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FCC PART 15.247 TEST REPORT

DIGITAL SPREAD SPECTRUM

Applicant	ONE WORLD TECHNOLOGIES, INC
Address	1428 PEARMAN DAIRY ROAD
	ANDERSON SOUTH CAROLINA 29625 USA
FCC ID	VMZES5
Model Number	ES5000
Product Description	INSPECTION SCOPE RADIO WITH WI FI
Date Sample Received	8/6/2014
Date Tested	August 7 to 12th, 2014
Tested By	Mario de Aranzeta
Approved By	Sid Sanders
Report Number	1380AUT14TestReport.docx
Issue Date:	August 11th 2014
Total Pages:	49
Test Results	☒ PASS ☐ FAIL

TABLE OF CONTENT

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:

Mario R. de Aranzeta
Engineering Project Manager

Date: August 2014

TABLE OF CONTENTS

GENERAL INFORMATION

DUT Specification

Applicable Standard	Part 15.247		
DUT Description	INSPECTION SCOPE RADIO WITH WI FI		
FCC ID	VMZES5		
Operating Frequency	TX: 2437 MHz		
Number of channels	1		
Modulation:	OFDM /802.11 g, n		
DUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☐ Mobile	☒ Portable
Antenna Connector	None		
Antenna	Integral PCB antenna <2 dBi		
Test Facility	Timco Engineering Inc. 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 26ºC Relative humidity: 50%		
Test Exercise	The DUT was placed in continuous transmit mode of operation.		

The device is a handheld inspection video scope utilizing a WIFI transceiver which uses only modes 802.11 g and n to communicate to a smart phone. The WIFI transmitter is locked to using only 1 transmit channel 2437 MHz.

Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
N/A			

TEST RESULTS SUMMARY

Specification – Rules Part No.	RESULTS Pass/Fail/NA
Radiated Emissions - FCC Rules 15.247, 15.209	Pass
Power Line Conducted Emissions – FCC Rules 15.207	NA
Occupied Bandwidth – FCC Rules 15.247 (a)(2)	Pass
Power Output – FCC Rules 15.247 (b)	Pass
Spurious Emissions at Antenna Terminals – FCC Rules 15.247(c)	Pass
Radiated Spurious Emissions Into Adjacent Restricted Band – FCC Rules 15.205	Pass
Power Spectral Density – FCC Rules 15.247(d)	Pass

TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worst case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBµV	+ 10.36 dB	+ 0.5 = 30.86 dBµV/m @ 3m

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was captured. The vertical scale is set to -10 dBm per division.

Bandwidth 6.0dB: The measurements were made with the spectrum analyzer's using the procedures outlined in kdb 558074 dated 6/2014.

Power Output: The RF power output was measured at the antenna feed point using a spectrum analyzer.

Antenna Conducted Emissions: The RBW=100 kHz, VBW=300 kHz and the span set to 10 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

ANSI C63.4-2003 10.1 Measurement Procedures: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Emissions attenuated more than 20 dB below the permissible value are not reported.

The test procedures of kdb 558074 dated June of 2014 were used throughout this report.

TABLE OF CONTENTS

RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/m @ 3 meters
Part 15.247	
Fundamental 902 – 928 MHz	127.37 dBµV/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dBµV/m @ 3 meters
Harmonics	54.0 dBµV/m @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to 54 dBµV/m. Spurious emissions not in a restricted band must be 20 dBc. A prescan was done from 9 kHz or the lowest frequency generated to 30 MHz, with no significant emissions found. Then measurements were made from 30 MHz to the 10th harmonic.

Below 1000 MHz the radiated emissions from both mode g and mode n are identical and will not be displayed twice.

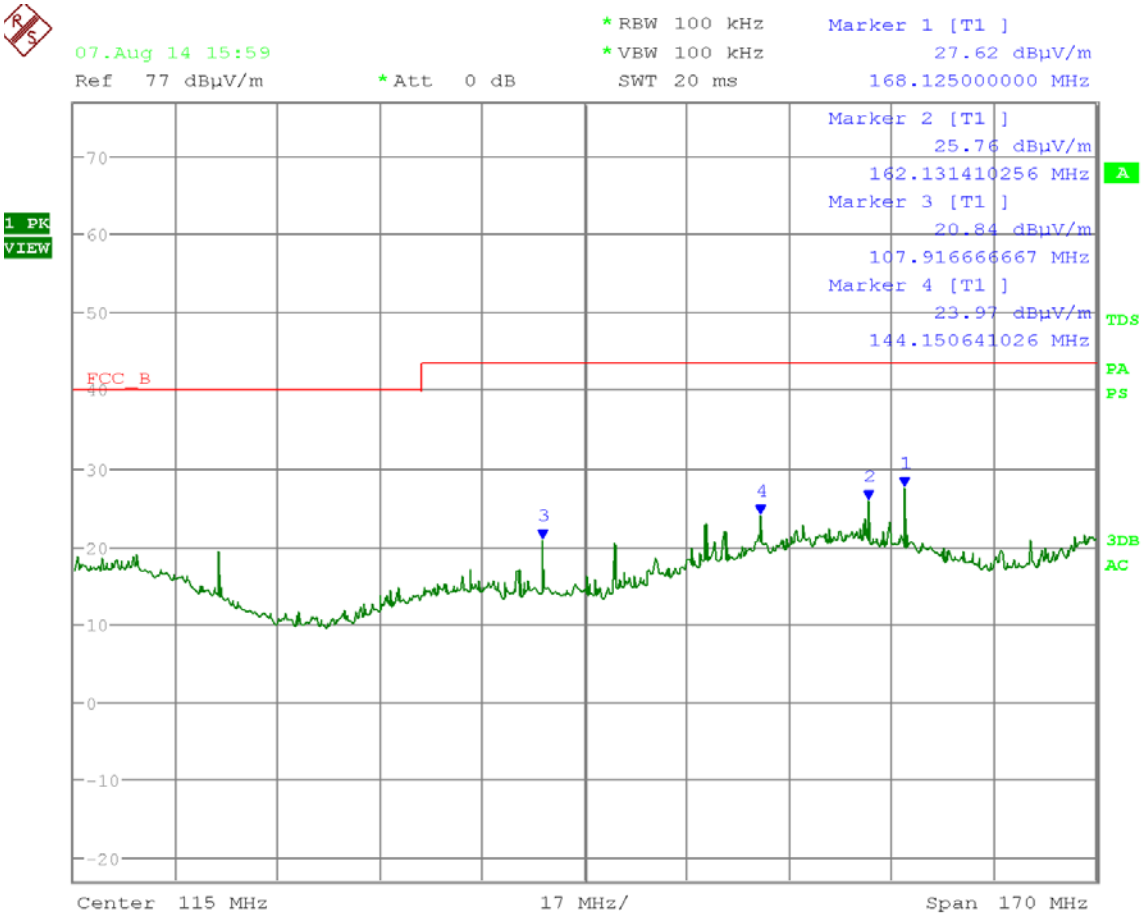
No significant emissions were noted above the 3rd harmonic (7311 MHz) and are not represented in plots.

Test Data: All values are peak unless noted.

RADIATION INTERFERENCE 30 to 200MHz Horizontal

Rules Part No.: 15.247, 15.209

Mode n

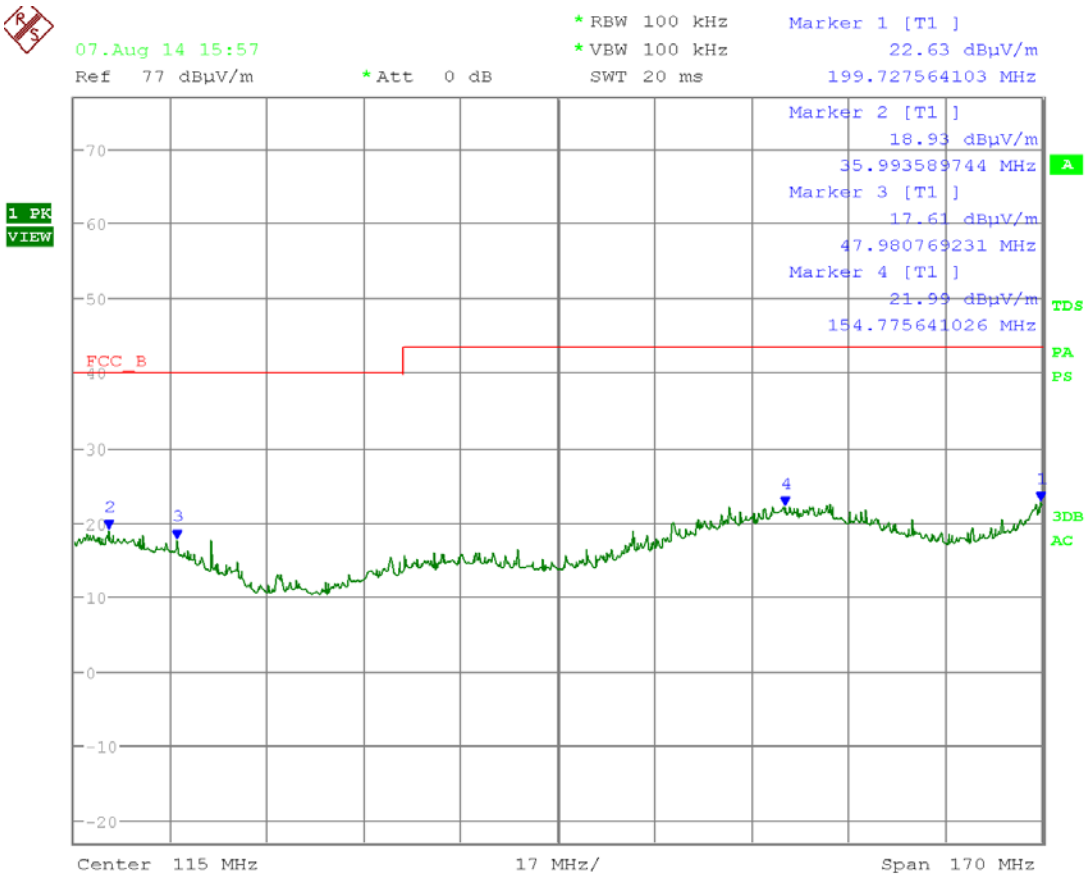


30 to 200 MHz radiated emissions Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE 30 – 200MHz Vertical

Rules Part No.: 15.247, 15.209

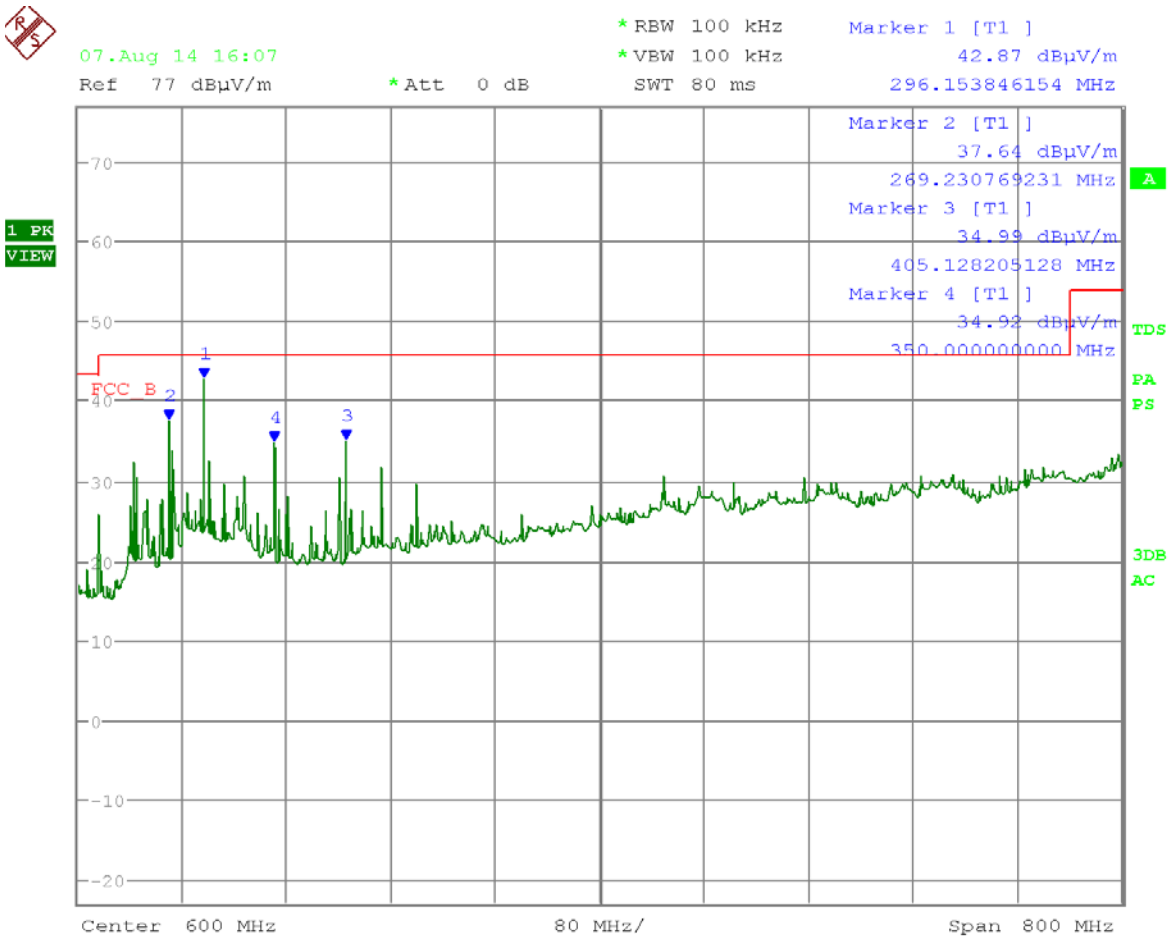


30 to 200 MHz radiated emissions Vertical

Results: Meets Requirements

RADIATION INTERFERENCE 200 – 1000MHz Horizontal

Rules Part No.: 15.247, 15.209

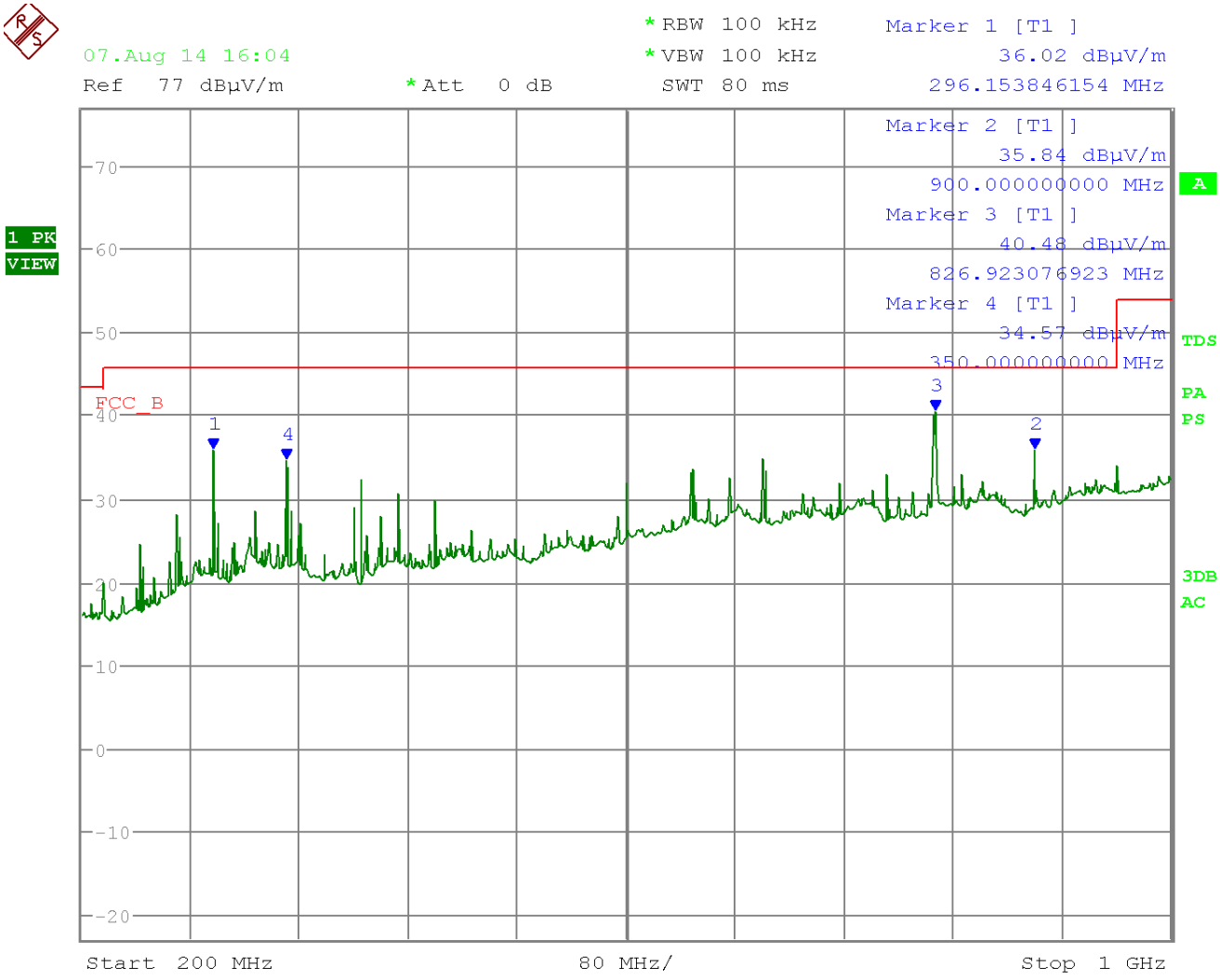


200 to 1000 MHz radiated emissions Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE 200 – 1000MHz Vertical

Rules Part No.: 15.247, 15.209



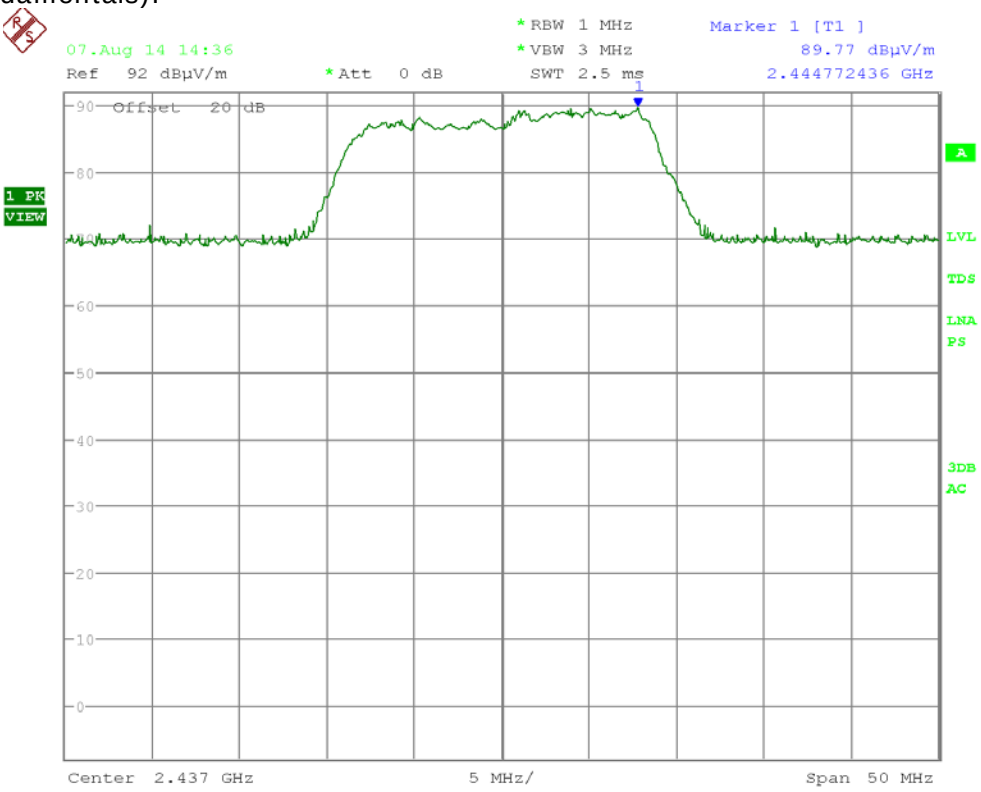
200 to 1000 MHz radiated emissions Vertical

Results: Meets Requirements

RADIATION INTERFERENCE Fundamental Mode n Vertical

Rules Part No.: 15.247, 15.209

Mode n (fundamentals).



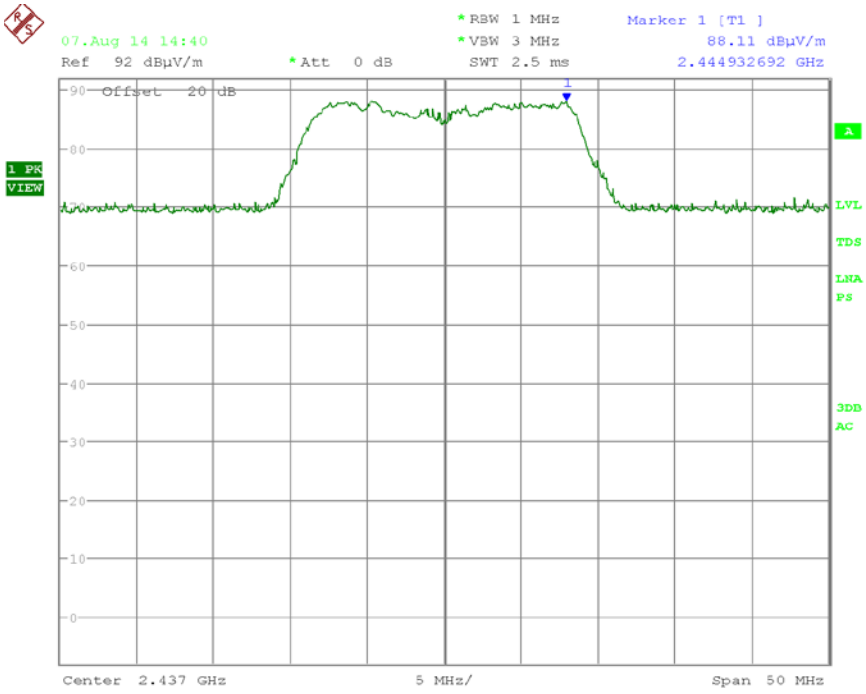
Vertical

Results: Meets Requirements

RADIATION INTERFERENCE Fundamental Horizontal

Rules Part No.: 15.247, 15.209

Mode n Fundamental



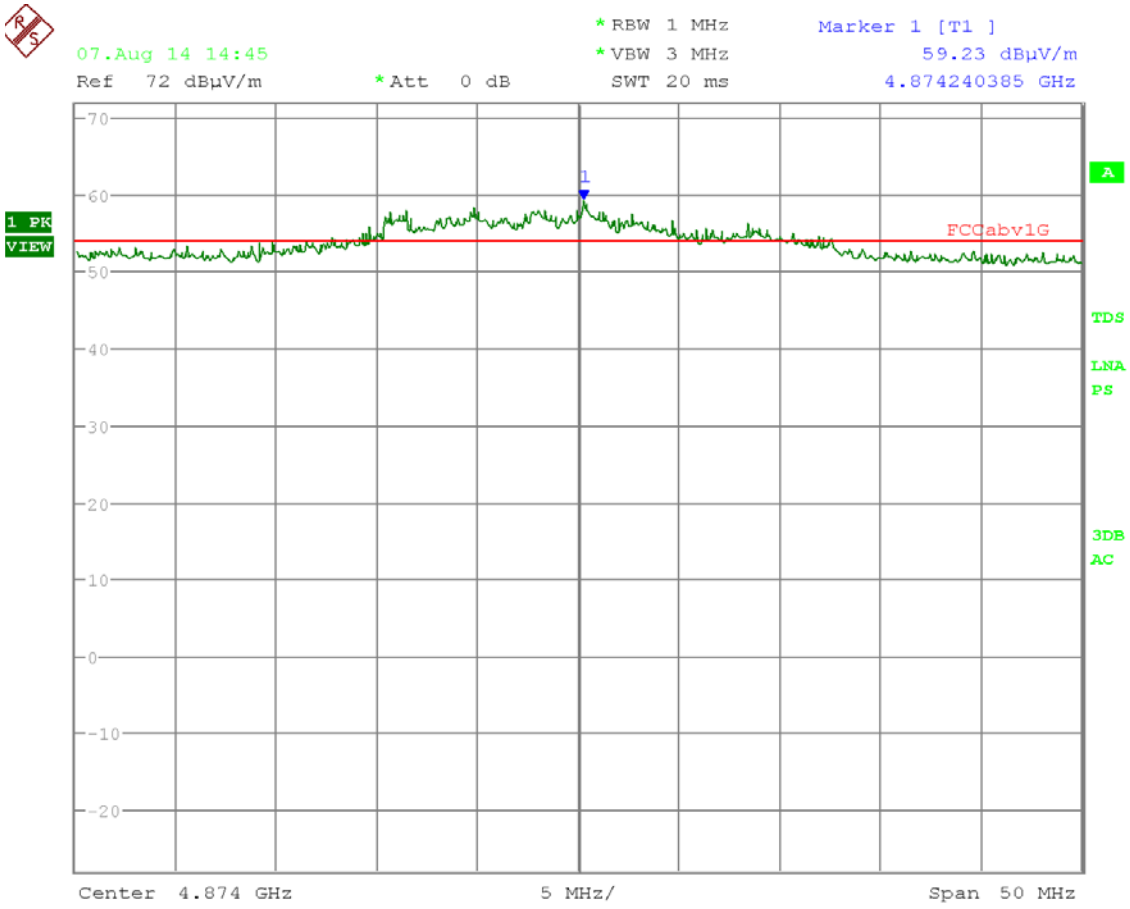
Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE Fundamental Vertical Peak

Rules Part No.: 15.247, 15.209

Mode n 2nd Harmonic



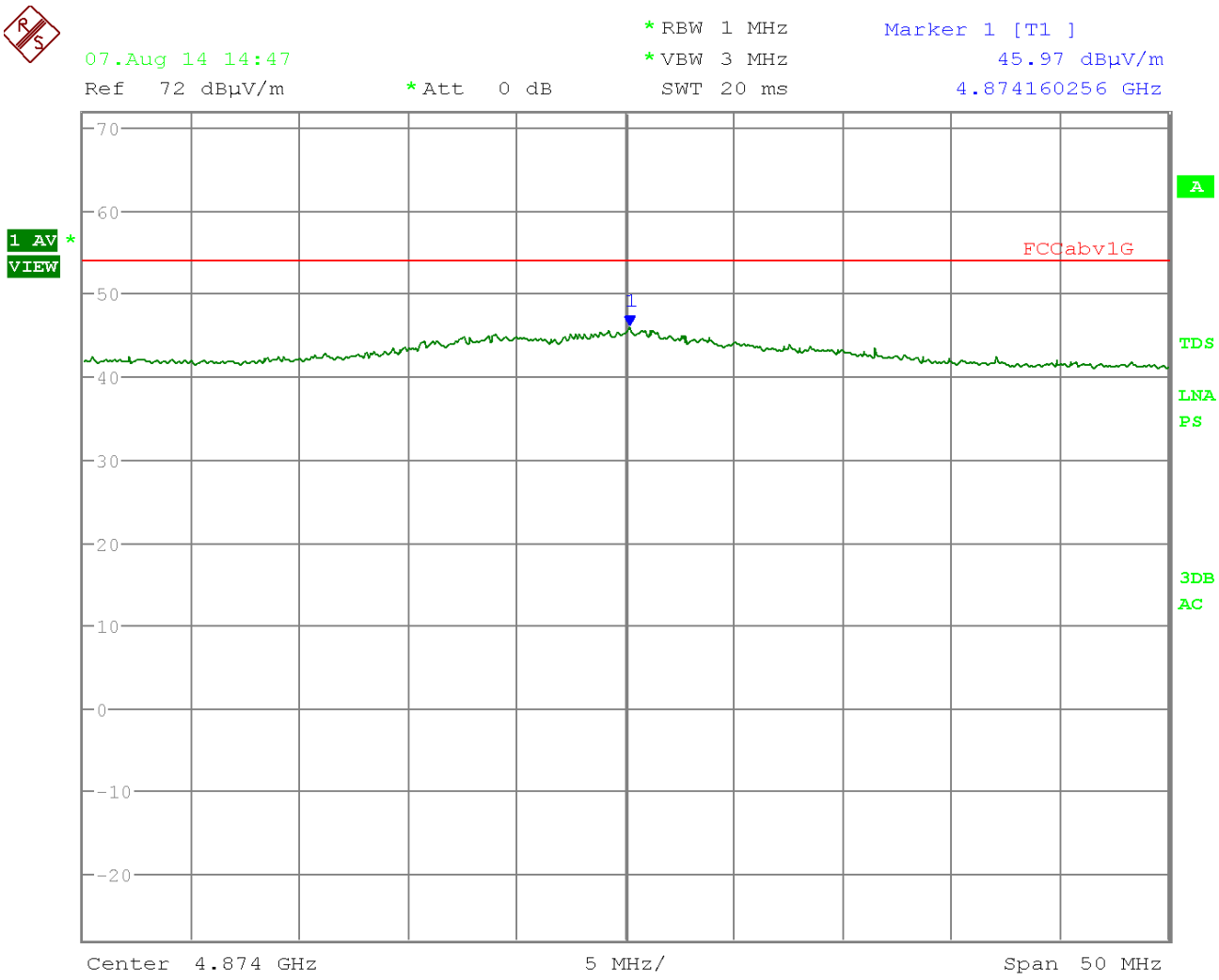
Peak Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE 2nd Harmonic Horizontal

Rules Part No.: 15.247, 15.209

Mode n 2nd Harmonic



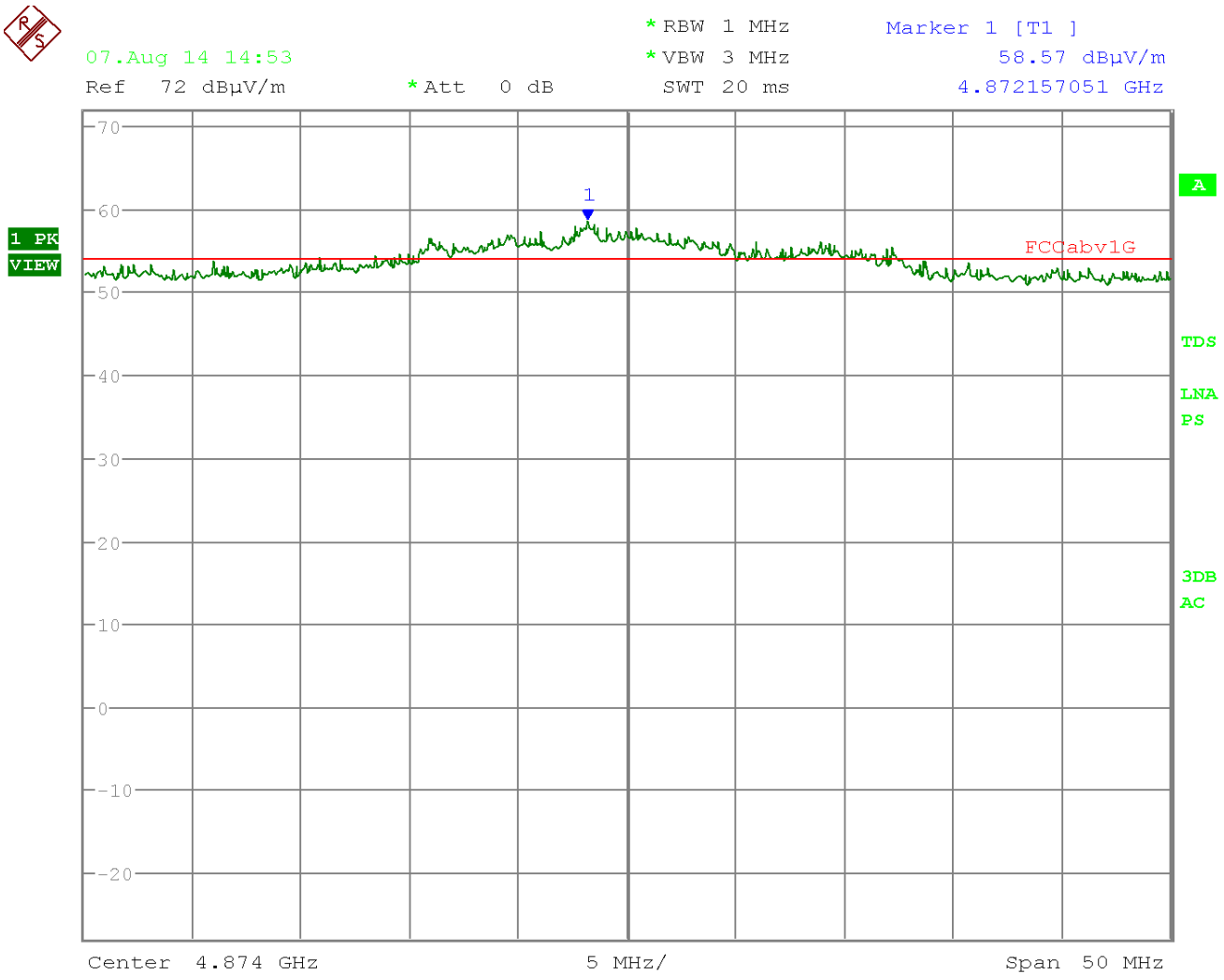
Average Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE 2nd Harmonic Vertical Peak

Rules Part No.: 15.247, 15.209

Mode n 2nd Harmonic



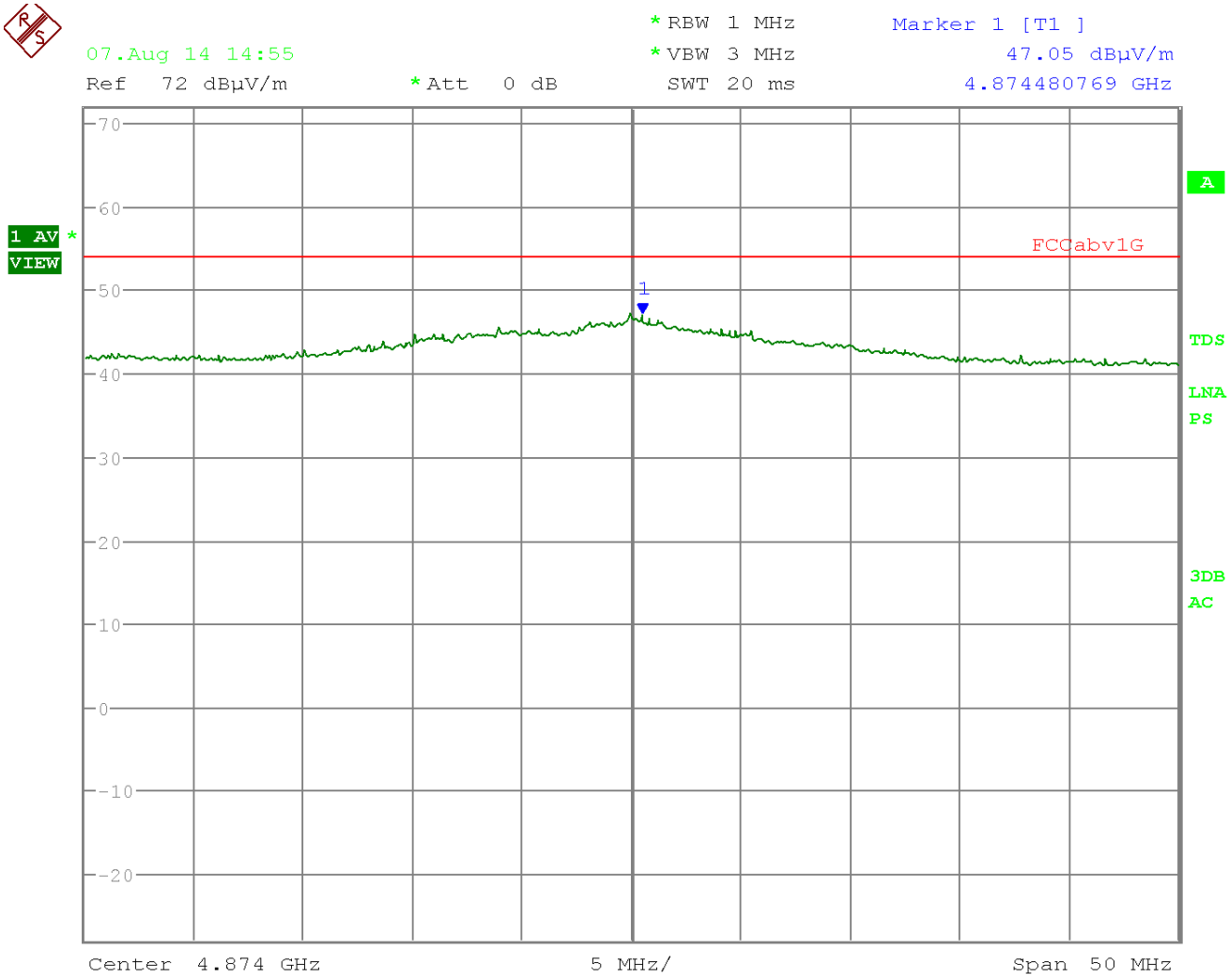
2nd Harmonic Peak Vertical

Results: Meets Requirements

RADIATION INTERFERENCE 2nd Harmonic Vertical Average

Rules Part No.: 15.247, 15.209

Mode n 2nd Harmonic



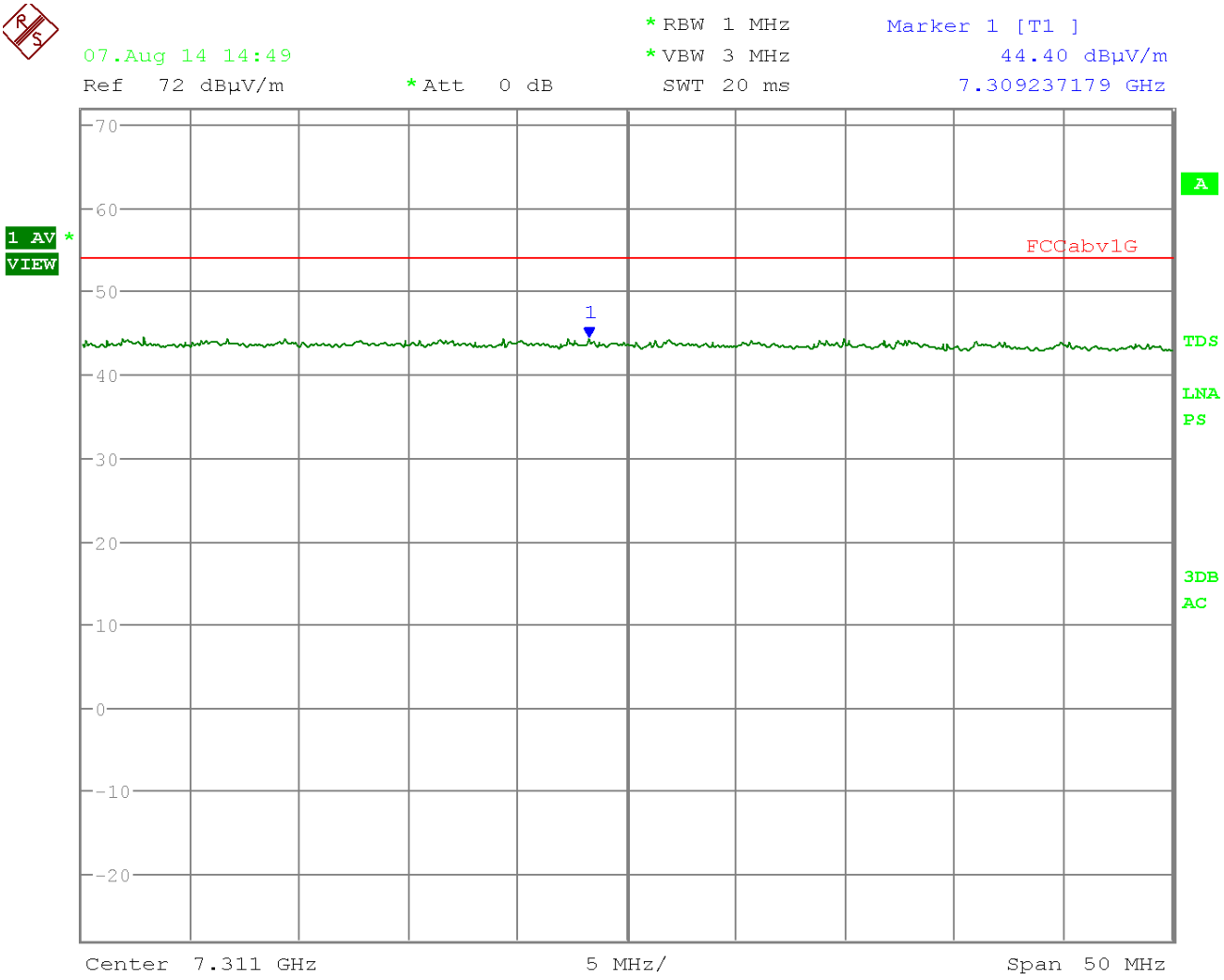
2nd Harmonic Vertical Average

Results: Meets Requirements

RADIATION INTERFERENCE 3rd Harmonic Horizontal

Rules Part No.: 15.247, 15.209

Mode n 3nd Harmonic



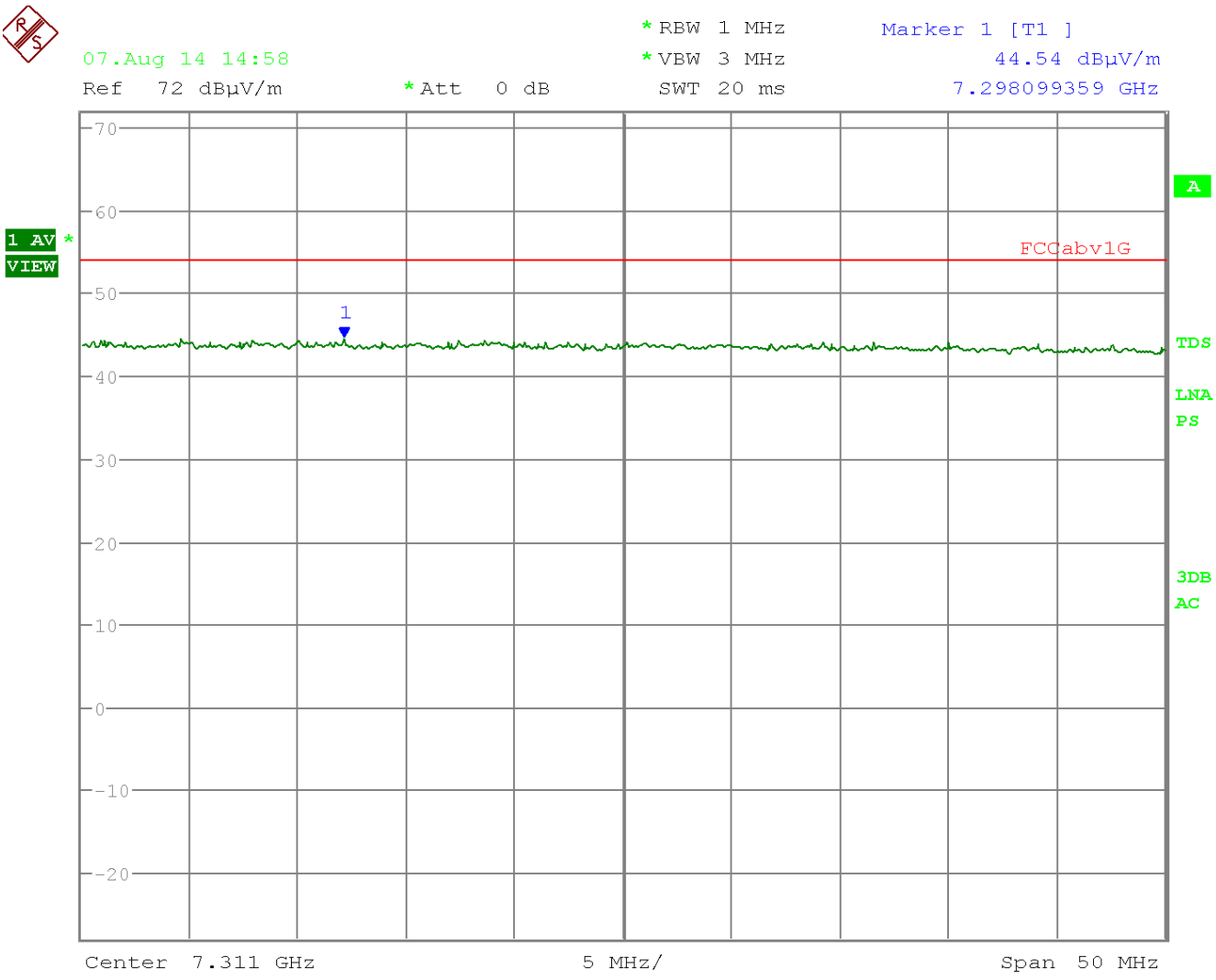
3rd Peak Horizontal

Results: Meets Requirements

RADIATION INTERFERENCE 3rd Harmonic Vertical

Rules Part No.: 15.247, 15.209

Mode n 3nd Harmonic



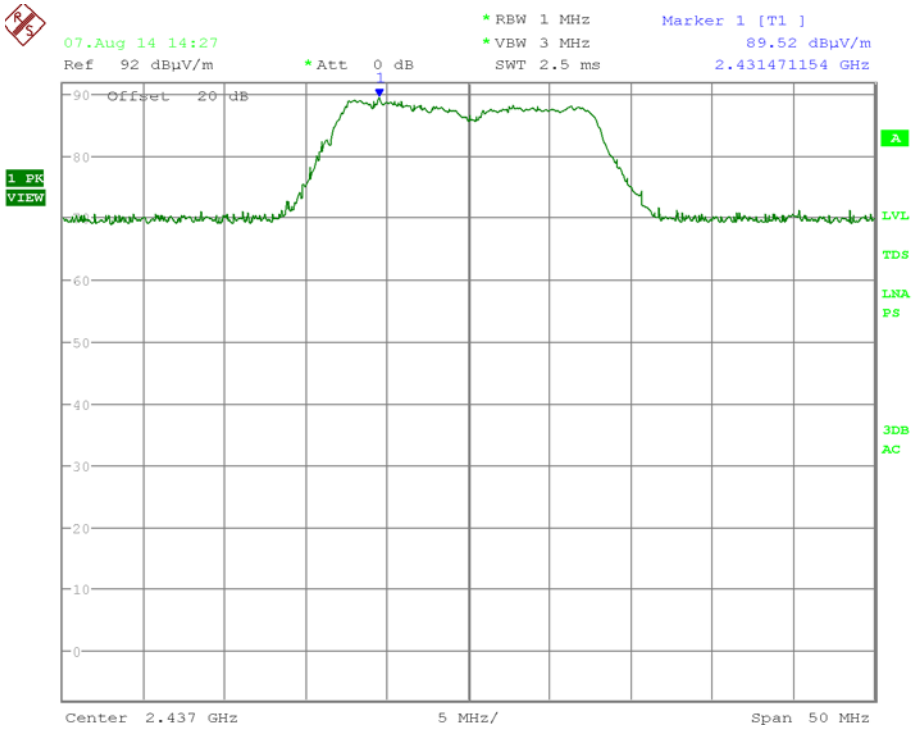
3rd Harmonic Peak Vertical

Results: Meets Requirements

RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209

Mode G Fundamental

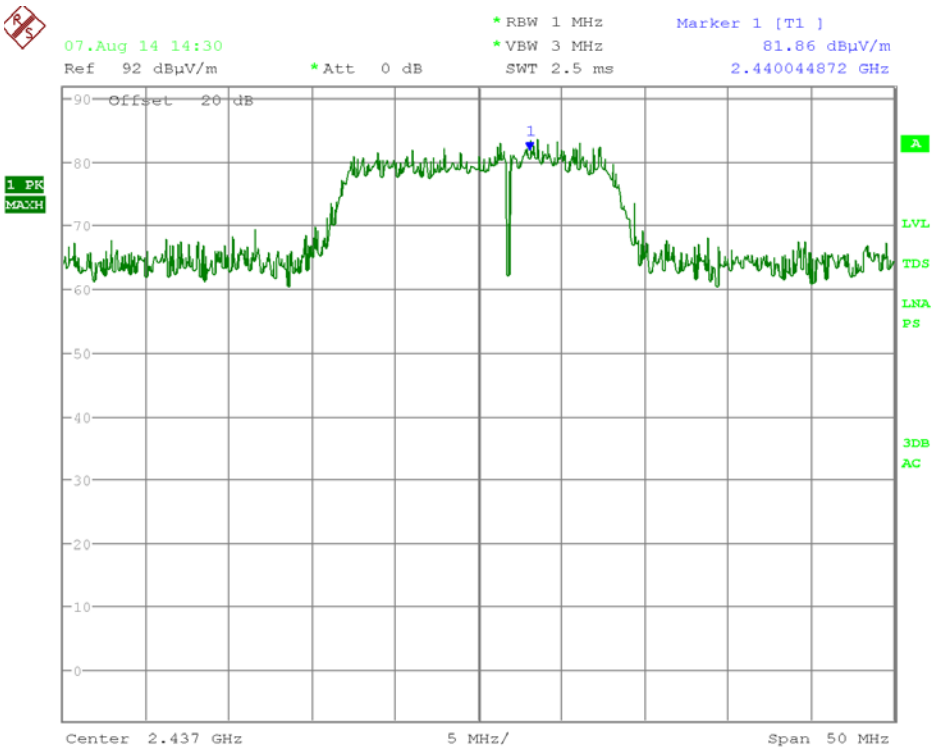


Vertical Peak

RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209

Mode G Fundamental

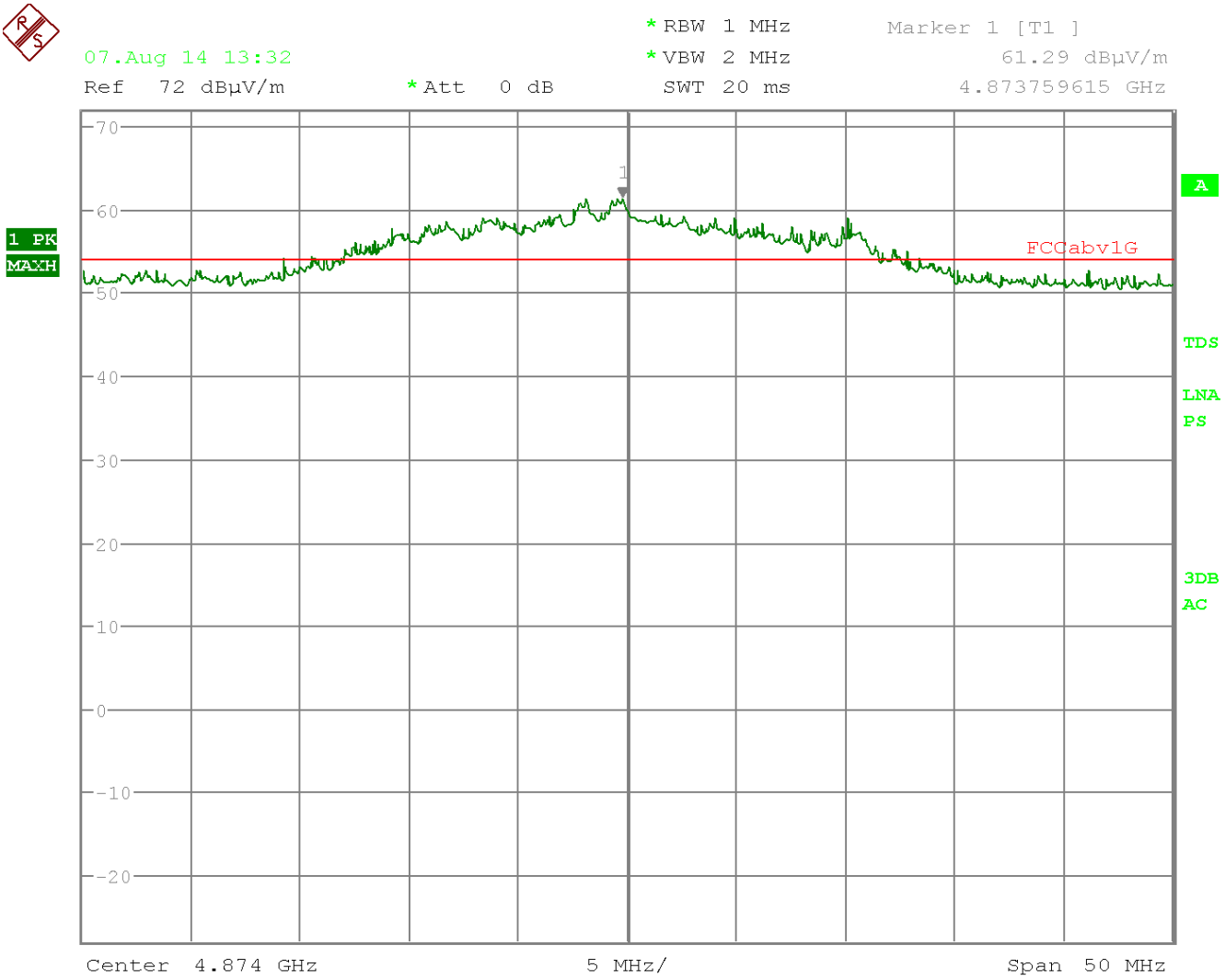


Horizontal Peak

RADIATION INTERFERENCE Vertical Peak

Rules Part No.: 15.247, 15.209

Mode G 2nd Harmonic

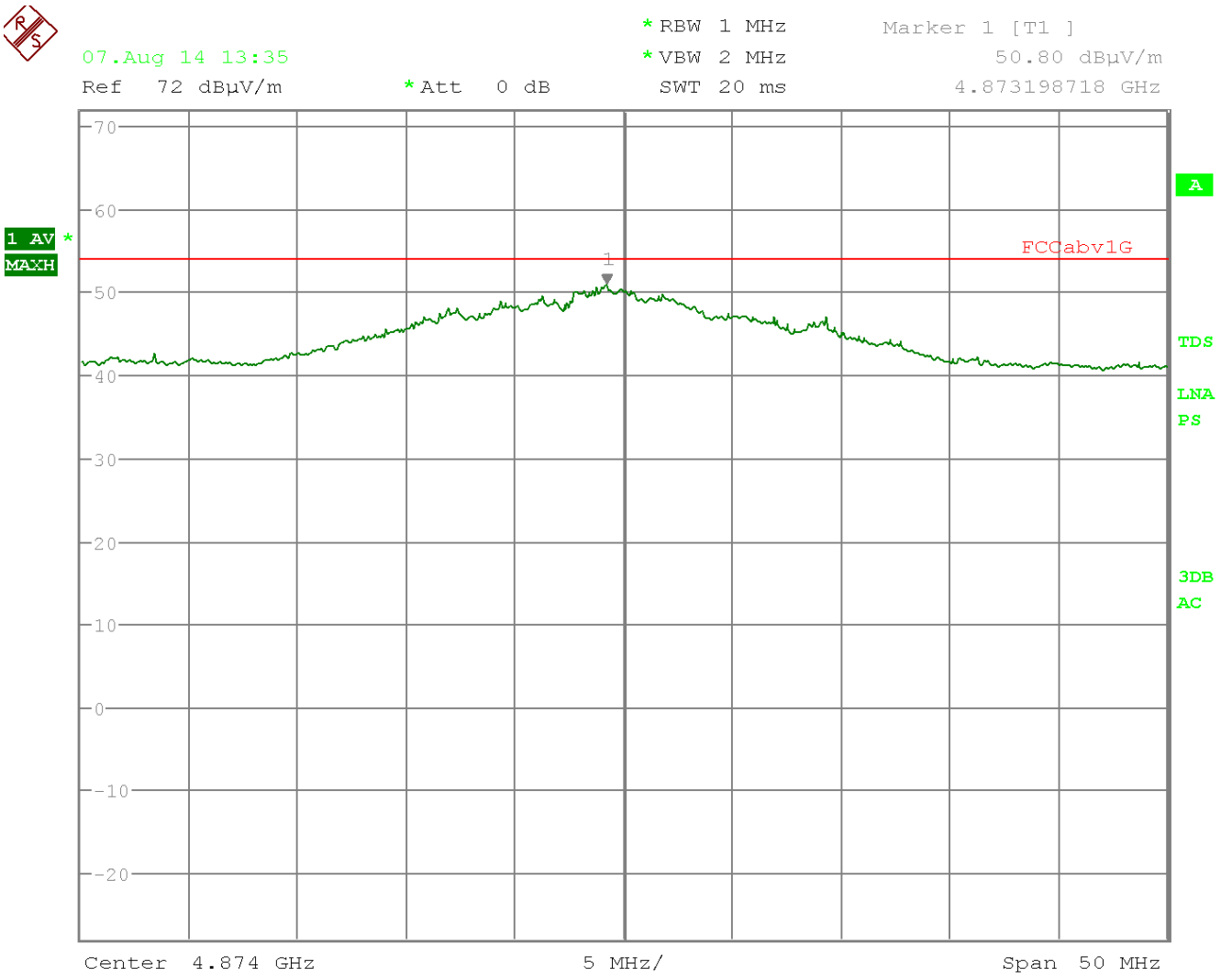


Vertical Peak

RADIATION INTERFERENCE Vertical Average

Rules Part No.: 15.247, 15.209

Mode G 2nd Harmonic

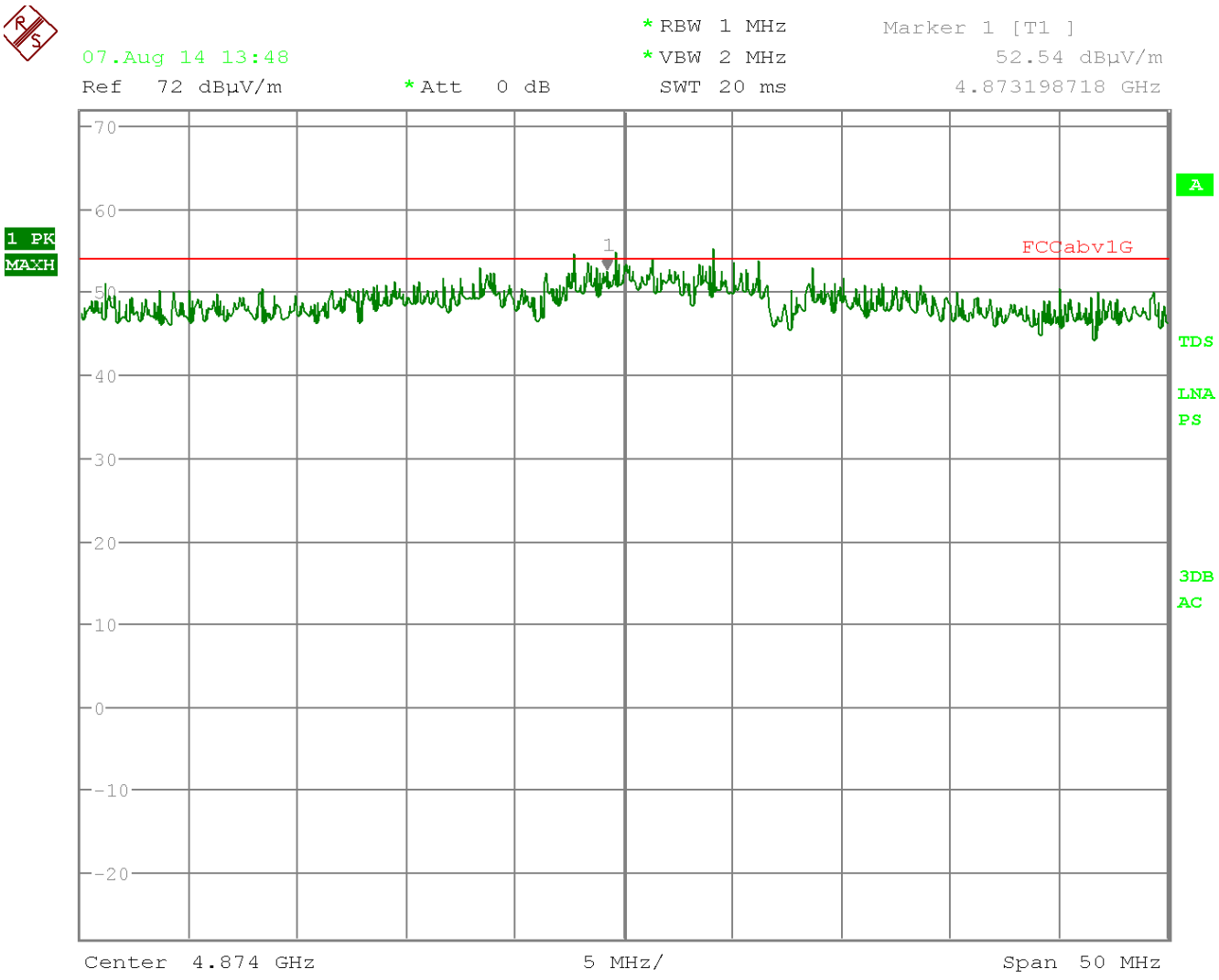


Vertical Average

RADIATION INTERFERENCE Horizontal Peak

Rules Part No.: 15.247, 15.209

Mode G 2nd Harmonic

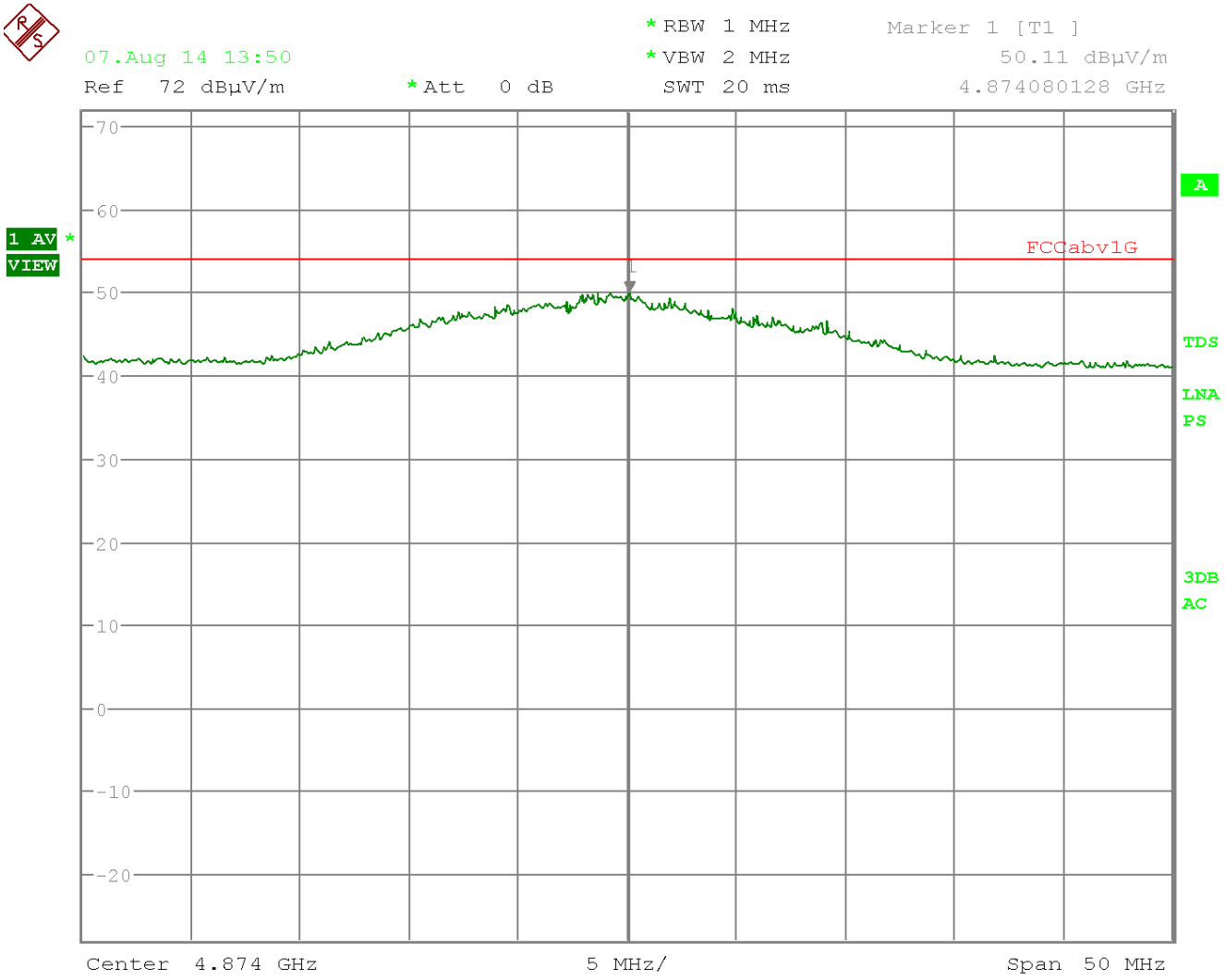


Horizontal Peak

RADIATION INTERFERENCE Horizontal Average

Rules Part No.: 15.247, 15.209

Mode G 2nd Harmonic

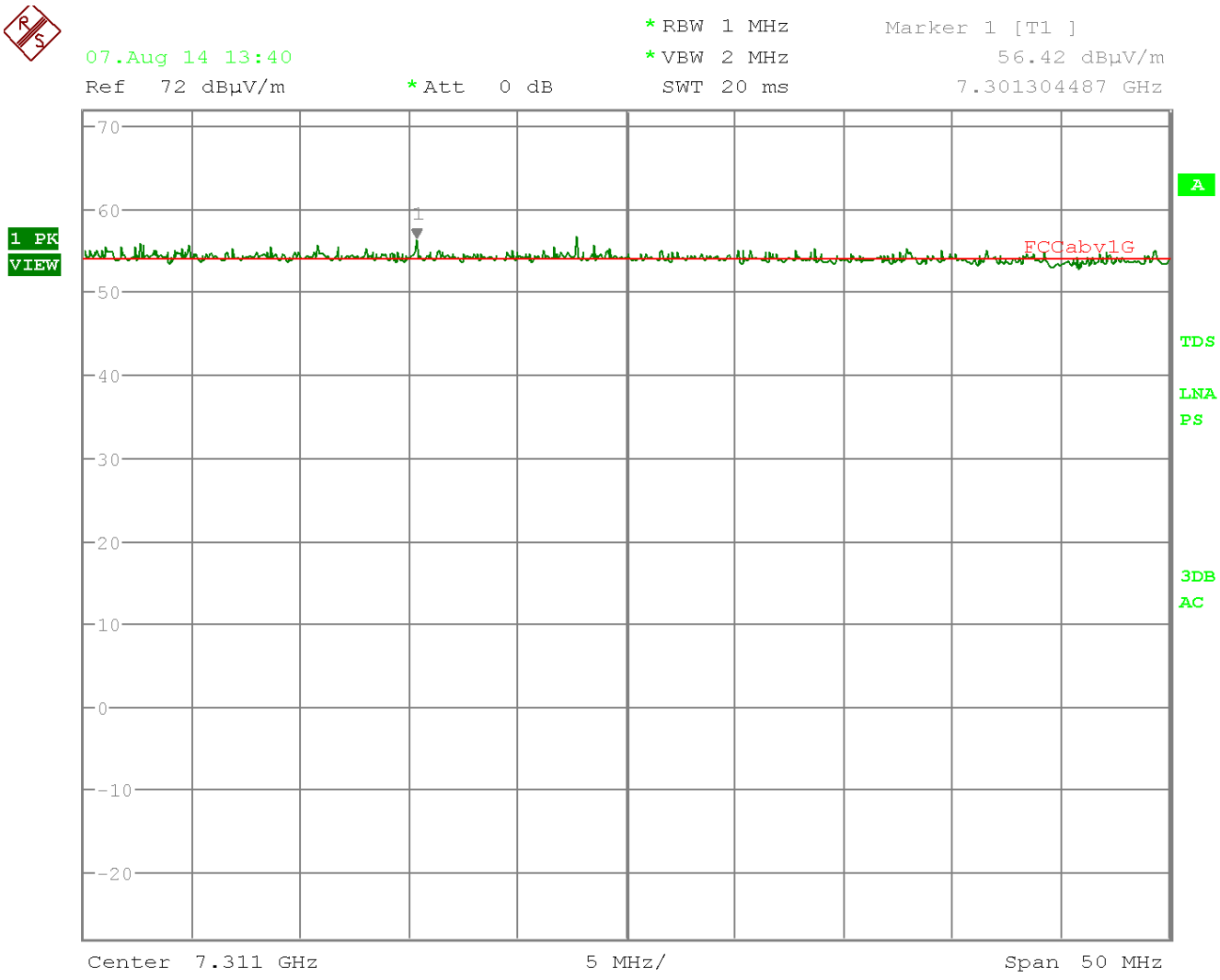


Horizontal Average

RADIATION INTERFERENCE Horizontal peak

Rules Part No.: 15.247, 15.209

Mode G 3rd Harmonic

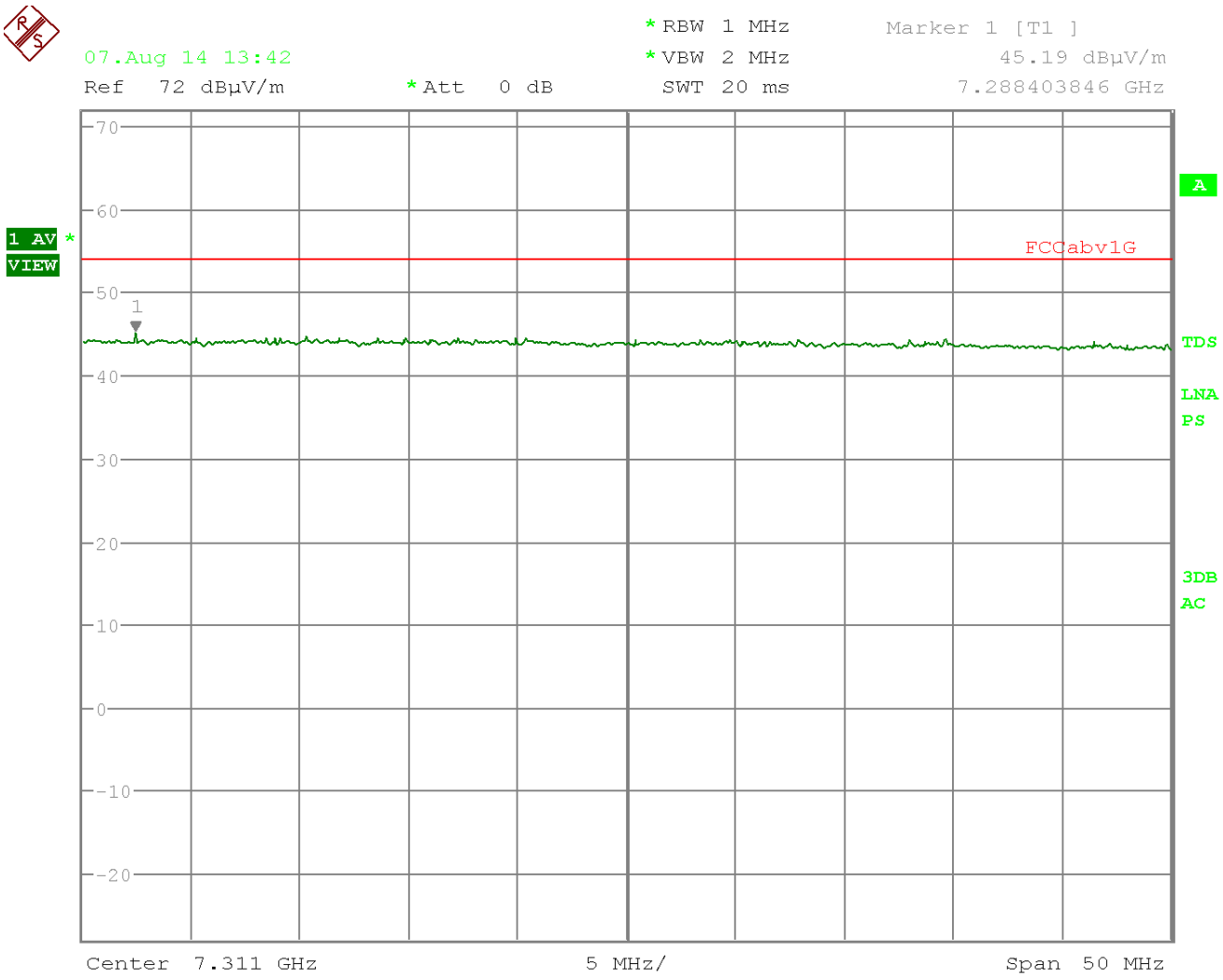


Vertical Peak

RADIATION INTERFERENCE Vertical Average

Rules Part No.: 15.247, 15.209

Mode G 3rd Harmonic

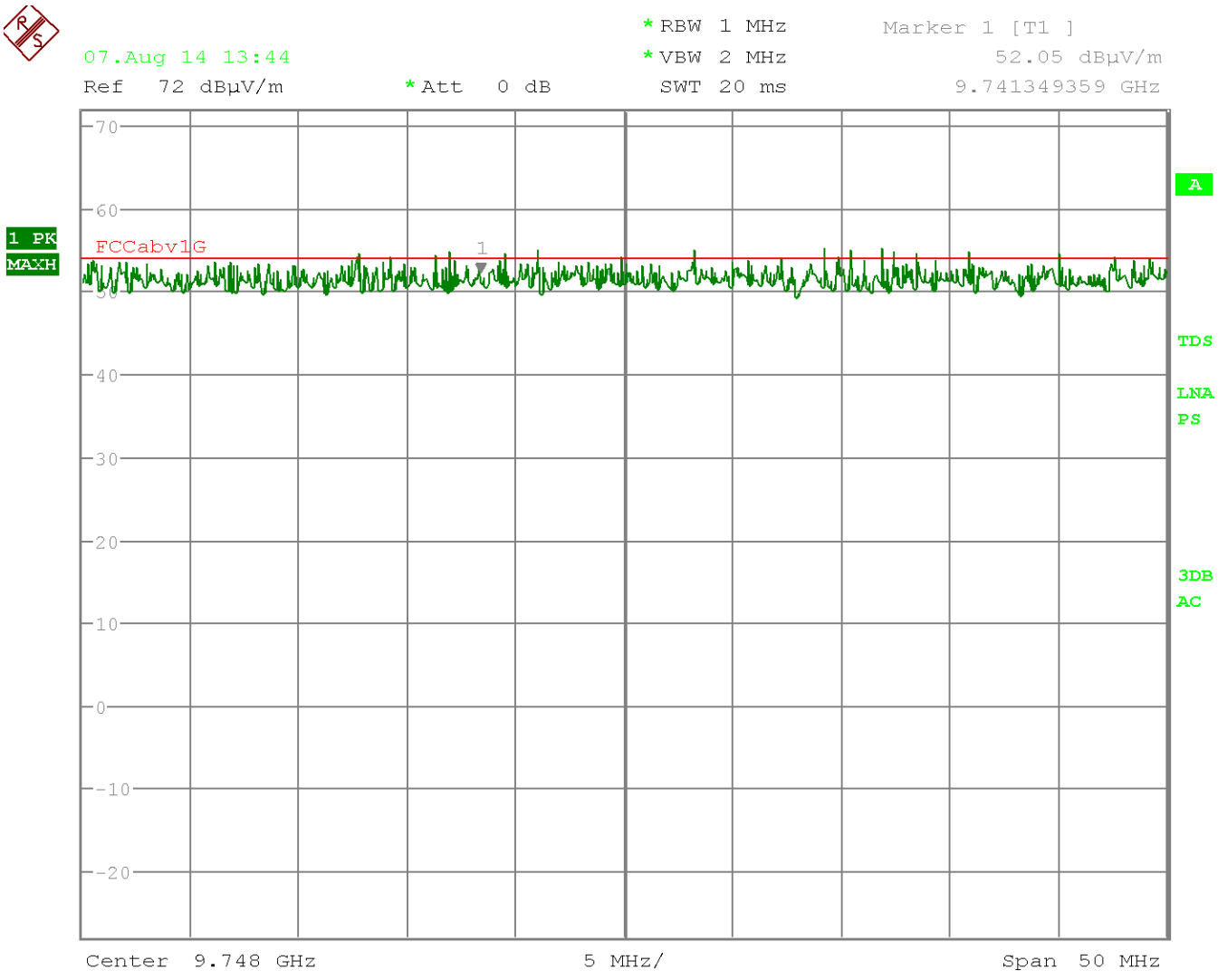


Vertical Average

RADIATION INTERFERENCE Vertical Peak

Rules Part No.: 15.247, 15.209

Mode G 4nd Harmonic

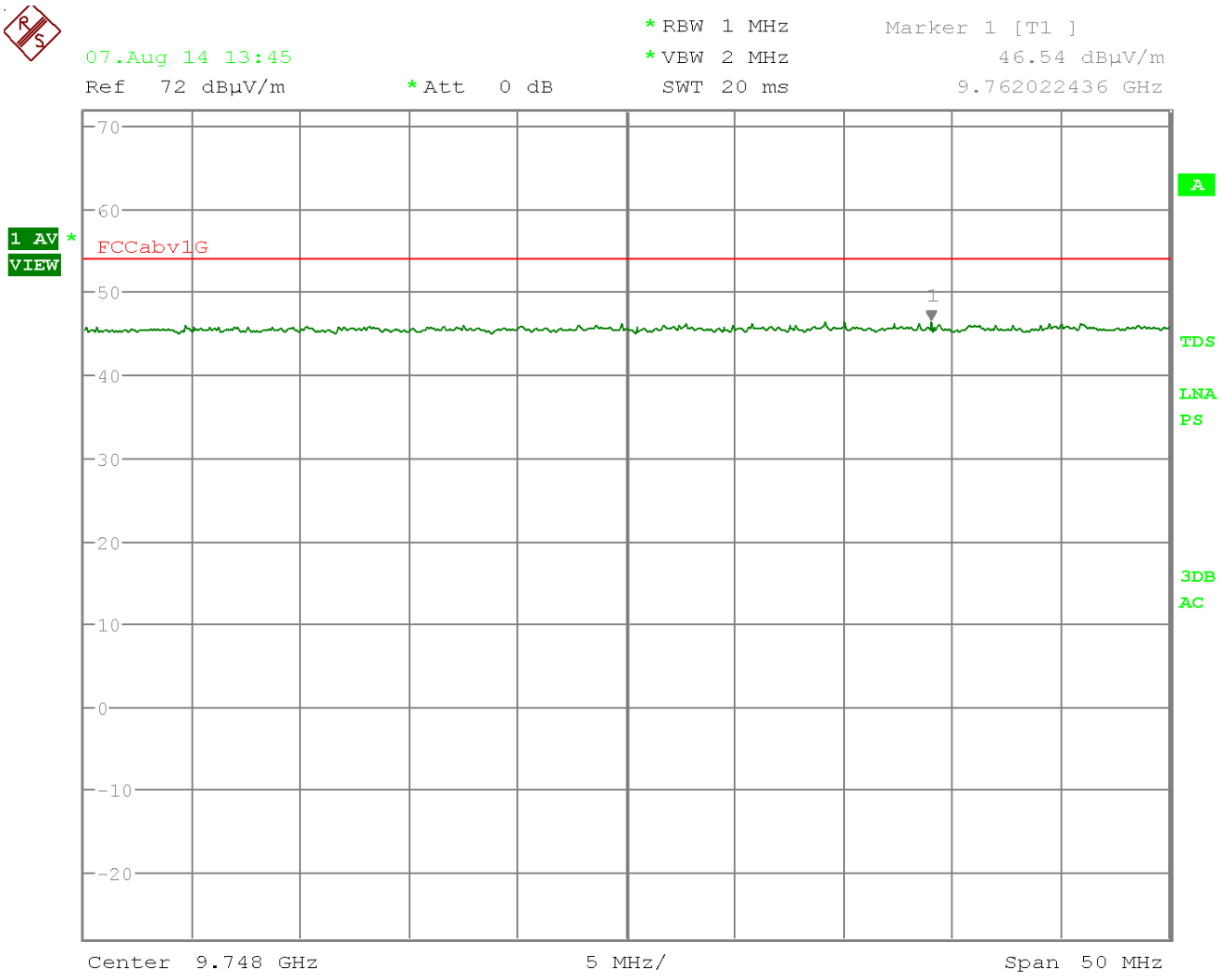


Vertical Peak

RADIATION INTERFERENCE Vertical Average

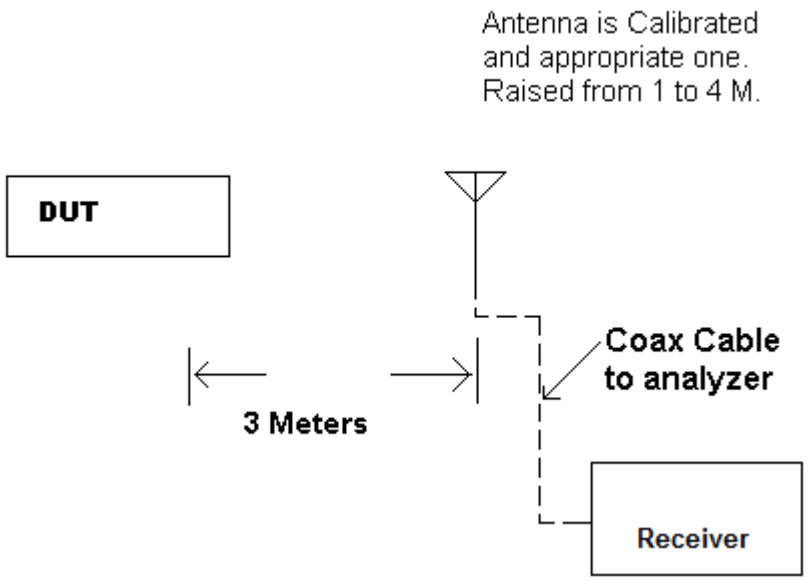
Rules Part No.: 15.247, 15.209

Mode G 4nd Harmonic



Vertical Average

Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI C63.4-2003 & the FCC/OET Guidance on Measurements for Spread Spectrum Systems – KDB 558074 or ANSI 63.10: 2010

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBµV)	Average Limits (dBµV)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decrease with logarithm of frequency		

Test Data:

The device is capable of battery operation only (3 “AA” cells).

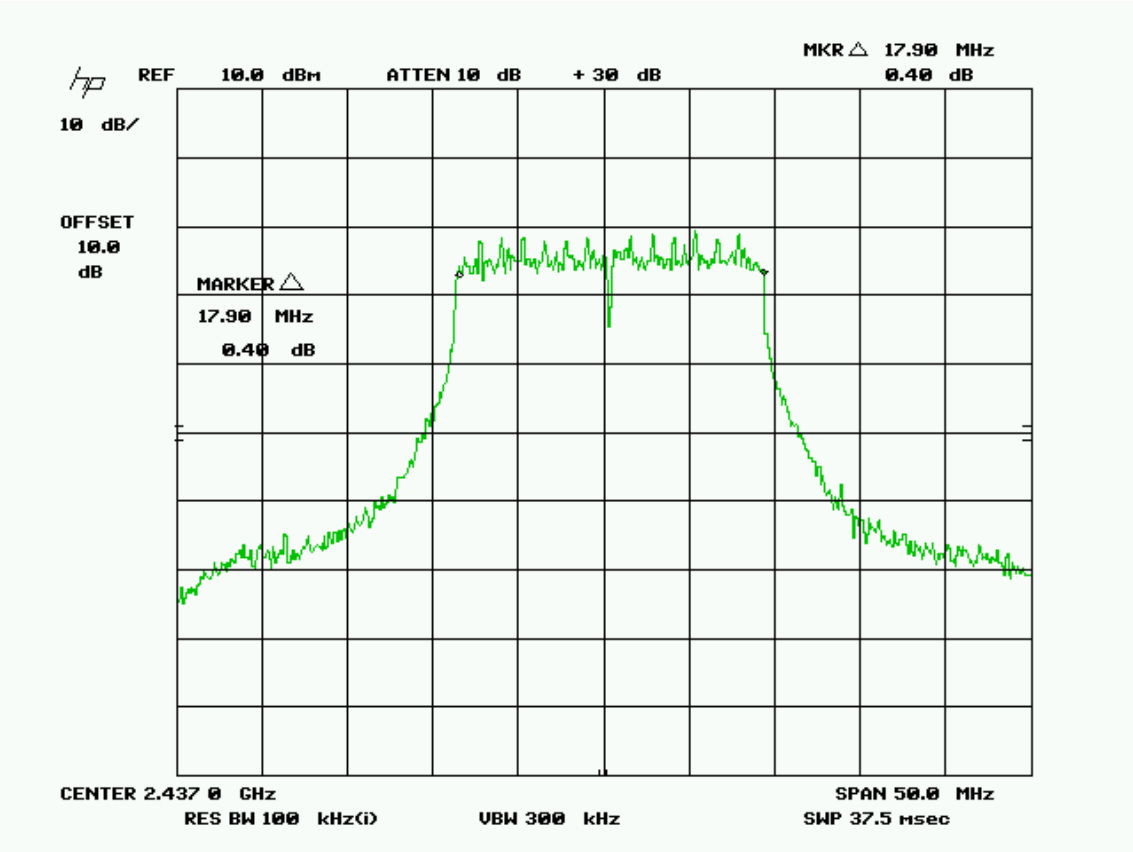
OCCUPIED BANDWIDTH

Rules Part No.: 15.247(a)(2

Requirements: The 6 dB bandwidth must be greater than 500 kHz.

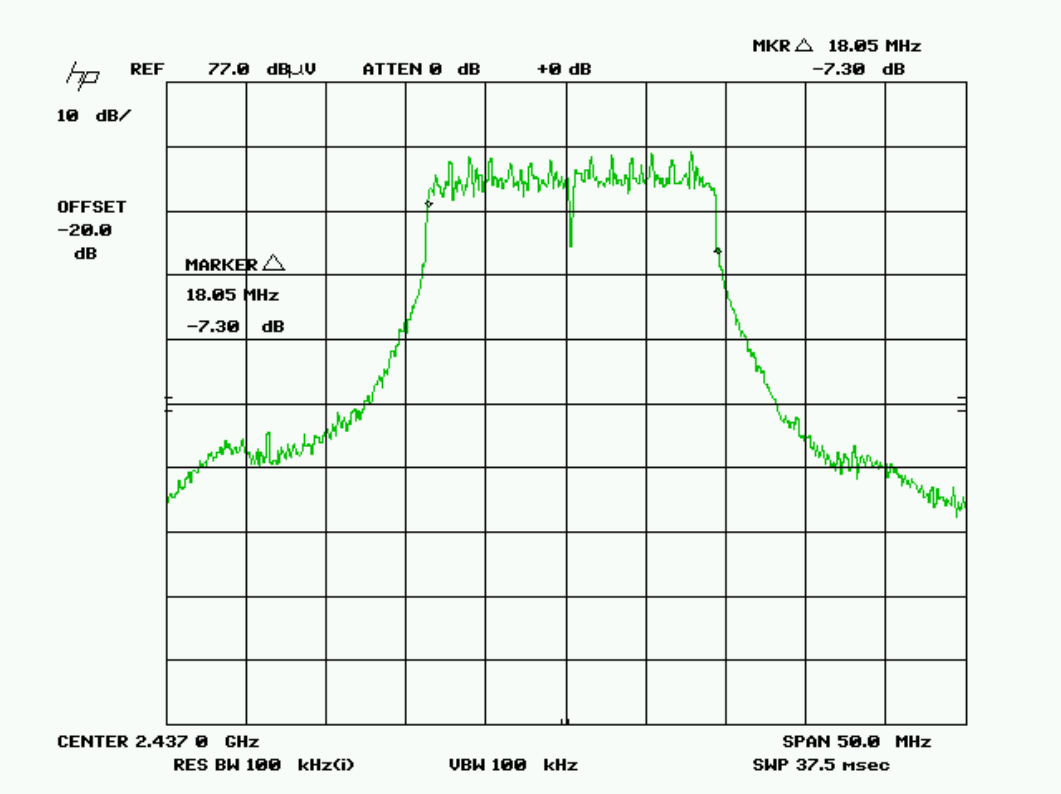
Test Data:
The device is capable of limited number of channels (1) and data rates, the worst case 6 and 20 dB bandwidths are shown in the plots.

Mode g



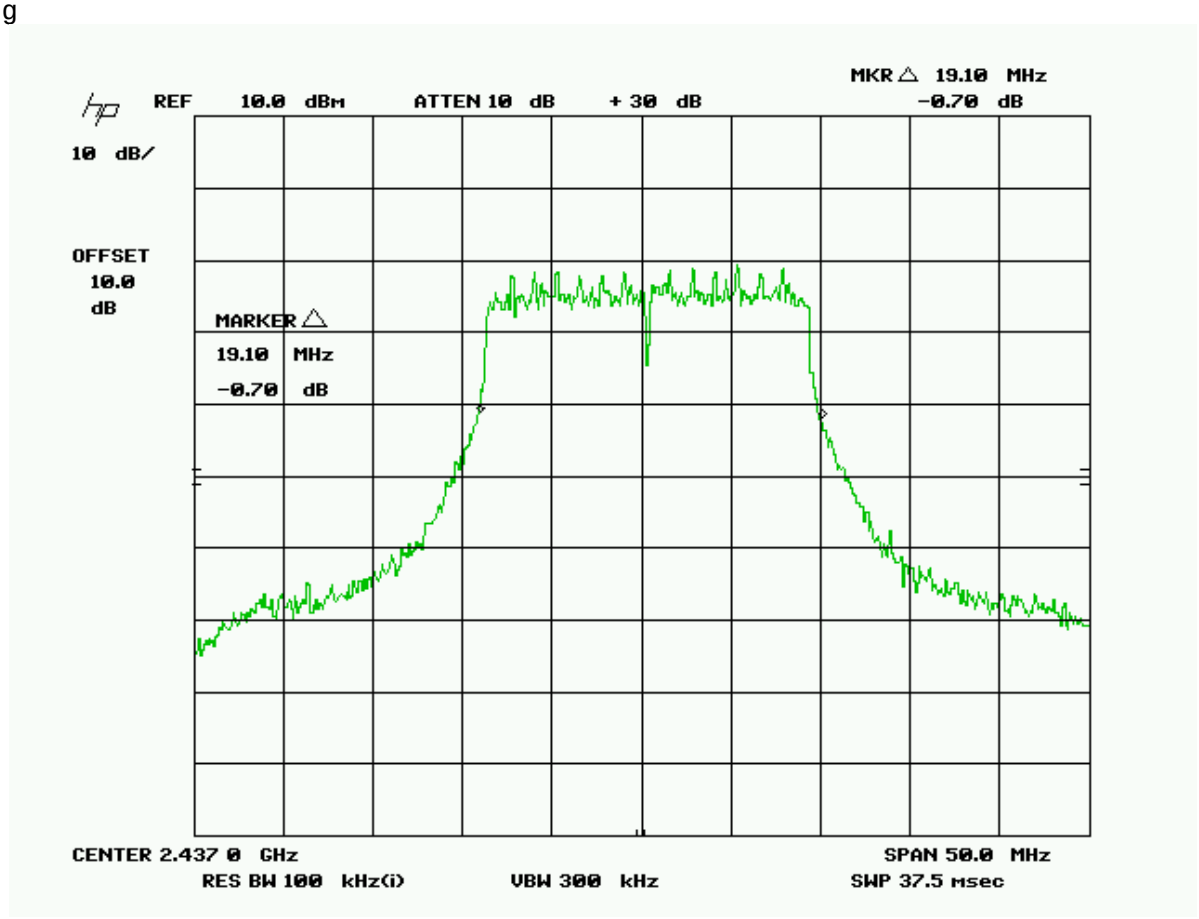
OCCUPIED BANDWIDTH

Mode n



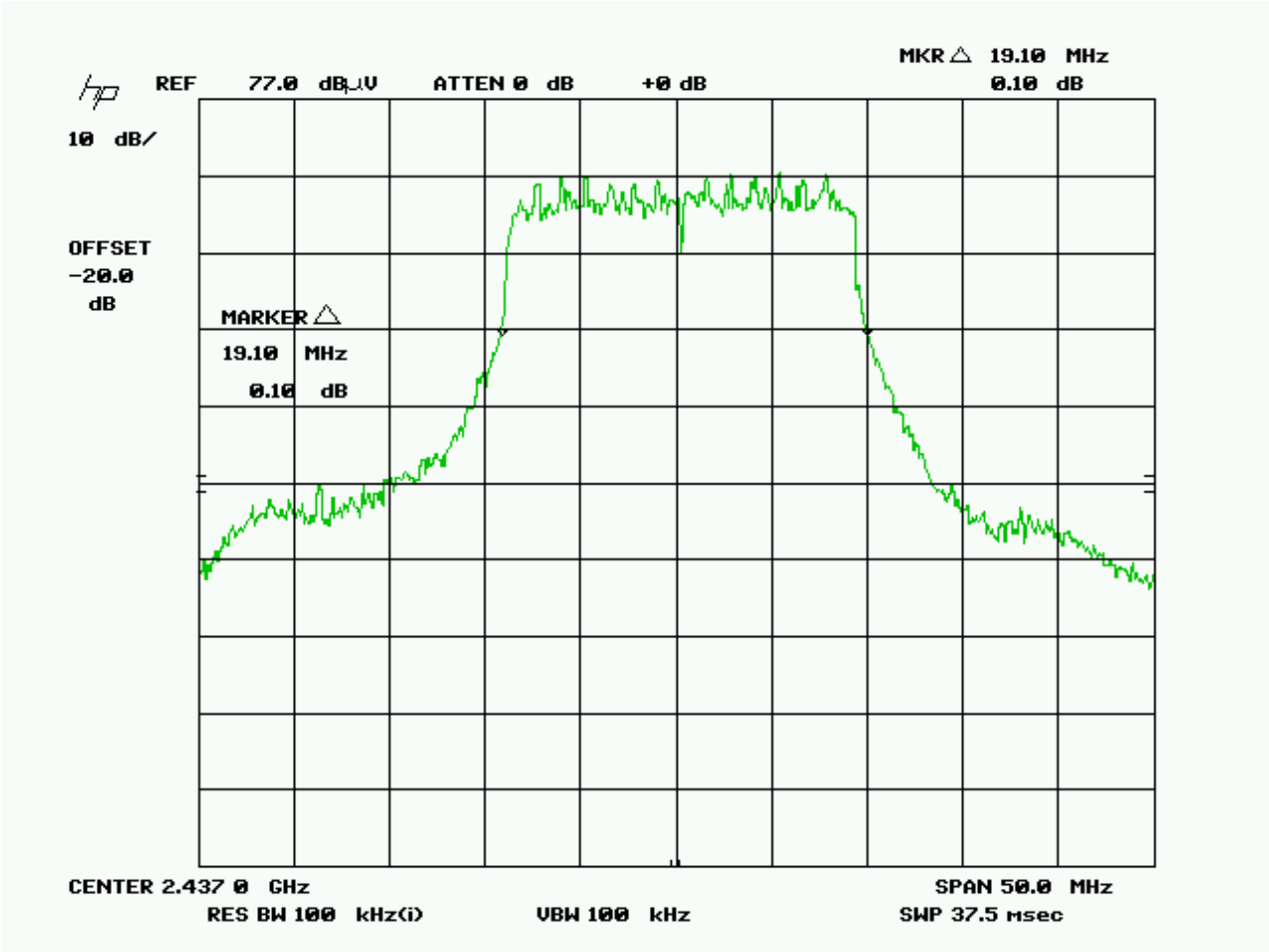
OCCUPIED BANDWIDTH

20 dB bandwidth plots
Mode g



OCCUPIED BANDWIDTH

Mode n

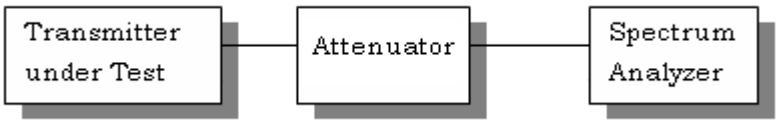


POWER OUTPUT

Rules Part #: 15.247(b) 1 Watt conducted, 4W EIRP

The device is capable of using only a single transmit channel and 2 modulation modes (g and n). Various data rates were pretested and the worst case data for each mode represented.

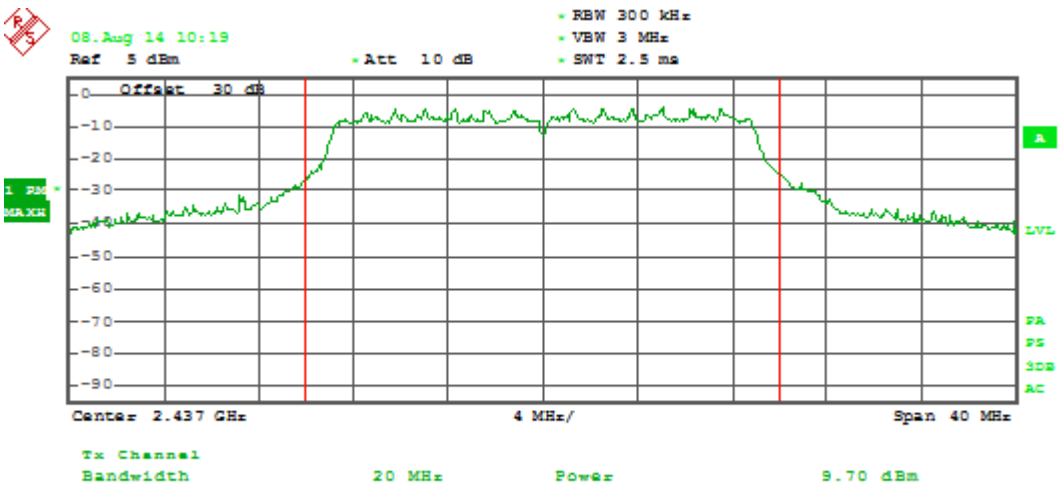
TEST SET UP:



Test Results:

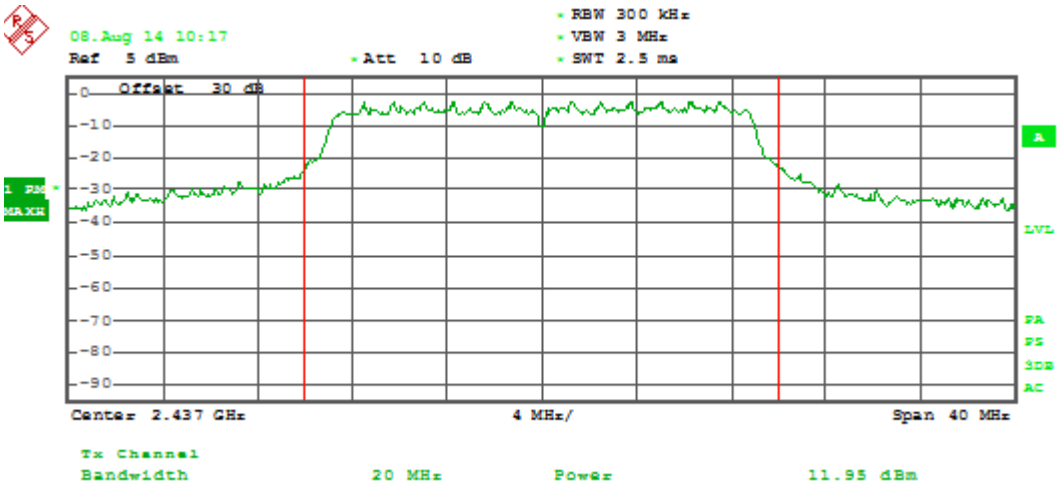
Frequency MHz	Mode	Po Watts	Po dBm
2437 MHz	g	0.01	9.7
2437 MHz	n	0.016	11.9

Mode g



POWER OUTPUT

Mode n



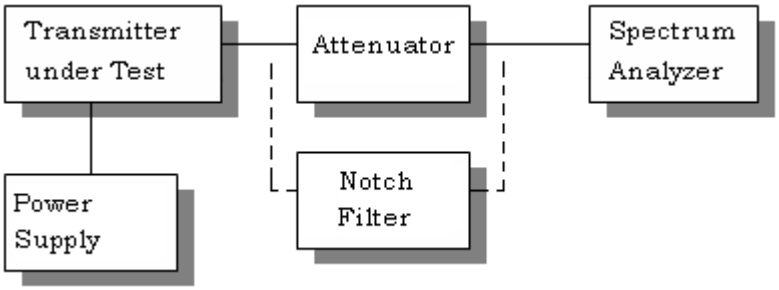
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Requirements: Emissions must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

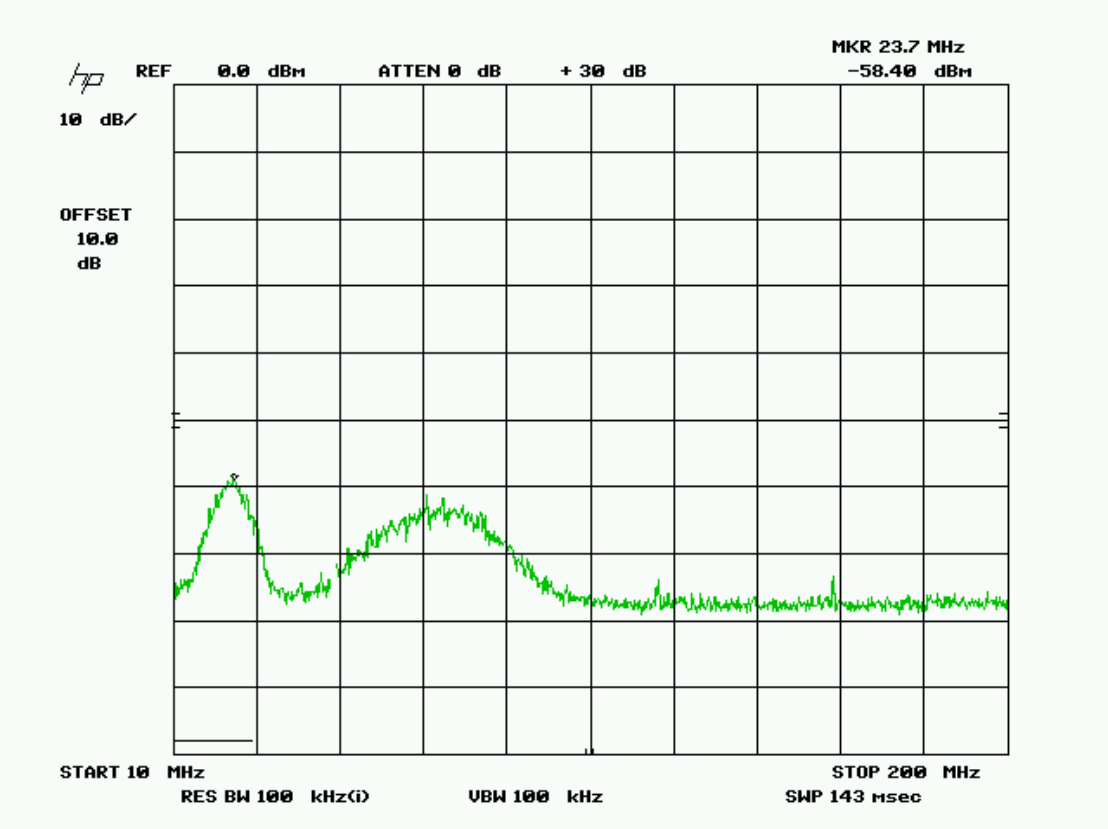
Test Data:

The device has a permanently attached antenna and a temporary antenna connector was used to make the following plots. Emissions were checked from 9 kHz or the lowest frequency generated to the 10th harmonic. There were no significant emissions past 7.4 GHz.

15.247c Method of Measuring RF Conducted Spurious Emissions

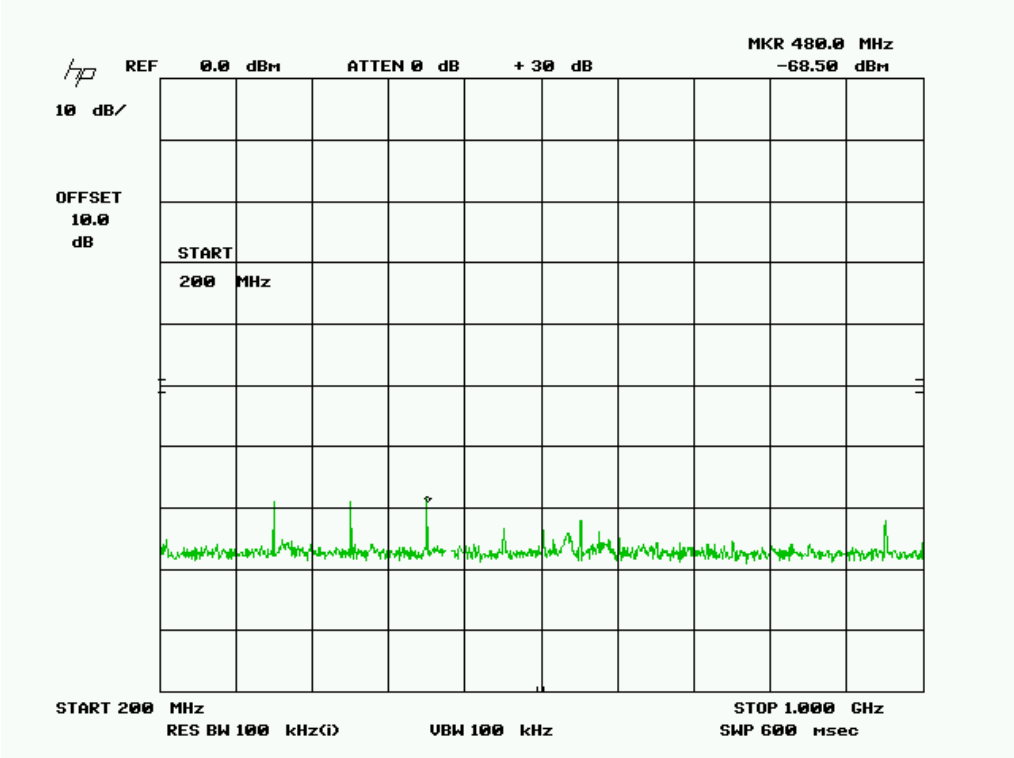


Test Data:

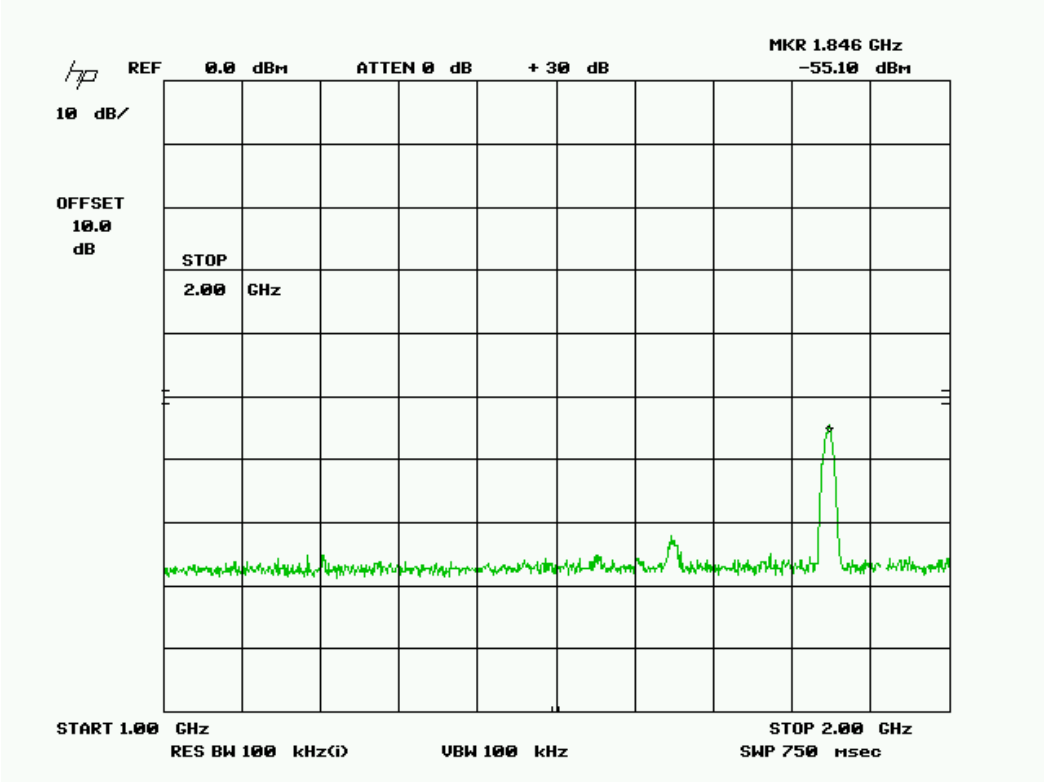

MKR 23.7 MHz
REF 0.0 dBm
ATTEN 0 dB
+ 30 dB
-58.40 dBm
10 dB/
OFFSET
10.0
dB
START 10 MHz
STOP 200 MHz
RES BW 100 kHz(i)
VBW 100 kHz
SWP 143 msec

10 to 200 MHz

SPURIOUS EMISSIONS AT ANTENNA TERMINALS



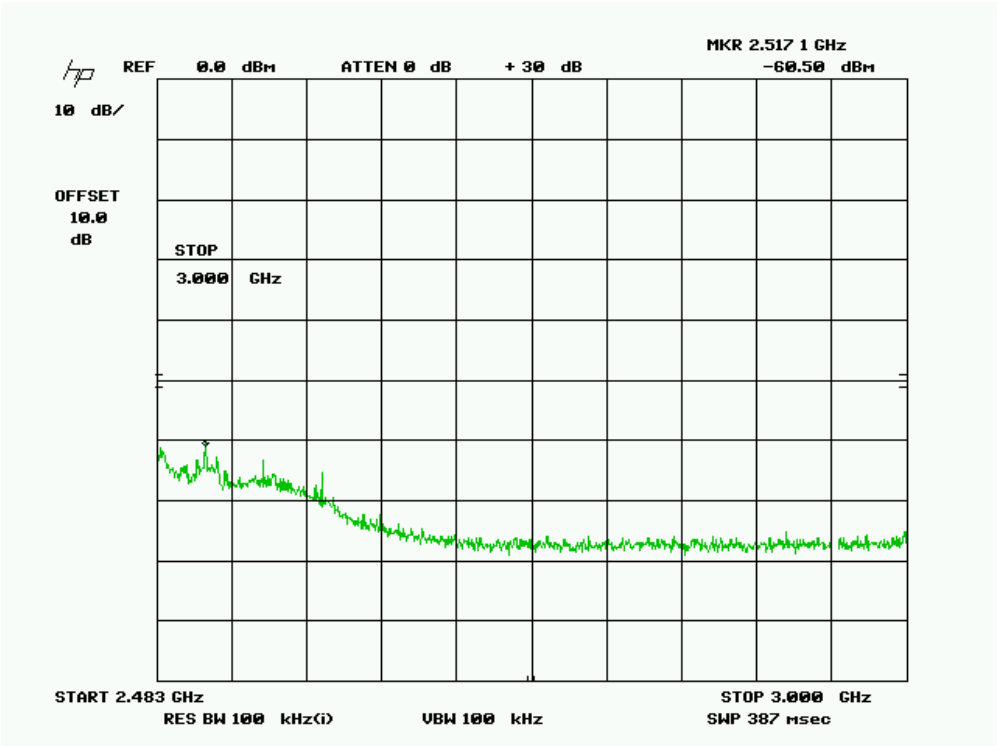
200 to 1000 MHz



1 to 2 GHz

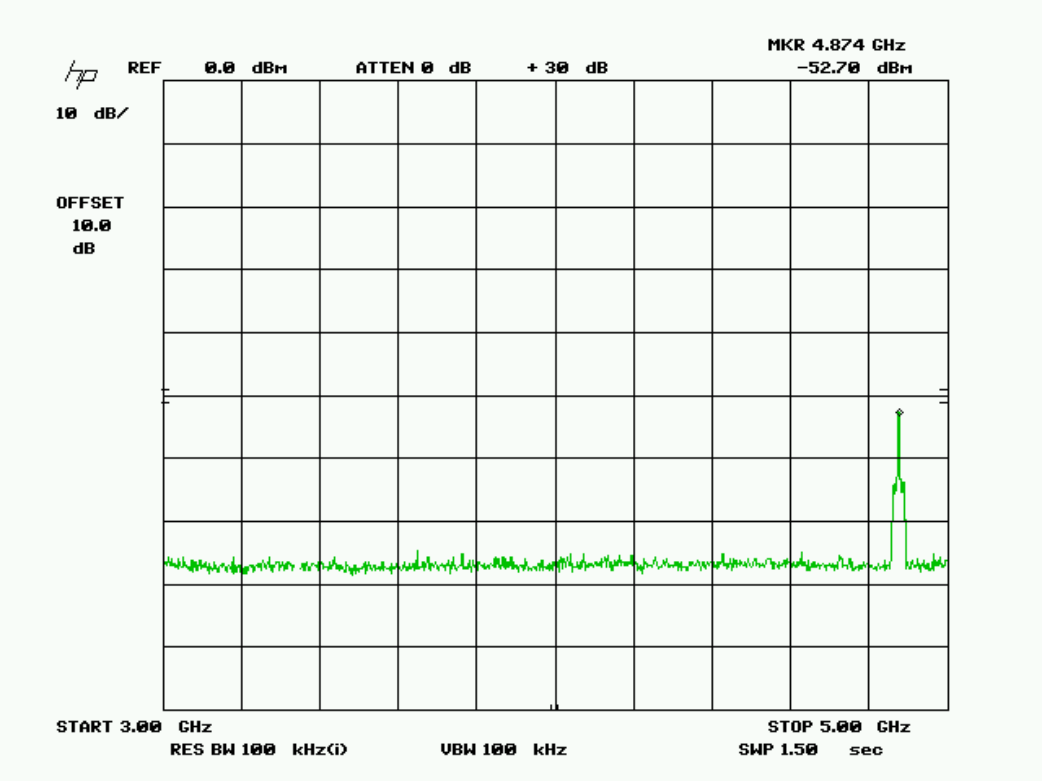
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

2 to 2.4 GHz

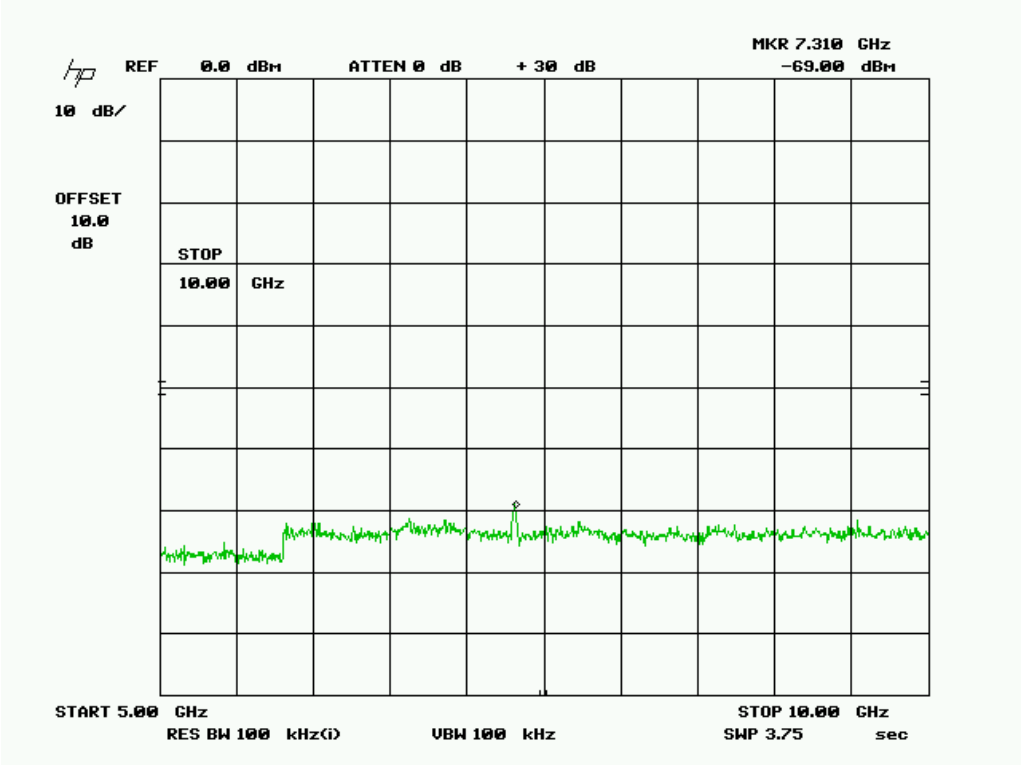


2483.5 MHz to 3 GHz

SPURIOUS EMISSIONS AT ANTENNA TERMINALS



3 to 5 GHz



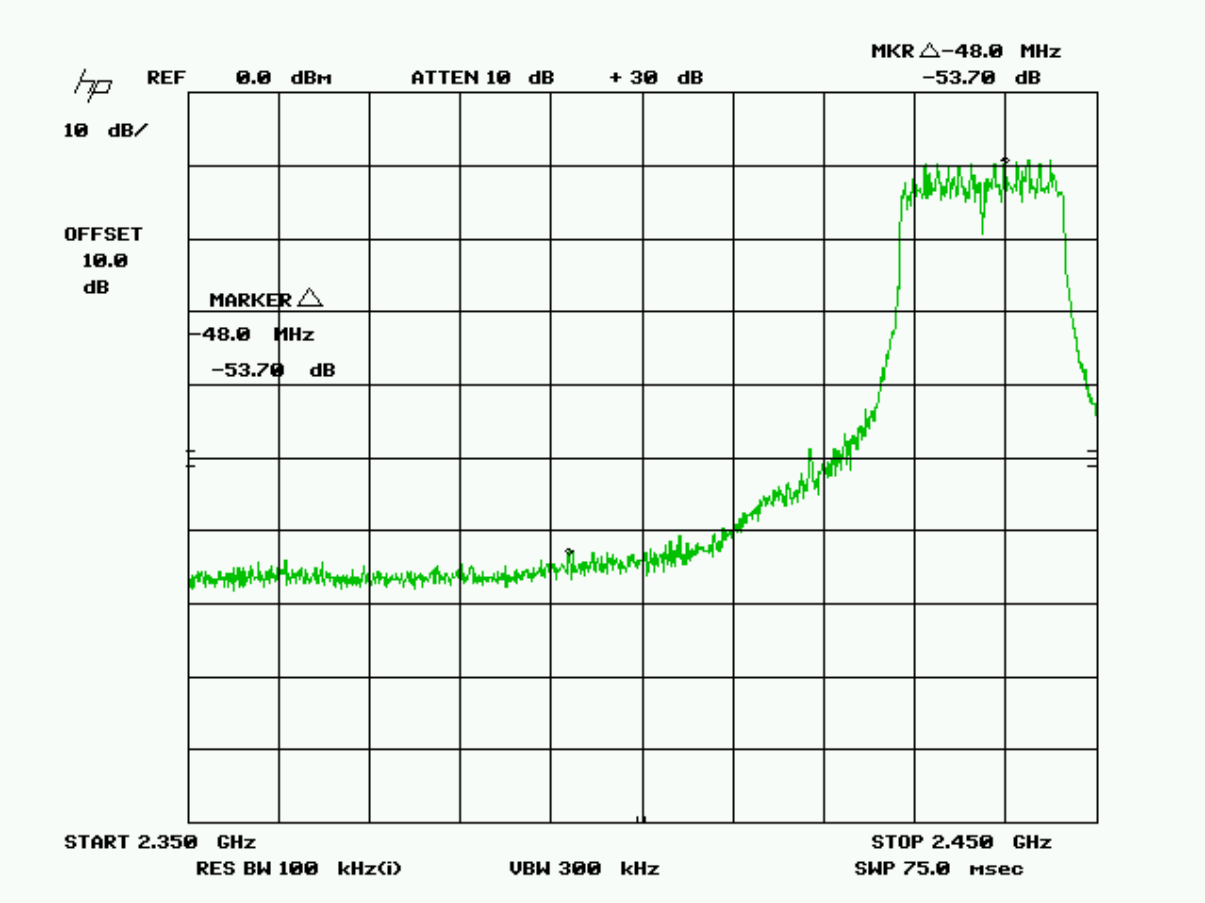
5 to 10 GHz

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Requirements: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 µV/m (54 dBµV/m).

Test Procedure: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2003 or kdb 558074 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Lower band edge (conducted) mode g



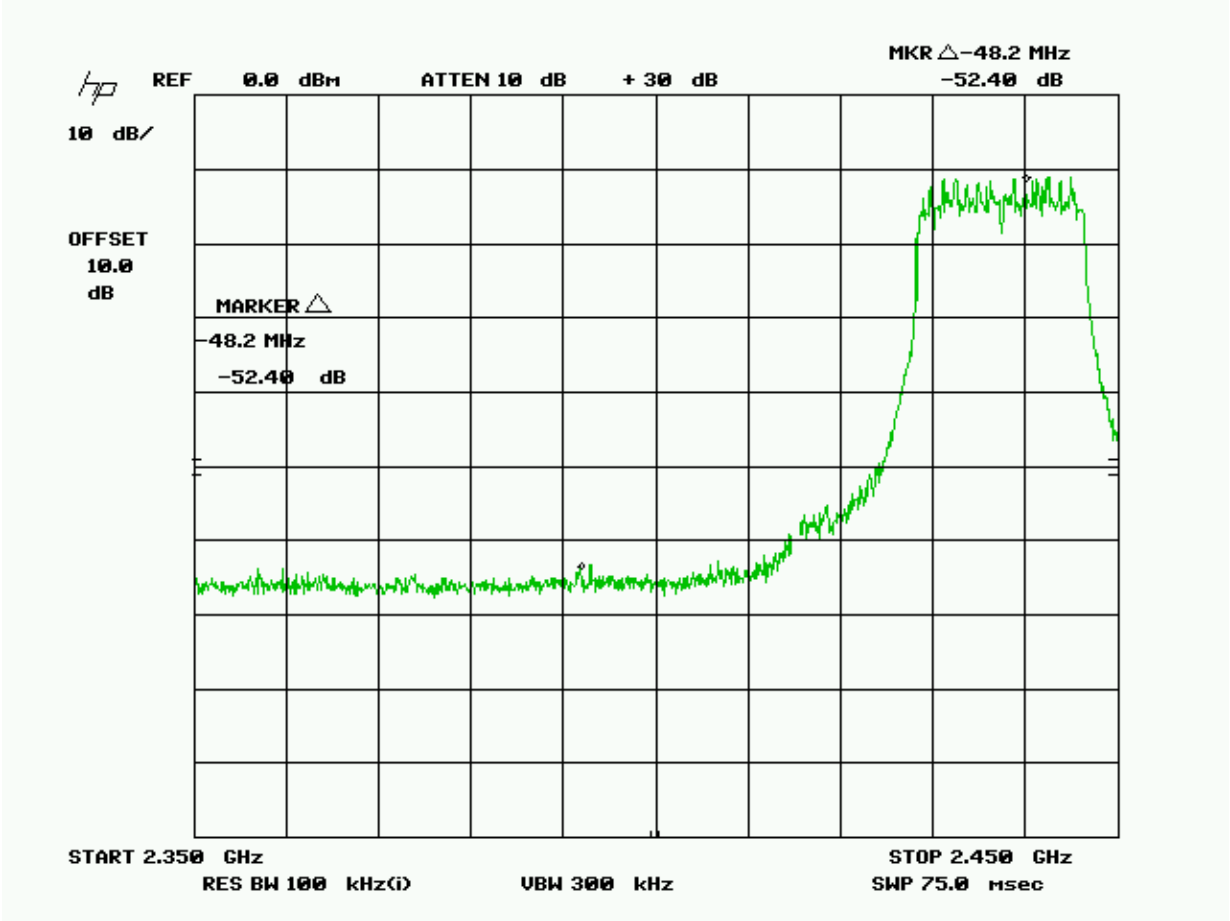
Meets the 20 dBc requirement at the bandedge

Field strength of the fundamental 89.52 dBuV/m

89.52dBuV/m – 53.7 dB = 35.82 dBuV/m

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Lower band edge mode n (conducted).



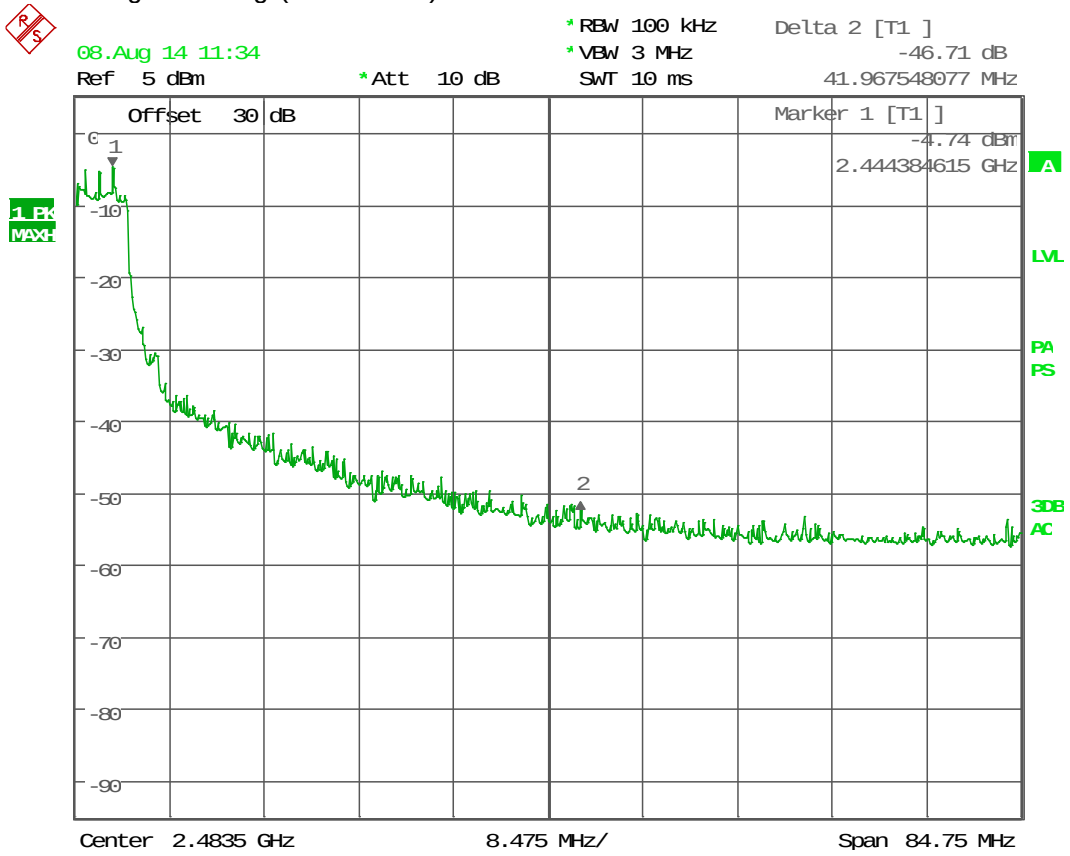
Meets the 20 dBc requirements at the bandedge

Field strength of the fundamental 89.77 dBµV/m

89.77 dBµV/m – 52.40 dB = 37.37 dBµV/m

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Upper band edge mode g (conducted)

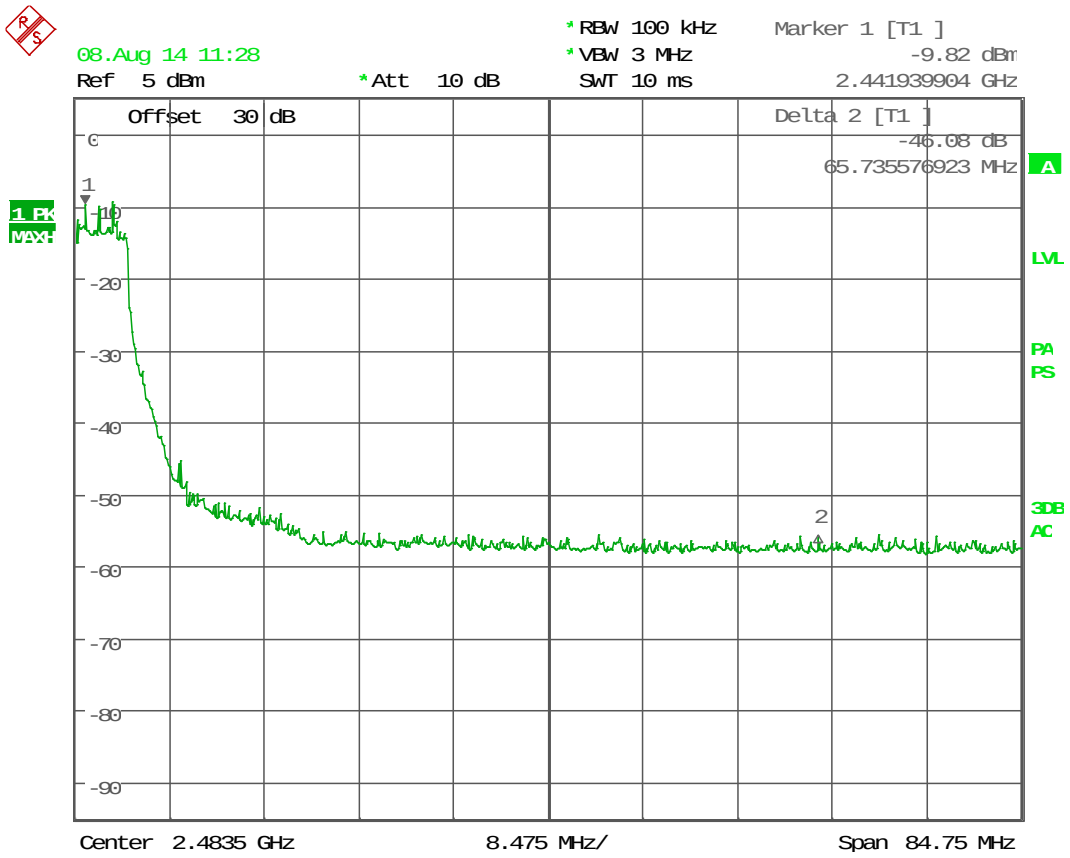


Date: 8.AUG.2014 11:34:50

Field strength of the fundamental 89.52 dBµV/m

89.52 dBµV/m – 46.71 dB = 42.81 dBµV/m

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND



Date: 8.AUG.2014 11:28:42

Field strength of the fundamental 89.77 dBµV/m

89.77 dBµV/m – 46.08 dB = 43.69 dBµV/m

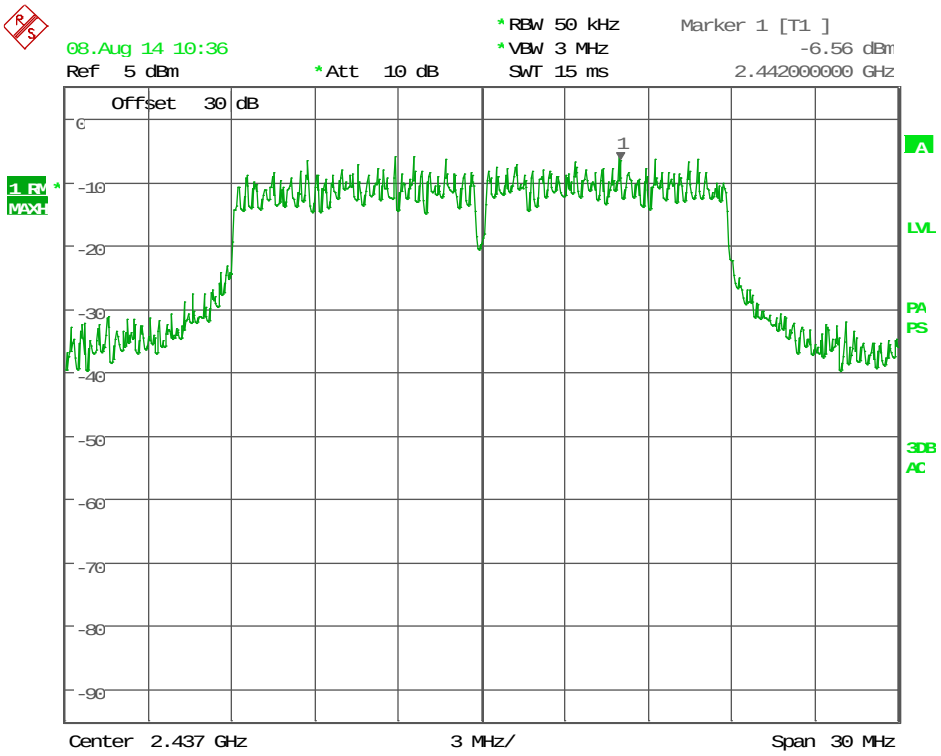
POWER SPECTRAL DENSITY

Rules Part No.: 15.247(d)

Requirements: The peak level measured must be less than +8.0 dBm/3 kHz.

All the data rates were checked and the worst case (highest) presented below.

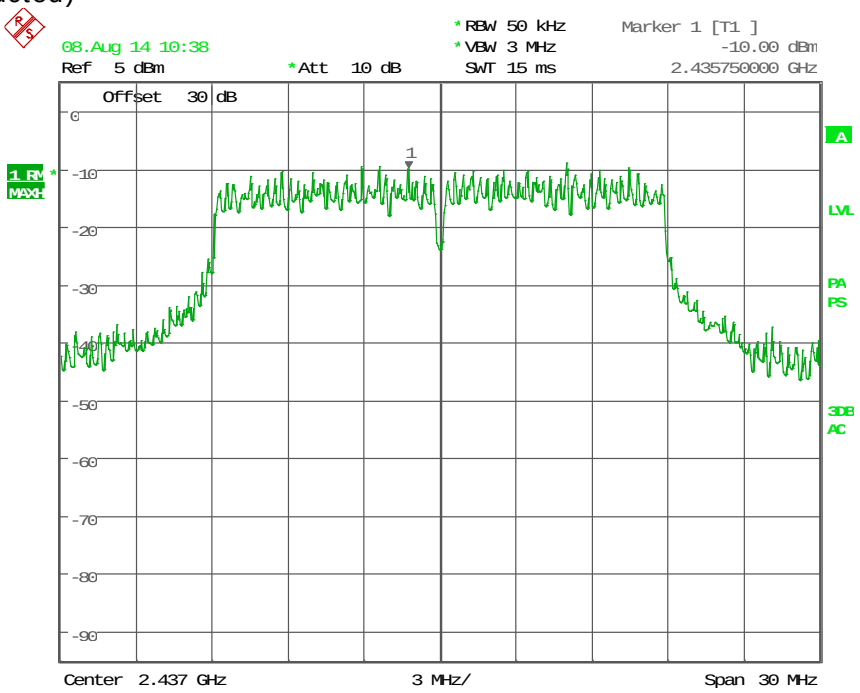
Test Data: SEE THE FOLLOWING PLOTS
Mode n (conducted)



Date: 8.AUG.2014 10:36:26

POWER SPECTRAL DENSITY

Mode g (conducted)



Date: 8.AUG.2014 10:38:16

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Shielded Enclosure Screen Room	Timco	Shielded Enclosure	N/A	N/A	N/A
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Coaxial Cable - Chamber 3 cable set	Semiflex	N/A	Chamber 3 cable set	1/26/12	1/26/15
EMI Test Receiver	Rhode & Schwarz	*ESU40	1302.6005.40	3/21/13	3/21/15
Antenna: Biconnical	Eaton	94455-1	1096	5/10/13	5/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	5/09/13	5/09/15
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14
Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	6/26/13	6/26/15
LISN	Electro-Metrics	EM-7820	2682	6/5/13	6/5/15

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3