



FCC Test Report

Test report no.: EMC_856FCC15.247_2005_WLAN

FCC Part 15.247 for DSSS systems / CANADA RSS-210

Model: PCG-4E1L

FCC ID: AK8PCG4E1L

IC: 409B-PCG4E1L



TTI-P-G 081/94-A0

Accredited according to **ISO/IEC 17025**

Bluetooth™
Bluetooth Qualification
Test Facility
(BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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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 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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E-mail: lothar.schmidt@cetecomusa.com

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1.3 Details of applicant

Name	:	SONY CORPORATION
Street	:	6-7-35, Kitashinagawa, Shinagawa-Ku
City / Zip Code	:	Tokyo 141-0001
Country	:	Japan
Contact	:	Takumi Ozawa
Telephone	:	+81-3-5795-8716
Fax	:	+81-3-5795-8981
e-mail	:	ozawa@sm.sony.co.jp

1.4 Application details

Date of receipt test item	:	2005-02-22
Date of test	:	2005-02-22/23/24/25, 2005-03-03

1.5 Test item

Marketing Name	:	PCG-4E1L
Model No.	:	PCG-4E1L
Description	:	Laptop computer with GSM, WLAN & BT radios.
HW / SW version	:	FP1 / P1A41
FCC-ID	:	AK8PCG4E1L
IC ID	:	409B-PCG4E1L

Additional information

Test Sample ID	:	#23
Frequency	:	2412MHz – 2462MHz
Type of modulation	:	DSSS / OFDM (orthogonal frequency division multiplexing)
Number of channels	:	11
Power supply	:	via host Tablet PC
Output power	:	0.056W conducted peak power

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.

The EUT (model# PCG-4E1L) carries pre-certified WLAN mini PCI card with FCC ID: PD9WM3B2200BG

This test report covers full radiated testing as per FCC 15.247 on Laptop with WLAN. All conducted measurements are covered under test report# INTEL-031111F

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:

2005-03-18 **EMC & Radio** **Lothar Schmidt (Manager)**

**Date****Section****Name****Signature****Responsible for test report and project leader:**

2005-03-18 **EMC & Radio** **Harpreet Sidhu (EMC Engineer)**

**Date****Section****Name****Signature**

2.2 Test report

TEST REPORT

Test report no.: EMC_856FCC15.247_2005_WLAN

FCC Part 15.247 for DSSS systems / CANADA RSS-210

TEST REPORT REFERENCE

LIST OF MEASUREMENTS		PAGE
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NOTE: WLAN was tested for spurious emissions in both DSSS & OFDM modes at different data rates to ensure compliance in all modes of operation. Test report shows only worst-case test results of all data rates.

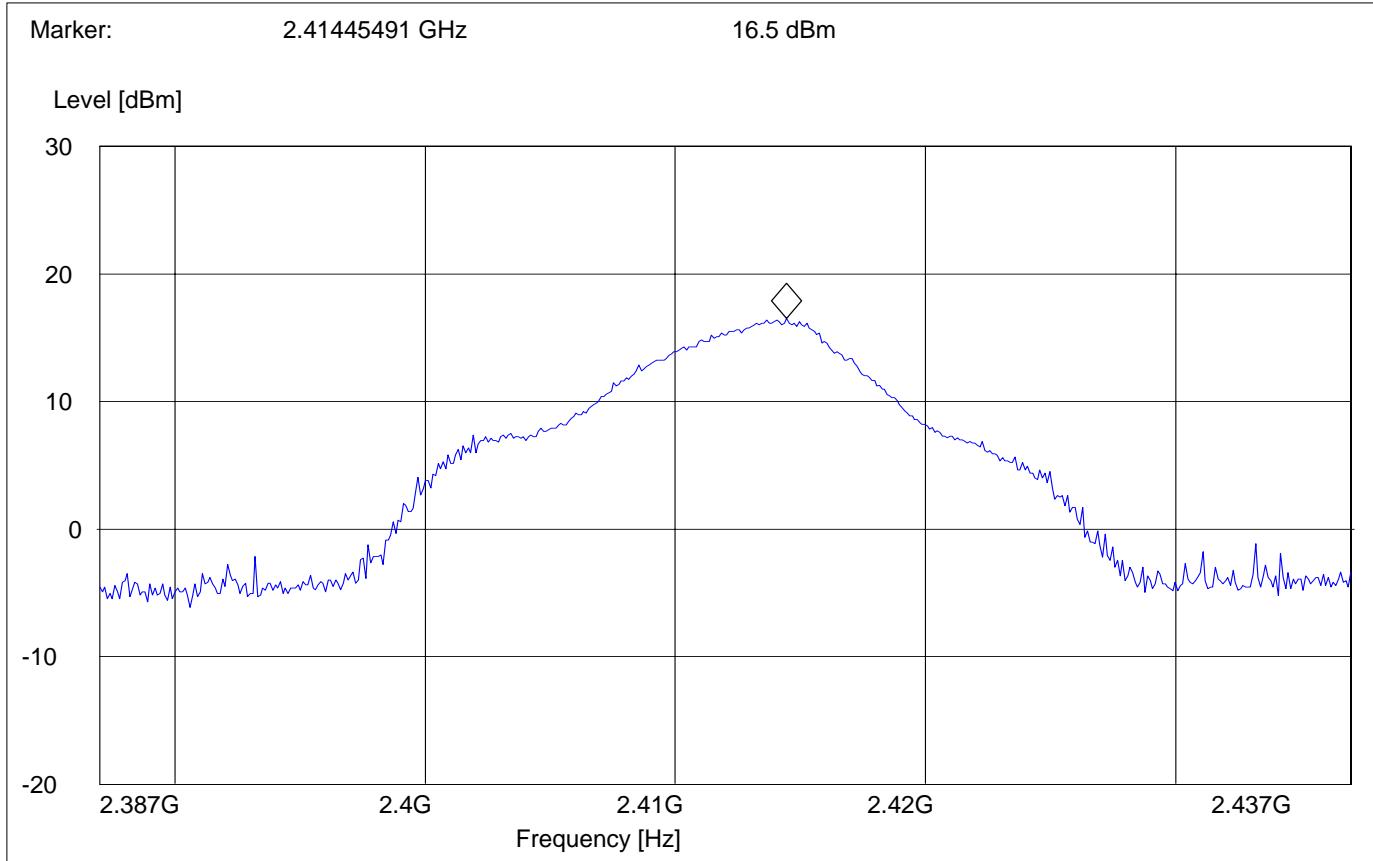
**MAXIMUM PEAK OUTPUT POWER
(RADIATED)****§ 15.247 (b) (1)****EIRP:**

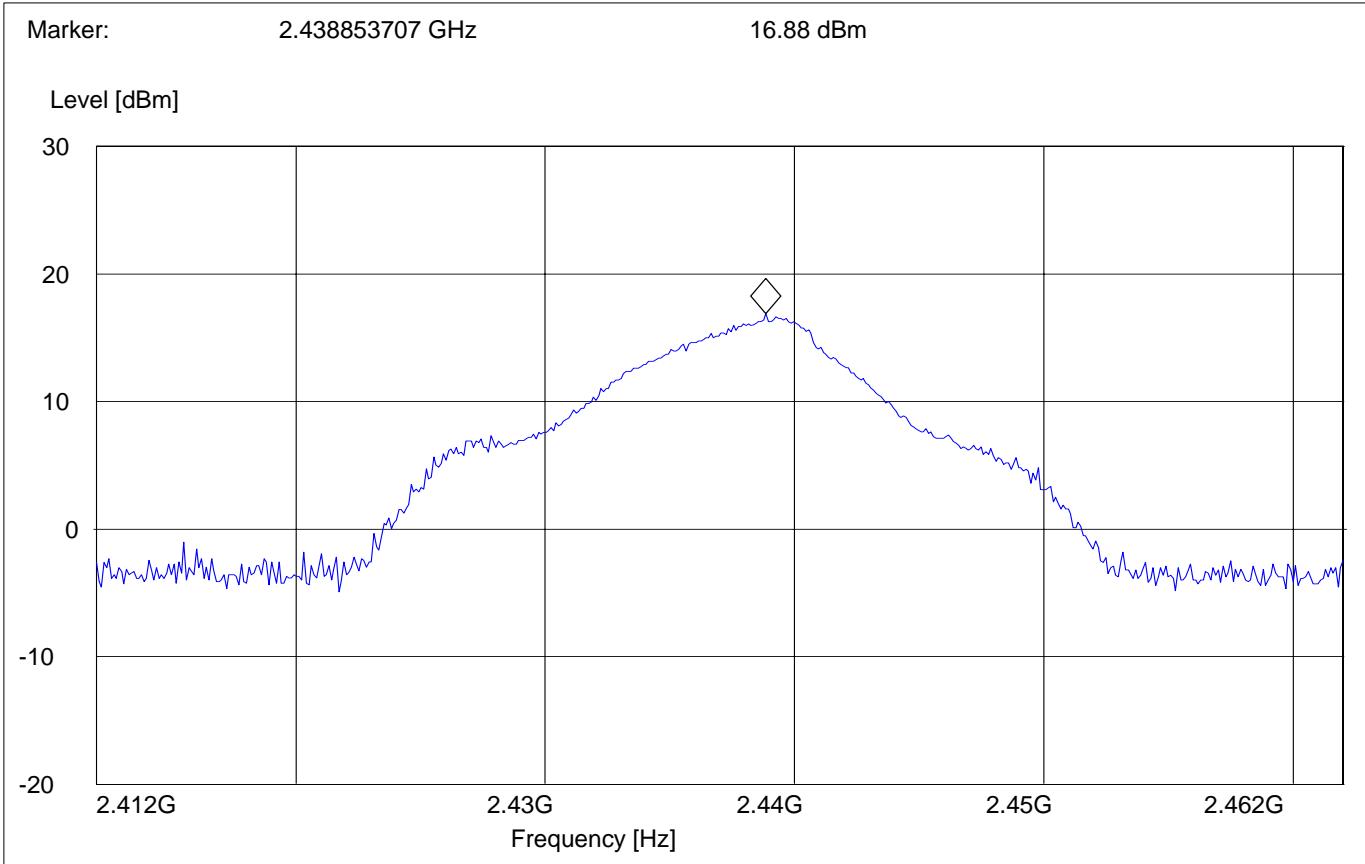
TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2412	2437	2462
T _{nom} (23)°C	V _{nom} VDC	16.5	16.88	16.31
Measurement uncertainty		±0.5dBm		

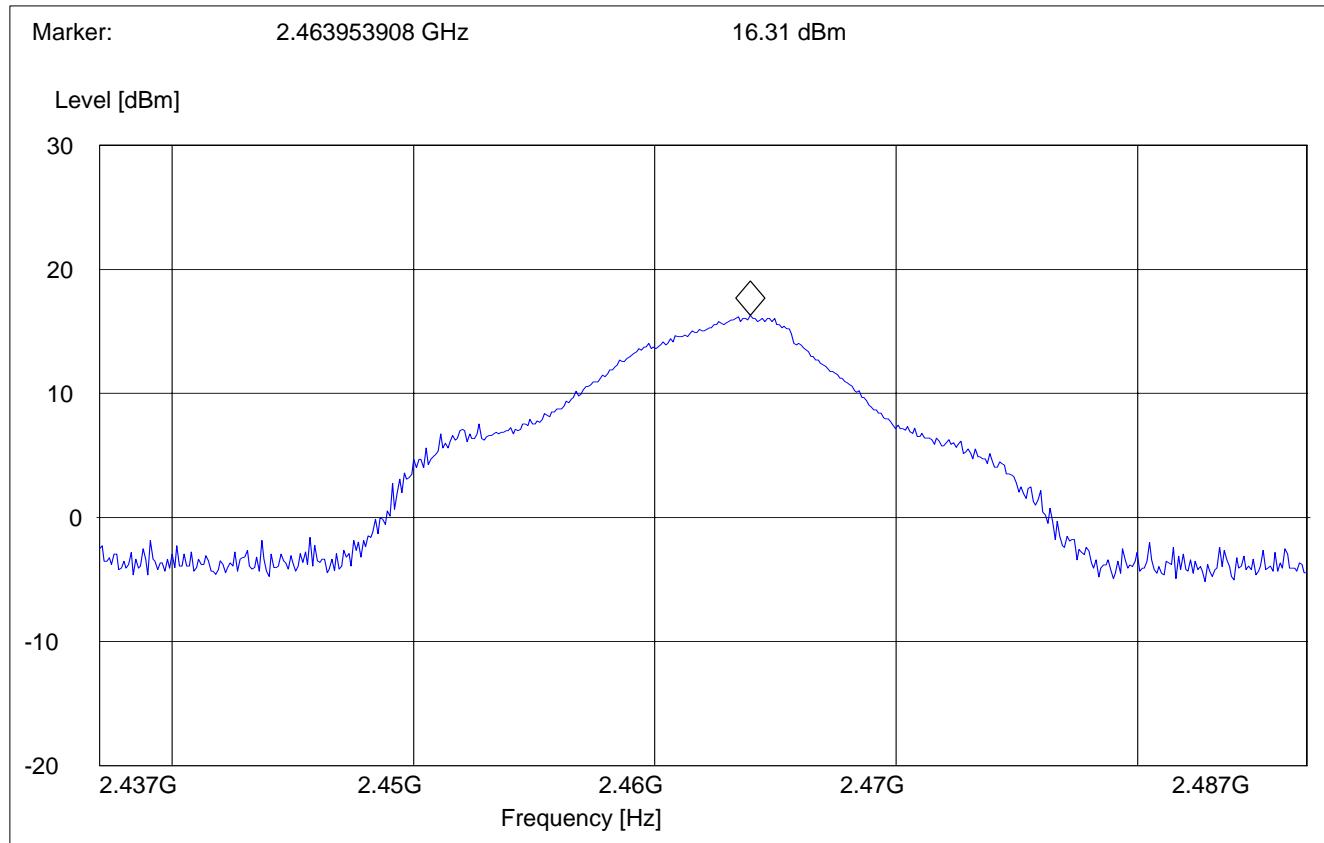
ANALYZER SETTINGS: RBW=VBW=10MHz

LIMIT**SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	30dBm on Conducted

**EIRP LOW CHANNEL
2412MHz**

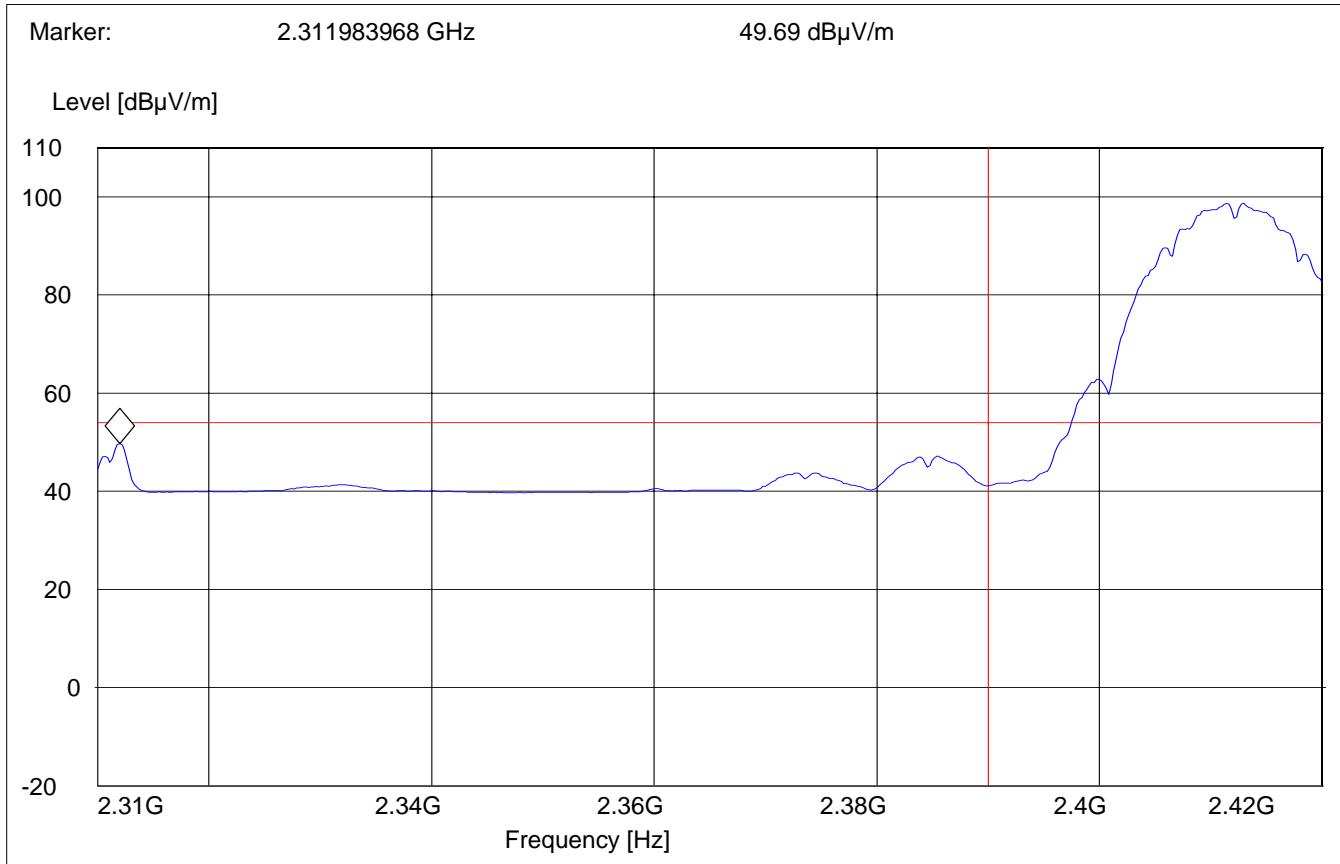
**EIRP MID CHANNEL
2437MHz**

**EIRP HIGH CHANNEL
2462MHz**

BAND EDGE COMPLIANCE**§15.247 (c)****Low frequency section (spurious in the restricted band 2310 – 2390 MHz)**

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

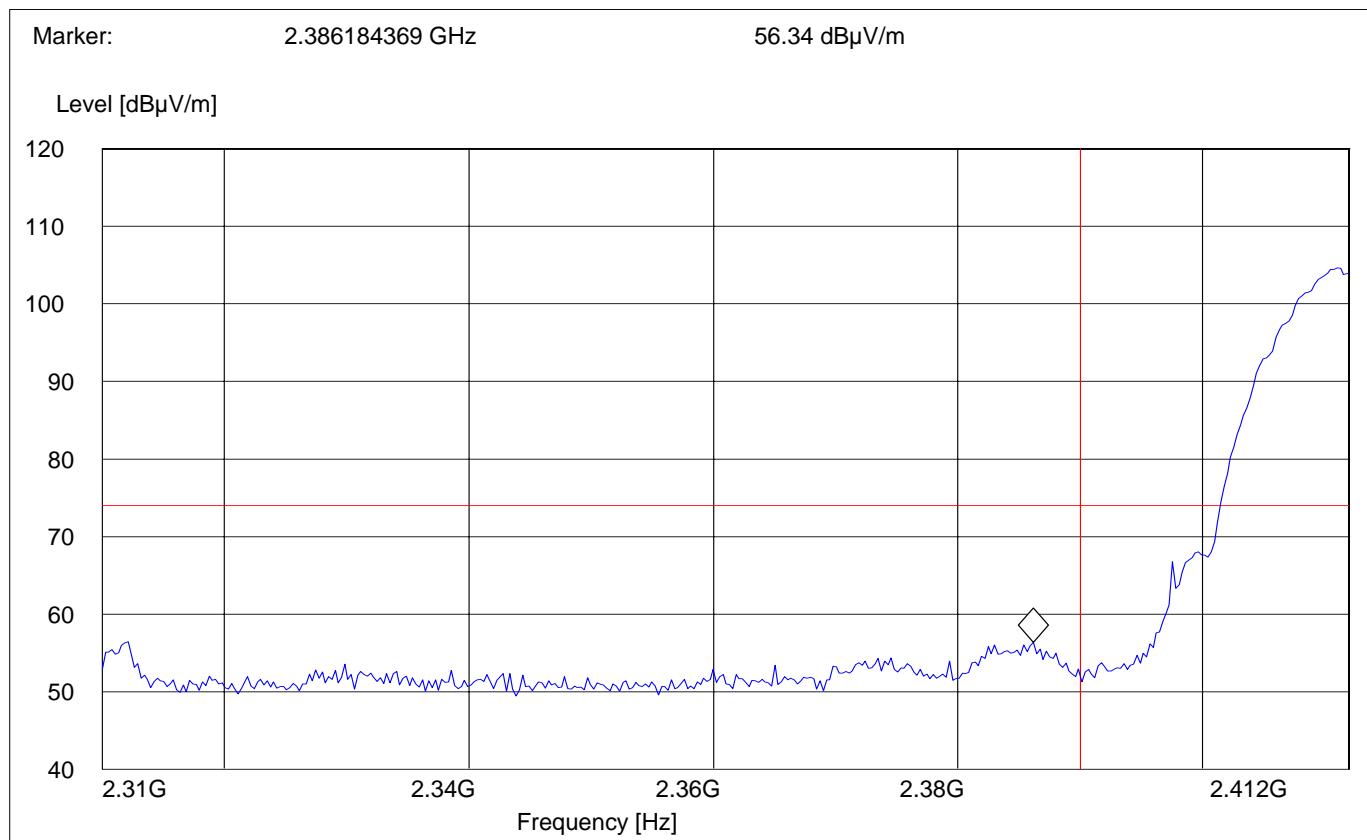
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****Low frequency section (spurious in the restricted band 2310 – 2390 MHz)**

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

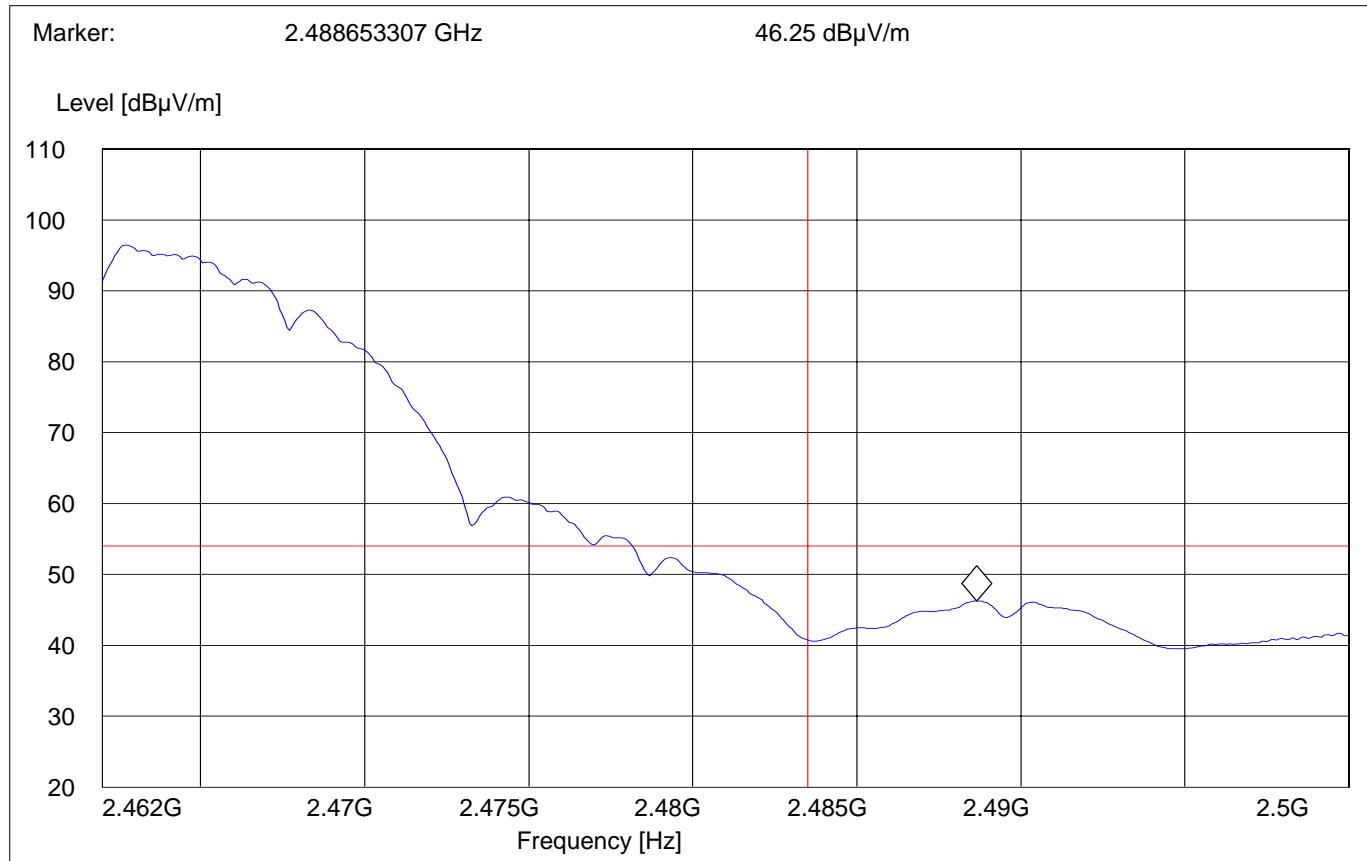
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)
(Average measurement @ 6Mbps)**

Operating condition : Tx at 2462MHz
SWEEP TABLE : "FCC15.247 HBE_AVG"
Limit Line : 54dB μ V

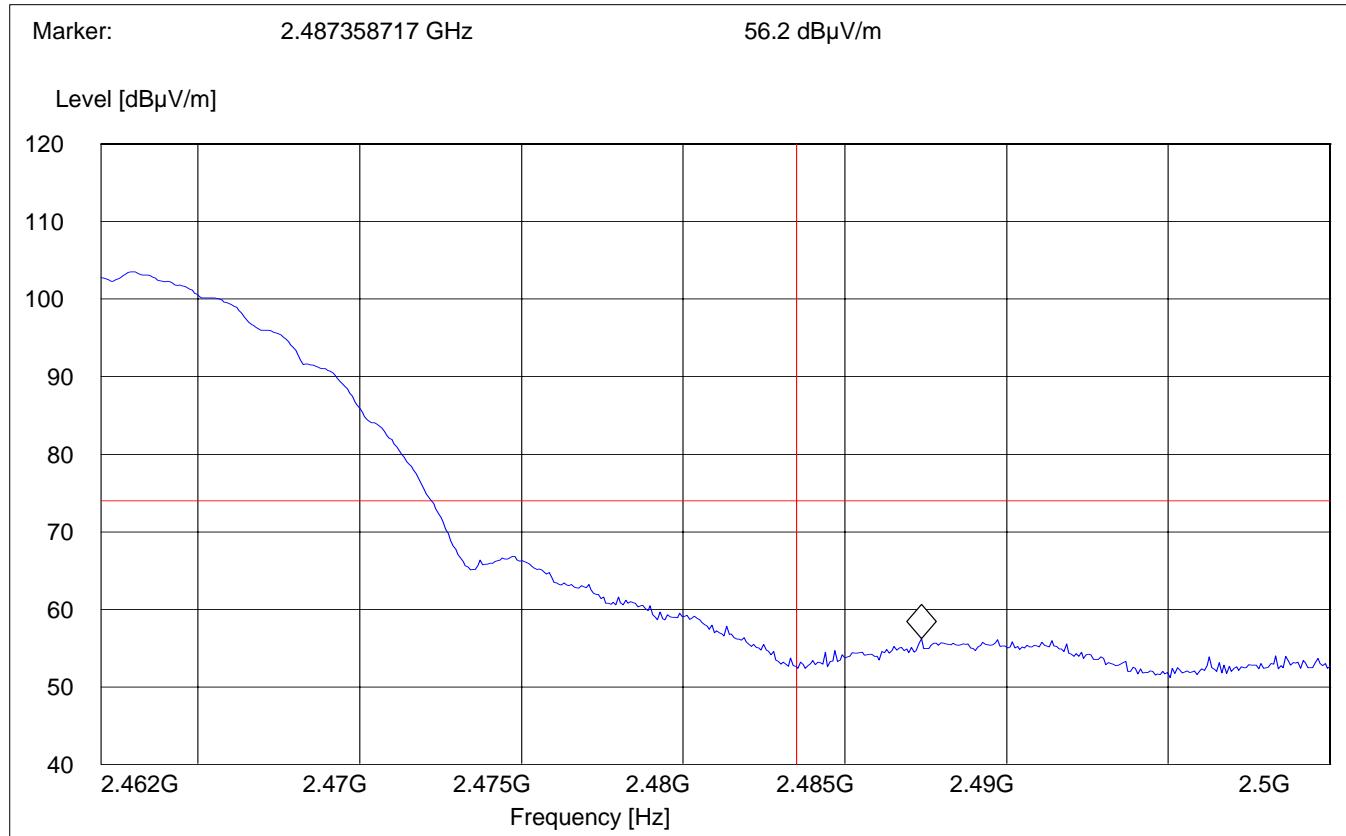
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
2.462 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



BAND EDGE COMPLIANCE**§15.247 (c)****High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)****(Peak measurement @ 54Mbps)**

Operating condition : Tx at 2462MHz
SWEEP TABLE : "FCC15.247 HBE_PK"
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 (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, 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 3 and 25 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.

Results for the radiated measurements below 30MHz according § 15.33

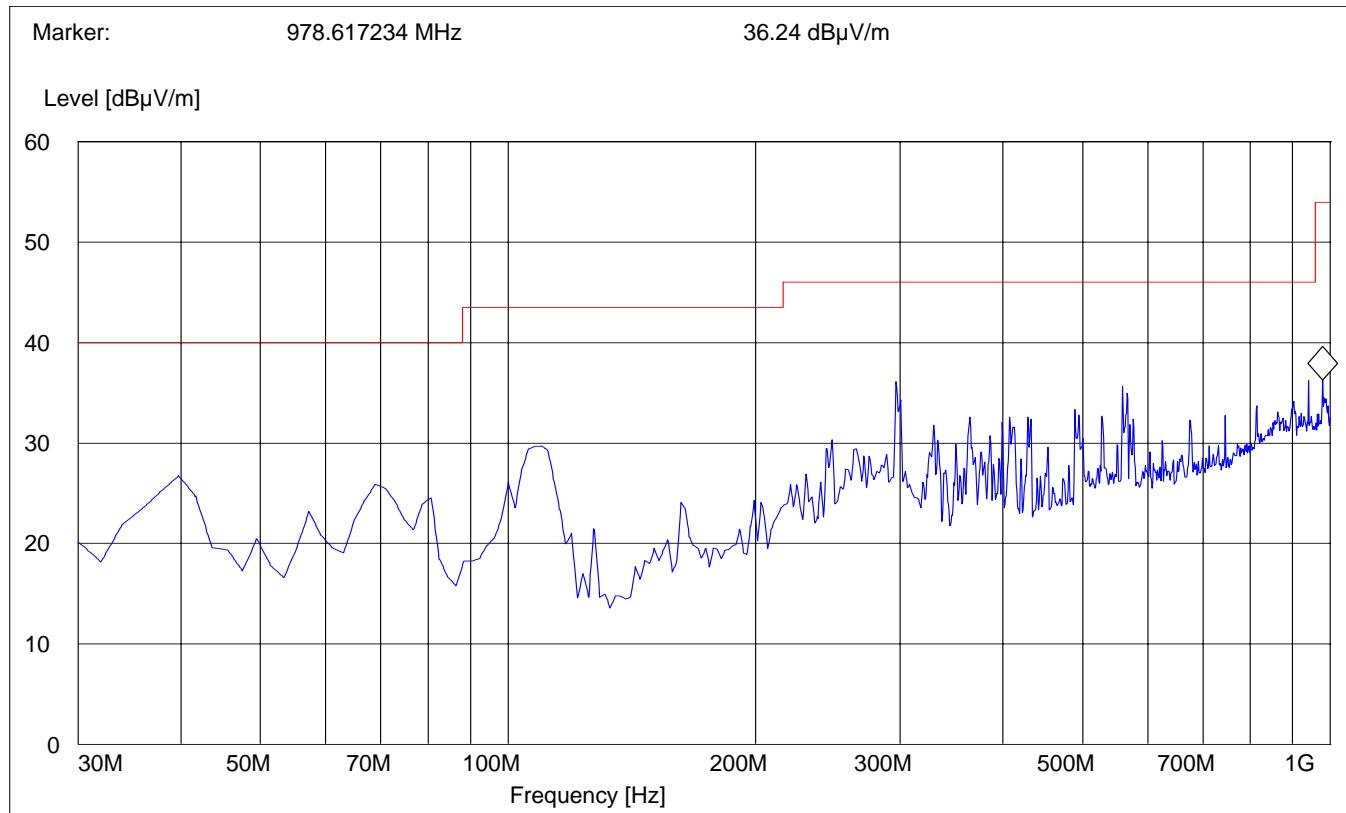
Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

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

Transmit at Lowest channel Frequency 2412MHz			
Frequency (MHz)	Level (dBμV/m)		
	Peak	Quasi-Peak	Average
See plots			
Transmit at Middle channel Frequency 2437MHz			
Frequency (MHz)	Level (dBμV/m)		
	Peak	Quasi-Peak	Average
See plots			
Transmit at Highest channel Frequency 2462MHz			
Frequency (MHz)	Level (dBμV/m)		
	Peak	Quasi-Peak	Average
See plots			

EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Lowest Channel (2412MHz): 30MHz – 1GHz****Antenna: vertical****Note: This plot is valid for low, mid, high channels (worst-case plot)**

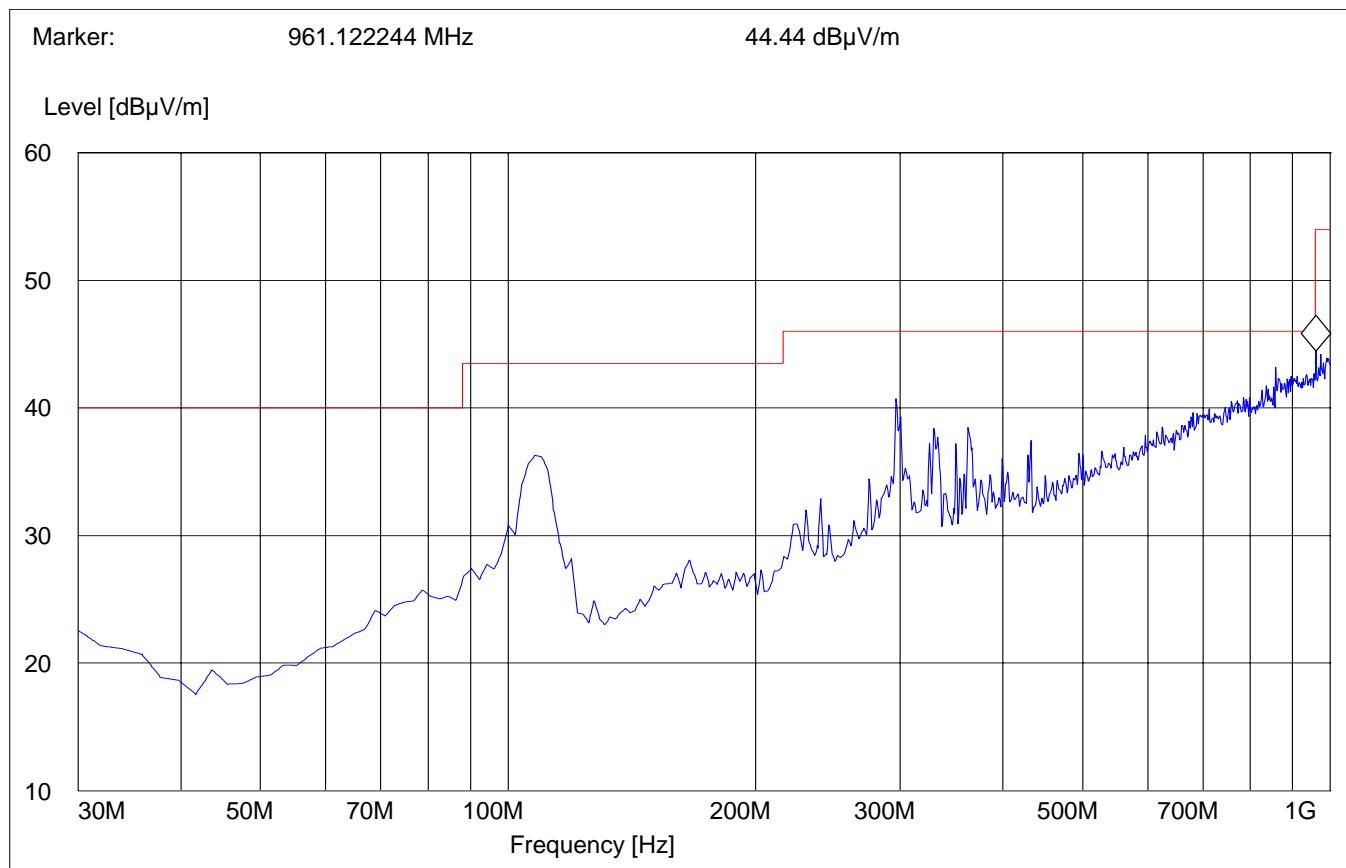
SWEEP TABLE: "BT Spuri hi 30-1G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time VBW
30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186



EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Lowest Channel (2412MHz): 30MHz – 1GHz****Antenna: horizontal****Note: This plot is valid for low, mid, high channels (worst-case plot)**

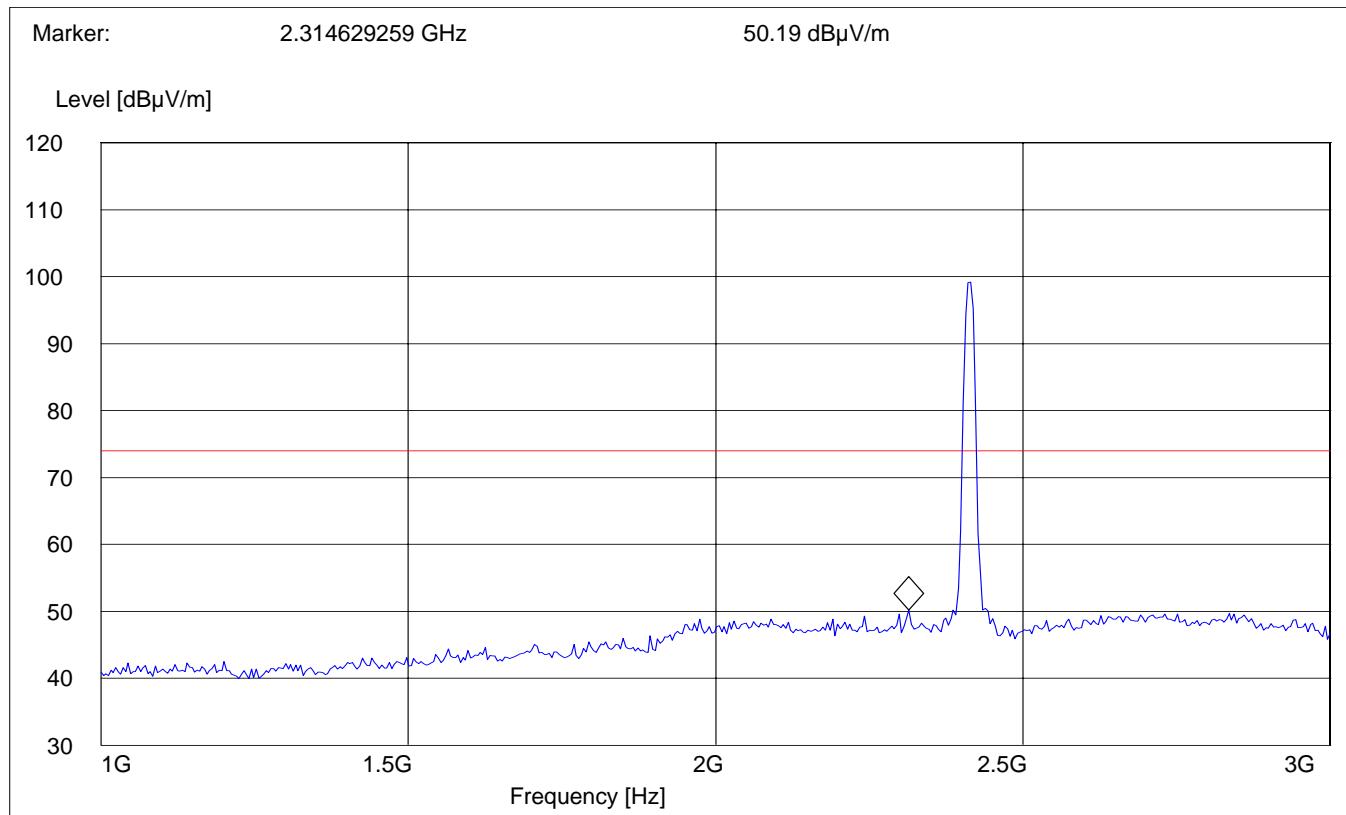
SWEEP TABLE: "BT Spuri hi 30-1G"

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



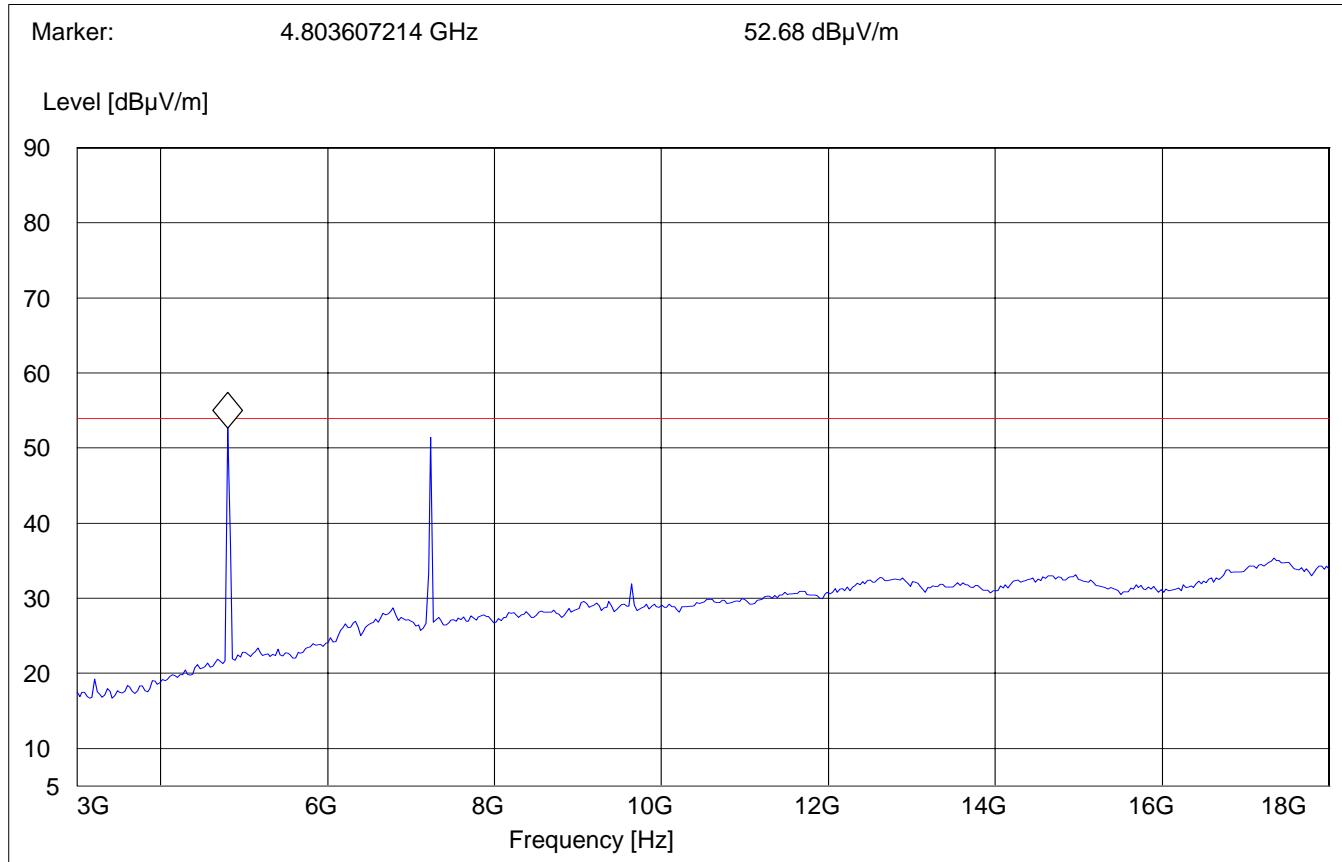
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Lowest Channel (2412MHz): 1GHz – 3GHz****Note: The peak above the limit line is the carrier freq.**

SWEEP TABLE:		"BT Spuri hi 1-3G"				
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



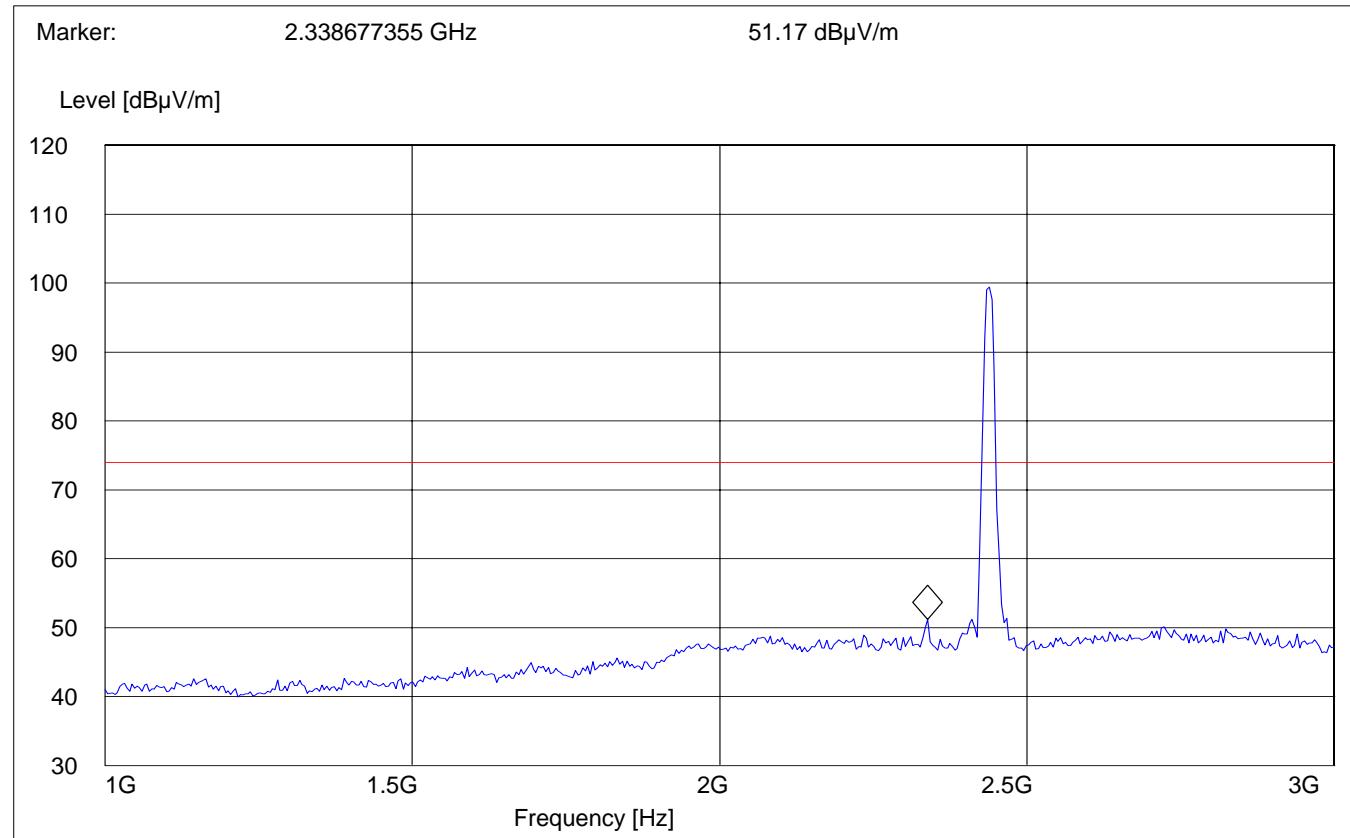
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Lowest Channel (2412MHz): 3GHz – 18GHz****Average measurement****SWEEP TABLE: "BT Spuri hi 3-18G"**

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



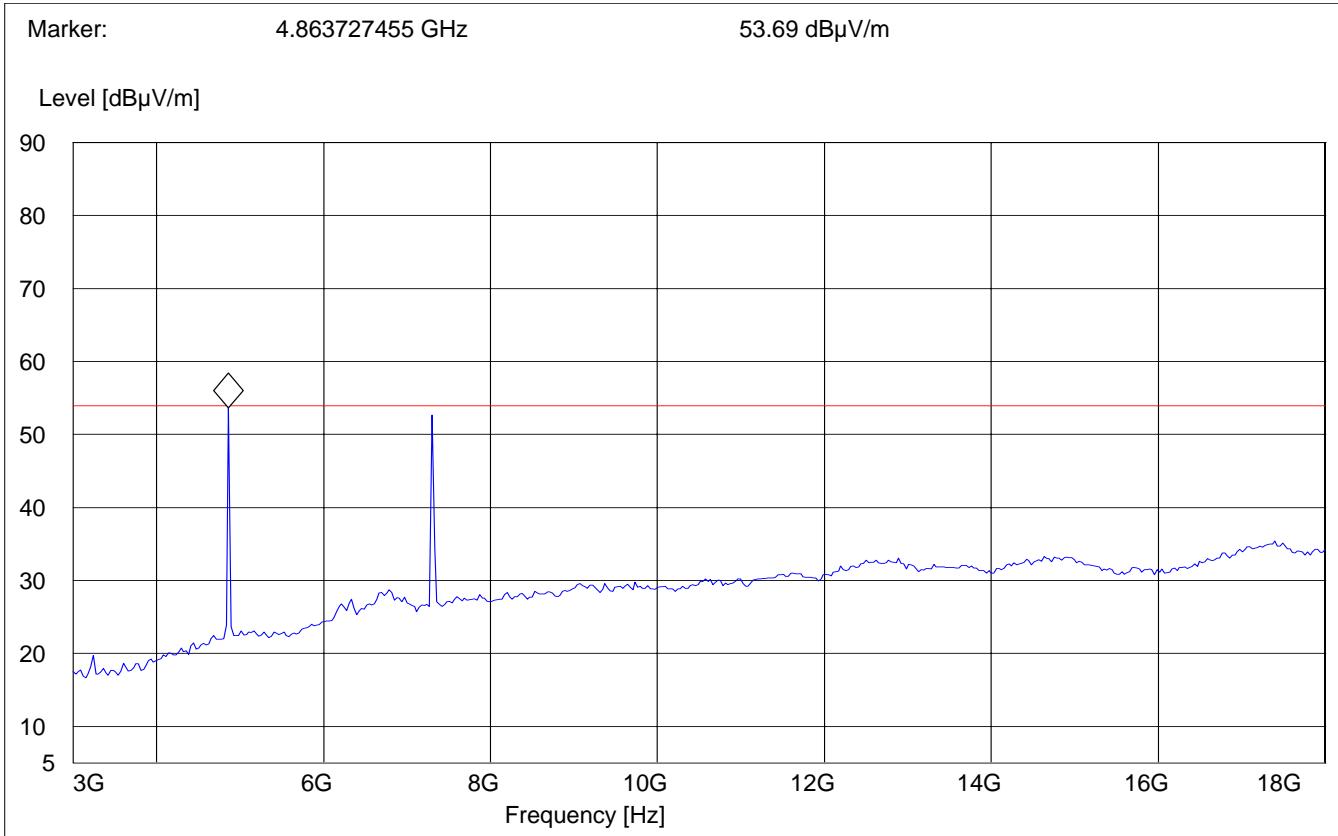
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Mid Channel (2437MHz): 1GHz – 3GHz****Note: The peak above the limit line is the carrier freq.****SWEEP TABLE: "BT Spuri hi 1-3G"**

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



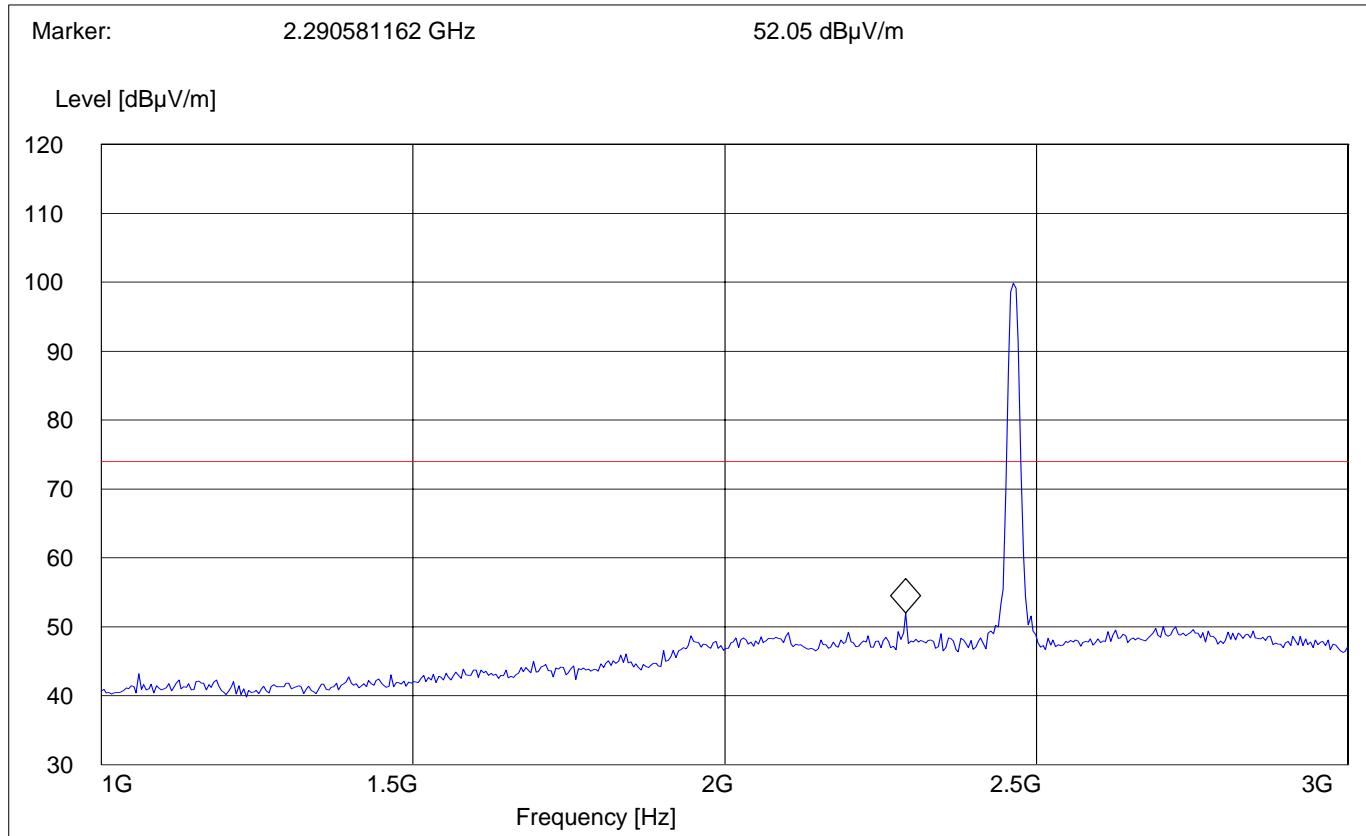
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Mid Channel (2437MHz): 3GHz – 18GHz****Average measurement****SWEEP TABLE: "BT Spuri hi 3-18G"**

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



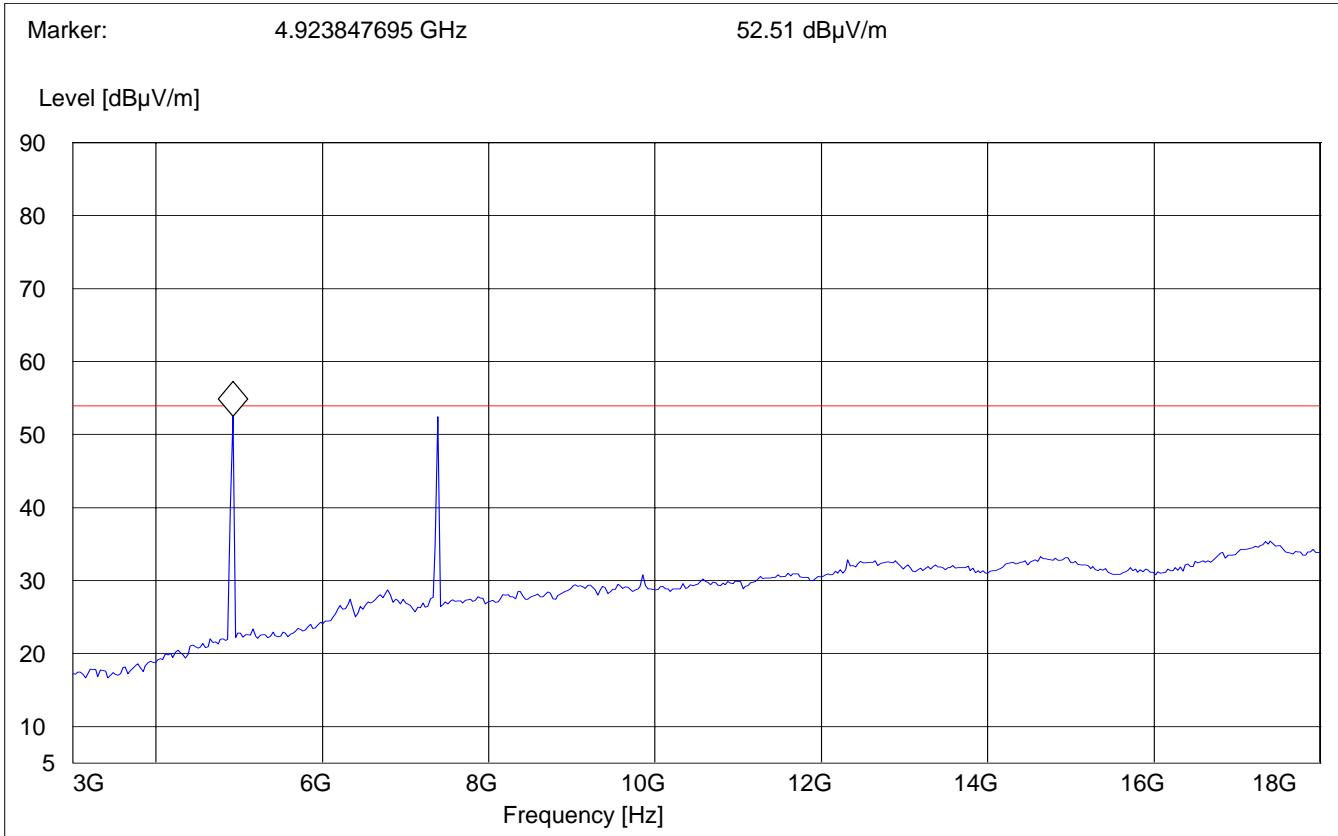
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Highest Channel (2462MHz): 1GHz – 3GHz****Note: The peak above the limit line is the carrier freq.****SWEEP TABLE: "BT Spuri hi 1-3G"**

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



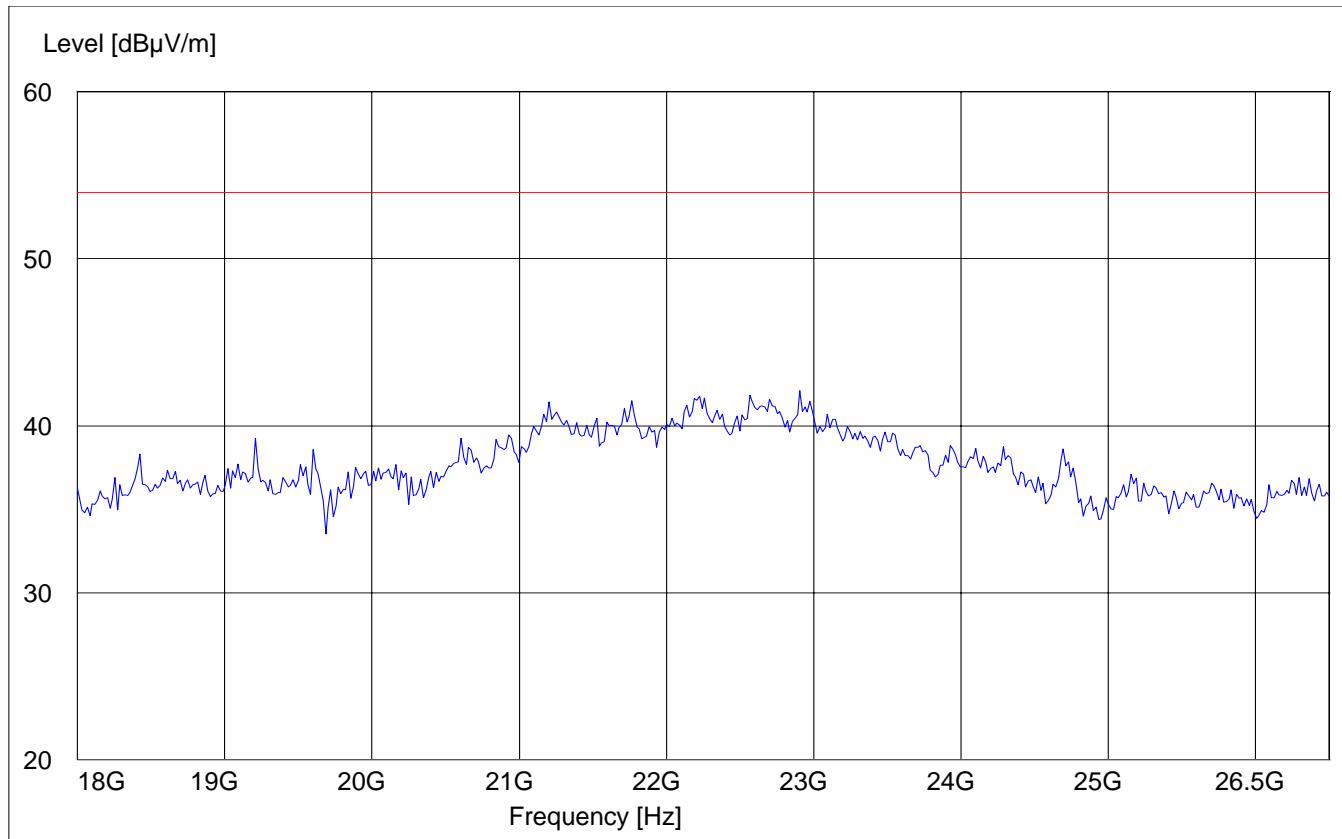
EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (c) (1)****Highest Channel (2462MHz): 3GHz – 18GHz****Average measurement****SWEEP TABLE: "BT Spuri hi 3-18G"**

Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
3.0 GHz	18.0 GHz	Time MaxPeak	Bandw. Coupled	1 MHz	1Hz	#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"**

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



CONDUCTED EMISSIONS**§ 15.107/207****Measured with AC/DC power adapter*****SWEEP TABLE: "55022 cond"***

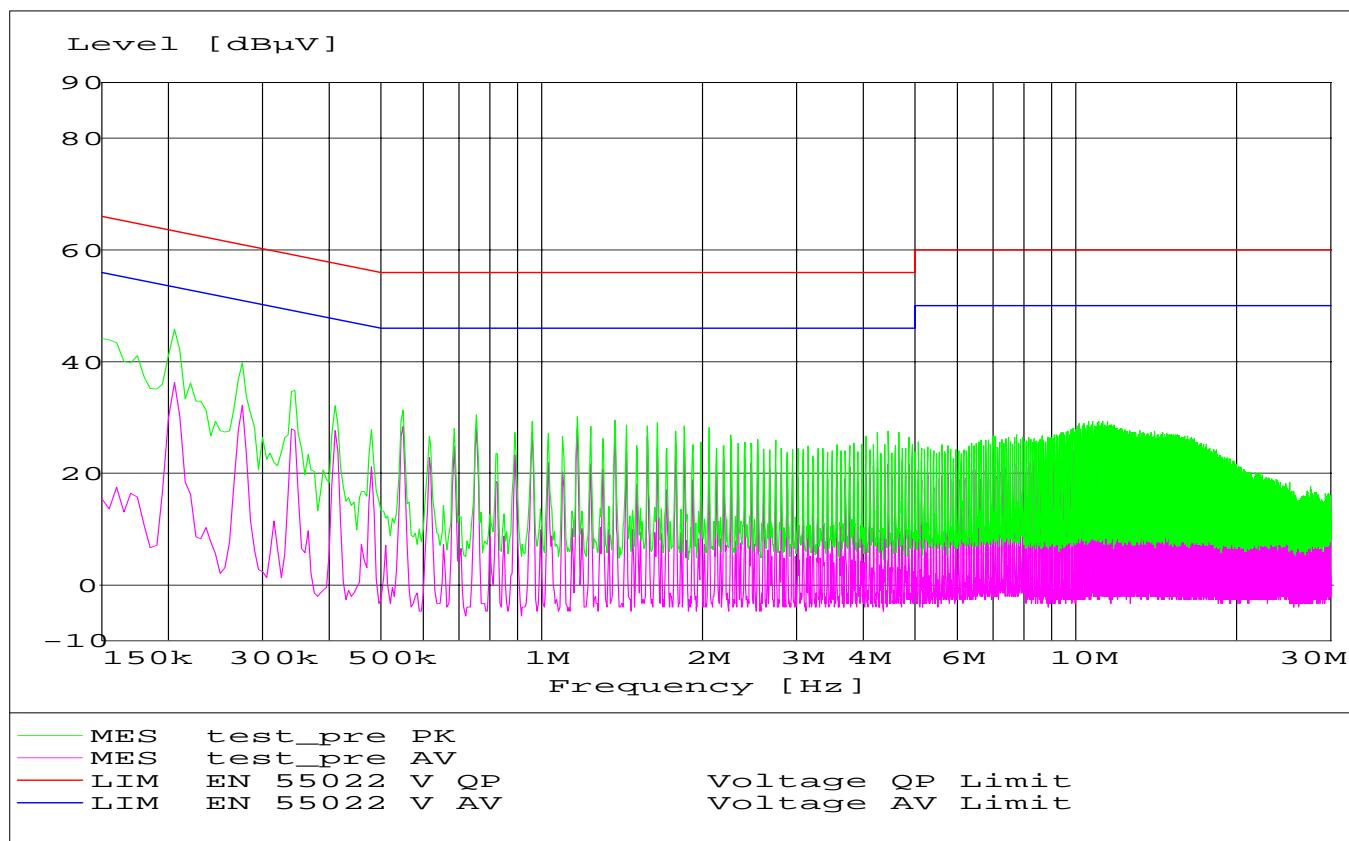
Short Description: EN 55022 for 150KHz-30MHz

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

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**

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

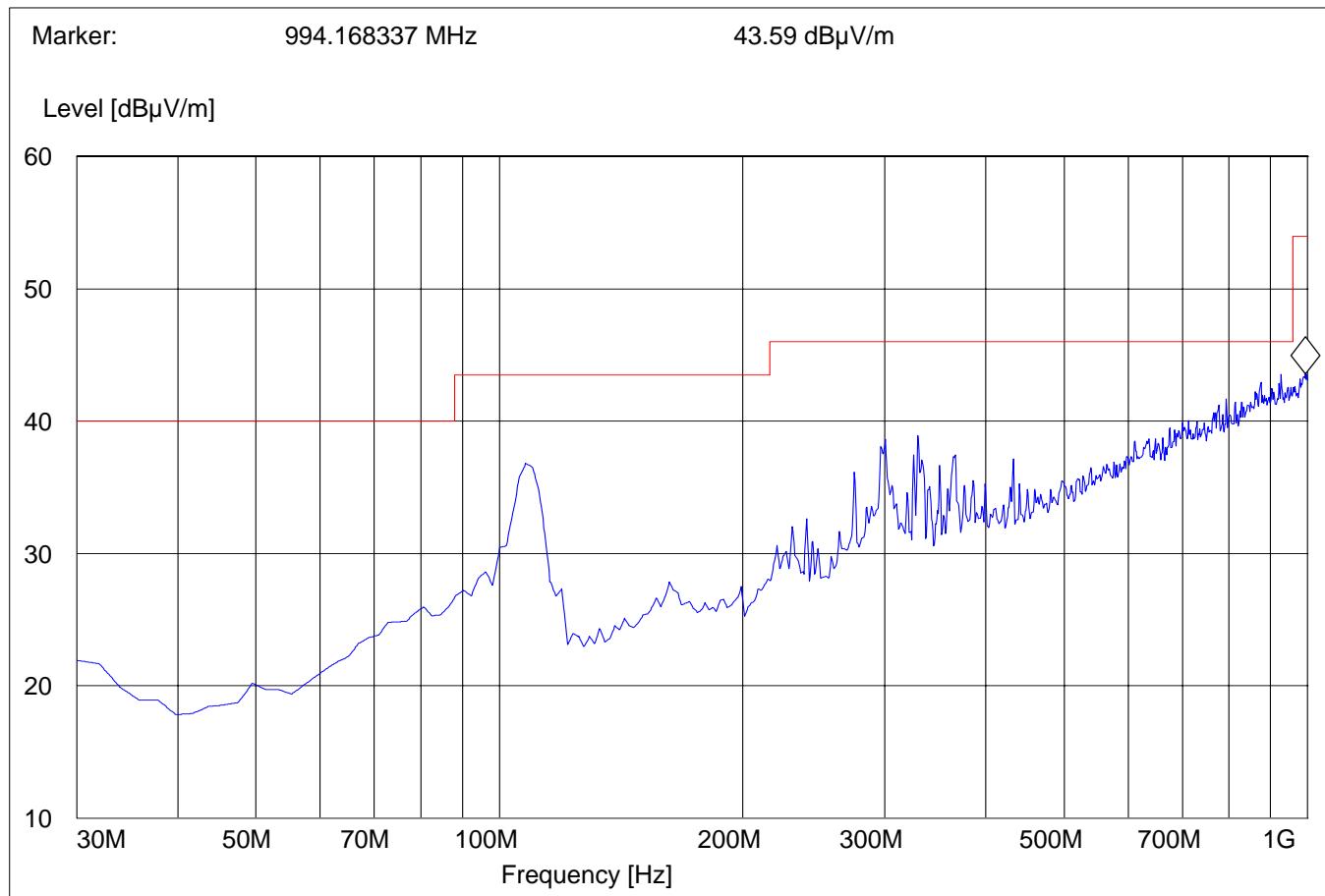
Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

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.

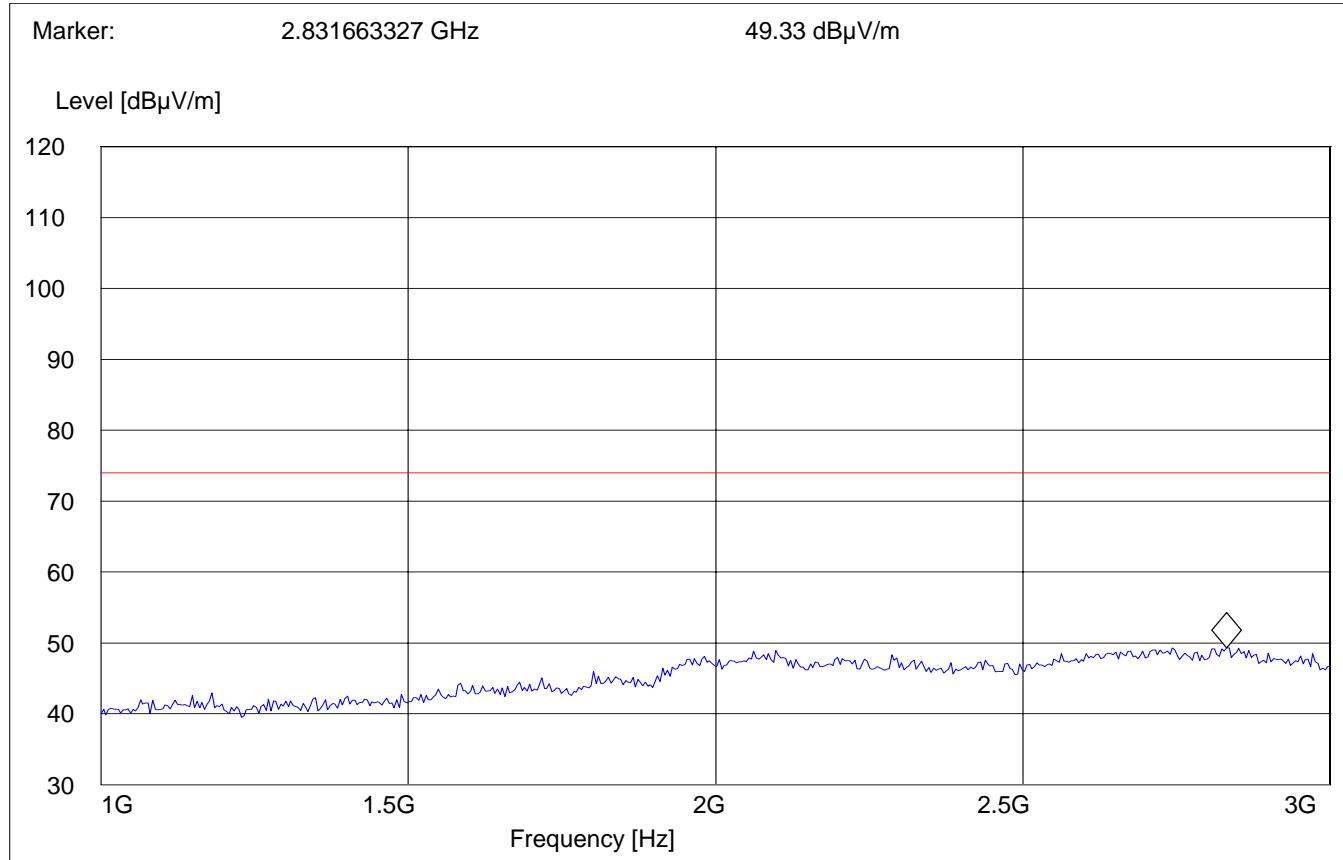
**RECEIVER SPURIOUS RADIATION
30MHz – 1GHz****§ 15.209**

SWEEP TABLE: " Spuri hi 30-1G"
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
1GHz – 3GHz****§ 15.209**

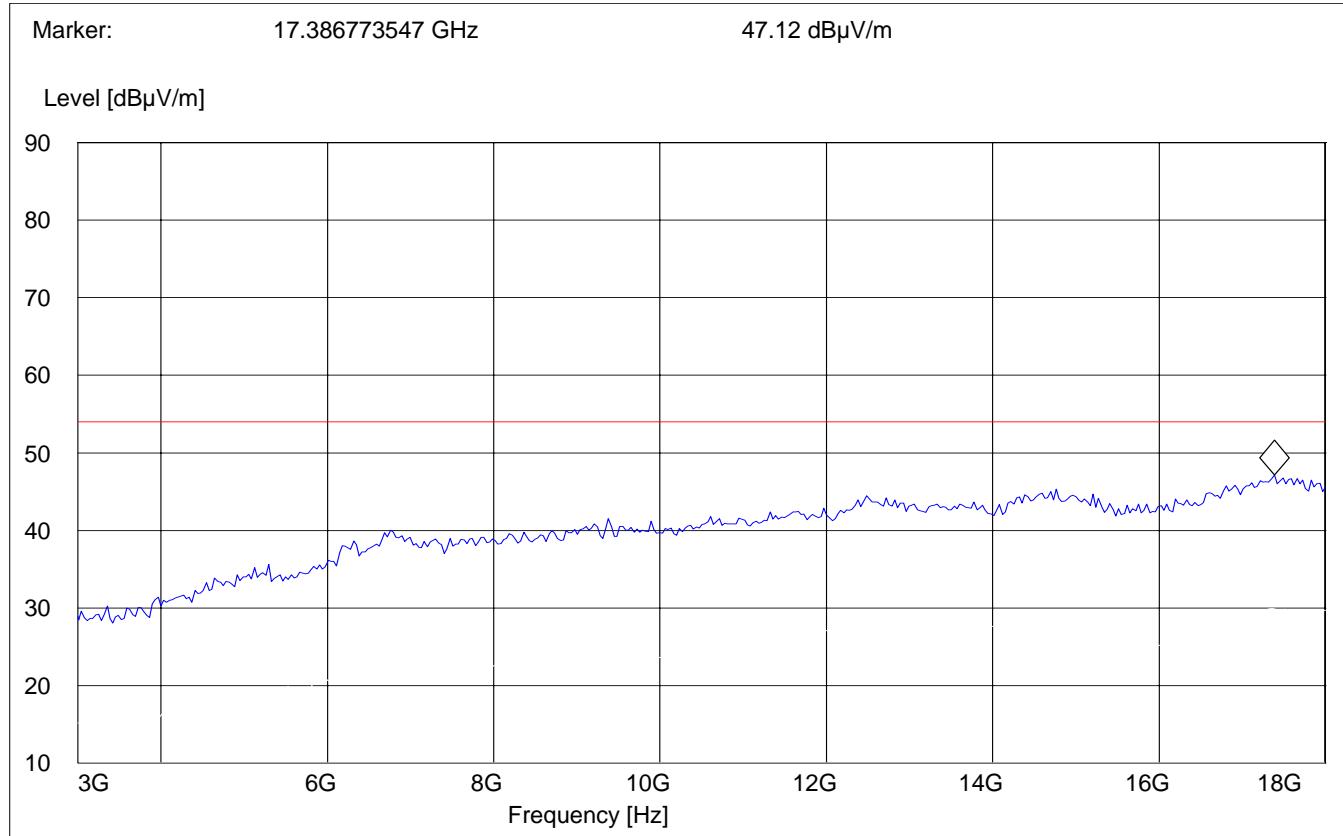
SWEEP TABLE:		"Spuri hi 1-3G"				
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



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

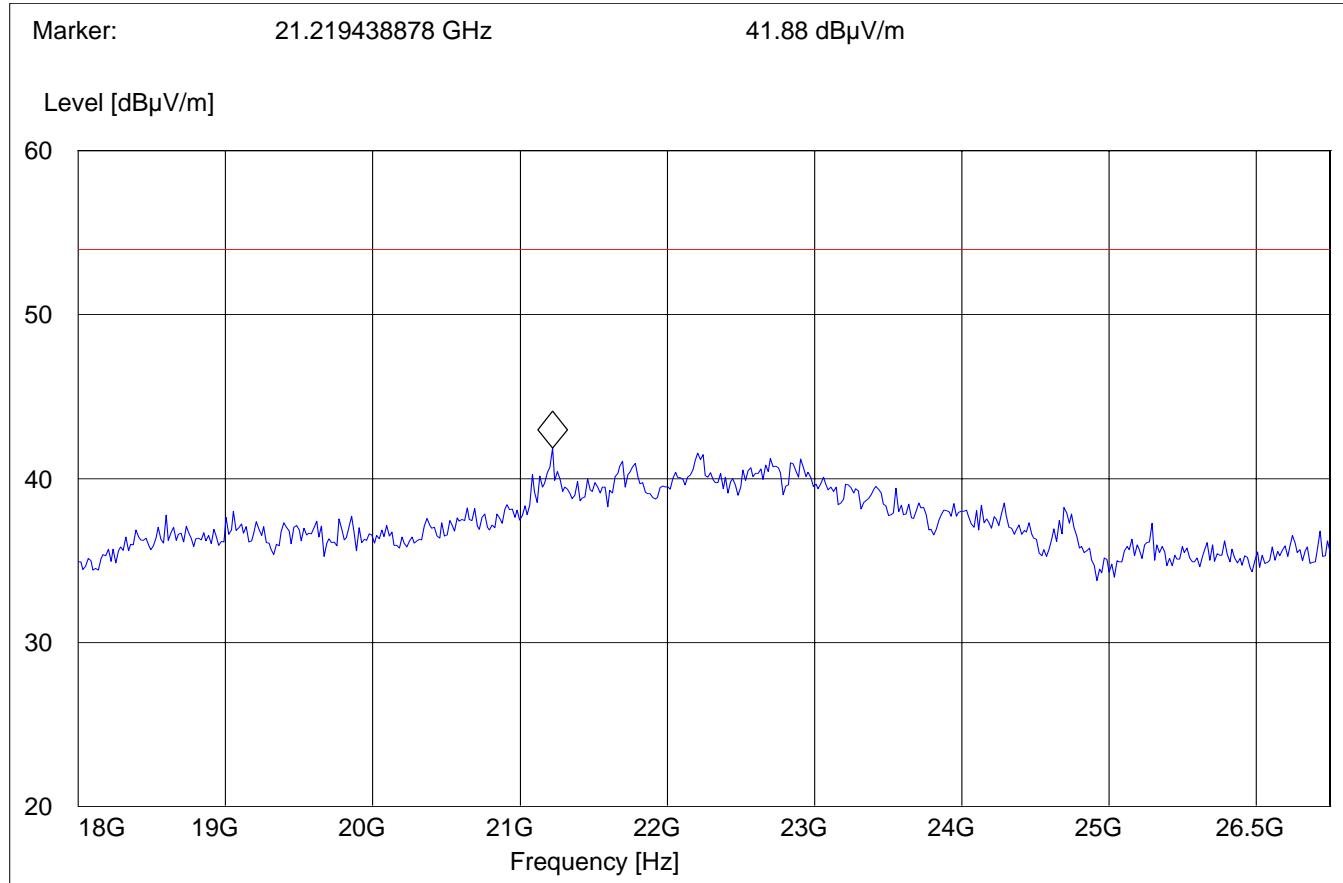
SWEEP TABLE: "Spuri hi 3-18G"

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



**RECEIVER SPURIOUS RADIATION
18GHz – 26.5GHz****§ 15.209****SWEEP TABLE: "Spuri hi 18-26.5G"**

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
18 GHz	26.5 GHz	Time	Bandw.	VBW	
		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	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	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
08	Pre-Amplifier	TS-ANA	Rohde & Schwarz	--
09	Pre-Amplifier	JS4-00102600	Miteq	00616

BLOCK DIAGRAMS**Radiated Testing****ANECHOIC CHAMBER**