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FCC Test Firm Registration	409640
IC Site Registration	8517-A2, 8517-A1
Date	17 th Jan 2019
IC Equipment Authorisation	Test Report
EUT Description	RFID Module
FCC ID	SCCNUR0W1
IC ID	5137A-NUR0W1
Authorised by	Paul Reilly
Authorised Signature:	

TEST SUMMARY

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

<u>FCC Spec.</u>	<u>IC Spec.</u>	<u>Test Parameters</u>	<u>Status</u>
15.247 b 2	RSS-247 5.4	Maximum Peak Conducted Output power	Pass
15.247 a 1 i	RSS-247 5.1	Carrier Freq Separation for hopping channels	Pass
15.247 a 1 i	RSS-247 5.1	Number of hopping Channels.	Pass
15.247 a 1 i	RSS-247 5.1	Average Time of Occupancy of Hopping Frequency	Pass
15.247 a 1 i	RSS-247 5.1	20 dB Bandwidth	Pass
	RSS-Gen 67	99% bandwidth.	Pass
15.247d	RSS-247 5.5	100KHz RBW at band edges and Conducted Spurious emissions.	Pass
15.247d 15.209a	RSS-247 5.5	Radiated Emissions within restricted bands	Pass
15.209	RSS-Gen 6.13	Unintentional Radiated Emissions	Pass
15.207a	RSS-Gen 8.8	Conducted Emissions on the mains	Pass

RSS 247-2

RSS Gen Issue5

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF COMPLIANCE ENGINEERING IRELAND LTD

Exhibit A – Technical Report

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*Note appendix E, F, G, H are on a separate report, .entitled 18E7583-1b additional appendices

1.0 EUT Description

Model:	NUR-0W1
Type:	RFID Module
Test Standards:	47 CFR, Part 15.247
Type of radio:	Stand-alone
Transmitter Type:	RFID FHSS
Operating Frequency Range(s):	902-928 MHz
Number of Channels:	50
Channel Separation:	500KHz
Antenna:	External
Power configuration:	4.5V .
Ports:	None
Classification:	DSS, JBP
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The NUR-0W1 was an RFID module using frequency hopping in the 902-928MHz frequency band.

The EUT had 2 alternative external antennas.

b) Antenna #1 = Nordic ID Sampo S0 max gain 6dBi

a) Antenna #2 = Nordic ID SA0408 max gain -4dBi

Ref to the following data sheets which are included in the application doc pack
Nordic ID Sampo S0_Datasheet_AM_V1006.pdf
Nordic ID SA0408 Antenna_Datasheet_V1008.pdf

1.1 EUT Operation

Operating Conditions during Test:

The EUT (RFID module) was fitted to a host pcb to allow powering and control of the module. Conducted measurements were carried out with the analyser connected to the SMA connector fitted on the host pcb.

The EUT was operated in test mode where the channel and modulation were set via USB connection from the host pcb to a laptop.

The EUT was powered from a bench PSU Type Hewlett Packard E3620A set to 4.5Vdc. 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 the EUT where the Antenna port was connected to the 2 alternative antennas.

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 15th 16th and 17th Oct 2018 .

1.4 Description of Test modes

Channel List

Channel	Freq MHz
Low Ch0	902.75
Mid Ch24	914.75
High Ch 49	927.25

1.5 Description of Test methods

Tests were performed manually and no special test software was used.

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

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

Emissions below 1GHz were measured using an 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. A bi-conical antenna was used for frequencies below 300MHz and a log periodic antenna was used for the 300MHz to 1GHz frequency range

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 and by raising and lowering the antenna from 1 to 4 metres. 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)

3.0 Results for Conducted emissions on the mains

Conducted Emissions on the mains test was performed with the EUT connected to a LISN through PSU as per section 1.1

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Average	12.7523	21.56	-28.44	Live
Quasi-Peak	12.7815	26.29	-33.71	Live
Average	12.9300	21.58	-28.42	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	12.6758	25.35	-34.65	Neutral
Average	12.8378	20.60	-29.4	Neutral

Ref Appendix G for Scans

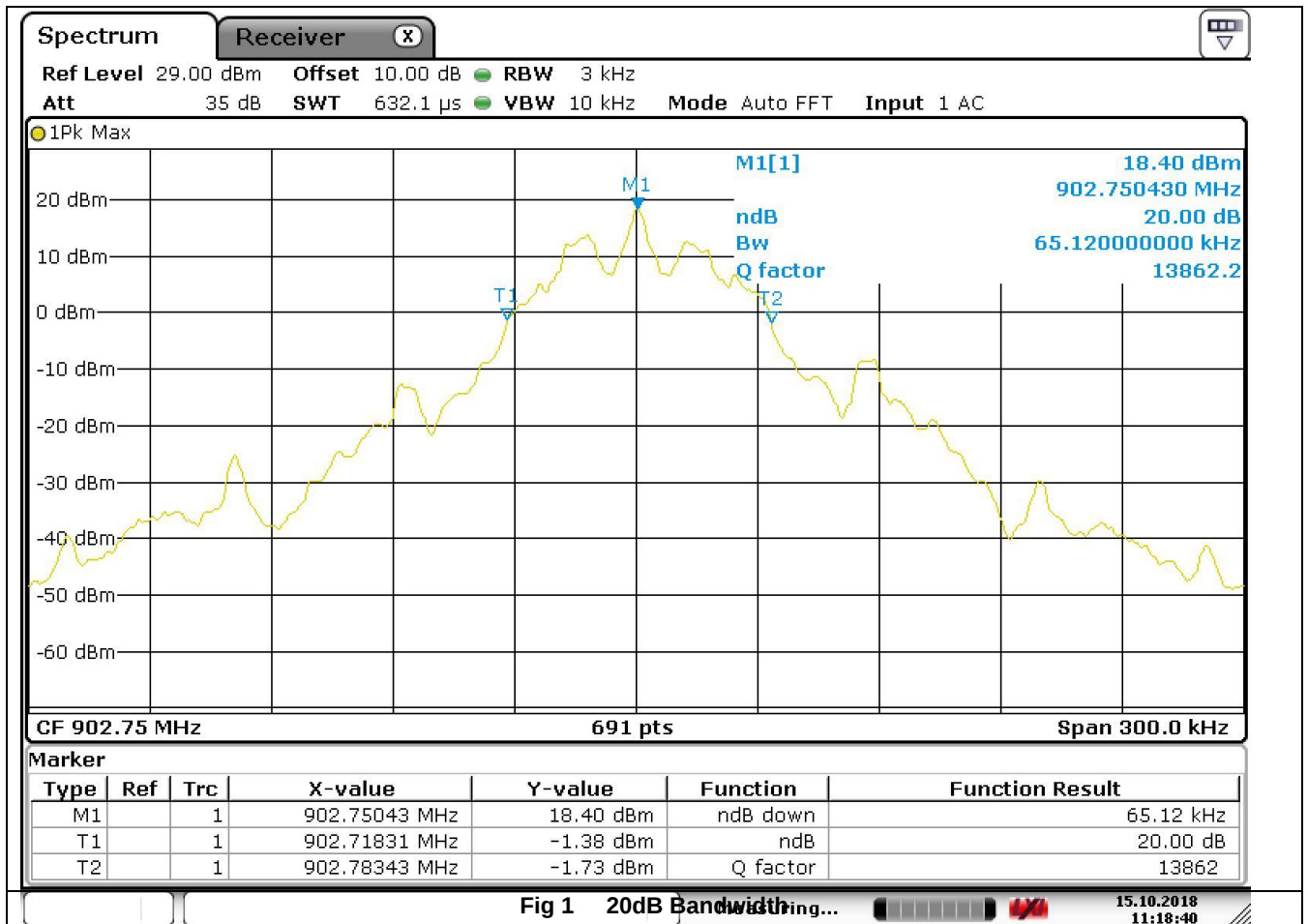
Test Result : Pass

4. Conducted Measurements on the Antenna port

4.1 Bandwidth

4.1.1 20dB bandwidth

As per Ansi63.10 Section 11.8.2



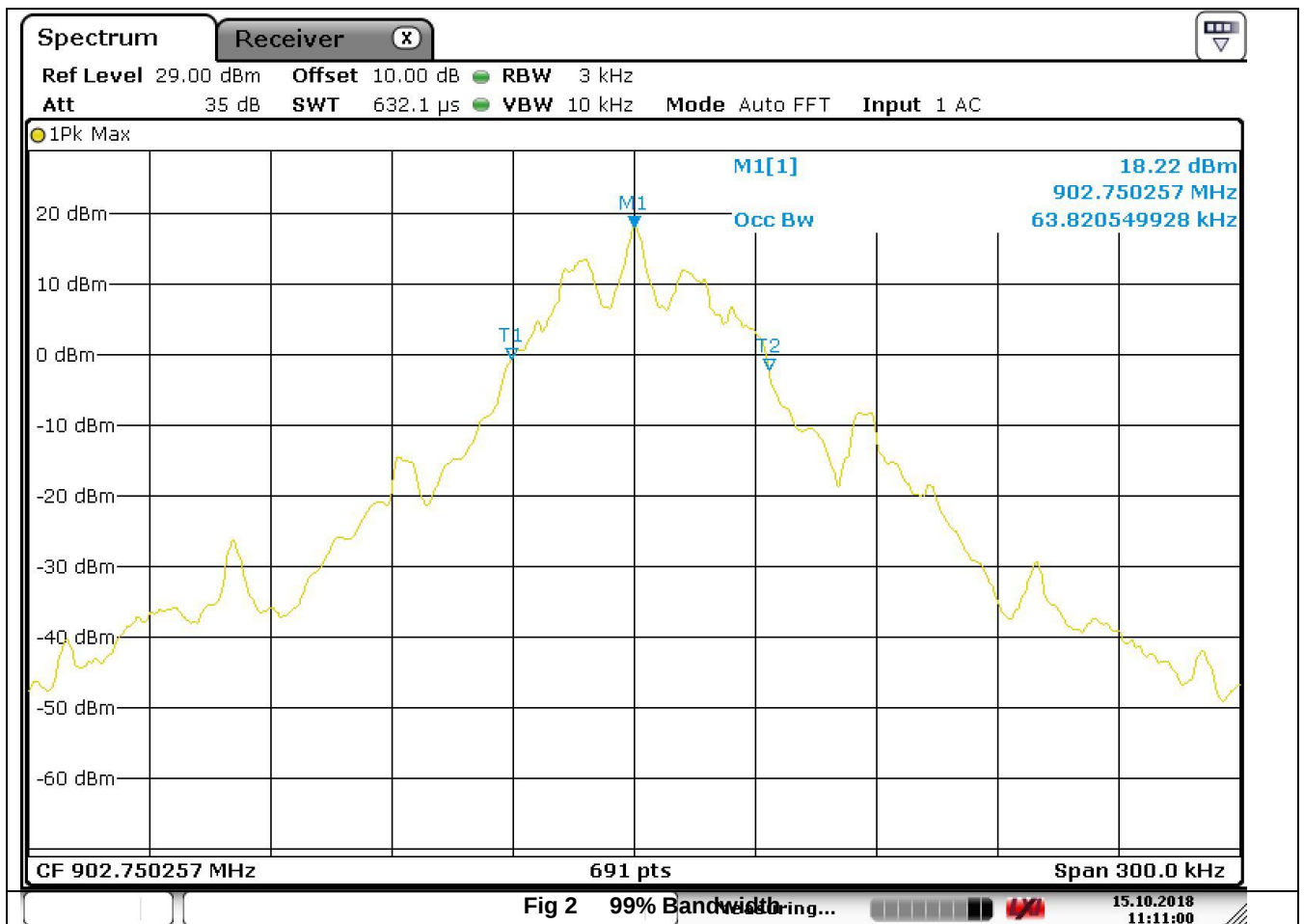
Date: 15.OCT.2018 11:18:40

Channel	Freq	20dB Bandwidth
	MHz	KHz
Low	902.75	65.12
Mid	914.75	62.52
High	927.25	62.08

Limit

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.1.2 99% bandwidth



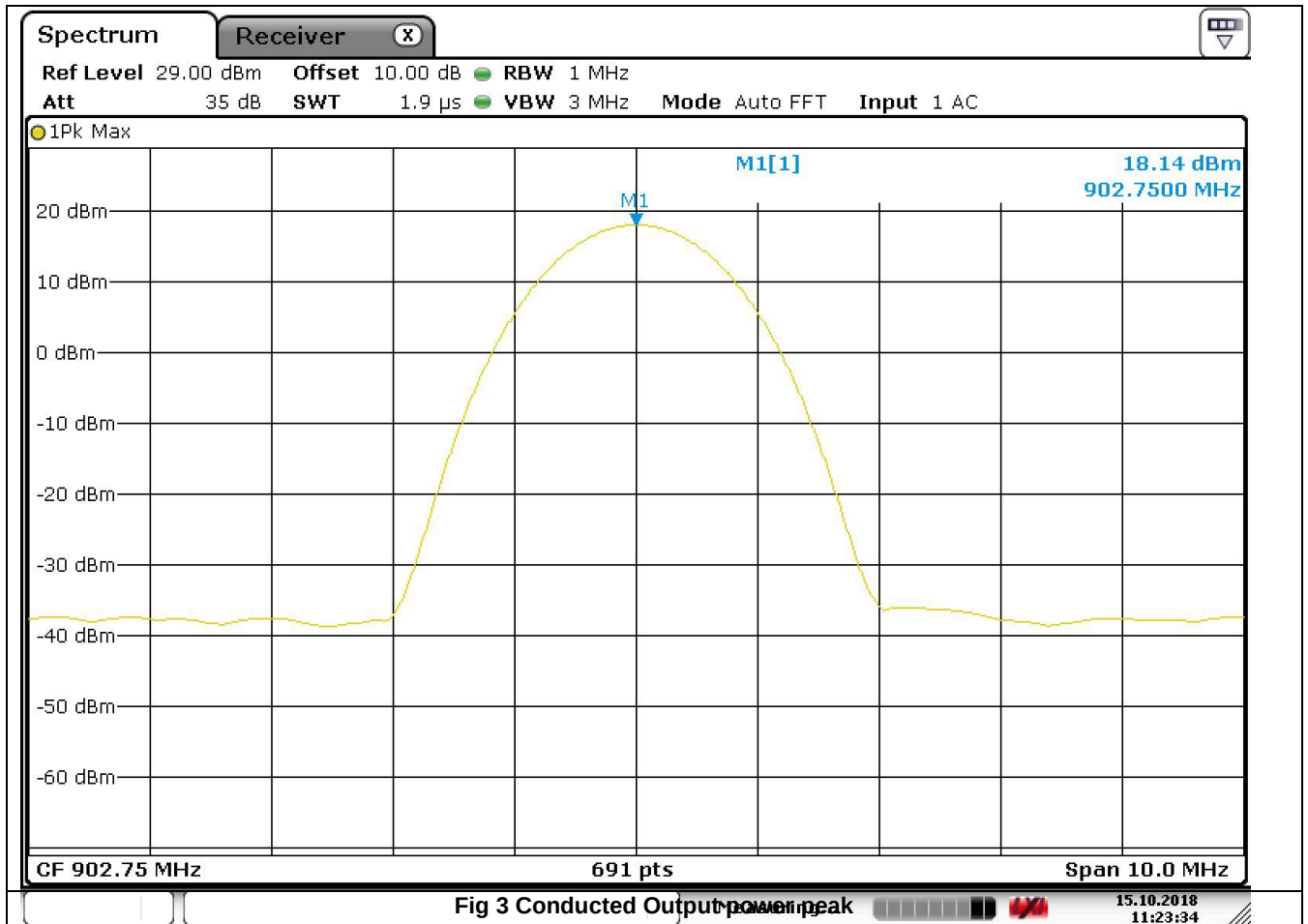
Date: 15.OCT.2018 11:11:00

Bandwidth

Channel	Freq	99% Bandwidth
	MHz	KHz
Low	902.75	63.82
Mid	914.75	70.67
High	927.25	81.86

Result :- Pass

4.2 Output power Conducted



Date: 15.OCT.2018 11:23:35

Channel	Freq	Output Power Peak	Limit	Margin
	MHz	dBm	dBm	dB
Low	902.75	18.14	30	11.86
Mid	914.75	18.27	30	11.73
High	927.25	18.09	30	11.91

Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels

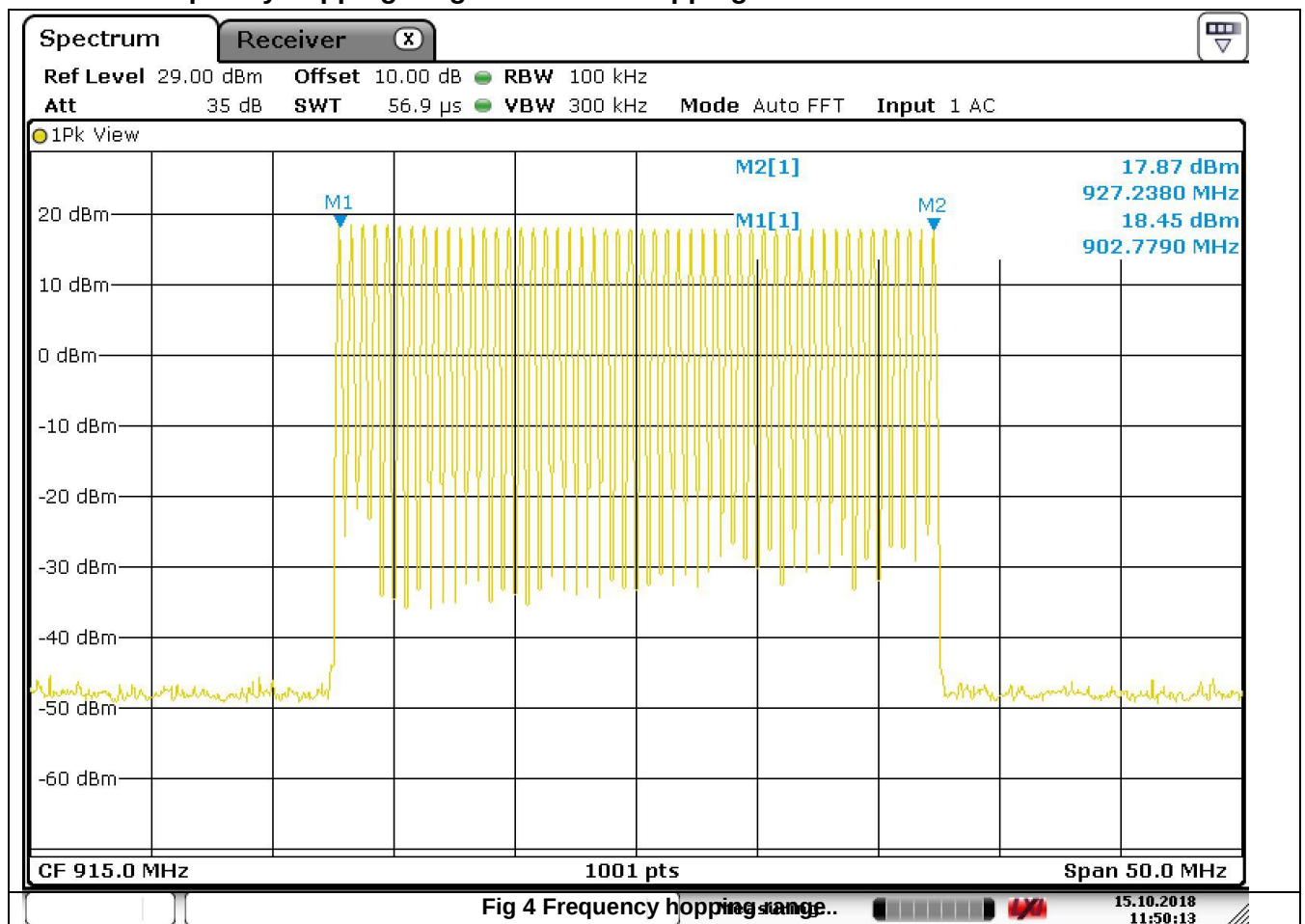
Test Result: Pass

4.3 Frequency Hopping Characteristics

Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.3.1 Frequency hopping range number of hopping Channels



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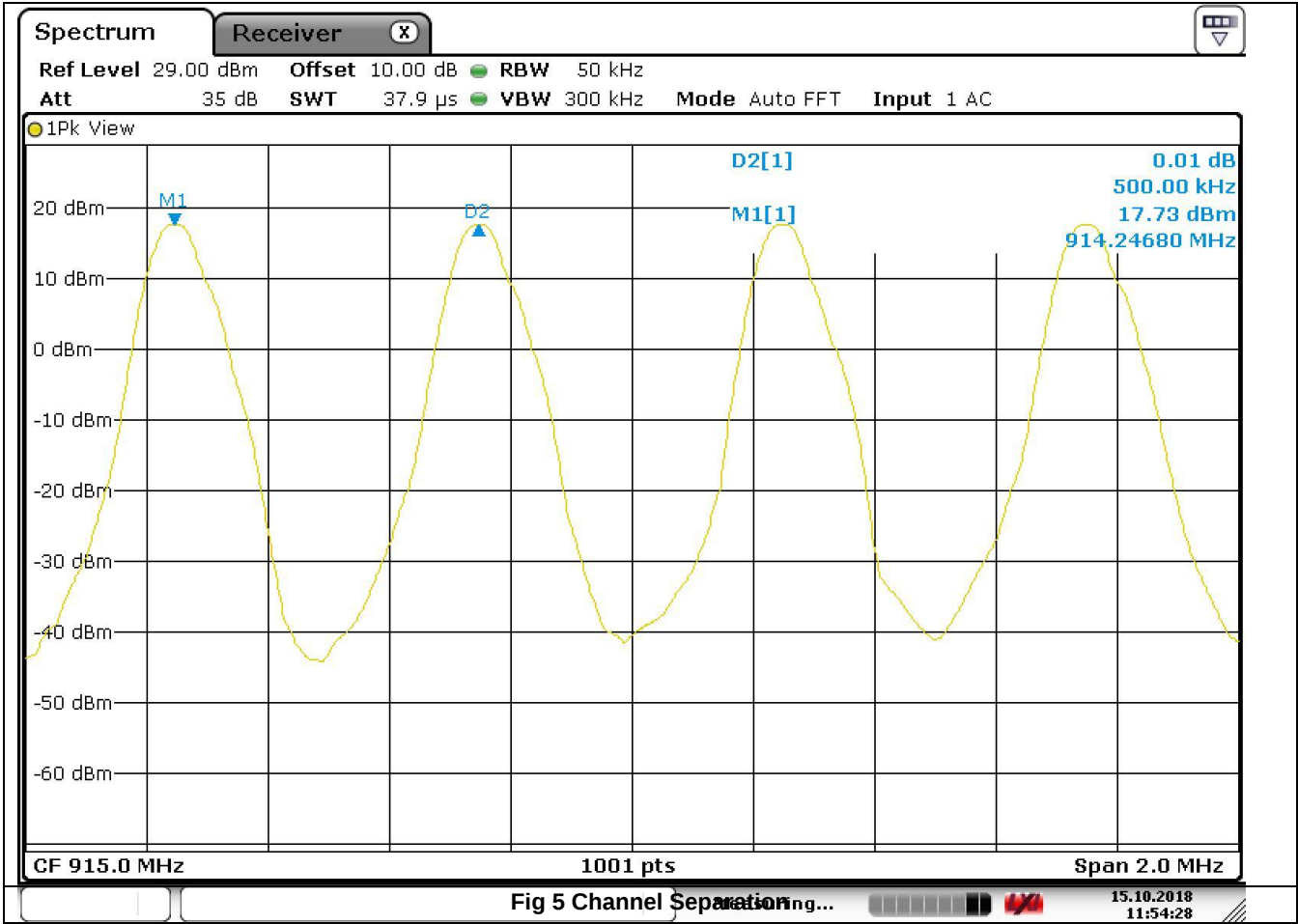
Lowest channel 902.75MHz
 Highest channel 927.25MHz

Number of hopping channels =50-

Limit: Min 50 hopping channels if the bandwidth is less than 250KHz

Test Result: Pass

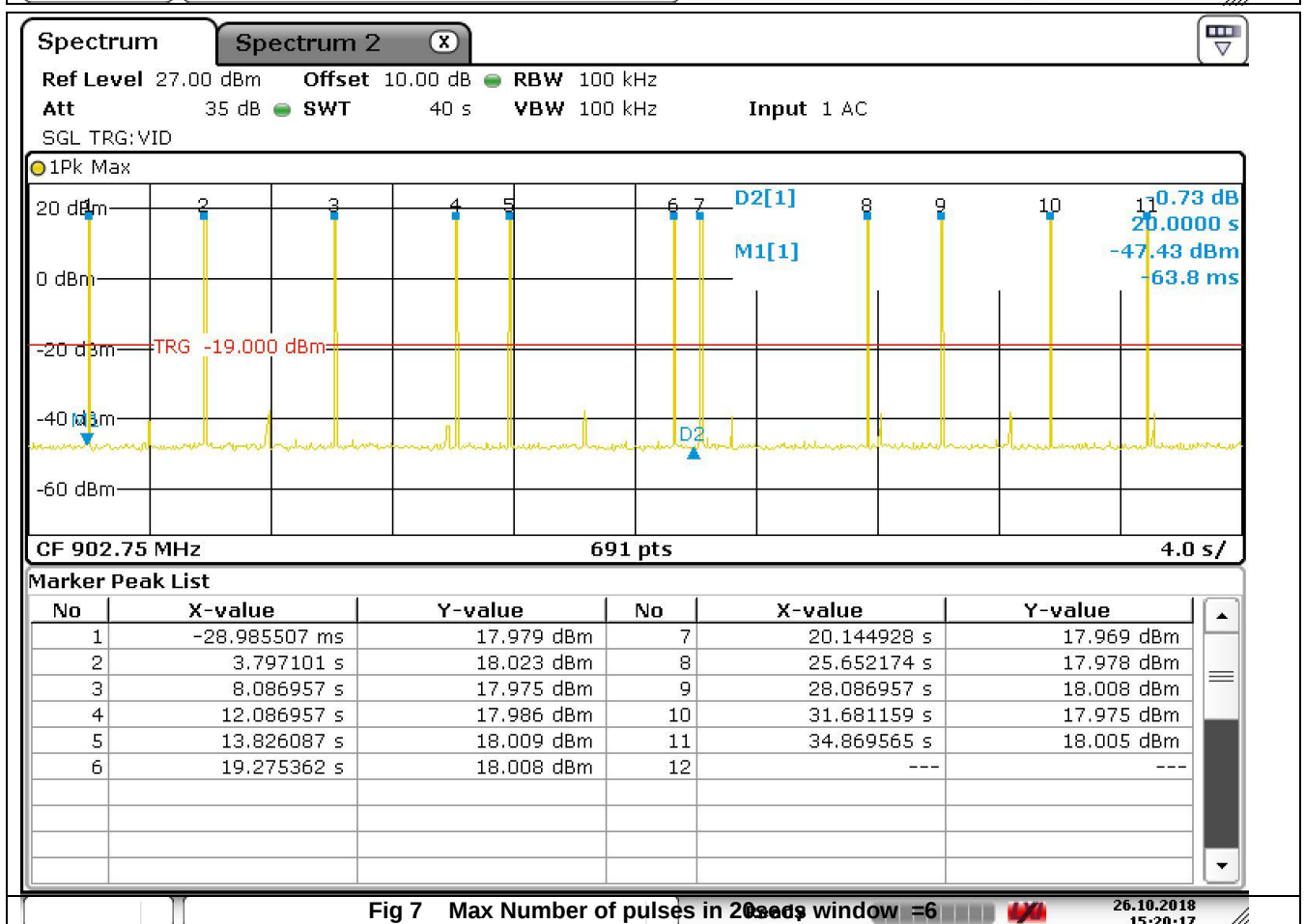
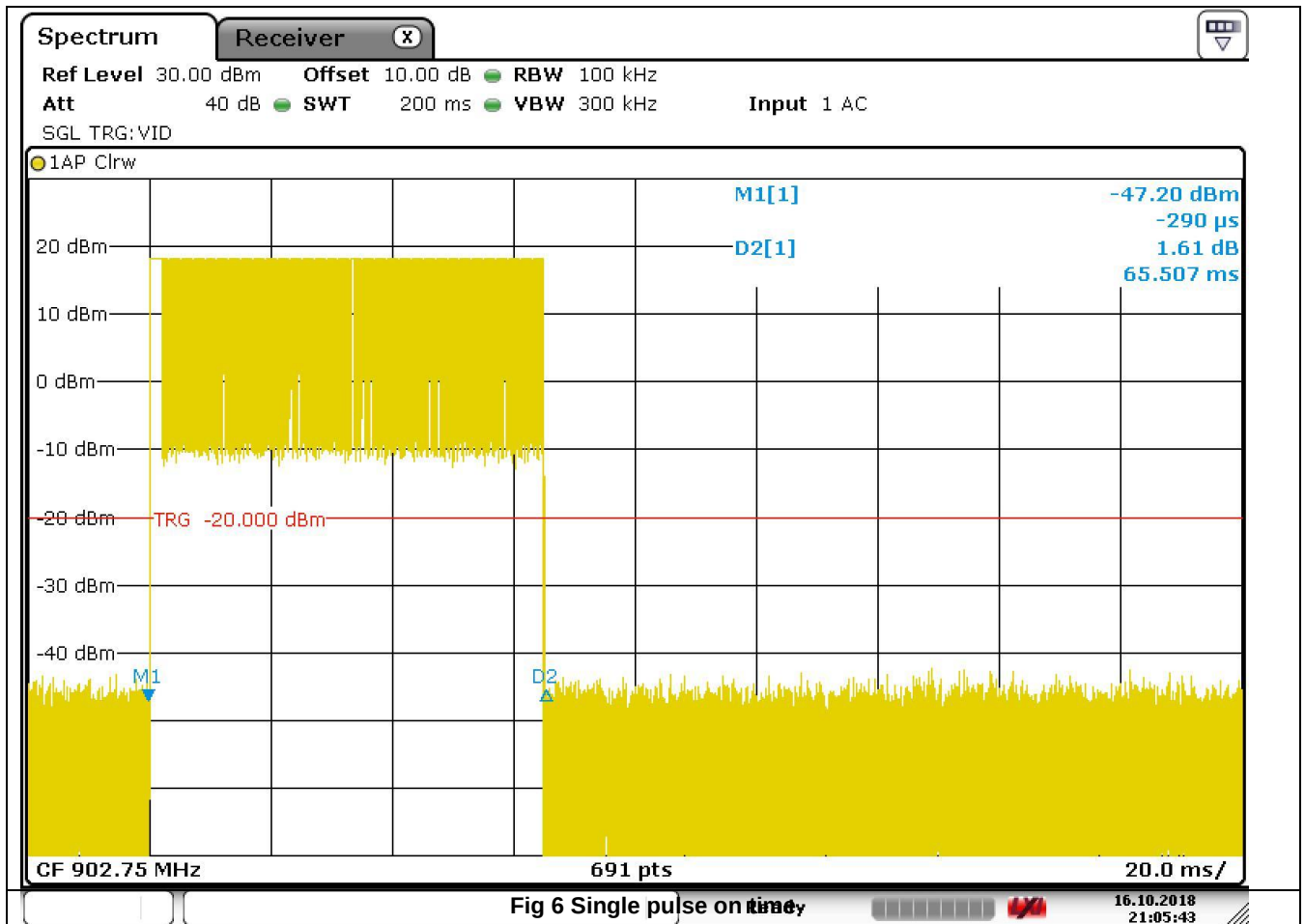
4.3.2 Frequency hopping channel separation



Channel separation =500KHz

Date: 15.OCT.2018 11:54:29

4.3.3 Frequency hopping average time of channel occupancy



Calculation

Single pulse on time =65.5mS

Max Num of pulses in 20sec window = 6

Max on time in 20secs window = $6 \times 0.0655 = 0.393$ secs < 0.4 secs limit

Test result Pass

5. Spurious Emissions EUT

5.1 Conducted Spurious Emissions

5.1.1 Conducted Spurious Emissions

Note Low, Mid and High Channels tested ...
Results similar for all three

Ref Appendix A for Scans

Test Result Pass

5.1.2 Conducted Emissions Band Edge

Ref Appendix B for Scans

Test Result Pass

5.2. Radiated Spurious Emissions

5.2.1 Radiated Spurious Emissions with Antenna port Terminated

Note Low, Mid and High Channels tested ...

Results similar for all three

Ref Appendix C for Scans

5.2.2 Radiated Spurious Emissions Restricted Bands with Antenna #1

Frequency	Quasi peak Level	Antenna Factor	Preamplifier Gain	Cable Loss	Antenna Polarity	Final Field Strength Quasi Peak	Average Limit	Margin
MHz	dBuV/m	dB	dB	dB	V/H	dBuV/m	dBuV/m	dB
192.06	16.7	8.6	0	0.2	Vertical	25.5	43.5	18.0
192.02	15.2	8.6	0	0.2	Horizontal	24.0	43.5	19.5

Frequency	Average Level	Antenna Factor	Preamplifier Gain	Cable Loss	Antenna Polarity	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dBuV/m	dBuV/m	dB
3.591	49.5	30.6	37.8	4.5	Horizontal	46.8	54.0	27.2
3.597	48.8	30.6	37.8	4.5	Vertical	46.1	54.0	27.9
5.647	45.9	34.2	37.6	6.4	Vertical	48.9	54.0	25.1
5.419	48.4	34	37.5	5.6	Vertical	50.5	54.0	23.4

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

Ref Appendix D for Scans

Test Result Pass

5.2.3 Radiated Spurious Emissions Restricted Bands with Antenna #2

Frequency	Quasi peak Level	Antenna Factor	Preamplifier Gain	Cable Loss	Antenna Polarity	Final Field Strength Quasi Peak	Average Limit	Margin
MHz	dBuV/m	dB	dB	dB	V/H	dBuV/m	dBuV/m	dB
192.06	16.7	8.6	0	0.2	Vertical	25.5	43.5	18.0
192.02	15.2	8.6	0	0.2	Horizontal	24.0	43.5	19.5

Frequency	Average Level	Antenna Factor	Preamplifier Gain	Cable Loss	Antenna Polarity	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dBuV/m	dBuV/m	dB
5.342	50.4	34	37.7	5.4	Vertical	52.1	54.0	21.8
5.416	49.3	34	37.5	5.6	Horizontal	51.4	54.0	22.6

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

Ref Appendix E for Scans

Test Result Pass

5.2.4 Radiated Spurious Emissions Band Edge with Antenna #1

Ref Appendix F for Scans

Test Result Pass

5.2.5 Radiated Spurious Emissions Band Edge with Antenna #2

Ref Appendix G for Scans

Test Result Pass

6 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-Sep-19	12
Spectrum Analyser 30Hz-40GHz	Rohde& Schwarz	FSP40	100053	850	09-Nov-18	36
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	07-Jun-20	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	03-Sep-21	36
Anechoic Chamber	CEI	SAR 10M	845	845	16-Mar-19	36
Antenna Horn	EMCO	3115	9905-5809	655	06-Nov-19	24
Fully Anechoic Chamber	CEI	FAR 3M	906	906	22-Mar-21	36
Antenna Log Periodic	Chase	UPA6108	1072	609	03-Sep-21	36
LISN	Rohde& Schwarz	ESH3-Z5	825460/003	604	15-Sep-19	12

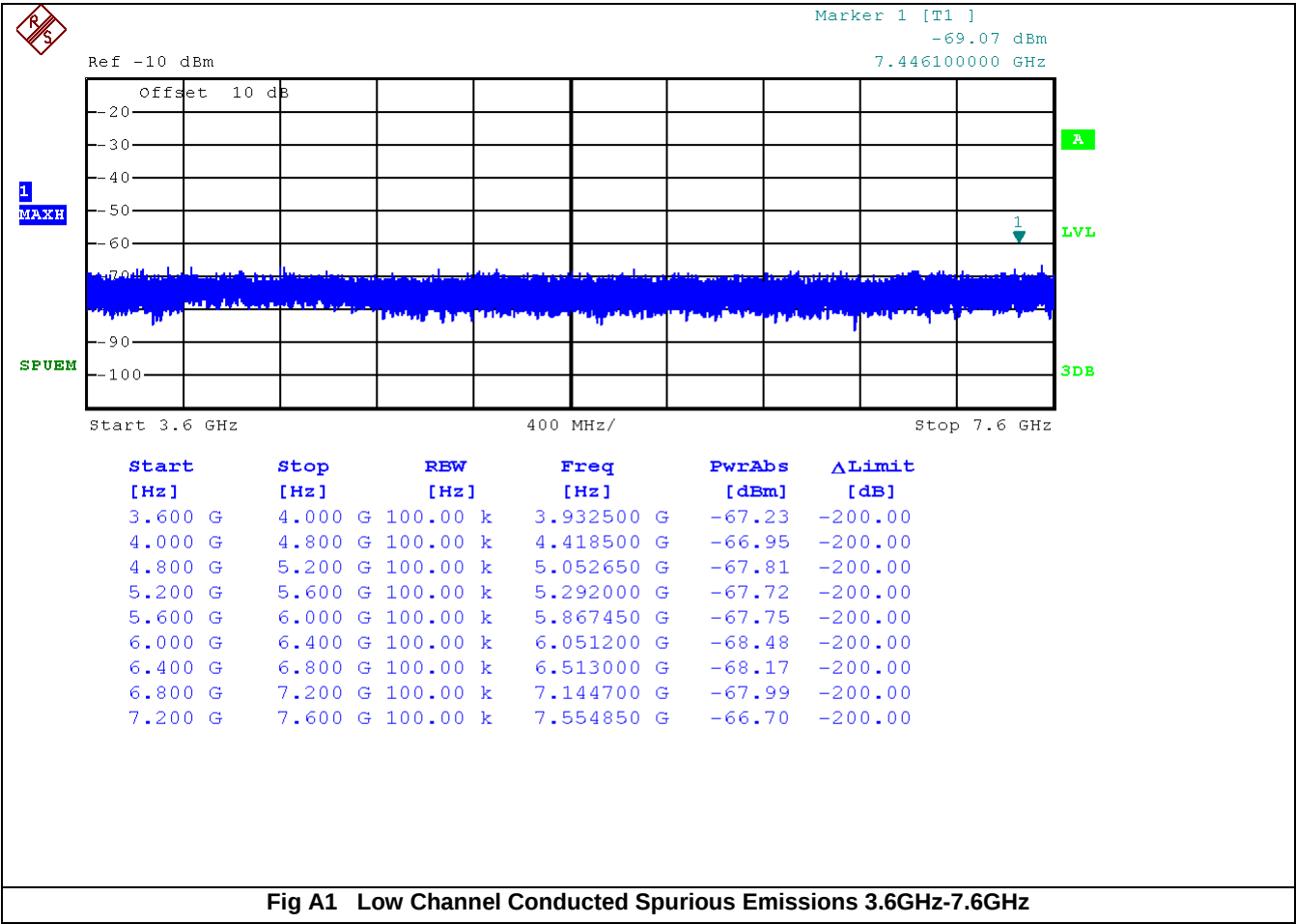
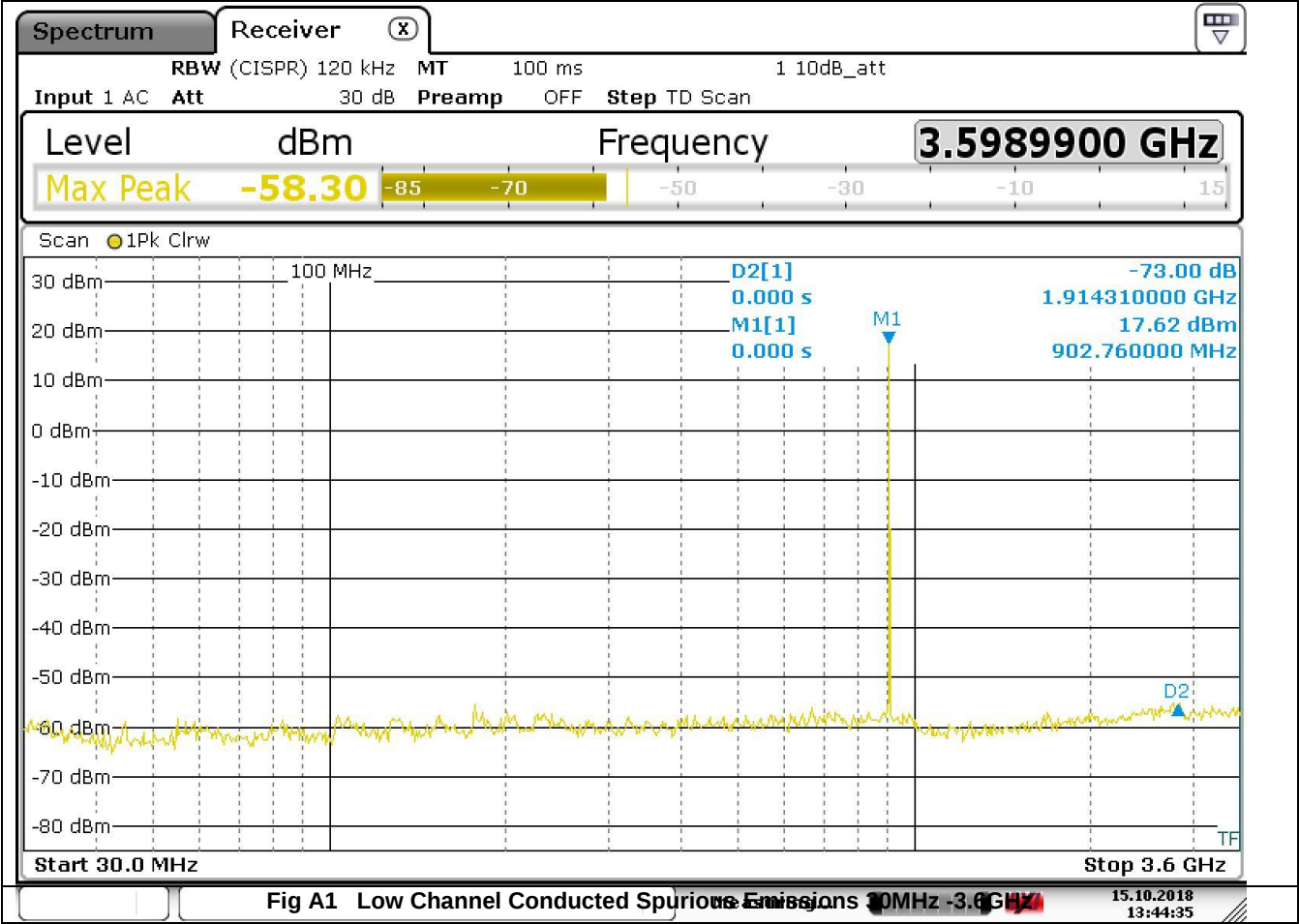
8 Measurement Uncertainties

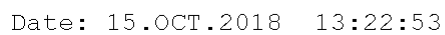
Measurement	Uncertainty
Radio Frequency	+/- 5×10^{-7}
Maximum Frequency Deviation	+/- 1.7 %
Conducted Emissions	+/- 1 dB
Radiated Emission 30MHz-100MHz	+/- 5.3 dB
Radiated Emission 100MHz-300MHz	+/- 4.7 dB
Radiated Emission 300MHz-1GHz	+/- 3.9 dB
Radiated Emission 1GHz-40GHz	+/- 3.8 dB

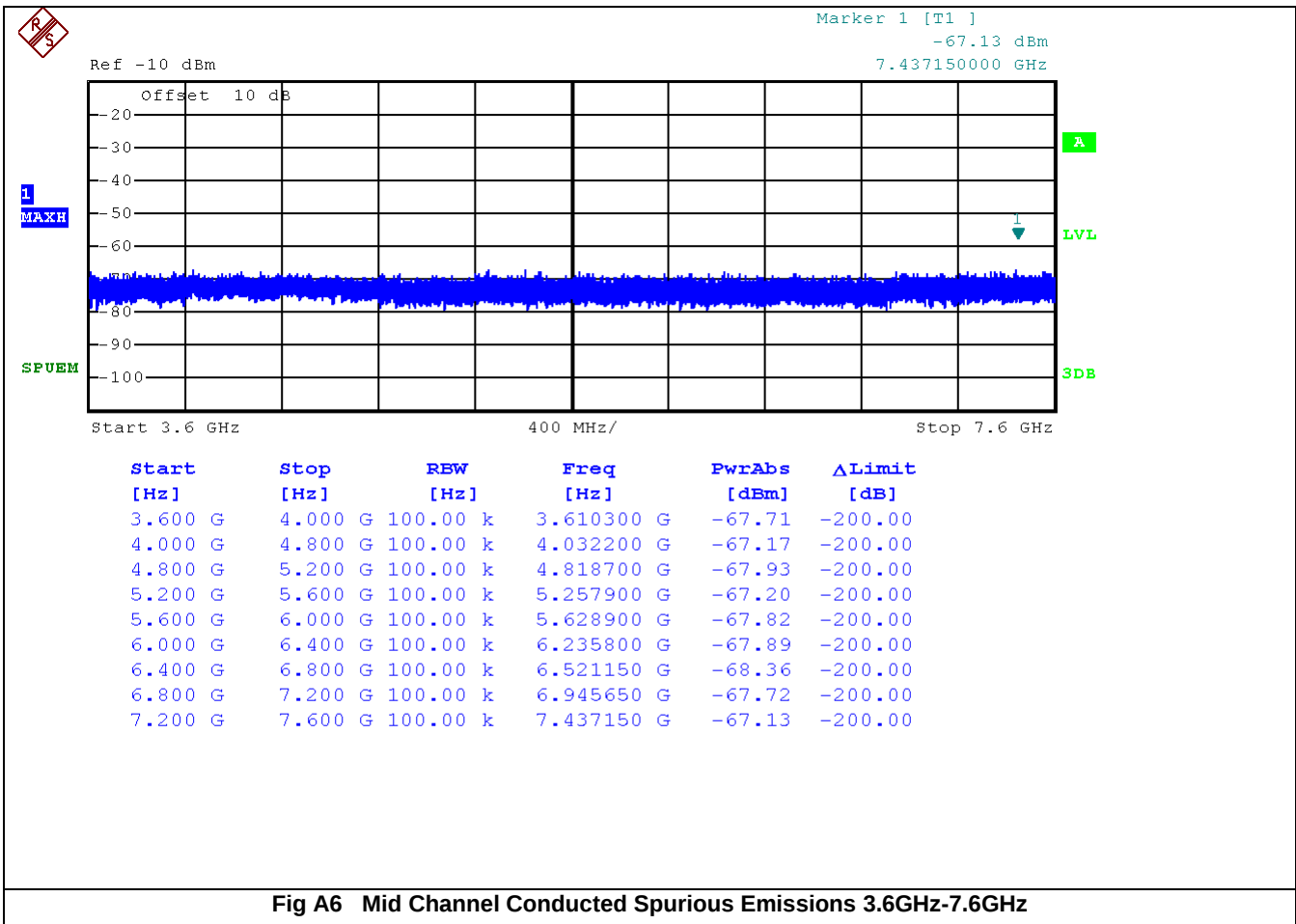
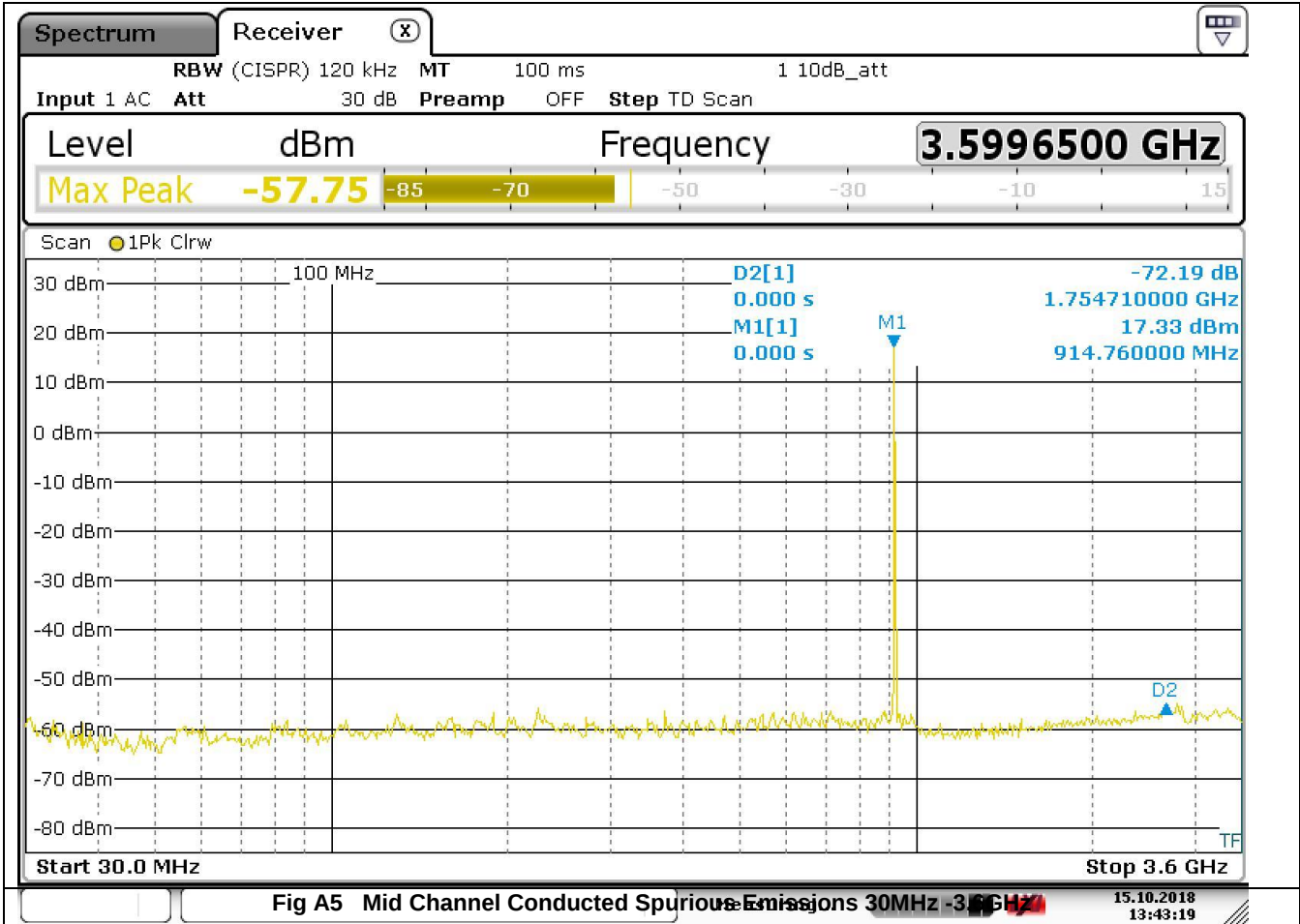
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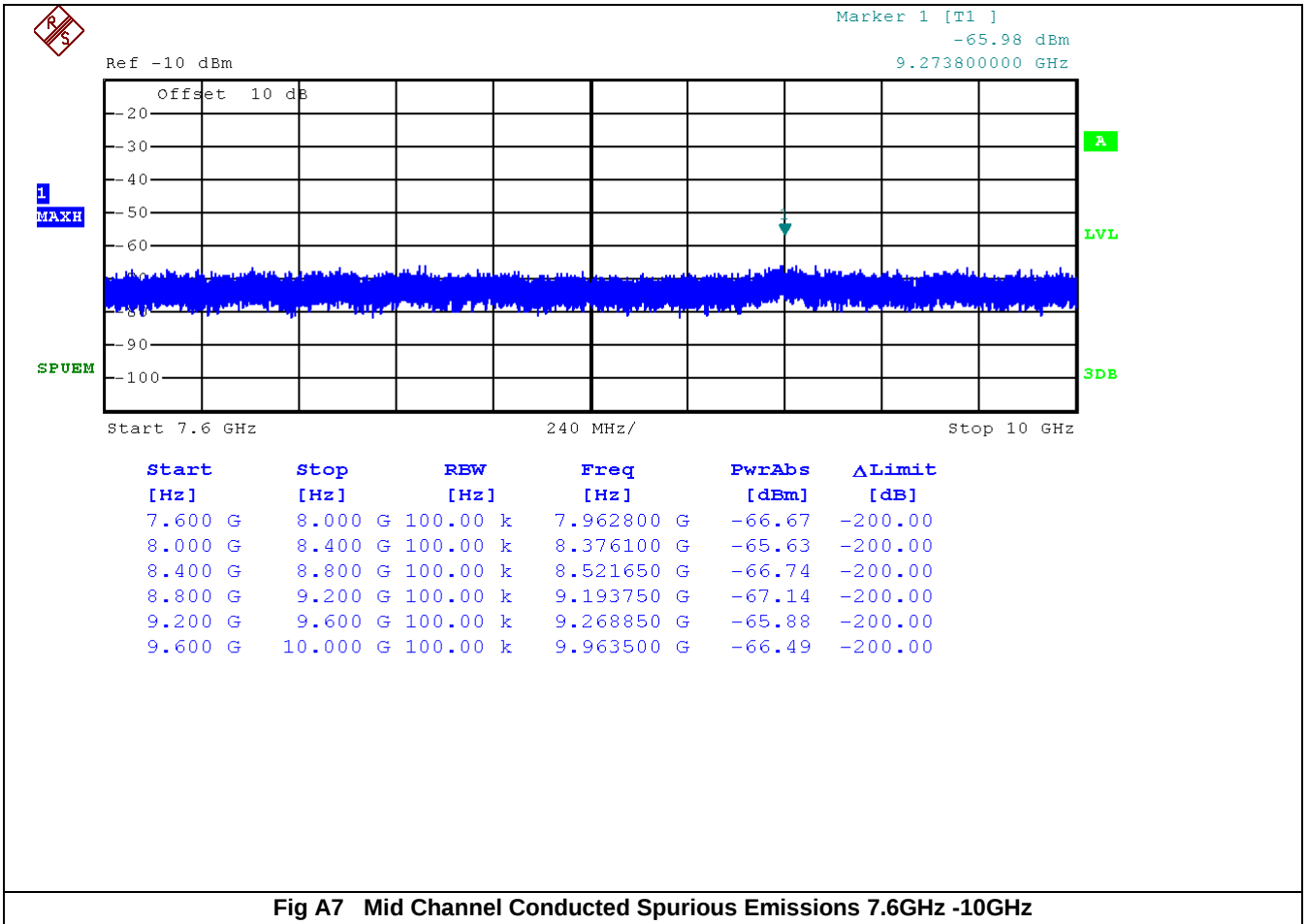
Appendix A

**Additional Test Results
For
Conducted Measurements Spurious Emissions**

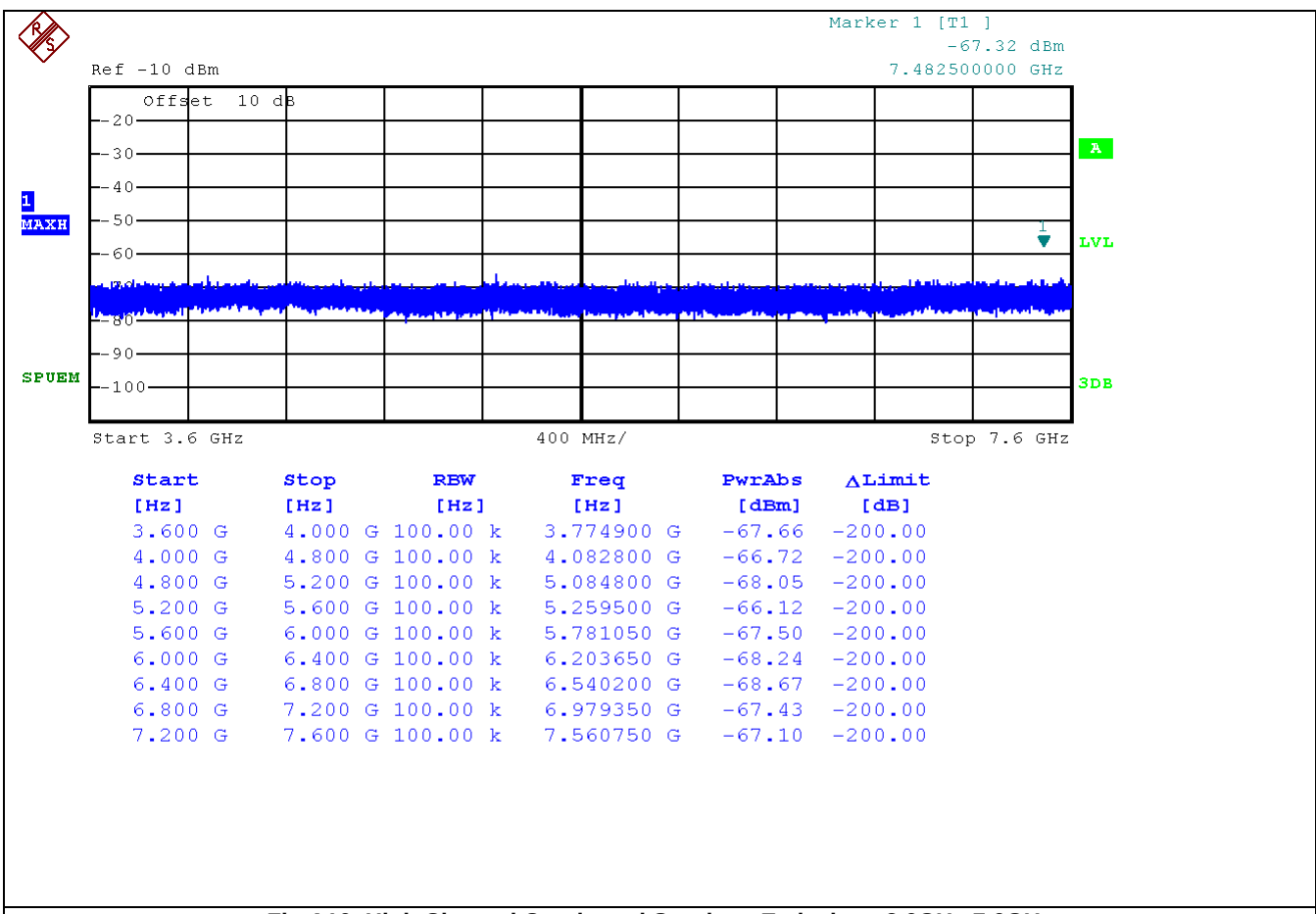
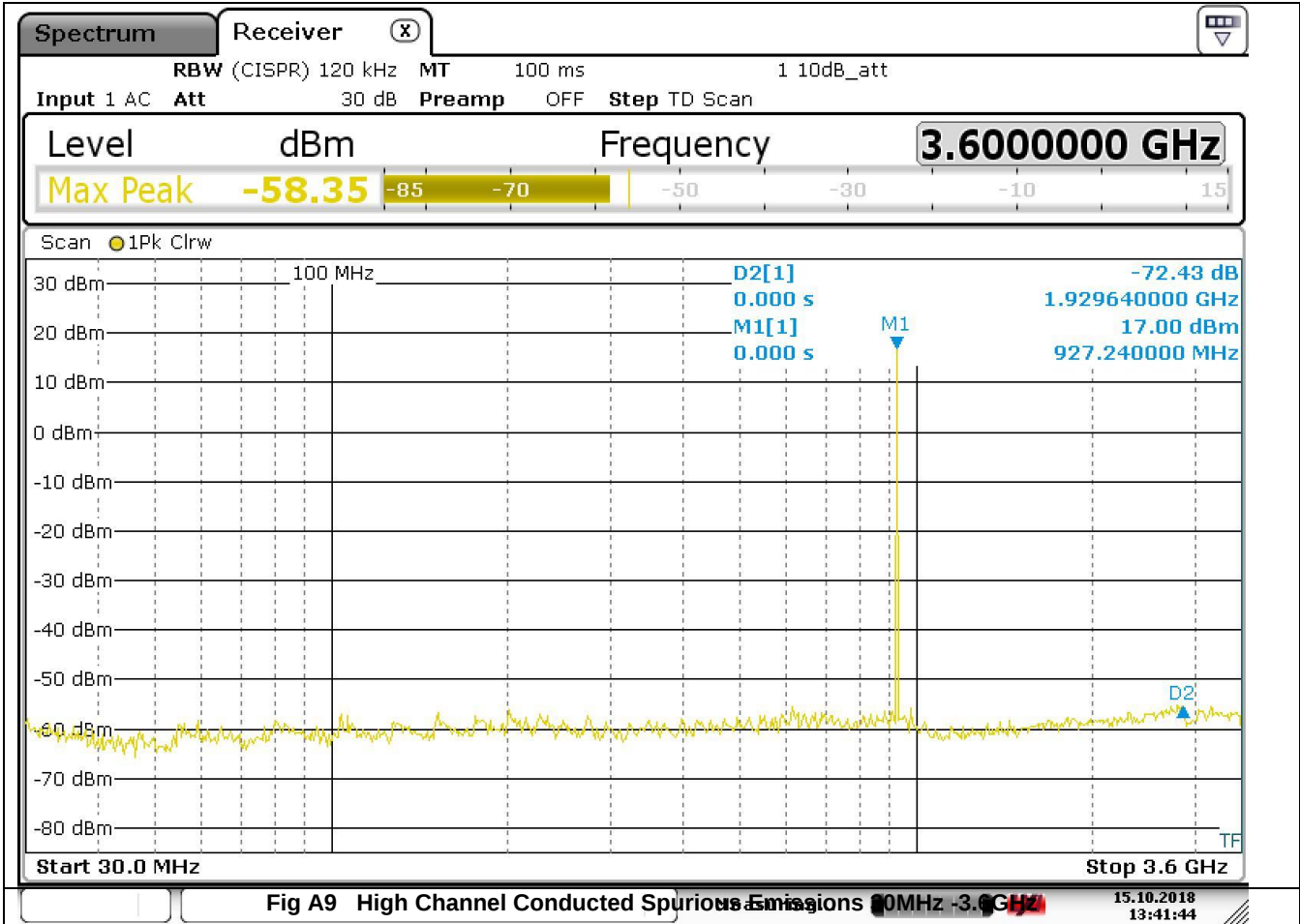


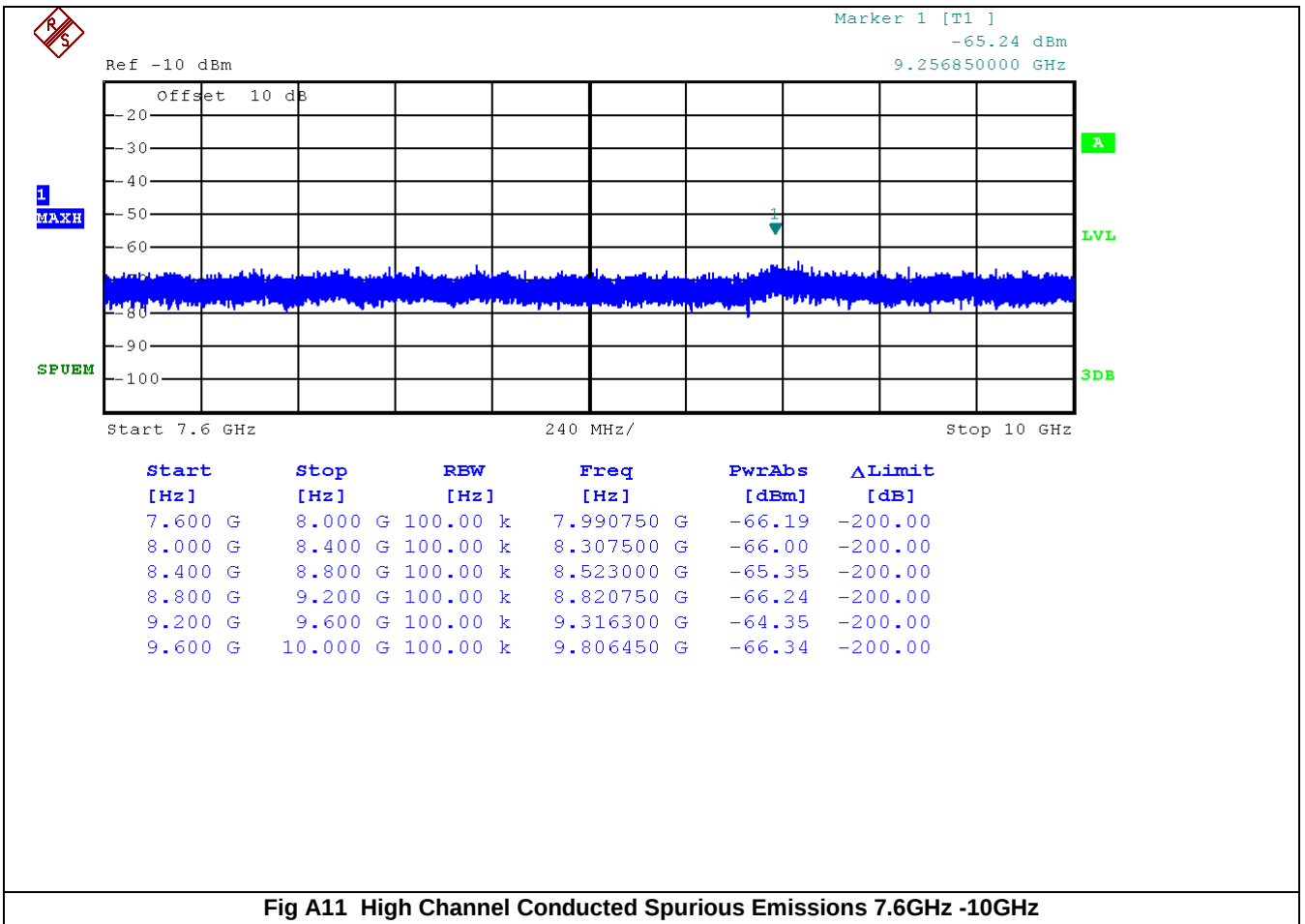






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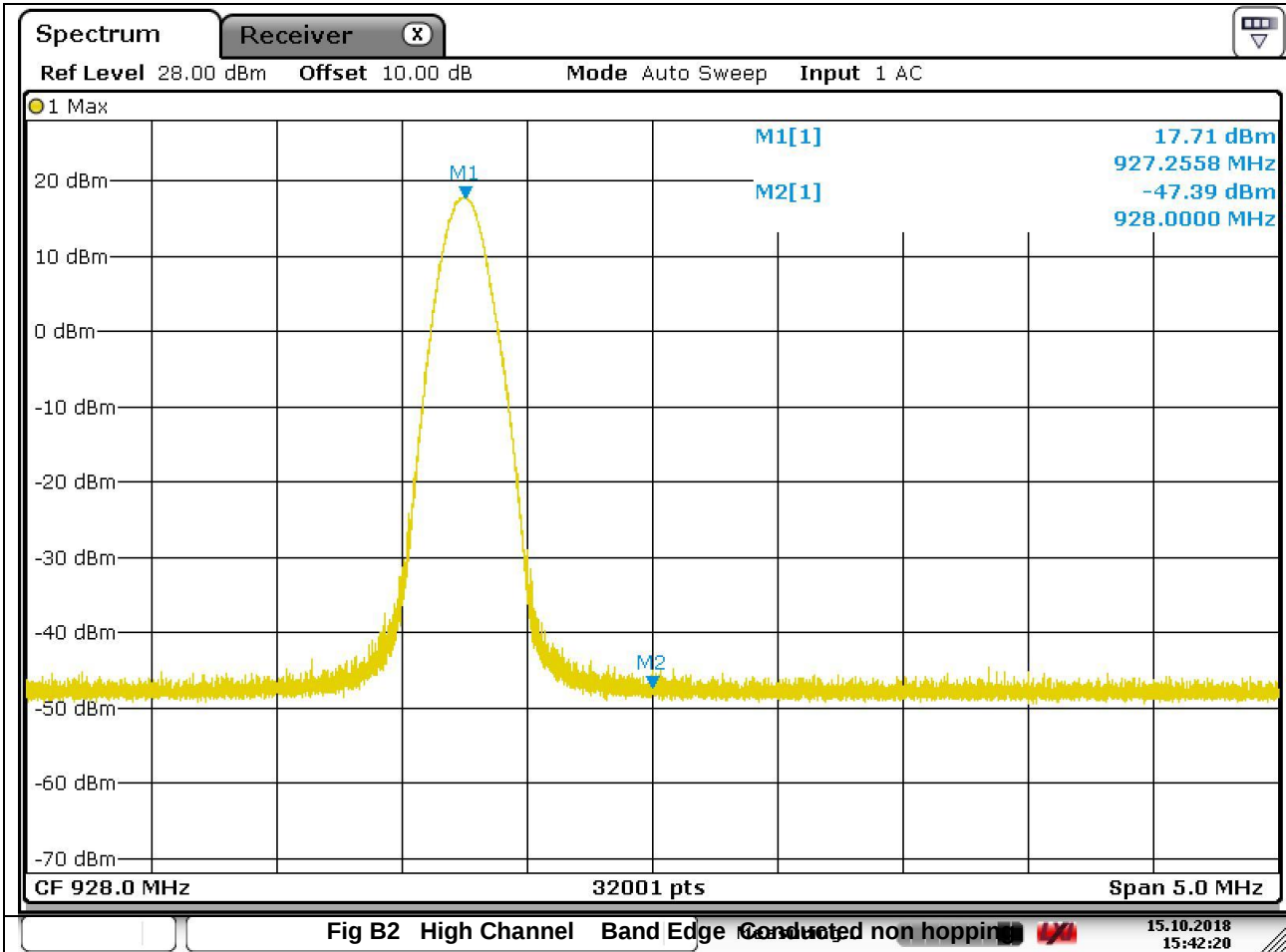
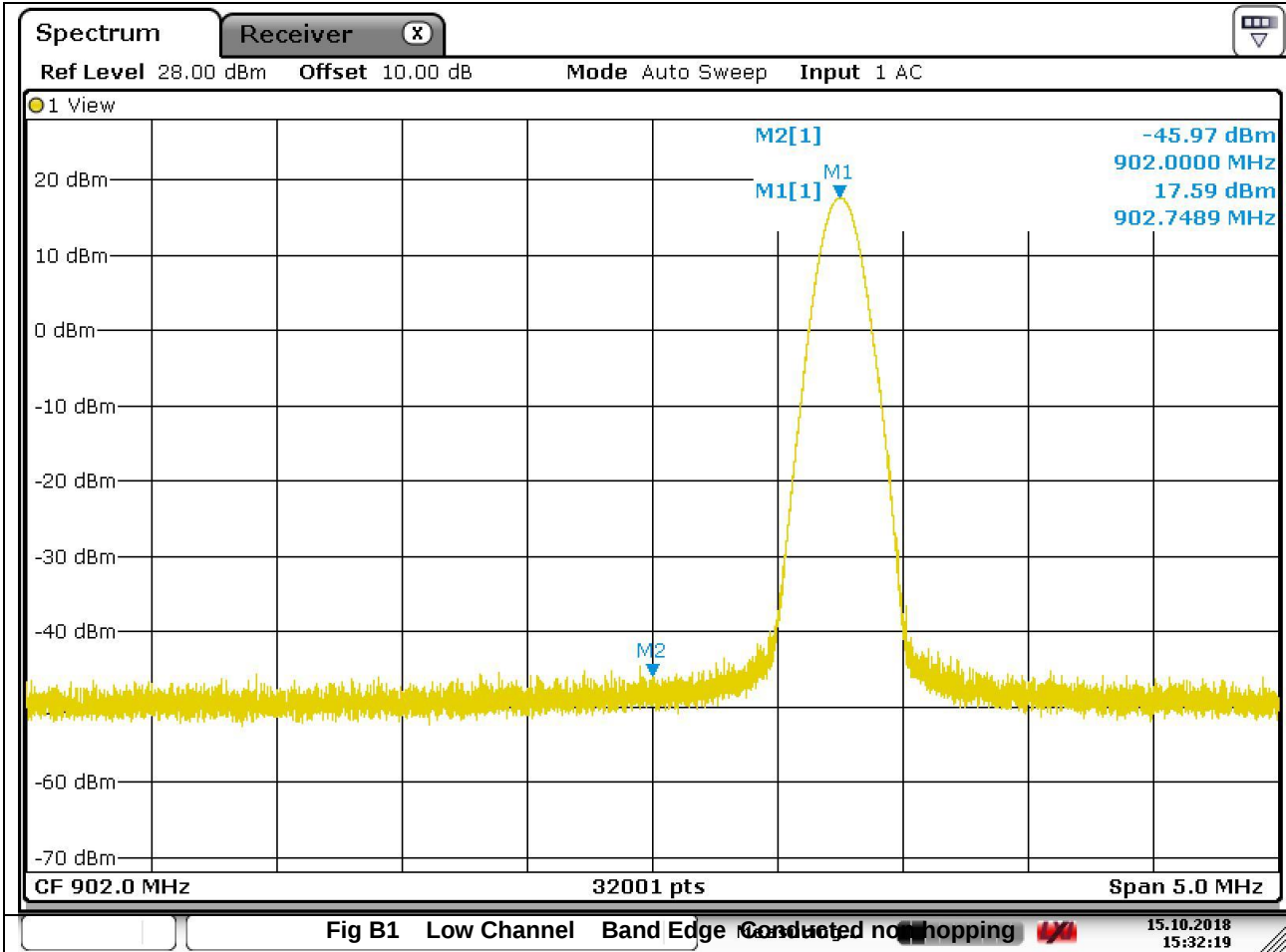


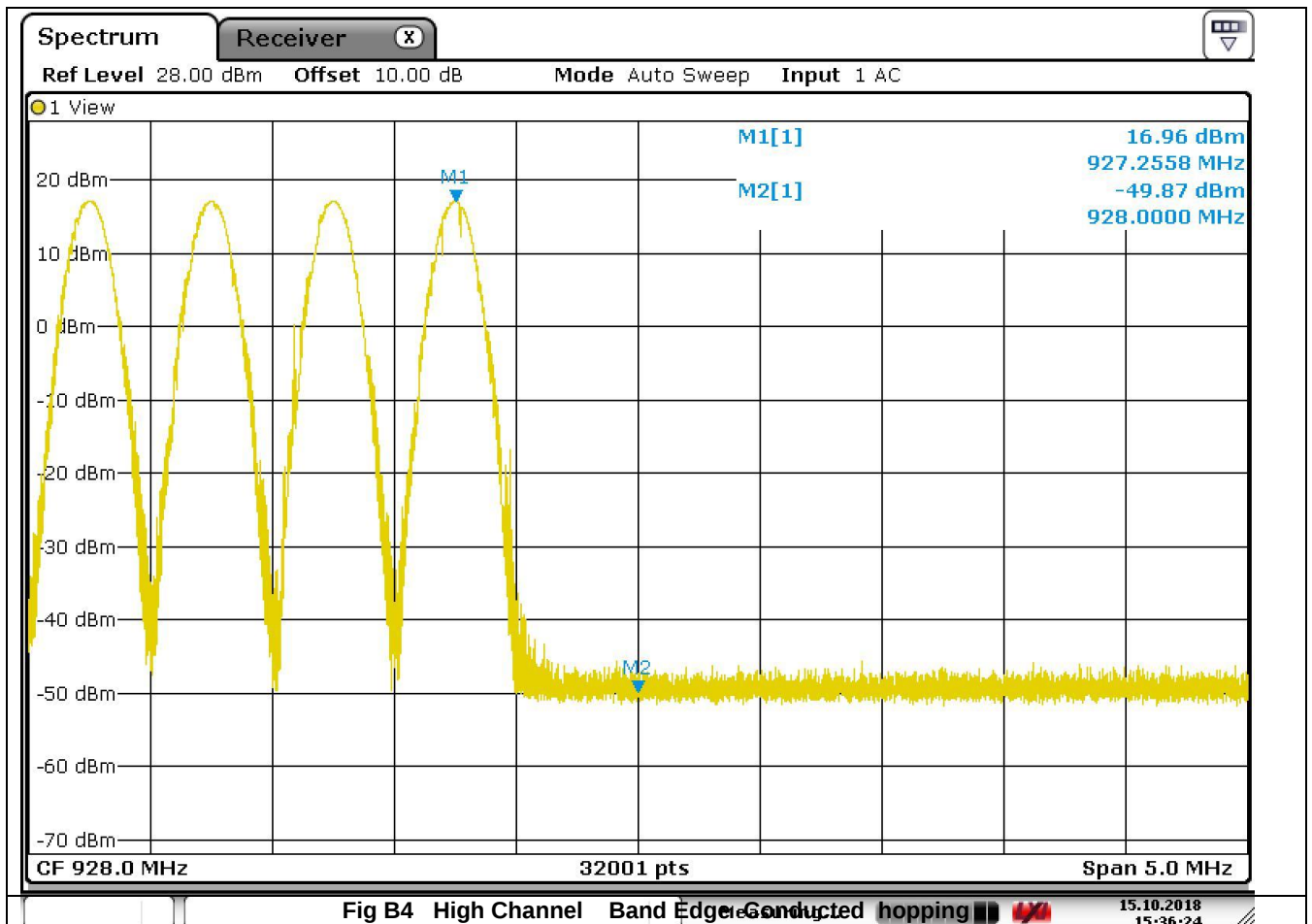
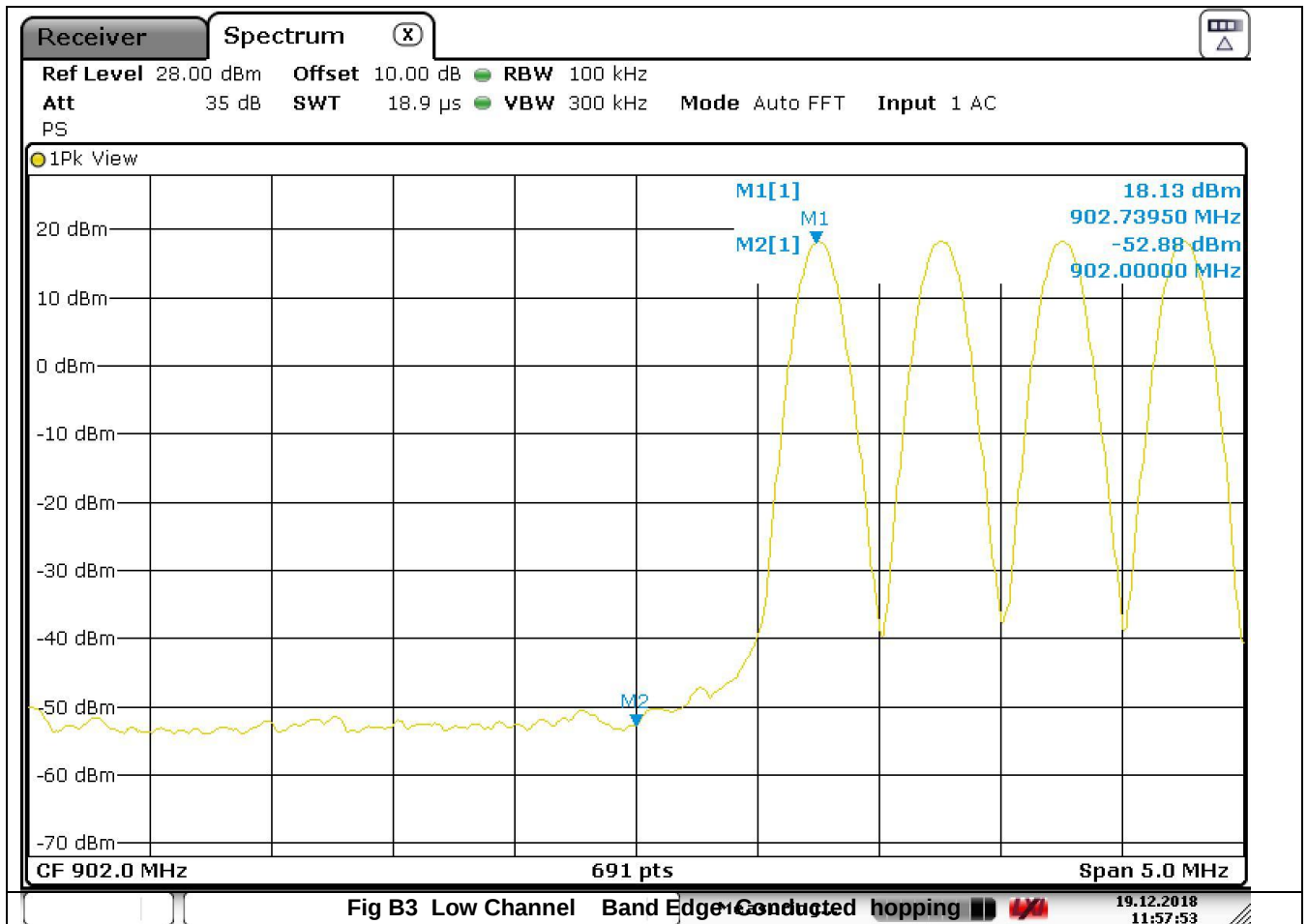


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Appendix B

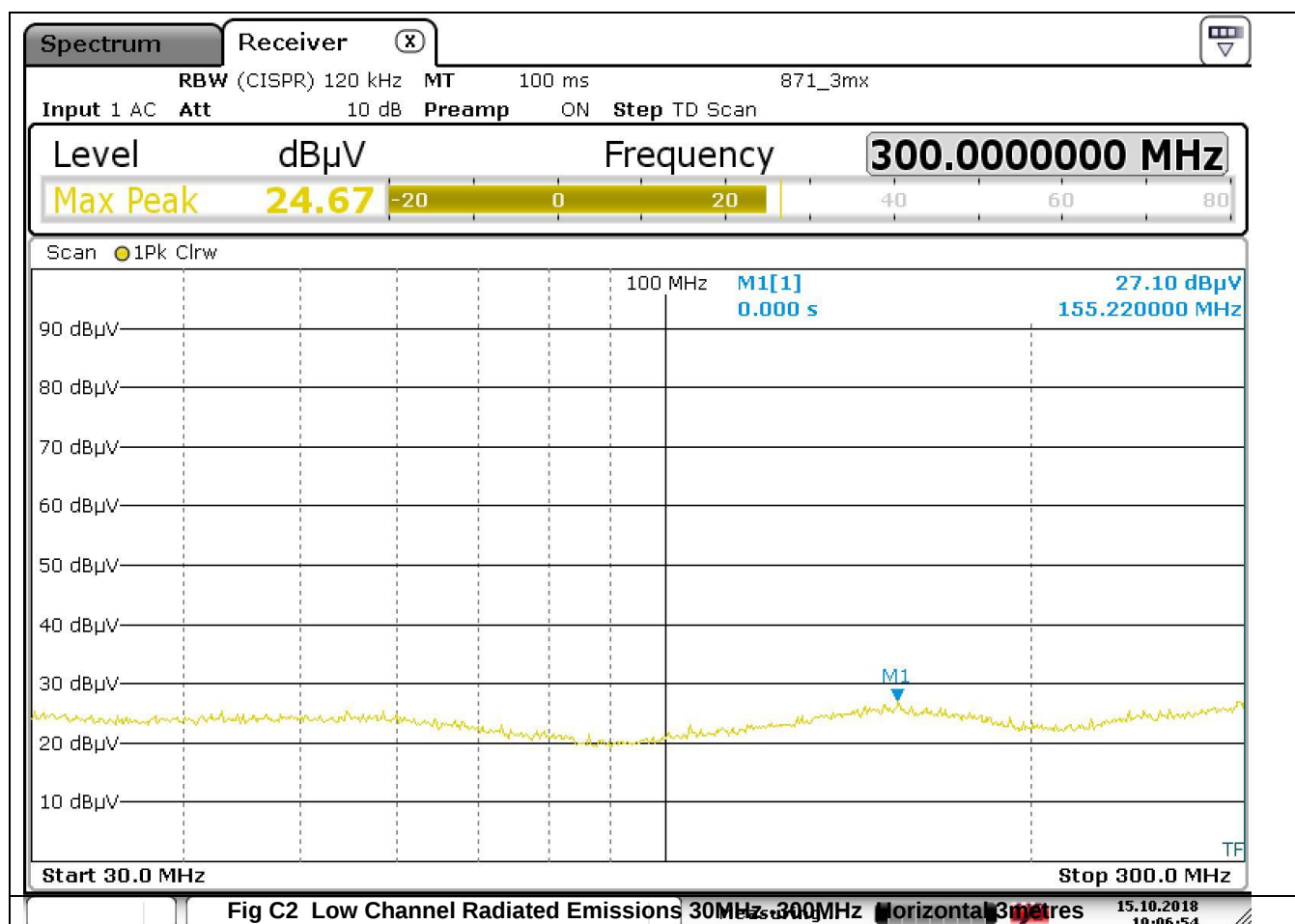
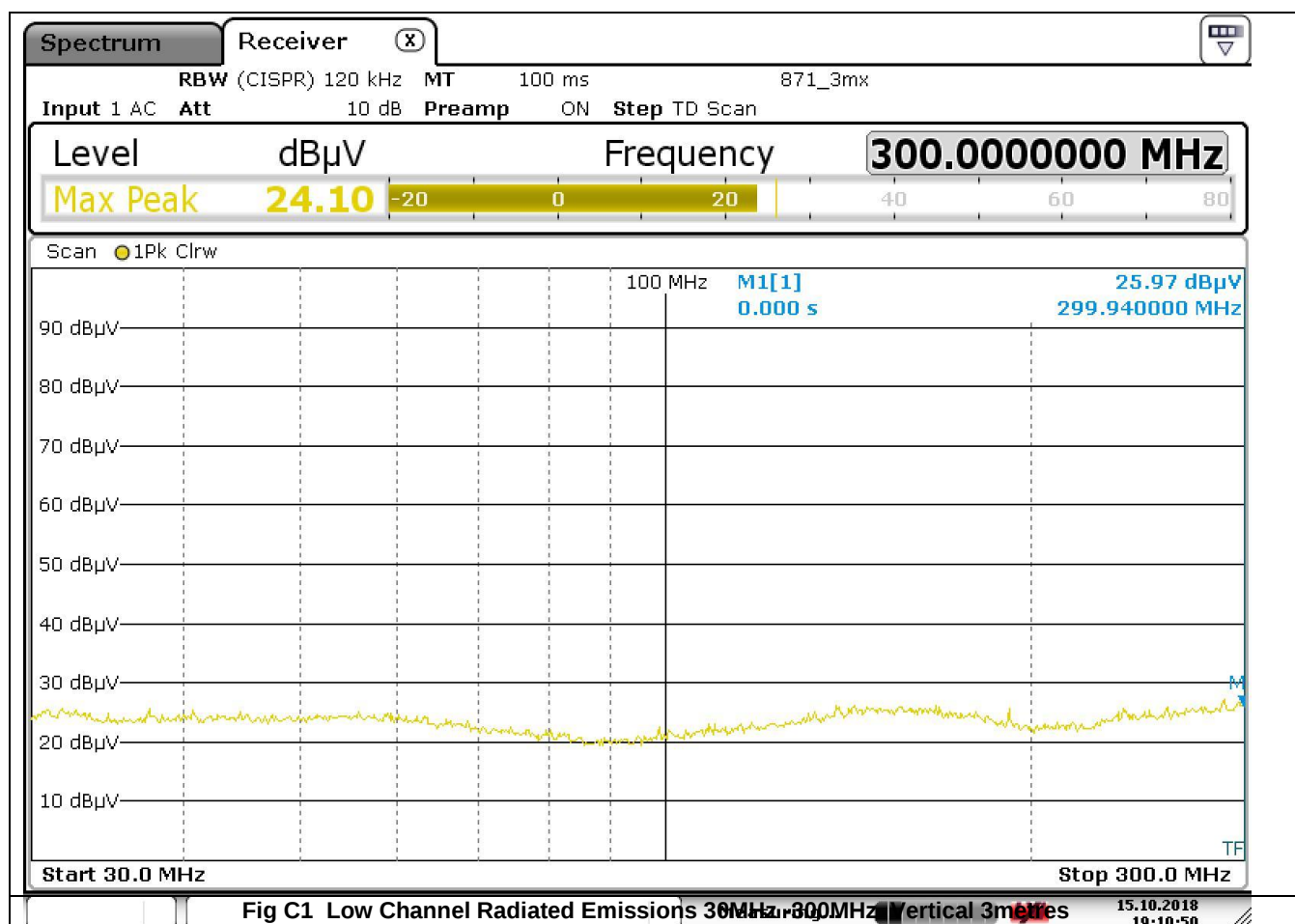
Conducted Tests for Band Edges

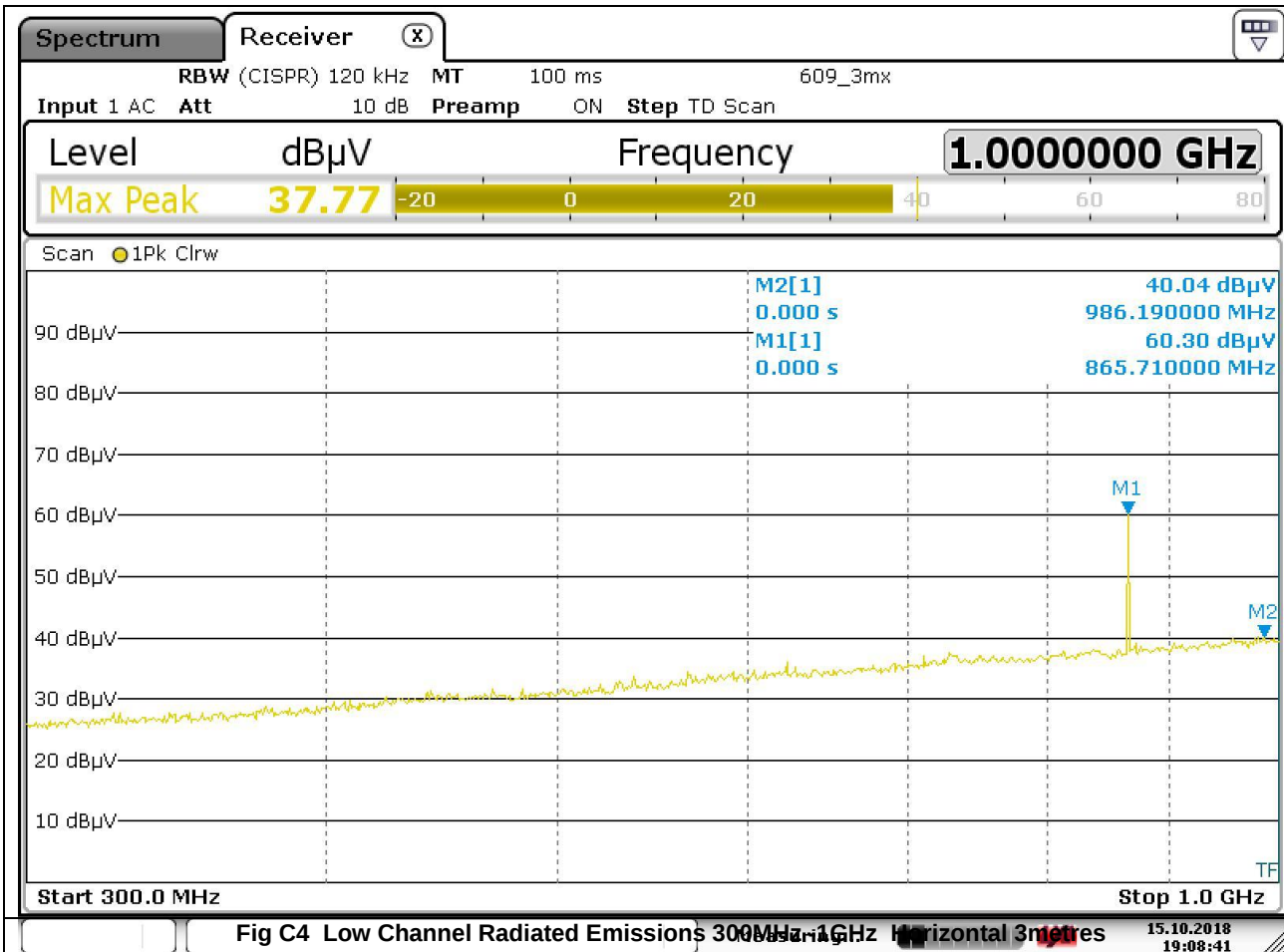
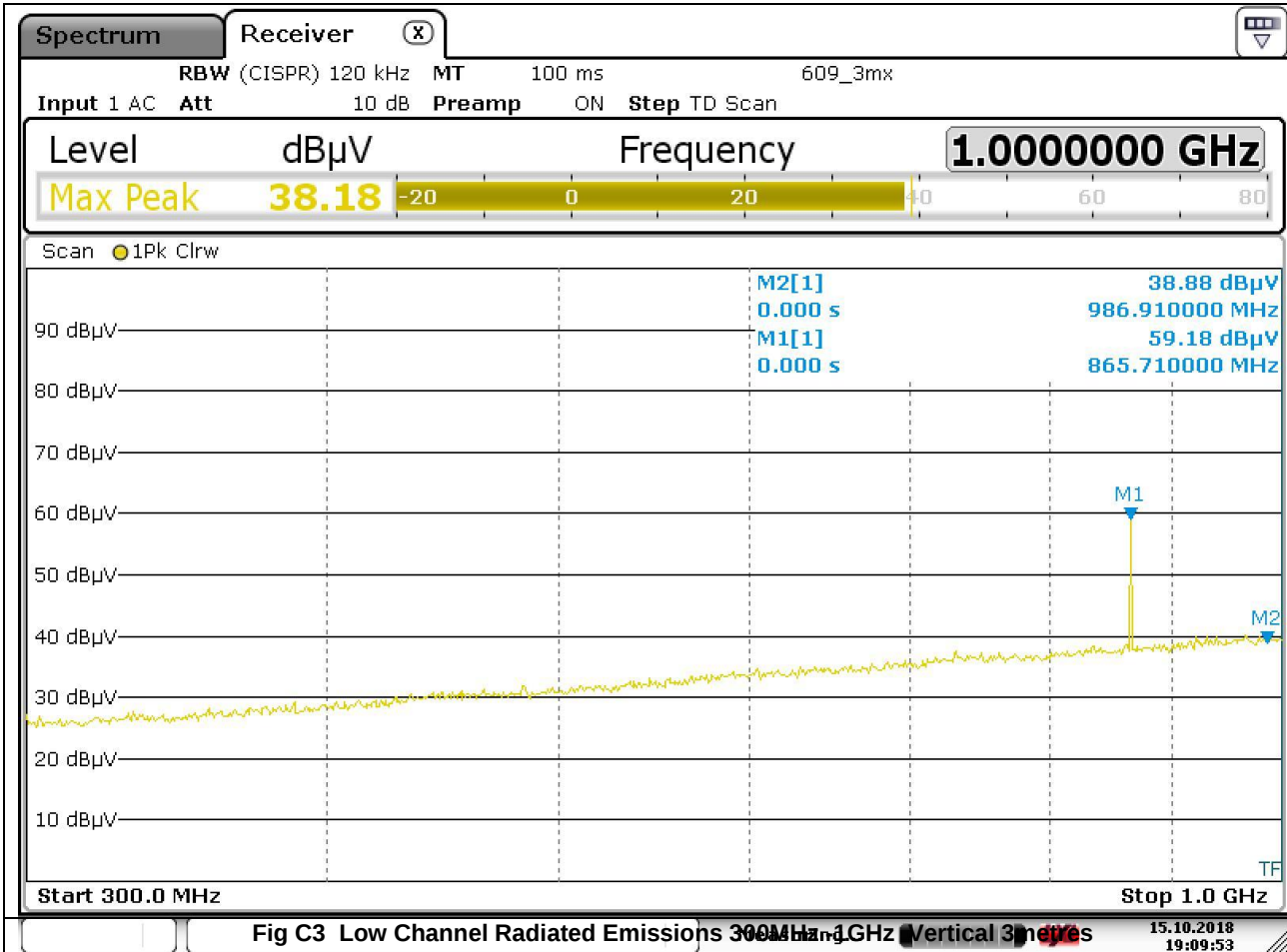


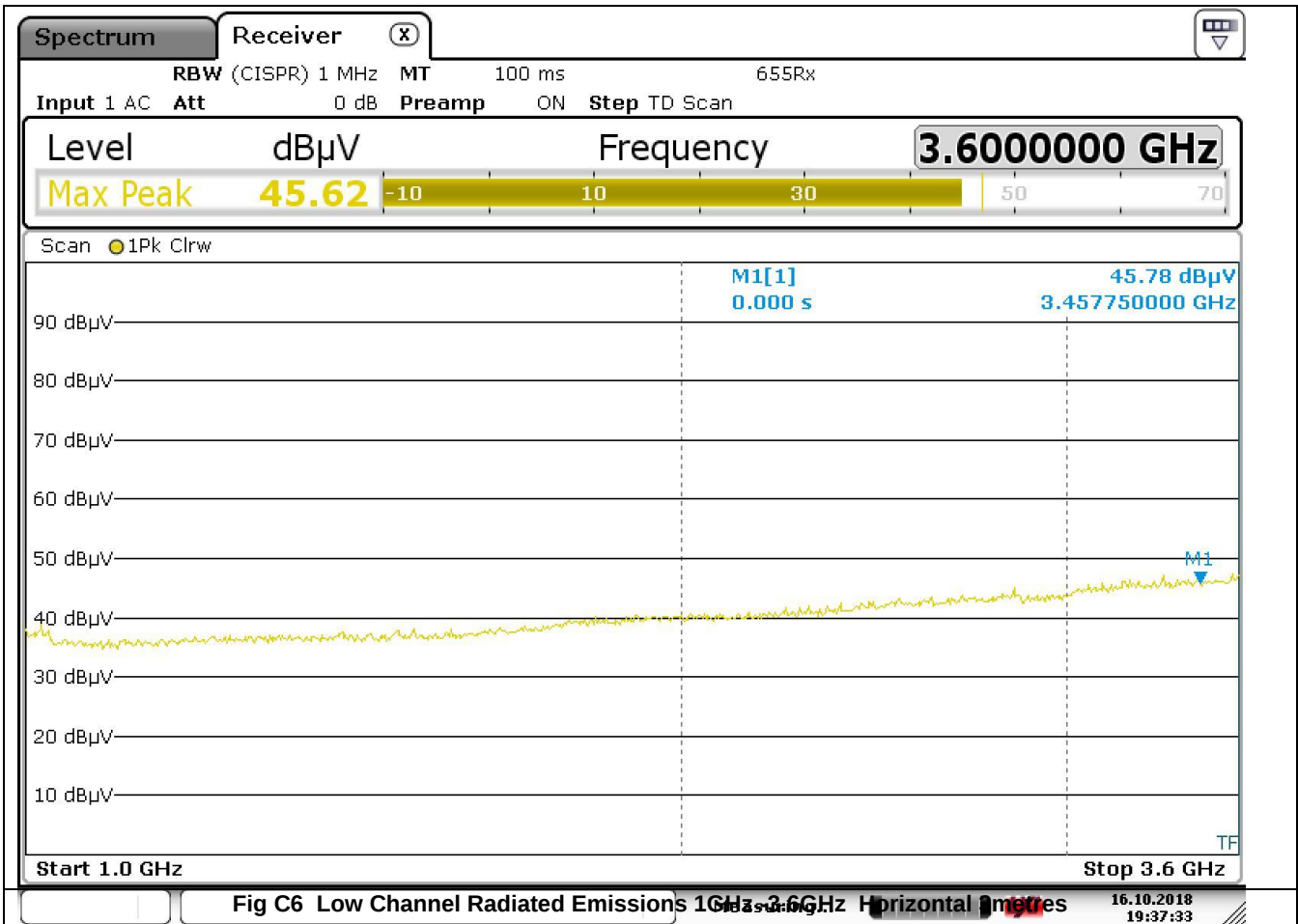
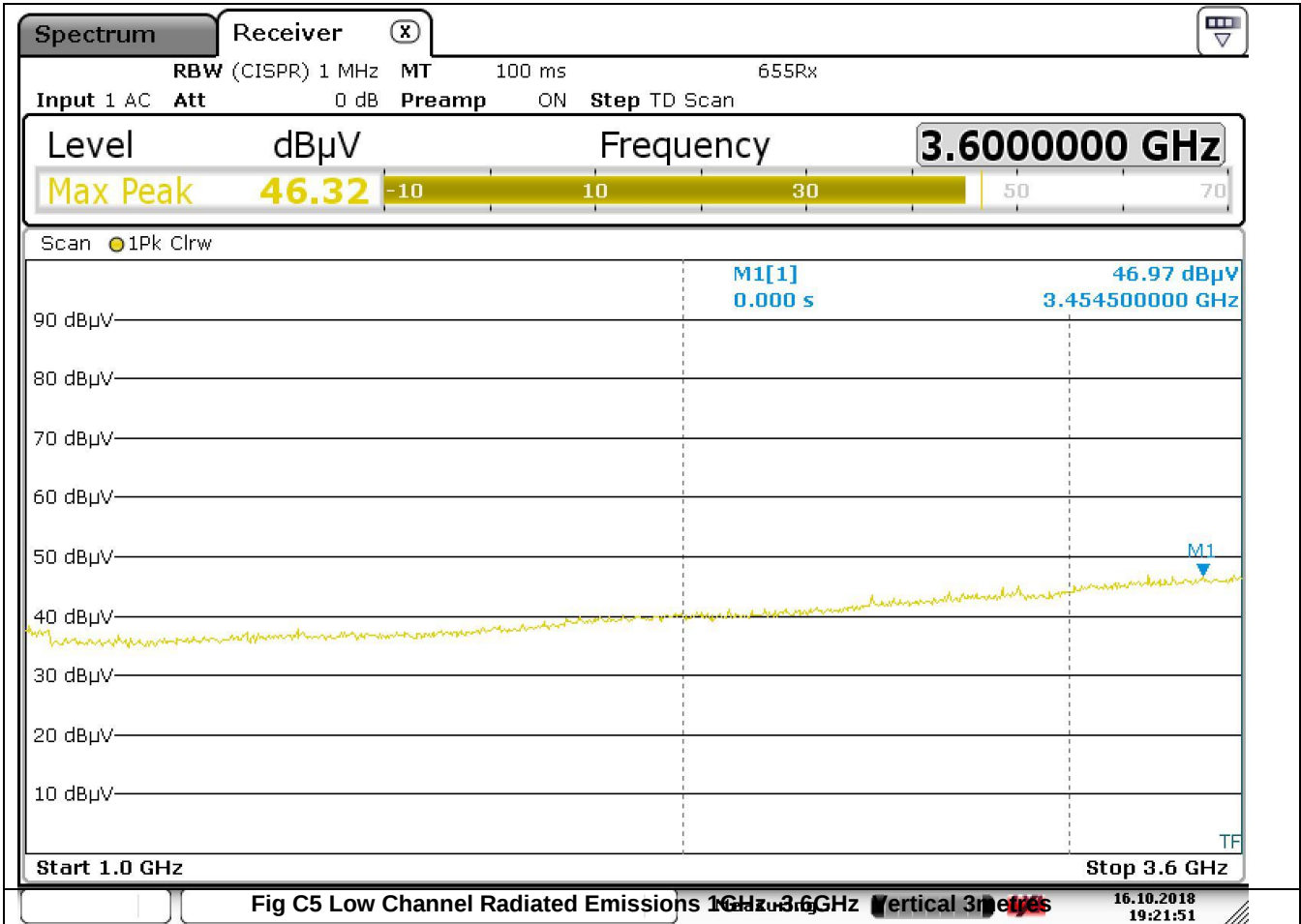


Appendix C

Radiated Spurious Emissions with antenna port terminated







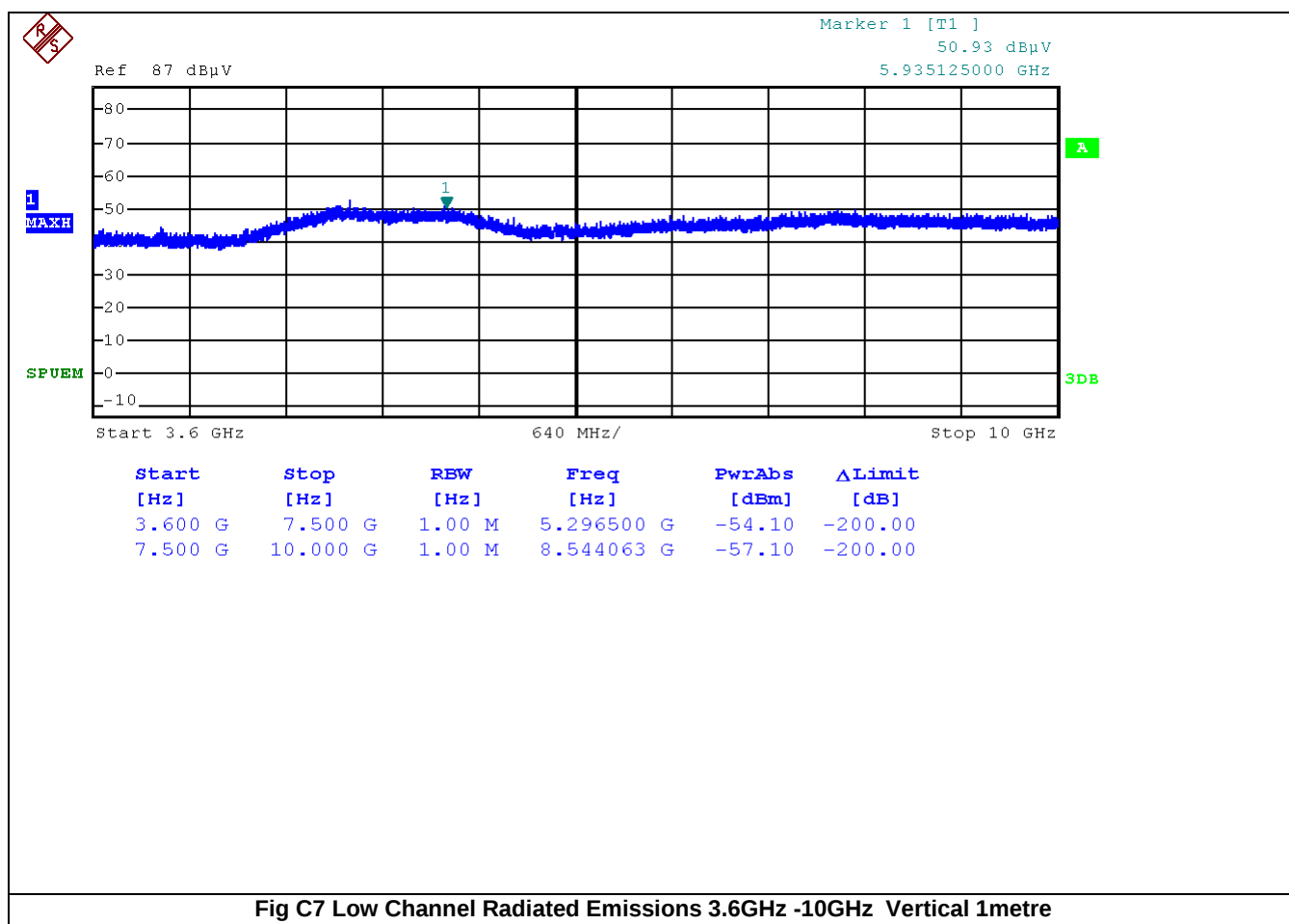


Fig C7 Low Channel Radiated Emissions 3.6GHz -10GHz Vertical 1metre

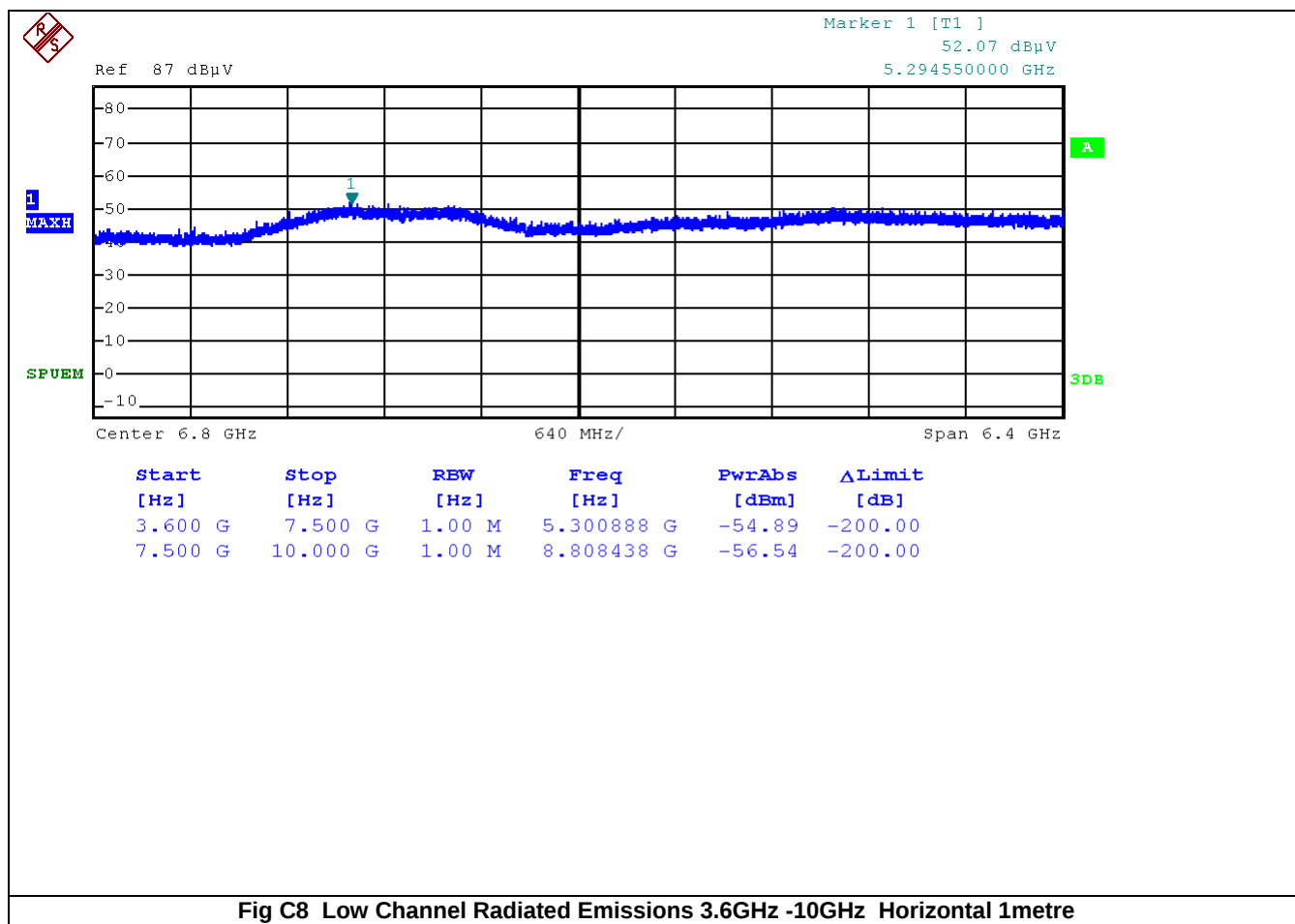
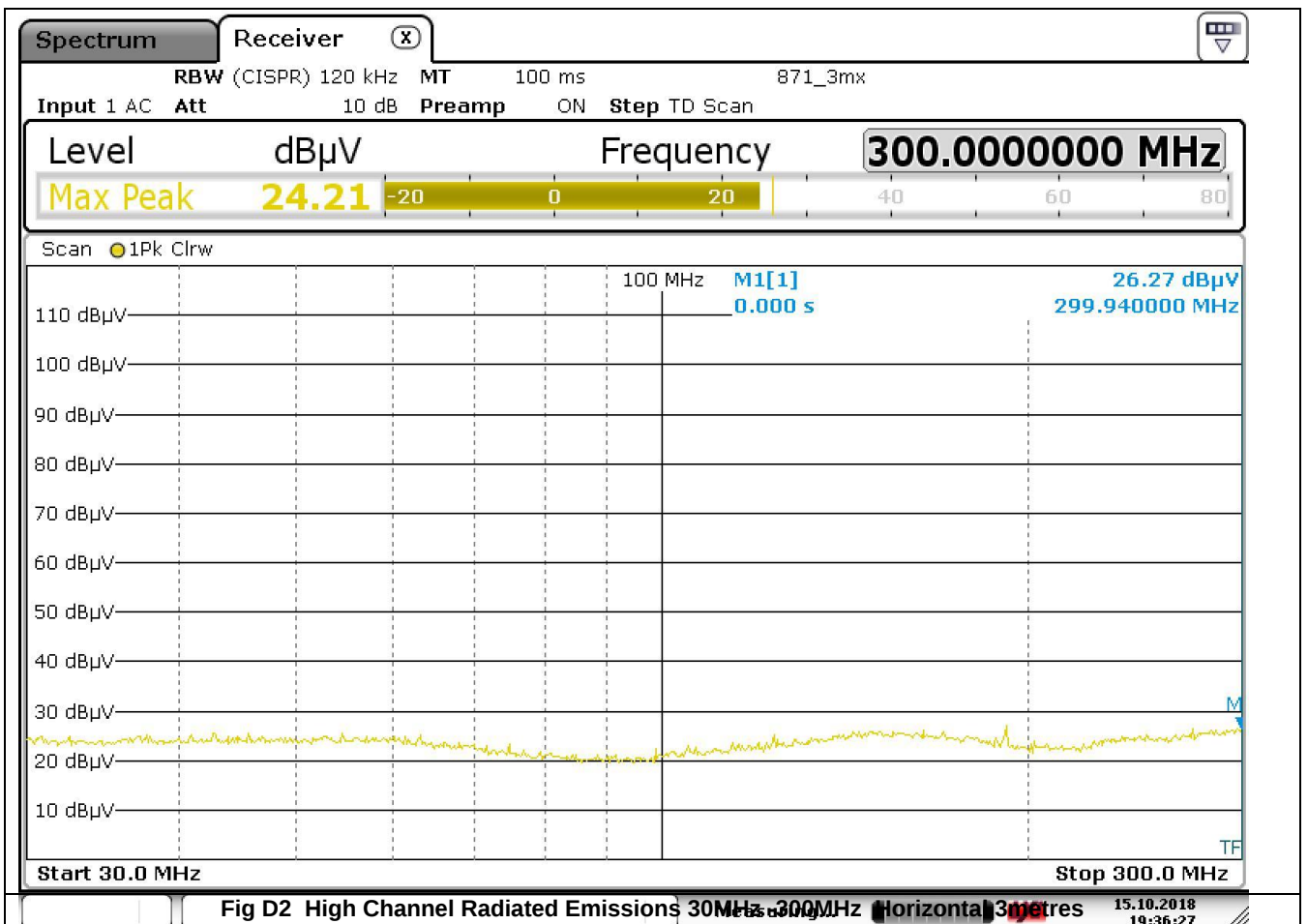
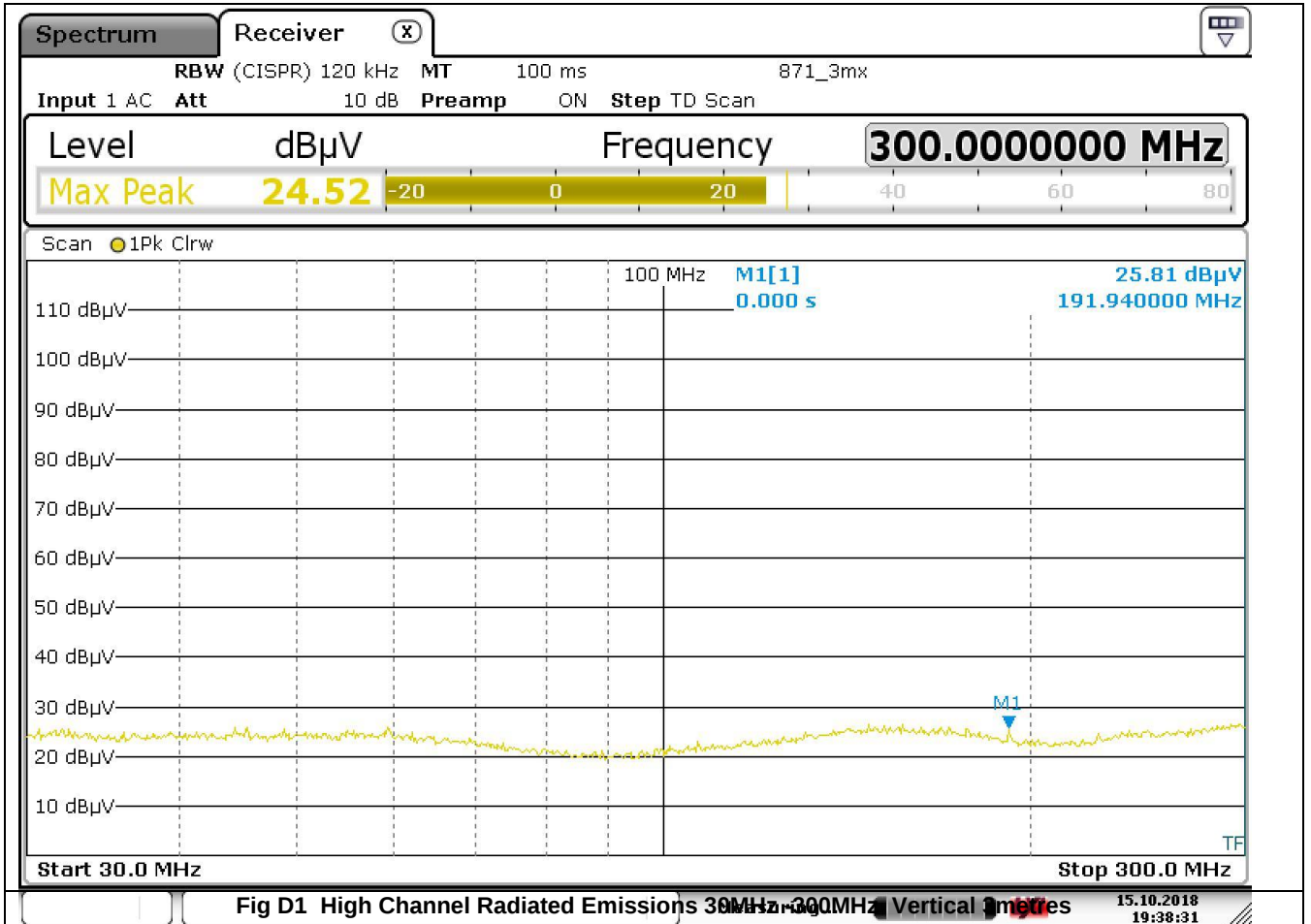
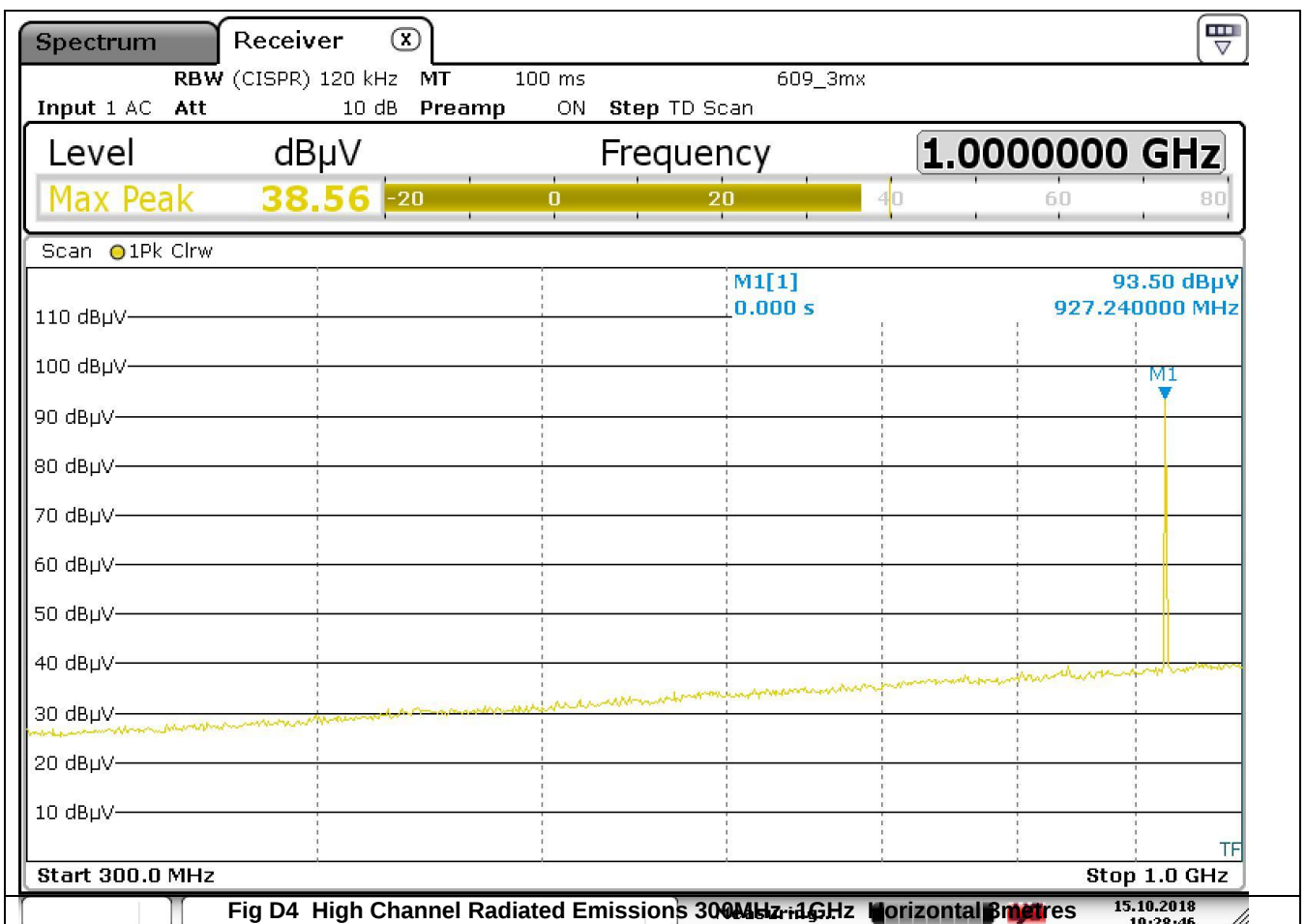
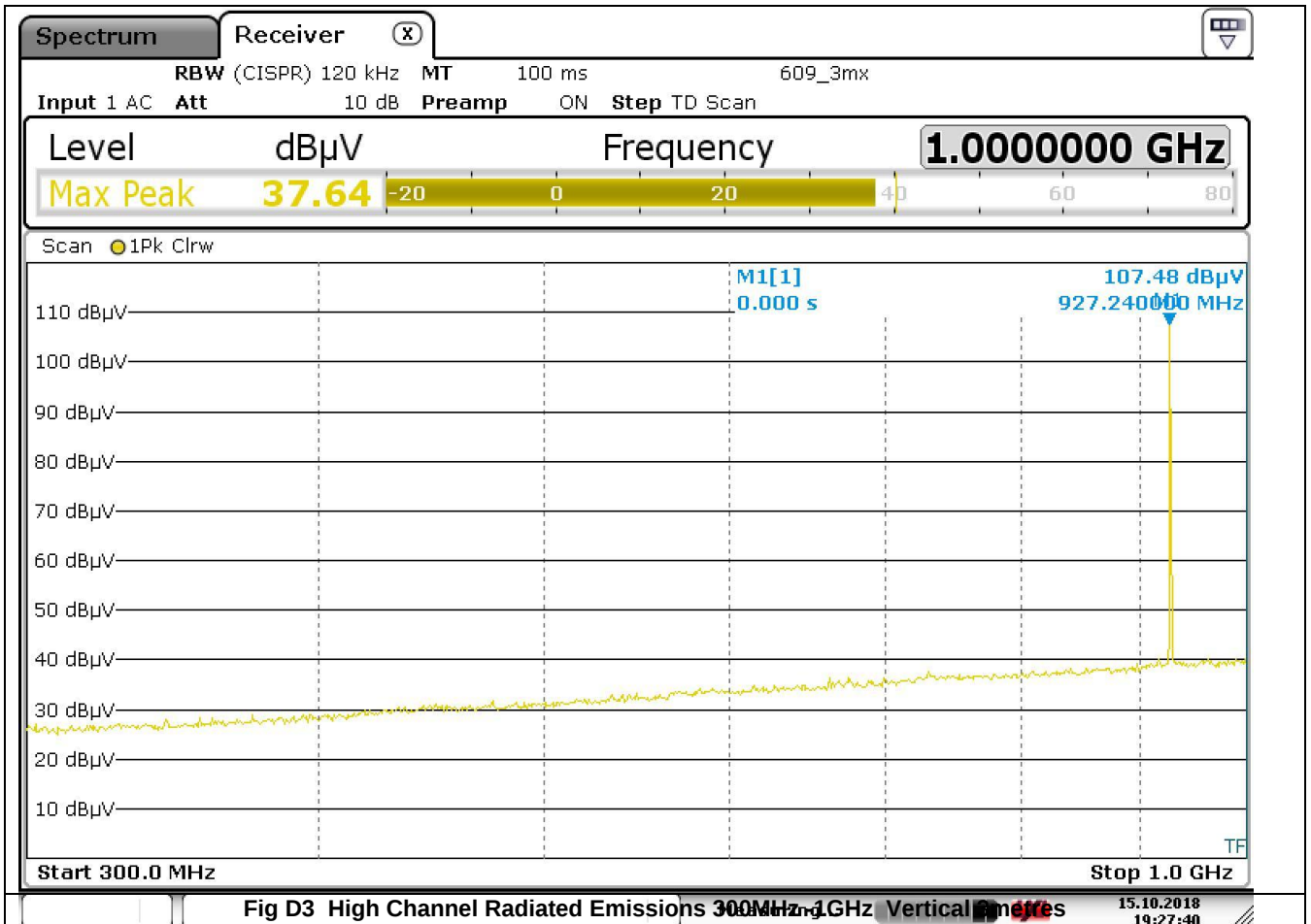


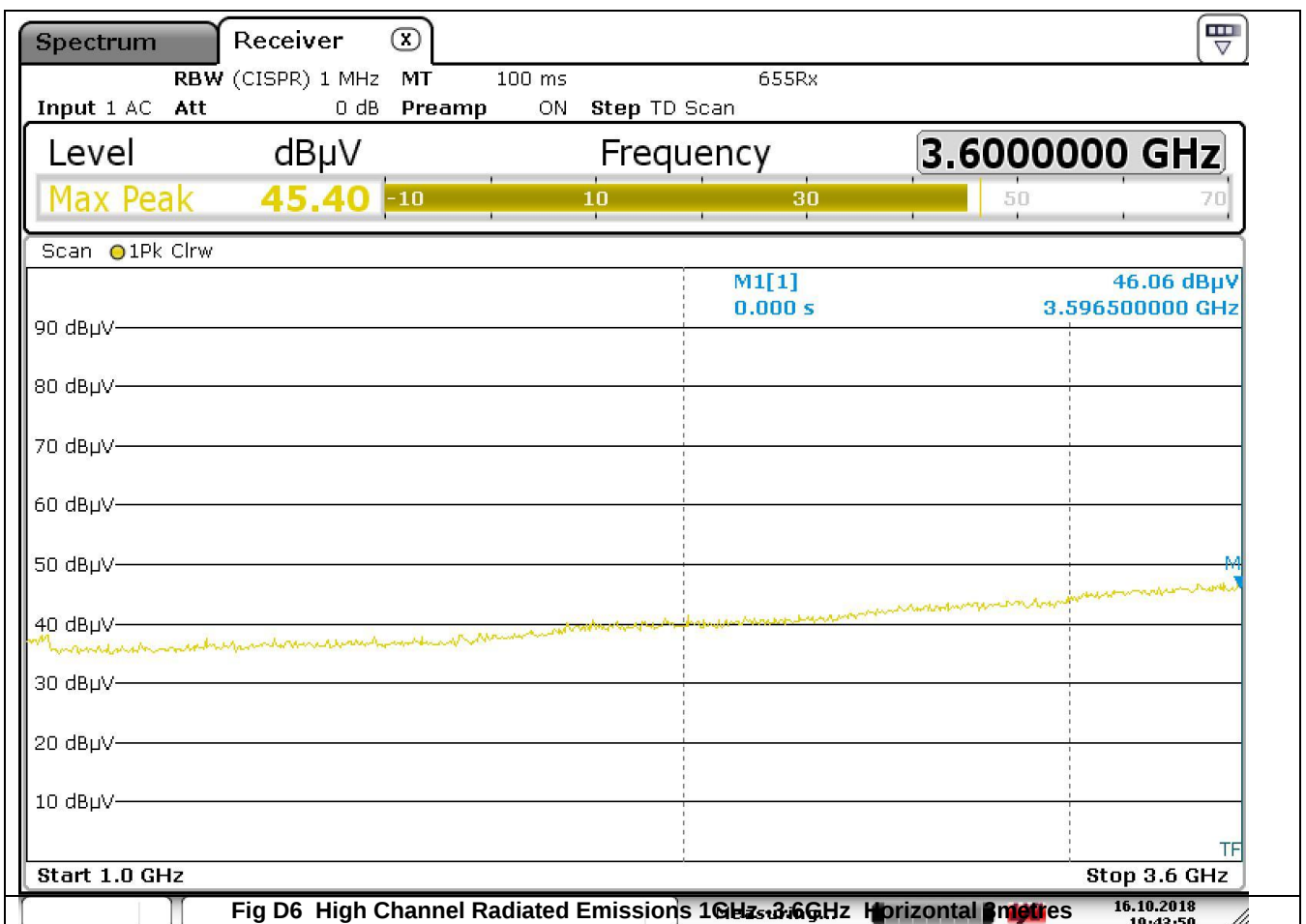
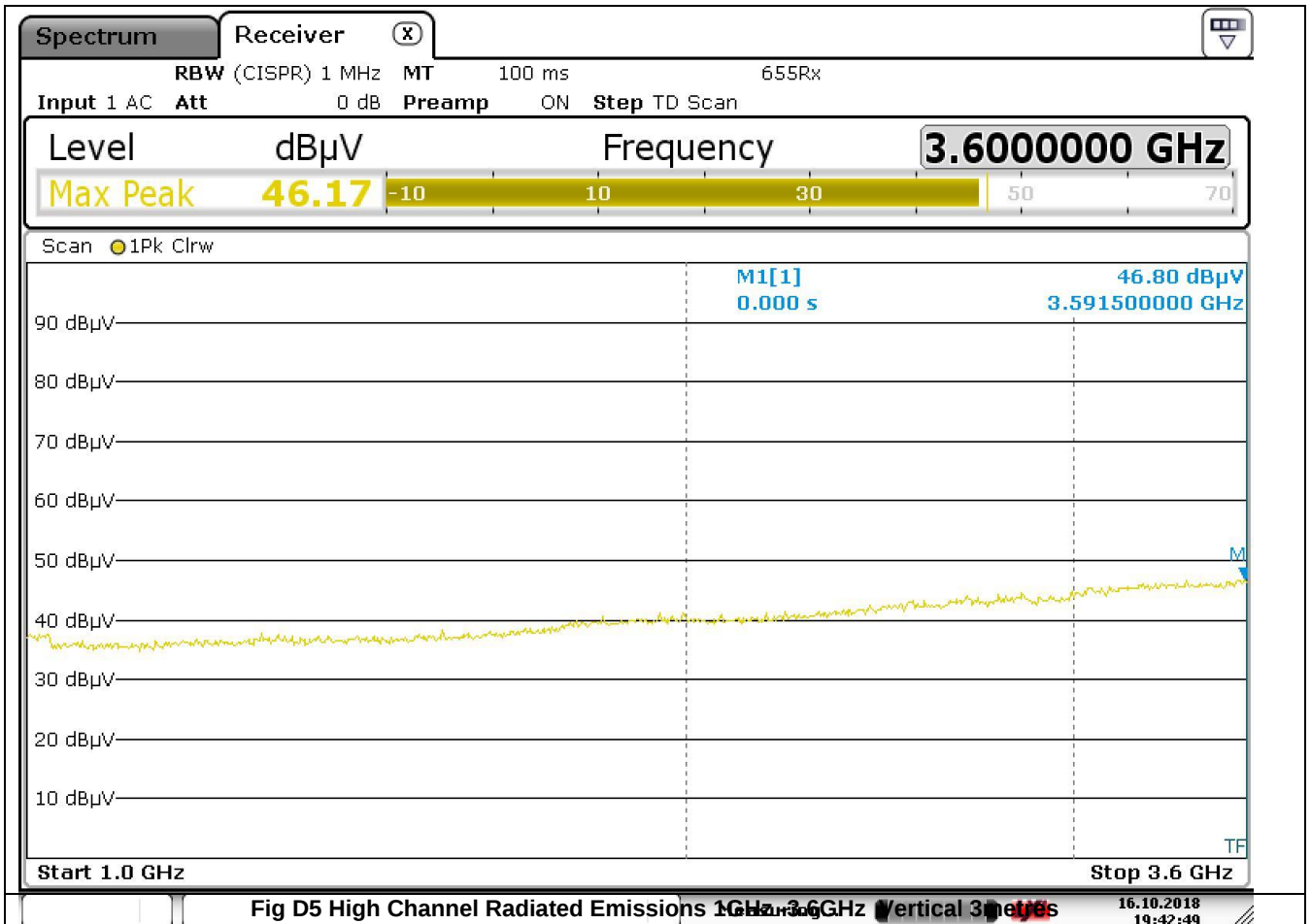
Fig C8 Low Channel Radiated Emissions 3.6GHz -10GHz Horizontal 1metre

Appendix D

Radiated Spurious Emissions Restricted Bands with antenna #1







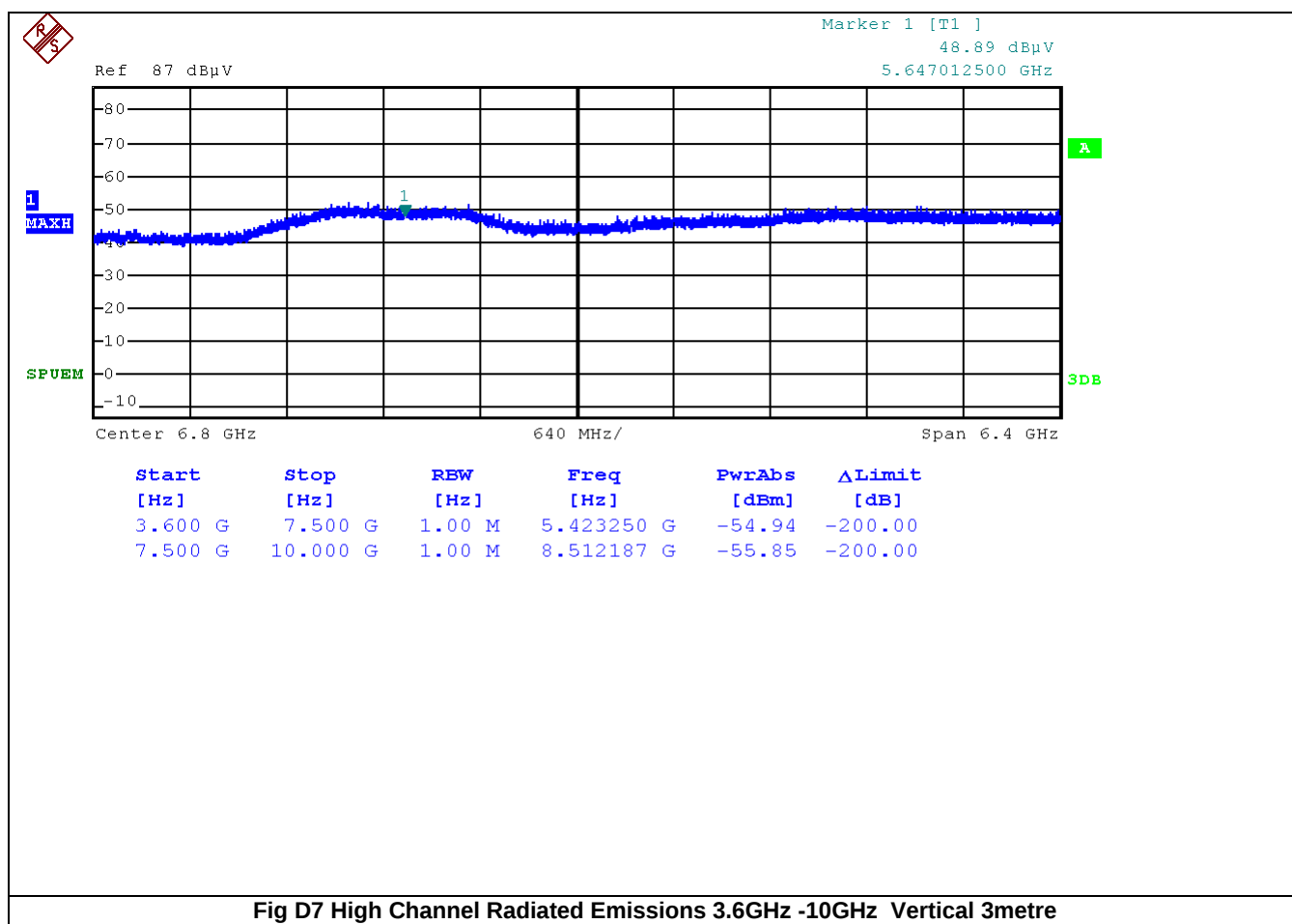


Fig D7 High Channel Radiated Emissions 3.6GHz -10GHz Vertical 3metre

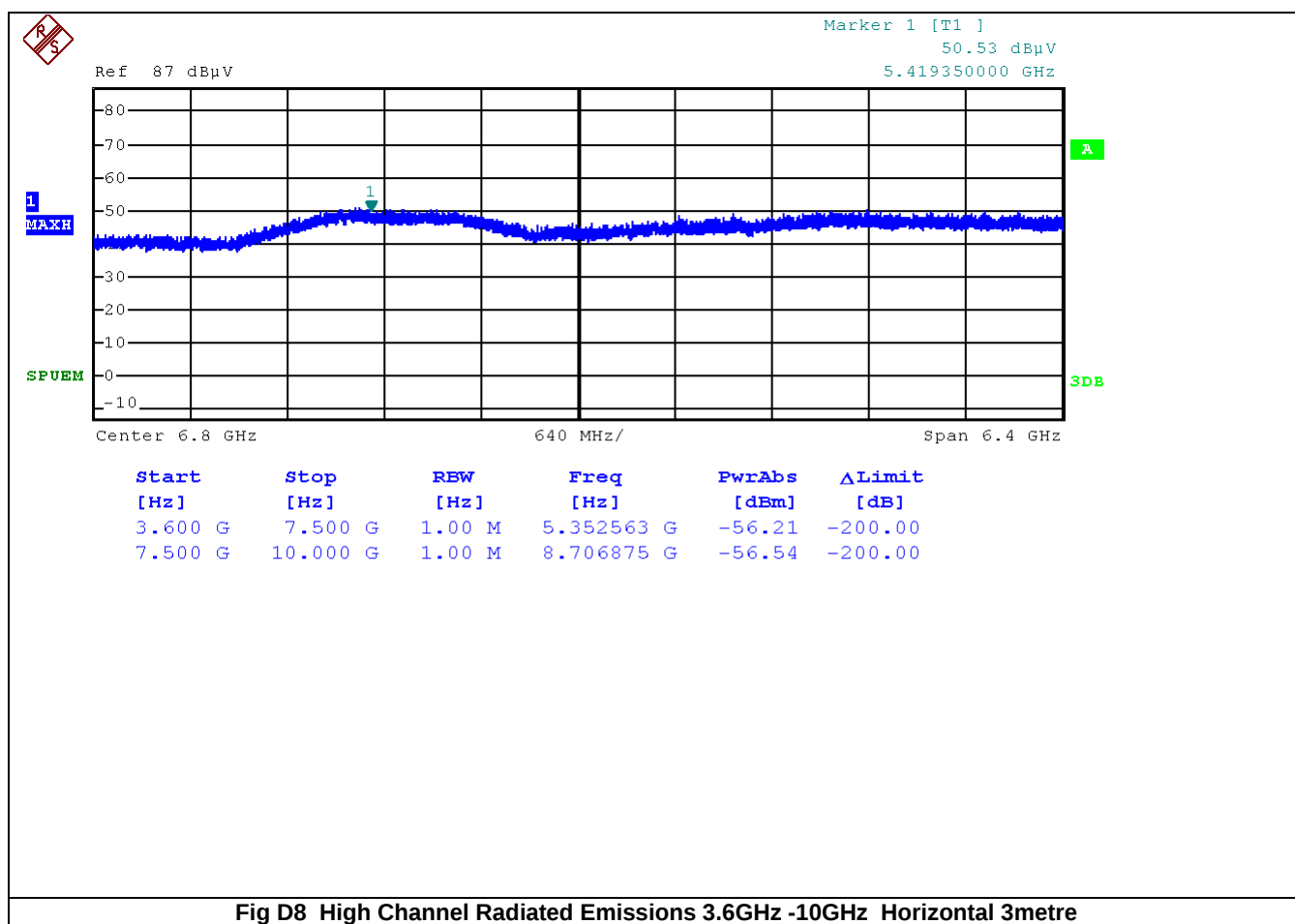


Fig D8 High Channel Radiated Emissions 3.6GHz -10GHz Horizontal 3metre

Note see additional report “18E7583-1b additional appendices” for the following appendices

Appendix E

**Radiated Emissions
Restricted Bands with antenna #2**

Appendix F

**Radiated Emissions
Band Edge with antenna #1**

Appendix G

**Radiated Emissions
Band Edge with antenna #2**

Appendix H

Conducted Emissions on the mains

End of Report