

CETECOM Inc.



CETECOM Inc.

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Issued test report consists of 33 Pages

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**FCC LISTED, REG. NO.: 101450
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IC – 3925**

**Test report no.: EMC_381EN328_2002
ETSI EN 300 328 V1.4.1 (2002-11)
ETSI EN 300 328-2 V1.2.1 (2001-12)
(BCM94306CB)**

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- 1 General information**
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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 Engineer: Harpreet Sidhu

1.2 Testing laboratory

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E-mail: lothar.schmidt@cetecomusa.com

Internet: www.cetecom.com

1.3 Details of applicant

Name : **Broadcom corporation**
Street : **190 Mathilda Place**
City / Zip Code : **Sunnyvale, 94086**
Country : **USA**
Contact : **Chris McGough**
Telephone : **408-922-5810**
Tele-fax : **408-543-3399**
e-mail : cmcgough@broadcom.com

1.4 Application details

Date of receipt of application : 2002-12-16
Date of receipt test item : 2002-11-21
Date of test : 2002-12-06/13 and 2003-01-02

1.5 Test item

Manufacturer : See Applicant
Model No. : BCM94306CB
Description : [54g Wireless Lan cardbus PC card](#)

Additional information

Frequency : 2412MHz – 2472MHz
Type of modulation : DSSS / OFDM (orthogonal frequency division multiplexing)
Number of channels : 13
Antenna : 1dBi antenna
Power supply : From Host
Output power : 16.09dBm (40.64mW) max. EIRP
Extreme temp. Tolerance : 0 to +70°C

1.6 Test standards: ETSI EN 300 328 V1.4.1 (2002-11)
ETSI EN 300 328-2 V1.2.1 (2001-12)


Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.

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	
Final Verdict: (only "passed" if all single measurements are "passed")	Passed

Technical responsibility for area of testing:

2003-01-10	EMC & Radio	Lothar Schmidt (Manager)	
Date	Section	Name	Signature

Responsible for test report and project leader:

2003-01-10	EMC & Radio	Harpreet Sidhu (EMC Engineer)	
Date	Section	Name	Signature

2.2 Test report

TEST REPORT

**Test report no. : EMC_381EN328_2002
(BCM94306CB)**

TEST REPORT REFERENCE

LIST OF MEASUREMENTS		PAGE
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Note: The clause numbers are referenced to ETSI EN 300 328 V1.4.1 (2002-11)

EFFECTIVE ISOTROPIC RADIATED POWER

CLAUSE 5.2.1

EIRP is calculated by method described under sub clause 7.2.1.2, using following formulae;

$P = A + G + 10 \log (1/x);$

Where;

A = Average power (measured)

Freq.(MHz)	Average Power measured using wide band Power meter (dBm)
2412	13.9
2442	14.4
2472	14.4

G = Antenna gain = 1dBi (Provided by Broadcom)

x = Duty cycle = 0.945 (measured)

$x = T_{X_{on}} / T_{X_{on}} + T_{X_{off}}$	
$T_{X_{on}}$	2.08msec
$T_{X_{on}} + T_{X_{off}}$	2.2msec
x	0.945
$10\log(1/x)$	0.24

Worst case variance (deltas) at extreme temperatures from nominal power measured at 23°C (Provided by Broadcom)

Freq.(MHz)	Delta in dB @ 0°C	Delta in dB @ +70°C
2412	+0.01	+0.27
2442	+0.45	+0.29
2472	+0.21	+0.07

EFFECTIVE ISOTROPIC RADIATED POWER

CLAUSE 5.2.1

TEST CONDITIONS		TRANSMITTER POWER (dBm) EIRP					
		Low frequency 2412MHz		Mid frequency 2442MHz		High frequency 2472MHz	
$T_{nom}(23)^{\circ}C$	$V_{nom}(3.3)$	Pk	15.14	Pk	15.64	Pk	15.64
$T_{min}(0)^{\circ}C$	$V_{nom}(3.3)$	Pk	15.15	Pk	16.09	Pk	15.85
$T_{max}(+70)^{\circ}C$	$V_{nom}(3.3)$	Pk	15.41	Pk	15.93	Pk	15.71

Av – Average power during Burst

LIMITS:

CLAUSE 5.2.1

Under all test conditions	$\leq 20dBm / -10dBW / 100mW$
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PEAK POWER DENSITY
For DSSS Systems

CLAUSE 5.2.2

TEST CONDITIONS		Peak Power Density (dBm/MHz)		
		Low frequency 2412MHz	Mid frequency 2442MHz	High frequency 2472MHz
$T_{nom}(23)^{\circ}C$	$V_{nom}(3.3)$	8.04	9.35	8.22

Under normal test conditions only	$\leq -20dBW/MHz$ (10dBm/MHz)
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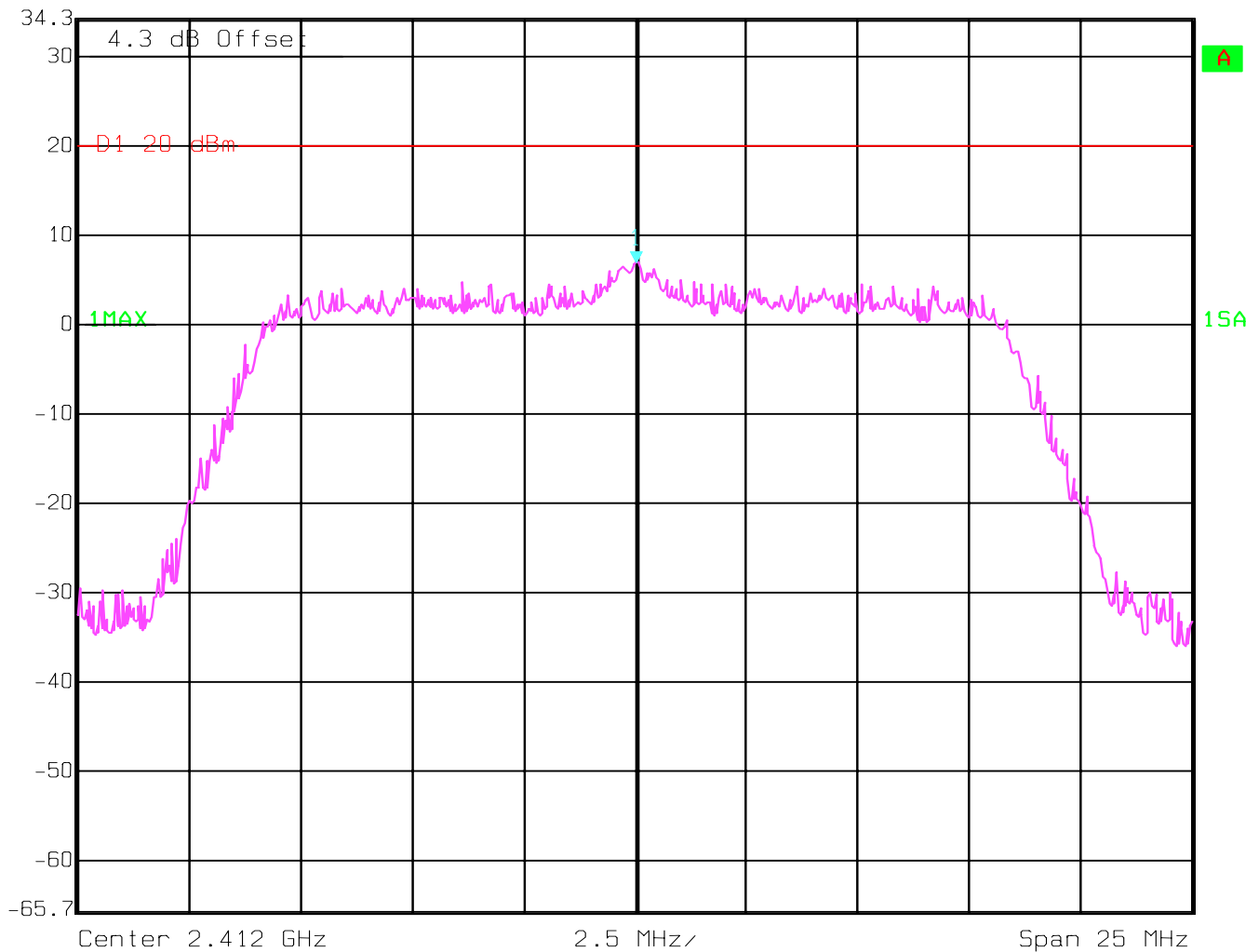
PEAK POWER DENSITY

CLAUSE 5.2.2

Lowest Channel: 2412MHz

Notes: -51.96 dBm/Hz is added with 60dB to compensate for the dBm/MHz, therefore 8.04dBm/MHz.

	Marker 1 [T1 NO1]	RBW	1 MHz	RF Att	40 dB
	Ref Lvl	-51.96 dBm/Hz	VBW	1 MHz	
	34.3 dBm	2.41202505 GHz	SWT	5 ms	Unit dBm



Date: 13.DEC.2002 06:09:32

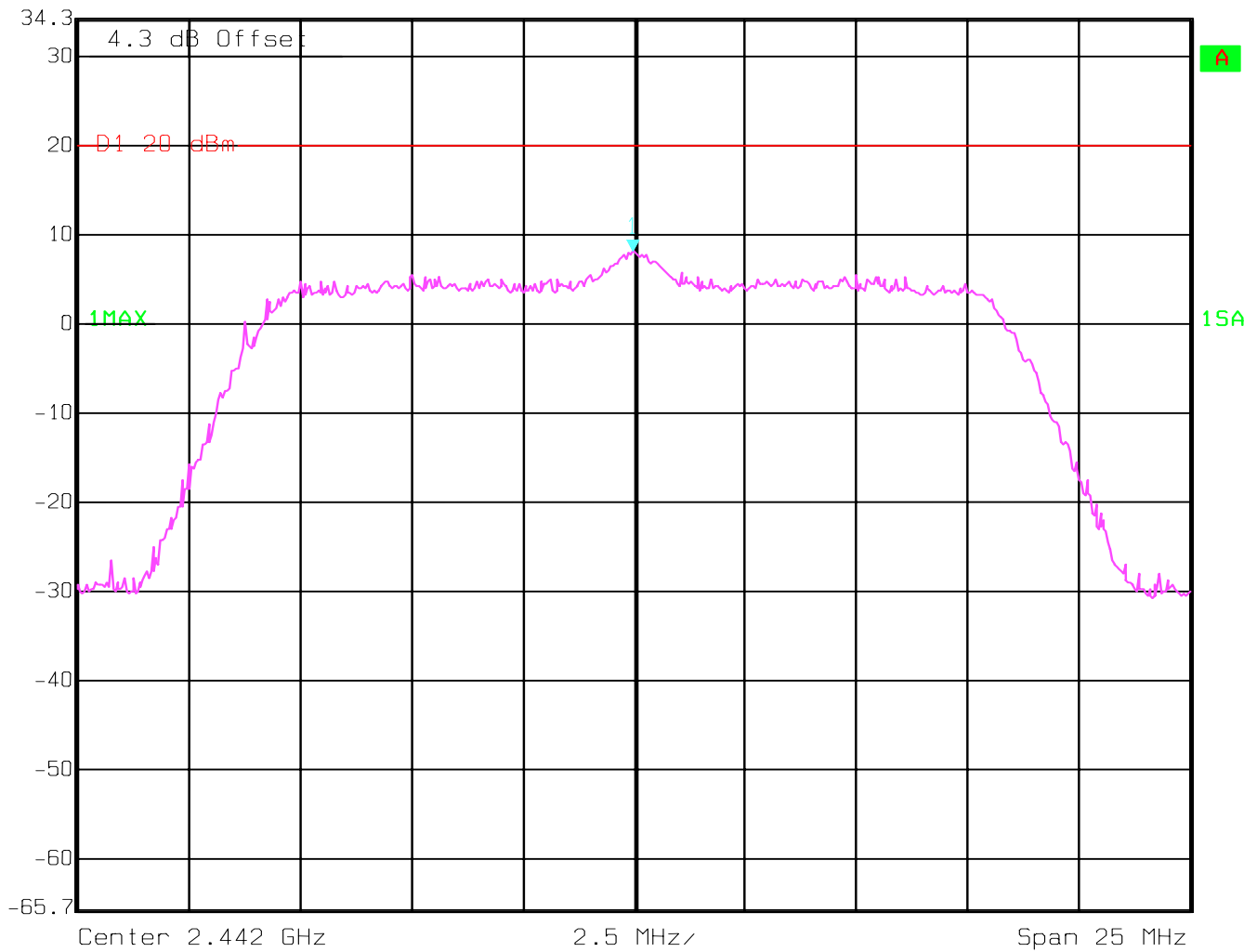
PEAK POWER DENSITY

CLAUSE 5.2.2

Mid Channel: 2442MHz

Notes: -50.57 dBm/Hz is added with 60dB to compensate for the dBm/MHz, therefore 9.35dBm/MHz.

	Marker 1 [T1 NO1]	RBW	1 MHz	RF Att	40 dB
	Ref Lvl	-50.57 dBm/Hz	VBW	1 MHz	
	34.3 dBm	2.44197495 GHz	SWT	5 ms	Unit dBm



Date: 13.DEC.2002 06:08:30

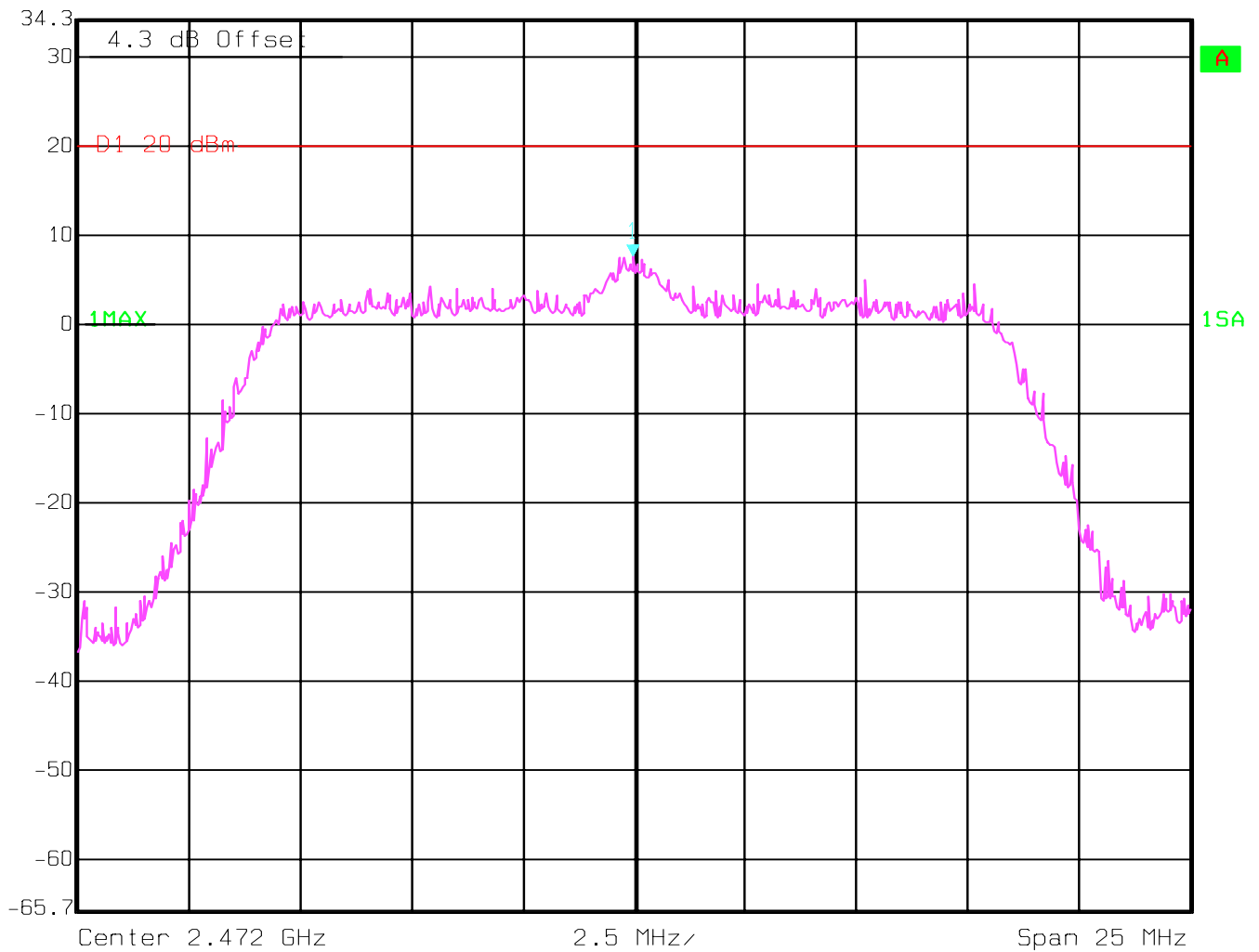
PEAK POWER DENSITY

CLAUSE 5.2.2

Highest Channel: 2472MHz

Notes: -51.78 dBm/Hz is added with 60dB to compensate for the dBm/MHz, therefore 8.22dBm/MHz.

	Ref Lvl	Marker 1 [T1 NOI]	RBW	1 MHz	RF Att	40 dB
	34.3 dBm	-51.78 dBm/Hz	VBW	1 MHz		
		2.47197495 GHz	SWT	5 ms	Unit	dBm



Date: 13.DEC.2002 06:10:45

FREQUENCY RANGE
For DSSS Systems

CLAUSE 5.2.3

TEST CONDITIONS		FREQUENCY (MHz) at which -80dBm/Hz occurs	
		Low Frequency (f_L) 2412 MHz	High Frequency (f_H) 2472MHz
$T_{nom}(23)^{\circ}C$	$V_{nom}(3.3)$	2403MHz	2481MHz
$T_{min}(0)^{\circ}C$	$V_{nom}(3.3)$	2404MHz	2480MHz
$T_{max}(+70)^{\circ}C$	$V_{nom}(3.3)$	2402MHz	2482MHz

LIMITS

CLAUSE 5.2.3

Under all test conditions	$f_L > 2400 \text{ MHz}$	$f_H < 2483.5 \text{ MHz}$
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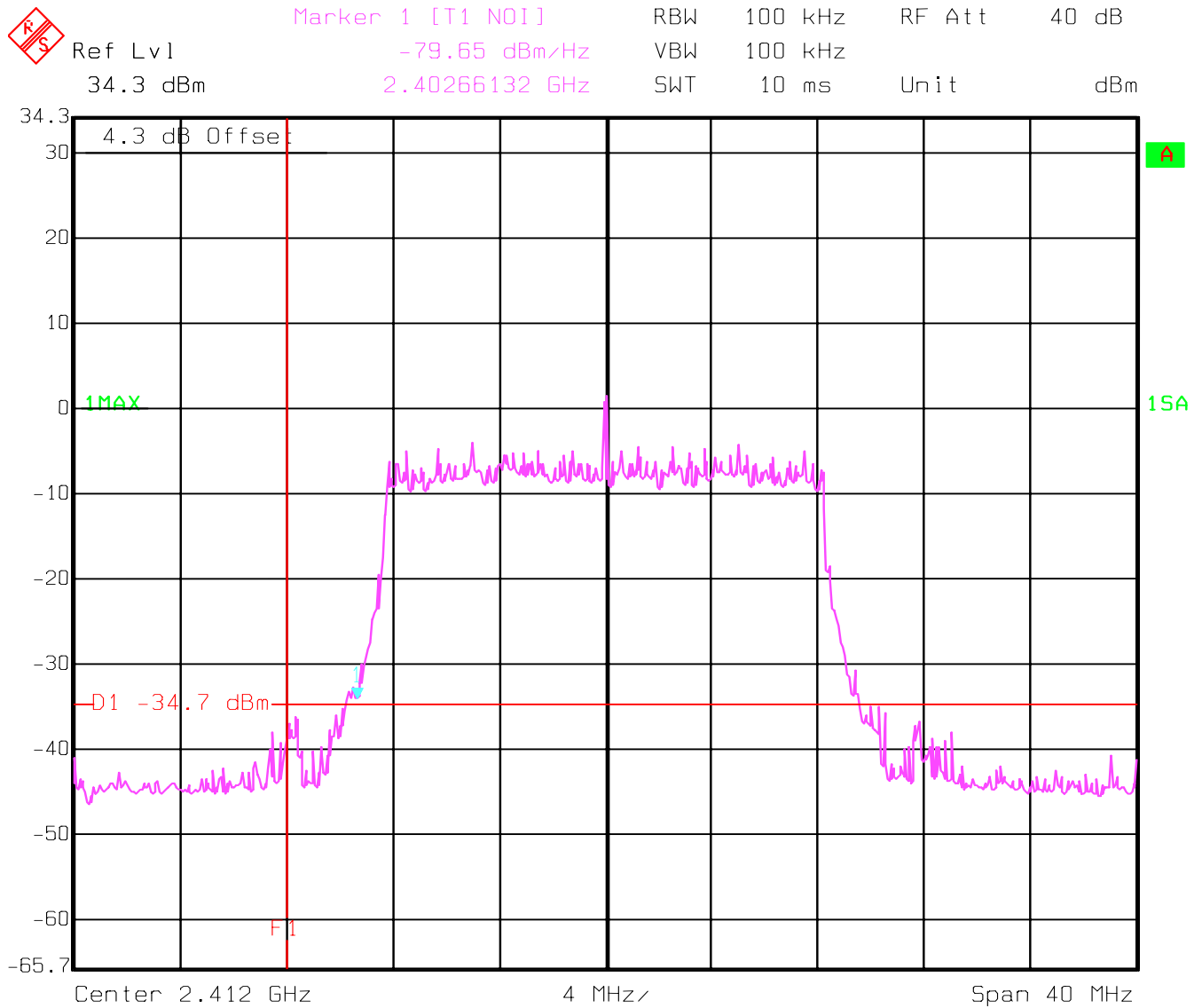
FREQUENCY RANGE

CLAUSE 5.2.3

Lowest Channel: 2412MHz

Temp.:23 C

Voltage:3.3Vdc



Date: 13.DEC.2002 06:33:25

FREQUENCY RANGE

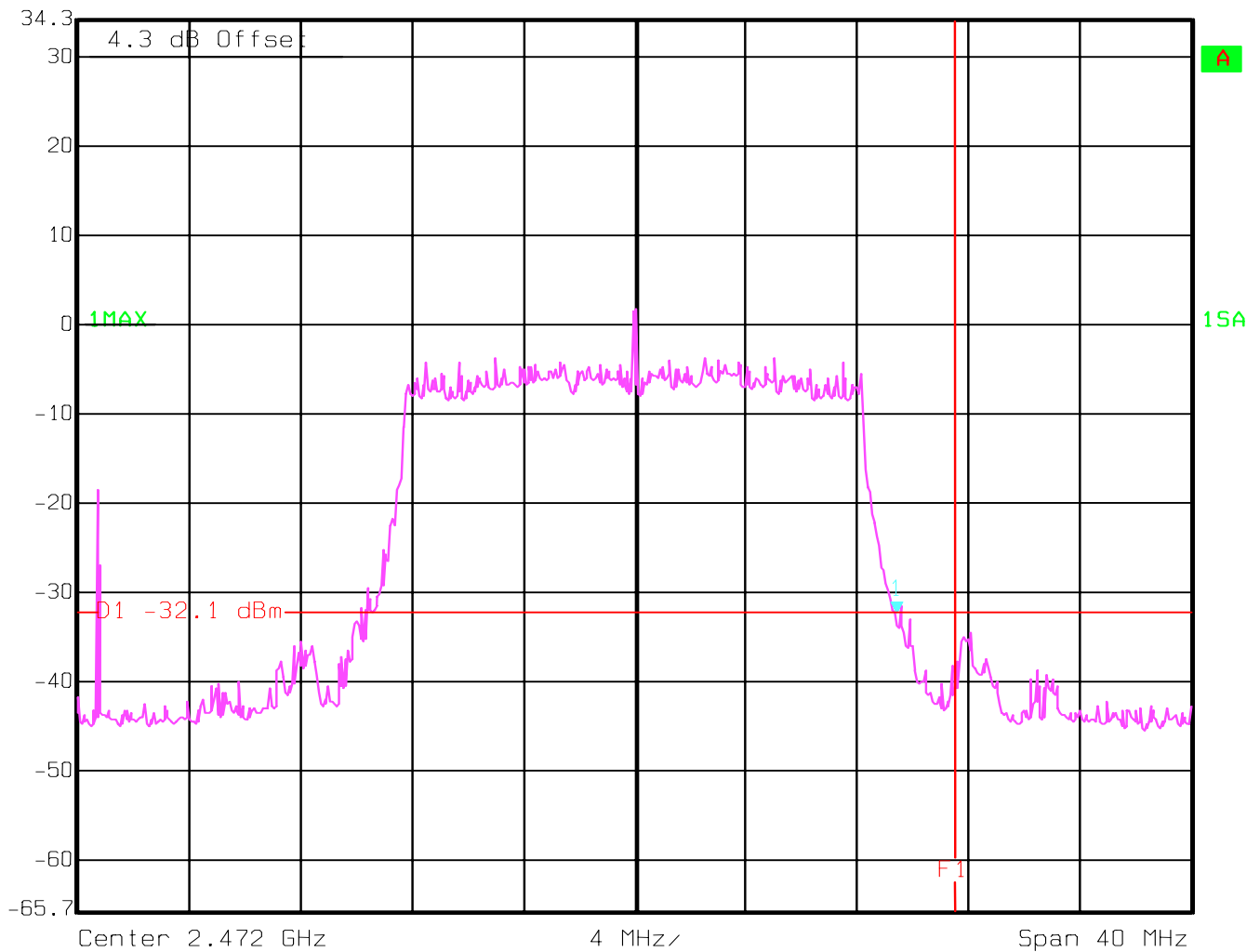
CLAUSE 5.2.3

Highest Channel: 2472MHz

Temp.:23 C

Voltage:3.3Vdc

 Marker 1 [T1 NOI] RBW 100 kHz RF Att 40 dB
Ref Lvl -79.54 dBm/Hz VBW 100 kHz
34.3 dBm 2.48141884 GHz SWT 10 ms Unit dBm



Date: 13.DEC.2002 06:31:54

SPURIOUS EMISSIONS

CLAUSE 5.2.4

(Radiated)

Transmitter operating

NOTE:

1. Measurements were done on low & high channels, but plots depicting the worst case are submitted in the test report.
2. The spurious 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.

Lowest Frequency			Highest Frequency		
f (MHz)	Bandwidth (kHz)	Level (dBm)	f (MHz)	Bandwidth (kHz)	Level (dBm)
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
NF			NF		
Measurement uncertainty		± 6 dB			

Note: NF = No Significant Peak was found.

LIMITS

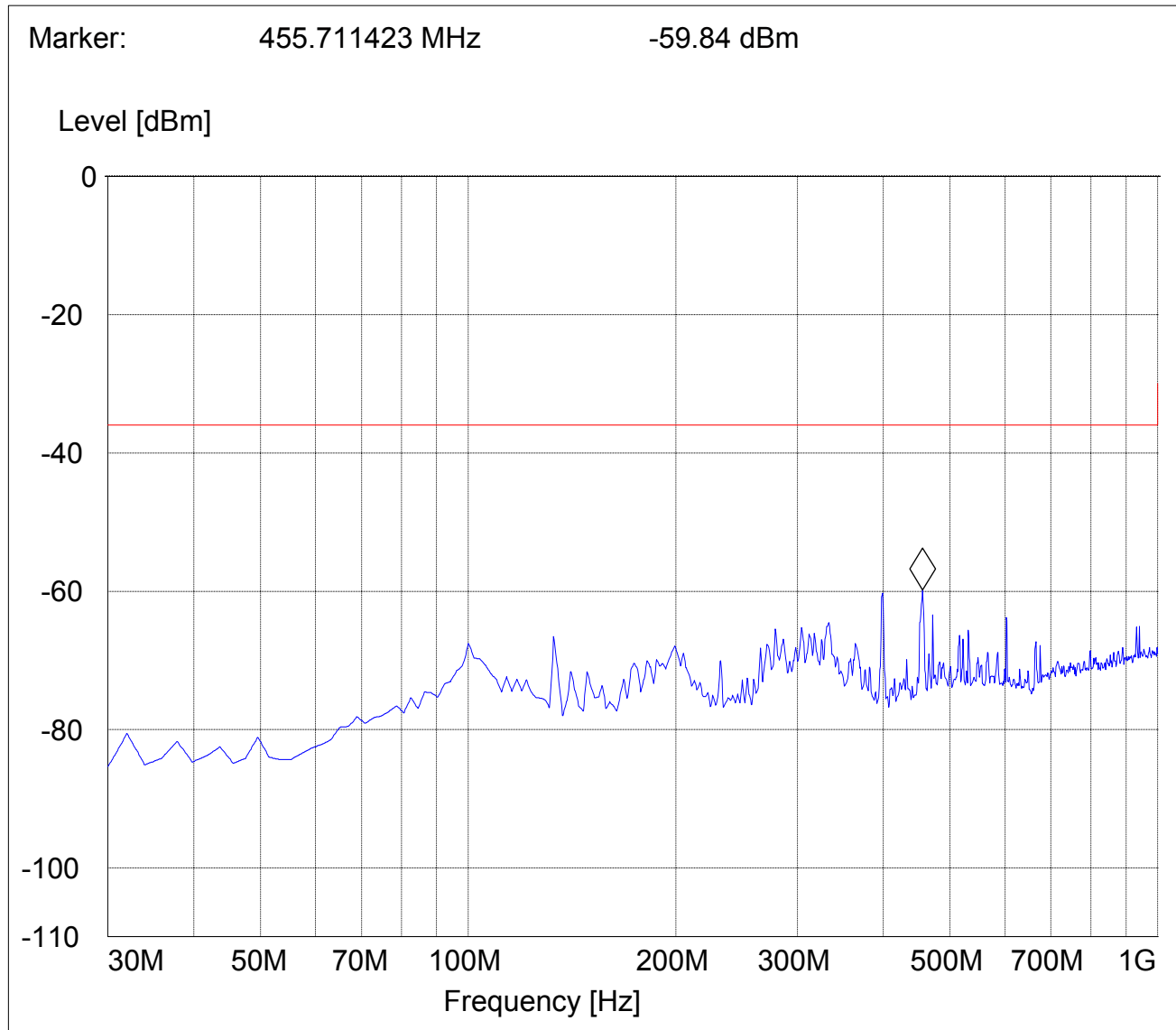
Clause 5.2.4

Frequency Range	Narrowband spurious emissions		Wideband spurious emissions	
	Limit when operating	Limit when in standby	Limit when operating	Limit when in standby
30 MHz - 1 GHz	-36 dBm	-57 dBm	-86 dBm/Hz	-107 dBm/Hz
above 1 GHz - 12,75 GHz	-30 dBm	-47 dBm	-80 dBm/Hz	-97 dBm/Hz
1,8 - 1,9 GHz 5,15 - 5,3 GHz	-47 dBm	-47 dBm	-97 dBm/Hz	-97 dBm/Hz

SPURIOUS EMISSIONS

CLAUSE 5.2.4

Transmitter operating @ lowest frequency (2412MHz)
30MHz – 1GHz

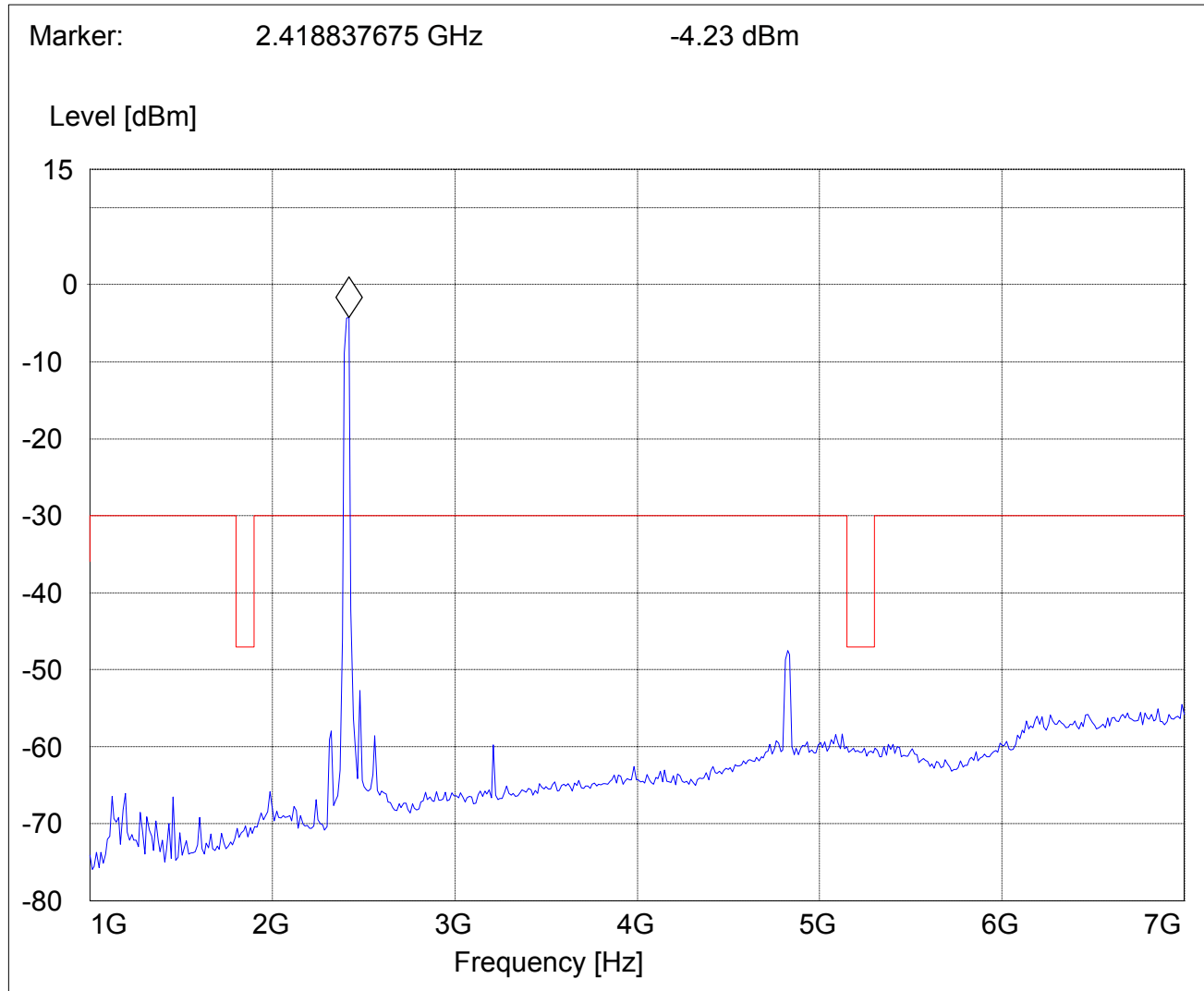


SPURIOUS EMISSIONS

CLAUSE 5.2.4

Transmitter operating @ lowest frequency (2412MHz)
1GHz – 7GHz

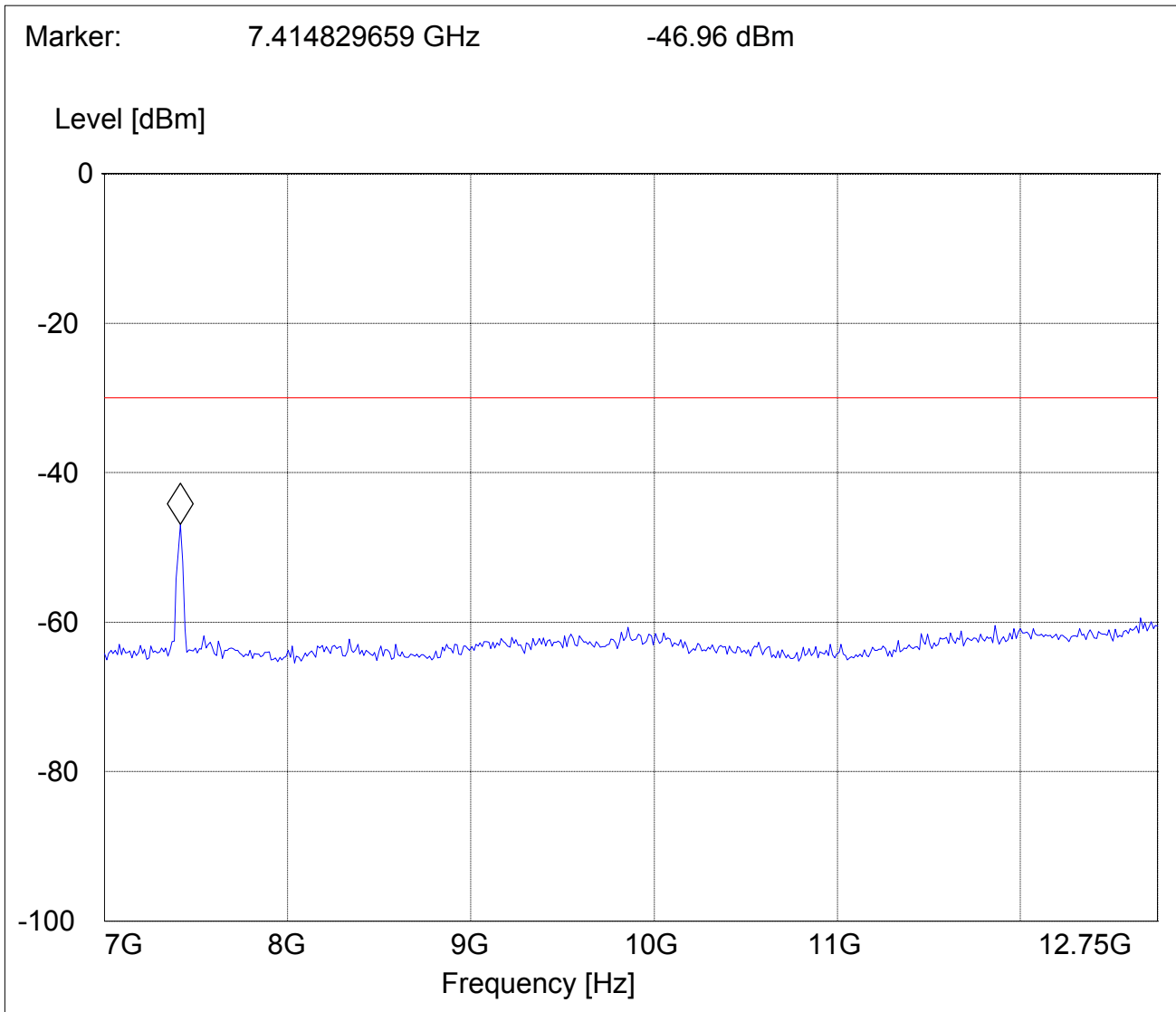
Notes: Marked frequency is the carrier @ 2412MHz.



SPURIOUS EMISSIONS

CLAUSE 5.2.4

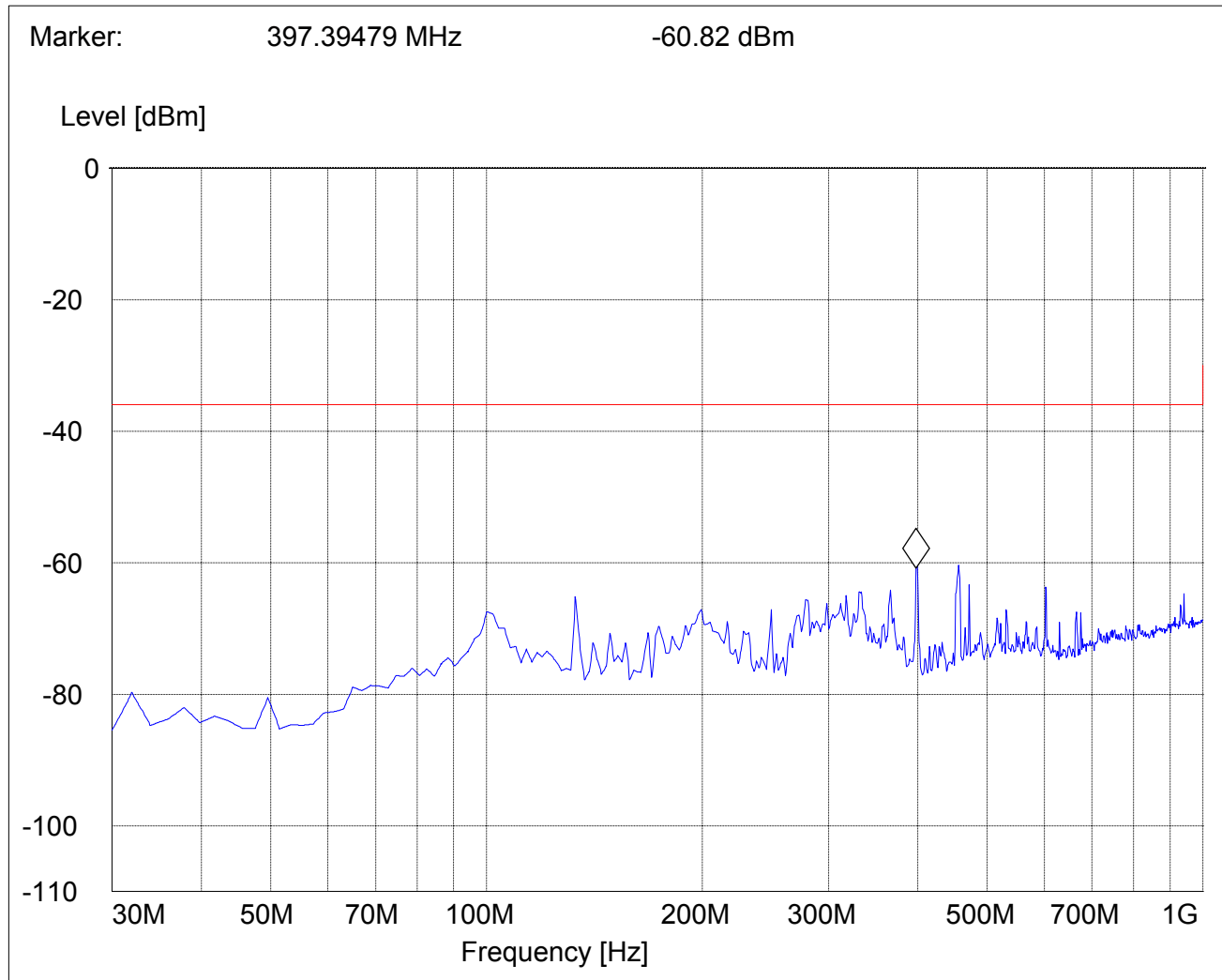
Transmitter operating @ lowest frequency (2412MHz)
7GHz – 12.75GHz



SPURIOUS EMISSIONS

CLAUSE 5.2.4

Transmitter operating @ highest frequency (2472MHz)
30MHz-1GHz

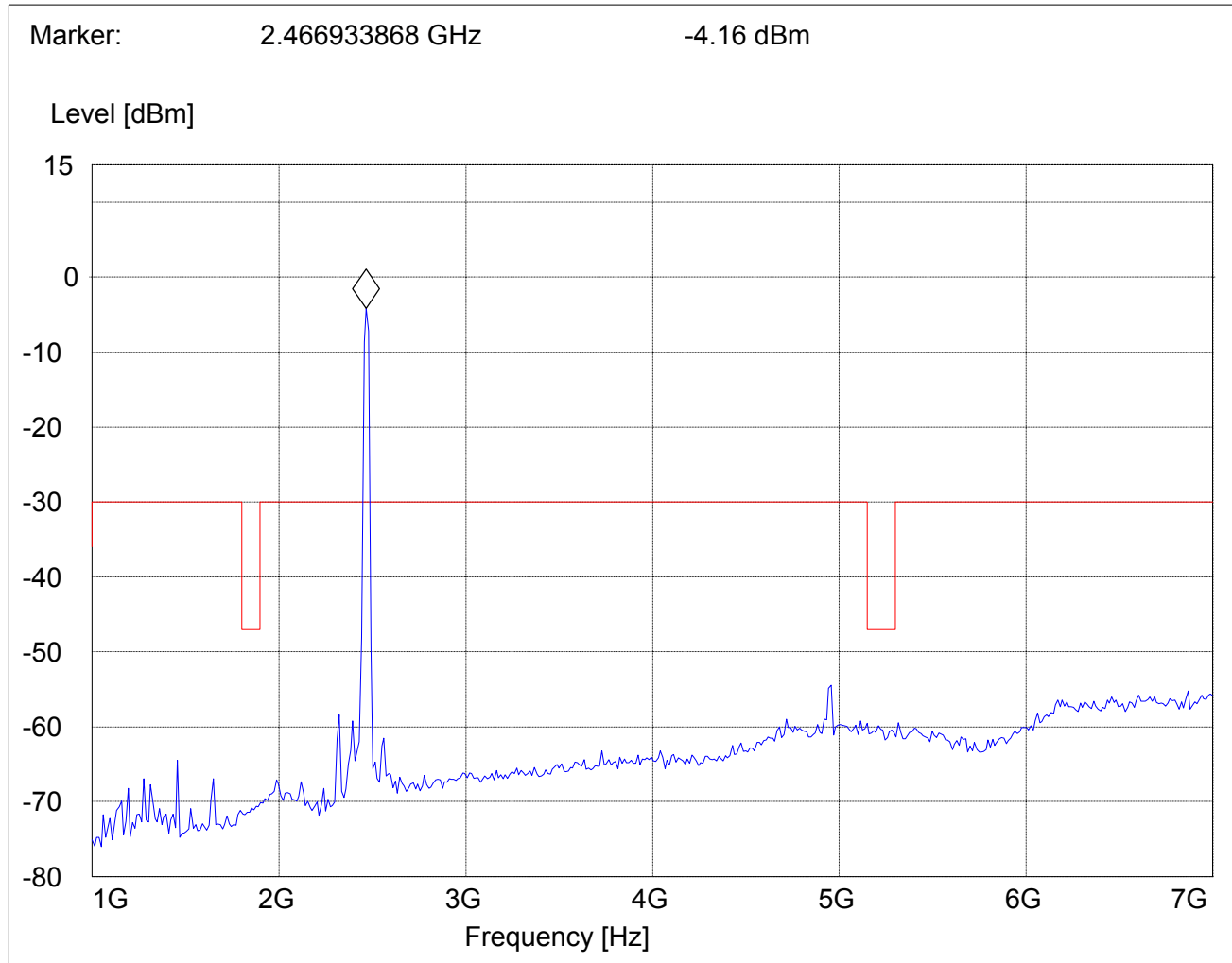


SPURIOUS EMISSIONS

CLAUSE 5.2.4

Transmitter operating @ highest frequency (2472MHz)
1GHz – 7GHz

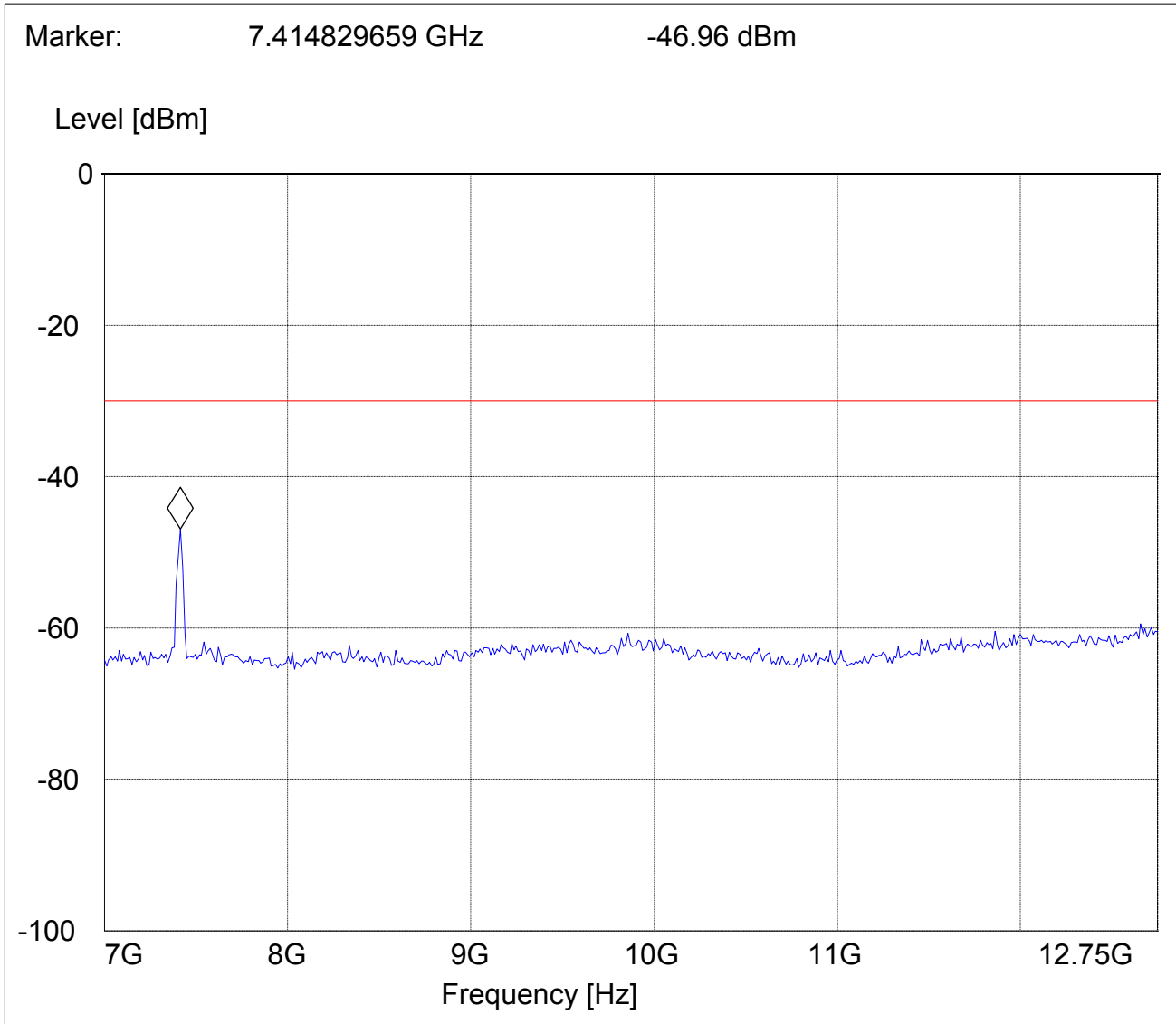
Notes: Marked frequency is the carrier @ 2472MHz.



SPURIOUS EMISSIONS

CLAUSE 5.2.4

Transmitter operating @ highest frequency (2472MHz)
7GHz – 12.75GHz



**SPURIOUS EMISSIONS
(Radiated)
Transmitter Standby**

CLAUSE 5.2.4

NOTE: Plots under section Receiver spurious emissions are valid for this section also.

Lowest Frequency			Highest Frequency		
f (MHz)	Bandwidth (kHz)	Level (dBm)	f (MHz)	Bandwidth (kHz)	Level (dBm)
Measurement uncertainty		± 6 dB			

LIMITS

Clause 5.2.4

Frequency Range	Narrowband spurious emissions		Wideband spurious emissions	
	Limit when operating	Limit when in standby	Limit when operating	Limit when in standby
30 MHz - 1 GHz	-36 dBm	-57 dBm	-86 dBm/Hz	-107 dBm/Hz
above 1 GHz - 12,75 GHz	-30 dBm	-47 dBm	-80 dBm/Hz	-97 dBm/Hz
1,8 - 1,9 GHz 5,15 - 5,3 GHz	-47 dBm	-47 dBm	-97 dBm/Hz	-97 dBm/Hz

**RECEIVER SPURIOUS EMISSIONS
(Radiated)**

CLAUSE 5.3.2

NOTE:

1. Measurements were done on low & high channels, but plots depicting the worst case are submitted in the test report.
2. The receiver spurious 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.

Lowest Frequency			Highest Frequency		
f (MHz)	Band-width (kHz)	Level (dBm)	f (MHz)	Band-width (kHz)	Level (dBm)
455.7	100	-5878			
399.3	100	-59.47			
333.2	100	-62.08-			
325.4	100	-67.83			
292.4	100	-70.30			
197.1	100	-67.99			
133.0	100	-66.19			
603.4	100	-64.15			
665.7	100	-67.88			
Measurement uncertainty		± 6 dB			

LIMITS

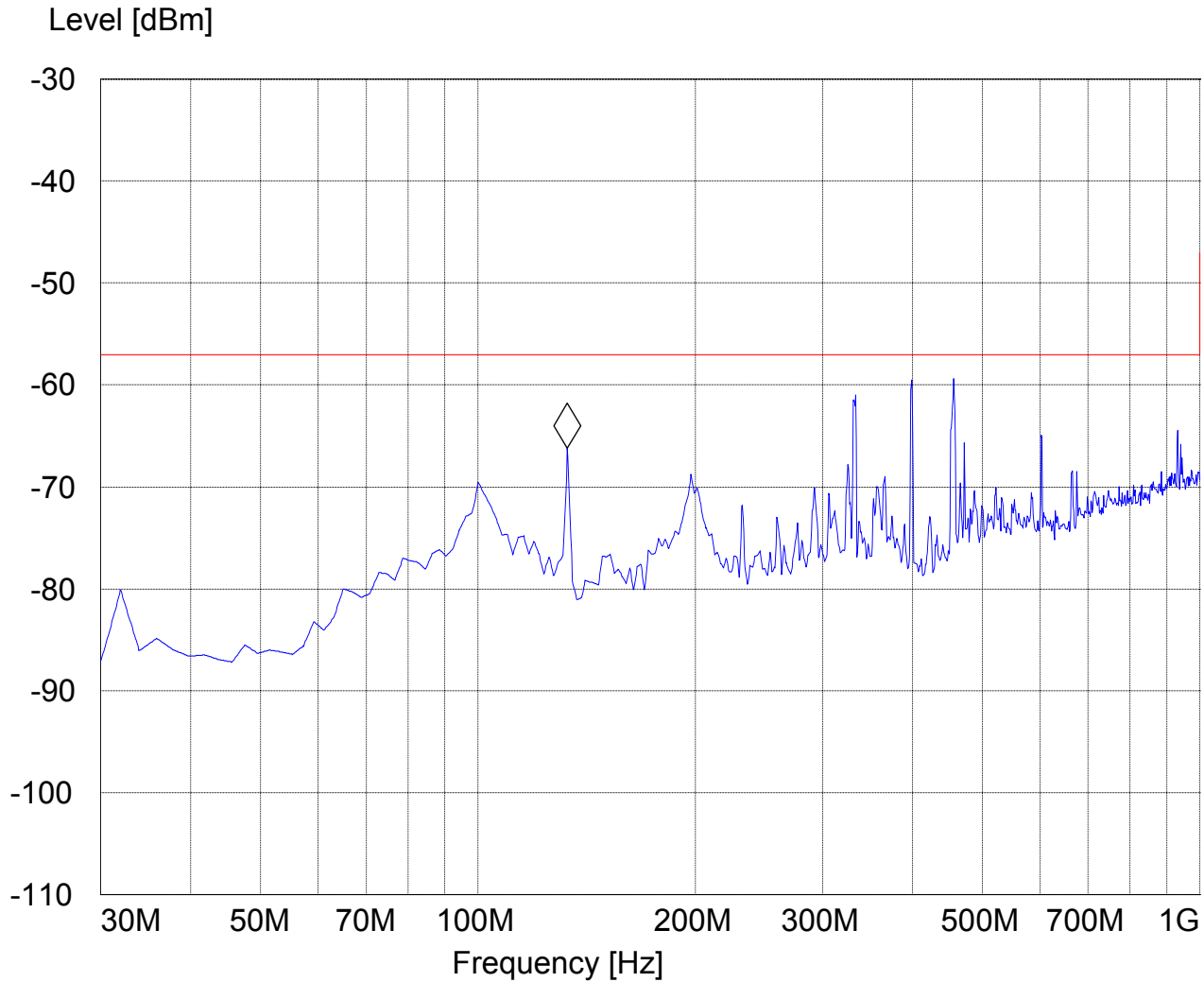
Clause 5.3.2

Frequency range	Narrowband spurious emission	Wideband spurious emission
30 MHz - 1 GHz	-57 dBm	-107 dBm/Hz
above 1 GHz – 12.75 GHz	-47 dBm	-97 dBm/Hz

RECEIVER SPURIOUS EMISSIONS
30MHz – 1GHz

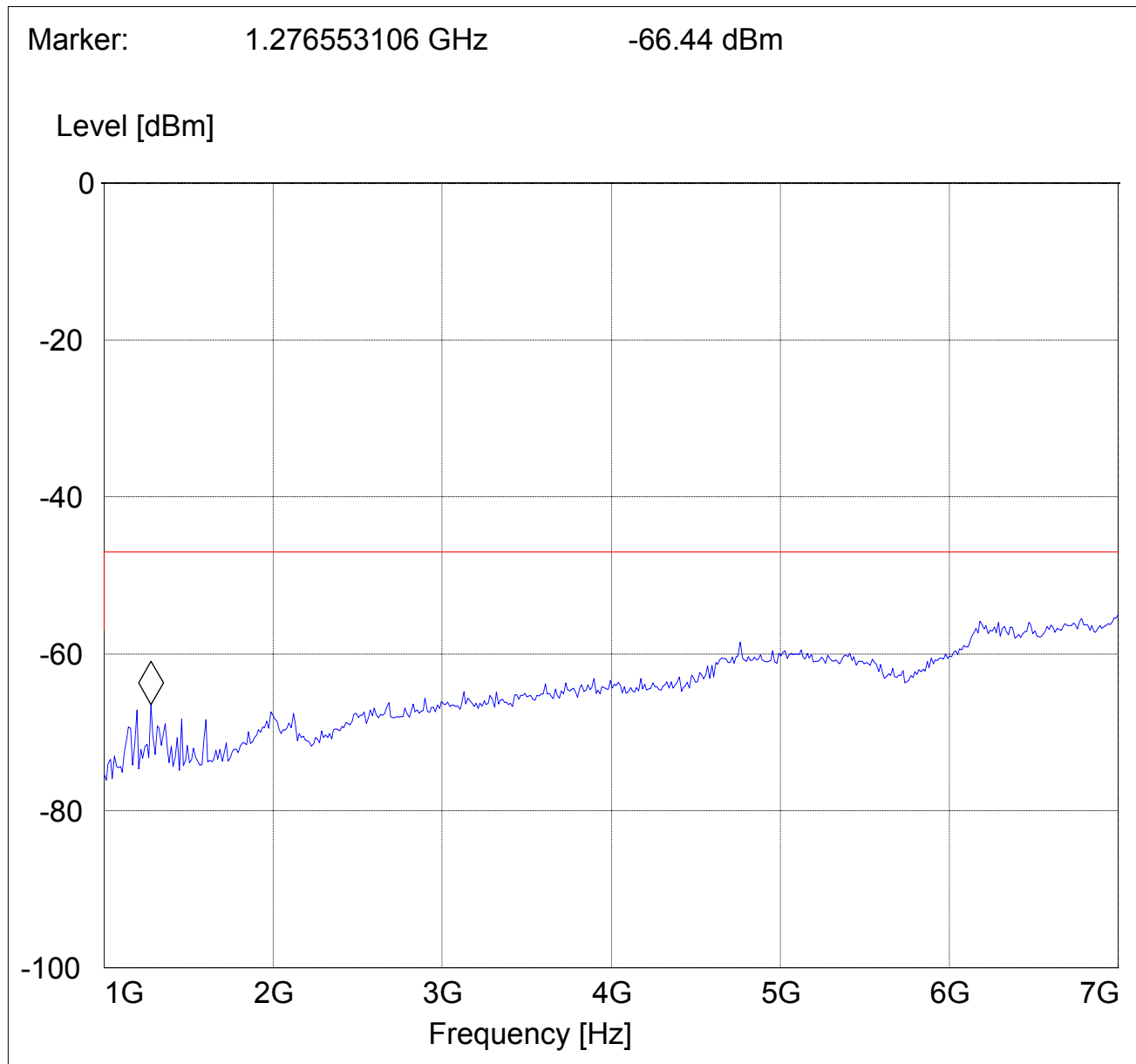
CLAUSE 5.3.2

Marker: 133.026052 MHz -66.19 dBm



RECEIVER SPURIOUS EMISSIONS
1GHz – 7GHz

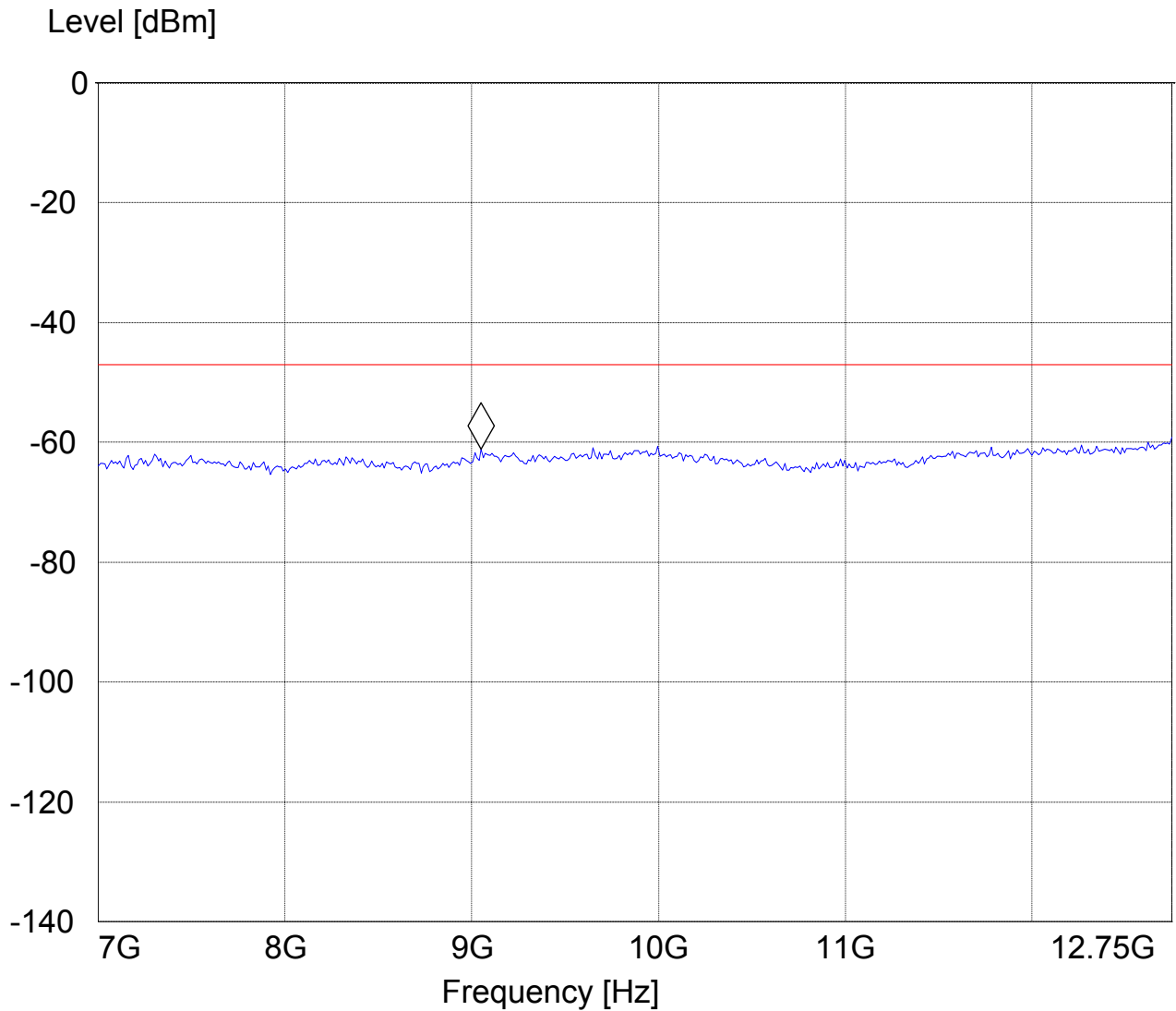
CLAUSE 5.3.2



RECEIVER SPURIOUS EMISSIONS
7GHz – 12.75GHz

CLAUSE 5.3.2

Marker: 9.051102204 GHz -61.15 dBm

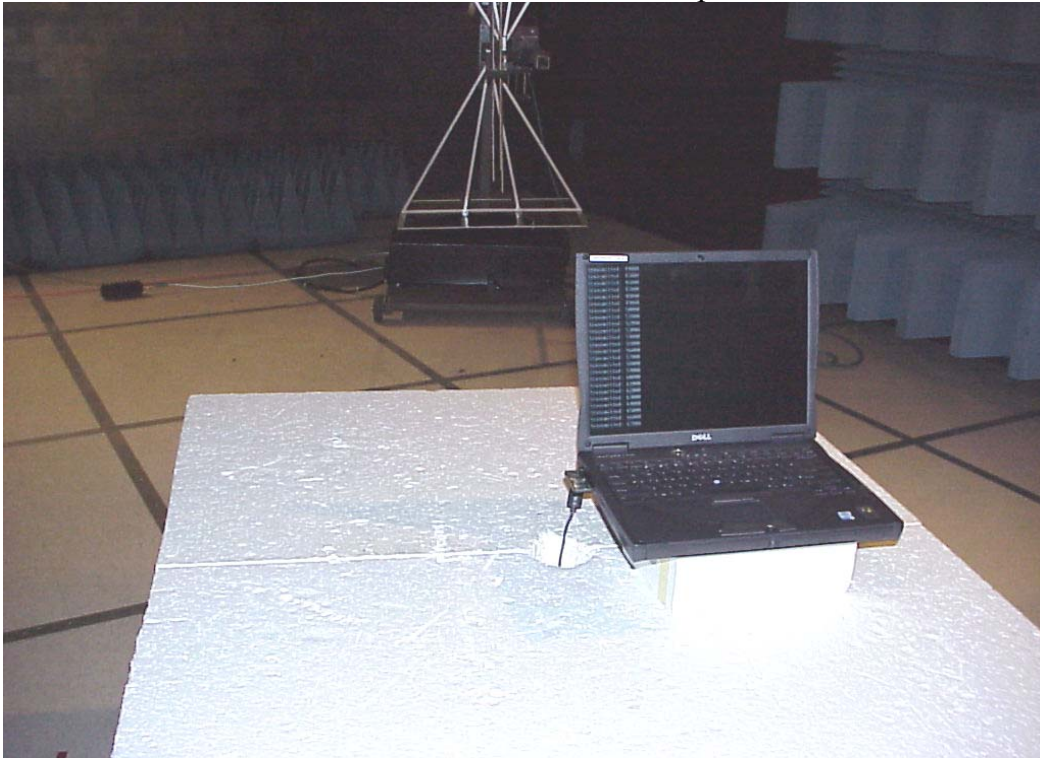


TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

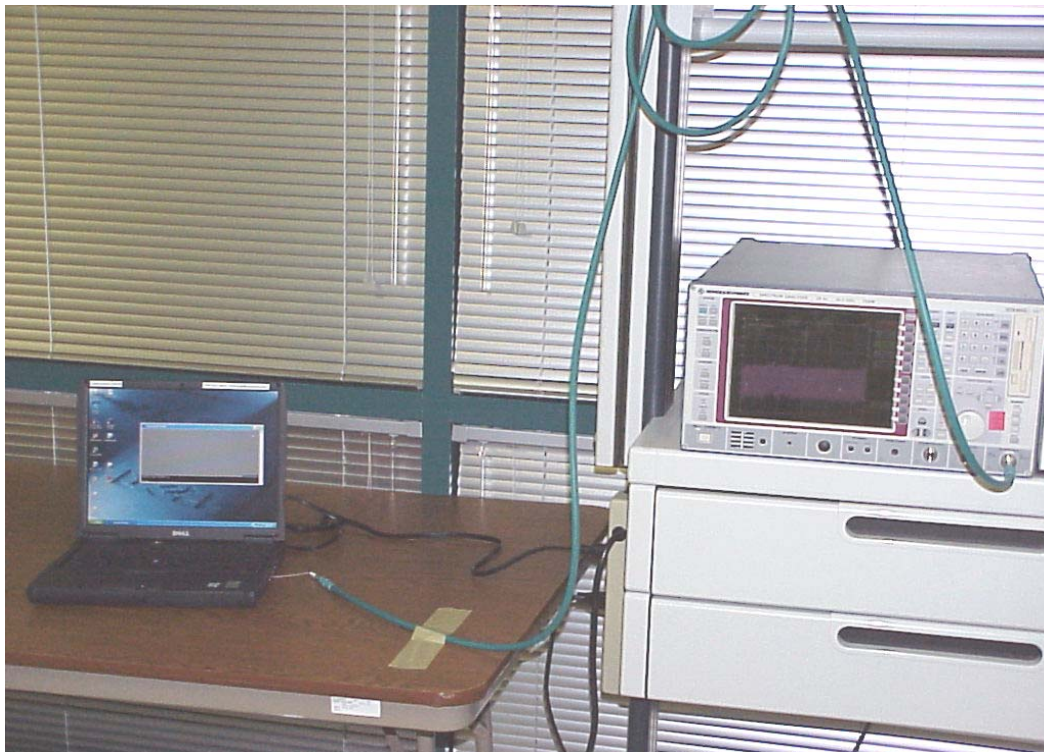
No	Instrument/Ancillary	Type	Manufacturer	Serial No.
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02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011
04	Power-Meter	EPM-442A	Hewlett Packard	GB37170232
05	Power Amplifier	250W1000	Amplifier Research	300031
06	Biconilog Antenna	3141	EMCO	0005-1186
07	Horn Antenna	SAS-200/571	AH Systems	325
08	Power Splitter	11667B	Hewlett Packard	645348
09	Pre-Amplifier	JS4-00102600	Miteq	00616

PHOTOGRAPHS

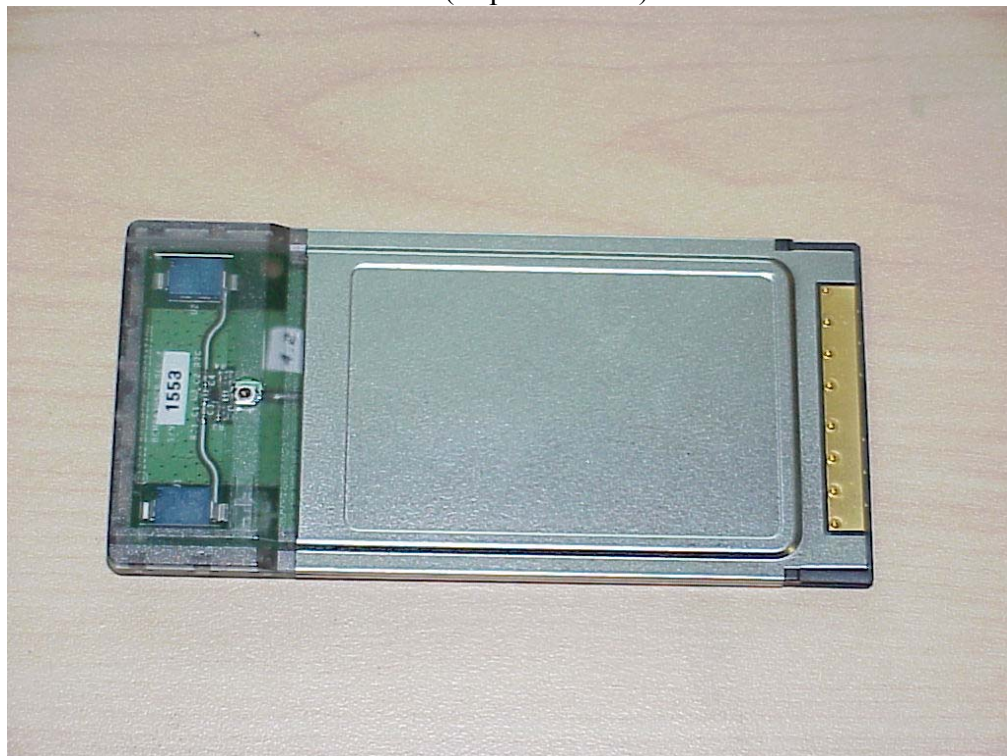
Radiated Measurement Setup



Conducted Measurement



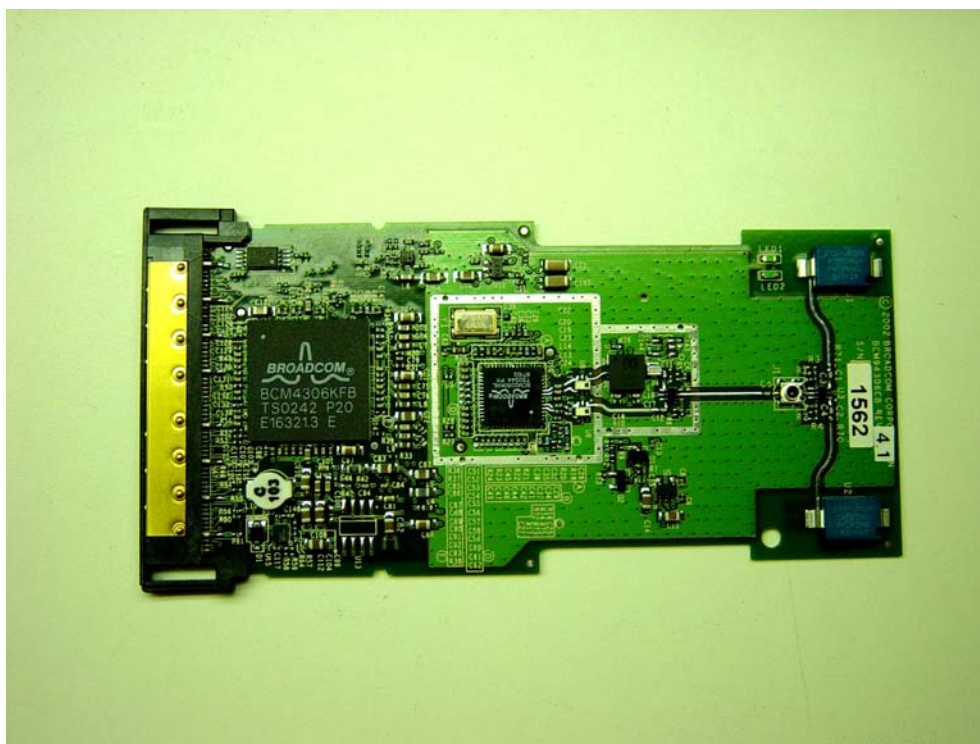
EUT (Top - shielded)



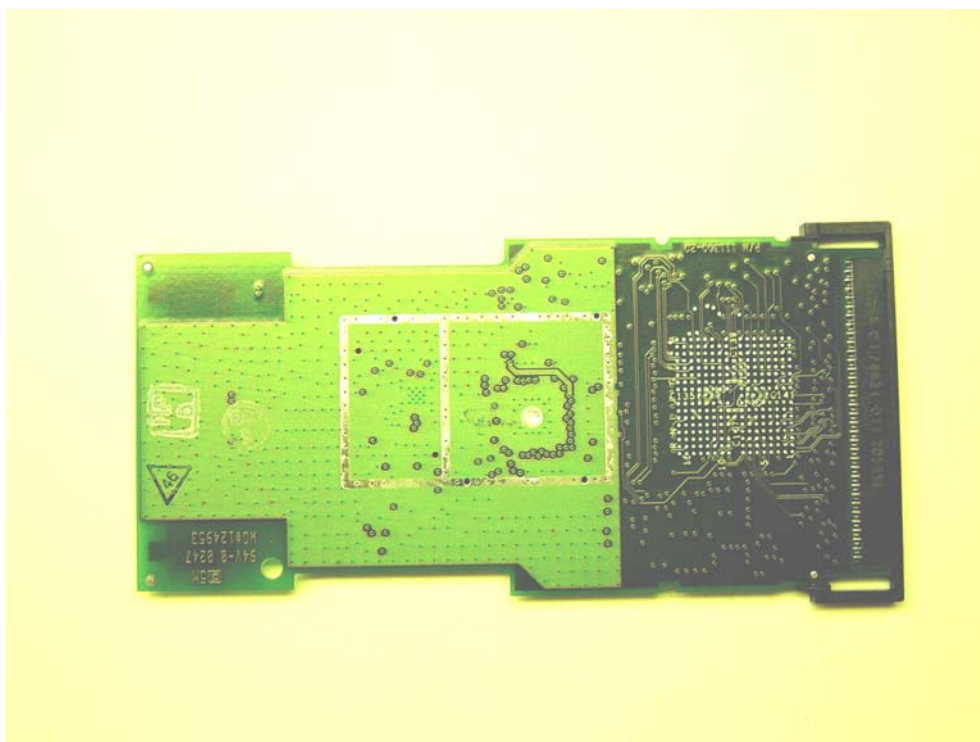
EUT (Bottom - shielded)



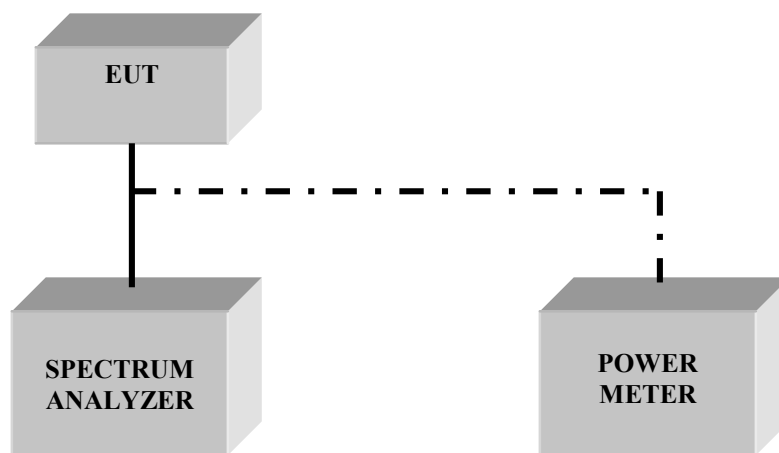
EUT (Top – unshielded)



EUT (Bottom – unshielded)



BLOCK DIAGRAMS
Conducted Testing



Radiated Testing

ANECHOIC CHAMBER

