FCC PART 20.21

MEASUREMENT AND TEST REPORT

For

JDTECK INC

215 Celebration Place, Suite 190 Kissimmee FL

FCC ID: SQX-JDCR-LCPA

Report Type:	Product Type:
Original Report	Wireless Cellular Repeater

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Report Date:	2015-12-01
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *JDTECK INC*'s product, model number: *JDCR-LCPA-17 (FCC ID: SQX-JDCR-LCPA)* or the "EUT" as referred to in this report is a *Wireless Cellular Repeater*,

Radio System Type	Wide Band Consumer Signal Booster
Frequency Bands	LTE Low 700MHz:698-716MHz(Uplink), 728-746MHz(Downlink) LTE Upper 700MHz: 776-787MHz(Uplink), 746-757MHz(Downlink) Cellular: 824-849MHz (Uplink), 869-894MHz(Downlink) AWS: 1710-1755MHz (Uplink), 2110-2155MHz(Downlink) PCS: 1850-1910MHz(Uplink), 1930-1990MHz(Downlink)
Max. Gain	Uplink: 48dB Downlink: 48dB
AGC Level	Uplink: -25 dBm Downlink: -55 dBm
Max. Output Power (Antenna Port)	Uplink: 19dBm+/-2dB Downlink: -10dBm+/-5dB
Max. Antenna Gain:	Uplink: 10dBi Down Link: 10dBi
Nominal Power Supply:	DC 12V from adapter
External Dimension	25.0 cm (L) x 25.0 cm (W) x5.2 cm (H)
Temperature Range	-25℃ to 55℃

Accessory Equipment List and Details

Manufacturer	Description	Model	Serial Number	Details
/	Adapter	GV601-120500	/	Input: 100-240V~50/60Hz, 2.0A, Output: 12V, 5.0A

Note: The series product, model JDCR-LCPA-17, JDCR-LCPA-15, JDCR-LCPA-10 are electrically identical, the difference between them is just gain, we selected JDCR-LCPA-17 for fully testing, the details was explained in the attached declaration letter.

**All measurement and test data in this report was gathered from production sample serial number: 151020003 (Assigned by BACL, Dongguan). The EUT supplied by applicant was received on 2015-10-22.*

Objective

This type approval report is prepared on behalf of *JDTECK INC* in accordance with Part 2, Part 20.21，Part 22, part 24 and part 27 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

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 parts:

Applicable Standards: TIA-1037, TIA/EIA 603-D. KDB 935210 D03 Signal Booster Measurements v03.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

Equipment Modifications

No modifications were made to the EUT.

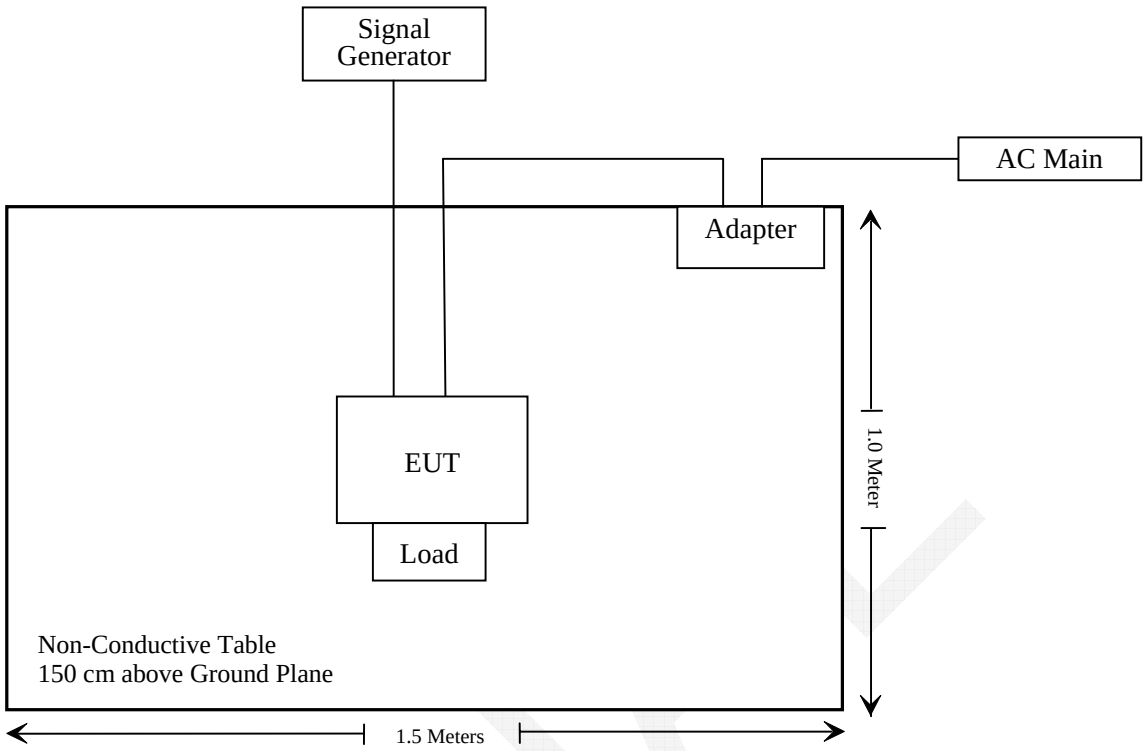
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Agilent	MXG Vector Signal Generator	N5182B	MY513502142
R & S	Wideband Radio Communication Tester	CMW500	114772

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	no	no	1.0	Adapter	EUT
RF Cable	Yes	no	1.0	Signal generator	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	KDB 935210 D03 procedures	Result
§20.21(e)(3) Frequency Bands	§7.1 Authorized frequency band verification test	Compliance
§20.21(e)(8)(i)(A) Noise Limits §20.21(e)(8)(i)(H)Transmit Power Off Mode §20.21(e)(4) Self-monitoring	§7.7 Noise limits test procedure	Compliance
§20.21(e)(8)(i)(B) Bidirectional Capability §20.21(e)(3) Frequency Bands	§7.13 Spectrum block filtering test procedure	Not Applicable[Note4]
§20.21(e)(8)(i)(C)(1) Booster Gain Limits §20.21(e)(8) (i)(H)Transmit Power Off mode §20.21(e)(4) Self-monitoring	§7.9 Variable booster gain test procedure	Compliance
§20.21(e)(8)(i)(C)(2) Booster Gain Limits §20.21(e)(8) (i)(B)Bidirectional Capability	§7.3 Maximum booster gain computation	Compliance
§20.21(e)(8)(i)(D)Power Limits §20.21(e)(8) (i)(B)Bidirectional Capability §20.21(e)(4) Self-monitoring	§7.2 Maximum power measurement test procedure	Compliance
§20.21(e)(8)(i)(E)Out Of Band Emission Limits	§7.5 Out-of-band emissions test procedure	Compliance
§20.21(e)(8)(i)(F)Intermodulation Limits	§7.4 Intermodulation product test procedure	Compliance
§20.21(e)(8)(i)(G)Booster Antenna Kitting	Note1	Compliance
§20.21(e)(8)(i)(H)Transmit Power Off Mode	Note2	Compliance
§20.21(e)(8)(i)(I)Uplink Inactivity §20.21(e)(4) Self-monitoring	§7.8 Uplink inactivity test procedure	Compliance
§20.21(e)(8)(ii)(A)Anti-Oscillation §20.21(e)(4) Self-monitoring	§7.11 Oscillation detection test procedure	Compliance
§20.21(e)(8)(ii)(B)Gain Control	Note3	Compliance
§2.1049 Measurements Required: Occupied Bandwidth	§7.10 Occupied bandwidth test procedure	Compliance
§2.1051 Measurements Required: Spurious emissions at antenna terminals	§7.6 Conducted spurious emissions test procedure	Compliance
§2.1053 Measurements Required: Field strength of spurious radiation	§7.12 Radiated spurious emissions test procedure	Compliance

Note:

1. Generic testing requirements are not established; rather technical documentation is used describing all antennas, cables, and/or coupling devices that may be used with a consumer booster and how those meet the requirements.
2. There is no specific test for this functionality but it is instead addressed through a combination of the variable noise, variable gain, and oscillation detection tests.
3. Conformance to the requirement to include AGC circuitry is verified in 7.1 and 7.2.
4. The rest is required only for wideband consumer boosters utilizing spectrum block filtering.

§ 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.

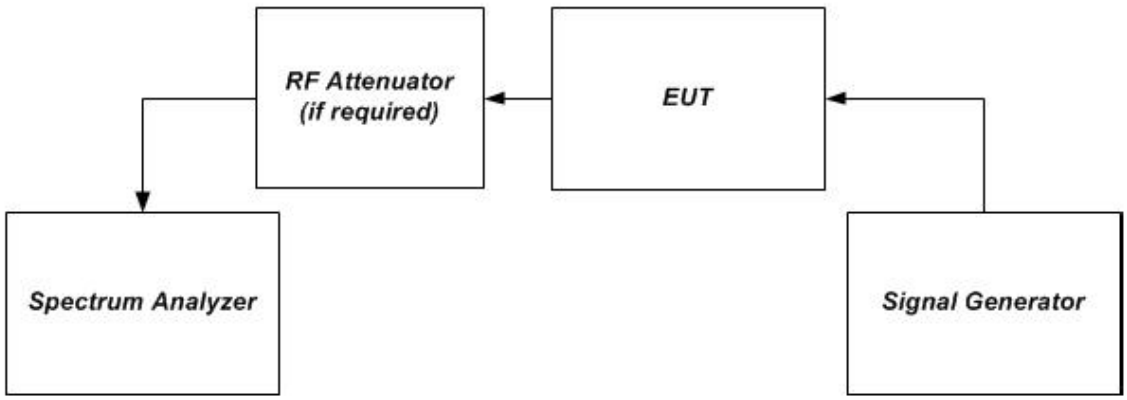


Figure 1 – Band verification test instrumentation setup

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2015-03-30	2016-03-29

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

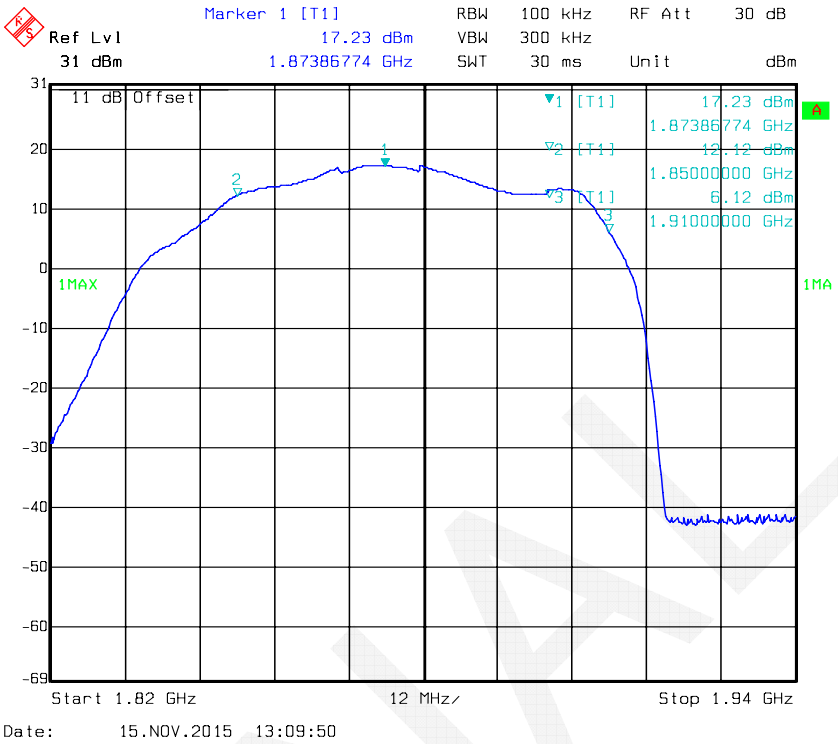
Temperature:	25.2~25.8℃
Relative Humidity:	45~53%
ATM Pressure:	100.8~101 kPa

The testing was performed by Dean Liu from 2015-11-15 to 2015-11-18.

Test Result: Compliance. Please refer to the following plots.

Uplink:

PCS Band



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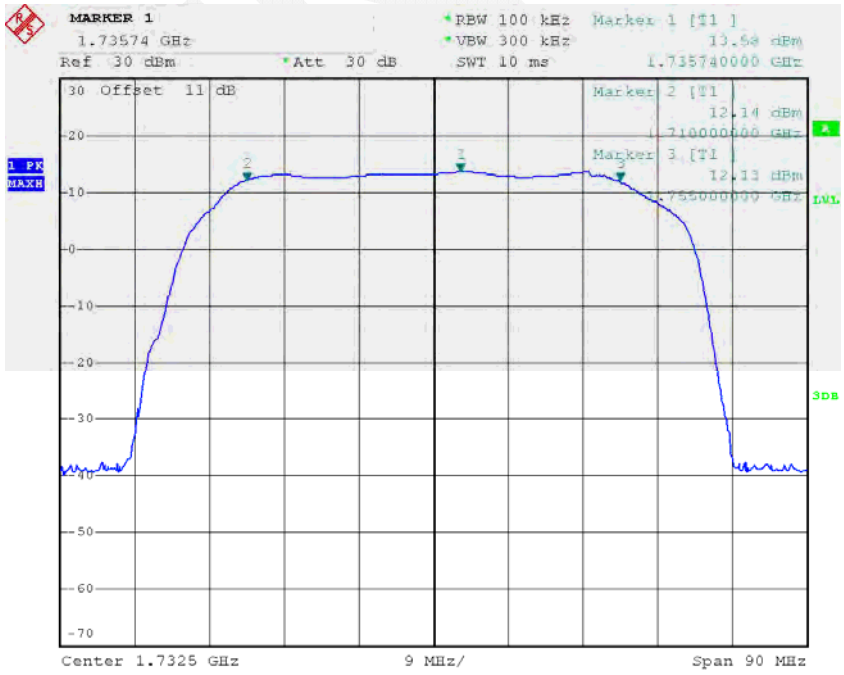
AWS Band



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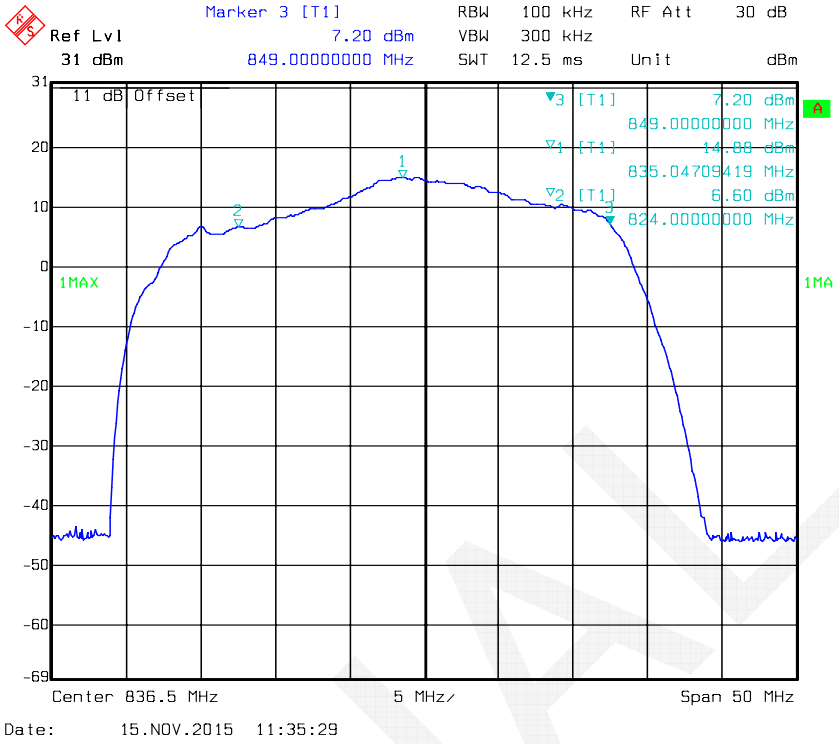
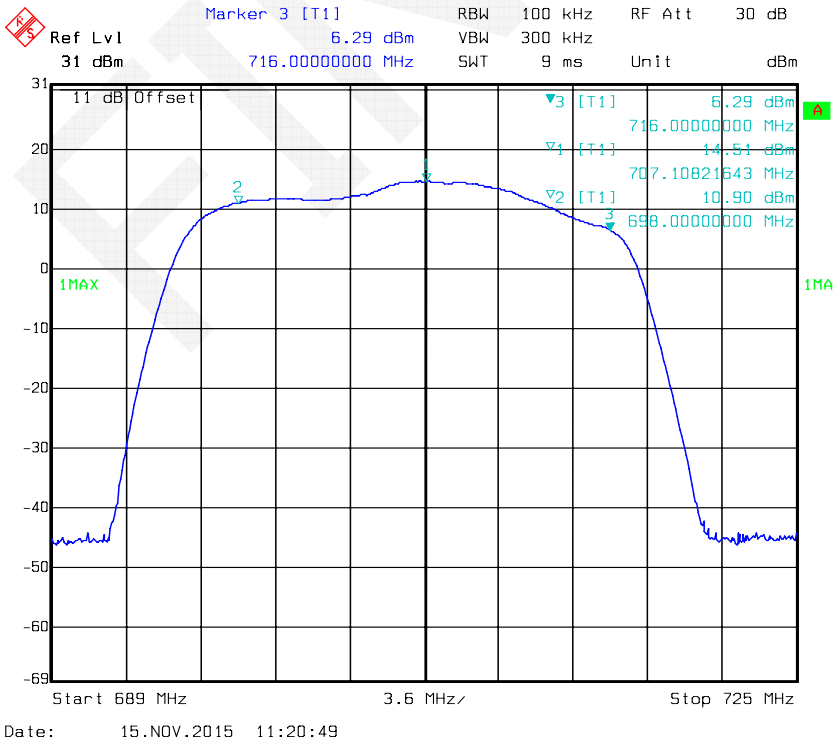
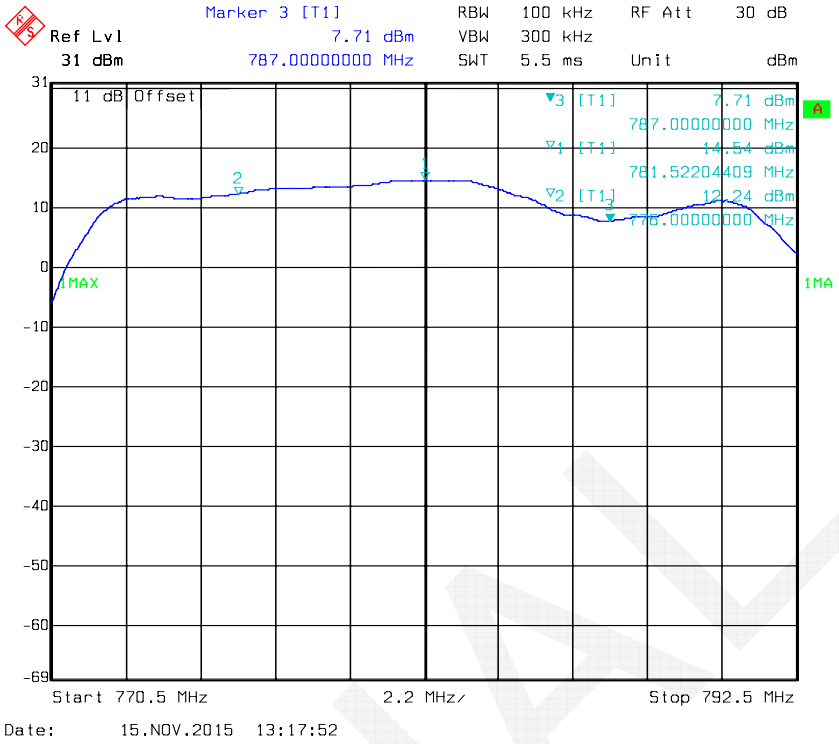
Cellular Band



Low 700MHz

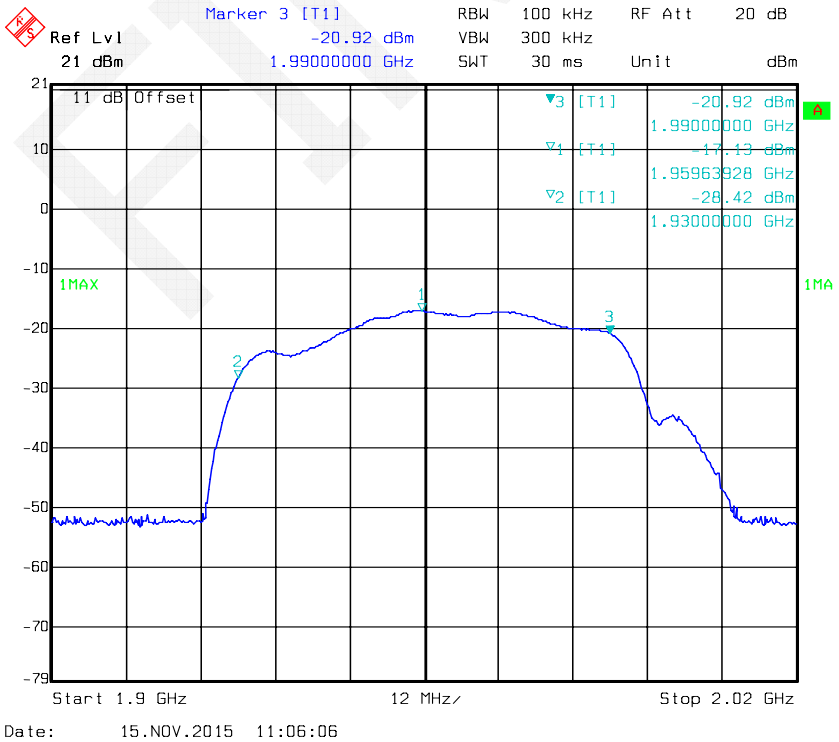


Upper 700MHz

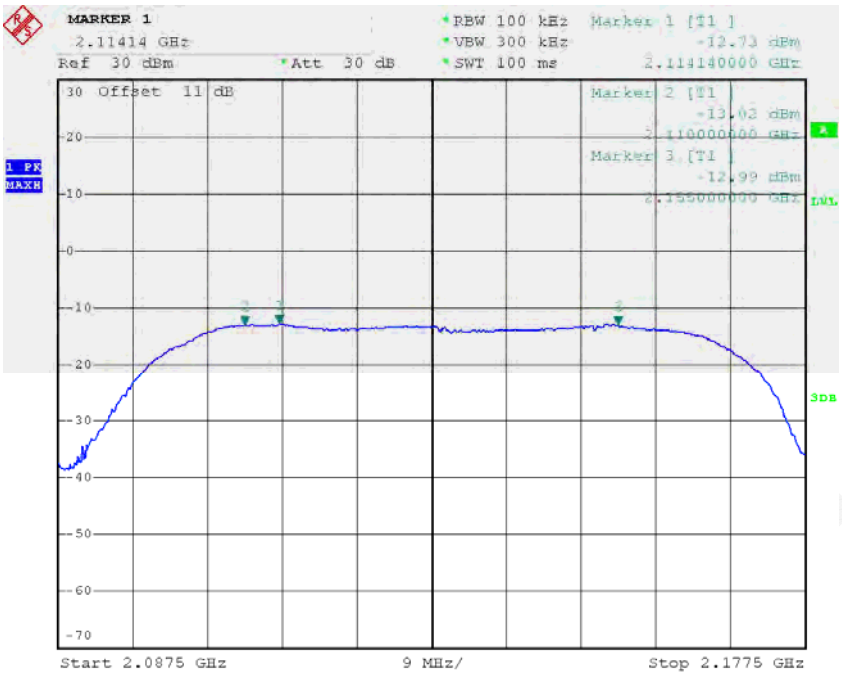


Downlink:

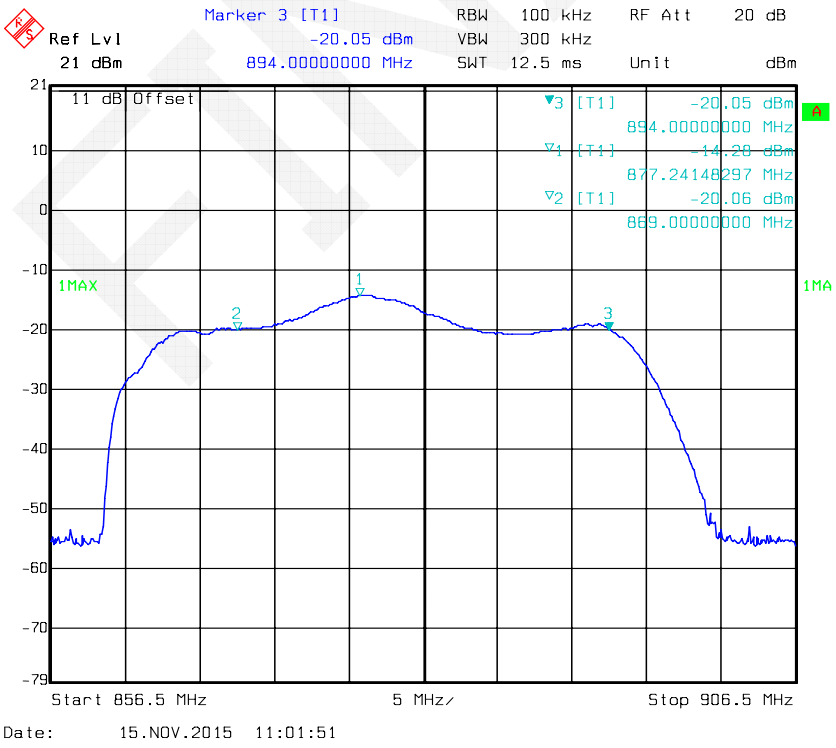
PCS Band



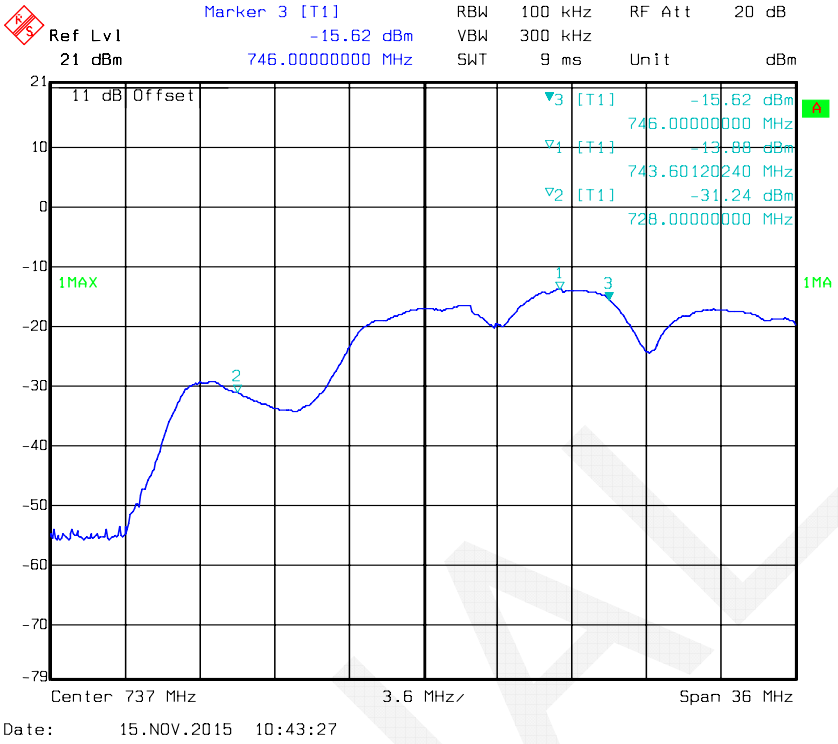
AWS Band



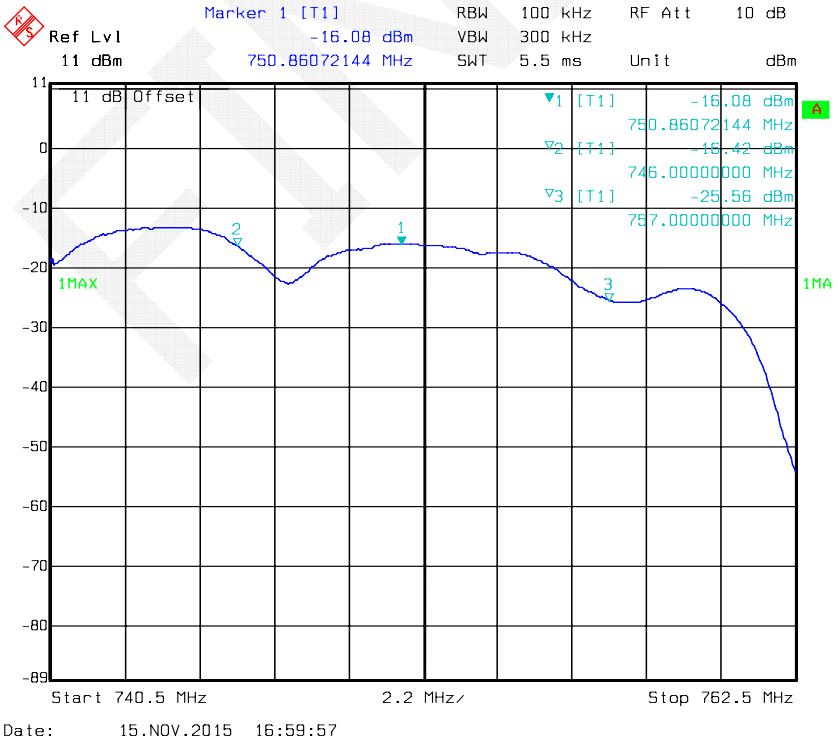
Cellular Band



Lower 700



Upper 700



§ 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 $\geq 3 \times$ 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2014-12-19	2015-12-19

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	24.2~25.8℃
Relative Humidity:	45~53%
ATM Pressure:	100.8~101.5 kPa

The testing was performed by Dean Liu from 2015-11-15 to 2015-11-27.

Test Result: Compliance. Please refer to the following tables and plots

Output Power:

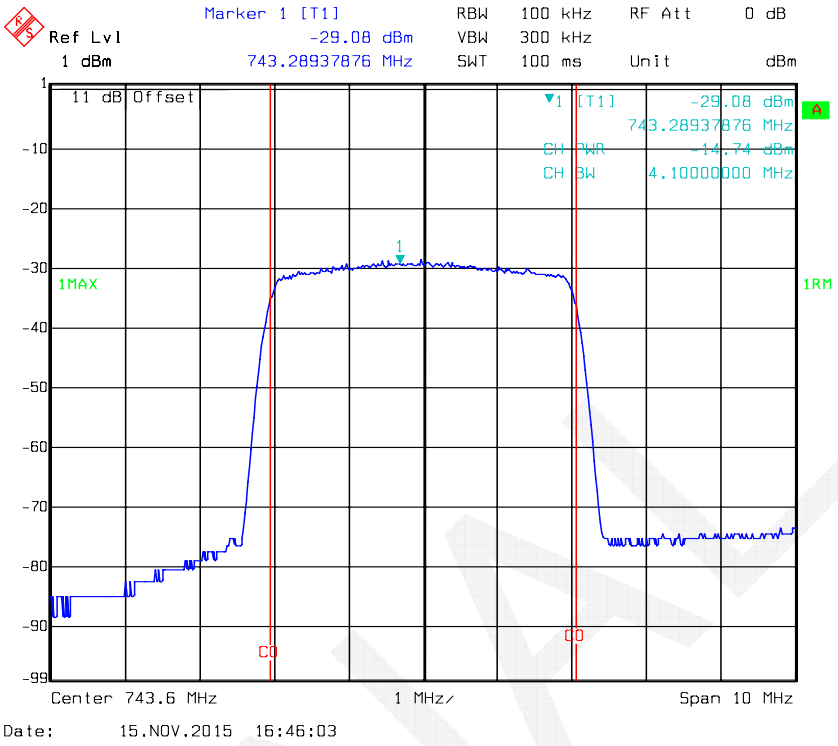
Mode	Operation Band	Signal type	Pre AGC Input level	Conducted Output level	Antenna Gain	Cable loss	EIRP	Limit
			dBm	dBm	dBi	dB	dBm	dBm
Uplink	Lower 700	AWGN	-26.7	18.14	10	0.7	27.44	17~30
		GSM	-26.5	18.34			27.64	
	Upper 700	AWGN	-26.3	18.95	10	0.7	28.25	
		GSM	-26.3	18.06			27.36	
	Cellular	AWGN	-29.0	18.44	10	0.7	27.74	
		GSM	-28.5	18.41			27.71	
	AWS	AWGN	-23.0	17.75	10	1	26.75	
		GSM	-22.3	17.71			26.71	
	PCS	AWGN	-24.2	17.12	10	1	26.12	
		GSM	-24.1	17.51			26.51	
Downlink	Lower 700	AWGN	-56.2	-14.74	10	1.0	-13.74	≤17
		GSM	-56.0	-15.19			-14.19	
	Upper 700	AWGN	-56.7	-13.44	10	1.0	-12.44	
		GSM	-56.2	-13.94			-12.94	
	Cellular	AWGN	-59.5	-9.19	10	1.0	-8.19	
		GSM	-57.5	-9.87			-8.87	
	ASW	AWGN	-54.5	-9.35	10	1.5	-7.85	
		GSM	-54.2	-9.64			-8.14	
	PCS	AWGN	-55.5	-10.26	10	1.5	-8.76	
		GSM	-55.5	-11.59			-10.09	

Maximum Input level:

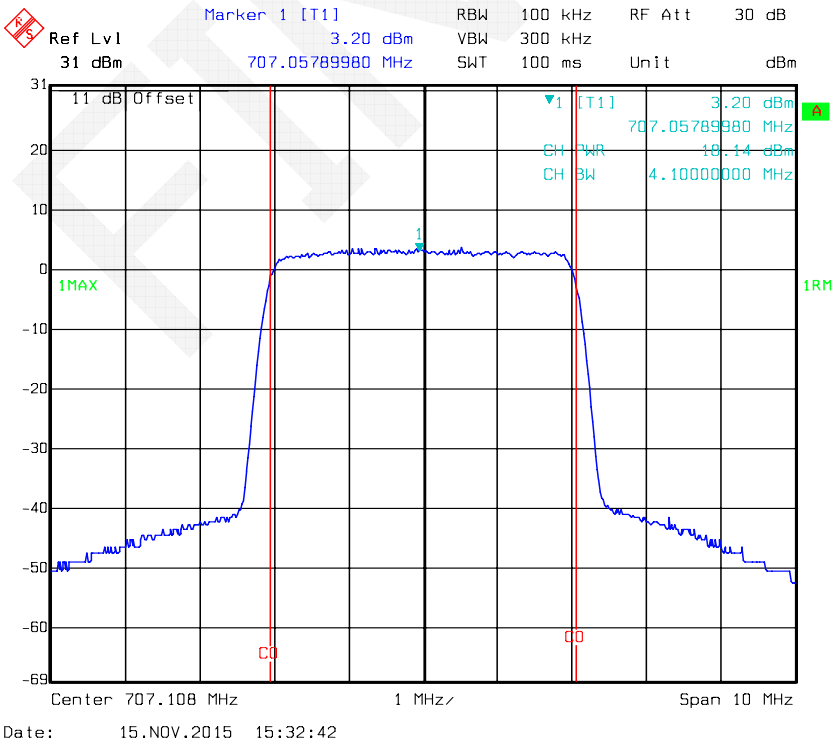
Mode	Operation Band	Signal type	Maximum Input level	Maximum Input level Limits	Conducted Output level
			dBm	dBm	dBm
Uplink	Lower 700	AWGN	-13.6	27.0	18.20
		GSM	-13.5		18.59
	Upper 700	AWGN	-12.6		18.25
		GSM	-12.4		18.70
	Cellular	AWGN	-17.6		17.94
		GSM	-17.5		19.19
	AWS	AWGN	-11.5		18.03
		GSM	-11.5		18.05
	PCS	AWGN	-11.2		17.11
		GSM	-11.3		18.16
Downlink	Lower 700	AWGN	-43.6	-20	-14.80
		GSM	-43.5		-14.49
	Upper 700	AWGN	-44.3		-13.82
		GSM	-43.4		-11.74
	Cellular	AWGN	-44.0		-6.82
		GSM	-44.8		-8.36
	AWS	AWGN	-40.5		-9.83
		GSM	-39.5		-8.33
	PCS	AWGN	-41.2		-10.62
		GSM	-40.9		-10.27

AWGN:
Output Power

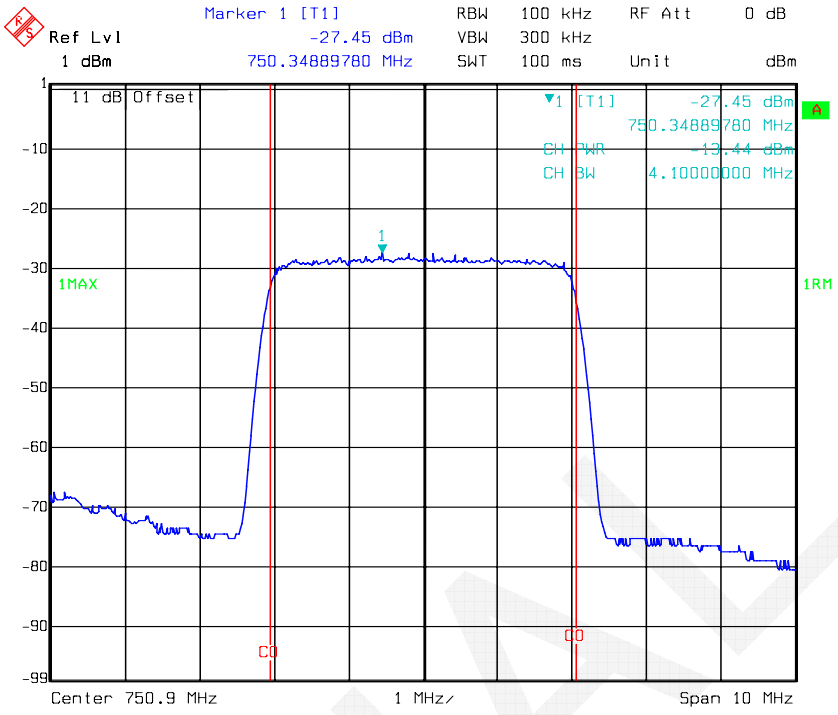
Lower 700 Downlink



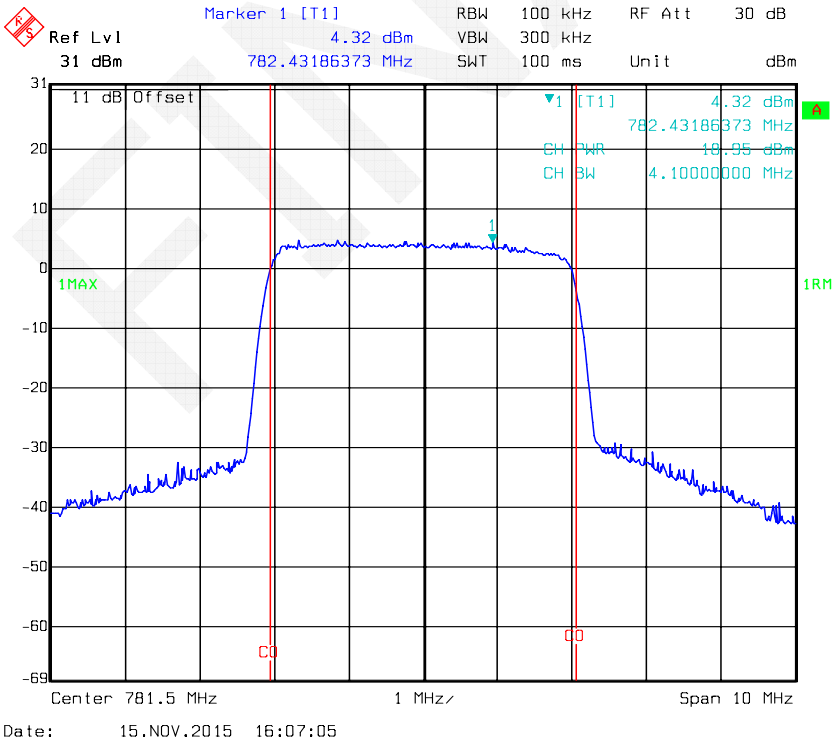
Lower 700 Uplink



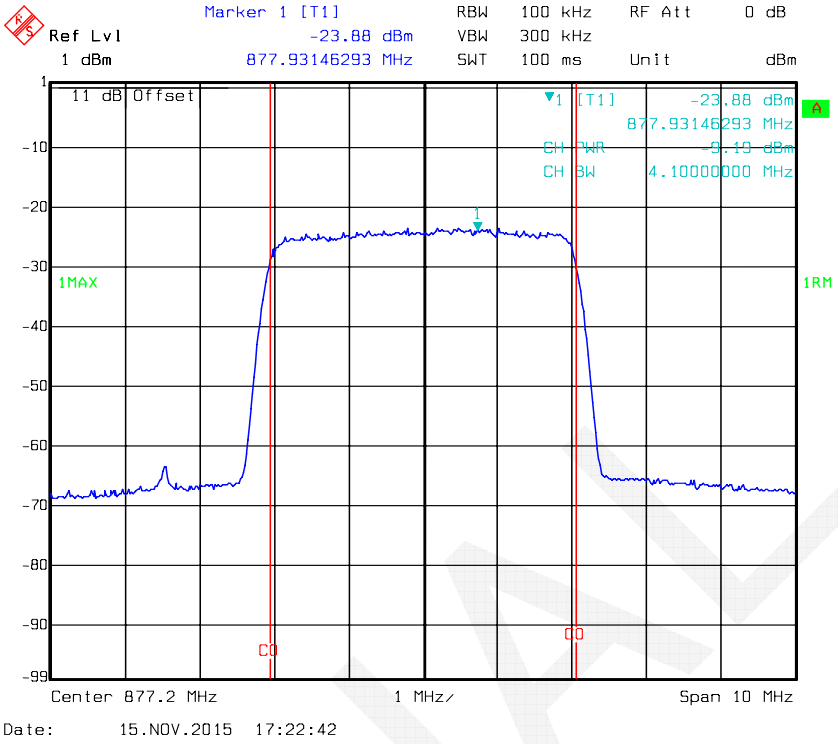
Upper 700 Downlink



Upper 700 Uplink



Cellular Downlink



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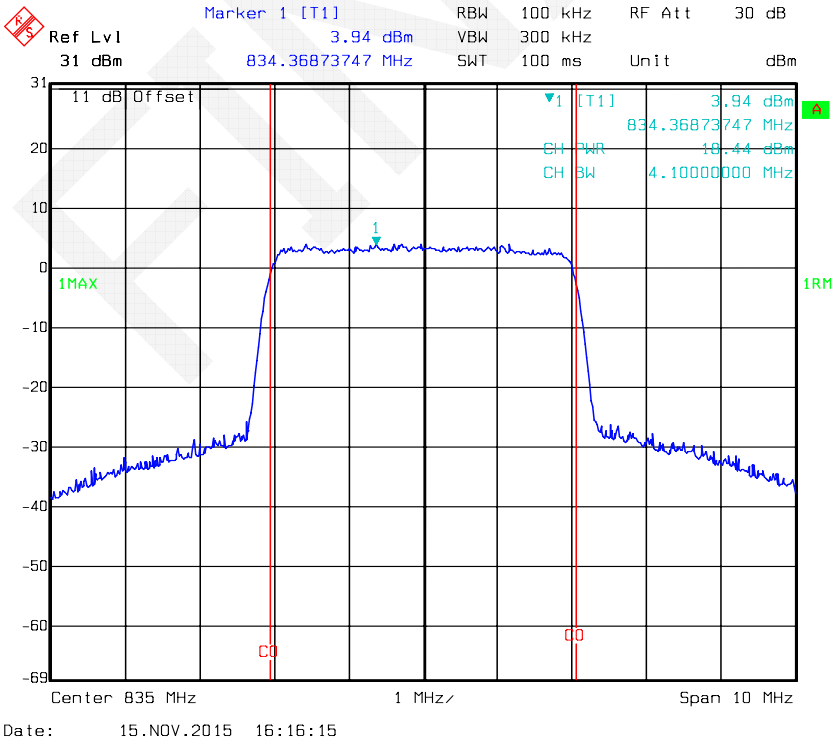
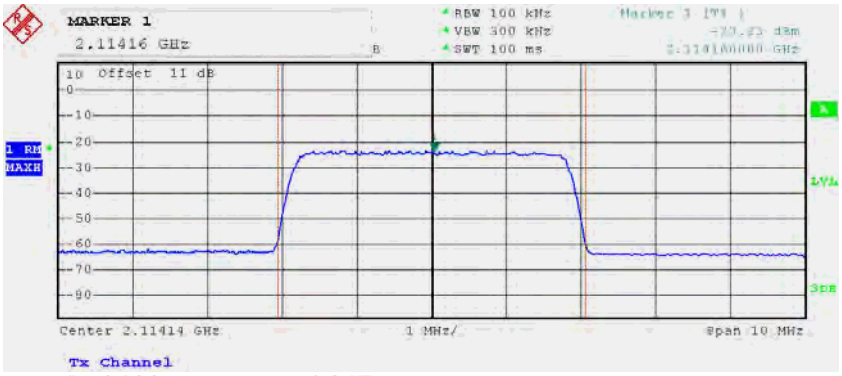


AWS Band Downlink



Date: 18.NOV.2015 23:16:35

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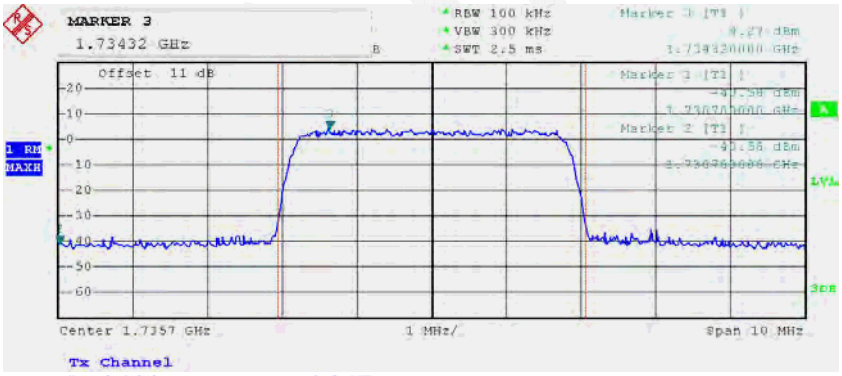
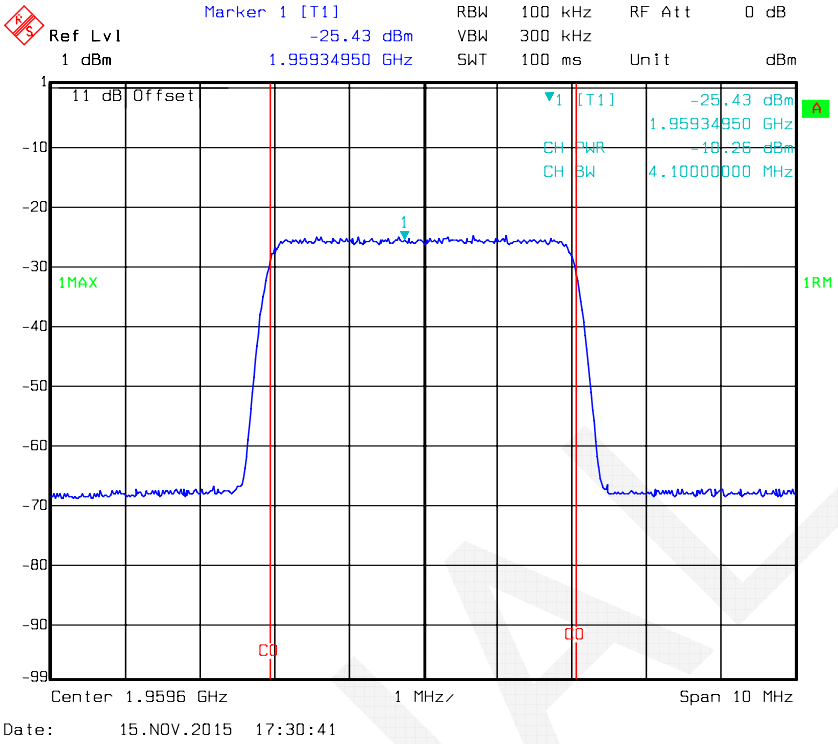
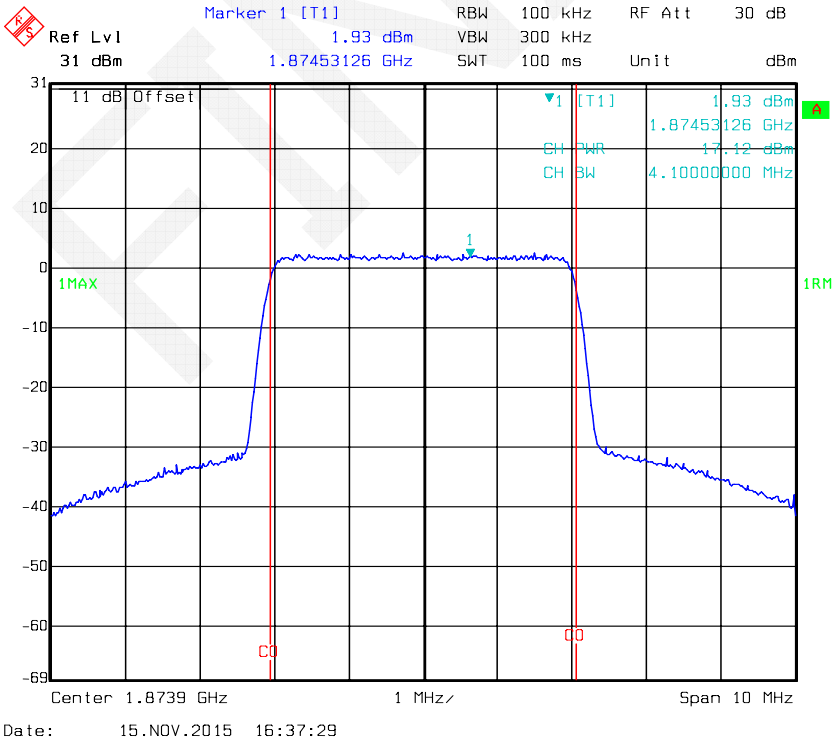


Date: 18.NOV.2015 22:42:20

PCS Downlink

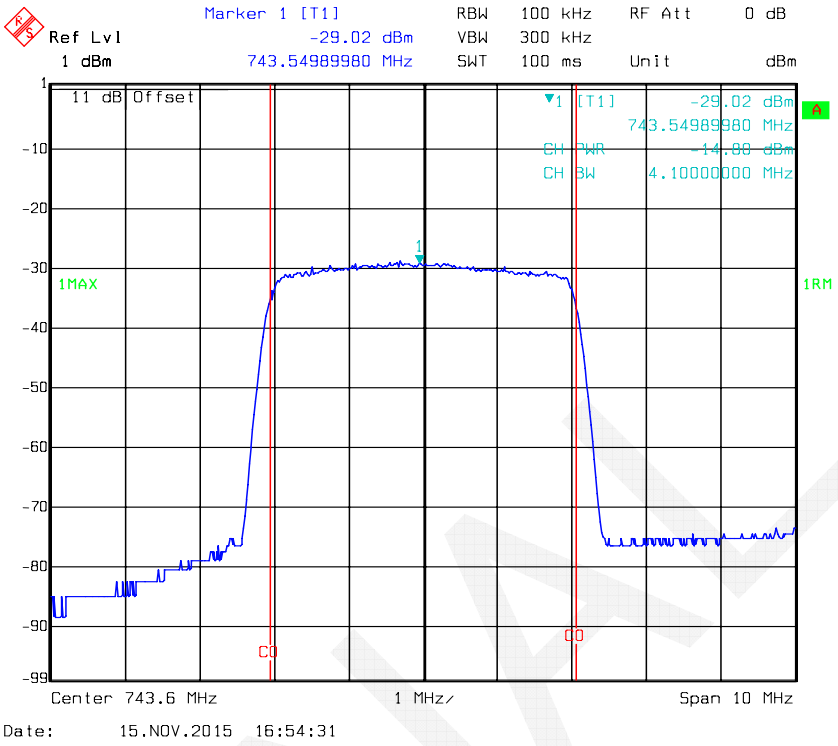


PCS 700 Uplink

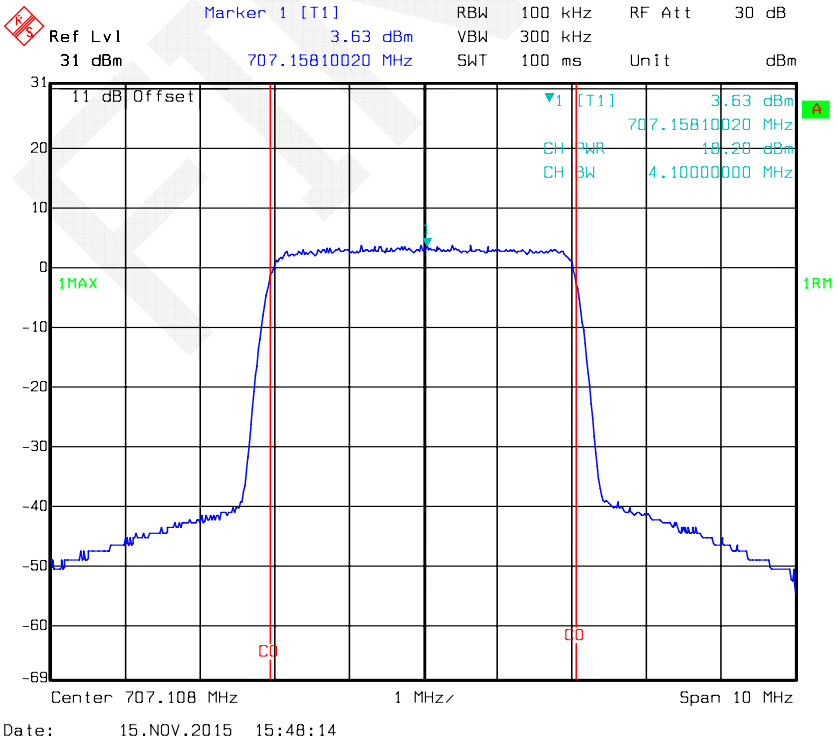


Maximum Input level:

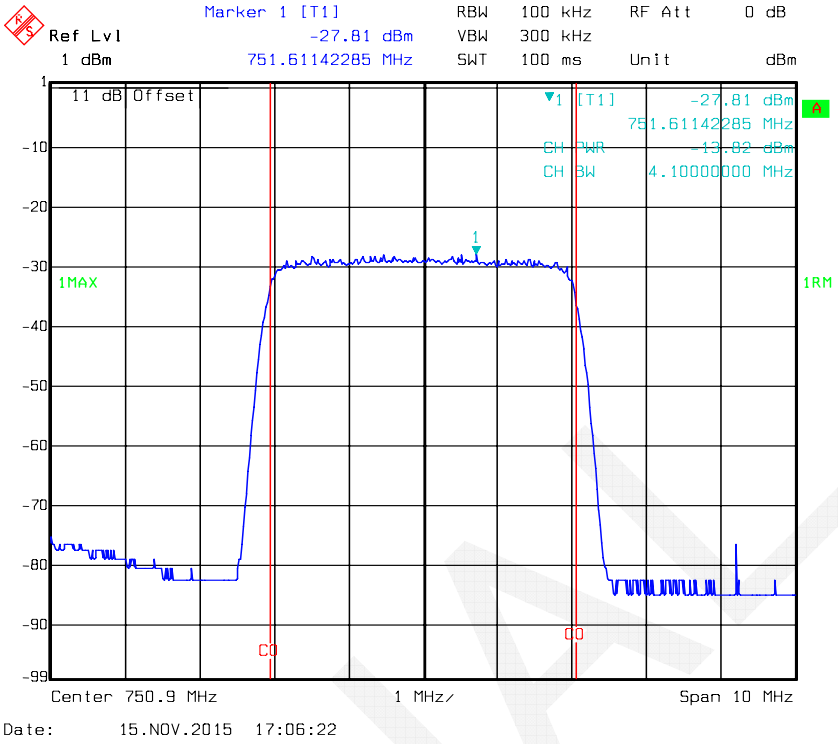
Lower 700 Downlink



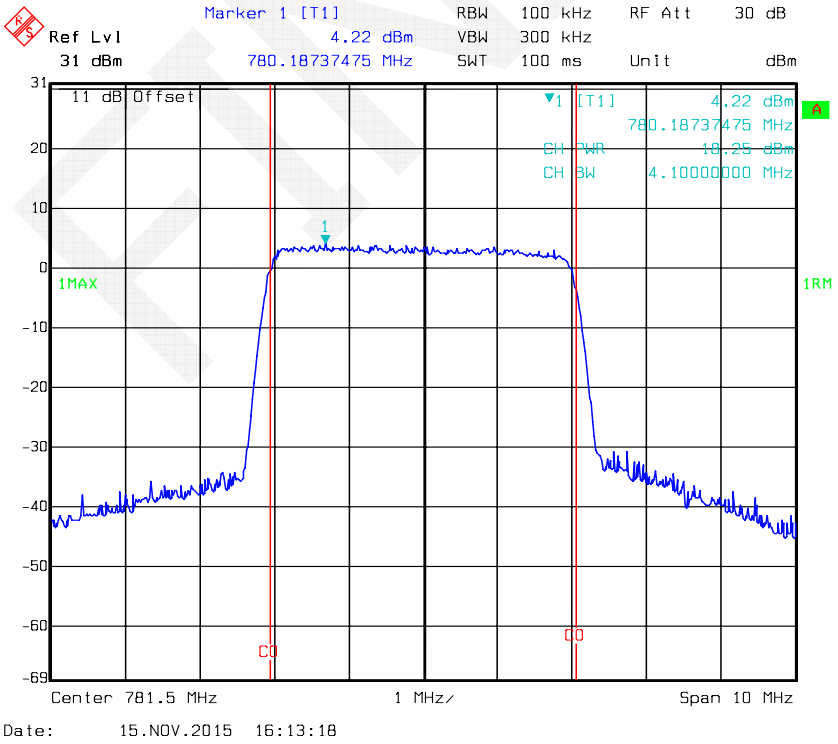
Lower 700 Uplink



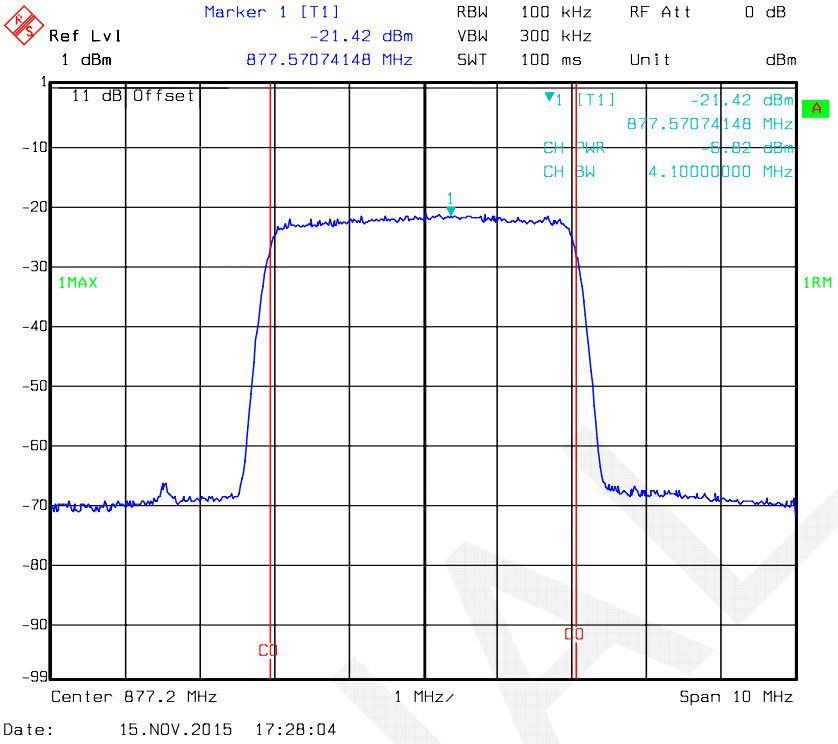
Upper 700 Downlink



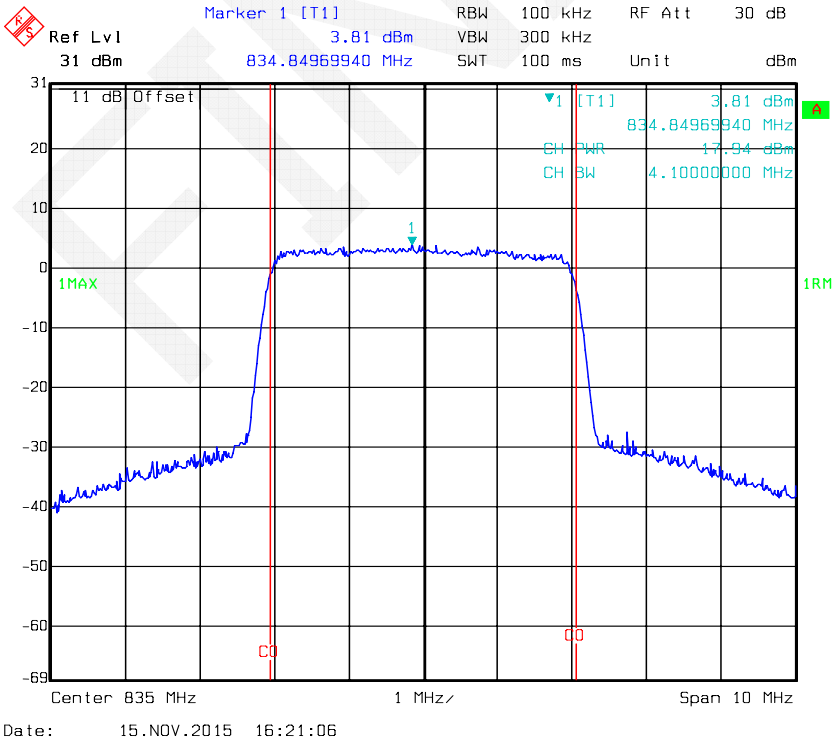
Upper 700 Uplink



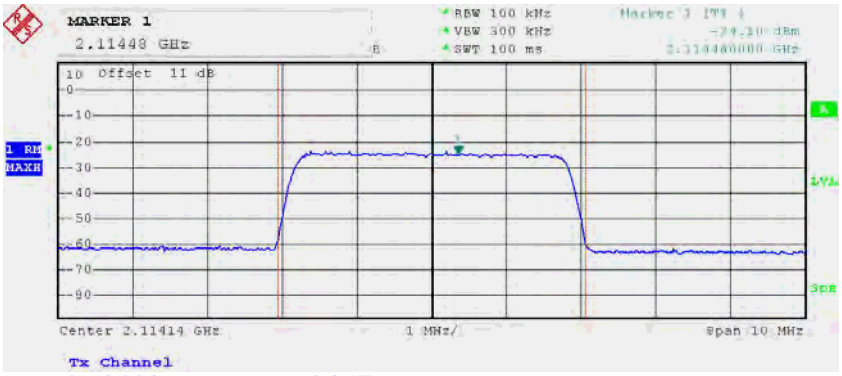
Cellular Downlink



Cellular Uplink

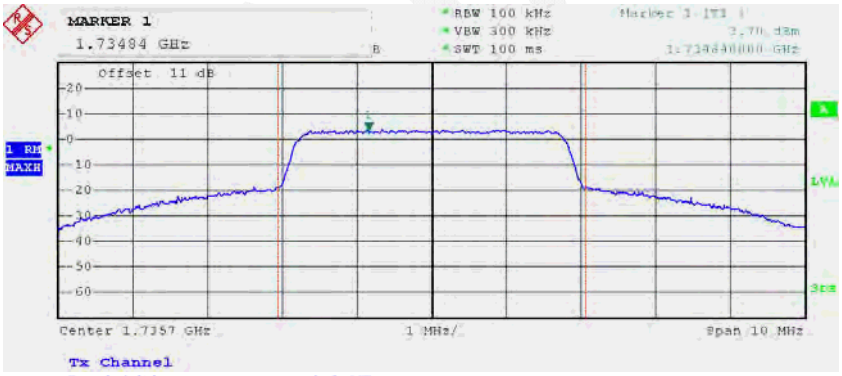


AWS Downlink



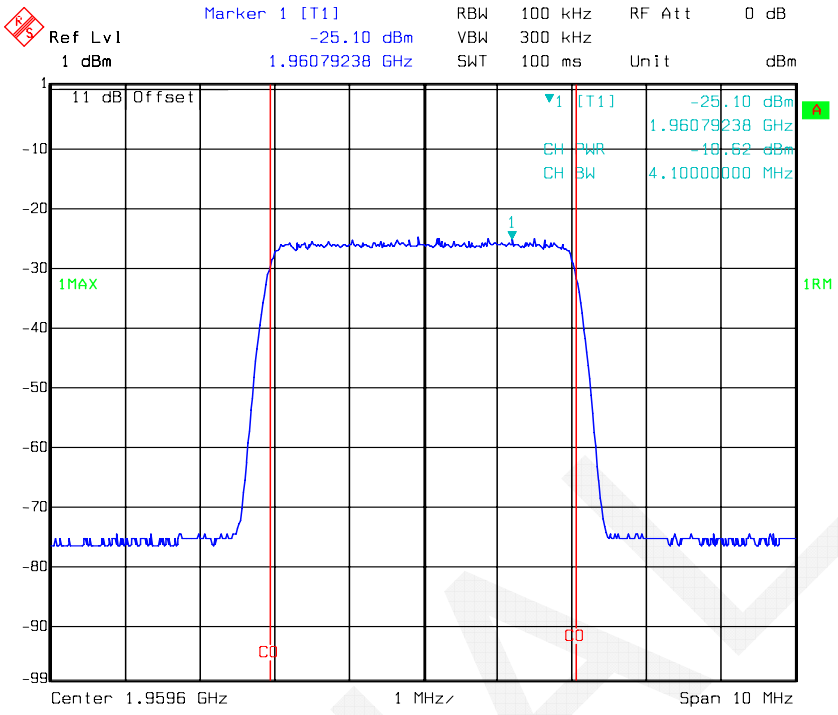
Date: 18.NOV.2015 23:19:29

AWS Uplink

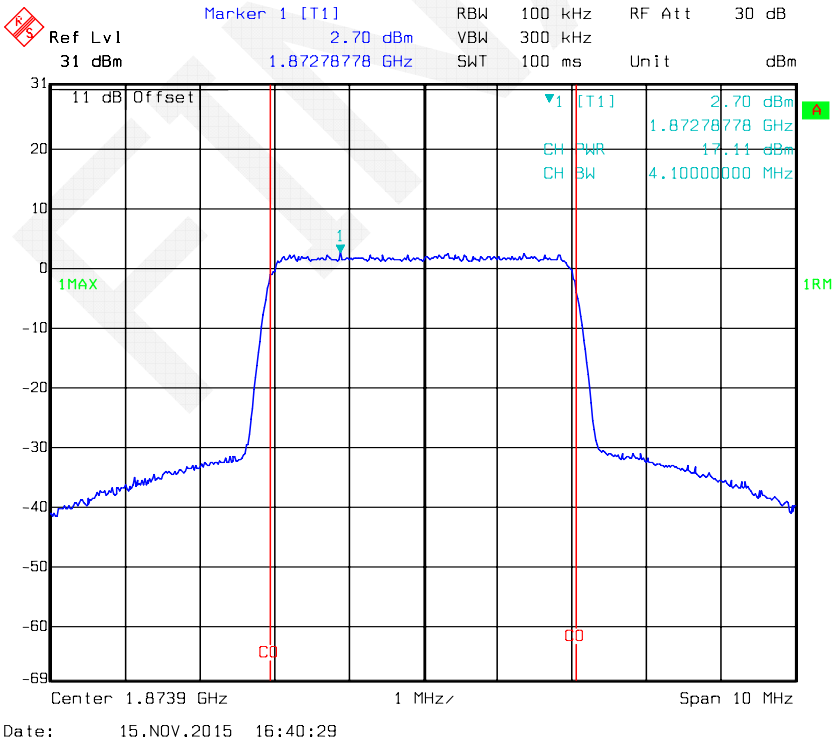


Date: 18.NOV.2015 22:45:31

PCS Downlink

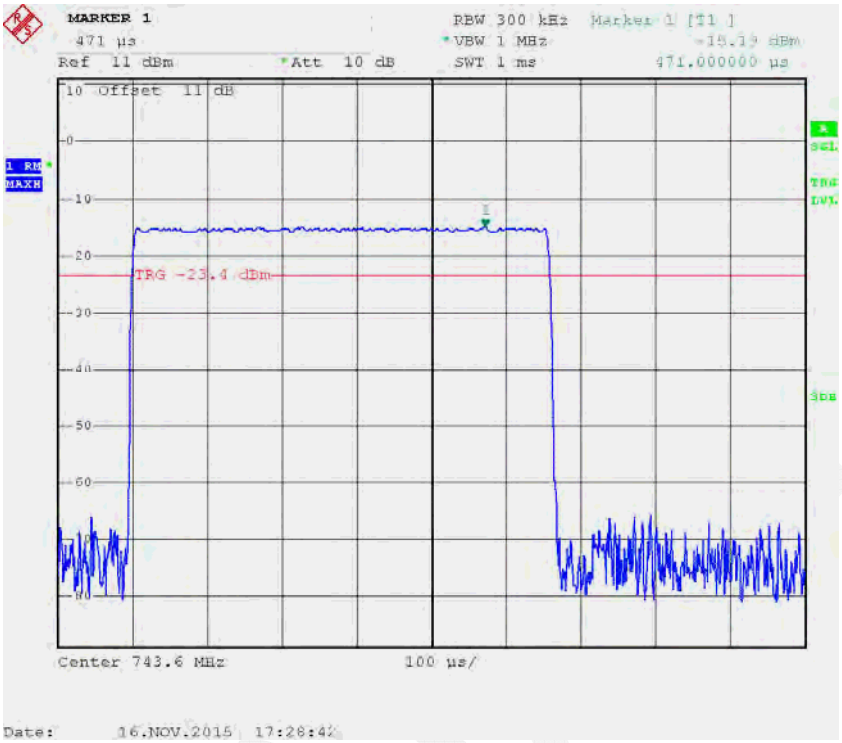


PCS Uplink

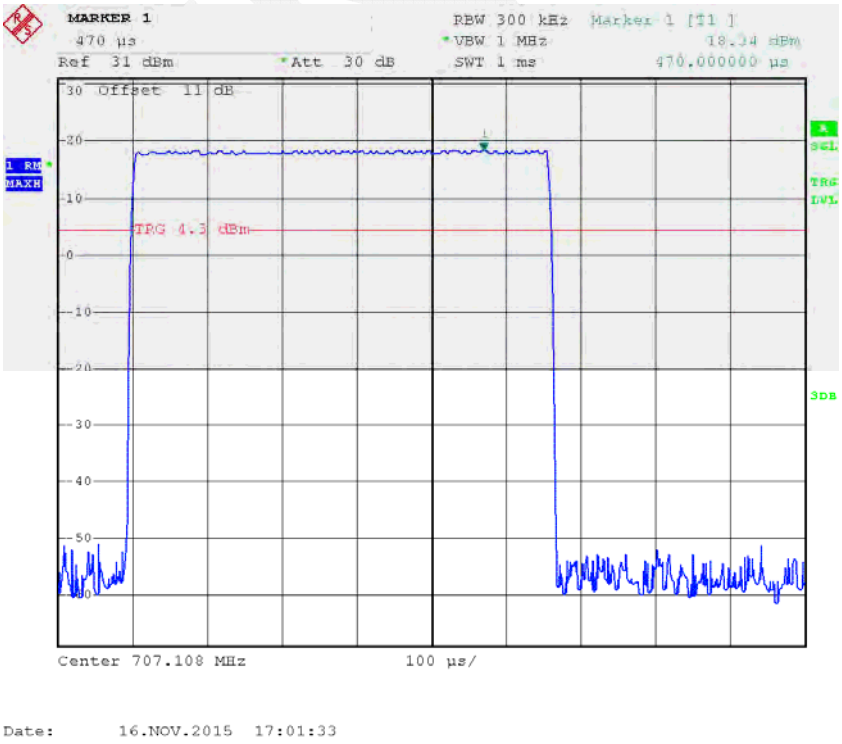


GSM Signal:
Output Power

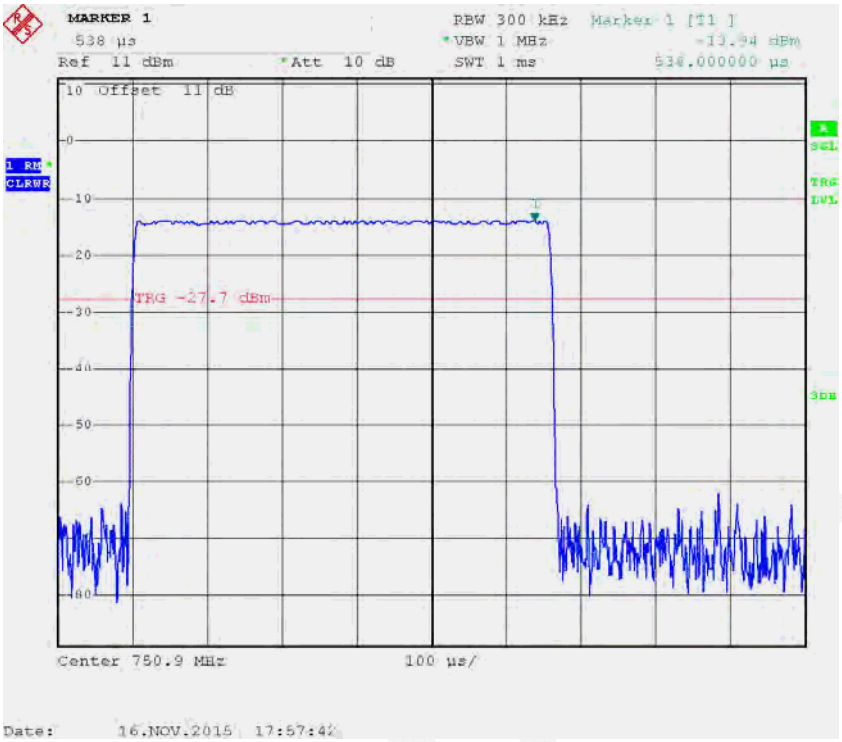
Lower 700 Downlink



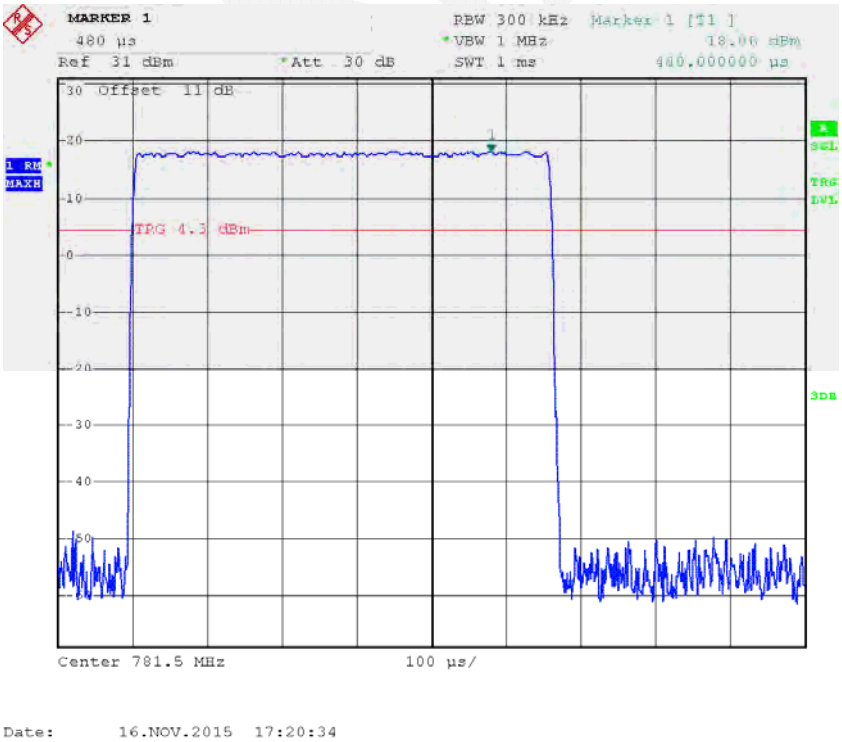
Lower 700 Uplink



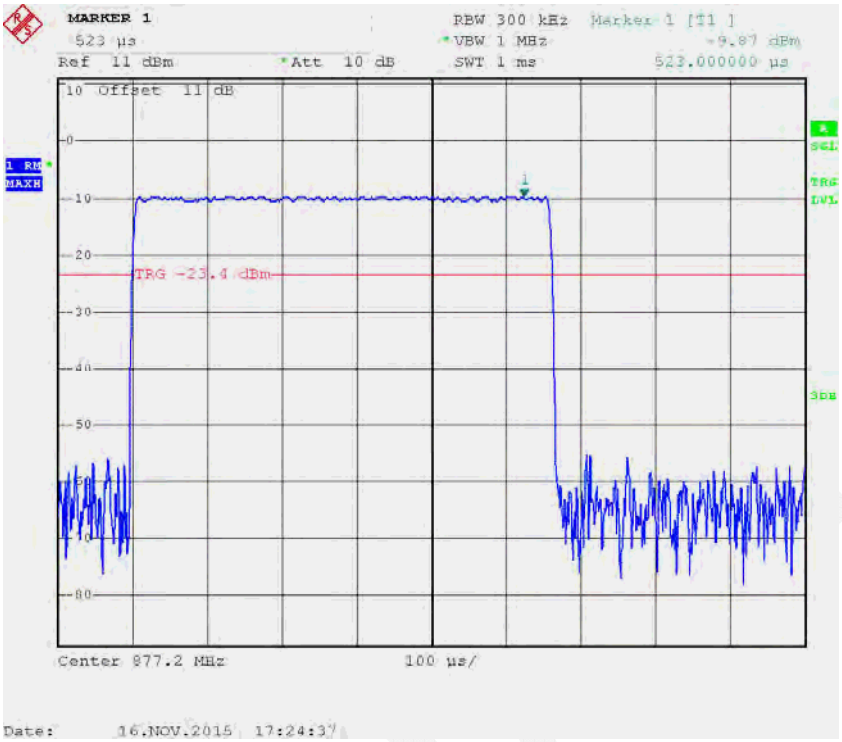
Upper 700 Downlink



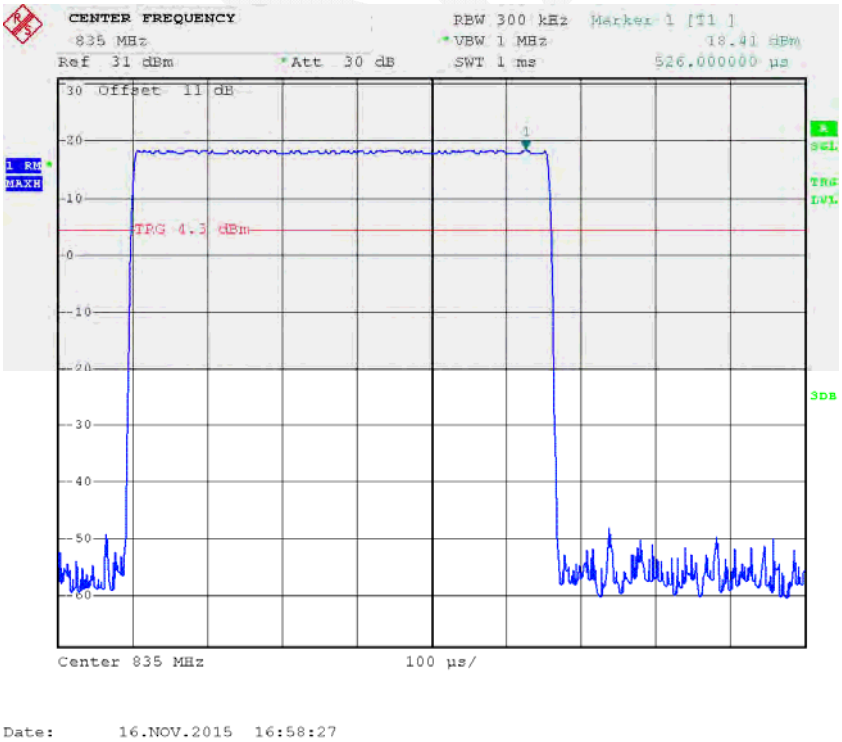
Upper 700 Uplink



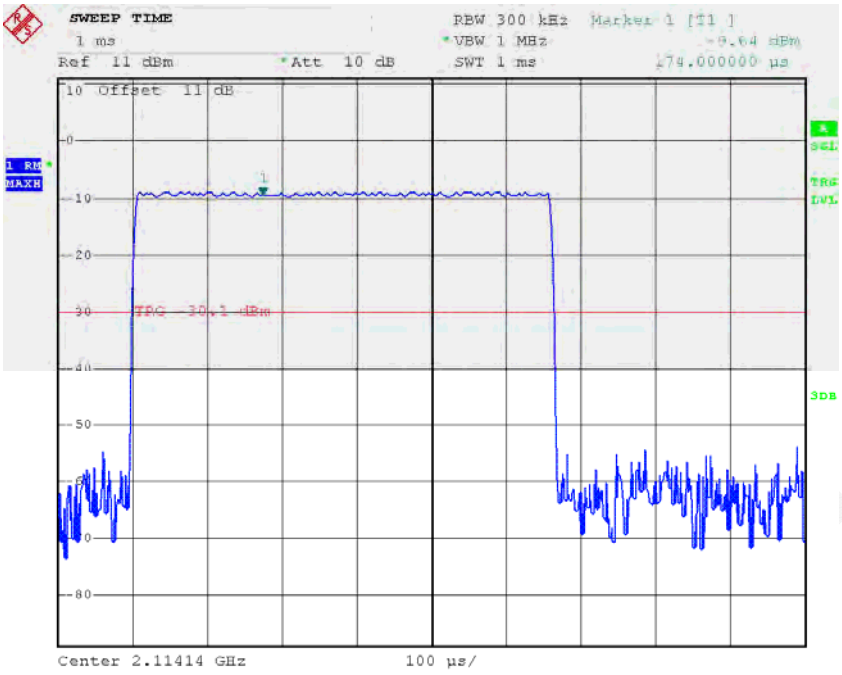
Cellular Downlink



Cellular Uplink

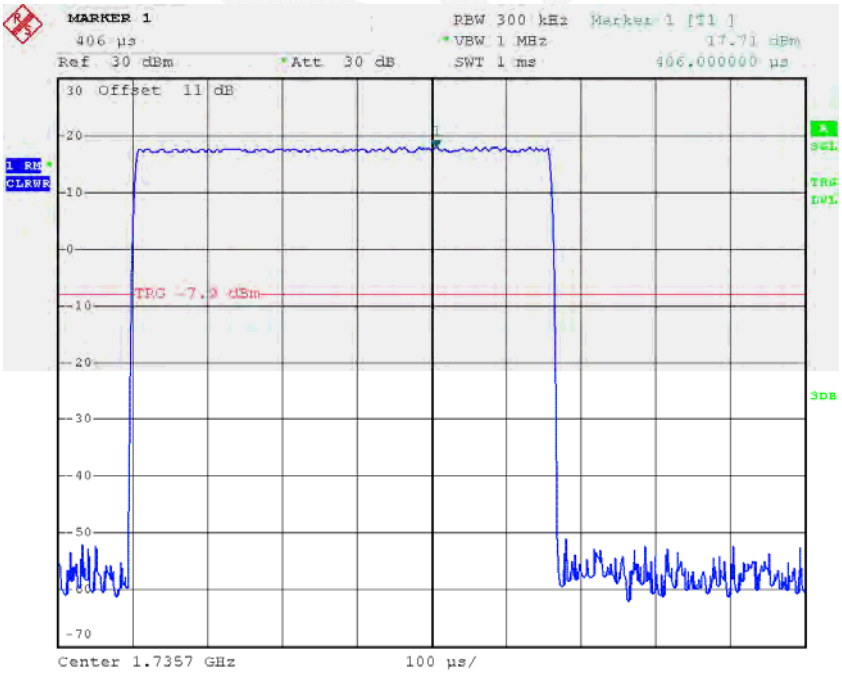


AWS Downlink



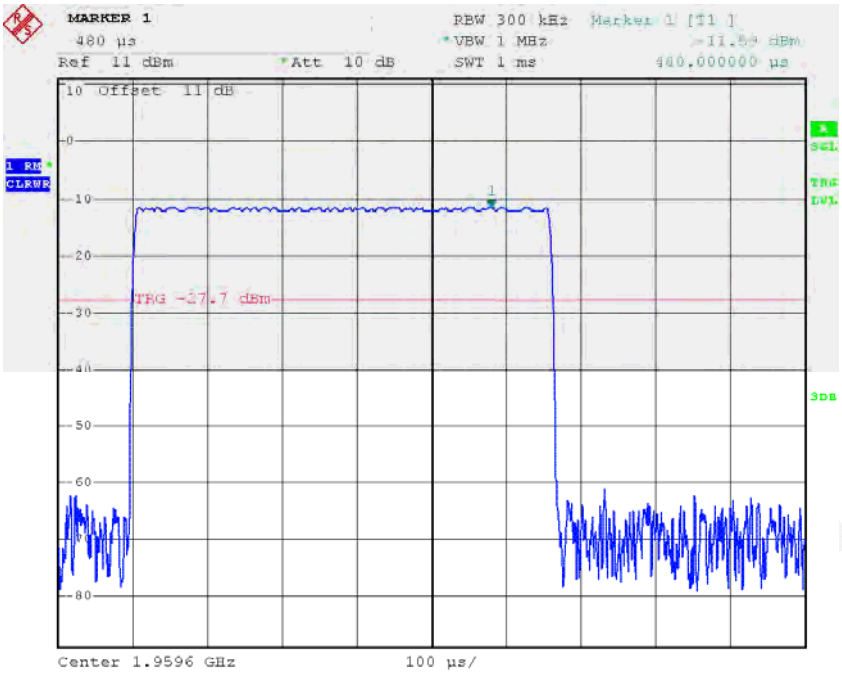
Date: 18.NOV.2015 23:14:27

AWS Uplink



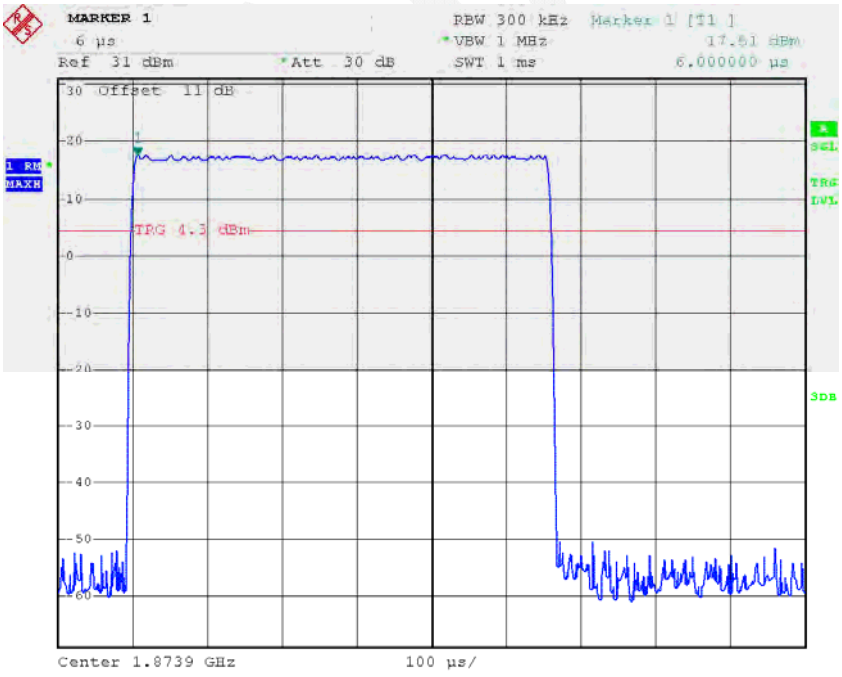
Date: 18.NOV.2015 22:52:30

PCS Downlink



Date: 16.NOV.2015 17:55:16

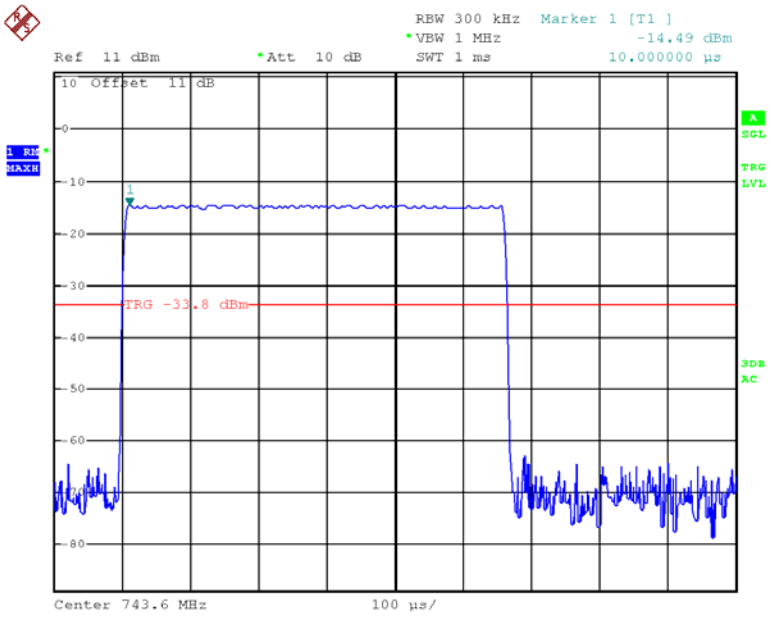
PCS 700 Uplink



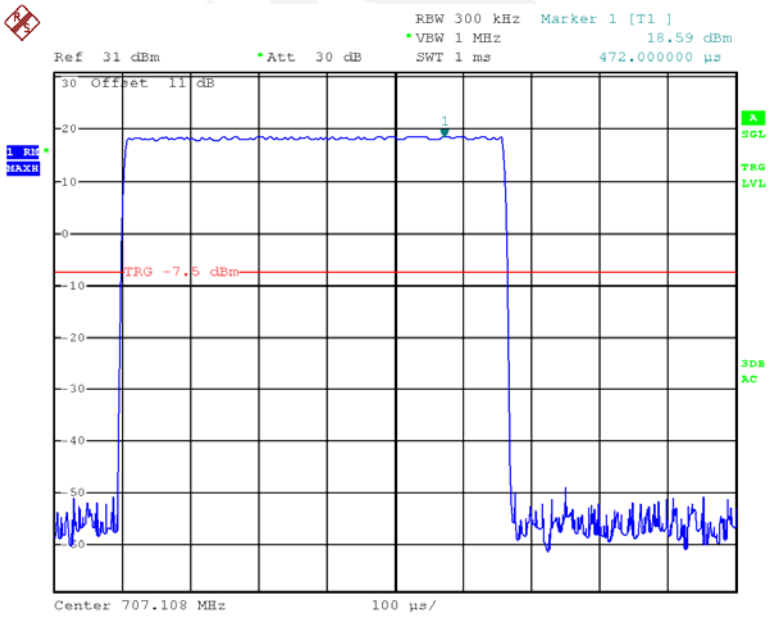
Date: 16.NOV.2015 17:10:43

Maximum Input level:

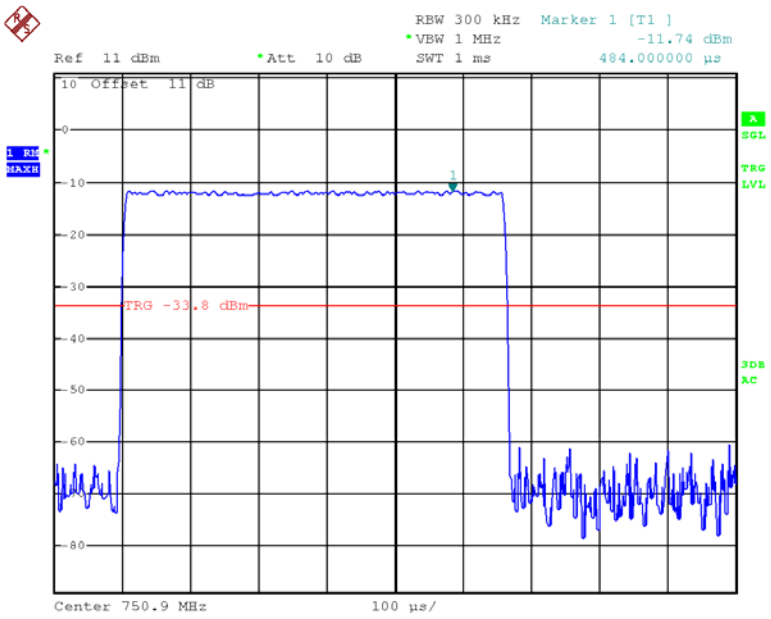
Lower 700 Downlink



Lower 700 Uplink

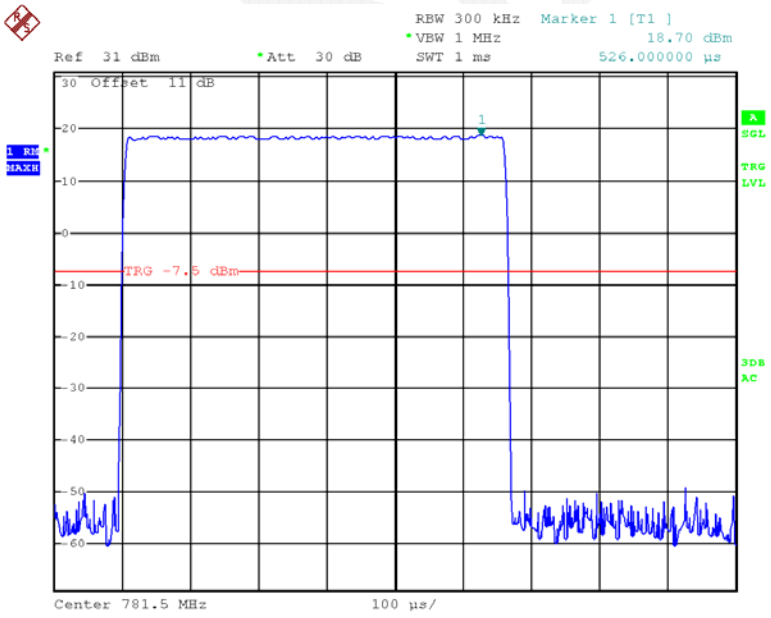


Upper 700 Downlink



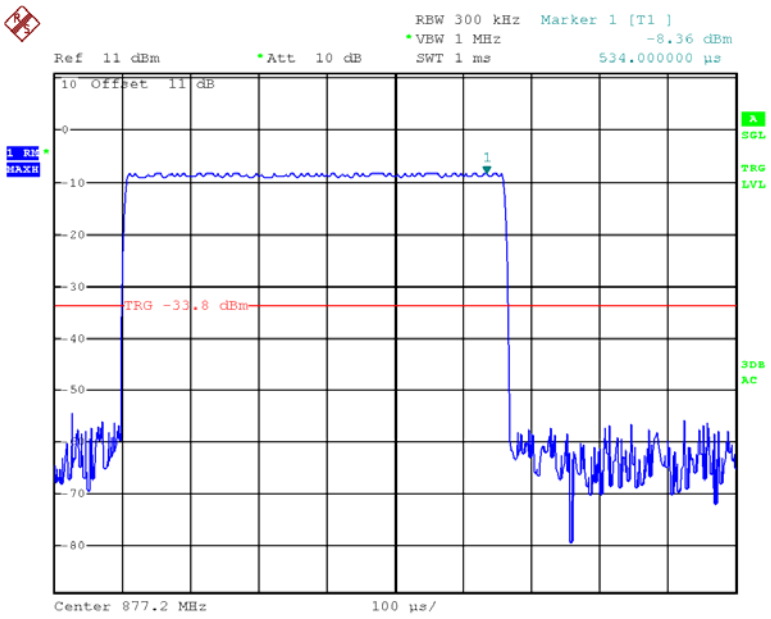
Date: 27.NOV.2015 23:05:37

Upper 700 Uplink



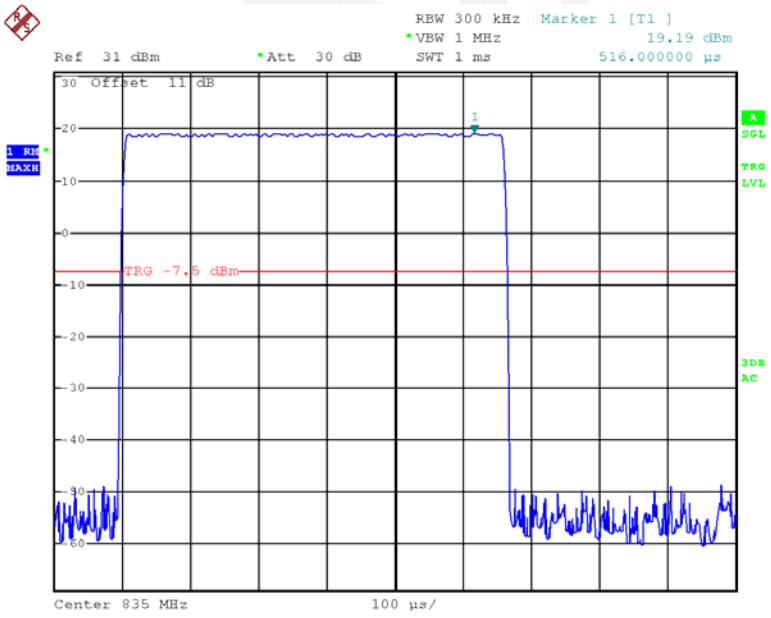
Date: 27.NOV.2015 23:02:09

Cellular Downlink



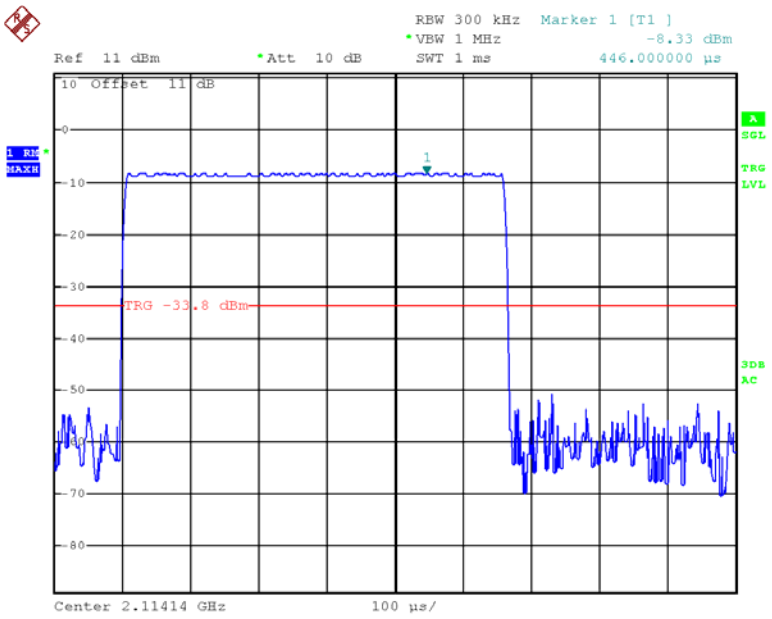
Date: 27.NOV.2015 23:04:35

Cellular Uplink



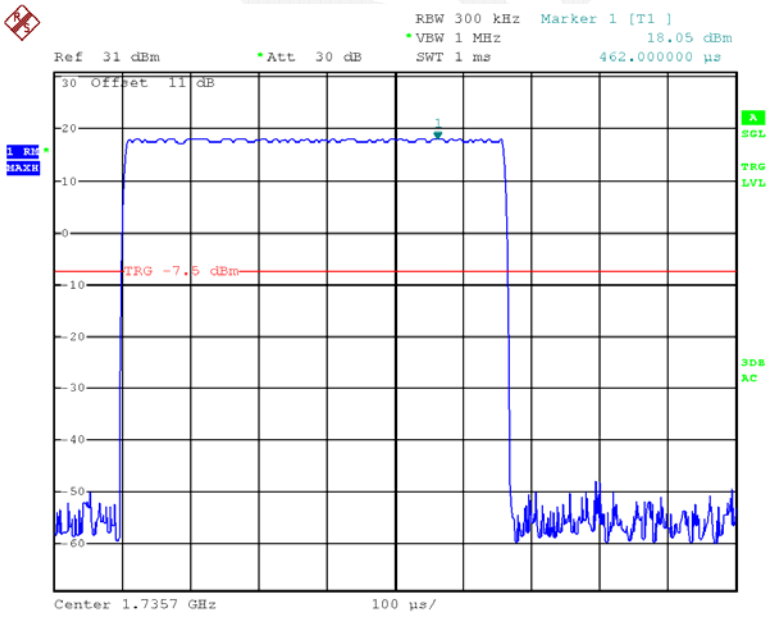
Date: 27.NOV.2015 22:59:20

AWS Downlink



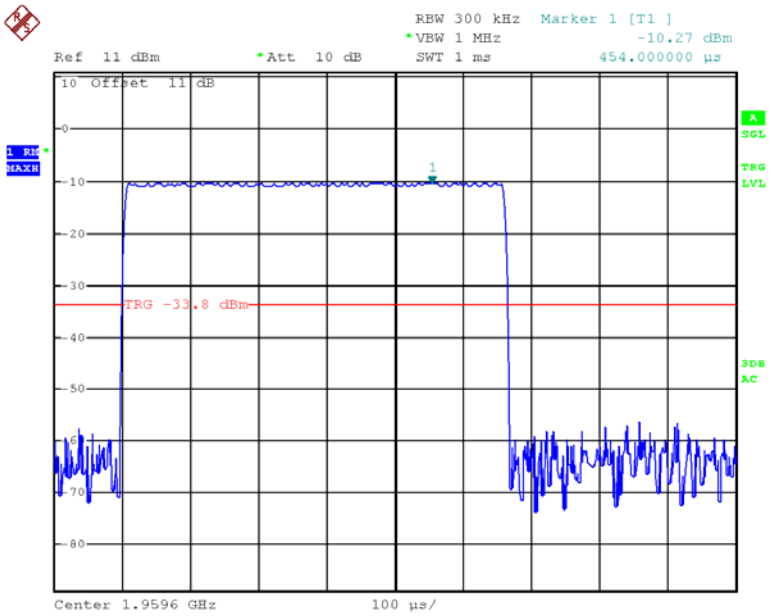
Date: 27.NOV.2015 23:04:00

AWS Uplink



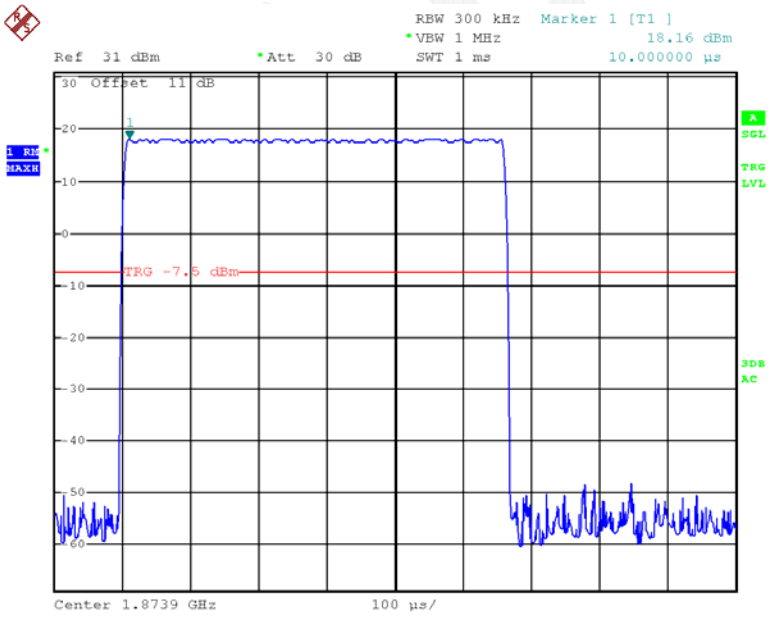
Date: 27.NOV.2015 22:57:57

PCS Downlink, 1930~1990MHz



Date: 27.NOV.2015 23:05:19

PCS 700 Uplink, 1850~1910MHz



Date: 27.NOV.2015 23:01:47

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

Applicable Standards

According to§ 20.21(e)(8)(i)(C)(2) 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2014-12-19	2015-12-19

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	24.1~25.2 ℃
Relative Humidity:	43~44 %
ATM Pressure:	100.8~101.3 kPa

The testing was performed by Dean Liu from 2015-11-19 to 2015-11-20.

Test Result: Compliance. Please refer to the following tables and the plots please refer to section 7.2.

Maximum gain:

Mode	Operation Band	Signal type	Pre AGC Input level	Conducted Output level	Gain	Limit
			dBm	dBm	dB	dB
Uplink	Lower 700	AWGN	-26.7	18.14	44.84	63.49
		GSM	-26.5	18.34	44.84	
	Upper 700	AWGN	-26.3	18.95	45.25	64.36
		GSM	-26.3	18.06	44.36	
	Cellular	AWGN	-29.0	18.44	47.44	64.95
		GSM	-28.5	18.41	46.91	
	AWS	AWGN	-23.0	17.75	40.75	71.27
		GSM	-22.3	17.71	40.01	
	PCS	AWGN	-24.2	17.12	41.32	71.98
		GSM	-24.1	17.51	41.61	
Downlink	Lower 700	AWGN	-56.2	-14.74	41.46	63.49
		GSM	-56.0	-15.19	40.81	
	Upper 700	AWGN	-56.7	-13.44	43.26	64.36
		GSM	-56.2	-13.94	42.26	
	Cellular	AWGN	-59.5	-9.19	50.31	64.95
		GSM	-57.5	-9.87	47.63	
	AWS	AWGN	-54.5	-9.35	45.15	71.27
		GSM	-54.2	-9.64	44.56	
	PCS	AWGN	-55.5	-10.26	45.24	71.98
		GSM	-55.5	-11.59	43.91	

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:

Operation Band	Signal type	Uplink Gain	Downlink Gain	Difference	Limit
		dB	dB	dB	dB
Lower 700	AWGN	44.84	41.46	3.38	+/- 9
	GSM	44.84	40.81	4.03	
Upper 700	AWGN	45.25	43.26	1.99	
	GSM	44.36	42.26	2.10	
Cellular	AWGN	47.44	50.31	-2.87	
	GSM	46.91	47.63	-0.72	
AWS	AWGN	40.75	45.15	-4.40	
	GSM	40.01	44.56	-4.55	
PCS	AWGN	41.32	45.24	-3.92	
	GSM	41.61	43.91	-2.30	

§ 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

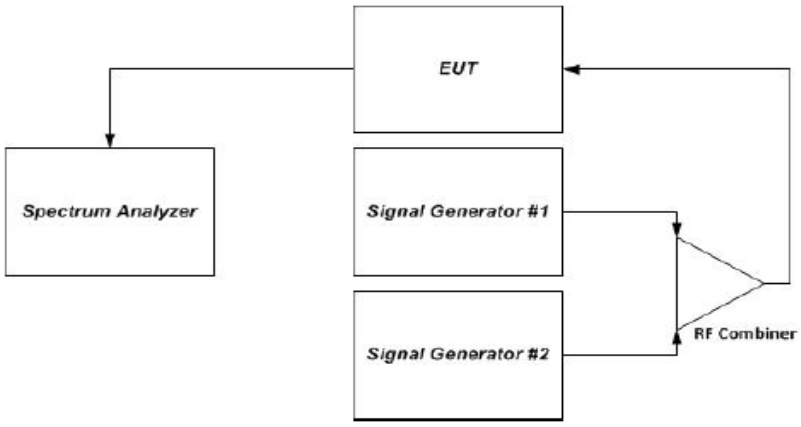


Figure 2 – Intermodulation product instrumentation test setup

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2014-12-19	2015-12-19
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2015-03-30	2016-03-29

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

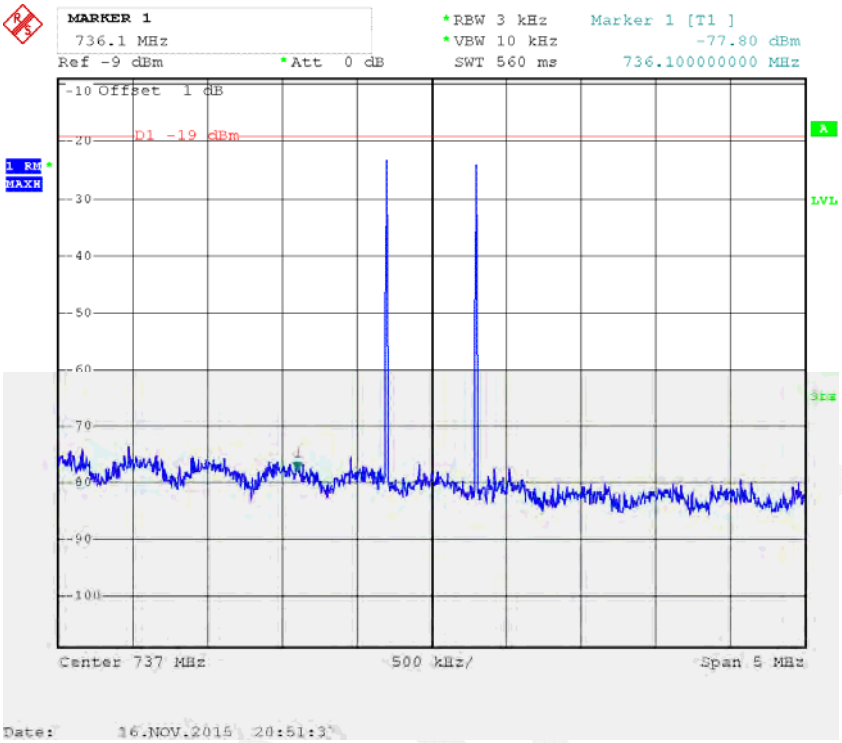
Temperature:	24.2~25.1℃
Relative Humidity:	43~48 %
ATM Pressure:	101.1~101.8 kPa

The testing was performed by Dean Liu from 2015-11-16 to 2015-11-19.

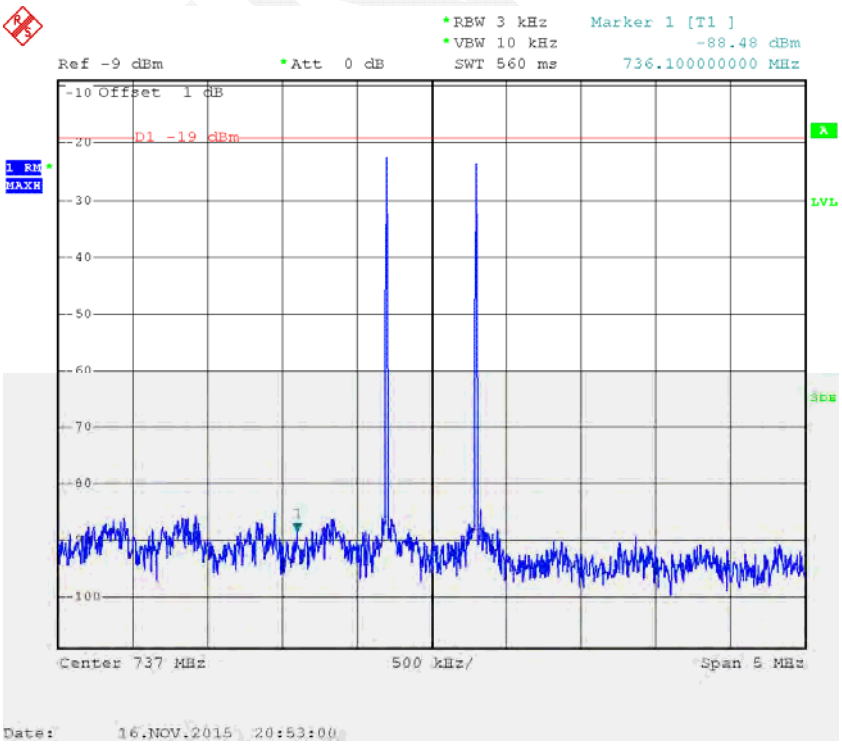
Please refer to the following plots.

Downlink

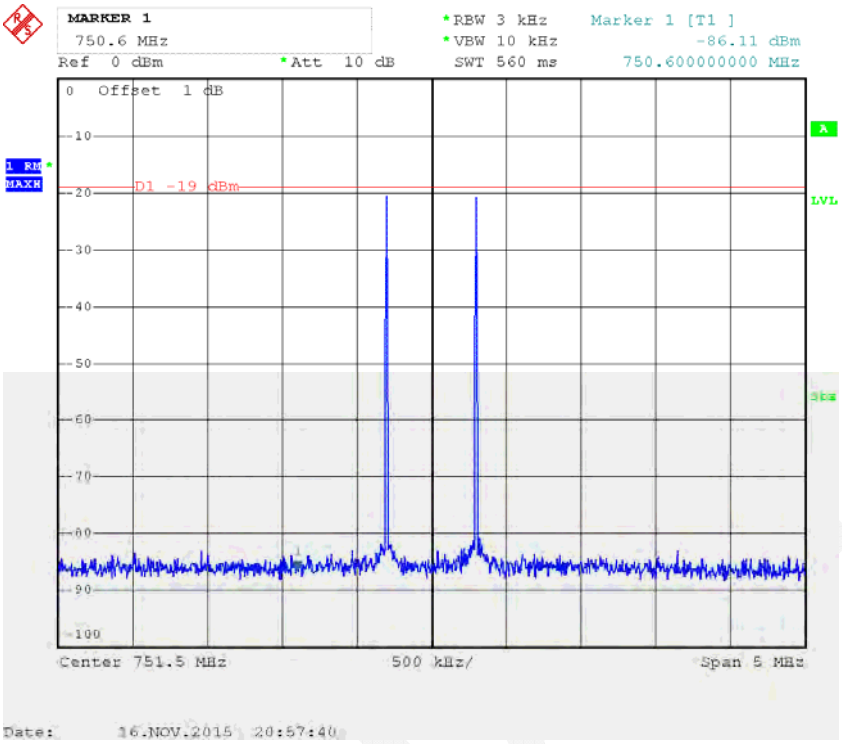
Lower 700 Pre-AGC



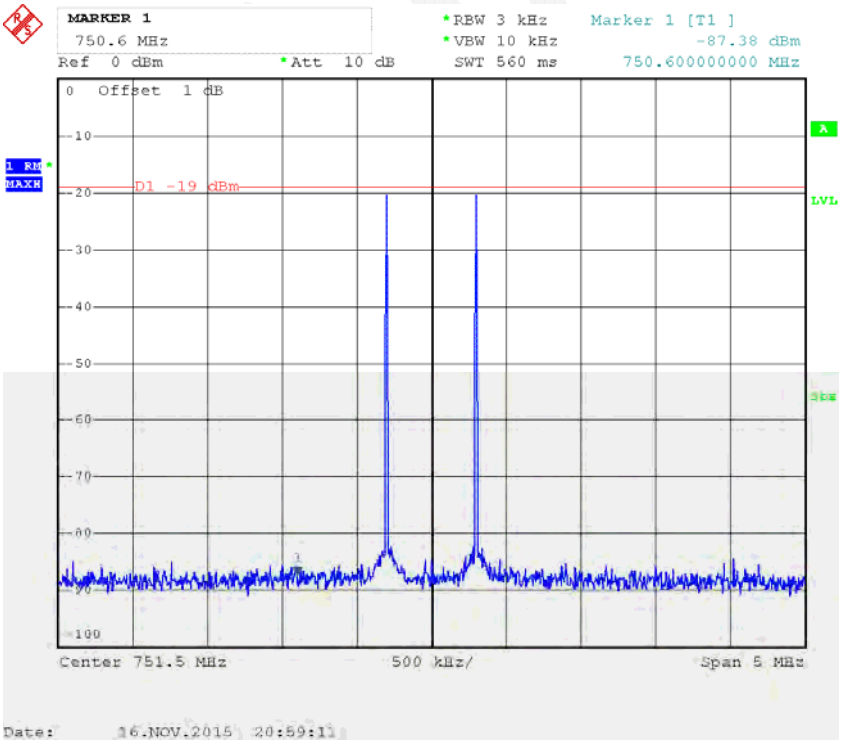
Lower 700 Above AGC



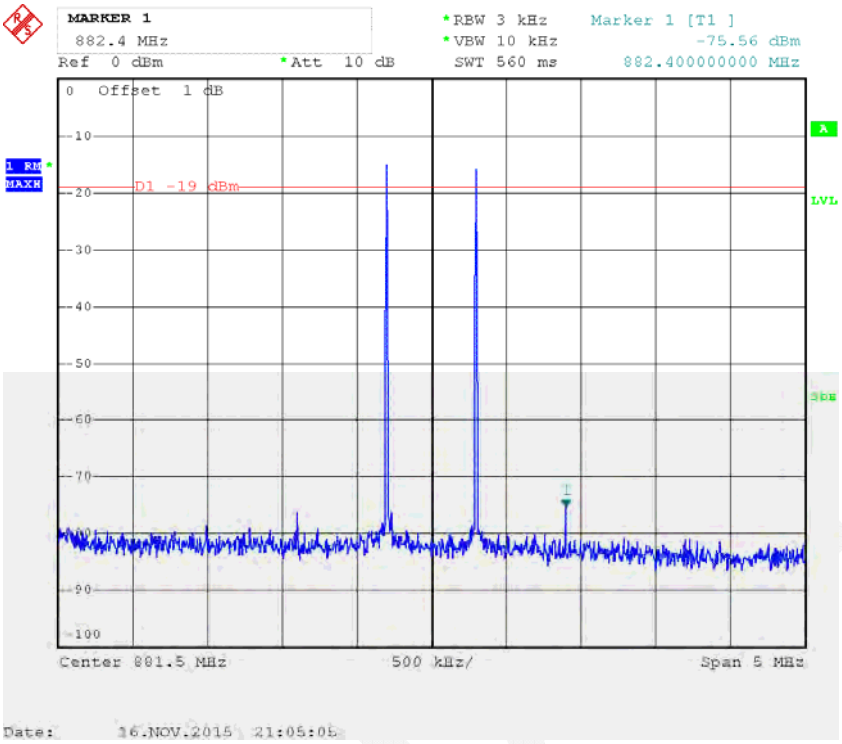
Upper 700 Pre-AGC



Upper 700 Above AGC



Cellular Pre-AGC



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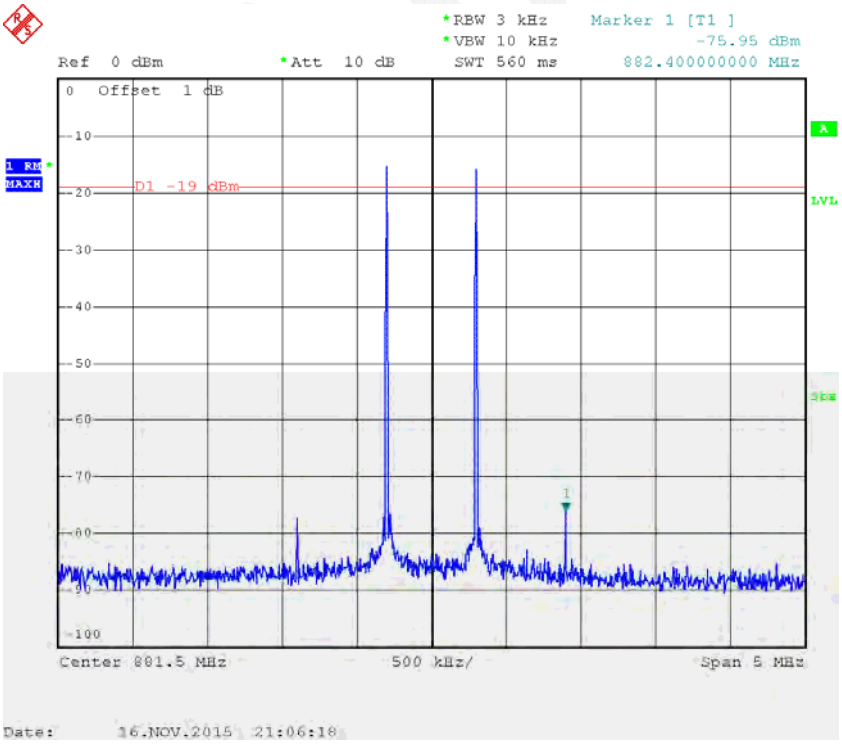
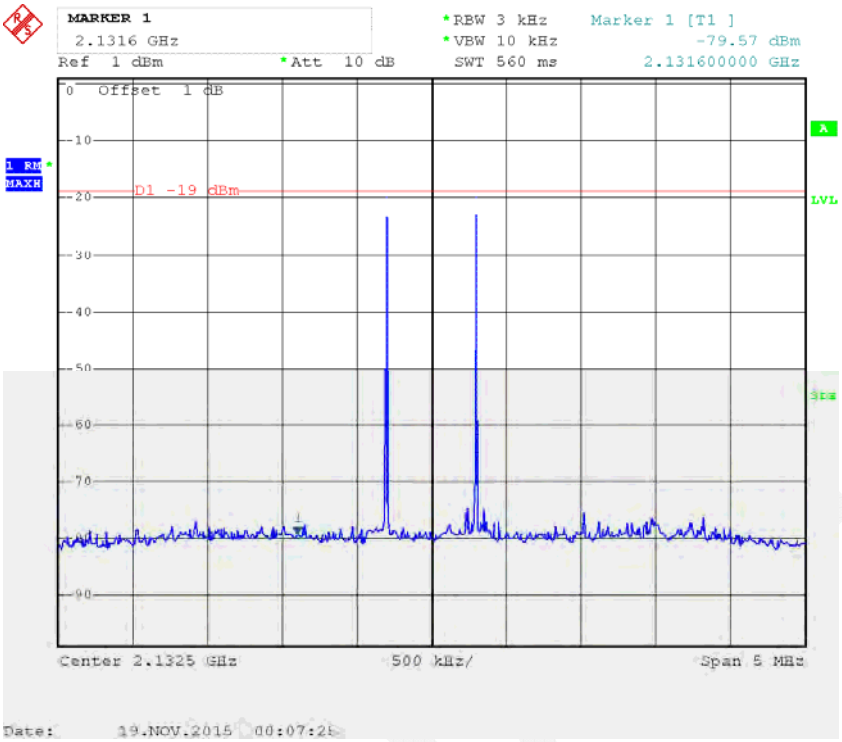


AWS Pre-AGC



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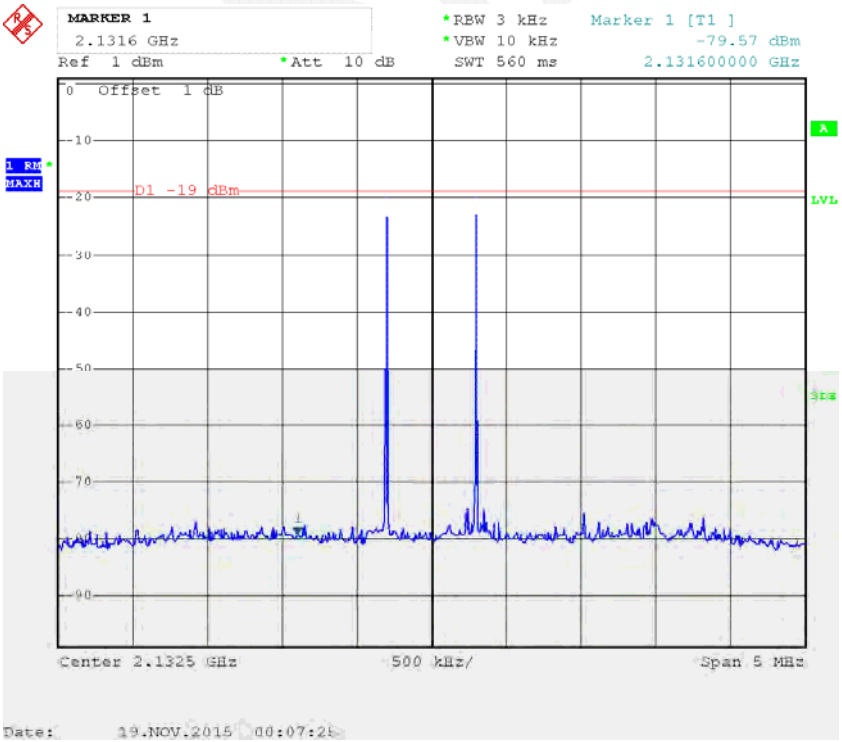
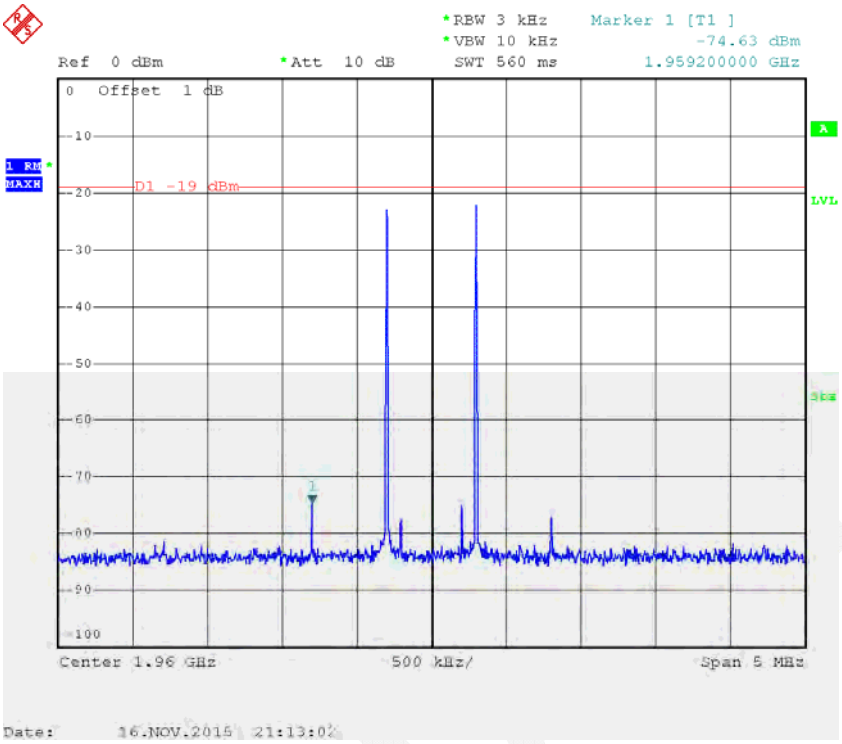


PCS Pre-AGC



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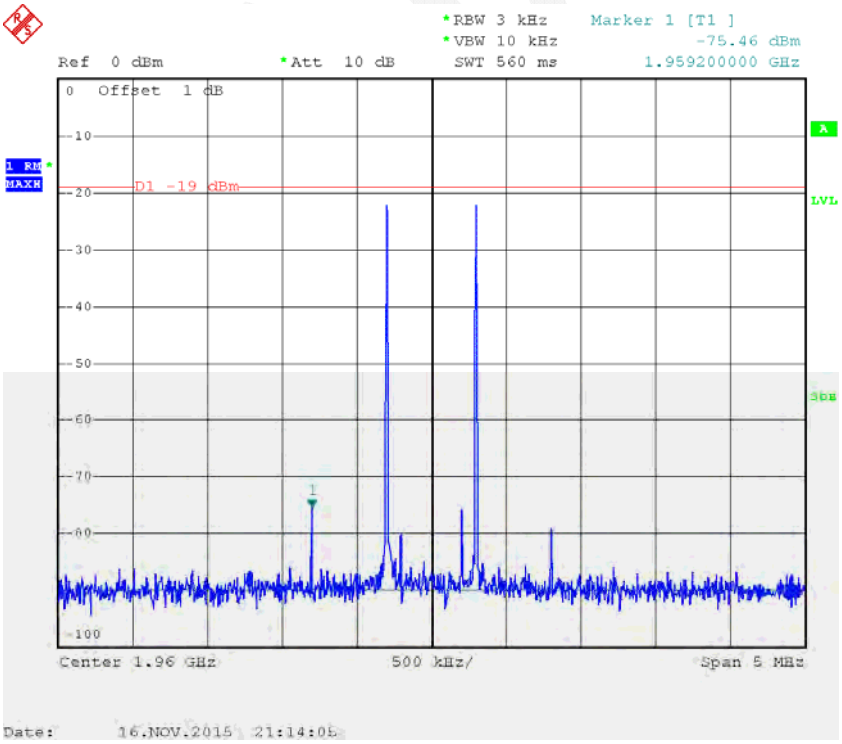
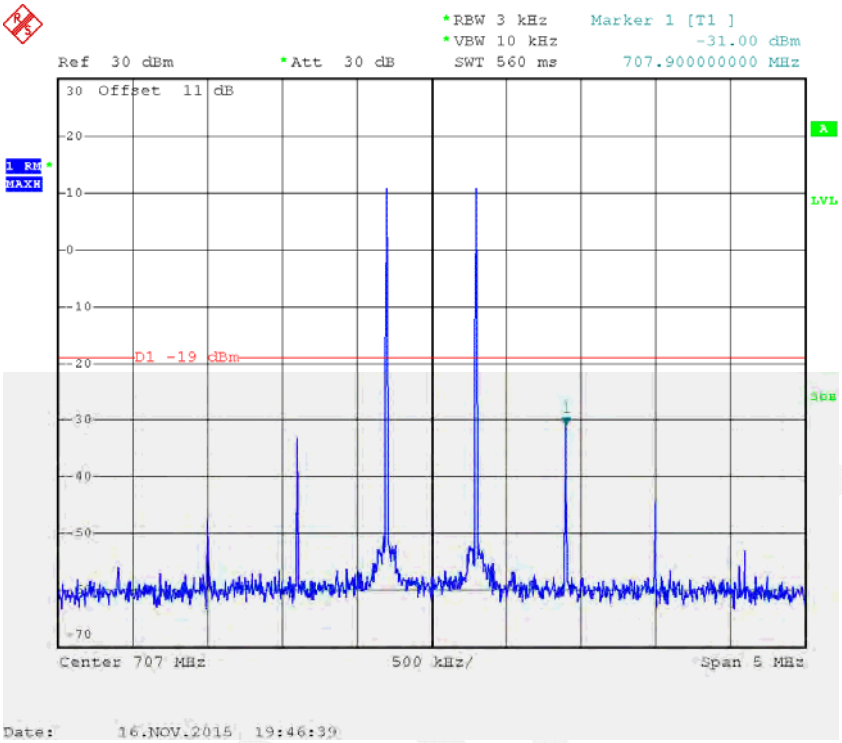
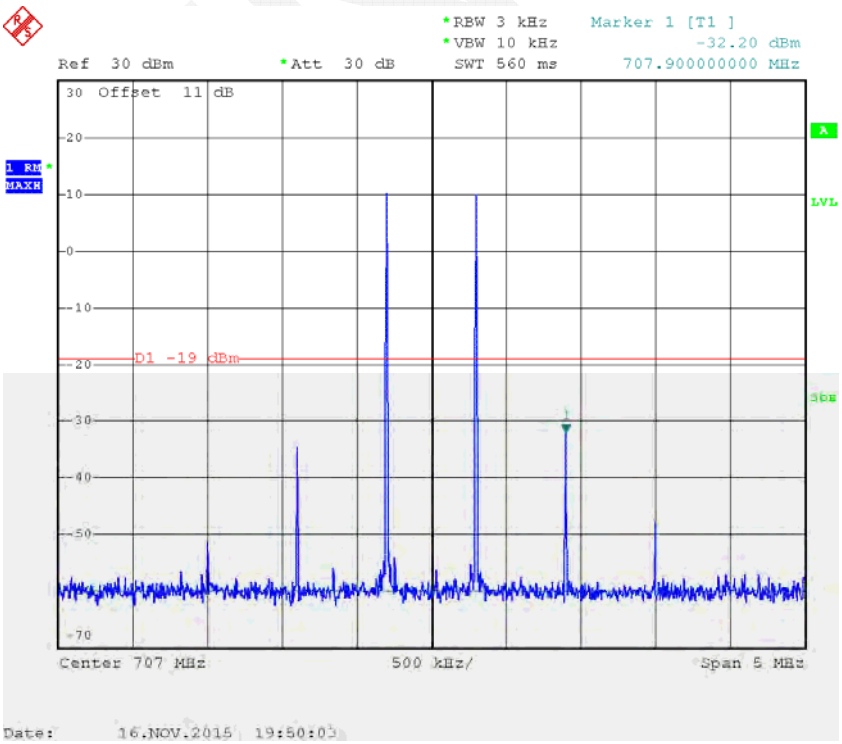


Uplink

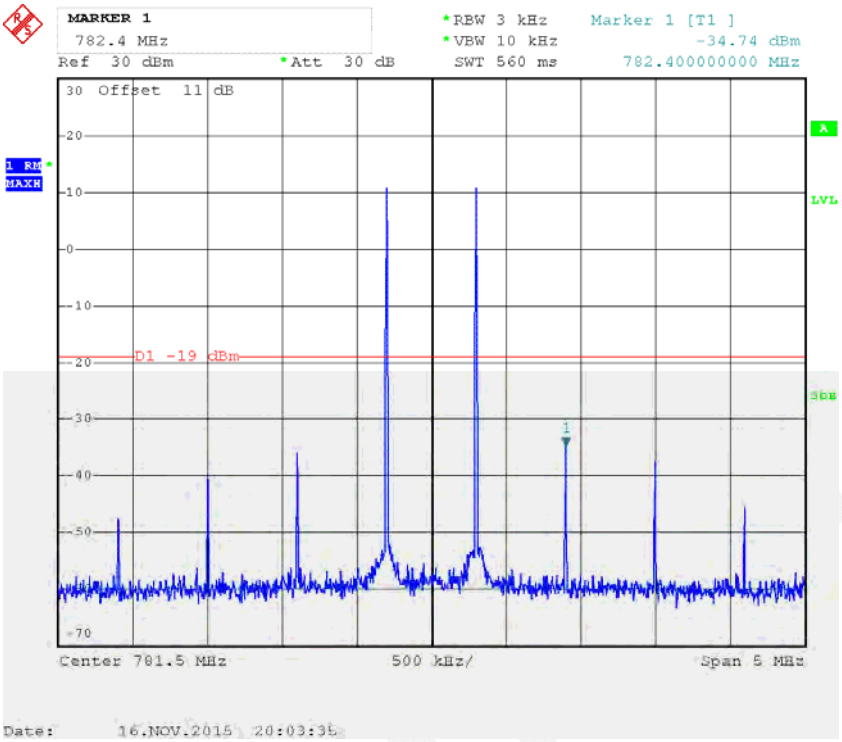
Lower 700 Pre-AGC



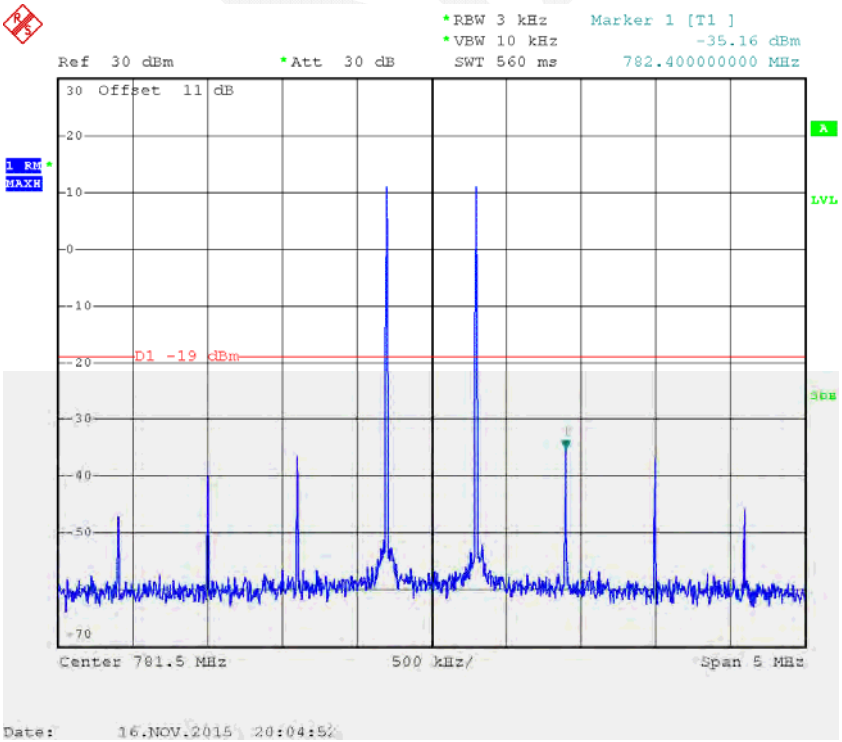
Lower 700 Above AGC



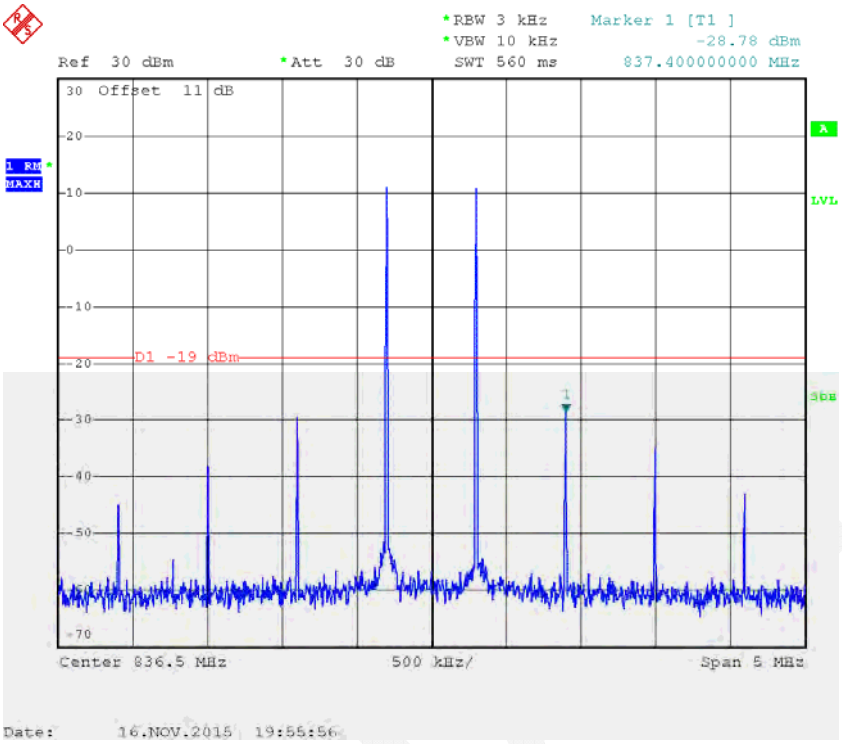
Upper 700 Pre-AGC



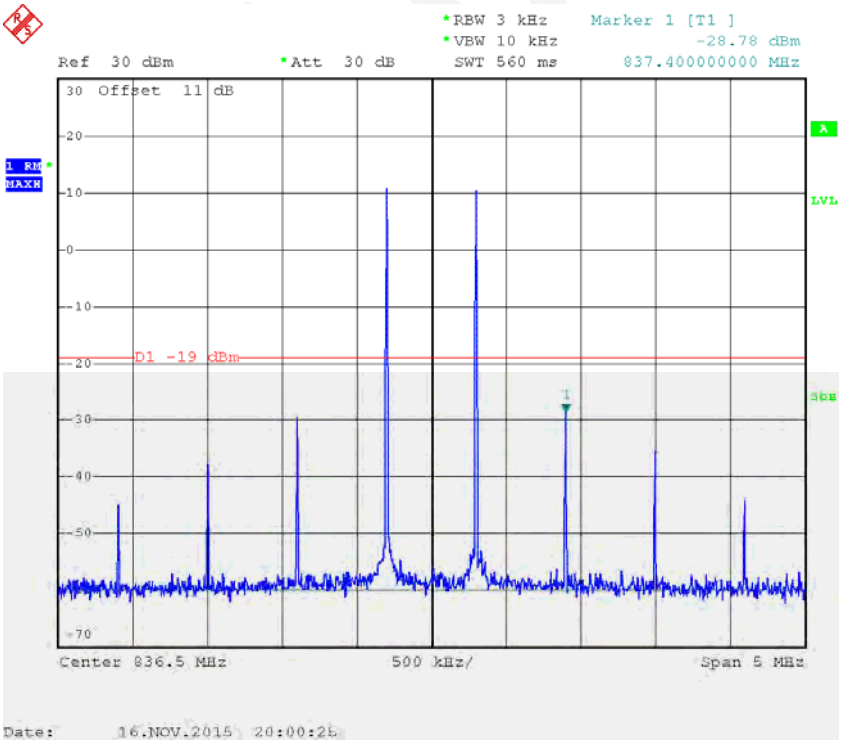
Upper 700 Above AGC



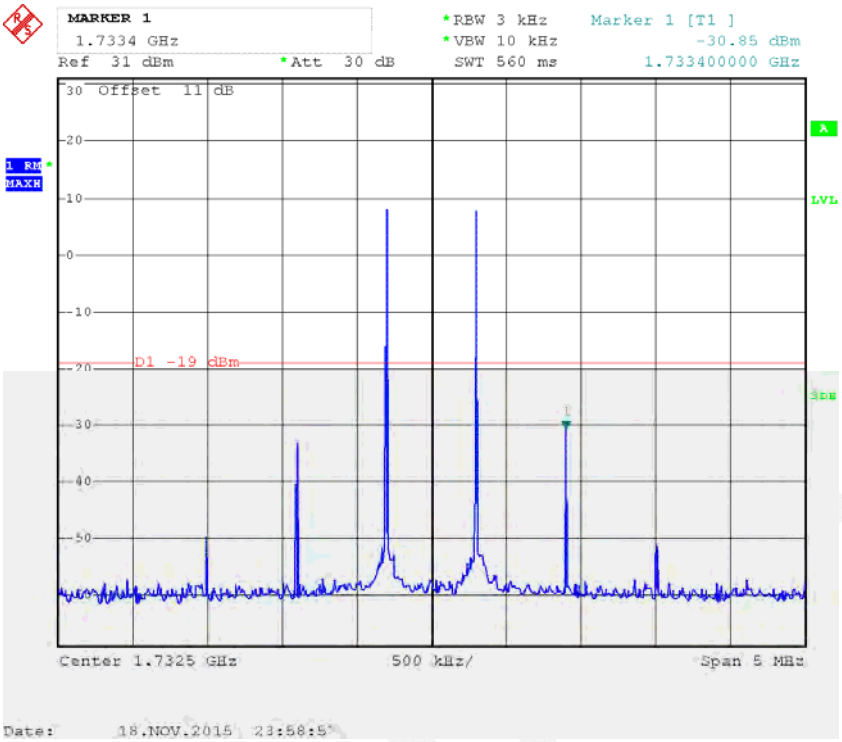
Cellular Pre-AGC



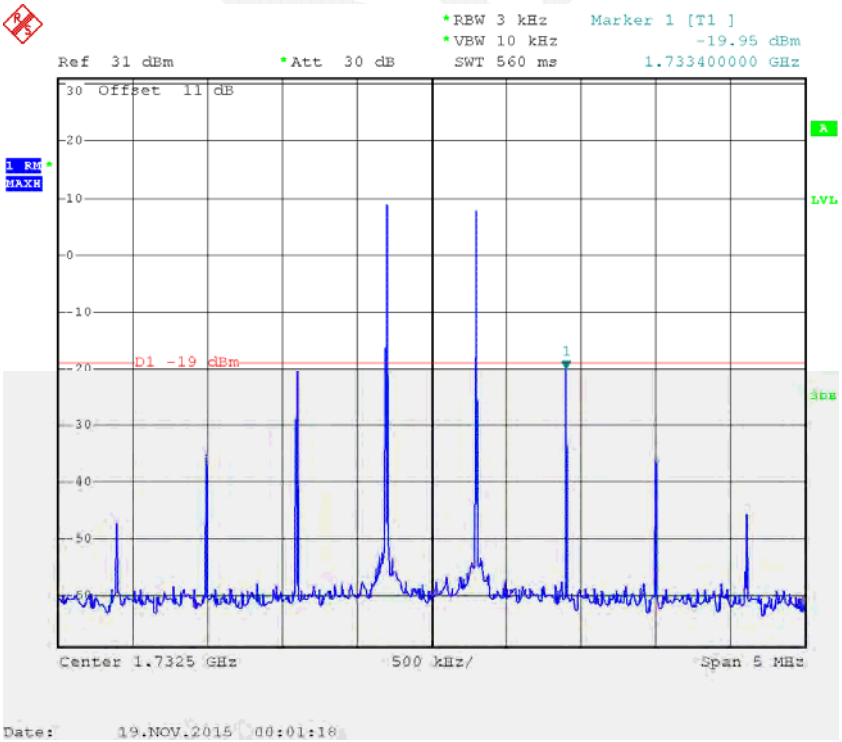
Cellular Above AGC



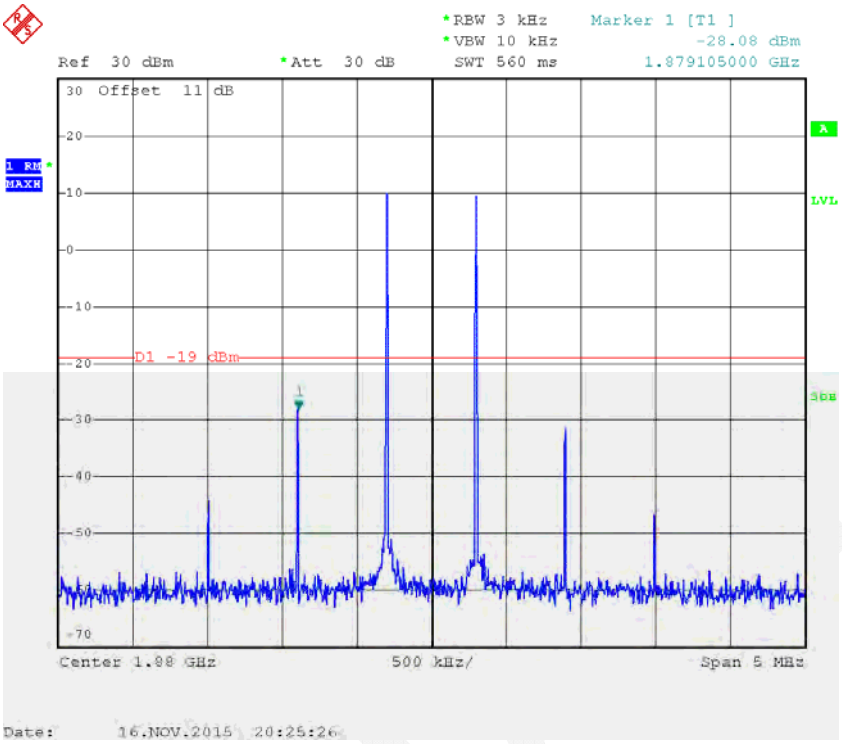
AWS Pre-AGC



AWS Above AGC



PCS Pre-AGC



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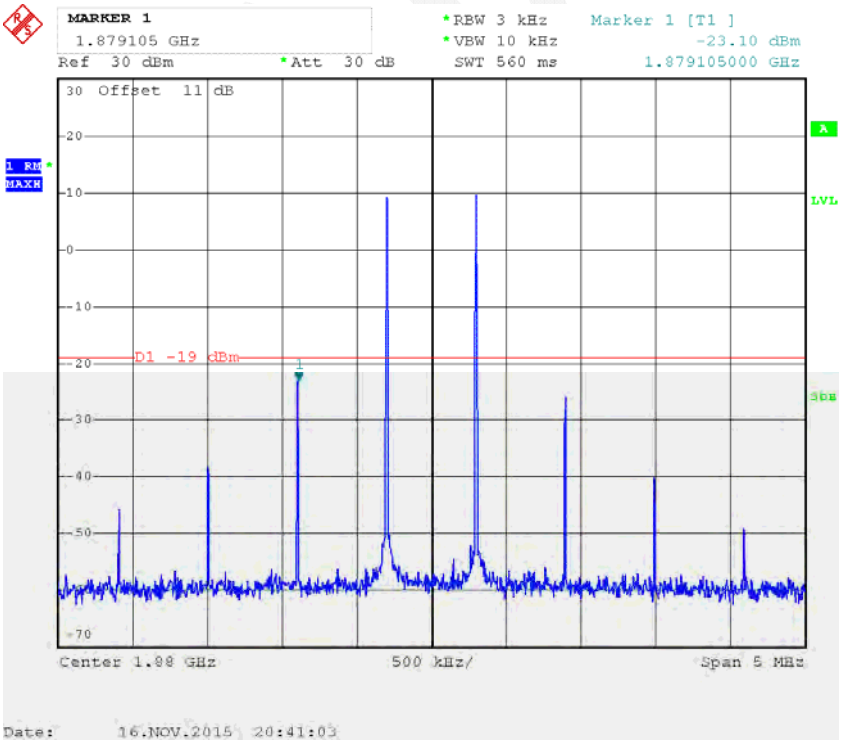


§ 20.21(e)(8)(i)(E)- OUT OF BAND EMISSIONS

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.

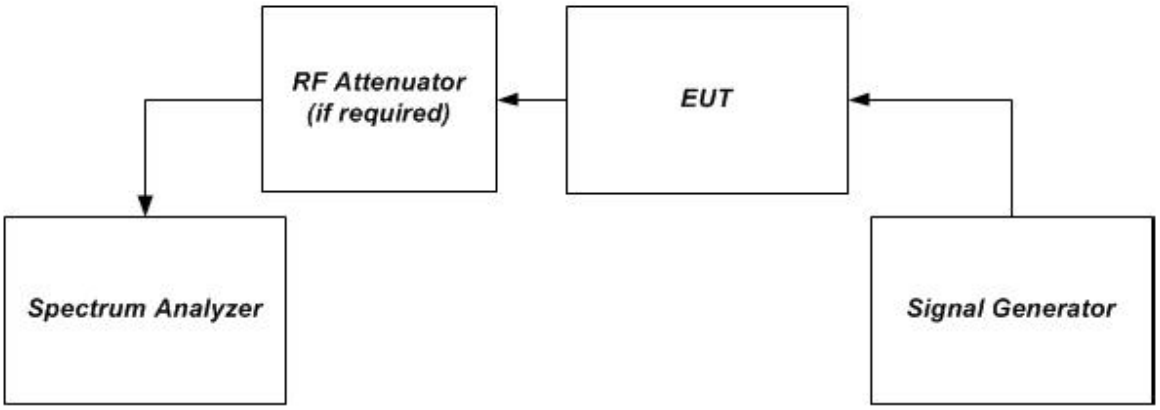


Figure 1 – Band verification test instrumentation setup

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
R & S	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2014-12-19	2015-12-19
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2015-03-30	2016-03-29

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

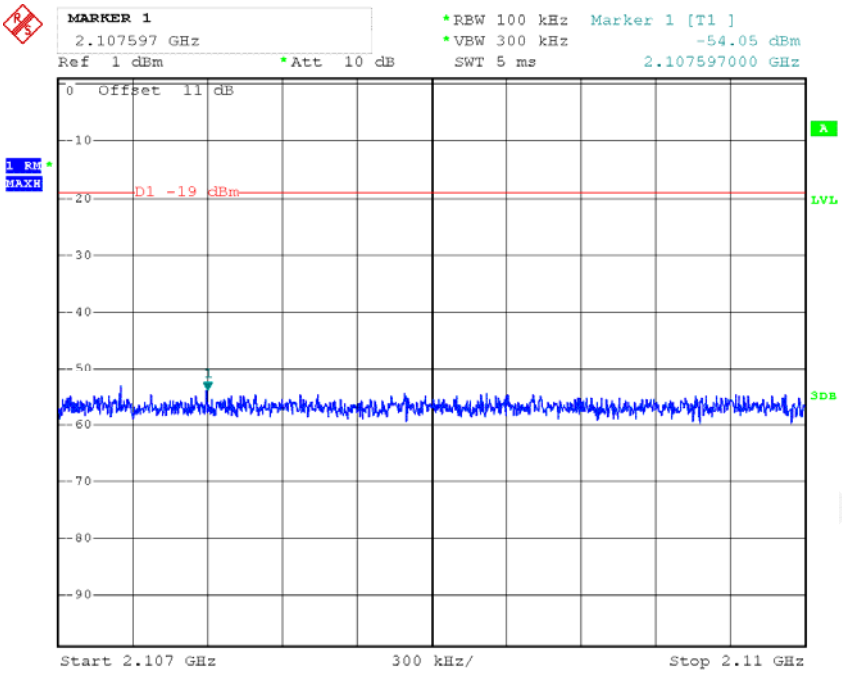
Temperature:	24.2~25.1℃
Relative Humidity:	43~48 %
ATM Pressure:	101.1~101.8 kPa

The testing was performed by Dean Liu from 2015-11-16 to 2015-11-19.

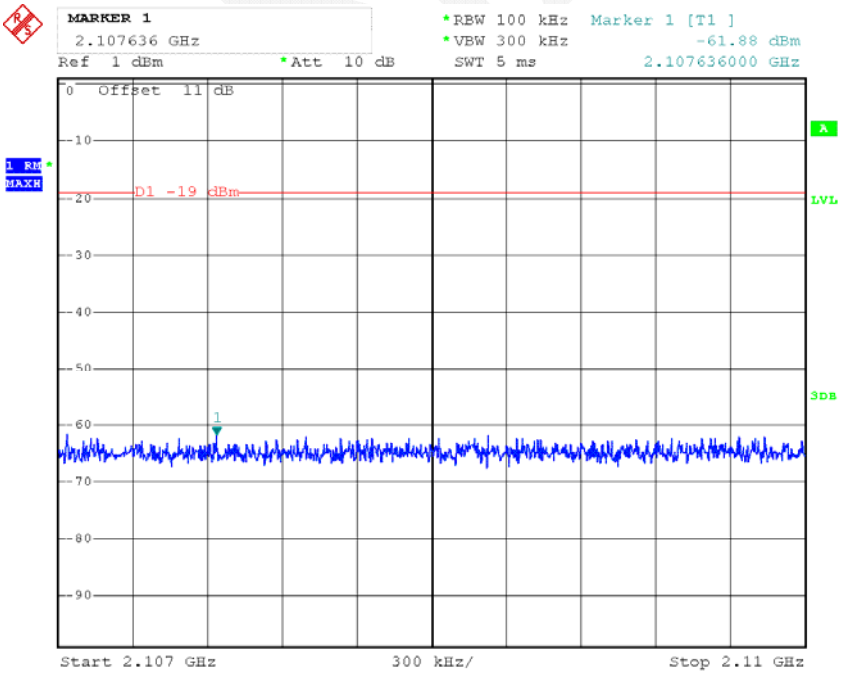
Please refer to the following plots.

Downlink

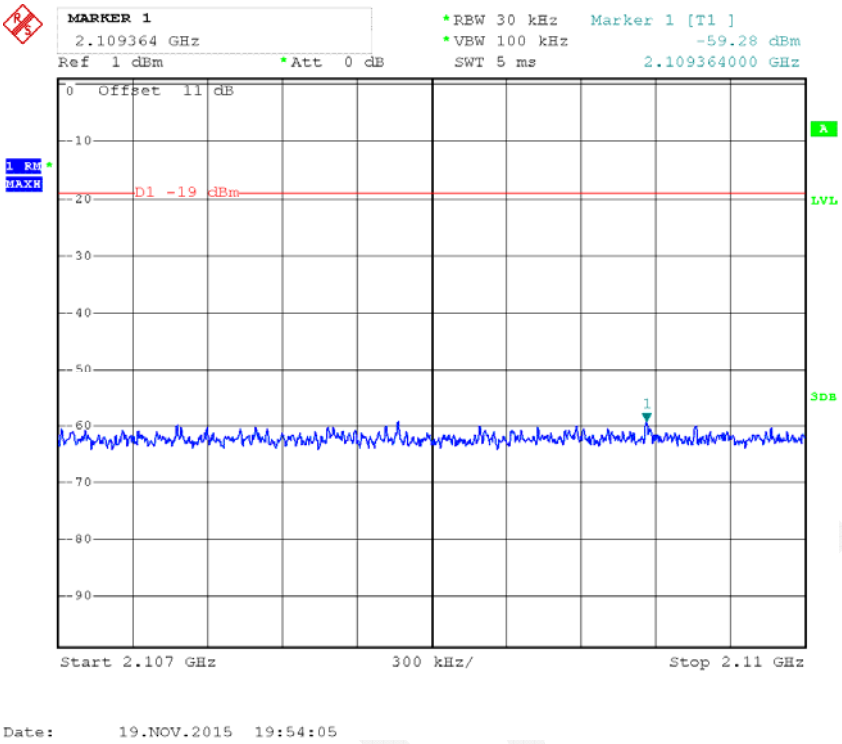
AWS Band LTE Left Side 2112.5MHz Pre-AGC



AWS Band LTE Left Side 2112.5MHz Above AGC



AWS Band CDMA Left Side 2111.25MHz Pre-AGC



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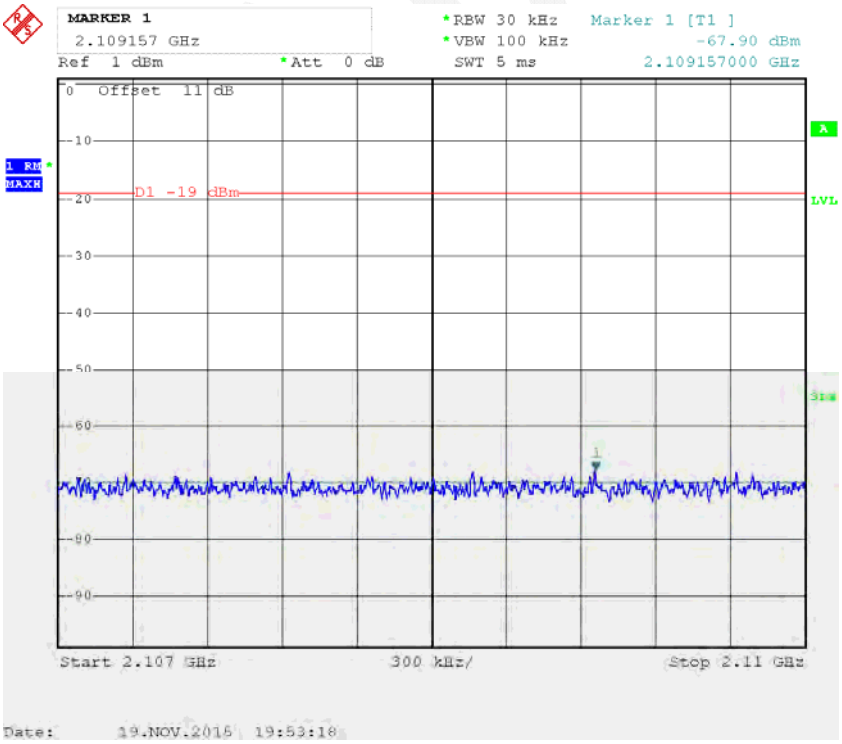
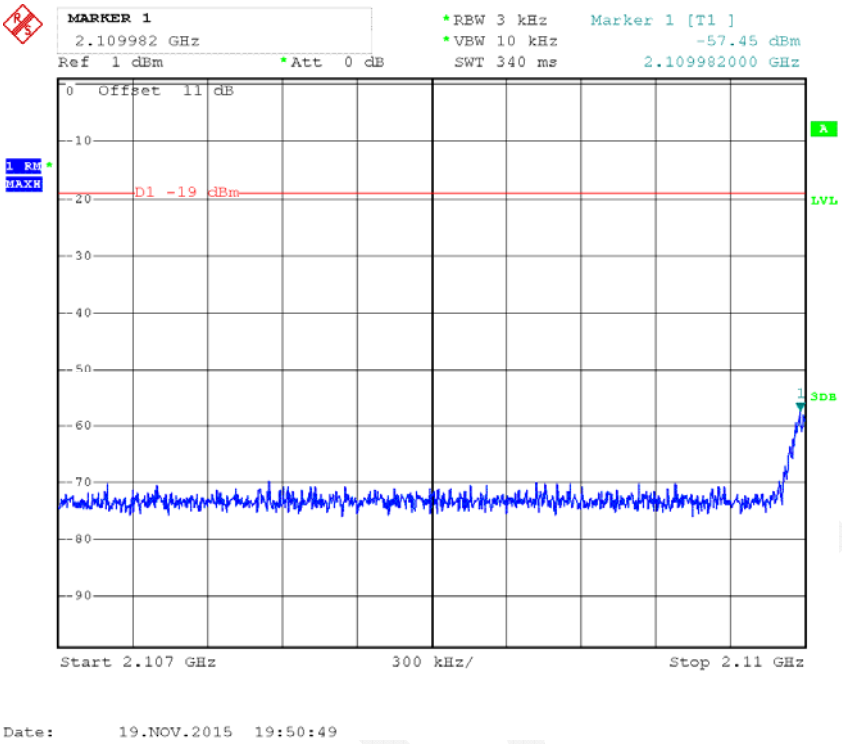
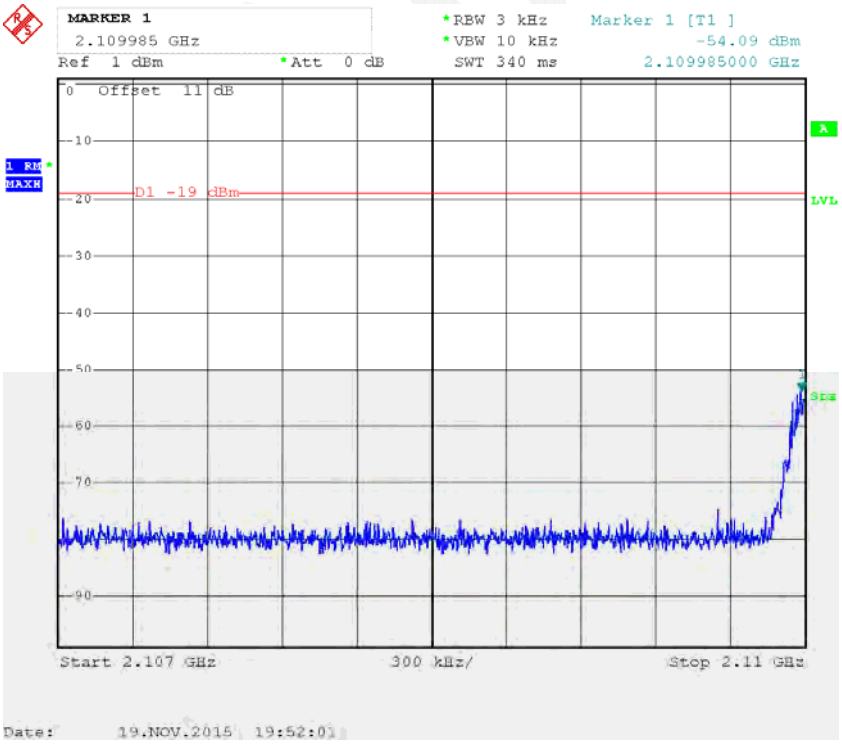


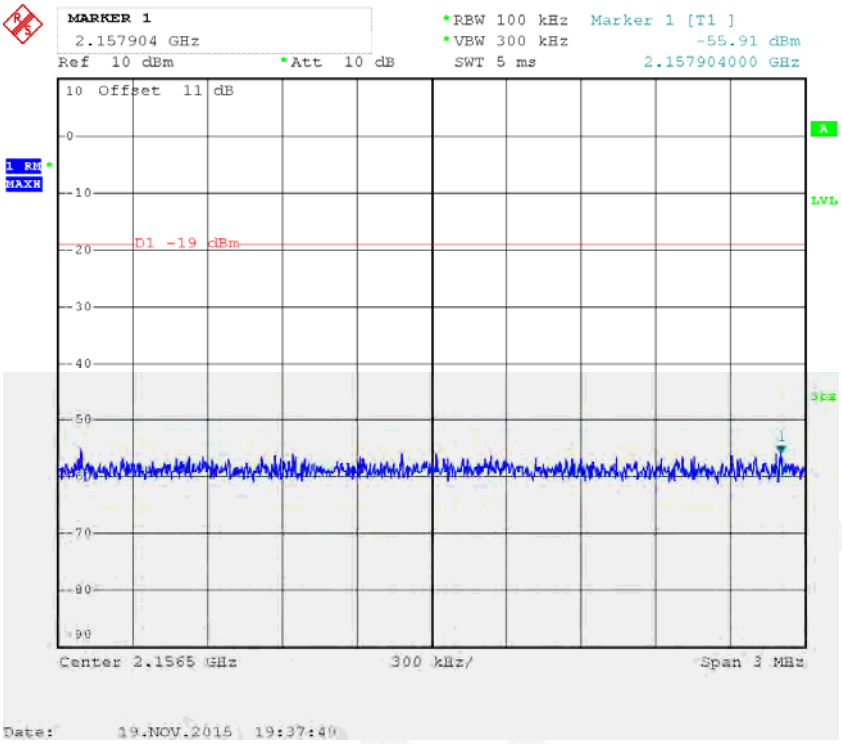
AWS Band GSM Left Side 2110.2MHz Pre-AGC



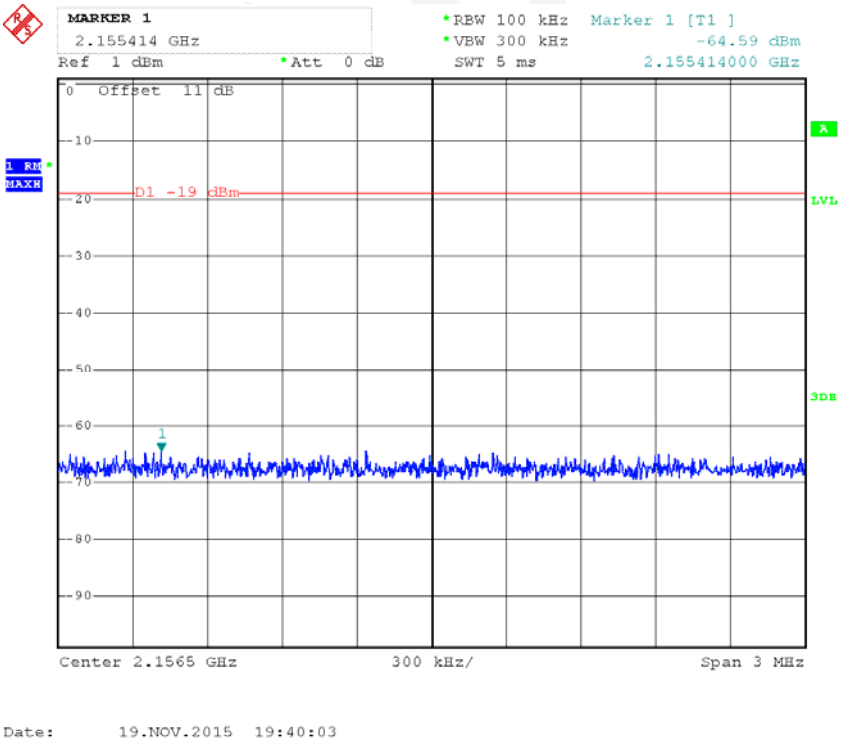
AWS Band GSM Left Side 2110.2MHz Above AGC



AWS Band LTE Right Side 2152.5MHz Pre-AGC



AWS Band LTE Right Side 2152.5MHz Above AGC



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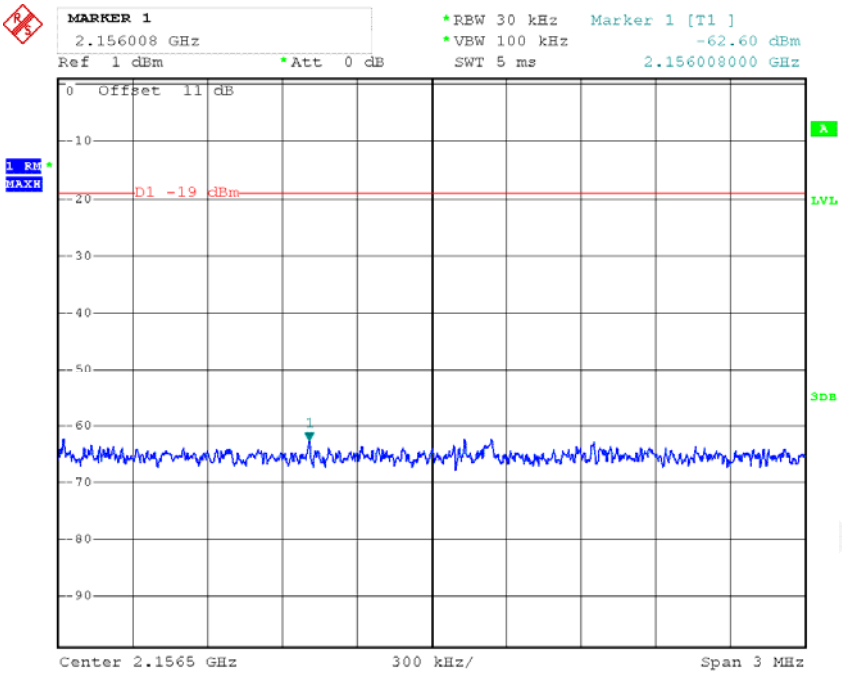

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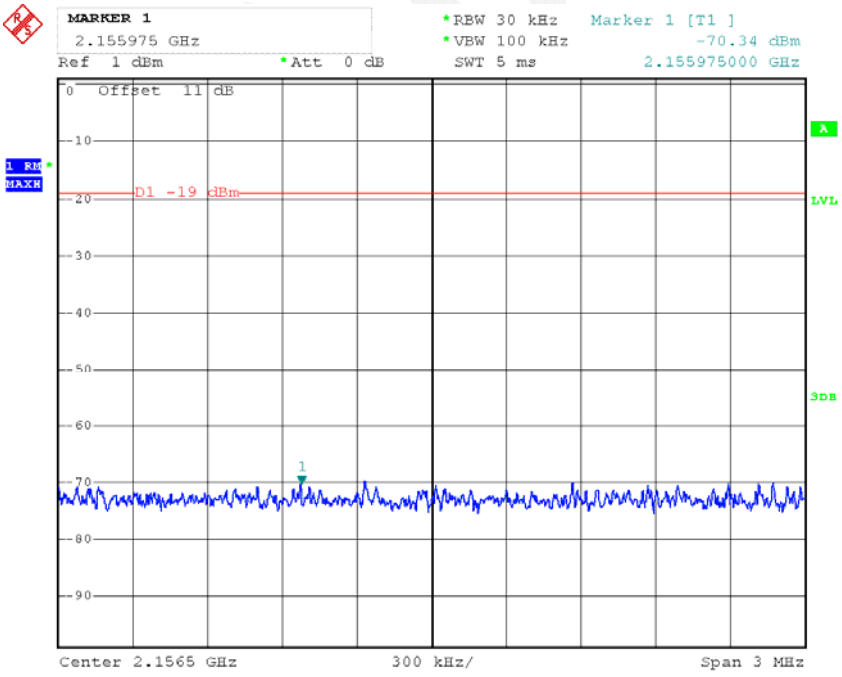
AWS Band CDMA Right Side 2153.75MHz Above AGC



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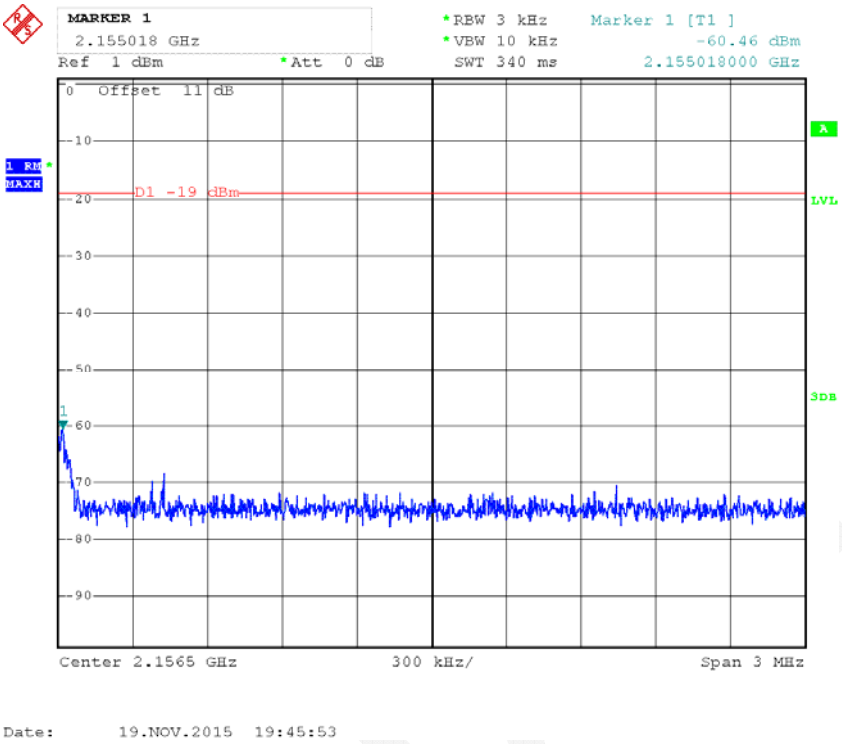
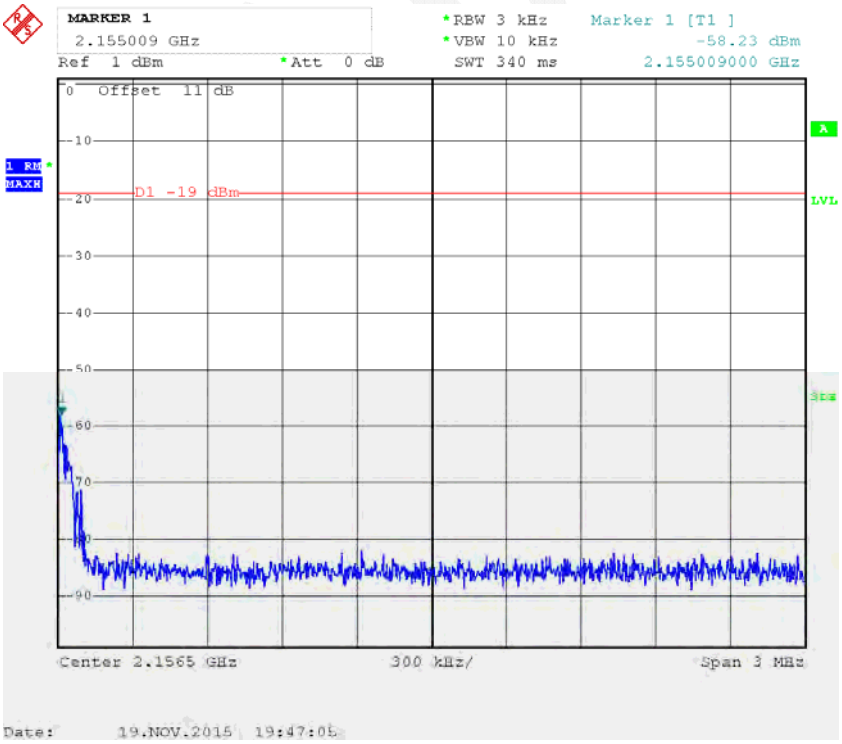
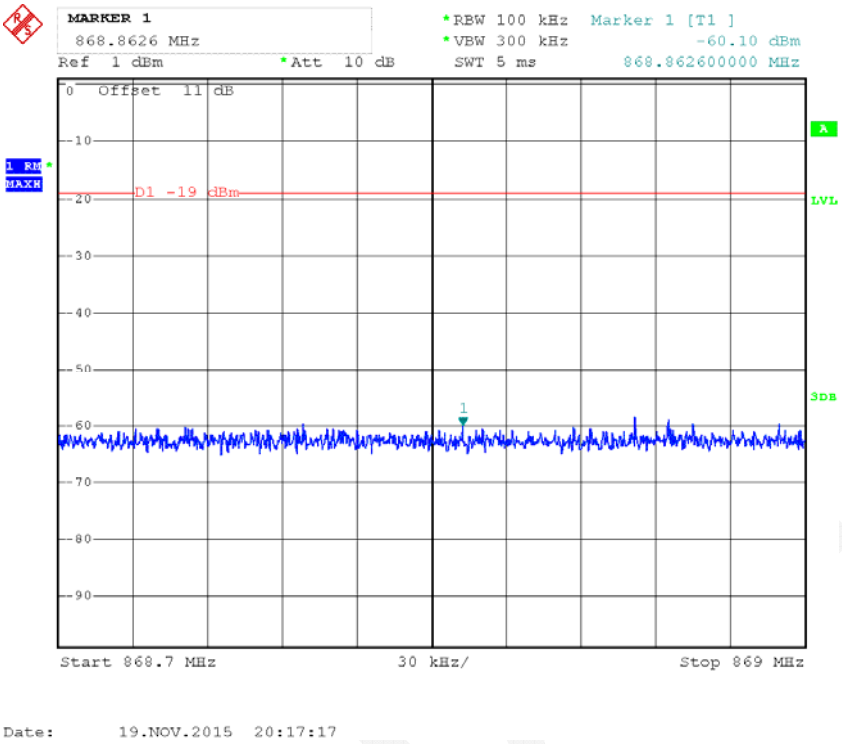


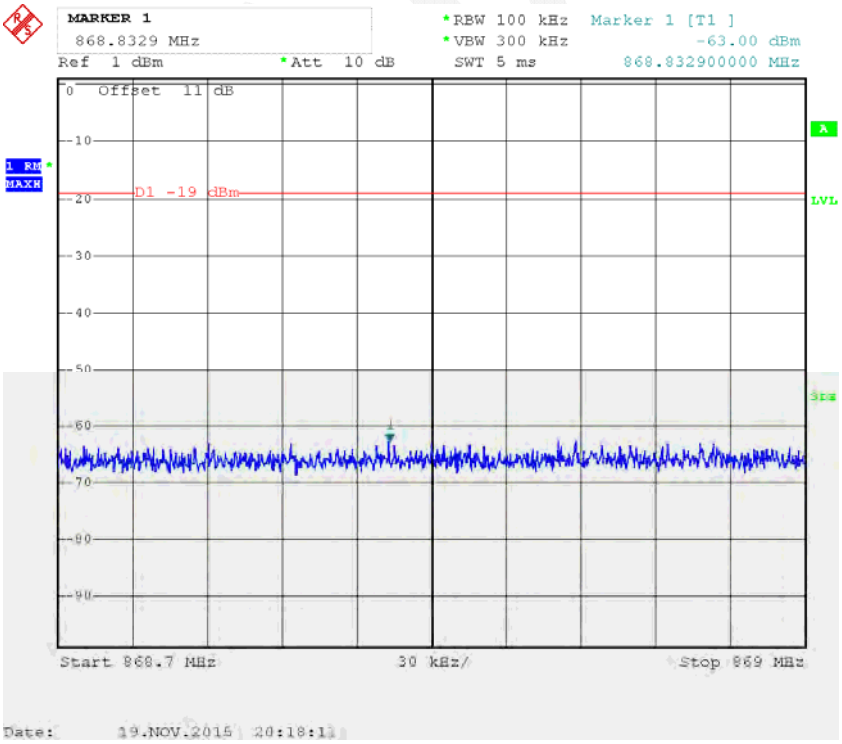
AWS Band GSM Right Side 2154.8MHz Above AGC



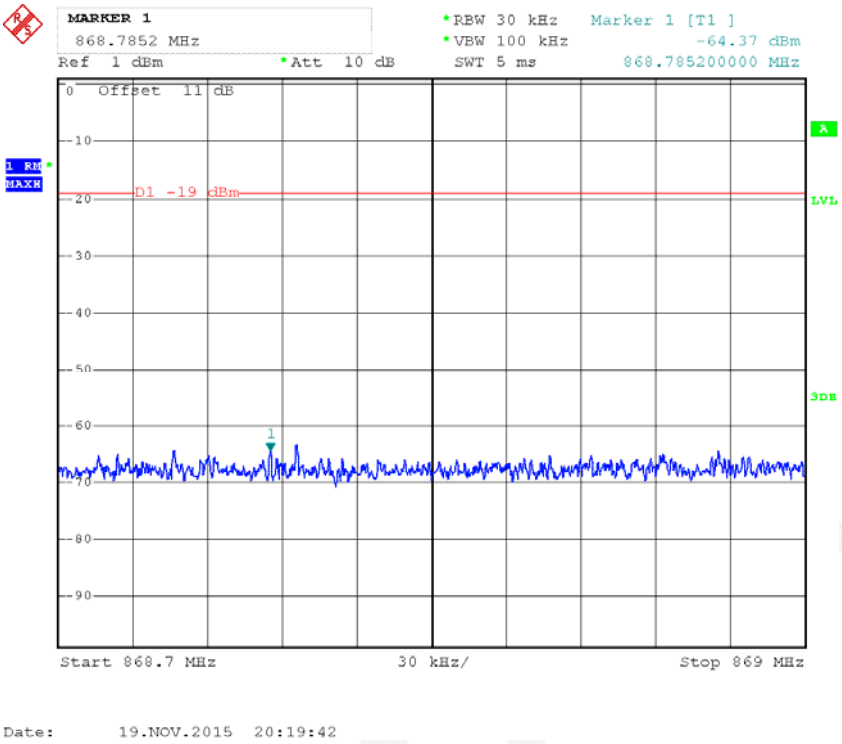
Cellular Band LTE Left Side 871.5MHz Pre-AGC



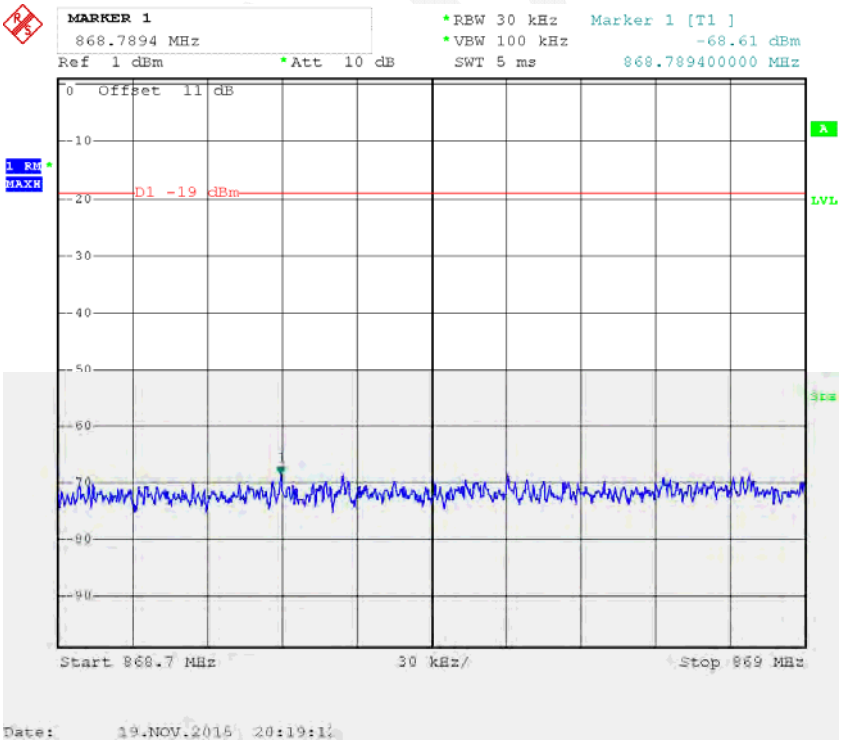
Cellular Band LTE Left Side 871.5MHz Above AGC



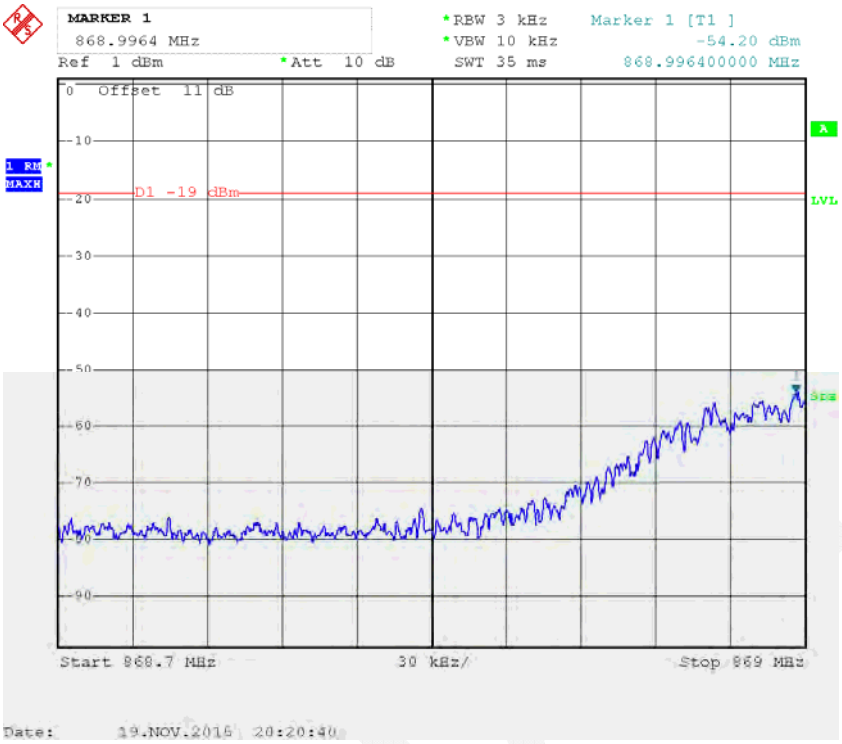
Cellular Band CDMA Left Side 869.88MHz Pre-AGC



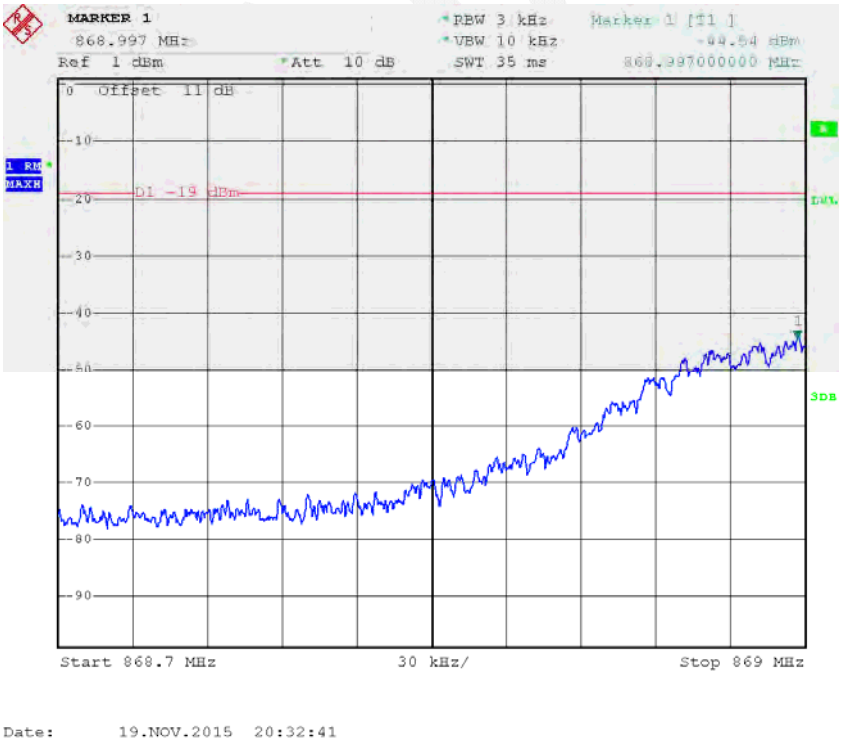
Cellular Band CDMA Left Side 869.88MHz Above AGC



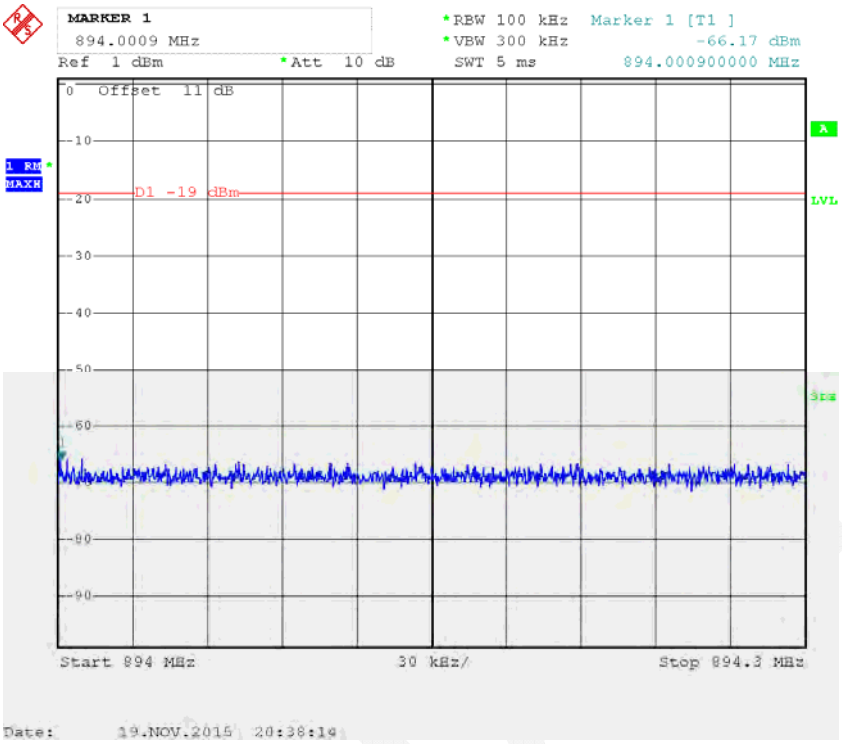
Cellular Band GSM Left Side 869.2MHz Pre-AGC



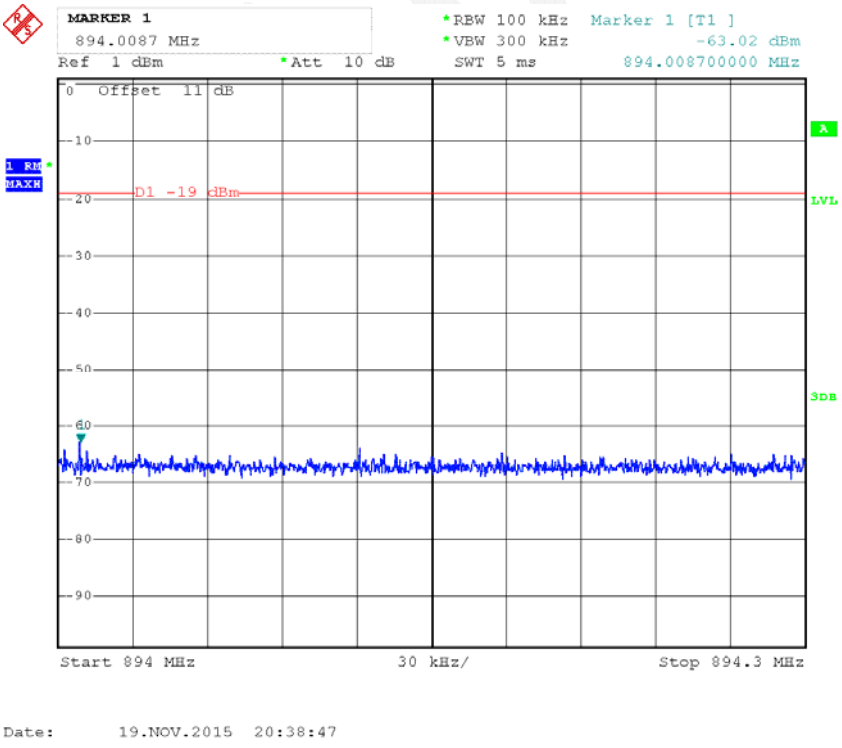
Cellular Band GSM Left Side 869.2MHz Above AGC



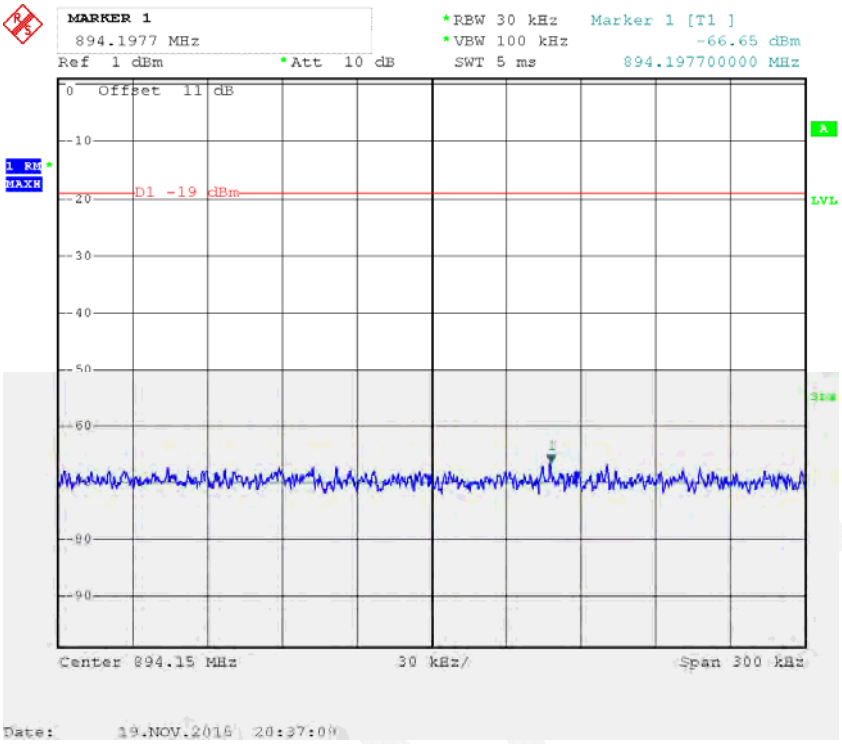
Cellular Band LTE Right Side 891.5MHz Pre-AGC



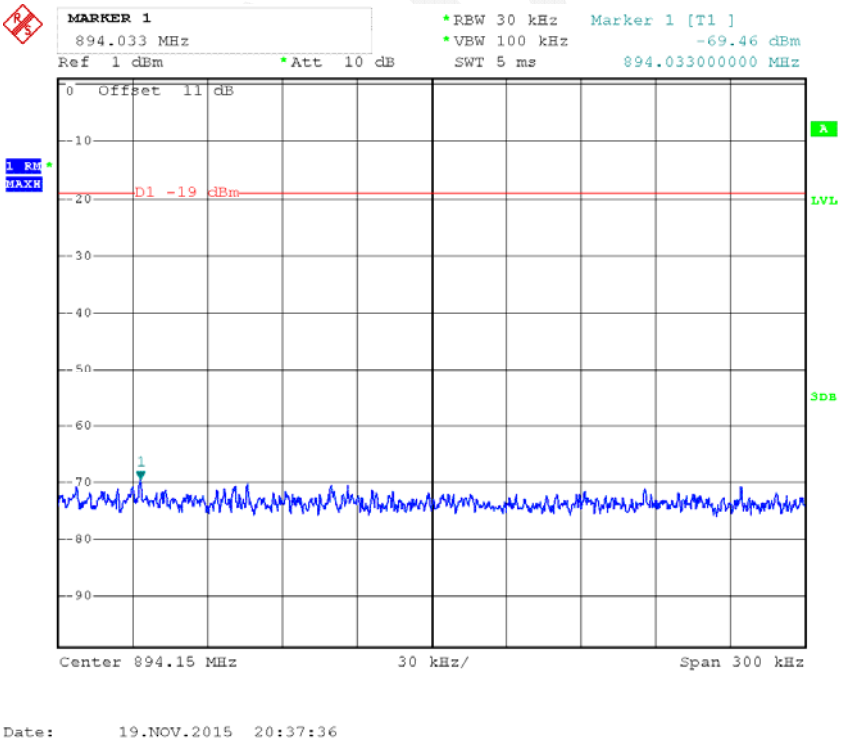
Cellular Band LTE Right Side 891.5MHz Above AGC



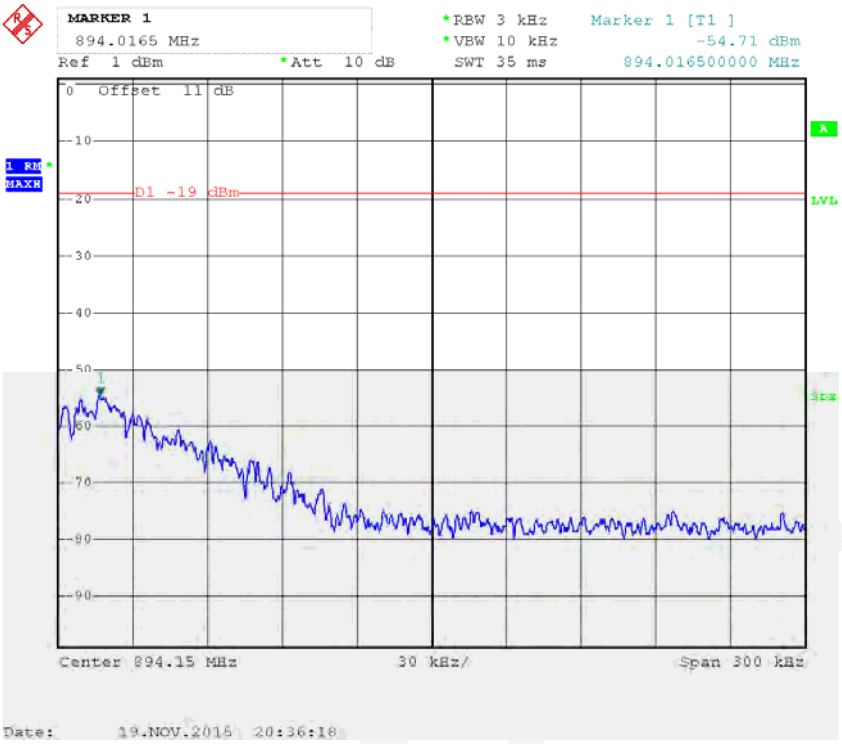
Cellular Band CDMA Right Side 893.10MHz Pre-AGC



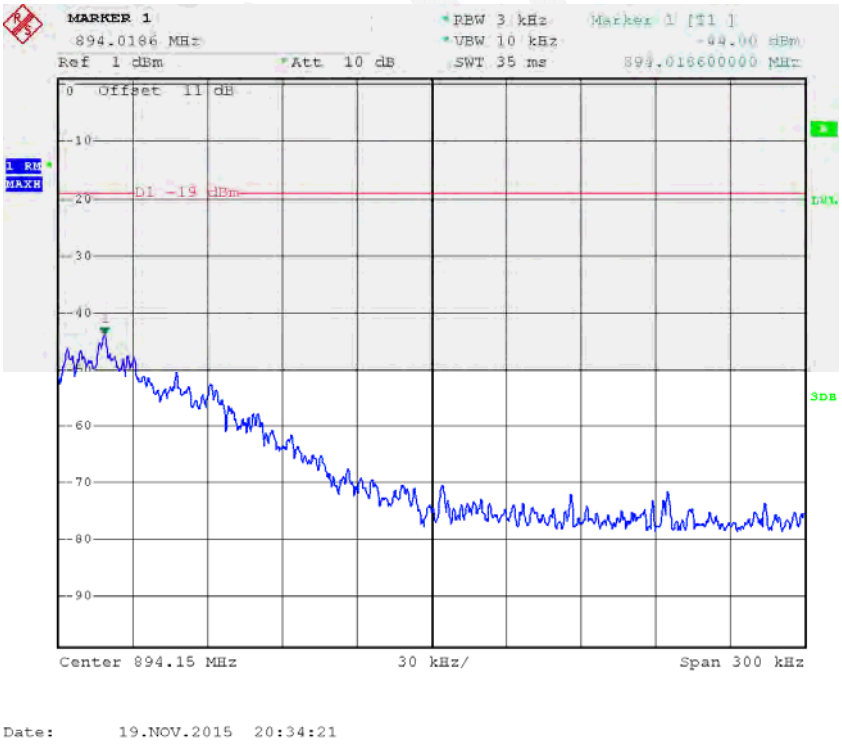
Cellular Band CDMA Right Side 893.10MHz Above AGC



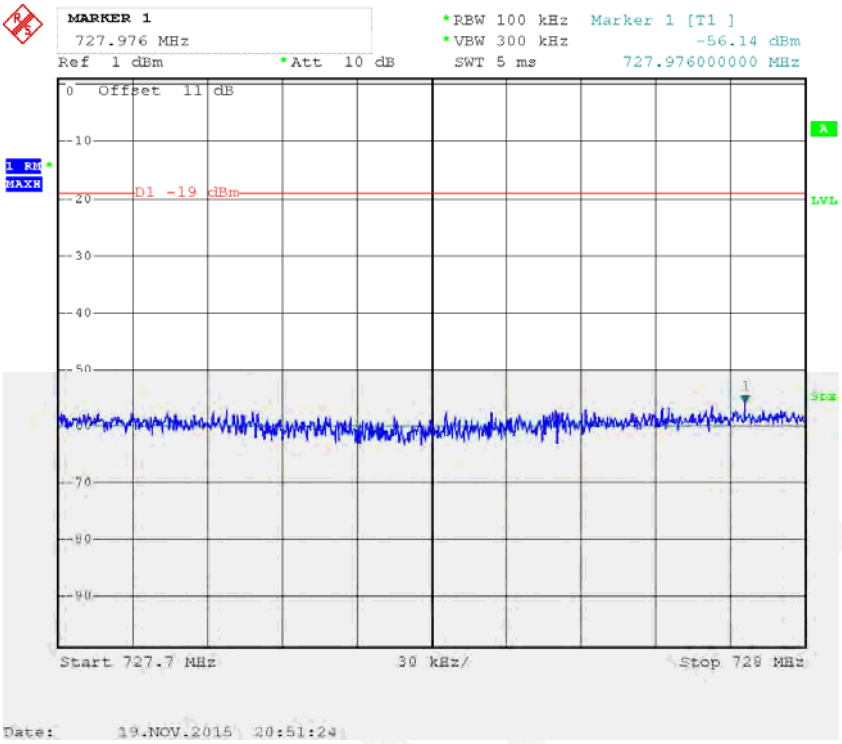
Cellular Band GSM Right Side 893.8MHz Pre-AGC



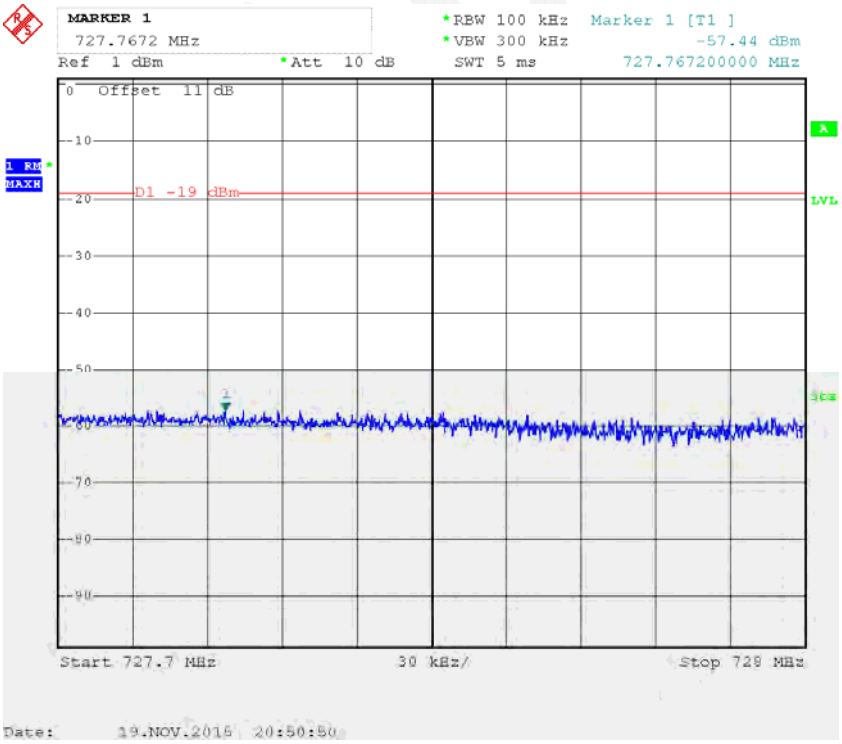
Cellular Band GSM Right Side 893.8MHz Above AGC



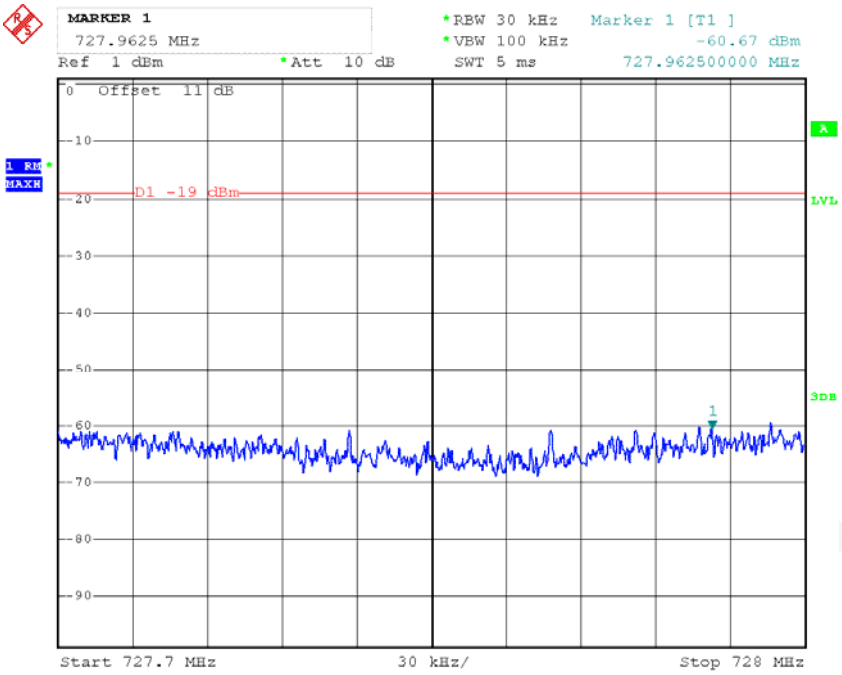
Lower 700 LTE Left Side 730.5MHz Pre-AGC



Lower 700 LTE Left Side 730.5MHz Above AGC



Lower 700 CDMA Left Side 729.25MHz Pre-AGC



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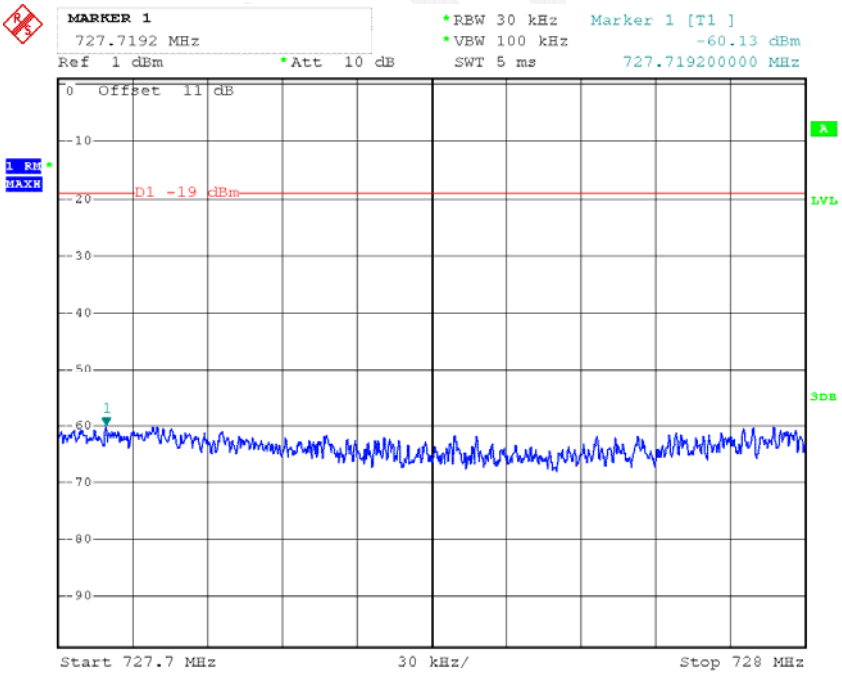
Lower 700 CDMA Left Side 729.25MHz Above AGC



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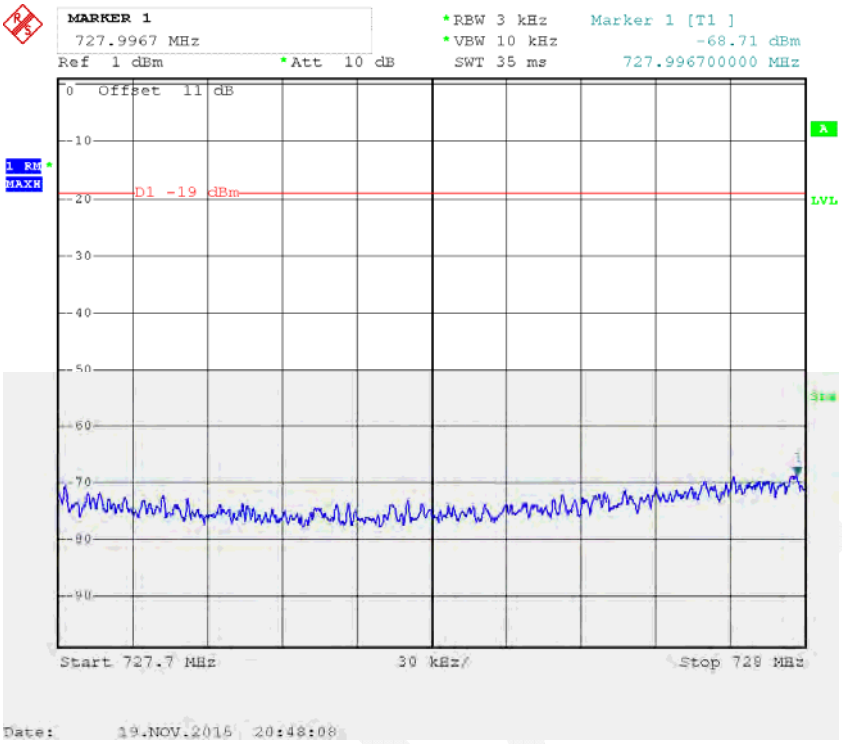
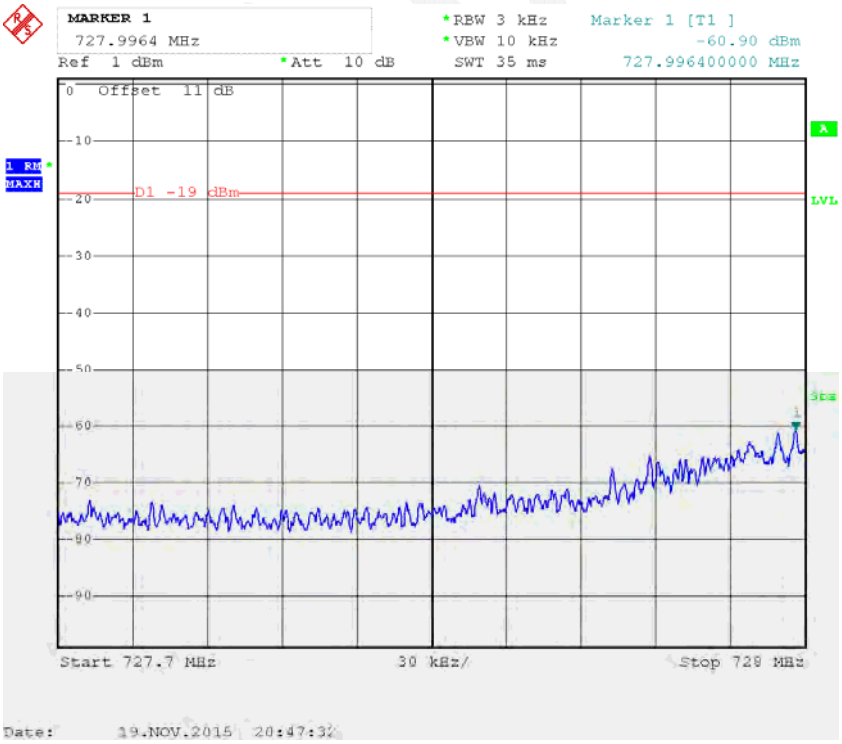
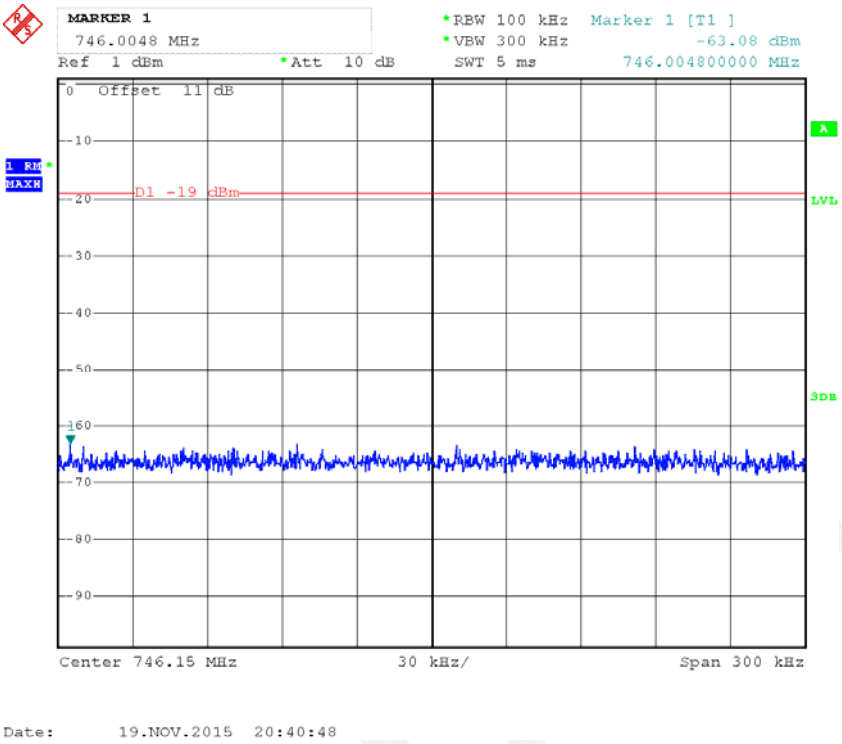
Lower 700 GSM Left Side 728.2MHz Pre-AGC



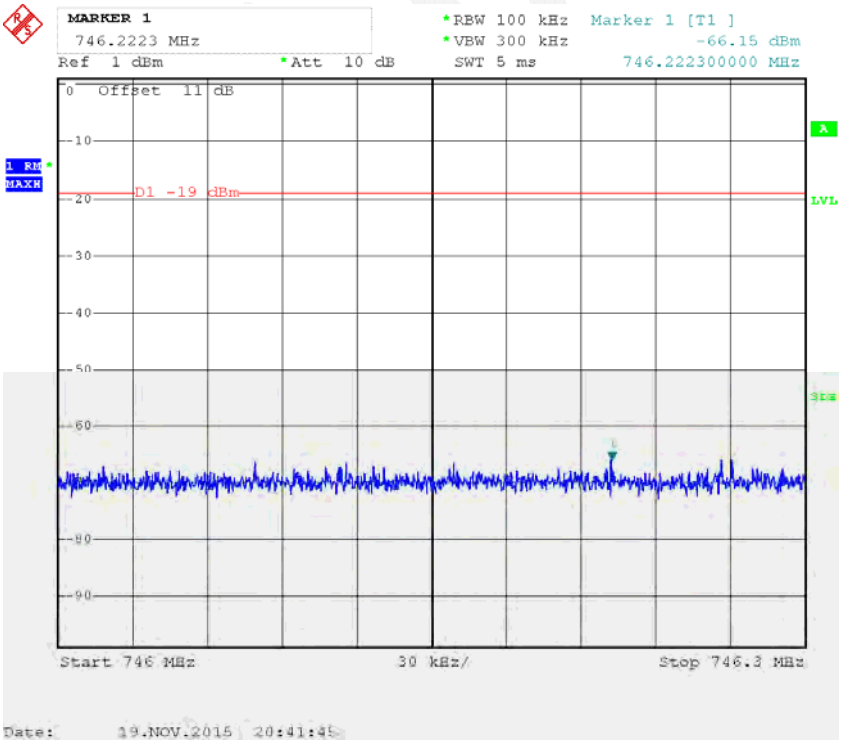
Lower 700 GSM Left Side 728.2MHz Above AGC



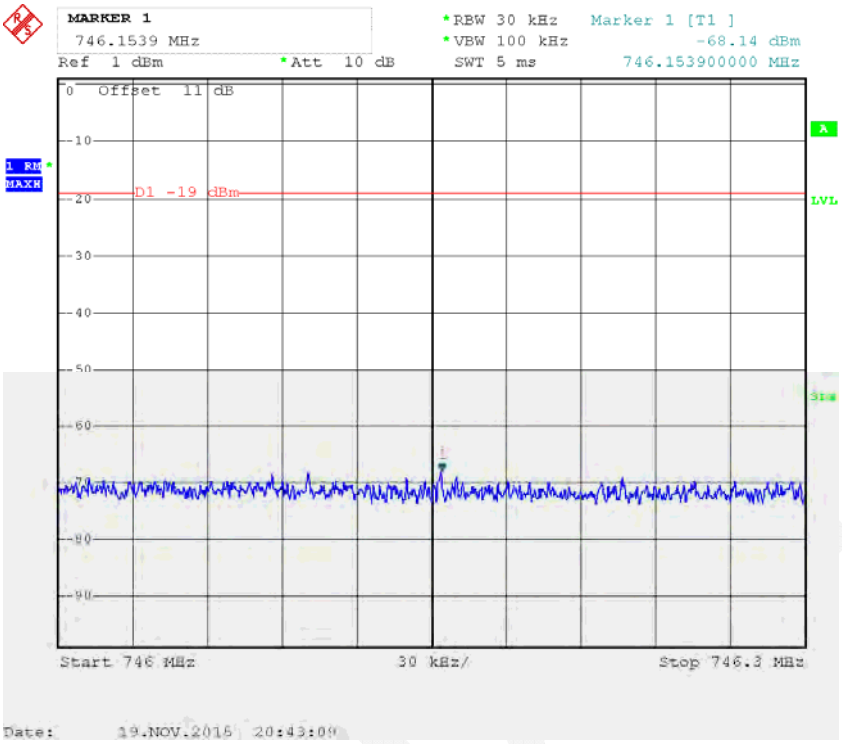
Lower 700 LTE Right Side 743.5MHz Pre-AGC



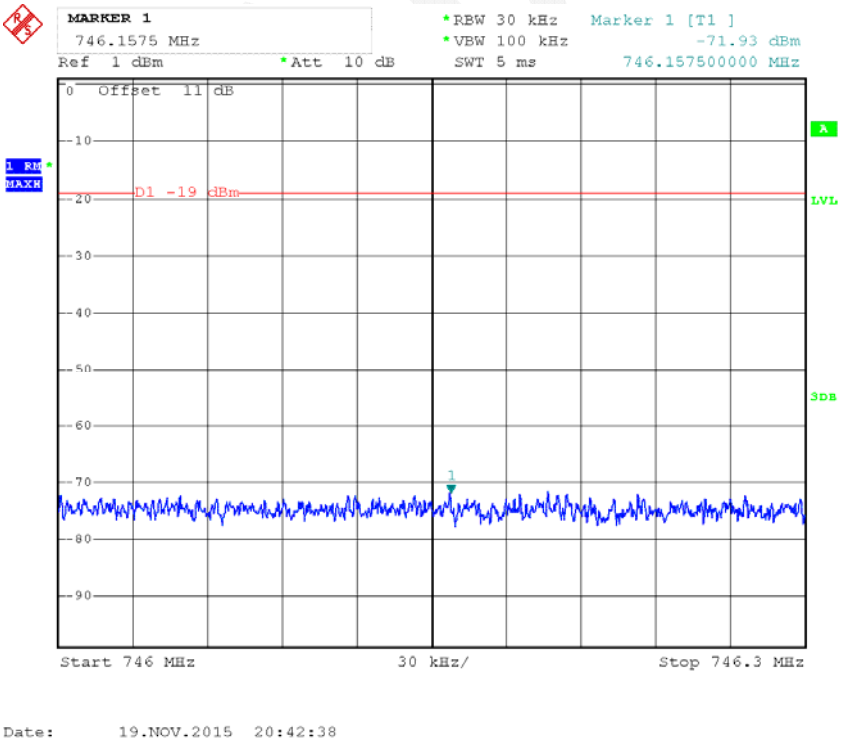
Lower 700 LTE Right Side 743.5MHz Above AGC



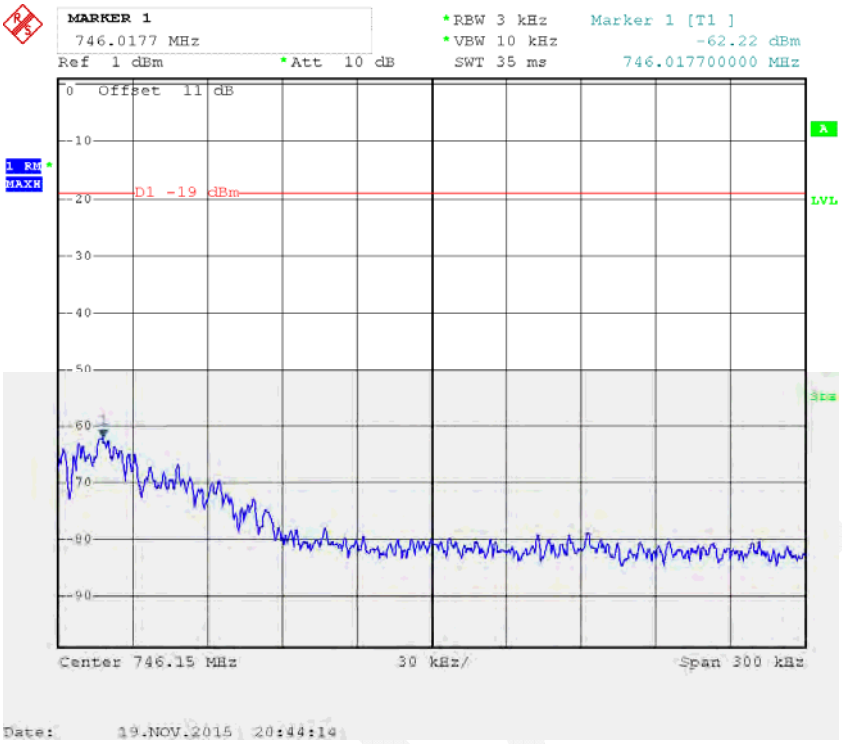
Lower 700 CDMA Right Side 744.75MHz Pre-AGC



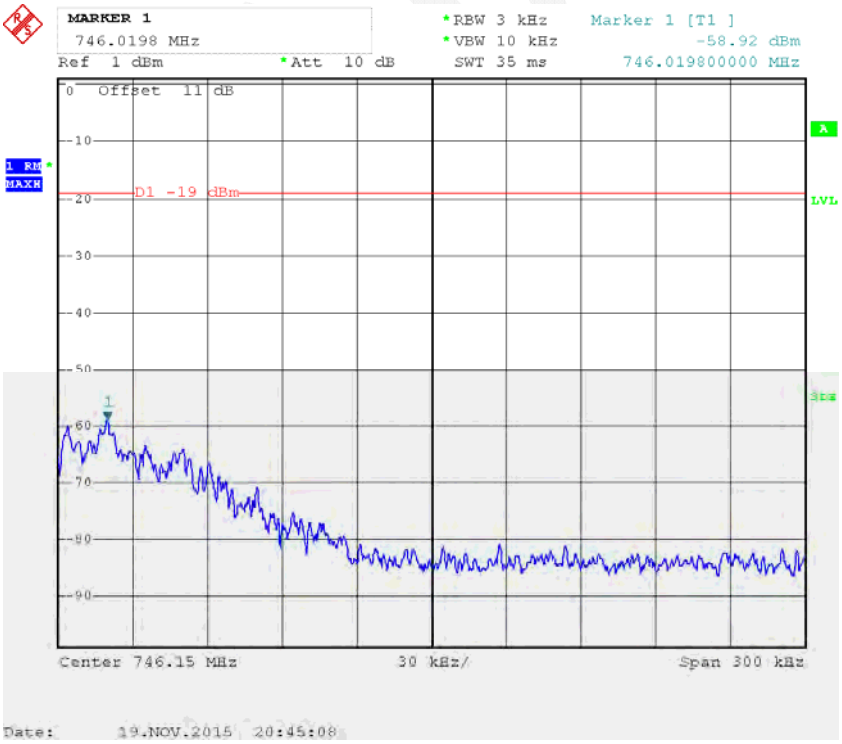
Lower 700 CDMA Right Side 744.75MHz Above AGC



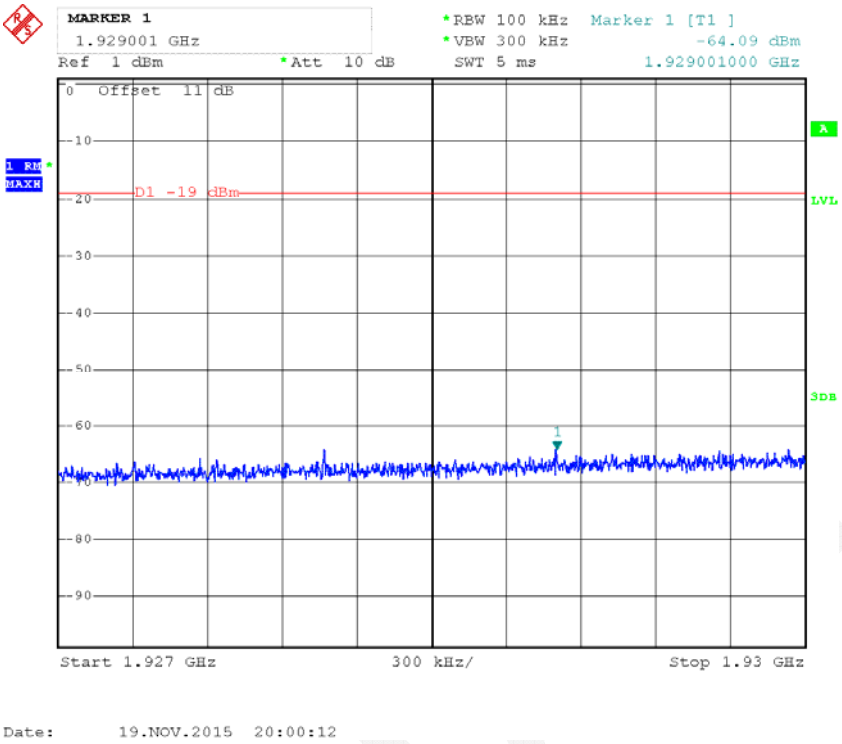
Lower 700 GSM Right Side 745.8MHz Pre-AGC



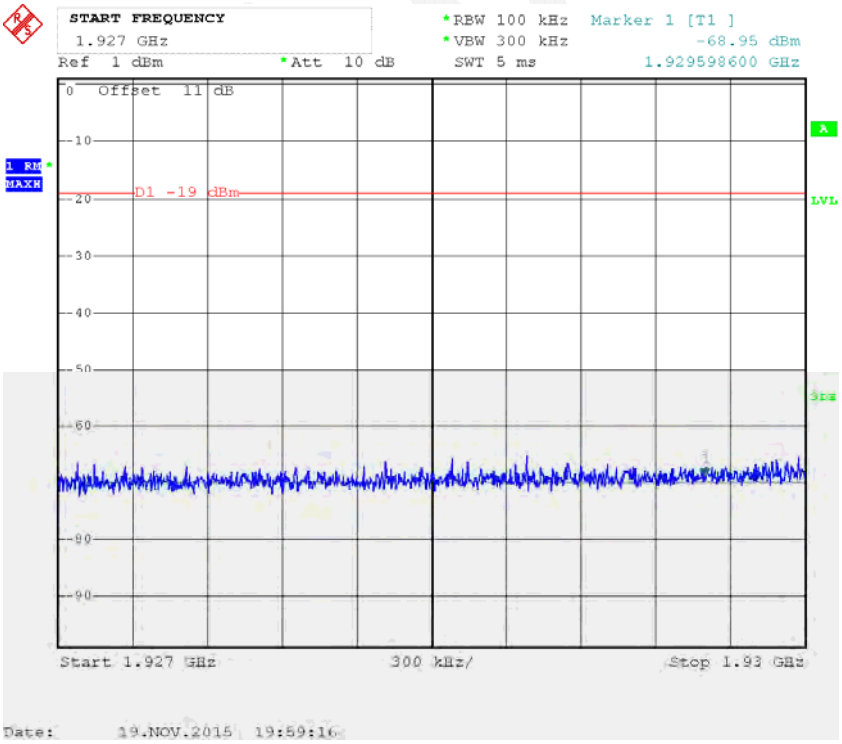
Lower 700 GSM Right Side 745.8MHz Above AGC



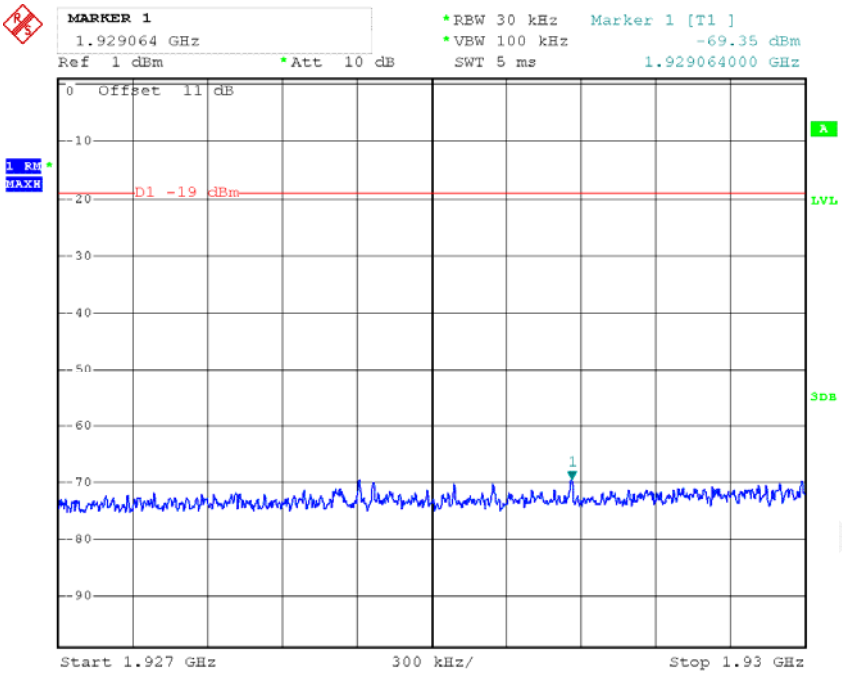
PCS Band LTE Left Side 1932.5MHz Pre-AGC



PCS Band LTE Left Side 1932.5MHz Above AGC



PCS Band CDMA Left Side 1931.25MHz Pre-AGC



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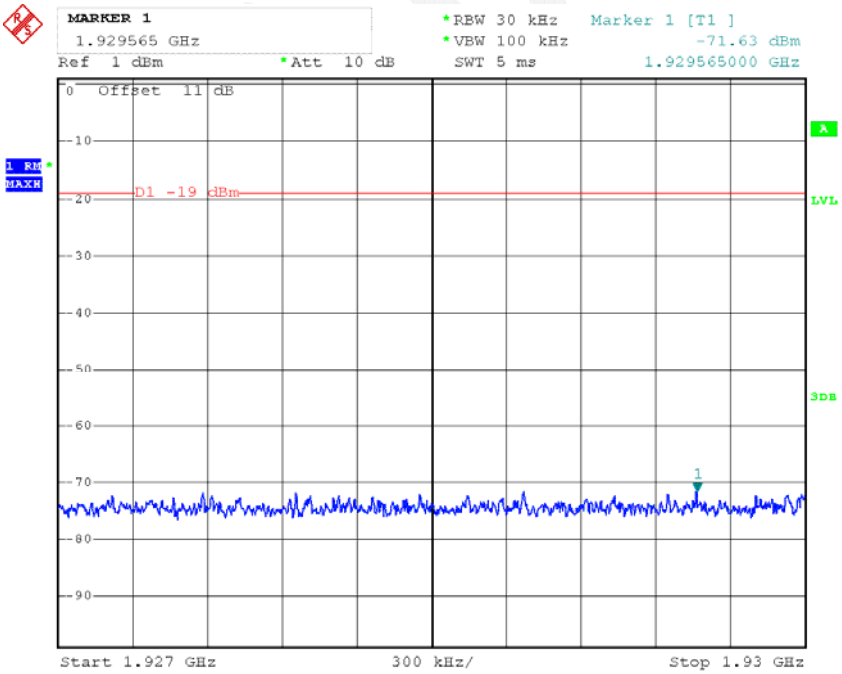
PCS Band CDMA Left Side 1931.25MHz Above AGC



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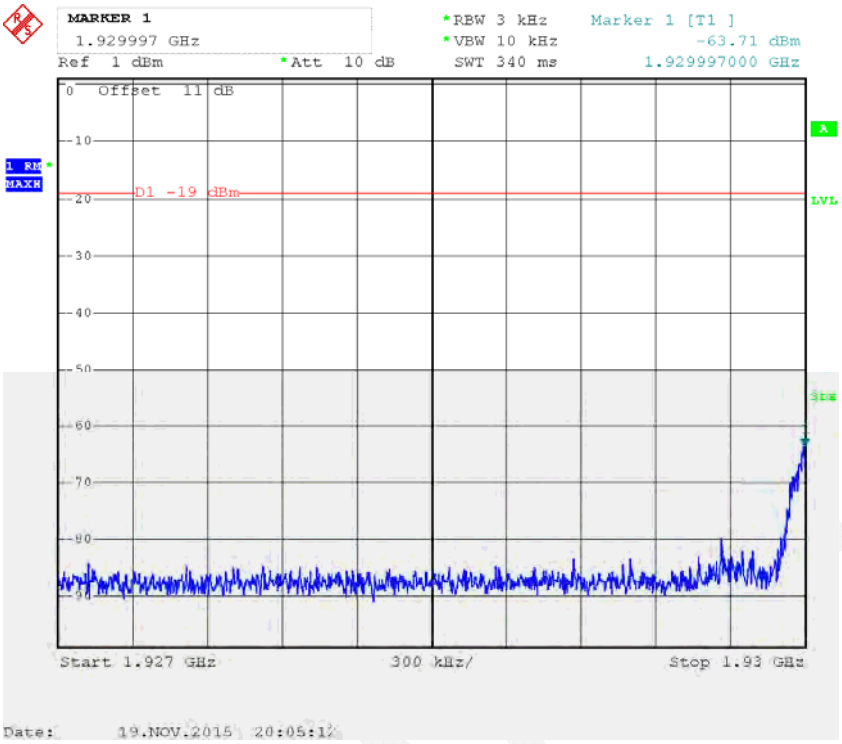
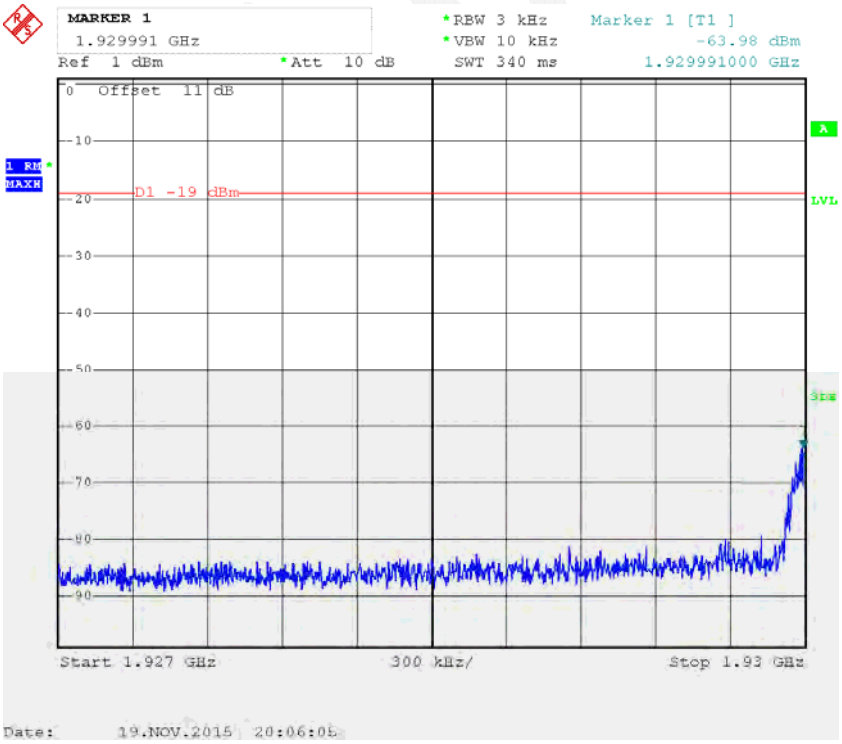
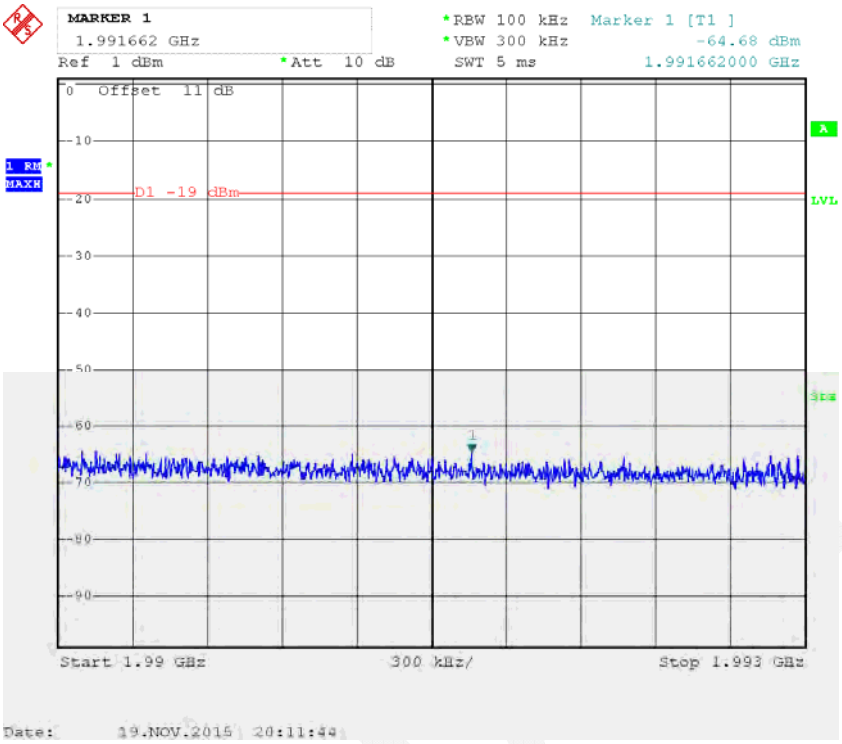
PCS Band GSM Left Side 1930.20MHz Pre-AGC



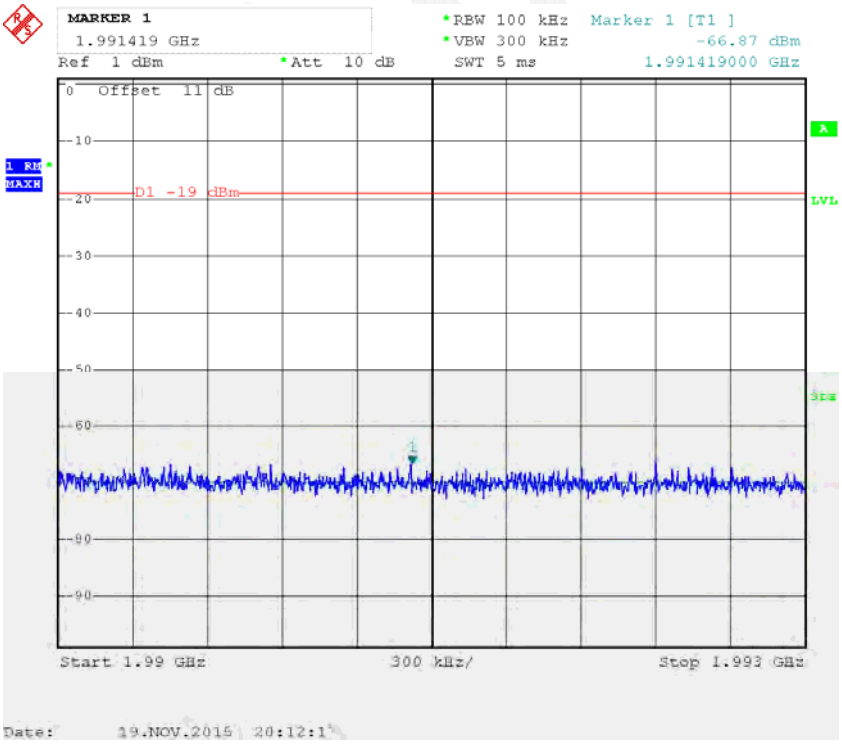
PCS Band GSM Left Side 1930.20MHz Above AGC



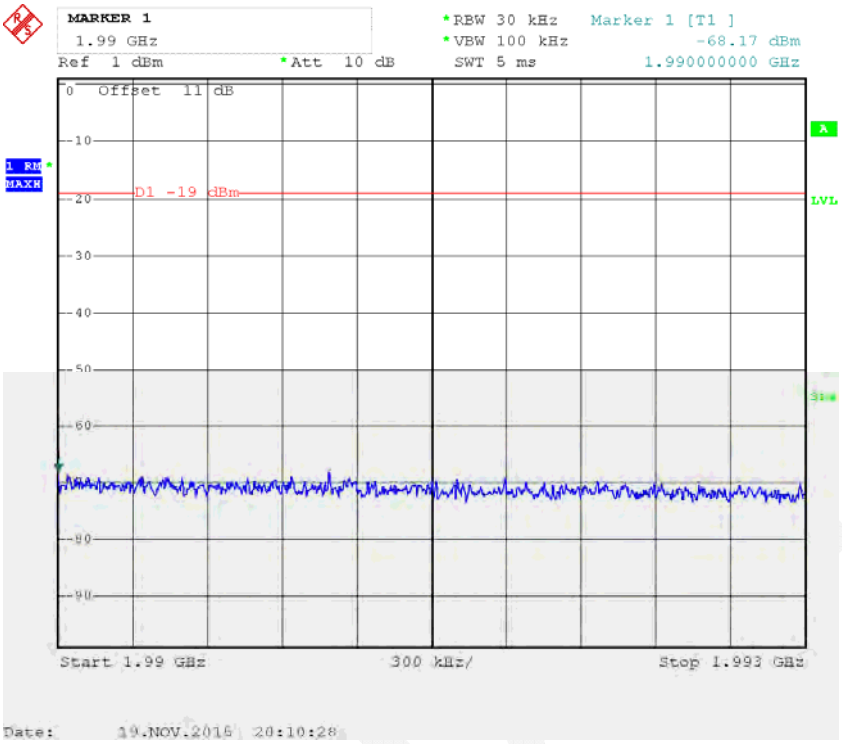
PCS Band LTE Right Side 1987.5MHz Pre-AGC



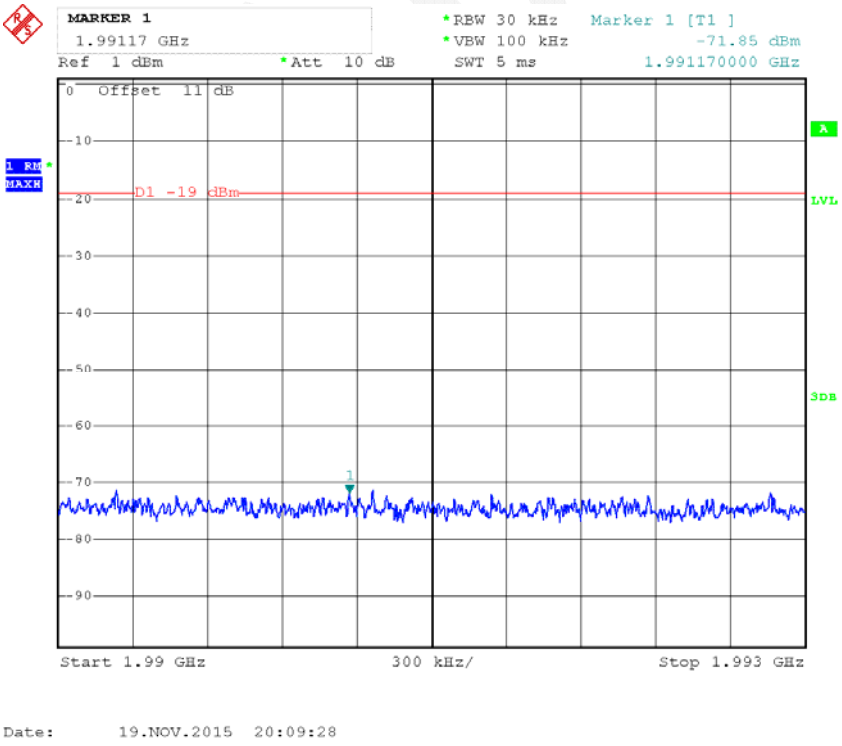
PCS Band LTE Right Side 1987.5MHz Above AGC



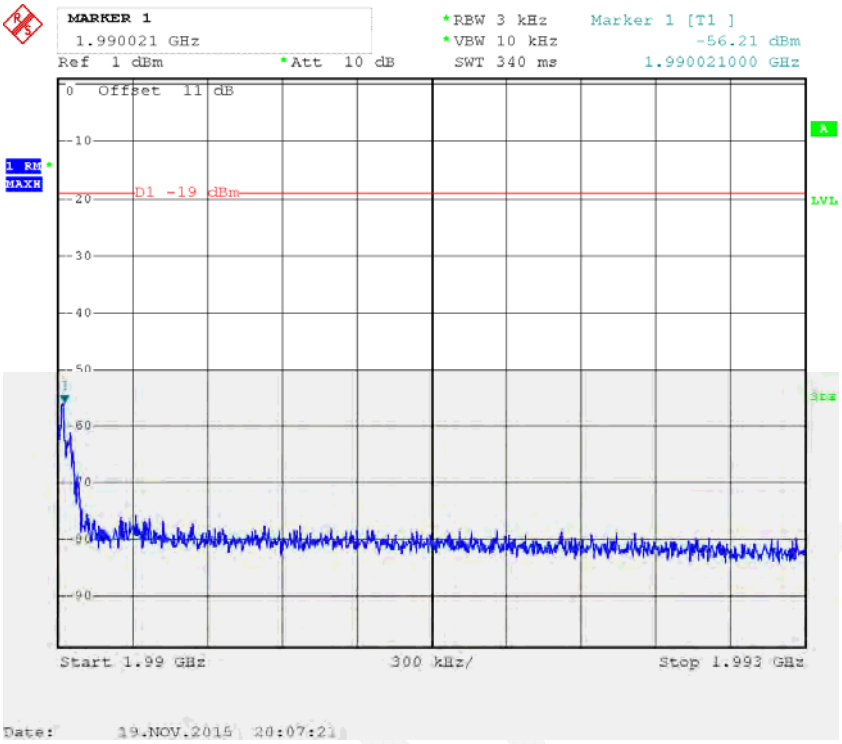
PCS Band CDMA Right Side 1988.75MHz Pre-AGC



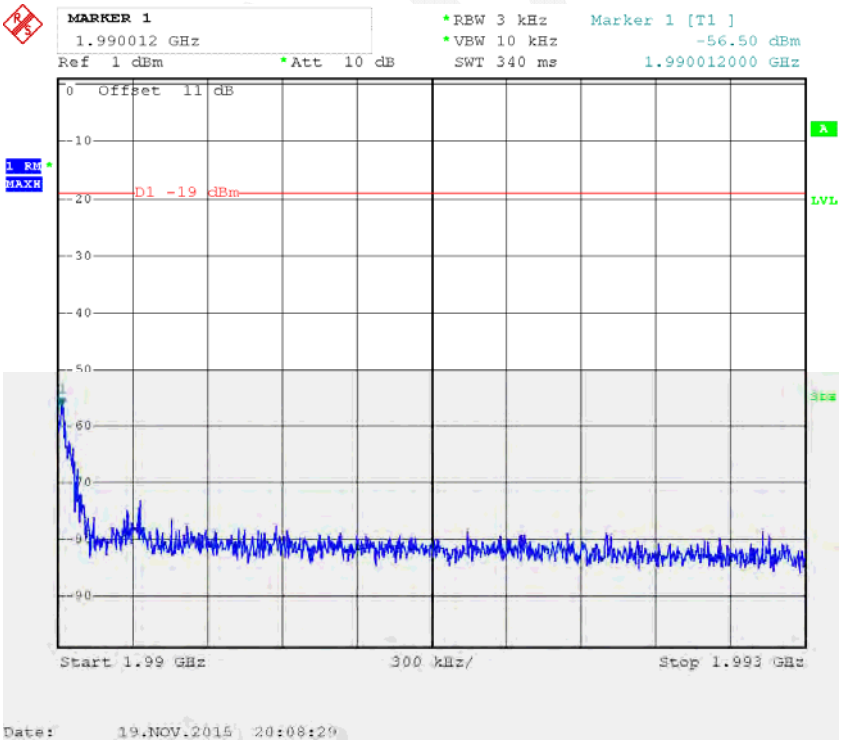
PCS Band CDMA Right Side 1988.75MHz Above AGC



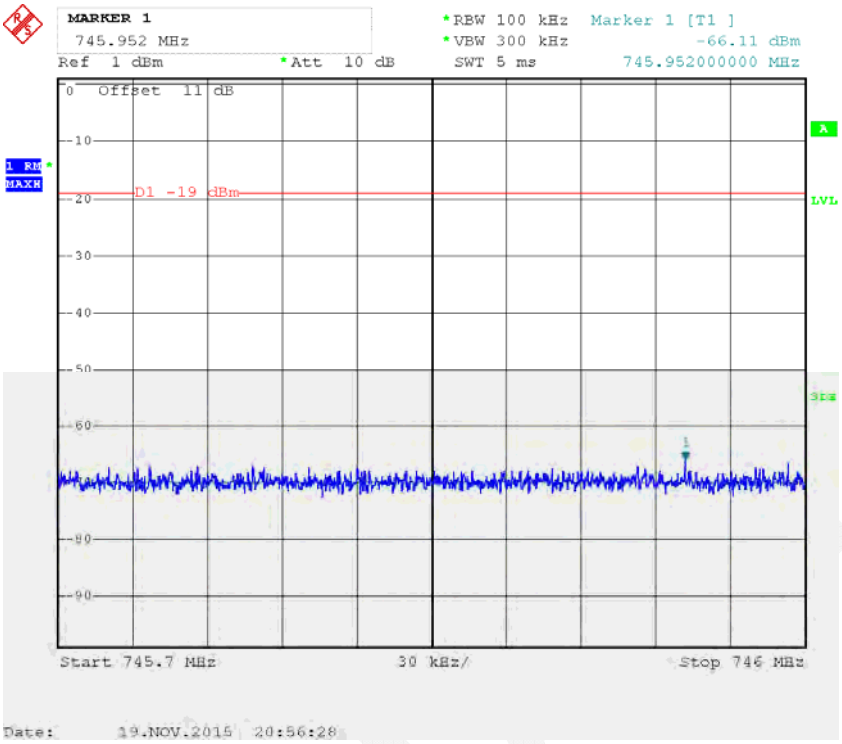
PCS Band GSM Right Side 1989.8MHz Pre-AGC



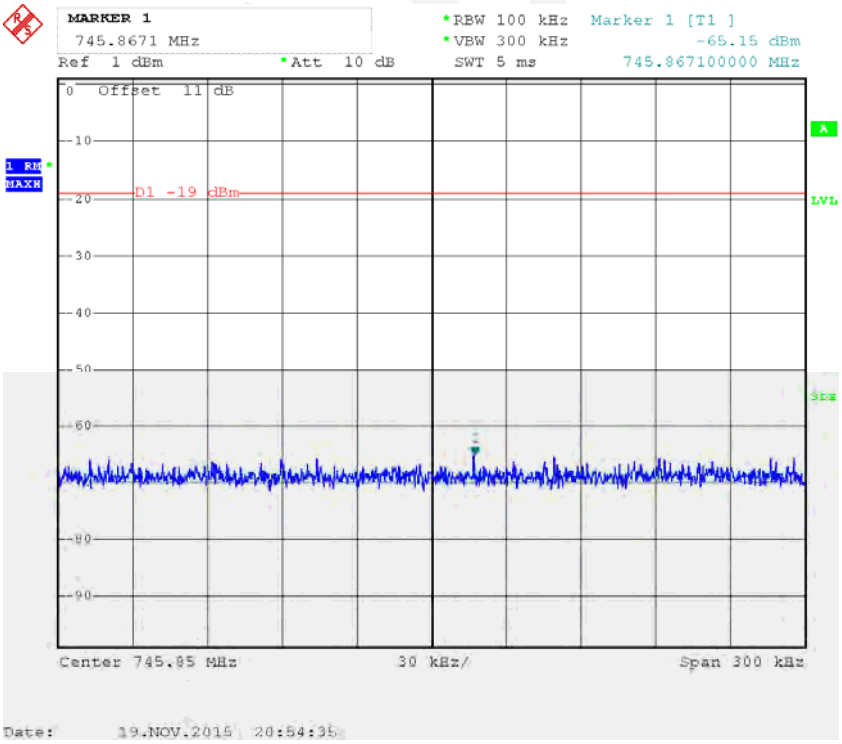
PCS Band GSM Right Side 1989.8MHz Above AGC



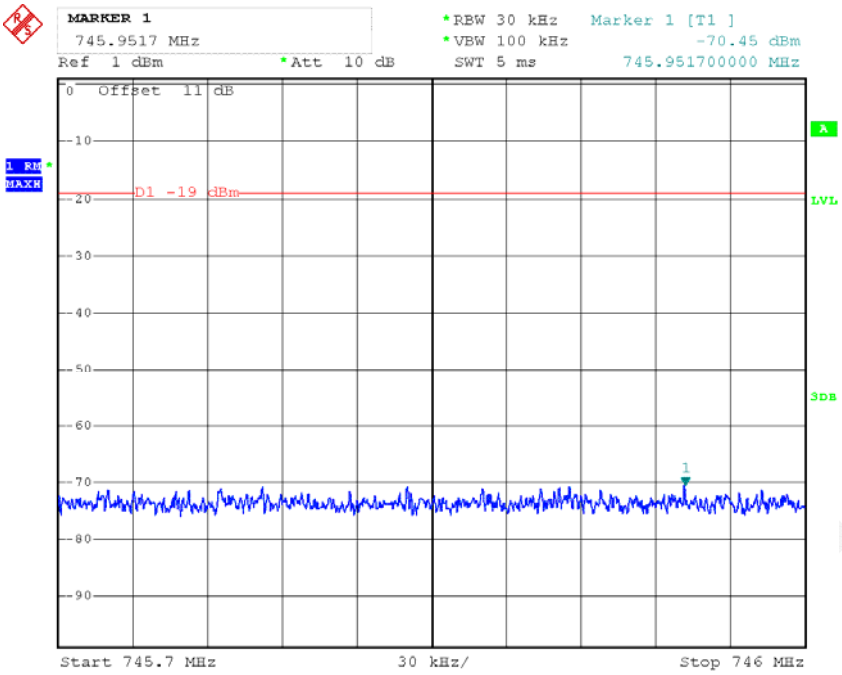
Upper 700 LTE Left Side 748.5MHz Pre-AGC



Upper 700 LTE Left Side 748.5MHz Above AGC



Upper 700 CDMA Left Side 744.75MHz Pre-AGC



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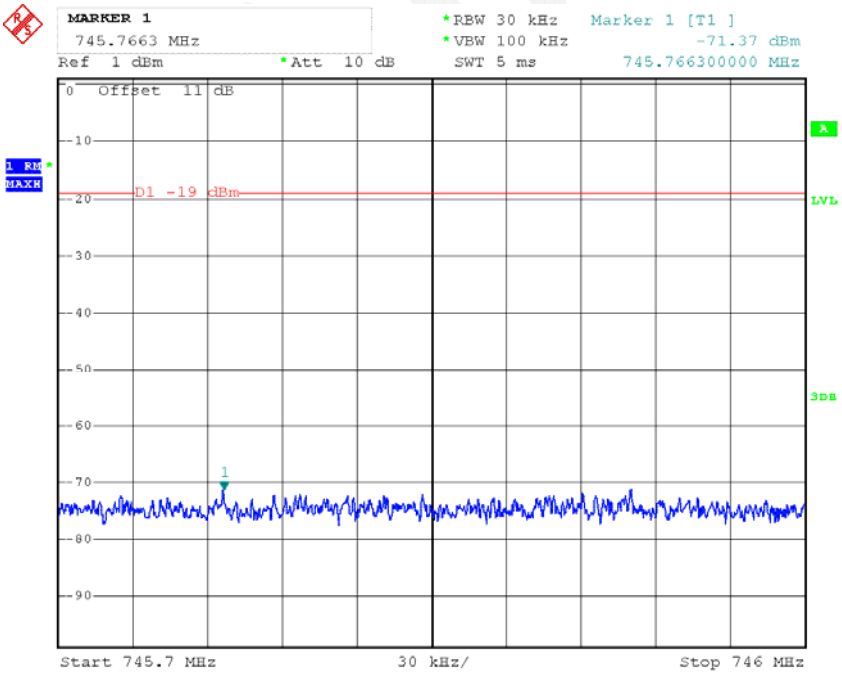
Upper 700 CDMA Left Side 744.75MHz Above AGC



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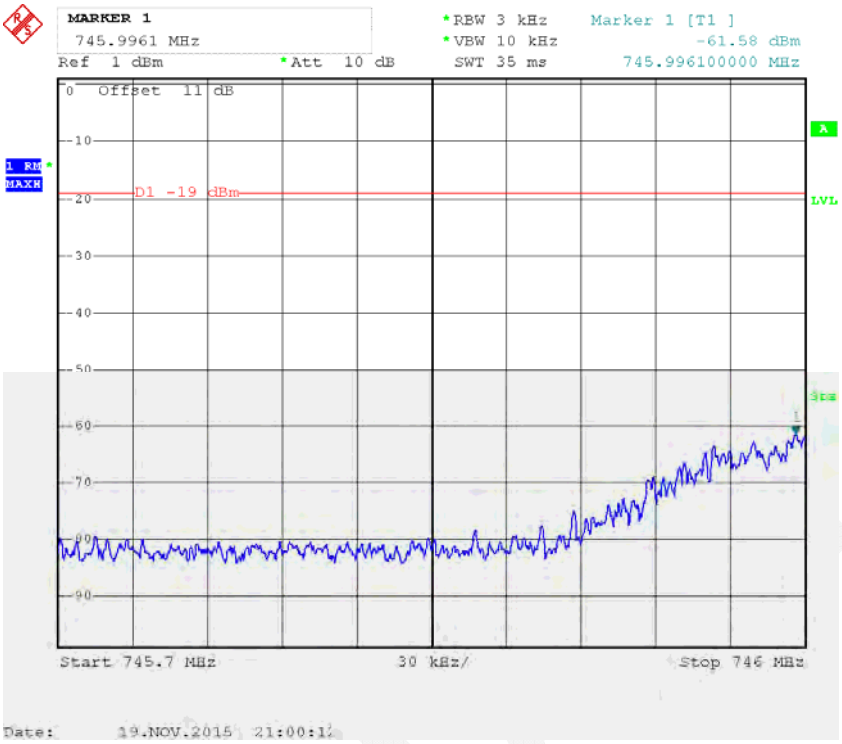
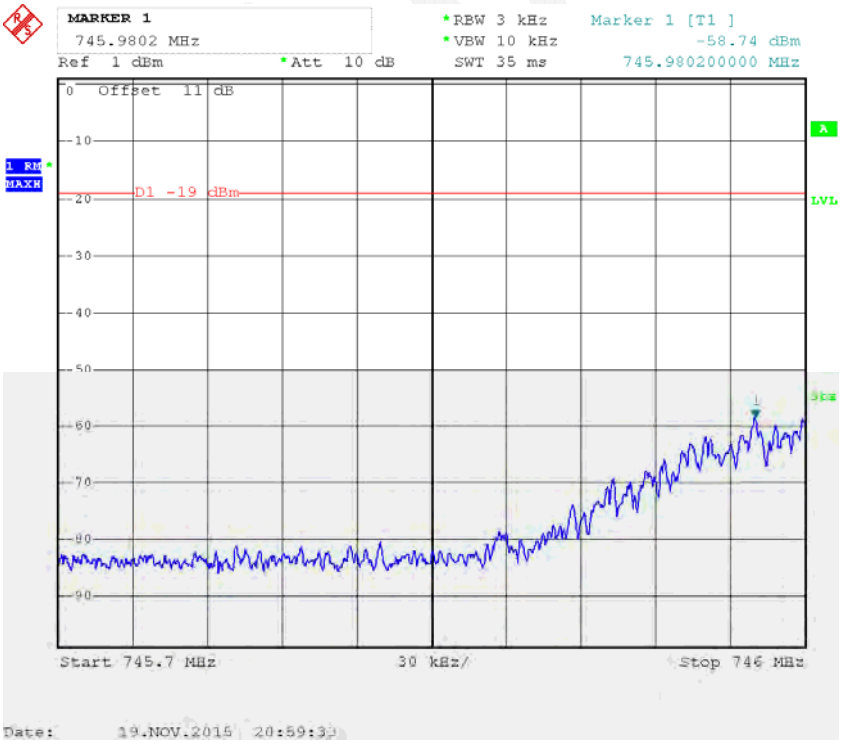
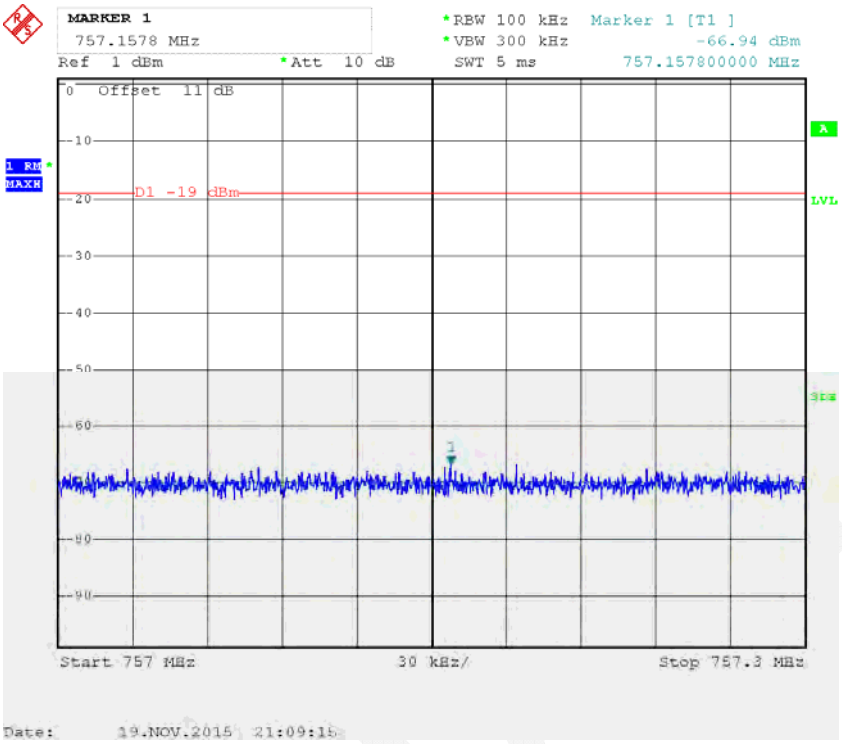
Upper 700 GSM Left Side 745.8MHz Pre-AGC



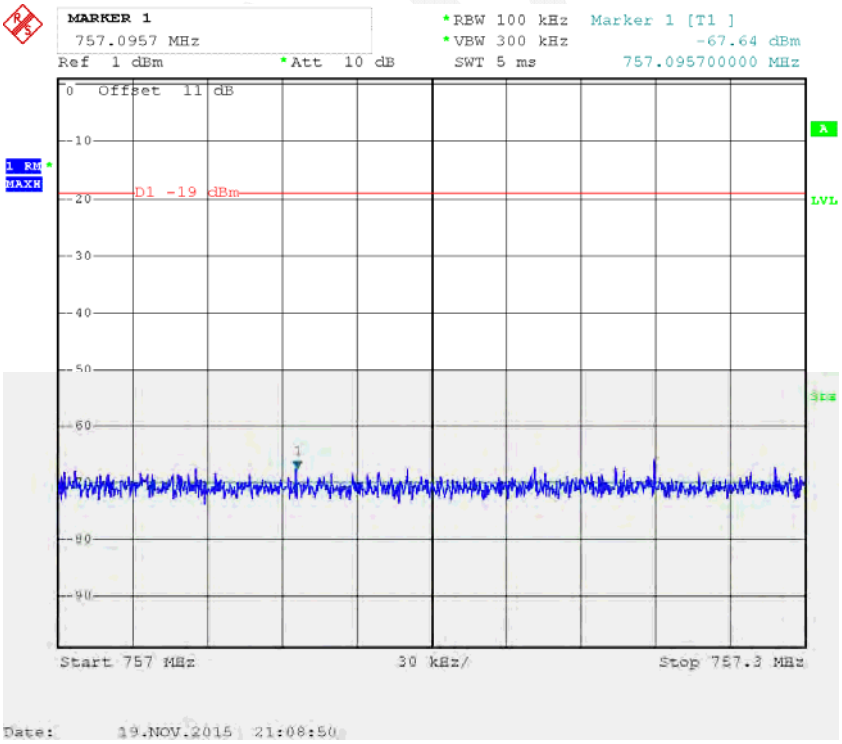
Upper 700 GSM Left Side 745.8MHz Above AGC



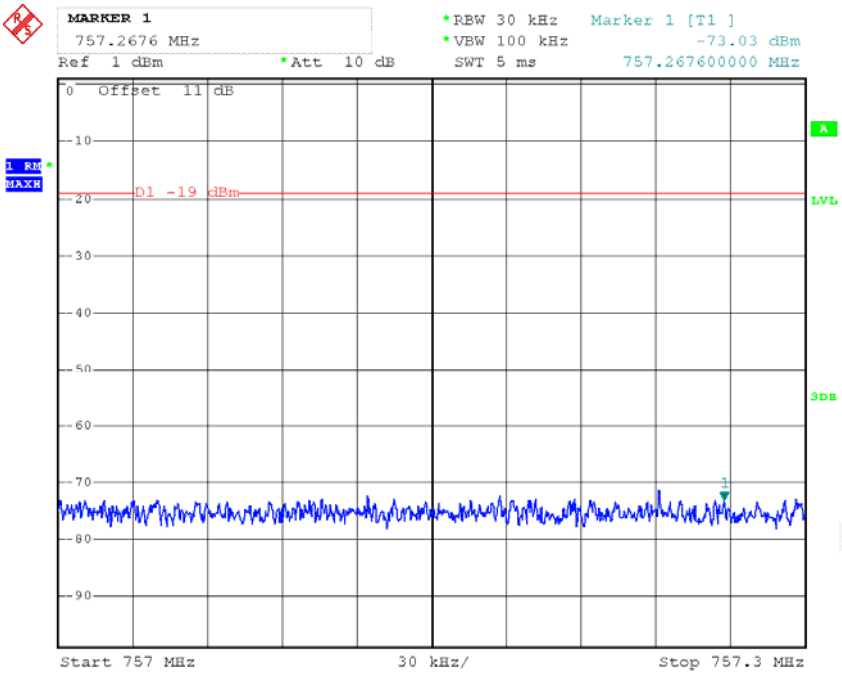
Upper 700 LTE Right Side 754.5MHz Pre-AGC



Upper 700 LTE Right Side 754.5MHz Above AGC



Upper 700 CDMA Right Side755.75MHz Pre-AGC



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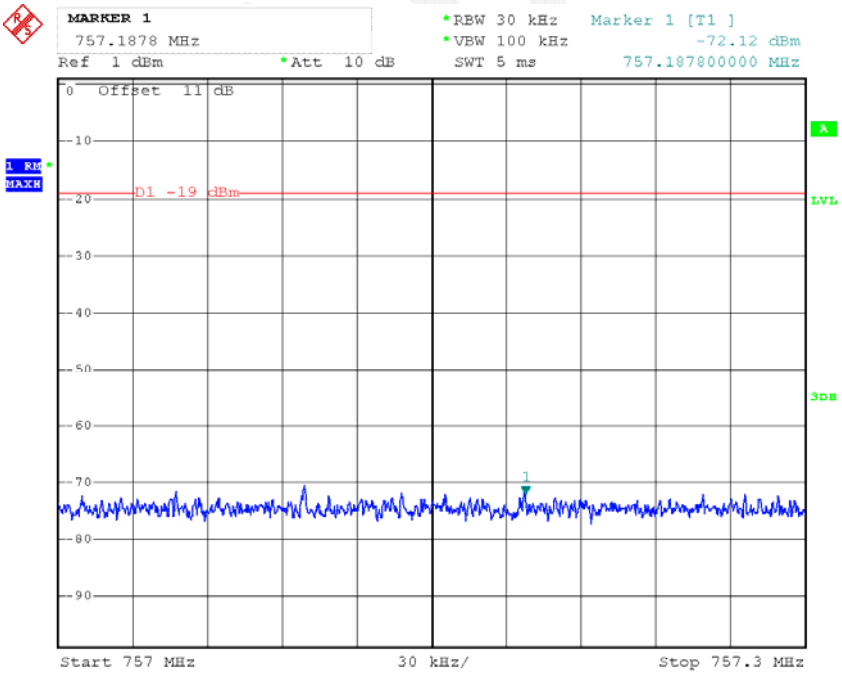
Upper 700 CDMA Right Side755.75MHz Above AGC



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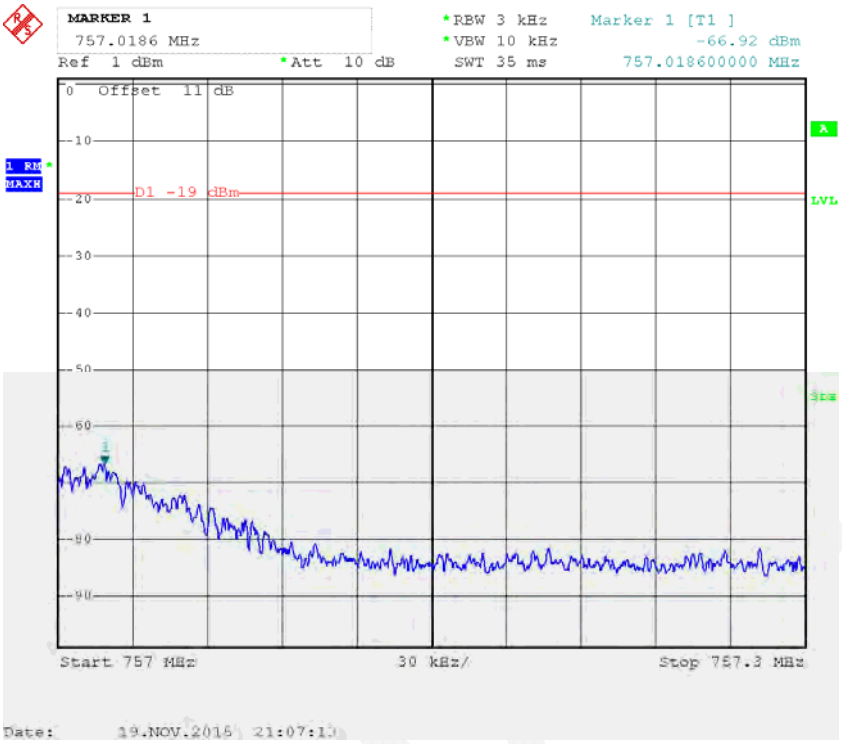
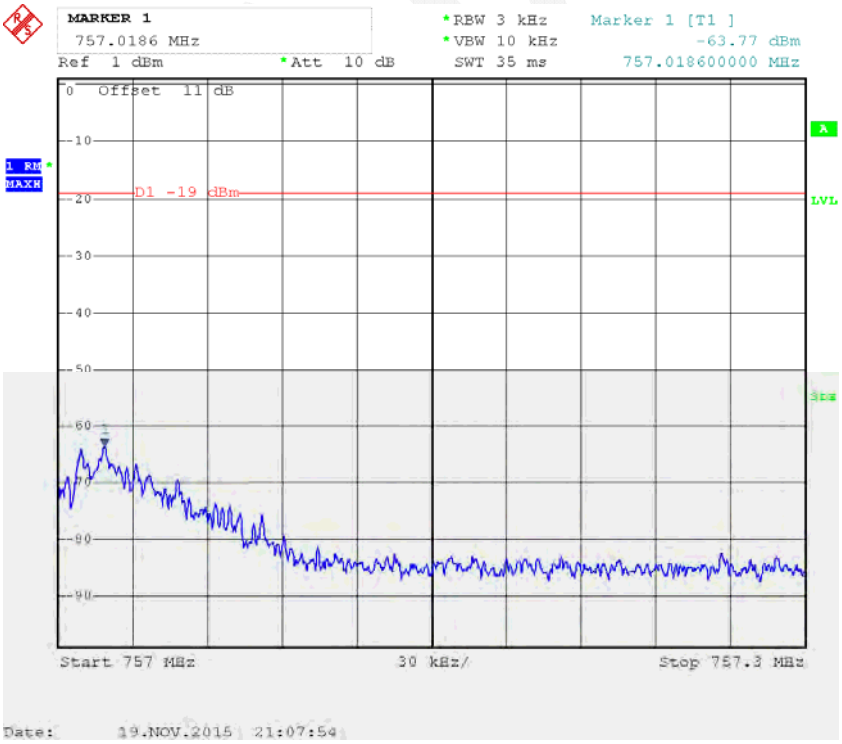
Upper 700 GSM Right Side 756.8MHz Pre-AGC

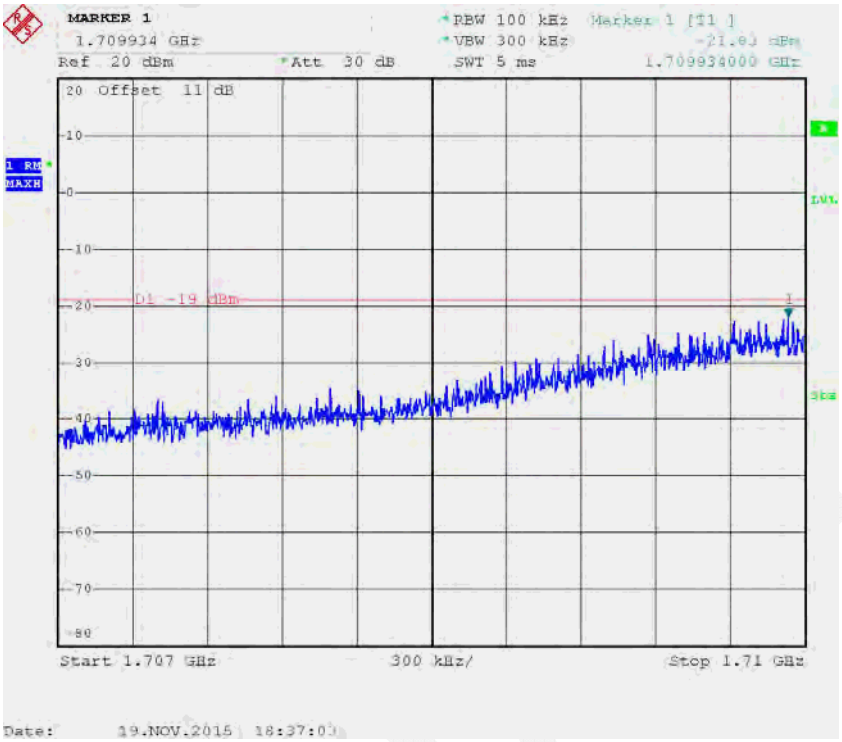


Upper 700 GSM Right Side 756.8MHz Above AGC



Uplink

AWS Band LTE Left Side 1712.5MHz Pre-AGC



AWS Band LTE Left Side 1712.5MHz Above AGC