



FCC Test Report

Test report no.: EMC_448-2003FCC15.247_IX104-12
FCC Part 15.247 for DSSS systems / CANADA RSS-210
(iX104-12)

FCC ID: Q2GIX104-111



TTI-P-G 081/94-A0

Accredited according to **ISO/IEC 17025**



FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

411 Dixon Landing Road • Milpitas, CA 95035 • U.S.A.

Phone: + 1 (408) 586 6200 • Fax: + 1 (408) 586 6299 • E-mail: info@cetecomusa.com • <http://www.cetecom.com>

CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686

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: Philip Kim**

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 : Xplore Technologies
Street : 11675 Jollyville Road, Suite 150
City / Zip Code : Austin, TX 78759
Country : USA
Contact : Douglas L. Fowler
Telephone : 512-336-7797
Tele-fax : 512-336-7791
e-mail : dfowler@xploretech.com

1.4 Application details

Date of receipt of application : 2003-03-24
Date of receipt test item : 2003-03-24
Date of test : 2003-03-24~2003-03-28

1.5 Test item

Manufacturer : Winston Corporation
Street : 21F, 88, Sec. 1, Hsin Tai Wu Rd, Hsichih
City / Zip Code : Taipei Hsien 221
Country : Taiwan, R.O.C.
Marketing Name : IX104
Model No. : iX104-12
Description : Tablet PC with Wireless LAN
FCC-ID : Q2GIX104-111

Additional information

Frequency : 2400MHz (WLAN)
Type of modulation :
Number of channels : 2400: 11 Channels
Antenna : Internal
Power supply : 9-18Vdc
Output power : WLAN = 112mW (Max)
Extreme temp. Tolerance : Lower:-20°C Upper: 60°C

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

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

Note: Please refer to the test reports J99013298B for conducted results. Otherwise, this report contains only radiated results for the Tablet PC with embedded PCMCIA card and antenna. The PCMCIA card is unchanged from the tested configuration in report J99013298B.

Technical responsibility for area of testing:

2003-04-22 EMC & Radio Lothar Schmidt (Manager)



Date

Section

Name

Signature

Responsible for test report and project leader:

2003-04-08 EMC & Radio Philip Kim(EMC Engineer)



Date

Section

Name

Signature

2.2 Test report

TEST REPORT

**Test report no.: EMC_448-2003FCC15.247_IX104-12
(iX104-12)**

TEST REPORT REFERENCE

LIST OF MEASUREMENTS		PAGE
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MAXIMUM PEAK OUTPUT POWER**§ 15.247 (b) (1)****(RADIATED)****Note:** EIRP is calculated from the following equation:**EIRP = Conducted power (Measured) + Antenna Gain (Measured)****Antenna Gain was measured with a different WLAN card using the same tablet PC and antenna (results from Report EMC_448-2003FCC15.247_IX104-11).****EIRP:**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402MHz	2441MHz	2480MHz
T _{nom} (23)°C	V _{nom} (5.0) VDC	19.4	18.34	18.27
Measurement uncertainty		±0.5dBm		

RBW/VBW: 10MHz**LIMIT****SUBCLAUSE § 15.247 (b) (1)**

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

BAND EDGE COMPLIANCE

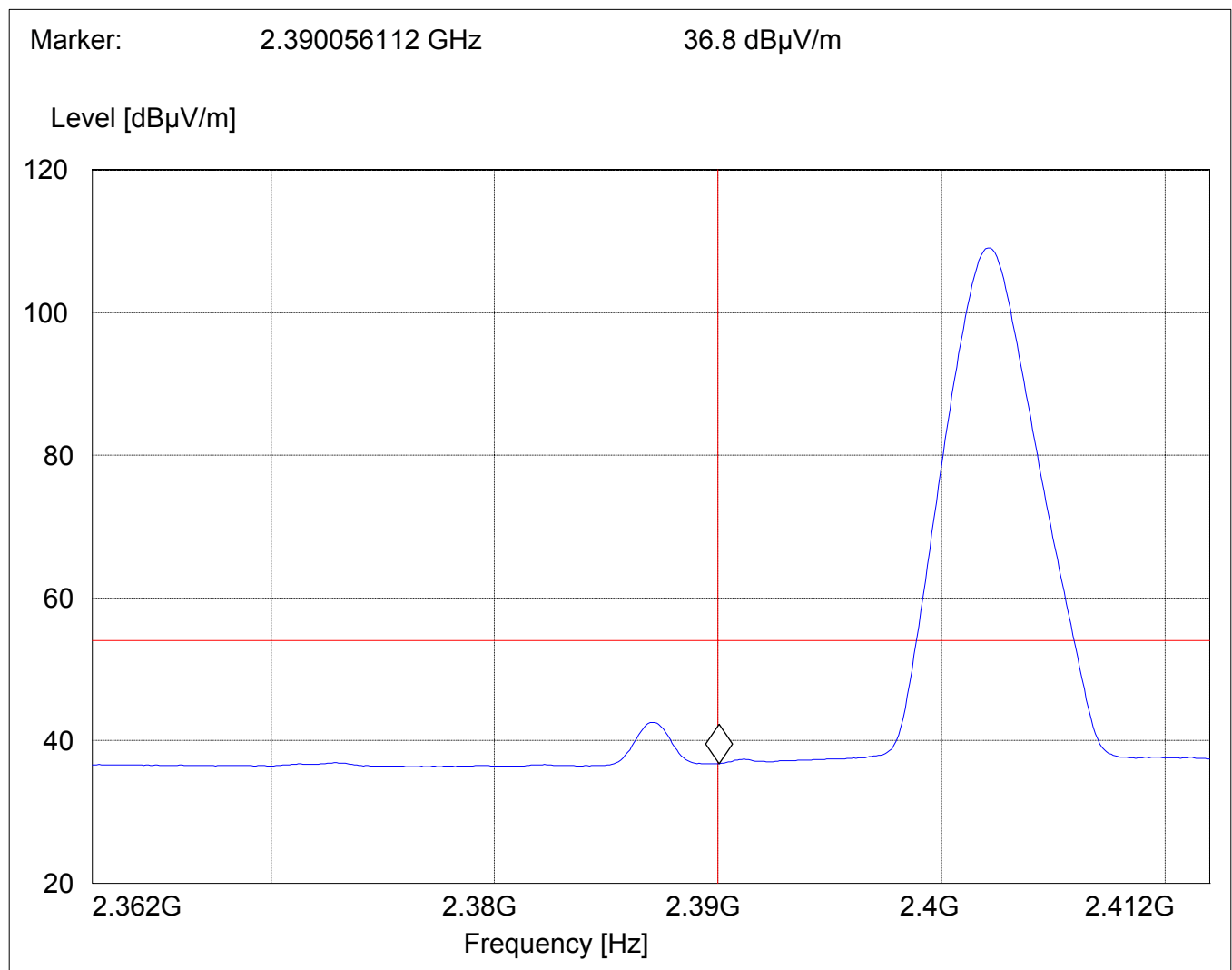
§15.247 (c)

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



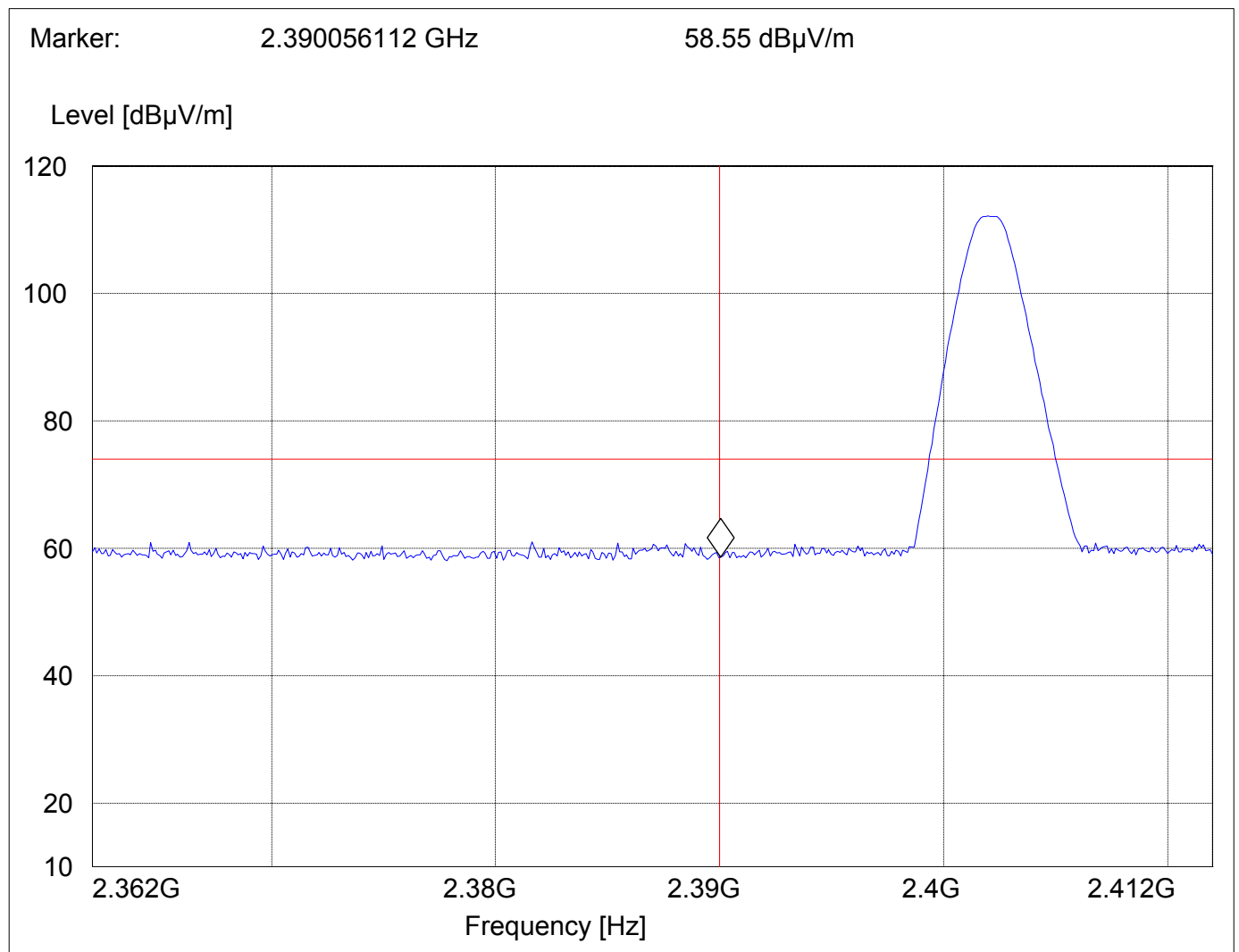
BAND EDGE COMPLIANCE

§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 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)

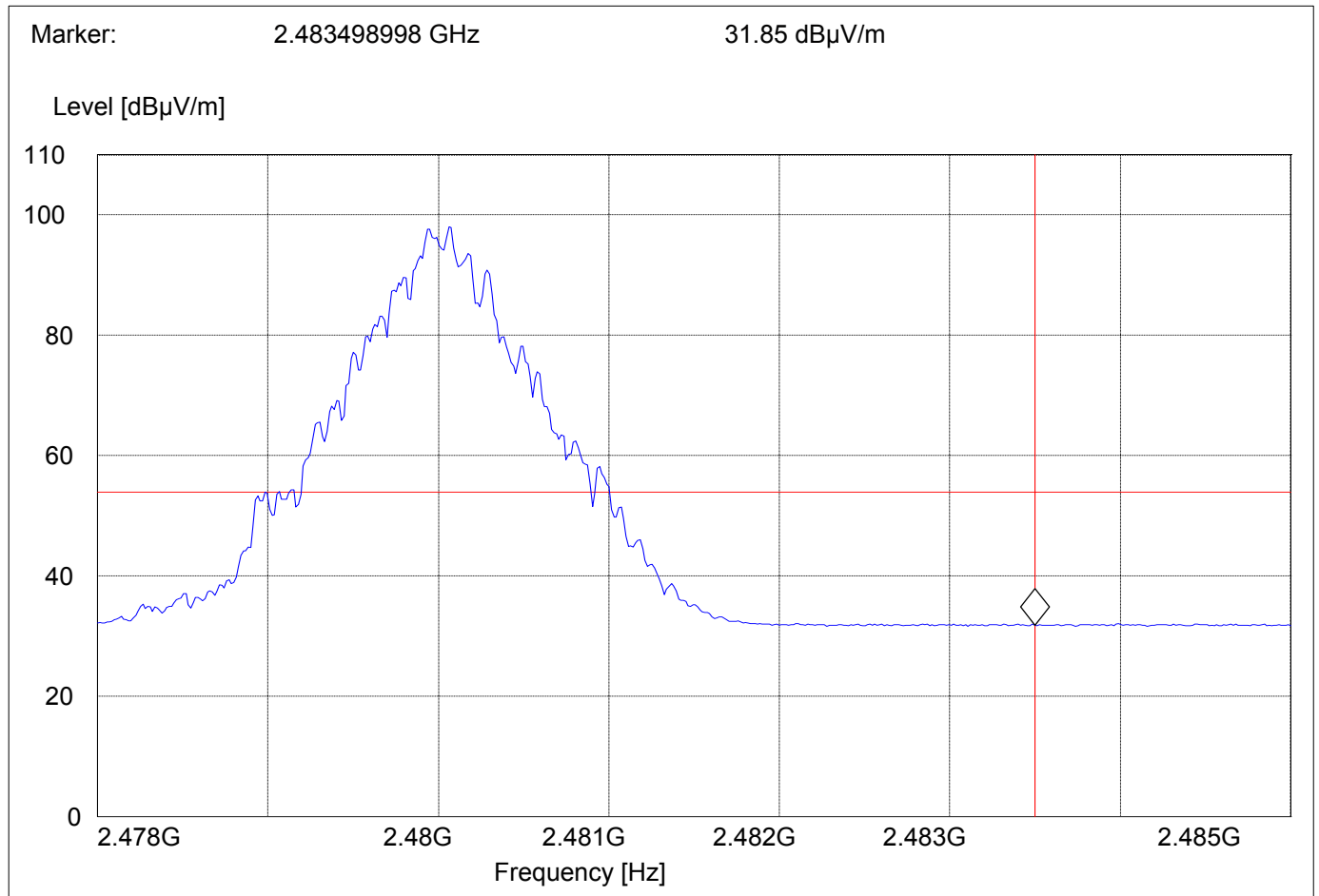
(Average measurement)

Note: Delta Marker method was applied in this test. Plot only displays the 30KHz RBW.

Calculations are explained under Marker-Delta Method page 16.

Operating condition : Tx at 2472MHz
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	30 KHz	10Hz	#326 horn (dBi)



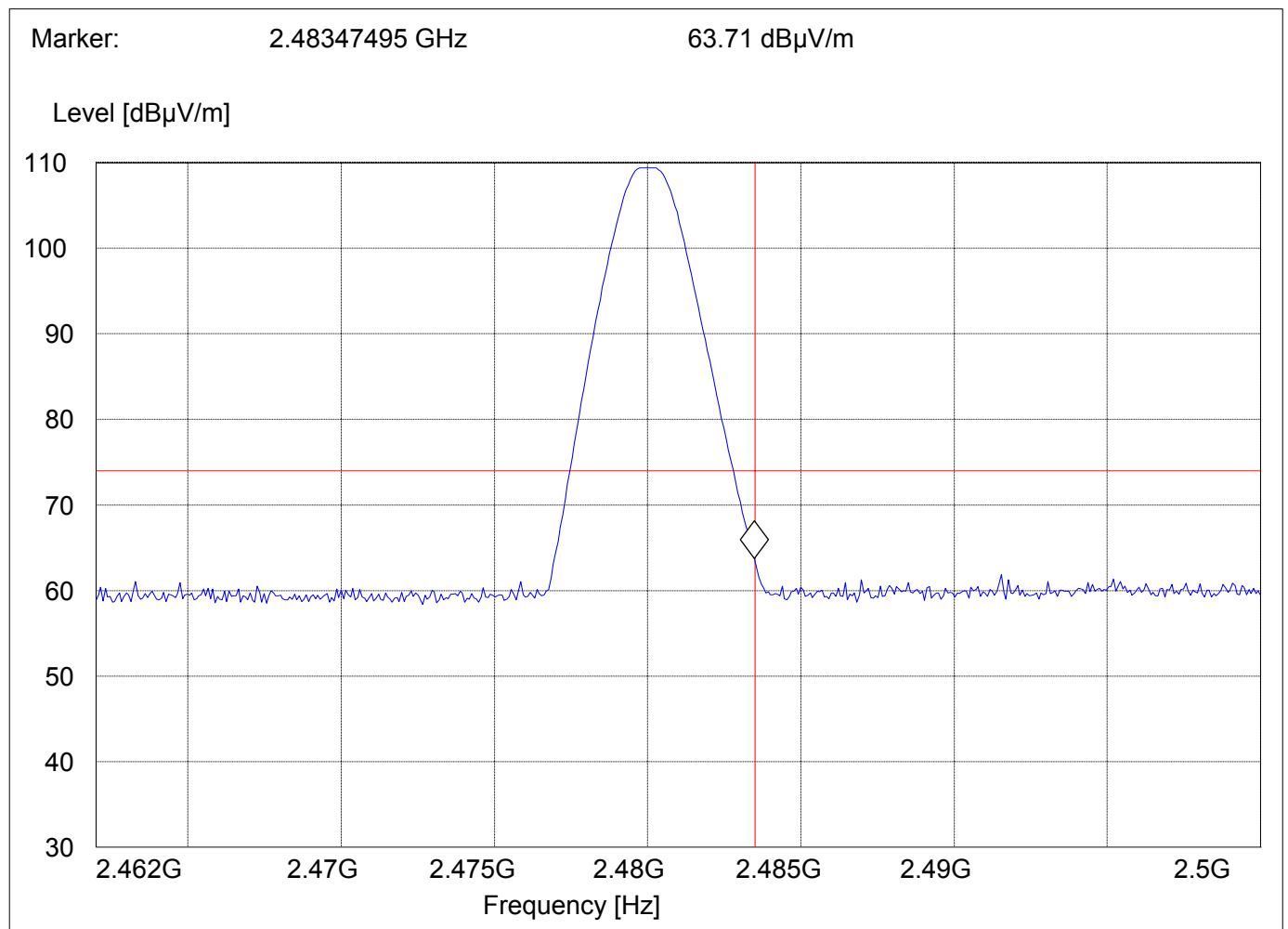
BAND EDGE COMPLIANCE

§15.247 (c)

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

Operating condition : Tx at 2472MHz
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)



Calculation for Marker-Delta Method

1) In-band field strength measurement of the fundamental emission using the RBW and detector function required by C63.4 and FCC Rules for the frequency being measured:

106.49dBuV/m

2) Analyzer RBW to 1% of the total span (but never less than 30kHz) with a video bandwidth equal to or greater than the RBW. The peak levels of the fundamental emission is 98.02dBuV and relevant band-edge emission is 31.85dBuV.

Delta from step 2 is $98.02 - 31.85 = 66.17\text{dB}$

3) Subtract the delta measured in step 2 (66.17dB) from the field strengths measured in step 1 (106.49dBuV/m) therefore ($106.49\text{dBuV/m} - 66.17\text{dB} = 40.32\text{dBuV/m}$).

FCC Limit from §15.205.

54dBuV/m (Avg)

Margin

$54\text{dBuV/m} - 40.32\text{dBuV/m} = 13.68\text{dB}$

EMISSION LIMITATIONS**§ 15.247 (c) (1)****Transmitter (Radiated)****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.
3. 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)**

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 (dBµV/m)		
	Peak	Quasi-Peak	Average
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF
Transmit at Middle channel Frequency 2440MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Quasi-Peak	Average
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF
Transmit at Highest channel Frequency 2480MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Quasi-Peak	Average
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF
	NF	NF	NF

Note: NF = No significant peak found.

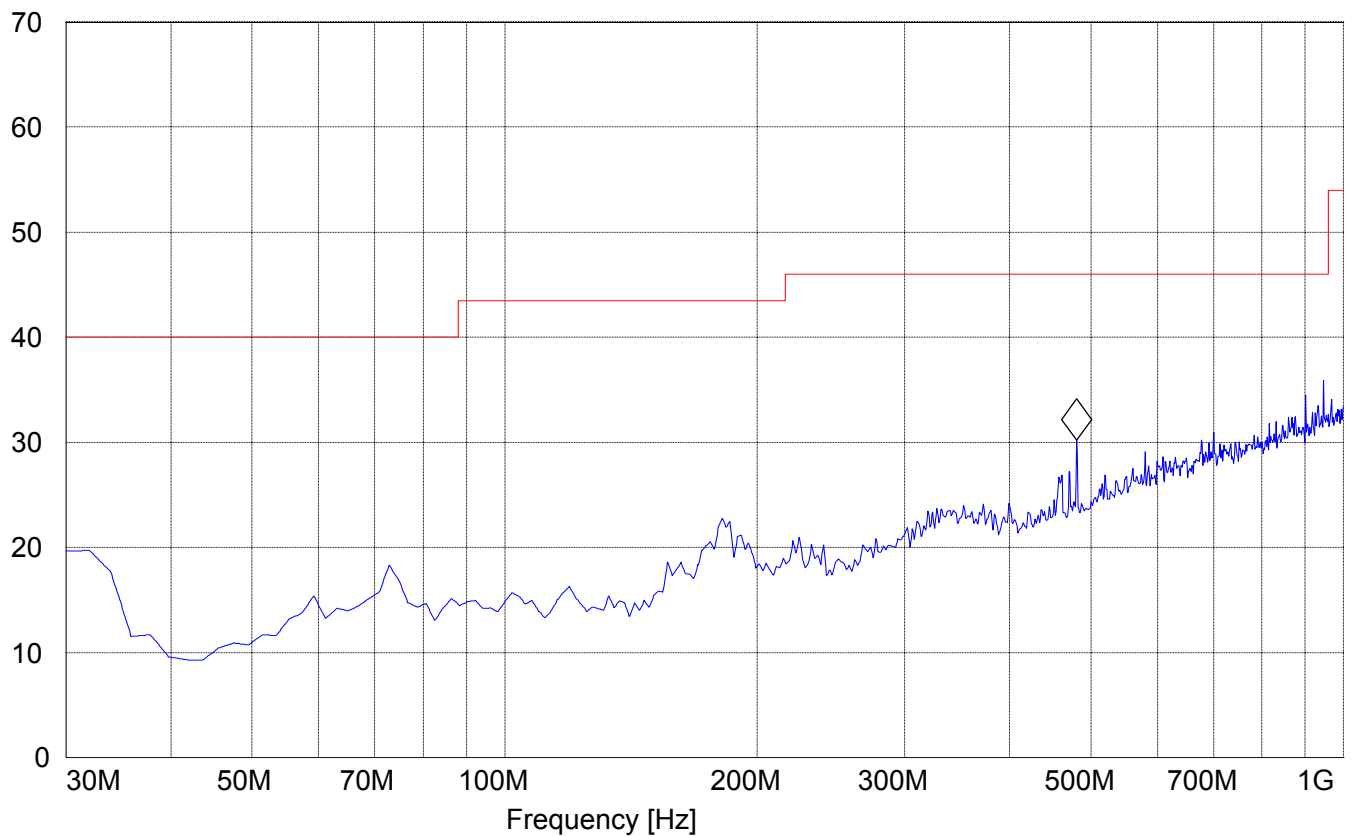
EMISSION LIMITATIONS - Radiated (Transmitter)
Lowest Channel (2402MHz): 30MHz – 1GHz

§ 15.247 (c) (1)

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

Marker: 480.981964 MHz 30.24 dBµV/m

Level [dBµV/m]



EMISSION LIMITATIONS - Radiated (Transmitter)

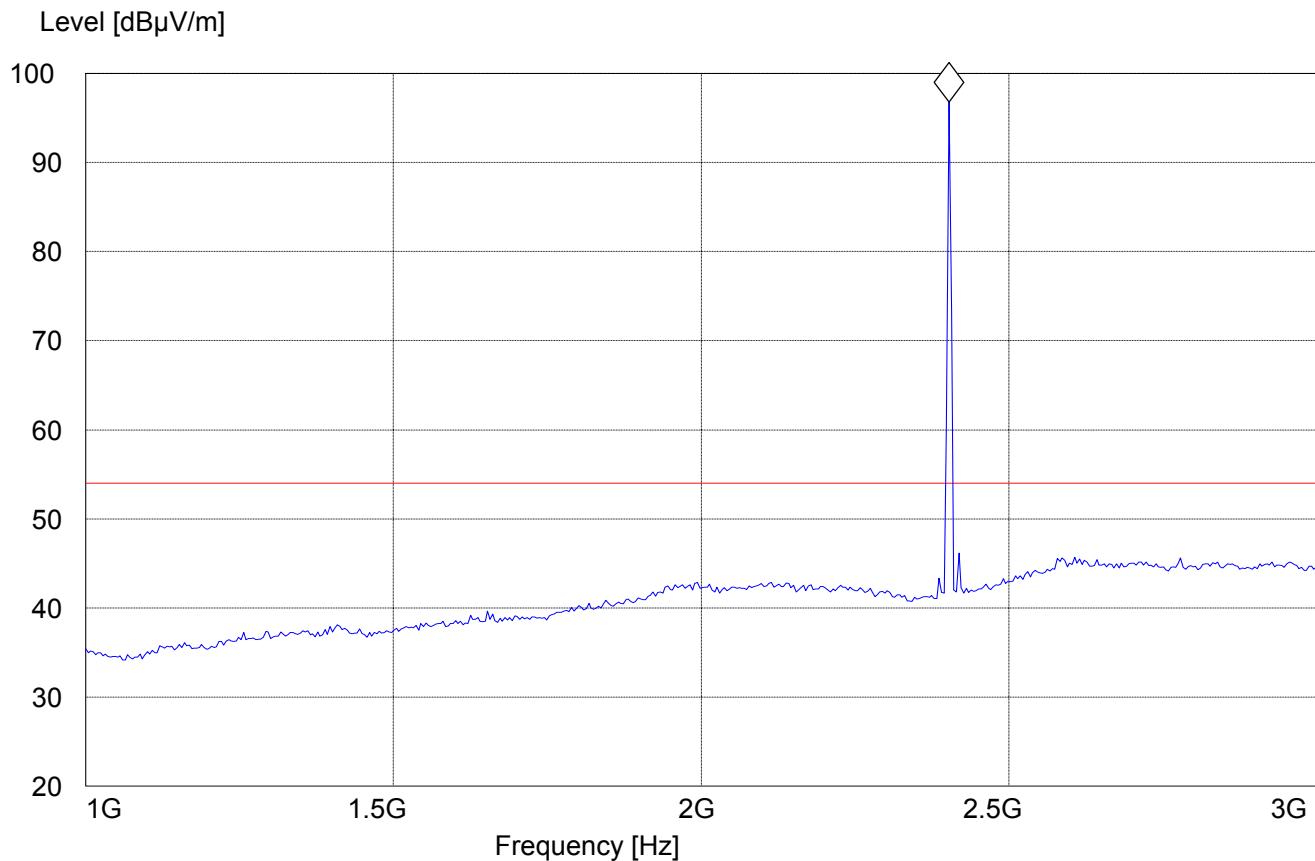
§ 15.247 (c) (1)

Lowest Channel(2402MHz): 1GHz – 3GHz

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

SWEEP TABLE:		"BT Spuri hi 1-8G"			
Short Description:		Bluetooth Spurious 1-8 GHz			
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Marker: 2.402805611 GHz 96.79 dBµV/m



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

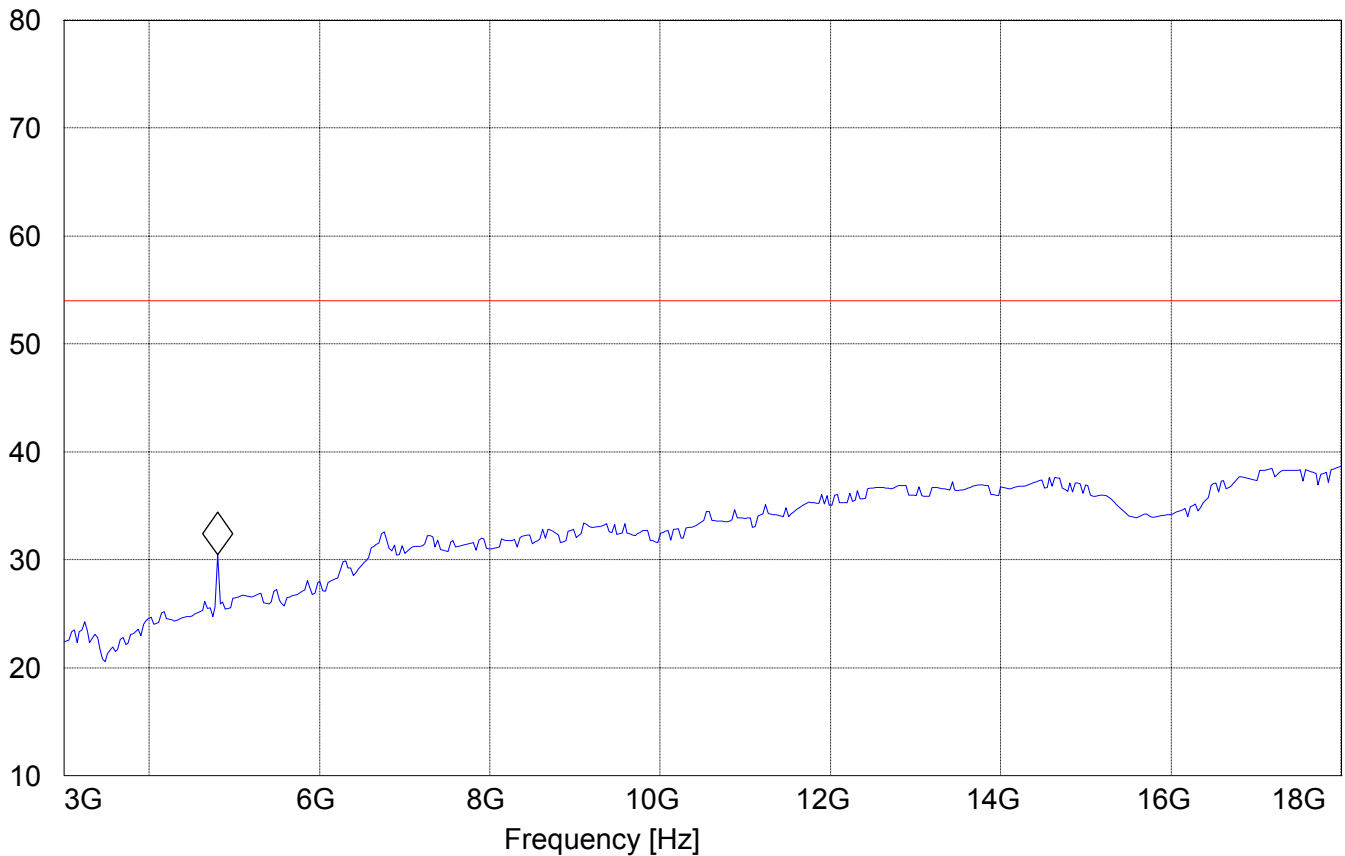
Lowest Channel(2402MHz): 3GHz – 18GHz

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

SWEEP TABLE:		"BT Spuri hi 1-8G"			
Short Description:		Bluetooth Spurious 1-8 GHz			
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
3.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Marker: 4.803607214 GHz 30.46 dB μ V/m

Level [dB μ V/m]



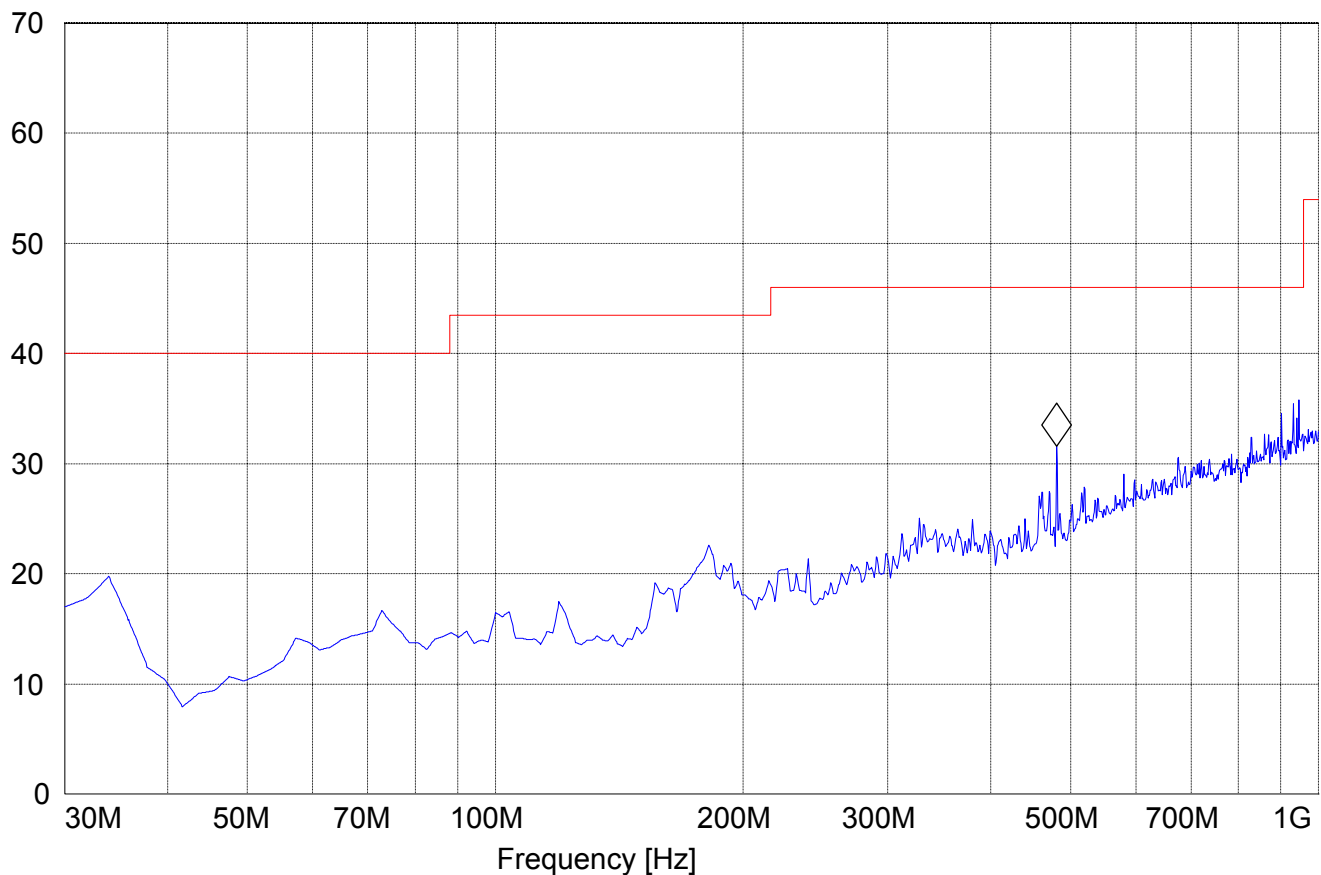
EMISSION LIMITATIONS - Radiated (Transmitter)
Middle Channel(2441MHz): 30MHz – 1GHz

§ 15.247 (c) (1)

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

Marker: 480.981964 MHz 31.54 dBμV/m

Level [dBμV/m]



EMISSION LIMITATIONS - Radiated (Transmitter)
Middle Channel(2441MHz): 1GHz – 3GHz

§ 15.247 (c) (1)

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

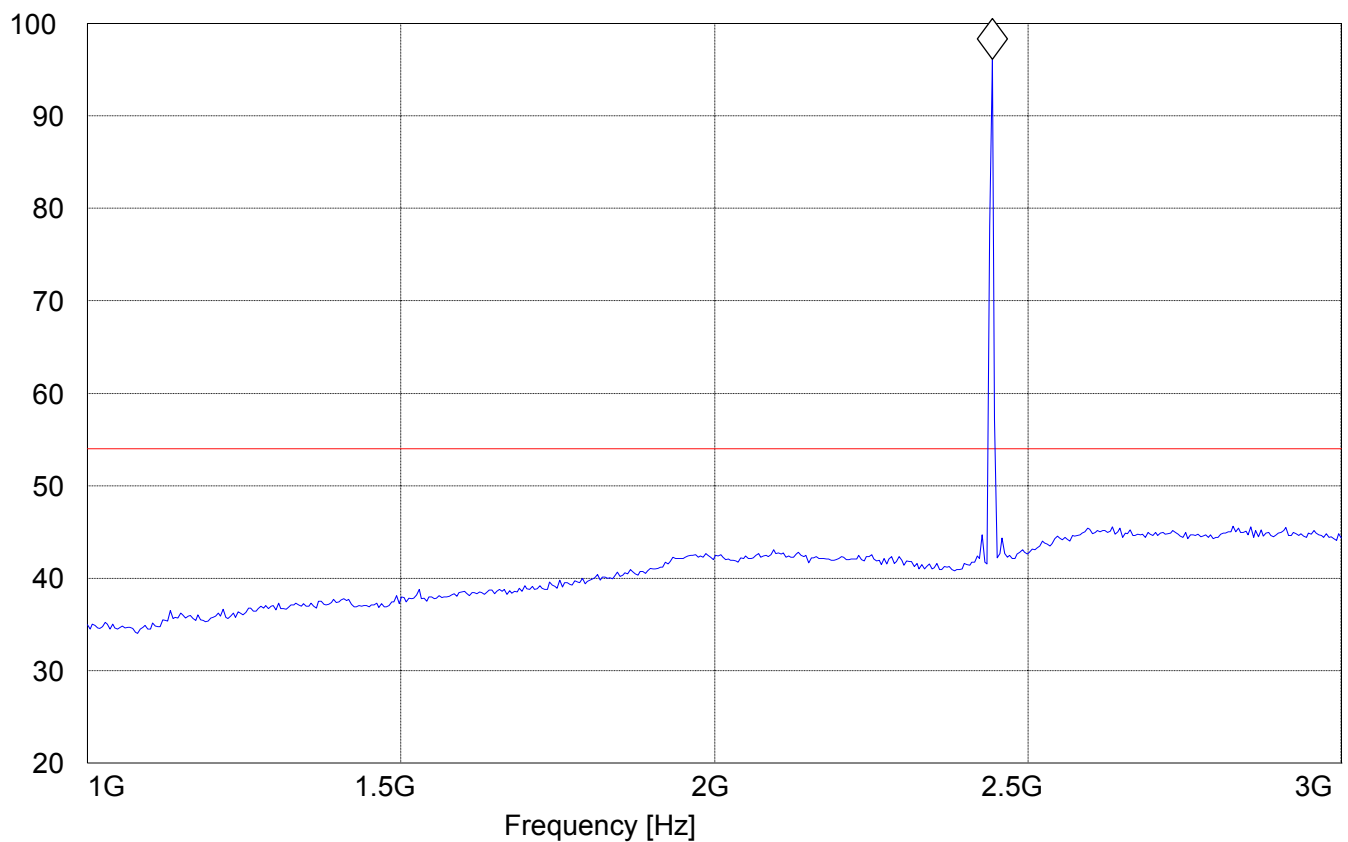
SWEEP TABLE: "BT Spuri hi 1-8G"

Short Description: Bluetooth Spurious 1-8GHz

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

Marker: 2.442885772 GHz 96.13 dBµV/m

Level [dBµV/m]



EMISSION LIMITATIONS - Radiated (Transmitter)

Middle Channel(2441MHz): 3GHz – 18GHz

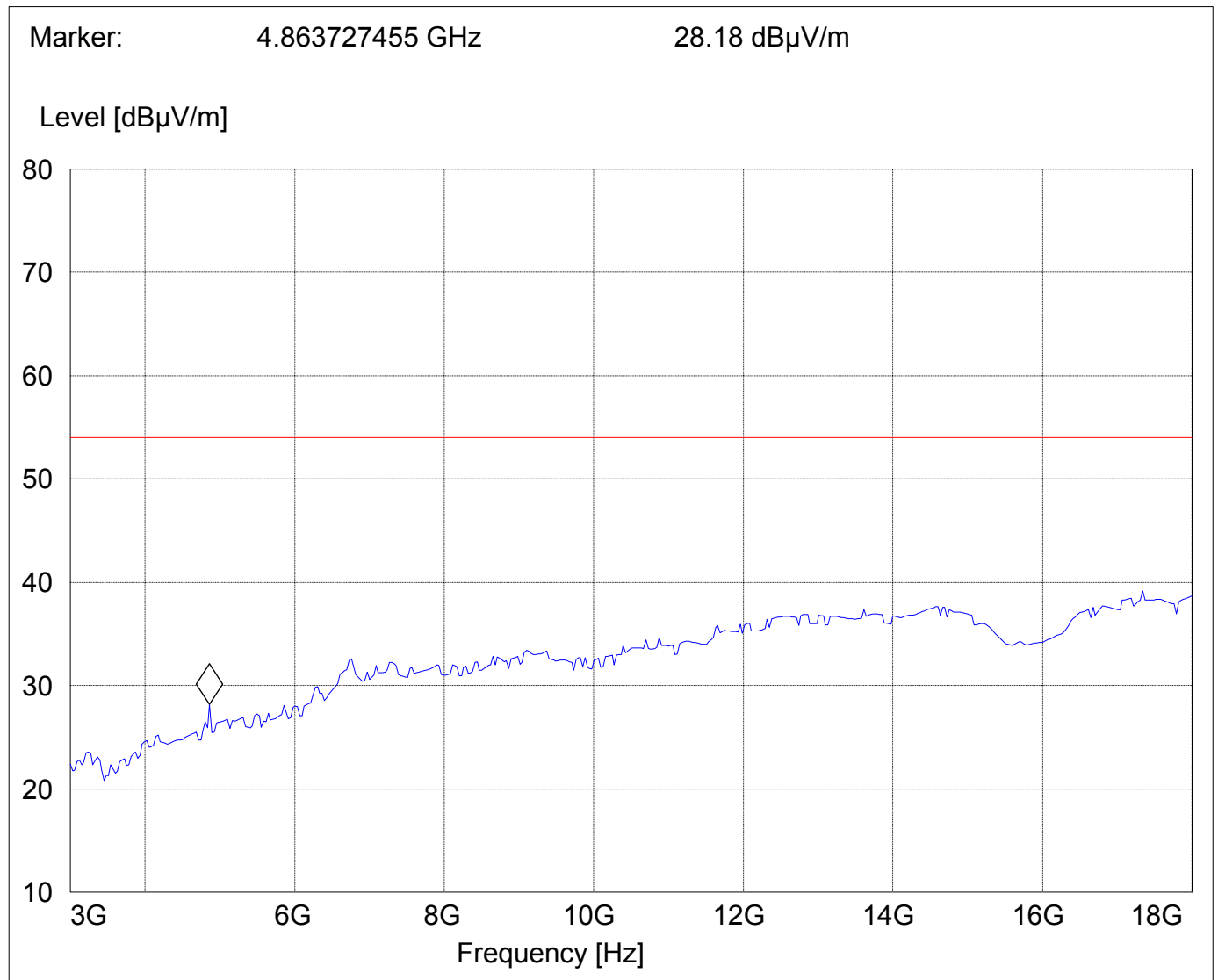
§ 15.247 (c) (1)

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

SWEEP TABLE: "BT Spuri hi 1-8G"

Short Description: Bluetooth Spurious 1-8GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
3.0 GHz	8.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)



EMISSION LIMITATIONS - Radiated (Transmitter)

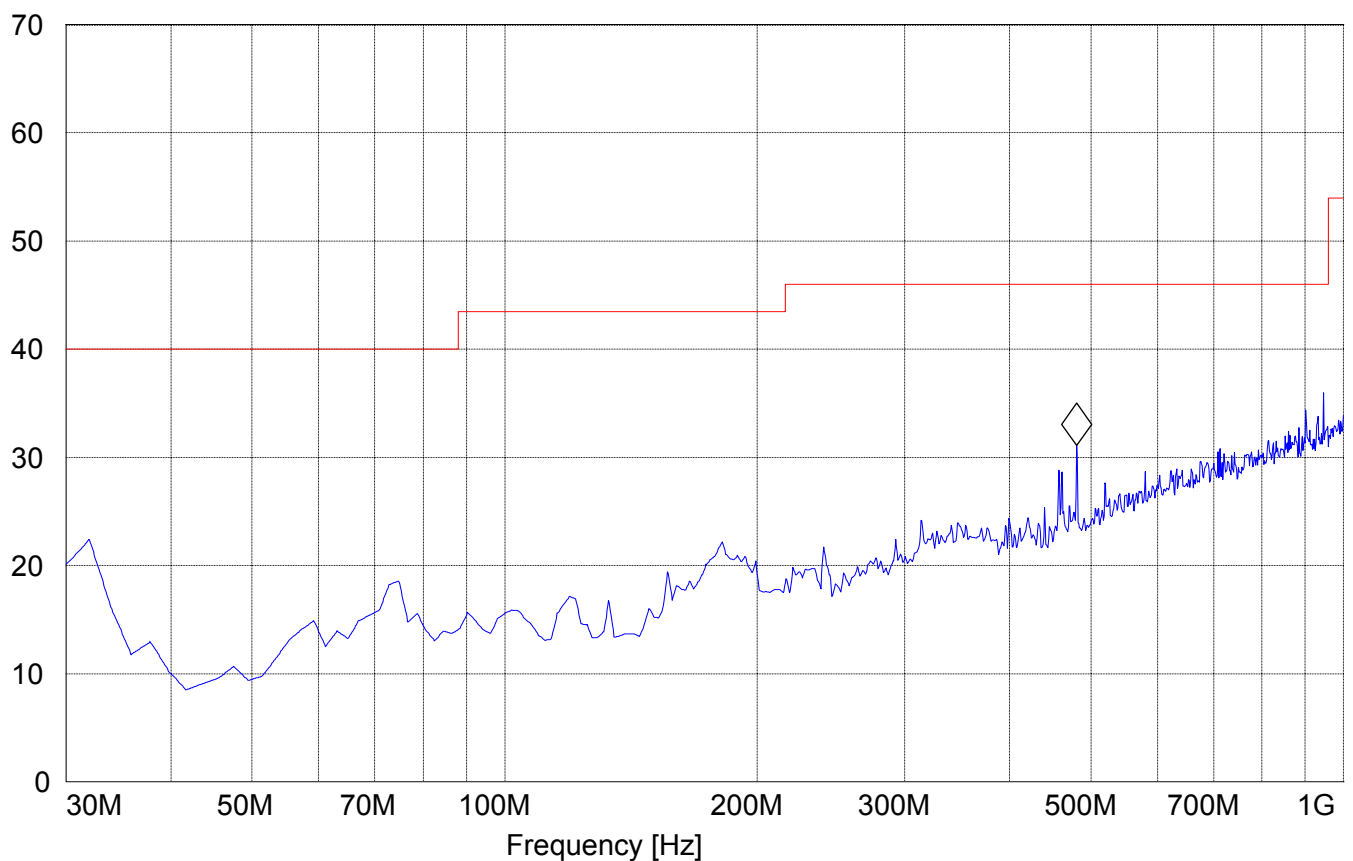
§ 15.247 (c) (1)

Highest Channel(2480MHz): 30MHz – 1GHz

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

Marker: 480.981964 MHz 31.12 dBµV/m

Level [dBµV/m]



EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

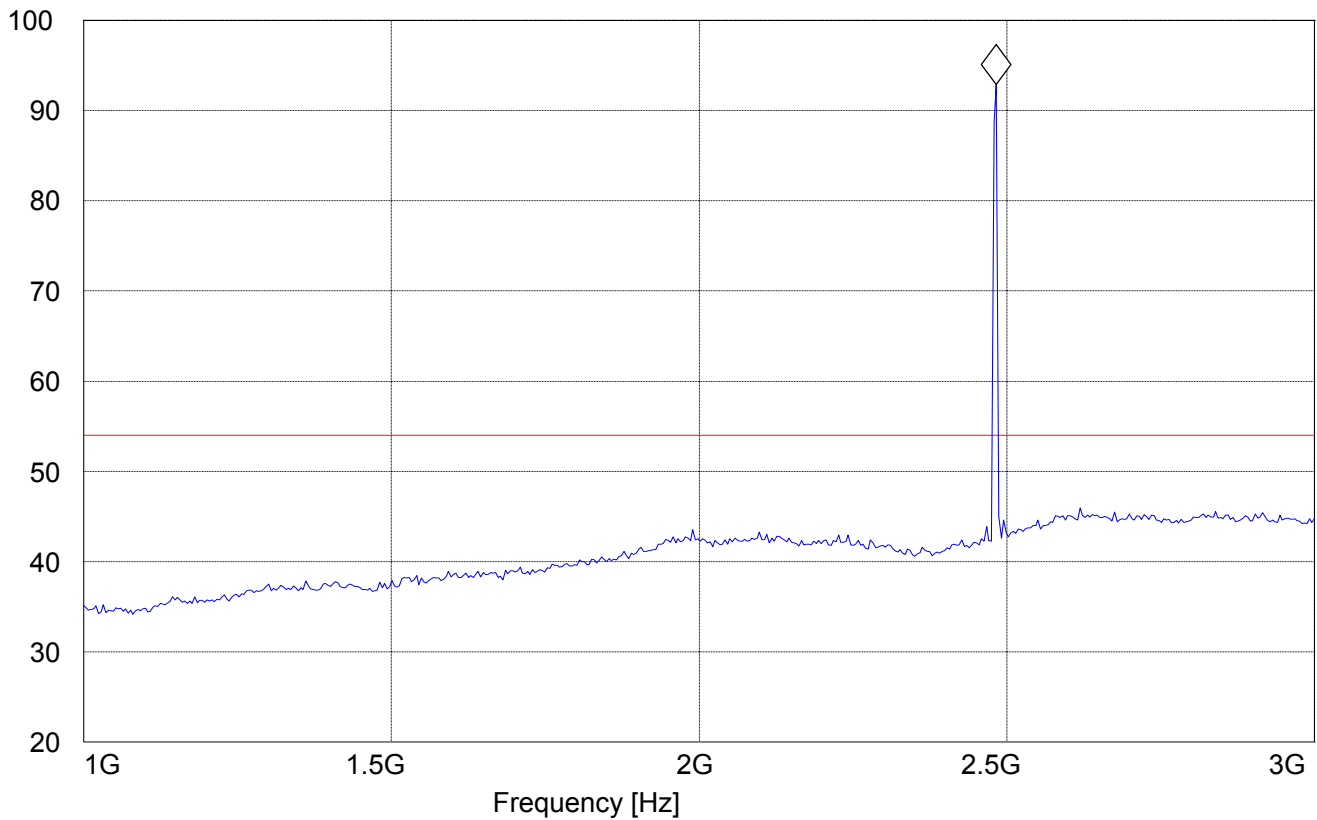
Highest Channel(2480MHz): 1GHz – 3GHz

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

SWEEP TABLE:		"BT Spuri hi 1-8G"			
Short Description:		Bluetooth Spurious 1-8GHz			
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

Marker: 2.482965932 GHz 92.9 dBµV/m

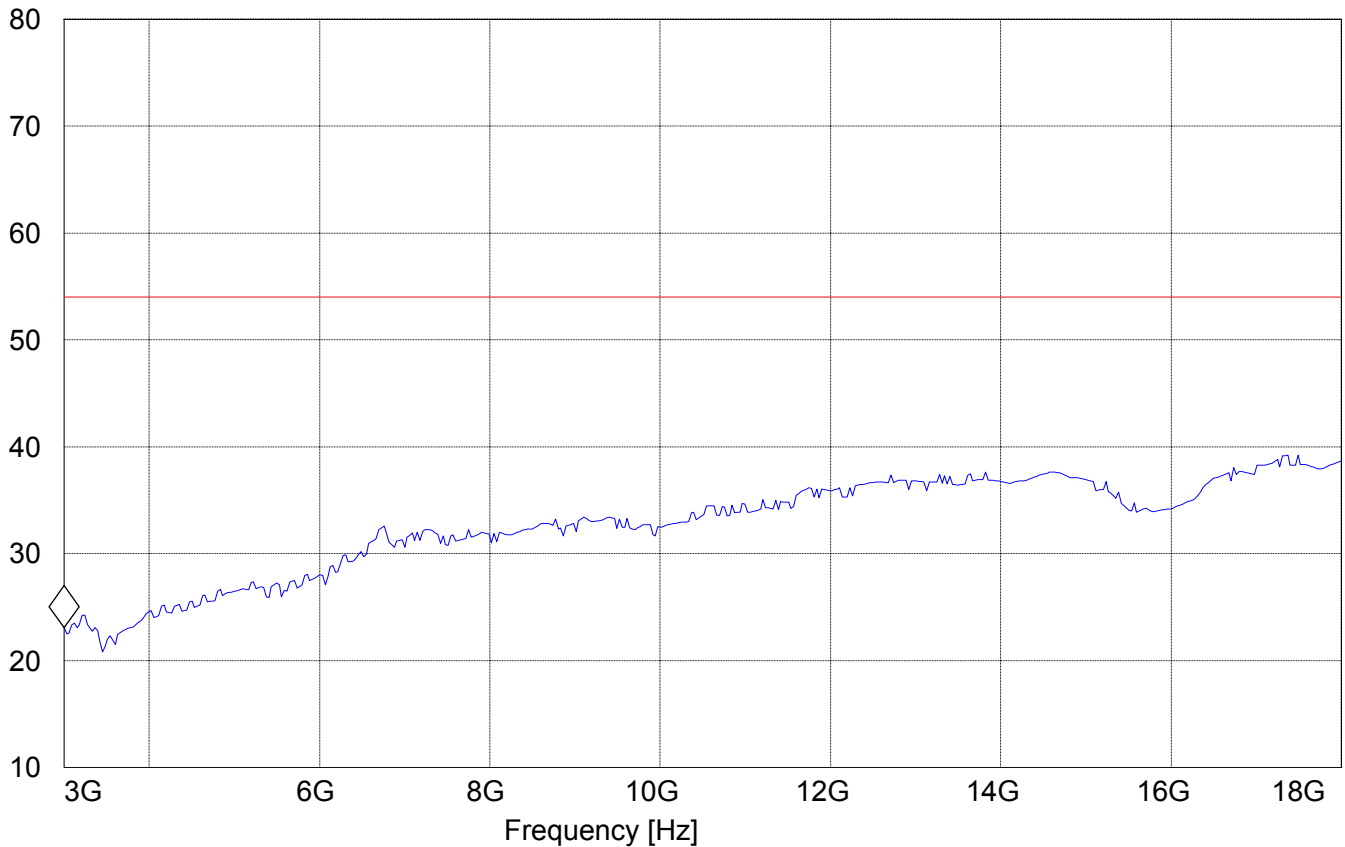
Level [dBµV/m]



EMISSION LIMITATIONS - Radiated (Transmitter)
§ 15.247 (c) (1)
Highest Channel(2480MHz): 3GHz – 18GHz
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE:		"BT Spuri hi 1-8G"				
Short Description:		Bluetooth Spurious 1-8GHz				
Start	Stop	Detector	Meas.	RBW	Transducer	
Frequency	Frequency	Time	Bandw.	VBW		
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)	

Marker: 3 GHz 23.1 dB μ V/m

Level [dB μ V/m]


EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

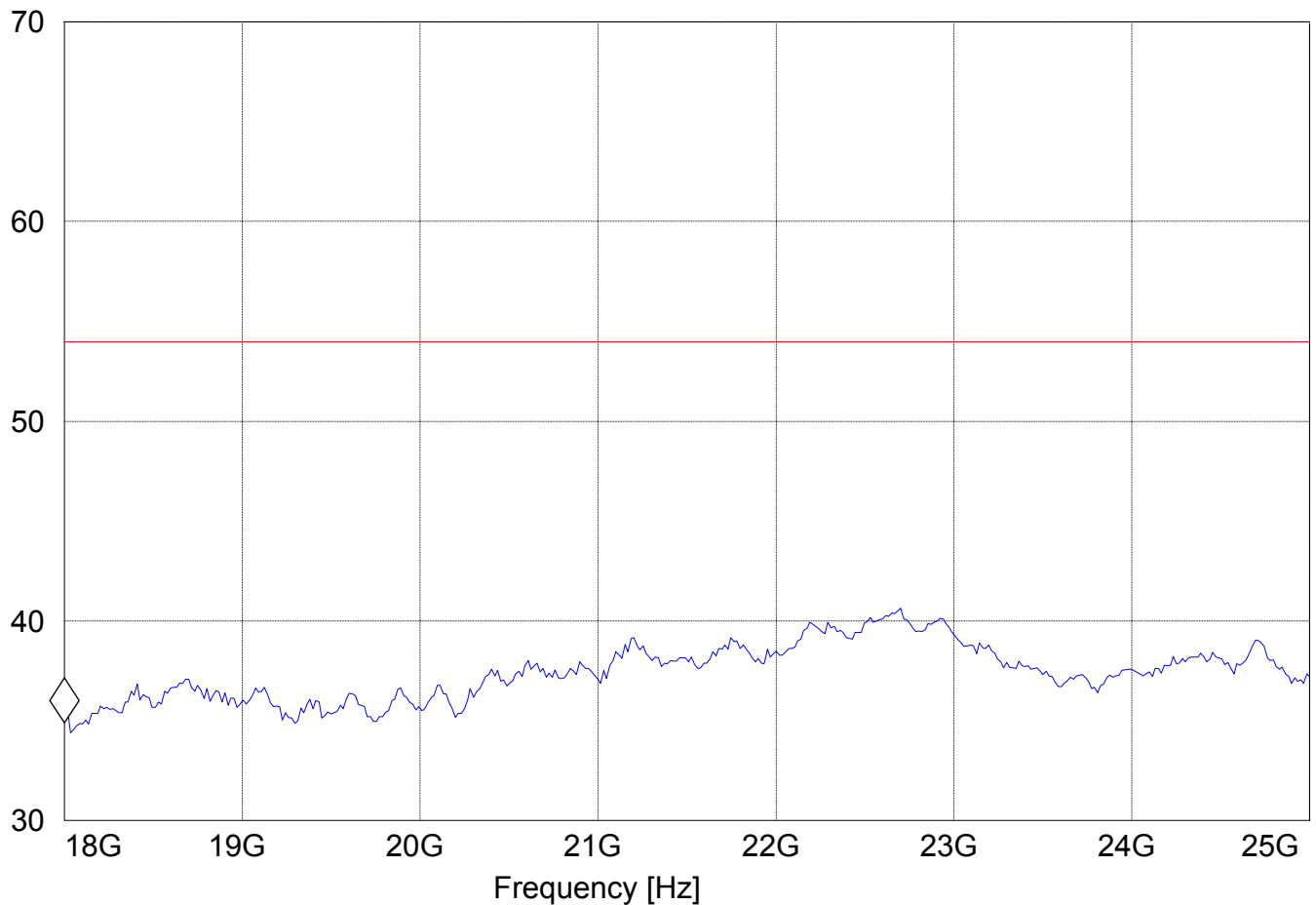
18GHz – 25GHz

(This plot is valid for all three channels)

SWEEP TABLE:		"BT Spuri hi 18-25G"			
Short Description:		Bluetooth Spurious 18-25GHz			
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	25 GHz	MaxPeak	Coupled	1 MHz	#141 horn (dBi)

Marker: 18 GHz 34.89 dBµV/m

Level [dBµV/m]



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 Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None

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

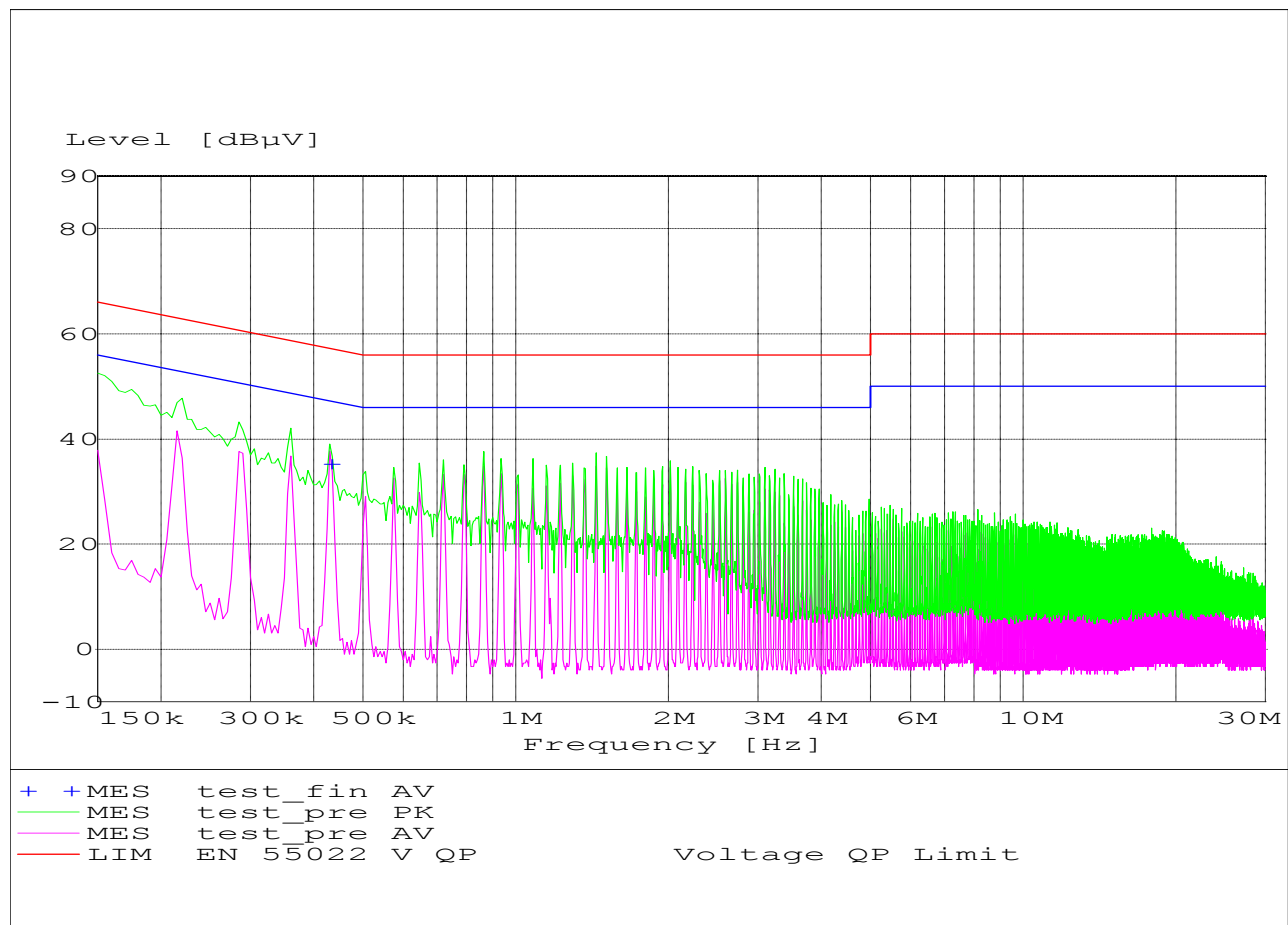
Limit

Frequency of Emission (MHz)	Conducted Limit (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



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

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	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 18 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.

RECEIVER SPURIOUS RADIATION

§ 15.209

30MHz – 1GHz

SWEEP TABLE:

"BT Spuri hi 30-1G"

Short Description:

Bluetooth 30MHz-1GHz

Start Stop

Detector

Meas.

RBW

Transducer

Frequency Frequency

Time

VBW

30.0 MHz 1.0 GHz

MaxPeak

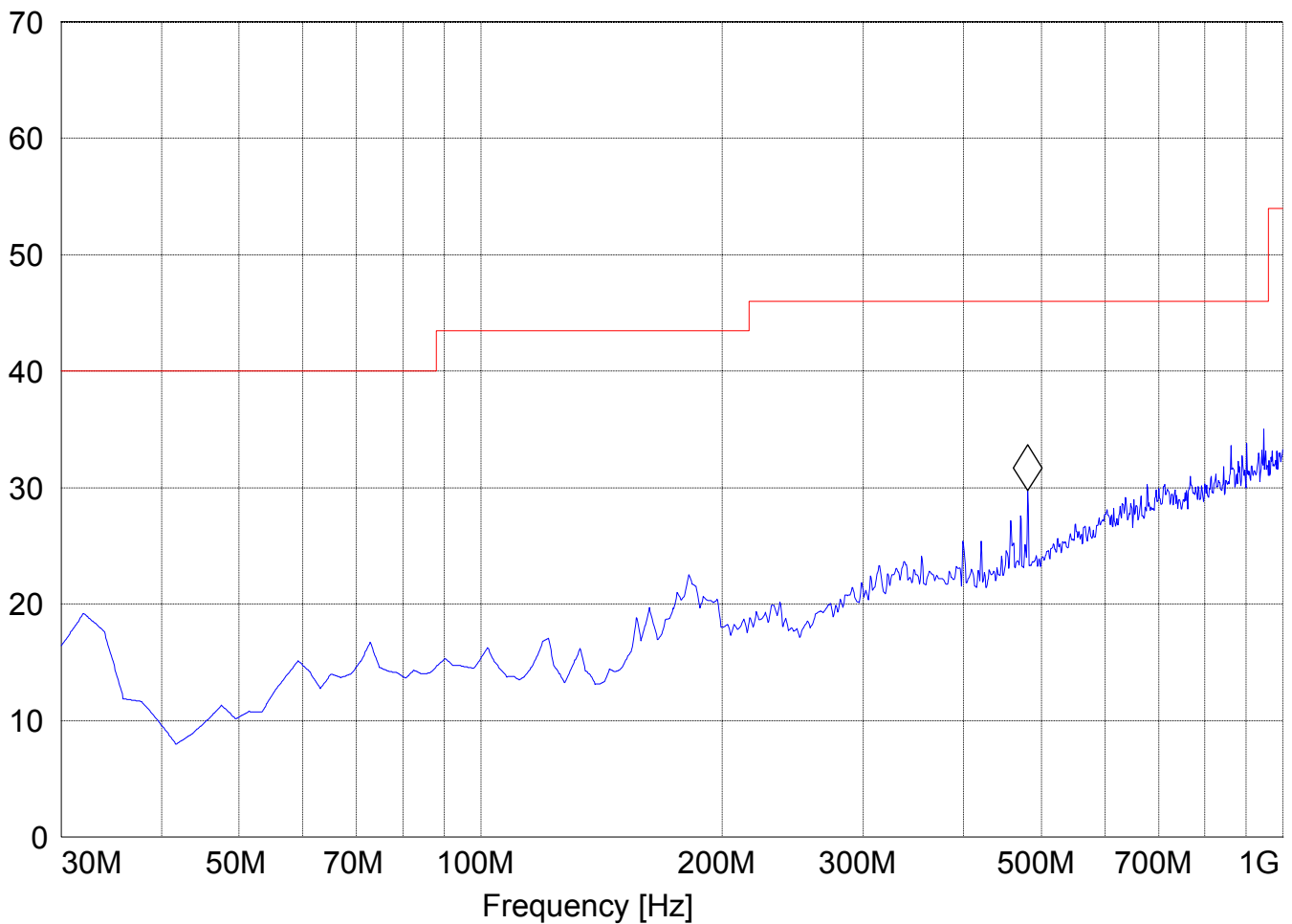
Coupled

100 kHz

3141-#1186

Marker: 480.981964 MHz 29.78 dBµV/m

Level [dBµV/m]



RECEIVER SPURIOUS RADIATION

§ 15.209

1GHz – 3GHz

SWEEP TABLE:

"BT Spuri hi 1-8G"

Short Description:

Bluetooth Spurious 1-8 GHz

Start Stop

Detector

Meas.

RBW

Transducer

Frequency Frequency

Time

Bandw.

VBW

1.0 GHz 8.0 GHz

MaxPeak

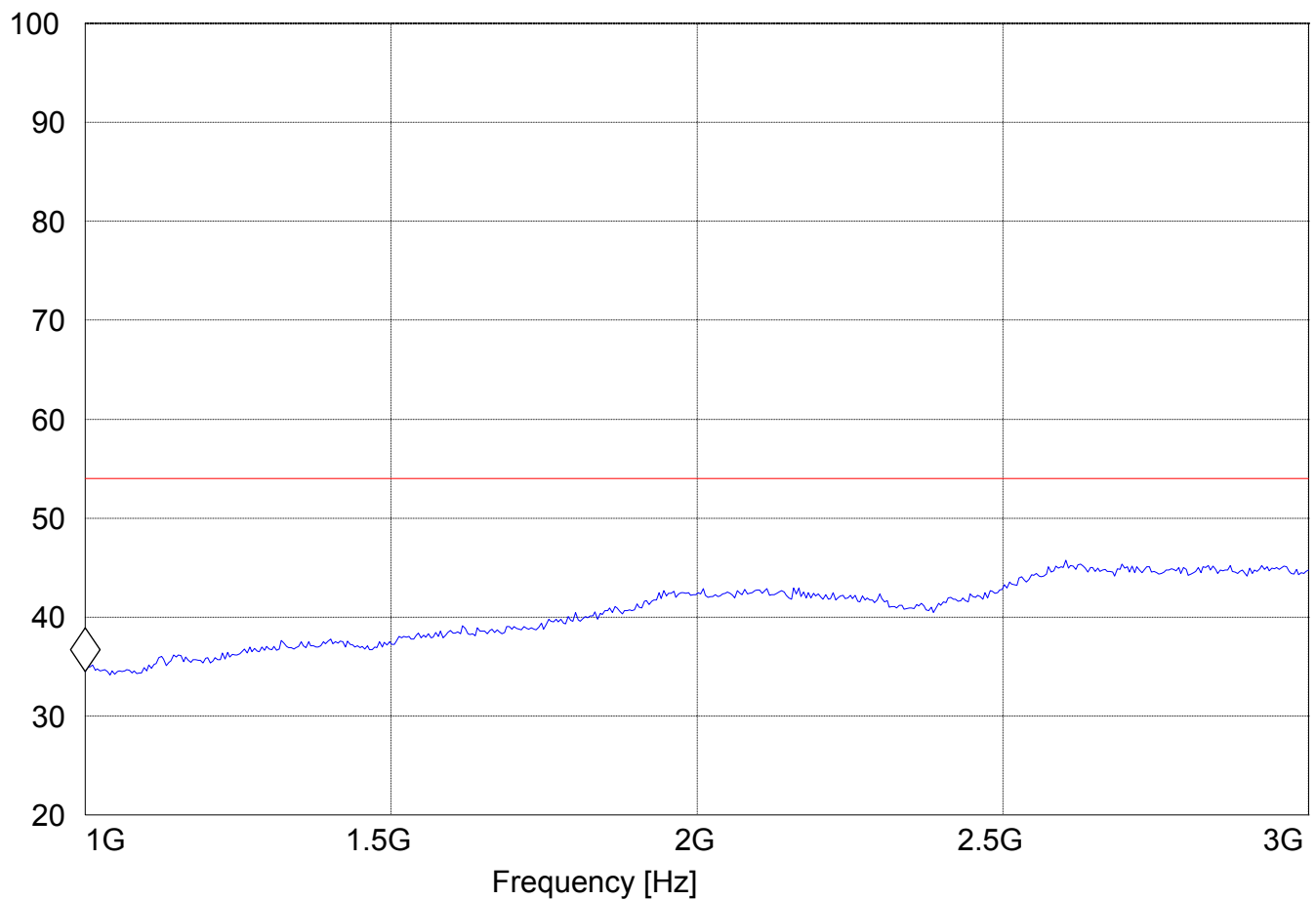
Coupled

1 MHz

#326 horn (dBi)

Marker: 1 GHz 34.49 dB μ V/m

Level [dB μ V/m]



RECEIVER SPURIOUS RADIATION

§ 15.209

8GHz – 18GHz

SWEEP TABLE:

"BT Spuri hi 8-18G"

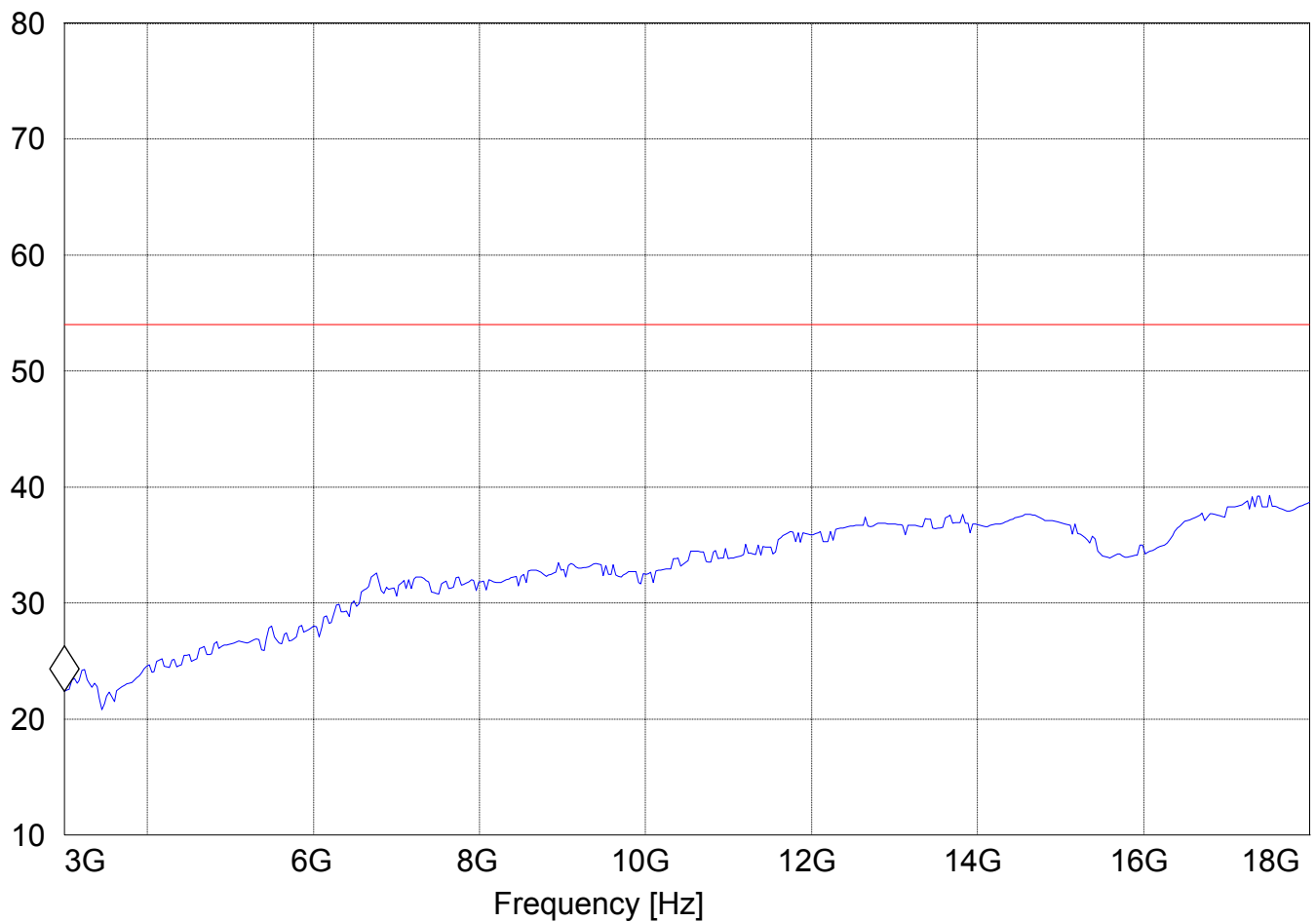
Short Description:

Bluetooth Spurious 8-18GHz

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

Marker: 3 GHz 22.4 dBμV/m

Level [dBμV/m]



RECEIVER SPURIOUS RADIATION

§ 15.209

18GHz – 25GHz

SWEEP TABLE:

"BT Spuri hi 18-25G"

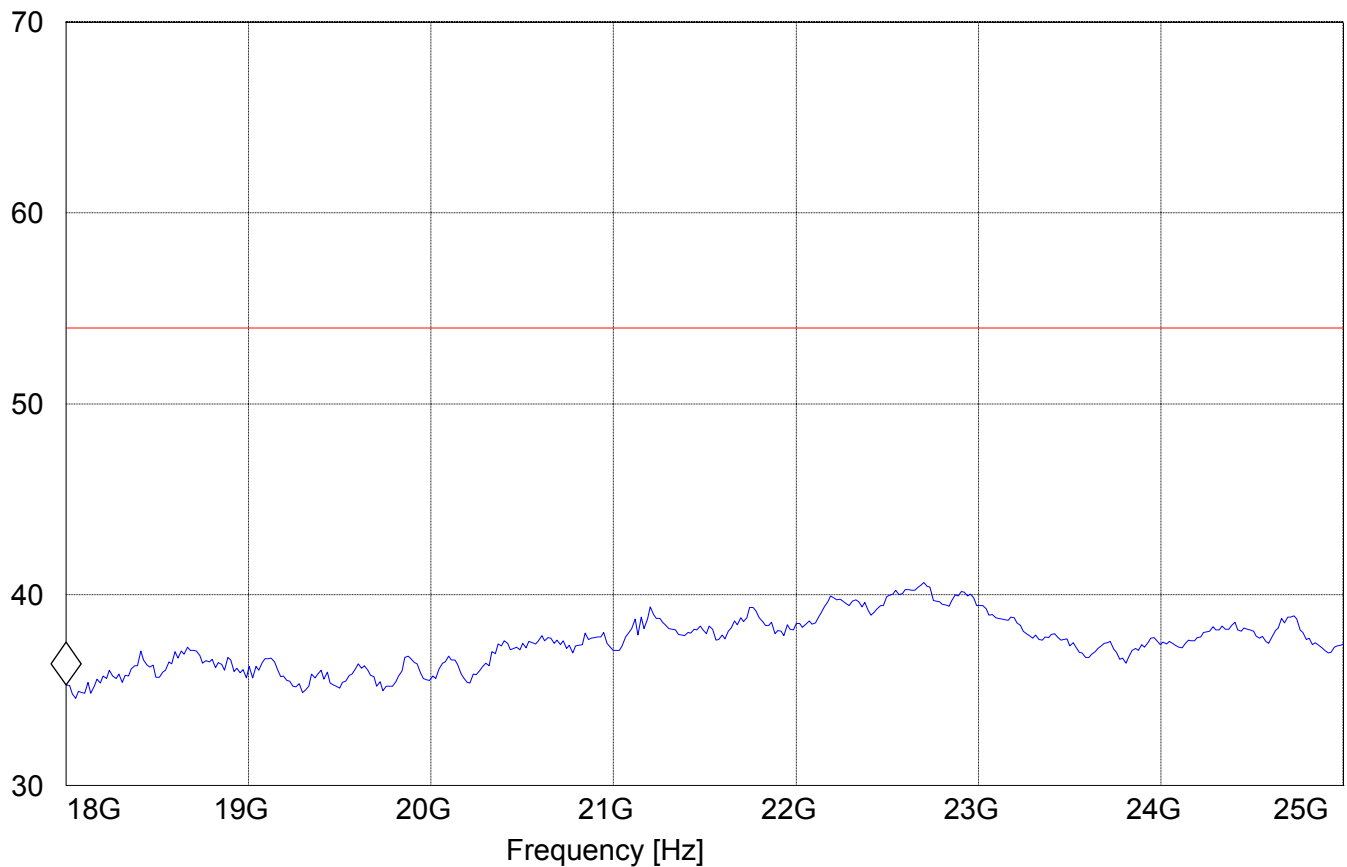
Short Description:

Bluetooth Spurious 18-25GHz

Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency	Time	Bandw.	VBW	
18 GHz	25 GHz	MaxPeak	Coupled	1 MHz	#141 horn (dBi)

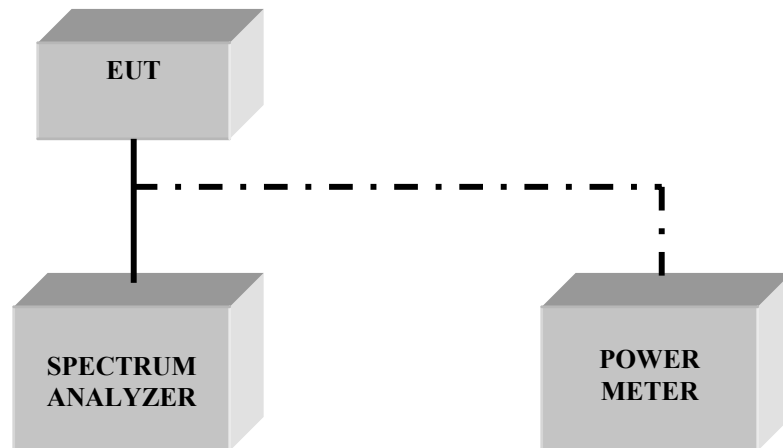
Marker: 18 GHz 35.27 dBµV/m

Level [dBµV/m]



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	Signal Generator	SMY02	Rohde & Schwarz	836878/011
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
05	Power Amplifier	250W1000	Amplifier Research	300031
06	Biconilog Antenna	3141	EMCO	0005-1186
07	Horn Antenna	SAS-200/571	AH Systems	325
08	Power Splitter	11667B	Hewlett Packard	645348
09	Climatic Chamber	VT4004	Votch	G1115
10	Pre-Amplifier	JS4-00102600	Miteq	00616
11	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807
12	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008

BLOCK DIAGRAMS**Conducted Testing**

Radiated Testing

ANECHOIC CHAMBER

