CETECOM Inc.

CETECOM Inc.

411 Dixon Landing Road, Milpitas, CA-95035, USA
Phone: +1 408 586 6200 Fax: +1 408 586 6299
www.cetecom.com

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

Test report no.: 237FCC/2002
FCC Part 15.247
(POGOSTICK)

Table of Contents

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 & Radio Engineer : Harpreet Sidhu

1.2 Testing laboratory

CETECOM Inc.
411 Dixon Landing Road, Milpitas, CA-95035, USA
Phone: +1 408 586 6200 Fax: +1 408 586 6299
E-mail: lothar.schmidt@cetecomusa.com
Internet: www.cetecom.com

1.3 Details of applicant

Name : Trimble Navigation Ltd.
Street : 645 N Mary Av.
City : Sunnyvale, CA 94086
Country : USA
Contact : Dennis Connor
Telephone : +1 408 481 7314
Telefax : +1 408 481 2097
e-mail : dennis_connor@trimble.com

1.4 Application details

Date of receipt of application	:	2002-01-01
Date of receipt test item	:	2002-01-16
Date of test	:	2002-01-16/17

1.5 Test item

Manufacturer	:	Applicant
Name of EUT	:	POGOSTICK
Description	:	GPS Receiver with integrated Bluetooth and receive only Radio Modem
Model No.	:	5800
Serial No.	:	0012284317
FCC ID.	:	

Additional information

Frequency	:	2402MHz – 2480MHz
Type of modulation	:	FHSS
Number of channels	:	79
Antenna	:	Quater wave dipole
Power supply	:	Internal Battery
Output power	:	-8.81dBm (0.131mW)
Extreme vol. Limits	:	Battery operated (8V-20V DC)
Extreme temp. Tolerance	:	-30ºC – +60ºC

1.6 Test standards: FCC Part 15 §15.247 (DA00-705)

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 :

Date	Section	Name	Signature
2002-02-05	EMC & Radio	Lothar Schmidt	

2.2 Testreport

TEST REPORT

Test report no. : 237FCC/2002
(POGOSTICK)

TEST REPORT REFERENCE

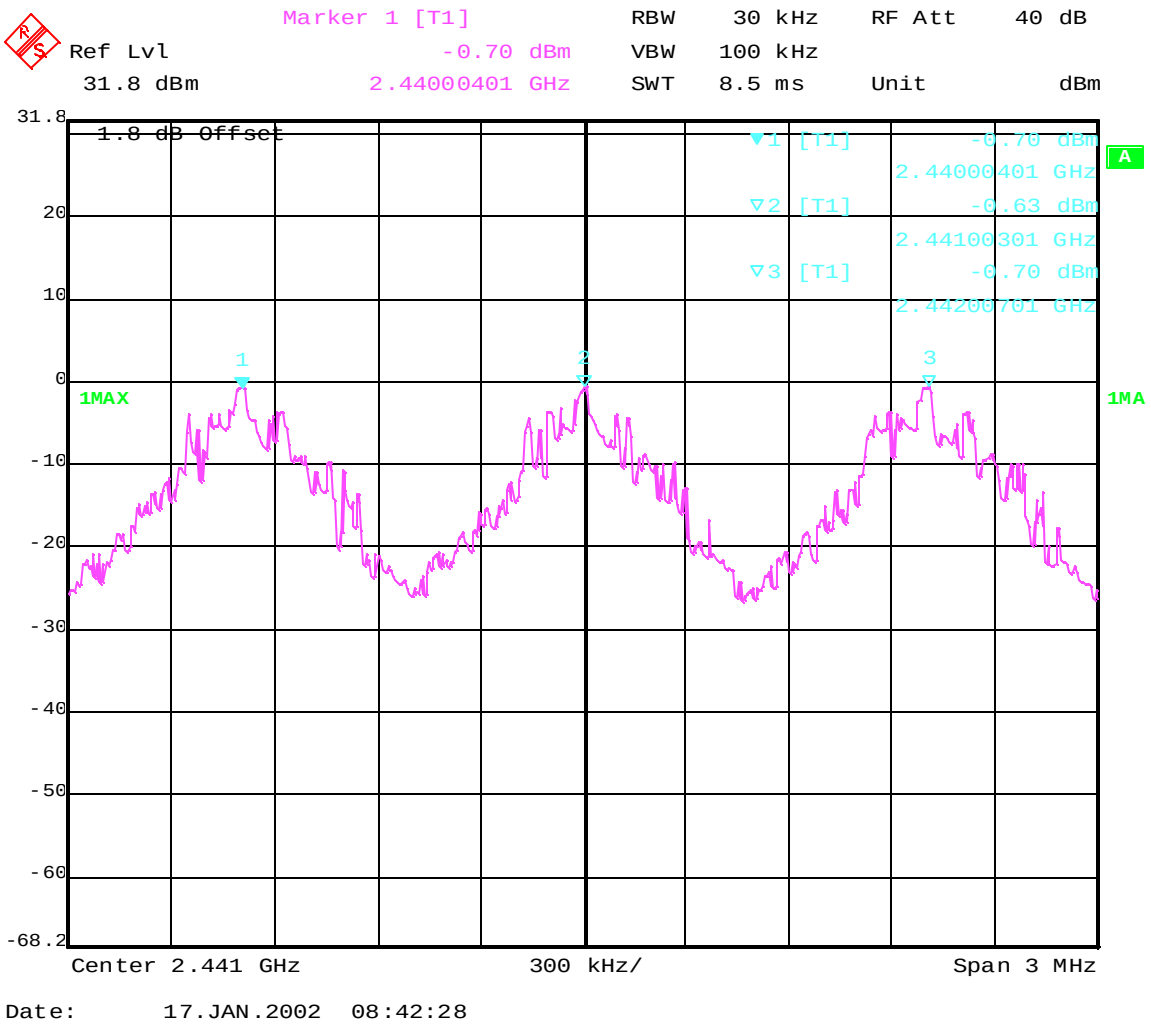
LIST OF MEASUREMENTS

Antenna Gain **SUBCLAUSE § 15.204**

The max gain is: -9.27dBi

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

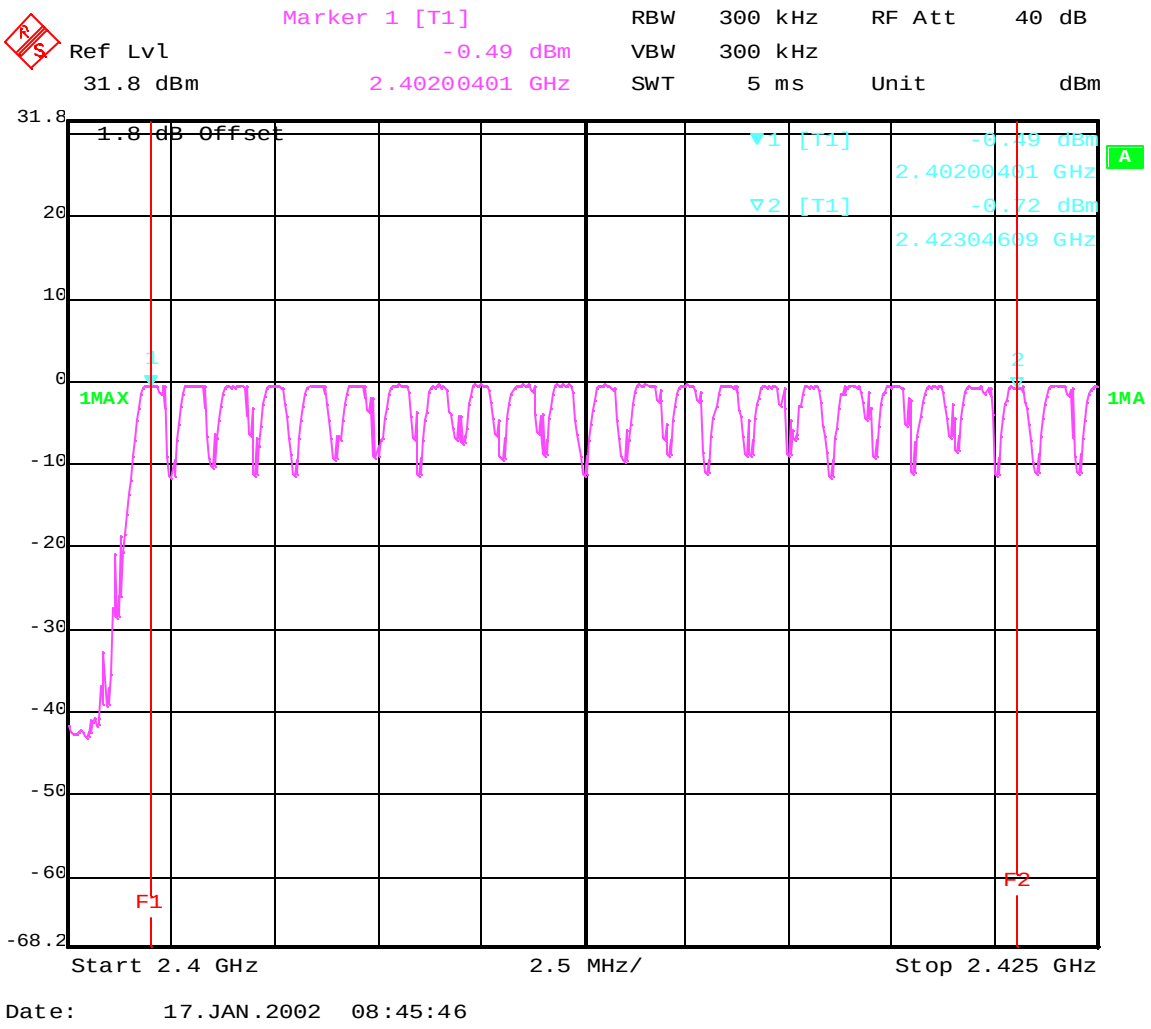
CARRIER FREQUENCY SEPERATION §15.247(a)



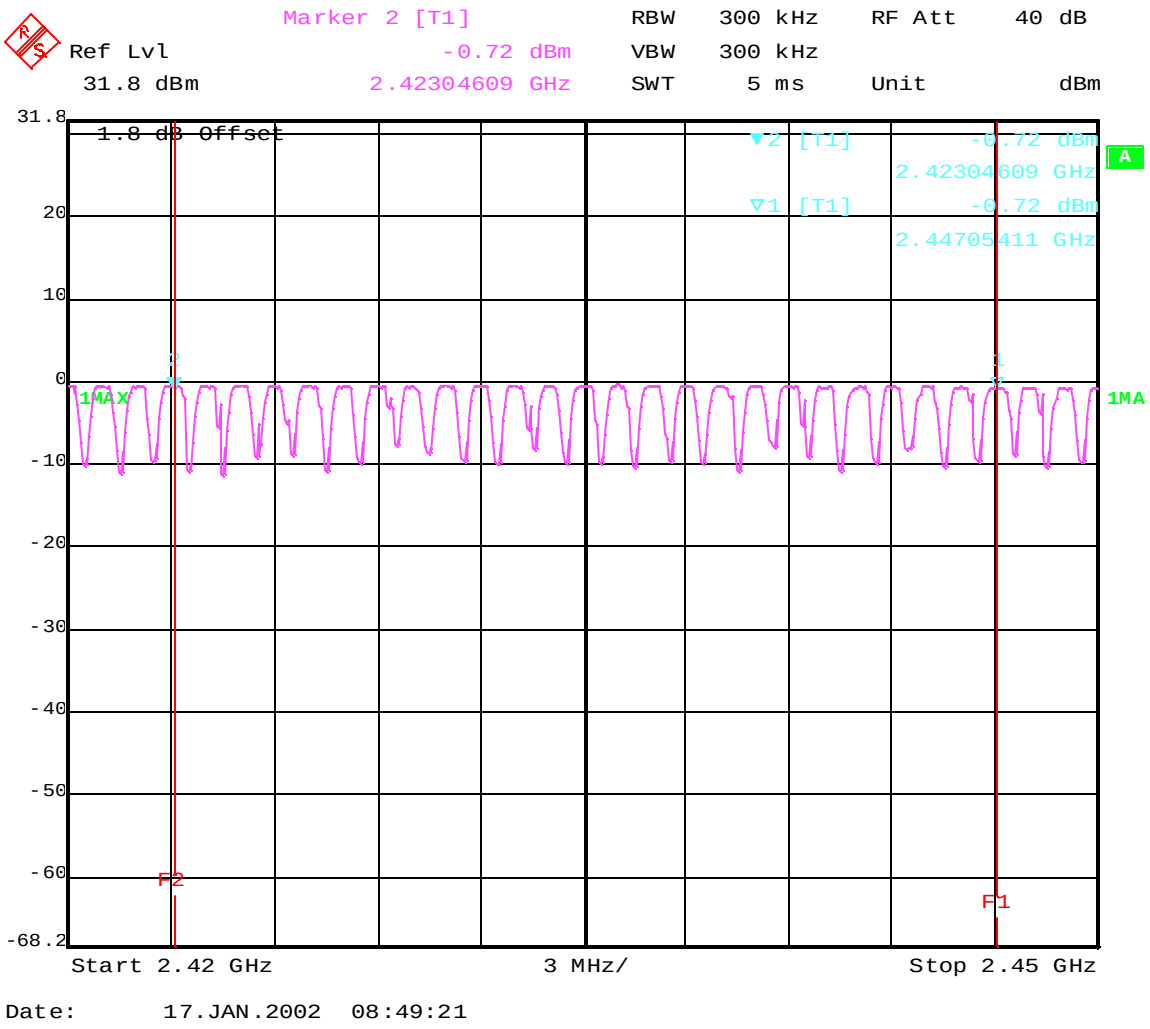
NUMBER OF HOPPING CHANNELS §15.247(a)

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.

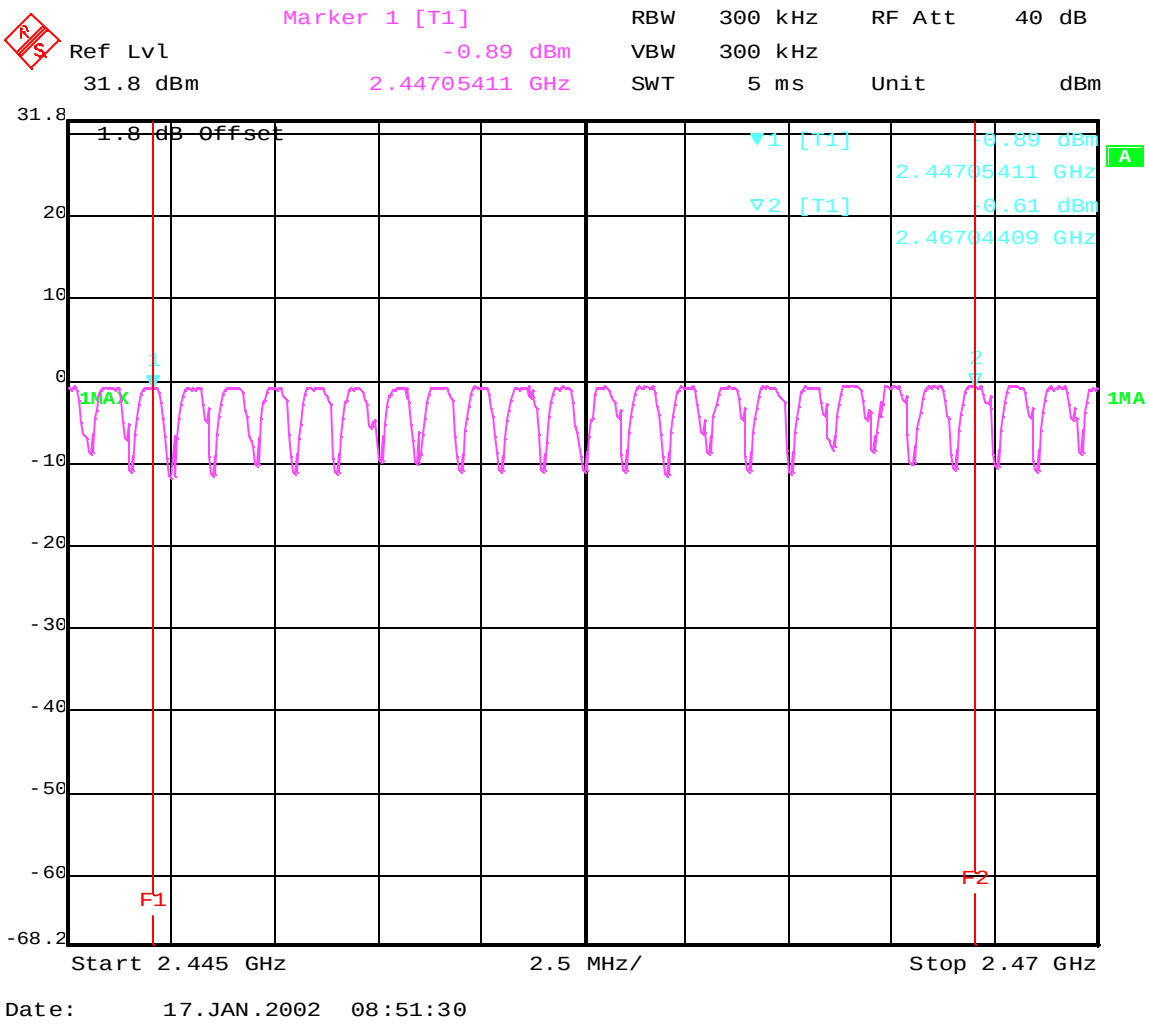
Plot 1: Total 22



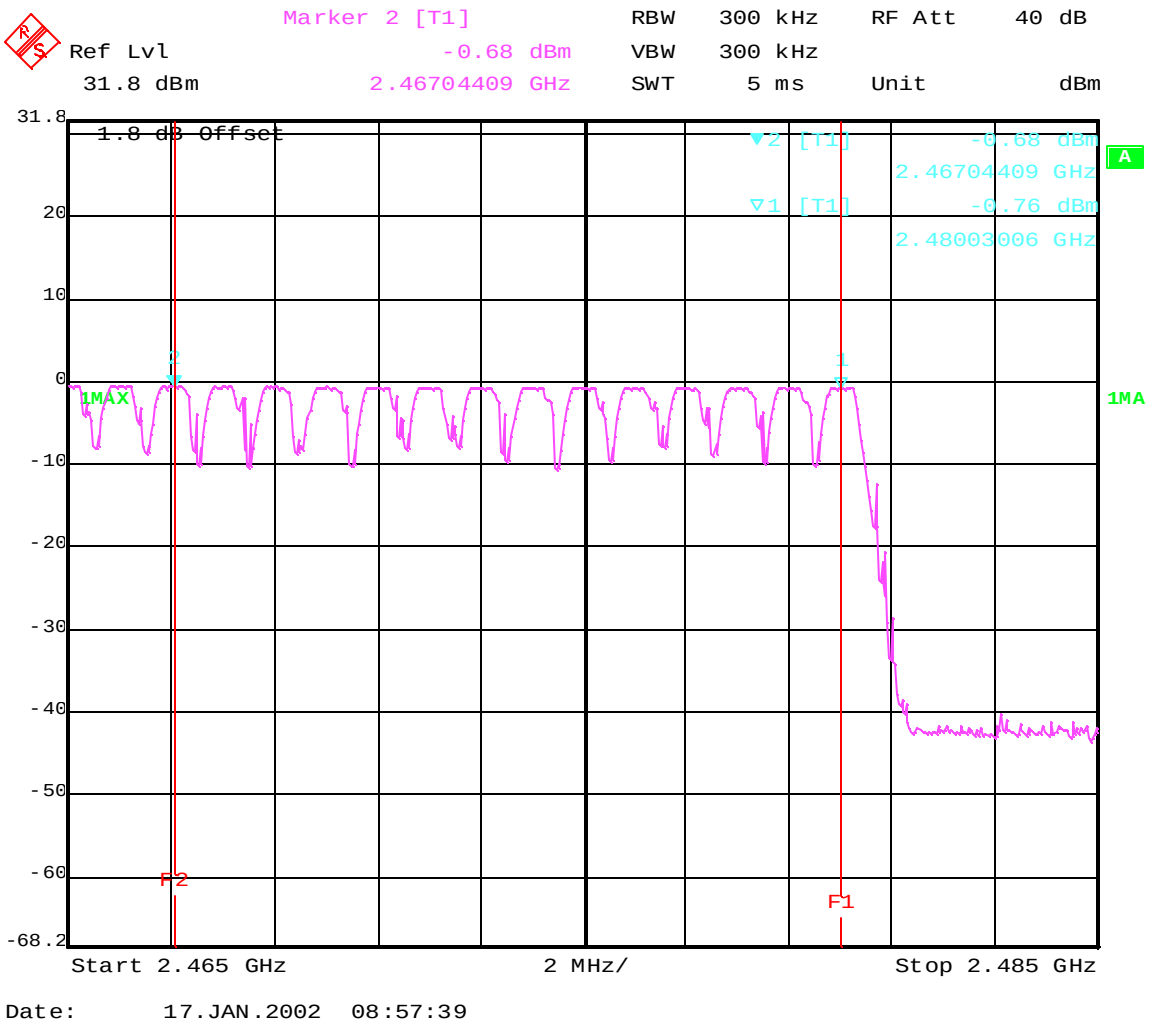
Plot 2: Total 24



Plot 3: Total 20

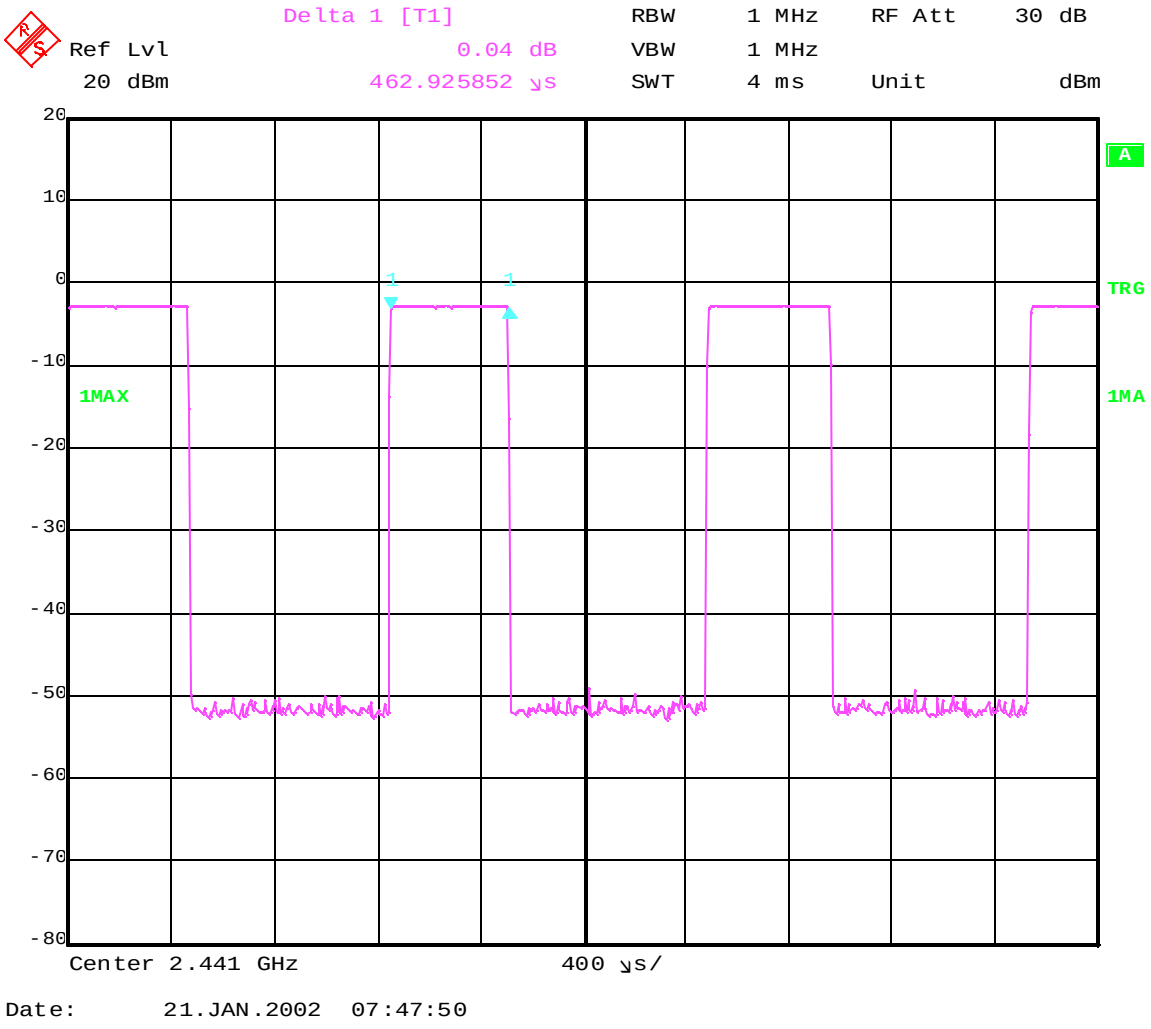


Plot 4: Total 13



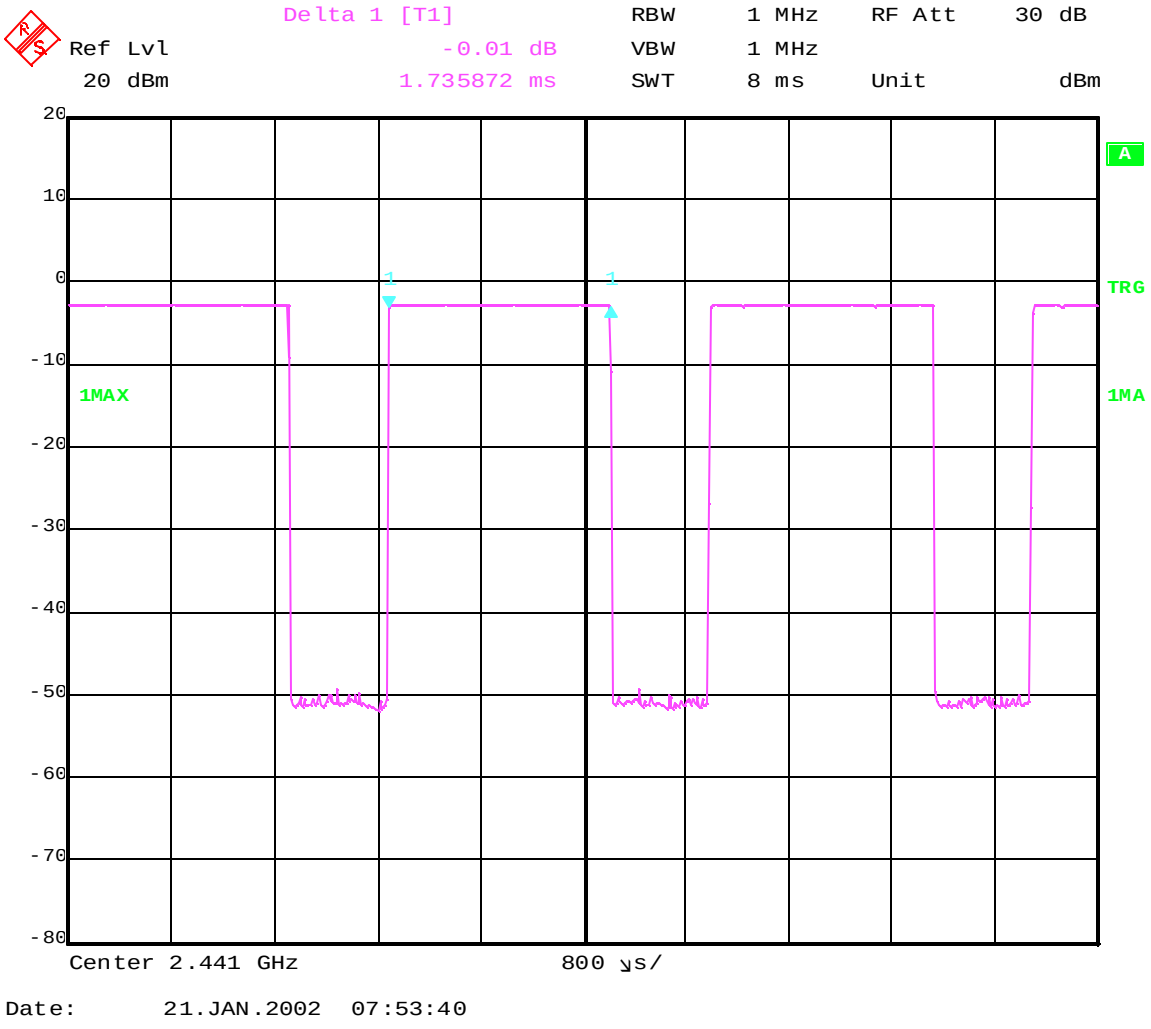
TIME OF OCCUPANCY (DWELL TIME) FOR DH1 **§15.247(a)**

The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs 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 appearence .
Each Tx-time per appearence is 462.92 µs.
So we have 303.9 * 462.92 µs = 140.68 ms per 30 seconds.



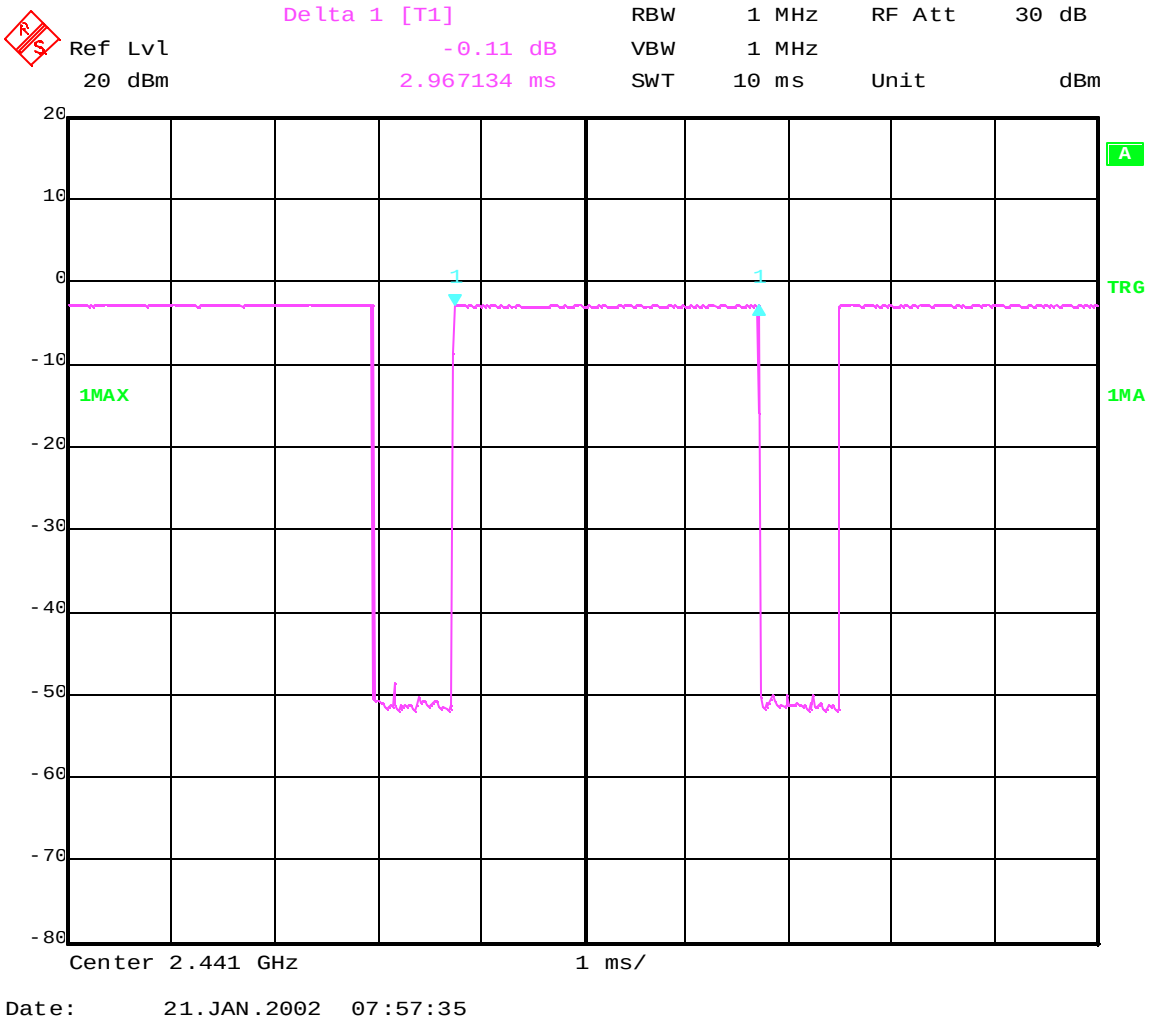
TIME OF OCCUPANCY (DWELL TIME) FOR DH3 **§15.247(a)**

A DH3 Packets need 3 time slots for transmit and 1 for re ceicing, 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 appearence .
Each Tx-time per appearence is 1.72 ms.
So we have 153 * 1.72 ms = 263.16 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 2.96 ms.
So we have 100.8 * 2.96ms = 298.36 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_{nom}(23)° C	V_{nom}	641.28	625.25	657.97
Measurement uncertainty		±3dB		

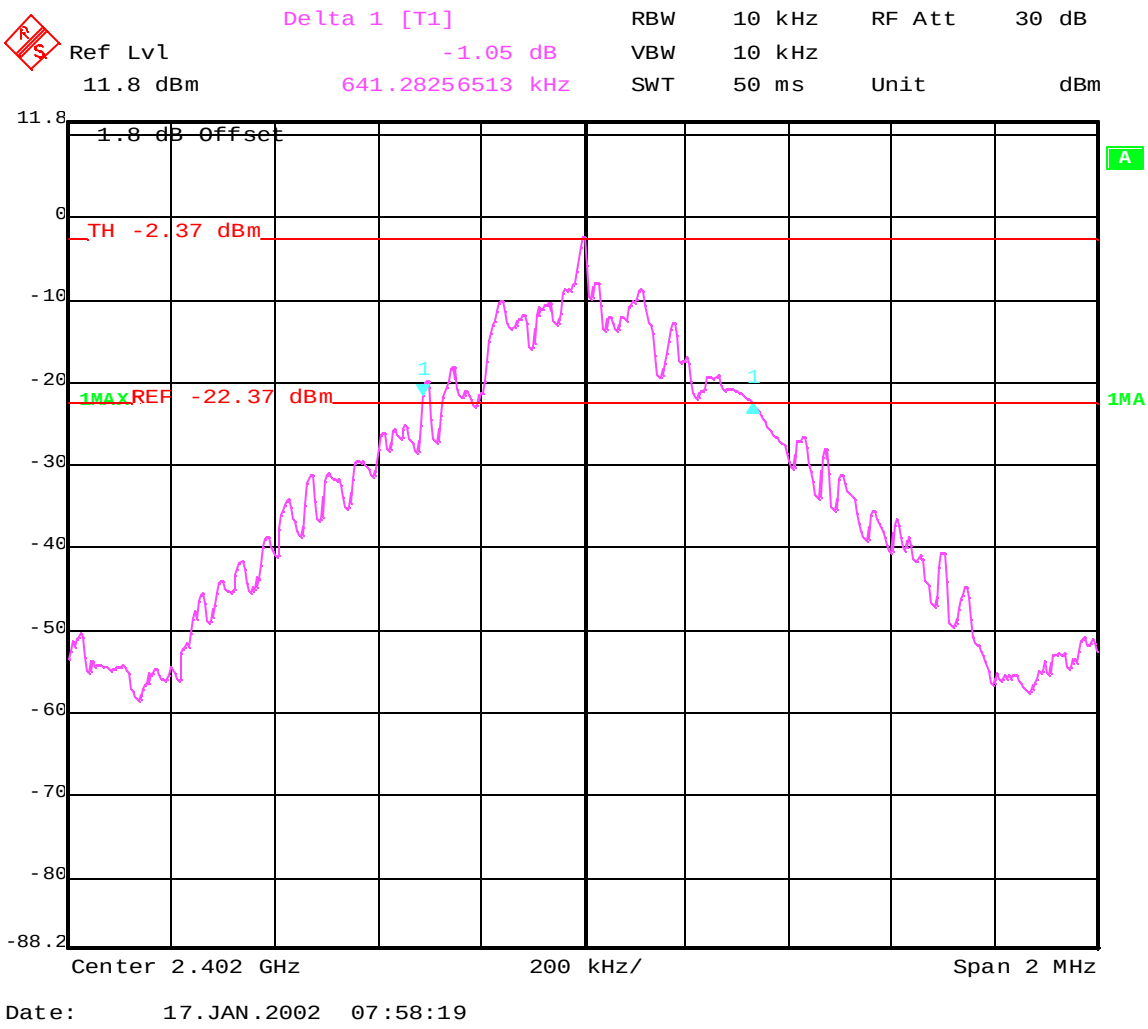
RBW / VBW as provided in the "Measurement Guidelines'' (DA 00-705, March 30, 2000)

LIMIT **SUBCLAUSE §15.247(a) (1)**

The maximum 20dB bandwith shall be at maximum 1000 KHz

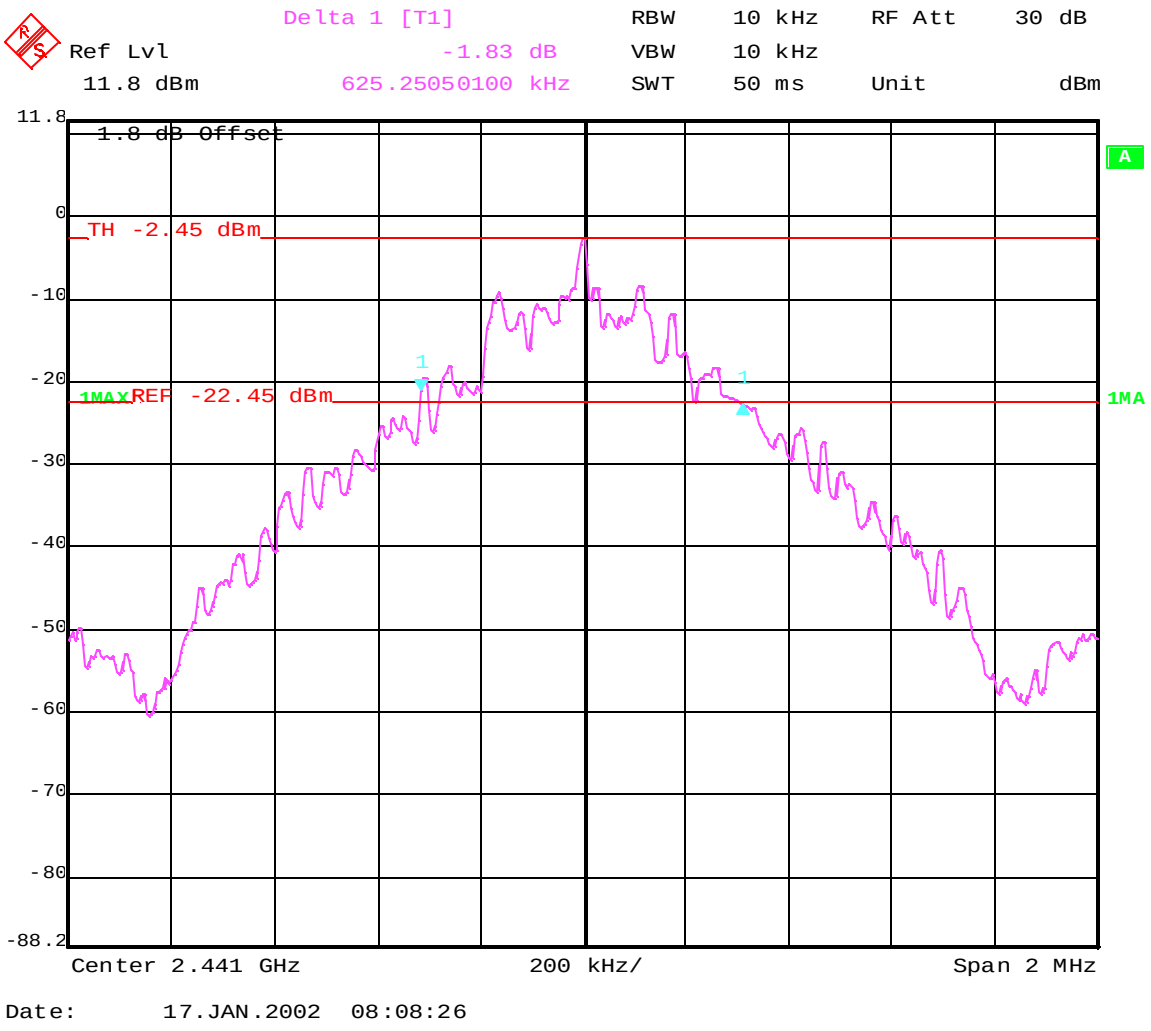
SPECTRUM BANDWIDTH OF FHSS SYSTEM **§15.247(a)**
20 dB bandwidth

Lowest Channel: 2402MHz



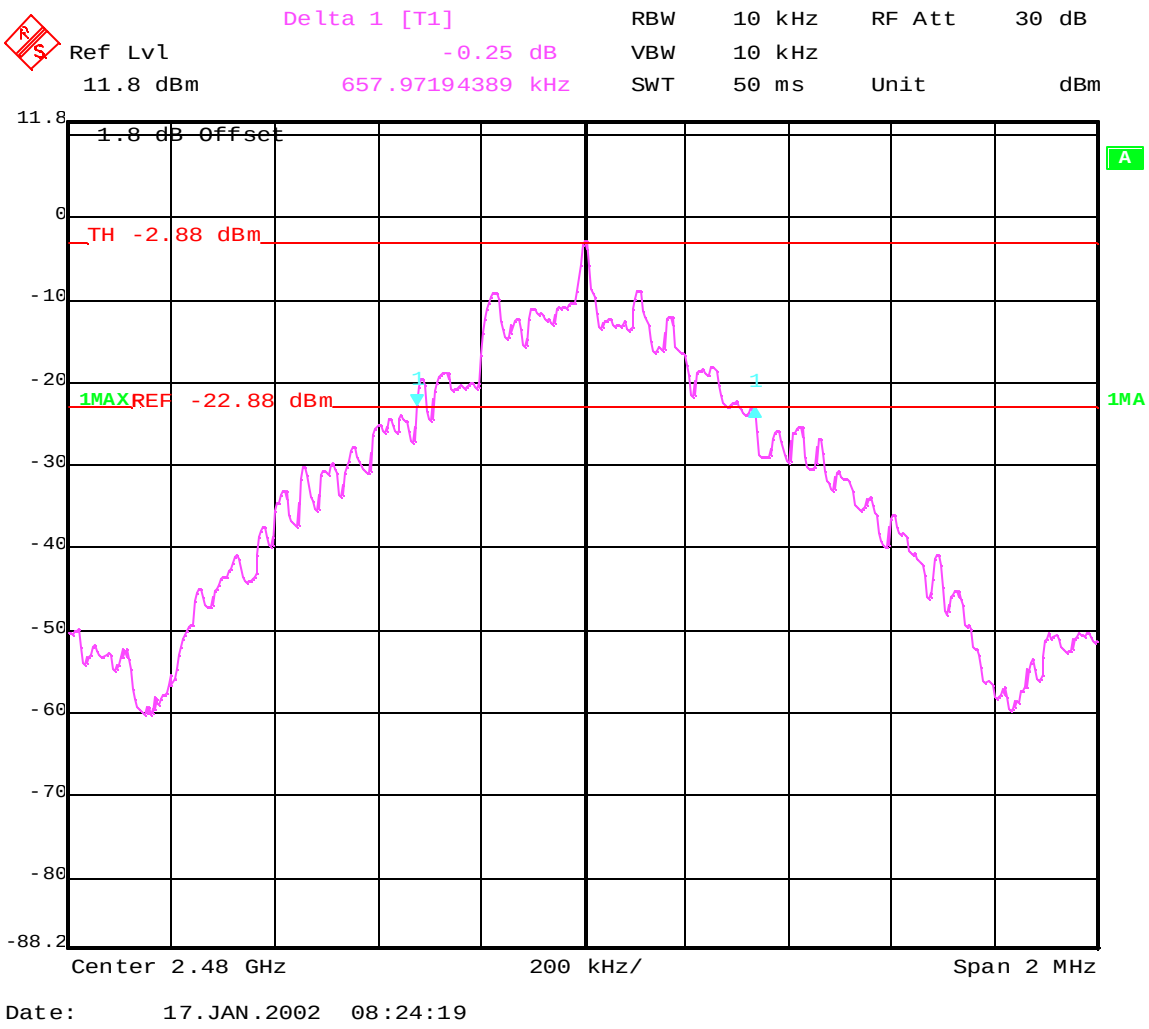
SPECTRUM BANDWIDTH OF FHSS SYSTEM **§15.247(a)**
20 dB bandwidth

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)**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)			2402	2441	2480
T_{nom}(23)° C	V_{nom}	PK	-0.47	-0.47	-0.79
Measurement uncertainty		±3dB			

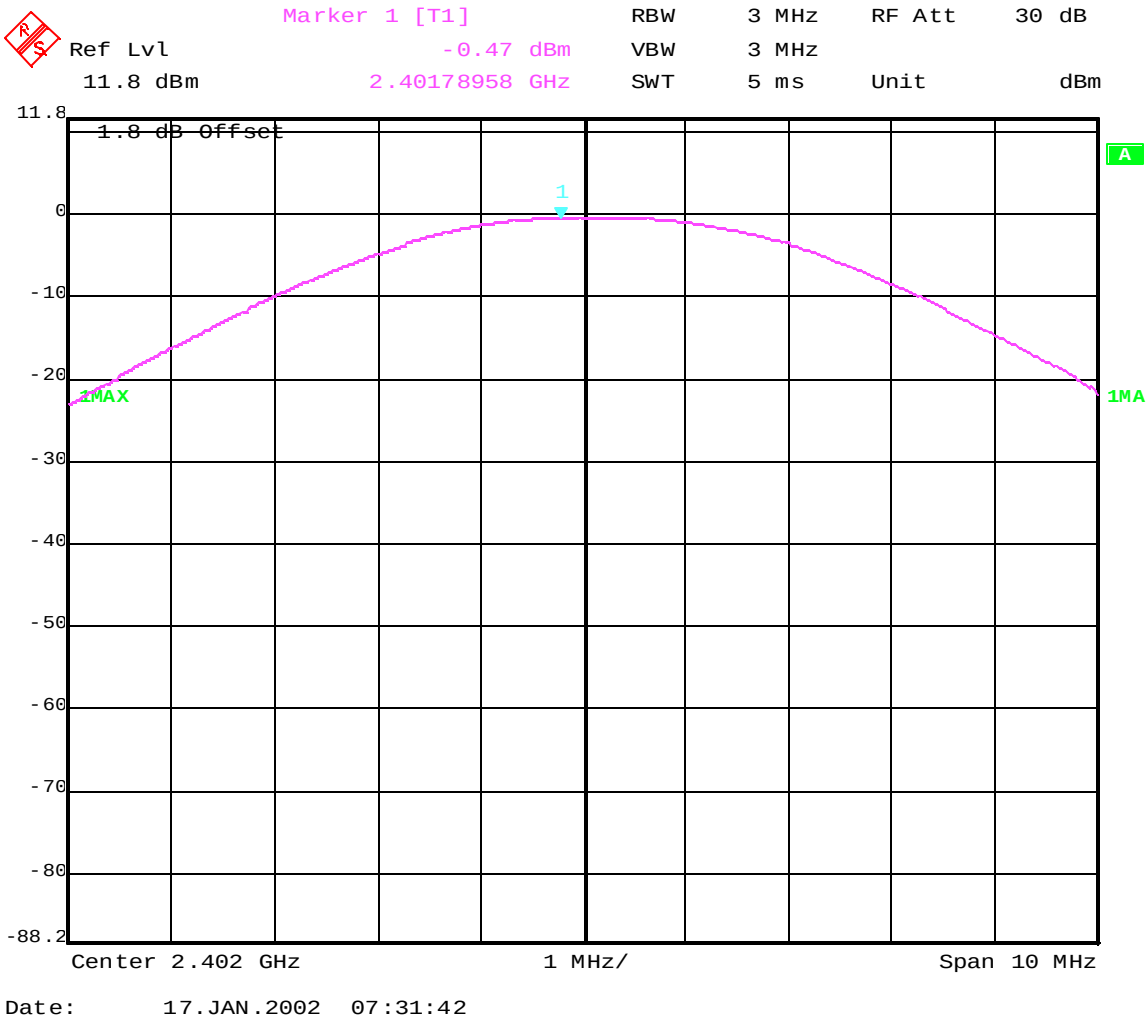
RBW / VBW : 3 MHz

LIMIT **SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

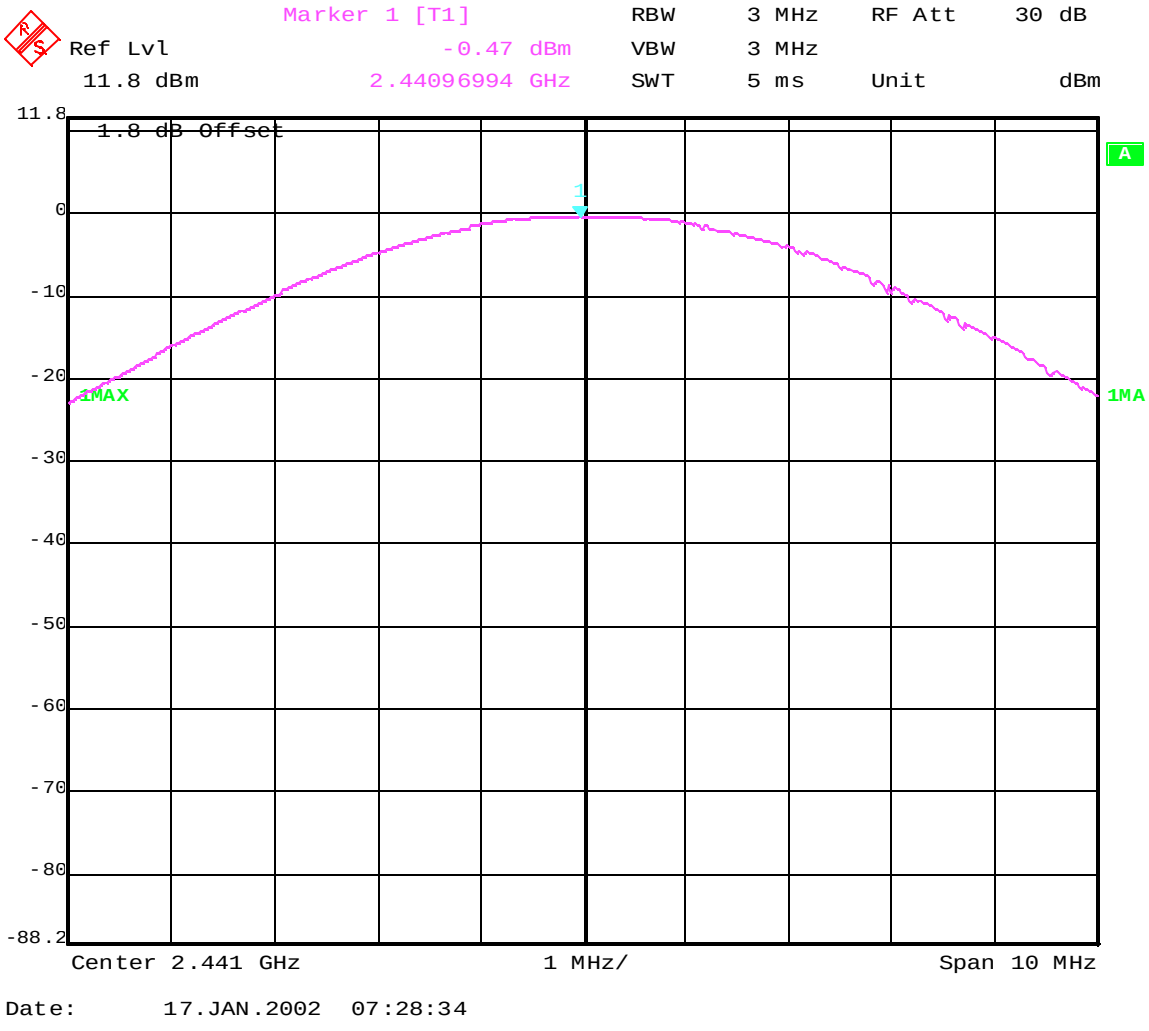
PEAK OUTPUT POWER (CONDUCTED) §15.247 (b)

Lowest Channel: 2402MHz



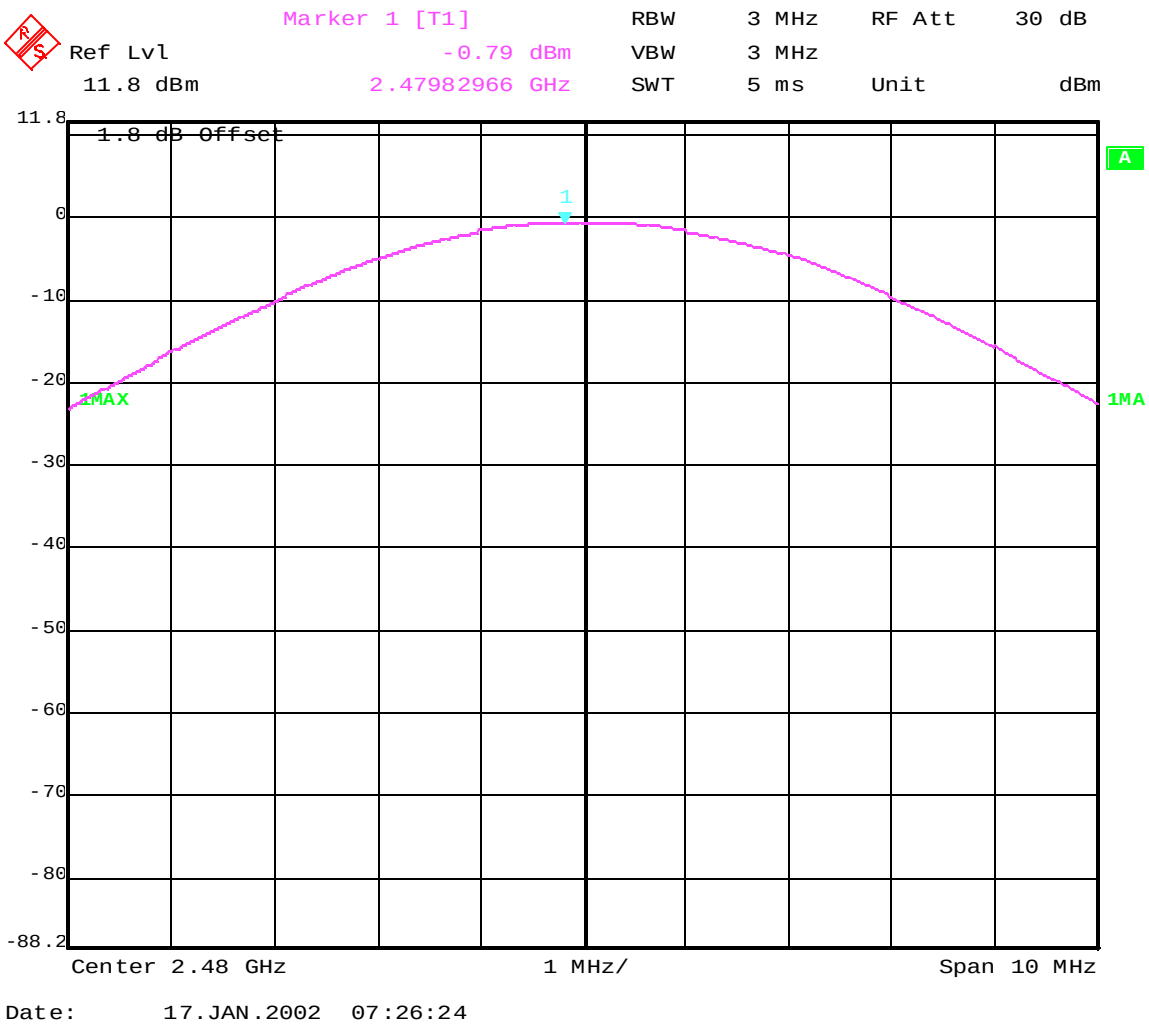
PEAK OUTPUT POWER (CONDUCTED) **§15.247 (b)**

Mid Channel: 2441MHz



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)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)° C	V_{nom}	-8.81	-9.51	-11.24
Measurement uncertainty		±3dB		

RBW/VBW : 3 MHz

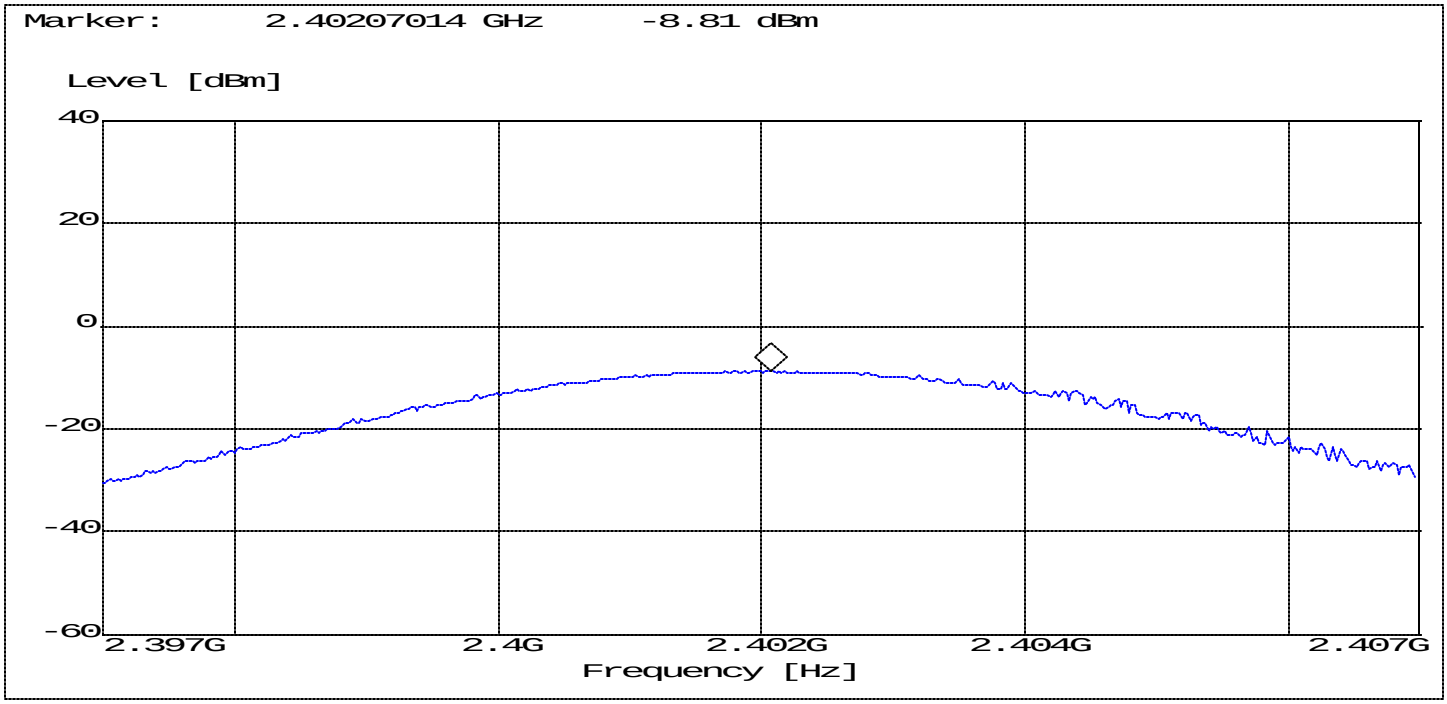
LIMIT **SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

PEAK OUTPUT POWER (RADIATED) **§15.247 (b) (1)**

Lowest Channel: 2402MHz

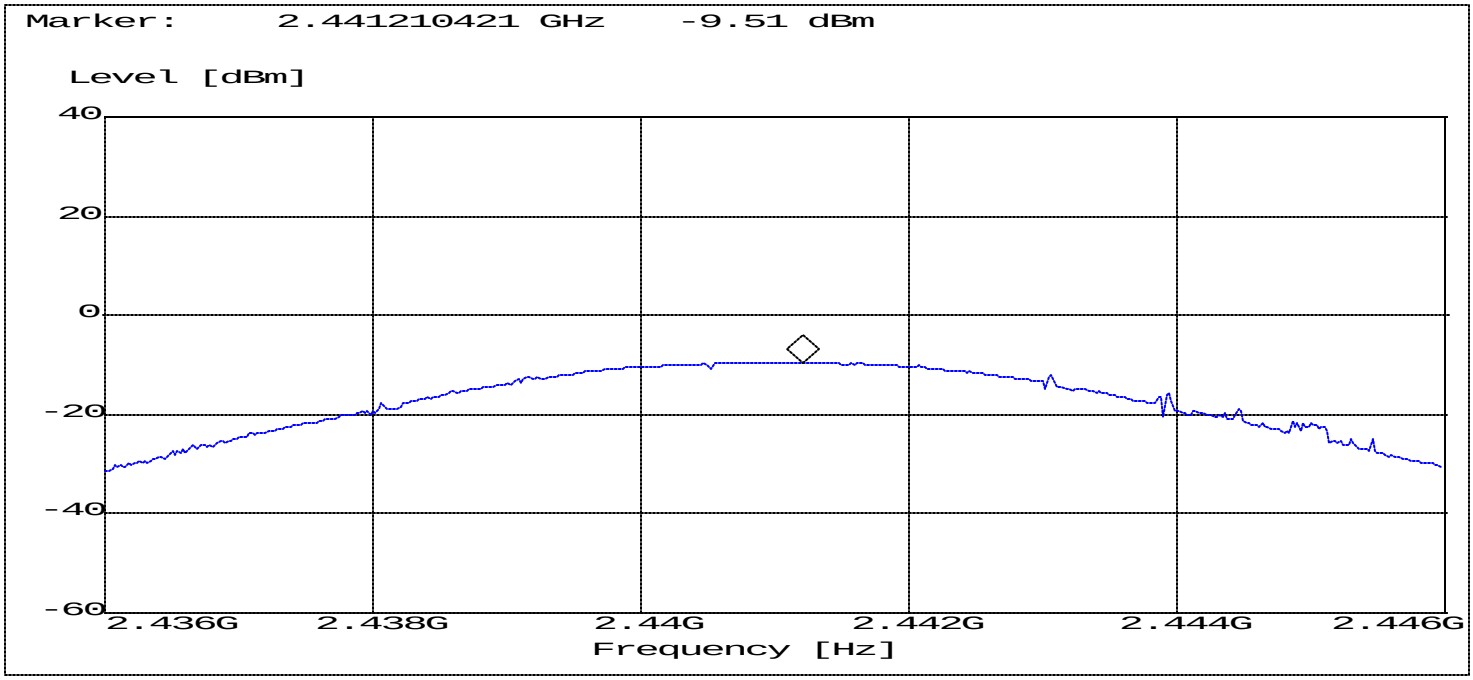
ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz



PEAK OUTPUT POWER (RADIATED) **§15.247 (b) (1)**

Mid Channel: 2441MHz

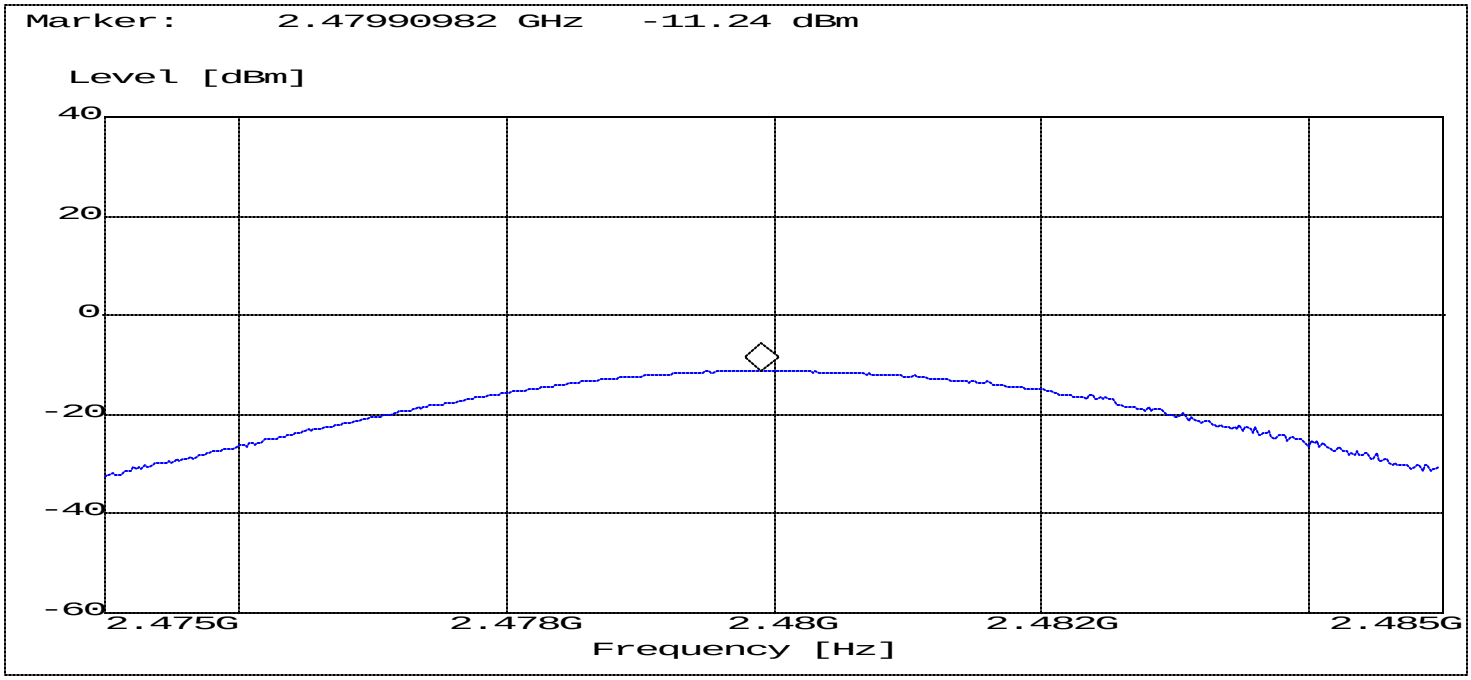
ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz



PEAK OUTPUT POWER (RADIATED) **§15.247 (b) (1)**

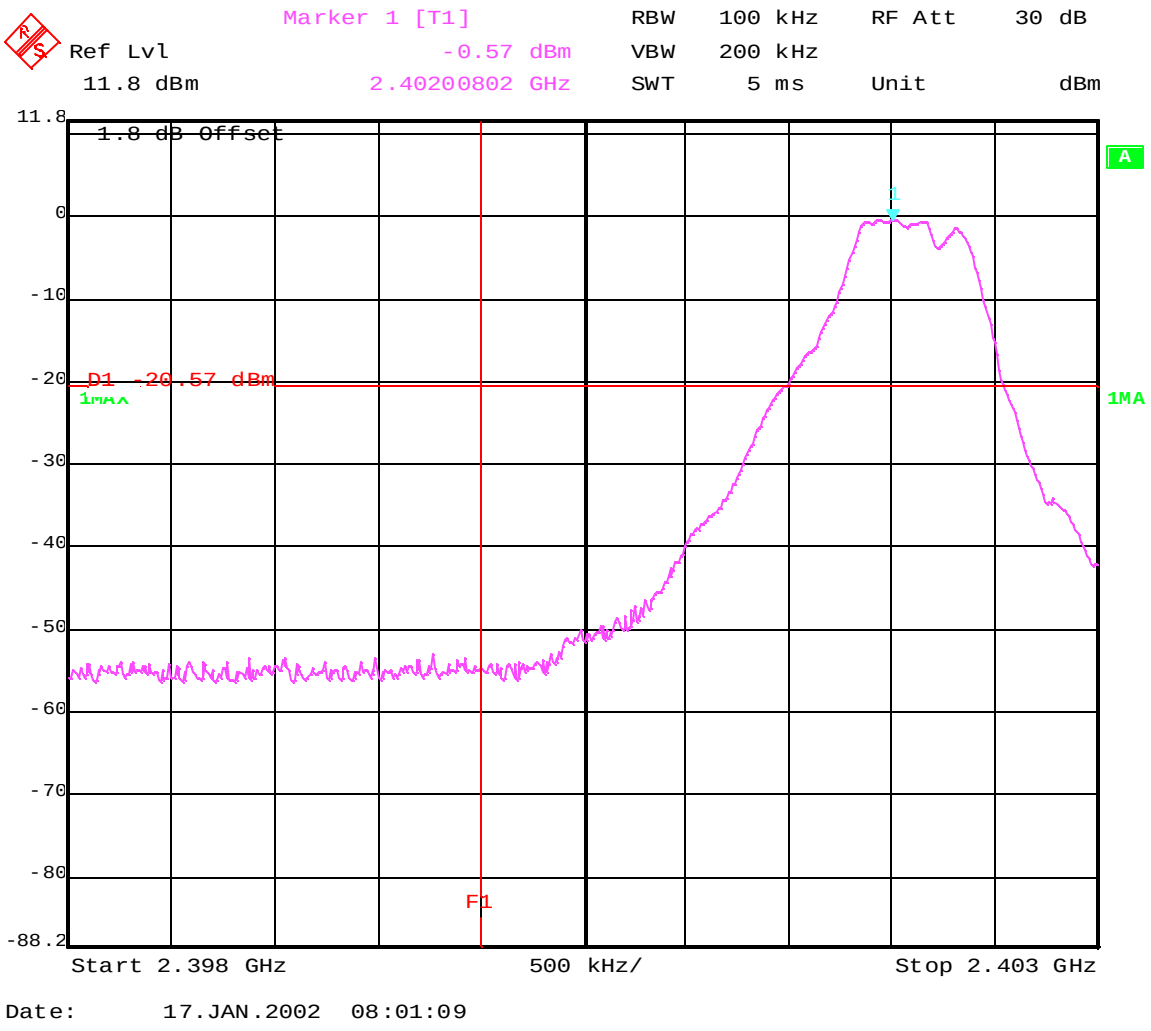
Highest Channel: 2480MHz

ANALYZER SETTINGS: RBW = 3MHz VBW = 3MHz



BAND EDGE COMPLIANCE **§15.247 (c)**

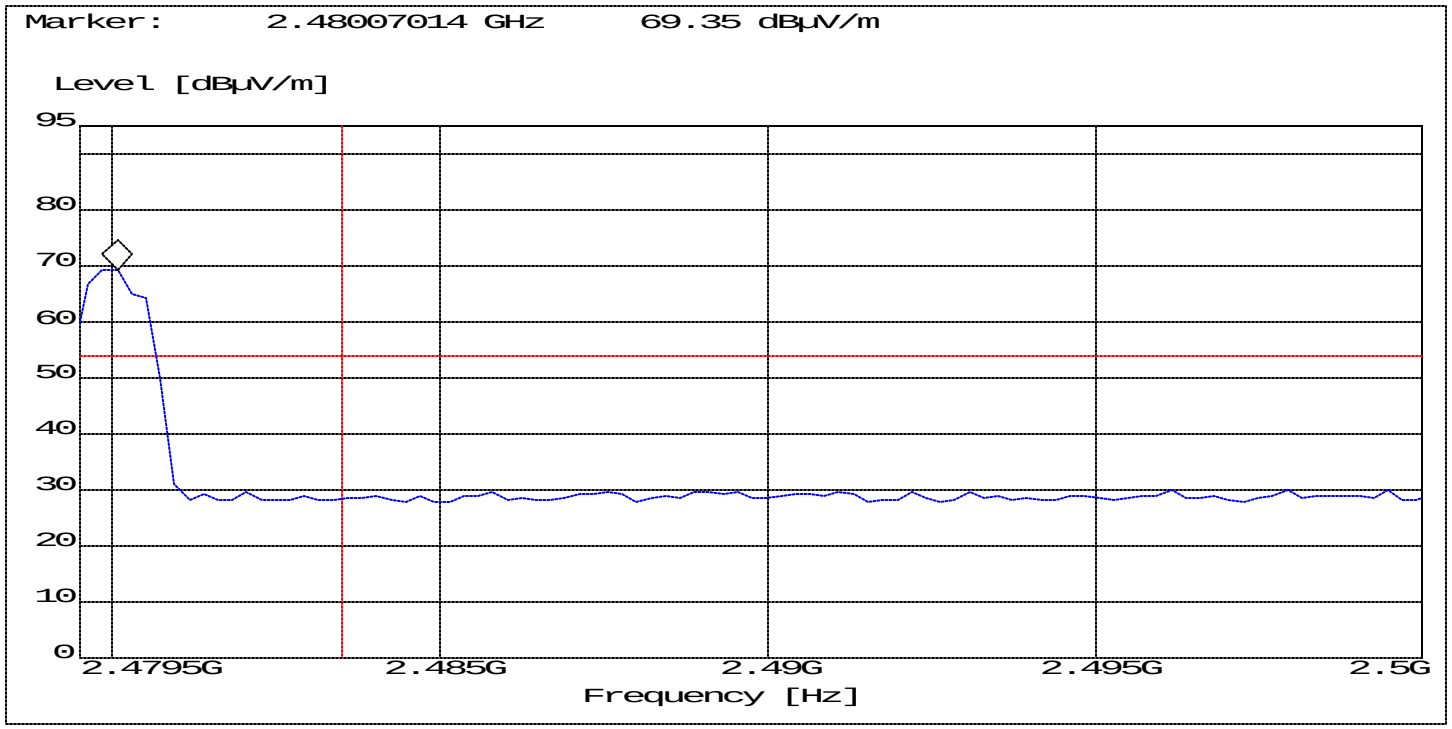
Low frequency section (2400MHz)
(valid for both hopping ON & OFF)



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)**

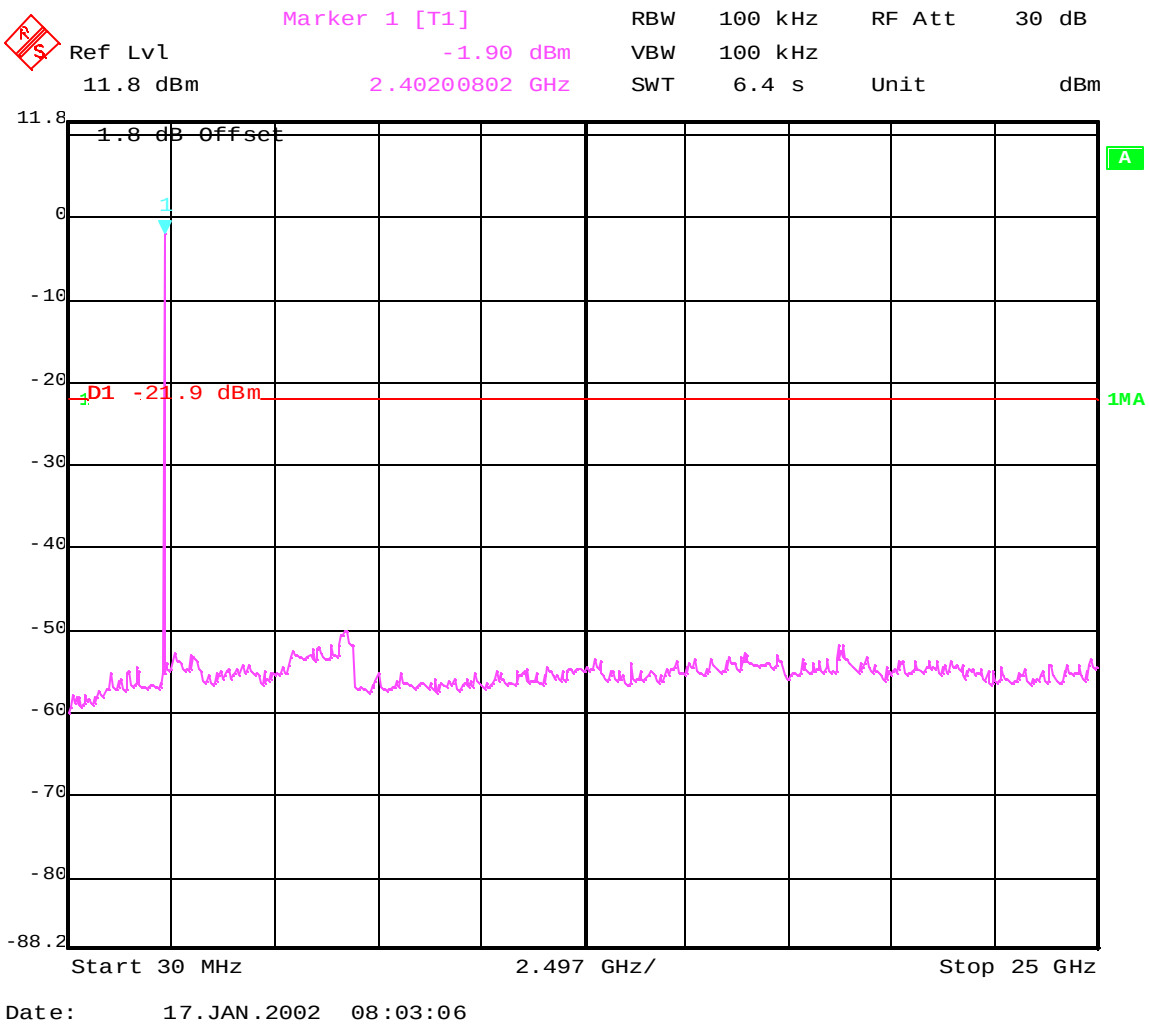
LIMITS

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)**

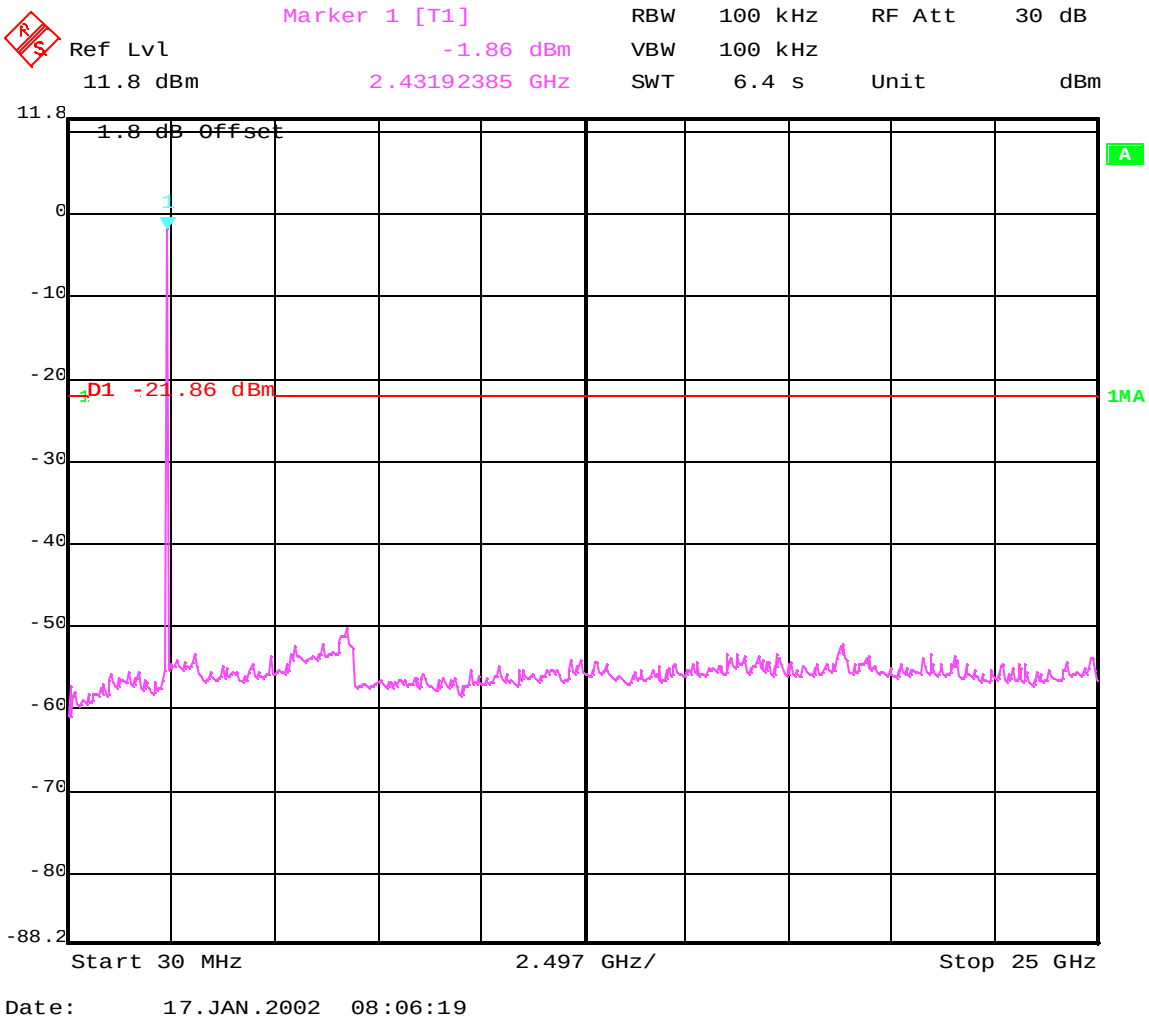
Lowest Channel(2402MHz): 30MHz - 25 GHz



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

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

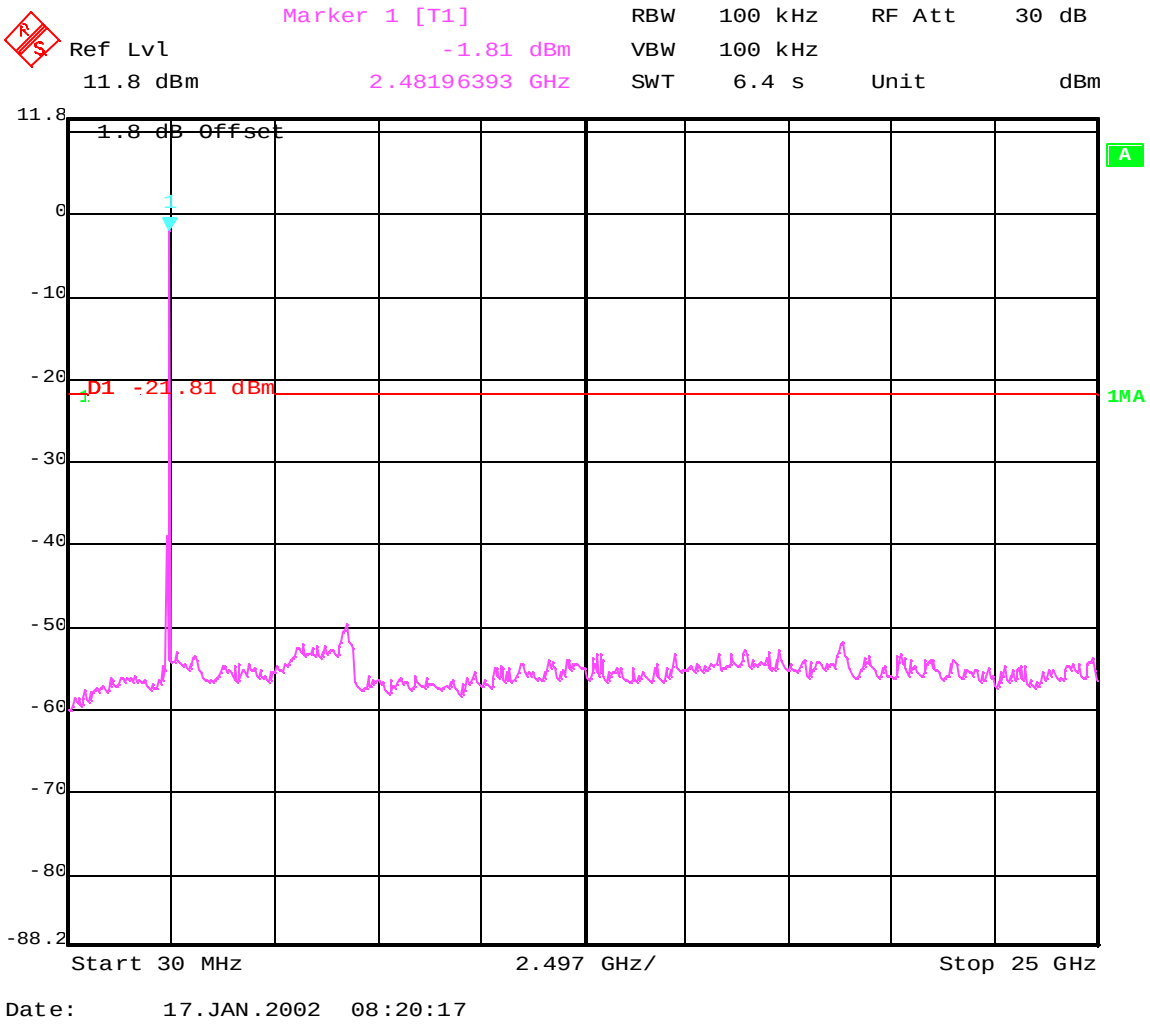
Mid Channel(2441MHz): 30MHz - 25GHz



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.

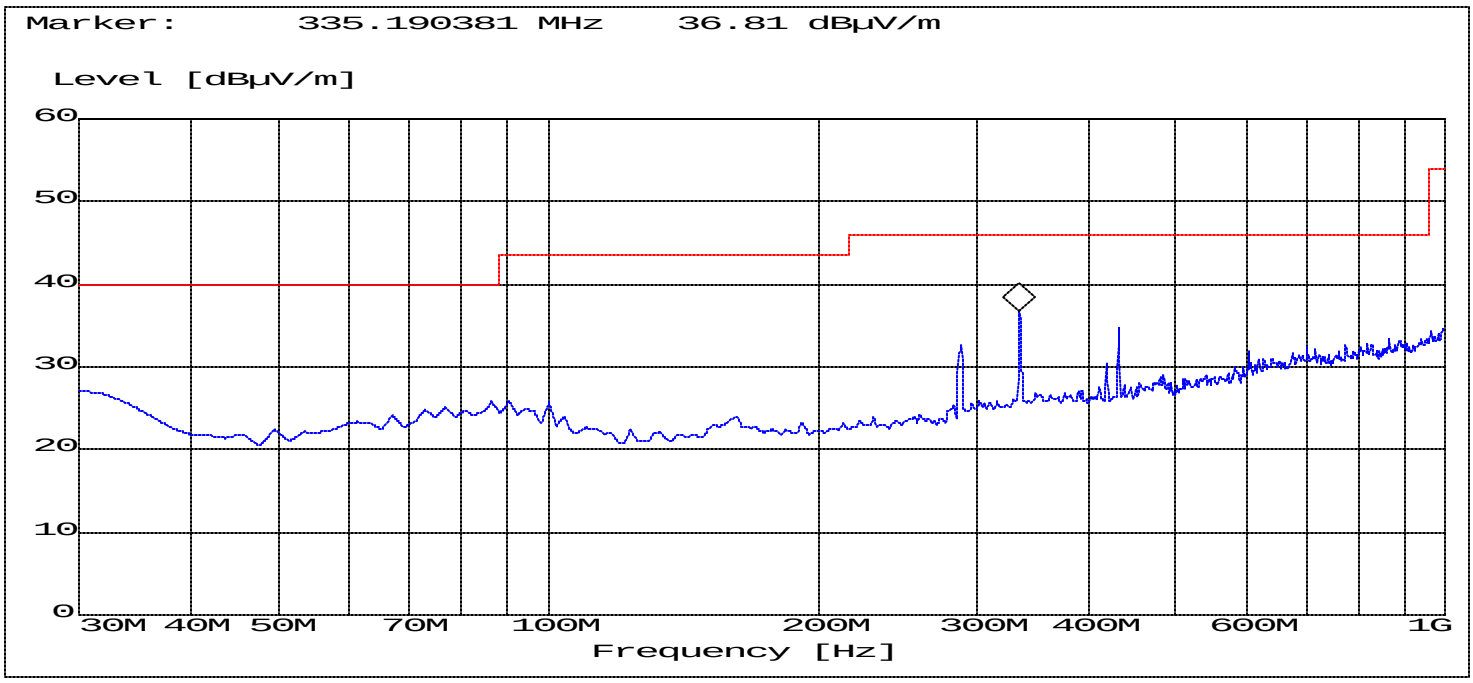
2. Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.

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

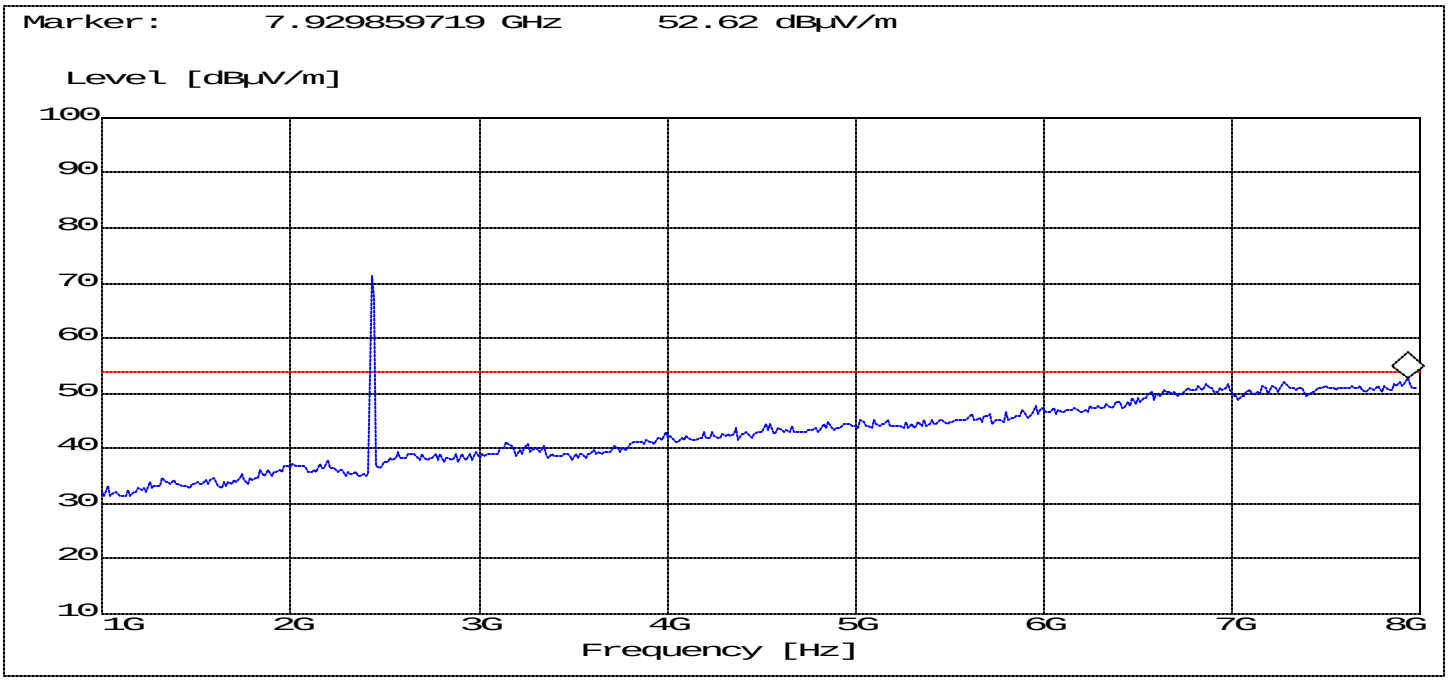
ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz



EMISSION LIMITATIONS - Radiated (Transmitter) SUBCLAUSE § 15.247 (c) (1)
Lowest Channel(2402MHz): 1GHz – 8GHz

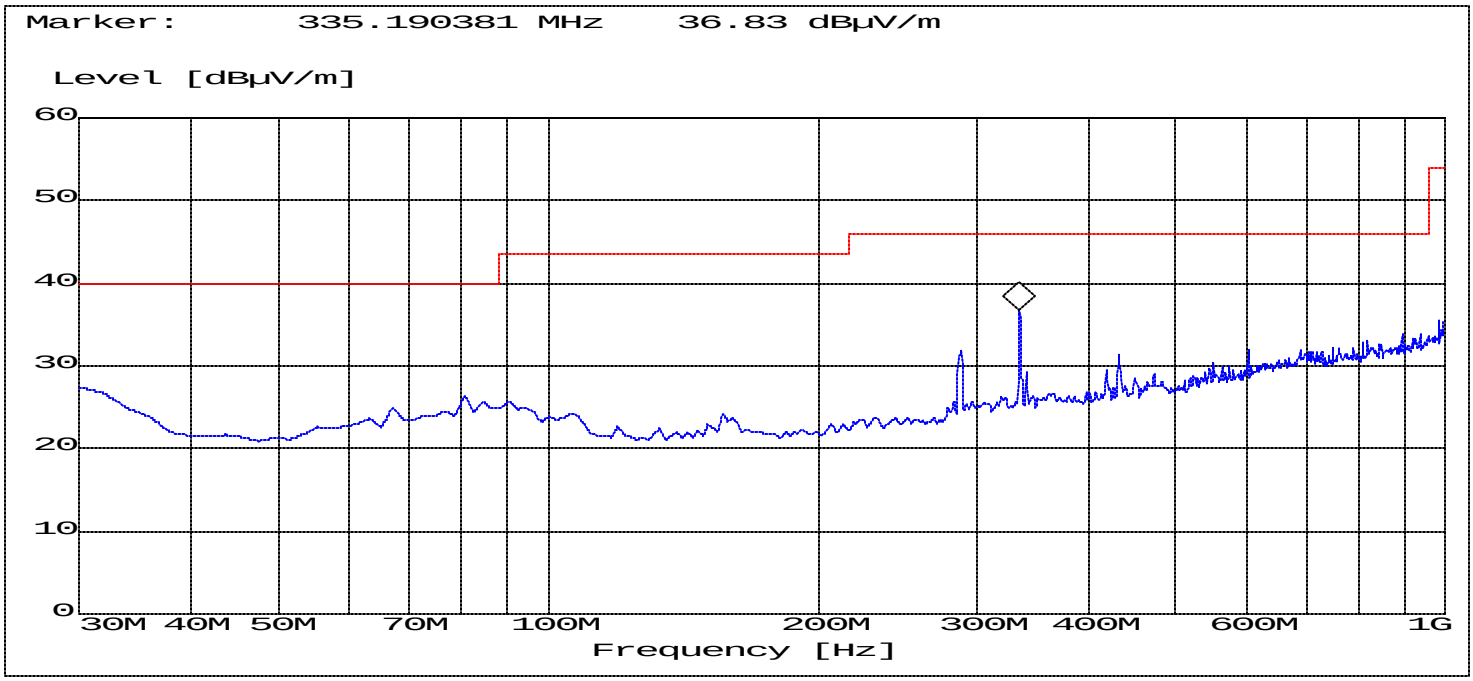
NOTE: The peak above the limit is the carrier frequency.

ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



EMISSION LIMITATIONS - Radiated (Transmitter) SUBCLAUSE § 15.247 (c) (1)
Mid Channel(2441MHz): 30MHz – 1GHz

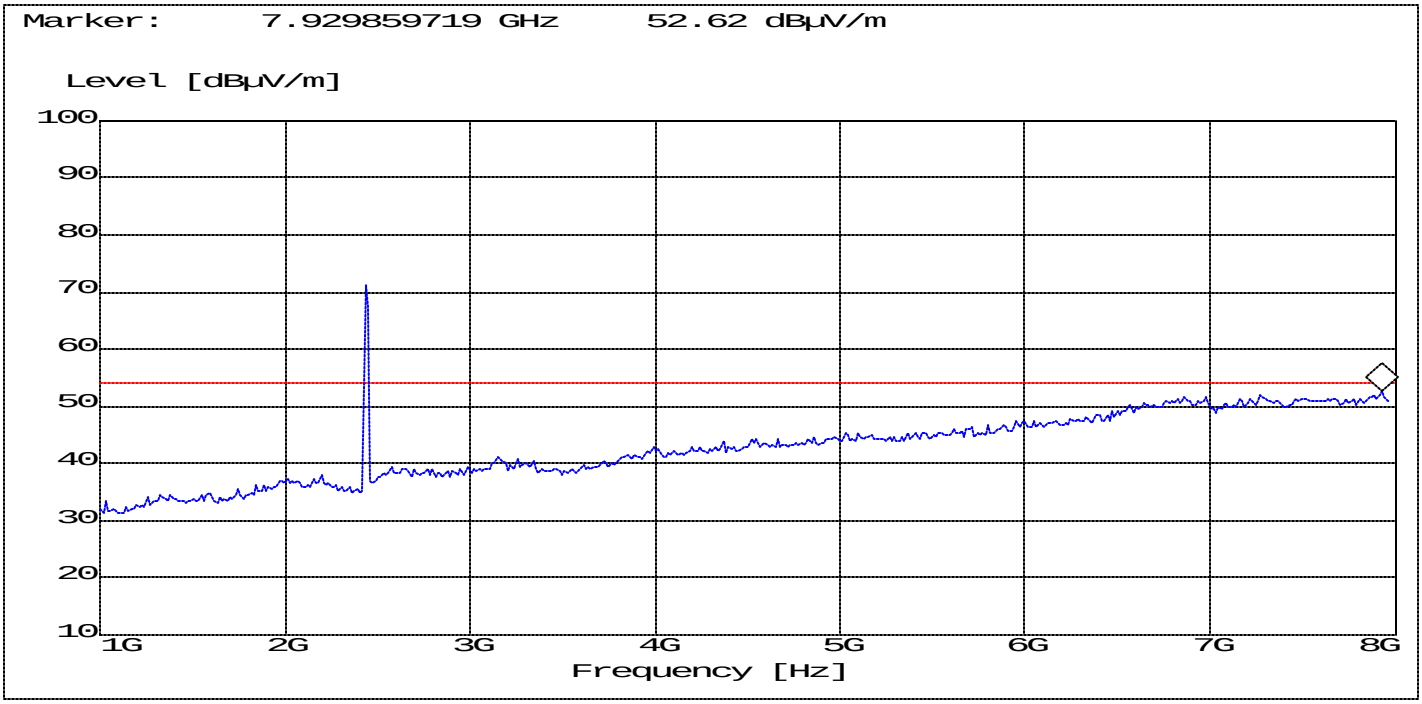
ANALYZER SETTINGS: RBW = 100KHz VBW = 100KHz



EMISSION LIMITATIONS - Radiated (Transmitter) SUBCLAUSE § 15.247 (c) (1)
Mid Channel(2441MHz): 1GHz – 8GHz

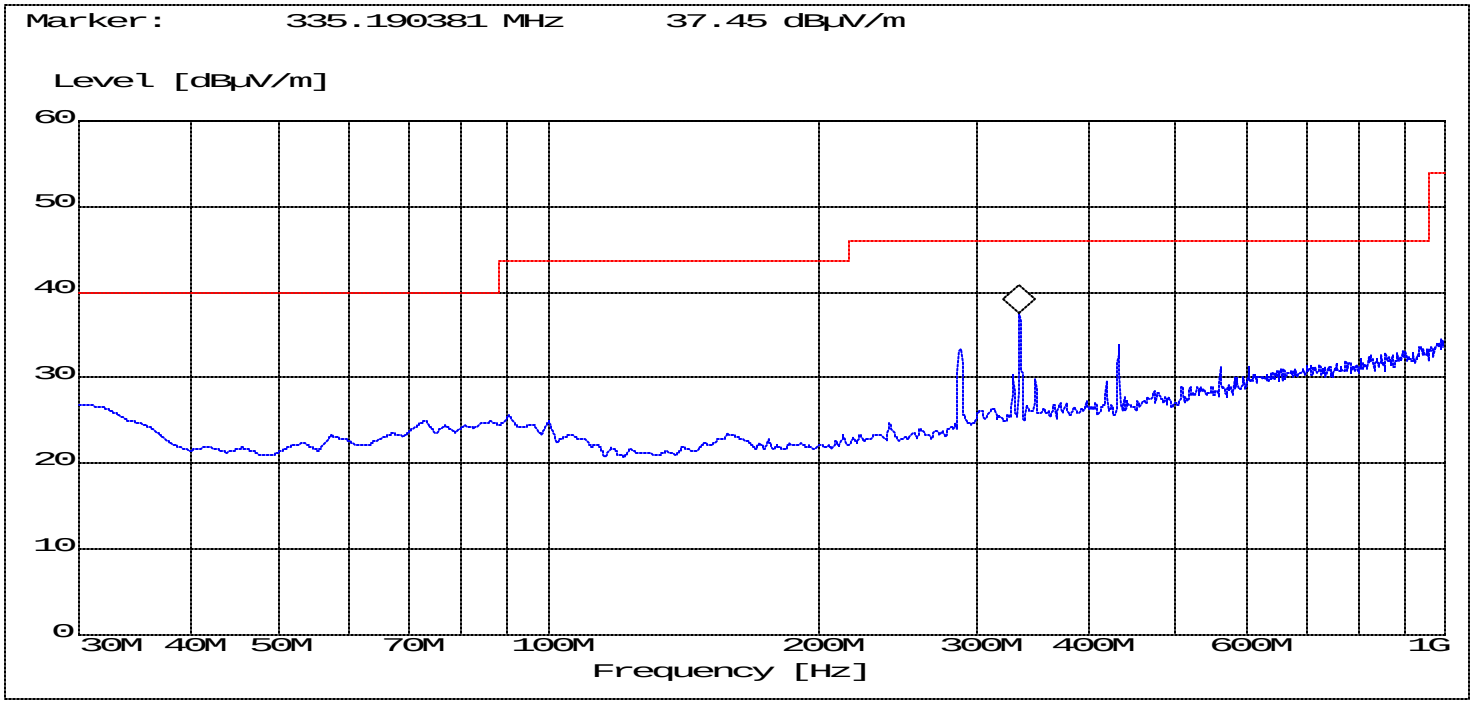
NOTE: The peak above the limit is the carrier frequency.

ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



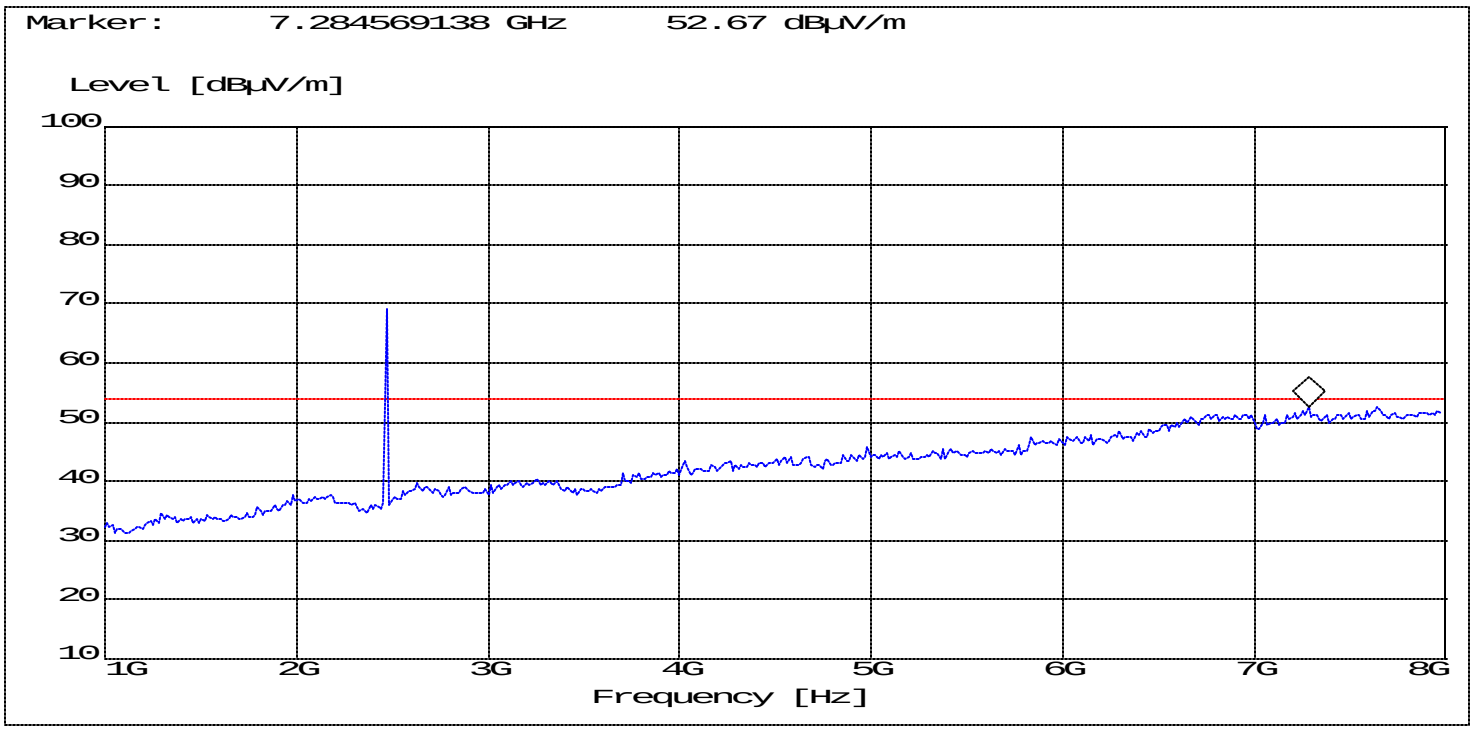
EMISSION LIMITATIONS - Radiated (Transmitter) **SUBCLAUSE § 15.247 (c) (1)**
Highest Channel(2480MHz): 30MHz – 1GHz

ANALYZER SETTINGS: RBW = 100KH VBW = 100KHz



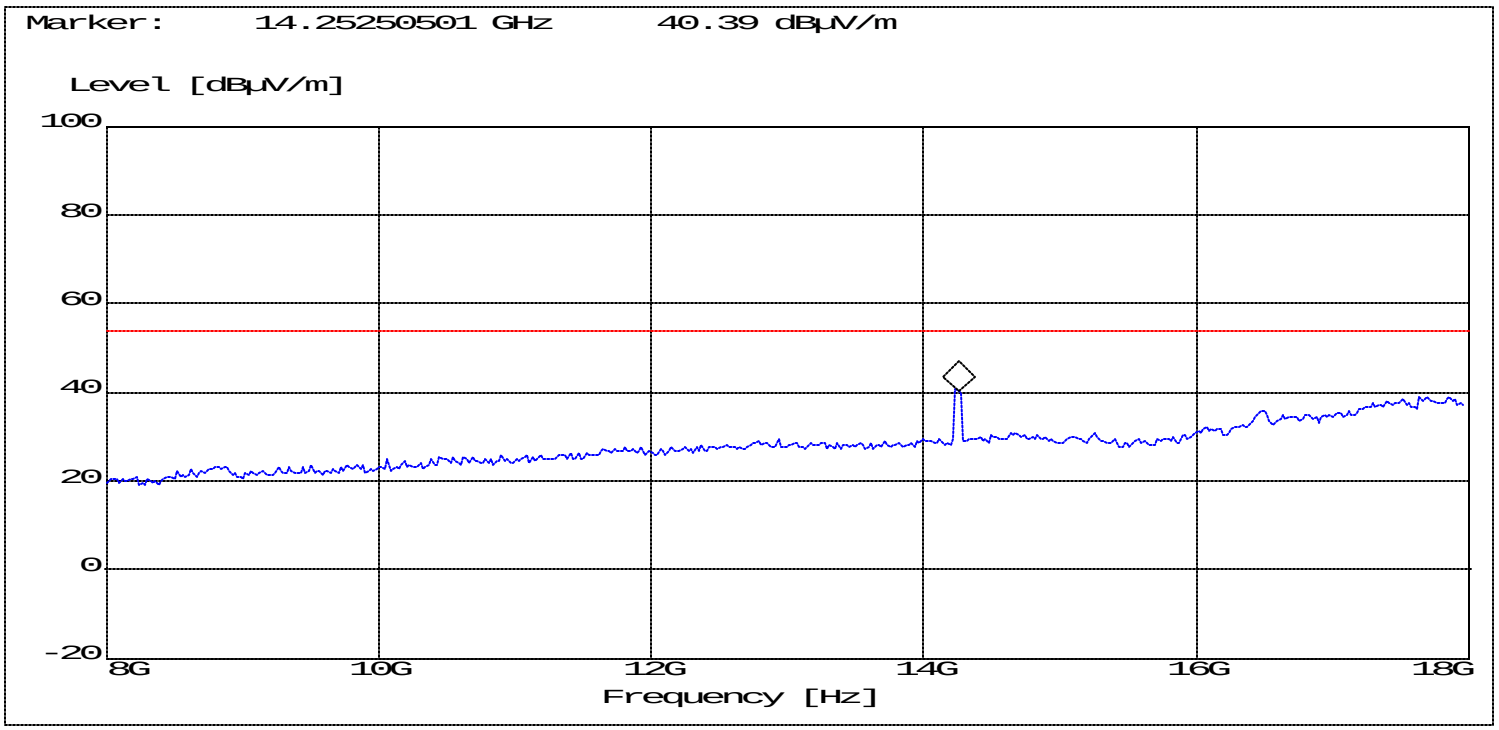
EMISSION LIMITATIONS - Radiated (Transmitter) SUBCLAUSE § 15.247 (c) (1)
Highest Channel: 1GHz – 8GHz

NOTE: The peak above the limit is the carrier frequency.
ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



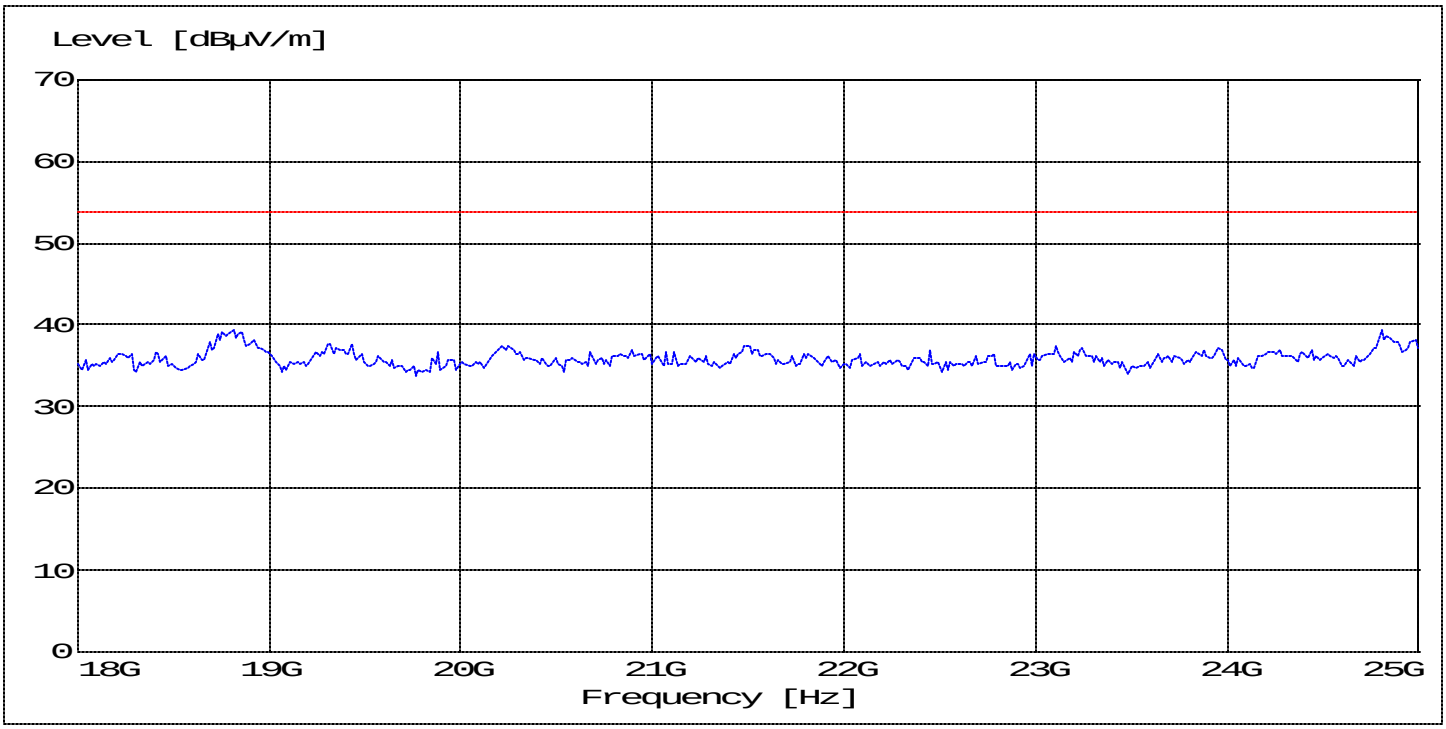
EMISSION LIMITATIONS - Radiated (Transmitter) SUBCLAUSE § 15.247 (c) (1)
8GHz – 18GHz
(This plot is valid for all three channels)

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**

(Not applicable – Battery operated device)

RECEIVER SPURIOUS RADIATION **§ 15.209**

Limits

Frequency (MHz)	Field strength (µV/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:

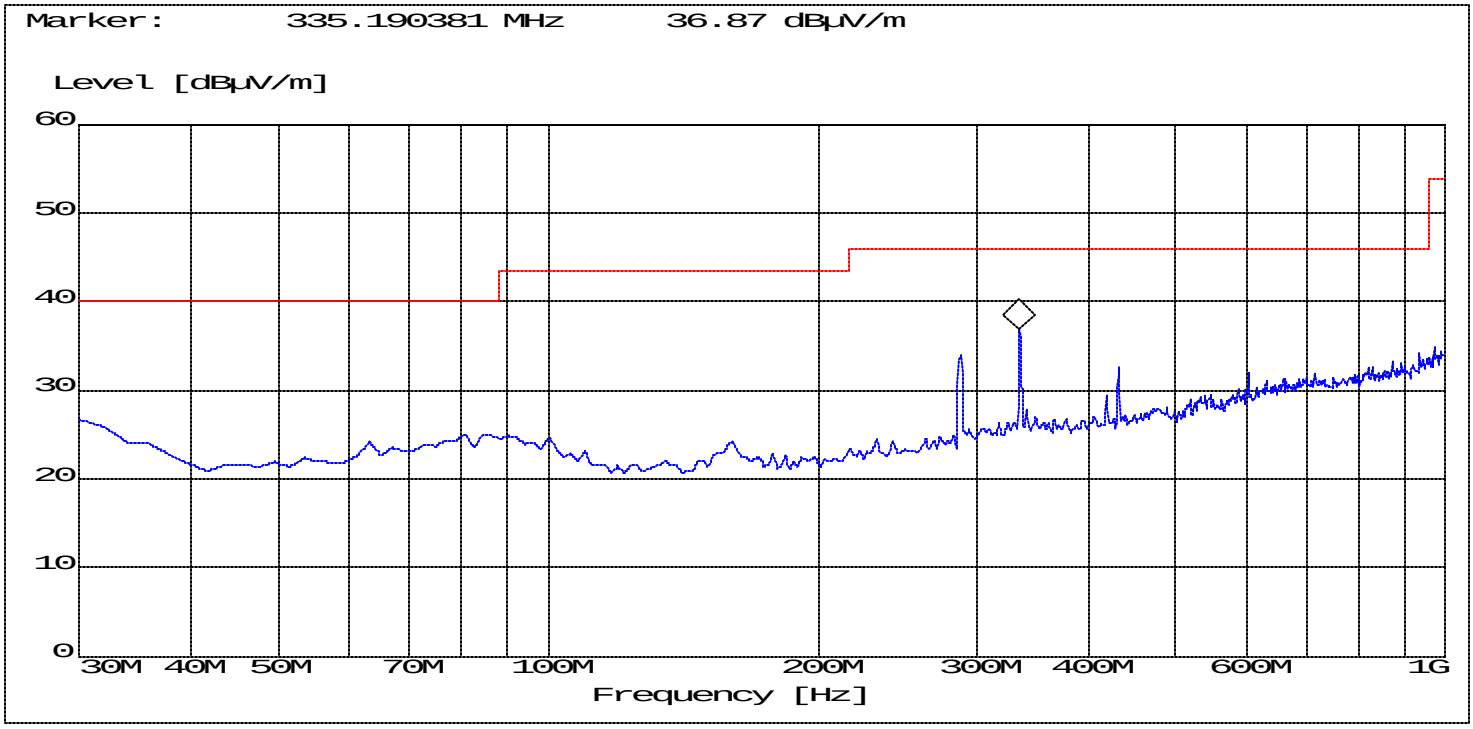
1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 18 and 25 GHz very short cable connections to the antenna was used to minimize the noise 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)

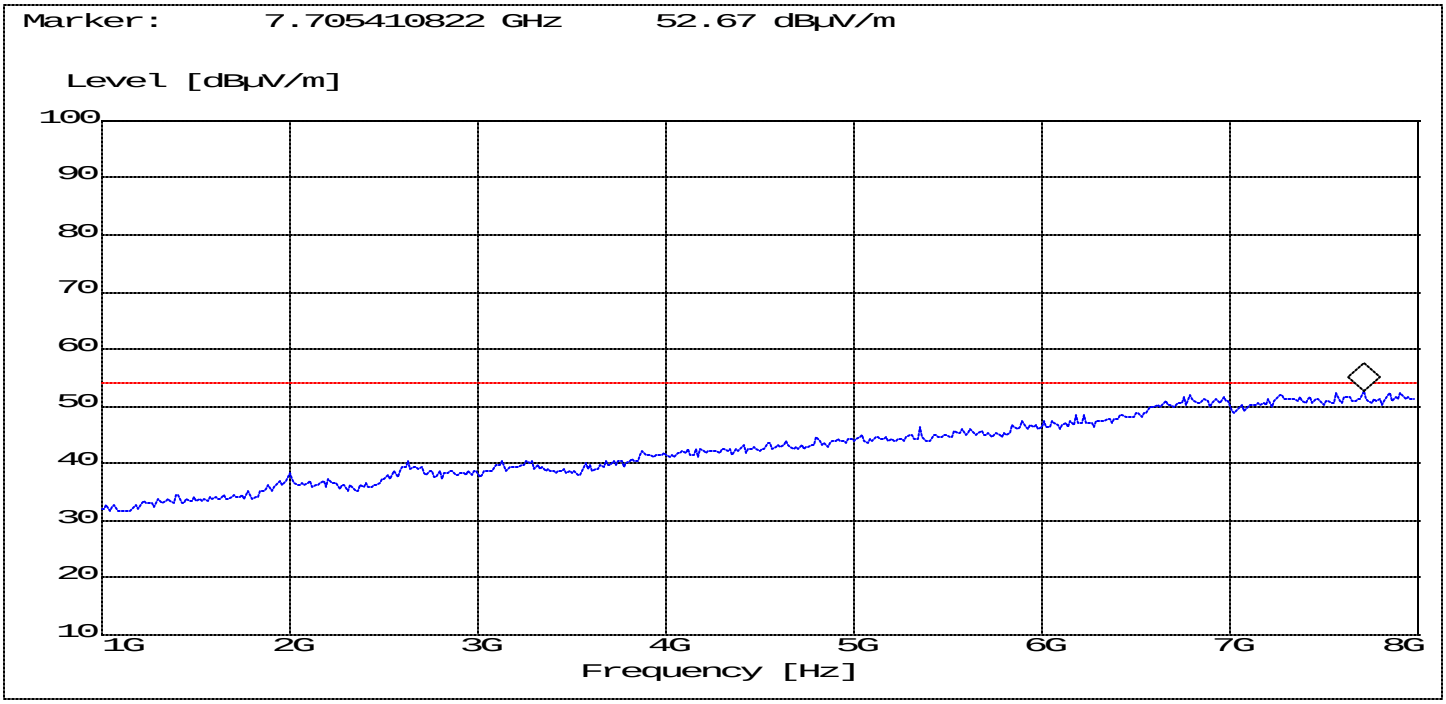
ANALYZER SETTINGS: RBW = 100KHz **VBW = 100KHz**



RECEIVER SPURIOUS RADIATION **§ 15.209**

1GHz – 8GHz
(This plot is valid for all three channels)

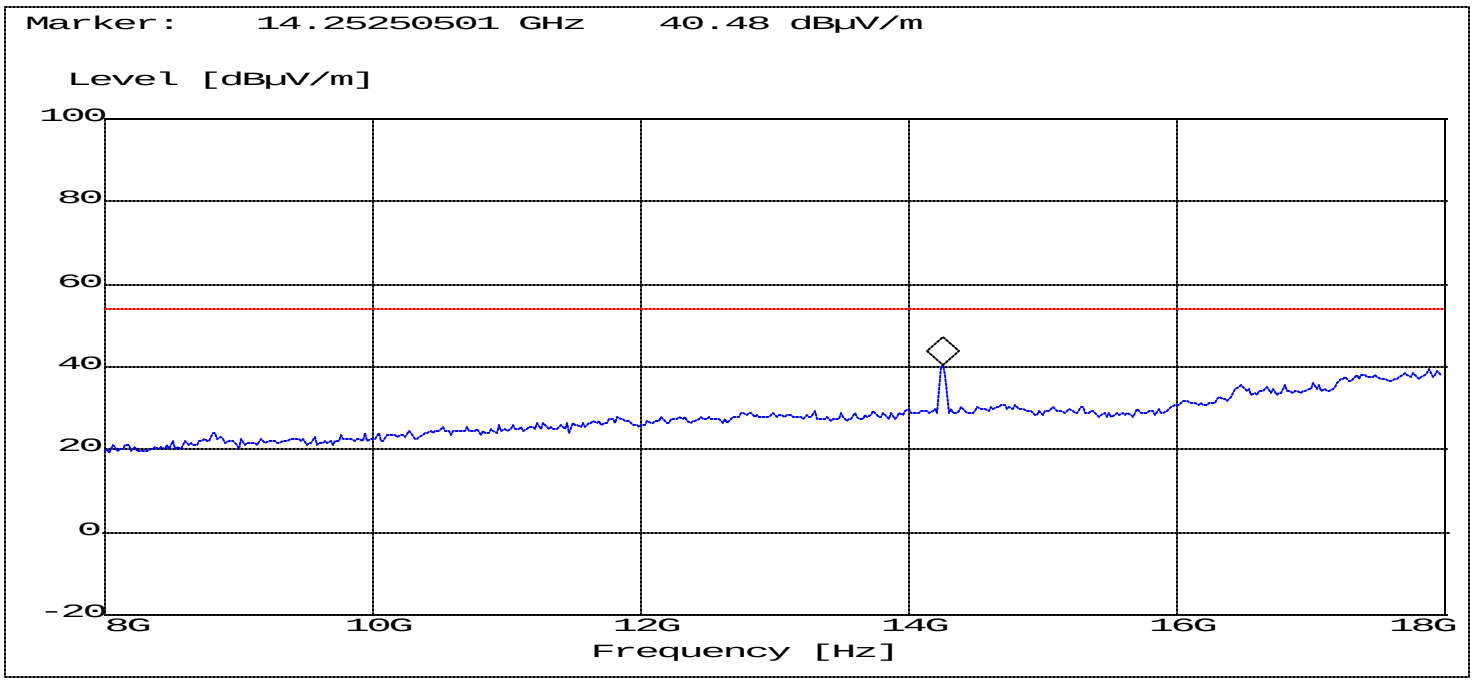
ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



RECEIVER SPURIOUS RADIATION **§ 15.209**

8GHz – 18GHz
(This plot is valid for all three channels)

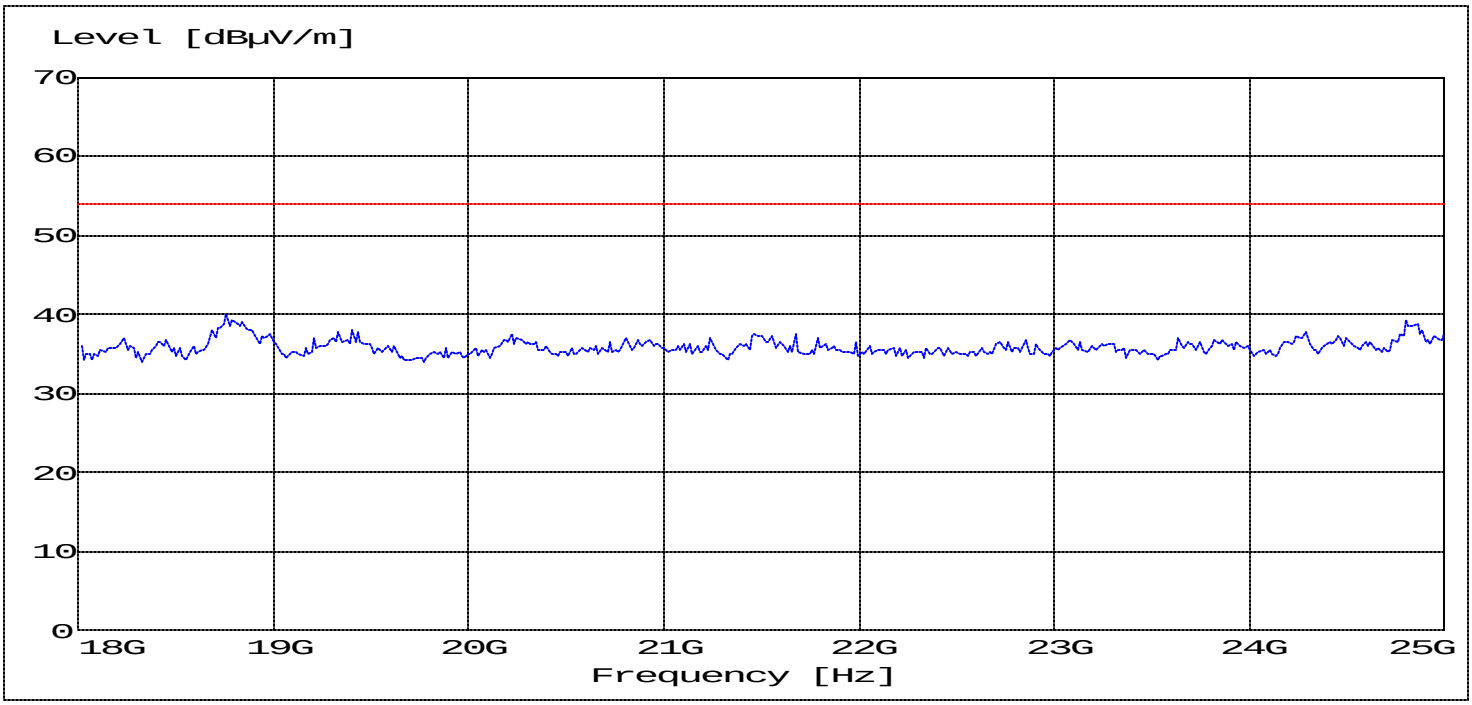
ANALYZER SETTINGS: RBW = 1MHz VBW = 1MHz



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

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
02	Signal Generator	SMY0	Rohde & Schwarz	836878/011
03	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
04	Power Amlifier	250W1000	Amplifier Research	300031
05	Biconilog Antenna	3141	EMCO	0005-1186
06	Horn Antenna	SAS-200/571	AH Systems	325
07	Power Splitter	11667B	Hewlett Packard	645348
08	Climatic Chamber	VT4004	Votch	G1115
09	Pre-Amplifier	JS4-00102600	Miteq	00616
10	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807
11	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30808