

Recognized by the
Federal Communications Commission
Anechoic chamber registration no.: 90462 (FCC)
Anechoic chamber registration no.: IC 3463A-1
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. : 2-4689-01-02/07
Applicant : Ads-tec GmbH
Type : WLAN AP/Client RAP/RAC1X1X
Test Standard : FCC Part 15.247
RSS 210 Issue 7
FCC ID : T9GRAX1X1X
IC Certification No. : 6275A-RAX1X1X

*The Bluetooth word mark and logos are owned by the Bluetooth SIG,
Inc. and any use of such marks by Cetecom ICT is under license*

Table of contents

1. ADMINISTRATIVE DATA	3
1.1. ADMINISTRATIVE DATA OF THE TEST FACILITY	3
1.1.1 Identification of the testing laboratory	3
1.1.2 Organizational items.....	3
1.1.3 Applicant's details	4
1.2 ADMINISTRATIVE DATA OF MANUFACTURER / MEMBER	4
1.3 DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)	5
1.3.1 EUT: Type, S/N etc.	5
1.3.2 If RF component testing only, description of additional used HW/SW.....	5
1.3.3 Additional EUT information	6
1.3.4 Additional EUT information For IC Canada (appendix 2).....	7
1.3.5 EUT operating modes.....	8
1.3.6 Extreme conditions testing values.....	8
2 TEST STANDARD & SUMMARY LIST OF ALL PERFORMED TEST CASES	9
3 RF MEASUREMENT TESTING	10
3.1 DESCRIPTION OF TEST SET-UP	10
3.1.1 Radiated measurements	10
3.1.2 Conducted measurements	10
3.1.3 AC-conducted measurements.....	10
3.2 REFERENCED DOCUMENTS	11
3.3 ADDITIONAL COMMENTS	11
3.4 ANTENNA GAIN	11
3.5 PEAK POWER SPECTRAL DENSITY (DSSS) §15.247(E).....	12
3.6 PEAK POWER SPECTRAL DENSITY (OFDM) §15.247(E).....	14
3.7 SPECTRUM BANDWIDTH OF A DSSS SYSTEM §15.247(A2).....	16
3.8 SPECTRUM BANDWIDTH OF A OFDM SYSTEM §15.247(A2).....	21
3.9 MAXIMUM OUTPUT POWER (CONDUCTED) (DSSS) §15.247 (B) (3).....	26
3.10 MAXIMUM OUTPUT POWER (CONDUCTED) (OFDM) §15.247 (B) (3).....	28
3.11 MAX. PEAK OUTPUT POWER (RADIATED) §15.247 (B) (3)	31
3.12 BAND-EDGE COMPLIANCE OF CONDUCTED EMISSIONS §15.247 (D)	32
3.13 BAND-EDGE COMPLIANCE OF RADIATED EMISSIONS (DSSS) §15.205.....	34
3.14 BAND-EDGE COMPLIANCE OF RADIATED EMISSIONS (OFDM) §15.205.....	37
3.15 SPURIOUS EMISSIONS - CONDUCTED (TRANSMITTER) §15.247 (D).....	40
3.16 SPURIOUS EMISSIONS - RADIATED (TRANSMITTER) DSSS §15.209.....	44
3.17 SPURIOUS EMISSIONS - RADIATED (TRANSMITTER) OFDM §15.209	49
3.18 SPURIOUS EMISSIONS - RADIATED RECEIVER §15.109 / 209.....	55
3.19 SPURIOUS EMISSIONS - RADIATED <30 MHz §15.209	58
3.20 CONDUCTED EMISSIONS <30 MHz §15.107/207	59
4 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS	60
5 PHOTOGRAPHS OT TEST SITE	63
6 PHOTOGRAPHS OT EQUIPMENT UNDER TEST	66

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



Responsible for testing laboratory
(Harro Ames)

1.1.2 Organizational items

Reference No.:	
Order No.:	
Responsible for test report and project leader:	Harro Ames, Michael Berg
Receipt of EUT:	2007-10-22
Date(s) of test:	2007-10-22 to 2007-11-20
Date of report:	2007-11-21
Number of report pages:	70
Number of diagram pages (annex):	

Version of template:	1.6



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. Steffen Pfendtner Tel: +49 (0)711 45894-380 Fax: +49 (0)711 45894-987 email: s.pfendtner@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
RAP1X1X RAC1X1X		Dual WLAN AP / Client single card version	-	-	-
Frequency Band [MHz]	Type of Modulation	Number of channels	Antenna	Power Supply	Temperature Range
ISM 2.400 - 2.483.5	DSSS / OFDM	11	2 external rod antennas RB-H01	External AC power supply	-20°C to +55°C

for more infos see subpart 1.3.3

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 dual access point / dual client for dualband use. (2.4 and 5 GHz).

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

The only difference between AP and client is the software setting, RF-part is identical.

There are no differences in RF behaviour between AP and client.

In this report we test the AP with the dedicated rod antennas at 2.4 GHz.

Other antennas and frequency ranges are tested in separate reports.

Access Point	RAP1110	RAP1111	RAP1210	RAP1211	RAP1120	RAP1121	RAP1220	RAP1221
1 WLAN Module	X	X	X	X				
2 WLAN Modules					X	X	X	X
1xCU Ethernet Port (RJ45)	X	X			X	X		
5xCU Ethernet Port (integrated switch) (RJ45)								
1xOptical Ethernet Port			X	X			X	X
PoE (IEEE 802.3af) 48V DC	X	X			X	X		
24 V DC	X		X		X		X	
AC integrated 110-230 V AC		X		X		X		X
Client Mode available	X	X	X	X	X	X	X	X
Access Client	RAC1110	RAC1111	RAC1510	RAC1511	RAC1120	RAC1121	RAC1220	RAC1221
1 WLAN Module	X	X	X	X				
2 WLAN Modules					X	X	X	X
1xCU Ethernet Port	X	X			X	X		
5xCU Ethernet Port (integrated switch)			X	X				
1xOptical Ethernet Port							X	X
PoE (IEEE 802.3af) 48V DC	X	X	X	X	X	X		
24 V DC	X		X		X		X	
AC integrated 110-230 V AC		X		X		X		X

1.3.4 Additional EUT information For IC Canada (appendix 2)

IC Certification Number:	6275A-RAX1X1X
Model Name:	RAP1110, RAP1111, RAP1210, RAP1211 / RAC1110, RAC1111, RAC1510, RAC1511
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]:	2412 – 2462 MHz
RF: Power [W] (max):	Rad. EIRP: DSSS:400 mW, OFDM: 396 mW Conducted : DSSS:214 mW, OFDM: 191 mW
Antenna Type:	rod antennas 2.4 GHz: DZ-PCKO-11032-0
Occupied Bandwidth (99% BW) [MHz]:	DSSS:18.07 / OFDM: 17.95
Type of Modulation:	DSSS and OFDM
Emission Designator (TRC-43):	18M1G1D / 18M0G7D
Transmitter Spurious (worst case) [μ V/m in 3m]:	No peaks found
Receiver Spurious (worst case) [μ V/m in 3m]:	No peaks found

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: 2007-11-21

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 AC power supply with 24V DC output, 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 §15.247 - CANADA RSS-210	pass	2007-11-21	

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
None	Antenna Gain	Yes			
§15.247 (e)	Peak power spectral density	Yes			
§15.247(a2)	Spectrum Bandwidth of a DSSS /OFDMSystem 6dB/20dB/26dB BW	Yes			
§ 15.247 (b) (3)	Maximum output power (conducted)	Yes			
§ 15.247 (b) (3)	Max. peak output power (radiated)	Yes			
§15.247 (d)	Band-edge compliance of conducted emissions	Yes			
§15.205	Band-edge compliance of radiated emissions	Yes			
§15.247 (d)	Spurious Emission - conducted (Transmitter)	Yes			
§ 15.209	Spurious Emission -radiated (Transmitter)	Yes			
§ 15.247 (d)	Spurious Emissions-radiated (Receiver)	Yes			
§ 15.109	Spurious Emissions-radiated <30 MHz	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	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 C63.2-1996 clause 15 and ANSI C63.4-2003 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 C63-4-2003 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.

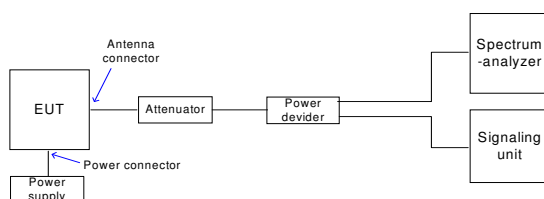
30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

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

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 are first checked within a calibration. The measurement readings on the spectrum analyzer are 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

This test report covers all type of hosts that includes one RF-card only.

3.4 Antenna gain

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

For the dedicated rod antenna, we calculated ~ 3.2 dBi at 2437 MHz. (see page 31)

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

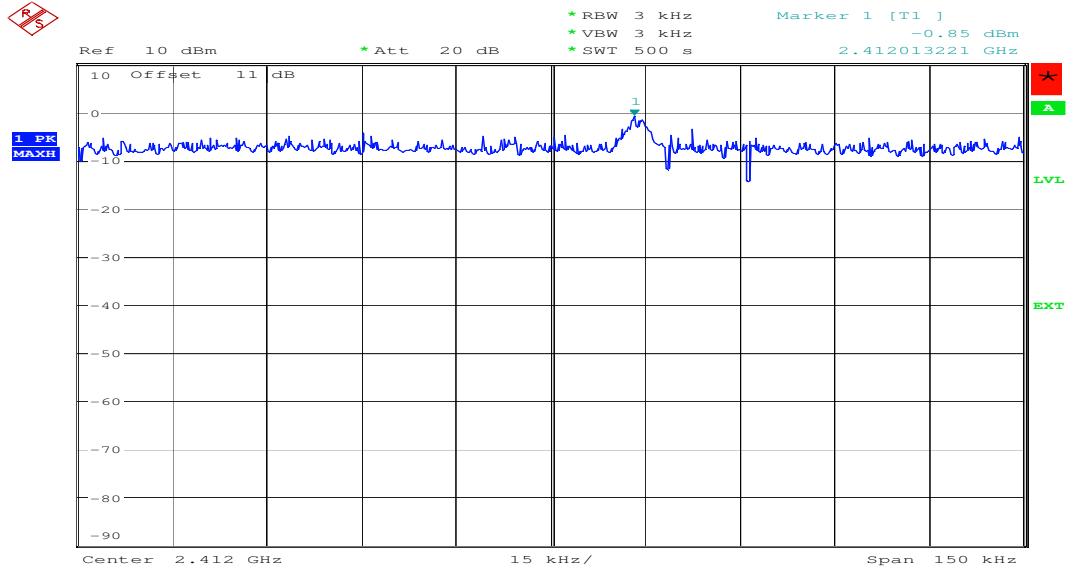
Date: 2007-11-21

Page 12 of 70

3.5 Peak Power Spectral density (DSSS)

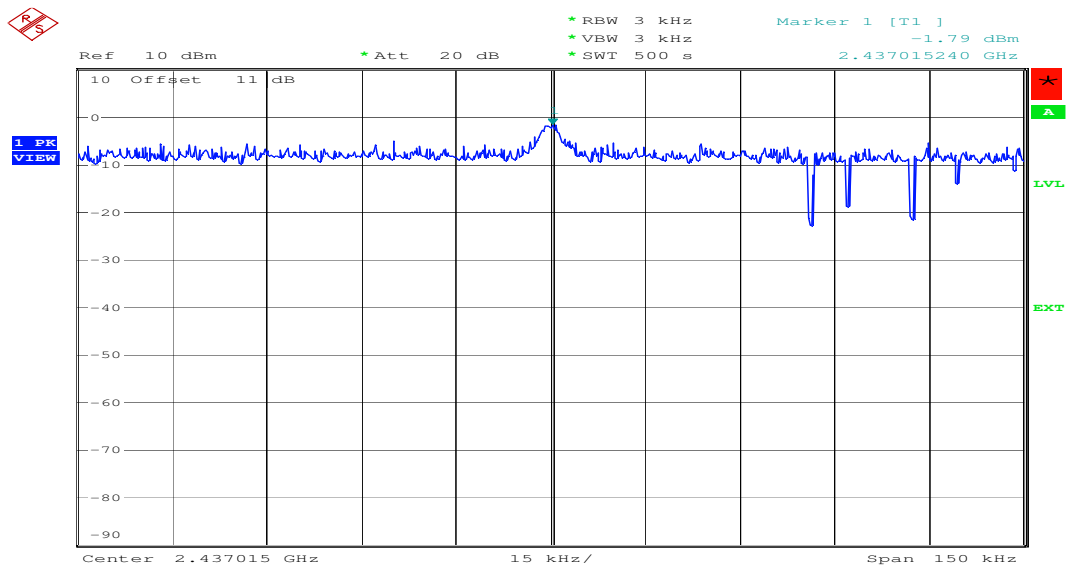
§15.247(e)

Plot 1:



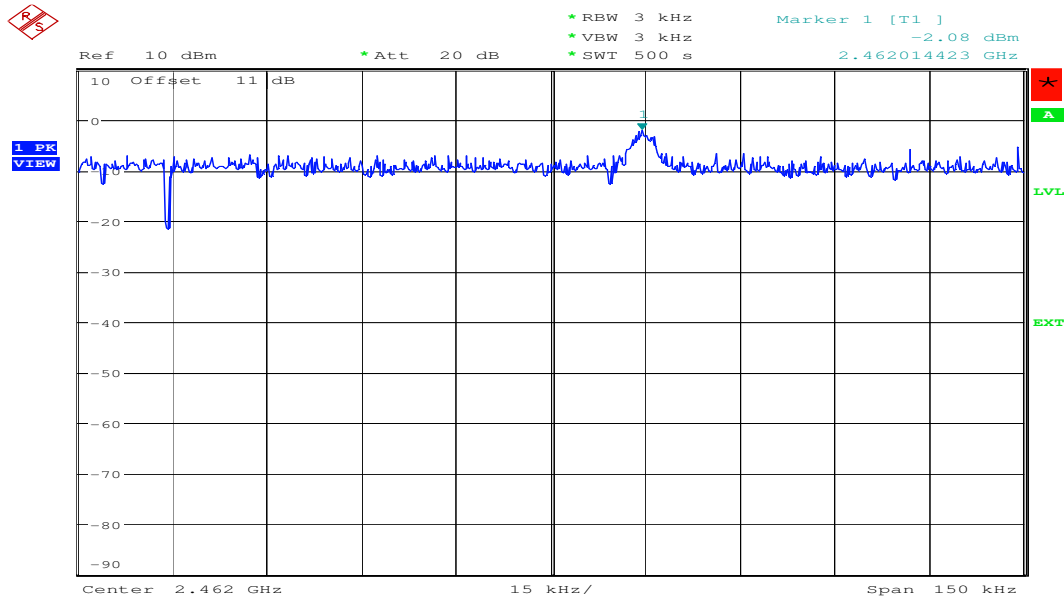
Date: 10.NOV.2007 10:18:28

Plot 2:



Date: 10.NOV.2007 10:25:55

Plot 3:



Date: 10.NOV.2007 10:31:18

Results: Plot 1: Power density : = - 0.85 dBm / 3 KHz
 Plot 2: Power density : = - 1.79 dBm / 3 KHz
 Plot 3: Power density : = - 2.40 dBm / 3 KHz

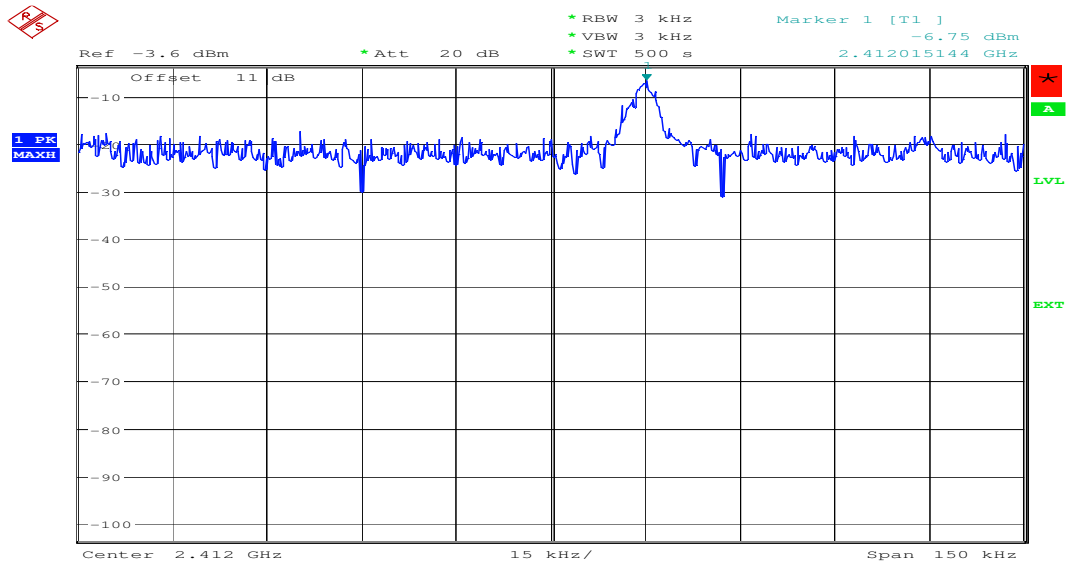
Limits :

Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmission
-----------------------------------	---

3.6 Peak Power Spectral density (OFDM)

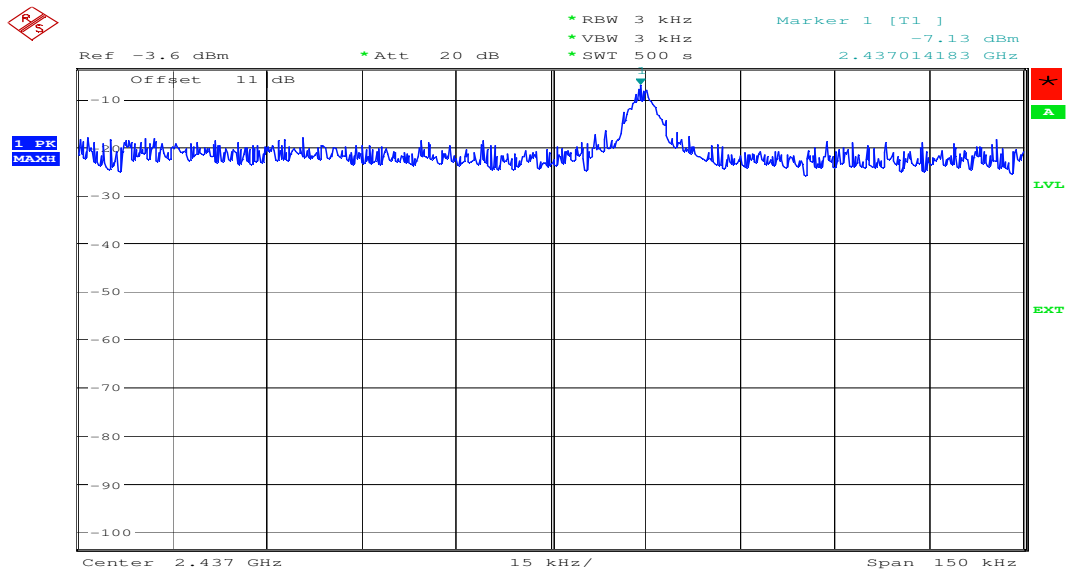
§15.247(e)

Plot 1:



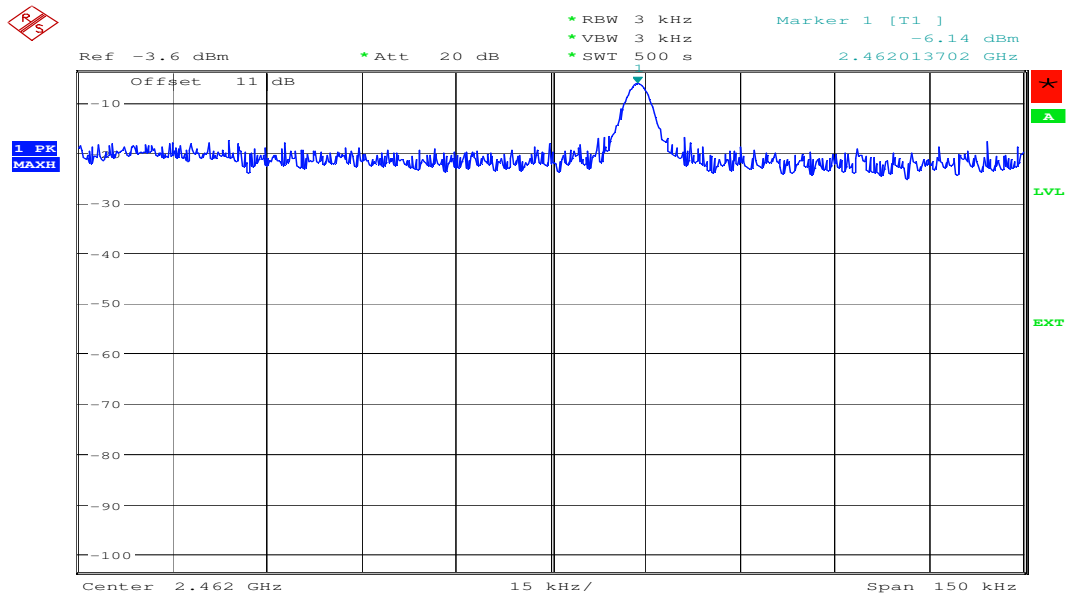
Date: 10.NOV.2007 11:06:48

Plot 2:



Date: 10.NOV.2007 11:13:09

Plot 3:



Date: 10.NOV.2007 10:45:18

Results: Plot 1: Power density : = - 6.6 dBm / 3 KHz
 Plot 2: Power density : = - 7.1 dBm / 3 KHz
 Plot 3: Power density : = - 6.1 dBm / 3 KHz

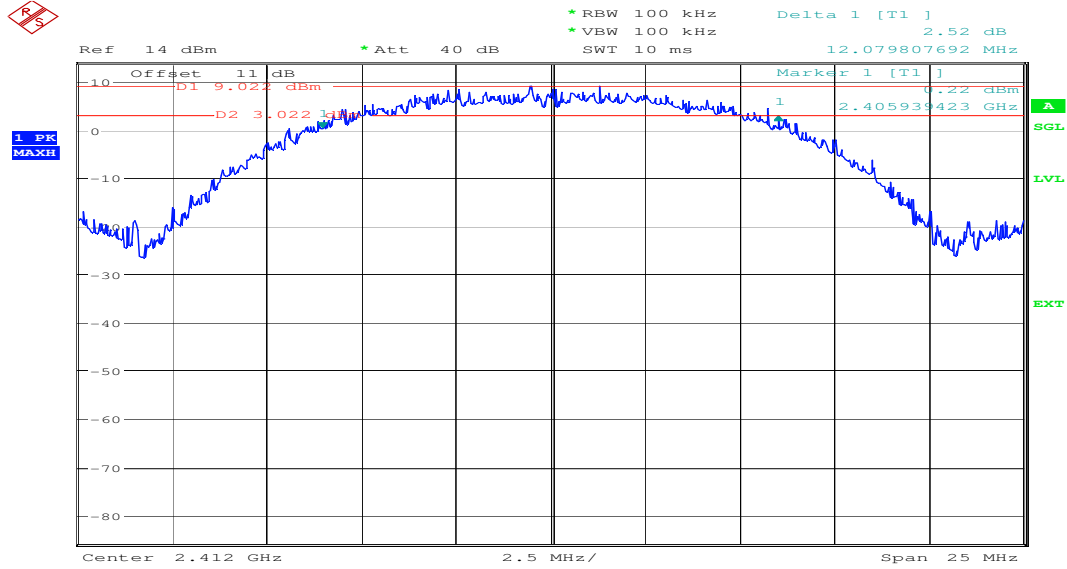
Limits :

Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmission
-----------------------------------	---

3.7 Spectrum Bandwidth of a DSSS System

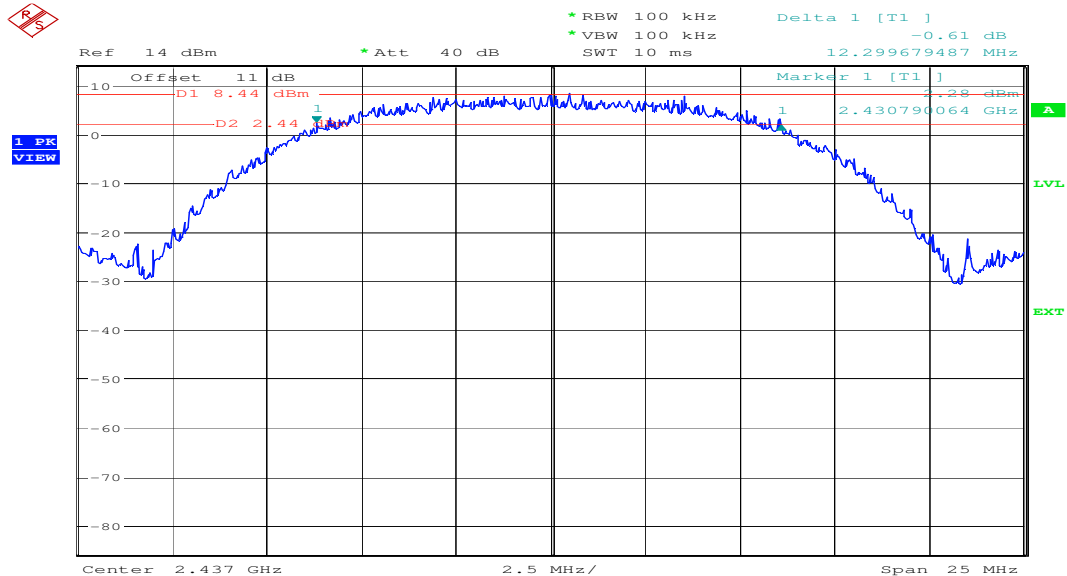
§15.247(a2)

Plot 1: 6 dB-Bandwidth (2412 MHz)



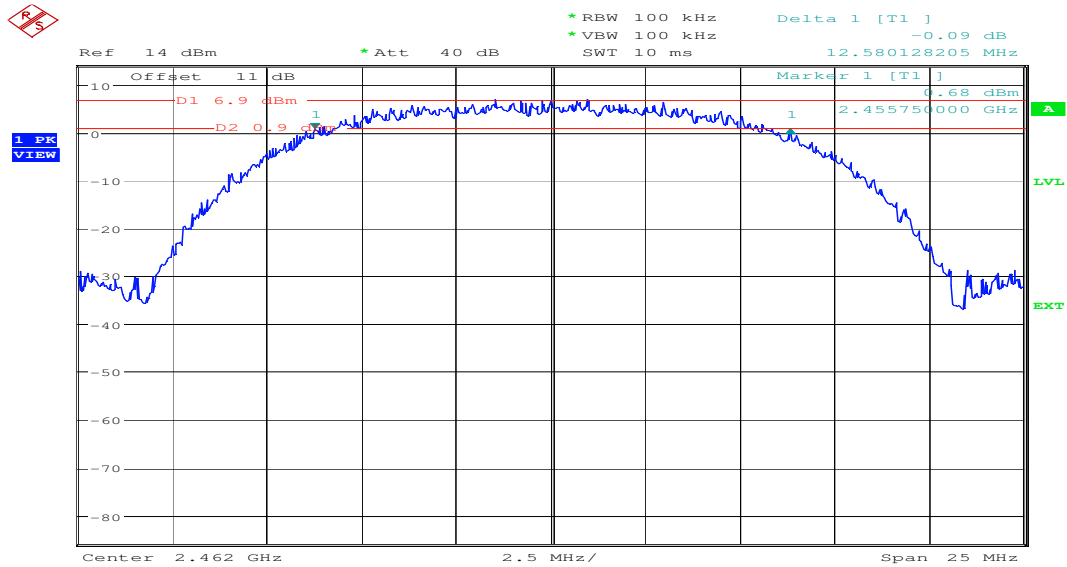
Date: 10.NOV.2007 11:16:31

Plot 2: 6 dB-Bandwidth (2437 MHz)



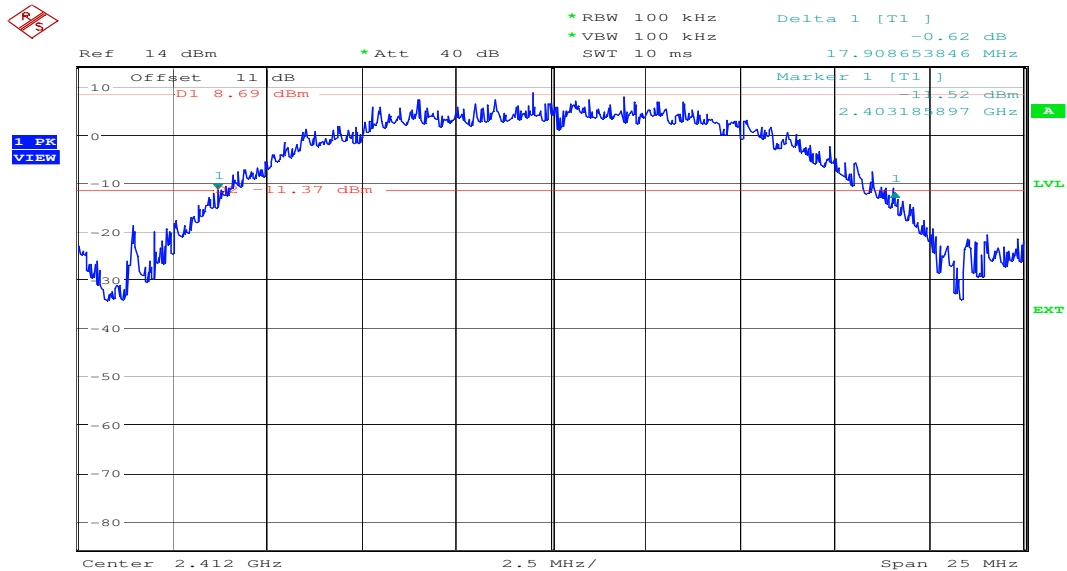
Date: 10.NOV.2007 11:20:34

Plot 3: 6 dB-Bandwidth (2462 MHz)



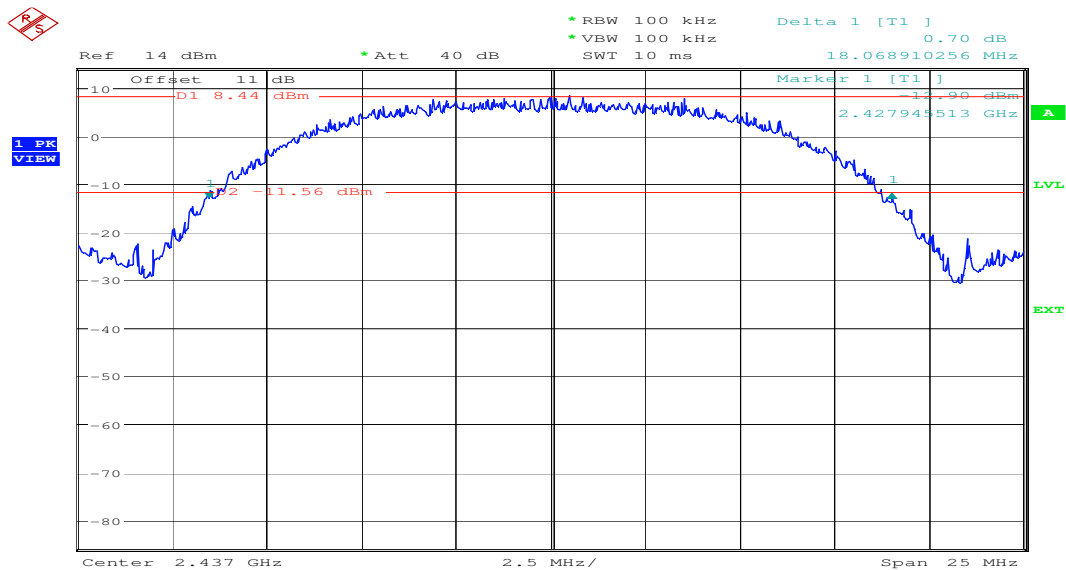
Date: 10.NOV.2007 11:33:44

Plot 4: 20 dB-Bandwidth (2412 MHz)



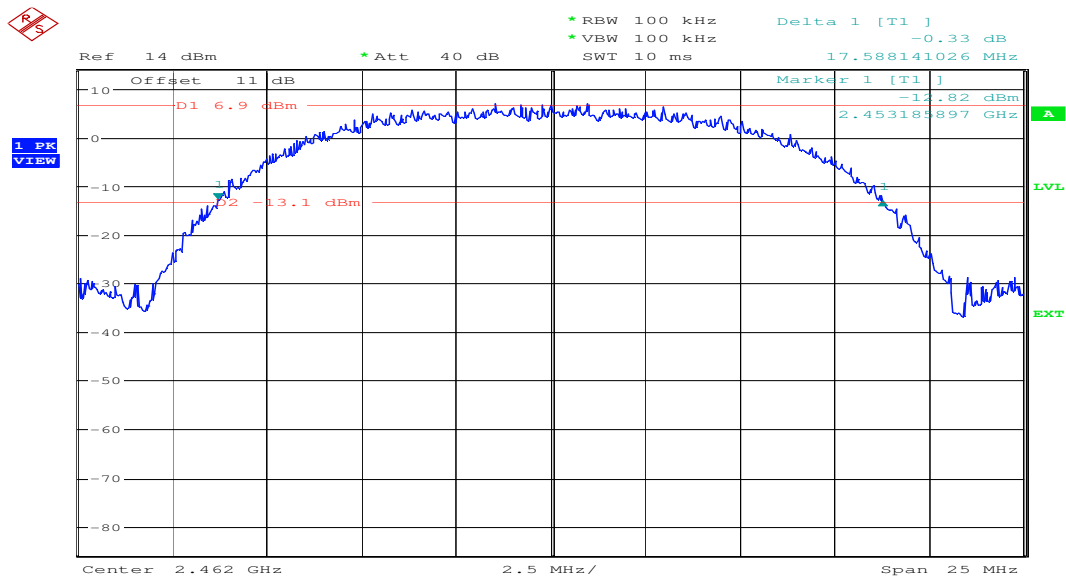
Date: 10.NOV.2007 11:27:31

Plot 5: 20 dB-Bandwidth (2437 MHz)



Date: 10.NOV.2007 11:24:07

Plot 6: 20 dB-Bandwidth (2462 MHz)



Date: 10.NOV.2007 11:31:44

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

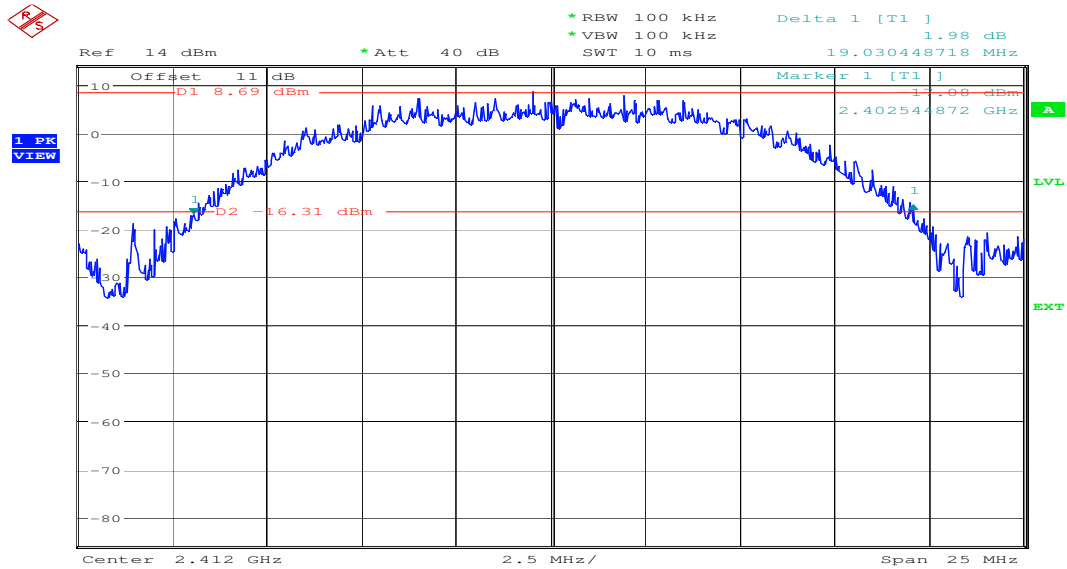


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

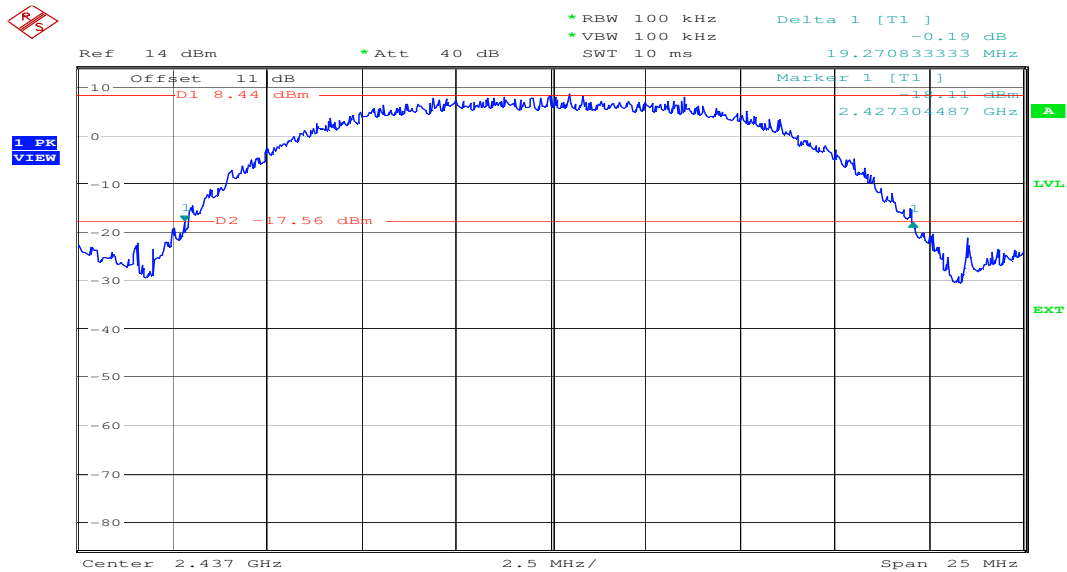
Page 19 of 70

Plot 7: 26 dB-Bandwidth (2412 MHz)



Date: 10.NOV.2007 11:29:07

Plot 8: 26 dB-Bandwidth (2437 MHz)



Date: 10.NOV.2007 11:25:11

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

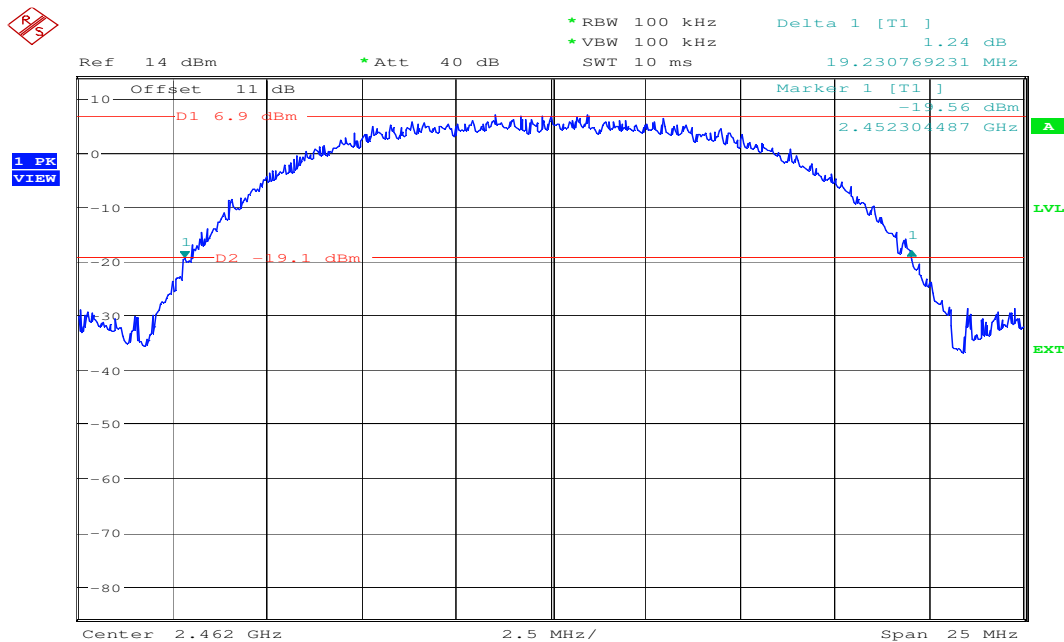


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 20 of 70

Plot 9: 26 dB-Bandwidth (2462 MHz)



Date: 10.NOV.2007 11:32:49

Results:

Test conditions	BANDWIDTH [MHz]		
	2412	2437	2462
Frequency [MHz]	2412	2437	2462
6 dB - Bandwidth	12.06	12.30	12.58
20 dB - Bandwidth	17.91	18.07	17.59
26 dB - Bandwidth	19.03	19.27	19.23
Measurement uncertainty	±1kHz		

RBW: 100 kHz / VBW 100 kHz

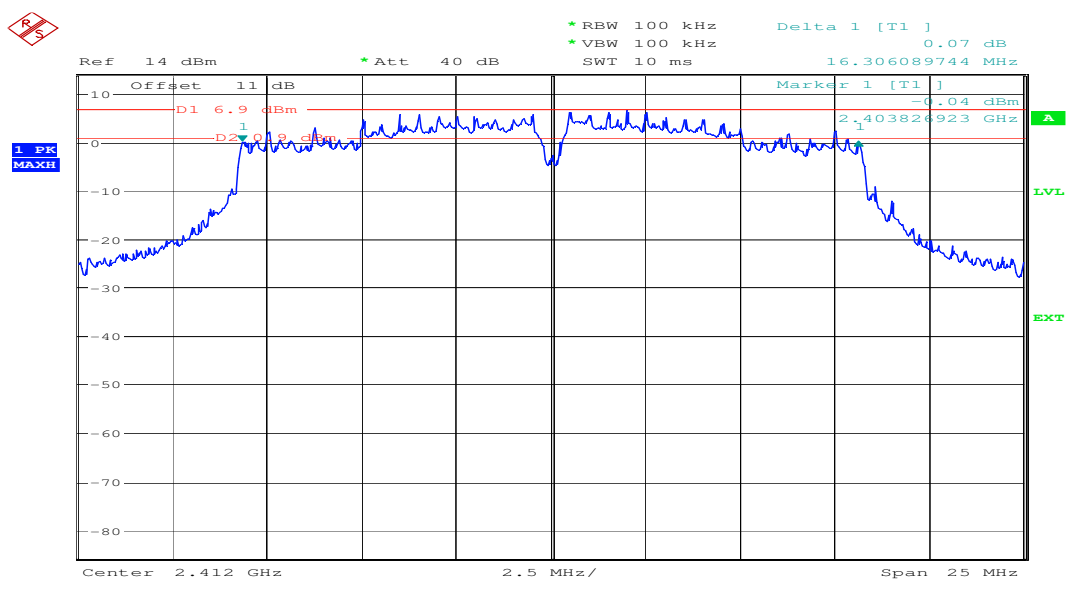
Limits :

Under normal test conditions only	> 500 KHz
-----------------------------------	-----------

3.8 Spectrum Bandwidth of a OFDM System

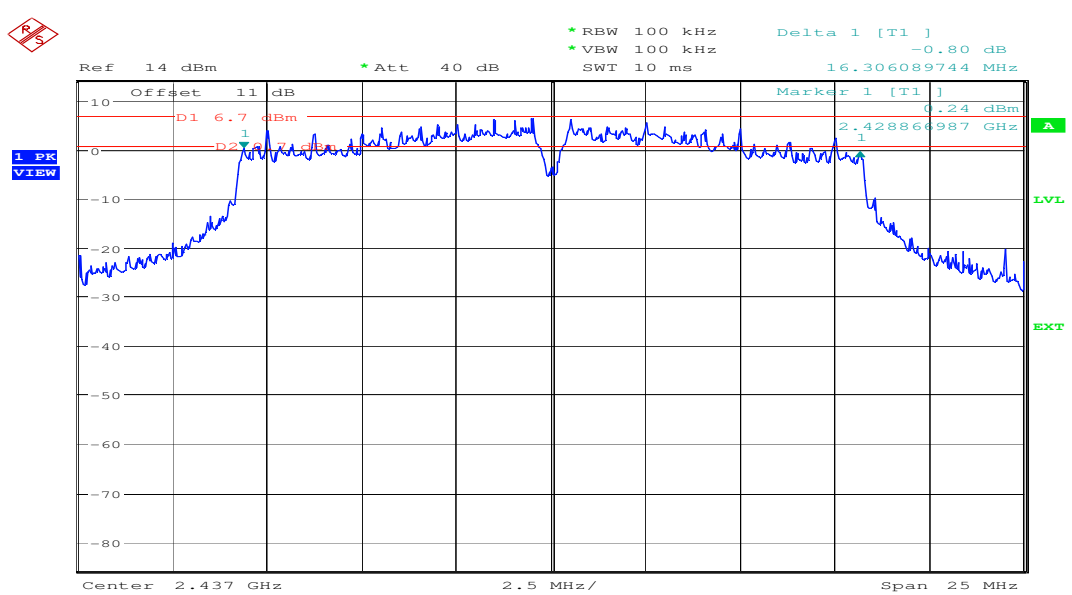
§15.247(a2)

Plot 1: 6 dB-Bandwidth (2412 MHz)



Date: 10.NOV.2007 11:37:57

Plot 2: 6 dB-Bandwidth (2437 MHz)



Date: 10.NOV.2007 11:43:21

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

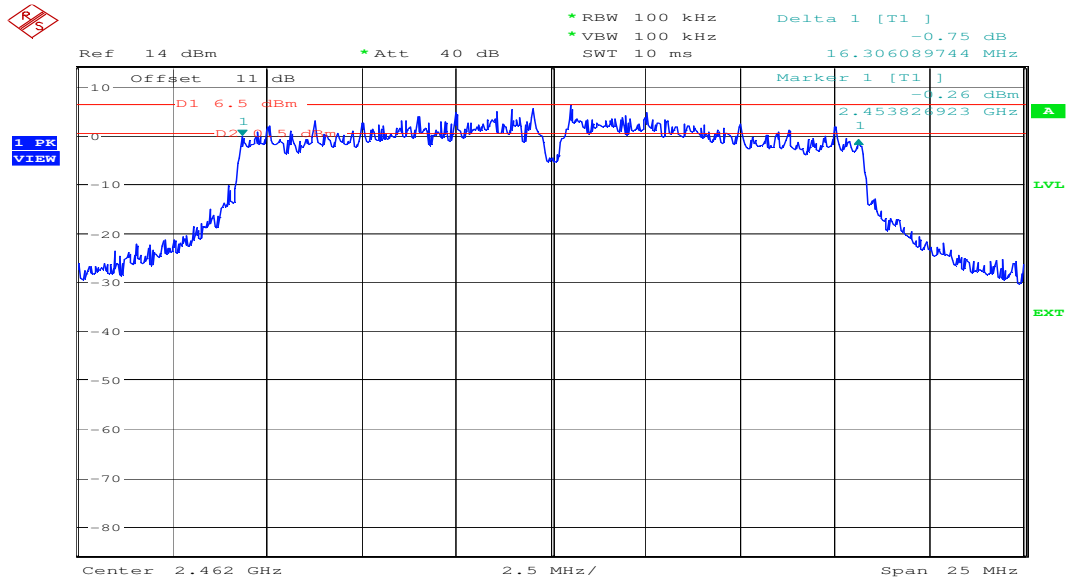


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

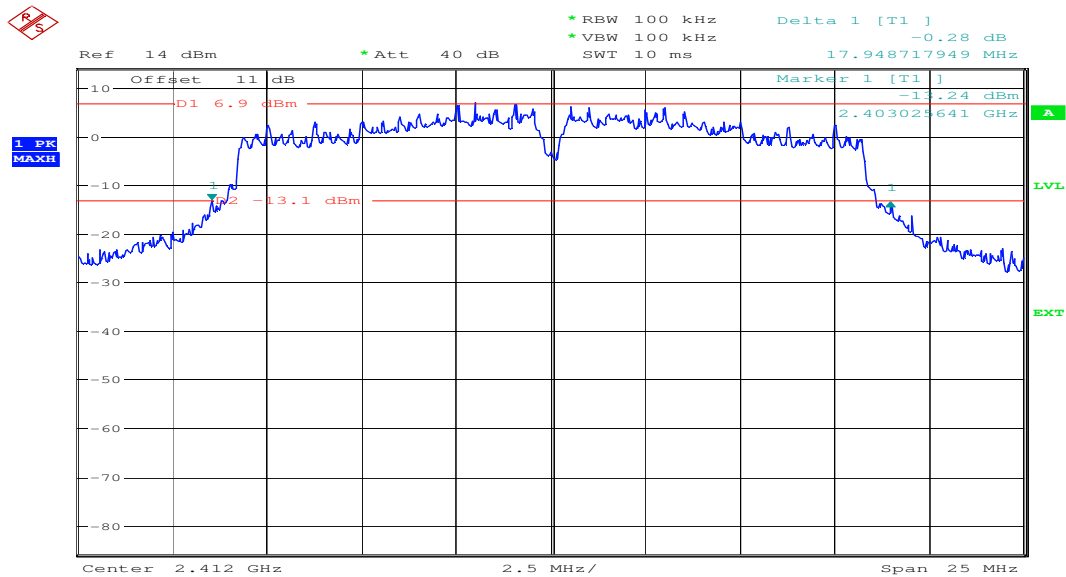
Page 22 of 70

Plot 3: 6 dB-Bandwidth (2462 MHz)



Date: 10.NOV.2007 11:46:56

Plot 4: 20 dB-Bandwidth (2412 MHz)



Date: 10.NOV.2007 11:39:50

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

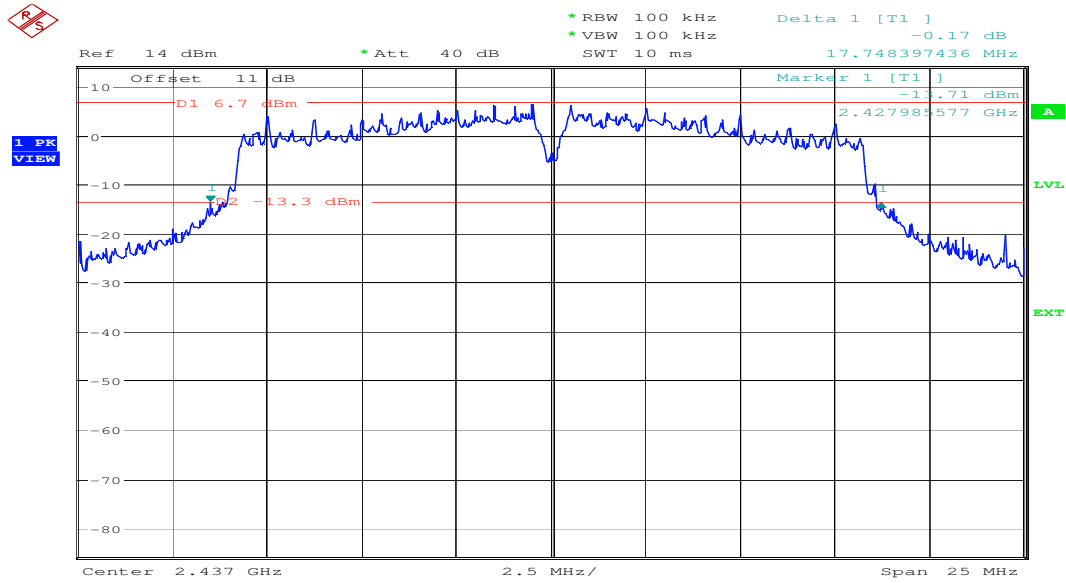


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

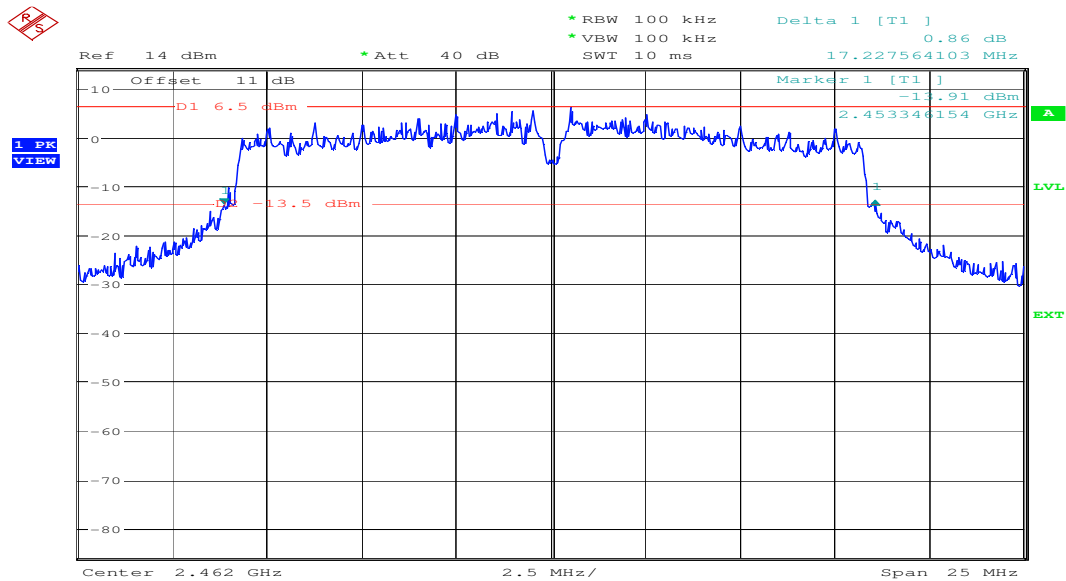
Page 23 of 70

Plot 5: 20 dB-Bandwidth (2437 MHz)



Date: 10.NOV.2007 11:44:16

Plot 6: 20 dB-Bandwidth (2462 MHz)



Date: 10.NOV.2007 11:47:51

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

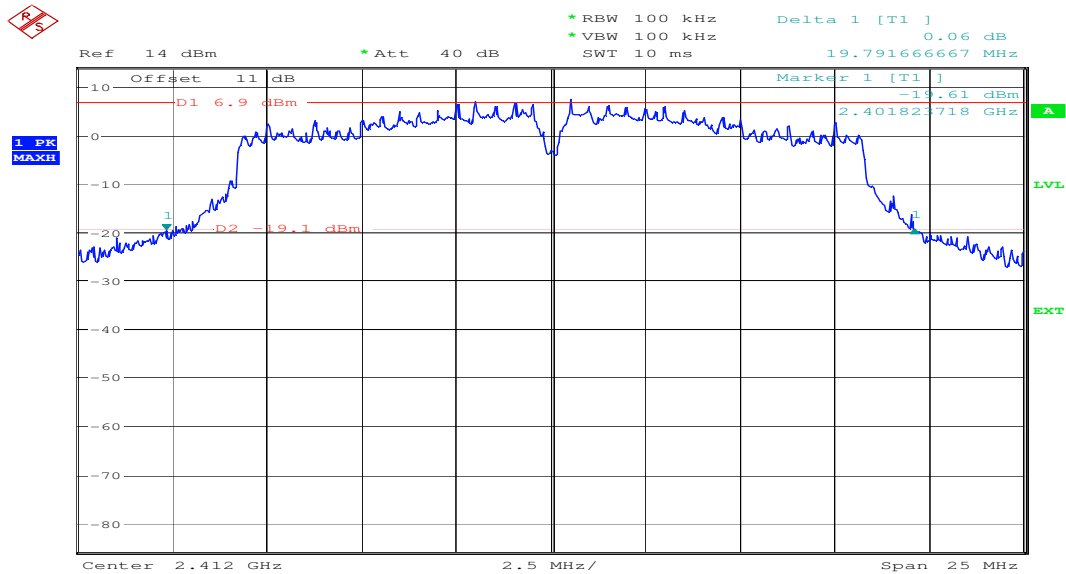


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

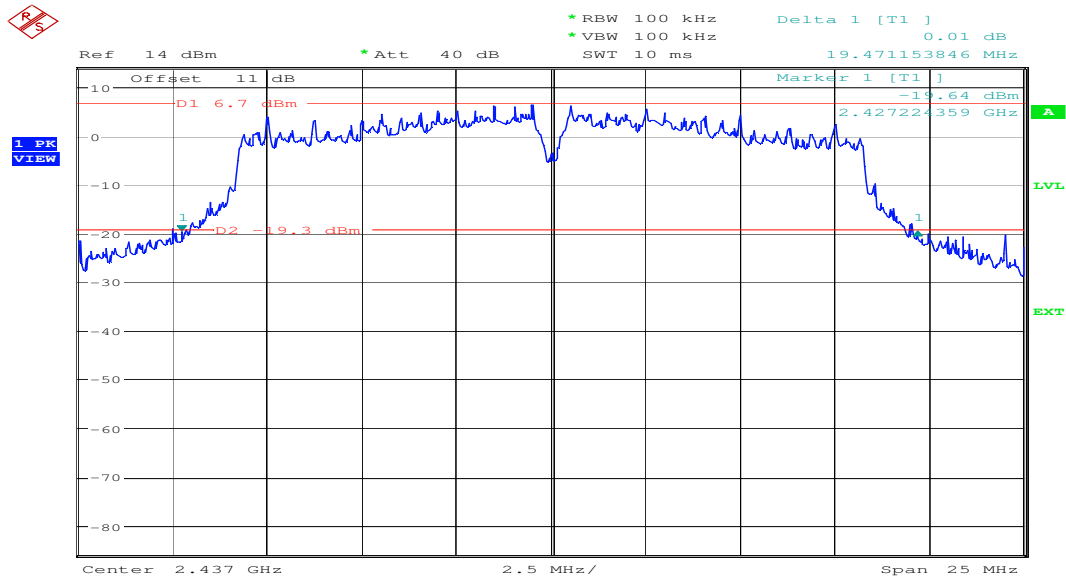
Page 24 of 70

Plot 7: 26 dB-Bandwidth (2412 MHz)



Date: 10.NOV.2007 11:41:30

Plot 8: 26 dB-Bandwidth (2437 MHz)



Date: 10.NOV.2007 11:45:09

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

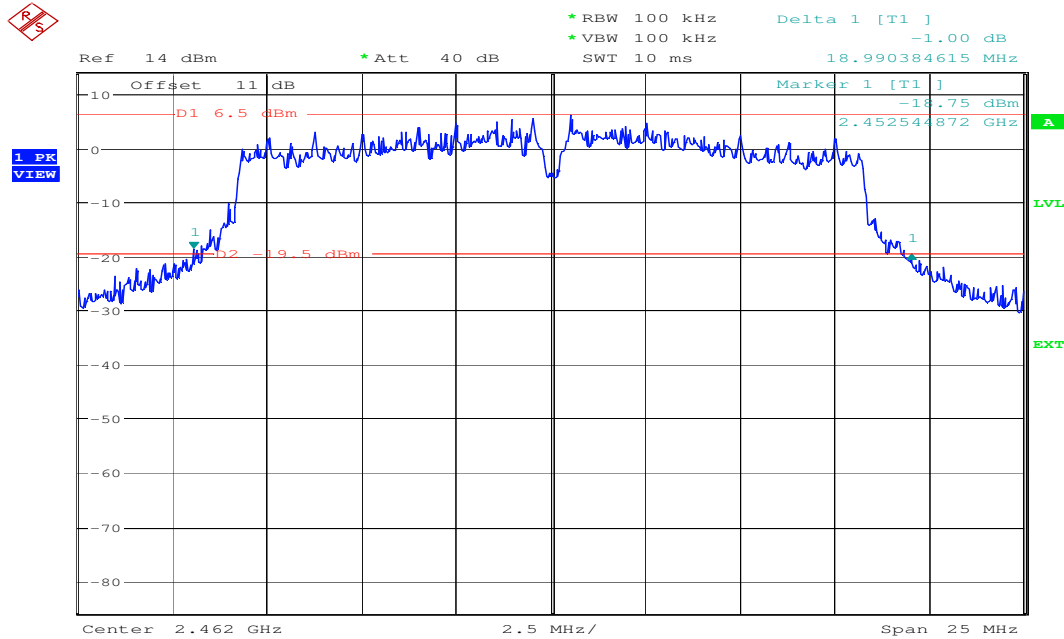


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 25 of 70

Plot 9: 26 dB-Bandwidth (2462 MHz)



Date: 10.NOV.2007 11:48:34

Results:

Test conditions	6 dB BANDWIDTH [MHz]		
	2412	2437	2462
Frequency [MHz]			
6 dB - Bandwidth	16.31	16.31	16.31
20 dB - Bandwidth	17.95	17.75	17.23
26 dB - Bandwidth	19.79	19.47	18.99
Measurement uncertainty	±1kHz		

RBW: 100 kHz / VBW 100 kHz

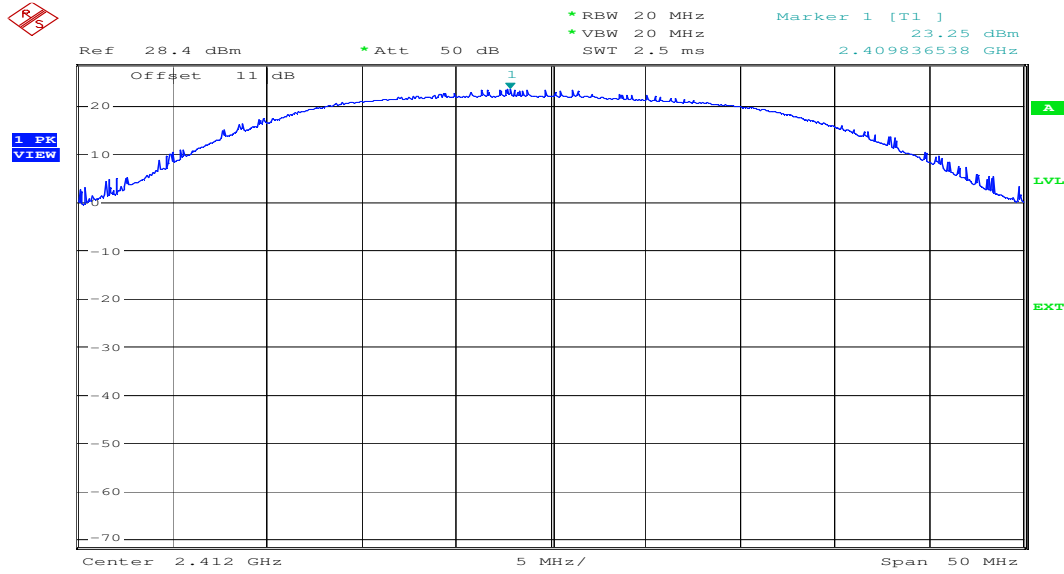
Limits :

Under normal test conditions only	> 500 KHz
-----------------------------------	-----------

3.9 Maximum output power (conducted) (DSSS)

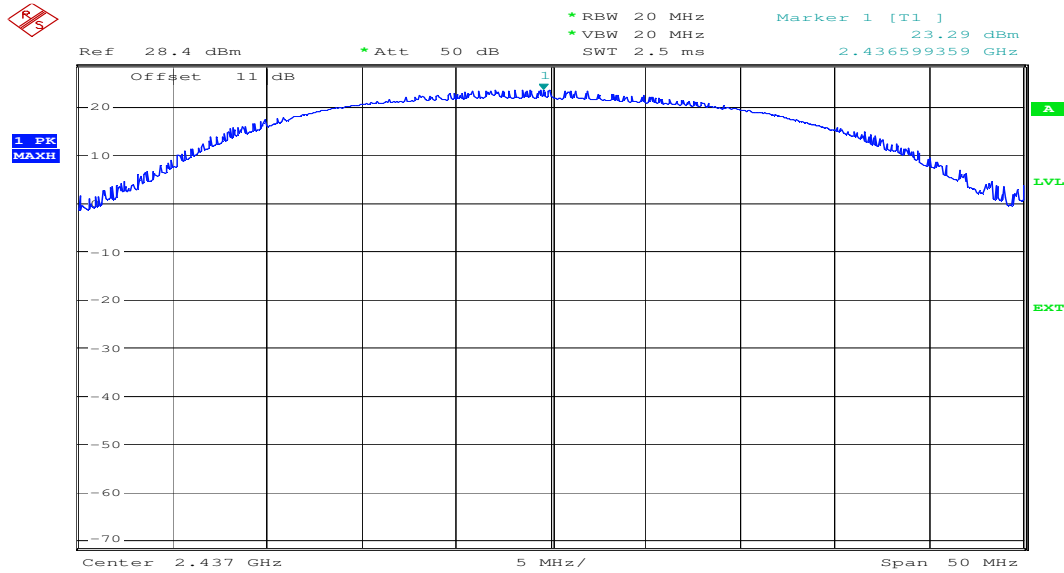
§15.247 (b) (3)

Plot 1:



Date: 10.NOV.2007 12:07:09

Plot 2:



Date: 10.NOV.2007 12:08:26

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

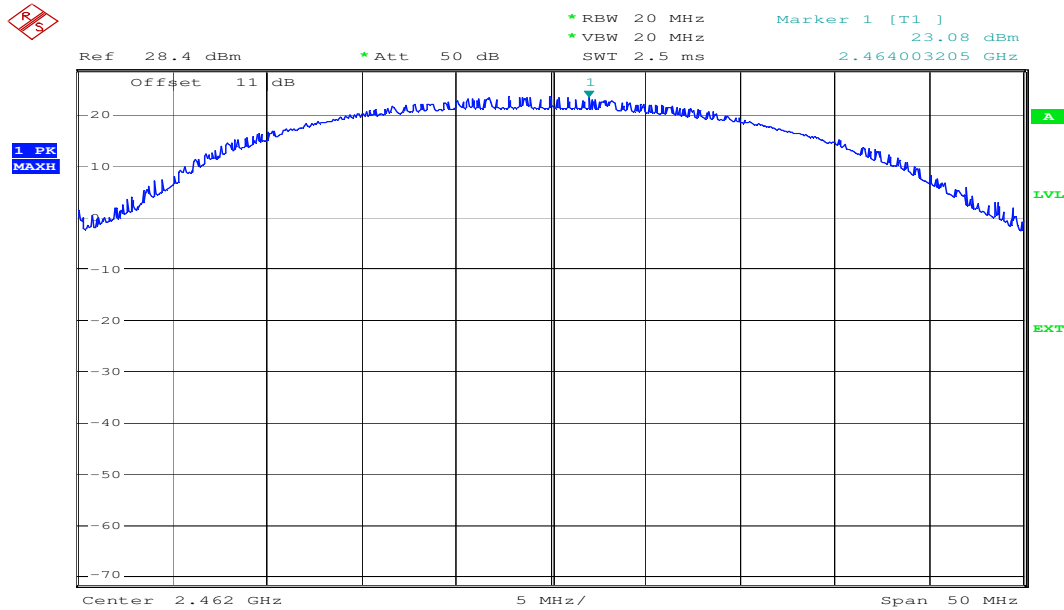


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 27 of 70

Plot 3:



Date: 10.NOV.2007 12:09:26

Results:

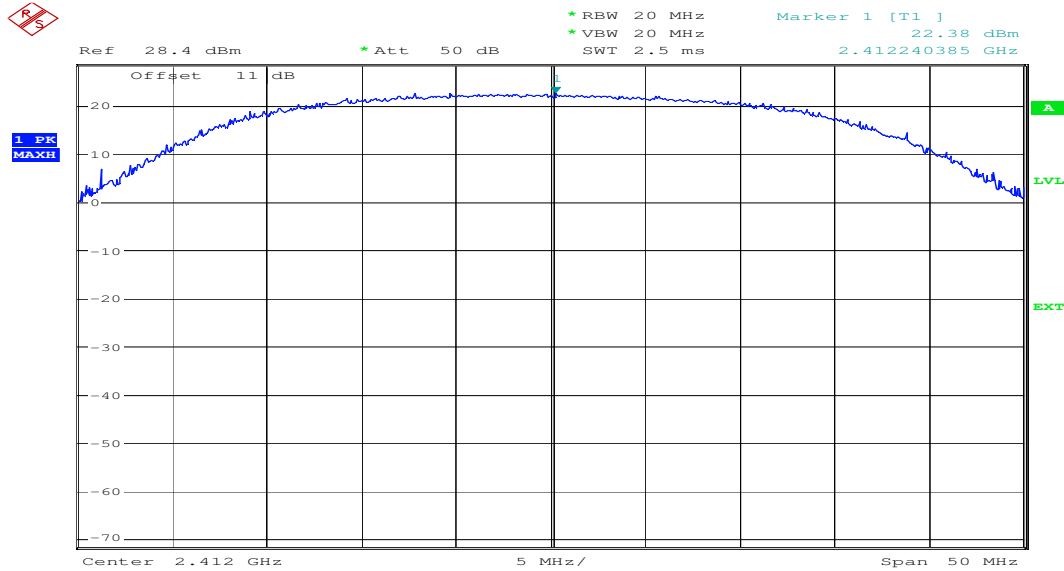
Test conditions		Max. peak output power [dBm]			
		Frequency [MHz]			
		2412	2437	2462	
T _{nom}	V _{nom}	PK	23.25	23.29	23.08
Measurement uncertainty		±3dB			

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt / 30 dBm
--	------------------------

3.10 Maximum output power (conducted) (OFDM)

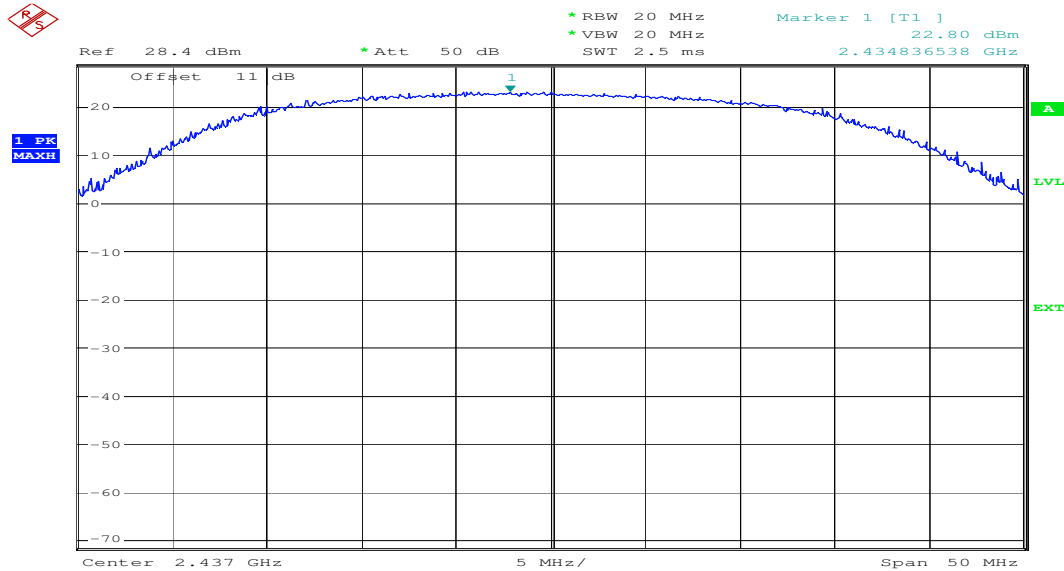
§15.247 (b) (3)

Plot 1:



Date: 10.NOV.2007 12:11:31

Plot 2:



Date: 10.NOV.2007 12:12:31

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

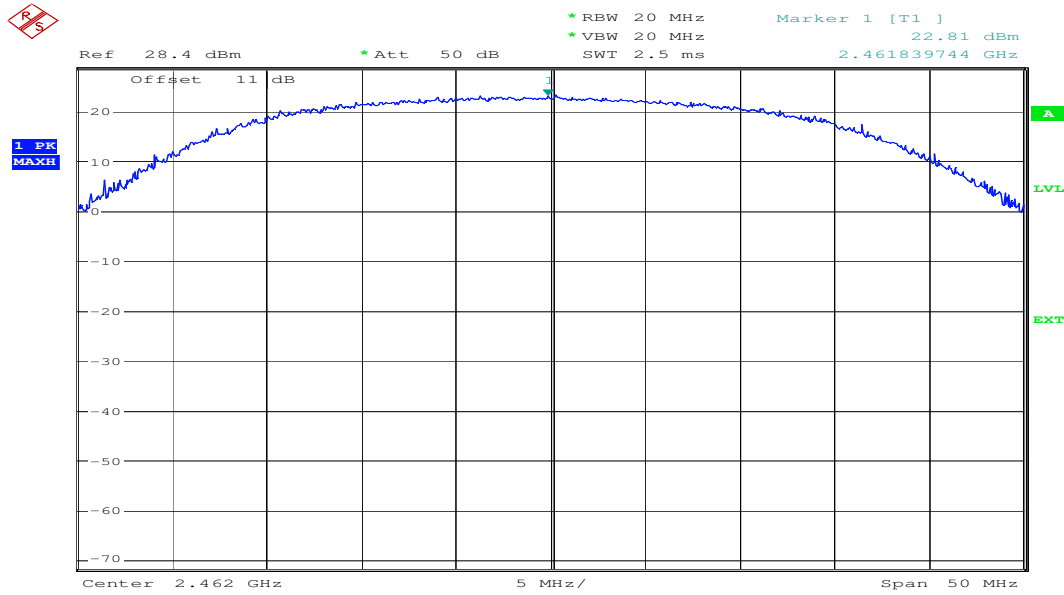


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 29 of 70

Plot 3:



Date: 10.NOV.2007 12:10:40

Results:

Test conditions		Max. peak output power [dBm]			
Frequency [MHz]		2412	2437	2462	
T _{nom}	V _{nom}	PK	22.38	22.80	22.81
Measurement uncertainty		±3dB			

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt / 30 dBm
--	------------------------

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: 25.98 dBm = 396 mW

calculated at distance of 20 cm:

power density = $396 / 4\pi 20^2 = 0.079 \text{ mW/cm}^2$

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)

§15.247 (b) (3)

Results:

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2412	2437	2462
T _{nom} DSSS	V _{nom}	23.25 cond	23.29 cond	23.08 cond
		25.64 rad	24.53 rad	24.14 rad
T _{nom} OFDM	V _{nom}	22.38 cond	22.80 cond	22.81 cond
		25.26 rad	25.98 rad	24.86 rad
Measurement uncertainty		±3dB		

RBW / VBW : 20 MHz

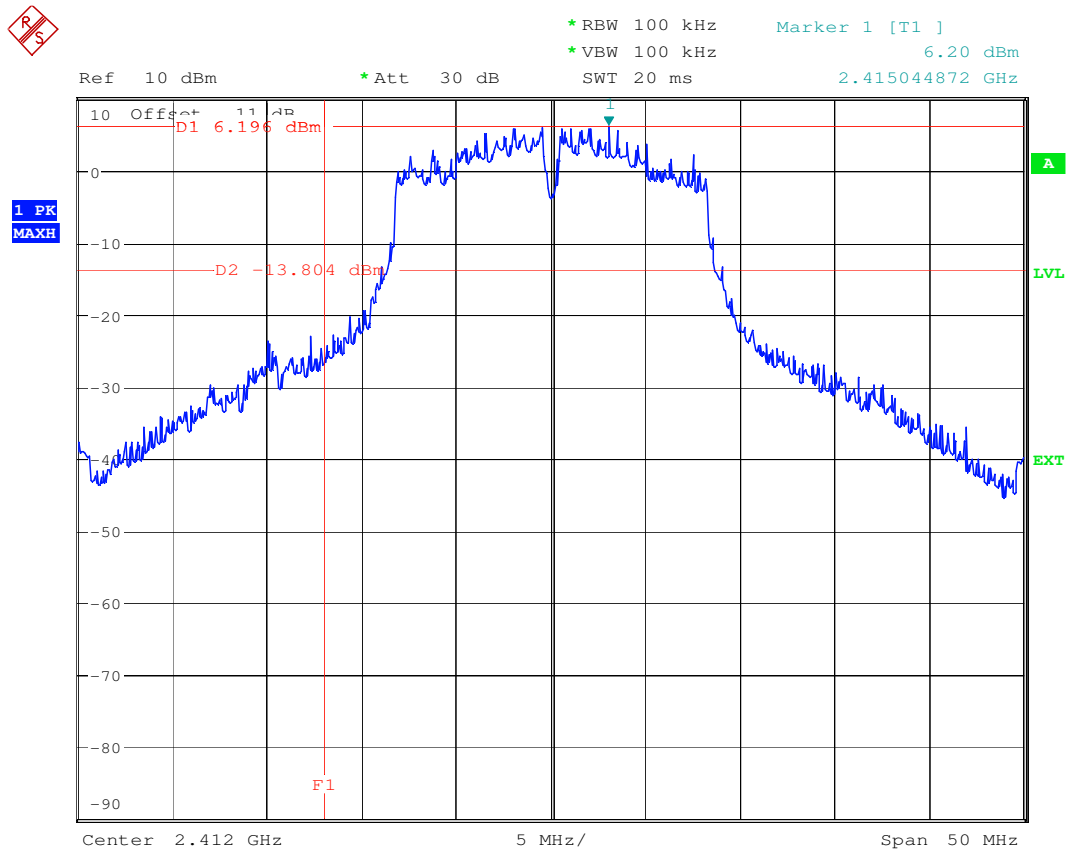
Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt / 30 dBm
--	------------------------

3.12 Band-edge compliance of conducted emissions

§15.247 (d)

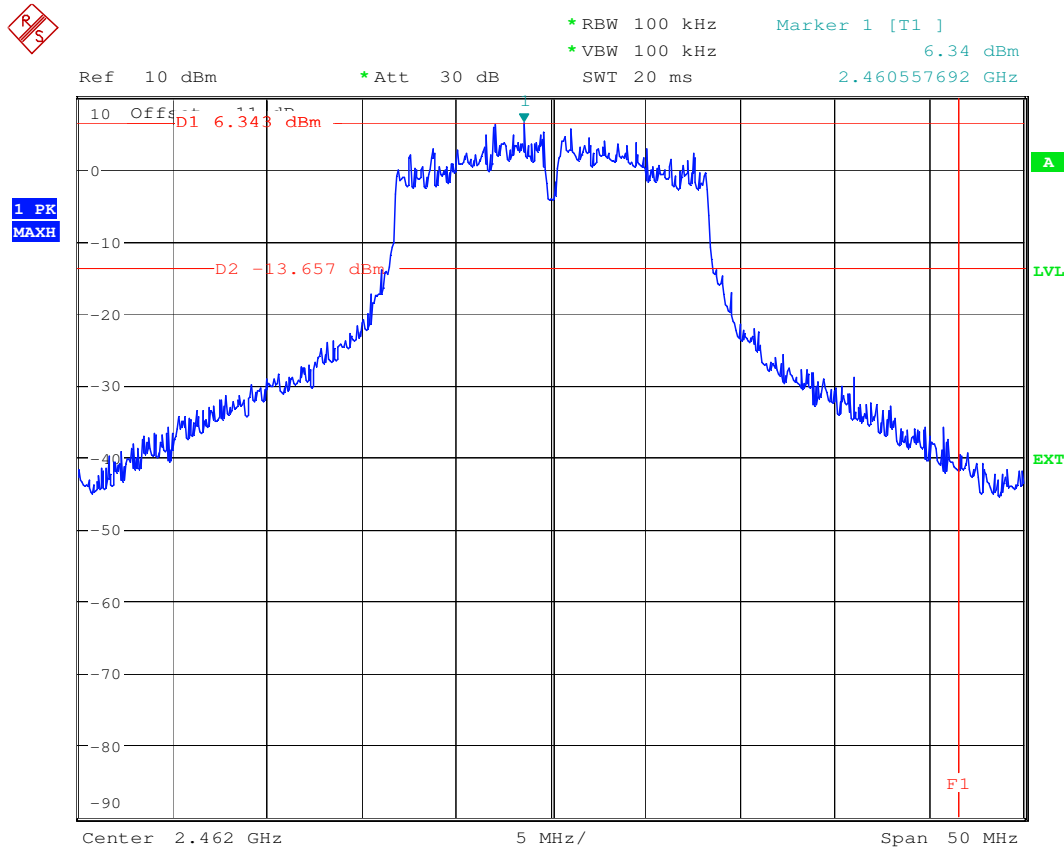
Plot 1, lowest channel



Date: 10.NOV.2007 12:35:27

We used OFDM modulation as this is the worst case regarding used BW.

Plot 2, highest channel



Date: 10.NOV.2007 12:34:32

We used OFDM modulation as this is the worst case regarding used BW.

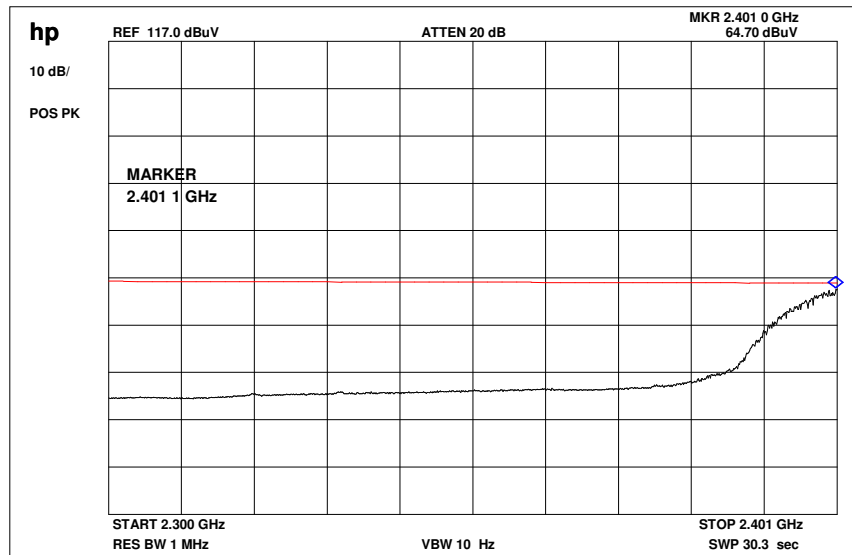
Limits:

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).
-----------------------------------	--

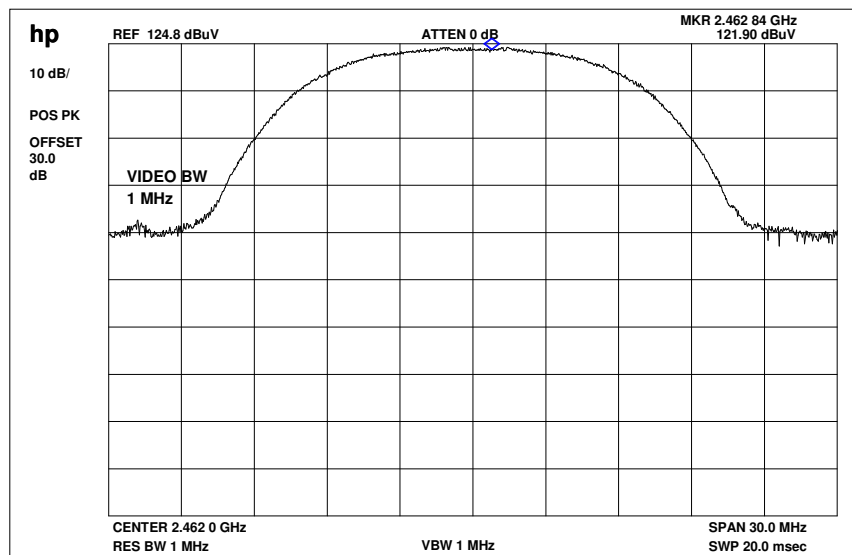
3.13 Band-edge compliance of radiated emissions (DSSS)

§15.205

Plot 1: Low channel 2412 MHz,



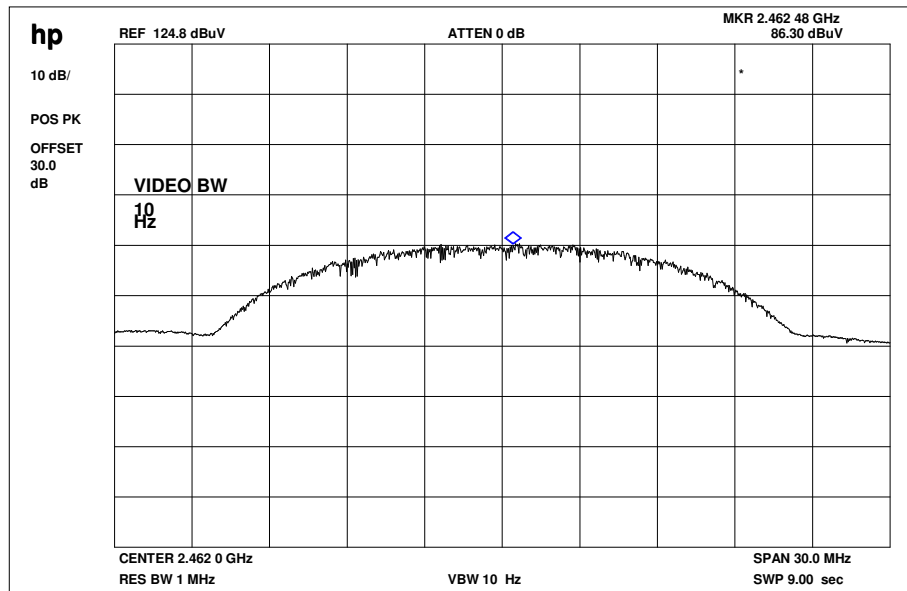
Plot 2 : Max field strength in 3m distance (single frequency) peak



Result:

Frequency	Cable loss	Antenna factor	Results
2462 MHz	22.8 dB	-6.8	121.9 dB μ V/m at 3m

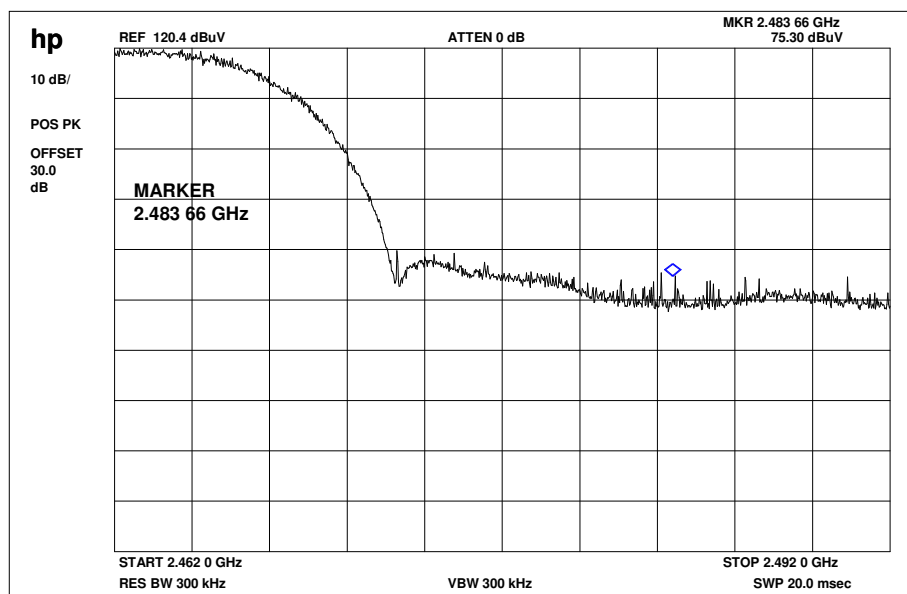
Plot 3 : Max field strength in 3m distance (single frequency) average



Result:

Frequency	Meter reading	Cable loss	Antenna factor	Results
2462 MHz		22.8 dB	-6.8	86.3 dB μ V/m at 3m

Plot 4: Marker-Delta Method RBW/VBW = 1% of span

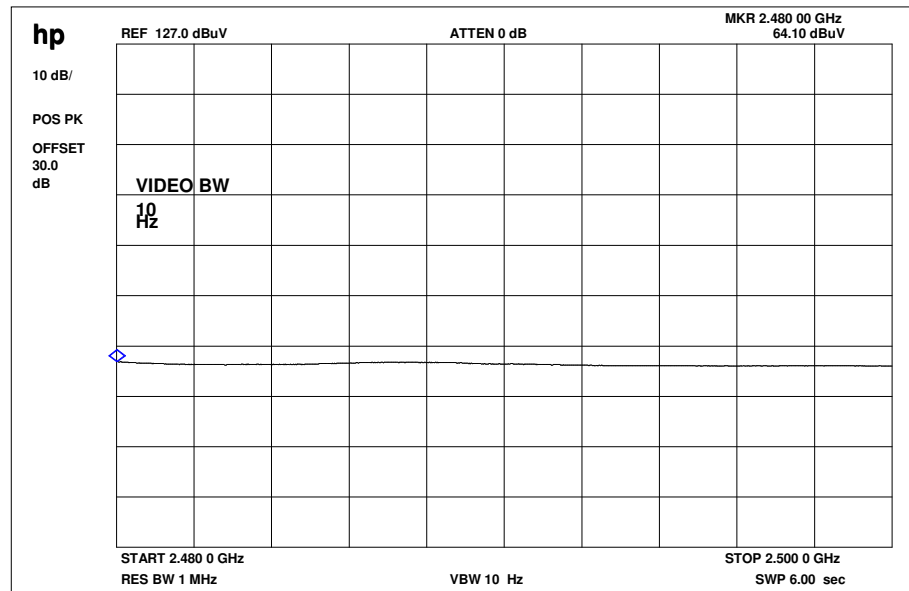


Result:

Marker-Delta-Value : 45.1 dB

This measurement was made to show that the behavior of the system is conform to FCC 15.205 (restricted bands)

Here the complete restricted band 2483,5 to 2500 MHz



Results & Limits:

Radiated field strength

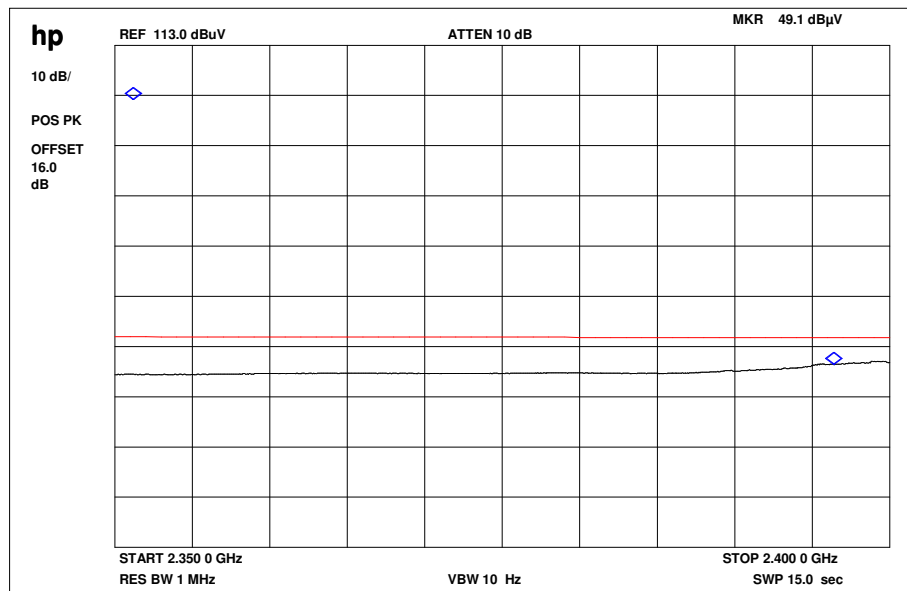
The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	105.6 dB μ V/m	+16 dB	121.9 dB μ V/m
Max. average value	1 MHz RBW 10 Hz VBW	70.3 dB μ V/m	+16 dB	86.3 dB μ V/m
Delta value	Peak 300 kHz RBW/VBW	45.1 dB μ V/m		
Value at band edge	limit 54 dB μ V/m			41.2 dB μ V/m
Statement:				Complies

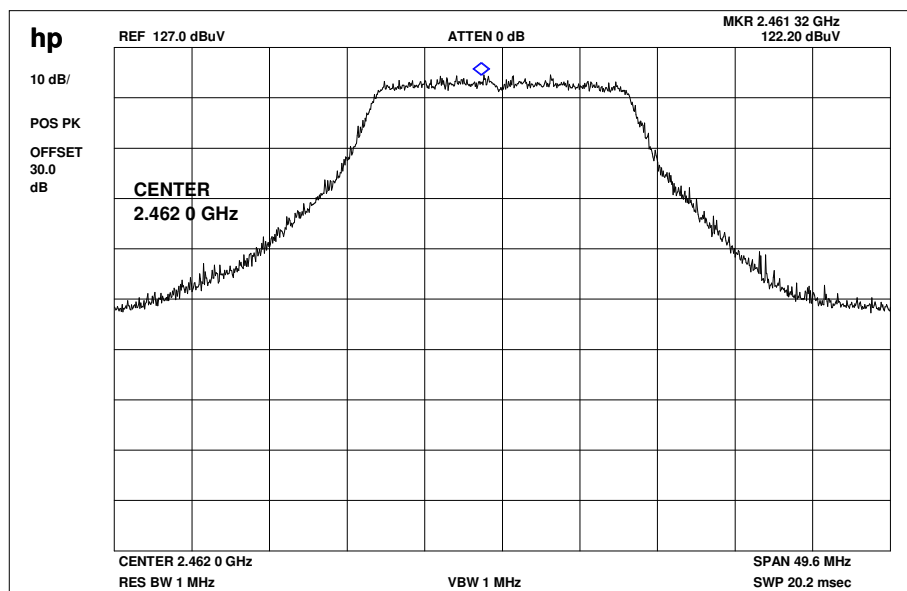
3.14 Band-edge compliance of radiated emissions (OFDM)

§15.205

Plot 1: Low channel 2412 MHz



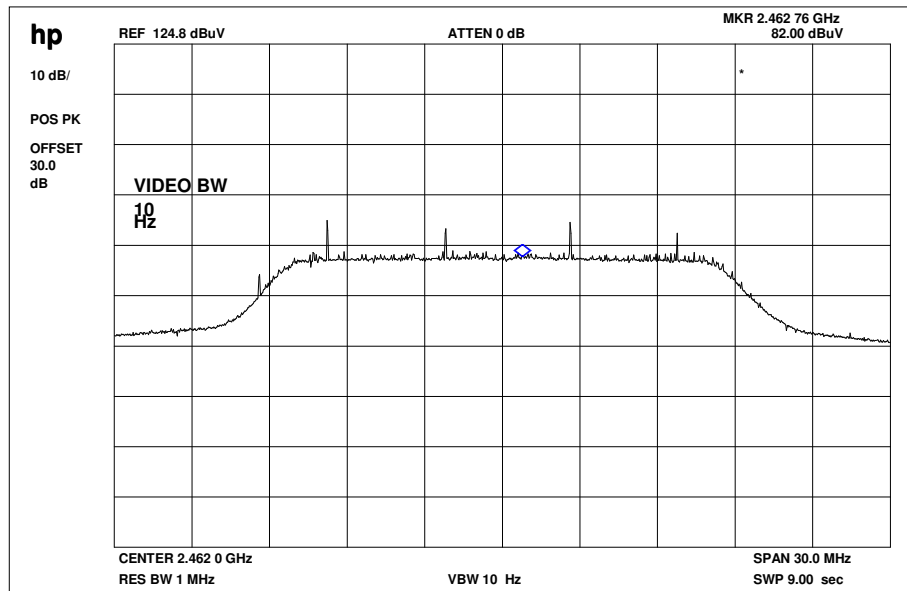
Plot 2 : Max field strength in 3m distance (single frequency) peak



Result:

Frequency	Cable loss	Antenna factor	Results
2462 MHz	22.8 dB	-6.8	122.2 dB μ V/m at 3m

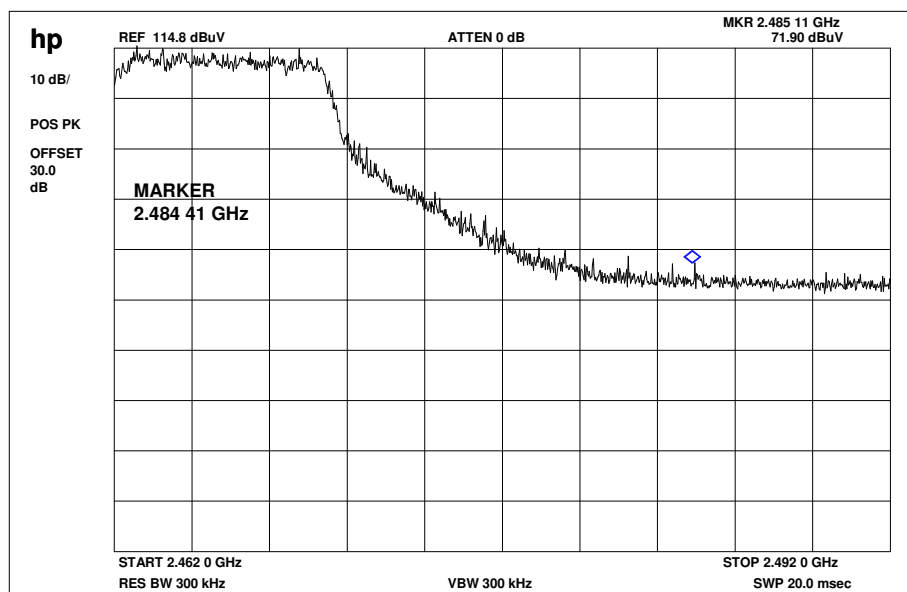
Plot 3 : Max field strength in 3m distance (single frequency) average, measured with antenna 2



Result:

Frequency	Meter reading	Cable loss	Antenna factor	Results
2462 MHz		22.8 dB	-6.8	82.0 dB μ V/m at 3m

Plot 4: Marker-Delta Method RBW/VBW = 1% of span, measured with antenna 2

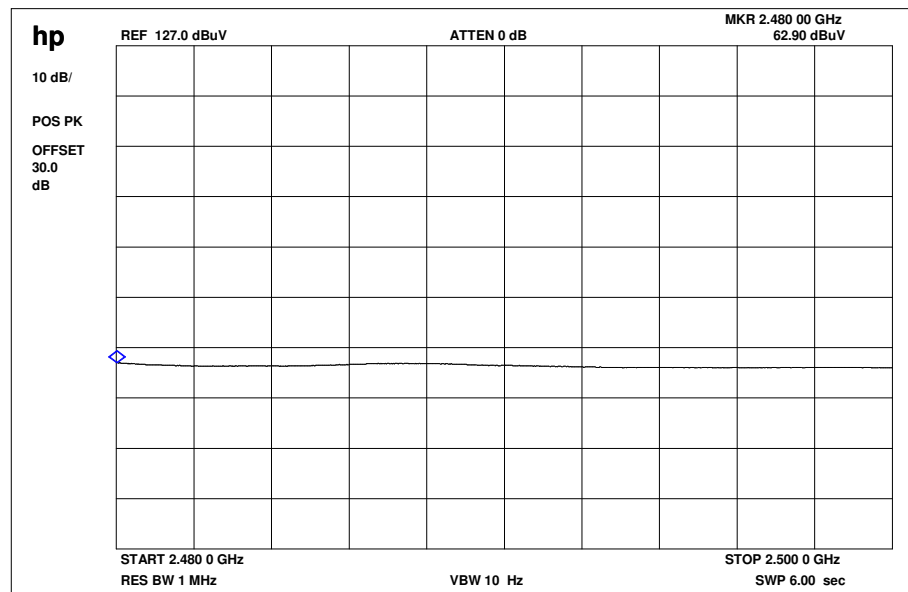


Result:

Marker-Delta-Value : 42.9 dB

This measurement was made to show that the behavior of the system is conform to FCC 15.205 (restricted bands)

Here the complete restricted band 2483.5 to 2500 MHz



Results & Limits:

Radiated field strength

The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

high channel	setup	measured value (3m)	correction factor (3m)	calculated value (3m)
Max. peak value	1 MHz RBW 1 MHz VBW	106.2 dB μ V/m	+16 dB	122.2 dB μ V/m
Max. average value	1 MHz RBW 10 Hz VBW	66.0 dB μ V/m	+16 dB	82.0 dB μ V/m
Delta value	Peak 300 kHz RBW/VBW	42.9 dB		
Value at band edge	limit 54 dB μ V/m			40.1 dB μ V/m
Statement:				Complies

3.15 Spurious Emissions - conducted (Transmitter)

§15.247 (d)

Result & Limits

Emission Limitations (worst case)					
f [MHz]	Modulation (DSSS/OFDM)	amplitude of emission [dBm]	limit max. allowed emmission power	actual attenuation below frequency of operation [dB]	results
2412	DSSS	23.3	30 dBm	-	Operating frequency
80	DSSS	-37.7	-20 dBc	> 20 dB	pass
4824	DSSS	-51.1		> 20 dB	pass
2437	DSSS	23.3	30 dBm		Operating frequency
105	DSSS	-21.1	-20 dBc	> 20 dB	pass
2462	DSSS	23.1	30 dBm		Operating frequency
130	DSSS	-38.5	-20 dBc	> 20 dB	pass
4924	DSSS	-48.3		> 20 dB	pass
7386	DSSS	-57.4		> 20 dB	pass
Measurement uncertainty		± 3dB			

RBW : 100 kHz VBW: 100 kHz

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.

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

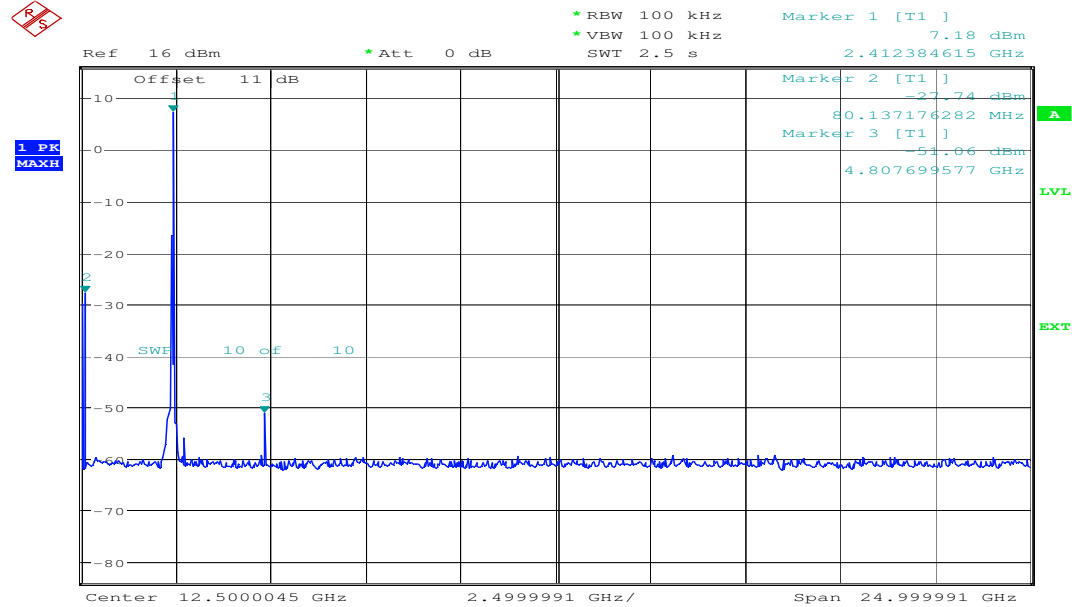


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

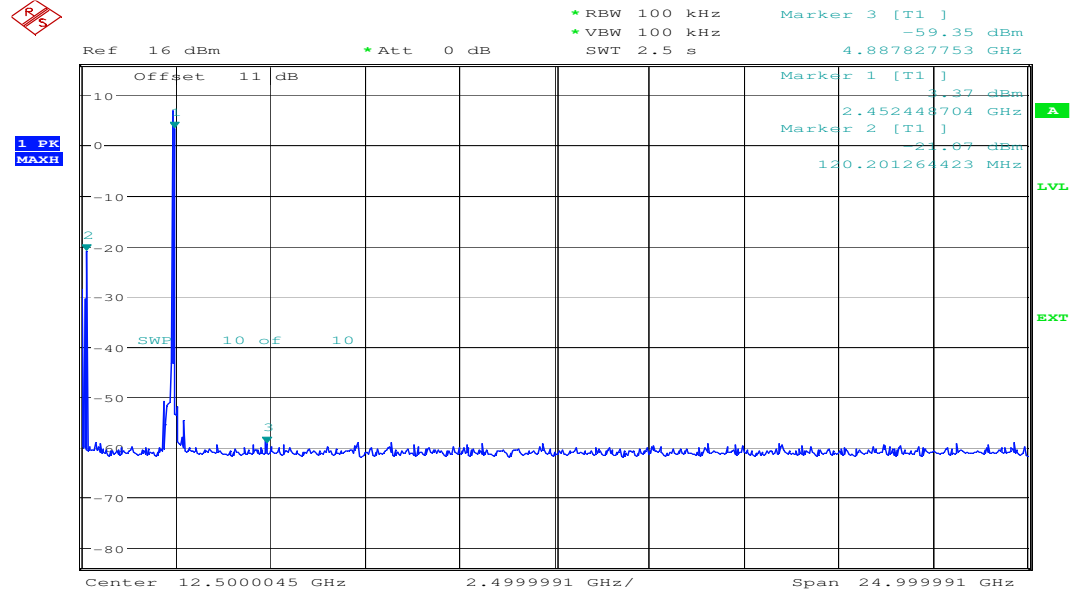
Page 41 of 70

2412 MHz DSSS



Date: 10.NOV.2007 12:46:22

2437 MHz DSSS



Date: 10.NOV.2007 12:48:09

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

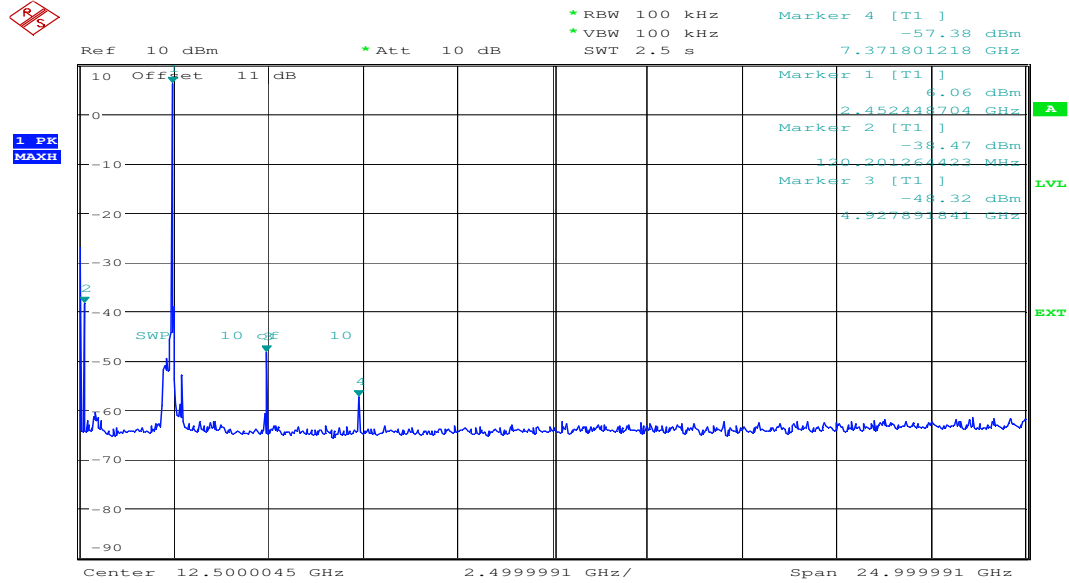


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

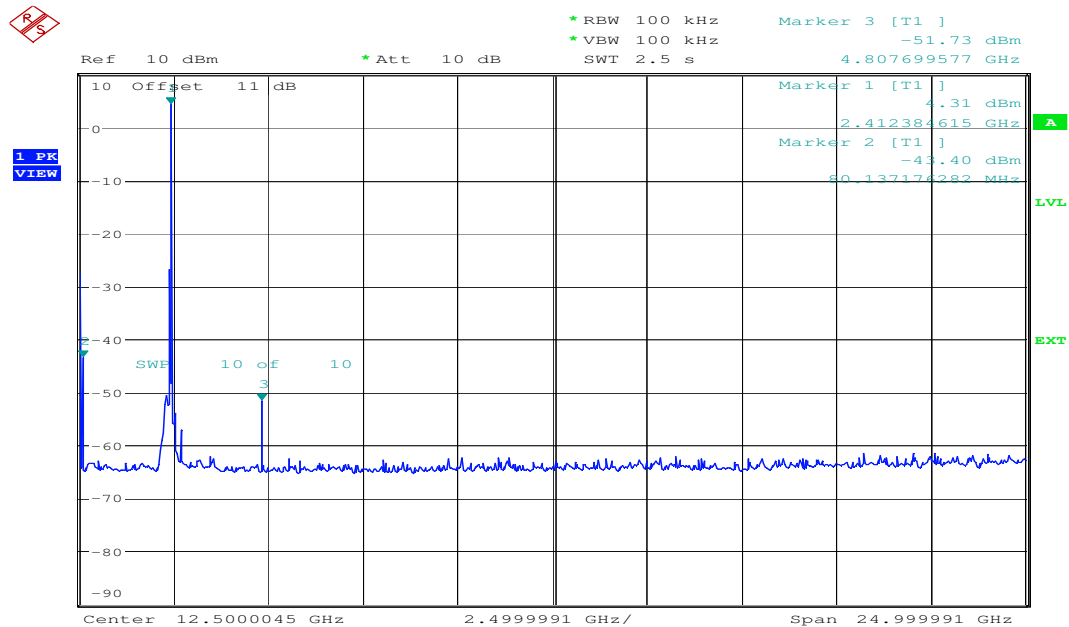
Page 42 of 70

2462 MHz DSSS



Date: 10.NOV.2007 12:44:10

2412 MHz OFDM



Date: 10.NOV.2007 12:39:17

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

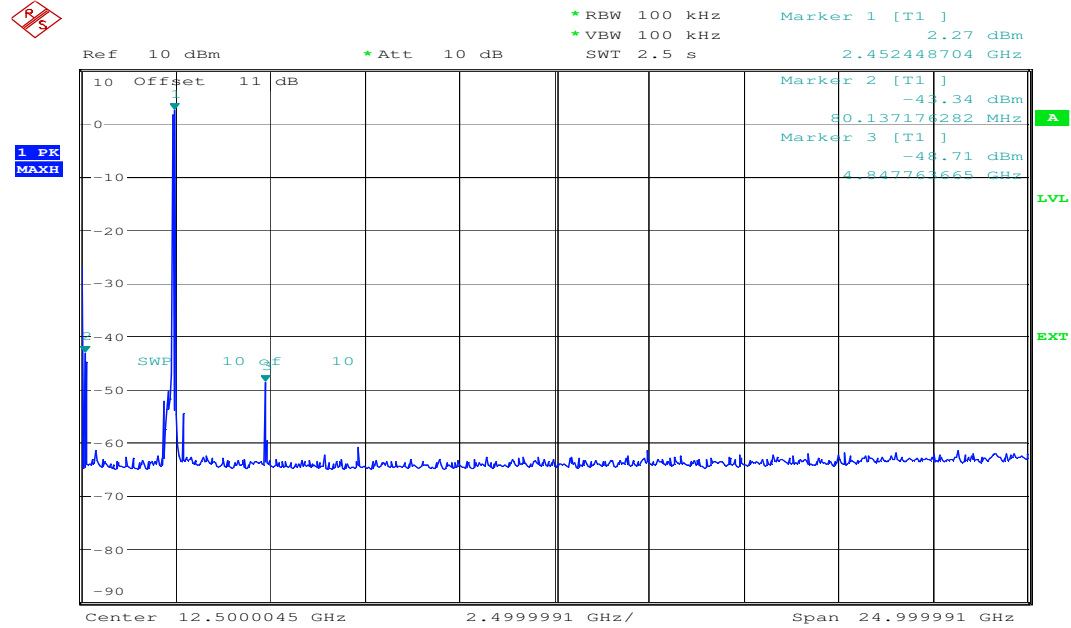


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

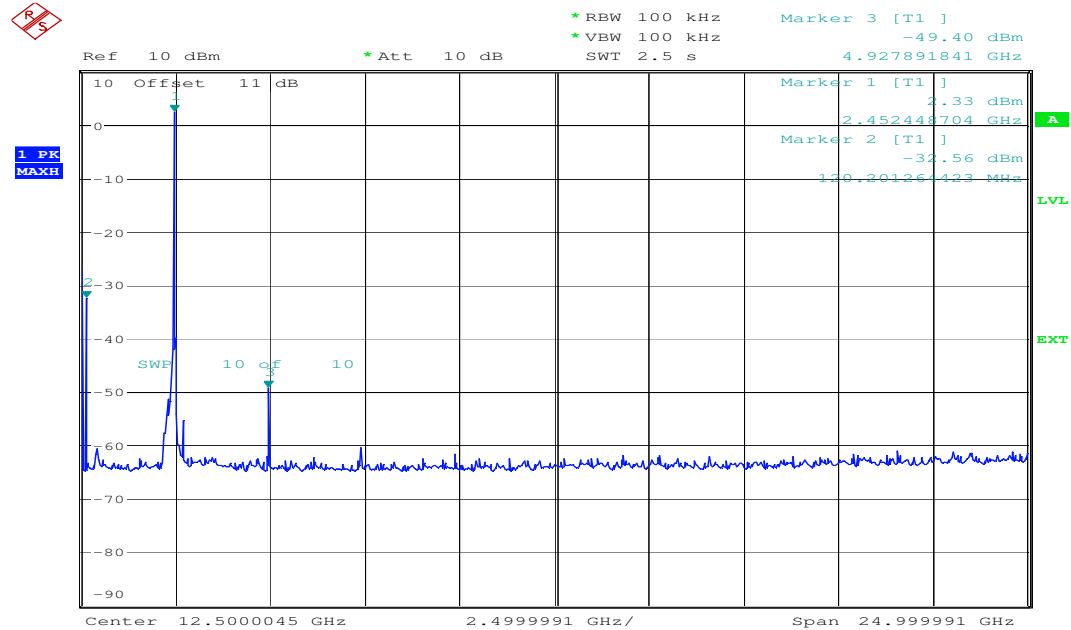
Page 43 of 70

2437 MHz OFDM



Date: 10.NOV.2007 12:40:54

2462 MHz OFDM



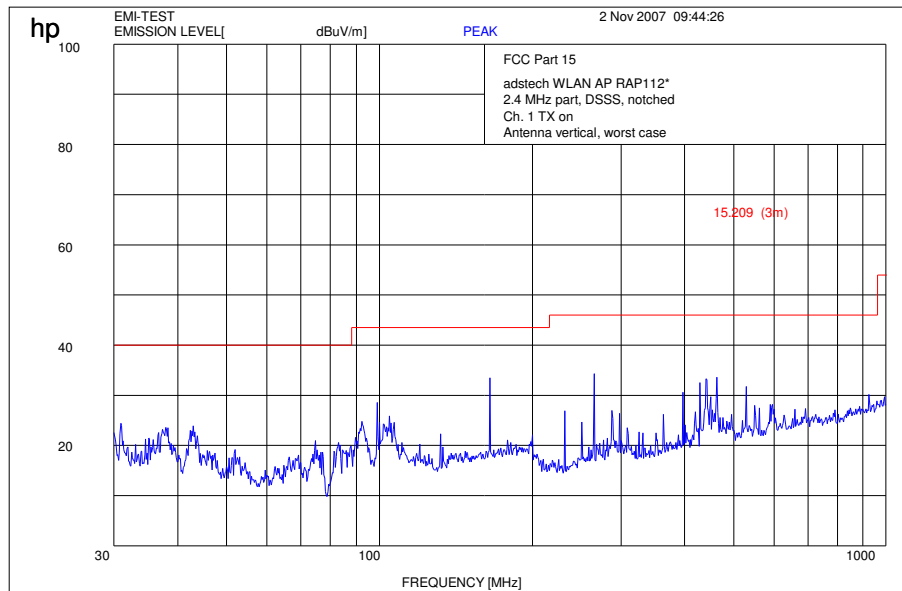
Date: 10.NOV.2007 12:42:49

3.16 Spurious Emissions - radiated (Transmitter)

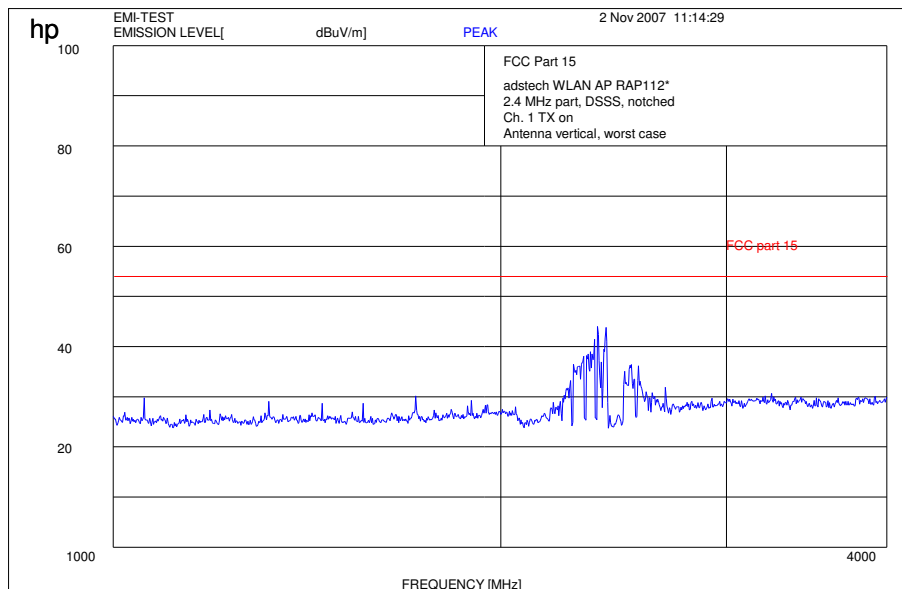
DSSS

§15.209

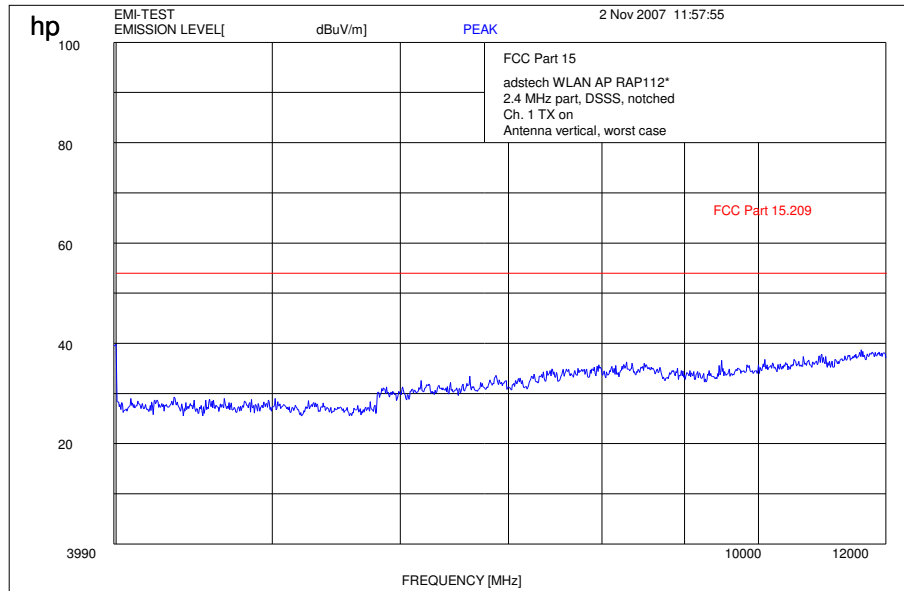
Plot 1: 0.03 - 1 GHz vertical (worst case) (lowest channel)



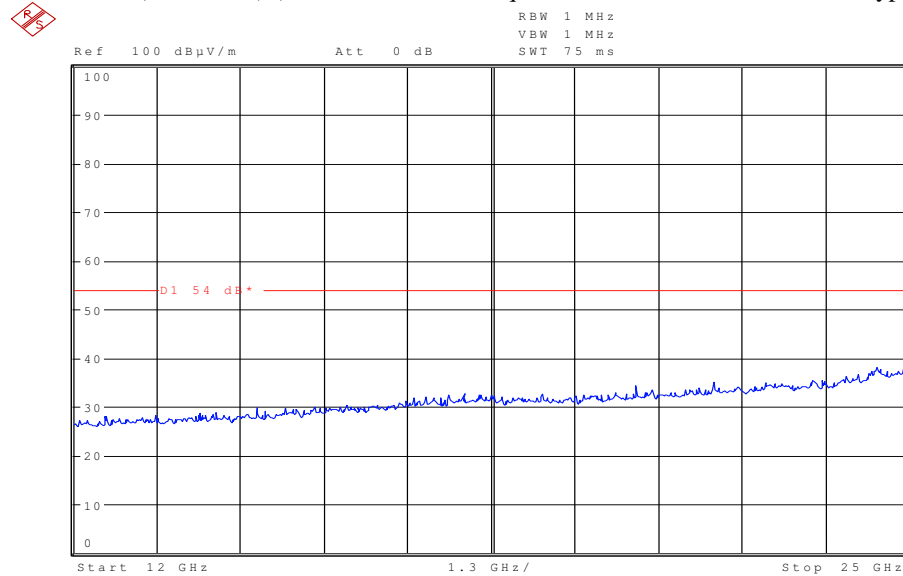
Plot 2: 1- 4 GHz vertical (worst case) (lowest channel)



Plot 3: 4 – 12 GHz vertical (worst case)

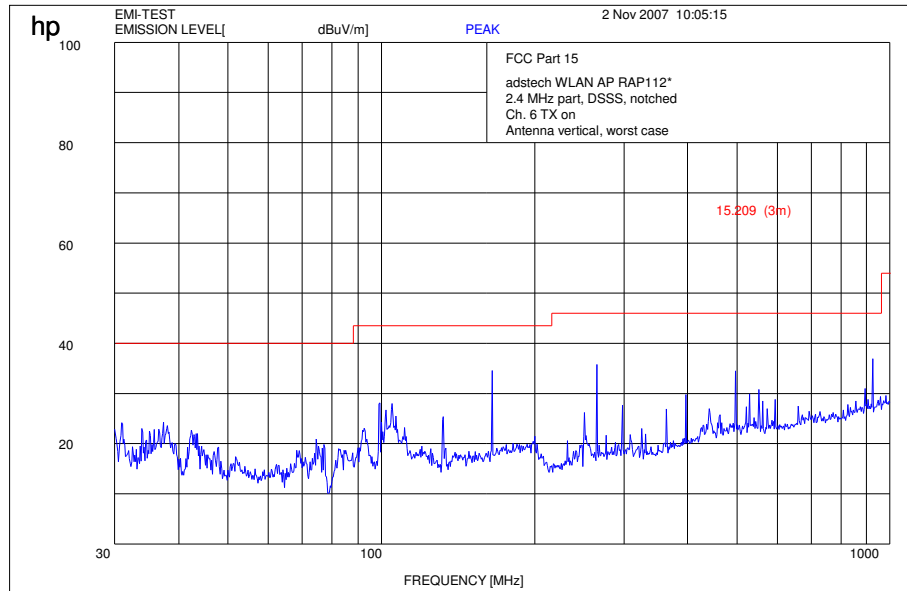


Plot 4: 12 – 25 GHz vertical (worst case) (valid for all three frequencies and for both modulation types)

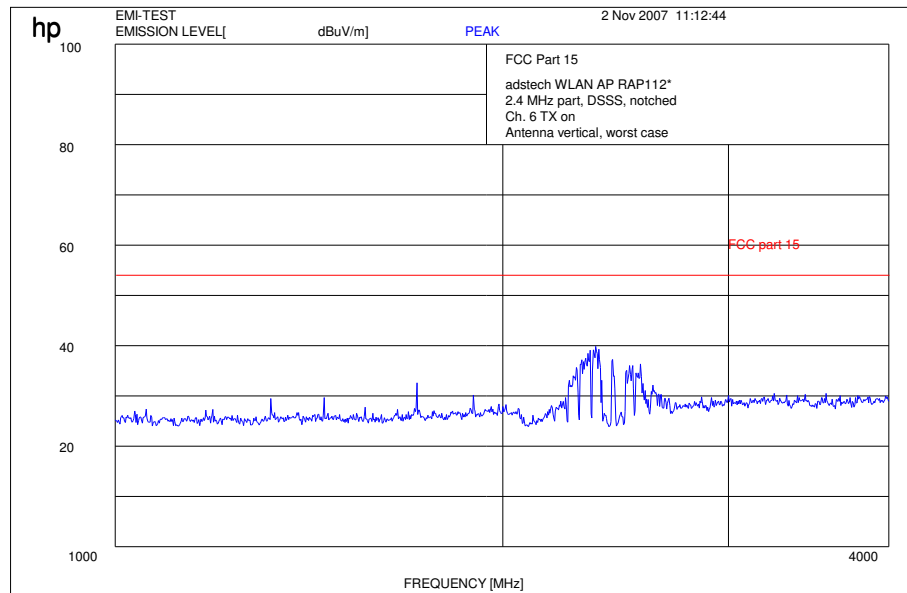


There were no peaks found.

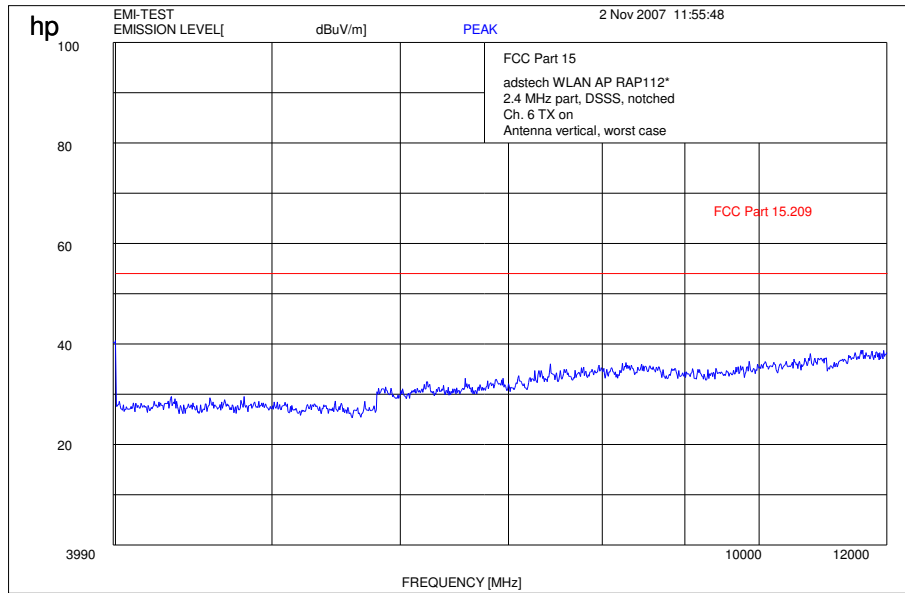
Plot 5: 0.03 - 1 GHz vertical (middle channel)



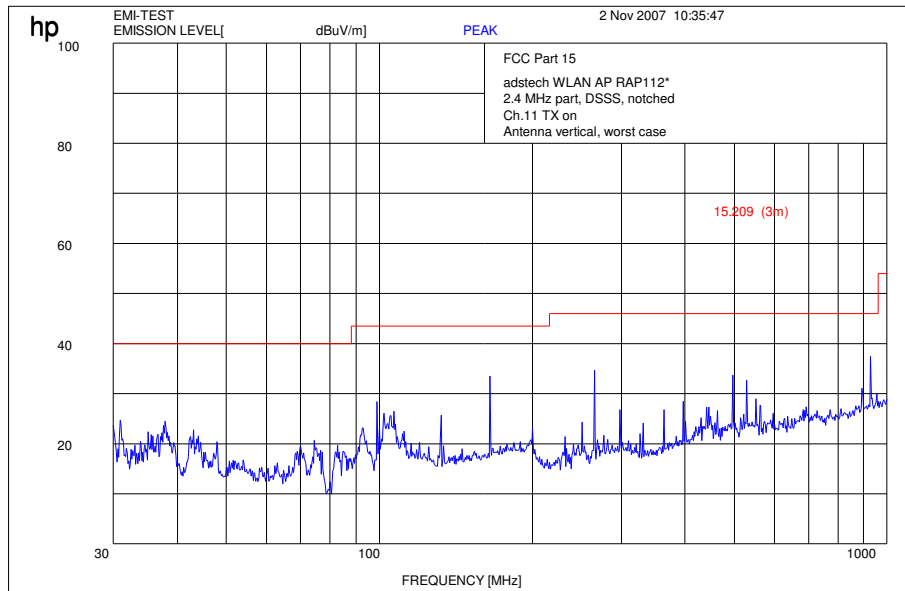
Plot 6: 1 - 4 GHz vertical (middle channel)



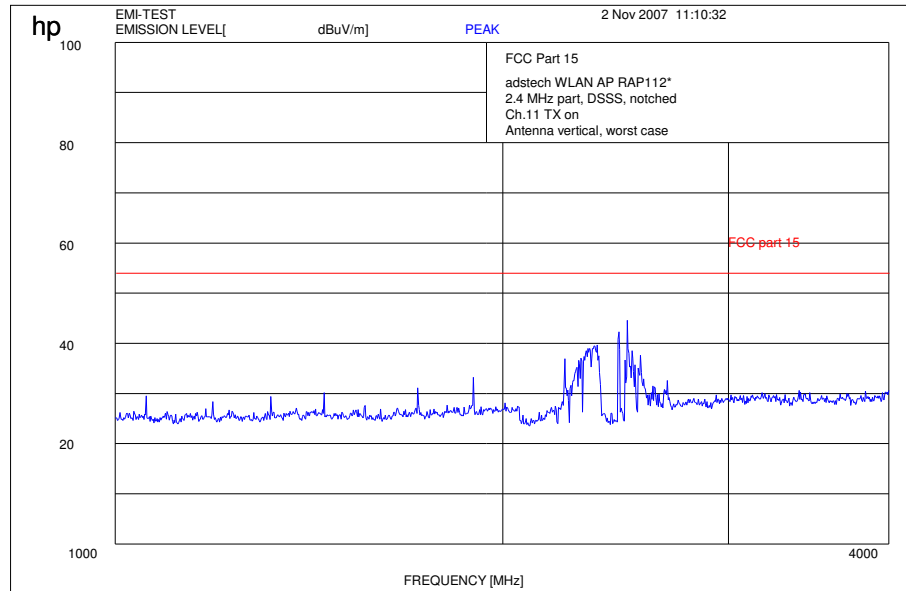
Plot 7: 4- 12 GHz (middle channel)



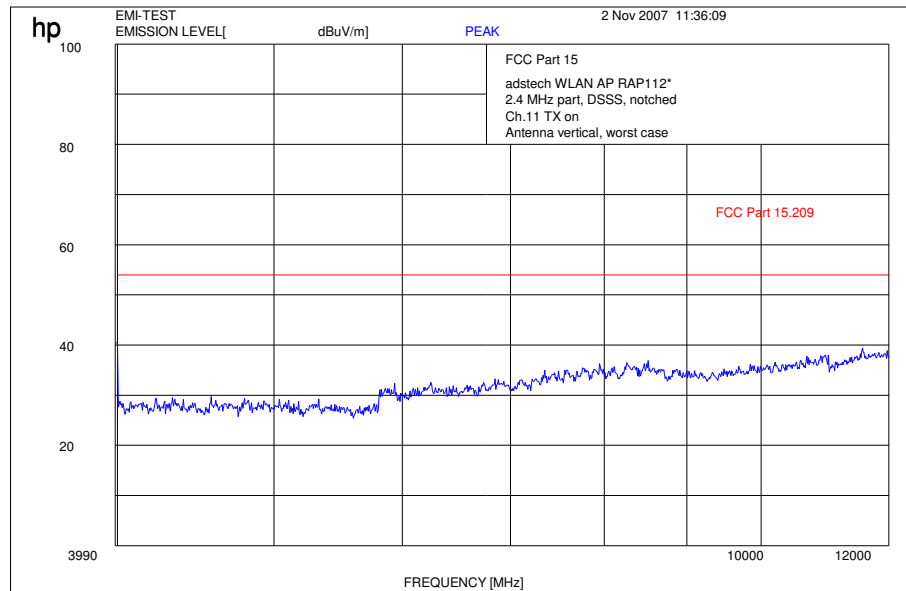
Plot 8: 0.03 - 1 GHz vertical (worst case) (highest channel)



Plot 9: 1- 4 GHz (highest channel) (worst case)



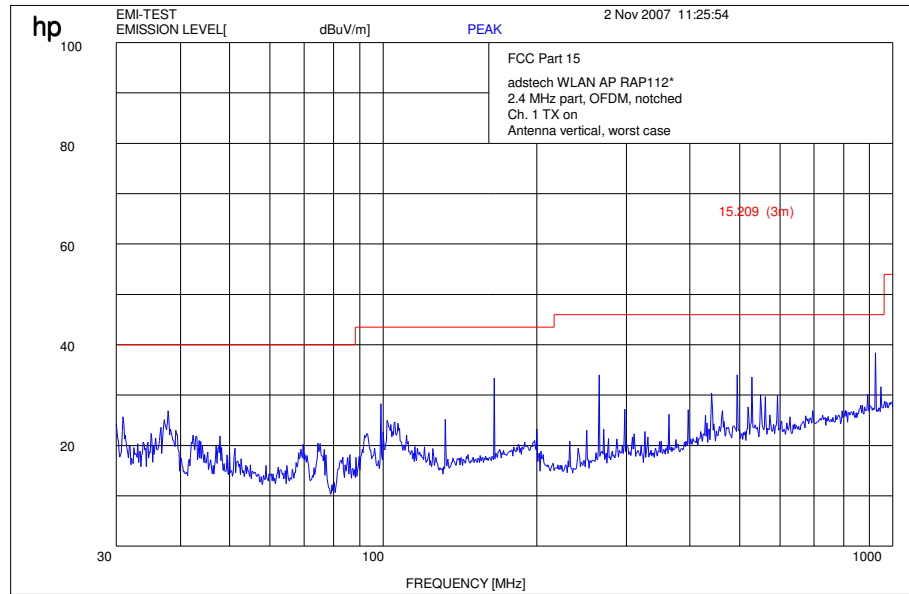
Plot 10: 4- 12 GHz (highest channel) (worst case)



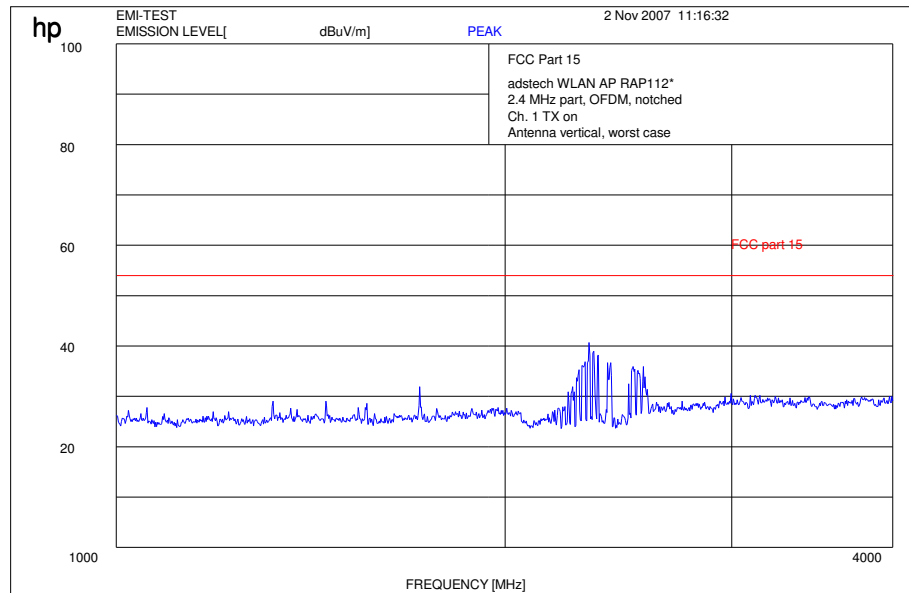
3.17 Spurious Emissions - radiated (Transmitter) OFDM

§15.209

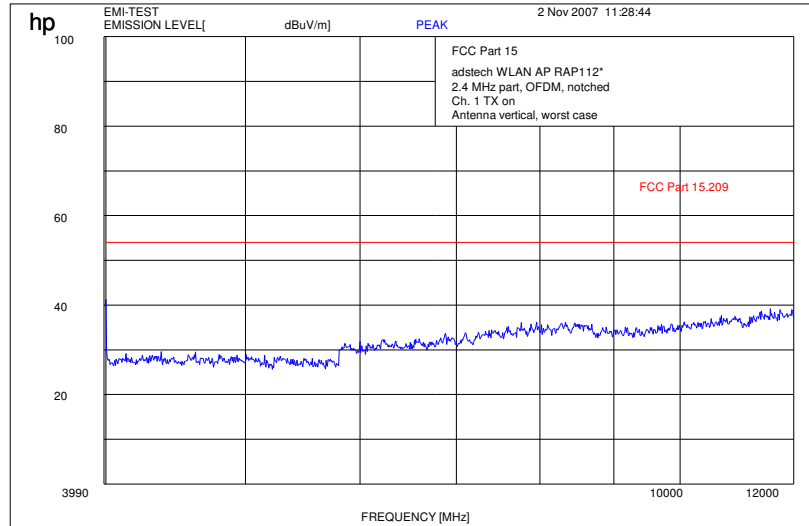
Plot 1: 0.03 - 1 GHz vertical (worst case) (lowest channel)



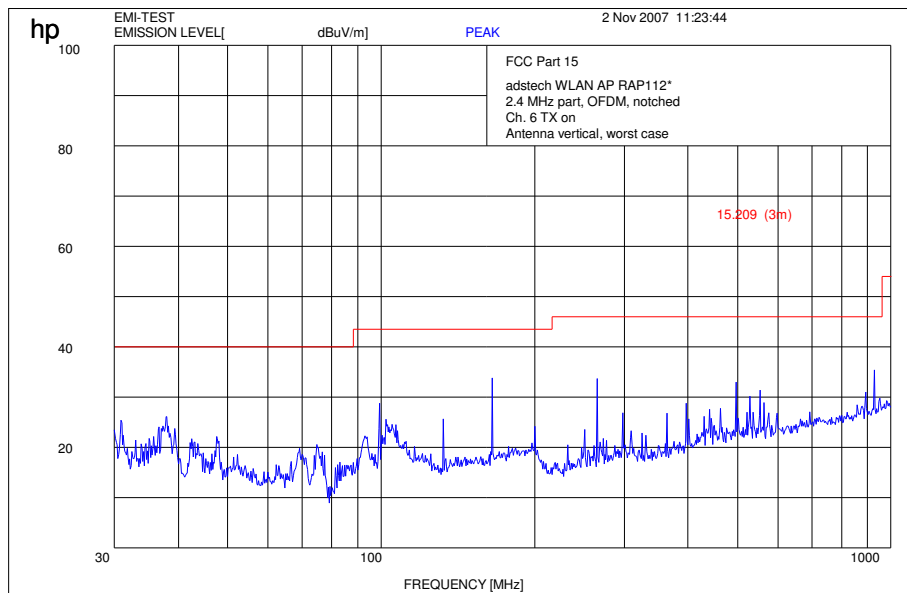
Plot 2: 1 - 4 GHz vertical (worst case) (lowest channel)



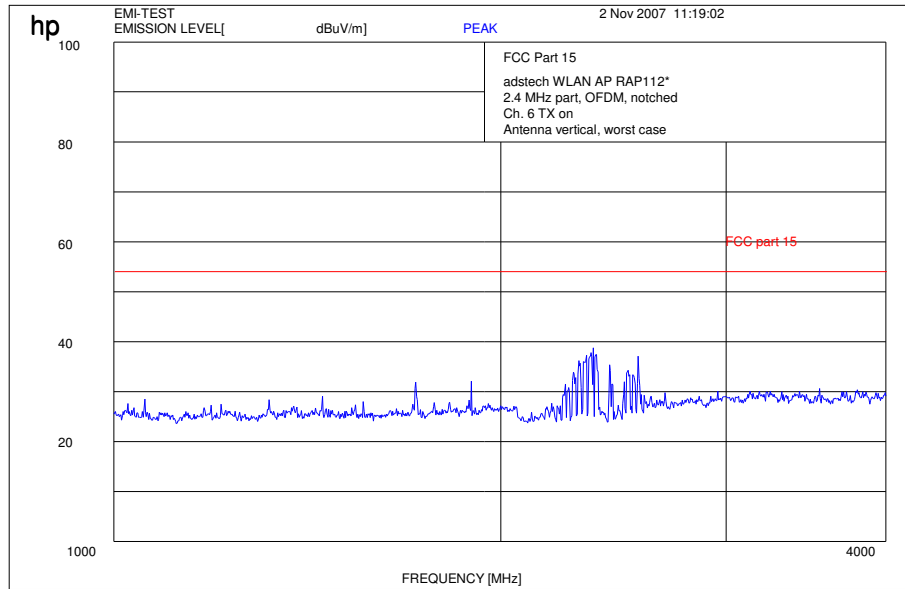
Plot 3: 4- 12 GHz vertical (worst case) (lowest channel)



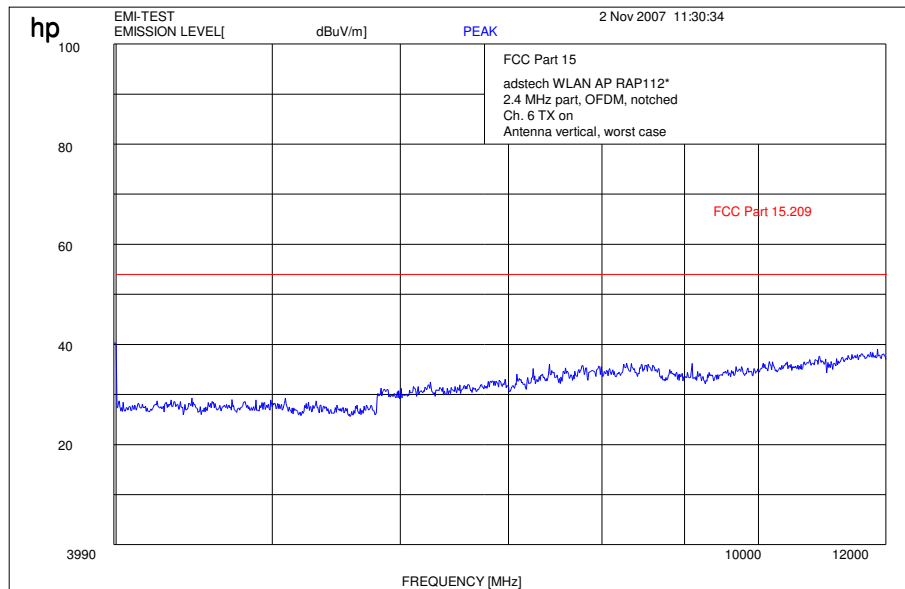
Plot 4: 0.03 - 1 GHz vertical (worst case) (middle channel)



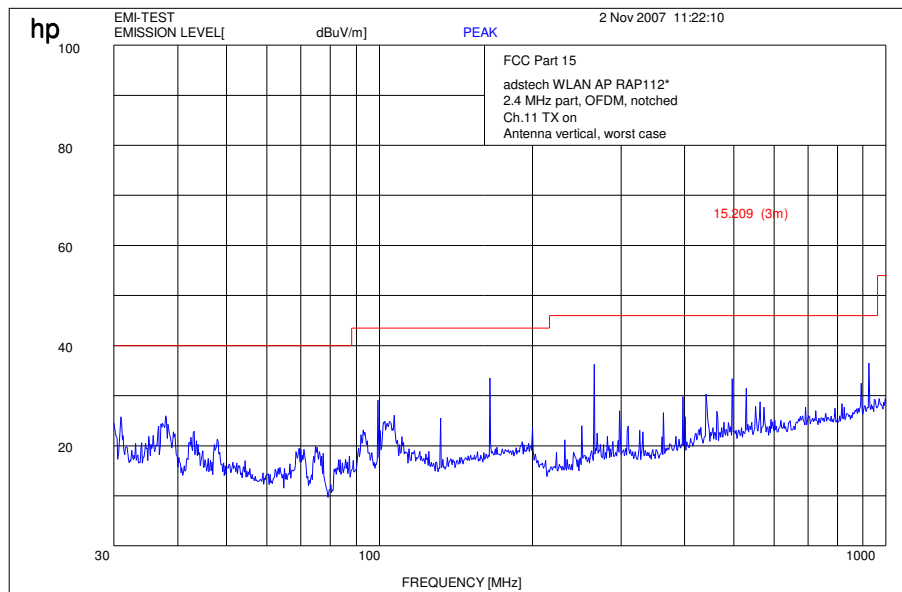
Plot 5: 1- 4 GHz (middle channel) vertical (worst case)



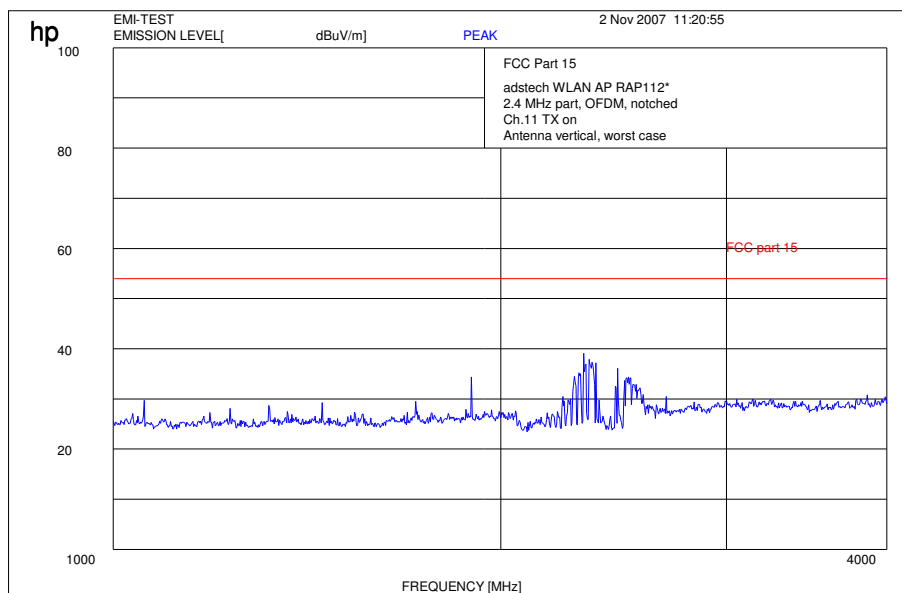
Plot 6: 4- 12 GHz (middle channel) vertical (worst case)



Plot 7: 0.03 - 1 GHz vertical (worst case) (highest channel)



Plot 8: 1- 4 GHz (highest channel) vertical (worst case)



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

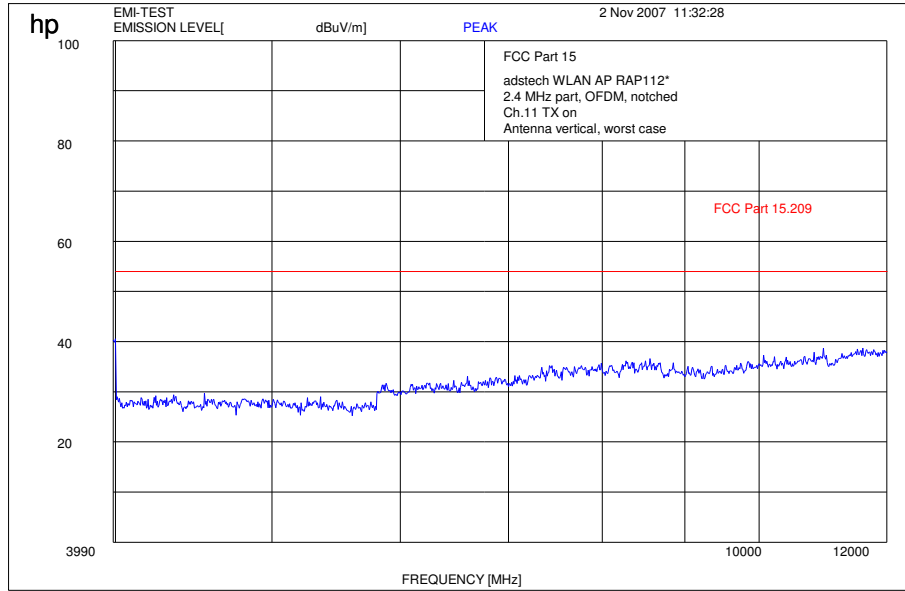


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 53 of 70

Plot 7: 4- 12 GHz (highest channel) vertical (worst case)



Results: (black line on the plots)

SPURIOUS EMISSIONS LEVEL §15.209								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All peaks found below 1 Ghz were caused by the laptop we used to set the sample.								
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Limits: § 15.247 (d)

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)).

Limits: § 15.209

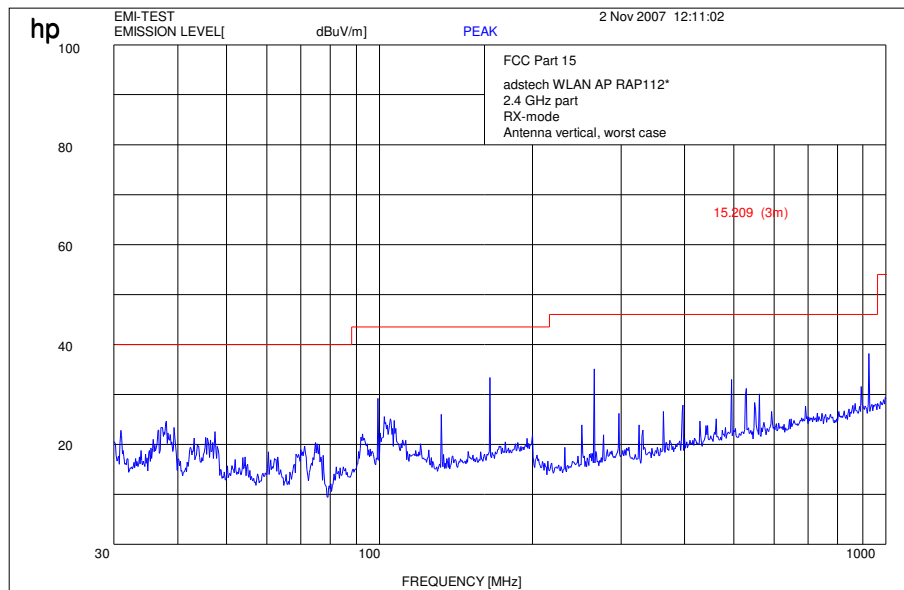
Frequency [MHz]	Field strength [µV/m]	Measurement distance (m)
30 - 88	100 (40 dBµV/m)	3
88 - 216	150 (43.5 dBµV/m)	3
216 - 960	200 (46 dBµV/m)	3
above 960	500 (54 dBµV/m)	3

3.18 Spurious Emissions - radiated Receiver

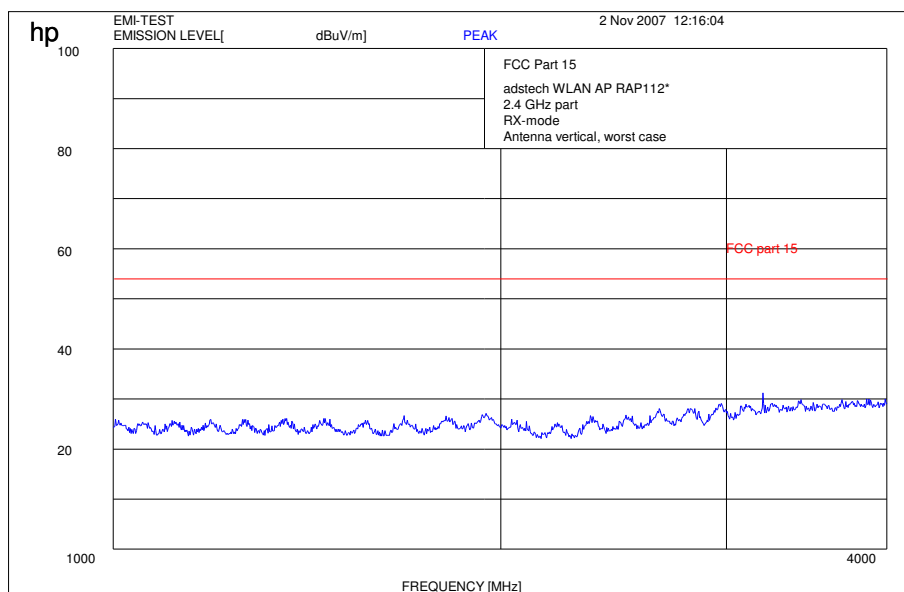
§15.109 / 209

DSSS and OFDM mode, no difference in result

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



Plot 2: 1- 4 GHz (receiver)



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

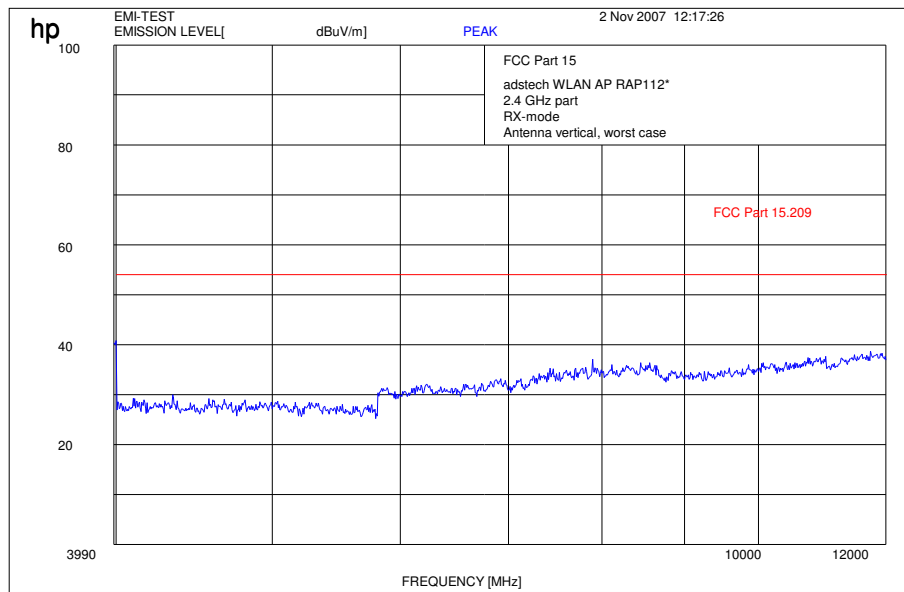


Test report No.: 2-4689-01-02/07

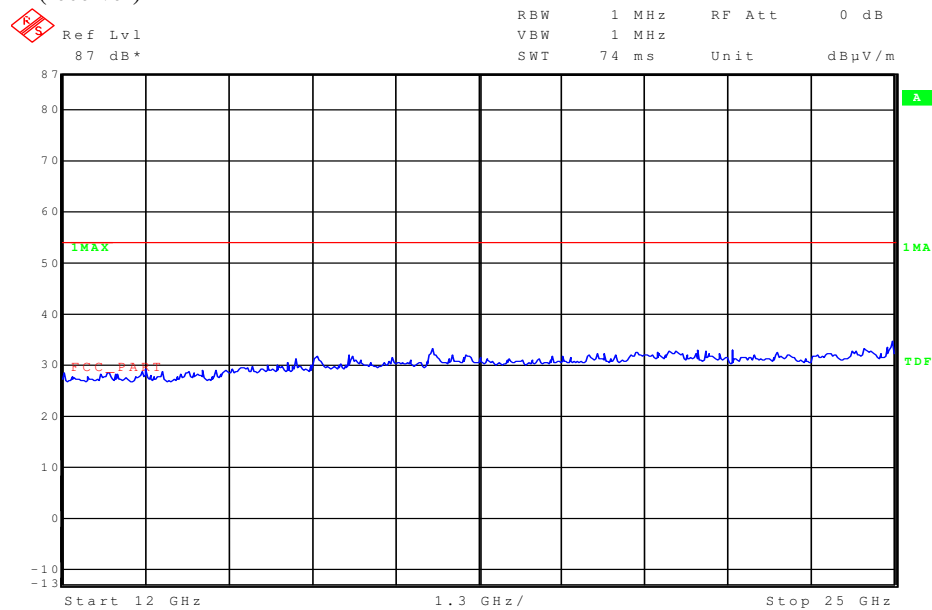
Date: 2007-11-21

Page 56 of 70

Plot 3: 4- 12 GHz (receiver)



Plot 4: 12- 25 GHz (receiver)



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 57 of 70

Results:

Spurious Emissions level [$\mu\text{V/m}$]								
CH 1 / 2 / 3								
f[MHz]	Detector	Level [$\mu\text{V/m}$]	f[MHz]	Detector	Level [$\mu\text{V/m}$]	f[MHz]	Detector	Level [$\mu\text{V/m}$]
All peaks found below 1 Ghz were caused by the laptop we used to set the sample.								
Measurement uncertainty			± 3 dB					

f < 1 GHz : RBW/VBW: 100 kHz
see above plots

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

Measurement distance see table

Limits : § 15.109 / 209

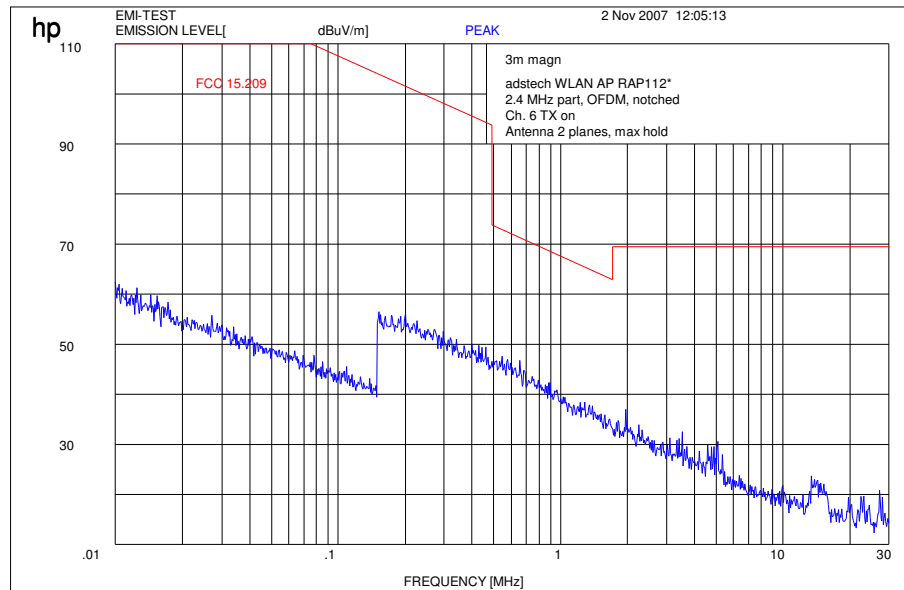
Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
30 - 88	100 (40 dB $\mu\text{V/m}$)	3
88 - 216	150 (43.5 dB $\mu\text{V/m}$)	3
216 - 960	200 (46 dB $\mu\text{V/m}$)	3
above 960	500 (54 dB $\mu\text{V/m}$)	3

3.19 Spurious Emissions - radiated <30 MHz

§15.209

Transmit mode, valid for all three channels

Valid for OFDM and DSSS mode, no difference



Measured at 3 m distance.

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

Limits:

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	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 $\mu\text{V}/\text{m}$	30
30 - 88	100 / 40 dB $\mu\text{V}/\text{m}$	3
88 - 216	150 / 43.5 dB $\mu\text{V}/\text{m}$	3
216 - 960	200 / 46 dB $\mu\text{V}/\text{m}$	3
above 960	54 dB $\mu\text{V}/\text{m}$	3

3.20 Conducted Emissions <30 MHz

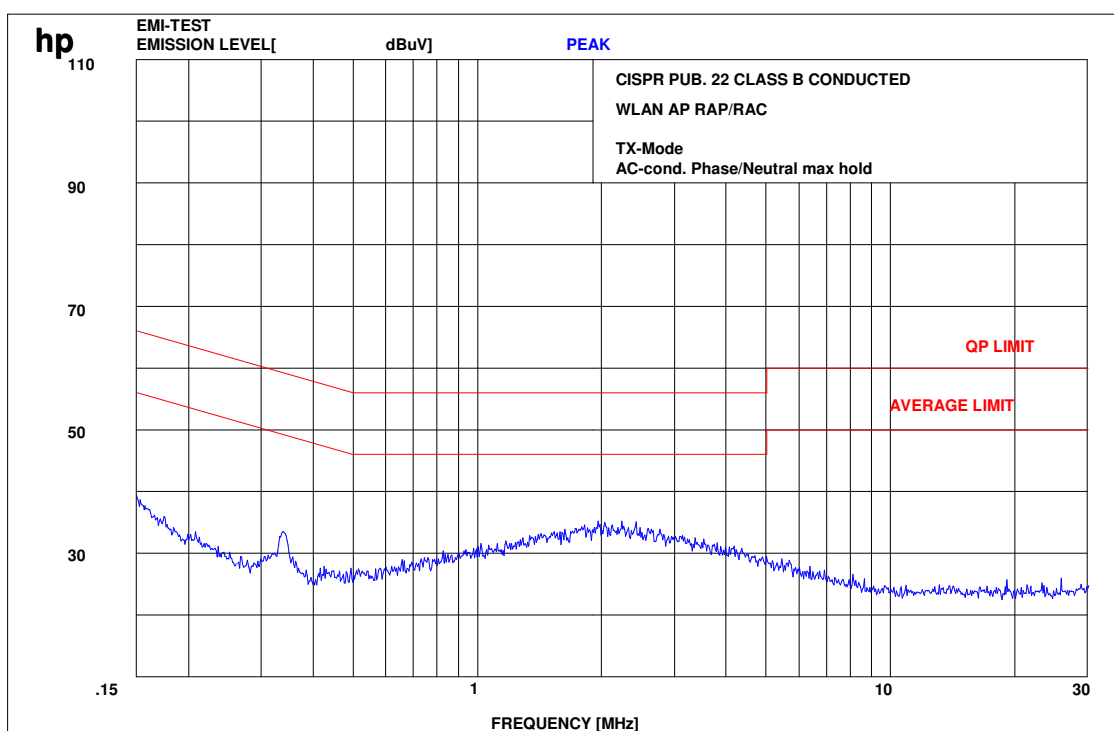
§15.107/207

(measured with the 115V AC power supplied by the customer)

Transmit mode

Valid for OFDM and DSSS mode and all three channels

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
-----------------------------------	--

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 61 of 70

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		

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 62 of 70

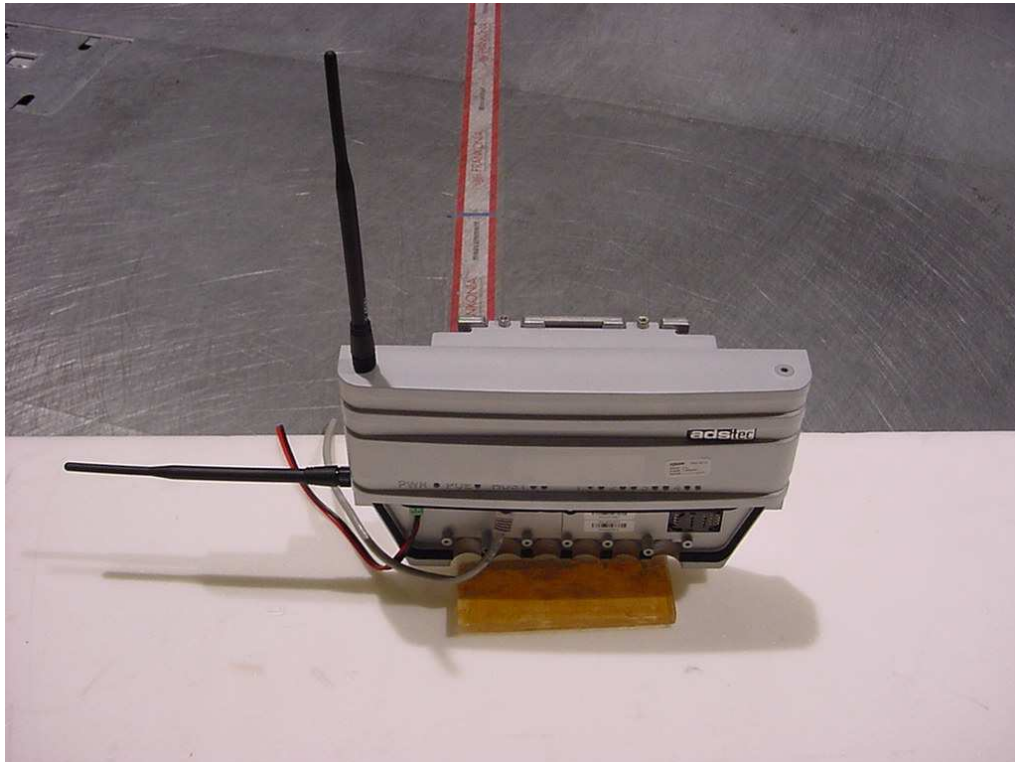
35	RSP programmable attenuator	R&S	834500/010	3000002681-0007	01.08.2006	24	01.08.2008
36	Signalling Unit	R&S	838312/011	3000002681	n.a.		
37	NGPE programmable Power Supply for EUT	R&S	192.033.41	3000002681			
38	Climatic box VT 4002	Heraeus Vötsch	58566046820010	300003019	11.05.2007	24	11.05.2009
39	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.		

SRD Laboratory Room 005:

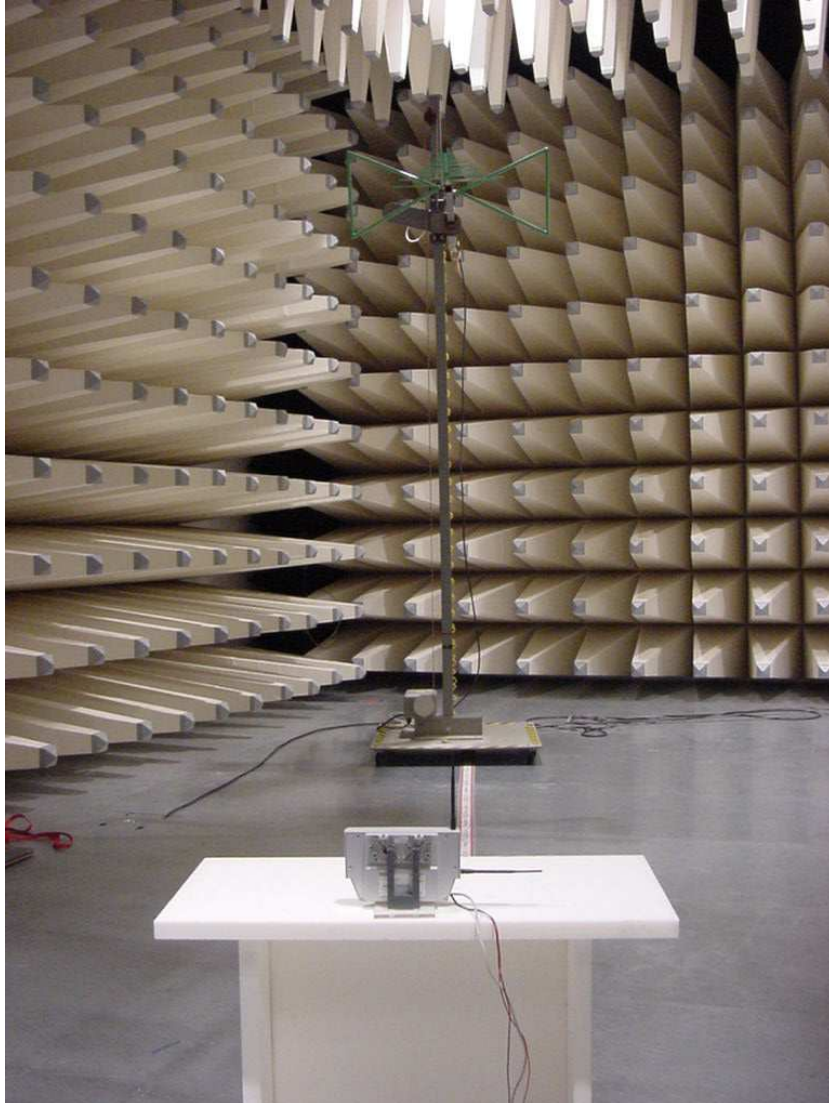
No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Spektrum Analyzer 8566B	HP	2747A05275	300000219	08.11.2006	24	08.11.2008
2	Spektrum Analyzer Display 85662A	HP	2816A16497	300001690	08.11.2006	24	08.11.2008
3	Quasi-Peak-Adapter 85650A	HP	2811A01135	300000216	08.11.2006	24	08.11.2008
4	Power Supply	Heiden	003202	300001187	12.05.2007	36	12.05.2010
5	Power Supply	Heiden	1701	300001392	12.05.2007	36	12.05.2010

5 Photographs of test site

Test site Radiated Emissions:



Test site Radiated Emissions:



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

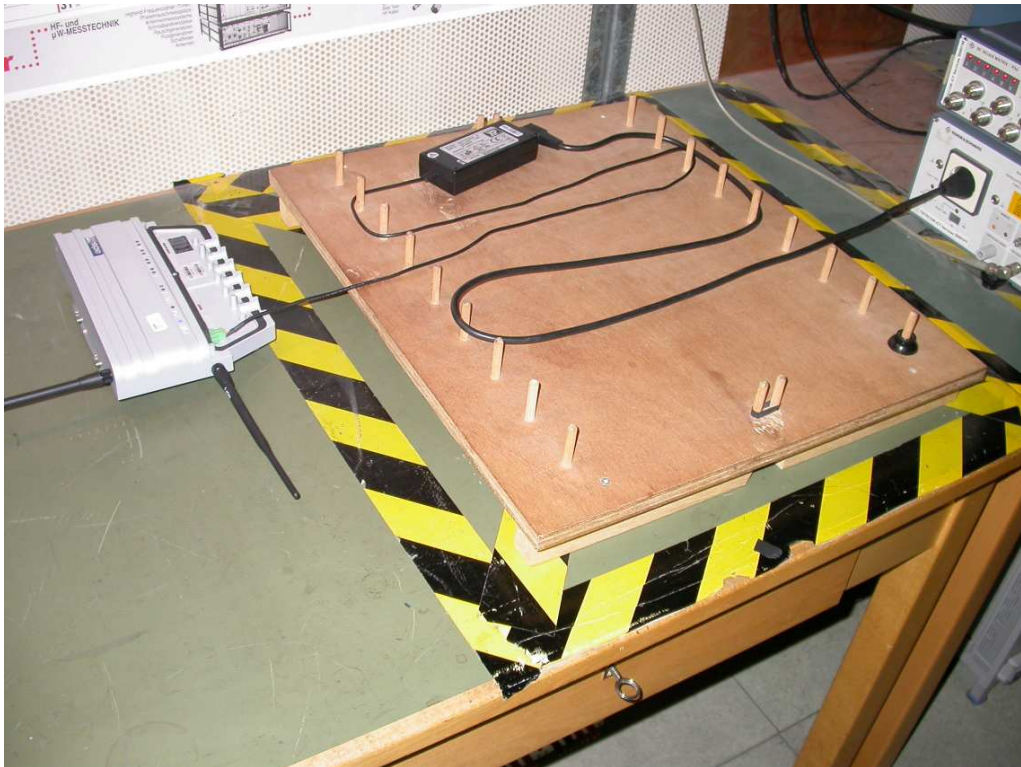


Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 65 of 70

AC-conducted:



6 Photographs of equipment under test

Photograph No.: 1



Photograph No.: 2



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 67 of 70

Photograph No.: 3



Photograph No.: 4



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 68 of 70

Photograph No.: 5



Photograph No.: 6



Photograph No.: 7



Photograph No.: 8



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4689-01-02/07

Date: 2007-11-21

Page 70 of 70

Photograph No.: 9

