

# **CETECOM Inc.**



## **CETECOM Inc.**

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Issued test report consists of 50 Pages

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**FCC LISTED, REG. NO.: 101450**  
**&**  
**RECOGNIZED BY INDUSTRY CANADA**  
**IC – 3925**

**Test report no.:225FCC/2001**  
**FCC Part 15.247**  
**(BT2000-CF)**

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The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalisations 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 Inc USA.

**TEST REPORT PREPARED BY:**

**EMC & Radio Engineer: Harpreet Sidhu**

**1.2 Testing laboratory****CETECOM Inc.**

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**1.3 Details of applicant**

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Street : 48295 Fremont Blvd., Ste A  
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Country : USA  
Contact : Dennis Kuang  
Telephone : +1 510 249 0581 ext-205  
Telefax : +1 510 249 0583  
e-mail : Dennis\_kuang@ambicom.com

**1.4 Application details**

Date of receipt of application : 2001-12-10  
Date of receipt of test item : 2001-12-20  
Date of test : 2001-12-20/21

**1.5 Test item**

Manufacturer : Solomon Technology Corp.  
Street Address : No. 42, Sing Zhong Rd., Nei Hu Dist  
City / Country : Taipei, Taiwan, R.O.C  
Name of EUT :  
**Description** : Air2Net Bluetooth CompactFlash Card  
Model No. : BT2000-CF  
Serial No. : N/A  
FCC ID. : P5T-2000CF

**Additional information**

Frequency : 2.402 - 2.480 GHz  
Type of modulation : GFSK, BT=0.5  
Number of channels : 79  
Antenna : Embedded Antenna with 0dBi max. directivity  
Power supply : 3.3VDC  
Output power : -2.88 dBm  
Extreme vol. Limits : 3.3VDC - 5.0VDC  
Extreme temp. Tolerance :

**1.6 Test standards:** **FCC Part 15 §15.247 using FCC DA00-0705**

**2      Technical test****2.1    Summary of test results**

**No deviations from the technical specification(s) were ascertained in the course of the tests performed.**

**Technical responsibility for area of testing :**

2002-01-23

EMC &amp; Radio

Lothar Schmidt



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Date

Section

Name

Signature

**2.2 Testreport**

**TEST REPORT**

**Test report no. : 225FCC/2001  
(BT2000-CF)**

**TEST REPORT REFERENCE****LIST OF MEASUREMENTS**

Paragraph	PARAMETER TO BE MEASURED	PAGE
	<b>Transmitter parameters</b>	
§ 15.204	Antenna gain	7
§ 15.247 (a)	Carrier frequency separation	8
§ 15.247 (a)	Number of hopping channels	9
§ 15.247 (a)	Time of occupancy (dwell time)	13
§ 15.247 (a)(1)	Spectrum Bandwidth of a FHSS System	16
§ 15.247 (b)(2)	Maximum peak output power	20
§ 15.247	Band edge compliance	28
§ 15.247 (c)(1)	Emission limitations	30
§ 15.107/207	AC Line Conducted Emission	43
	<b>Receiver parameters</b>	
§ 15.209	Spurious radiations - Radiated	45
	Test equipment listing	50

**Antenna Gain**

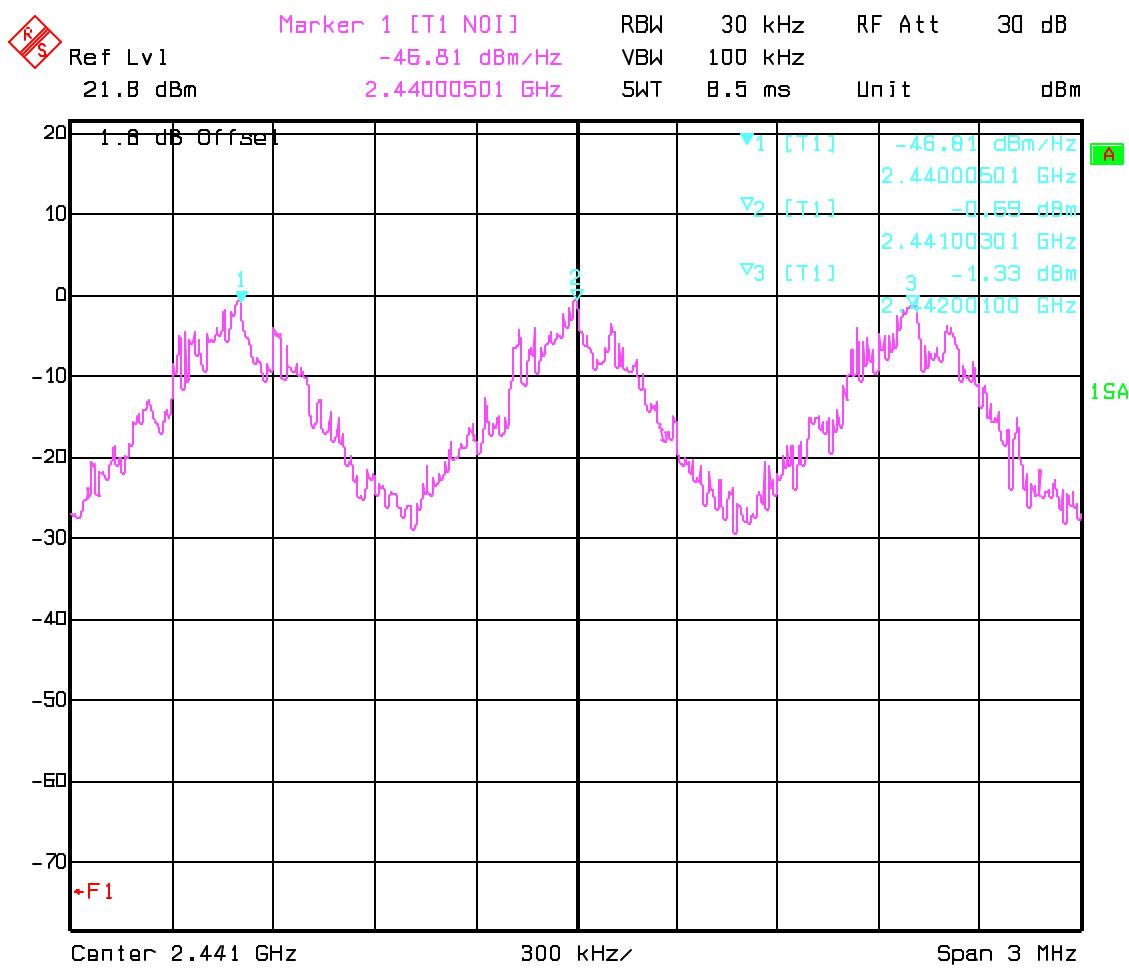
**SUBCLAUSE § 15.204**

**The max gain is: -2.75dBdBi**

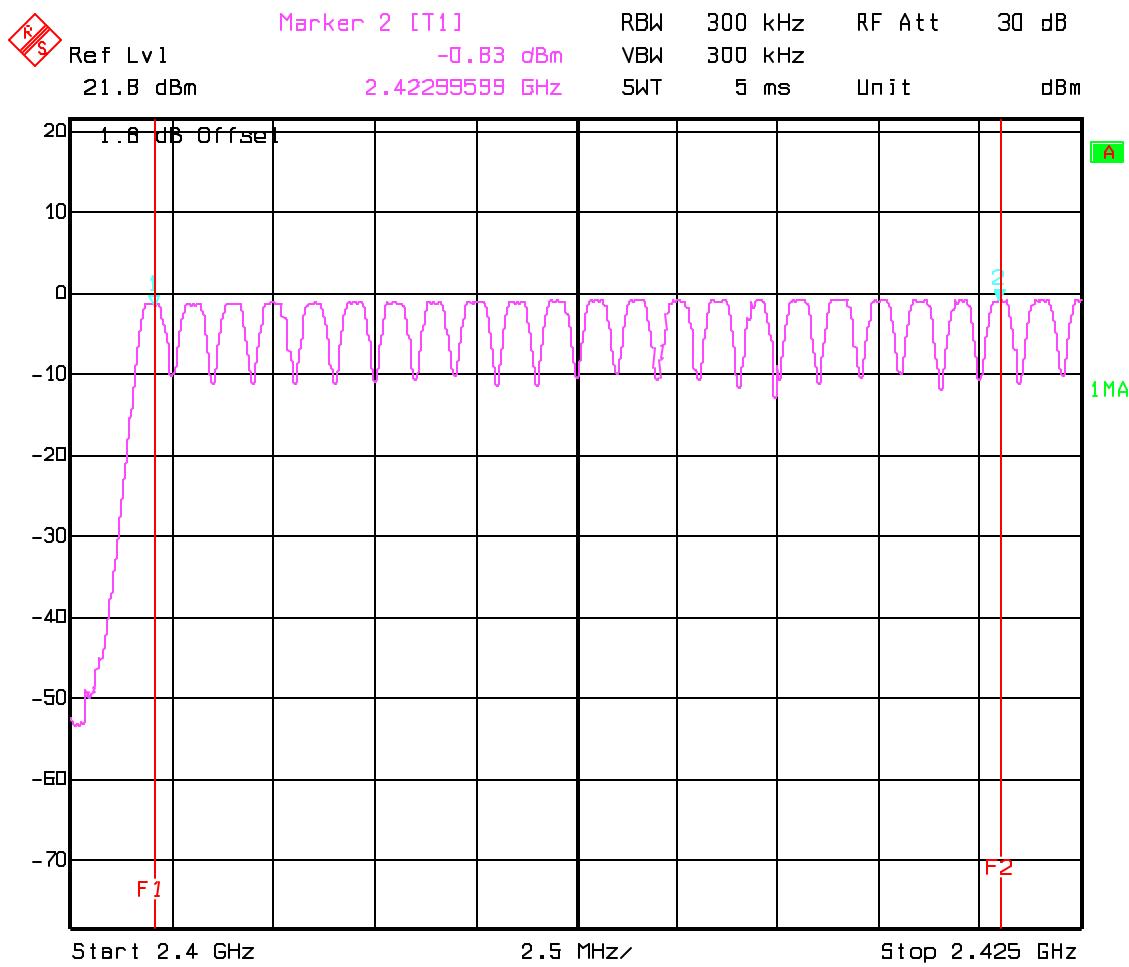
**(measured effectiv radiated power – measured conducted power with a temporary RF-connector)**

## CARRIER FREQUENCY SEPERATION

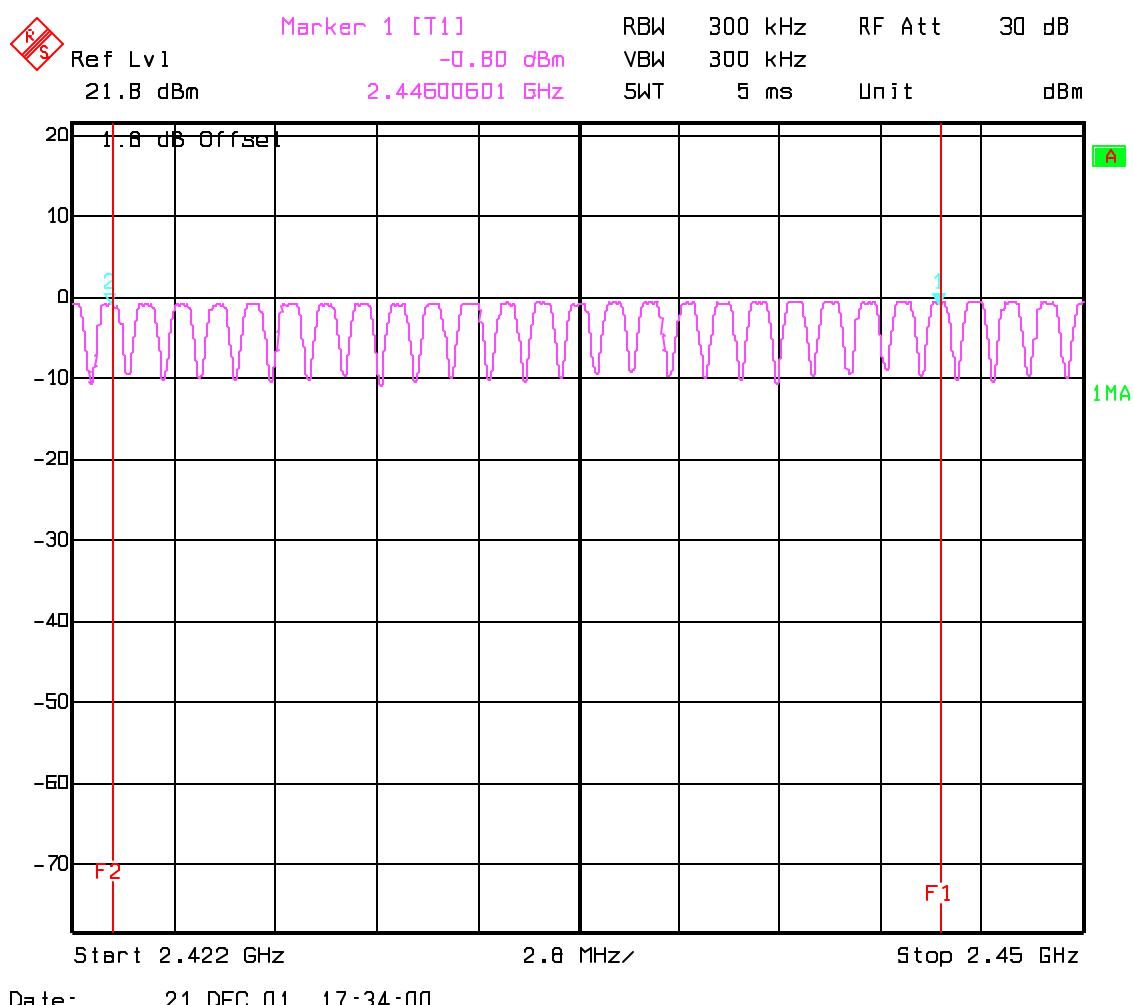
**§15.247(a)**

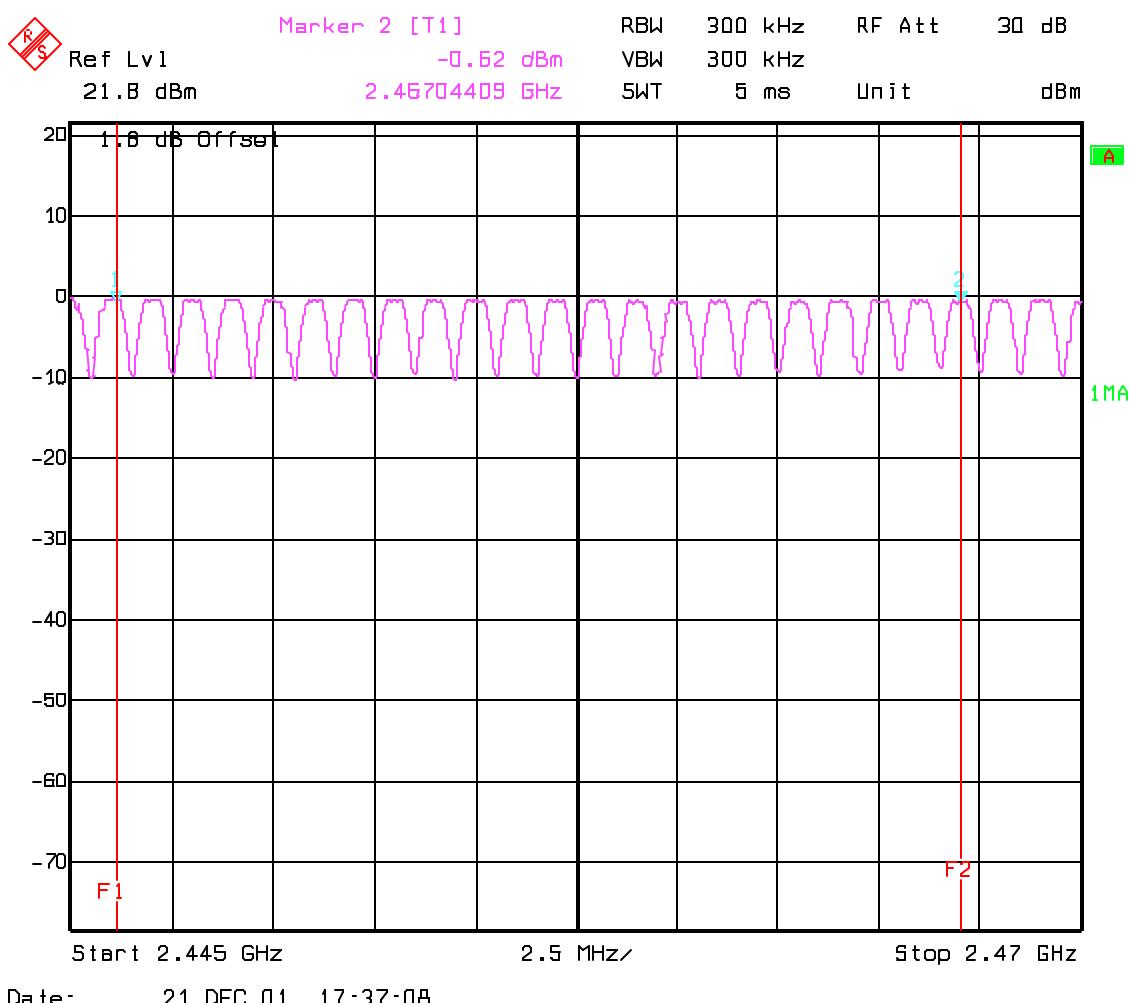


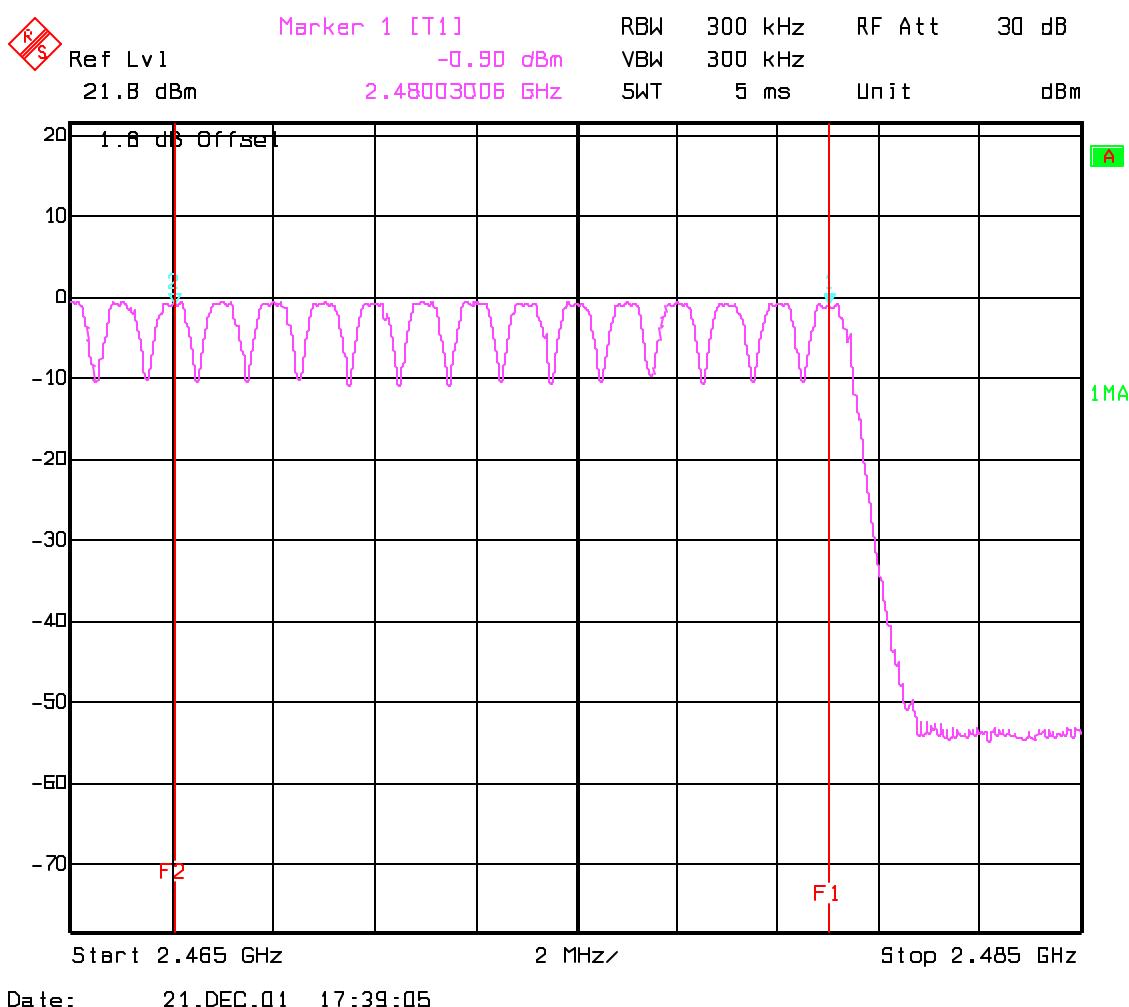
Date: 21.DEC.01 17:26:52

**NUMBER OF HOPPING CHANNELS****§15.247(a)****The number of hopping channels is 79 (see next 4 plots)****The right red line corresponds to the left red line from the next plot.****Plot 1: Total 22**

Date: 21.DEC.01 17:30:38

**Plot 2: Total 23**

**Plot 3: Total 21**

**Plot 4: Total 13**

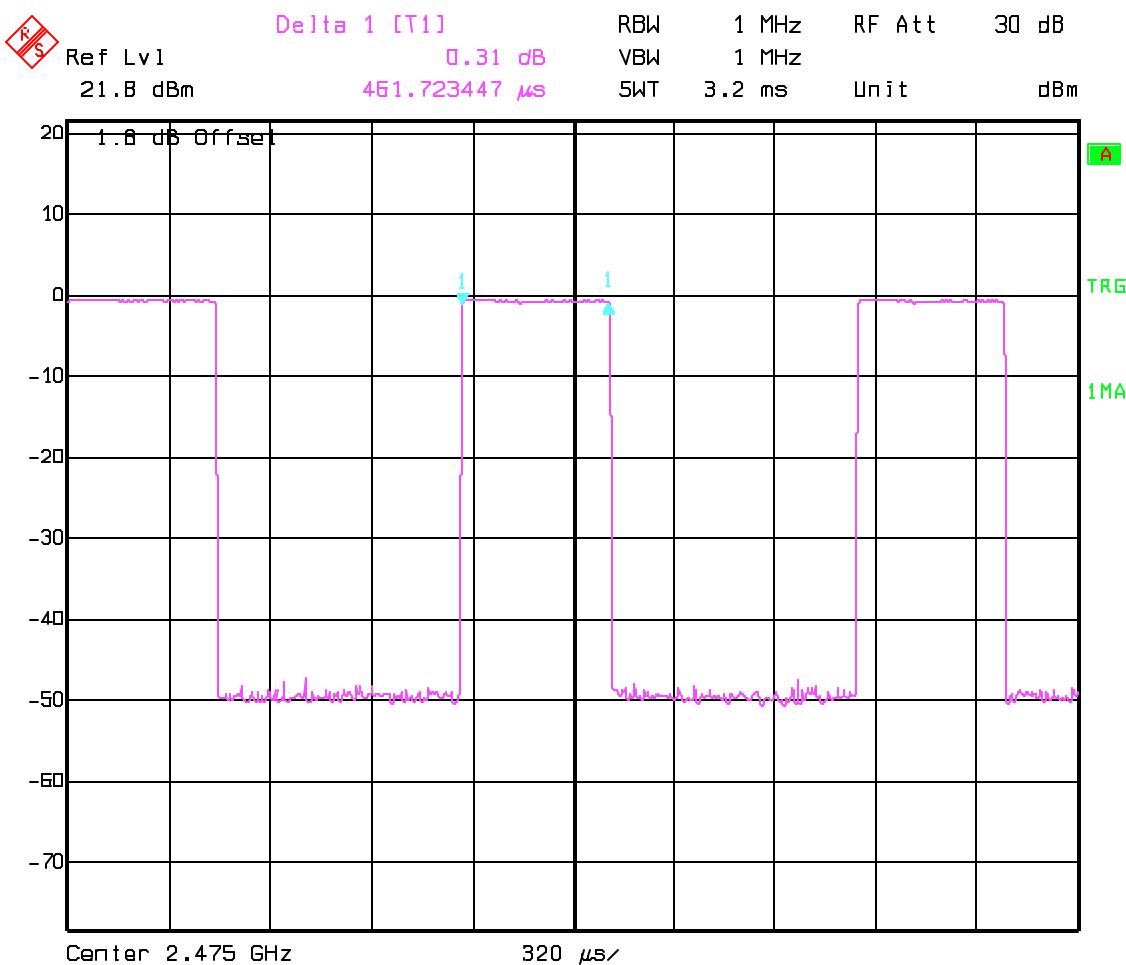
## TIME OF OCCUPANCY (DWELL TIME) FOR DH1

§15.247(a)

The system makes worst case 1600 hops per second or 1 time slot has a length of 625 $\mu$ s with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 800 hops per second with 79 channels. So you have each channel 10.13 times per second and so for 30 seconds you have 303.9 times of appearance.

Each Tx-time per appearance is 461.72  $\mu$ s.

So we have 303.9 \* 461.72  $\mu$ s = 140.31 ms per 30 seconds.



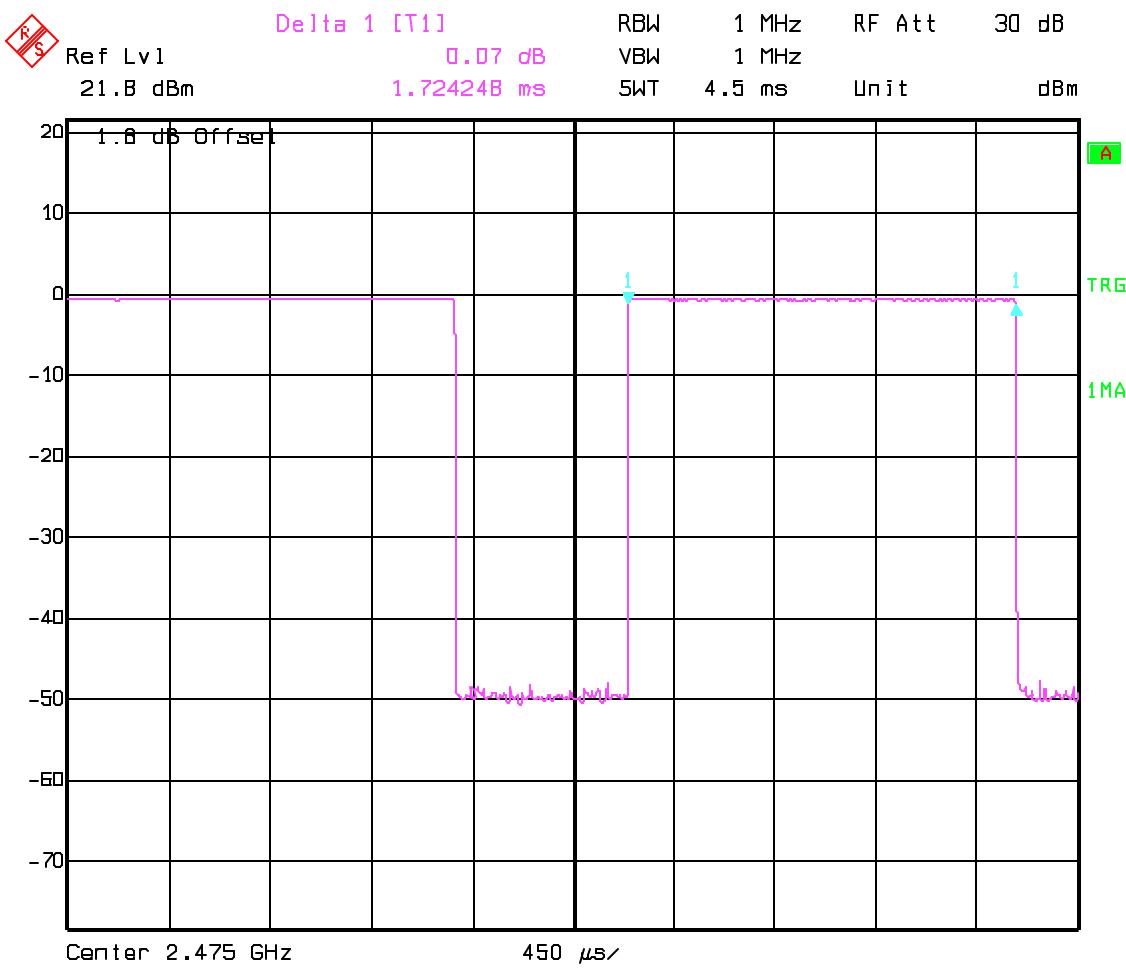
## TIME OF OCCUPANCY (DWELL TIME) FOR DH3

§15.247(a)

A DH3 Packets need 3 time slots for transmit and 1 for receiving, then the system makes worst case 400 hops per second with 79 channels. So you have each channel 5.1 times per second and so for 30 seconds you have 153 times of appearance.

Each Tx-time per appearance is 1.72 ms.

So we have  $153 * 1.72 \text{ ms} = 263.16 \text{ ms per 30 seconds.}$



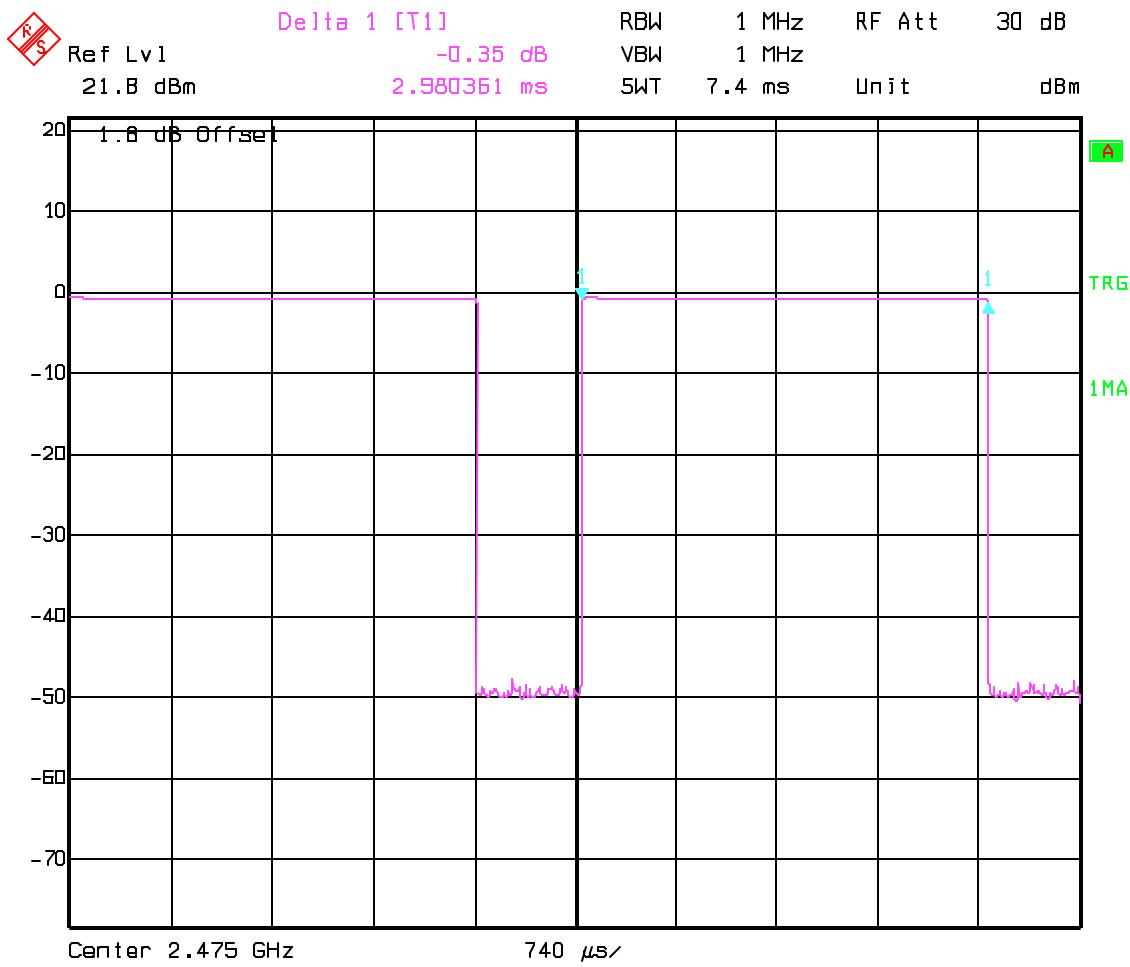
## TIME OF OCCUPANCY (DWELL TIME) FOR DH5

§15.247(a)

At DH5 Packets you need 5 time slots for transmit and 1 for receicing,then the system makes worst case 266,7 hops per second with 79 channels. So you have each channel 3.36 times per second and so for 30 seconds you have 100,8 times of appearence .

Each tx-time per appearence is 2.98 ms.

So we have  $100.8 * 2.98\text{ms} = 300.38\text{ ms per 30 seconds.}$

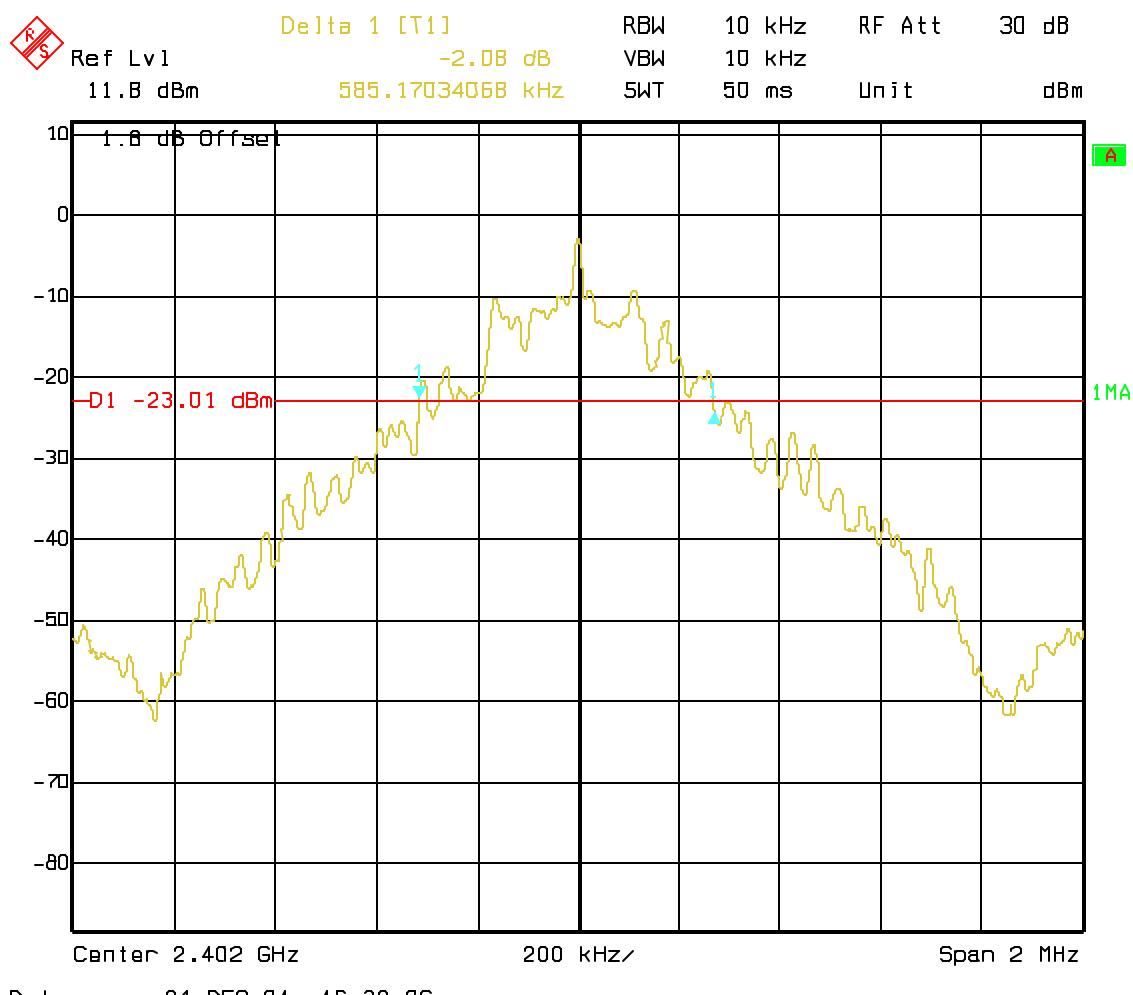


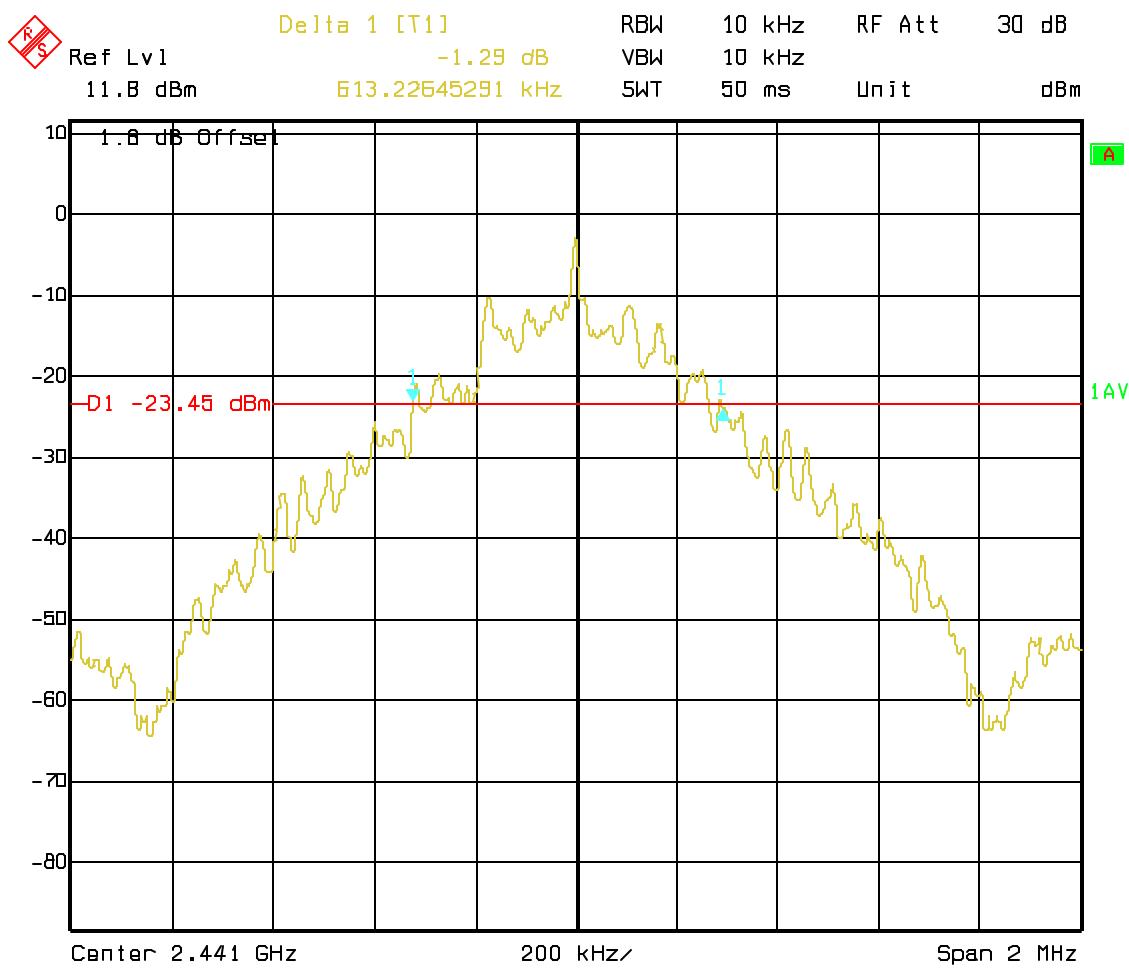
**SPECTRUM BANDWIDTH OF FHSS SYSTEM****§15.247(a)****20 dB bandwidth**

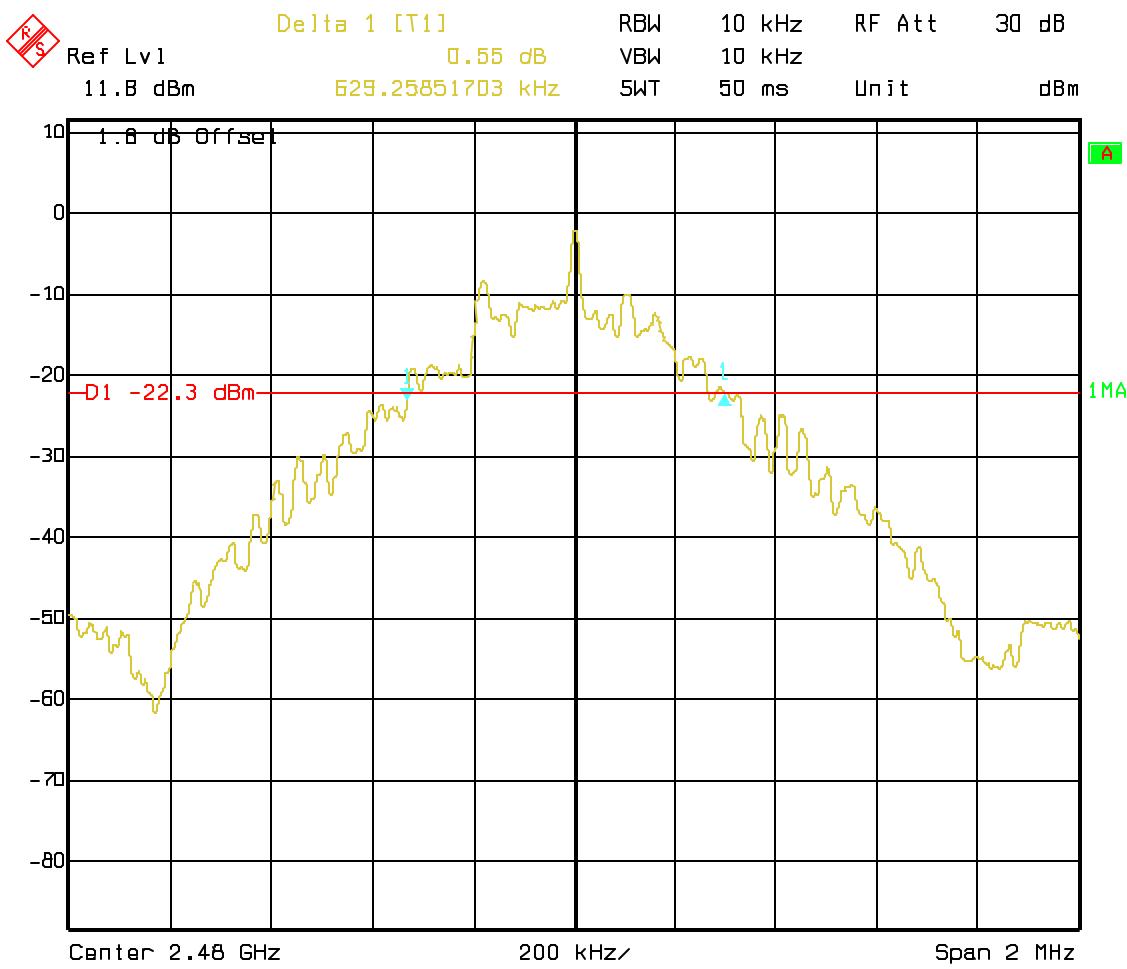
TEST CONDITIONS		20 dB BANDWIDTH ( kHz )		
Frequency (MHz)		2402	2441	2480
T <sub>nom</sub> ( 23 )°C	V <sub>nom</sub> (3.3)V	585.17	613.22	629.25
Measurement uncertainty		±3dB		

RBW / VBW as provided in the "Measurement Guidelines" (DA 00-705, March 30, 2000)

**LIMIT****SUBCLAUSE §15.247(a) (1)****The maximum 20dB bandwidth shall be at maximum 1000 KHz**

**SPECTRUM BANDWIDTH OF FHSS SYSTEM****§15.247(a)****20 dB bandwidth****Lowest Channel: 2402MHz**

**SPECTRUM BANDWIDTH OF FHSS SYSTEM****§15.247(a)****20 dB bandwidth****Mid Channel: 2441MHz**

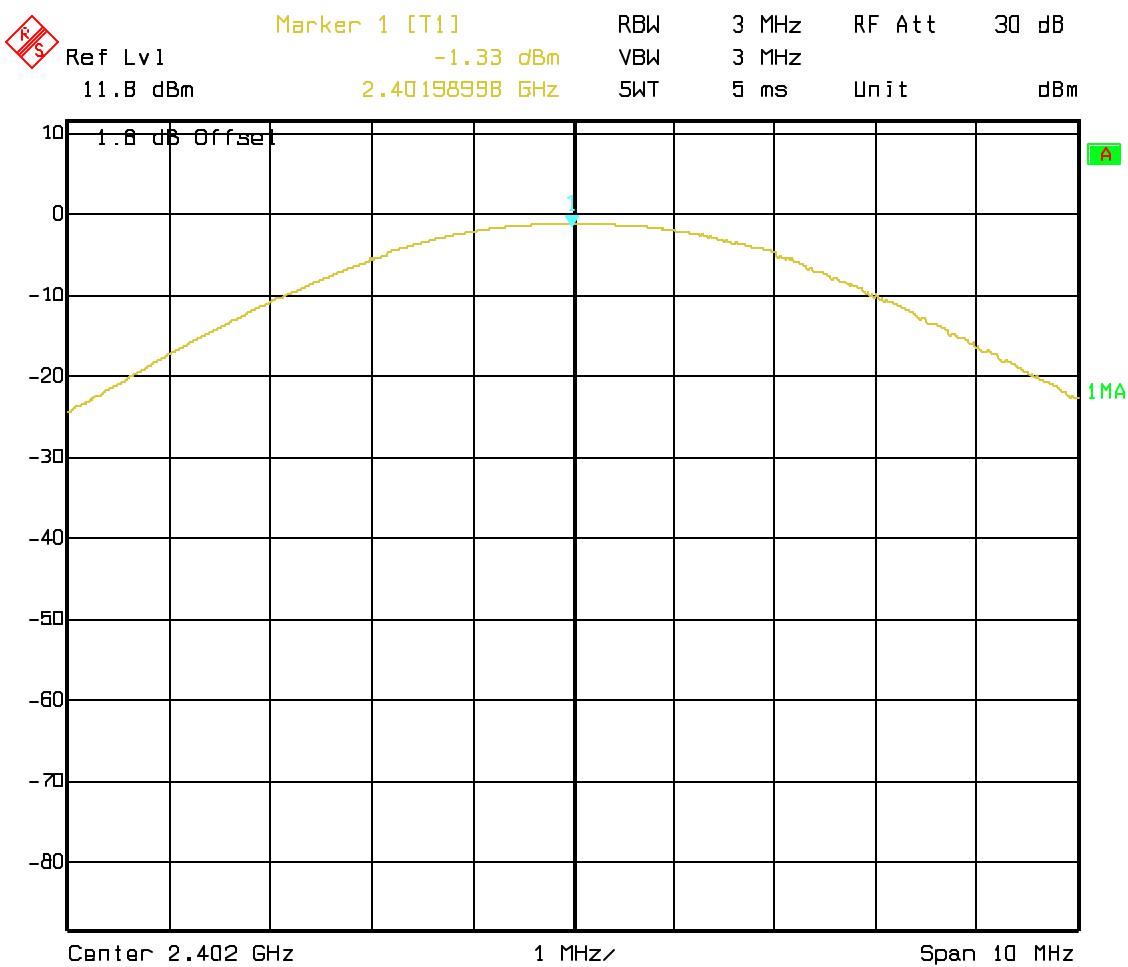
**SPECTRUM BANDWIDTH OF FHSS SYSTEM****§15.247(a)****20 dB bandwidth****Highest Channel: 2480MHz**

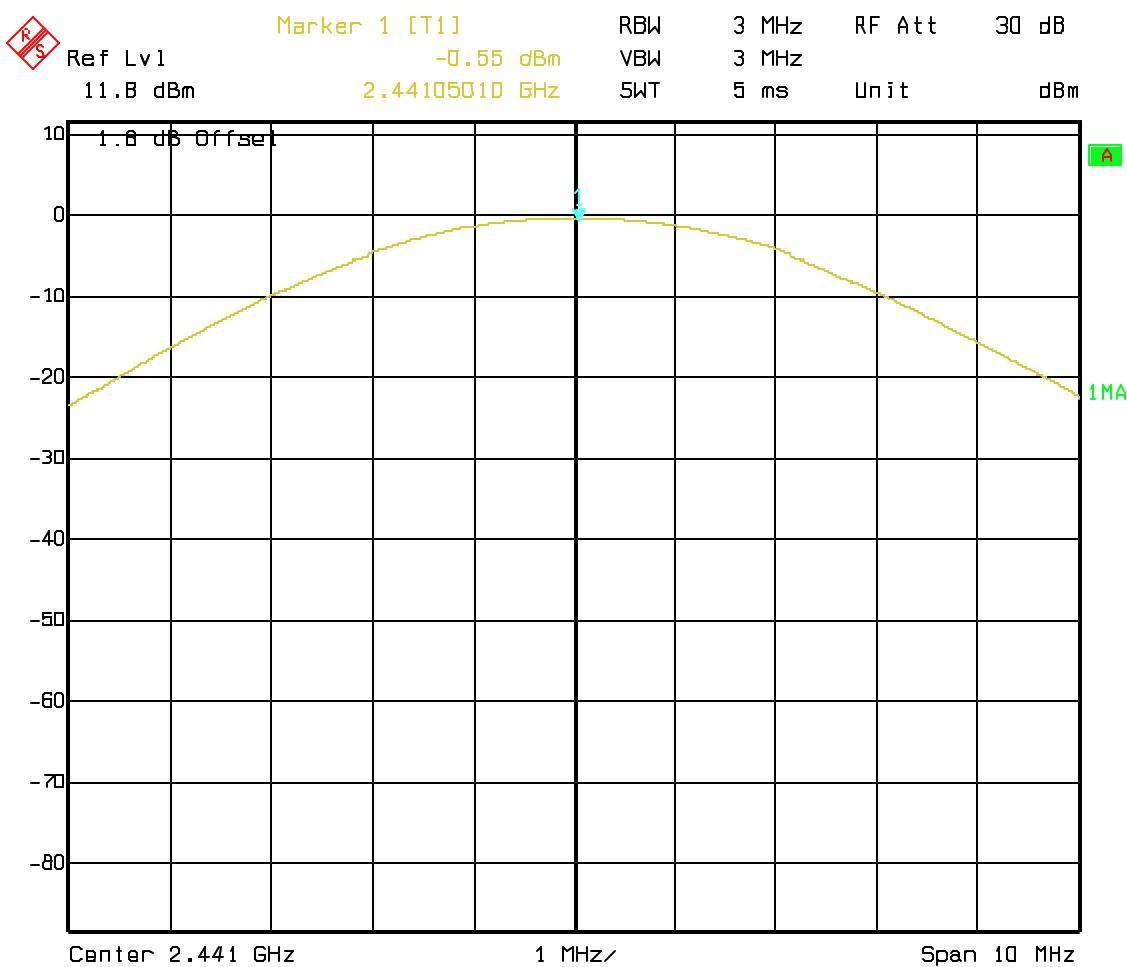
**MAXIMUM PEAK OUTPUT POWER  
(conducted)****SUBCLAUSE § 15.247 (b) (1)**

<b>TEST CONDITIONS</b>		<b>MAXIMUM PEAK OUTPUT POWER (dBm)</b>		
		<b>2402</b>	<b>2441</b>	<b>2480</b>
$T_{\text{nom}}(23)^\circ\text{C}$	$V_{\text{nom}}(3.3)\text{V}$	PK	-1.33	-0.55
<b>Measurement uncertainty</b>		<b>±3dB</b>		

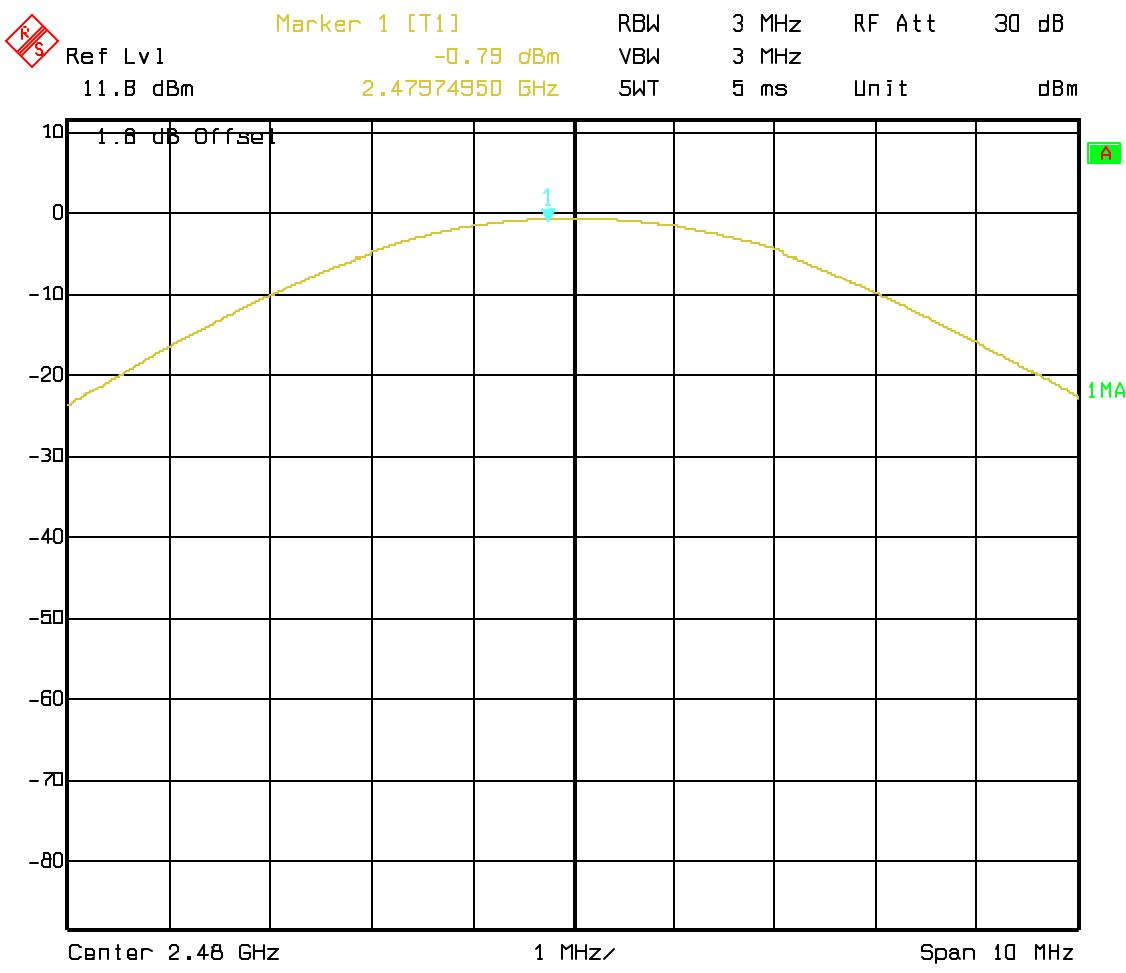
**RBW / VBW : 3 MHz****LIMIT****SUBCLAUSE § 15.247 (b) (1)**

<b>Frequency range</b>	<b>RF power output</b>
<b>2400-2483.5 MHz</b>	<b>1.0 Watt</b>

**PEAK OUTPUT POWER (CONDUCTED)****§15.247 (b)****Lowest Channel: 2402MHz**

**PEAK OUTPUT POWER (CONDUCTED)****§15.247 (b)****Mid Channel: 2441MHz**

Date: 21.DEC.01 16:48:16

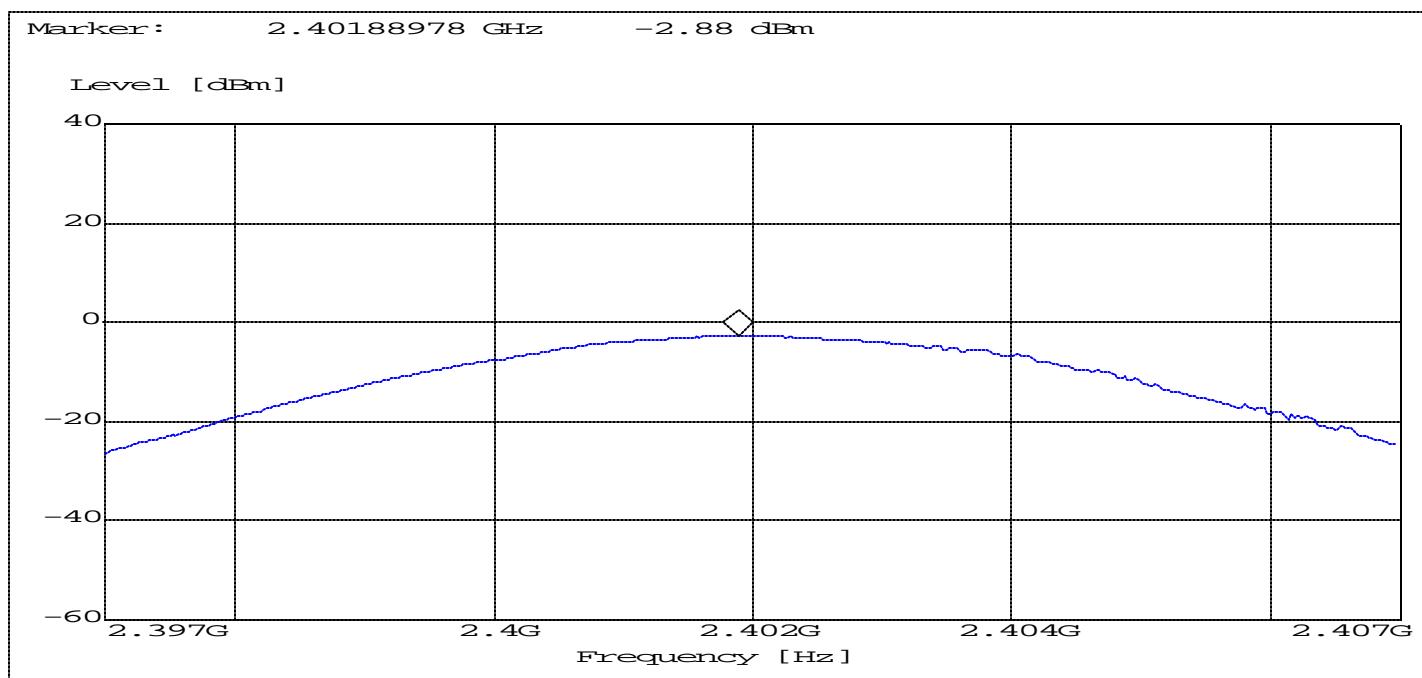
**PEAK OUTPUT POWER (CONDUCTED)****§15.247 (b)****Highest Channel: 2480MHz**

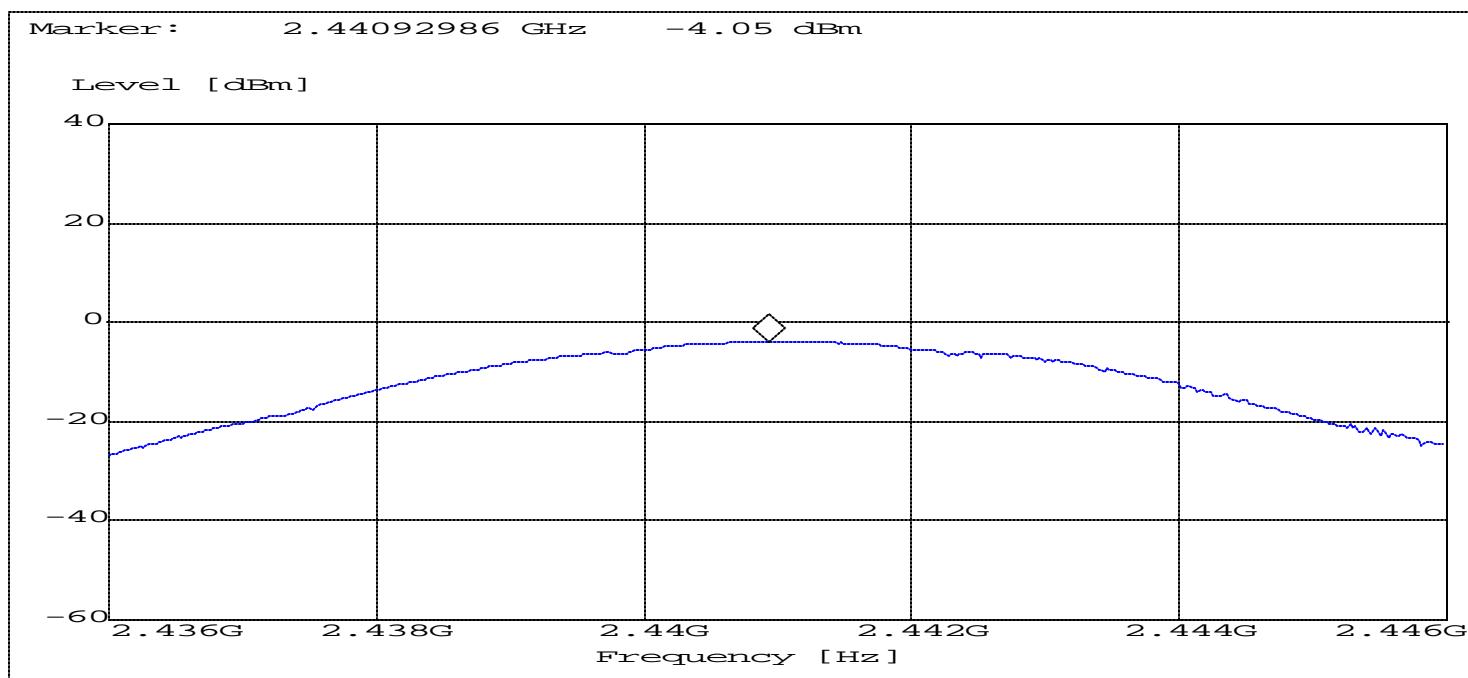
**MAXIMUM PEAK OUTPUT POWER  
(RADIATED)****SUBCLAUSE § 15.247 (b) (1)****EIRP:**

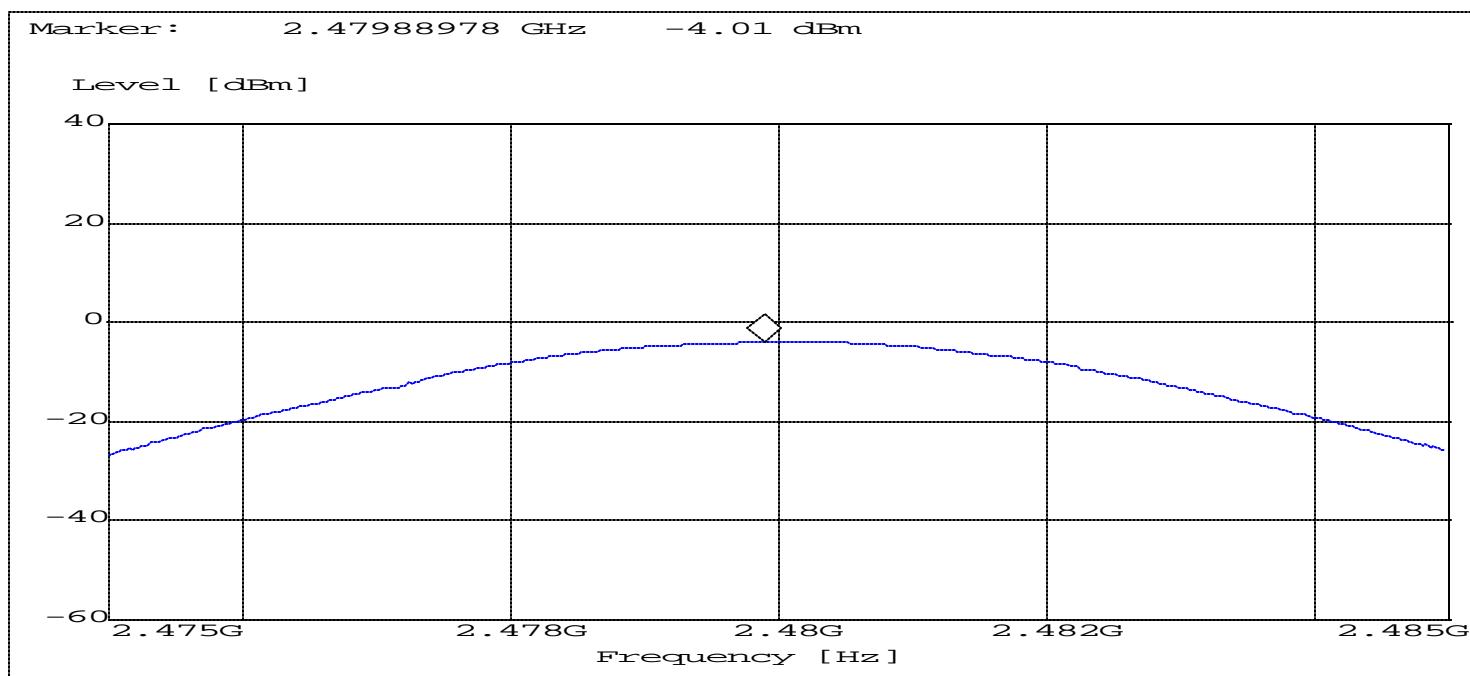
TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
		2402	2441	2480
$T_{\text{nom}}$ ( 23 )° C	$V_{\text{nom}}$ (3.3)V	-2.88	-4.05	-4.01
<b>Measurement uncertainty</b>		<b>±3dB</b>		

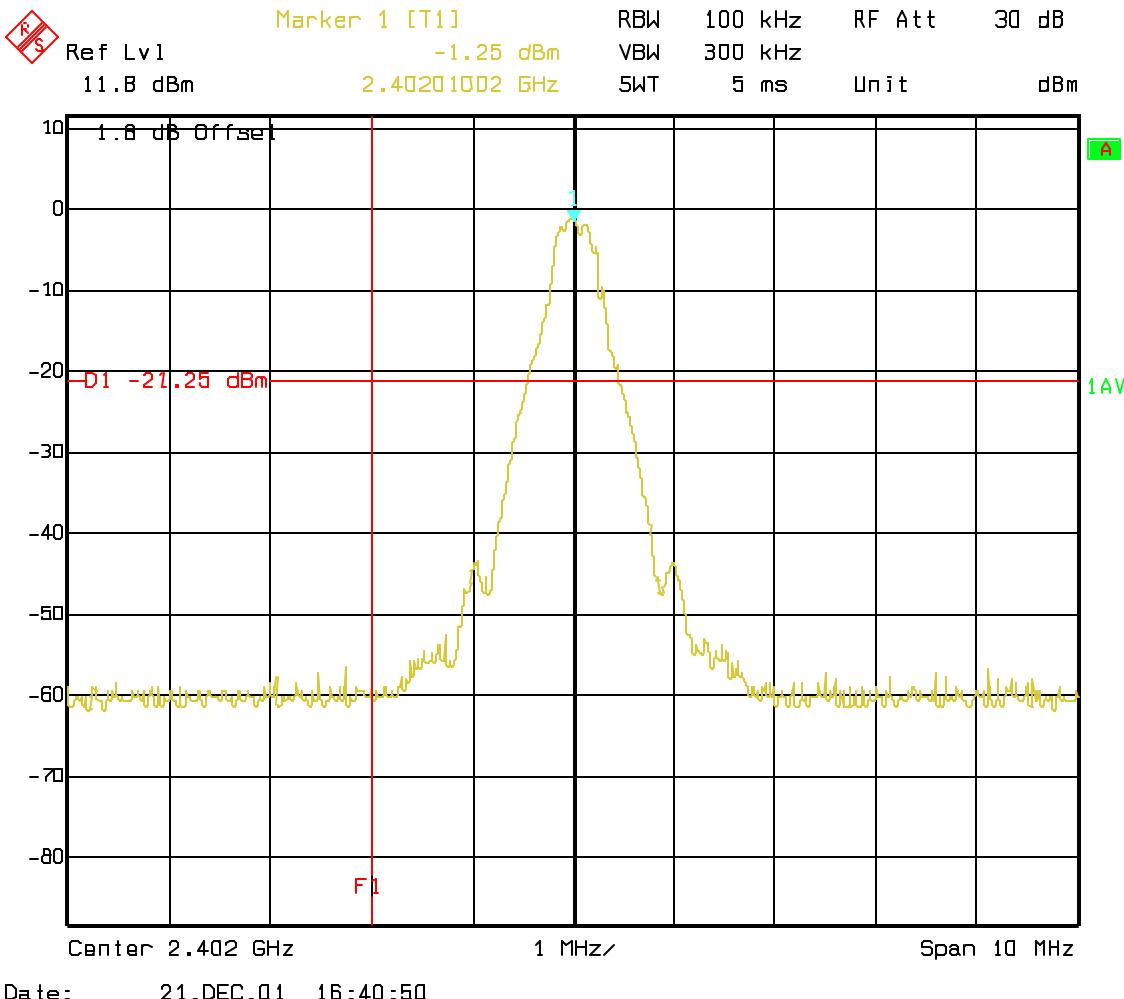
**RBW/VBW : 3 MHz****LIMIT****SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

**PEAK OUTPUT POWER (RADIATED)****§15.247 (b) (1)****Lowest Channel: 2402MHz****ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz**

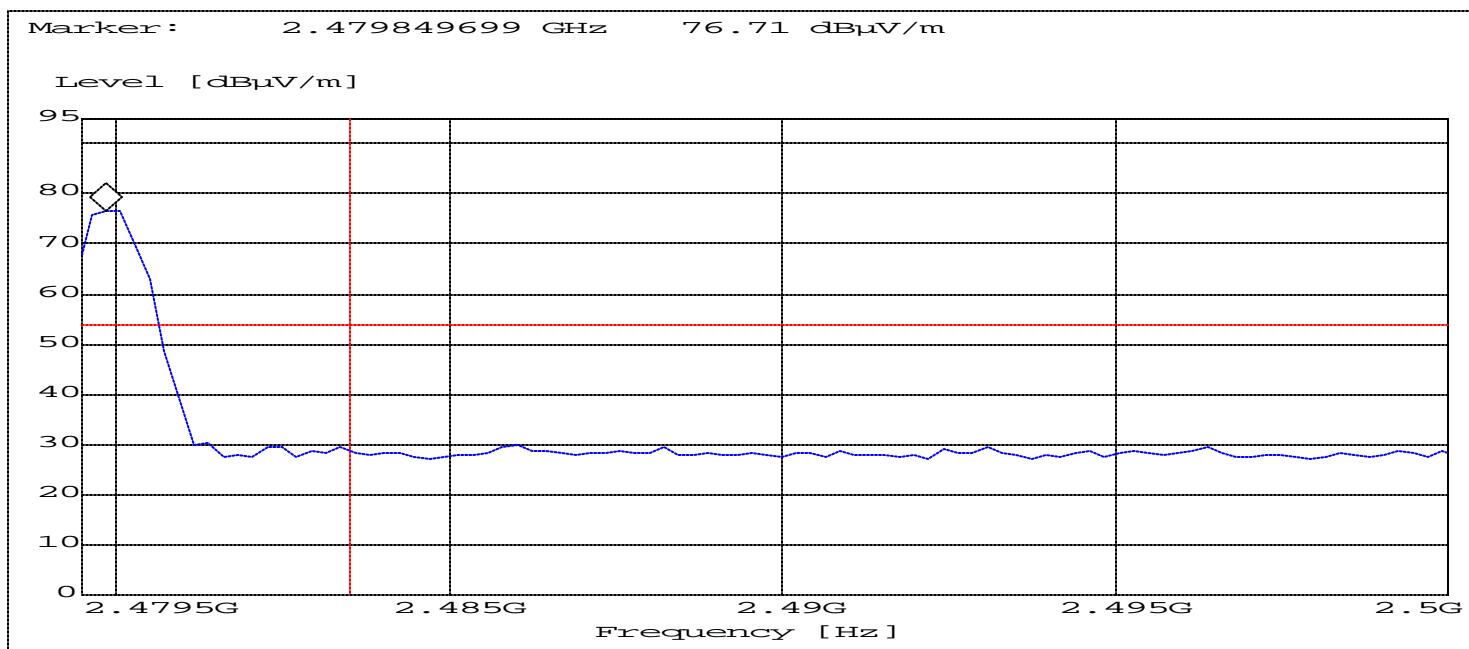
**PEAK OUTPUT POWER (RADIATED)****§15.247 (b) (1)****Mid Channel: 2441MHz****ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz**

**PEAK OUTPUT POWER (RADIATED)****§15.247 (b) (1)****Highest Channel: 2480MHz****ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz**

**BAND EDGE COMPLIANCE****§15.247 (c)****Low frequency section (2400MHz)  
(valid for both hopping ON & OFF)**

**BAND EDGE COMPLIANCE****§15.247 (c)**

**high frequency section (spurious in the restricted band 2483.5 – 2500 MHz)  
(valid for both hopping ON & OFF)**



ANALYZER SETTINGS: RBW = 100KHz

VBW = 200KHz

**EMISSION LIMITATIONS - Conducted (Transmitter)****§ 15.247 (c) (1)****LIMITS**

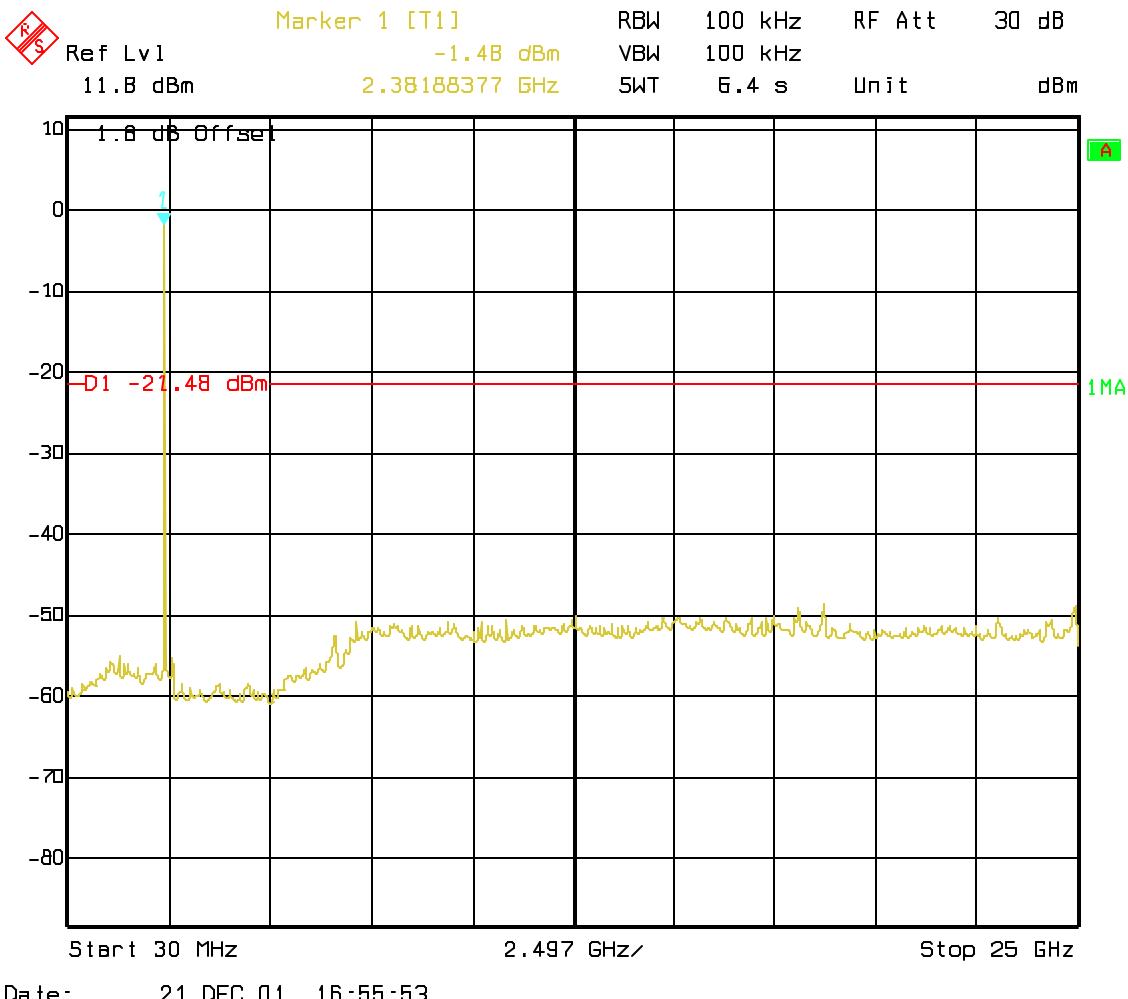
In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**NOTE:** Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.

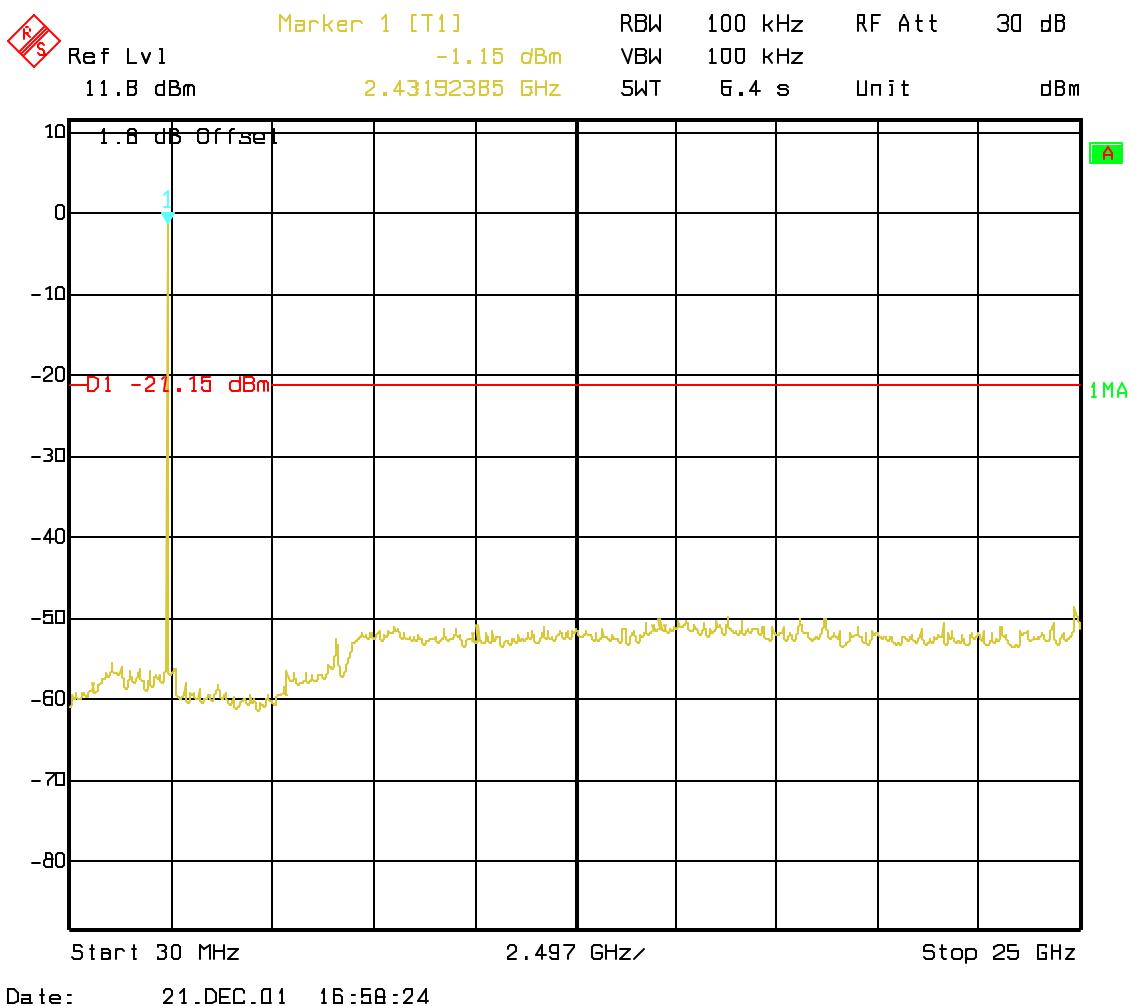
## EMISSION LIMITATIONS - Conducted (Transmitter)

§ 15.247 (c) (1)

Lowest Channel(2402MHz): 30MHz - 25 GHz



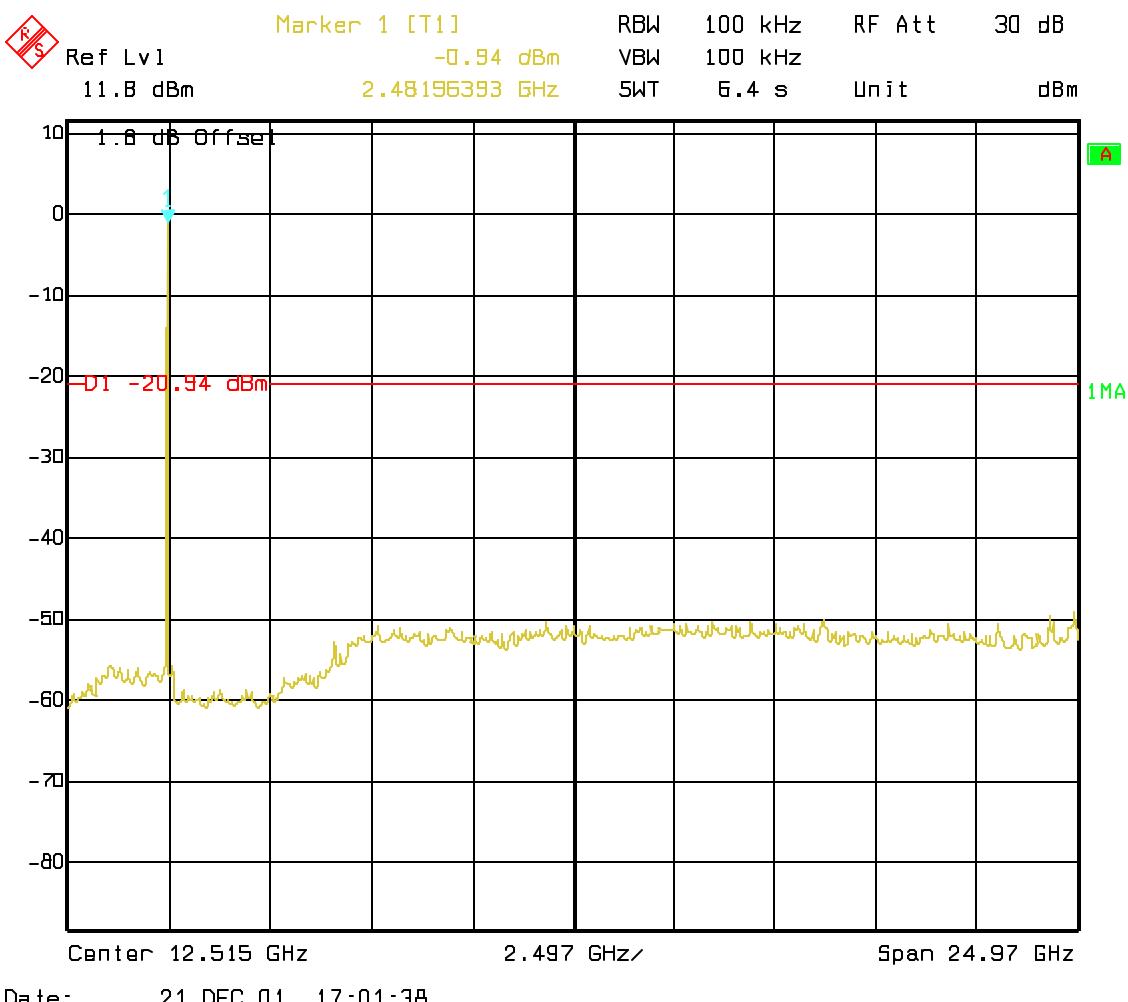
NOTE: The peak above the limit is the carrier frequency.

**EMISSION LIMITATIONS - Conducted (Transmitter)****§ 15.247 (c) (1)****Mid Channel(2441MHz): 30MHz - 25GHz****NOTE: The peak above the limit is the carrier frequency.**

## EMISSION LIMITATIONS - Conducted (Transmitter)

§ 15.247 (c) (1)

Highest Channel(2480MHz): 30MHz - 25GHz



NOTE: The peak above the limit is the carrier frequency.

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****LIMITS**

**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:**

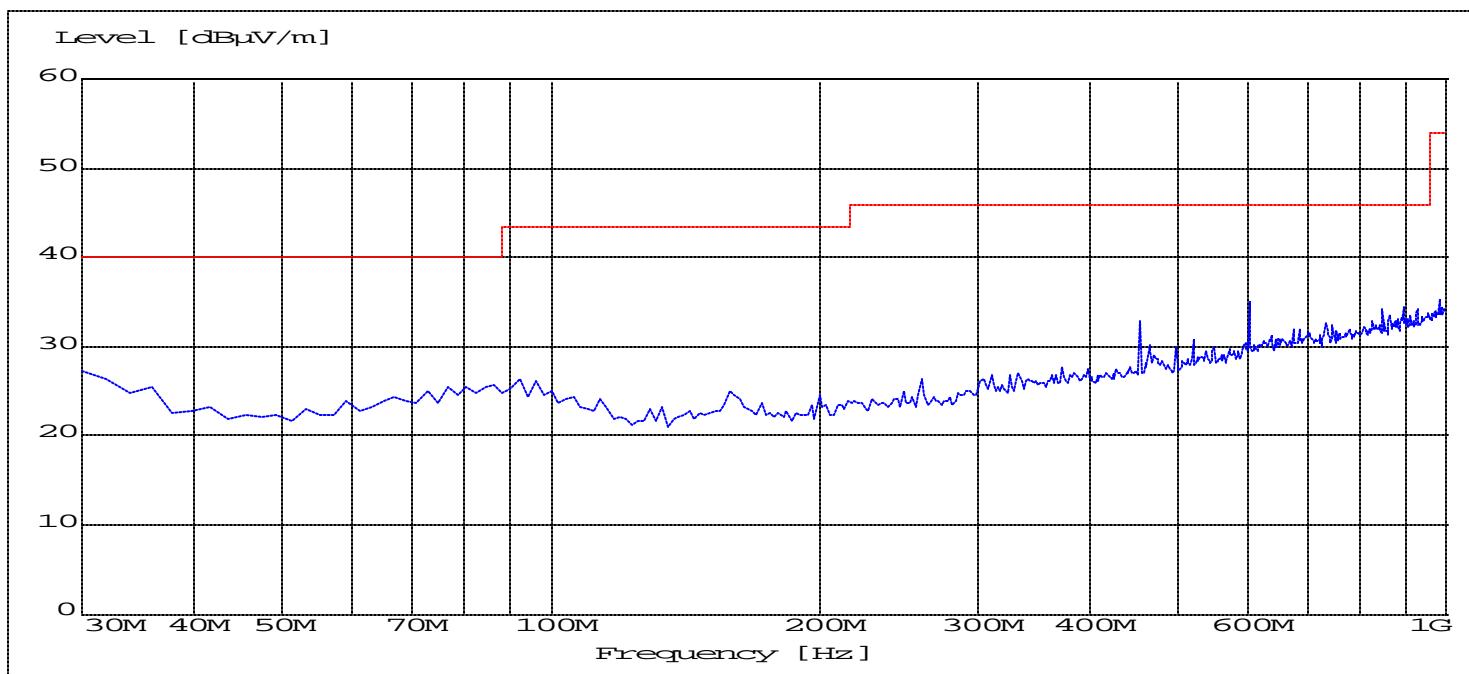
1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 18 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.

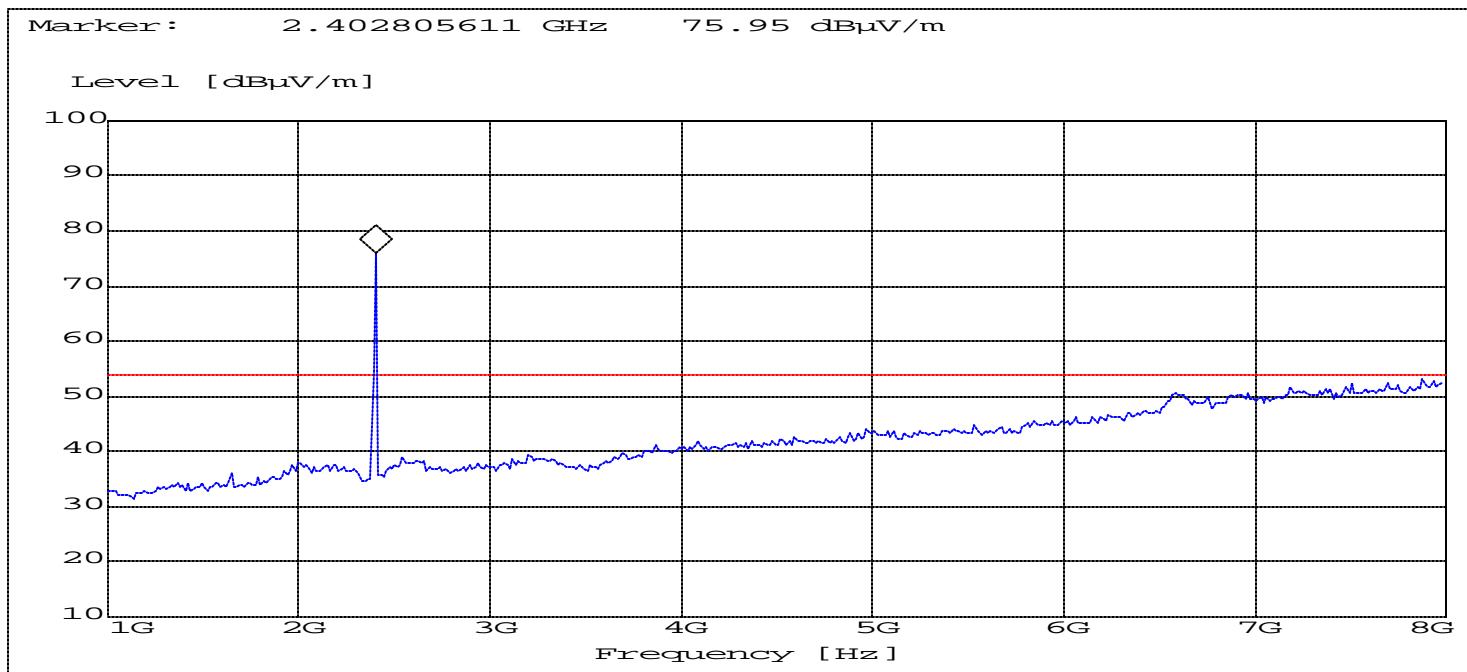
**Results for the radiated measurements below 30MHz according § 15.33**

Frequency	Measured values	Remarks
10KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)**

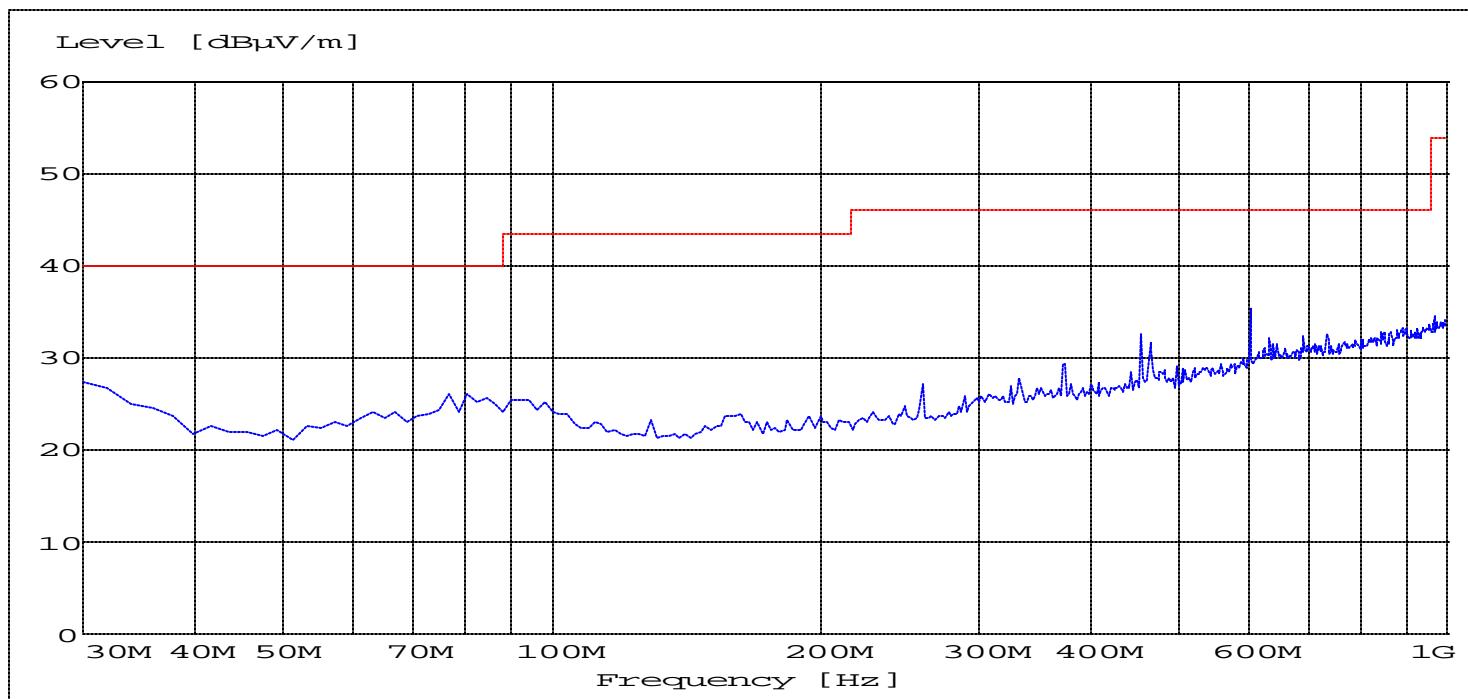
Lowest Channel(2402MHz): 30MHz – 1GHz



**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Lowest Channel(2402MHz): 1GHz – 8GHz****SUBCLAUSE § 15.247 (c) (1)****NOTE: The peak above the limit is the carrier frequency.****ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz**

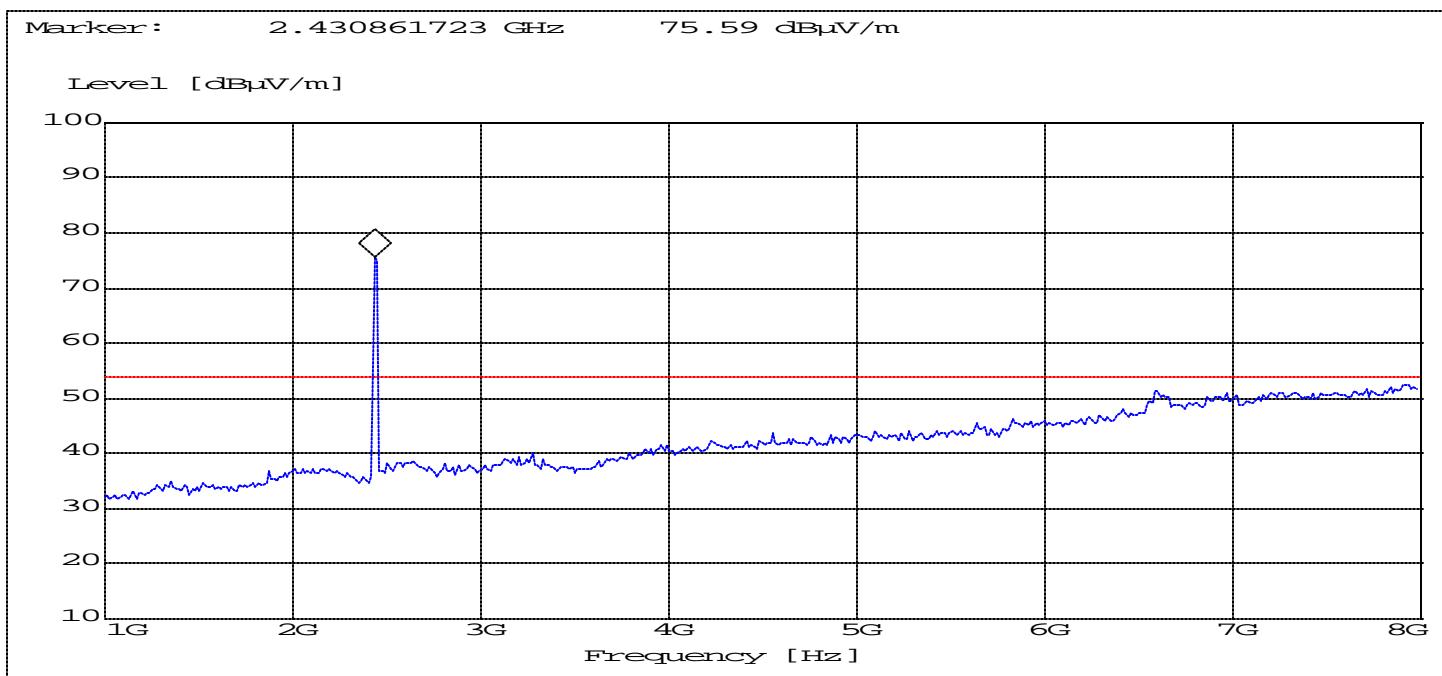
**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)**

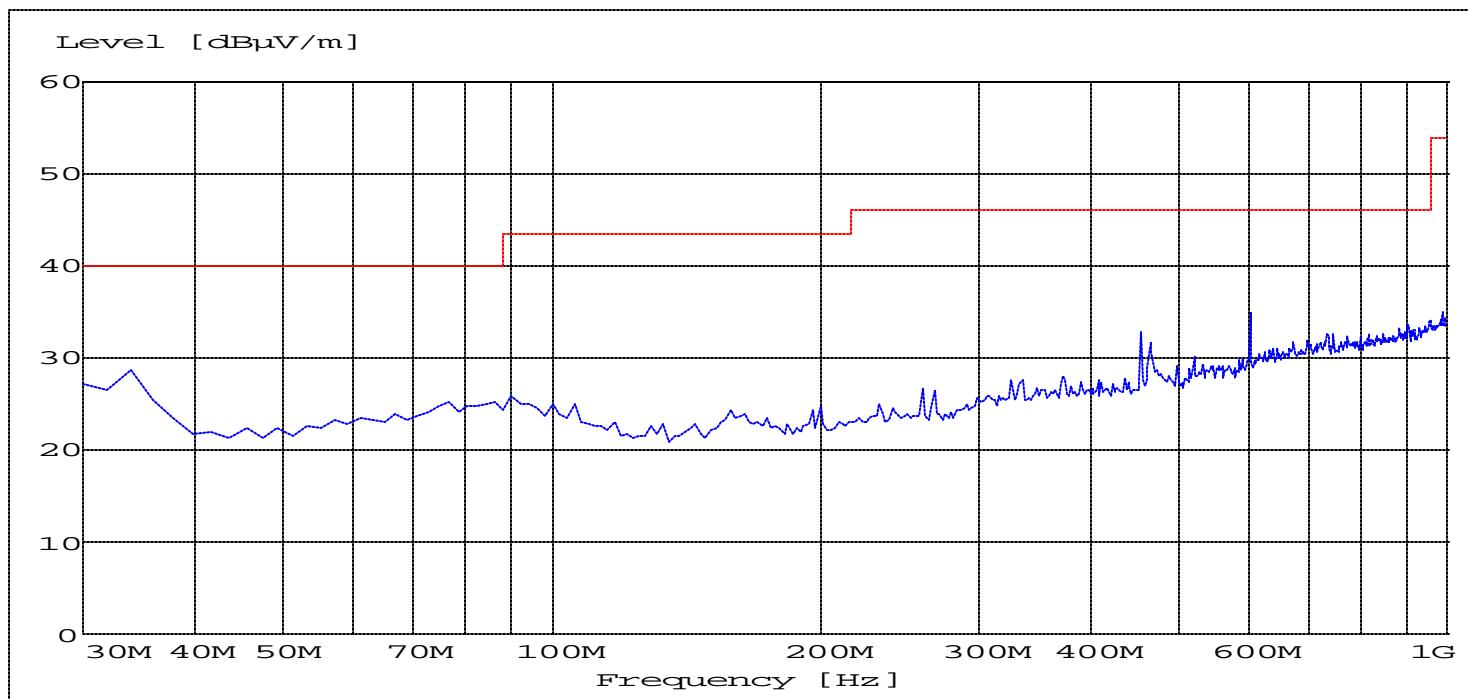
Mid Channel(2441MHz): 30MHz – 1GHz

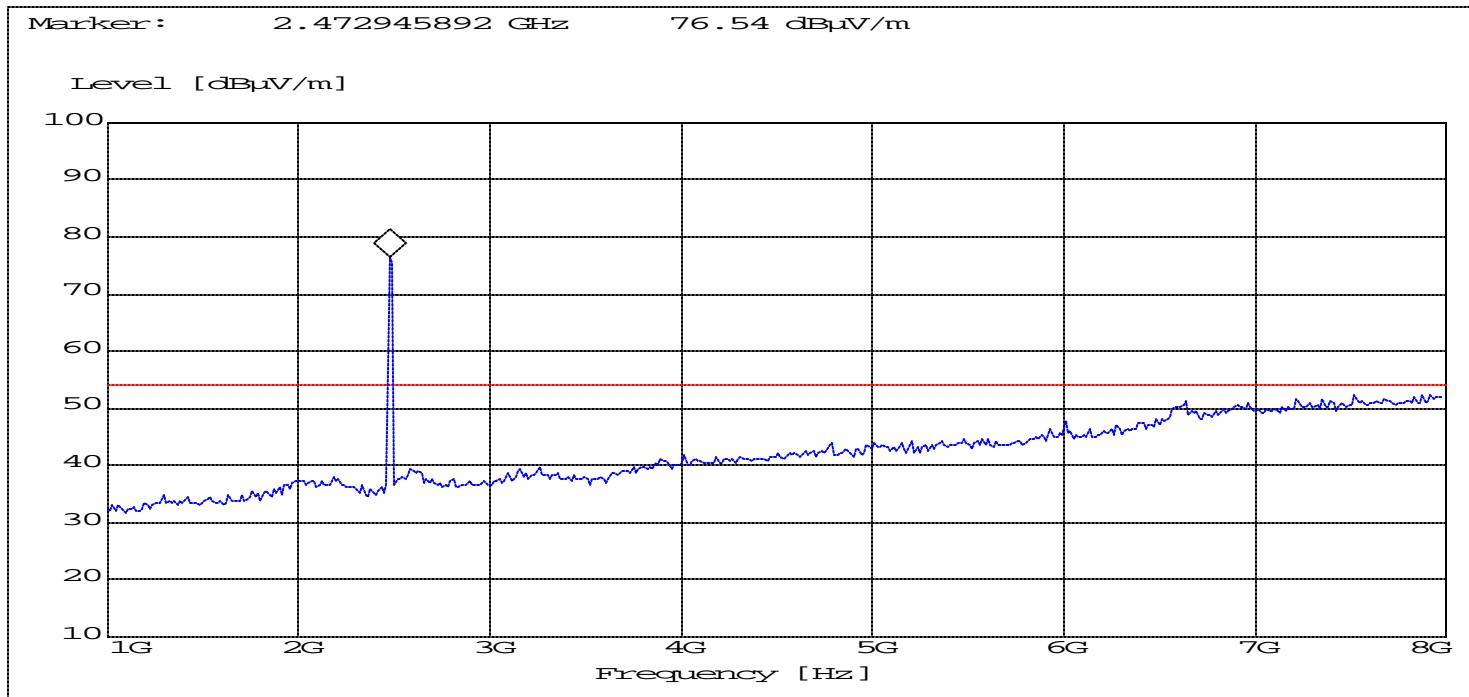


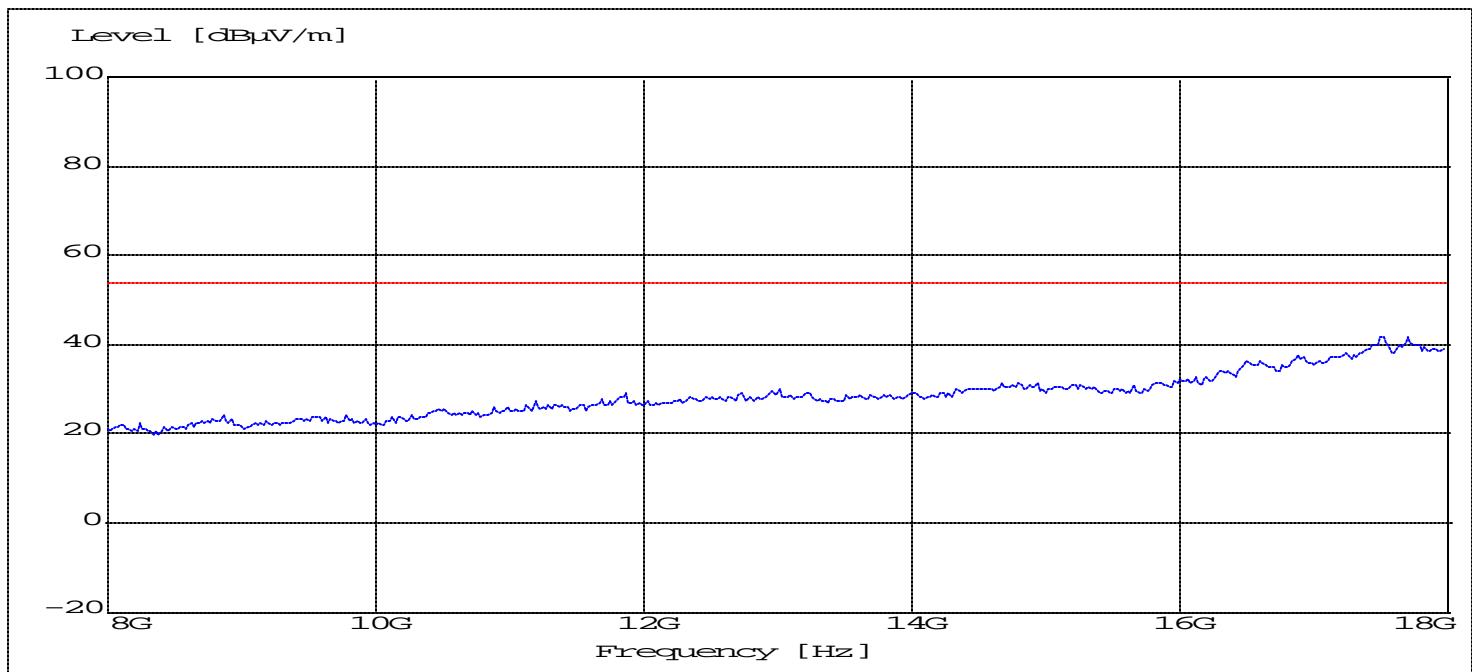
ANALYZER SETTINGS: RBW = 100KHz

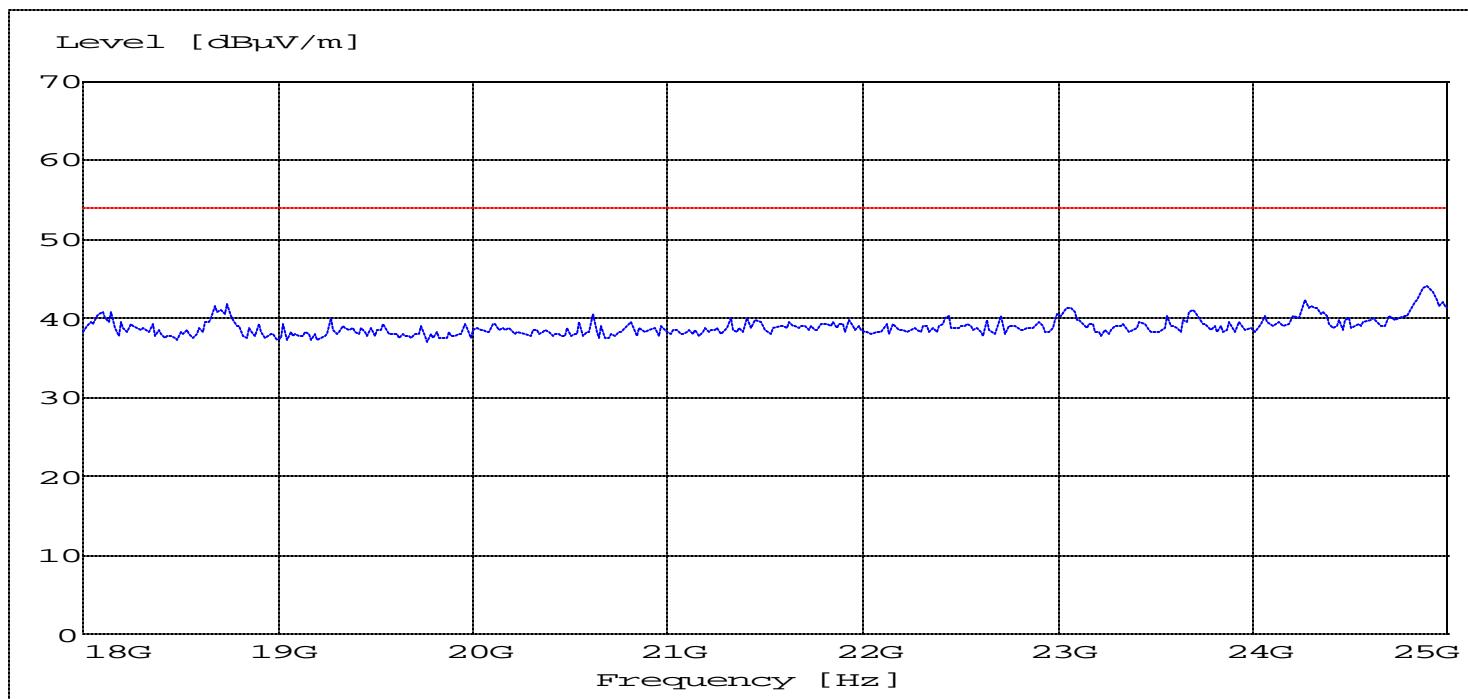
VBW = 100KHz

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****Mid Channel(2441MHz): 1GHz – 8GHz****NOTE: The peak above the limit is the carrier frequency.****ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz**

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****Highest Channel(2480MHz): 30MHz – 1GHz****ANALYZER SETTINGS: RBW = 100KH VBW = 100KHz**

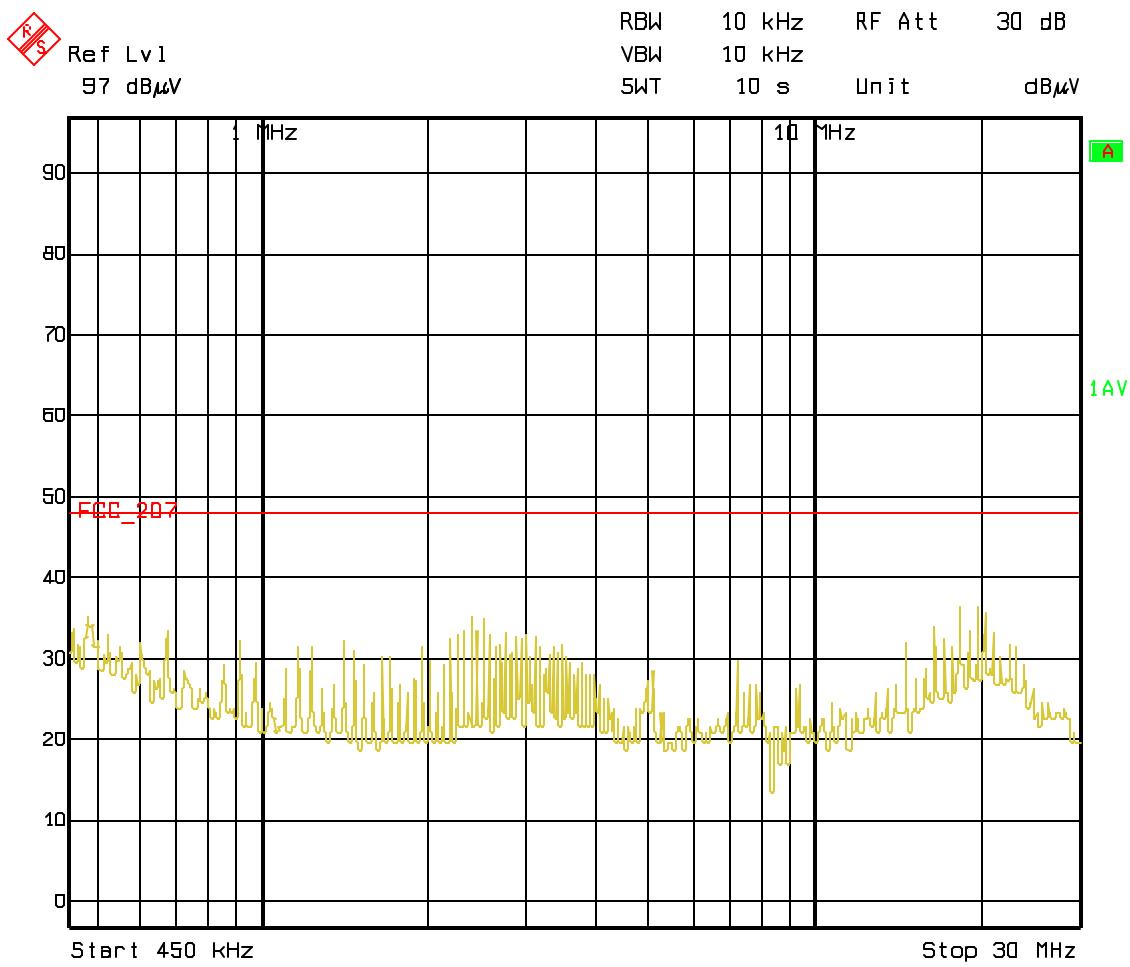
**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****Highest Channel: 1GHz – 8GHz****NOTE: The peak above the limit is the carrier frequency.****ANALYZER SETTINGS: RBW = 1MHz****VBW = 1MHz**

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****8GHz – 18GHz****(This plot is valid for all three channels)****ANALYZER SETTINGS: RBW = 1MHz****VBW = 1MHz**

**EMISSION LIMITATIONS - Radiated (Transmitter)****SUBCLAUSE § 15.247 (c) (1)****18GHz – 25GHz****(This plot is valid for all three channels)****ANALYZER SETTINGS: RBW = 1MHz****VBW = 1MHz**

**CONDUCTED EMISSIONS****§ 15.107/207**

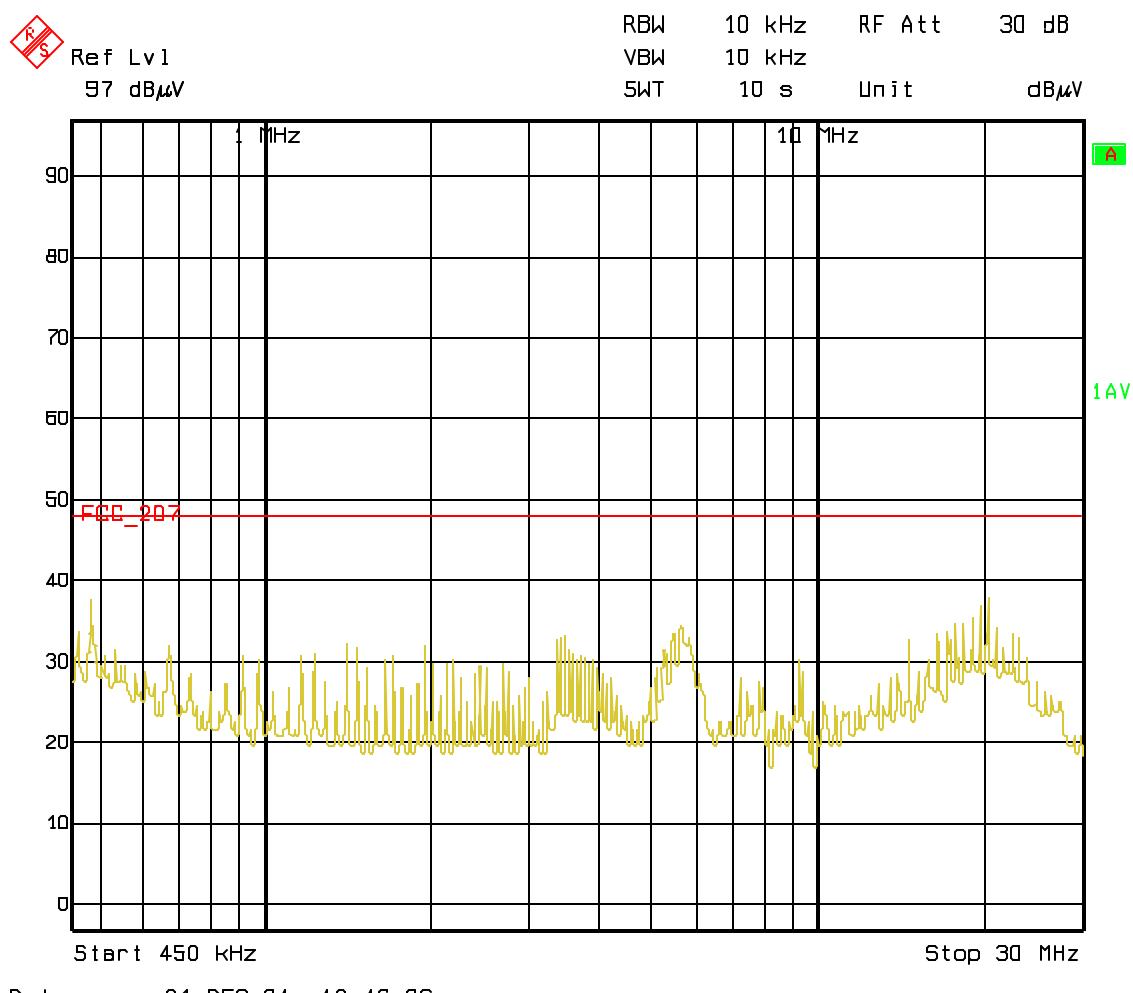
Measured with AC/DC power adapter

**Phase: Line****Technical specification: 15.107 / 15.207 (Revised as of October 1, 1991)****Limit**

0.45 to 30 MHz

250  $\mu$ V / 47.96dB $\mu$ V

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

**Phase: Neutral****Technical specification: 15.107 / 15.207 (Revised as of October 1, 1991)****Limit**

0.45 to 30 MHz	250 $\mu$ V / 47.96dB $\mu$ V
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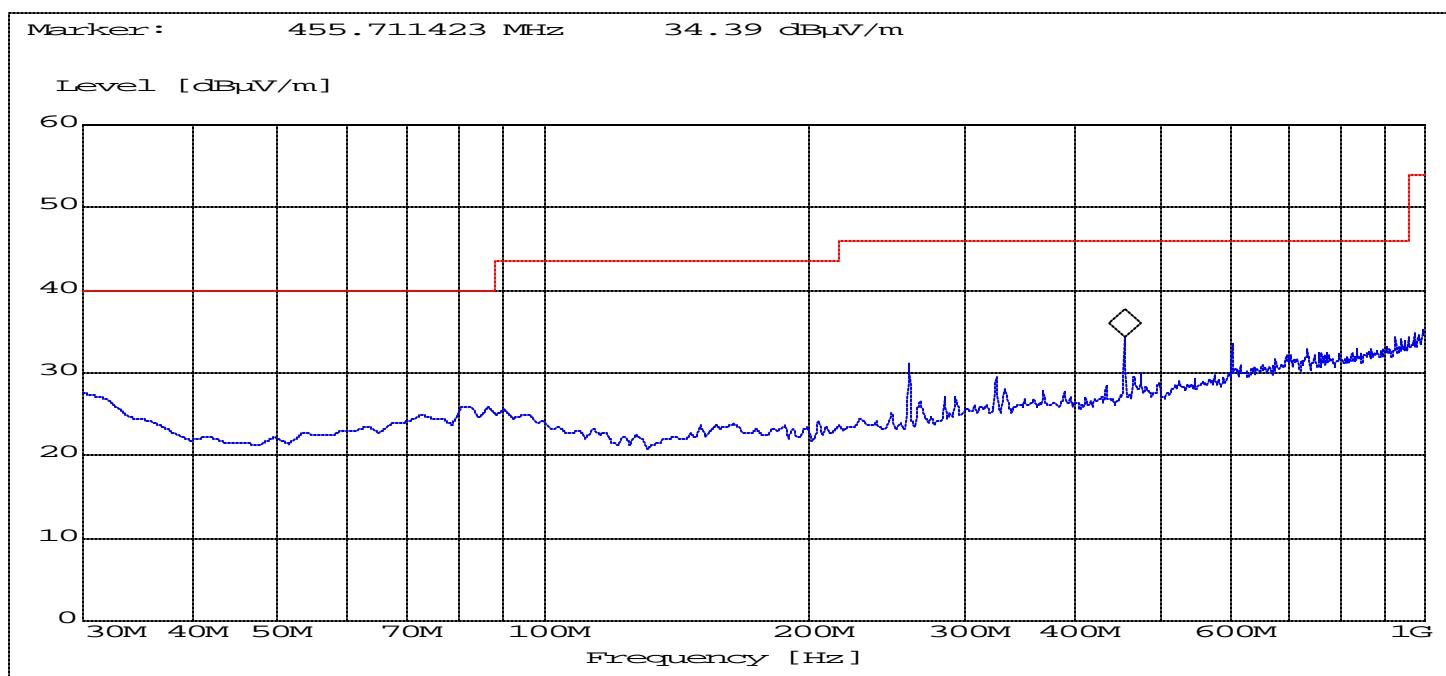
ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

**RECEIVER SPURIOUS RADIATION****§ 15.209****Limits**

Frequency (MHz)	Field strength ( $\mu$ 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	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

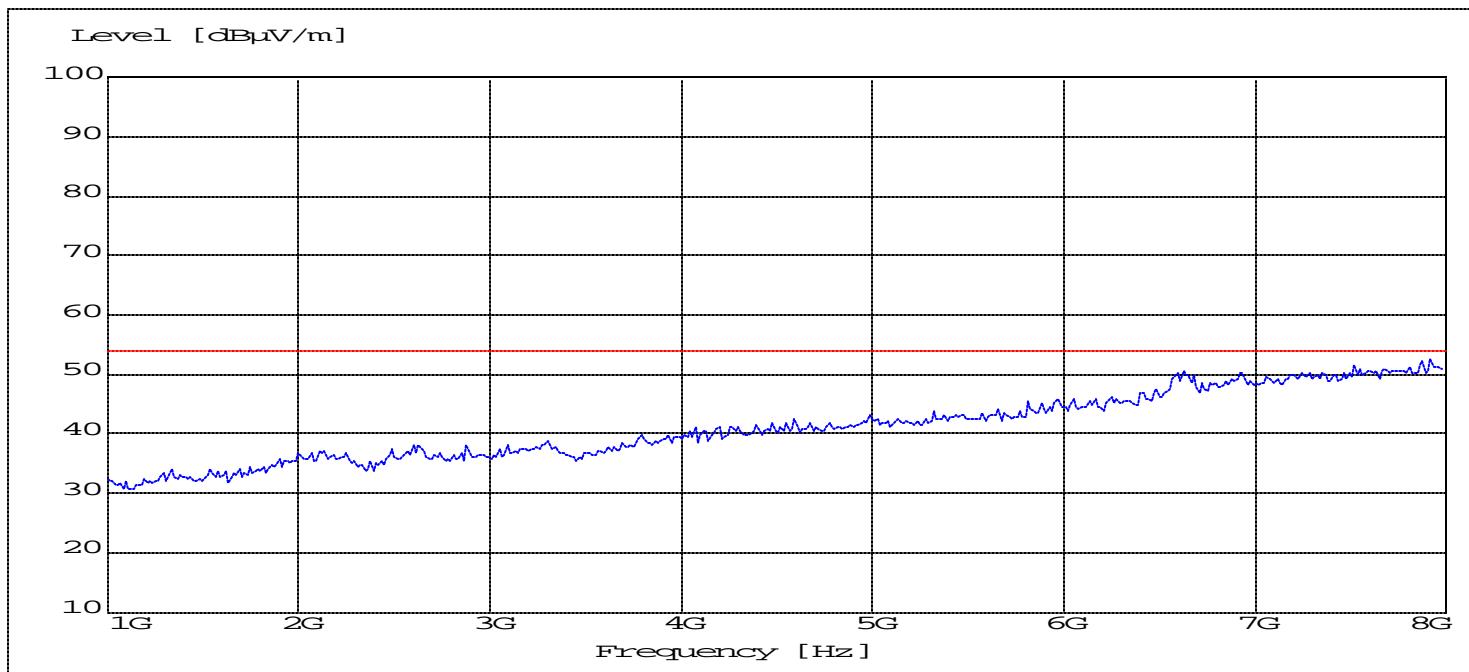
**NOTE:**

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 18 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. Measurements were done on low, mid & high channels, but plots depicting the worst case are submitted in the test report.

**RECEIVER SPURIOUS RADIATION****§ 15.209****30MHz – 1GHz****(This plot is valid for all three channels)****ANALYZER SETTINGS: RBW = 100KHz****VBW = 100KHz**

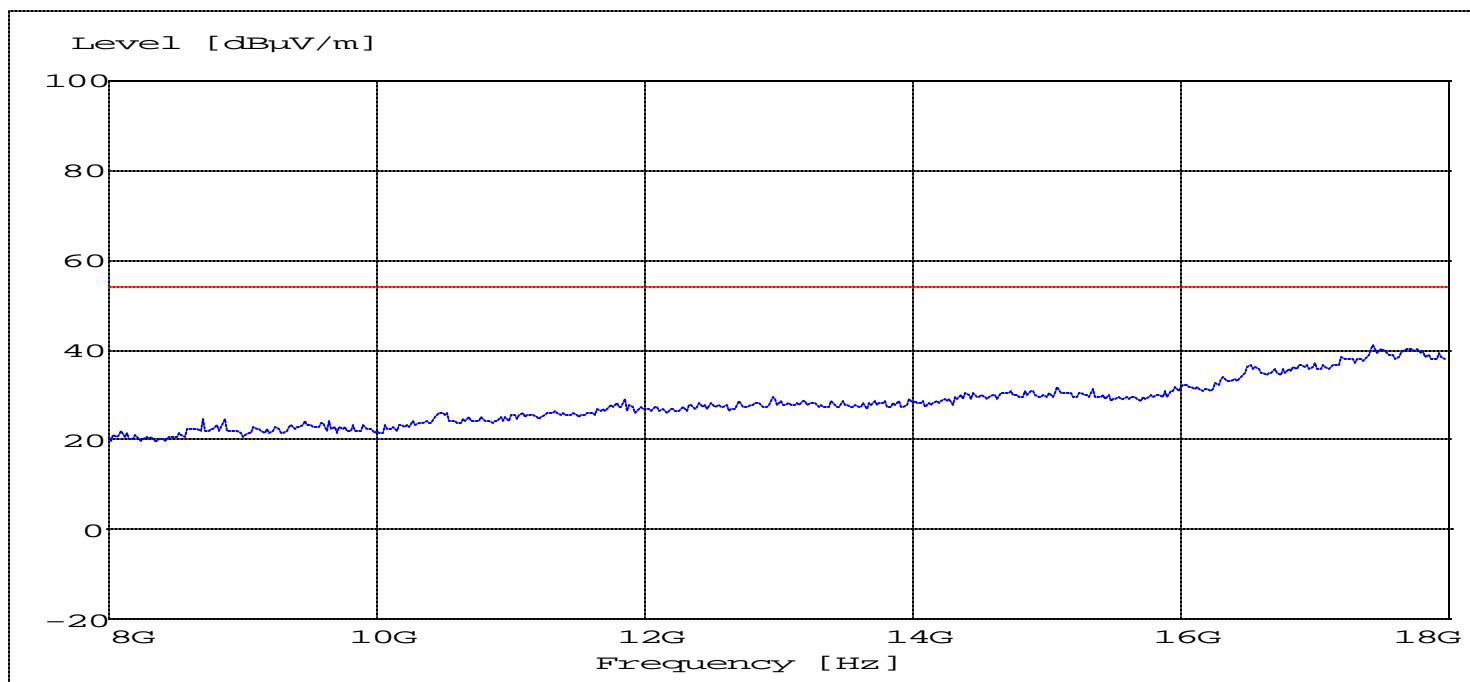
**RECEIVER SPURIOUS RADIATION****§ 15.209****1GHz – 8GHz**

(This plot is valid for all three channels)

**ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz**

**RECEIVER SPURIOUS RADIATION****§ 15.209****8GHz – 18GHz**

(This plot is valid for all three channels)

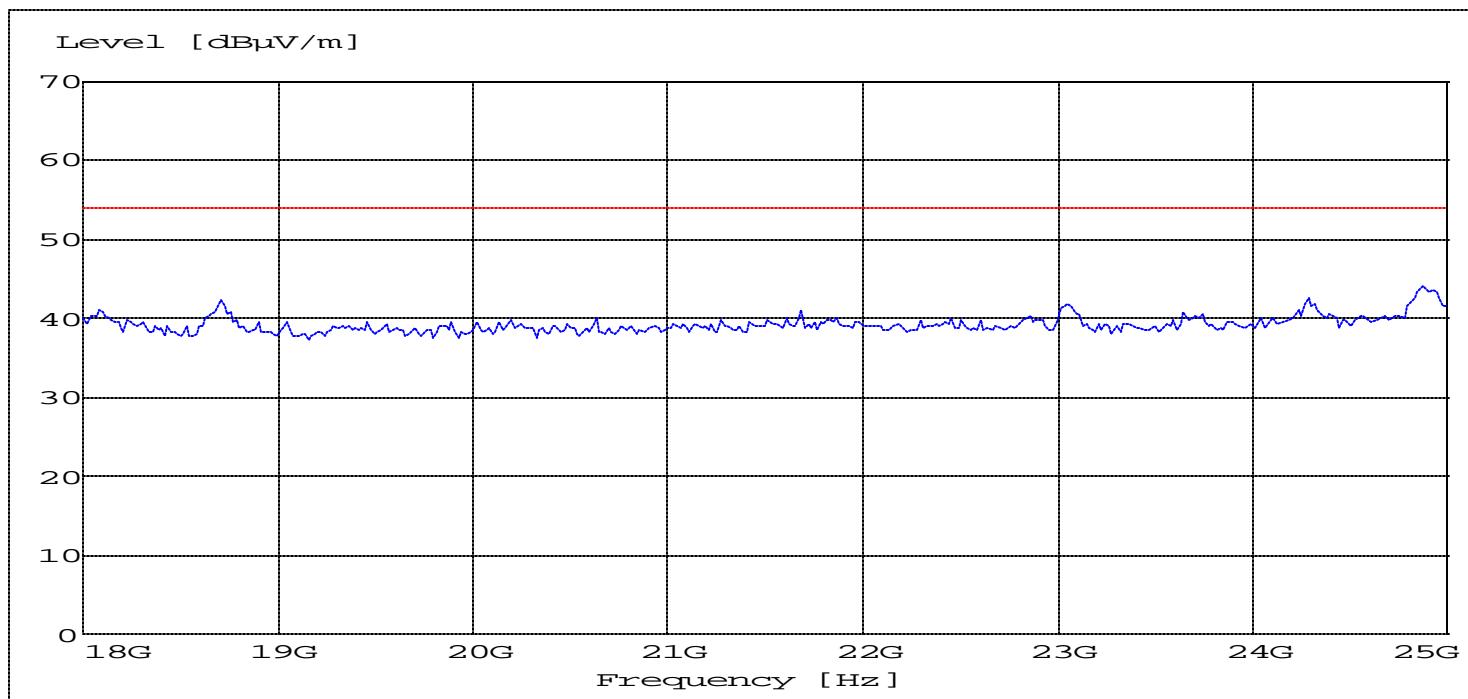


ANALYZER SETTINGS: RBW = 1MHz

VBW = 1MHz

**RECEIVER SPURIOUS RADIATION****§ 15.209****18GHz – 25GHz**

(This plot is valid for all three channels)

**ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz**

## TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS