



# FCC Test Report

Test report no.: EMC\_694FCC15.247\_2004

FCC Part 15.247 for DSSS systems / CANADA RSS-210

EUT: WLAN                      Model: BCM94306MPSG

HOST: e-machines Laptop        Model: M2105

FCC ID: QDS-BRCM1005-E



**TTI-P-G 081/94-A0**

Accredited according to **ISO/IEC 17025**



**Bluetooth Qualification  
Test Facility  
(BQTF)**

**CTIA Authorized Test Lab**

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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<b>1</b>	<b>General information</b>
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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****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](mailto:lothar.schmidt@cetecomusa.com)****Internet: [www.cetecom.com](http://www.cetecom.com)**

**1.3 Details of applicant**

**Name** : **Broadcom corporation**  
**Street** : **190 Mathilda Place**  
**City / Zip Code** : **Sunnyvale, CA 94086**  
**Country** : **USA**  
**Contact** : **Daniel Lawless**  
**Telephone** : **408-922-5870**  
**Tele-fax** : **408-543-3399**  
**e-mail** : [dlawless@broadcom.com](mailto:dlawless@broadcom.com)

**1.4 Application details**

Date of receipt test item : 2004-07-27  
Date of test : 2004-07-27

**1.5 Test item**

Manufacturer : Applicant  
Model No. (EUT) : BCM94306MPSG  
Model No. (Host) : M2105 (eMachines Laptop)  
Description : 54g wireless LAN mini PCI card in Laptop PC  
FCC ID : QDS-BRCM1005-E

**Additional information**

Frequency : 2412MHz – 2462MHz  
Type of modulation : DSSS / OFDM (orthogonal frequency division multiplexing)  
Number of channels : 11  
Antenna : 2.02dBi max. gain antenna  
Power supply : 3.3 VDC from Host  
Output power : 25.83dBm (382.82mW) conducted peak power  
Extreme temp. Tolerance : 0°C to +70°C

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

**PROJECT OVERVIEW:**

This test report carries all radiated measurements required as per FCC 15.247 on WLAN mini PCI card model# BCM94306MPSG in e-Machines Laptop Model# M2105.

All measurements are done with 2.02dBi max. gain antenna. The antenna location is at the right hand side middle of the display. The antenna gain is lower than gain of antenna that was tested for the modular approval.

WLAN was tested for spurious emissions in both DSSS & OFDM modes at different data rates (1, 2, 5.5, 6, 11, and 54) to ensure compliance of the whole device. Test report shows only worst-case test results of all data rates.

For all conducted measurements please refer to test report# *EMC\_380FCC15.247\_2003\_Si-Ge*  
Conducted out put power was measured and found same as mentioned under test report# *EMC\_380FCC15.247\_2003\_Si-Ge*.


Customer ensured each measured channel is tuned to 15dBm average packet power that corresponds to conducted output power measured in above mentioned test report.

**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”)	<b>Passed</b>

**Technical responsibility for area of testing:**

<b>2004-08-13</b>	<b>EMC &amp; Radio</b>	<b>Lothar Schmidt (Manager)</b>	
<b>Date</b>	<b>Section</b>	<b>Name</b>	<b>Signature</b>

**Responsible for test report and project leader:**

<b>2004-08-13</b>	<b>EMC &amp; Radio</b>	<b>Harpreet Sidhu (EMC Engineer)</b>	
<b>Date</b>	<b>Section</b>	<b>Name</b>	<b>Signature</b>

**2.2 Test report**

**TEST REPORT**

**Test report no.: EMC\_694FCC15.247\_2004**

**TEST REPORT REFERENCE**

<b>LIST OF MEASUREMENTS</b>		<b>PAGE</b>
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**MAXIMUM PEAK OUTPUT POWER  
(Conducted)**

§ 15.247 (b) (1)

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)		2412	2437	2462	
T <sub>nom</sub> (23)°C	V <sub>nom</sub> (3.3) VDC	Pk	25.62	25.83	25.09
Measurement uncertainty		±0.5dBm			

**LIMIT**

SUBCLAUSE § 15.247 (b) (1)

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



**MAXIMUM PEAK OUTPUT POWER  
(RADIATED)**

**§ 15.247 (b) (1)**

**EIRP:**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
		2412	2437	2462
<b>T<sub>nom</sub>(23)°C</b>	<b>V<sub>nom</sub>(3.3) VDC</b>	<b>*27.64</b>	<b>*27.85</b>	<b>*27.11</b>
<b>Measurement uncertainty</b>		<b>±0.5dBm</b>		

**\*Note: EIRP is calculated based on 2.02dBi antenna and conducted peak power measurements.**

**LIMIT**

**SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
<b>2400-2483.5 MHz</b>	<b>30dBm on Conducted</b>

**BAND EDGE COMPLIANCE**

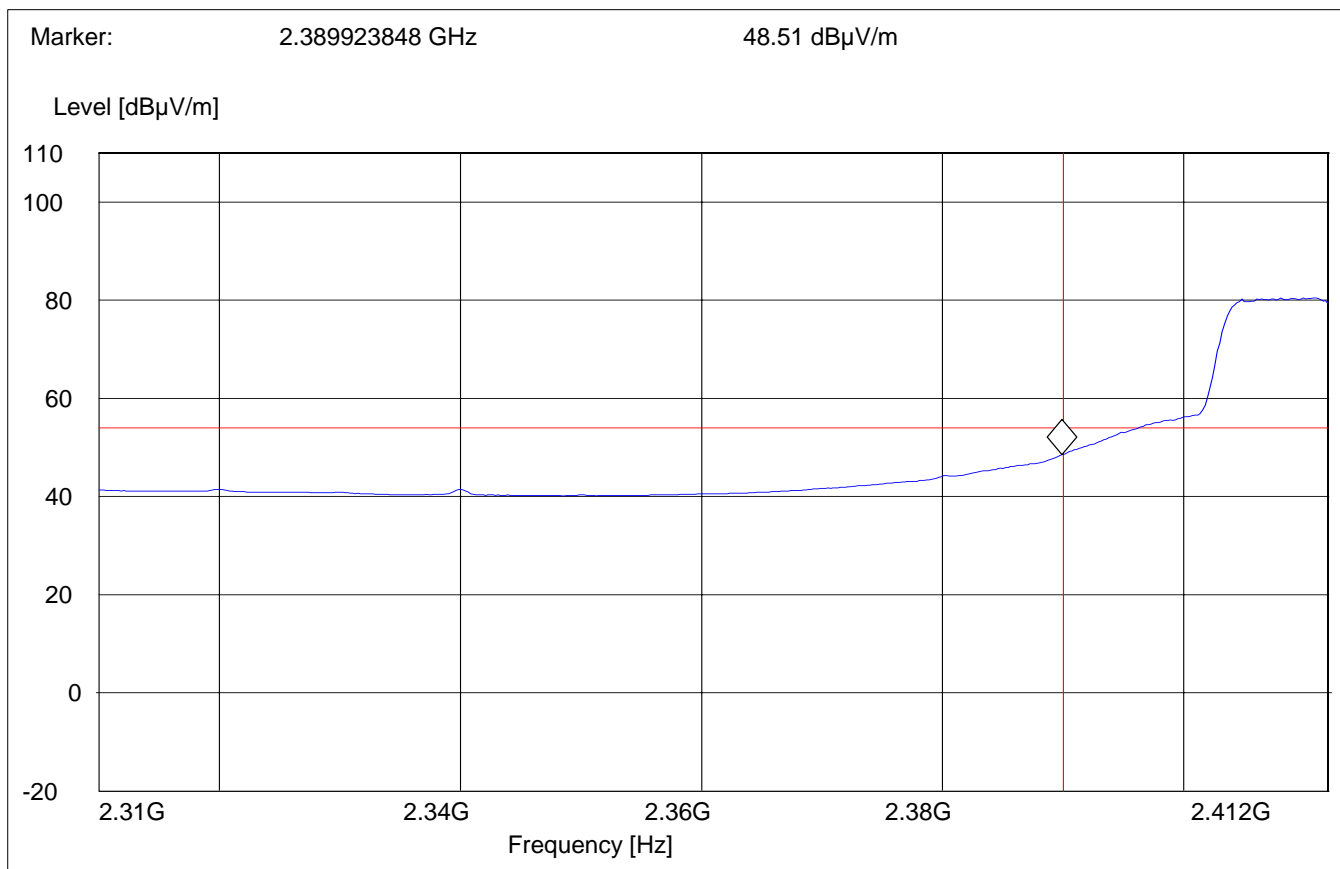
§15.247 (c)

**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**

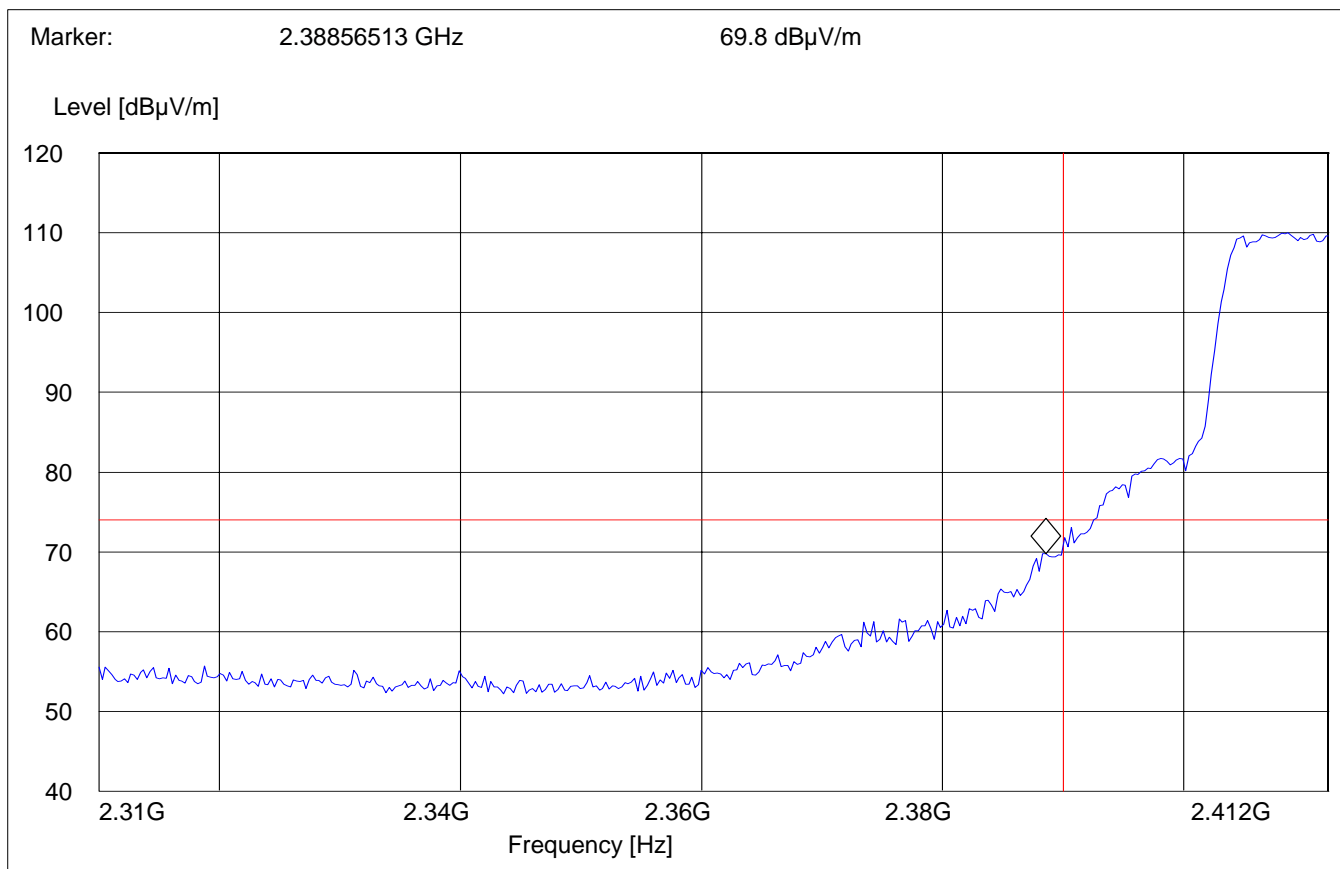
**§15.247 (c)**

**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**

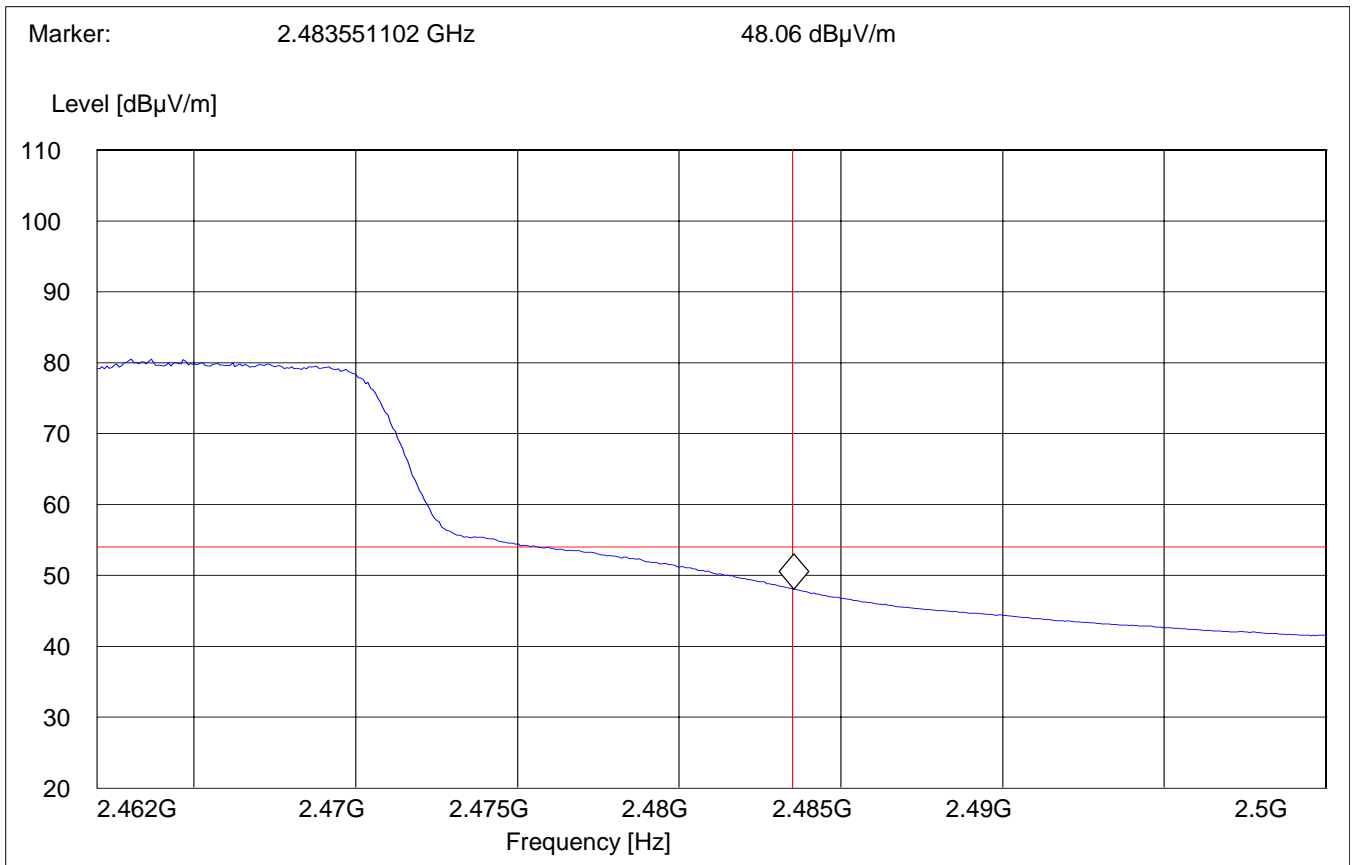
**§15.247 (c)**

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

**(Average measurement)**

Operating condition : Tx at 2462MHz  
 SWEEP TABLE : "FCC15.247 HBE\_AVG"  
 Limit Line : 54dBμV

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)



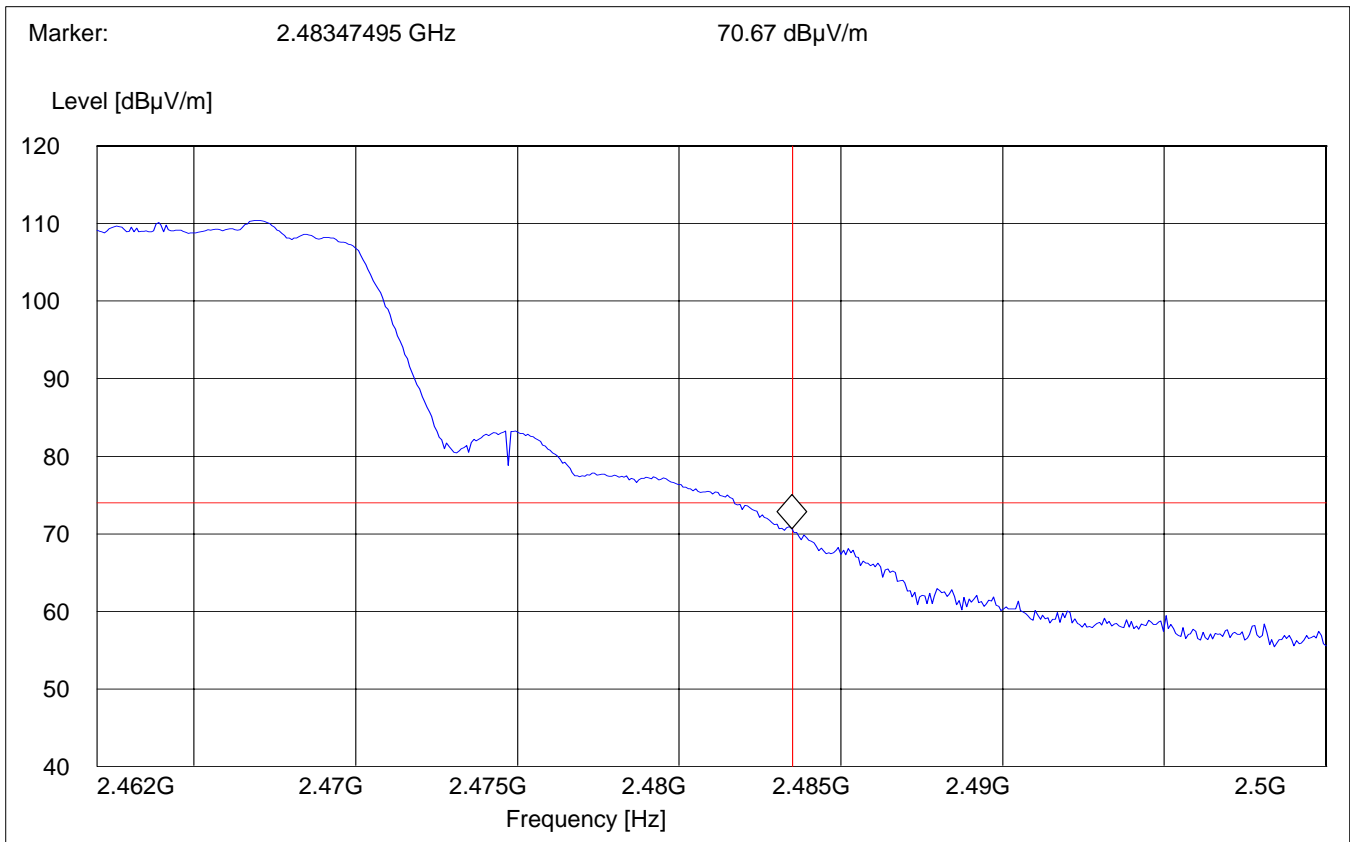
**BAND EDGE COMPLIANCE**

**§15.247 (c)**

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

Operating condition : Tx at 2462MHz  
 SWEEP TABLE : "FCC15.247 HBE\_PK"  
 Limit Line : 74dBμV

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**

<b>Frequency</b>	<b>Measured values</b>	<b>Remarks</b>
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)**

<b>Transmit at Lowest channel Frequency 2412MHz</b>			
<b>Frequency (MHz)</b>	<b>Level (dBµV/m)</b>		
	<b>Peak</b>	<b>Quasi-Peak</b>	<b>Average</b>
3214	3745		
4815	44.06		
7234	43.72		
9613	45.20		
<b>Transmit at Middle channel Frequency 2437MHz</b>			
<b>Frequency (MHz)</b>	<b>Level (dBµV/m)</b>		
	<b>Peak</b>	<b>Quasi-Peak</b>	<b>Average</b>
3248	34.67		
4849	45.72		
7302	47.44		
9755	44.13		
<b>Transmit at Highest channel Frequency 2462MHz</b>			
<b>Frequency (MHz)</b>	<b>Level (dBµV/m)</b>		
	<b>Peak</b>	<b>Quasi-Peak</b>	<b>Average</b>
3282	33.89		
4917	49.79		
7370	46.95		
98.57	47.46		

**EMISSION LIMITATIONS - Radiated (Transmitter)**

**§ 15.247 (c) (1)**

**Lowest Channel (2412MHz): 30MHz – 1GHz**

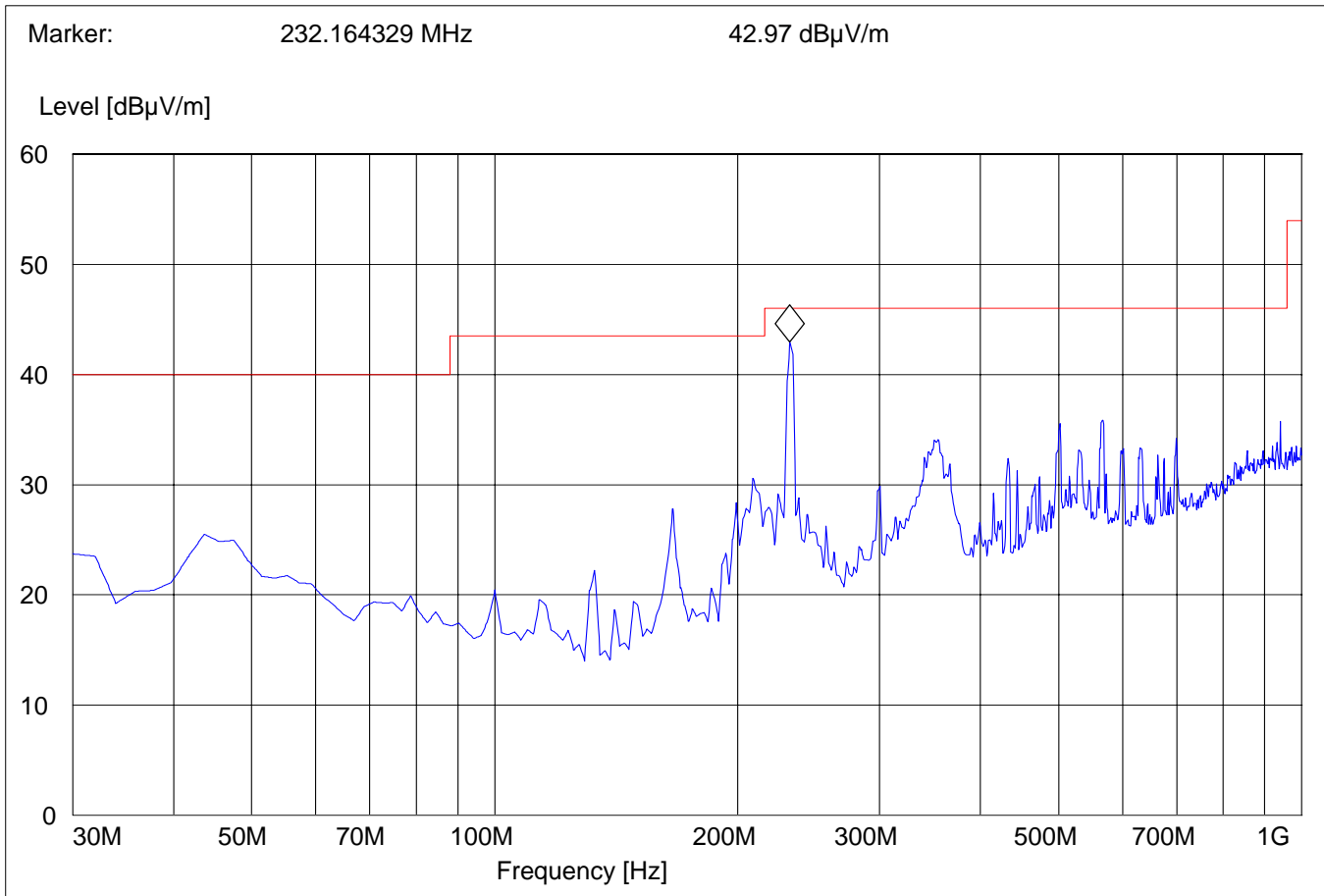
**Antenna: Vertical**

**Note: This plot is valid for low, mid, high channels (worst-case plot)**

**SWEEP TABLE:**

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

"Spuri hi 30-1G"





## EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Lowest Channel (2412MHz): 30MHz – 1GHz

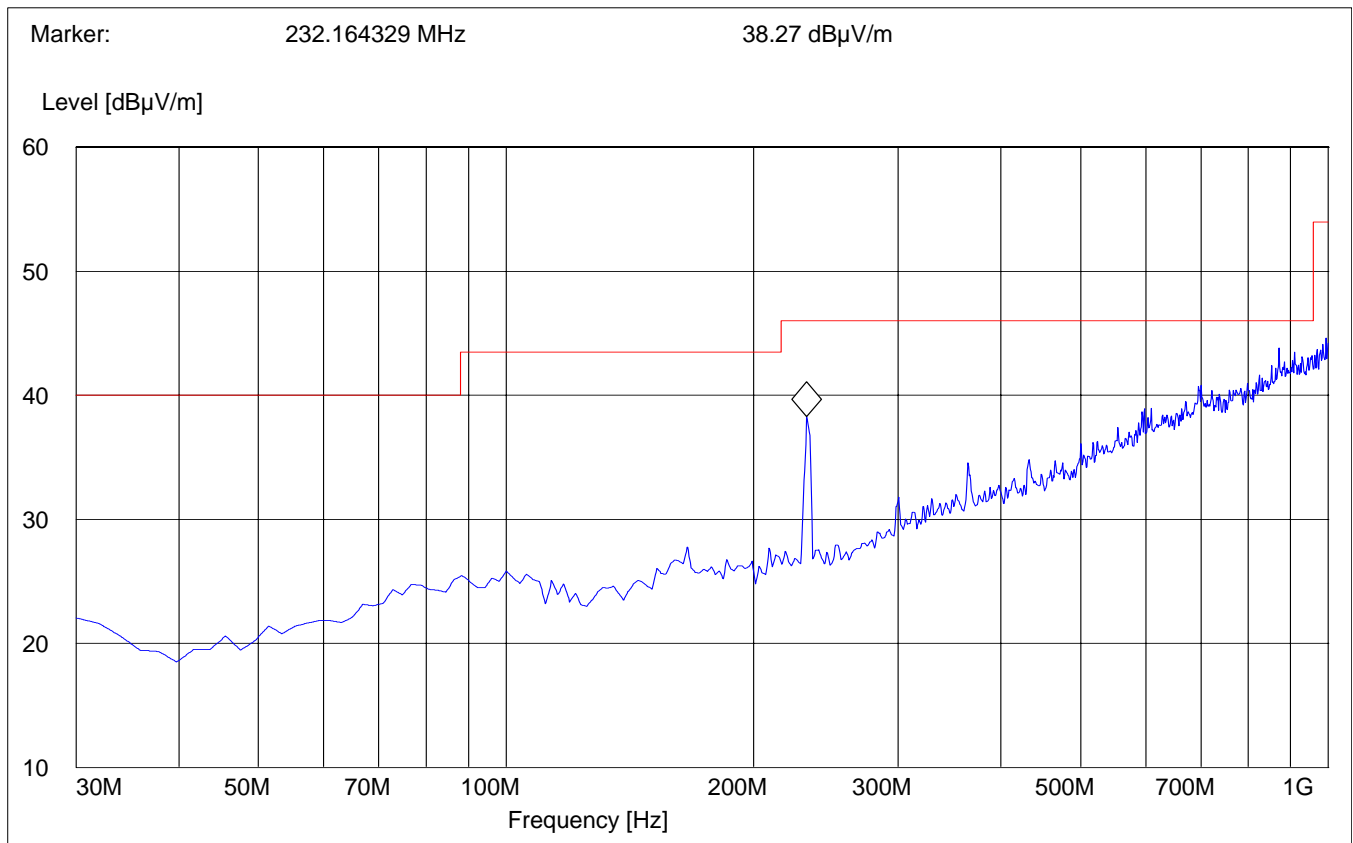
Antenna: Horizontal

**Note: This plot is valid for low, mid, high channels (worst-case plot)**

### SWEEP TABLE:

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

"Spuri hi 30-1G"



**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Lowest Channel (2412MHz): 1GHz – 3GHz**

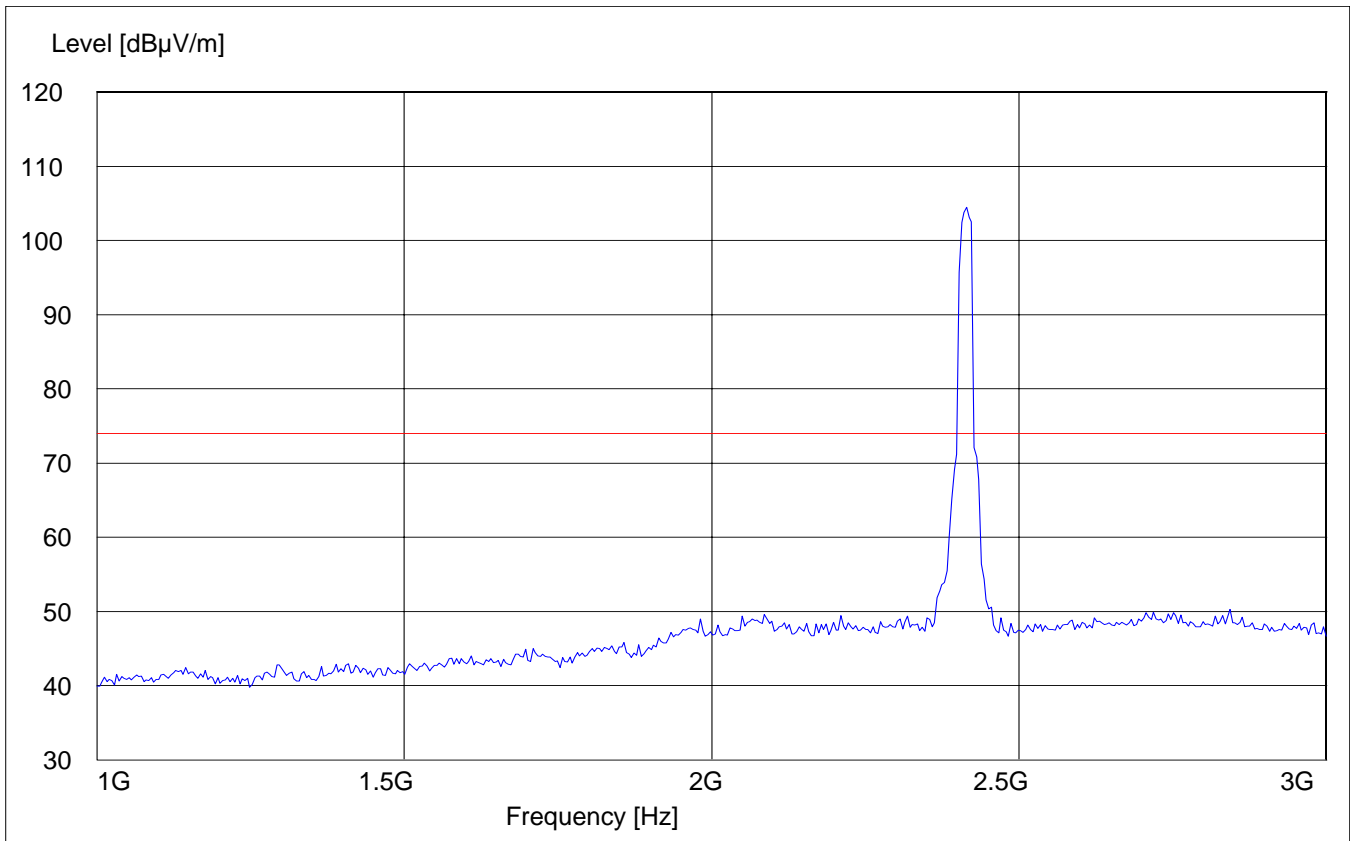
§ 15.247 (c) (1)

**Note: Peak above the limit line is the carrier freq.**

**SWEEP TABLE:**

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

"Spuri hi 1-3G"

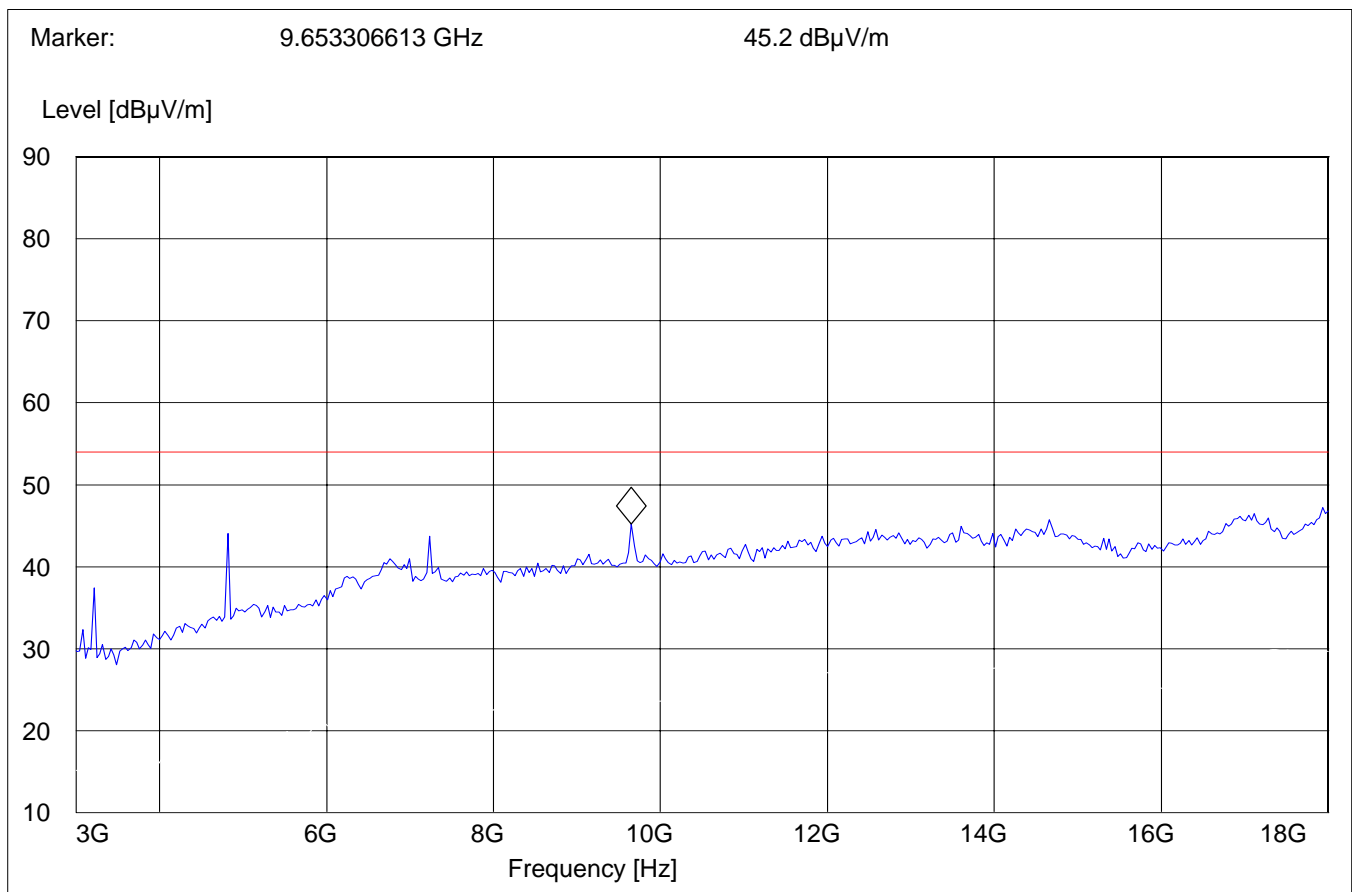


**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Lowest Channel (2412MHz): 3GHz – 18GHz**

§ 15.247 (c) (1)

SWEEP TABLE: "Spuri hi 3-18G"

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

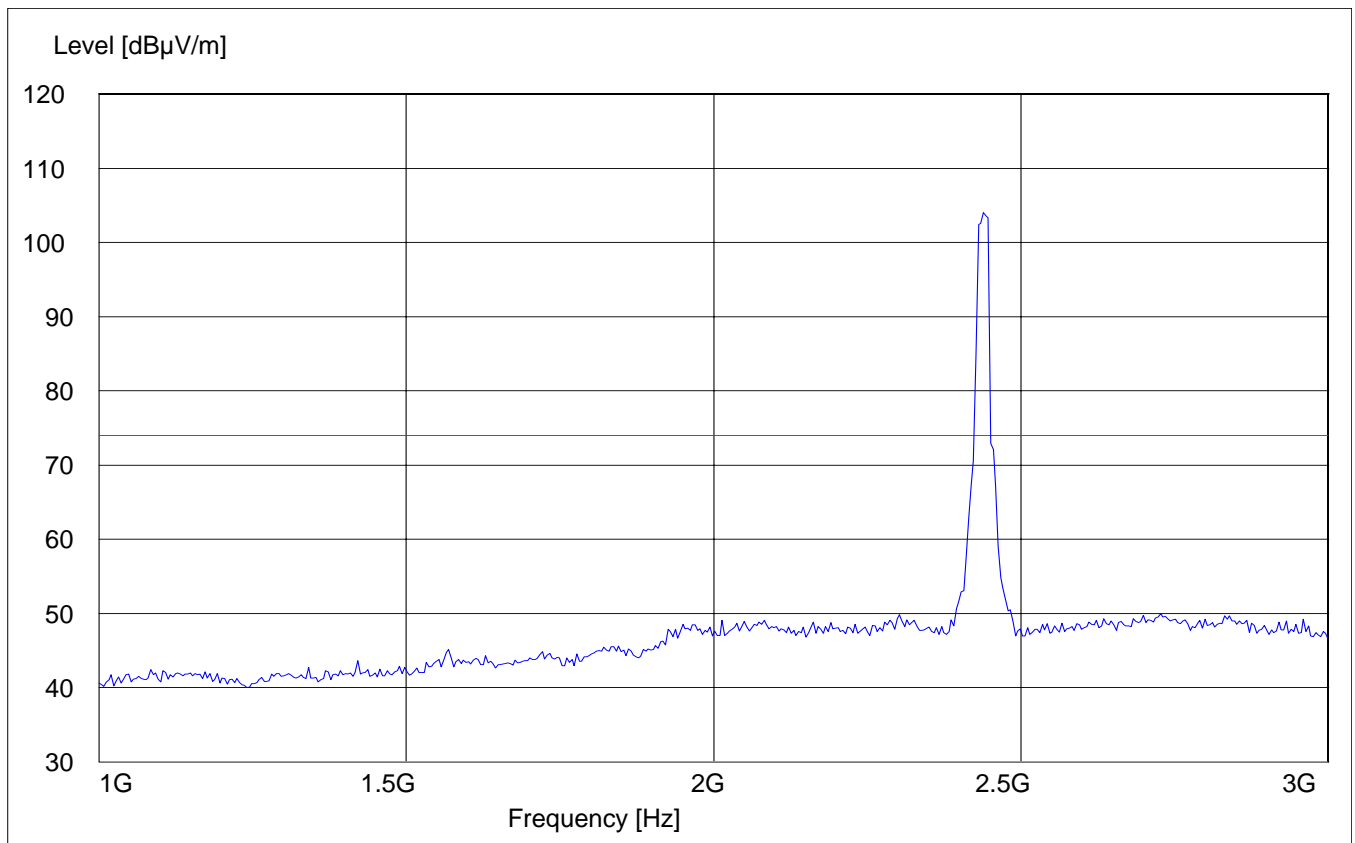


**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Mid Channel (2437MHz): 1GHz – 3GHz**

§ 15.247 (c) (1)

**Note: The peak above the limit line is the carrier freq.**

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



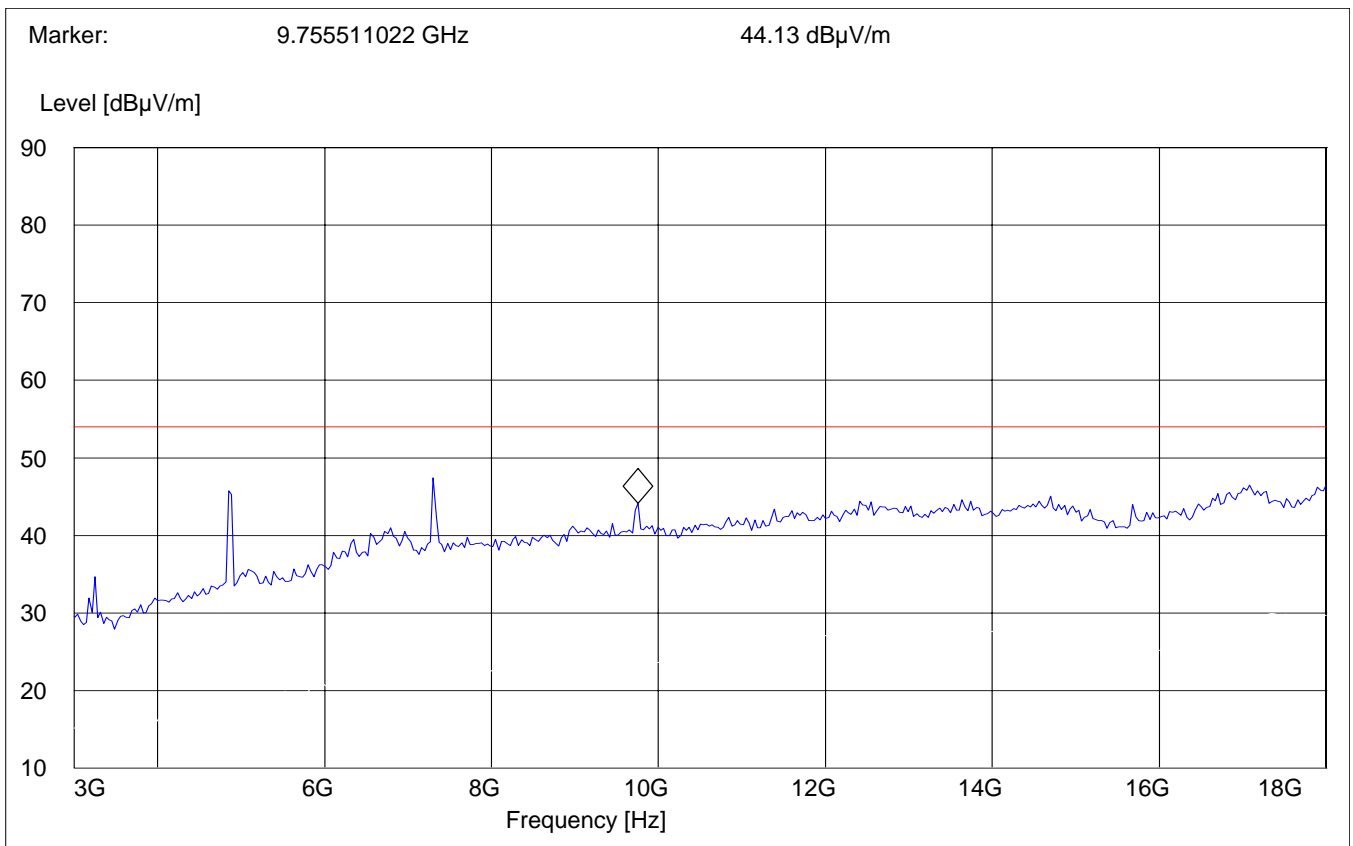
**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Mid Channel (2437MHz): 3GHz – 18GHz**

§ 15.247 (c) (1)

**SWEEP TABLE:**

"Spuri hi 3-18G"

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



**EMISSION LIMITATIONS - Radiated (Transmitter)**  
**Highest Channel (2462MHz): 1GHz – 3GHz**

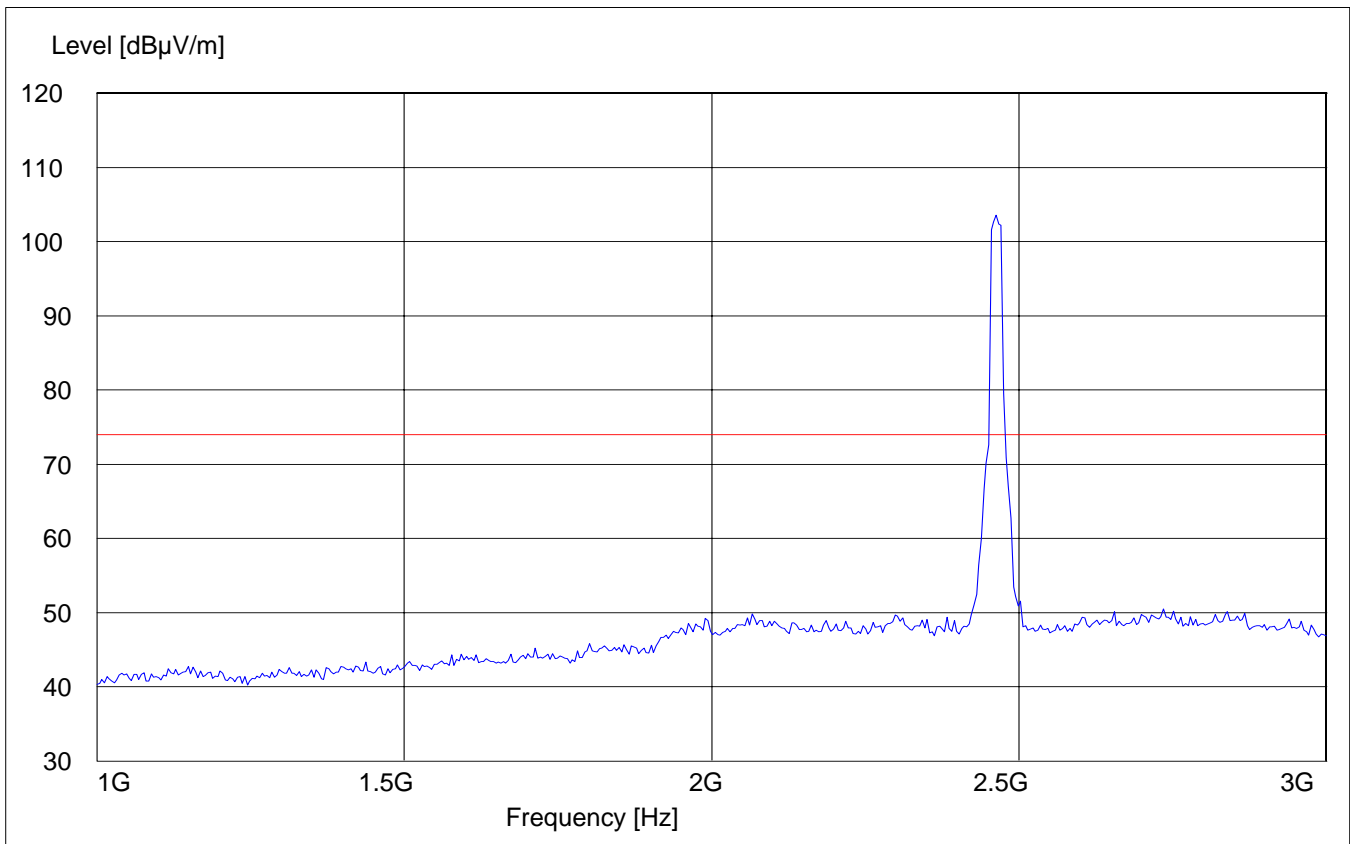
§ 15.247 (c) (1)

**Note: The peak above the limit line is the carrier freq.**

**SWEEP TABLE:**

"Spuri hi 1-3G"

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



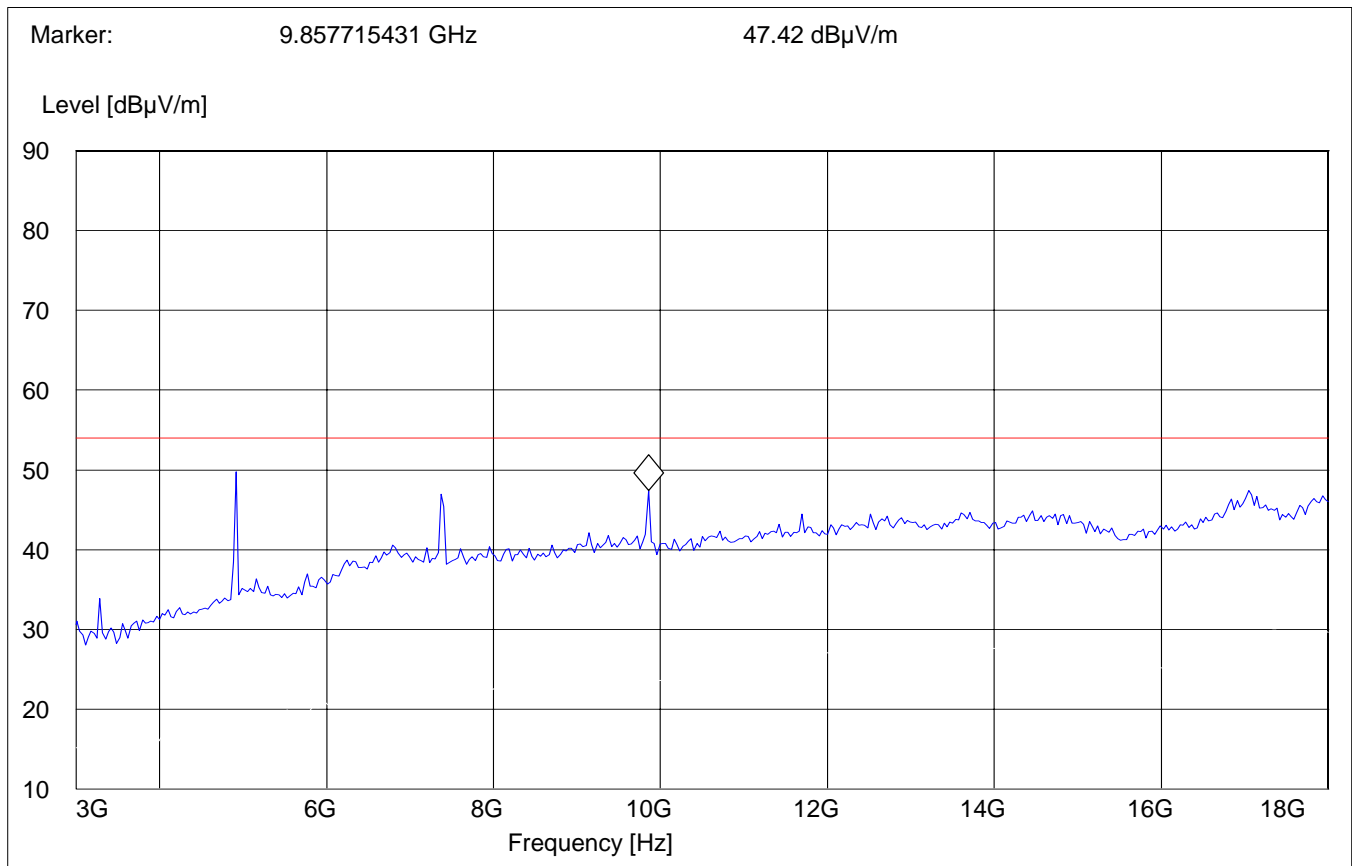
**EMISSION LIMITATIONS - Radiated (Transmitter)**

**§ 15.247 (c) (1)**

**Highest Channel (2462MHz): 3GHz – 18GHz**

SWEEP TABLE: "Spuri hi 3-18G"

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



**EMISSION LIMITATIONS - Radiated (Transmitter)**

**§ 15.247 (c) (1)**

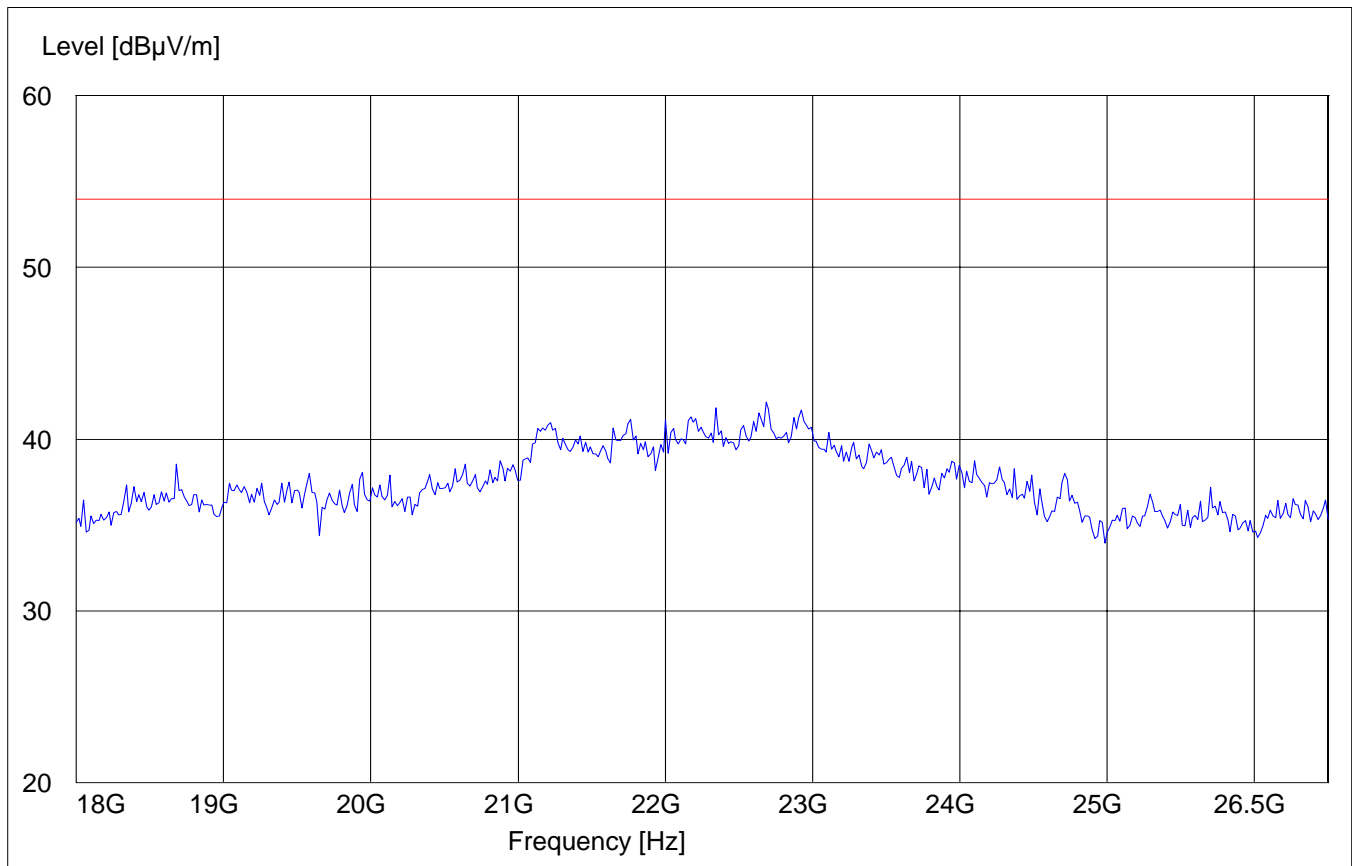
**18GHz – 25GHz**

**Note: This plot is valid for low, mid, high channels (worst-case plot)**

SWEEP TABLE:

"Spuri hi 18-25G"

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	25 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)





**CONDUCTED EMISSIONS**

§ 15.107/207

Measured with AC/DC power adapter

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 August 20, 2002)

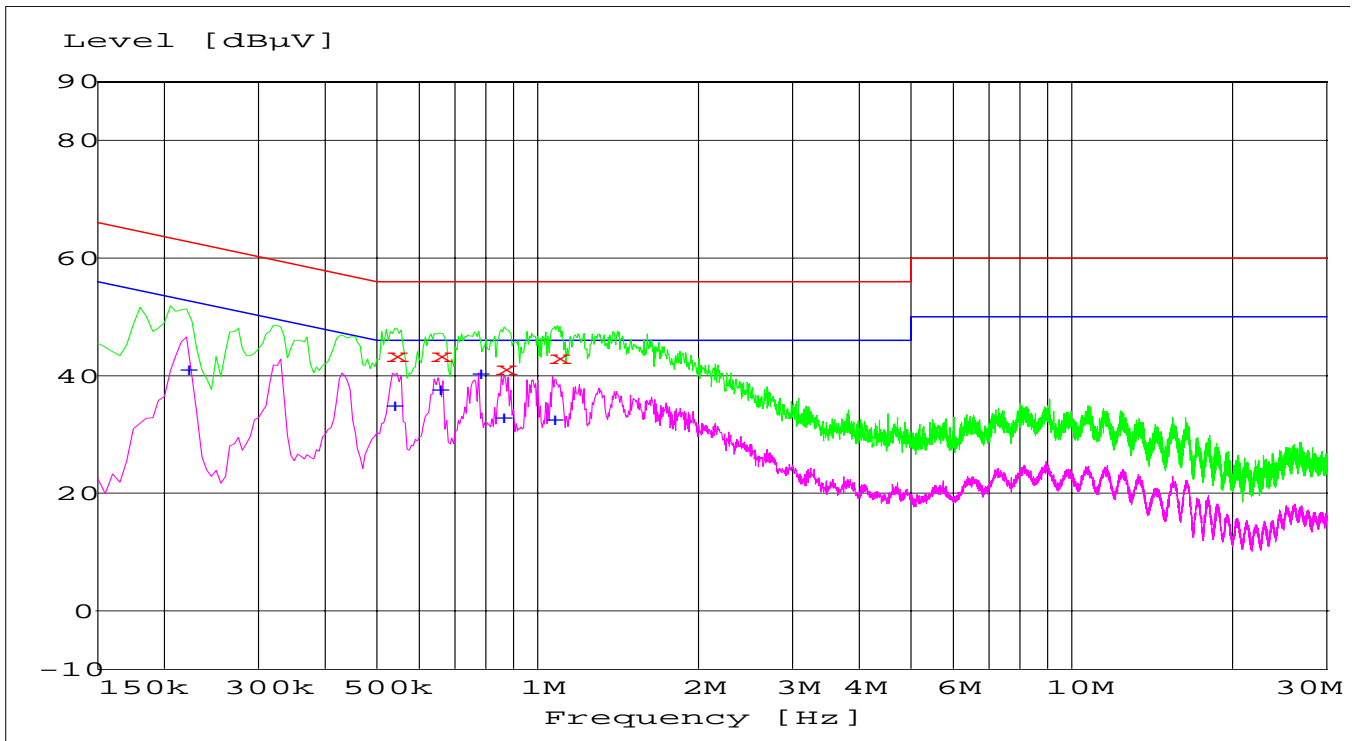
**Limit**

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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



x x MES test\_fin QP  
 + + MES test\_fin AV  
 — MES test\_pre PK  
 — MES test\_pre AV  
 — LIM EN 55022 V QP Voltage QP Limit  
 — LIM EN 55022 V AV Voltage AV Limit

**MEASUREMENT RESULT: "test\_fin QP"**

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.540000	43.50	0.0	56	12.5	N	GND
0.655000	43.50	0.0	56	12.5	L1	GND
0.865000	41.20	0.0	56	14.8	N	GND
1.090000	43.10	0.0	56	12.9	L1	GND

**MEASUREMENT RESULT: "test\_fin AV"**

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.220000	41.10	0.0	53	11.7	N	GND
0.535000	35.00	0.0	46	11.0	N	GND
0.650000	37.70	0.0	46	8.3	L1	GND
0.775000	40.50	0.0	46	5.5	L1	GND
0.855000	33.00	0.0	46	13.0	N	GND
1.065000	32.70	0.0	46	13.3	N	GND

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

<b>Frequency (MHz)</b>	<b>Field strength (<math>\mu\text{V/m}</math>)</b>	<b>Measurement distance (m)</b>
<b>0.009 - 0.490</b>	<b>2400/F (kHz)</b>	<b>300</b>
<b>0.490 - 1.705</b>	<b>24000/F (kHz)</b>	<b>30</b>
<b>1.705 - 30.0</b>	<b>30</b>	<b>30</b>
<b>30 - 88</b>	<b>100</b>	<b>3</b>
<b>88 - 216</b>	<b>150</b>	<b>3</b>
<b>216 - 960</b>	<b>200</b>	<b>3</b>
<b>above 960</b>	<b>500</b>	<b>3</b>

**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 25 GHz very short cable connections to the antenna was used to minimize the noise level.

**RECEIVER SPURIOUS RADIATION**

§ 15.209

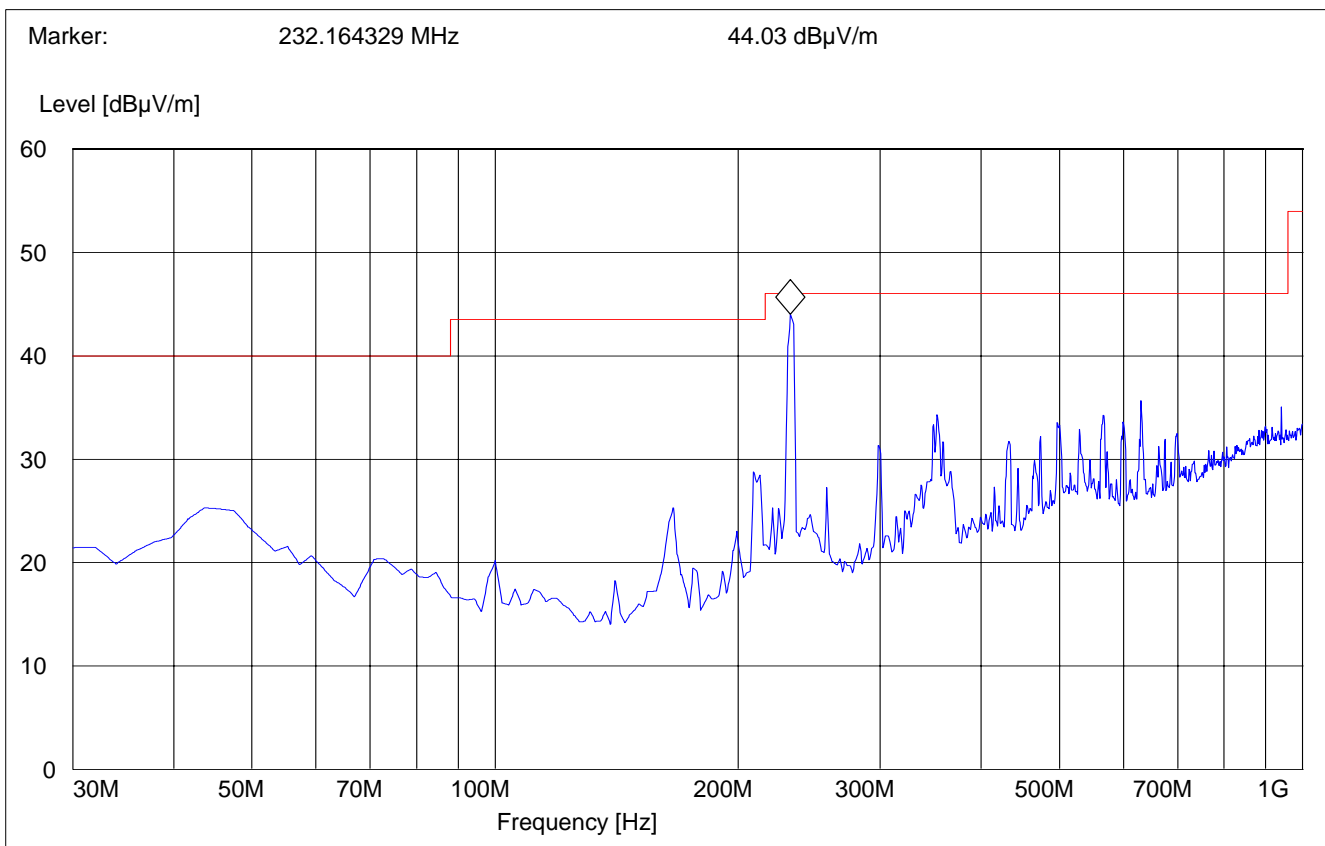
**30MHz – 1GHz**

**Antenna: vertical**

SWEEP TABLE:

"Spuri hi 30-1G"

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



RECEIVER SPURIOUS RADIATION

§ 15.209

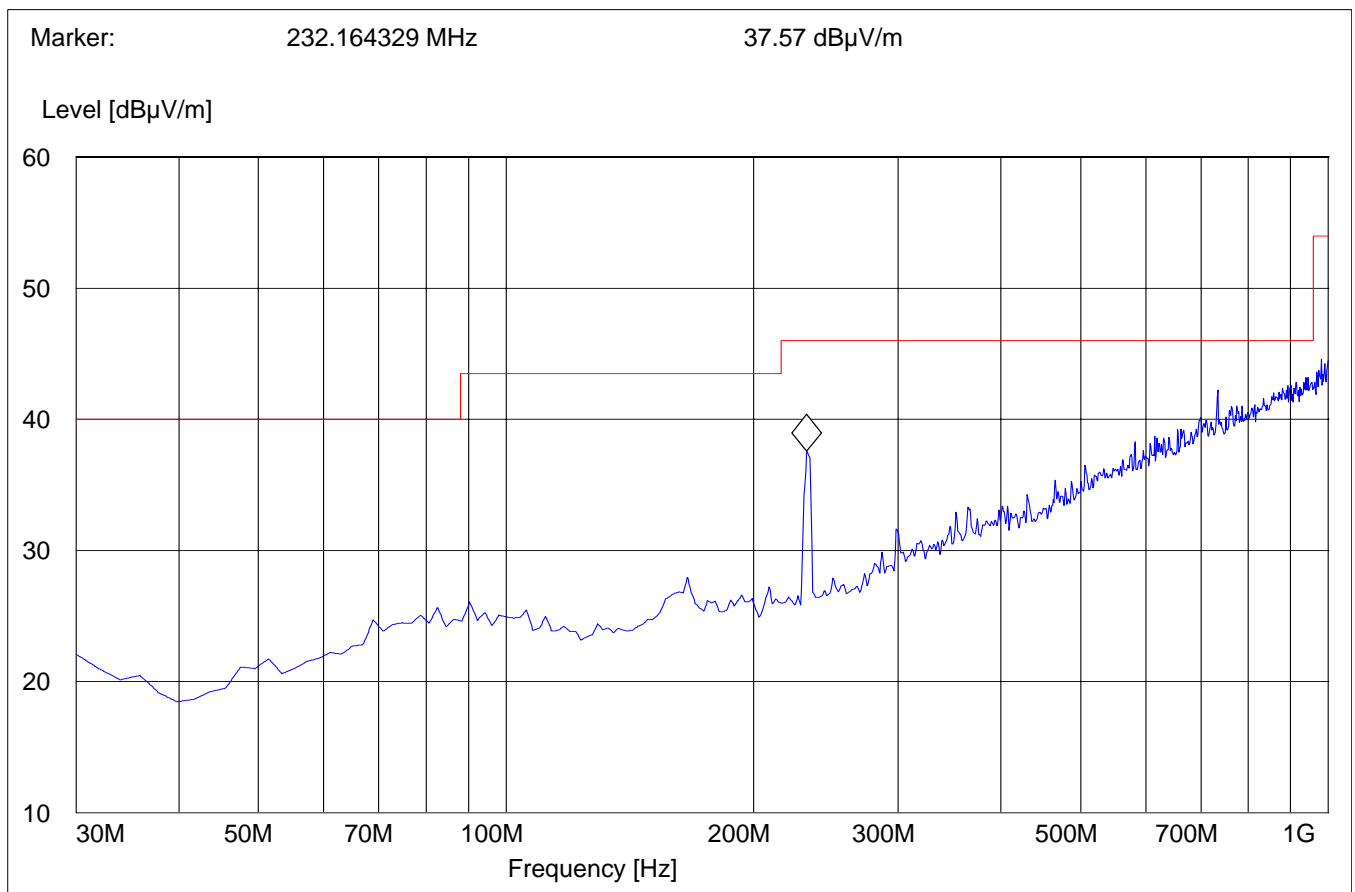
30MHz – 1GHz

Antenna: horizontal

SWEEP TABLE:

"Spuri hi 30-1G"

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



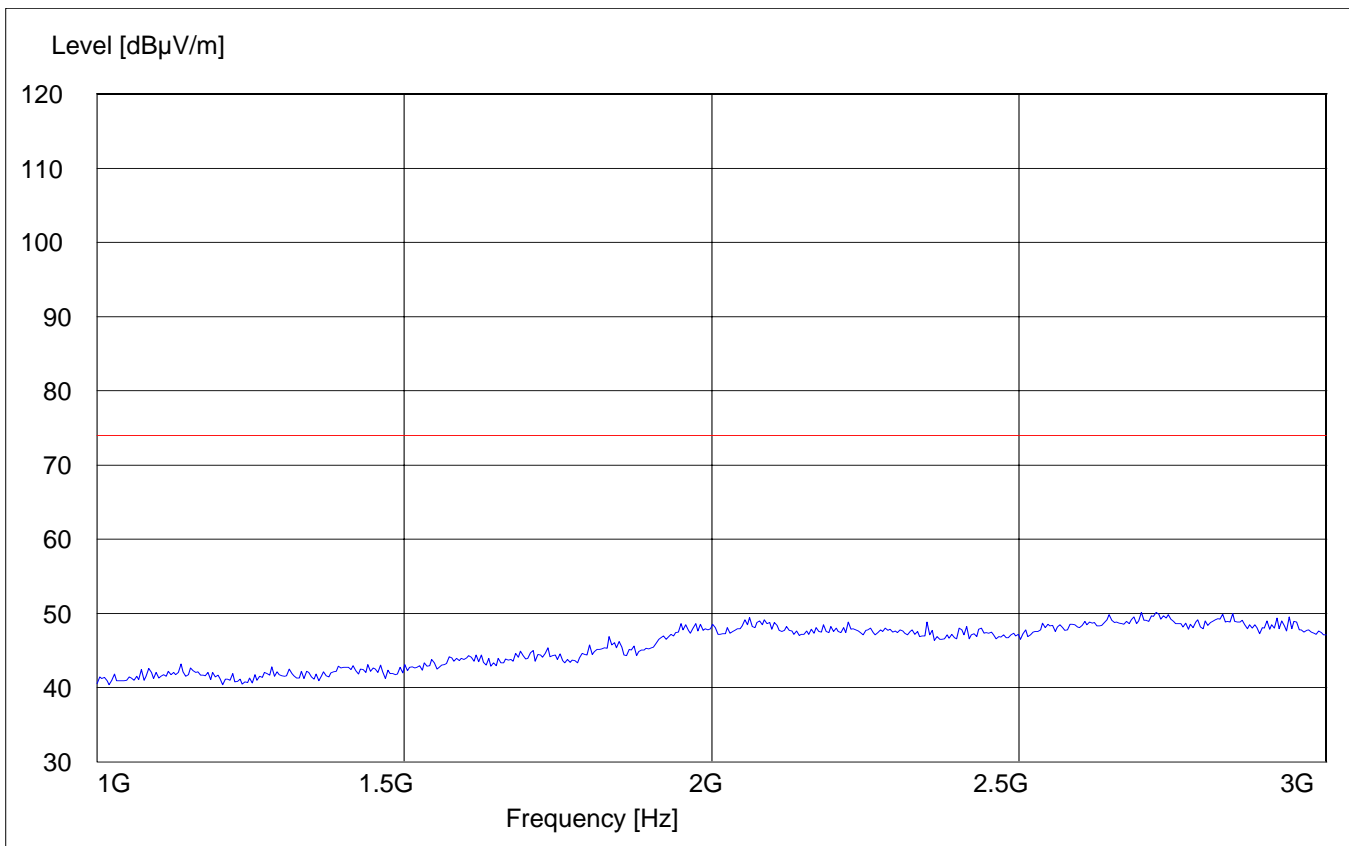
**RECEIVER SPURIOUS RADIATION**  
**1GHz – 3GHz**

**§ 15.209**

**SWEEP TABLE:**

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

"Spuri hi 1-3G"



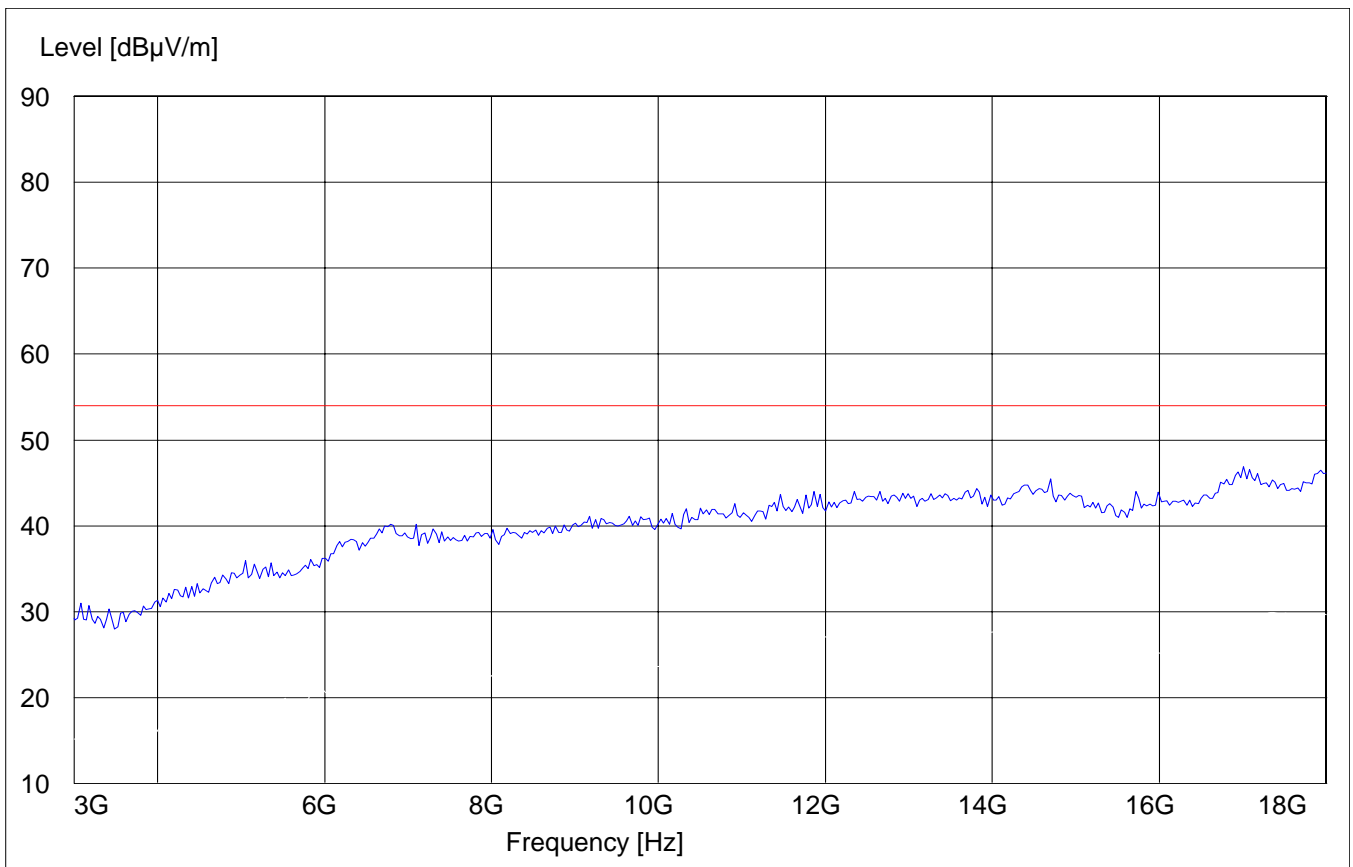
**RECEIVER SPURIOUS RADIATION**  
**3GHz – 18GHz**

§ 15.209

**SWEEP TABLE:**

"Spuri hi 3-18G"

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



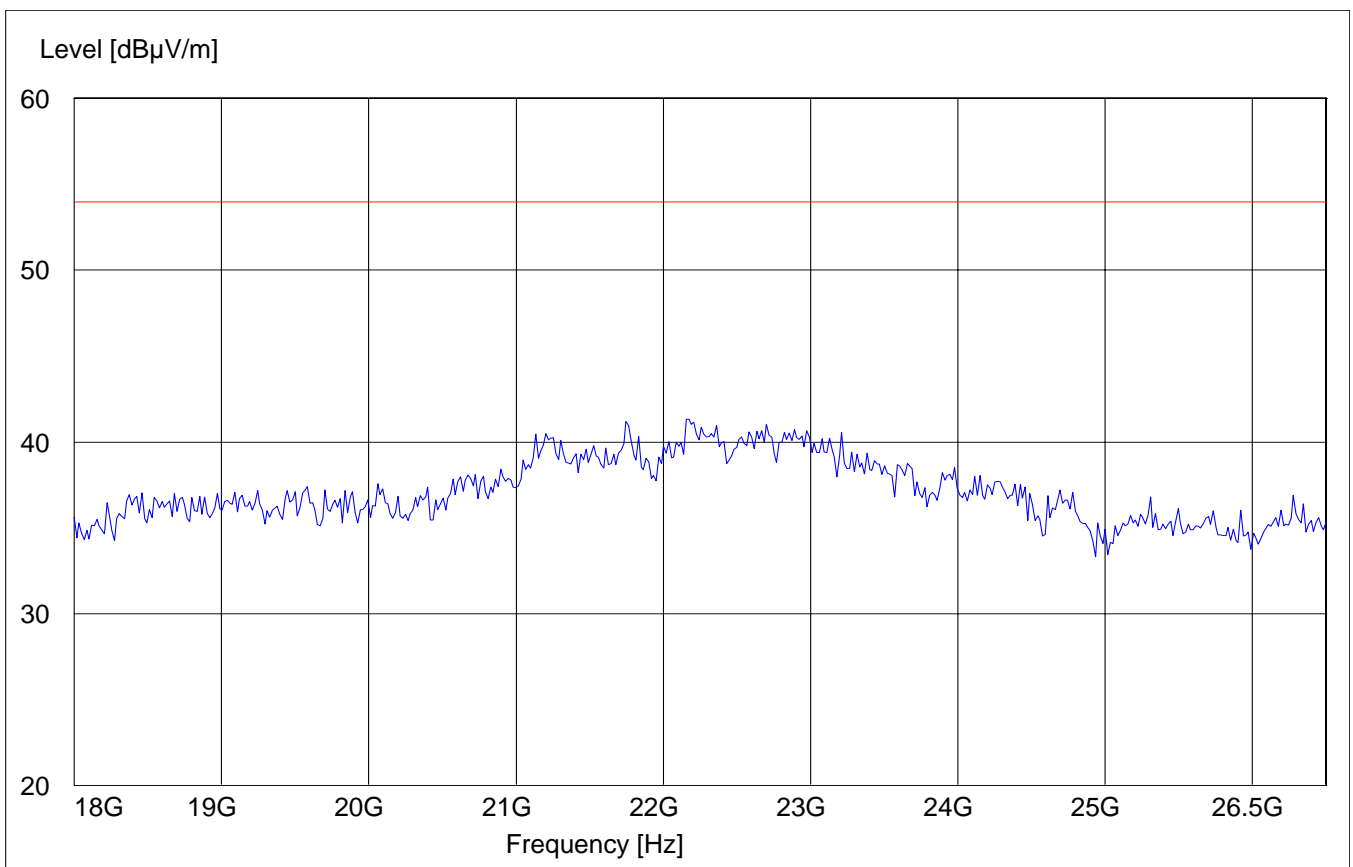
**RECEIVER SPURIOUS RADIATION**  
**18GHz – 25GHz**

§ 15.209

**SWEEP TABLE:**

"Spuri hi 18-25G"

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**

<b>No</b>	<b>Instrument/Ancillary</b>	<b>Type</b>	<b>Manufacturer</b>	<b>Serial No.</b>
<b>01</b>	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107
<b>02</b>	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
<b>03</b>	Biconilog Antenna	3141	EMCO	0005-1186
<b>04</b>	Horn Antenna (700M-18GHz)	SAS-200/571	AH Systems	325
<b>05</b>	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240
<b>06</b>	2-3GHz Band reject filter	BRM50701	Microtronics	6
<b>07</b>	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
<b>08</b>	Pre-Amplifier	TS-ANA	Rohde & Schwarz	--
<b>09</b>	Pre-Amplifier	JS4-00102600	Miteq	00616

**BLOCK DIAGRAMS**  
**Radiated Testing**

**ANECHOIC CHAMBER**

