

Test Report

Radio Characteristics

Product	Wi-Fi handset		
Name and address of the applicant	Ascom Sweden AB P.O.Box 8783, SE-402 76 Gothenburg		
Name and address of the manufacturer	Ascom Sweden AB P.O.Box 8783, SE-402 76 Gothenburg		
Model	WH2		
Rating	3.7Vdc Battery		
Trademark	ASCOM		
Serial number	Radiated sample: T26060FH2 Conducted sample: 18AM39501350		
Additional information	This test report covers only radiated emissions of 5GHz wi-fi in the frequency band 5150 – 5725 MHz		
Tested according to	ETSI EN 301 893 v.2.1.1 (2017-05) parts of		
Order number	362353		
Tested in period	2019-01-16 – 2019-01-30		
Issue date	2019-03-04		
Name and address of the testing laboratory	Nemko Group Nemko AS Gaustadalléen 30, P.O.Box 73 Blindern, 0314 Oslo, Norway	Tel: +47 22 96 03 30 Fax: +47 22 96 05 50	 
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [G.Suhanthakumar]		 Approved by [Frode Sveinsen]	
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1 GENERAL INFORMATION

2 Test Information

Name :	Ascom
Model/version :	WH2
Serial number :	Radiated sample: T26060FH2 Conducted sample: 18AM39501350
Hardware identity and/or version:	PB
Software identity and/or version :	1.0.4_Nemko
Frequency Ranges :	5150 – 5350 MHz 5470 – 5725 MHz
Type of Modulation :	IEEE 802.11a :OFDM IEEE 802.11n -HT20/HT40:OFDM IEEE 802.11ac-VHT20/VHT40/VHT80: OFDM
Channel Spacing :	20 MHz
User Frequency Adjustment :	None
Rated Output Power :	< 23 dBm
Antenna Connector :	None
Number of Antennas :	1
Antenna Diversity Supported :	No
Smart antennas :	No
Beamforming possible:	No
Power Source :	3.7Vdc, Battery
Desktop Charger :	Yes

Information provided by the client for DFS and adaptivity:

Description	Information Provided by Client
DFS related operating mode(s) of the equipment:	Slave without radar detection
Transmit Power Control(TPC) feature available:	No
User access restrictions:	DFS controls (hardware or software) related to radar detection are NOT accessible to the user.
Adaptivity (channel access Mechanism):	Yes, Load Based equipment
Maximum e.i.r.p	< 23 dBm

Description of Tested Device(s)

The tested equipment is a Wi-fi handset with following radio technologies, BLE, BT, 2.4GHz wi-fi, and 5GHz wi-fi.

2.1 Normal test condition

Temperature:	22 – 25 °C
Relative humidity:	30 – 50 %
Normal test voltage:	3.7Vdc

The values are the limit registered during the test period.

2.2 Extreme test conditions

None.

2.3 Test Engineer

G.Suwanthakumar

2.4 Test Equipment

See list of test equipment in clause 8.

2.5 Other Comments

The EUT has been tested radiated spurious emissions according to ETSI EN 301 893 and tests are passed.

The worst case data rate and modulation is considered in this test report. The power setting is maximum (the default value in test mode is "-129").

3 TEST REPORT SUMMARY

3.1 General

The tests were conducted on a sample of the equipment for demonstrating compliance with

EN 301 893 V2.1.1 (2017-05):

5 GHz RLAN; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

The test methods have been in accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 301 893 where applicable.

Radiated tests were performed in accordance with TM-NO-WLS-500, TM-NO-WLS-204A and EN 301 893. Radiated emissions are made in a 3m fully-anechoic chamber.

Production Unit

Pre-production Unit



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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4 Test Report Summary

4.1 Abbreviations

The following abbreviations are used in the test summary:

- Pass** The test results are inside the limits given in EN 301 893.
Fail The test results are outside the limits given in EN 301 893.
N/A Not applicable. The testcase is not applicable for the tested equipment.
N/T Not tested. The testcase is not covered by this test report.

Requirement			Test Specification			
No	Description	Reference: Clause No	U/C	Reference: Clause No	Condition/Test channels	Verdict
1	Carrier frequencies	4.2.1	U	5.4.2		N/T
2	Nominal, and occupied, channel bandwidth	4.2.2	U	5.4.3		N/T
3	RF output power	4.2.3	U	5.4.4		N/T
	Transmit Power Control (TPC)	4.2.3	U	5.4.4	Note 1 and 2	N/T
	Power Density	4.2.3	U	5.4.4		N/T
4	Transmitter unwanted emissions outside the 5 GHz RLAN bands	4.2.4.1	U	5.4.5		Pass
5	Transmitter unwanted emissions within the 5 GHz RLAN bands	4.2.4.2	U	5.4.6		N/T
6	Receiver spurious emissions	4.2.5	U	5.4.7		Pass

Requirement			Test Specification		Condition/Test channels	Verdict
No	Description	Reference: Clause No	U/C	Reference: Clause No		
7	DFS: Channel Availability Check	4.2.6.2.2	U	5.4.8	Notes 1,2 and 3	NT
8	DFS: Off-Channel CAC - Radar Detection Threshold	4.2.6.2.3	U	5.4.8	Notes 1,2,3 and 4	NT
9	DFS: Off-Channel CAC - Detection Probability	4.2.6.2.3	C	5.4.8	Notes 1, 2, 3 and 4	NT
10	DFS: In service Monitoring	4.2.6.2.4	C	5.4.8	Notes 1 and 2	NT
11	DFS: Channel shutdown	4.2.6.2.5	C	5.4.8	Note 1	NT
12	DFS: Non-occupancy period	4.2.6.2.6	C	5.4.8	Notes 1 and 2	NT
13	DFS: Uniform spreading	4.2.6.2.7	C		Notes 1 and 5	NT
14	Adaptivity	4.2.7	U	5.4.9		NT
15	Receiver Blocking	4.2.8	U	5.4.10		NT
16	User Access Restrictions	4.10	U			NT
17	Geo-Location capability	4.2.10	C	5.4.1	Not 4	NT

NT: Not required by the client (Wi-fi module pre-tested, Test report number from TUV Rheinland 50132219 001)

NOTE 1: Not required for devices that operate at a maximum mean e.i.r.p. of 20 dBm when operating in 5250 MHz to 5350 MHz or 27 dBm when operating in 5470 MHz to 5725 MHz.

NOTE 2: Not required for Slave devices with a maximum transmit power of less than 200 mW e.i.r.p

NOTE 3: Not required at initial use of a channel for slave devices with a maximum transmit power of 200 mW e.i.r.p

NOTE 4: Where implemented by the manufacturer.

NOTE 5: Not required for Slave devices.

5 Test Results

5.1 RF Output Power

ETSI EN 301 893 subclause 4.2.3

RF Carrier	Temperature	Voltage	eirp (dBm)
			rms
Ch36: 5180MHz/amcs0_20	Nominal	Normal	15.20
Ch38: 5190MHz/amcs0_40	Nominal	Normal	14.94
Ch40: 5200MHz/amcs0_20	Nominal	Normal	14.10
Ch42: 5210MHz/amcs0_80	Nominal	Normal	11.60
Ch44: 5220MHz/amcs0_20	Nominal	Normal	14.25
Ch46: 5230MHz/amcs0_40	Nominal	Normal	14.46
Ch48: 5240MHz/amcs0_20	Nominal	Normal	14.75
Measurement Uncertainty U₉₅			+1.6 / -1.9 dB

The EUT was programmed to transmit continuously during testing (duty cycle = 100%).

The measurement was performed with a RMS Power Meter. The maximum eirp is obtained in vertical polarization.

Limits: Clause 4.2.3.2

Mean EIRP limits for RF Output Power at the Highest Power Level:	
5150 to 5350 MHz:	23 dBm
5470 to 5725 MHz:	30 dBm (for devices with radar detection function)
	23 dBm (for Slave devices without radar detection function)
Mean EIRP limits for RF Output Power at the Lowest Power Level of the TPC range:	
5150 to 5350 MHz:	17 dBm
5470 to 5725 MHz:	24 dBm (for devices with radar detection function)
	17 dBm (for Slave devices without radar detection function)

Test Equipment Used: 2,7,8,9

5.2 Transmitter unwanted emissions outside the 5 GHz RLAN bands

ETSI EN 301 893 subclause 4.2.4.1

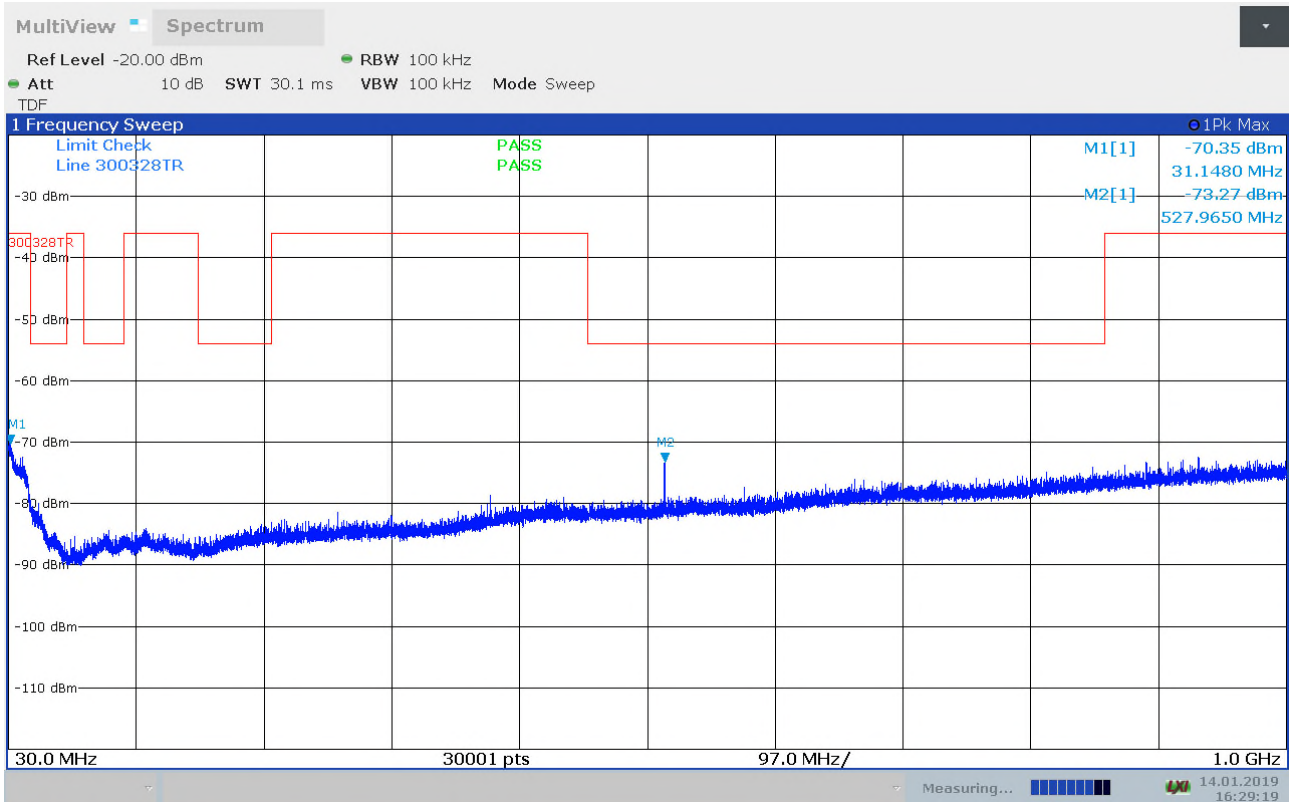
Frequency (MHz)	Polarization	Spurious Emission Level (dBm)
Ch36/5180MHz/amcs0_20MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Ch42/5210MHz/amcs0_80MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Ch46/5230MHz/amcs0_40MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Ch100/5500MHz/amcs0_20MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Ch118/5590MHz/amcs0_40MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Ch122/5610MHz/amcs0_80MHz		
30 - 1000	VP/HP	< -54/-36
1000 - 26 000	VP/HP	< -30
Measurement Uncertainty	25 MHz – 1 GHz - +1,9/-2,4 dB 1 – 8 GHz - +1,8/-2,1 dB 8 – 18 GHz - +1,9/-2,4 dB	

The measurement bandwidth was as specified in the standard for all measurements. Peak detector Above 18GHz only a pre scan.

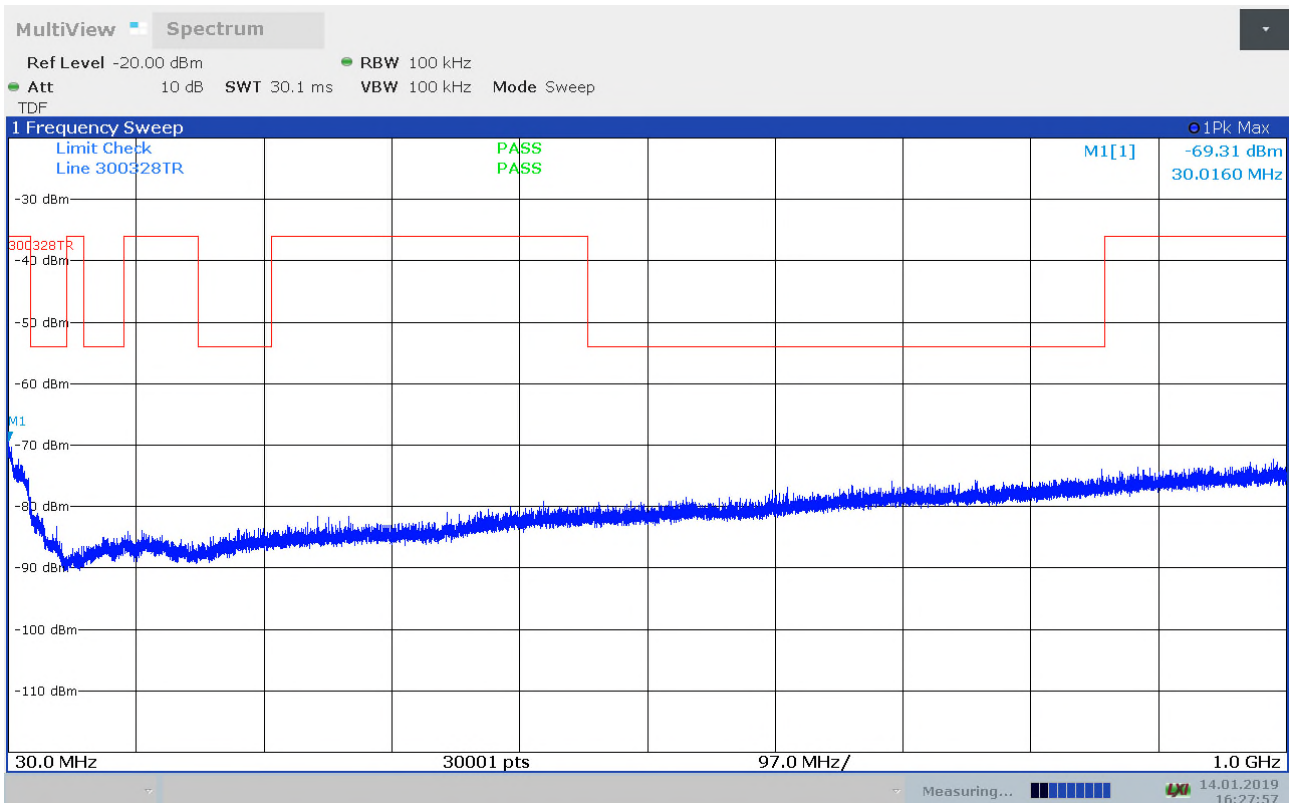
Limits: Clause 4.2.4.1.2

Frequency Range	Maximum Power ERP	Bandwidth
30 – 1000 MHz	-36 dBm	100 kHz
1 – 5.15 GHz	-30 dBm	1 MHz
5.35 – 5.47 GHz		
5.725 – 26 GHz		
Except the following bands:	-54 dBm	100 kHz
47 – 74 MHz		
87.5 – 118 MHz		
174 – 230 MHz		
470 – 862 MHz		

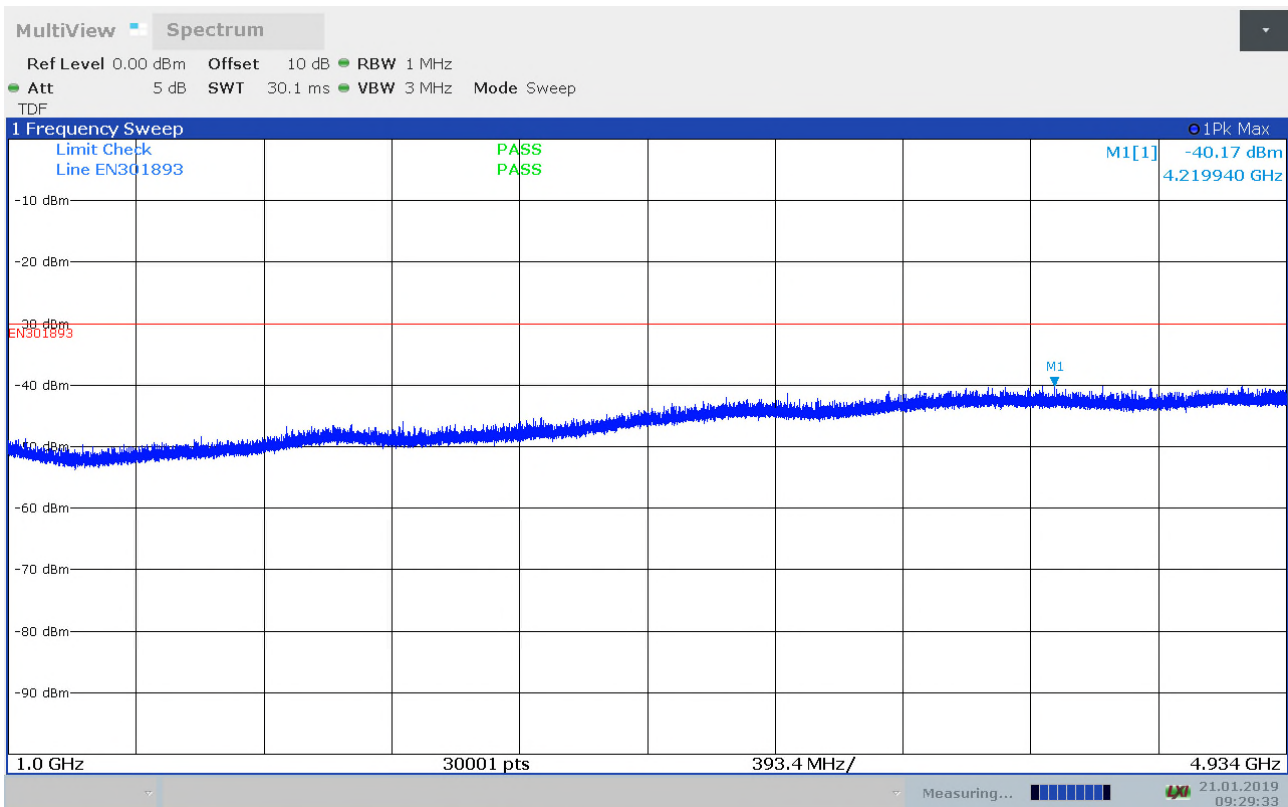
Test Equipment Used: 6,8,9,11,12,14



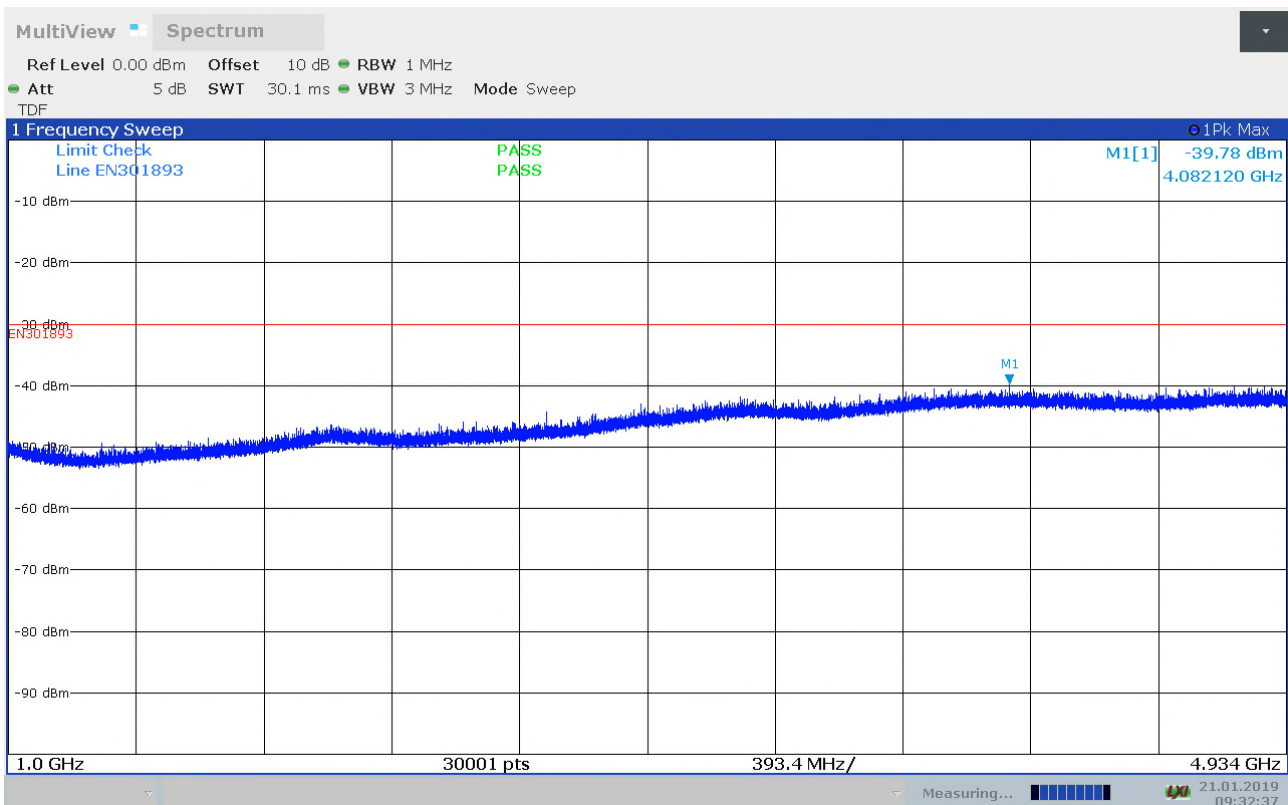
Radiated Spurious Emissions, 30 – 1000 MHz, VP, TX



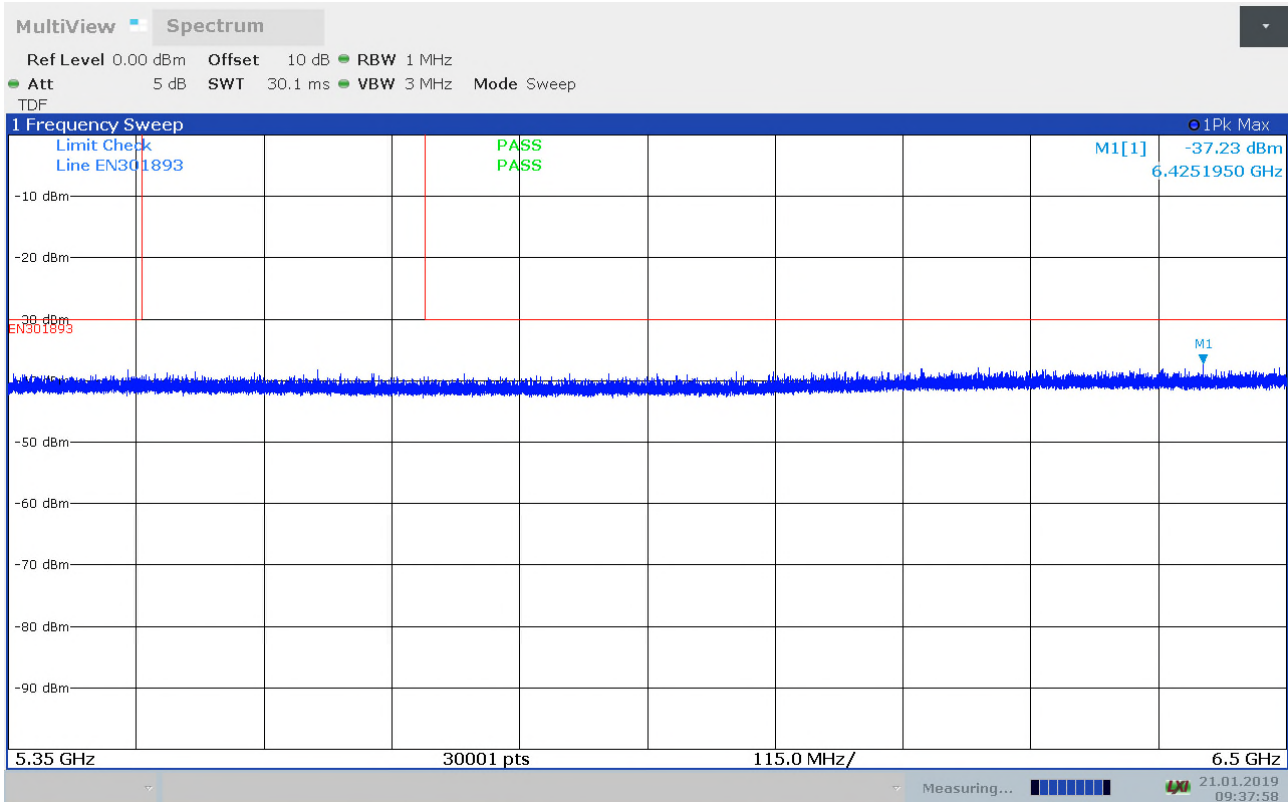
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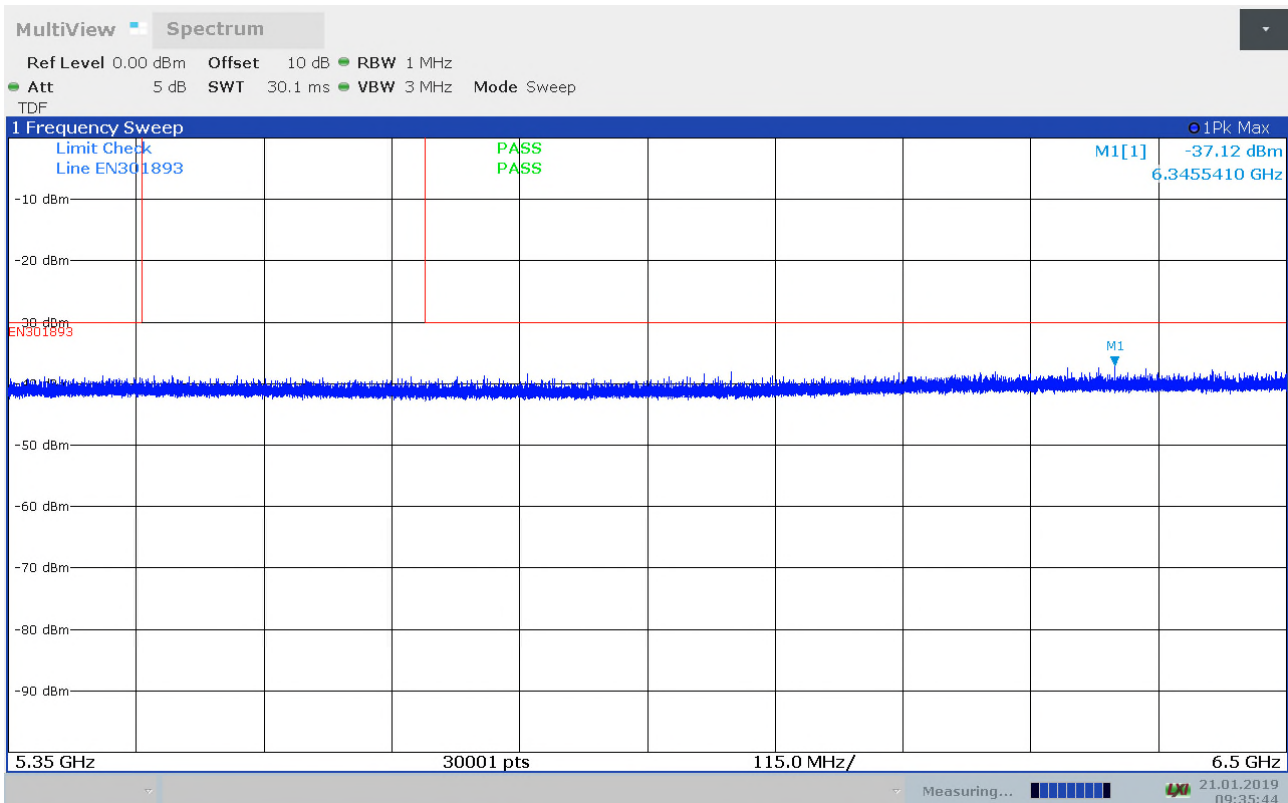
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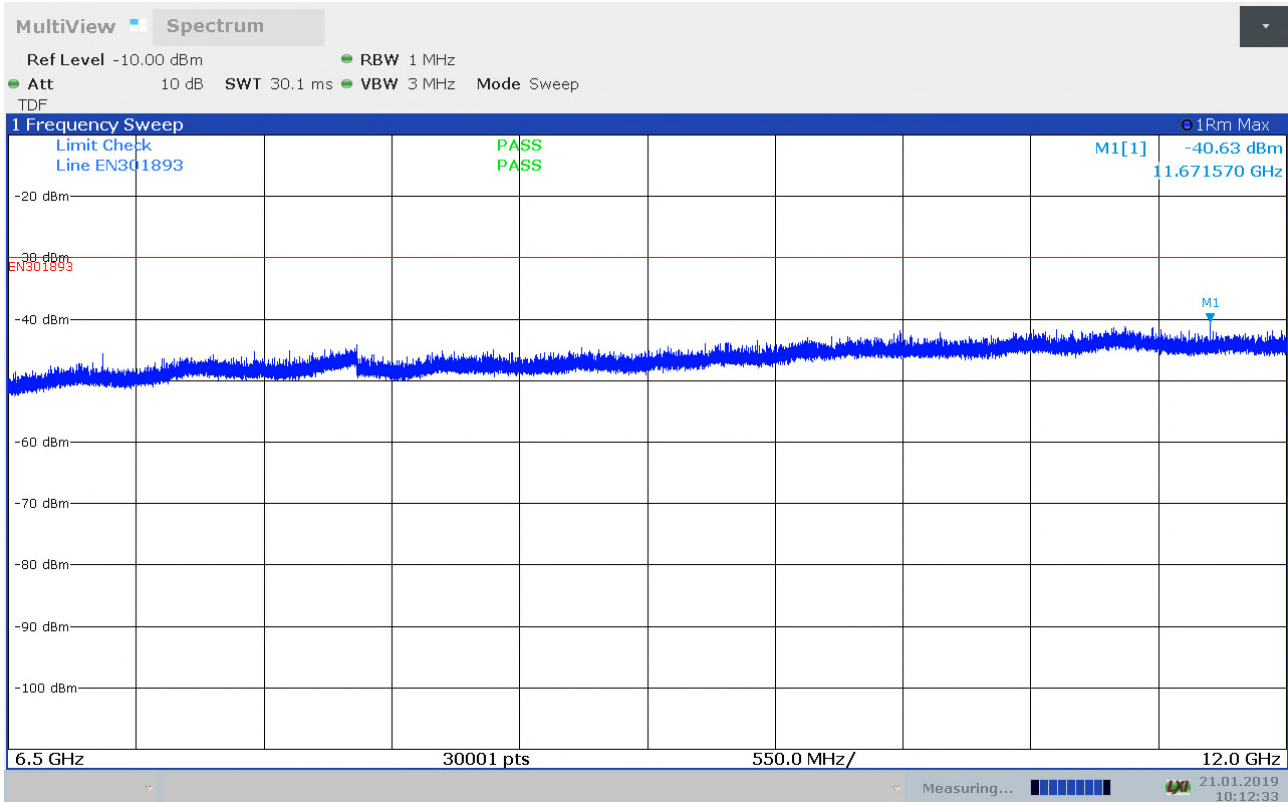
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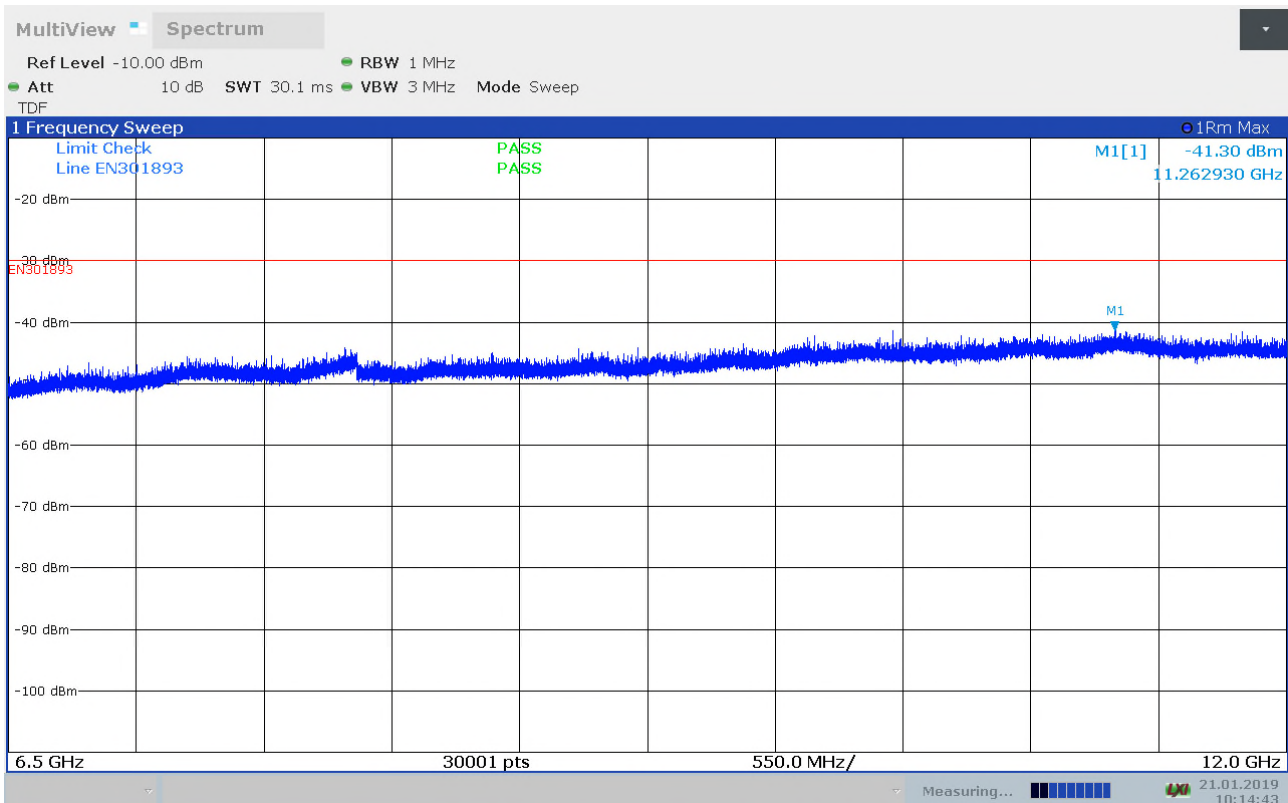
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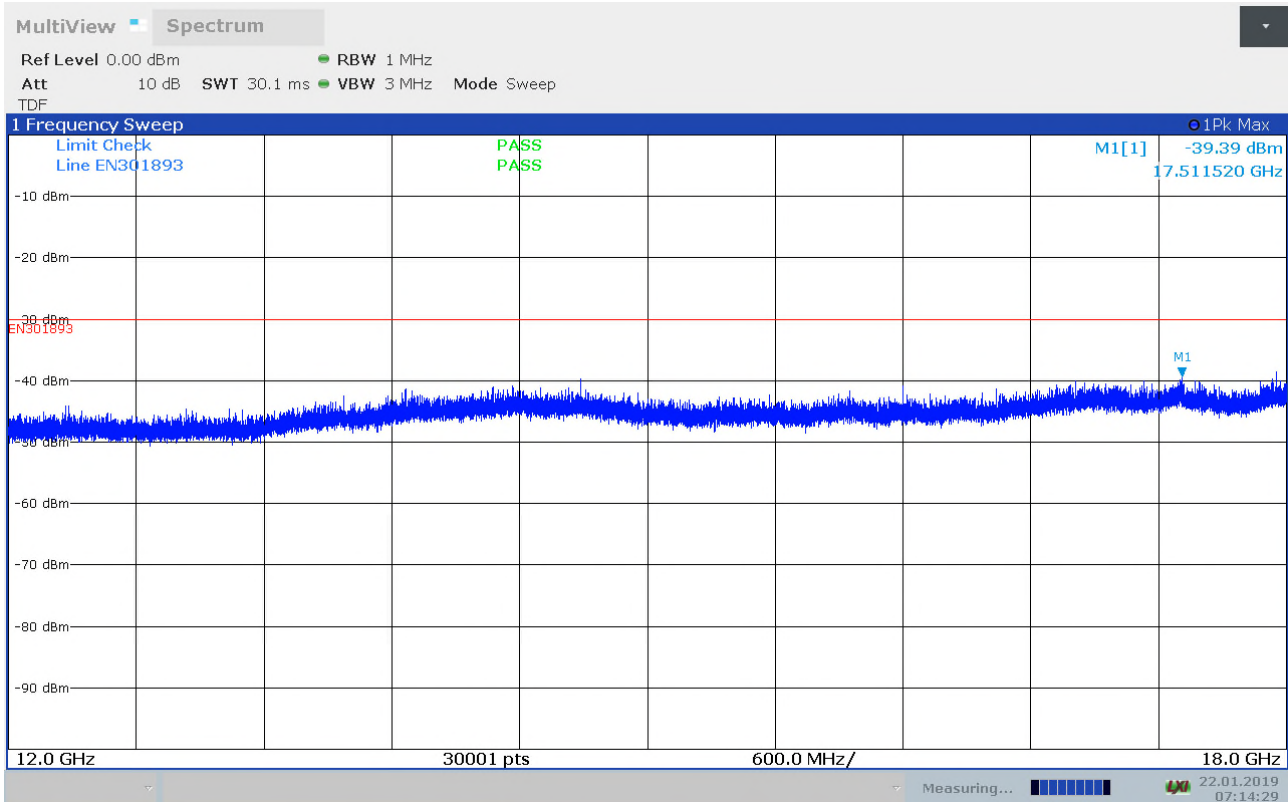
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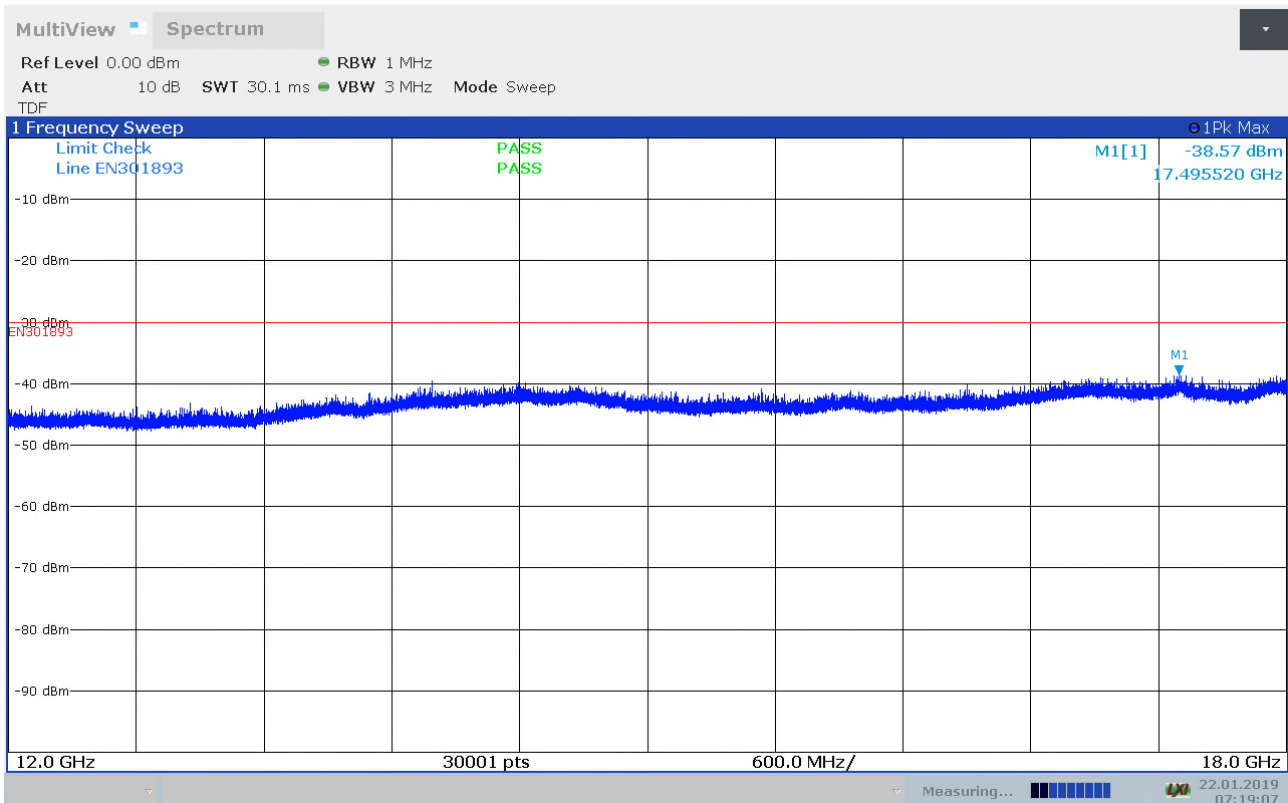
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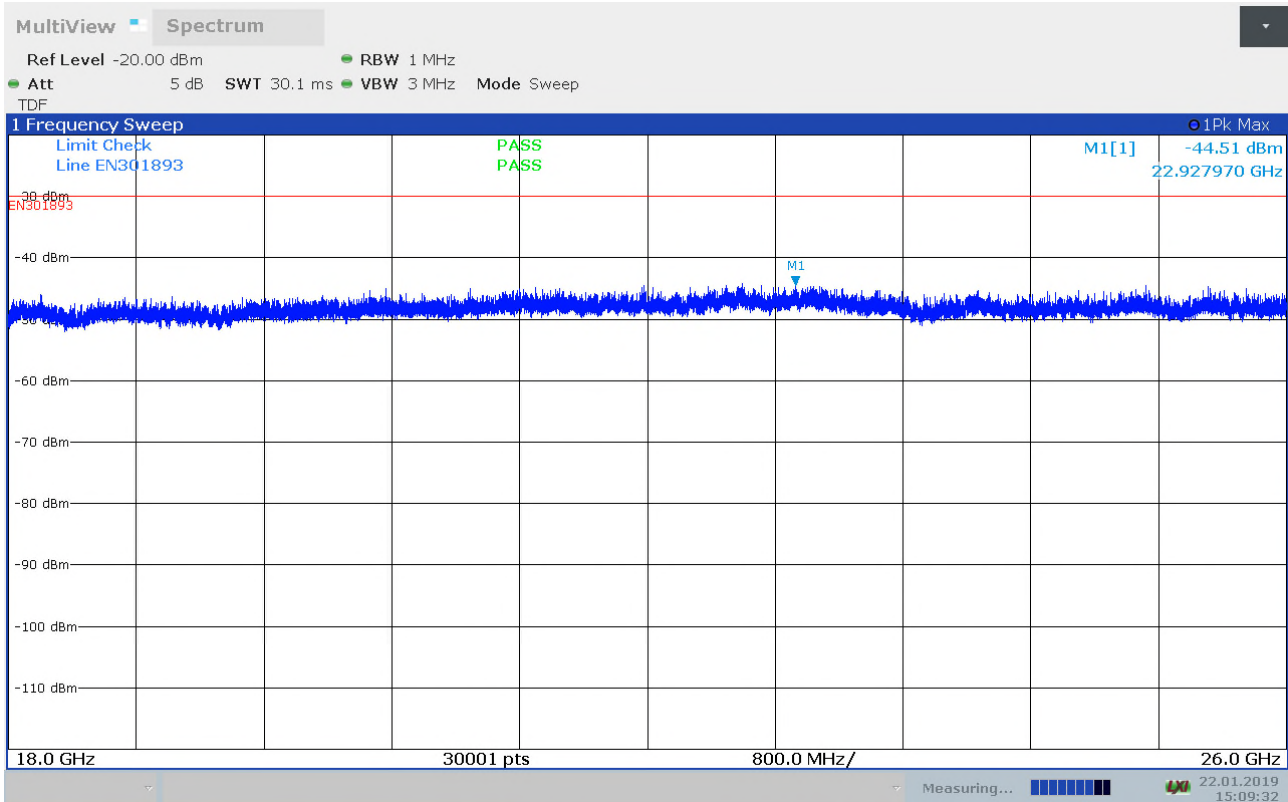
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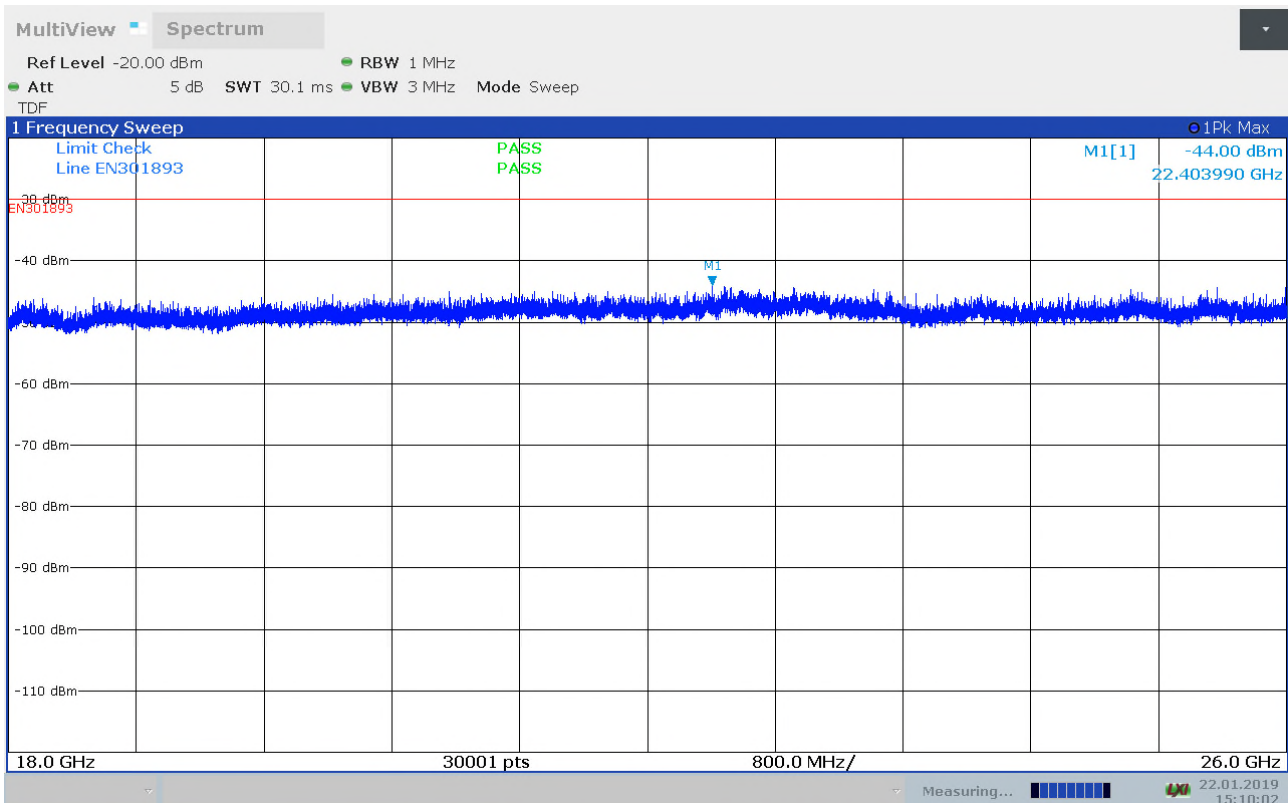
Radiated Spurious Emissions, 12 - 18GHz, ch36, ch5230MHz, amcs0, 20MHz, VP, TX



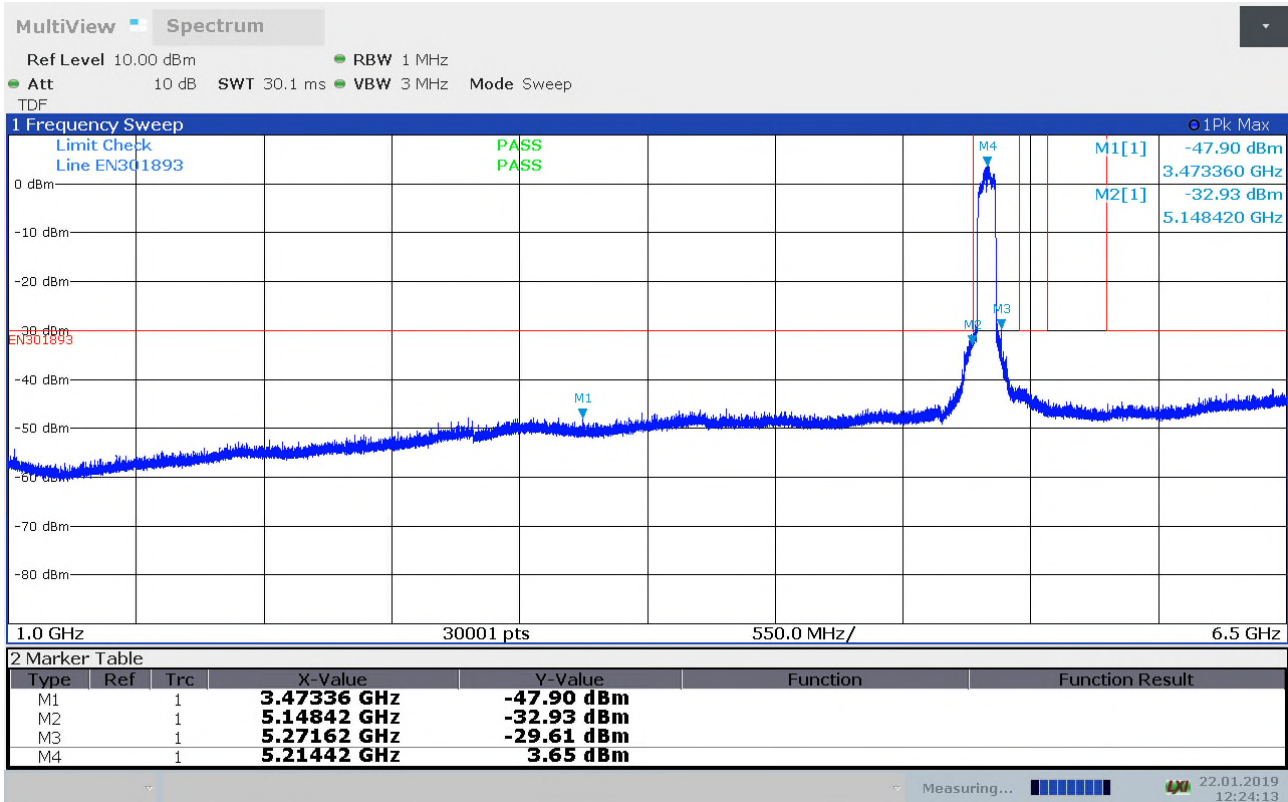
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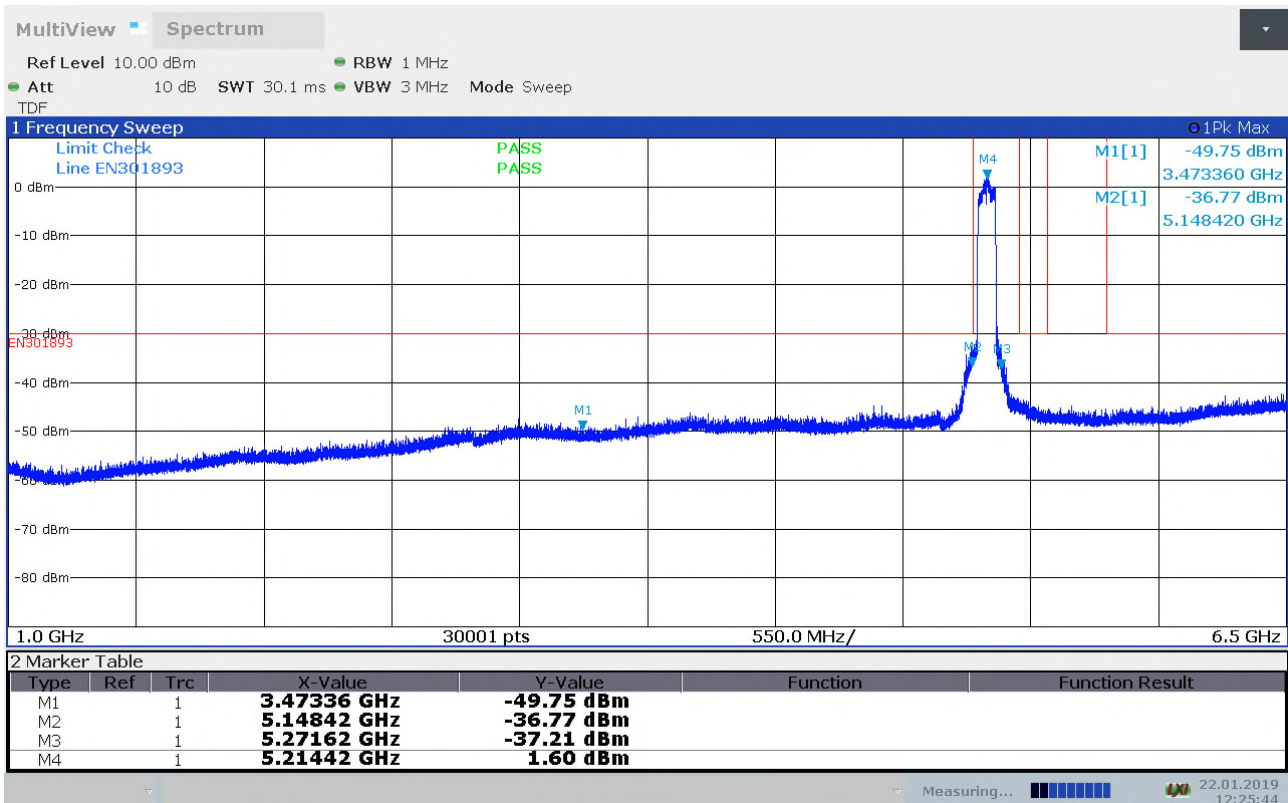
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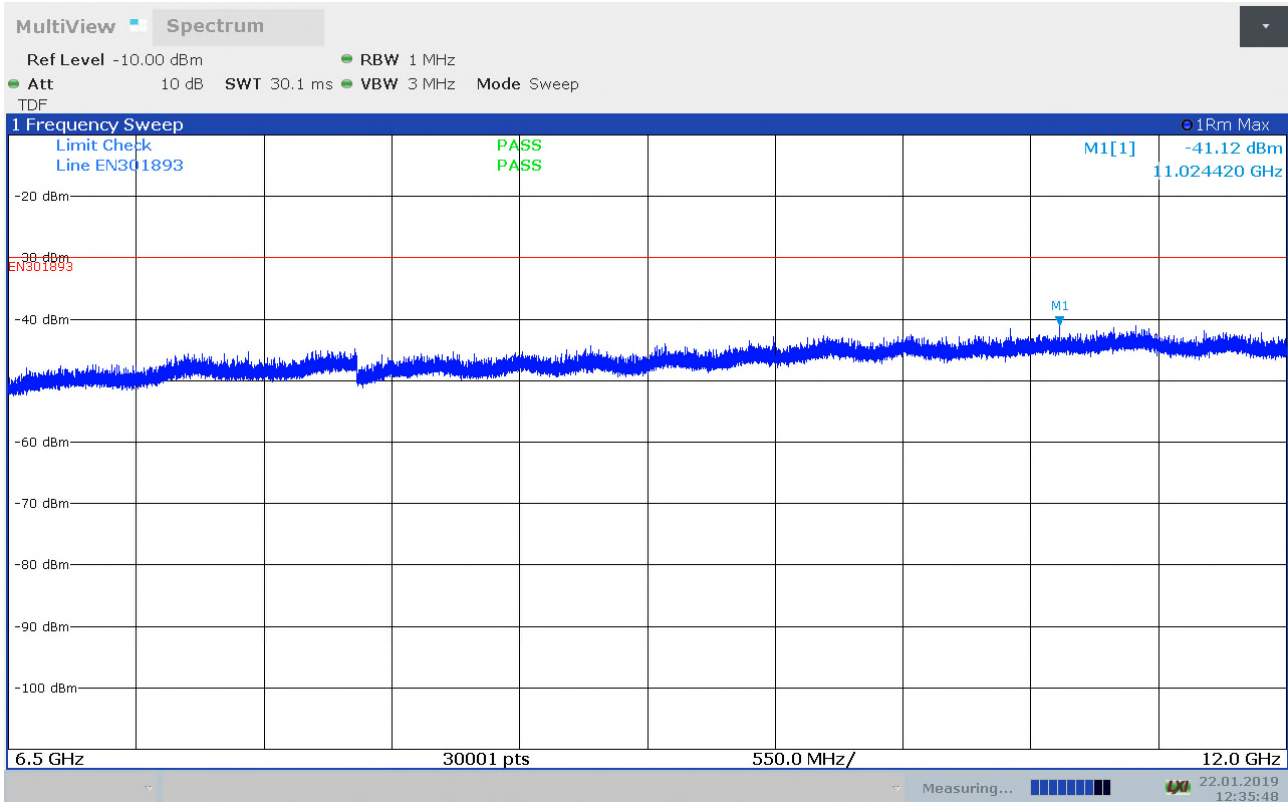
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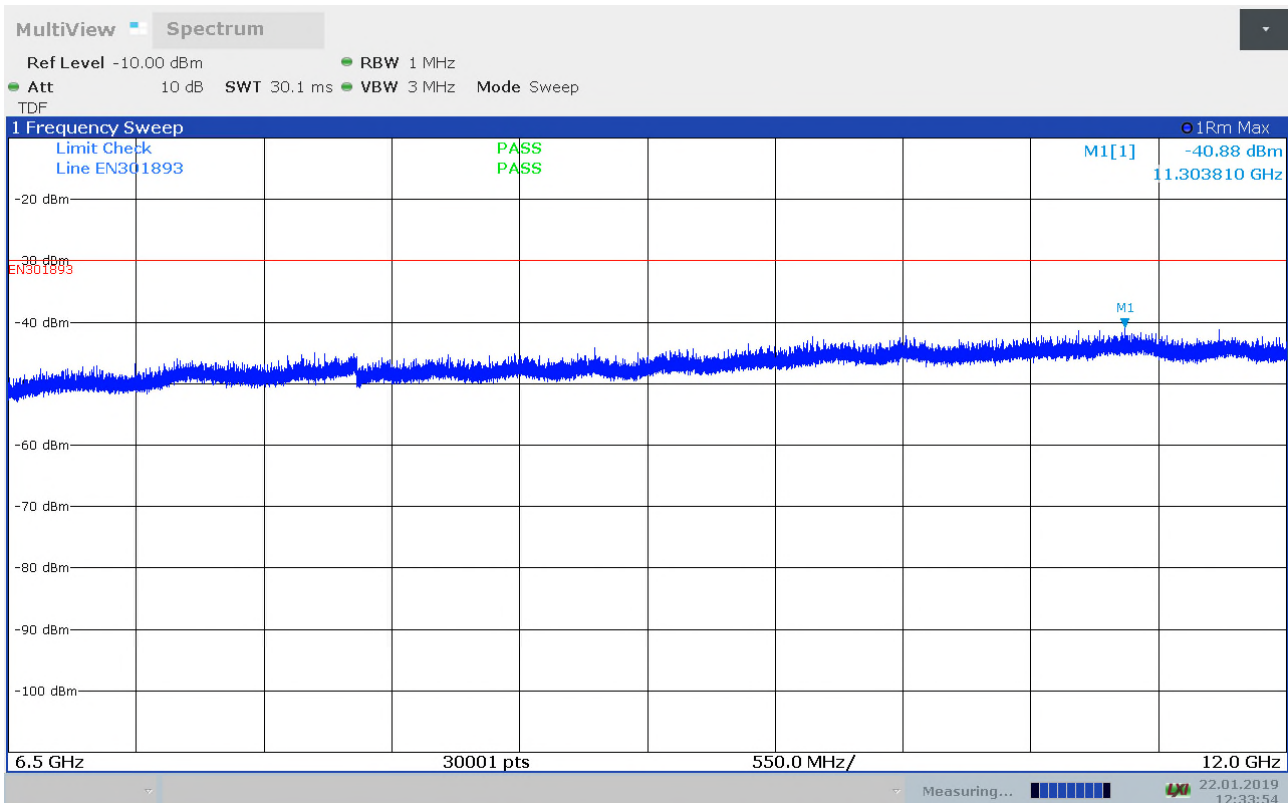
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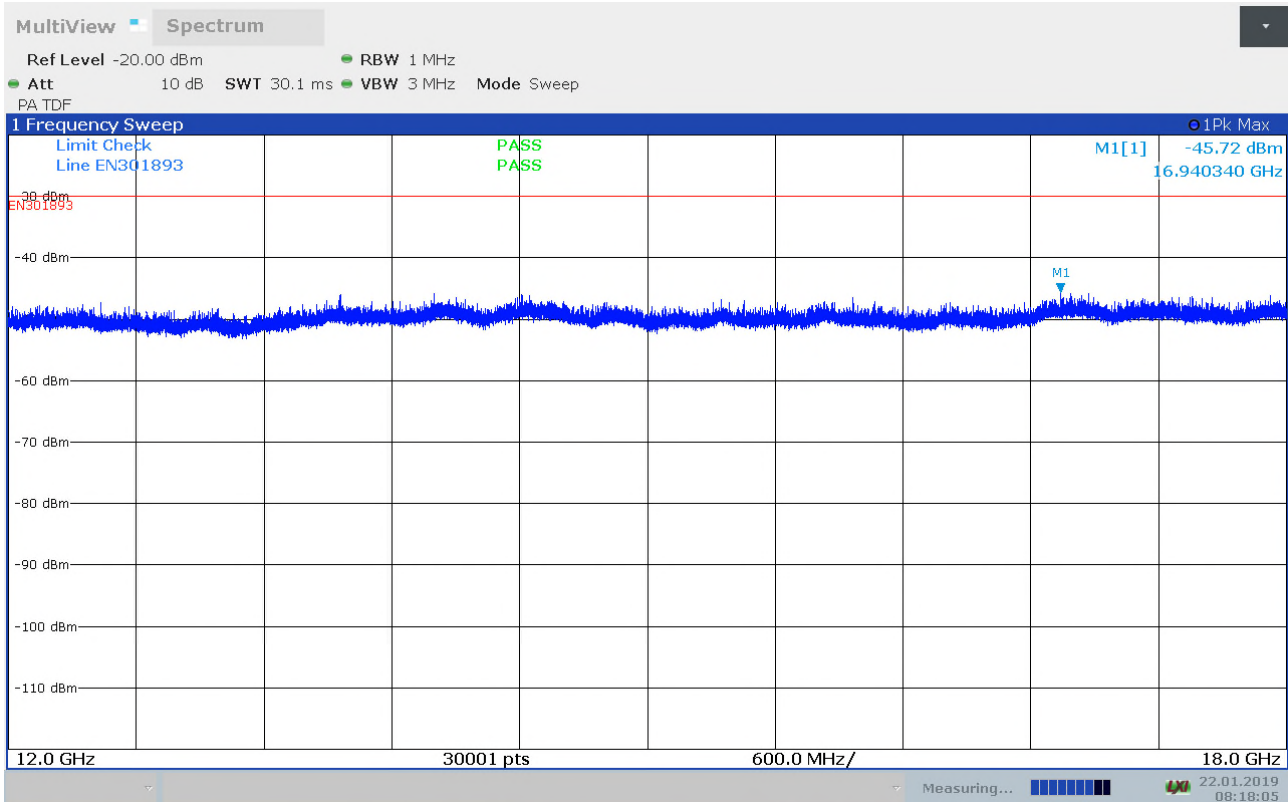
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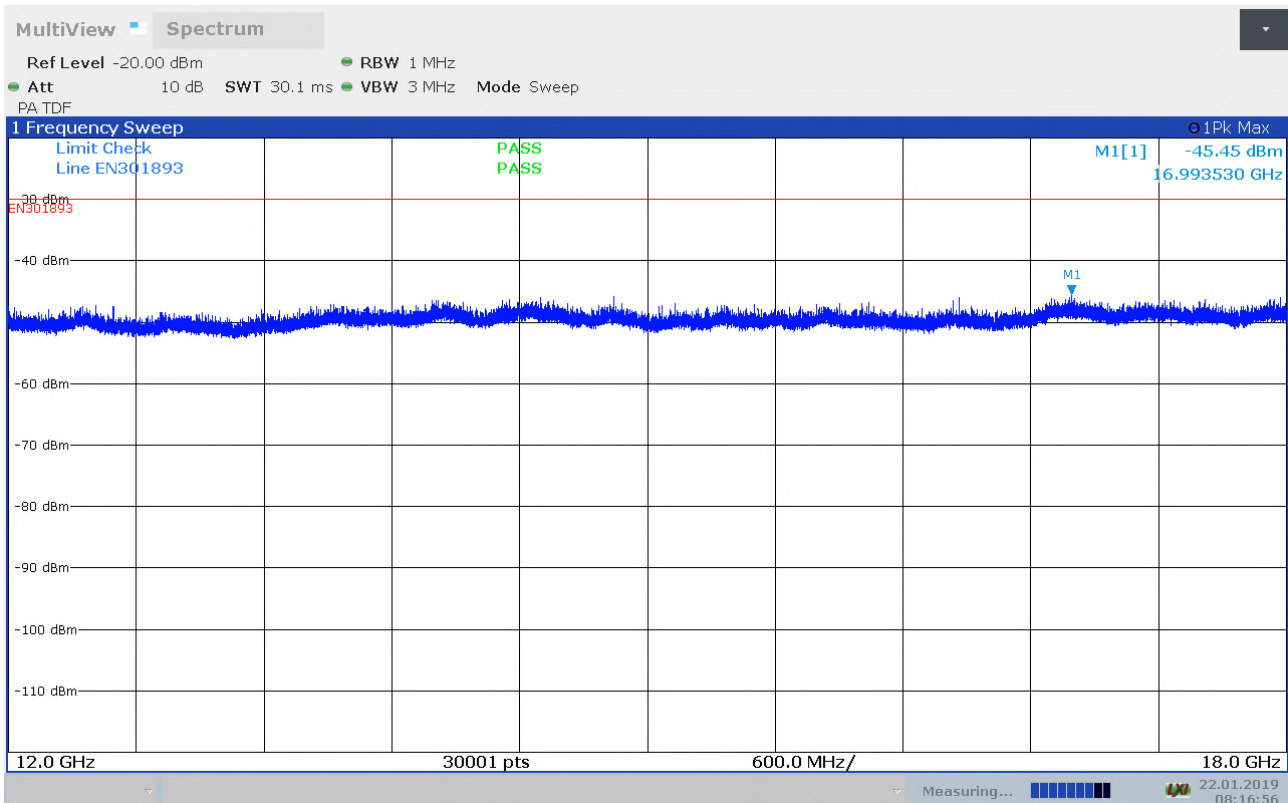
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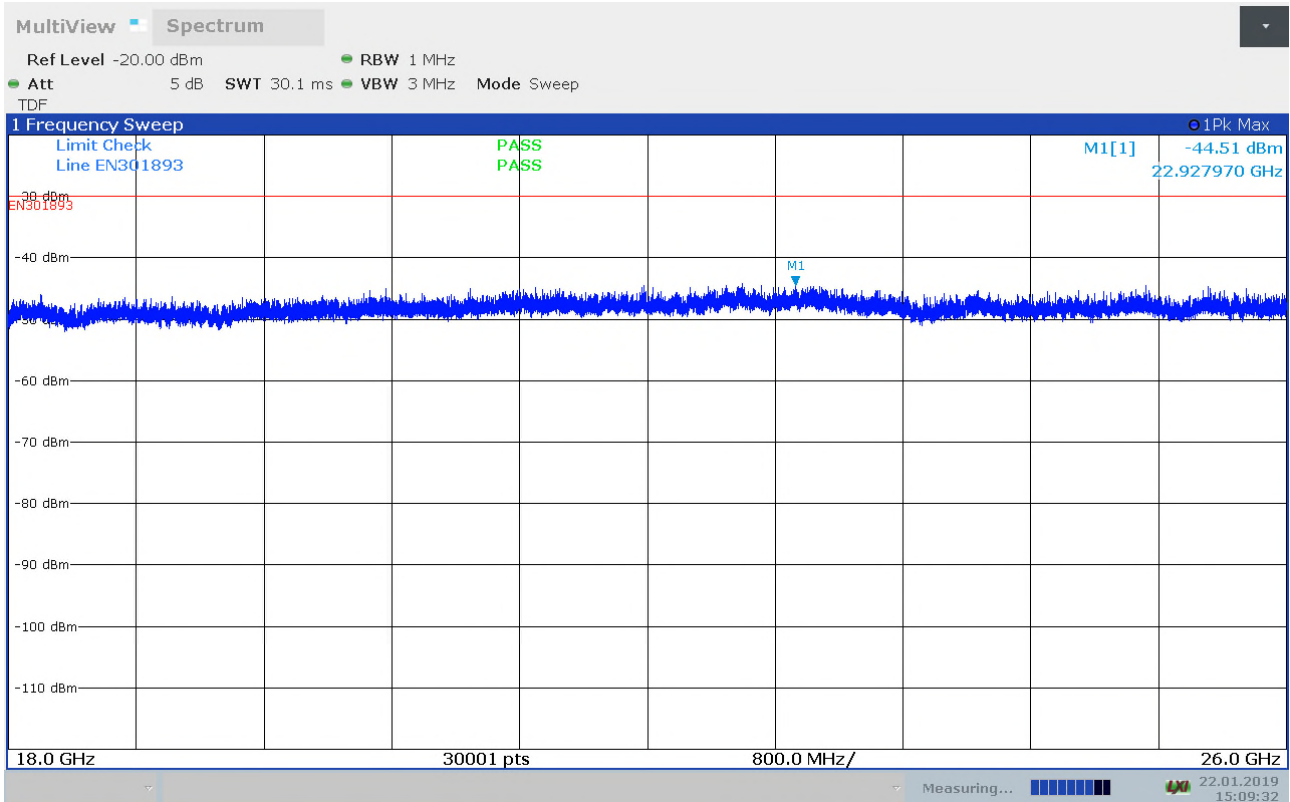
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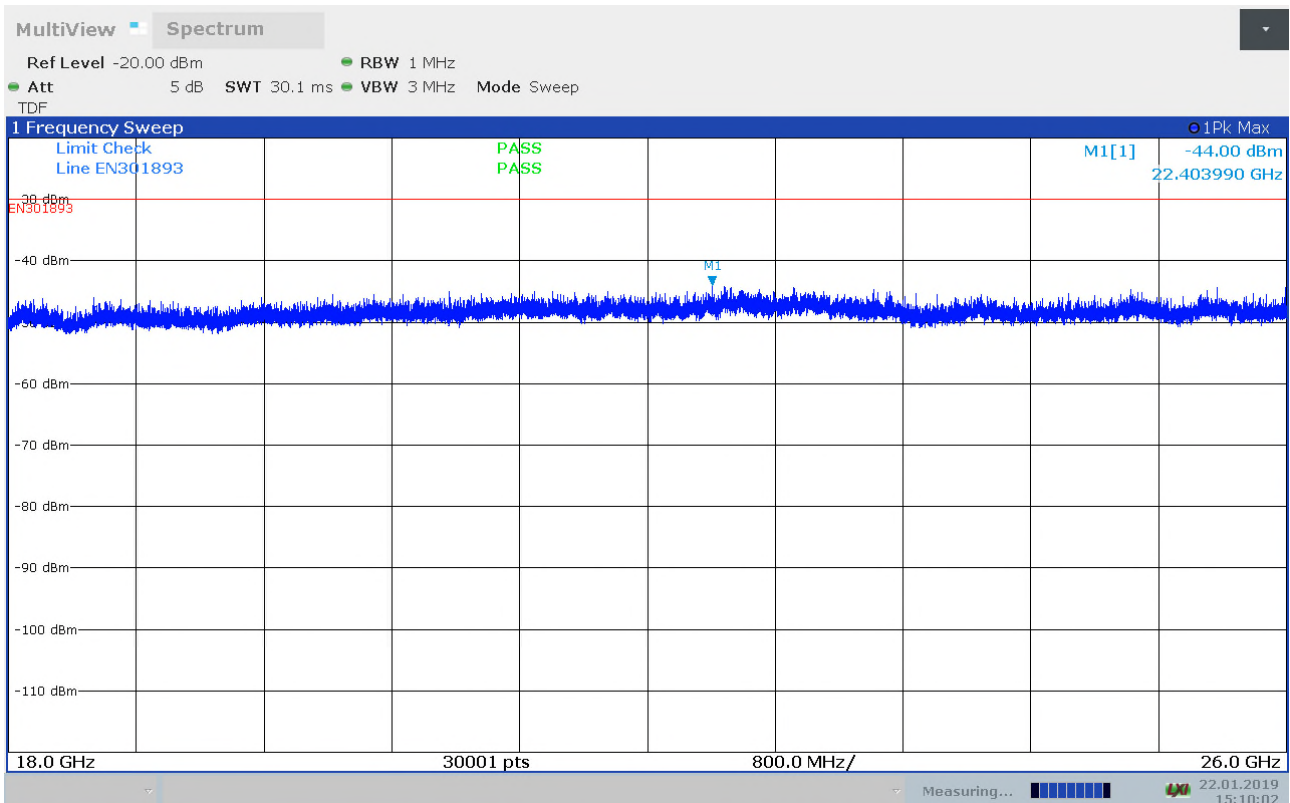
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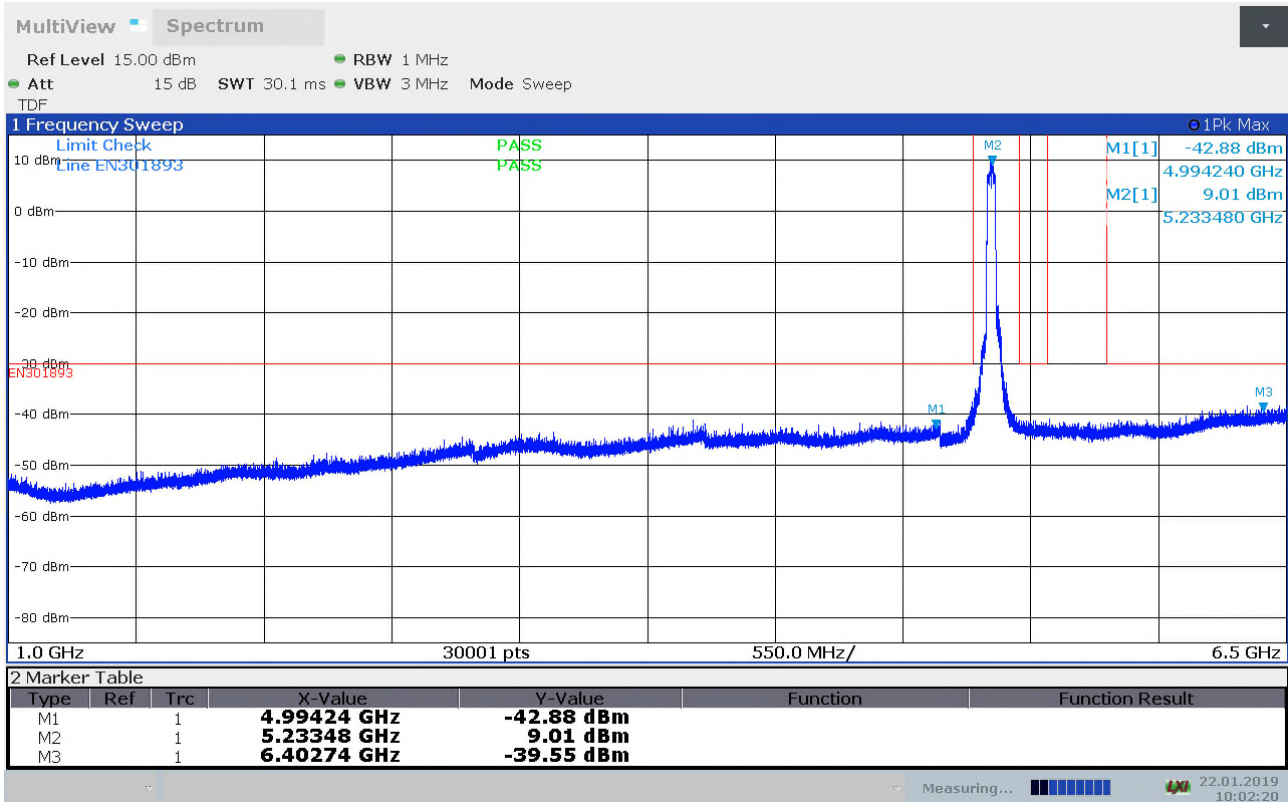
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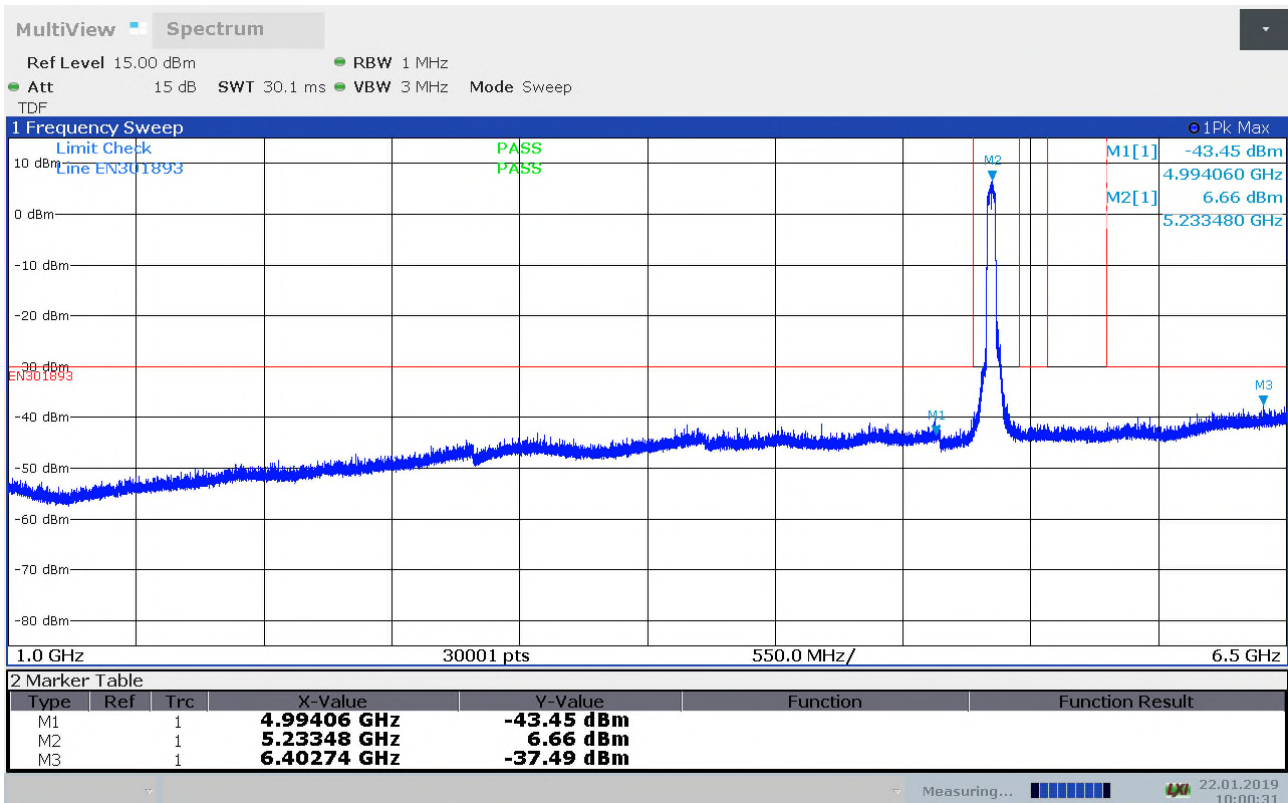
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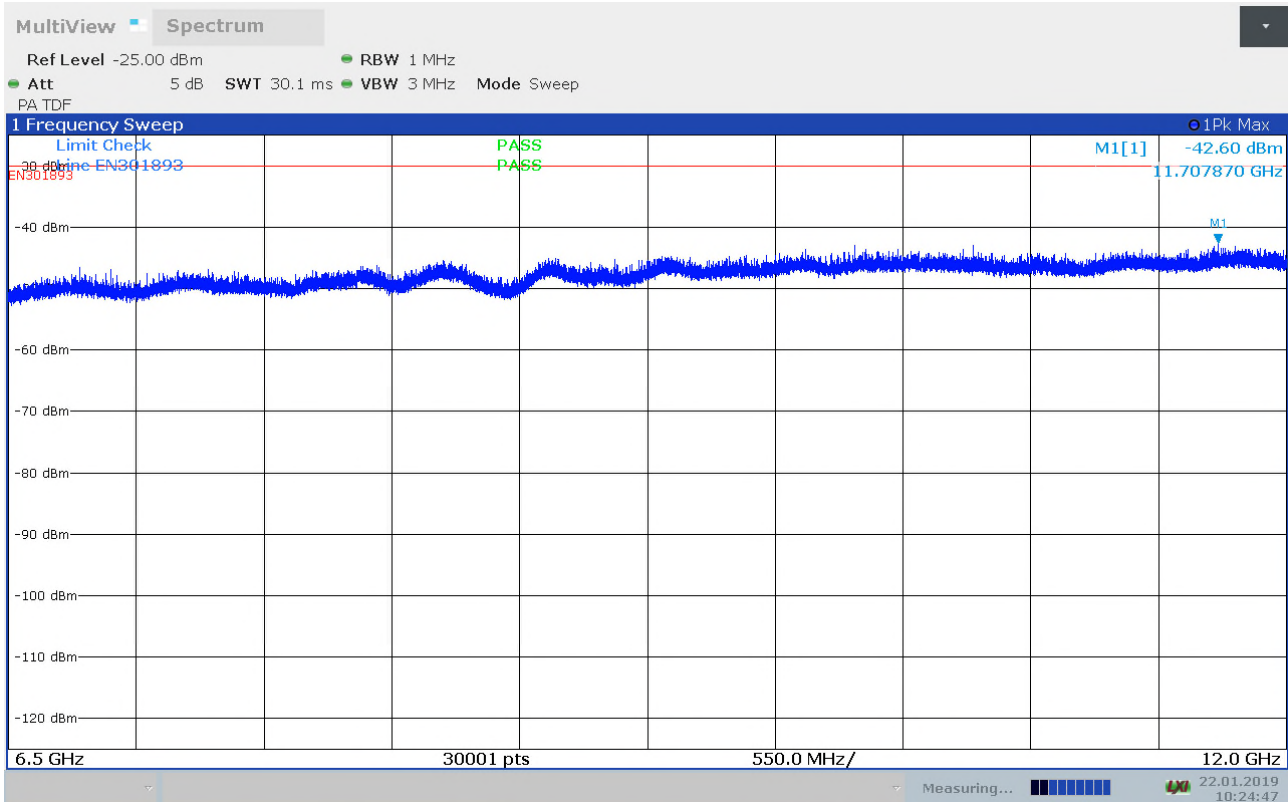
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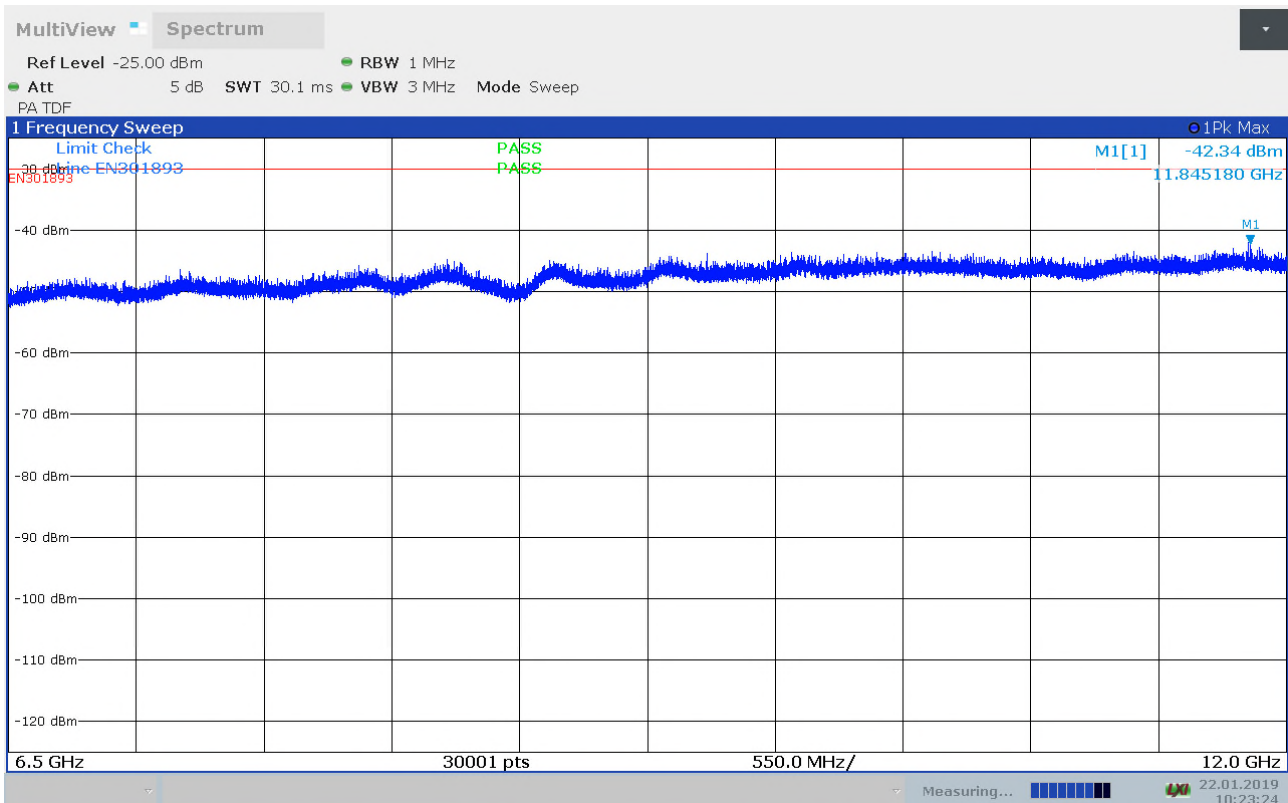
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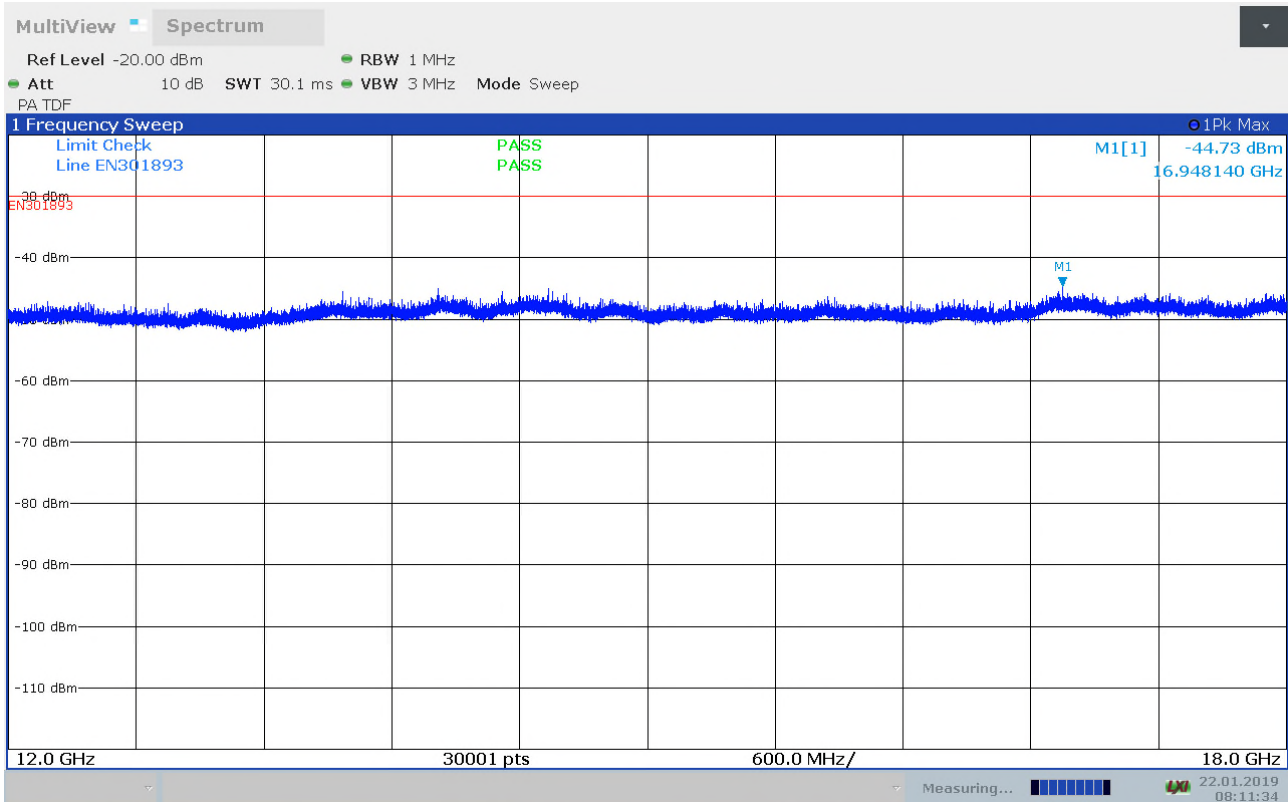
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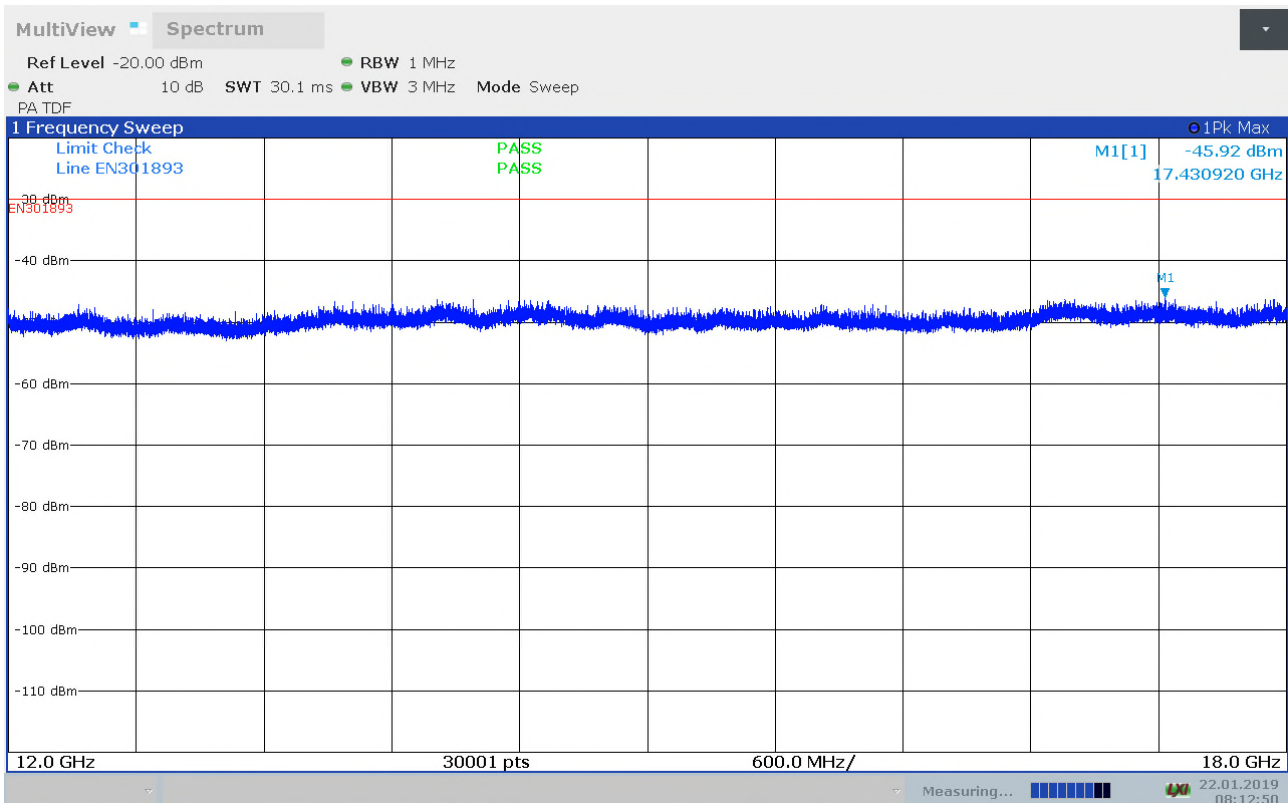
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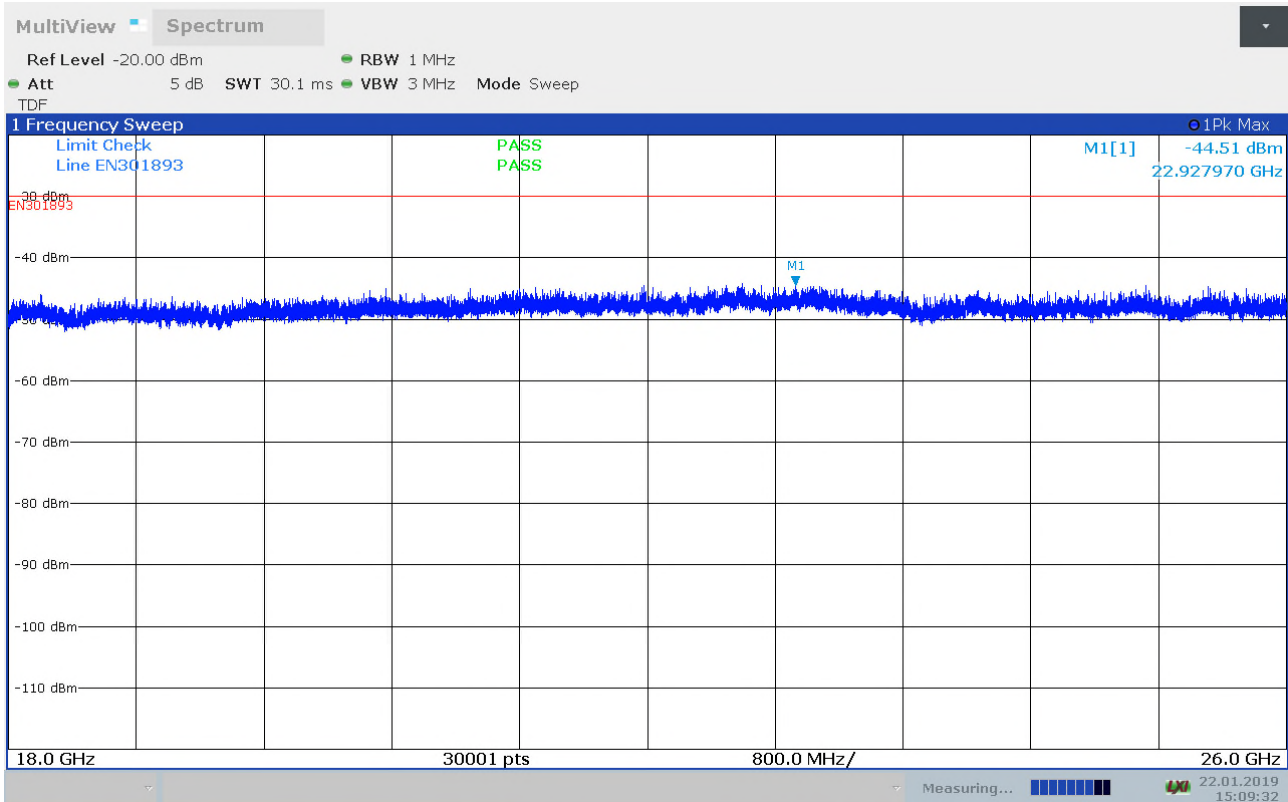
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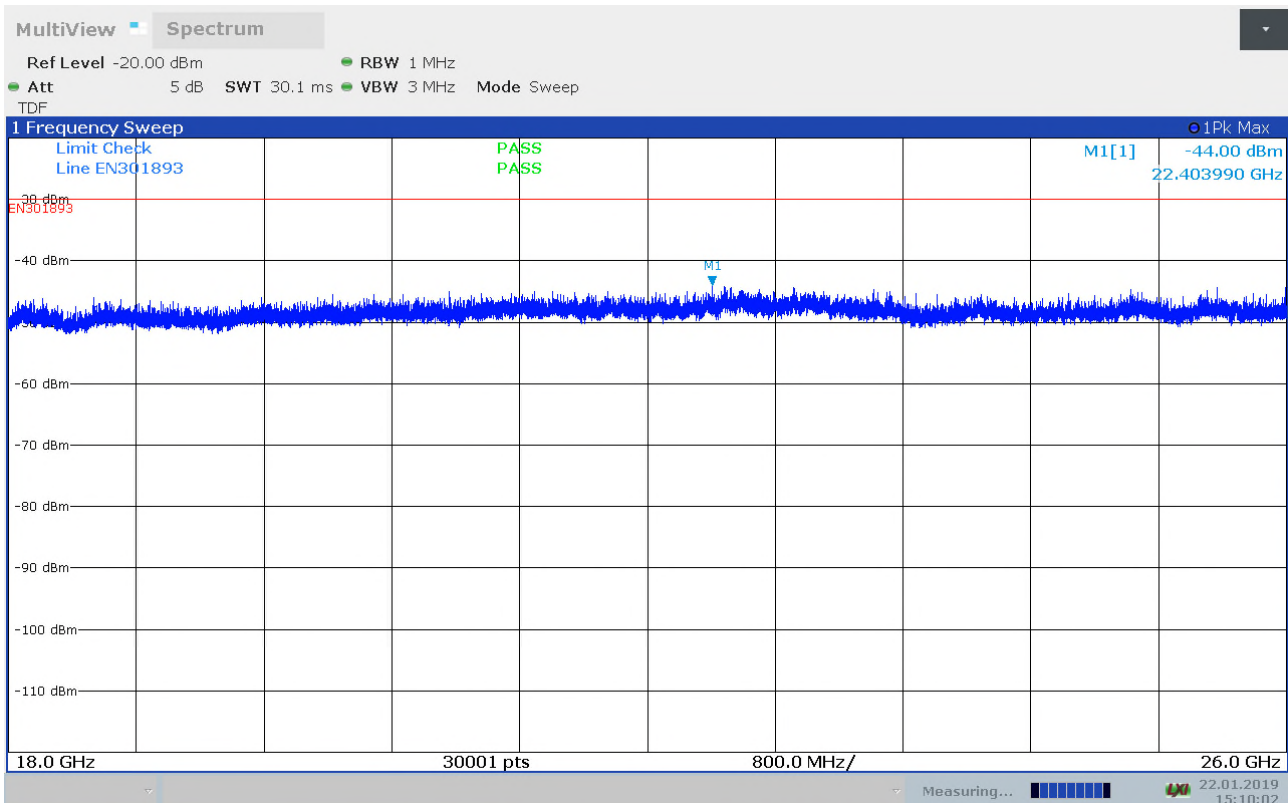
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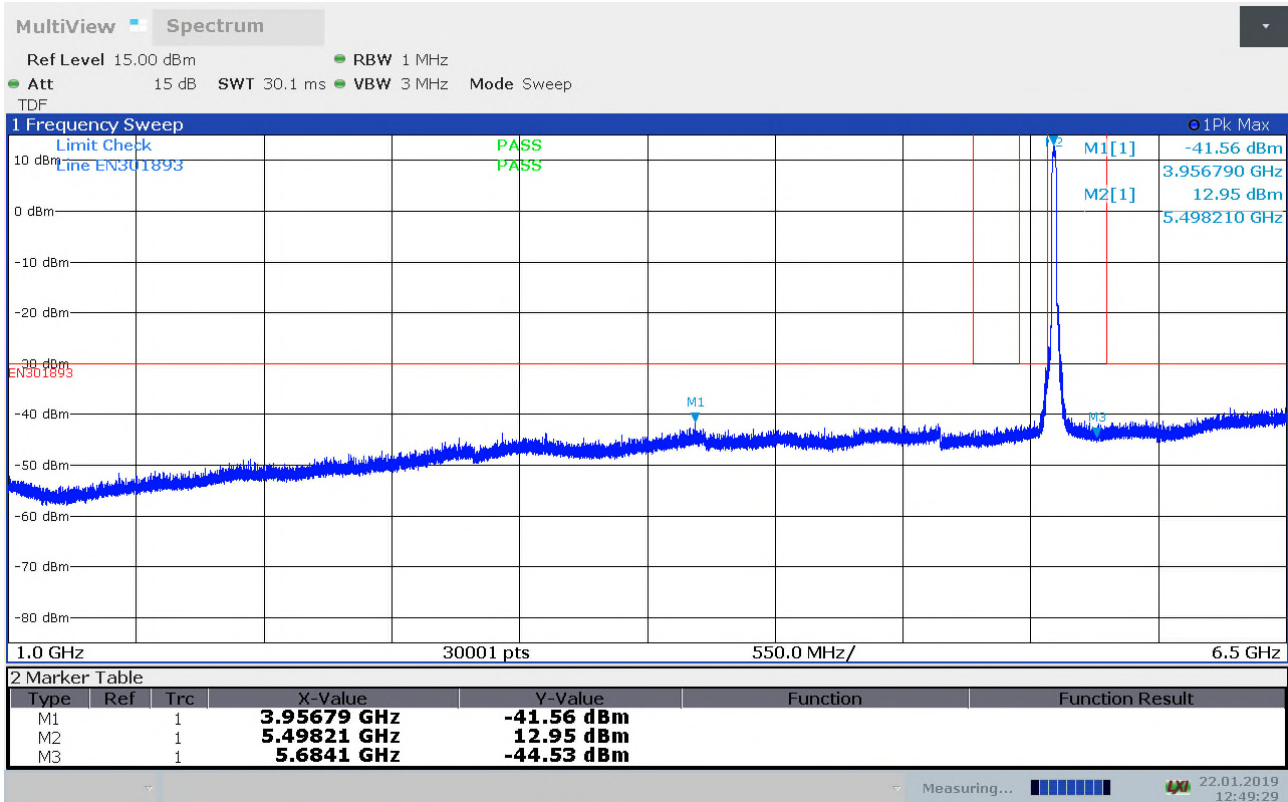
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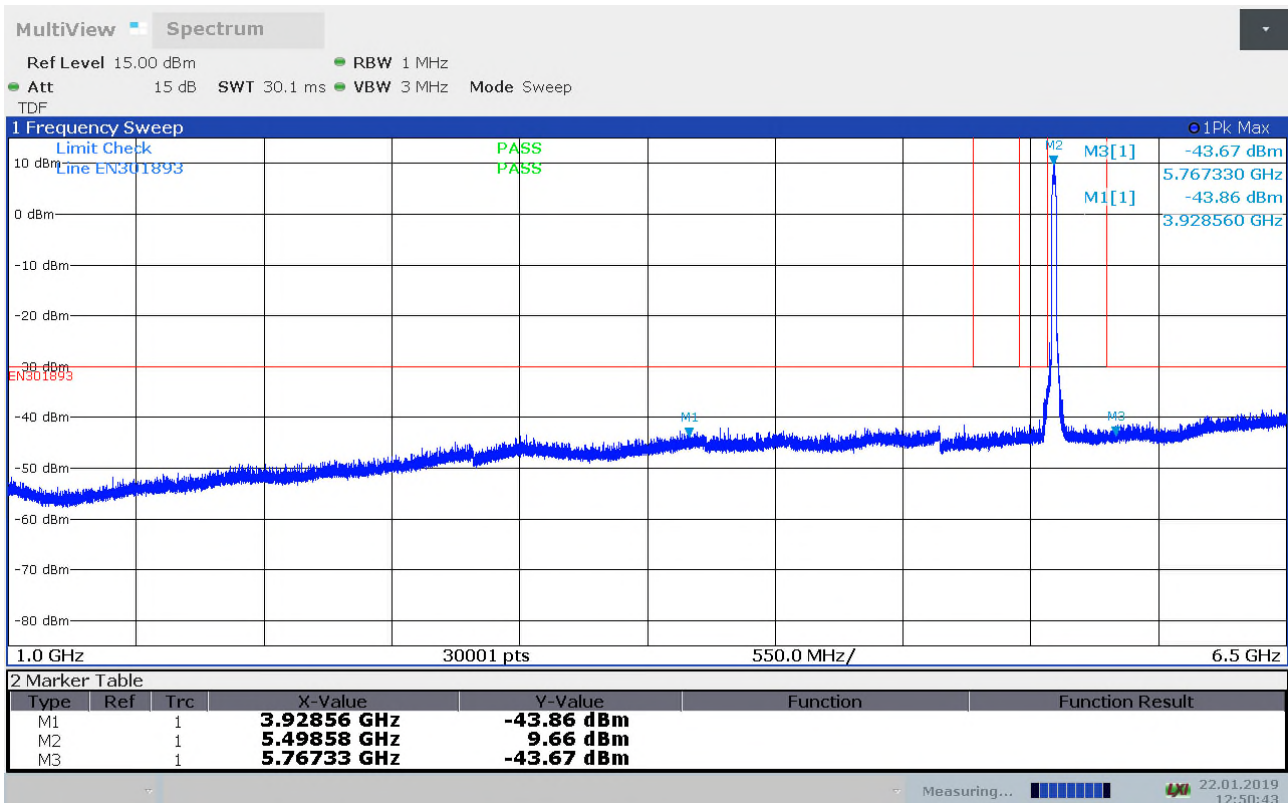
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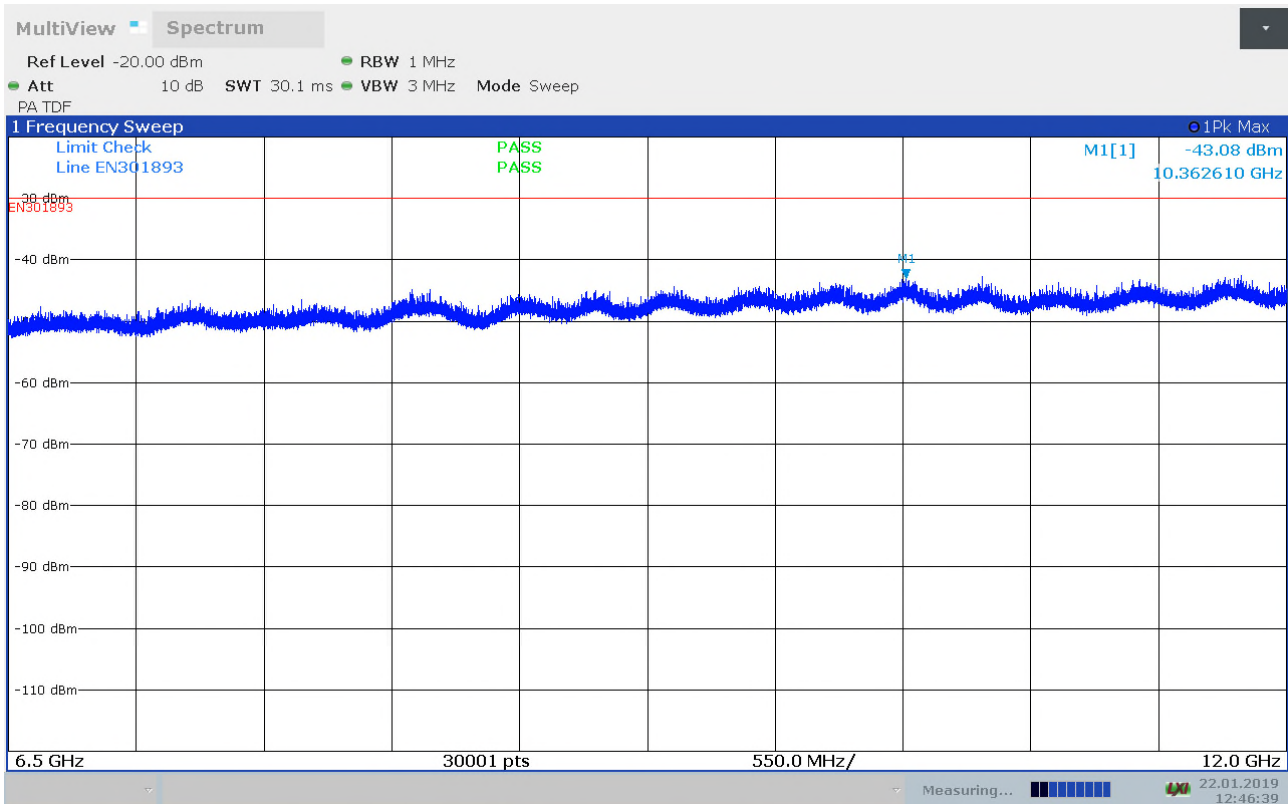
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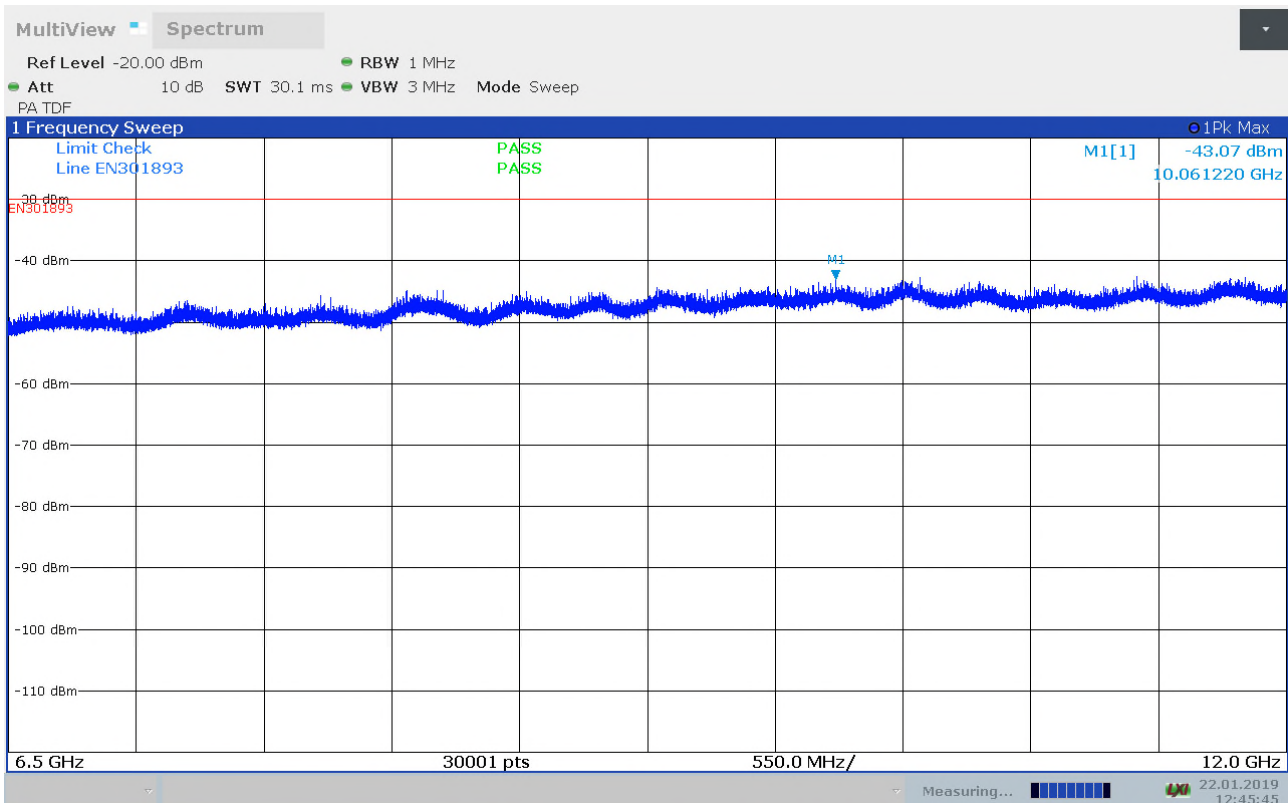
Radiated Spurious Emissions, 1 – 6.5GHz, ch100, ch5500MHz, amcs0, 20MHz, VP, TX



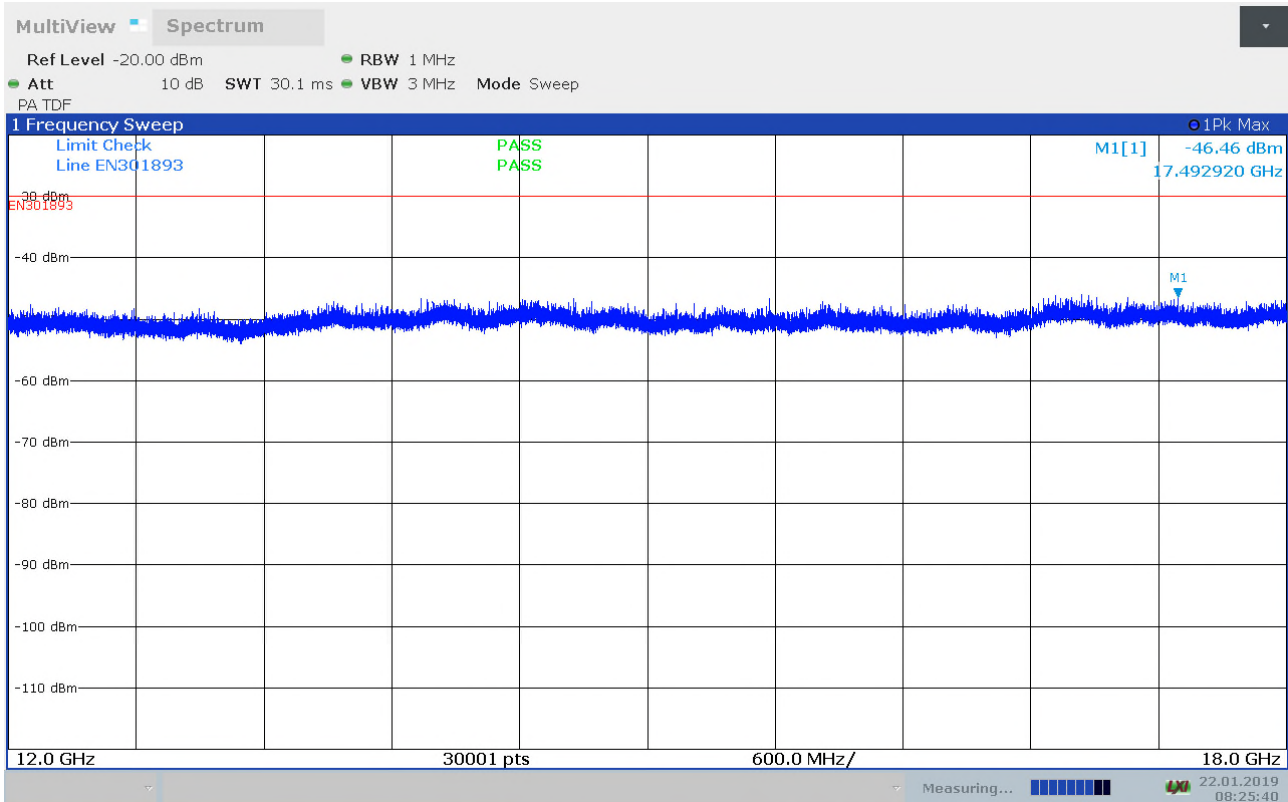
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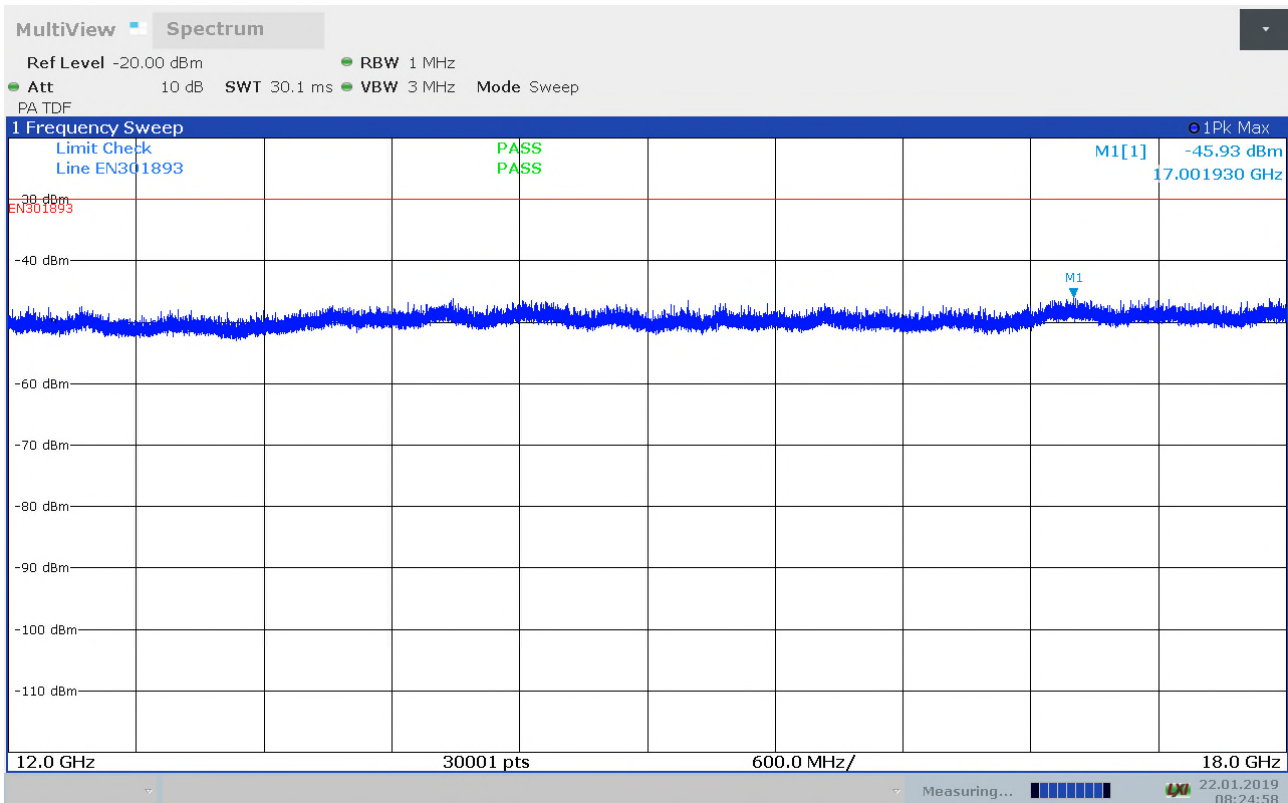
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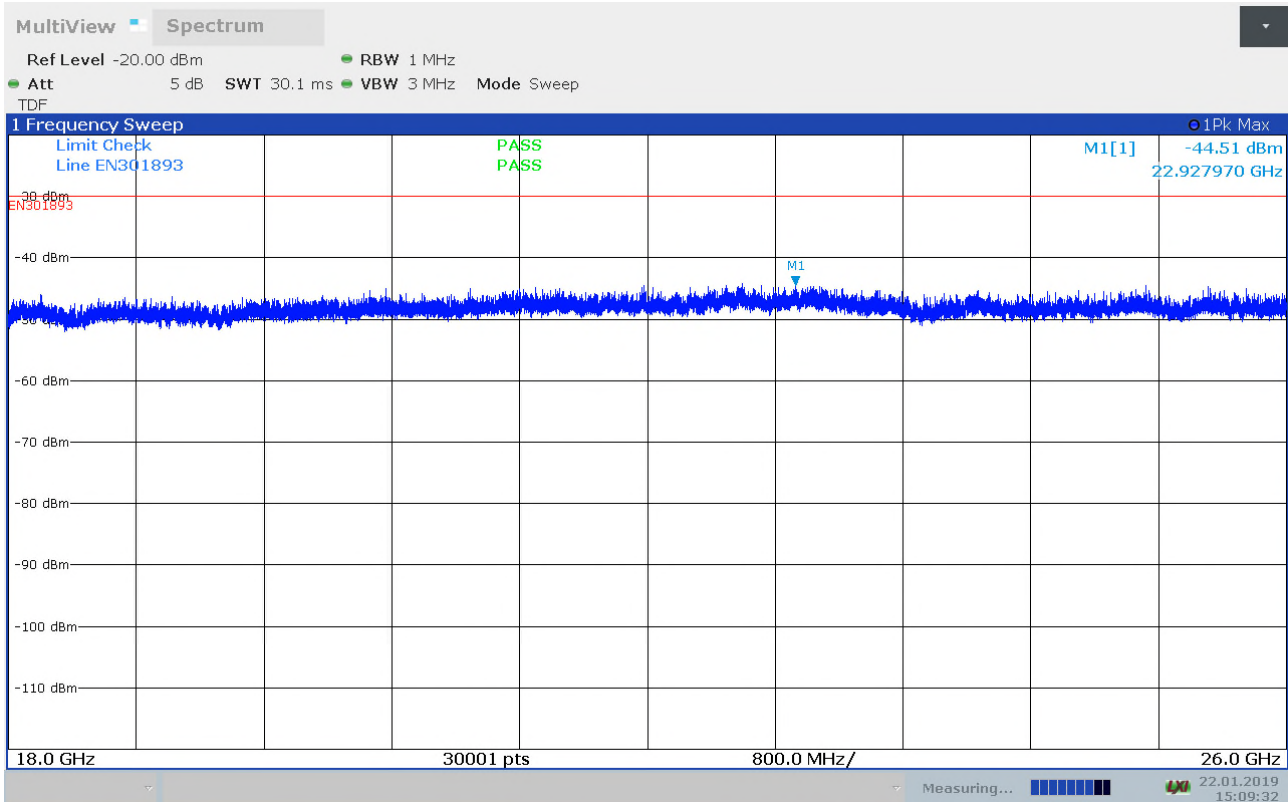
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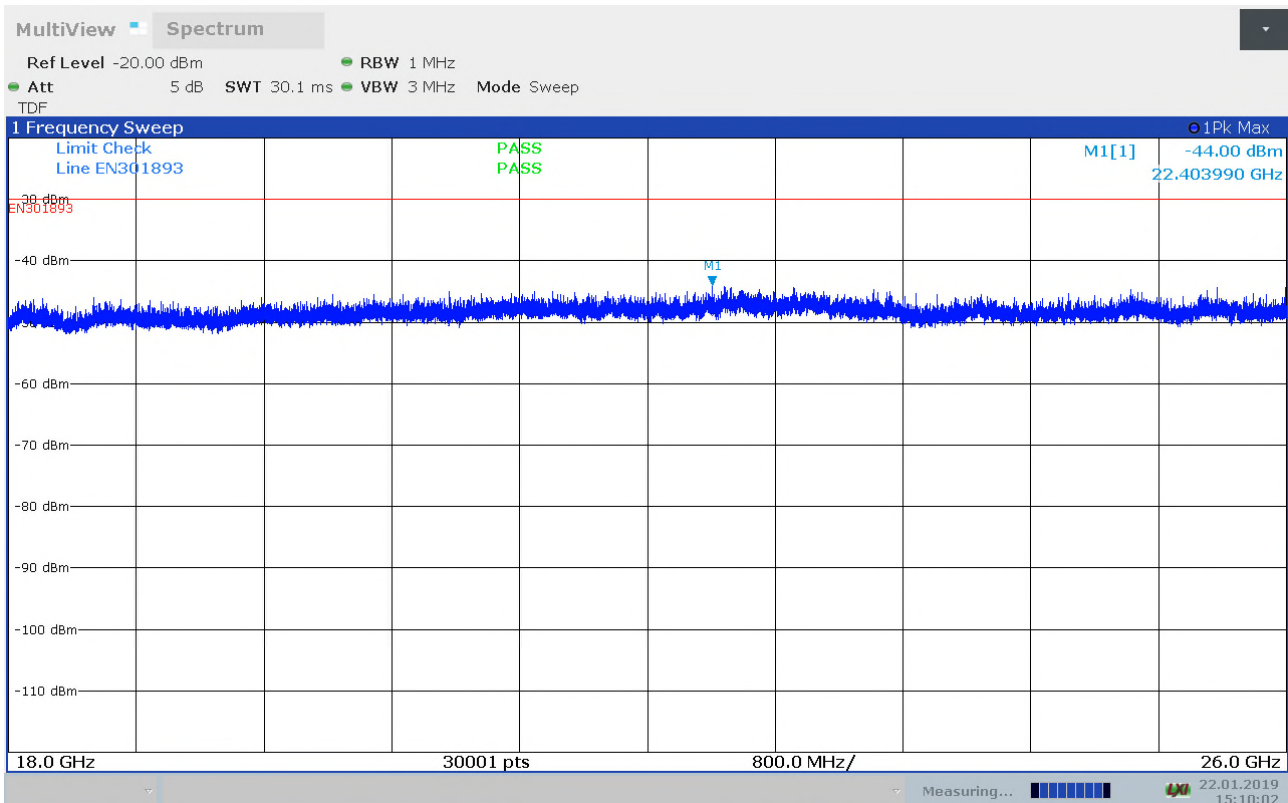
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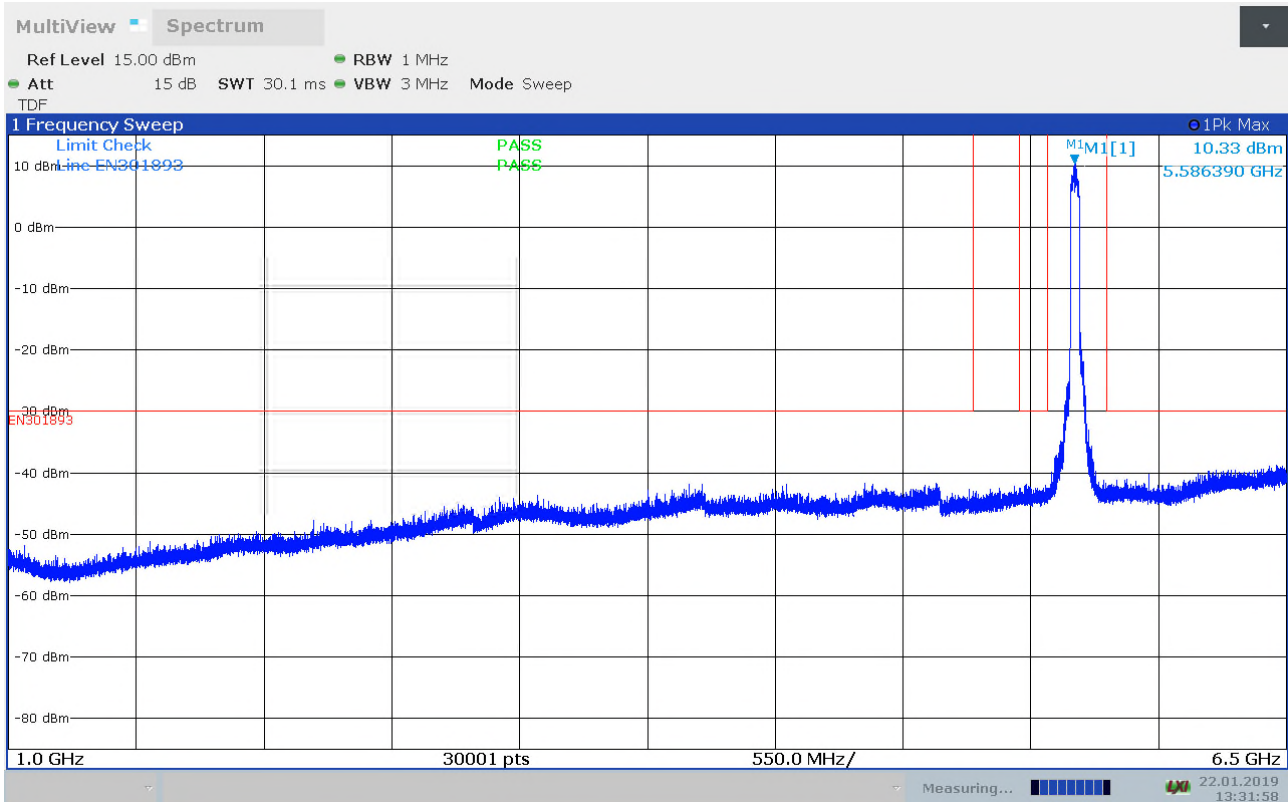
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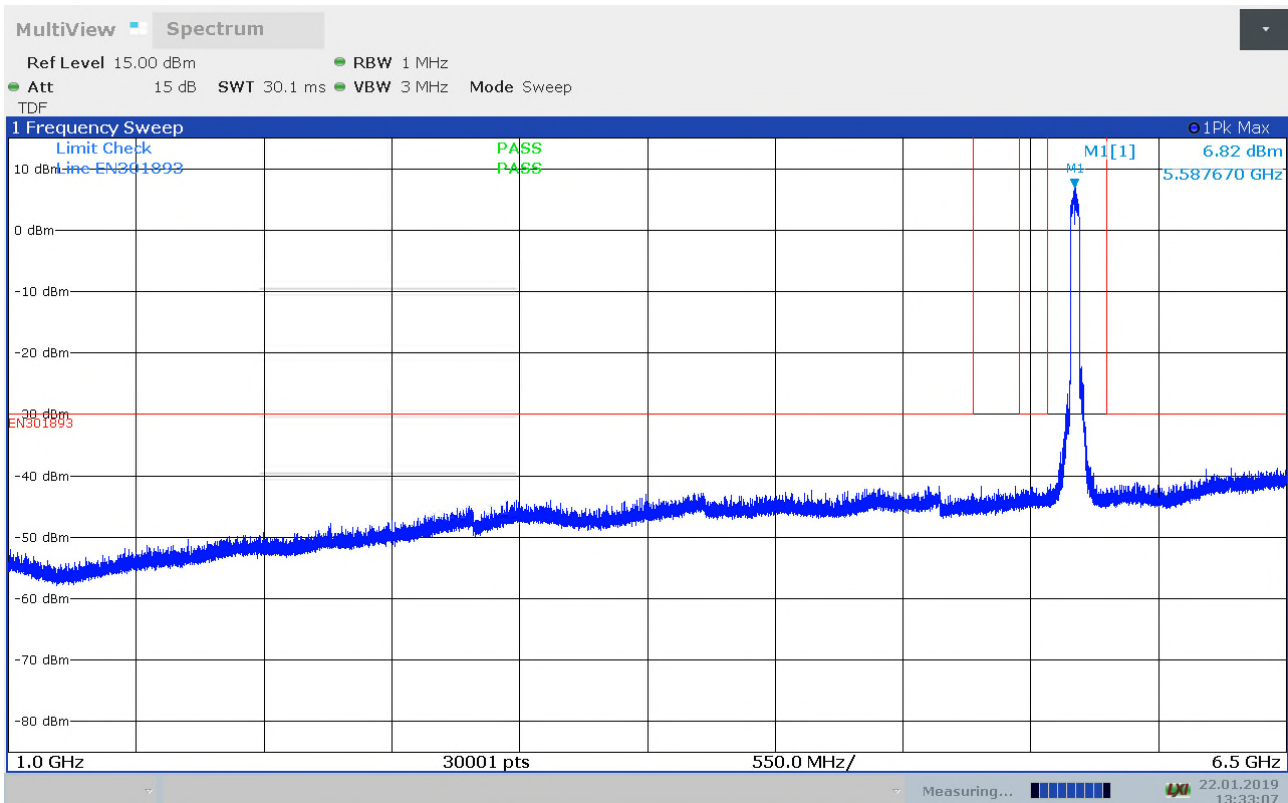
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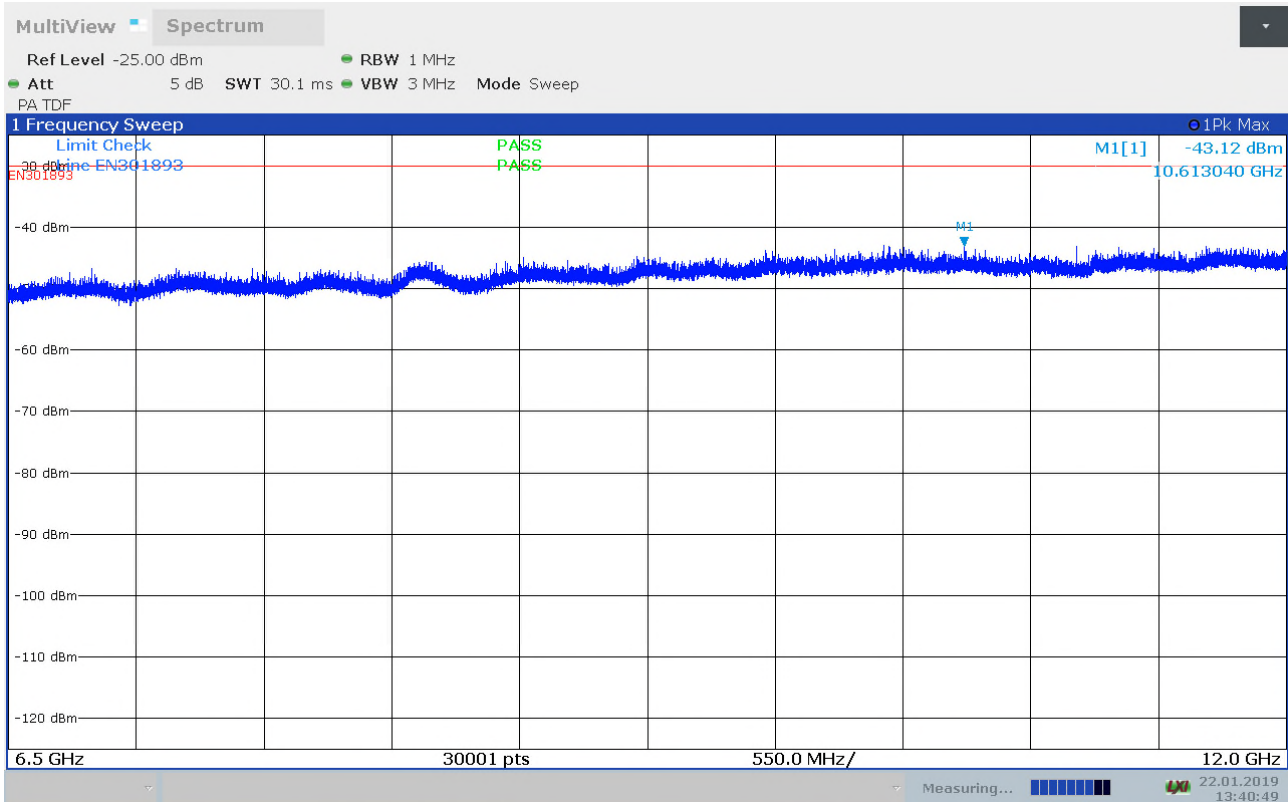
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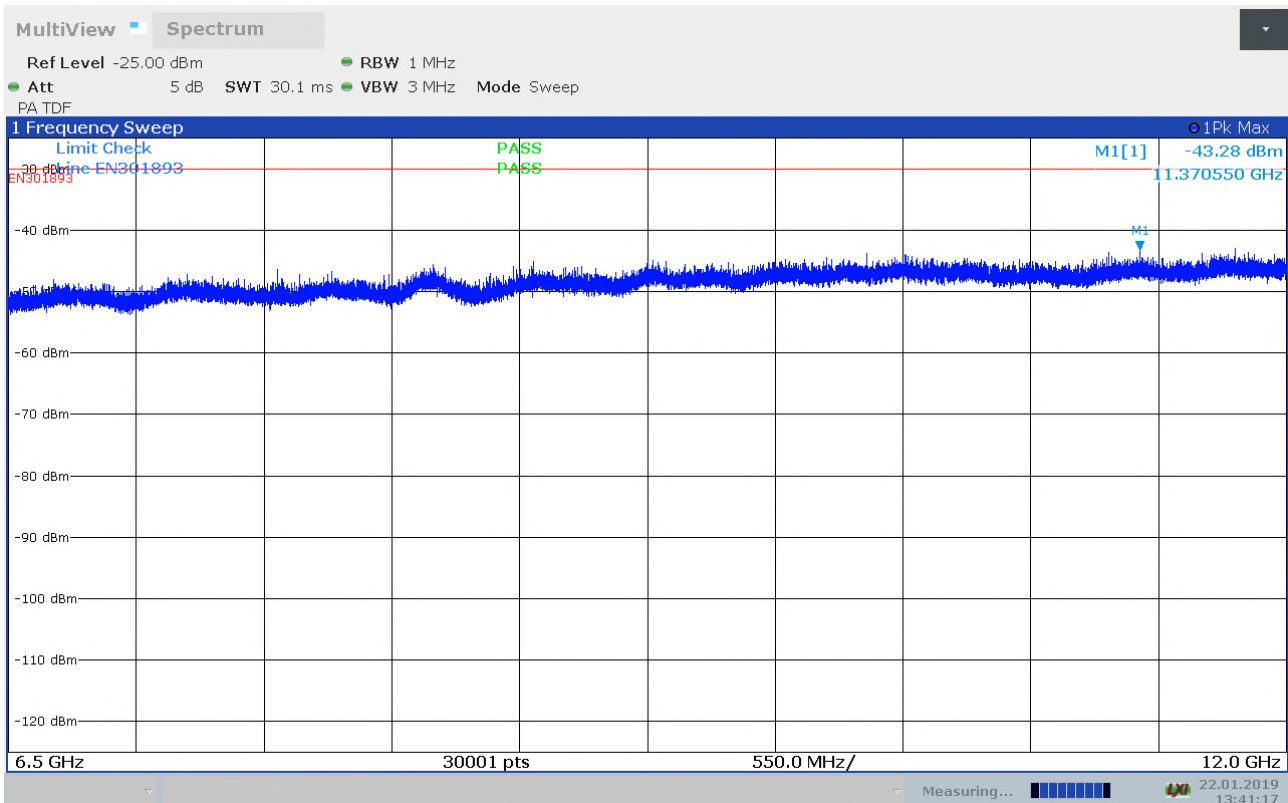
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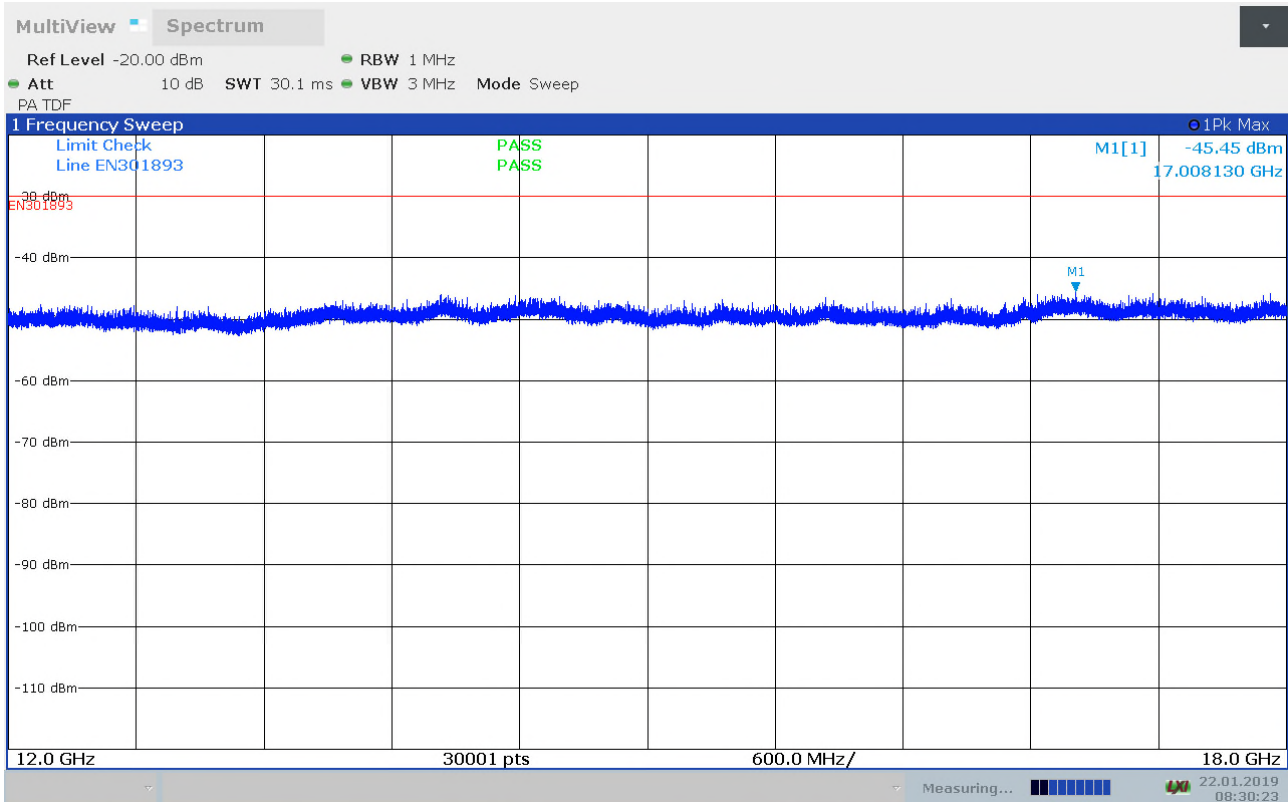
Radiated Spurious Emissions, 1 - 6.5GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, TX



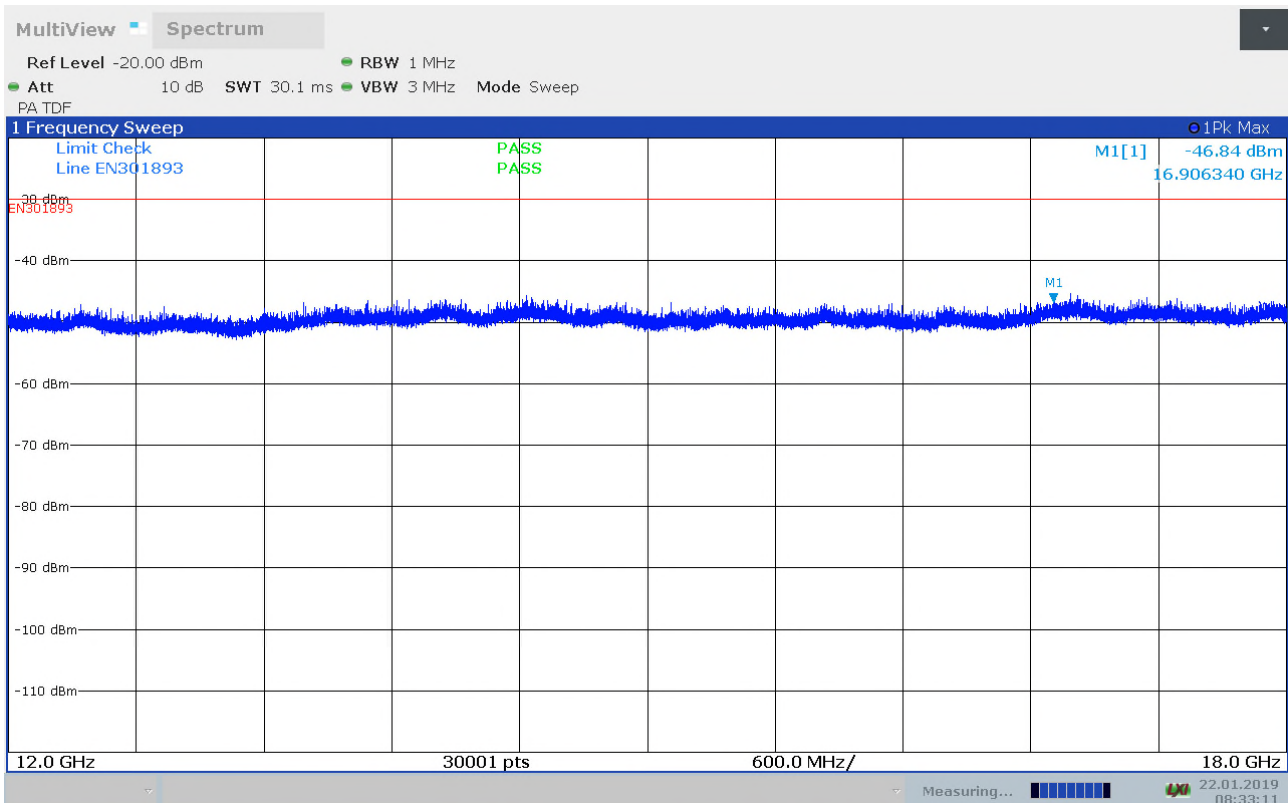
Radiated Spurious Emissions, 6.5 – 12GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, TX



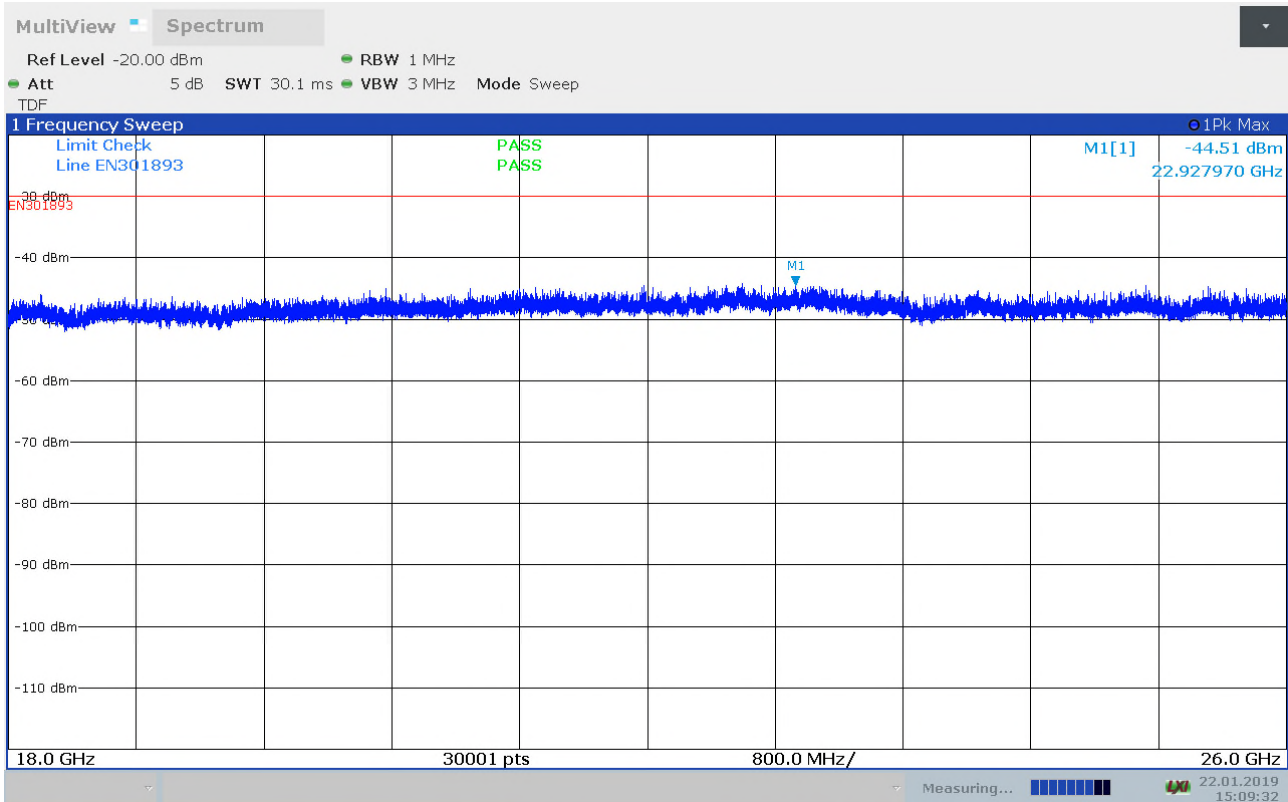
Radiated Spurious Emissions, 6.5 – 12GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, TX



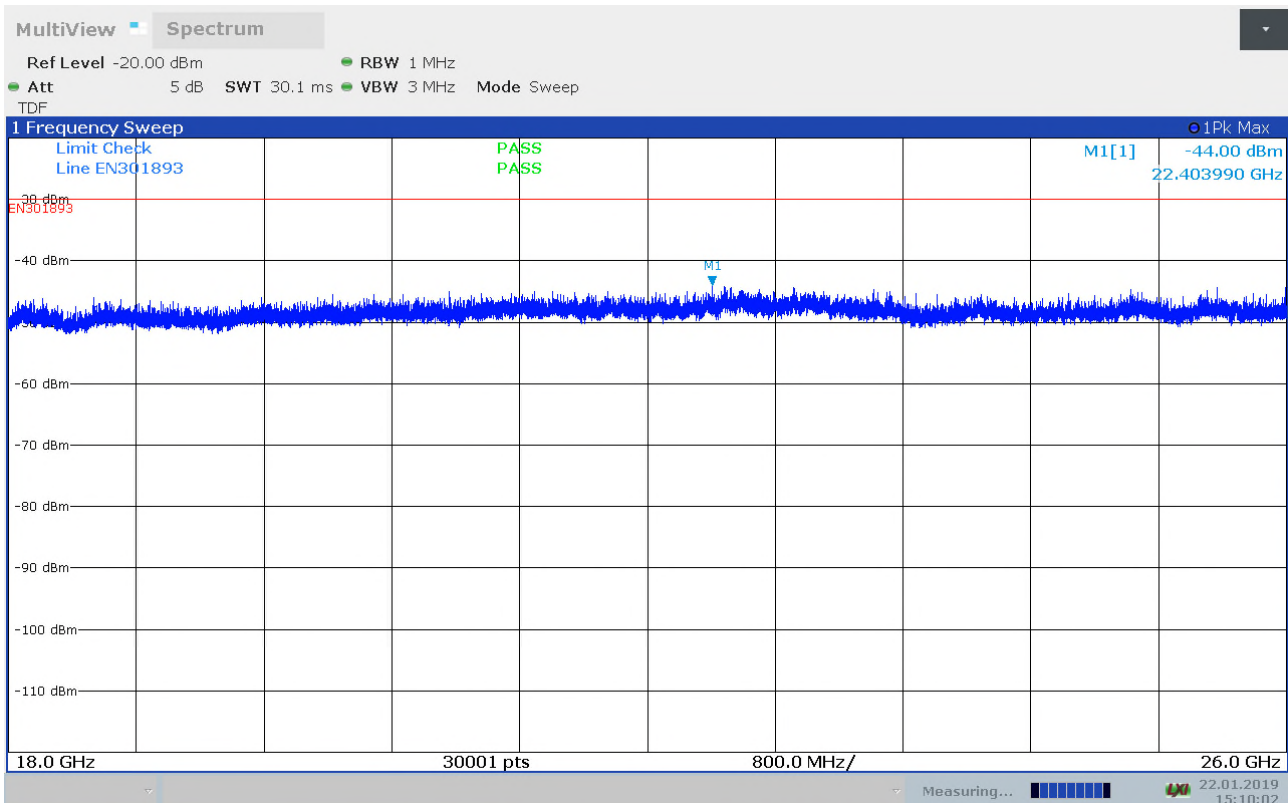
Radiated Spurious Emissions, 12 - 18GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, TX



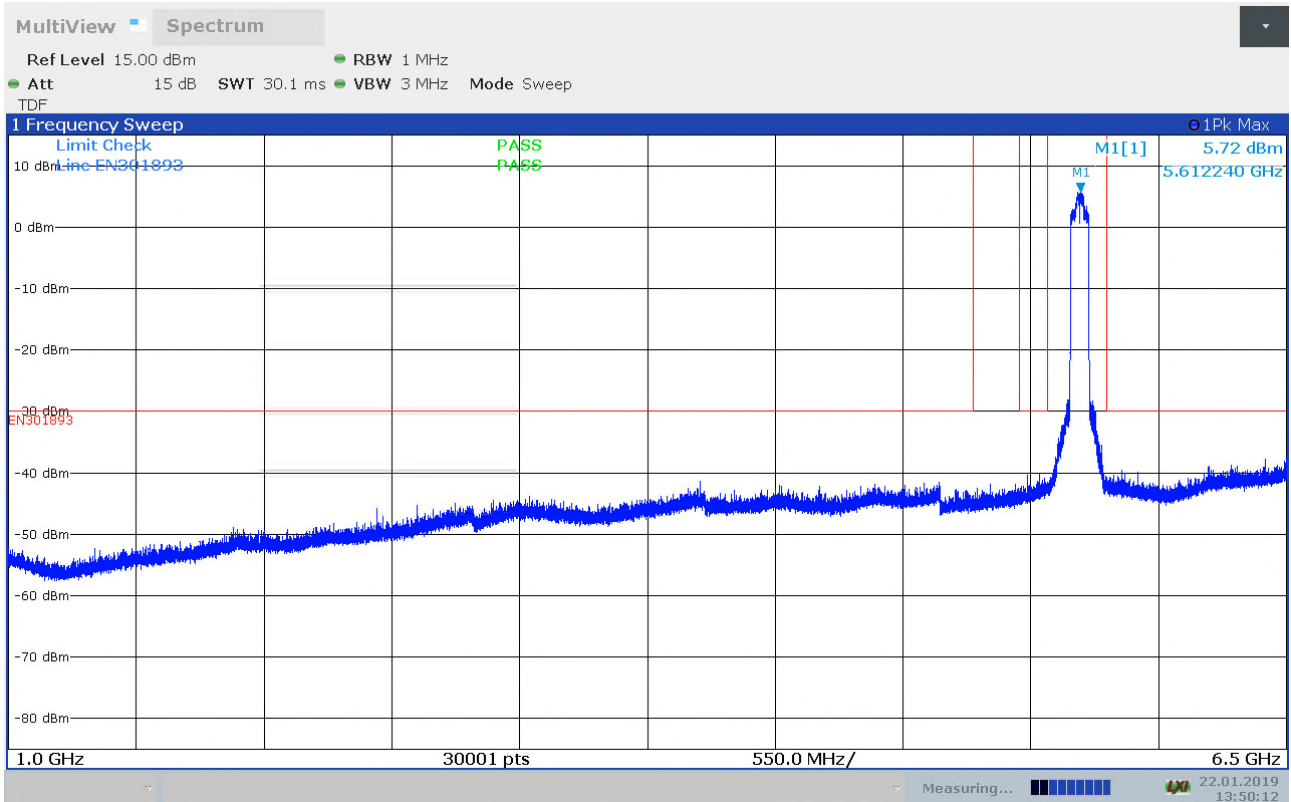
Radiated Spurious Emissions, 12 - 18GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, TX



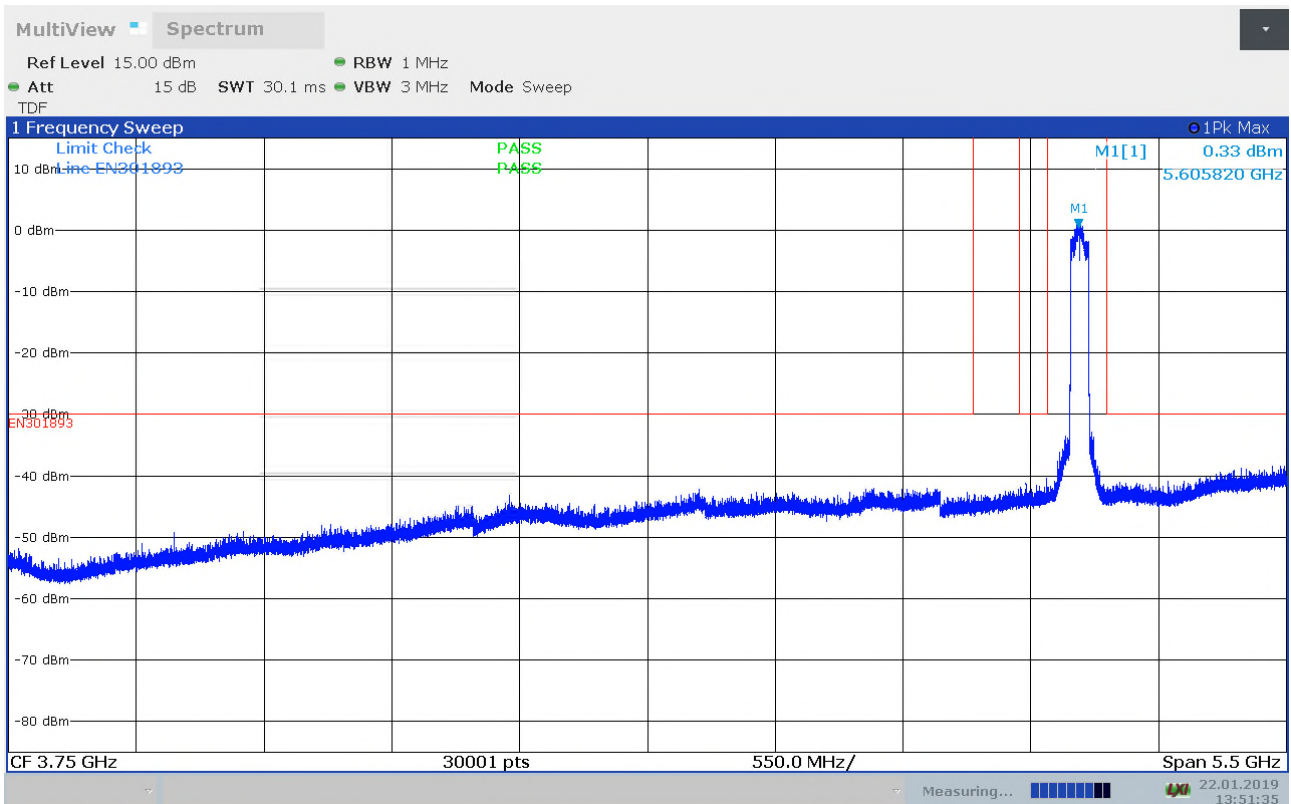
Radiated Spurious Emissions, 18 - 26GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, TX



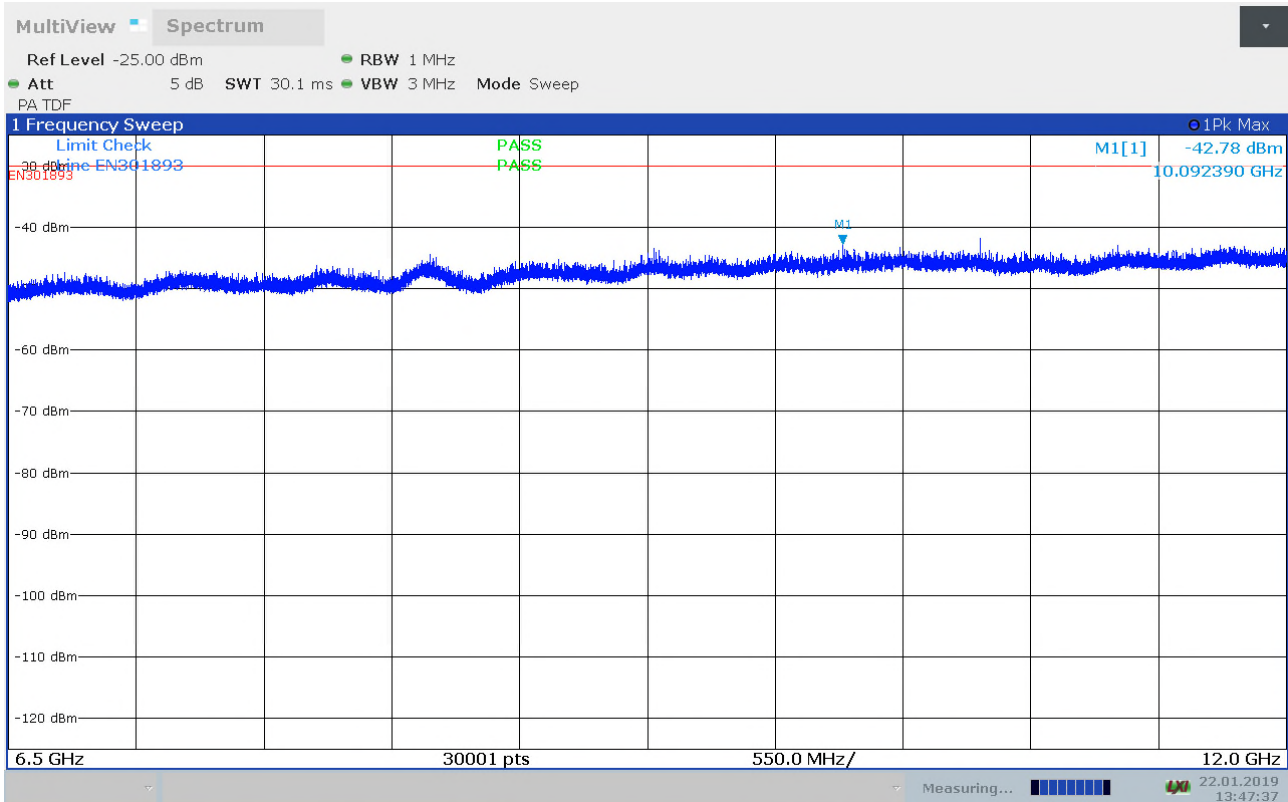
Radiated Spurious Emissions, 18 - 26GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, TX



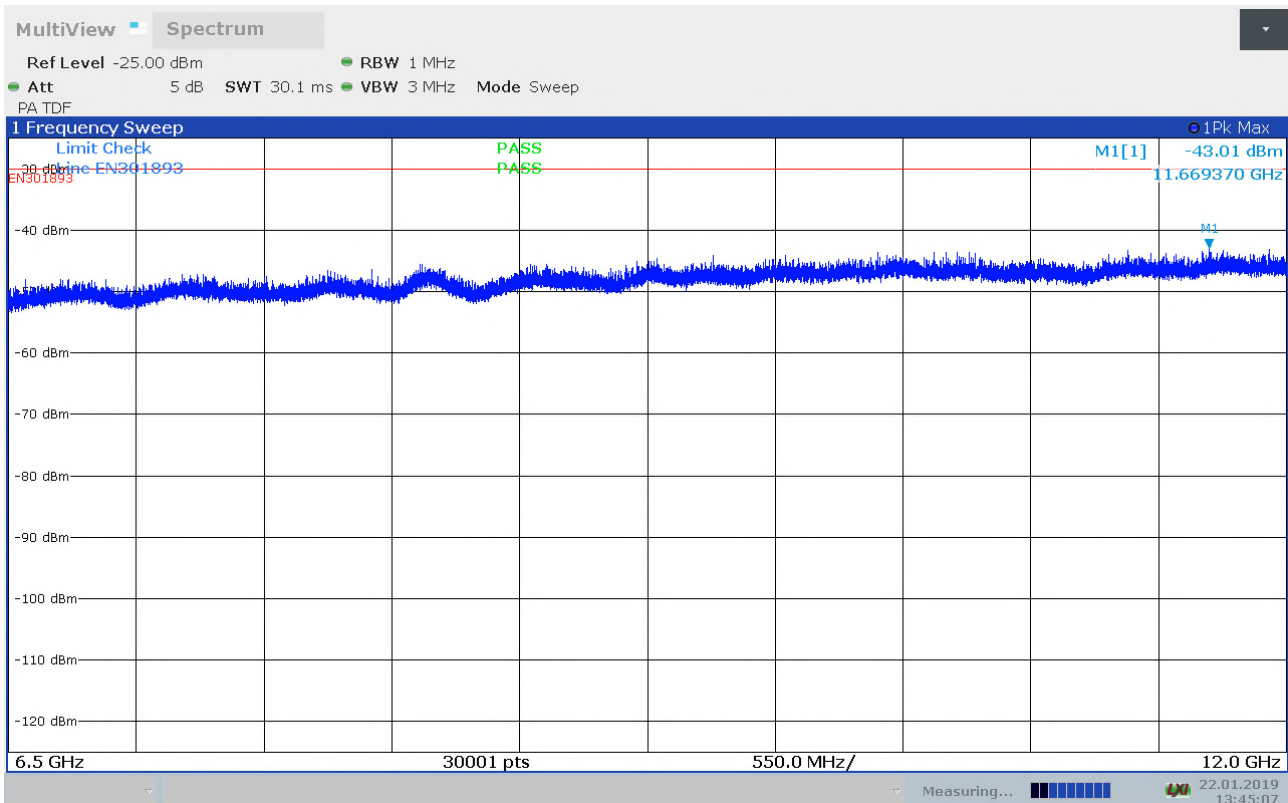
Radiated Spurious Emissions, 1 - 6.5GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, TX



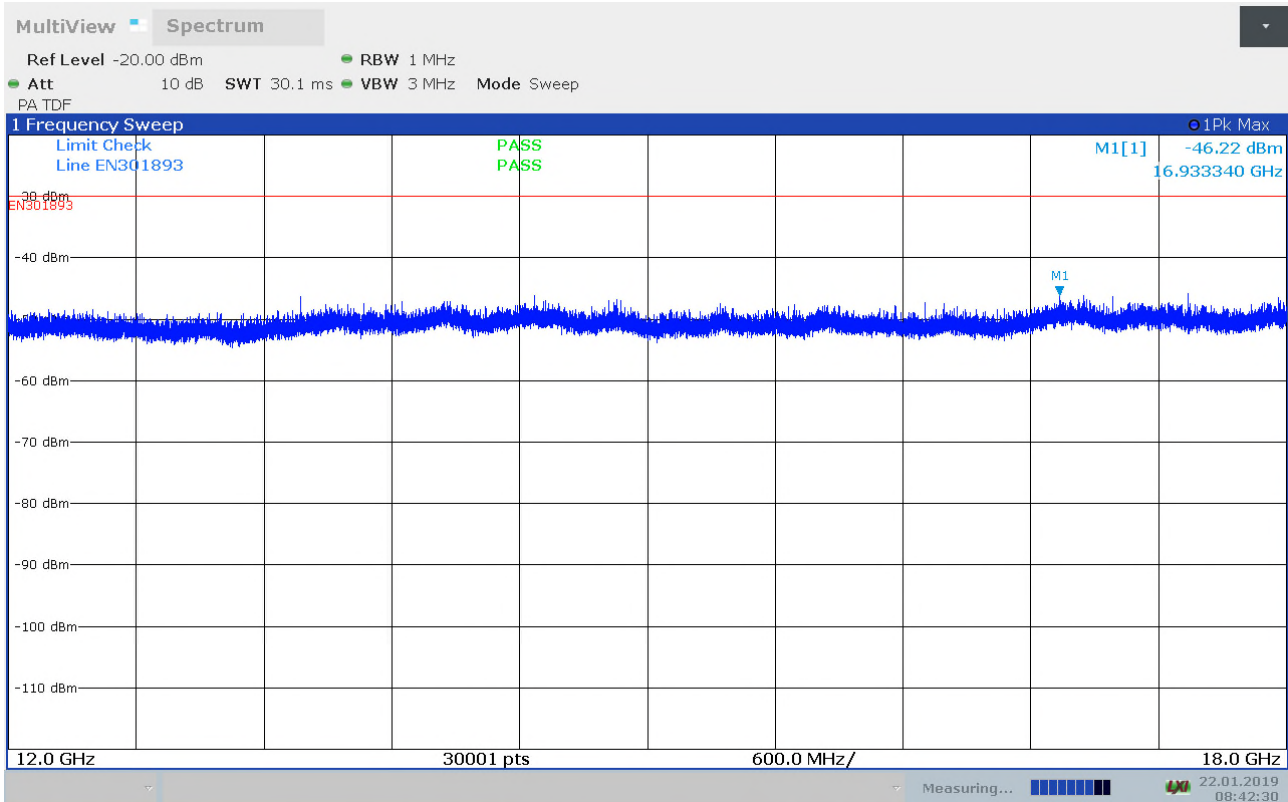
Radiated Spurious Emissions, 1 - 6.5GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, TX



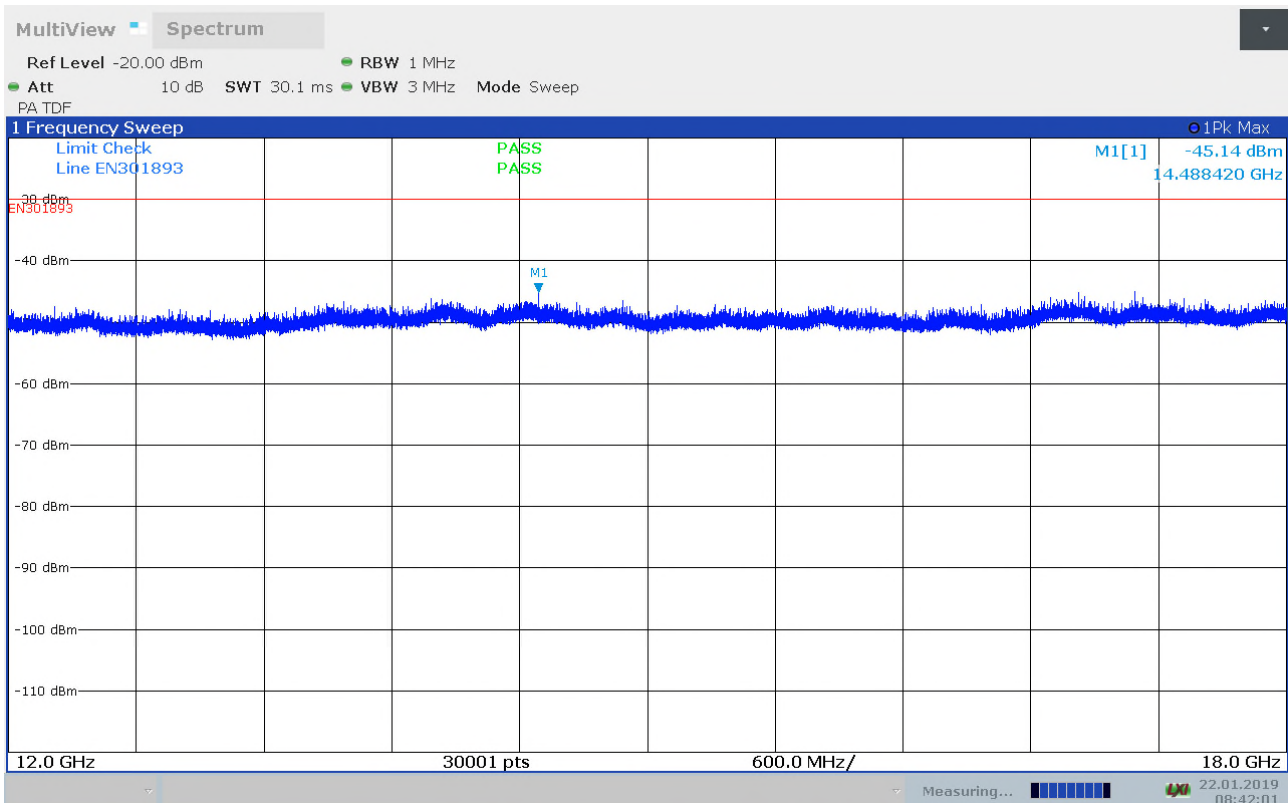
Radiated Spurious Emissions, 6.5 – 12GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, TX



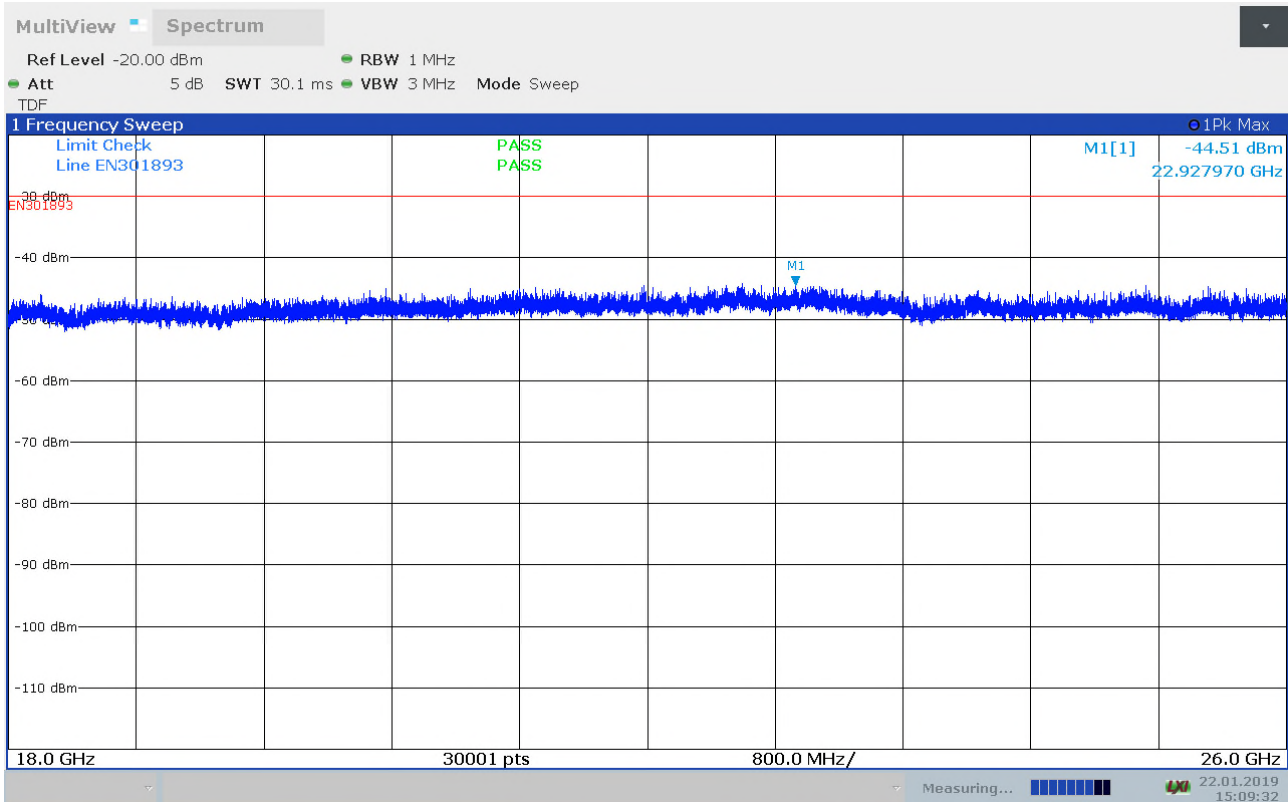
Radiated Spurious Emissions, 6.5 – 12GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, TX



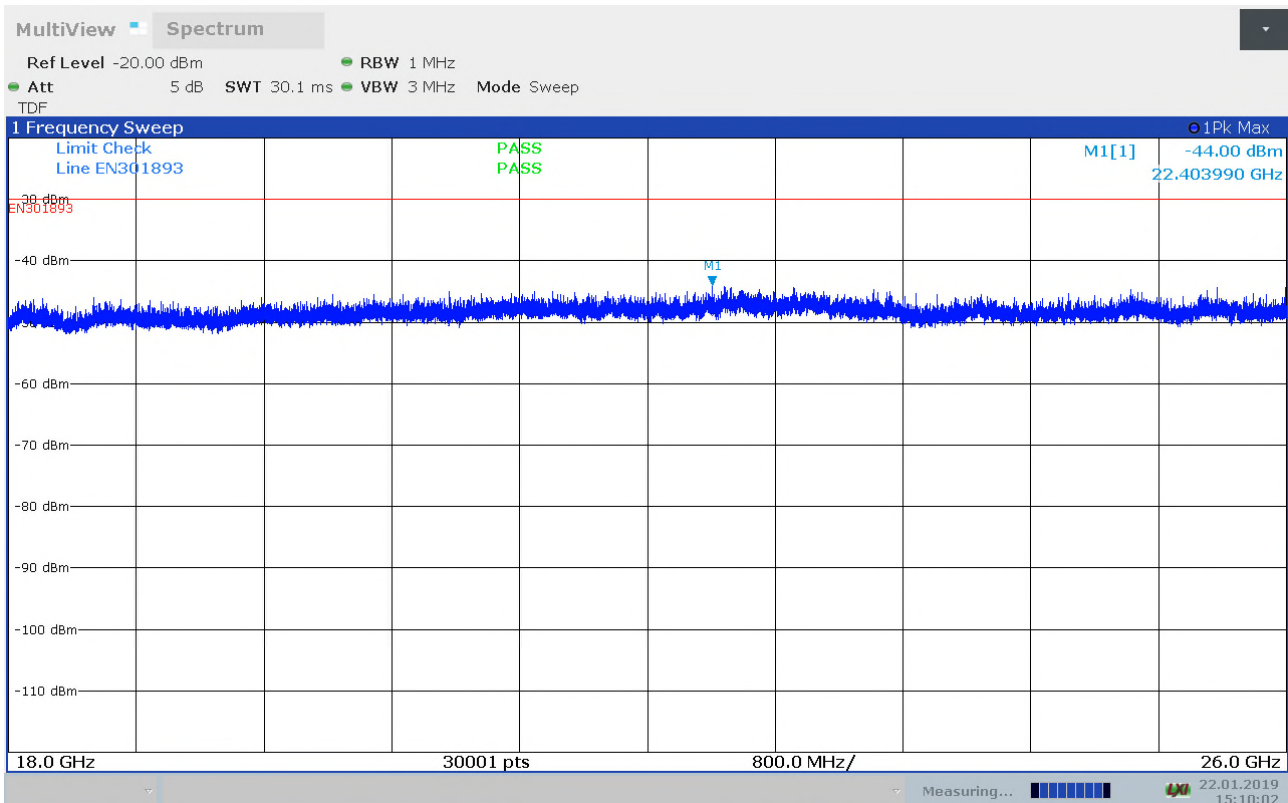
Radiated Spurious Emissions, 12 - 18GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, TX



Radiated Spurious Emissions, 12 - 18GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, TX



Radiated Spurious Emissions, 18 - 26GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, TX



Radiated Spurious Emissions, 18 - 26GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, TX

5.4 Receiver spurious emissions – Radiated

ETSI EN 301 893 subclause 4.2.5

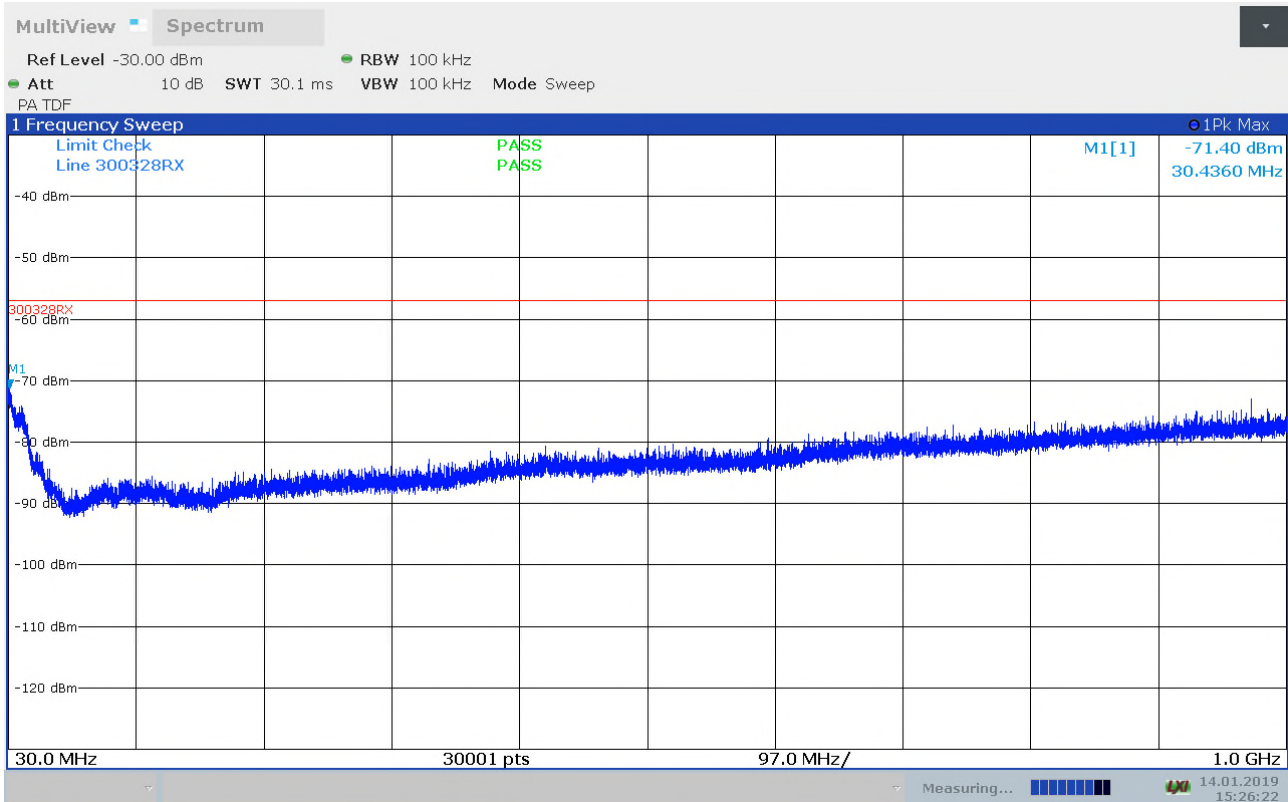
Frequency (MHz)	Polarization	Spurious Emission Level (dBm)
Ch36/5180MHz/amcs0_20MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Ch42/5210MHz/amcs0_80MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Ch46/5230MHz/amcs0_40MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Ch100/5500MHz/amcs0_20MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Ch118/5590MHz/amcs0_40MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Ch122/5610MHz/amcs0_80MHz		
30 - 1000	VP/HP	< -57
1000 - 26 000	VP/HP	< -47
Measurement Uncertainty	25 MHz – 1 GHz - +1,9/-2,4 dB 1 – 8 GHz - +1,8/-2,1 dB 8 – 18 GHz - +1,9/-2,4 dB	

The measurement bandwidth was as specified in the standard for all measurements. Peak detector. Above 6GHz only a pre scan and measured with 100kHz RBW , because of large background noise.

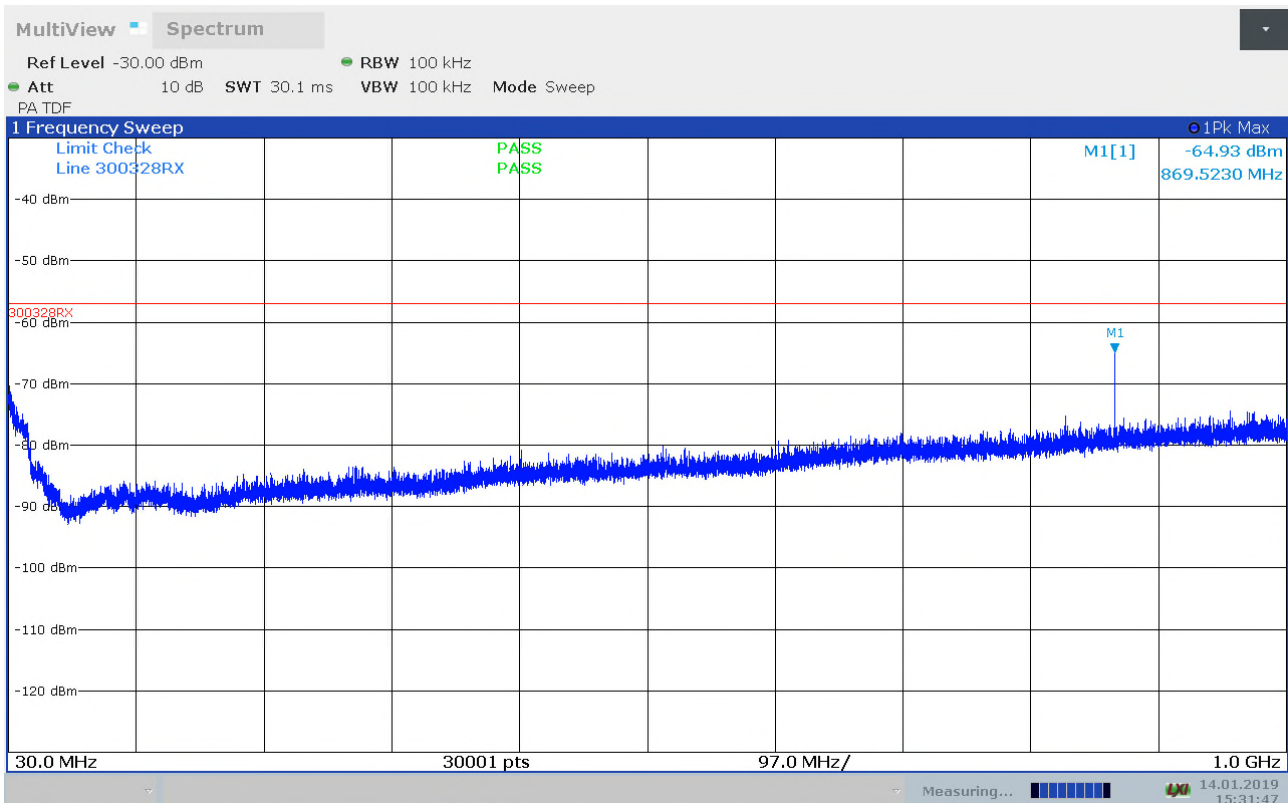
Limits: Clause 4.2.5.2

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 26 GHz	-47 dBm

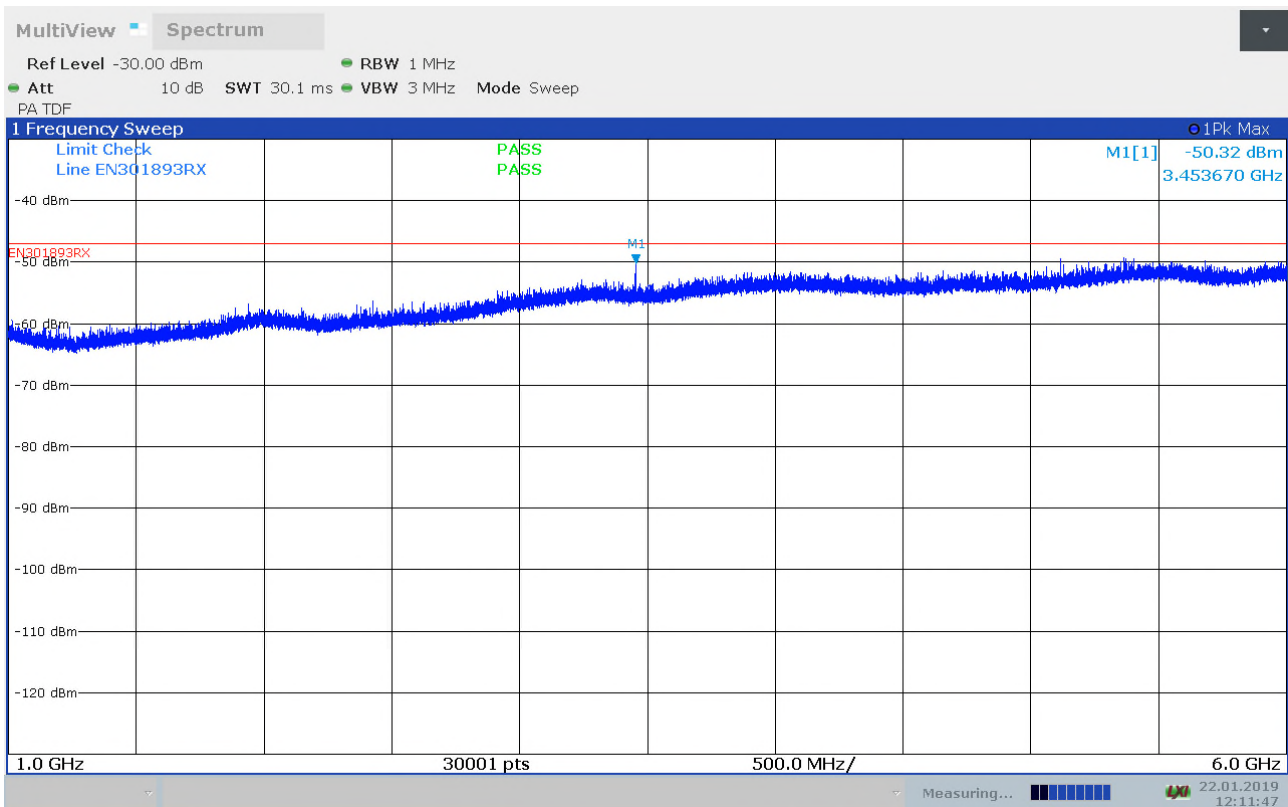
Test Equipment Used: 6,8,9,11,12,14



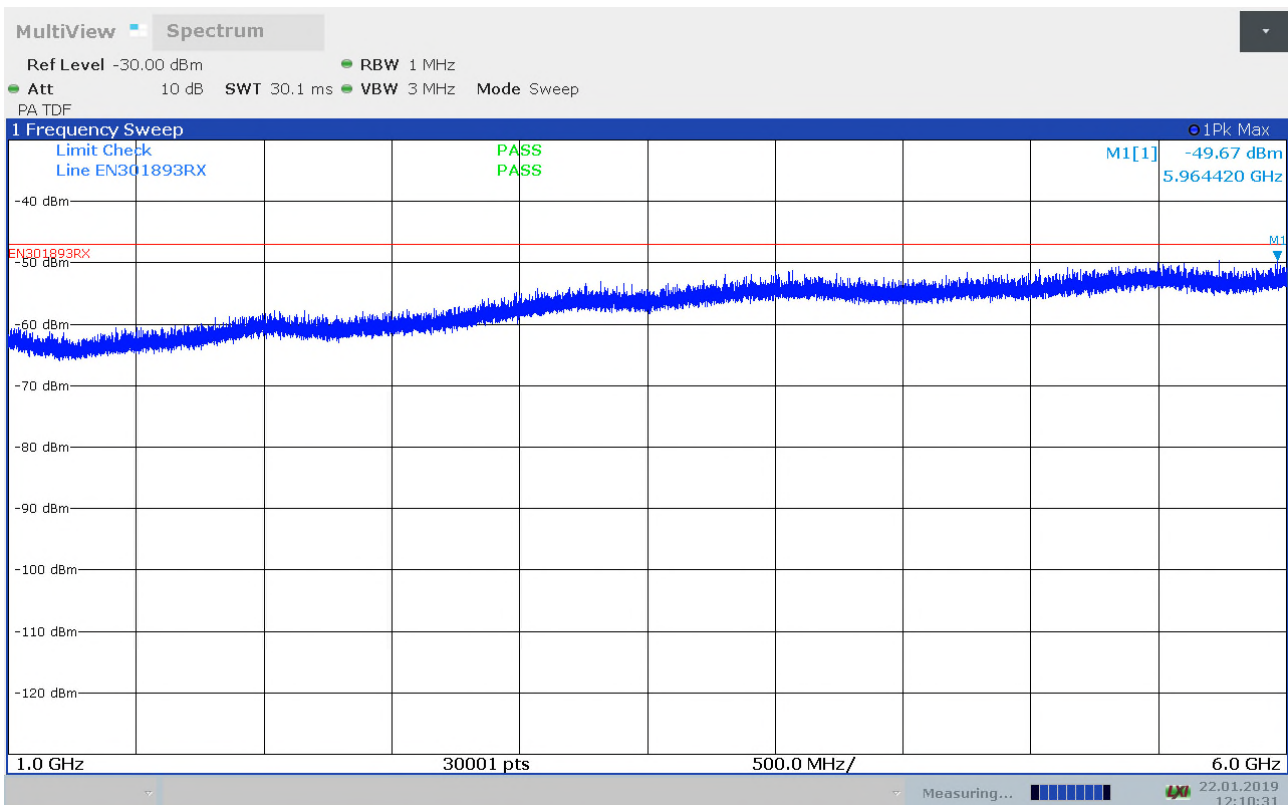
Radiated Spurious Emissions, 30 – 1000 MHz , VP, RX



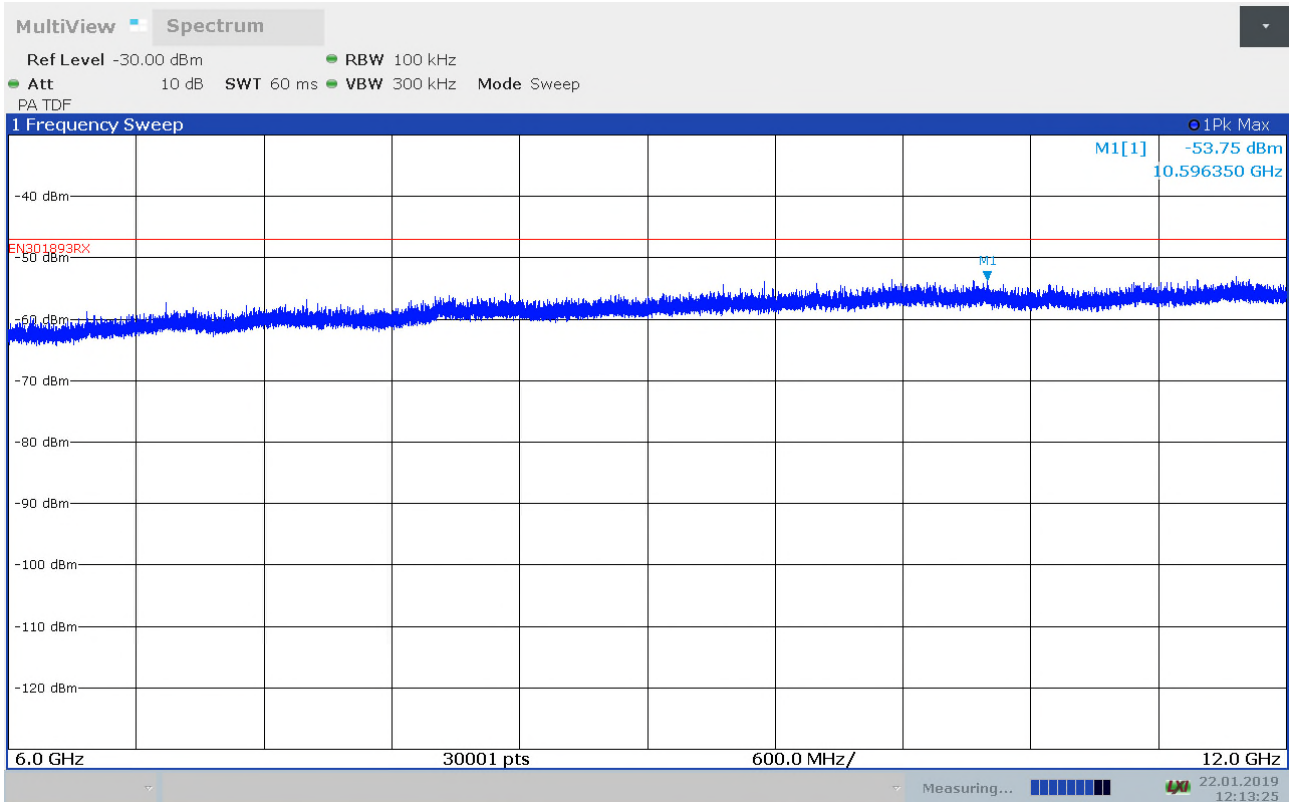
Radiated Spurious Emissions, 30 – 1000 MHz, HP, RX



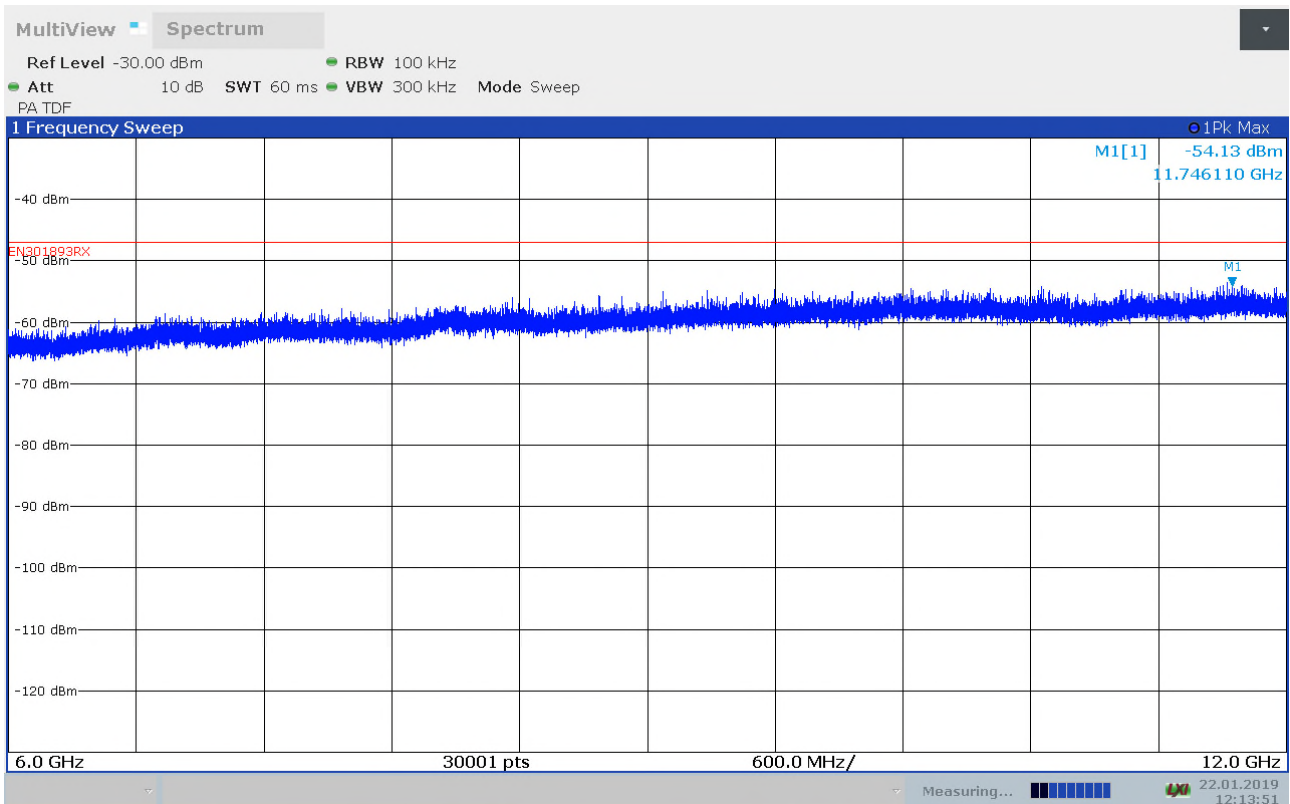
Radiated Spurious Emissions, 1 – 6GHz, ch36, ch5180MHz, amcs0, 20MHz, VP, RX



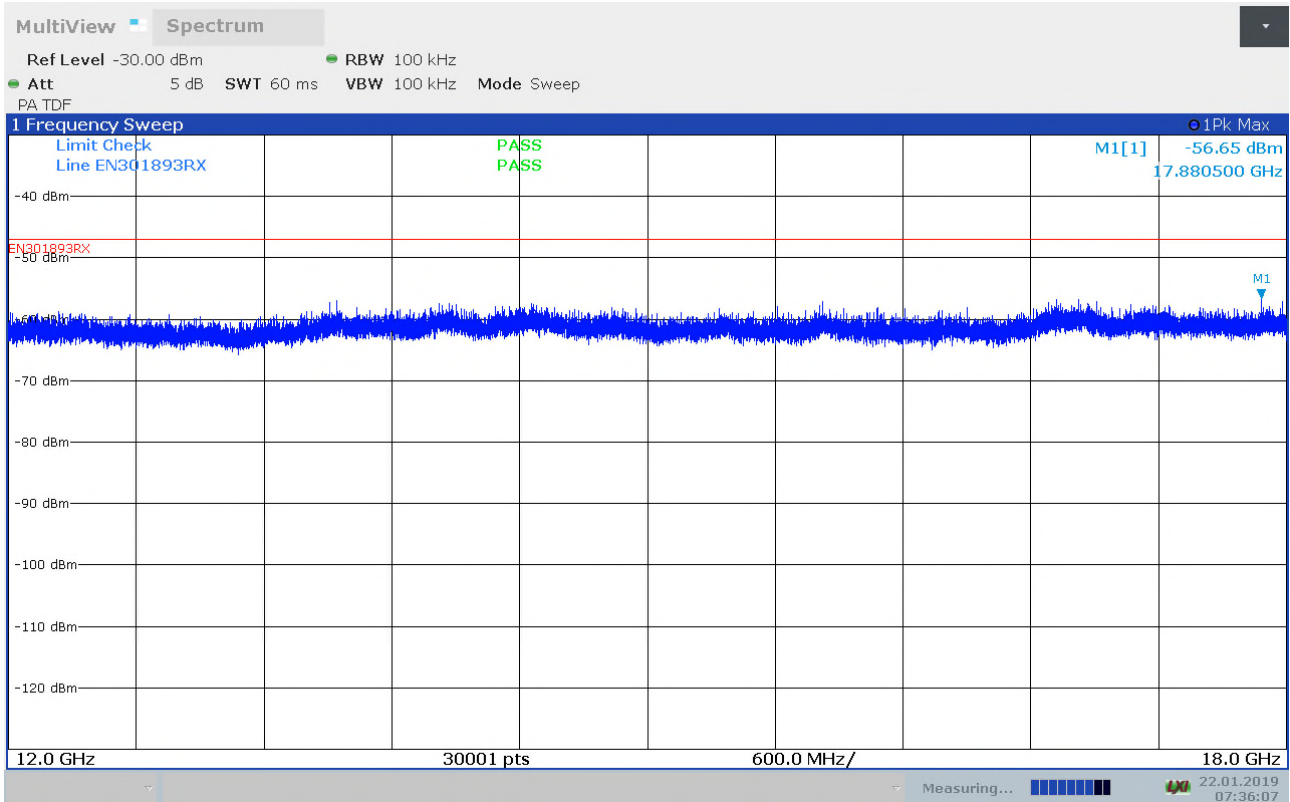
Radiated Spurious Emissions, 1 - 6GHz, ch36, ch5180MHz, amcs0, 20MHz, HP, RX



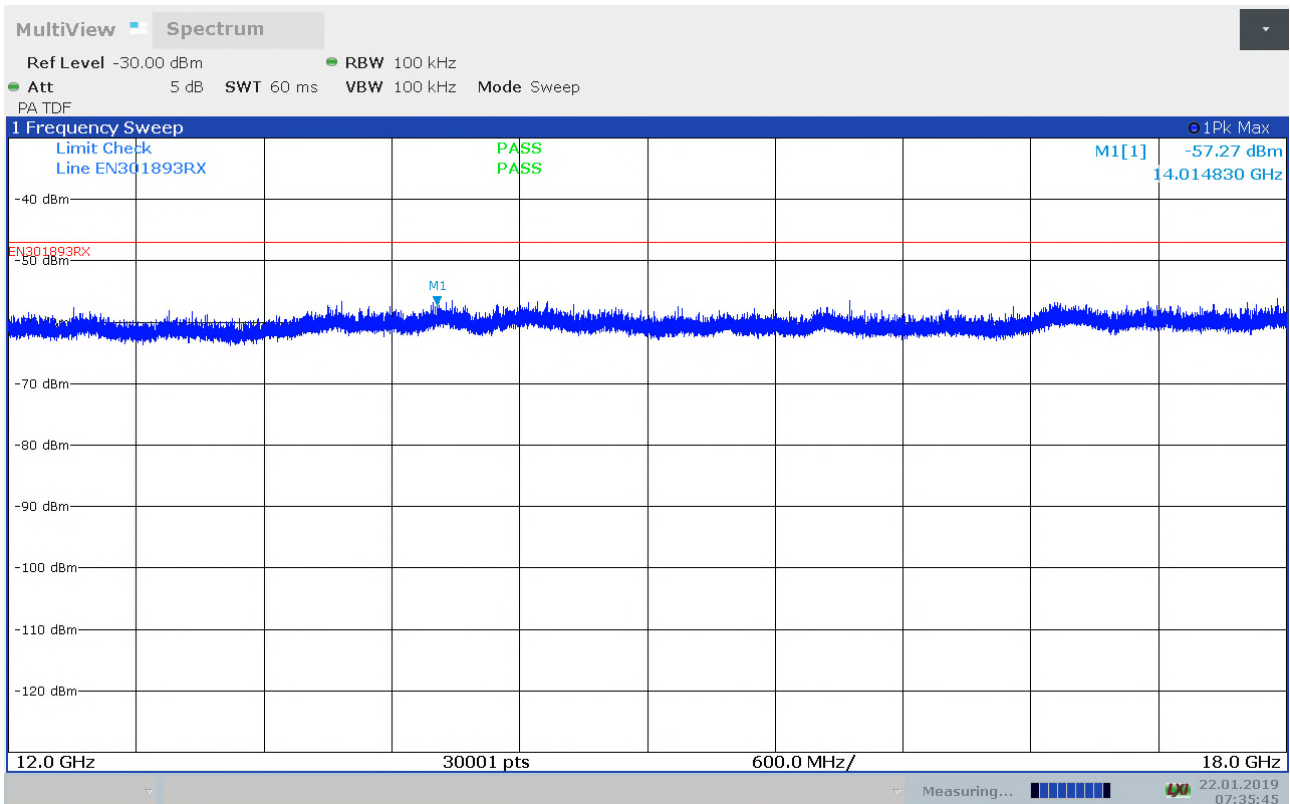
Radiated Spurious Emissions, 6 - 12GHz, ch36, ch5180MHz, amcs0, 20MHz, VP, RX



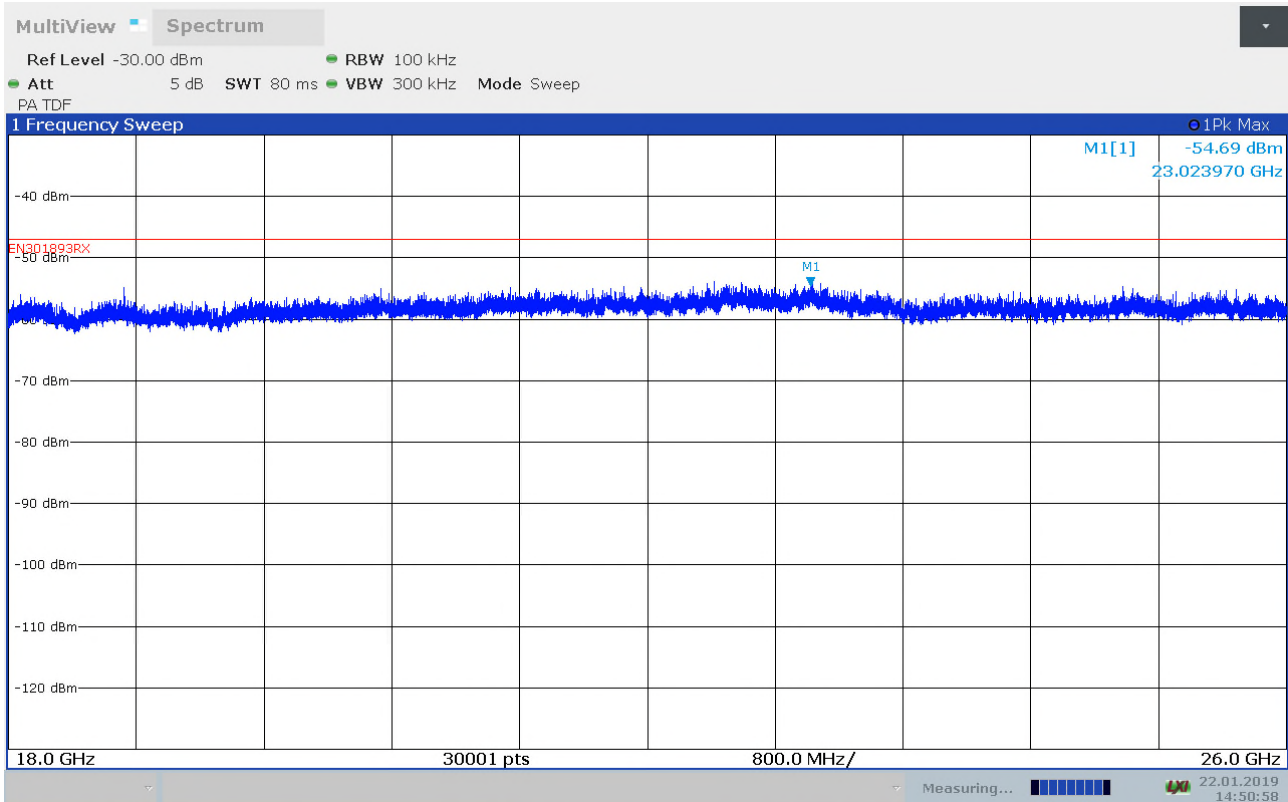
Radiated Spurious Emissions, 6 - 12GHz, ch36, ch5180MHz, amcs0, 20MHz, HP, RX



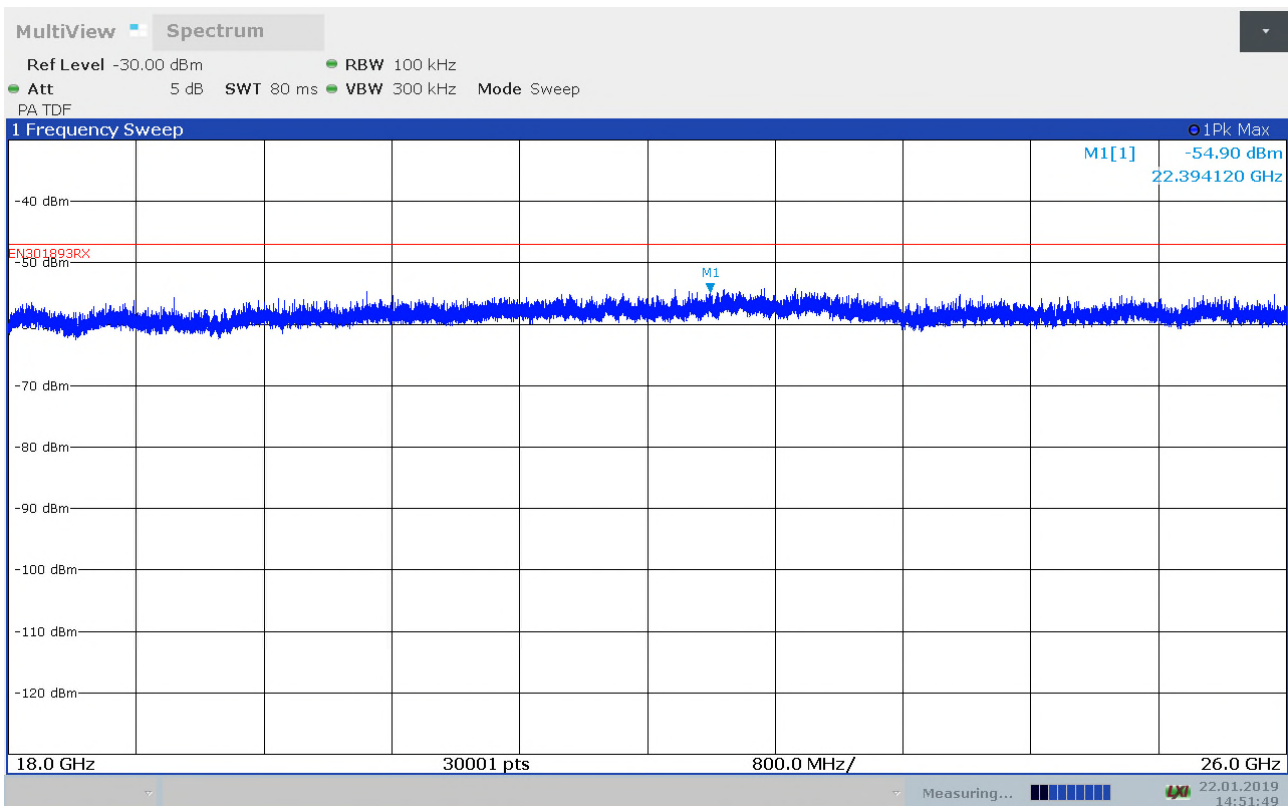
Radiated Spurious Emissions, 12 - 18GHz, ch36, ch5230MHz, amcs0, 20MHz, VP, RX



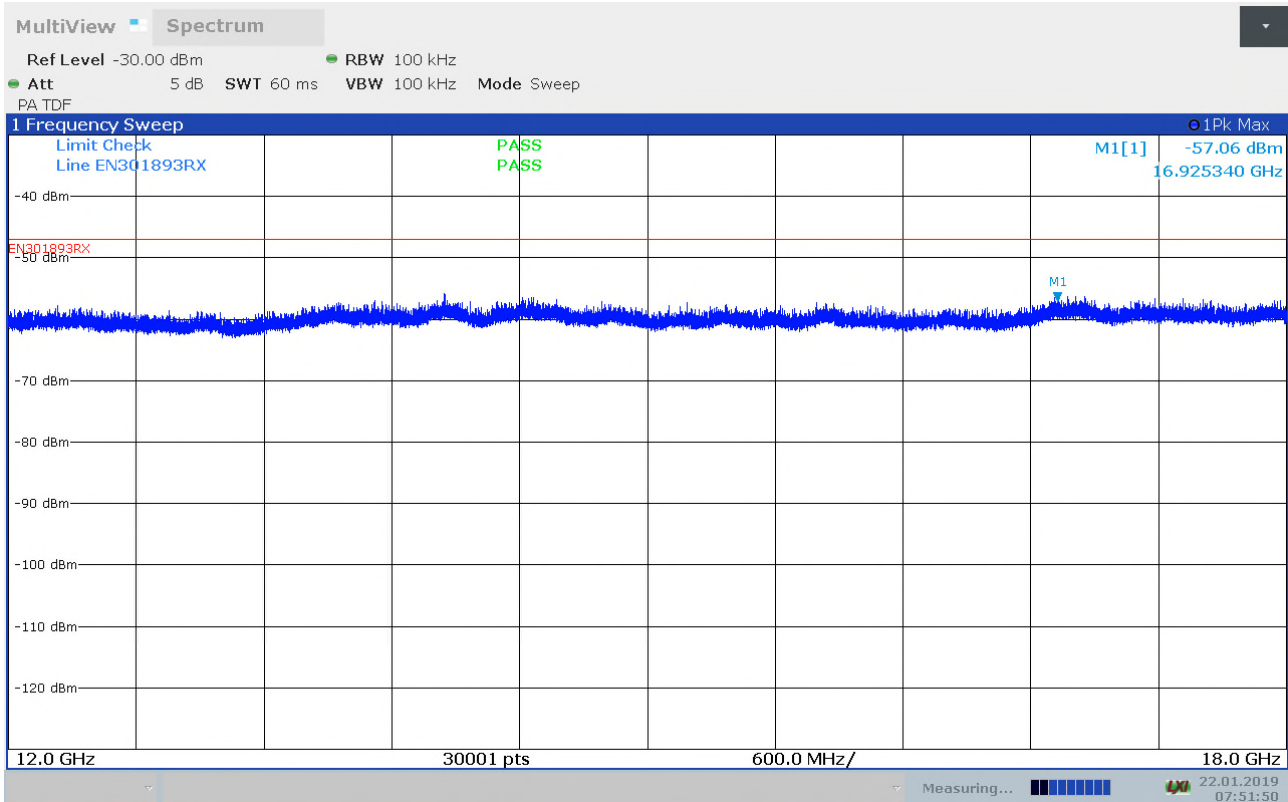
Radiated Spurious Emissions, 12 - 18GHz, ch36, ch5230MHz, amcs0, 20MHz, HP, RX



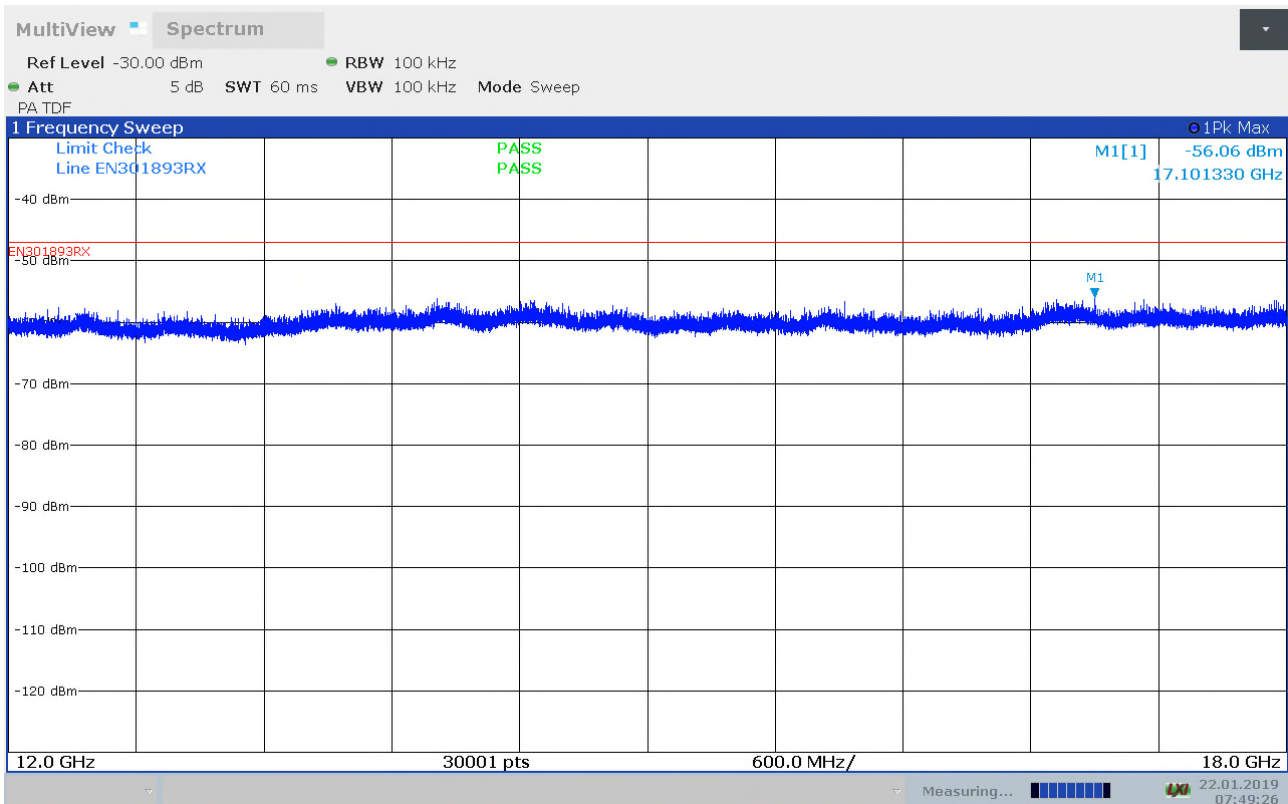
Radiated Spurious Emissions, 18 - 26GHz, ch36, ch5230MHz, amcs0, 20MHz, VP, RX



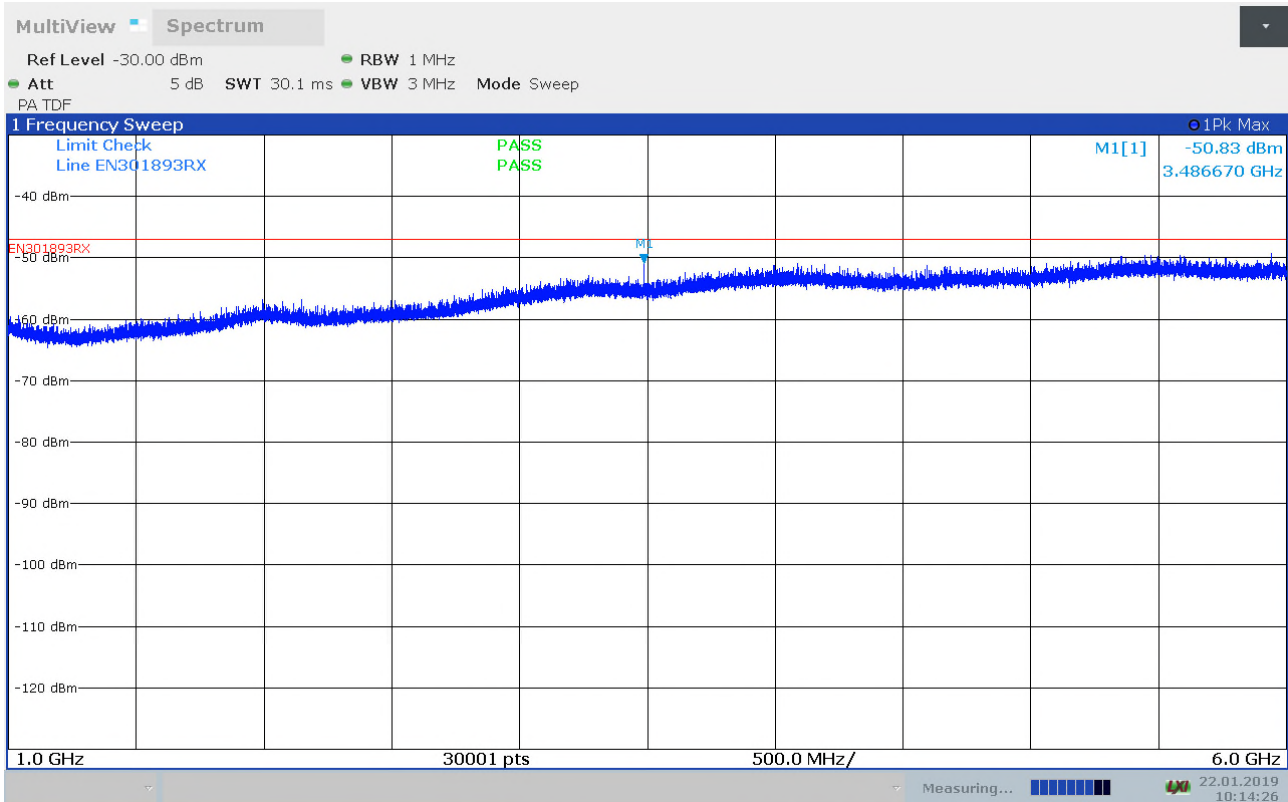
Radiated Spurious Emissions, 18 - 26GHz, ch36, ch5230MHz, amcs0, 20MHz, HP, RX



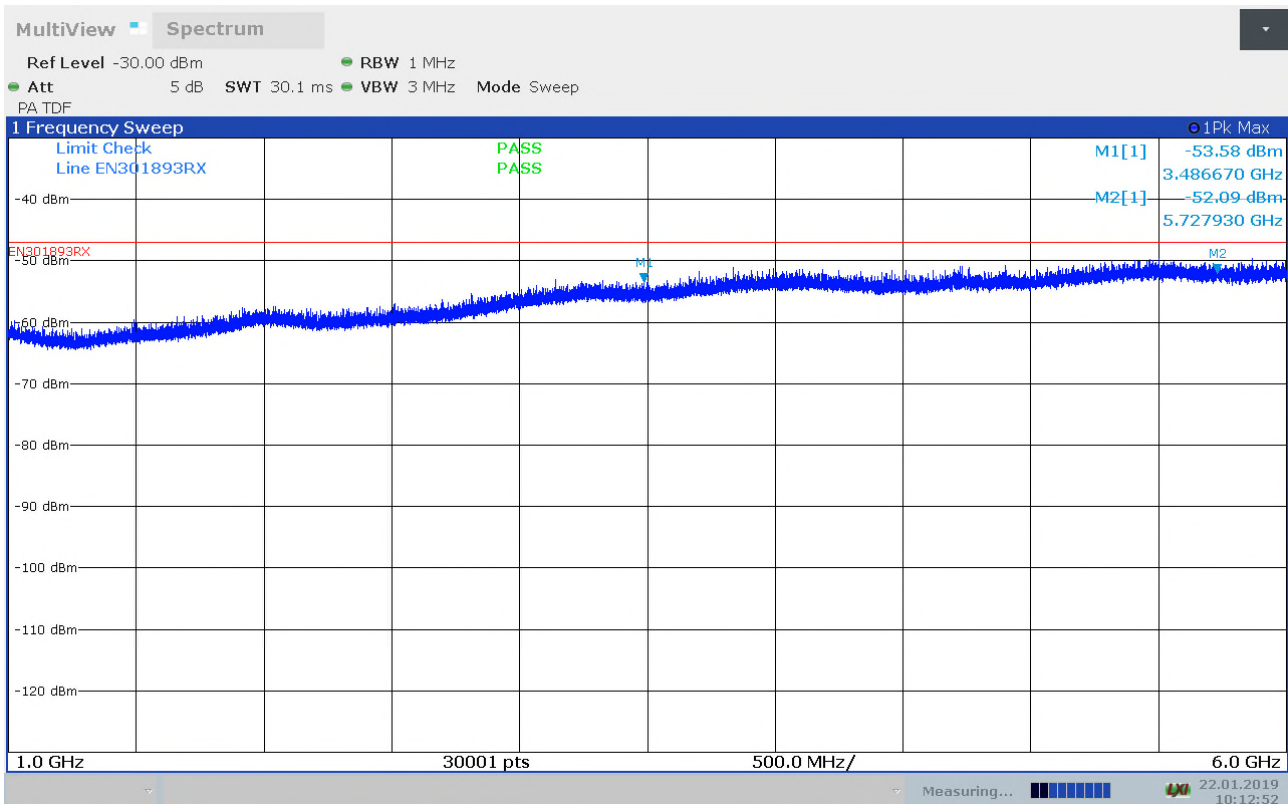
Radiated Spurious Emissions, 12 - 18GHz, ch42, ch5210MHz, amcs0, 80MHz, VP, RX



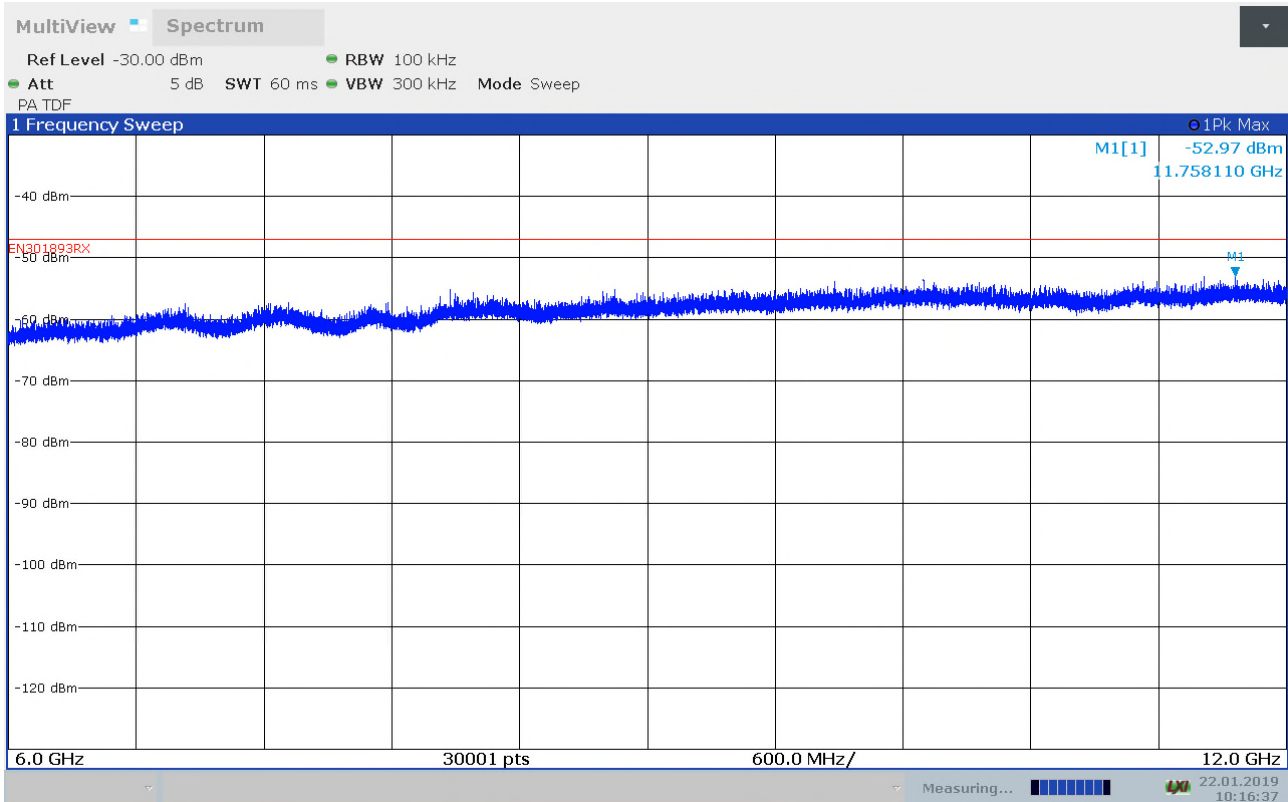
Radiated Spurious Emissions, 12 - 18GHz, ch42, ch5210MHz, amcs0, 80MHz, HP, RX



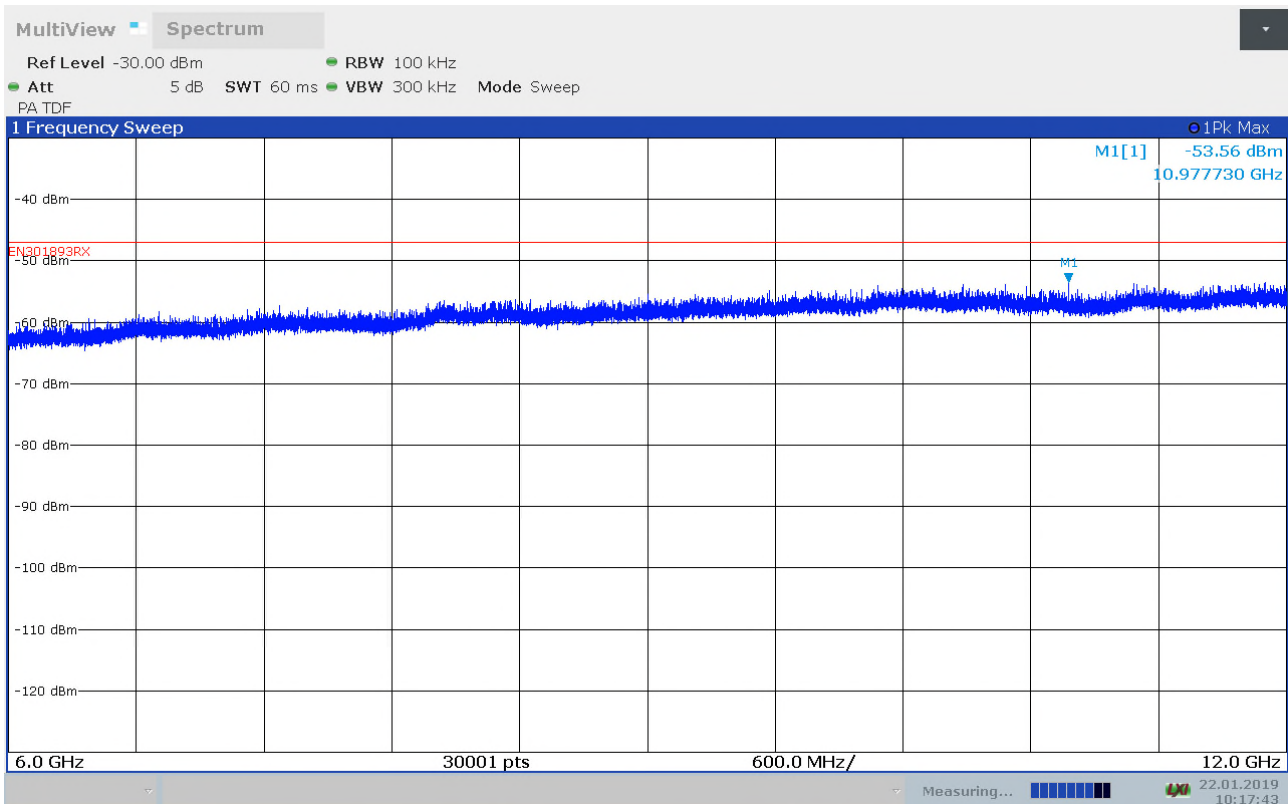
Radiated Spurious Emissions, 1 – 6GHz, ch46, ch5230MHz, amcs0, 40MHz, VP, RX



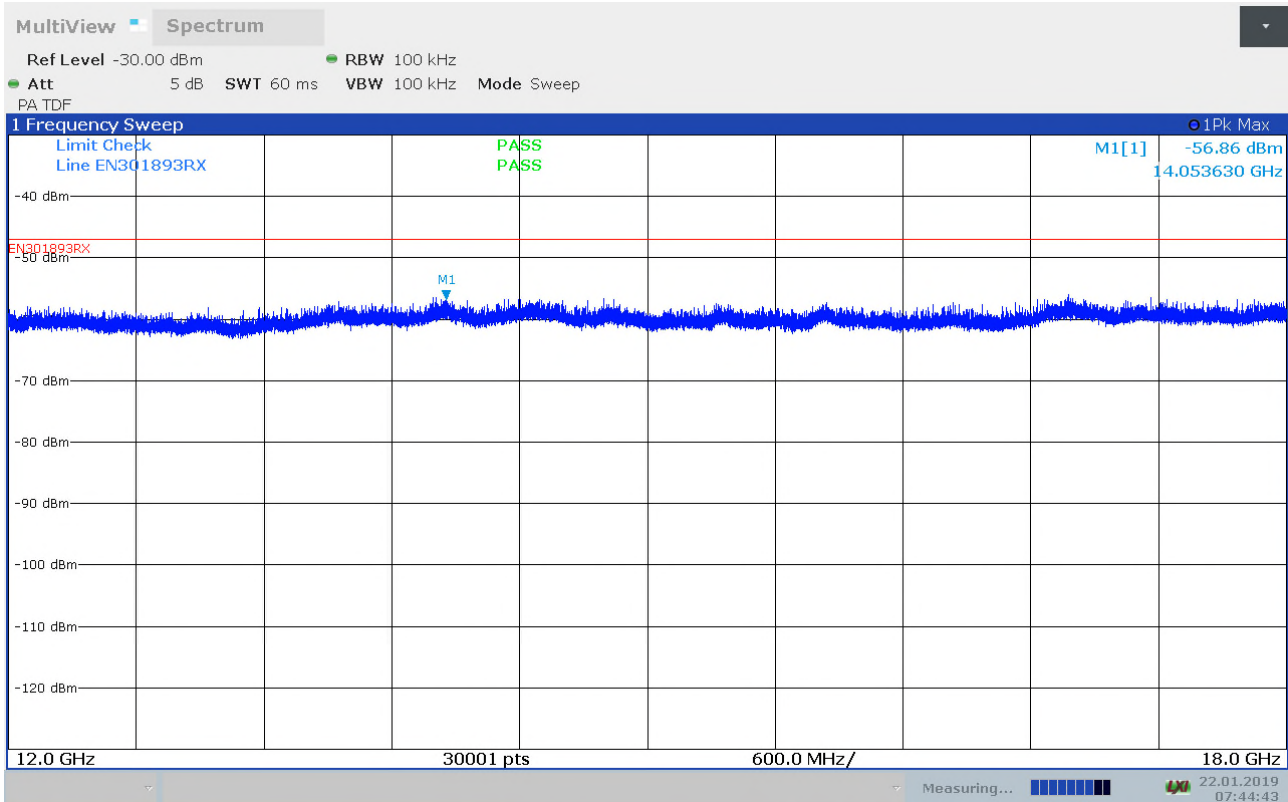
Radiated Spurious Emissions, 1 - 6GHz, ch46, ch5230MHz, amcs0, 40MHz, HP, RX



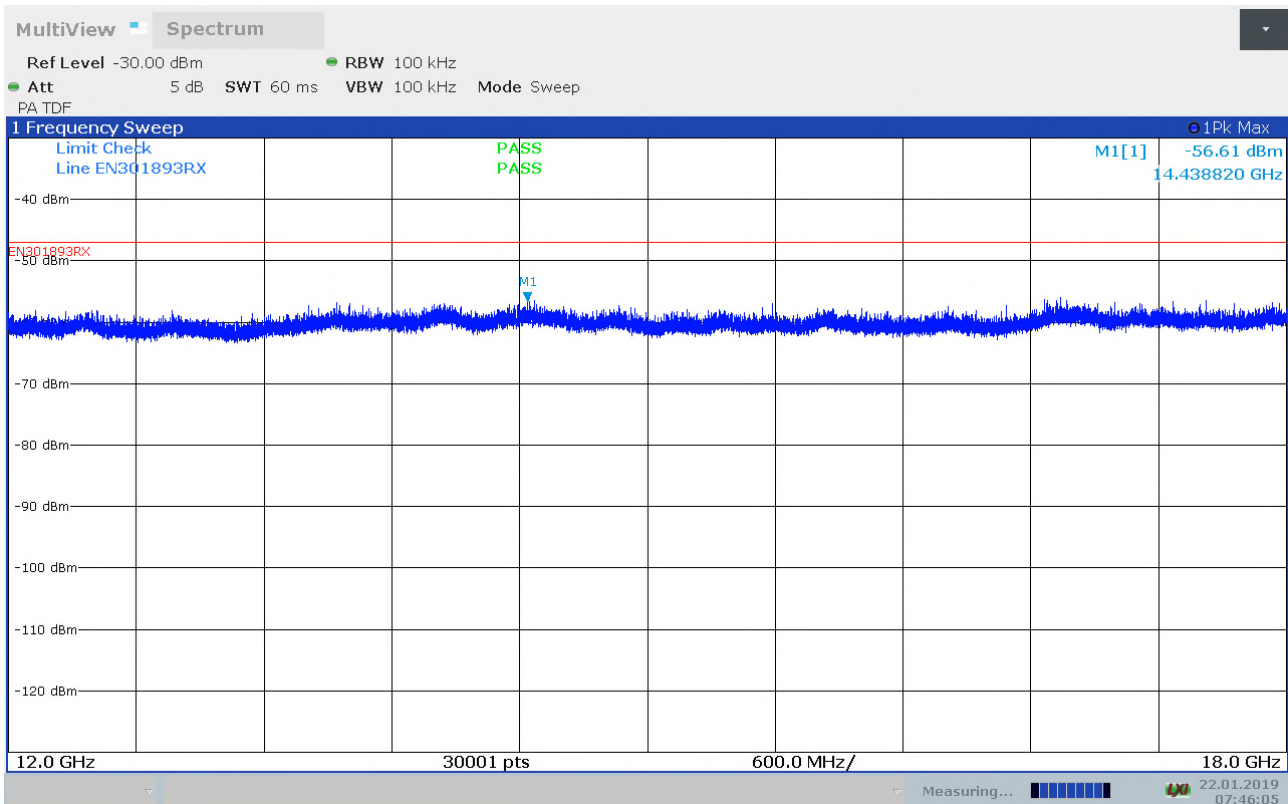
Radiated Spurious Emissions, 6 – 12GHz, ch46, ch5230MHz, amcs0, 40MHz, VP, RX



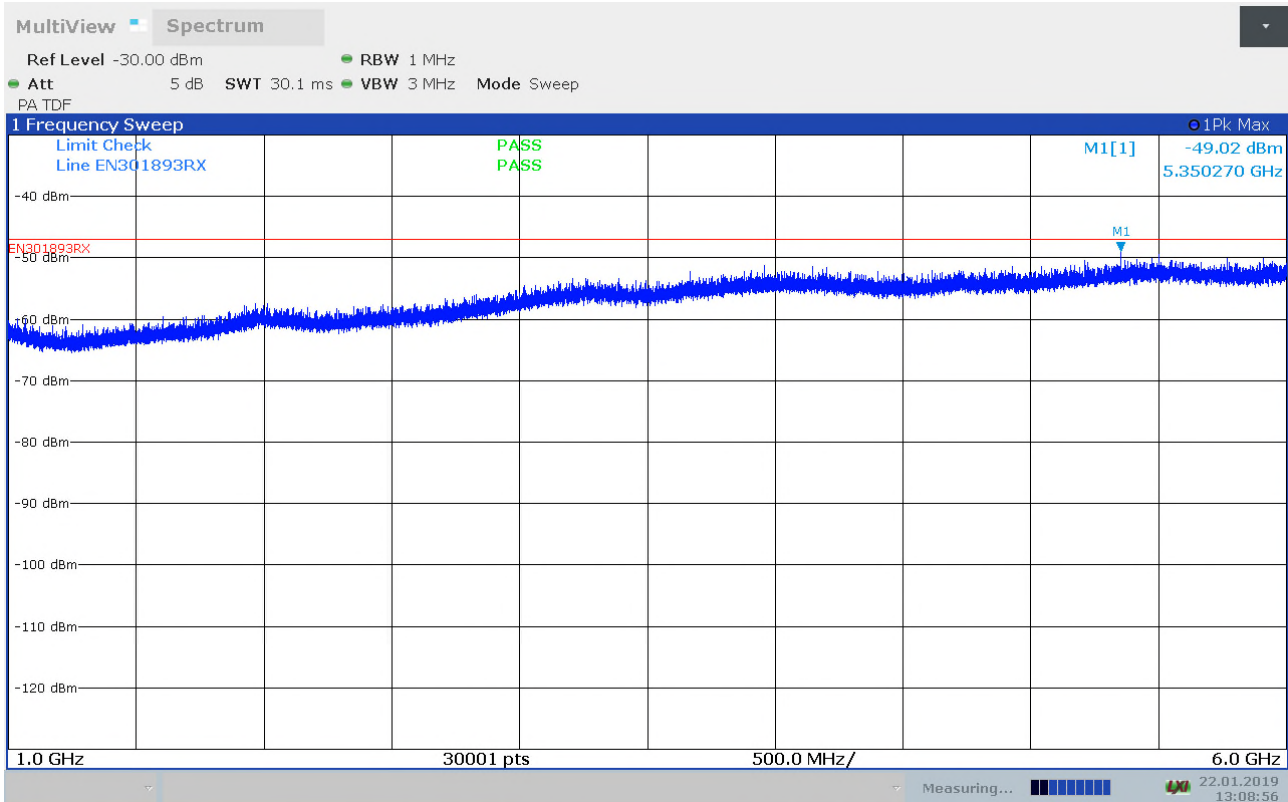
Radiated Spurious Emissions, 6 – 12GHz, ch46, ch5230MHz, amcs0, 40MHz, HP, RX



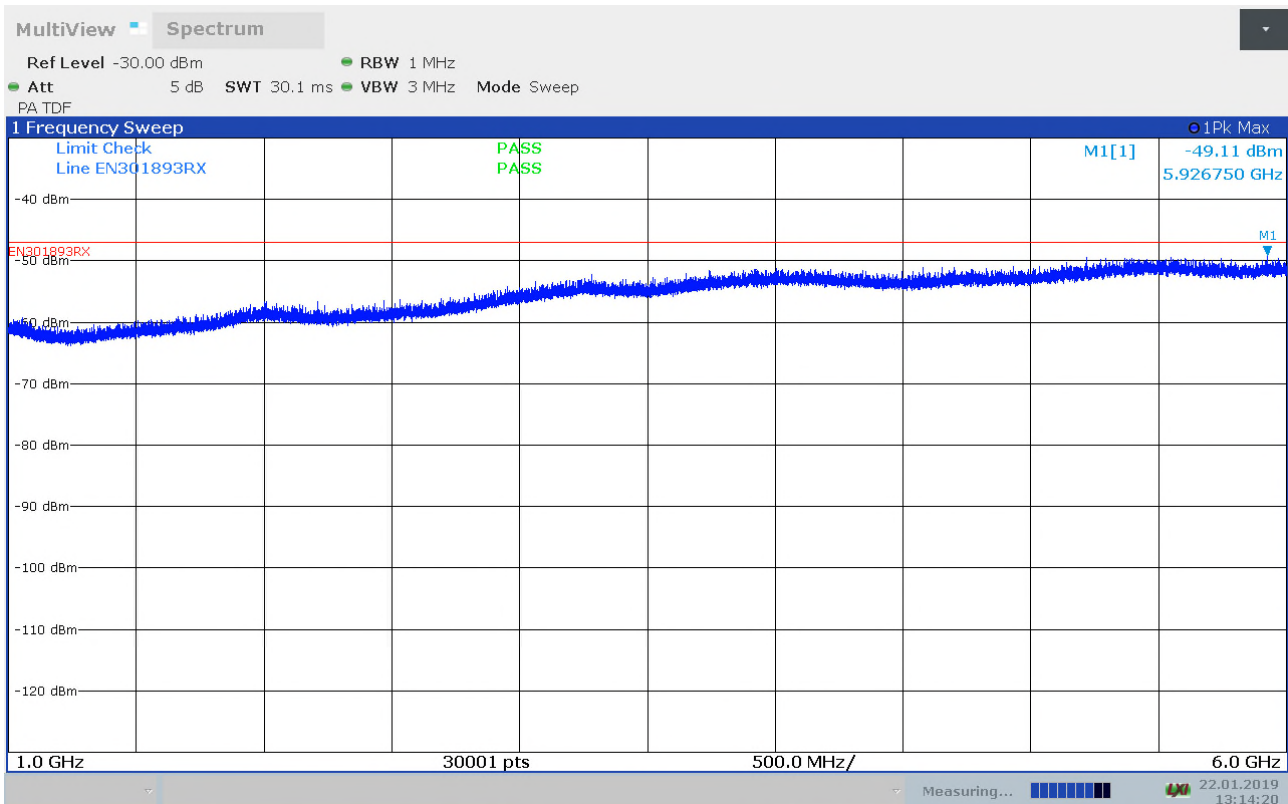
Radiated Spurious Emissions, 12 - 18GHz, ch46, ch5230MHz, amcs0, 40MHz, VP, RX



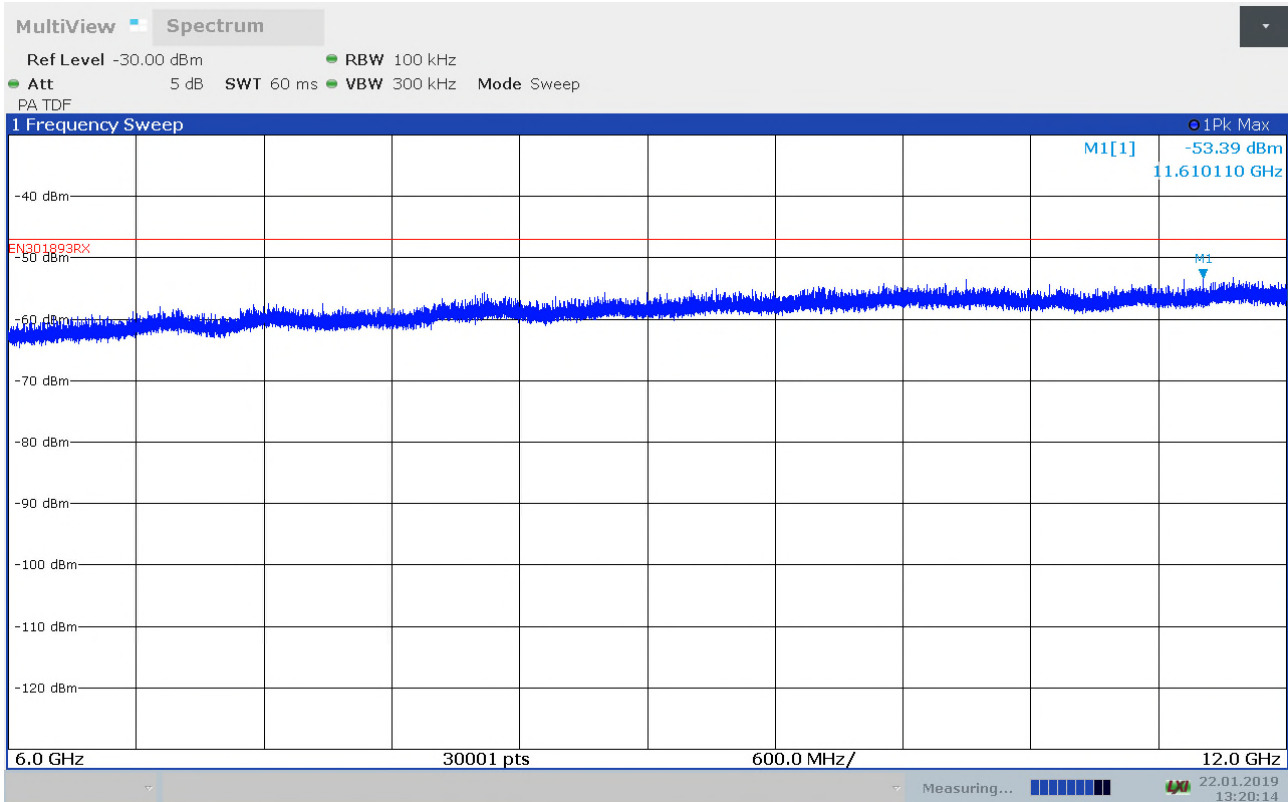
Radiated Spurious Emissions, 12 - 18GHz, ch46, ch5230MHz, amcs0, 40MHz, HP, RX



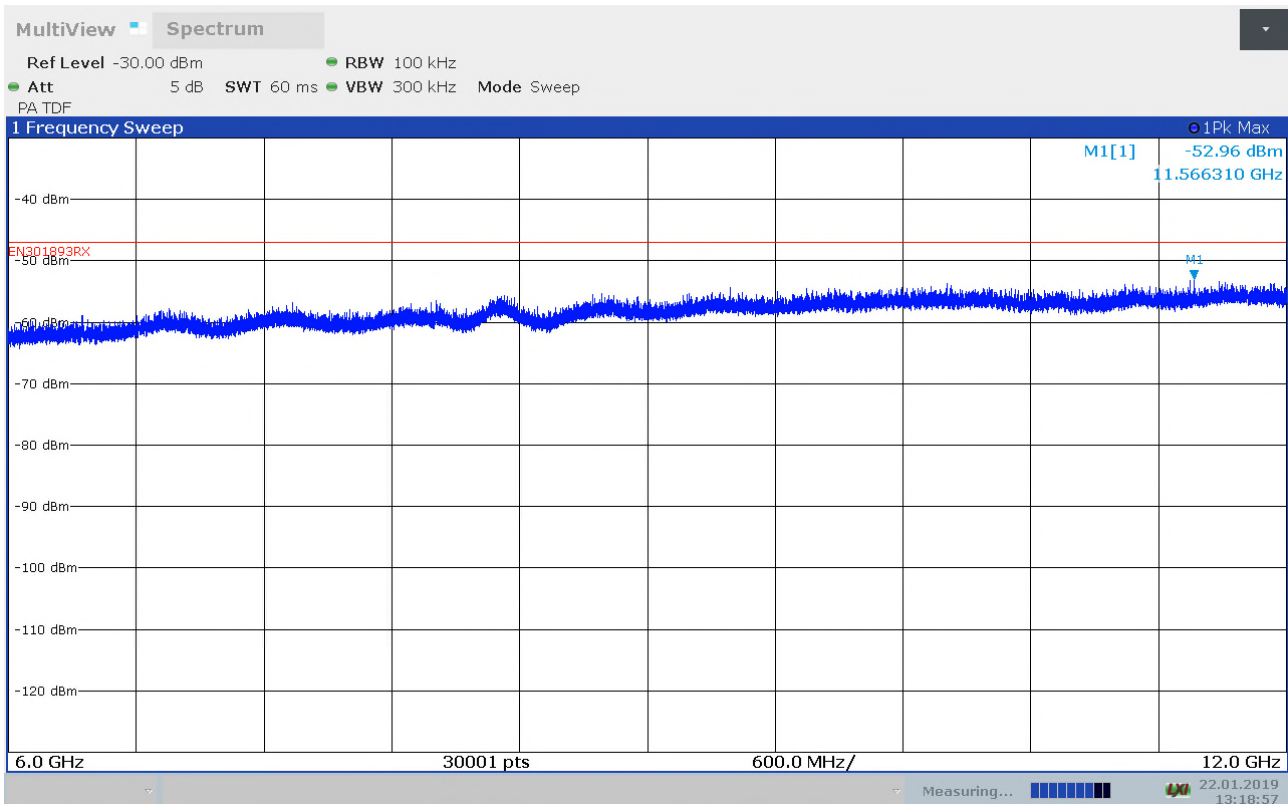
Radiated Spurious Emissions, 1 – 6GHz, ch100, ch5500MHz, amcs0, 20MHz, VP, RX



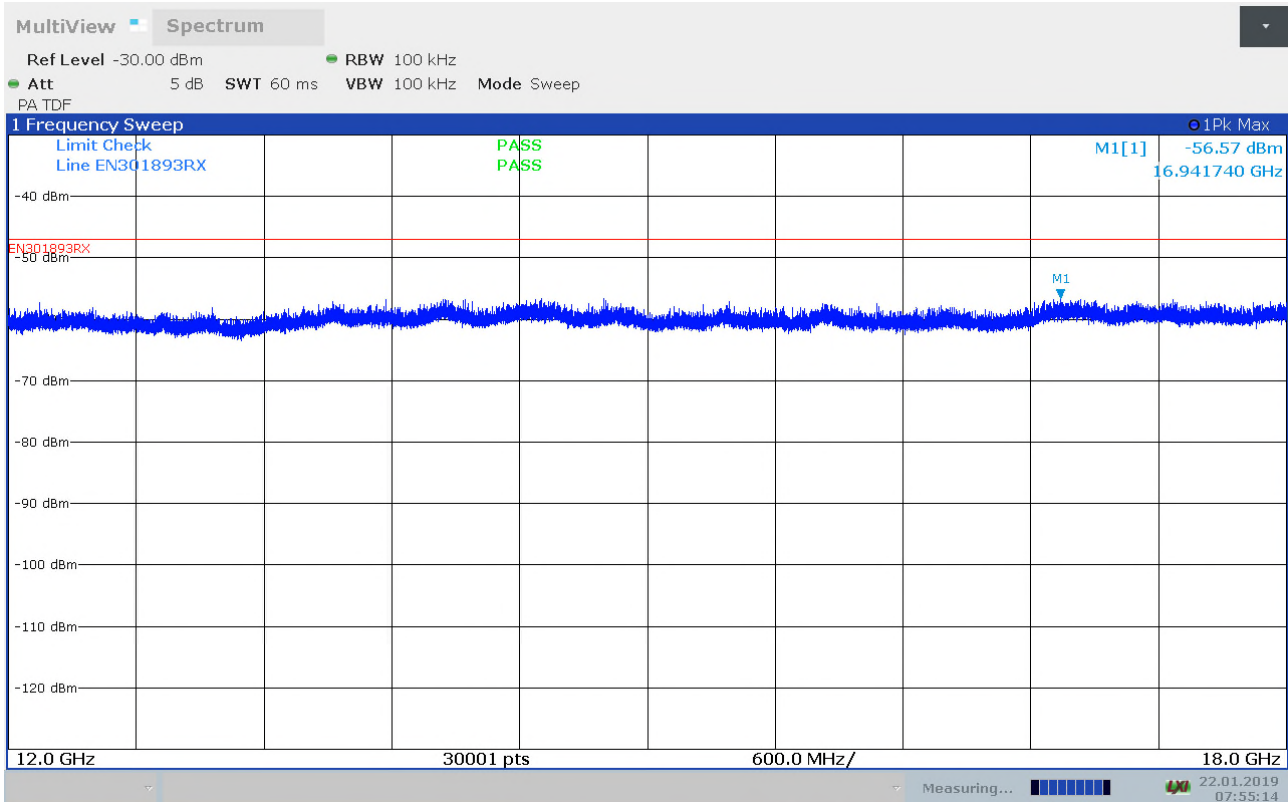
Radiated Spurious Emissions, 1 - 6GHz, ch100, ch5500MHz, amcs0, 20MHz, HP, RX



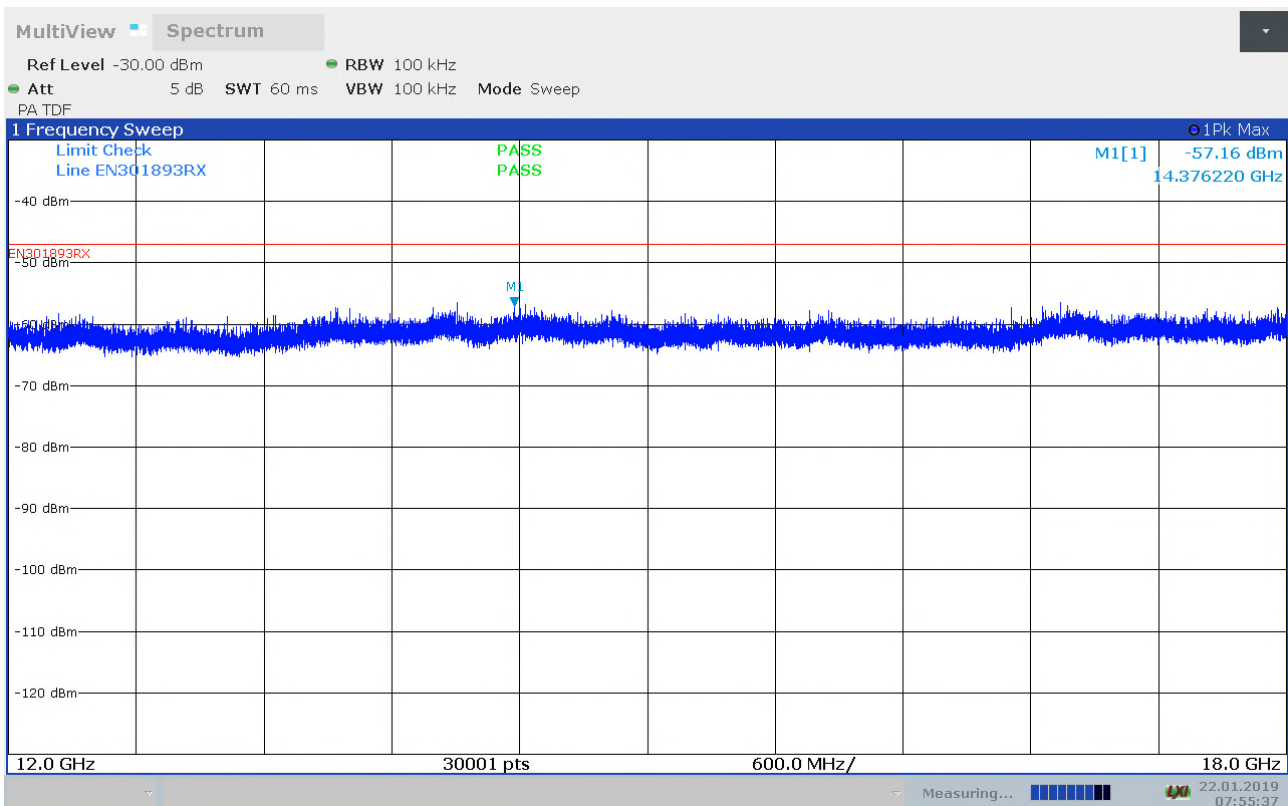
Radiated Spurious Emissions, 6 – 12GHz, ch100, ch5500MHz, amcs0, 20MHz, VP, RX



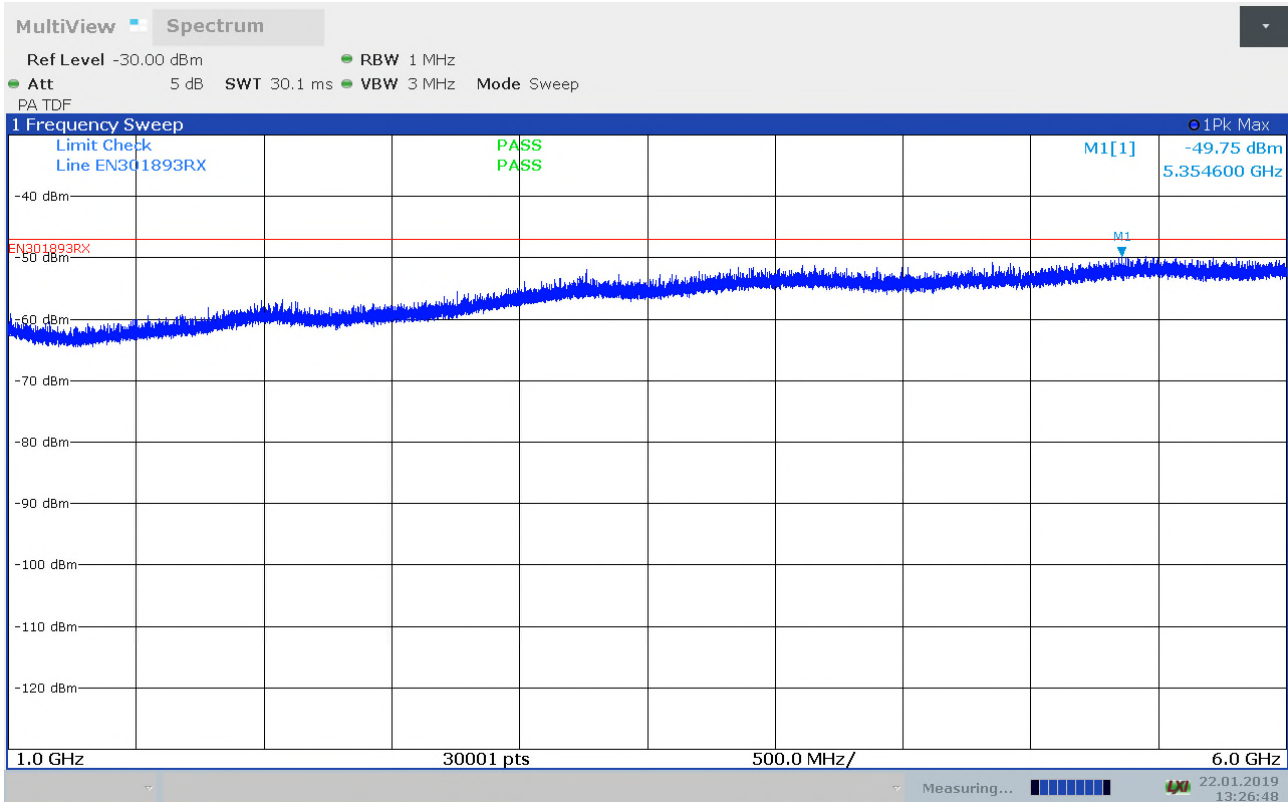
Radiated Spurious Emissions, 6 – 12GHz, ch100, ch5500MHz, amcs0, 20MHz, HP, RX



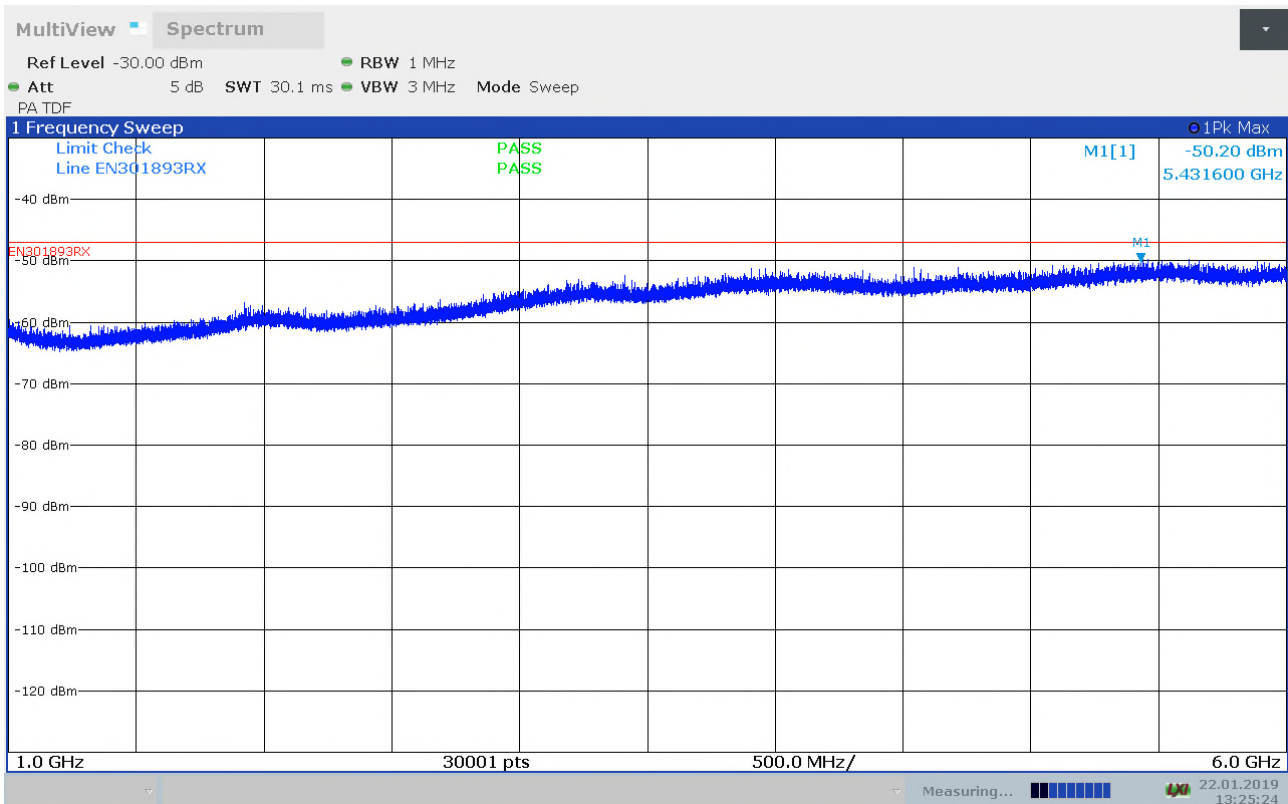
Radiated Spurious Emissions, 12 - 18GHz, ch100, ch5500MHz, amcs0, 20MHz, VP, RX



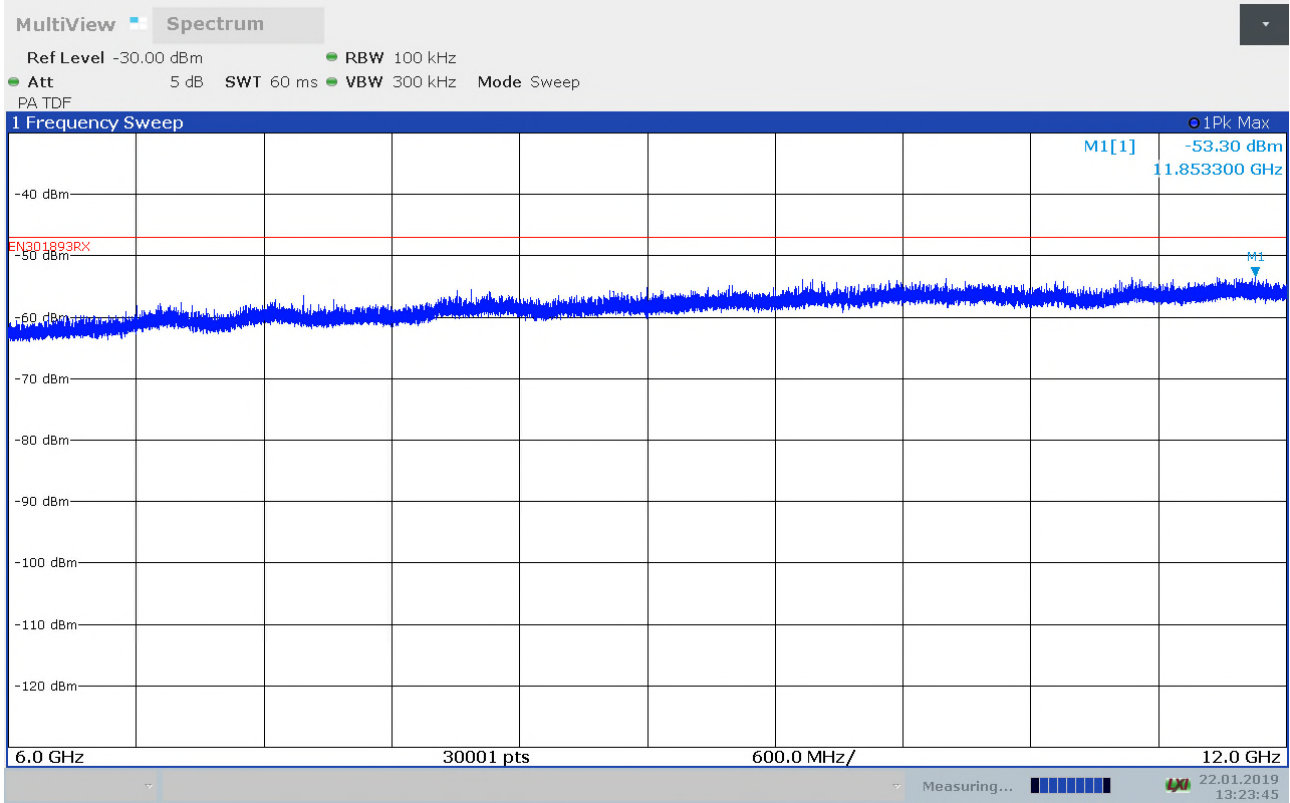
Radiated Spurious Emissions, 12 - 18GHz, ch100, ch5500MHz, amcs0, 20MHz, HP, RX



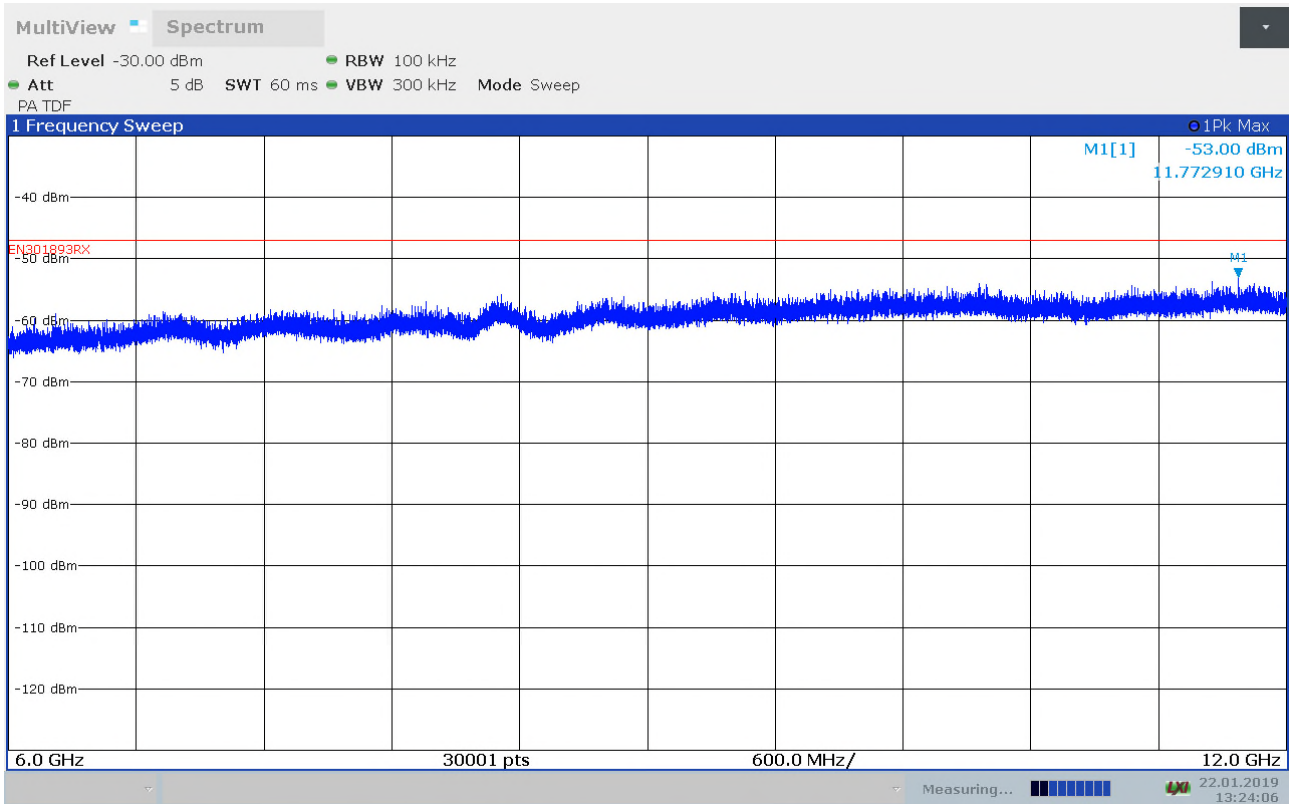
Radiated Spurious Emissions, 1 – 6GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, RX



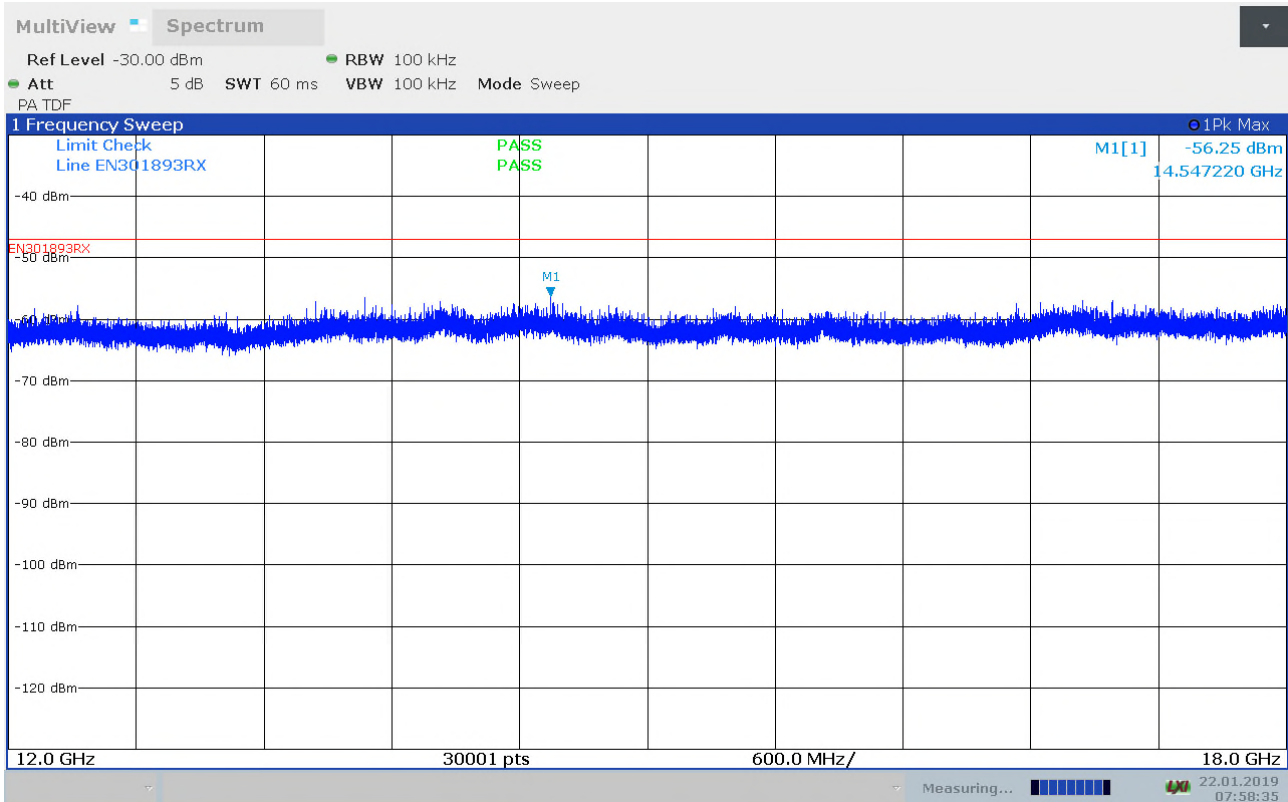
Radiated Spurious Emissions, 1 - 6GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, RX



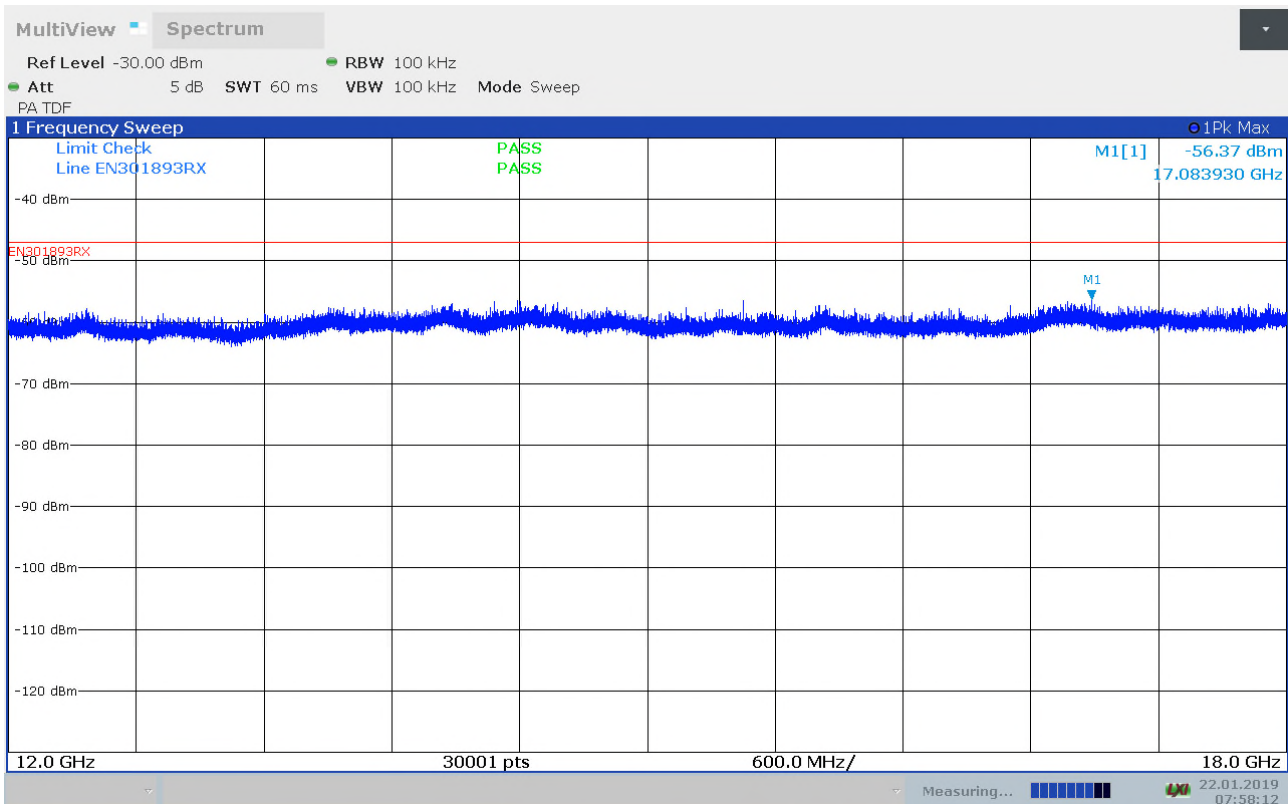
Radiated Spurious Emissions, 6 – 12GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, RX



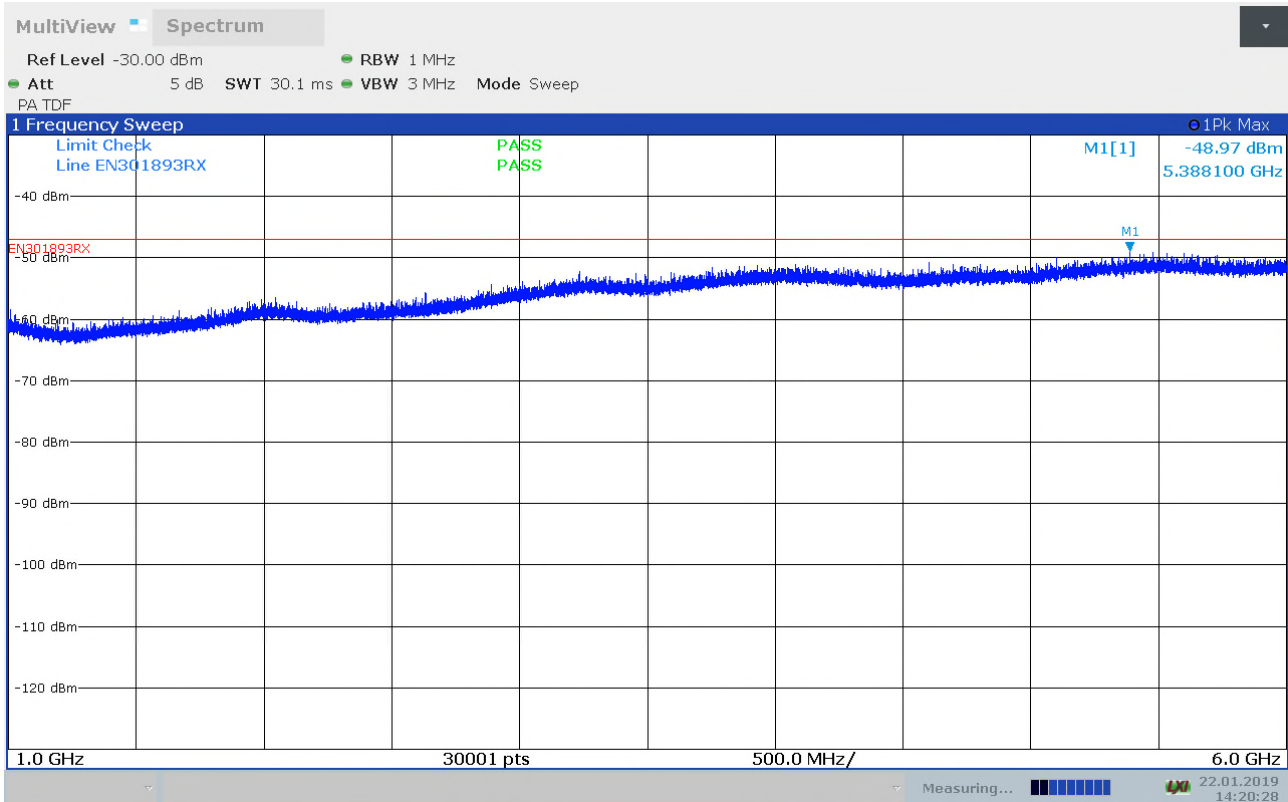
Radiated Spurious Emissions, 6 – 12GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, RX



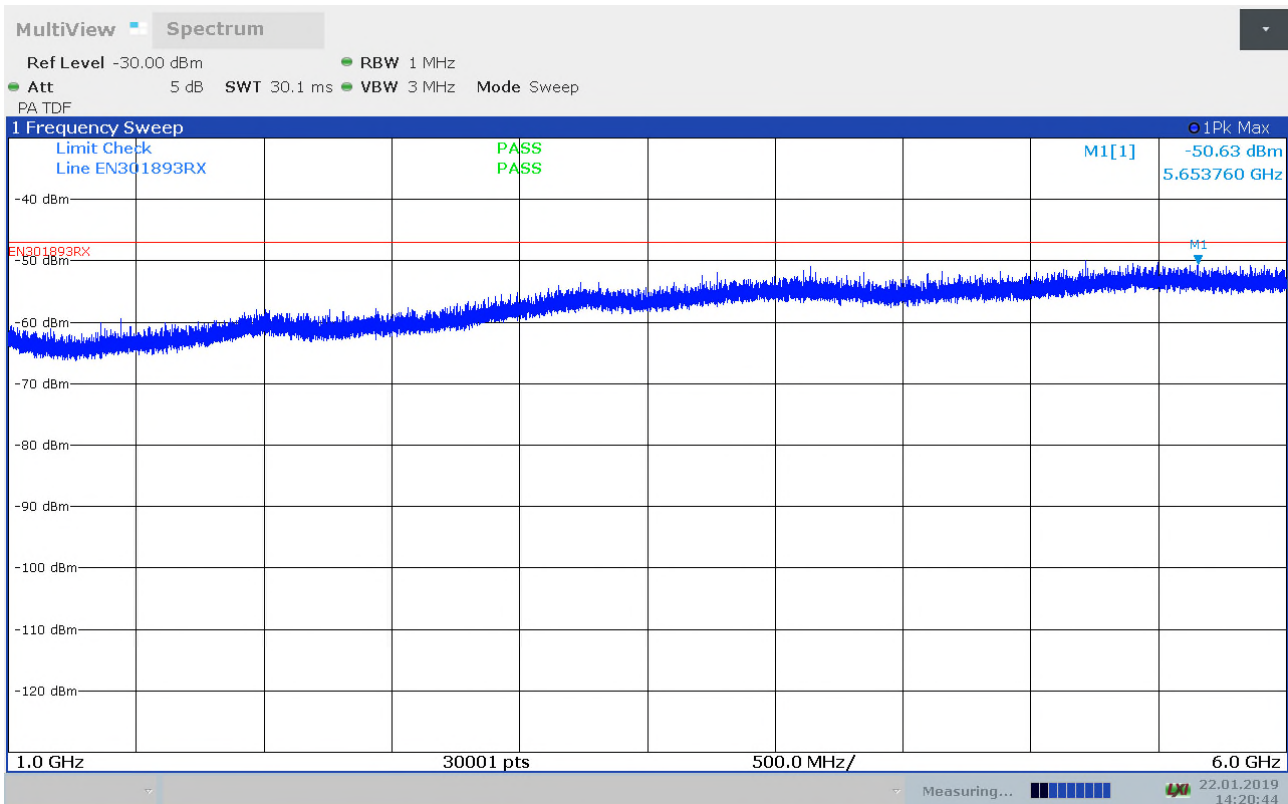
Radiated Spurious Emissions, 12 - 18GHz, ch118, ch5590MHz, amcs0, 40MHz, VP, RX



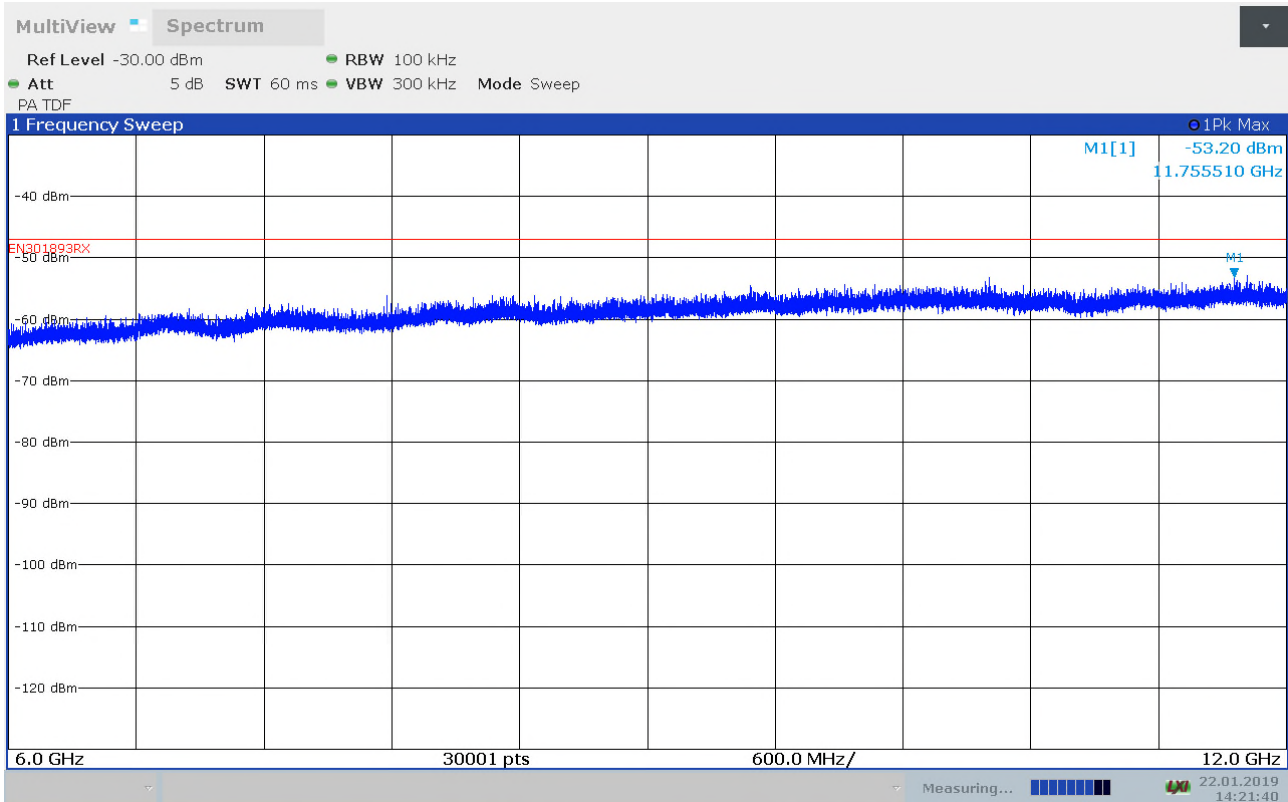
Radiated Spurious Emissions, 12 - 18GHz, ch118, ch5590MHz, amcs0, 40MHz, HP, RX



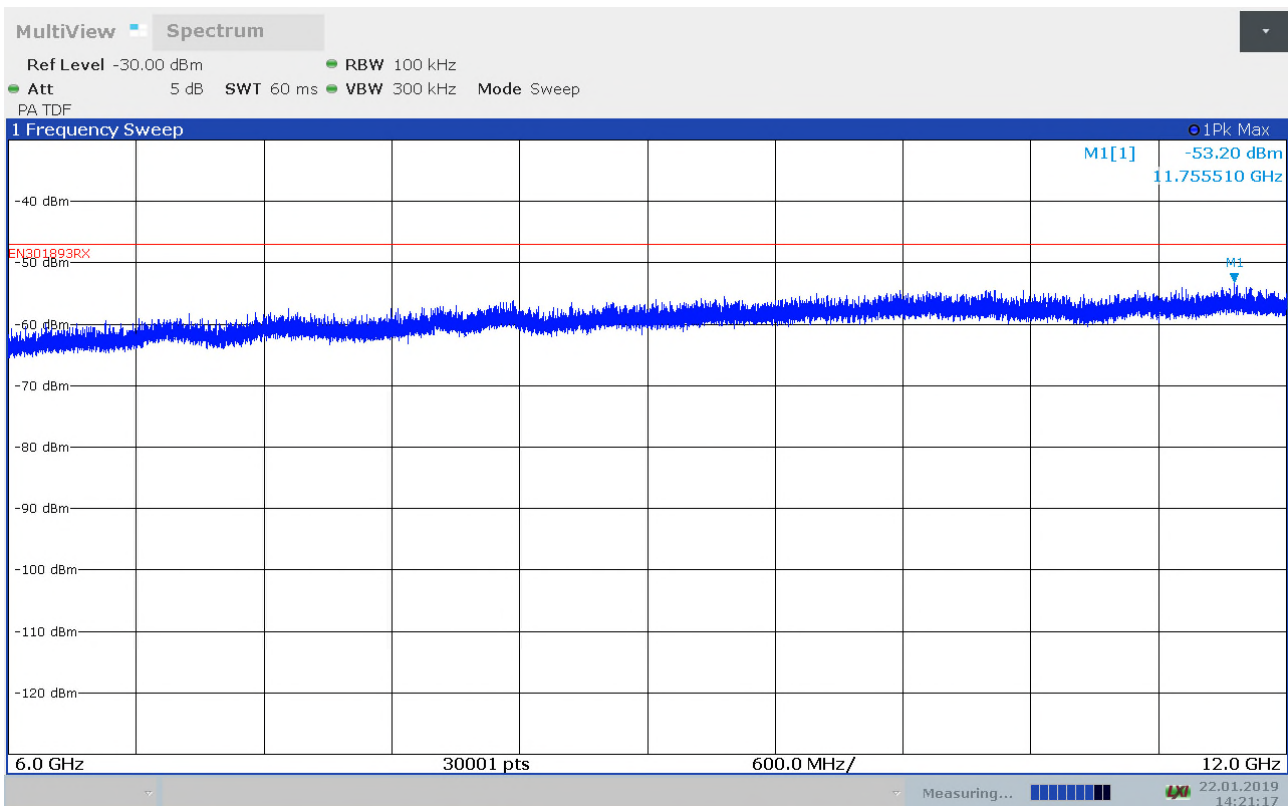
Radiated Spurious Emissions, 1 - 6GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, RX



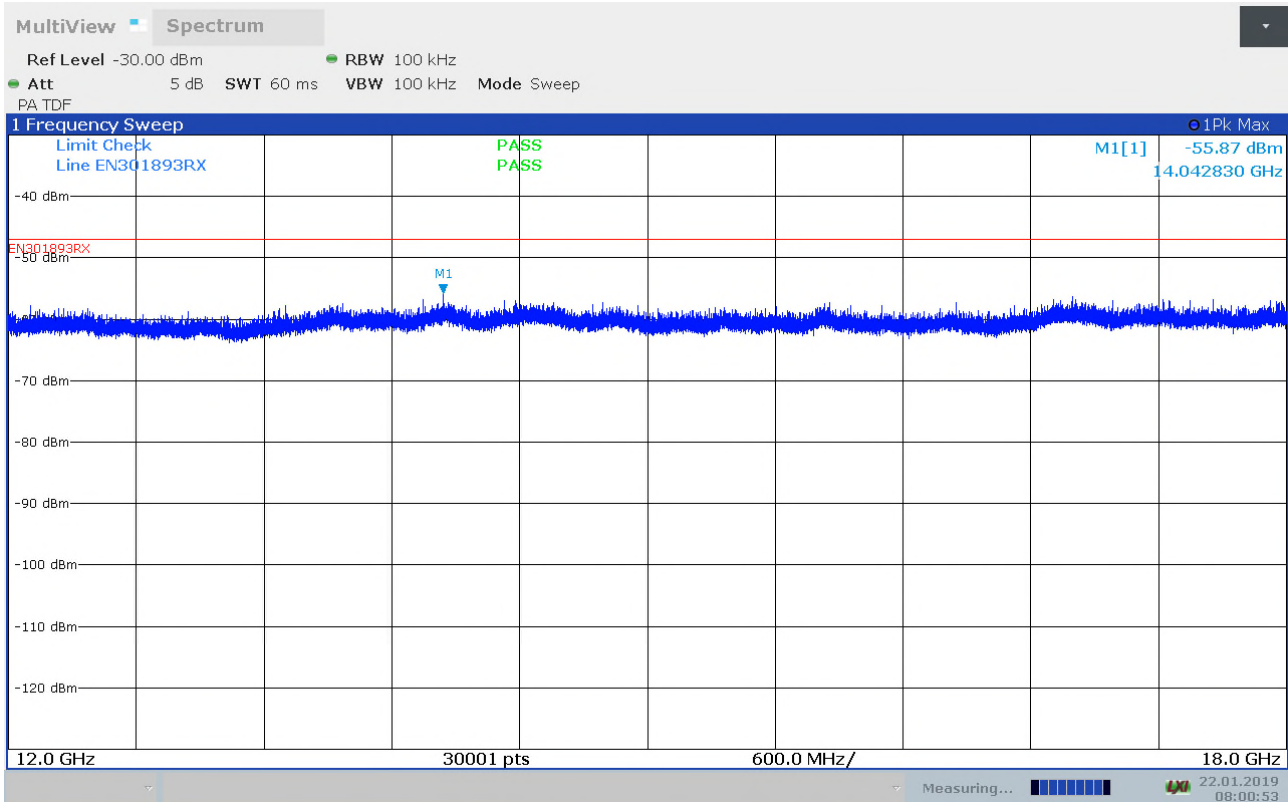
Radiated Spurious Emissions, 1 - 6GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, RX



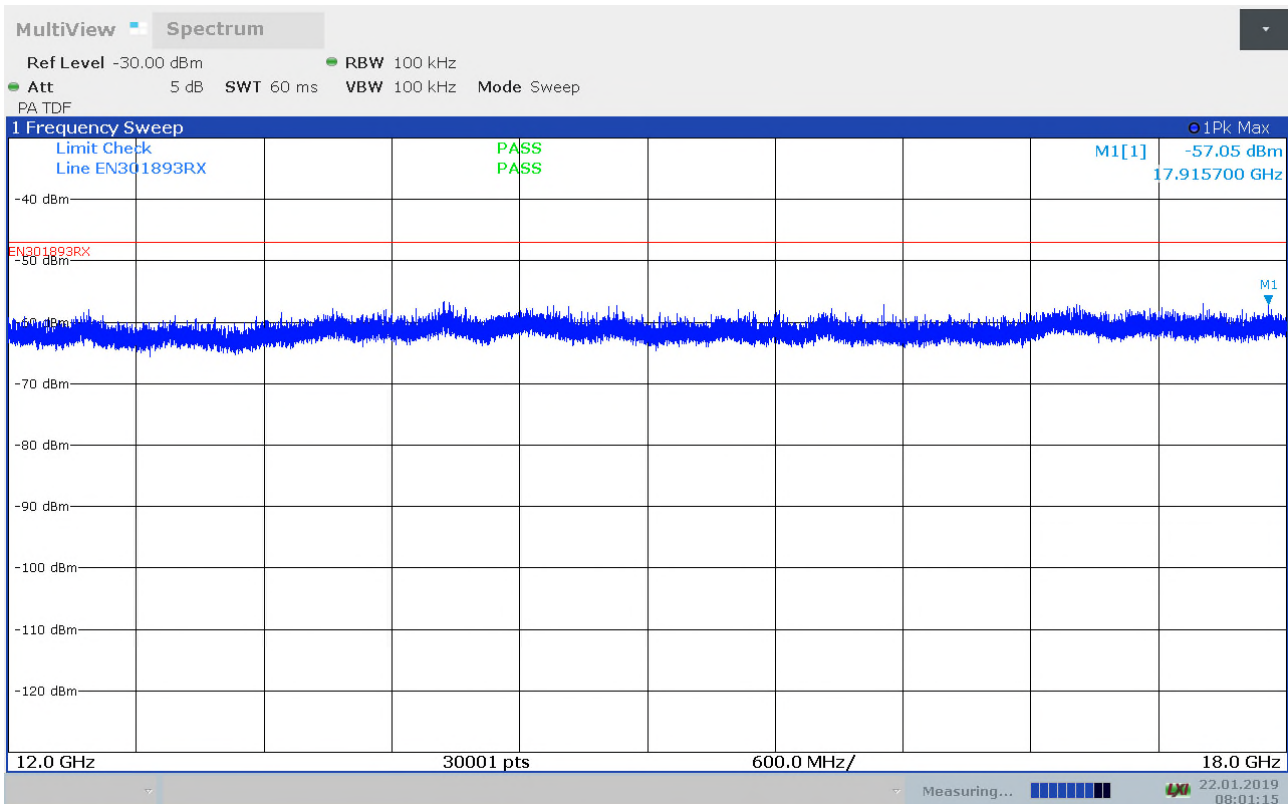
Radiated Spurious Emissions, 6 – 12GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, RX



Radiated Spurious Emissions, 6 – 12GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, RX



Radiated Spurious Emissions, 12 - 18GHz, ch122, ch5610MHz, amcs0, 80MHz, VP, RX



Radiated Spurious Emissions, 12 - 18GHz, ch122, ch5610MHz, amcs0, 80MHz, HP, RX

6 Test Setups



Radiated measurements – YZ plane

7 PHOTOGRAPHS OF THE EUT



Front view



Rear view

8 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the testhouse.

No	Ref. No	Description	Manufacturer	Type	Cal. date	Cal. due
1.	LR 1654	Spectrum Analyzer	Rohde & Schwarz	FSV 30	01.2019	01.2020
2.	LR 1657	Power meter	Rohde & Schwarz	OSP –B157	01.2019	01.2020
3.	LR 1655	Vector Signal generator	Rohde & Schwarz	SMBV 100A	01.2019	01.2020
4.	LR 1656	Signal generator	Rohde & Schwarz	SMB100A	01.2019	01.2020
5.	-	EMC 32, TS8997 (Software)	Rohde & Schwarz	V9.26.00/1.26.01	N/A	
6.	LR 1540	Spectrum Analyzer	Rohde & Schwarz	FSW26	01.2017 01.2019	01.2019 01.2021
7.	LR 1673	Attenuator	NARDA	4768-10	Cal b4 use	
8.	LR 1552	Pre-Amplifier	Miteq	JS4	10.2018	10.2019
9.	LR 1226	Double Ridged Horn Antenna	EMCO	3115	11.2013	11.2023
10.	LR 1614	Highpass Filter	Trilithic	6HC3000/18000	Cal b4 use	
11.	N-4525	Biconical-Log hybrid	Sunol Sciences	JB3	05.2019	05.2020
12.	LR1619	HP filter	Wainwright Instr.	WHKX6.5/18G-8	Cal b4 use	
13.	LR 102	Antenna, Horn	Sivers	PM7320X	12.2008	12.2020
14.	LR 101	Antenna, Horn	Systron	DBF-5230	12.2008	12.2020
15.	LR 1480	Antenna, Horn	Narda	638	12.2008	12.2020
16.	LR 1598	Multimeter, Digital	Fluke	87V	10.2018	10.2020

Revisions

Revision #	Date	Order #	Description
00	2019-03-04	362353	First issued