



FCC Test Report

Test report no.: EMC_706FCC15.247_2004_IT5620

FCC Part 15.247 for FHSS systems / CANADA RSS-210

Model: IT5620

FCC ID: HD5MX2702

IC: 1693B-MX2702



Accredited according to **ISO/IEC 17025**



FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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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 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 Inc USA.

TEST REPORT PREPARED BY:

EMC Engineer: Harpreet Sidhu

1.2 Testing laboratory

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1.3 Details of applicant

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e-mail : velagapudin@hhp.com

1.4 Application details

Date of receipt test item : 2004-08-16
Date of test : 2004-08-11/13/16, 2004-09-09/10

1.5 Test item

Manufacturer : Applicant
Marketing Name : IT5620
Model No. : **IT5620**
Description : **BT Scanner**
FCC-ID : HD5MX2702
IC ID : 1693B-MX2702

Additional information

Test Sample for BT : s/n X-32-03740
Frequency : 2402MHz – 2480MHz
Type of modulation : GFSK
Number of channels : 79
Antenna : Internal
Power supply : Battery or Charger (AC Adaptor)
Output power : -0.13dBm (0.97mW) max. conducted peak power

1.6 Test standards:**FCC Part 15 §15.247 (DA00-705) / 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
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Technical responsibility for area of testing:2004-10-28 EMC & Radio Lothar Schmidt (Manager)

Date	Section	Name	Signature
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Responsible for test report and project leader:2004-10-28 EMC & Radio Harpreet Sidhu (EMC Engineer)

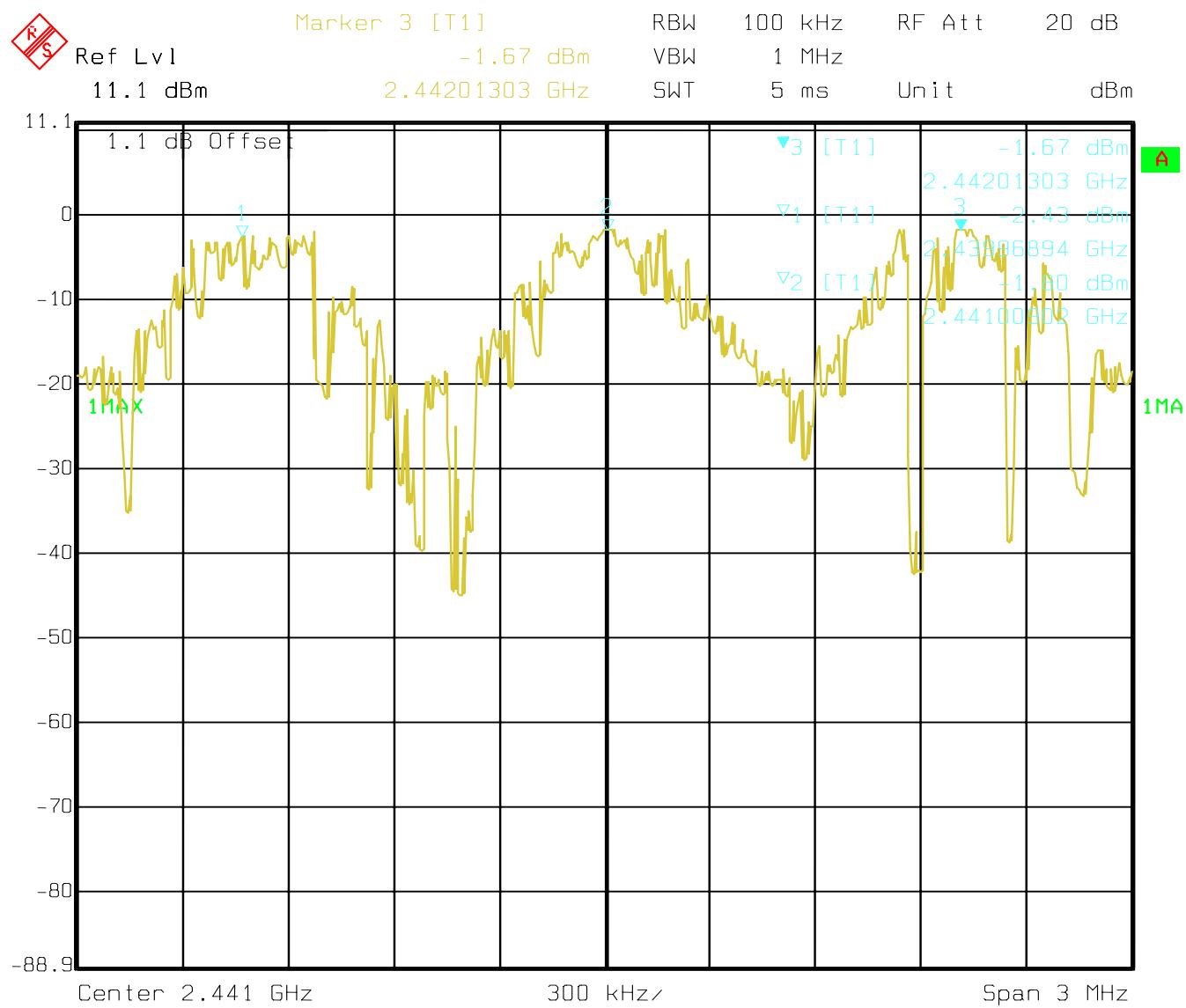
Date	Section	Name	Signature
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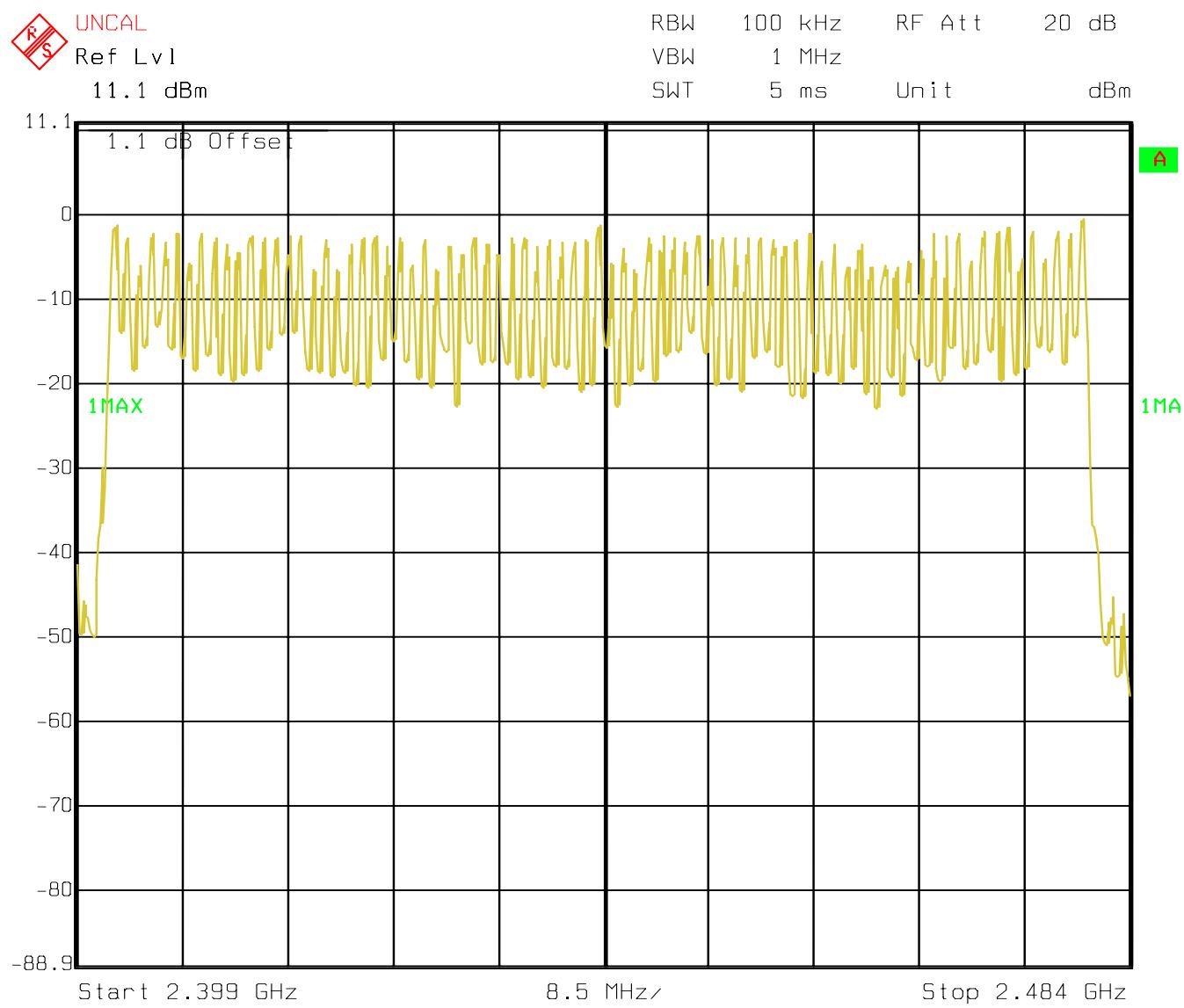
2.2 Test report**TEST REPORT**

Test report no.: EMC_706FCC15.247_2004_IT5620

TEST REPORT REFERENCE

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CARRIER FREQUENCY SEPERATION**§15.247(a)**

NUMBER OF HOPPING CHANNELS**§15.247(a)****The number of hopping channels is 79**

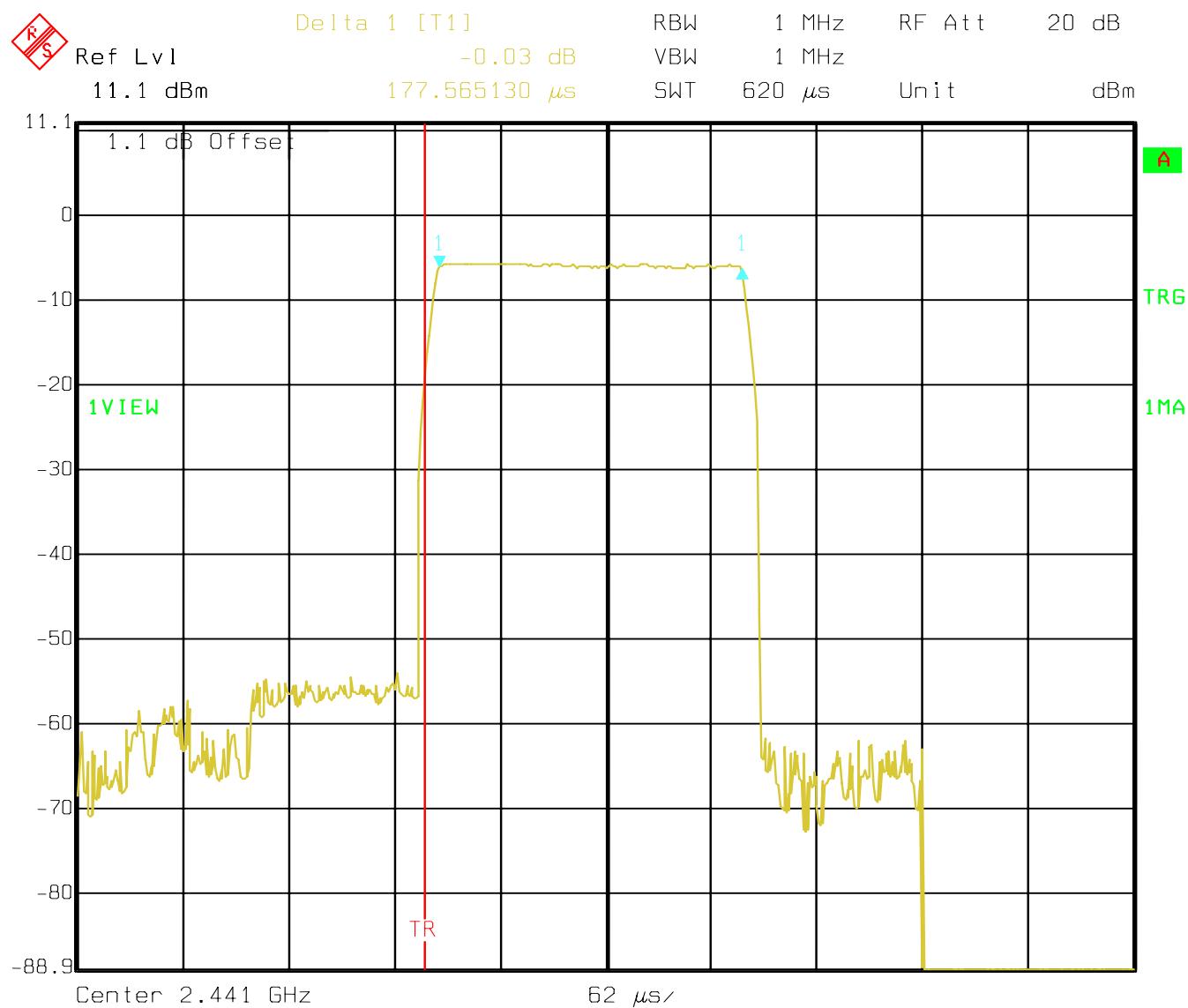
Date: 27.OCT.2004 14:50:47

TIME OF OCCUPANCY (DWELL TIME)**§15.247(a)****DH1 – Packet****EUT supports only DH1 Packet**

The system makes worst case 1600 hops per second or 1 time slot has a length of 625 μ 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 31.6 seconds you have 320.108 times of appearance.

Each Tx-time per appearance is 177.56 μ s.

So we have 320.108 * 177.56 μ s = 56.83ms per 31.6 seconds.



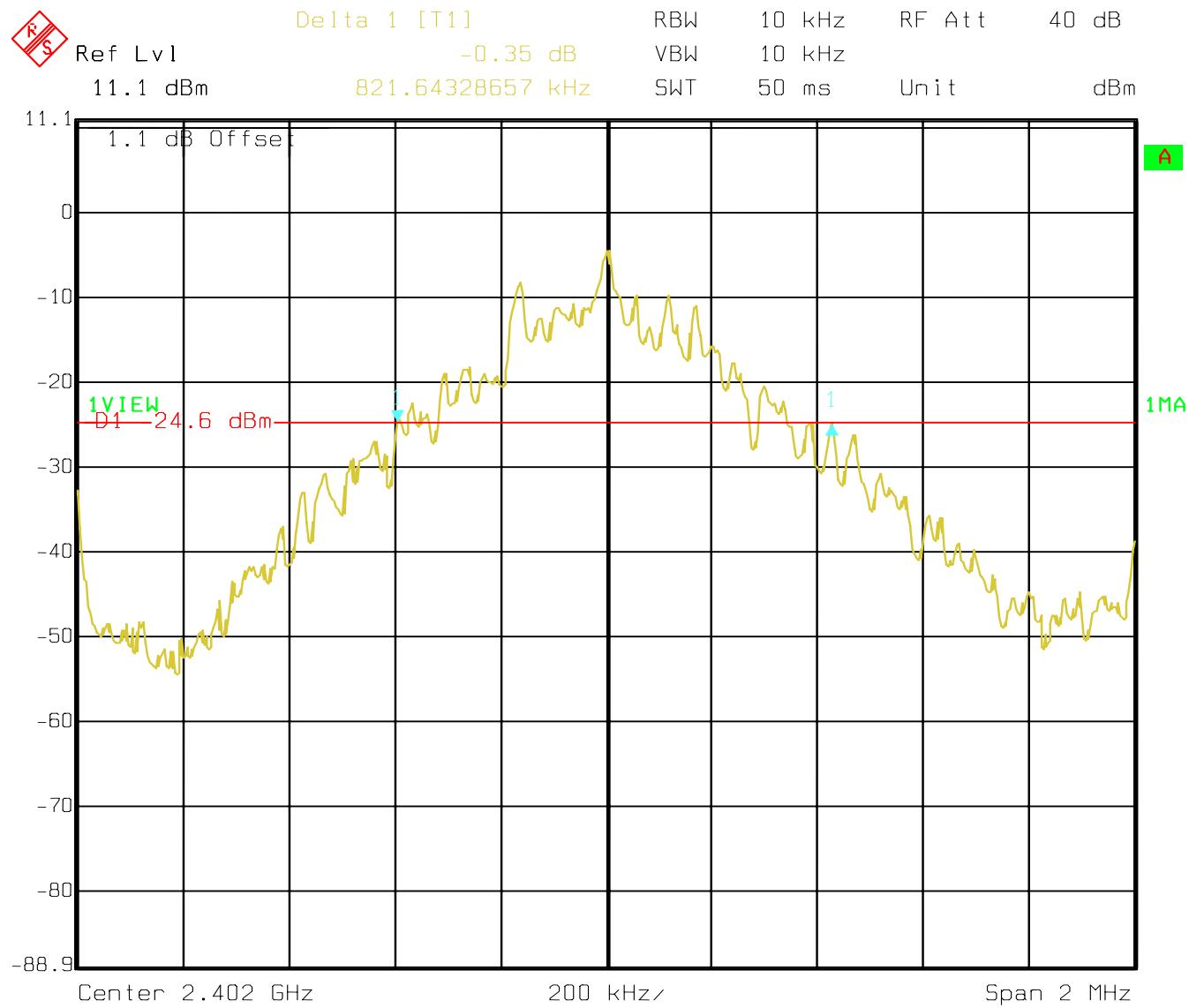
SPECTRUM BANDWIDTH OF FHSS SYSTEM **§15.247(a)**
20 dB bandwidth

TEST CONDITIONS		20 dB BANDWIDTH (kHz)		
Frequency (MHz)		2402	2441	2480
$T_{nom}(23)^\circ C$	V_{nom}	821.64	821.64	821.64

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
20 dB bandwidth**§15.247(a)****Lowest Channel: 2402MHz**

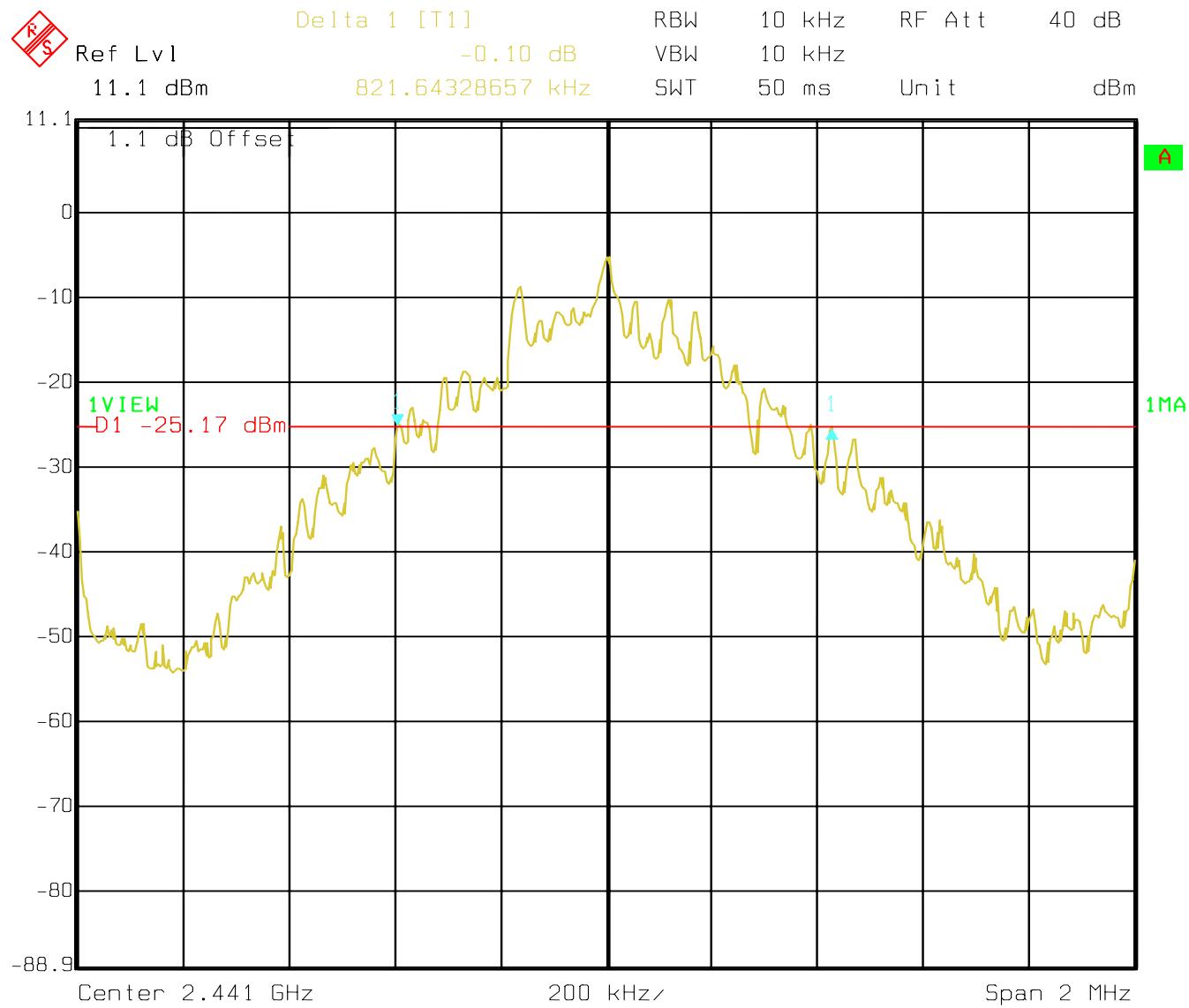
Date: 25.OCT.2004 16:55:29

SPECTRUM BANDWIDTH OF FHSS SYSTEM

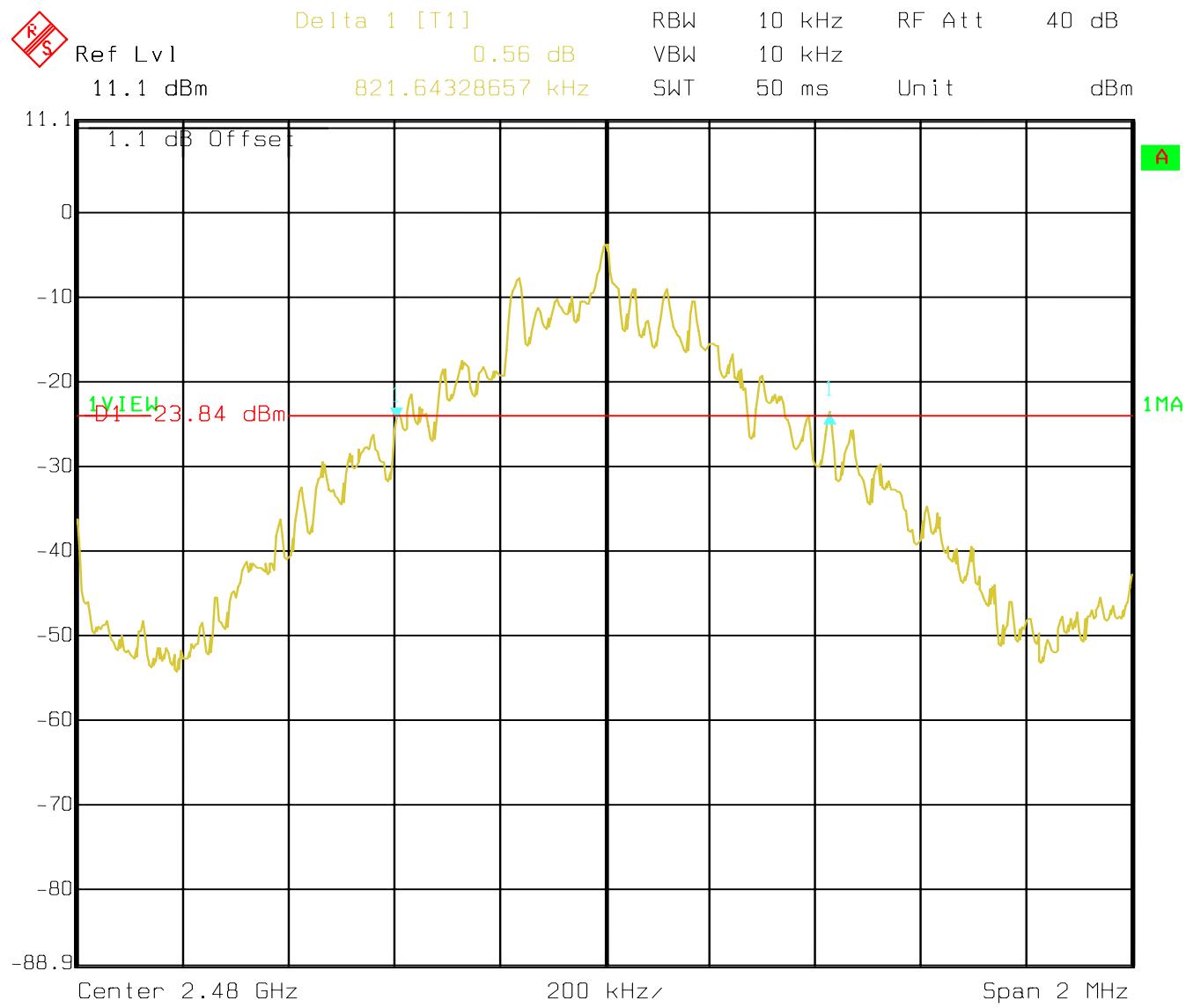
20 dB bandwidth

§15.247(a)

Mid Channel: 2441MHz



Date: 25.OCT.2004 16:54:30

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

Date: 25.OCT.2004 16:56:28

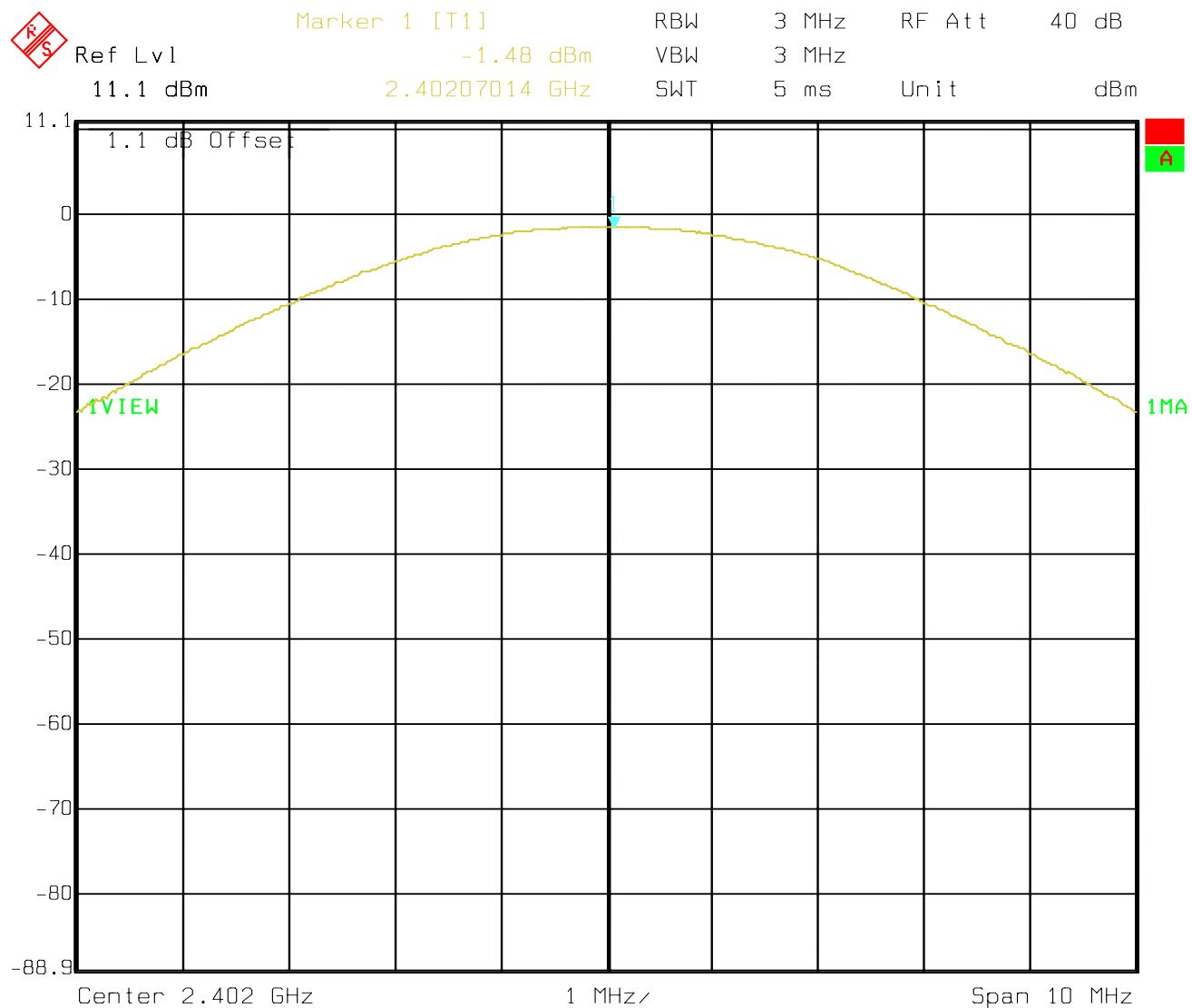
**MAXIMUM PEAK OUTPUT POWER
(Conducted)****§ 15.247 (b) (1)**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T_{nom} (23)°C	V_{nom}	-1.48	-1.30	-0.13
Measurement uncertainty		±0.5dBm		

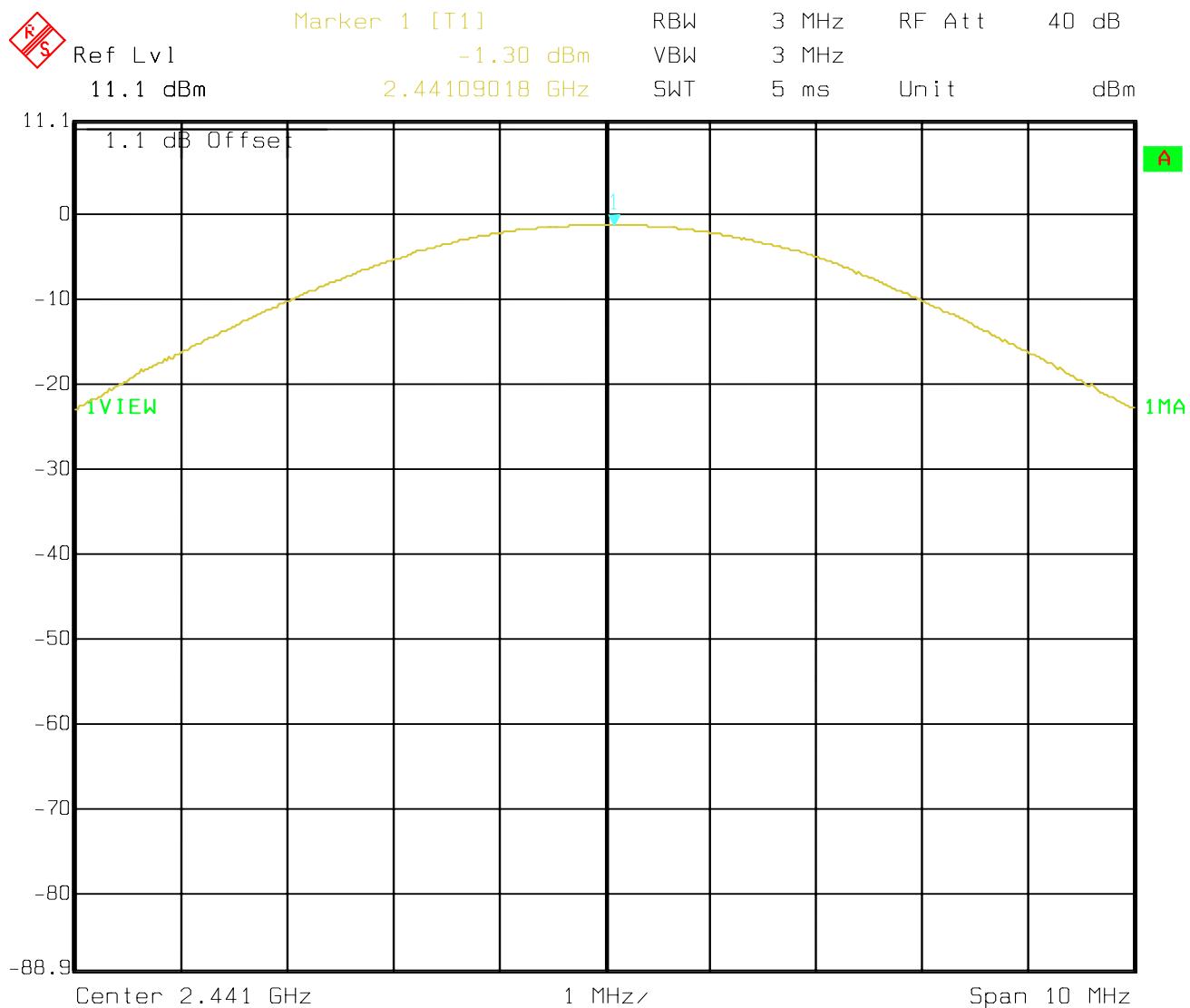
RBW / VBW: 3 MHz

LIMIT**SUBCLAUSE § 15.247 (b) (1)**

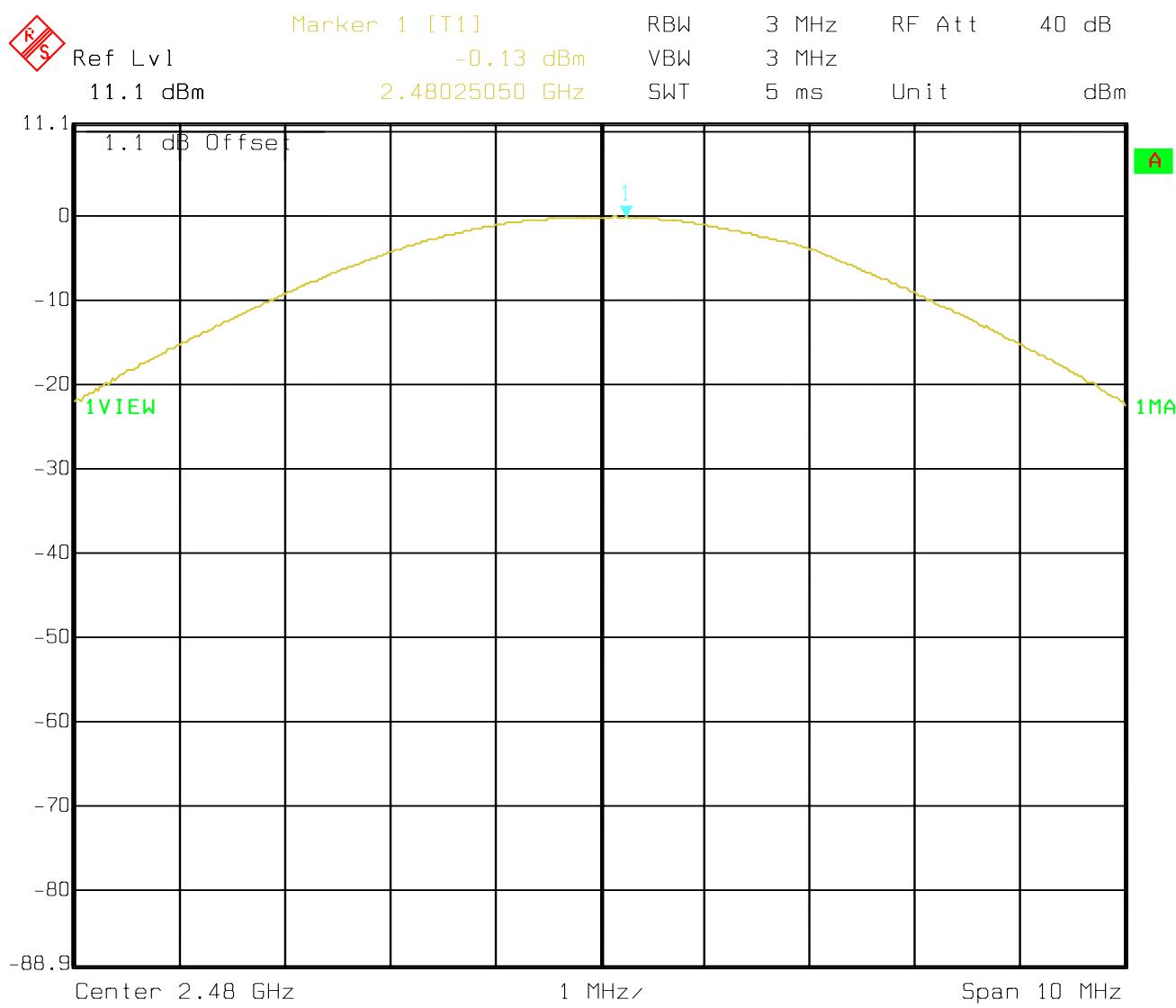
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt

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

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

Date: 25.OCT.2004 16:51:36

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

Date: 25.OCT.2004 16:52:03

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

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	-3.18	-0.12	1.03
Measurement uncertainty		±0.5dBm		

RBW/VBW: 3 MHz

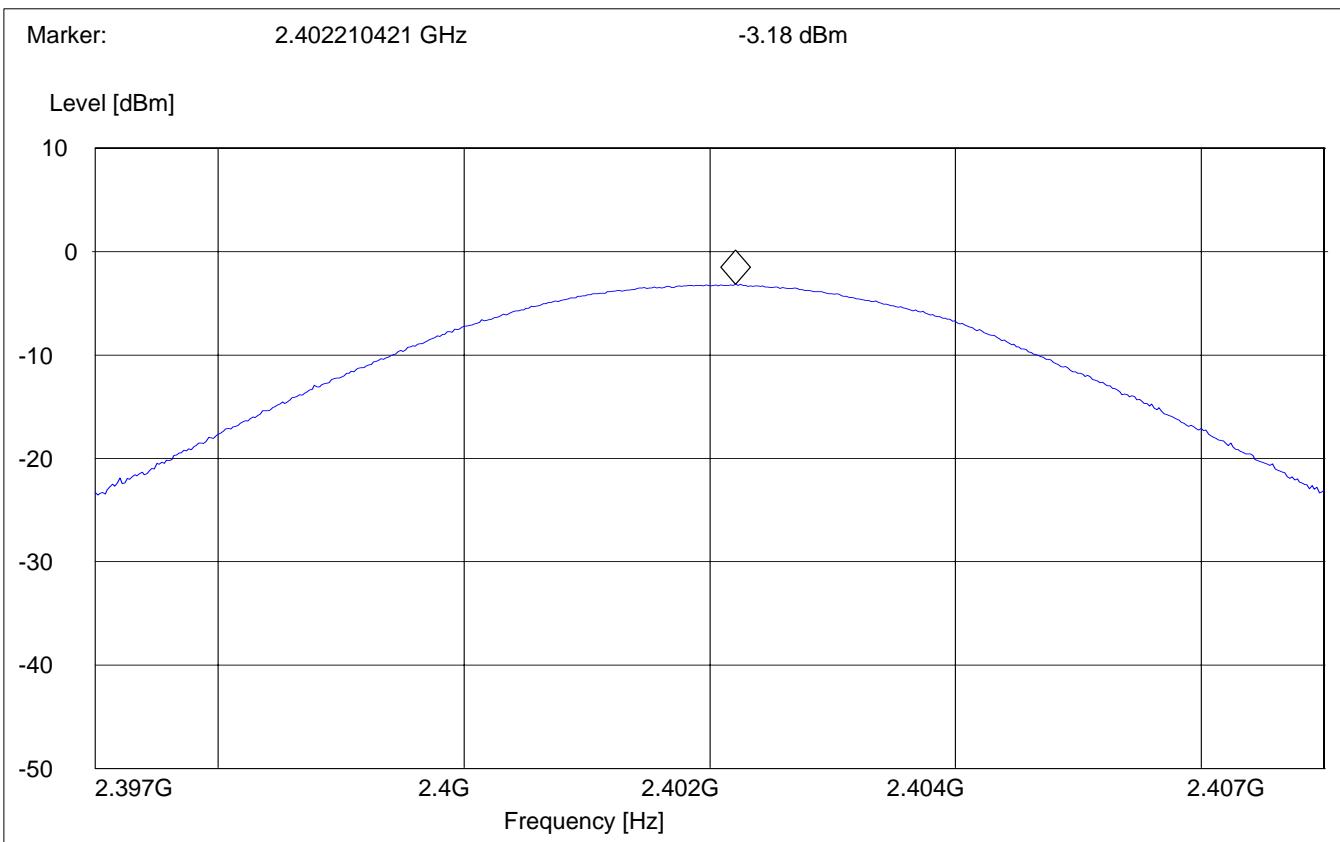
LIMIT**SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt conducted

PEAK OUTPUT POWER (RADIATED)**§15.247 (b) (1)****Lowest Channel: 2402MHz**

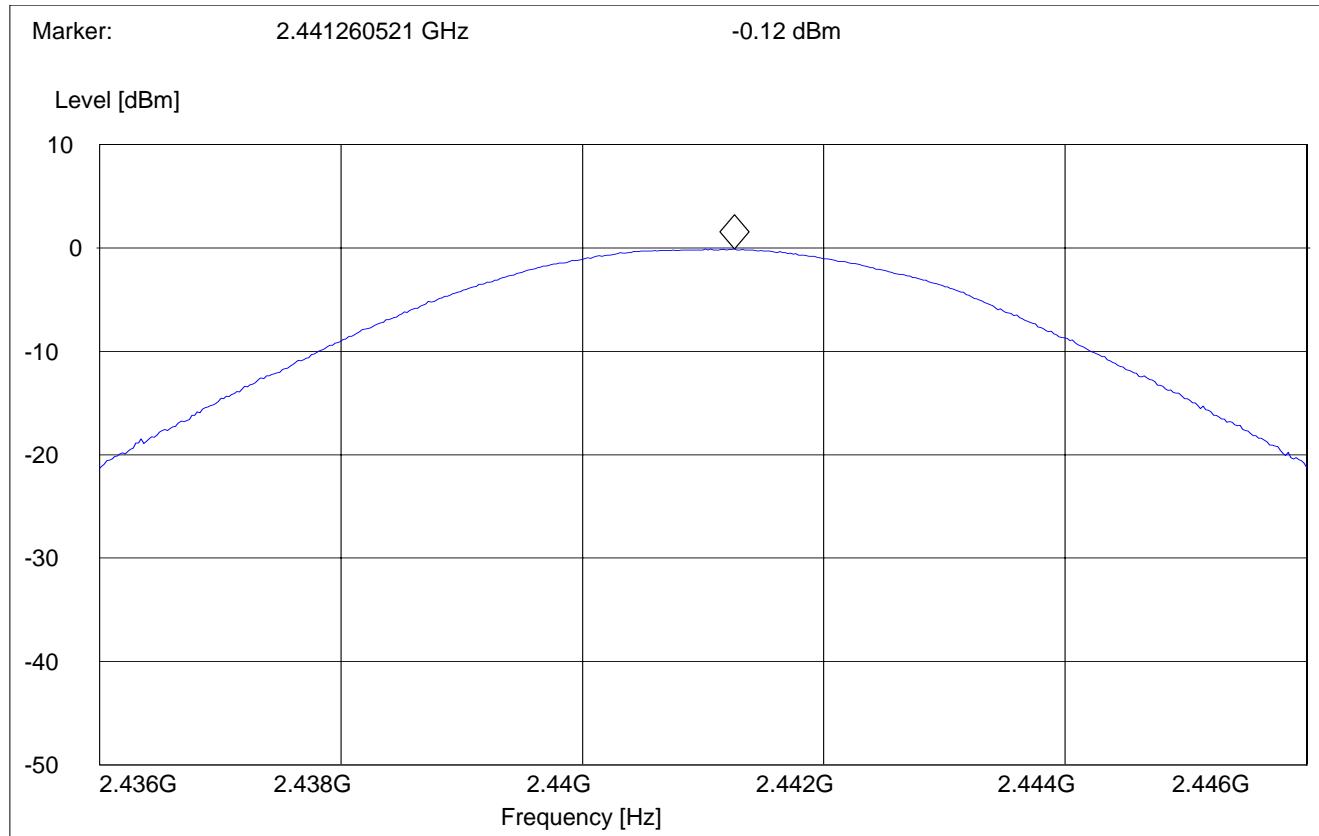
SWEEP TABLE: "EIRP BT low channel"

Start Frequency	Stop Frequency	Detector	Meas.	IF
2.397GHz	2.407GHz	MaxPeak	Coupled	3 MHz



PEAK OUTPUT POWER (RADIATED)**§15.247 (b) (1)****Mid Channel: 2441MHz****SWEEP TABLE: "EIRP BT Mid channel"**

Start Frequency	Stop Frequency	Detector	Meas.	IF
2.436GHz	2.446GHz	MaxPeak	Time Coupled	BW 3 MHz

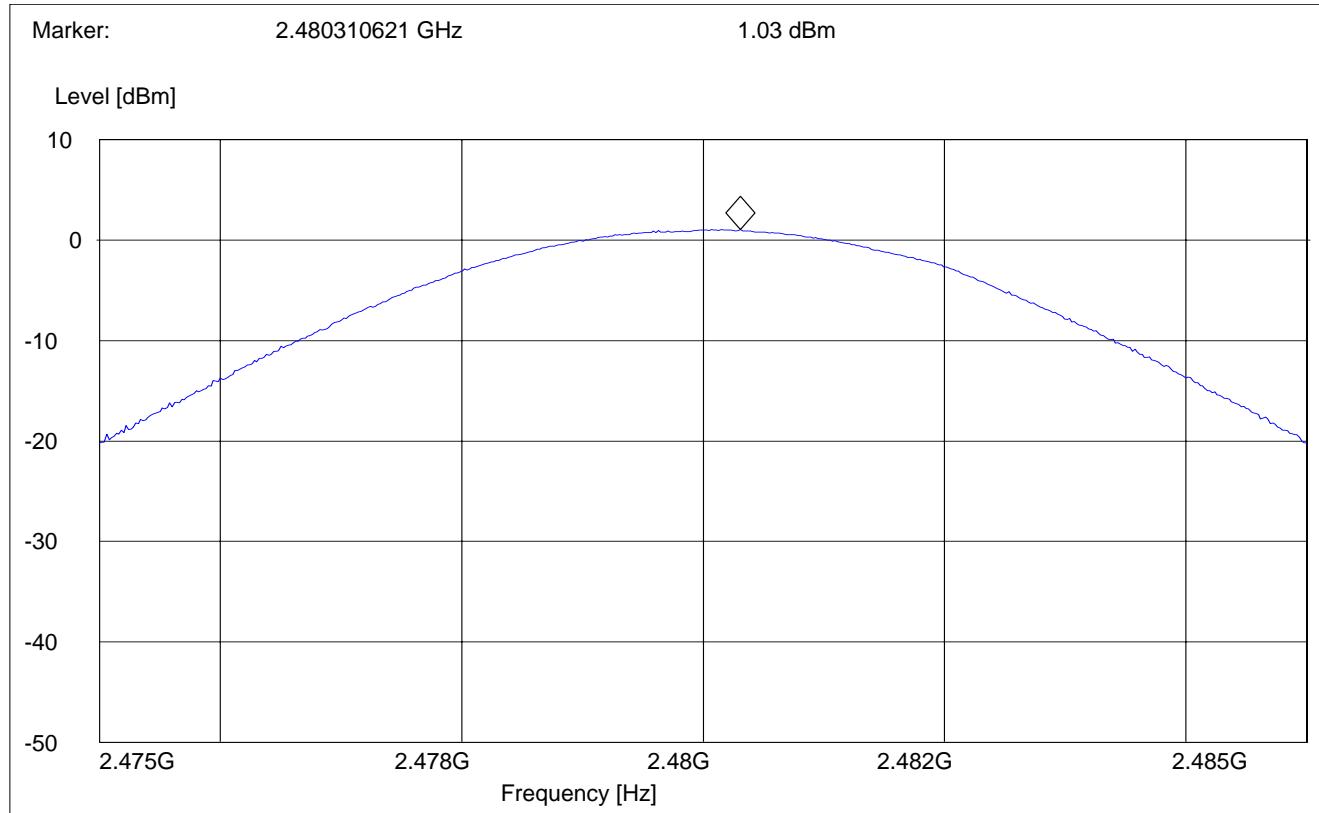


PEAK OUTPUT POWER (RADIATED)**§15.247 (b) (1)****Highest Channel: 2480MHz**

SWEEP TABLE: "EIRP BT High channel"

Short Description: EIRP Bluetooth channel-2480MHz

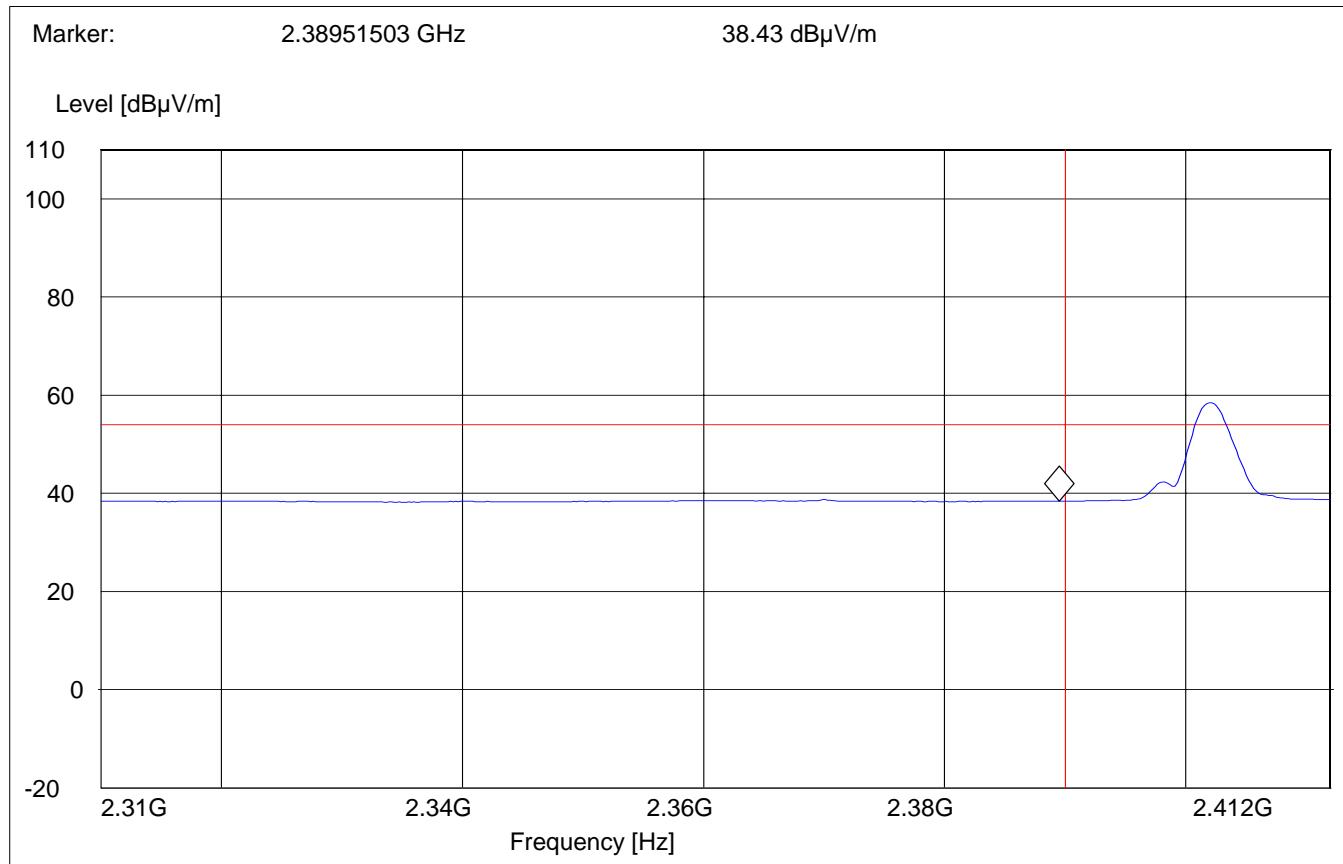
Start Frequency	Stop Frequency	Detector	Meas.	IF
2.475GHz	2.485GHz	MaxPeak	Time Coupled	BW 3 MHz



BAND EDGE COMPLIANCE**§15.247 (c)****Low frequency section (spurious in the restricted band 2310 – 2390 MHz)****Average Measurement****(This plot is valid for both Hopping ON & OFF)**

Operating condition : Tx at 2402MHz
SWEEP TABLE : "FCC15.247 LBE_AVG"
Short Description : FCC15.247 BT Low-band-edge
Limit Line : 54dB μ V

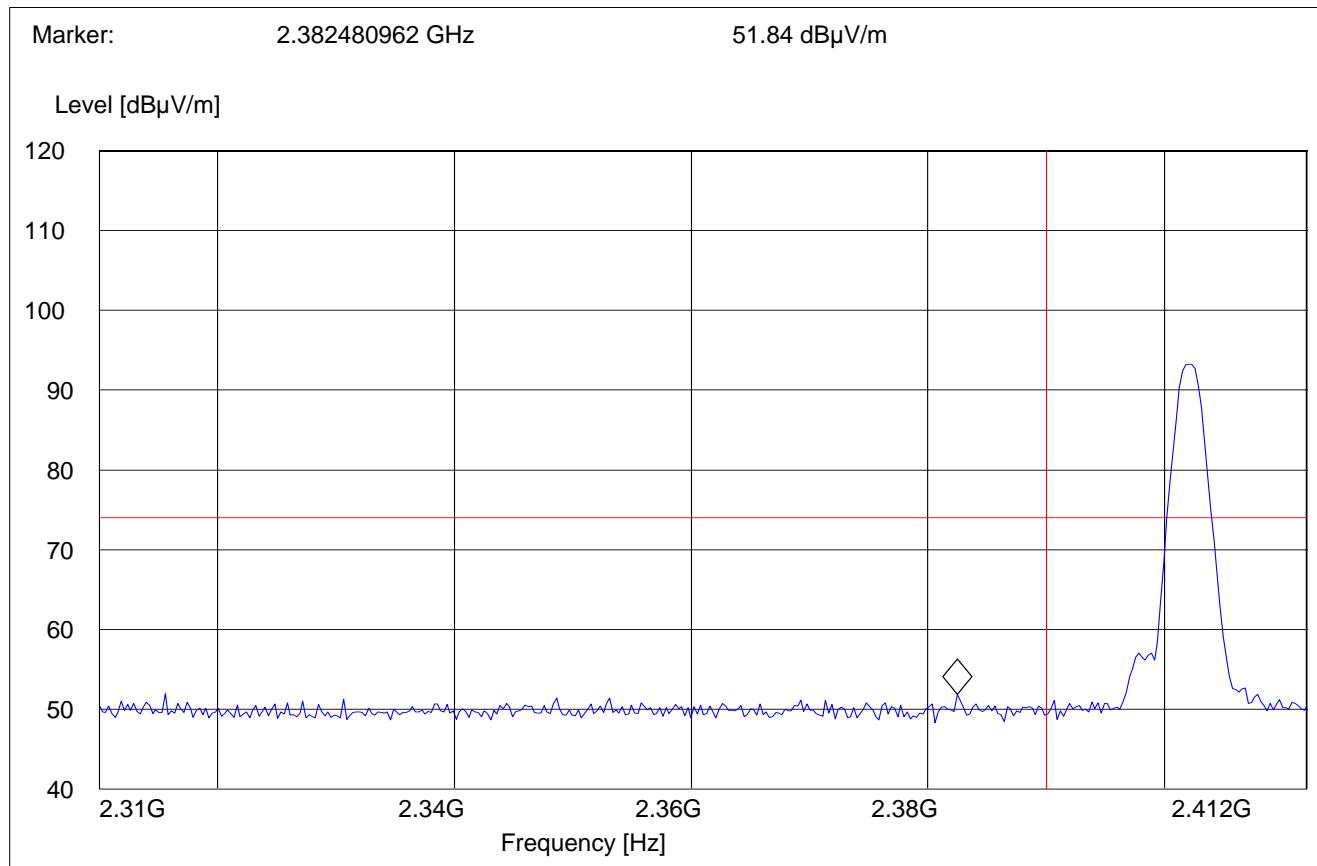
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****Low frequency section (spurious in the restricted band 2310 – 2390 MHz)****Peak Measurement****(This plot is valid for both Hopping ON & OFF)**

Operating condition : Tx at 2402MHz
SWEEP TABLE : "FCC15.247 LBE_Pk"
Short Description : FCC15.247 BT Low-band-edge
Limit Line : 74dB μ V

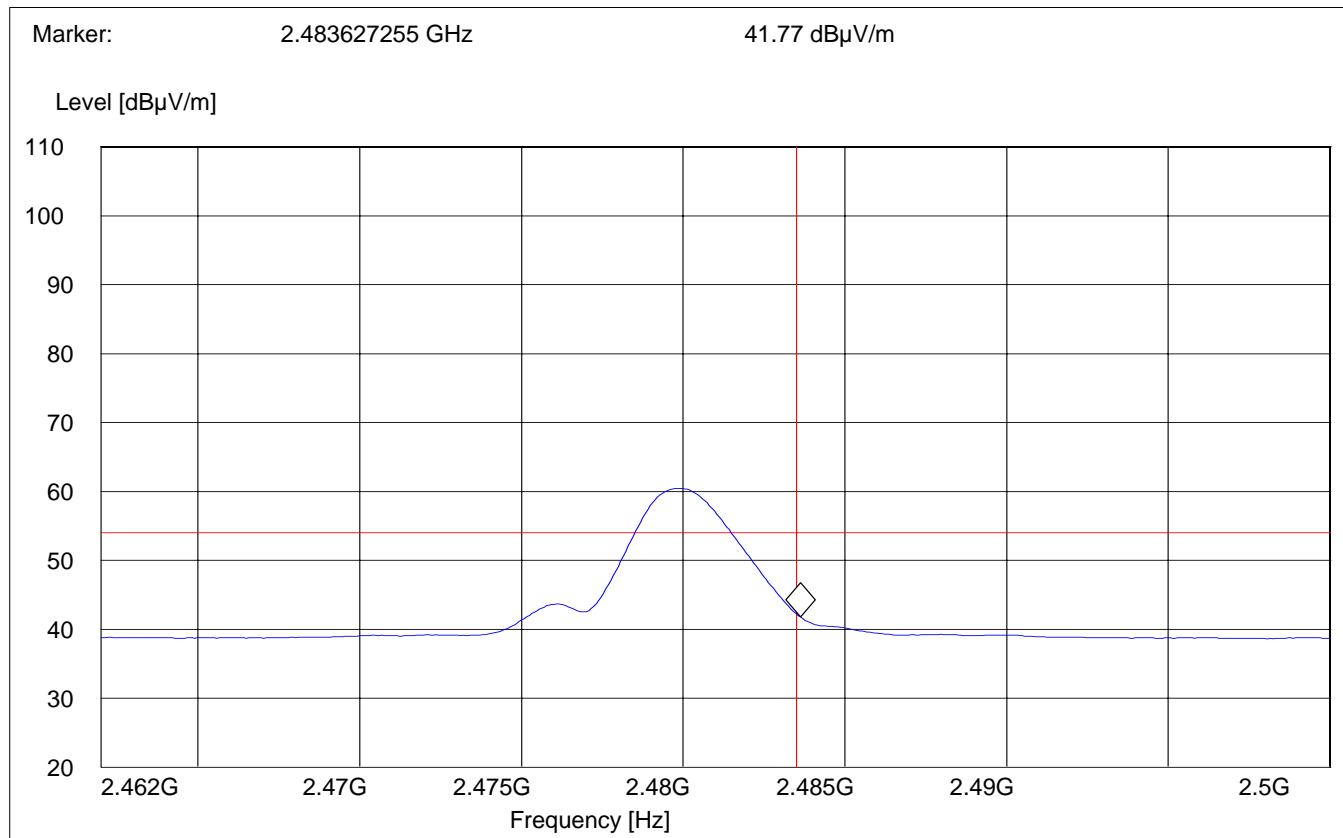
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)****Average Measurement****(This plot is valid for both Hopping ON & OFF)**

Operating condition : Tx at 2480MHz
SWEEP TABLE : "FCC15.247 HBE_AVG"
Short Description : FCC15.247 BT High-band-edge
Limit Line : 54dB μ V

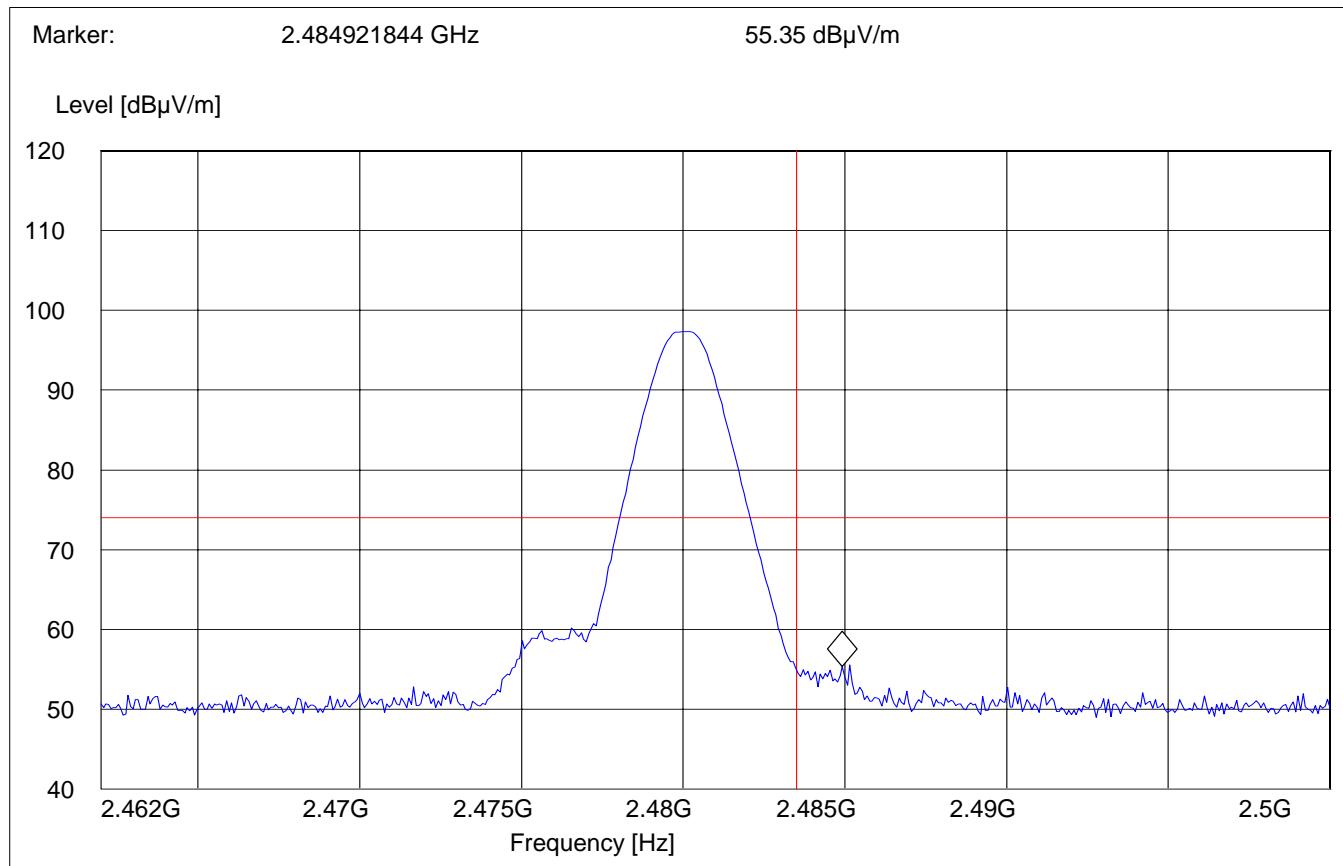
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.462 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)****Peak Measurement****(This plot is valid for both Hopping ON & OFF)**

Operating condition : Tx at 2480MHz
SWEEP TABLE : "FCC15.247 HBE_PK"
Short Description : FCC15.247 BT High-band-edge
Limit Line : 74dB μ V

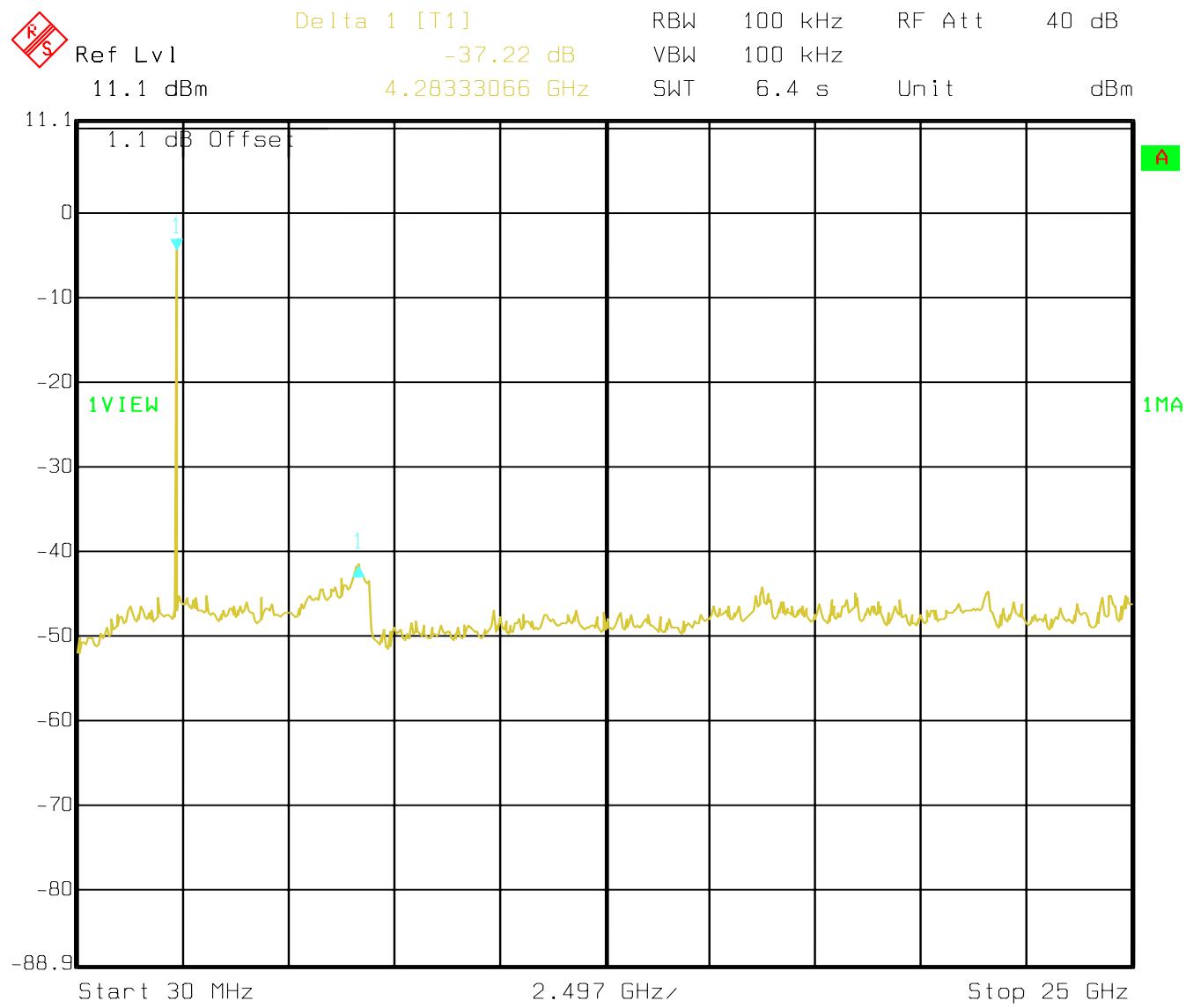
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.462 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



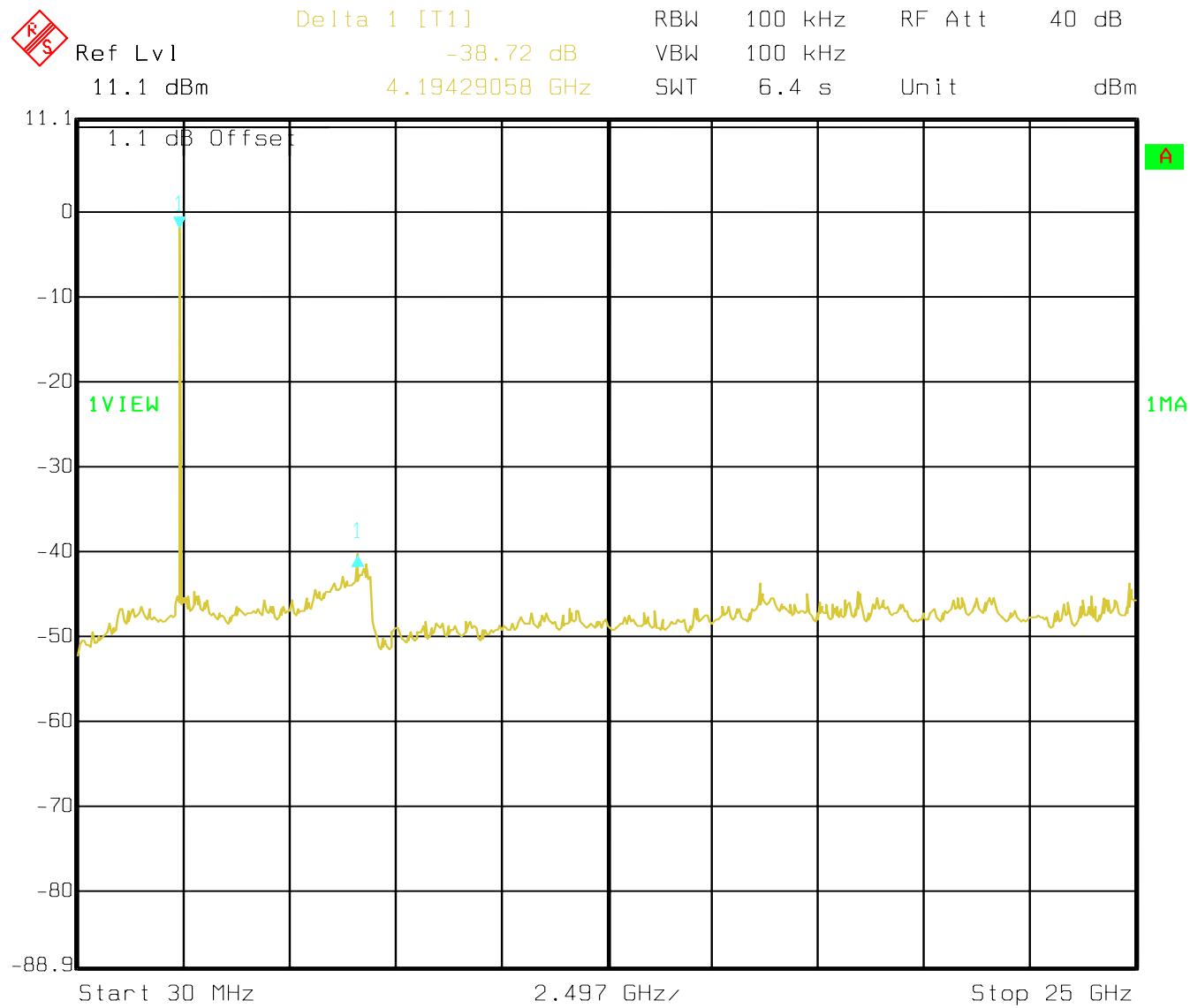
**EMISSION LIMITATIONS
Transmitter (Conducted)
LIMITS****§ 15.247 (c) (1)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions that 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)).

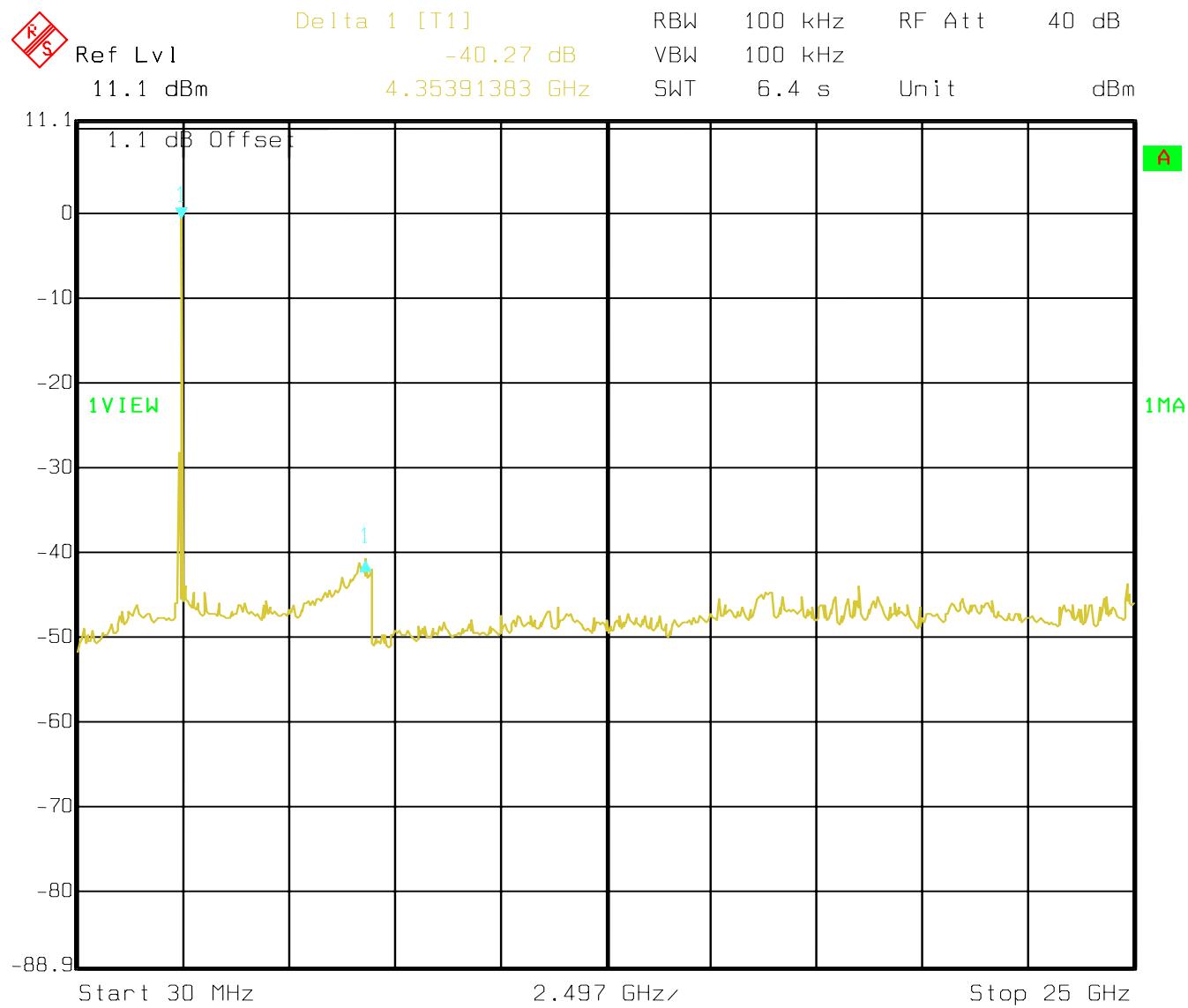
NOTE: Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.

EMISSION LIMITATIONS - Conducted (Transmitter)**§ 15.247 (c) (1)****Lowest Channel (2402MHz): 30MHz - 25GHz**

Date: 25.OCT.2004 16:59:34

EMISSION LIMITATIONS - Conducted (Transmitter)**§ 15.247 (c) (1)****Mid Channel (2441MHz): 30MHz - 25GHz**

Date: 25.OCT.2004 16:58:52

EMISSION LIMITATIONS - Conducted (Transmitter)**§ 15.247 (c) (1)****Highest Channel (2480MHz): 30MHz - 25GHz**

Date: 25.OCT.2004 16:58:07

EMISSION LIMITATIONS
Transmitter (Radiated)**§ 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 that 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 3 and 26.5 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.
3. All measurements are done in peak mode unless specified with plots.

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

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

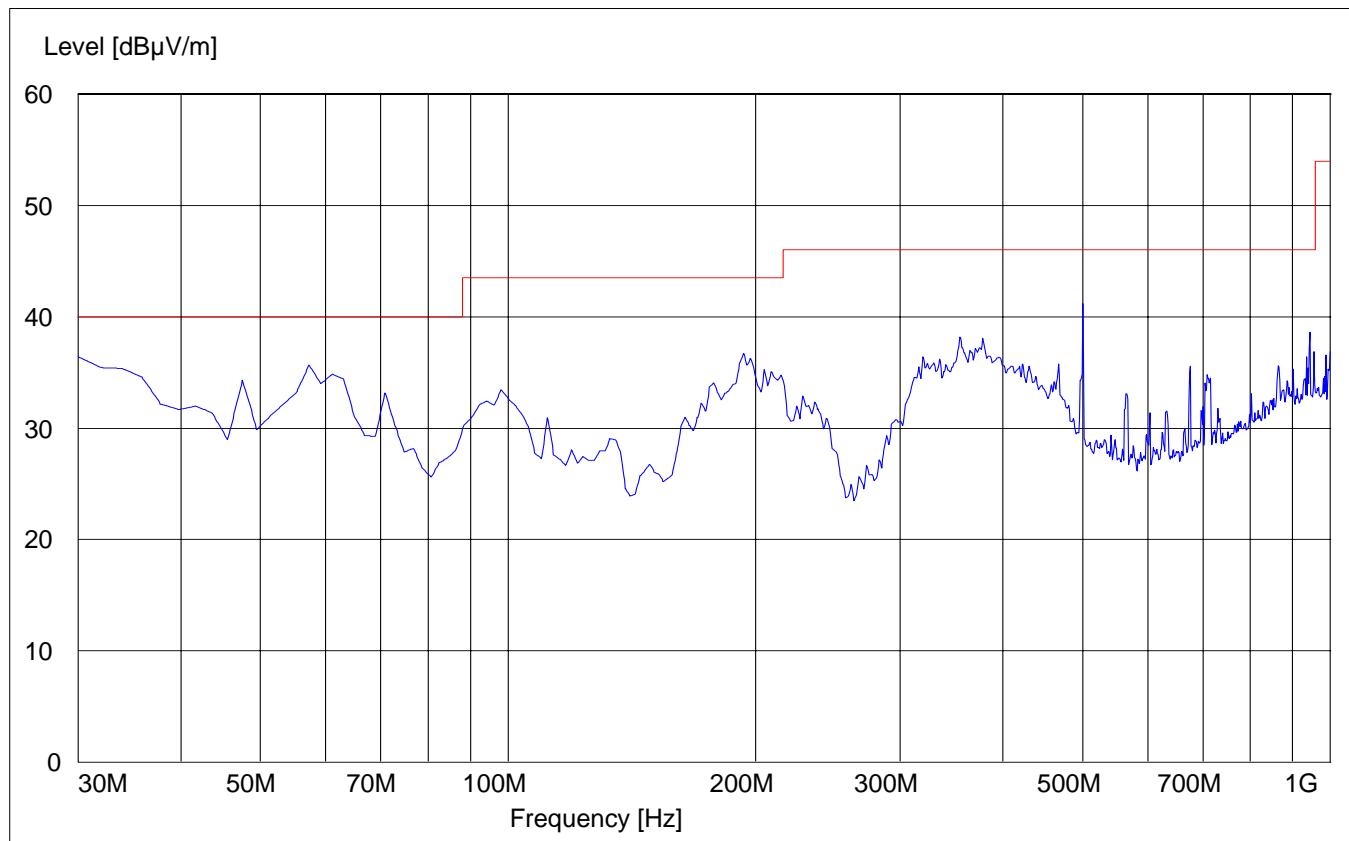
Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.

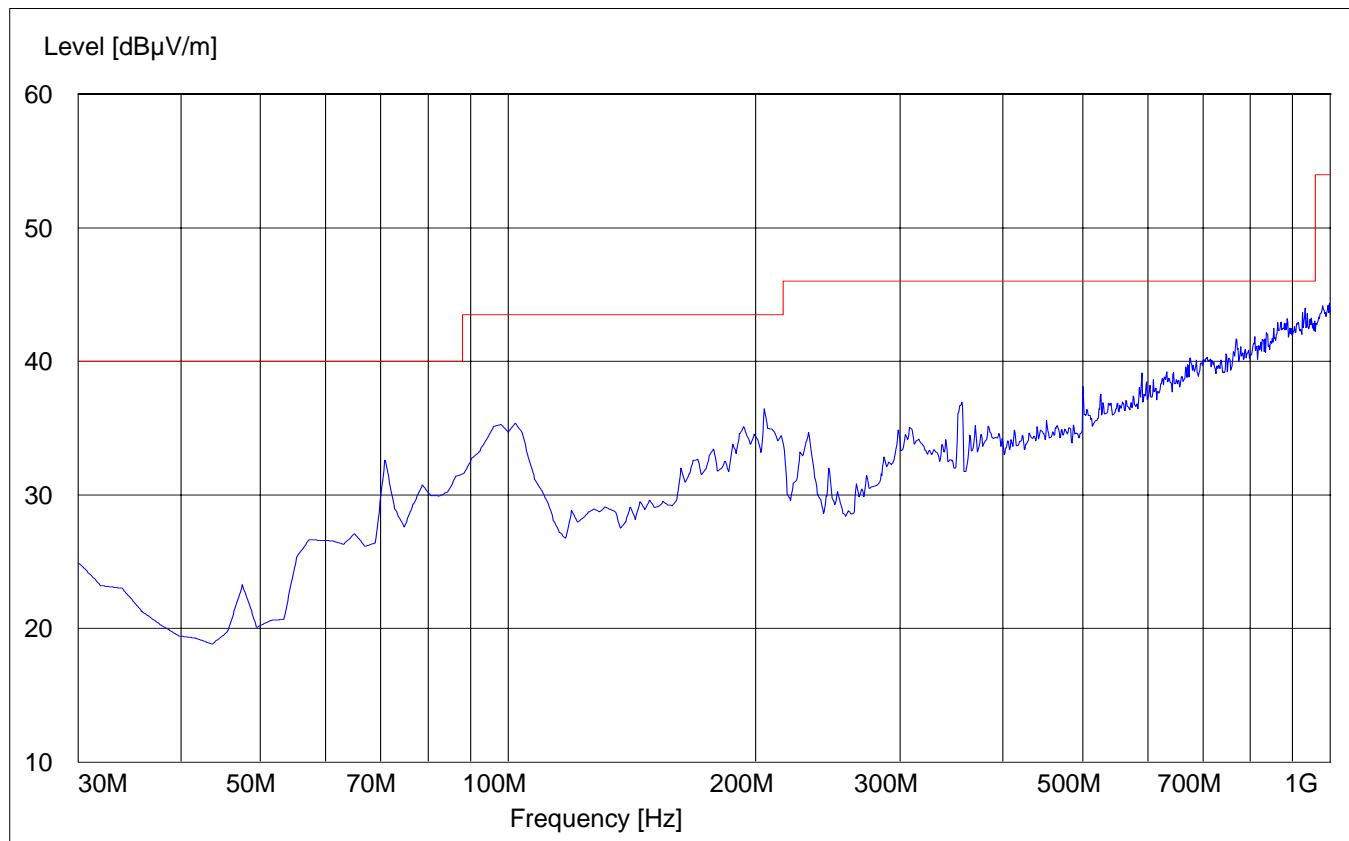
Transmit at Lowest channel Frequency 2402MHz			
Frequency (MHz)	Level (dB μ V/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			
Transmit at Middle channel Frequency 2441MHz			
Frequency (MHz)	Level (dB μ V/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			
Transmit at Highest channel Frequency 2480MHz			
Frequency (MHz)	Level (dB μ V/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			

EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****30MHz – 1GHz****Antenna: vertical****Note: This plot is valid for low, mid & high channels (worst-case plot)**

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

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



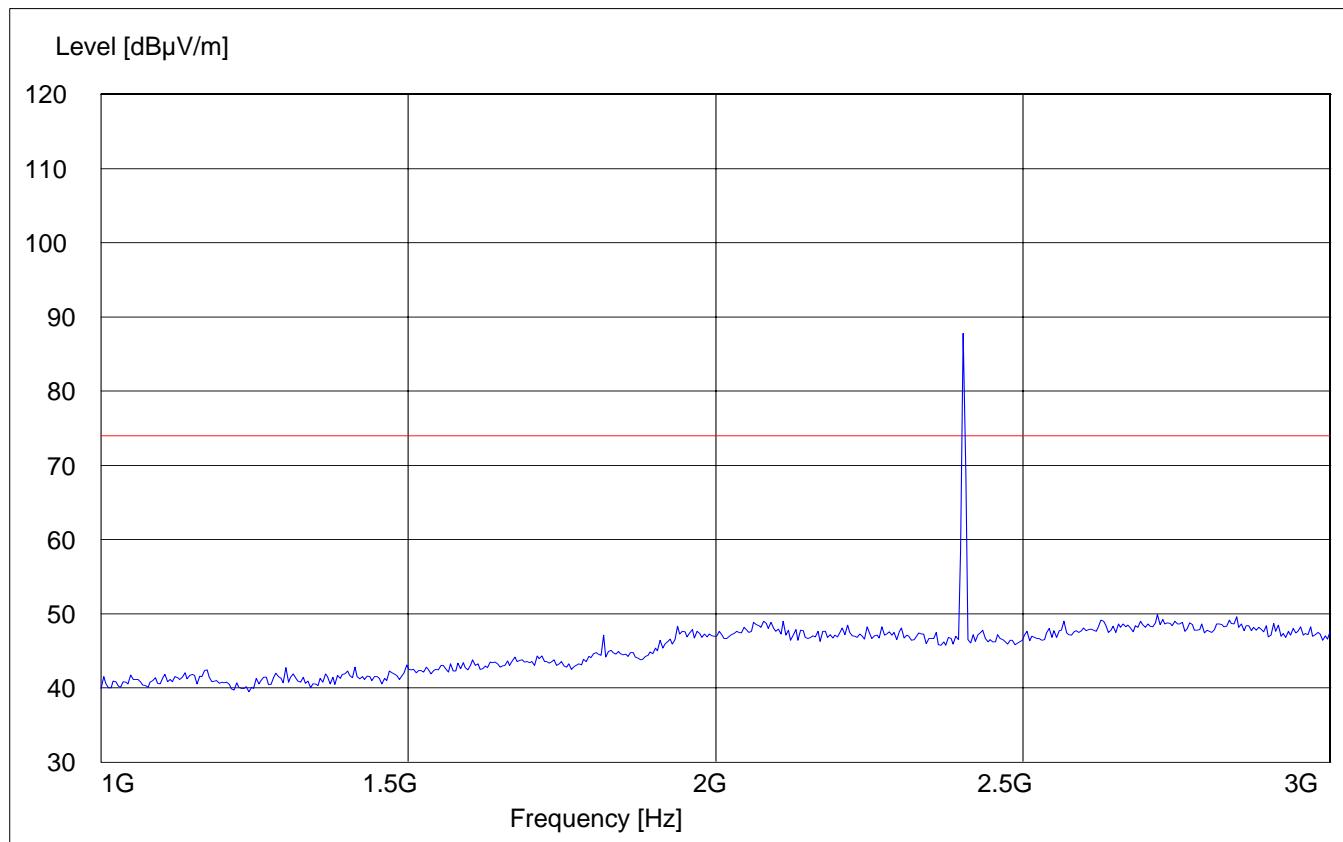
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****30MHz – 1GHz****Antenna: horizontal****Note: This plot is valid for low, mid & high channels (worst-case plot)****SWEEP TABLE:****"BT Spuri hi 30-1G"****Short Description:****Bluetooth 30MHz-1GHz****Start Frequency****Stop Frequency****Detector****Meas.****RBW****Transducer****30.0 MHz****1.0 GHz****MaxPeak****Coupled****Time****VBW****100 kHz****3141-#1186**

EMISSION LIMITATIONS - Radiated (Transmitter)
Lowest Channel (2402MHz): 1GHz – 3GHz**§ 15.247 (c) (1)****NOTE: The peak is the carrier frequency.**

SWEEP TABLE: "BT Spuri hi 1-3G"

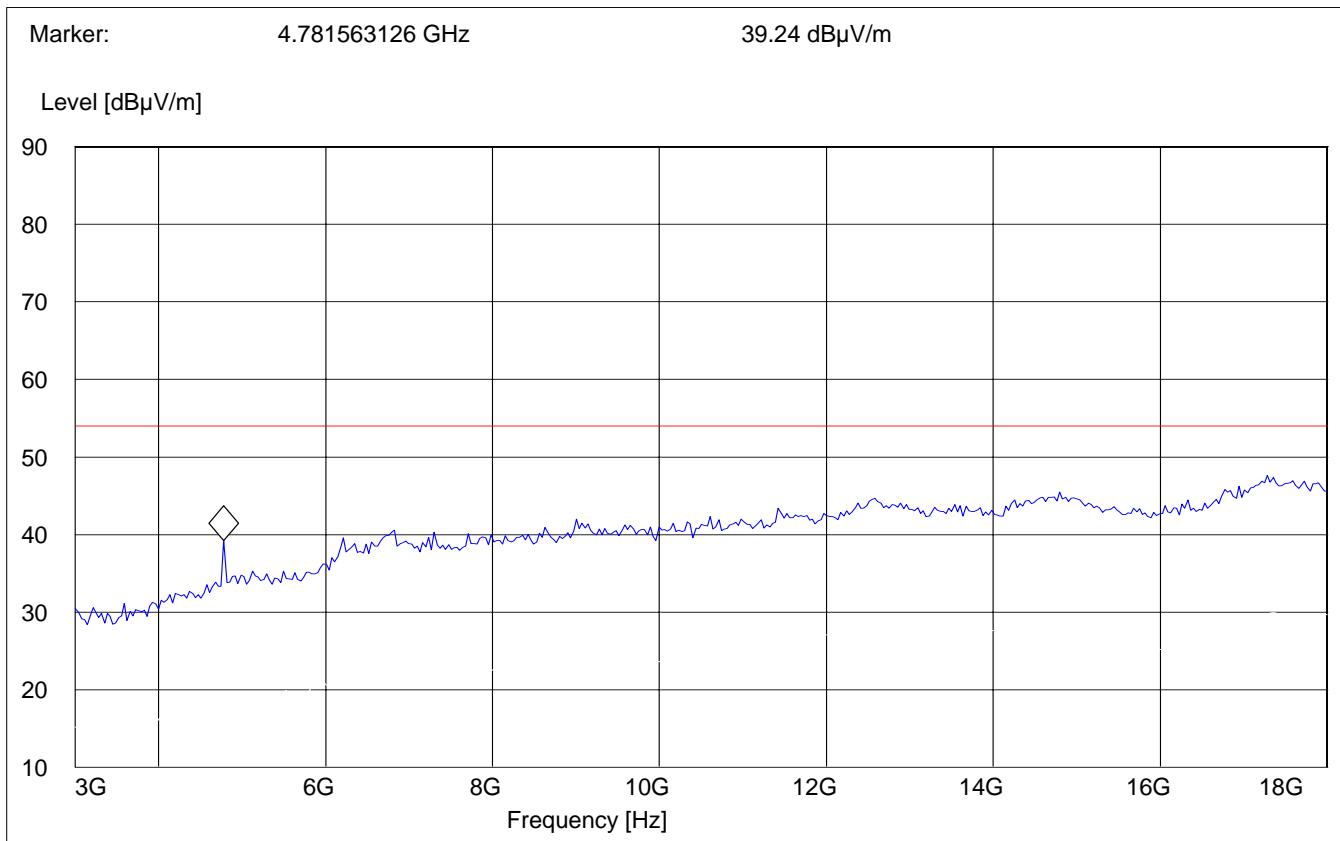
Short Description: Bluetooth Spurious 1-3GHz

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
1.0 GHz	3.0 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)



EMISSION LIMITATIONS - Radiated (Transmitter)
Lowest Channel (2402MHz): 3GHz – 18GHz**§ 15.247 (c) (1)**

SWEEP TABLE: "BT Spuri hi 3-18G"
Short Description: Bluetooth Spurious 3-18 GHz
Start Frequency: 3.0 GHz **Stop Frequency:** 18.0 GHz **Detector:** MaxPeak **Meas. Time:** Coupled **RBW:** 1 MHz **Transducer:** #326 horn (dBi)

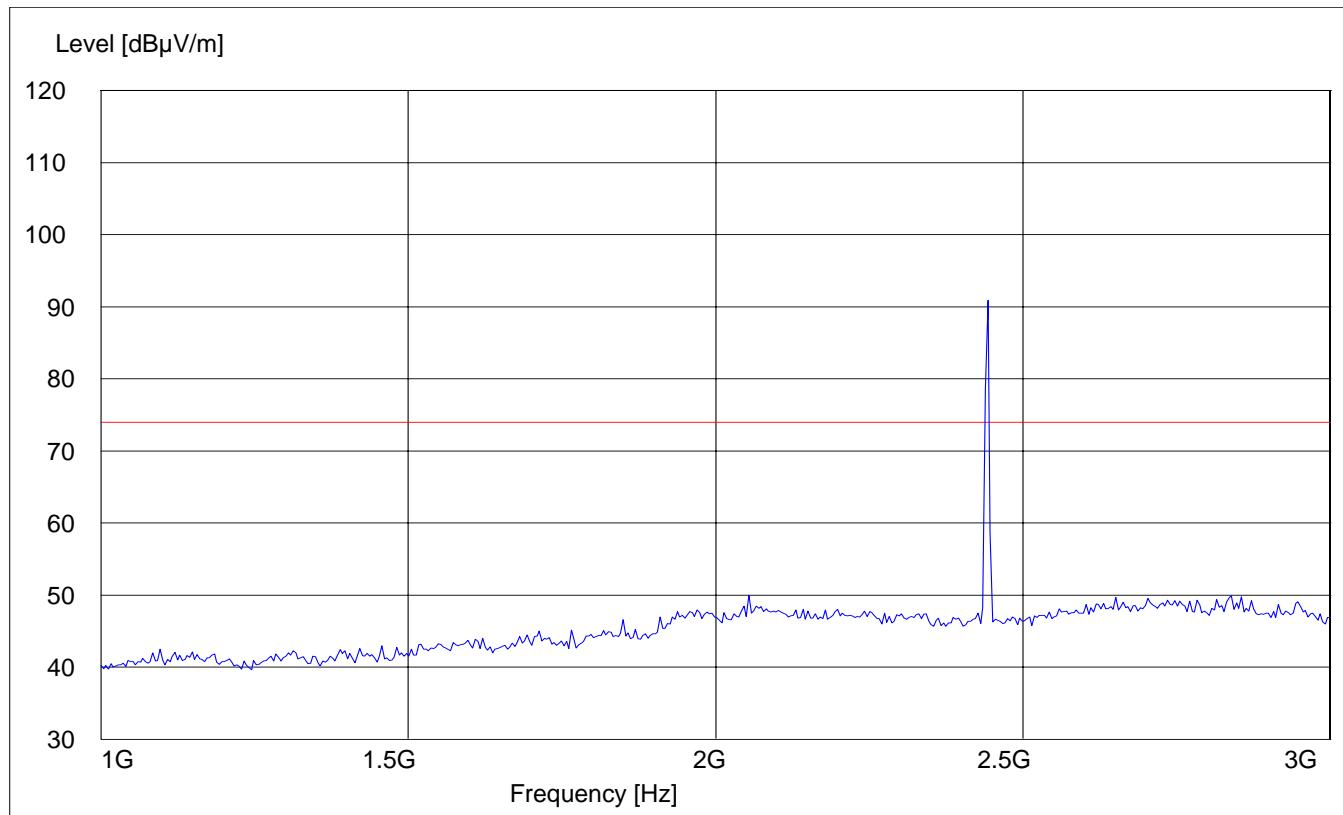


EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Middle Channel (2441MHz): 1GHz – 3GHz**NOTE: The peak is the carrier frequency.**

SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

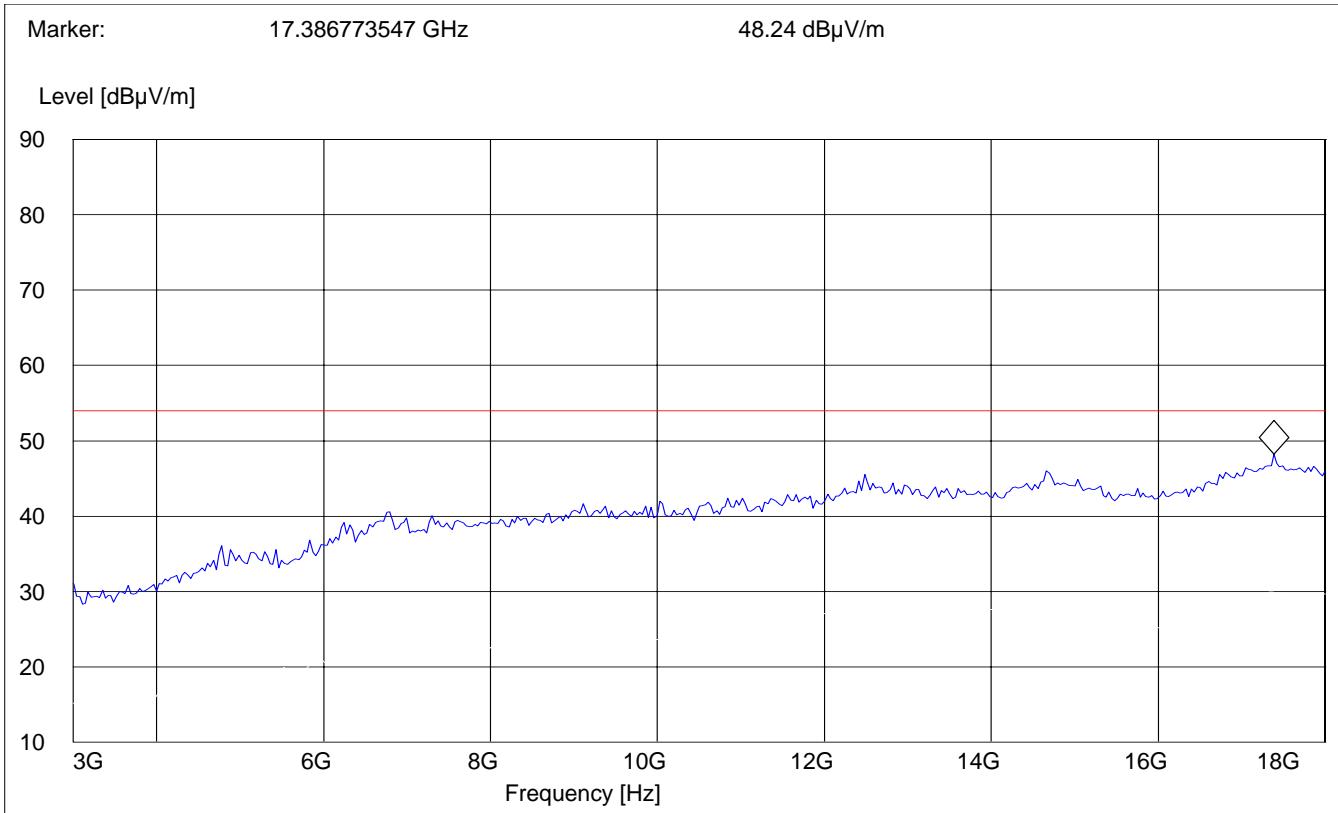
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz		#326 horn (dBi)



EMISSION LIMITATIONS - Radiated (Transmitter)
Middle Channel (2441MHz): 3GHz – 18GHz**§ 15.247 (c) (1)**

SWEEP TABLE: "BT Spuri hi 3-18G"
Short Description: Bluetooth Spurious 3-18GHz

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

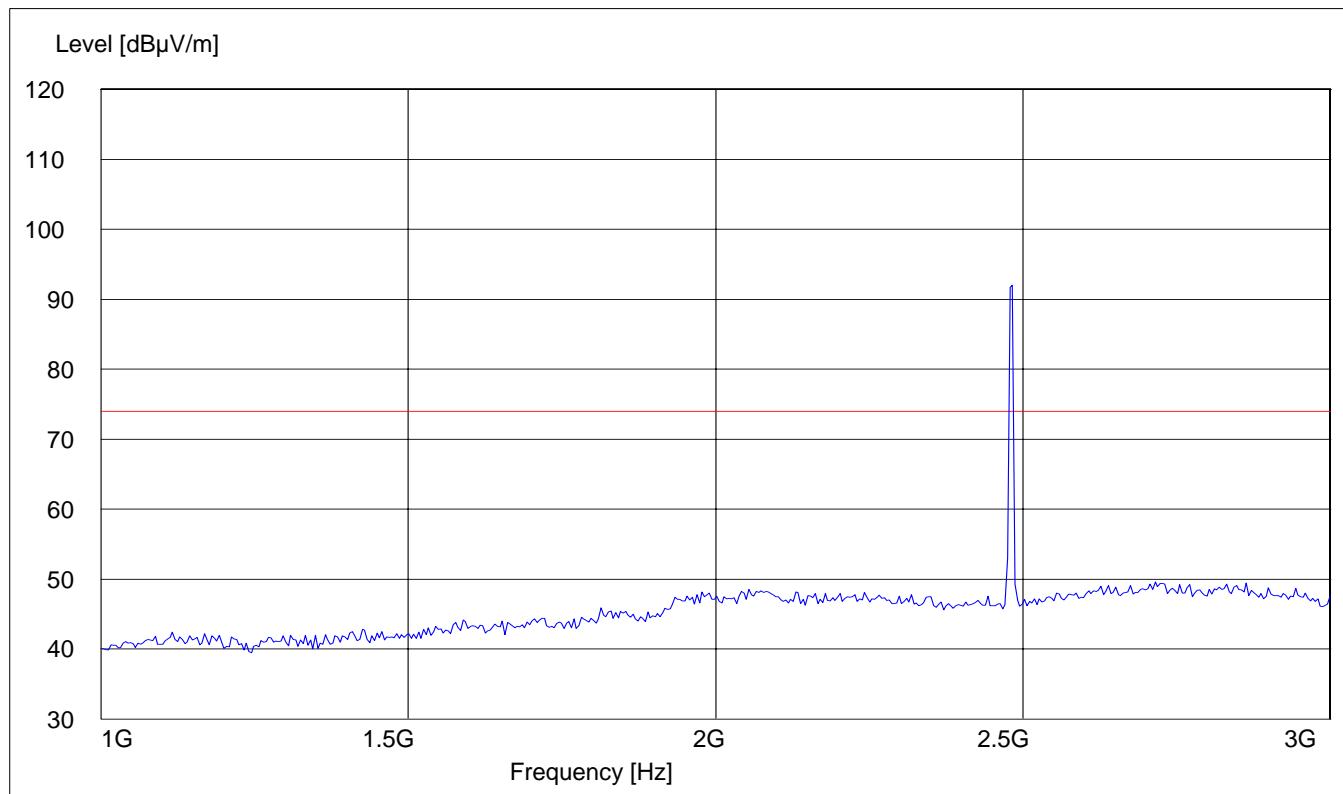


EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Highest Channel (2480MHz): 1GHz – 3GHz****NOTE: The peak is the carrier frequency.**

SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

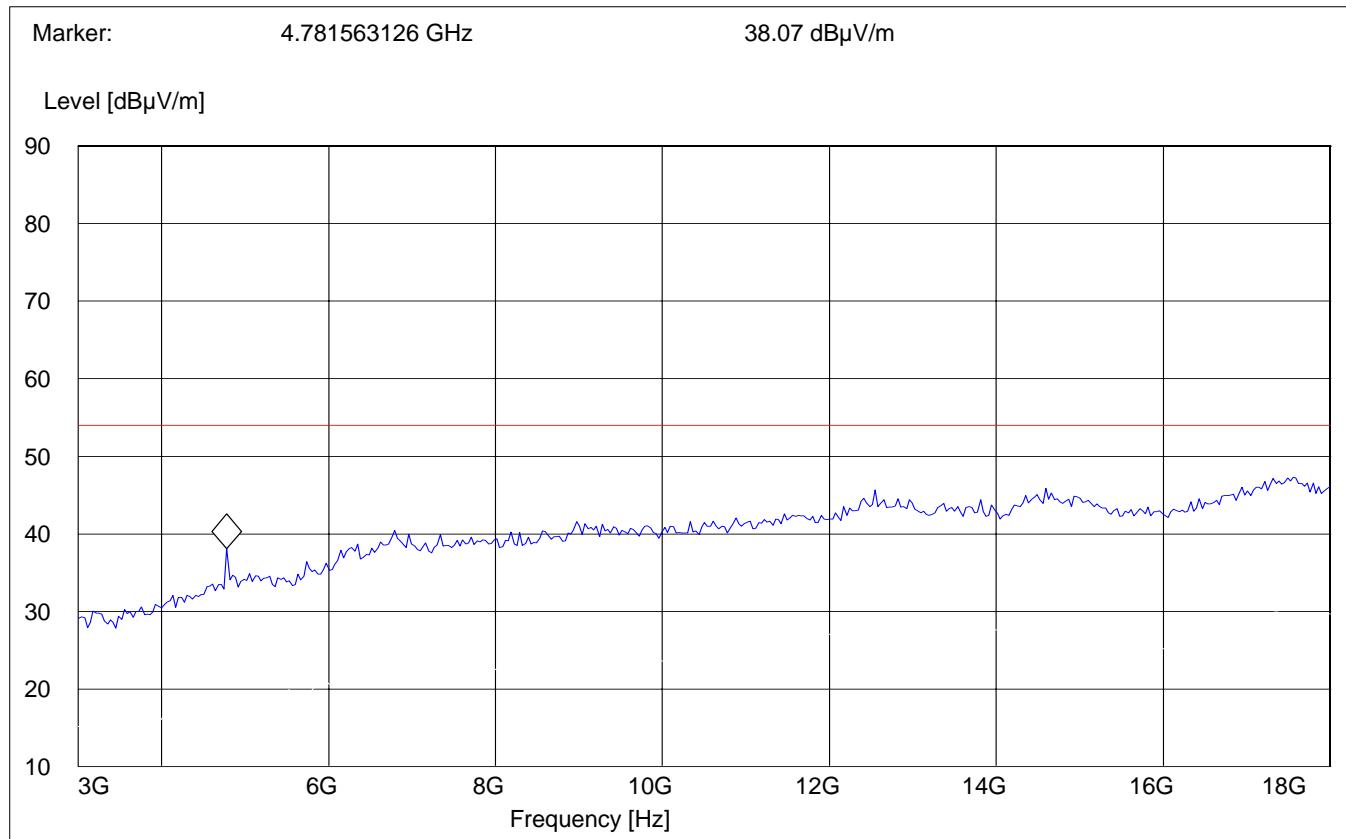
Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
1.0 GHz	3.0 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)



EMISSION LIMITATIONS - Radiated (Transmitter)
Highest Channel (2480MHz): 3GHz – 18GHz**§ 15.247 (c) (1)**

SWEEP TABLE: "BT Spuri hi 3-18G"
Short Description: Bluetooth Spurious 3-18GHz

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
3.0 GHz	18.0 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)

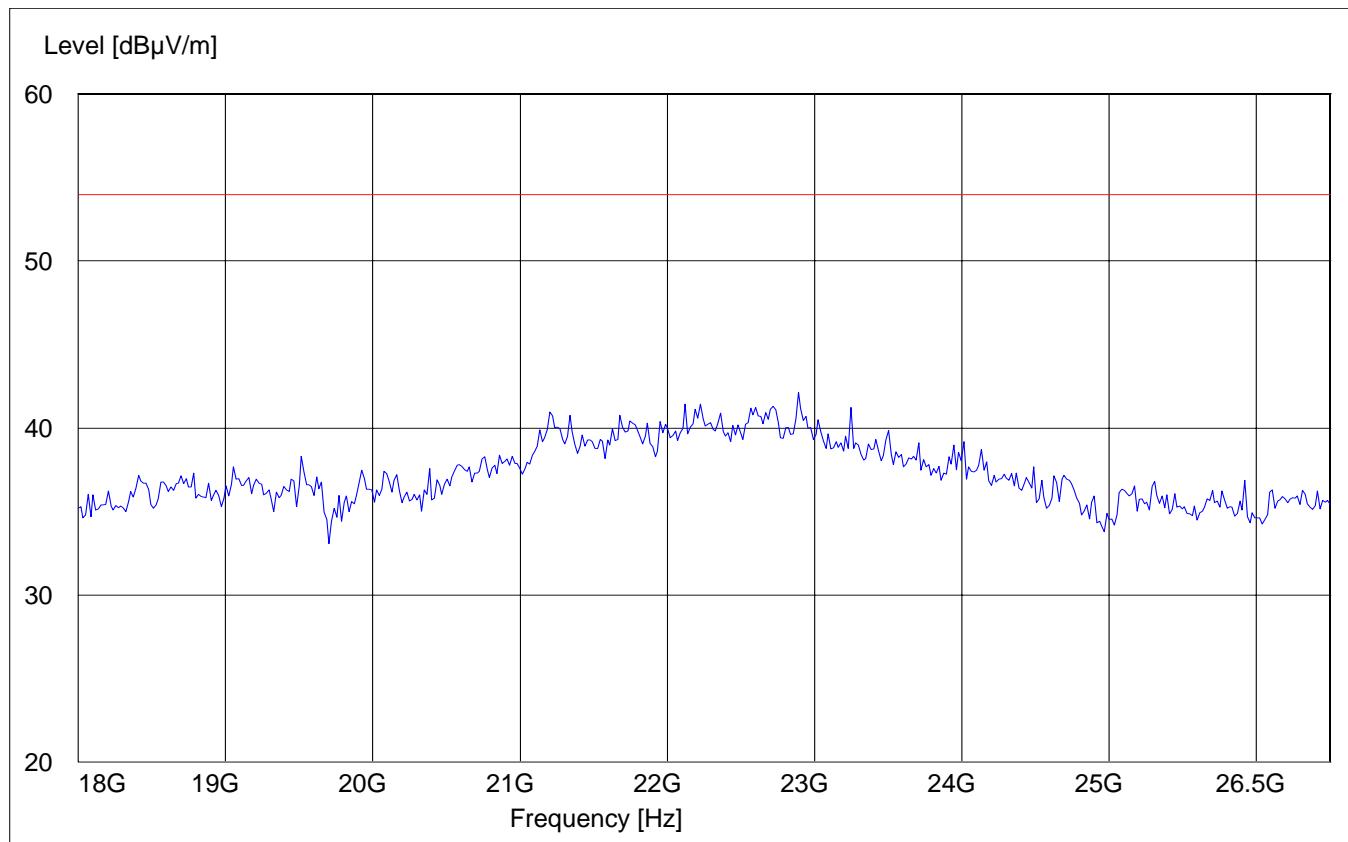


EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****18GHz – 26.5GHz****Note: This plot is valid for low, mid & high channels (worst-case plot)**

SWEEP TABLE: "BT Spuri hi 18-26.5G"

Short Description: Bluetooth Spurious 18-26.5GHz

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
18 GHz	26.5 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#141 horn (dBi)



CONDUCTED EMISSIONS

§ 15.107/207

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)

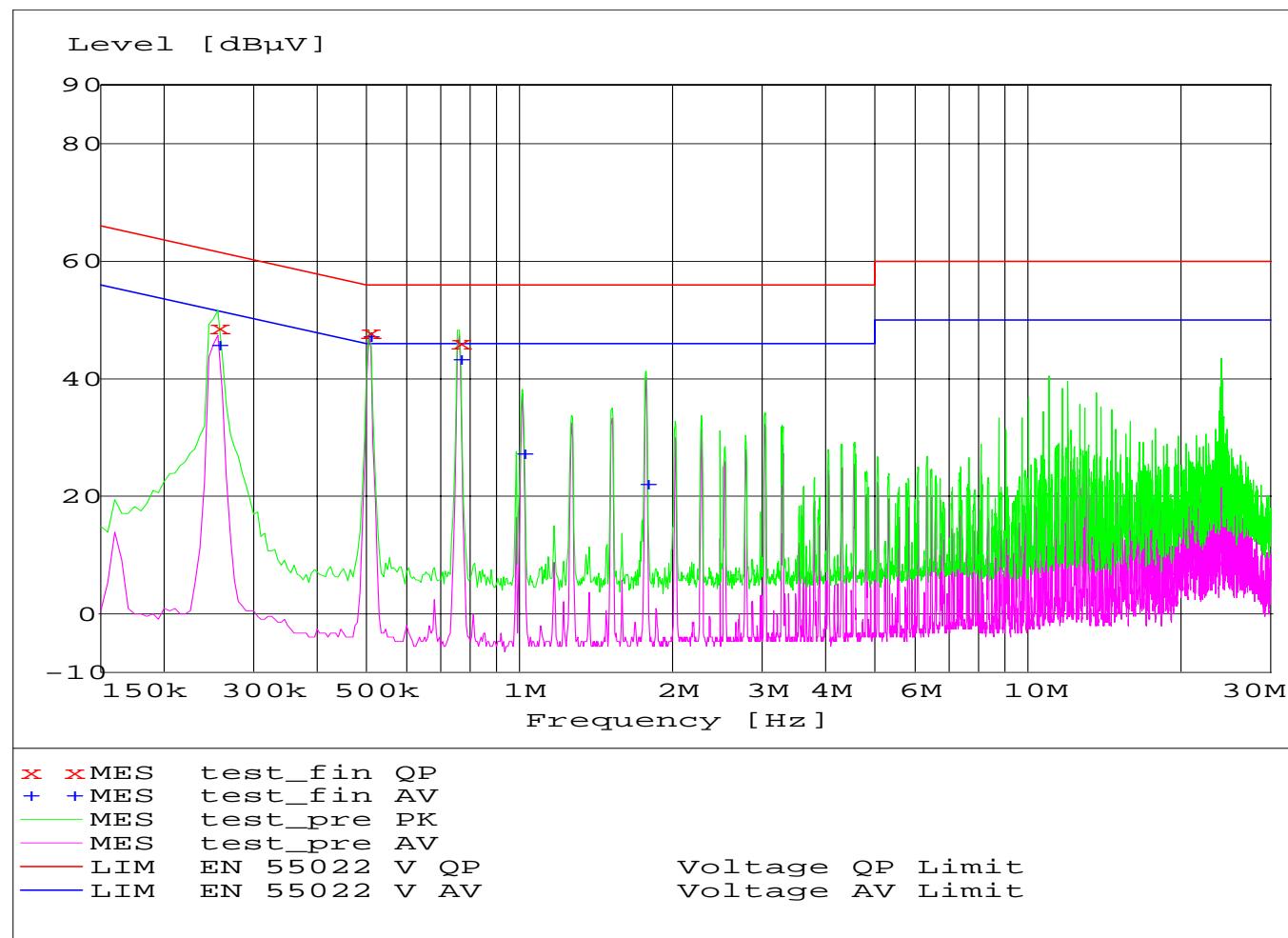
Limit

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with logarithm of the frequency

ANALYZER SETTINGS: RBW = 10KHz

VBW = 10KHz



MEASUREMENT RESULT: "test_fin QP"

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Line	PE
0.255000	48.70	0.0	62	12.9	L1	GND
0.505000	47.90	0.0	56	8.1	L1	GND
0.760000	46.10	0.0	56	9.9	N	GND

MEASUREMENT RESULT: "test_fin AV"

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Line	PE
0.255000	45.80	0.0	52	5.8	N	GND
0.505000	47.30	0.0	46	-1.3	L1	GND
0.760000	43.30	0.0	46	2.7	L1	GND
1.015000	27.30	0.0	46	18.7	N	GND
1.775000	22.20	0.0	46	23.8	N	GND

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

Frequency (MHz)	Field strength (μ 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:

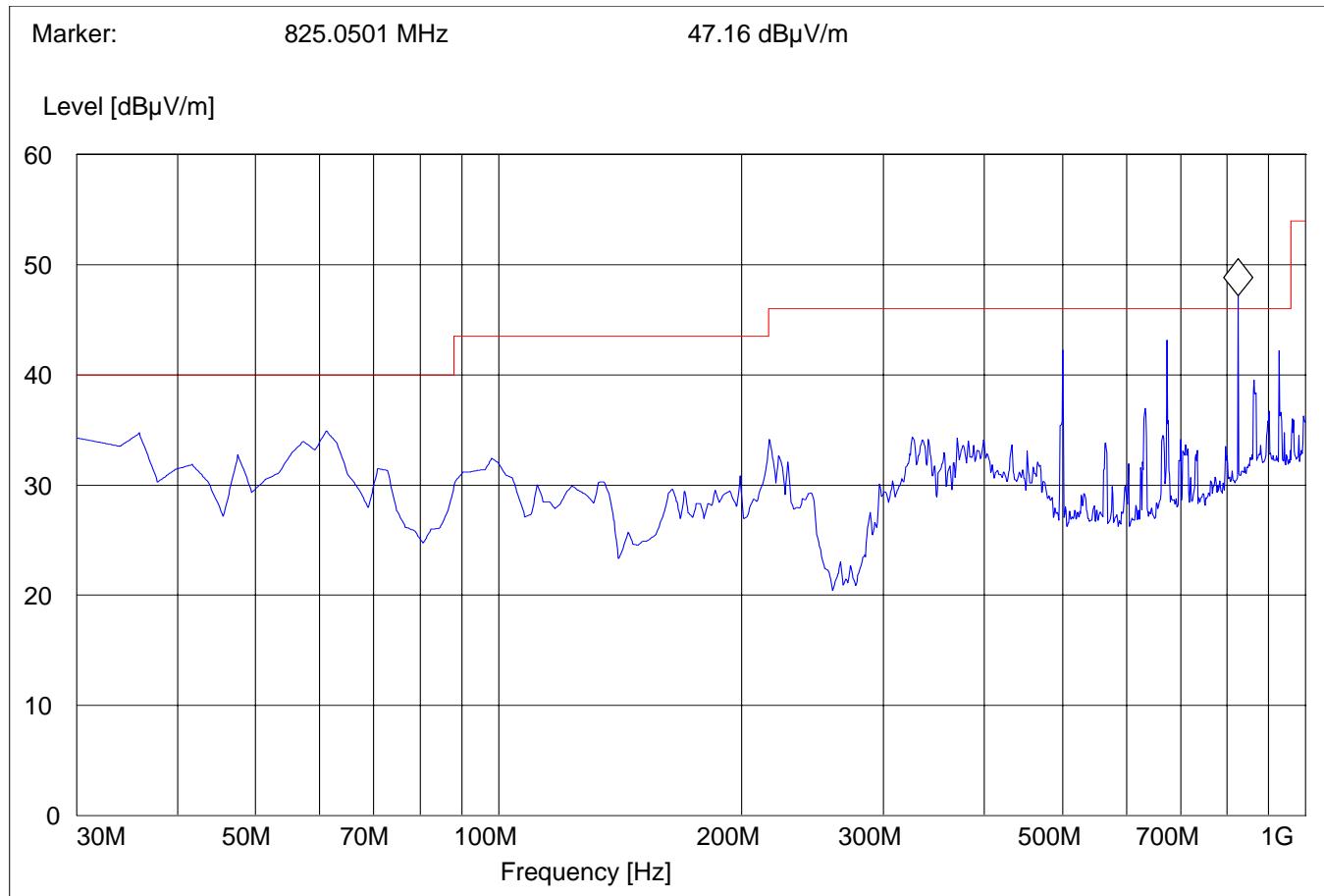
1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 26.5 GHz very short cable connections to the antenna was used to minimize the noise level.
2. All measurements are done in peak mode unless specified with the plots.

RECEIVER SPURIOUS RADIATION**§ 15.209****30MHz – 1GHz****Antenna: vertical (worst-case plot)**

SWEEP TABLE: "BT Spuri hi 30-1G"

Short Description: Bluetooth 30MHz-1GHz

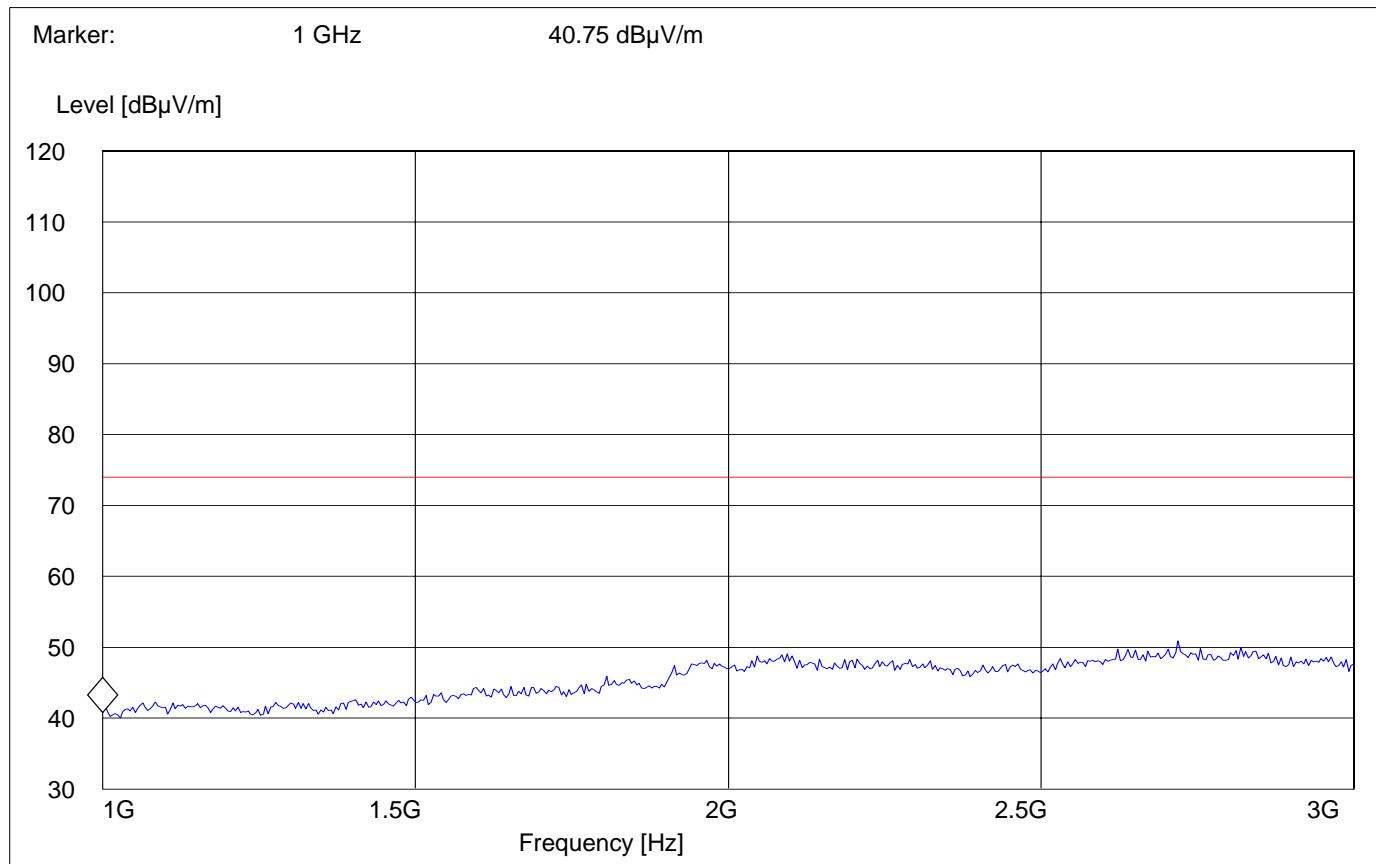
Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186

QP level @ 825.05MHz is 6.99 dB lower than Pk level

**RECEIVER SPURIOUS RADIATION
1GHz – 3GHz****§ 15.209**

SWEEP TABLE: "BT Spuri hi 1-3G"
Short Description: Bluetooth Spurious 1-3GHz

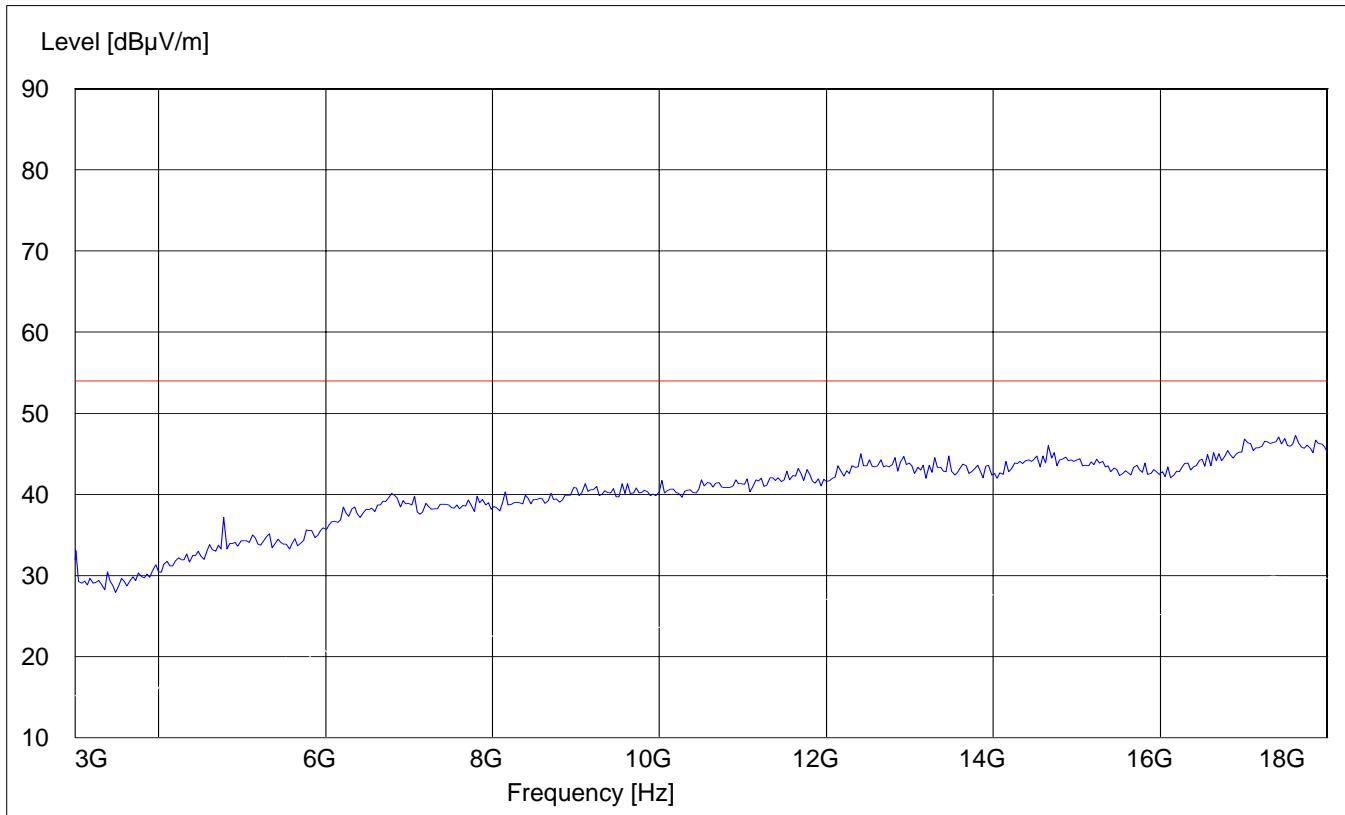
Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
1.0 GHz	3.0 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)



**RECEIVER SPURIOUS RADIATION
3GHz – 18GHz****§ 15.209**

SWEEP TABLE: "BT Spuri hi 3-18G"
Short Description: Bluetooth Spurious 3-18 GHz

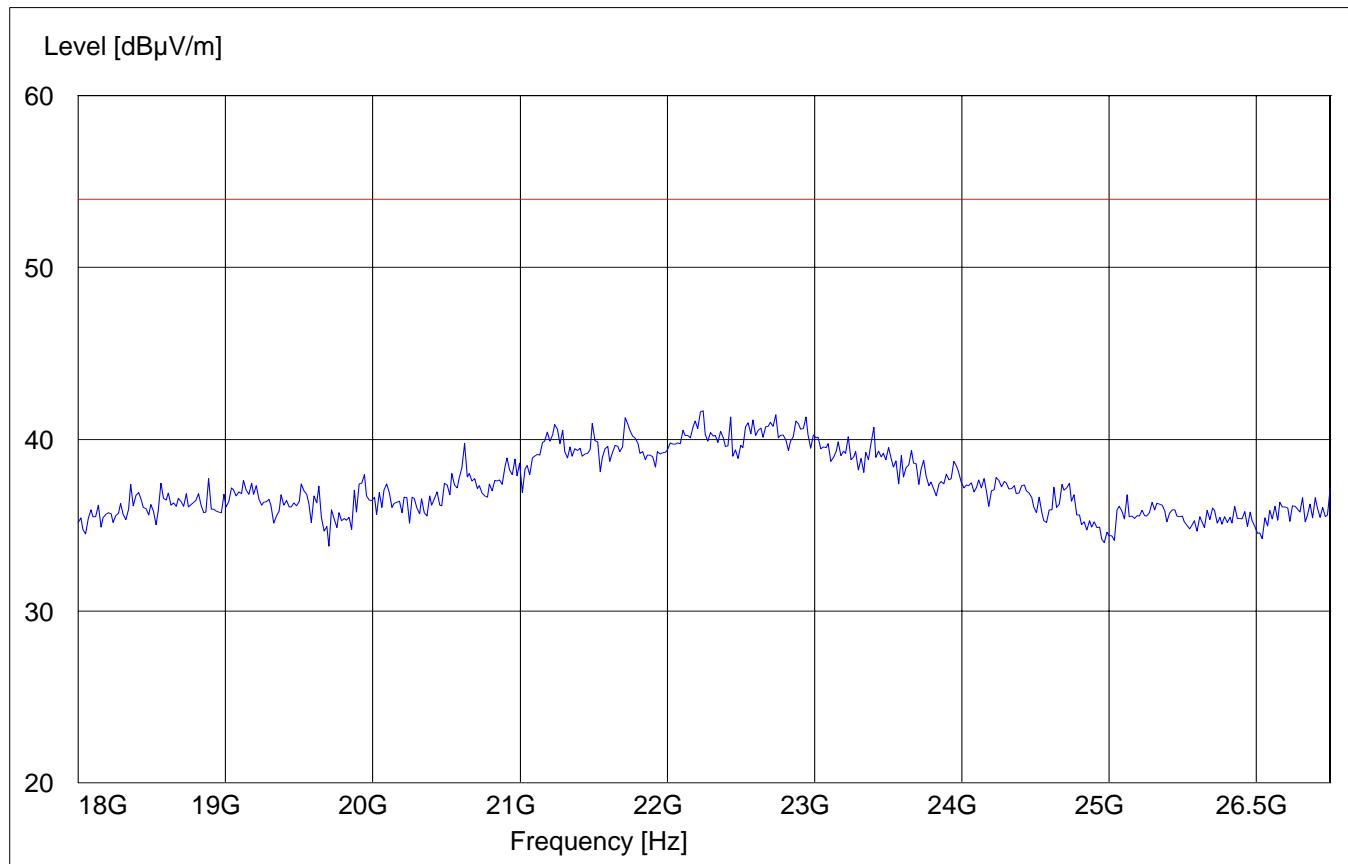
Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
3.0 GHz	18.0 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)



**RECEIVER SPURIOUS RADIATION
18GHz – 26.5GHz****§ 15.209**

SWEEP TABLE: "BT Spuri hi 18-26.5G"
Short Description: Bluetooth Spurious 18-26.5GHz

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
18.0 GHz	26.5 GHz	Time	Bandw.	VBW	
		MaxPeak	Coupled	1 MHz	#326 horn (dBi)

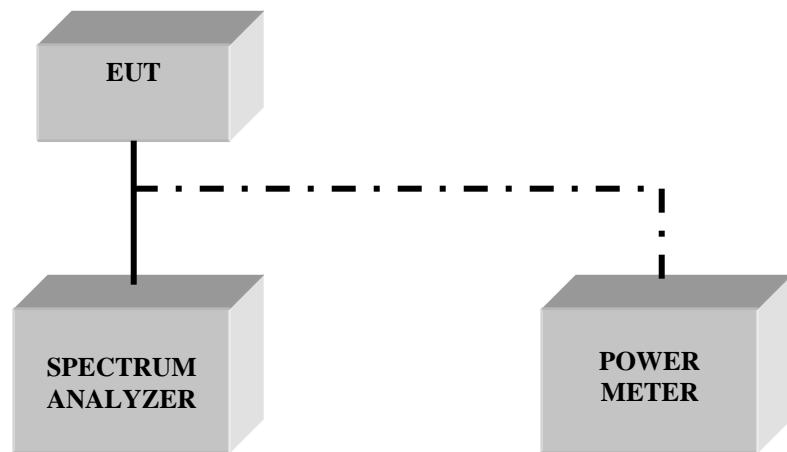


TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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	Biconilog Antenna	3141	EMCO	0005-1186
04	Horn Antenna (700M-18GHz)	SAS-200/571	AH Systems	325
05	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240
06	2-3GHz Band reject filter	BRM50701	Microtronics	6
07	Pre-Amplifier	TS-ANA	Rohde & Schwarz	--
08	Pre-Amplifier	JS4-00102600	Miteq	00616

BLOCK DIAGRAMS

Conducted Testing



Radiated Testing**ANECHOIC CHAMBER**