DEKRA Certification, Inc
405 Glenn Drive, Suite 12
Sterling · VA 20164 · United States of America

Test report No:
NIE: 02590RCB.002A3

Test report

Test and Certification for Citizens Broadband Radio Service (CBRS): WINNF-TS-0122

Identification of item tested	CPE8100
Trademark	Telrad
Model and /or type reference	CPE8100 -PRO-1D-3X
Other identification of the product	FCC ID: ARA-CPE81003X96
Features	CPE-CBSD Category: B CPE-CBSD with Domain Proxy
Final HW Version:	V1.0
Final SW Version:	Domain Proxy: 7.3 CBSD: R1832
Manufacturer	Telrad Networks Ltd 1 Bat Sheva Street, P.O.B. 6118, Lod, Israel 711600
Test method requested, standard	940660 D02 CPE-CBSD Handshake Procedures v01 WINNF-TS-0122
Approved by (name / position & signature)	Gonzalo Casado (Lab Manager)
Date of issue	Nov/14/2019
Report template No	FDT08_22

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DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

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Abbreviations

Abbreviation	Meaning
CBRS	Citizens Broadband Radio Services
CBSD	Citizens Broadband Radio Service Device
DP	Domain Proxy
DUT	Device Under Test
SAS	Spectrum Access System
UUT	Unit Under Test
CPI	Certified Professional Installer
N/A	Not Applicable
SA	Spectrum Analyzer

Data provided by the client

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results: DUT HW and SW version, CBSD HW and SW version

Usage of samples

Samples undergoing test have been selected by: the client

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
2590.003	CPE-CBSD	CPE8100 -PRO-1D-3X	TLR41DFE970D	2019-08-05
2590.004	CPE-CBSD	CPE8100 -PRO-1D-3X	TLR41DFE970B	2019-08-05

1. Sample M/01 has undergone the test(s) specified in subclause “Test method requested”.

Supported Features

Condition	Feature Description	Supported (Y/N)
C3	Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message.	Y
DP	CBSD with Domain Proxy	Y
CPE-CBSD	DUT is a CPE-CBSD	Y

Identification of the client

Same as manufacturer

Testing period and place

Test Location	DEKRA Certification Inc 405 Glenn Drive, Suite 12, Sterling, Virginia, USA, 20164
Date (start)	2019-08-05
Date (finish)	2019-11-11

Document history

Report number	Date	Description
2590RCB.002	09-17-2019	First release
2590RCB.002A1	10-02-2019	Second release(Modifications performed are described in the subclause “Modifications to the reference test report”)
2590RCB.002A2	11-11-2019	Third release(Modifications performed are described in the subclause “Modifications to the reference test report”)

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 2590RCB.002A2 related with the same samples, in the next clauses and sub-clauses:

Clauses/ Sub-Clauses	Modification	Justification
Page 47 and Page 48	Expanded plot description	Clarification requested by Telecommunication Certification Body

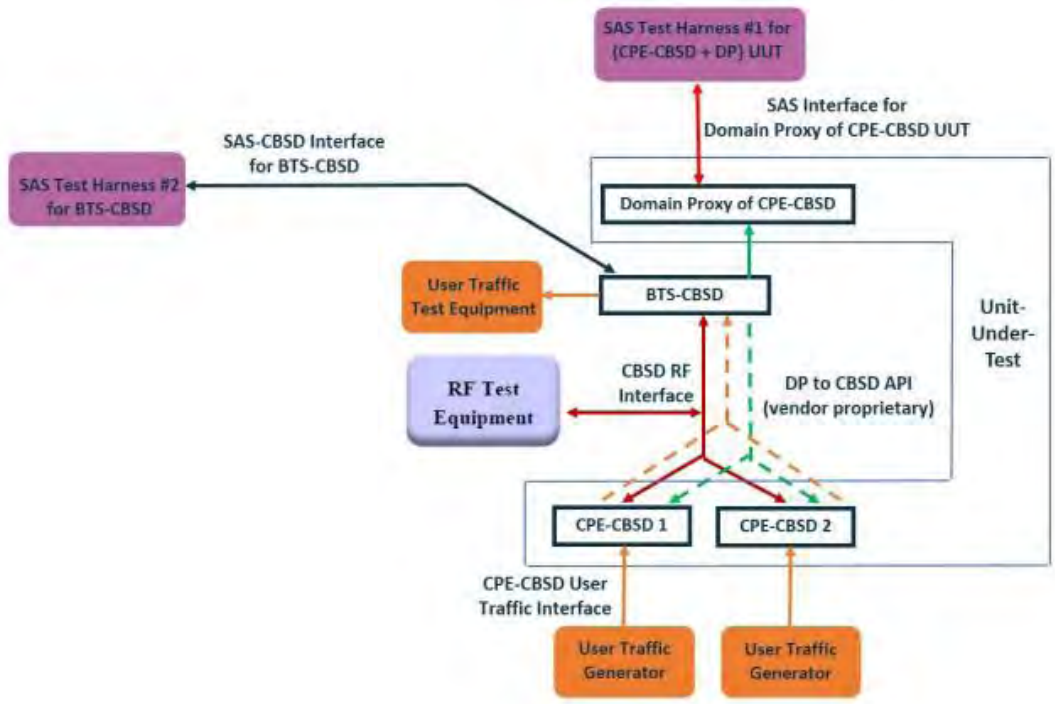
Remarks and comments

Testing performed by Gonzalo Casado

List of equipment used during the test

Test Equipment				
Description	Model	Control Number	SW Version	Serial Number
Signal Analyzer	MXA N9020A	0382	A.04.26	R9-L2D1V
Test SAS Harness	N/A	N/A	Test Harness:1.0.3	N/A
Compliant CBSD	CMP.XT-BS-3.4.3.7	-	7.0	95032353 & LKT-COMPACT3X

Test Setup Diagram



Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Test Results Summary

Test Cases Verdicts	Number of Test Cases
Not applicable :	0
Pass :	6
Fail :	0
Not measured :	0
Total Number of Test Cases	6

Appendix A: Test results

ID	Description	Verdict	Date	Sample
WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	P	9-Aug-19	M/01
CPE.KDB.1	CPE Handshake transmissions are used only for communicating to the SAS for registration and authorization of the device	P	8-Aug-19	M/01
CPE.KDB.3	CPE Handshake transmissions are on a channel used by or indicated by the BTS-CBSD after receiving an authorization signal from the BTS-CBSD	P	8-Aug-19	M/01
CPE.KDB.4	CPE Handshake transmissions are limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS; this time should not exceed 1 second within any 10-second period, 10seconds within any 300-second period, or 20 seconds within any 3600-second period	P	11-Nov-19	M/01
CPE.KDB.6	In the event the CPE-CBSD needs to reconnect to a SAS or renew its connection for registration and (re)authorization purposes, the device can use the same or a shortened protocol to reestablish connection.	P	9-Aug-19	M/01
CPE.KDB.7	Verify that the CPE-CBSD register with SAS even with transmit power level below 23dBm EIRP	P	11-Nov-19	M/01

Notes:

- Signal Analyzer Screenshots for test cases CPE.KDB.3, CPE.KDB.4 and CPE.KDB.7 included in appendix D
- Test cases steps described in appendix C

Appendix B: Photographs

Figure B1. Top View of DUT

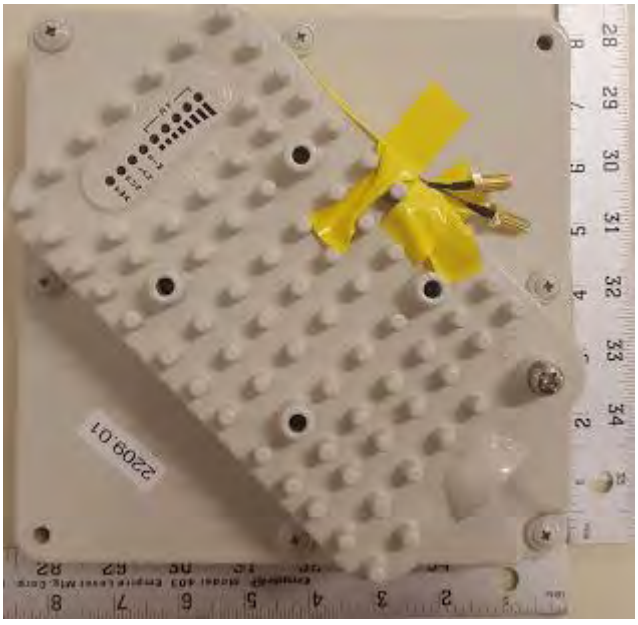


Figure B2. DUT rear view

Appendix C: Test Cases Details

- [WINNF.FT.D.REG.6] Domain Proxy Single-Step registration for CBSD with CPI signed data

This test is mandatory for DP with CBSDs which report all Required and REG-Conditional parameters in the Registration request to the SAS using CPI signed data. This test validates that each of the required and REG-Conditional parameters appear within the registration request message. This test case applies to Domain Proxy supervising two CBSDs.

All Category B devices, and Category A devices not able to determine its own location require installation by a CPI. This test is for devices where the CPI enters data into the CBSD and this information along with the CPI signature are sent in the request message. Excluded from this test are devices which require the CPI to enter the information into a SAS interface. These devices would follow the multiple step registration test [WINNF.FT.D.REG.2].

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state • All of the required and REG-Conditional parameters shall be configured and CPI signature provided	--	--

- CPE.KDB.1: CPE Handshake transmissions are used only for communicating to the SAS for registration and authorization of the device

Test Case applicable only to CPE-CBSD

#	Test Execution Steps
1	Connect a laptop to DUT and start a ping to an equipment connected behind CBSD
2	Verify that Laptop doesn't have ping connectivity to the machine targeted in step #1
3	Start test WINNF-0122 WINNF.FT.C.HBT.10
4	Verify that Laptop has ping connectivity to the machine targeted in step #1 once it has been authorized by the SAS and with a valid Grant
5	Wait until execution of test WINNF.FT.C.HBT.10 is completed
6	Verify that Laptop doesn't have ping connectivity to the machine targeted in step #1

- CPE.KDB.3: CPE Handshake transmissions are on a channel used by or indicated by the BTS-CBSD after receiving an authorization signal from the BTS-CBSD

Test Case applicable only to CPE-CBSD

#	Test Execution Steps
1	Note the channel and channel BW used by the CBSD-CBSD
2	Power cycle DUT and verify that the CPE doesn't have a valid grant
3	Verify using a SA that the CPE is using the channel and channel BW used by the CBSD-CBSD

- CPE.KDB.4: CPE Handshake transmissions are limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS; this time should not exceed 1 second within any 10-second period, 10seconds within any 300-second period, or 20 seconds within any 3600-second period

Test Case applicable only to CPE-CBSD

#	Test Execution Steps
1	Start test WINNF-0122 WINNF.FT.C.GRA.1
2	Keep CPE-CBSD in registered state with SAS, but no grant.
3	Measure CPE-CBSD transmission durations
4	Verify that CPE-CBDS transmission duration doesn't exceed 1 second within 10seconds, 10 seconds within 300seconds and 20seconds within 3600seconds

- CPE.KDB.6: In the event the CPE-CBSD needs to reconnect to a SAS or renew its connection for registration and (re)authorization purposes, the device can use the same or a shortened protocol to reestablish connection.

Test Case applicable only to CPE-CBSD

#	Test Execution Steps
1	Configure SA to perform a new sweep of 1ms only when it detects signal from the DUT
2	Start test WINNF-0122 WINNF.FT.C.HBT.10
3	Wait until execution of test WINNF.FT.C.HBT.10 is completed
4	Start a timer once the first transmission from DUT is detected and start counting the number of sweeps performed. This is, count each transmission from DUT detected
5	Wait ten seconds
6	Verify that the number of data transmissions from DUT is less than 1000 (Totally one second of data transmissions)
7	Repeat steps #1 through 5 verifying that the DUT sends less than 10000 data transmissions of 1ms in 300seconds and less than 20000 data transmissions of 1m in 3600secods

- CPE.KDB.7: Verify that the CPE-CBSD register with SAS even with transmit power level below 23dBm EIRP

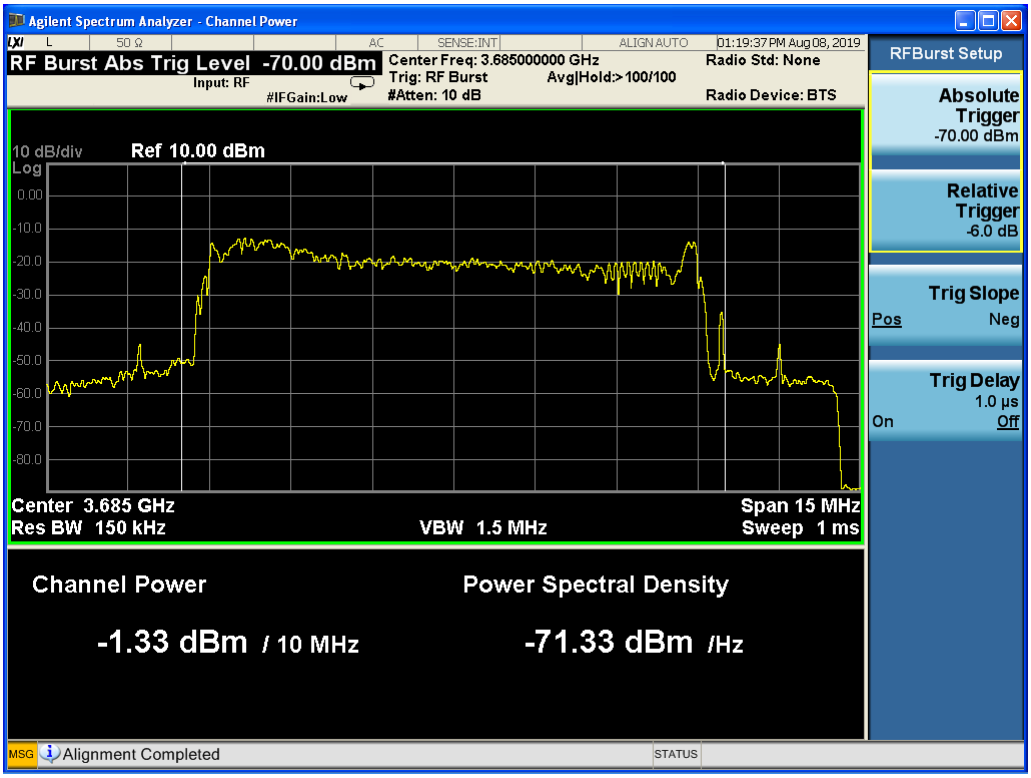
Test Case applicable only to CPE-CBSD

#	Test Execution Steps
1	Adjust RF path attenuation between CPE-CBSD and CBSD so that the CPE-CBSD transmit power is below 23dBm EIRP
2	Start test WINNF-0122 WINNF.FT.D.HBT.8 so test SAS replies to CPE-CBSD requests
3	Trigger CPE-CBSD request to register to test SAS
4	Verify that CPE-CBSD is registered successfully with test SAS and CPE-CBSD transmit power is below 23dBm EIRP using rf equipment.
5	Trigger CPE-CBSD request to request grant to test SAS
6	Verify that CPE-CBSD is receives grant successfully from test SAS and CPE-CBSD transmit power is below 23dBm EIRP using rf equipment.

#	Test Execution Steps
7	Start Uplink traffic to occupy channel
8	Measure Uplink Channel Power and verify that it doesn´t exceed maxEIRP indicated in grant

Appendix D: Spectrum Analyzer Screenshots

1. CPE.KDB.3

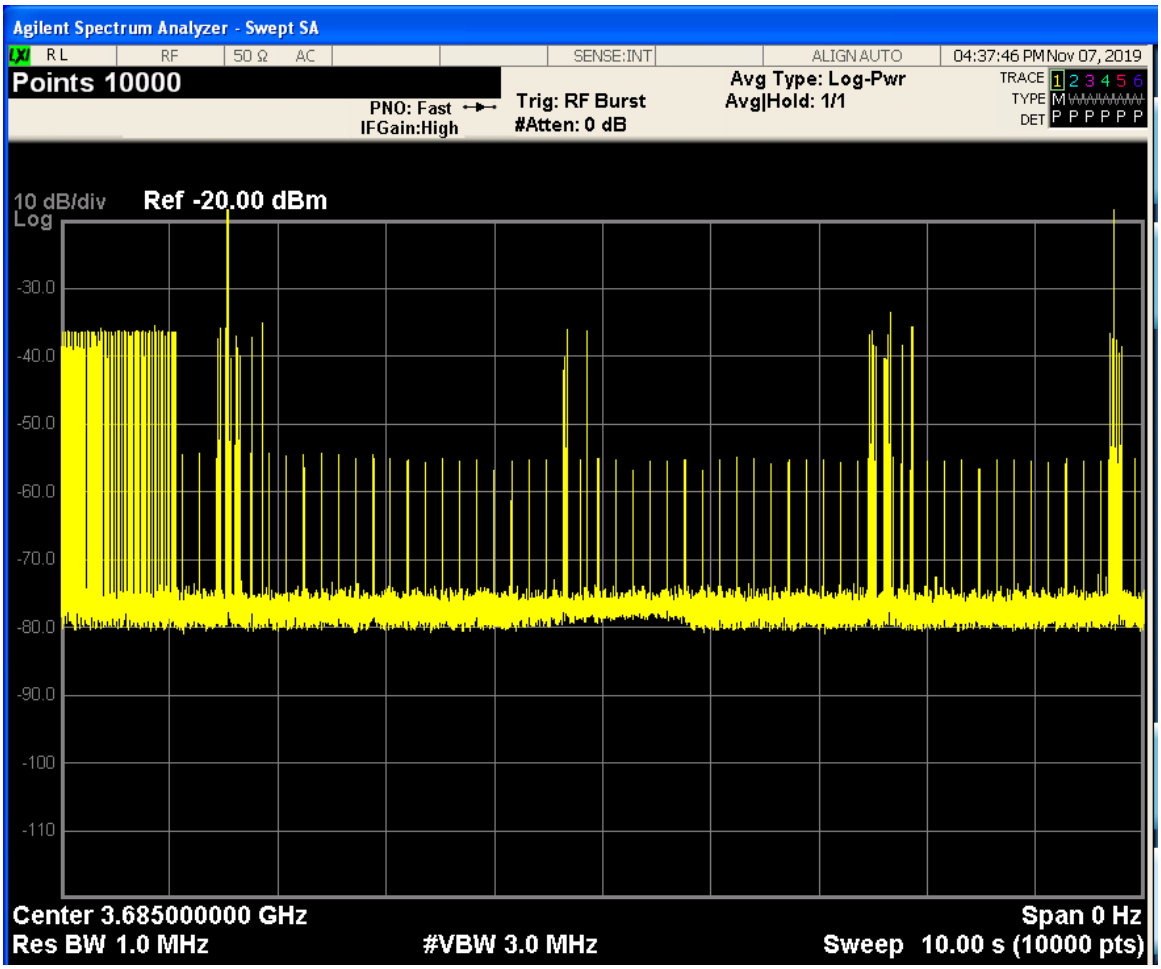


Capture showing DUT using 10MHz Channel Bandwidth at 3685MHz frequency.

2. CPE.KDB.4: Results for CPE-CBSD transmission duty cycle without grant

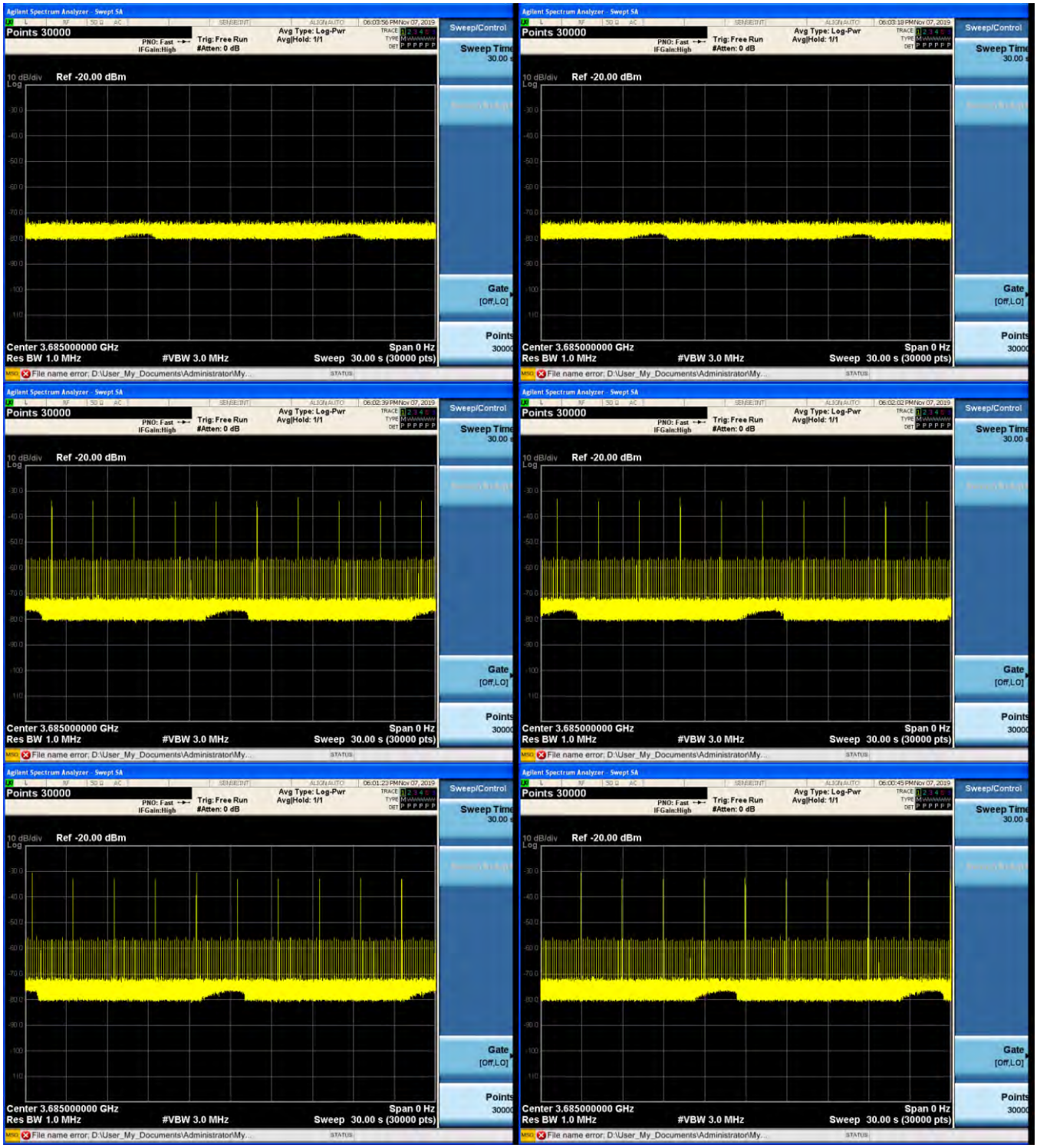
Time Period (s)	Time Limit (s)	DUT Tx Duration Measured (s)	Result
10	1	0.34	PASS
300	10	3.41	PASS
3600	20	17.38	PASS

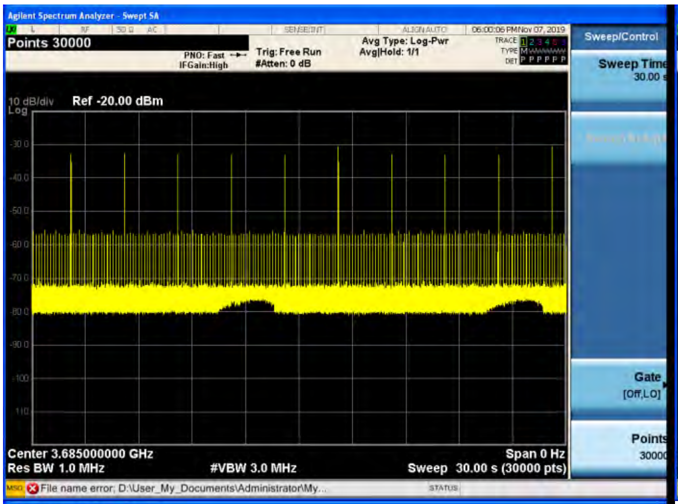
2.1. 1 seconds within 10 second period



2.2. 10 seconds within 300 second period

Note: The 300-period test was measured by doing 10 consecutive automatic sweeps of 30seconds. The value reported is the aggregated time of all the sweeps where signal was detected by the signal analyzer

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Trig: Free Run
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Avg Type: Log-Pwr
Avg|Hold: 1/1
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 30.00 s (30000 pts)
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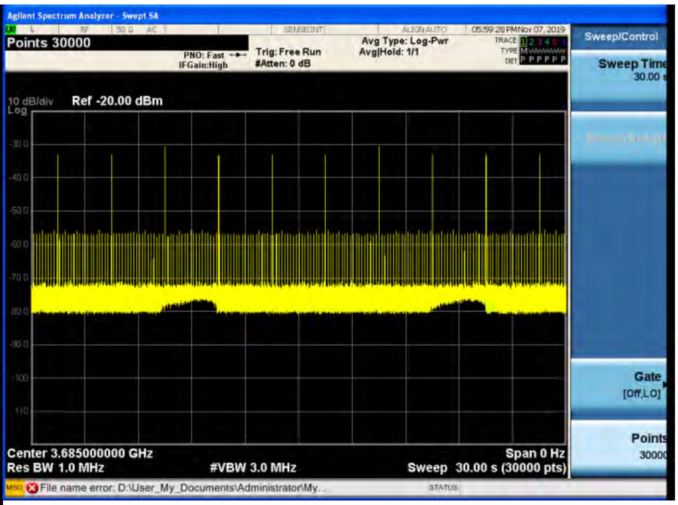
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Ref -20.00 dBm
Gate
[Off,LO]
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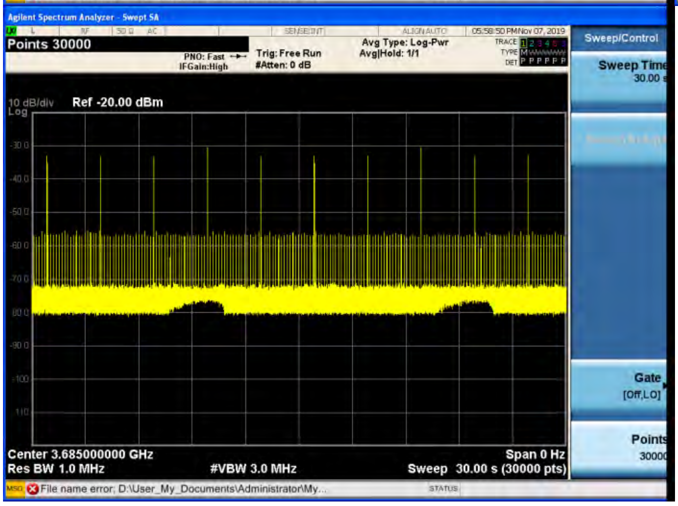
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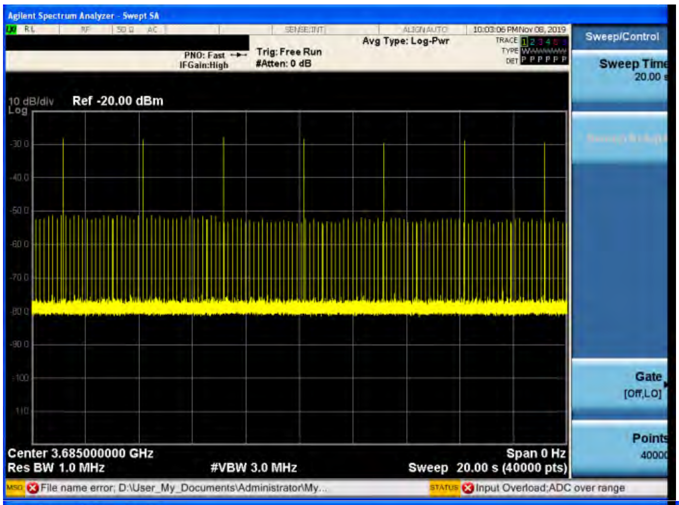
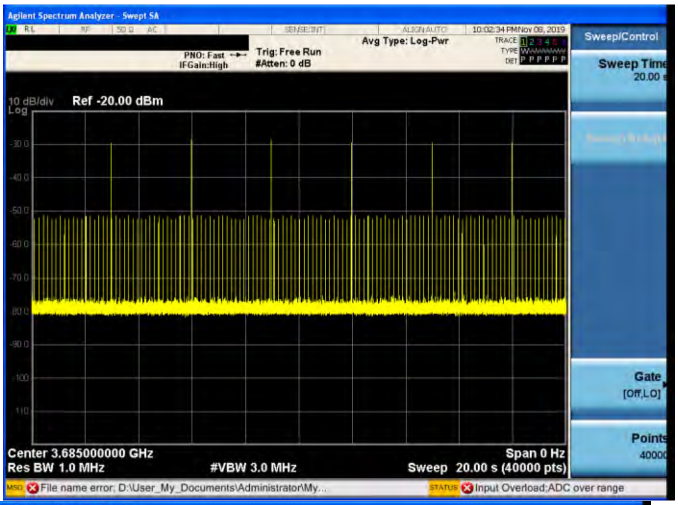
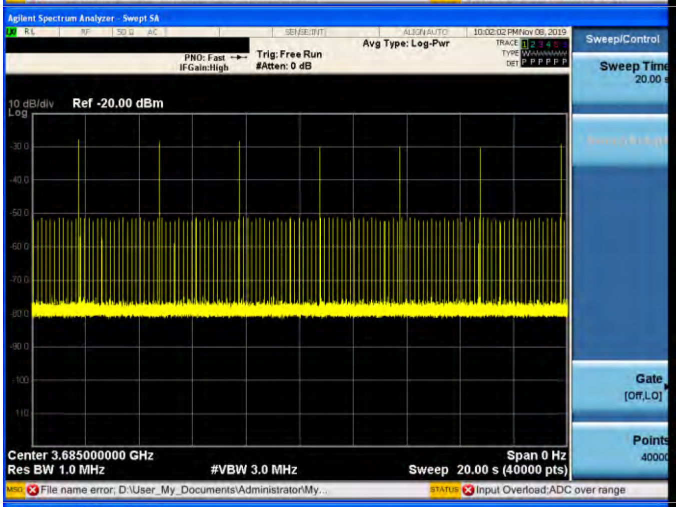
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 30.00 s (30000 pts)
File name error: D:\User_My_Documents\Administrator\My...

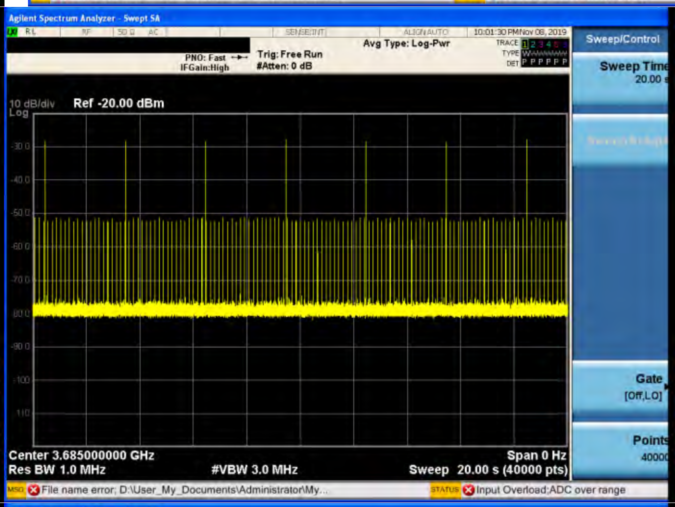
2.3. 20 seconds within 3600 second period

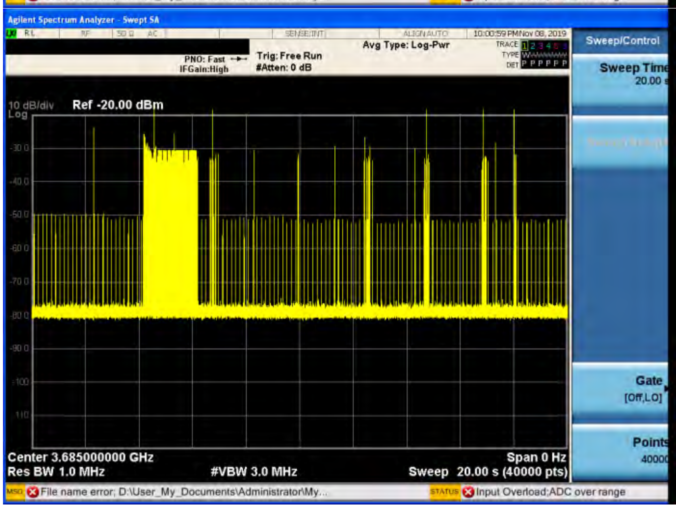
Note: The 3600-period test was measured by doing 180 consecutive automatic sweeps of 20seconds and 40000 points with a measurement time resolution of 0.5ms . The value reported is the aggregated time of all the sweeps where signal was detected by the signal analyzer

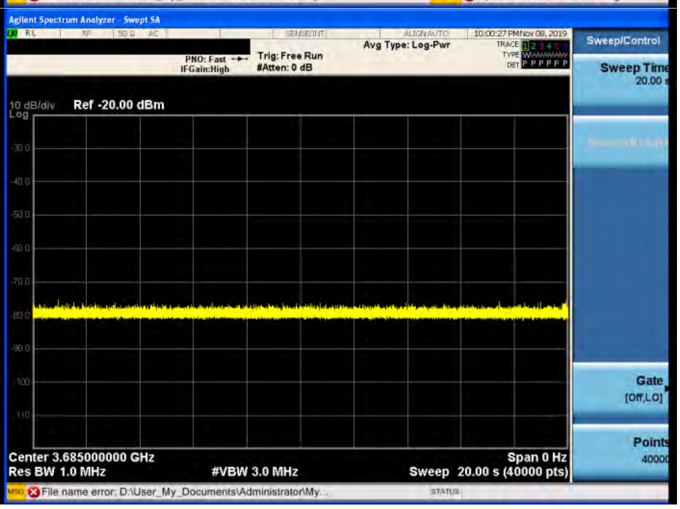










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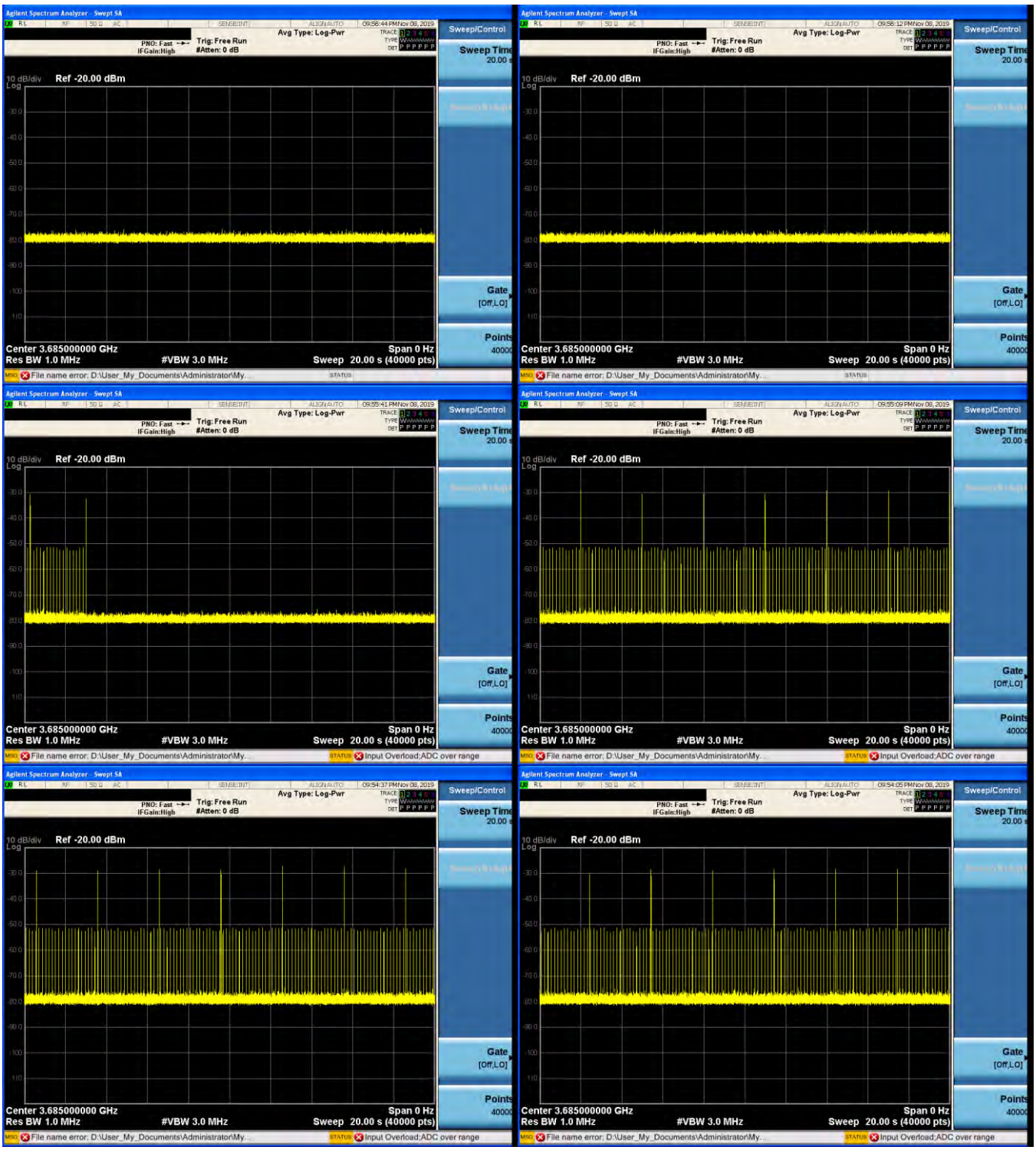
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Input Overload;ADC over range


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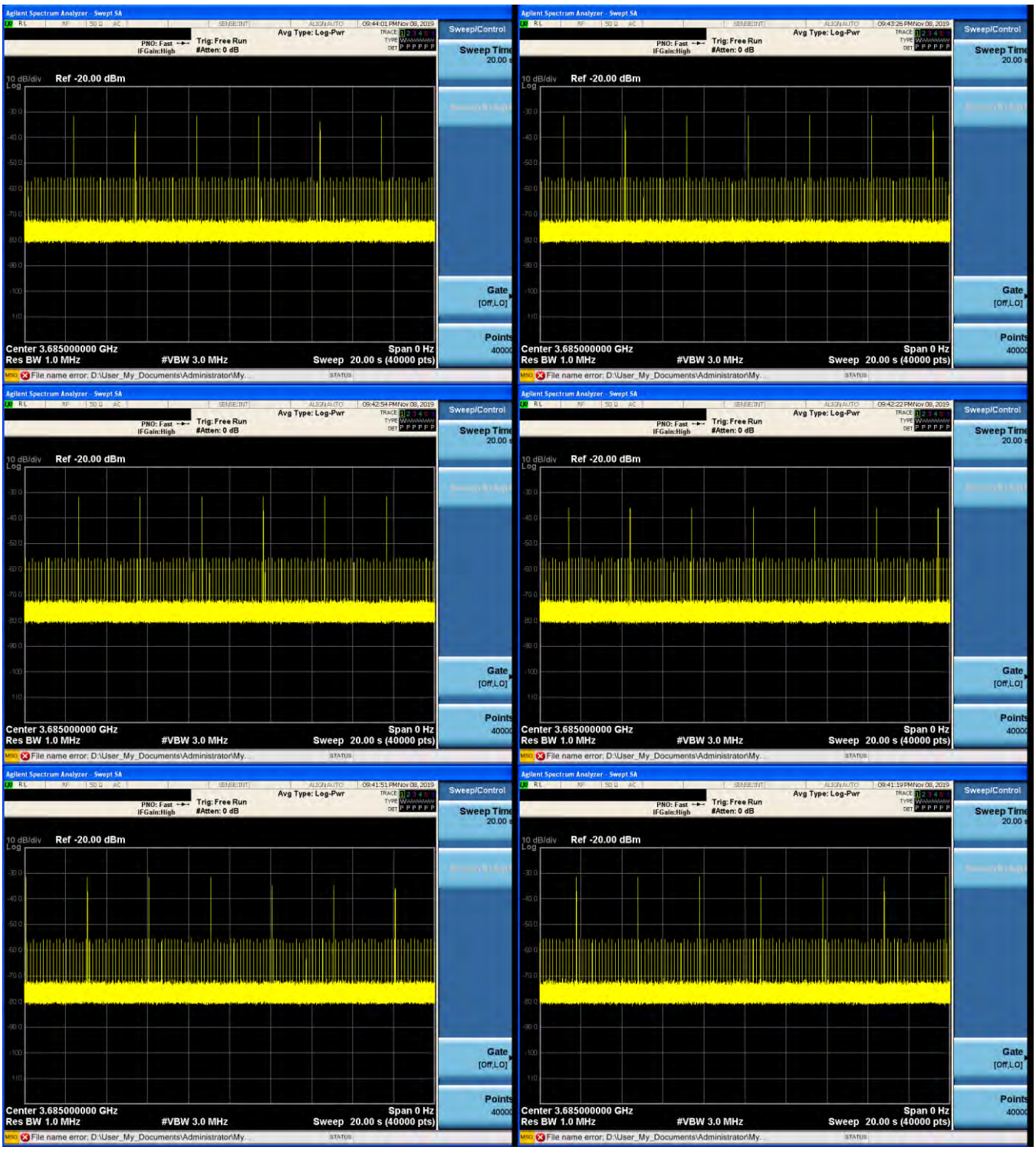
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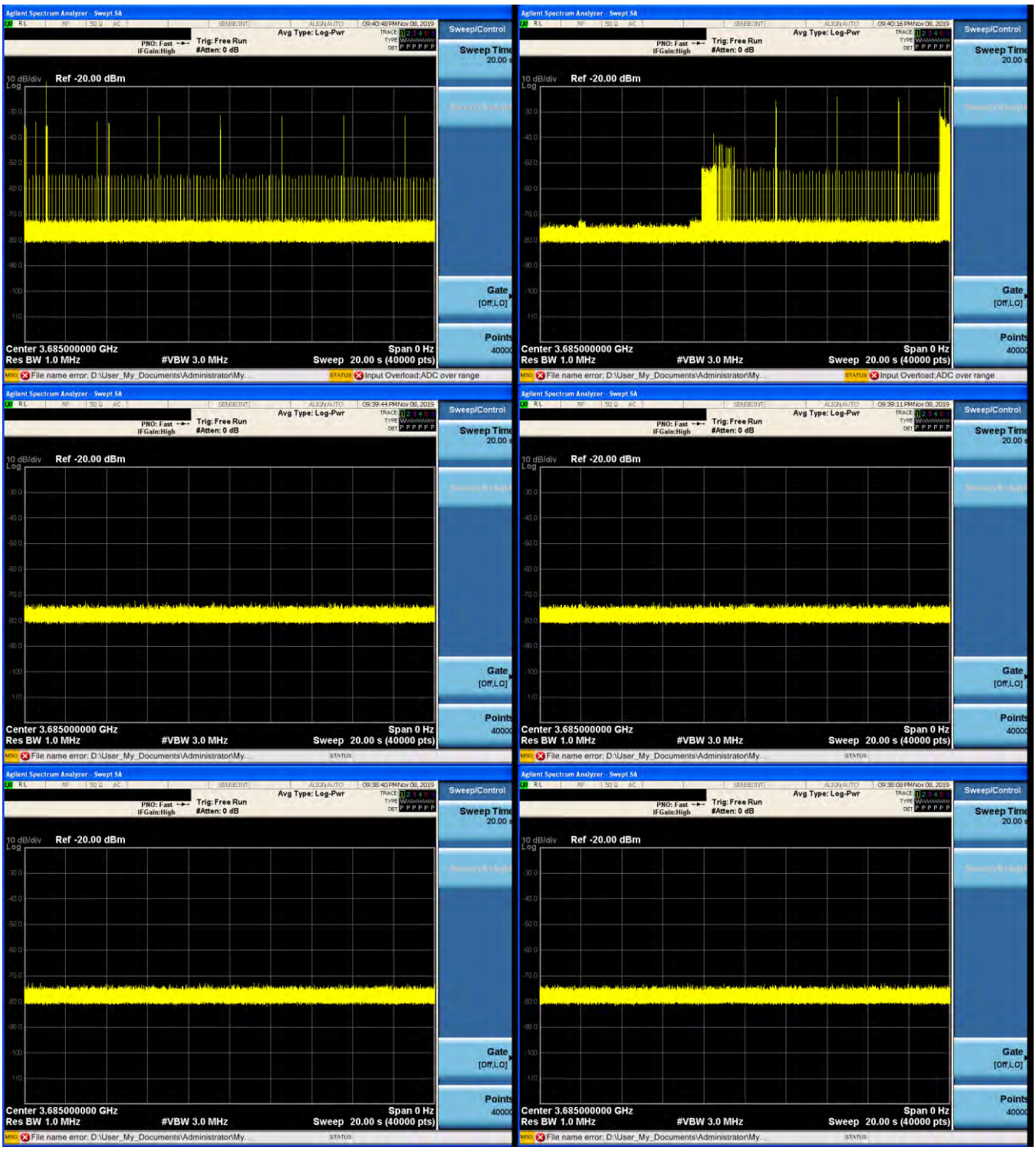
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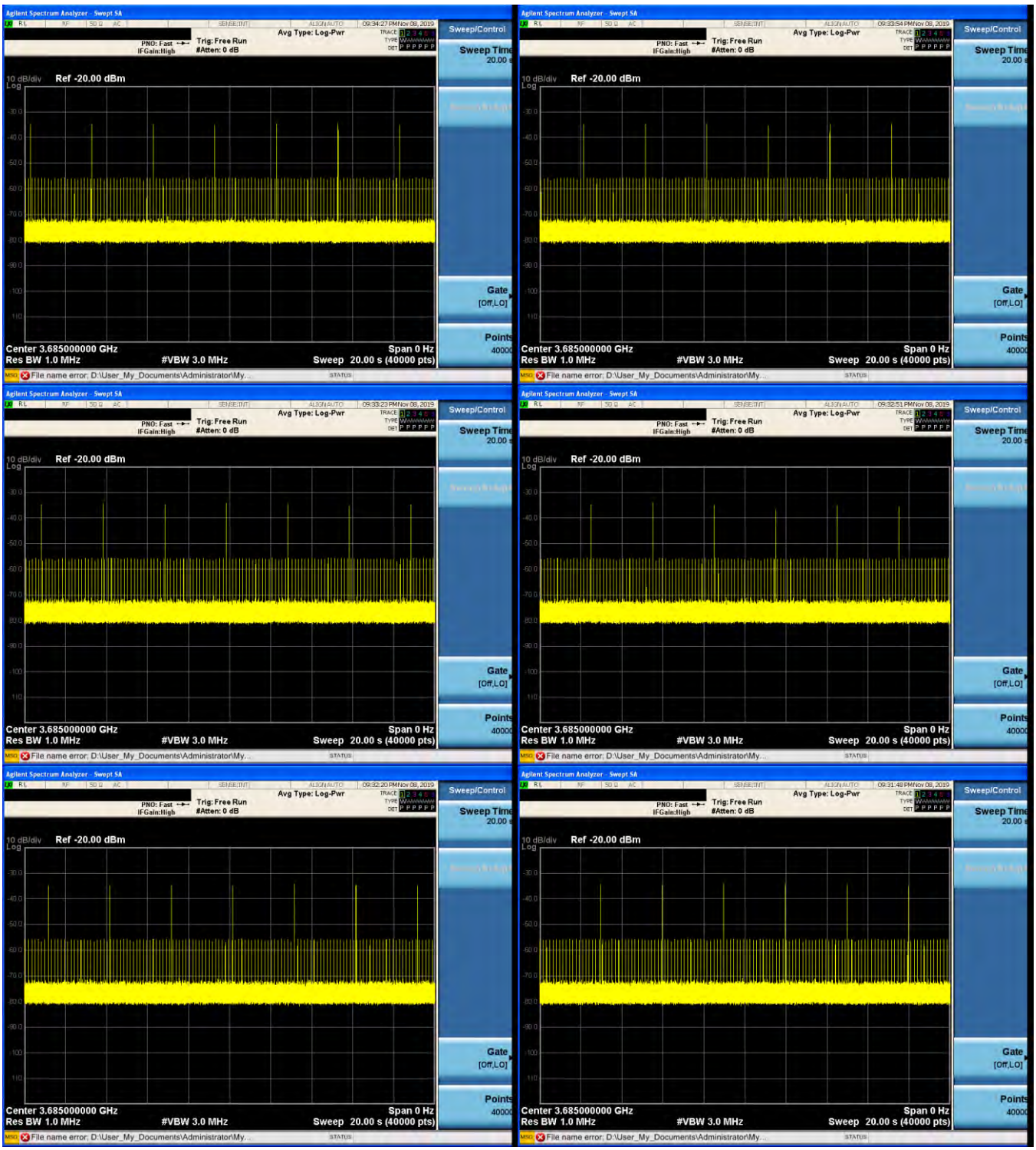
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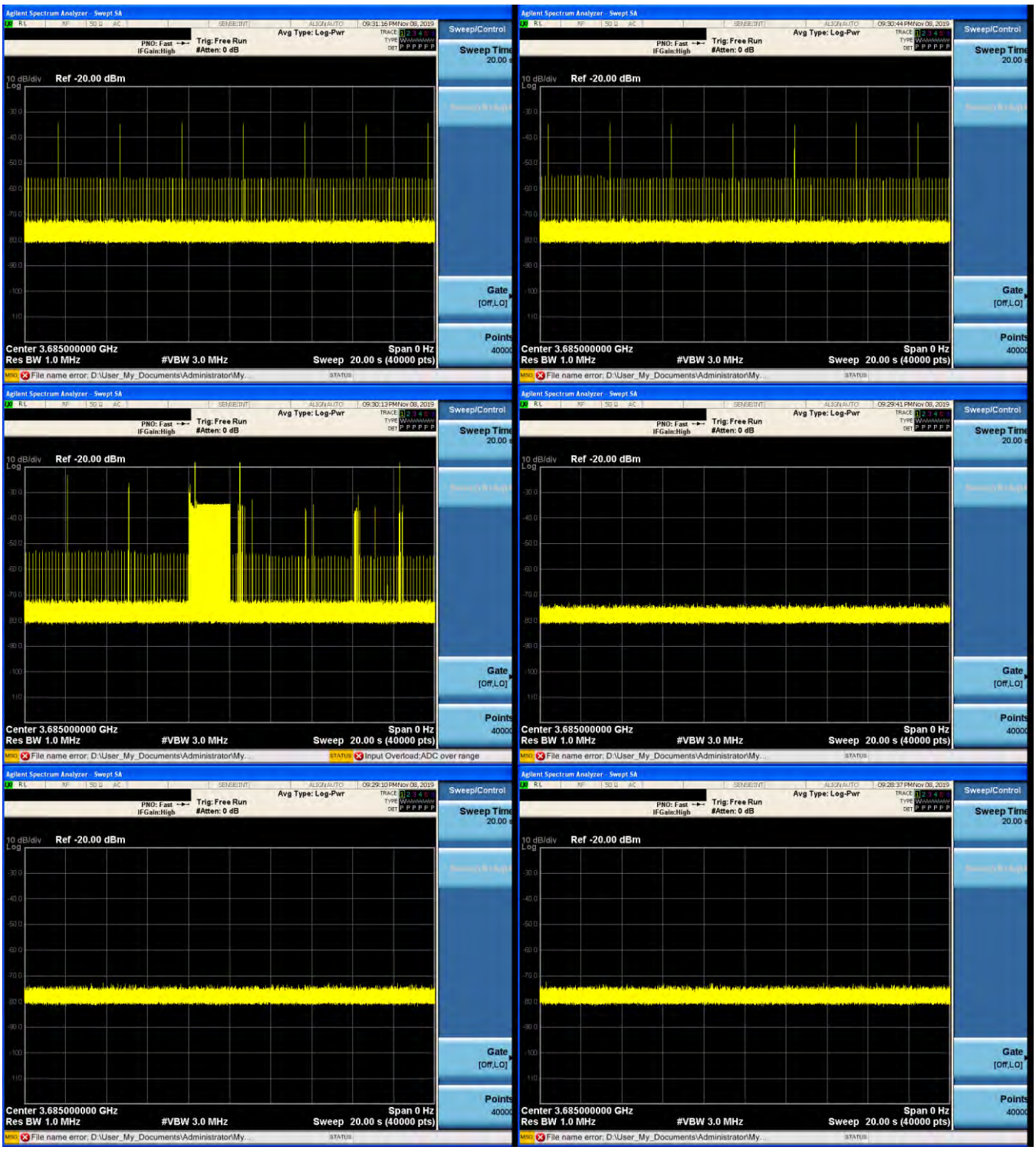
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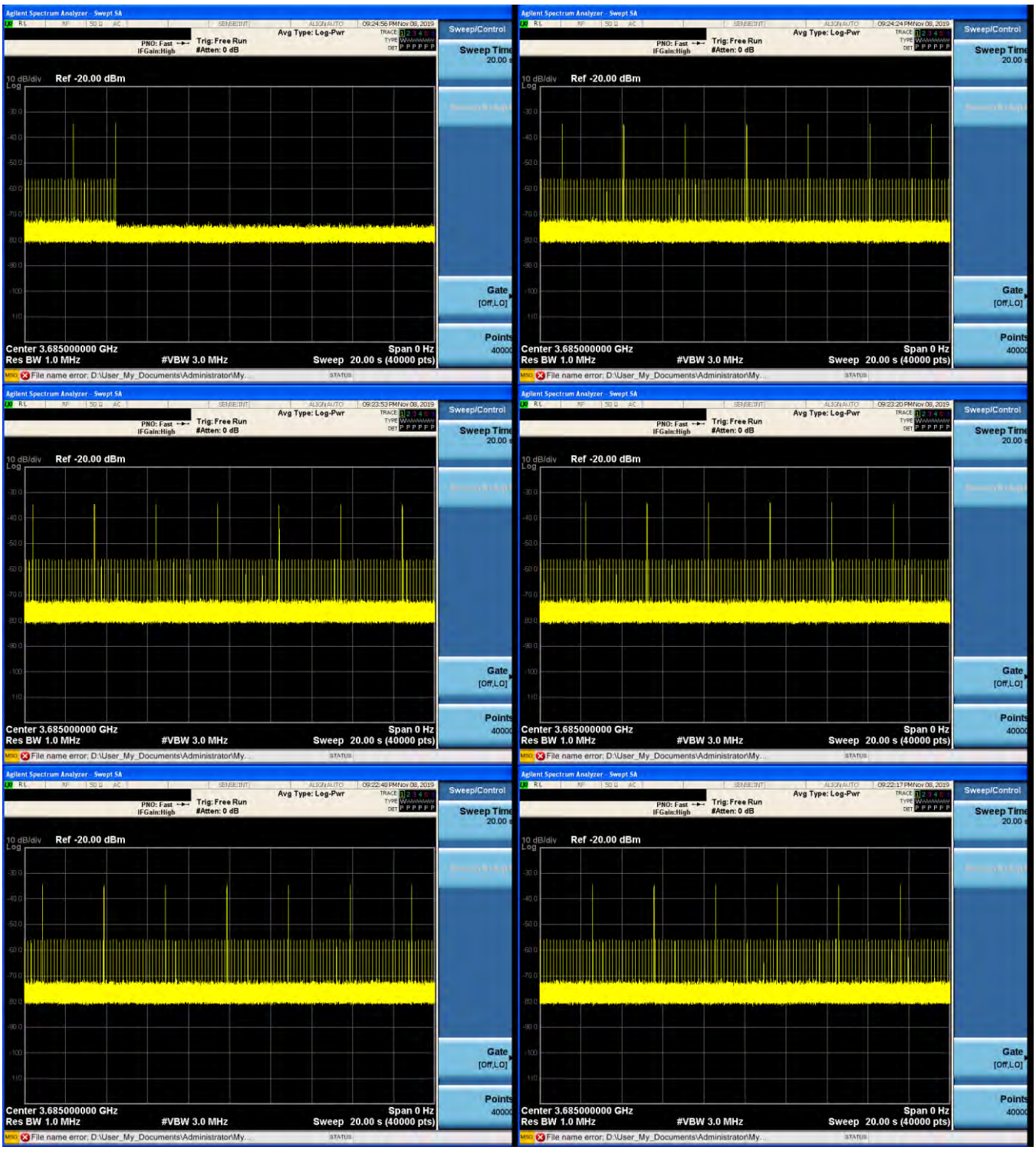
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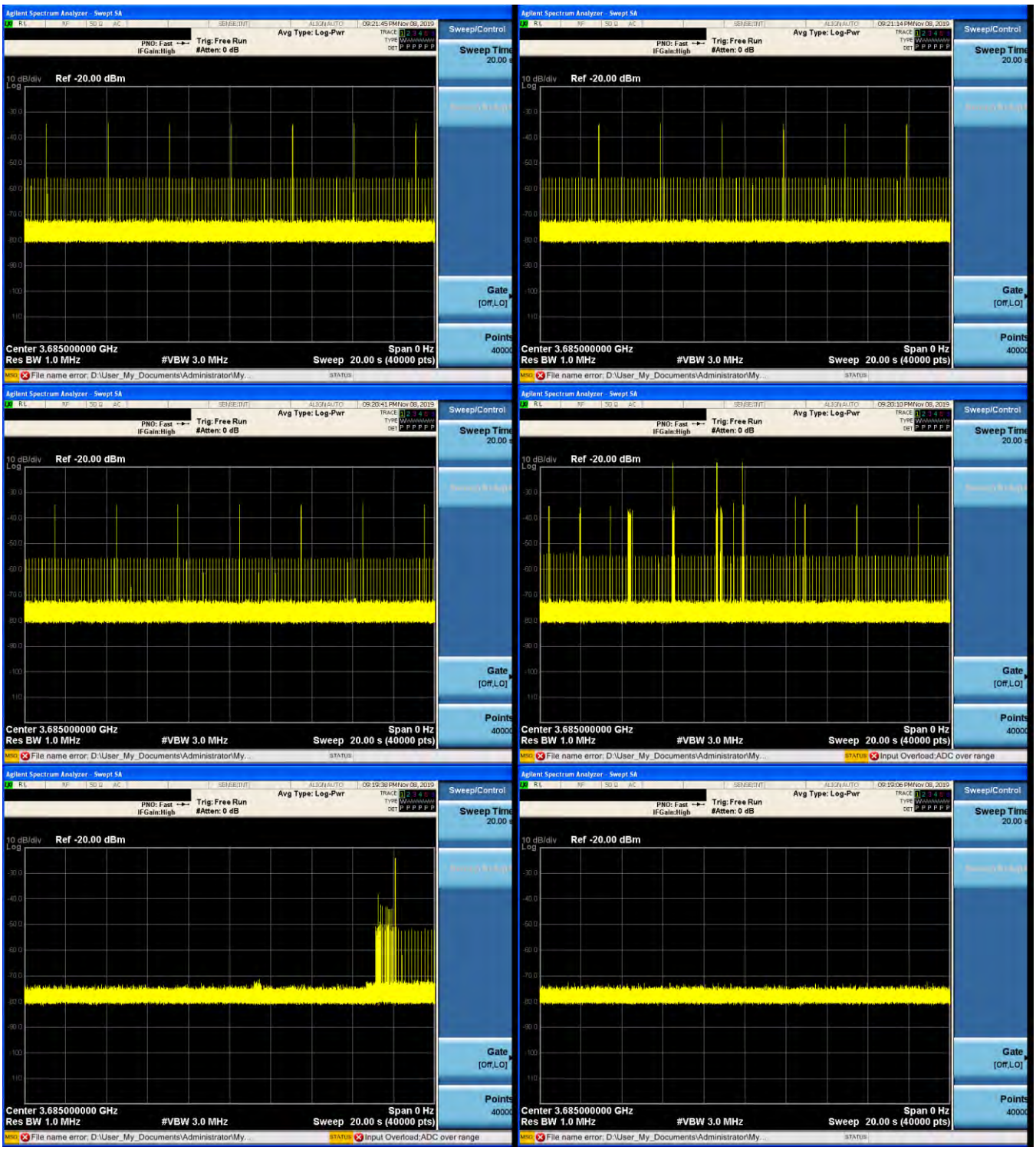
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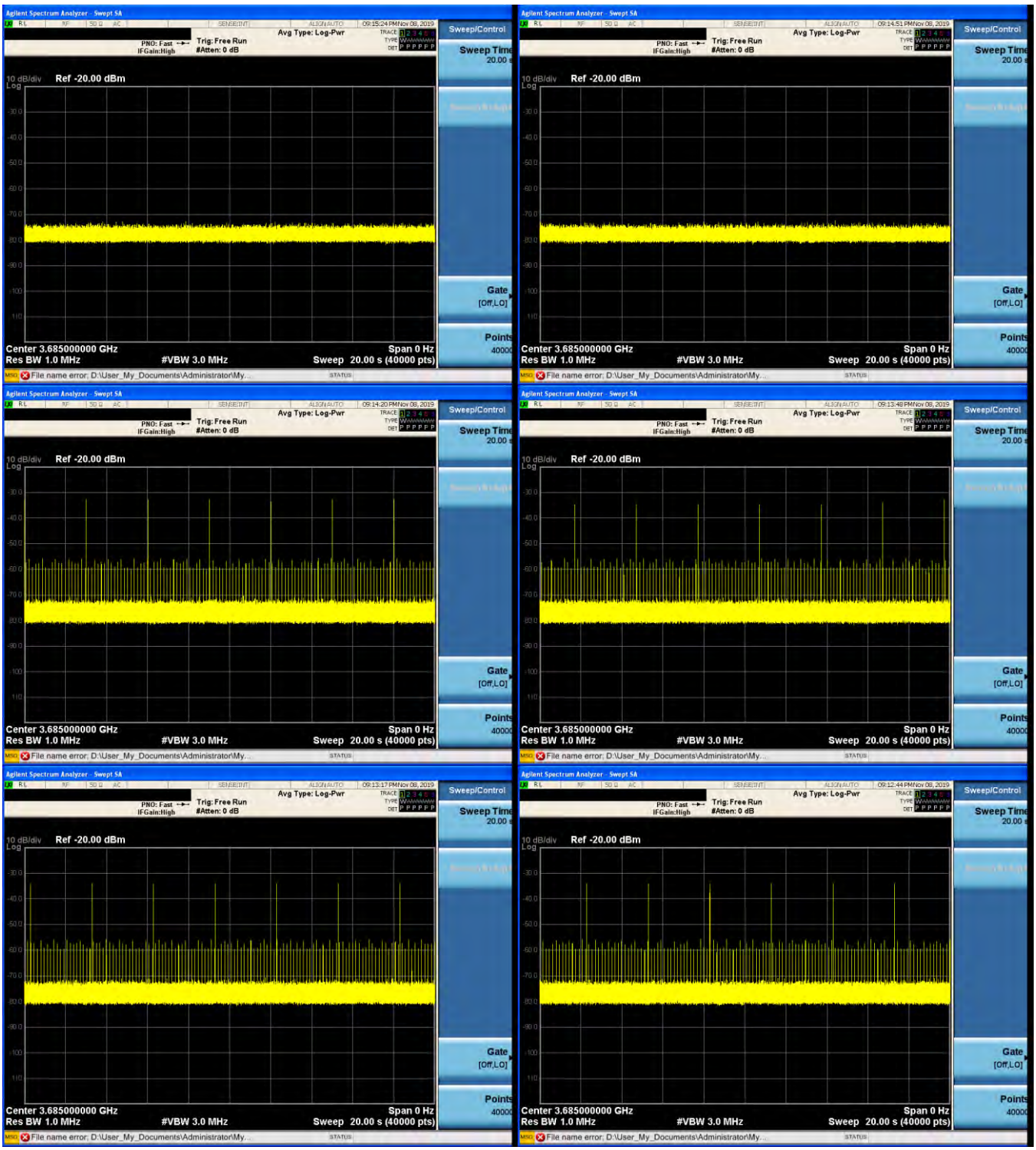
Gate
Points
File name error; D:\User_My_Documents\Administrator\My...
Input Overload;ADC over range


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points
File name error; D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
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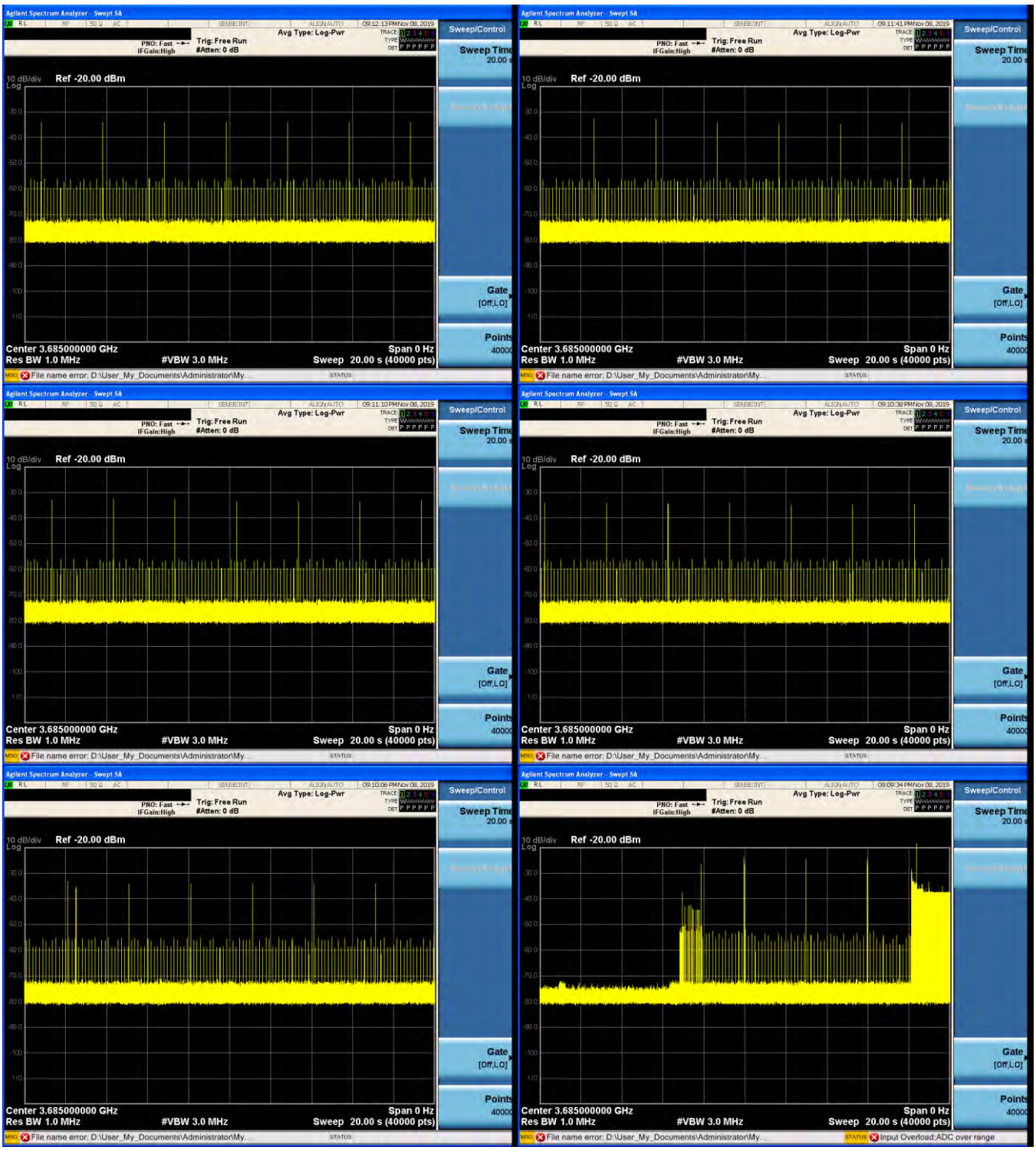
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points
File name error; D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
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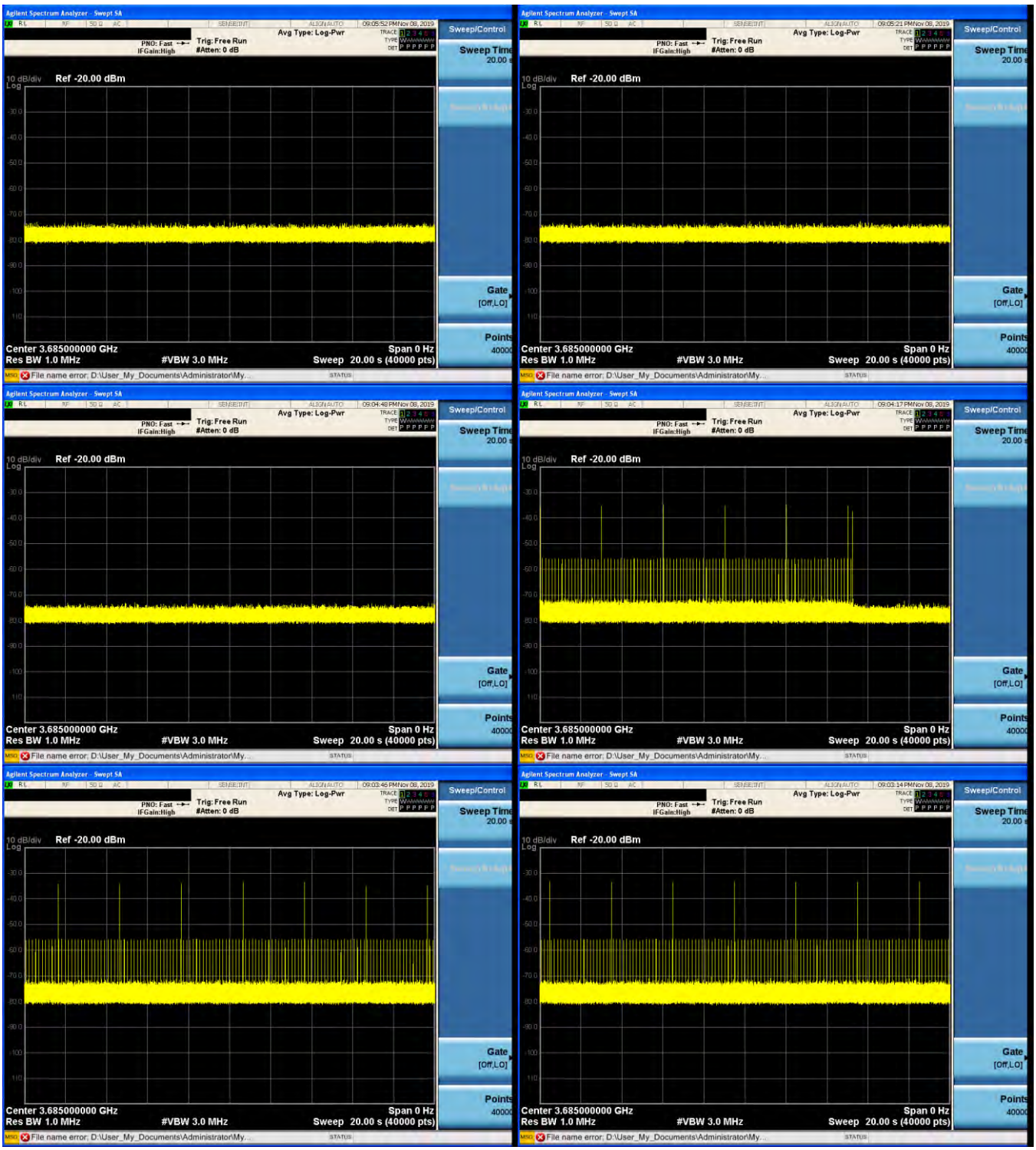
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points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Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
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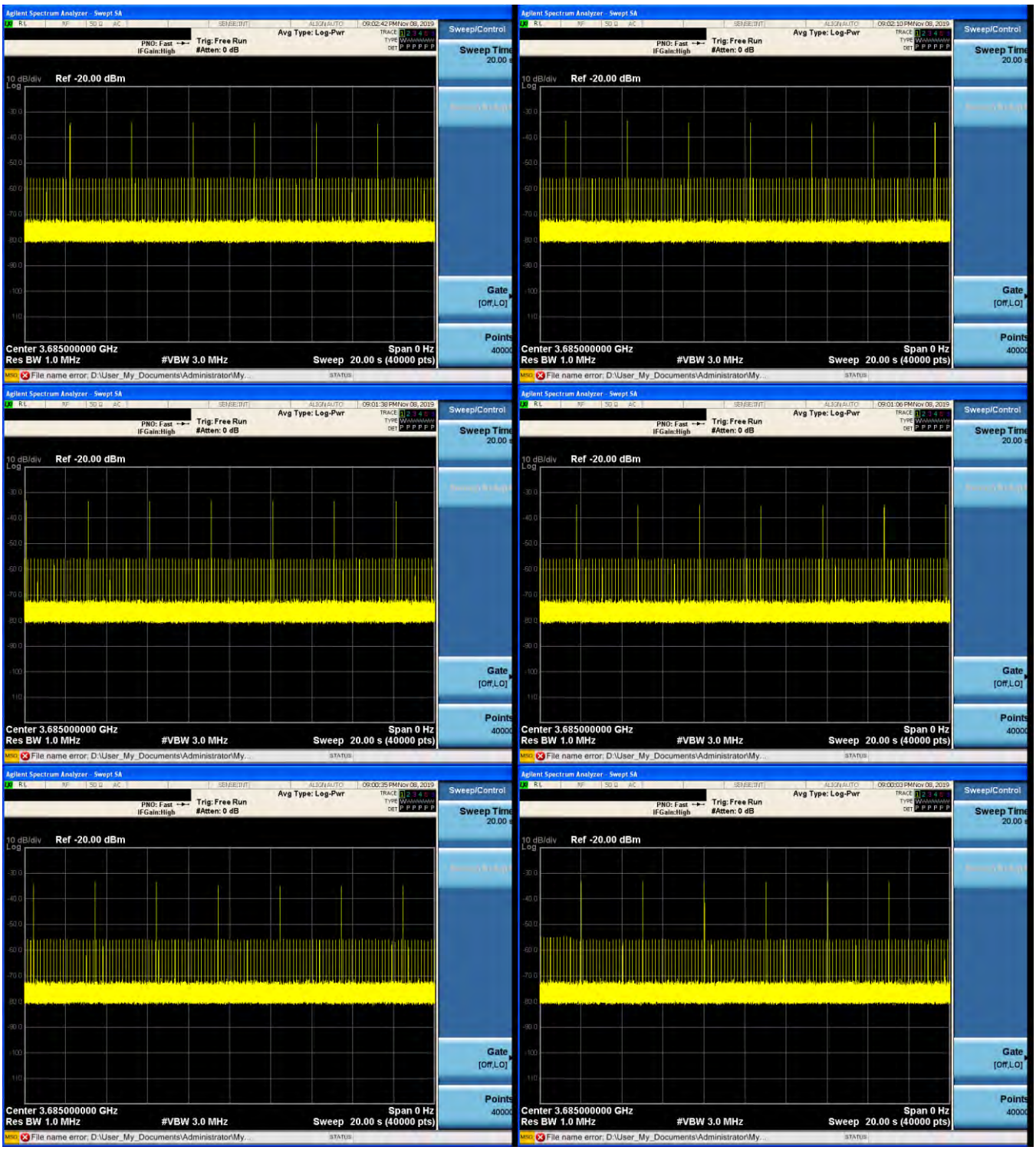
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
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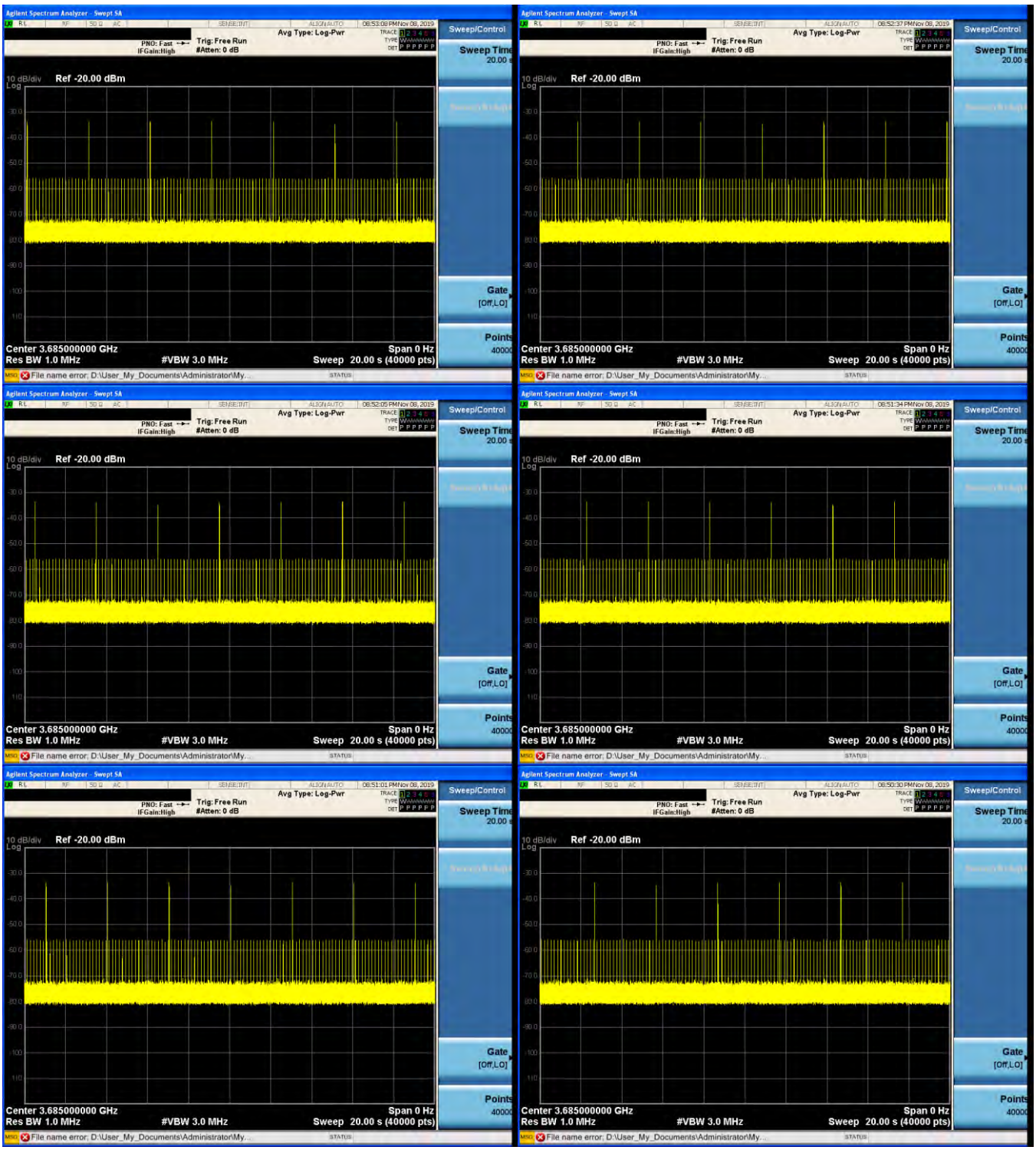
Sweep/Control
Gate
Points
File name error; D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
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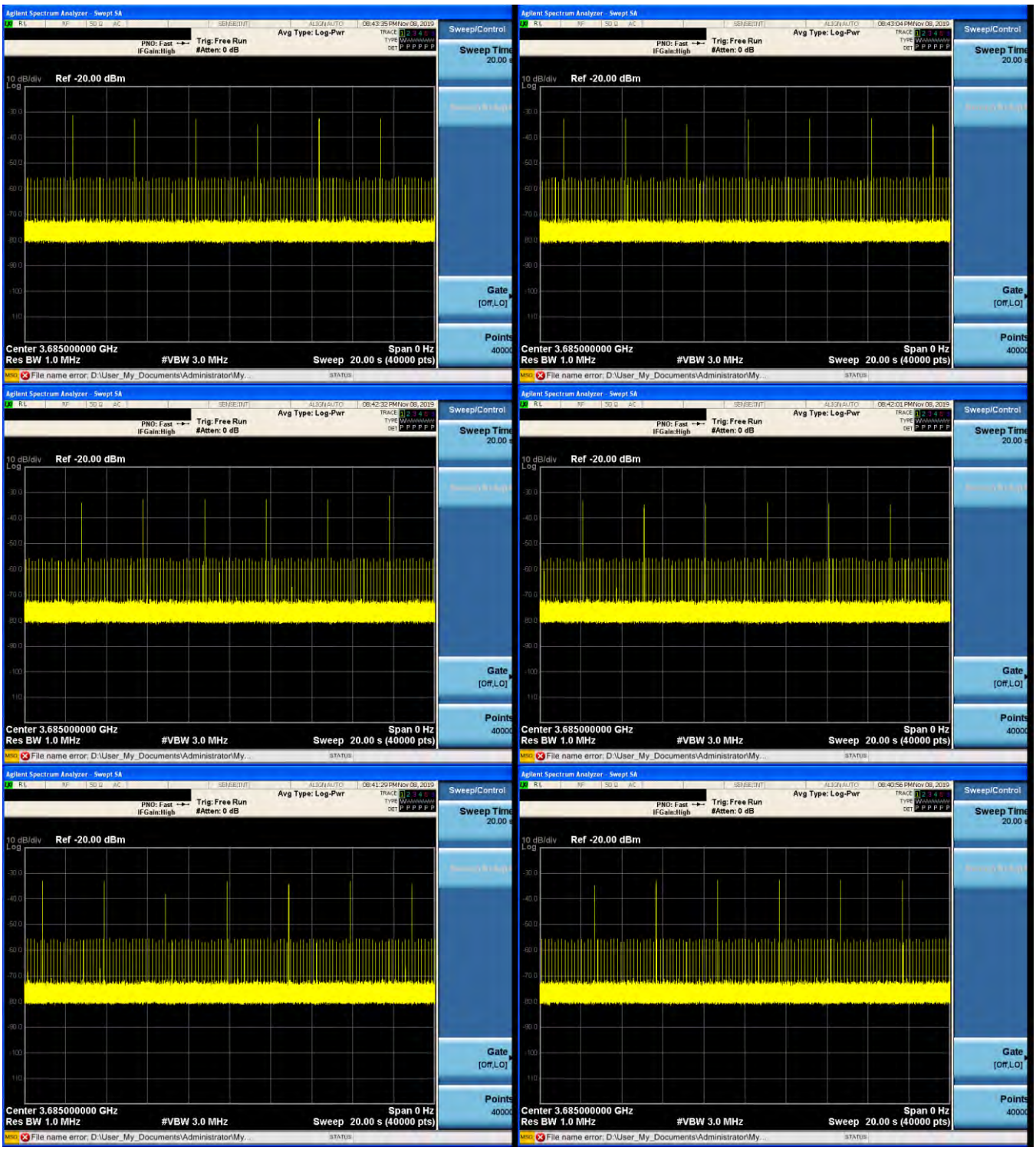
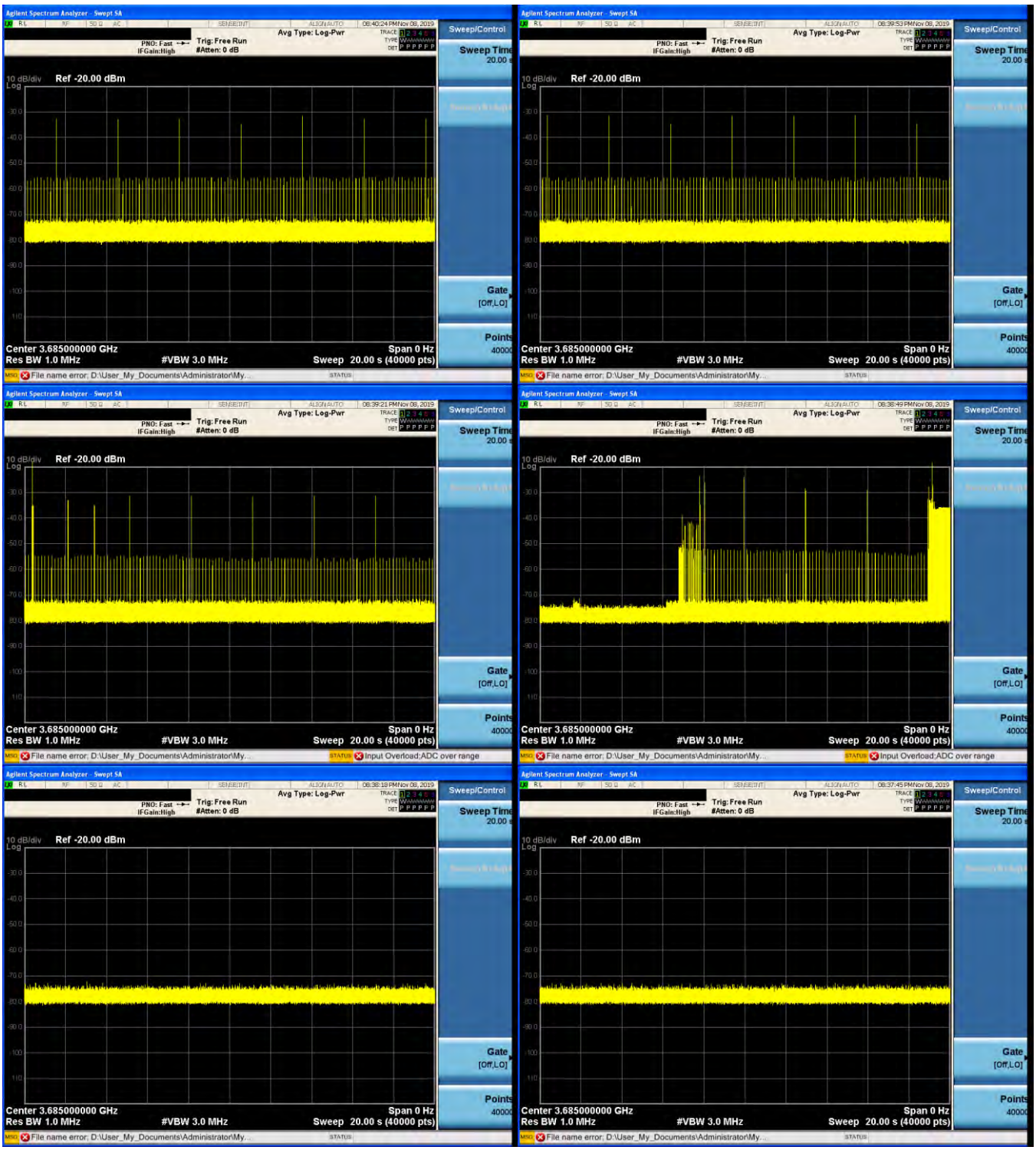
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points


Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
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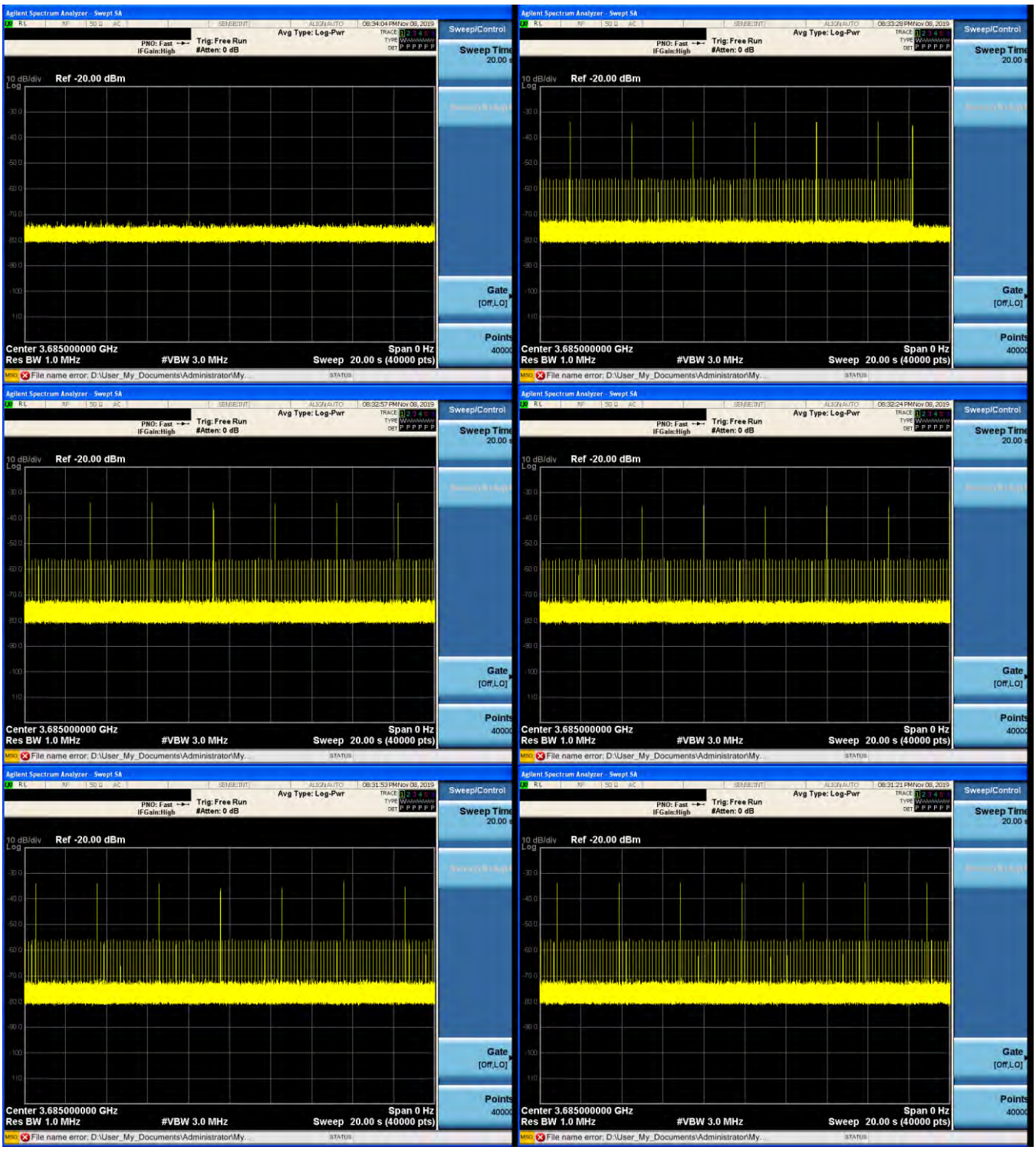
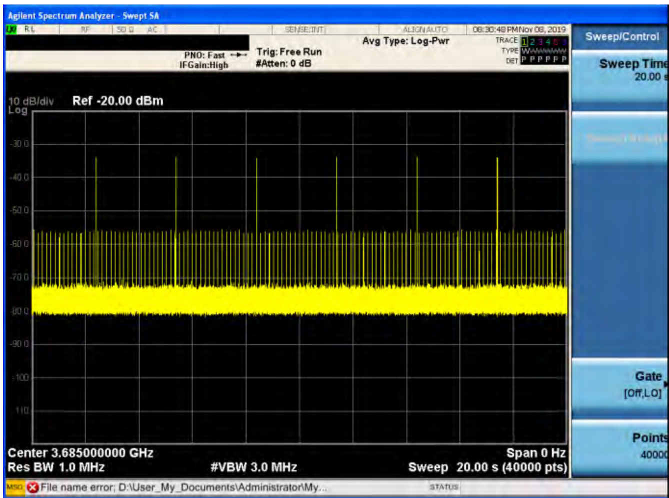
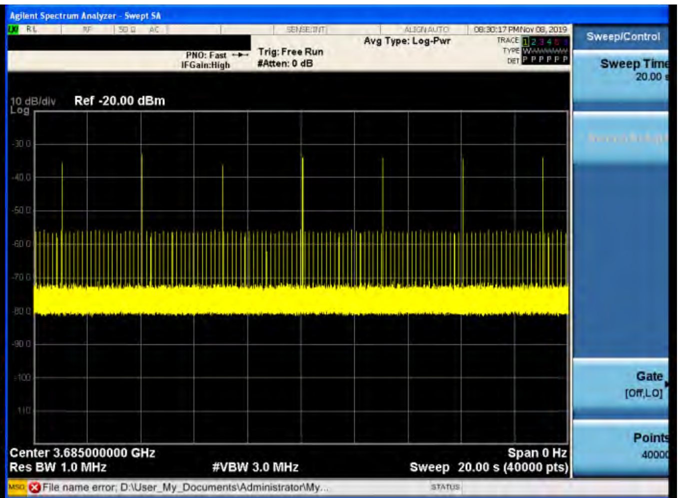
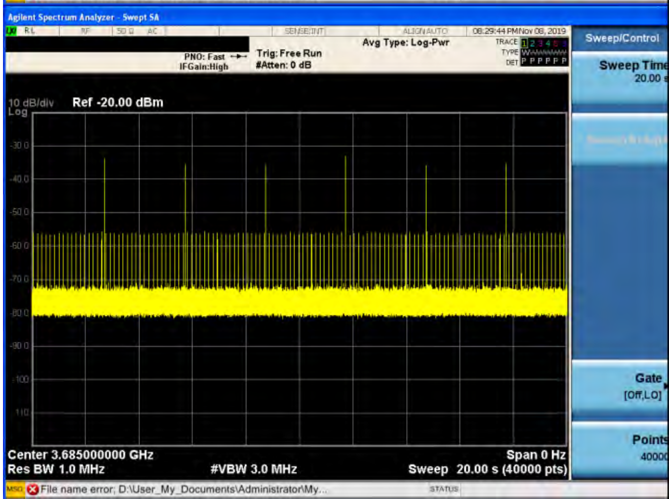
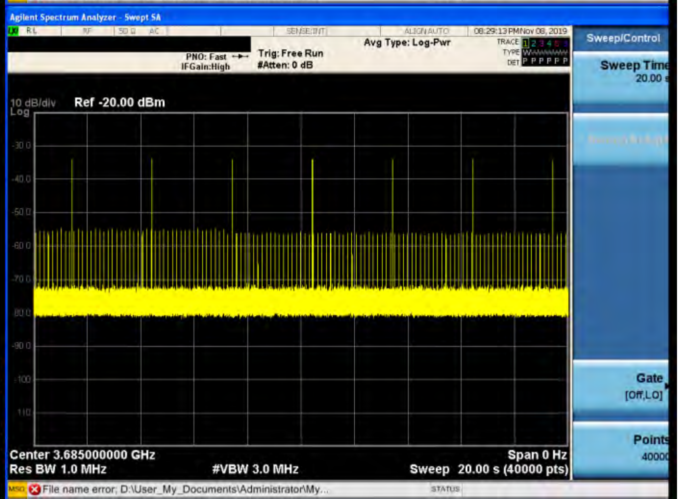
Sweep/Control
Gate
Points
File name error; D:\User_My_Documents\Administrator\My...

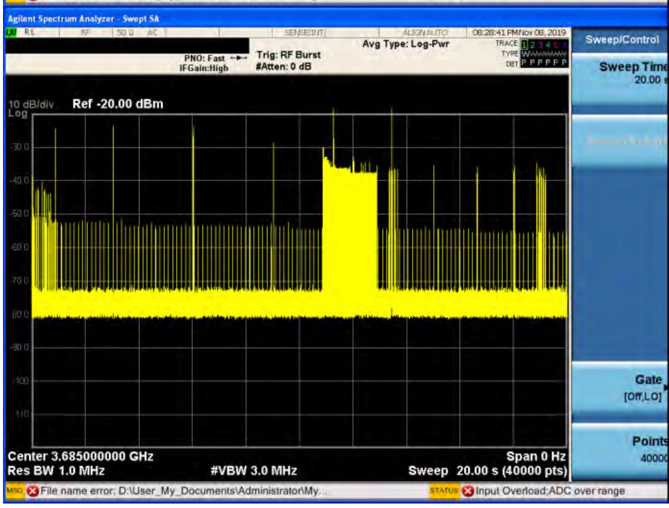

Agilent Spectrum Analyzer - Swept SA
Avg Type: Log-Pwr
Trig: Free Run
#Atten: 0 dB
10 dB/div
Ref -20.00 dBm
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
Sweep/Control
Gate
Points

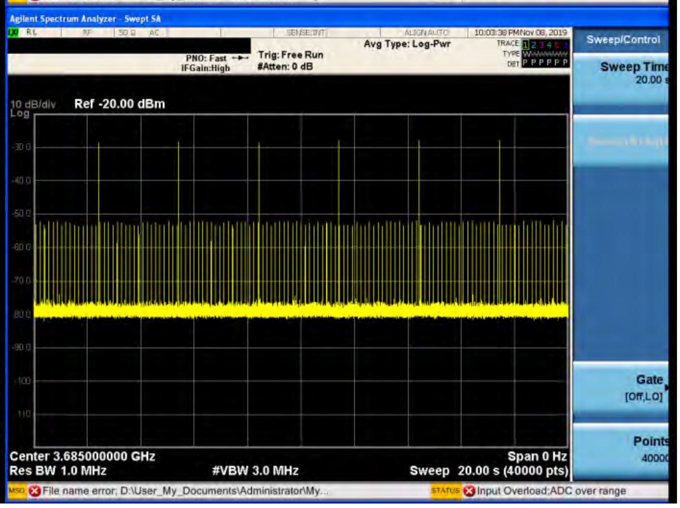

Agilent Spectrum Analyzer - Swept SA
08:30:48 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
08:30:17 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
08:29:44 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
08:29:13 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...


Agilent Spectrum Analyzer - Swept SA
08:28:41 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: RF Burst
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...
Input Overload;ADC over range


Agilent Spectrum Analyzer - Swept SA
10:03:38 PM Nov 08, 2019
Avg Type: Log-Pwr
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Sweep/Control
Sweep Time
10 dB/div
Ref -20.00 dBm
Gate
[Off,LO]
Points
Center 3.685000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 s (40000 pts)
File name error: D:\User_My_Documents\Administrator\My...
Input Overload;ADC over range

3. CPE.KDB.7: Verify CPE-CBSD can register with SAS with transmit power below 23dBm EIRP

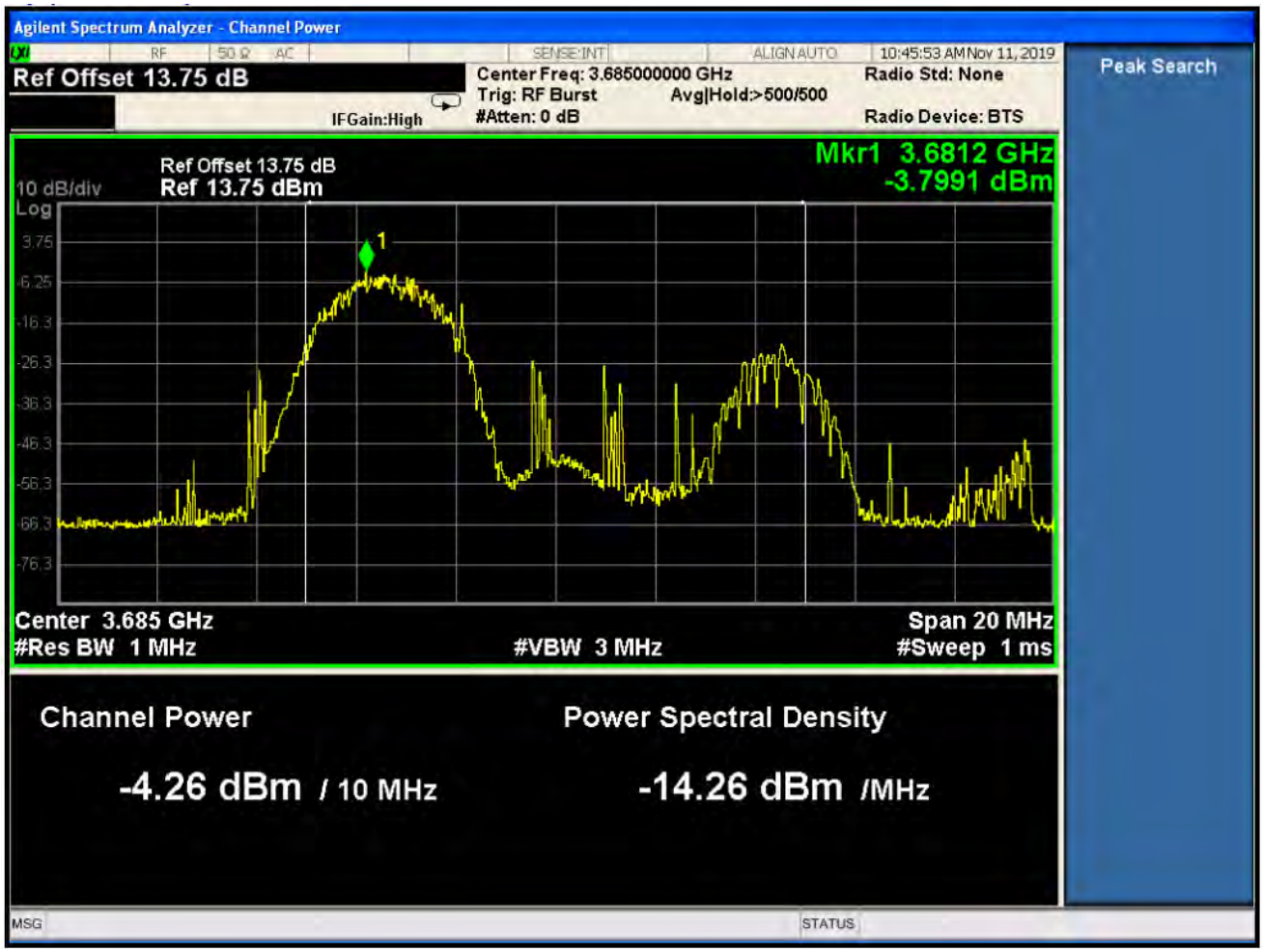


Figure CPE.KDB.7 A: MaxHold trace capture during registration and grant request procedure. This plot shows that the CPE-CBSD was able to register with test-SAS and obtain a grant operating at transmit power below 23dBm/10MHz EIRP.

MaxHold transmit power measured while obtaining grant is 10.74dBm/10MHz EIRP

Peak Power Spectral Density EIRP detected during grant request procedure was 11.20 dBm/MHz EIRP

Notes

Peak PSD EIRP (dBm/MHz) = Antenna Gain (15dB) + Conducted Peak PSD (-3.7991 dBm/MHz)

Transmit power EIRP (dBm/10MHz) = Antenna Gain (15dB) + Conducted Channel Power (-4.26 dBm/10MHz)

RF Path loss = 13.75dB (Already considered in rf equipment measurement)

Figure CPE.KDB.7 B: CPE-CBSD EIRP transmit channel power measurement after CPE-CBSD has obtained a grant from test SAS and it is fully utilizing the channel with user data traffic. This plot shows CPE-CBSD obtains connection and can operate at below 23dBm/10MHz EIRP

Measured CPE-CBSD transmit power is 10.27 (dBm/10MHz) EIRP

Note: Channel Power calculated as:

EIRP (dBm/10MHz) = Antenna Gain (15dB) + Conducted Tx. Power (-4.73 dBm/10 MHz)

RF Path loss = 13.75dB (Already considered in rf equipment measurement)