



Engineering Solutions & Electromagnetic Compatibility Services

VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
Germany

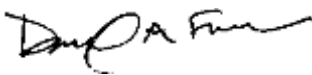
MODEL: VEGAPULS 69
FCC ID: O6QPS60XW1

May 25, 2015

Standards Referenced for this Report	
Part 2: October 2014	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 15: October 2014	Radio Frequency Devices - §15.209: Radiated Emissions Limits
RSS-210	Low Power License-Exempt Radio Communication Devices (All Frequency Bands)
ANSI C63.10-2009:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Frequency Range	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
78.5 – 79.5 GHz	0.575	N/A	N/A

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the above standards for Certification methodology.

Signature: 

Date: May 25, 2015

Typed/Printed Name: Desmond Fraser

Position: President

Signature: 

Date: May 25, 2015

Typed/Printed Name: Dan Baltzell

Position: Test Engineer

Document Number: 2015107

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These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

The following Type Certification Report is prepared on behalf of Vega Grieshaber KG in accordance with the Federal Communications Commission . The Equipment Under Test (EUT) was the VEGAPULS 69 Level Probing Radar, FCC ID: O6QPS60XW1, tested with two different antennas.

The EUT is available with two different electronics units:

- 1) HART (PS60HW)
- 2) PA and FF (PS60PAW and PS60FFW)

The worst case emissions are found with the HART electronics unit (PS60HW) implemented in the EUT.

The test results reported in this document relate only to the items tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2010. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.2 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.3 Related Submittal(s)/Grant(s)

This is an original Part 15.209 application report to support a composite application.

1.4 Modifications

None.

2 Tested System Details

The test sample was received on January 30, 2015. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this testing, as applicable.

Table 2-1: Equipment under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Type	RTL Bar Code
VEGAPULS 69	VEGA Grieshaber KG	PS69 AXBXXCH XKNAXX	29045593	O6Q PS60XW1	N/A	21607
VEGAPULS 69	VEGA Grieshaber KG	PS69 AXCFDAH XANAXX	29045594	O6Q PS60XW1	N/A	21606
75mm Plastic Horn Antenna (33.8 dBi)	VEGA Grieshaber KG	N/A	N/A	N/A	N/A	21604
67mm DN80 Lens-Antenna (32.1 dBi)	VEGA Grieshaber KG	N/A	N/A	N/A	N/A	21605
DC Power Supply	Hewlett Packard	6024A	1912A00331	N/A	1 m un-shielded	901635

2.1 Test Configurations

The EUT was tested in the following configurations, and the test data is included in this report. The appropriate test configuration numbers (TC #1 or TC #2) are provided with the test data.

Table 2-2: Test Configuration #1 (TC #1)

Part	Model	Manufacturer	Cable Type	RTL Bar Code
VEGAPULS 69	PS69 AXBXXCHXKNAXX	VEGA Grieshaber KG	N/A	21607
Electronics	PS60HW	VEGA Grieshaber KG	N/A	N/A
75mm Plastic Horn Antenna (33.8 dBi)	N/A	VEGA Grieshaber KG	N/A	21604

Photograph 1: Test Configuration #1 (TC #1)



Table 2-3: Test Configuration #2 (TC #2)

Part	Model	Manufacturer	Cable Type	RTL Bar Code
VEGAPULS 69	PS69 AXCFDAHXXANAXX	VEGA Grieshaber KG	N/A	21606
Electronics	PS60HW	VEGA Grieshaber KG	N/A	N/A
67mm DN80 Lens-Antenna (32.1 dBi)	N/A	VEGA Grieshaber KG	N/A	21605

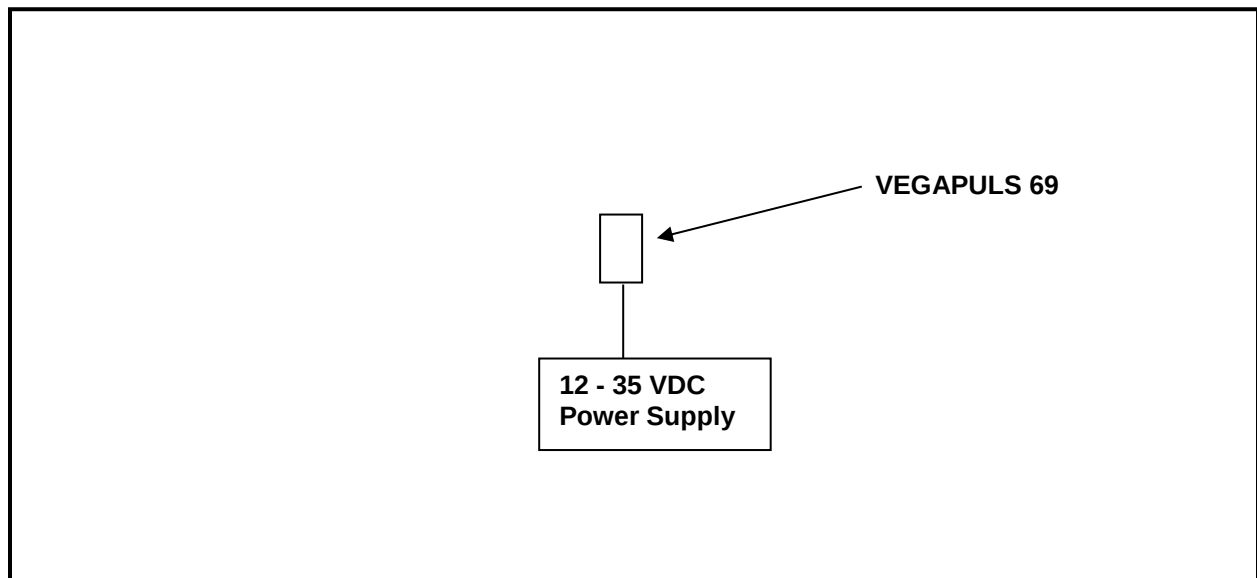
Photograph 2: Test Configuration #2 (TC #2)



Photograph 3: EUT in Swivel Holder



Figure 2-1: Configuration of Tested System



3 Test Distance and Exercising the EUT

The EUT's normal operating measurement mode is transmitting 2 pulses every second continuously. In measurement mode, the EUT maintains its full power. The EUT's spurious emissions were investigated and tested in the restricted and non-restricted bands from 9 kHz to 200 GHz at 3 meters. Furthermore, test antenna handheld measurements were performed in and around the EUT to determine radiated emissions emanating from the EUT since it was mounted on metal and concrete containers such that its main beam was enclosed and perpendicularly pointing downwards.

All measurements above 1 GHz were performed at an antenna–EUT test distance of 0.1 meter with the test antenna polarized horizontally and vertically in order to determine the EUT's worst-case emissions. The measurement results were then corrected to the 3 meter limit. Measurements below 1 GHz were performed at an antenna distance of 3 meters on the EUT as a digital interface device. The EUT was tested with its main beam pointing vertically downward within steel and concrete enclosed containers, as well as with a swivel attached to the EUT installed in the enclosed containers.

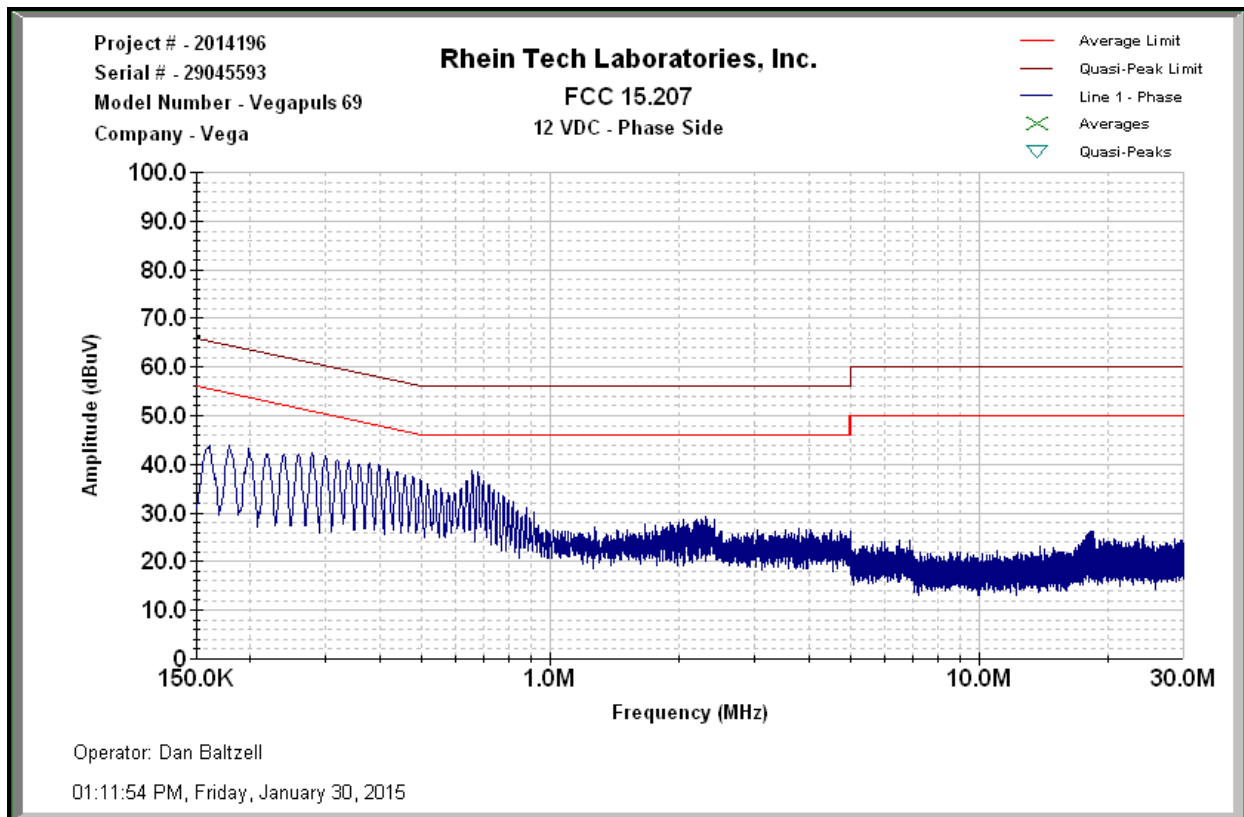
4 Conducted Limits - §15.207

Conducted emissions were performed on the EUT using an off-the-shelf 12 volt power supply. This was considered adequate since the EUT is used in industrial environments where industrial 12 VDC power is provided. The general conducted limit under Part 15.207 was applied. The EUT was investigated and tested in TC #1 and TC #2. The data below shows the worst case emissions from each configuration.

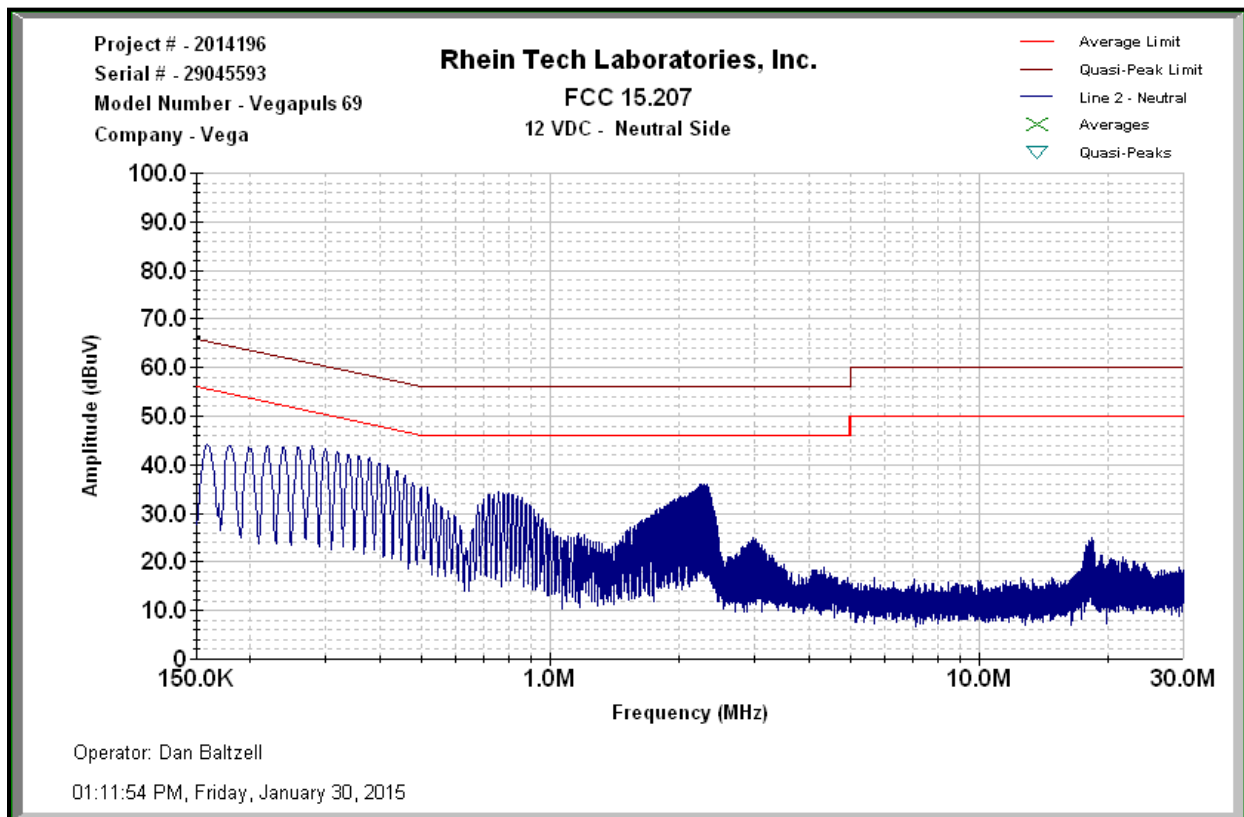
4.1 Conducted Emission Limits Test Data

4.1.1 Test Configuration #1 (TC #1)

Plot 4-1: Conducted Emissions Transmit - Phase (TC #1)

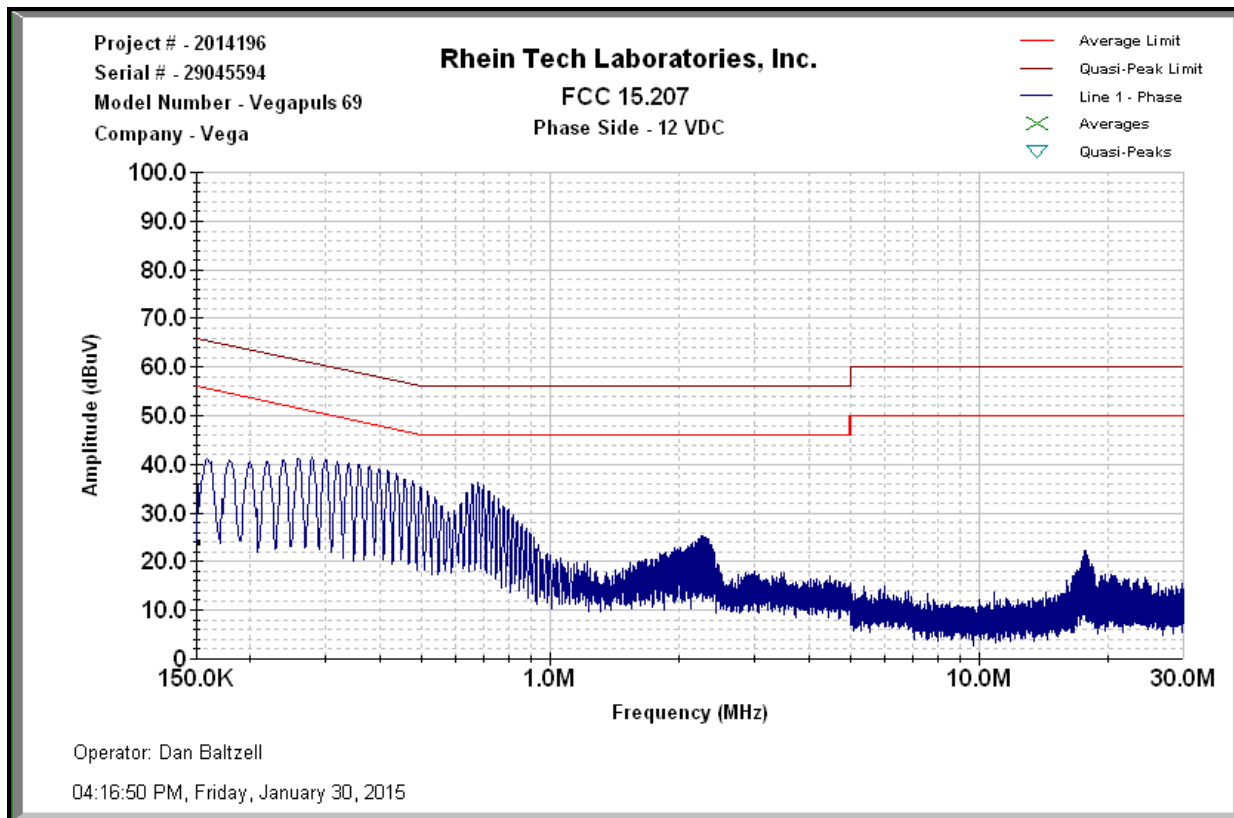


Plot 4-2: Conducted Emissions Transmit – Neutral (TC #1)



4.1.2 Test Configuration #2 (TC #2)

Plot 4-3: Conducted Emissions Transmit - Phase (TC #2)



Plot 4-4: Conducted Emissions Transmit – Neutral (TC #2)

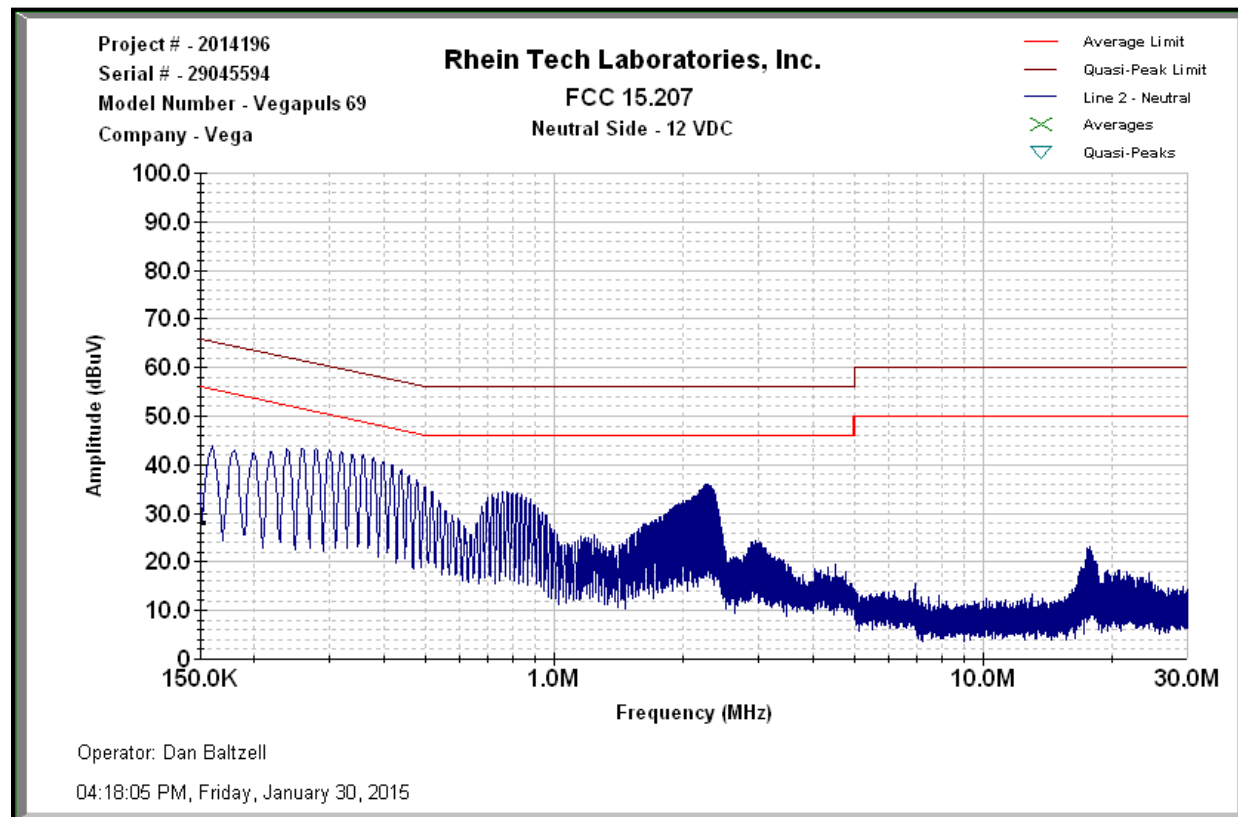


Table 4-1: Conducted Line Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz - 1.5 GHz)	2602A00160	2/17/16
900339	Hewlett Packard	85650A	Quasi-Peak Adapter	2521A00743	2/17/16
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A11239	2/17/16
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	8/27/15
N/A	Rhein Tech Laboratories, Inc.	Automated Emissions Tester	Emissions Testing Software Rev. 14.0.2	N/A	N/A

Test Personnel:

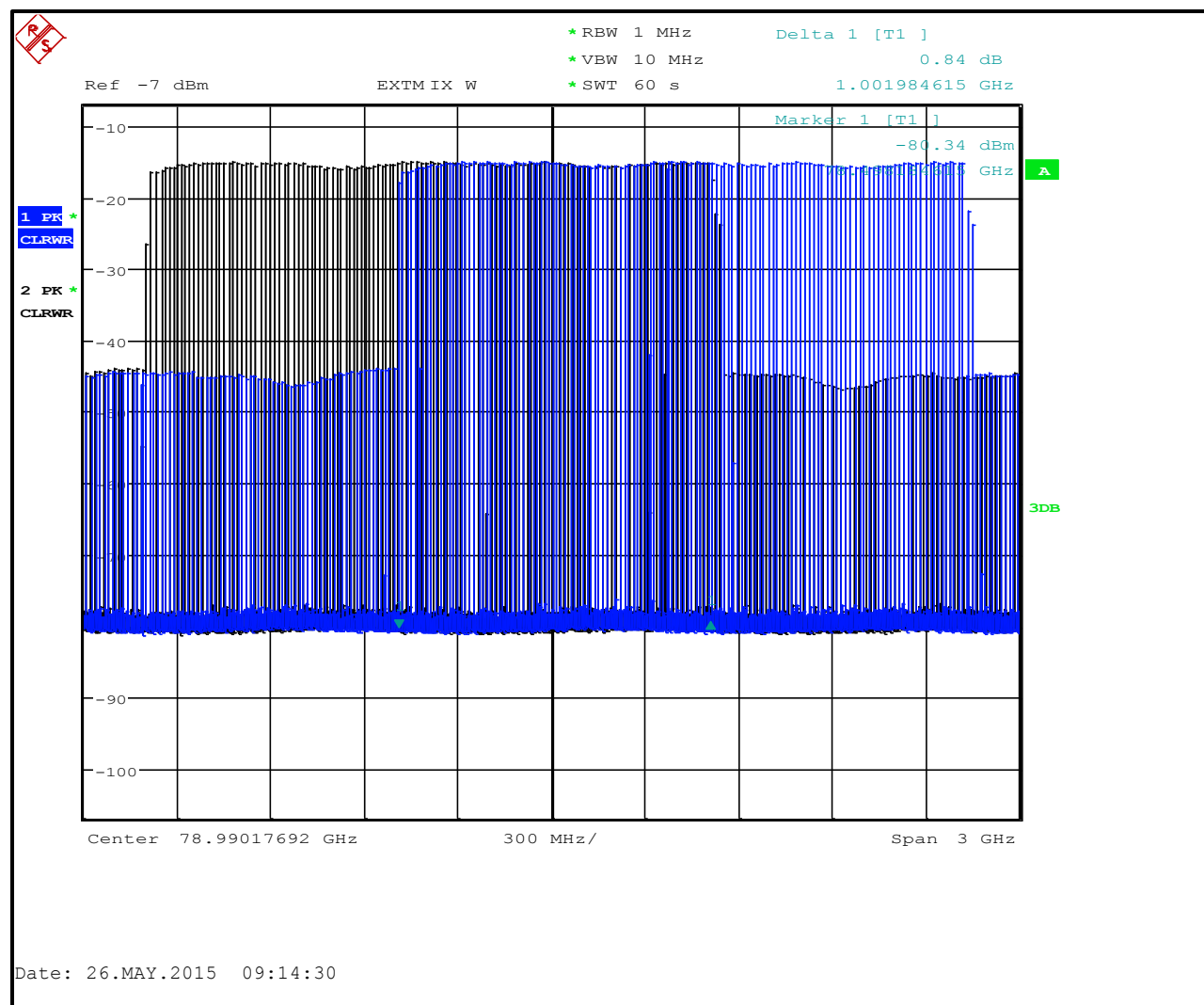
Daniel W. Baltzell		January 30, 2015
Test Engineer	Signature	Date of Test

5 Modulated Bandwidth – ANSI C63.10 6.9

5.1 Modulated Bandwidth Test Procedure – ANSI C63.10 6.9

The minimum 26 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 1 MHz and the video bandwidth set at 3 MHz. The spectrum analyzer's mixer mode resulted in an overlapping bandwidth image with the actual image and a ghost image. The analyzer "Signal ID" and "Auto ID" were used to aid in discerning between the ghost images displayed by the mixer; the left and right markers can be calculated from twice the intermediate frequency of 404.4 MHz (808.8 MHz) from the ghost edge images to the actual bandwidth edges (distance between ghost images). The display markers could not be set to -26 dB from the peak since the spectral lines were completely vertical resulting in a noise floor placement. Max hold was used until the spectrum was adequately filled to portray the bandwidth and a plot was taken.

Plot 5-1: Modulated Bandwidth - TC #1



Plot 5-2: Modulated Bandwidth - TC #2

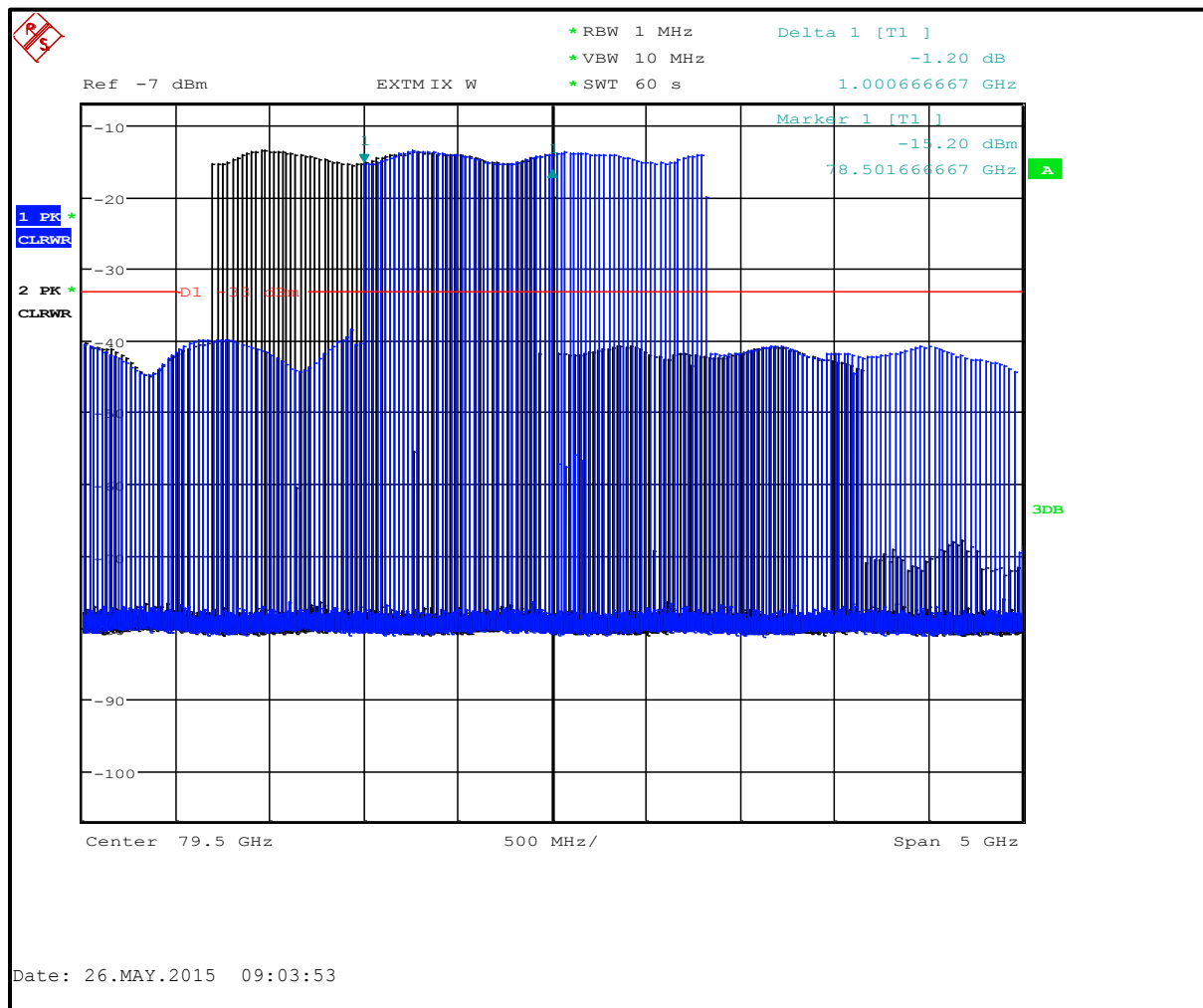


Table 5-1: Modulated Bandwidth Data

Model	EUT Configuration	26 dB Bandwidth (MHz)
Electronics PS60HW	TC #1	1001.984
	TC #2	1000.666

6 Radiated Emission Limits - §15.209

6.1 Radiated Emission Limits Test Procedure

The EUT's radiated spurious emissions, comprised of harmonic and spurious emissions that fall in the restricted and non-restricted bands, were investigated and tested from 0.009 kHz to 200 GHz in accordance with C63.4 2009. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. To determine worst-case emissions, the EUT was tested while installed perpendicularly downwards in steel and concrete containers, and the EUT was rotated along its axis.

The test antenna was horizontally and vertically polarized during testing. The general limit under Part 15.209 was applied for all frequencies from 0.009 kHz to 200 GHz, per FCC 15.209. Radiated spurious emissions were detected between 30 MHz to 500 MHz; none were detected from 1 GHz to 200 GHz. Horizontal and vertical antenna polarization radiated spurious emissions plots are provided from 2 GHz to 26.5 GHz to demonstrate that the EUT has no discernable radiated spurious emissions to measure. A handheld test-antenna measurement method was also used in, around, and close to the EUT, to investigate radiated spurious emissions; no radiated spurious emissions were found, except the carrier at 78 GHz.

The EUT was investigated and tested with test configurations TC #1 and TC #2 in enclosed steel and concrete containers. The EUT configurations TC #1 and TC #2 were also investigated and tested configured with a swivel holder and installed inside the enclosed steel and concrete containers.

6.2 Field Strength Calculation

The field strength is calculated by adding the antenna factor and the cable factor from the measured Spectrum Analyzer reading.

Spectrum Analyzer Level Corrected (dBuV/m) = Spectrum Analyzer Level (dBuV/m) + AF (dB/m) + CL (dB);

where AF = antenna factor and CL = cable loss

6.3 Radiated Emission Limits Test Data

6.3.1 Radiated Emissions Below 1 GHz Test Data

Table 6-1: Digital Radiated Emissions Test Data (TC #1)

Temperature: 32°F						Humidity: 76%				
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
46.490	Qp	V	80	1.0	41.5	-18.0	23.5	40.0	-16.5	Pass
72.852	Qp	V	180	1.0	47.0	-23.8	23.2	40.0	-16.8	Pass
118.429	Qp	V	0	1.0	35.4	-20.0	15.4	43.5	-28.1	Pass
345.013	Qp	H	90	1.0	48.4	-15.2	33.2	46.0	-12.8	Pass
355.013	Qp	H	90	1.0	49.7	-15.2	34.5	46.0	-11.5	Pass
365.013	Qp	H	90	1.0	49.0	-15.0	34.0	46.0	-12.0	Pass
375.013	Qp	H	80	1.0	49.7	-14.5	35.2	46.0	-10.8	Pass
385.013	Qp	H	85	1.0	50.3	-14.2	36.1	46.0	-9.9	Pass
395.013	Qp	H	70	1.0	48.7	-14.1	34.6	46.0	-11.4	Pass
405.013	Qp	H	30	1.0	47.3	-13.8	33.5	46.0	-12.5	Pass
415.013	Qp	H	70	1.0	47.2	-13.5	33.7	46.0	-12.3	Pass
425.013	Qp	H	80	1.0	46.5	-13.4	33.1	46.0	-12.9	Pass
435.013	Qp	H	80	1.0	46.3	-13.7	32.6	46.0	-13.4	Pass
445.013	Qp	H	80	1.0	44.9	-13.5	31.4	46.0	-14.6	Pass

Table 6-2: Digital Radiated Emissions Test Data (TC #2)

Temperature: 32°F						Humidity: 67%				
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
46.490	Qp	H	0	1.0	34.3	-17.7	16.6	40.0	-23.4	Pass
72.852	Qp	H	0	1.0	34.9	-23.7	11.2	40.0	-28.8	Pass
118.429	Qp	H	0	1.0	32.6	-20.5	12.1	43.5	-31.4	Pass
355.000	Qp	H	270	1.0	35.8	-15.3	20.5	46.0	-25.5	Pass
365.000	Qp	H	120	1.0	37.7	-15.0	22.7	46.0	-23.3	Pass
375.000	Qp	H	280	1.0	36.7	-14.4	22.3	46.0	-23.7	Pass
385.000	Qp	V	90	1.0	36.1	-14.1	22.0	46.0	-24.0	Pass
395.000	Qp	H	90	1.0	34.6	-14.2	20.4	46.0	-25.6	Pass
435.000	Qp	H	0	1.0	35.3	-13.1	22.2	46.0	-23.8	Pass
445.000	Qp	H	30	1.0	35.5	-13.0	22.5	46.0	-23.5	Pass
455.000	Qp	V	0	1.0	37.2	-12.9	24.3	46.0	-21.7	Pass
485.000	Qp	V	0	1.0	35.5	-12.1	23.4	46.0	-22.6	Pass

Note: Unwanted emissions were investigated as a digital device (other than harmonics) as required by 15.33(a)(3).

6.3.1 Radiated Emissions Carrier Test Data, EUT Installed in Containers

Plot 6-1: Radiated Emissions of Carrier - TC #1; Steel Container

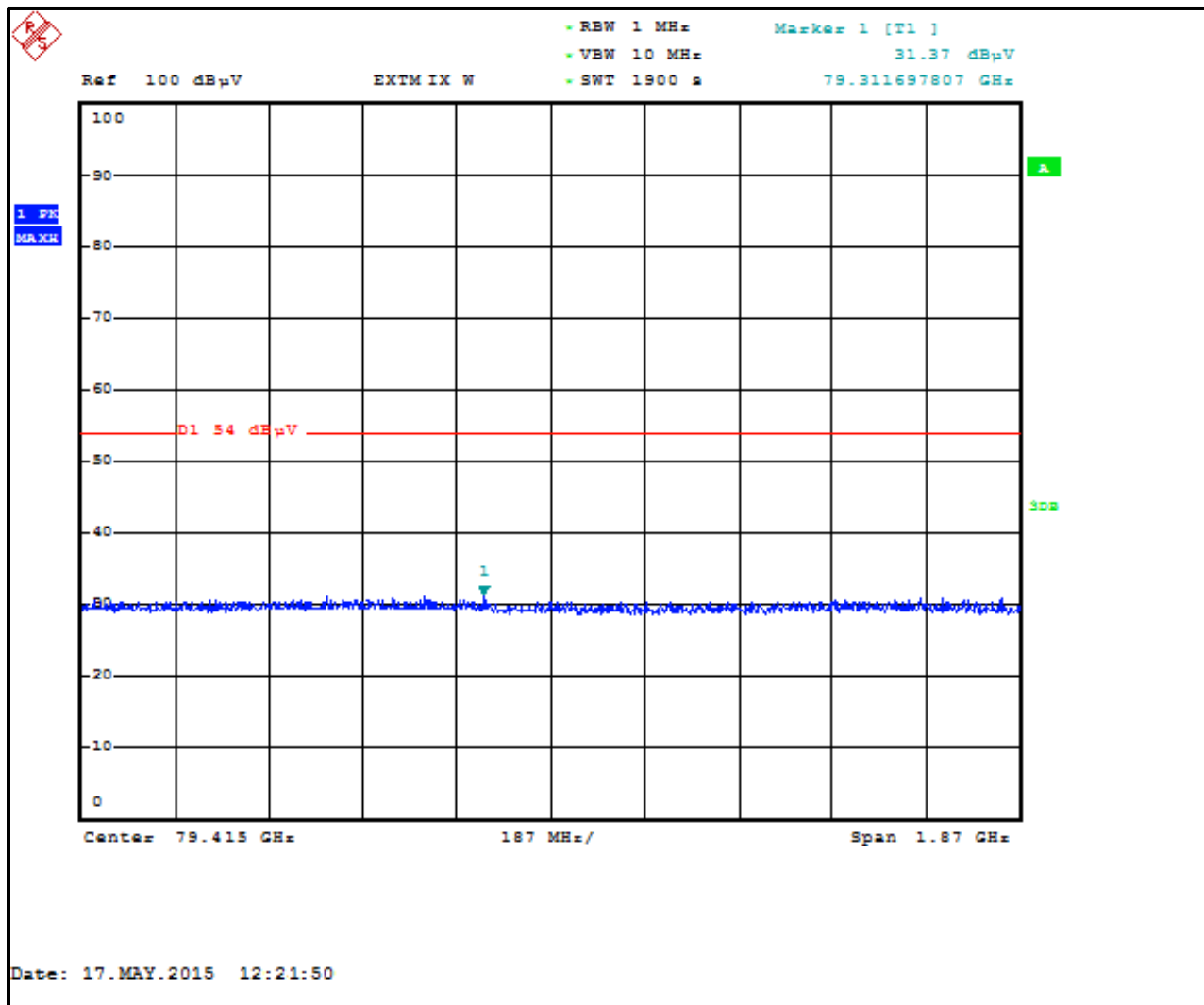


Table 6-3: Radiated Emissions of Carrier – TC #1; Steel Container

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBμV)	Test Antenna Correction Factor (dB/m)	Correction from .01m to 3m	Corrected Spectrum Analyzer Level (dBμV/m)	FCC Limit (dBμV)	Margin (dB)
79.312	Peak	H	31.4	42.1	-49.5	24.0	54.0	-30.0

Plot 6-2: Radiated Emissions of Carrier - TC #2; Steel Container

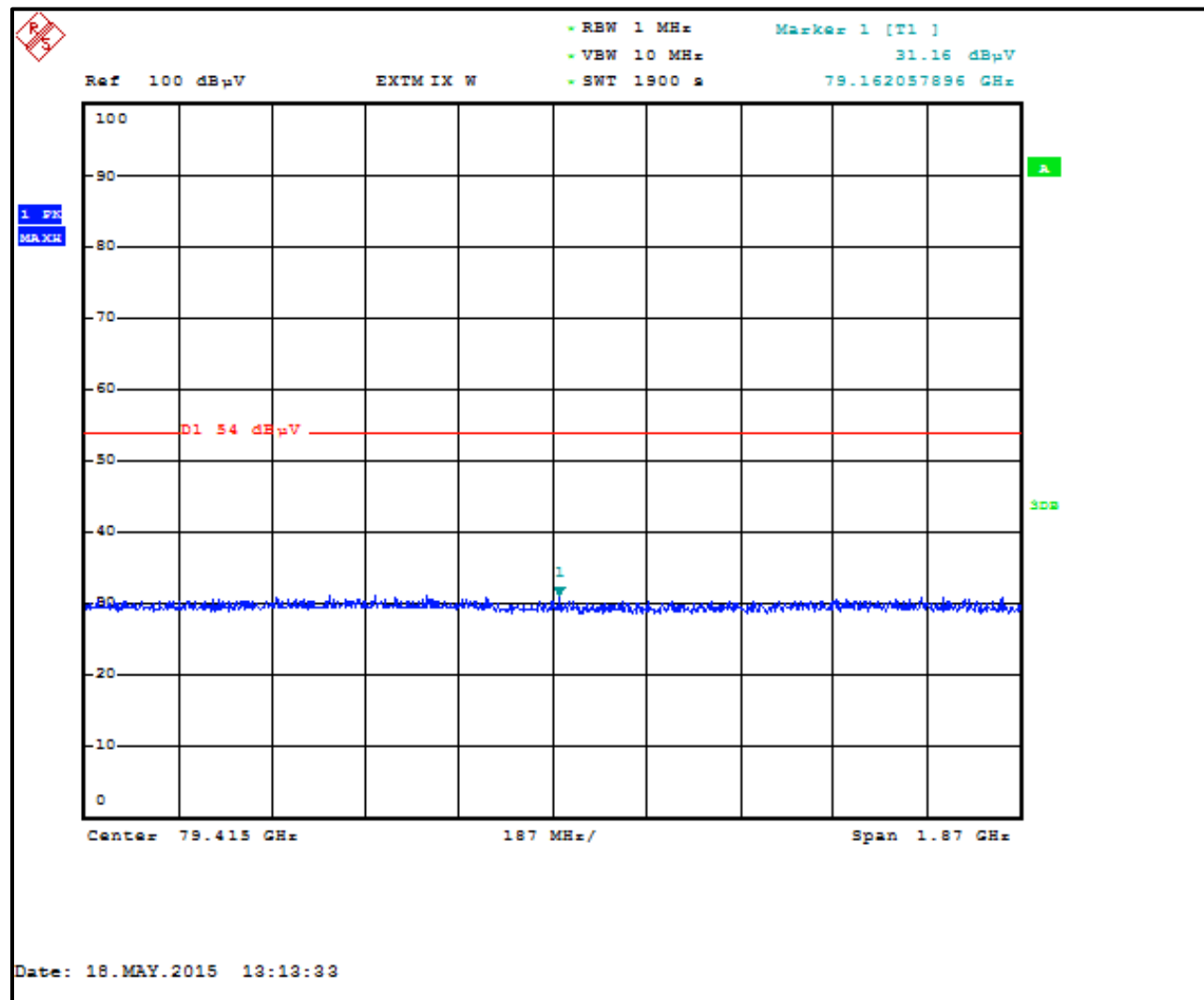


Table 6-4: Radiated Emissions of Carrier – TC #2; Steel Container

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBμV)	Test Antenna Correction Factor (dB/m)	Correction From .01m to 3m	Corrected Spectrum Analyzer Level (dBμV/m)	FCC Limit (dBμV)	Margin (dB)
79.162	Peak	H	31.2	42.1	-49.5	23.8	54.0	-30.2

Plot 6-3: Radiated Emissions of Carrier - TC #1; Concrete Container

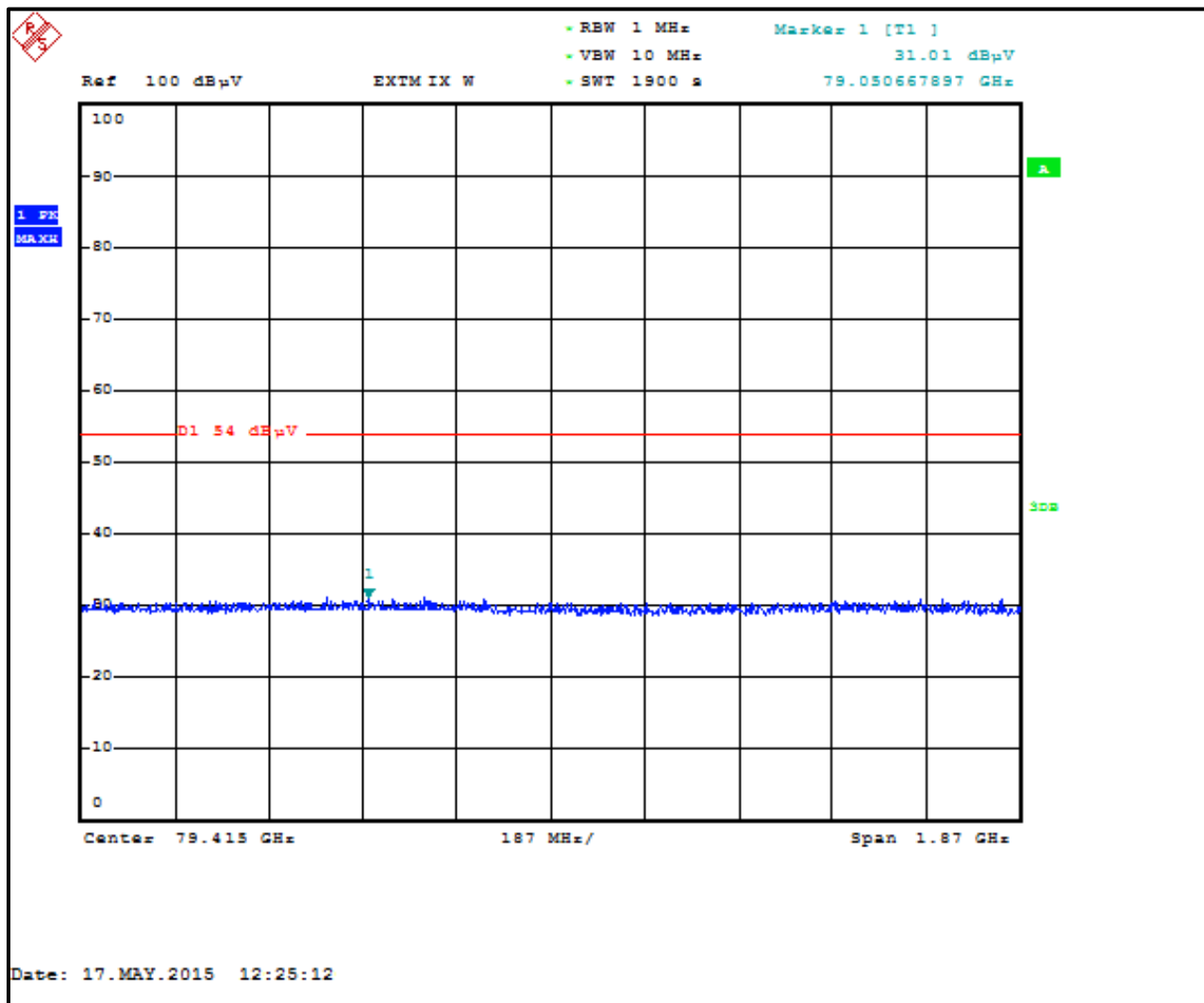


Table 6-5: Radiated Emissions of Carrier – TC #1; Concrete Container

Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBuV)	Test Antenna Correction Factor (dB/m)	Correction from .01m to 3m	Corrected Spectrum Analyzer Level (dBuV/m)	FCC Limit (dBuV)	Margin (dB)
79.100	Peak	H	31.0	42.1	-49.5	23.6	54.0	-30.4

Plot 6-4: Radiated Emissions of Carrier - TC #2; Concrete Container

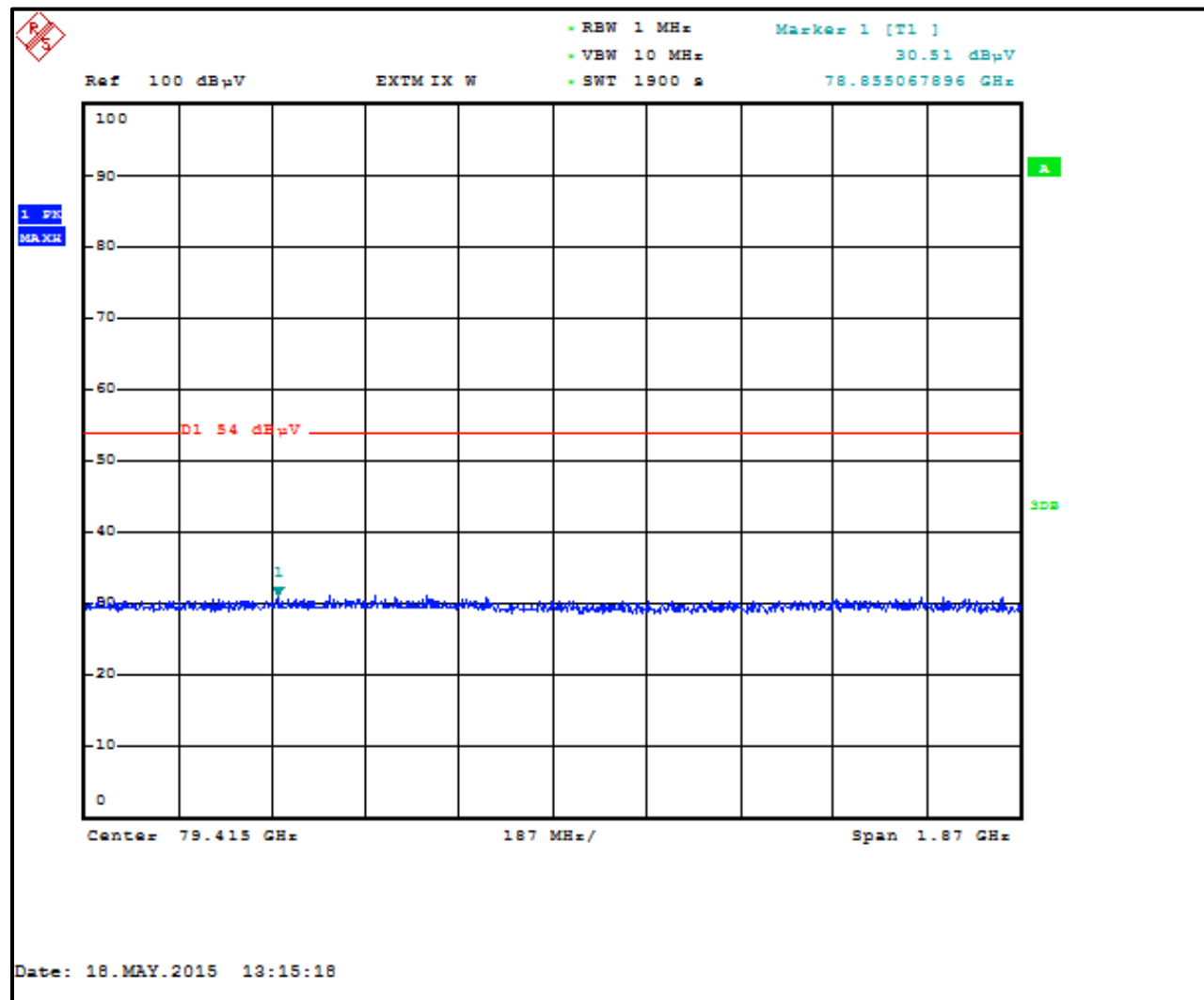
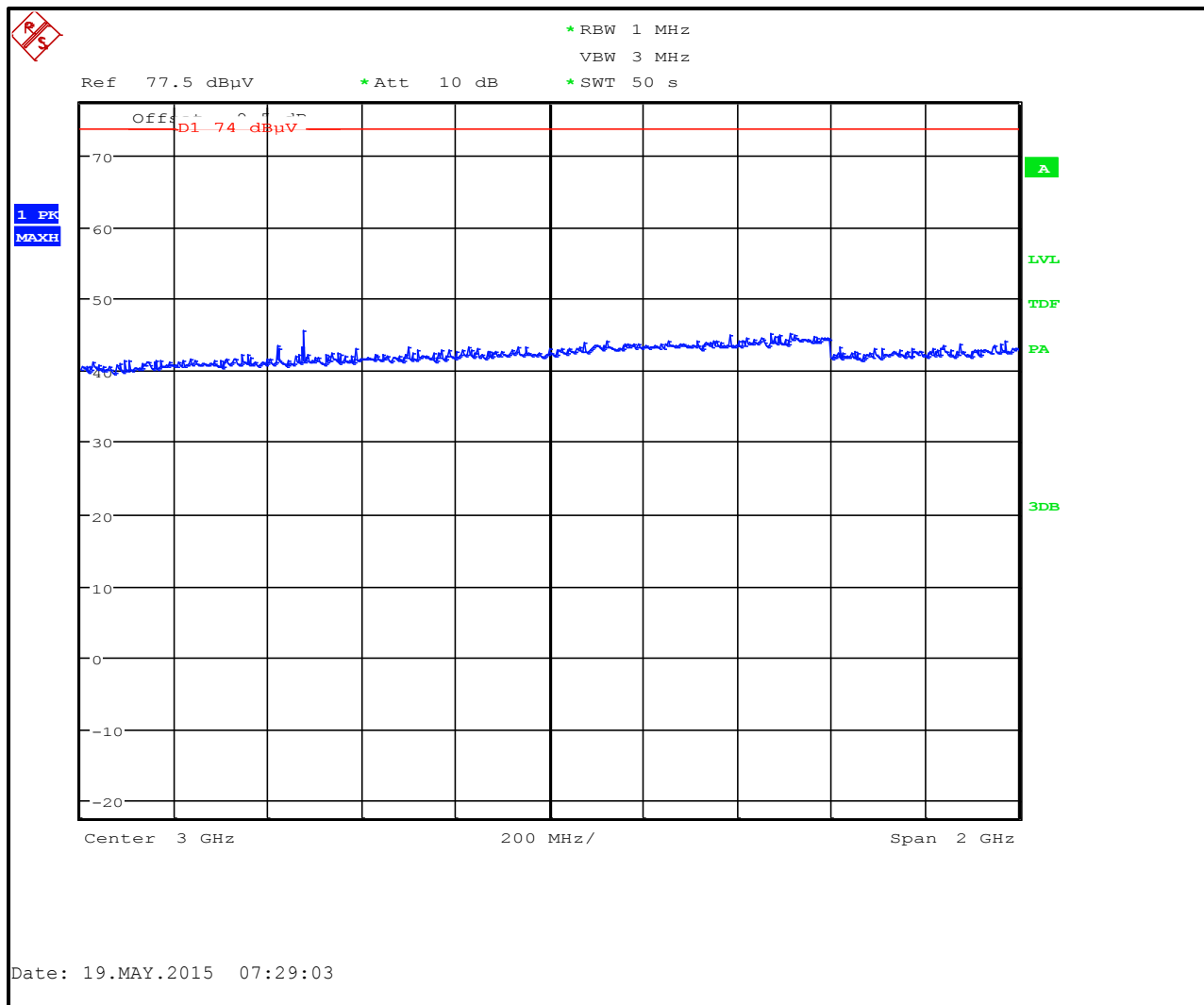


Table 6-6: Radiated Emissions of Carrier – TC #2; Concrete Container

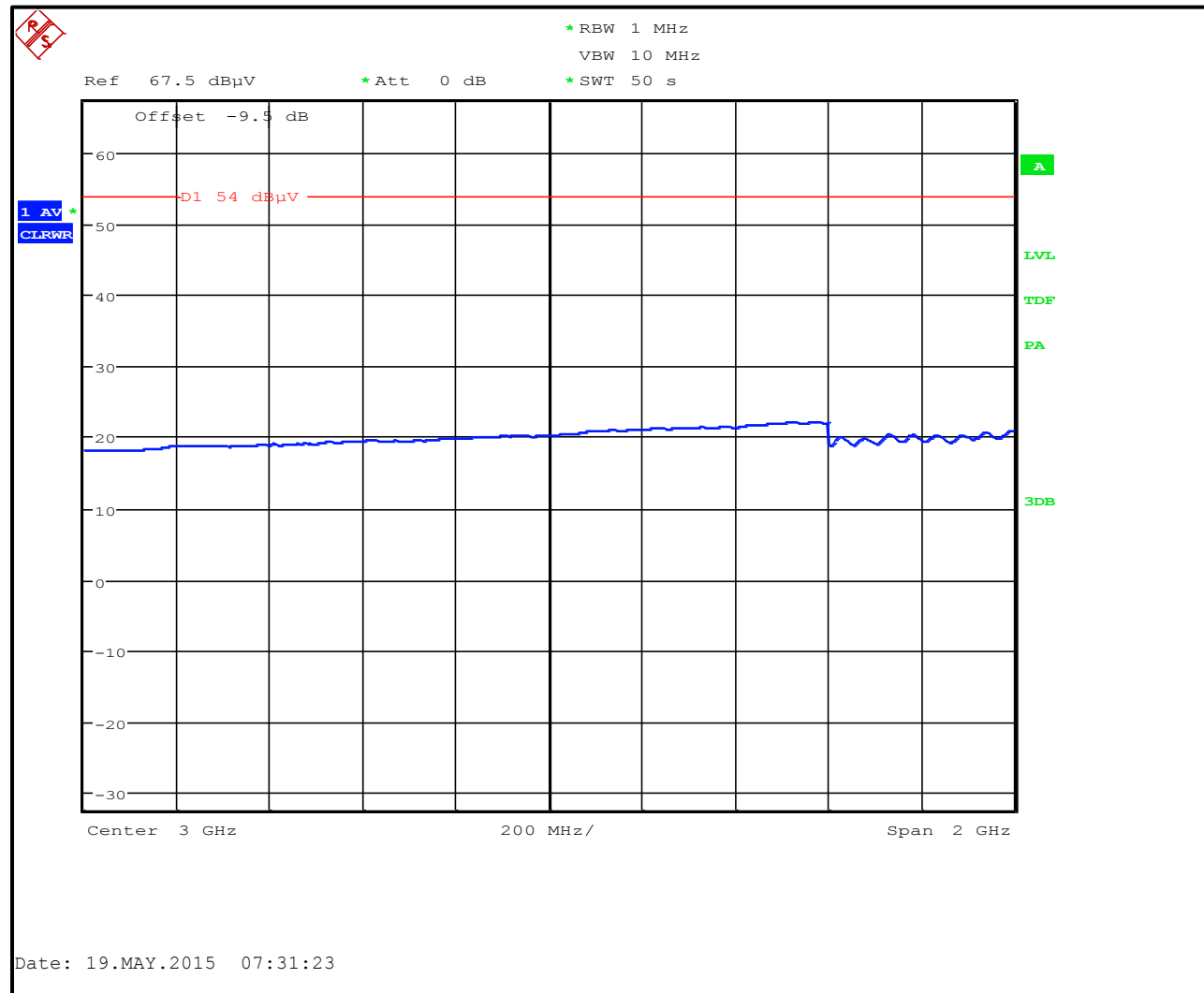
Frequency (GHz)	Detector	Test Antenna Pol	Measured Spectrum Analyzer Level (dBμV)	Test Antenna Correction Factor (dB/m)	Correction From .01m to 3m	Corrected Spectrum Analyzer Level (dBμV/m)	FCC Limit (dBμV)	Margin (dB)
79.100	Peak	H	31.5	42.1	-49.5	24.1	54.0	-29.9

6.3.2 Radiated Emissions Test Data - 2 GHz – 26.5 GHz; Steel Container, TC #1

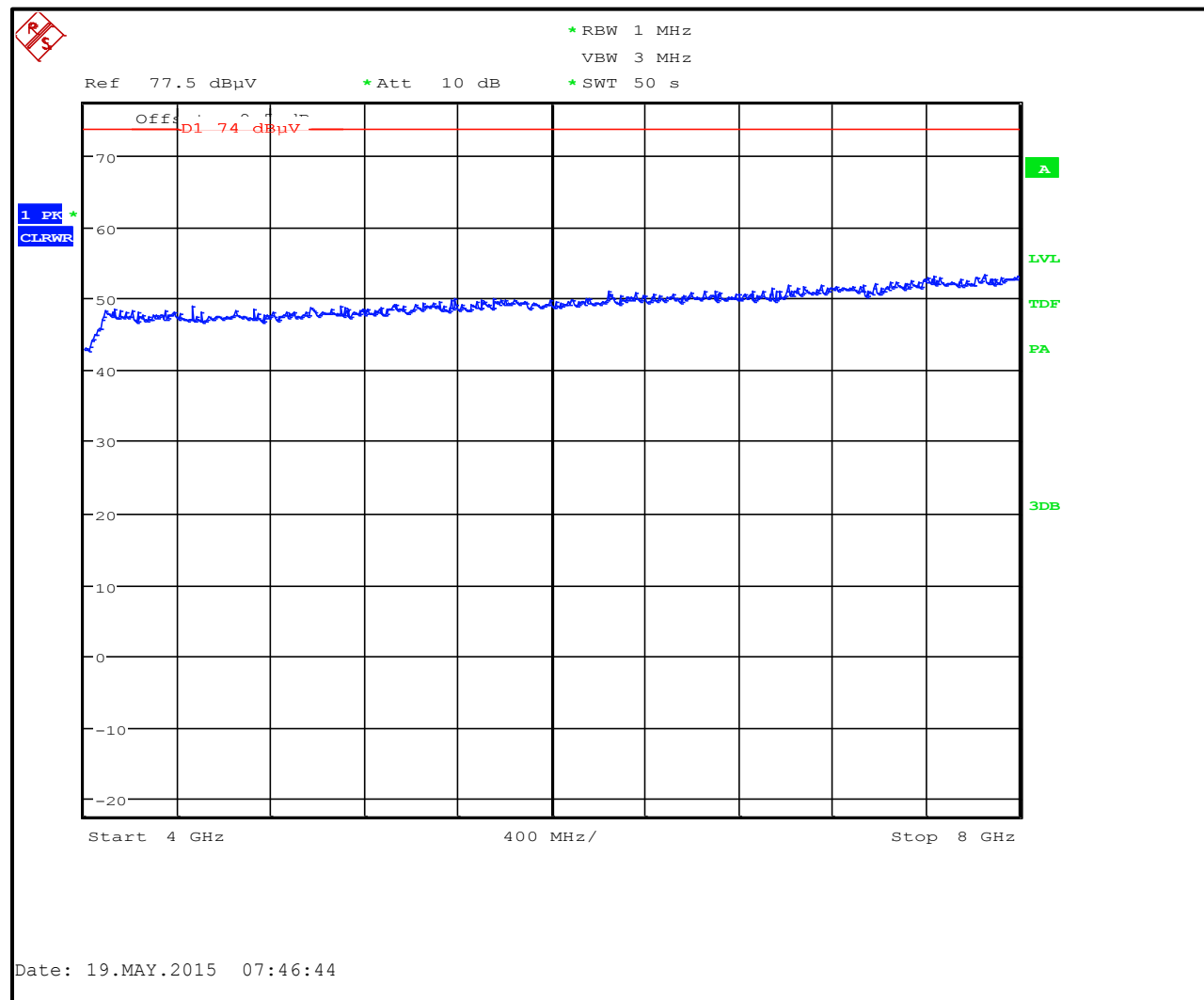
Plot 6-5: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #1; Horizontal, Peak



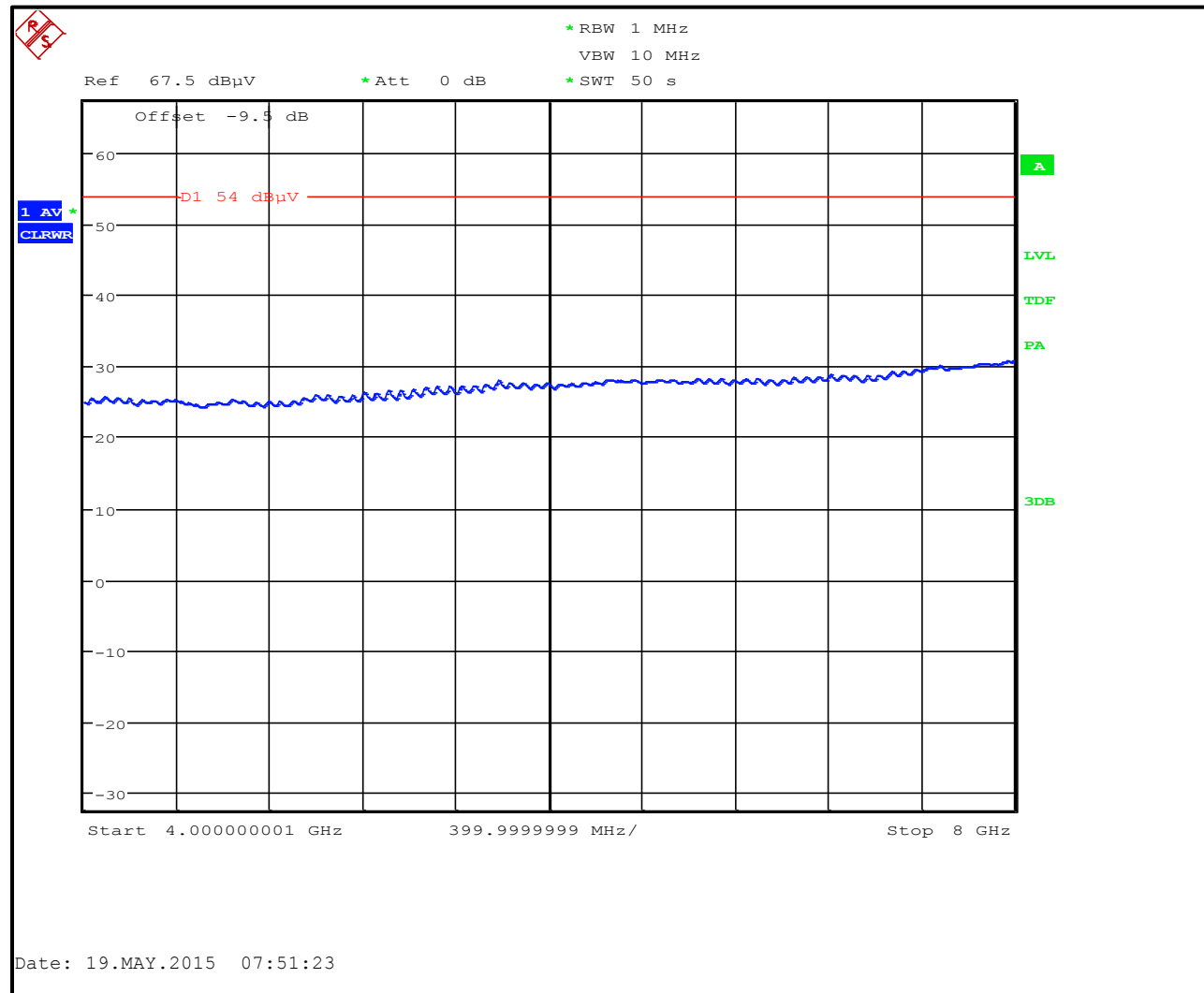
Plot 6-6: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #1; Horizontal, Average



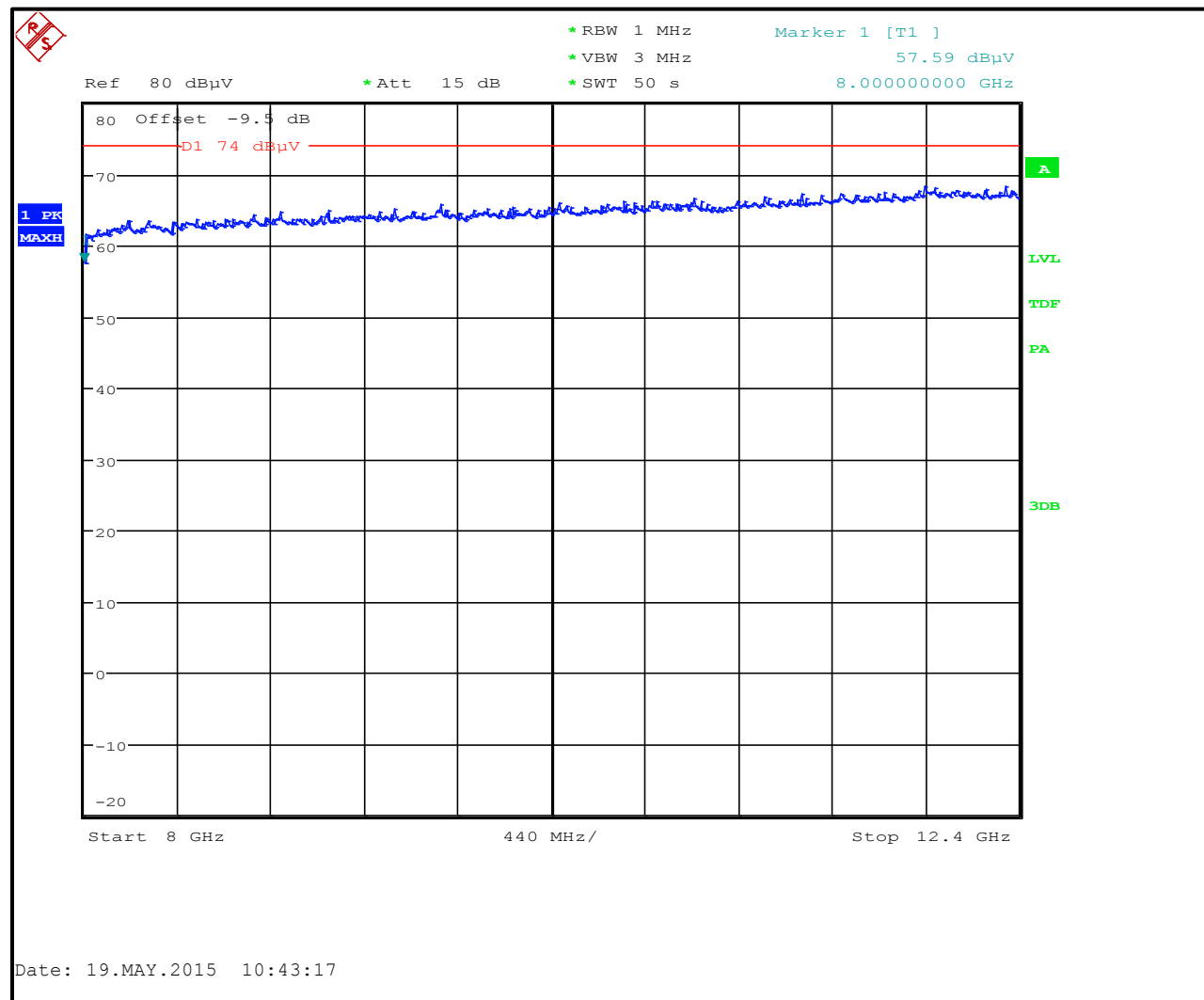
Plot 6-7: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #1; Horizontal, Peak



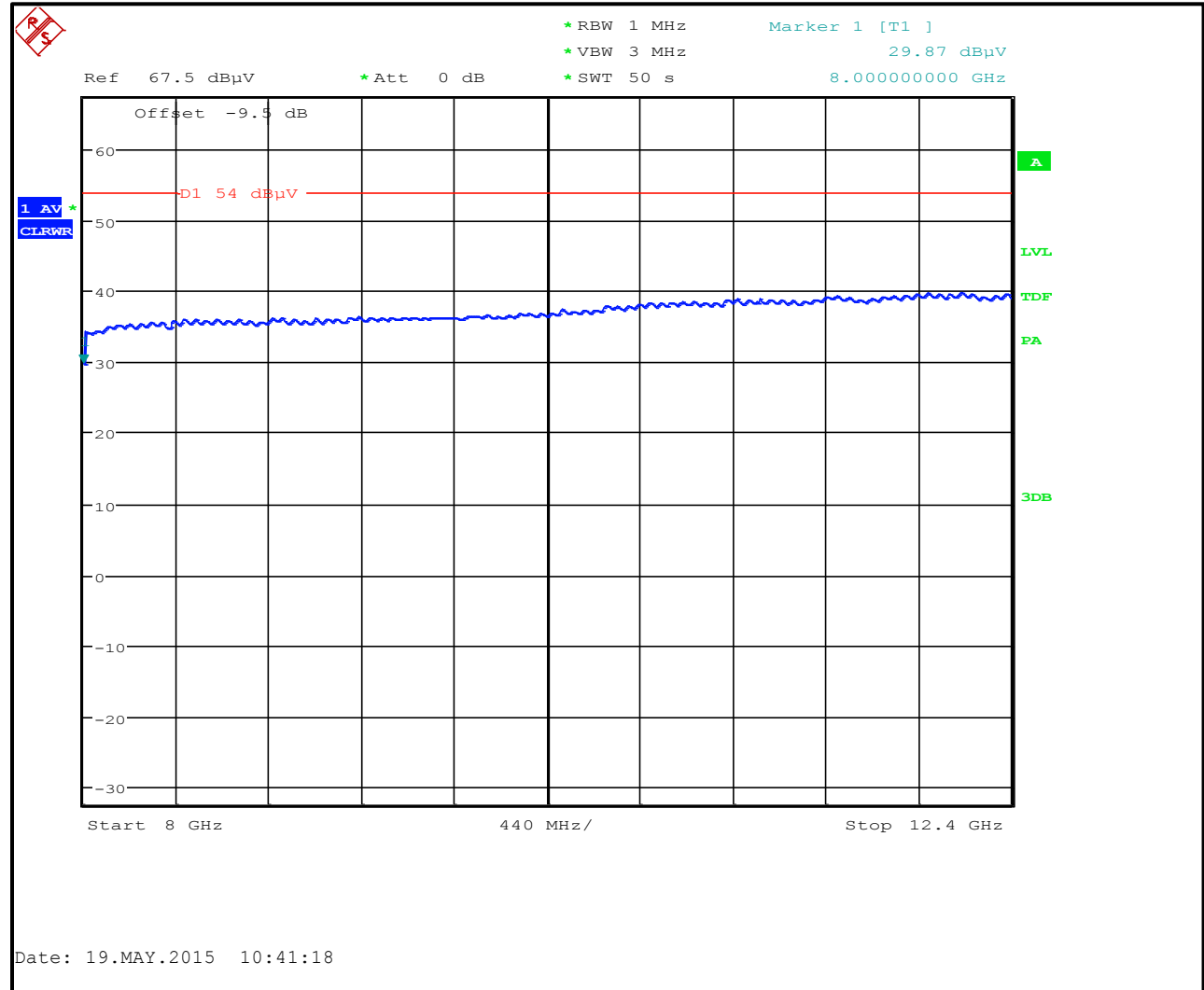
Plot 6-8: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #1; Horizontal, Average



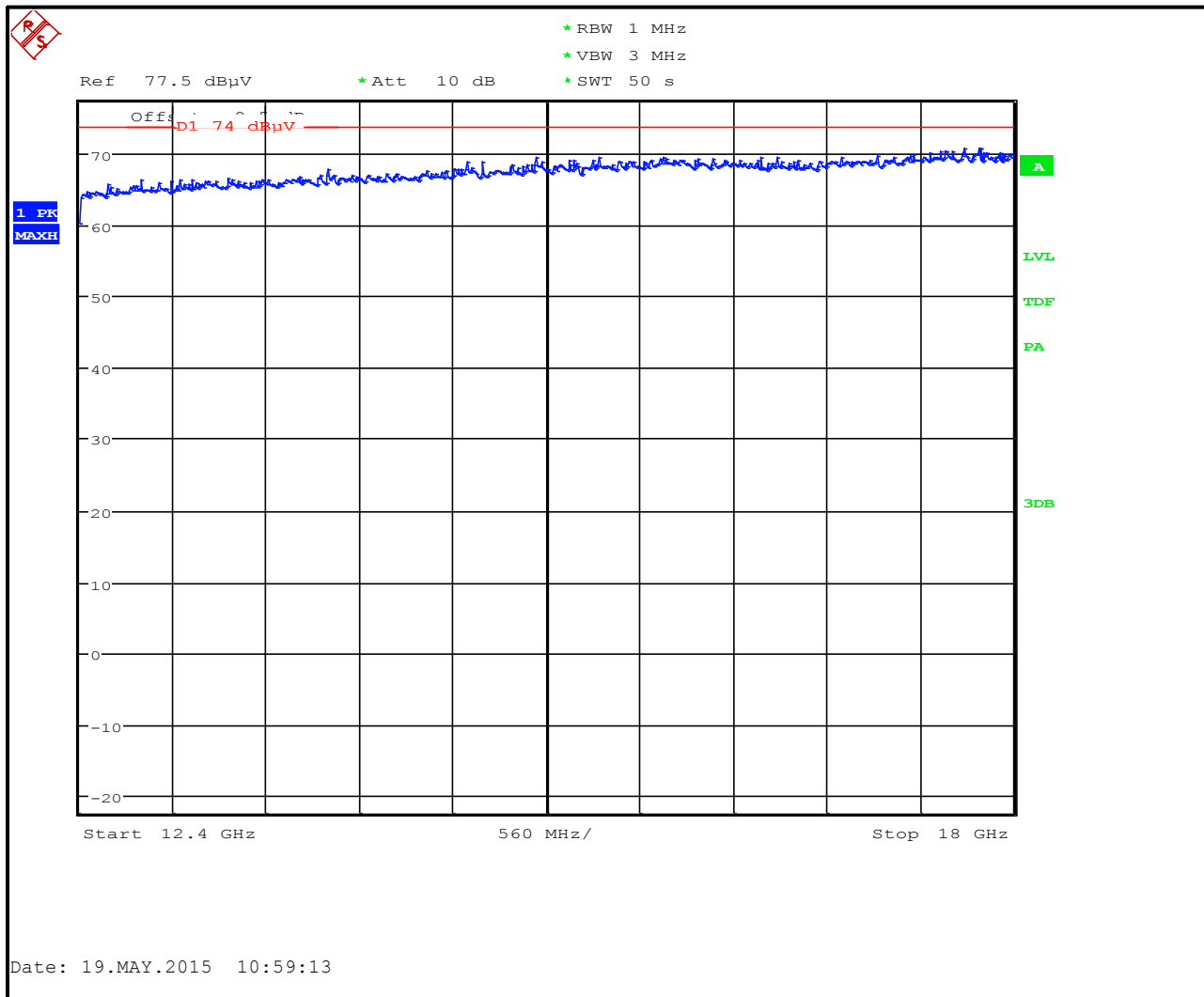
Plot 6-9: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #1, Horizontal, Peak



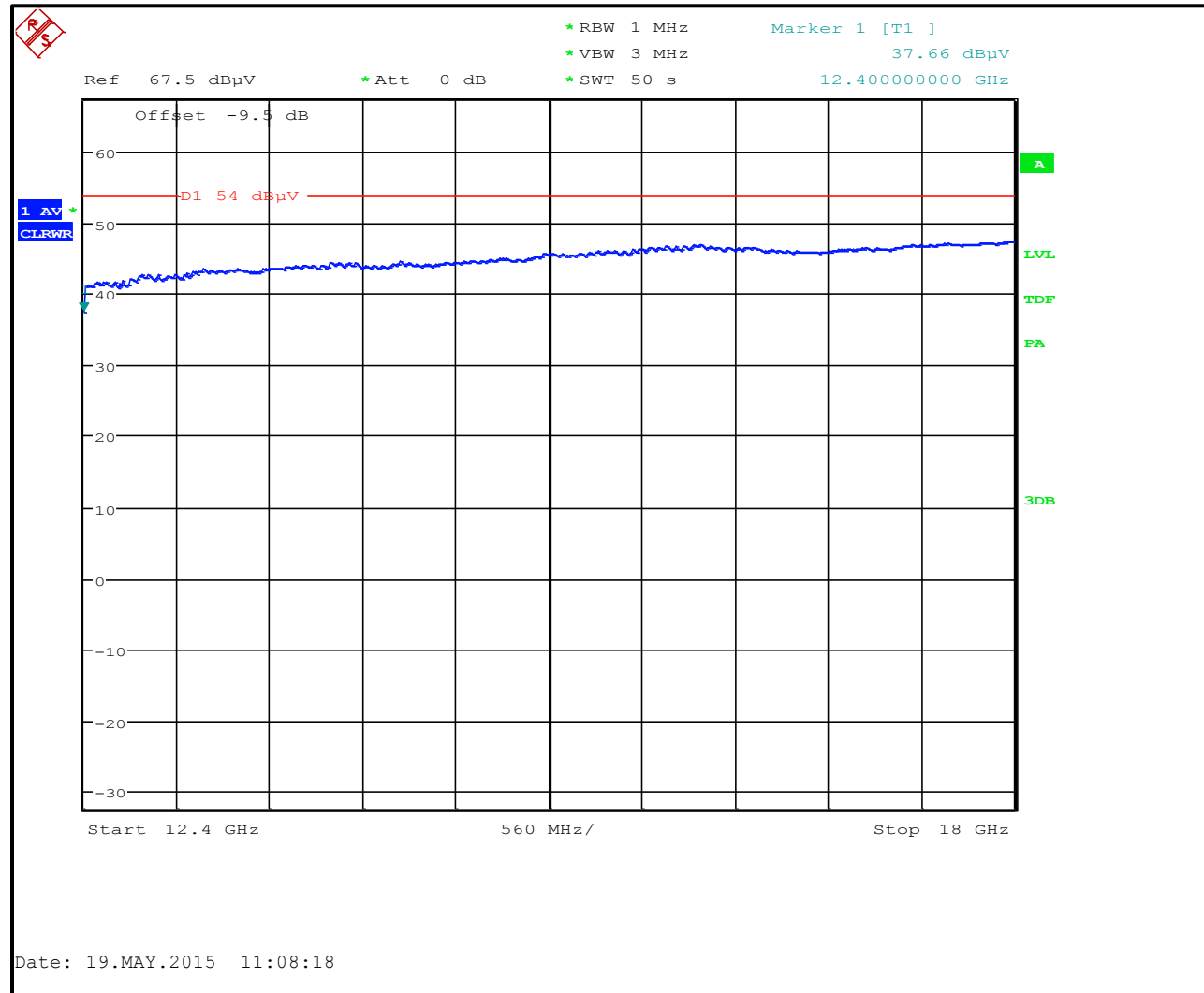
Plot 6-10: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #1, Horizontal, Average



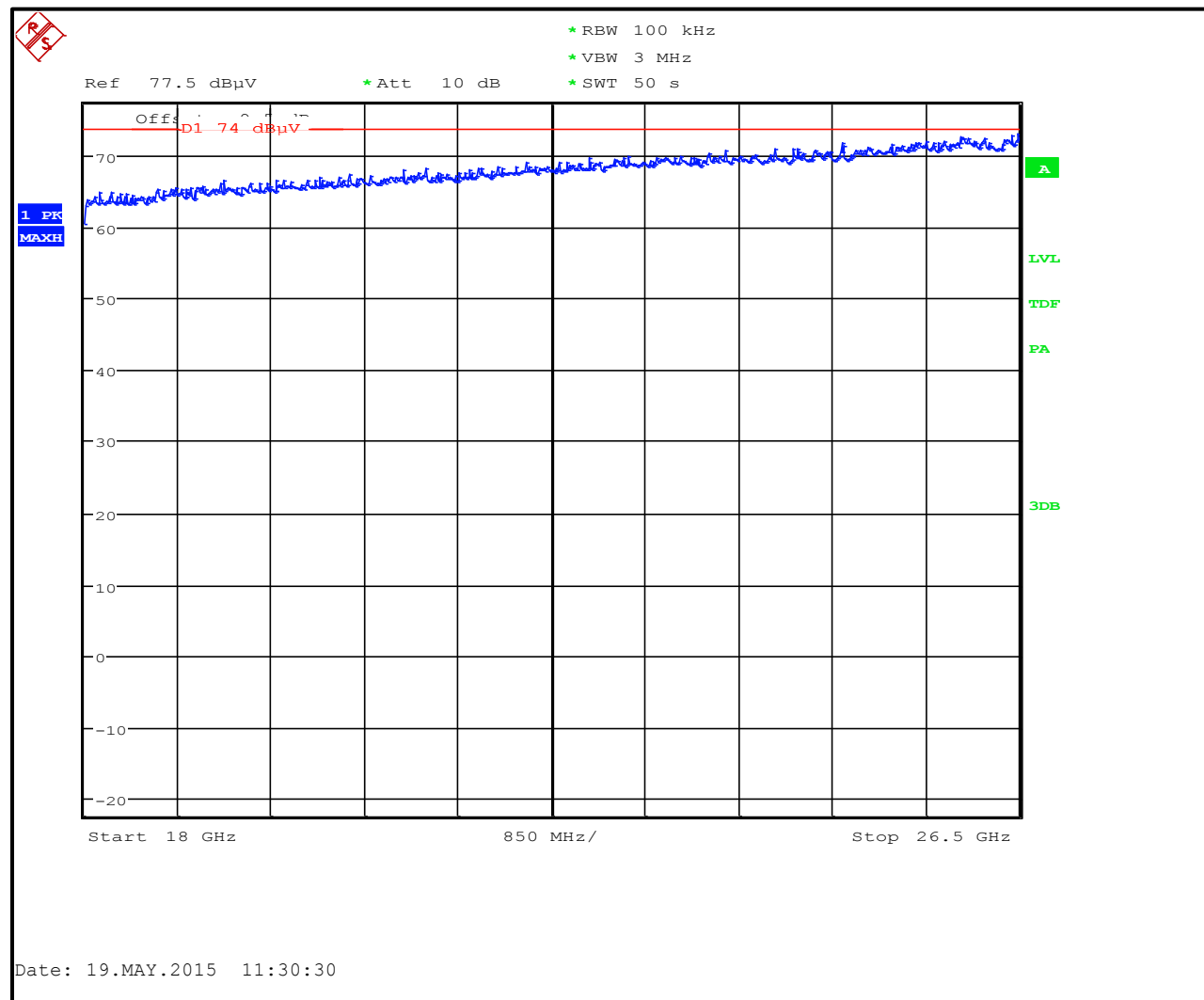
Plot 6-11: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #1, Horizontal, Peak



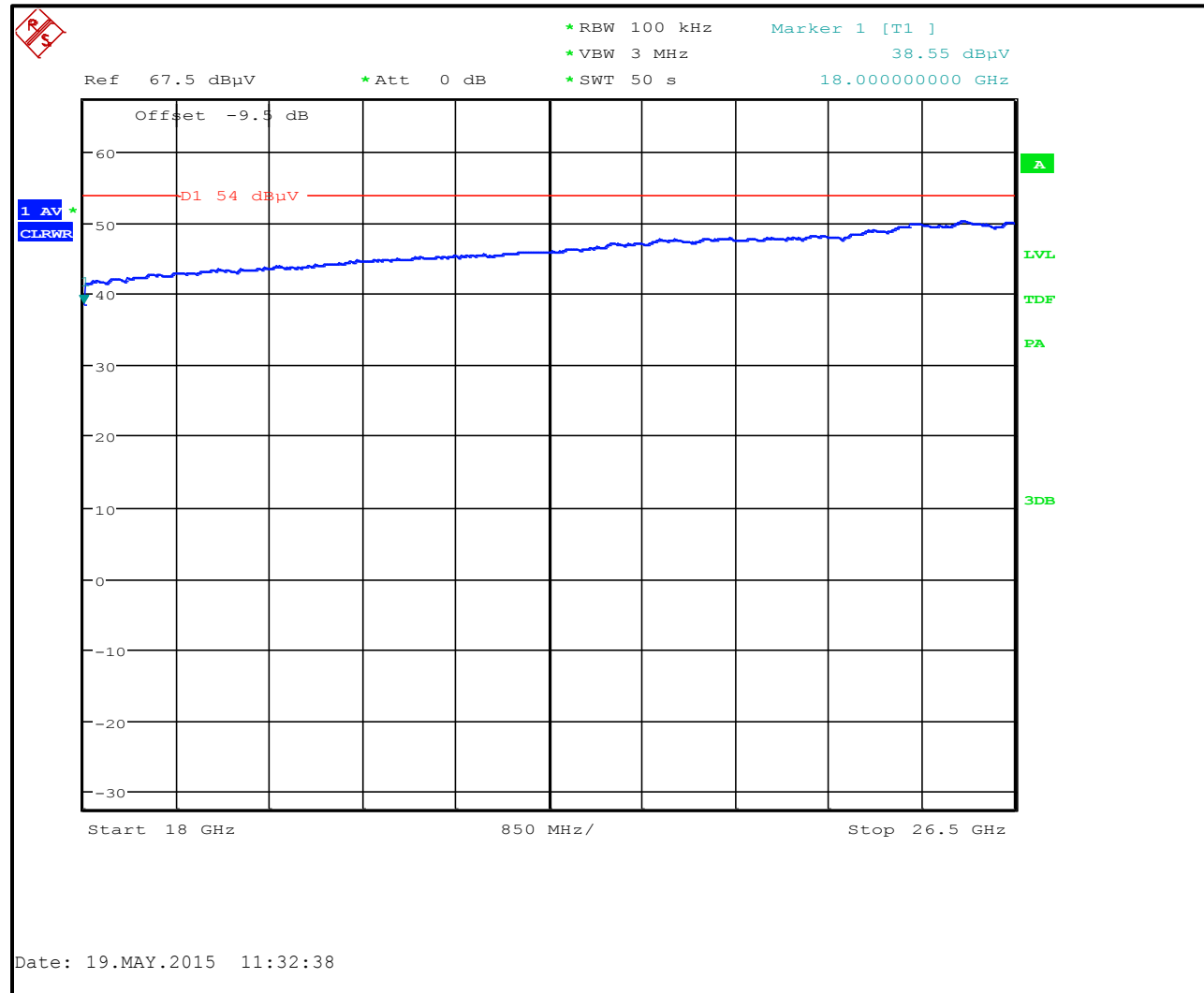
Plot 6-12: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #1, Horizontal, Average



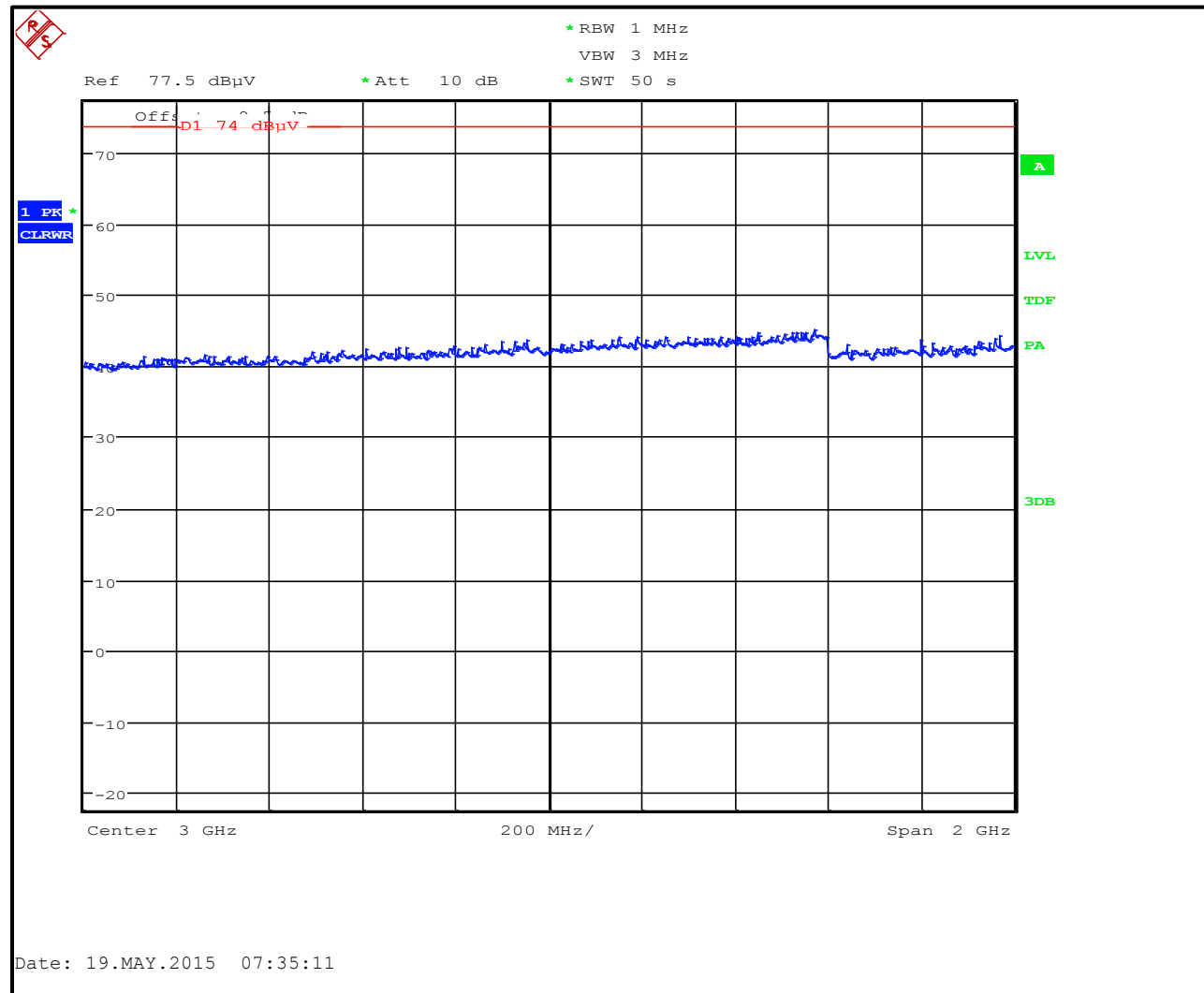
Plot 6-13: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #1, Horizontal, Peak



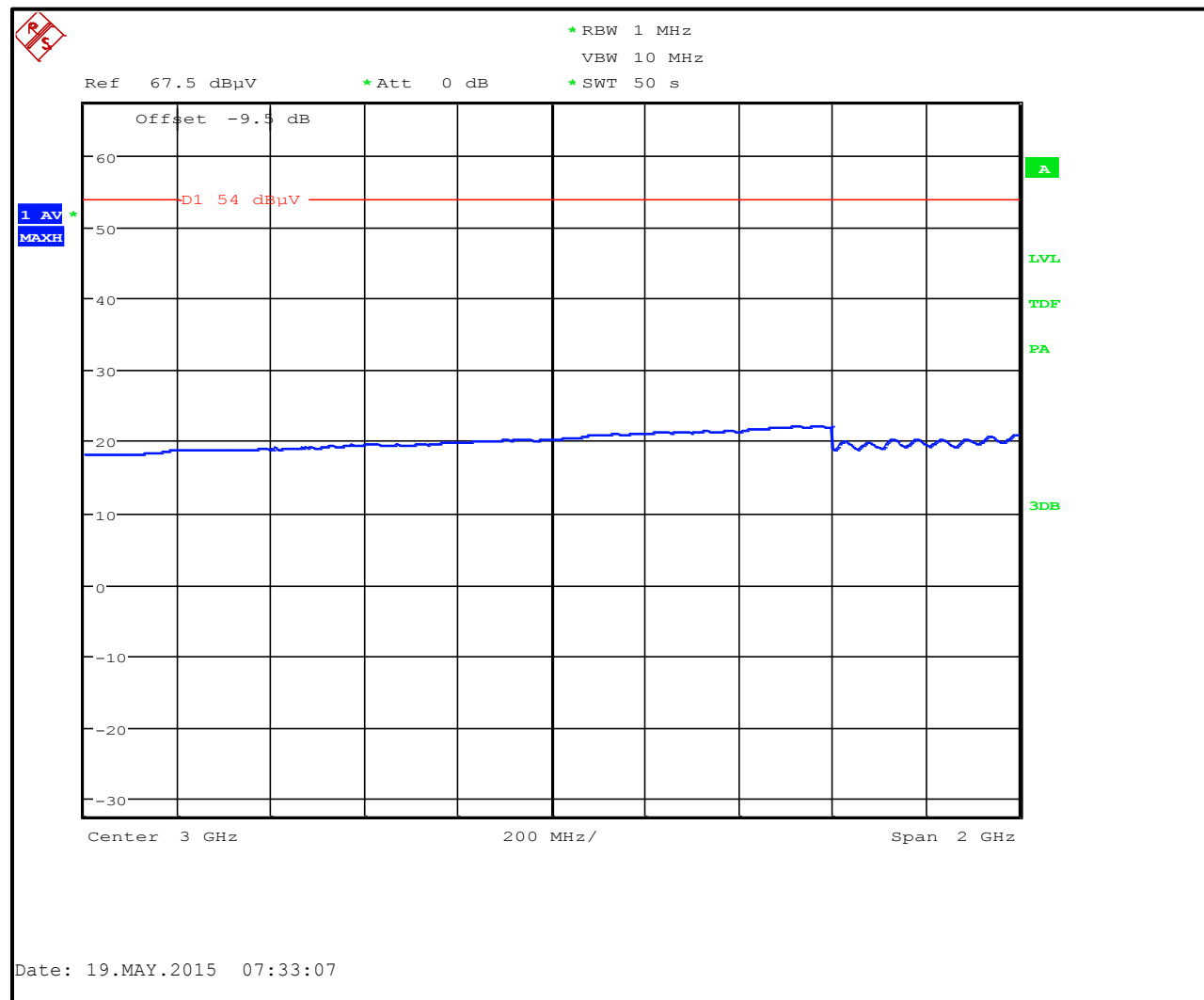
Plot 6-14: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #1, Horizontal, Average



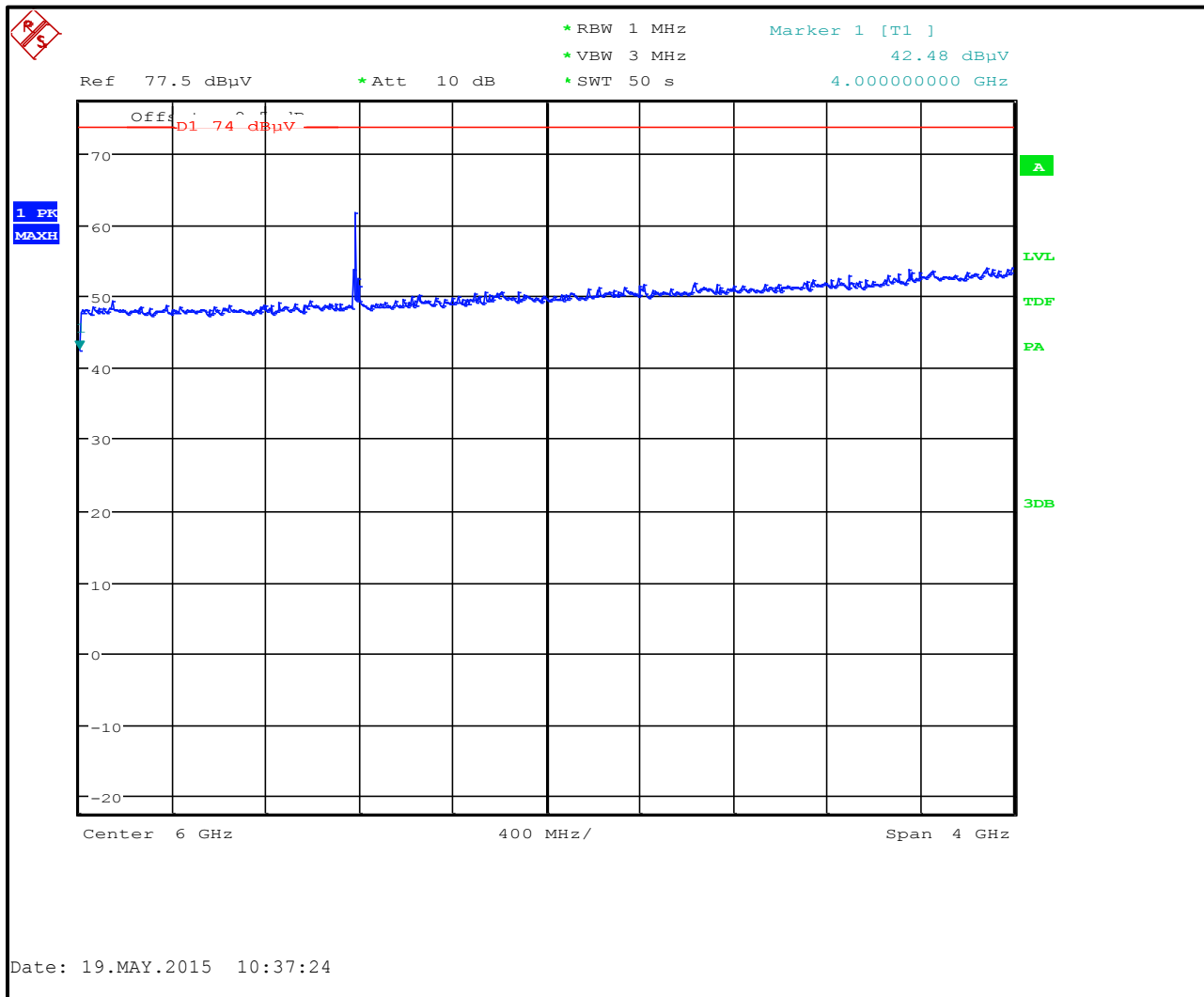
Plot 6-15: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #1, Vertical, Peak



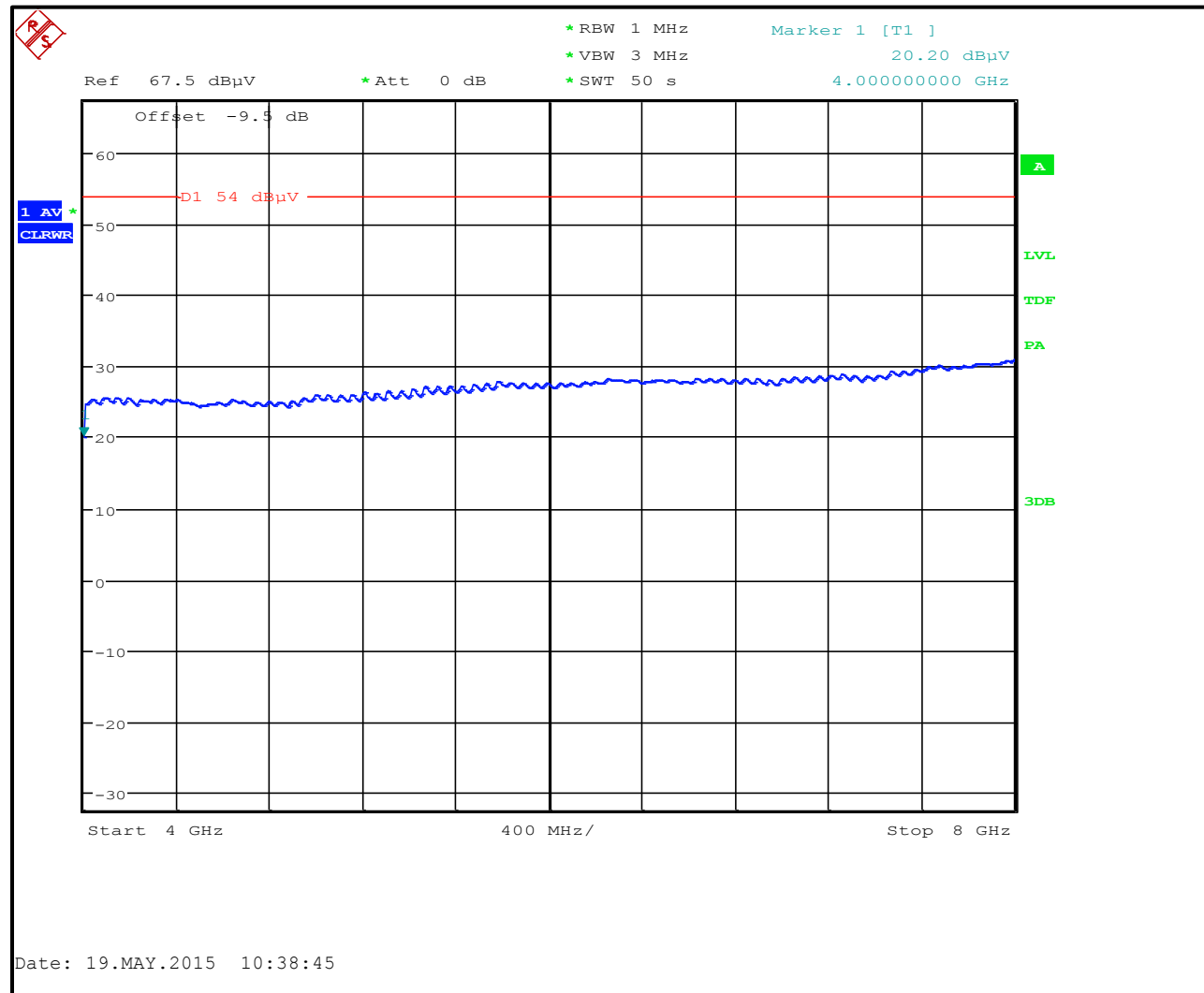
Plot 6-16: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #1, Vertical, Average



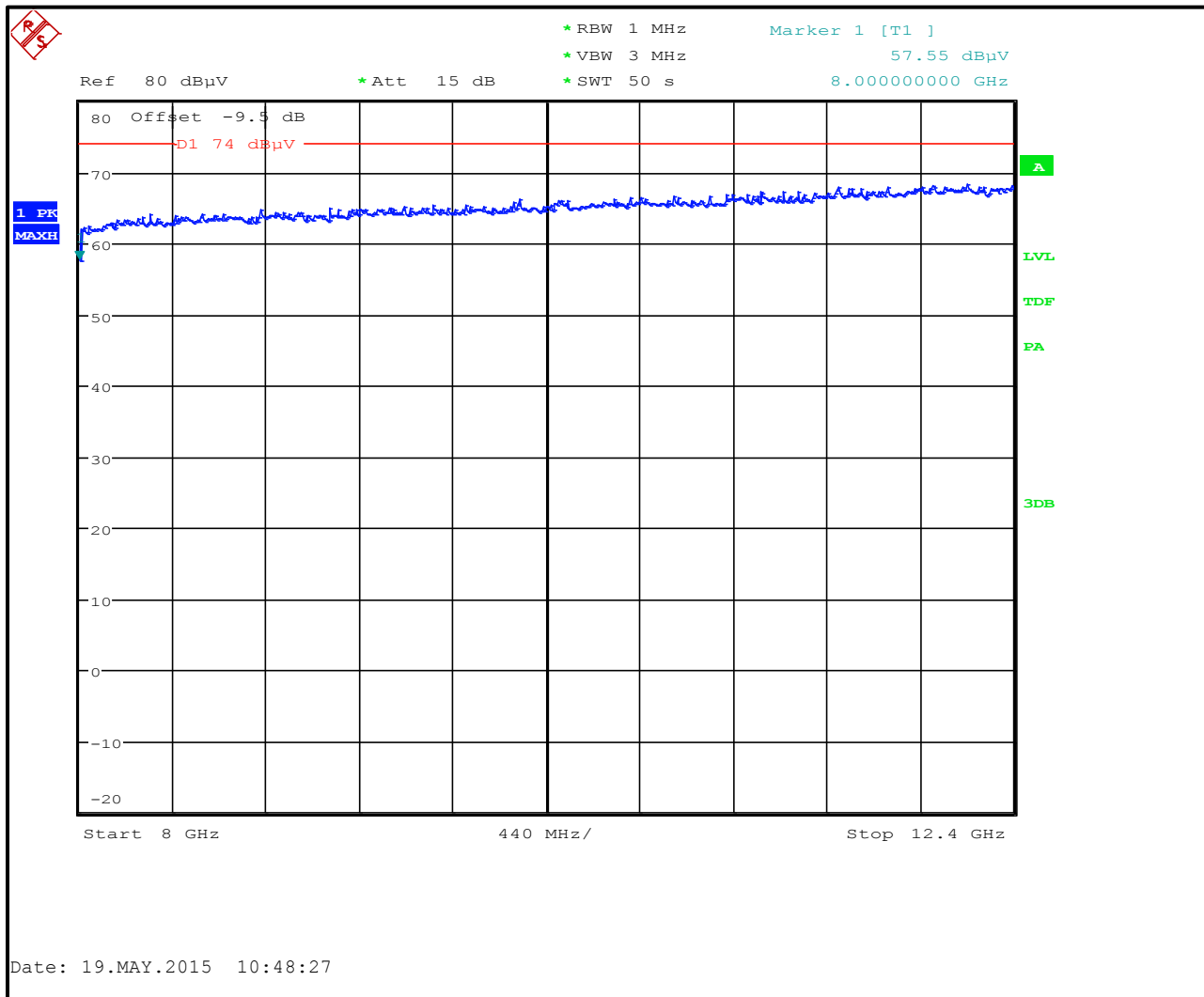
Plot 6-17: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #1, Vertical, Peak



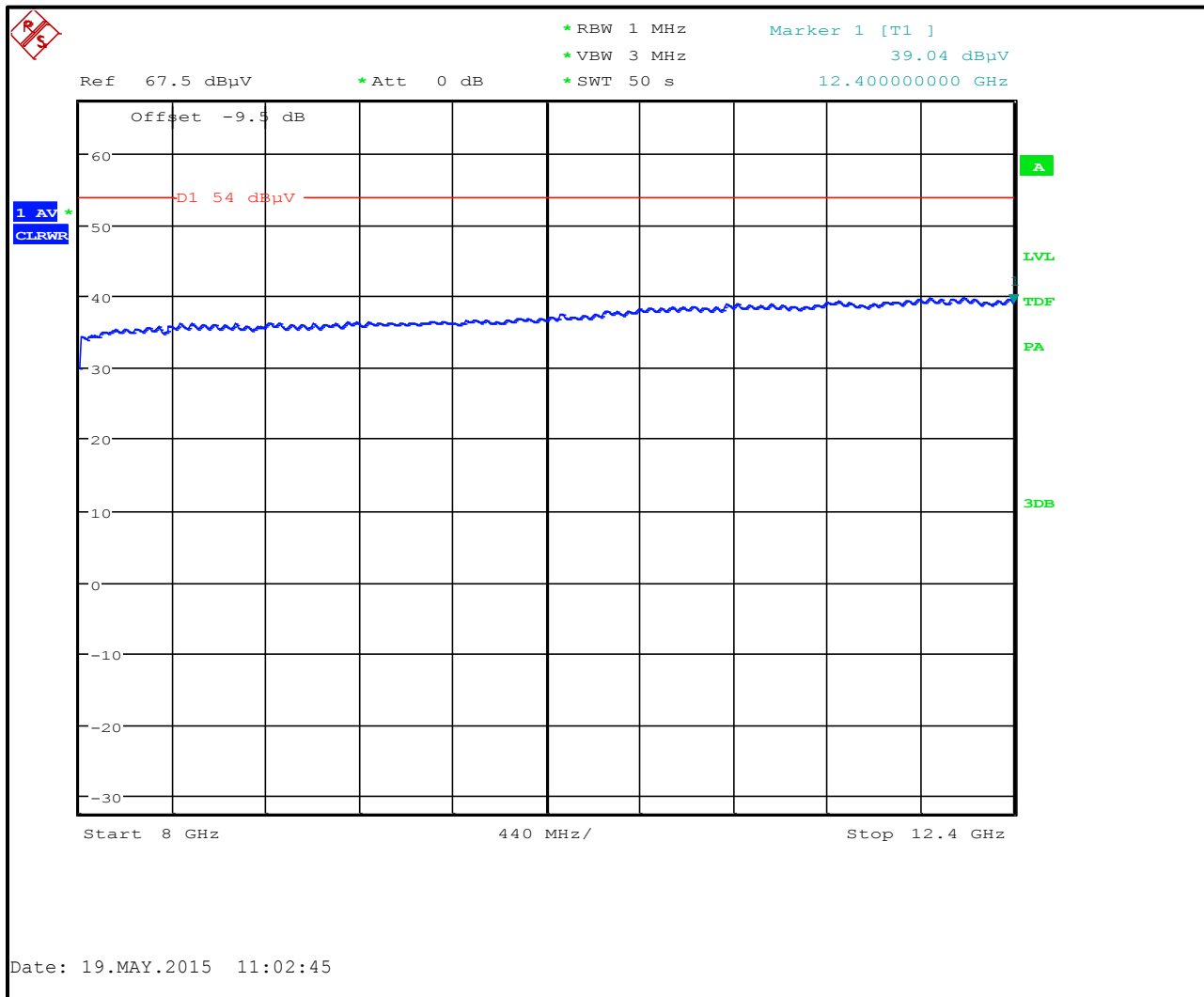
Plot 6-18: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #1, Vertical, Average



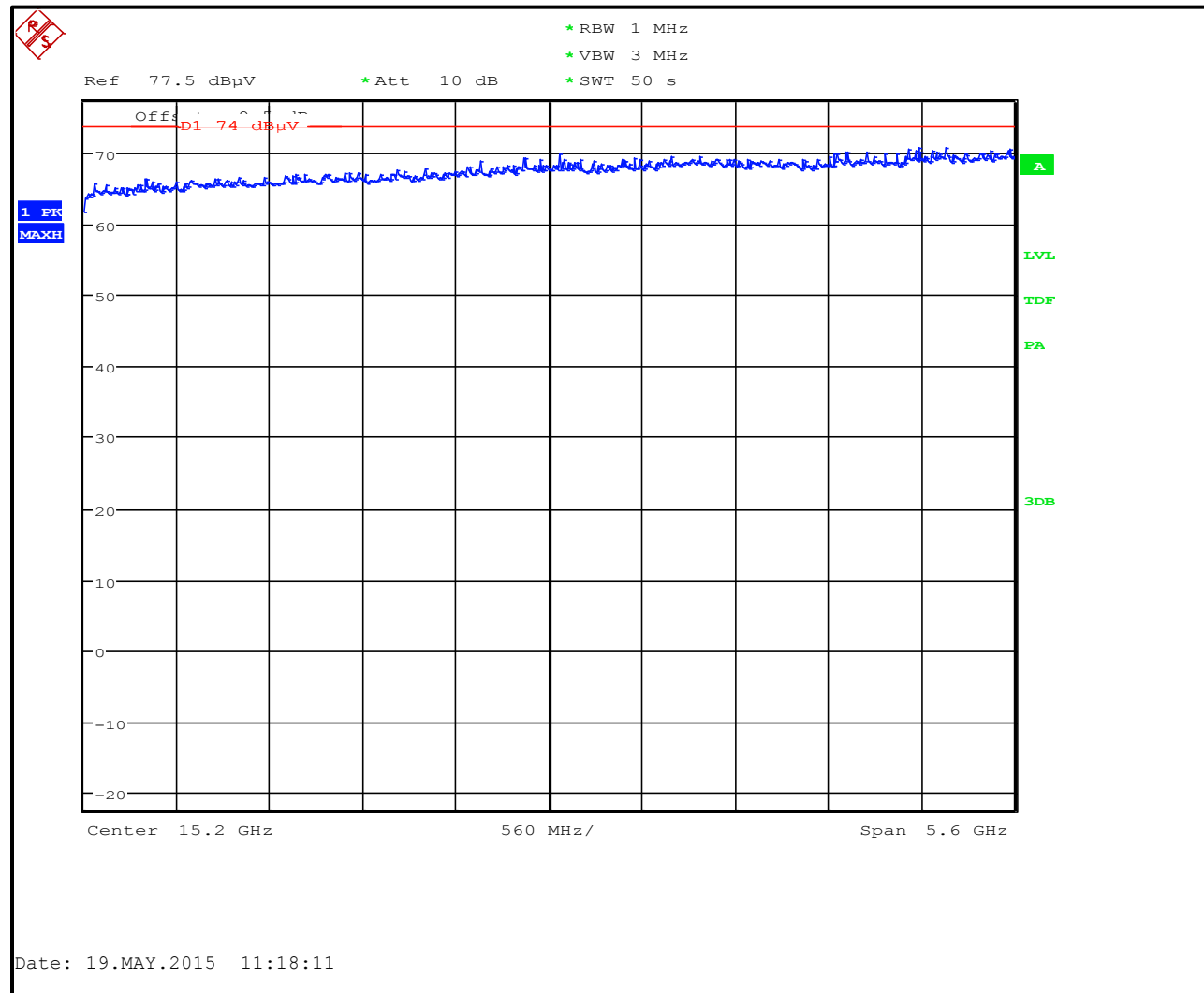
Plot 6-19: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #1, Vertical, Peak



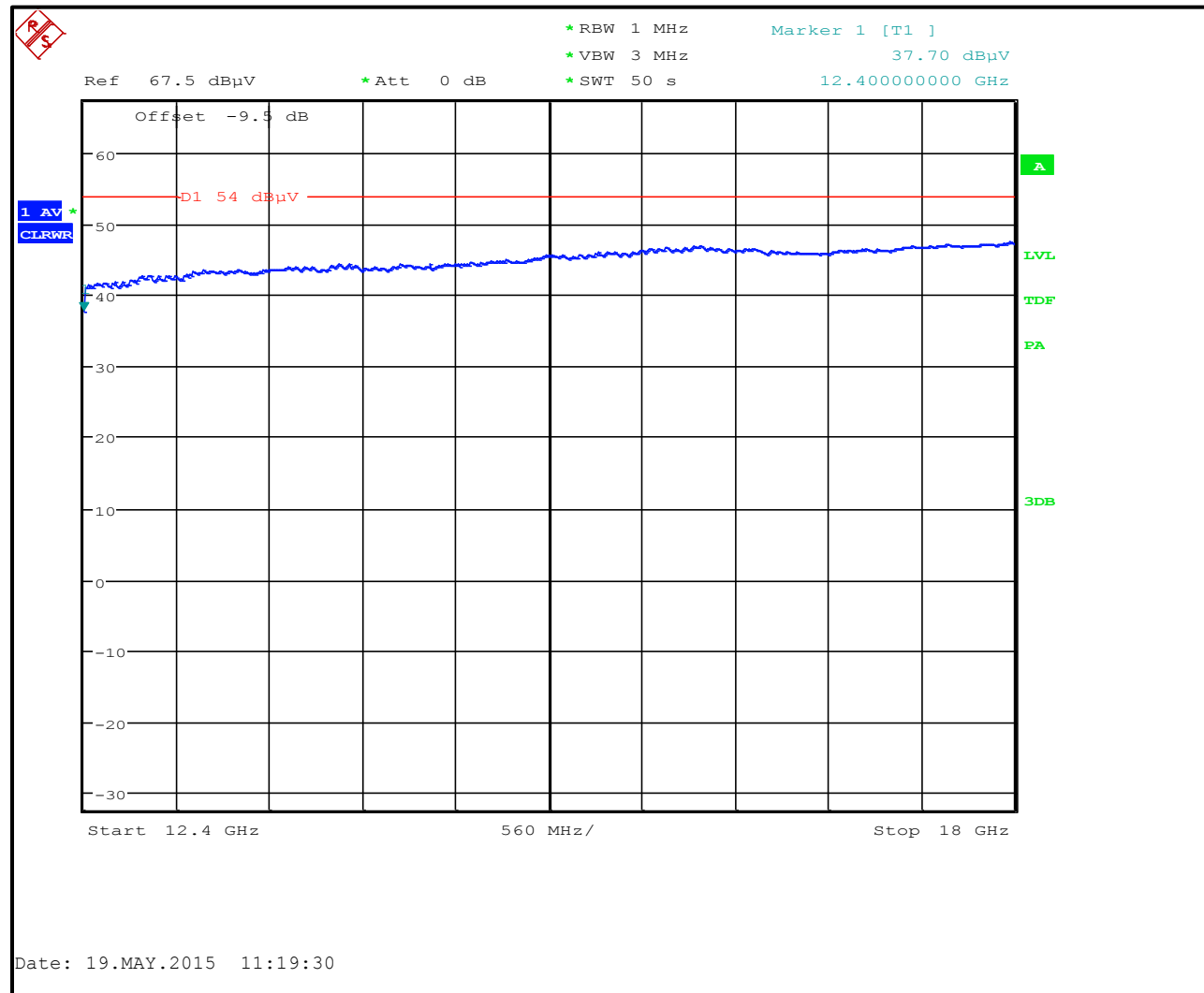
Plot 6-20: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #1, Vertical, Average



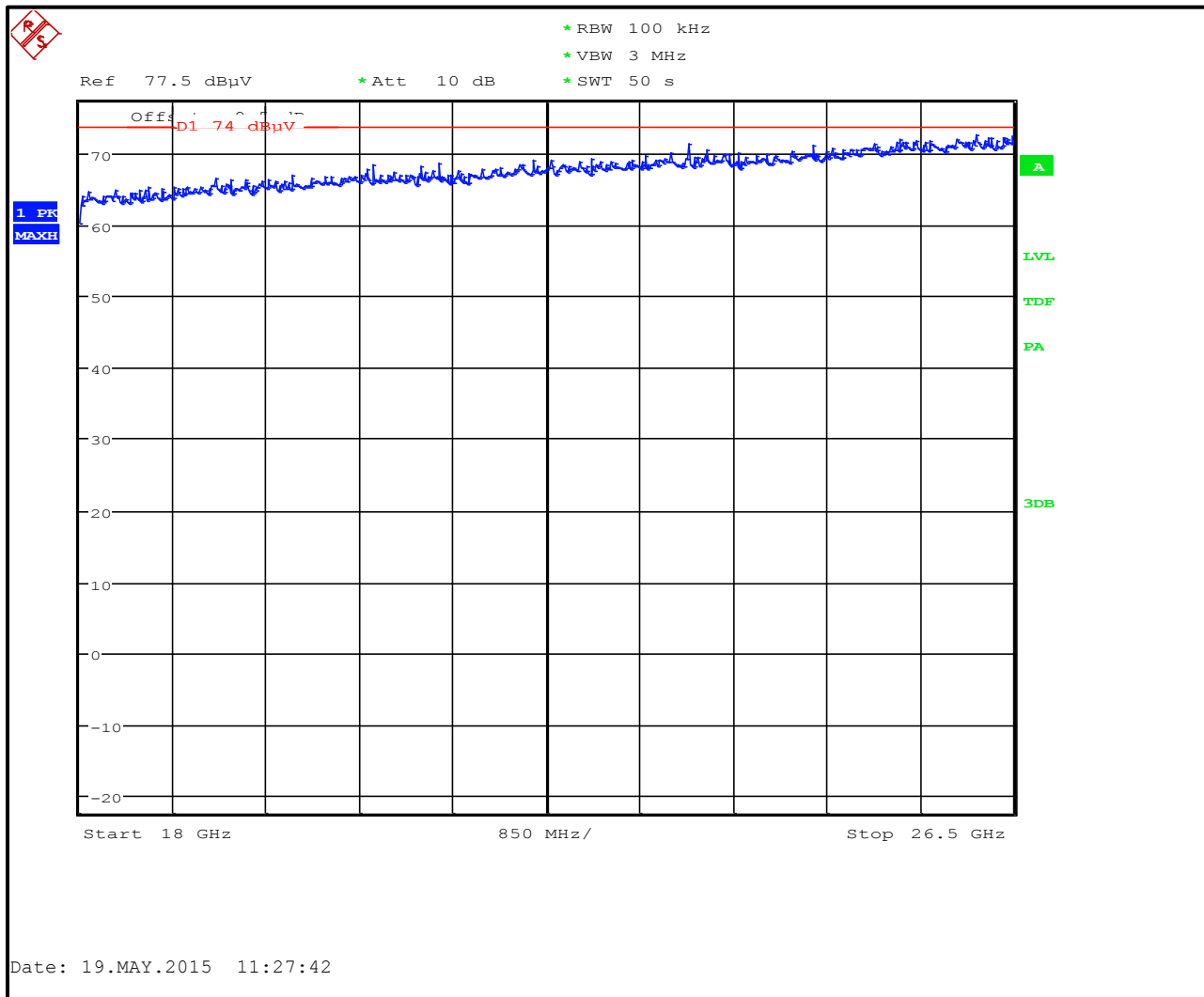
Plot 6-21: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #1, Vertical, Peak



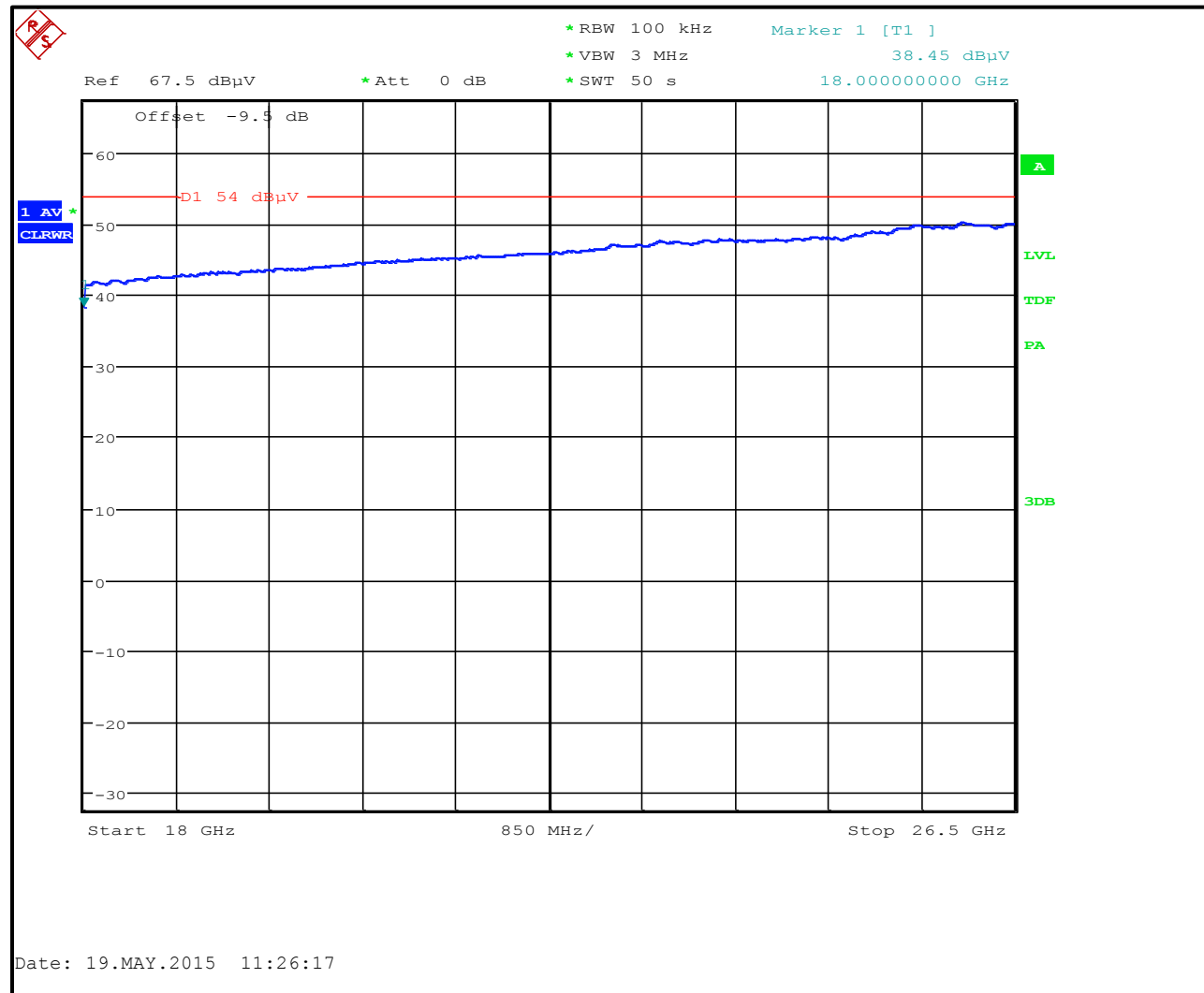
Plot 6-22: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #1, Vertical, Average



Plot 6-23: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #1, Vertical, Peak

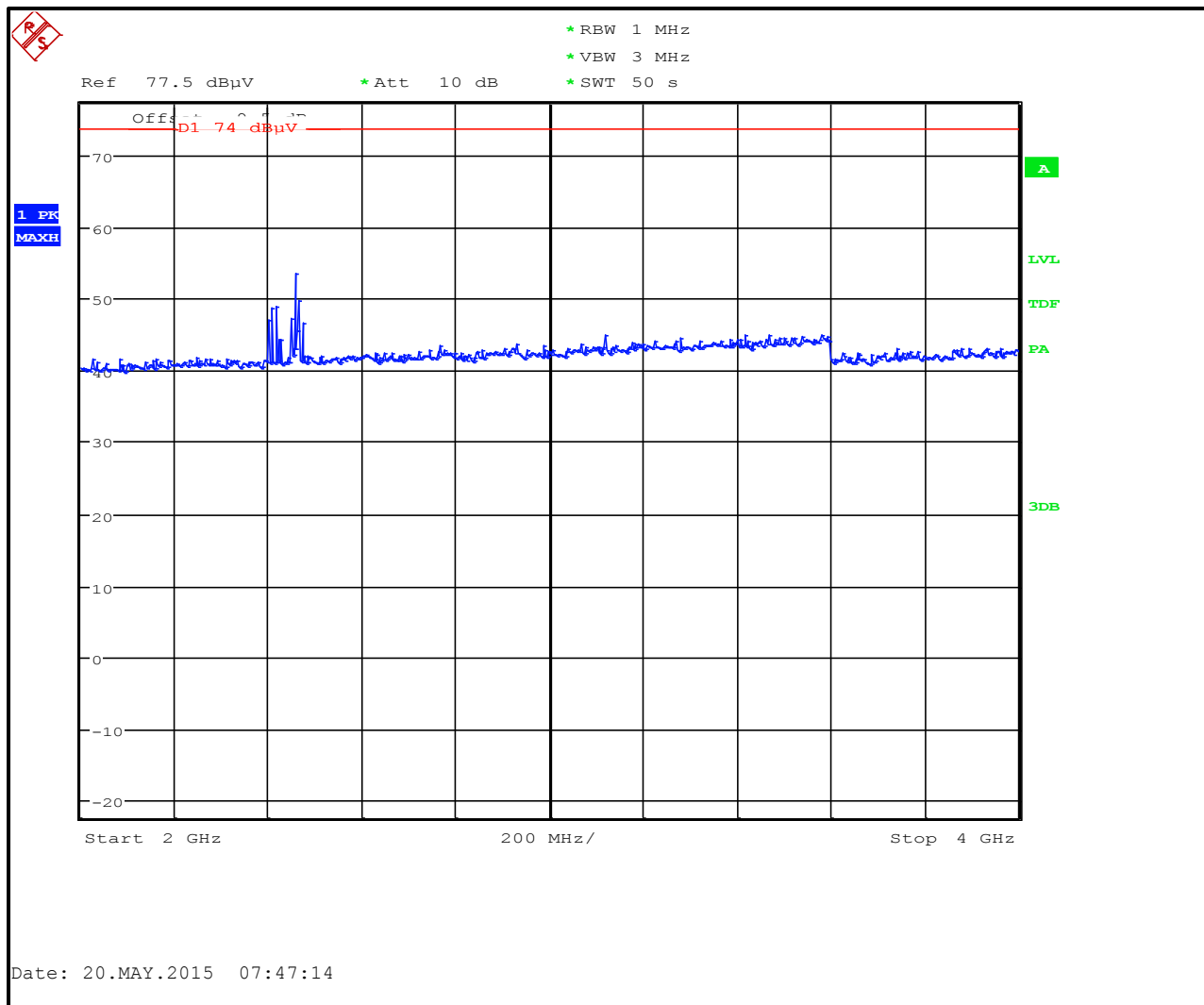


Plot 6-24: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #1, Vertical, Average

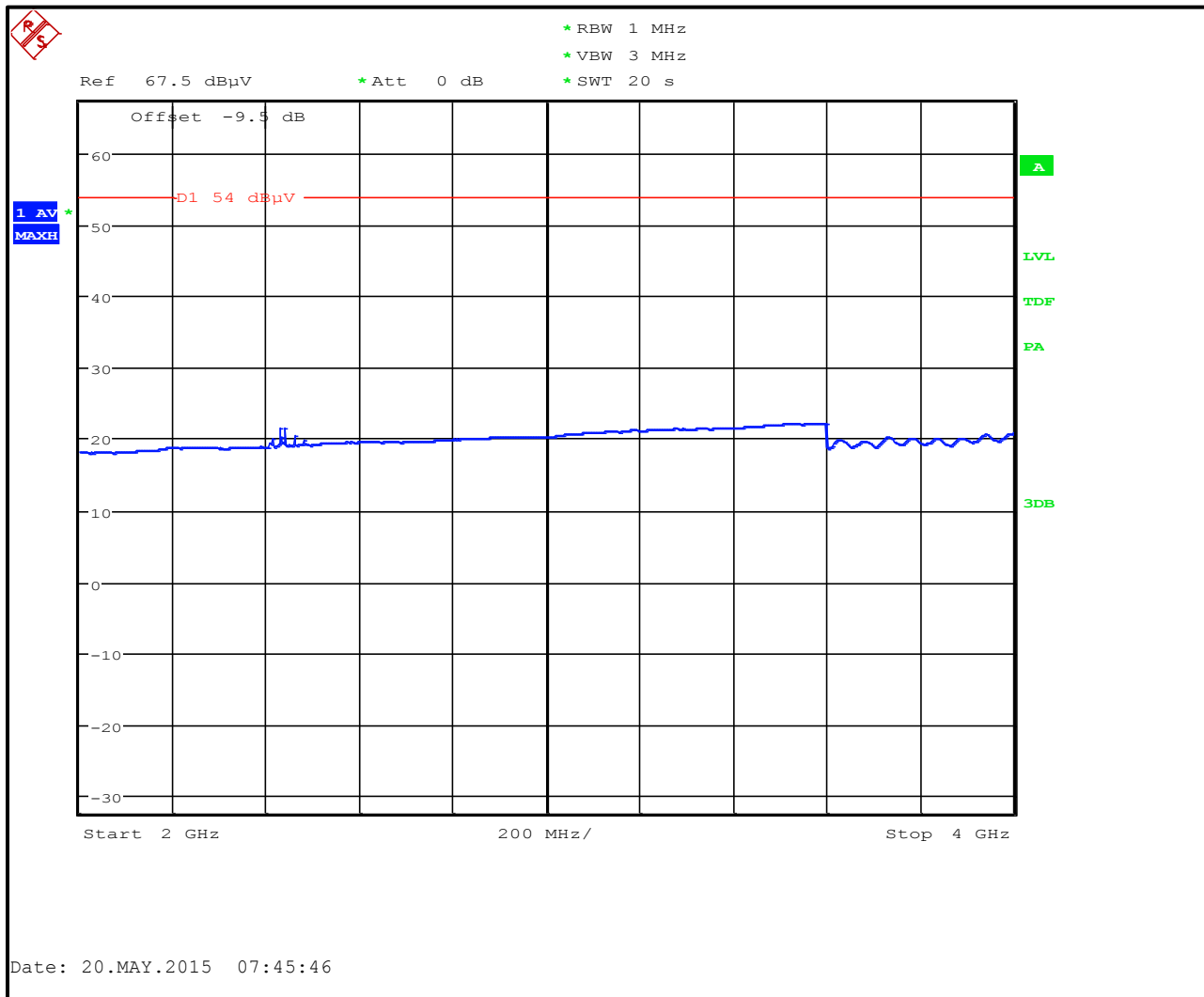


6.3.3 Radiated Emissions Test Data - 2 GHz – 26.5 GHz; Steel Container, TC #2

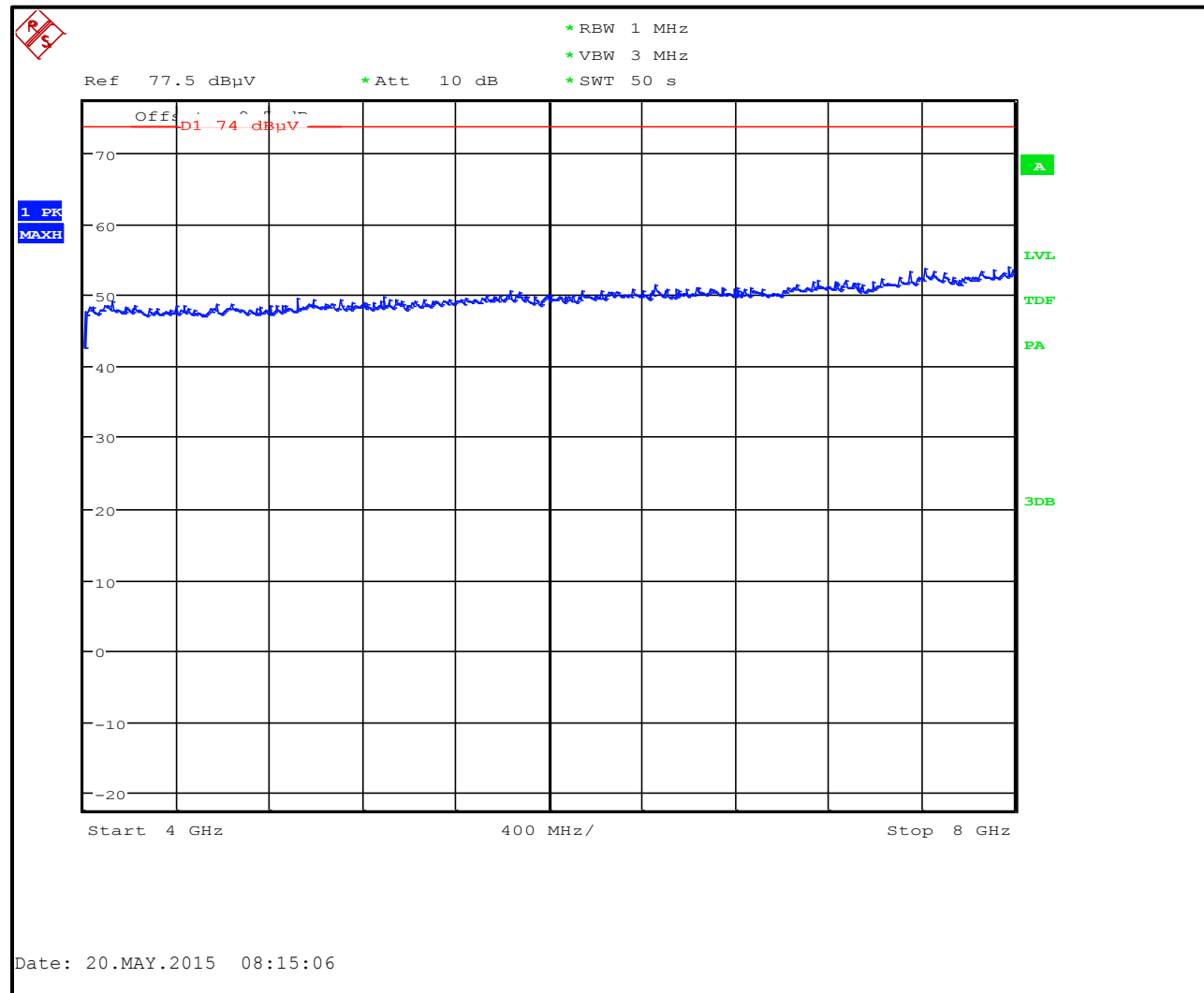
Plot 6-25: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #2, Horizontal, Peak



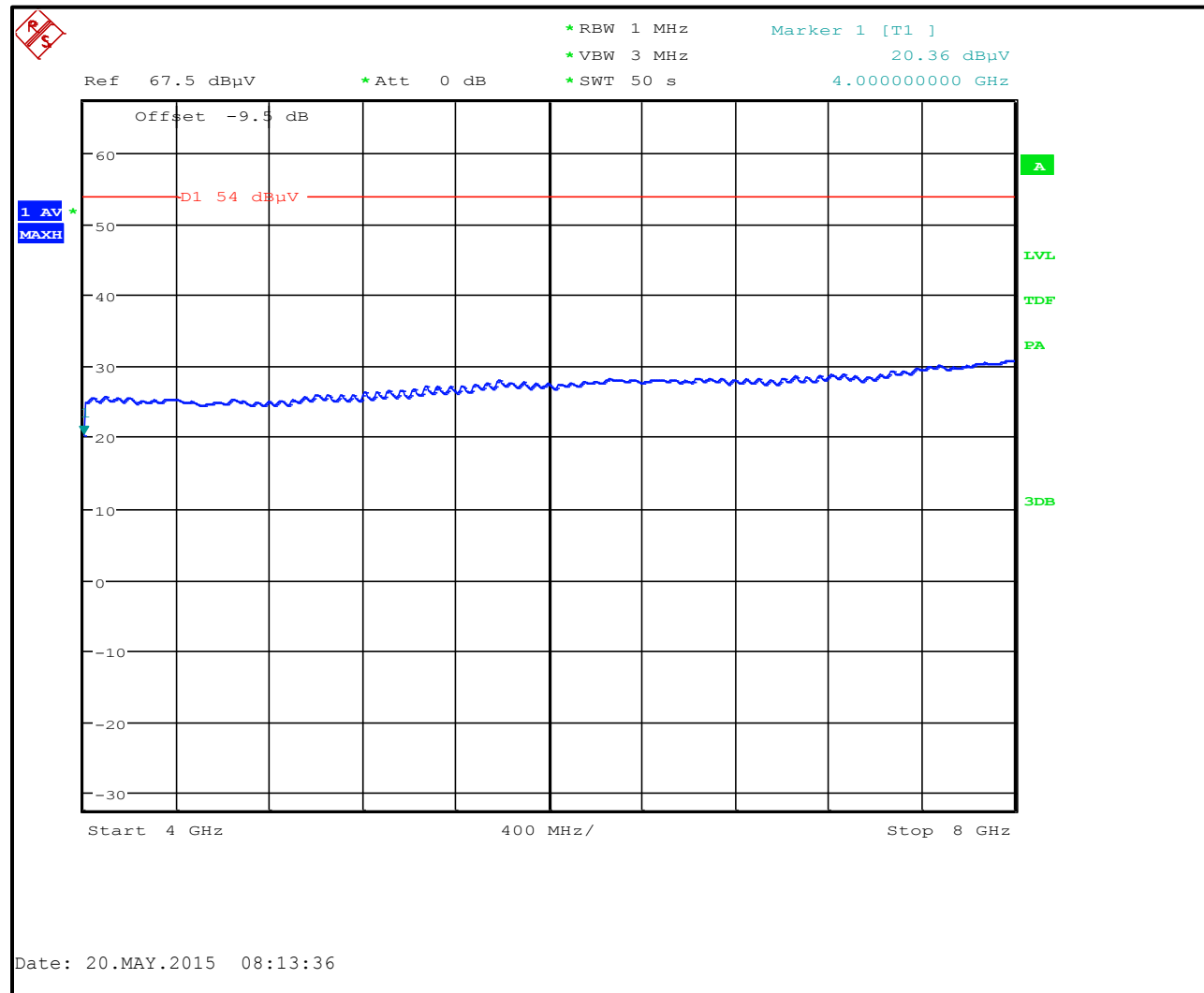
Plot 6-26: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #2, Horizontal, Average



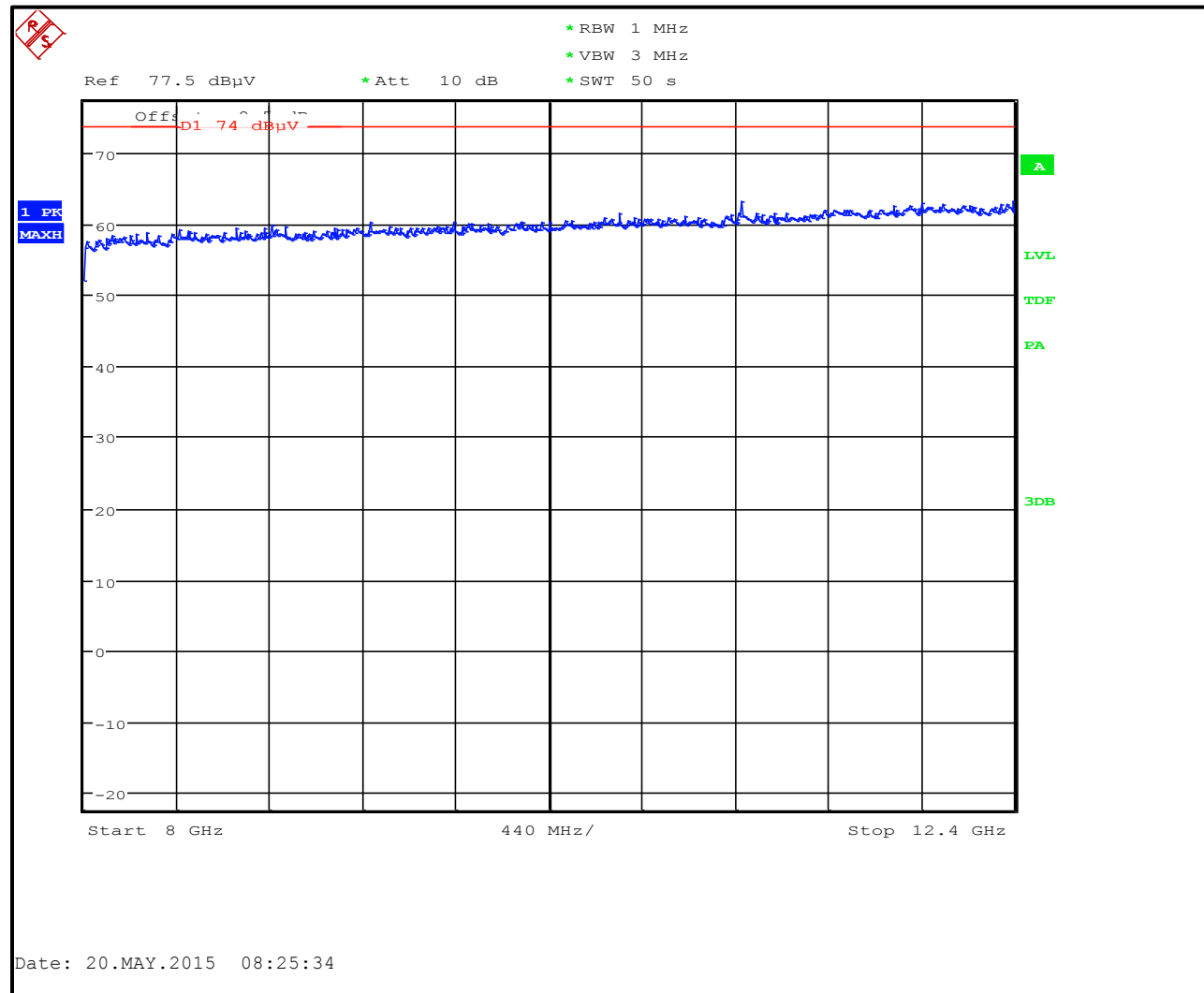
Plot 6-27: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #2, Horizontal, Peak



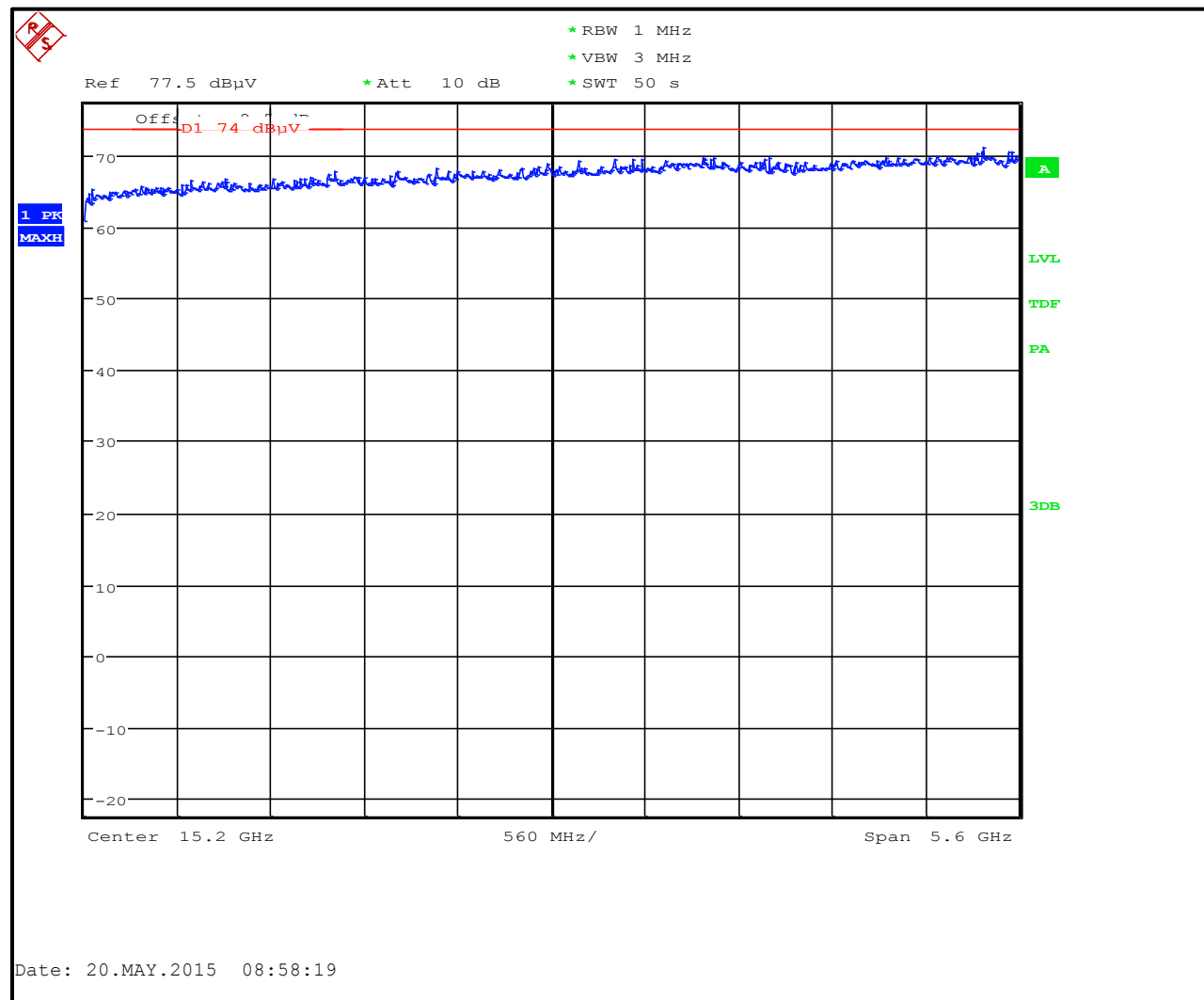
Plot 6-28: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #2, Horizontal, Average



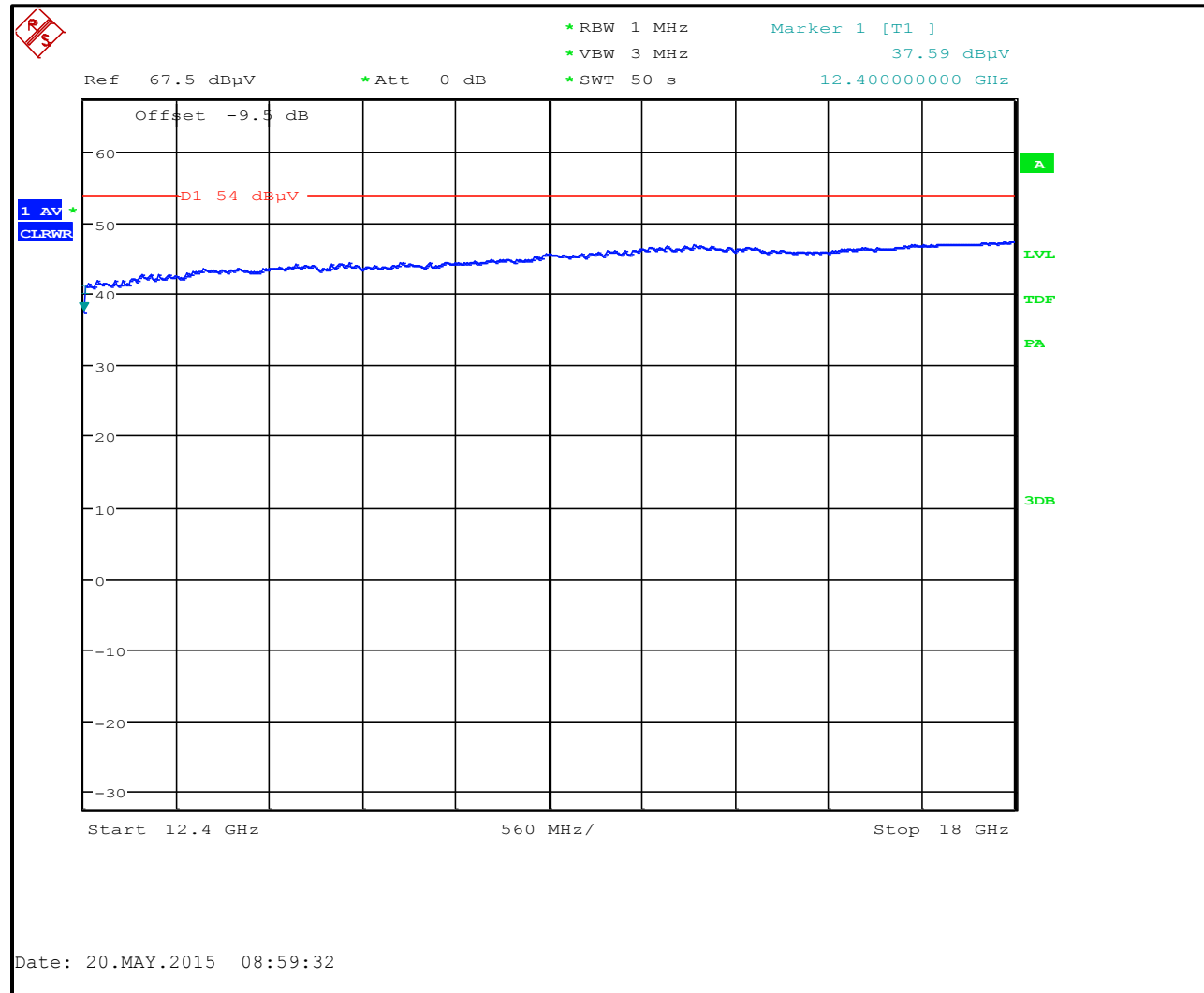
Plot 6-29: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #2, Horizontal, Peak



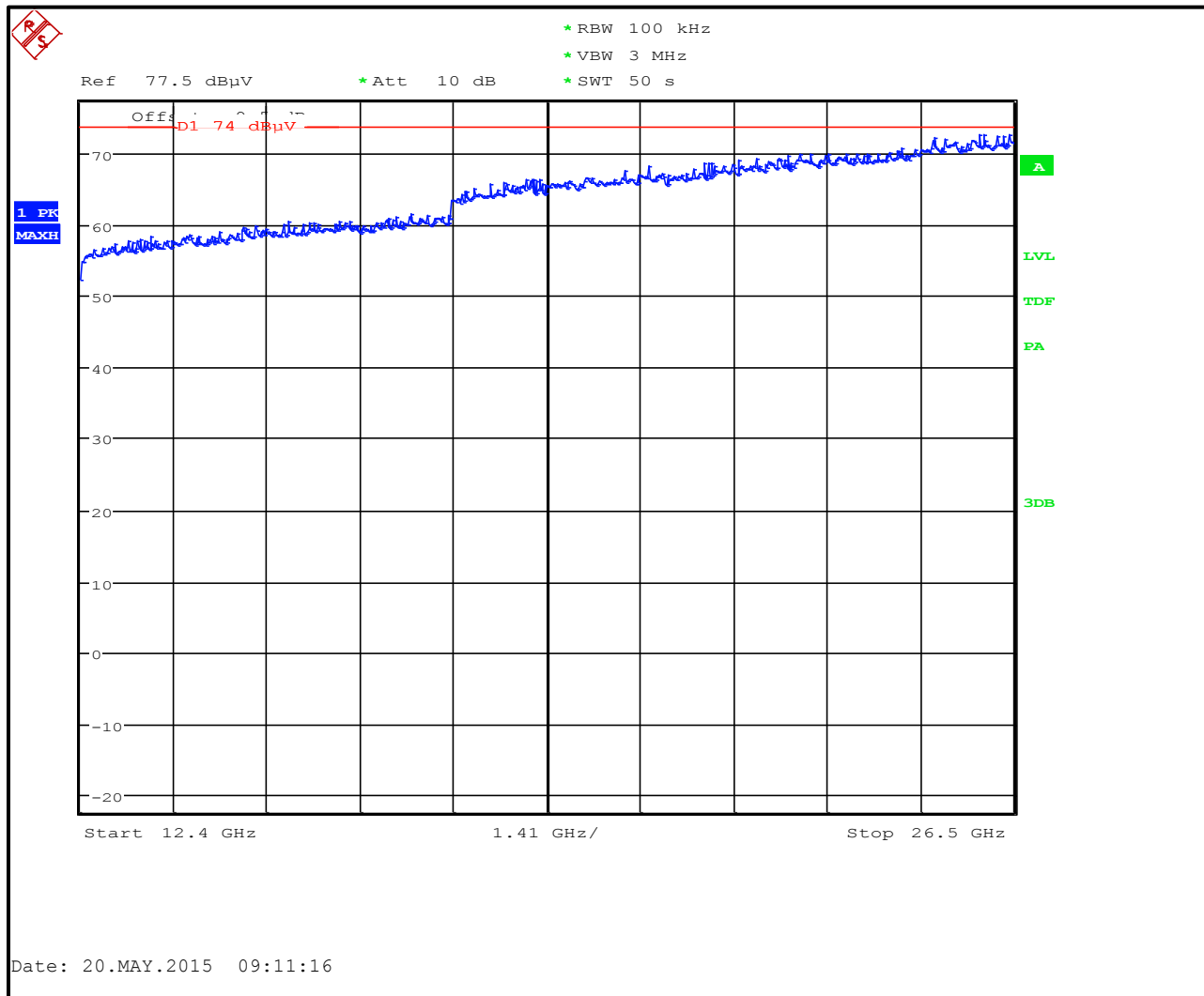
Plot 6-31: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #2, Horizontal, Peak



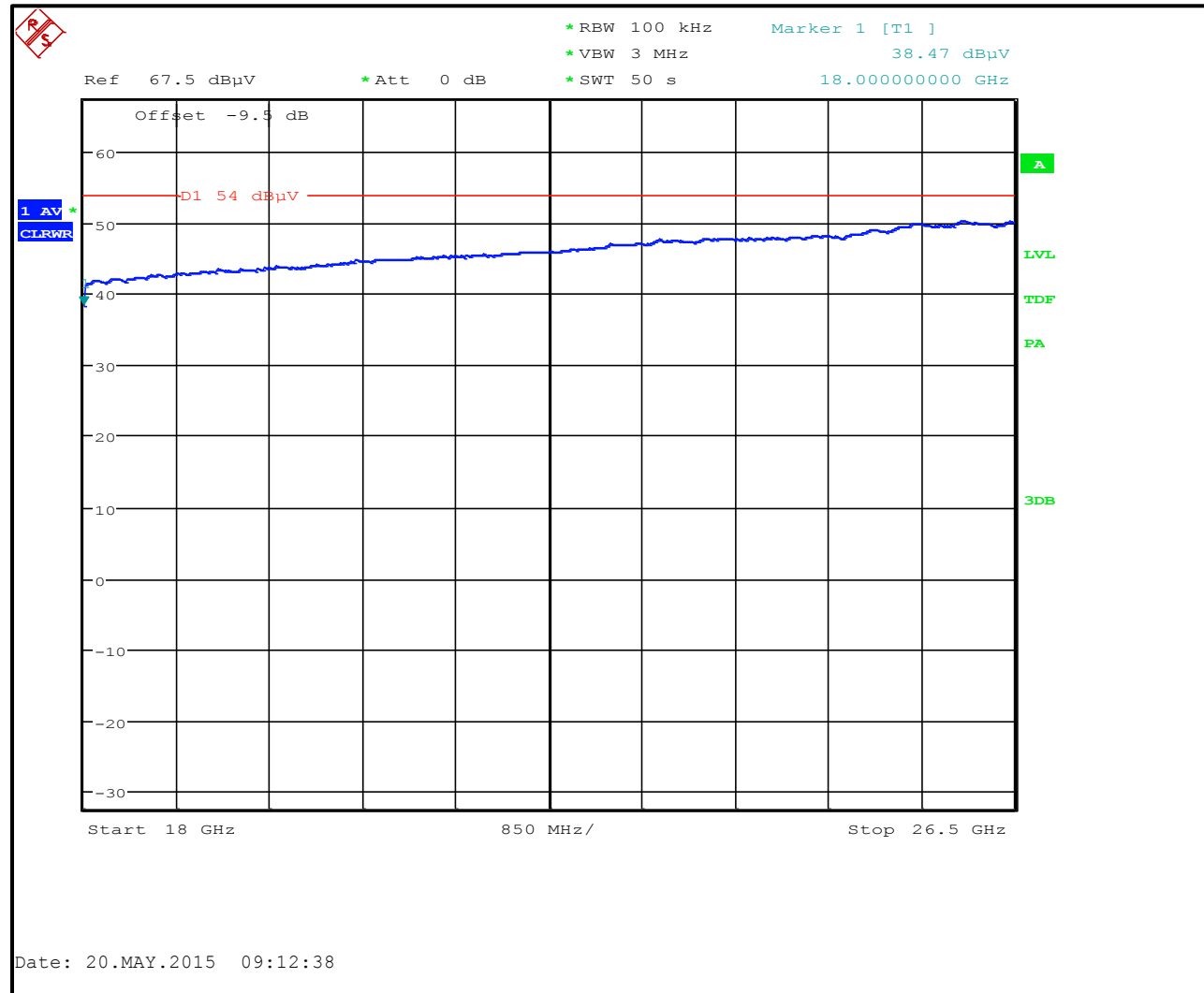
Plot 6-32: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #2, Horizontal, Average



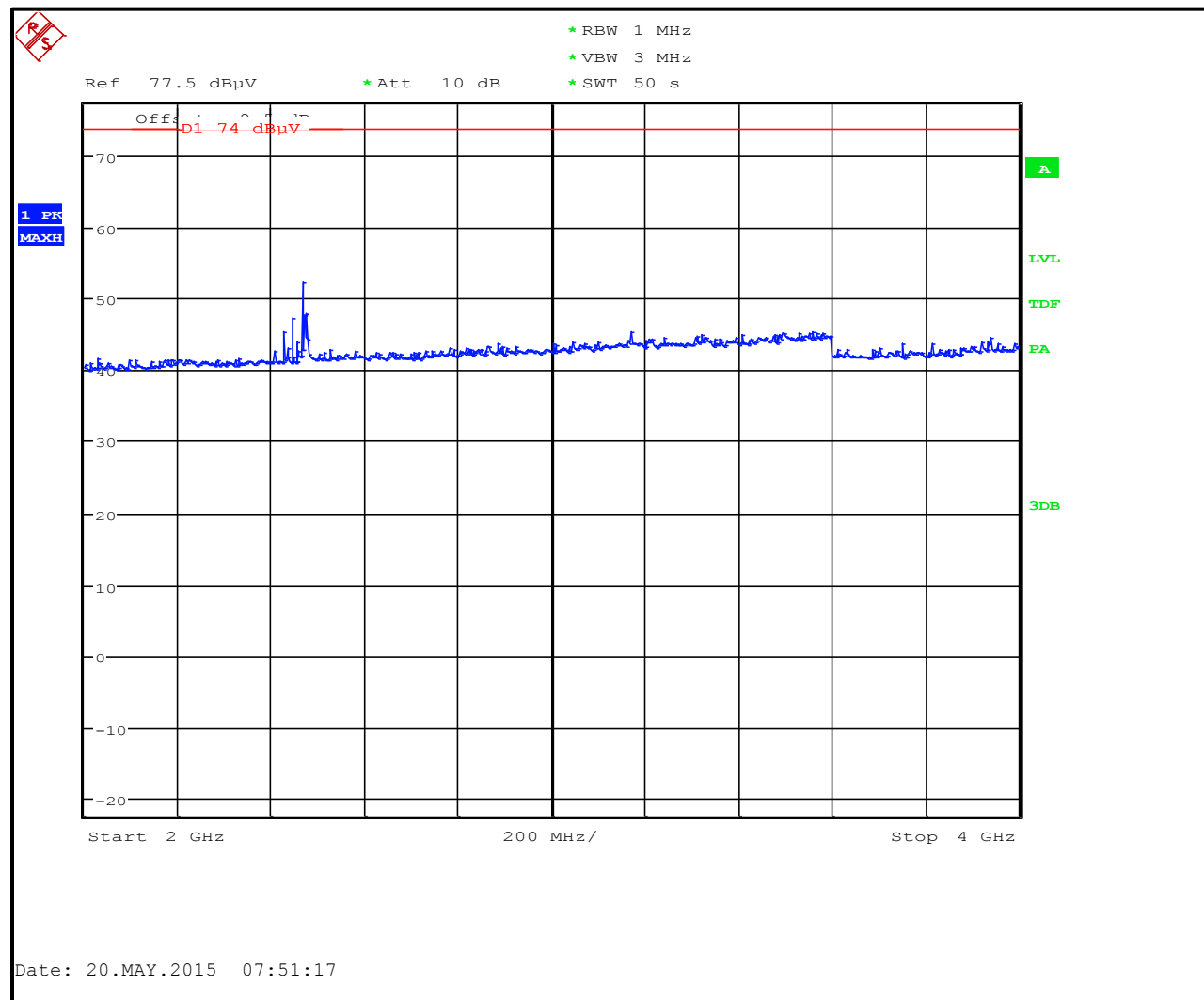
Plot 6-33: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #2, Horizontal, Peak



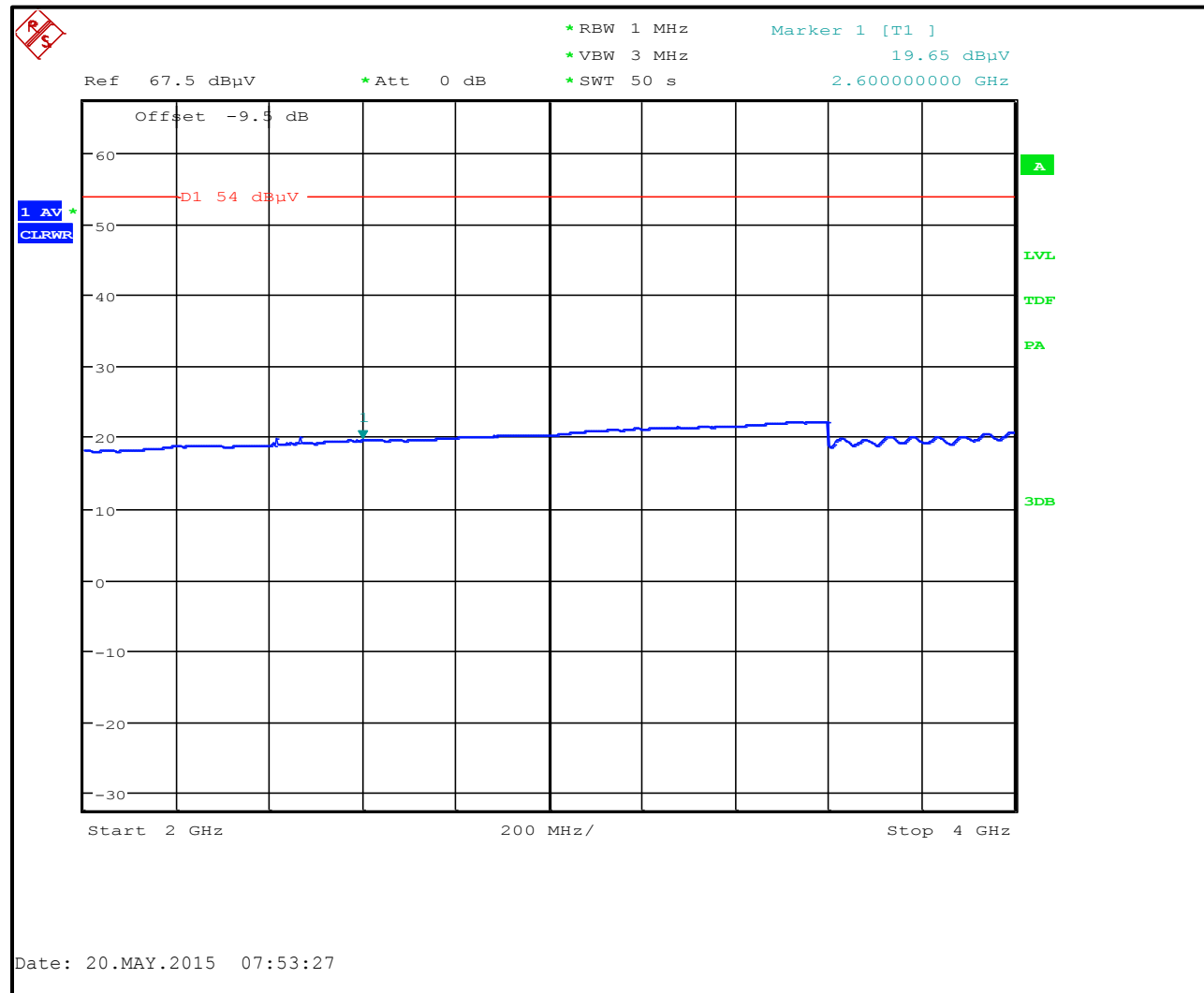
Plot 6-34: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #2, Horizontal, Average



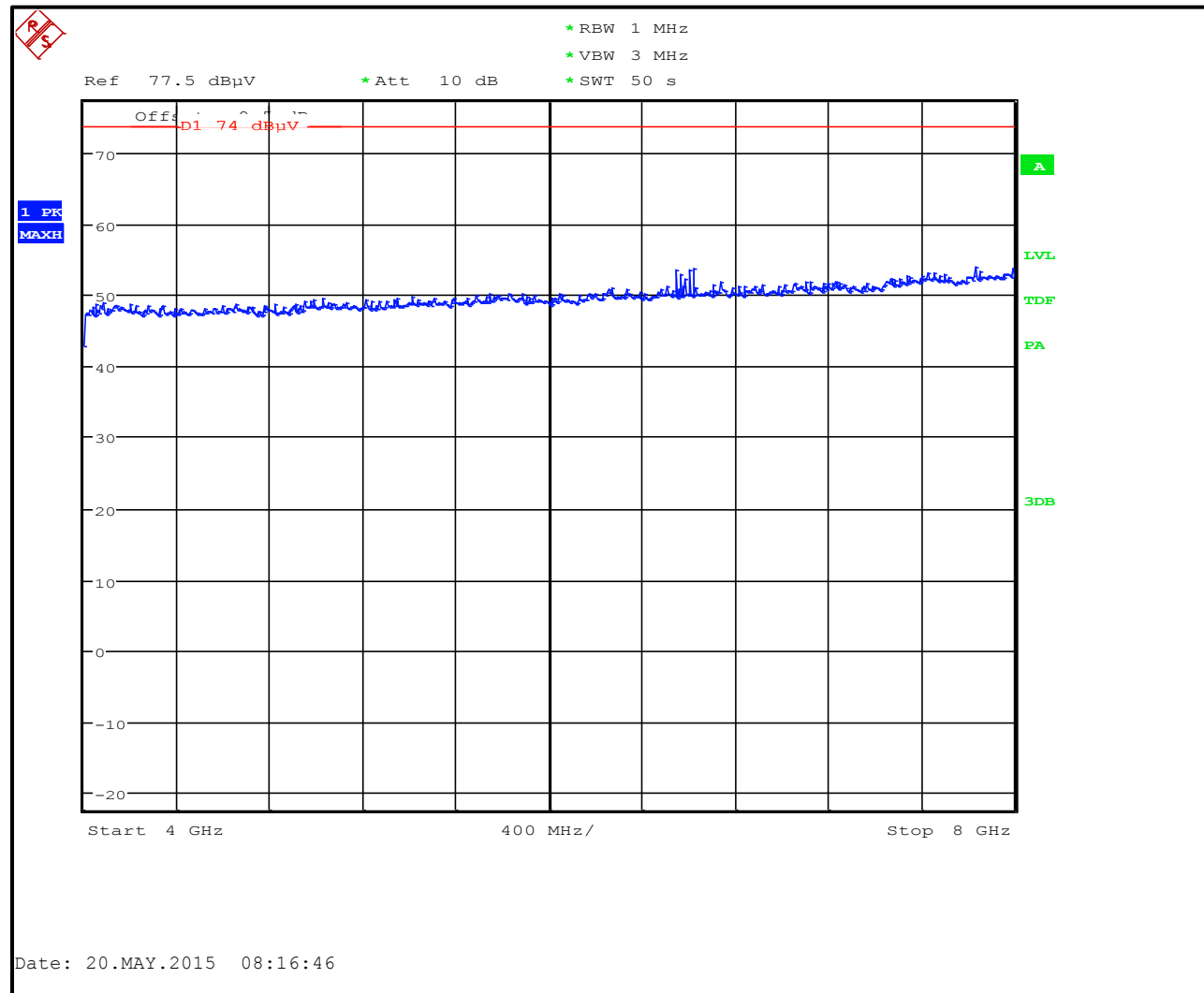
Plot 6-35: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #2, Vertical, Peak



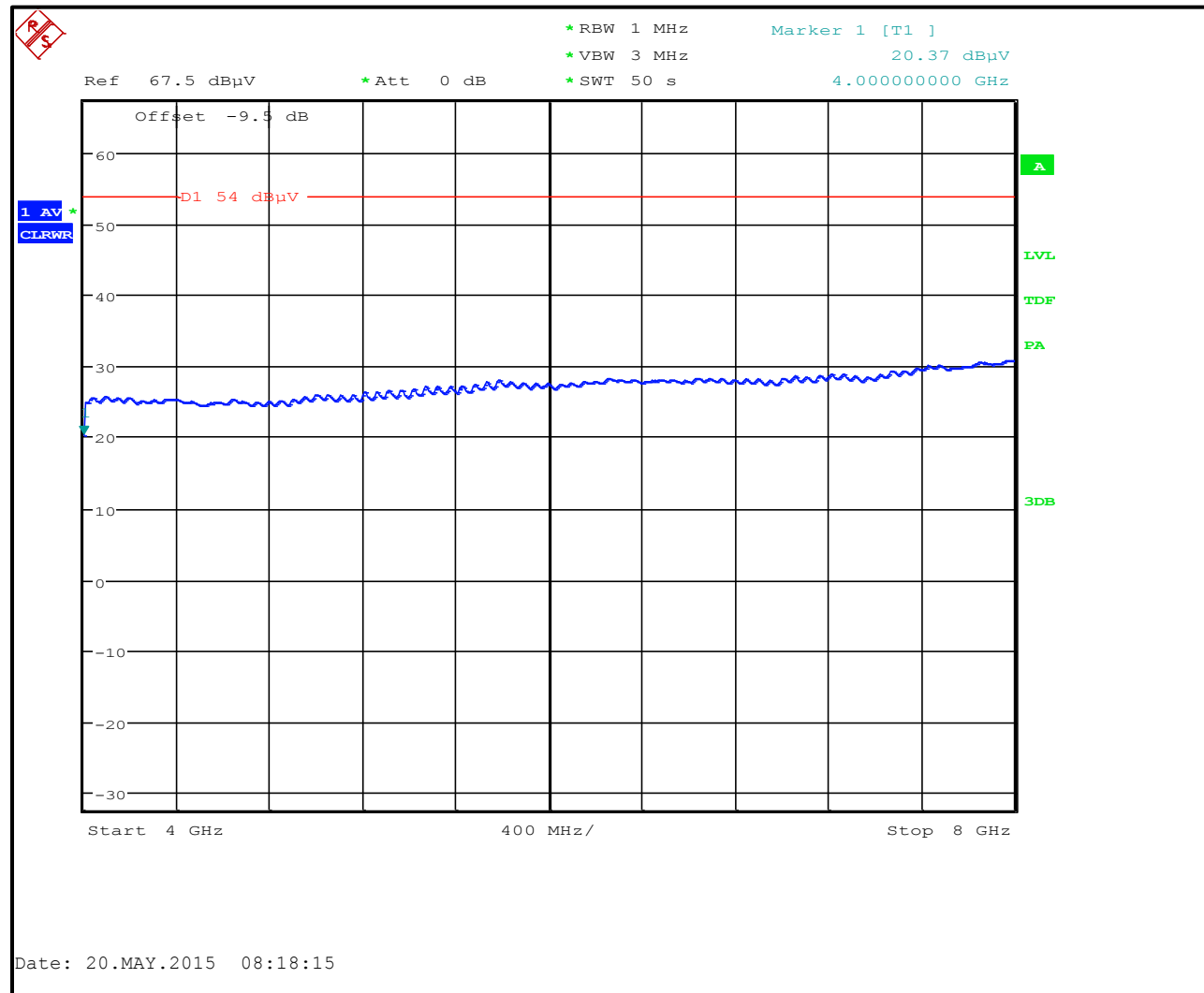
Plot 6-36: Radiated Emissions 2 GHz – 4 GHz; Steel Container; TC #2, Vertical, Average



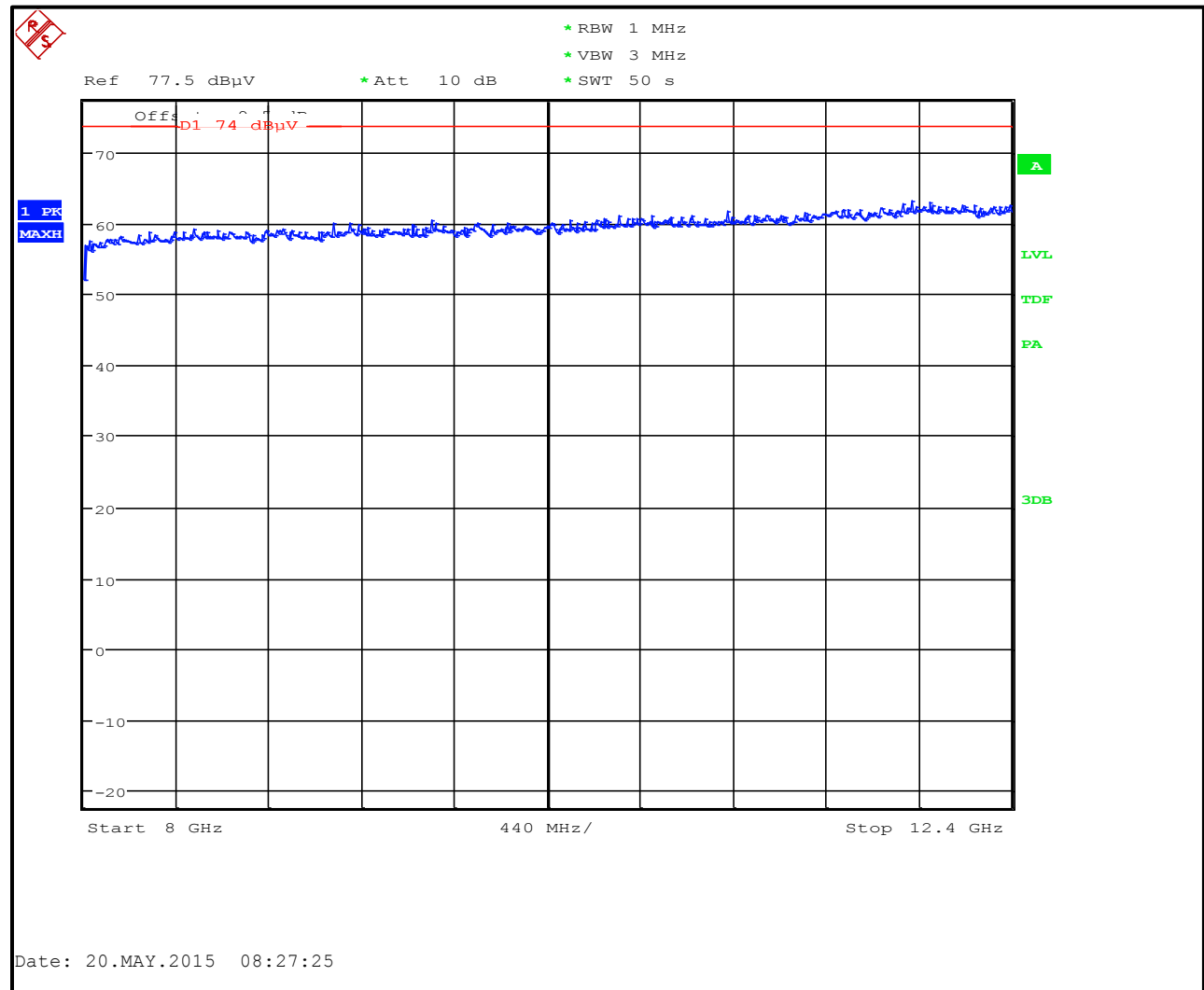
Plot 6-37: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #2, Vertical, Peak



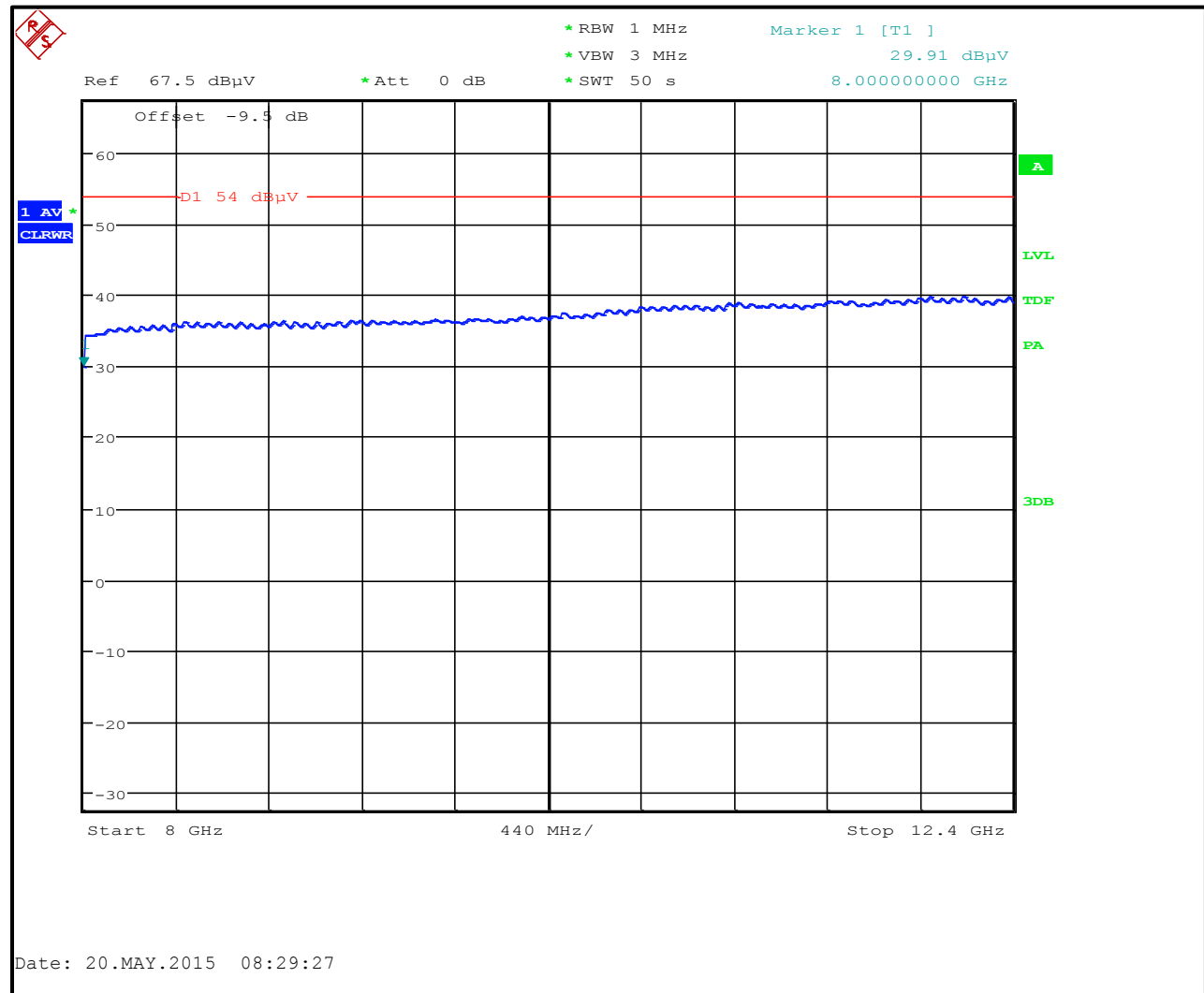
Plot 6-38: Radiated Emissions 4 GHz – 8 GHz; Steel Container; TC #2, Vertical, Average



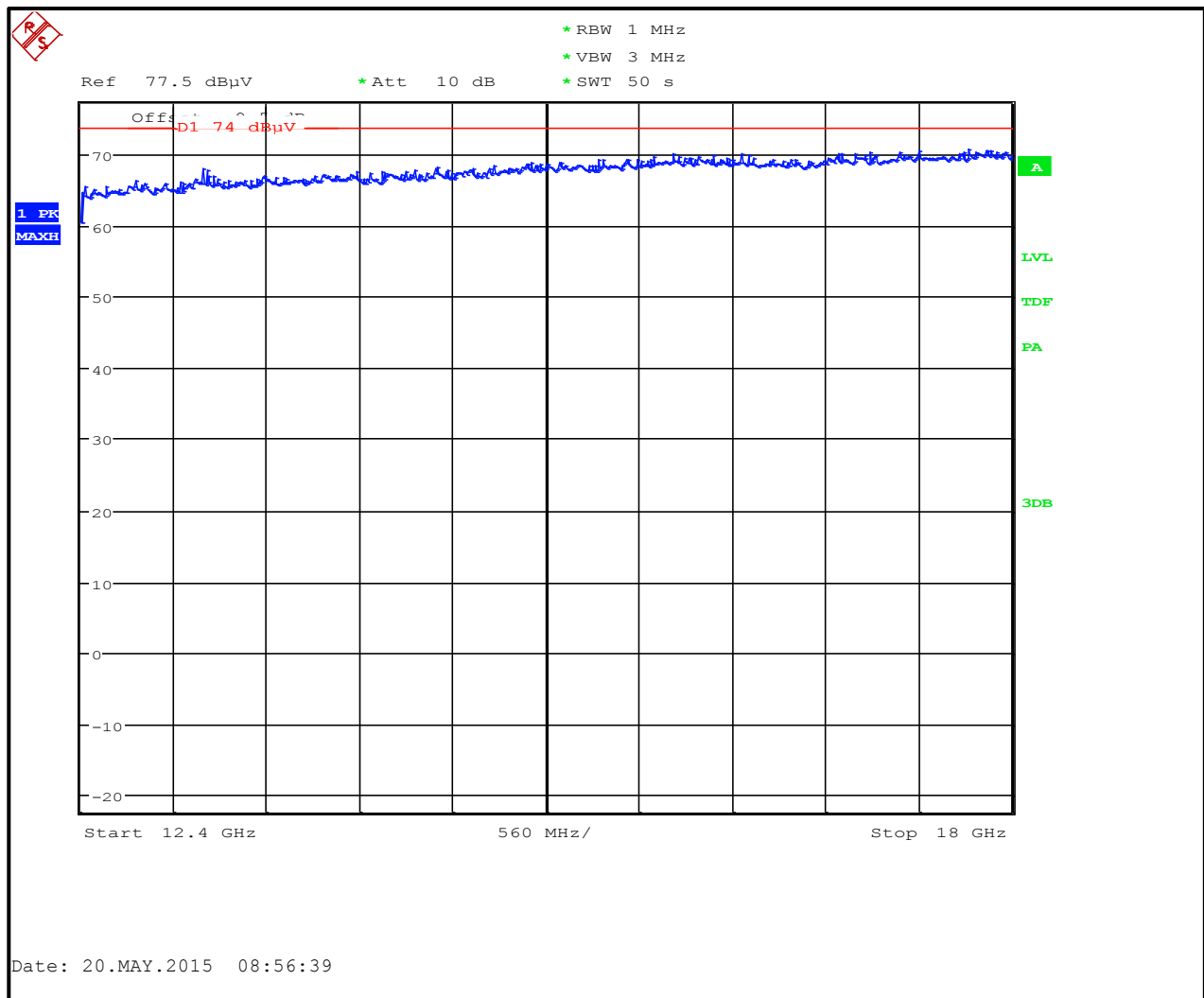
Plot 6-39: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #2, Vertical, Peak



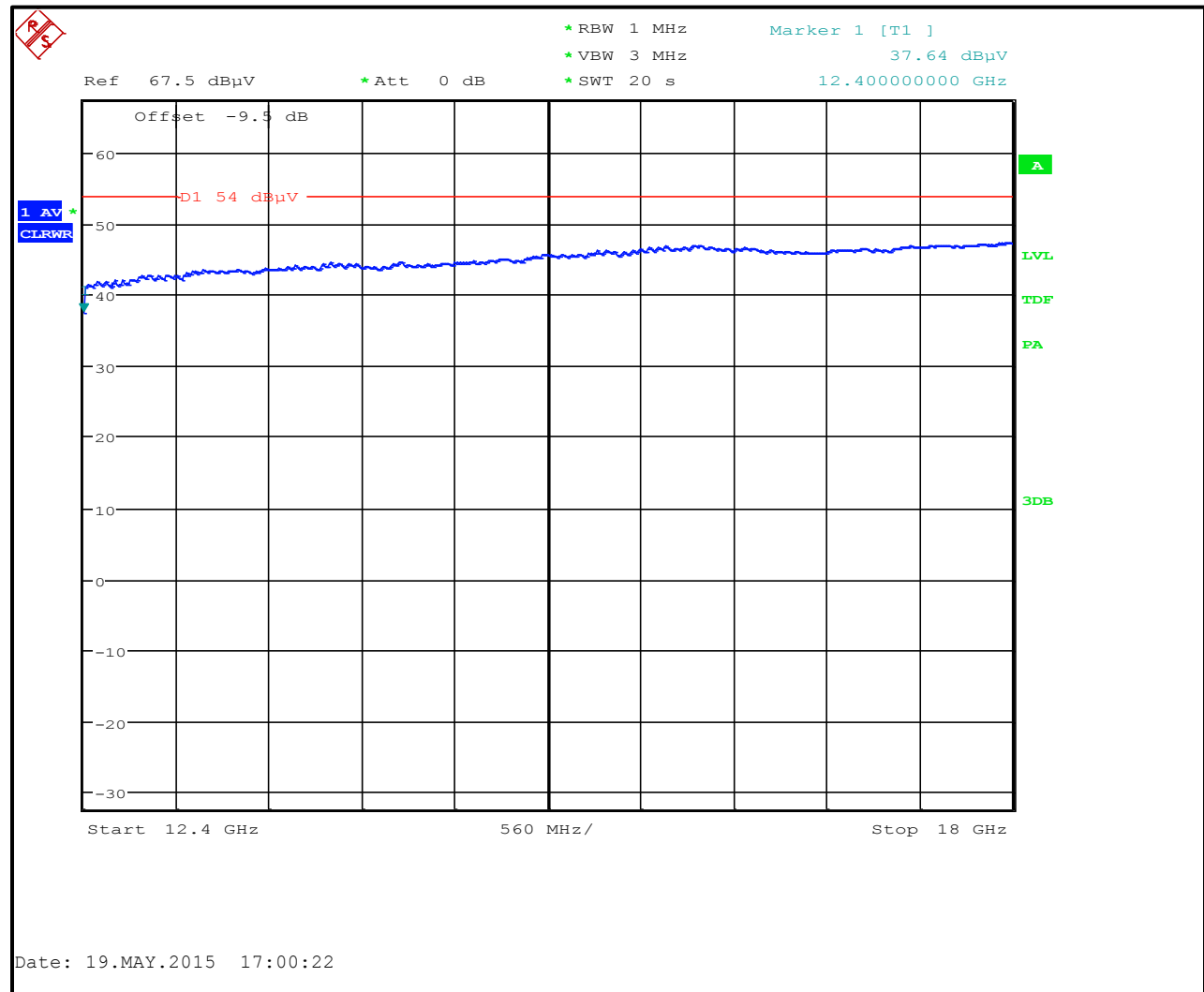
Plot 6-40: Radiated Emissions 8 GHz – 12.4 GHz; Steel Container; TC #2, Vertical, Average



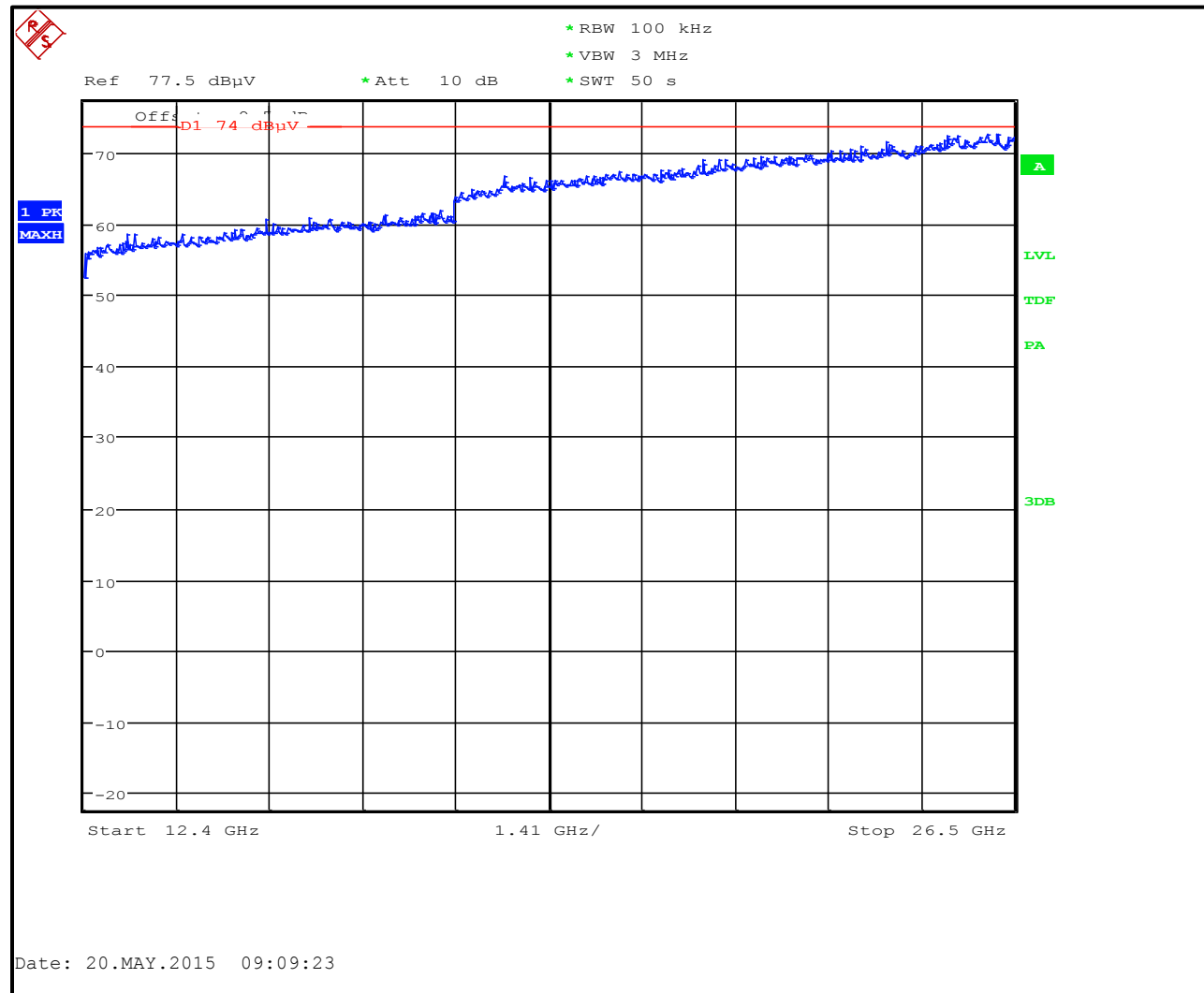
Plot 6-41: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #2, Vertical, Peak



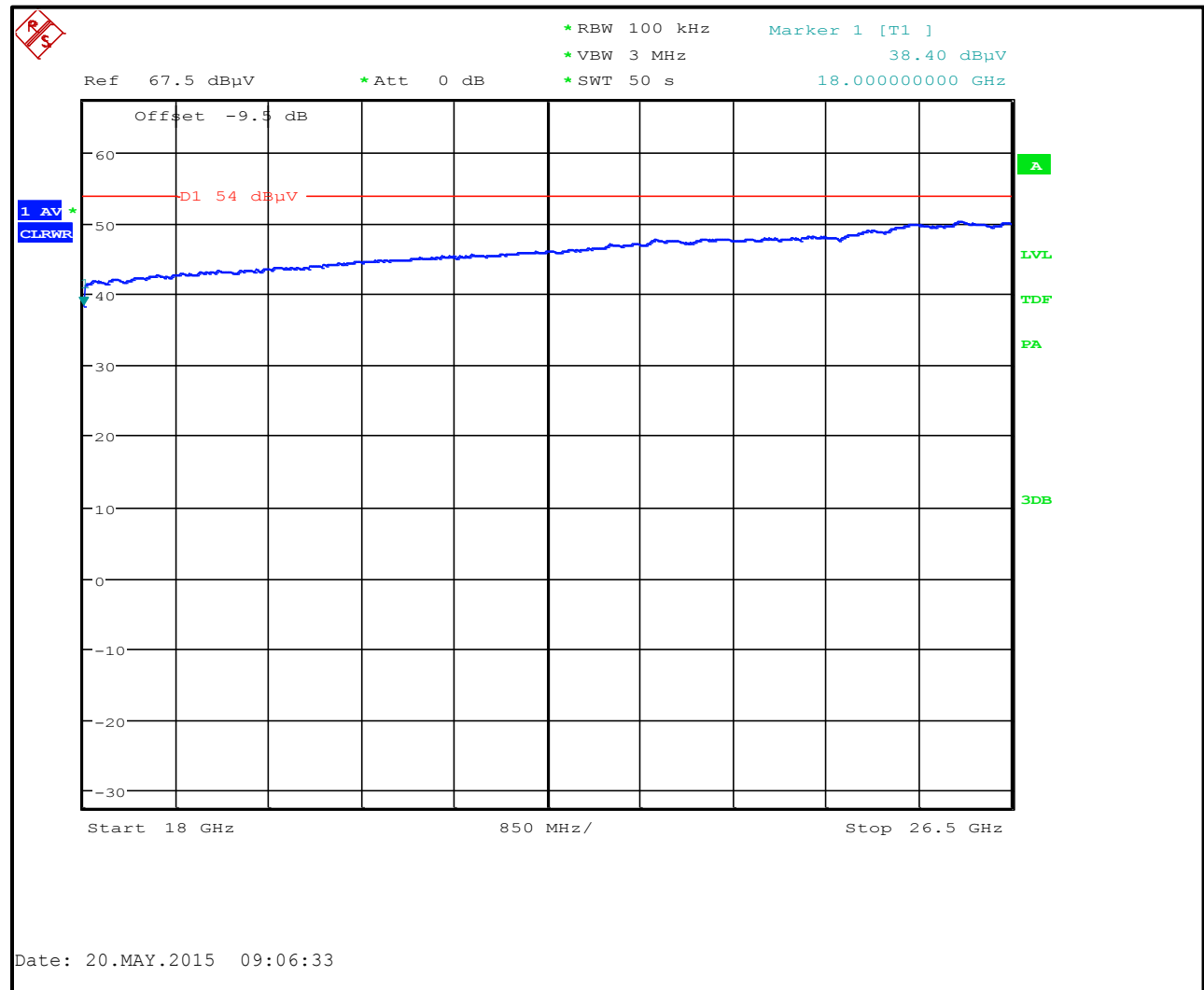
Plot 6-42: Radiated Emissions 12.4 GHz – 18 GHz; Steel Container; TC #2, Vertical, Average



Plot 6-43: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #2, Vertical, Peak

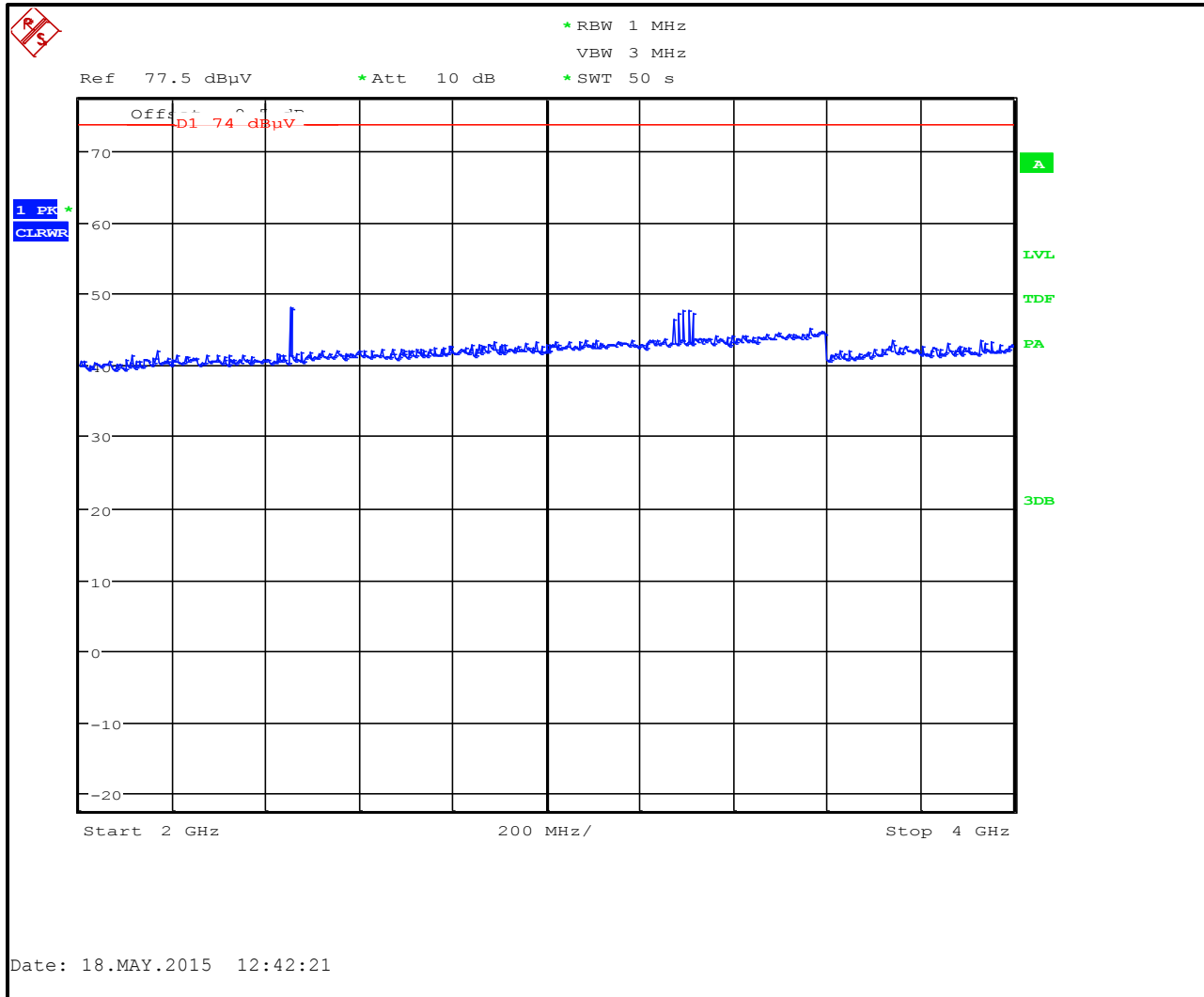


Plot 6-44: Radiated Emissions 18 GHz – 26.5 GHz; Steel Container; TC #2, Vertical, Average

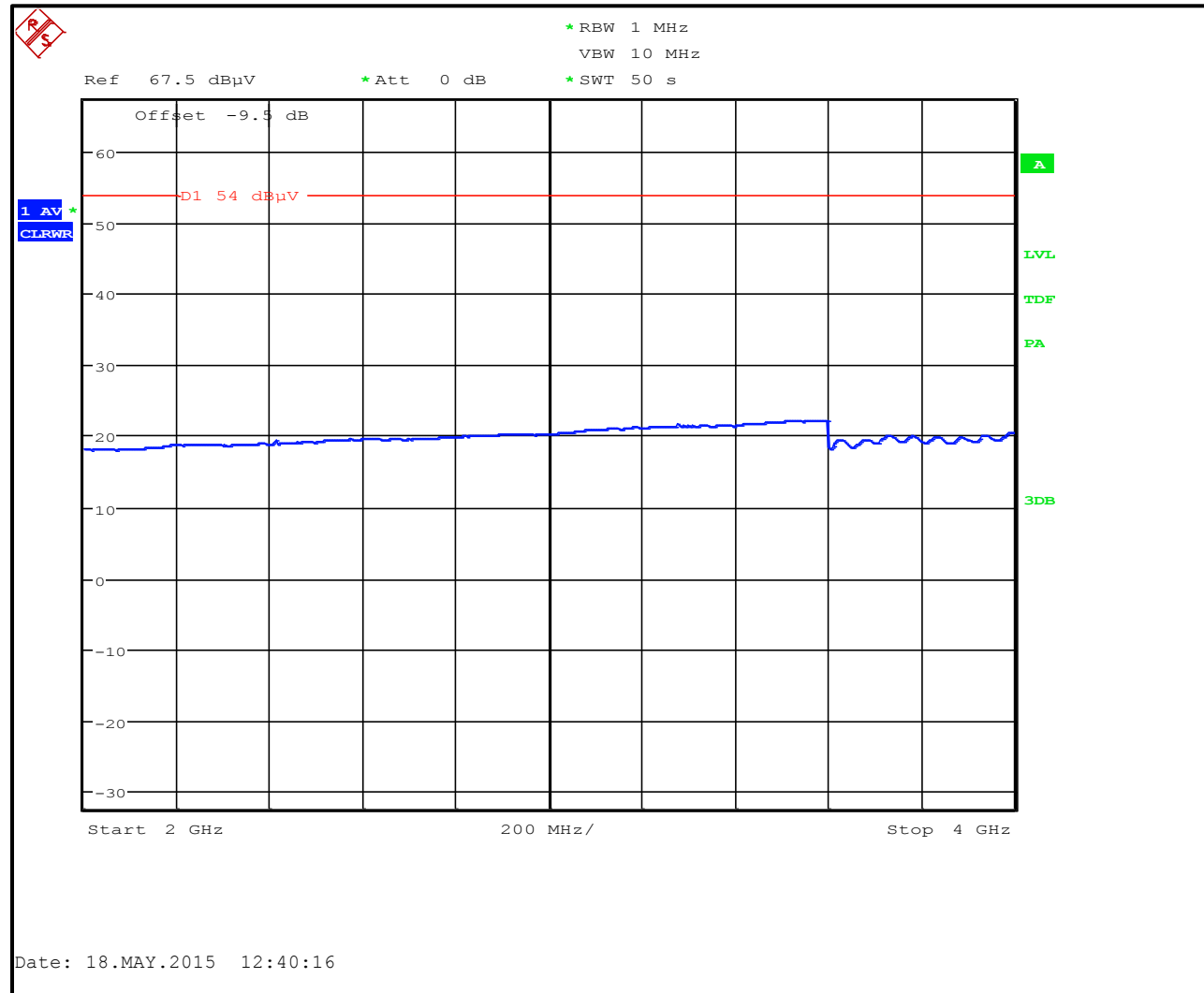


6.3.1 Radiated Emissions Test Data - 2 GHz – 26.5 GHz; Concrete Container, TC #1

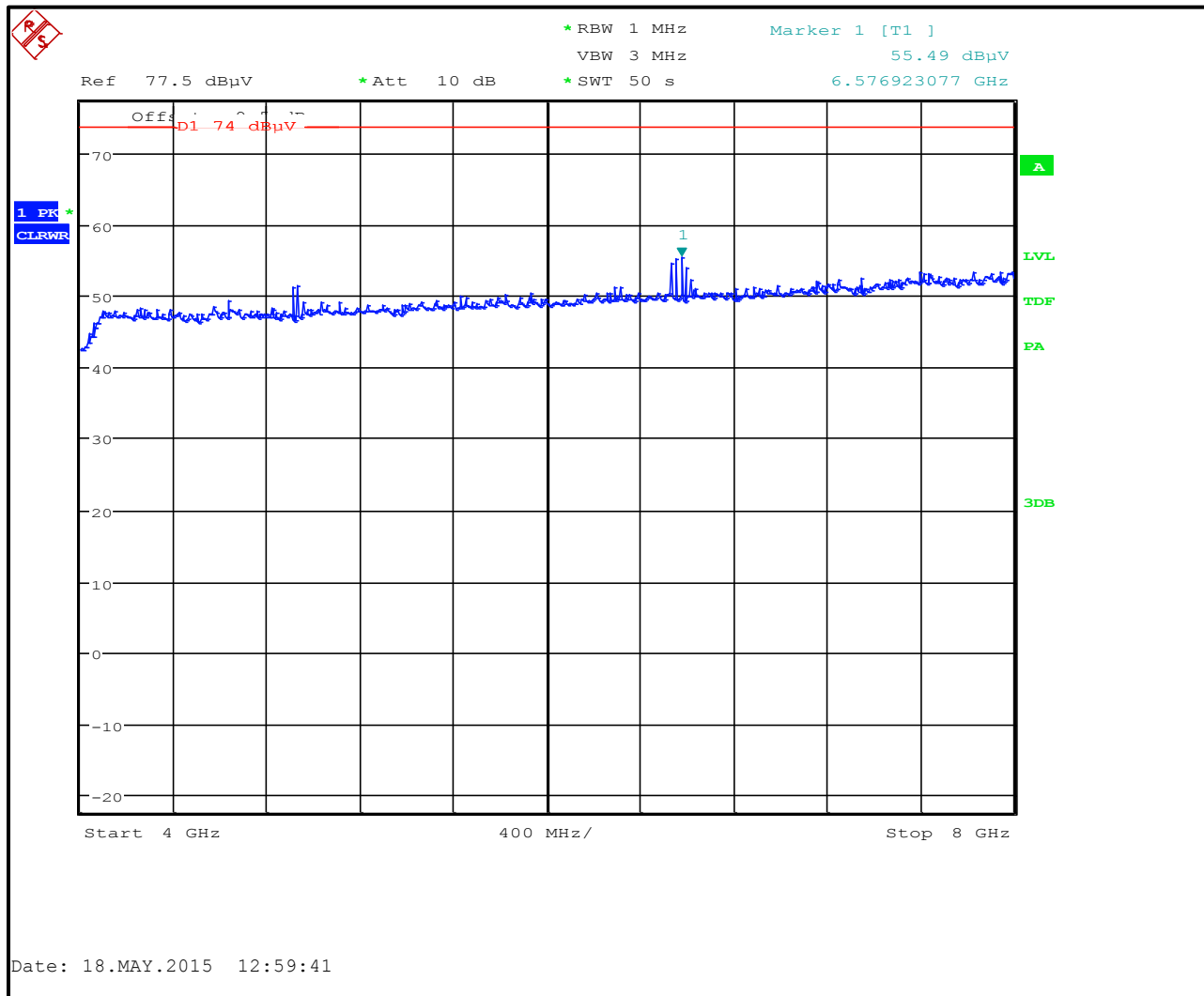
Plot 6-45: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #1, Horizontal, Peak



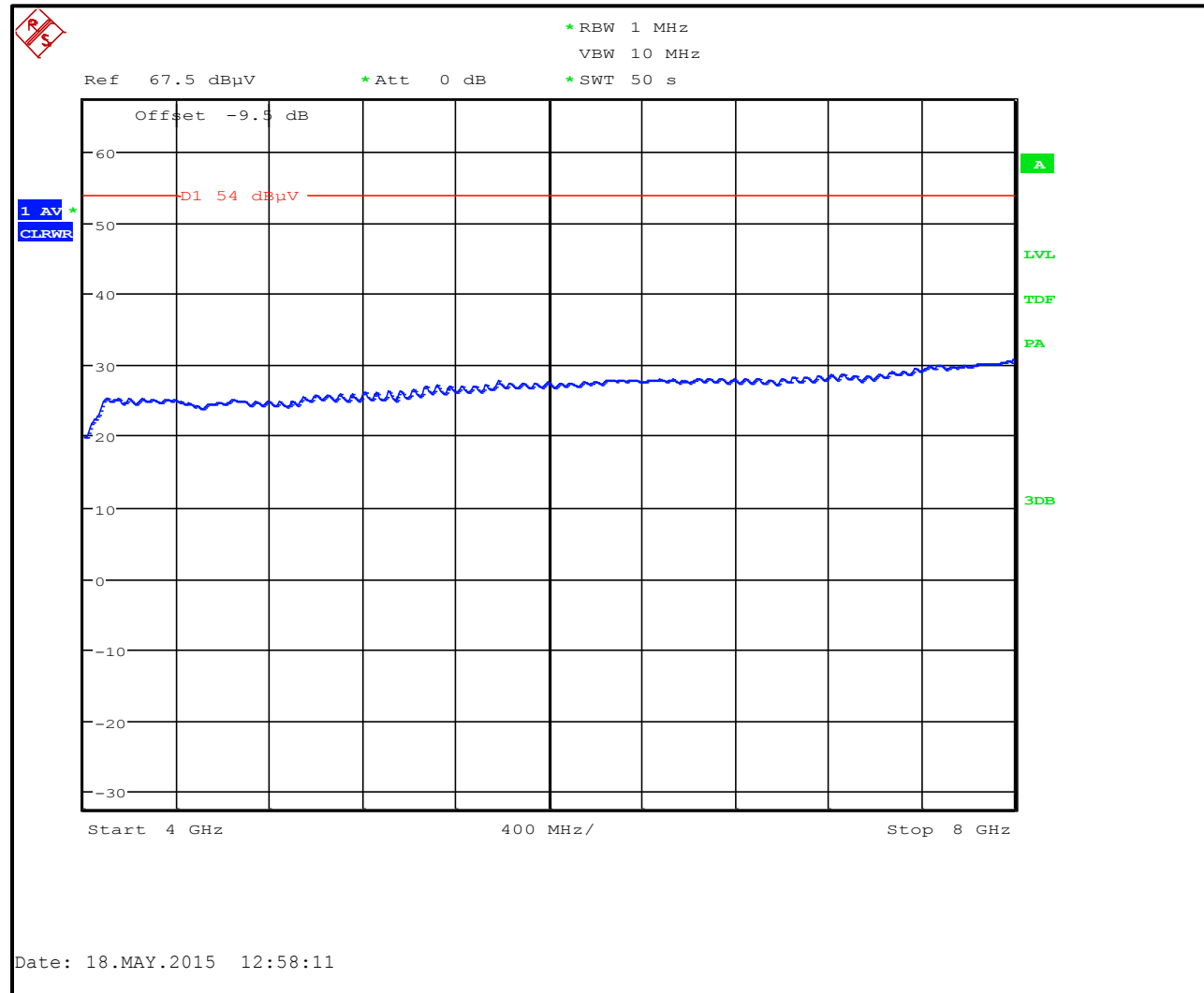
Plot 6-46: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #1, Horizontal, Average



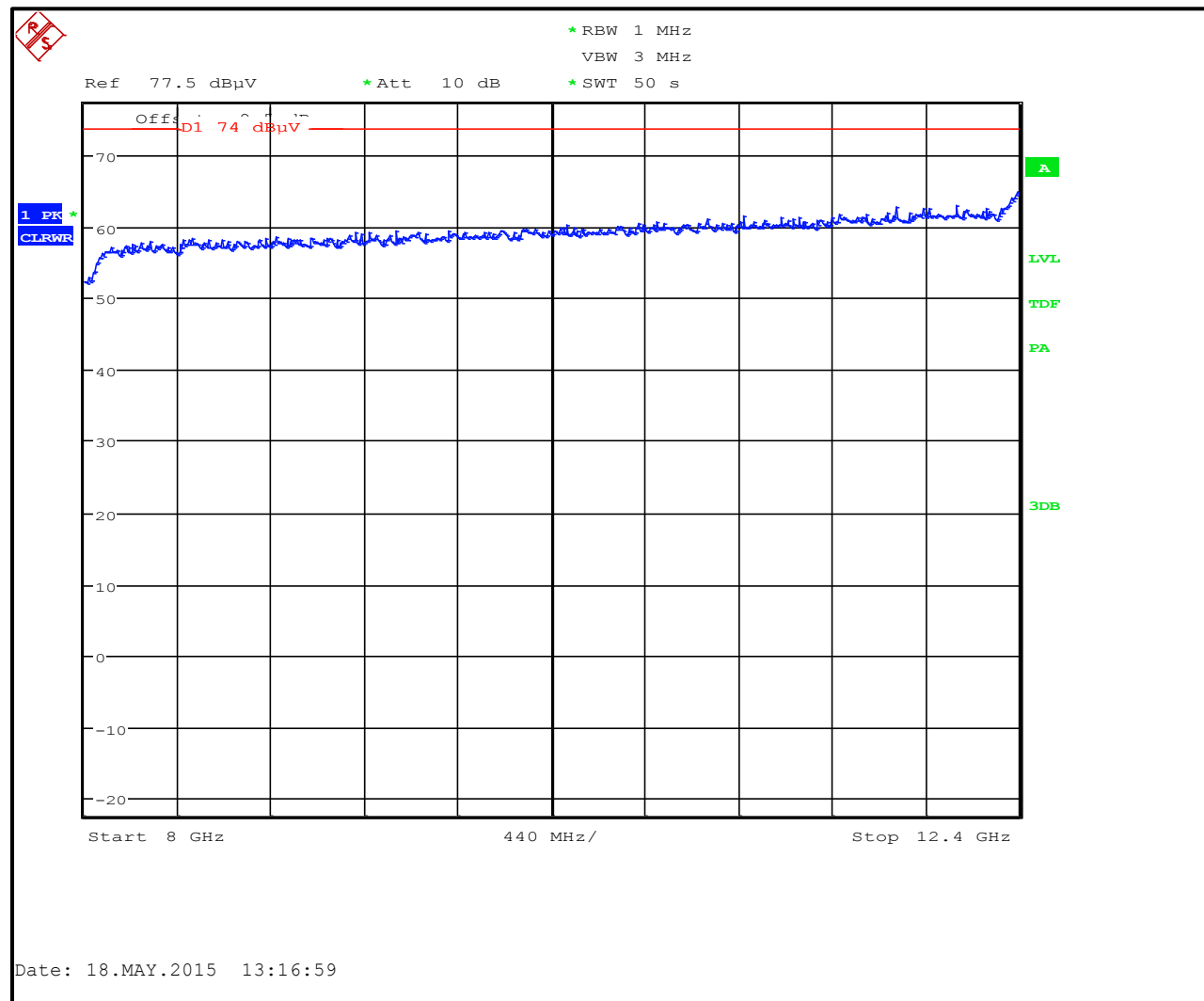
Plot 6-47: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #1, Horizontal, Peak



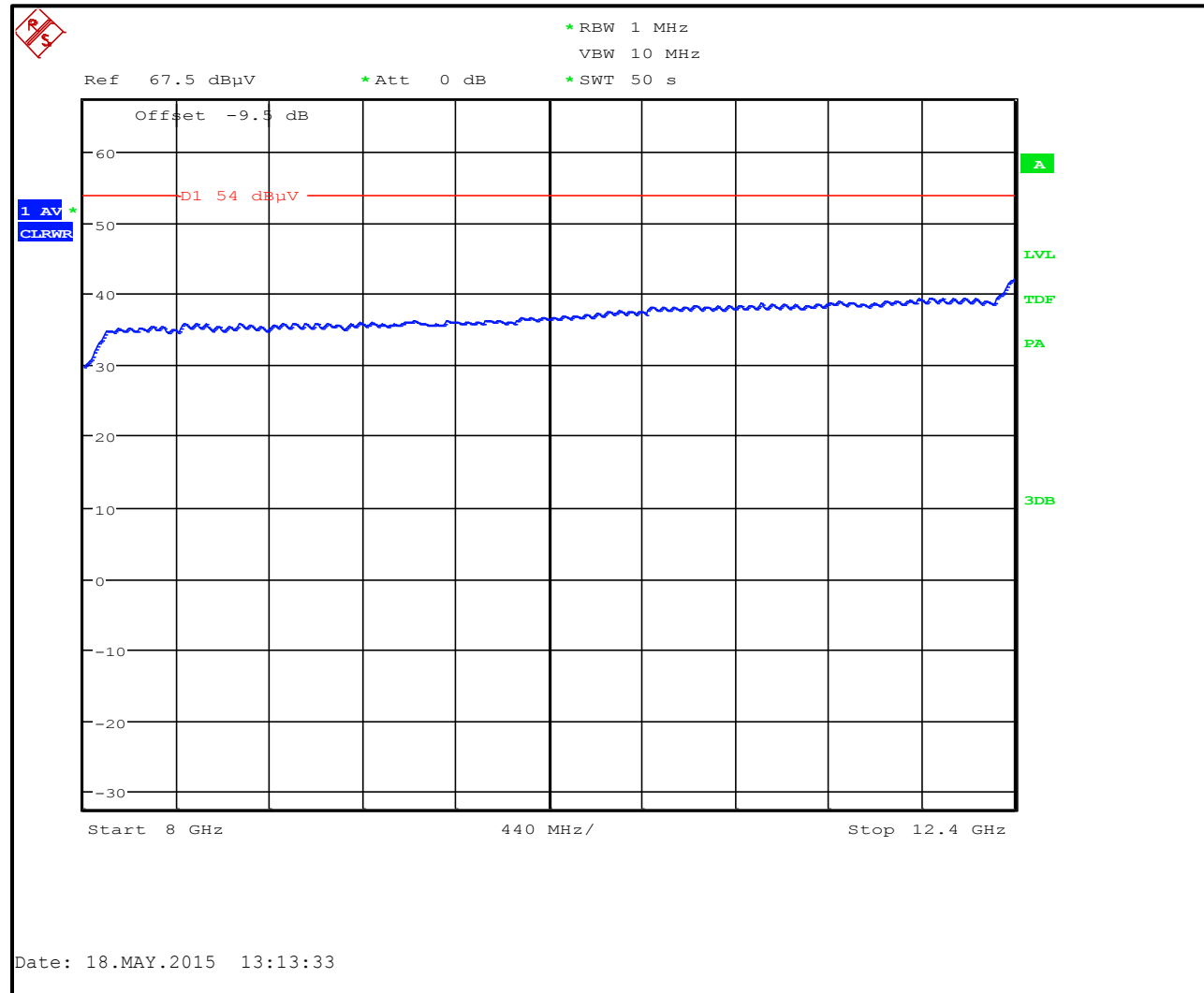
Plot 6-48: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #1, Horizontal, Average



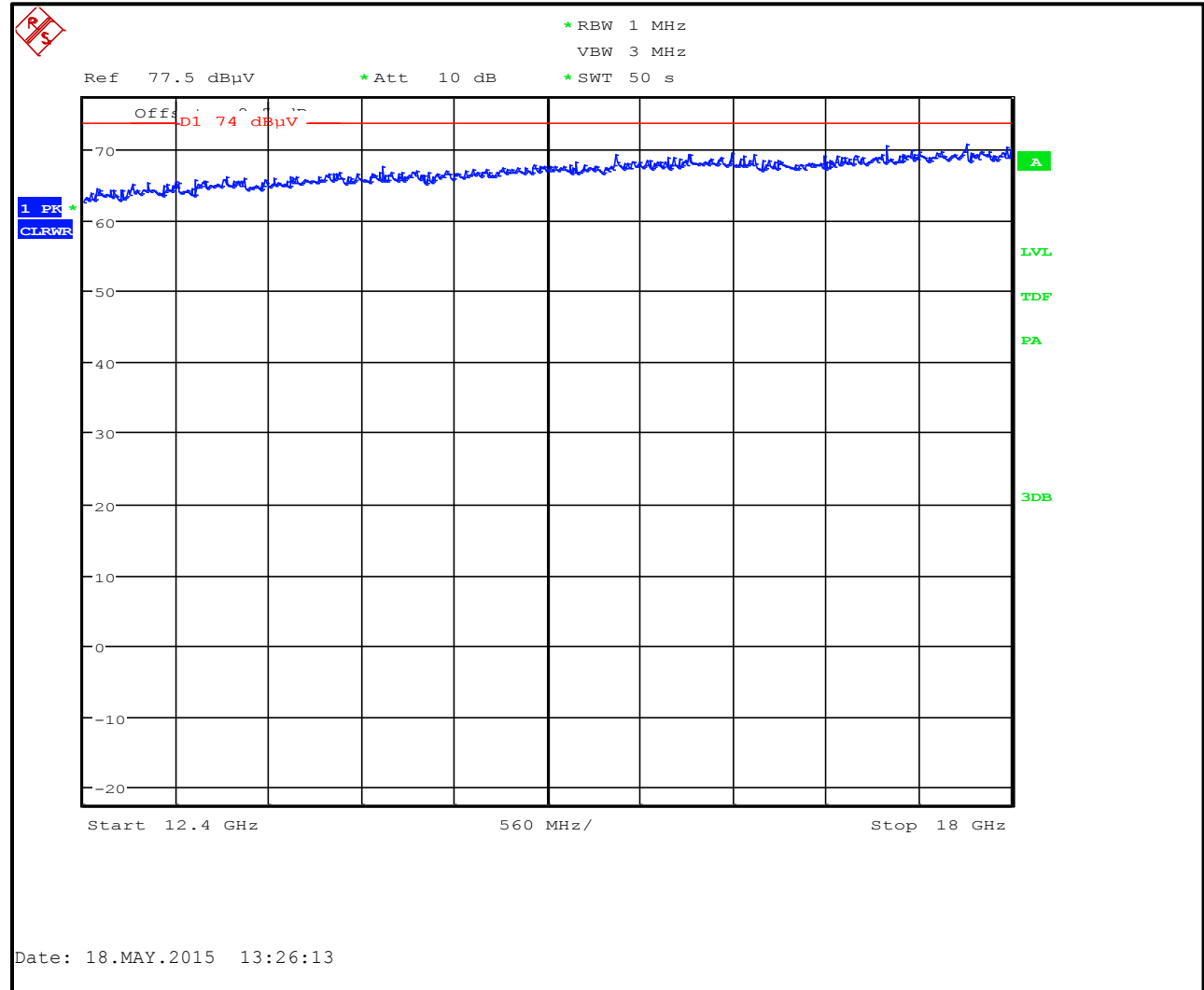
Plot 6-49: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #1, Horizontal, Peak



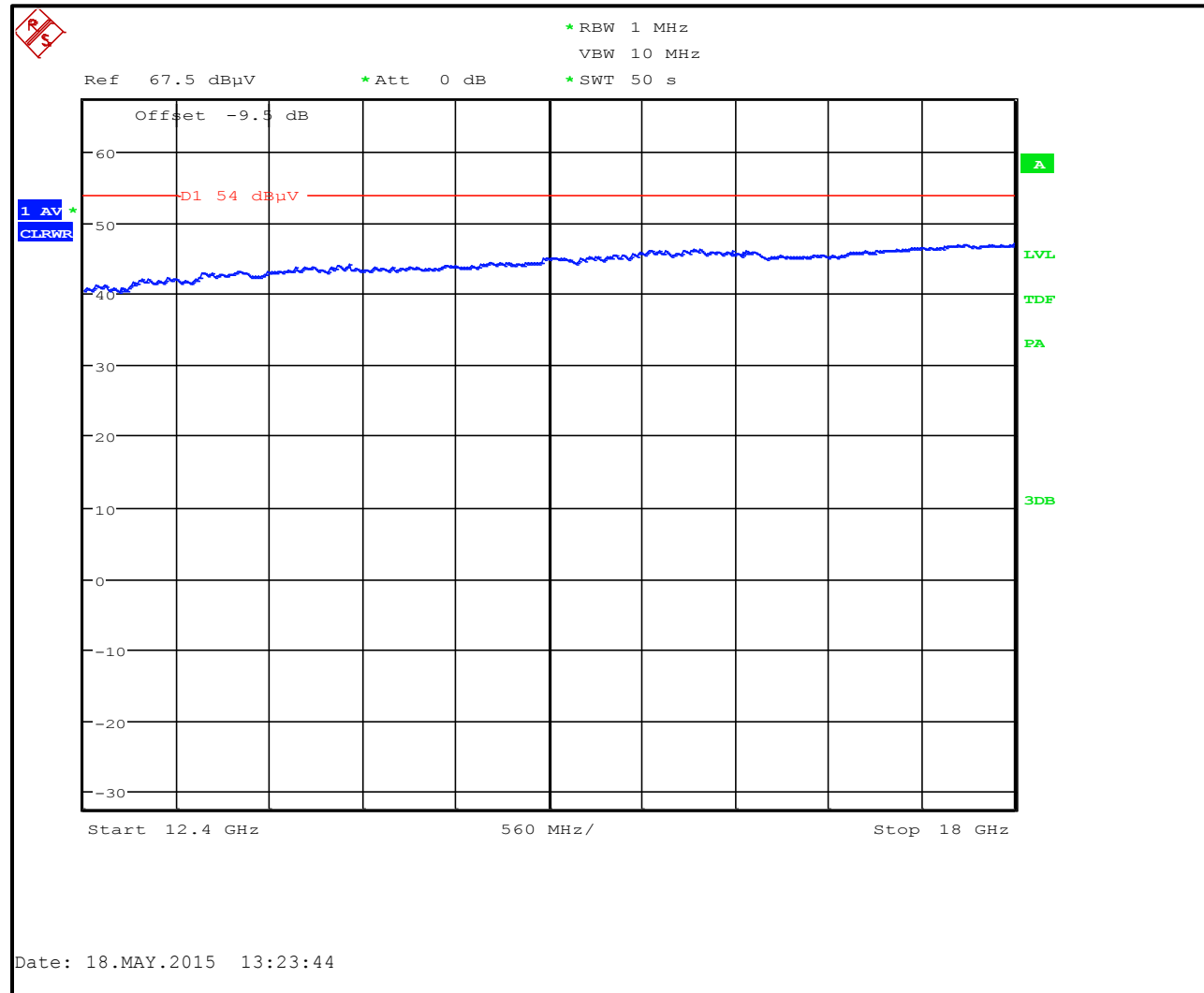
Plot 6-50: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #1, Horizontal, Average



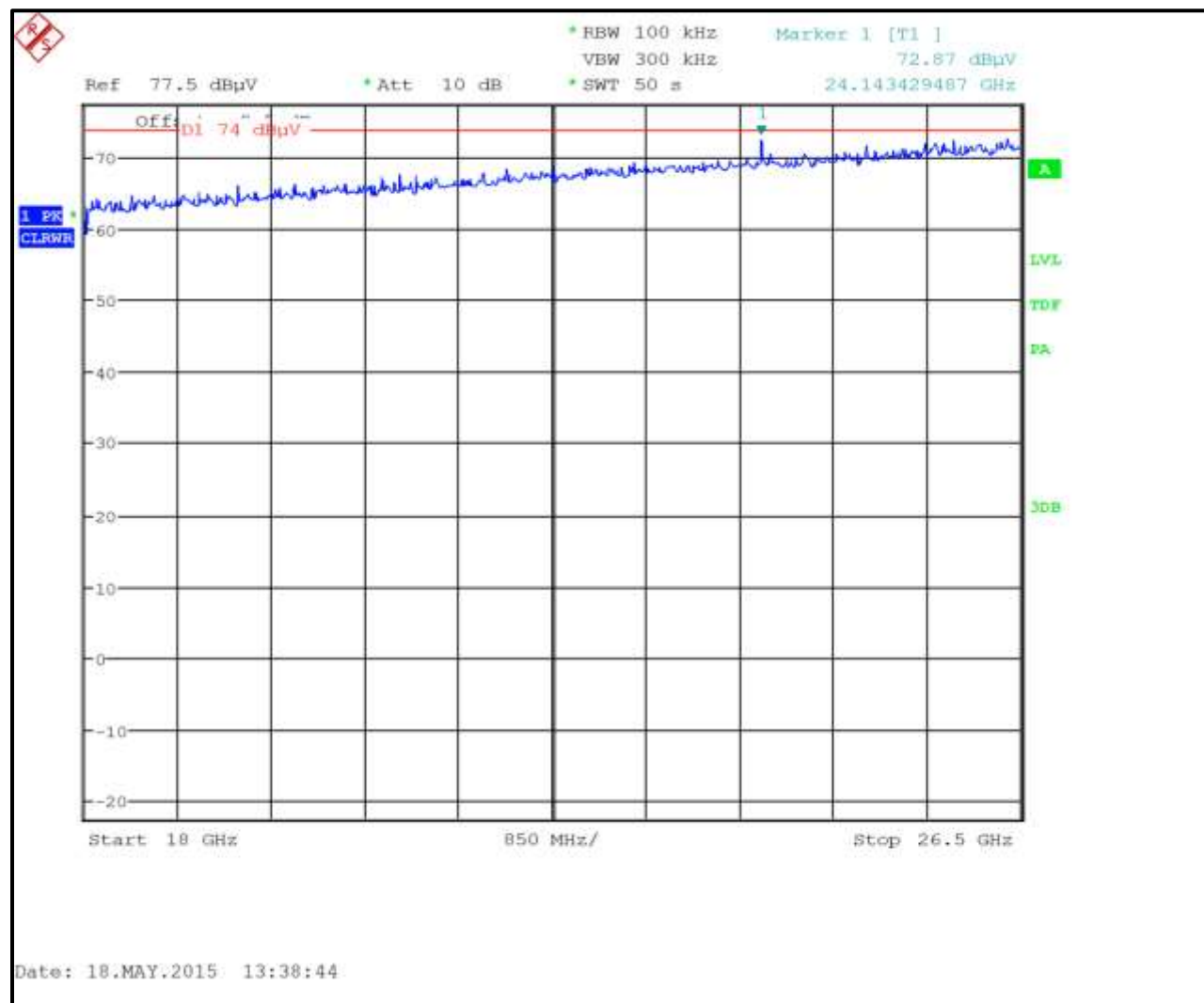
Plot 6-51: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #1, Horizontal, Peak



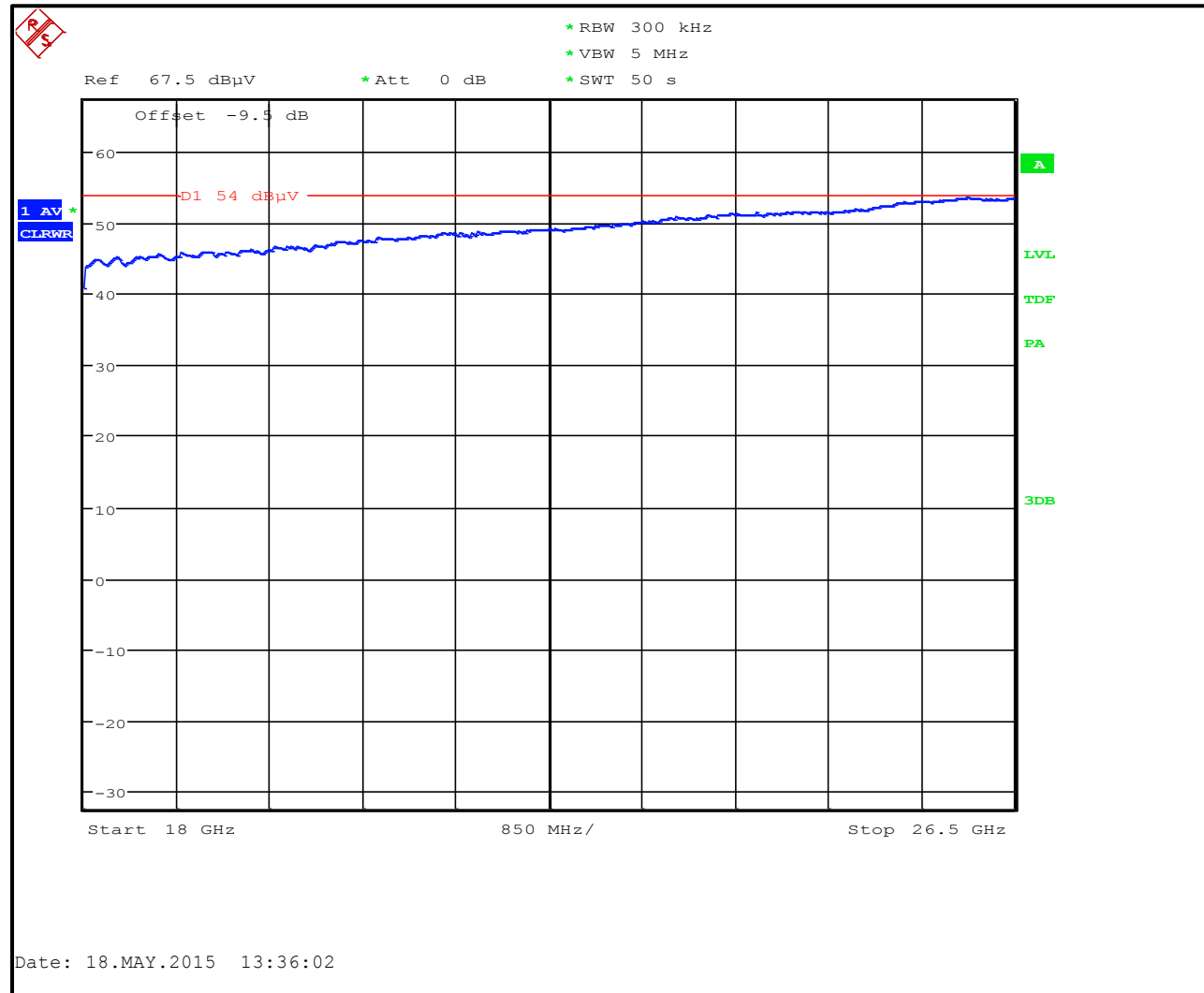
Plot 6-52: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #1, Horizontal, Average



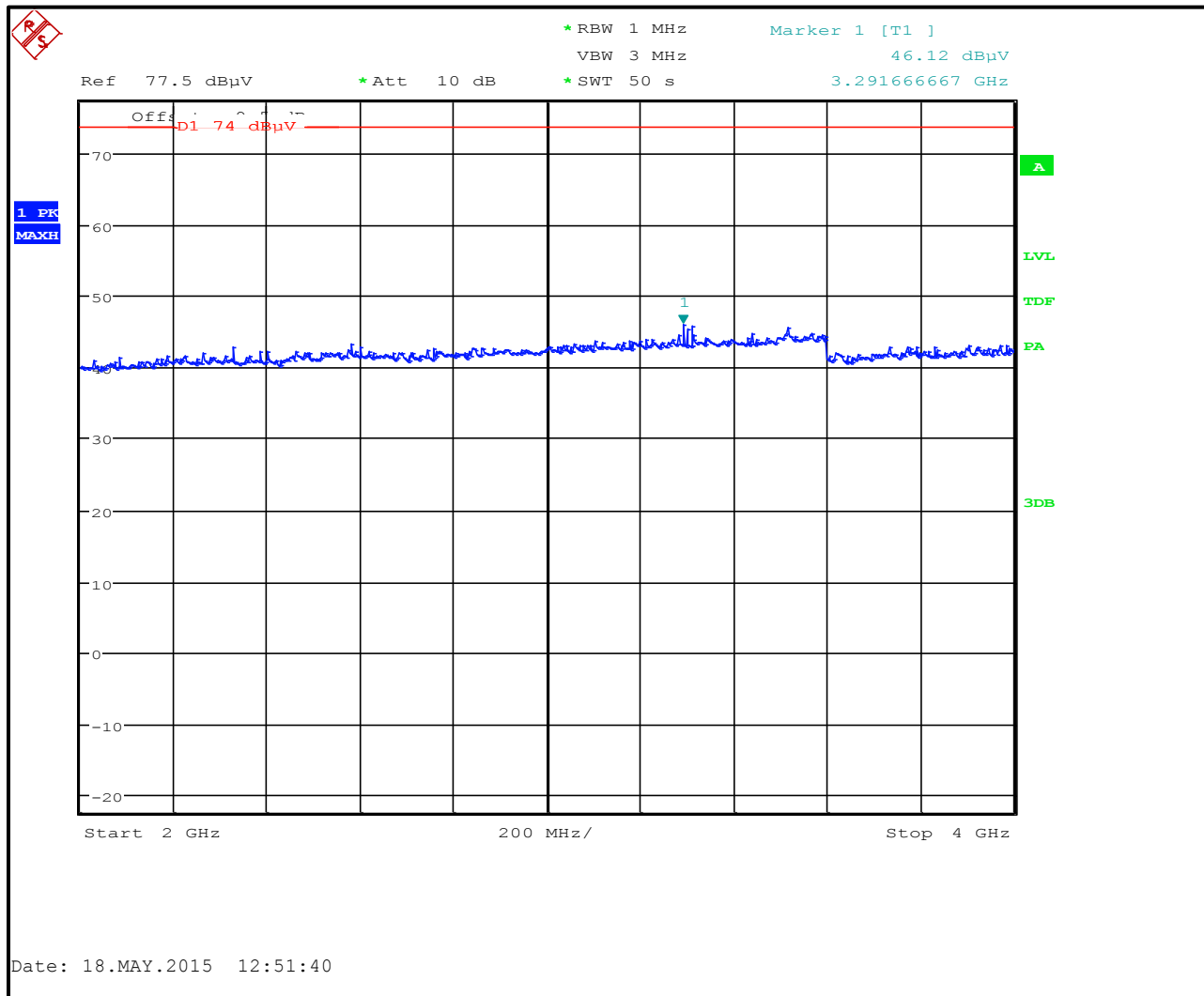
Plot 6-53: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #1, Horizontal, Peak



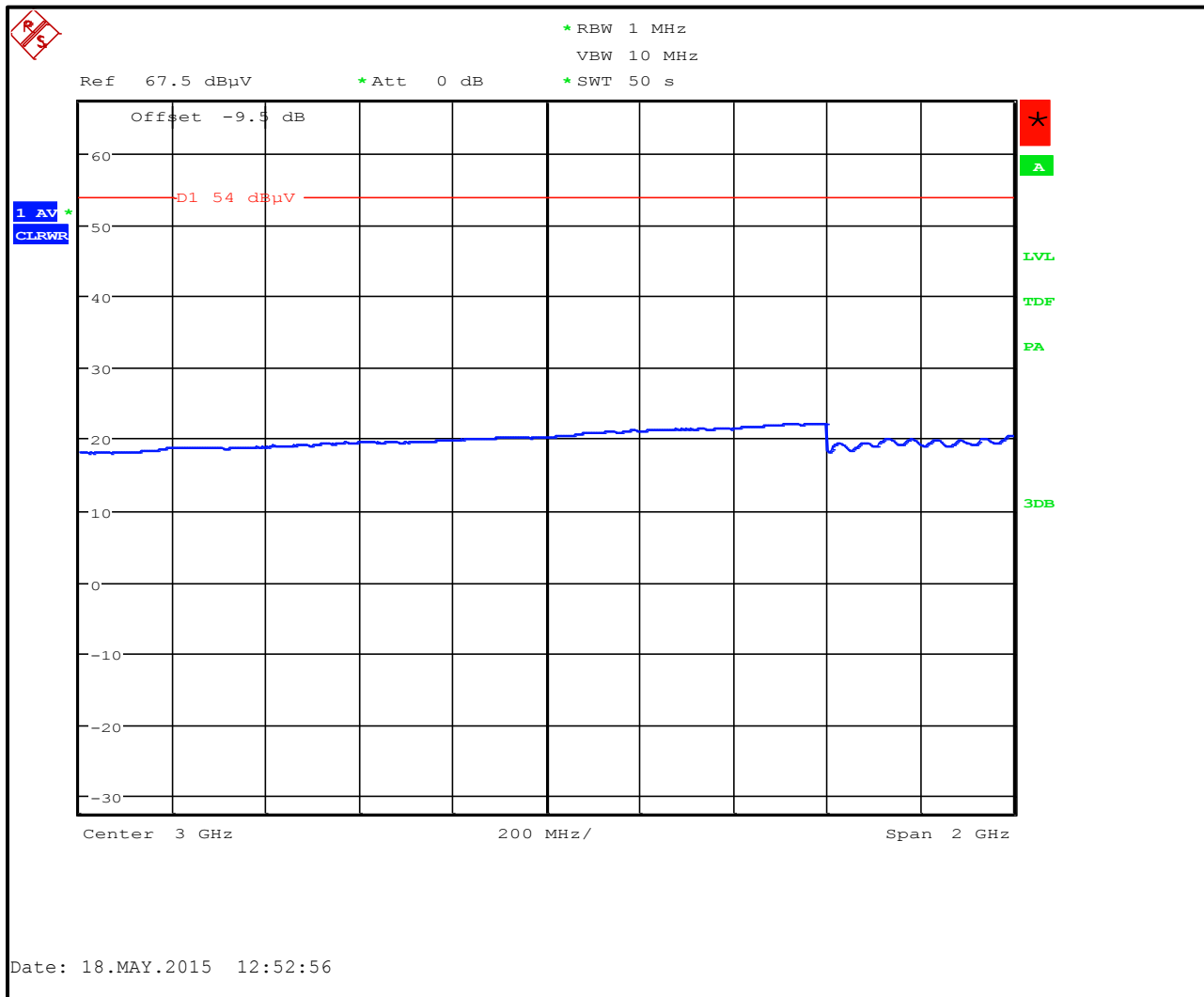
Plot 6-54: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #1, Horizontal, Average



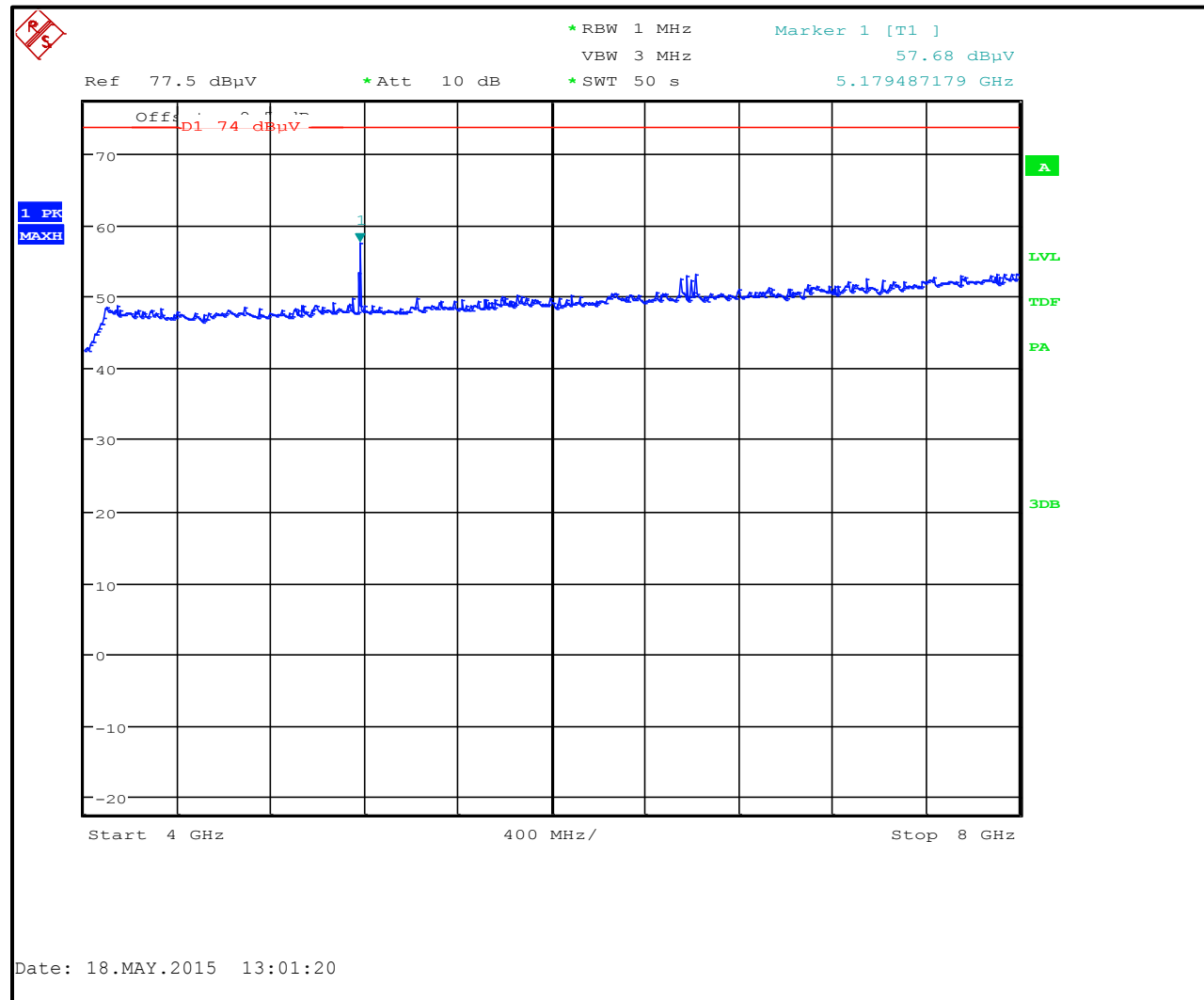
Plot 6-55: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #1, Vertical, Peak



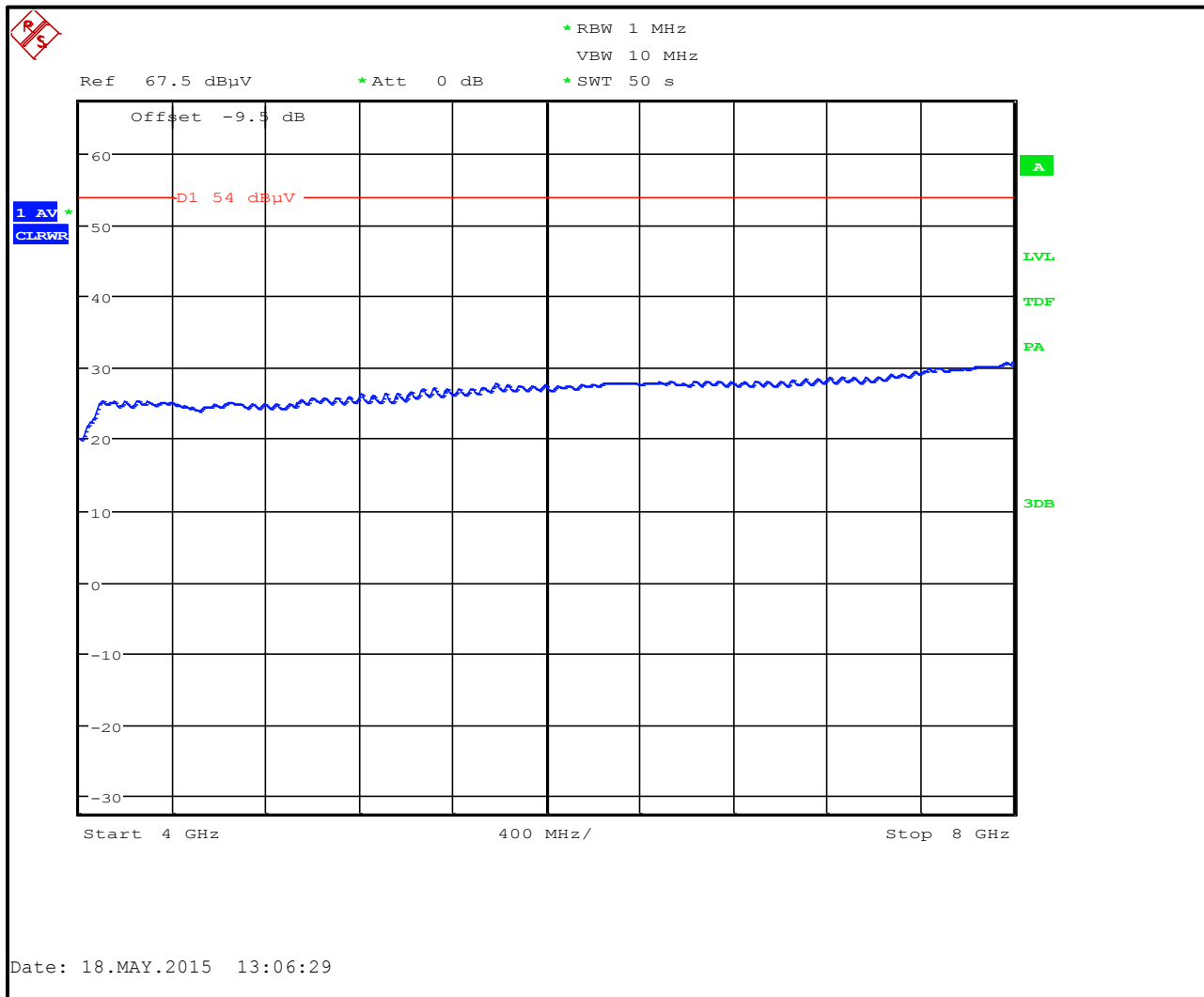
Plot 6-56: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #1, Vertical, Average



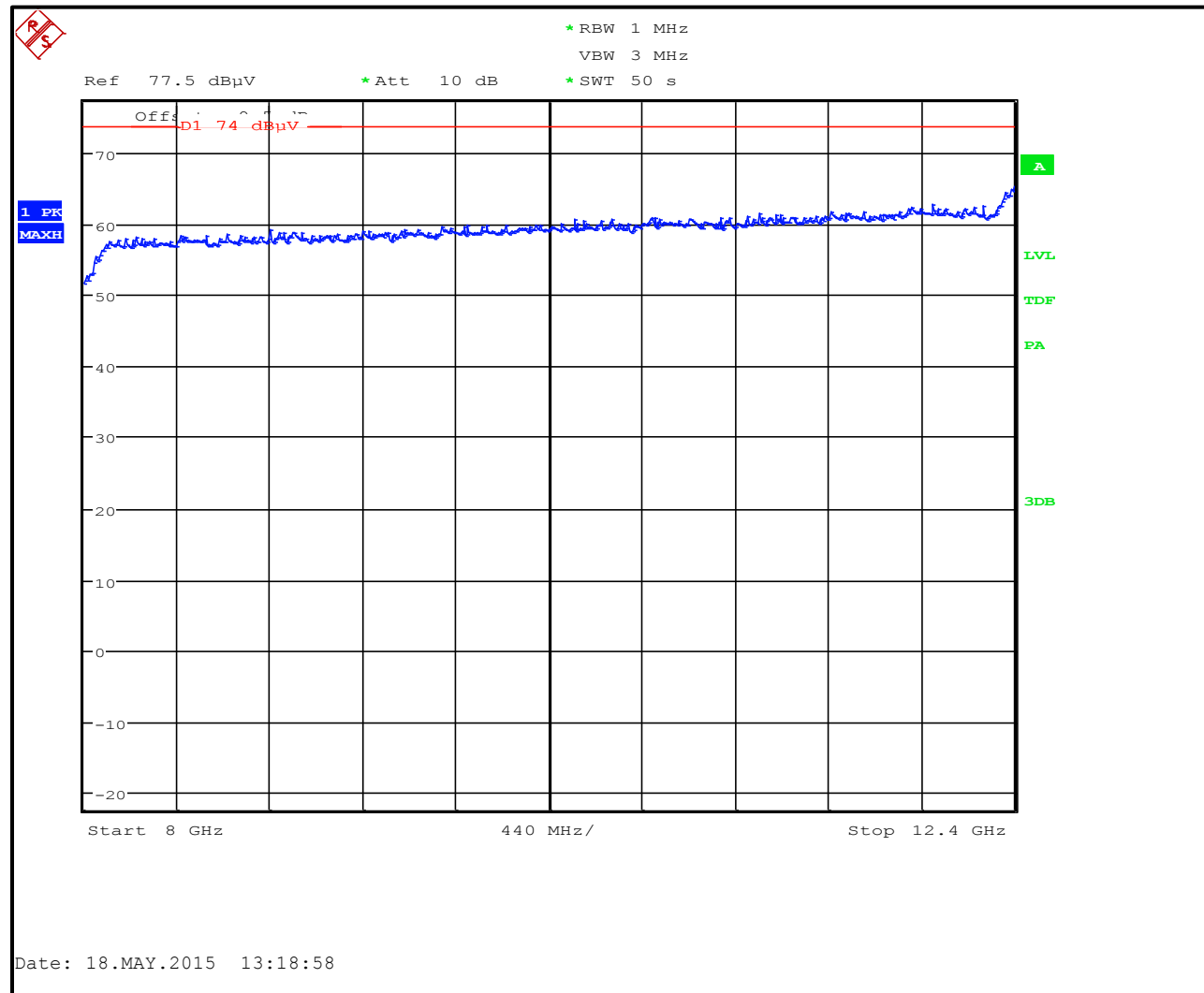
Plot 6-57: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #1, Vertical, Peak



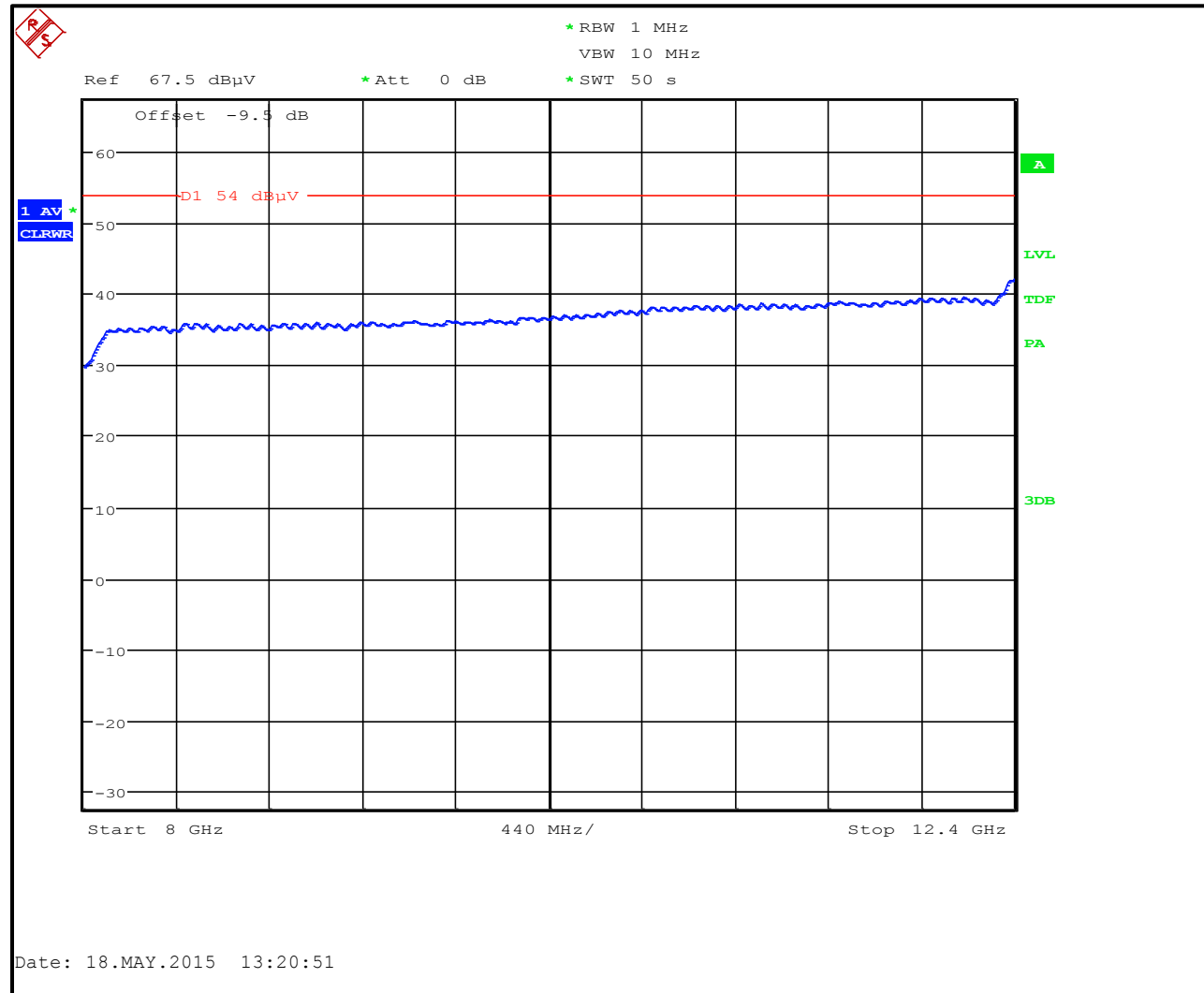
Plot 6-58: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #1, Vertical, Average



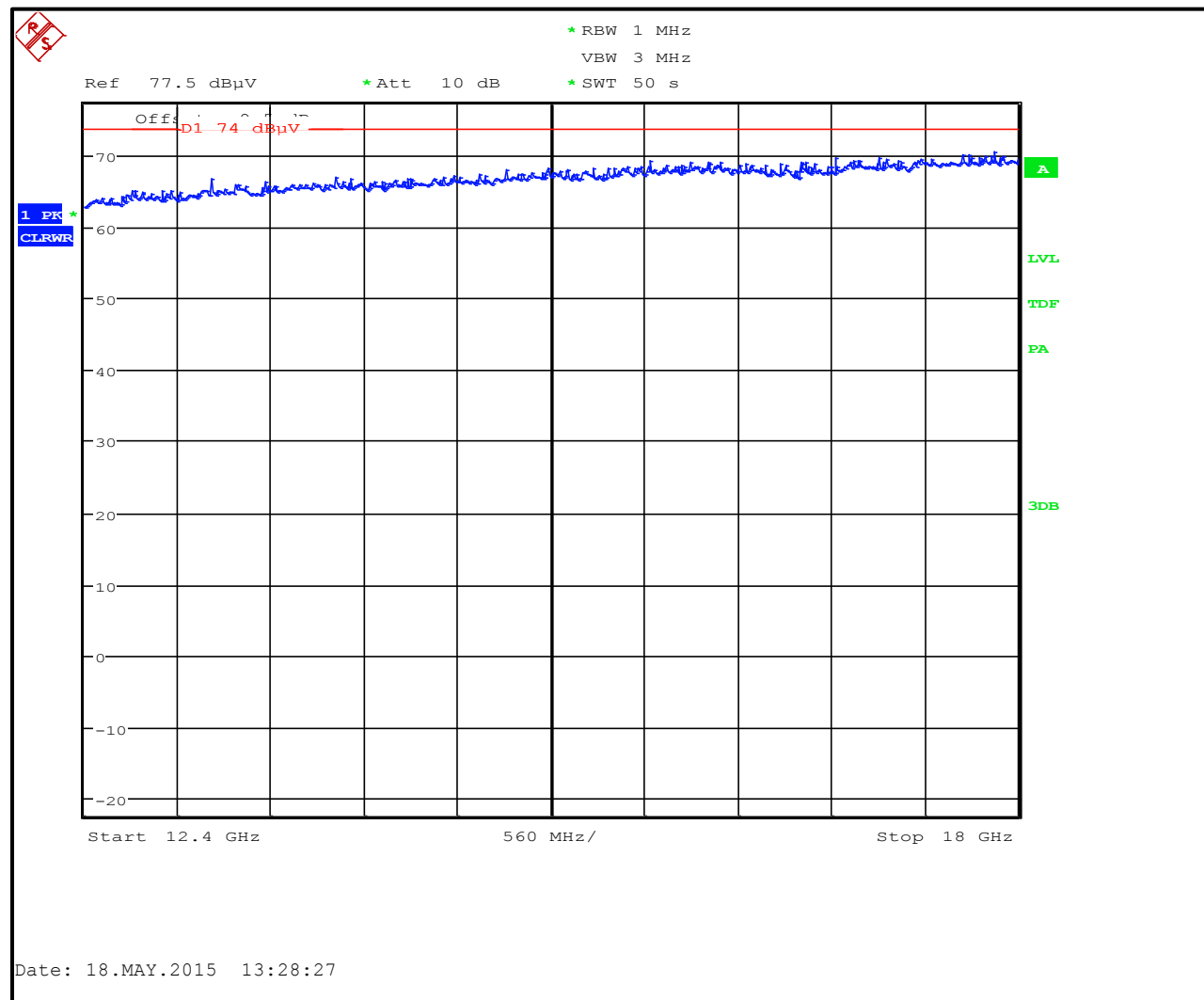
Plot 6-59: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #1, Vertical, Peak



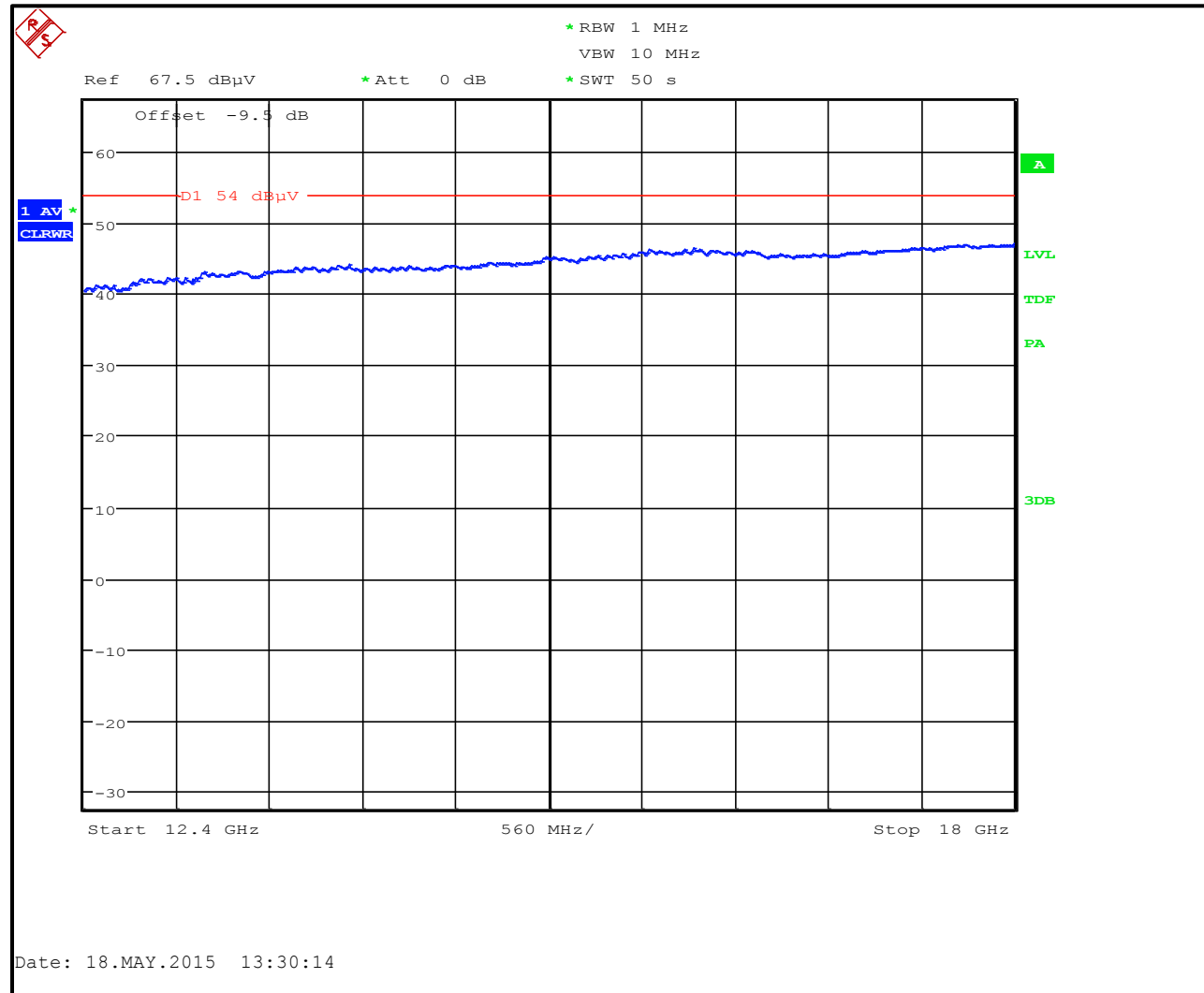
Plot 6-60: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #1, Vertical, Average



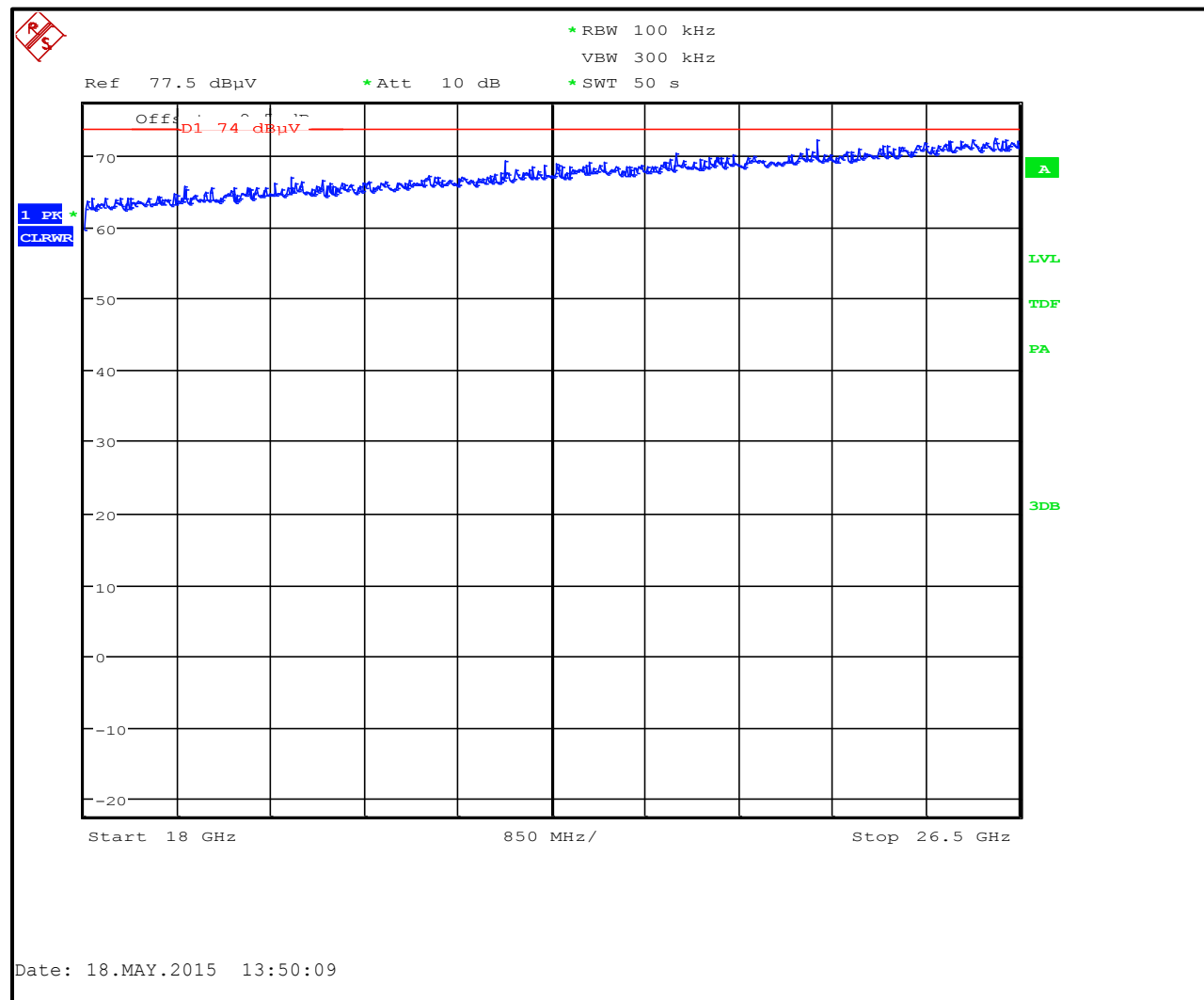
Plot 6-61: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #1, Vertical, Peak



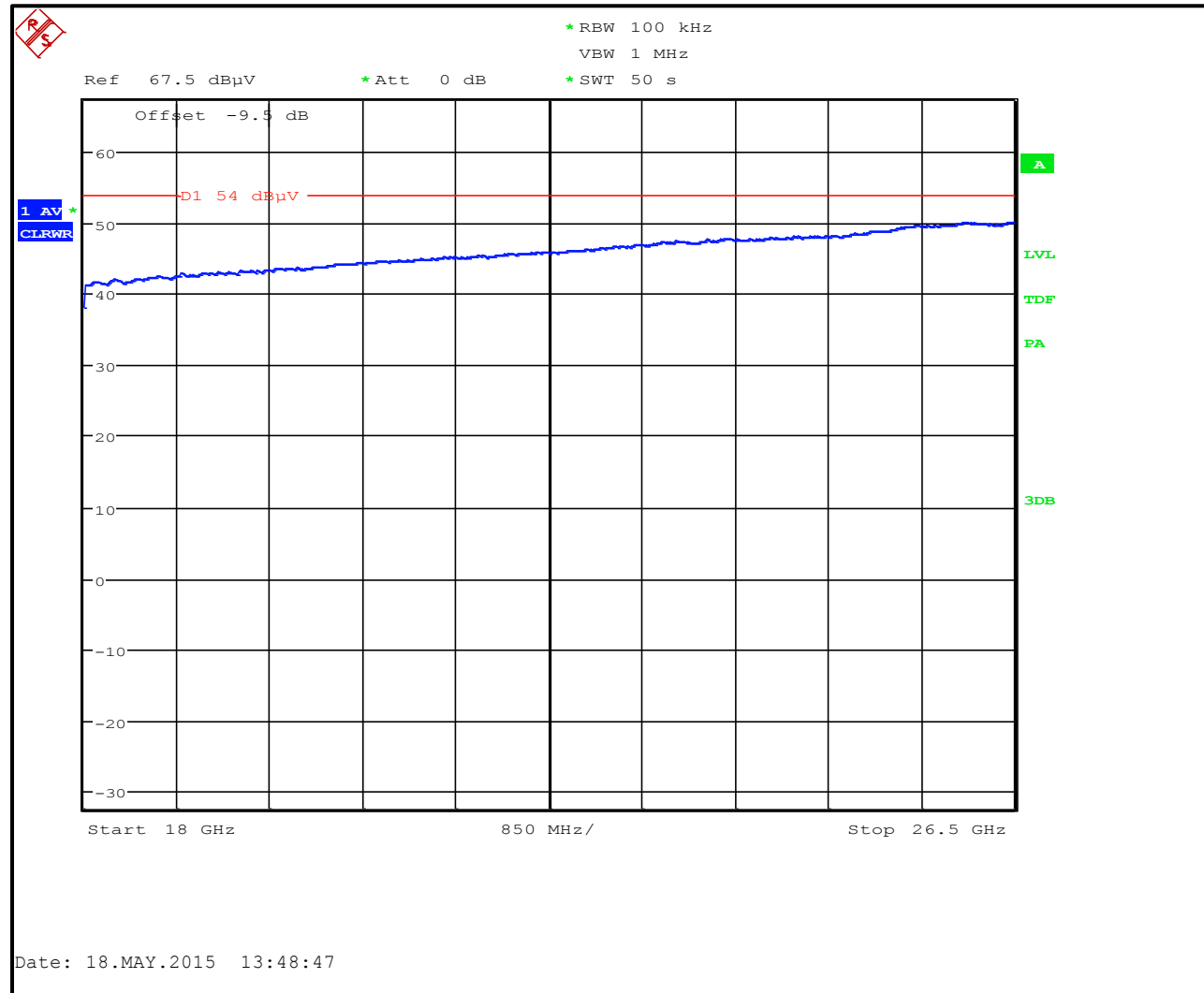
Plot 6-62: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #1, Vertical, Average



Plot 6-63: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #1, Vertical, Peak

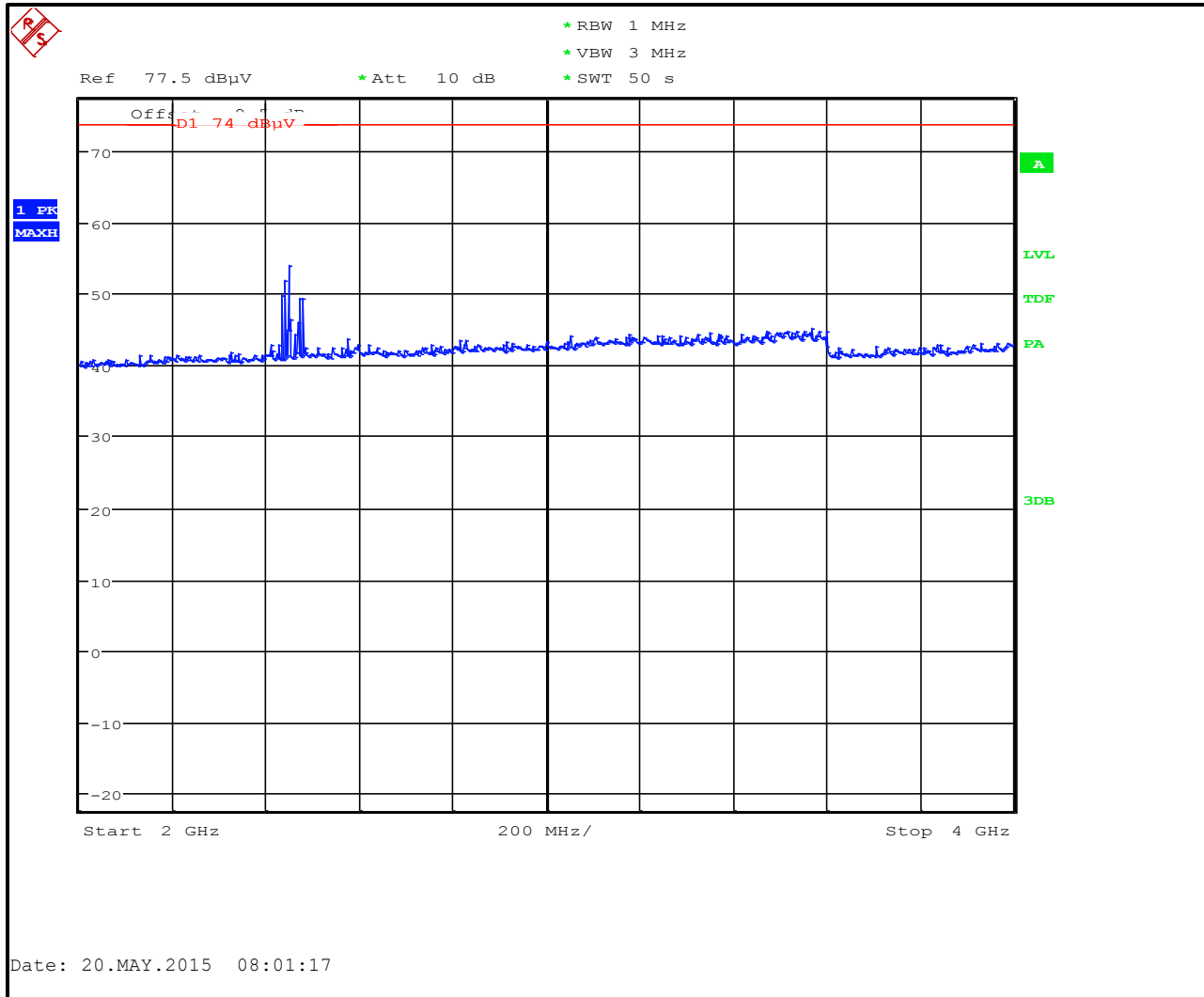


Plot 6-64: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #1, Vertical, Average

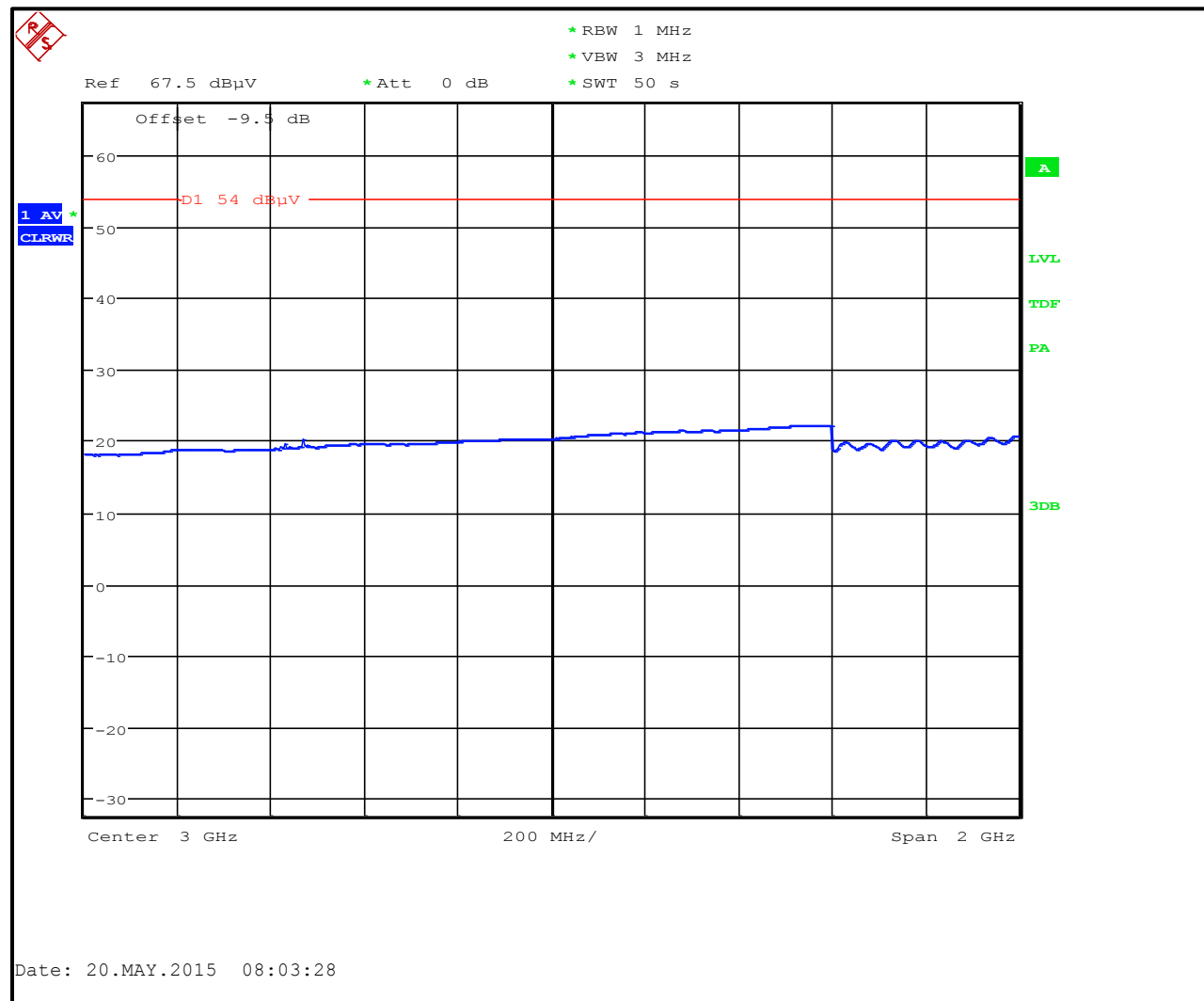


6.3.2 Radiated Emissions Test Data - 2 GHz – 26.5 GHz; Concrete Container, TC #2

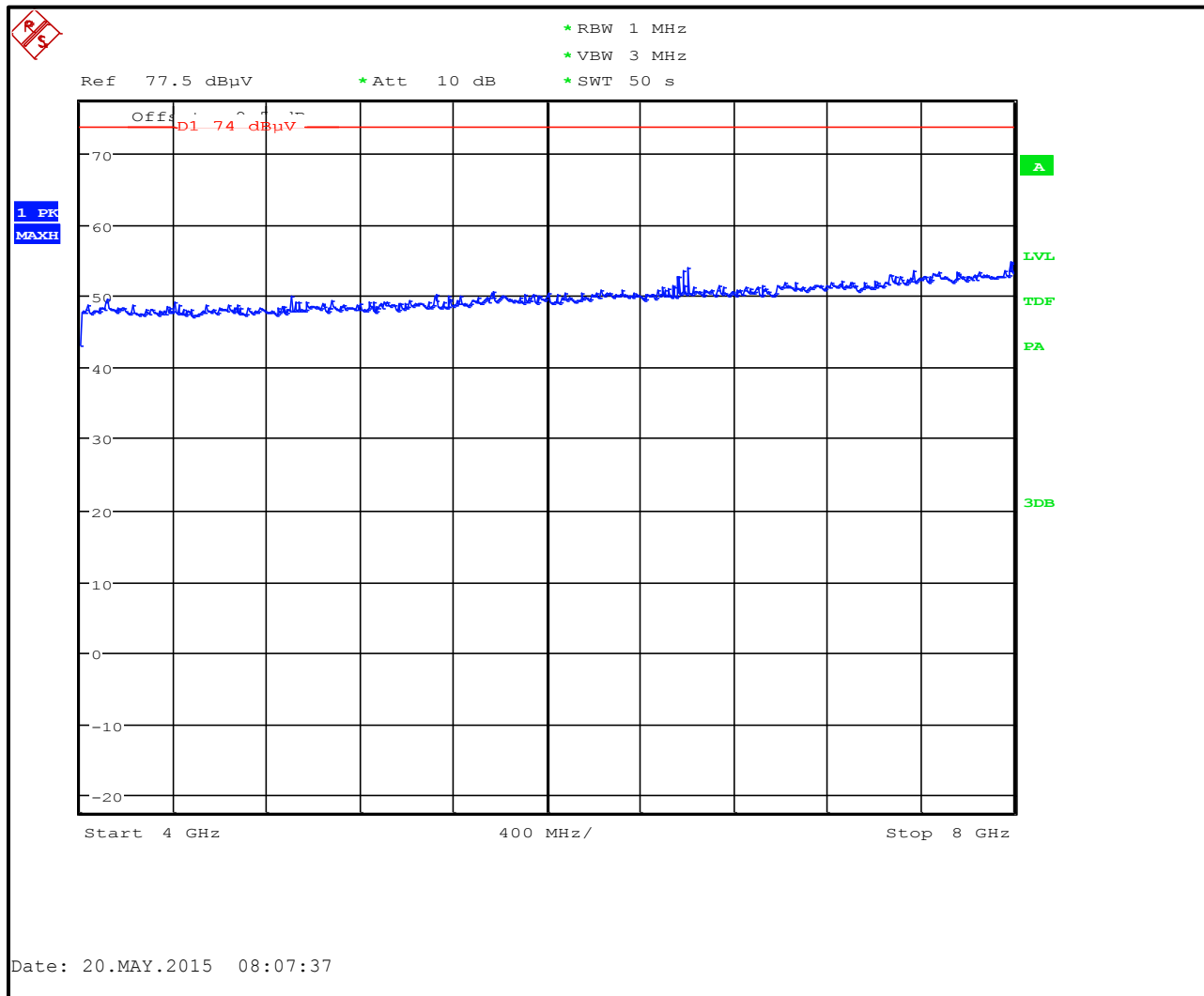
Plot 6-65: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #2, Horizontal, Peak



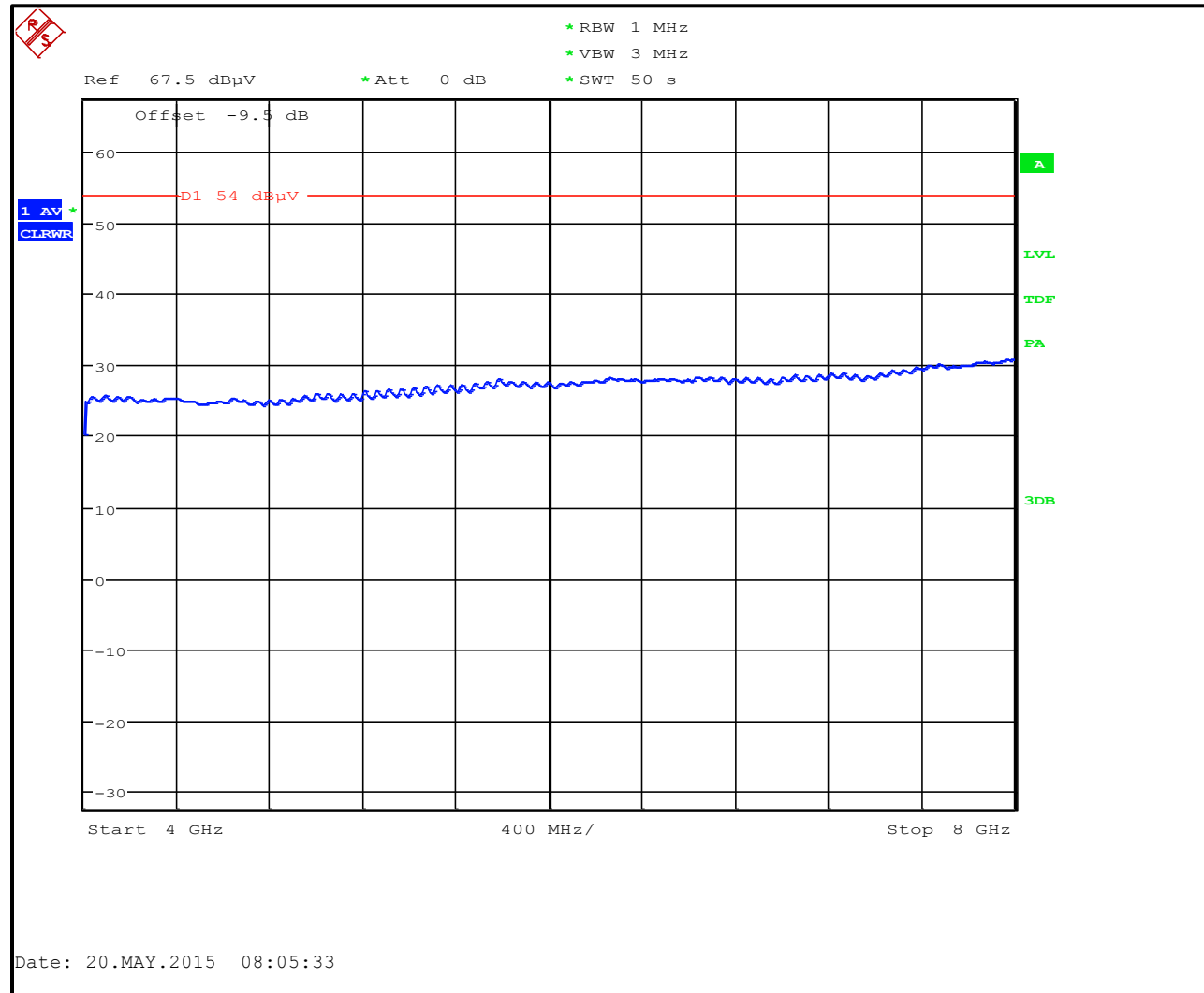
Plot 6-66: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #2, Horizontal, Average



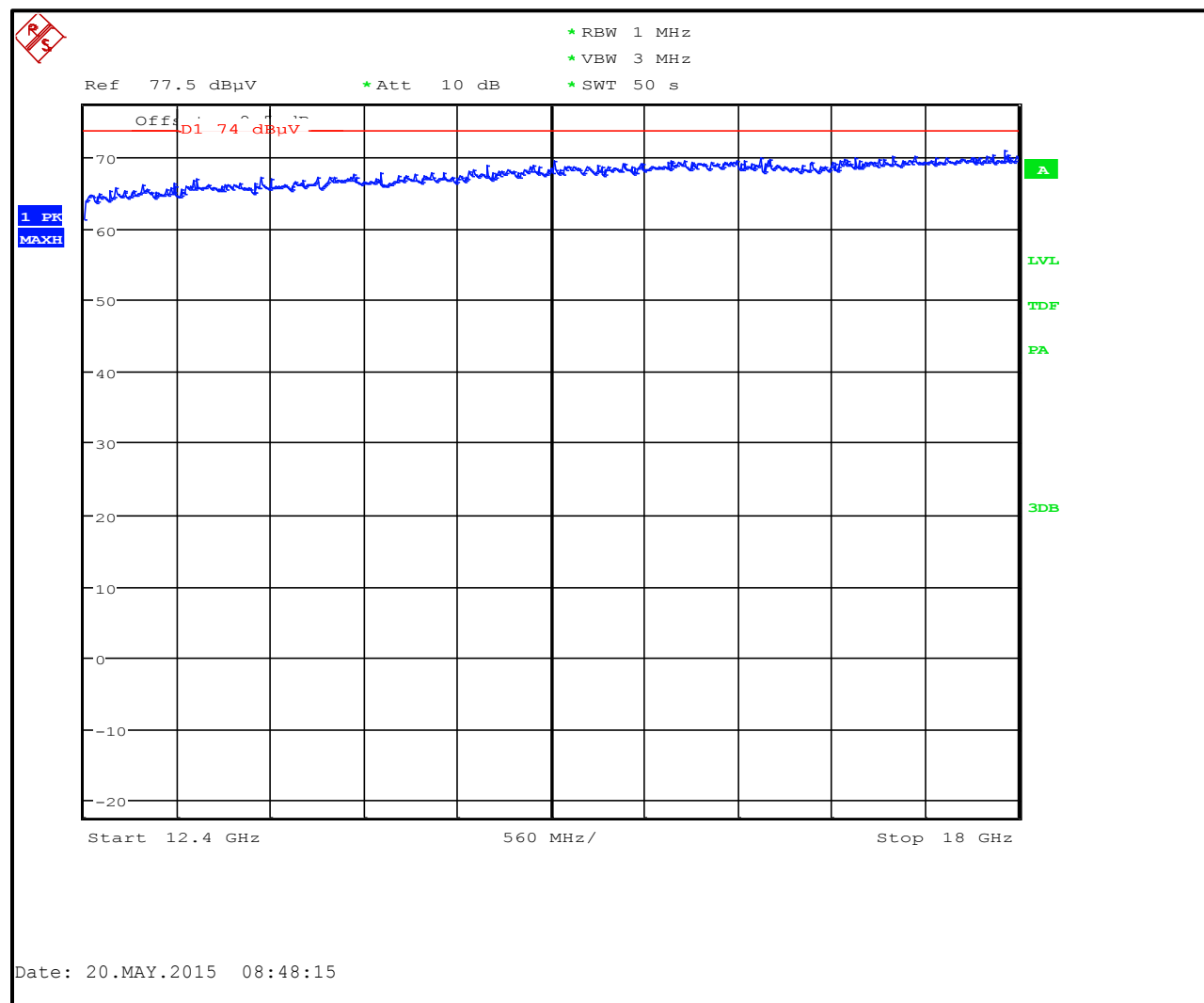
Plot 6-67: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #2, Horizontal, Peak



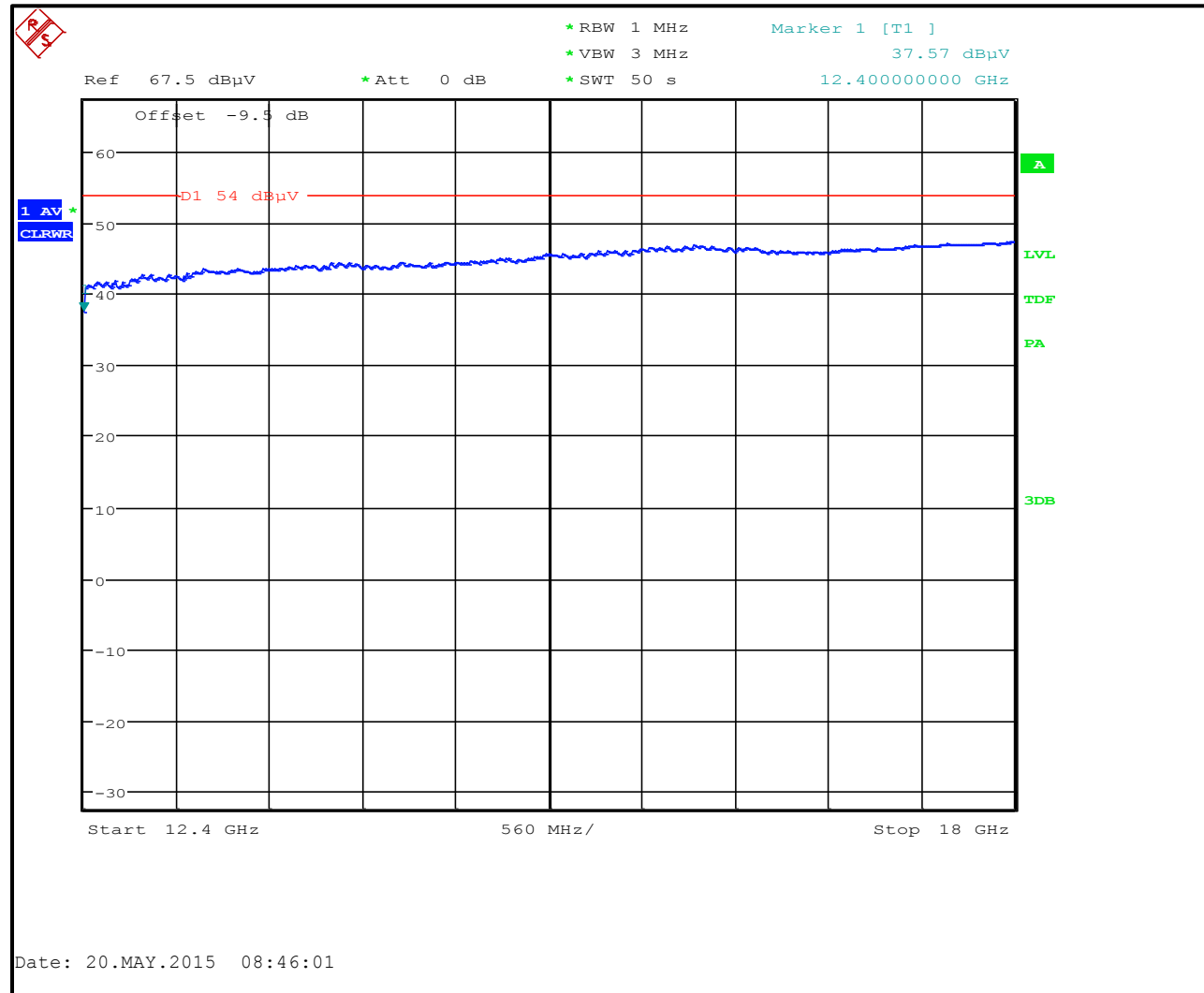
Plot 6-68: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #2, Horizontal, Average



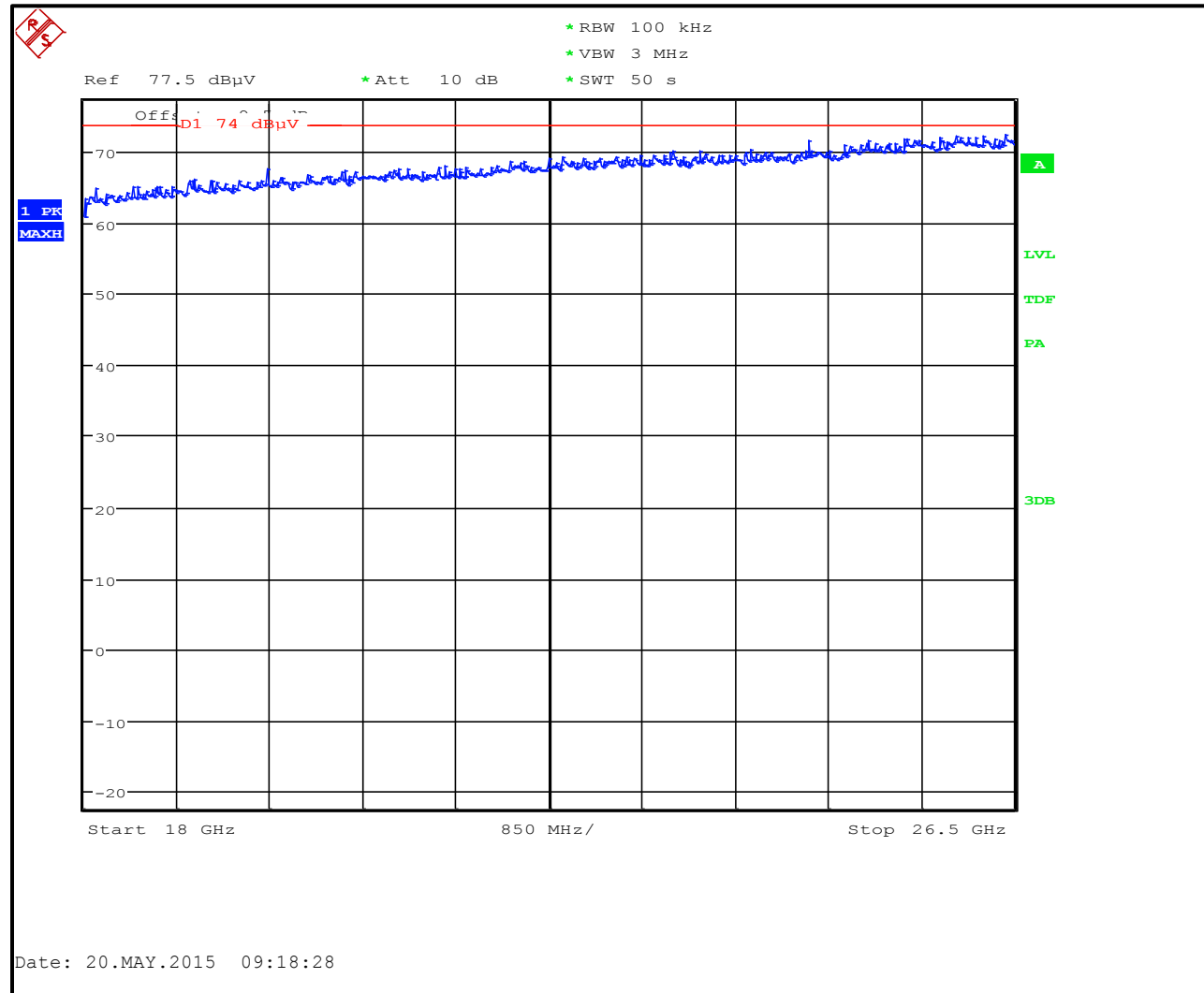
Plot 6-71: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #2, Horizontal, Peak



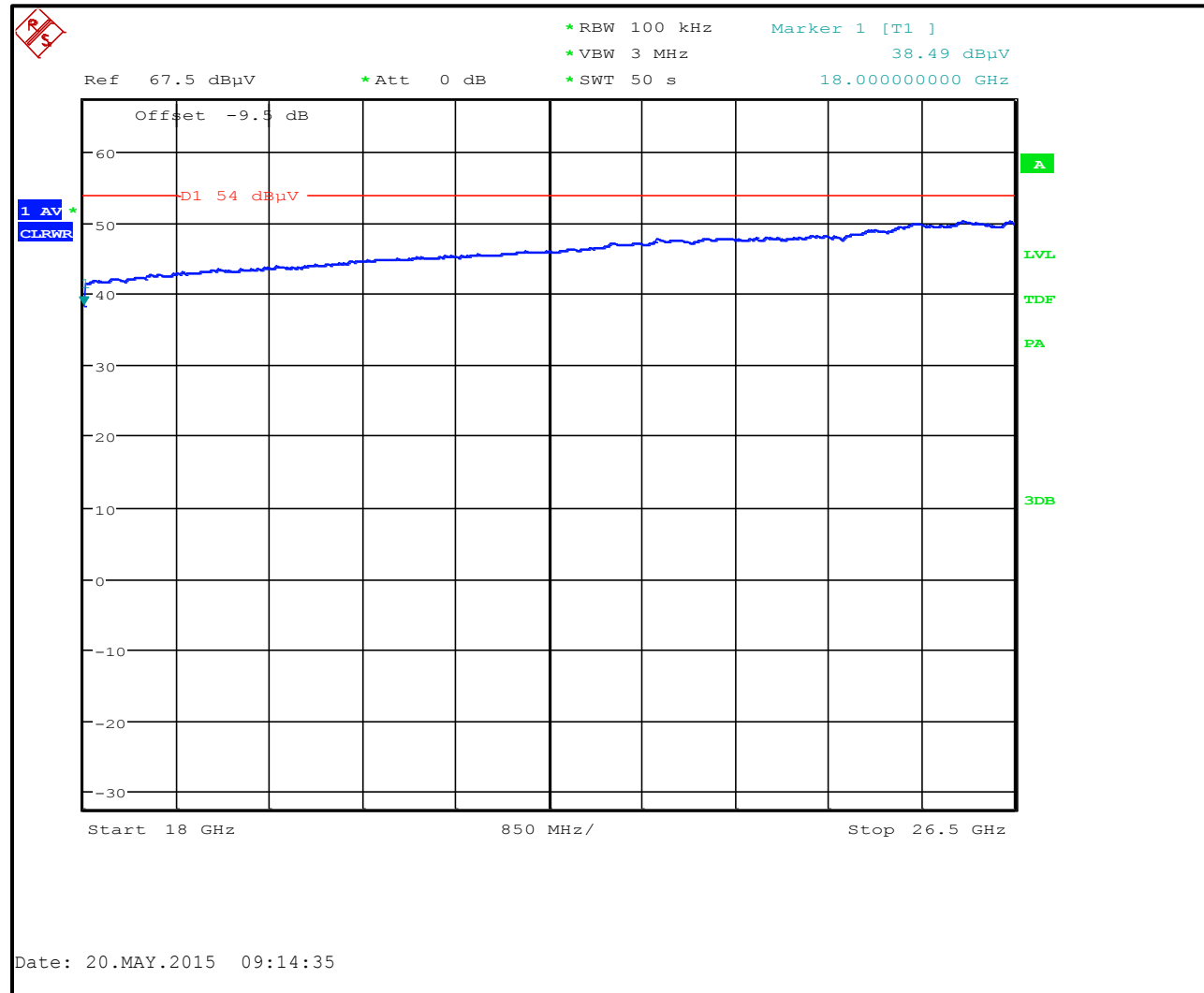
Plot 6-72: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #2, Horizontal, Average



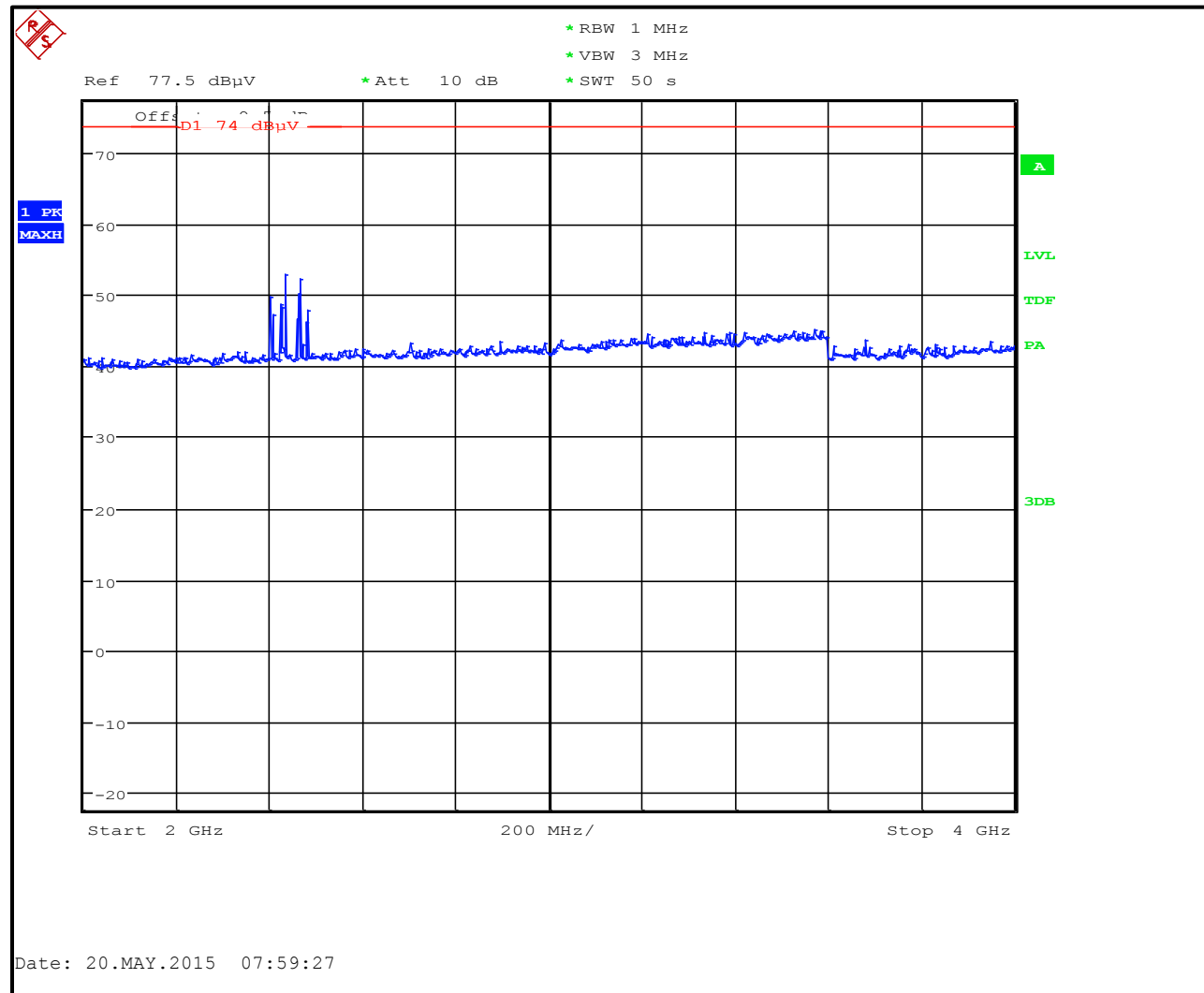
Plot 6-73: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #2, Horizontal, Peak



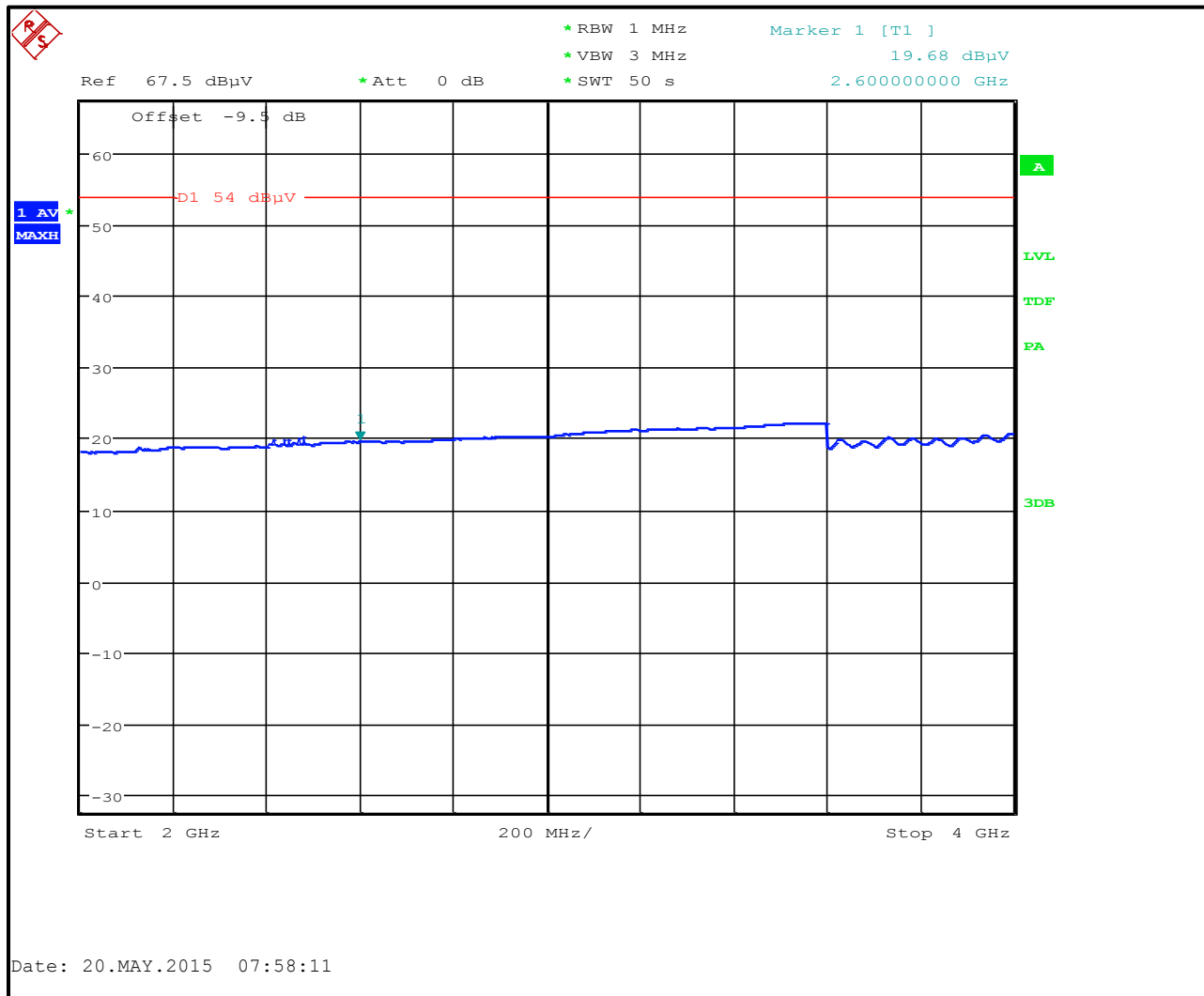
Plot 6-74: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #2, Horizontal, Average



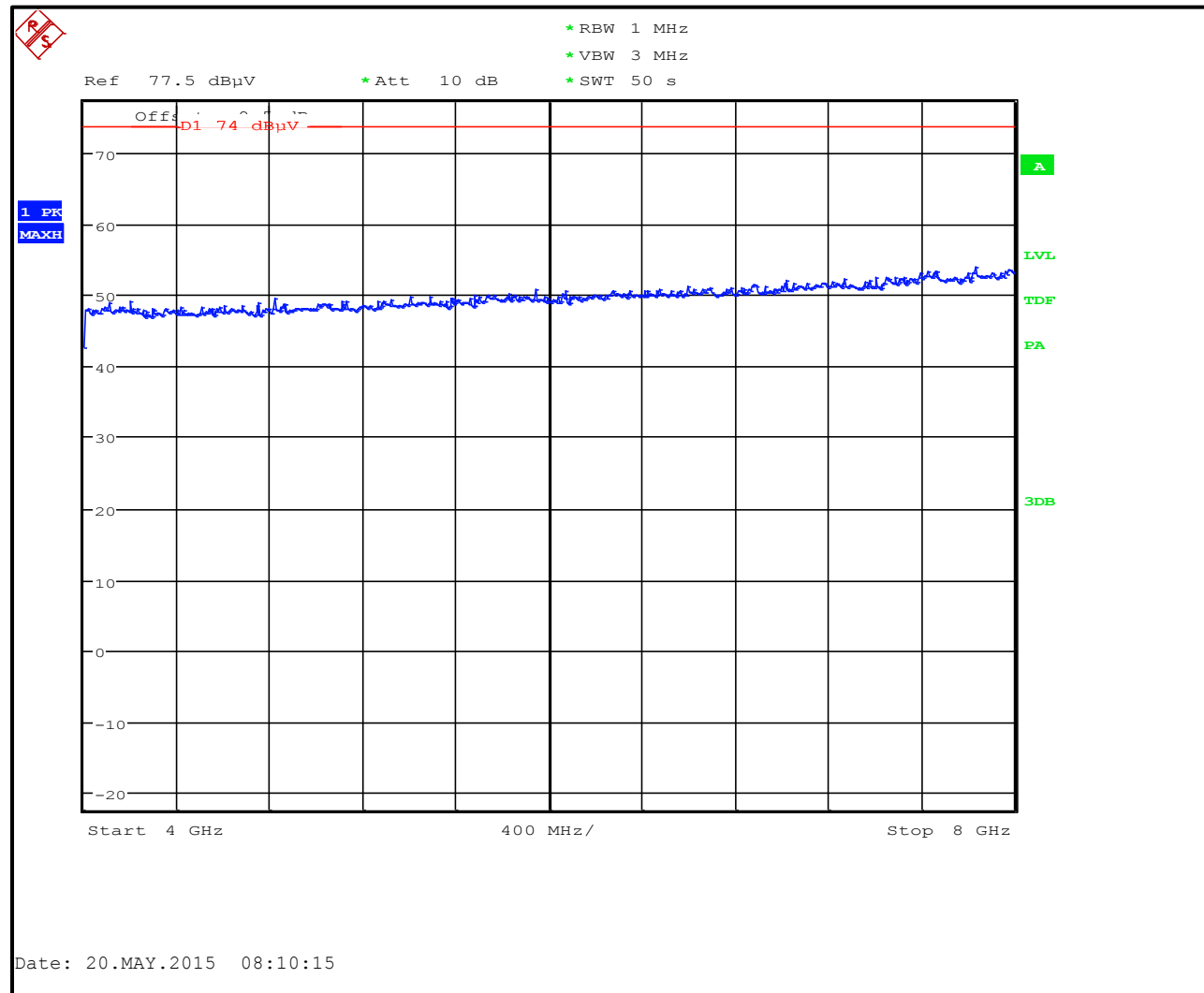
Plot 6-75: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #2, Vertical, Peak



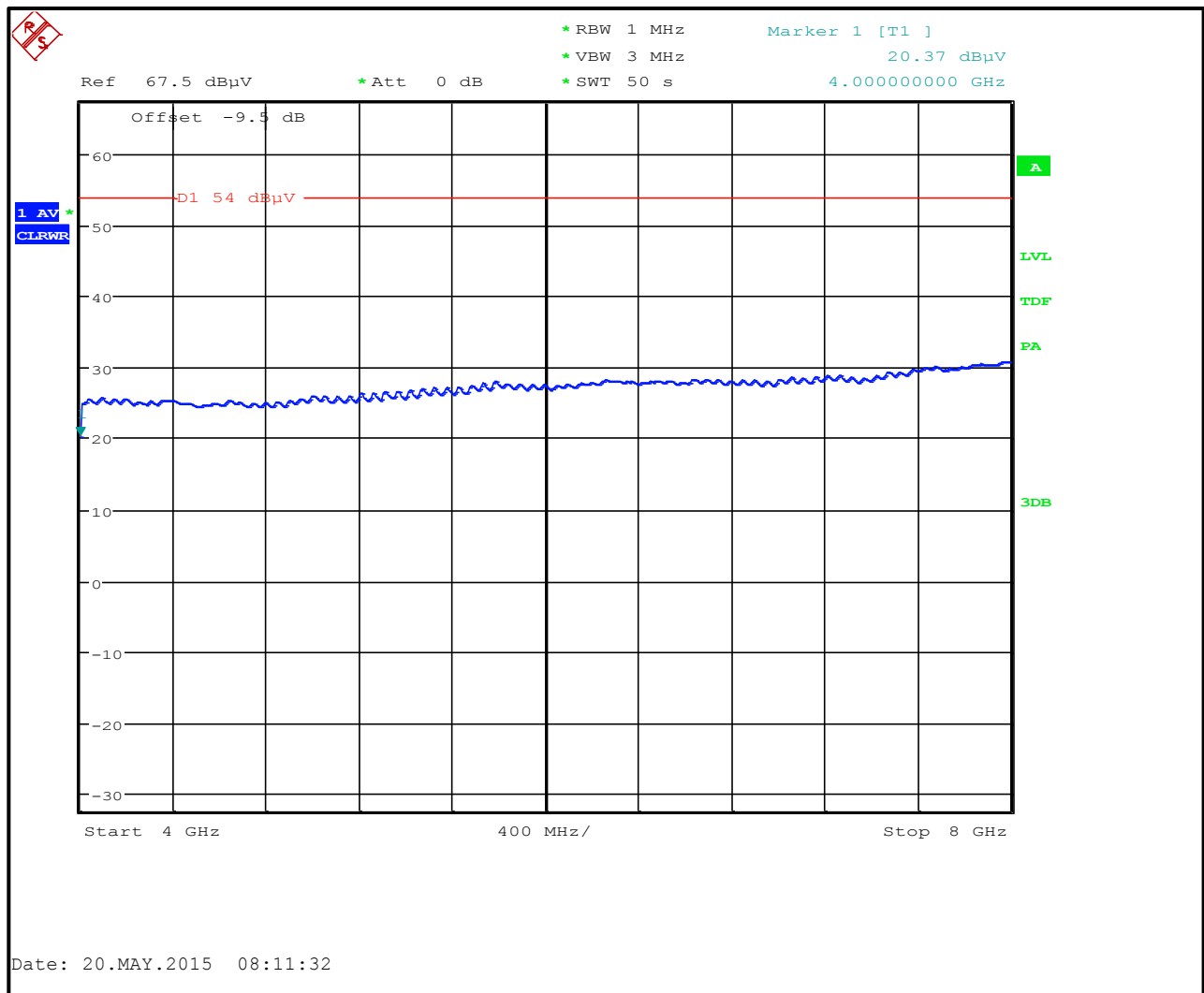
Plot 6-76: Radiated Emissions 2 GHz – 4 GHz; Concrete Container; TC #2, Vertical, Average



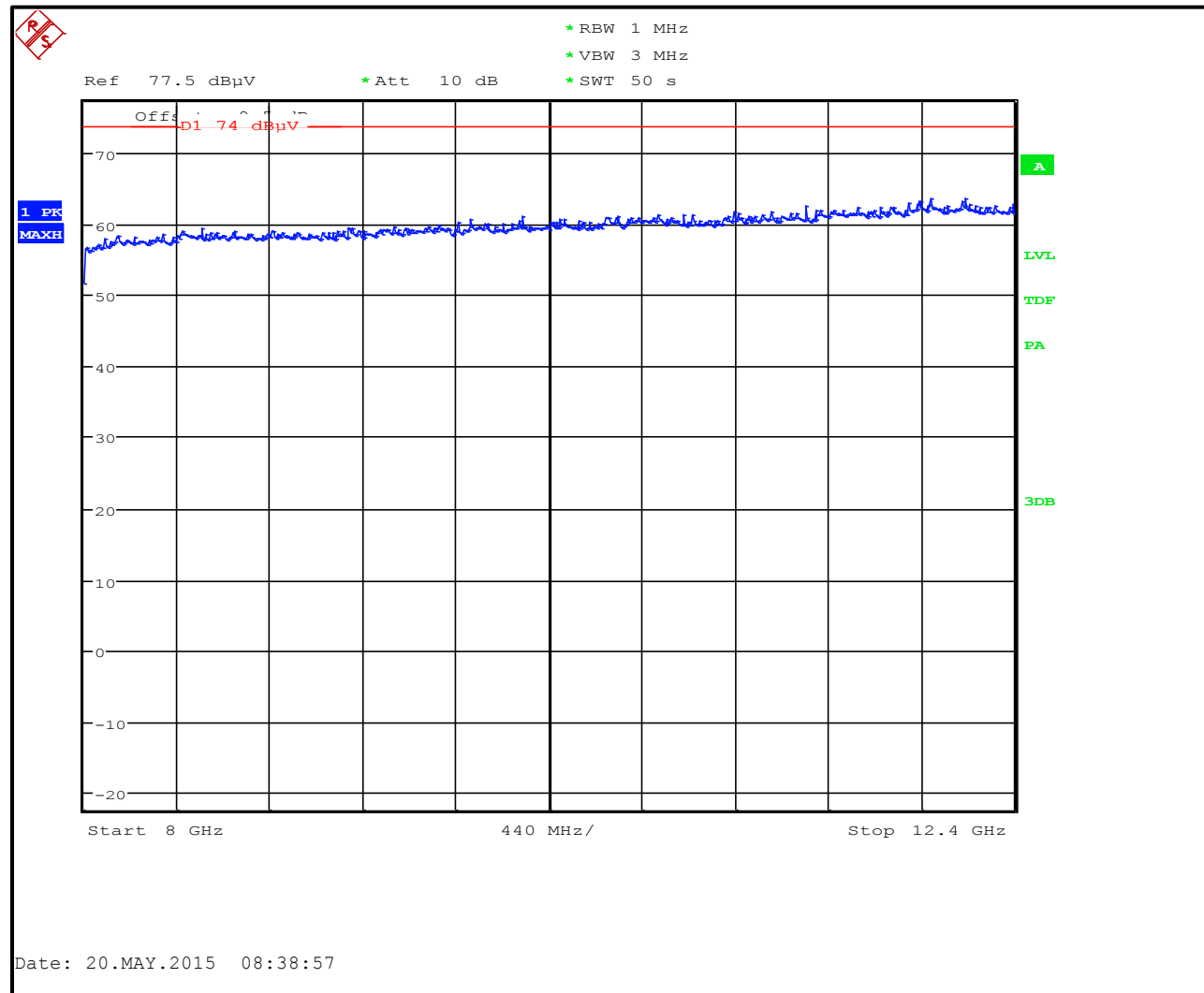
Plot 6-77: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #2, Vertical, Peak



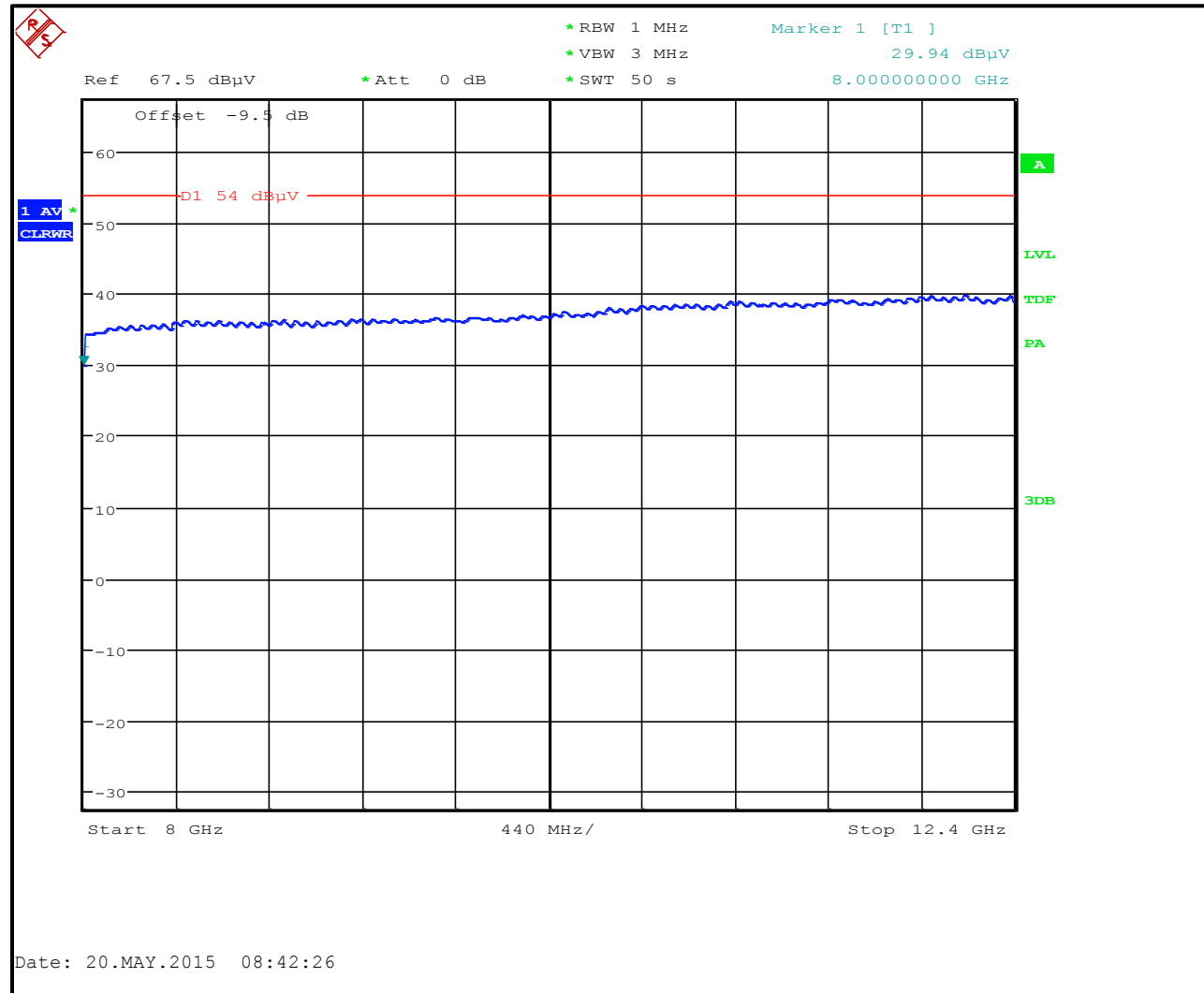
Plot 6-78: Radiated Emissions 4 GHz – 8 GHz; Concrete Container; TC #2, Vertical, Average



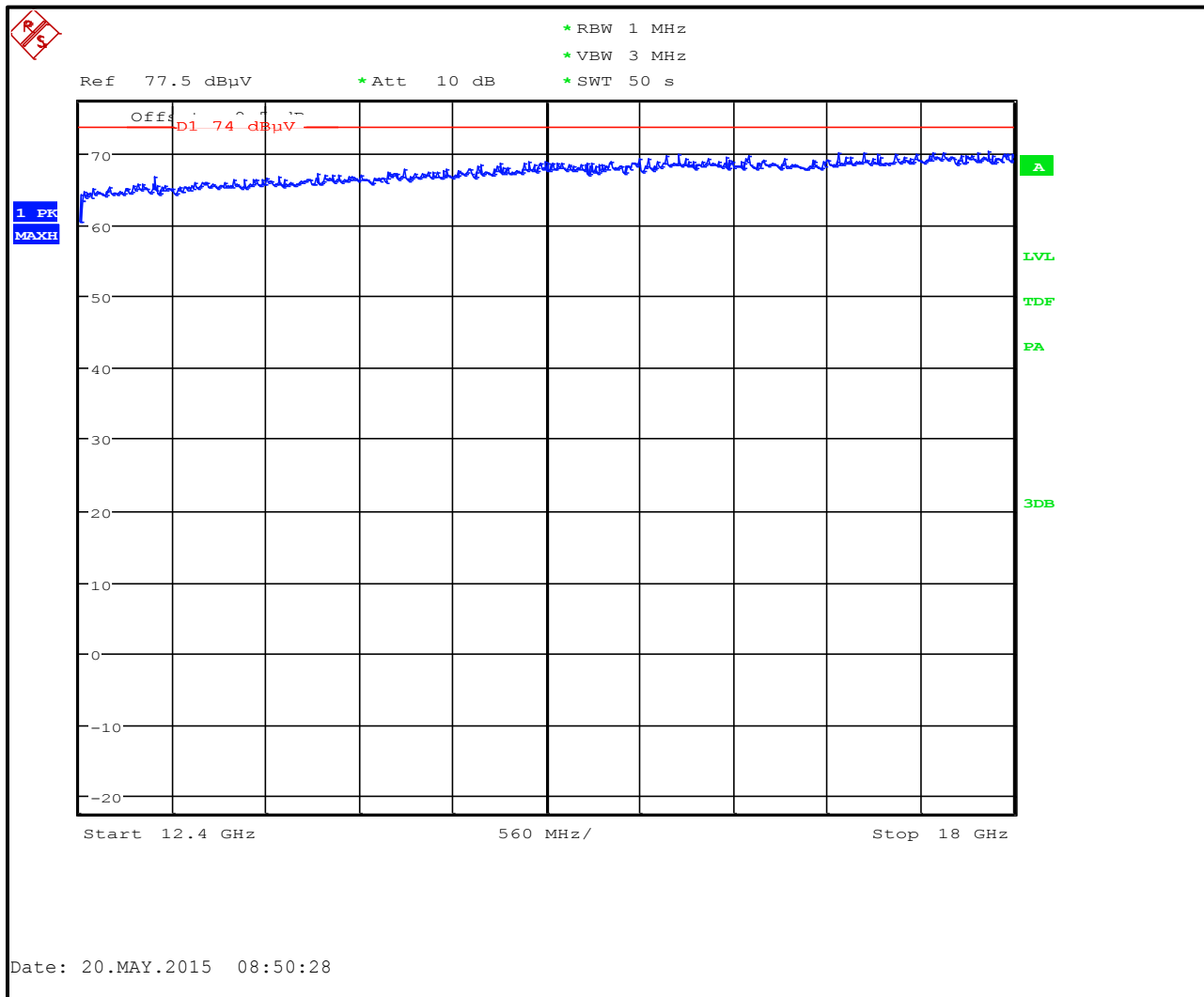
Plot 6-79: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #2, Vertical, Peak



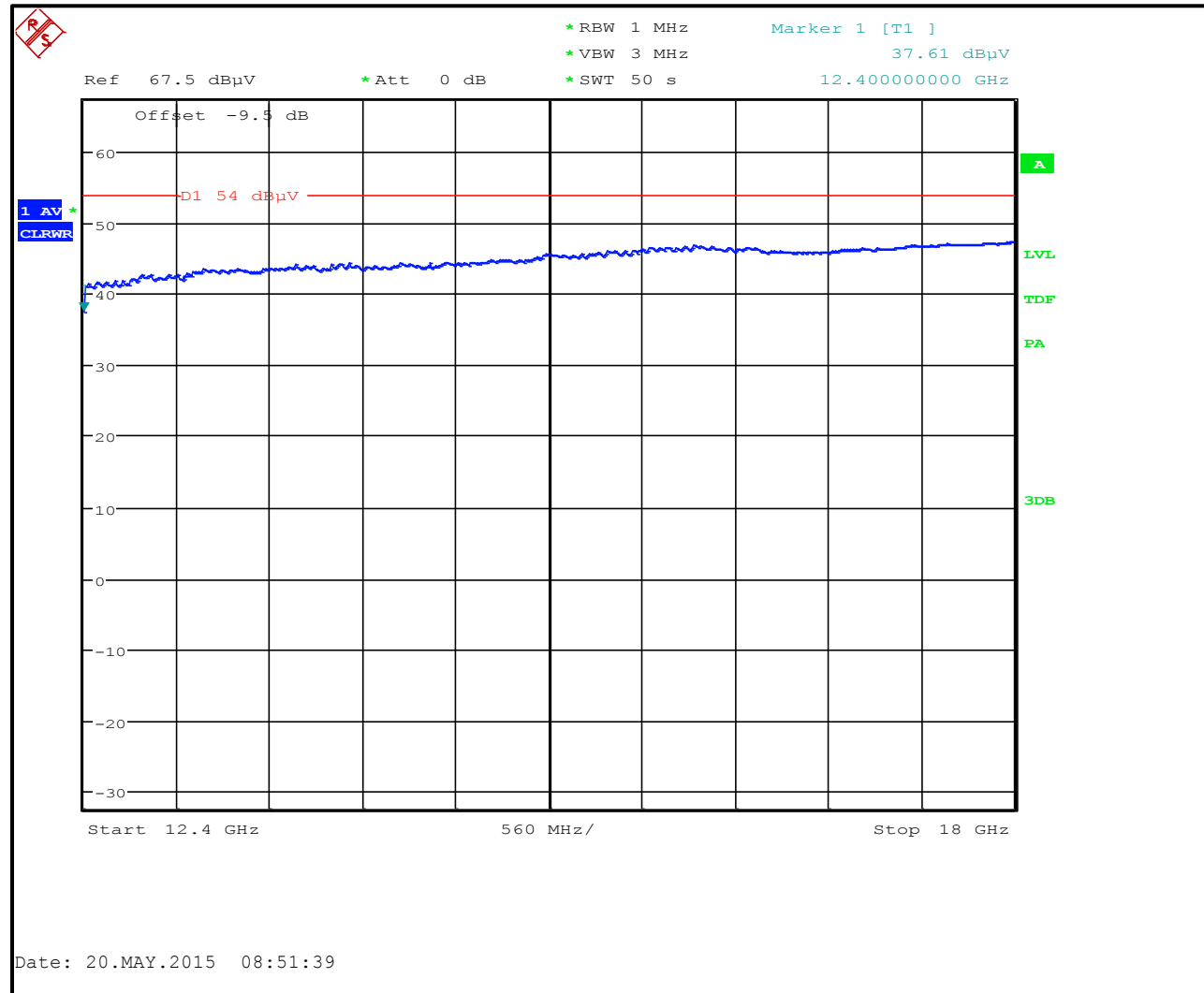
Plot 6-80: Radiated Emissions 8 GHz – 12.4 GHz; Concrete Container; TC #2, Vertical, Average



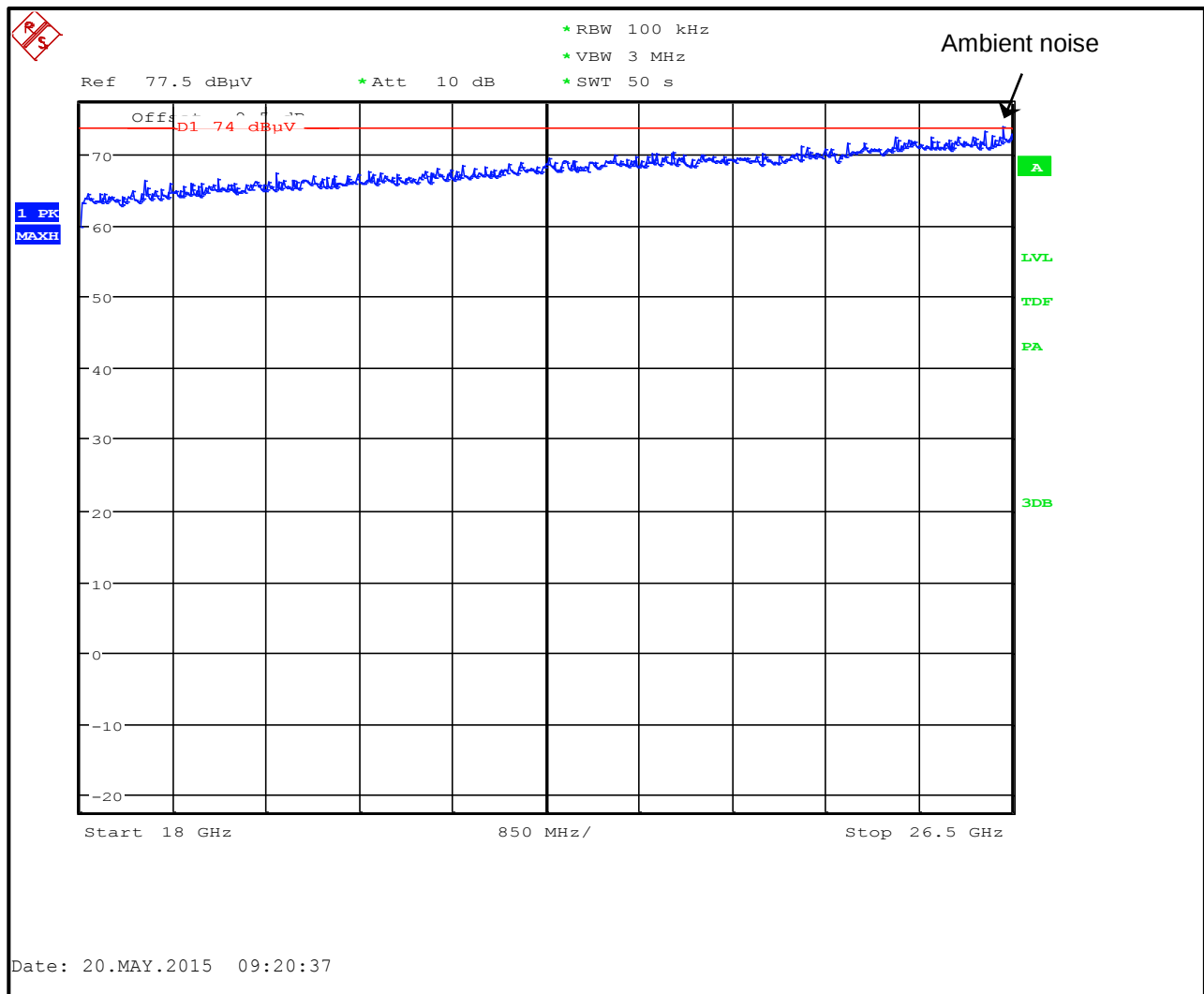
Plot 6-81: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #2, Vertical, Peak



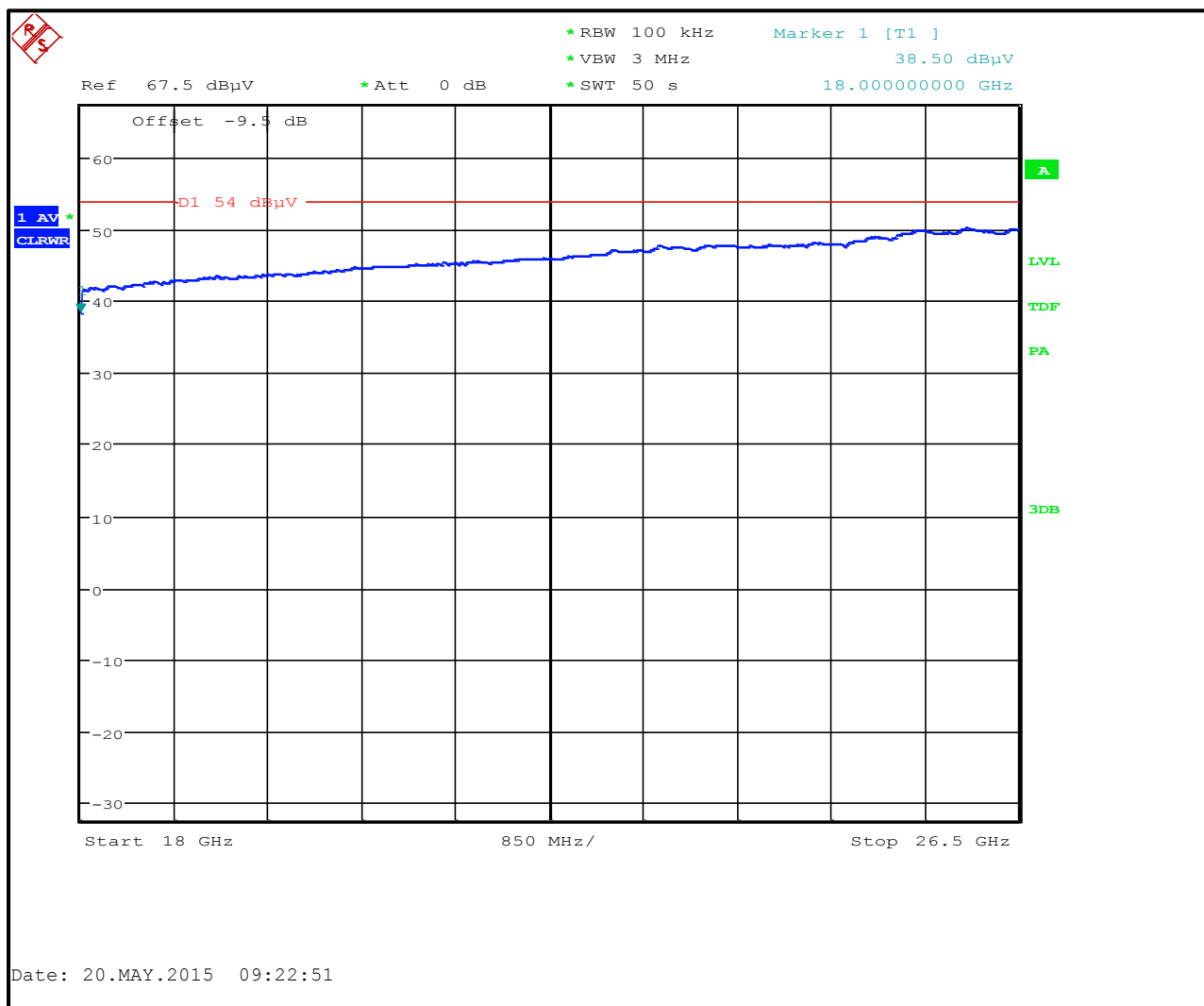
Plot 6-82: Radiated Emissions 12.4 GHz – 18 GHz; Concrete Container; TC #2, Vertical, Average



Plot 6-83: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #2, Vertical, Peak



Plot 6-84: Radiated Emissions 18 GHz – 26.5 GHz; Concrete Container; TC #2, Vertical, Average



Test Personnel:

Daniel W. Baltzell
Test Engineer

Daniel W. Baltzell

Signature

May 20, 2015
Date of Test

Table 6-7: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	9/3/15
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	9/3/15
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	9/3/15
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	9/5/15
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna, (9 kHz - 30 MHz)	827525/019	3/4/17
900717	Hewlett Packard	11970U	Harmonic Mixer (40 – 60 GHz)	2332A01110	4/20/17
901639	Wiltron	35WR19F	Waveguide (40 – 50 GHz)	N/A	6/18/15
901640	Rohde & Schwarz	FS-Z110	Mixer (75 – 110 GHz)	100010	4/02/17
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
901586	Rohde & Schwarz	FS-Z75	Harmonic Mixer (50 – 75 GHz)	100098	1/23/17
901256	ATM	19-443-6R	Horn Antenna (40-60 GHz, WR-19)	8041704-01	1/23/16
901303	EMCO	3160-10	Horn Antenna (26.5-40.0 GHz) WR-28	960452-007	6/19/15
901161	ATM	28-25K-6	Waveguide (26.5 – 40 GHz)	B082304	Not required
900711	ATM	10-443-6R	Horn Antenna (75 - 110 GHz)	8051905-1	12/5/15
900712	ATM	15-443-6R	Horn Antenna (50 - 75 GHz)	8051805-1	3/16/16
900724	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25 - 2000 MHz)	1037	4/19/17
901629	Teledyne Cougar	A4C2123	Amplifier	003-003	9/5/15
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/17
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/20/17
901587	Radiometer Physics GMBH	SAM-220	140-220 GHz Mixer	20005	2/13/17
900713	ATM	05-443-6R	Horn Antenna, 140-220	S0685	5/20/15
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/20/17
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	4/20/17
901218	EMCO	3160-09	Horn Antenna (18 - 26.5 GHz)	960281-003	4/19/17
900874	Continental Microwave & Tool	RA42-K-F-4B-C	Waveguide (18 - 26.5 GHz)	990706-002	1/23/16

7 Conclusion

The data in this measurement report shows that the Vega Grieshaber KG, Inc., Model VEGAPULS 69, FCC ID: O6QPS60XW1, complies with all the requirements of Parts 2 and 15 of the FCC Rules and Regulations.

The worst-case radiated emissions occur with the EUT in configurations TC #1 and TC #2 tested with the main beam pointing perpendicularly downwards within the enclosed steel and concrete containers.

The EUT in configurations TC #1 and TC # 2 was also investigated and tested with a swivel attached to the EUT's housing and installed inside the enclosed steel and concrete containers. There were no radiated emissions detected with the swivel attached to the EUT in configurations TC #1 and TC # 2 installed inside the enclosed containers.