



FCC Test Report

Test report no.: EMC_799FCC15.247_2004_C2P_2

FCC Part 15.247 for DSSS systems / CANADA RSS-210

EUT: WLAN Model: BCM94318MPG
Modular Approval
FCC ID: QDS-BRCM1016
IC ID: 4324A-BRCM1016



TTI-P-G 081/94-A0

Accredited according to **ISO/IEC 17025**



**Bluetooth Qualification
Test Facility
(BQTF)**



FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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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:

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1.2 Testing laboratory
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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

1.4 Application details

Date of receipt test item : 2005-03-17
Date of test : 2005-03-17/28/29

1.5 Test item

Manufacturer : Applicant
Model No. : [BCM94318MPG](#)
Host : Test fixture
Description : [Broadcom 802.11g mini PCI card](#)
FCC ID : **QDS-BRCM1016**
IC ID : **4324A-BRCM1016**

Additional information

Frequency : 2412MHz – 2462MHz
Type of modulation : DSSS / OFDM (orthogonal frequency division multiplexing)
Number of channels : 11
Antenna : 5dBi max. gain antenna
(Netgear MR814 Omni-directional Dipole antenna)
Power supply : 3.3 VDC from Host
Output power : 28.95dBm (785.24mW) 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 for doing a class-2 permissive change on WLAN mini PCI card model# BCM94318MPG tested in test fixture as per DA001407 requirements for modular transmitter approval. Conducted power was measured and found within limits of C2P change rules.

Following are the changes filed under this application;

Change #1 Adding alternate Skyworks power amp. The associated layout and filter circuitry is the same. The average power in packet is maintained the same, 16.5dBm OFDM and 18dBm CCK.

**Change #2 Add additional antenna:
Netgear MR814 Omni-directional Dipole antenna Peak gain 5dBi.**

All measurements are done with 5dBi max. gain antenna. 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 with following power levels.

802.11g mode: 16.5dBm


802.11b mode: 18dBm

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:

2005-04-06	EMC & Radio	Lothar Schmidt (Manager)	
Date	Section	Name	Signature

Responsible for test report and project leader:

2005-04-06	EMC & Radio	Harpreet Sidhu (EMC Engineer)	
Date	Section	Name	

2.2 Test report

TEST REPORT

Test report no.: EMC_799FCC15.247_2004_C2P_2

TEST REPORT REFERENCE

LIST OF MEASUREMENTS		PAGE
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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 _{nom} (23)°C	V _{nom} (3.3) VDC	Pk	28.59	28.95	28.57
Measurement uncertainty		±0.5dBm			

RBW / VBW: 10MHz

*To comply with following;

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

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

(Therefore correction factor of 2.18, 2.16 & 2.16 is added to low, mid& high channel measurements respectively)

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)		
Frequency (MHz)		2412	2437	2462
T _{nom} (23)°C	V _{nom} (3.3) VDC	27.06	27.46	27.85
Measurement uncertainty		±0.5dBm		

RBW / VBW: 10MHz

LIMIT

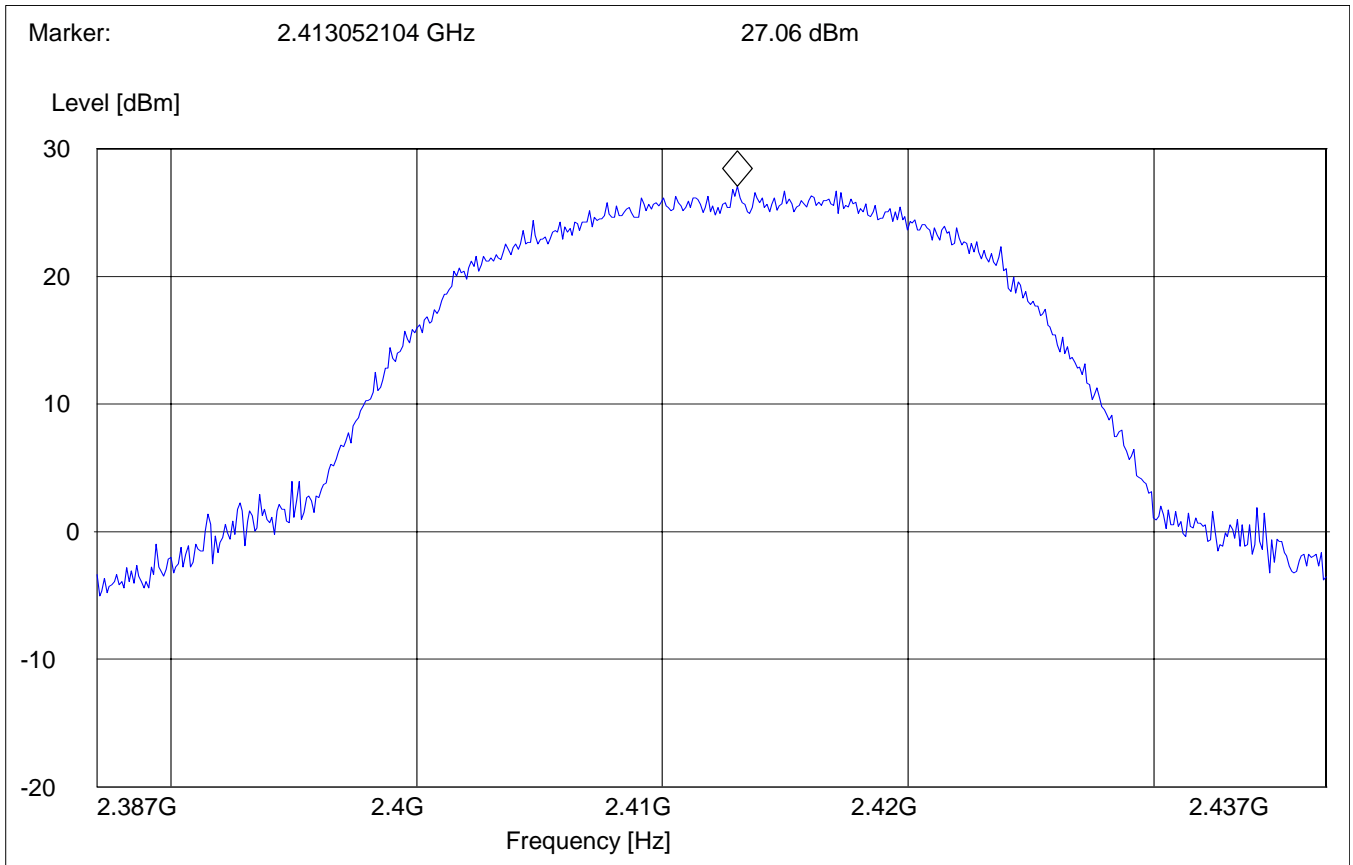
SUBCLAUSE § 15.247 (b) (1)

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

PEAK OUTPUT POWER (RADIATED)

EIRP

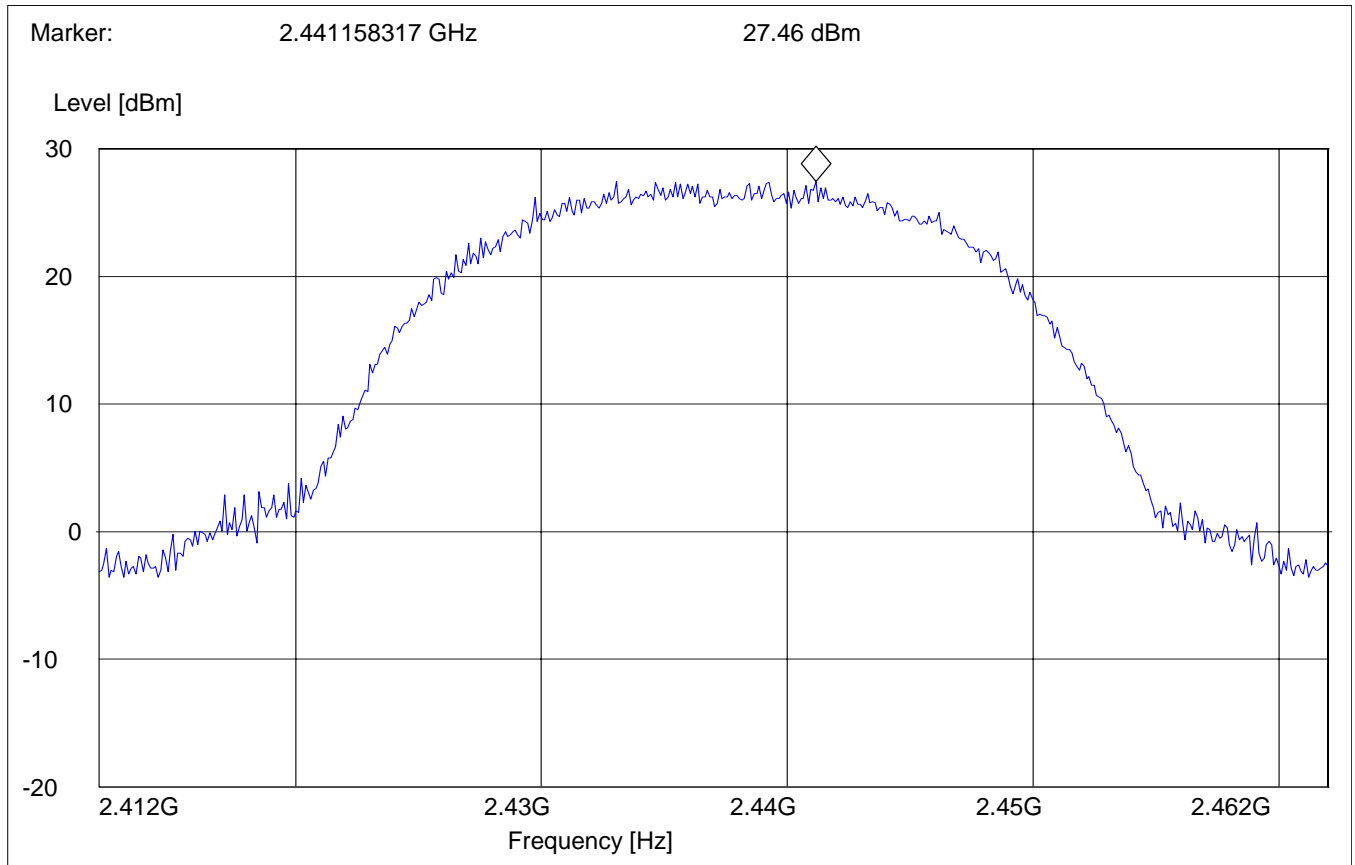
Lowest Channel: 2412MHz



PEAK OUTPUT POWER (RADIATED)

EIRP

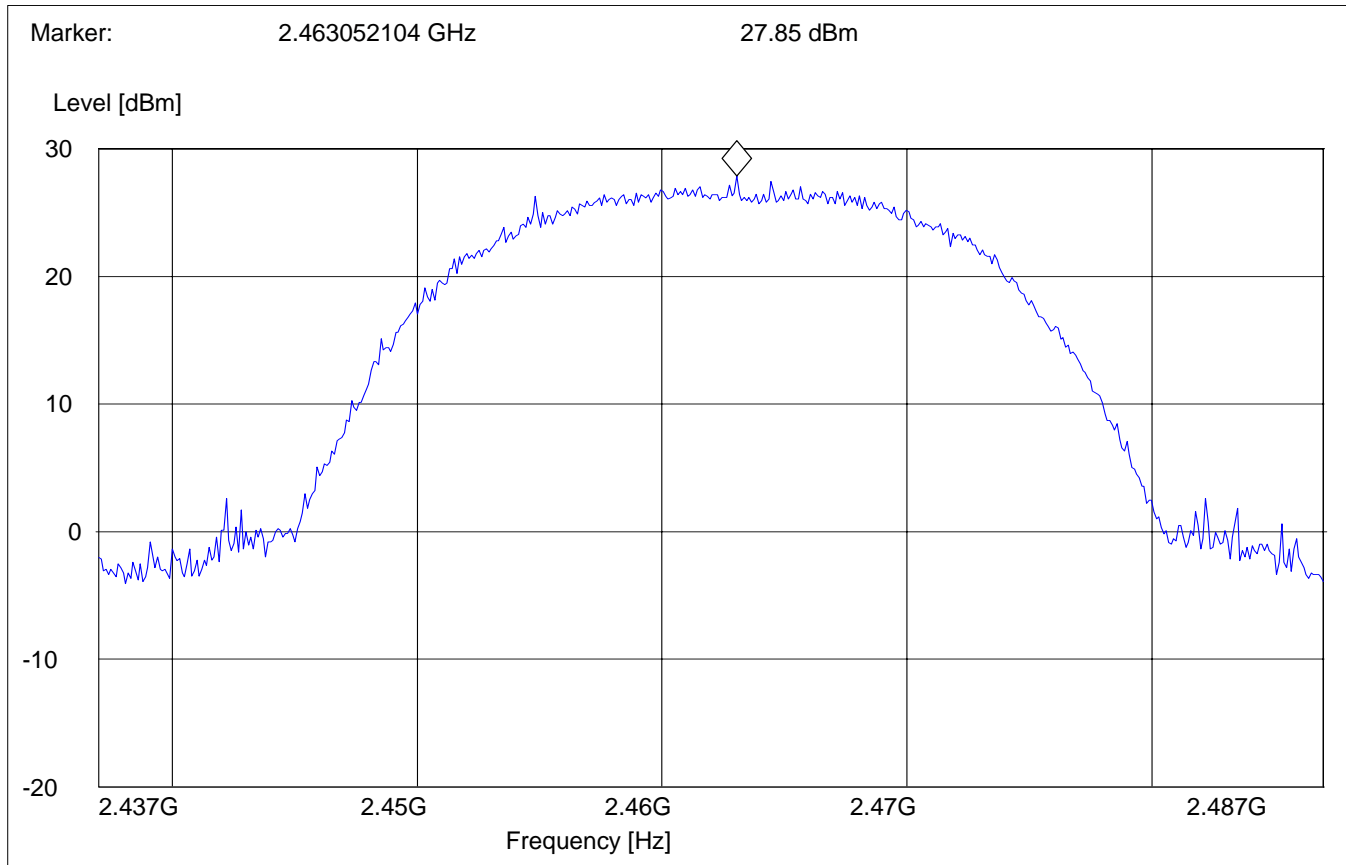
Mid Channel: 2437MHz



PEAK OUTPUT POWER (RADIATED)

EIRP

Highest Channel: 2462MHz



BAND EDGE COMPLIANCE (802.11g)

§15.247 (c)

Data rate: 1Mbps

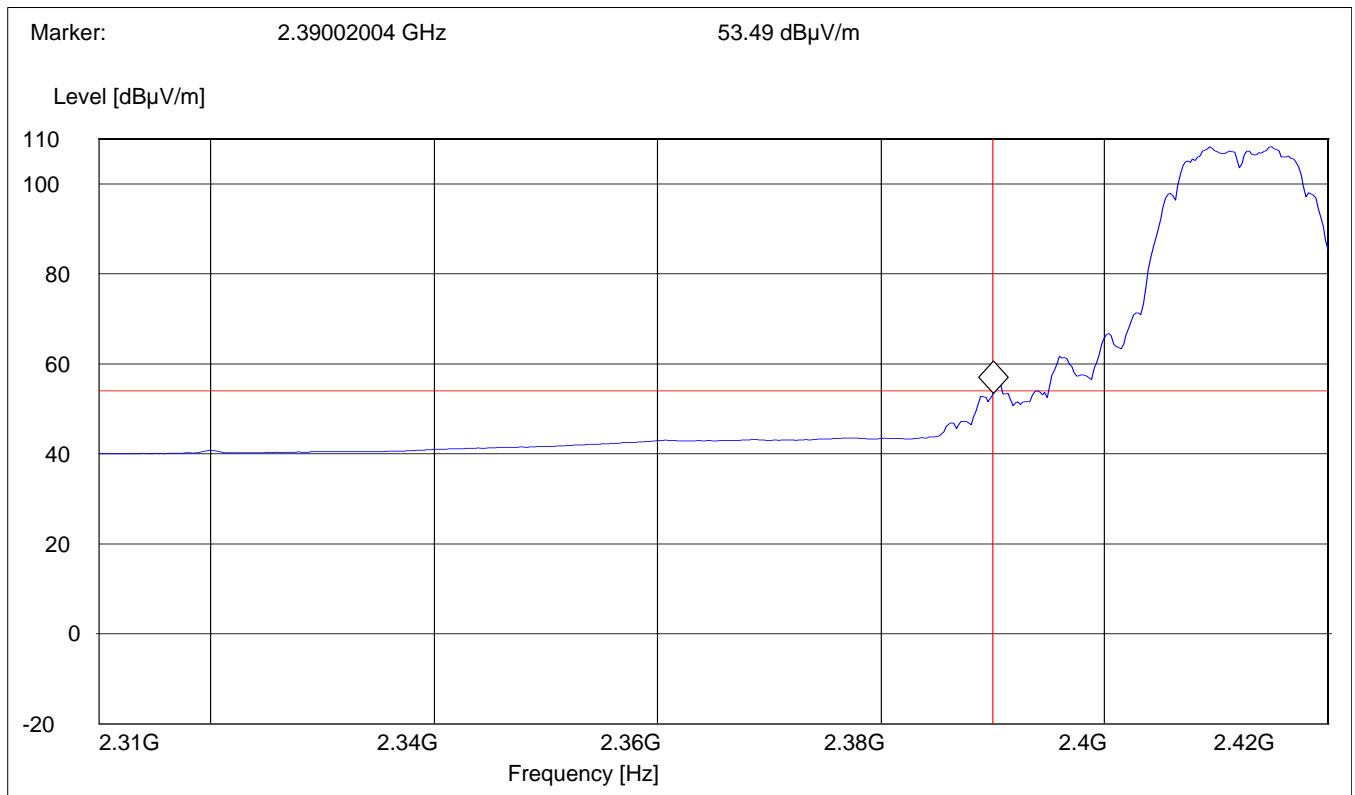
Power Level: 18dBm avg. power in packet

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 : 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)

Data rate: 54Mbps

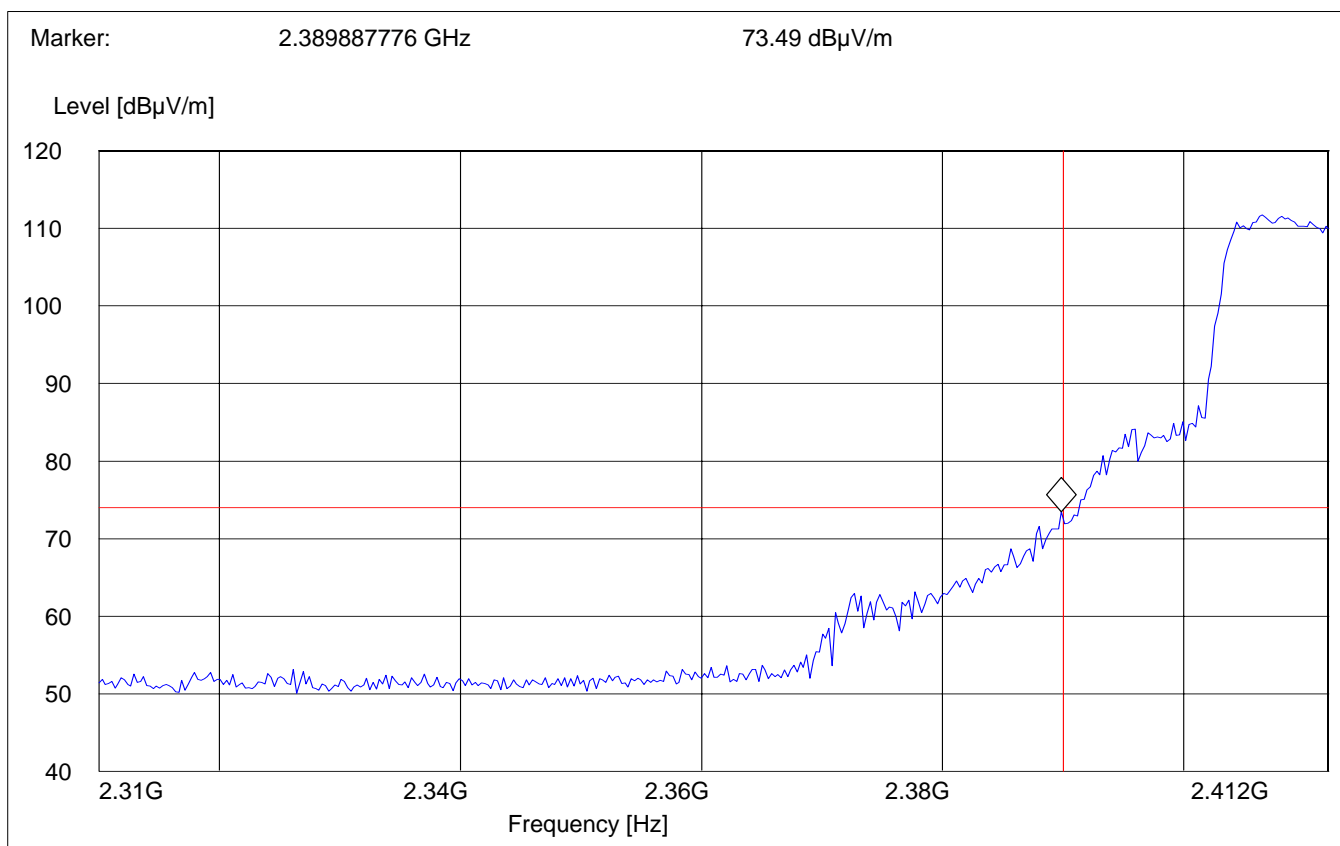
Power Level: 16.5dBm avg. power in packet

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 : 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)

Data rate: 1Mbps

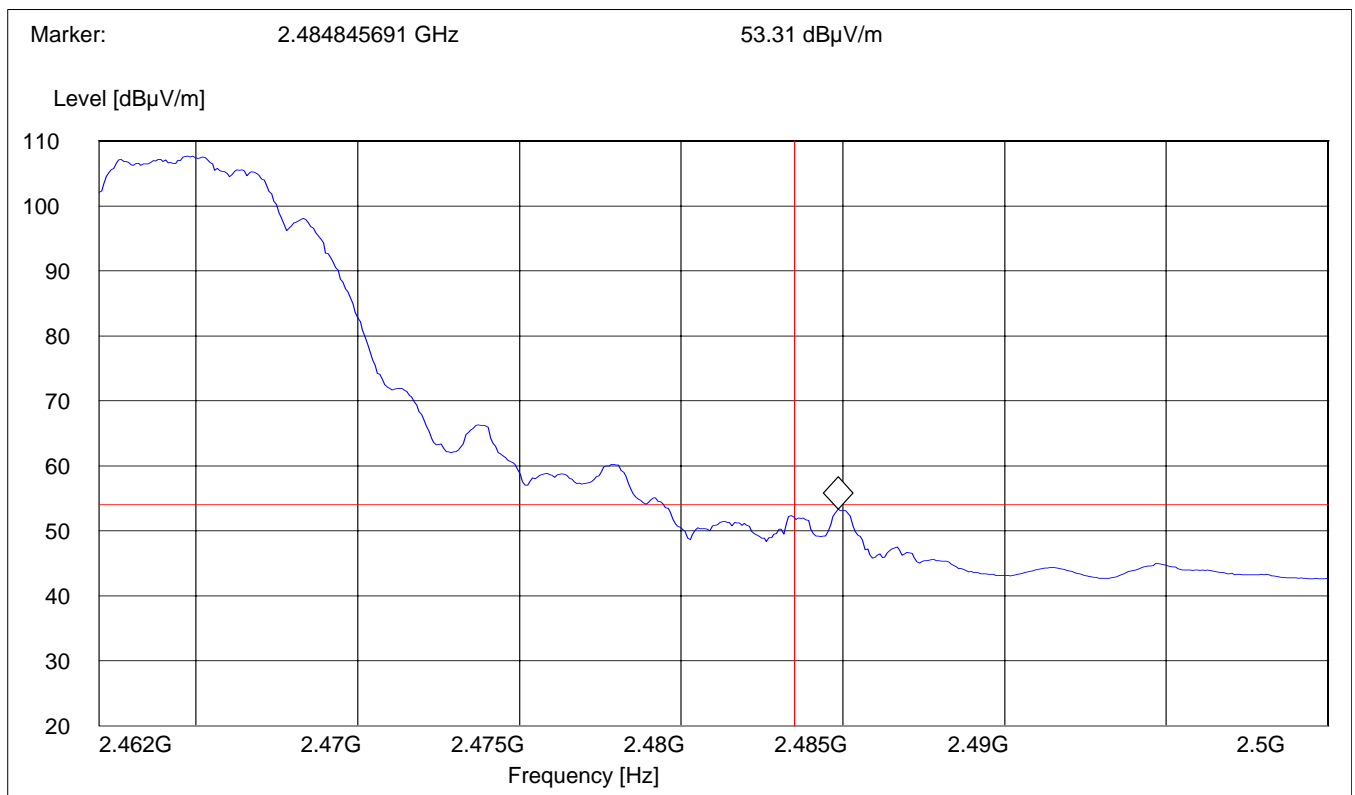
Power Level: 18dBm avg. power in packet

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)

Data rate: 54Mbps

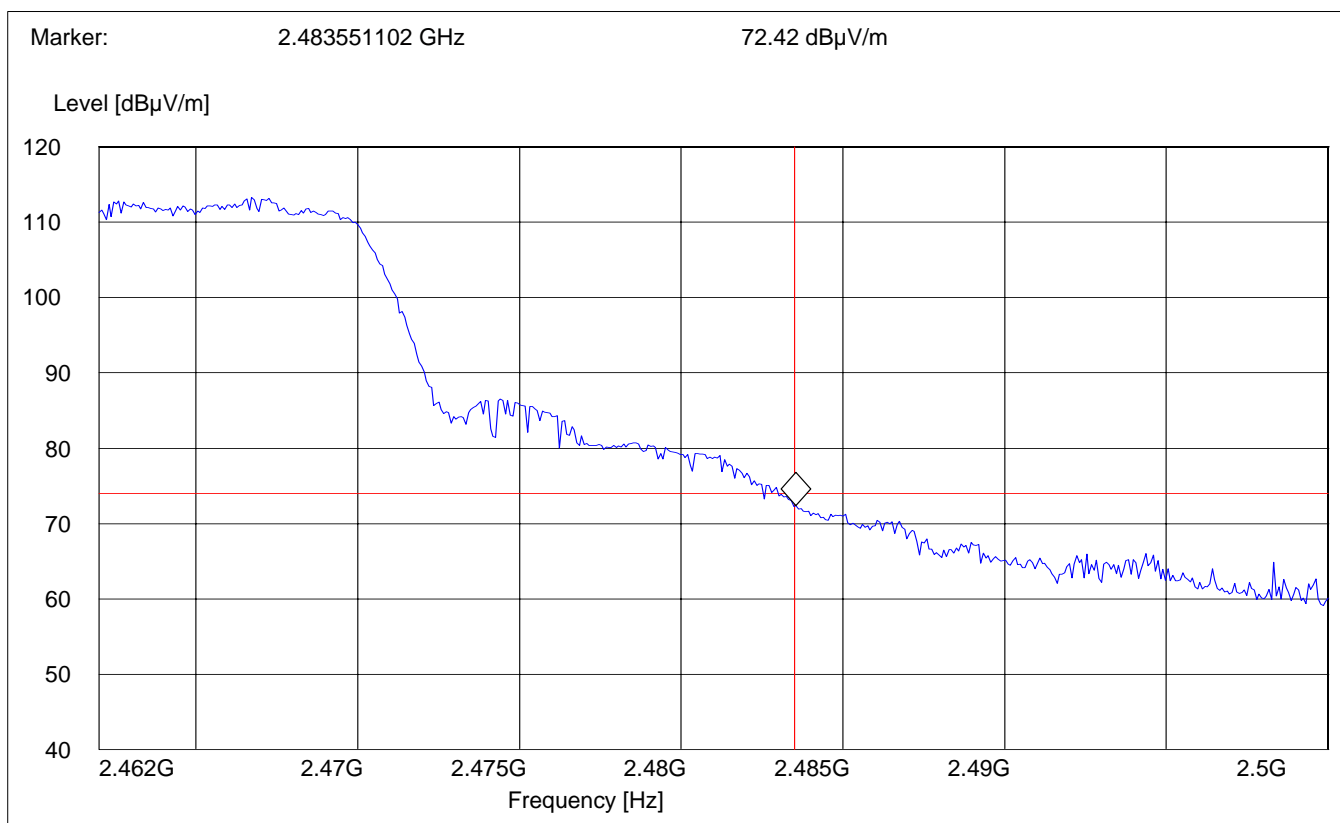
Power Level: 16.5dBm avg. power in packet

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 : 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 (802.11g)

§ 15.247 (c) (1)

Transmitter (Radiated)

Data rate: 54Mbps

Power Level: 16.5dBm avg. power in packet

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 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.

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)

Power level: 16.5dBm for 802.11g mode

Transmit at Lowest channel Frequency 2412MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Average 54Mbps	Average 6Mbps
SEE PLOTS			
Transmit at Middle channel Frequency 2437MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Average 54Mbps	Average 6Mbps
SEE PLOTS			
Transmit at Highest channel Frequency 2462MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Average 54Mbps	Average 6Mbps
SEE PLOTS			

EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

30MHz – 1GHz

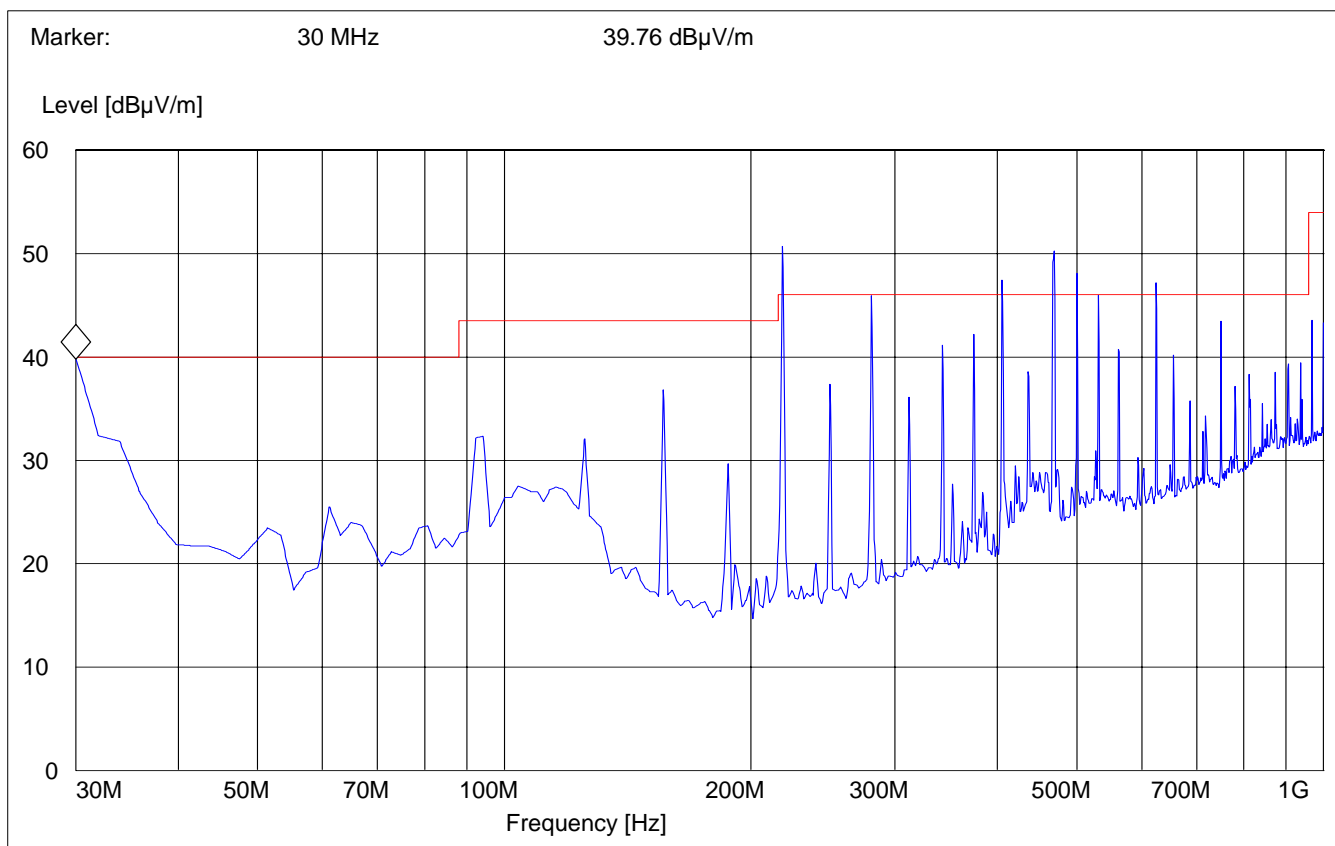
Antenna: Vertical

Note: This plot is valid for low, mid, high channels for all data rates and power levels (worst-case plot) All peaks above the limit line are confirmed coming from test fixture. Refer to plots on next pages.

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



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

30MHz – 1GHz

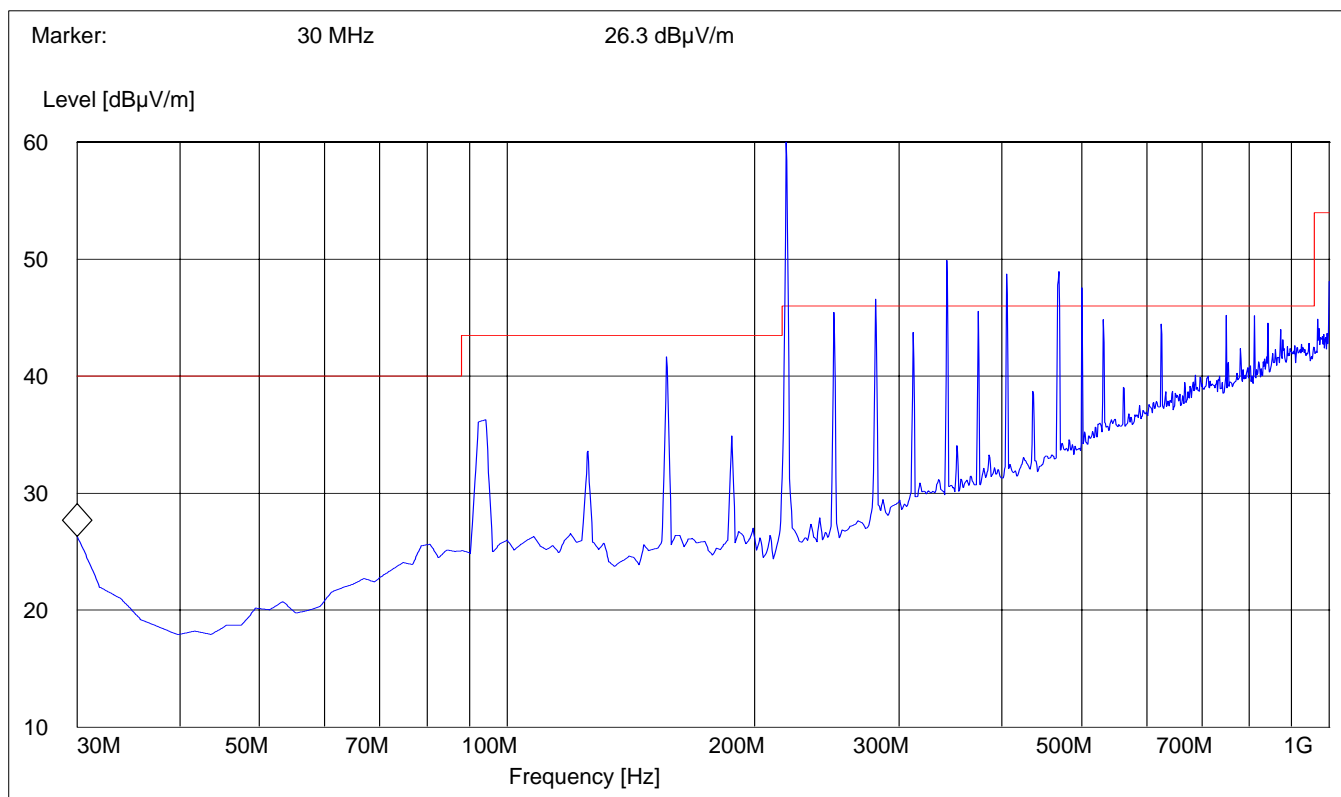
Antenna: Horizontal

Note: This plot is valid for low, mid, high channels for all data rates and power levels (worst-case plot) All peaks above the limit line are confirmed coming from test fixture. Refer to plots on next pages.

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



EMISSION LIMITATIONS - Radiated (Transmitter)
30MHz – 1GHz

§ 15.247 (c) (1)

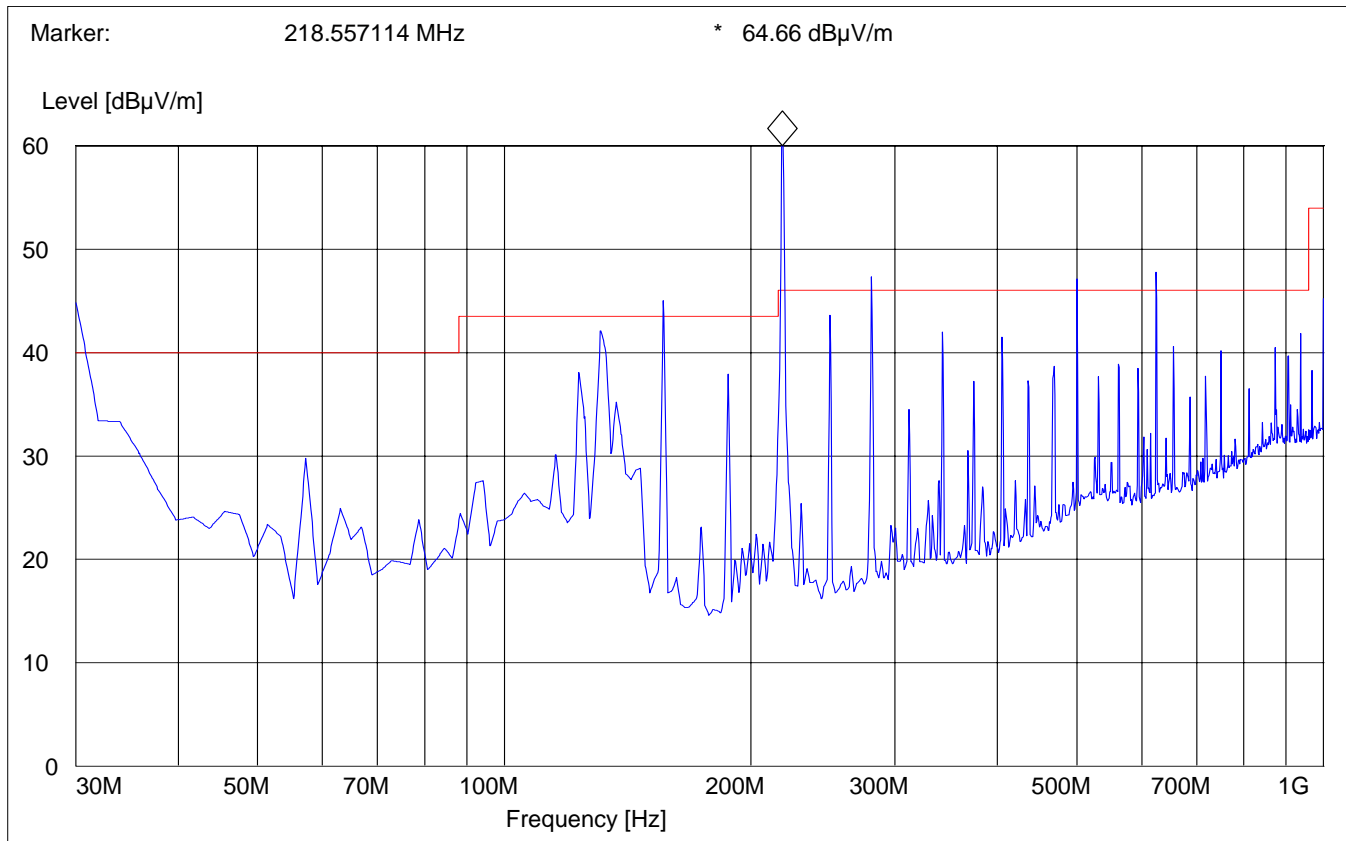
NOTE: Test fixture only

Antenna: Vertical

SWEEP TABLE:

Start	Stop	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)
30MHz – 1GHz

§ 15.247 (c) (1)

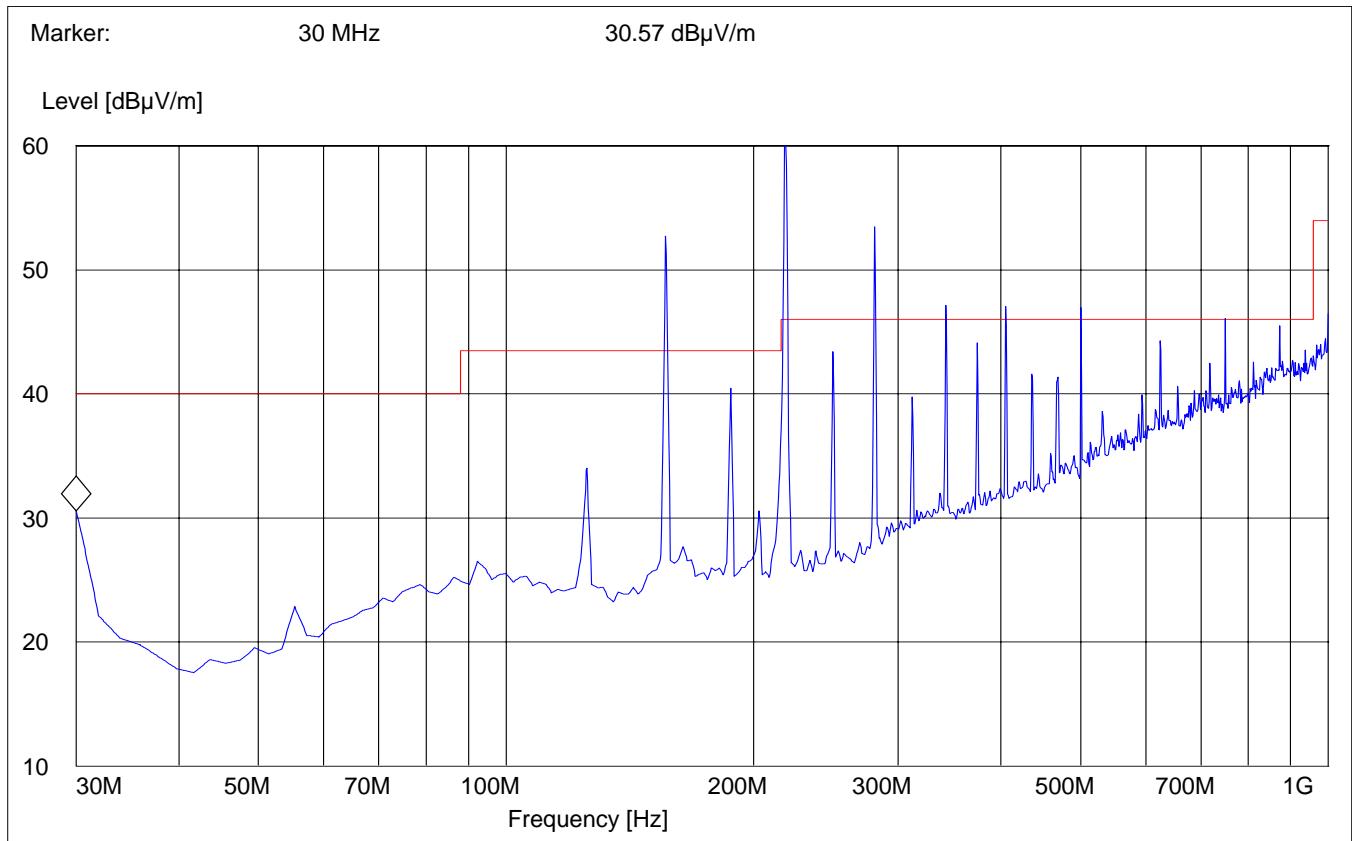
NOTE: Test fixture only

Antenna: Horizontal

SWEEP TABLE:

"Spuri hi 30-1G"

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)

Lowest Channel (2412MHz): 1GHz – 3GHz

Data rate: 54Mbps

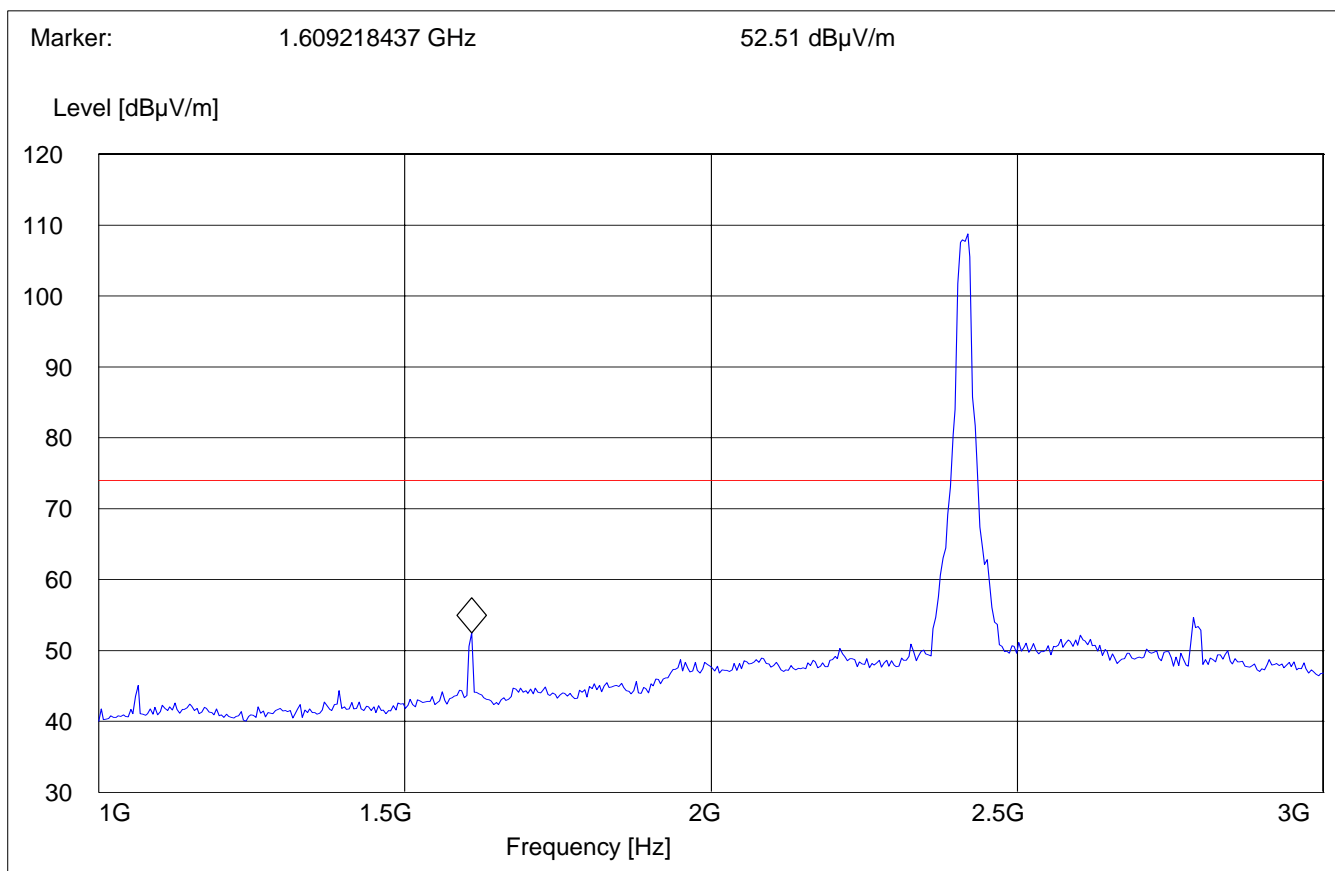
Power Level: 16.5dBm avg. power in packet

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

SWEEP TABLE:

"Spuri hi 1-3G"

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



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Lowest Channel (2412MHz): 3GHz – 18GHz

Data rate: 54Mbps

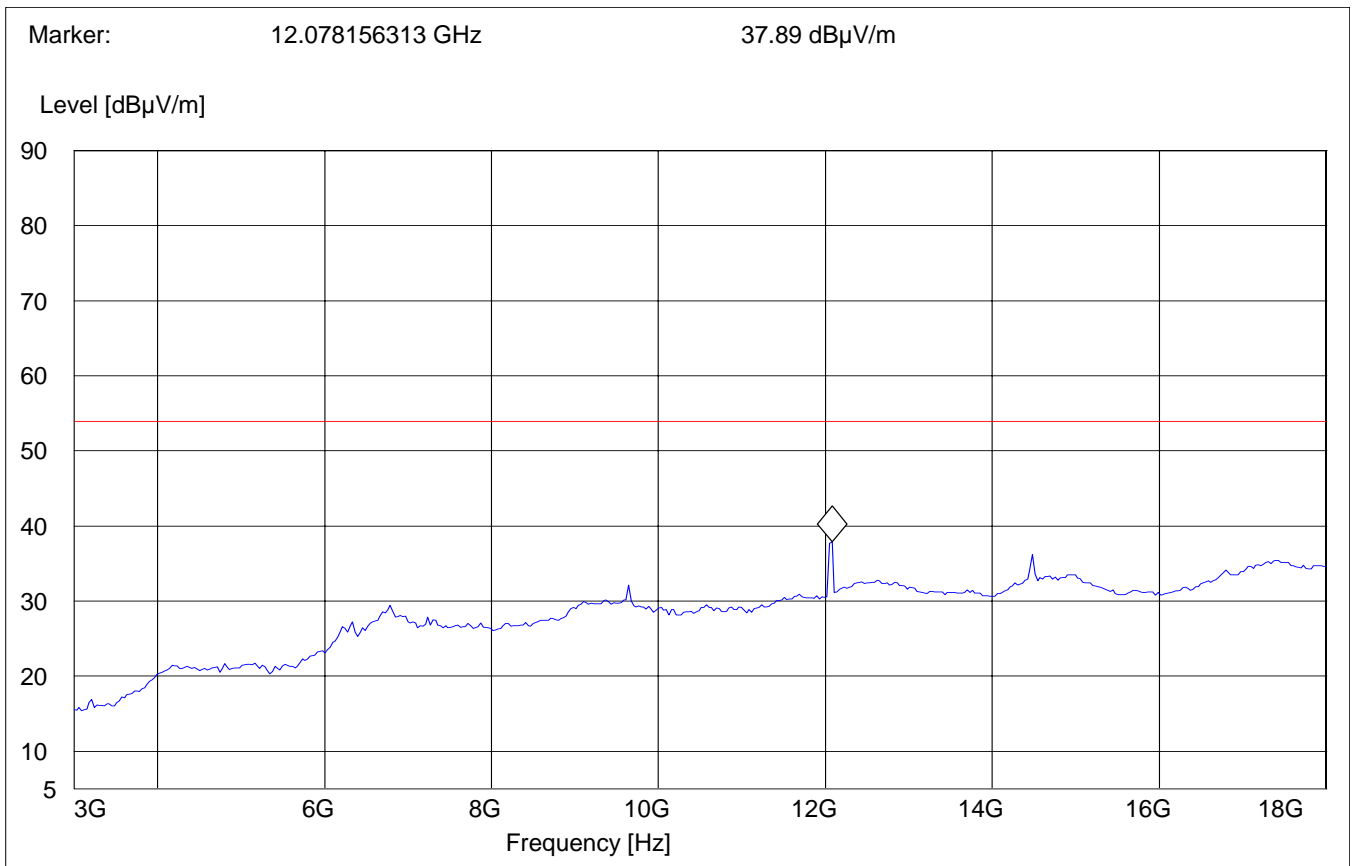
Power Level: 16.5dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

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



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

Lowest Channel (2412MHz): 3GHz – 18GHz

Data rate: 1Mbps

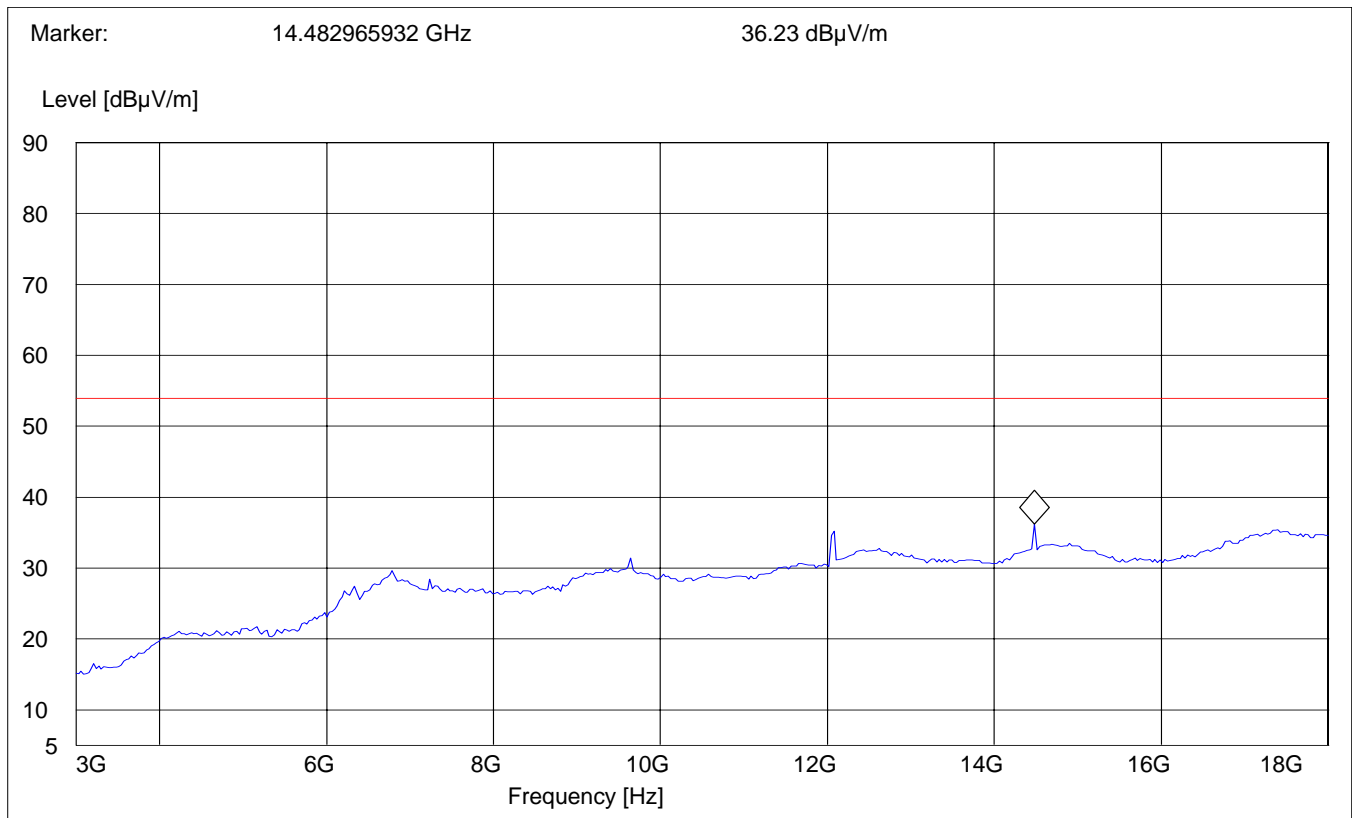
Power Level: 18dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

Start	Stop	Detector	Meas.	RBW	VBW	Transducer
Frequency	Frequency	Time	Bandw.			
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

Data rate: 54Mbps

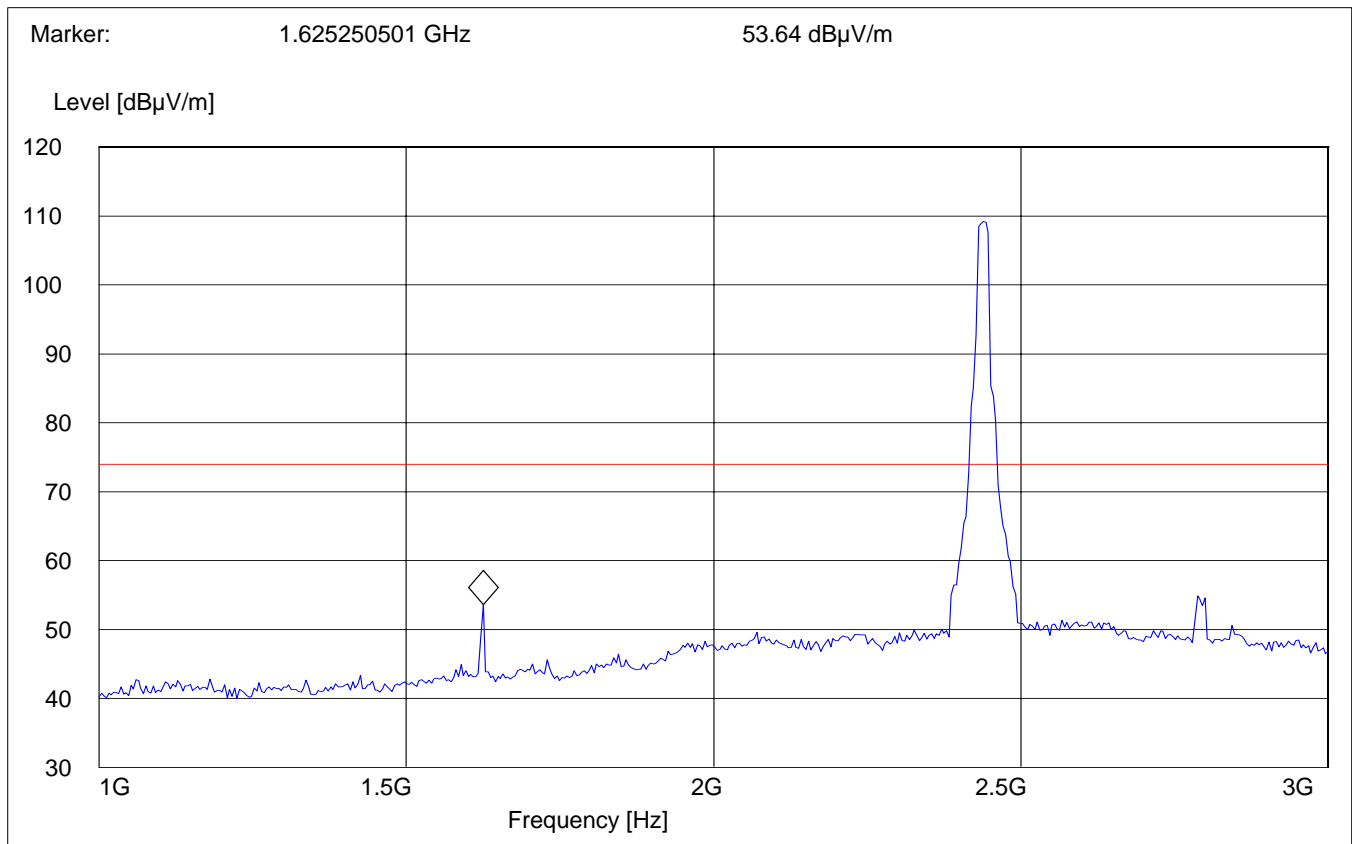
Power Level: 16.5dBm avg. power in packet

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)

§ 15.247 (c) (1)

Mid Channel (2437MHz): 3GHz – 18GHz

Data rate: 54Mbps

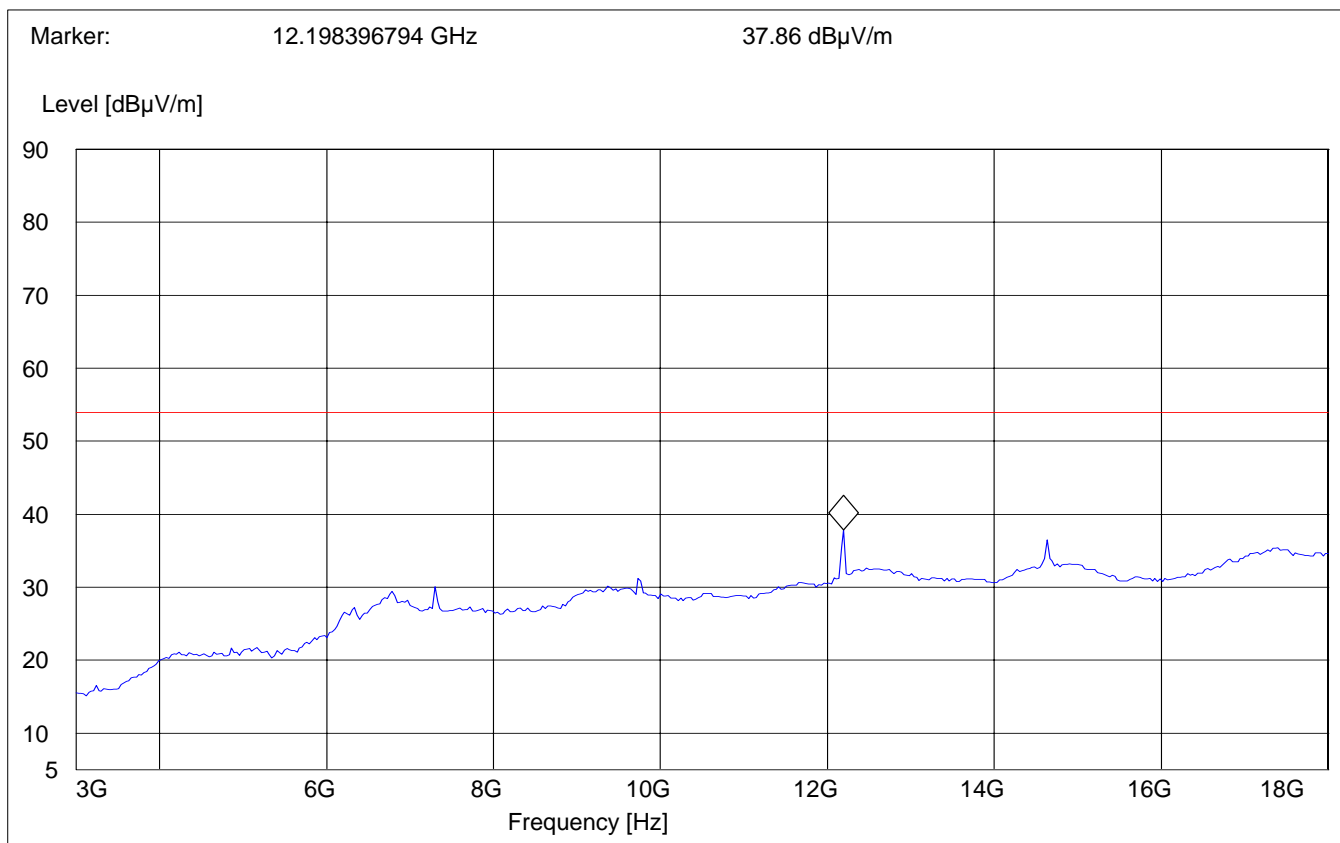
Power Level: 16.5dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

Start	Stop	Detector	Meas.	RBW	VBW	Transducer
Frequency	Frequency	Time	Bandw.			
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): 3GHz – 18GHz

Data rate: 1Mbps

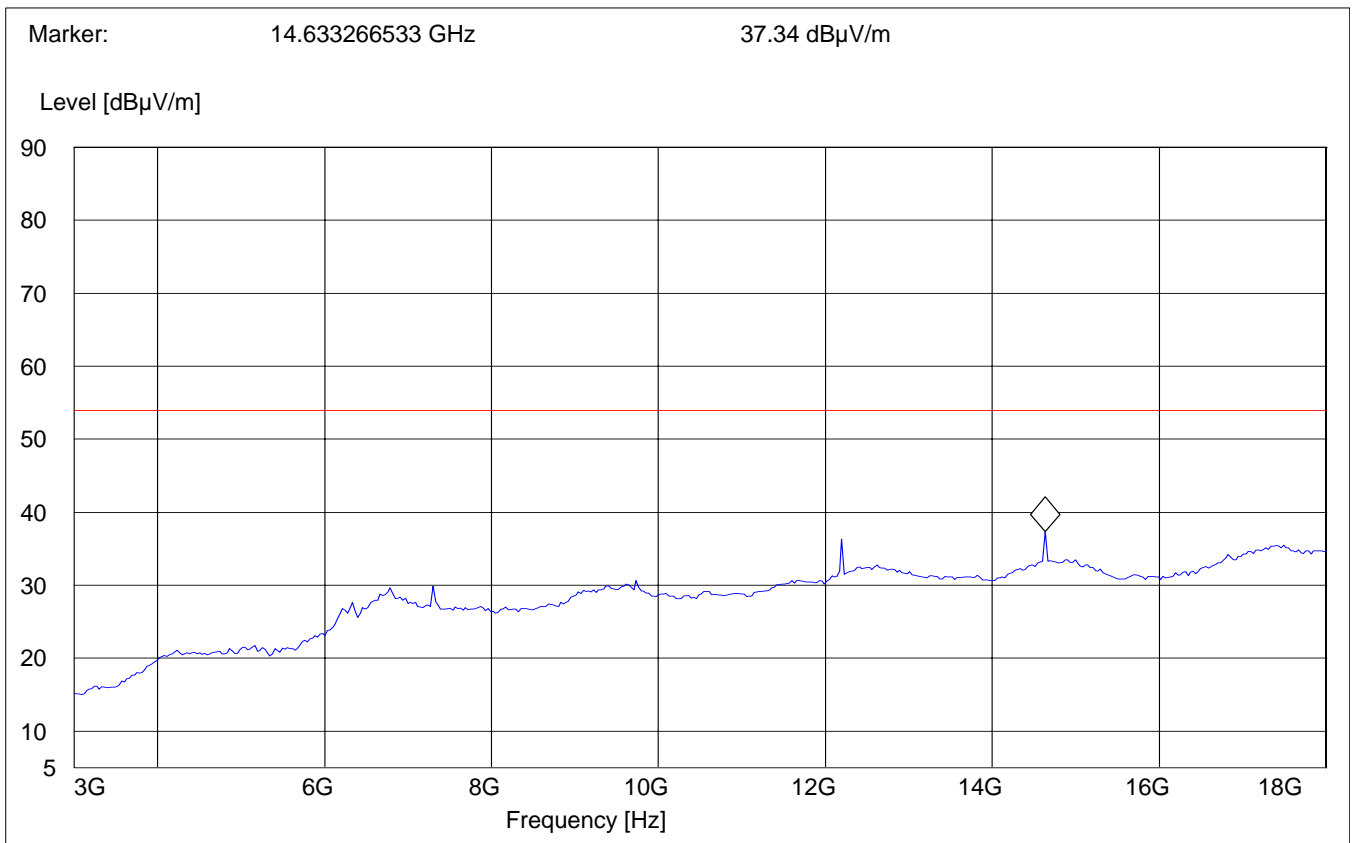
Power Level: 18dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

Start	Stop	Detector	Meas.	RBW	VBW	Transducer
Frequency	Frequency	Time	Bandw.			
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

Data rate: 54Mbps

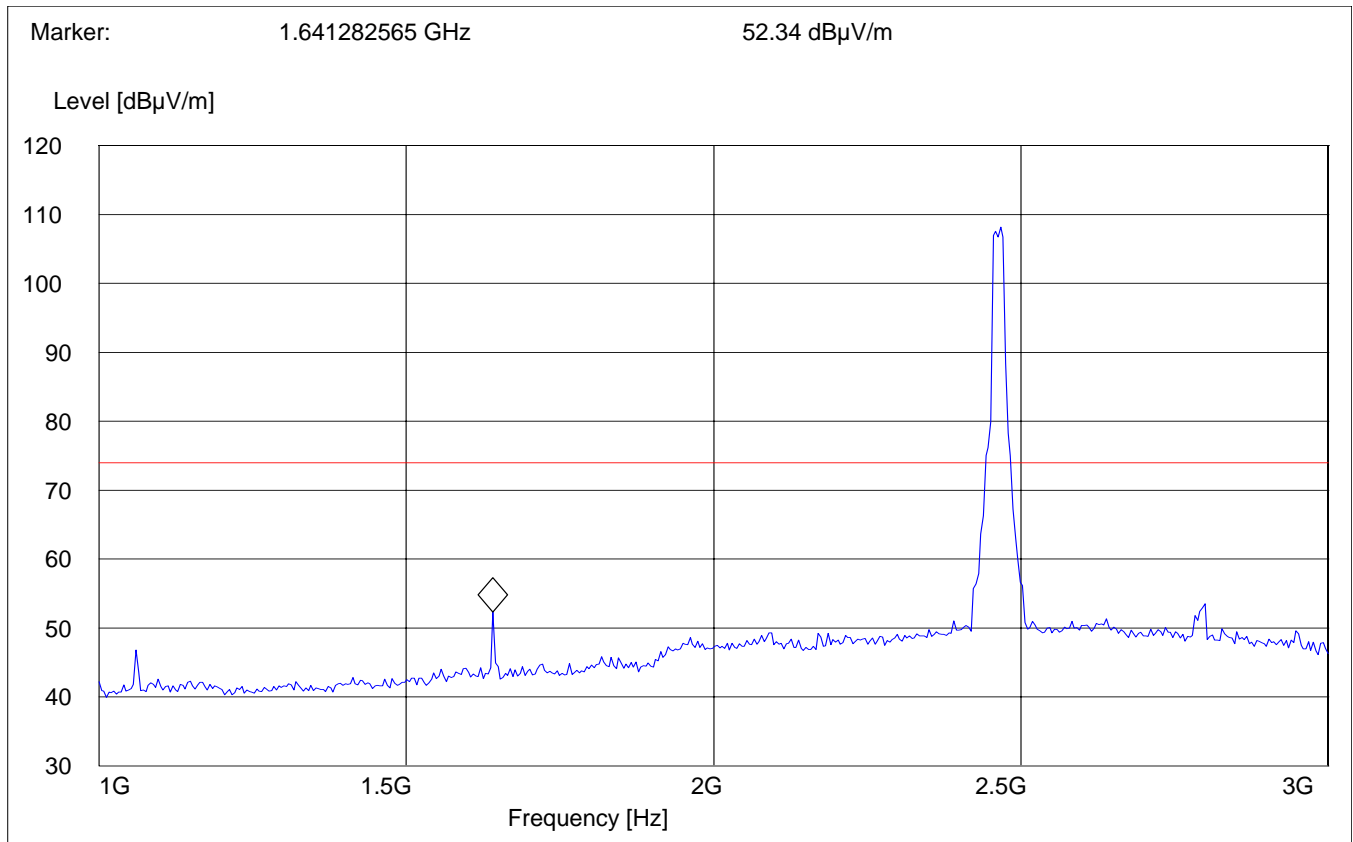
Power Level: 16.5dBm avg. power in packet

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)

§ 15.247 (c) (1)

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

Data rate: 54Mbps

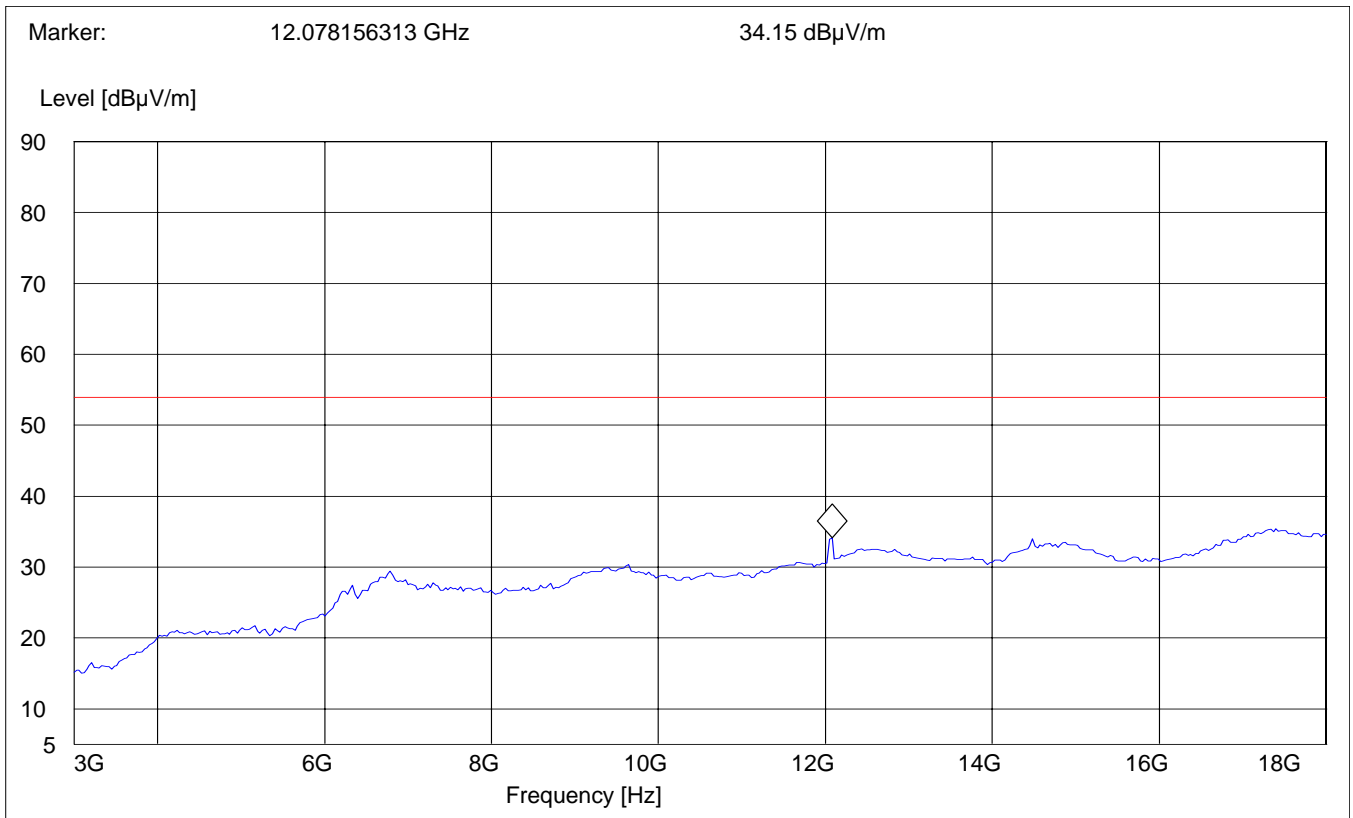
Power Level: 16.5dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

Start	Stop	Detector	Meas.	RBW	VBW	Transducer
Frequency	Frequency	Time	Bandw.			
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): 3GHz – 18GHz

Data rate: 1Mbps

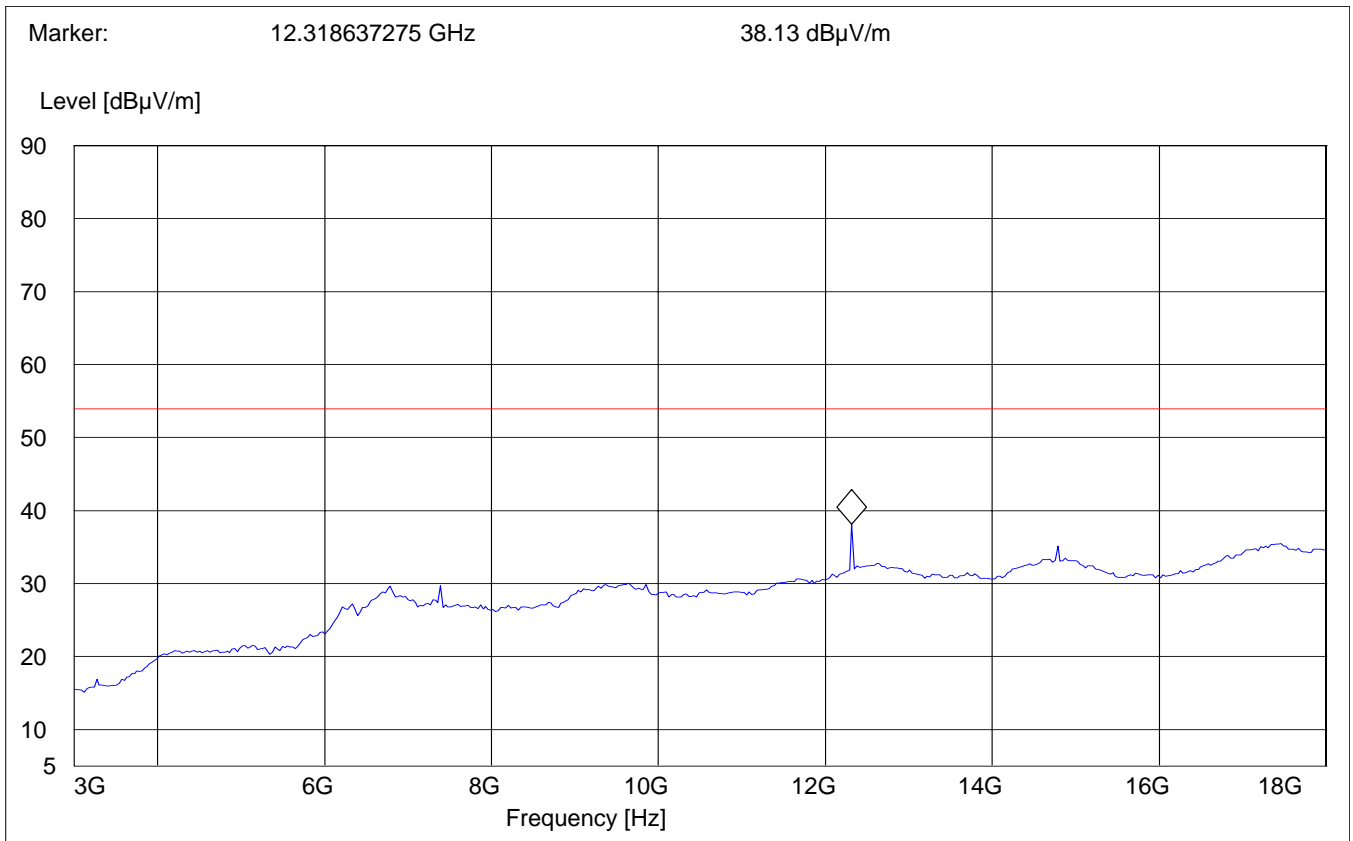
Power Level: 18dBm avg. power in packet

Average Measurement

SWEEP TABLE:

"Spuri hi 3-18G"

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

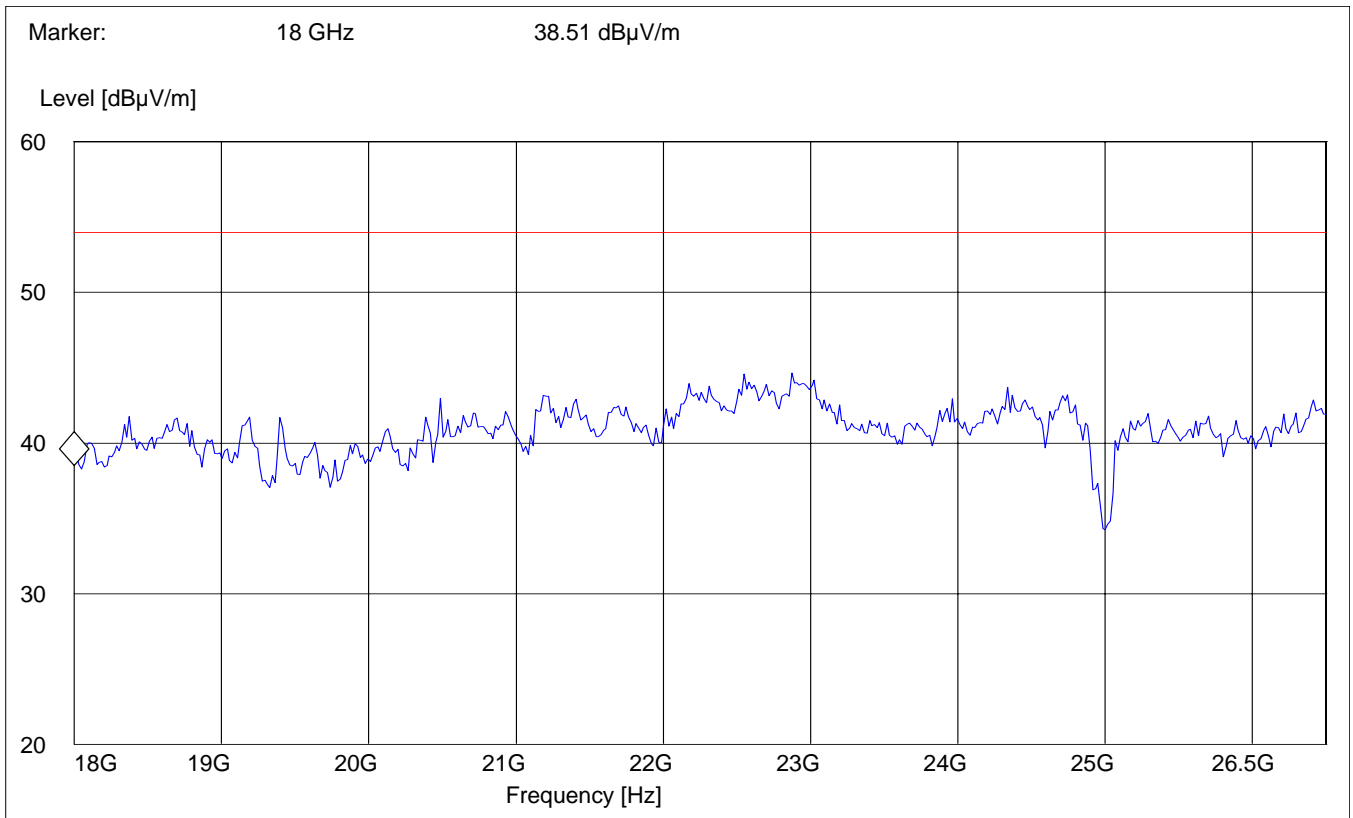
Data rate: 54Mbps

Power Level: 16.5dBm avg. power in packet

SWEEP TABLE:

"Spuri hi 18-26.5G"

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	26.5 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)

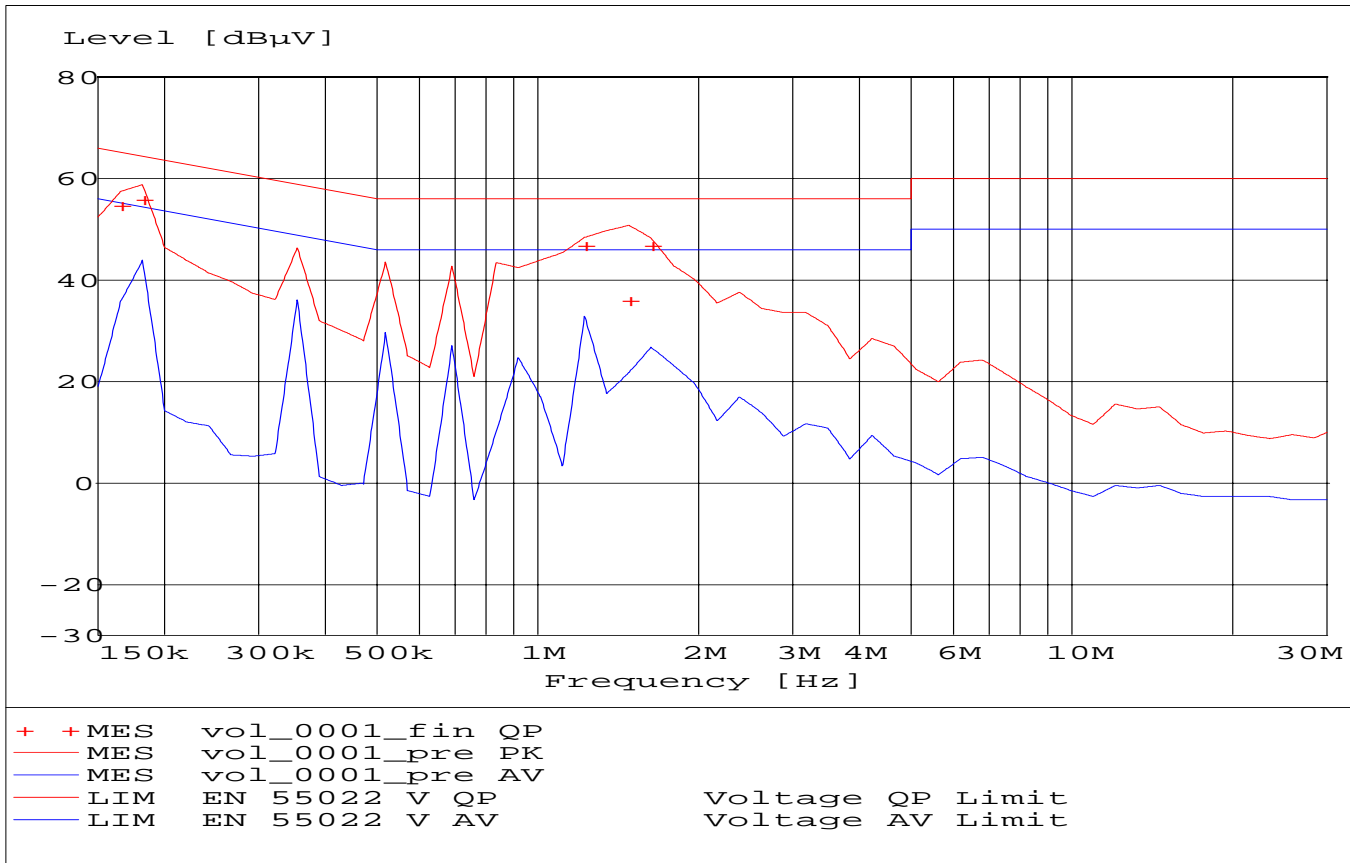
Limit

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



MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Line	PE
0.165000	54.70	0.0	65	10.5	2	---
0.181500	55.90	0.0	64	8.5	1	---
1.221041	46.80	0.0	56	9.2	2	---
1.477460	35.90	0.0	56	20.1	1	---
1.625206	46.90	0.0	56	9.1	1	---

RECEIVER SPURIOUS RADIATION**§ 15.109****Limits**

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	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:

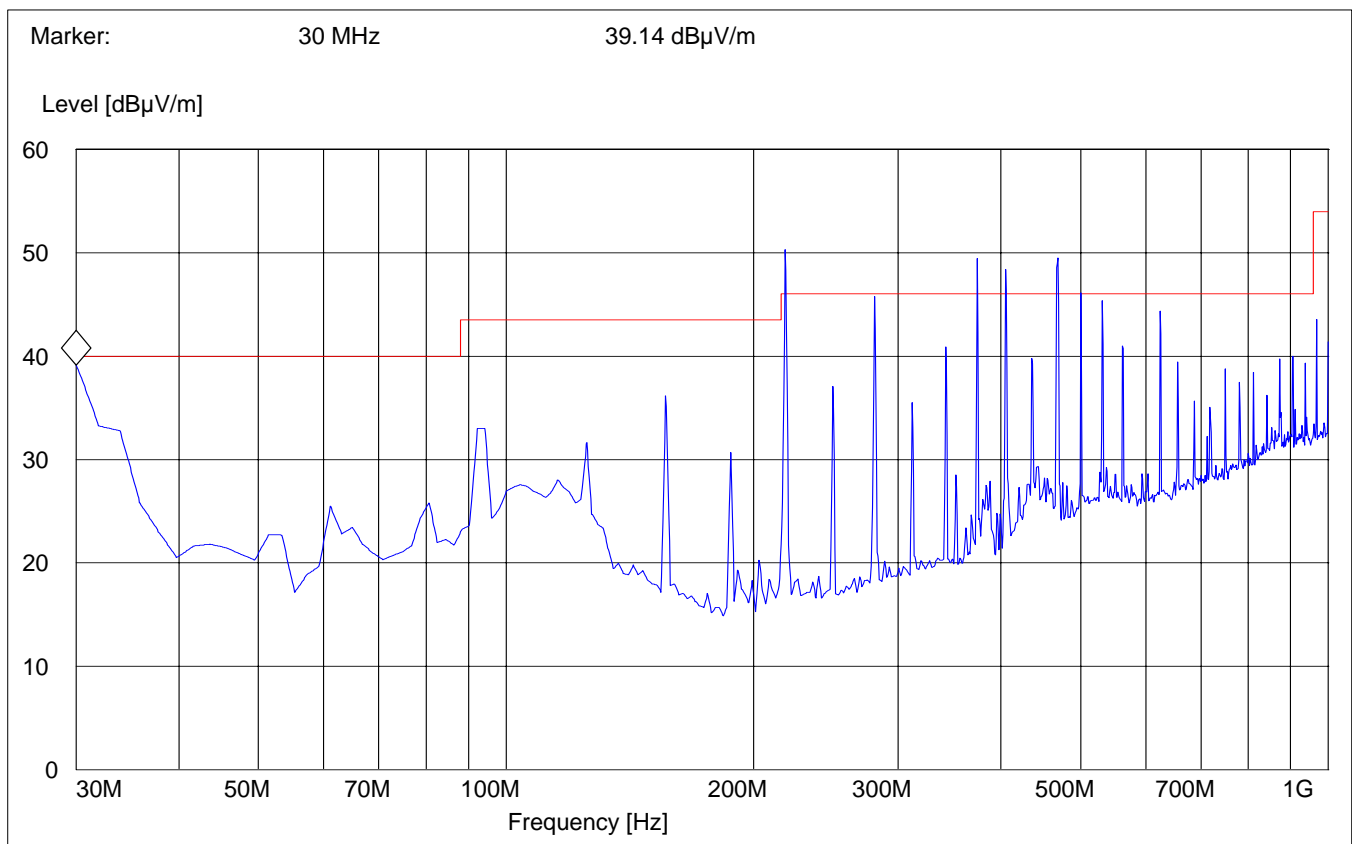
The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 26.5 GHz very short cable connections to the antenna was used to minimize the noise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

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

§ 15.109

Note: This plot is valid for both polarities (worst-case plot). All peaks above the limit line are confirmed coming from test fixture. Refer to plot on next page.

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



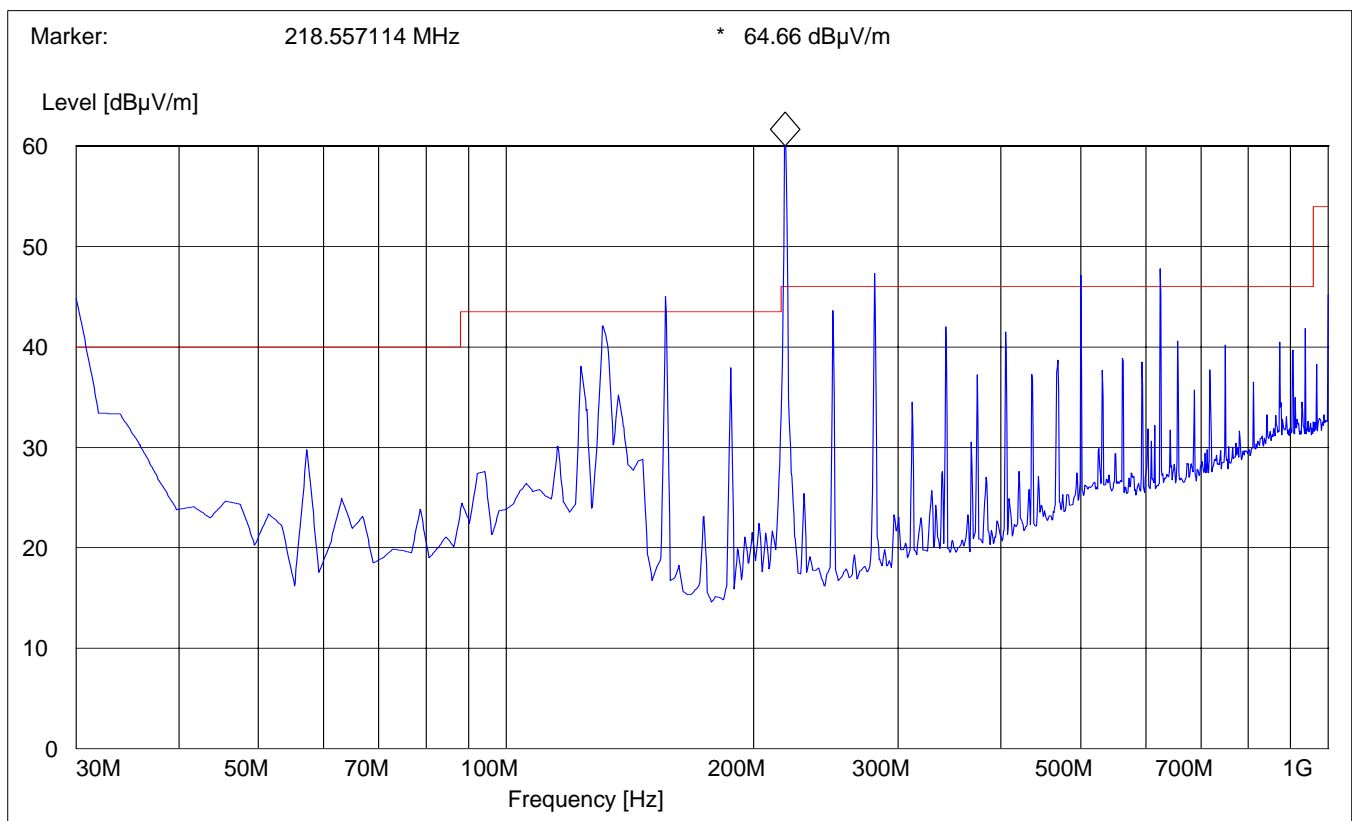
RECEIVER SPURIOUS RADIATION

§ 15.109

30MHz – 1GHz

Test fixture only

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

§ 15.109

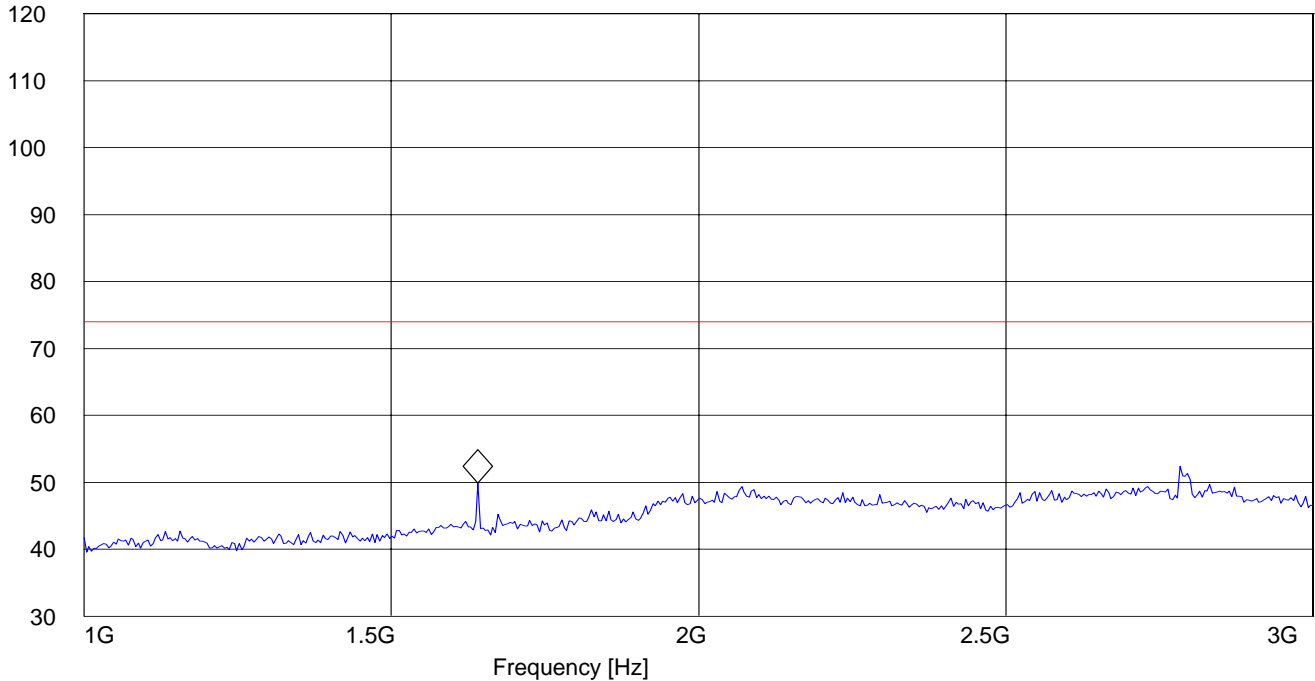
SWEEP TABLE:

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"

Marker: 1.641282565 GHz 49.94 dBµV/m

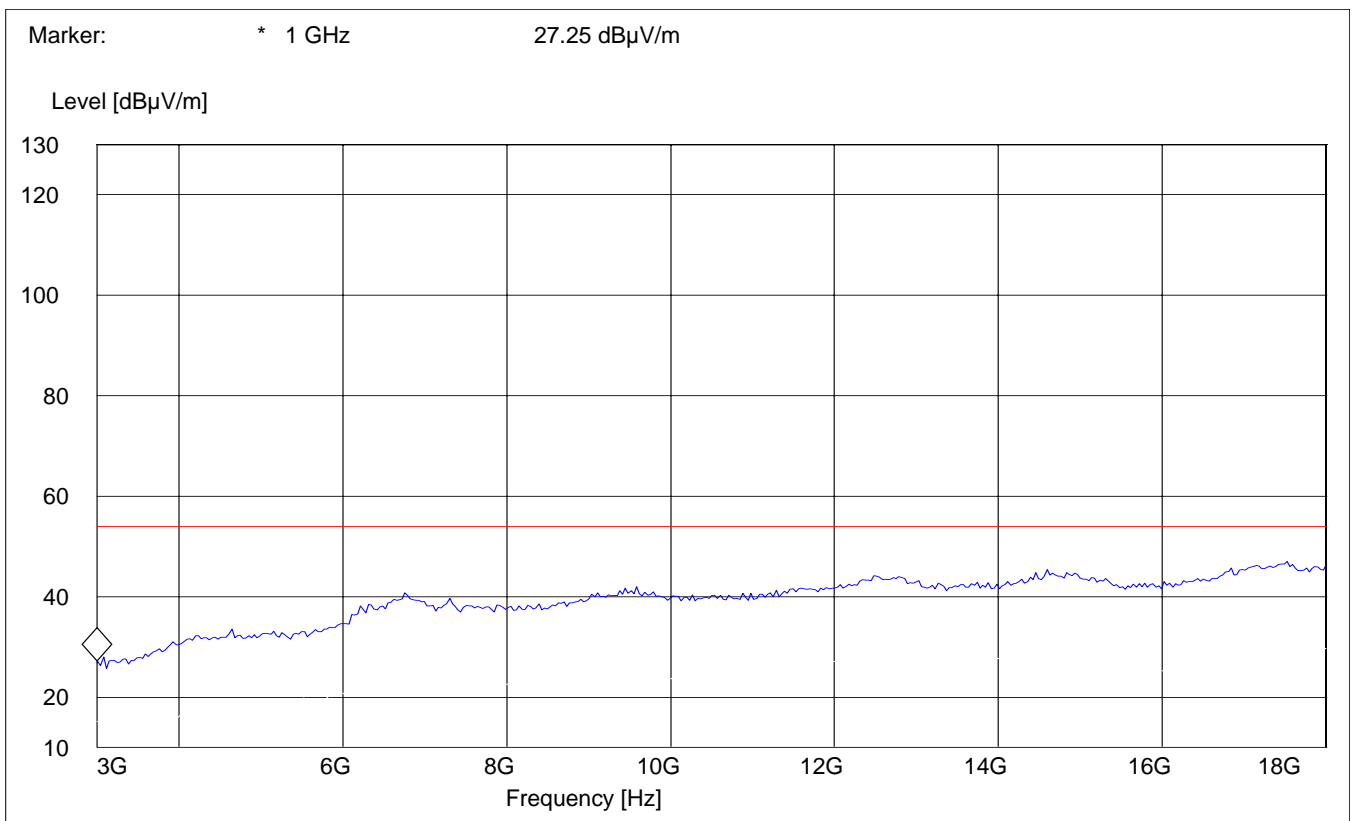
Level [dBµV/m]



RECEIVER SPURIOUS RADIATION
3GHz – 18GHz

§ 15.109

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)

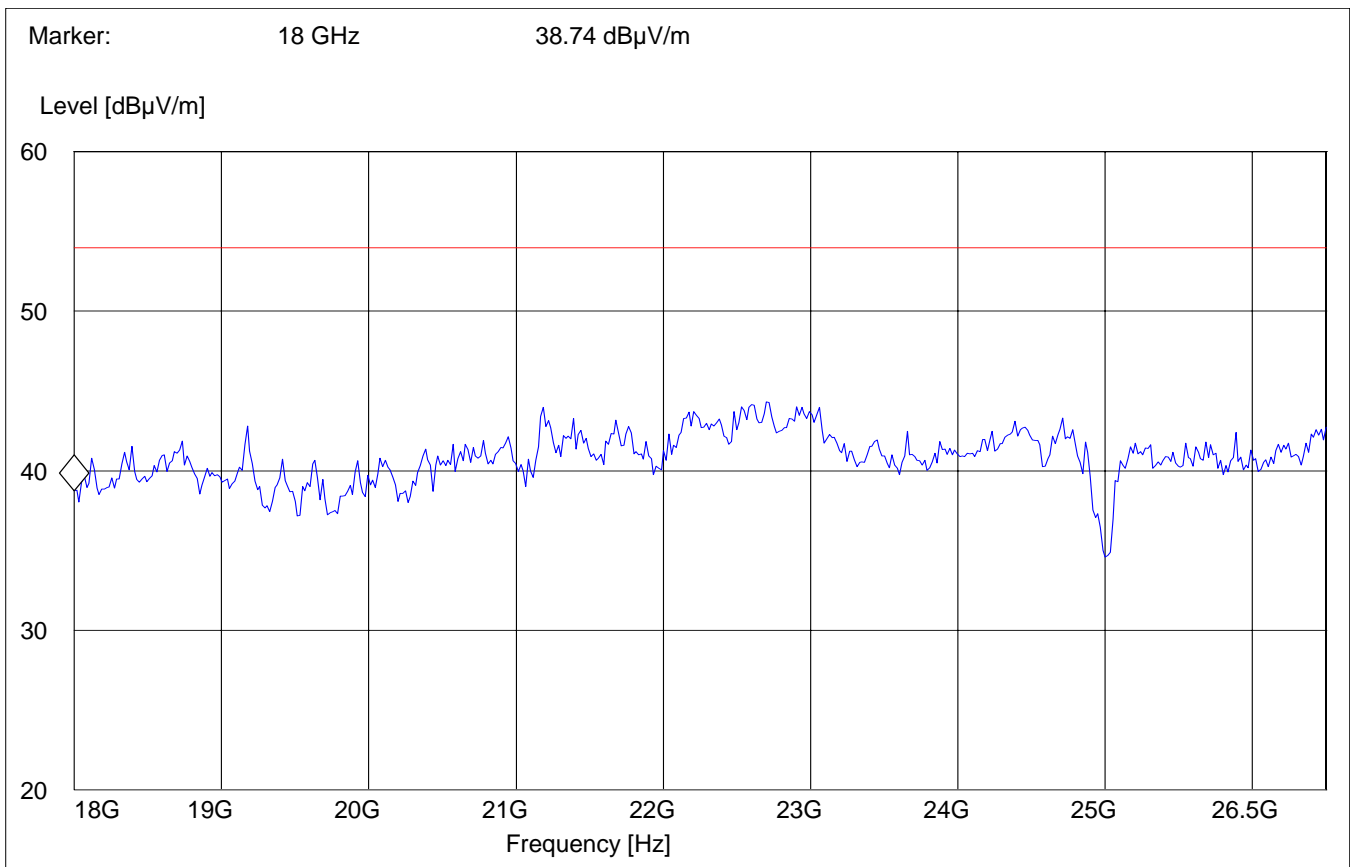


RECEIVER SPURIOUS RADIATION
18GHz – 26.5GHz

§ 15.109

SWEEP TABLE: "Spuri hi 18-26.5G"

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

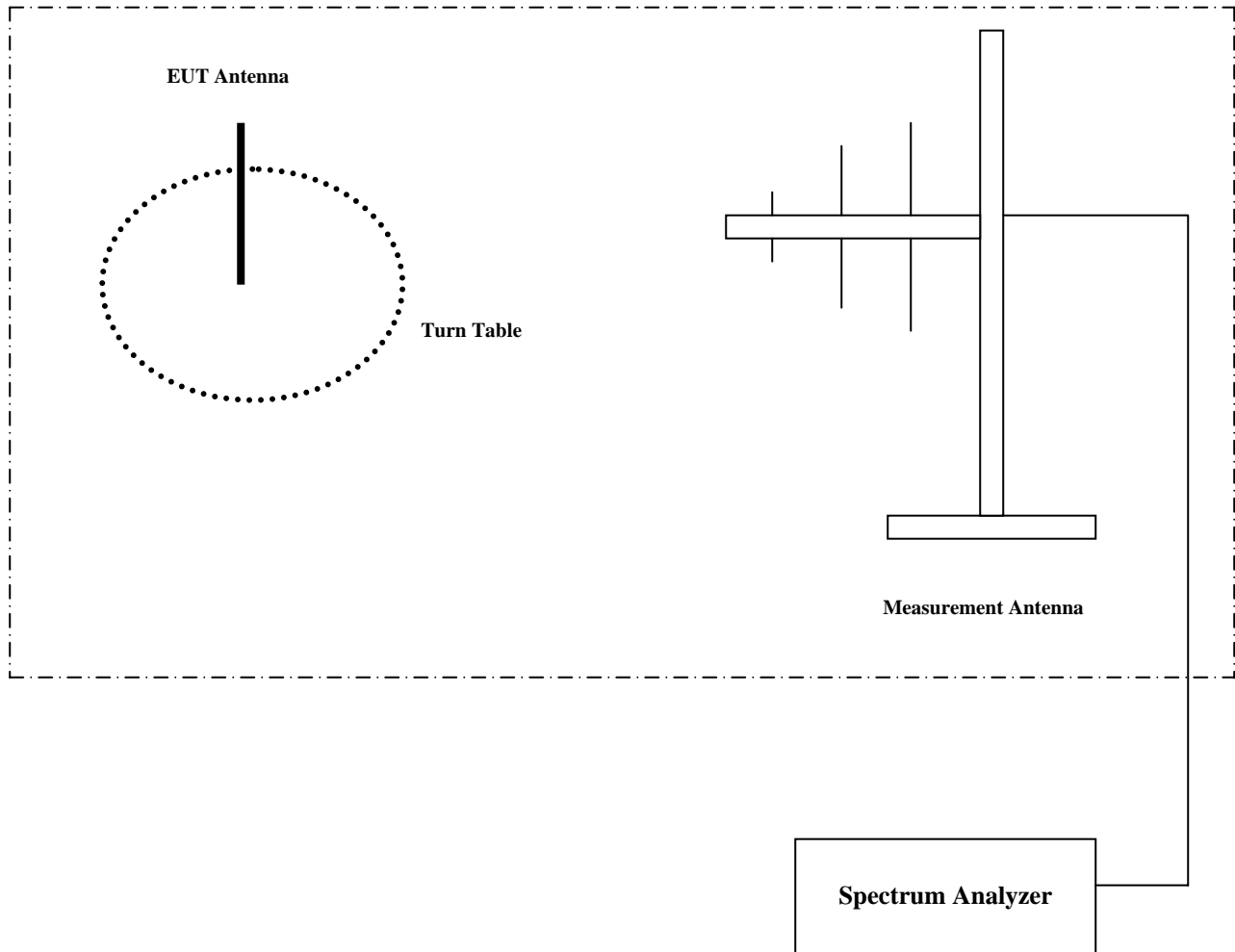


TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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	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



Conducted Testing

