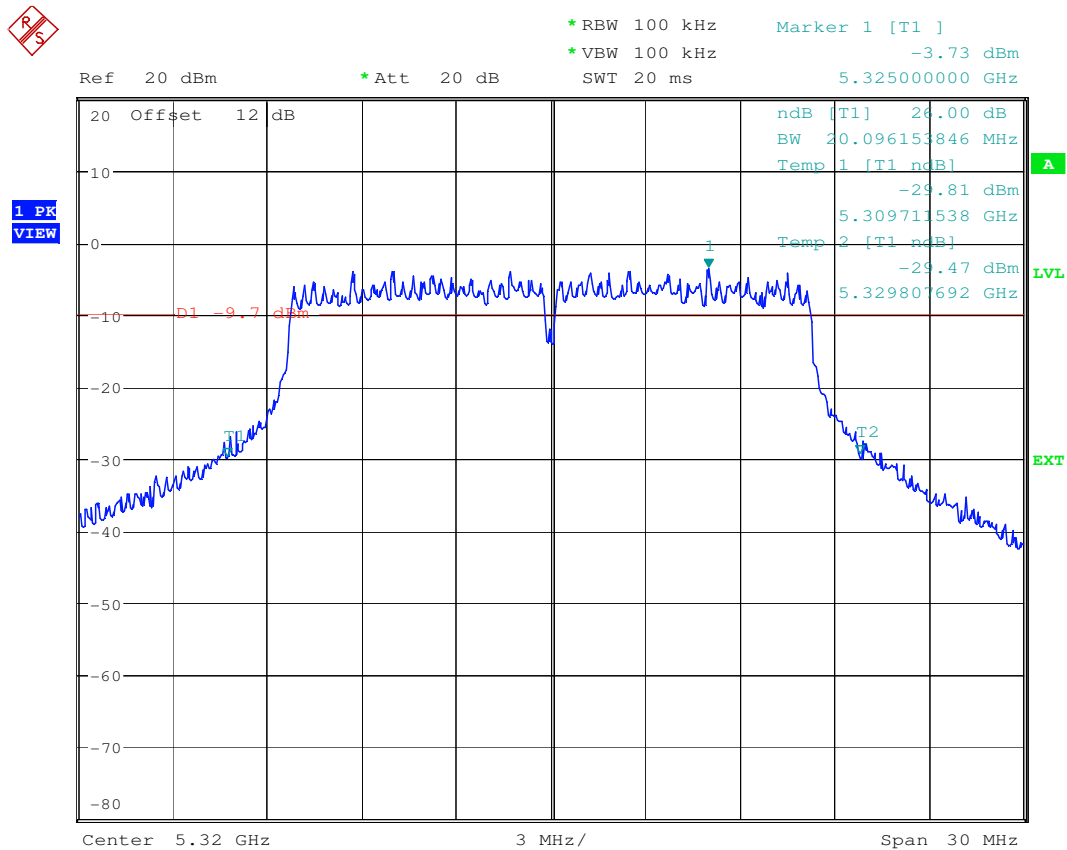


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Plot 12: 5320 MHz 26 dB BW



Date: 13.MAR.2008 14:51:29

Results:

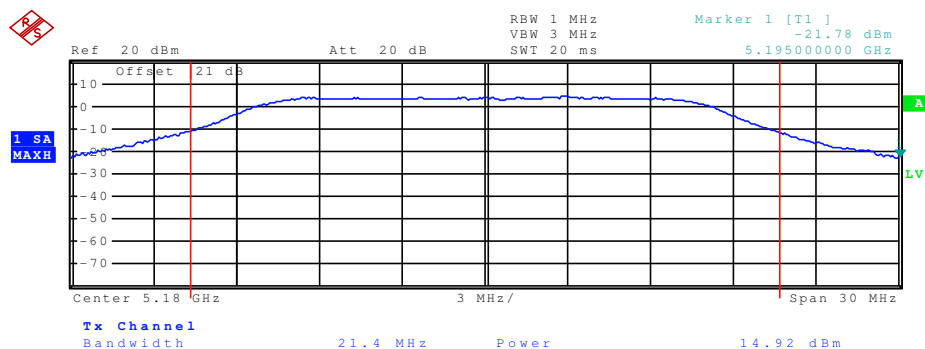
Frequenz (MHz)	6 dB BW (MHz)	20 dB BW (MHz)	26 dB BW (MHz)
5180	16.59	18.22	21.78
5240	16.54	17.79	20.43
5260	16.59	17.74	20.19
5320	16.54	17.74	20.10

Measurement 2: Peak conducted transmit output power

Measured with the spectrum analyzer's band power measurement according to the guidelines of the FCC public notice DA 02-2138 - method #3:

- Set span to encompass the entire emission bandwidth (EBW) of the signal
- Set sweep trigger to "free run"
- Set RBW = 1 MHz. Set VBW $\geq 1/T$
- Use linear display mode
- Use sample detector mode if bin width (i.e., span/number of points in spectrum) < 0.5 RBW. Otherwise use peak detector mode
- Set max hold
- Allow max hold to run for 60 seconds
- Compute power by integrating the spectrum across the 26 dB EBW or apply a bandwidth correction factor of $10 \cdot \log(EBW/1 \text{ MHz})$ to the spectral peak of the emission. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

Plot 1: 5180 MHz



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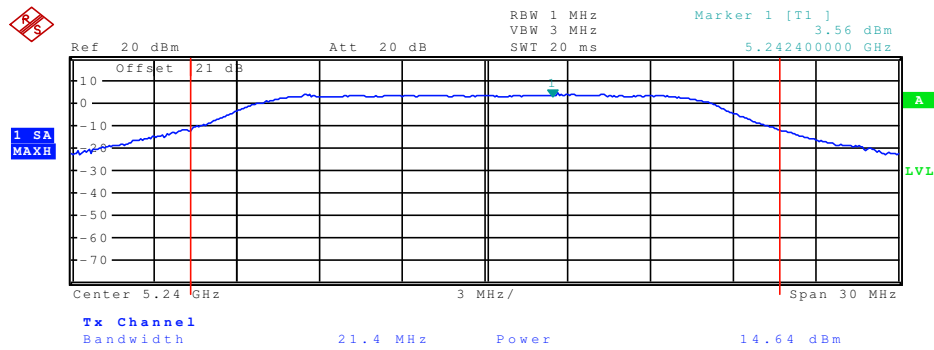


Test report No.: 2-4856-02-09/07

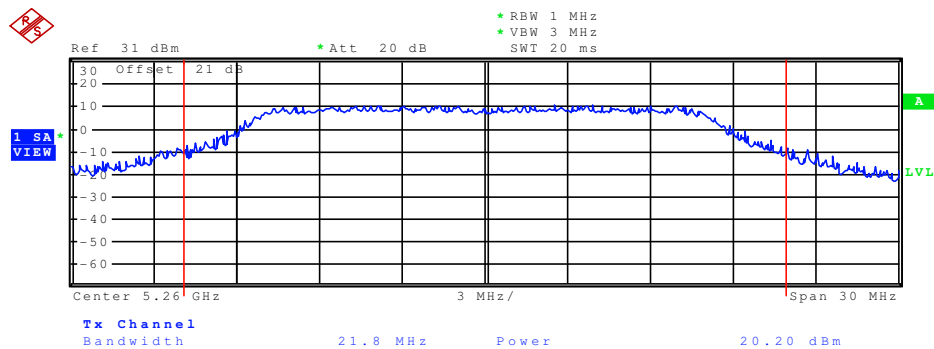
Date:2008-04-17

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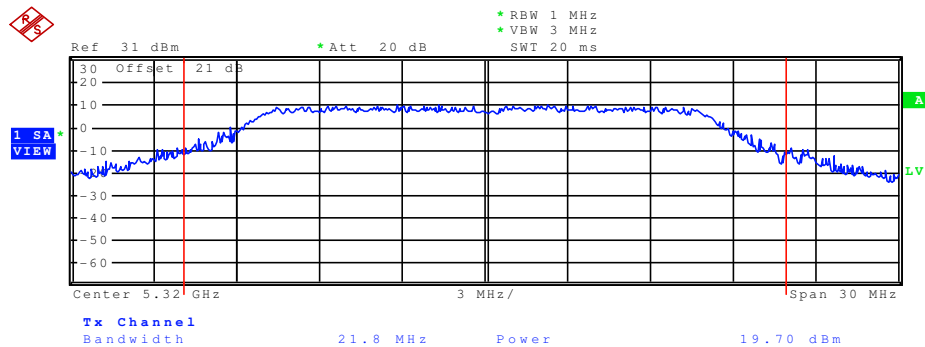
Plot 2: 5240 MHz



Plot 3: 5260 MHz



Plot 4: 5320 MHz



- Results:**
- Plot 1: Peak transmit power: 14.92 dBm**
 - Plot 2: Peak transmit power: 14.64 dBm**
 - Plot 3: Peak transmit power: 20.20 dBm**
 - Plot 4: Peak transmit power: 19.70 dBm**

Limits:

Under normal test conditions only	<p>For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26dB-emission bandwidth in MHz. If transmitting antennas if directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.</p> <p>For the band 5.25 – 5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW /24 dBm or $11\text{dBm} + 10\log (26 \text{ dB BW})$</p> <p>The peak spectral density shall be equal or lower 11 dBm/MHz</p>
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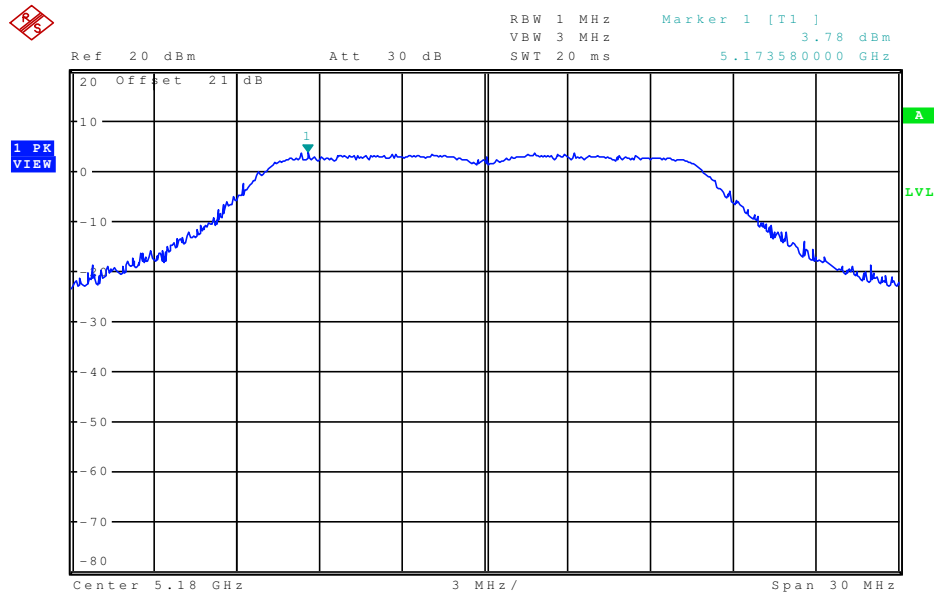
3.6 Peak power spectral density

§15.407(a5)

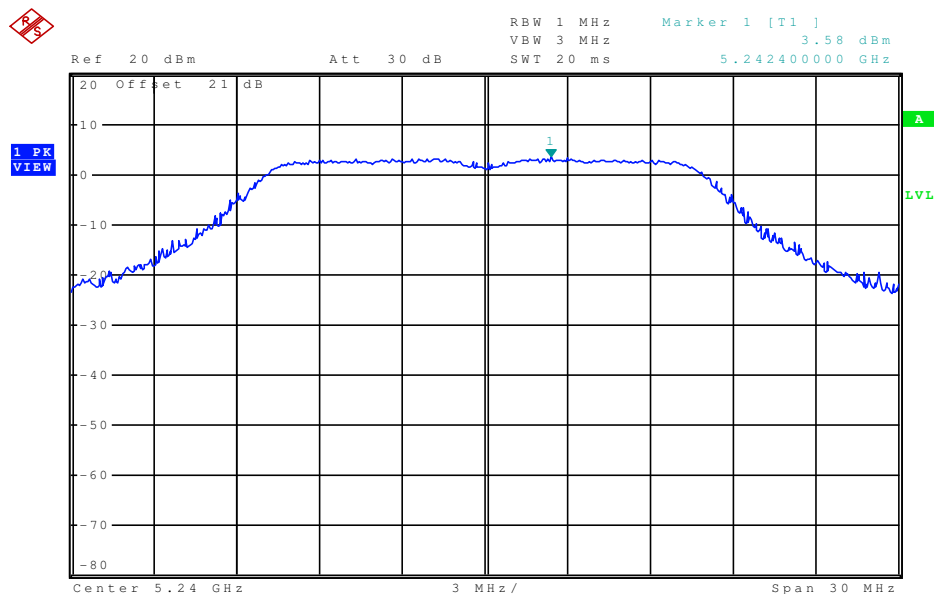
Measured according to the guidelines of the FCC public notice DA 02-2138 - method #1:

- Use peak detector and max hold
- Set RBW = 1 MHz. Set VBW > 1 MHz
- The PPSD is the highest level found across the emission in any 1 MHz band.

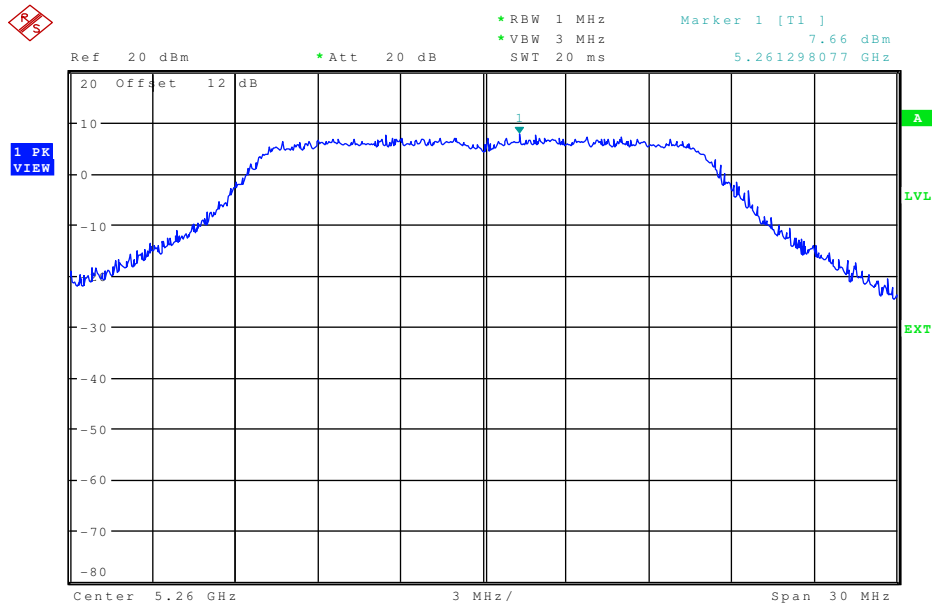
Plot 1 : 5180 MHz



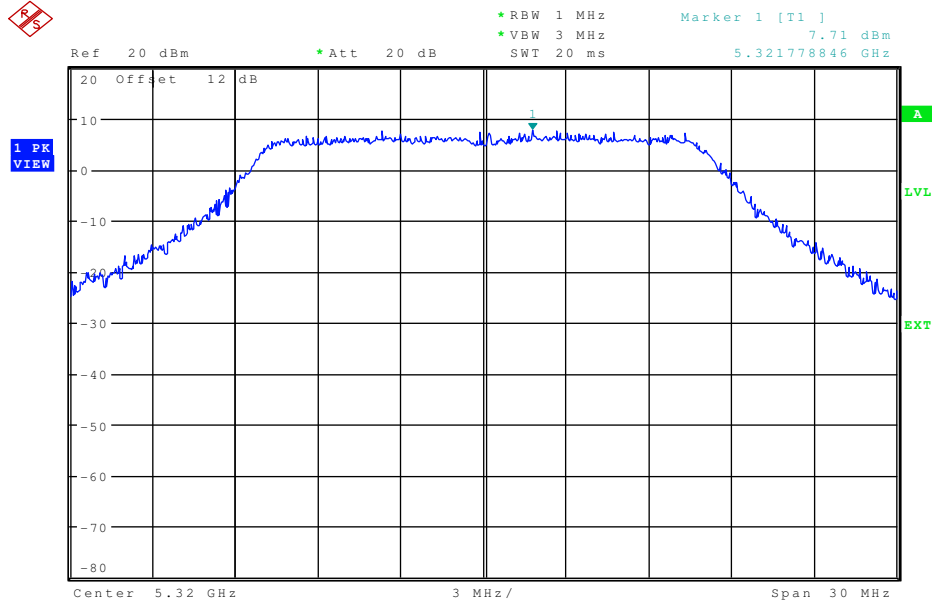
Plot 2: 5240 MHz



Plot 3: 5260 MHz



Plot 4: 5320 MHz



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Test conditions Frequency [MHz]	Peak power spectral density		
	1 MHz BW	Limit	Result
5180 MHz	3.78 dBm	4 dBm	Pass
5240 MHz	3.58 dBm	4 dBm	Pass
5260 MHz	7.66 dBm	11 dBm	Pass
5320 MHz	7.71 dBm	11 dBm	Pass

Limits:

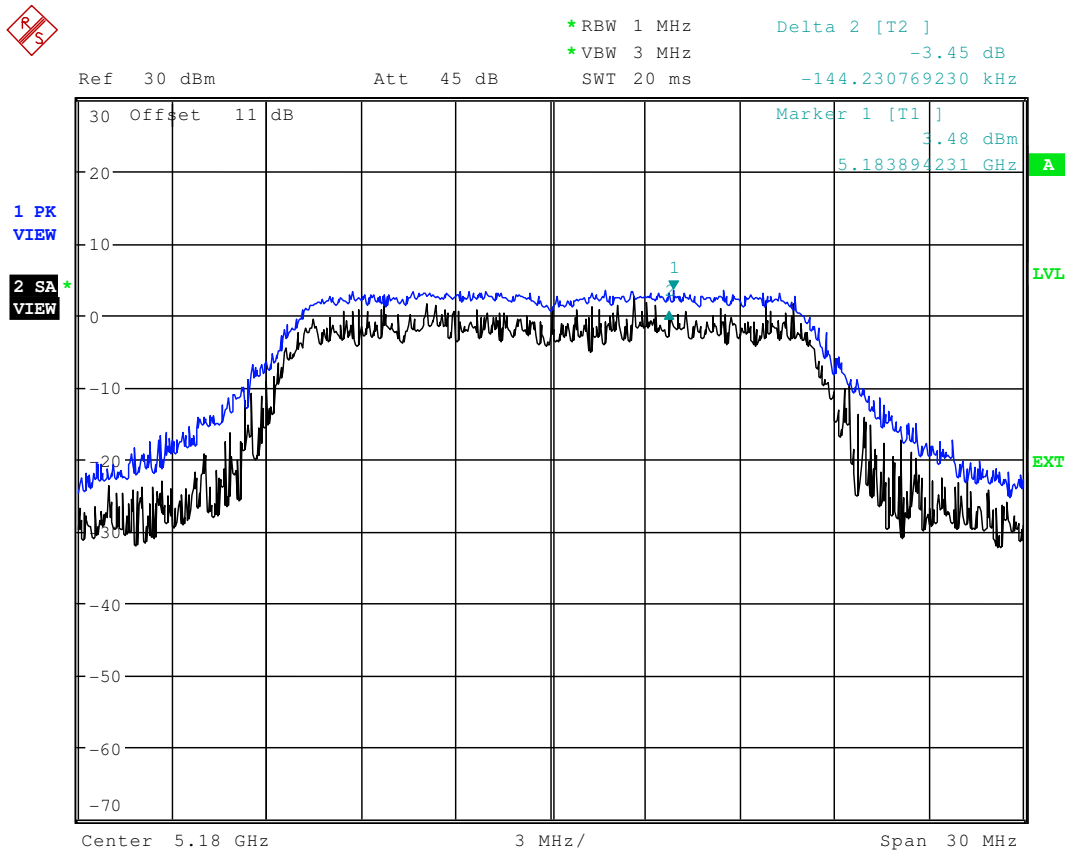
Under normal test conditions only	<p>For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1 MHz-band. If transmitting antennas if directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.</p> <p>For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1 MHz-band</p>
-----------------------------------	--

3.7 Ratio of Peak Excursion

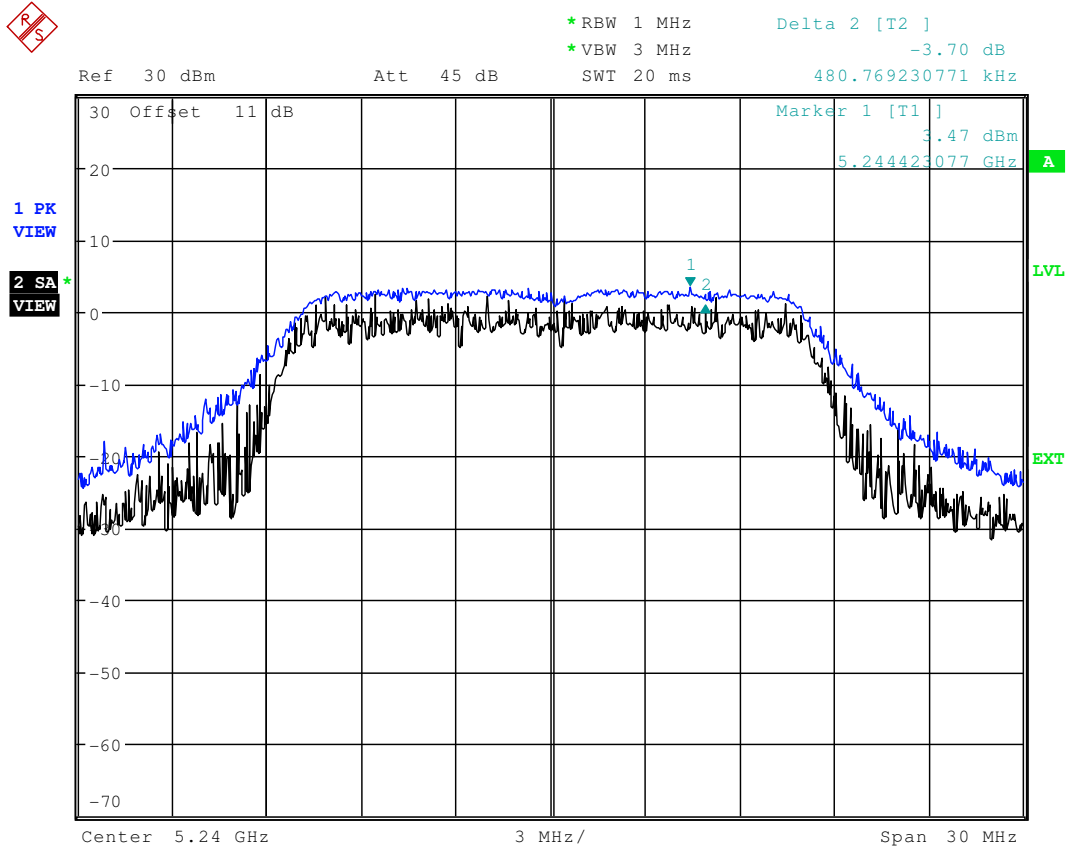
§15.407(a6)

Measured according to the guidelines of the FCC public notice DA 02-2138.

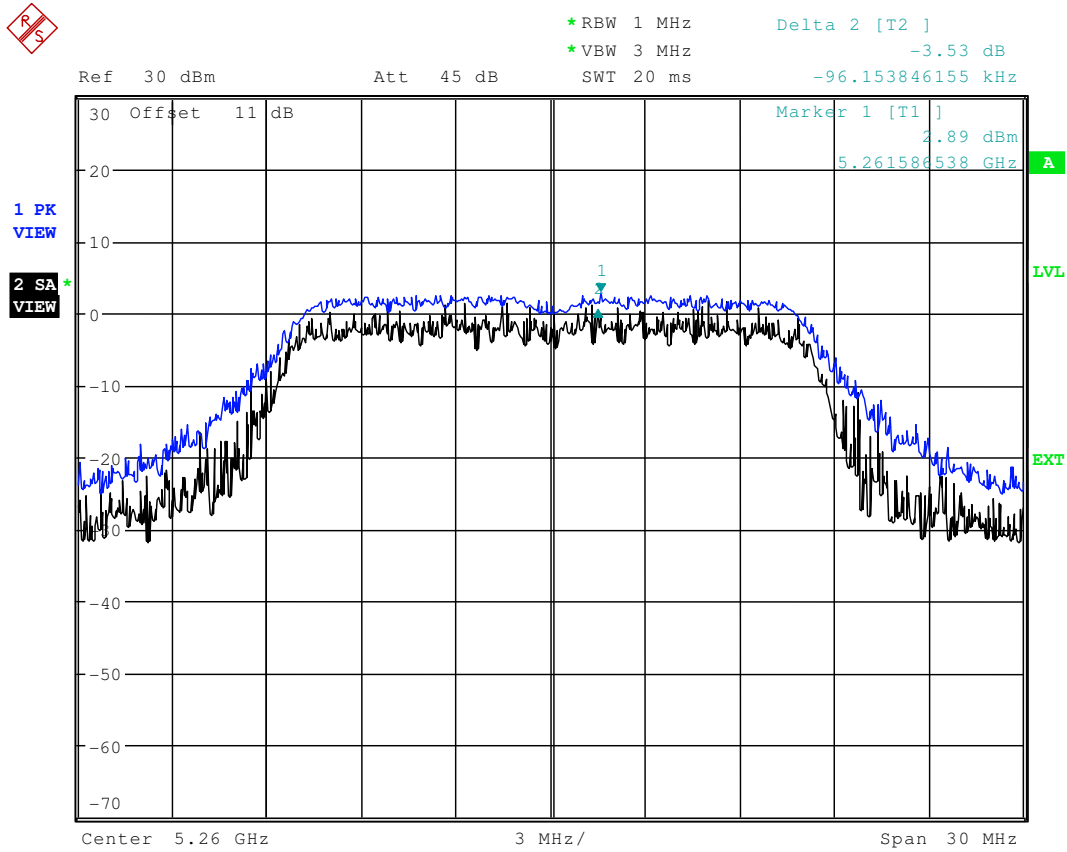
Plot 1 : 5180 MHz



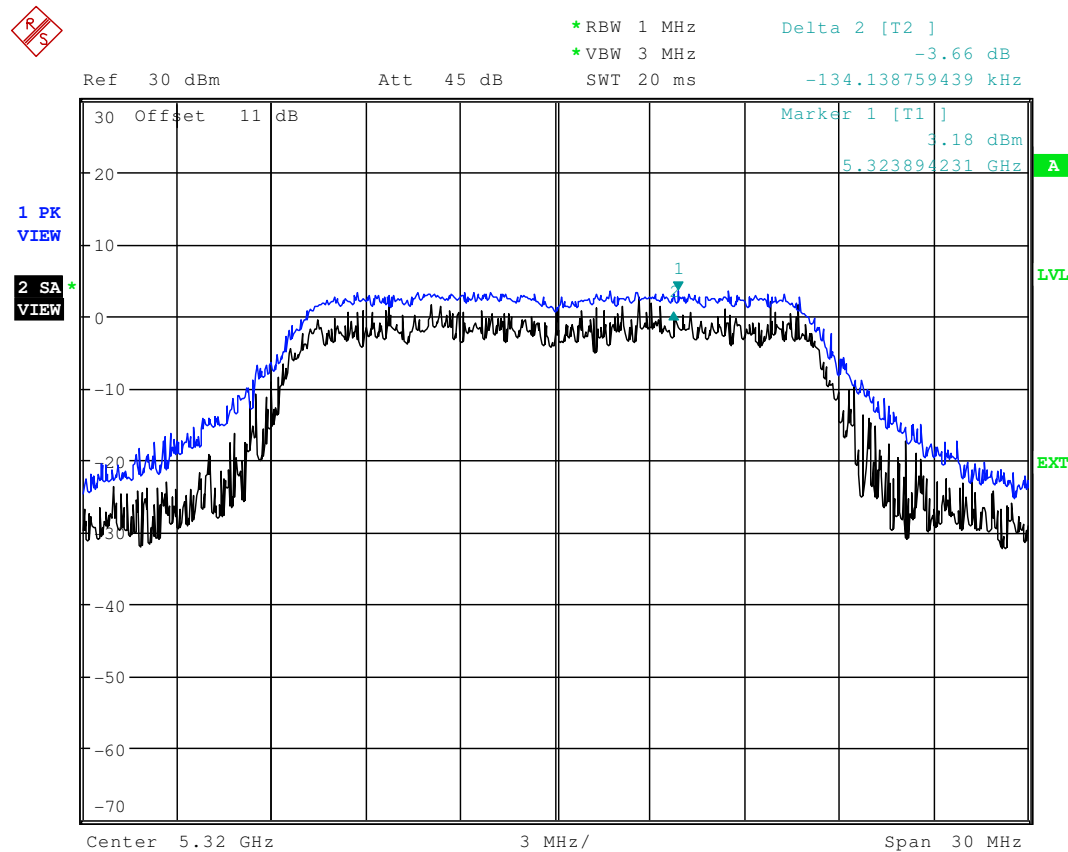
Plot 2: 5240 MHz



Plot 3: 5260 MHz



Plot 3: 5320 MHz



Results

Frequency	Ratio of peak excursion of the modulation envelope		
		Ratio(dB)	Pass/fail
5180 MHz		< 13 dB	pass
5240 MHz		< 13 dB	pass
5260 MHz		< 13 dB	pass
5320 MHz		< 13 dB	pass
Measurement uncertainty		±1dB	

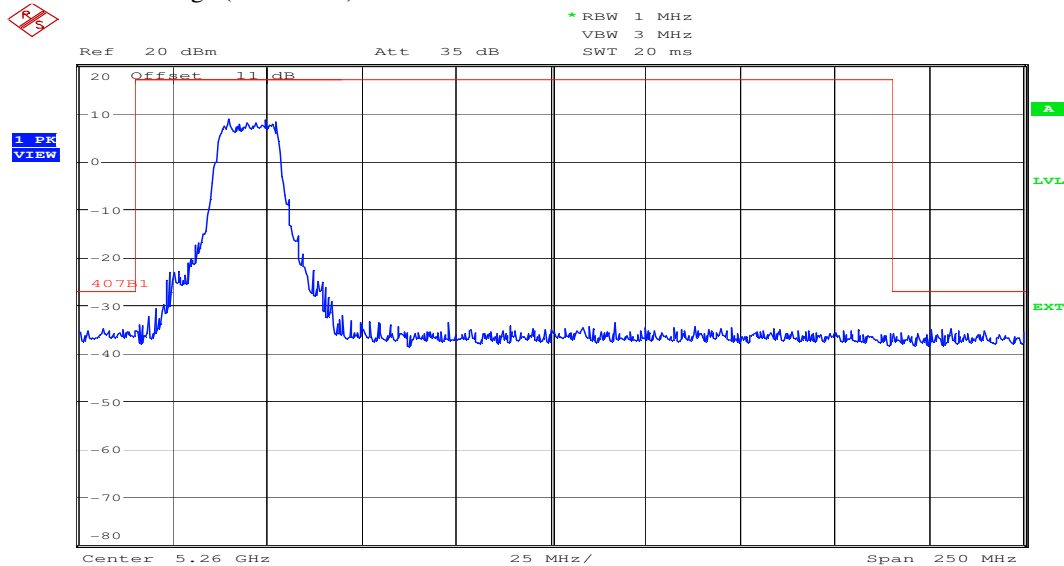
Limits:

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

3.8 Undesirable emission limits at band edges

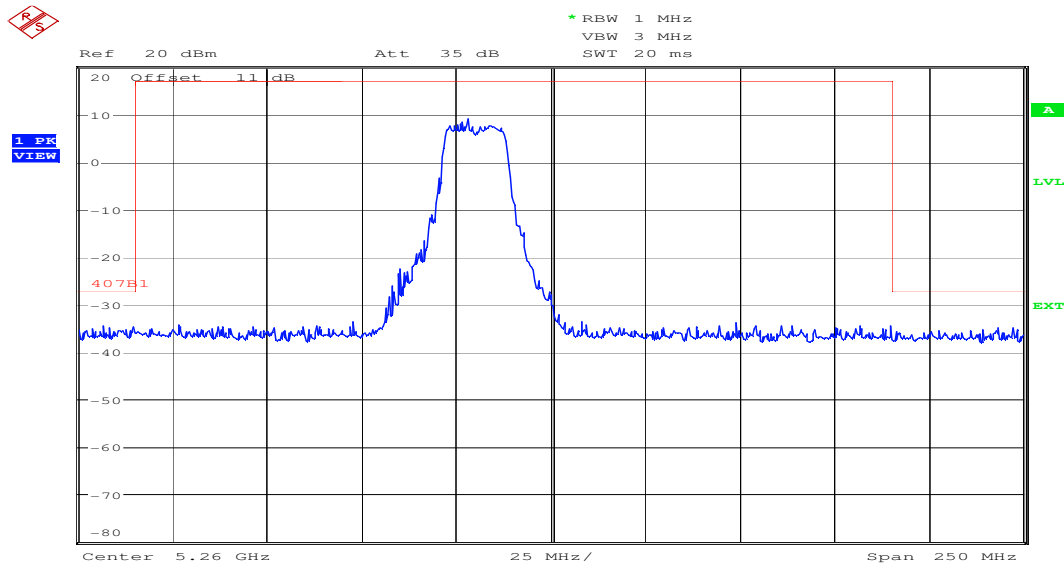
15.407 (b3)

Plot 1: lower band edge (5180 MHz)



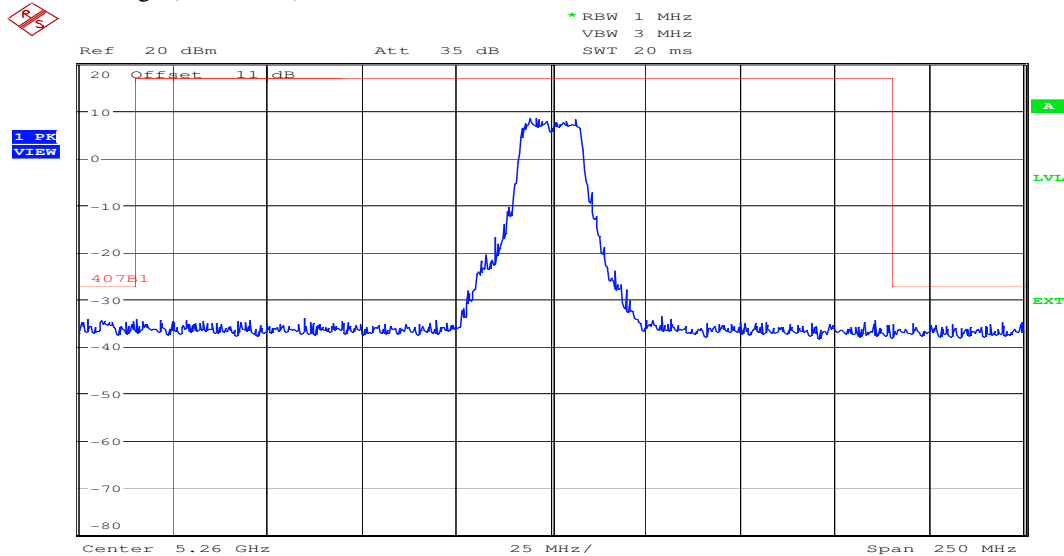
Date: 26.MAR.2008 15:00:51

Plot 2: band edge (5240 MHz)



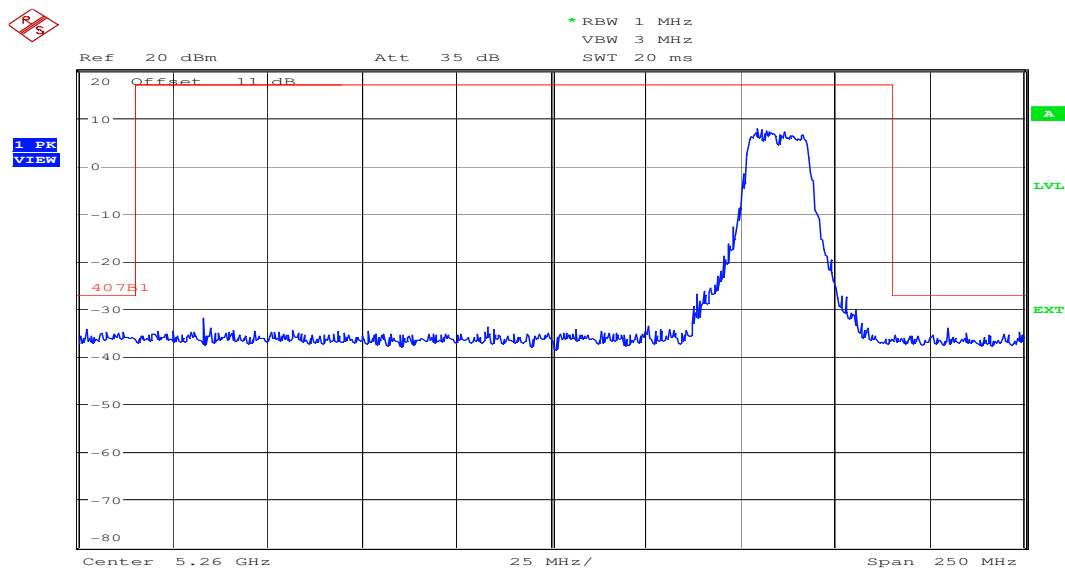
Date: 26.MAR.2008 15:01:26

Plot 3: 1 band edge (5260 MHz)



Date: 26.MAR.2008 15:01:46

Plot 2: upper band edge (5320 MHz)



Date: 26.MAR.2008 15:02:13

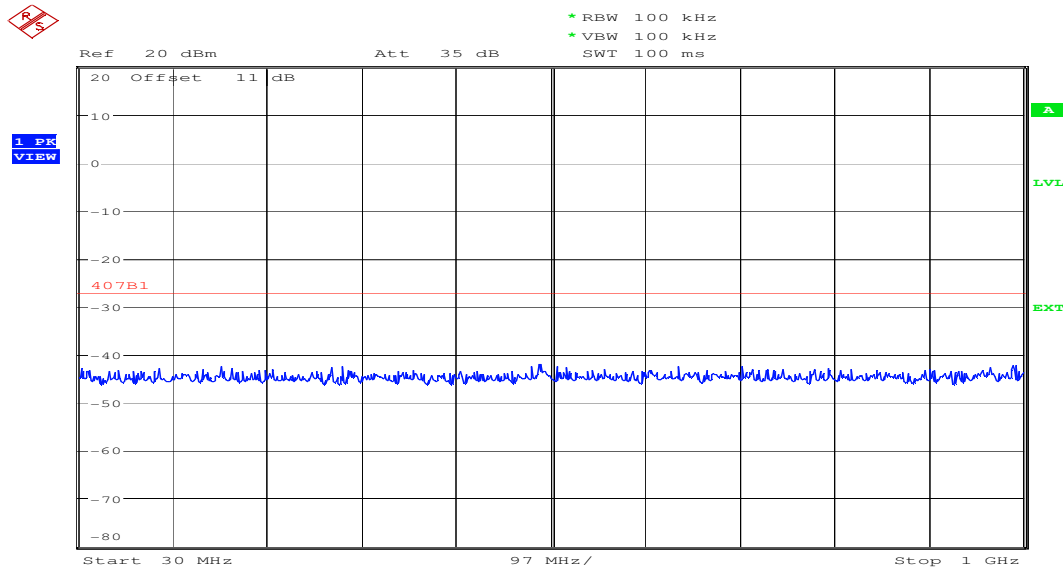
Limits: - above or below -27 dBm/MHz

Result: - all frequencies above or below band edge < -30 dBm/MHz => pass

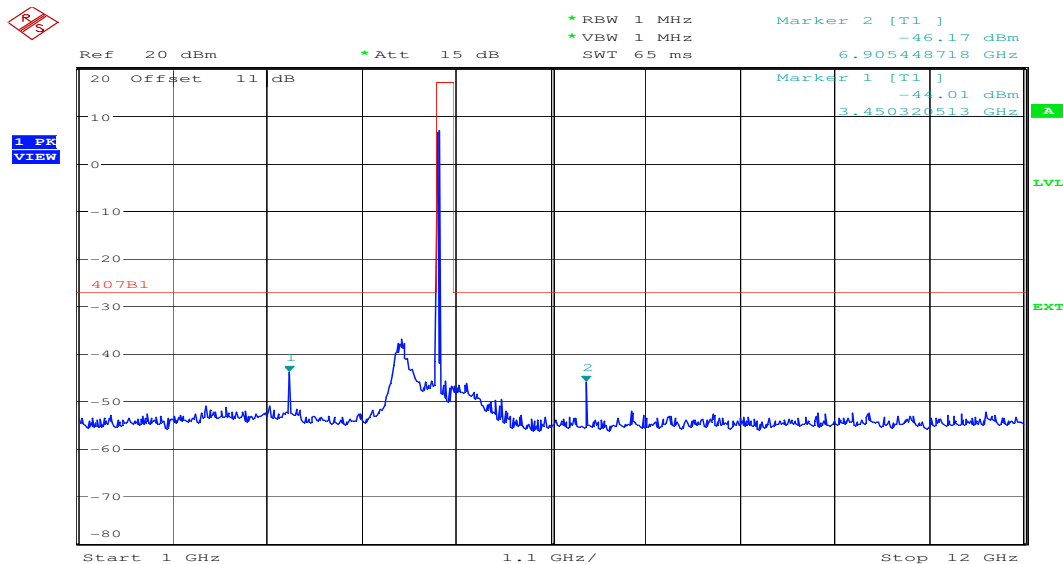
3.9 Spurious (conducted)

15.407 (b3)

5180 MHz



Date: 26.MAR.2008 15:04:46



Date: 26.MAR.2008 15:06:03

SRD-Testreport

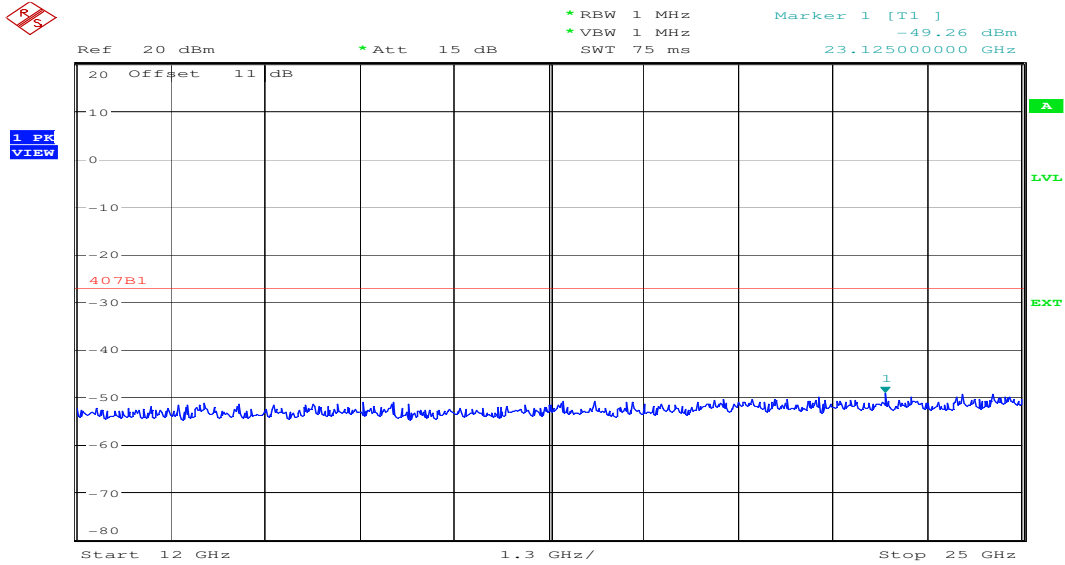
CETECOM ICT Services GmbH Saarbruecken, Germany



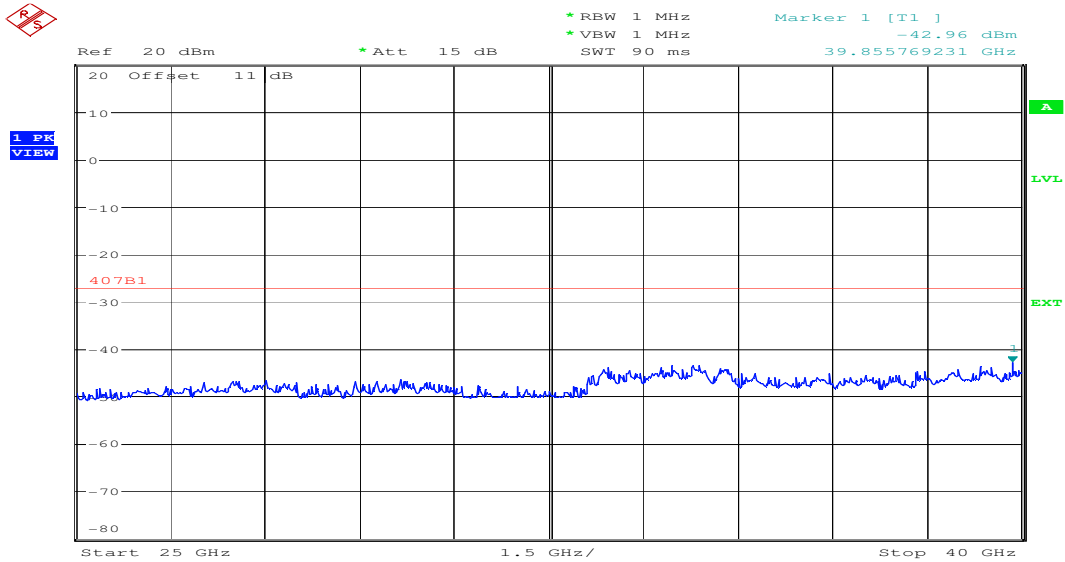
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Date: 26.MAR.2008 15:07:04



Date: 26.MAR.2008 15:07:39

SRD-Testreport

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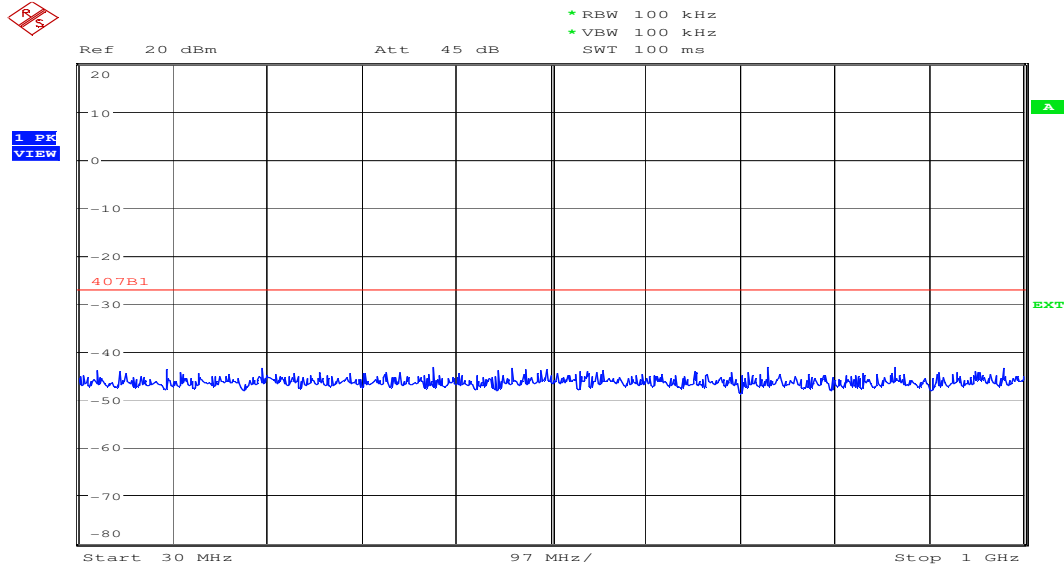


Test report No.: 2-4856-02-09/07

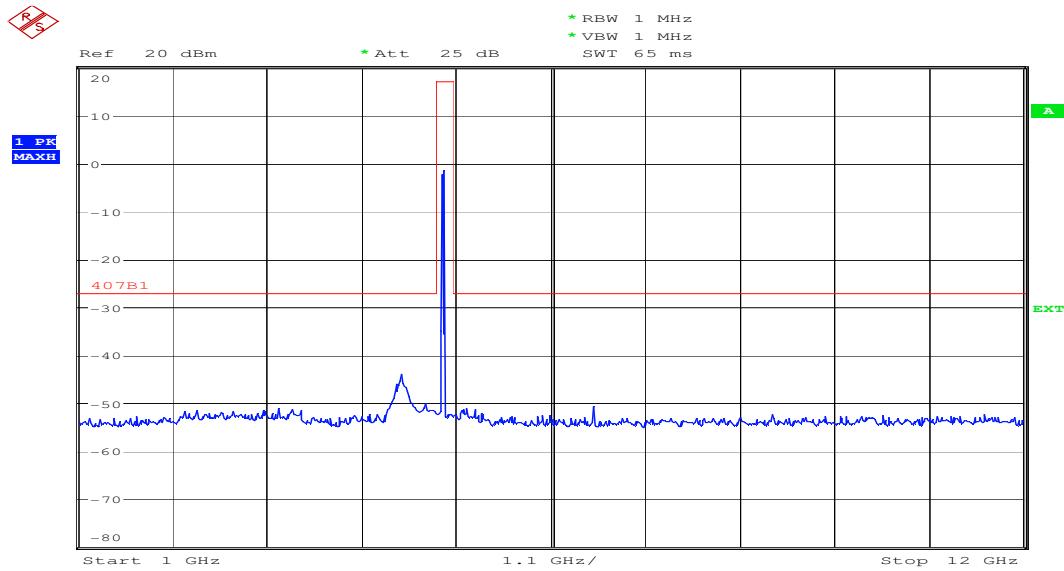
Date: 2008-04-17

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5240 MHz



Date: 27.MAR.2008 09:09:06



Date: 27.MAR.2008 09:10:04

SRD-Testreport

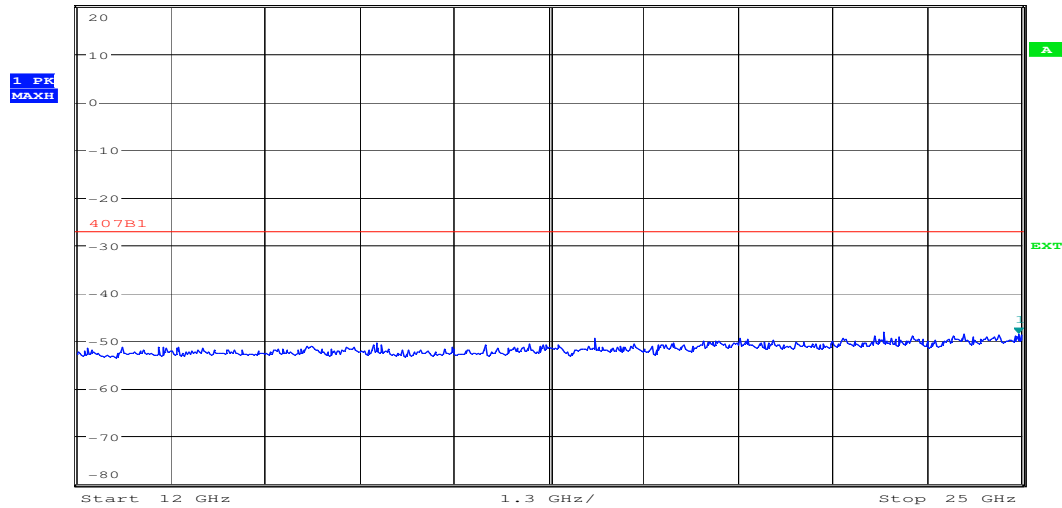
CETECOM ICT Services GmbH Saarbruecken, Germany



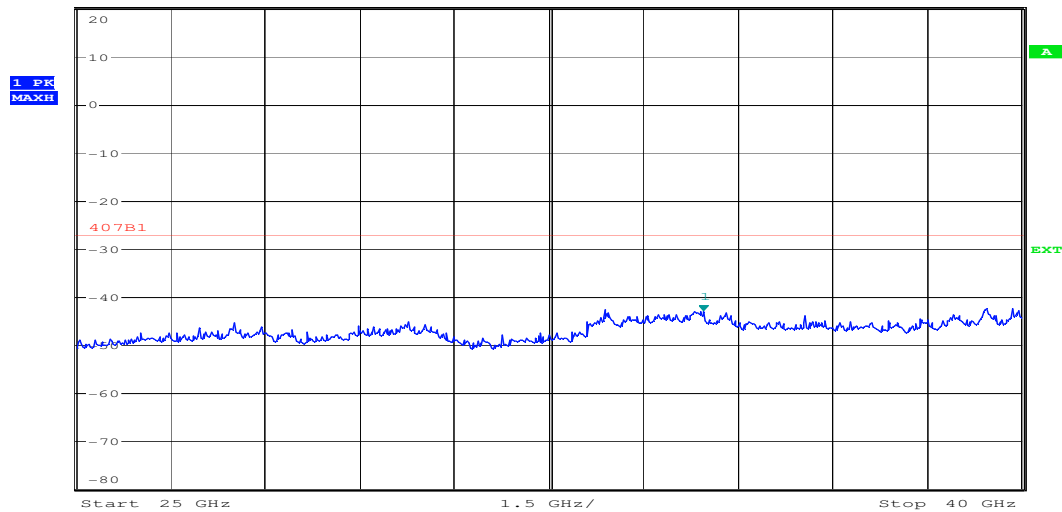
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Date: 2008-04-17

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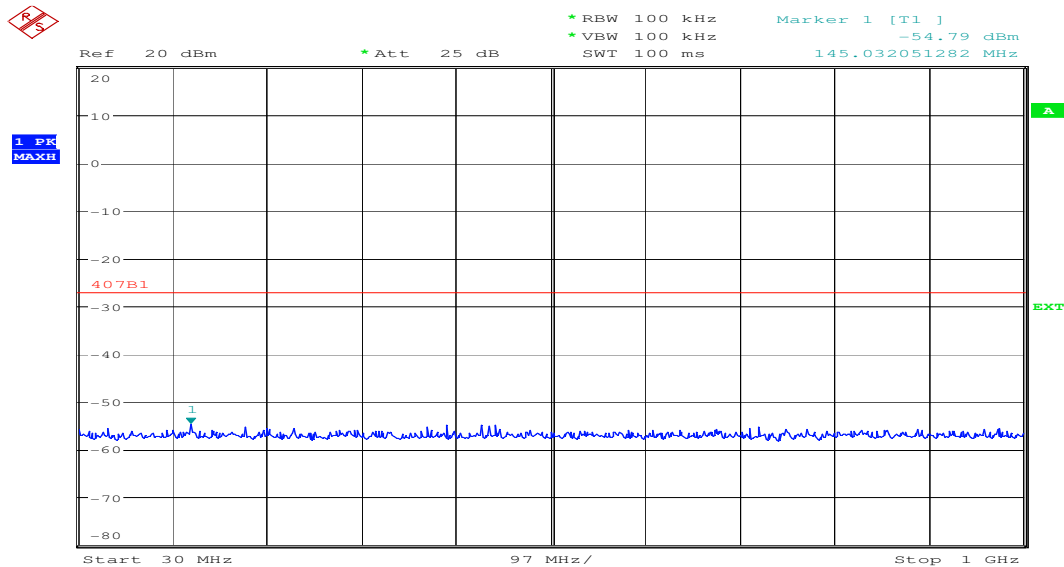


Date: 27.MAR.2008 09:11:07

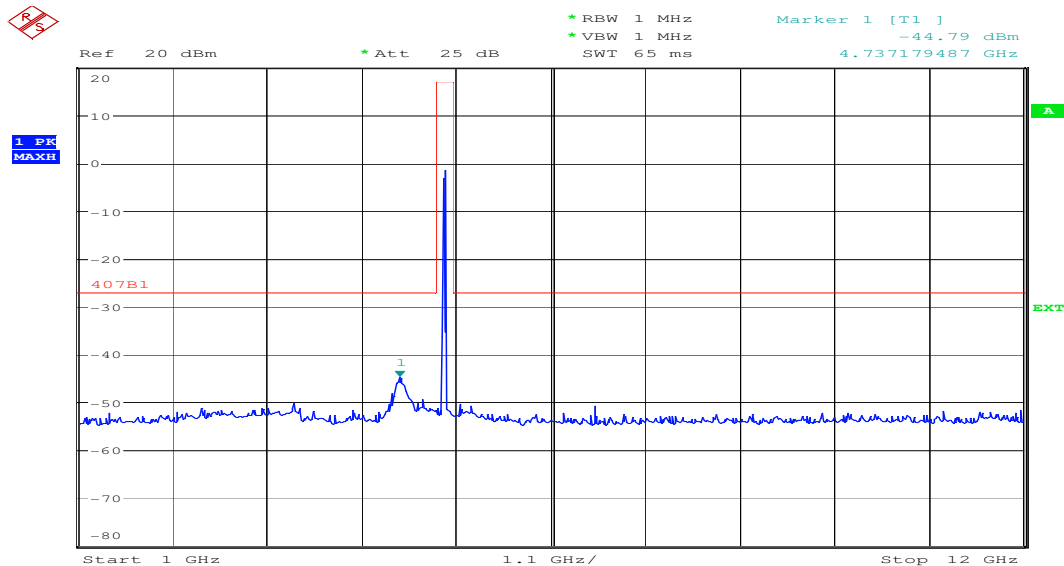


Date: 27.MAR.2008 09:11:29

5260 MHz



Date: 27.MAR.2008 09:13:14



Date: 27.MAR.2008 09:13:49

SRD-Testreport

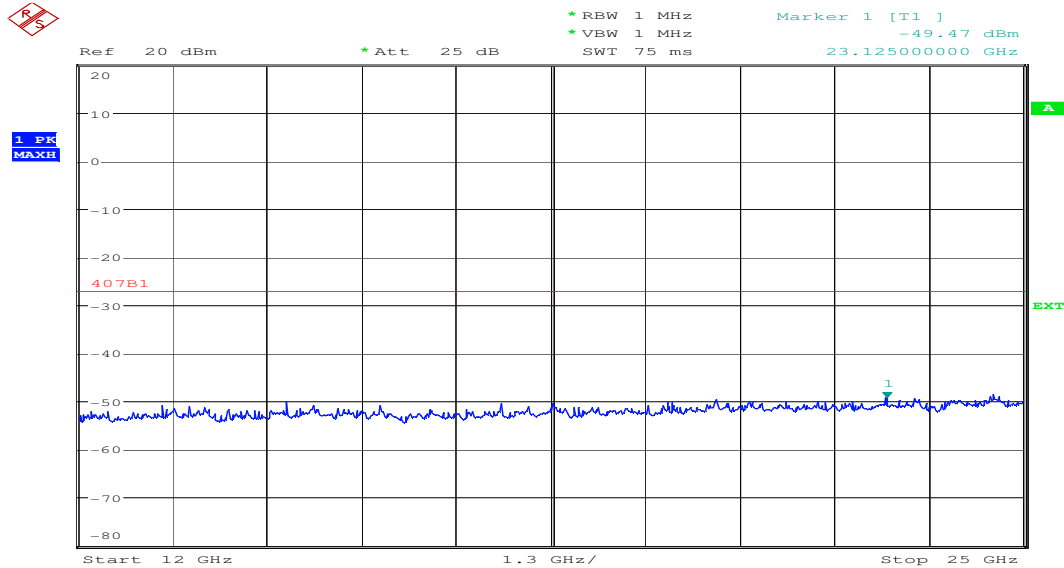
CETECOM ICT Services GmbH Saarbruecken, Germany



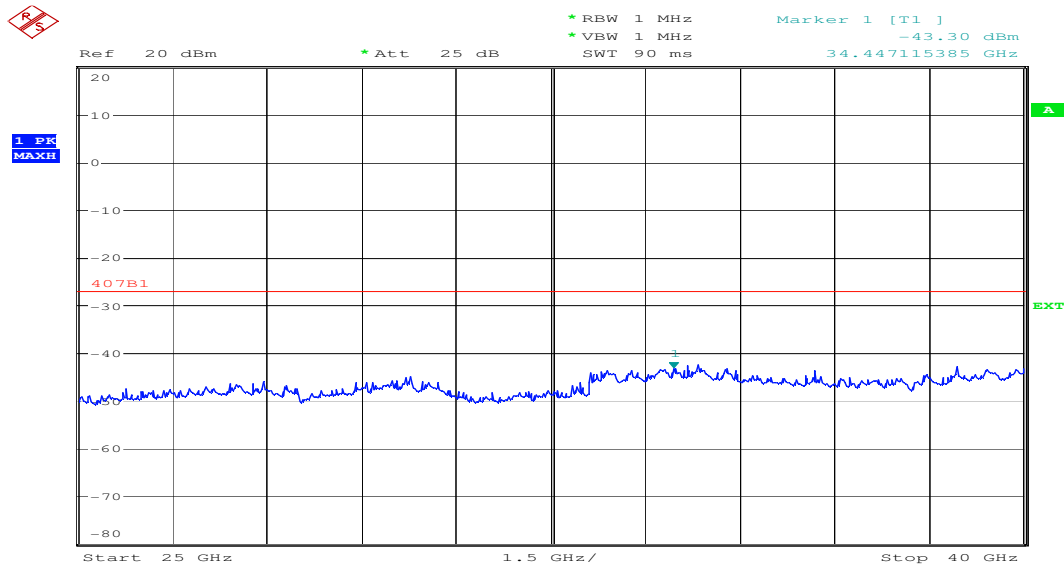
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Date: 27.MAR.2008 09:14:20



Date: 27.MAR.2008 09:14:38

SRD-Testreport

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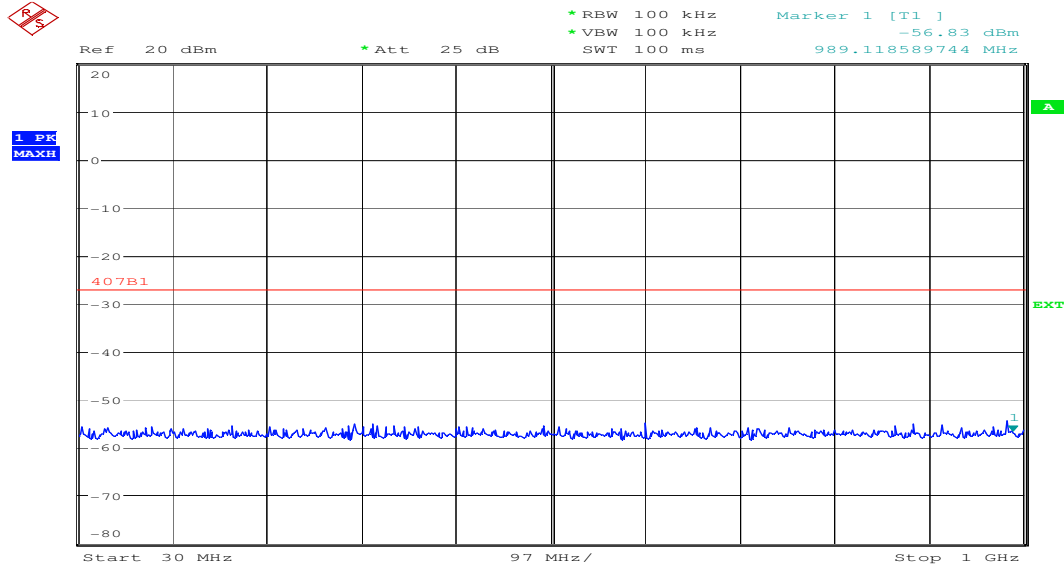


Test report No.: 2-4856-02-09/07

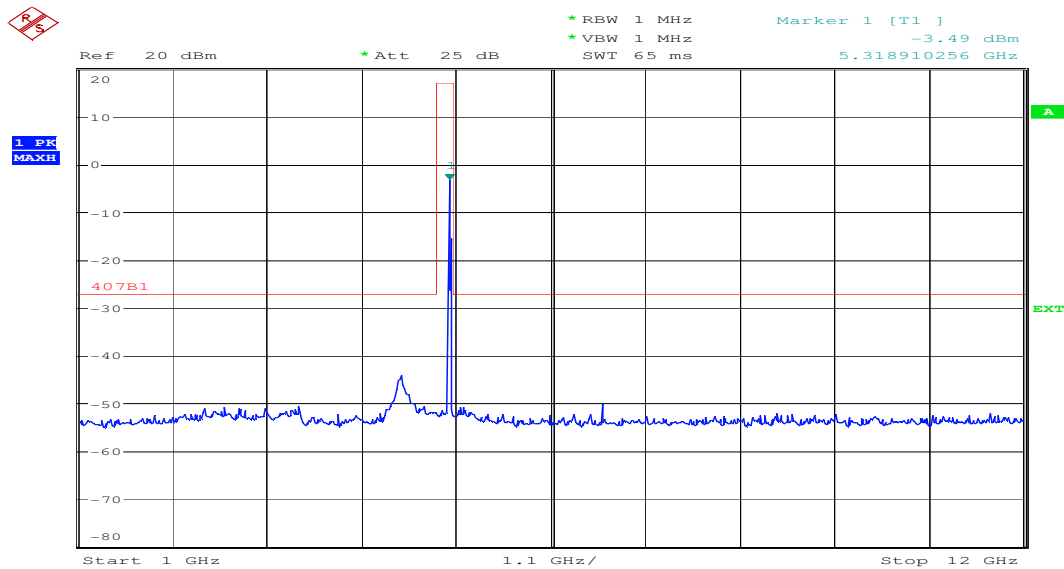
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5320 MHz



Date: 27.MAR.2008 09:25:33



Date: 27.MAR.2008 09:21:49

SRD-Testreport

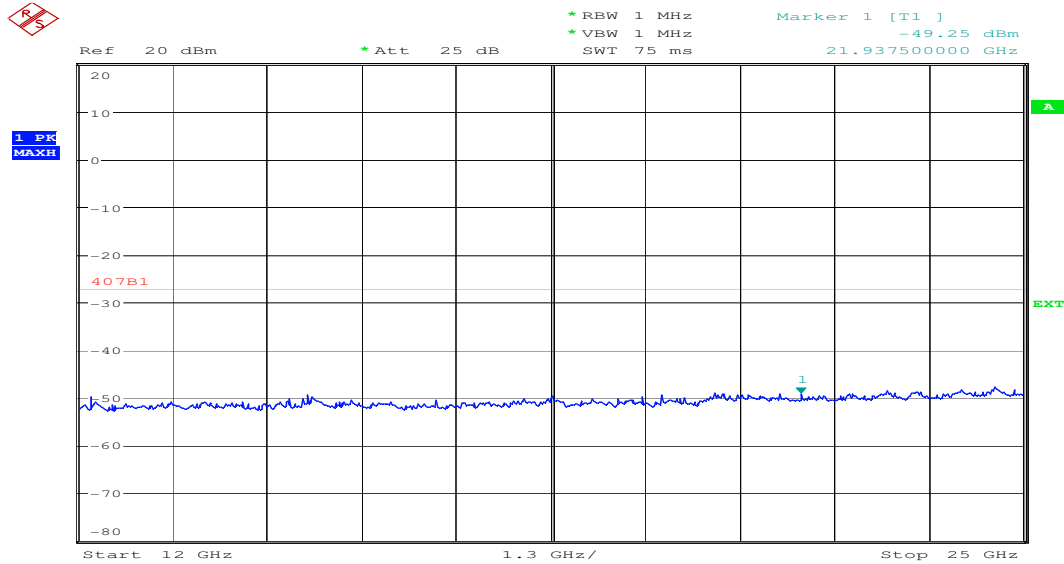
CETECOM ICT Services GmbH Saarbruecken, Germany



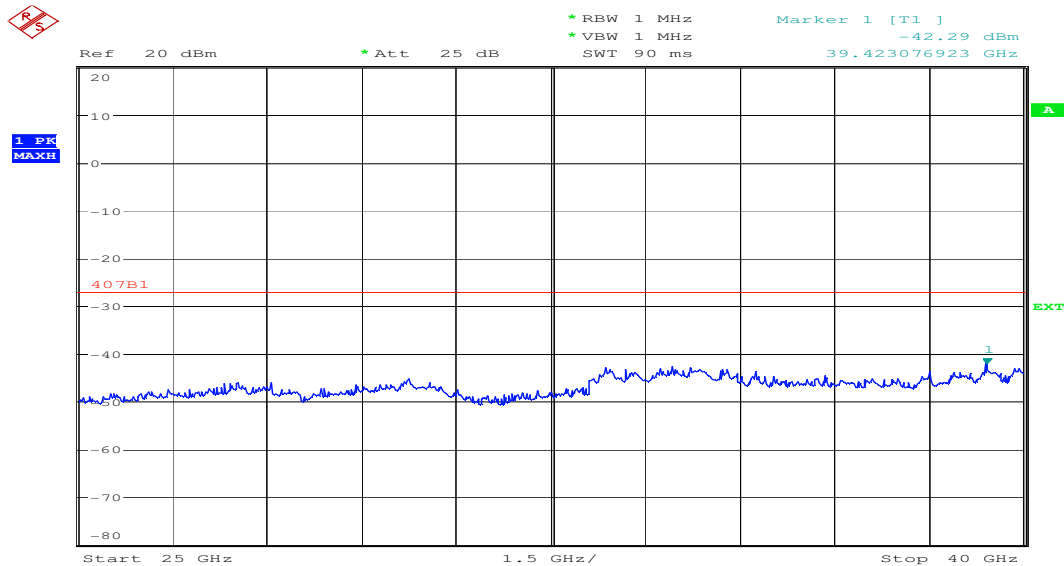
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Date: 27.MAR.2008 09:21:21



Date: 27.MAR.2008 09:15:13

Spurious emissions conducted

Result & Limits

Emission Limitations					
f [MHz]	Detector	amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
5180			17 dBm	-	Operating frequency
3450	Peak	-44.0		> 20 dB	pass
6905	Peak	-46.2		> 20 dB	pass
5240			17 dBm	-	Operating frequency
5260			24 dBm	-	Operating frequency
4737	Peak	-44.8		> 20 dB	pass
5320			24 dBm	-	Operating frequency
Measurement uncertainty		± 3dB			

RBW : 1 MHz VBW: 1 MHz

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
-----------------------------------	--

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

3.10 MPE calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm²)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation:

(Calculated for max. EIRP)

EIRP: **22.3 dBm** = 169.8 mW (Peak power)
calculated at distance of 20 cm:

$$\text{power density} = 169.8 / 4\pi 20^2 = 0.0338 \text{ mW/ cm}^2$$

Limit:

1mW/ cm ² is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

3.11 Max. peak output power (radiated and conducted) §15.247 (b) (1)

Results:

Test conditions	Max. peak output power EIRP [dBm]			
	5180 MHz	5240 MHz	5260 MHz	5320 MHz
T _{nom} / V _{nom}	14.9 cond	14.6 cond	20.2 cond	19.7 cond
	16.9 rad	16.8 rad	22.3 rad	22.3 rad
Antenna gain	2.0	2.2	2.1	2.6
Measurement uncertainty	±3dB			

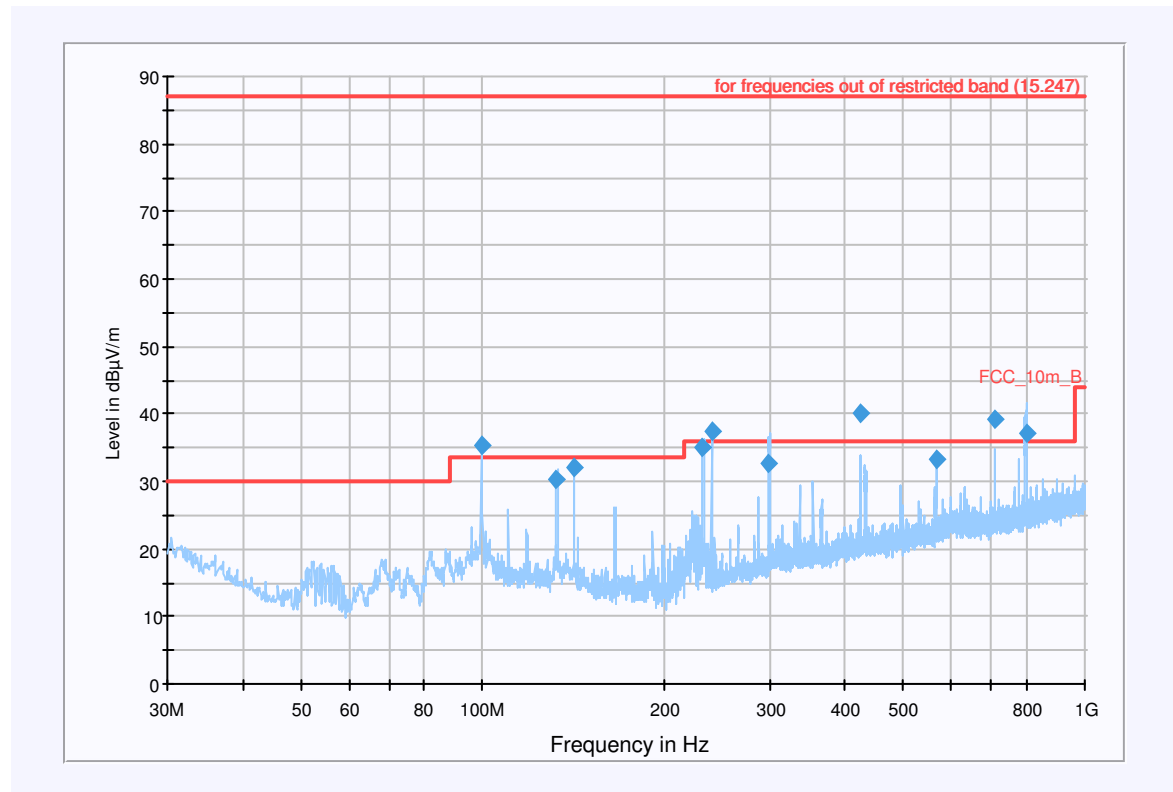
Limits:

Under normal test conditions	Max. 0.05 Watt / 17 dBm Or 0.25 Watt / 24 dBm
for antennas with gain > 6 dBi	reduce the conducted output power by the amount in dB that the directional gain exceeds 6 dBi

3.12 Spurious Emissions - radiated (Transmitter)

§15.209

Plot 1: 0.03 - 1GHz vertical / horizontal (valid for all 4 channels, no difference in emission)



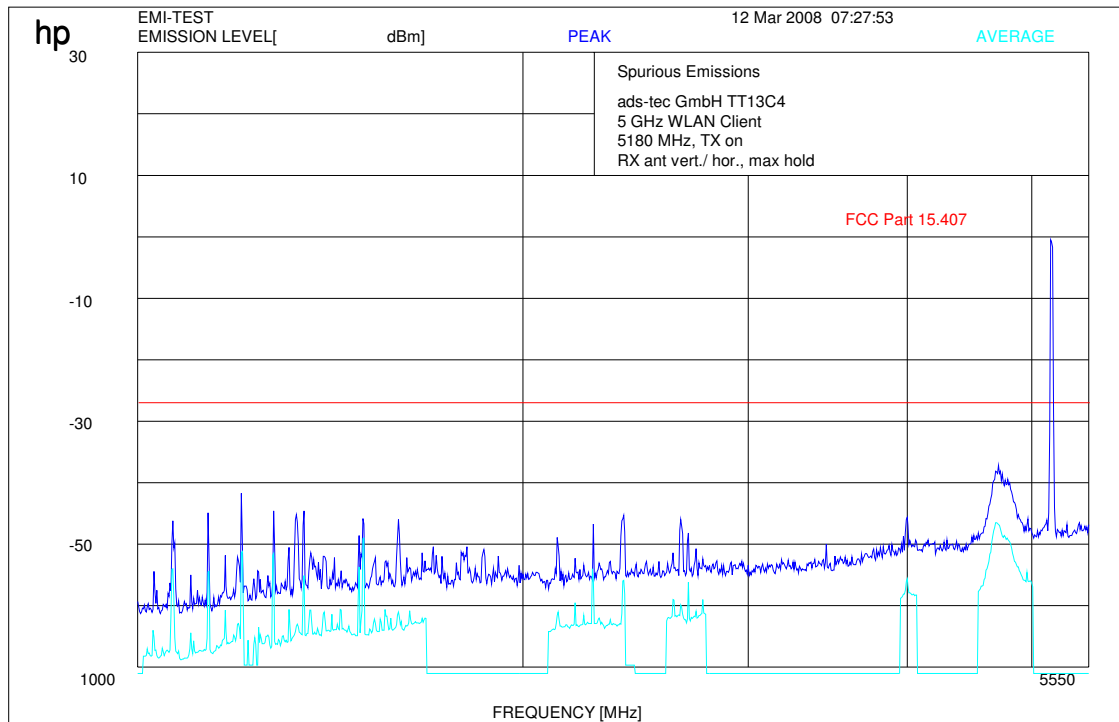
Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
99.852600	35.4	15000.000	120.000	127.0	V	55.0	12.8	-1.9	33.5	No restr.band
132.822000	30.2	15000.000	120.000	114.0	V	45.0	13.3	3.3	33.5	
141.716100	32.1	15000.000	120.000	115.0	V	103.0	12.8	1.4	33.5	No restr.band
232.289300	34.9	15000.000	120.000	100.0	V	34.0	13.1	1.1	36.0	No restr.band
239.999150	37.5	15000.000	120.000	100.0	V	80.0	13.6	-1.5	36.0	No restr.band
299.356450	32.6	15000.000	120.000	100.0	V	92.0	16.0	3.4	36.0	No restr.band
425.130350	40.1	15000.000	120.000	200.0	H	5.0	19.0	-4.1	36.0	No restr.band
566.892150	33.3	15000.000	120.000	283.0	V	0.0	20.9	2.7	36.0	No restr.band
708.561550	39.2	15000.000	120.000	124.0	H	53.0	21.8	-3.2	36.0	No restr.band
798.215400	37.2	15000.000	120.000	115.0	H	272.0	22.8	-1.2	36.0	No restr.band

Calculated Limit for frequencies out of restricted bands

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
99.852600	35.4	15000.000	120.000	127.0	V	55.0	12.8	51.6	87	
132.822000	30.2	15000.000	120.000	114.0	V	45.0	13.3	3.3	33.5	Restr. band
141.716100	32.1	15000.000	120.000	115.0	V	103.0	12.8	54.9	87	
232.289300	34.9	15000.000	120.000	100.0	V	34.0	13.1	52.1	87	
239.999150	37.5	15000.000	120.000	100.0	V	80.0	13.6	49.5	87	
299.356450	32.6	15000.000	120.000	100.0	V	92.0	16.0	54.4	87	
425.130350	40.1	15000.000	120.000	200.0	H	5.0	19.0	46.9	87	
566.892150	33.3	15000.000	120.000	283.0	V	0.0	20.9	53.7	87	
708.561550	39.2	15000.000	120.000	124.0	H	53.0	21.8	47.8	87	
798.215400	37.2	15000.000	120.000	115.0	H	272.0	22.8	49.8	87	

Plot 2: 1 GHz - 5.5 GHz vertical (5180 MHz) (worst case)



f < 1 GHz : RBW/VBW: 100 kHz

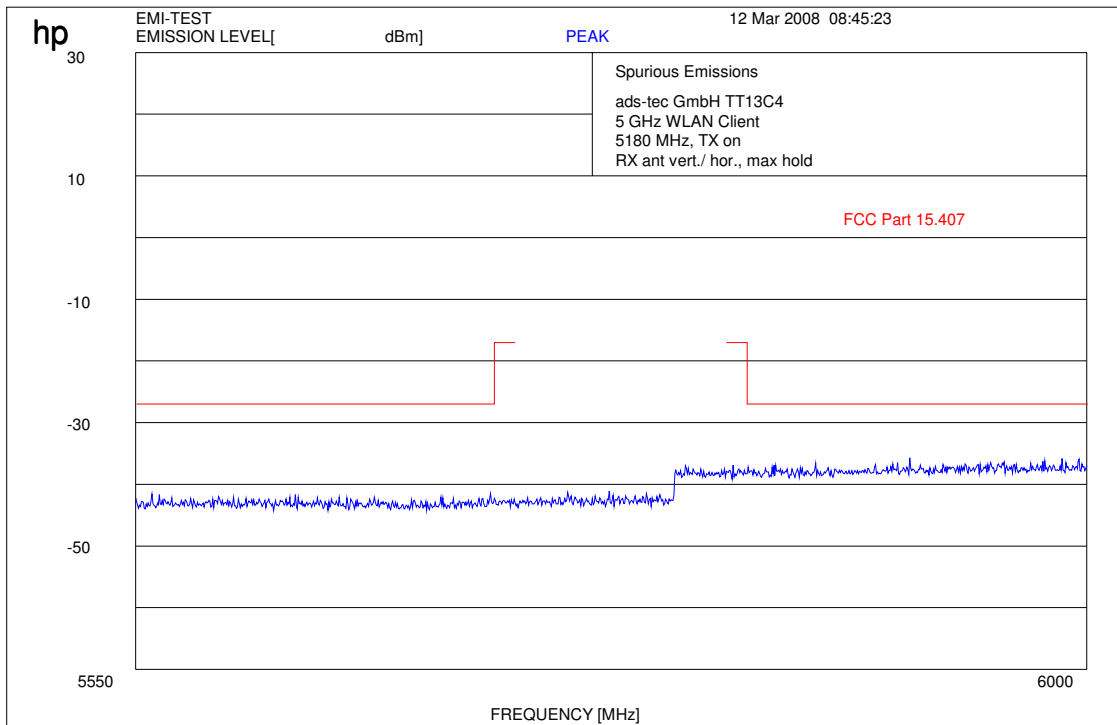
f ≥ 1GHz : RBW/VBW: 1 MHz

AV-detector

PEAK#	FREQ (MHz)	(dBm)
1	1065.4	-54
2	1137	-54.4
3	1207.2	-51.2
4	1277.4	-51.5
5	1349.3	-55.1
6	1490.2	-53.7
7	1503	-49
8	2266.8	-54
9	2398.6	-55.9
10	2694.7	-56.2
11	3995.1	-55.6
12	4684.7	-46.5

This results are valid for all 4 measured channels. They are caused by the display of the PC.

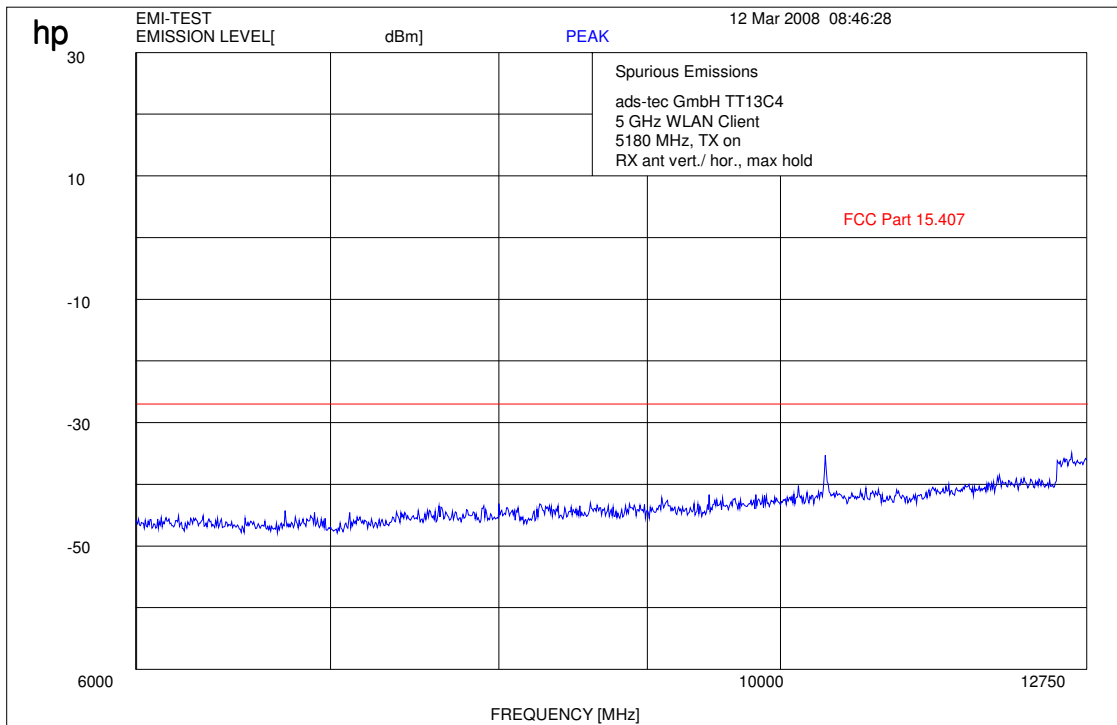
Plot 3: 5.5 GHz – 6 GHz vertical (5180 MHz) (worst case)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

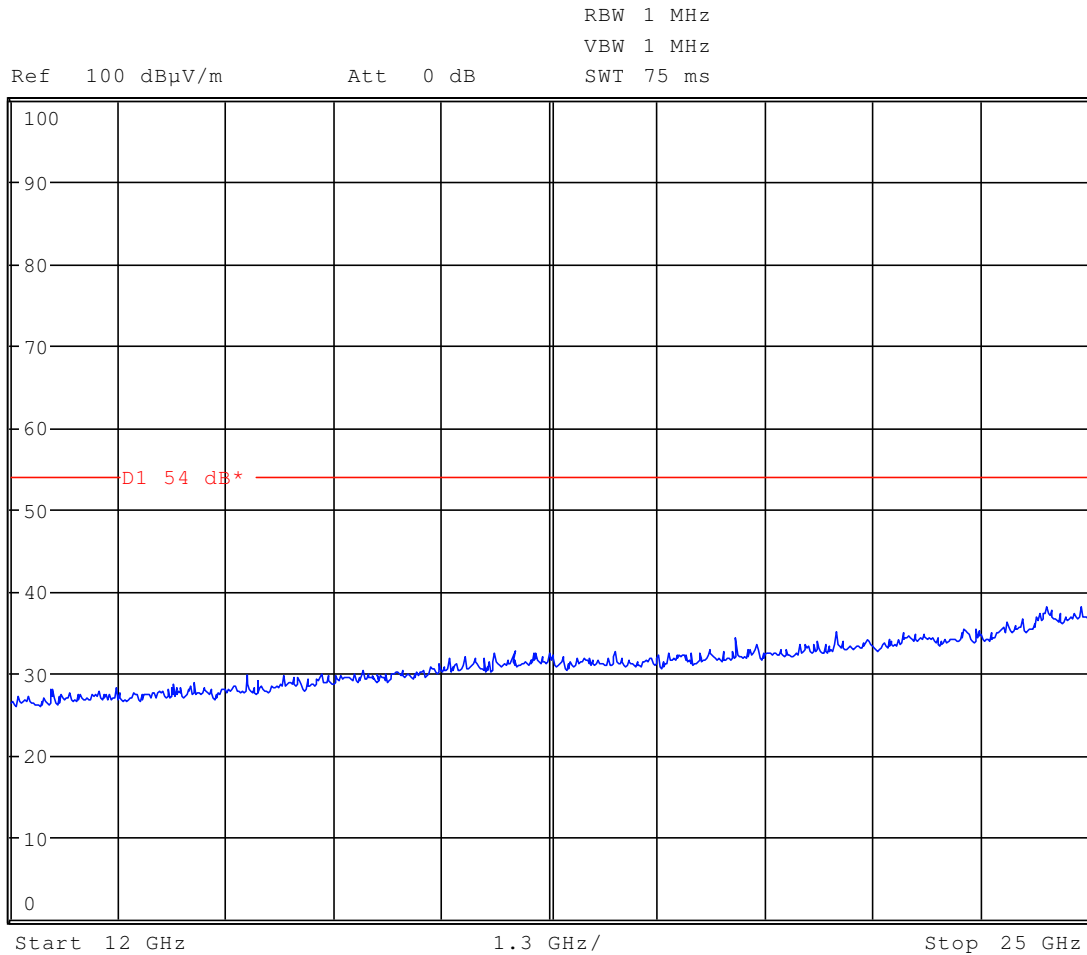
Plot 4: 6 GHz – 12 GHz vertical (5180 MHz) (worst case)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 5: 12-25 GHz vertical (valid for all 4 channels) (worst case)



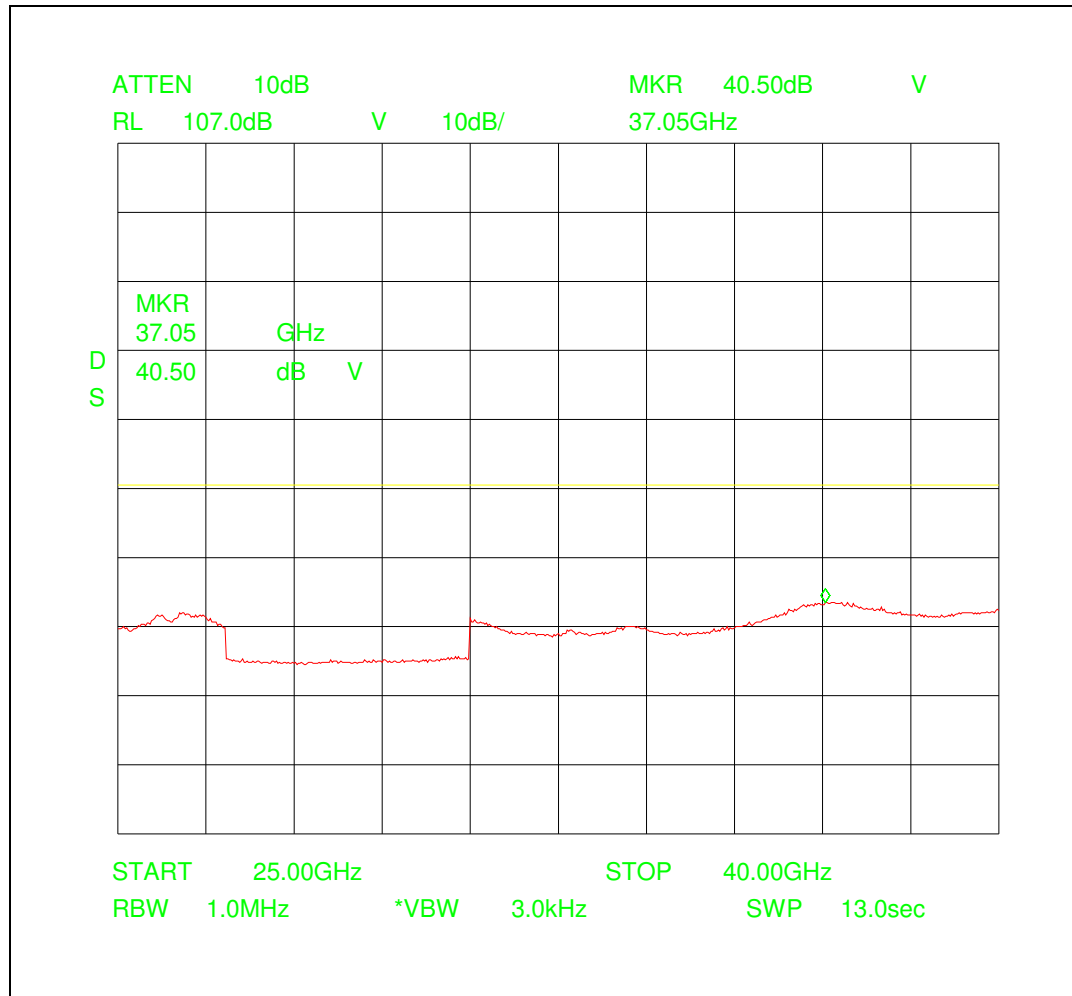
f < 1 GHz : RBW/VBW: 100 kHz

f \geq 1GHz : RBW/VBW: 1 MHz

We also measured with external mixers up to 40 GHz.

The plots are valid for all 4 channels. There were no peaks found.

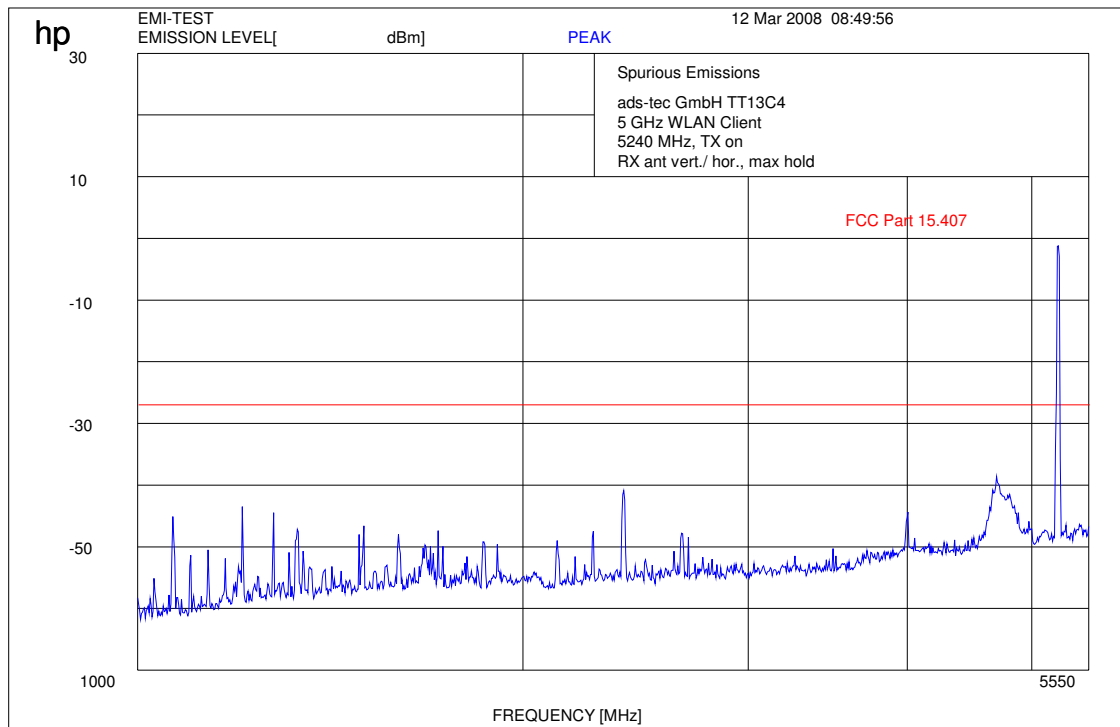
Plot 6: 25 – 40 GHz



Measured under following conditions.

- Distance 0.5 Meter - 15.56 dB,
- Antenna k-factor 37.5 dB (1/m),
- Amplifier 30 dB,
- Cabel loss 3.5 dB

Plot 7: 1 GHz to 5.5 GHz (5240 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

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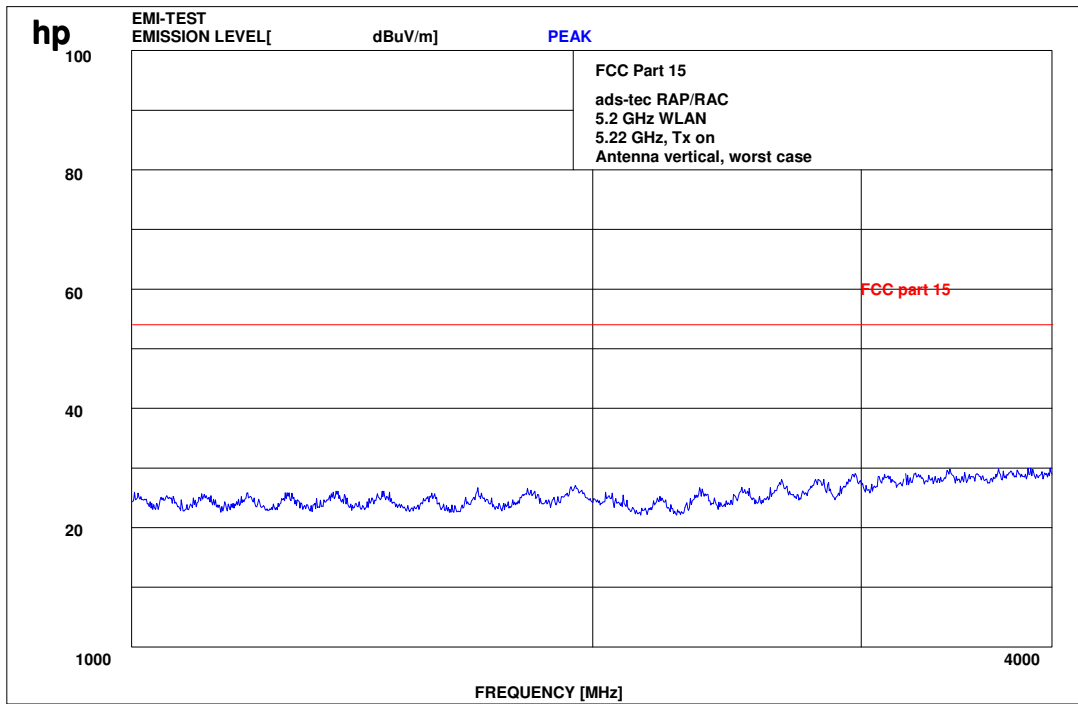


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Plot 8: 5.5 GHz to 6GHz (5240 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

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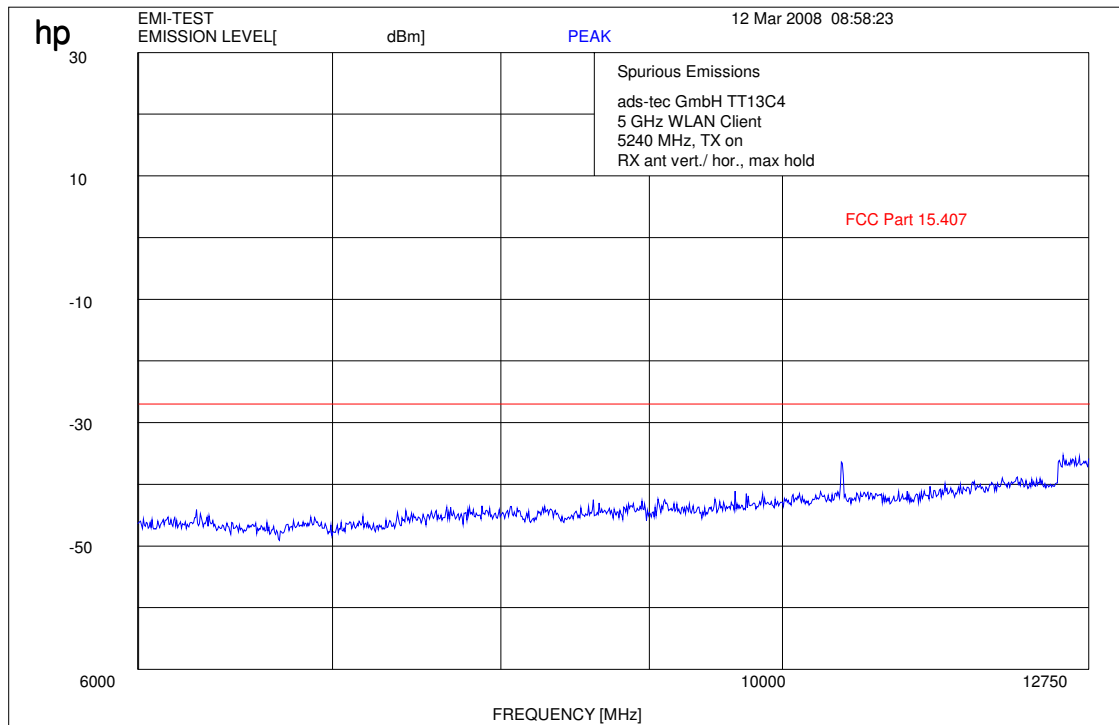


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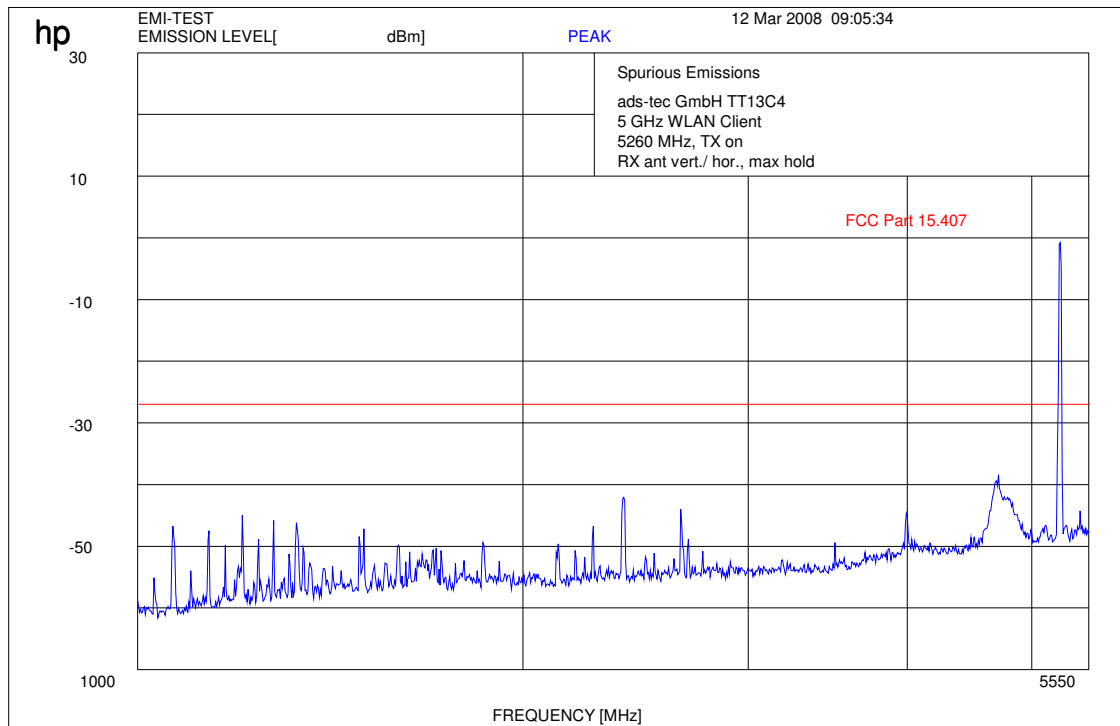
Plot 9: 6 GHz to 12 GHz (5240 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

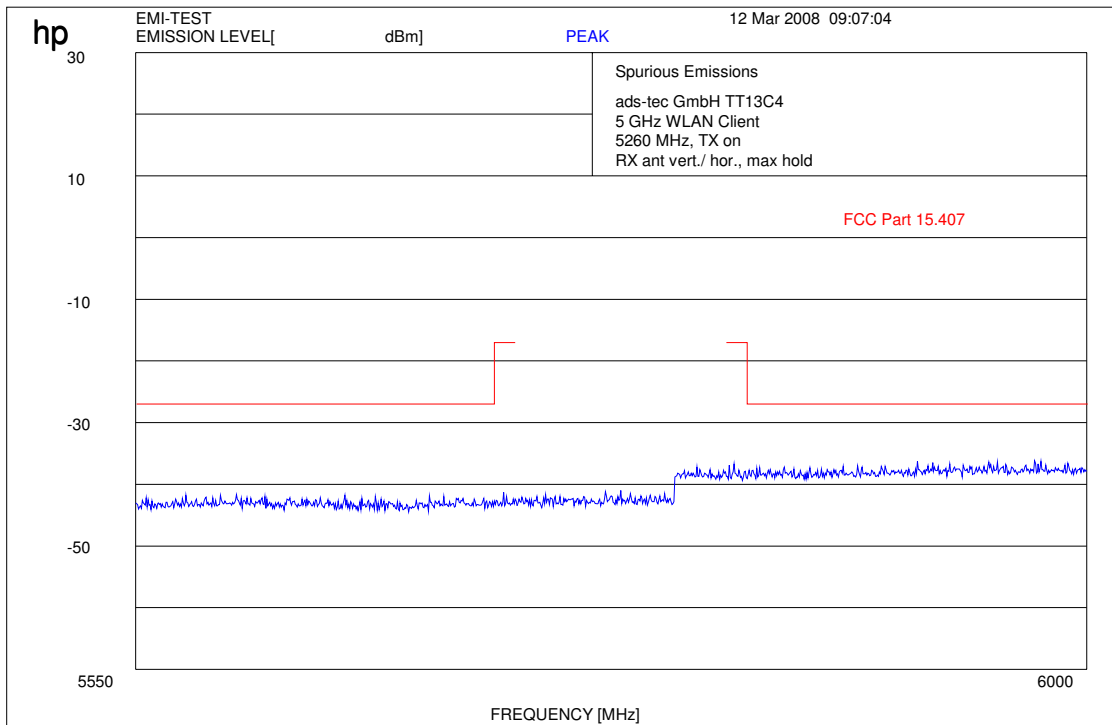
Plot 10: 1 GHz to 5.5 GHz (5260 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 11: 5.5 GHz to 6 GHz (5260 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

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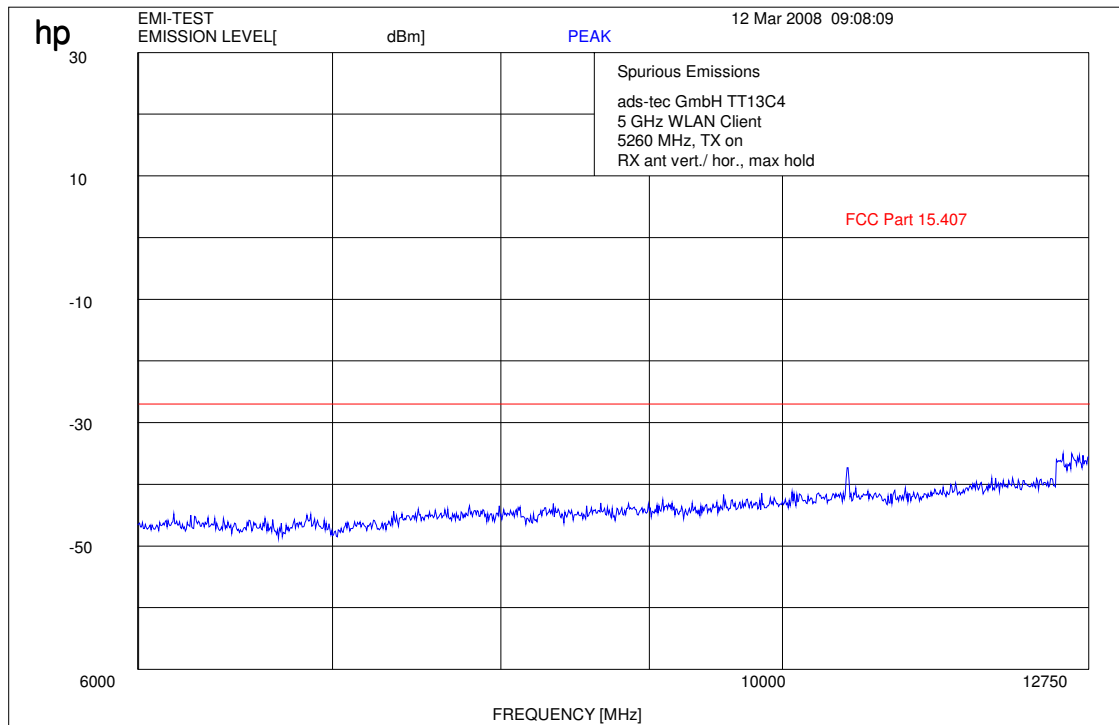


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Plot 12: 6 GHz to 12 GHz (5260 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

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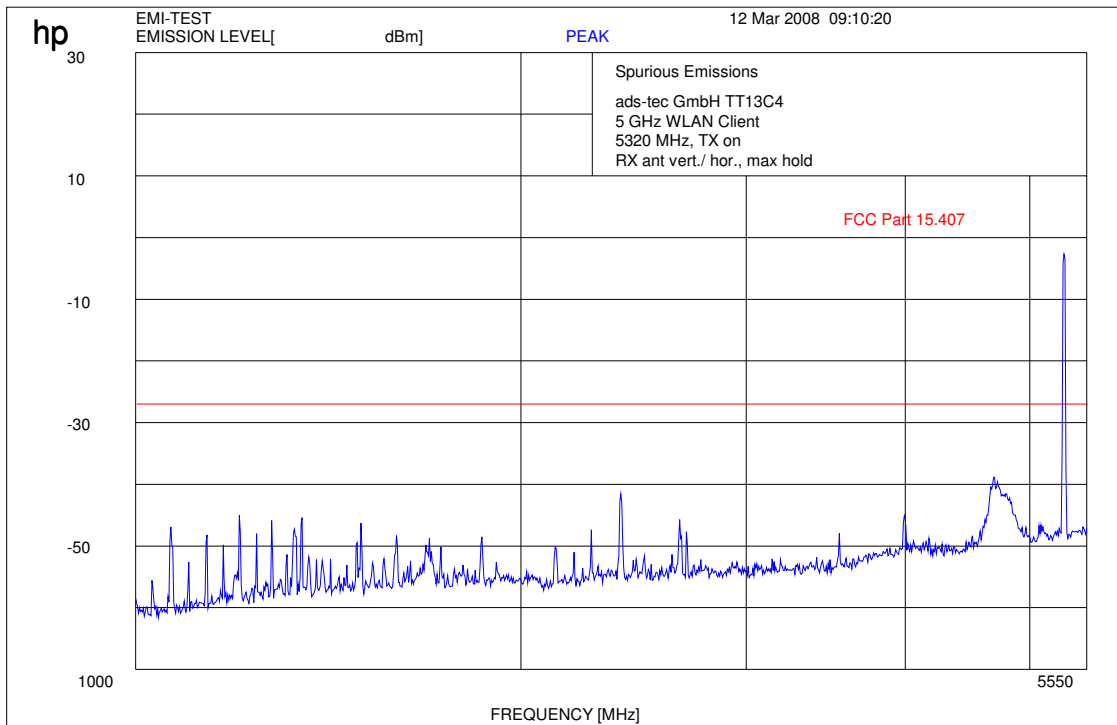


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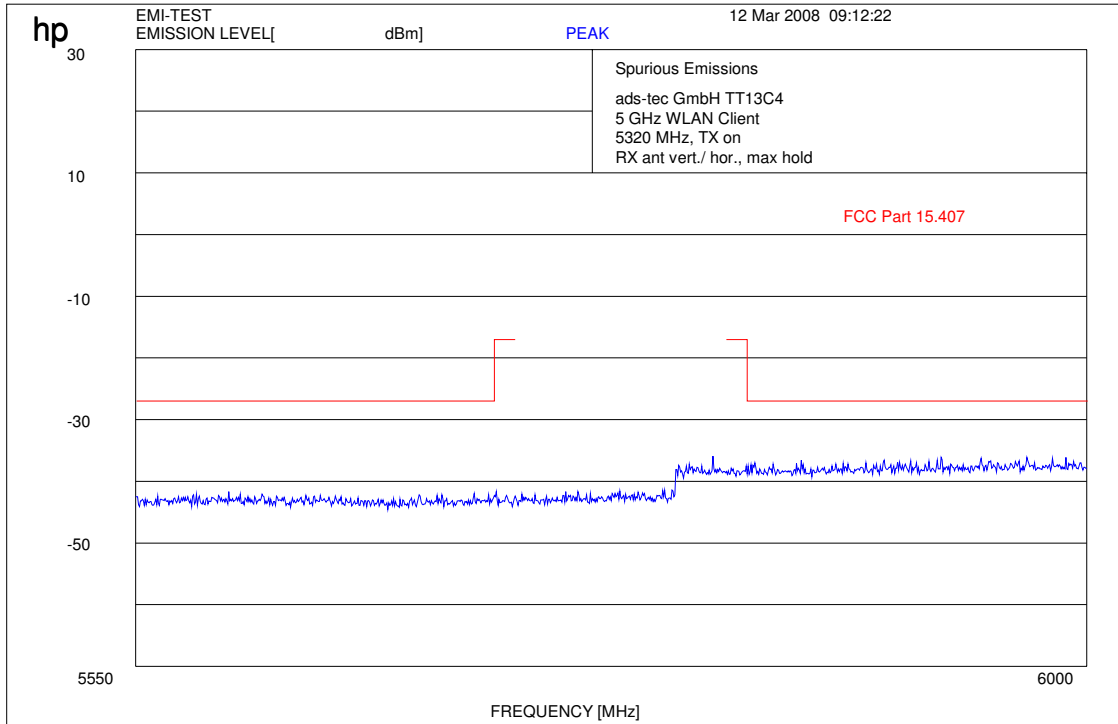
Plot 13: 1 GHz to 5.5 GHz (5320 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

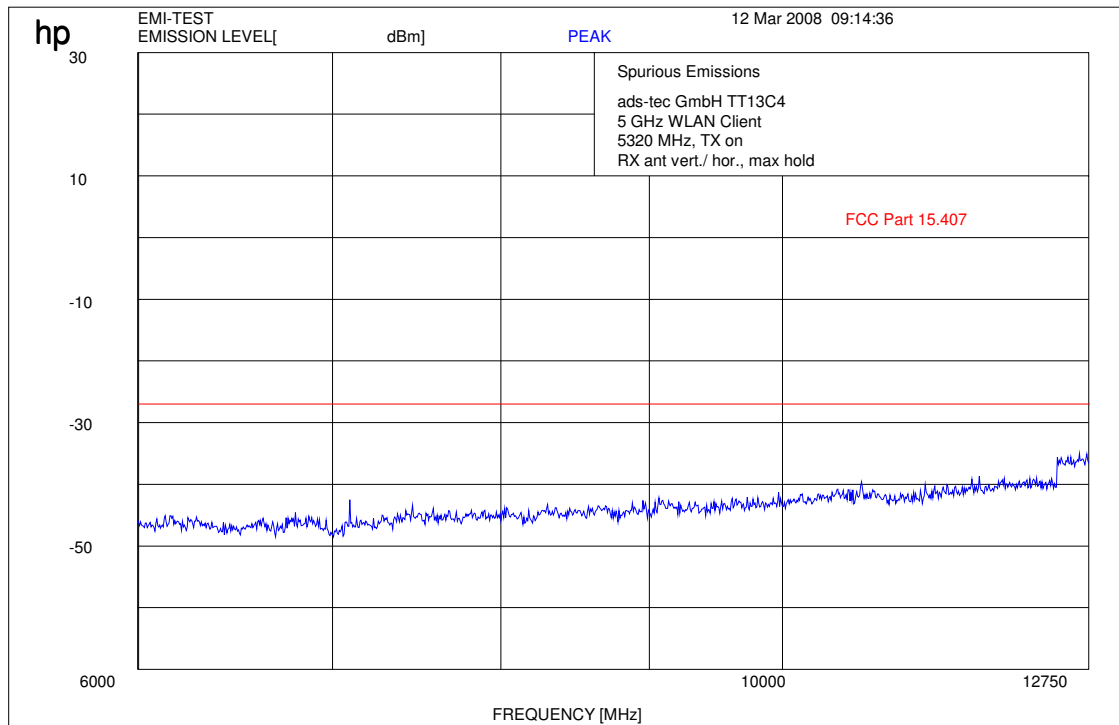
Plot 14: 5.5 GHz to 6 GHz (5320 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Plot 15: 6 GHz to 12 GHz (5320 MHz)



f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Harmonics

SPURIOUS EMISSIONS LEVEL §15.209 (Harmonics)								
5180 MHz			5240 MHz			5260 MHz		
F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
10360	AV	-44.2	11480	AV	-46.5	10520	AV	-47.4
All other harmonics > 20 dB below limit line								
Measurement uncertainty			±3 dB					

f ≥ 1GHz : RBW/VBW: 1 MHz

Limits: § 15.407 (b)(1) and (2)

For transmitters operating in the 5.15 – 5.25 or 5.25 – 5.35 GHz band: all emissions outside of the band shall not exceed an EIRP of -27 dBm/MHz

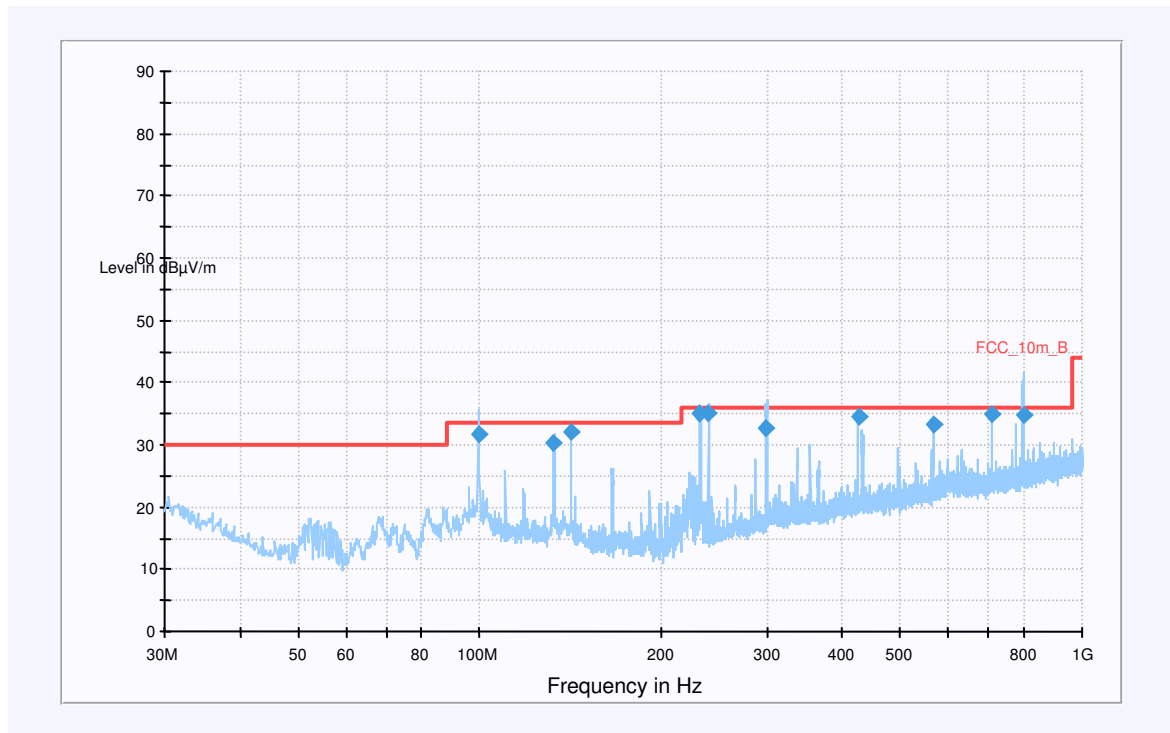
Limits: § 15.209

Frequency [MHz]	Field strength [μ V/m]	Measurement distance (m)
30 - 88	100 (40 dB μ V/m)	3
88 - 216	150 (43.5 dB μ V/m)	3
216 - 960	200 (46 dB μ V/m)	3
above 960	500 (54 dB μ V/m)	3

3.13 Spurious emissions radiated (RX)

§ 15.209

Plot 1: 0.03 - 1 GHz vertical / horizontal (receiver)



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
99.852600	30.4	15000.000	120.000	127.0	V	55.0	12.8	3.1	33.5	No restr.band
132.822000	30.2	15000.000	120.000	114.0	V	45.0	13.3	3.3	33.5	Restr. band
141.716100	32.1	15000.000	120.000	115.0	V	103.0	12.8	1.4	33.5	No restr.band
232.289300	34.9	15000.000	120.000	100.0	V	34.0	13.1	1.1	36.0	No restr.band
239.999150	34.5	15000.000	120.000	100.0	V	80.0	13.6	1.5	36.0	No restr.band
299.356450	32.6	15000.000	120.000	100.0	V	92.0	16.0	3.4	36.0	No restr.band
425.130350	34.9	15000.000	120.000	200.0	H	5.0	19.0	1.1	36.0	No restr.band
566.892150	33.3	15000.000	120.000	283.0	V	0.0	20.9	2.7	36.0	No restr.band
708.561550	35.2	15000.000	120.000	124.0	H	53.0	21.8	0.8	36.0	No restr.band
798.215400	35.2	15000.000	120.000	115.0	H	272.0	22.8	0.8	36.0	No restr.band

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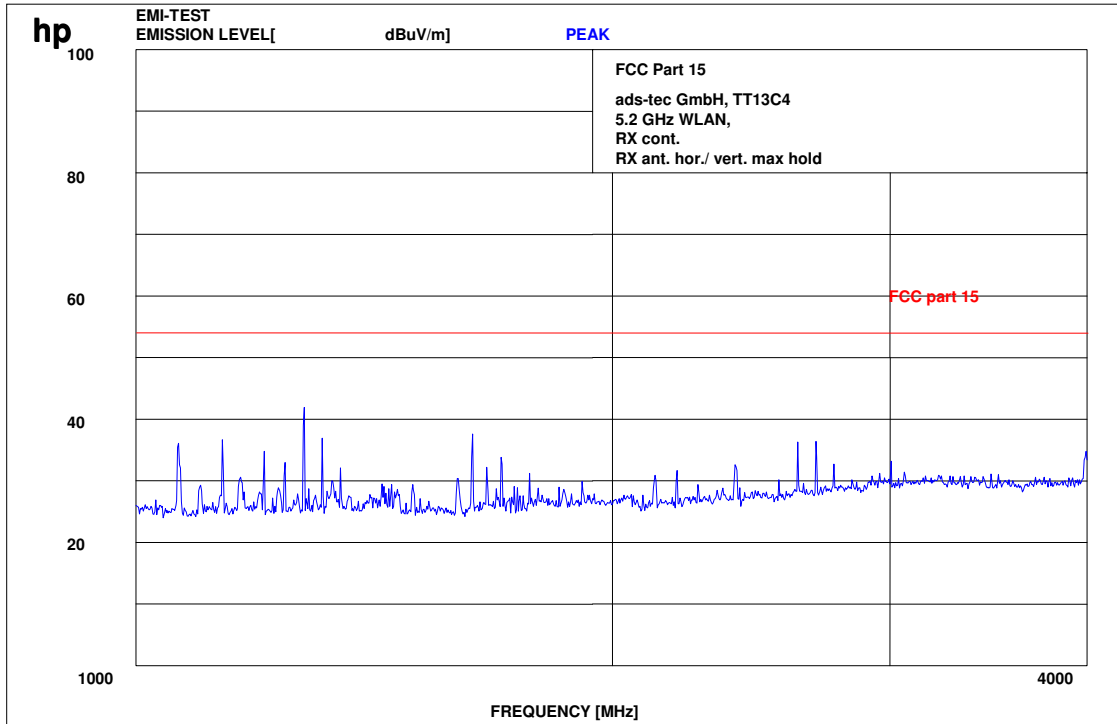


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Plot 2: 1- 4 GHz (receiver)



Results see TX-mode

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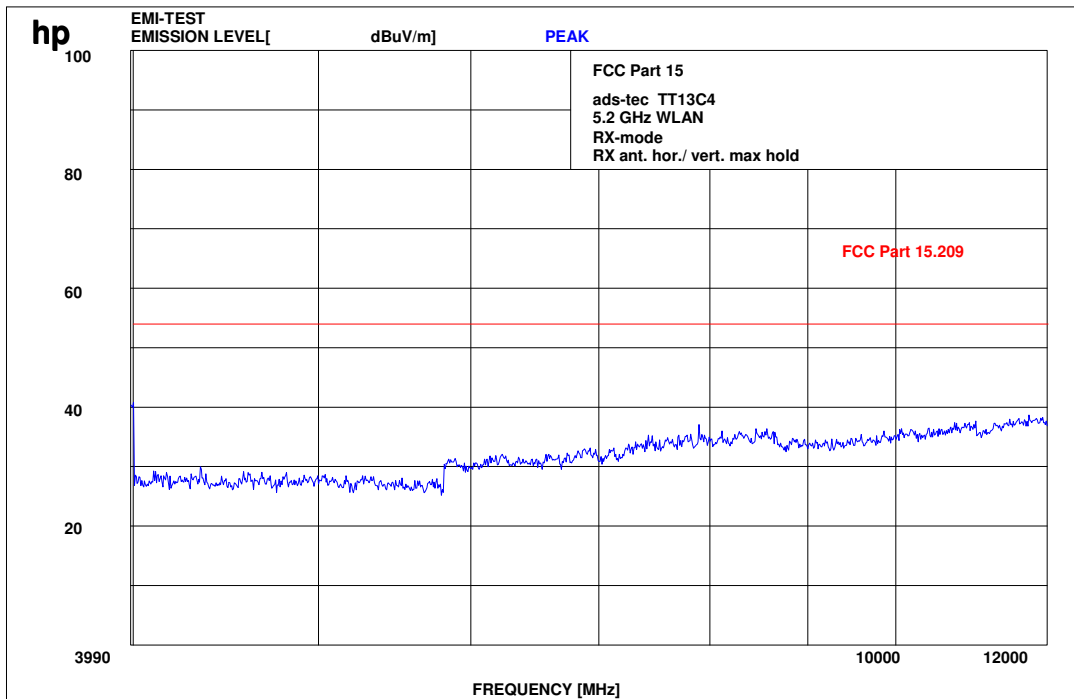


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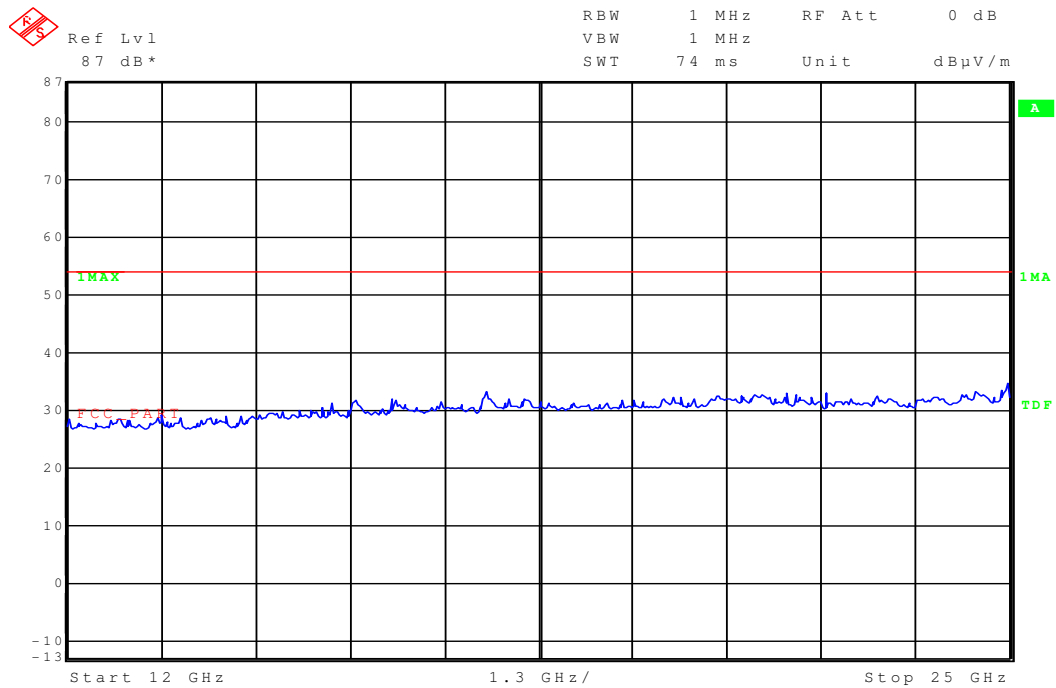
Date:2008-04-17

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Plot 3: 4- 12 GHz (receiver)



Plot 4: 12- 25 GHz (receiver)



The measurements were performed up to 40 GHz. There were no peaks found.
 f < 1 GHz : RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz

Limits: § 15.209

Frequency [MHz]	Field strength [µV/m]	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

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Results:

EMI-TEST 12 Mar 2008 07:27:53

=====

1. FCC CFR 47,Part 15J WITHOUT PRESELECTOR
1.9 FCC Part 15.407 1.0 - 5.5 GHz

=====

Avg Peaks above -58 dBm
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBm)	DELTA
1	1065.4	-54	4.0
2	1137	-54.4	3.6
3	1207.2	-51.2	6.8
4	1277.4	-51.5	6.5
5	1349.3	-55.1	2.9
6	1490.2	-53.7	4.3
7	1503	-49	9.0
8	2266.8	-54	4.0
9	2398.6	-55.9	2.1
10	2694.7	-56.2	1.8

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Measurement distance see table

Limits : § 15.109 / 209

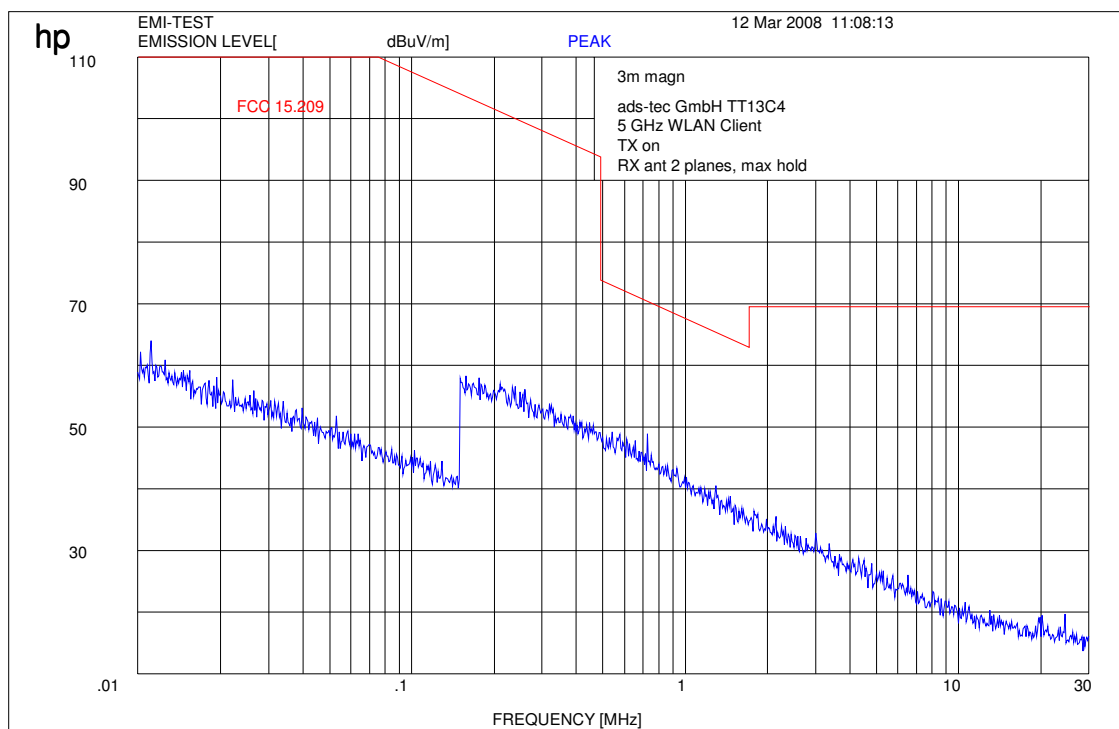
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

3.14 Spurious Emissions - radiated <30 MHz (valid for all channels) §15.109

Measured at 3 m distance.

Values recalculated with 40 dB/decade according to FCC rules.

Plot 1:



Limits:

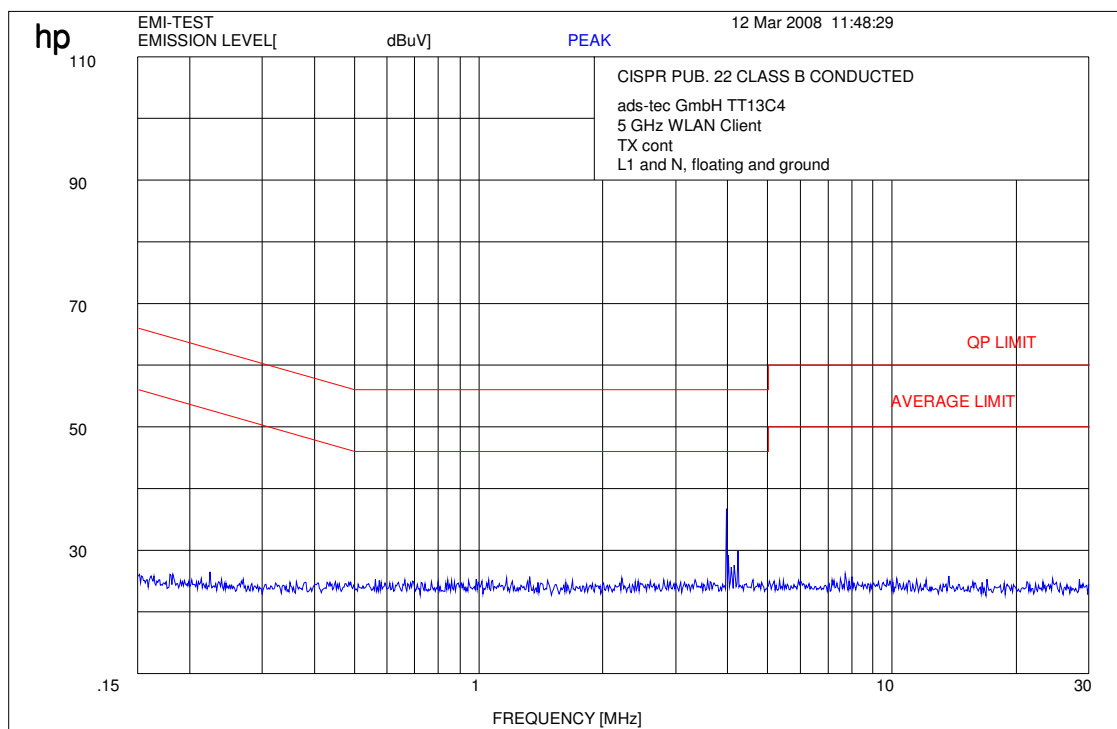
Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB $\mu\text{V/m}$	30
30 - 88	100 / 40 dB $\mu\text{V/m}$	3
88 - 216	150 / 43.5 dB $\mu\text{V/m}$	3
216 - 960	200 / 46 dB $\mu\text{V/m}$	3
above 960	54 dB $\mu\text{V/m}$	3

3.15 Conducted Emissions <30 MHz

§15.107/207

(measured with the 110V AC power supplied by the customer)

Plot 1: CISPR 22



We measured in TX and RX mode, L1 and N floating and grounded, max value was hold.

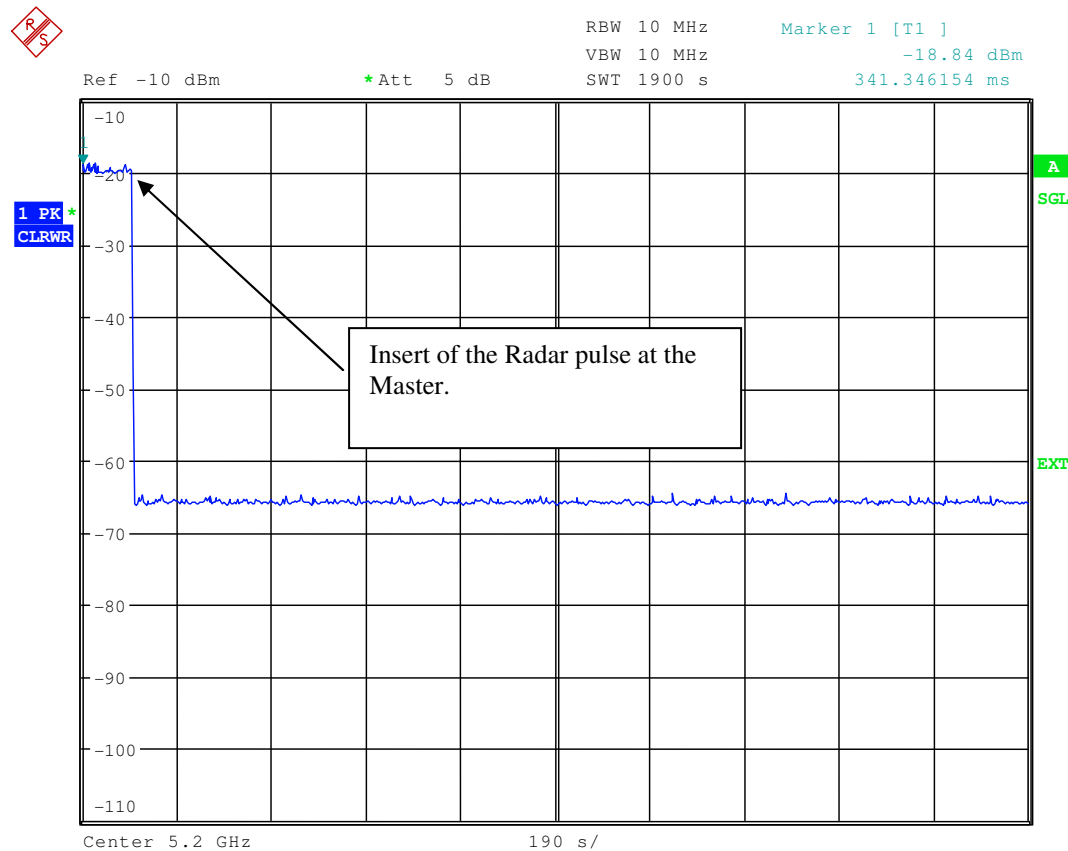
Limits :

Under normal test conditions only	0.15 to 0.5 MHz, 66-56 dB μ V QP, 56-46 dB μ V AV 0.5 to 5.0 MHz, 56 dB μ V QP, 46 dB μ V AV 5.0 to 30 MHz, 60 dB μ V QP, 50 dB μ V AV
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3.16 Non-occupancy Period (DFS requirement for client)

§15.407

Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

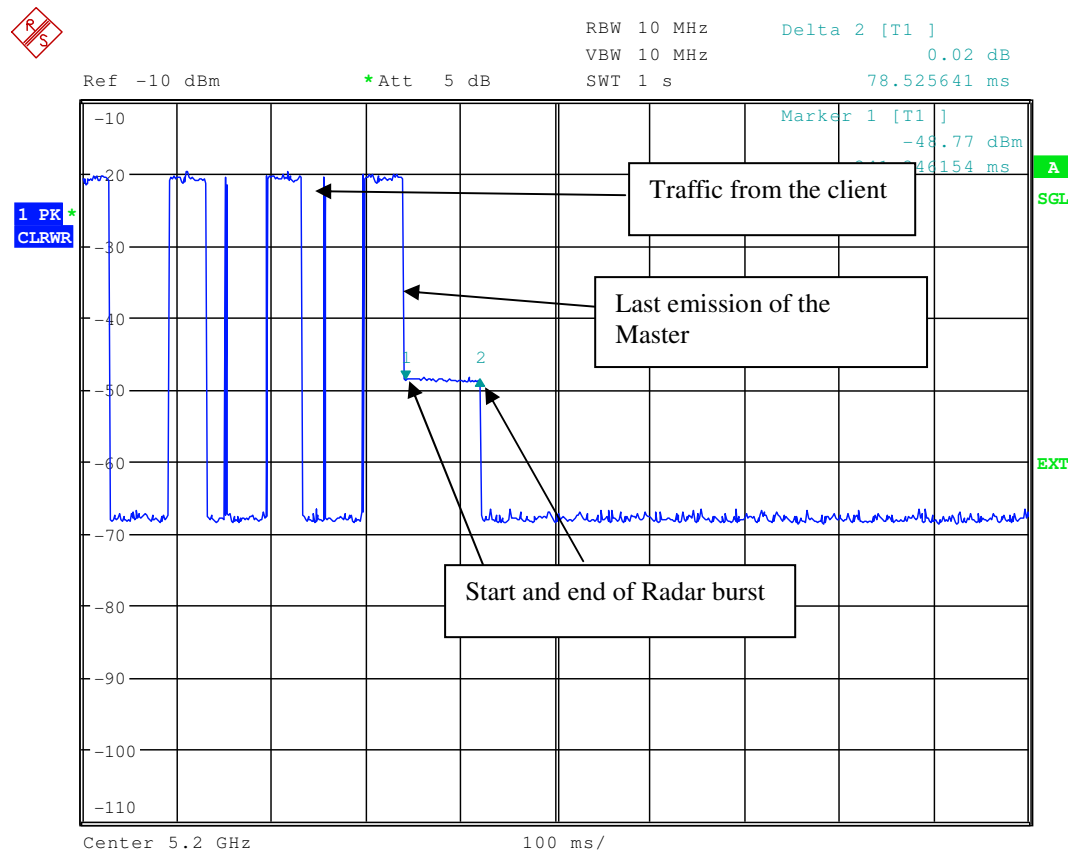


In the plot above you can see, that the client does not transmit any emission within 30 minutes after having received the “stop transmit” order from the Access Point (Master)

3.17 Channel Move Time (DFS requirement for client)

§15.407

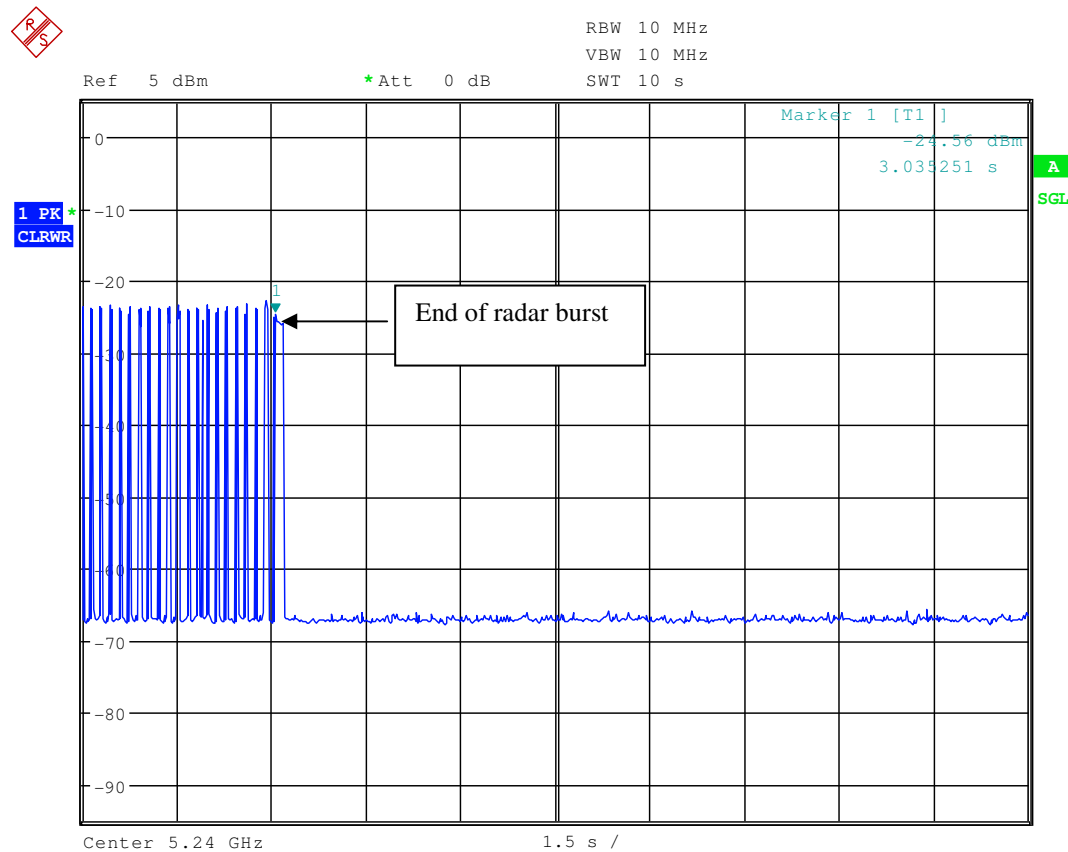
Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.



The analyzer was set to 30001 Points in horizontal resolution to get in any case a display result , if there is any emission.

Here we have no emission within 200 ms after the detection of the radar burst by the Master.

Here we see the 10 second period after the detection.
It took place on another frequency as the plot before because of the DFS mechanism.



We used the same resolution of the analyzer. (30001 point in horizontal resolution)
The marker 1 is the start of the radar burst.
There is no emission within 10 seconds after the last emission.

We repeated this tests with Radar type 1 (short pulse) and Radar type 5 (long pulse).

In both cases the test sample shows the same behaviour.

Final verdict: Pass

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SRD Laboratory Room 002:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	System Controller PSM 12	R&S	835259/007	3000002681-00xx	n.a.		
2	Memory Extension PSM-K10	R&S	To 1	3000002681	n.a.		
3	Operating Software PSM-B2	R&S	To 1	3000002681	n.a.		
4	19" Monitor		22759020-ED	3000002681	n.a.		
5	Mouse		LZE 0095/6639	3000002681	n.a.		
6	Keyboard		G00013834L 461	3000002681	n.a.		
7	Spectrum Analyser FSIQ 26	R&S	835540/018	3000002681-0005	01.08.2006	24	01.08.2008
8	Tracking Generator FSIQ-B10	R&S	835107/015	3000002681	s.No.7		
10	RF-Generator SMIQ03 (B1 Signal)	R&S	835541/056	3000002681-0002	01.08.2006	36	01.08.2009
11	Modulation Coder SMIQ-B20	R&S	To 10	3000002681	s.No.10		
12	Data Generator SMIQ-B11	R&S	To 10	3000002681	s.No.10		
13	RF Rear Connection SMIQ-B19	R&S	To 10	3000002681	s.No.10		
14	Fast CPU SM-B50	R&S	To 10	3000002681	s.No.10		
15	FM Modulator SM-B5	R&S	835676/033	3000002681	s.No.10		
16	RF-Generator SMIQ03 (B2 Signal)	R&S	835541/055	3000002681-0001	01.08.2006	36	01.08.2009
17	Modulation Coder SMIQ-B20	R&S	To 16	3000002681	s.No.16		
18	Data Generator SMIQ-B11	R&S	To 16	3000002681	s.No.16		
19	RF Rear Connection SMIQ-B19	R&S	To 16	3000002681	s.No.16		
20	Fast CPU SM-B50	R&S	To 16	3000002681	s.No.16		
21	FM Modulator SM-B5	R&S	836061/022	3000002681	s.No.16		
22	RF-Generator SMP03 (B3 Signal)	R&S	835133/011	3000002681-0003	01.08.2006	36	01.08.2009
23	Attenuator SMP-B15	R&S	835136/014	3000002681	S.No.22		
24	RF Rear Connection SMP-B19	R&S	834745/007	3000002681	S.No.22		
25	Power Meter NRVD	R&S	835430/044	3000002681-0004	01.08.2006	24	01.08.2008
26	Power Sensor NRVD-Z1	R&S	833894/012	3000002681-0013	01.08.2006	24	01.08.2008
27	Power Sensor NRVD-Z1	R&S	833894/011	3000002681-0010	01.08.2006	24	01.08.2008
28	Rubidium Standard RUB	R&S		3000002681-0009	01.08.2006	24	01.08.2008
29	Switching and Signal Conditioning Unit SSCU	R&S	338864/003	3000002681-0006	01.08.2006	24	01.08.2008
30	Laser Printer HP Deskjet 2100	HP	N/A	3000002681-0011	n.a.		
31	19" Rack	R&S	11138363000 004	3000002681	n.a.		
32	RF-cable set	R&S	N/A	3000002681	n.a.		
33	IEEE-cables	R&S	N/A	3000002681	n.a.		
34	Sampling System FSIQ-B70	R&S	835355/009	3000002681	s.No.7		

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35	RSP programmable attenuator	R&S	834500/010	3000002681-0007	01.08.2006	24	01.08.2008
36	Signalling Unit	R&S	838312/011	3000002681	n.a.		
37	NGPE programmable Power Supply for EUT	R&S	192.033.41	3000002681			
38	Climatic box VT 4002	Heraeus Vötsch	58566046820 010	300003019	11.05.2007	24	11.05.2009
39	Signaling Unit CMU200	R&S	832221/0055	300002862	12.01.2006	24	12.01.2008
40	Power Splitter 6005-3	Inmet Corp.	none	300002841	23.12.2006	24	23.12.2008
41	SMA Cables SPS-1151-985-SPS	Insulated Wire	different	different	n.a.		
42	CBT32 with EDR Signaling Unit	R&S					
43	Coupling unit	Narda	N/A	--	n.a.		
44	2xSwitch Matrix PSU	R&S	872584/021	300001329	n.a.		
45	RF-cable set	R&S	N/A	different	n.a.		
46	IEEE-cables	R&S	N/A	--	n.a.		

Anechoic chamber F:

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
Radiated emission in chamber F					
F-1	Control Computer	F+W		FW0502032	300003303
F-2	Bilog antenna	Chase	CBL 6112A	2110	300000573
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	HP	3488A	- / -	300000368
F-5	EMI Test receiver	R&S	ESCI	100083	300003312
F-6	Turntable Controller	EMCO	1061 3M	1218	300000661
F-7	Tower Controller	EMCO	1051 Controller	1262	300000625
F-8	Tower	EMCO	1051 Tower	1262	300000625
F-9	Ultra Notch-Filter Rejected band Ch. 62	WRCD		9	

3 Photographs of test site

Radiated Emissions:



Radiated Emissions:



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AC-conducted:



4 Photographs of equipment under test

Photograph No.: 1



Photograph No.: 2



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Photograph No.: 3



Photograph No.: 4



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Photograph No.: 5



Photograph No.: 6



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Photograph No.: 7



Photograph No.: 8



Photograph No.: 9



Photograph No.: 10



Photograph No.: 11



Photograph No.: 12



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Photograph No.: 13



Photograph No.: 14



Photograph No.: 15



Photograph No.: 16

