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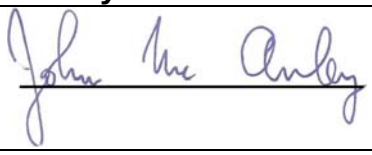
Project Num	16E6465-1b
Quotation	Q16-1312-1
Prepared For	Tekelek Europe Ltd
Prepared By	Compliance Engineering Ireland
Test Lab Address	Clonross Lane, Derrockstown, Dunshaughlin, Co. Meath, Ireland
Tested By	Michael Kirby
Test Report By	Michael Kirby
FCC Site Registration	92592
IC Site Registration	8517-A2, 8517-A1
Date	10th Mar 2017
IC Equipment Authorisation	Test Report
EUT Description	Wifi Radio Module
FCC ID	S6T784
IC ID	20606-784
Authorised by	**John McAuley**
Authorised Signature :	

TEST SUMMARY

The equipment complies with the requirements according to the following standards.

FCC Part Section(s)	RSS-247 Section	TEST PARAMETERS	Test Result
15.247a 2	5.2.1	6dB bandwidth	Pass
15.247e	5.2.2	Power Spectral Density	Pass
15.247(b)1	5.4.4	Output power Conducted	Pass
15.247(d)1	5.5	Conducted Spurious Emissions	Pass
15.209	5.5	Radiated Spurious Emissions	Pass
15.247a	RSS Gen 6.6	99% bandwidth	Pass

RSS 247-1

Exhibit A – Technical Report

Table of Contents

1.0 EUT Description

Model:	TEK784
Type:	Wifi Radio Module
FCC ID:	S6T784
Company:	Tekelek Europe Ltd
Contact	Rory Keating
Address:	Unit 118 Shannon Co Clare Ireland
Phone:	+353 61 471511
e-mail:	rory.keating@tekelek.ie
Test Standards:	47 CFR, Part 15.247
Type of radio:	Stand-alone
Transmitter Type:	802.11b, g, n
Operating Frequency Range(s):	2.412 GHz, - 2.462GHz
Number of Channels:	11
Antenna:	Integral
Power configuration:	3.6 v Battery.
Ports:	None
Oper. Temp Range:	-40° C to +85° C
Classification:	DTS
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The TEK784 is a Wifi module which is installed on a host pcb. The Wifi module does not have an internal antenna and radio power is available on an output pin from the module. It is intended that the host pcb will contain options to connect an internal (host pcb) antenna and an EFL connector for connecting to a reverse SMA external antenna connector. Switching between antenna connections on the host is achieved by changing the location of a capacitor on the host pcb.
Therefore it is required that the TEK784 module would only be fitted to hosts which contain a fixed pcb and tracking pattern in the antenna output section of the host pcb
Note the external antenna fitted to the host pcb connector is limited to 7dBi gain .

1.1 EUT Operation

Operating Conditions during Test:

The EUT (TEK 784 module) was fitted to a host pcb (TEK750) to allow powering and control of the module. An SMA was connected to the module radio output pin via a cable soldered directly to the module output pin. Conducted measurements were carried out with the analyser connected to the SMA connector.

The EUT was operated in test mode where the channel and modulation was set via USB connection from the host pcb to a laptop.
The EUT was powered from a bench PSU set to 3.6Vdc. for all tests

Radiated measurements (Cabinet spurious emission) were carried out on this sample with the SMA connector terminated.

Further Radiated tests were carried out on a second unit TEK784 fitted onto a host which had the internal antenna option enabled.

Environmental conditions

	Temperature	**Relative Humidity**
Test	°C	%
Conducted Emissions	19	47
Radiated Emissions <1GHz	18	42
Radiated Emissions >1GHz	19	47

1.2 Modifications

No modifications were required in order to pass the test specifications.

1.3 Date of Test

The tests were carried out on 11th, 12th, 13th , 16th, 17th Jan 2017 .

1.4 Description of Test modes

Channel List

Channel	Freq MHz	Channel	Freq MHz
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

Available Data Rates

802.11 B	802.11 G	802.11 N
MB/s	MB/s	MB/s
1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65
1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65
1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65

Evaluation test for max power test carried out on the following

Channel	Freq	B	G	N
	MHz	MB/s	MB/s	MB/s
1	2412	1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65
6	2437	1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65
11	2462	1,2,5.5,11	6,9,12,18,24,36,48,54	6.5,13,19.5,26,39,52,58.5,65

Complete test was carried out on the worst cases for Ch1 B/G/N Ch6 B/G/N and Ch11 B/G/N
It was found that the highest output levels were recorded on the 802.11B modulation

2 Emissions Measurements

2.1 Conducted Emissions Measurements

Radio Conducted measurements were carried out on the EUT as per section 1.1 above.

All results were measured as conducted on the antenna except radiated spurious emissions.

2.2 Radiated Emissions Measurements

Radiated Power measurements were made at the Compliance Engineering Ireland Ltd anechoic chamber located in Dunshaughlin, Co. Meath, Ireland to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

The EUT was centred on a motorized turntable, which allows 360 degree rotation.

Emissions below 1GHz were measured using a bi-log antenna positioned at a distance of 3 metres from the EUT (as measured from the closest point of the EUT). The radiated emissions were maximised by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 metres.. In this case the resolution bandwidth was 100kHz.

Emissions in the 1GHz-3.6GHz range were measured using a horn antenna located at 3 metres distance from the EUT in a fully anechoic chamber. The radiated emissions were maximised by configuring the EUT and by rotating the EUT In this case the resolution bandwidth was 1MHz and video bandwidth was 1MHz. for peak measurements. The Video bandwidth was changed to 10Hz for Average measurements (as per ANSI 63.10 2013 Section 4.1.4.2.3)

Emissions above 3.6GHz were measured using a horn antenna located at 1 metre distance from the EUT in a fully anechoic chamber. The radiated emissions were maximised by configuring the EUT and by rotating the EUT In this case the resolution bandwidth was 1MHz and video bandwidth was 1MHz. for peak measurements. The Video bandwidth was changed to 10Hz for Average measurements (as per ANSI 63.10 2013 Section 4.1.4.2.3)

2.3 Antenna Requirements

According to FCC 47 CFR 15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

There is no direct antenna connection to the module The module is intended for soldering to host with Internal antenna complies with this requirement.
The option for external antenna has a reverse polarity SMA connector and thereby meets this requirement.
*The E.U.T Complies with the requirement of 15.203

3.0 Results for Conducted emissions on the mains

Test not performed as the host for the EUT is battery powered only and battery cannot be recharged while in the host unit.

4. Conducted Measurements

4.1 Bandwidth

4.1.1 6dB bandwidth

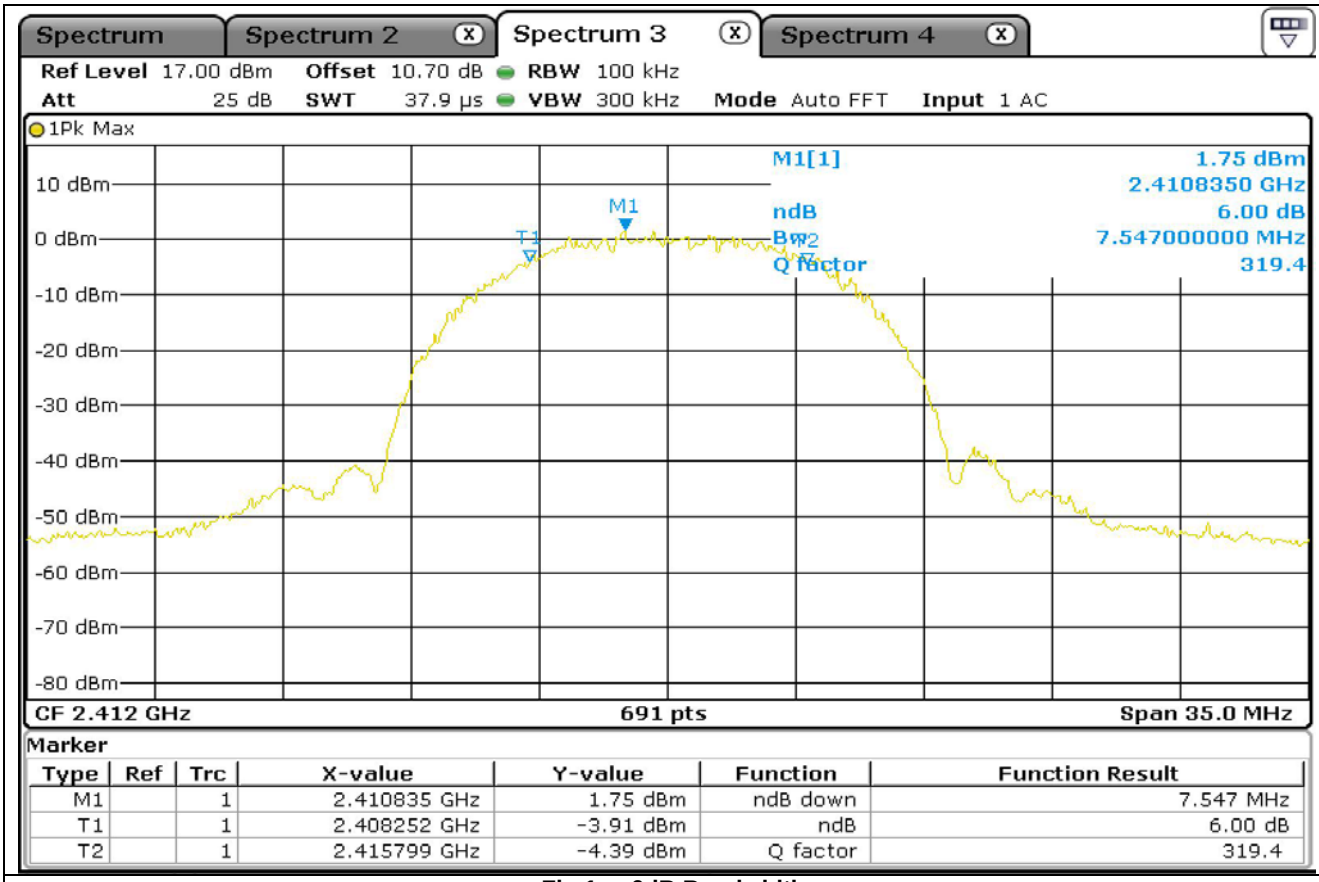


Fig 1 6dB Bandwidth

4.1.2 99% bandwidth

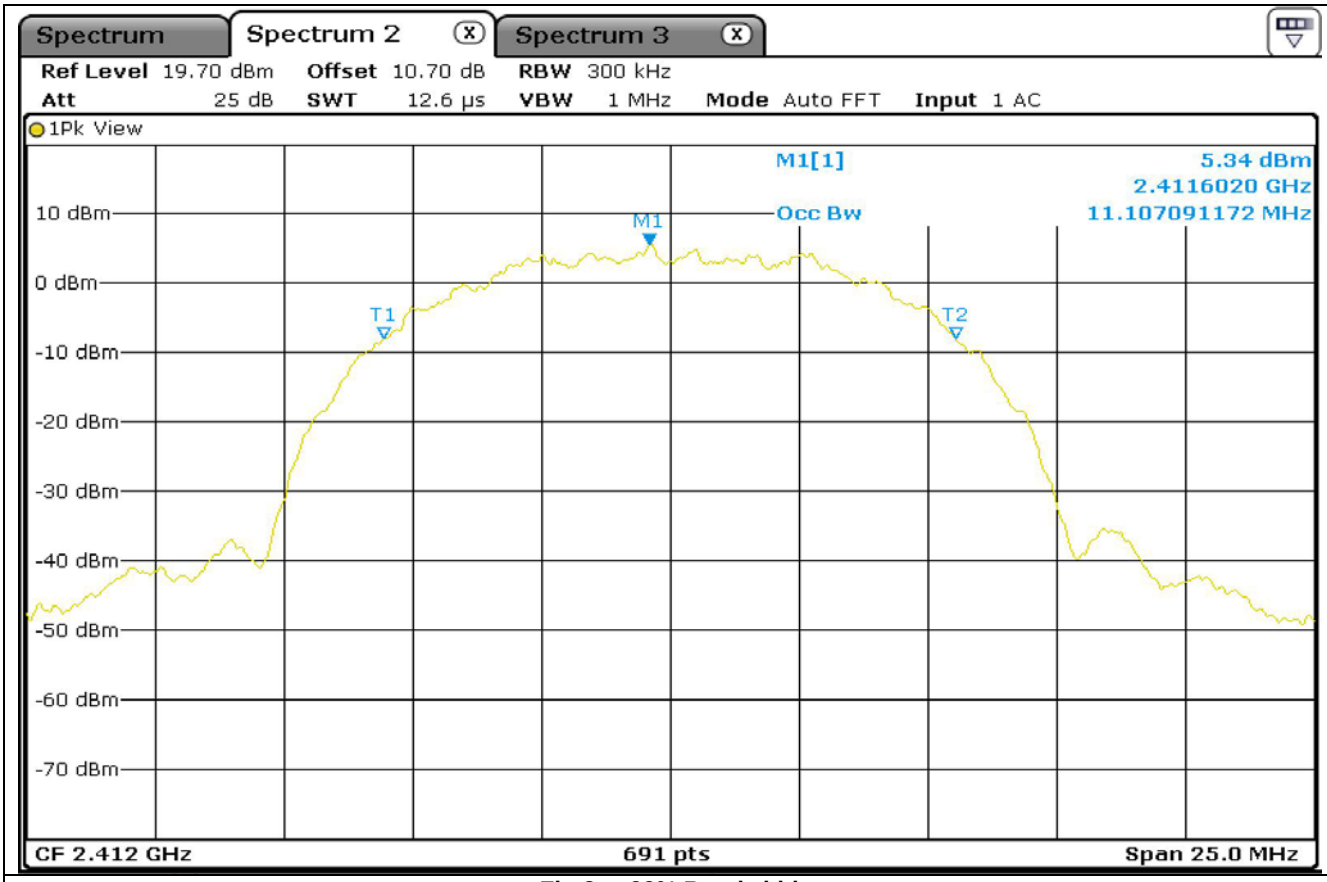


Fig 2 99% Bandwidth

Bandwidth

Channel	802.11	Frequency	6dB Bandwidth	99% Bandwidth
		GHz	MHz	MHz
Low	B	2.412	7.55	11.1
Mid	B	2.437	7.65	11.1
High	B	2.462	6.79	11.14
Low	G	2.412	16.66	17.22
Mid	G	2.437	16.66	17.12
High	G	2.462	16.66	17.17
Low	N	2.412	17.78	18.08
Mid	N	2.437	17.88	18.08
High	N	2.462	17.88	18.03

As per KDB 558074 Section 8.1

Limit for 6dB Bandwidth = 500KHz min

Result :- Pass

4.2 Power Spectral Density

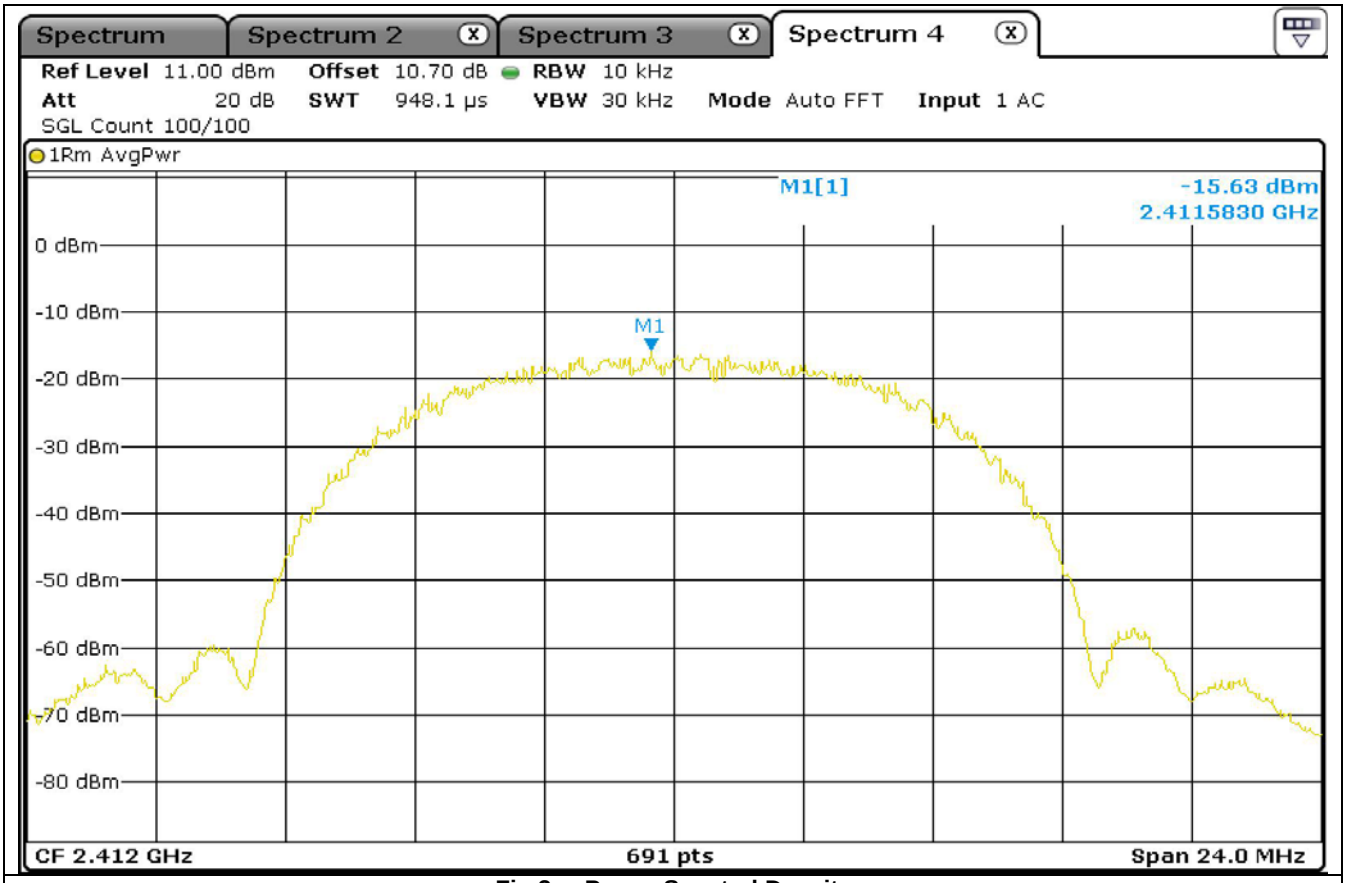


Fig 3 Power Spectral Density

Channel	802.11	Frequency	Power Spectral Density	Limit
		GHz	dBm	dBm
Low	B	2.412	-15.63	8
Mid	B	2.437	-20.43	8
High	B	2.462	-21.75	8
Low	G	2.412	-16.67	8
Mid	G	2.437	-19.86	8
High	G	2.462	-21.42	8
Low	N	2.412	-16.83	8
Mid	N	2.437	-20.39	8
High	N	2.462	-20.61	8

As per KDB 558074 Section 10.3

Result :- Pass

4.3 Output power Conducted

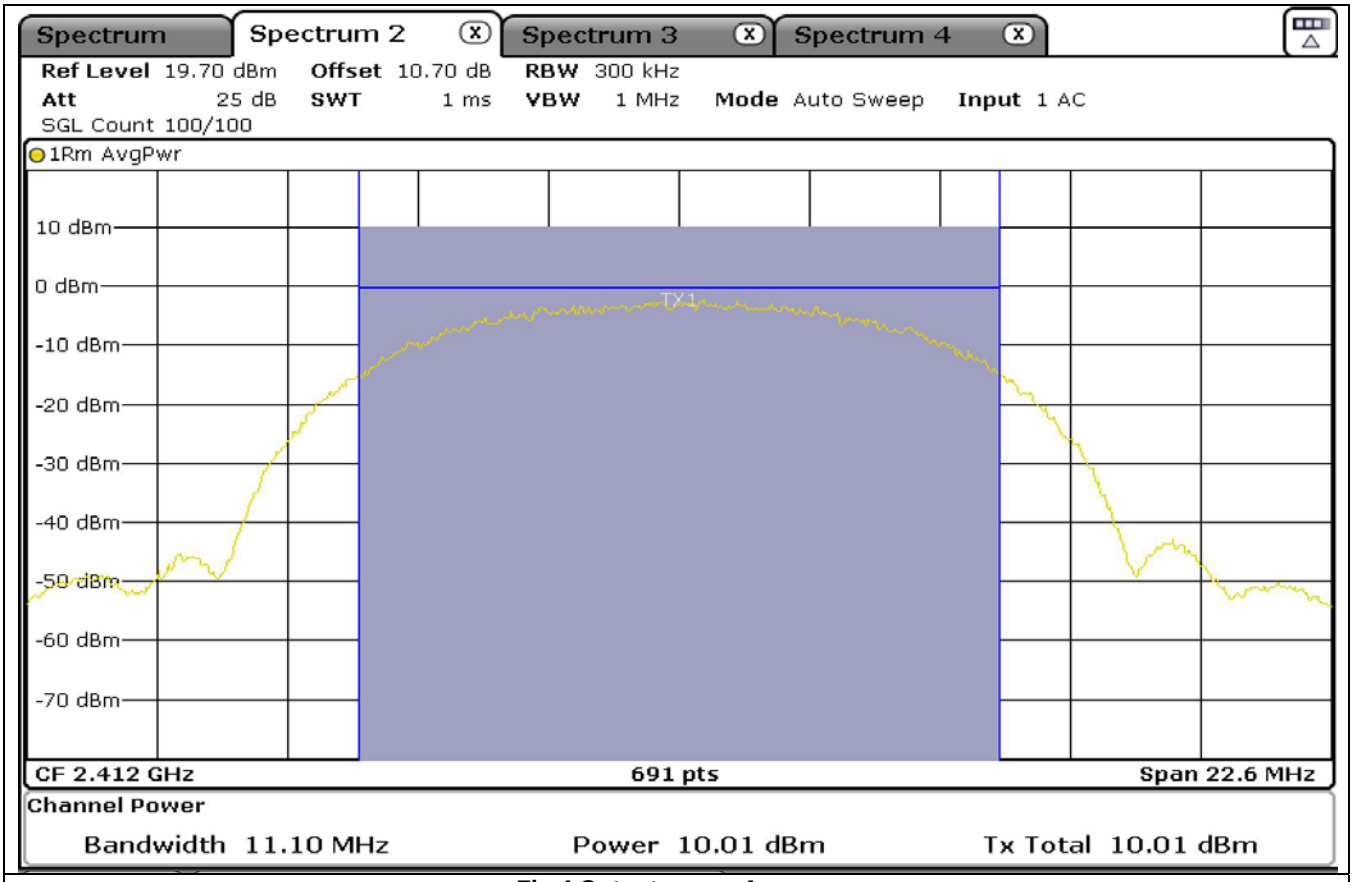


Fig 4 Output power Average

Channel	802.11	Frequency	Output Power Average	Antenna Gain	Eirp	Limit	Margin
		GHz	dBm	dBi	dBm	dBm	dB
Low	B	2.412	10.01	7	17.01	29	11.99
Mid	B	2.437	9.37	7	16.37	29	12.63
High	B	2.462	8.7	7	15.7	29	13.3
Low	G	2.412	9.05	7	16.05	29	12.95
Mid	G	2.437	9.12	7	16.12	29	12.88
High	G	2.462	8.69	7	15.69	29	13.31
Low	N	2.412	8.6	7	15.6	29	13.4
Mid	N	2.437	8.83	7	15.83	29	13.17
High	N	2.462	8.5	7	15.5	29	13.5

As per KDB 558074 Section 9.2.2.2

Test Result :- Pass

5. Radiated Emissions EUT

5.1 Spurious Emissions in Restricted bands

5.1.1 Antenna-port conducted measurements

As per KDB 558074 section 12.2.2 and 12.2.5.1

Freq	Average	Antenna Gain	EIRP	20log(D)		Duty cycle correction	Max Ground Reflection	E	Limit	Margin	Pass /Fail
GHz	dBm	dB	dB	dB		dB	dB	dBuV/m	dBuV/m	dB	
4.828	-57.63	7	-50.63	-9.54	104.80	0.00	0.0	44.63	54	9.37	Pass
7.236	-75.75	7	-68.75	-9.54	104.80	0.00	0.0	26.51	54	27.49	Pass
9.648	-71.2	7	-64.2	-9.54	104.80	0.00	0.0	31.06	54	22.94	Pass
4.874	-53.93	7	-46.93	-9.54	104.80	0.00	0.0	48.33	54	5.67	Pass
7.311	-75.7	7	-68.7	-9.54	104.80	0.00	0.0	26.56	54	27.44	Pass
9.746	-71.92	7	-64.92	-9.54	104.80	0.00	0.0	30.34	54	23.66	Pass
4.924	-51.84	7	-44.84	-9.54	104.80	0.00	0.0	50.42	54	3.58	Pass
7.386	-75.59	7	-68.59	-9.54	104.80	0.00	0.0	26.67	54	27.33	Pass
9.848	-73.12	7	-66.12	-9.54	104.80	0.00	0.0	29.14	54	24.86	Pass

5.1.2 Radiated Emissions with antenna port terminated

Frequency	Reading Peak	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB
GHz	dBuV/m	V/H	dB	dB	dB	dBuV/m	dBuV/m	dB
4.824	52.9	Vertical	32.5	38.6	3.6	50.4	54.0	23.6
4.824	52.3	Horizontal	32.5	38.6	3.6	49.8	54.0	24.2
7.236	41.0	Vertical	35.5	39	3.9	41.4	54.0	32.6
7.236	41.1	Horizontal	35.5	39	3.9	41.5	54.0	32.5
4.874	53.4	Vertical	32.5	38.6	3.6	50.9	54.0	23.1
4.874	55.2	Horizontal	32.5	38.6	3.6	52.7	54.0	21.3
7.311	40.5	Vertical	35.5	39	3.9	40.9	54.0	33.1
7.311	40.4	Horizontal	35.5	39	3.9	40.8	54.0	33.2
4.924	55.0	Vertical	32.5	38.6	3.6	52.5	54.0	21.5
4.924	55.3	Horizontal	32.5	38.6	3.6	52.8	54.0	21.2
7.386	40.7	Vertical	35.5	39	3.9	41.1	54.0	32.9
7.386	40.5	Horizontal	35.5	39	3.9	40.9	54.0	33.1

Average measurements not performed as peak results were below average limit

Peak measurement performed with Resolution Bandwidth set to 1MHz as per ANSI C63.10-2013 Section 4.1.4.2.2 and KDB 558074 Section 12.2.4 Peak power measurement procedure

Test Result :- Pass

Average measurements as per KDB 558074 Section 12.2.5.1 Trace averaging with continuous EUT transmission at full power

6. Radiated Emissions Host

6.1 Output Power Radiated Results Host Internal Antenna

Channel	802.11	Frequency	Radiated Field Strength	Output Power	Limit
		GHz	dBuV/m	dBm	dBm
Low	B	2.412	106.90	11.67	30
Mid	B	2.437	104.59	9.36	30
High	B	2.462	105.44	10.21	30
Low	G	2.412	105.23	10.00	30
Mid	G	2.437	104.83	9.60	30
High	G	2.462	105.22	9.99	30
Low	N	2.412	105.79	10.56	30
Mid	N	2.437	104.90	9.67	30
High	N	2.462	105.75	10.52	30

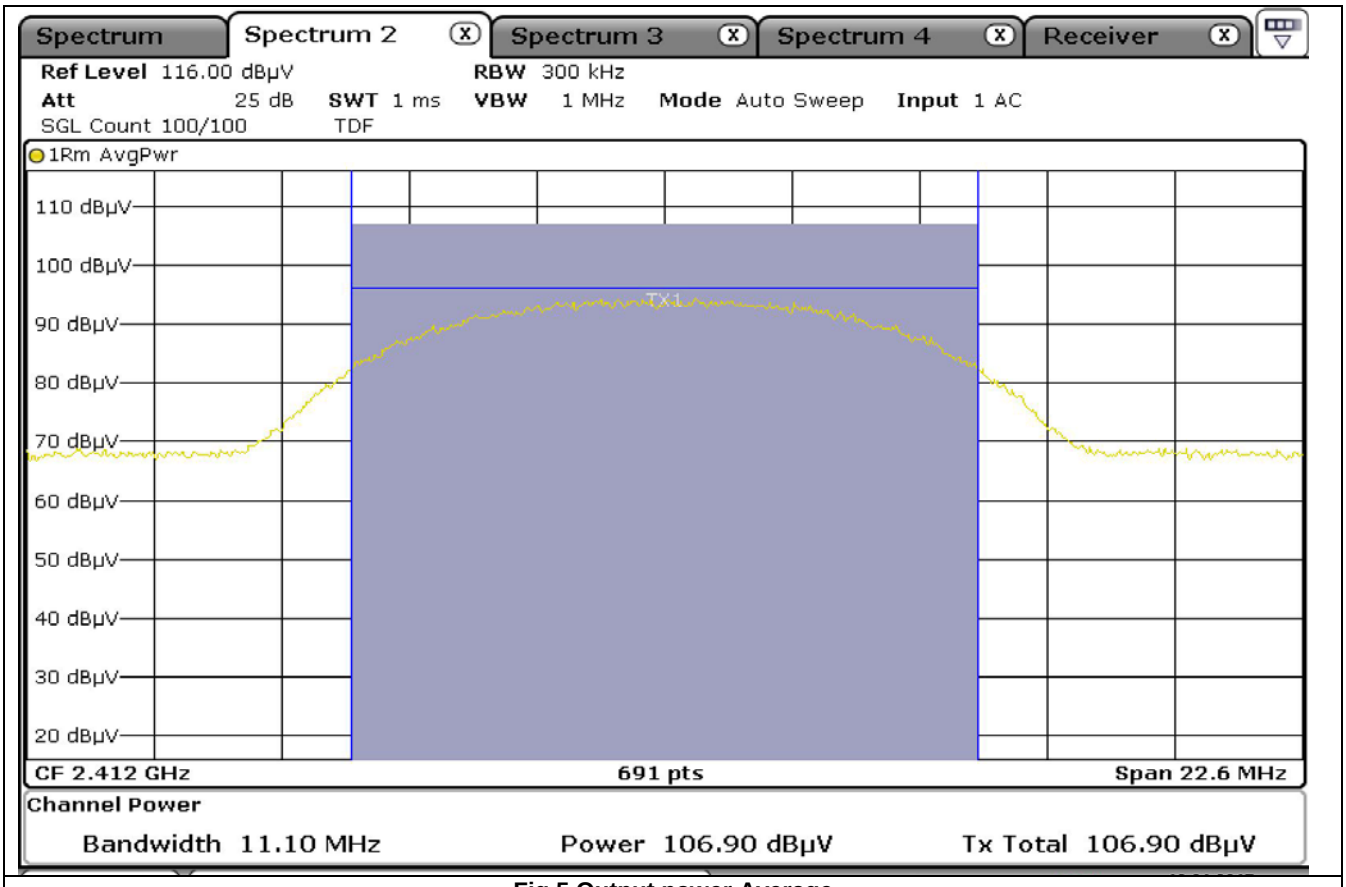


Fig 5 Output power Average

Radiated Field Strength measured at 3 metres.
Output power calculated using
eirp = pt x gt = (E x d)2 /30
As per eq 1 KDB 412172 D01 Determining ERP and EIRP v01r01
Test Result :- Pass

6.2 Radiated Spurious Emissions Measurements (1GHz – 26 GHz)

6.2.1 Host Internal Antenna

Frequency	Reading Peak	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB
GHz	dBuV/m	V/H	dB	dB	dB	dBuV/m	dBuV/m	dB
4.824	50.9	Vertical	32.5	38.6	3.6	48.4	54.0	25.6
4.824	46.3	Horizontal	32.5	38.6	3.6	43.8	54.0	30.2
7.236	39.8	Vertical	35.5	39	3.9	40.2	54.0	33.8
7.236	39.9	Vertical	35.5	39	3.9	40.3	54.0	33.7
4.874	50.3	Vertical	32.5	38.6	3.6	47.8	54.0	26.2
4.874	48.1	Vertical	32.5	38.6	3.6	45.6	54.0	28.4
7.311	40.4	Vertical	35.5	39	3.9	40.8	54.0	33.2
7.311	40.7	Vertical	35.5	39	3.9	41.1	54.0	32.9
4.924	49.7	Vertical	32.5	38.6	3.6	47.2	54.0	26.8
4.924	48.6	Horizontal	32.5	38.6	3.6	46.1	54.0	27.9
7.386	39.8	Horizontal	35.5	39	3.9	40.2	54.0	33.8
7.386	41.1	Horizontal	35.5	39	3.9	41.5	54.0	32.5

Average measurements not performed as peak results were below the average limit

Peak measurement performed with Resolution Bandwidth set to 1MHz as per ANSI C63.10-2013 Section 4.1.4.2.2

Average measurements are performed with Video Bandwidth set to 10Hz as per ANSI C63.10-2013 Section 4.1.4.2.3 , where required,

Test Result :- Pass

7 List of Test Equipment

Instrument	Manufacturer	Model	Serial Num	CEI Ref	Cal Due Date	Cal Interval Months
Microwave Preamplifier	Hewlett Packard	83017A	3123A00175	805	29/09/2017	12
Spectrum Analyser 30Hz-40GHz	Rohde& Schwarz	FSP40	100053	850	09/11/2018	36
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	04/06/2017	36
Anechoic Chamber	CEI	SAR 10M	845	845	16/03/2019	36
Antenna Horn	EMCO	3115	9905-5809	655	03/11/2017	24
Fully Anechoic Chamber	CEI	FAR 3M	906	906	22/03/2018	36
Antenna Trilog	Schwarzbeck	VULB 9160	9160-3361	889	04/08/2018	24
LISN	Rohde& Schwarz	ESH3-Z5	825460/003	604	21/01/2019	36

8 Measurement Uncertainties

Measurement	Uncertainty
Radio Frequency	+/- $5x10^{-7}$
Maximum Frequency Deviation	+/- 1.7 %
Conducted Emissions	+/- 1 dB
Radiated Emission 30MHz-100MHz	+/- 5.3 dB
Radiated Emission 100MHz-300MHz	+/- 4.7 dB
Radiated Emission 300MHz-1GHz	+/- 3.9 dB
Radiated Emission 1GHz-40GHz	+/- 3.8 dB

The measurement uncertainties stated were calculated with a k=2 for a confidence level of over 95% as per ETS TR100 028.

Appendix A

Additional Test Results
For
Conducted Measurements on the Antenna Port

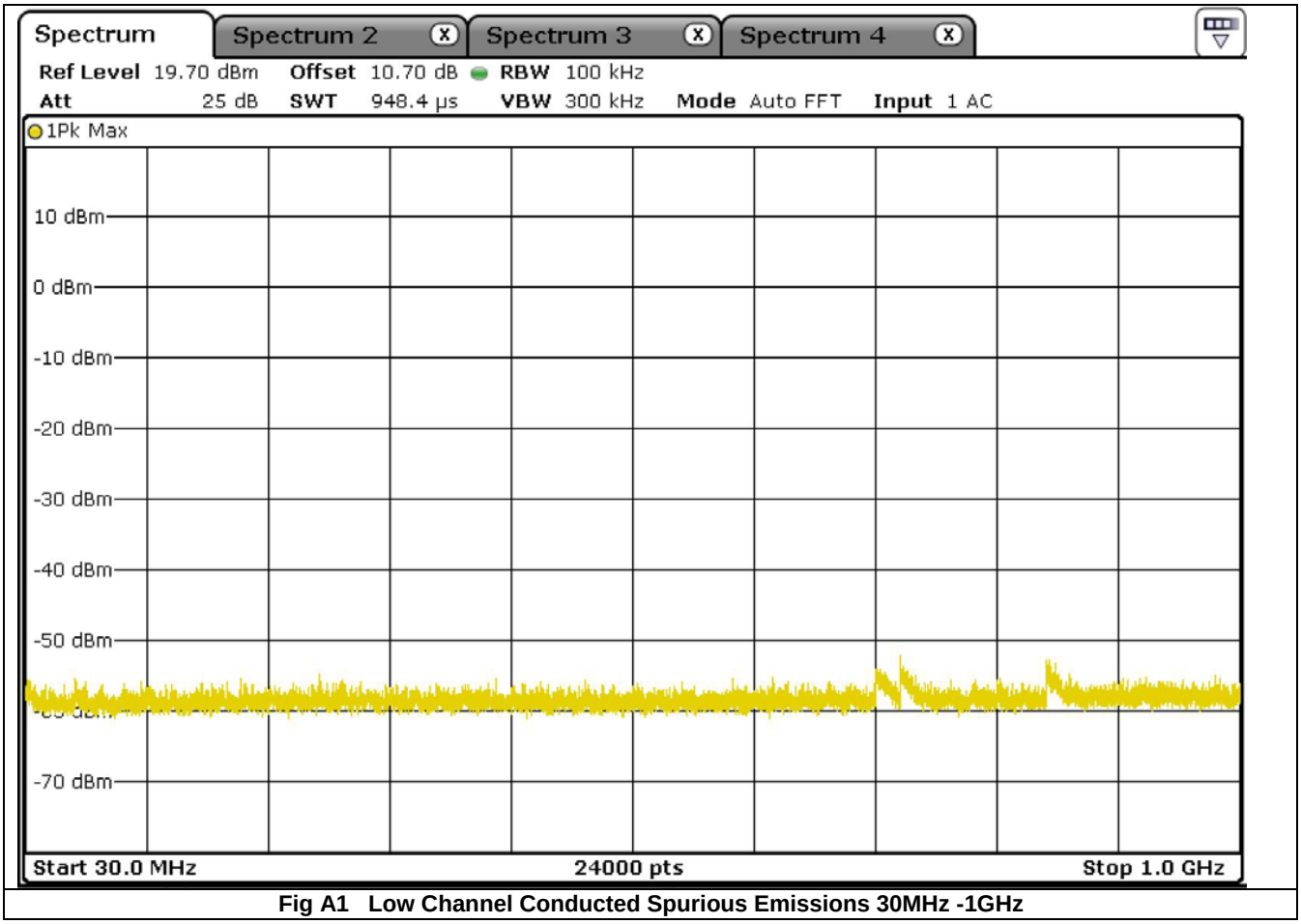


Fig A1 Low Channel Conducted Spurious Emissions 30MHz -1GHz

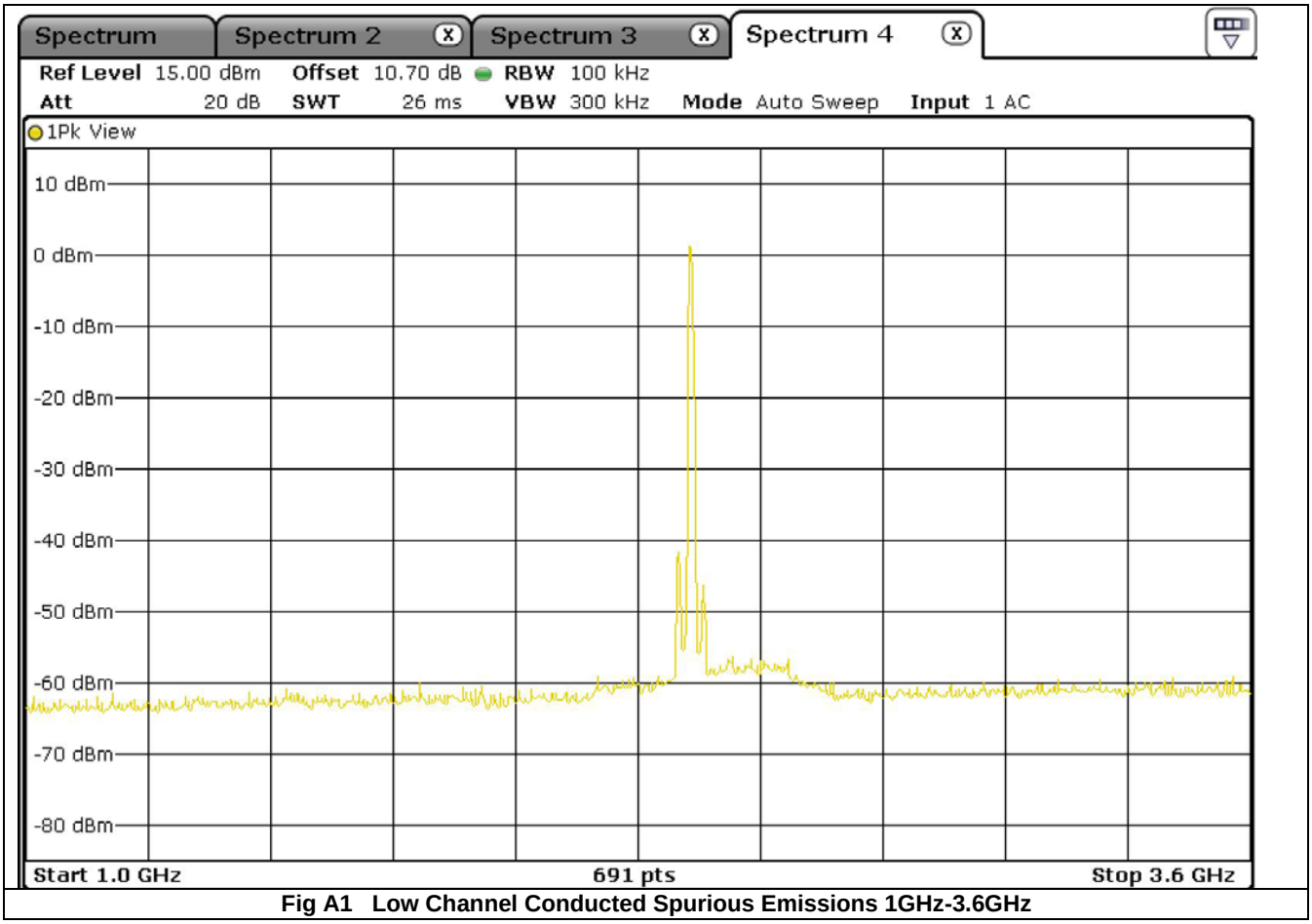


Fig A1 Low Channel Conducted Spurious Emissions 1GHz-3.6GHz

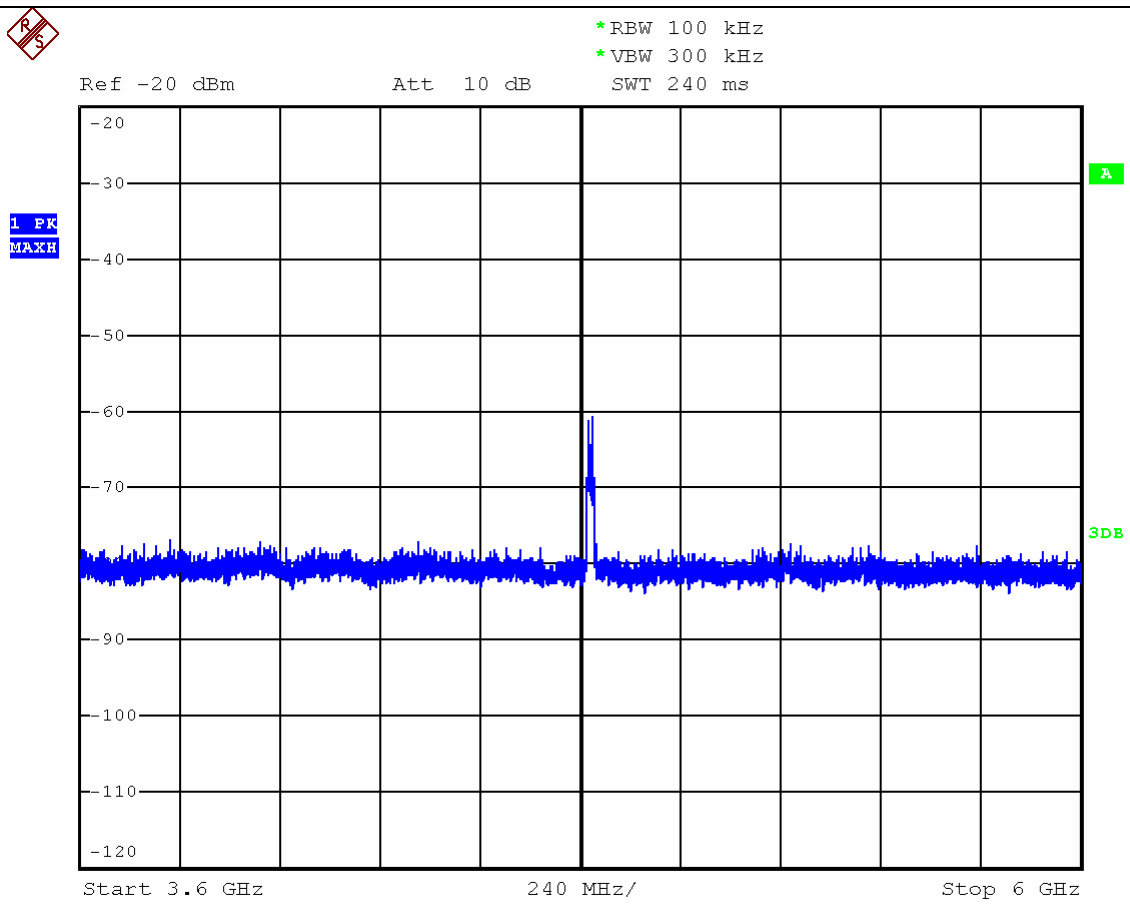


Fig A3 Low Channel Conducted Spurious Emissions 3.6GHz -6GHz

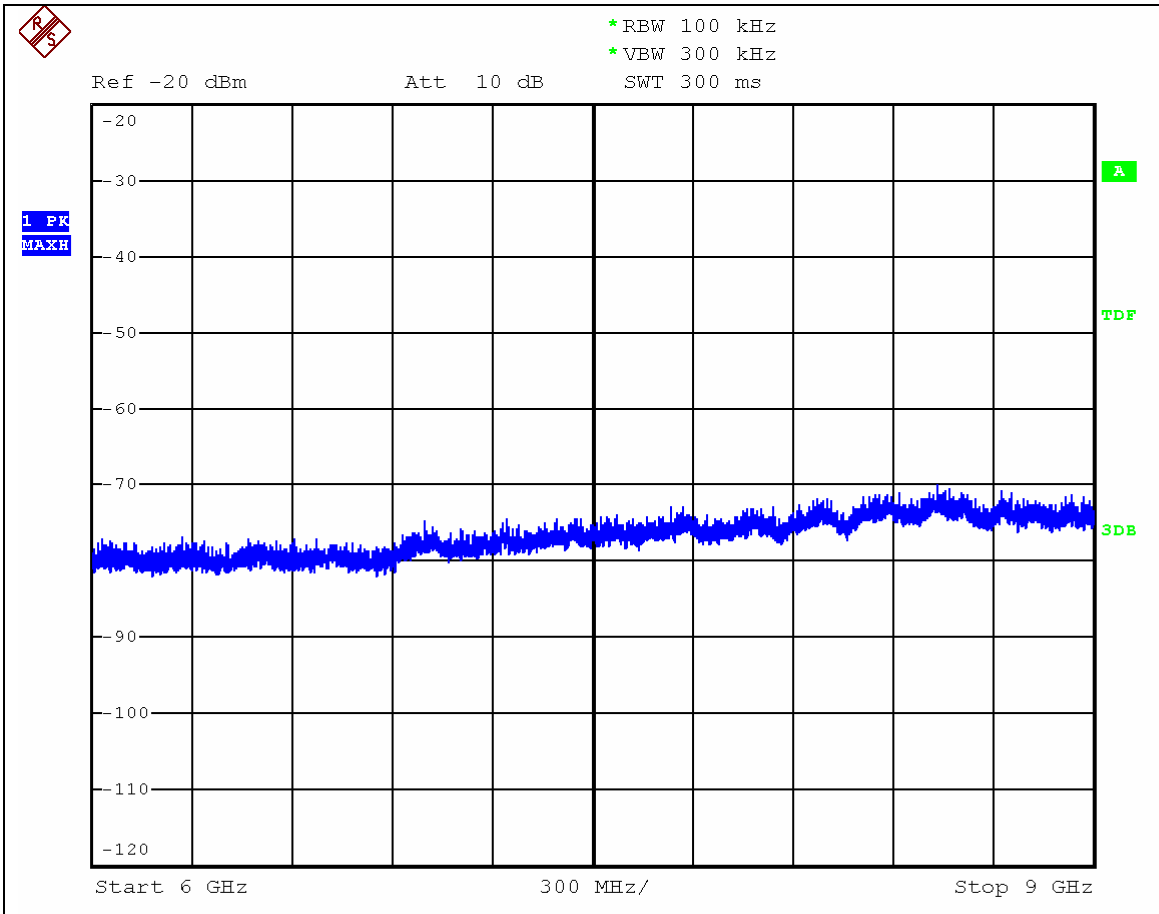


Fig A4 Low Channel Conducted Spurious Emissions 6GHz -9 GHz

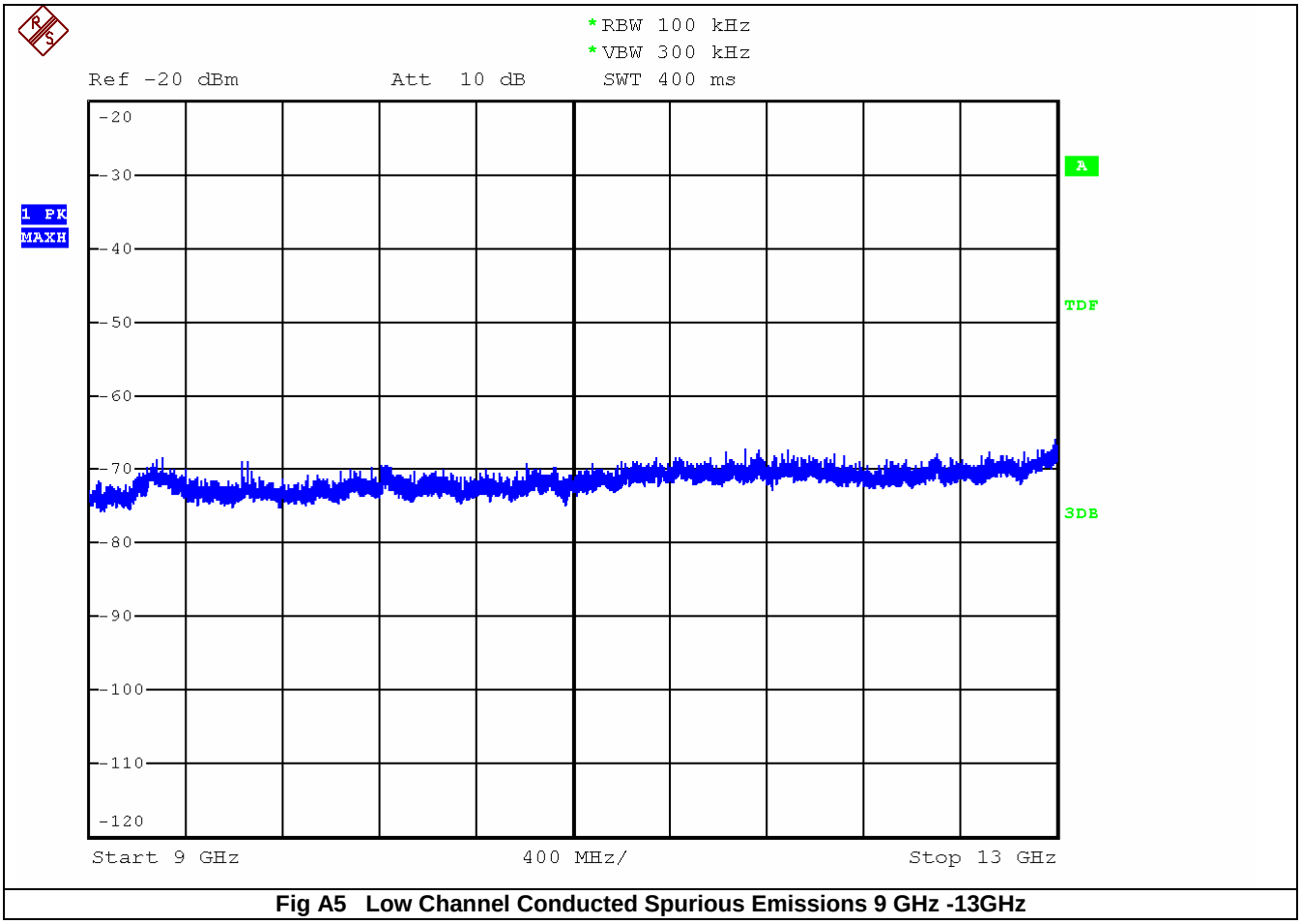


Fig A5 Low Channel Conducted Spurious Emissions 9 GHz -13GHz

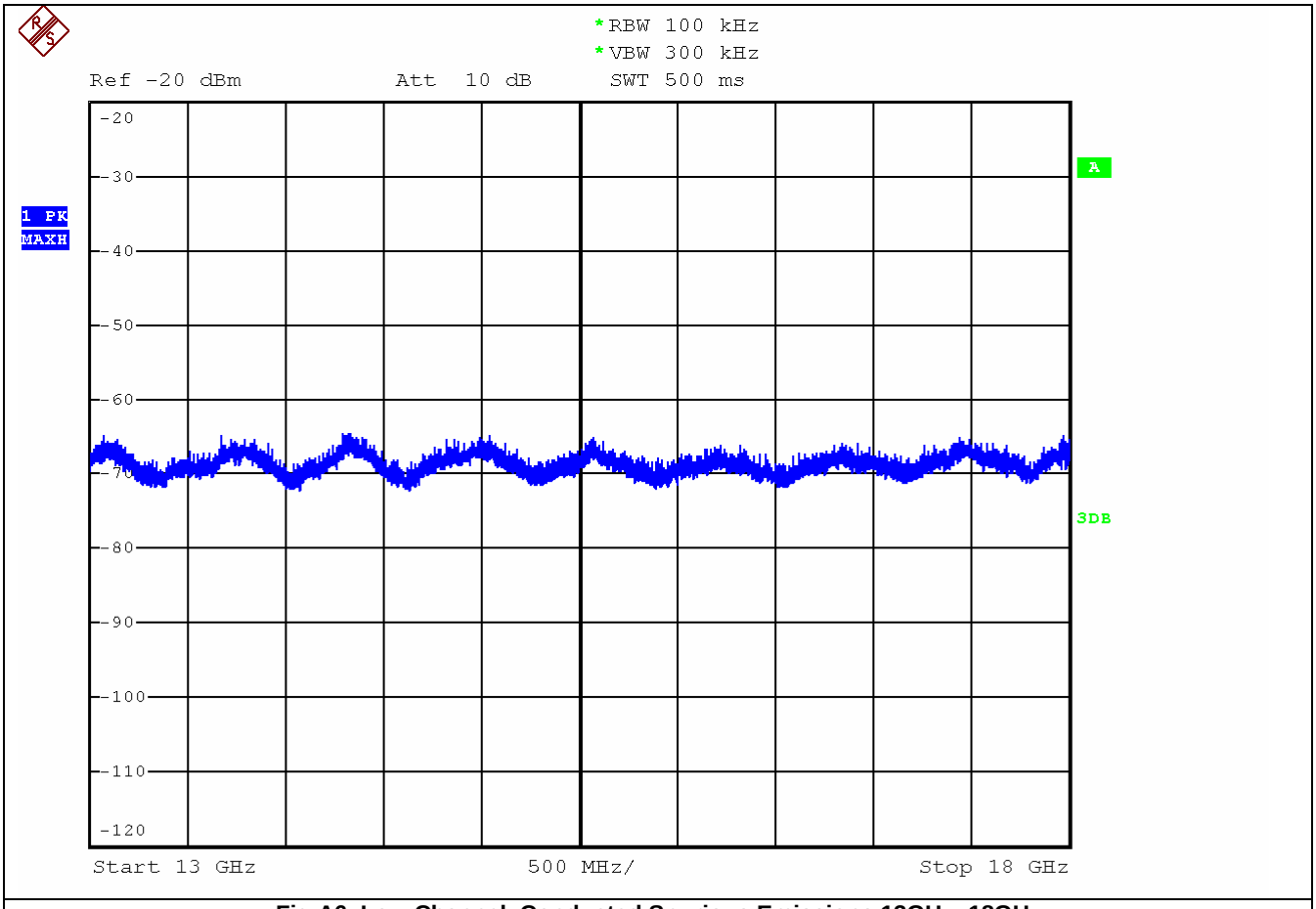


Fig A6 Low Channel Conducted Spurious Emissions 13GHz -18GHz

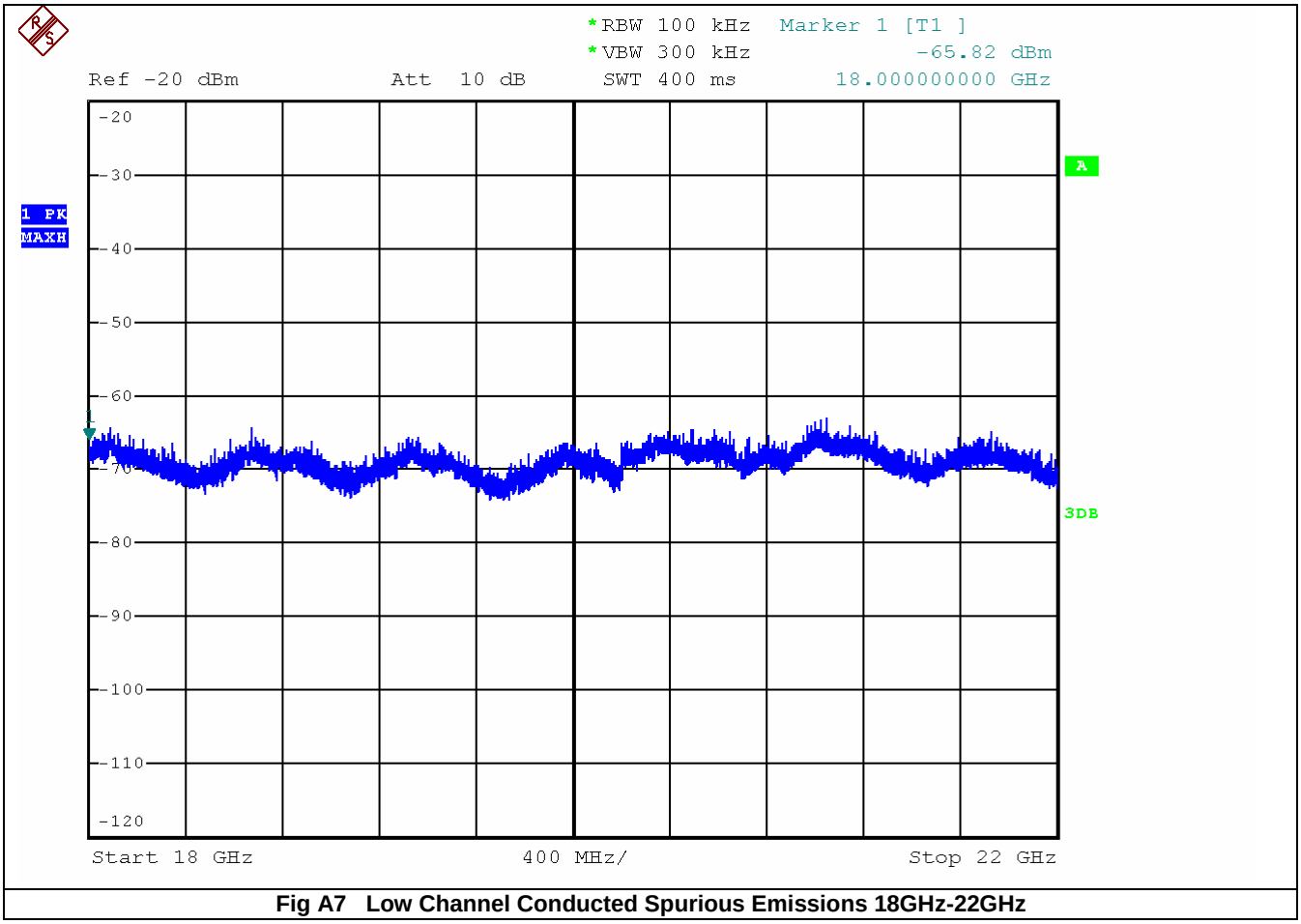


Fig A7 Low Channel Conducted Spurious Emissions 18GHz-22GHz

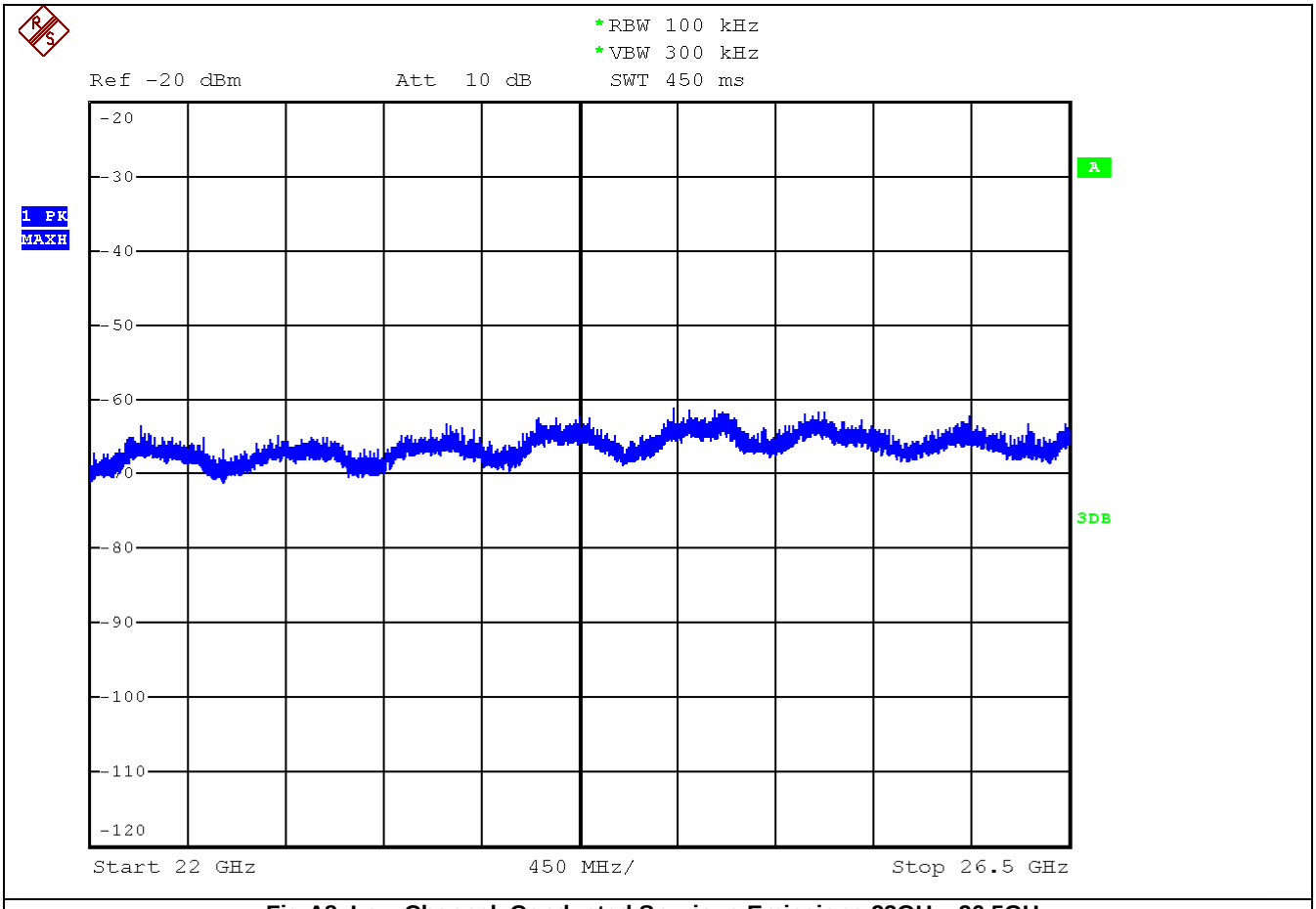


Fig A8 Low Channel Conducted Spurious Emissions 22GHz -26.5GHz

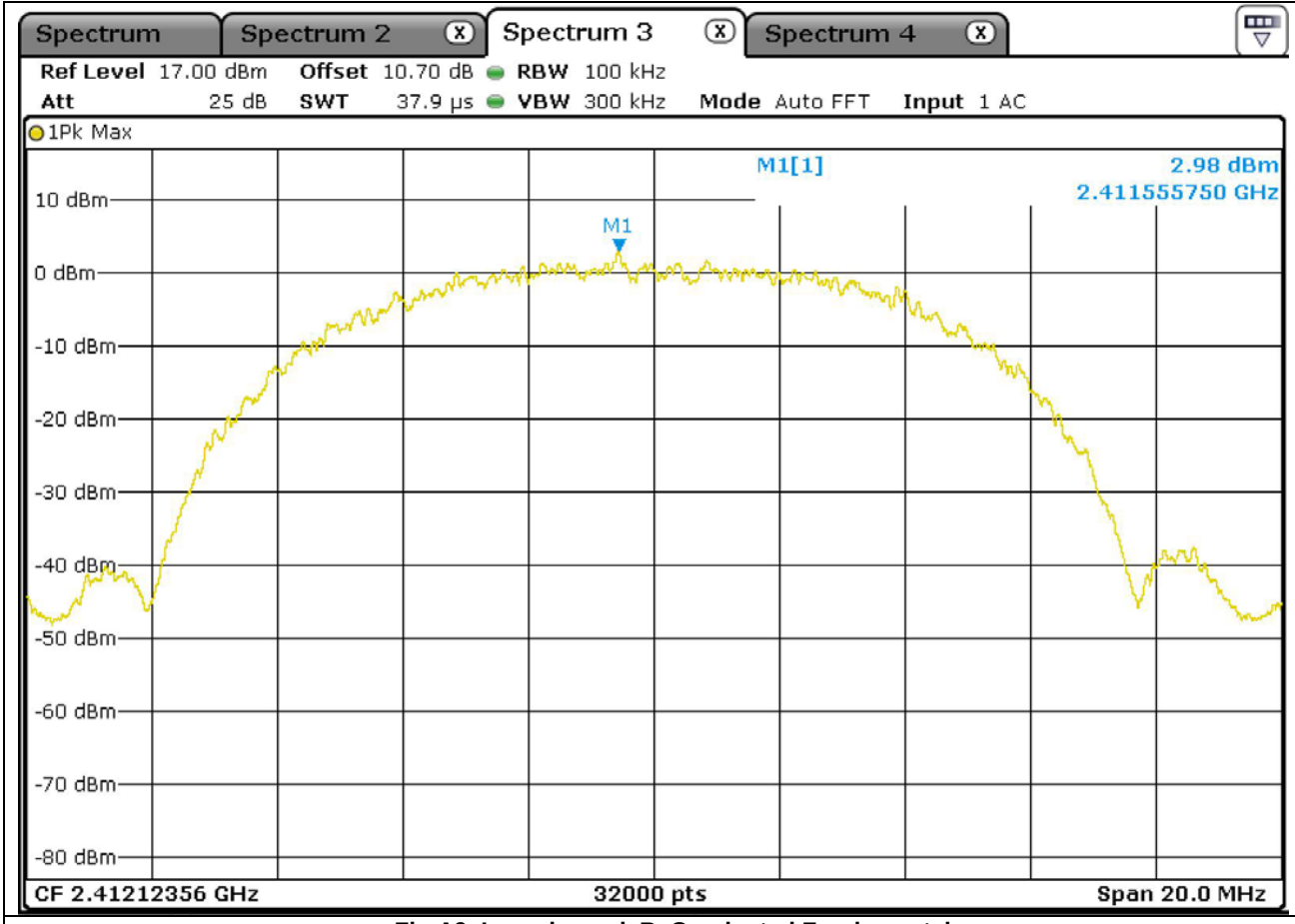


Fig A9 Low channel B Conducted Fundamental

Appendix B

Radiated tests for Band Edges /Restricted band

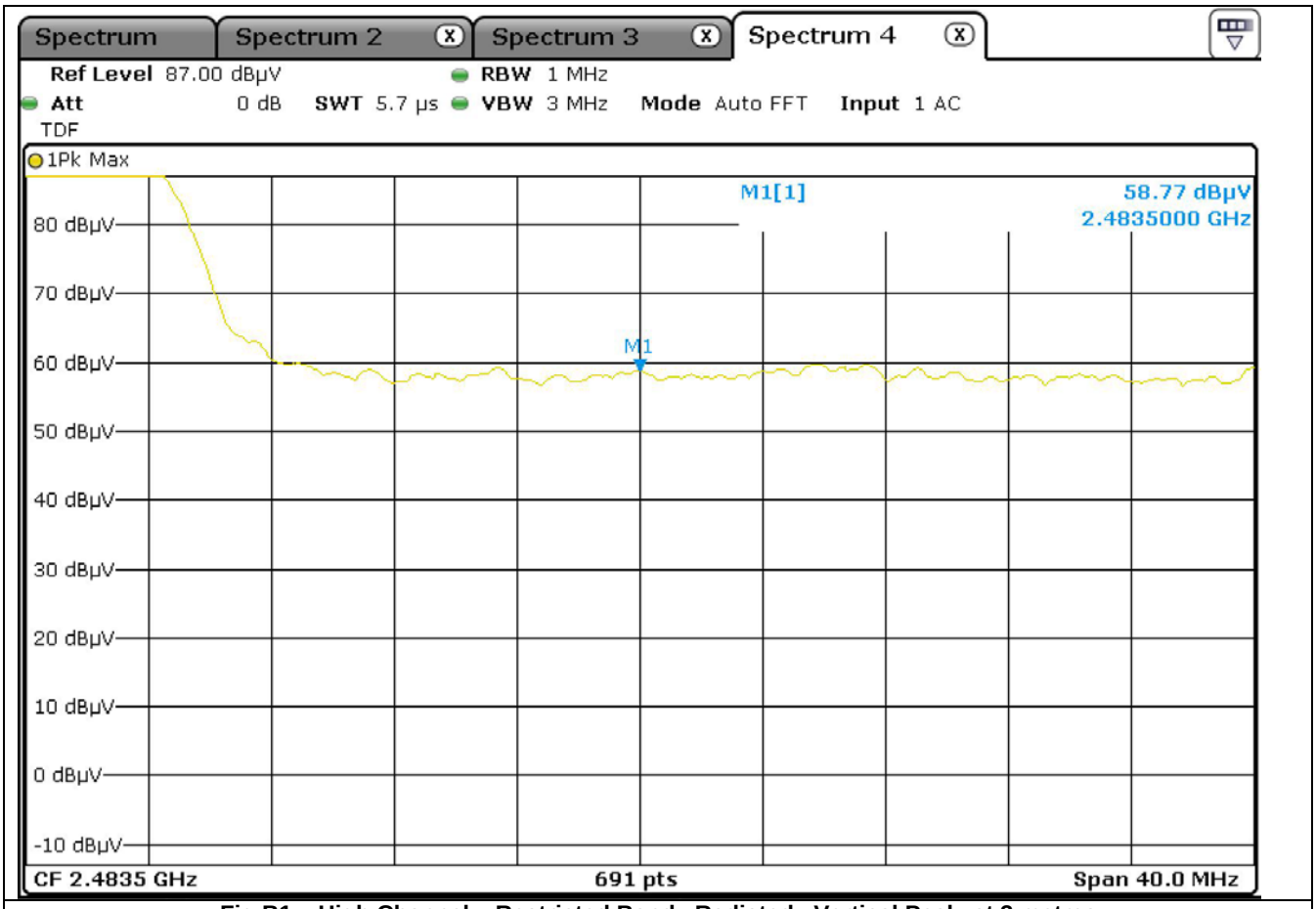


Fig B1 High Channel Restricted Band Radiated Vertical Peak at 3 metres

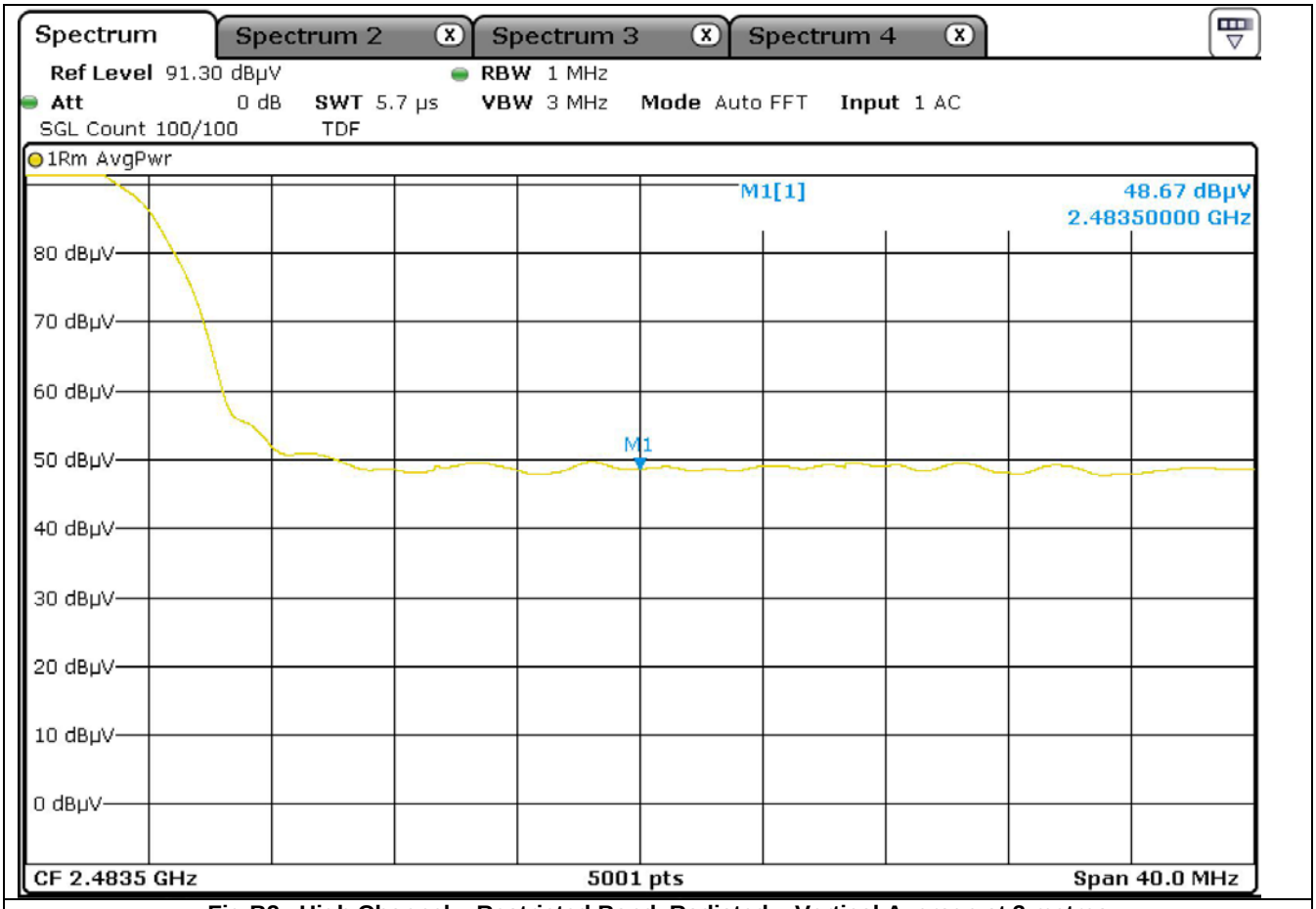


Fig B2 High Channel Restricted Band Radiated Vertical Average at 3 metres

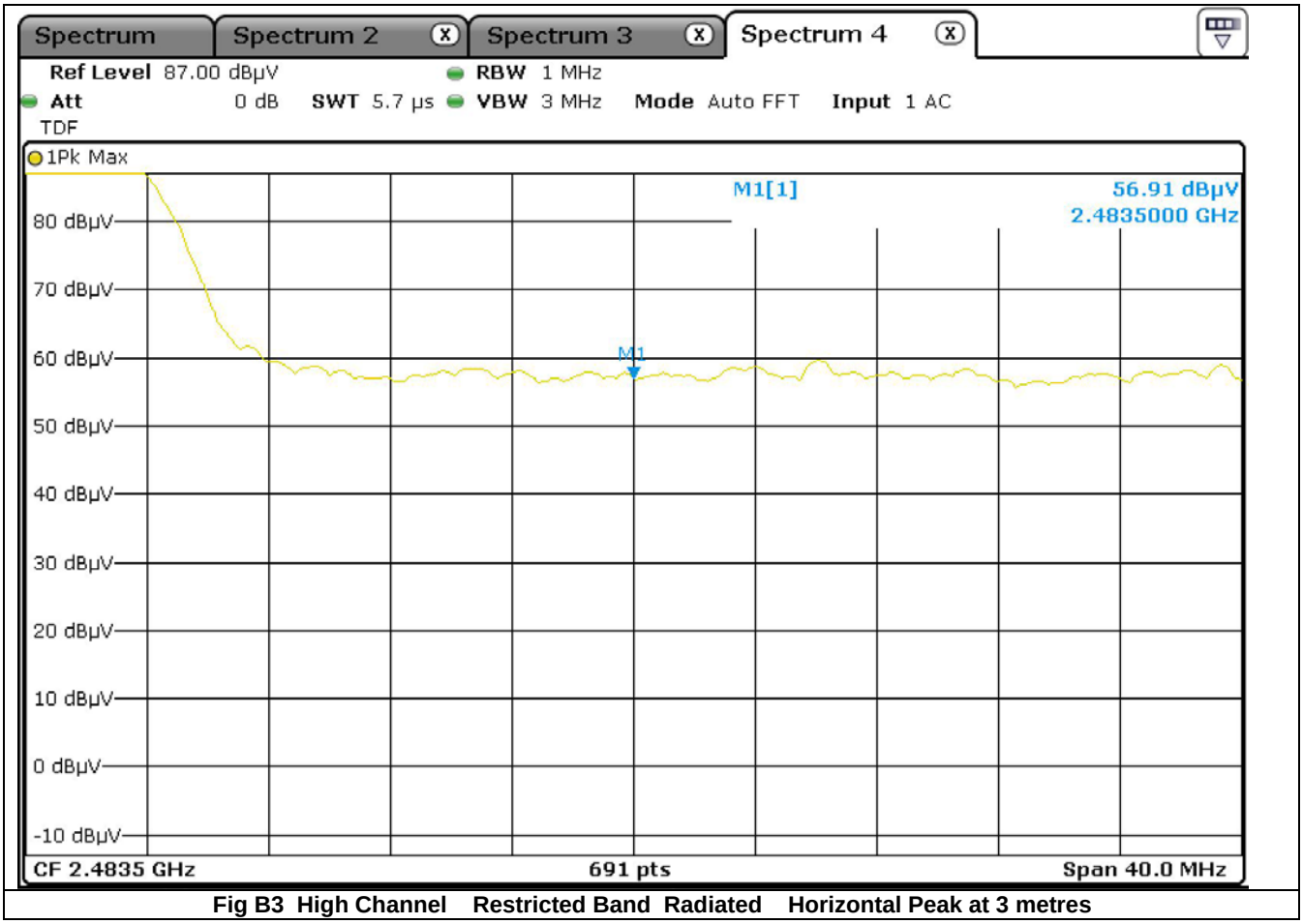


Fig B3 High Channel Restricted Band Radiated Horizontal Peak at 3 metres

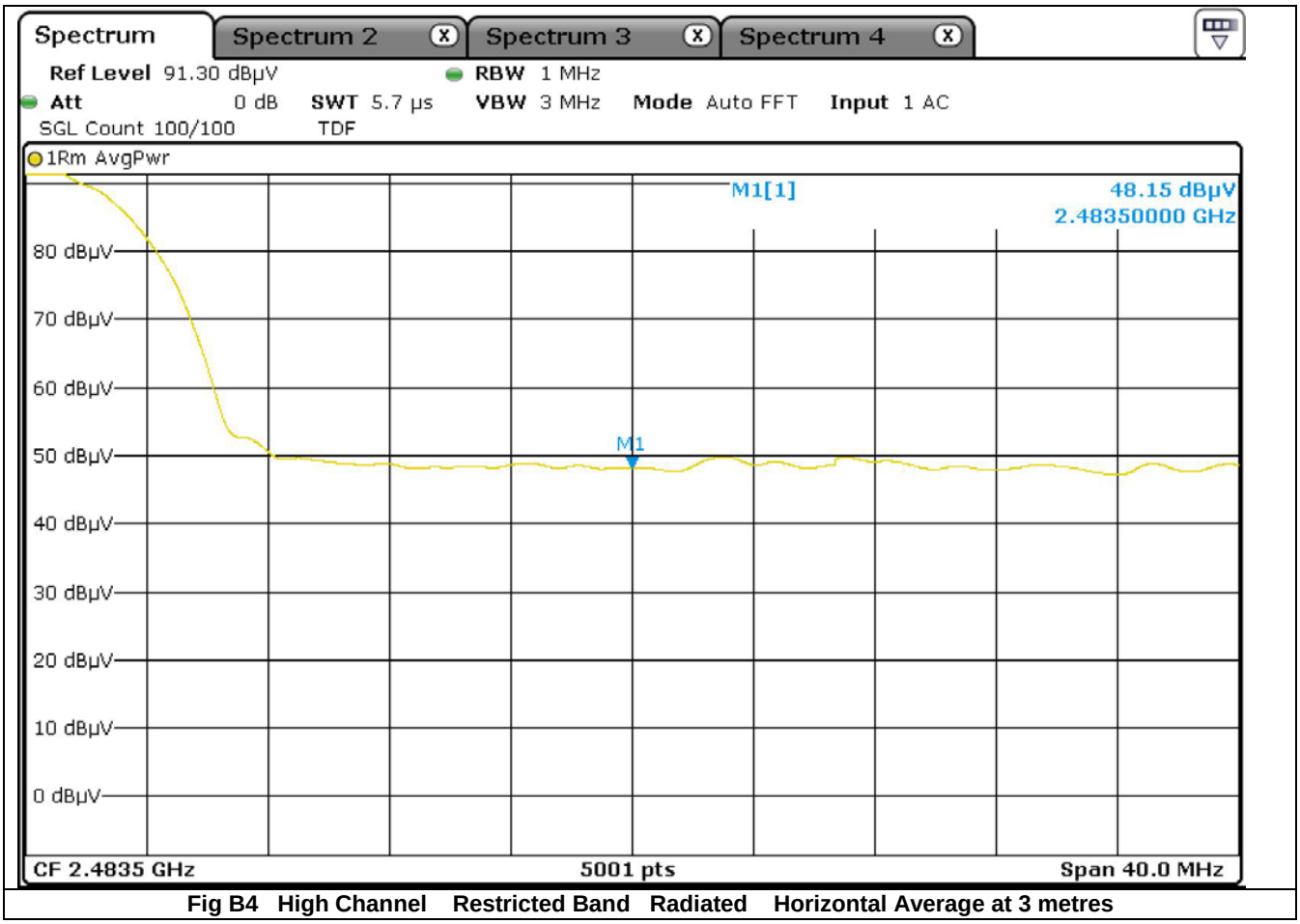


Fig B4 High Channel Restricted Band Radiated Horizontal Average at 3 metres

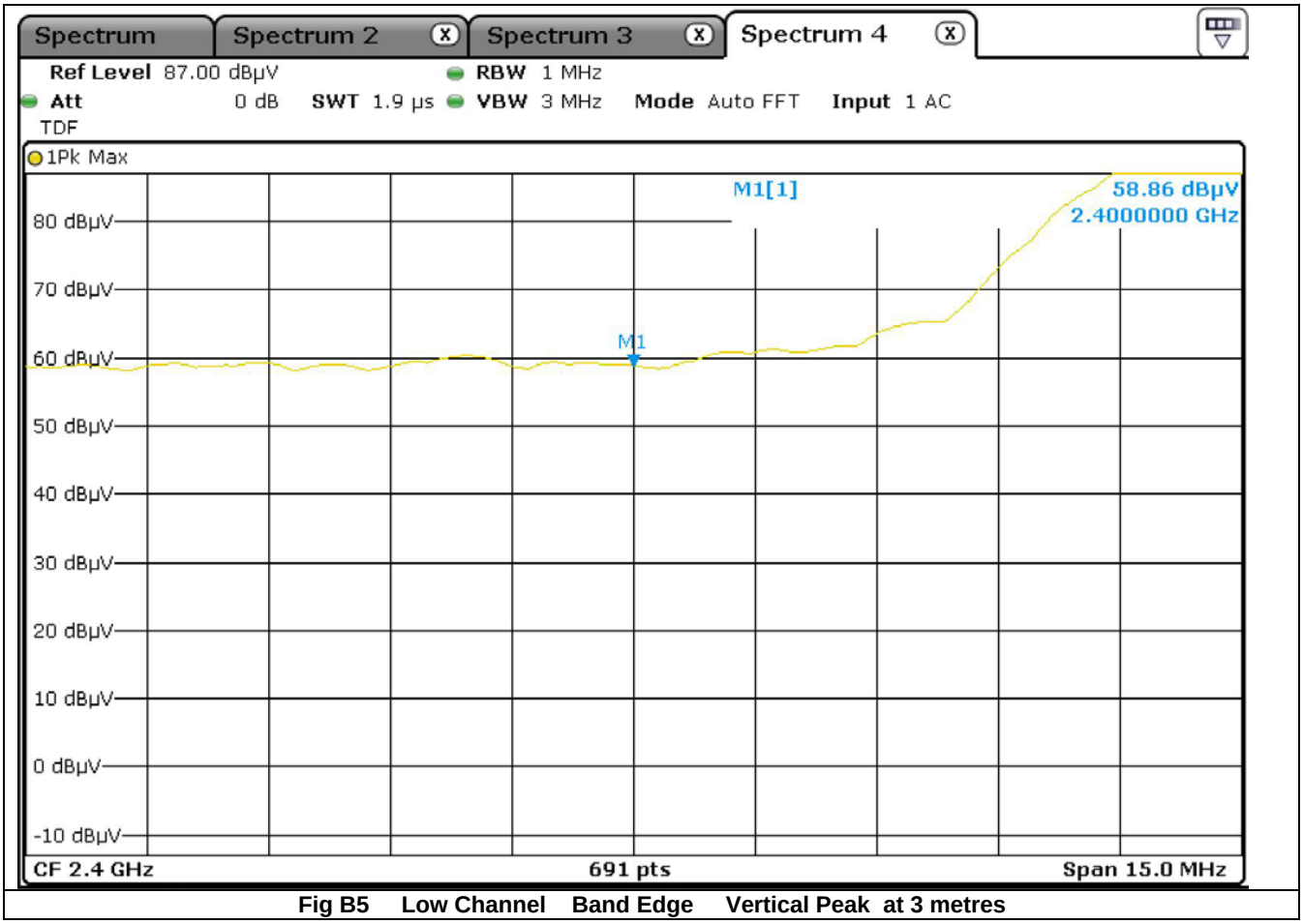


Fig B5 Low Channel Band Edge Vertical Peak at 3 metres

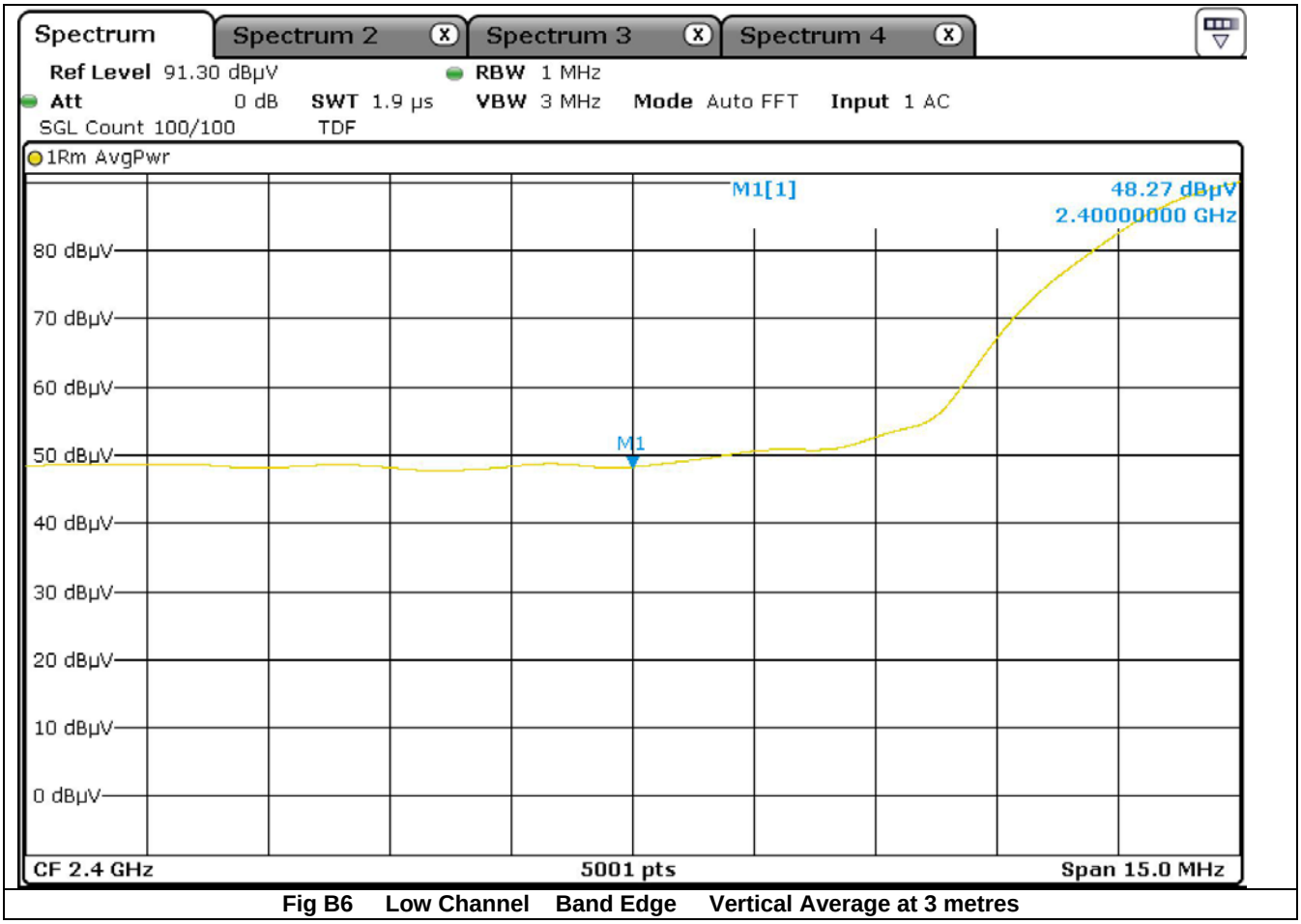


Fig B6 Low Channel Band Edge Vertical Average at 3 metres

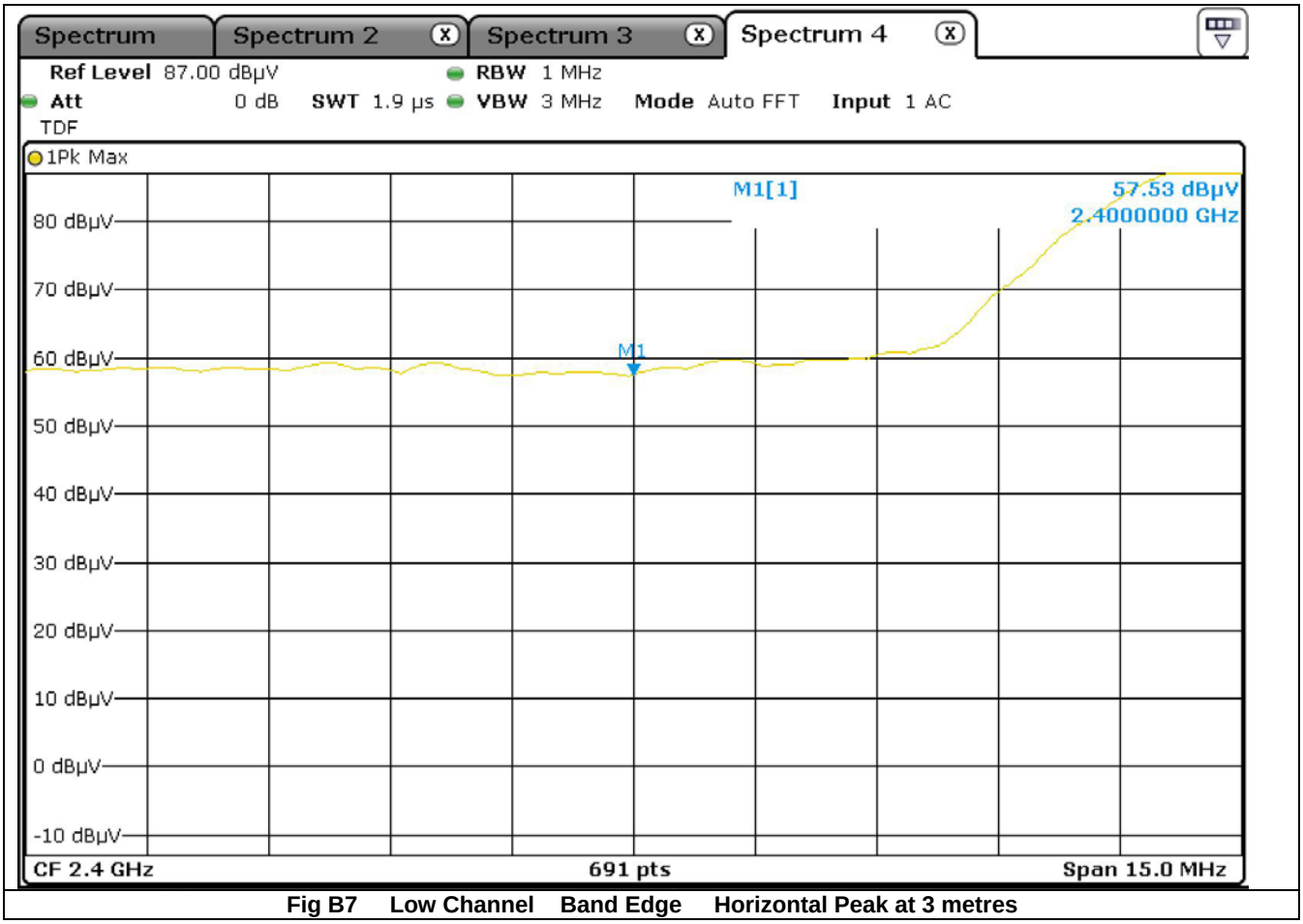


Fig B7 Low Channel Band Edge Horizontal Peak at 3 metres

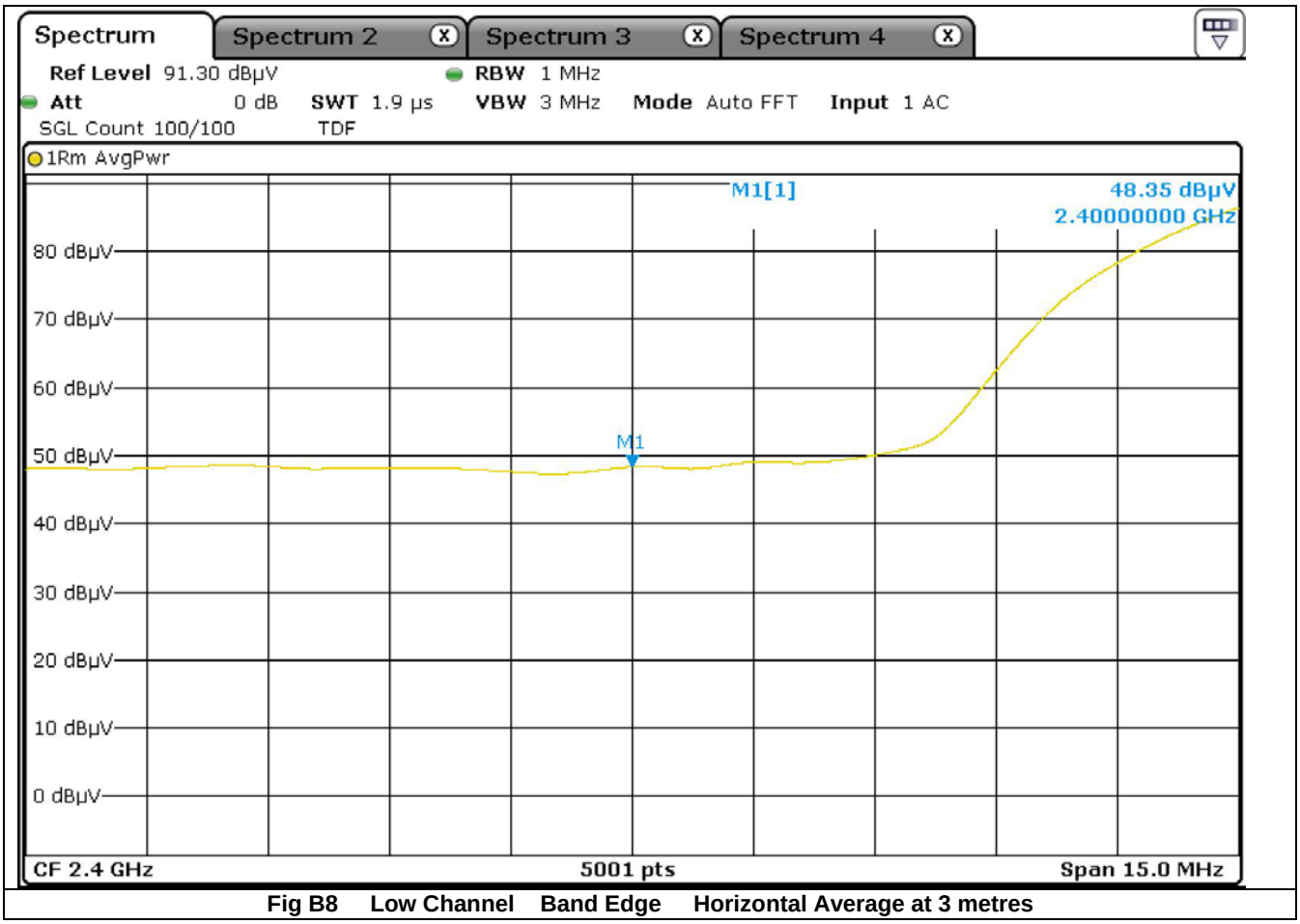


Fig B8 Low Channel Band Edge Horizontal Average at 3 metres

Peak measurement performed with Resolution Bandwidth set to 1MHz as per ANSI C63.10-2013 Section 4.1.4.2.2 and KDB 558074 Section 12.2.4 Peak power measurement procedure

Average measurements as per KDB 558074 Section 12.2.5.1 Trace averaging with continuous EUT transmission at full power

Appendix C

Radiated Spurious Emissions
Conducted sample with antenna port terminated

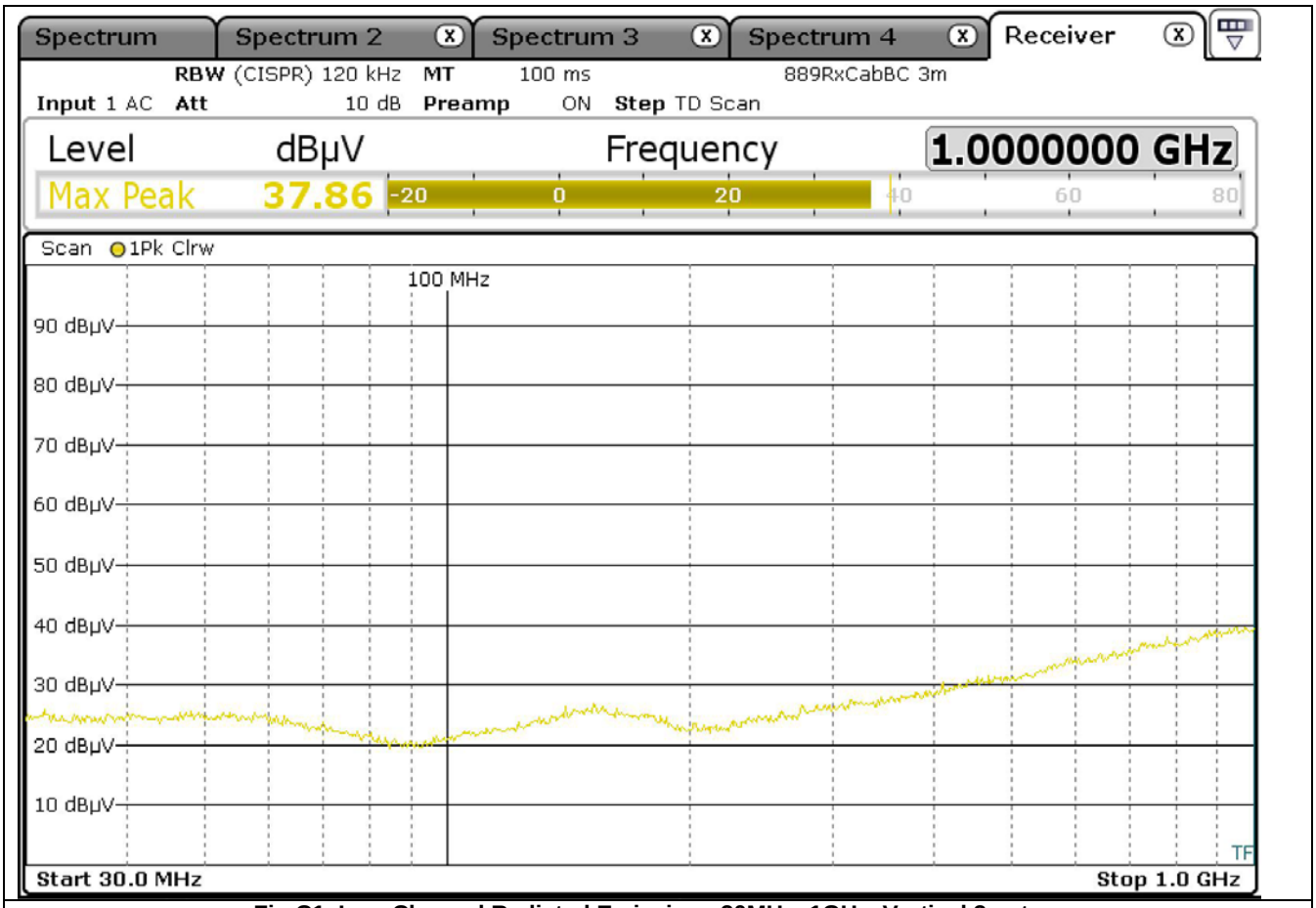


Fig C1 Low Channel Radiated Emissions 30MHz -1GHz Vertical 3metres

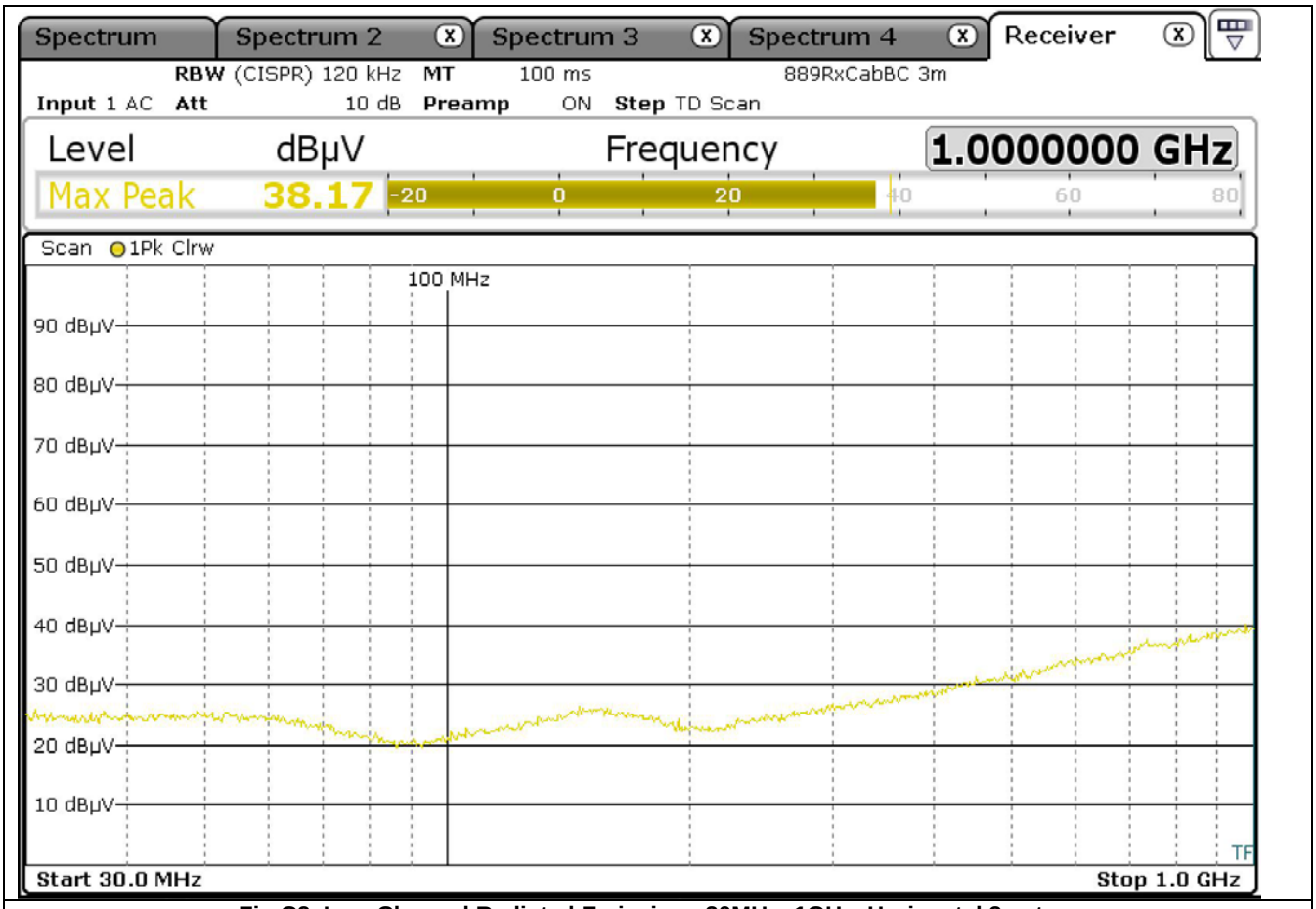


Fig C2 Low Channel Radiated Emissions 30MHz -1GHz Horizontal 3metres

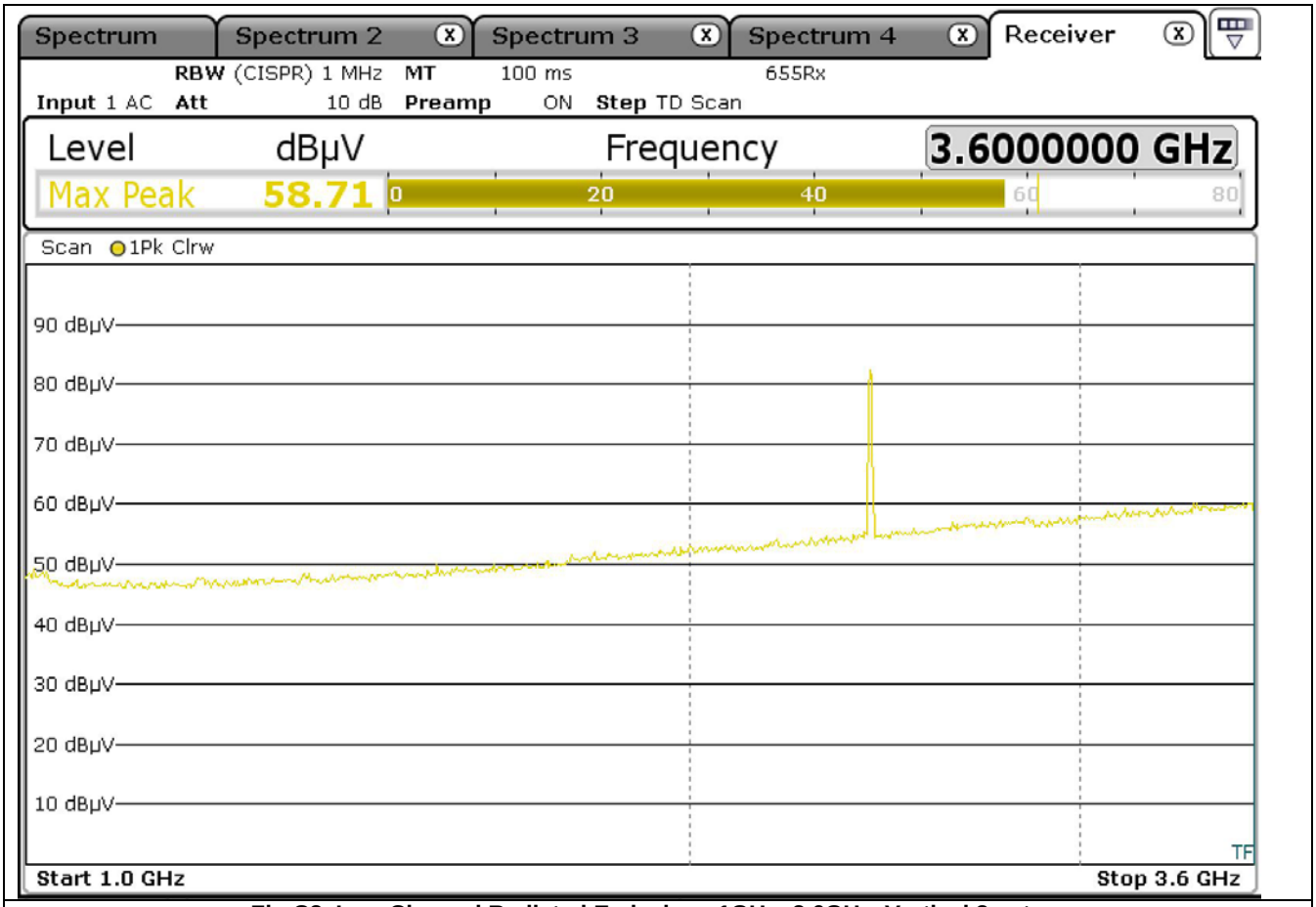


Fig C3 Low Channel Radiated Emissions 1GHz -3.6GHz Vertical 3metres

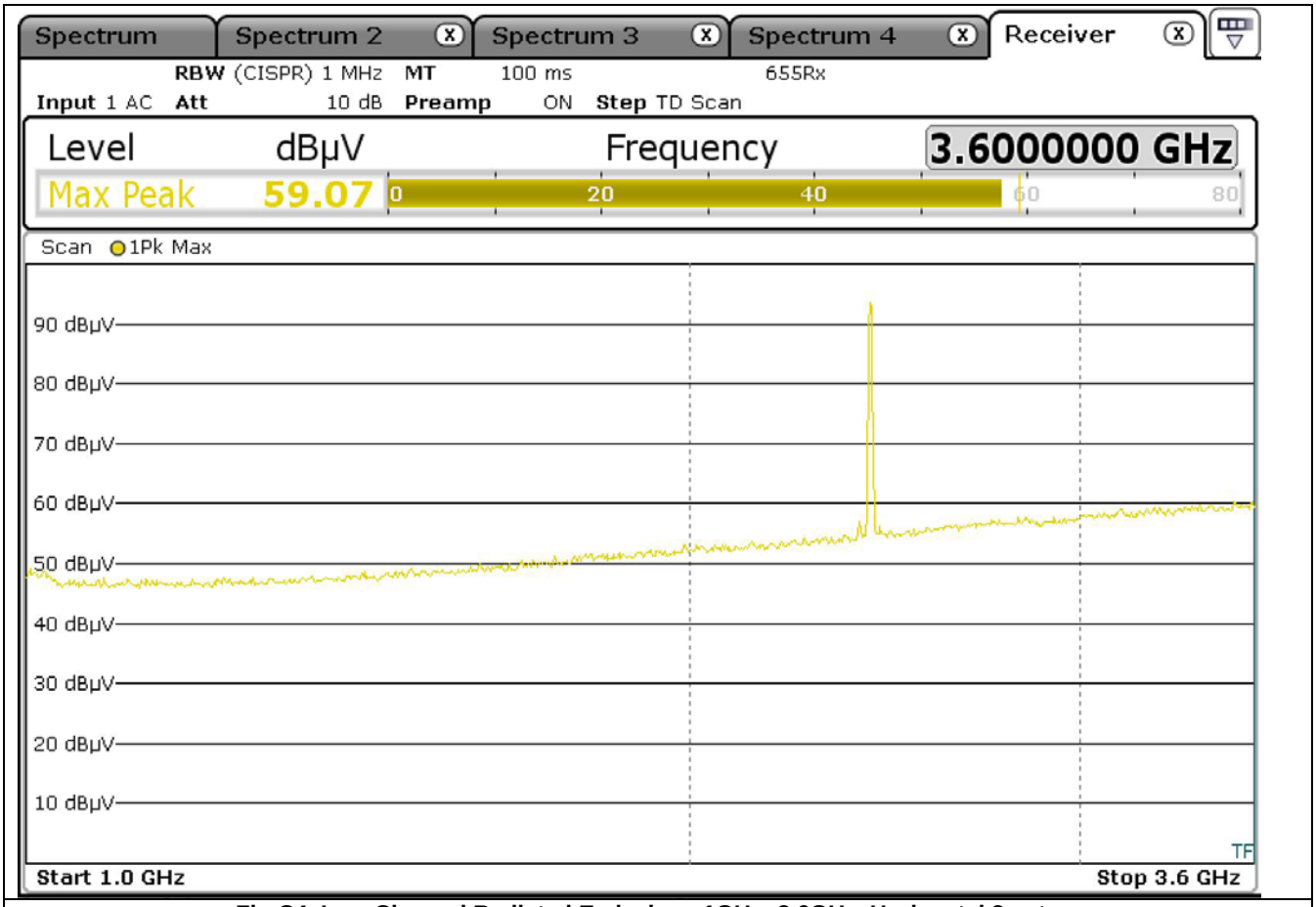


Fig C4 Low Channel Radiated Emissions 1GHz -3.6GHz Horizontal 3metres

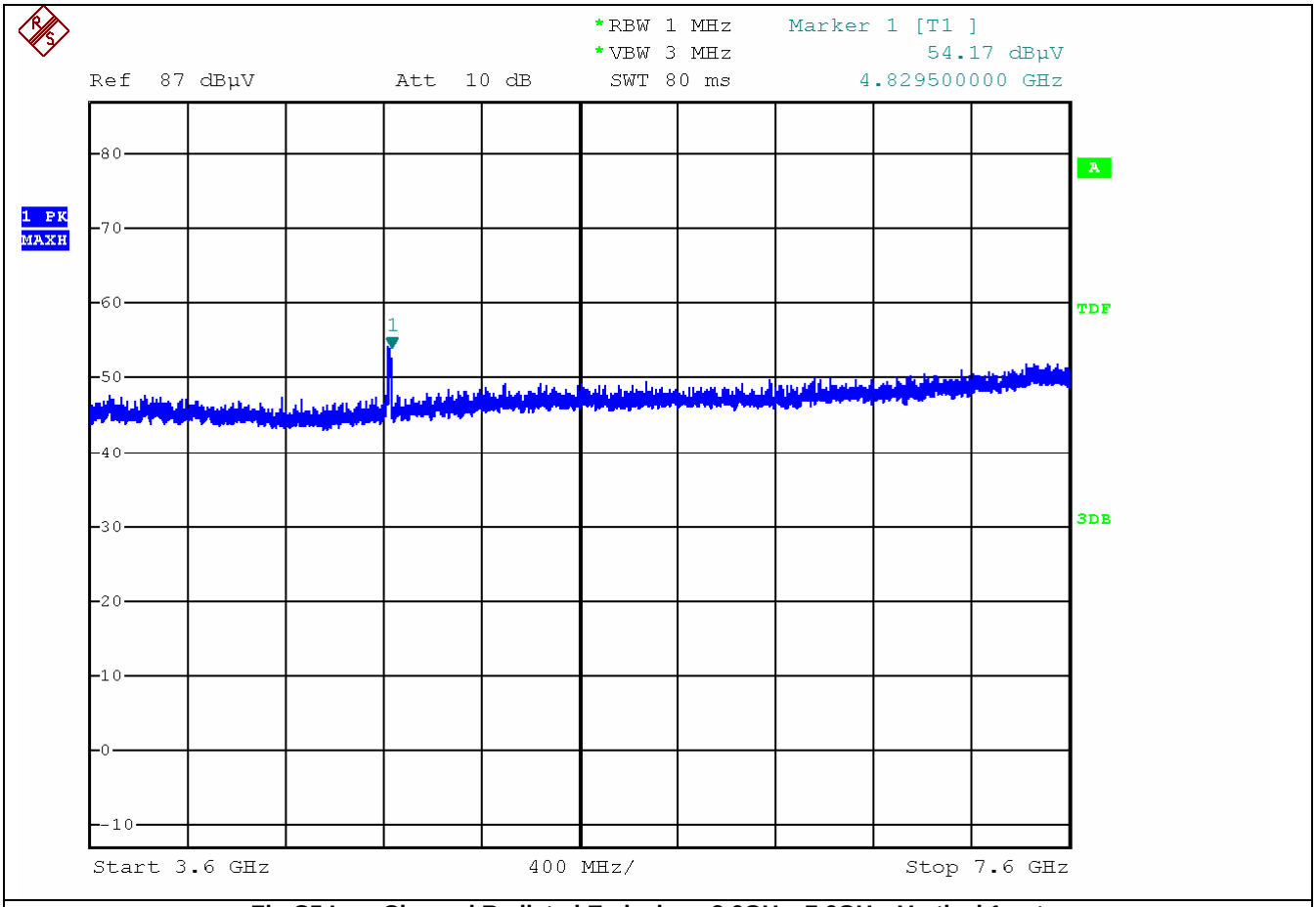


Fig C5 Low Channel Radiated Emissions 3.6GHz -7.6GHz Vertical 1metre

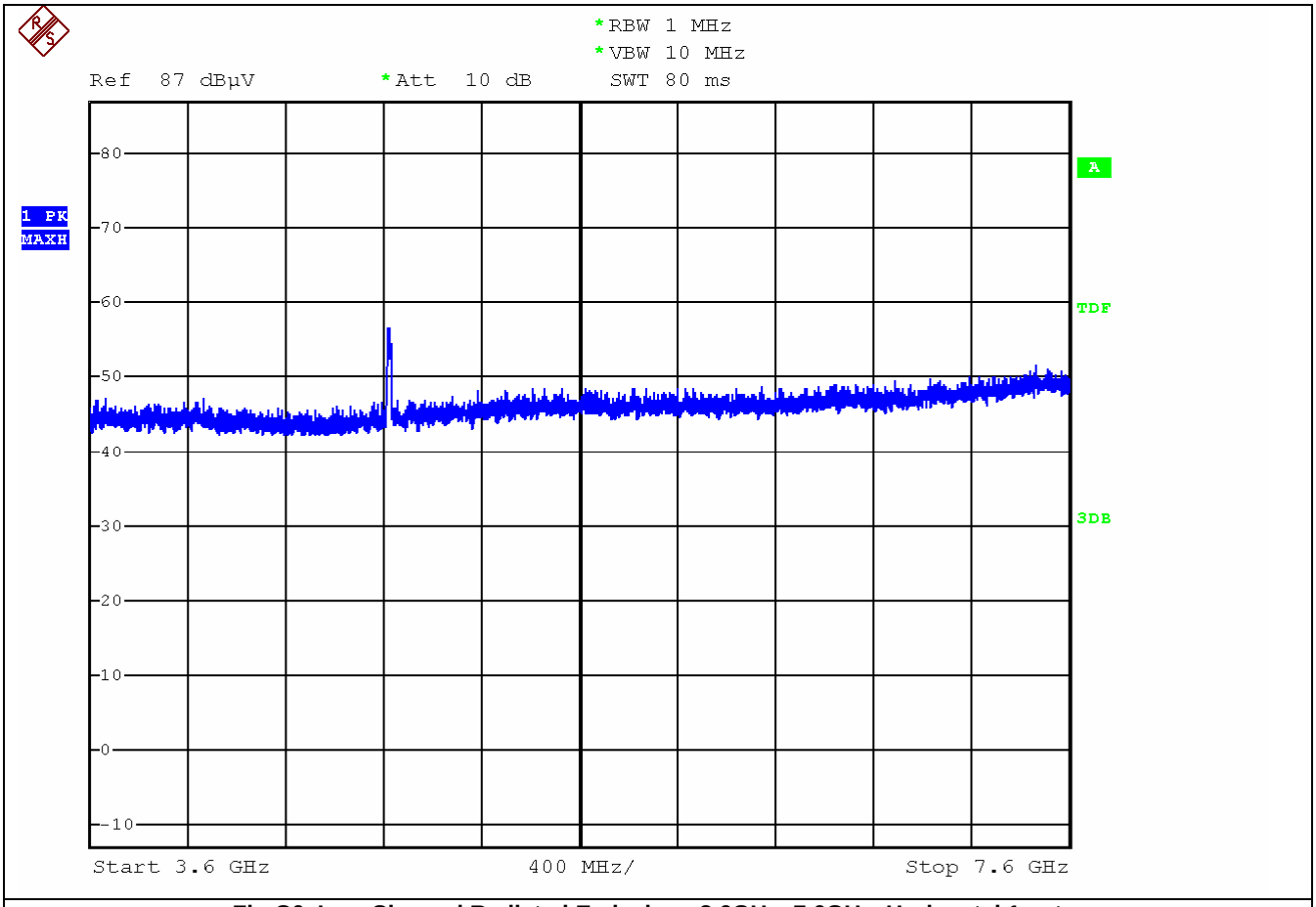


Fig C6 Low Channel Radiated Emissions 3.6GHz -7.6GHz Horizontal 1metre

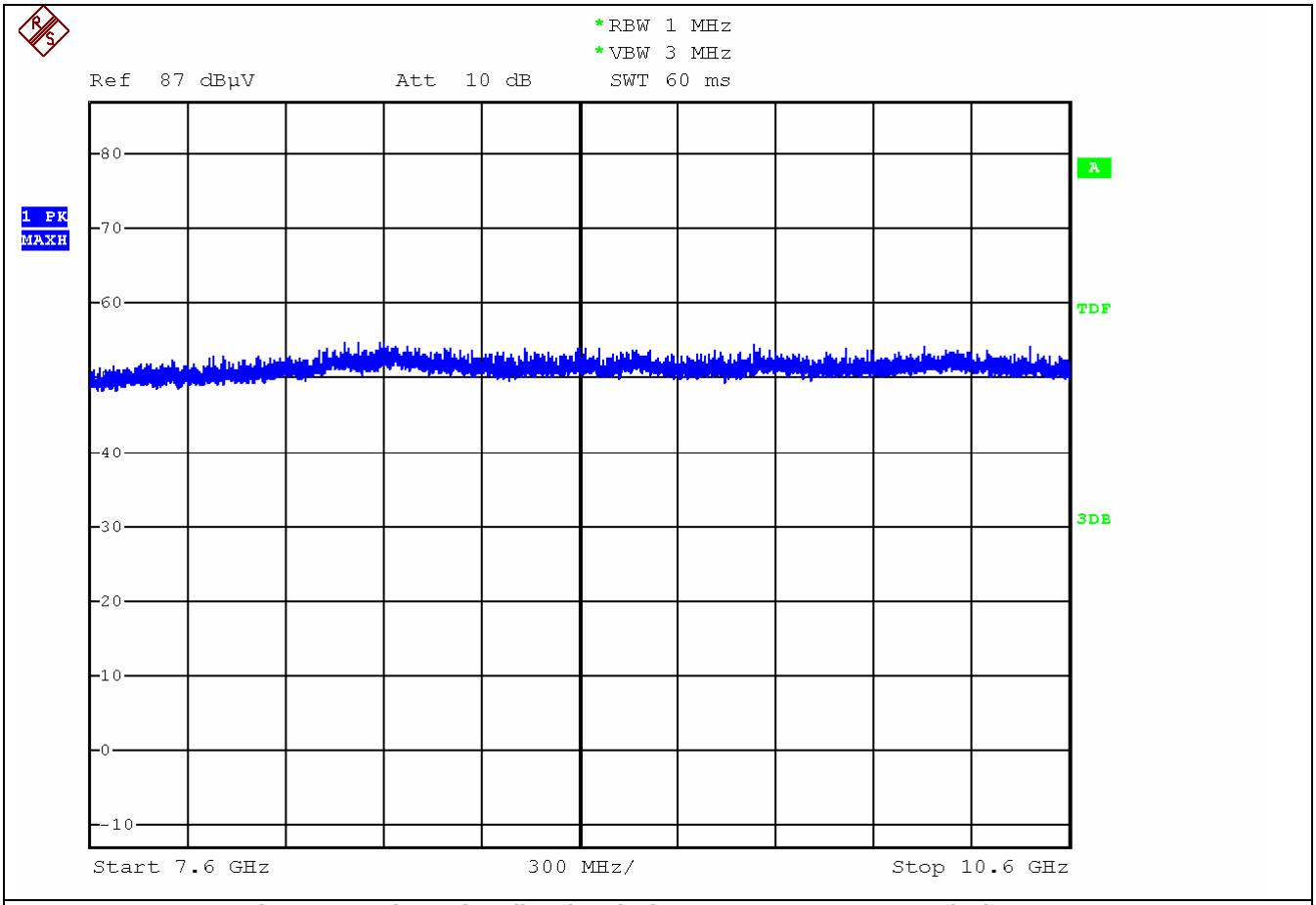


Fig C7 Low Channel Radiated Emissions 7.6GHz -10.6GHz Vertical 1metre

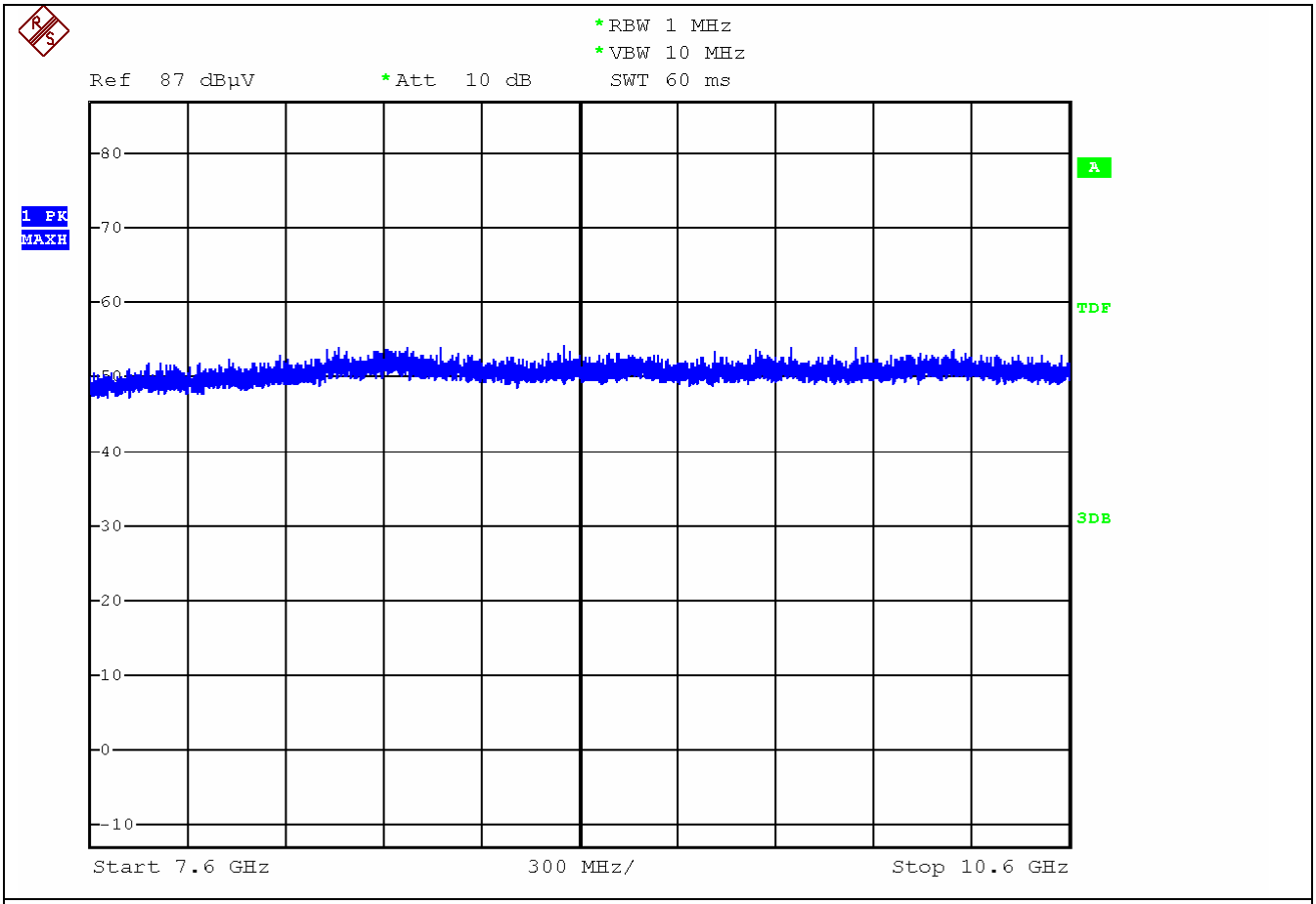


Fig C8 Low Channel Radiated Emissions 7.6GHz -10.6GHz Horizontal 1metre

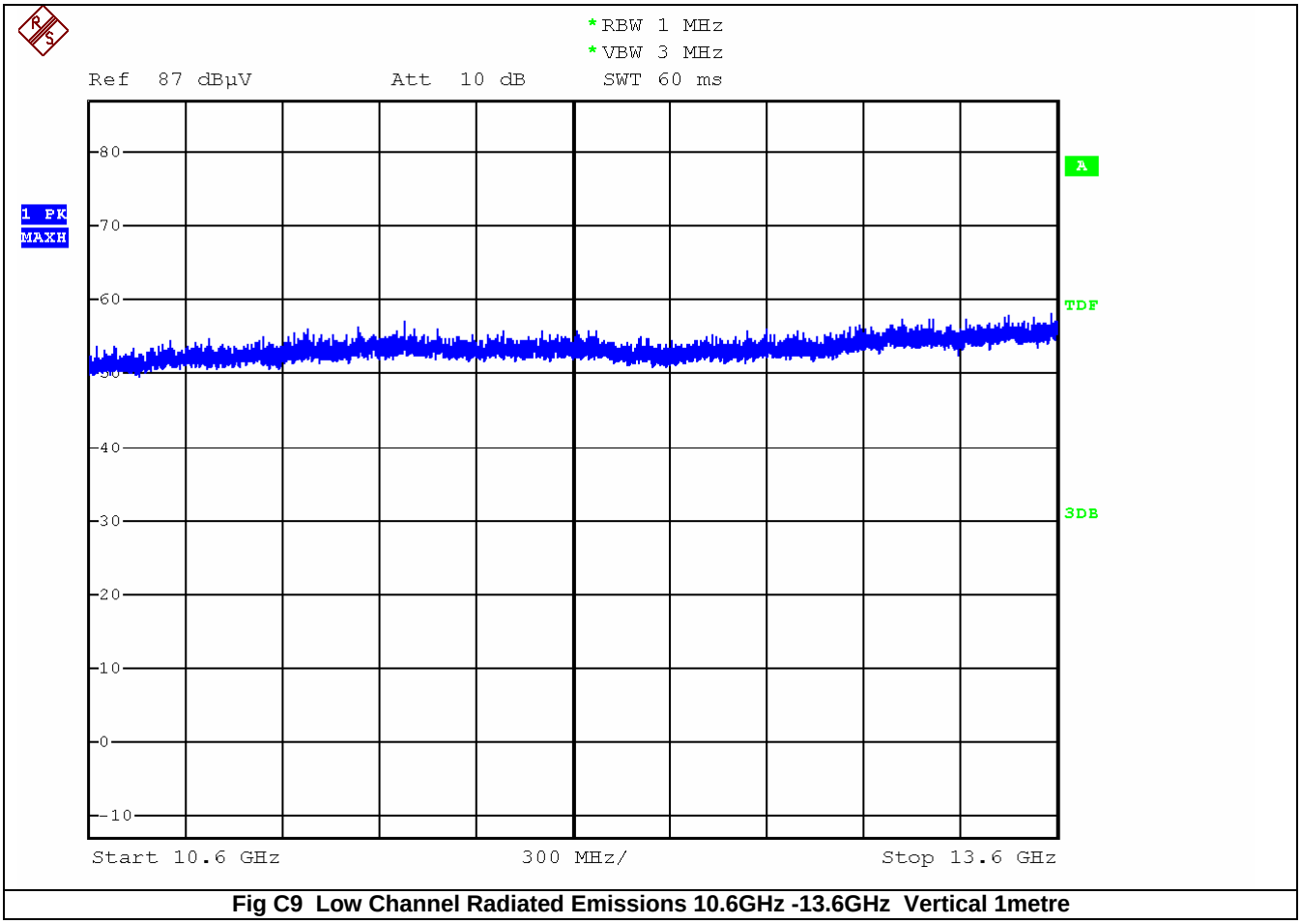


Fig C9 Low Channel Radiated Emissions 10.6GHz -13.6GHz Vertical 1metre

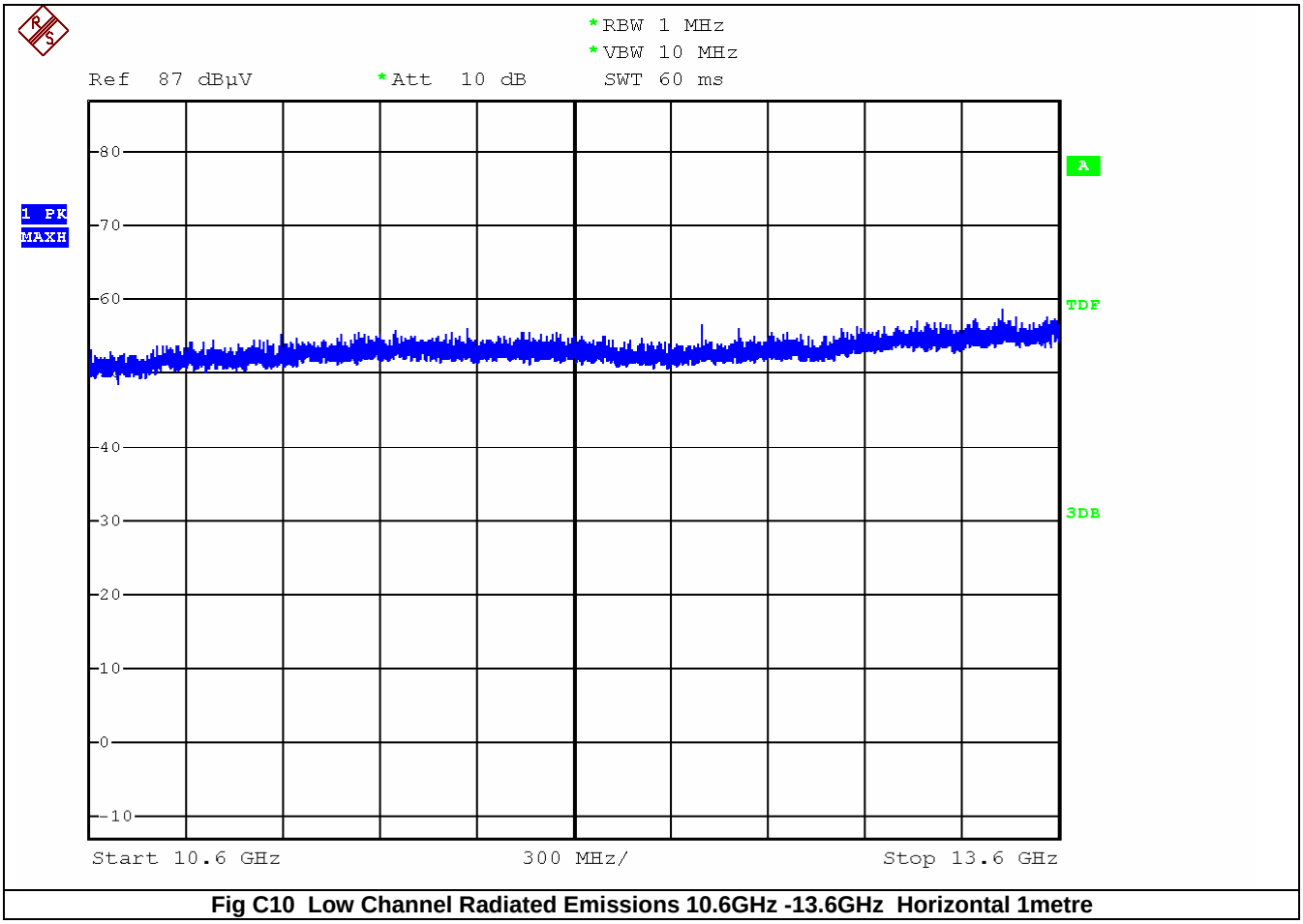


Fig C10 Low Channel Radiated Emissions 10.6GHz -13.6GHz Horizontal 1metre

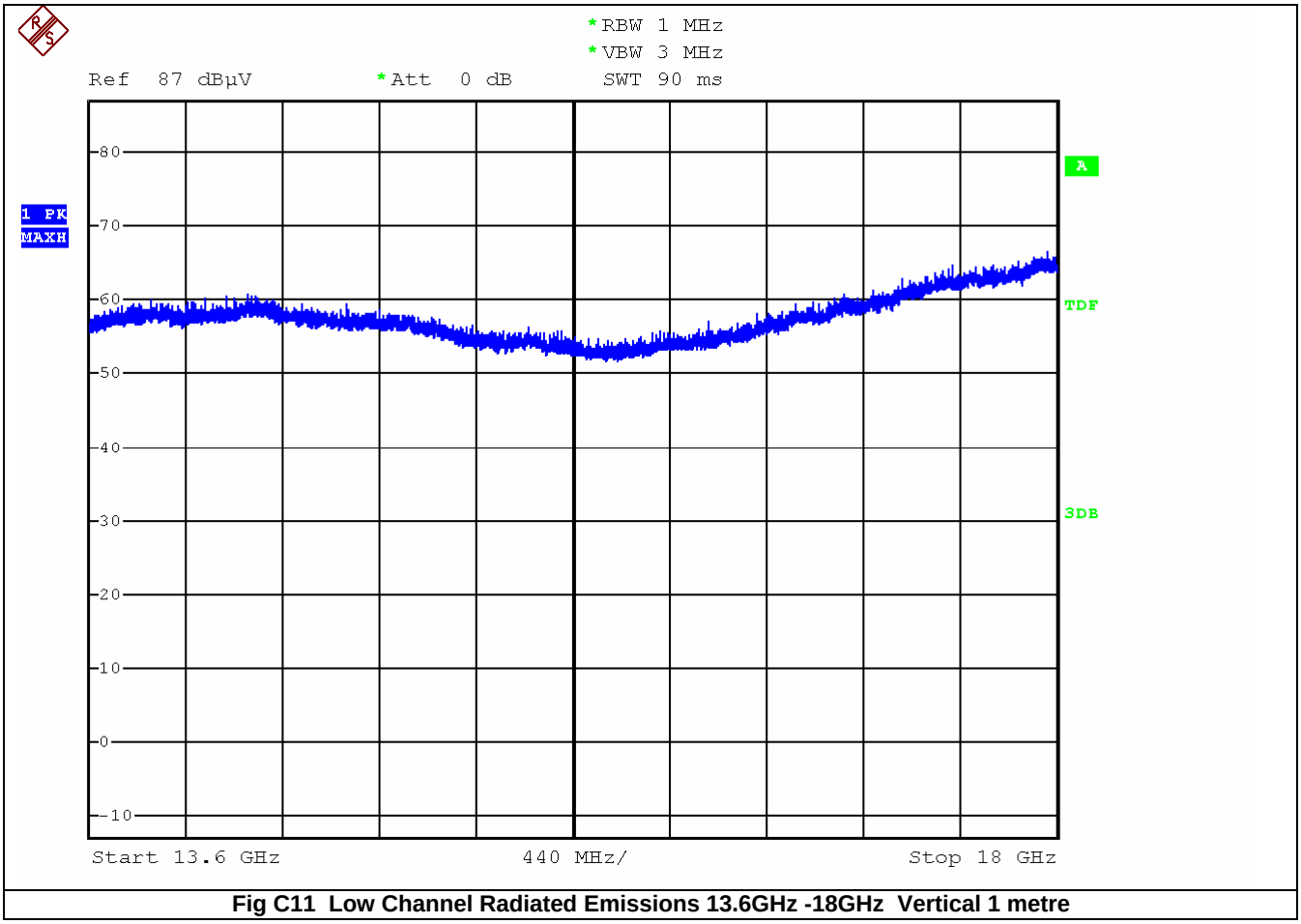


Fig C11 Low Channel Radiated Emissions 13.6GHz -18GHz Vertical 1 metre

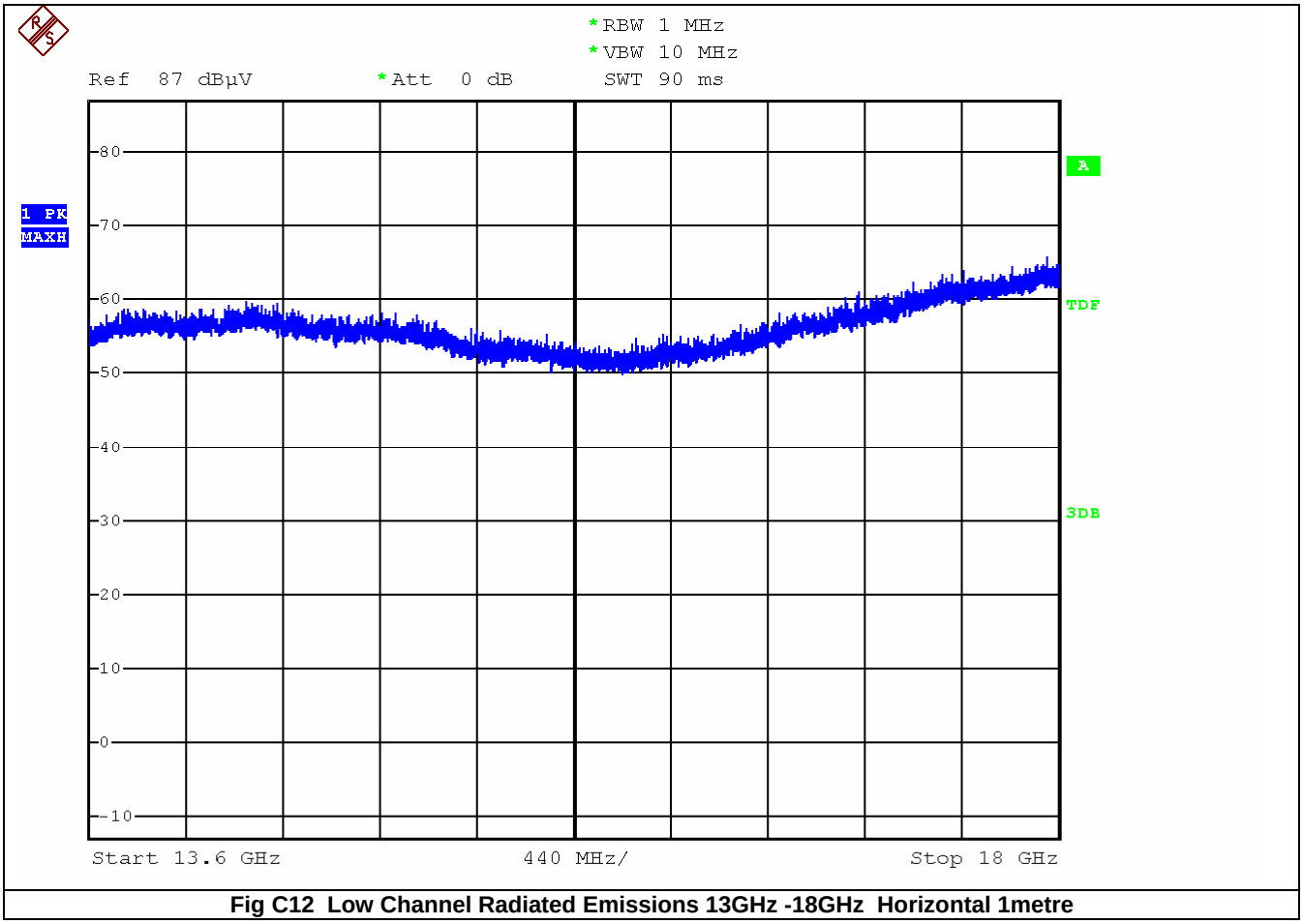


Fig C12 Low Channel Radiated Emissions 13GHz -18GHz Horizontal 1metre

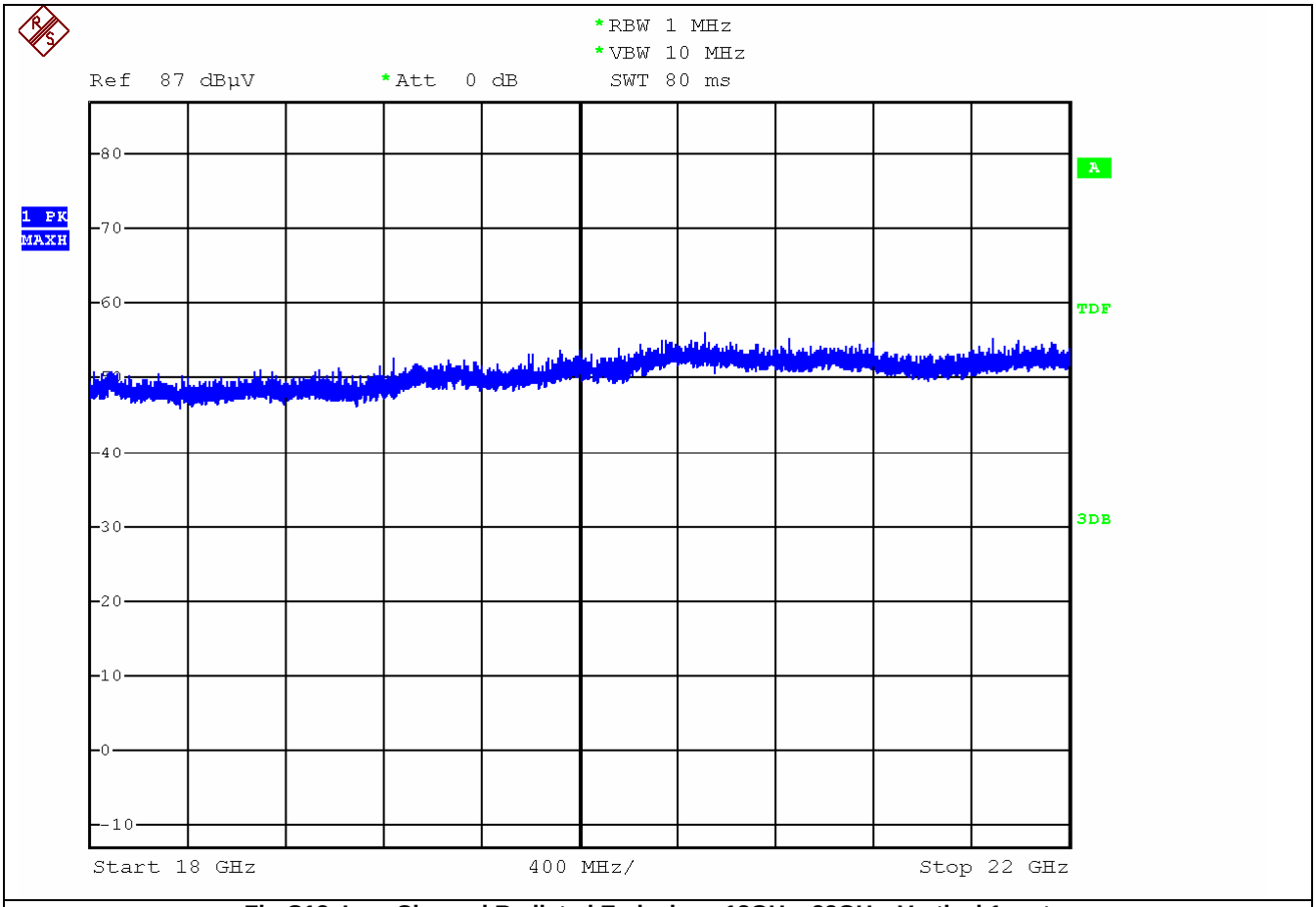


Fig C13 Low Channel Radiated Emissions 18GHz -22GHz Vertical 1 metre

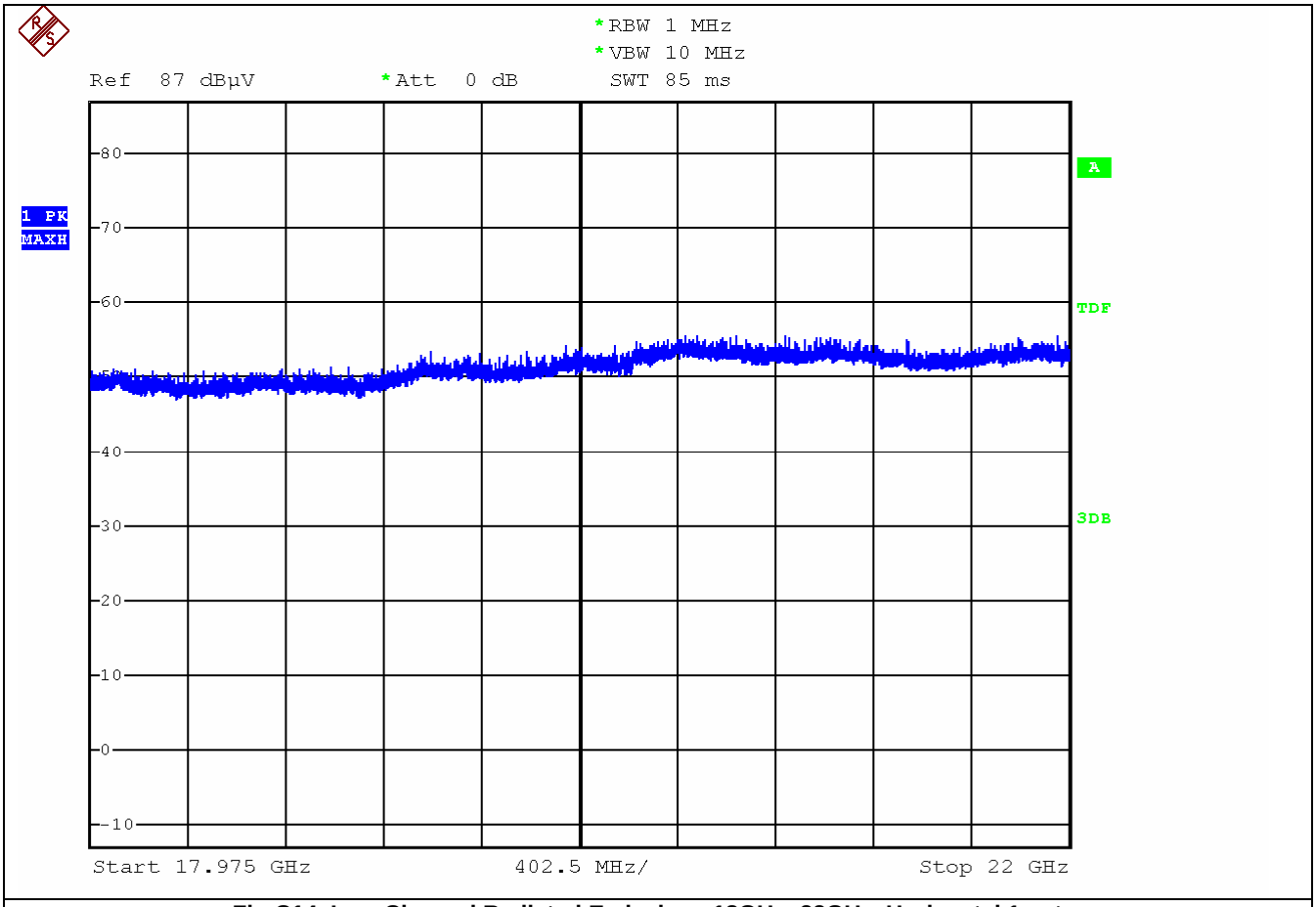


Fig C14 Low Channel Radiated Emissions 18GHz -22GHz Horizontal 1metre

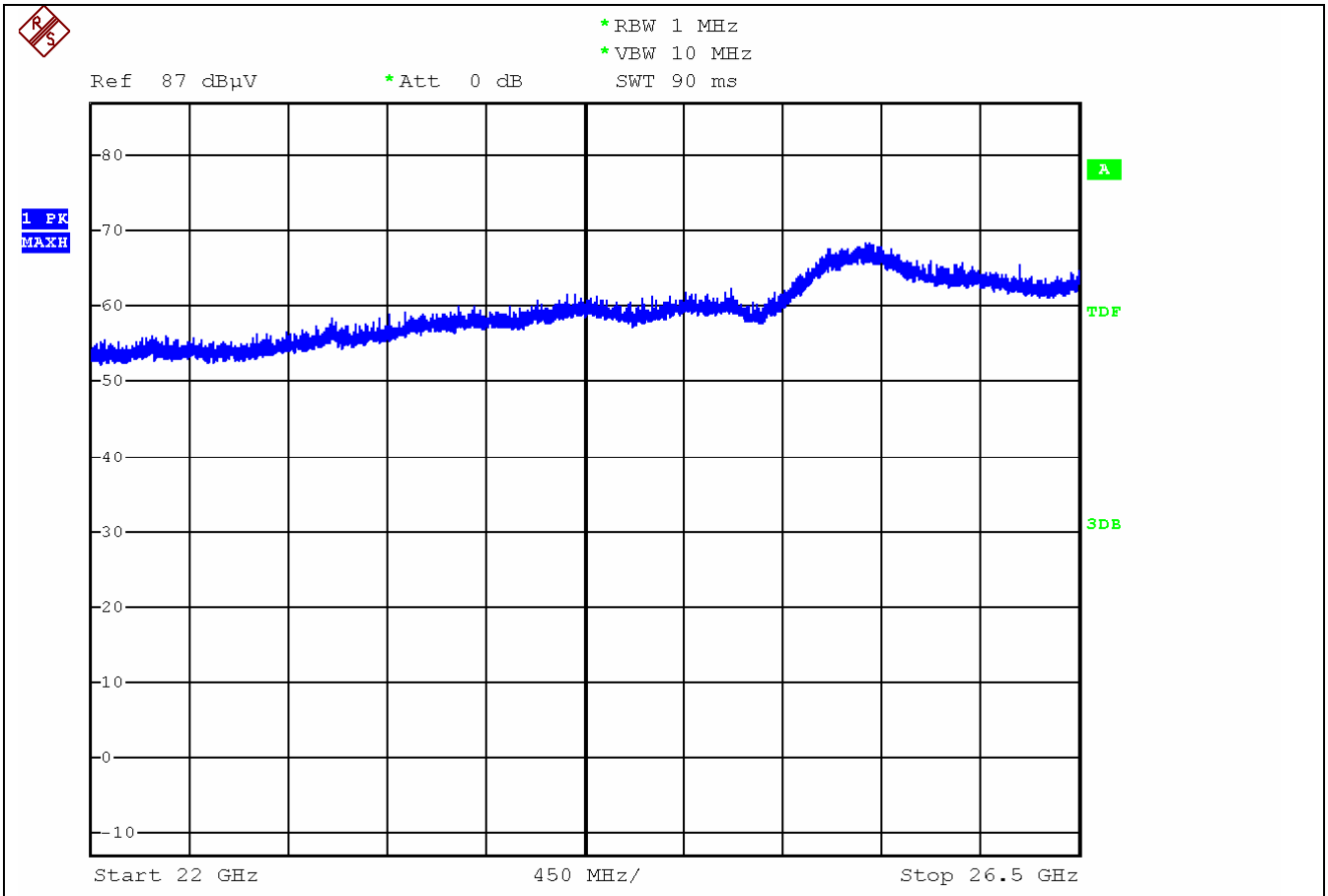


Fig C15 Low Channel Radiated Emissions 22GHz -26.5GHz Vertical 1 metre

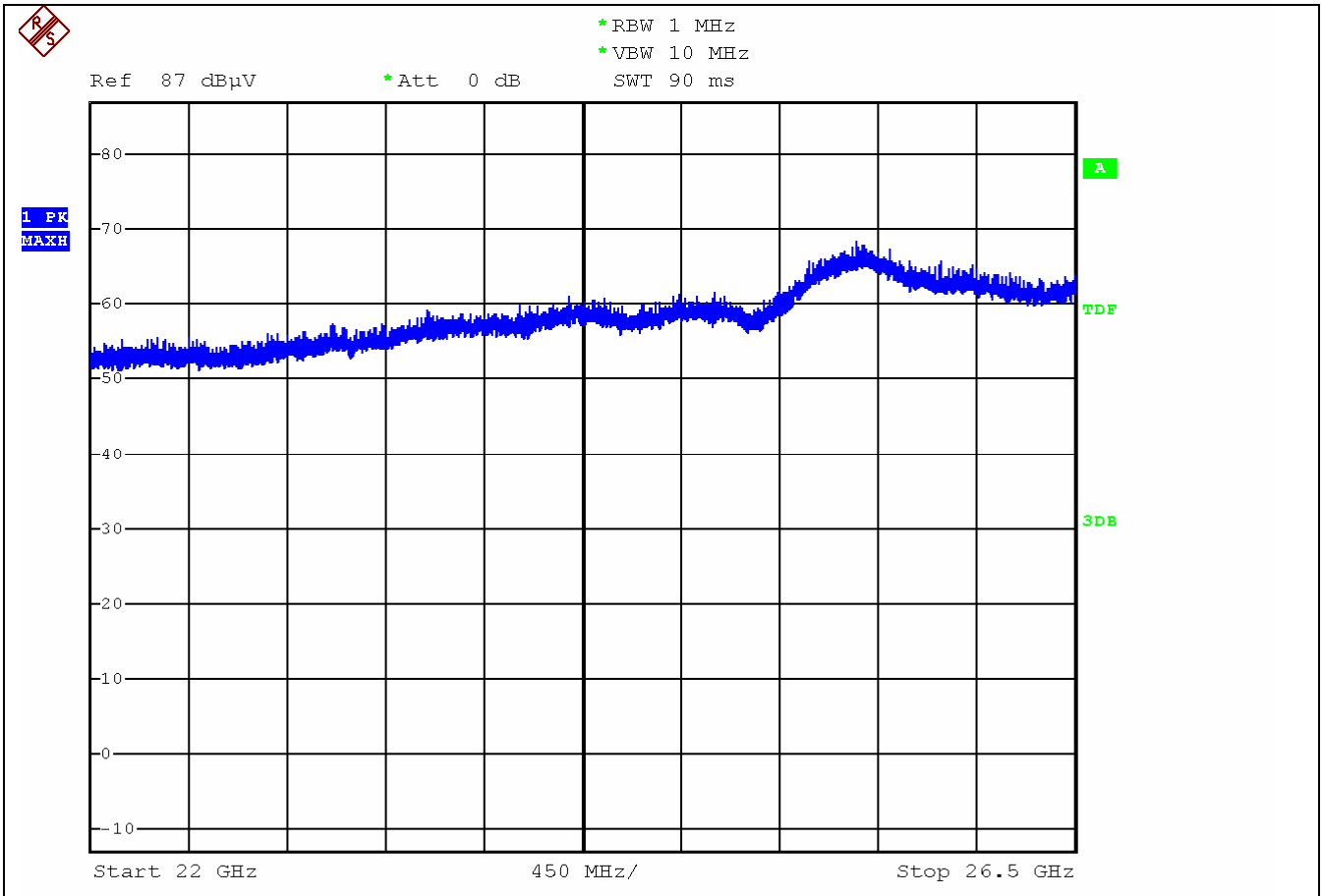


Fig C16 Low Channel Radiated Emissions 22GHz -26.5GHz Horizontal 1metre

Appendix D

Radiated Spurious Emissions
Radiated sample with Host internal antenna

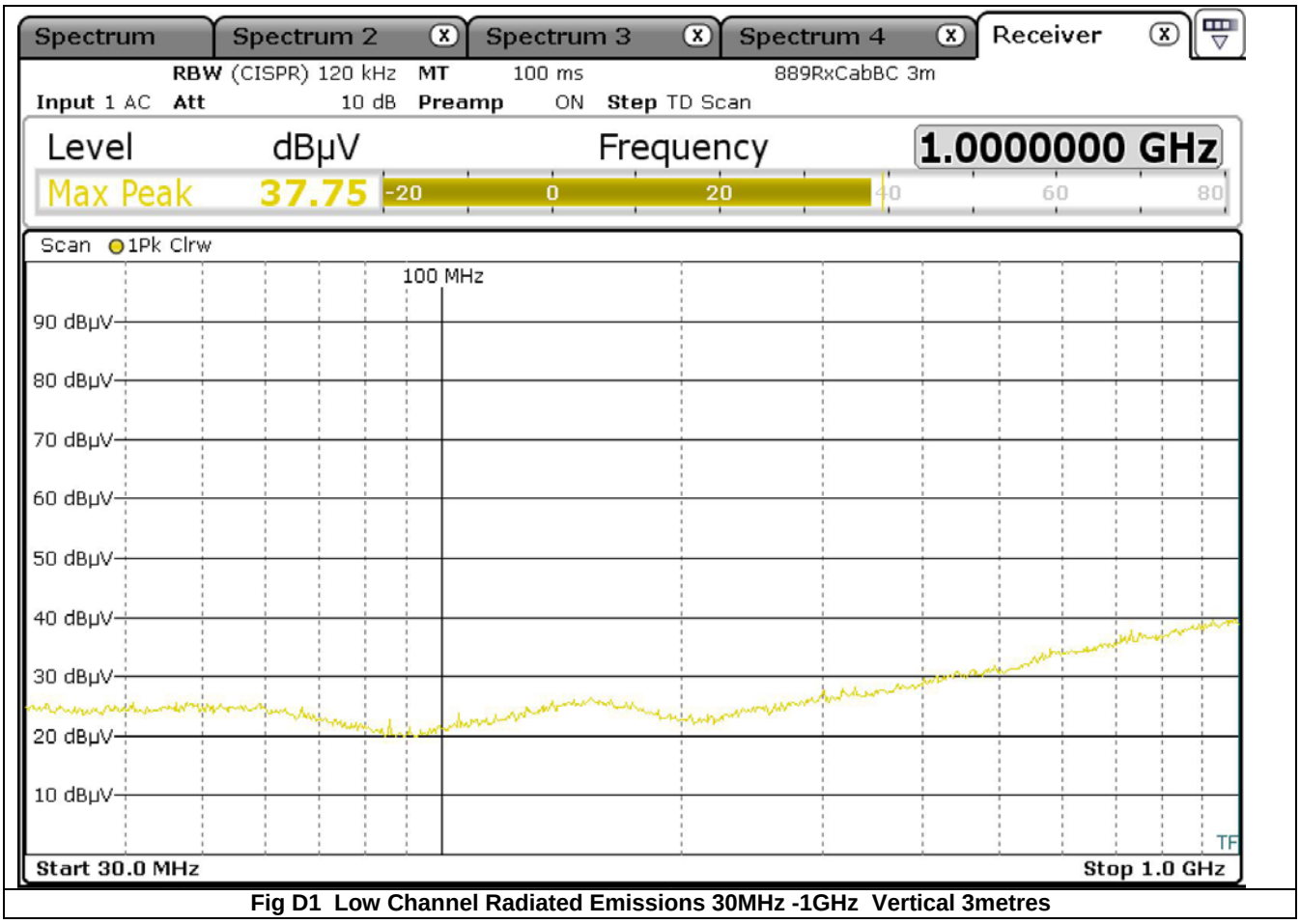


Fig D1 Low Channel Radiated Emissions 30MHz -1GHz Vertical 3metres

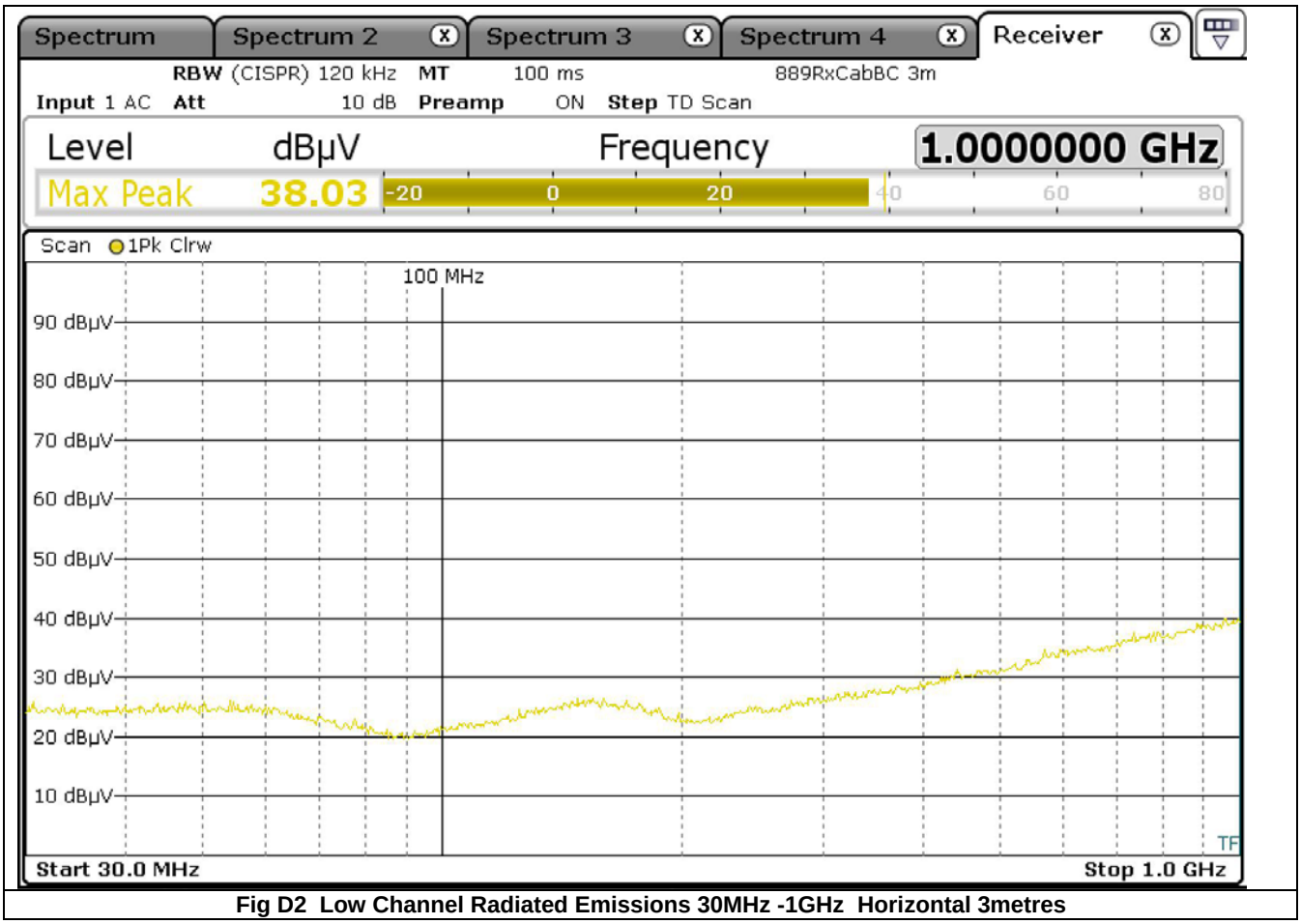


Fig D2 Low Channel Radiated Emissions 30MHz -1GHz Horizontal 3metres

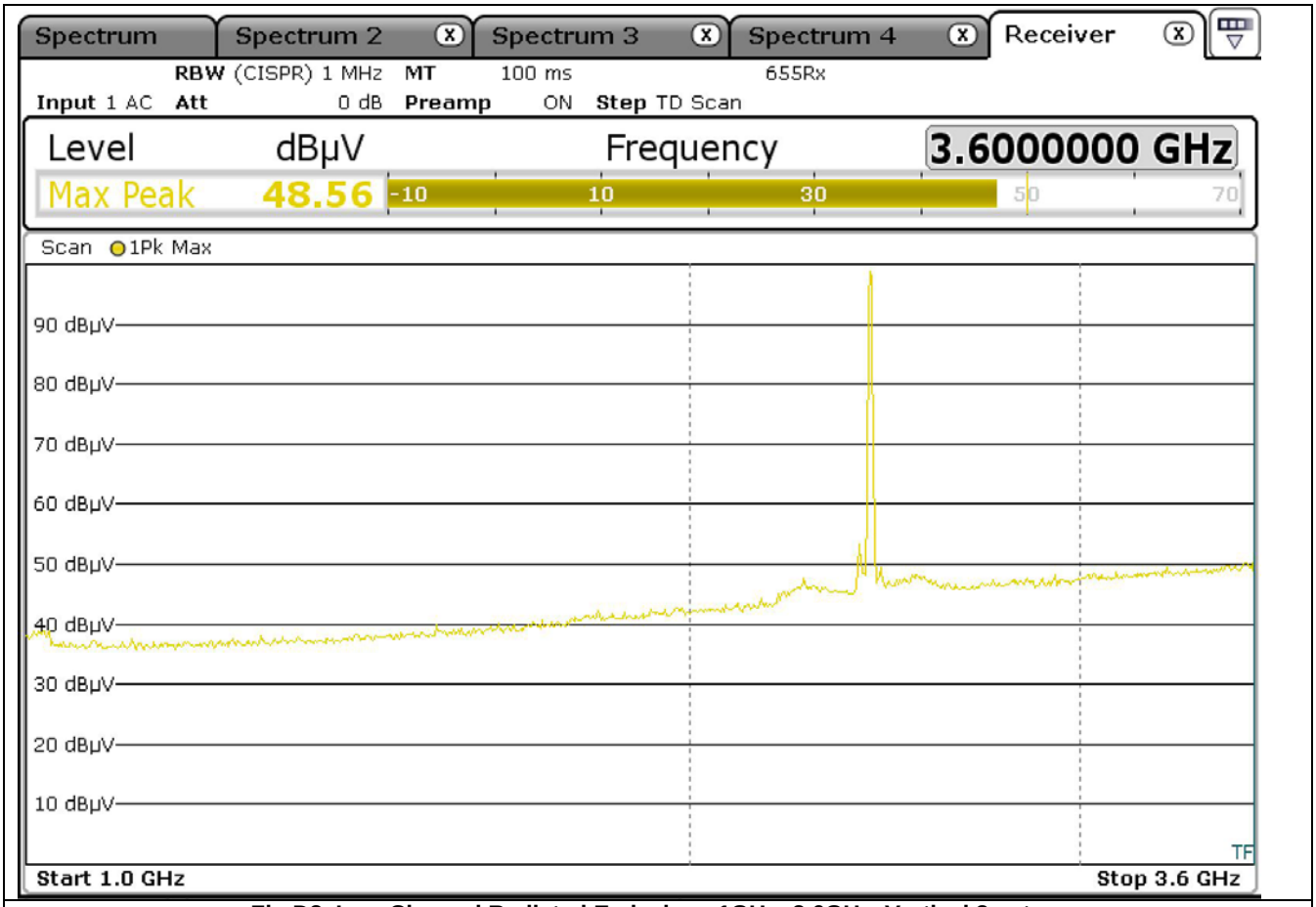


Fig D3 Low Channel Radiated Emissions 1GHz -3.6GHz Vertical 3metres

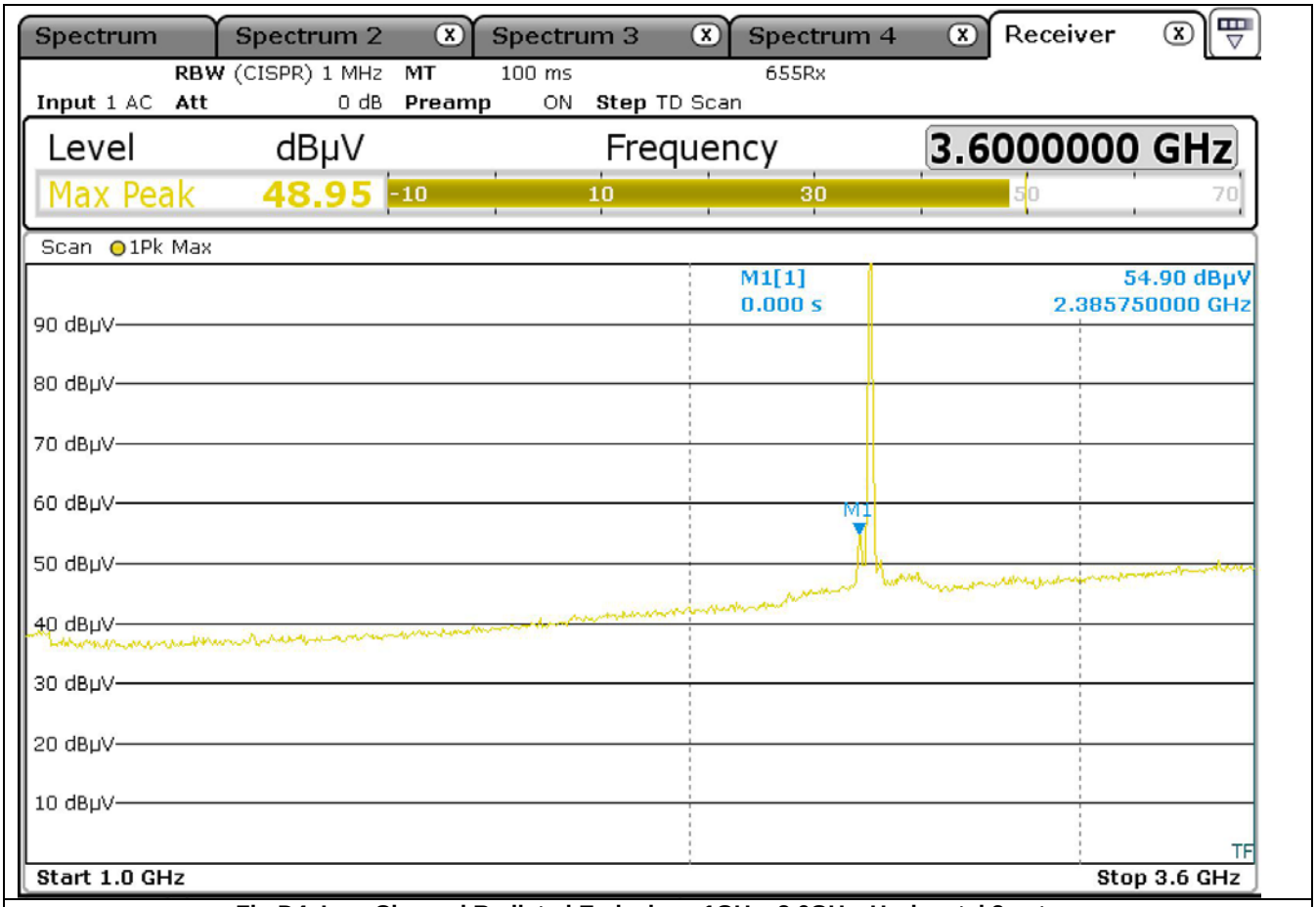


Fig D4 Low Channel Radiated Emissions 1GHz -3.6GHz Horizontal 3metres

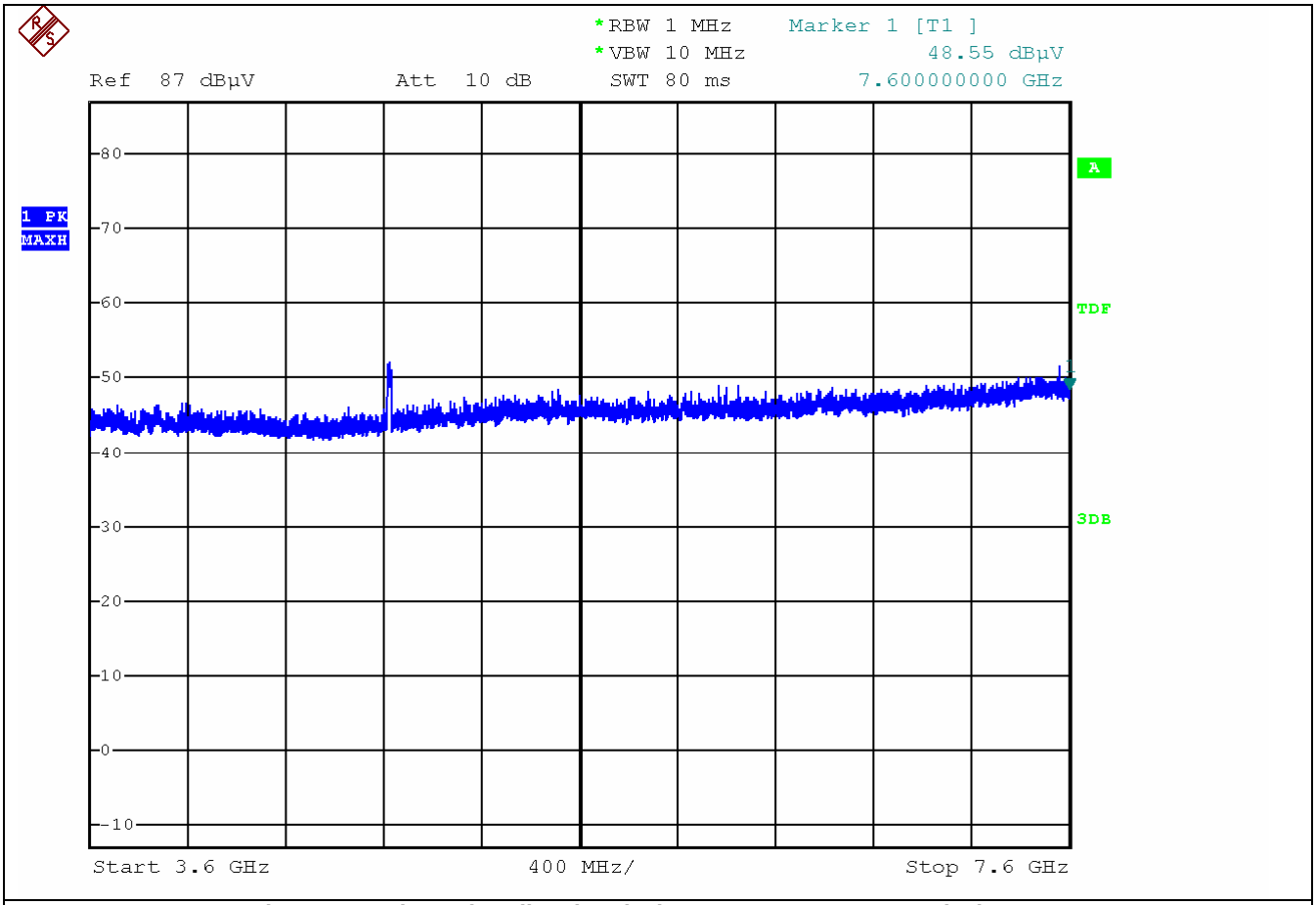


Fig D5 Low Channel Radiated Emissions 3.6GHz -7.6GHz Vertical 1metre

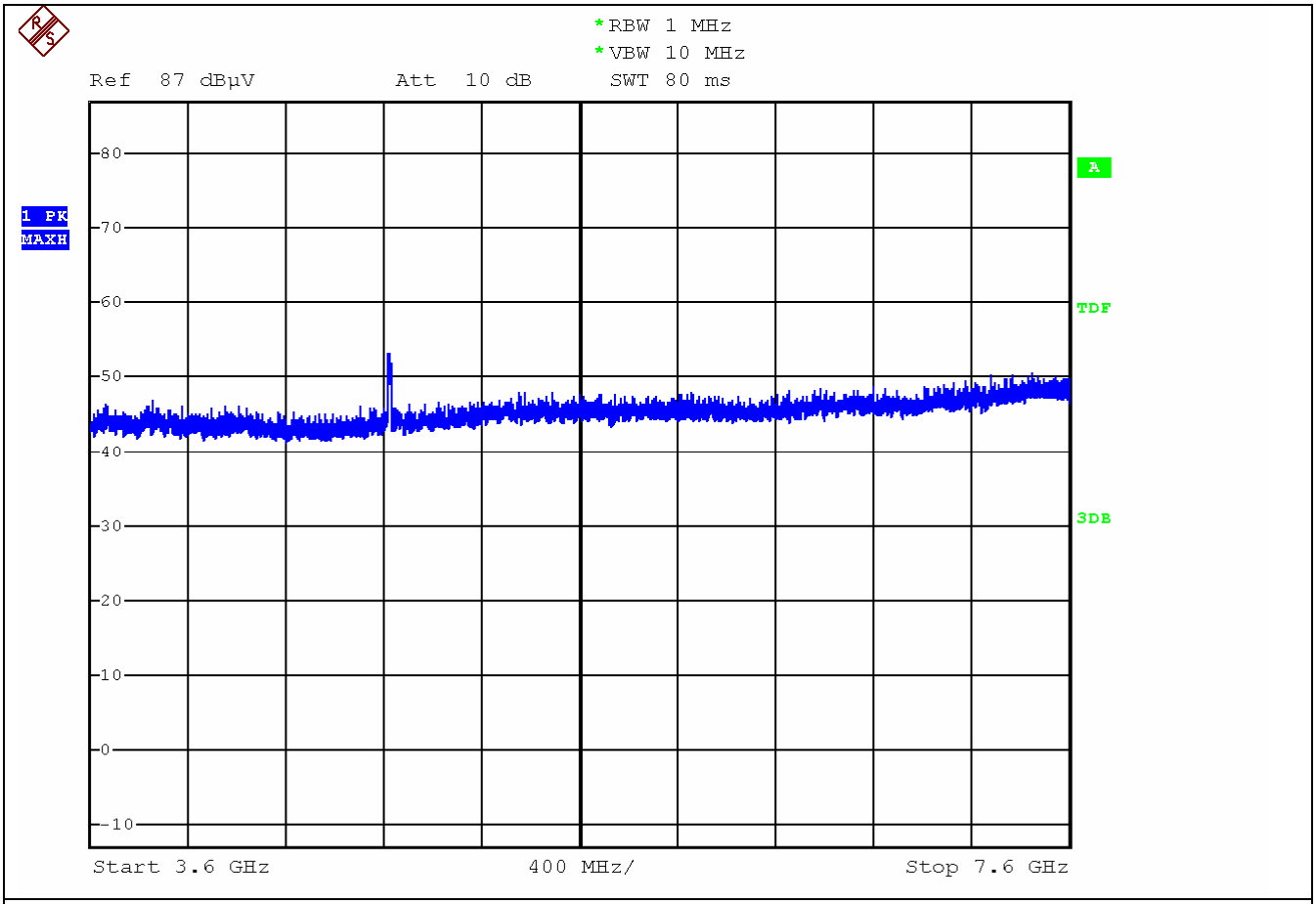


Fig D6 Low Channel Radiated Emissions 3.6GHz -7.6GHz Horizontal 1metre

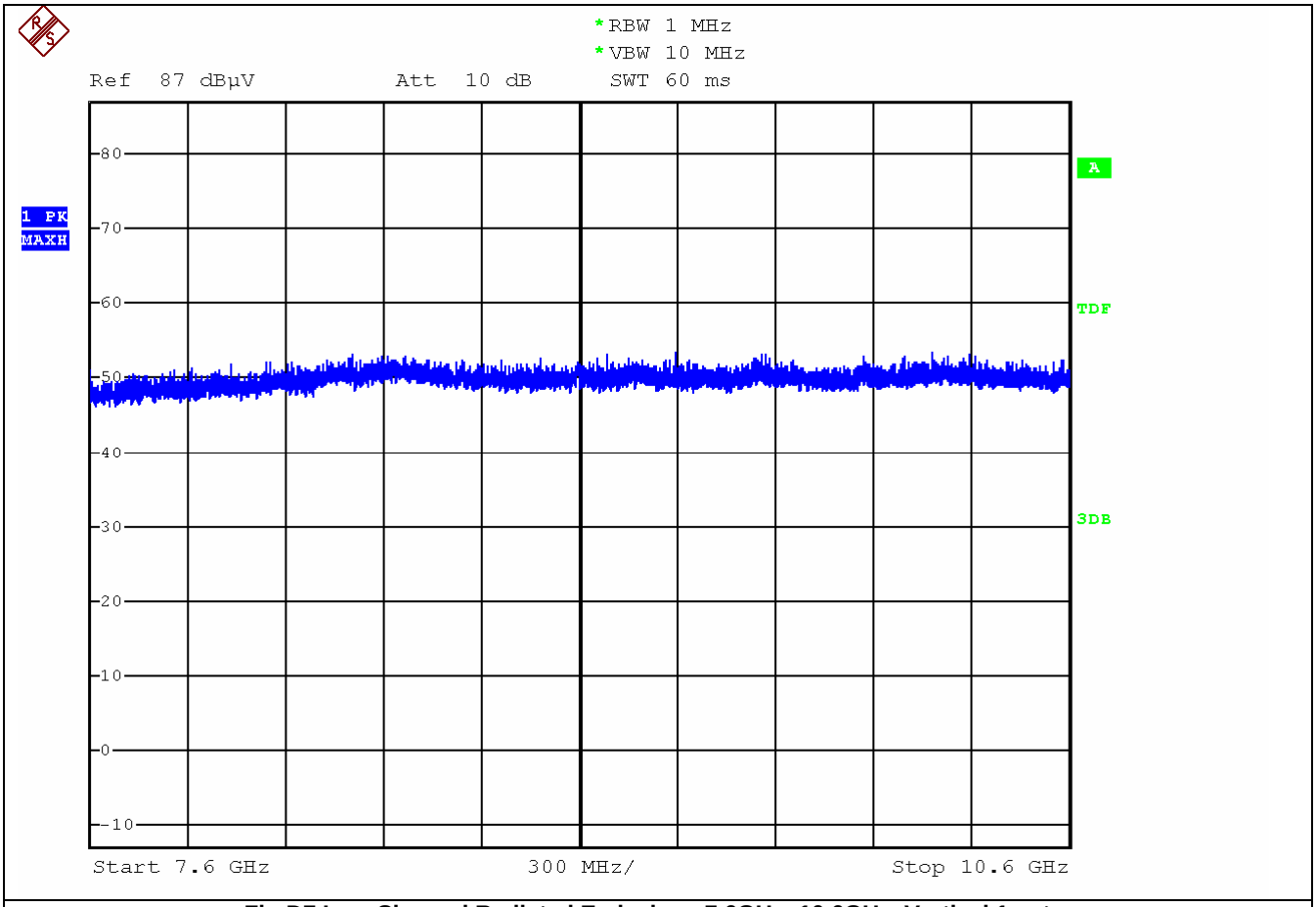


Fig D7 Low Channel Radiated Emissions 7.6GHz -10.6GHz Vertical 1metre

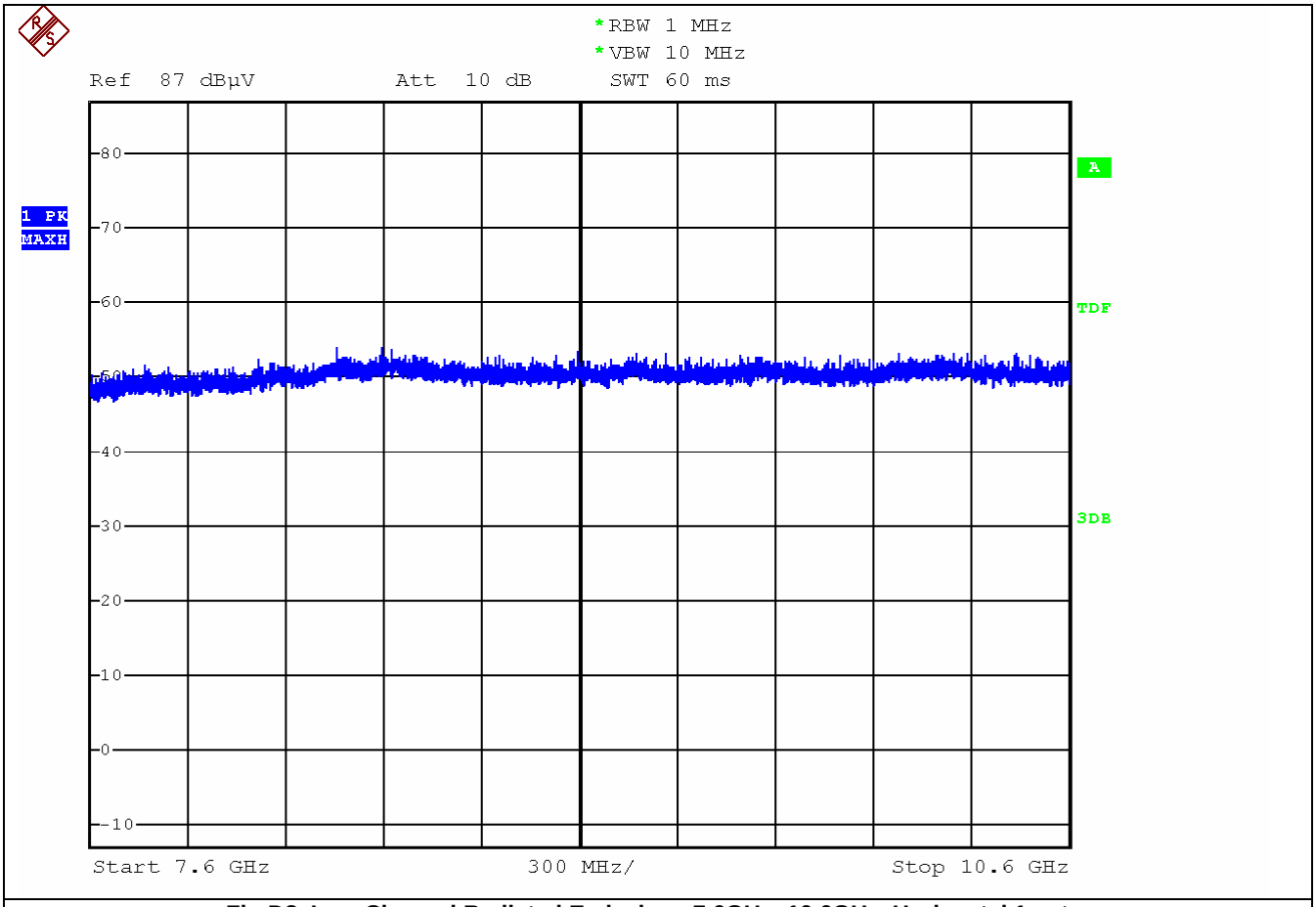


Fig D8 Low Channel Radiated Emissions 7.6GHz -10.6GHz Horizontal 1metre

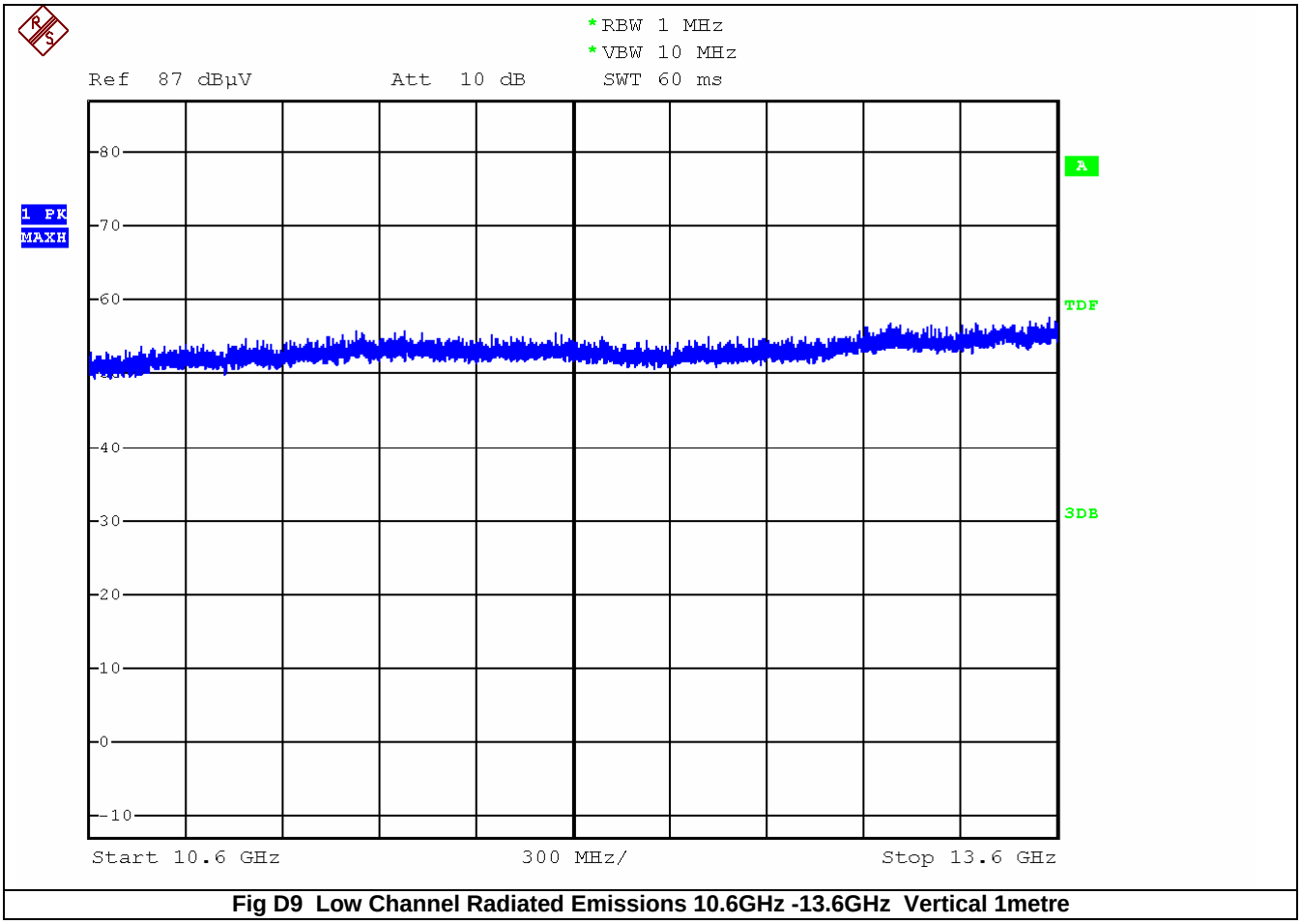


Fig D9 Low Channel Radiated Emissions 10.6GHz -13.6GHz Vertical 1metre

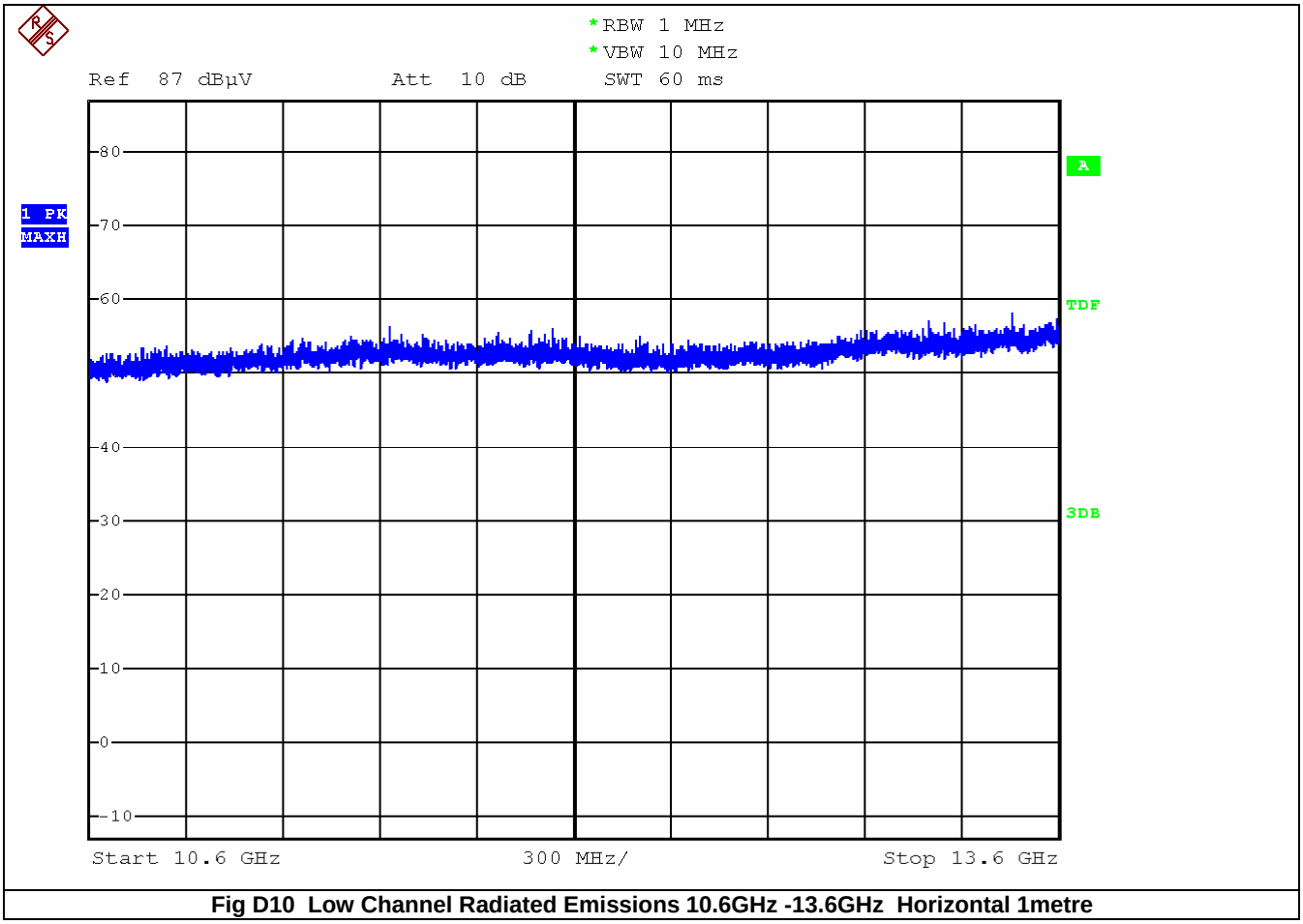


Fig D10 Low Channel Radiated Emissions 10.6GHz -13.6GHz Horizontal 1metre

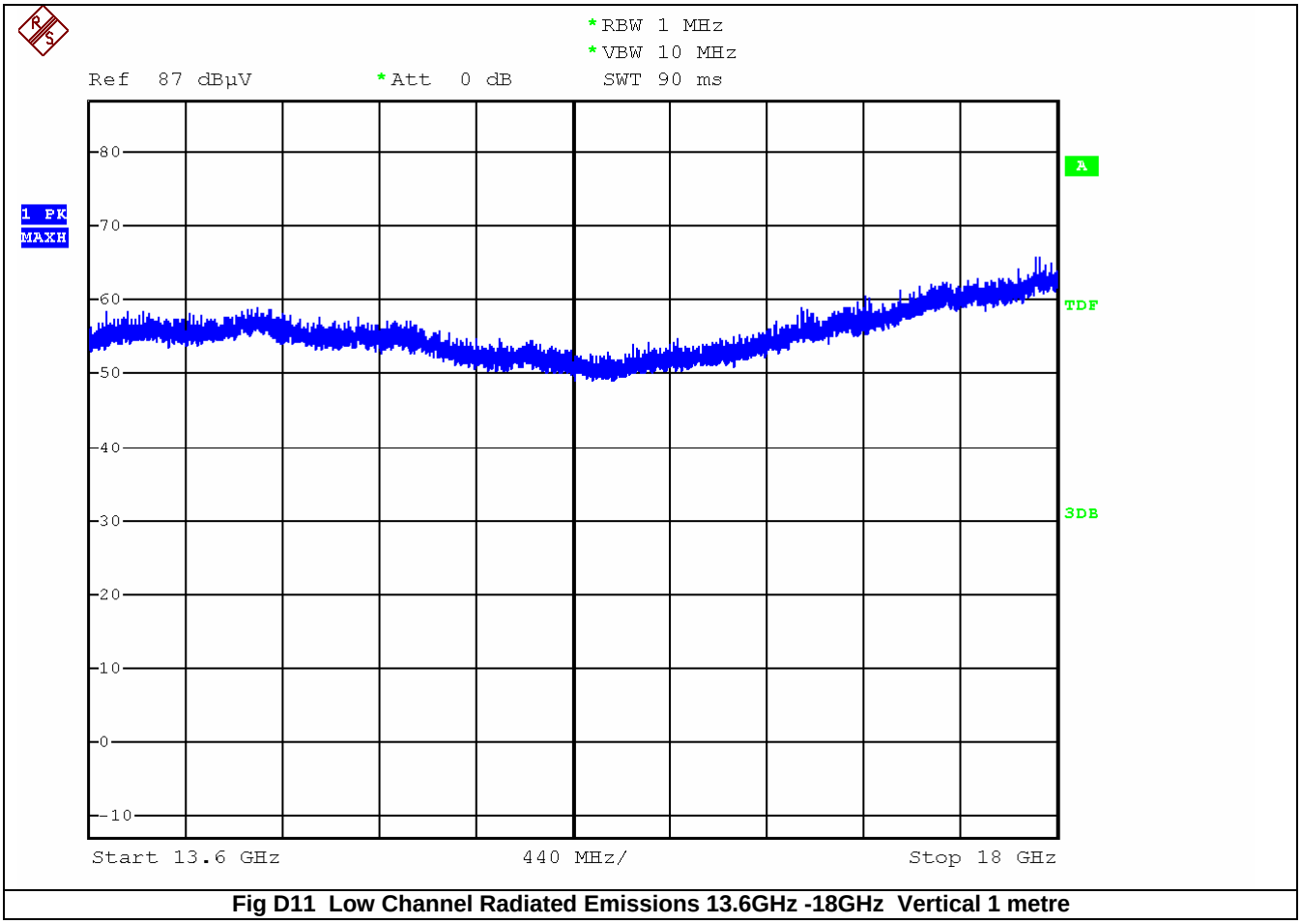


Fig D11 Low Channel Radiated Emissions 13.6GHz -18GHz Vertical 1 metre

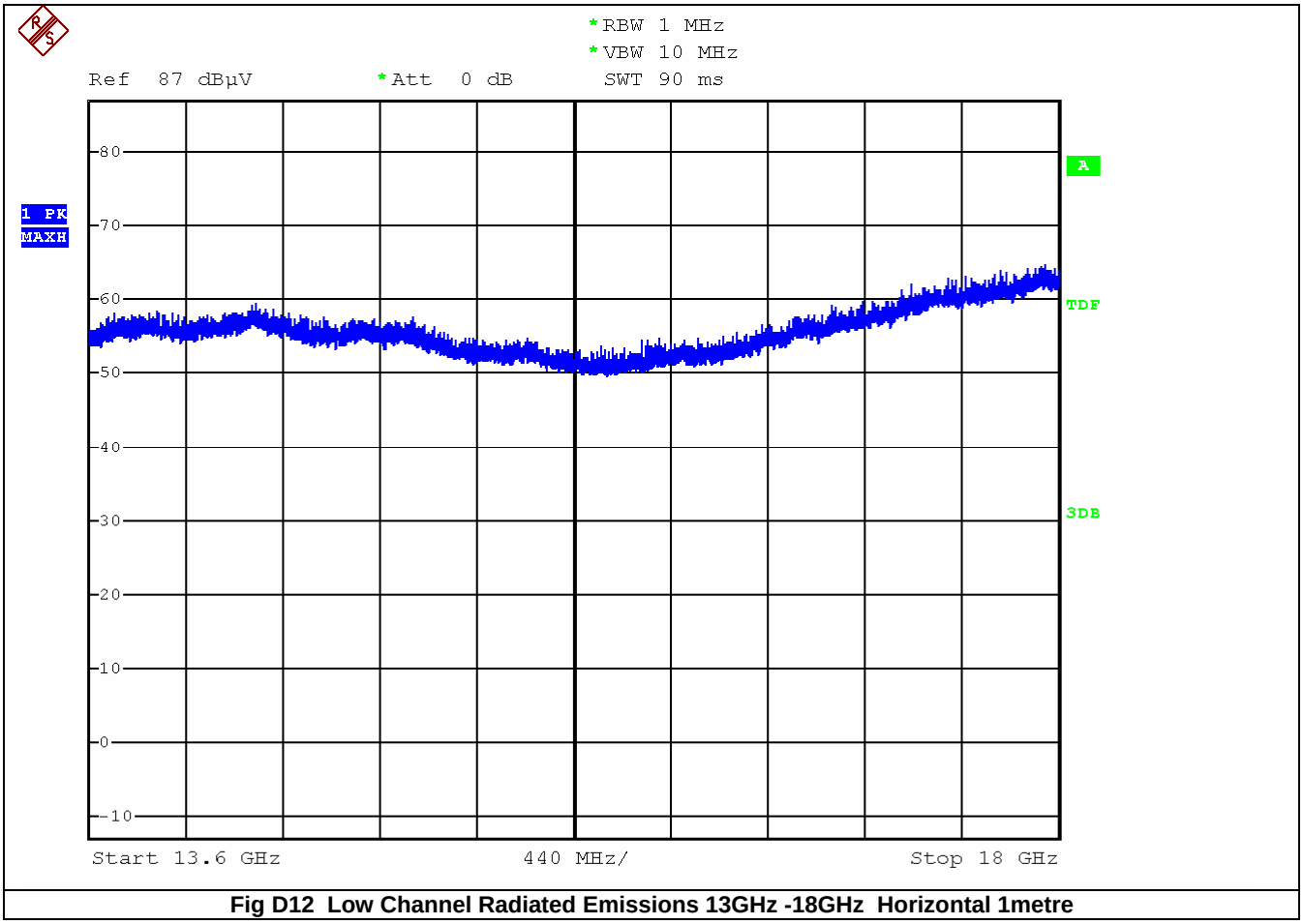


Fig D12 Low Channel Radiated Emissions 13GHz -18GHz Horizontal 1metre

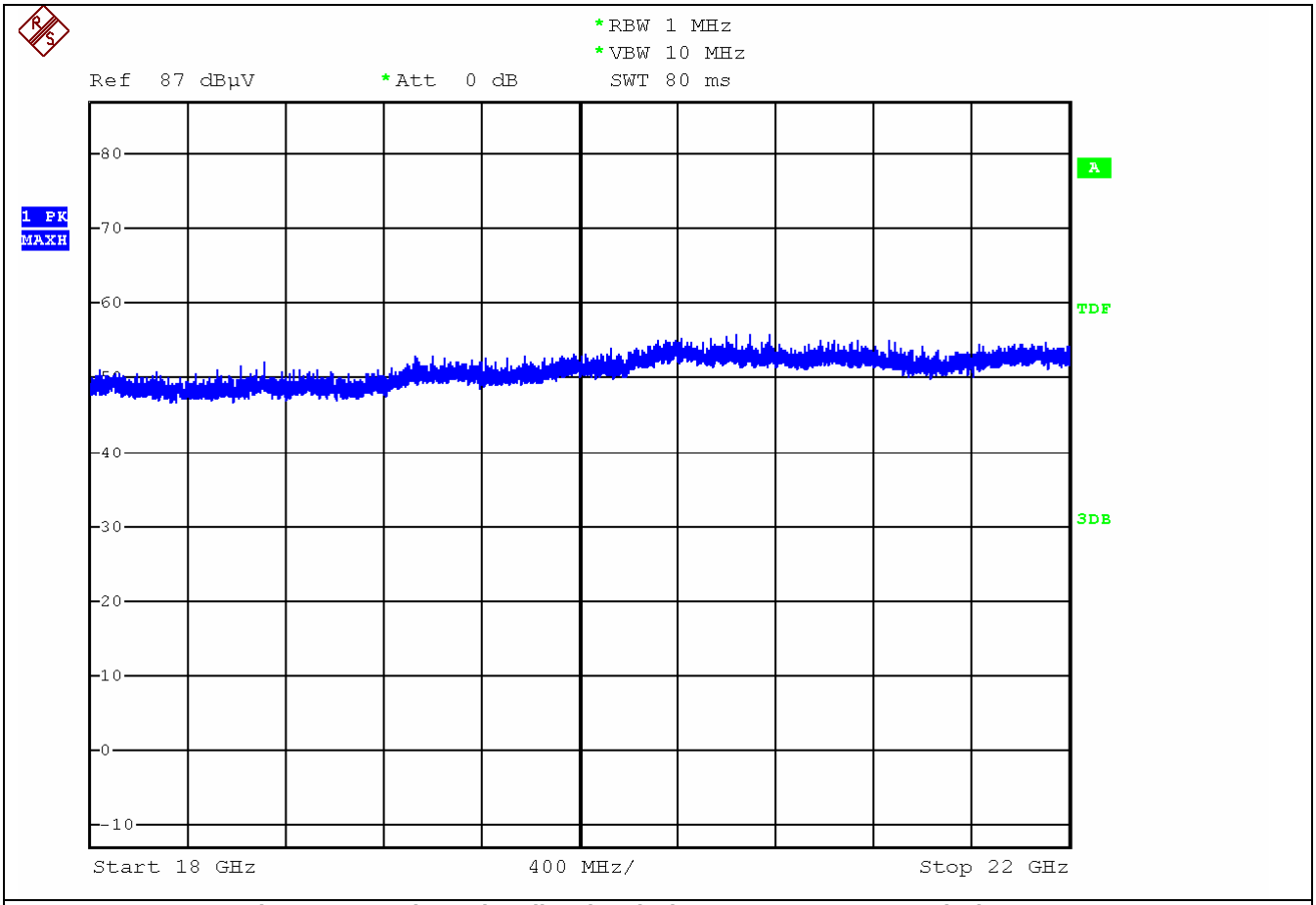


Fig D13 Low Channel Radiated Emissions 18GHz -22GHz Vertical 1 metre

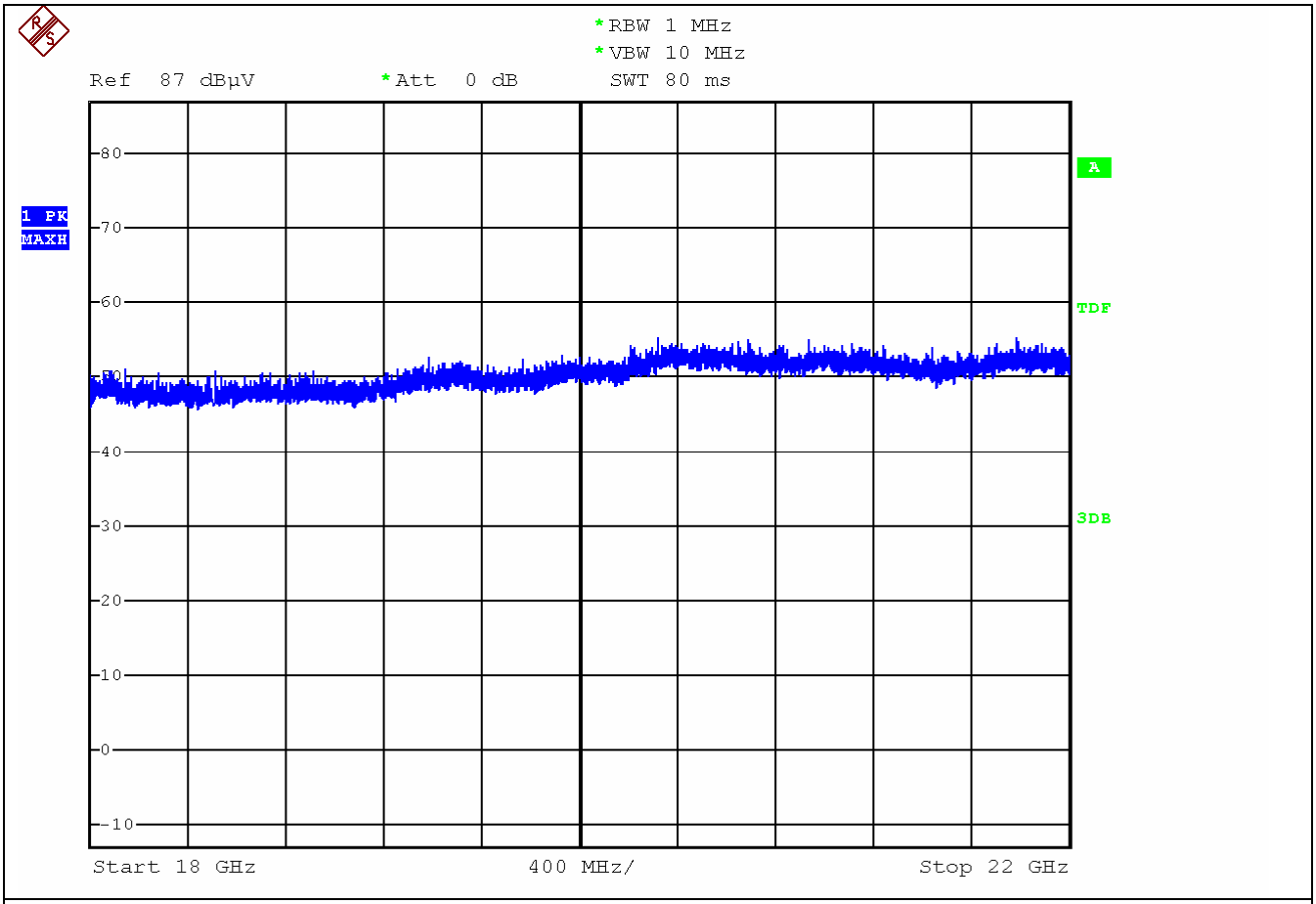


Fig D14 Low Channel Radiated Emissions 18GHz -22GHz Horizontal 1metre

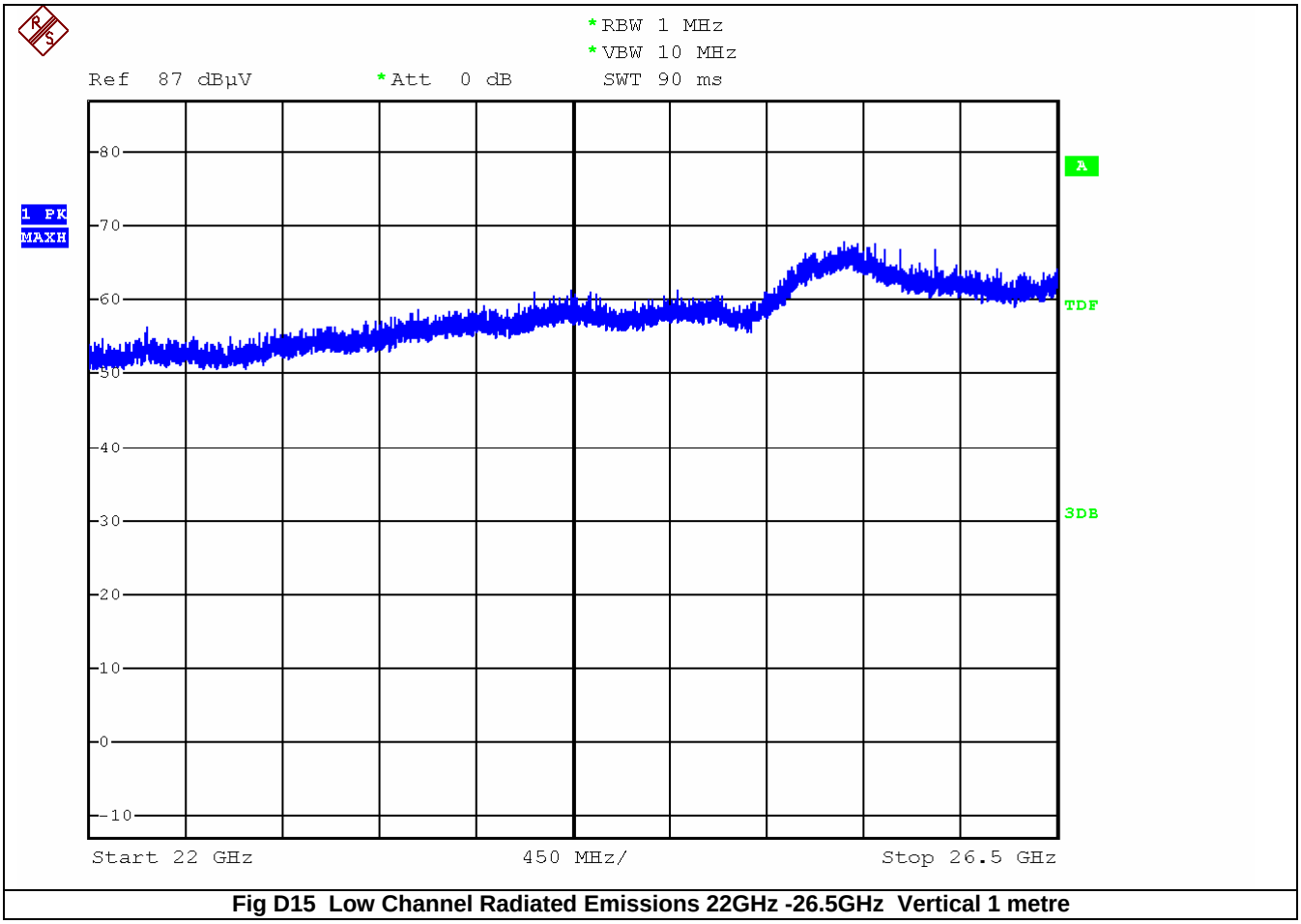


Fig D15 Low Channel Radiated Emissions 22GHz -26.5GHz Vertical 1 metre

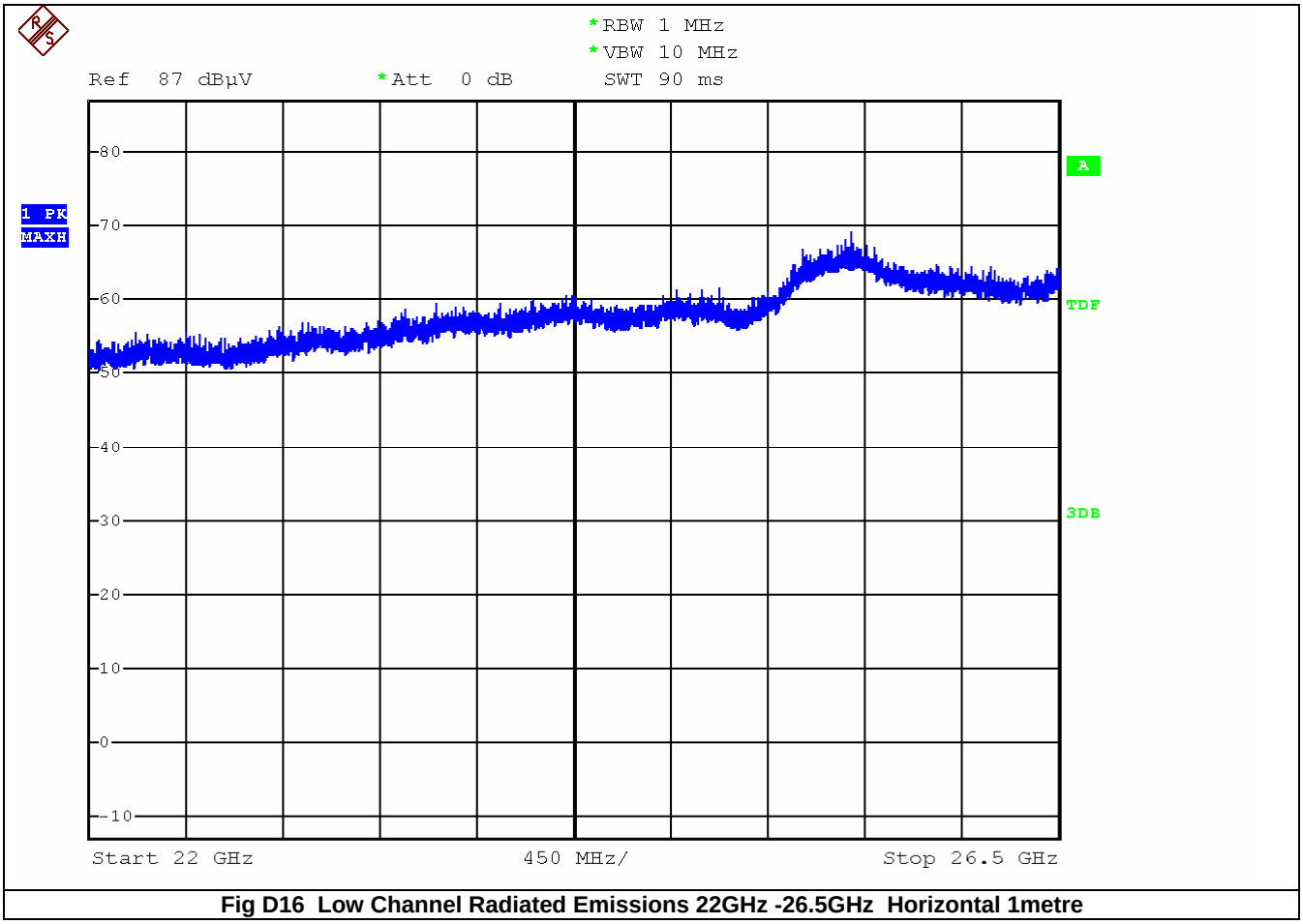


Fig D16 Low Channel Radiated Emissions 22GHz -26.5GHz Horizontal 1metre

End of Report