

CETECOM Inc.



CETECOM Inc.

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Issued test report consists of 55 Pages

Page 1 (55)

FCC LISTED, REG. NO.: 101450 & RECOGNIZED BY INDUSTRY CANADA IC – 3925
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**Test report no.: EMC_318_FCC15.247_2002
FCC Part 15.247 for DSSS systems / CANADA RSS-210
(BCM94301CB)**

SPECIAL NOTE:

This test report represents following three versions of EUT;

<u>Model</u>	<u>Description</u>
BCM94301CB	32-bit cardbus
BCM94301PC3	16-bit PCMCIA card
BCM94301PC5	16-bit PCMCIA card with power regulator

The difference between these three versions is only related to the digital interface between the card and the Laptop PC. The device with the higher bit rate (BCM94301CB) was used for the test measurements documented in this test report, considering worst case scenario.

Please refer to photographs to see physical difference between three models.

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1	General information
1.1	Notes

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 : **400 East Caribbean Drive**
City / Zip Code : **Sunnyvale, CA 94089**
Country : **USA**
Contact : **Chris McGough**
Telephone : **+1 408 922 5810**
Tele-fax : **+1 408 543 3399**
e-mail : cmcgough@broadcom.com

1.4 Application details

Date of receipt of application : 2002-07-15
Date of receipt test item : 2002-07-24
Date of test : 2002-07-24/25

1.5 Test item

Manufacturer : **Askey Computer Corp.**
Street : **10F, No. 119, ChienKang Road**
City / Zip code : **Chung-ho 235, Taipei**
Country : **Taiwan, R.O.C**
Marketing Name : **BCM94301CB**
Model No. : **Broadcom 802.11b Wireless LAN Card**
[Description](#) : [802.11b Wireless LAN 32-Bit Cardbus](#)
FCC-ID : **QDS-BRCM1003**

Additional information

Frequency : **2412 – 2472 MHz**
Type of modulation : **DSSS**
Number of channels : **13**
Antenna : **Chip antenna**
Power supply : **3.3 VDC via host PC**
Output power : **18.14dBm (65.16mW)**
Extreme temp. Tolerance : **0 C - +55 C**

1.6 Test standards: FCC Part 15 §15.247 / CANADA RSS-210

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:

2002-08-21 EMC & Radio Lothar Schmidt (Manager)

Date

Section

Name

Signature

Responsible for test report and project leader:

2002-08-21 EMC & Radio Harpreet Sidhu (EMC Engineer)

Date

Section

Name

Signature

2.2 Test report

TEST REPORT

**Test report no. : EMC_318_FCC15.247_2002
(BCM94301CB)**

TEST REPORT REFERENCE

LIST OF MEASUREMENTS	PAGE
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Note: All measurements are valid with following test software setting
Radio power level = 7

ANTENNA GAIN**§ 15.204**

The antenna gain of the complete system is calculated by the difference of conducted power of the module and the radiated power in EIRP.

	Low channel	Mid channel	High channel
Conducted Power	15.64dBm	13.89dBm	13.13dBm
Raidated Power (EIRP)	17.74dBm	18.14dBm	17.33dBm
Antenna Gain	2.1dBi	4.25dBi	4.2dBi

The calculated antenna gain is between 2.1dBi and 4.25dBi.

SPECTRUM BANDWIDTH OF DSSS SYSTEM**§15.247(a) (2)****6 dB bandwidth**

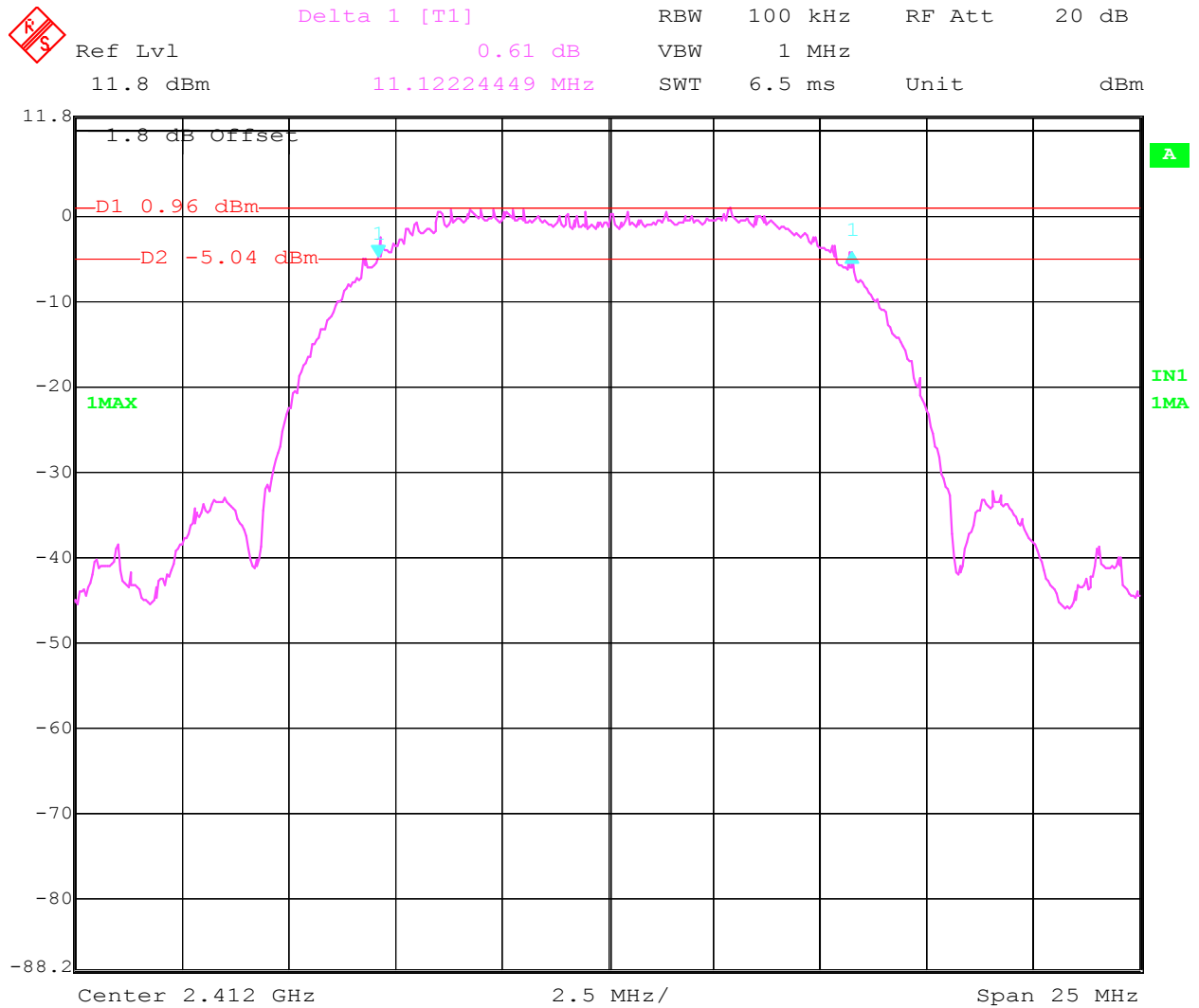
TEST CONDITIONS		6 dB BANDWIDTH (kHz)		
Frequency (MHz)		2412	2442	2472
T _{nom} (23)°C	V _{nom} (3.3)VDC	11.12	11.12	11.17

LIMIT**SUBCLAUSE §15.247(a) (2)****The minimum 6dB bandwidth shall be at least 500 KHz**

SPECTRUM BANDWIDTH OF DSSS SYSTEM 6 dB bandwidth

§15.247(a) (2)

Lowest Channel: 2412MHz

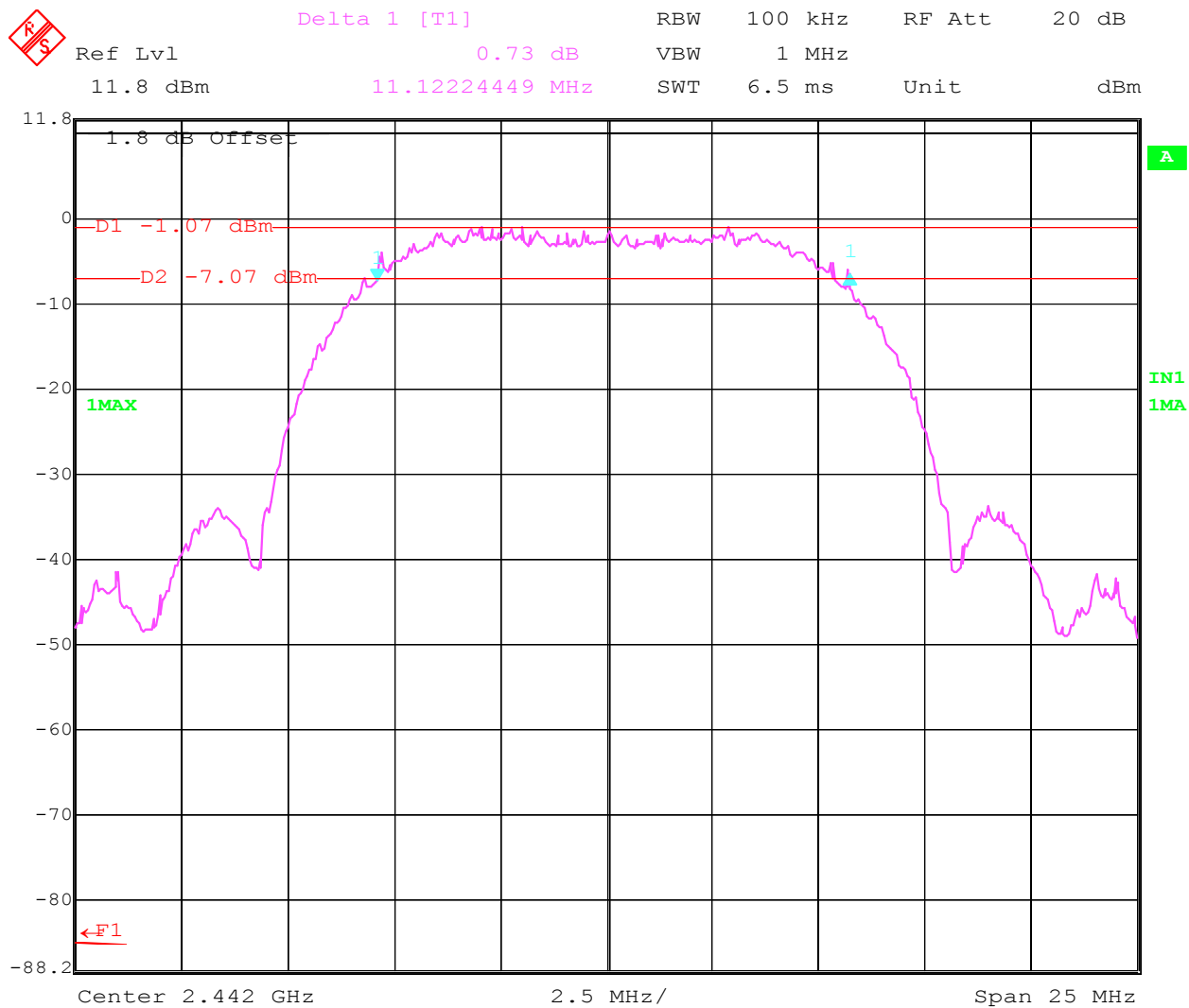


Date: 25.JUL.2002 12:29:50

SPECTRUM BANDWIDTH OF DSSSS SYSTEM 6 dB bandwidth

§15.247(a) (2)

Mid Channel: 2442MHz

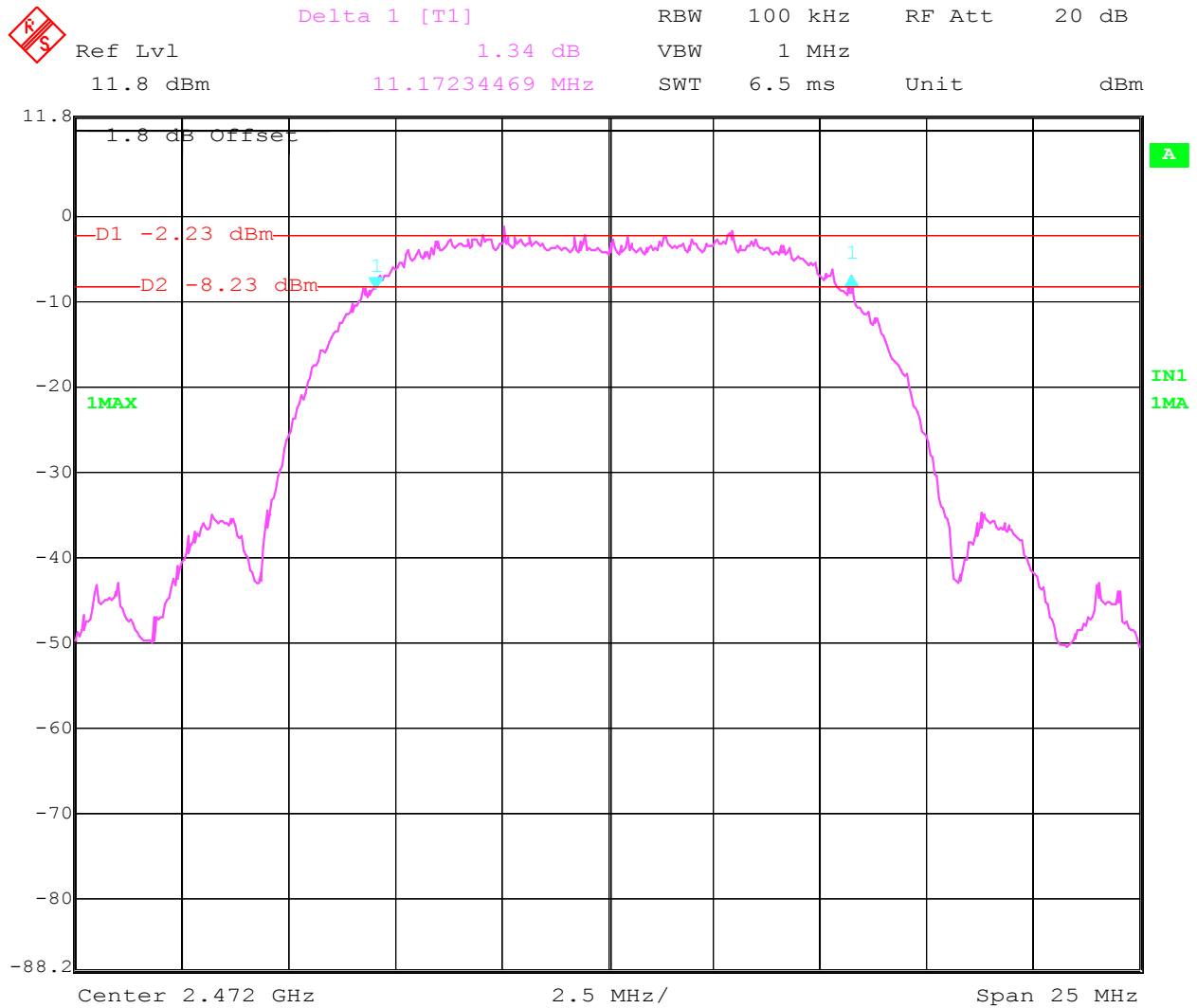


Date: 25.JUL.2002 10:15:31

SPECTRUM BANDWIDTH OF DSSS SYSTEM 6 dB bandwidth

§15.247(a) (2)

Highest Channel: 2472MHz



Date: 25.JUL.2002 10:48:27

**MAXIMUM PEAK OUTPUT POWER
(conducted)**

§ 15.247 (b) (1)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)		2412		2442	2472
T _{nom} (23)°C	V _{nom} (3.3)VDC	Pk	15.64	13.89	13.13
		Av	10.8	9.4	8.85
Measurement uncertainty		±0.5dBm			

RBW / VBW : 10MHz

To comply with following;

RBW / VBW should be equal to or greater than the 6dB BW

 All mesured values are corrected by **10log 6dB BW / used BW**

(Therefore correction factor of 0.46 is added to low & mid channel measurements and 0.48 is added to high channel measurements)

LIMIT

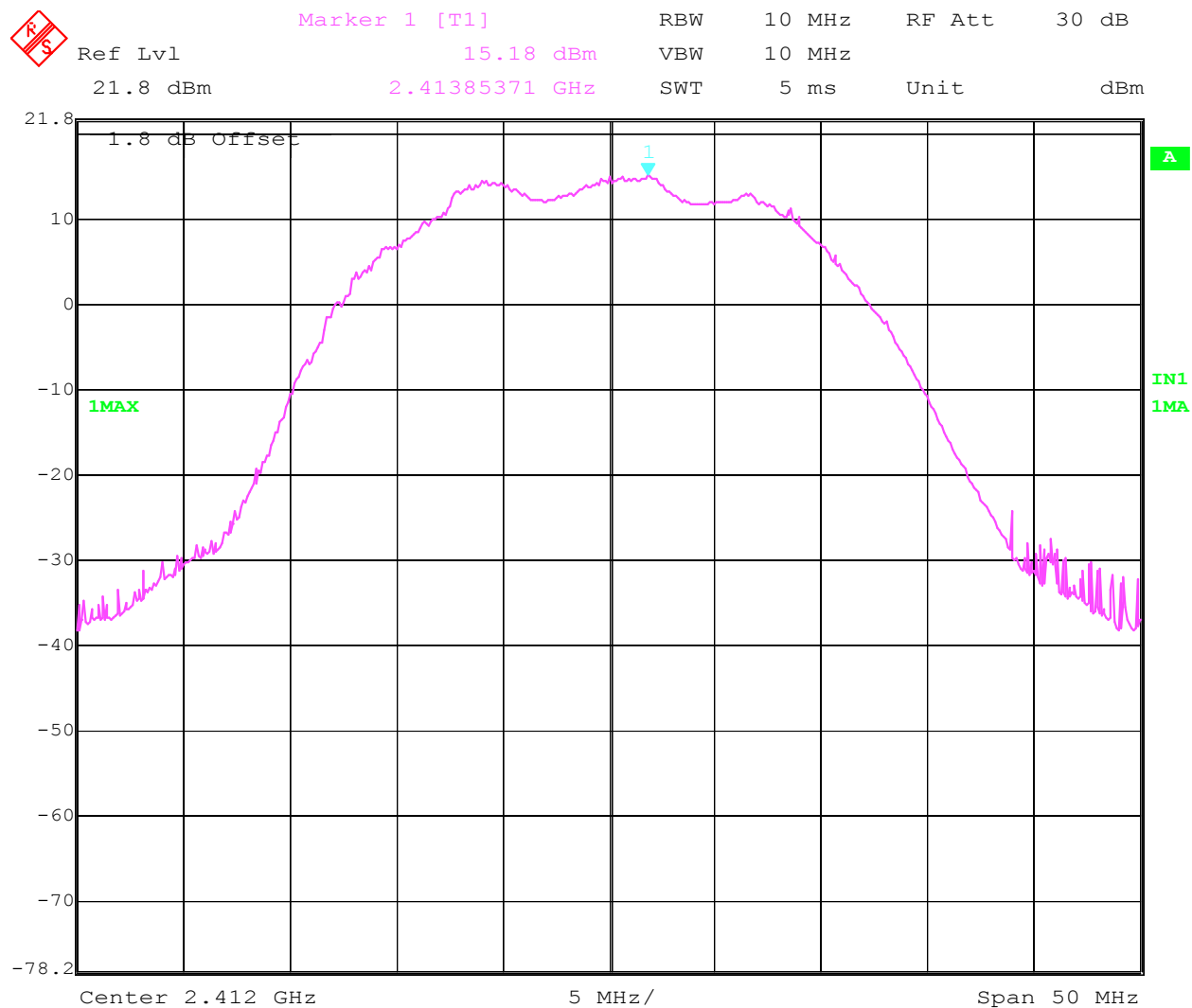
SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt / 30dBm

PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b) (1)

Lowest Channel: 2412MHz

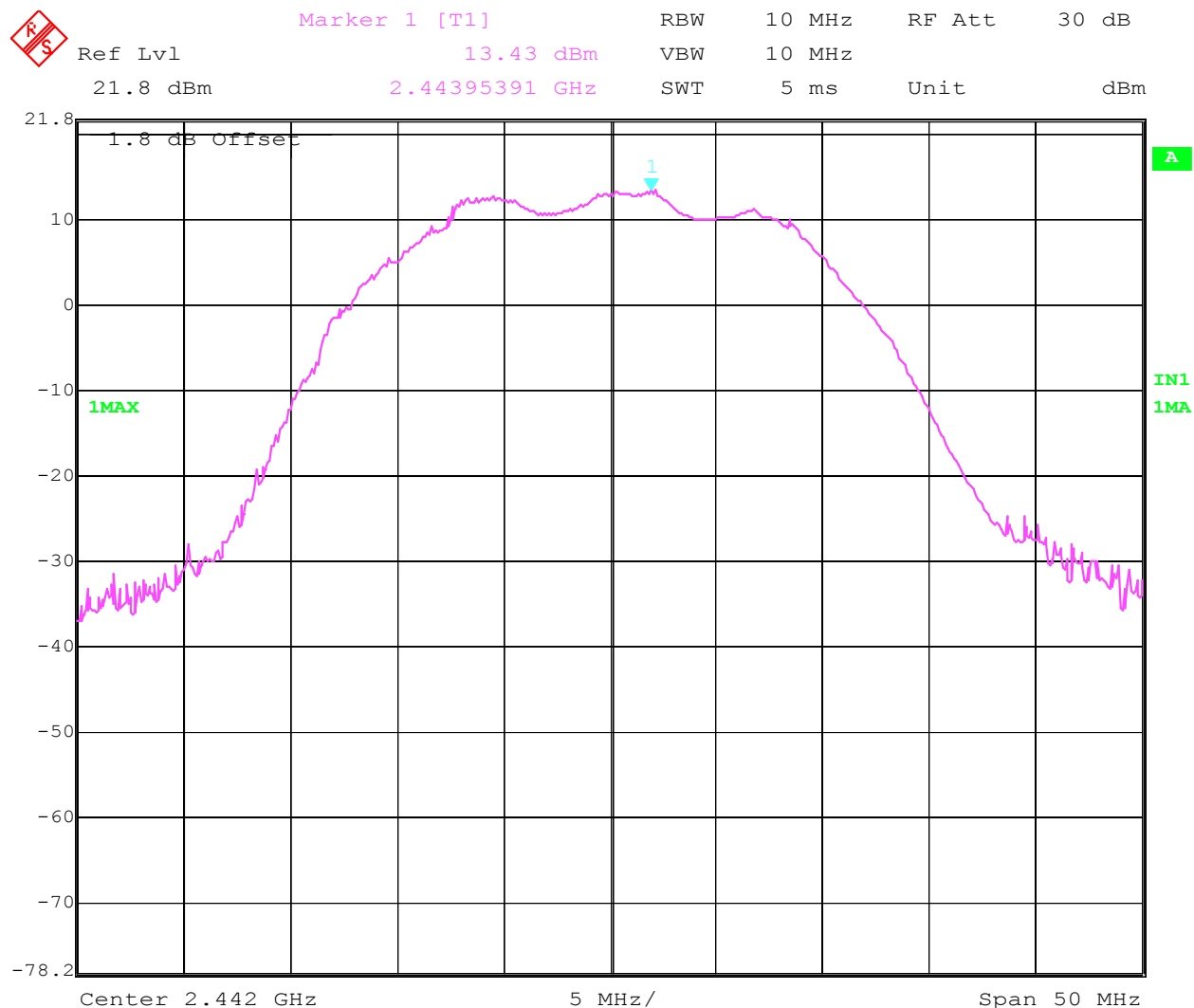


Date: 25.JUL.2002 08:29:50

PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b)

Mid Channel: 2442MHz

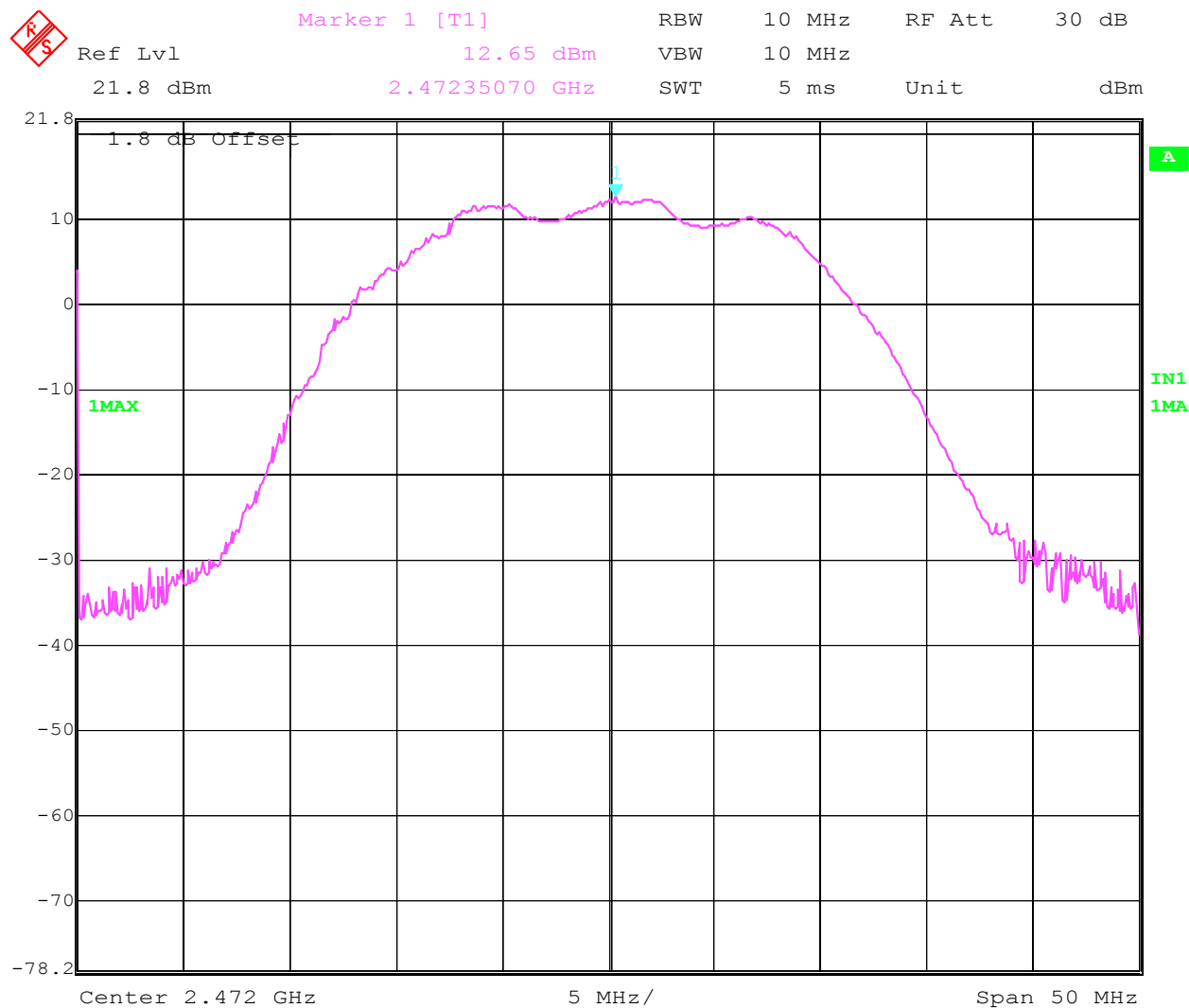


Date: 25.JUL.2002 10:20:58

PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b)

Highest Channel: 2472MHz



Date: 25.JUL.2002 10:50:11

**MAXIMUM PEAK OUTPUT POWER
(RADIATED)**

§ 15.247 (b) (1)

EIRP:

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2412	2442	2472
T _{nom} (23)°C	V _{nom} (3.3)VDC	17.74	18.14	17.33
Measurement uncertainty		±0.5dBm		

RBW/VBW : 10MHz

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

To comply with following;

RBW / VBW should be equal to or greater than the 6dB BW

All mesured values are corrected by **10log 6dB BW / used BW**

(Therefore correction factor of 0.46 is added to low & mid channel measurements and 0.48 is added to high channel measurements)

LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt / 30dBm

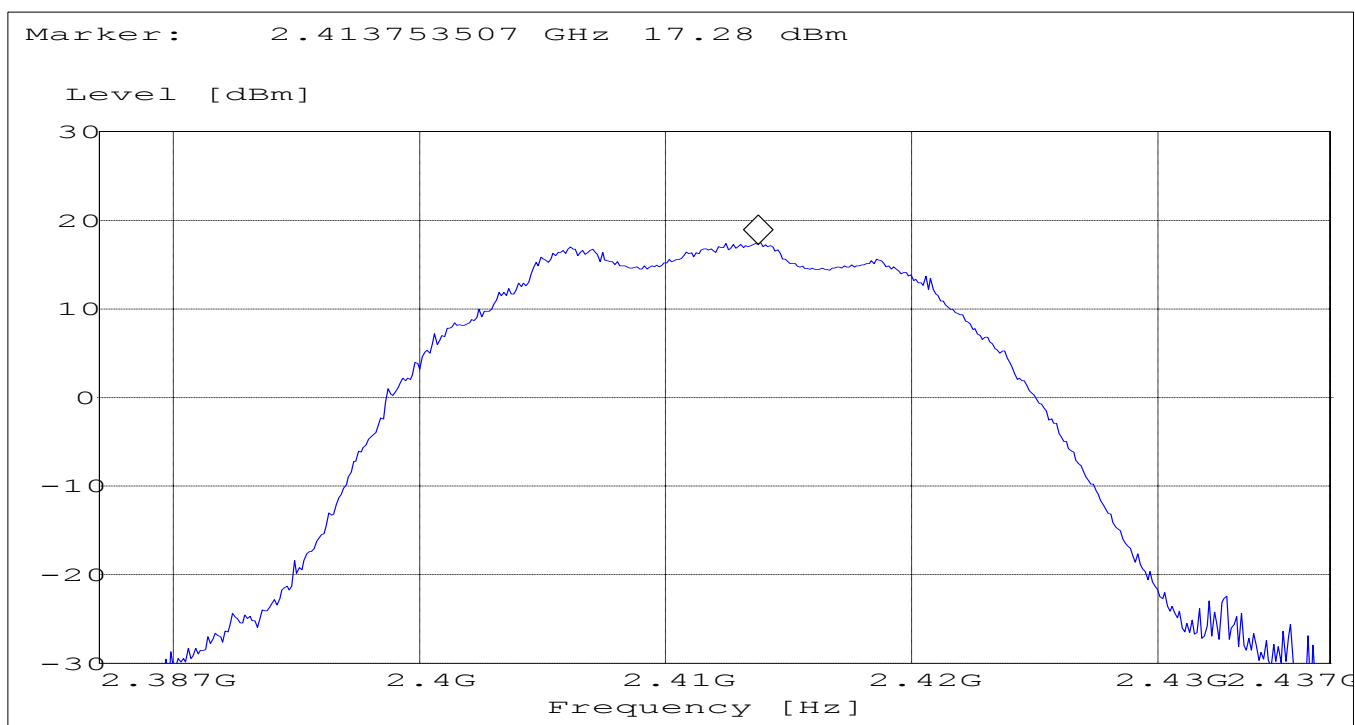
PEAK OUTPUT POWER (RADIATED)

§15.247 (b) (1)

Lowest Channel: 2412MHz

SWEEP TABLE: "EIRP RLAN ch-1"

Short Description:		EIRP RLAN channel-2412MHz			
Start	Stop	Detector	Meas.	IF	
Frequency	Frequency		Time	BW	
2.387GHz	2.437GHz	MaxPeak	Coupled	10 MHz	



PEAK OUTPUT POWER (RADIATED)

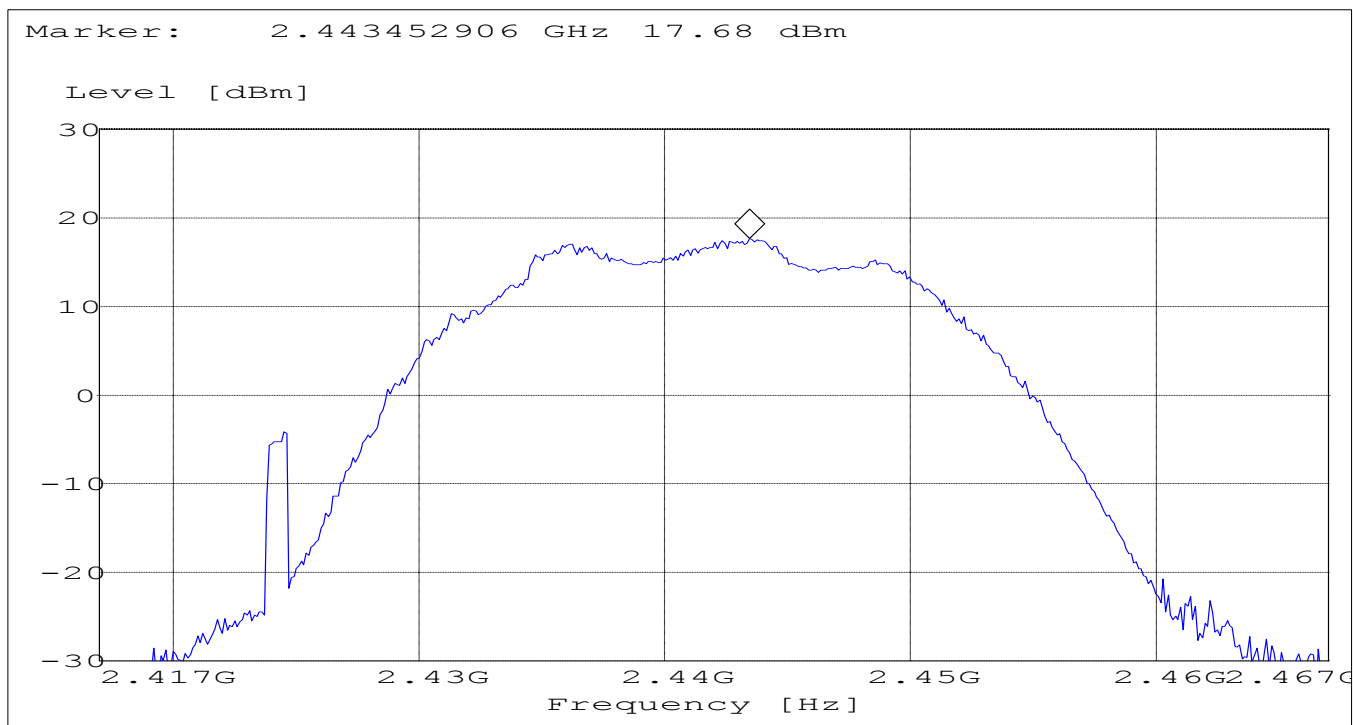
§15.247 (b) (1)

Mid Channel: 2442MHz

SWEEP TABLE: "EIRP RLAN CH7"

Short Description: EIRP RLAN channel-2442MHz

Start Frequency	Stop Frequency	Detector	Meas. Time	IF BW
2.417GHz	2.467GHz	MaxPeak	Coupled	10 MHz



PEAK OUTPUT POWER (RADIATED)

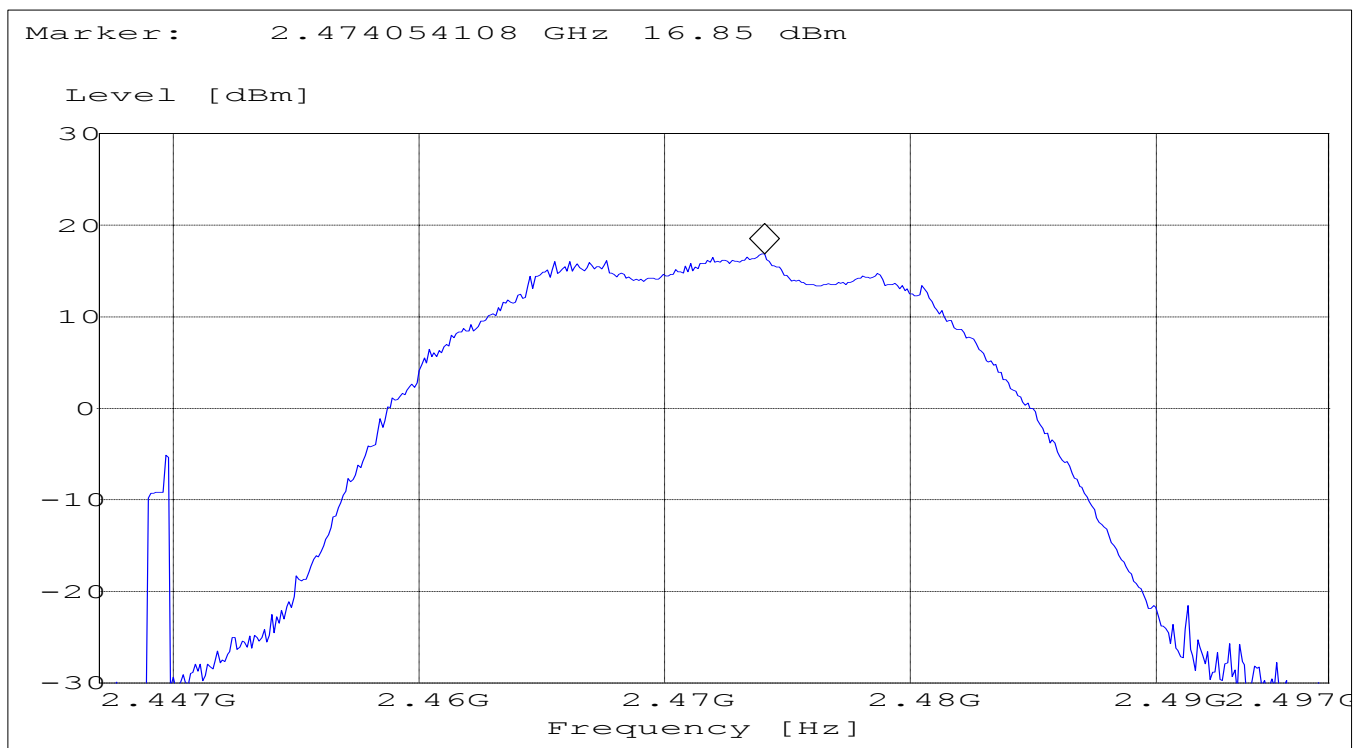
§15.247 (b) (1)

Highest Channel: 2472MHz

SWEEP TABLE: "EIRP RLAN CH13"

Short Description: EIRP RLAN channel-2472MHz

Start Frequency	Stop Frequency	Detector	Meas. Time	IF BW
2.447GHz	2.497GHz	MaxPeak	Coupled	10 MHz



POWER SPECTRAL DENSITY**§15.247 (d)**

TEST CONDITIONS Frequency (MHz)		POWER SPECTRAL DENSITY (dBm)		
		2412	2442	2472
T_{nom}(23)°C	V_{nom}(3.3)VDC	-14.83	-16.15	-18.43

LIMIT**SUBCLAUSE §15.247(d)**

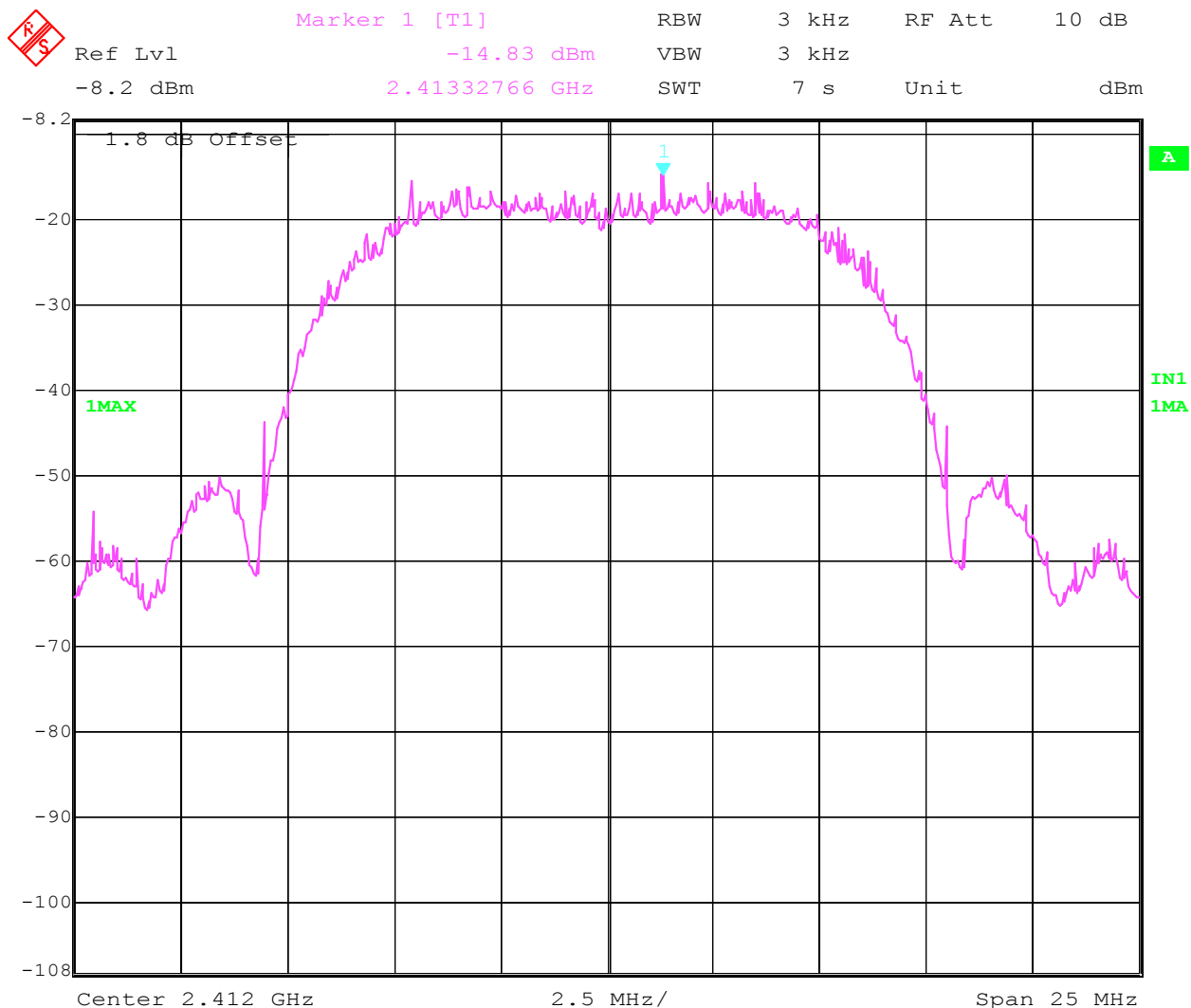
The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band

ANALYZER SETTINGS: RBW=3KHz, VBW=3KHz

POWER SPECTRAL DENSITY

§15.247(d)

Lowest Channel: 2412MHz

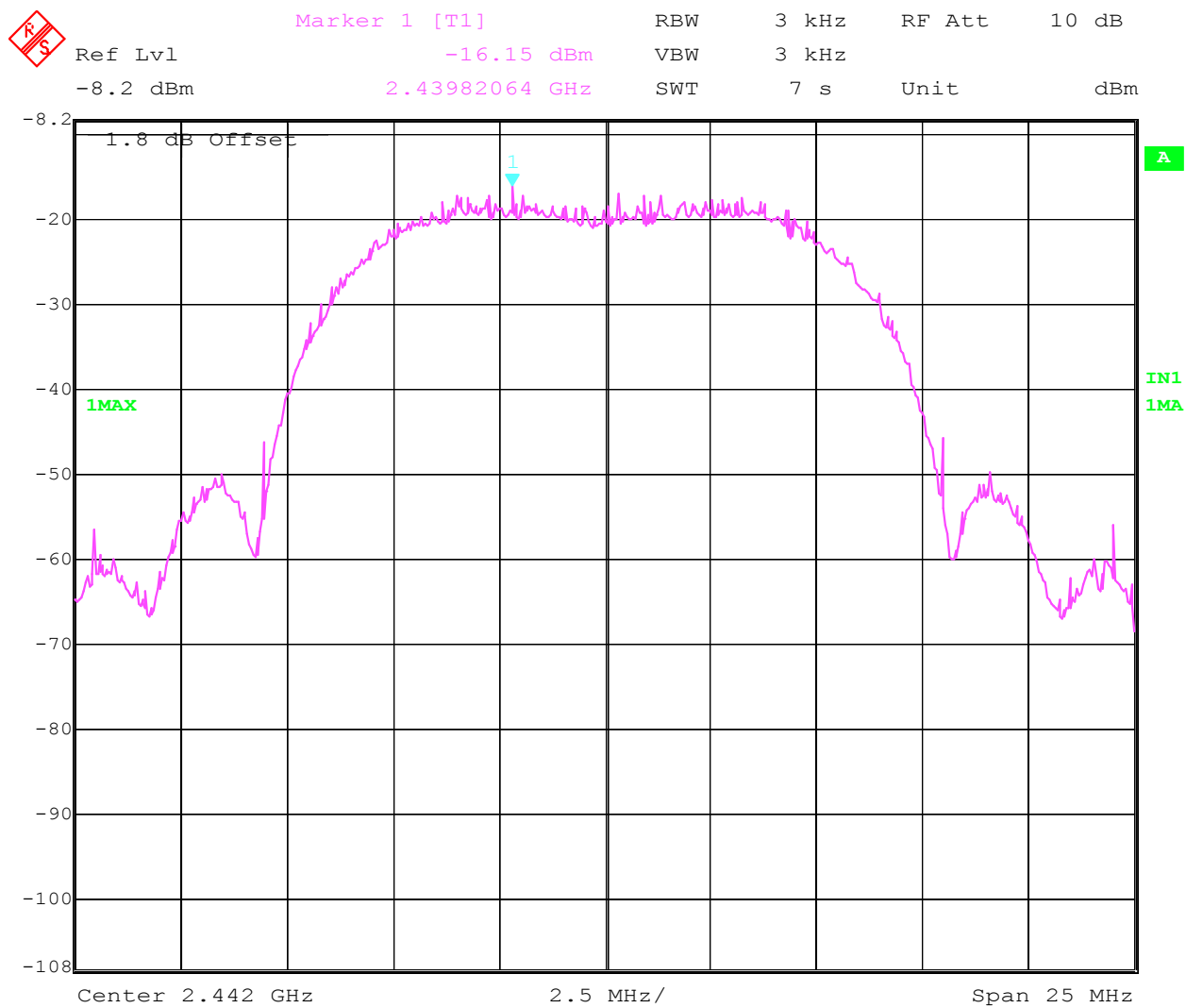


Date: 25.JUL.2002 08:41:21

POWER SPECTRAL DENSITY

§15.247(d)

Mid Channel: 2442MHz

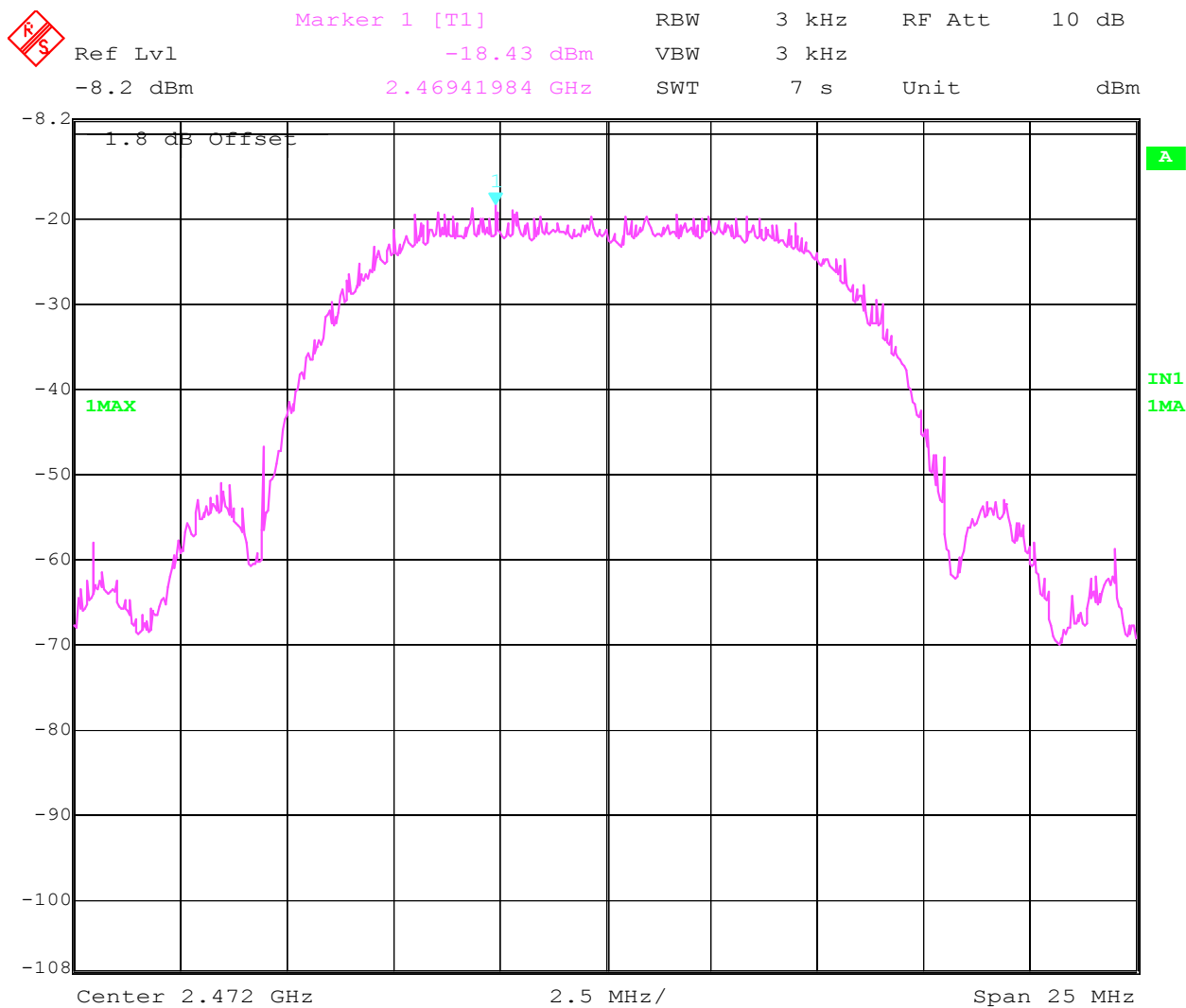


Date: 25.JUL.2002 10:33:56

POWER SPECTRAL DENSITY

§15.247(d)

Highest Channel: 2472MHz



Date: 25.JUL.2002 10:58:51

POWER SPECTRAL DENSITY**RSS-210**

TEST CONDITIONS		POWER SPECTRAL DENSITY (dBm/MHz)		
Frequency (MHz)		2412	2442	2472
T _{nom} (23)°C	V _{nom} (3.3)VDC	7.7	5.89	5.69

Correction factor of 60dBm is added to convert measured values from dBm/Hz to dBm/MHz

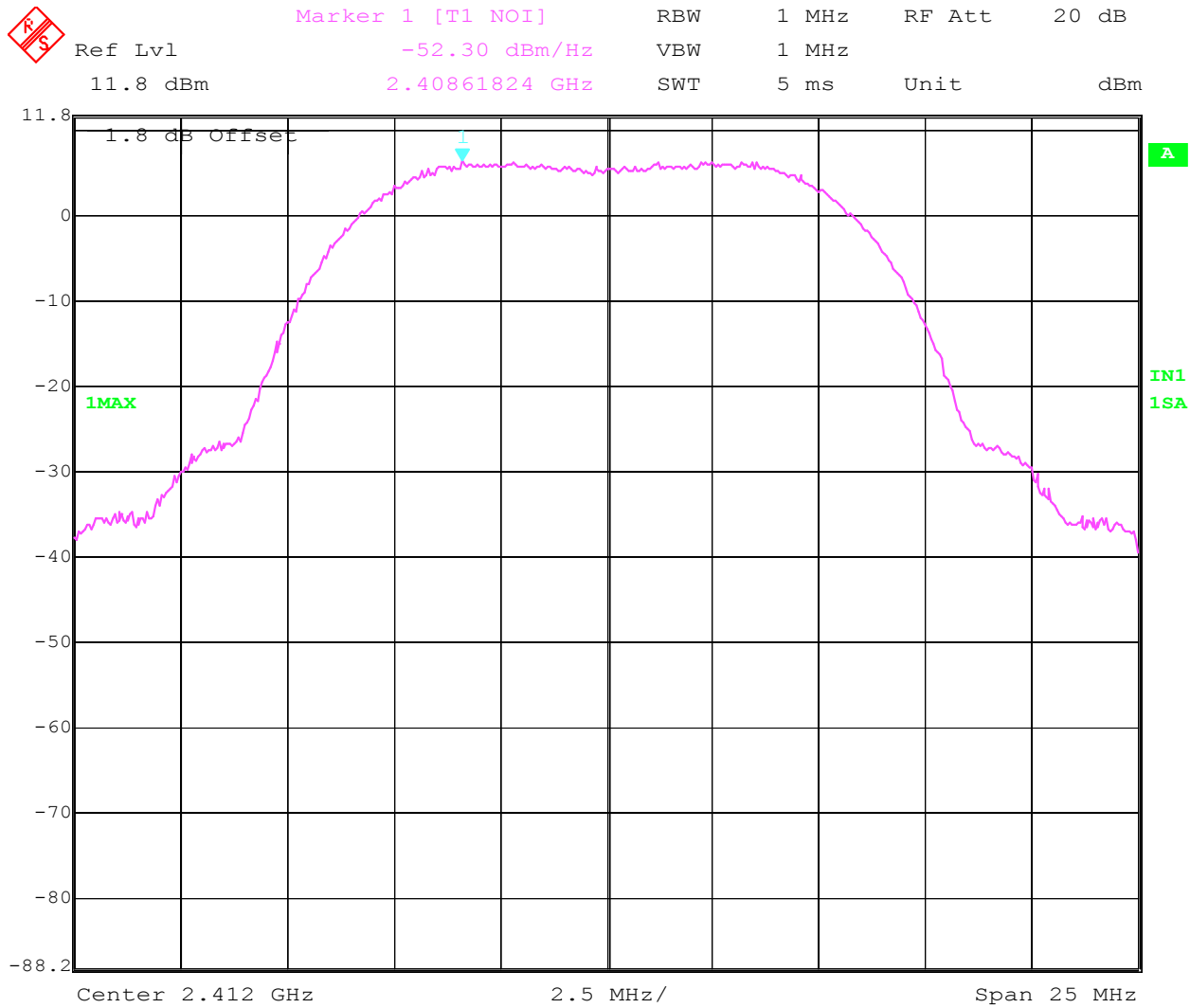
LIMIT**RSS-210**

The peak power spectral density shall be $\leq 50\text{mW/MHz}$ (17dBm/MHz)

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

POWER SPECTRAL DENSITY RSS-210

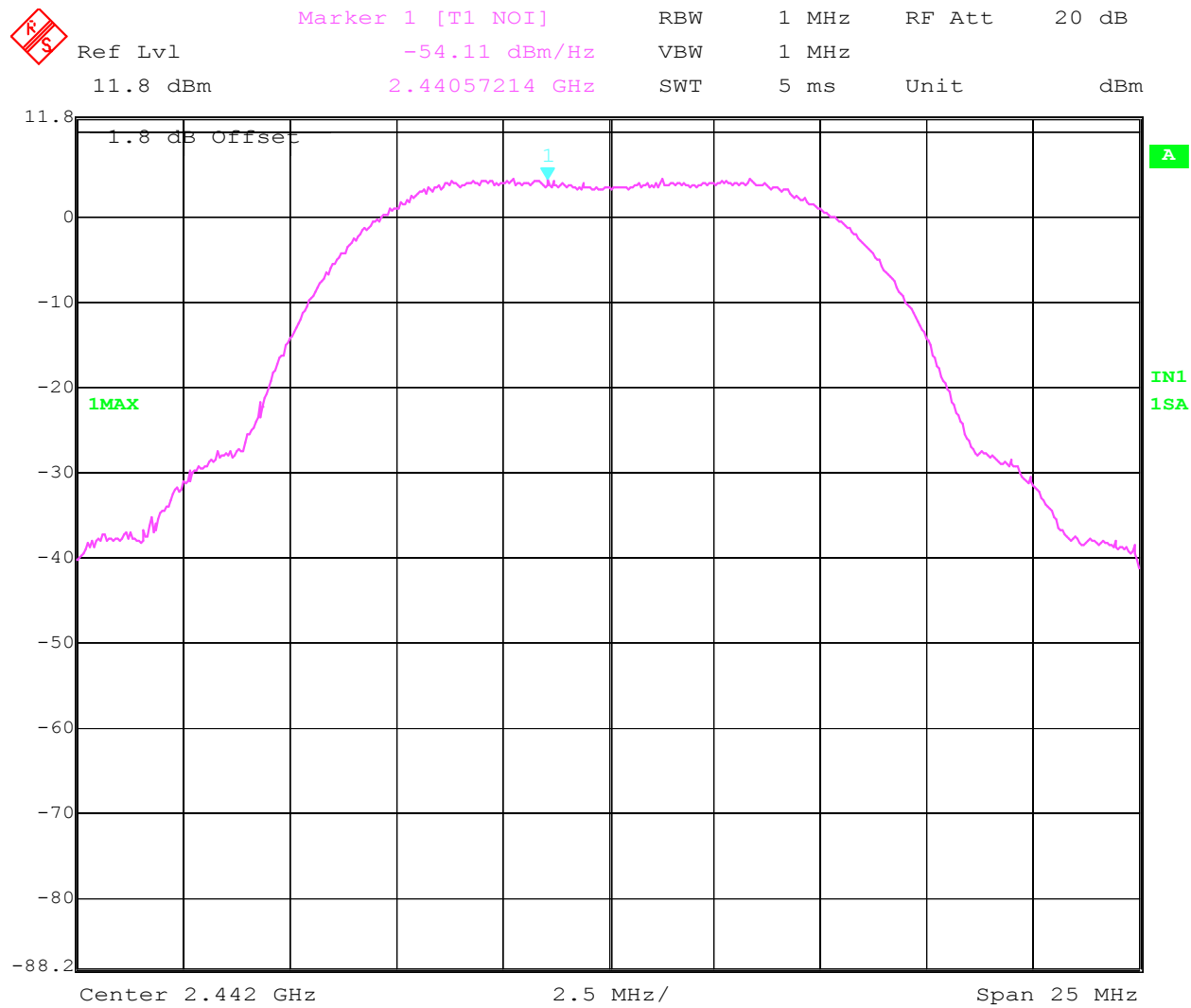
Lowest Channel: 2412MHz



Date: 25.JUL.2002 08:42:45

POWER SPECTRAL DENSITY RSS-210

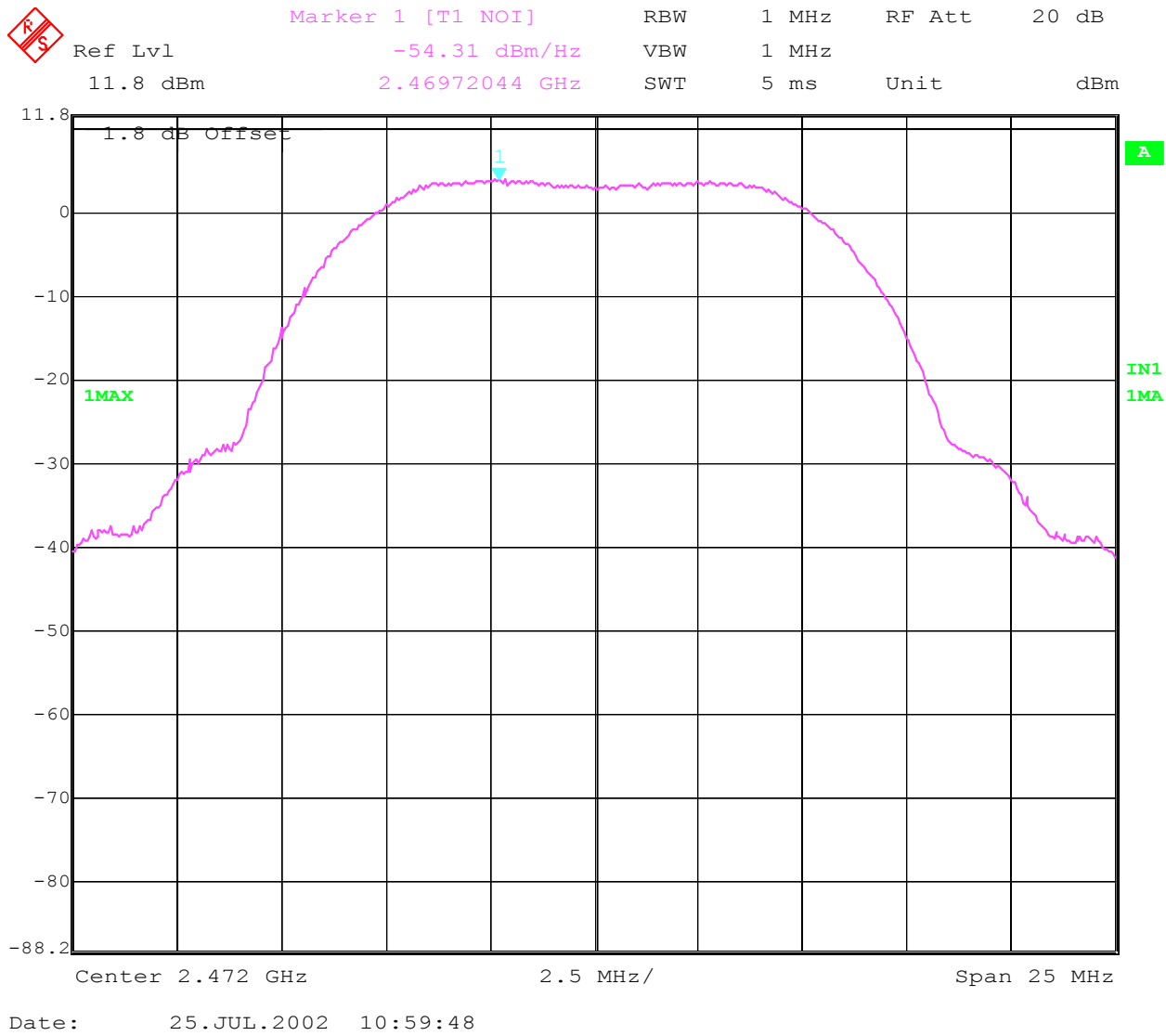
Mid Channel: 2442MHz



Date: 25.JUL.2002 10:36:12

POWER SPECTRAL DENSITY RSS-210

Highest Channel: 2472MHz



BAND EDGE COMPLIANCE

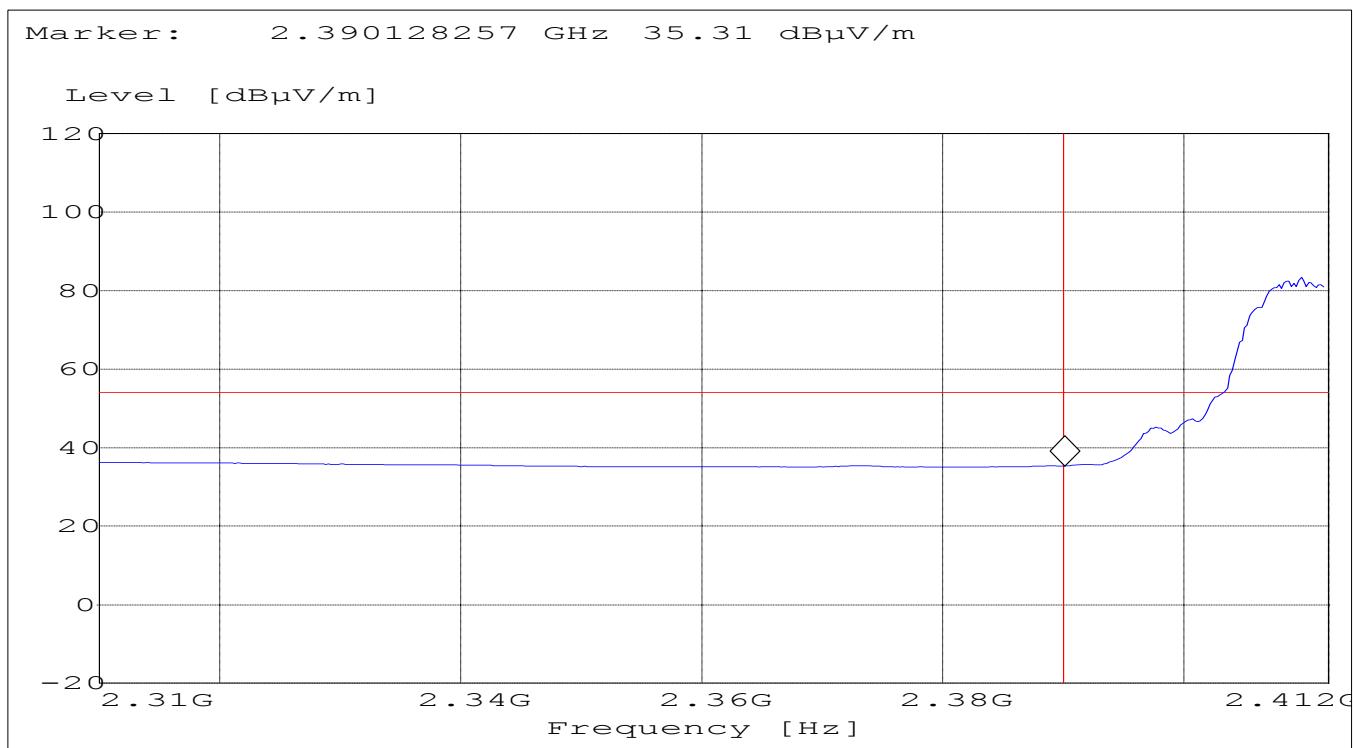
§15.247 (c)

Low frequency section (spurious in the restricted band 2310 – 2390 MHz)

(Average measurement)

Operating condition : Tx at 2412MHz
 SWEEP TABLE : "FCC15.247 LBE_AVG"
 Limit Line : 54dBμV

Start Frequency	Stop Frequency	Detector	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE

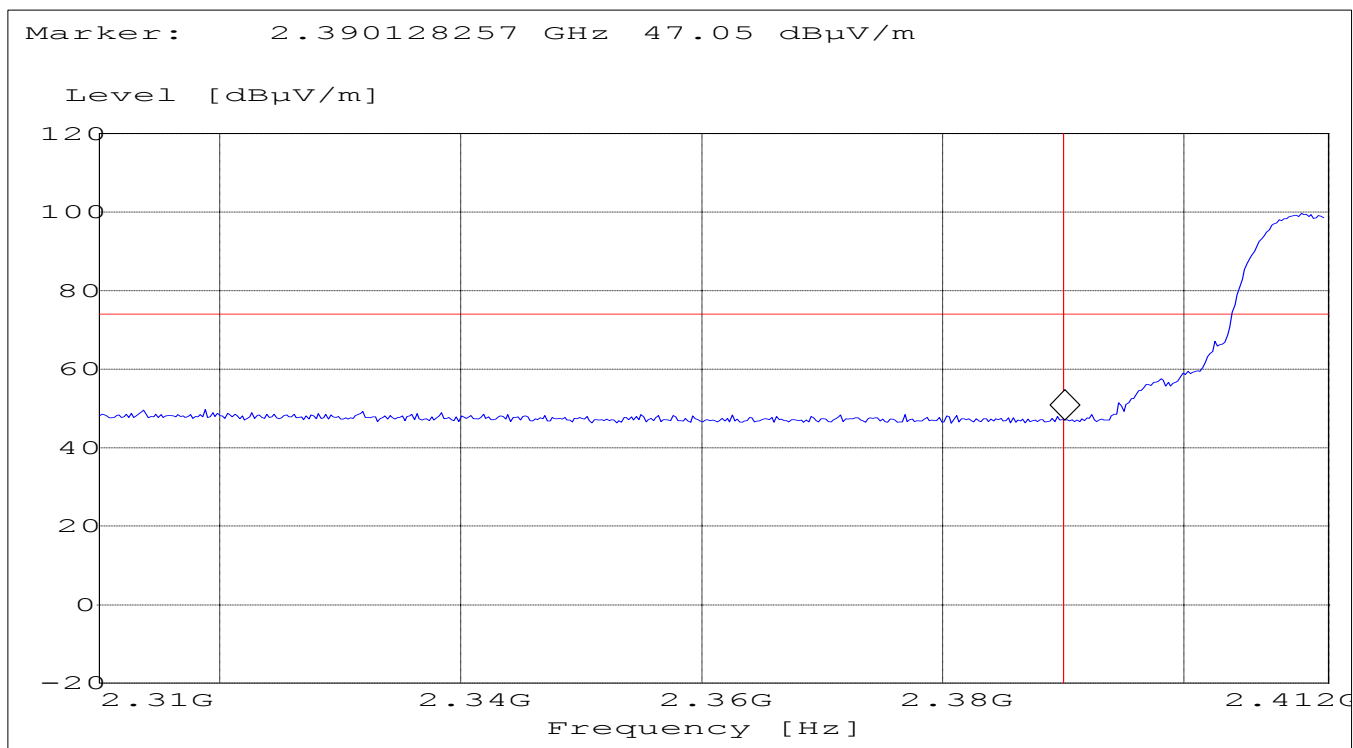
§15.247 (c)

Low frequency section (spurious in the restricted band 2310 – 2390 MHz)

(Peak measurement)

Operating condition : Tx at 2412MHz
 SWEEP TABLE : "FCC15.247 LBE_Pk"
 Limit Line : 74dBμV

Start Frequency	Stop Frequency	Detector	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



BAND EDGE COMPLIANCE

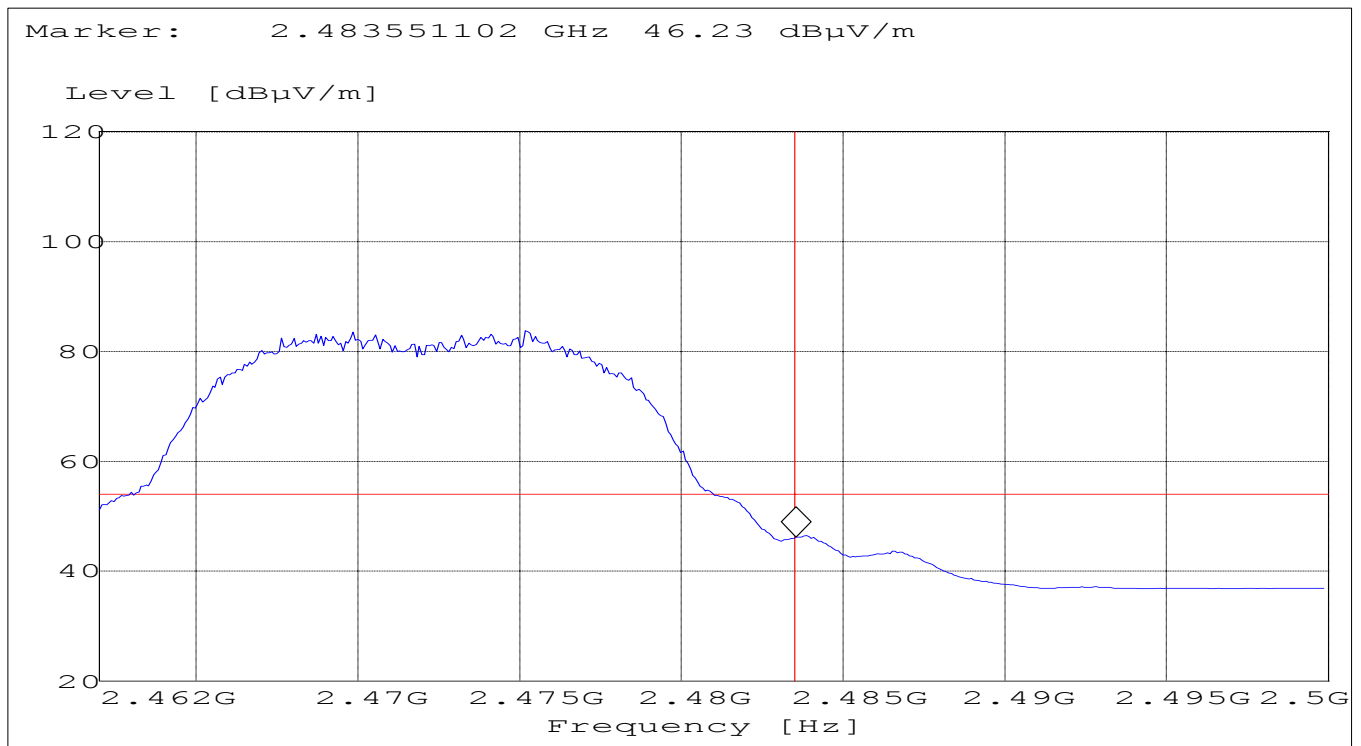
§15.247 (c)

High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)

(Average measurement)

Operating condition : Tx at 2472MHz
 SWEEP TABLE : "FCC15.247 HBE_AVG"
 Limit Line : 54dBμV

Start Frequency	Stop Frequency	Detector	Meas. Bandw.	RBW	VBW	Transducer
2.462 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE

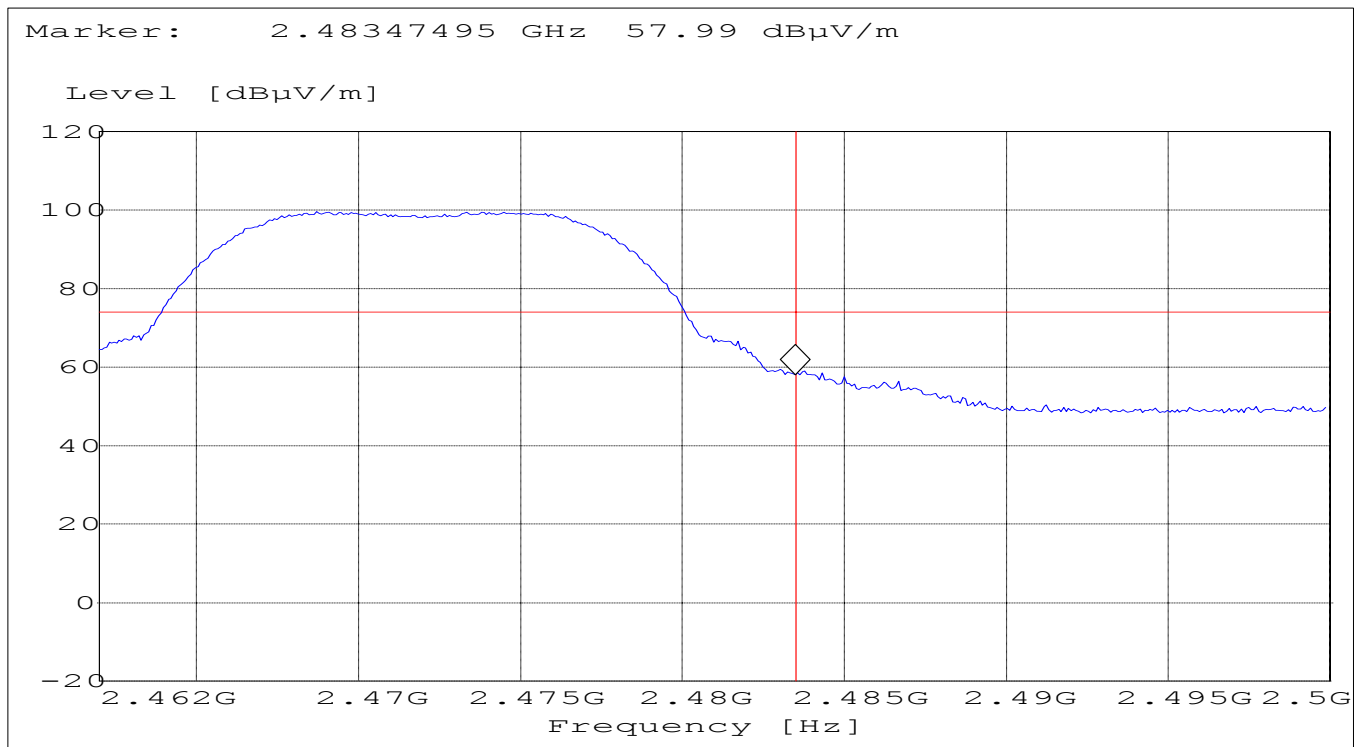
§15.247 (c)

High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)

(Peak measurement)

Operating condition : Tx at 2472MHz
 SWEEP TABLE : "FCC15.247 HBE_PK"
 Limit Line : 74dB μ V

Start Frequency	Stop Frequency	Detector	Meas. Bandw.	RBW	VBW	Transducer
2.462 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



EMISSION LIMITATIONS**§ 15.247 (c) (1)****Transmitter (Conducted)****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)).

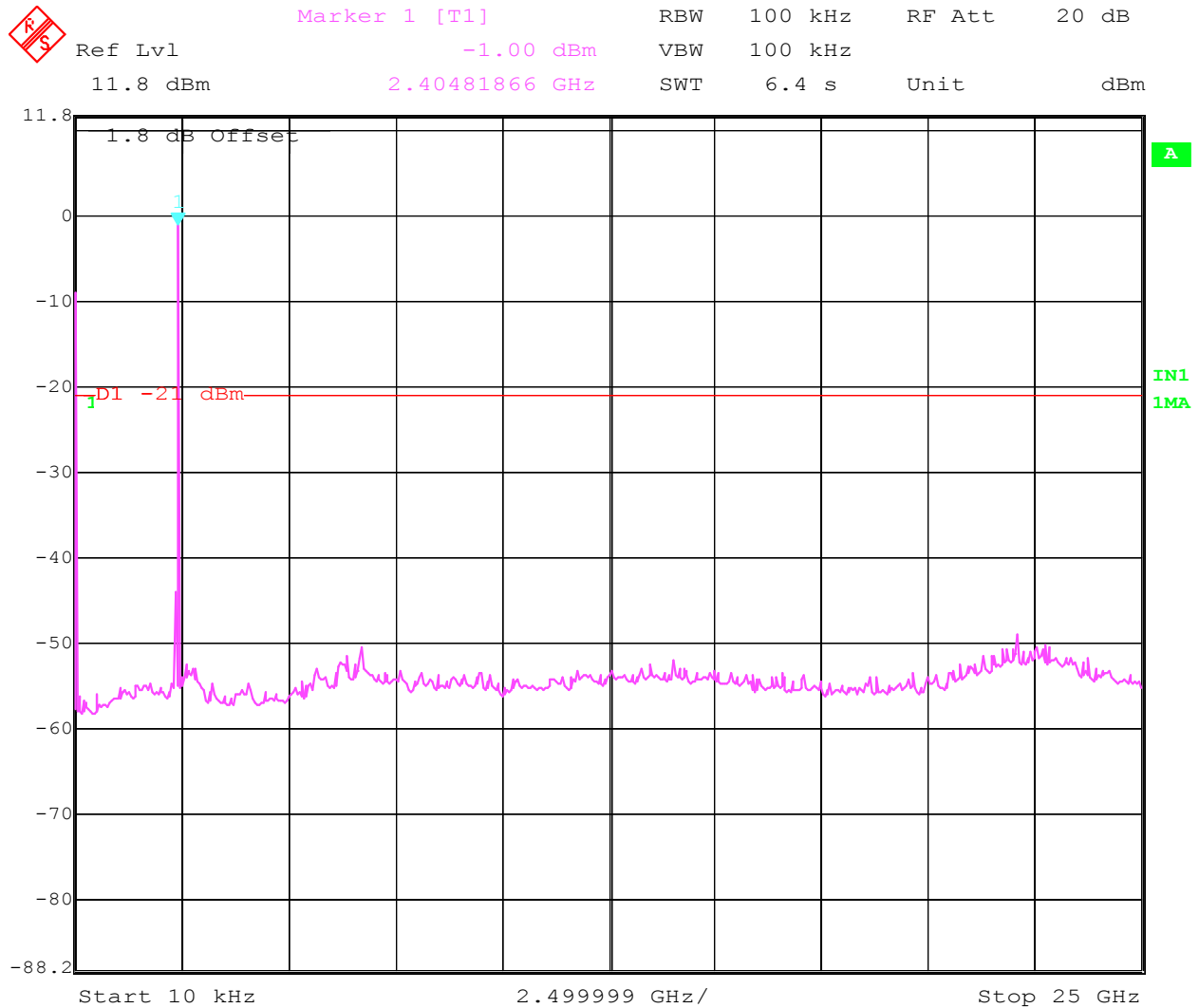
NOTE: Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.

EMISSION LIMITATIONS - Conducted (Transmitter)

§ 15.247 (c) (1)

Lowest Channel(2412MHz): 10KHz - 25GHz

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



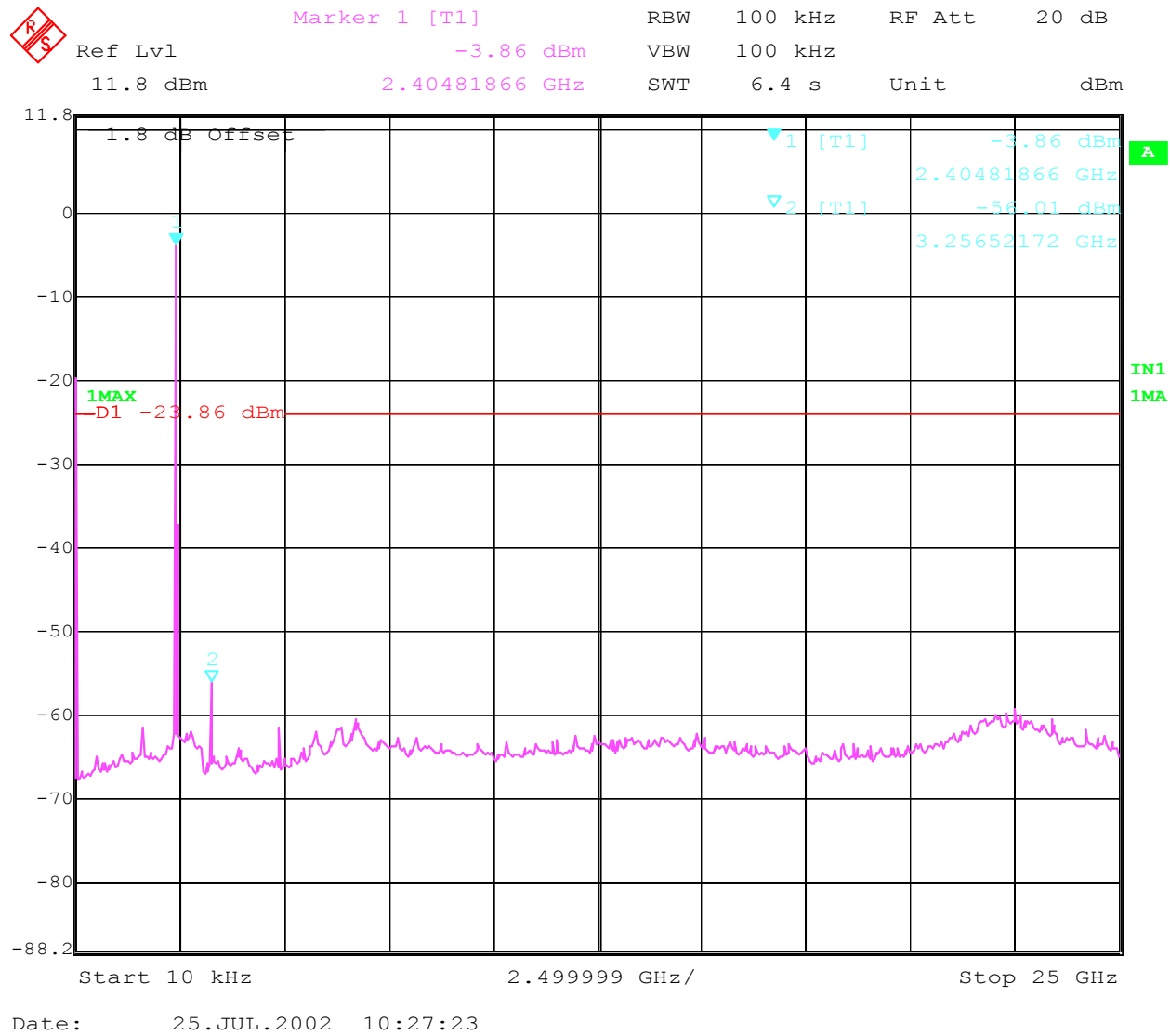
Date: 25.JUL.2002 08:37:04

EMISSION LIMITATIONS - Conducted (Transmitter)

§ 15.247 (c) (1)

Mid Channel(2442MHz): 10KHz - 25GHz

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

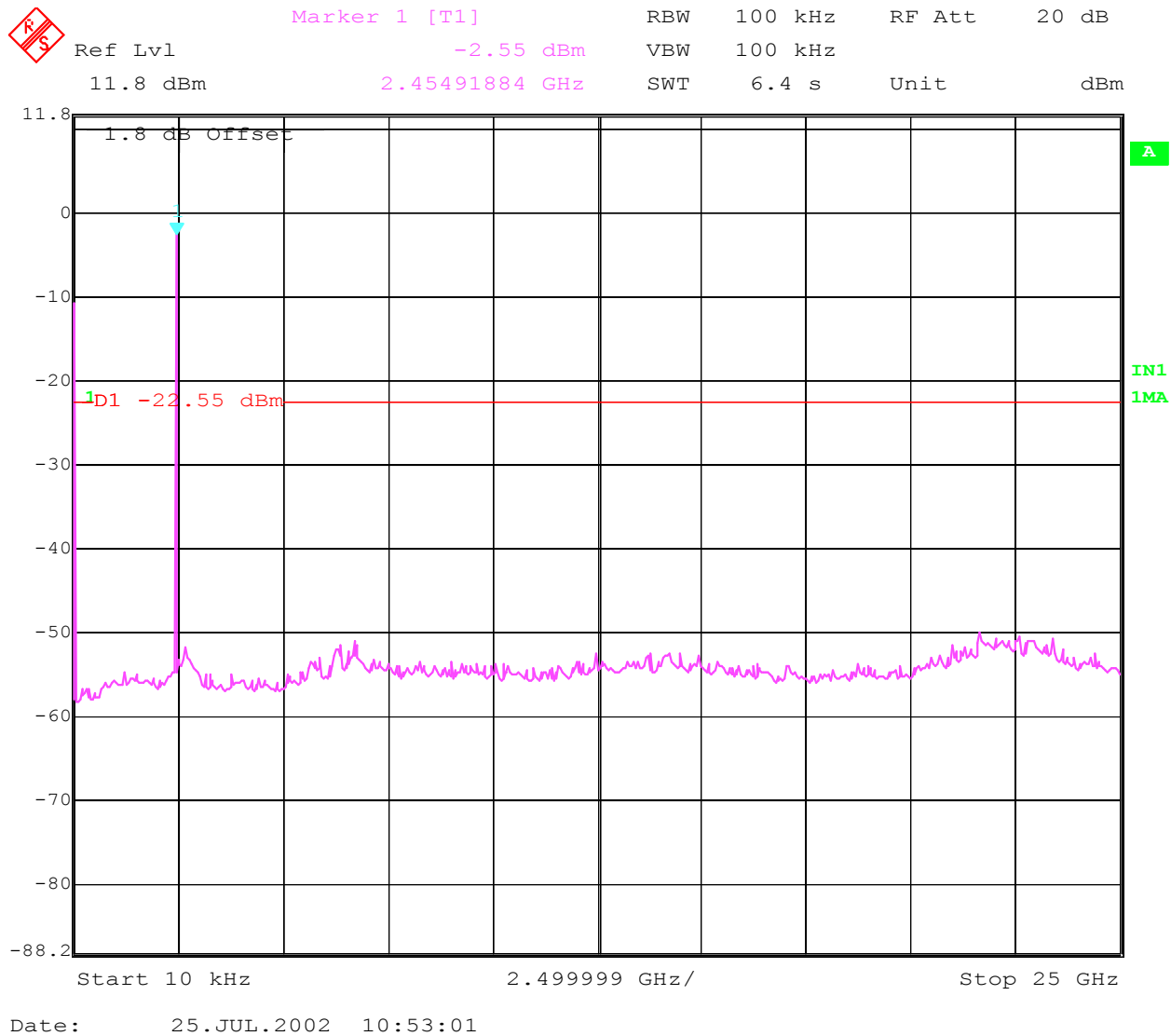


EMISSION LIMITATIONS - Conducted (Transmitter)

§ 15.247 (c) (1)

Highest Channel(2472MHz): 10KHz - 25GHz

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



EMISSION LIMITATIONS**§ 15.247 (c) (1)****Transmitter (Radiated)****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
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

§ 15.247 (c) (1)

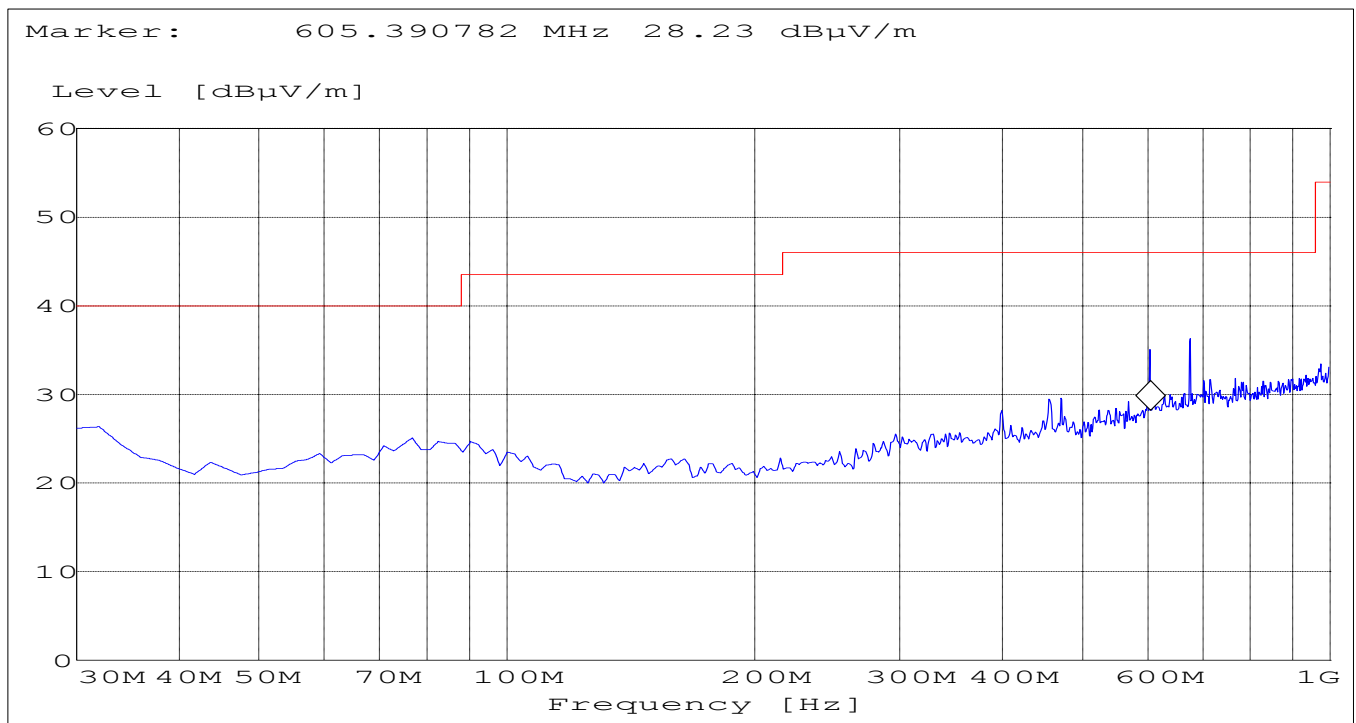
[illegible]

EMISSION LIMITATIONS - Radiated (Transmitter) Lowest Channel(2412MHz): 30MHz – 1GHz

§ 15.247 (c) (1)

SWEEP TABLE: "BT Spuri hi 30-1G"
Short Description: Bluetooth 30MHz-1GHz

Start	Stop	Detector	Meas. Time	RBW	Transducer
Frequency	Frequency			VBW	
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Lowest Channel(2412MHz): 1GHz – 8GHz

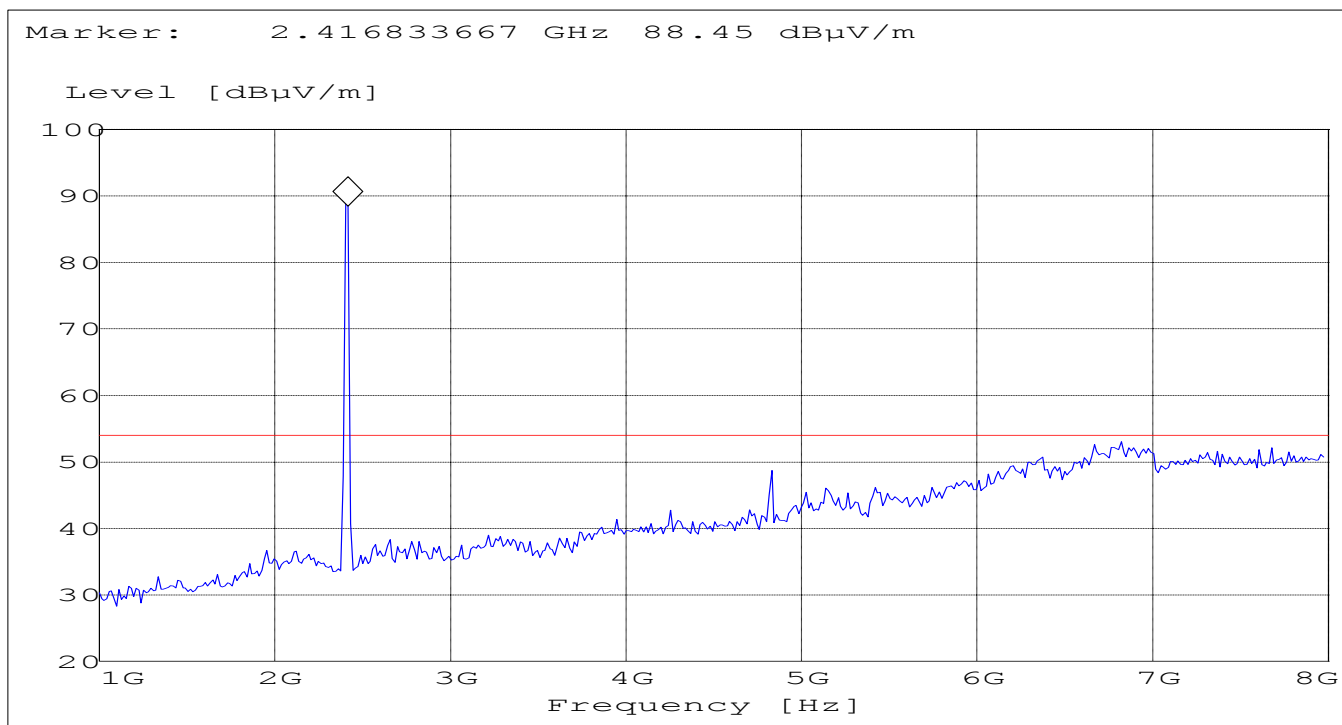
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-8G"

Short Description: Bluetooth Spurious 1-8 GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Note: due to the high noise floor measurement between 6GHz – 8GHz was repeated with different pre-amp and the emissions were found more than 6dB below the limit line.

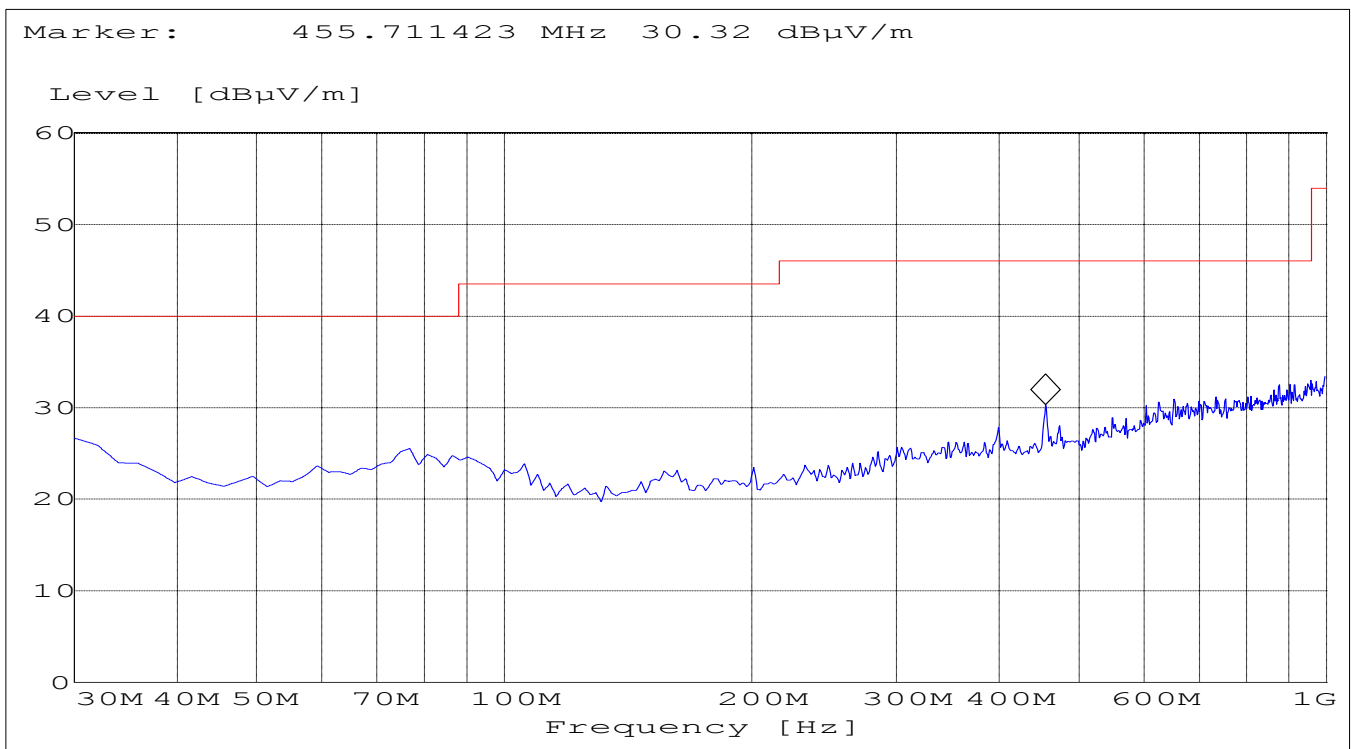


EMISSION LIMITATIONS - Radiated (Transmitter) Middle Channel(2442MHz): 30MHz – 1GHz

§ 15.247 (c) (1)

SWEEP TABLE: "BT Spuri hi 30-1G"
Short Description: Bluetooth 30MHz-1GHz

Start	Stop	Detector	Meas. Time	RBW	VBW	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz		3141-#1186



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Middle Channel(2442MHz): 1GHz – 8GHz

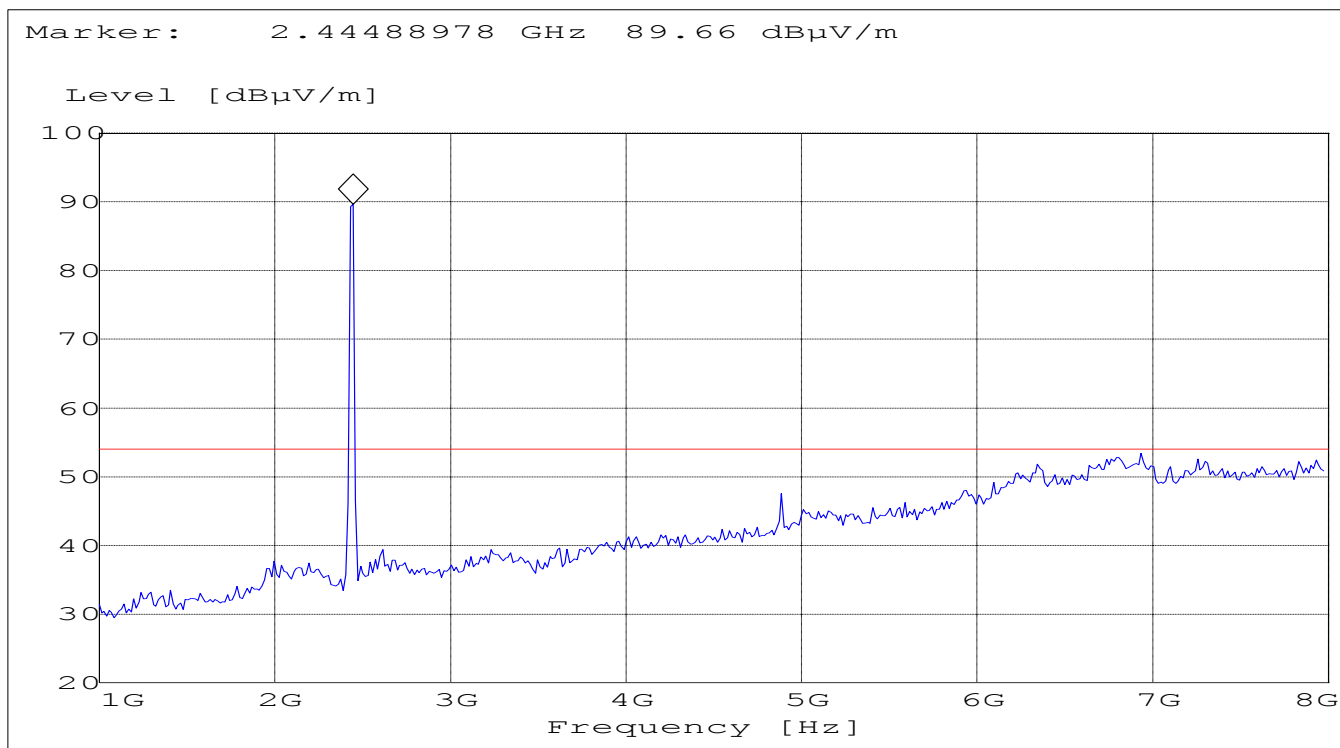
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-8G"

Short Description: Bluetooth Spurious 1-8GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Note: due to the high noise floor measurement between 6GHz – 8GHz was repeated with different pre-amp and the emissions were found more than 6dB below the limit line.

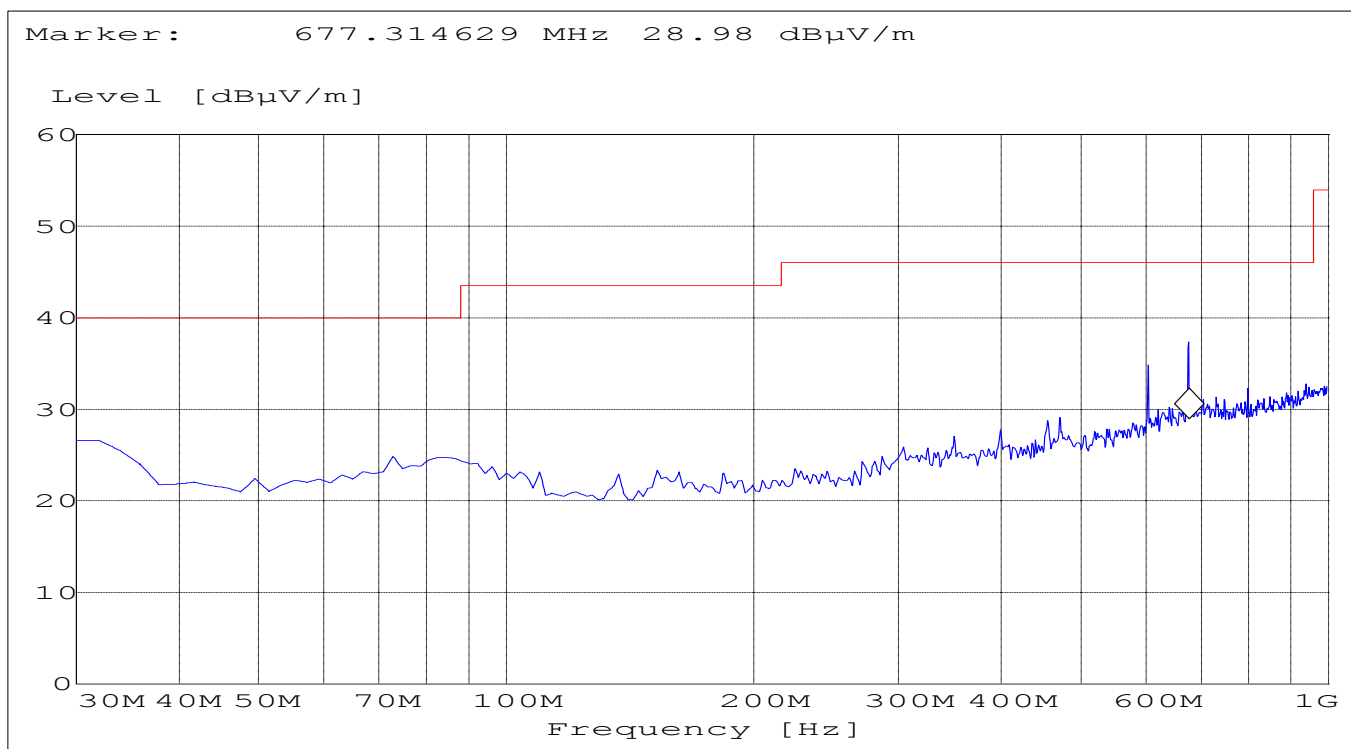


EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Highest Channel(2472MHz): 30MHz – 1GHz

SWEEP TABLE:		"BT Spuri hi 30-1G"			
Short Description:		Bluetooth 30MHz-1GHz			
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency		Time	VBW	
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Highest Channel(2472MHz): 1GHz – 8GHz

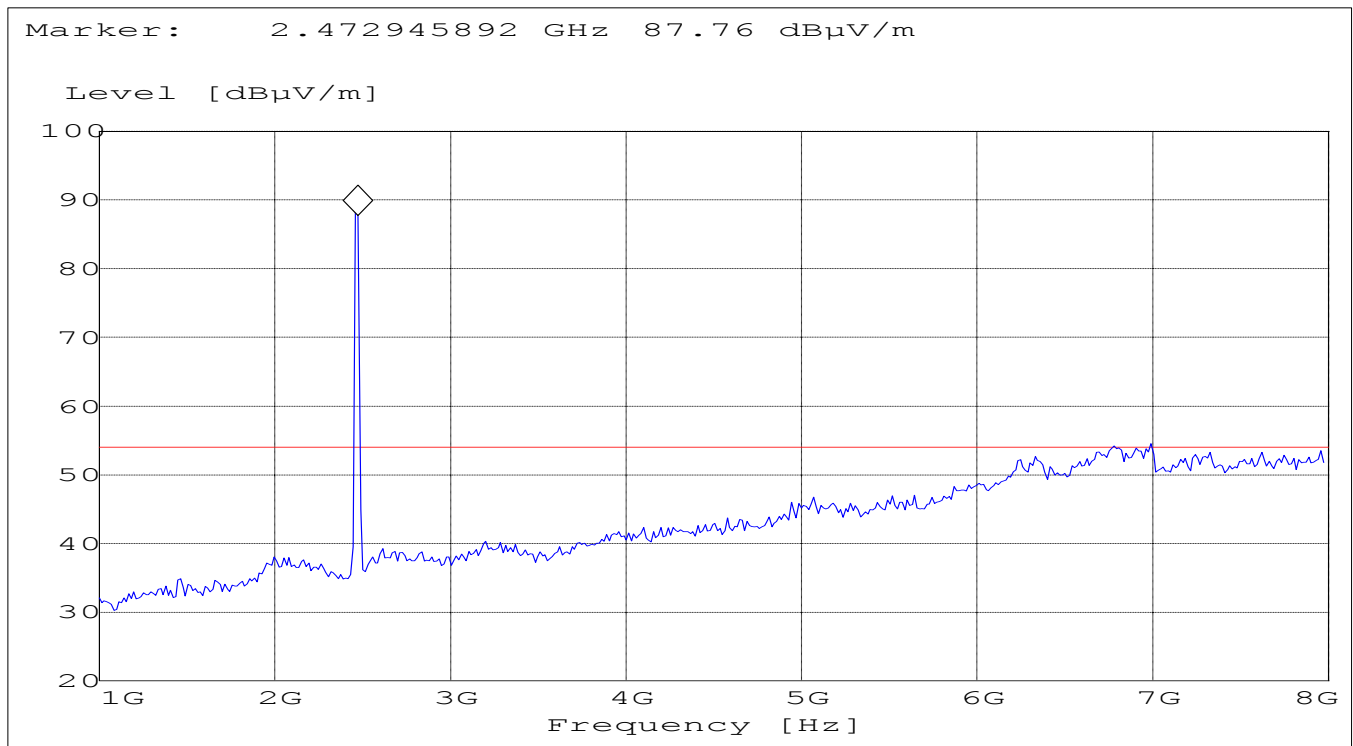
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-8G"

Short Description: Bluetooth Spurious 1-8GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Note: due to the high noise floor measurement between 6GHz – 8GHz was repeated with different pre-amp and the emissions were found more than 6dB below the limit line.



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

8GHz – 18GHz

(This plot is valid for all three channels)

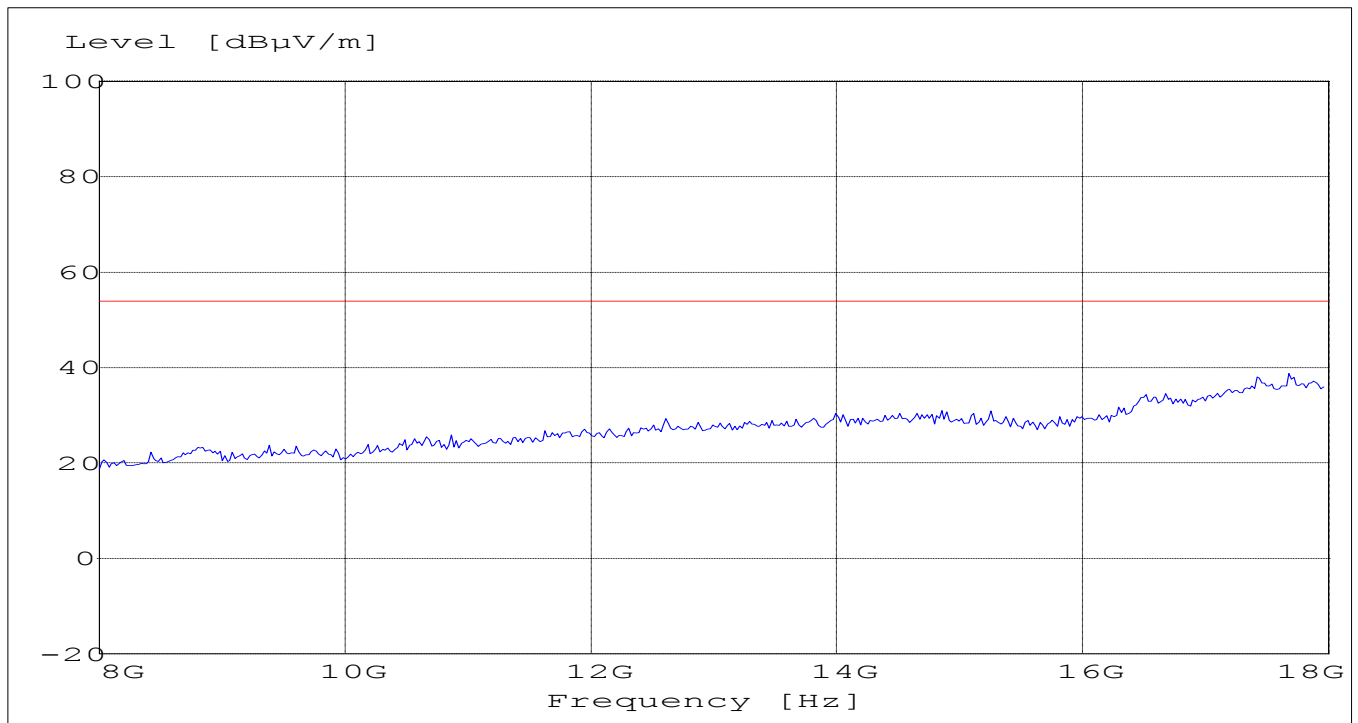
SWEEP TABLE:

"BT Spuri hi 8-18G"

Short Description:

Bluetooth Spurious 8-18GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
8.0 GHz	18 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

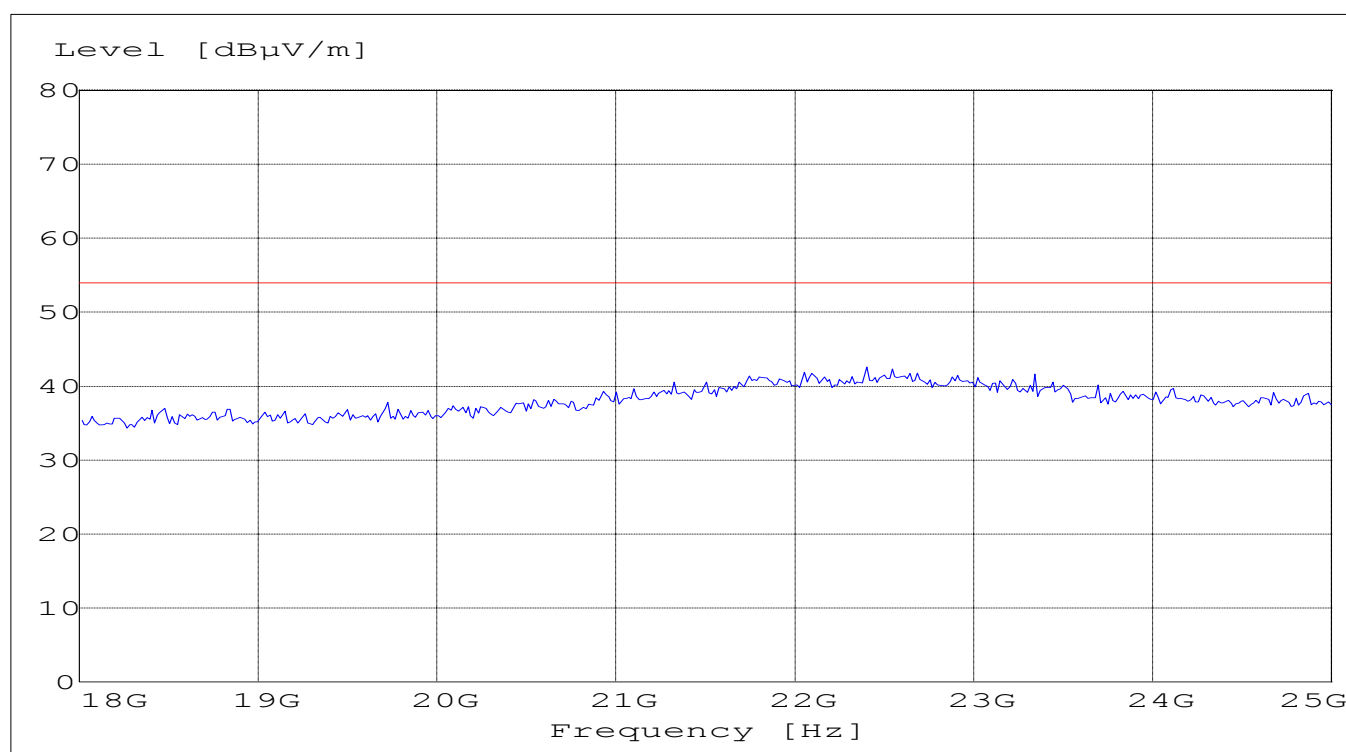
18GHz – 25GHz

(This plot is valid for all three channels)

SWEEP TABLE: "BT Spuri hi 18-25G"

Short Description: Bluetooth Spurious 18-25GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	25 GHz	MaxPeak	Coupled	1 MHz	#141 horn (dBi)



CONDUCTED EMISSIONS

§ 15.107/207

Measured with AC/DC power adapter

(Limit: CISPR 22 class-B)

Note: This measurement is carried out according to guidelines of FCC 02-157

SWEEP TABLE: "55022 cond"

Short Description: EN 55022 for 150KHz-30MHz

Start	Stop	Detector	Meas	IF	Transducer
Frequency	Frequency		Time	Bandw.	
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None

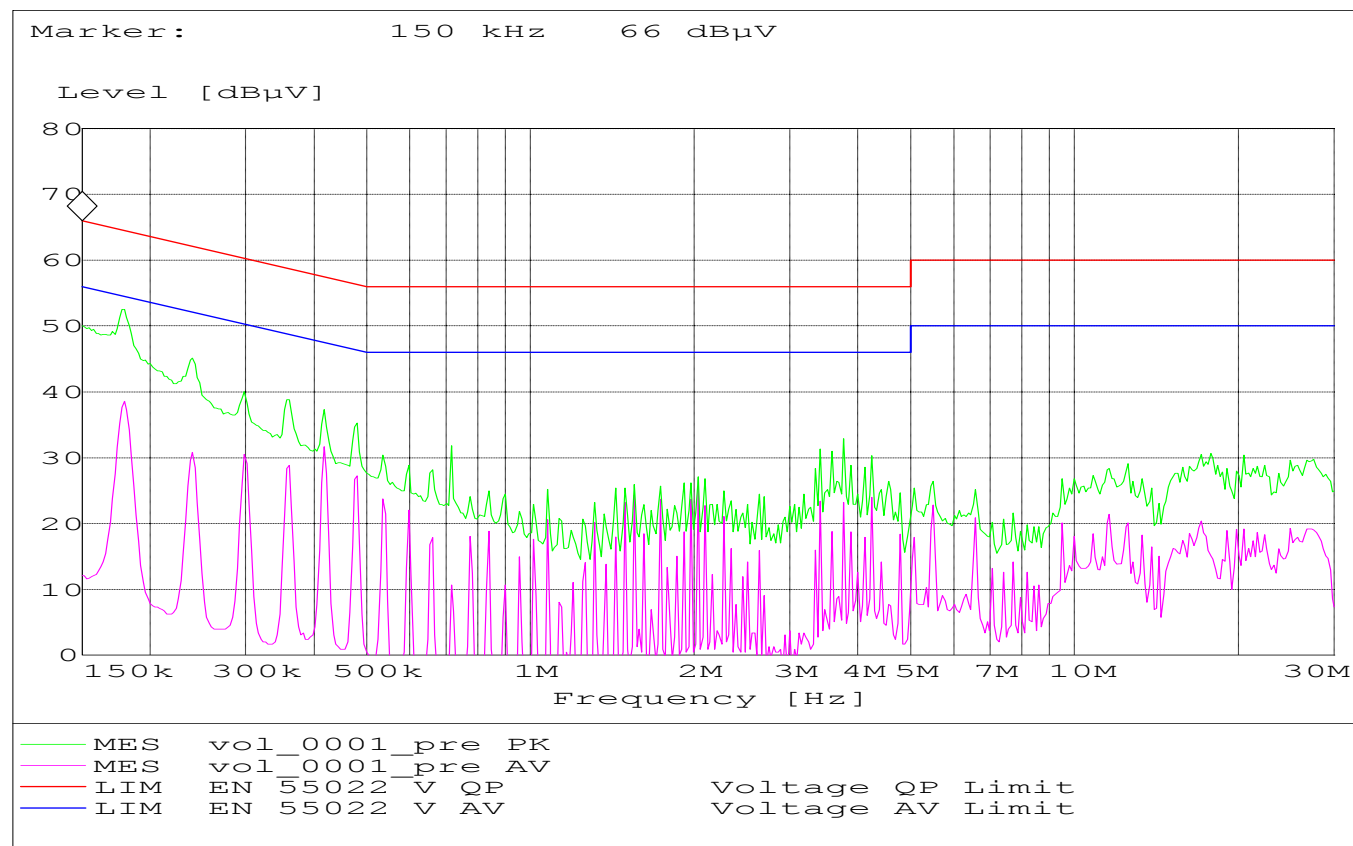
Technical specification : 15.107 / 15.207 (Revised as of October 1, 1991)

Limit

0.45 to 30 MHz	250 μ V / 47.96 dB μ V
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ANALYZER SETTINGS: RBW = 10KHz

VBW = 10KHz



RECEIVER SPURIOUS RADIATION**§ 15.209****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	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

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.

RECEIVER SPURIOUS RADIATION

§ 15.209

30MHz – 1GHz

SWEEP TABLE:

"BT Spuri hi 30-1G"

Short Description:

Bluetooth 30MHz-1GHz

Start Stop

Detector

Meas.

RBW

Transducer

Frequency Frequency

Time

VBW

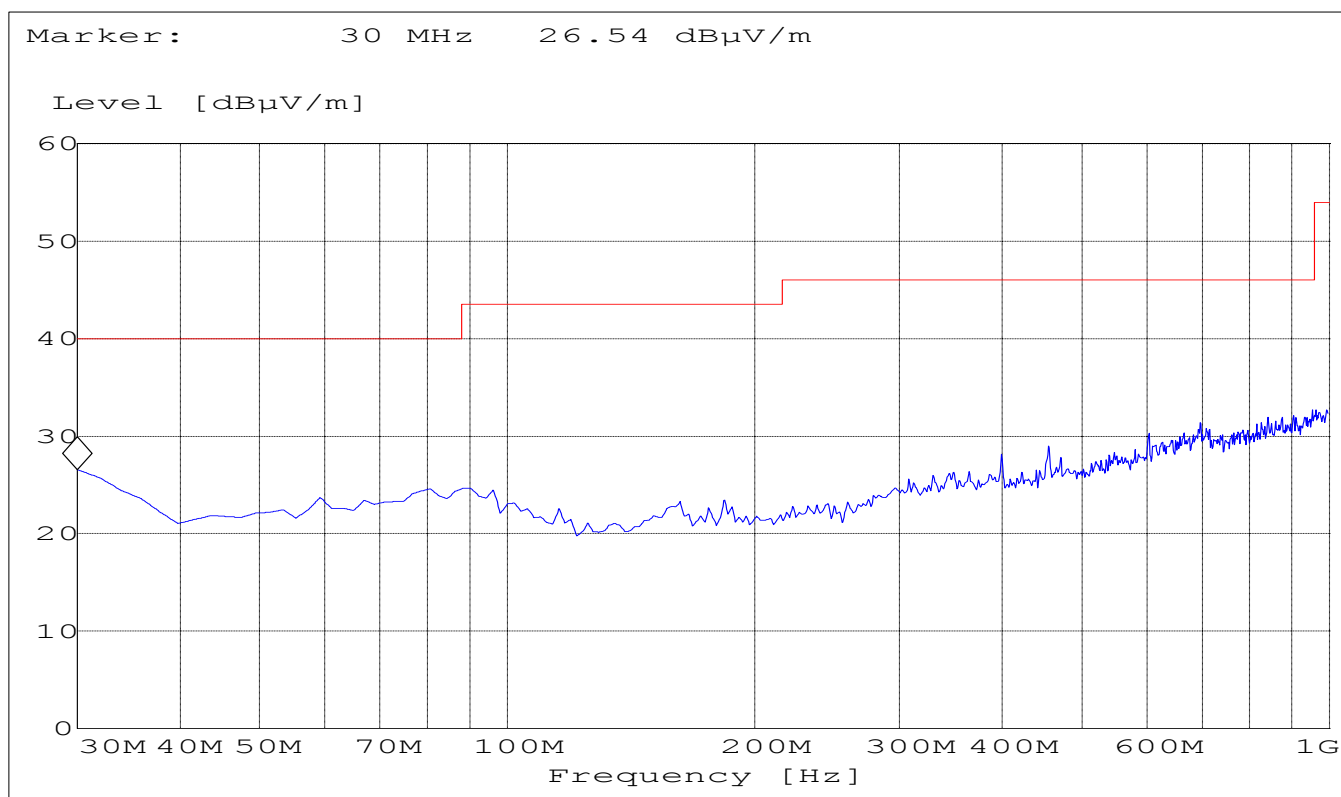
30.0 MHz 1.0 GHz

MaxPeak

Coupled

100 kHz

3141-#1186



RECEIVER SPURIOUS RADIATION

§ 15.209

1GHz – 8GHz

SWEEP TABLE:

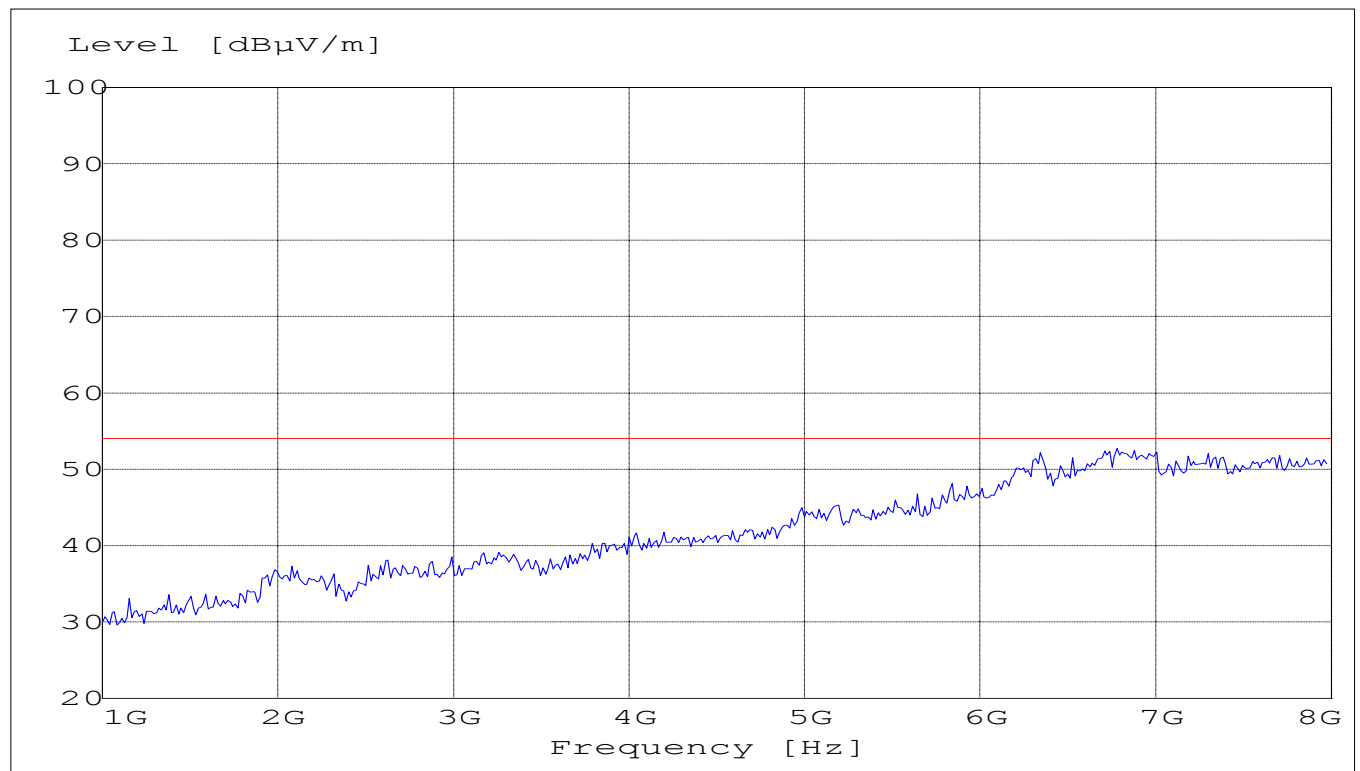
"BT Spuri hi 1-8G"

Short Description:

Bluetooth Spurious 1-8 GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Note: due to the high noise floor measurement between 6GHz – 8GHz was repeated with different pre-amp and the emissions were found more than 6dB below the limit line.



RECEIVER SPURIOUS RADIATION

§ 15.209

8GHz – 18GHz

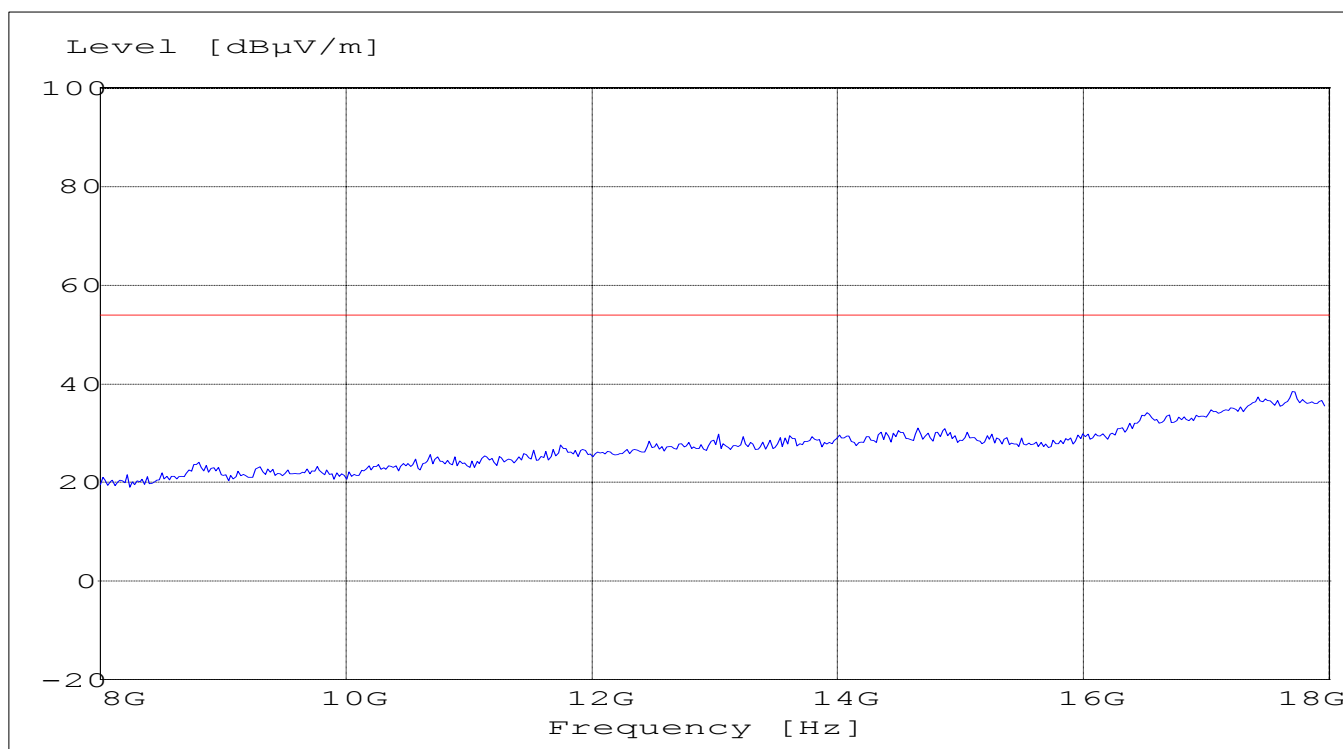
SWEEP TABLE:

"BT Spuri hi 8-18G"

Short Description:

Bluetooth Spurious 8-18GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
8.0 GHz	18 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)



RECEIVER SPURIOUS RADIATION

§ 15.209

18GHz – 25GHz

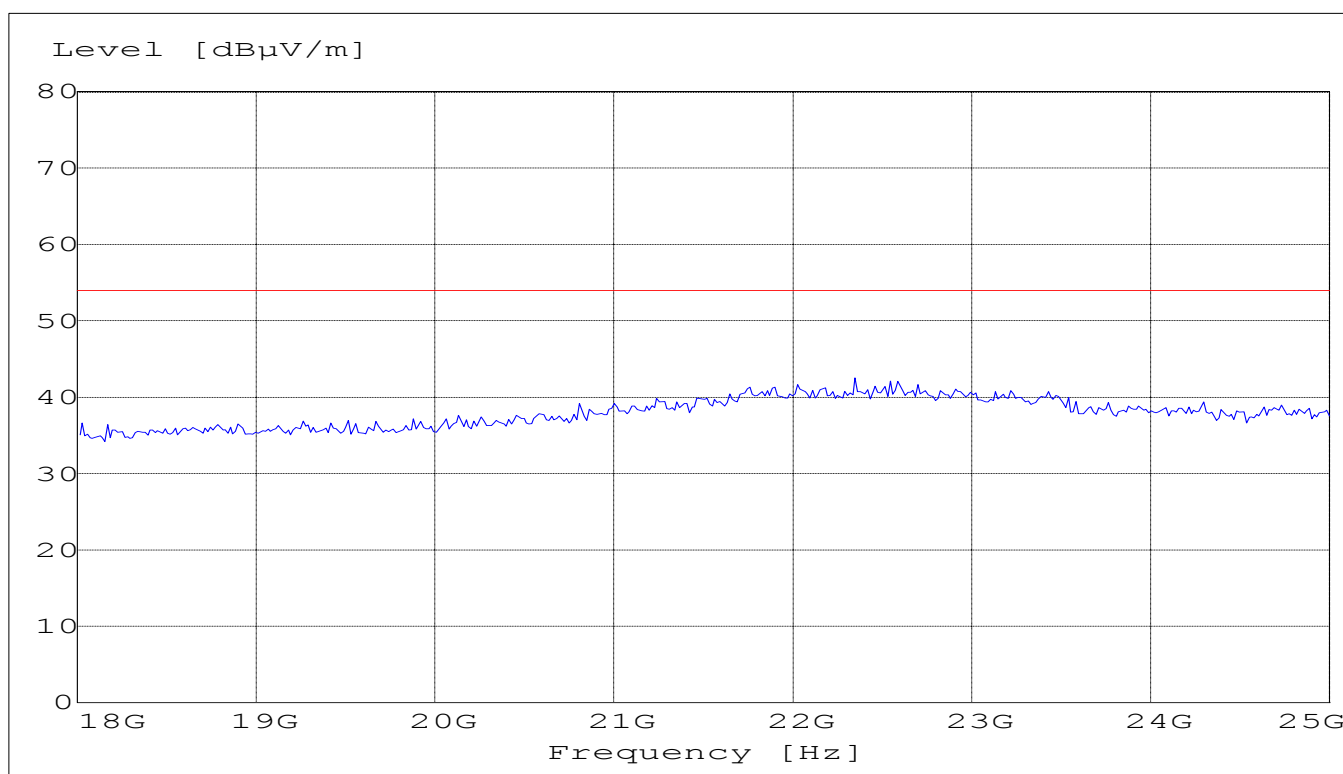
SWEEP TABLE:

"BT Spuri hi 18-25G"

Short Description:

Bluetooth Spurious 18-25GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	25 GHz	MaxPeak	Coupled	1 MHz	#141 horn (dBi)

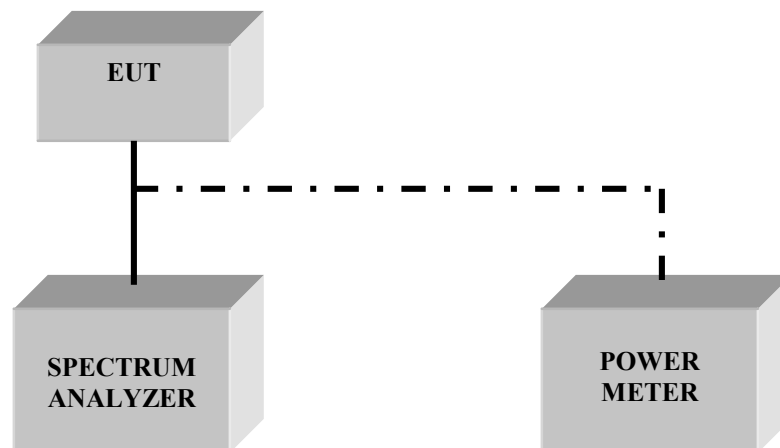


TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
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	Climatic Chamber	VT4004	Votch	G1115
10	Pre-Amplifier	JS4-00102600	Miteq	00616
11	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807
12	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008

BLOCK DIAGRAMS

Conducted Testing



Radiated Testing

ANECHOIC CHAMBER

