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Project Num	**19E8414-1a**
Quotation	**Q19-2410-1**
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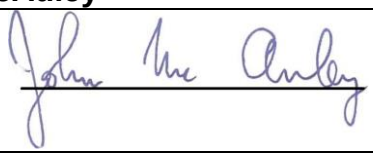
Tested By	**Michael Kirby**
Test Report By	**Michael Kirby**
FCC Test Firm Registration	**409640**
Date	**19th Dec 2019**
EUT Description	**SRD for liquid level reporting**
FCC ID	**S6T603**
Authorised by	**John McAuley**
Authorised Signature:	

TEST SUMMARY

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

FCC Part Section(s)	TEST PARAMETERS	Test Result
15.249(a)	RADIATED EMISSIONS	PASS
15.249(d)	RADIATED EMISSIONS	PASS
15.249(e)	RADIATED EMISSIONS	PASS
15.207(a)	CONDUCTED EMISSIONS ON THE MAINS	PASS

Exhibit A – Technical Report

Table of Contents

1.0 EUT Description

Model:	TEK 603
Type:	Receiver for SRD liquid level gauge
Test Standards:	47 CFR, Part 15.249(a,d,e)
Type of radio:	Stand-alone
Transmitter Type:	FM
Operating Frequency Range(s):	915 MHz
Number of Channels:	1
Antenna:	Integral
Oper. Temp Range:	-40° C to +85° C
Classification:	DXX, JBP
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The EUT was a receiver for a liquid level gauge tank sensor which transmits to the EUT over a radio link at 914.5MHz.
The EUT acts in transmit mode only at installation when it is required to pair with the tank sensor.
When in transmit mode the EUT transmits at 915MHz.

At all other times the EUT is in receive mode.
The EUT is powered directly from a mains to dc USB adapter.

In receive mode the EUT can be connected to a laptop to exchange data over the usb port.

1.1 EUT Operation

Operating Conditions during Test:

In order to test the transmit section the EUT was operated in test mode

a) CW mode for Carrier power and Spurious Emissions
b) Repeated Modulated mode
c) Receive mode

Note the EUT was powered from a mains to dc adapter
Manufacturer Simsukan Model SK01G-0500050z, for all tests

Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ Normal

Temperature: +15 to +35 ° C
Humidity: 20-75 %

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 one sample of the EUT on the 2nd ,3rd and 4th of Dec 2109

1.4 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the conducted emissions test was ±3.5 dB.
The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ±5.3 dB (from 30 to 100 MHz), ±4.7 dB (from 100 to 300 MHz), ±3.9 dB (from 300 to 1000 MHz) and ±3.8 dB (from 1 GHz to 40 GHz).

2.0 Emissions Measurements
2.1 Conducted Emissions Measurements

This test was performed with the EUT powered from the mains adapter (as per section 1.1) which was in turn plugged into the LISN.

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.

2.2.1 General

Emissions below 1GHz were measured using resolution bandwidth 100kHz at a measurement distance of 3 metres with EUT on a motorised turntable which allowed 360 degrees rotation. 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

Emissions above 1GHz were measured using a horn antenna with resolution bandwidth of 1MHz and video bandwidth of 3MHz at a measurement distance of 3 metres with EUT on a motorised turntable which allowed 360 degrees rotation. The radiated emissions were maximised by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters

Tests were carried out as per Ansi C63.10 -2013 for transmitter tests and Ansi 63.4 2014 for receiver tests.

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."

* The antennas of this E.U.T are permanently attached and internal to the unit.

*The E.U.T Complies with the requirement of 15.203

2.4 Field Strength of Fundamental

Test Criteria
Requirement: - 15.249 (a)
Operation within the bands 902-928 MHz

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	***Field strength of fundamental (millivolts/meter)***	***Field strength of harmonics (microvolts/meter)***
902-928 MHz	*50*	*500*

RESULTS

Frequency	**Quasi peak Level**	**Antenna Polarity**	**Antenna Factor**	**Preamp Gain**	**Cable loss**	**Final Field Strength Quasi Peak**	**Quasi Peak Limit**	**Margin**
MHz	**dBuV/m**	**V/H**	**dB**	**dB**	**dB**	**dBuV/m**	**dBuV/m**	**dB**
915	38.6	Vertical	23.5	0	2.4	64.5	94.0	29.5
915	36.7	Horizontal	23.5	0	2.4	62.6	94.0	31.4

Test Result Pass

3.2 Duty Cycle

15.35 (c)

The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative(provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 seconds interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

TEST PROCEDURE

EUT was tested in modulated mode.

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 100 kHz and the VBW is set to 1MHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.

RESULTS

3.2.1 Duty Cycle

One Period(mS)	Pulse Width (mS)	No of Pulses	Duty Cycle	20 log duty cycle (dB)	Duty Cycle %	Test Result
100	**1.44**	**1**	**0.0144**	**-36.8**	**1.4**	**Pass**

CALCULATION

Average Reading = Peak Reading dB(µV/m) +20log (Duty Cycle),
*where Duty Cycle is (No of pulses*pulse width)/100 or T*

Note correction for pulse mode operation is

20 log duty cycle (dB)
-36.8

Duty Cycle Modulation

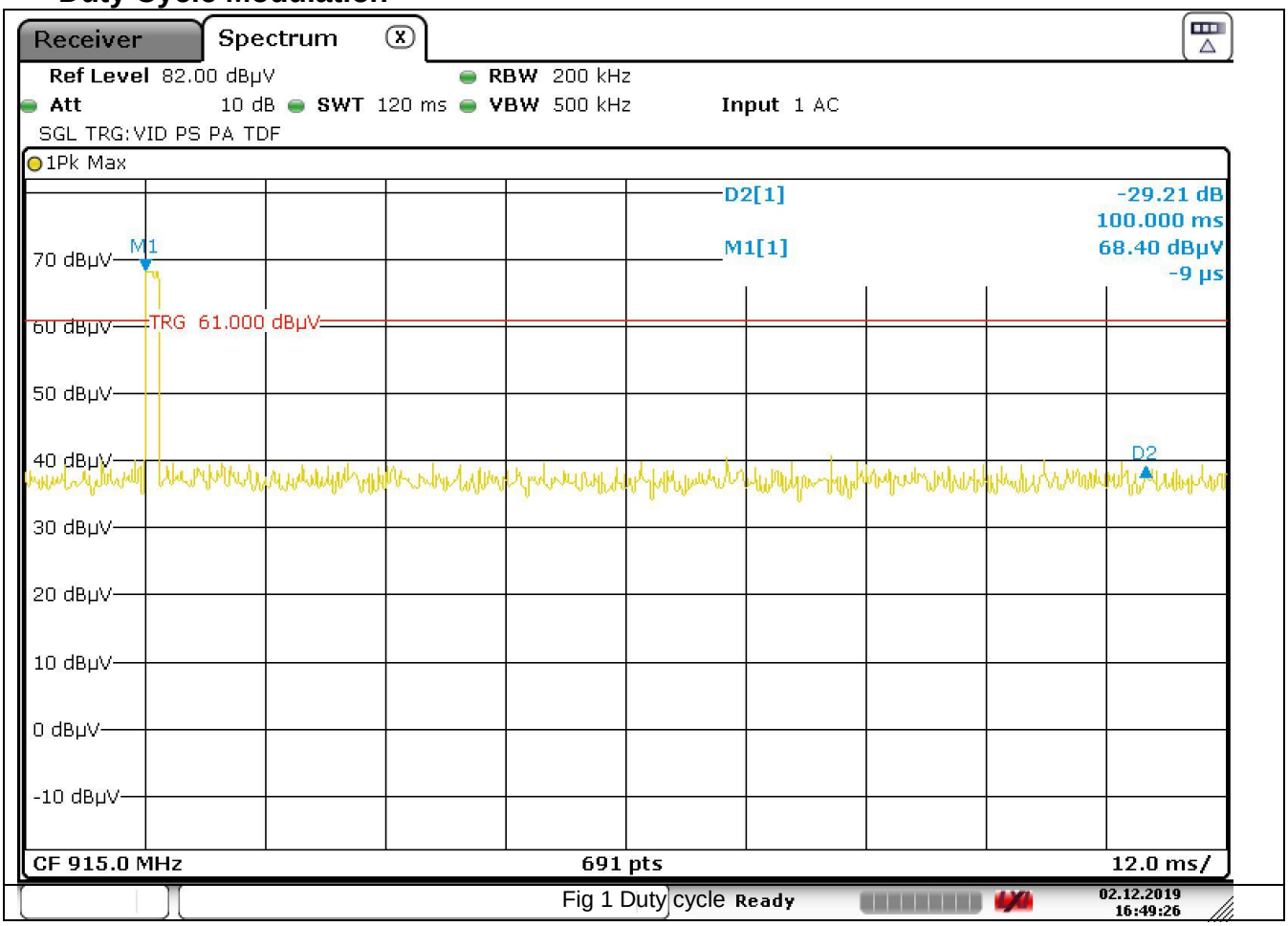


Fig 1 Duty cycle

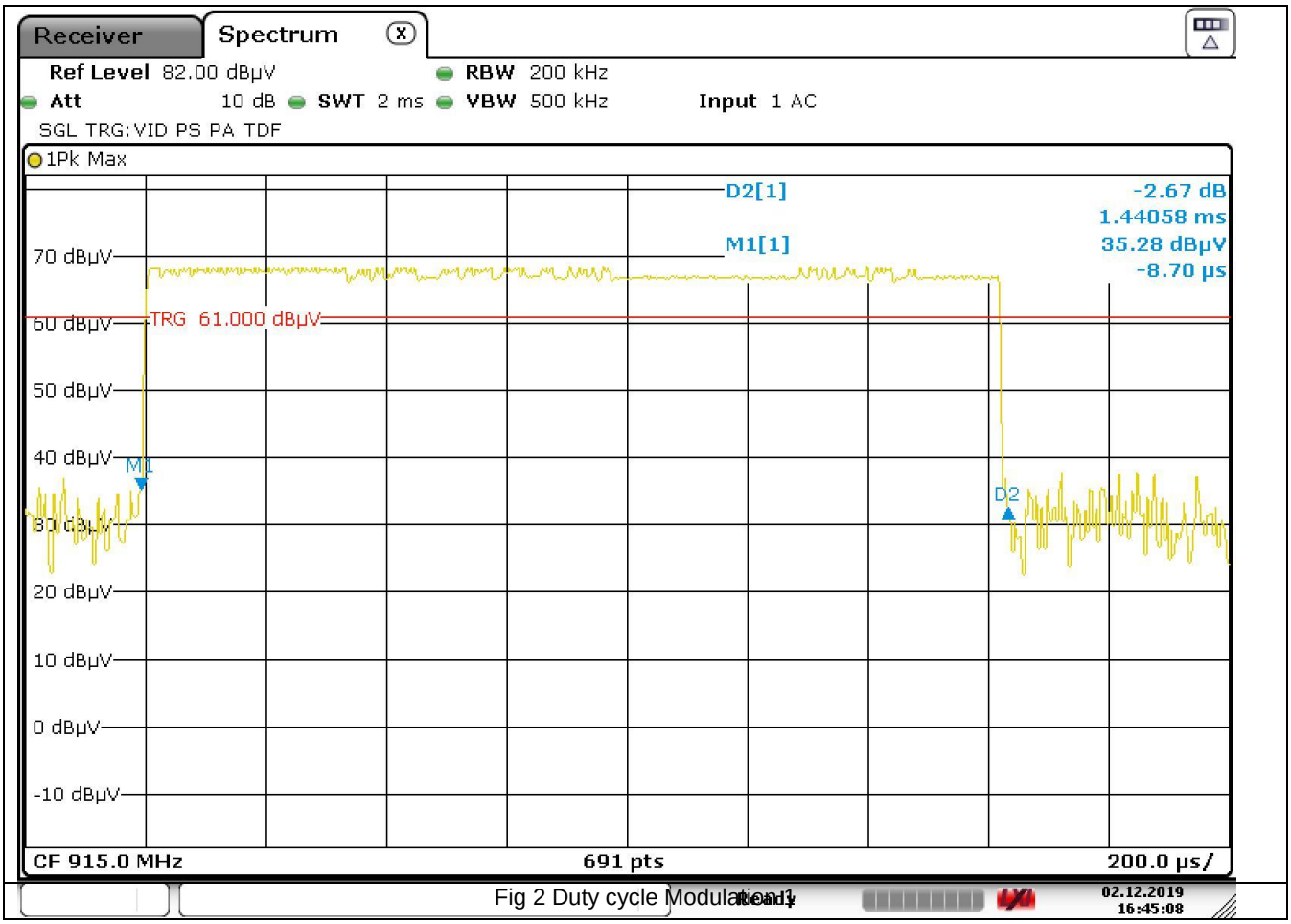


Fig 2 Duty cycle Modulation

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3.2 Occupied Bandwidth 20dB down

Test Criteria
Requirement :-

Bandwidth is determined at the points 20dB down from the modulated carrier.

RESULTS

Operating Frequency (MHz)	20dB Bandwidth (kHz)
914.919	205.5

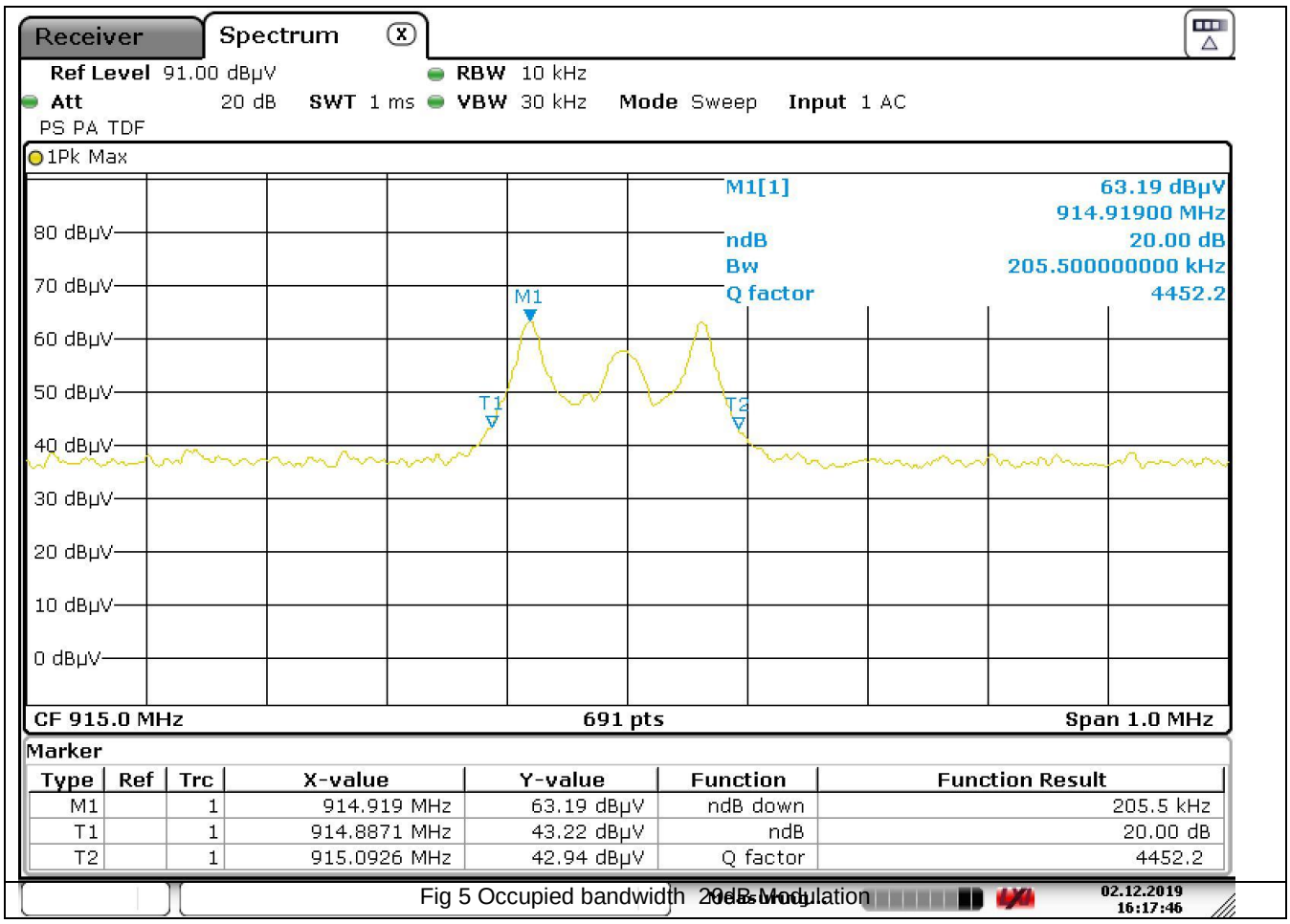

Fig 5 Occupied bandwidth 20dB Modulation

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3.3.1 Occupied Bandwidth 99%

Results

Operating Frequency (MHz)	20dB Bandwidth (kHz)
914.919	195.4

3.2 Occupied Bandwidth 99%

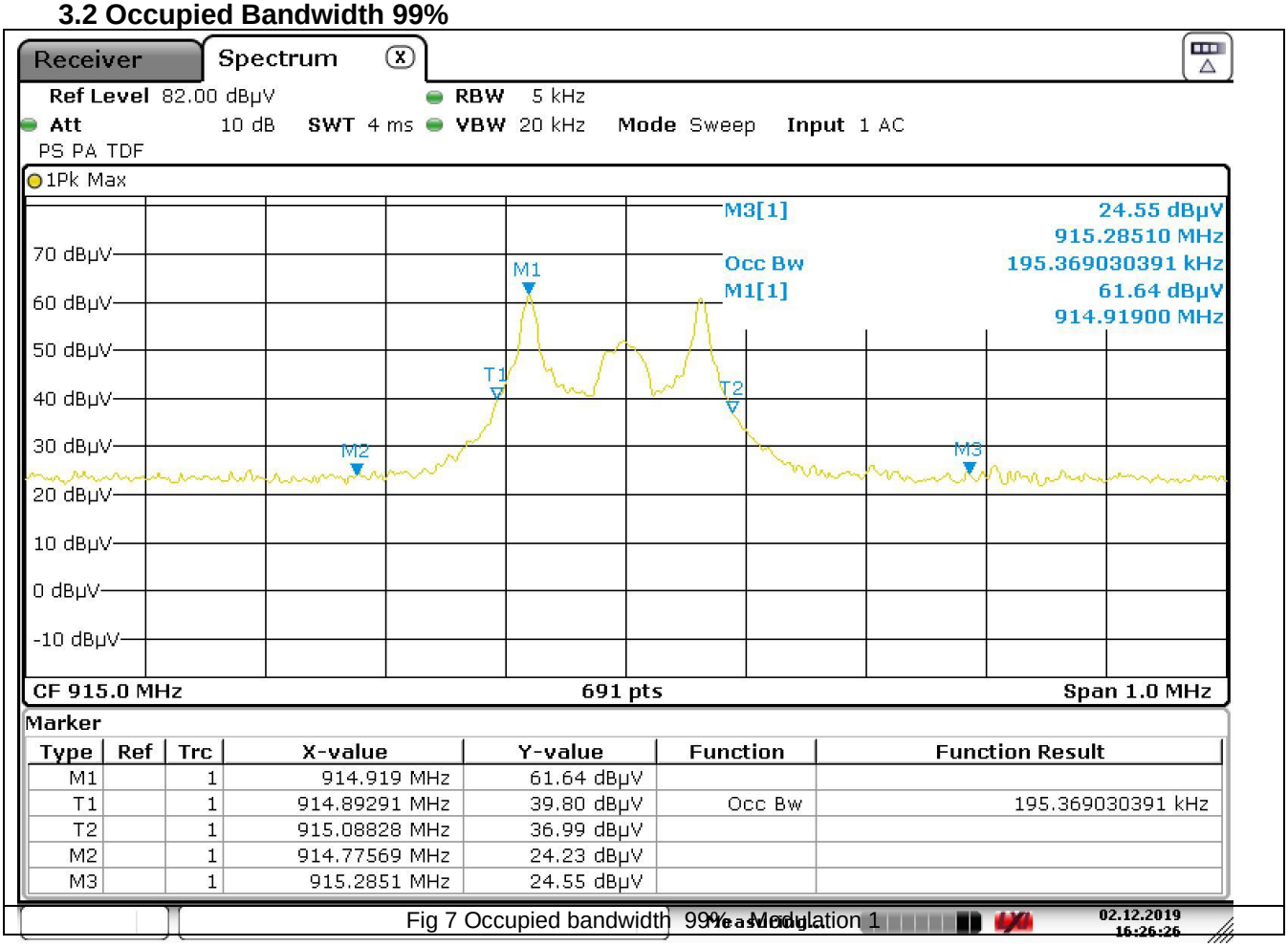

Fig 7 Occupied bandwidth 99% Modulation 1

Date: 2.DEC.2019 16:26:25

3 Field Strength of Spurious Radiated Emissions
Test Specification: FCC PART 15, SECTION 47 CFR 15.249(d)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation
Note this is the Average limit for 3 metre measurement.

For the spurious and harmonics measurements, the EUT was set up in an anechoic chamber. The EUT was rotated 360 degrees azimuth and the search antenna height was varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. Distance of EUT to the measurement antenna was 3m.

4. Results for Radiated emissions

Appendix A shows the results of the scans in the anechoic chamber.

4.1 Transmit mode

Frequency	Quasi peak Level	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Quasi Peak	Average Limit	Margin
MHz	dBuV/m	V/H	dB	dB	dB	dBuV/m	dBuV/m	dB
48.480	18.2	Vertical	10.3	0	0.8	29.3	40.0	30.7
72.690	9.9	Vertical	9.4	0	1	20.3	40.0	39.7
96.930	23.4	Vertical	9.3	0	1.1	33.8	43.5	29.7
145.410	17.8	Vertical	11.7	0	1.2	30.7	43.5	32.8
48.480	9.2	Vertical	10.3	0	0.8	20.3	40.0	39.7
96.930	25.5	Vertical	9.3	0	1.1	35.9	43.5	27.6
145.410	18.4	Vertical	11.7	0	1.2	31.3	43.5	32.2
242.340	8.6	Vertical	15.7	0	1.4	25.7	46.0	40.3

Harmonic Spurious Emissions

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
1.830	22.2	Vertical	26.5	0	4.8	53.5	54.0	20.5
2.745	18.5	Vertical	29.4	0	5.3	53.2	54.0	20.8
1.830	17.2	Horizontal	26.5	0	4.8	48.5	54.0	25.5
2.745	5.7	Horizontal	29.4	0	5.3	40.4	54.0	33.6
3.660	55.1	Vertical	30.4	37.6	4.6	52.5	54.0	21.5
5.236	38.1	Vertical	34.2	37	5.3	40.6	54.0	33.4
3.660	53.4	Vertical	30.4	37.6	4.6	50.8	54.0	23.2
5.336	49.9	Vertical	33.6	37.7	5.4	51.2	54.0	22.8

As the peak reading was less than the average limit, average measurement were not performed

Result: Pass

4.2 Receive mode

Frequency	Quasi peak Level	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Quasi Peak	Average Limit	Margin
MHz	dBuV/m	V/H	dB	dB	dB	dBuV/m	dBuV/m	dB
51.630	14.7	Vertical	10	0	0.8	25.5	40.0	34.5
71.400	8.2	Vertical	9.3	0	1	18.5	40.0	41.5
84.000	10.4	Vertical	9	0	1	20.4	40.0	39.6
142.800	2.4	Vertical	11.5	0	1.2	15.1	43.5	48.4
95.220	2.9	Horizontal	9.2	0	1.1	13.2	43.5	50.3
142.800	4.7	Horizontal	11.5	0	1.2	17.4	43.5	46.1
190.470	3.6	Horizontal	13.8	0	1.2	18.6	43.5	44.9

Result: Pass

5 Conducted Emissions on the mains

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.4245	24.90	-33.26	Live
Average	0.4515	35.82	-11.57	Live
Quasi-Peak	0.4538	38.42	-18.9	Live
Quasi-Peak	0.7665	30.21	-25.79	Live
Quasi-Peak	4.200	31.63	-24.37	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.4245	22.67	-35.49	Neutral
Quasi-Peak	0.4515	36.90	-20.49	Neutral
Average	0.4515	33.88	-13.51	Neutral

Result: Pass

List of Test Equipment

Instrument	Manufacturer	Model	Serial Num	CEI Ref	Cal Due Date	Cal Interval Months
Microwave Preamplifier	Hewlett Packard	83017A	3123A00175	805	30-Sep-20	12
Spectrum Analyser 30Hz-40GHz	Rohde& Schwarz	FSP40	100053	850	11-Dec-21	36
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	07-Jun-20	36
LISN	Rohde& Schwarz	ESH3-Z5	825460/003	604	16-Feb-22	36
Antenna Horn	AH Systems	SAS-200/571	373	839	14-Mar-21	36
Fully Anechoic Chamber	CEI	FAR 3M	906	906	23-Jul-22	36
Anechoic Chamber	CEI	SAR 10M	845	845	16-May-22	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	03-Sep-21	36
Antenna Log Periodic	Chase	UPA6108	1072	609	03-Sep-21	36

Appendix A

Transmitter Spurious Emissions

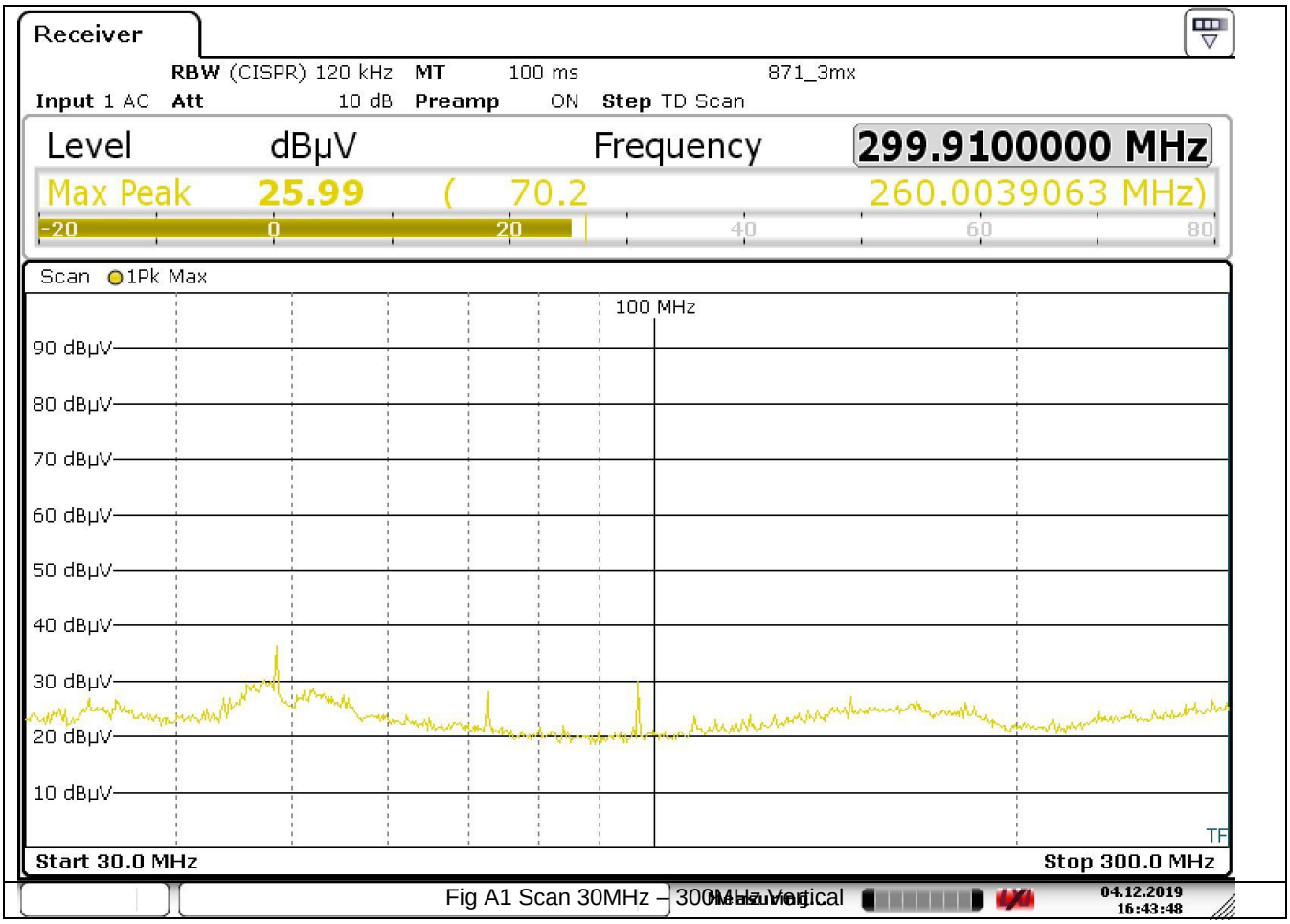

Fig A1 Scan 30MHz – 300MHz Vertical

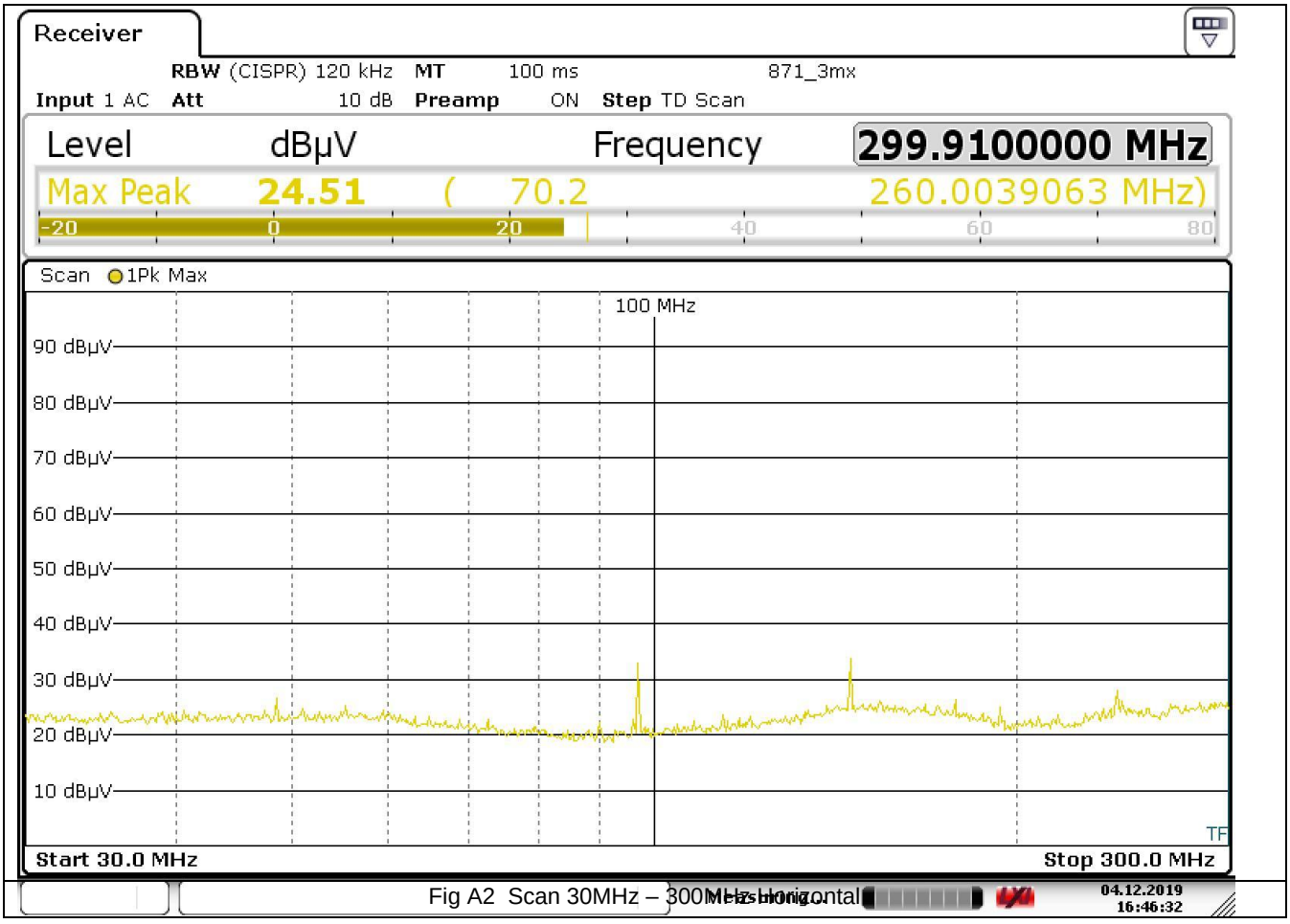

Fig A2 Scan 30MHz – 300MHz Horizontal

Date: 4.DEC.2019 16:46:32

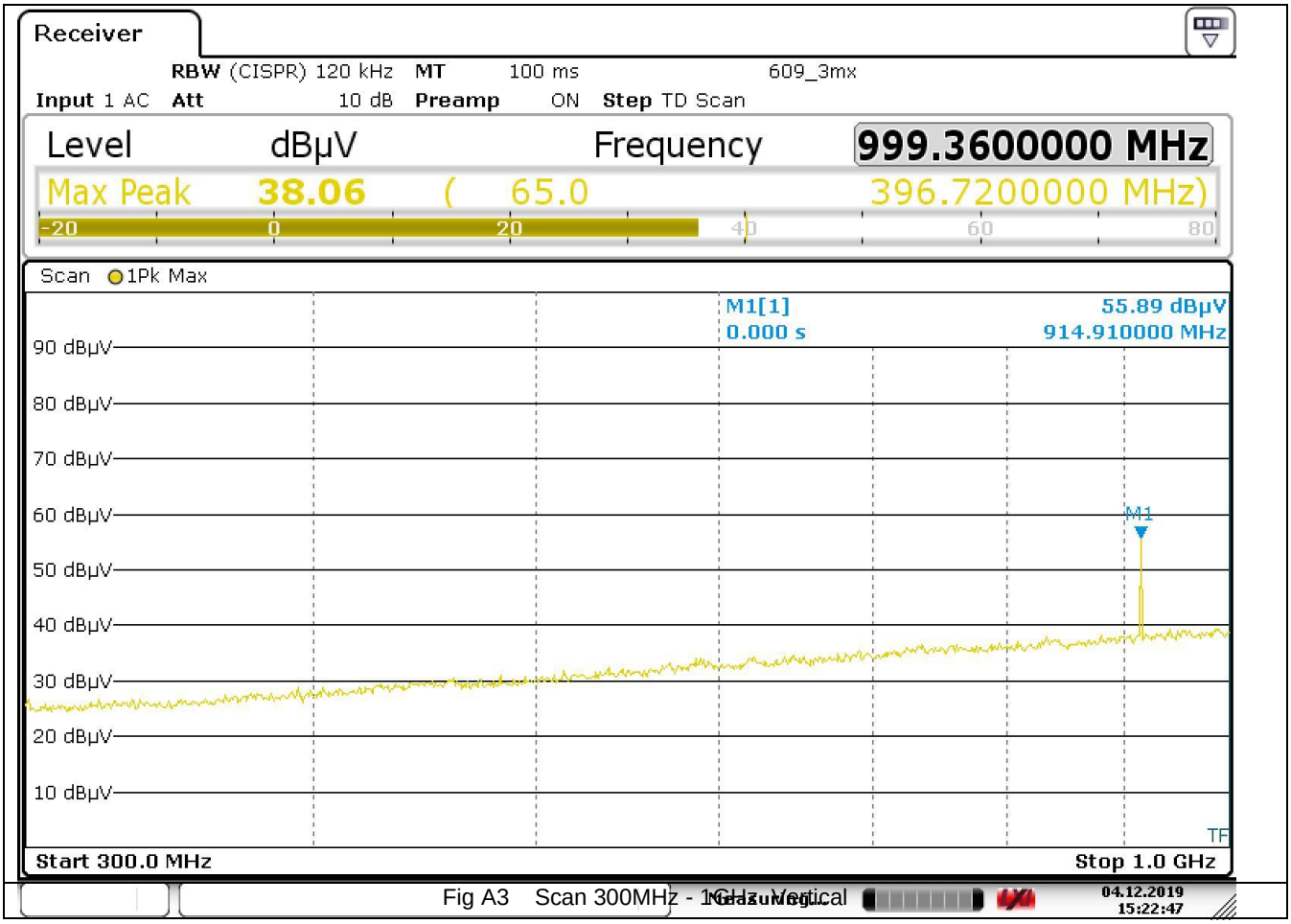

Fig A3 Scan 300MHz - 1GHz Vertical

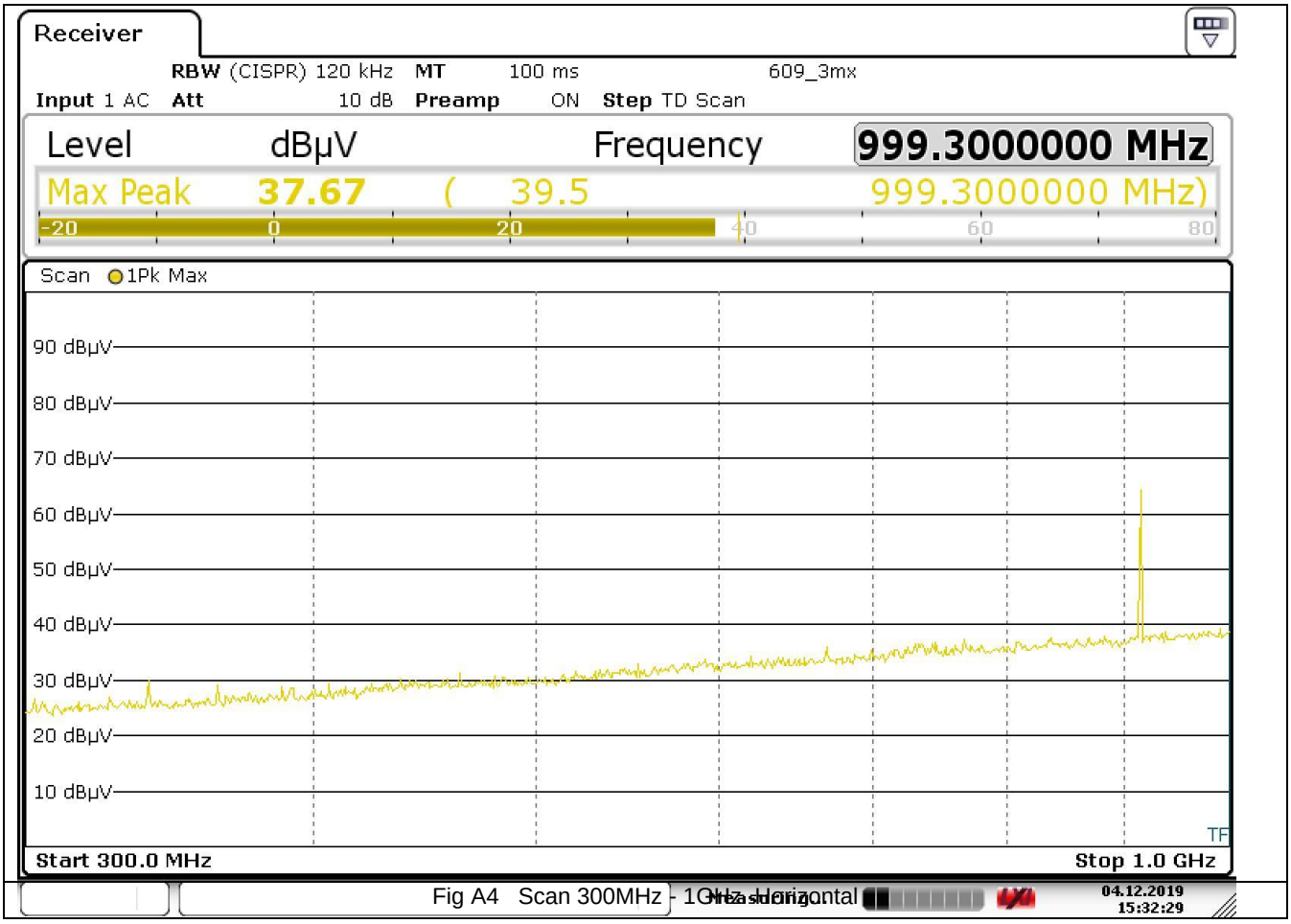

Fig A4 Scan 300MHz - 1GHz Horizontal

Date: 4.DEC.2019 15:32:30

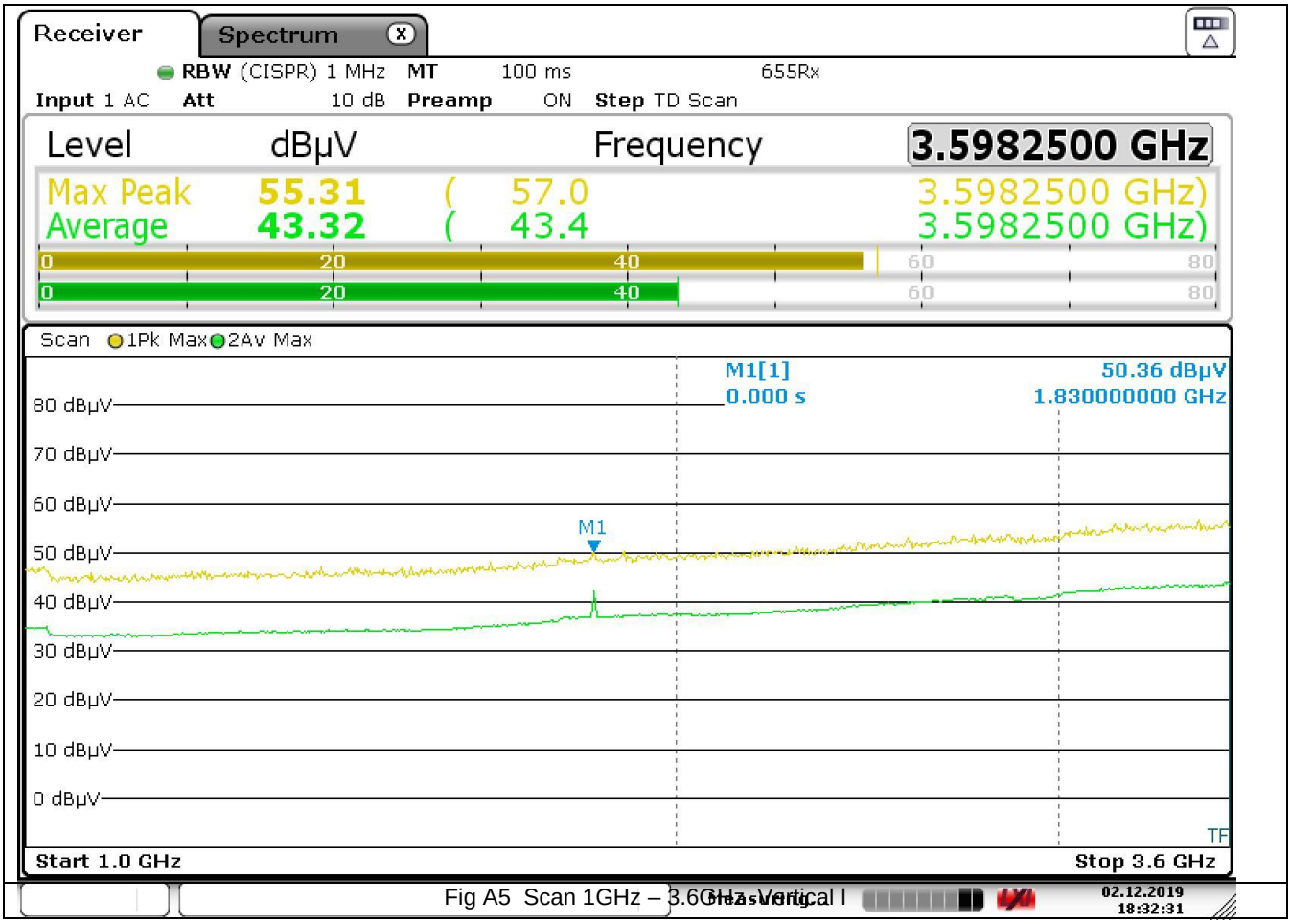

Fig A5 Scan 1GHz – 3.6GHz Vertical

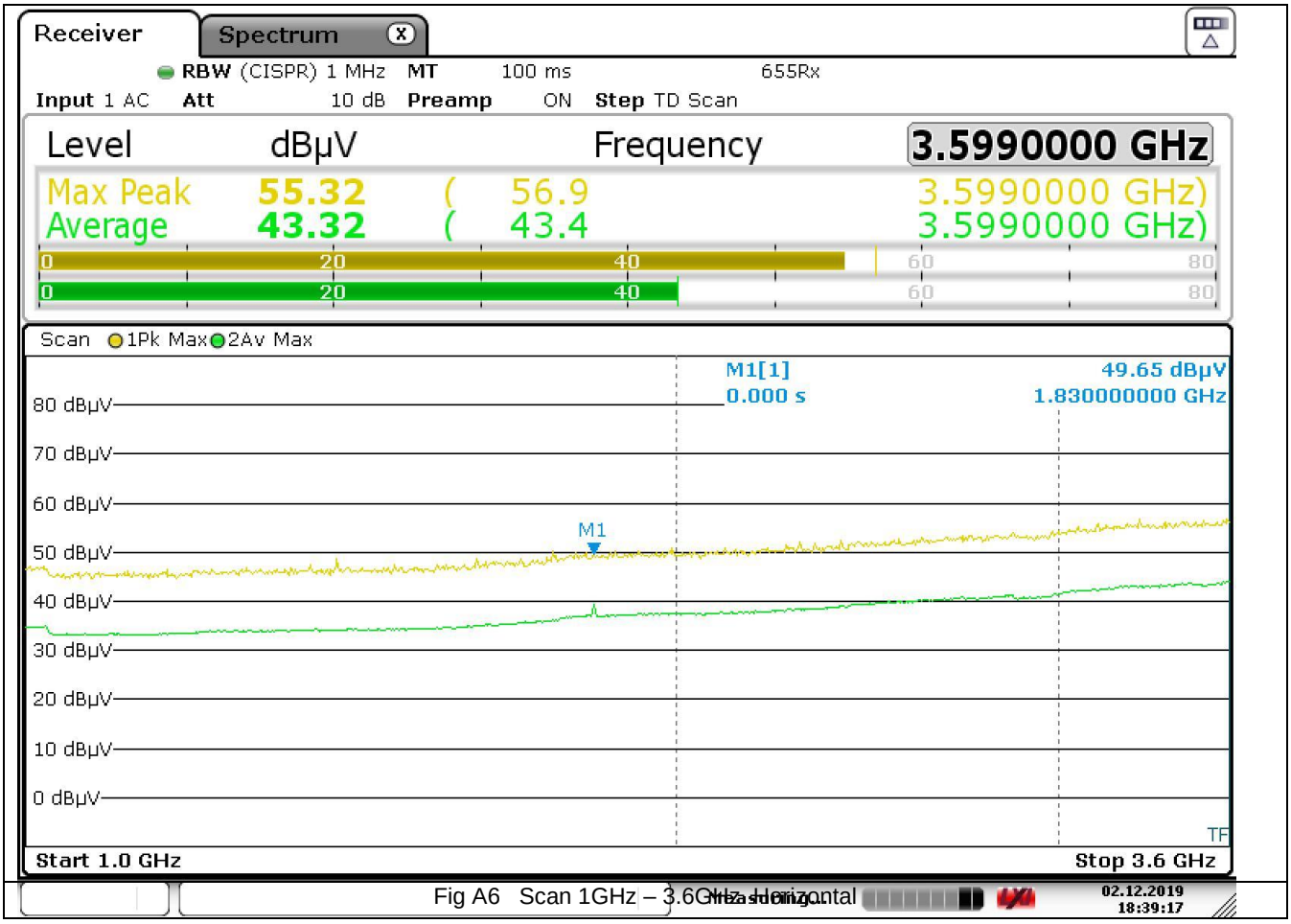

Fig A6 Scan 1GHz – 3.6GHz Horizontal

Date: 2.DEC.2019 18:39:16

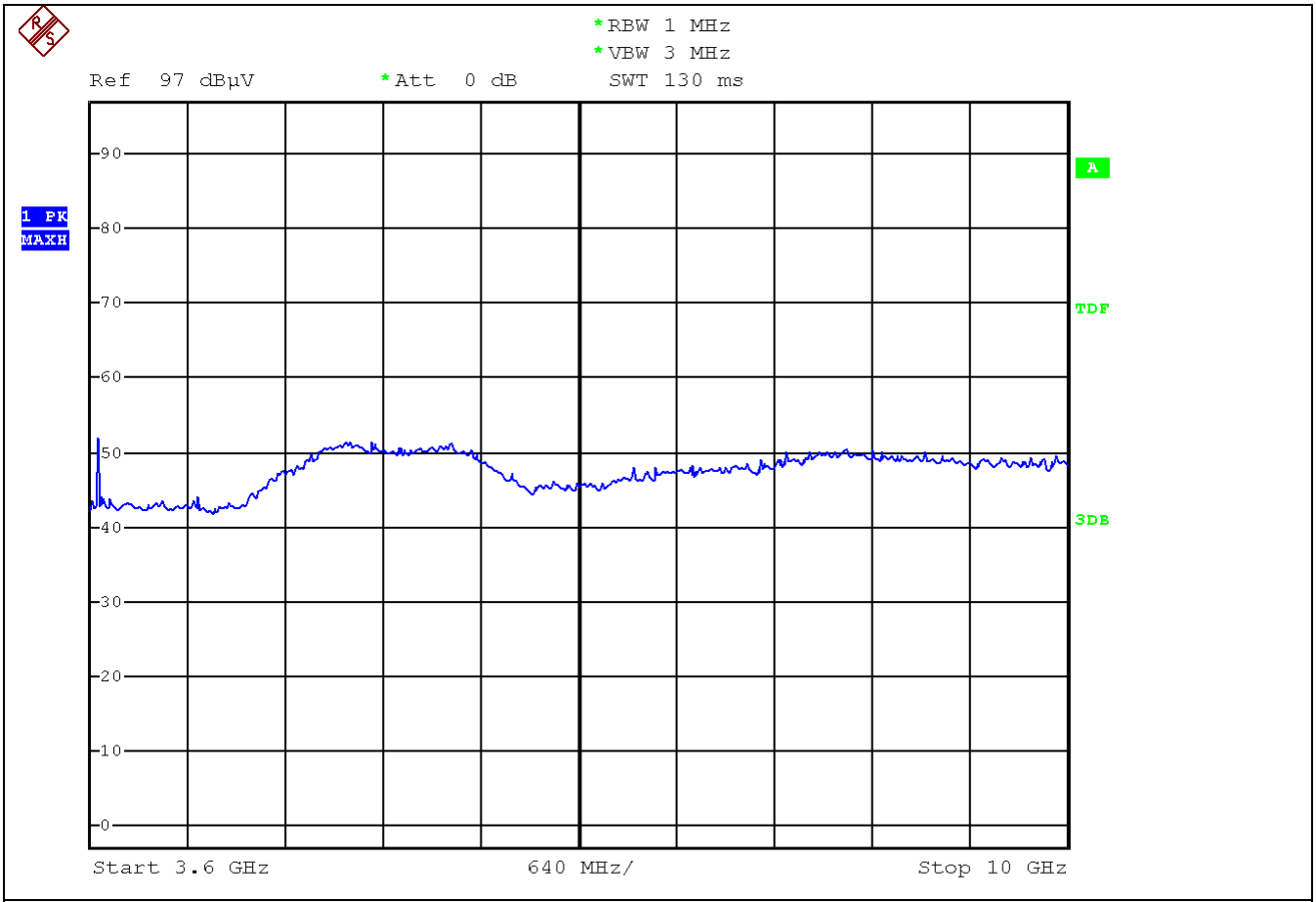

Fig A7 Scan 3.6 –10GHz Vertical 3m

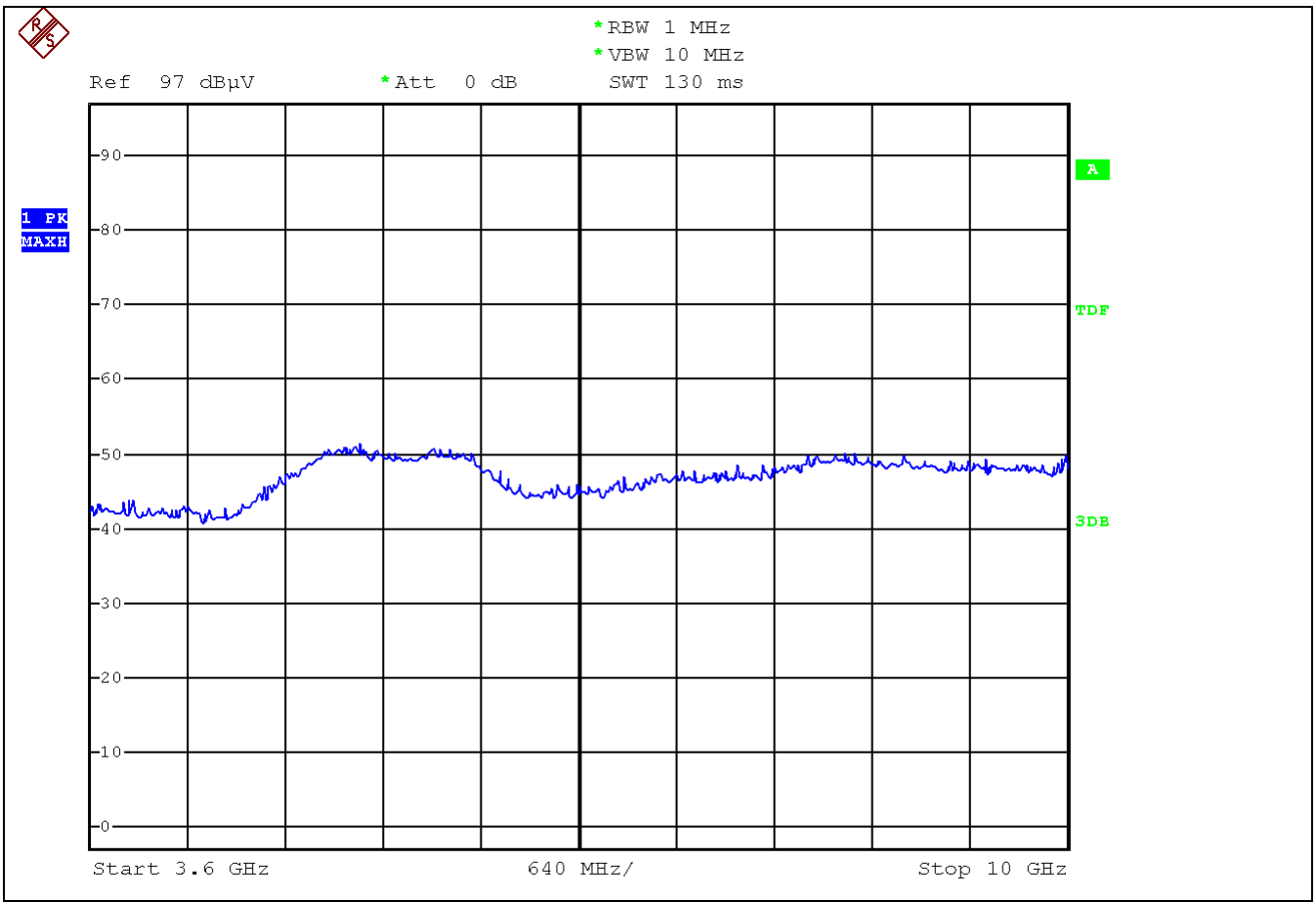

Fig A8 Scan 3.6 – 10GHz Horizontal 3m

Date: 2.DEC.2019 19:21:38

Appendix B

Receiver Spurious Emissions

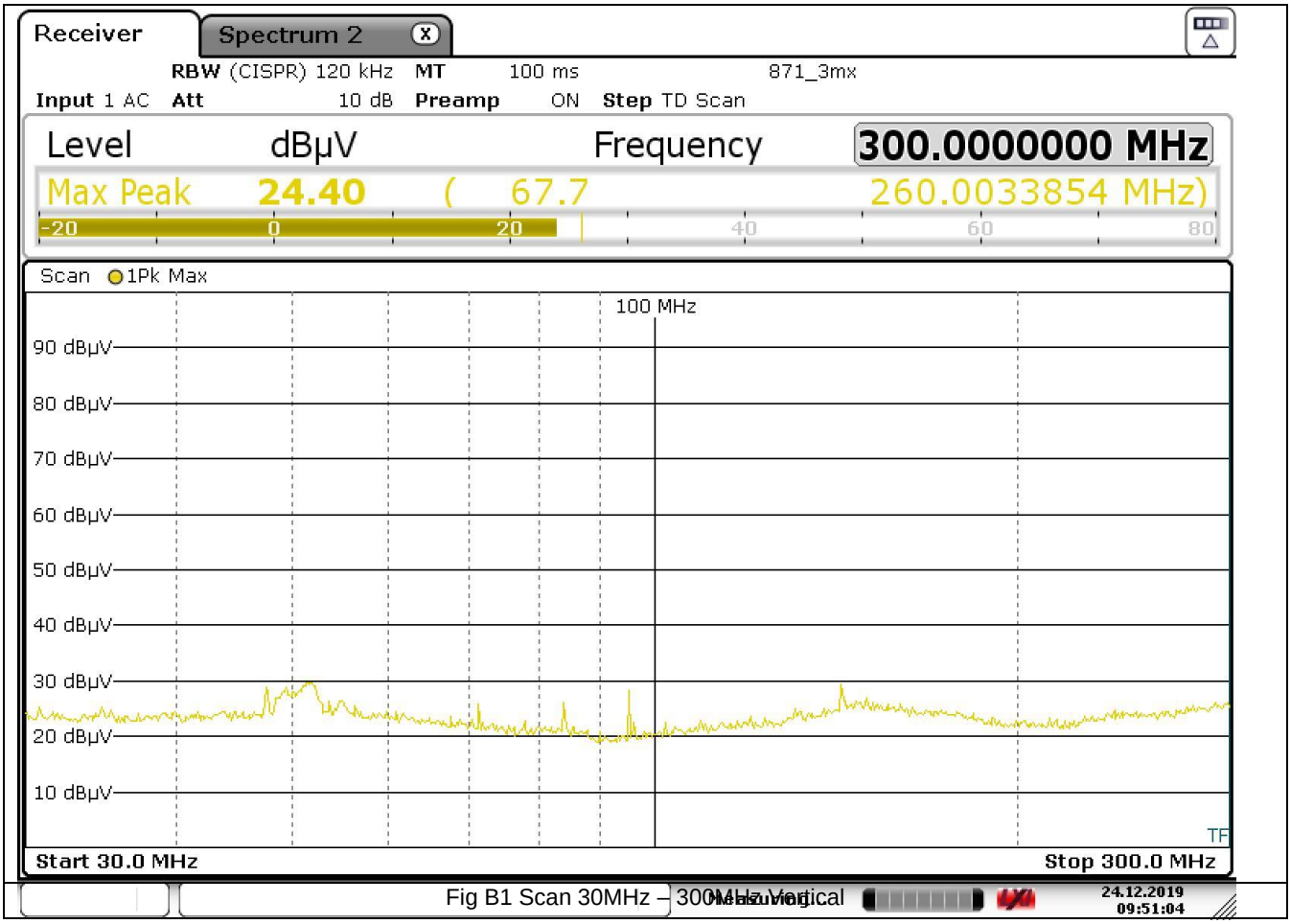

Fig B1 Scan 30MHz – 300MHz Vertical

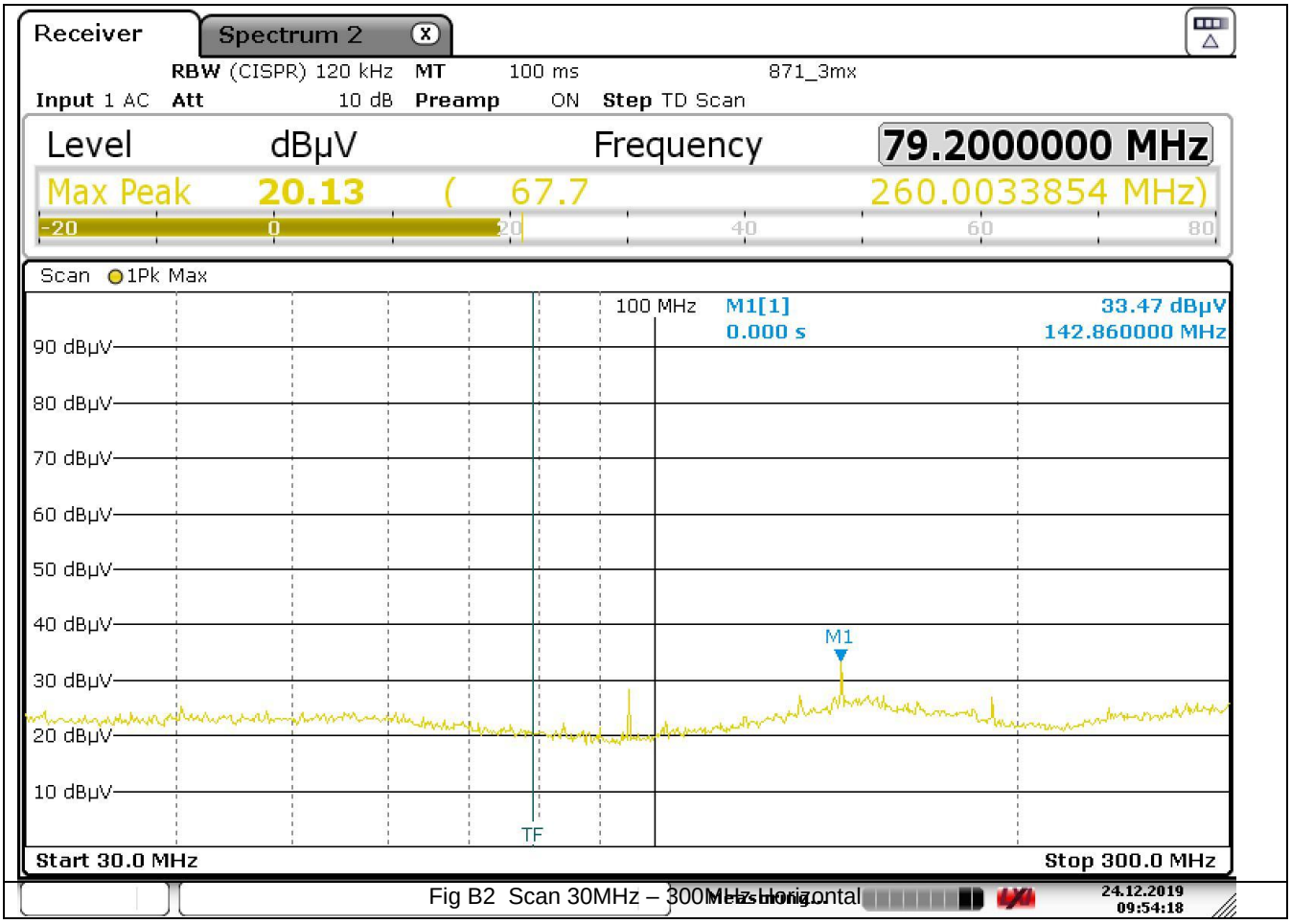

Fig B2 Scan 30MHz – 300MHz Horizontal

Date: 24.DEC.2019 09:54:18

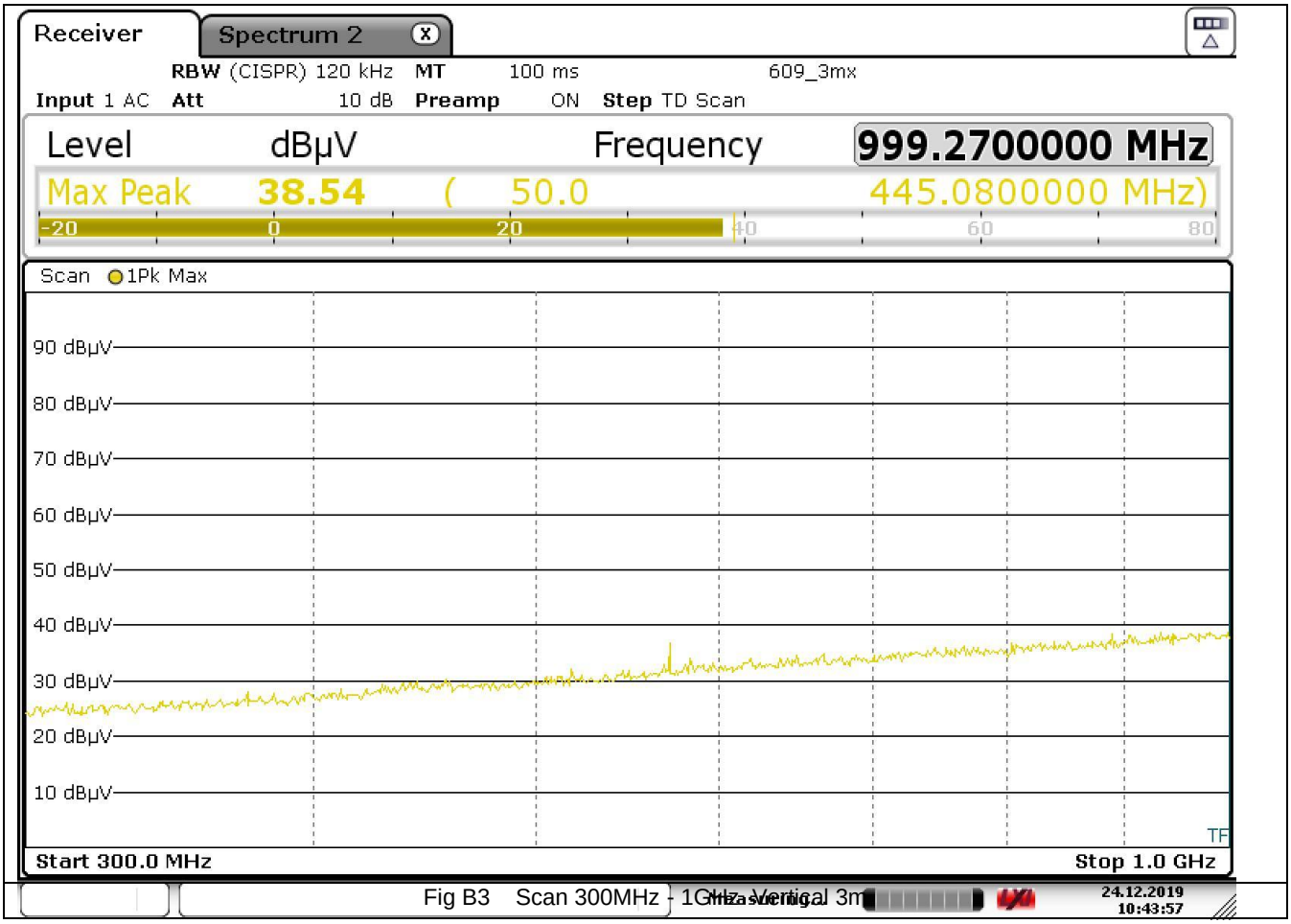

Fig B3 Scan 300MHz - 1GHz Vertical 3m

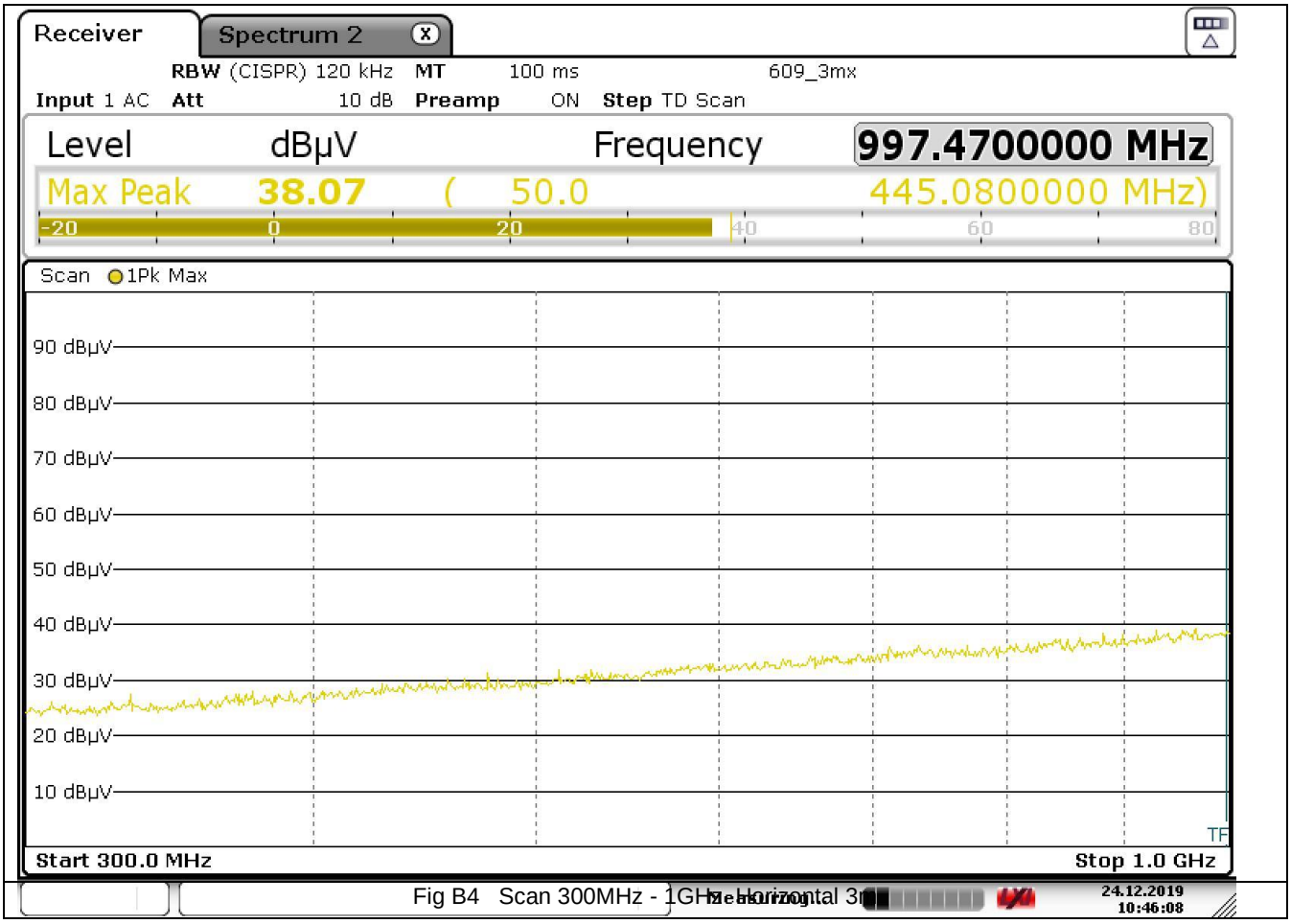

Fig B4 Scan 300MHz - 1GHz Horizontal 3m

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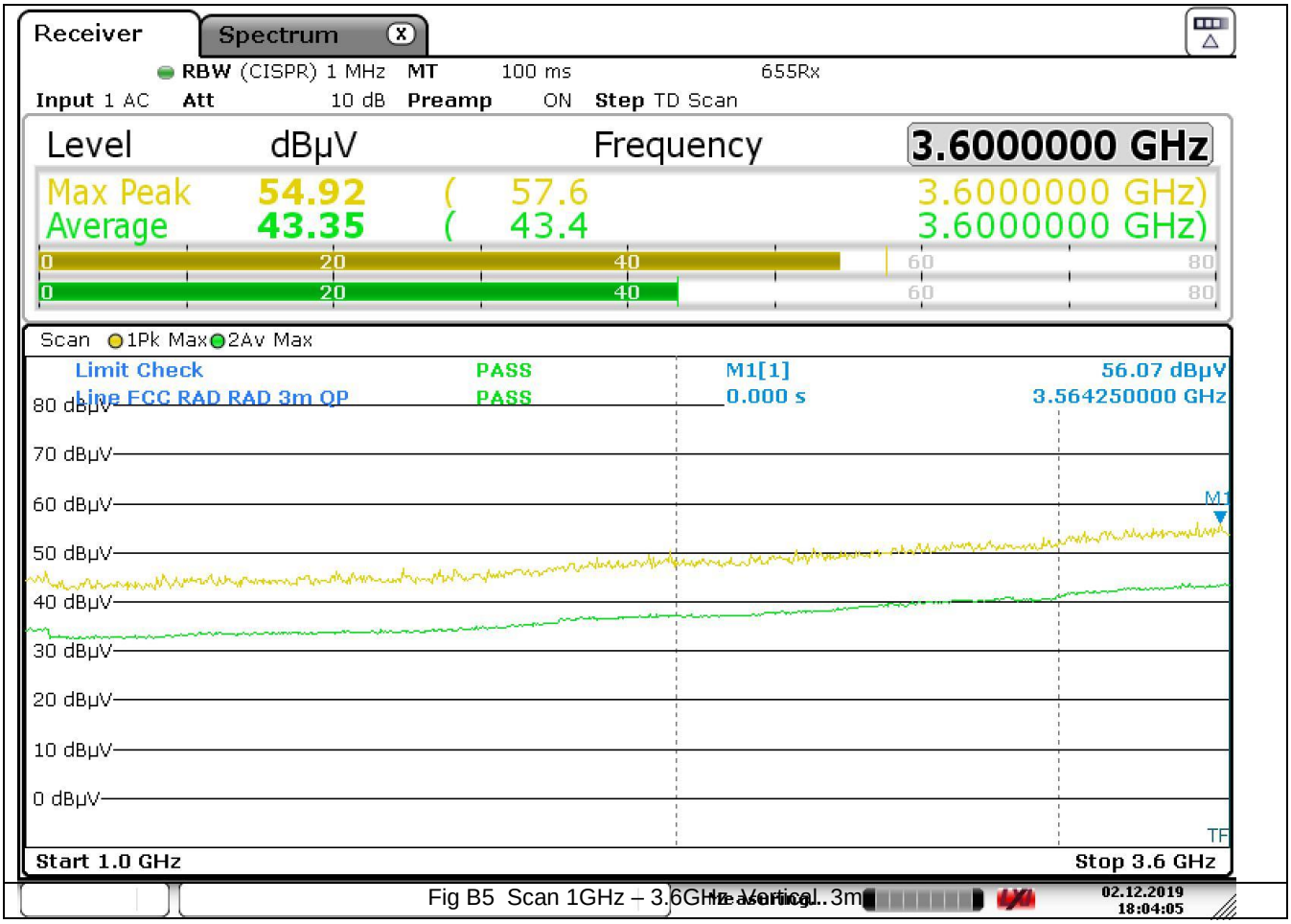

Fig B5 Scan 1GHz – 3.6GHz Vertical 3m

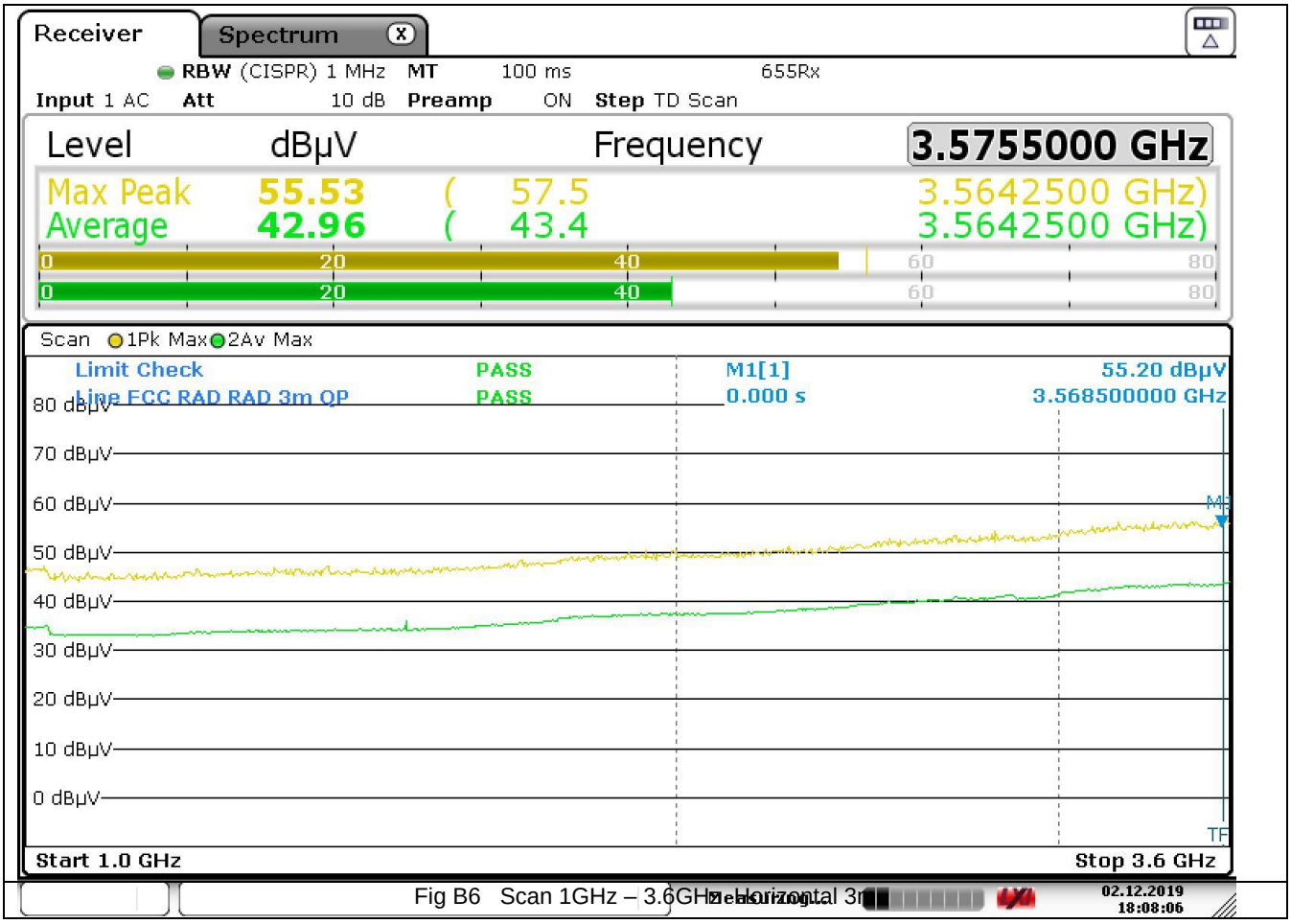

Fig B6 Scan 1GHz – 3.6GHz Horizontal 3m

Date: 2.DEC.2019 18:08:06

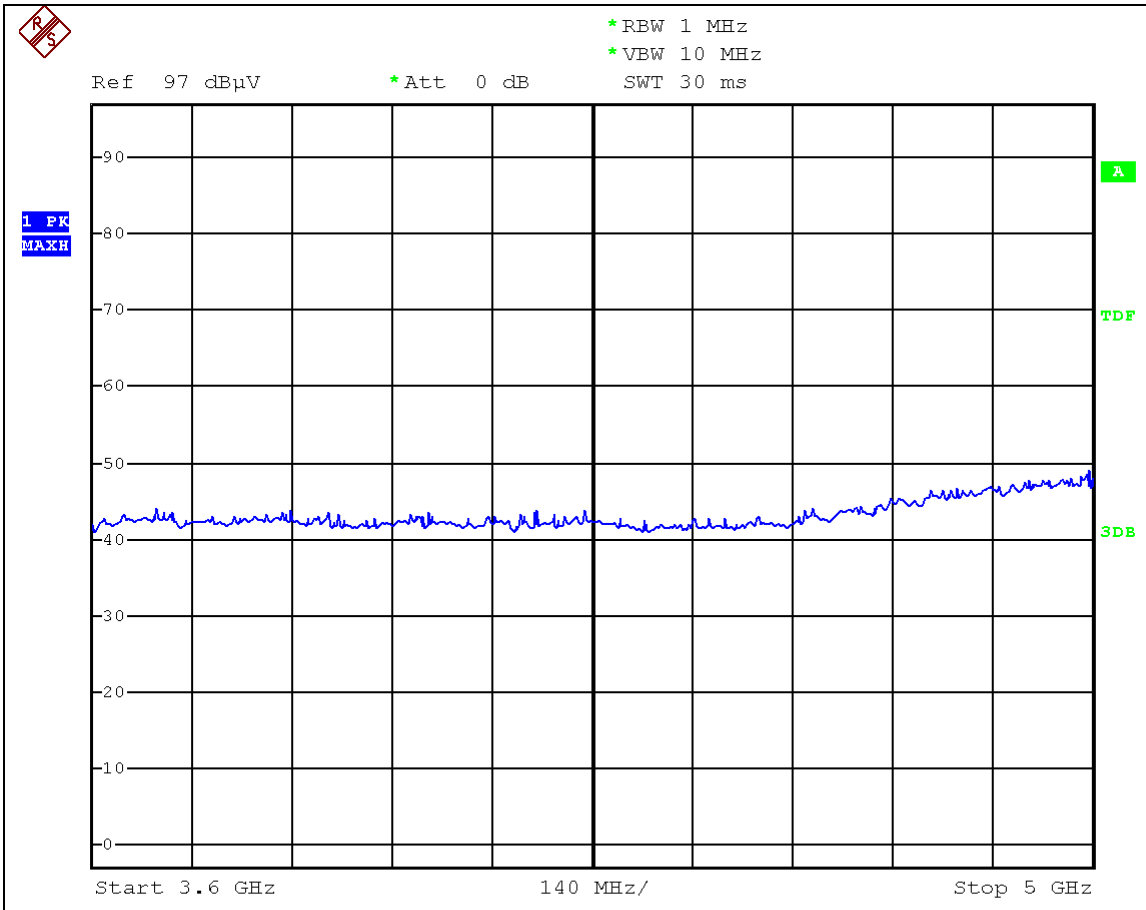

Fig B7 Scan 3.6 – 5GHz Vertical 3m

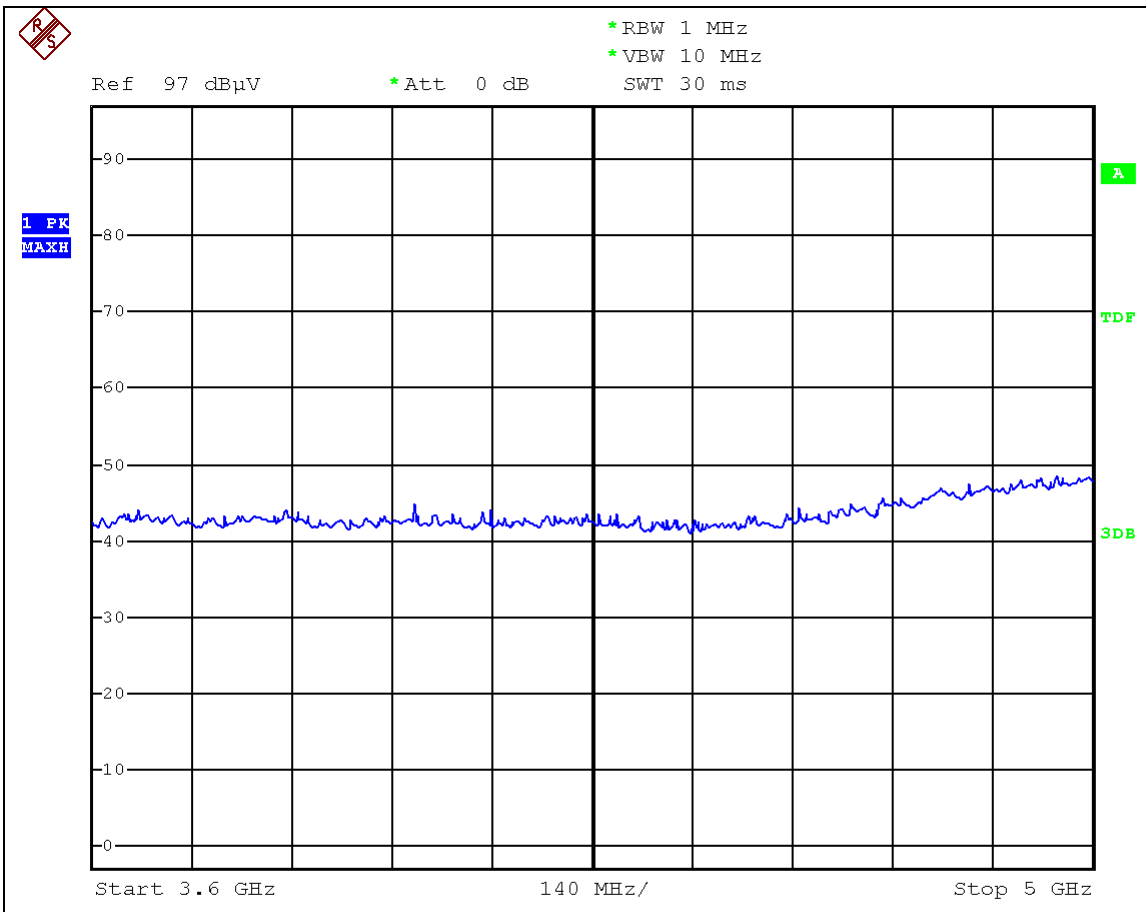

Fig B8 Scan 3.6 – 5GHz Horizontal 3m

Date: 2.DEC.2019 19:40:52

Appendix C

Conducted Emissions on the mains

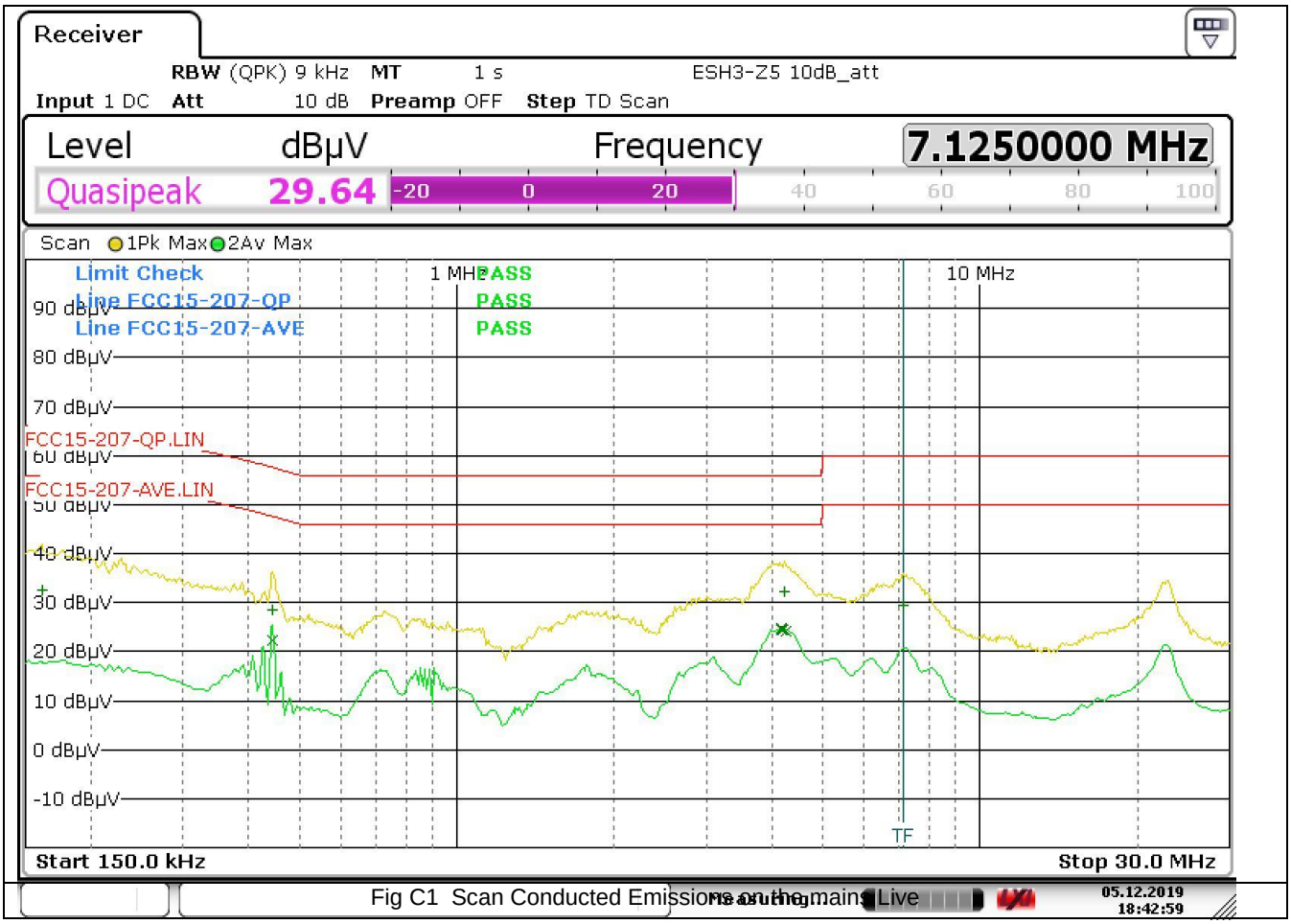

Fig C1 Scan Conducted Emissions on the mains Live

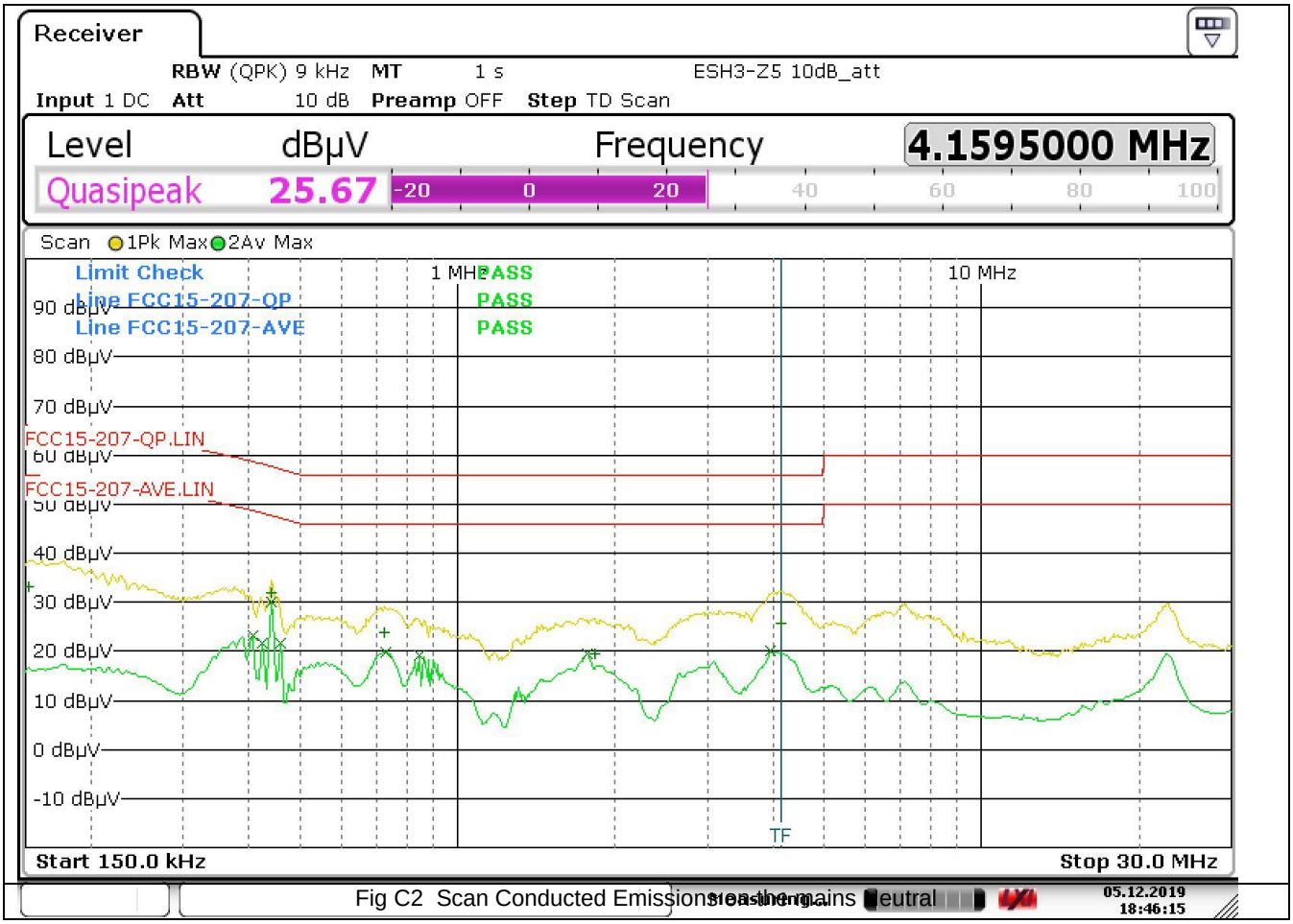

Fig C2 Scan Conducted Emissions on the mains Neutral

Date: 5.DEC.2019 18:46:15

End of Report