TEST REPORT

Applicant Name :	Sichuan Wanbo Runda Trading Co., Ltd.
Address :	No. 1713, 17F., Unit 3, Bldg. 3, No. 1700, North Tianfu Ave., Chengdu, P.C.R.
Report Number :	XMTN2220826-38799E-RF-00
FCC ID:	2A8ER-HG5B-US20I

Test Standard (s)

FCC PART 20.21

Sample Description

Product Type:	Cellphone Signal Amplifier
Model No.:	HG5B-US20
Multiple Model(s) No.:	HG5B-US20I,HG5B-US15,HG5B-US15I
Trade Mark:	N/A
Date Received:	2022/08/26
Report Date:	2023/03/14

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Roger Ling
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	XMTN2220826-38799E-RF-00	Original Report	2023/03/14

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product Type	Cellphone Signal Amplifier
Model No	HG5B-US20
Multiple Model(s) No	HG5B-US20I,HG5B-US15,HG5B-US15I(The customer declares that there is no difference in the product, and the model is different based on the difference in different markets or dealers, the details please see the DoS)
Voltage Range	DC 12V from adapter
Sample serial number	XMTN2220826-38799E-RF-S1 (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: BSG-1203000US Input: AC 100-240V, 50/60Hz, 0.8A Max Output: DC 12.0V, 3.0A

This device is a fixed wideband consumer and the Booster Operating frequency bands list below:

Electrical specification	Uplink	Downlink
Frequency Range	704 ～ 716MHz 777 ～ 787MHz 824 ～ 849 MHz 1850 ～ 1910MHz 1710 ～ 1755MHz	734 ～ 746MHz 746 ～ 756MHz 869 ～ 894 MHz 1930 ～ 1990MHz 2110 ～ 2155MHz

Objective

This test report is in accordance with Part 2, Part 20.21 and Part 22, Part 24, Part 27 of the Federal Communication Commissions rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Applicable Standards: KDB 935210 D03 Cellphone Signal Amplifier Measurements v04r04.
ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Audio Frequency Response		0.1dB
Low Pass Filter Response		1.2dB
Modulation Limiting		1%
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

Antenna kitting requirement: EUT has some antennas kitting for marketing, the antenna gain and cable loss for varies band were listed below, fulfill the requirement of FCC Part 20.21(e)(8)(i)(G), more detail information please refer to the user manuals.

Outdoor antenna kitting:

Frequency Range (MHz)	Yagi antenna (HG-1005) (dBi)	Omni antenna (HG-0727R5) (dBi)	50ft Cable loss (dB)
704-716	7.5	2	3.2
777-787	7.5	2	3.4
824-849	8	2	3.5
1850-1910	9	5	5.7
1710-1755	9	5	5.4

Indoor antenna kitting:

Frequency Range (MHz)	Panel antenna (HG-1003) (dBi)	Omni antenna (HG-38103) (dBi)	Built-in antenna (PFZZ-3011) (dBi)	30 feet Cable loss (dB)	50 feet Cable loss (dB)	2 inches Cable loss (dB)	Splitter (dB)
734-746	6.5	2.2	4	1.9	3.2	0.5	3.5
746-756	6.5	2.2	4	2.0	3.3	0.5	3.5
869-894	7.0	3.5	5	2.2	3.6	0.5	3.5
1930-1990	9.0	4.5	6	3.5	5.9	0.5	3.5
2110-2155	9.0	4.5	6	3.8	6.3	0.5	3.5

Note 1: The device has a built-in antenna, but it's not connect to PCB, when wanted to use this antenna, connect the service port and the ANT port use the 2 inches cable
Note 2: The 30/50 feet cable is used for connect the panel antenna and Omni antenna.

The antenna gain and cable loss list above was provided by manufacturer.

According to the user manual, the device has below configurations:

Model Name		HG5B-US20I Standard	HG5B-US20 Extended	HG5B-US20 Enhancement	HG5B-US15I Standard	HG5B-US15 Extended
Model Booster		HG5B-US20I	HG5B-US20	HG5B-US20	HG5B-US15I	HG5B-US15
Coverage Size		4K-6K Sq. FT	6K-8K Sq. FT	8K-10K Sq. FT	1K-4K Sq. FT	4K-5K Sq. FT
Outdoor Antenna		Outdoor Wide-Band Directional Antenna (Yagi)			Omni Antenna	
Outdoor Cable		Low-loss Cable 50ft (Qty:1)				
Service antenna	Built-in Antenna	✔				
	Indoor Antenna	✘	Wide-Band Directional Panel Antenna (Qty:1)	Wide-Band Directional Panel Antenna(Qty:1) Omni Dome(Qty:1)	✘	Wide-Band Directional Panel Antenna(Qty:1)
Indoor Cable		✘	Low-loss Cable 30ft (Qty:1)	Low-loss Cable 30ft (Qty:1); 50ft (Qty:1)	✘	Low-loss Cable 30ft (Qty:1)
Splitter		✘	Qty:1	Qty:2	✘	Qty:1

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory was used.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

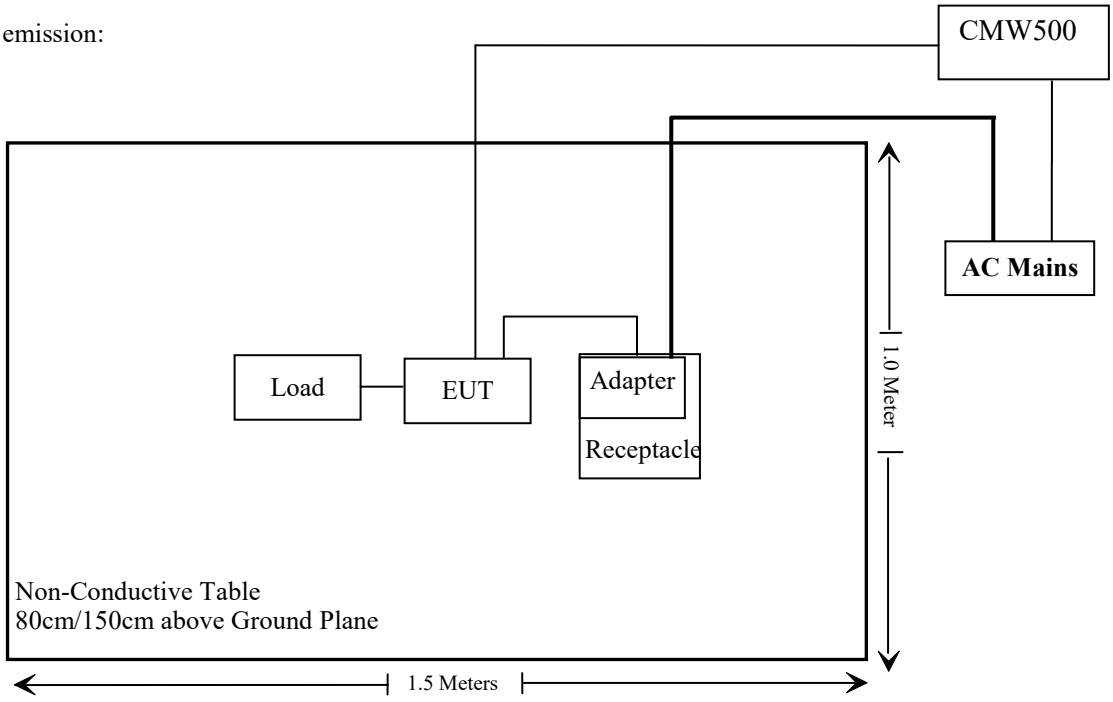
Manufacturer	Description	Model	Serial Number
Unknown	Load(50Ω)	Unknown	BACLload002
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606

External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-shielded Un-Detachable DC cable	1.2	Adapter	EUT
Shielded Detachable RF cable	5.0	CMW500	EUT
Shielded Detachable RF cable	1.0	EUT	Load

Block Diagram of Test Setup

Radiated emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§20.21(e)(3)	7.1 Authorized Frequency Band Verification	Compliant
§ 20.21(e)(8)(i)(D) § 20.21(e)(8)(i)(B) & §20.21(e)(4)	7.2 Maximum Power Measurement	Compliant
§ 20.21(e)(8)(i)(C)(2) § 20.21(e)(8)(i)(B) & §20.21(e)(4)	7.3 Maximum Booster Gain Computation	Compliant
§ 20.21(e)(8)(i)(B) § 20.21(e)(3)	7.13 Spectrum block filtering test procedure	Not applicable
§ 20.21(e)(8)(i)(F)	7.4 Intermodulation Product	Compliant
§ 20.21(e)(8)(i)(E)	7.5 Out Of Band Emissions	Compliant
§ 20.21(e)(8)(i)(A) § 20.21(e)(8)(i)(H) &§20.21(e)(4)	7.7 Noise Limits	Compliant
§ 20.21(e)(8)(i)(I) &§20.21(e)(4)	7.8 Uplink Inactivity	Compliant
§ 20.21(e)(8)(i)(C)(1) & § 20.21(e)(8)(i)(H)	7.9 Variable Booster Gain	Compliant
§ 2.1049	7.10 Occupied Bandwidth	Compliant
§ 20.21(e)(8)(ii)(A) &§20.21(e)(4)	7.11 Oscillation Detection	Compliant
§2.1051	7.6 Spurious Emissions At Antenna Terminals	Compliant
§ 2.1053	7.12 Radiated Spurious Emissions	Compliant

Not applicable: This item only for wideband consumer boosters utilizing spectrum block filtering.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2022/11/08	2023/11/07
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2021/12/14	2022/12/13
CD	High Pass Filter	HPM-1.2/18G-60	110	2021/12/14	2022/12/13
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2020/01/05	2023/01/04
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
PASTERNACK	Horn Antenn	PE9852/2F-20	1120 (ATC-BA-024-1)	2020/01/05	2023/01/04
PASTERNACK	Horn Antenn	PE9852/2F-20	1120 (ATC-BA-025-1)	2020/01/05	2023/01/04
Unknown	RFCoaxialCable	No.16	N200	2021/12/14	2022/12/13
Agilent	Signal Generator	N5183A	MY51040755	2021/12/13	2022/12/12

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606	2021/12/13	2022/12/12
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2021/12/14	2022/12/13
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
HP	20dB Attenuator	8491A	53857	2021/12/14	2022/12/13
HP	20dB Attenuator	8491A	53857	2022/11/25	2023/11/24
Agilent	adjustable attenuator	8494B-001	F-03-EM221	2021/11/26	2023/11/25
AGILENT	Vector Signal Generator	N5182A	MY50143401	2021/12/13	2022/12/12
AGILENT	Vector Signal Generator	N5182A	MY50143401	2022/11/25	2023/11/24
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2022/07/06	2023/07/05
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2021/12/14	2022/12/13
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.33	RF-03	Each time	
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	
Unknown	RF Coaxial Cable	No.32	RF-02	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§ 20.21(E)(3) – AUTHORIZED FREQUENCY BAND VERIFICATION

Applicable Standard

According to§ 20.21(e)(3) Frequency Bands

This test is intended to confirm that the signal booster only operates on the CMRS frequency bands authorized for use by the NPS. In addition, this test will identify the frequency at which the maximum gain is realized within each CMRS operational band, which then serves as a basis for subsequent tests.

Test Procedure

a) Connect the EUT to the test equipment as shown in Figure 1. Begin with the uplink output connected to the spectrum analyzer.
b) Set the spectrum analyzer RBW for 100 kHz with the VBW ≥ 3 × the RBW using a PEAK detector with the MAX HOLD function.
c) Set the center frequency of the spectrum analyzer to the center of the operational band under test with a span of 1 MHz.
d) Set the signal generator for CW mode and tune to the center frequency of the operational band under test.
e) Set the initial signal generator power to a level that is at least 6 dB below the AGC level specified by the manufacturer.
f) Slowly increase the signal generator power level until the output signal reaches the AGC operational level.
g) Reduce the signal generator power to a level that is 3 dB below the level noted above and manually reset the EUT.
h) Reset the spectrum analyzer span to 2 × the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2 × the CMRS band using the sweep function. The AGC must not be activated throughout the entire sweep.
i) Using three markers, identify the CMRS band edges and the frequency with the highest power. Affirm that the values of all markers are visible on the display of the spectrum analyzer (e.g., marker table set to on).
j) Capture the spectrum analyzer trace for inclusion in the test report.
k) Repeat 7.1c) to 7.1j) for all operational uplink and downlink bands.

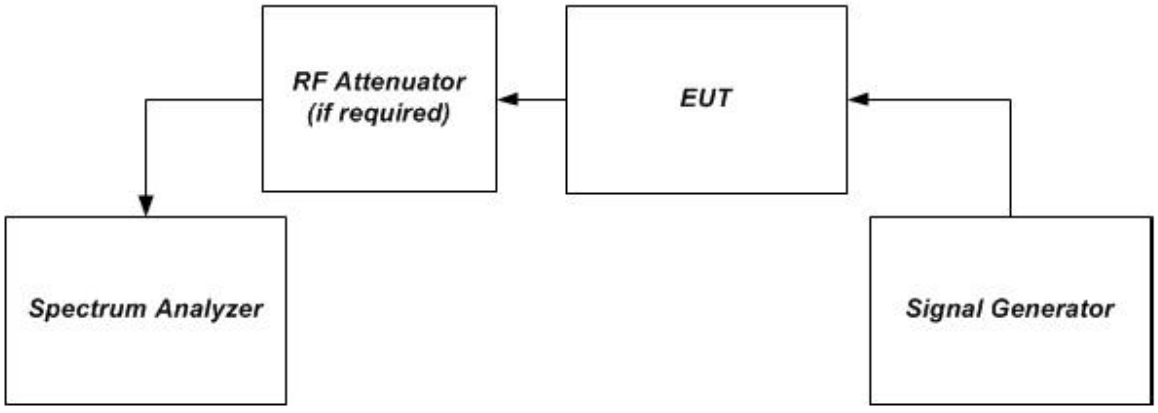


Figure 1 – Band verification test instrumentation setup

Test Data

Environmental Conditions

Temperature:	24.5℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

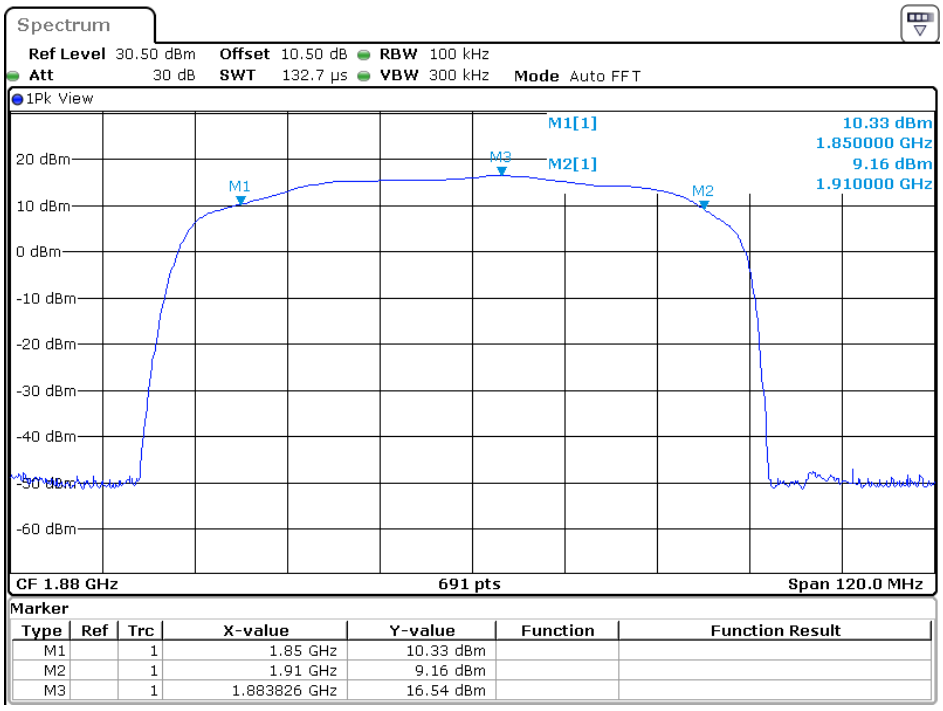
The testing was performed by Andy Yu from 2022-12-20 to 2023-02-25.

Test Result: Pass

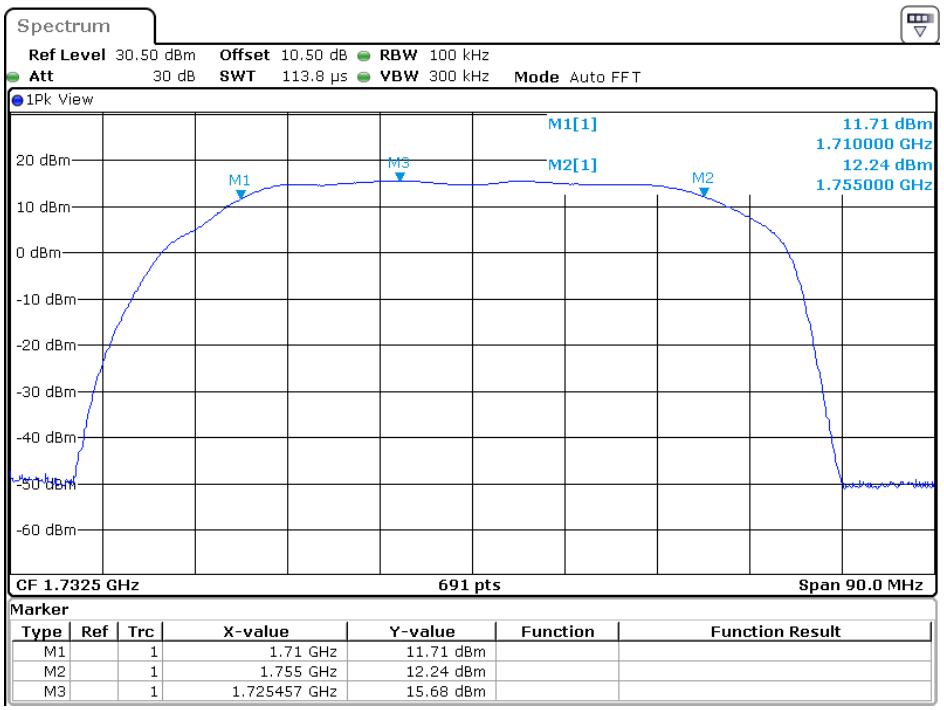
Please refer to following plots.

Uplink:

PCS Band



AWS Band



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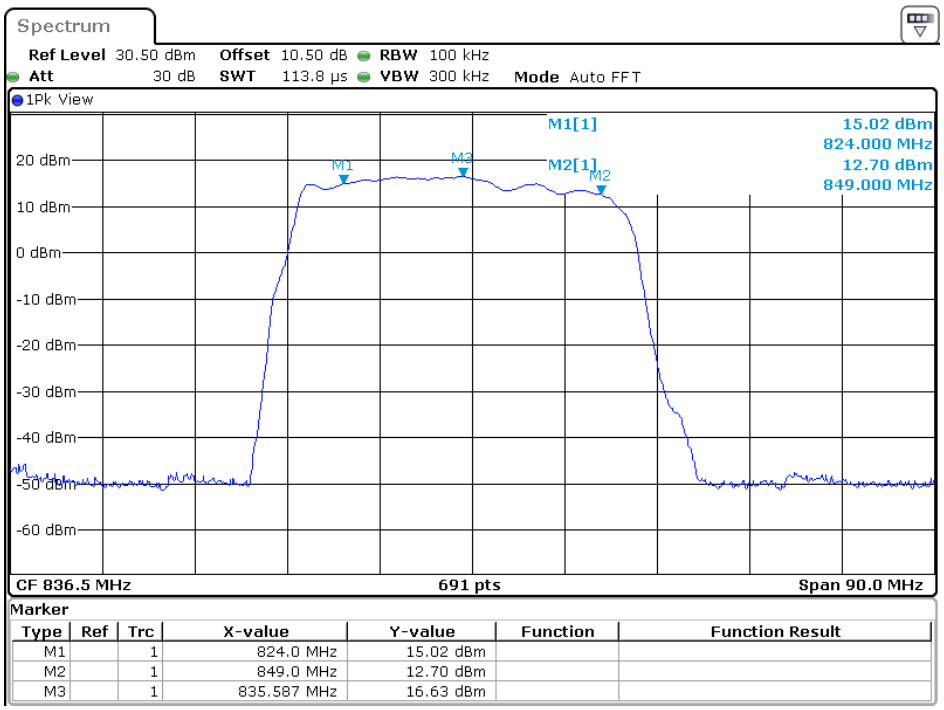
Cellular Band



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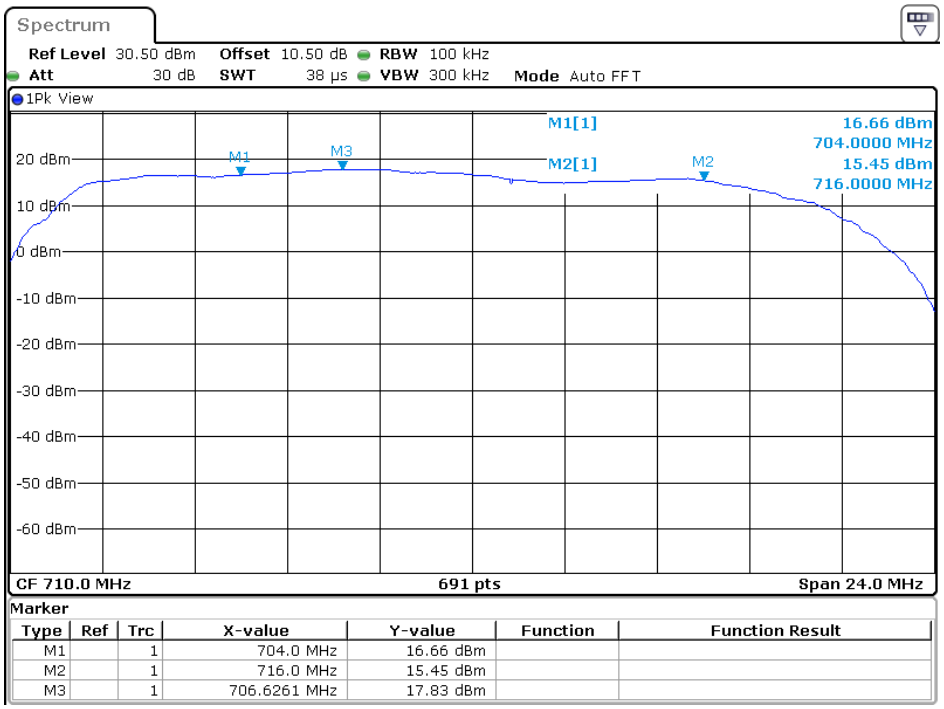
Lower 700MHz



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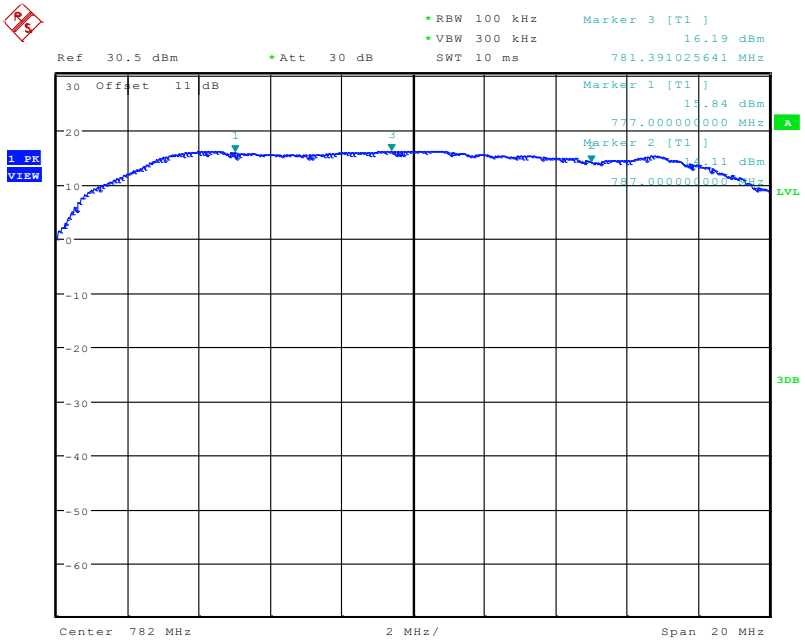
Upper 700MHz



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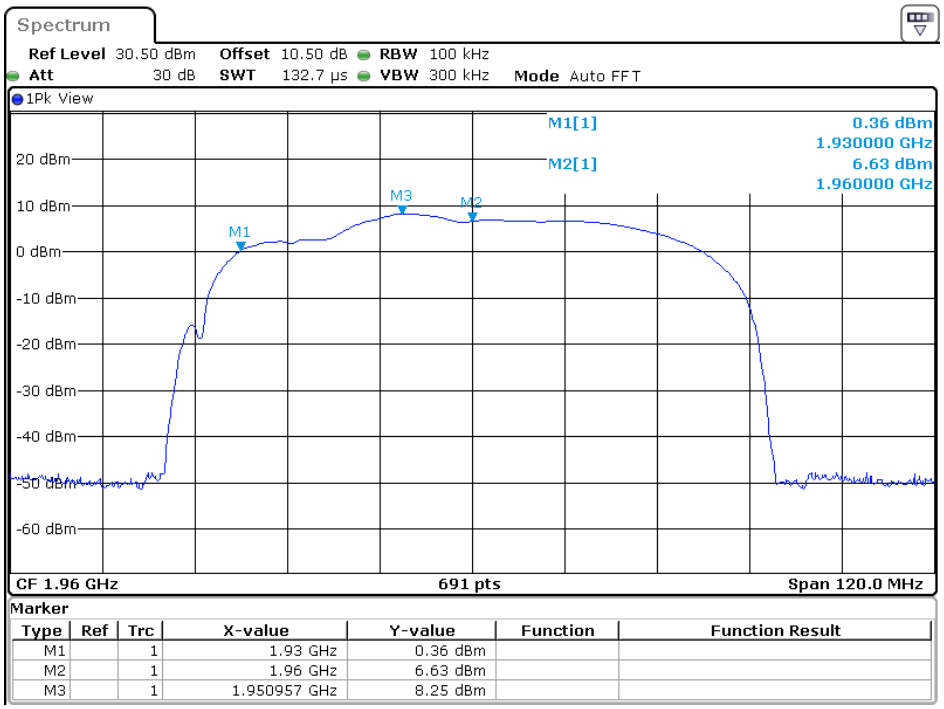
Downlink:

PCS Band



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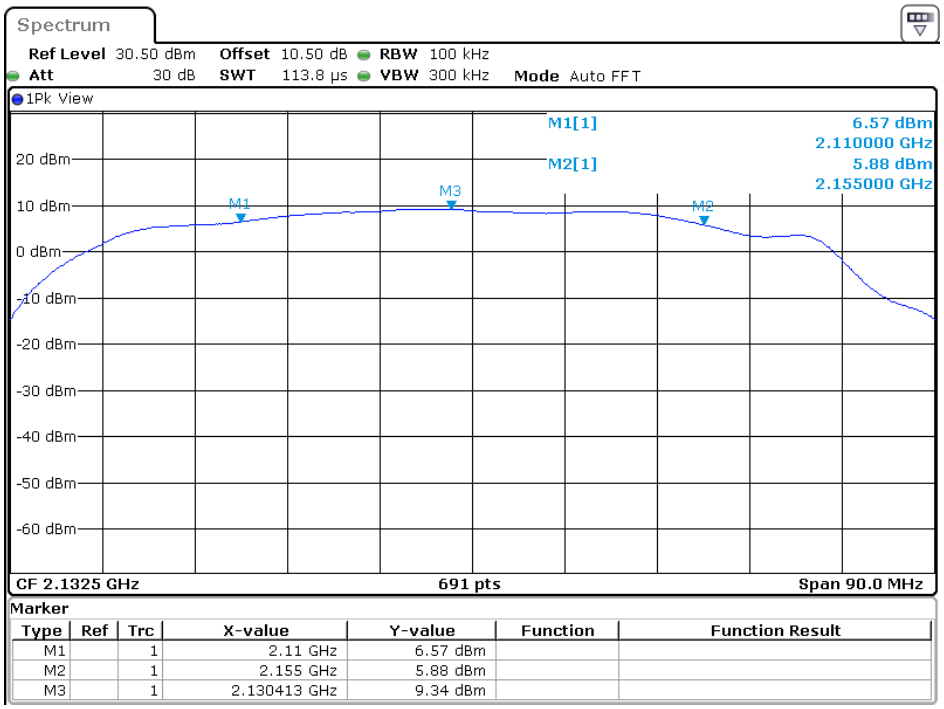
AWS Band



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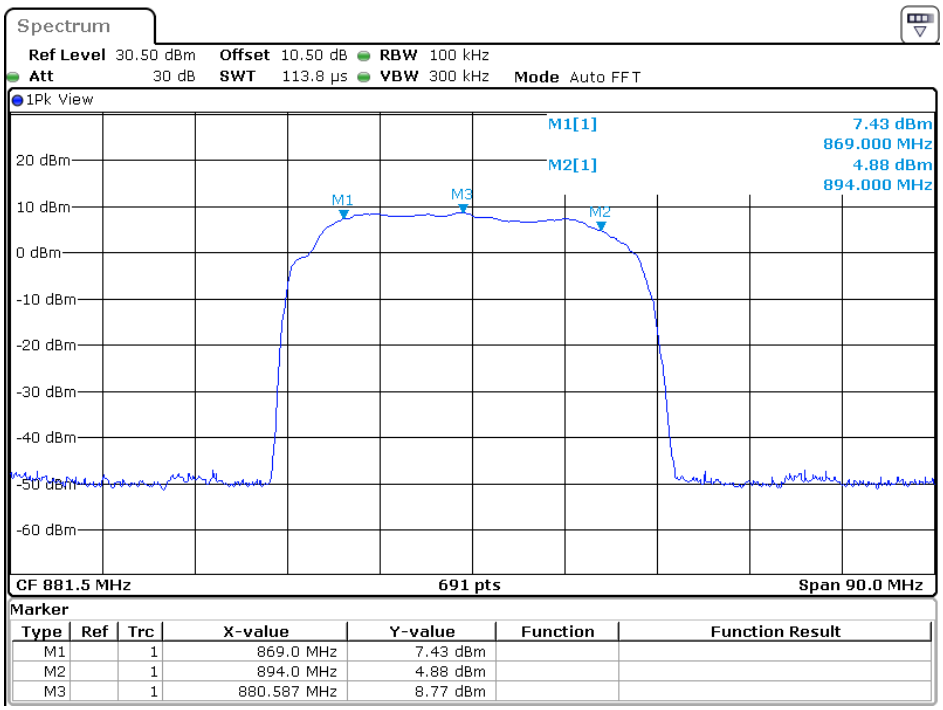
Cellular Band



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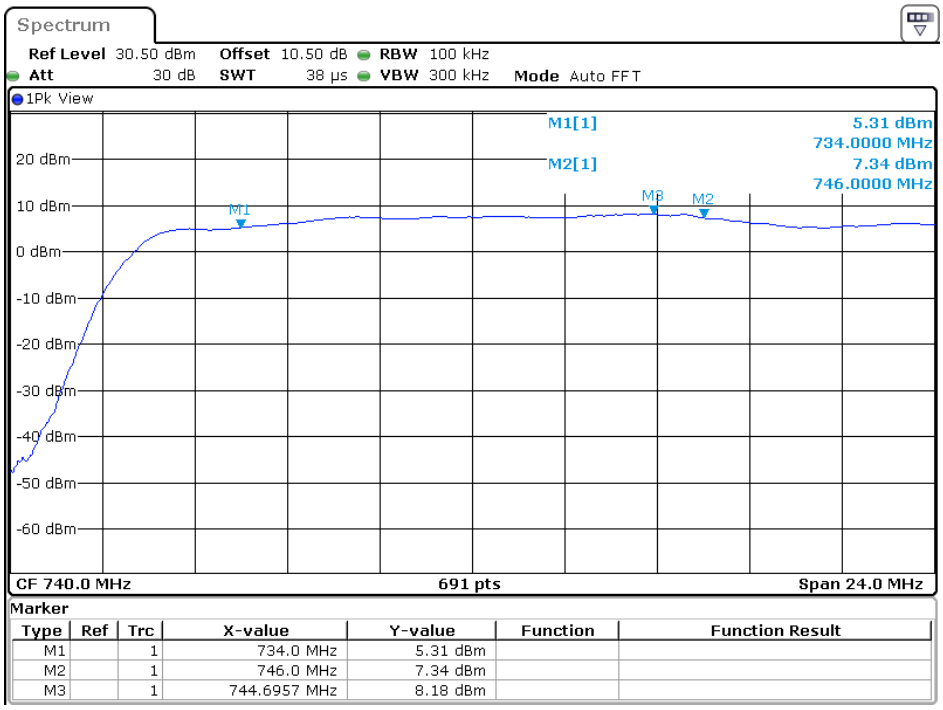
Lower 700MHz



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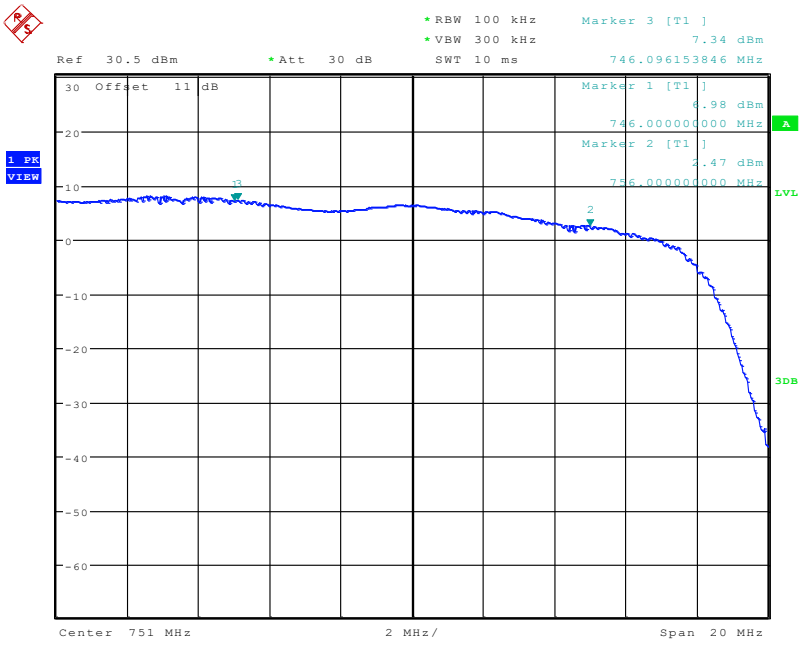
Upper 700MHz



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§ 20.21(e)(8)(i)(D) ,§ 20.21(e)(8)(i)(B)& §20.21(e)(4)– MAXIMUM POWER MEASUREMENT

Applicable Standard

According to§ 20.21(e)(8)(i)(D) Power Limits; § 20.21(e)(8)(i)(B) Bidirectional Capability (uplink minimum conducted power output); §20.21(e)(4) Self-monitoring.

This procedure shall be used to demonstrate compliance to the signal booster power limits and requirements as specified in §§ 20.21(e)(8)(i)(D) and 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

a) Compliance to authorized EIRP limits must be shown using the highest gains from the list of antennas, cabling, and coupling devices declared by the manufacturer for use with the consumer booster.
b) In addition, the maximum power levels measured in this procedure will be utilized in calculating the maximum gain as described in the next subclause.
c) The frequency with the highest power level in each operational band as determined in 7.1 is to be measured discretely by applying the following procedure utilizing the stated emission and power detector types independently.
d) Use a signal generator to create a pulsed CW or GSM signal with a pulse width of 570 μs and a duty cycle of 12.5% (i.e., one GSM timeslot), then measure utilizing the burst power function of the measuring instrument.
e) Use a signal generator to create an AWGN signal with a 99% occupied bandwidth of 4.1 MHz, then measure utilizing the channel power or band power function of the measuring instrumentation.
f) All modes of operation must be verified to maintain operation within authorized limits at the maximum uplink and downlink test levels per device type as defined in 5.4, by increasing the power level in 2 dB steps from the AGC level to the maximum input level specified in 5.5.

Test Procedure

a) Connect the EUT to the test equipment as shown in Figure 1. Begin with the uplink output (donor port) connected to the spectrum analyzer.
b) Configure the signal generator and spectrum analyzer for operation on the frequency determined in 7.1 with the highest power level, but with the center frequency of the signal no closer than 2.5 MHz from the band edge. The spectrum analyzer span shall be set to at least 10 MHz.
c) Set the initial signal generator power to a level well below that which causes AGC control.
d) Slowly increase the signal generator power level until the output signal reaches the AGC operational limit (from observation of signal behavior on the spectrum analyzer; i.e., no further increase in output power as input power is increased).
e) Reduce power sufficiently on the signal generator to ensure that the AGC is not controlling the power output.
f) Slowly increase the signal generator power to a level just below (within 0.5 dB of) the AGC limit without triggering the AGC. Note the signal generator power level as Pin.
g) Measure the output power Pout with the spectrum analyzer as follows.
   1) Set RBW = 100 kHz for AWGN signal type and 300 kHz for CW or GSM signal type.
   2) Set VBW ≥ 3 × RBW.
   3) Select either the BURST POWER or CHANNEL POWER measurement tool, as required for each signal type. The channel power integration bandwidth shall be 99% occupied bandwidth (4.1 MHz).
   4) Select the RMS (power averaging) detector.
   5) Ensure that the number Note: This requirement
   6) Set sweep time = auto

7) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
h) Record the measured power level as P_{OUT} with one set of results for the GSM or CW input stimulus and another set of results for the AWGN input stimulus.
i) Repeat step h) while increasing the signal generator amplitude in 2 dB steps until the maximum input level indicated in 5.5 is reached. If the booster has shut down at any point during the input power steps it should be noted and step h) shall be repeated at an input level 1 dB less than that found to cause the shutdown.
j) Repeat the entire procedure for each operational uplink and downlink frequency band supported by the booster.
k) Provide tabulated results in the test report.

Test Data

Environmental Conditions

Temperature:	24.5-25.1℃
Relative Humidity:	54-56%
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu from 2022-12-20 to 2023-02-18.

Test Result: Pass

Please refer to the following tables

AGC Level:

Mode	Operation Band	Signal type	AGC level dBm	Mode	Operation Band	Signal type	AGC level dBm
Uplink	Lower 700 MHz	AWGN	-40.55	Downlink	Lower 700 MHz	AWGN	-51.95
		GSM	-40.86			GSM	-52.52
	Upper 700 MHz	AWGN	-41.24		Upper 700 MHz	AWGN	-51.62
		GSM	-42.13			GSM	-51.84
	cellular	AWGN	-43.24		cellular	AWGN	-52.18
		GSM	-43.86			GSM	-52.28
	PCS	AWGN	-47.15		PCS	AWGN	-56.15
		GSM	-47.36			GSM	-56.98
	AWS	AWGN	-49.35		AWS	AWGN	-58.82
		GSM	-49.86			GSM	-58.64

Output Power:

Mode	Operation Band	Signal type	Pre AGC Input level	Conducted Output level	Limit	Antenna Gain	Cable loss	EIRP	Limit
			dBm	dBm	dBm	dB	dB	dBm	dBm
Uplink	Lower 700 MHz	AWGN	-41.05	21.64	17-30	7.5	3.2	25.94	≤30
		GSM	-41.36	21.72				26.02	
	Upper 700 MHz	AWGN	-41.74	19.02		7.5	3.4	23.12	
		GSM	-42.63	20.00				24.10	
	cellular	AWGN	-43.74	18.34		8	3.5	22.84	
		GSM	-44.36	18.97				23.47	
	PCS	AWGN	-47.65	18.33		9	5.7	21.63	
		GSM	-47.86	18.38				21.68	
	AWS	AWGN	-49.85	18.09		9	5.4	21.69	
		GSM	-50.36	18.79				22.39	
Downlink	Lower 700 MHz	AWGN	-52.45	10.21	≤17	6.5	1.9	14.81	≤17
		GSM	-53.02	10.35				14.95	
	Upper 700 MHz	AWGN	-52.12	11.69		6.5	2.0	16.19	
		GSM	-52.34	11.87				16.37	
	cellular	AWGN	-52.68	11.95		7	2.2	16.75	
		GSM	-52.78	12.11				16.91	
	PCS	AWGN	-56.65	10.95		6	0.5	16.45	
		GSM	-57.48	11.24				16.74	
	AWS	AWGN	-59.32	10.21		6	0.5	15.71	
		GSM	-59.14	10.65				16.15	

Note: worst case EIRP was calculated according to the antenna kitting.

Maximum Input level:

Mode	Operation Band	Signal type	Maximum Input level	Maximum Input level Limits	Conducted Output level
			dBm	dBm	dBm
Uplink	Lower 700 MHz	AWGN	-37.15	27.0	20.65
		GSM	-37.86		20.93
	Upper 700 MHz	AWGN	-37.24		18.85
		GSM	-38.13		19.83
	cellular	AWGN	-38.24		18.09
		GSM	-38.86		18.73
	PCS	AWGN	-44.15		18.20
		GSM	-44.36		18.26
	AWS	AWGN	-46.35		18.14
		GSM	-46.86		18.88
Downlink	Lower 700 MHz	AWGN	-47.95	-20	10.59
		GSM	-48.52		10.63
	cellular	AWGN	-48.15		10.56
		GSM	-48.64		11.72
	PCS	AWGN	-50.74		10.32
		GSM	-50.91		10.58
	AWS	AWGN	-53.15		9.35
		GSM	-53.98		9.56

§ 20.21(e)(8)(i)(C)(2), § 20.21(e)(8)(i)(B)&§20.21(e)(4) – MAXIMUM BOOSTER GAIN COMPUTATION

Applicable Standards

According to§ 20.21(e)(8)(i)(C)(2) (ii)Booster Gain Limits (maximum gain); § 20.21(e)(8)(i)(B) Bidirectional Capability (equivalent uplink and downlink gain); §20.21(e)(4) Self-monitoring.

This subclause provides guidance on the computation of the maximum gain based on the results obtained from previous measurements. The NPS limits on maximum gain for fixed and mobile wideband consumer signal boosters are provided in § 20.21(e)(8)(i)(C)(*2*). Additionally, § 20.21(e)(8)(i)(B) requires that wideband consumer signal boosters be able to provide equivalent uplink and downlink gain (within 9 dB)

Test Procedure

a) Calculate the maximum gain of the booster as follows to demonstrate compliance to the applicable gain limits as specified.
b) For both the uplink and downlink in each supported frequency band, use each of the P_{OUT} and P_{IN} result pairs for all signal types used in 7.2 in the following equation to determine the maximum gain (G) of the booster:
$G\ (dB) = P_{OUT}(dBm) - P_{IN}(dBm)$.
c) Record the maximum gain of the uplink and downlink paths for each supported frequency band, and verify that the each gain value complies with the applicable limit.
d) Provide tabulated results in the test report.

Test Data

Environmental Conditions

Temperature:	24.6℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu from 2022-12-20 to 2022-12-21.

Test Result: Pass

Please refer to the following tables

Maximum gain:

Mode	Operation Band	Signal type	Pre AGC Input level	Conducted Output level	Gain	Limit
			dBm	dBm	dB	dB
Uplink	Lower 700 MHz	AWGN	-41.05	21.64	62.69	63.53
		GSM	-41.36	21.72	63.08	
	Upper 700 MHz	AWGN	-41.74	19.15	60.76	64.36
		GSM	-42.63	20.16	62.63	
	cellular	AWGN	-43.74	18.56	62.08	64.95
		GSM	-44.36	18.98	63.33	
	PCS	AWGN	-47.65	17.59	64.98	71.98
		GSM	-47.86	18.46	66.24	
	AWS	AWGN	-49.85	17.23	66.94	71.27
		GSM	-50.36	18.09	68.15	
Downlink	Lower 700 MHz	AWGN	-52.45	10.21	62.66	63.53
		GSM	-53.02	10.35	63.37	
	Upper 700 MHz	AWGN	-52.12	11.69	63.81	64.36
		GSM	-52.34	11.87	64.21	
	cellular	AWGN	-52.68	11.95	64.63	64.95
		GSM	-52.78	12.11	64.89	
	PCS	AWGN	-56.65	10.95	67.60	71.98
		GSM	-57.48	11.24	68.72	
	AWS	AWGN	-59.32	10.21	69.53	71.27
		GSM	-59.14	10.65	69.79	

Note: Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log10 (Frequency), Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Equivalent Uplink and downlink gain:

Operating Band	Signal type	Uplink Gain	Downlink Gain	Caculated Value	Limit
MHz		dB	dB	dB	dB
Lower 700 MHz	AWGN	62.69	62.66	0.03	9
	GSM	63.08	63.37	0.29	
Upper 700 MHz	AWGN	60.76	63.81	3.05	
	GSM	62.63	64.21	1.58	
cellular	AWGN	62.08	64.63	2.55	
	GSM	63.33	64.89	1.56	
PCS	AWGN	64.98	67.60	2.62	
	GSM	66.24	68.72	2.48	
AWS	AWGN	66.94	69.53	2.59	
	GSM	68.15	69.79	1.64	

§ 20.21(e)(8)(i)(F)- INTERMODULATION PRODUCT

Applicable Standards

According to§ 20.21(e)(8)(i)(F) Intermodulation Limits.

Test Procedure

The following procedures shall be used to demonstrate compliance to the intermodulation limit specified in § 20.21(e)(8)(i)(F) for wideband consumer signal boosters.

a) Connect the signal booster to the test equipment as shown in **Figure 2**. Begin with the uplink output connected to the spectrum analyzer.
b) Set the spectrum analyzer RBW = 3 kHz.
c) Set the VBW ≥ 3 × RBW.
d) Select the RMS detector
e) Set the spectrum analyzer center frequency to the center of the supported operational band under test.
f) Set the span to 5 MHz. Affirm that the number of measurement points per sweep ≥ (2 × span)/RBW.
g) Configure the two signal generators for CW operation with generator 1 tuned 300 kHz below the operational band center frequency and generator 2 tuned 300 kHz above the operational band center frequency.
h) Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent, then turn on the RF output.
i) Increase the signal generators' amplitudes equally until just before the EUT begins AGC and affirm that all intermodulation products (if any exist) are below the specified limit of −19 dBm.
j) Utilize the trace averaging function of the spectrum analyzer and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation product.
k) Record the maximum intermodulation product amplitude level that is observed.
l) Capture the spectrum analyzer trace for inclusion in the test report.
m) Repeat 7.4e) to 7.4l) for all uplink and downlink operational bands.

Note: *If using a single signal generator with dual outputs, affirm that intermodulation products are not the result of the generator.*

n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in 7.4i), but to not to exceed the maximum input level in 5.5, to affirm that the EUT maintains compliance with the intermodulation limit

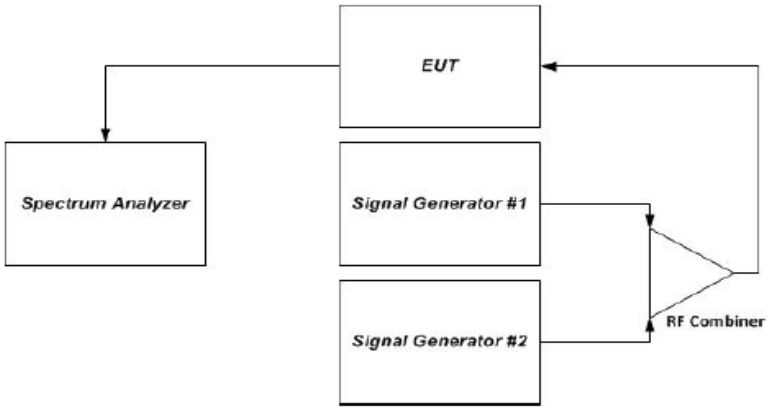


Figure 2 – Intermodulation product instrumentation test setup

Test Data

Environmental Conditions

Temperature:	24.6℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

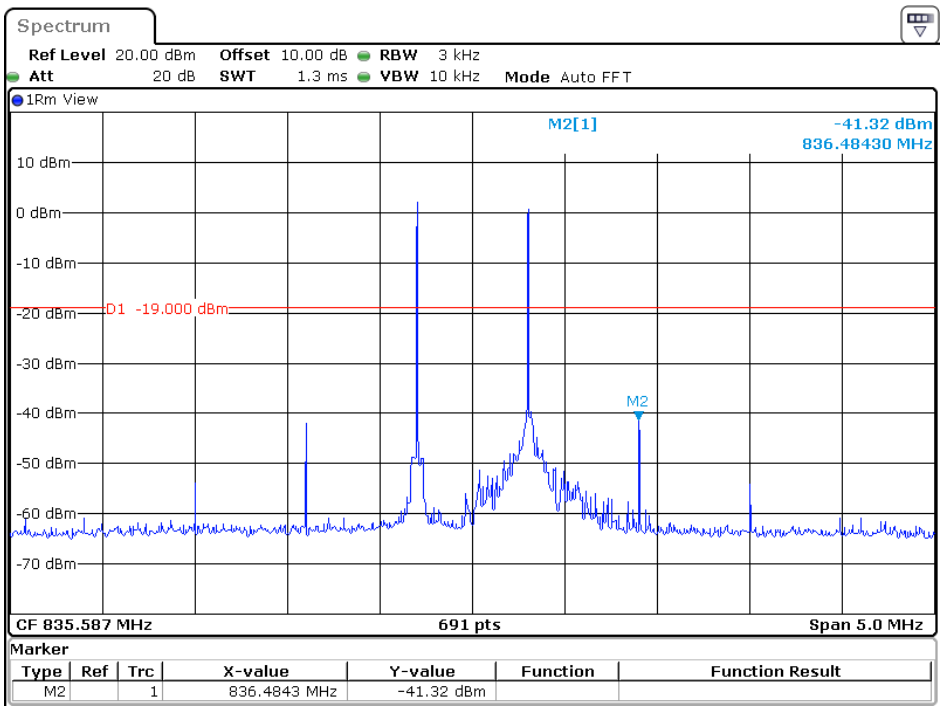
The testing was performed by Andy Yu from 2022-12-20 to 2023-02-25.

Test Result: Pass

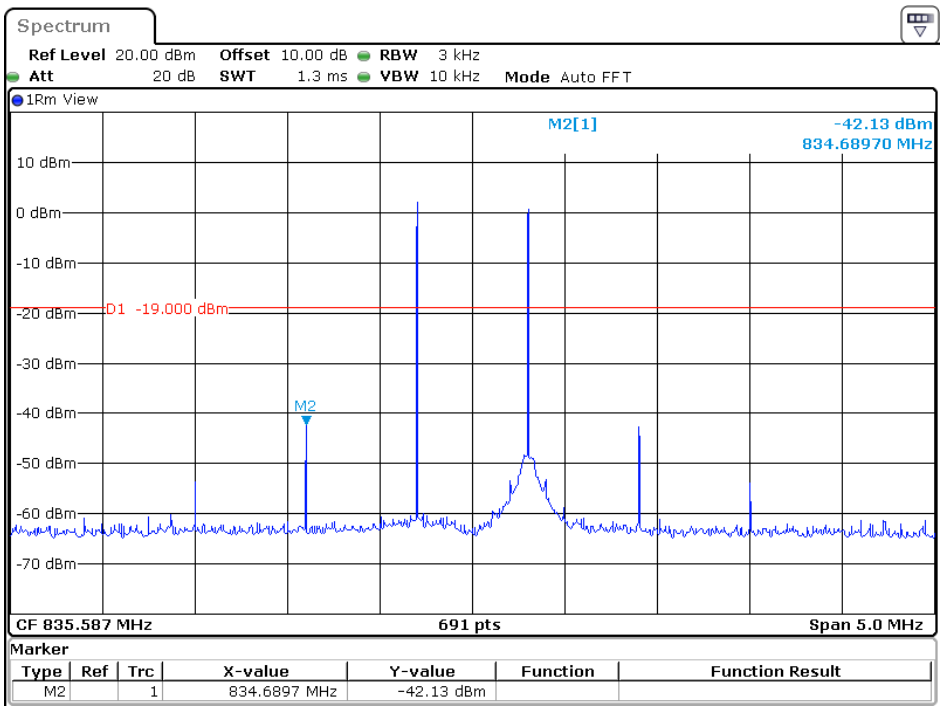
Please refer to the following plots

Uplink

Cellular Pre-AGC

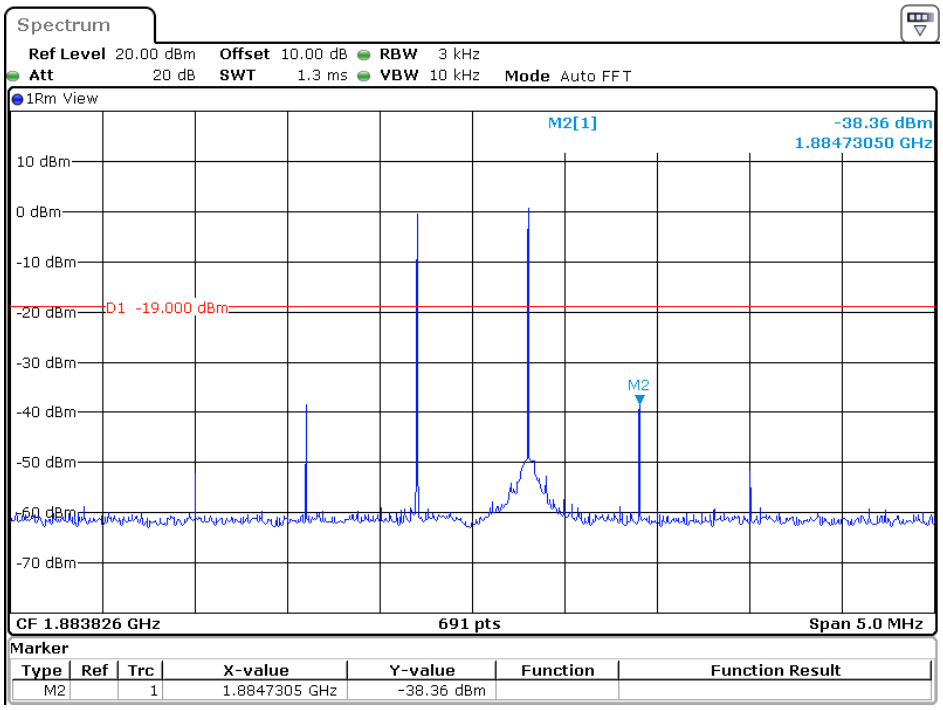


Cellular Above AGC



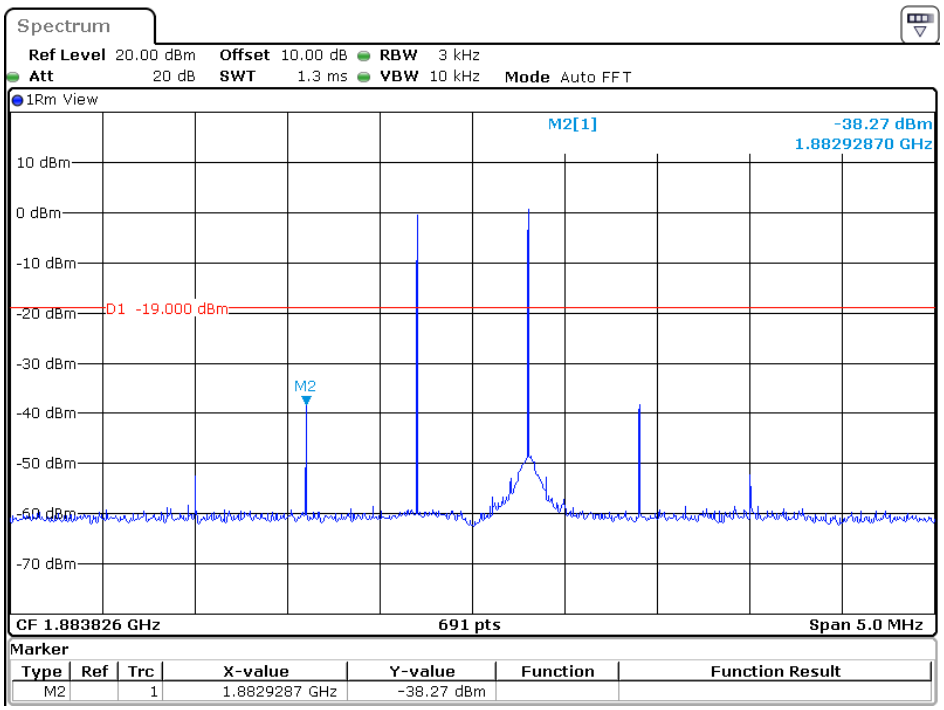
Date: 20.DEC.2022 16:06:55

PCS Pre-AGC



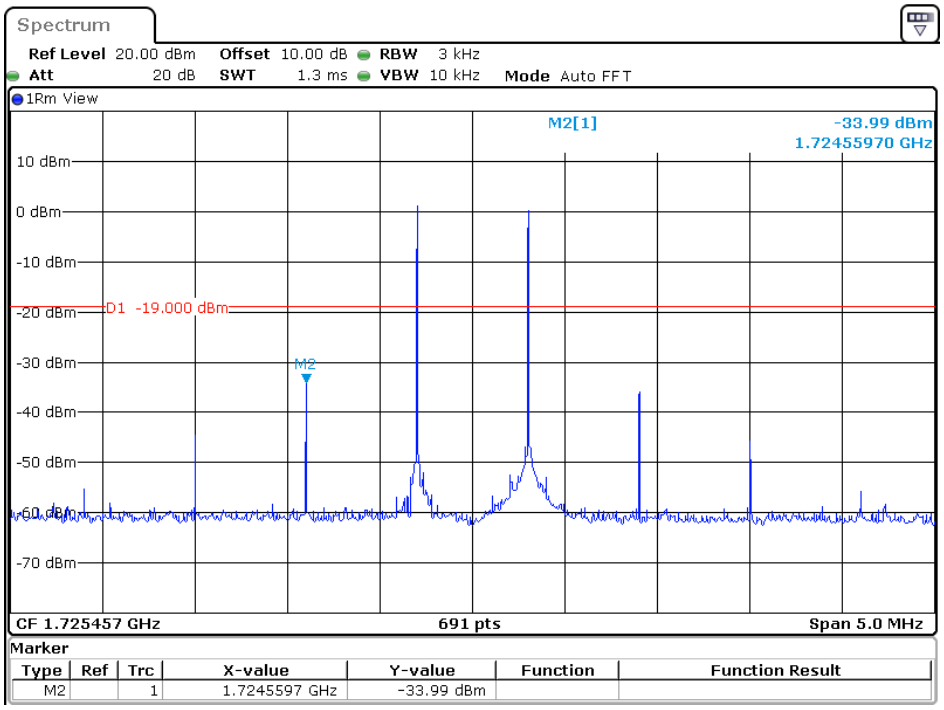
Date: 20.DEC.2022 16:08:12

PCS Above AGC



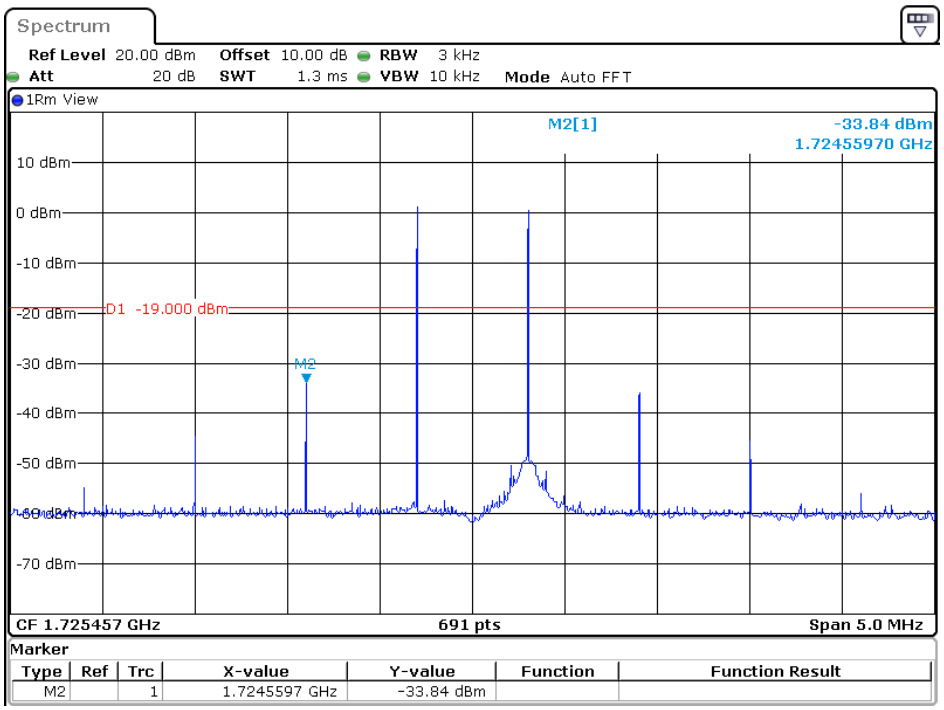
Date: 20.DEC.2022 16:08:31

AWS Pre-AGC



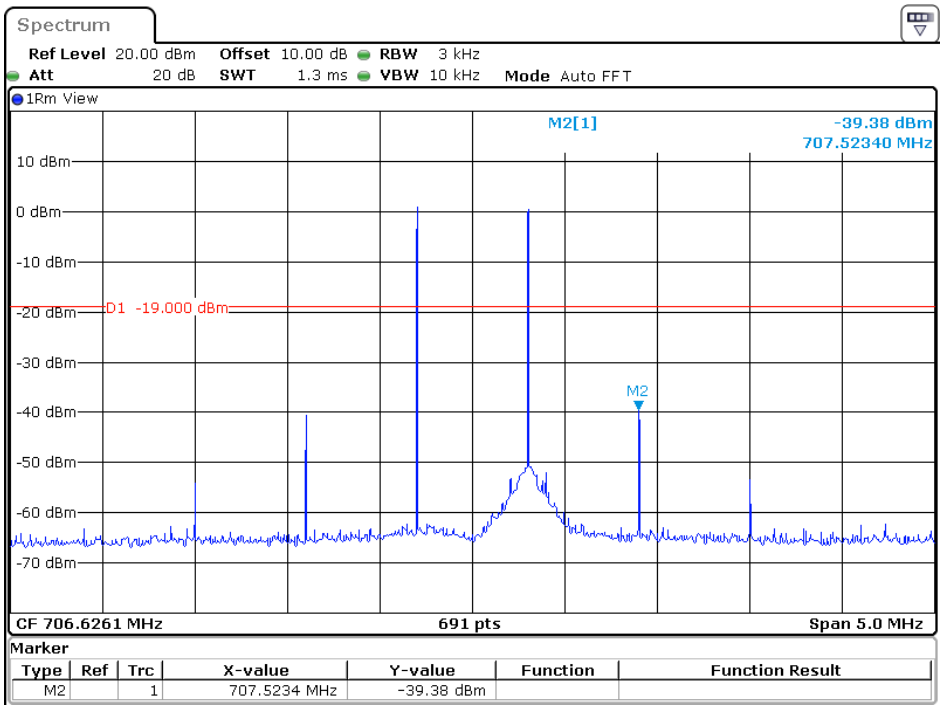
Date: 20.DEC.2022 16:09:32

AWS Above AGC



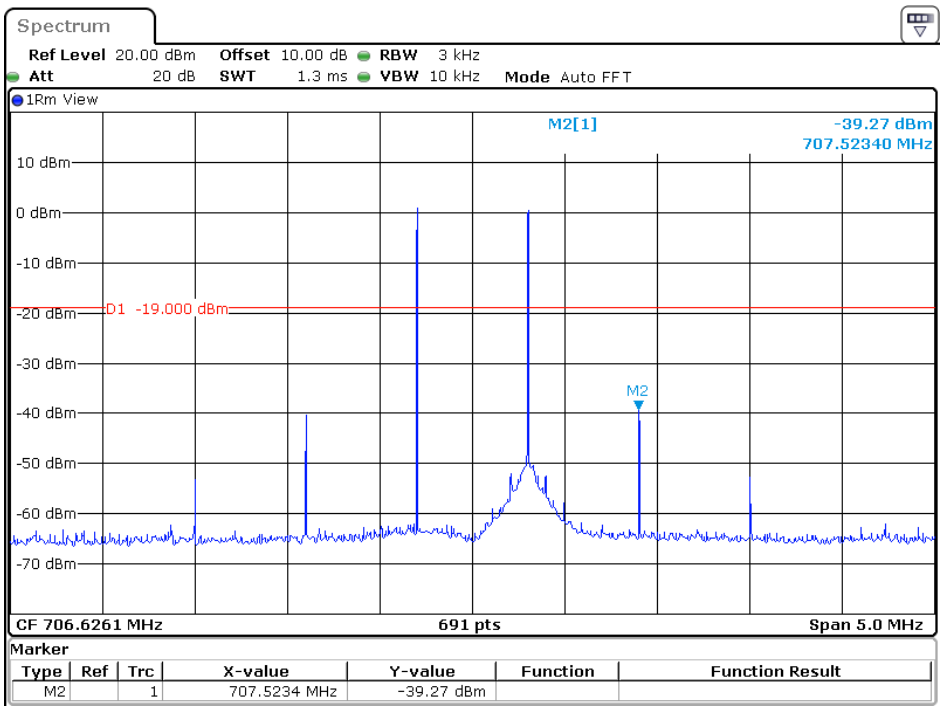
Date: 20.DEC.2022 16:10:00

Lower 700MHz Pre-AGC



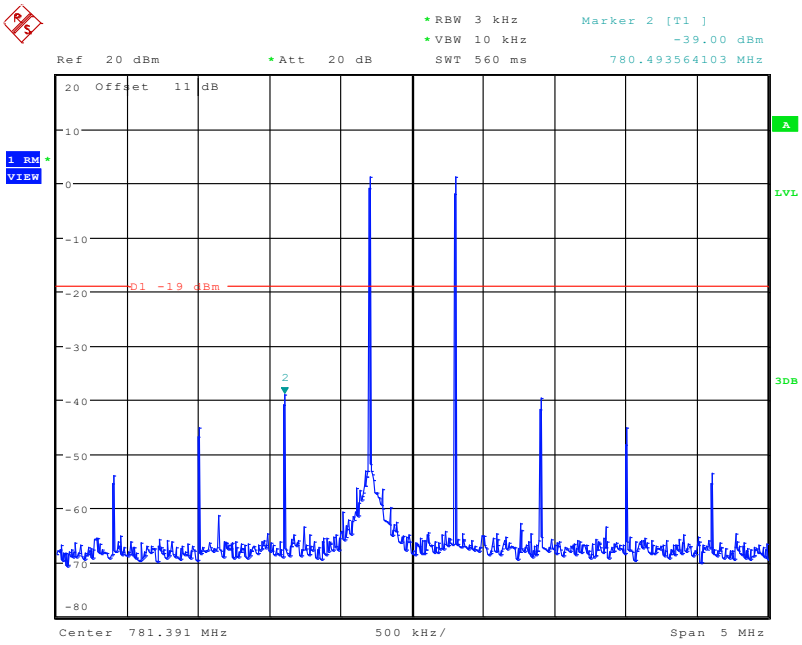
Date: 20.DEC.2022 16:03:25

Lower 700MHz Above AGC



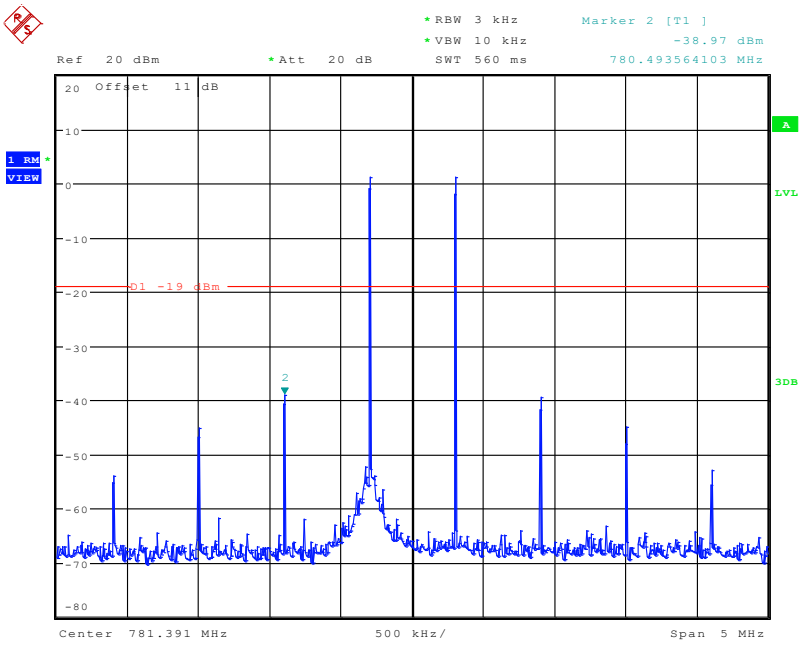
Date: 20.DEC.2022 16:03:44

Upper 700MHz Pre-AGC



Date: 25.FEB.2023 18:57:56

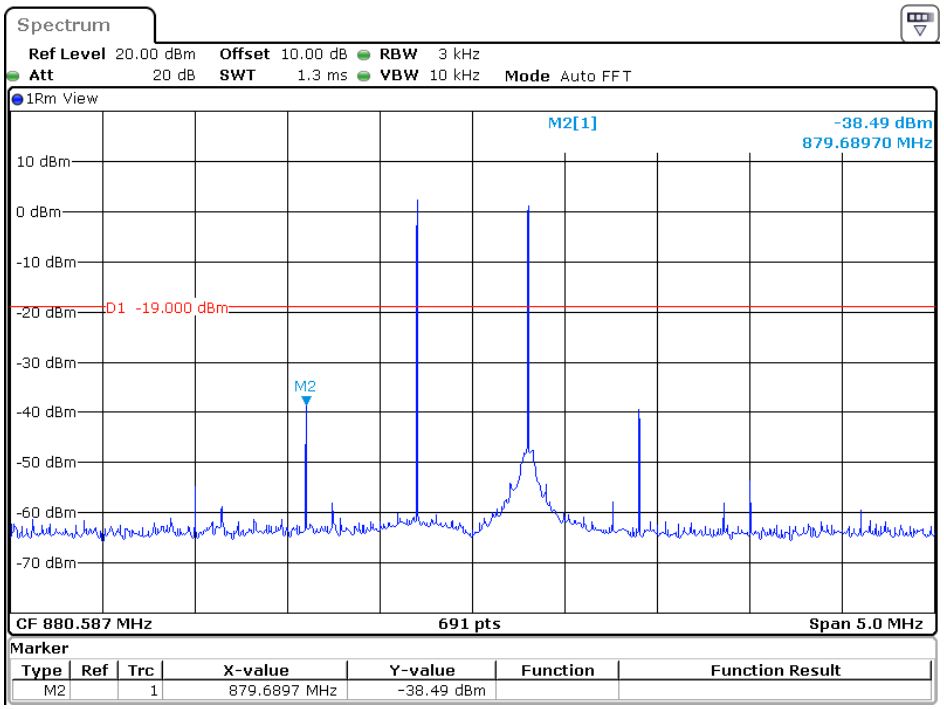
Upper 700MHz Above AGC



Date: 25.FEB.2023 18:58:14

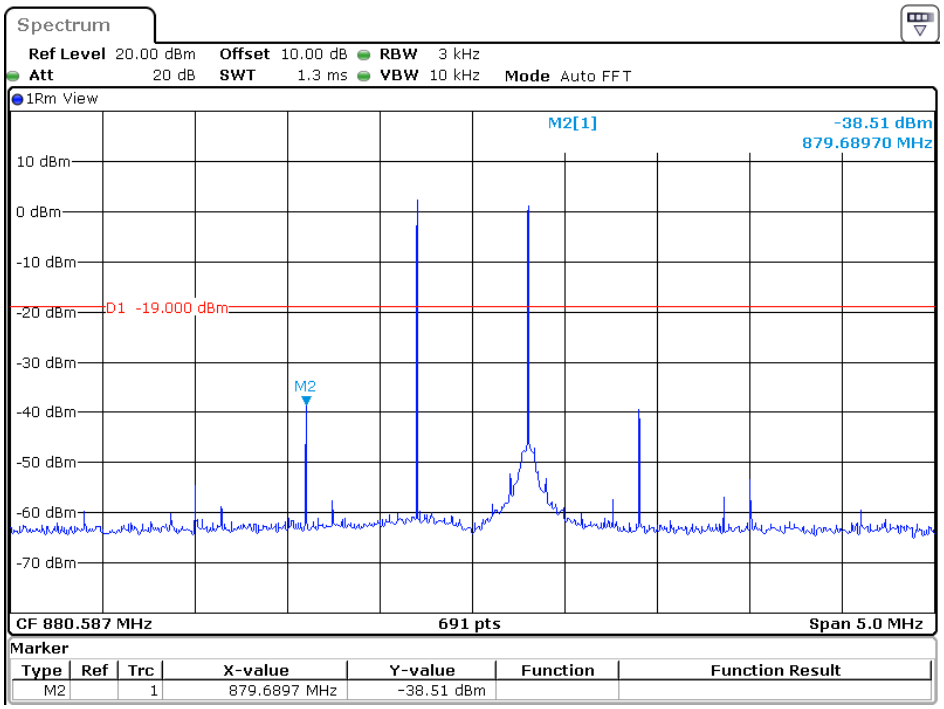
Downlink

Cellular Pre-AGC



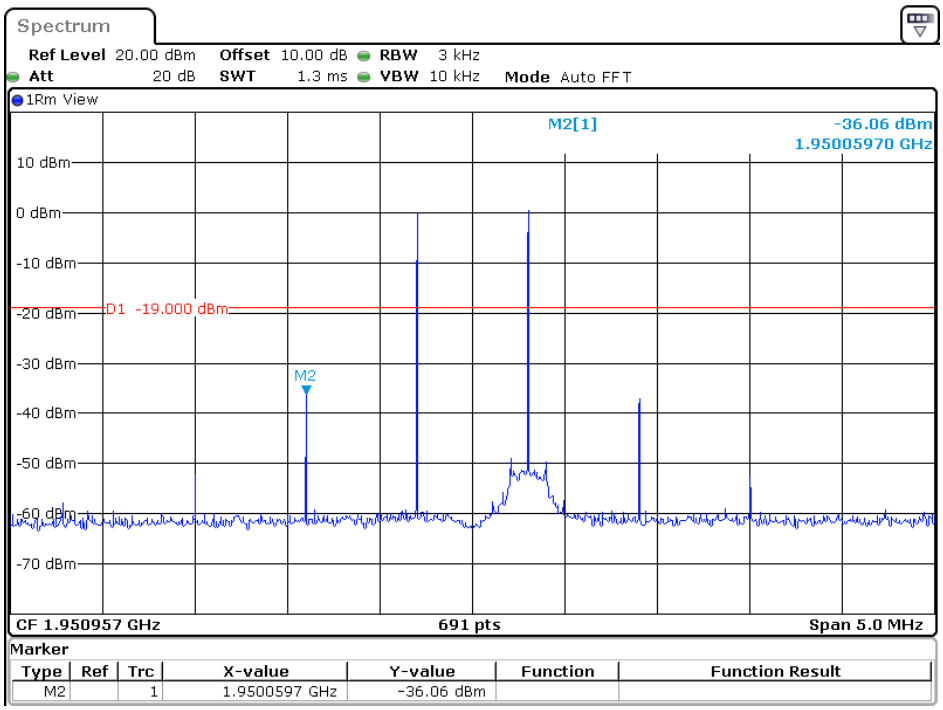
Date: 20.DEC.2022 16:17:13

Cellular Above AGC



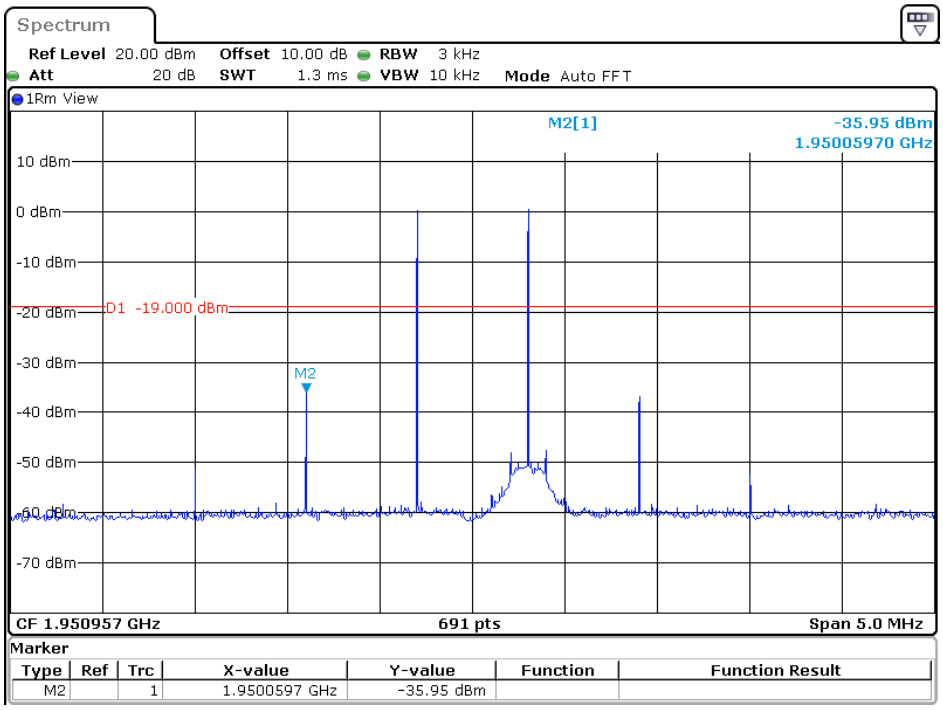
Date: 20.DEC.2022 16:17:33

PCS Pre-AGC



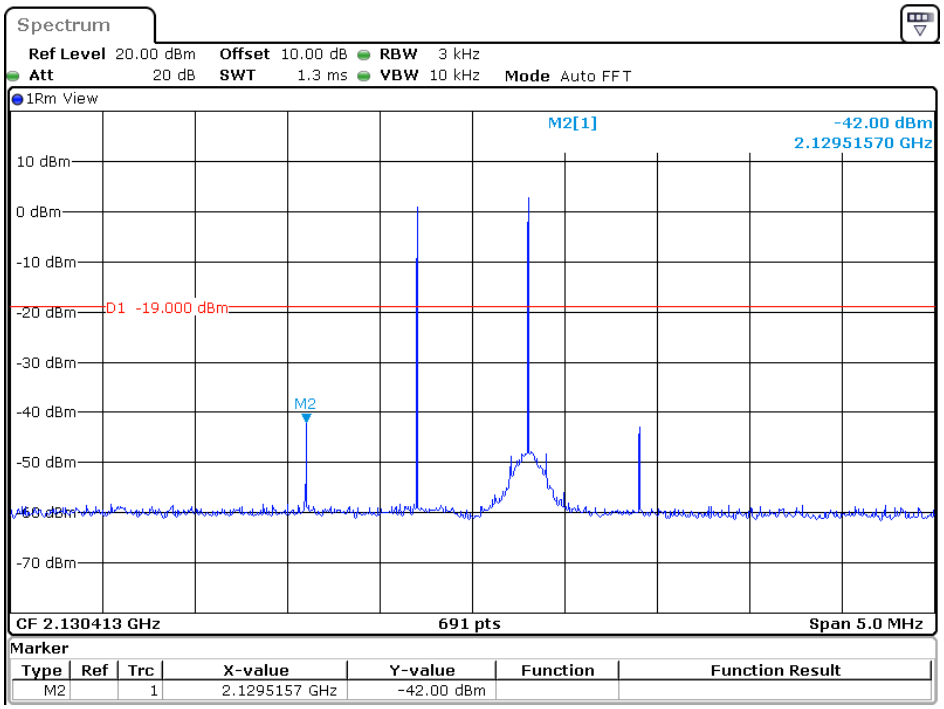
Date: 20.DEC.2022 16:18:28

PCS Above AGC



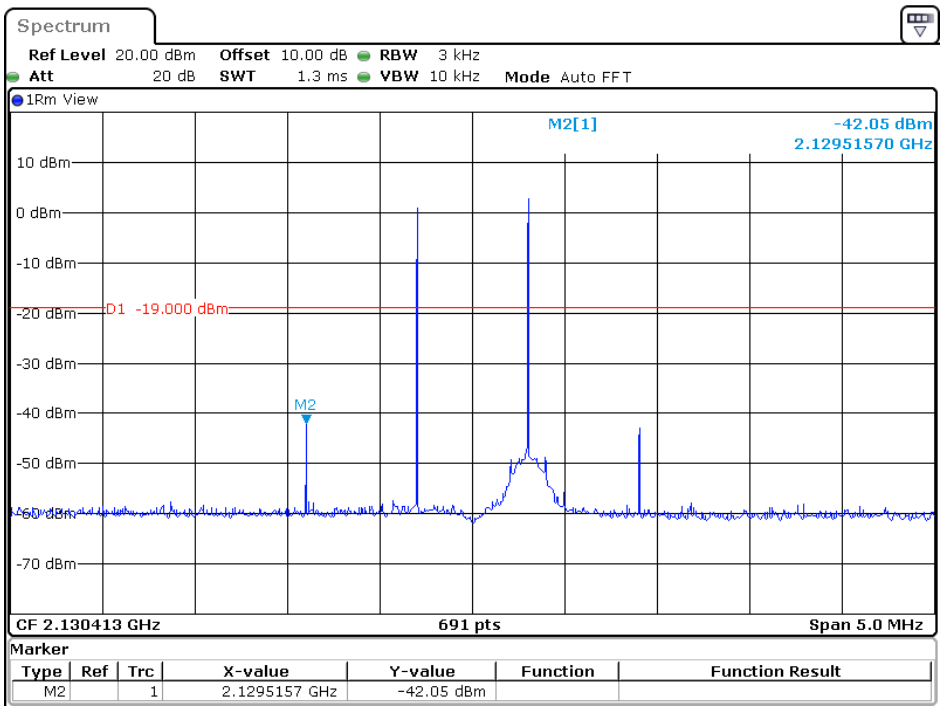
Date: 20.DEC.2022 16:18:57

AWS Pre-AGC



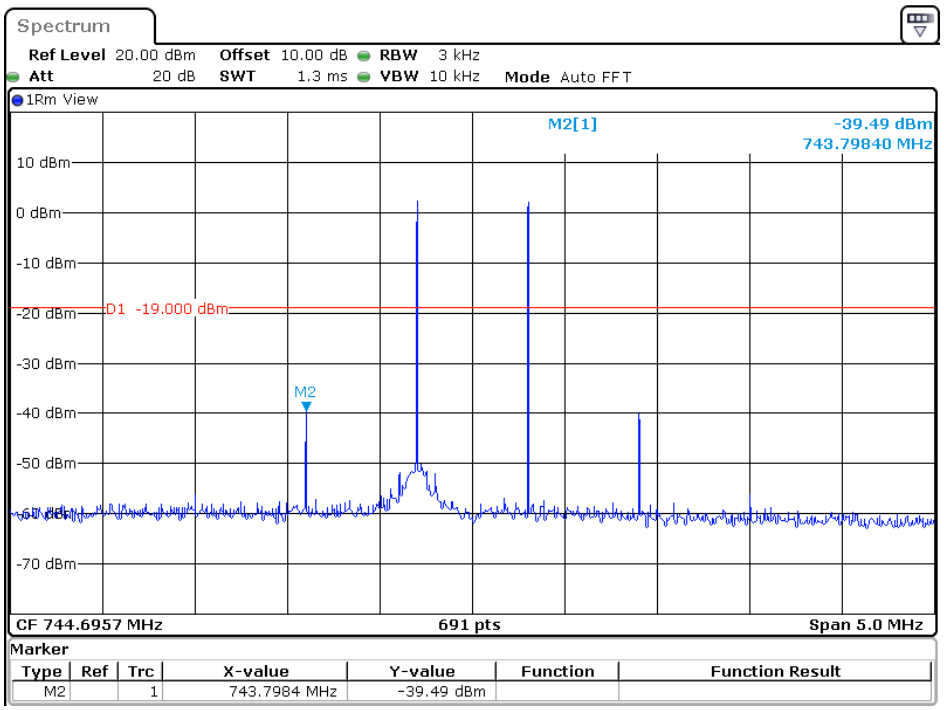
Date: 20.DEC.2022 16:20:19

AWS Above AGC



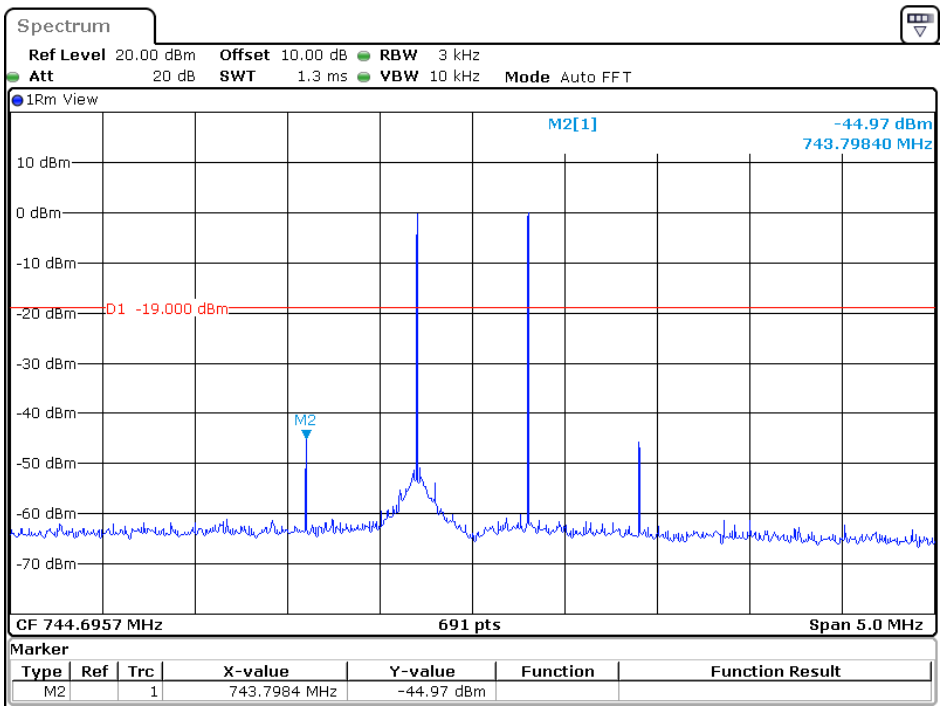
Date: 20.DEC.2022 16:20:37

Lower 700MHz Pre-AGC



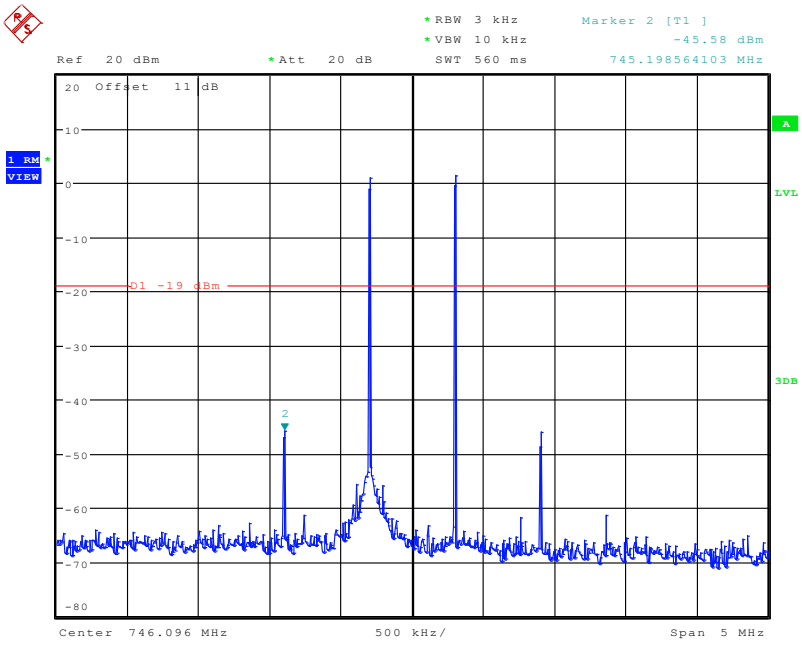
Date: 20.DEC.2022 16:12:28

Lower 700MHz Above AGC



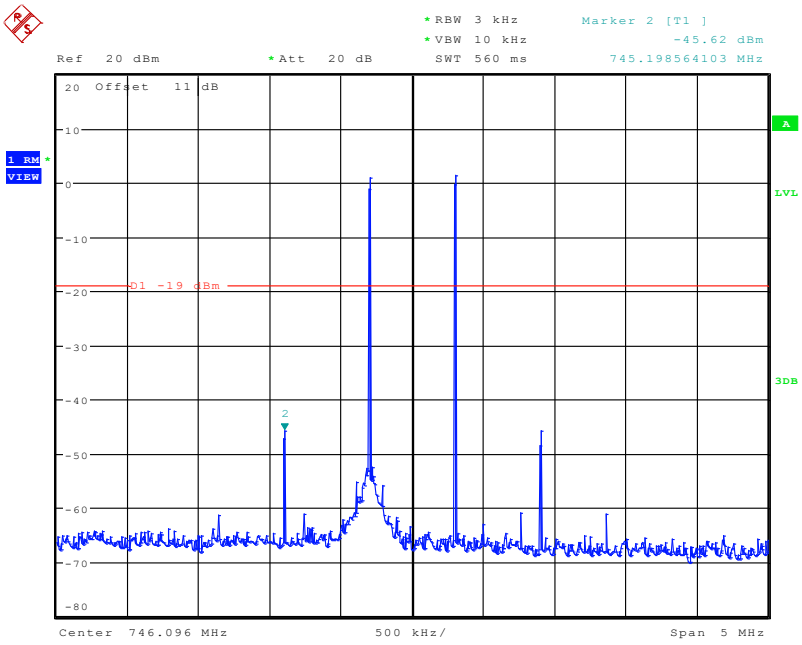
Date: 20.DEC.2022 16:12:54

Upper 700MHz Pre-AGC



Date: 25.FEB.2023 19:03:27

Upper 700MHz Above AGC



Date: 25.FEB.2023 19:03:49

§ 20.21(e)(8)(i)(E)- OUT OF BAND EMISSIONS

Applicable Standards

According to§ 20.21(e)(8)(i)(E) Out of Band Emission Limits.

Test Procedure

This measurement is intended to demonstrate compliance to the limit specified in § 20.21(e)(8)(i)(E). The mobile emission limit applicable to the supported band of operation can be determined from the applicable rule part as listed in Annex A for each authorized operating band.

a) Connect the EUT to the test equipment as shown in **Figure 1**. Begin with the uplink output connected to the spectrum analyzer.
b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:
i) GSM: 0.2 MHz from upper and lower band edges.
ii) LTE (5 MHz): 2.5 MHz from upper and lower band edges.
iii) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows (only the upper and lower frequencies need to be tested):

824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz, 869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz.
Note 1: *Alternative test modulation types:*
• CDMA (alternative 1.25 MHz AWGN)
• LTE 5 MHz (alternative W-CDMA or 4.1 MHz AWGN)
Note 2: *For LTE, the signal generator should utilize the uplink and downlink signal types for these modulations in uplink and downlink tests, respectively. LTE shall use 5 MHz signal, 25 resource blocks transmitting.*
Note 3: *When using an AWGN test signal, the bandwidth shall be the measured 99% occupied bandwidth.*

c) Set the signal generator amplitude to the maximum power level prior to AGC similar to the procedures in 7.2.2e) to 7.2.2f) of power measurement procedure for appropriate modulations.
d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band (*see Annex A for cross-reference to applicable rule section*).
e) Set VBW = 3 × RBW.
f) Select the RMS (power averaging) detector.
g) Sweep time = auto-couple.
h) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus 300 kHz (when operational frequency is < 1 GHz) or 3 MHz (when operational frequency is ≥ 1 GHz).
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
j) Use peak marker function to find the maximum power level.
k) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
l) Increase the signal generator amplitude in 2 dB steps until the maximum input level indicated in 5.5 is reached. Affirm that the EUT maintains compliance with the OOBE limits.
m) Reset the analyzer start frequency to the lower band/block edge frequency minus 300 kHz (when operational frequency is < 1 GHz) or 3 MHz (when operational frequency is ≥ 1 GHz), and the stop frequency to the lower band/block edge frequency and repeat 7.5j) to 7.5l).
n) Repeat 7.5b) through 7.5m) for each uplink and downlink operational band.

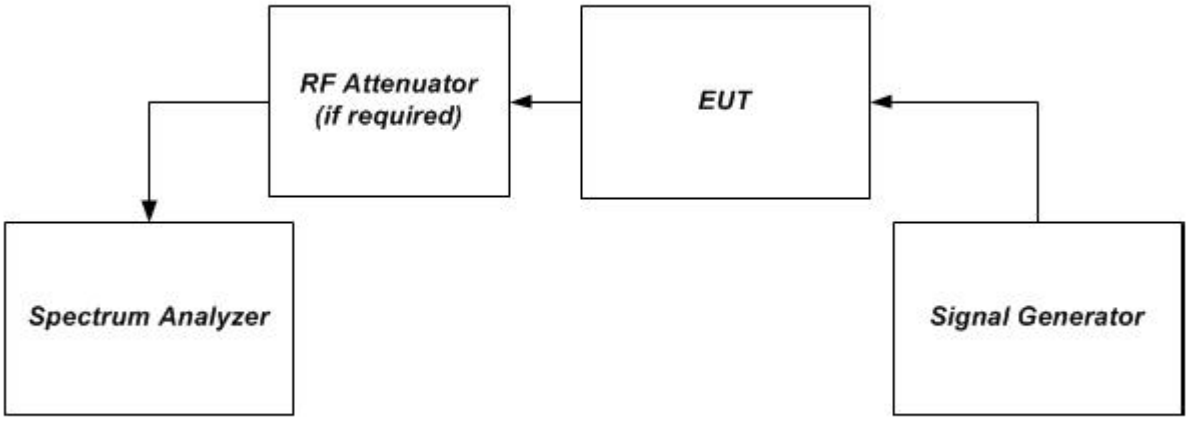


Figure 1 – Band verification test instrumentation setup

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu from 2022-11-22 to 2022-11-30.

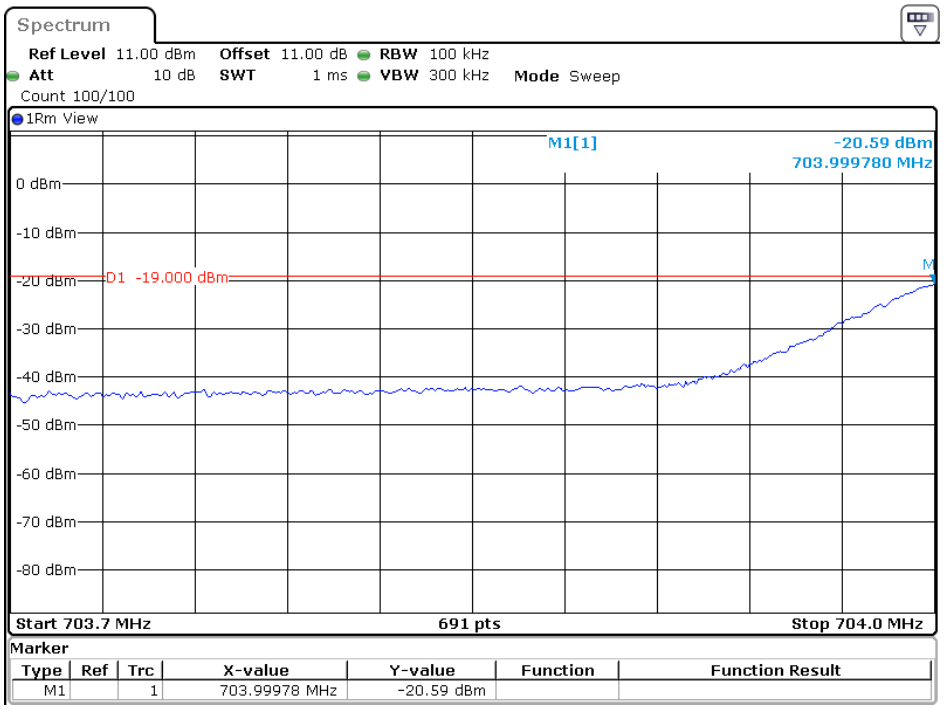
Test Result: Pass

:

Please refer to the following plots

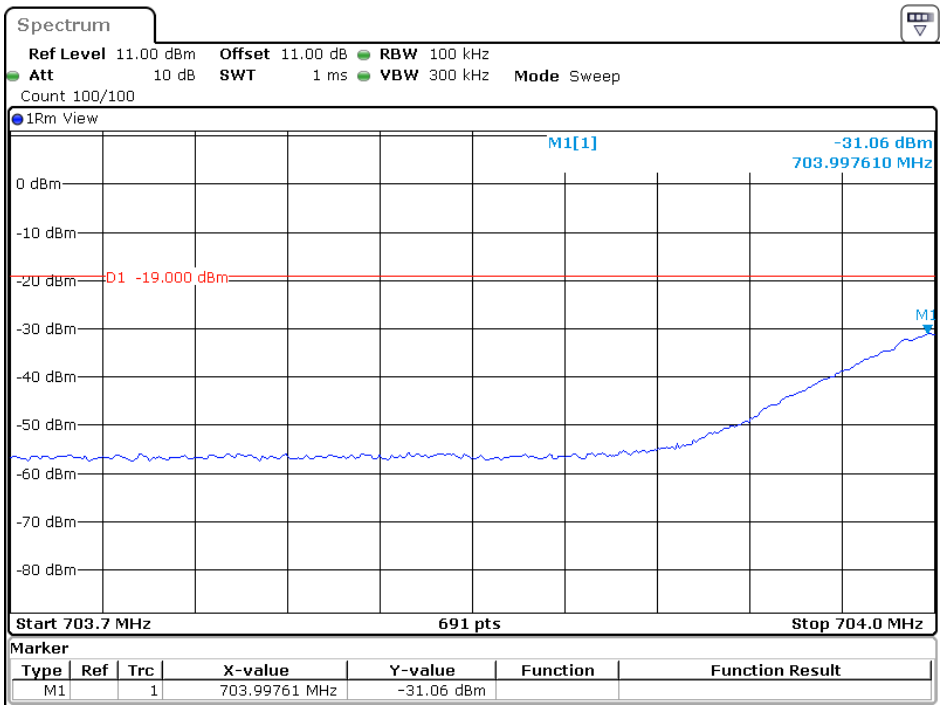
Uplink

Lower 700MHz CDMA Left Side Pre-AGC



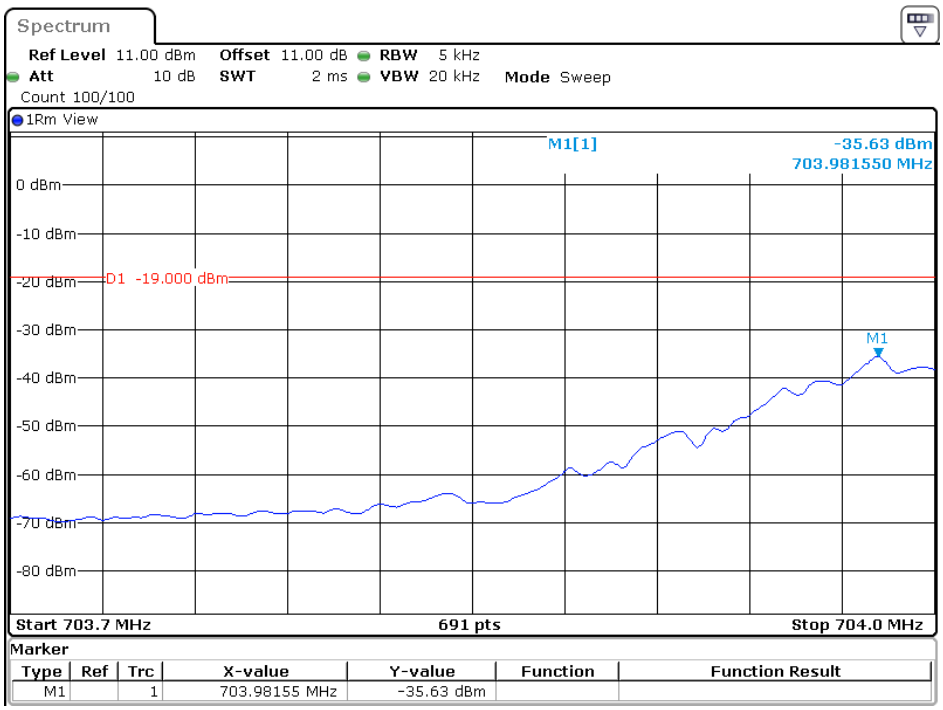
Date: 22.NOV.2022 15:10:19

Lower 700MHz CDMA Left Side Above AGC



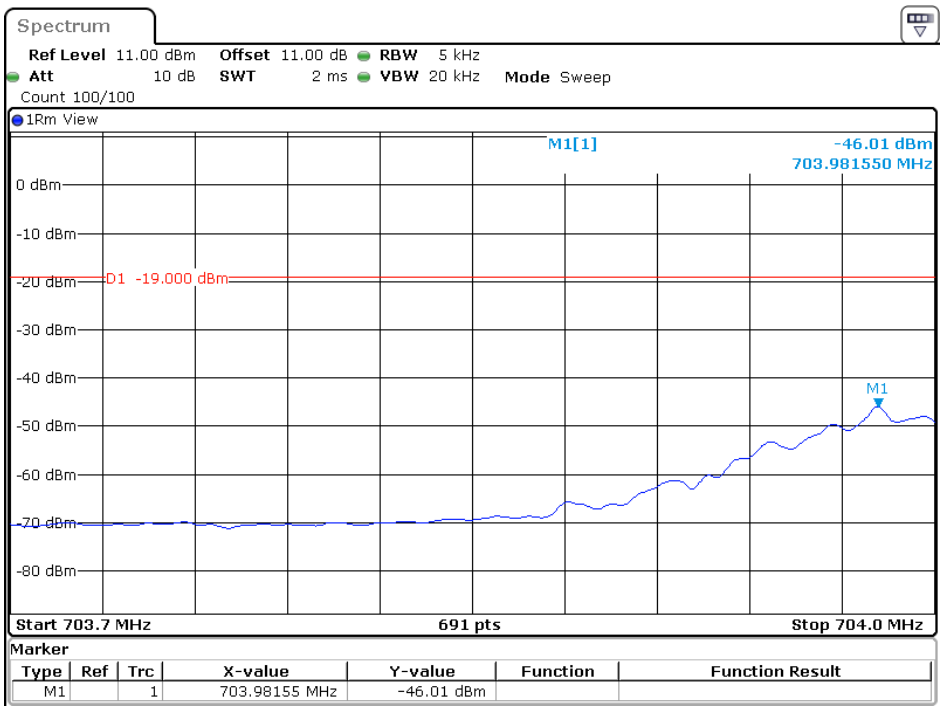
Date: 22.NOV.2022 15:09:56

Lower 700MHz GSM Left Side Pre-AGC



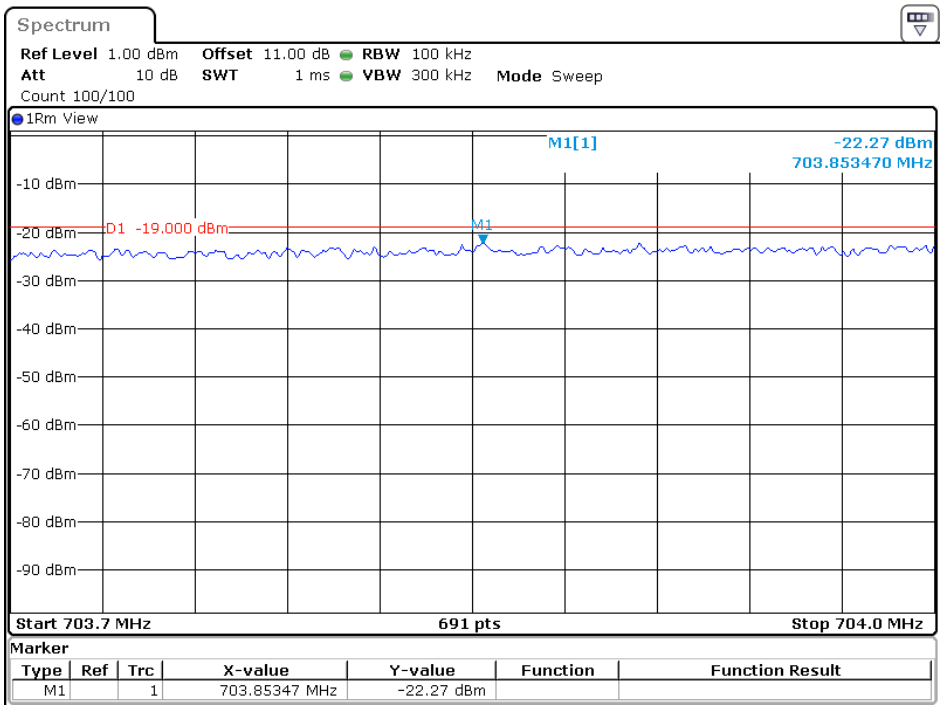
Date: 22.NOV.2022 15:41:53

Lower 700MHz GSM Left Side Above AGC



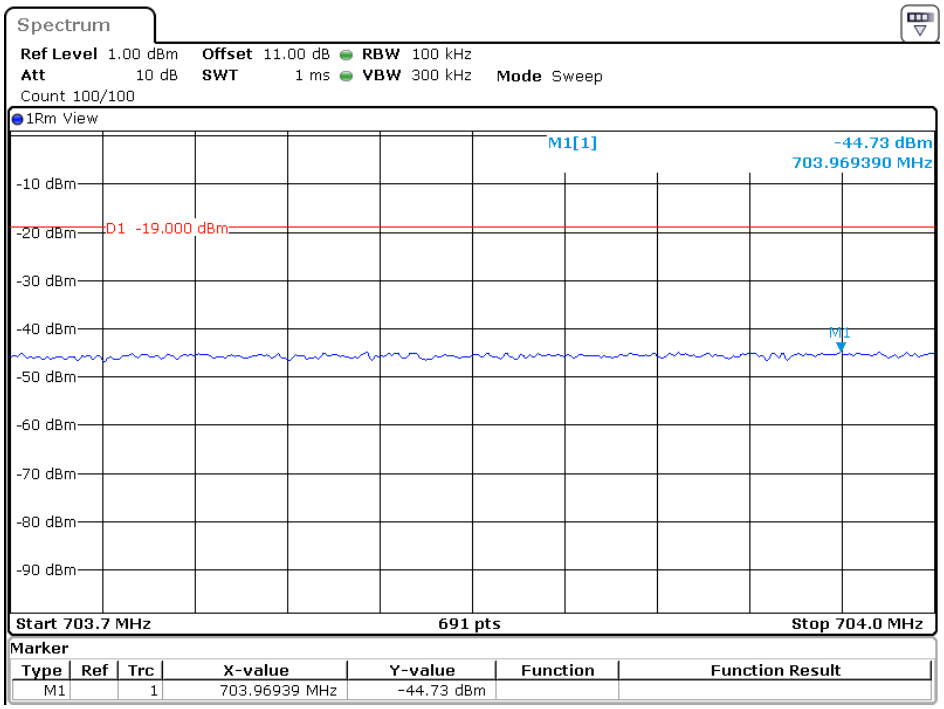
Date: 22.NOV.2022 15:42:30

Lower 700MHz WCDMA Left Side Pre-AGC



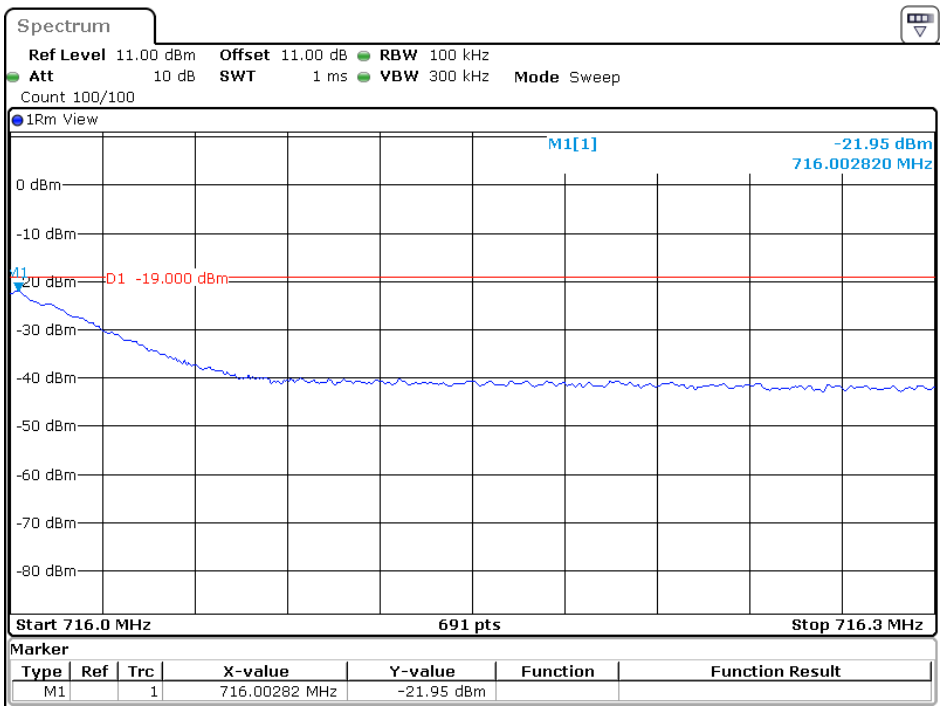
Date: 22.NOV.2022 14:31:42

Lower 700MHz WCDMA Left Side Above AGC



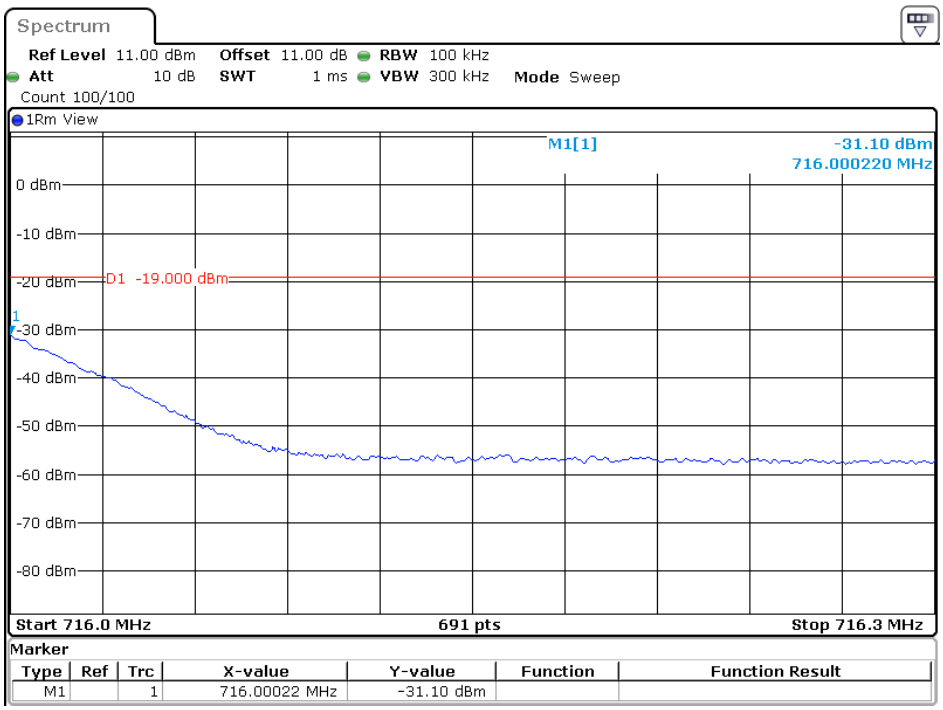
Date: 22.NOV.2022 14:31:16

Lower 700MHz CDMA Right Side Pre-AGC



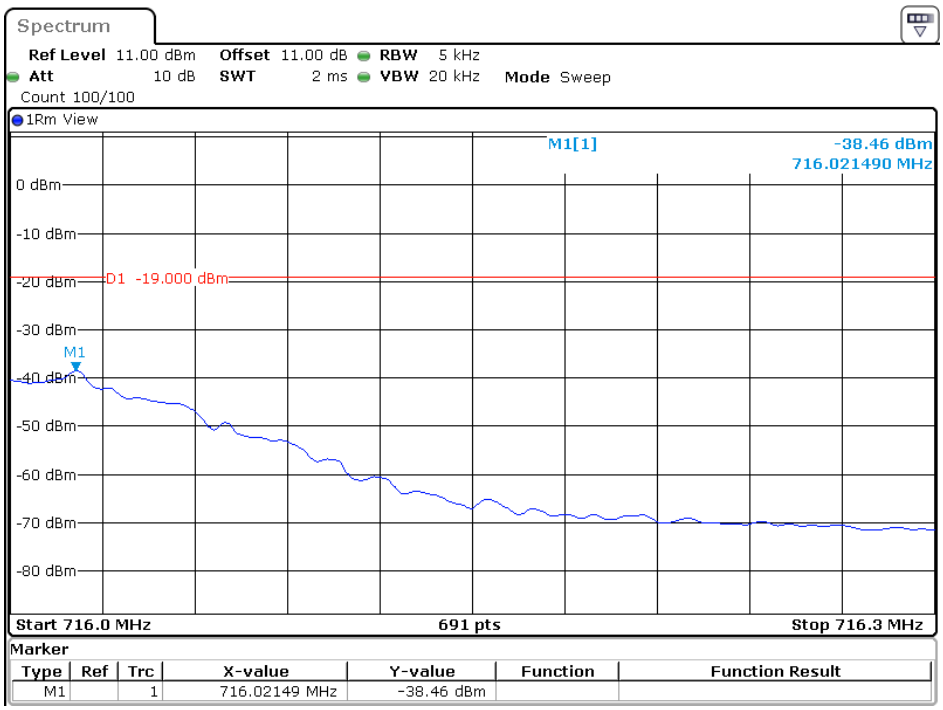
Date: 22.NOV.2022 15:08:33

Lower 700MHz CDMA Right Side Above AGC



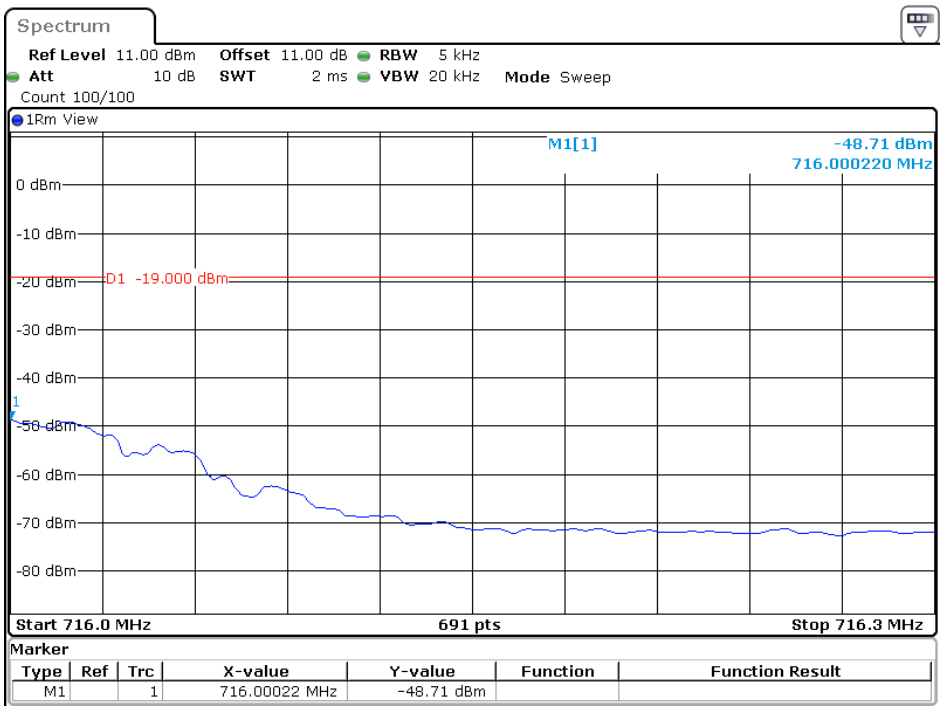
Date: 22.NOV.2022 15:08:57

Lower 700MHz GSM Right Side Pre-AGC



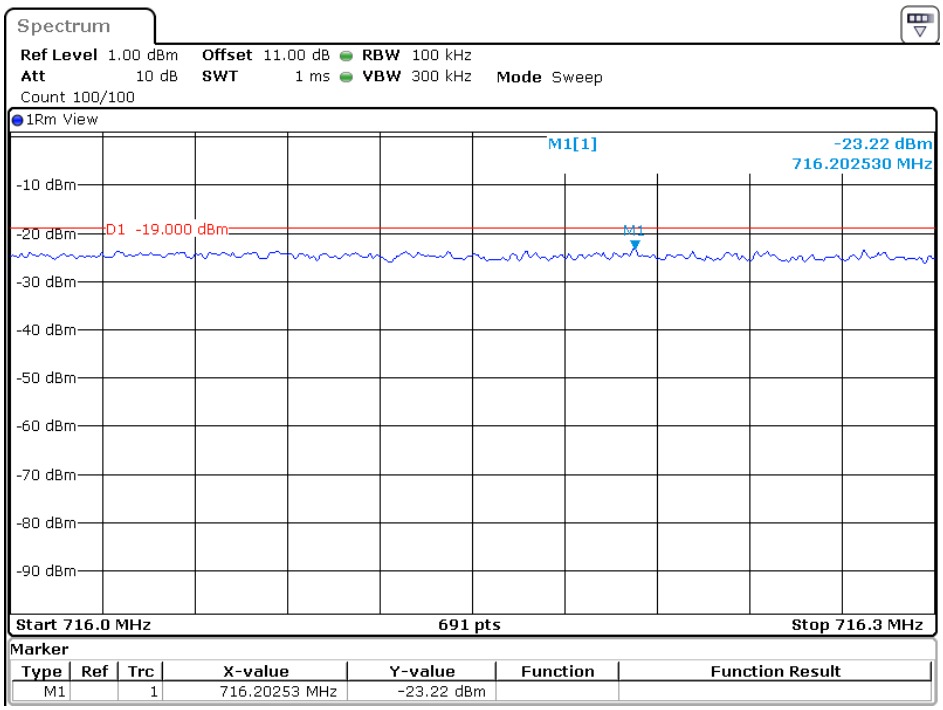
Date: 22.NOV.2022 15:43:58

Lower 700MHz GSM Right Side Above AGC



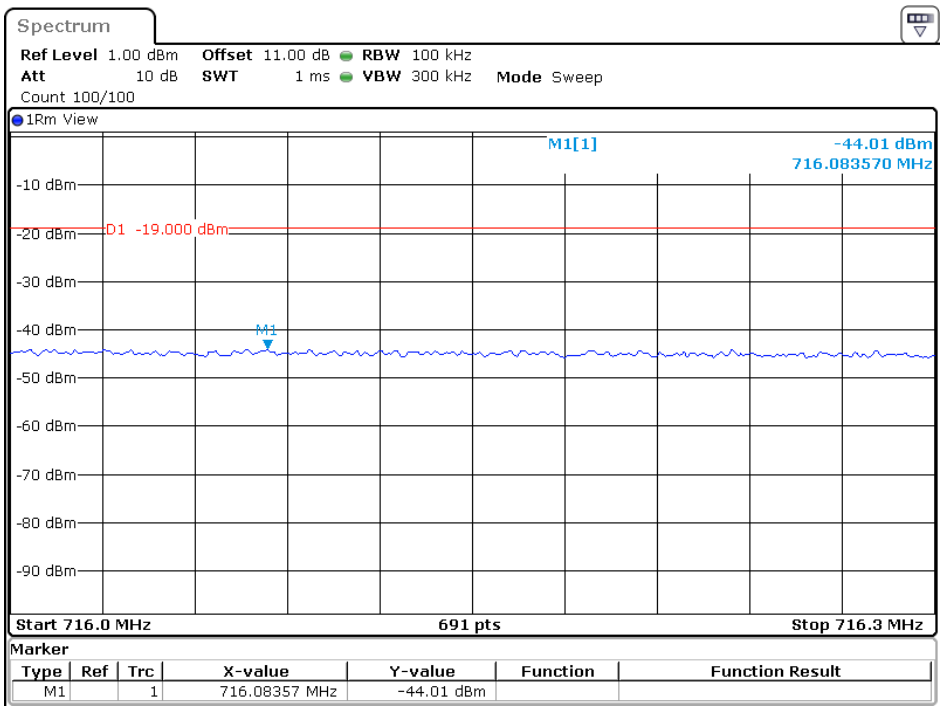
Date: 22.NOV.2022 15:43:37

Lower 700MHz WCDMA Right Side Pre-AGC



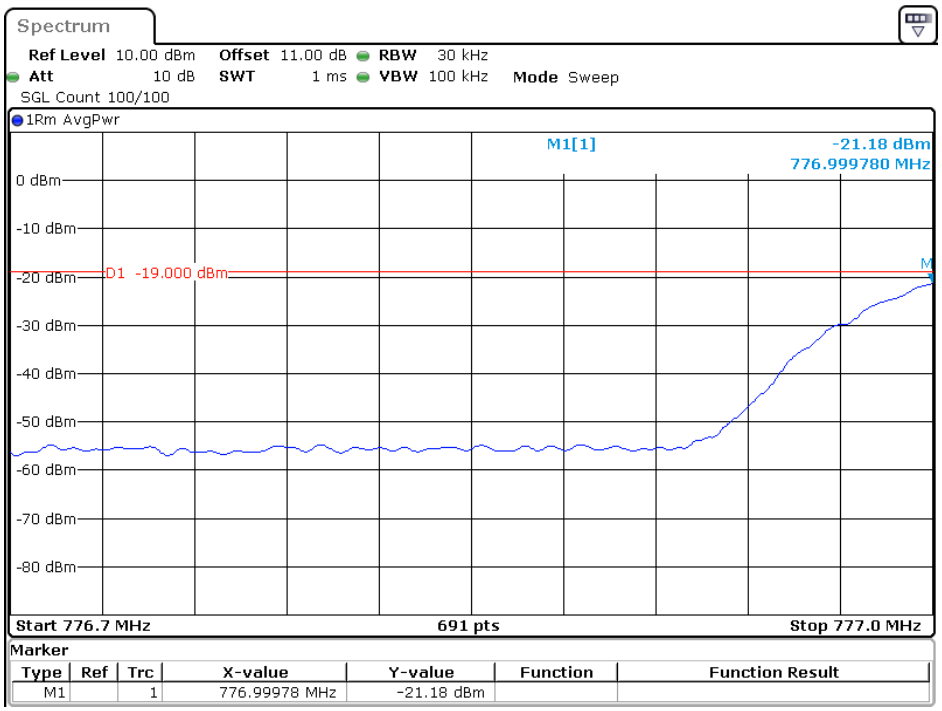
Date: 22.NOV.2022 14:30:05

Lower 700MHz WCDMA Right Side Above AGC



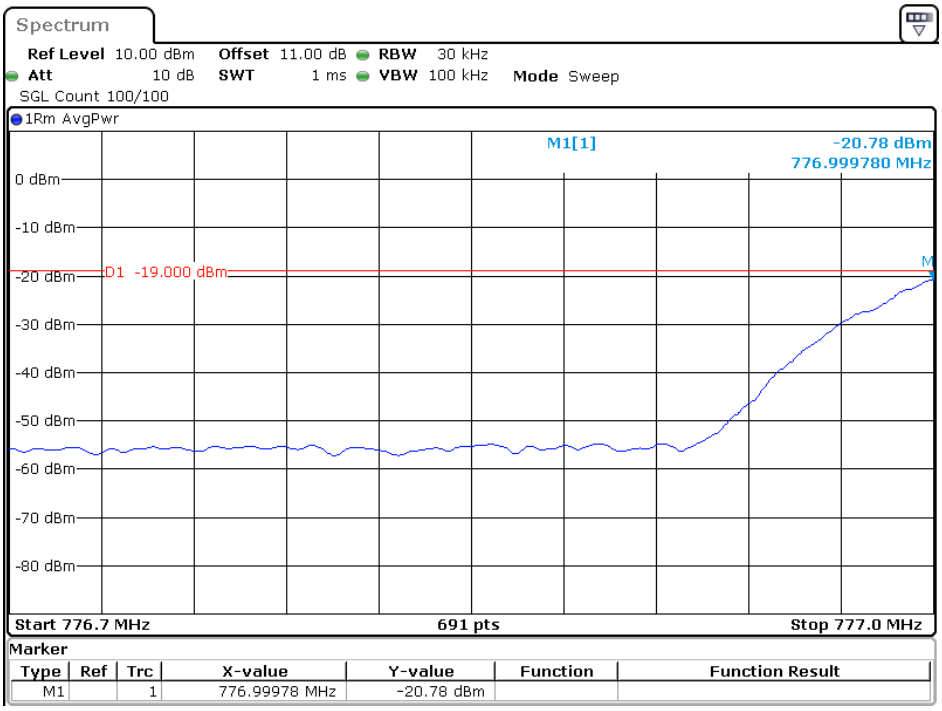
Date: 22.NOV.2022 14:30:25

Upper 700MHz CDMA Left Side Pre-AGC



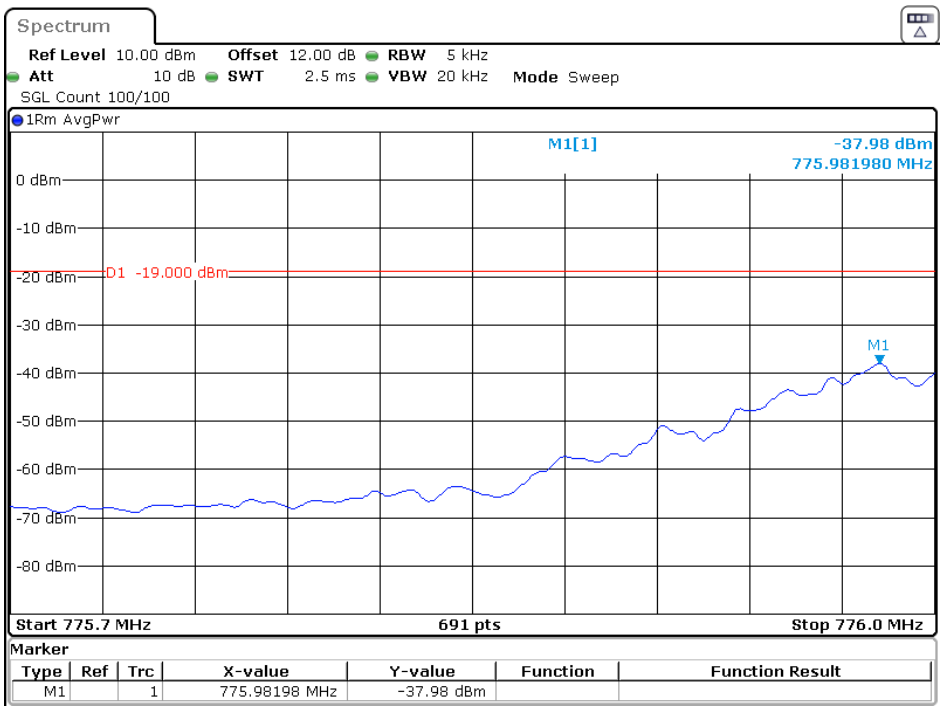
Date: 14.MAR.2023 14:10:50

Upper 700MHz CDMA Left Side Above AGC



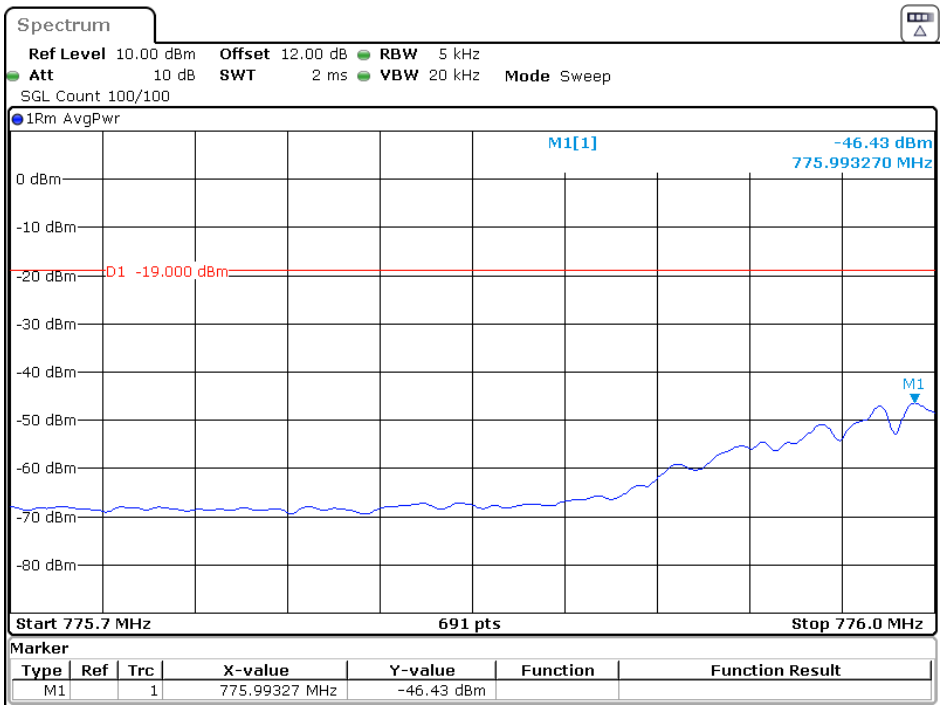
Date: 14.MAR.2023 14:10:57

Upper 700MHz GSM Left Side Pre-AGC



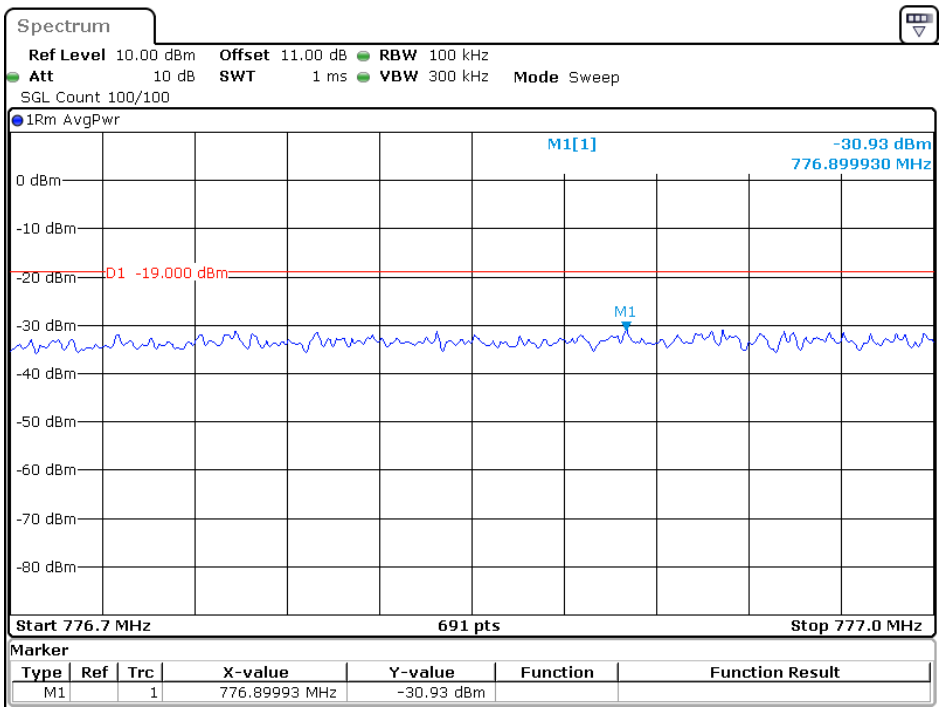
Date: 30.NOV.2022 17:01:54

Upper 700MHz GSM Left Side Above AGC



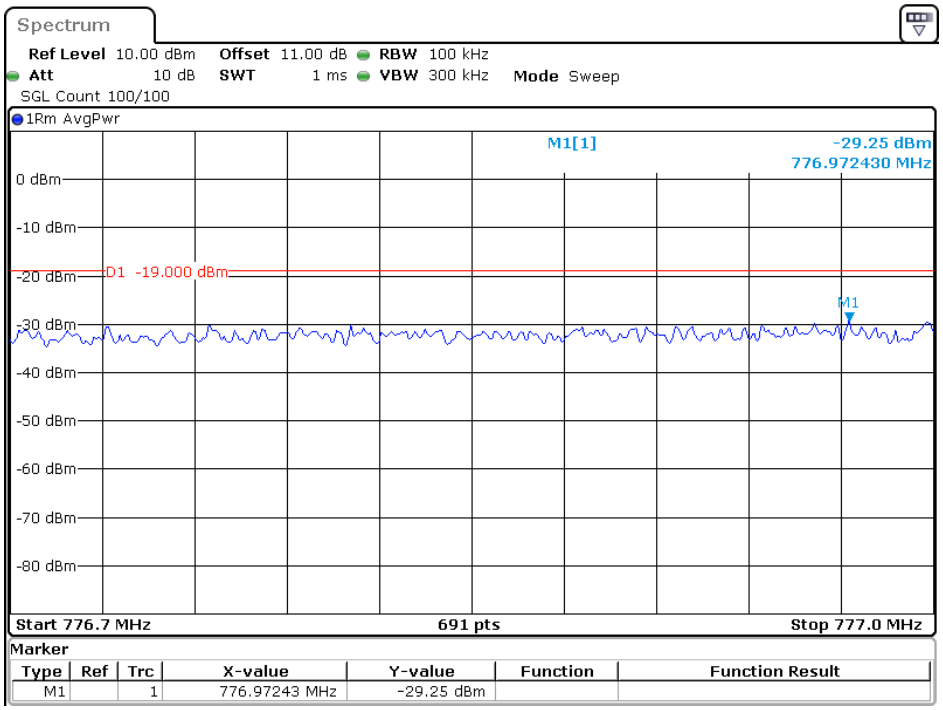
Date: 30.NOV.2022 17:03:56

Upper 700MHz WCDMA Left Side Pre-AGC



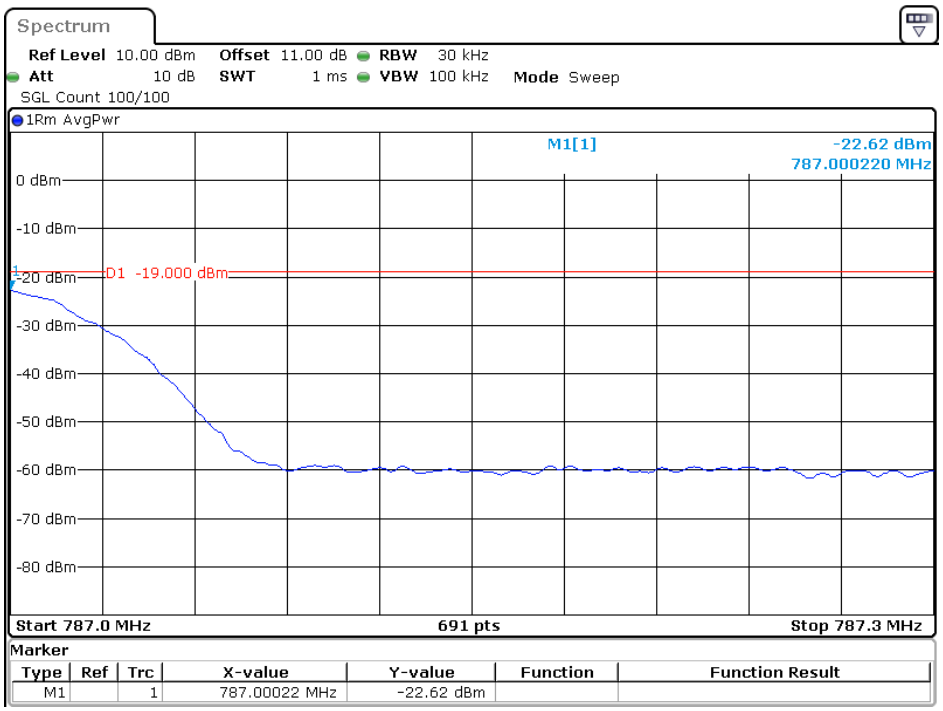
Date: 14.MAR.2023 14:08:39

Upper 700MHz WCDMA Left Side Above AGC



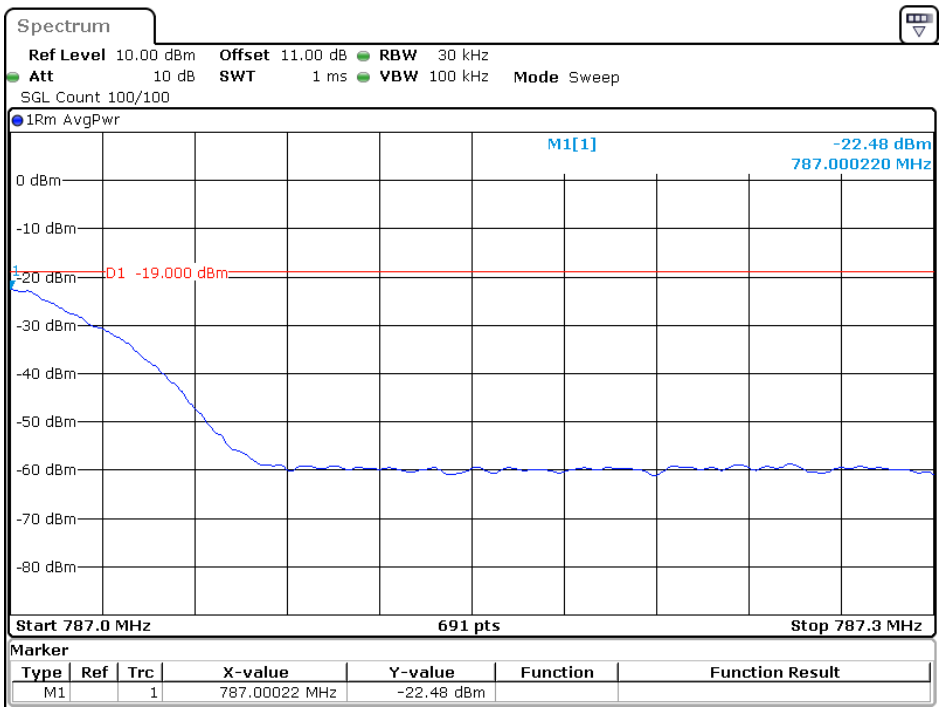
Date: 14.MAR.2023 14:08:46

Upper 700MHz CDMA Right Side Pre-AGC



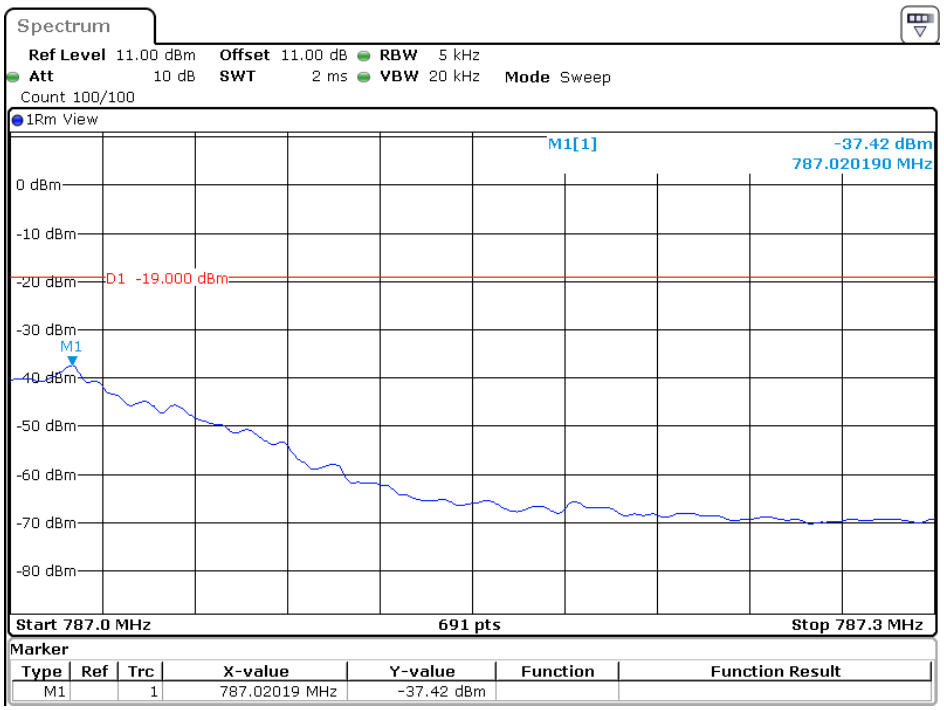
Date: 14.MAR.2023 14:11:04

Upper 700MHz CDMA Right Side Above AGC



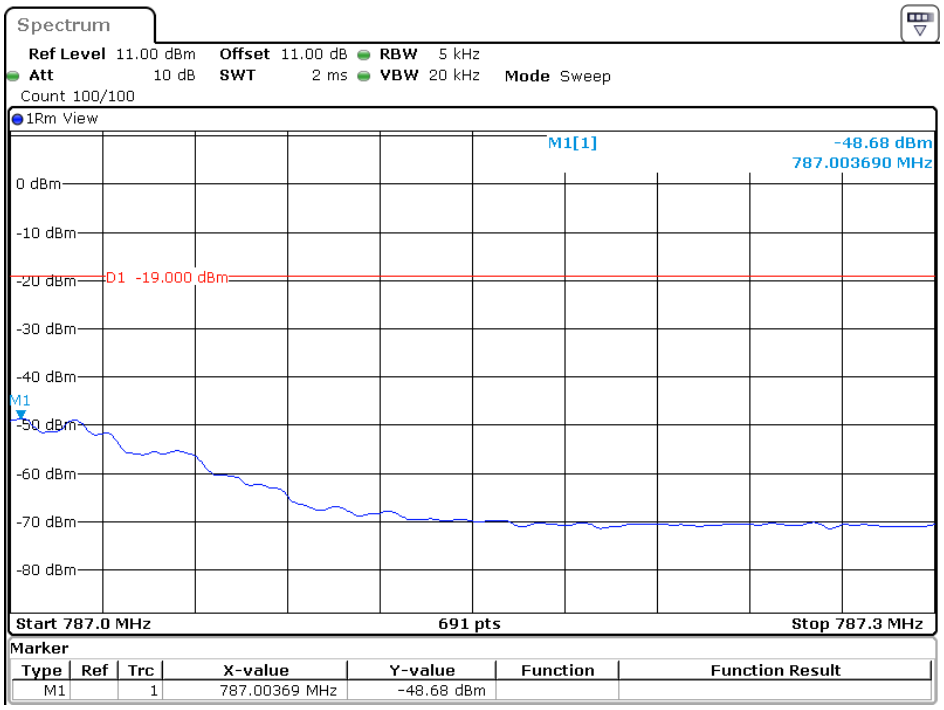
Date: 14.MAR.2023 14:11:11

Upper 700MHz GSM Right Side Pre-AGC



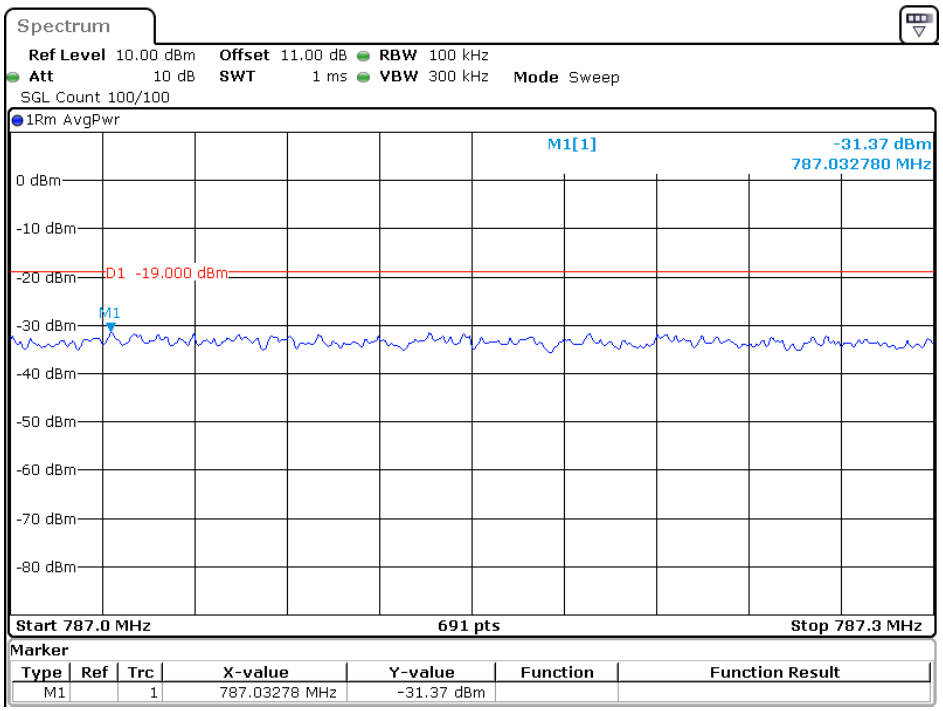
Date: 22.NOV.2022 15:46:30

Upper 700MHz GSM Right Side Above AGC



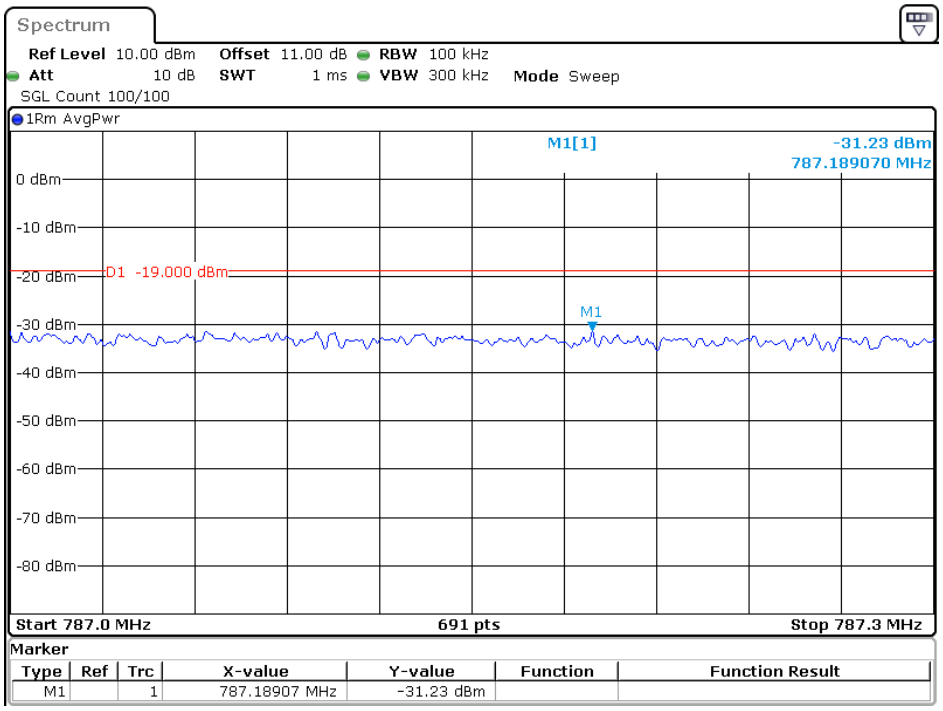
Date: 22.NOV.2022 15:46:05

Upper 700MHz WCDMA Right Side Pre-AGC



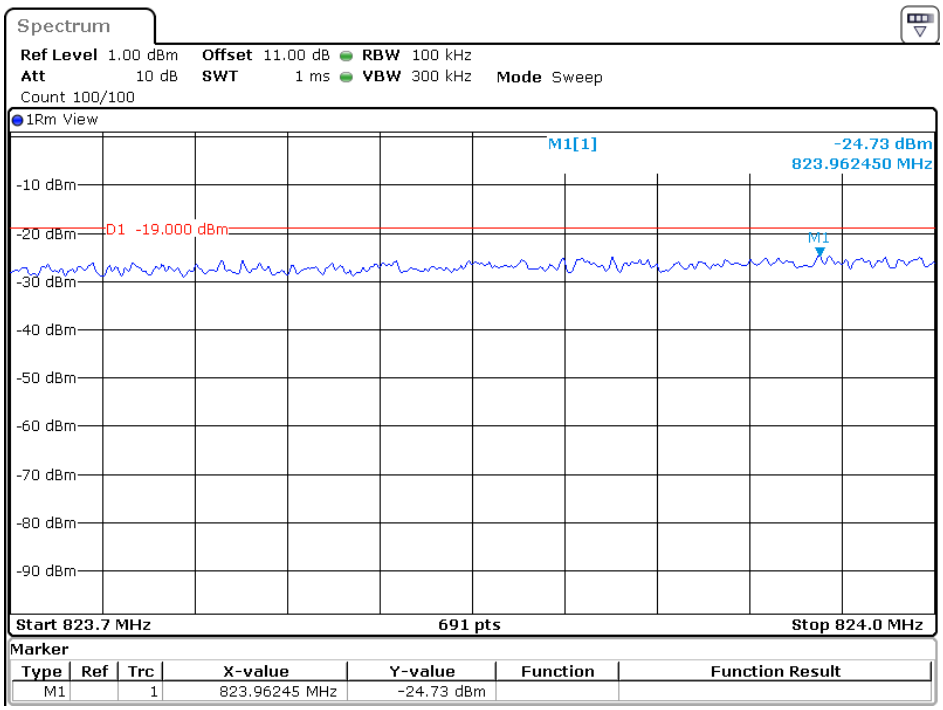
Date: 14.MAR.2023 14:08:53

Upper 700MHz WCDMA Right Side Above AGC



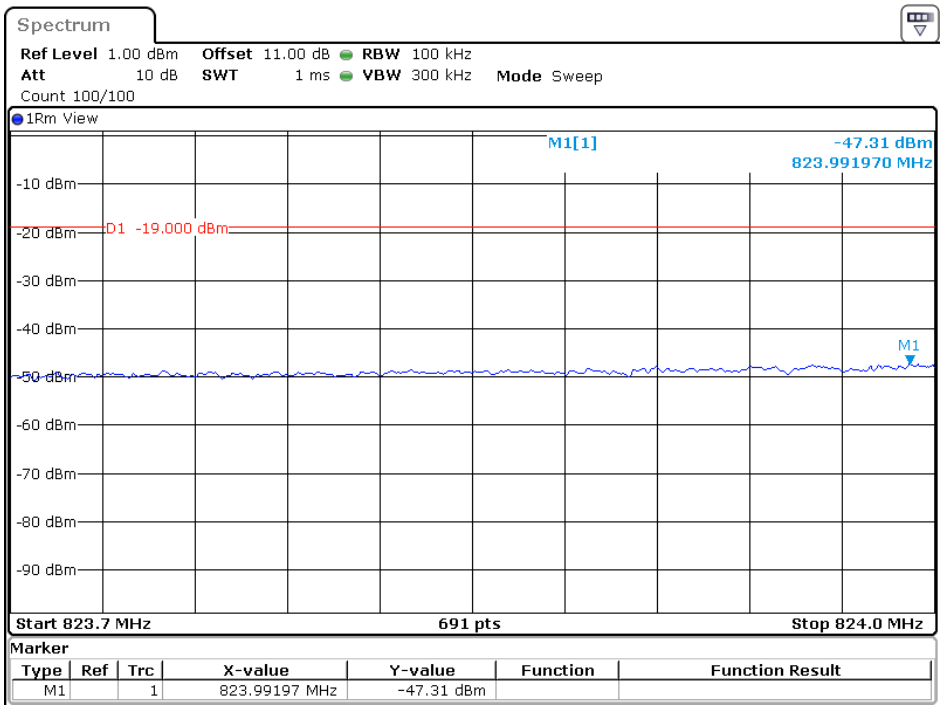
Date: 14.MAR.2023 14:09:00

Cellular Band CDMA Left Side Pre-AGC



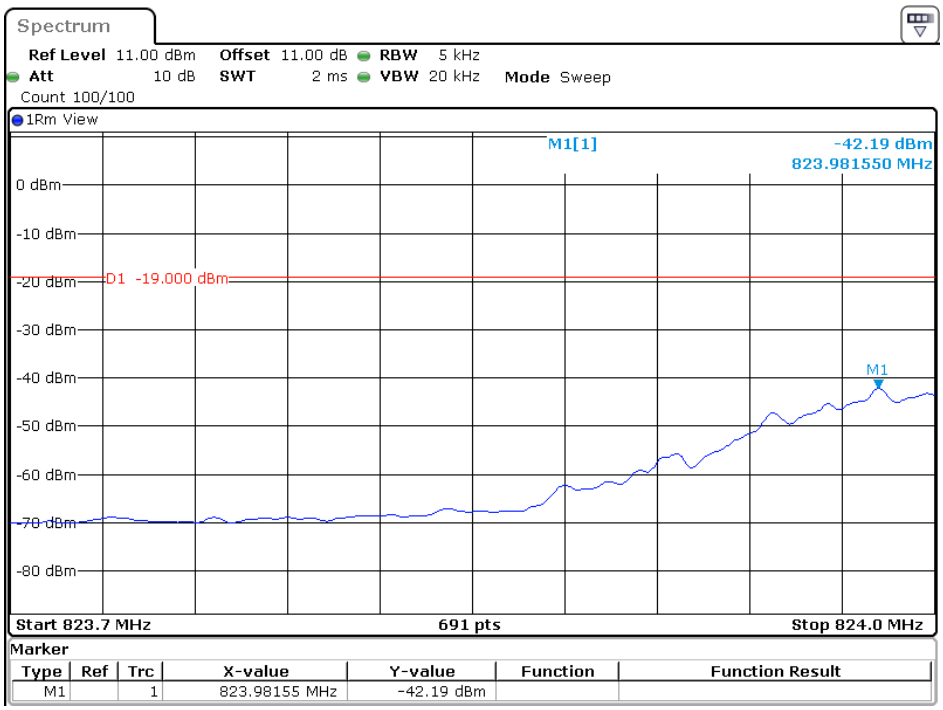
Date: 22.NOV.2022 14:55:24

Cellular Band CDMA Left Side Above AGC



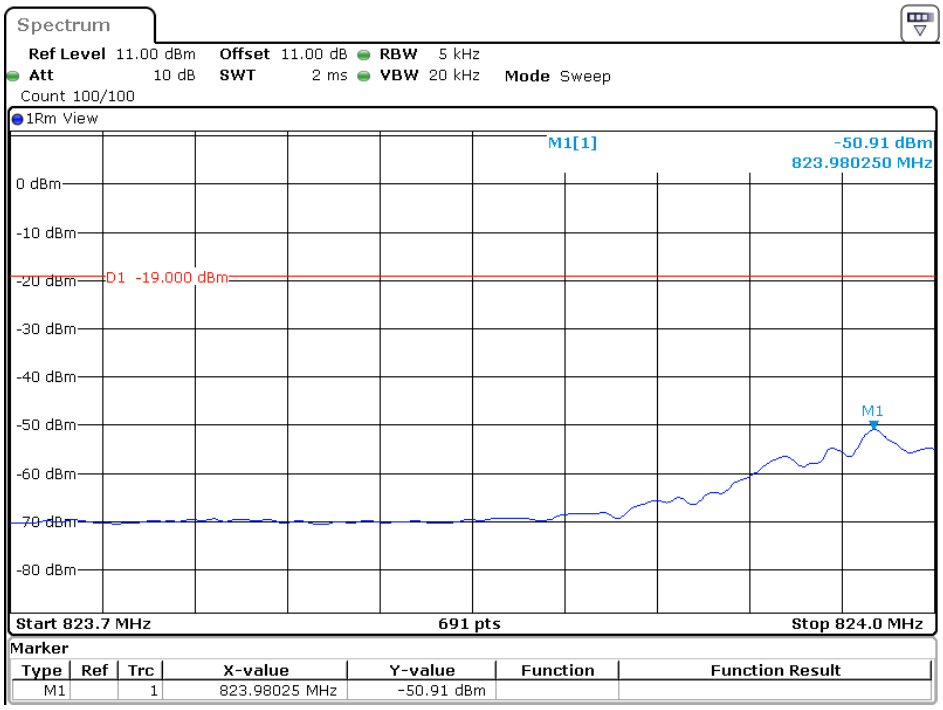
Date: 22.NOV.2022 14:54:53

Cellular Band GSM Left Side Pre-AGC



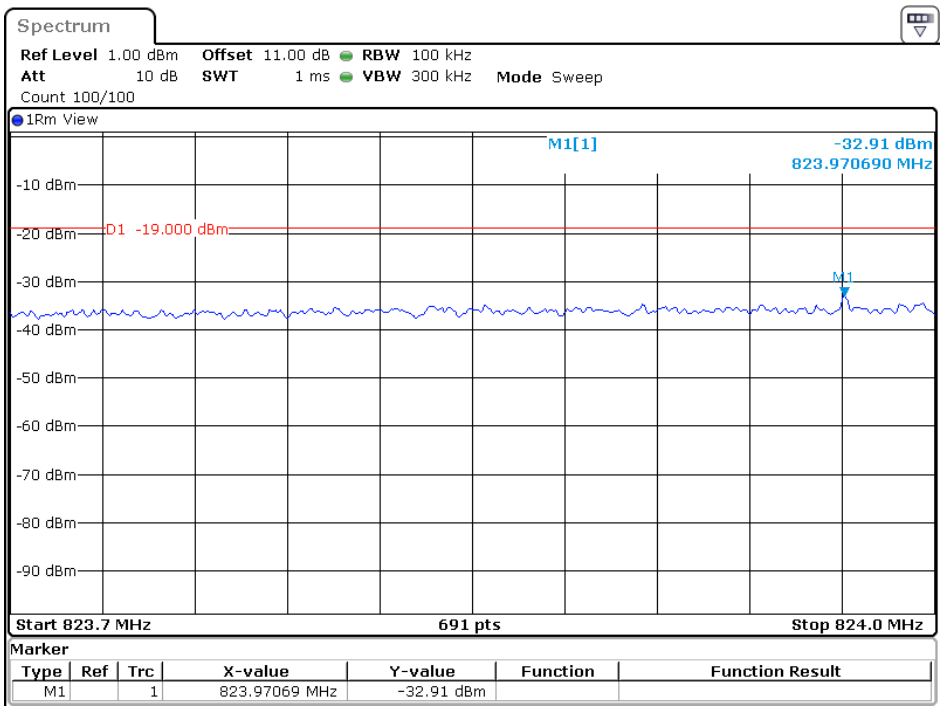
Date: 22.NOV.2022 15:47:41

Cellular Band GSM Left Side Above AGC



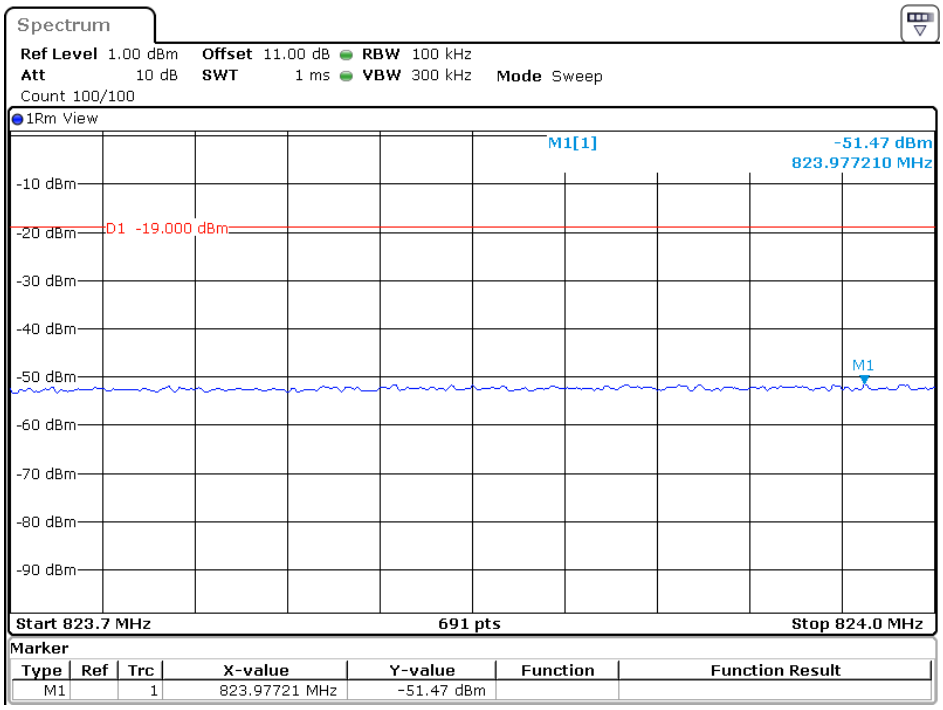
Date: 22.NOV.2022 15:48:06

Cellular Band WCDMA Left Side Pre-AGC



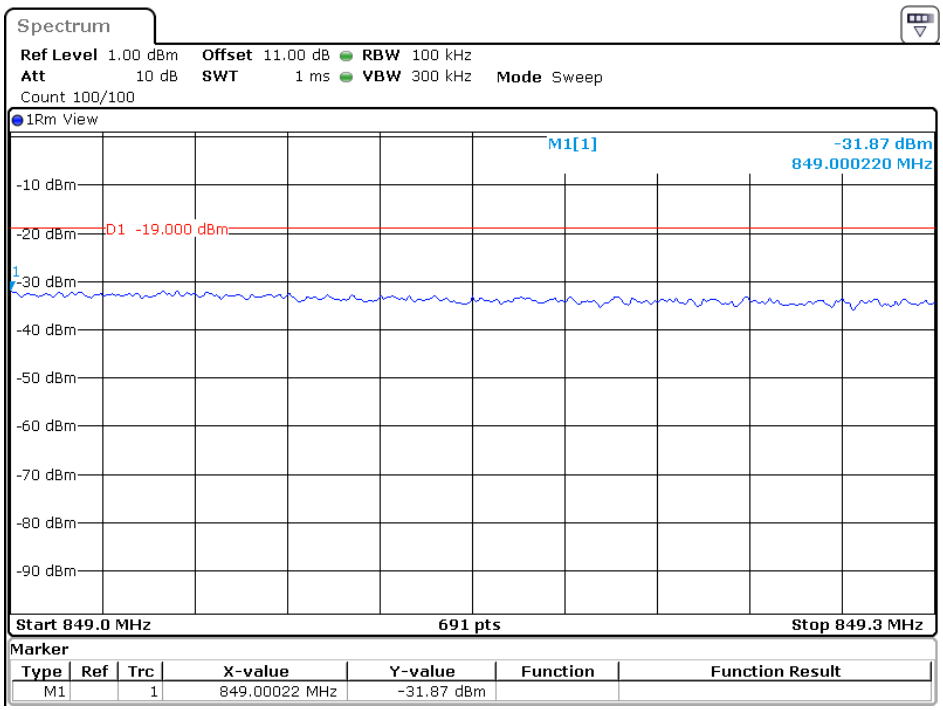
Date: 22.NOV.2022 14:33:04

Cellular Band WCDMA Left Side Above AGC



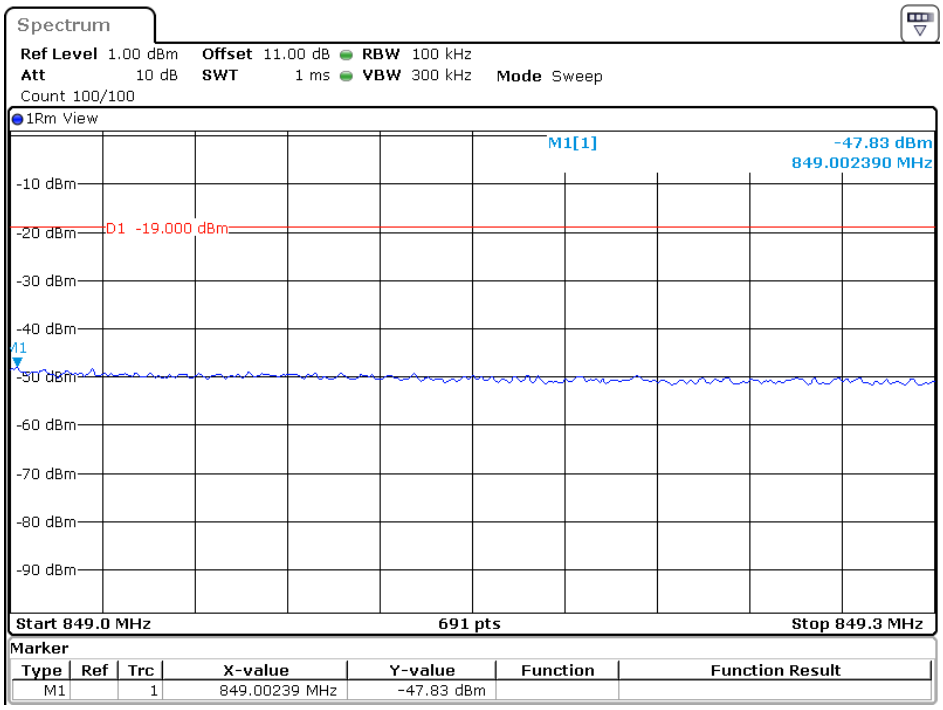
Date: 22.NOV.2022 14:35:34

Cellular Band CDMA Right Side Pre-AGC



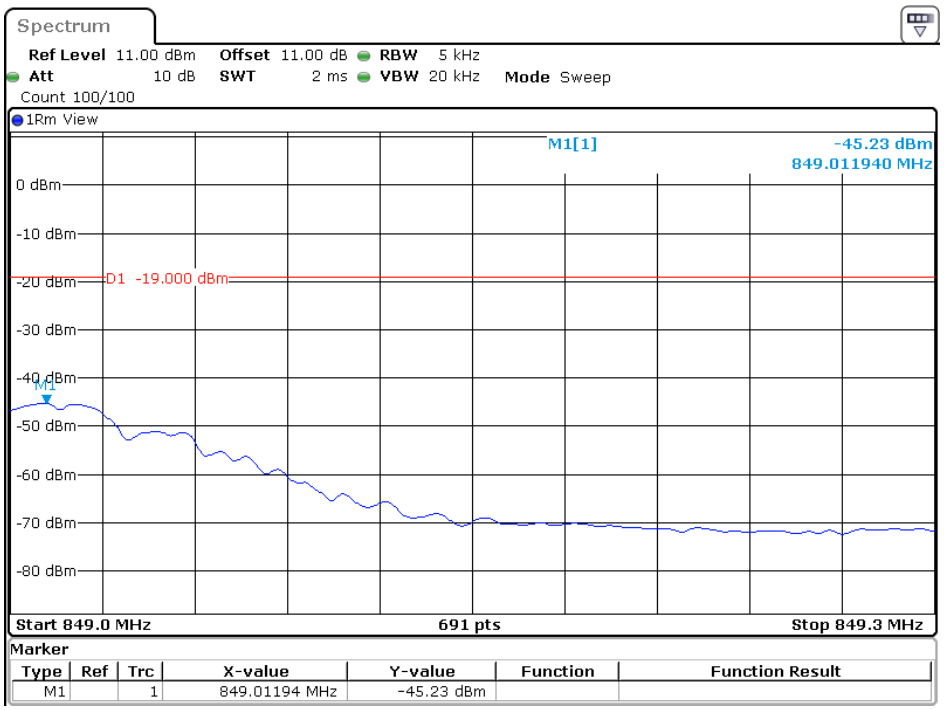
Date: 22.NOV.2022 14:53:32

Cellular Band CDMA Right Side Above AGC



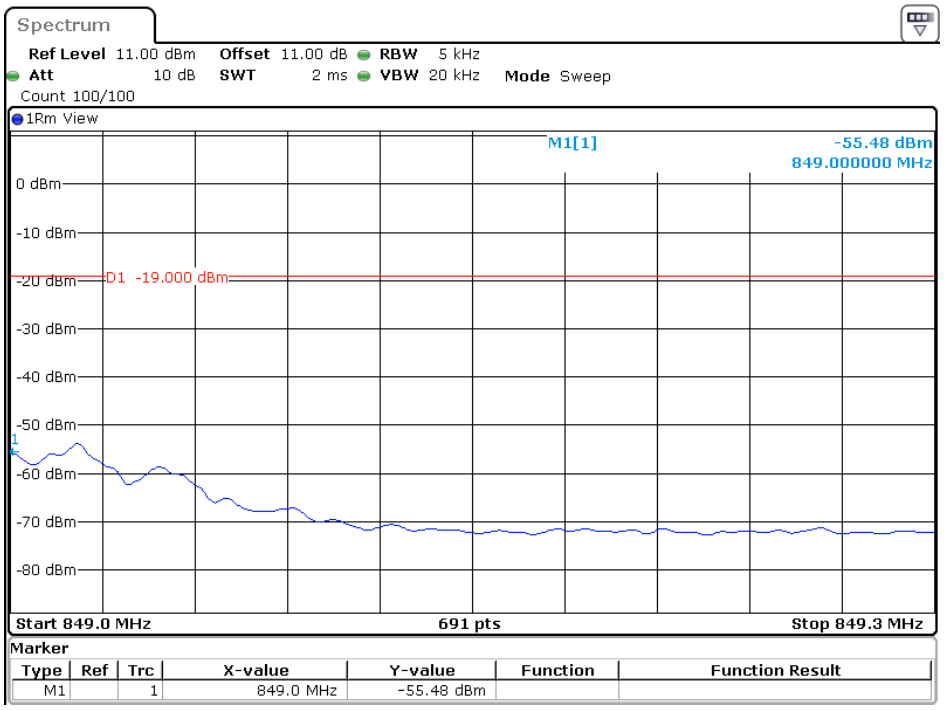
Date: 22.NOV.2022 14:53:55

Cellular Band GSM Right Side Pre-AGC



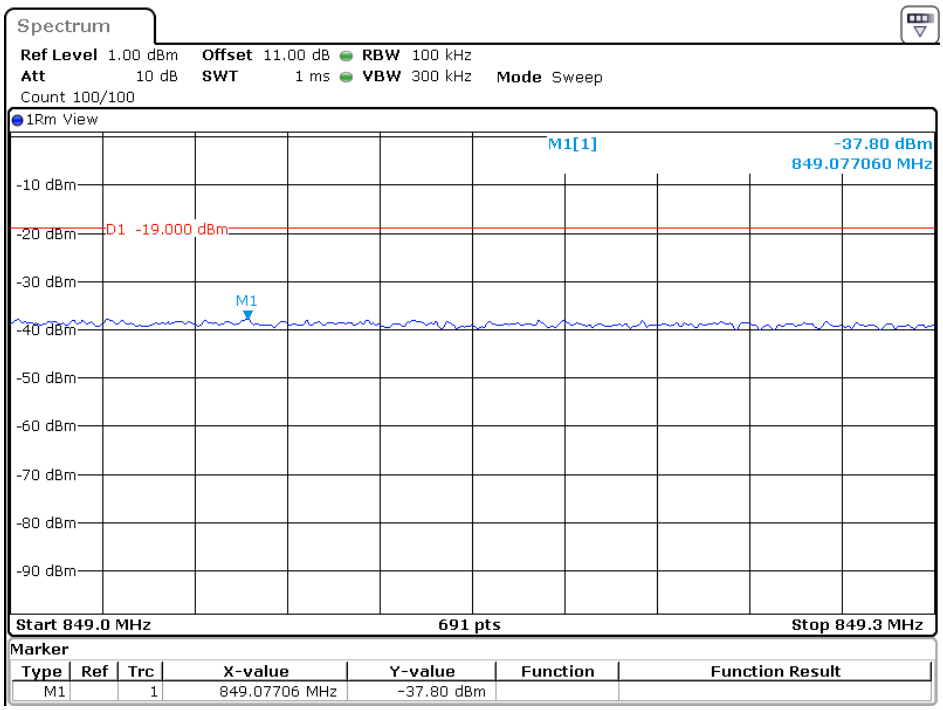
Date: 22.NOV.2022 15:49:17

Cellular Band GSM Right Side Above AGC



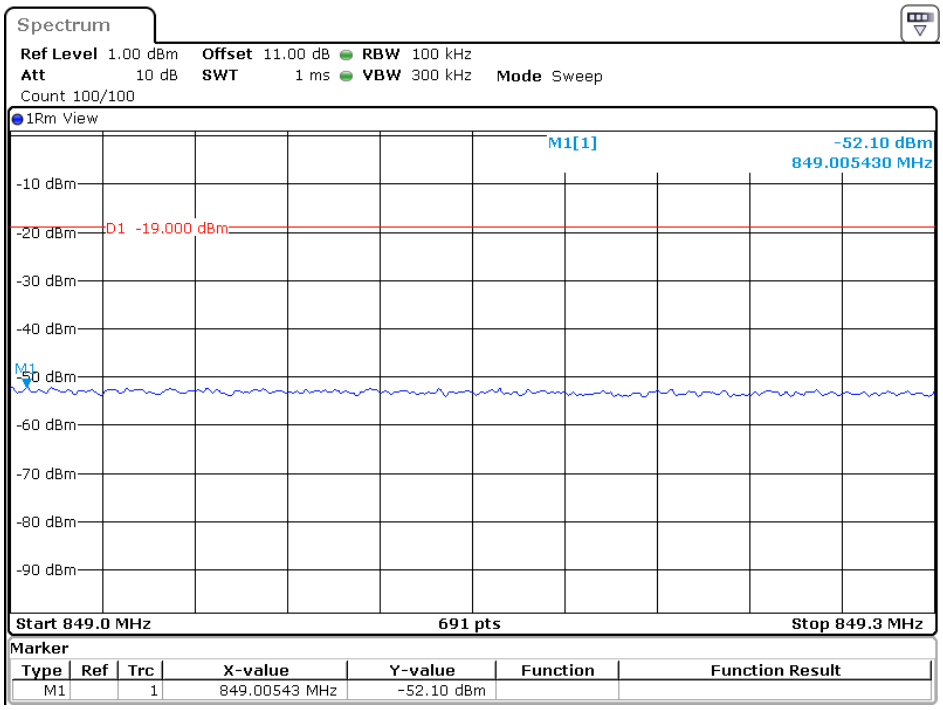
Date: 22.NOV.2022 15:48:50

Cellular Band WCDMA Right Side Pre-AGC



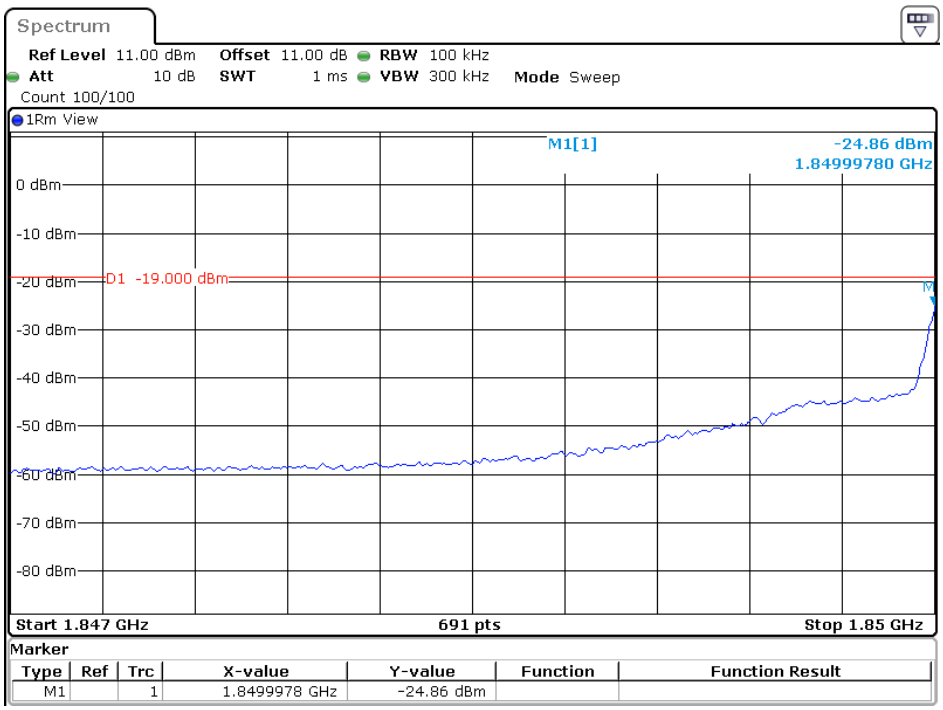
Date: 22.NOV.2022 14:37:37

Cellular Band WCDMA Right Side Above AGC



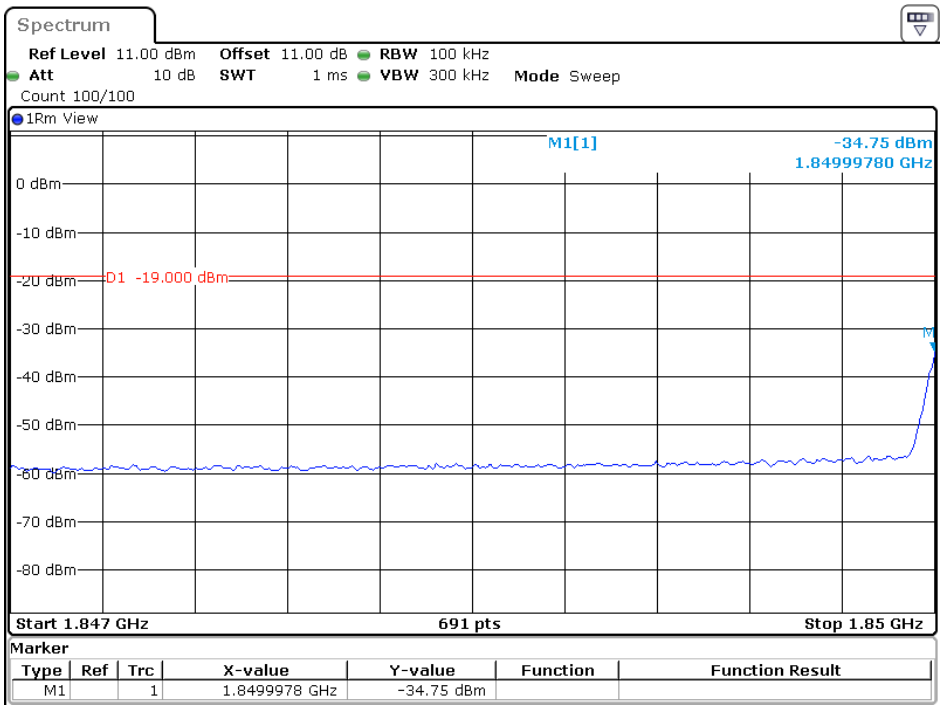
Date: 22.NOV.2022 14:50:45

PCS Band CDMA Left Side Pre-AGC



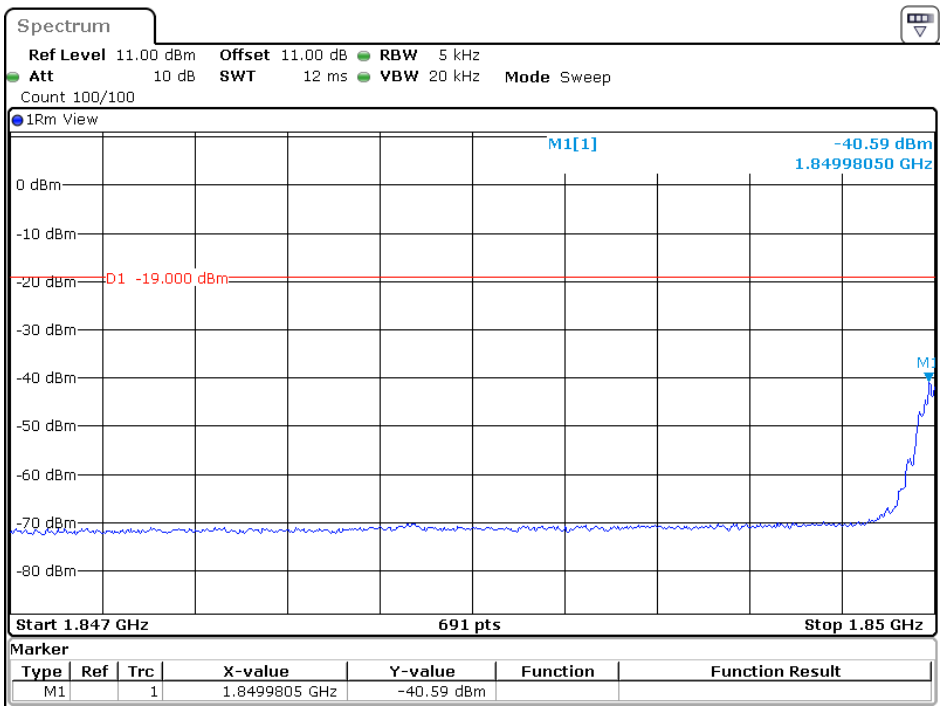
Date: 22.NOV.2022 15:14:51

PCS Band CDMA Left Side Above AGC



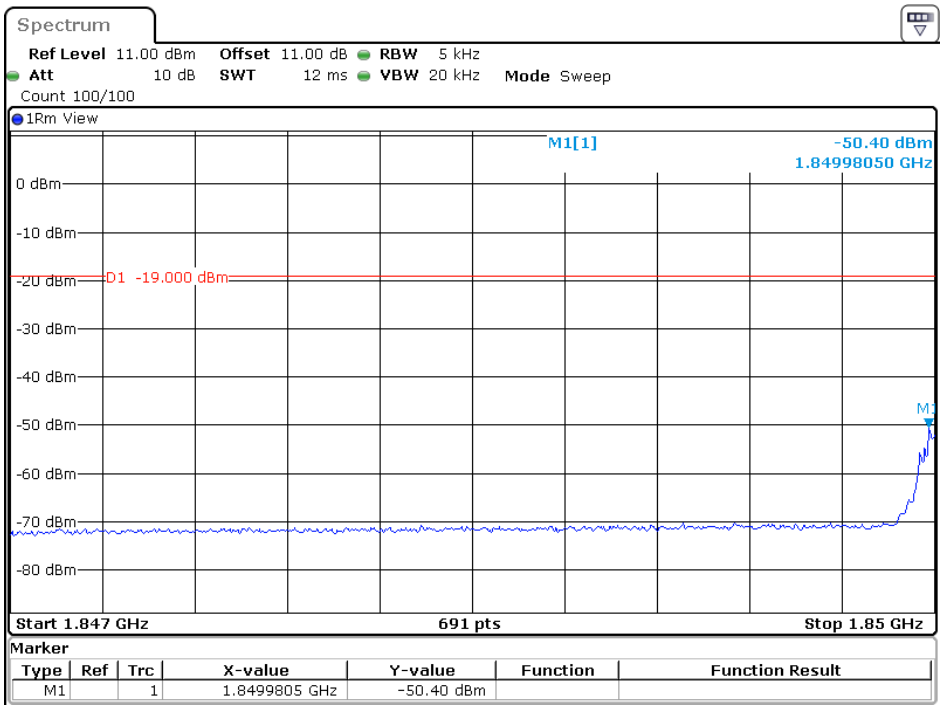
Date: 22.NOV.2022 15:15:13

PCS Band GSM Left Side Pre-AGC



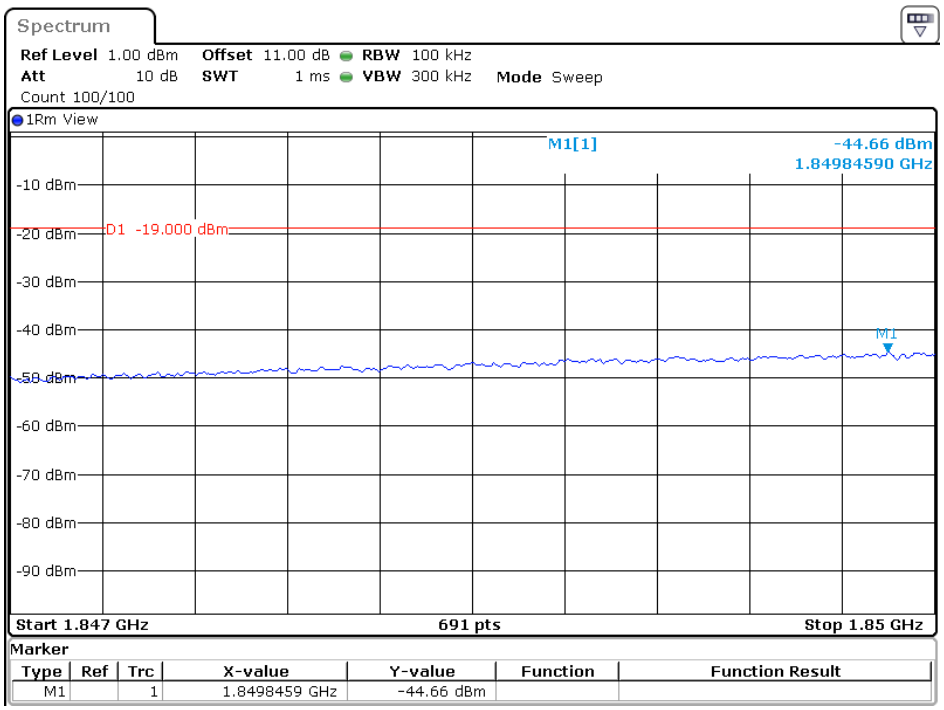
Date: 22.NOV.2022 15:35:51

PCS Band GSM Left Side Above AGC



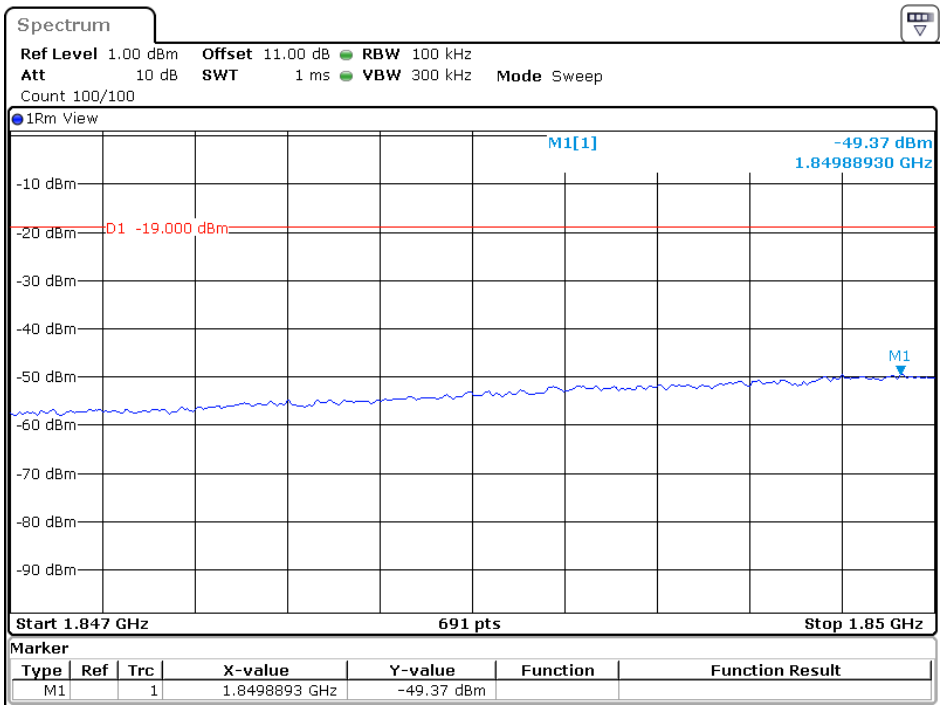
Date: 22.NOV.2022 15:34:36

PCS Band WCDMA Left Side Pre-AGC



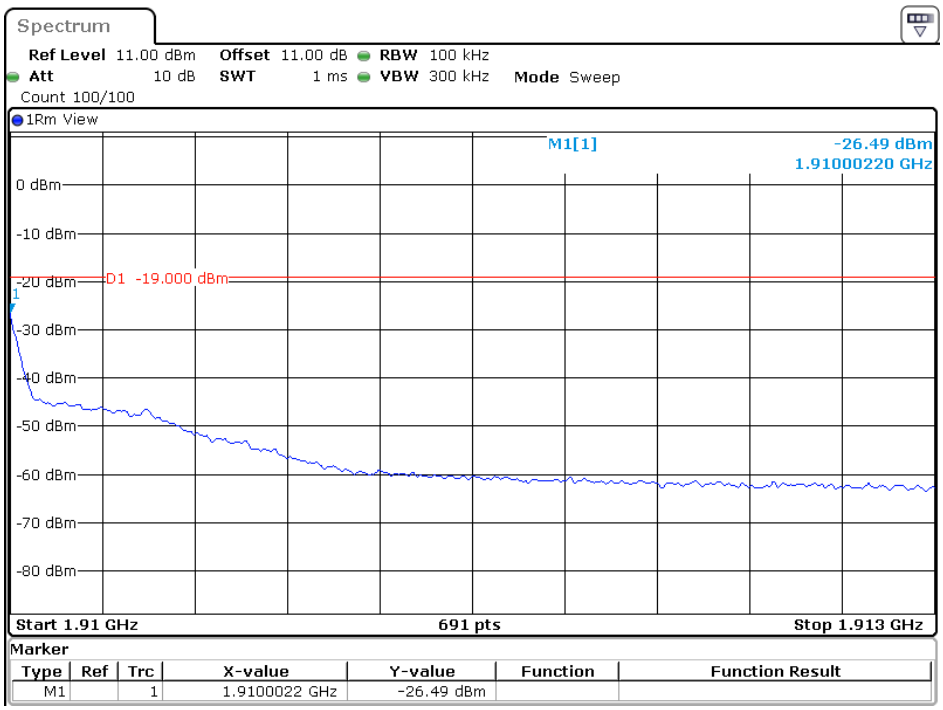
Date: 22.NOV.2022 14:42:19

PCS Band WCDMA Left Side Above AGC



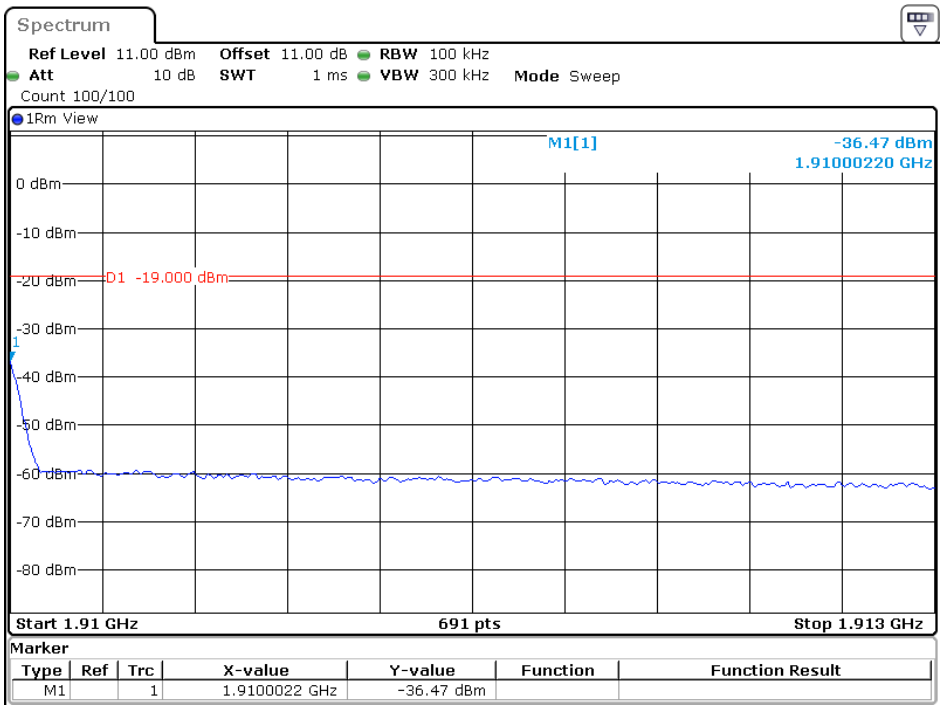
Date: 22.NOV.2022 14:42:45

PCS Band CDMA Right Side Pre-AGC



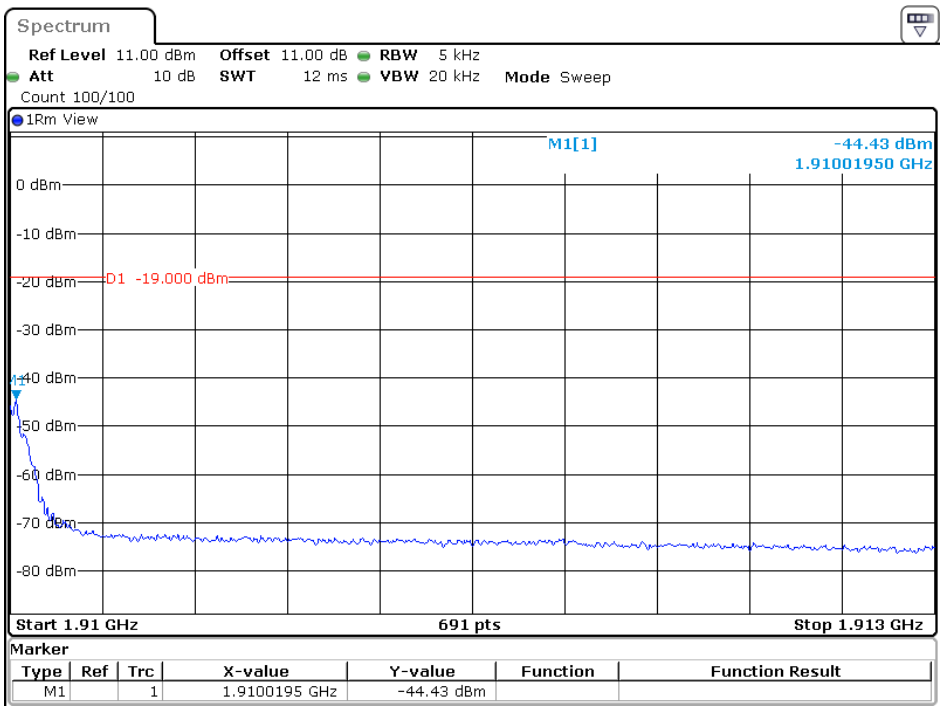
Date: 22.NOV.2022 15:16:37

PCS Band CDMA Right Side Above AGC



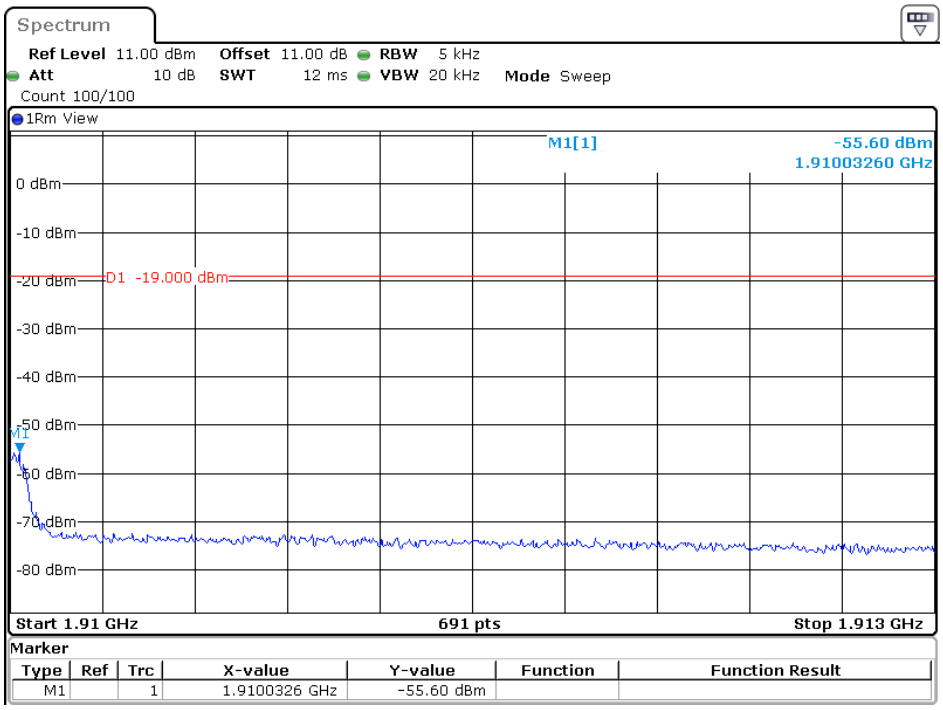
Date: 22.NOV.2022 15:16:13

PCS Band GSM Right Side Pre-AGC



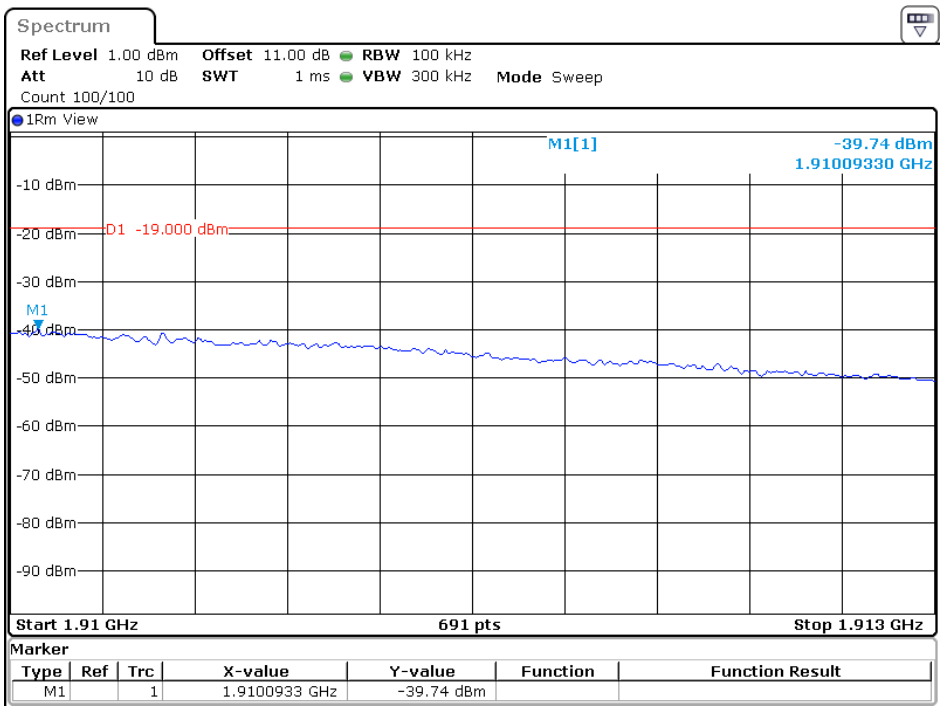
Date: 22.NOV.2022 15:36:50

PCS Band GSM Right Side Above AGC



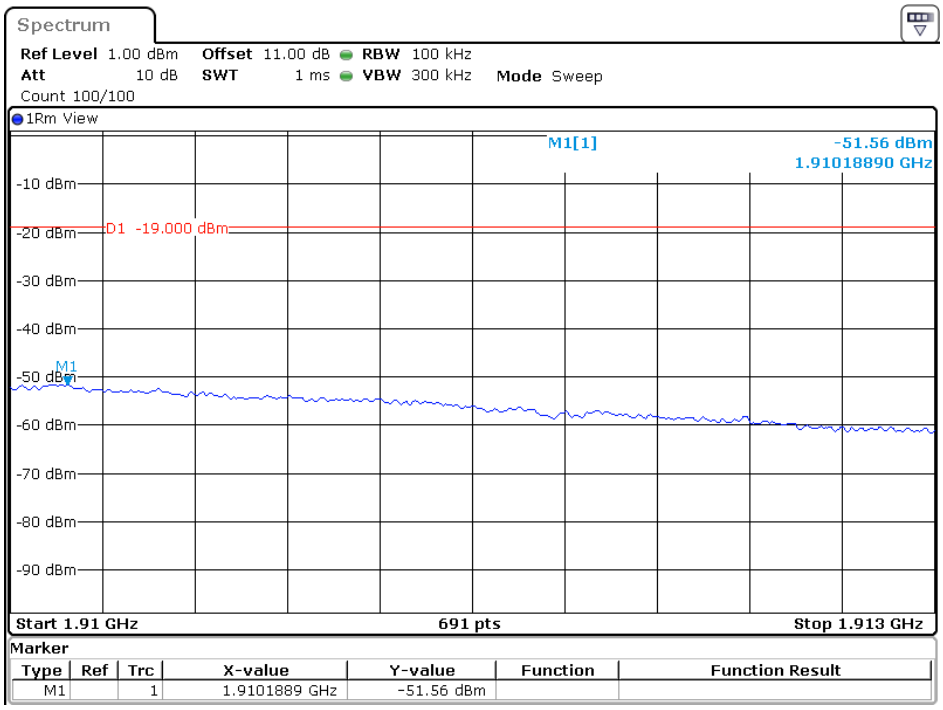
Date: 22.NOV.2022 15:37:10

PCS Band WCDMA Right Side Pre-AGC



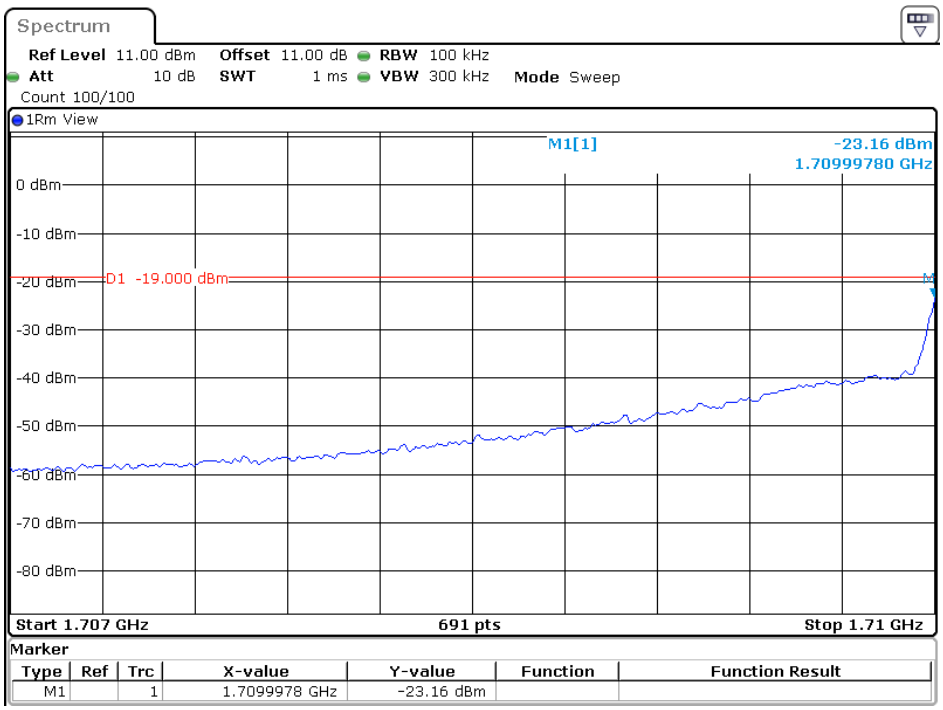
Date: 22.NOV.2022 14:41:25

PCS Band WCDMA Right Side Above AGC



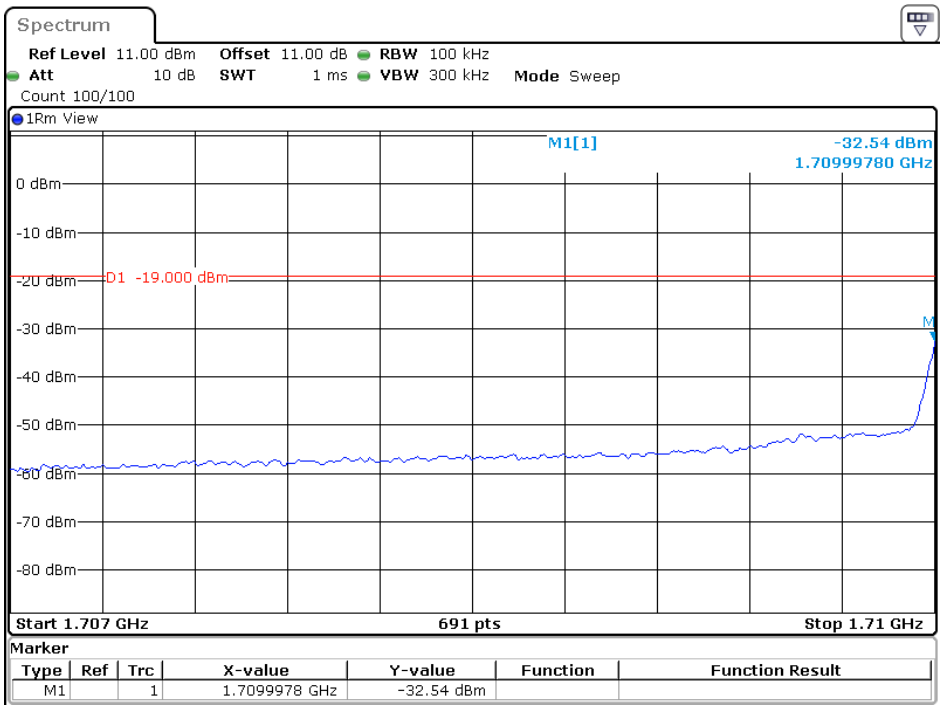
Date: 22.NOV.2022 14:40:58

AWS Band CDMA Left Side Pre-AGC



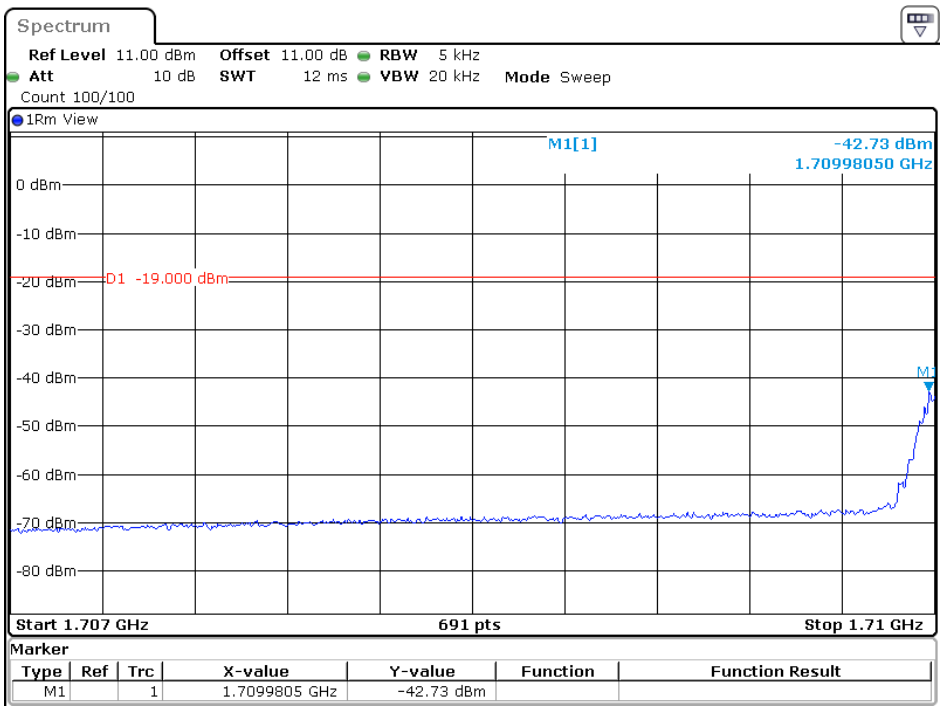
Date: 22.NOV.2022 15:24:17

AWS Band CDMA Left Side Above AGC



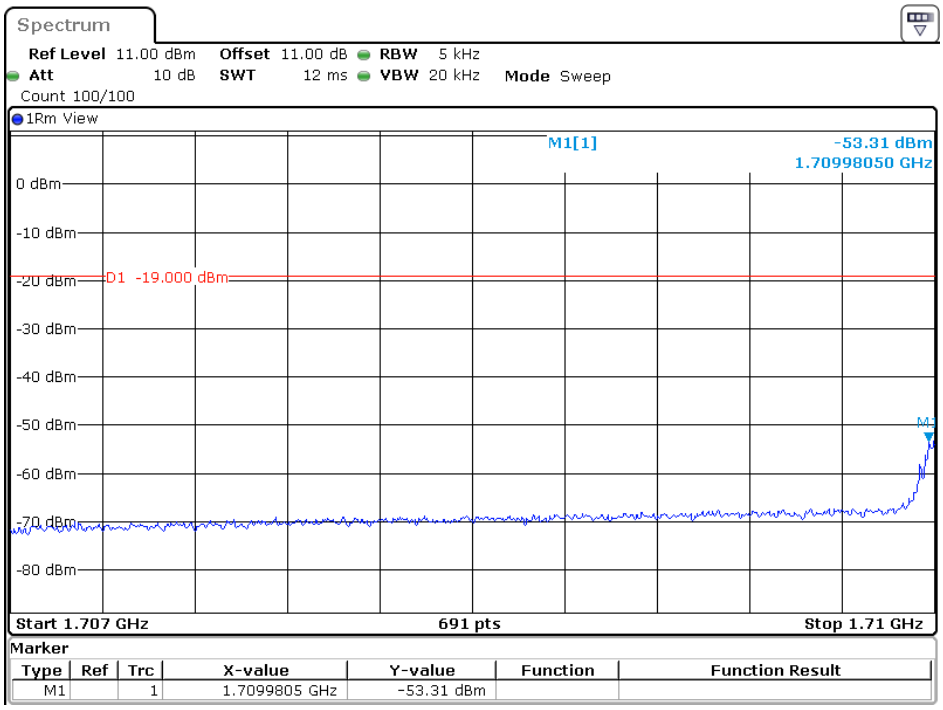
Date: 22.NOV.2022 15:24:36

AWS Band GSM Left Side Pre-AGC



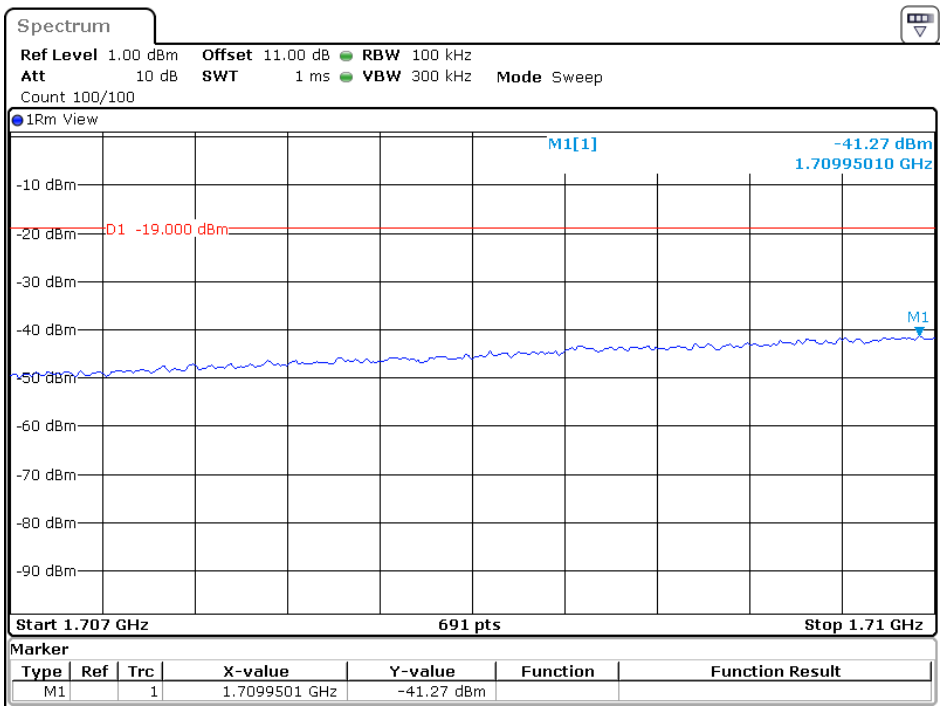
Date: 22.NOV.2022 15:39:13

AWS Band GSM Left Side Above AGC



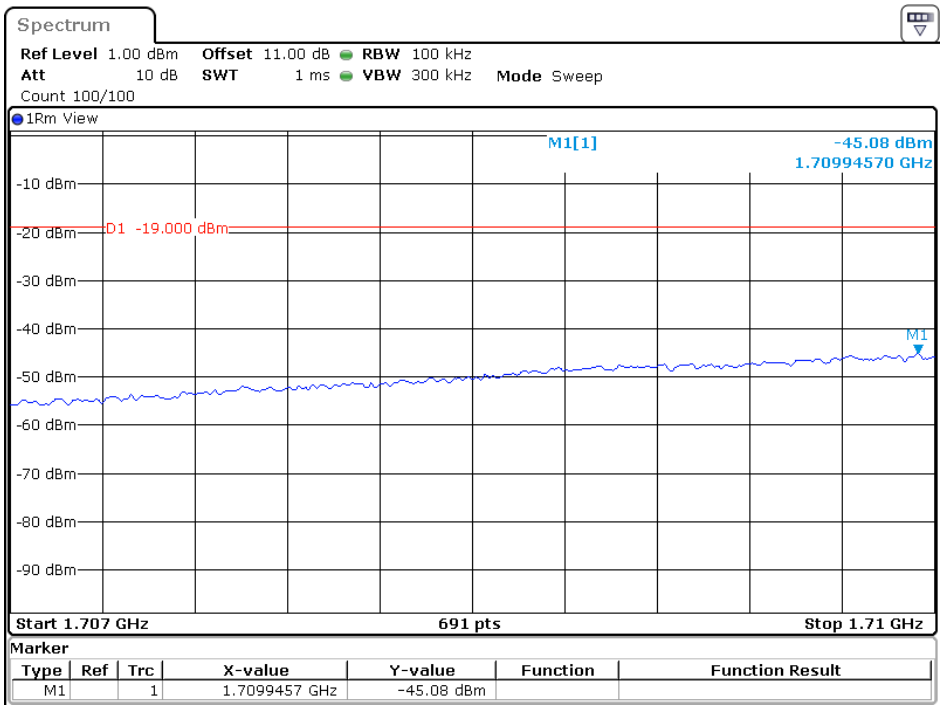
Date: 22.NOV.2022 15:39:39

AWS Band WCDMA Left Side Pre-AGC



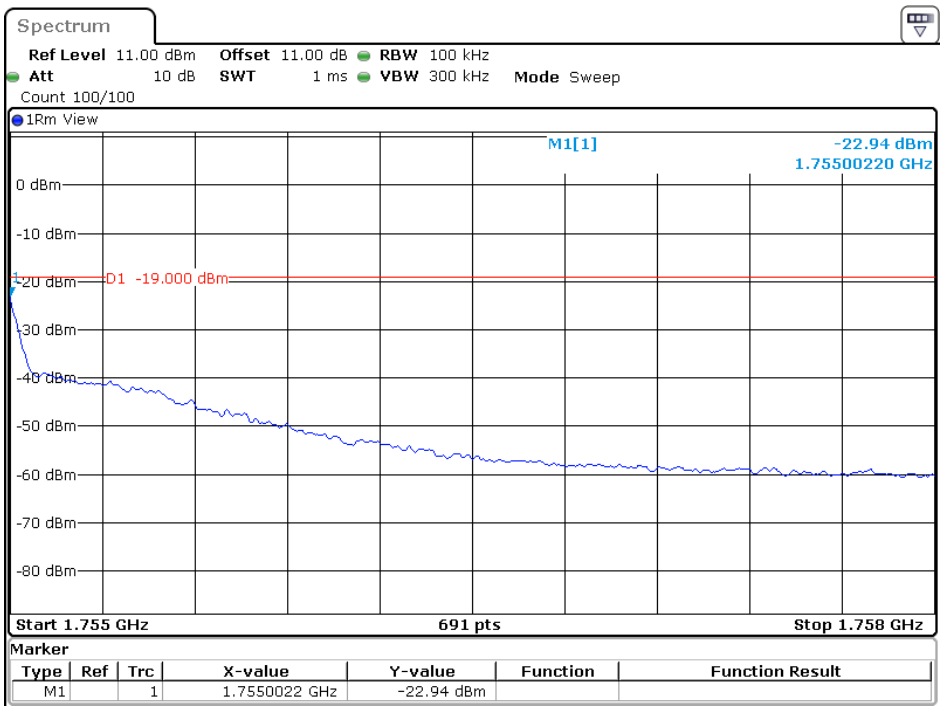
Date: 22.NOV.2022 14:44:26

AWS Band WCDMA Left Side Above AGC



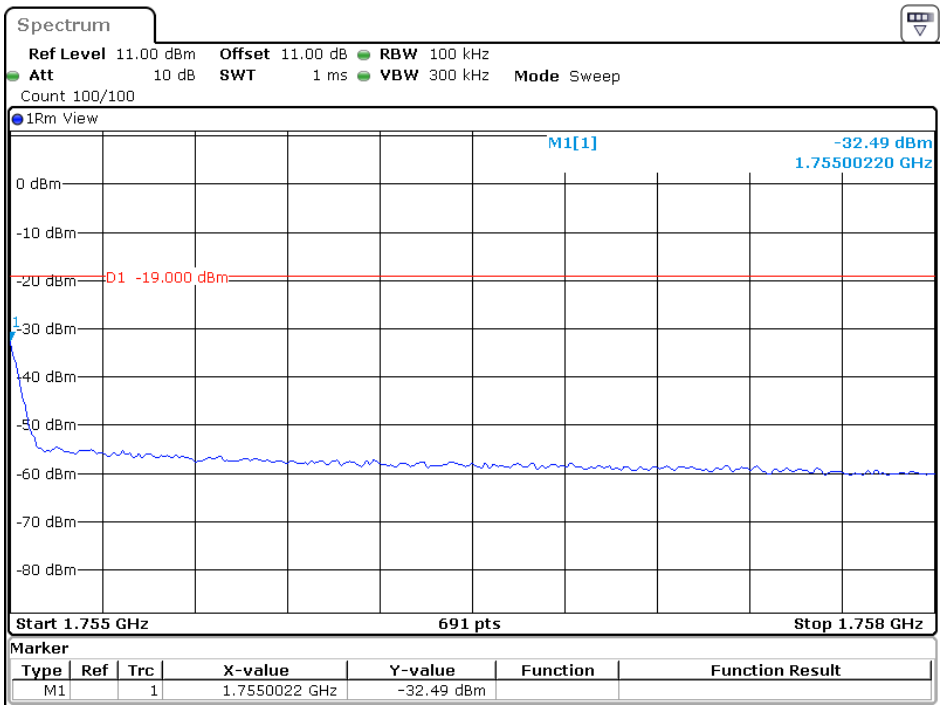
Date: 22.NOV.2022 14:44:51

AWS Band CDMA Right Side Pre-AGC



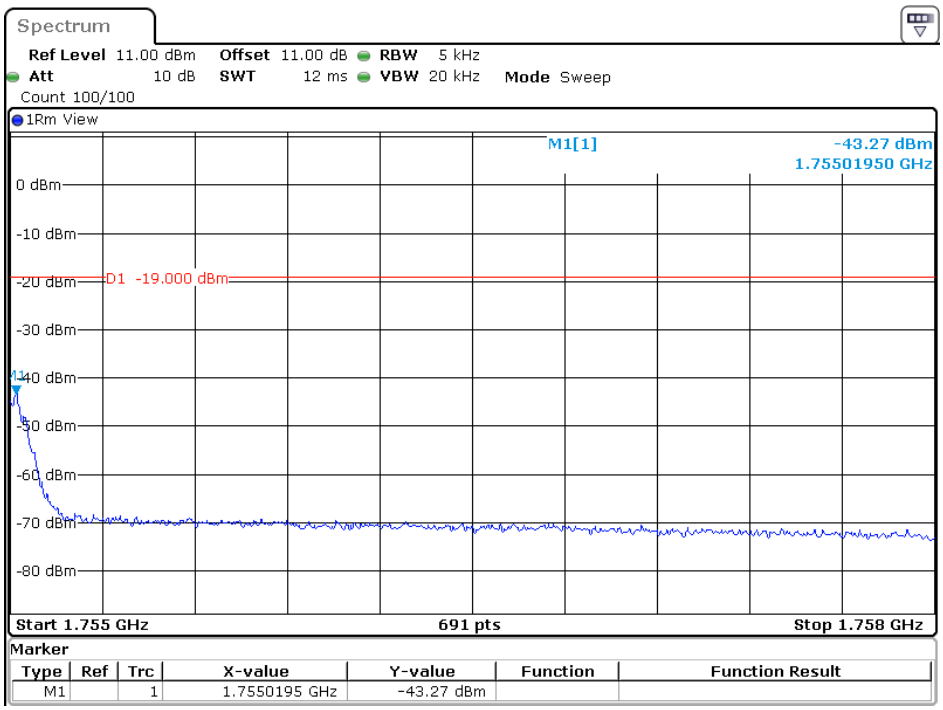
Date: 22.NOV.2022 15:25:52

AWS Band CDMA Right Side Above AGC



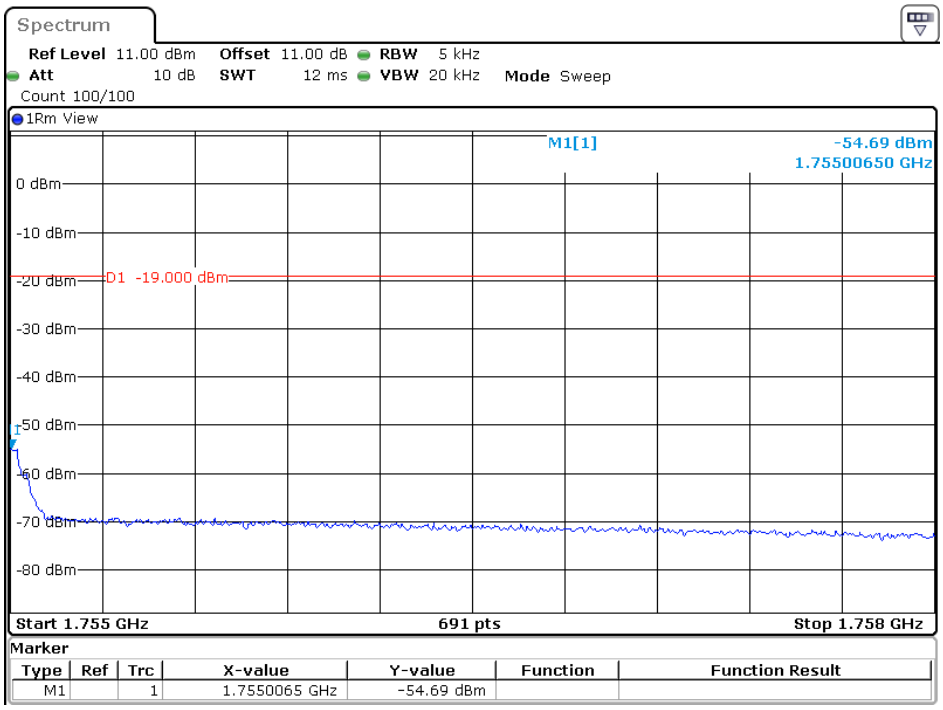
Date: 22.NOV.2022 15:25:30

AWS Band GSM Right Side Pre-AGC



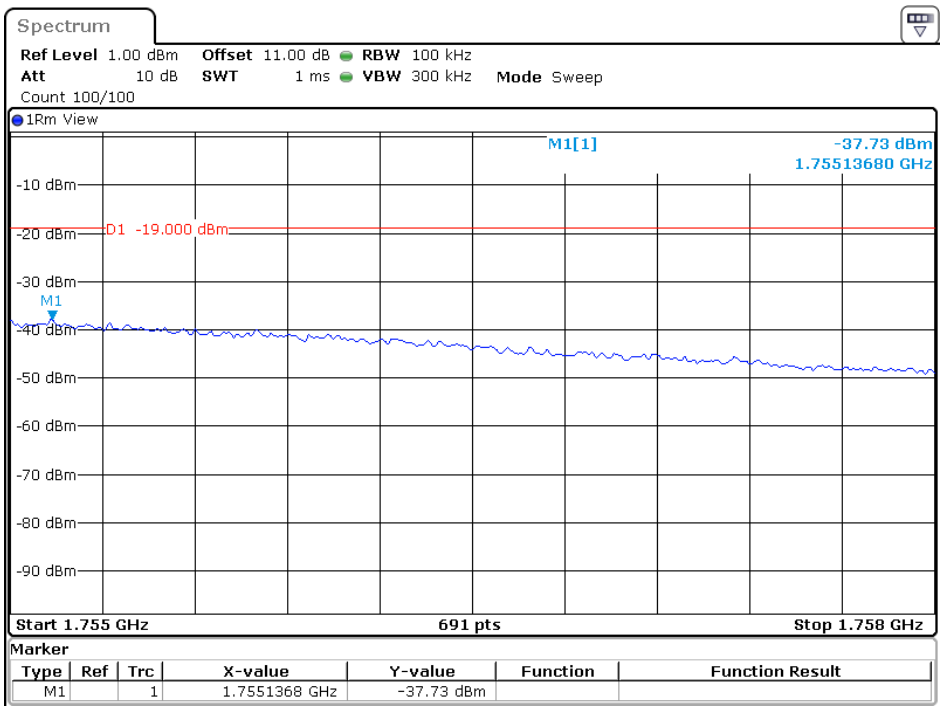
Date: 22.NOV.2022 15:40:39

AWS Band GSM Right Side Above AGC



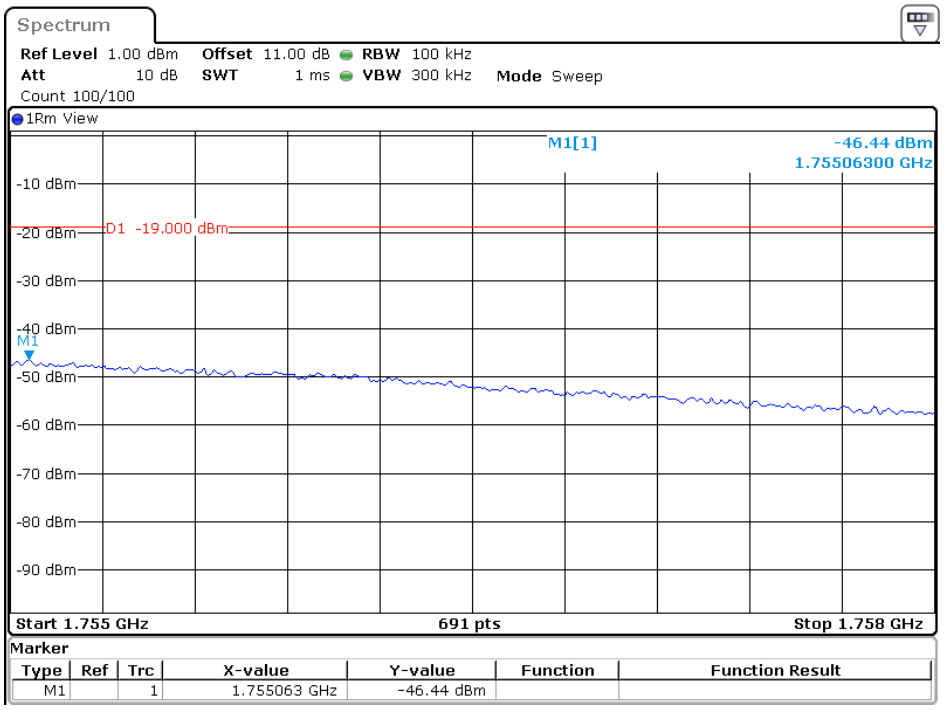
Date: 22.NOV.2022 15:40:23

AWS Band WCDMA Right Side Pre-AGC



Date: 22.NOV.2022 14:46:42

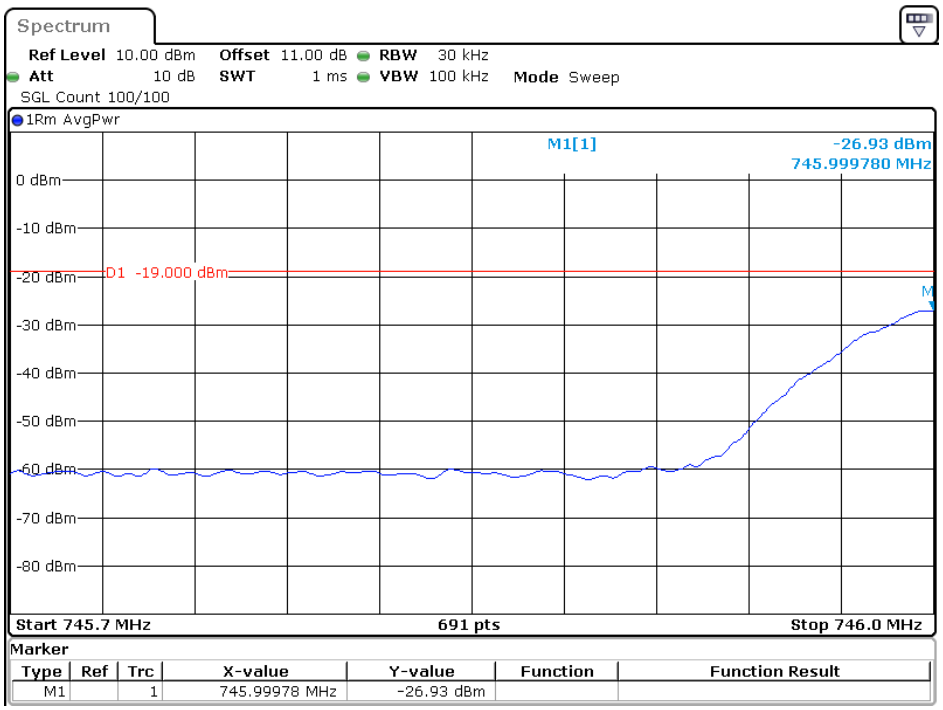
AWS Band WCDMA Right Side Above AGC



Date: 22.NOV.2022 14:46:07

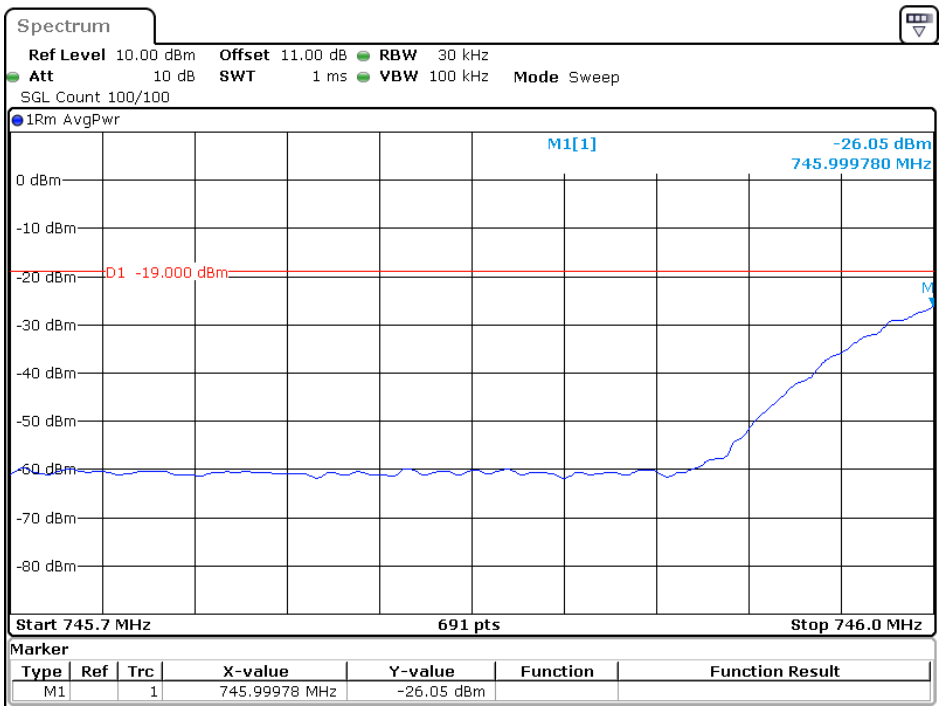
Downlink

Lower 700MHz CDMA Left Side Pre-AGC



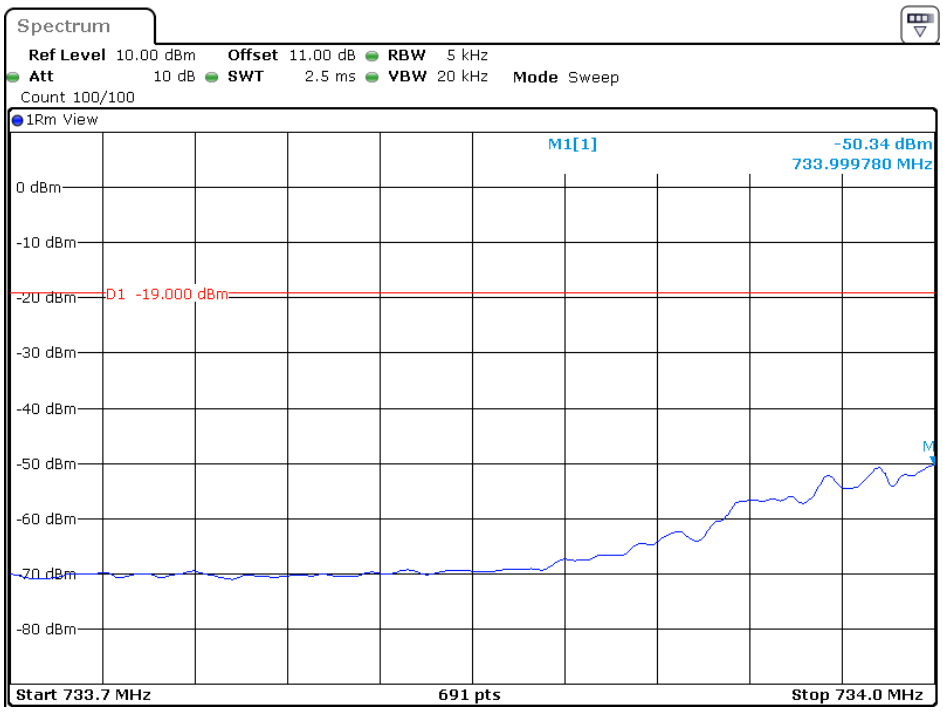
Date: 14.MAR.2023 14:13:09

Lower 700MHz CDMA Left Side Above AGC



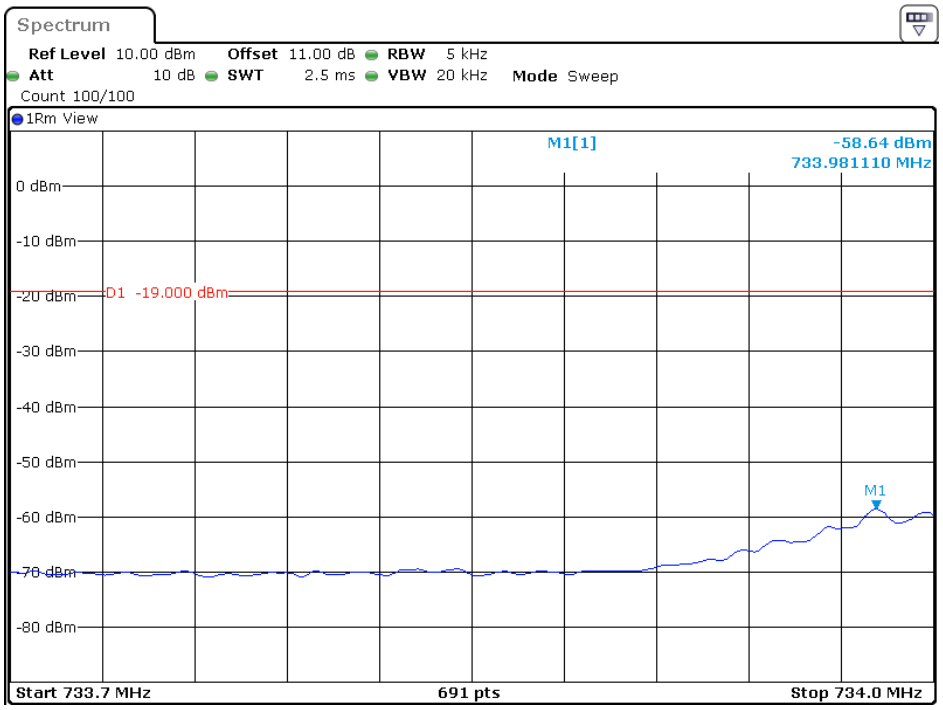
Date: 14.MAR.2023 14:13:17

Lower 700MHz GSM Left Side Pre-AGC



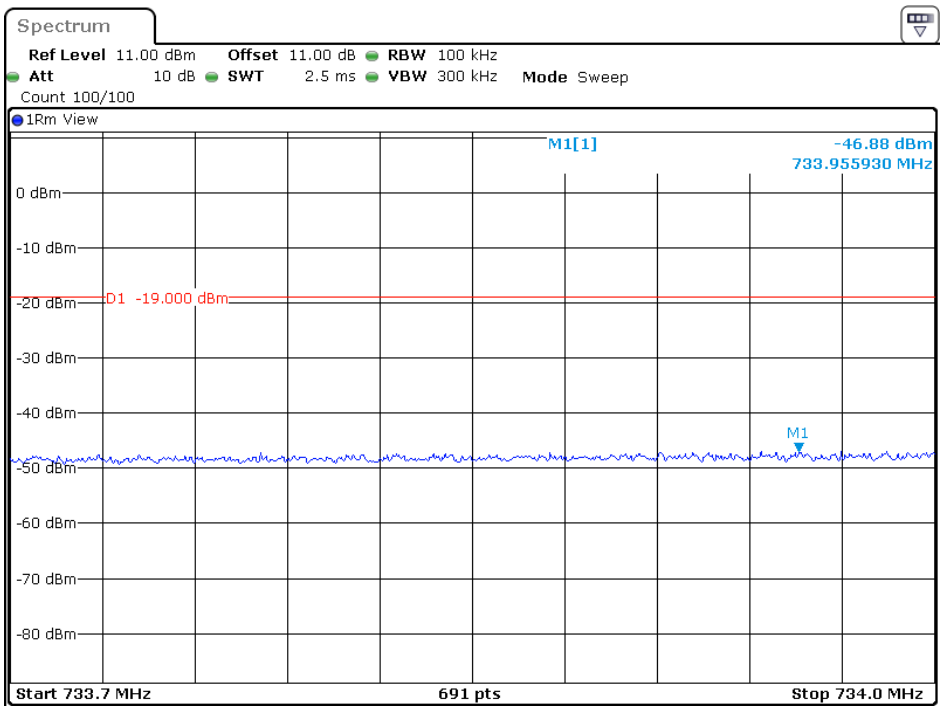
Date: 22.NOV.2022 04:36:13

Lower 700MHz GSM Left Side Above AGC



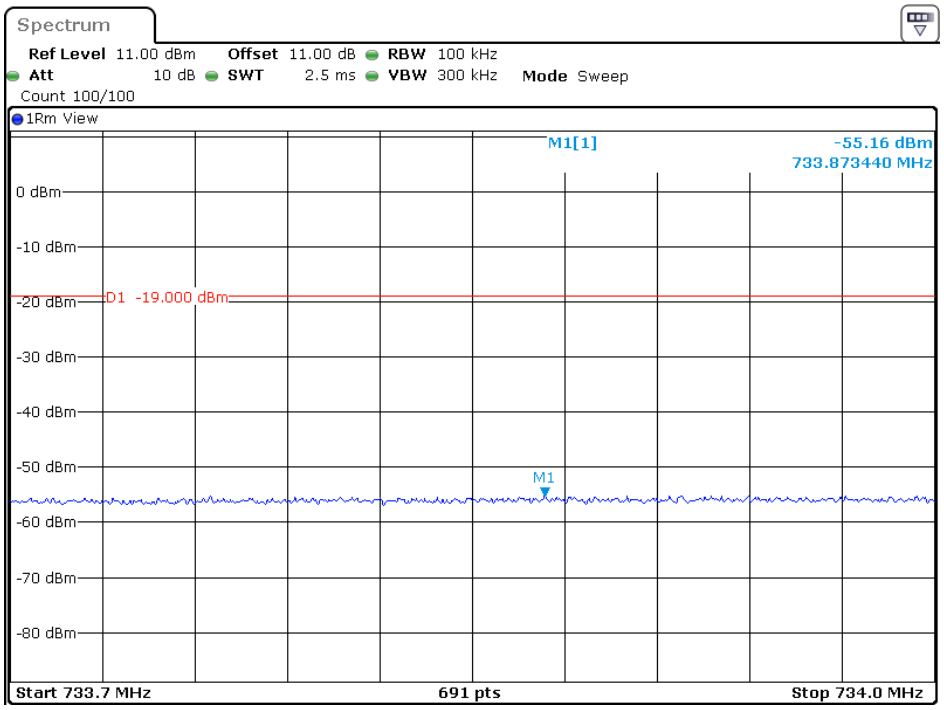
Date: 22.NOV.2022 04:36:41

Lower 700MHz WCDMA Left Side Pre-AGC



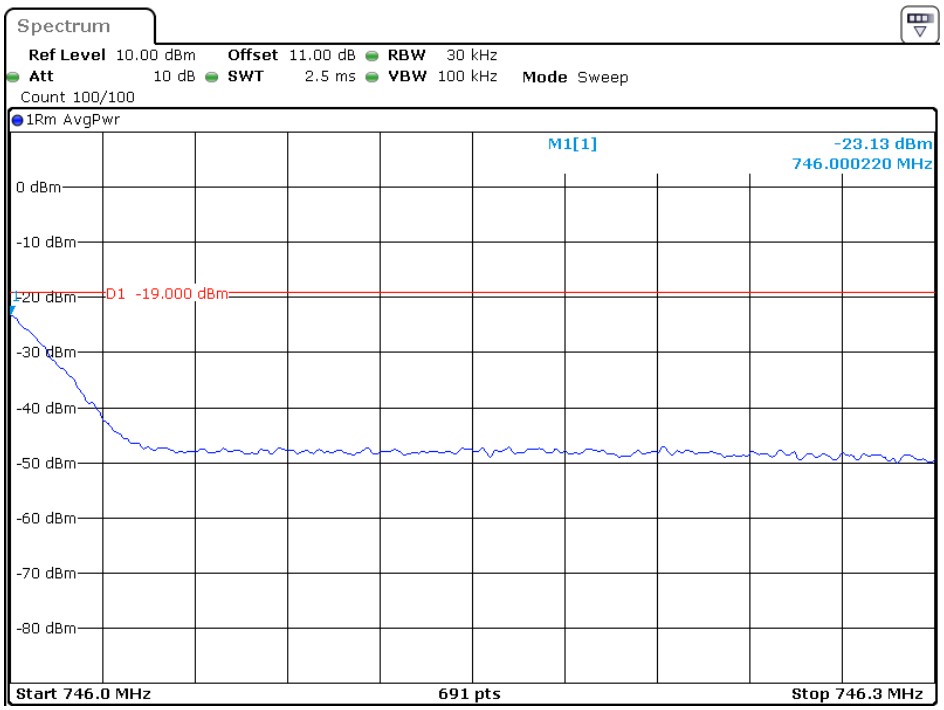
Date: 22.NOV.2022 06:46:21

Lower 700MHz WCDMA Left Side Above AGC



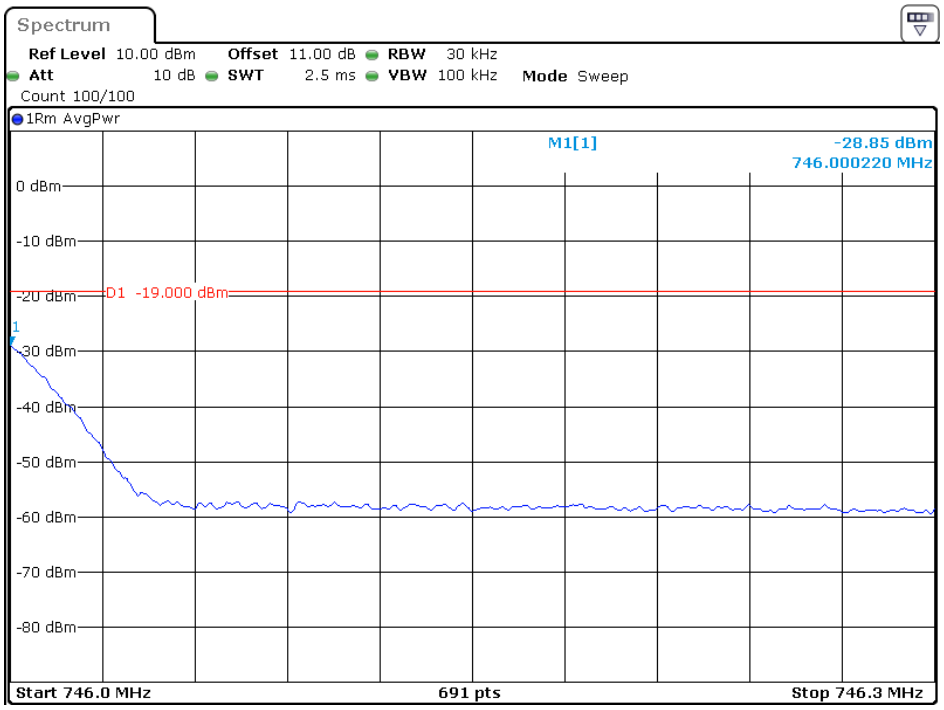
Date: 22.NOV.2022 06:46:54

Lower 700MHz CDMA Right Side Pre-AGC



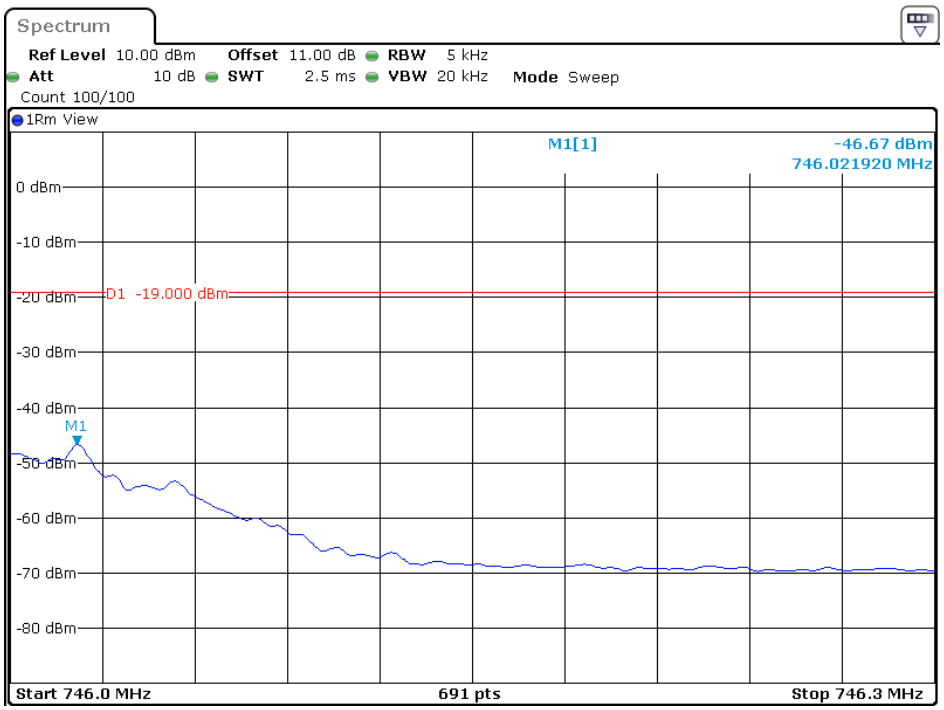
Date: 22.NOV.2022 03:38:52

Lower 700MHz CDMA Right Side Above AGC



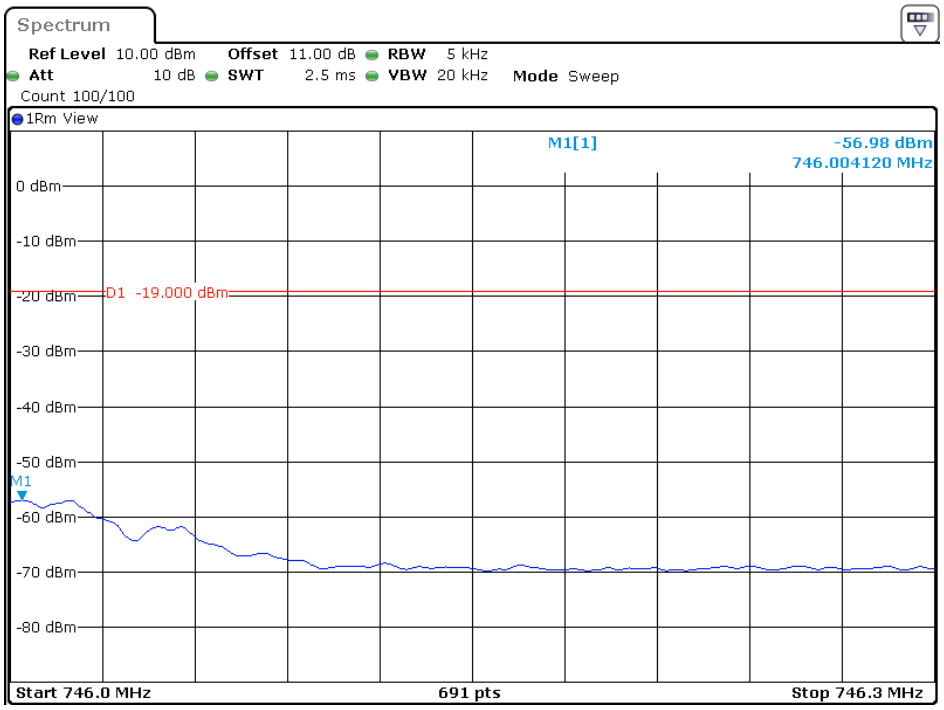
Date: 22.NOV.2022 03:39:35

Lower 700MHz GSM Right Side Pre-AGC



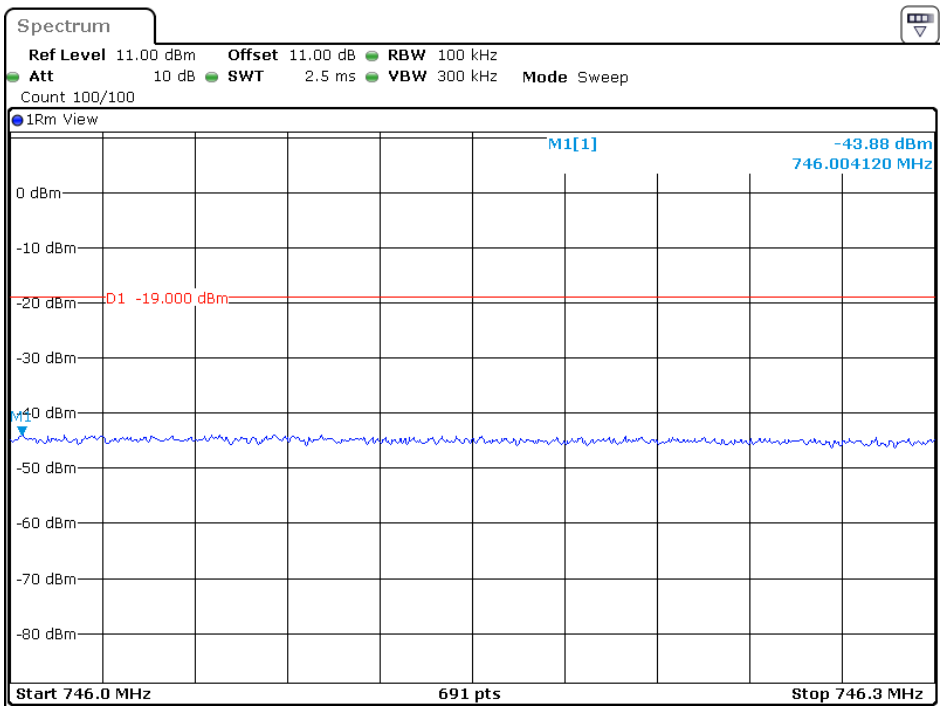
Date: 22.NOV.2022 04:34:47

Lower 700MHz GSM Right Side Above AGC



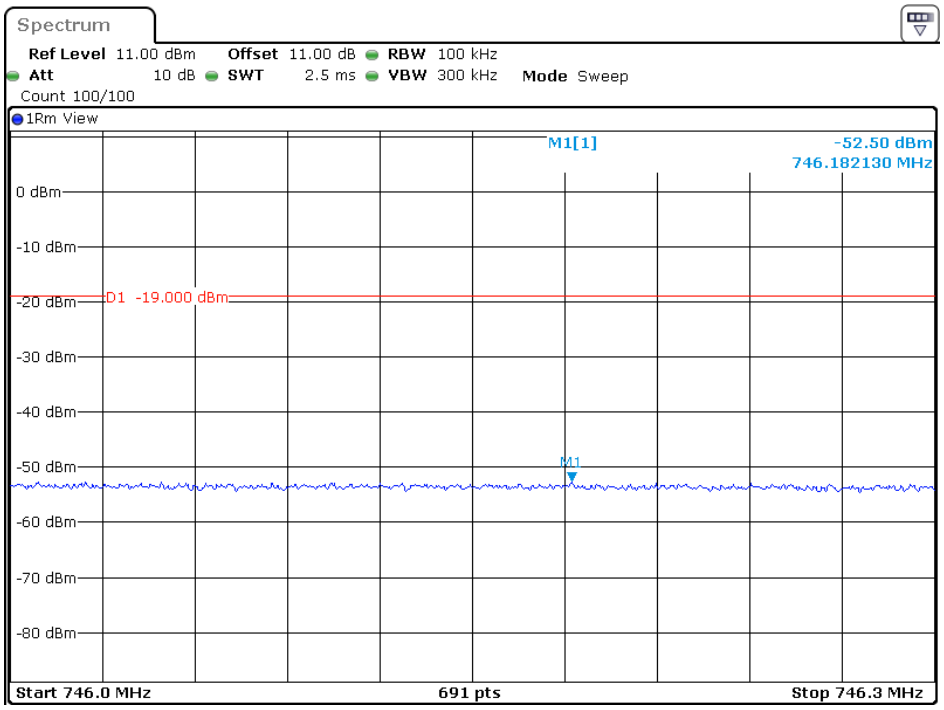
Date: 22.NOV.2022 04:35:18

Lower 700MHz WCDMA Right Side Pre-AGC



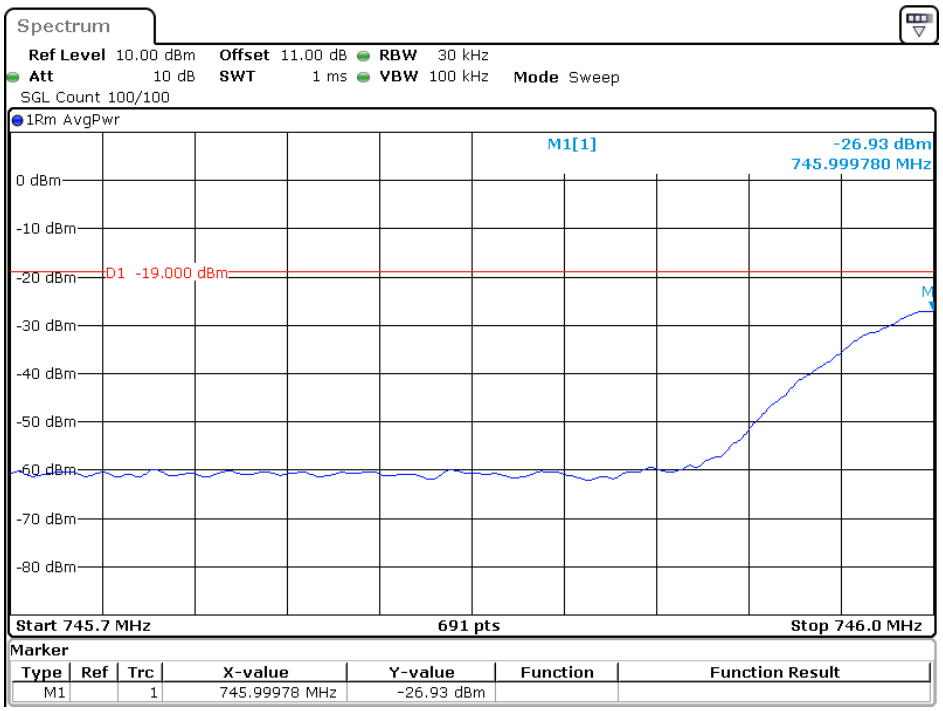
Date: 22.NOV.2022 06:48:22

Lower 700MHz WCDMA Right Side Above AGC



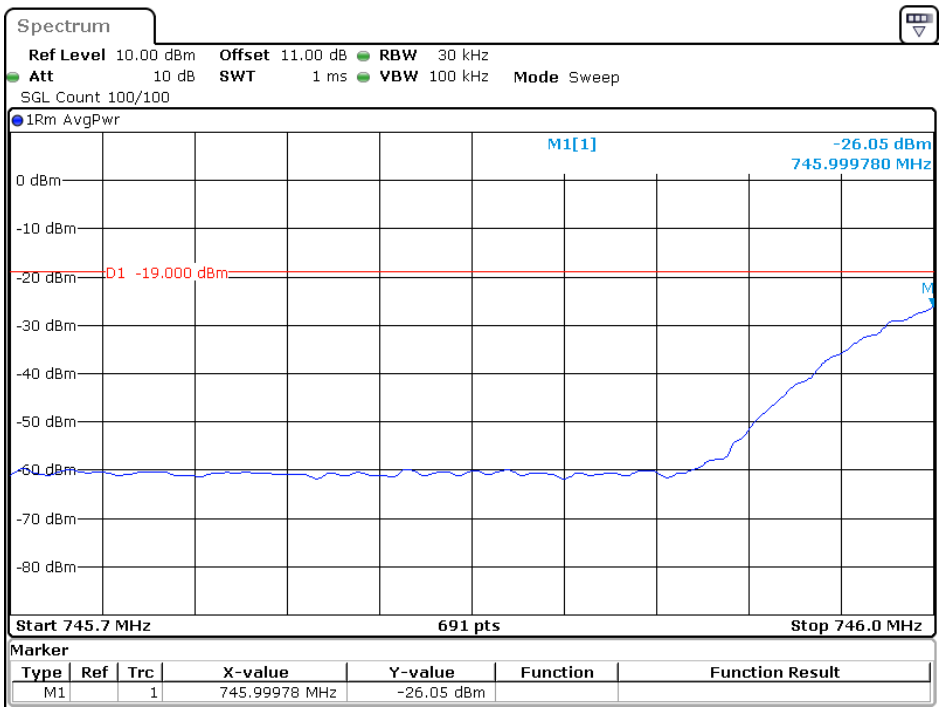
Date: 22.NOV.2022 06:48:51

Upper 700MHz CDMA Left Side Pre-AGC



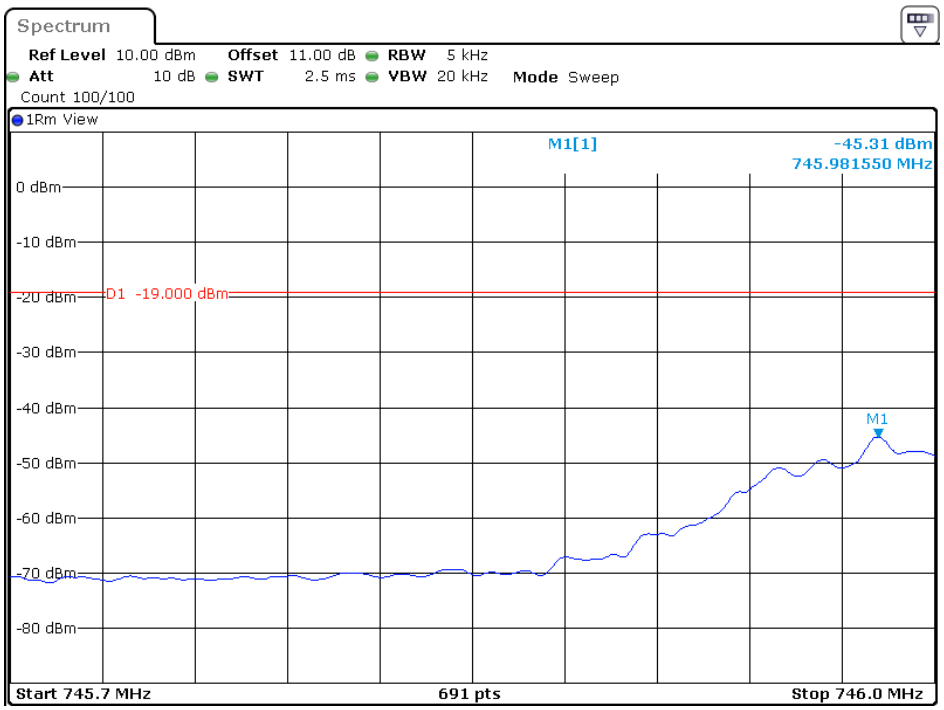
Date: 14.MAR.2023 14:13:09

Upper 700MHz CDMA Left Side Above AGC



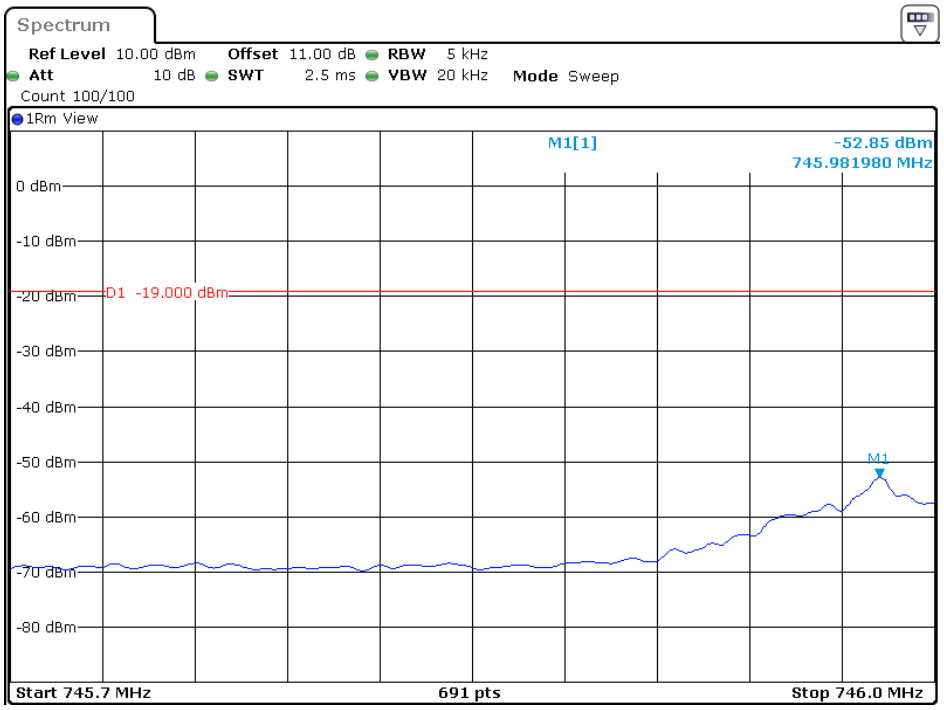
Date: 14.MAR.2023 14:13:17

Upper 700MHz GSM Left Side Pre-AGC



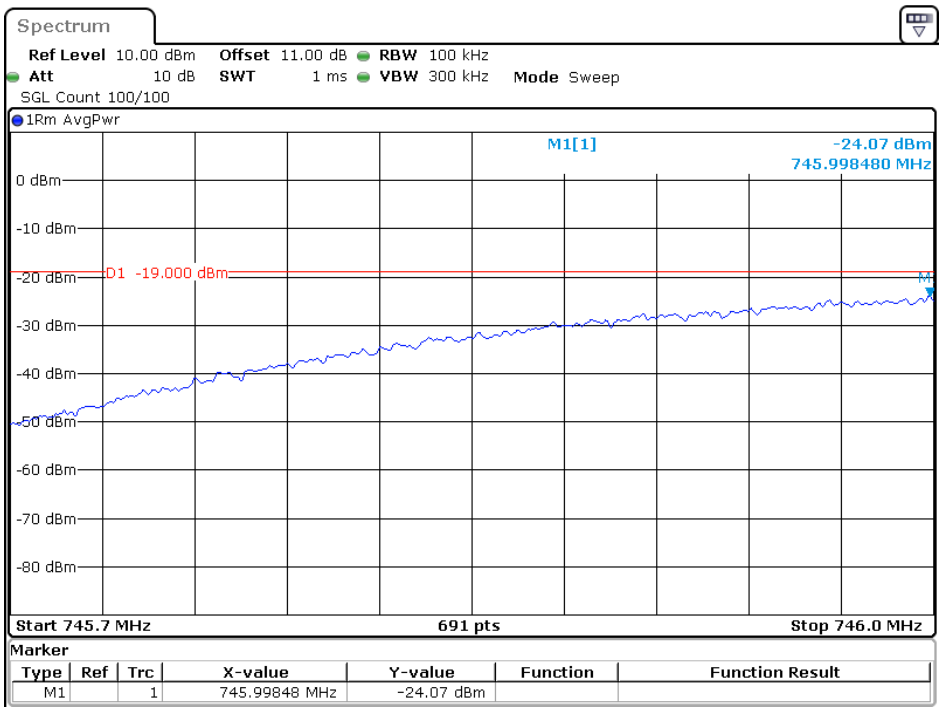
Date: 22.NOV.2022 04:40:57

Upper 700MHz GSM Left Side Above AGC



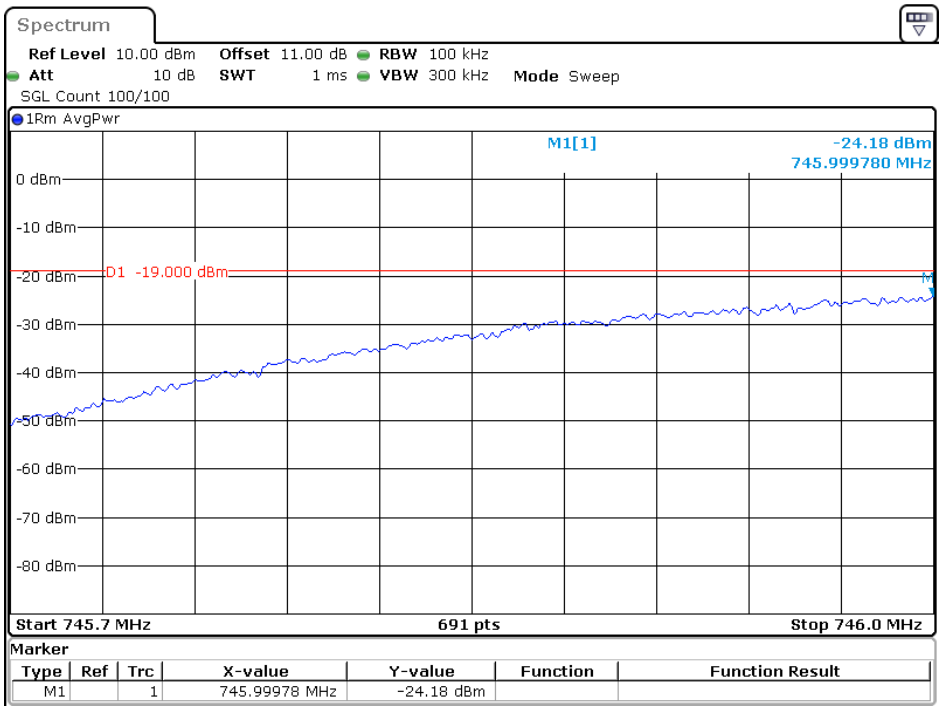
Date: 22.NOV.2022 04:41:31

Upper 700MHz WCDMA Left Side Pre-AGC



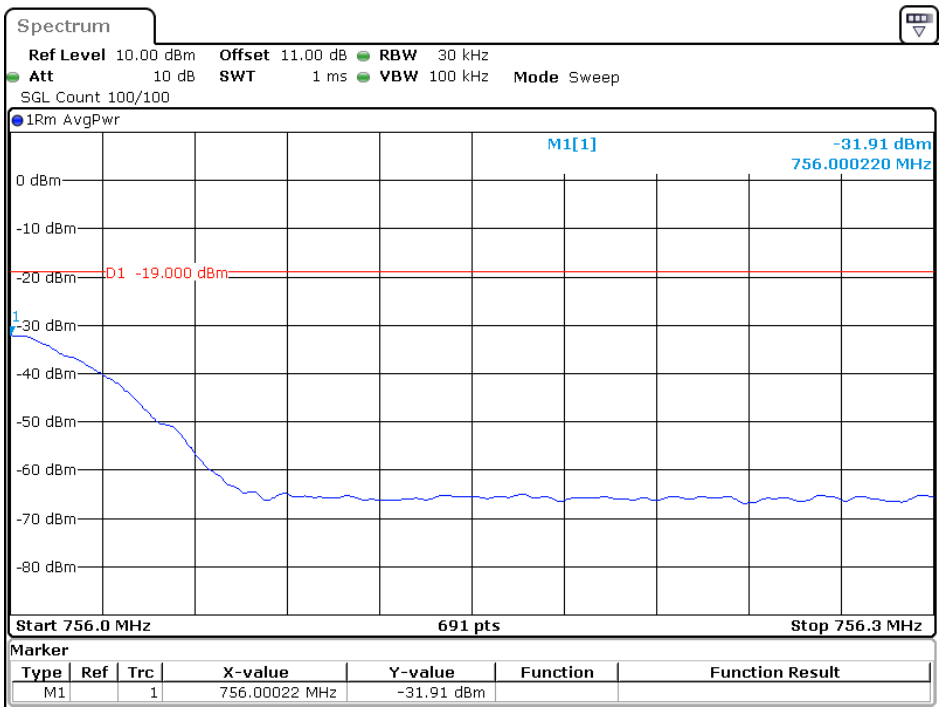
Date: 14.MAR.2023 14:14:01

Upper 700MHz WCDMA Left Side Above AGC



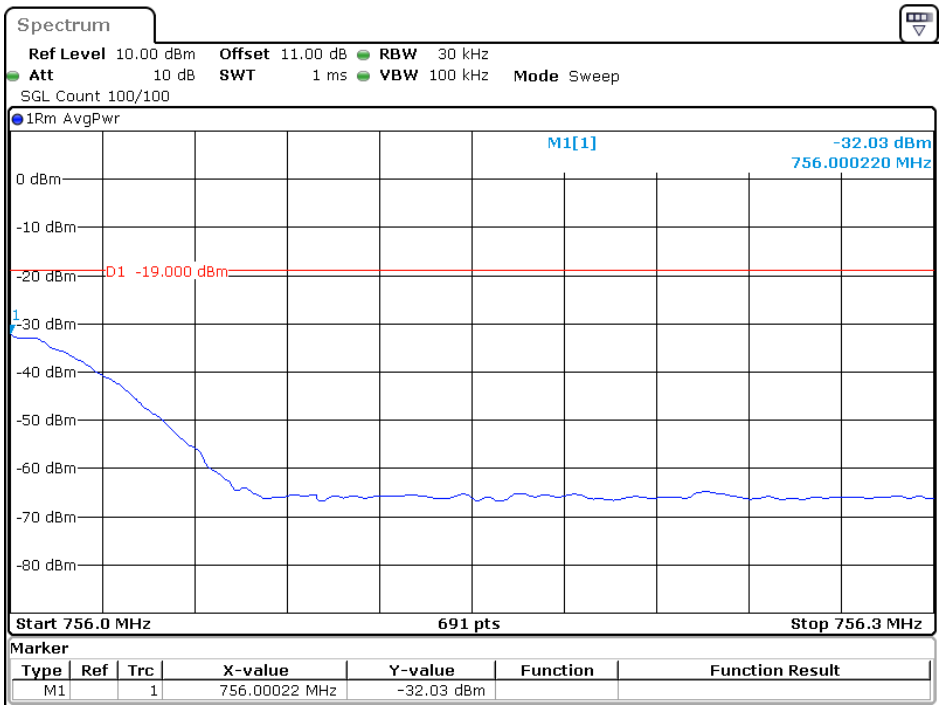
Date: 14.MAR.2023 14:14:08

Upper 700MHz CDMA Right Side Pre-AGC



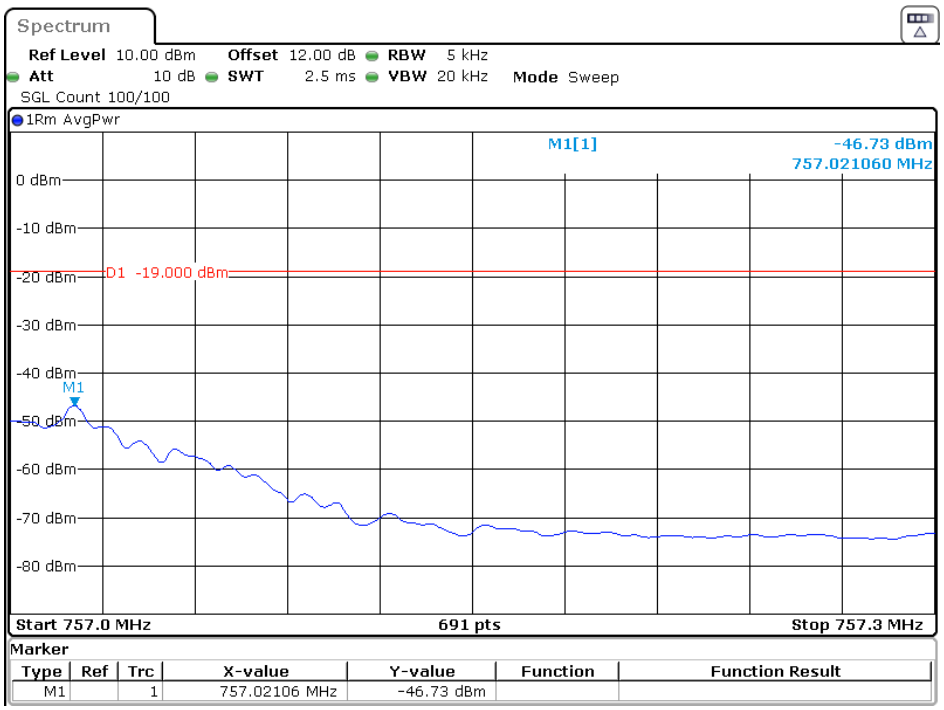
Date: 14.MAR.2023 14:13:25

Upper 700MHz CDMA Right Side Above AGC



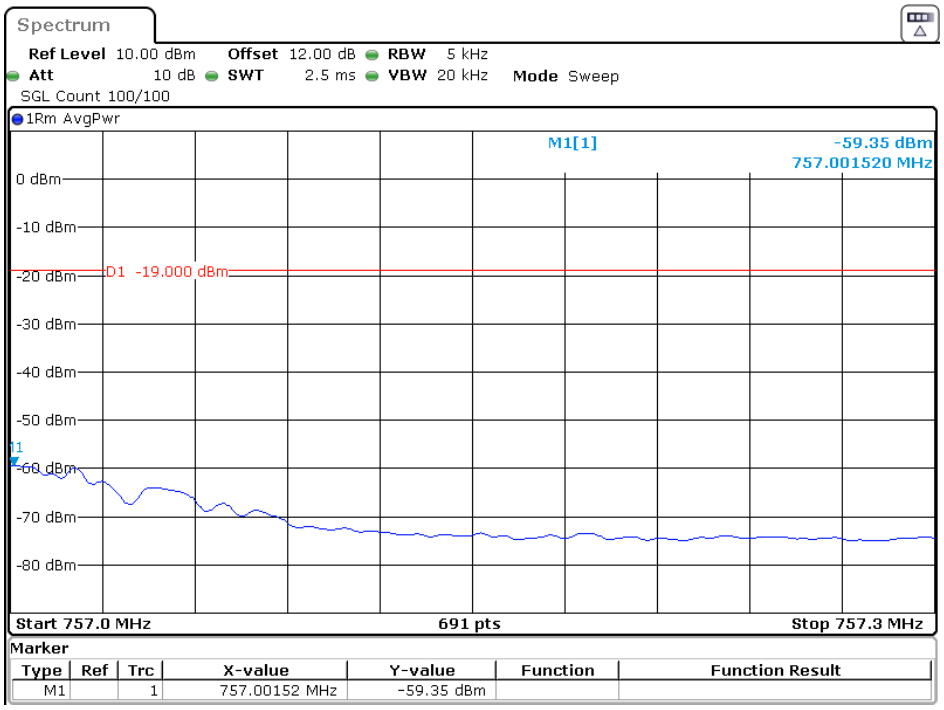
Date: 14.MAR.2023 14:13:31

Upper 700MHz GSM Right Side Pre-AGC



Date: 30.NOV.2022 17:31:45

Upper 700MHz GSM Right Side Above AGC



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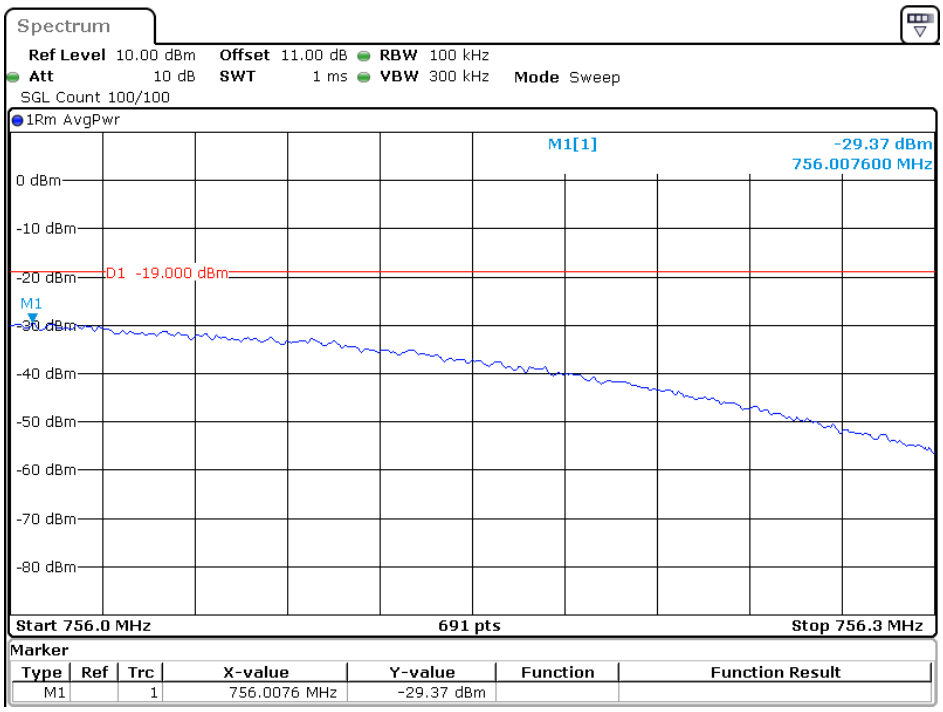
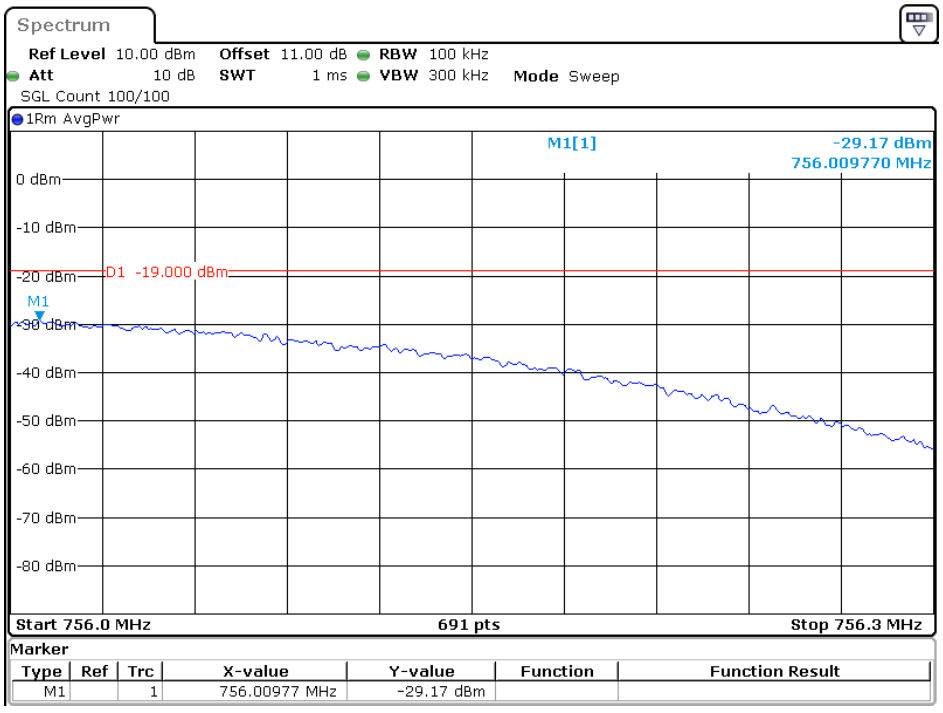
Upper 700MHz WCDMA Right Side Pre-AGC



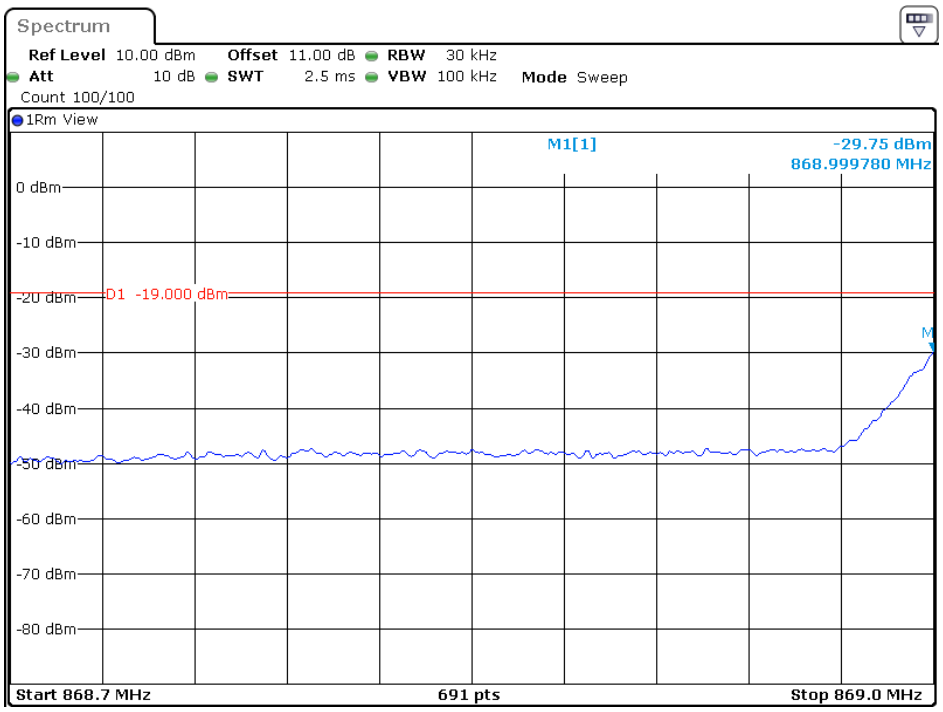
Date: 14.MAR.2023 14:14:16

Upper 700MHz WCDMA Right Side Above AGC



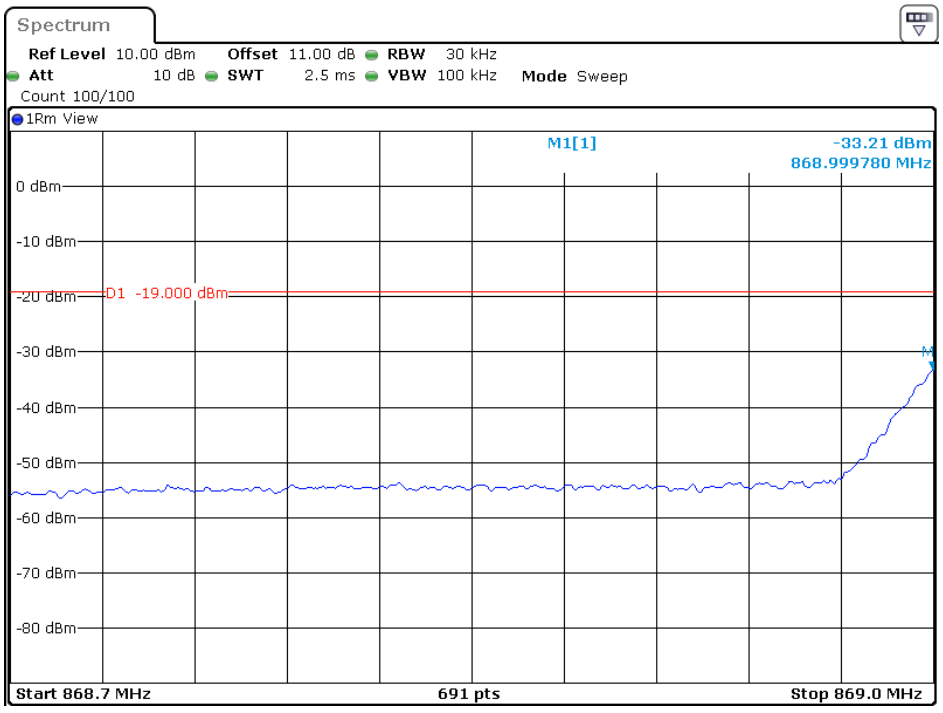
Date: 14.MAR.2023 14:14:24

Cellular Band CDMA Left Side Pre-AGC



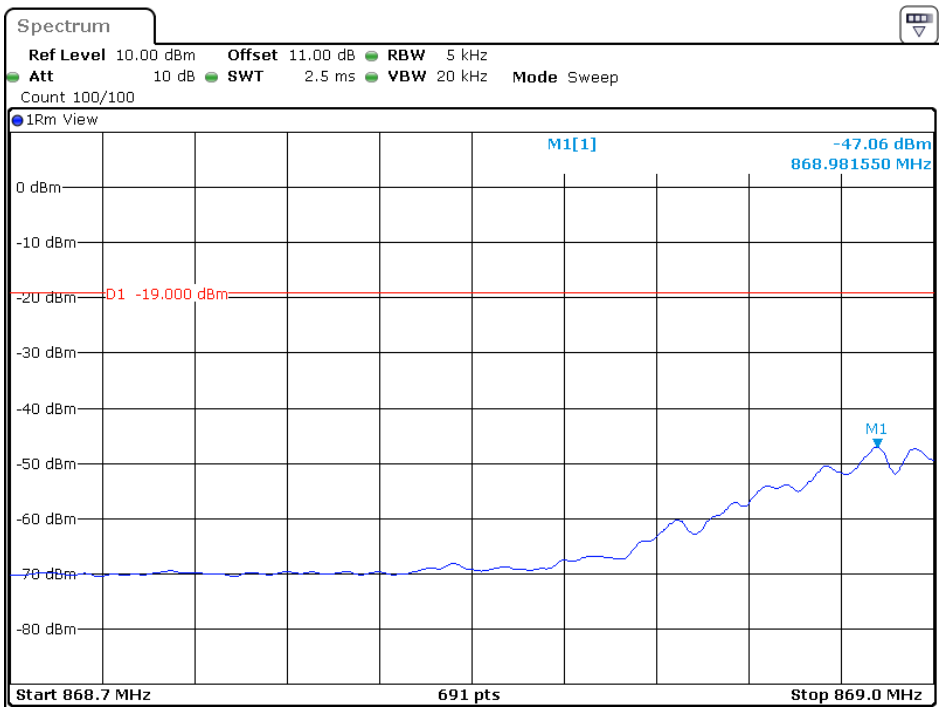
Date: 22.NOV.2022 03:54:01

Cellular Band CDMA Left Side Above AGC



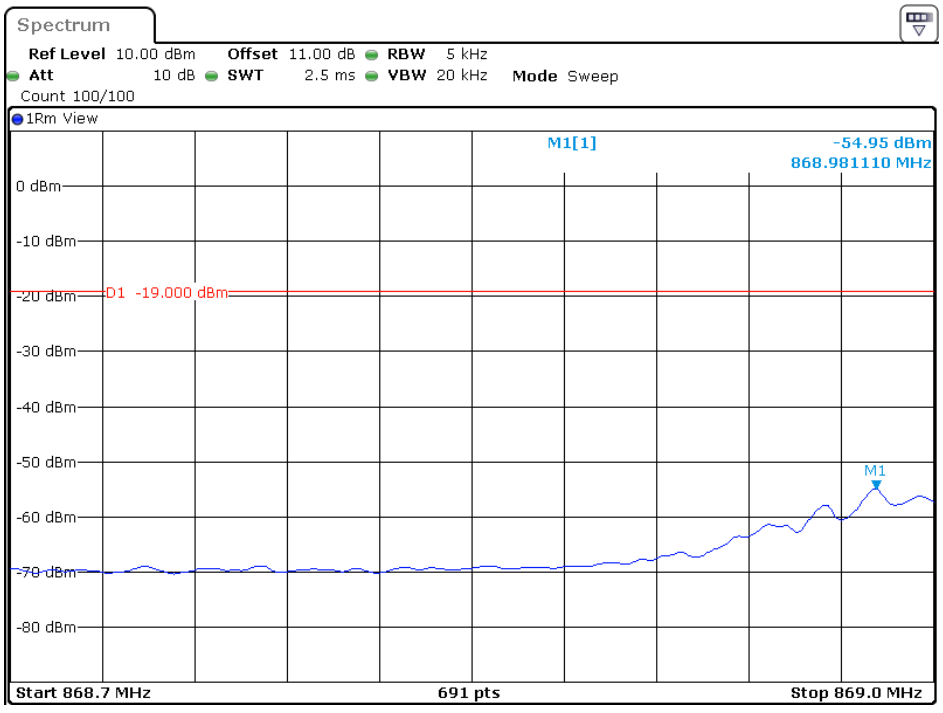
Date: 22.NOV.2022 03:54:33

Cellular Band GSM Left Side Pre-AGC



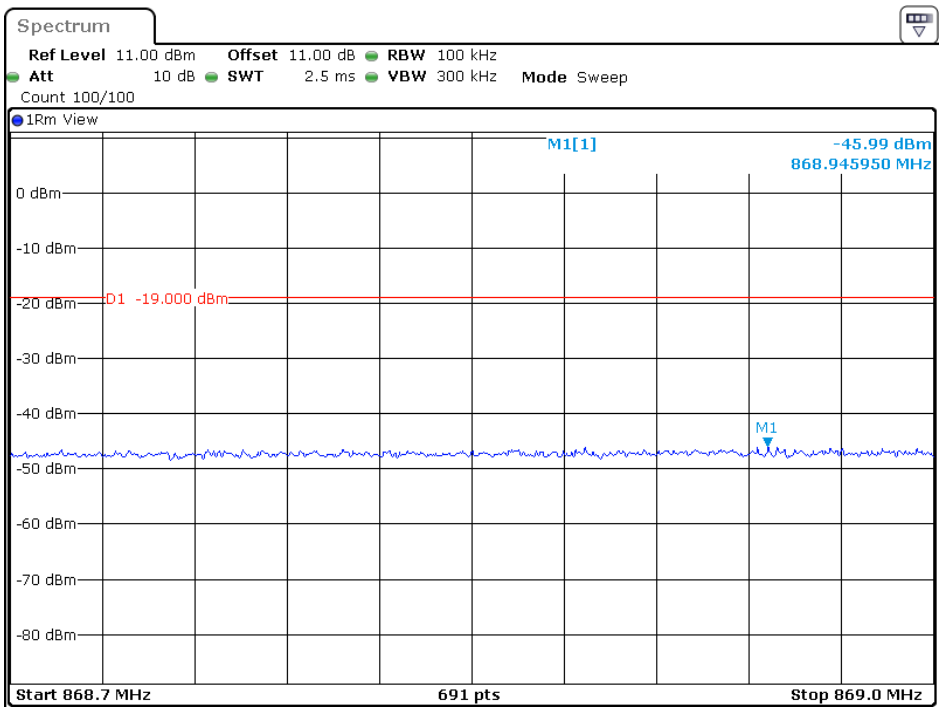
Date: 22.NOV.2022 04:44:35

Cellular Band GSM Left Side Above AGC



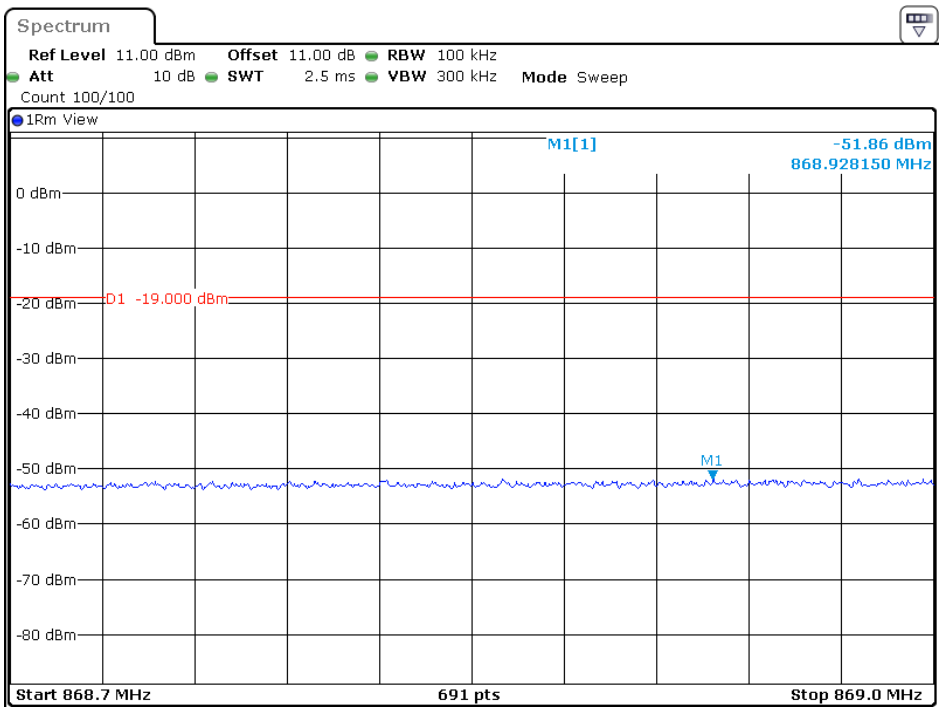
Date: 22.NOV.2022 04:45:11

Cellular Band WCDMA Left Side Pre-AGC



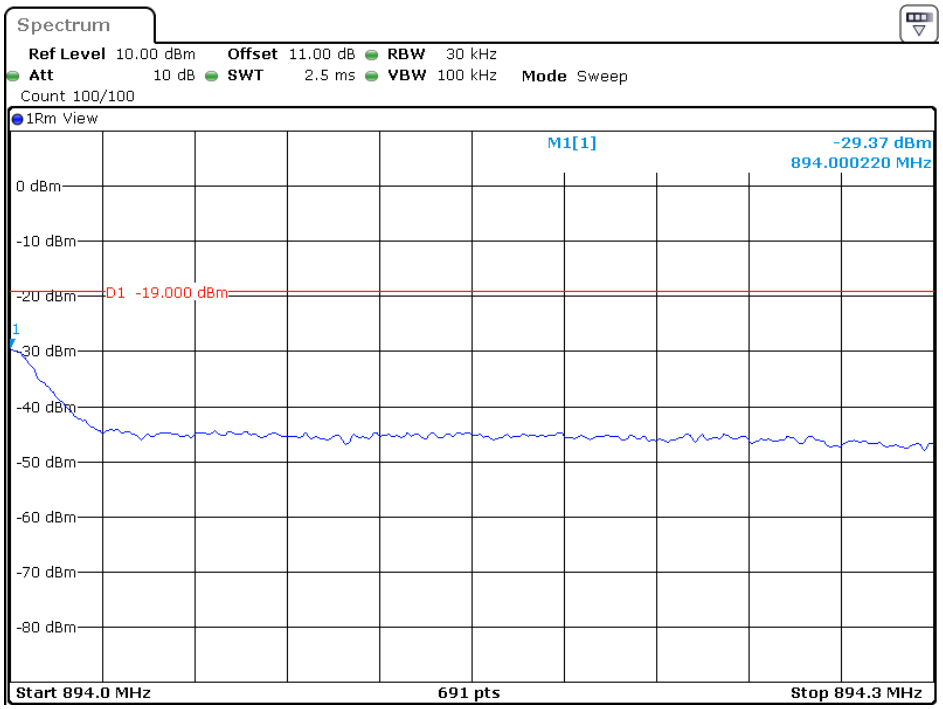
Date: 22.NOV.2022 06:55:05

Cellular Band WCDMA Left Side Above AGC



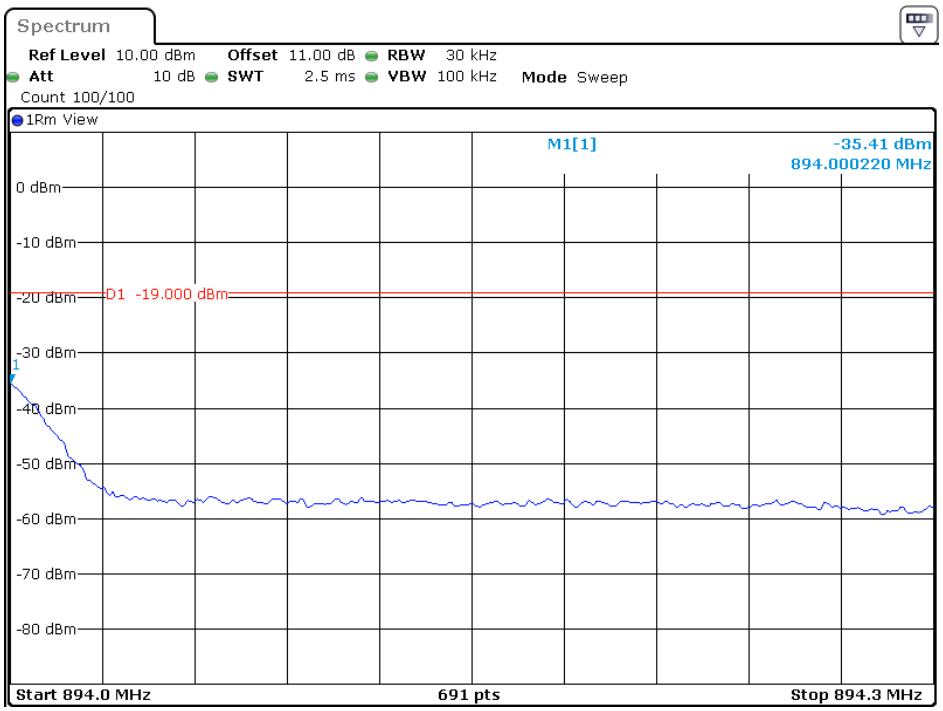
Date: 22.NOV.2022 06:55:33

Cellular Band CDMA Right Side Pre-AGC



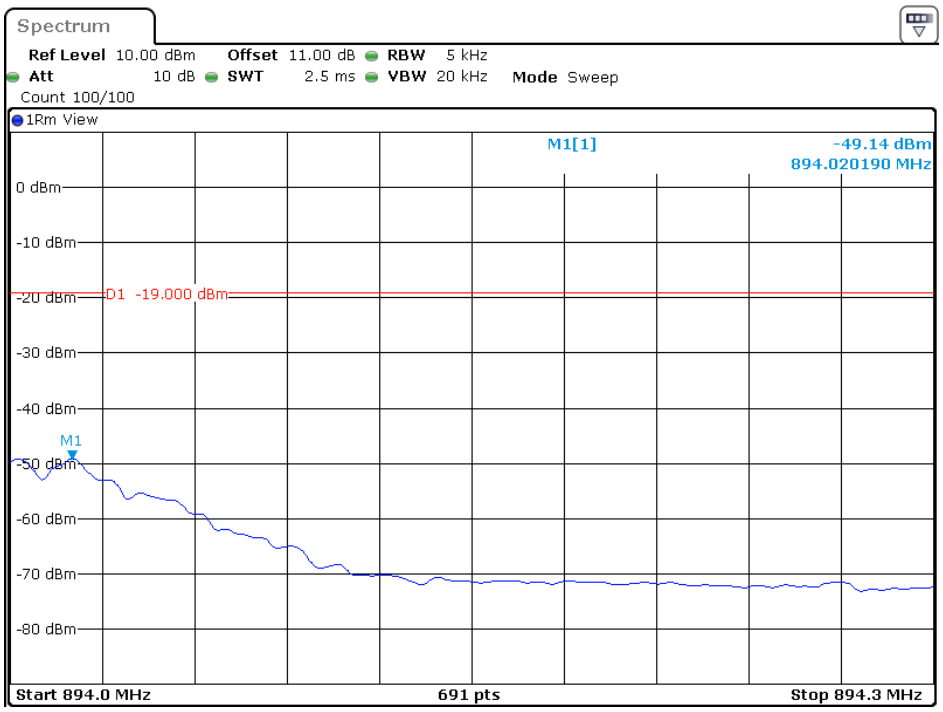
Date: 22.NOV.2022 03:51:58

Cellular Band CDMA Right Side Above AGC



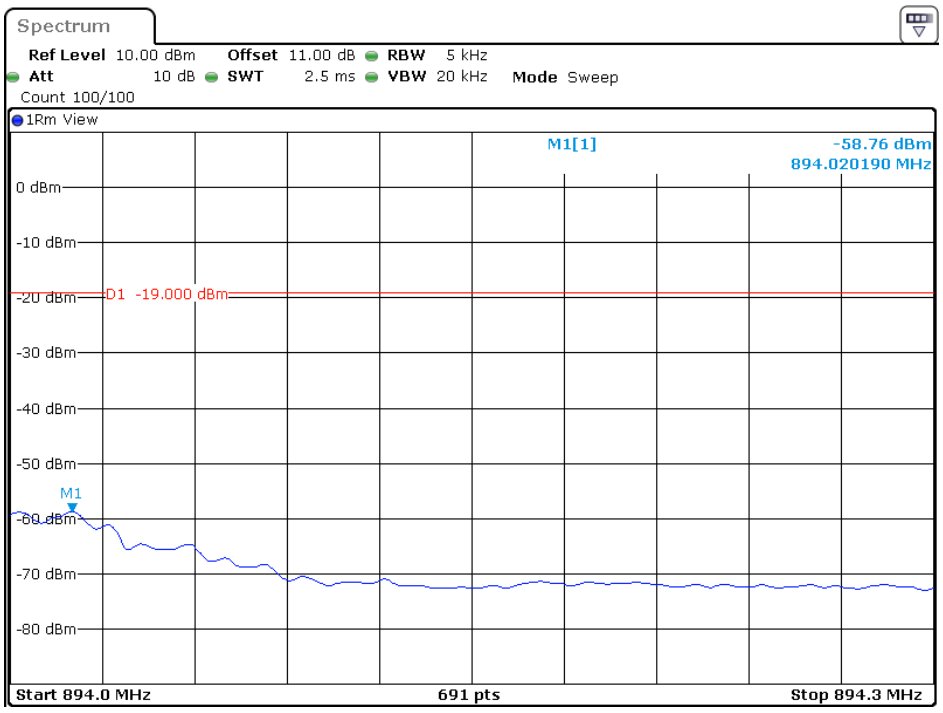
Date: 22.NOV.2022 03:52:22

Cellular Band GSM Right Side Pre-AGC



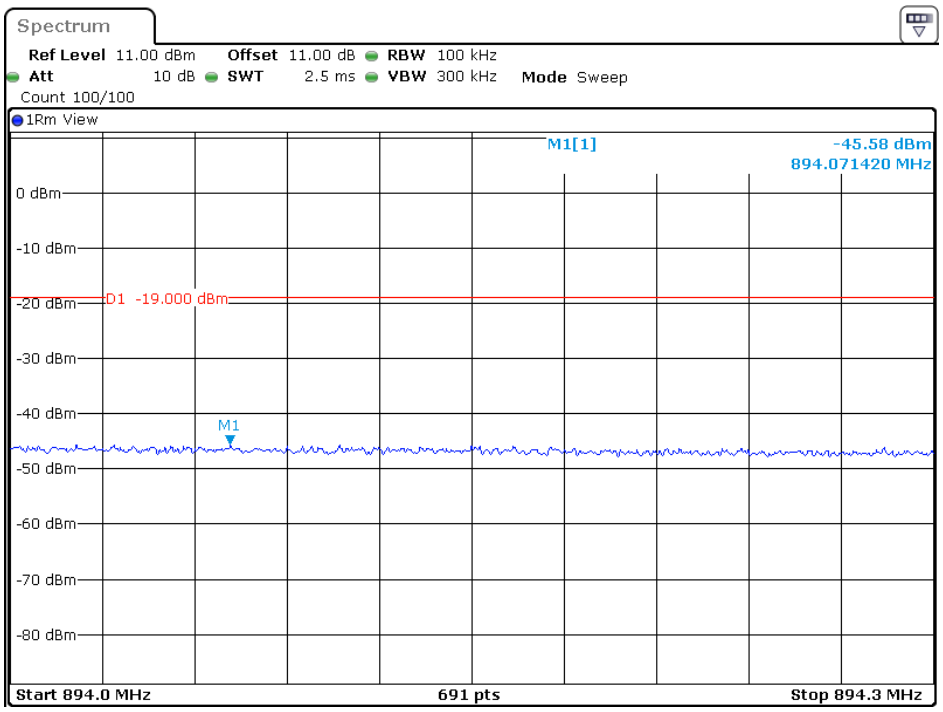
Date: 22.NOV.2022 04:46:35

Cellular Band GSM Right Side Above AGC



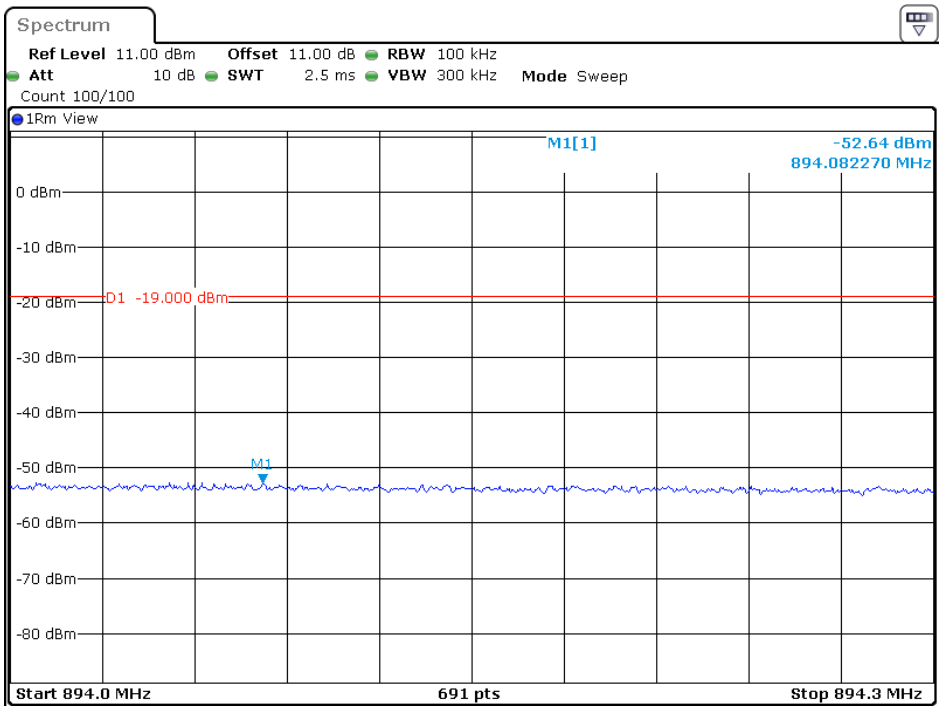
Date: 22.NOV.2022 04:46:13

Cellular Band WCDMA Right Side Pre-AGC



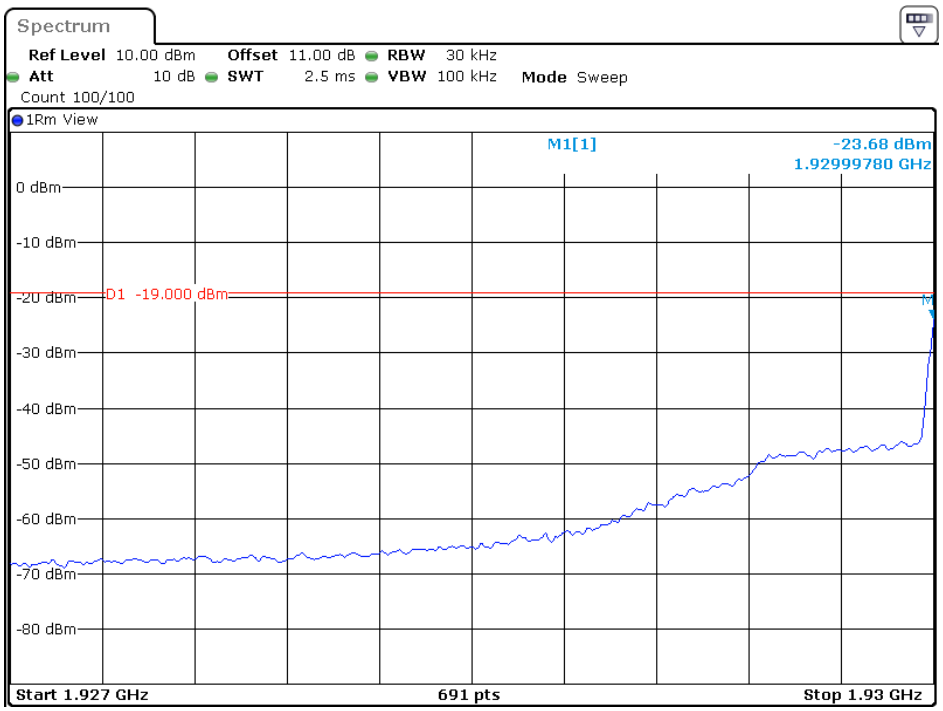
Date: 22.NOV.2022 06:57:00

Cellular Band WCDMA Right Side Above AGC



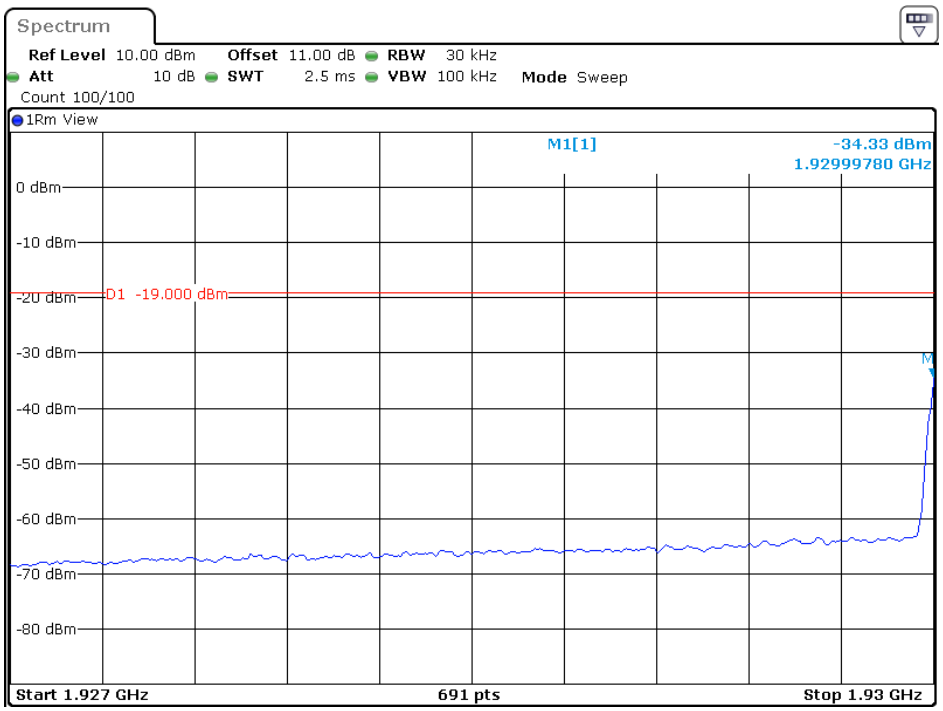
Date: 22.NOV.2022 06:56:33

PCS Band CDMA Left Side Pre-AGC



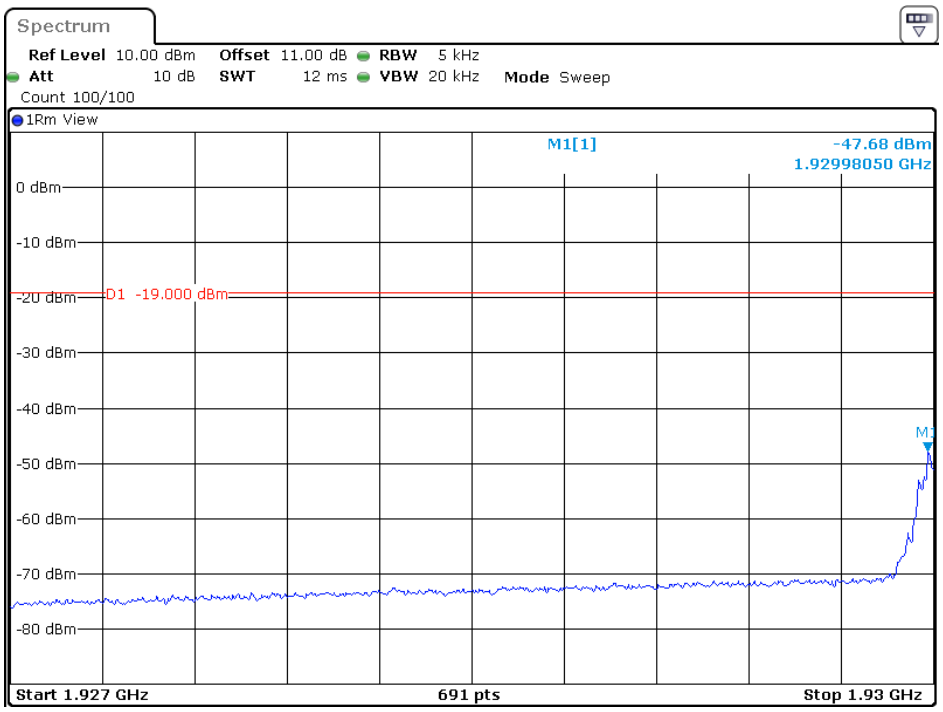
Date: 22.NOV.2022 04:03:15

PCS Band CDMA Left Side Above AGC



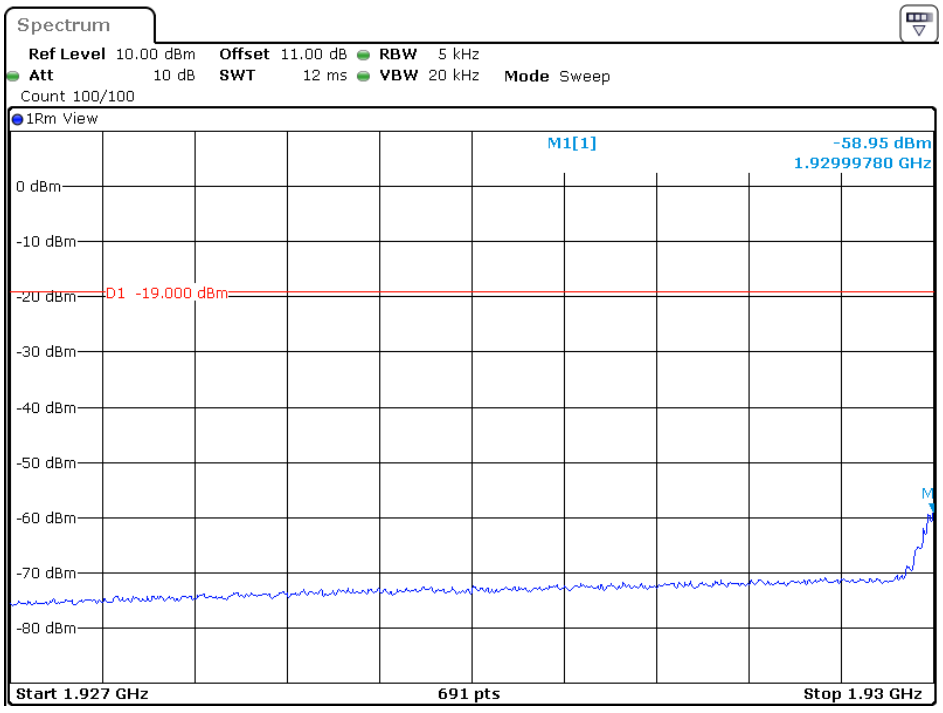
Date: 22.NOV.2022 04:05:02

PCS Band GSM Left Side Pre-AGC



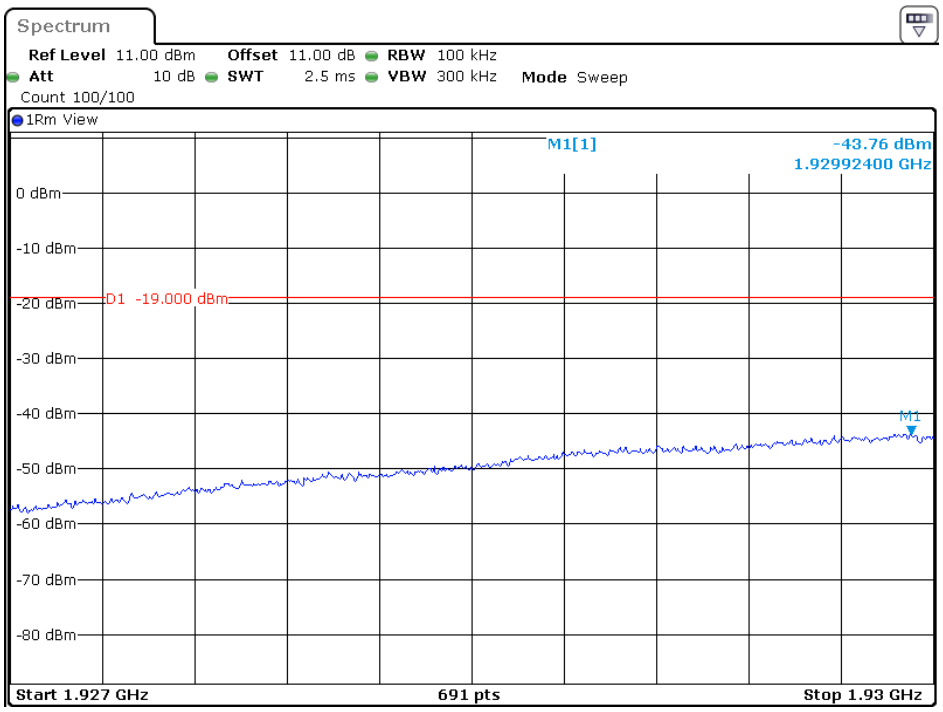
Date: 22.NOV.2022 06:28:40

PCS Band GSM Left Side Above AGC



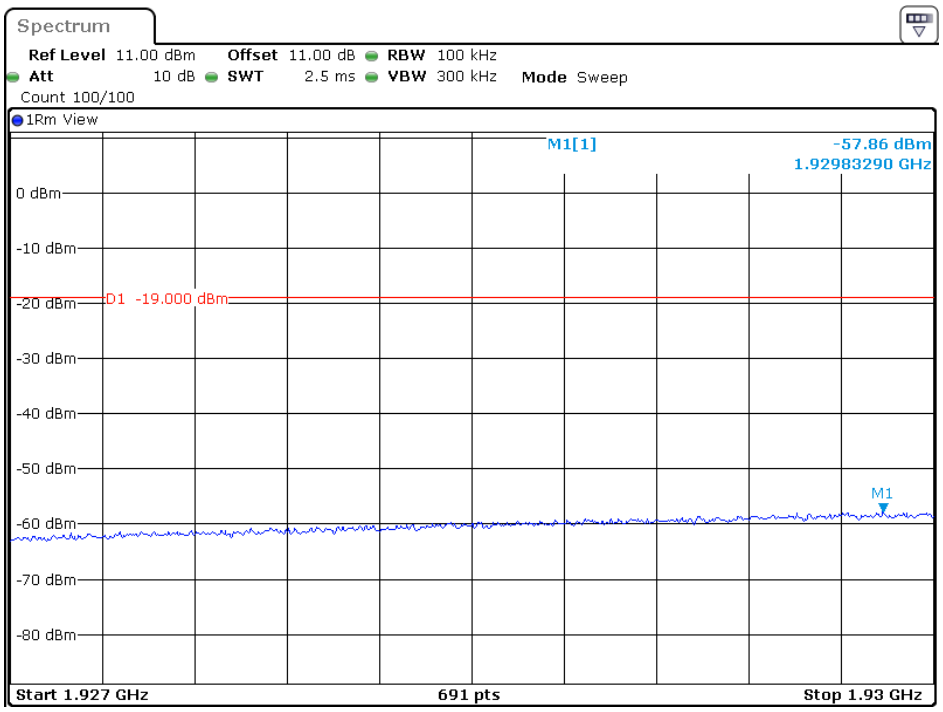
Date: 22.NOV.2022 06:30:43

PCS Band WCDMA Left Side Pre-AGC



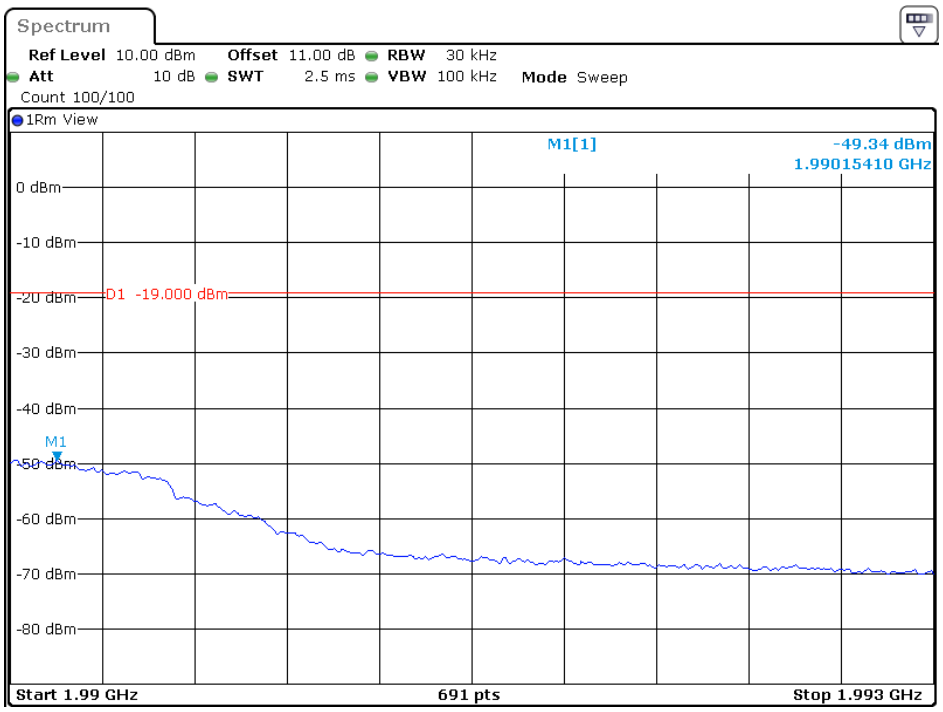
Date: 22.NOV.2022 06:58:33

PCS Band WCDMA Left Side Above AGC



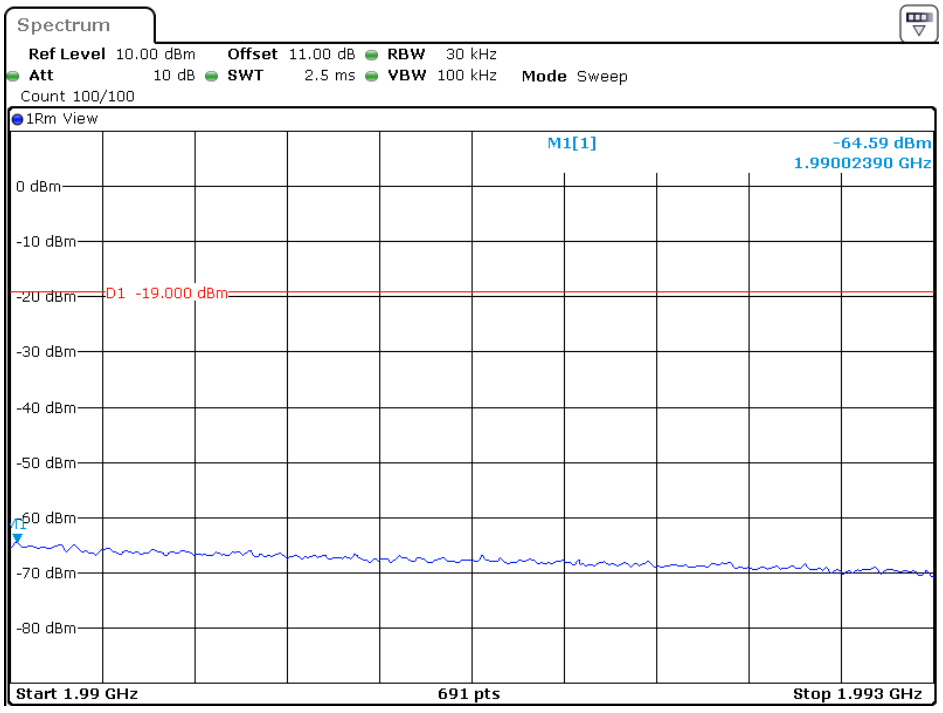
Date: 22.NOV.2022 06:58:58

PCS Band CDMA Right Side Pre-AGC



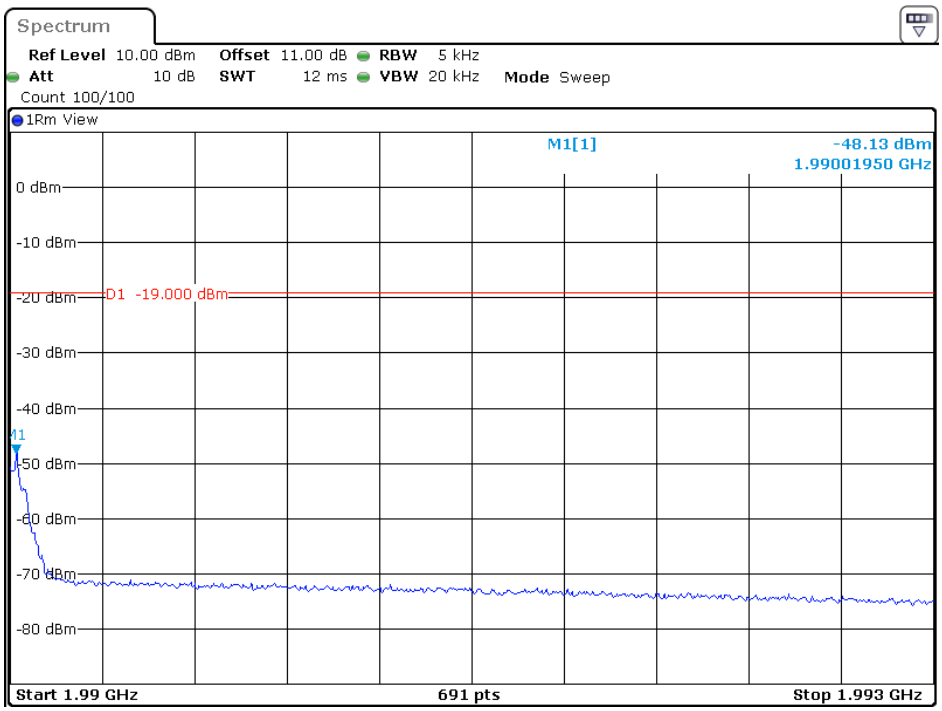
Date: 22.NOV.2022 04:23:24

PCS Band CDMA Right Side Above AGC



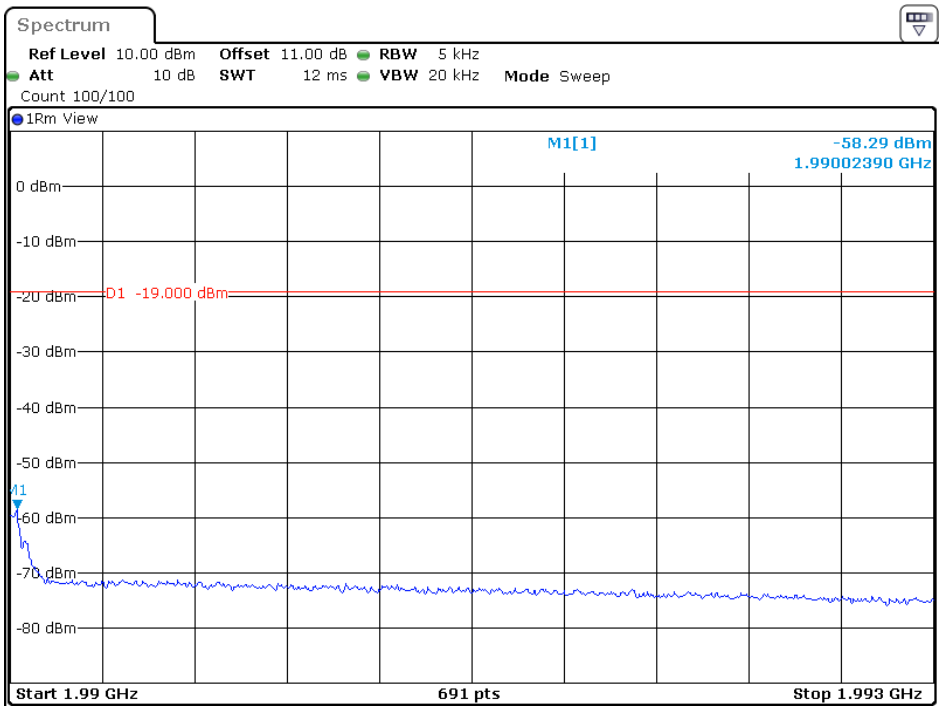
Date: 22.NOV.2022 04:23:48

PCS Band GSM Right Side Pre-AGC



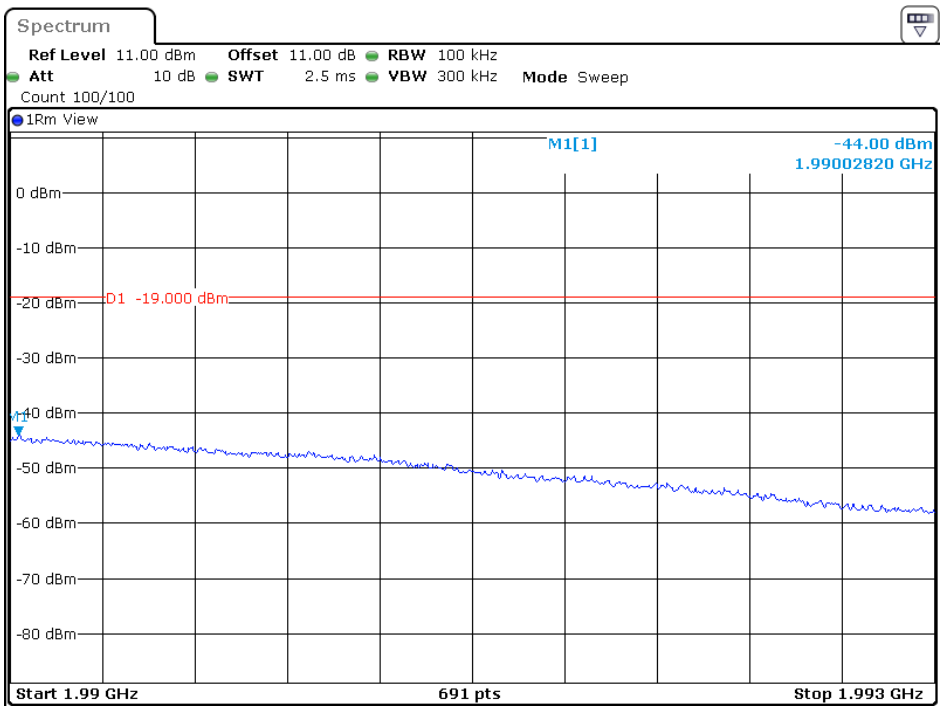
Date: 22.NOV.2022 06:34:57

PCS Band GSM Right Side Above AGC



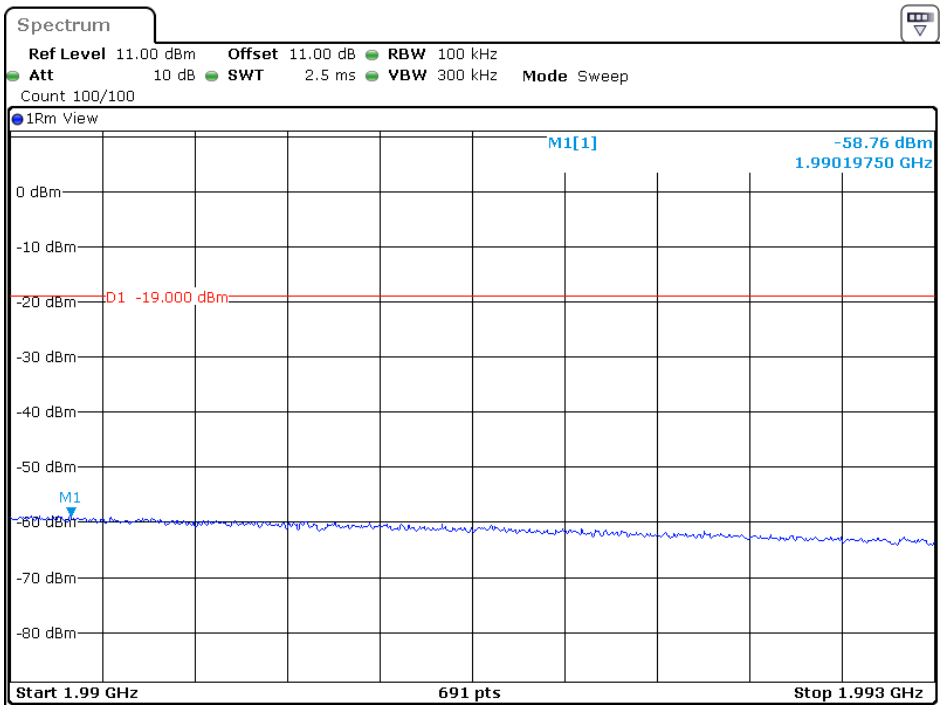
Date: 22.NOV.2022 06:35:51

PCS Band WCDMA Right Side Pre-AGC



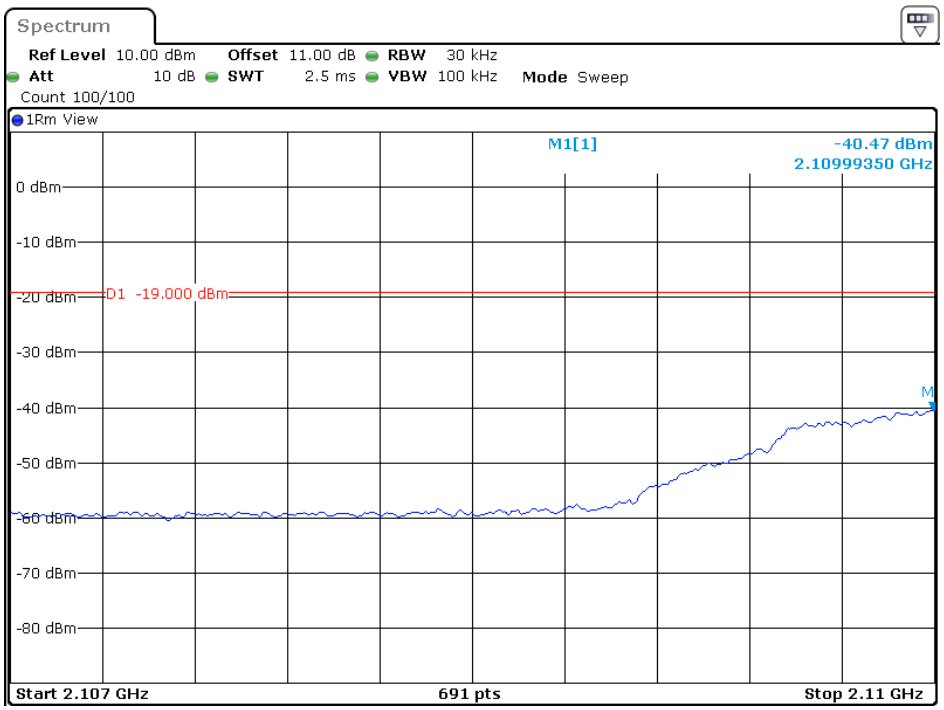
Date: 22.NOV.2022 07:00:29

PCS Band WCDMA Right Side 2107MHz Above AGC



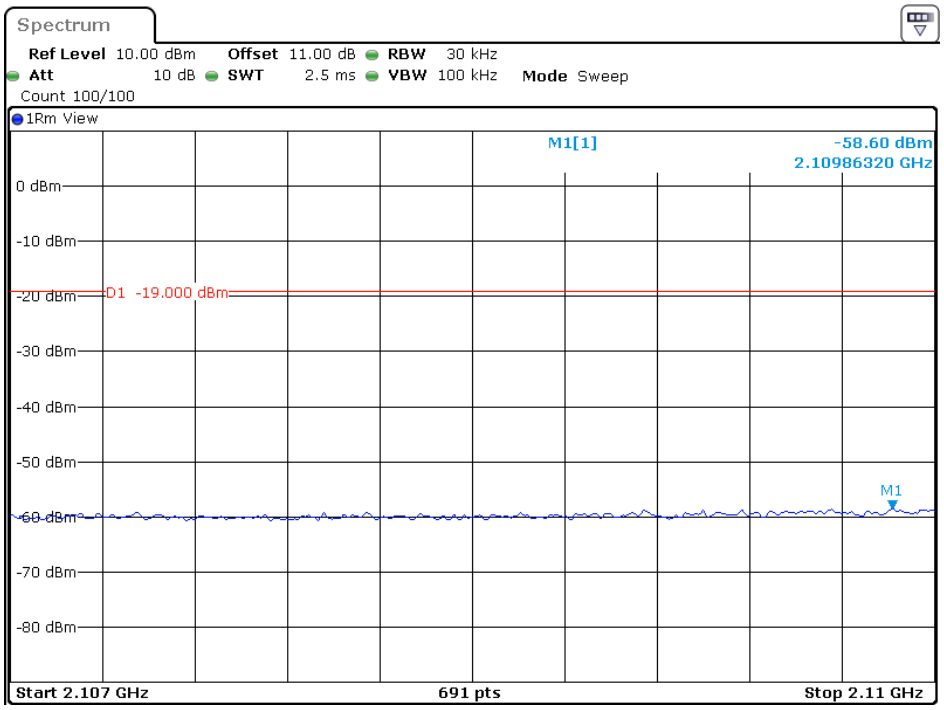
Date: 22.NOV.2022 06:59:56

AWS Band CDMA Left Side Pre-AGC



Date: 22.NOV.2022 04:19:43

AWS Band CDMA Left Side Above AGC



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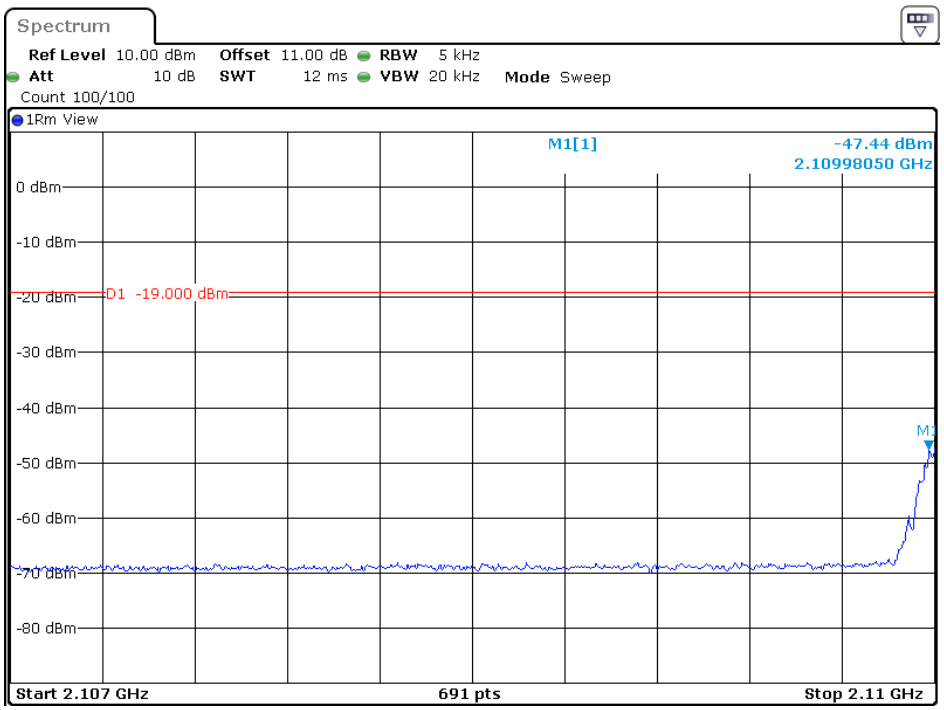
AWS Band GSM Left Side Pre-AGC



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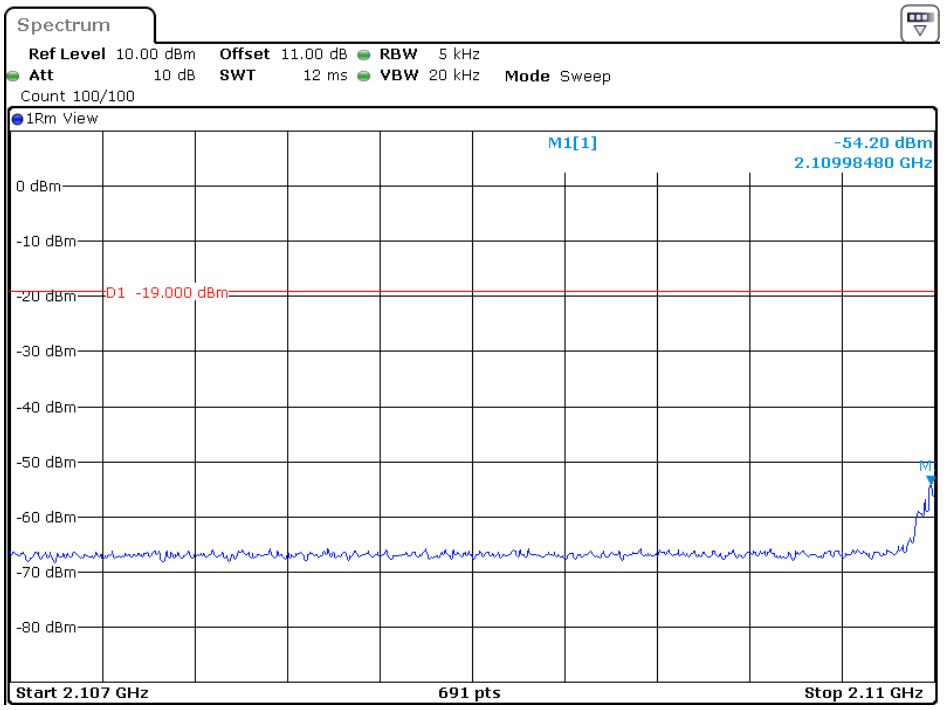
AWS Band GSM Left Side Above AGC



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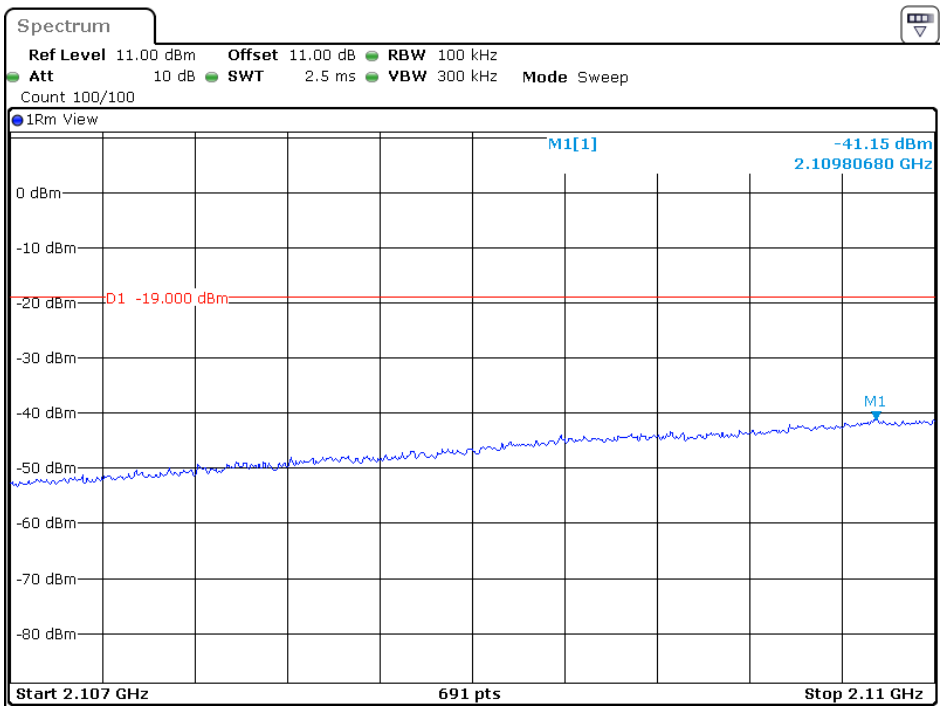
AWS Band WCDMA Left Side Pre-AGC



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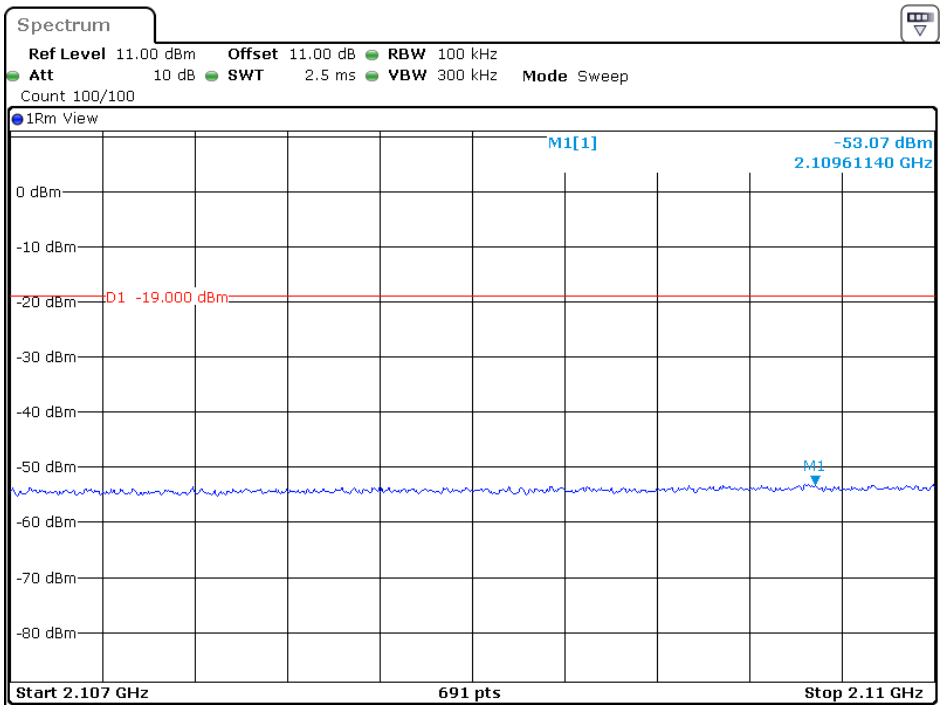

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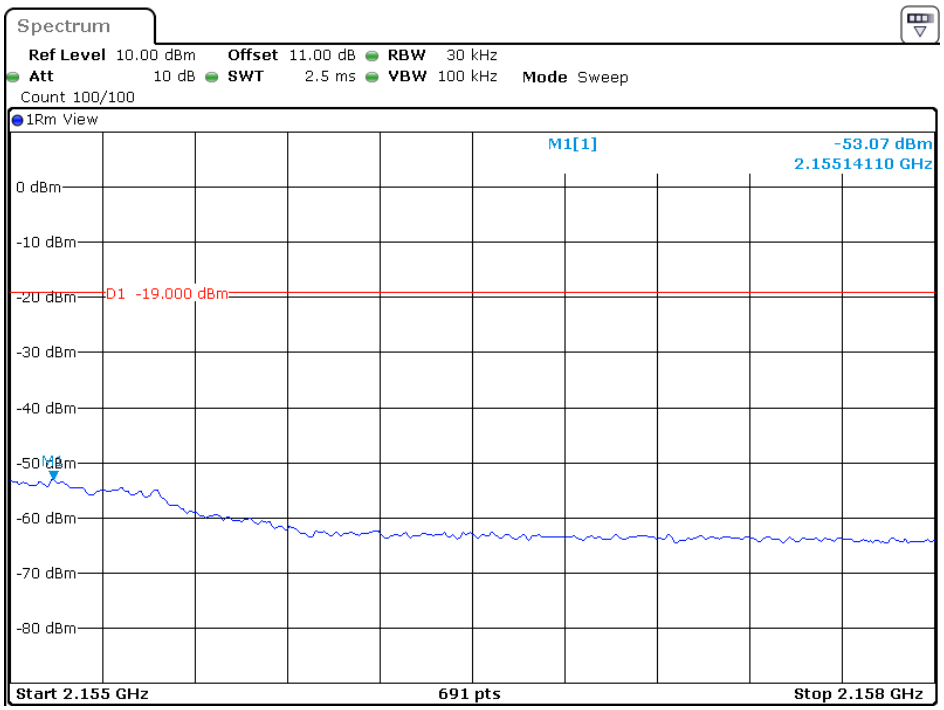

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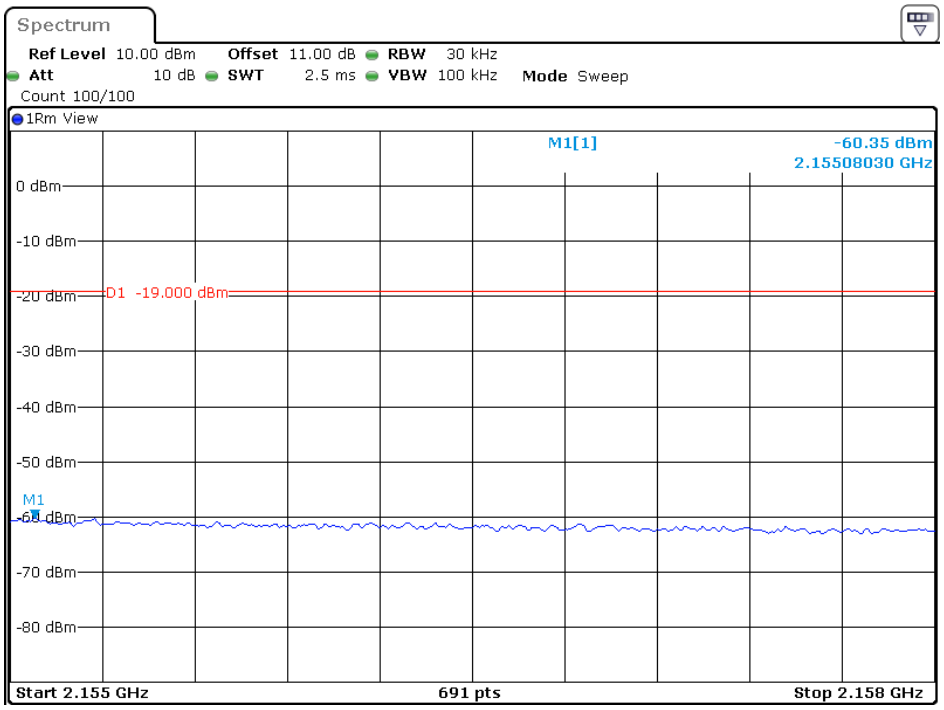

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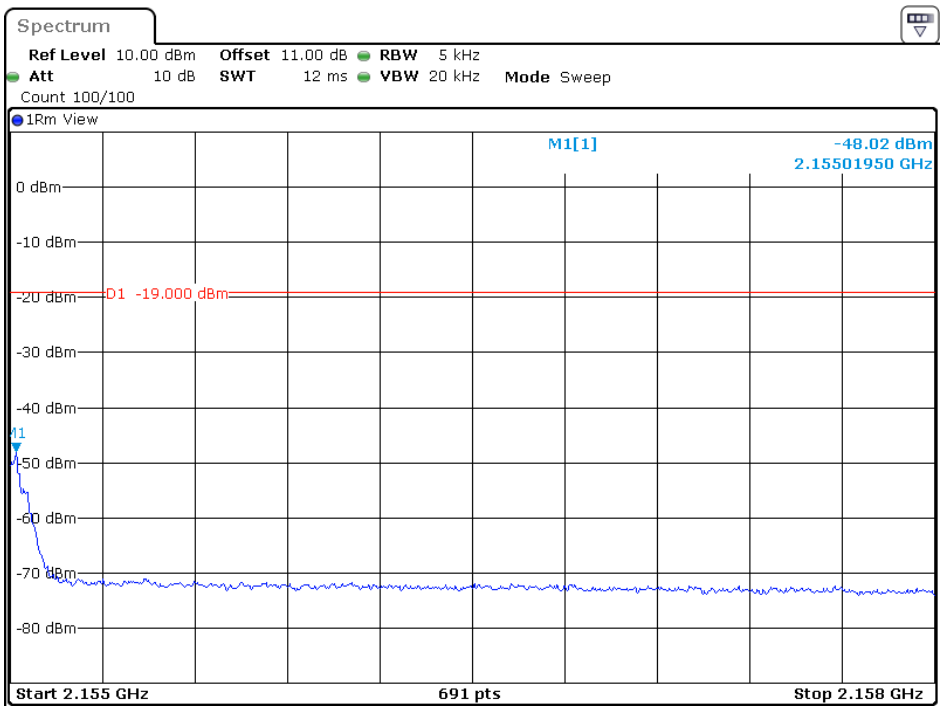
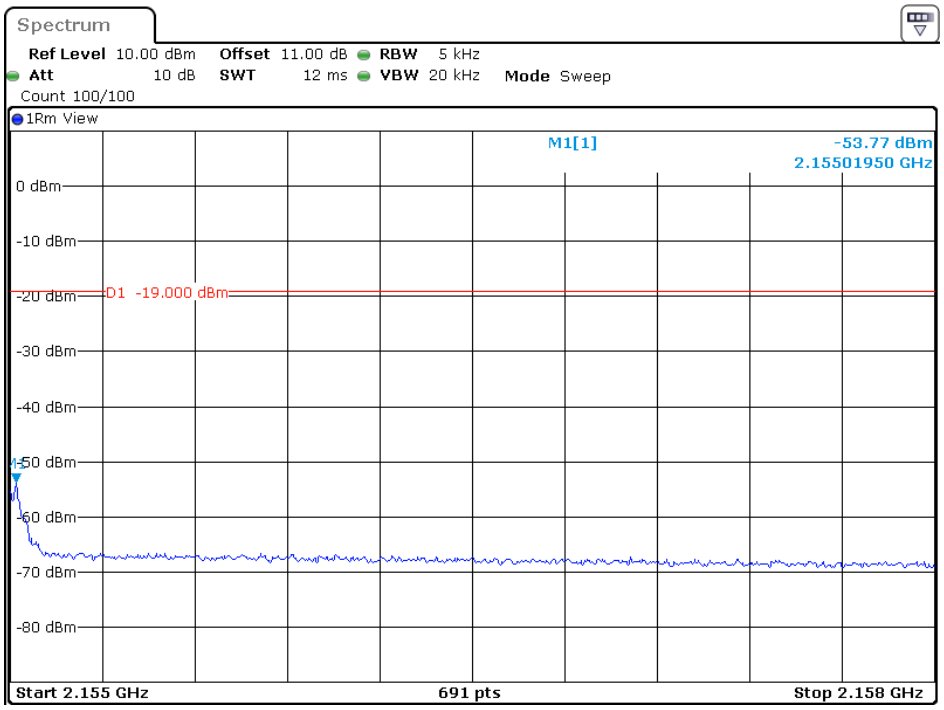
AWS Band GSM Right Side Pre-AGC



Date: 22.NOV.2022 06:38:50

AWS Band GSM Right Side Above AGC



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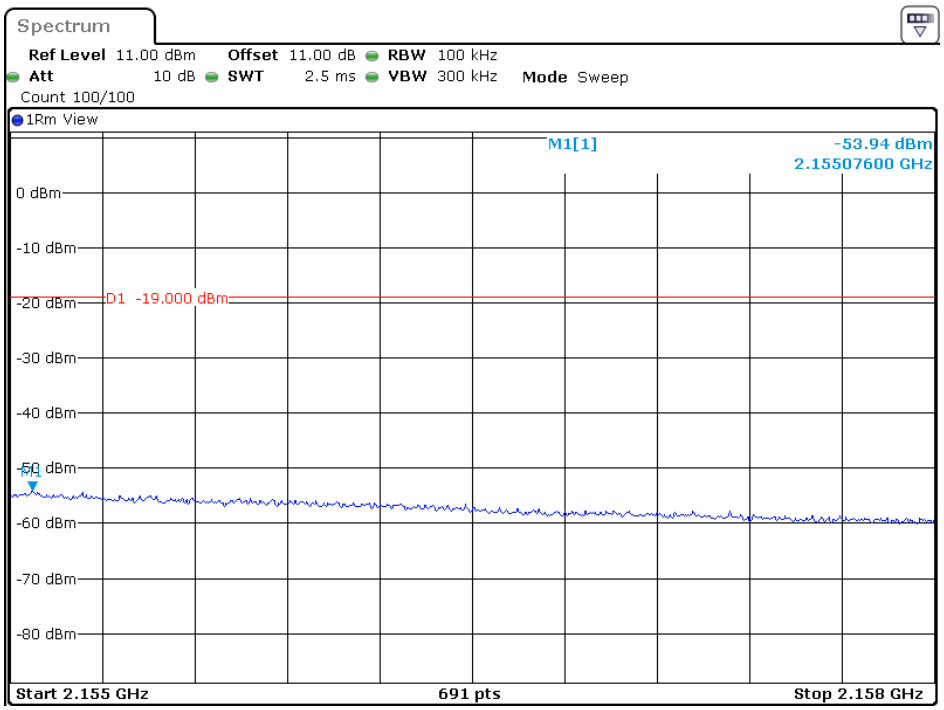

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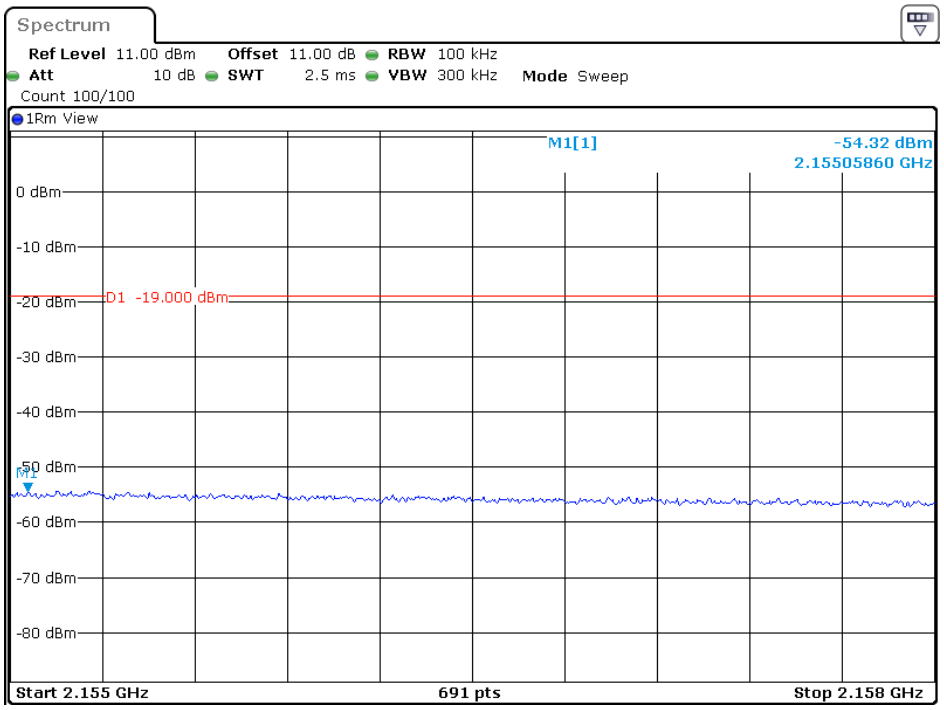

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§ 20.21(e)(8)(i)(A), § 20.21(e)(8)(i)(H) &§20.21(e)(4) - NOISE LIMITS

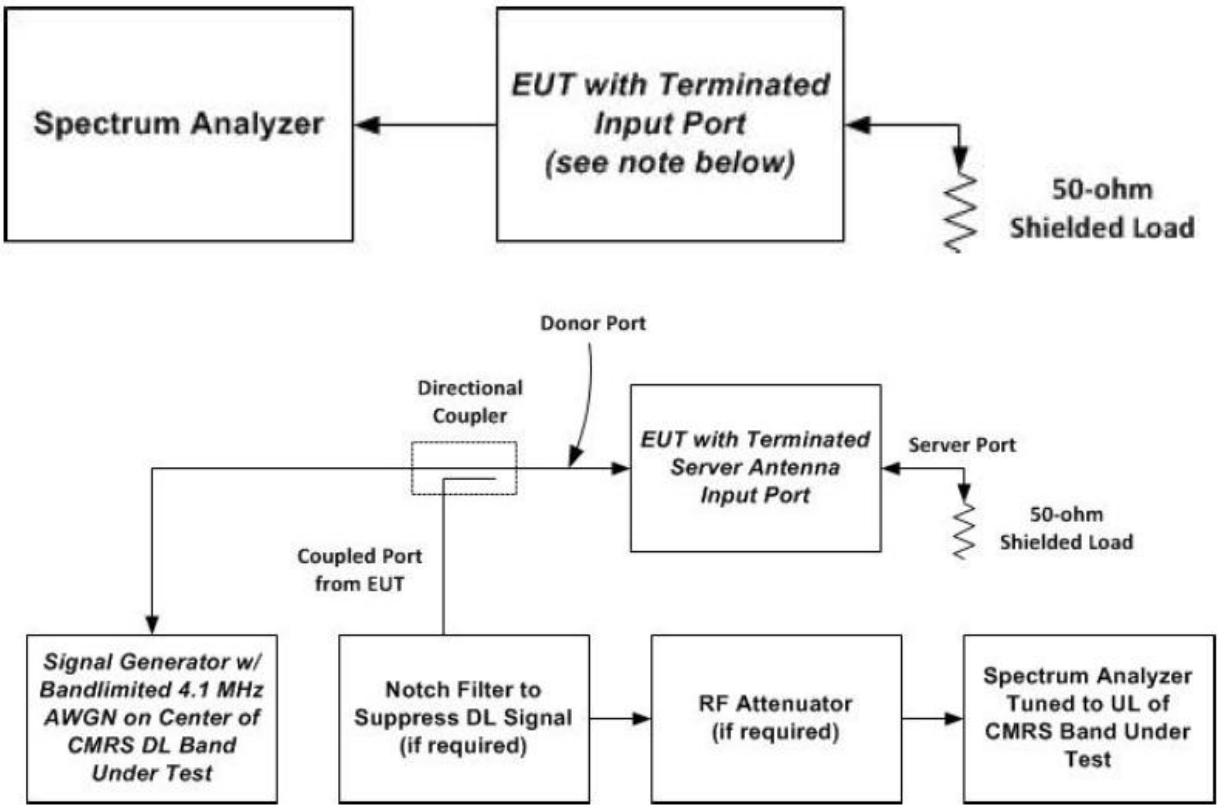
Applicable Standards

According to§ 20.21(e)(8)(i)(A) Noise Limits; § 20.21(e)(8)(i)(H) Transmit Power Off Mode (uplink and downlink noise power); §20.21(e)(4) Self-monitoring.

Test Procedure

Maximum transmitter noise power level
a) Connect the EUT to the test equipment as shown in **Figure 3**. Begin with the uplink output connected to the spectrum analyzer. When measuring downlink noise, connect the downlink output to the spectrum analyzer.
b) Set the spectrum analyzer RBW to 1 MHz with the VBW ≥ 3 × RBW.
c) Select the power averaging (RMS) detector and trace average over at least 100 traces.
d) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span ≥ 2 × the CMRS band.
e) Measure the maximum transmitter noise power level.
f) Save the spectrum analyzer plot as necessary for inclusion in the final test report.
g) Repeat 7.7b) to 7.7f) for all operational uplink and downlink bands.
h) Connect the EUT to the test equipment as shown in **Figure 4** for uplink. Affirm the coupled path of the RF coupler is connected to the spectrum analyzer.
i) Configure the signal generator for 4.1 MHz AWGN operation.
j) Set the spectrum analyzer RBW for 1 MHz with the VBW ≥ 3 × RBW with a power averaging (rms) detector with at least 100 trace averages.
k) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span ≥ 2 × the CMRS band. This shall include all spectrum blocks in the particular CMRS band under test (see Annex A).
l) For uplink noise measurements, set the spectrum analyzer center frequency for the uplink band under test and tune the signal generator to the center of the paired downlink band.
m) Measure the maximum transmitter noise power level when varying the downlink signal generator output level from −90 dBm to −20 dBm, as measured at the input port, in 1 dB steps inside the RSSI-dependent region and in 10 dB steps outside the RSSI-dependent region. Report the six values closest to the limit with at least two points within the RSSI-dependent region of the limit. See noise limit in Annex D.
n) Repeat 7.7.1h) through 7.7.1m) for all operational uplink.

Variable uplink noise timing
Variable uplink noise timing is to be measured as follows.
a) Set the spectrum analyzer to the uplink frequency to be measured.
b) Set the span to 0 Hz with a sweep time of 10 seconds.
c) Set the power level of signal generator 1 to the lowest level of the RSSI-dependent noise.
d) Select MAX HOLD and increase the power level of signal generator 1 by 10 dB for mobile boosters and 20 dB for fixed boosters.
e) Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices and 3 seconds for fixed devices
f) Repeat 7.7.2a) to 7.7.2e) for all operational uplink bands.
g) Include plots and summary table in test report.
Note: *Some signal boosters will require a signal generator input because they will not operate unless a signal is received at the input terminals. If this is the case, connect a second signal generator and cycle the RF output to simulate this function.*



Test Data

Environmental Conditions

Temperature:	22.7-25.5℃
Relative Humidity:	46-57 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu from 2022-10-10 to 2022-12-21.

Test Result: Pass

Please refer to following table.