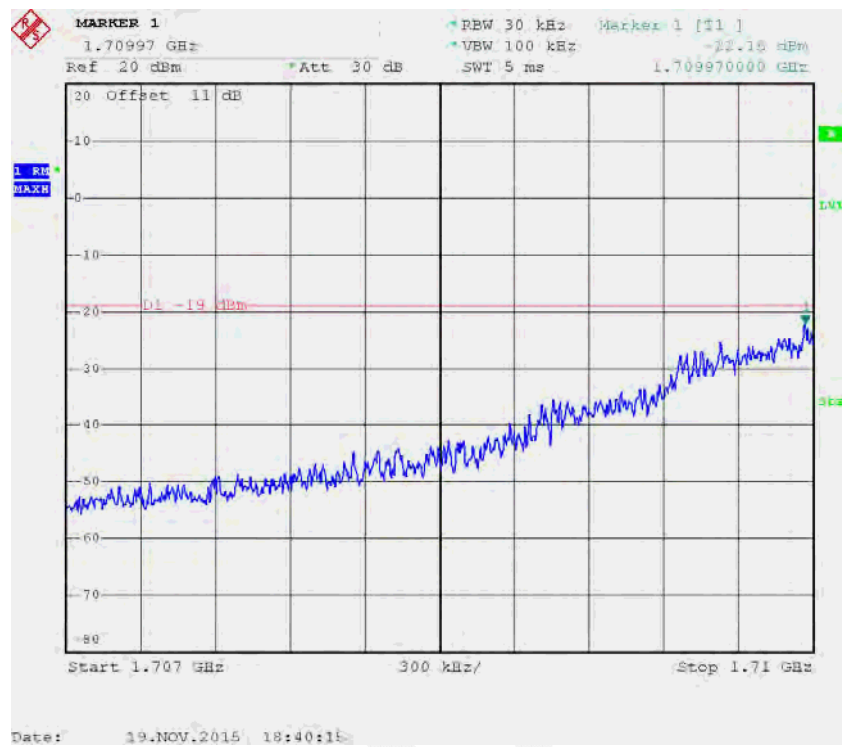
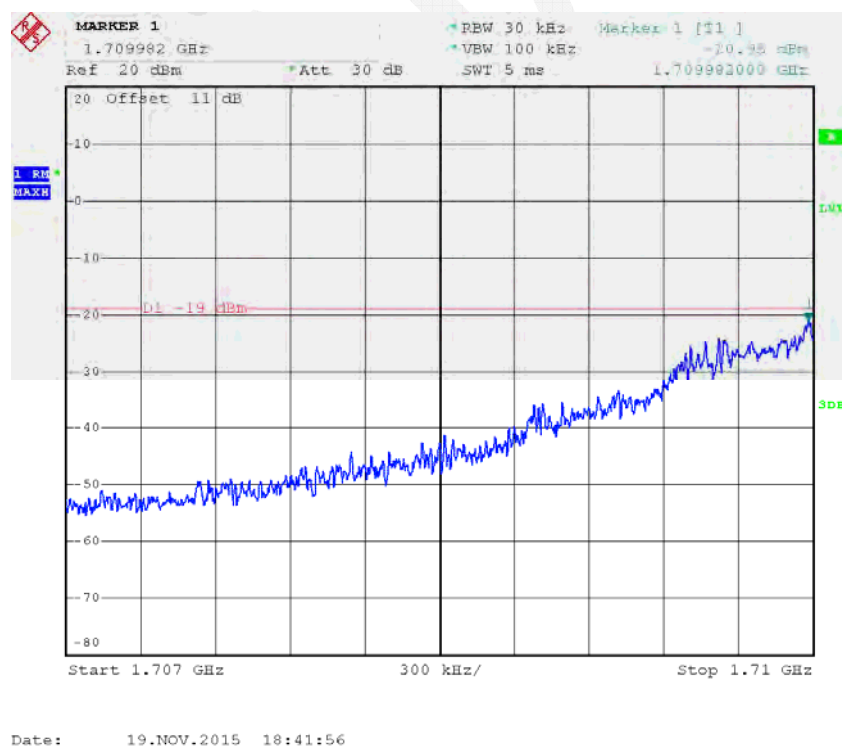


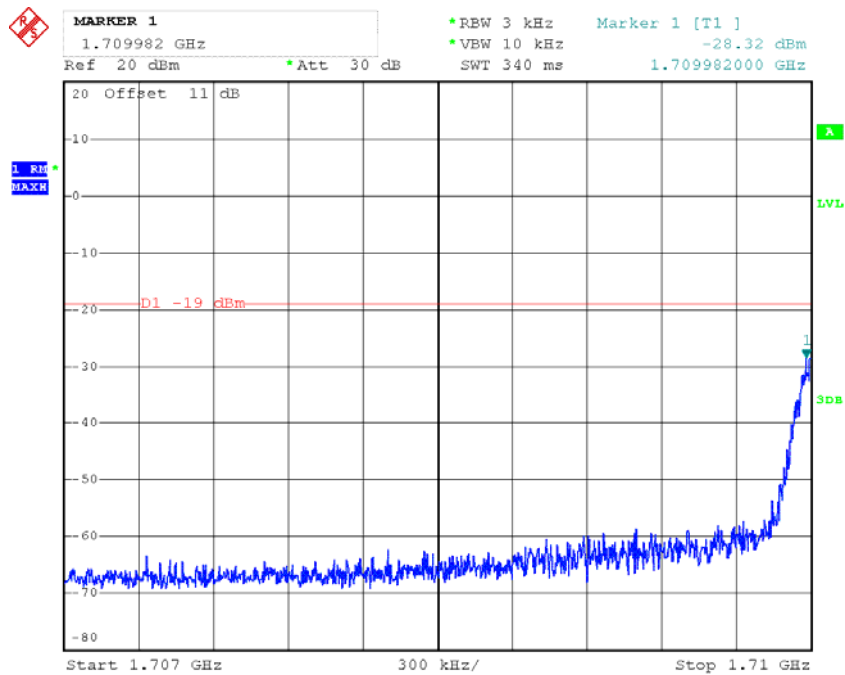
AWS Band CDMA Left Side 1711.25MHz Pre-AGC



AWS Band CDMA Left Side 1711.25MHz Above AGC

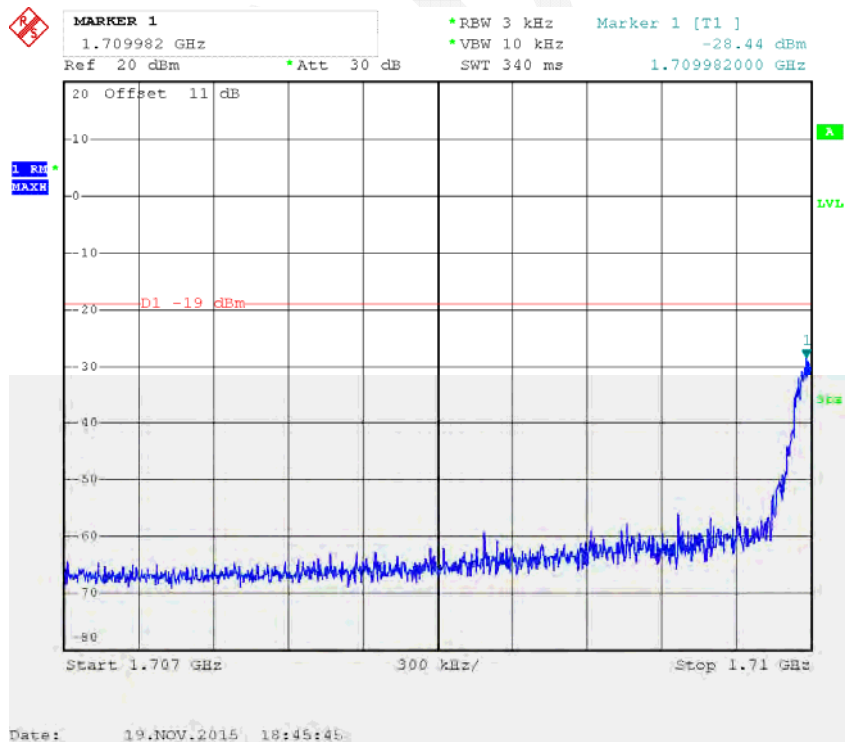


AWS Band CDMA Left Side 1710.2MHz Pre-AGC

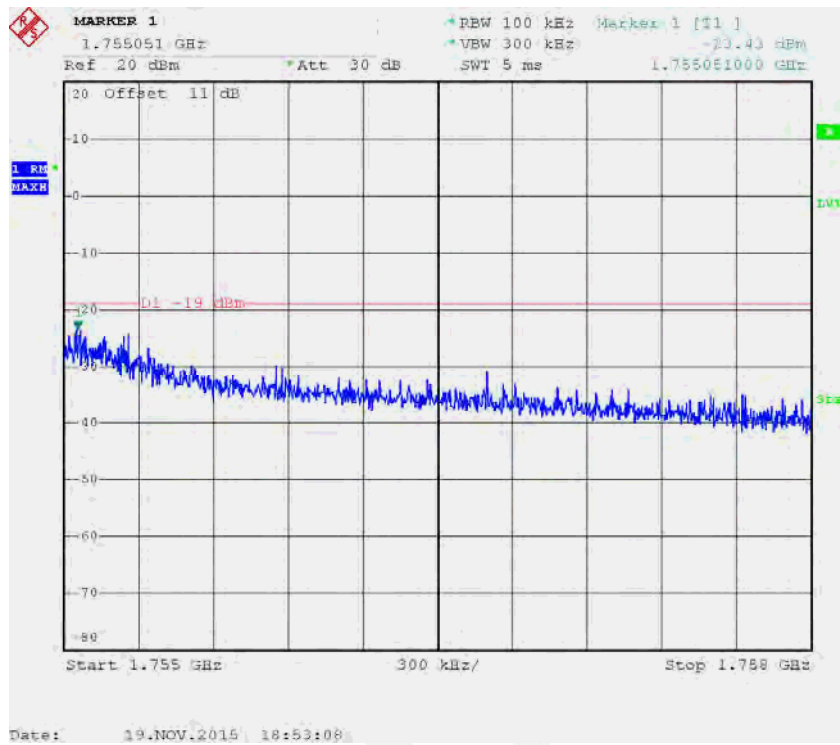


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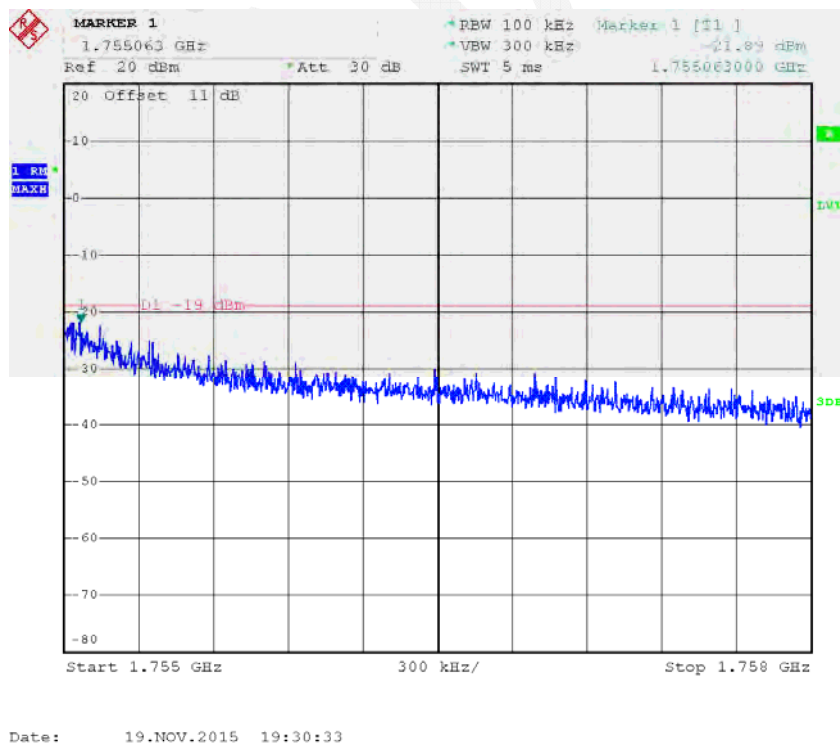
AWS Band CDMA Left Side 1710.2MHz Above AGC



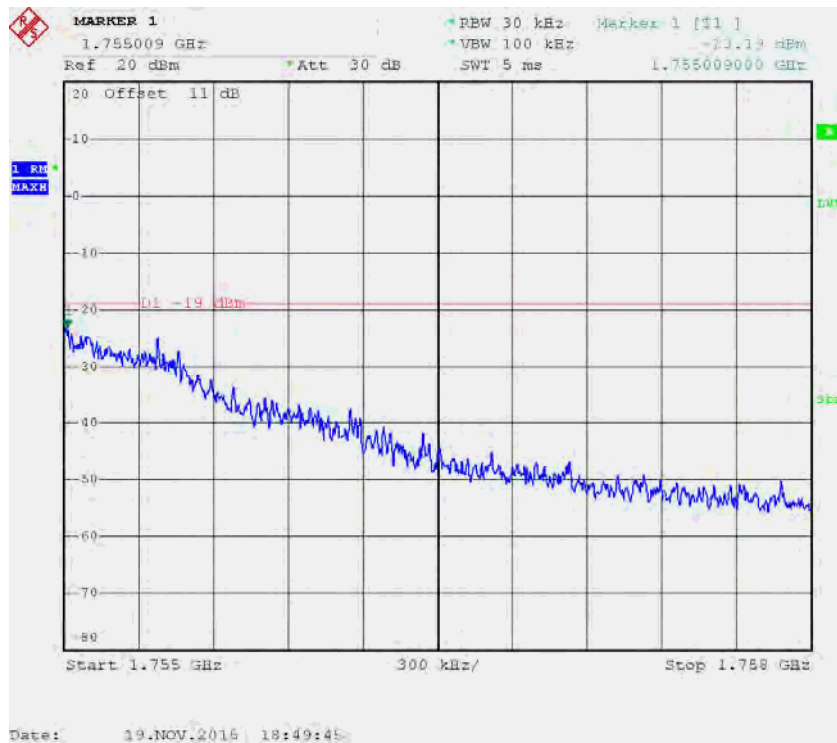
AWS Band LTE Right Side 1752.5MHz Pre-AGC



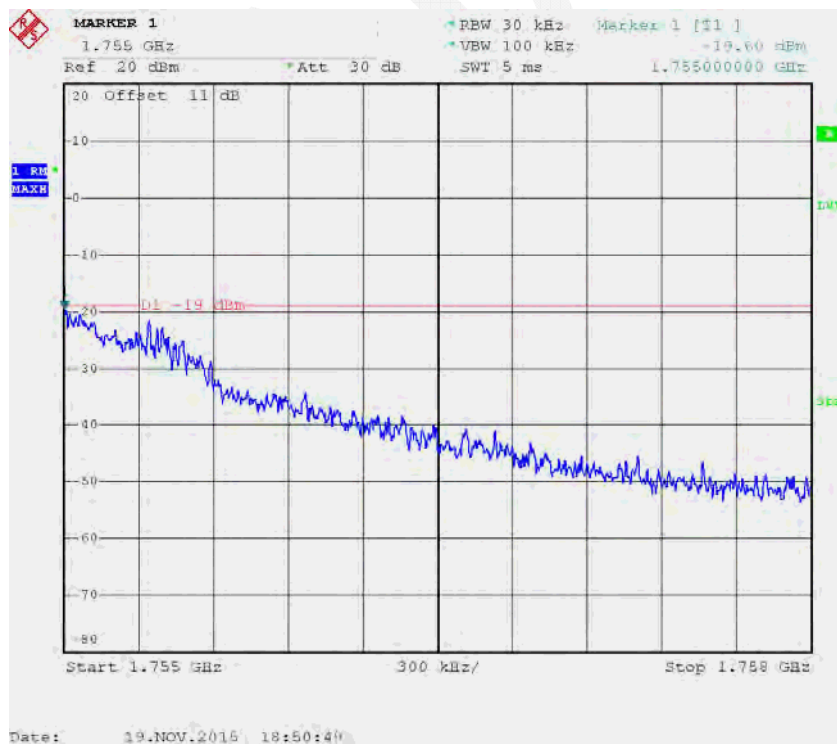
AWS Band LTE Right Side 1752.5MHz Above AGC



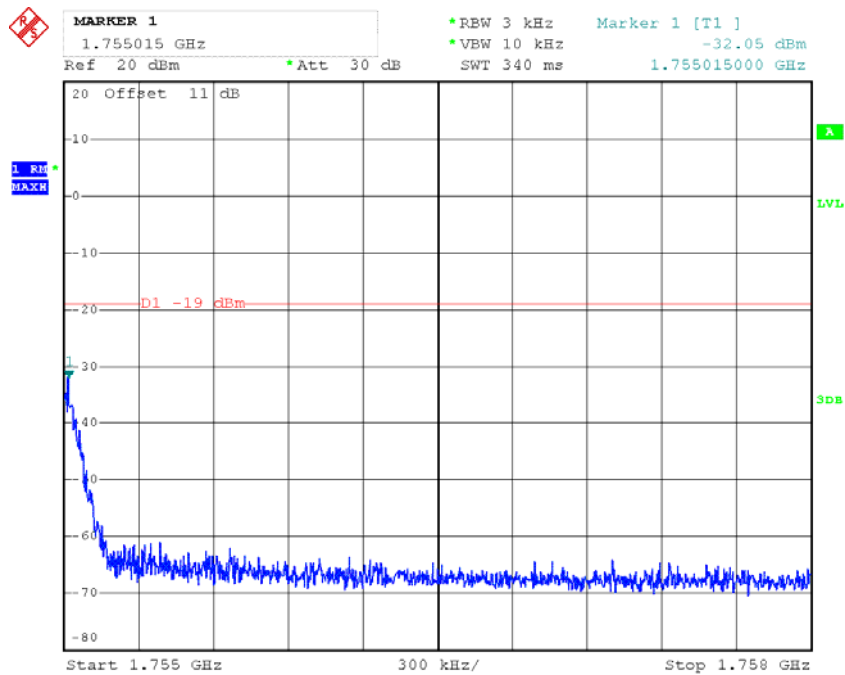
AWS Band CDMA Right Side 1753.75MHz Pre-AGC



AWS Band CDMA Right Side 1753.75MHz Above AGC

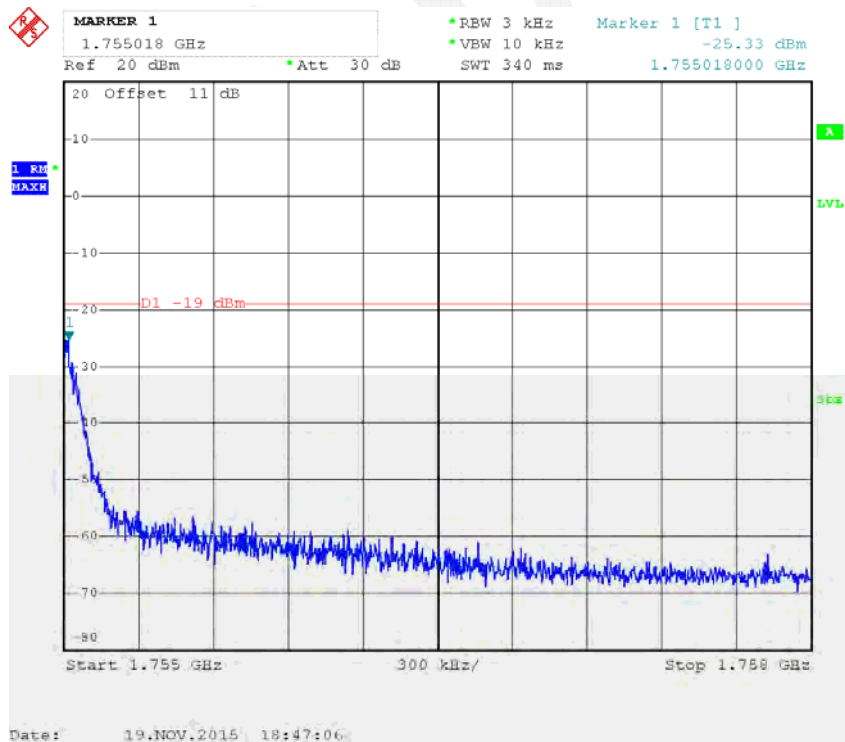


AWS Band GSM Right Side 1754.8MHz Pre-AGC

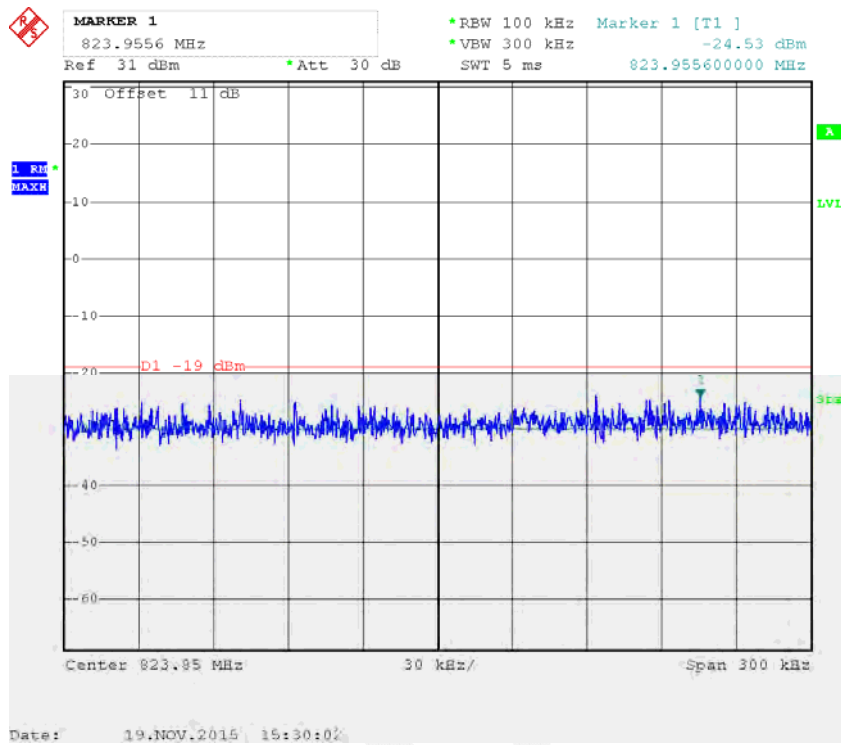


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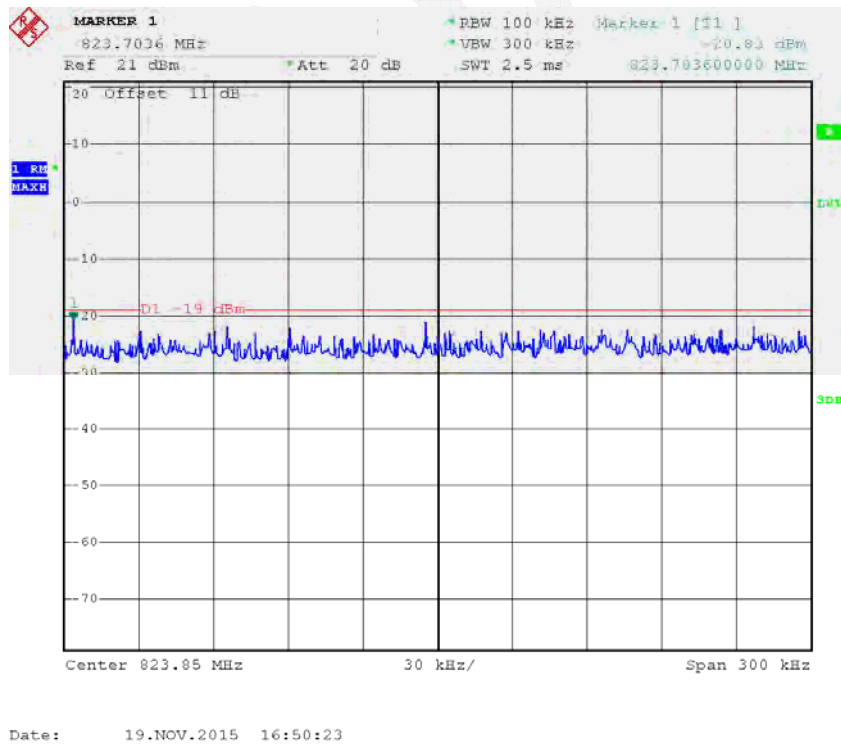
AWS Band GSM Right Side 1754.8MHz Above AGC



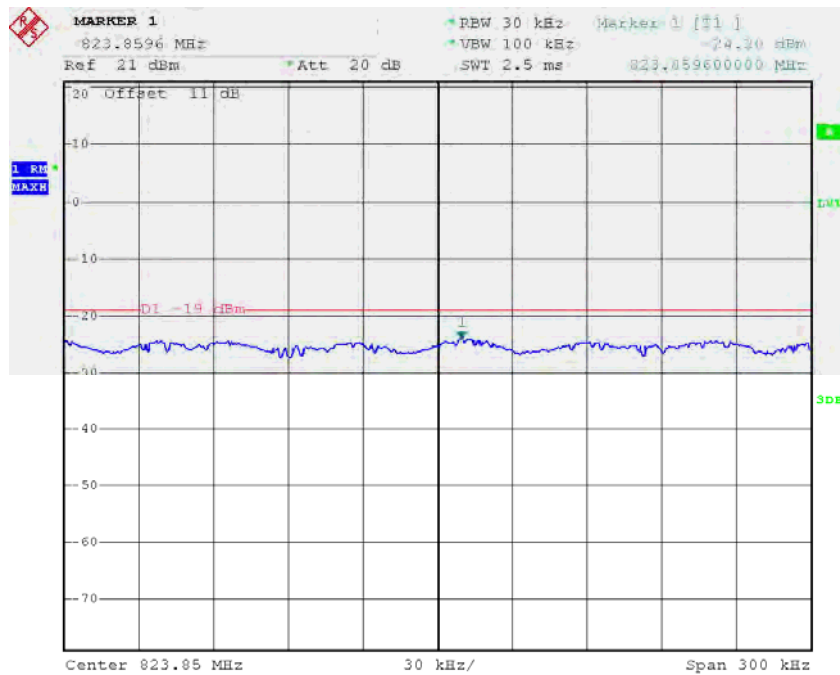
Cellular Band LTE Left Side 826.5MHz Pre-AGC



Cellular Band LTE Left Side 826.5MHz Above AGC

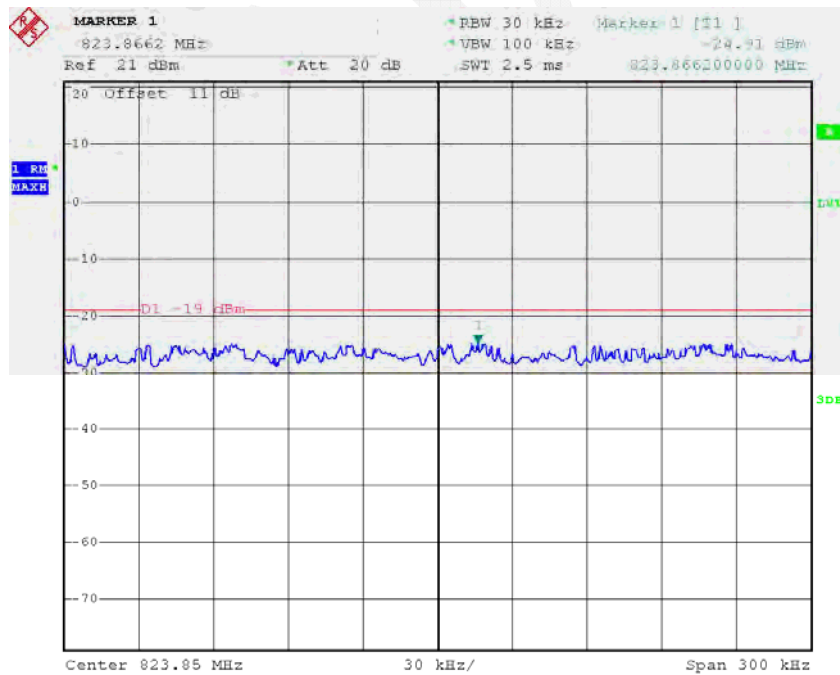


Cellular Band CDMA Left Side 824.88MHz Pre-AGC



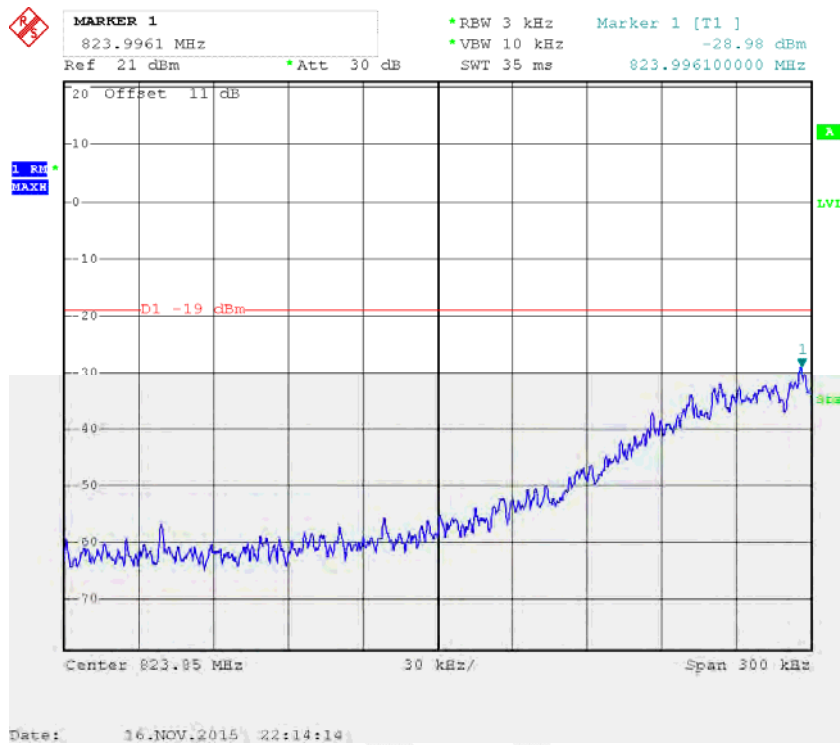
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Cellular Band CDMA Left Side 824.88MHz Above AGC

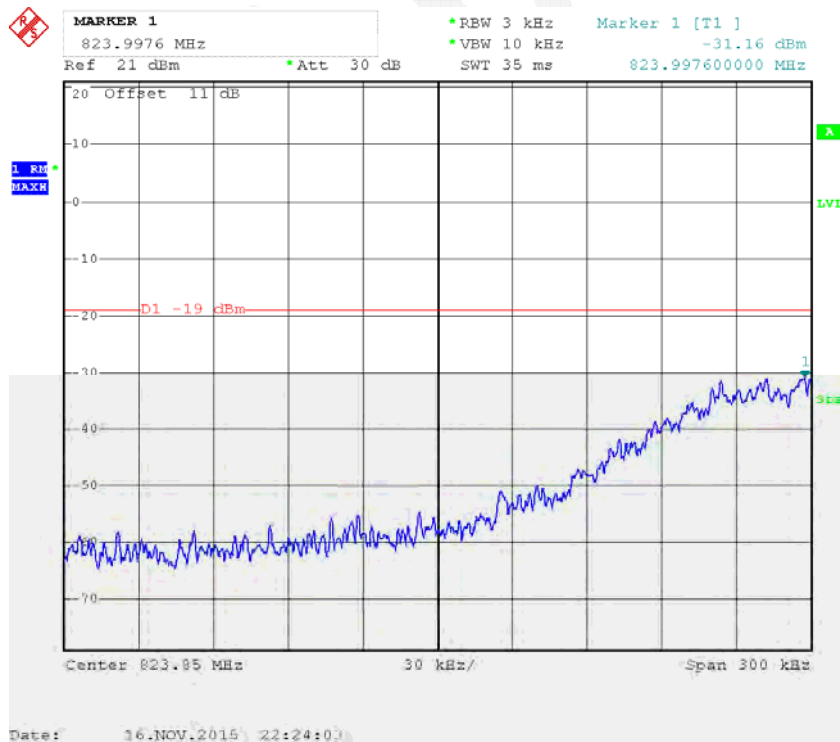


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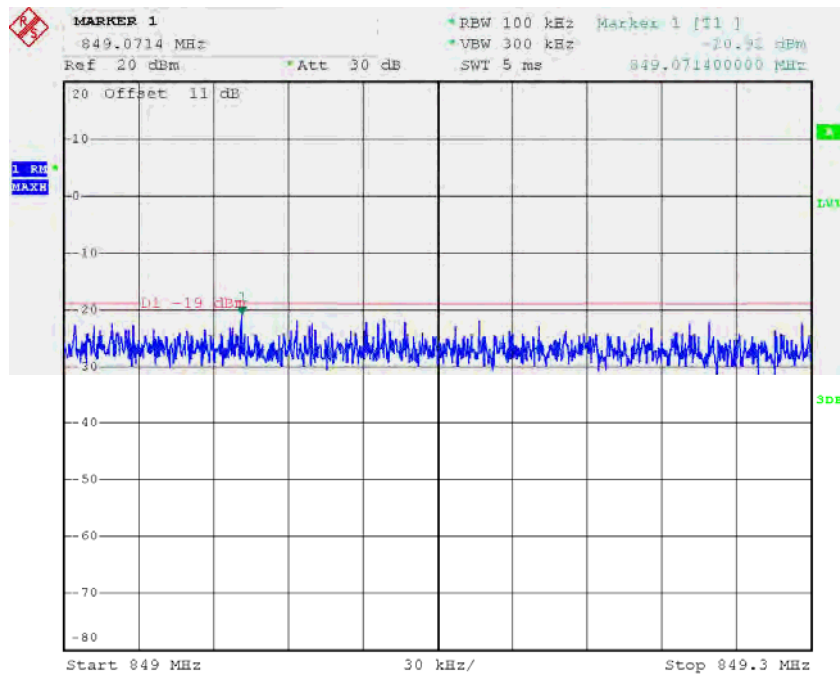
Cellular Band GSM Left Side 824.2MHz Pre-AGC



Cellular Band GSM Left Side 824.2MHz Above AGC

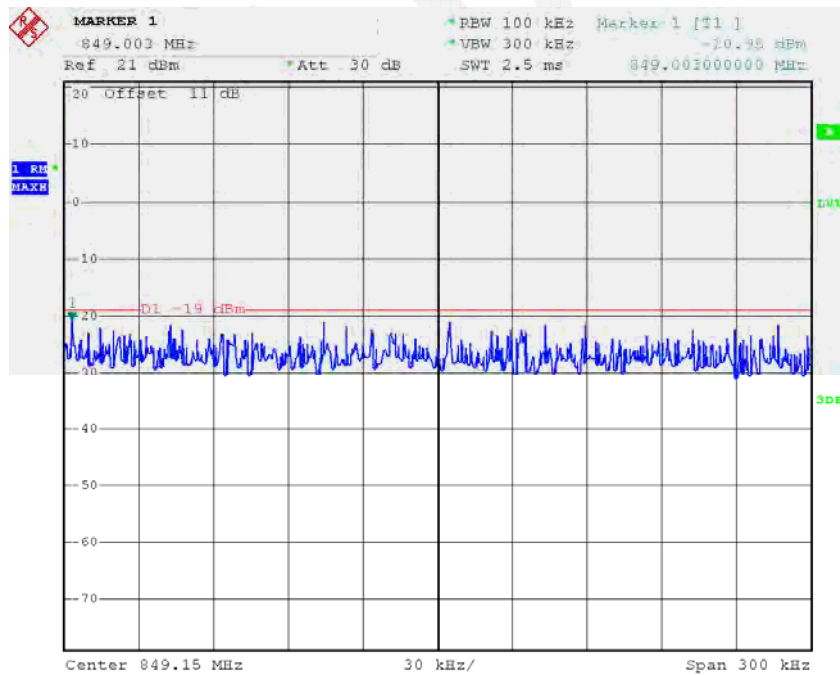


Cellular Band LTE Left Side 826.5MHz Pre-AGC



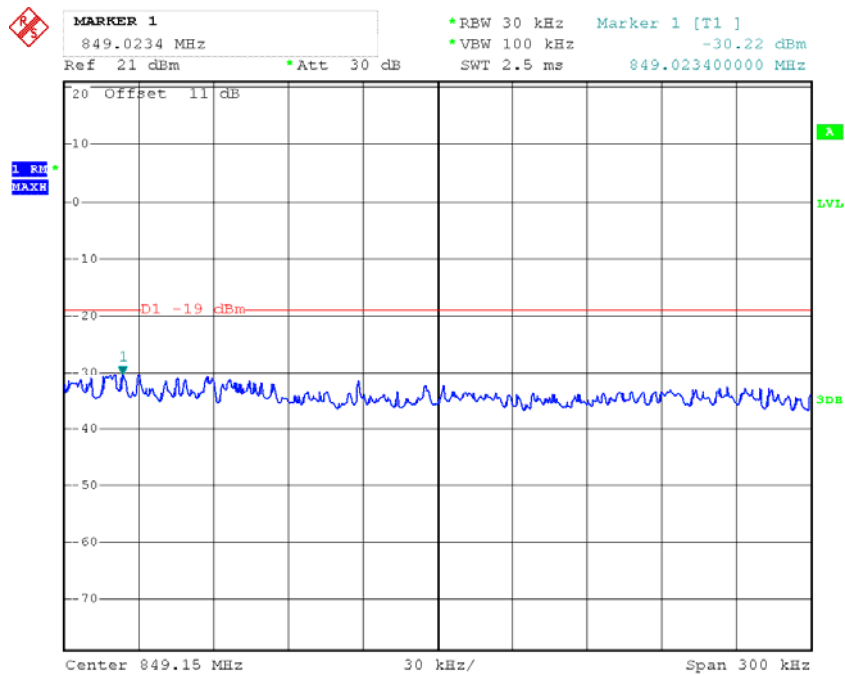
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Cellular Band LTE Left Side 826.5MHz Above AGC



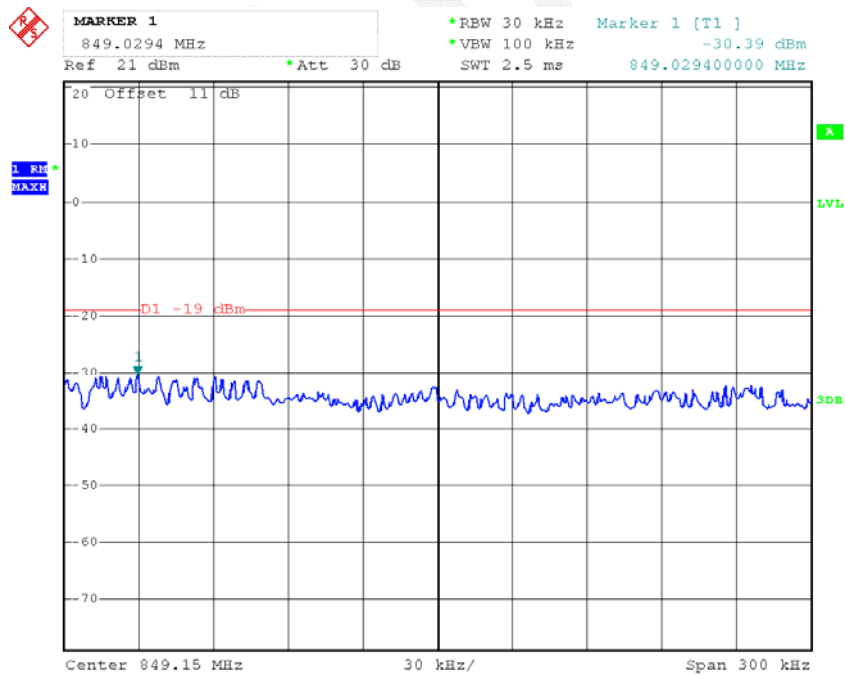
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Cellular Band CDMA Right Side 848.10MHz Pre-AGC



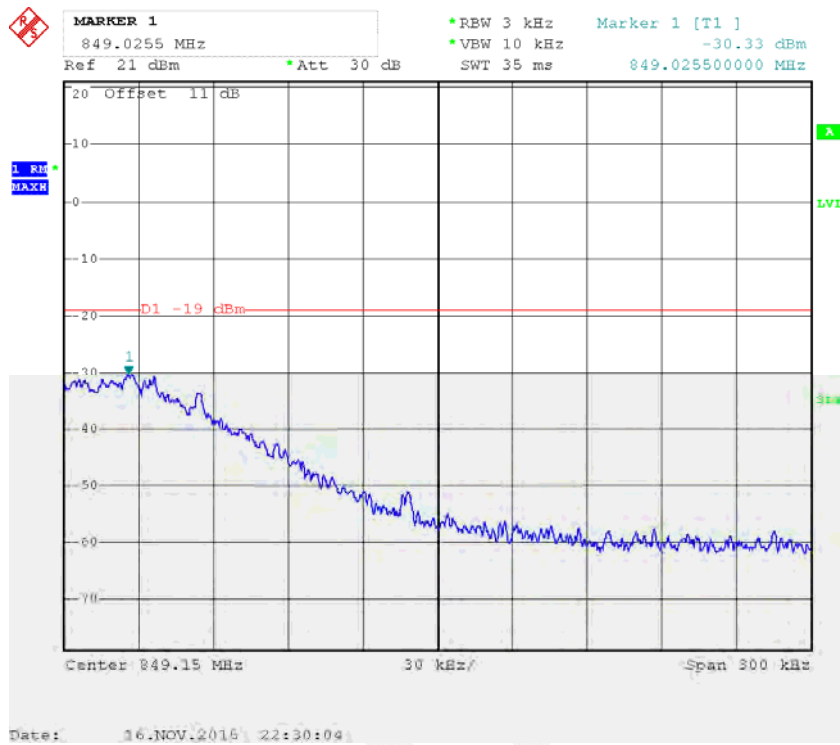
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Cellular Band CDMA Right Side 848.10MHz Above AGC

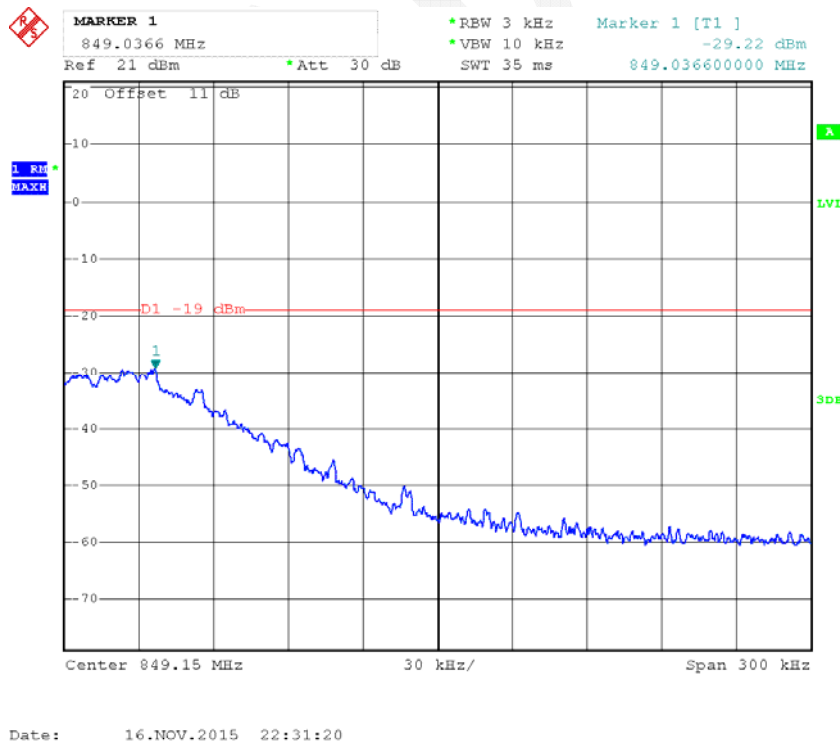


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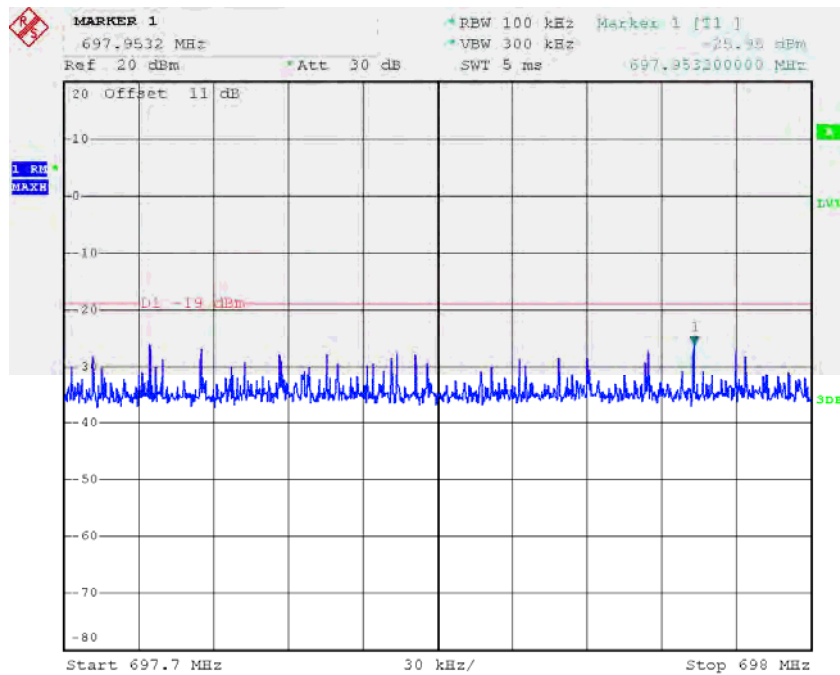
Cellular Band GSM Right Side 848.8MHz Pre-AGC



Cellular Band GSM Right Side 848.8MHz Above AGC

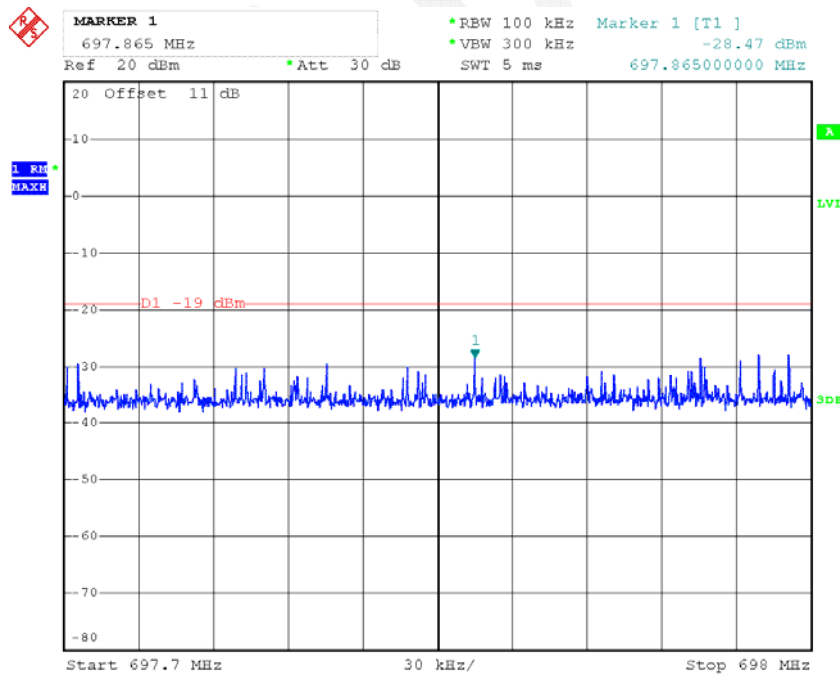


Lower 700 LTE Left Side 670.5MHz Pre-AGC



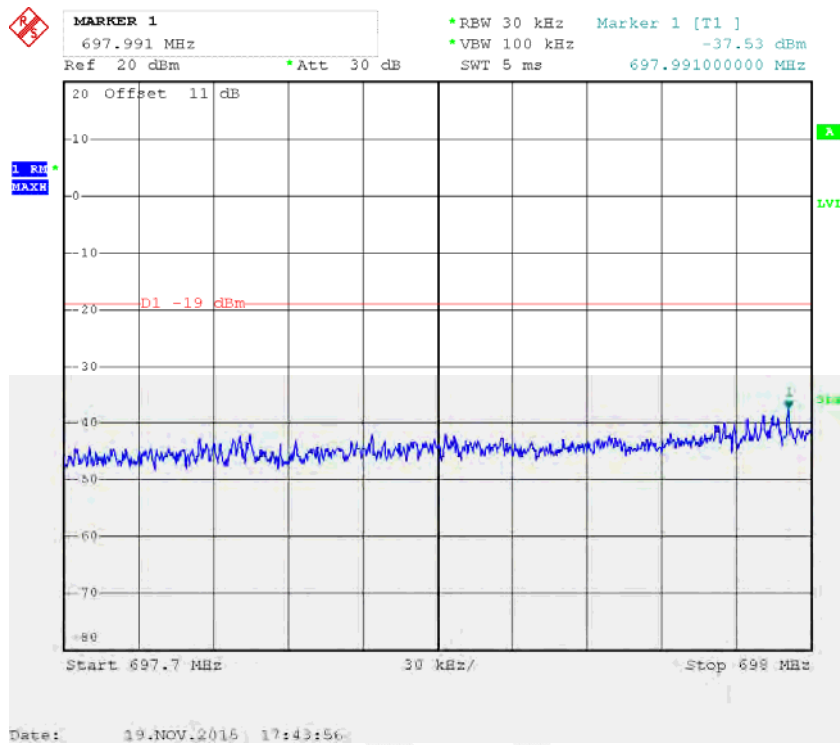
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Lower 700 LTE Left Side 670.5MHz Above AGC

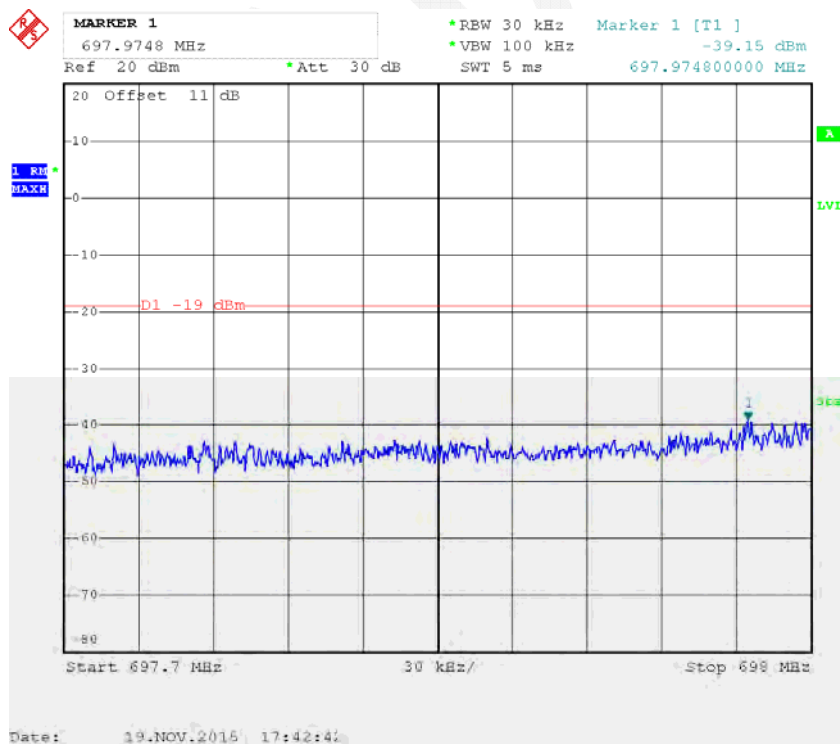


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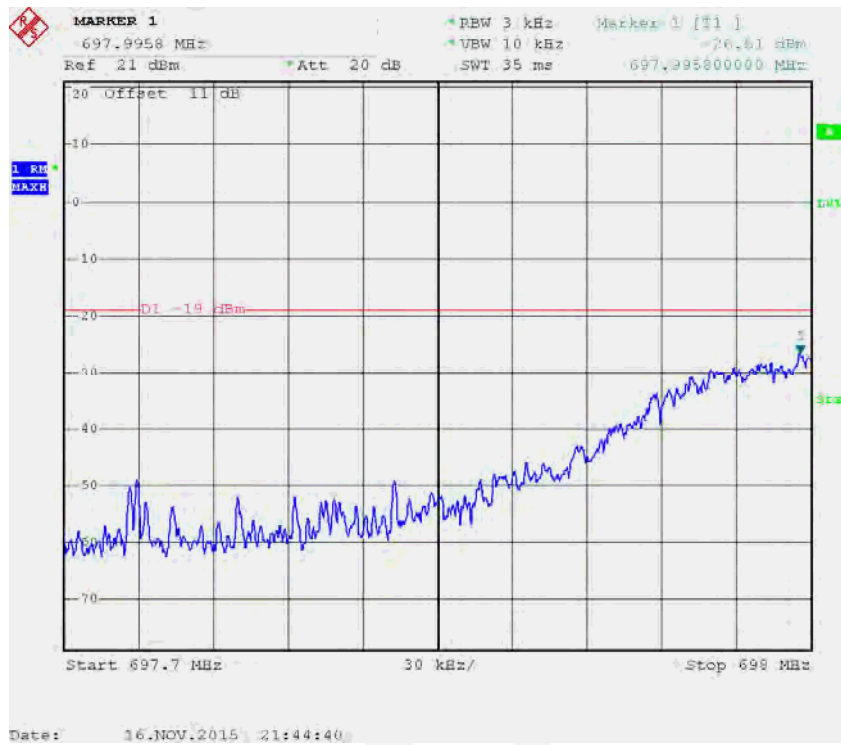
Lower 700 CDMA Left Side 699.25MHz Pre-AGC



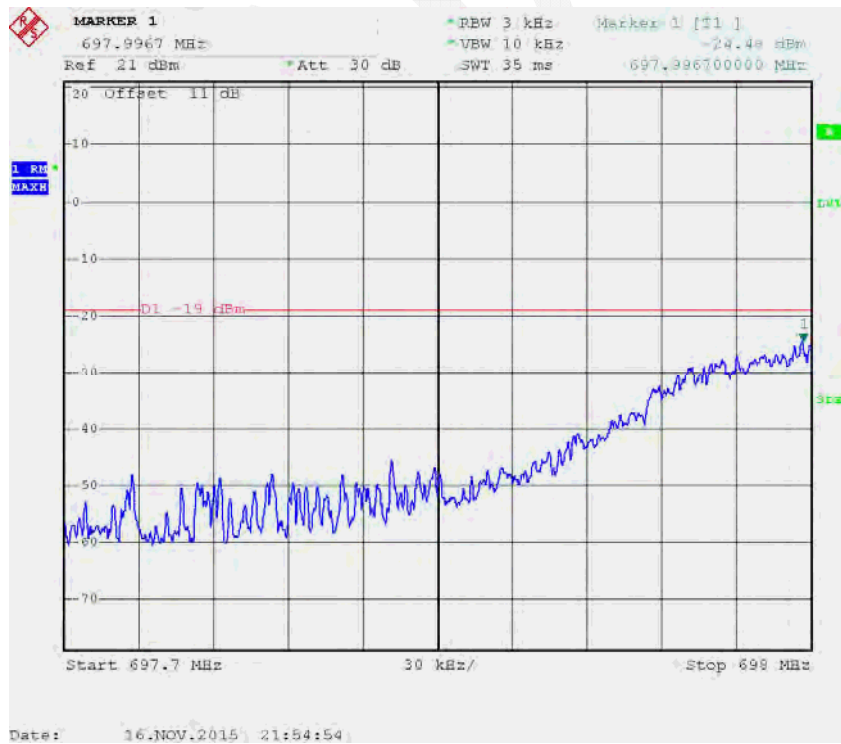
Lower 700 CDMA Left Side 699.25MHz Above AGC



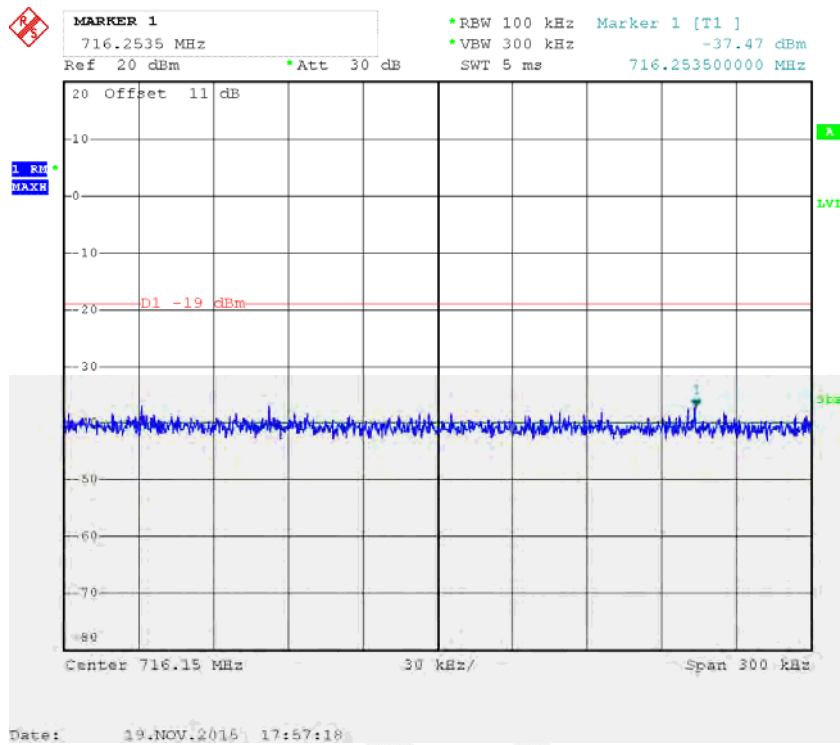
Lower 700 GSM Left Side 698.2MHz Pre-AGC



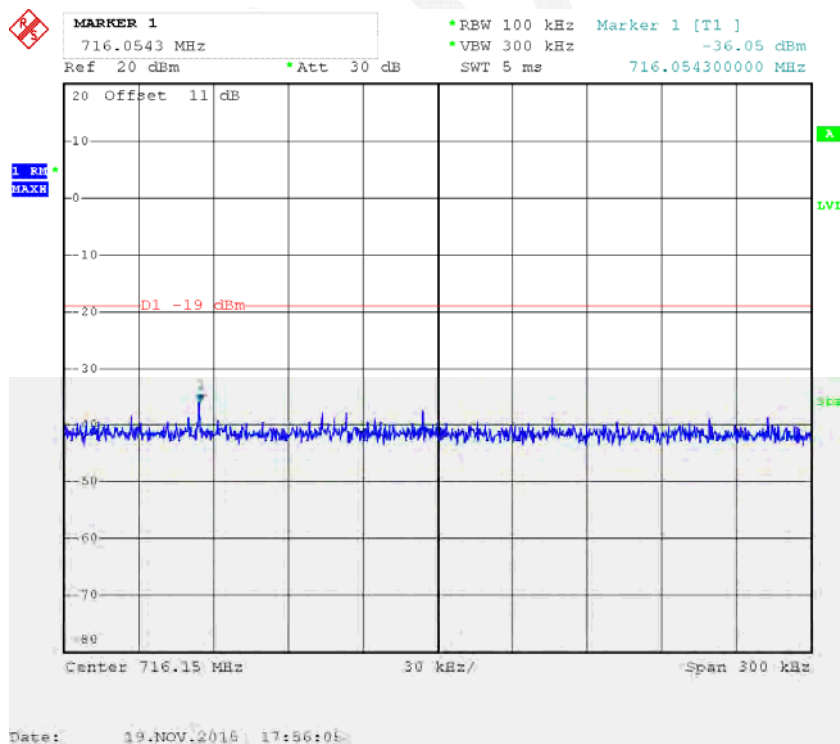
Lower 700 GSM Left Side 698.2MHz Above AGC



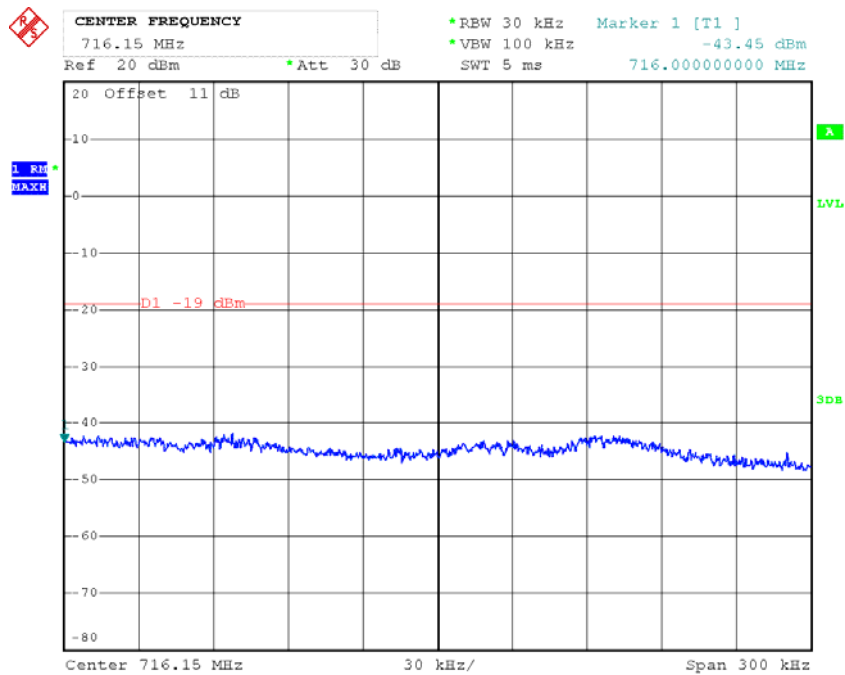
Lower 700 LTE Left Side 718.5MHz Pre-AGC



Lower 700 LTE Left Side 718.5MHz Above AGC

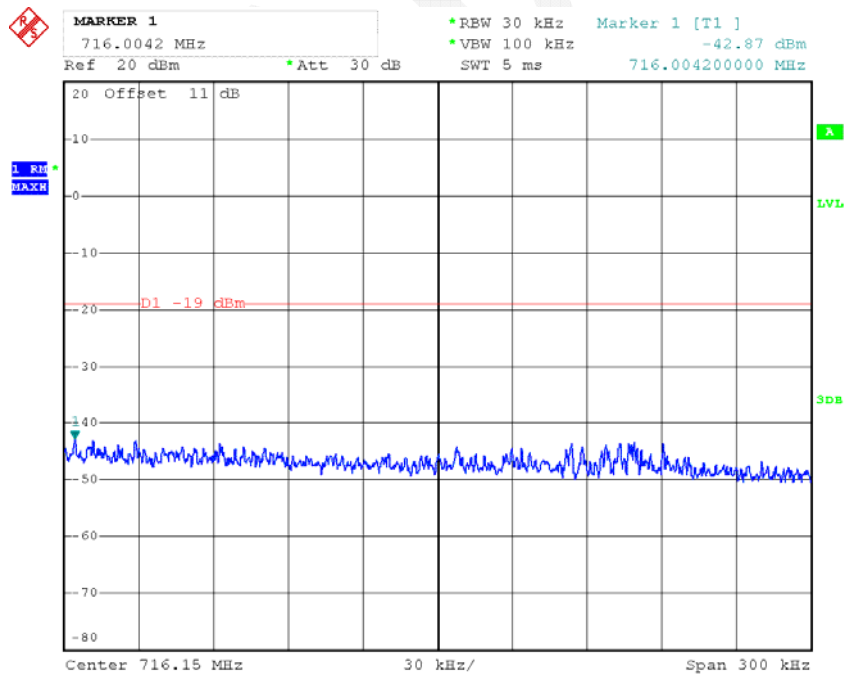


Lower 700 CDMA Left Side 717.25MHz Pre-AGC



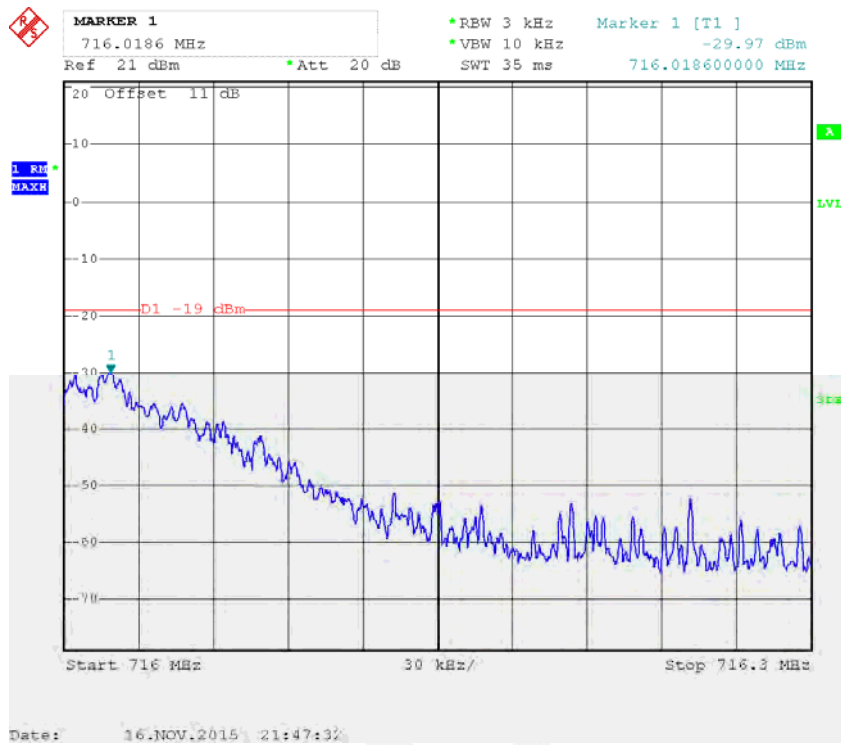
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Lower 700 CDMA Left Side 717.25MHz Above AGC

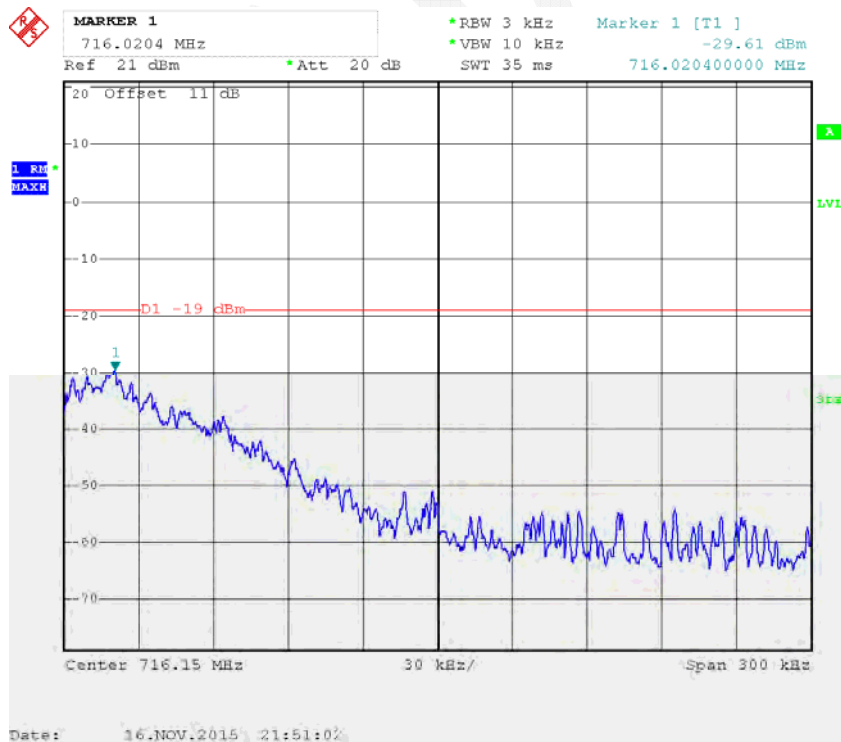


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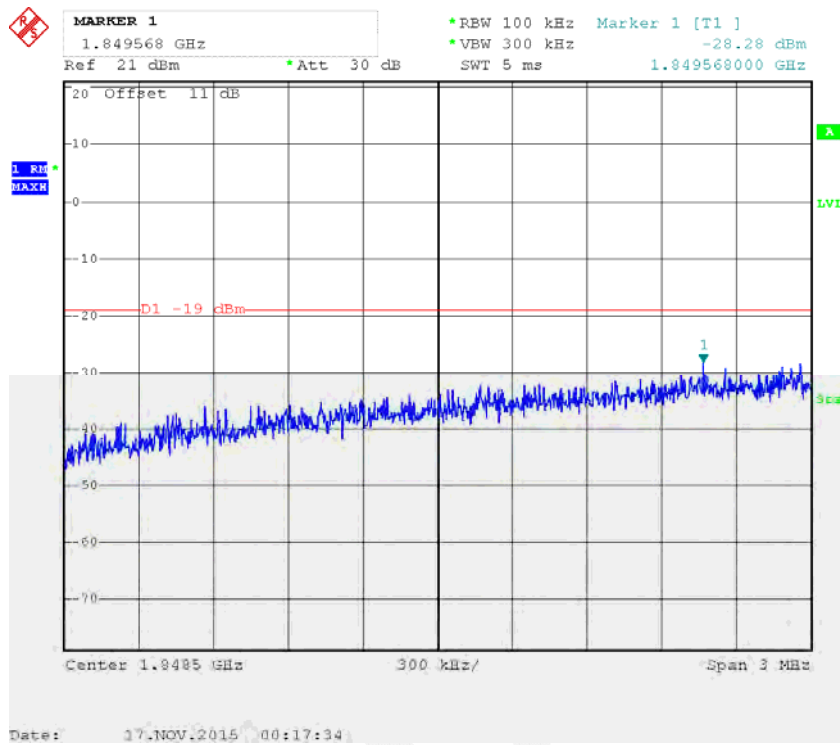
Lower 700 GSM Left Side 716.2MHz Pre-AGC



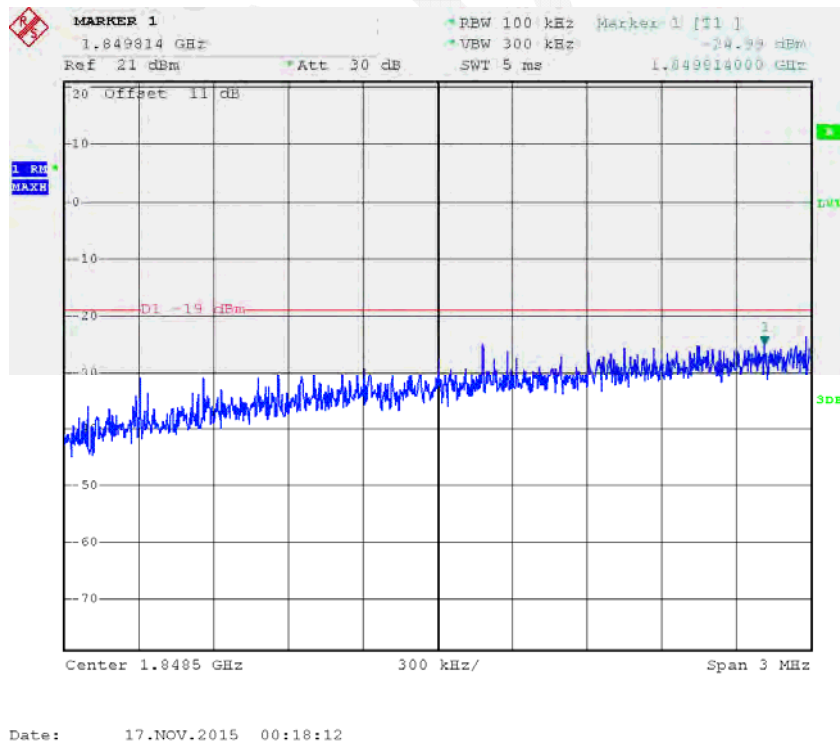
Lower 700 GSM Left Side 716.2MHz Above AGC



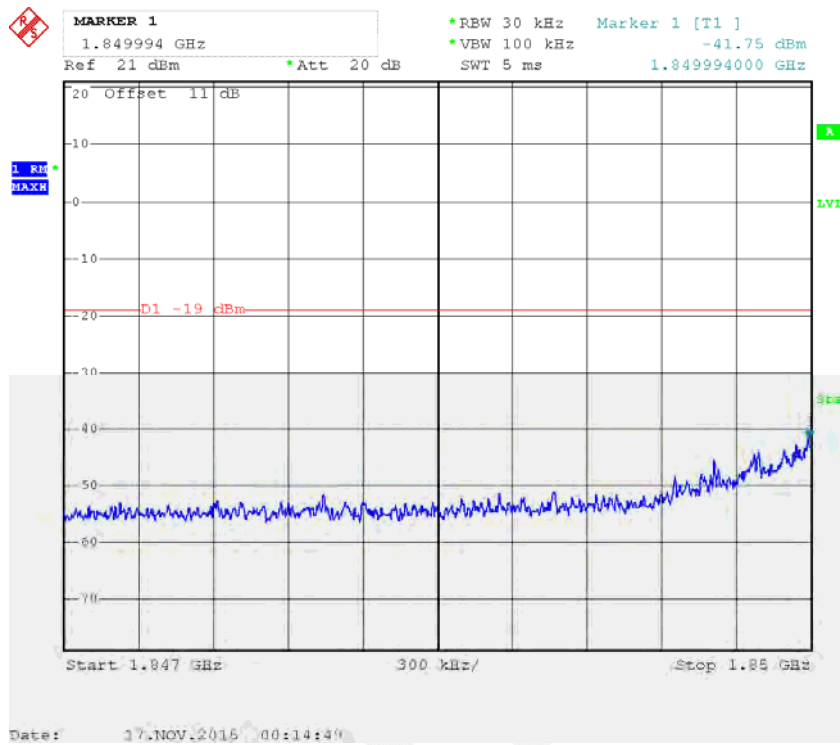
PCS Band LTE Left Side 1852.5MHz Pre-AGC



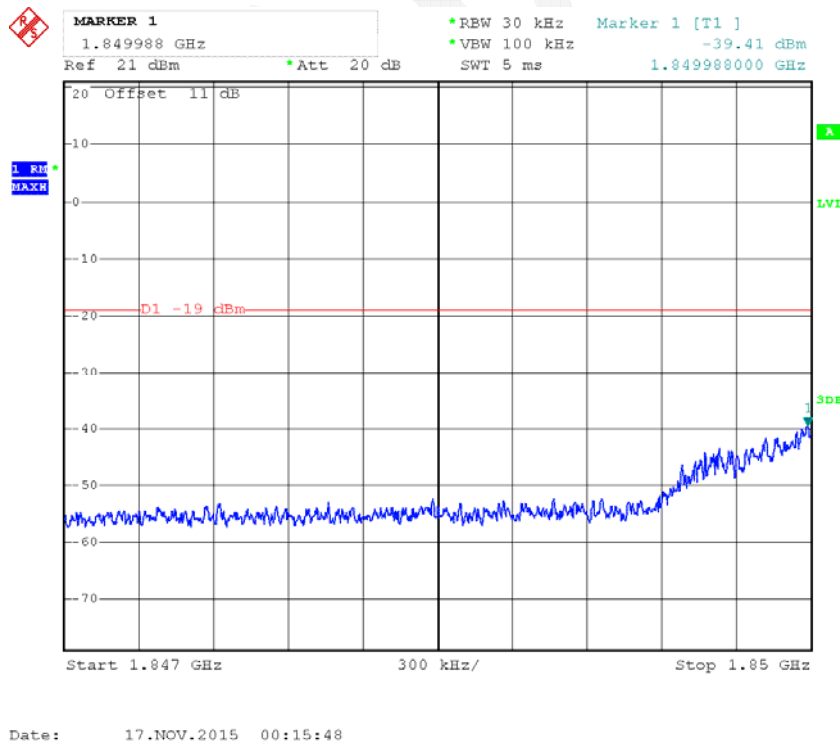
PCS Band LTE Left Side 1852.5MHz Above AGC



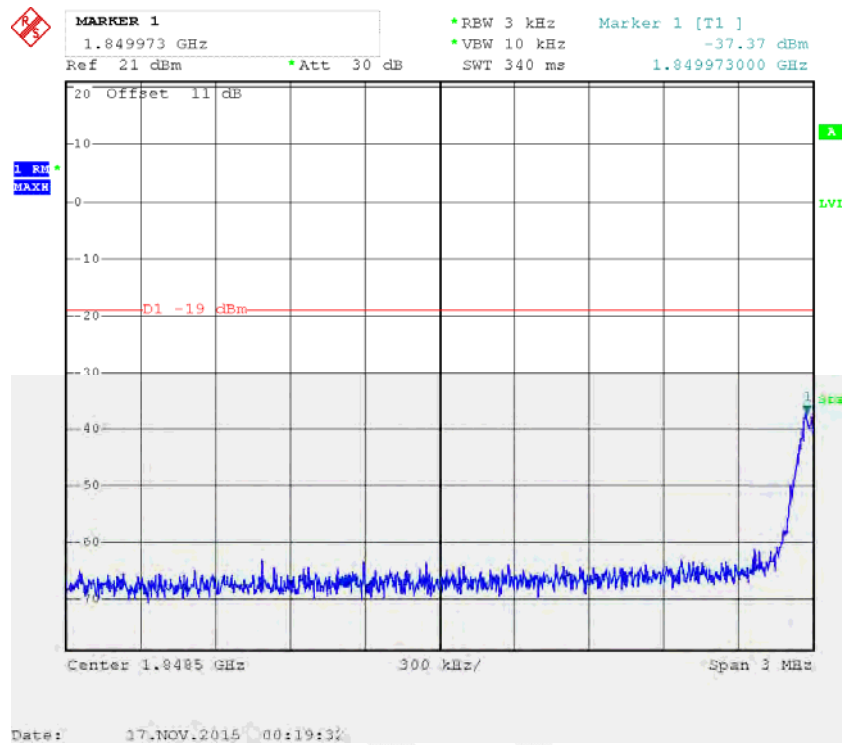
PCS Band CDMA Left Side 1851.25MHz Pre-AGC



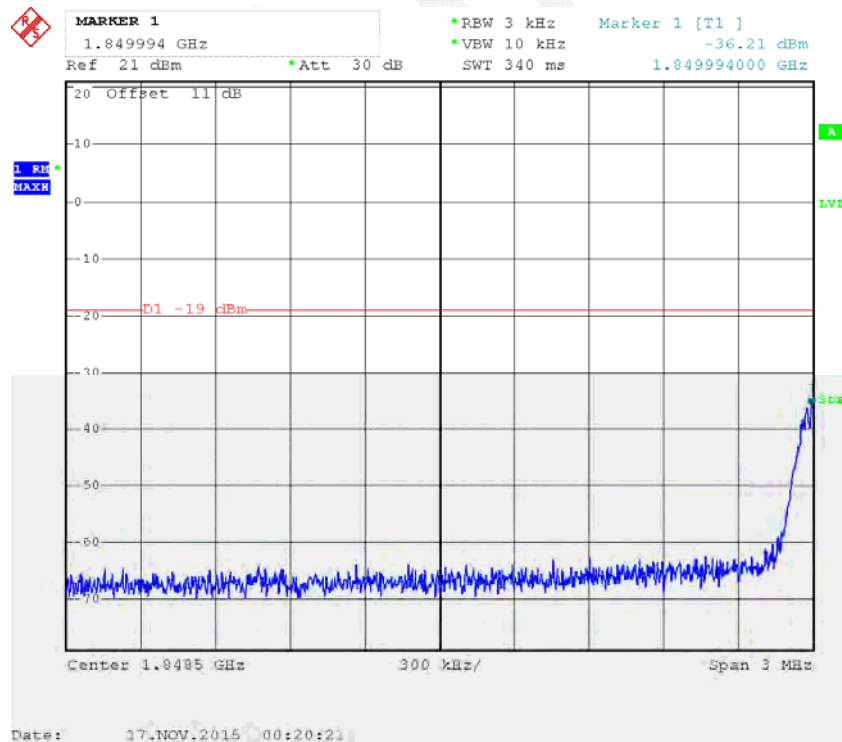
PCS Band CDMA Left Side 1851.25MHz Above AGC



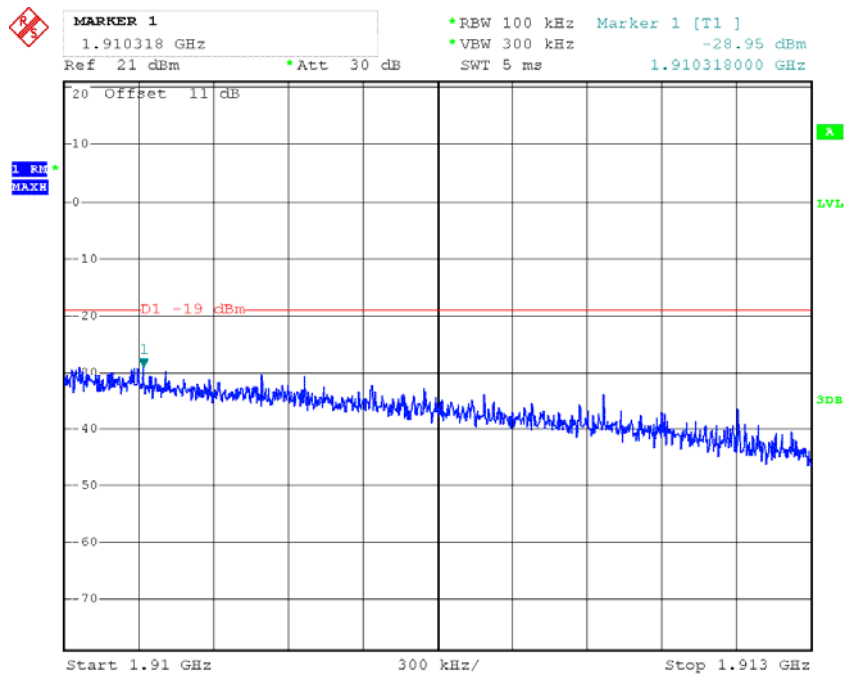
PCS Band GSM Left Side 1850.2MHz Pre-AGC



PCS Band GSM Left Side 1850.2MHz Above AGC

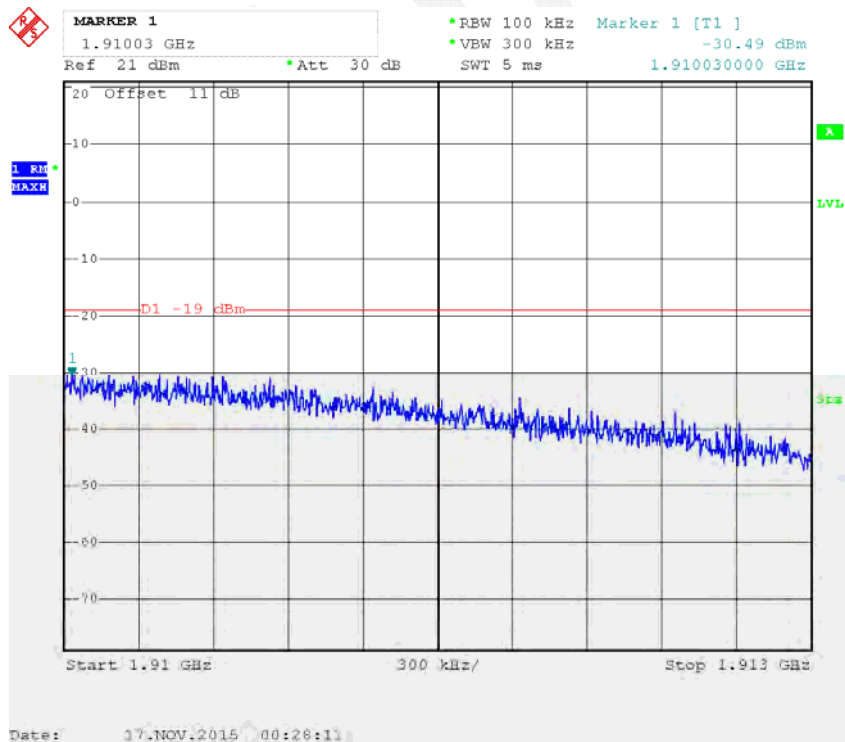


PCS Band LTE Right Side 1807.5MHz Pre-AGC

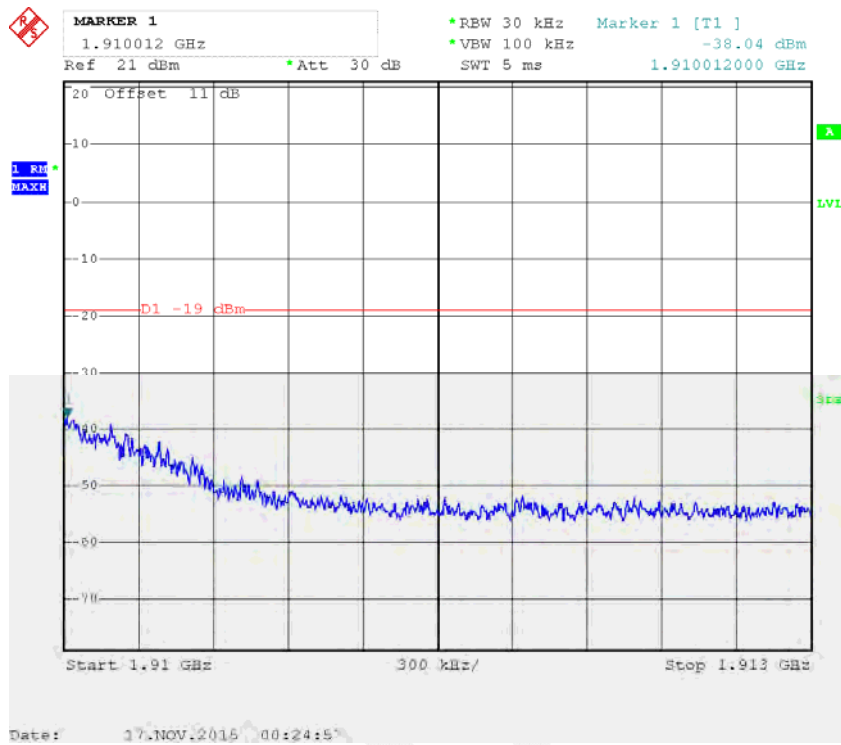


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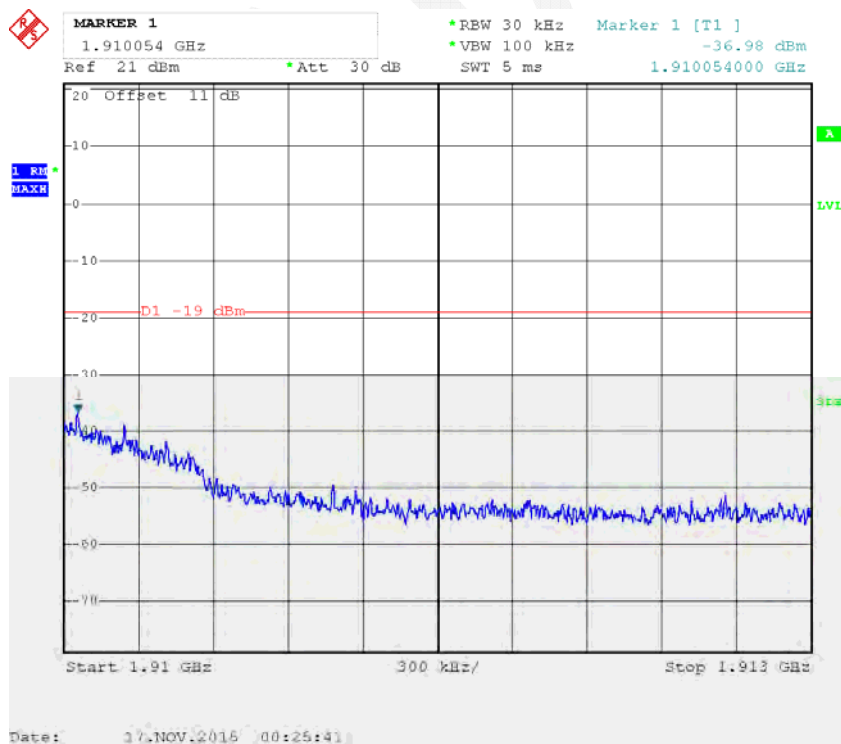
PCS Band LTE Right Side 1807.5MHz Above AGC



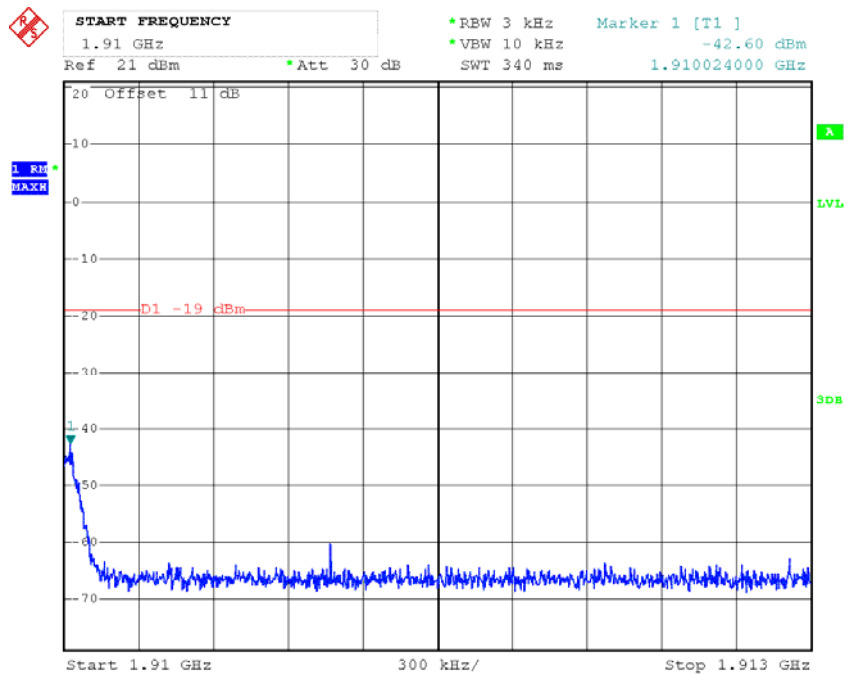
PCS Band CDMA Right Side 1808.75MHz Pre-AGC



PCS Band CDMA Right Side 1808.75MHz Above AGC

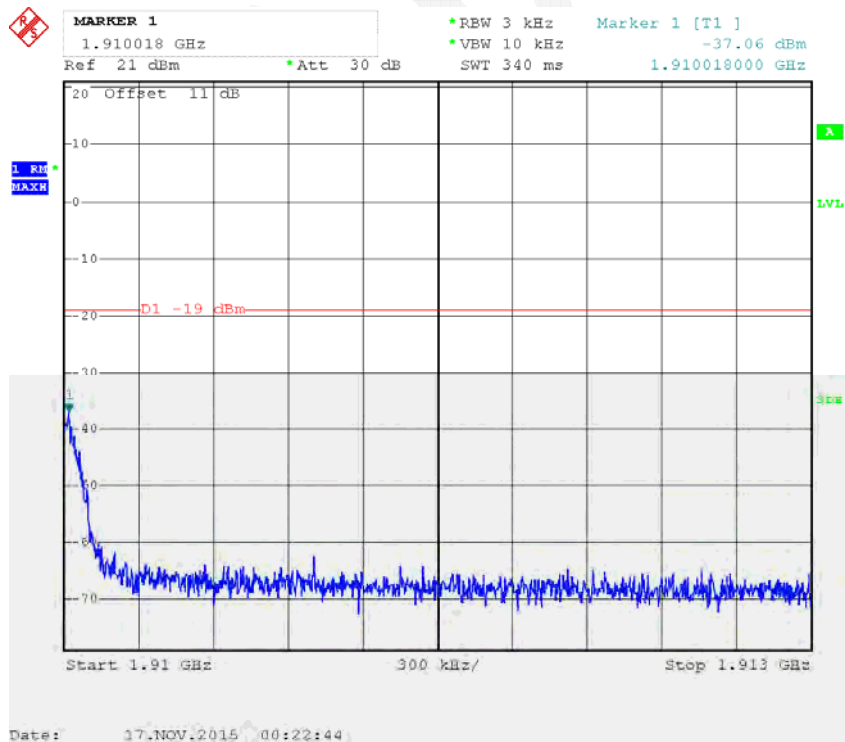


PCS Band GSM Right Side 1809.8MHz Pre-AGC

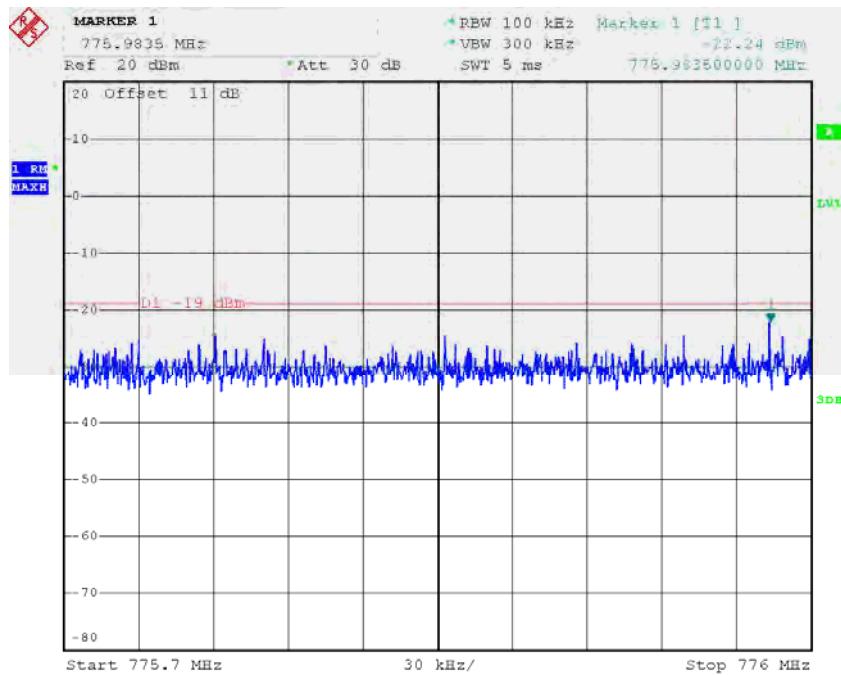


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PCS Band GSM Right Side 1809.8MHz Above AGC

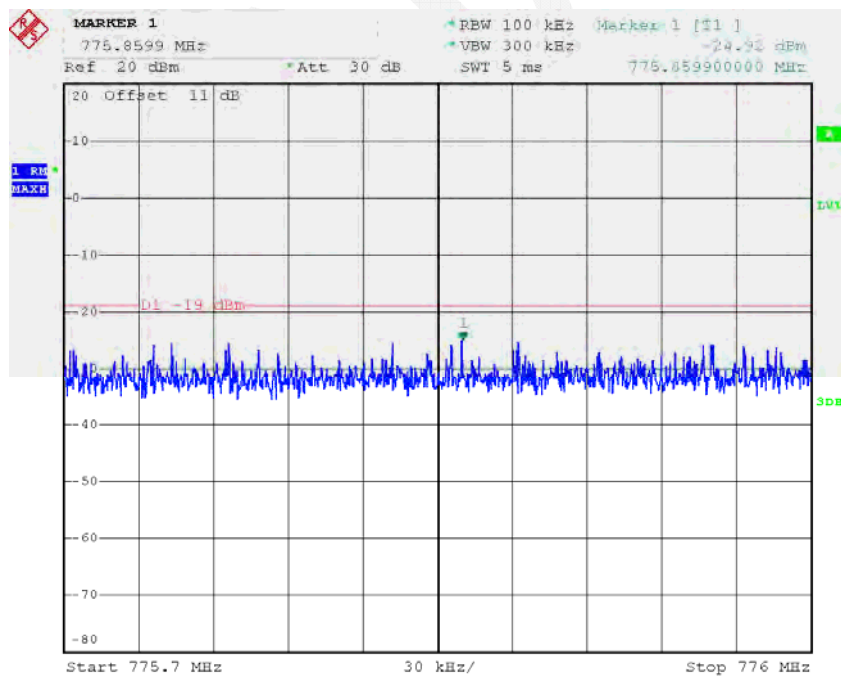


Upper 700 LTE Left Side 778.5MHz Pre-AGC



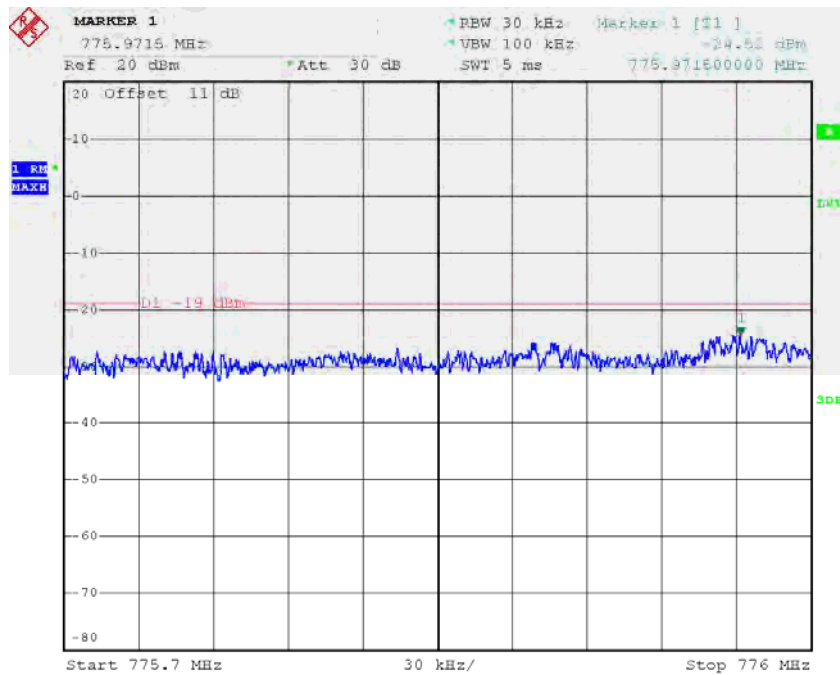
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Upper 700 LTE Left Side 778.5MHz Above AGC



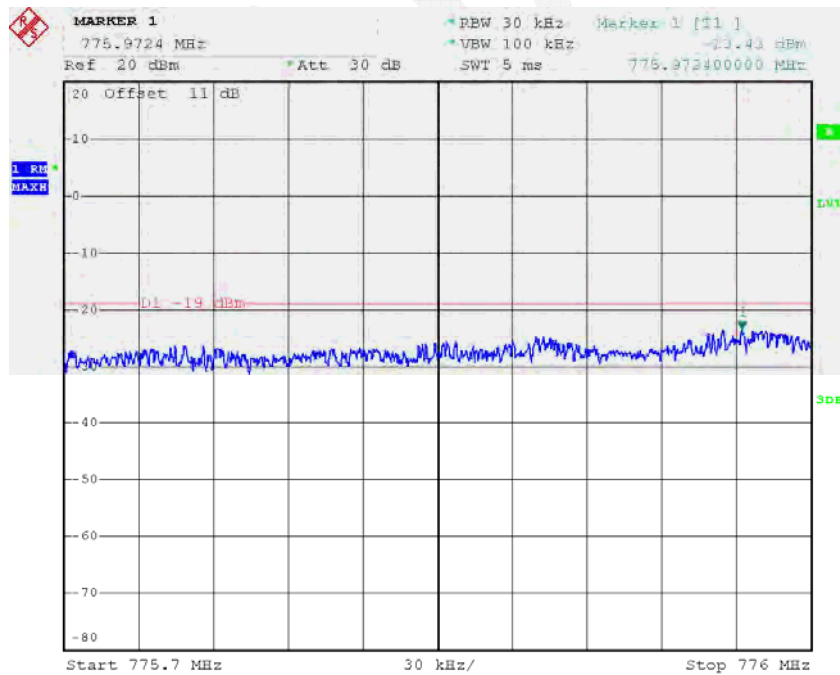
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Upper 700 CDMA Left Side 777.25MHz Pre-AGC



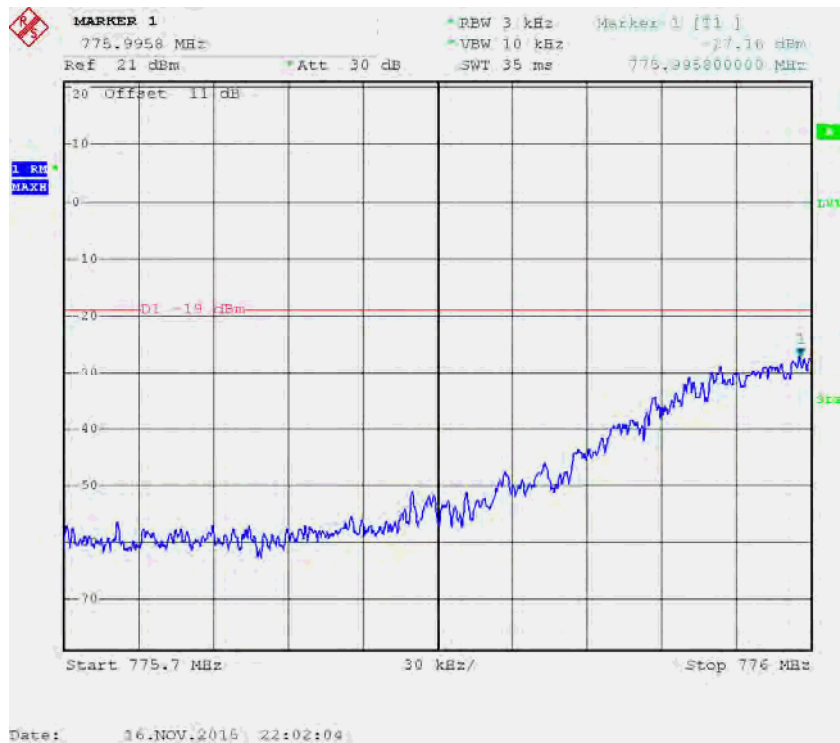
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Upper 700 CDMA Left Side 777.25MHz Above AGC

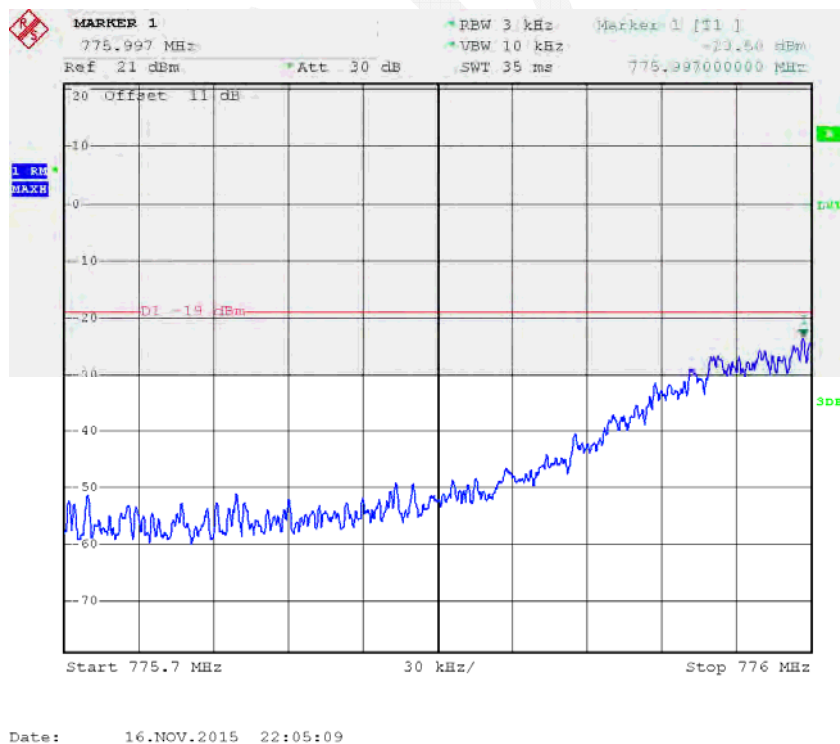


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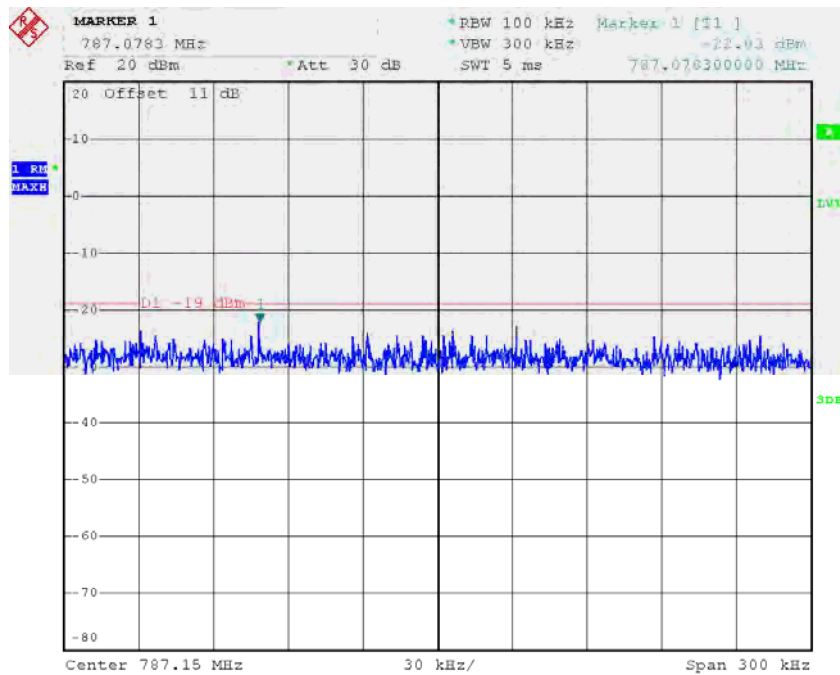
Upper 700 GSM Left Side 776.2MHz Pre-AGC



Upper 700 GSM Left Side 776.2MHz Above AGC

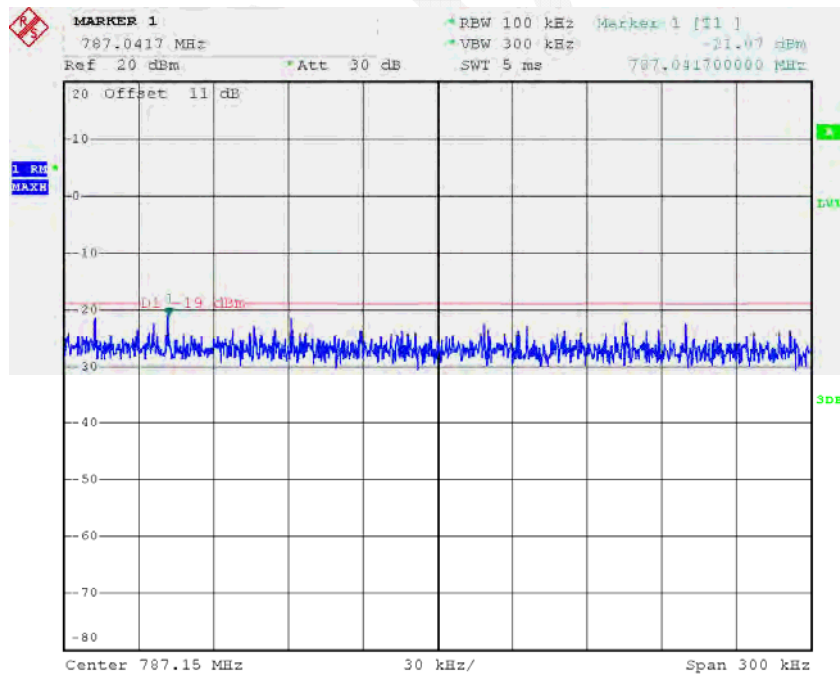


Upper 700 LTE Right Side 784.5MHz Pre-AGC



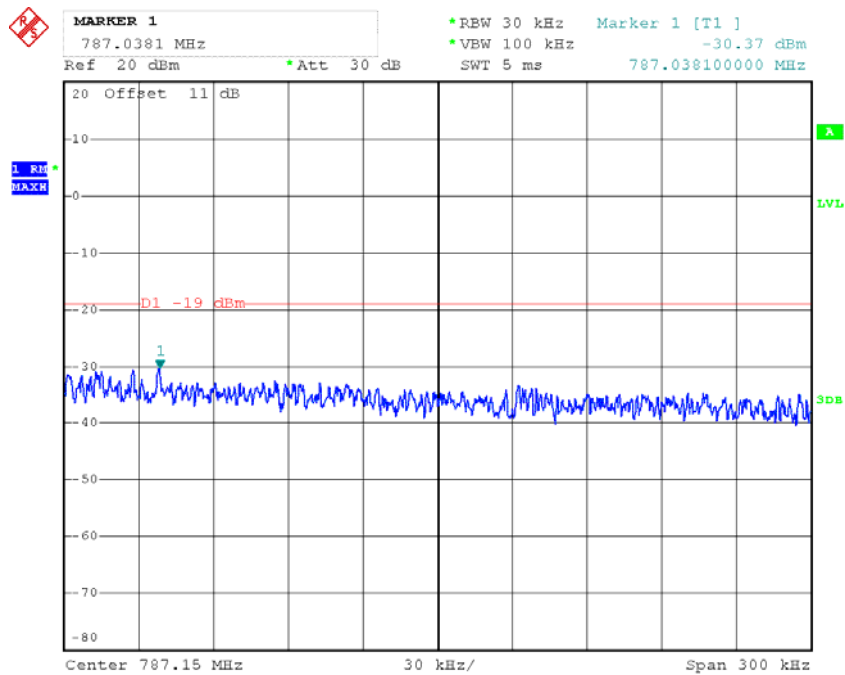
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Upper 700 LTE Right Side 784.5MHz Above AGC



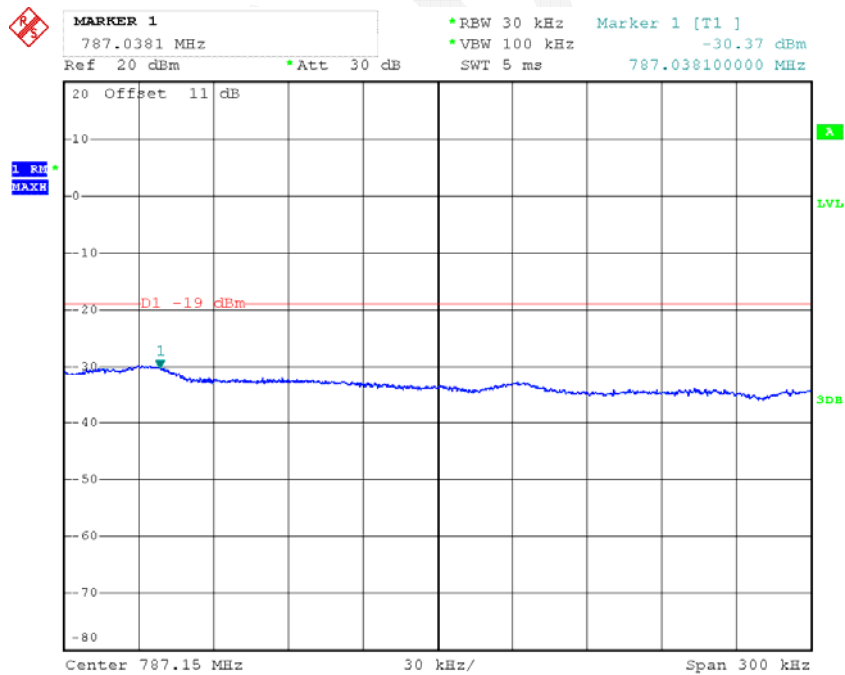
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Upper 700 CDMA Right Side 785.75MHz Pre-AGC



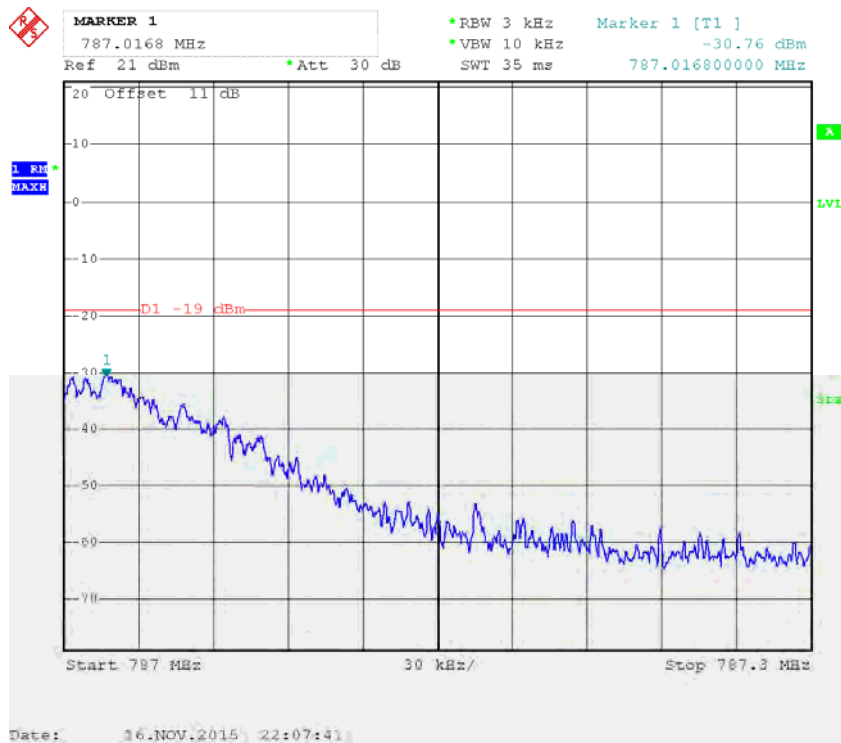
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Upper 700 CDMA Right Side 785.75MHz Above AGC

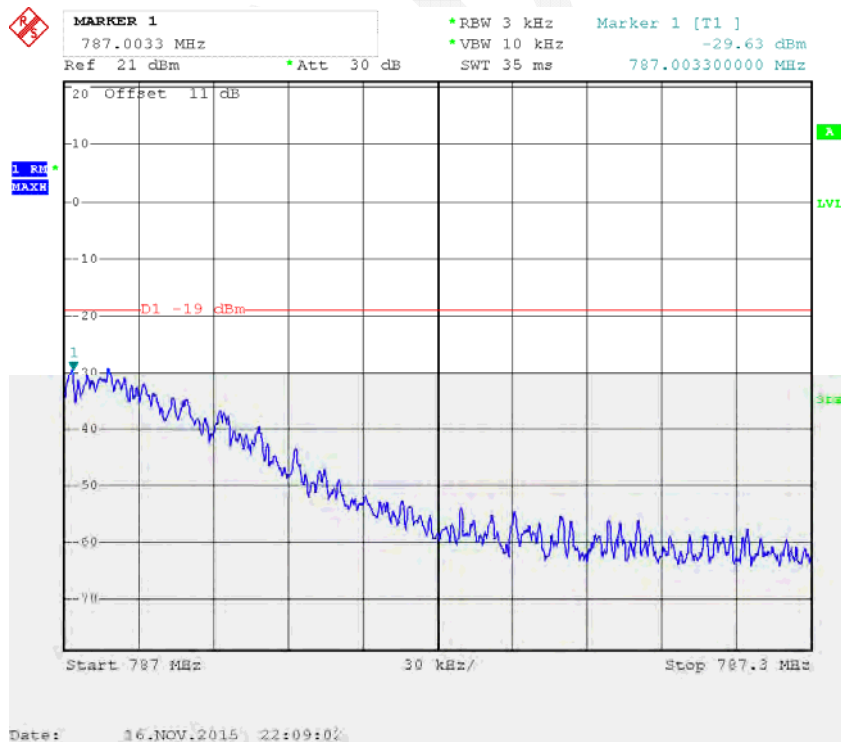


Date: 19.NOV.2015 18:26:52

Upper 700 GSM Right Side 786.8MHz Pre-AGC



Upper 700 GSM Right Side 786.8MHz Above AGC



§ 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

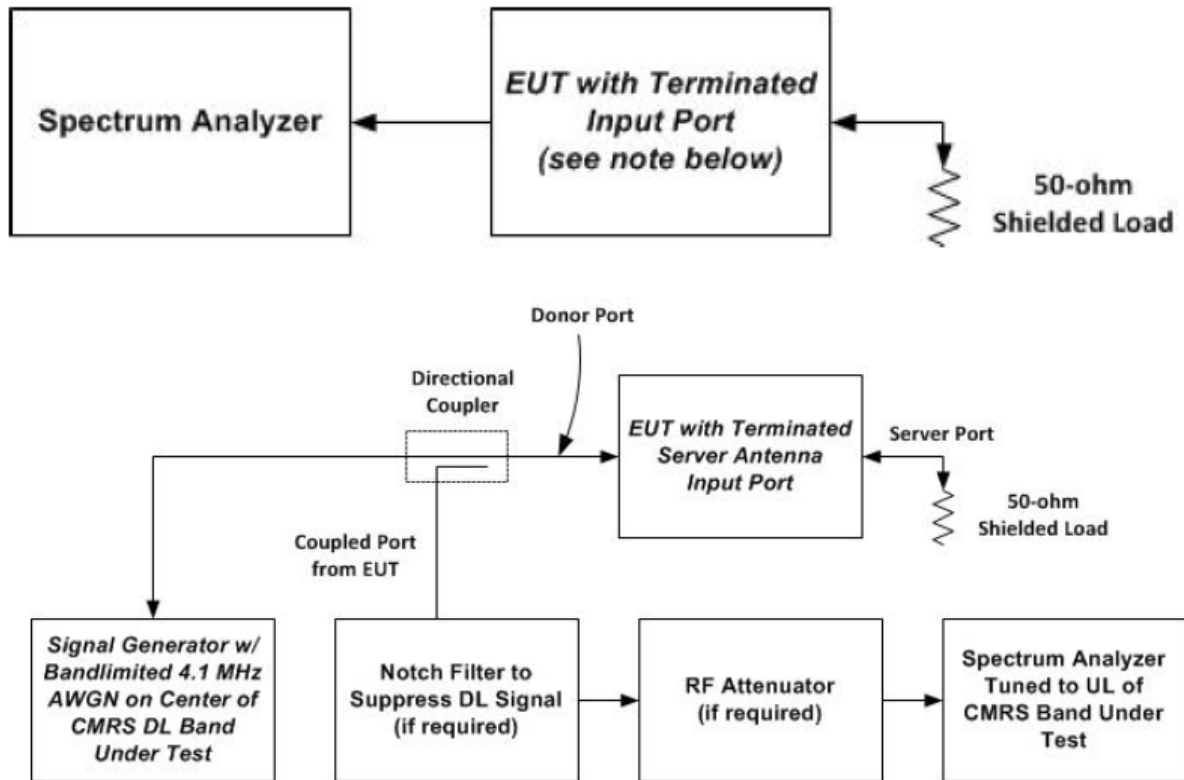
- a) Connect the EUT to the test equipment as shown in **Figure 3**. Begin with the uplink output connected to the spectrum analyzer. When measuring downlink noise, connect the downlink output to the spectrum analyzer.
- b) Set the spectrum analyzer RBW to 1 MHz with the VBW $\geq 3 \times$ RBW.
- c) 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 $\geq 2 \times$ 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 $\geq 3 \times$ 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 $\geq 2 \times$ 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 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	MY513502142	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 2015-11-13 to 2015-11-19.

Please refer to the following tables and plots.

Maximum Noise:

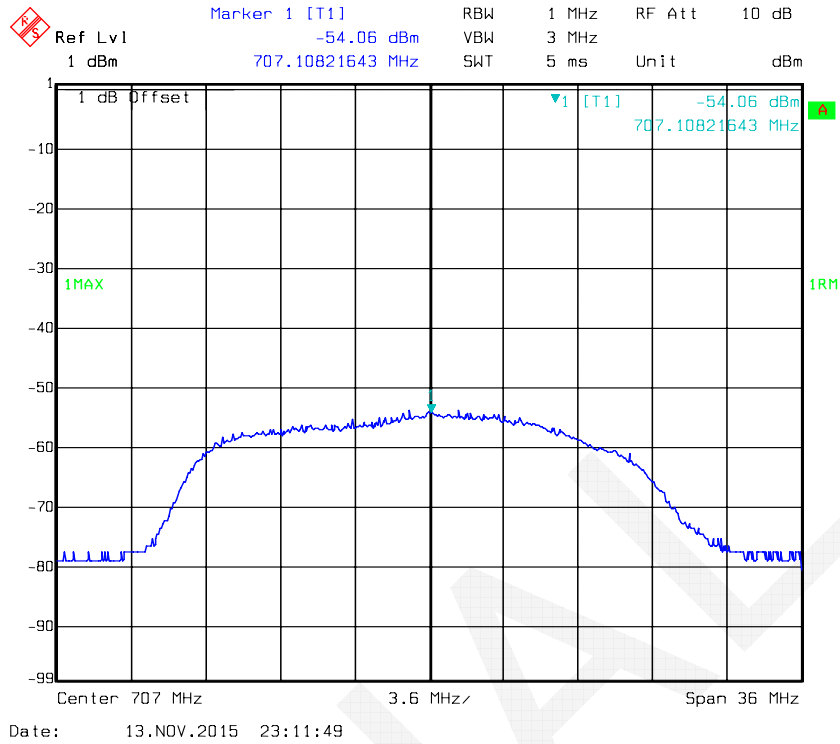
Mode	Operation Bands	Measured Value	Limit	Result
		dBm	dBm	
Uplink	Lower 700	-54.06	-45.51	Compliance
	Upper 700	-54.48	-44.64	Compliance
	Cellular	-52.02	-44.05	Compliance
	AWS	-63.85	-37.73	Compliance
	PCS	-59.45	-37.02	Compliance
Downlink	Lower 700	-50.32	-45.51	Compliance
	Upper 700	-53.82	-44.64	Compliance
	Cellular	-51.83	-44.05	Compliance
	AWS	-55	-37.73	Compliance
	PCS	-56.09	-37.02	Compliance

Note: Fixed booster maximum noise power shall not exceed $-102.5 \text{ dBm/MHz} + 20 \text{ Log}_{10}(\text{Frequency})$, where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

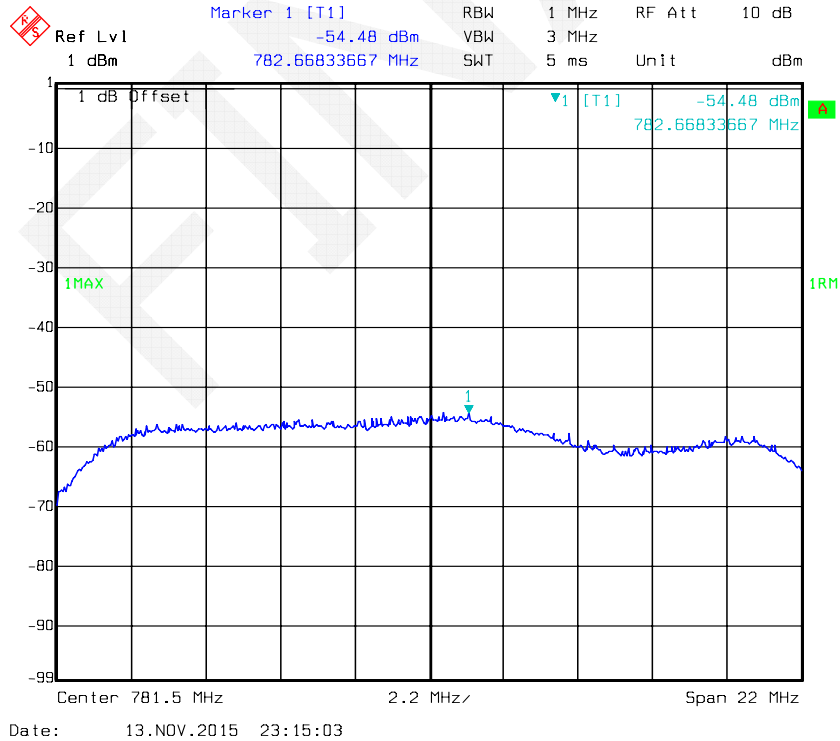
Variable uplink Noise limit test result:

Operation Bands	RSSI	Measured Value	Limit	Results
	dBm	dBm	dBm	
Lower 700	-90	-54.25	-45.51	Compliance
	-80	-54.13	-45.51	Compliance
	-70	-54.39	-45.51	Compliance
	-40	-64.03	-63.00	Compliance
	-35	-68.75	-68.00	Compliance
	-34	-69.22	-69.00	Compliance
Upper 700	-90	-54.62	-44.64	Compliance
	-80	-55.31	-44.64	Compliance
	-70	-57.12	-44.64	Compliance
	-45	-63.81	-58.00	Compliance
	-40	-64.89	-63.00	Compliance
	-34	-69.11	-69.00	Compliance
Cellular	-90	-53.08	-44.05	Compliance
	-80	-53.45	-44.05	Compliance
	-70	-55.69	-44.05	Compliance
	-40	-63.88	-63.00	Compliance
	-36	-67.33	-67.00	Compliance
	-34	-69.08	-69.00	Compliance
AWS	-80	-64.86	-37.73	Compliance
	-70	-64.86	-37.73	Compliance
	-60	-66.72	-43.00	Compliance
	-37	-77.73	-66.00	Compliance
	-36	-78.04	-67.00	Compliance
	-34	-78.21	-69.00	Compliance
PCS	-80	-62.39	-37.02	Compliance
	-70	-62.13	-37.02	Compliance
	-60	-61.99	-43.00	Compliance
	-50	-66.83	-53.00	Compliance
	-35	-76.02	-68.00	Compliance
	-34	-76.13	-69.00	Compliance

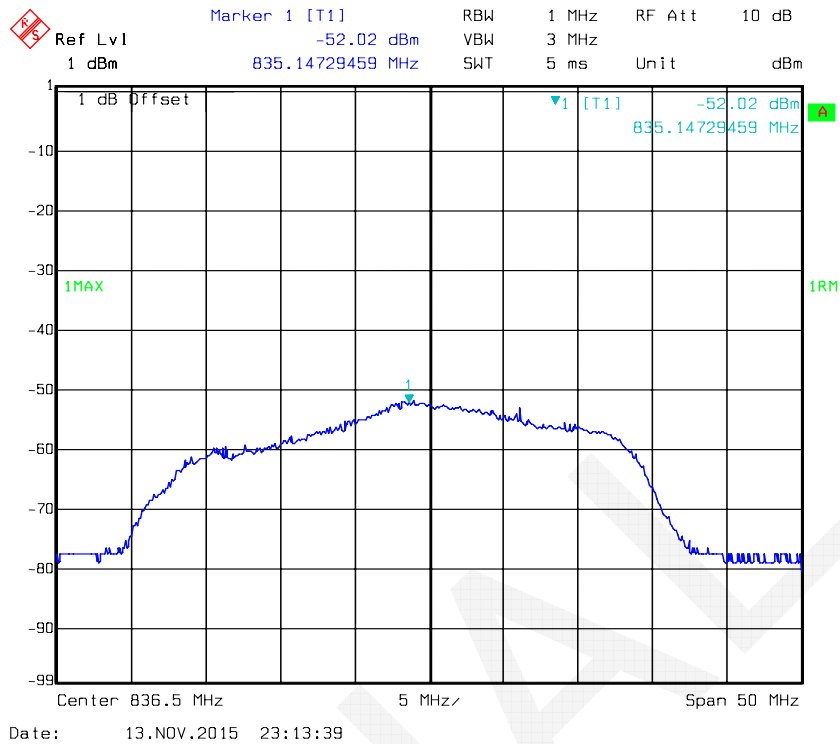
Uplink Lower 700



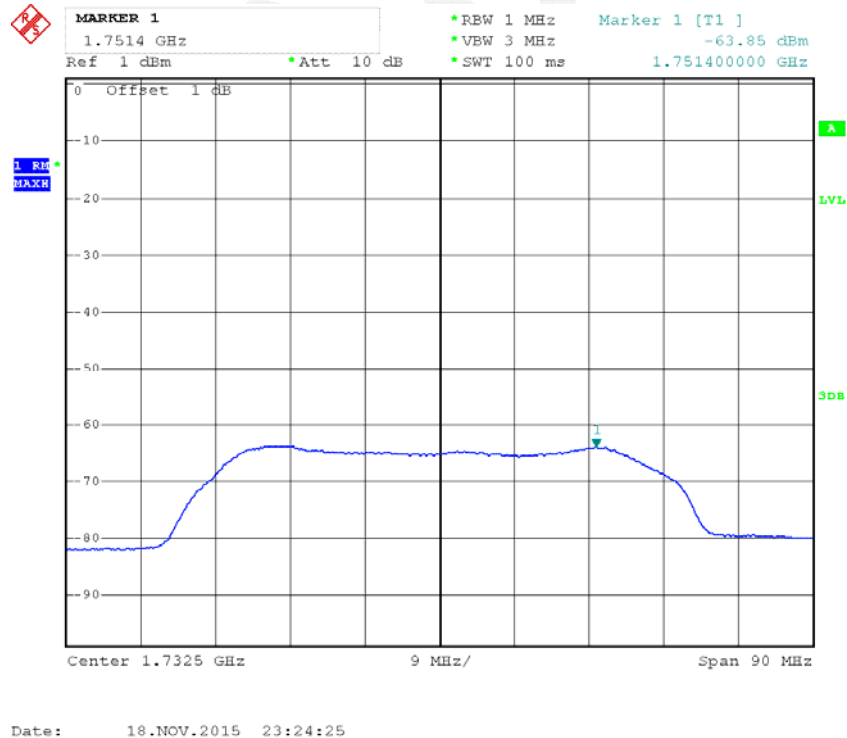
Uplink Upper 700



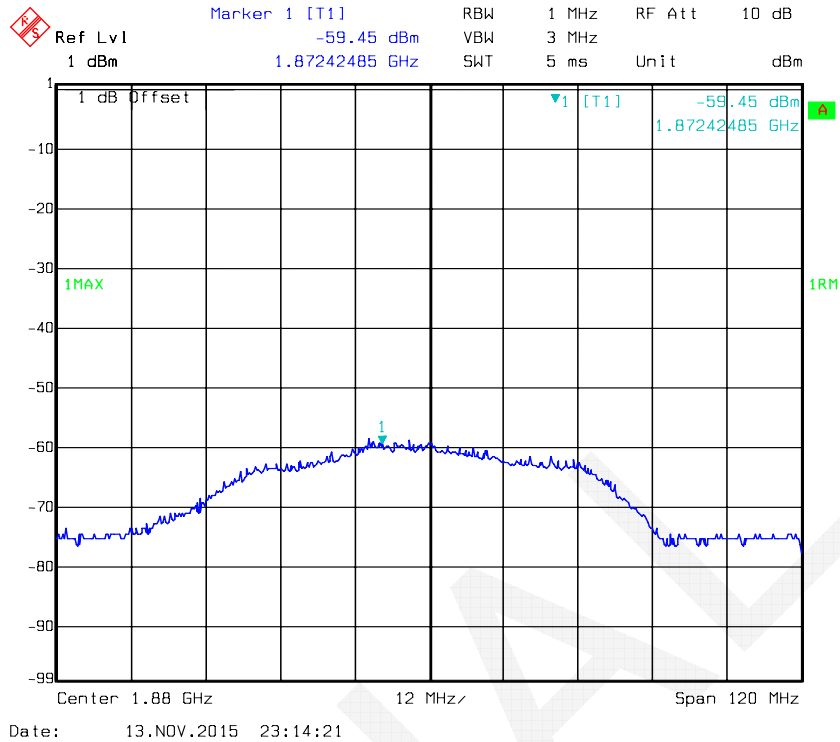
Uplink Cellular Band



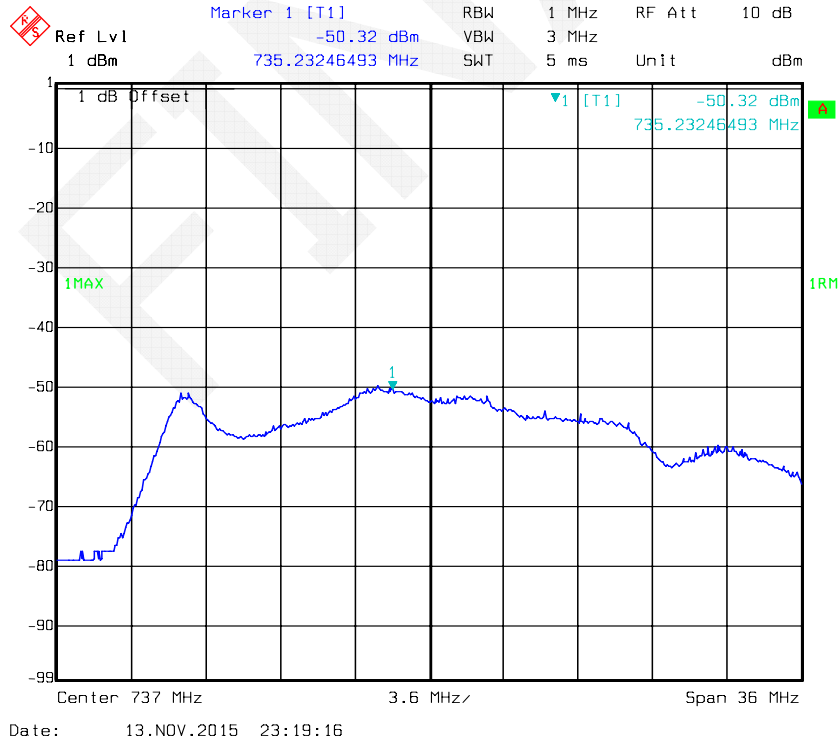
Uplink AWS Band



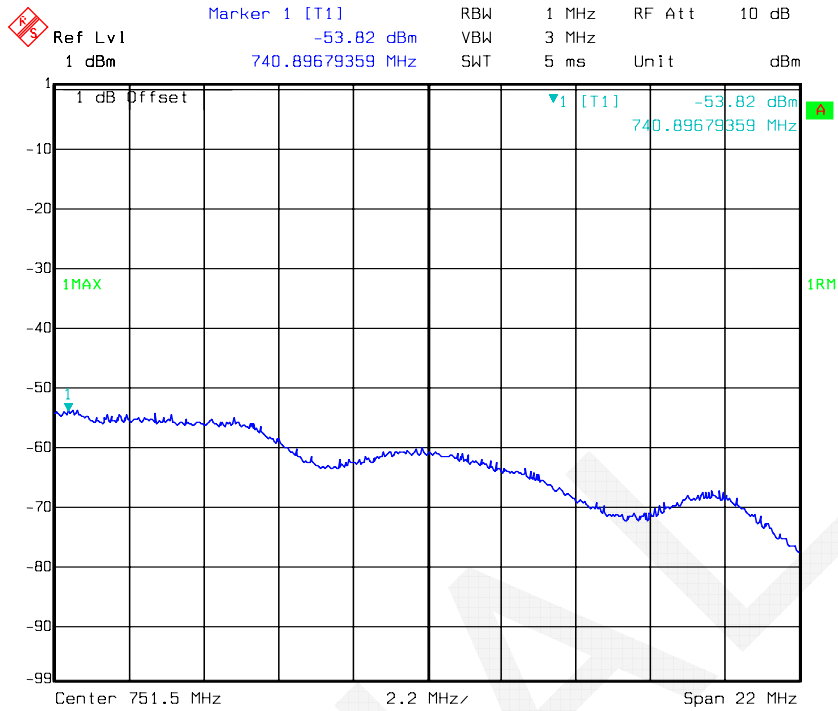
Uplink PCS Band



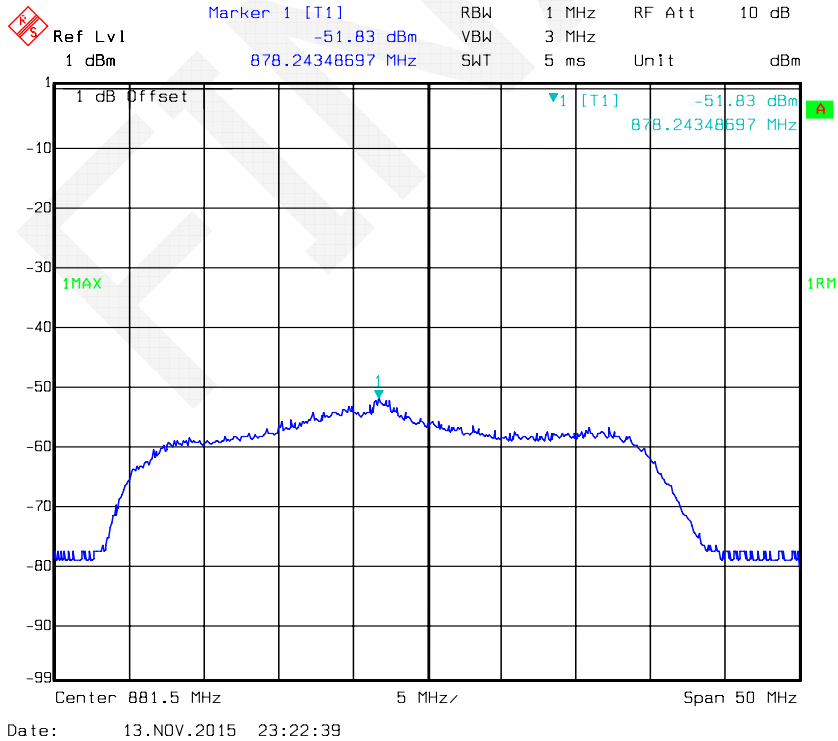
Downlink Lower 700



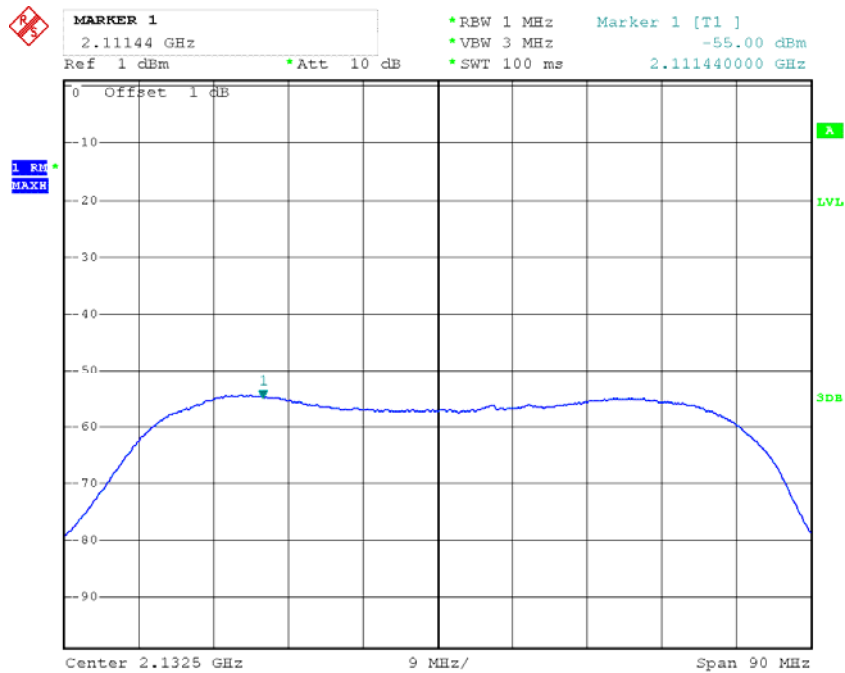
Downlink Upper 700



Downlink Cellular Band

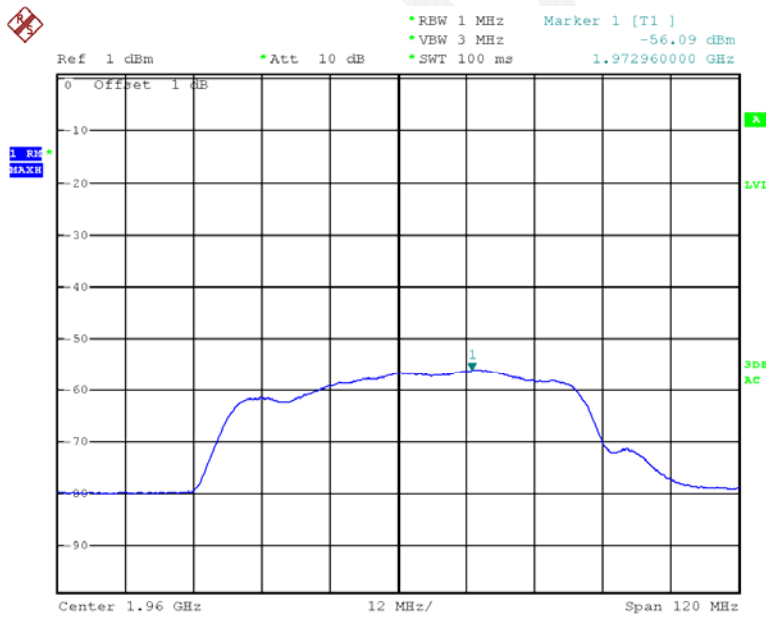


Downlink AWS Band



Date: 18.NOV.2015 23:22:56

Downlink PCS Band

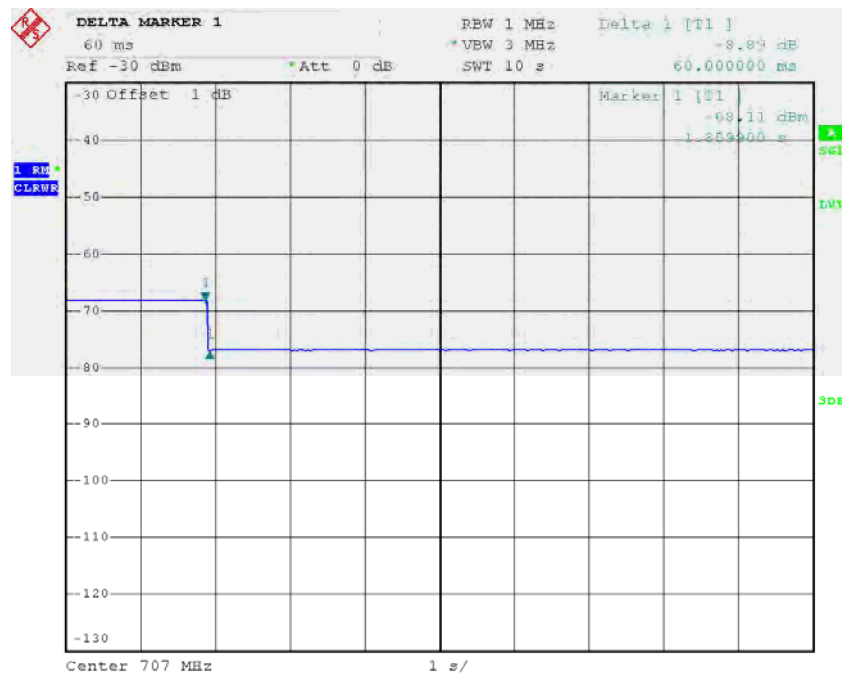


Date: 29.NOV.2015 14:15:12

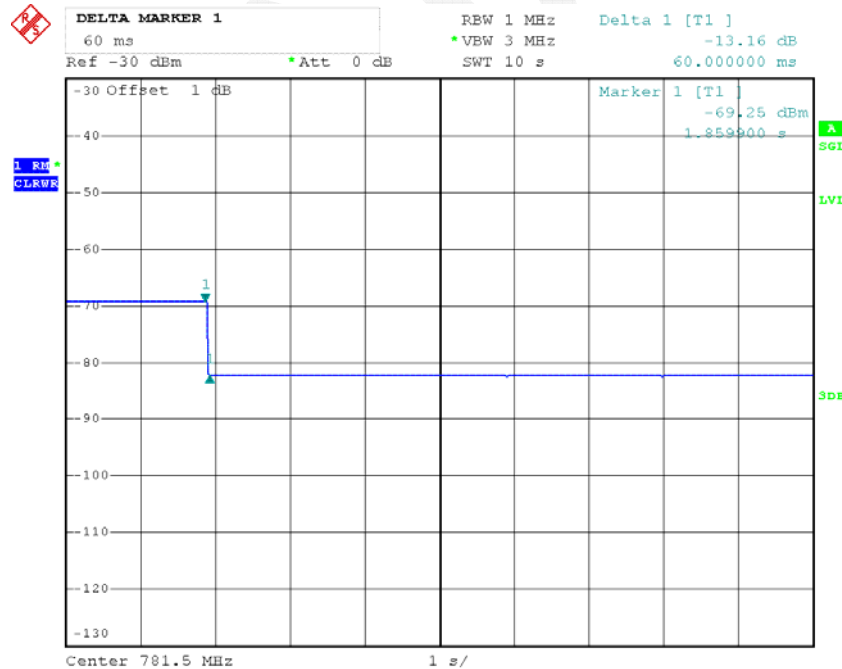
Variable Uplink Noise Timing:

Operating Band	Measured Value	Limit	Results
	s	s	
Lower 700	0.06	3	Compliance
Upper 700	0.06	3	Compliance
Cellular	0.06	3	Compliance
AWS	0.04	3	Compliance
PCS	0.04	3	Compliance

Note: The uplink noise decreases to the specified level within 1 second for mobile devices and 3 seconds for fixed devices.

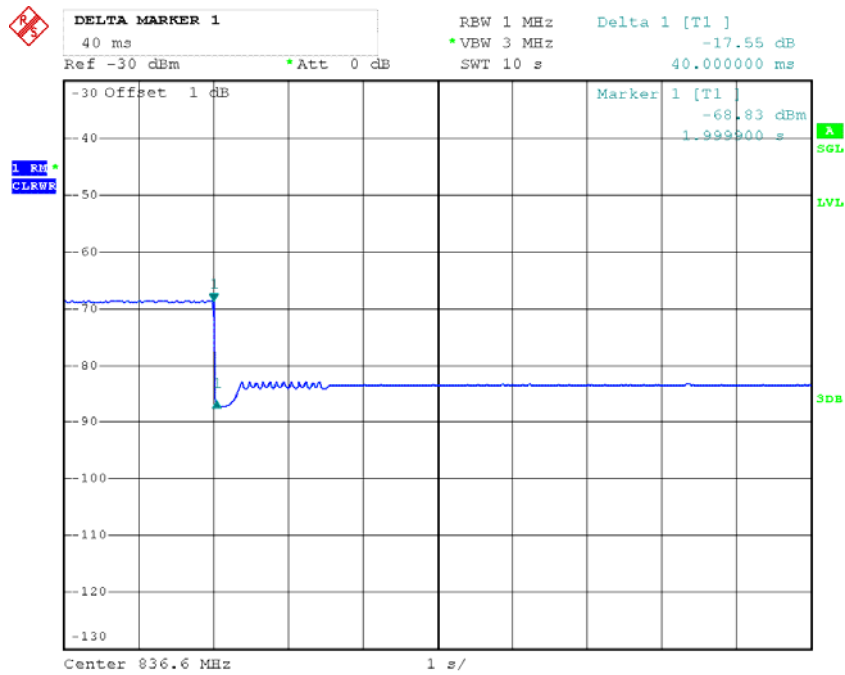
Lower 700 Band

Date: 19.NOV.2015 23:20:42

Upper 700 Band

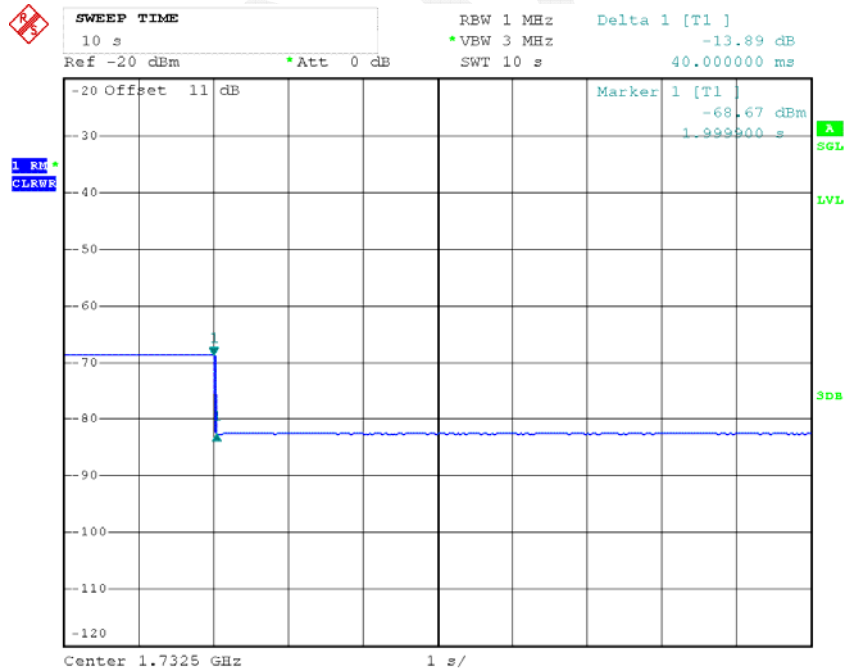
Date: 19.NOV.2015 23:24:29

Cellular Band



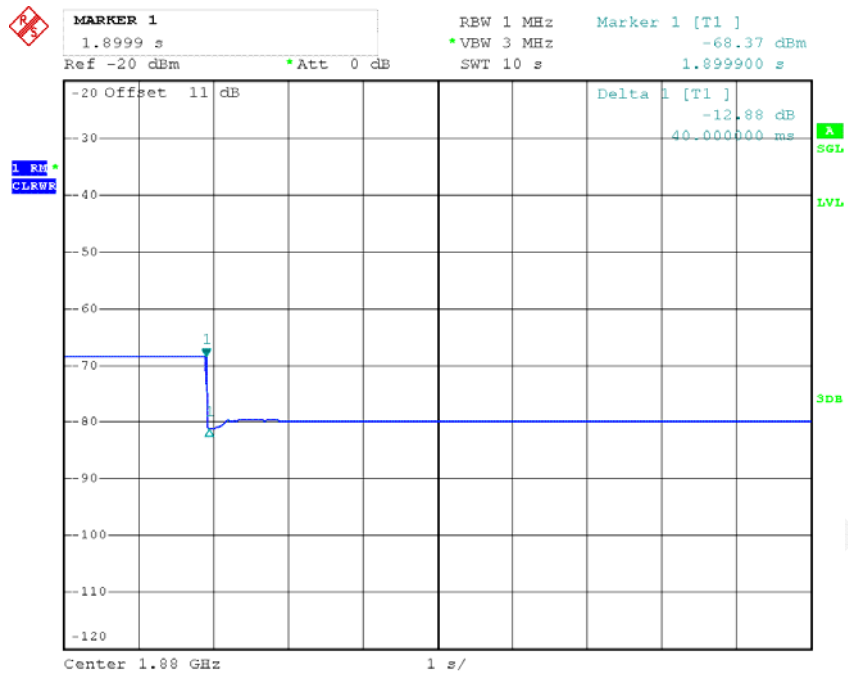
Date: 19.NOV.2015 23:28:15

AWS Band



Date: 19.NOV.2015 23:30:33

PCS Band



Date: 19.NOV.2015 23:32:25

§ 20.21(e)(8)(i)(I) & §20.21(e)(4) - UPLINK INACTIVITY

Applicable Standards

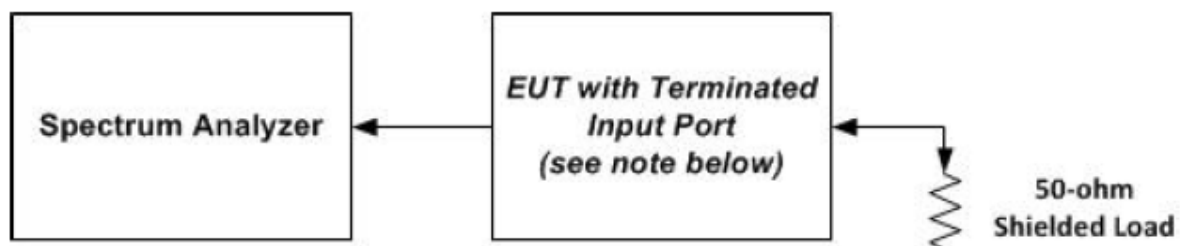
According to § 20.21(e)(8)(i)(I) Uplink Inactivity & §20.21(e)(4); §20.21(e)(4) Self-monitoring.

Test Procedure

This measurement procedure is intended to demonstrate compliance to the uplink inactivity requirements specified for wideband consumer signal boosters in § 20.21(e)(8)(i)(I).

- Connect the EUT to the test equipment as shown in **Figure 3** with the uplink output connected to the spectrum analyzer.
- Select the RMS power averaging detector.
- Set the spectrum analyzer RBW for 1 MHz with the $VBW \geq 3 \times RBW$.
- Set the center frequency of the spectrum analyzer to the center of the uplink operational band.
- Set the span for 0 Hz with a single sweep time for a minimum of 330 seconds.
- Start to capture a new trace using MAX HOLD.
- After approximately 15 seconds turn on the EUT power.
- Once the full spectrum analyzer trace is complete place a MARKER on the leading edge of the pulse and use the DELTA MARKER METHOD to measure the time until the uplink becomes inactive.
- Affirm that the noise level for the squelched signal is below the uplink inactivity noise power limit, as specified by the rules.
- Capture the plot for inclusion in the test report.
- Measure noise using procedures in 7.7.1a) to 7.7.1e).
- Repeat 7.8d) through 7.8k) for all operational uplink bands.

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 signal generator and cycle the RF output to simulate this function.



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

*** 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:	24.2~24.8
Relative Humidity:	43~44 %
ATM Pressure:	101.1~101.2 kPa

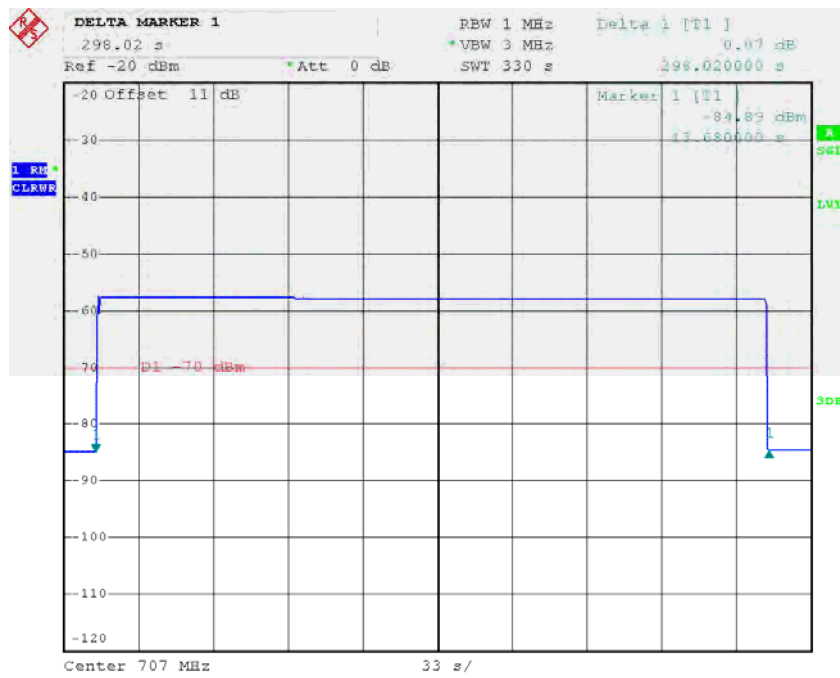
The testing was performed by Dean Liu from 2015-11-19 to 2015-11-20.

Please refer to the following plots.

Operation Band	Measured value	Limit	Result
	s	s	
Lower 700	298.02	300	Compliance
Upper 700	298.02		Compliance
Cellular	298.02		Compliance
AWS	298.02		Compliance
PCS	298.02		Compliance

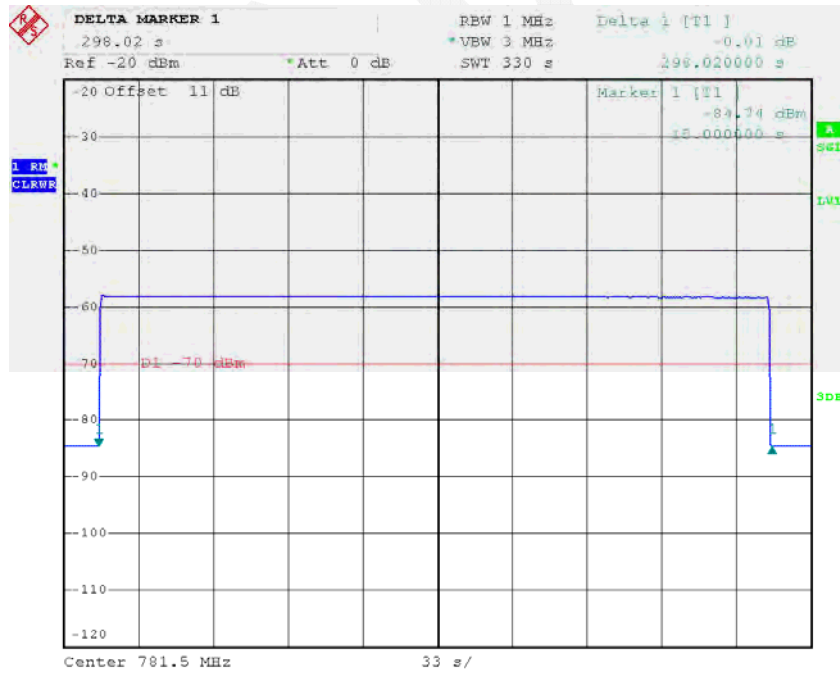
Note: When the consumer booster is not serving an active device connection after 5 minutes the uplink noise power not exceed -70 dBm/MHz.

Lower 700 Band



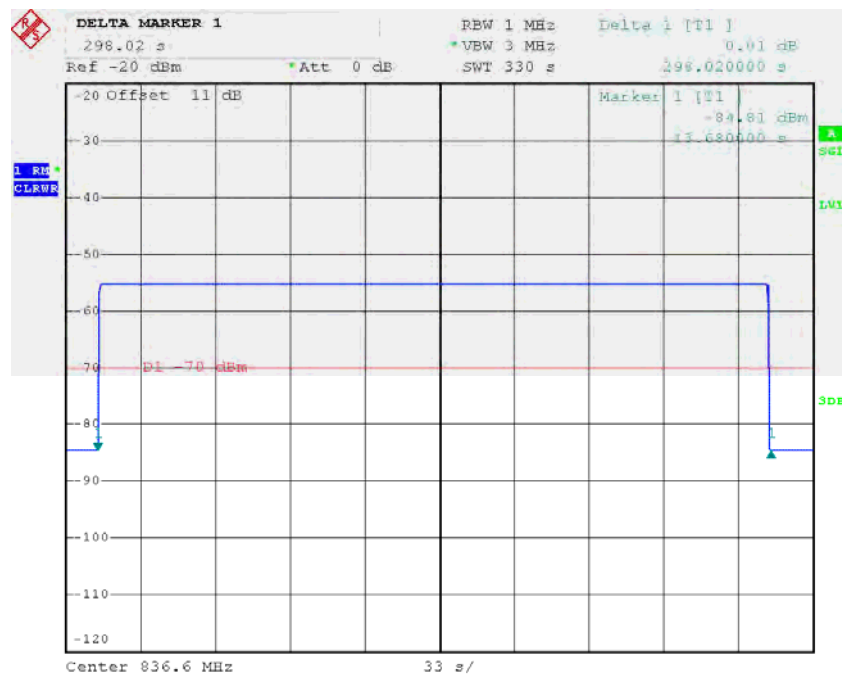
Date: 19.NOV.2015 23:44:35

Upper 700 Band



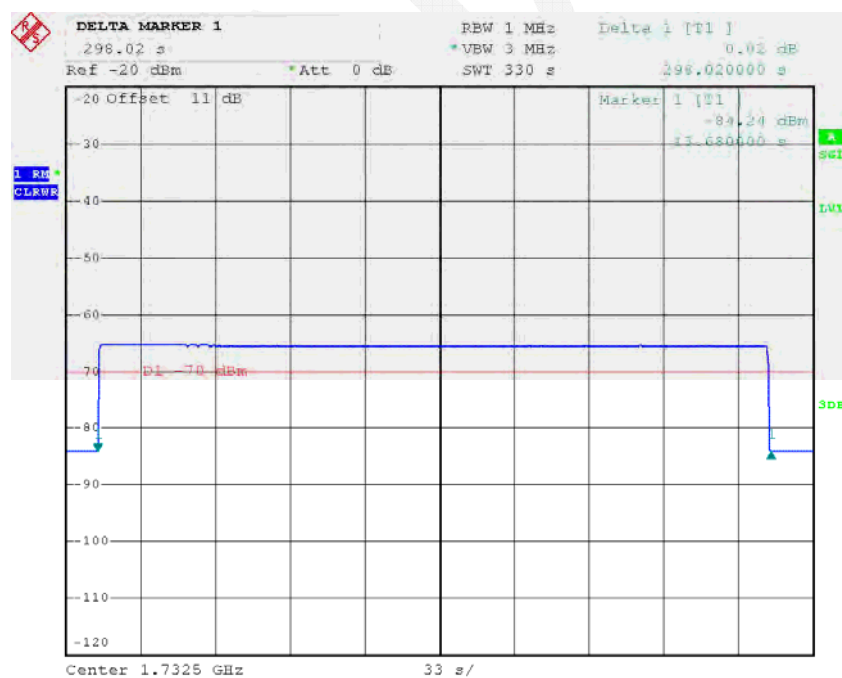
Date: 19.NOV.2015 23:56:47

Cellular Band



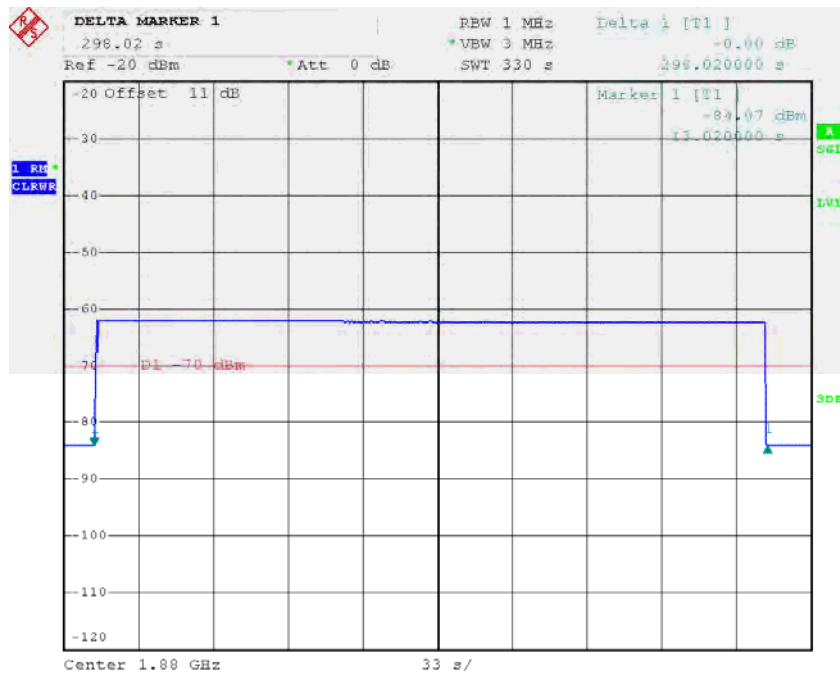
Date: 20.NOV.2015 00:03:38

AWS Band



Date: 20.NOV.2015 00:18:28

PCS Band



Date: 20.NOV.2015 00:09:23

§ 20.21(e)(8)(i)(C)(1) & § 20.21(e)(8)(i)(H) - VARIABLE BOOSTER GAIN

Applicable Standards

Rule paragraph(s): § 20.21(e)(8)(i)(C)(1) *Booster Gain Limits* (variable gain); § 20.21(e)(8)(i)(H) *Transmit Power Off Mode* (uplink gain).

Test Procedure

Maximum gain

This procedure shall be used to demonstrate compliance to the booster gain limits specified for wideband consumer signal boosters in § 20.21(e)(8)(i)(C) or § 20.21(e)(8)(i)(H). The variable booster gain limits are expressed as a function of RSSI and MSCL. The RSSI is varied over a range of values as specified within the procedure. Refer to Annex B of this document for guidance on determining the applicable MSCL value.

- Connect the EUT to the test equipment as shown in **Figure 5** with the uplink output connected to signal generator 1. Confirm that the coupled path of the RF coupler is connected to the spectrum analyzer.
- Configure downlink signal generator 1 for AWGN operation with a 99% occupied bandwidth of 4.1 MHz tuned to the center of the operational band.
- Set the power level and frequency of signal generator 2 to a value 5 dB below the AGC level determined from 7.2. The signal type is AWGN with a 99% OBW of 4.1 MHz.
- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Select the CHANNEL POWER measurement mode.
- Select the RMS (power averaging) detector.
- Ensure that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
- Sweep time = auto couple or as necessary (but no less than auto couple value).
- Trace average at least 10 traces in power averaging (i.e., RMS) mode.
- Measure the maximum channel power and compute maximum gain when varying the signal generator 1 output to a level from -90 dBm to -20 dBm as measured at the input port in 1 dB steps inside the RSSI-dependent region and 10 dB steps outside the RSSI-dependent region and report the six values closest to the limit, including at least two points from within the RSSI-dependent region of operation. See gain limit in charts in Annex D for uplink gain requirements. Additionally, document that the EUT provides equivalent uplink and downlink gain, and when operating in shutoff mode the uplink and downlink gain is within the transmit power off mode gain limits.
- Repeat 7.9.1c) to 7.9.1k) for all operational uplink bands.

Variable uplink gain timing

Variable uplink gain timing is to be measured as follows.

- Set the spectrum analyzer to the uplink frequency to be measured.
- Set the span to 0 Hz with a sweep time of 10 seconds.
- Set the power level of signal generator 1 to the lowest level of the RSSI-dependent gain.
- Select MAX HOLD and increase the power level of signal generator 1 by 10 dB for mobile boosters and 20 dB for fixed indoor boosters. Signal generator 2 remains same, as described in 7.9.1c).
- Confirm that the uplink gain decreases to the specified levels within 1 second for mobile devices and 3 seconds for fixed devices.
- Repeat 7.9.2a) to 7.9.2e) for all operational uplink bands.

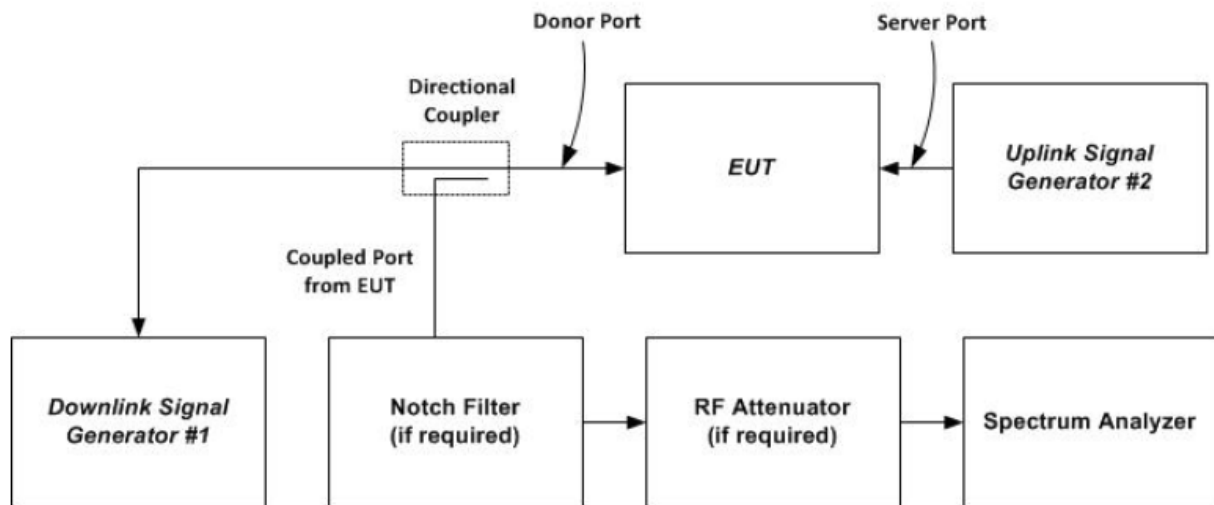


Figure 5 – Variable gain instrumentation test setup

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:	24.8
Relative Humidity:	44 %
ATM Pressure:	101.1 kPa

The testing was performed by Dean Liu on 2015-11-21.

Please refer to the following plots.

MSCL calculation:

Operation Bands	Frequency MHz	Distance m	Path Loss dB	Indoor Antenna Gain (dBi)	Indoor Cable Loss (dB)	Polarity Loss (dB)	MSCL
Lower 700	707	5	43.47	10	1.0	3.01	37.48
Upper 700	781.5	5	44.34	10	1.0	3.01	38.35
Cellular	836.5	5	44.93	10	1.0	3.01	38.94
AWS	1732.5	5	51.25	10	1.5	3.01	45.76
PCS	1880	5	51.96	10	1.5	3.01	46.47

Note:

Path loss=20logf+20logd-27.5

Polarity loss=20log(1/sin(45))=3.01

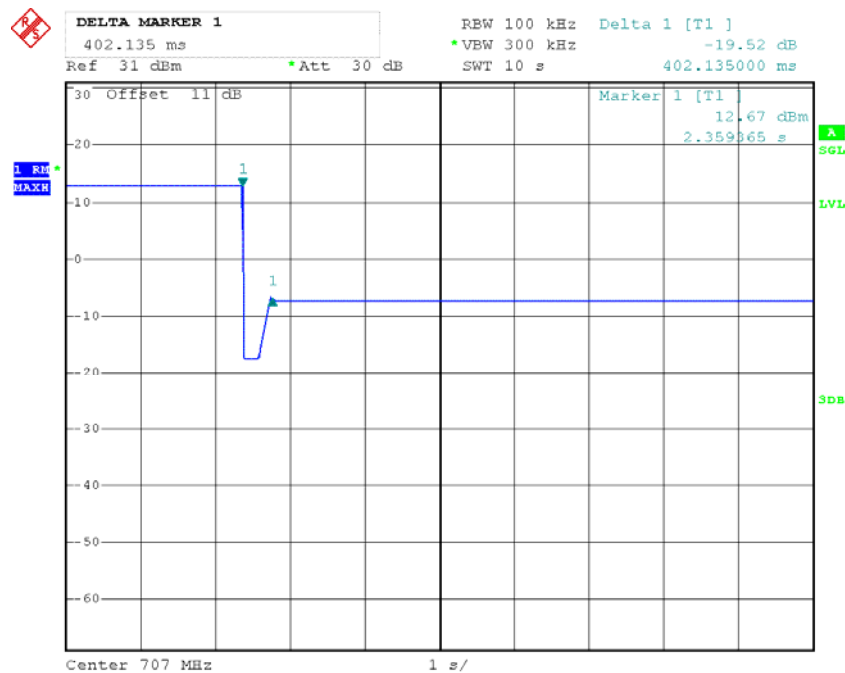
Variable booster gain:

Operation Bands	RSSI dBm	P _{in} dBm	P _{out} dBm	MSCL dB	Measured Value dB	Limit dB	Result
Lower 700	-40	-31.7	2.47	37.48	34.17	43.48	Compliance
	-34	-31.7	-2.47	37.48	29.23	37.48	Compliance
	-26	-31.7	-12.16	37.48	19.54	29.48	Compliance
	-24	-31.7	-12.16	37.48	19.54	27.48	Compliance
	-22	-31.7	-12.21	37.48	19.49	25.48	Compliance
	-20	-31.7	-12.18	37.48	19.52	23.48	Compliance
Upper 700	-50	-31.3	12.81	38.35	44.11	54.35	Compliance
	-40	-31.3	1.79	38.35	33.09	44.35	Compliance
	-34	-31.3	-3.93	38.35	27.37	38.35	Compliance
	-30	-31.3	-8.52	38.35	22.78	34.35	Compliance
	-25	-31.3	-13.31	38.35	17.99	29.35	Compliance
	-20	-31.3	-17.53	38.35	13.77	24.35	Compliance
Cellular	-90	-34.0	13.61	38.94	47.61	64.95	Compliance
	-50	-34.0	10.94	38.94	44.94	54.94	Compliance
	-39	-34.0	-0.40	38.94	33.6	43.94	Compliance
	-33	-34.0	-6.22	38.94	27.78	37.94	Compliance
	-32	-34.0	-7.15	38.94	26.85	36.94	Compliance
	-20	-34.0	-16.81	38.94	17.19	24.94	Compliance
AWS	-90	-28.0	12.53	45.76	40.53	71.27	Compliance
	-50	-28.0	3.12	45.76	31.12	61.76	Compliance
	-45	-28.0	-1.92	45.76	26.08	56.76	Compliance
	-44	-28.0	-2.96	45.76	25.04	55.76	Compliance
	-43	-28.0	-2.98	45.76	25.02	54.76	Compliance
	-42	-28.0	-3.02	45.76	24.98	53.76	Compliance
PCS	-70	-29.2	12.09	46.47	41.29	71.98	Compliance
	-50	-29.2	7.59	46.47	36.79	62.47	Compliance
	-39	-29.2	-3.03	46.47	26.17	51.47	Compliance
	-37	-29.2	-5.09	46.47	24.11	49.47	Compliance
	-36	-29.2	-6.09	46.47	23.11	48.47	Compliance
	-35	-29.2	-7.09	46.47	22.11	47.47	Compliance

Note: Variable booster gain Limit: -34 dB-RSSI + MSCL.

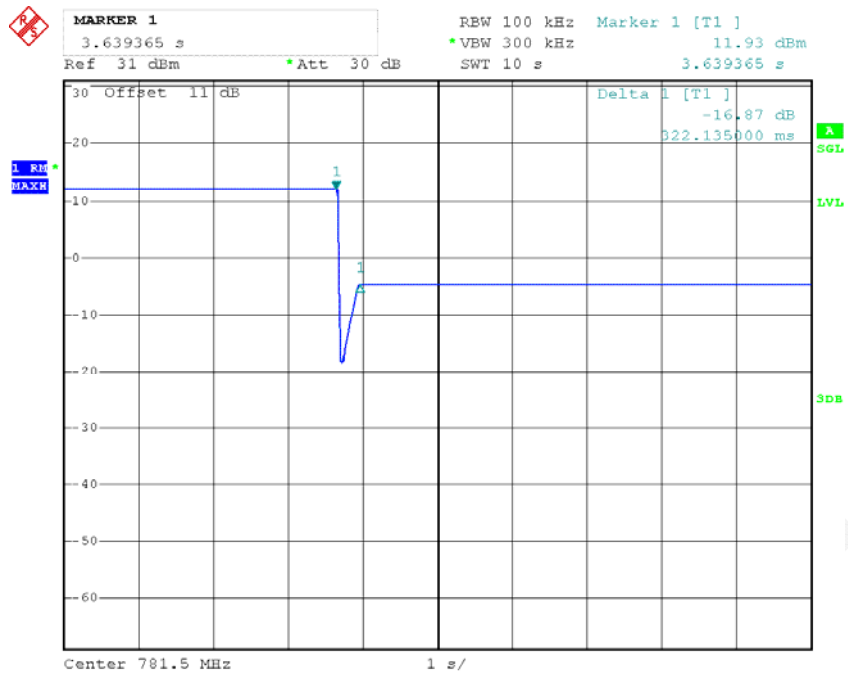
Variable gain timing:

Operation Bands	Measured value	Limit	Results
MHz	s	s	
Lower 700	0.40	3	Compliance
Upper 700	0.32		Compliance
Cellular	0.68		Compliance
AWS	0.34		Compliance
PCS	0.36		Compliance

Lower 700

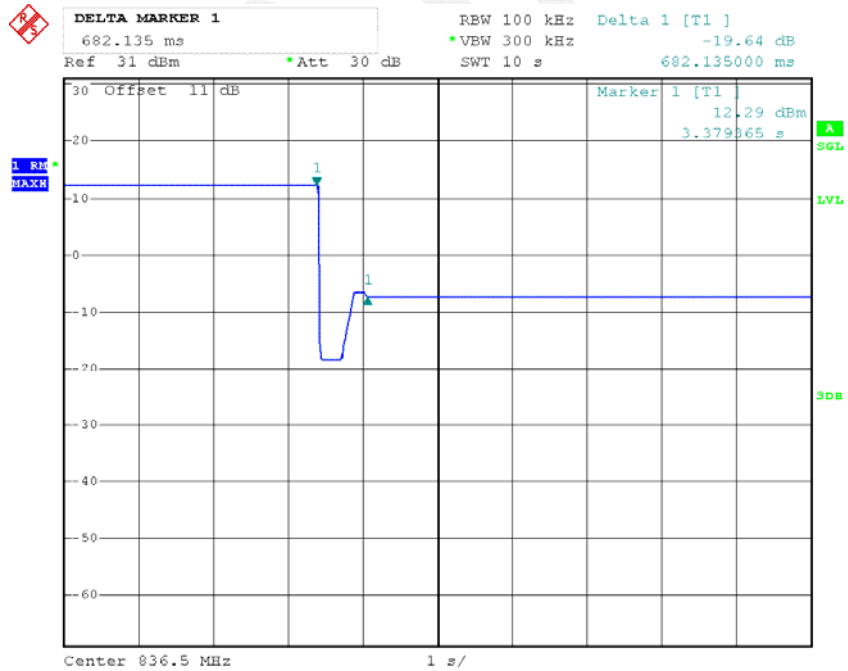
Date: 21.NOV.2015 17:44:24

Upper 700



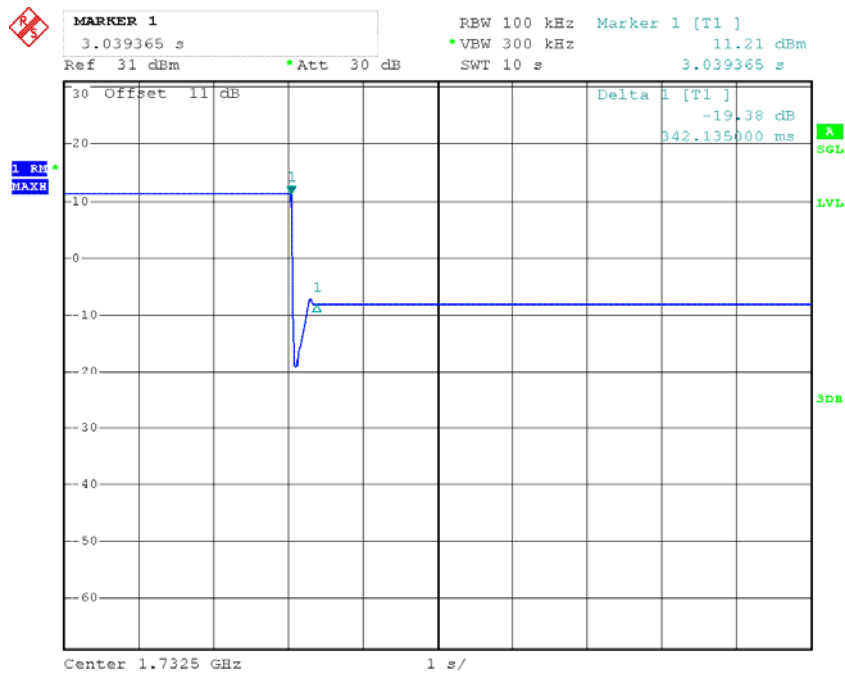
Date: 21.NOV.2015 17:47:01

Cellular Band



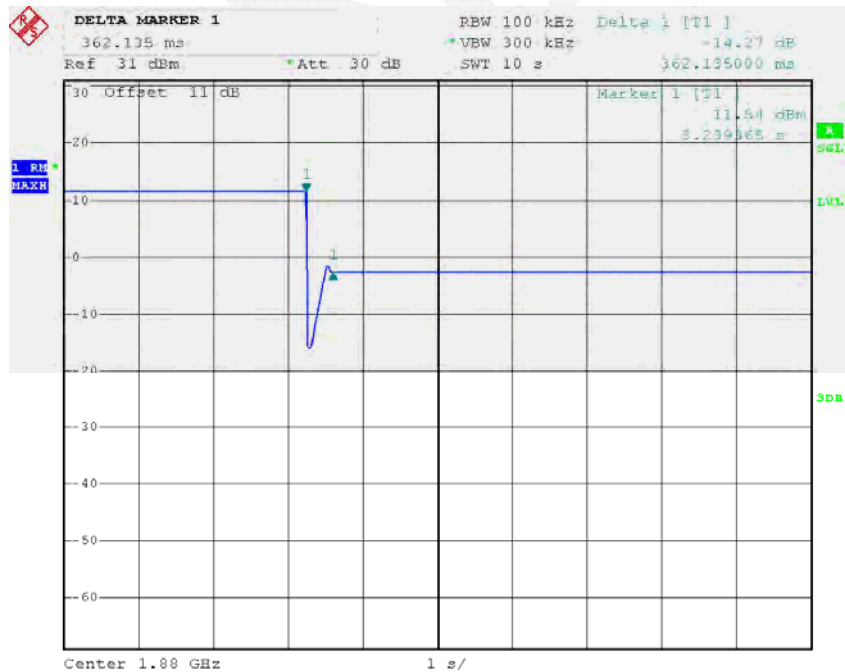
Date: 21.NOV.2015 17:49:13

AWS Band



Date: 21.NOV.2015 17:52:48

PCS Band



Date: 21.NOV.2015 17:55:08

§ 2.1049 - OCCUPIED BANDWIDTH

Applicable Standards

According to § 2.1049 Measurements required: Occupied bandwidth.

Test Procedure

This measurement is required to compare the uniformity of the output signal relative to the input signal and to satisfy the requirements of § 2.1049.

- Connect the test equipment as shown in **Figure 6** to measure the characteristics of the test signals produced by the signal generator.
- Set VBW to $\geq 3 \times \text{RBW}$.
- Set the center frequency of the spectrum analyzer to the center of the operational band. The span will be adjusted for each modulation type and occupied bandwidth as necessary for accurately viewing the signals.
- Set the signal generator for power level to match the values obtained in 7.2.
- Set the signal generator modulation type for GSM with a PRBS pattern and allow the trace on the signal generator to stabilize adjusting the span as necessary.
- Set the spectrum analyzer RBW for 1% to 5% of the emissions bandwidth.
- Capture the spectrum analyzer trace for inclusion in the test report.
- Repeat 7.10c) to 7.10g) for CDMA and W-CDMA modulation adjusting the span as necessary for all uplink and downlink operational bands. AWGN or LTE may be used in place of W-CDMA, as an option.
- Connect the test equipment as shown in **Figure 1**. Begin with the uplink output connected to the spectrum analyzer.
- Repeat 7.10c) to 7.10h) in this new configuration.

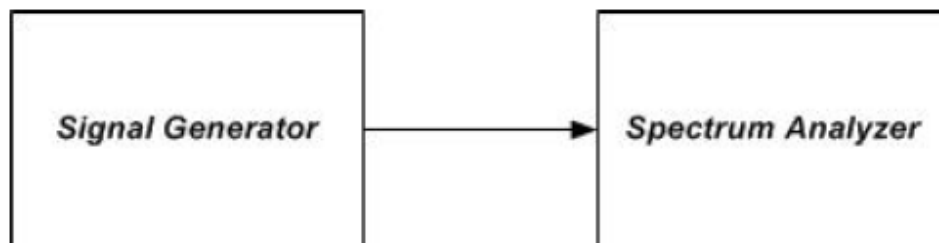


Figure 6 – Occupied bandwidth instrumentation test setup

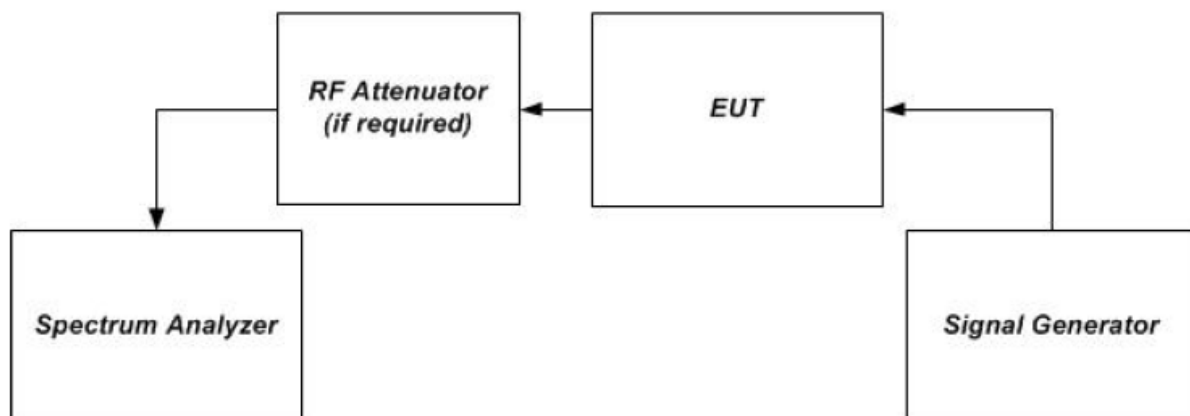


Figure 1 – Band verification test instrumentation setup

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

*** 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**

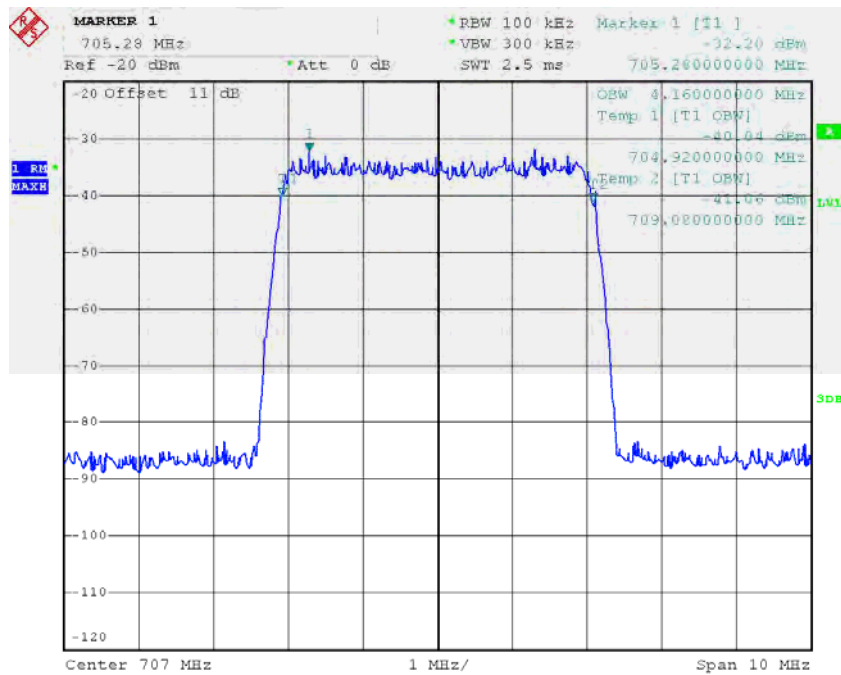
Temperature:	24.2~25.1
Relative Humidity:	45~48 %
ATM Pressure:	101.2~101.8 kPa

The testing was performed by Dean Liu from 2015-11-25 to 2015-11-29.

Input-versus-output signal comparison:

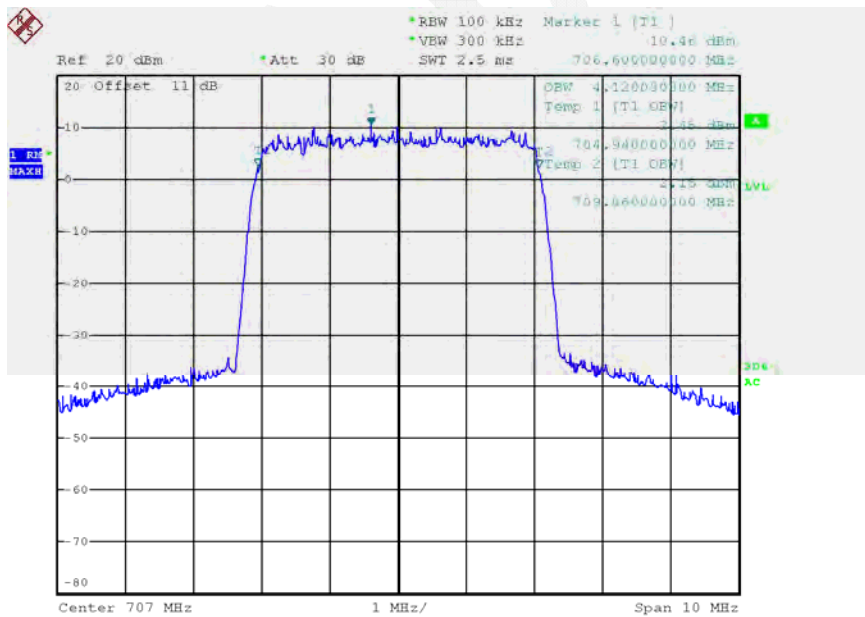
Mode	Operation Band	Signal type	Input	Output	Results
			MHz	MHz	
Uplink	Lower 700	AWGN	4.160	4.120	Compliance
		CDMA	1.266	1.272	Compliance
		GSM	0.248	0.246	Compliance
	Upper 700	AWGN	4.120	4.100	Compliance
		CDMA	1.266	1.266	Compliance
		GSM	0.242	0.246	Compliance
	Cellular	AWGN	4.120	4.120	Compliance
		CDMA	1.260	1.266	Compliance
		GSM	0.246	0.244	Compliance
	AWS	AWGN	4.120	4.140	Compliance
		CDMA	1.266	1.266	Compliance
		GSM	0.248	0.250	Compliance
	PCS	AWGN	4.140	4.140	Compliance
		CDMA	1.266	1.266	Compliance
		GSM	0.246	0.246	Compliance
Downlink	Lower 700	AWGN	4.160	4.140	Compliance
		CDMA	1.260	1.266	Compliance
		GSM	0.250	0.248	Compliance
	Upper 700	AWGN	4.120	4.120	Compliance
		CDMA	1.272	1.266	Compliance
		GSM	0.246	0.248	Compliance
	Cellular	AWGN	4.120	4.120	Compliance
		CDMA	1.260	1.260	Compliance
		GSM	0.248	0.246	Compliance
	AWS	AWGN	4.140	4.120	Compliance
		CDMA	1.272	1.266	Compliance
		GSM	0.246	0.246	Compliance
	PCS	AWGN	4.140	4.120	Compliance
		CDMA	1.266	1.260	Compliance
		GSM	0.248	0.244	Compliance

Uplink, 707MHz –AWGN(Input)



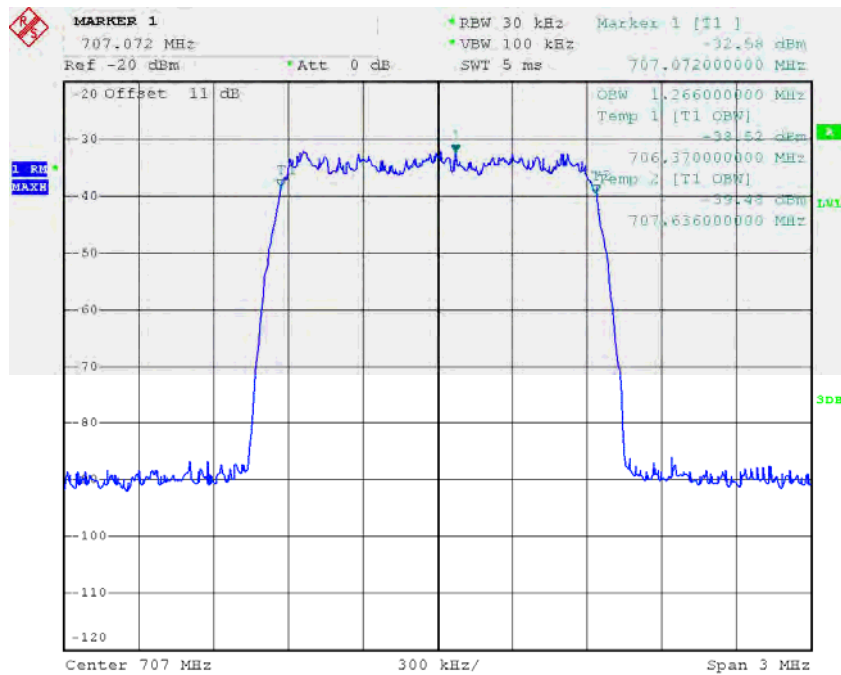
Date: 25.NOV.2015 23:11:29

Uplink, 707MHz -AWGN(Output)



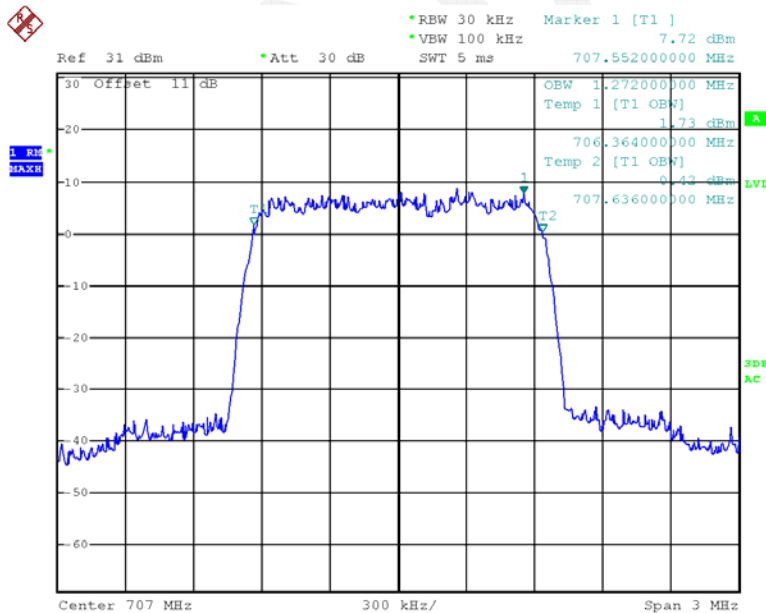
Date: 26.NOV.2015 23:05:45

Uplink, 707MHz -CDMA(Input)



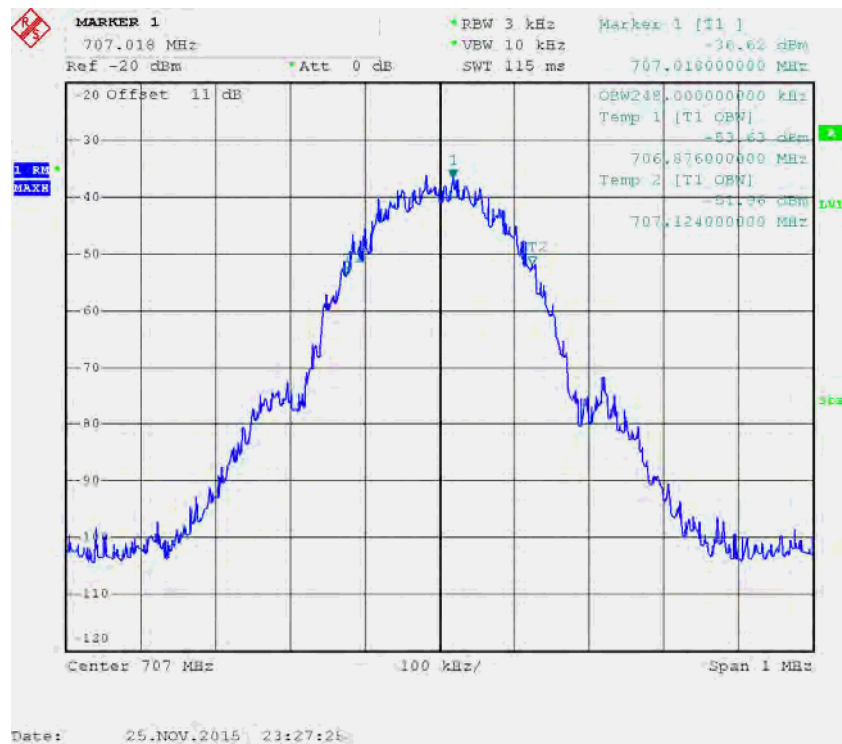
Date: 25.NOV.2015 23:36:12

Uplink, 707MHz -CDMA(Output)

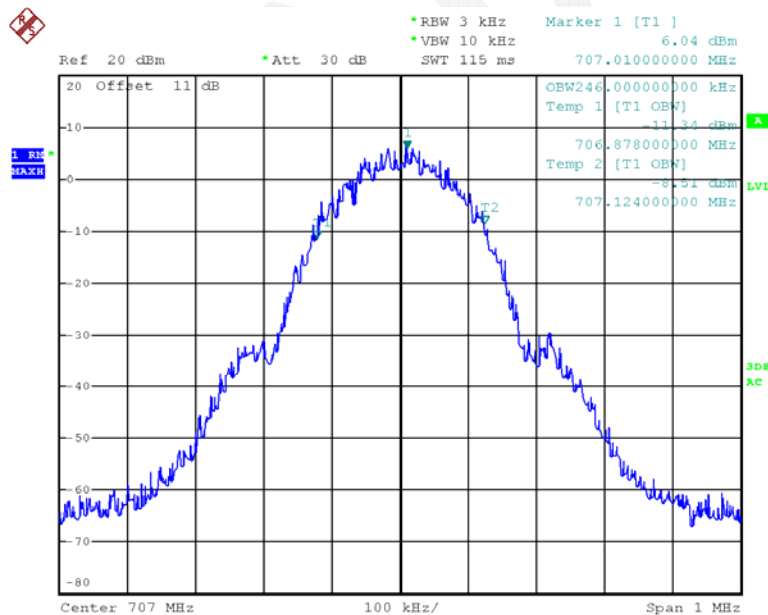


Date: 26.NOV.2015 22:59:14

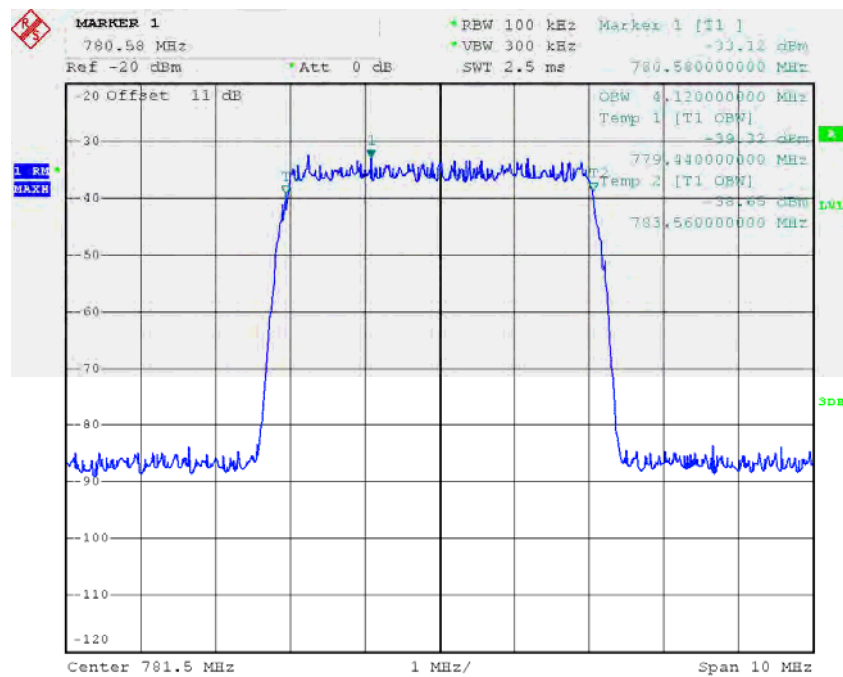
Uplink, 707MHz -GSM(Input)



Uplink, 707MHz -GSM(Output)

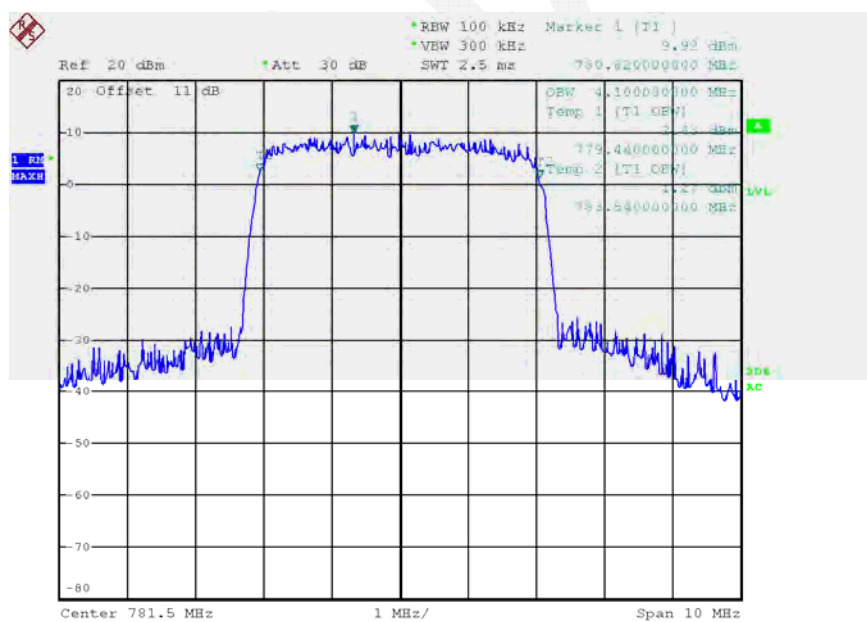


Uplink, 781.5MHz -AWGN(Input)



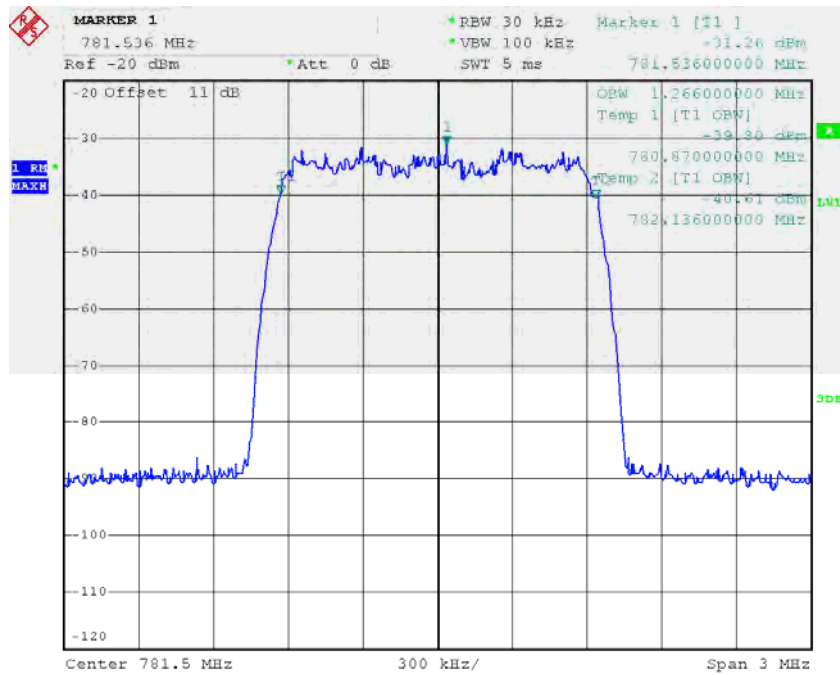
Date: 25.NOV.2015 23:12:24

Uplink, 781.5MHz -AWGN(Output)



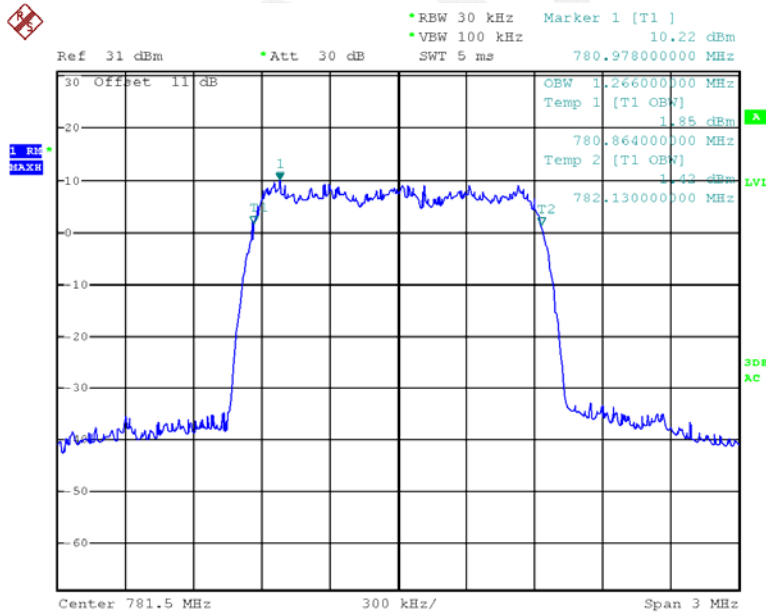
Date: 26.NOV.2015 23:06:12

Uplink, 781.5MHz -CDMA(Input)



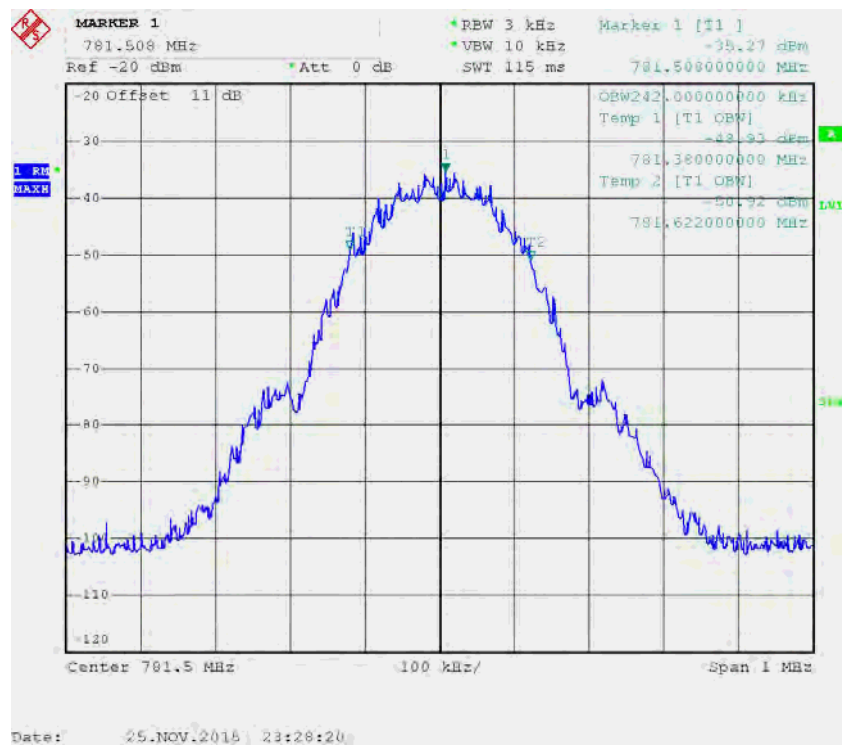
Date: 25.NOV.2015 23:38:11

Uplink, 781.5MHz -CDMA(Output)

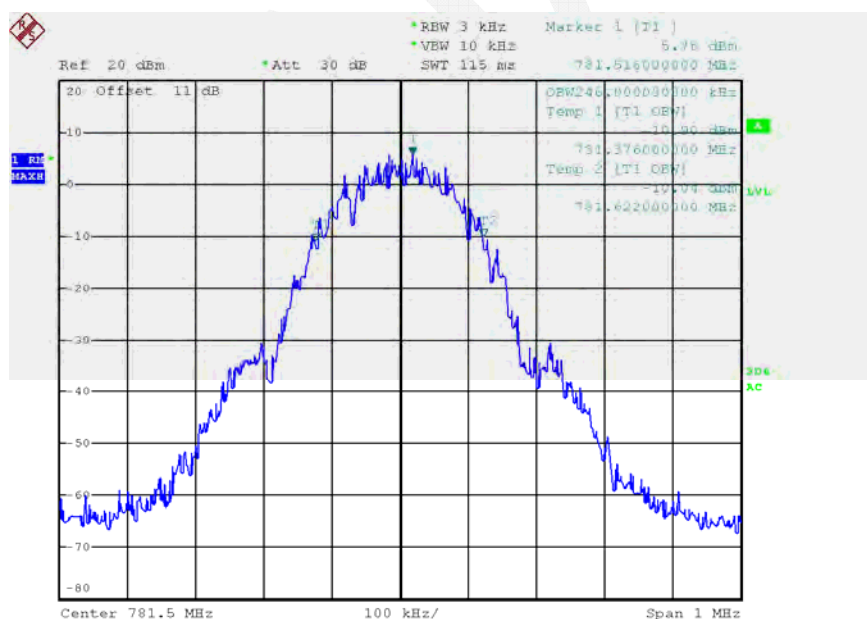


Date: 26.NOV.2015 23:00:03

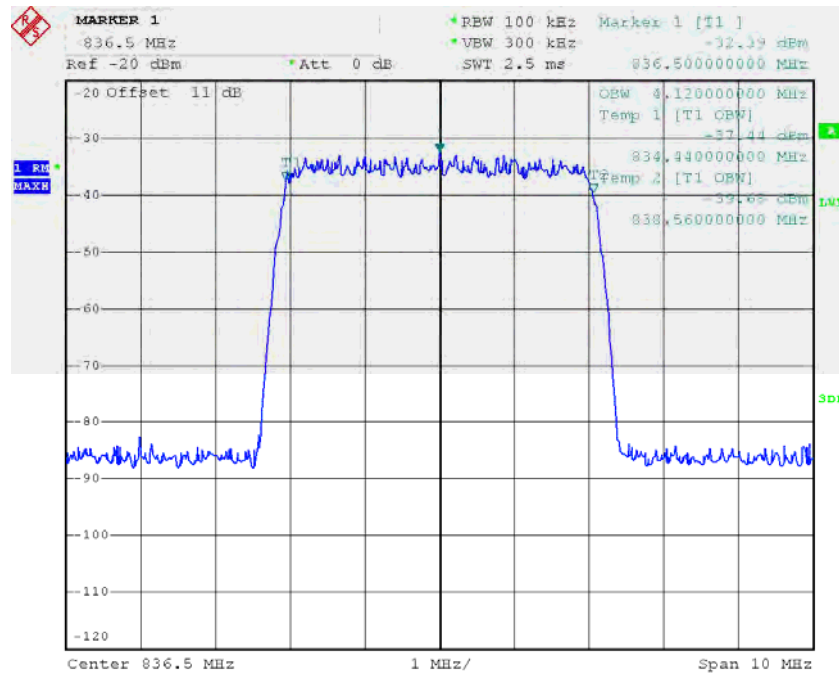
Uplink, 781.5MHz -GSM(Input)



Uplink, 781.5MHz -GSM(Output)

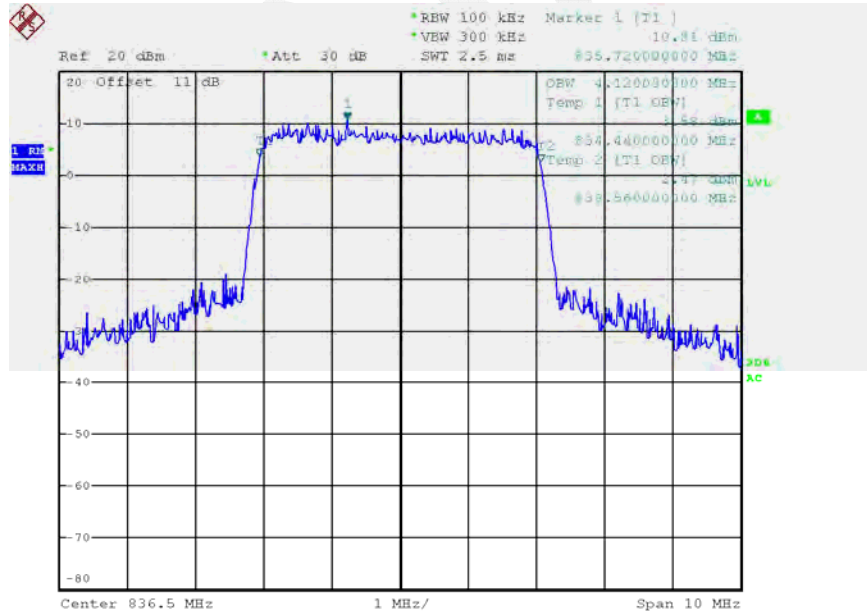


Uplink, 836.5MHz -AWGN(Input)



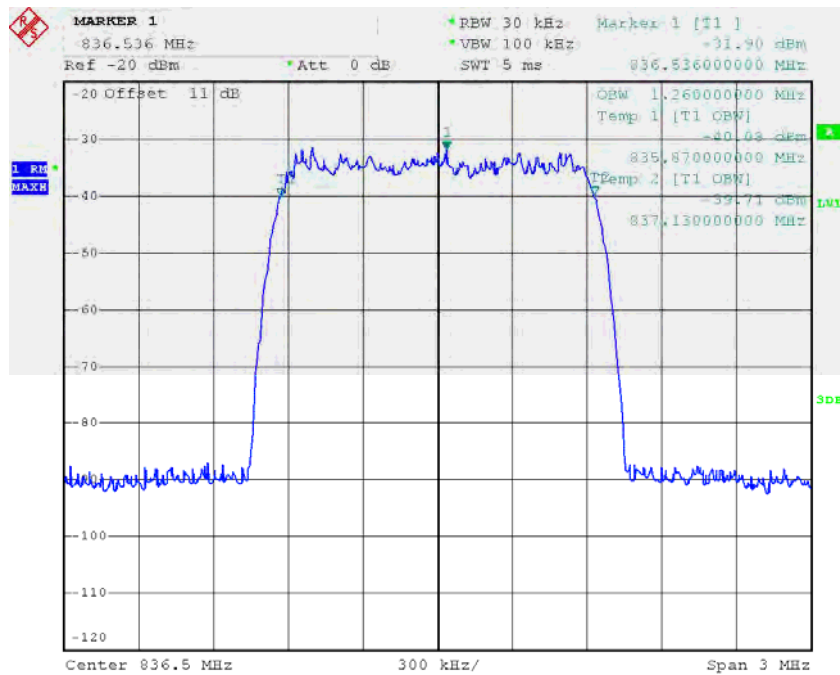
Date: 25.NOV.2015 23:11:12

Uplink, 836.5MHz -AWGN(Output)



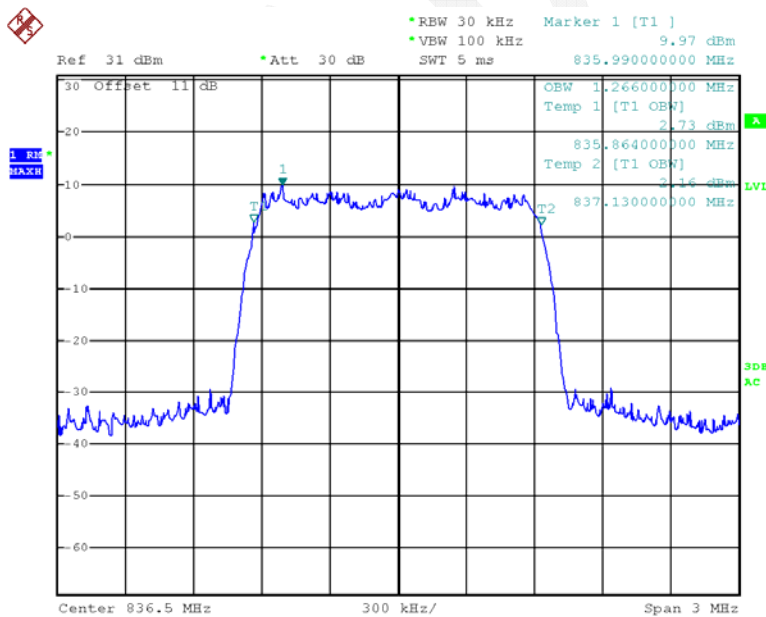
Date: 26.NOV.2015 23:06:35

Uplink, 836.5MHz -CDMA(Input)



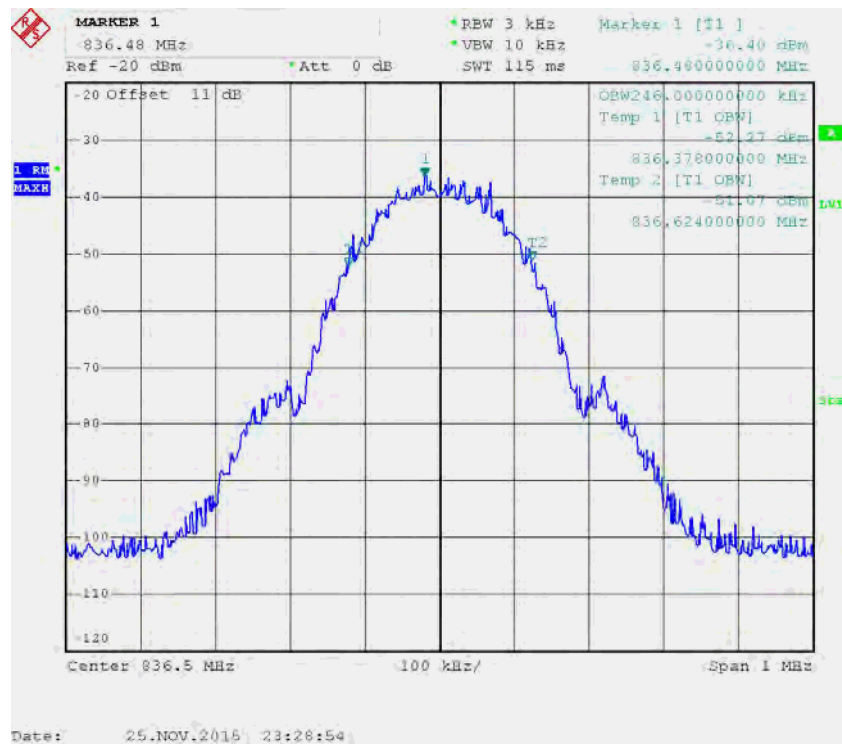
Date: 25.NOV.2015 23:38:32

Uplink, 836.5MHz -CDMA(Output)

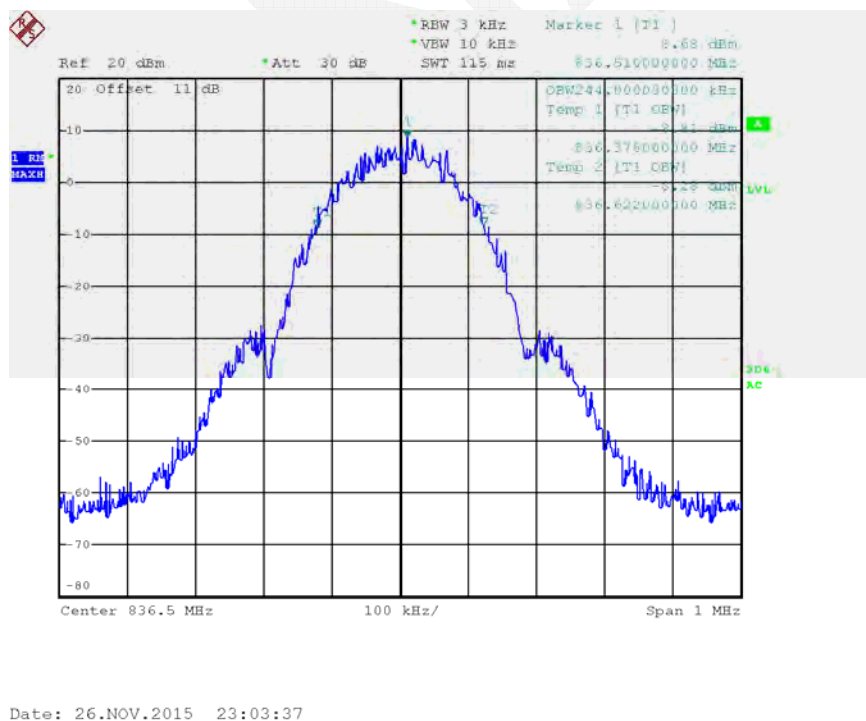


Date: 26.NOV.2015 23:00:41

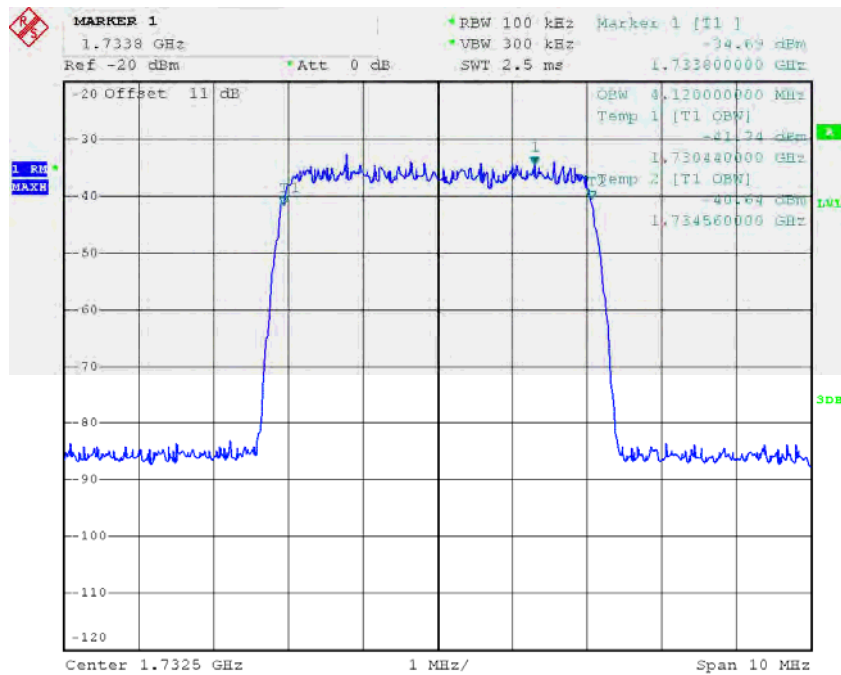
Uplink, 836.5MHz -GSM(Input)



Uplink, 836.5MHz -GSM(Output)

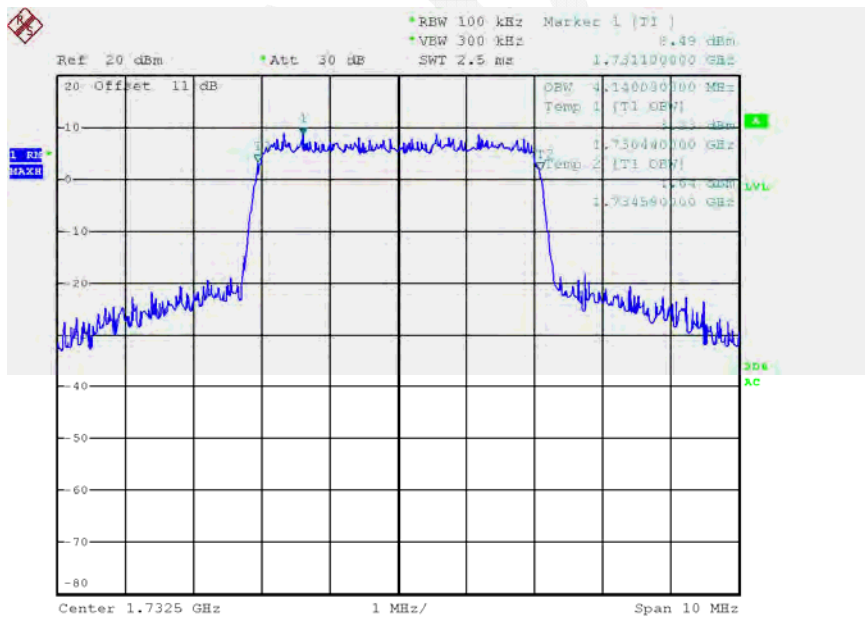


Uplink, 1732.5MHz -AWGN(Input)



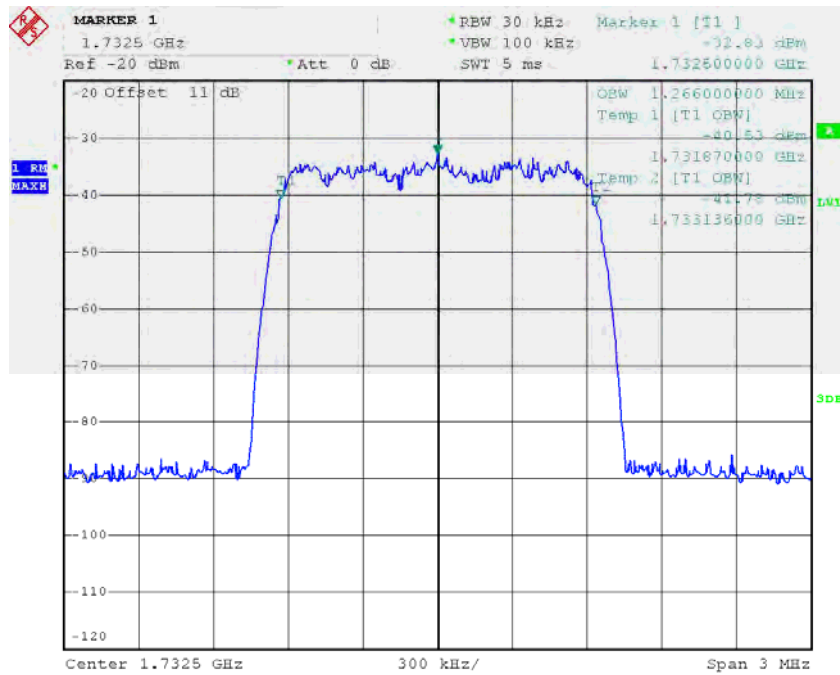
Date: 25.NOV.2015 23:10:49

Uplink, 1732.5MHz -AWGN(Output)



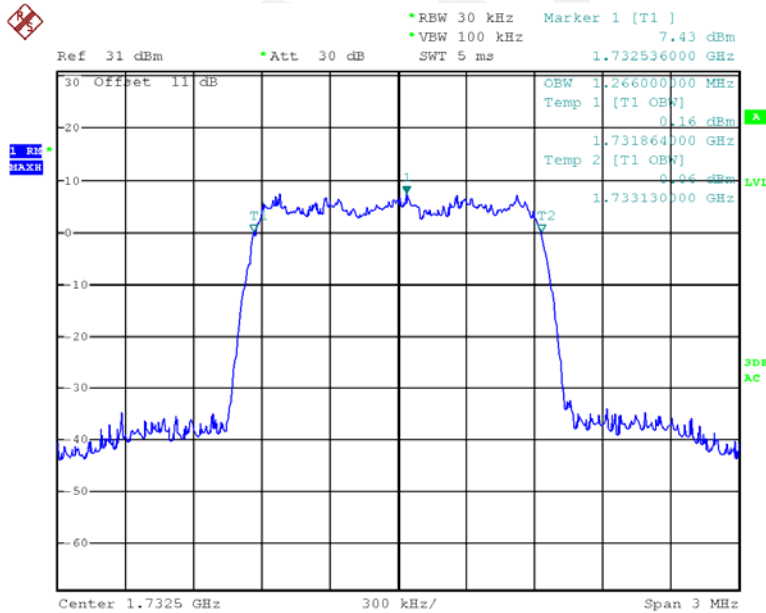
Date: 26.NOV.2015 23:07:05

Uplink, 1732.5MHz -CDMA(Input)



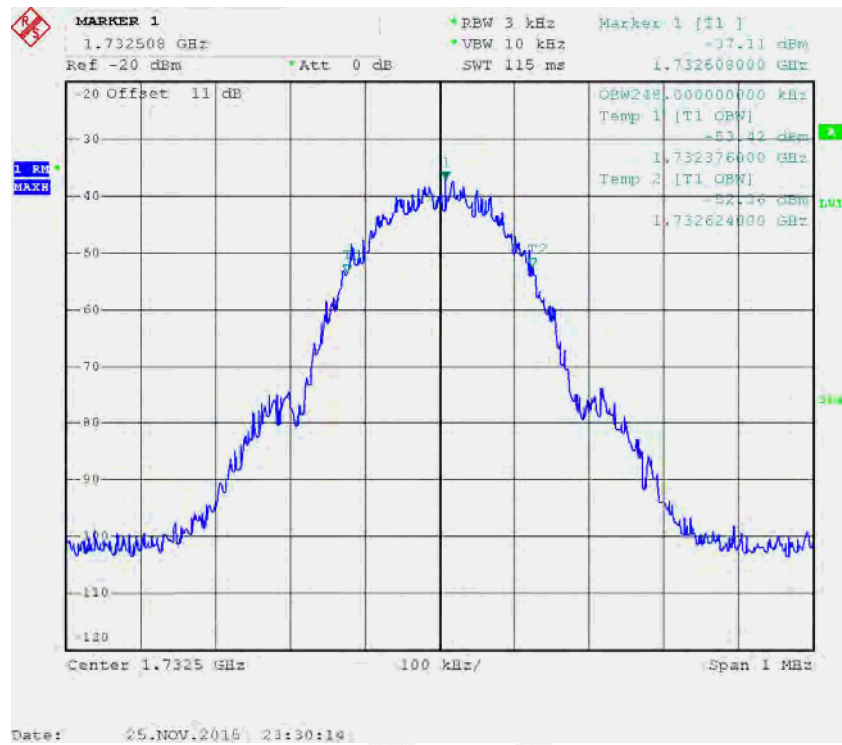
Date: 25.NOV.2015 23:39:01

Uplink, 1732.5MHz -CDMA(Output)

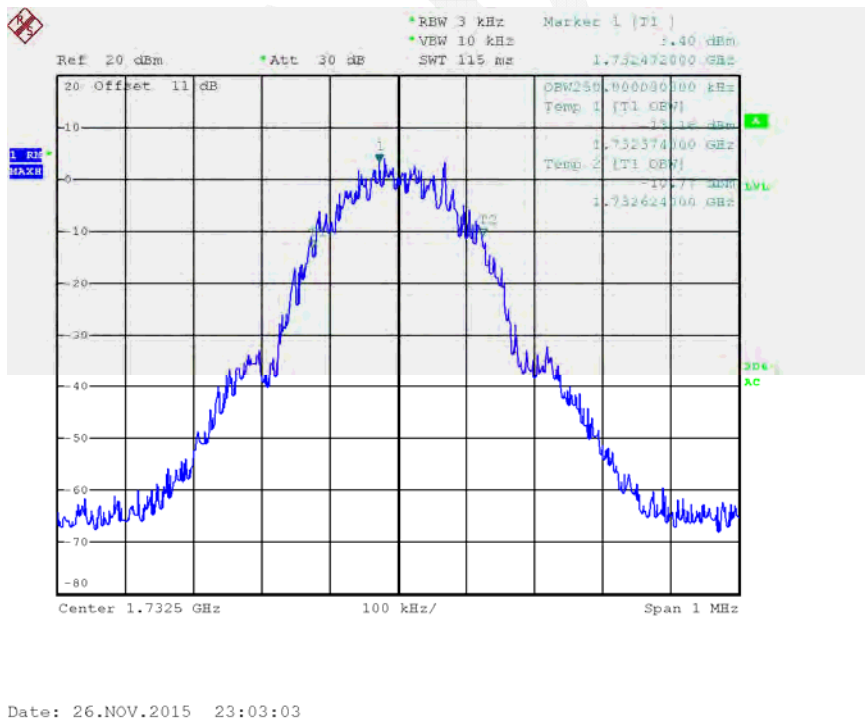


Date: 26.NOV.2015 23:01:22

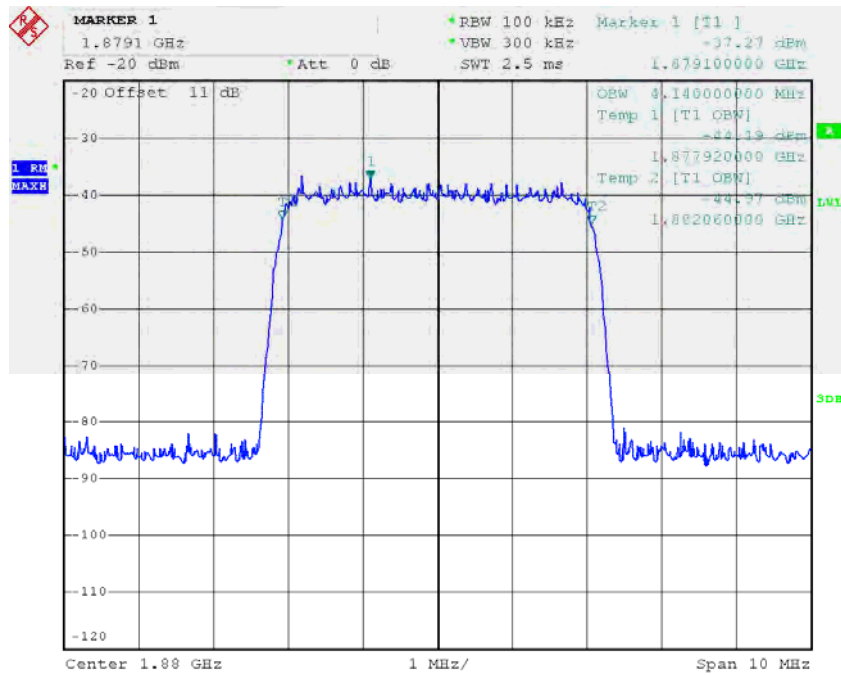
Uplink, 1732.5MHz -GSM(Input)



Uplink, 1732.5MHz -GSM(Output)

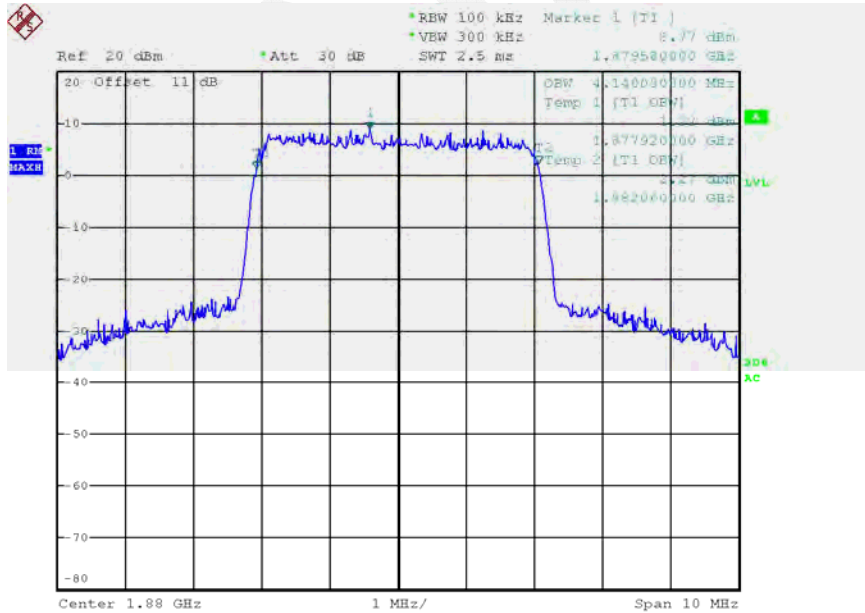


Uplink, 1880MHz-AWGN(Input)



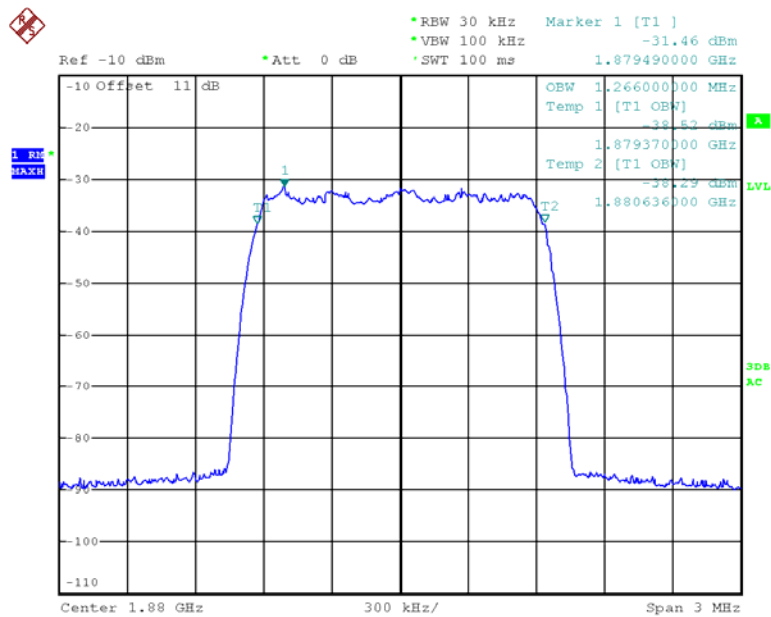
Date: 25.NOV.2015 23:10:22

Uplink, 1880MHz-AWGN(Output)



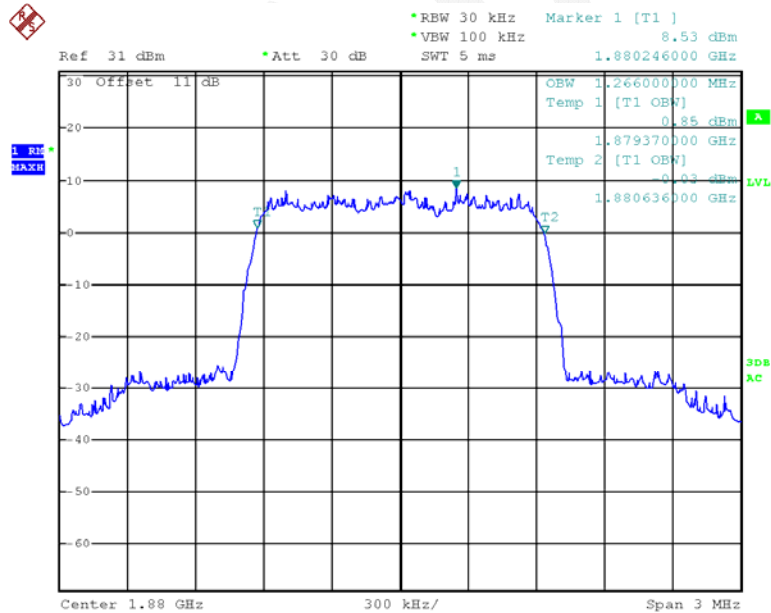
Date: 26.NOV.2015 23:07:32

Uplink, 1880MHz-CDMA(Input)



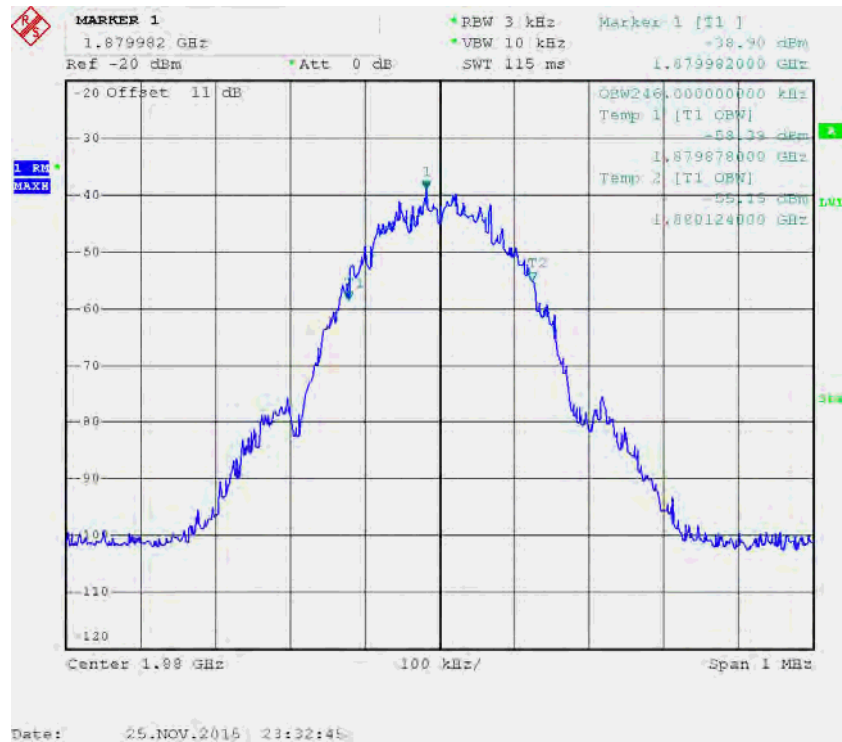
Date: 29.NOV.2015 14:57:45

Uplink, 1880MHz-CDMA(Output)

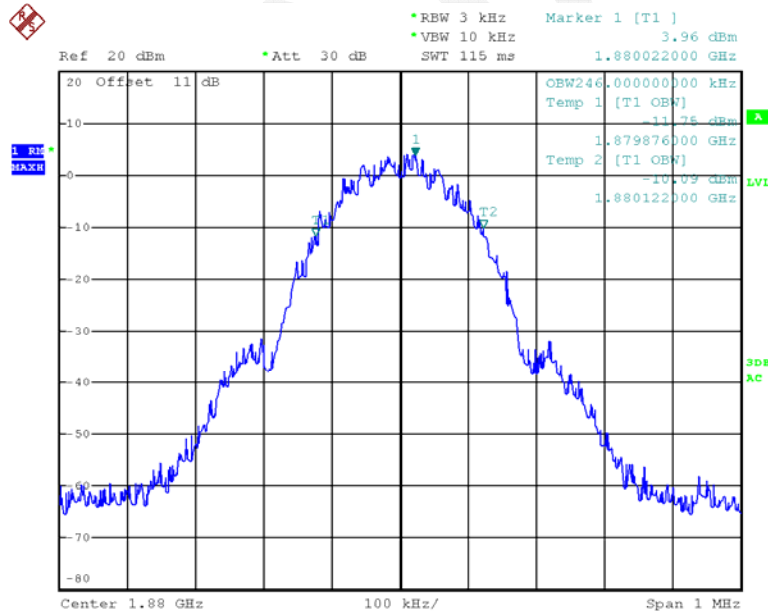


Date: 26.NOV.2015 23:02:00

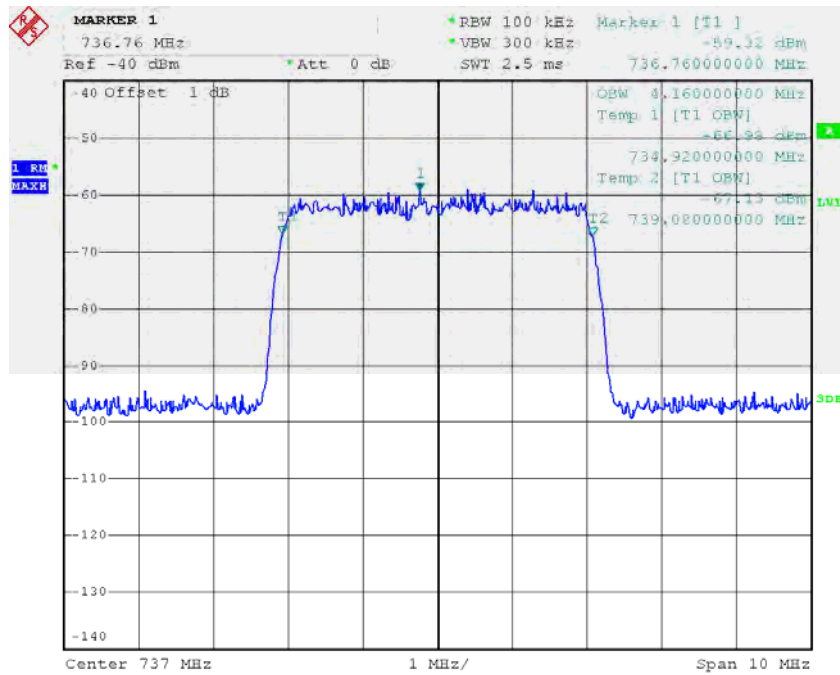
Uplink, 1880MHz-GSM(Input)



Uplink, 1880MHz-GSM(Output)

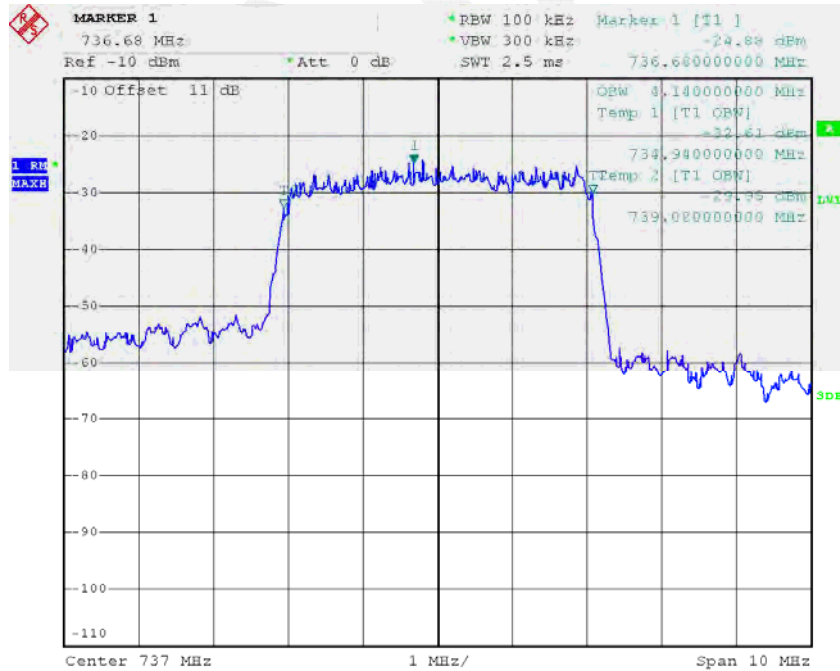


Downlink, 737MHz -AWGN(Input)



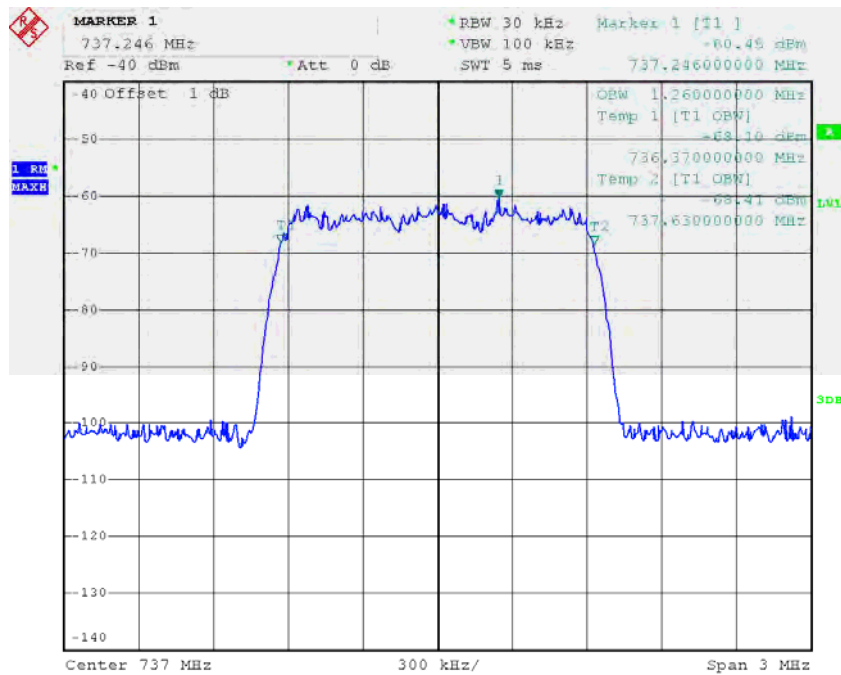
Date: 25.NOV.2015 23:16:36

Downlink, 737MHz -AWGN(Output)



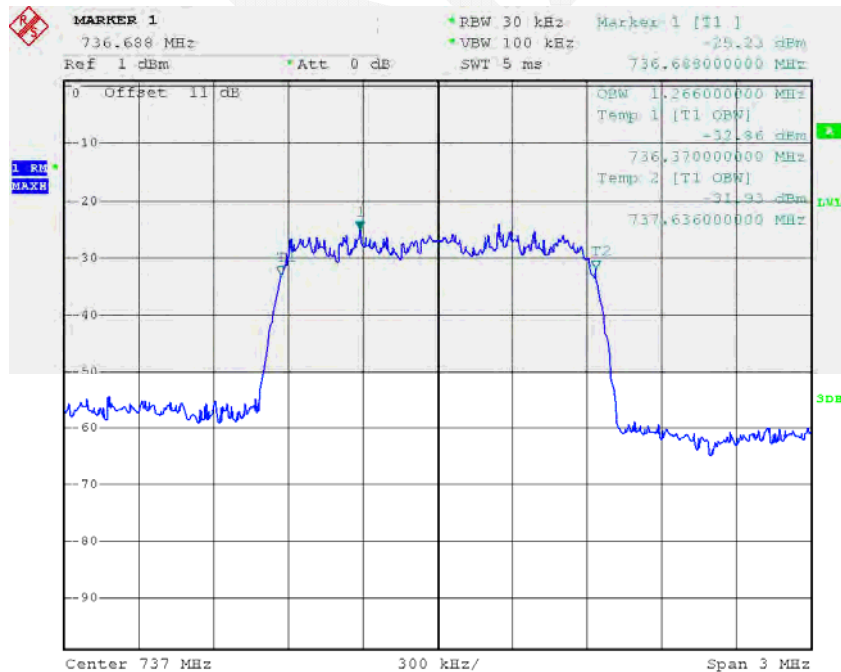
Date: 25.NOV.2015 23:58:28

Downlink, 737MHz -CDMA(Input)



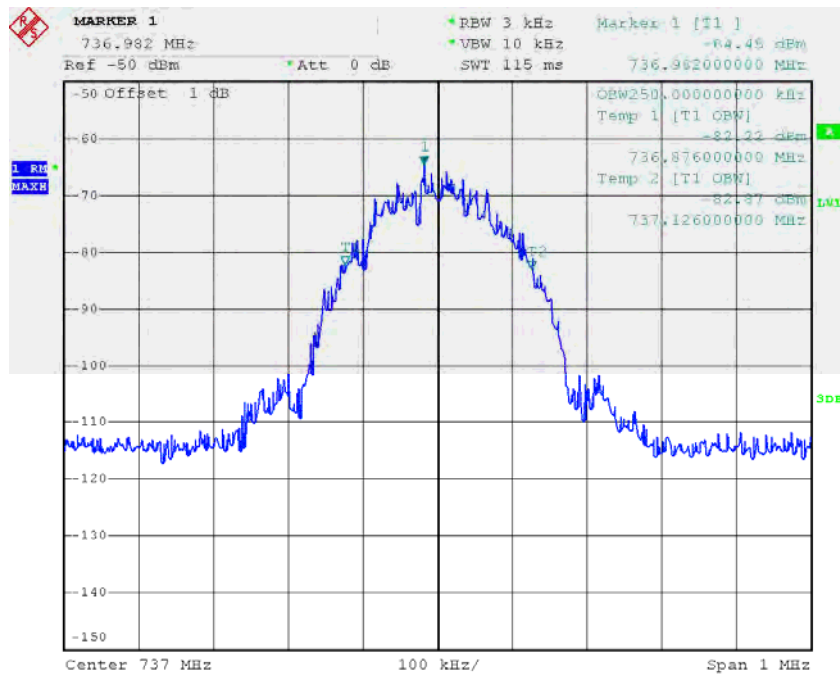
Date: 25.NOV.2015 23:44:00

Downlink, 737MHz -CDMA(Output)



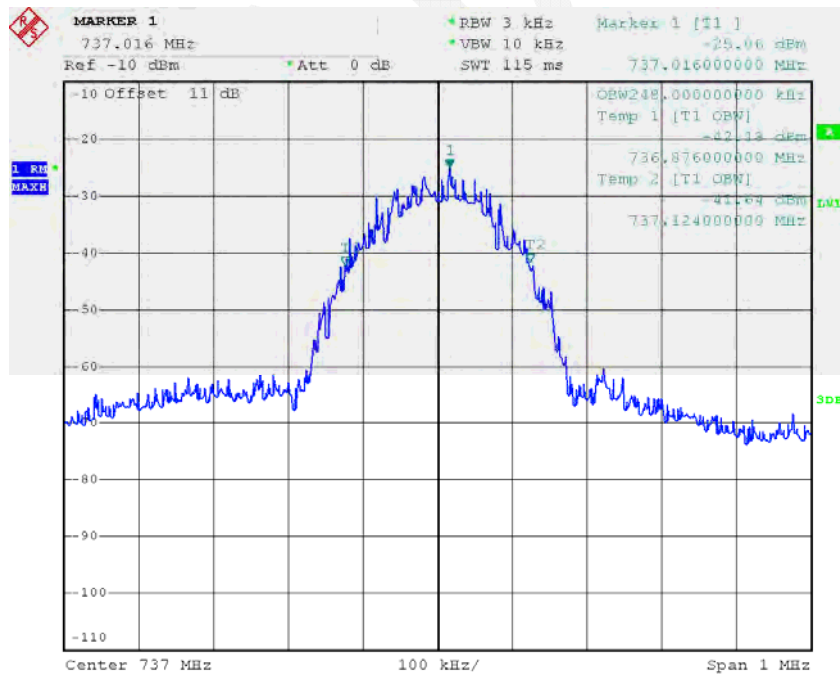
Date: 25.NOV.2015 23:52:01

Downlink, 737MHz -GSM(Input)



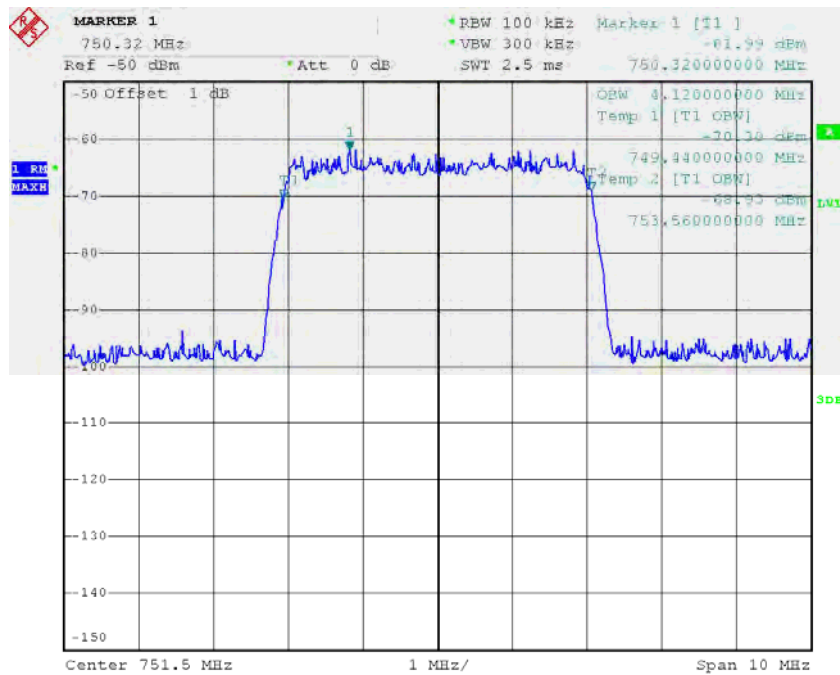
Date: 25.NOV.2015 23:25:06

Downlink, 737MHz -GSM(Output)



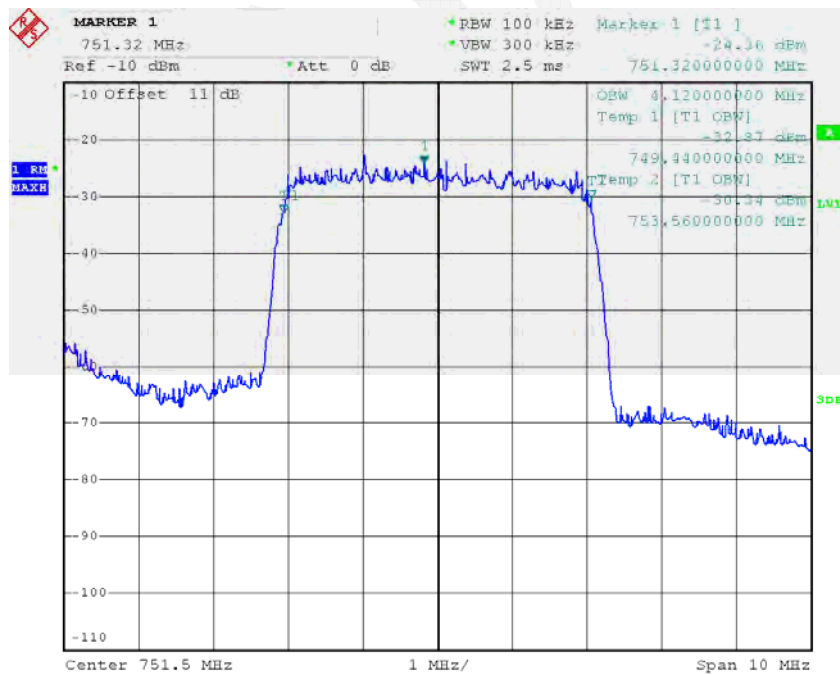
Date: 25.NOV.2015 23:54:00

Downlink, 751.5MHz -AWGN(Input)



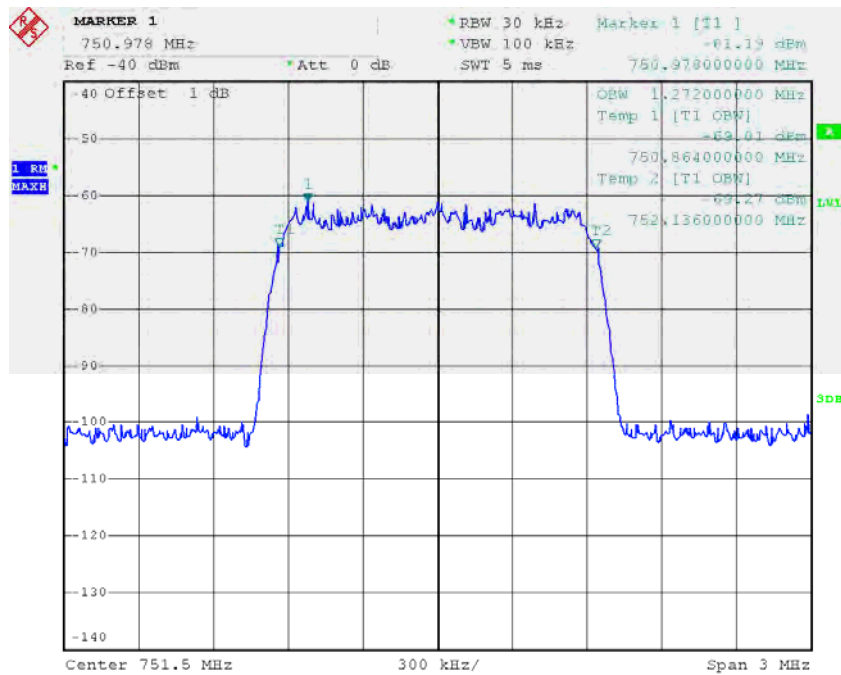
Date: 25.NOV.2015 23:17:43

Downlink, 751.5MHz -AWGN(Output)



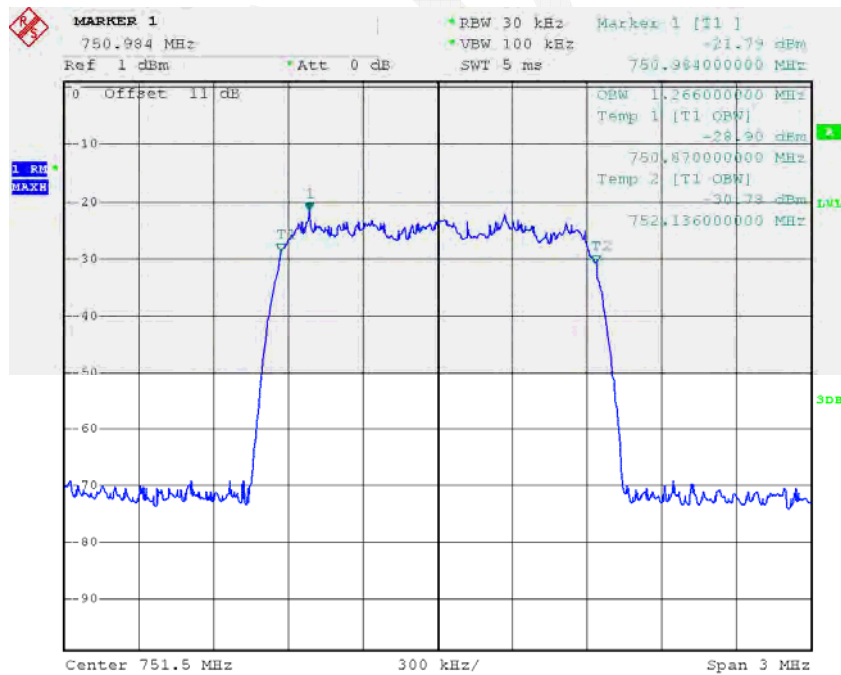
Date: 25.NOV.2015 23:58:54

Downlink, 751.5MHz -CDMA(Input)



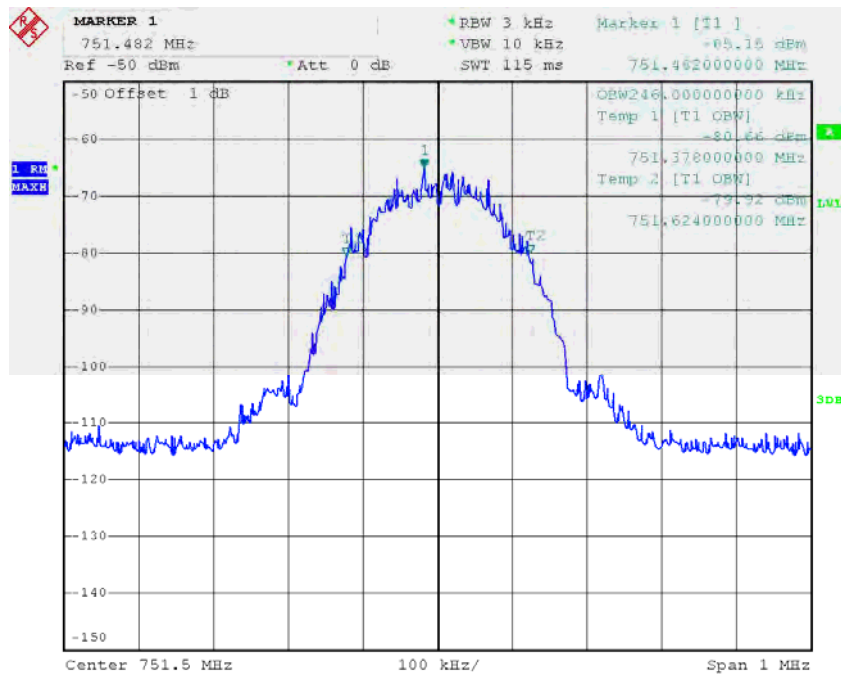
Date: 25.NOV.2015 23:44:23

Downlink, 751.5MHz -CDMA(Output)



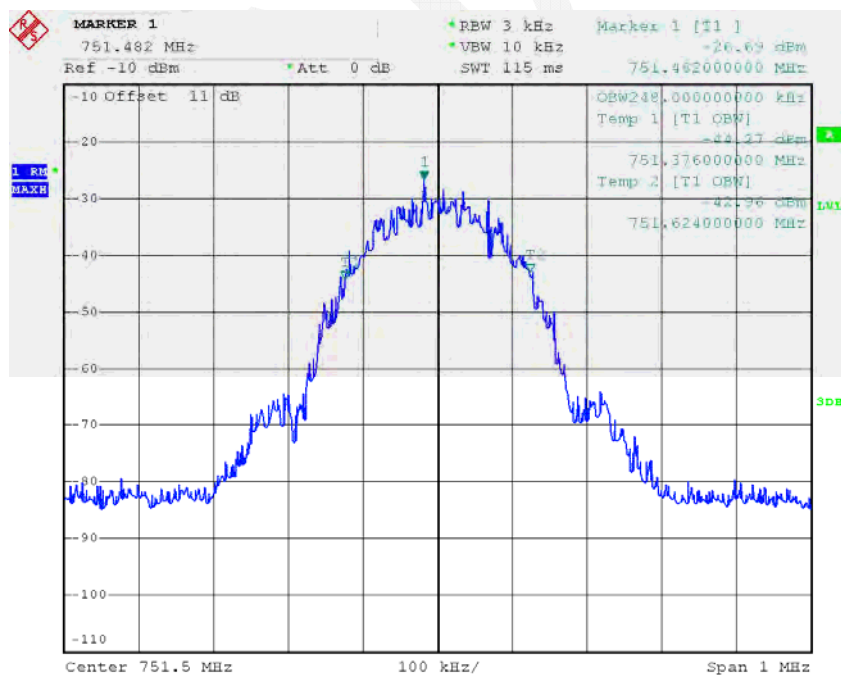
Date: 25.NOV.2015 23:51:15

Downlink, 751.5MHz -GSM(Input)



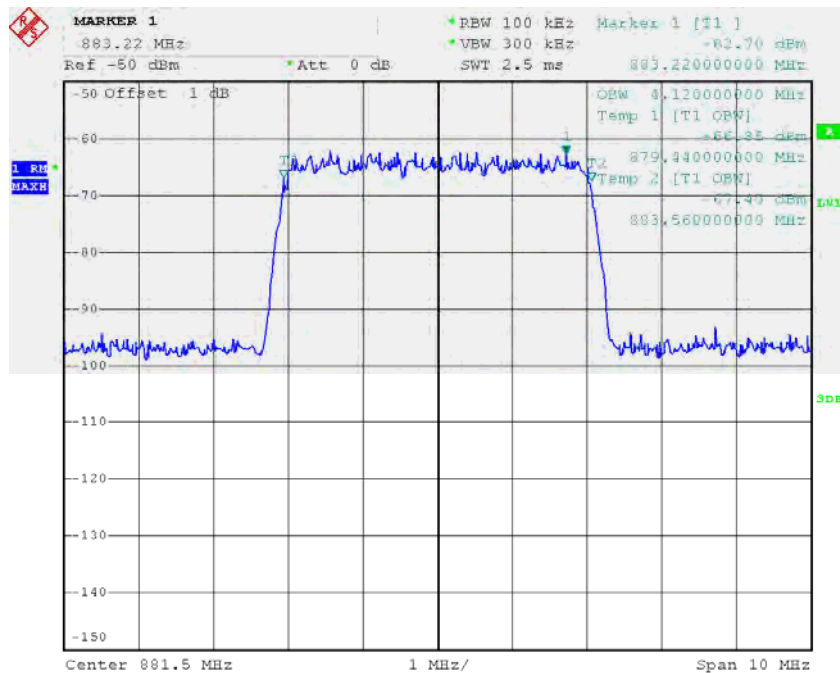
Date: 25.NOV.2015 23:24:47

Downlink, 751.5MHz -GSM(Output)



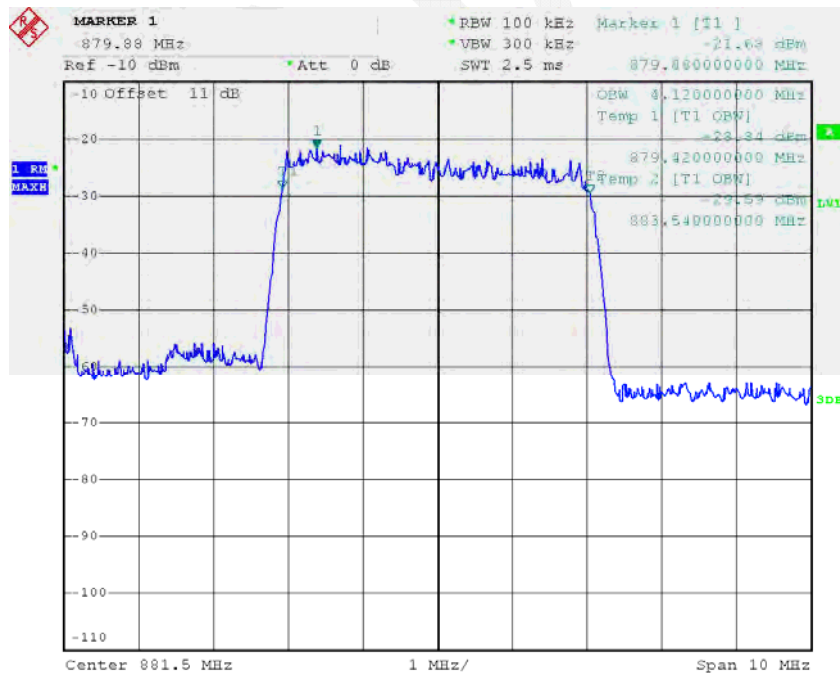
Date: 25.NOV.2015 23:54:25

Downlink, 881.5MHz -AWGN(Input)

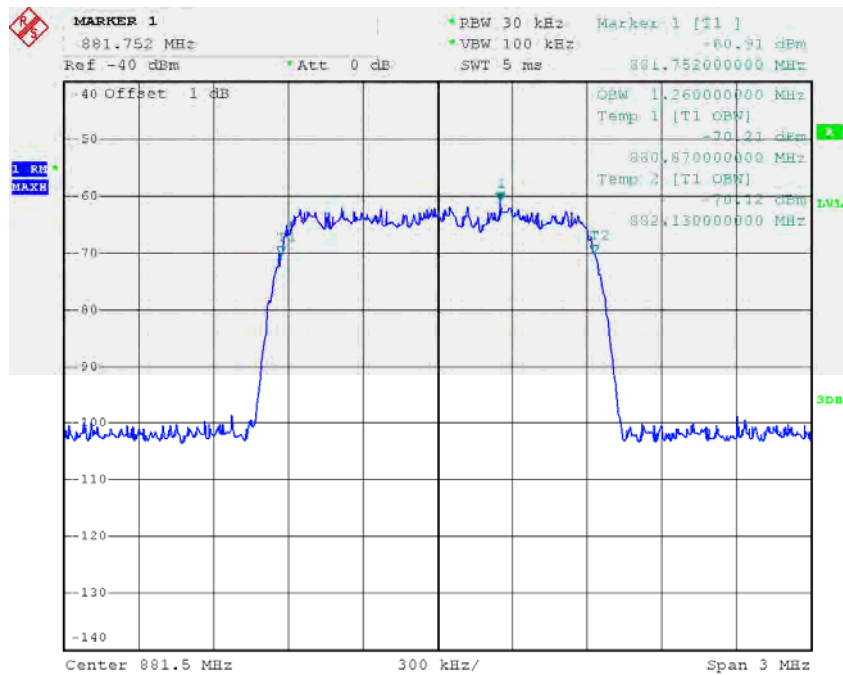


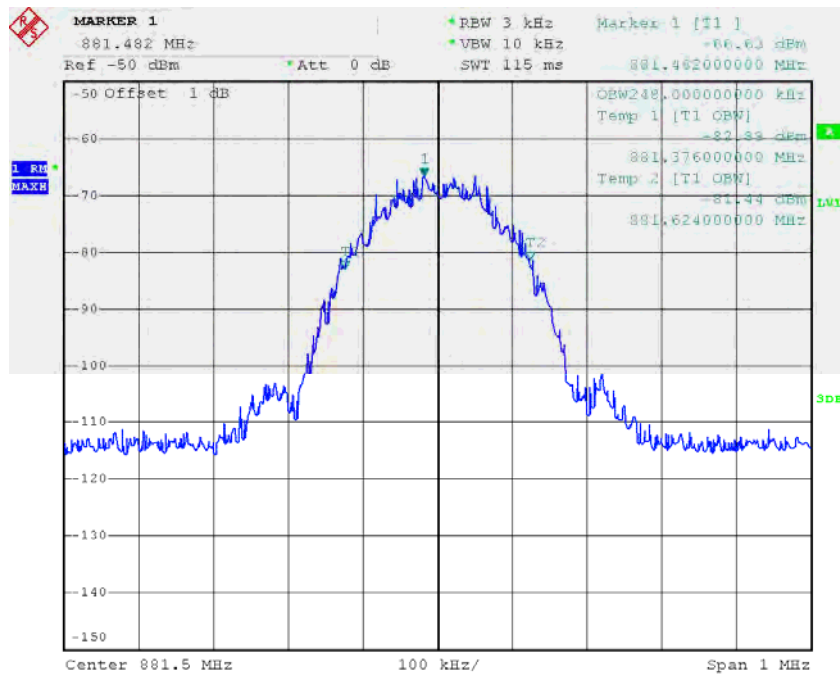
Date: 25.NOV.2015 23:18:36

Downlink, 881.5MHz -AWGN(Output)

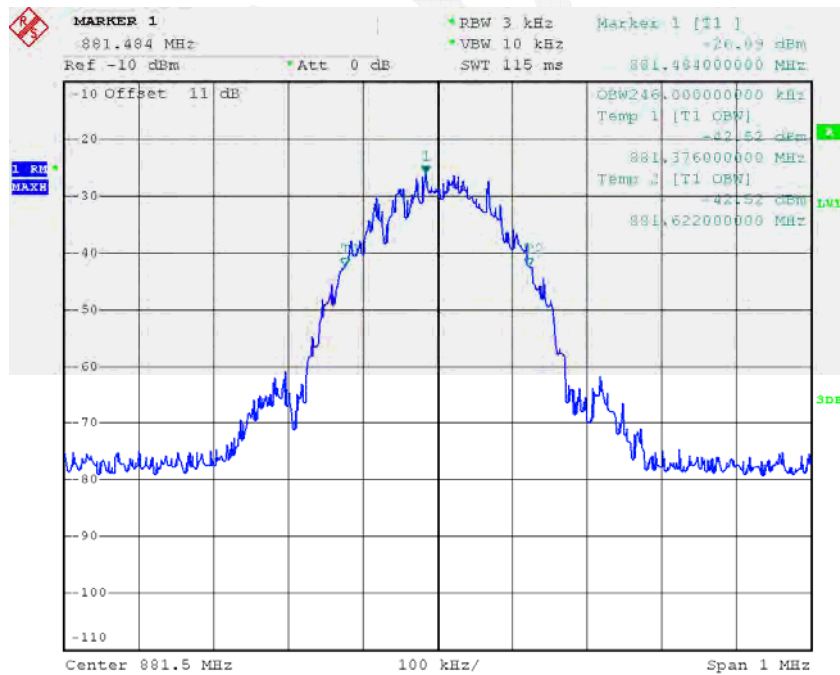


Date: 25.NOV.2015 23:58:15

Downlink, 881.5MHz -CDMA(Input)

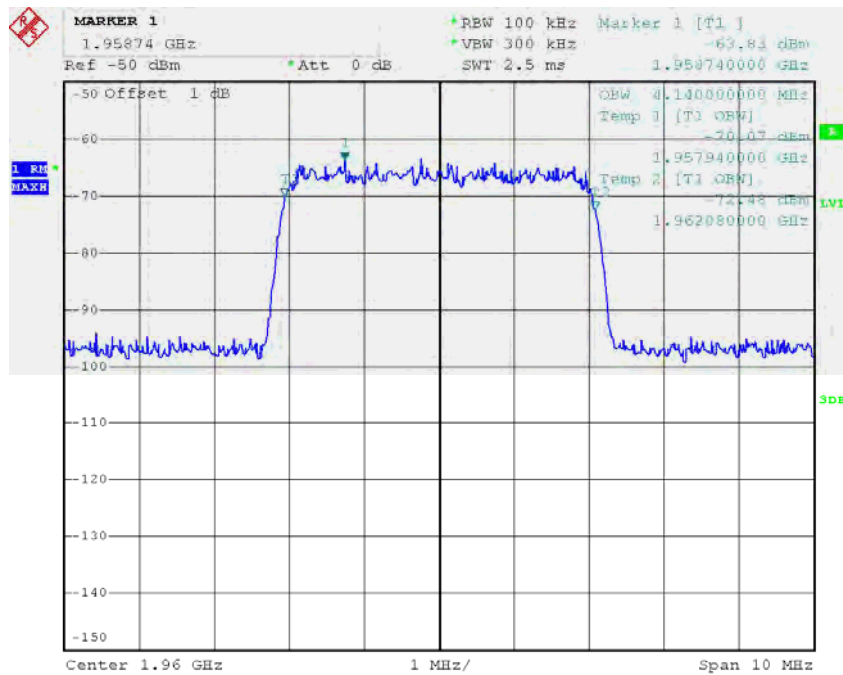
Downlink, 881.5MHz -GSM(Input)

Date: 25.NOV.2015 23:24:09

Downlink, 881.5MHz -GSM(Output)

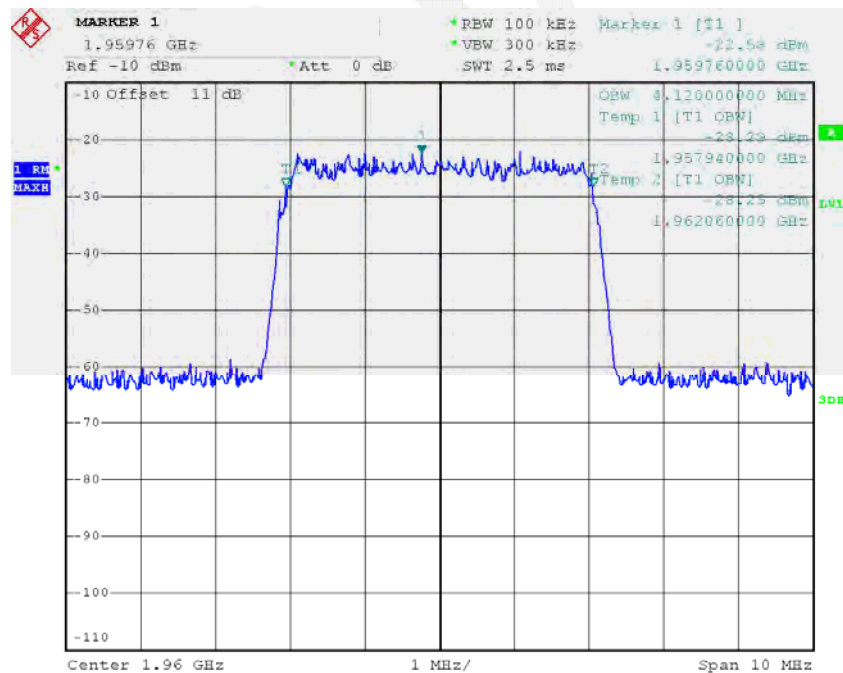
Date: 25.NOV.2015 23:54:50

Downlink, 1960MHz -AWGN(Input)

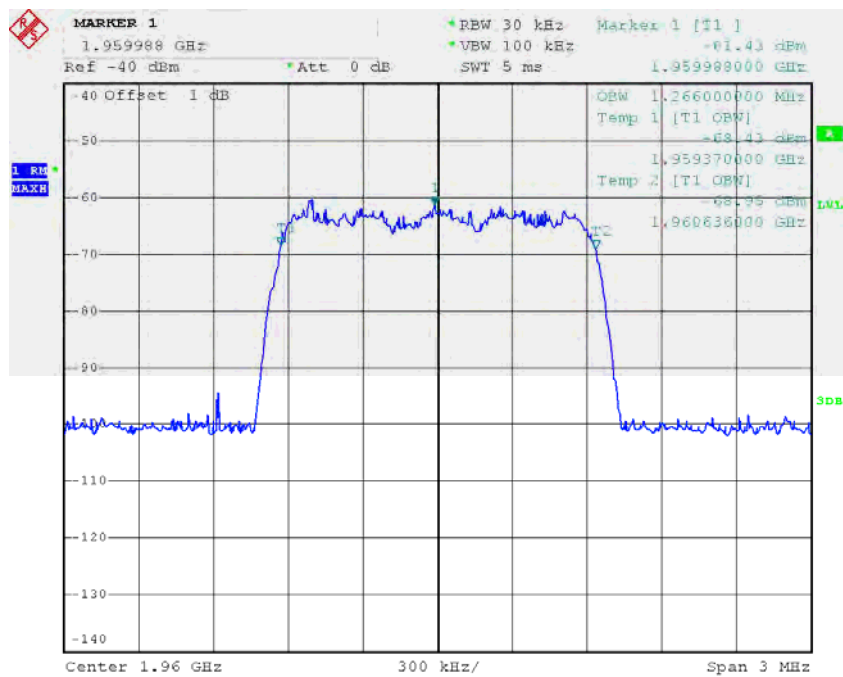


Date: 25.NOV.2015 23:19:30

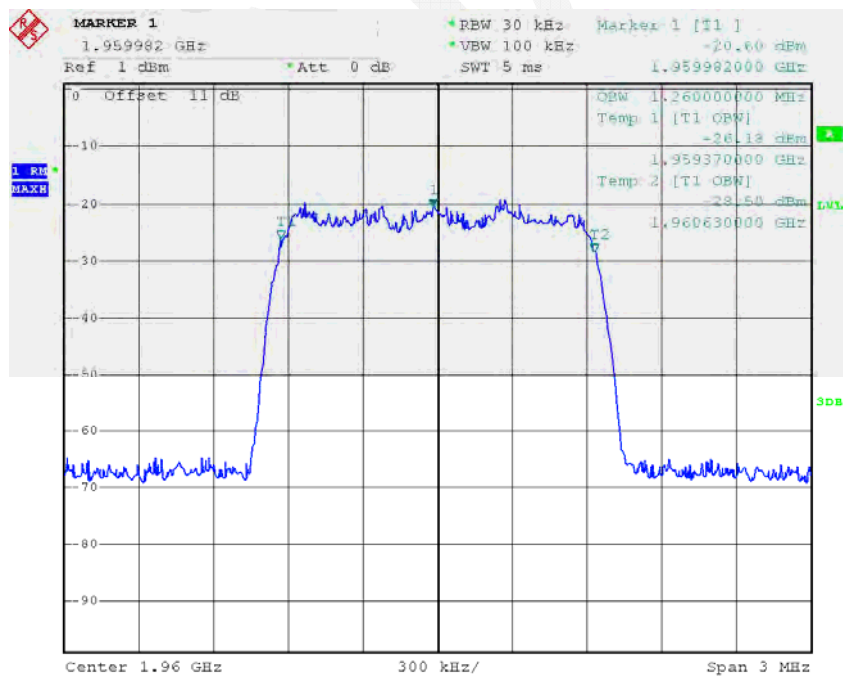
Downlink, 1960MHz -AWGN(Output)



Date: 25.NOV.2015 23:57:22

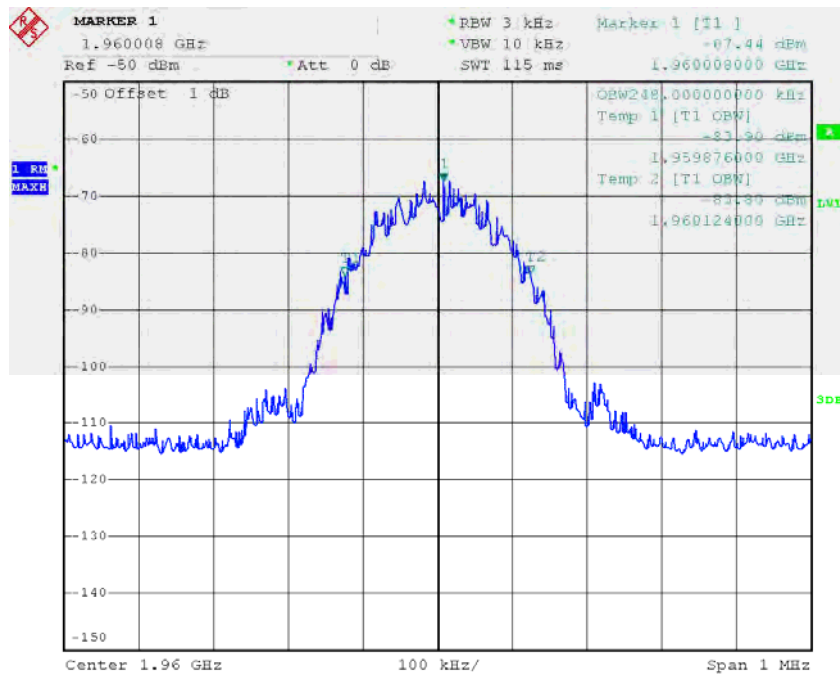
Downlink, 1960MHz -CDMA(Input)

Date: 25.NOV.2015 23:45:23

Downlink, 1960MHz -CDMA(Output)

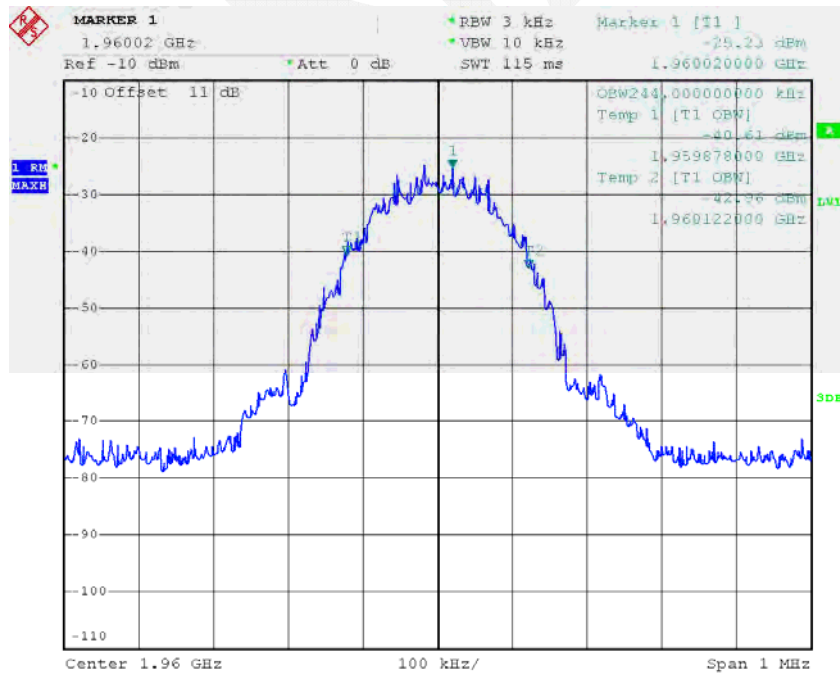
Date: 25.NOV.2015 23:50:24

Downlink, 1960MHz -GSM(Input)



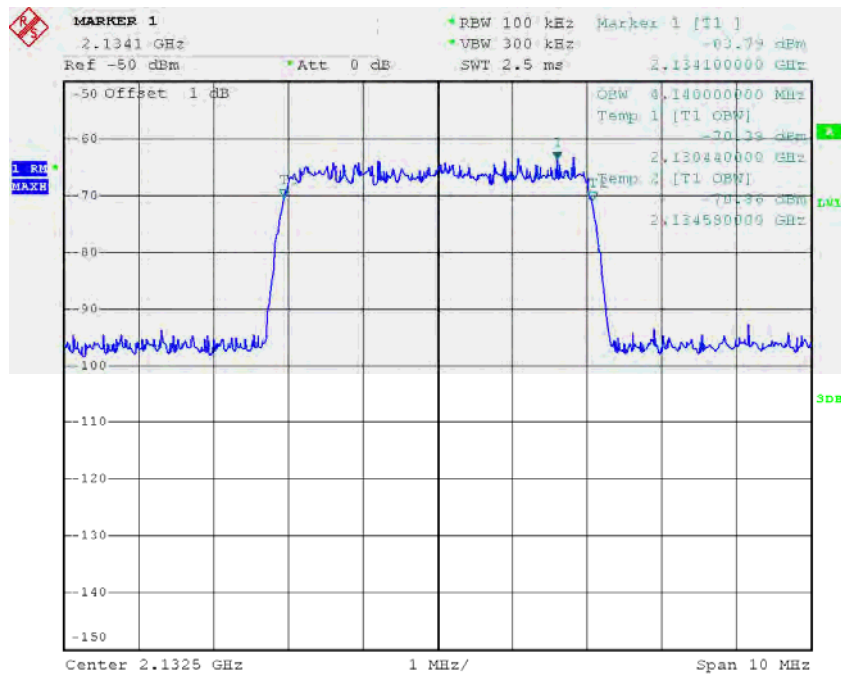
Date: 25.NOV.2015 23:22:50

Downlink, 1960MHz -GSM(Output)



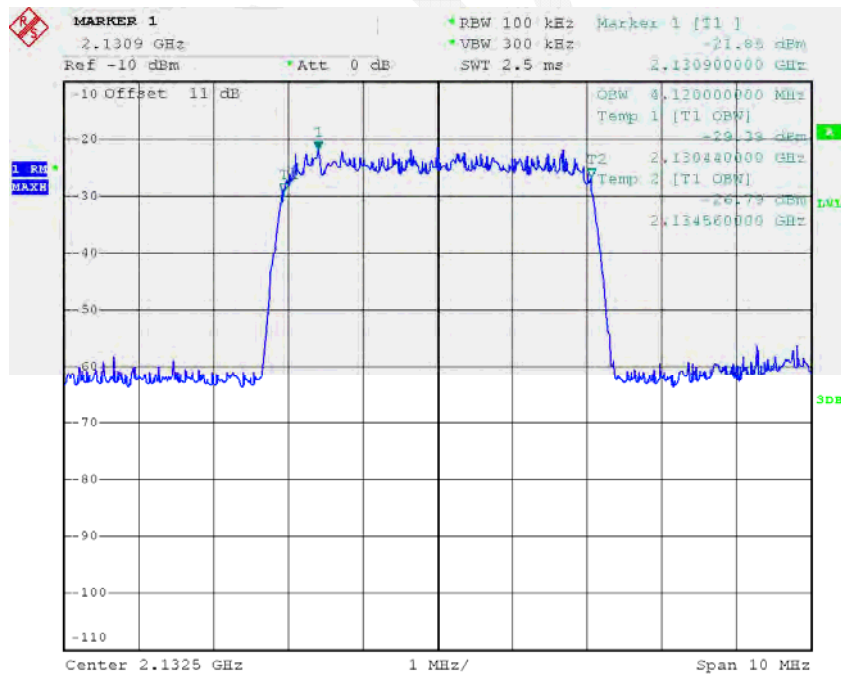
Date: 25.NOV.2015 23:55:20

Downlink, 2132.5MHz-AWGN(Input)



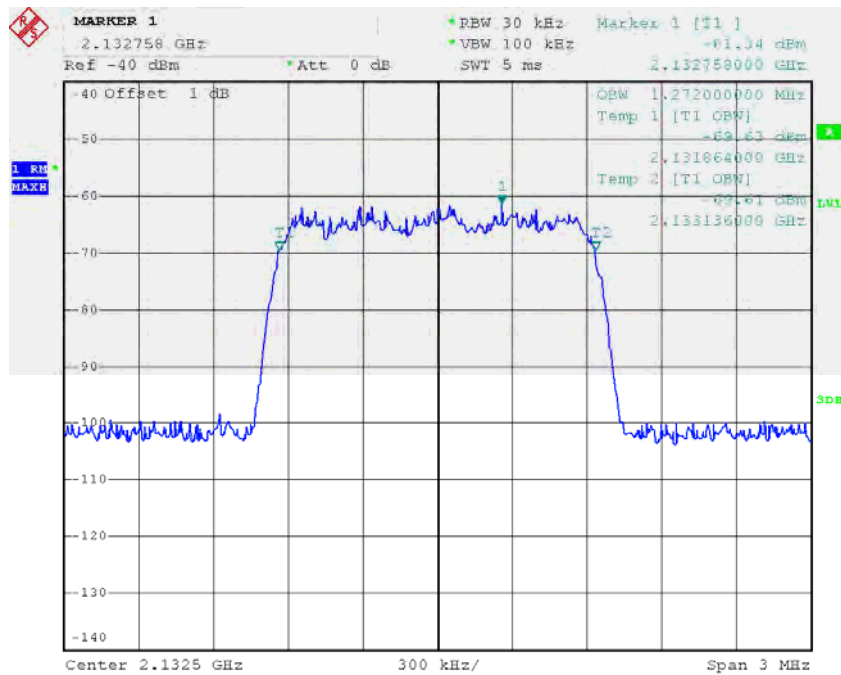
Date: 25.NOV.2015 23:19:58

Downlink, 2132.5MHz-AWGN(Output)



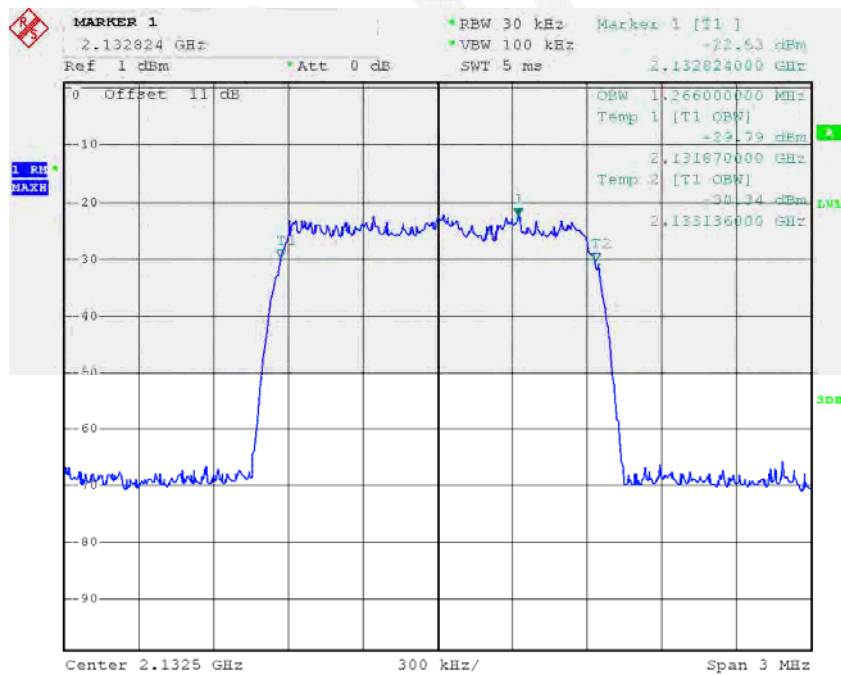
Date: 25.NOV.2015 23:57:09

Downlink, 2132.5MHz -CDMA(Input)



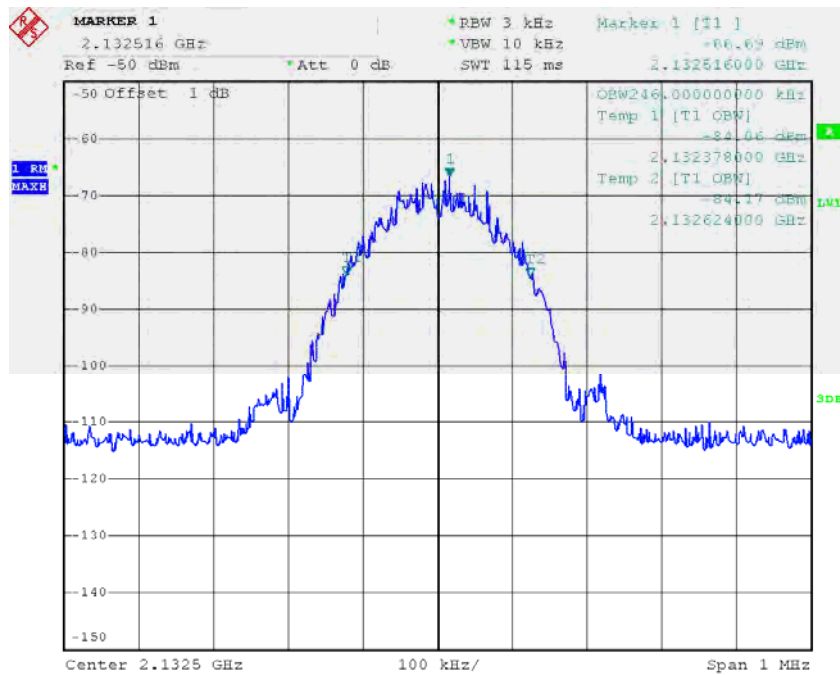
Date: 25.NOV.2015 23:45:37

Downlink, 2132.5MHz -CDMA(Output)



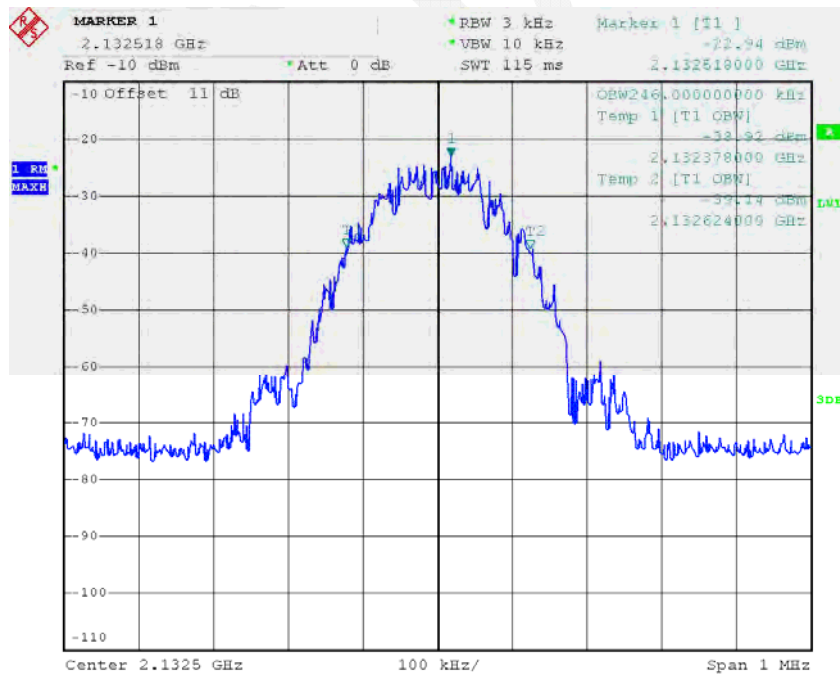
Date: 25.NOV.2015 23:49:43

Downlink, 2132.5MHz -GSM(Input)



Date: 25.NOV.2015 23:22:21

Downlink, 2132.5MHz -GSM(Output)



Date: 25.NOV.2015 23:55:49

§ 20.21(e)(8)(ii)(A) & §20.21(e)(4) - OSCILLATION DETECTION

Applicable Standards

Rule paragraph(s): § 20.21(e)(8)(ii)(A) Anti-Oscillation, §20.21(e)(4) Self-monitoring

For this measurement two EUTs will be permitted, one operating in a normal mode and the second operating in a test mode that is capable of disabling the uplink inactivity squelching and or a reduction of the time between restarts to 5 seconds. This will greatly decrease the test time required.

NOTE — Consumer boosters certified as direct connection mobile boosters having gain of less than or equal to 15 dB are exempt from compliance to testing procedures in 7.11.3 and 7.11.4.

Test Procedure

According to KDB 935210 D03 Signal Booster Measurements v03, §7.11.2 Oscillation restart tests and §7.11.3 Test procedure for measuring oscillation mitigation or shutdown

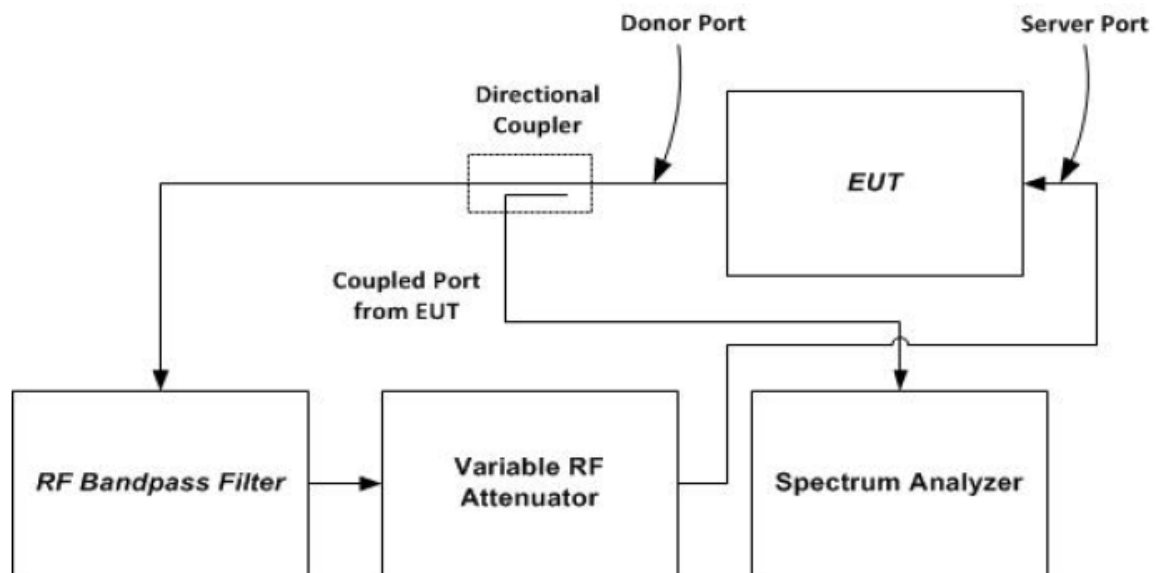


Figure 7 – Oscillation detection instrumentation test setup

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:	24.1~24.7
Relative Humidity:	44~48 %
ATM Pressure:	101.1~101.8 kPa

The testing was performed by Dean Liu from 2015-11-22 to 2015-11-25.

Please refer to the following plots.

Oscillation Restart Time:

Mode	Operation Bands	Detection Time (s)		Power level	Between restart time (s)		Number of restart		Result
		Reading	Limit	dBm	Reading	Limit	Reading	Limit	
Uplink	Lower 700	0.11	<0.3	26.02	63.6	>60	5	5	Compliance
	Upper 700	0.11		25.34	63.6		5		Compliance
	Cellular	0.11		22.02	64.8		5		Compliance
	AWS	0.11		15.09	63.6		5		Compliance
	PCS	0.11		18.19	63.6		5		Compliance
Downlink	Lower 700	0.12	<1	20.61	64.8		5		Compliance
	Upper 700	0.13		20.52	64.8		5		Compliance
	Cellular	0.12		16.54	63.6		5		Compliance
	AWS	0.11		19.72	64.8		5		Compliance
	PCS	0.11		16.67	63.6		5		Compliance

Oscillation Mitigation Or Shutdown:

Mode	Operation Band	Max gain dB	Isolation dB	Difference dB	Limit dB	Result
Uplink	Lower 700	44.84	+5	7.86	12.00	Compliance
			+4	7.95	12.00	Compliance
			+3	9.39	12.00	Compliance
			+2	10.21	12.00	Compliance
			+1	7.76	12.00	Compliance
			+0	8.70	12.00	Compliance
			-1	8.96	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance
	Upper 700	45.25	+5	10.12	12.00	Compliance
			+4	10.50	12.00	Compliance
			+3	9.79	12.00	Compliance
			+2	10.12	12.00	Compliance
			+1	9.61	12.00	Compliance
			+0	10.03	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance
	Cellular	47.44	+5	5.83	12.00	Compliance
			+4	9.21	12.00	Compliance
			+3	9.38	12.00	Compliance
			+2	10.06	12.00	Compliance
			+1	10.78	12.00	Compliance
			+0	10.89	12.00	Compliance
			-1	11.82	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance
	AWS	40.75	+5	4.74	12.00	Compliance
			+4	5.91	12.00	Compliance
			+3	9.89	12.00	Compliance
			+2	8.37	12.00	Compliance
			+1	10.27	12.00	Compliance
			+0	10.42	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance

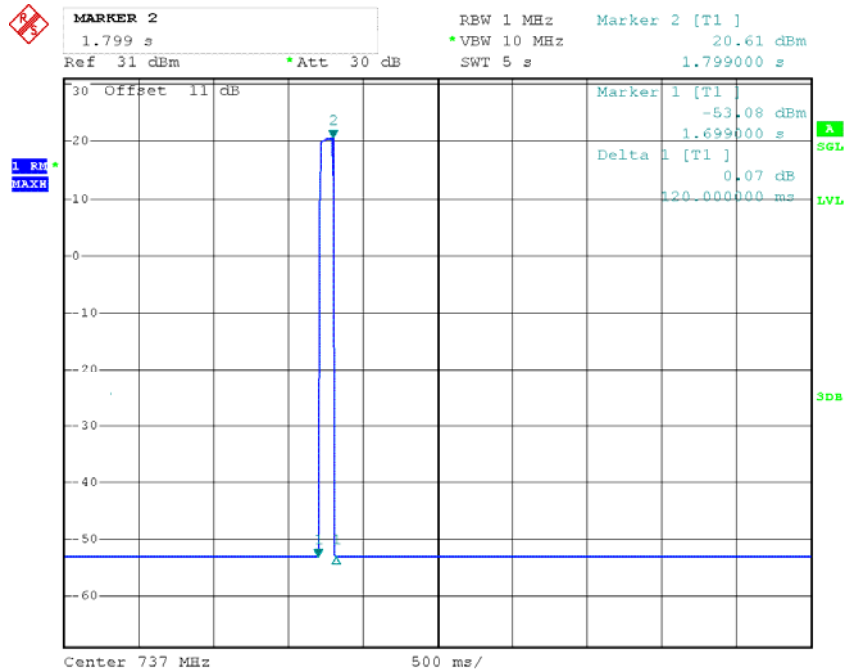
Mode	Operation Band	Max gain dB	Isolation dB	Difference dB	Limit dB	Result
Uplink	PCS	41.61	+5	5.59	12.00	Compliance
			+4	6.47	12.00	Compliance
			+3	6.26	12.00	Compliance
			+2	7.30	12.00	Compliance
			+1	8.32	12.00	Compliance
			+0	9.89	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
Downlink	Lower 700	41.46	+5	6.85	12.00	Compliance
			+4	7.71	12.00	Compliance
			+3	6.91	12.00	Compliance
			+2	7.56	12.00	Compliance
			+1	8.24	12.00	Compliance
			+0	8.73	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
	Upper 700	43.26	+5	4.16	12.00	Compliance
			+4	4.83	12.00	Compliance
			+3	5.22	12.00	Compliance
			+2	5.77	12.00	Compliance
			+1	6.31	12.00	Compliance
			+0	7.86	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
	Cellular	50.13	+5	6.66	12.00	Compliance
			+4	7.61	12.00	Compliance
			+3	8.30	12.00	Compliance
			+2	9.13	12.00	Compliance
			+1	9.86	12.00	Compliance
			+0	10.27	12.00	Compliance
			-1	11.68	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance

Mode	Operation Band	Max gain dB	Isolation dB	Difference dB	Limit dB	Result
Downlink	AWS	45.15	+5	7.16	12.00	Compliance
			+4	7.54	12.00	Compliance
			+3	7.77	12.00	Compliance
			+2	8.11	12.00	Compliance
			+1	9.99	12.00	Compliance
			+0	/	12.00	Compliance
			-1	/	12.00	Compliance
			-2	/	12.00	Compliance
			-3	/	12.00	Compliance
			+5	7.16	12.00	Compliance
	PCS	45.24	+4	7.54	12.00	Compliance
			+5	3.87	12.00	Compliance
			+4	4.52	12.00	Compliance
			+3	4.30	12.00	Compliance
			+2	5.34	12.00	Compliance
			+1	6.31	12.00	Compliance
			+0	7.18	12.00	Compliance
			-1	7.74	12.00	Compliance
			-2	9.22	12.00	Compliance
			-3	/	12.00	Compliance
			-4	/	12.00	Compliance
			-5	/	12.00	Compliance

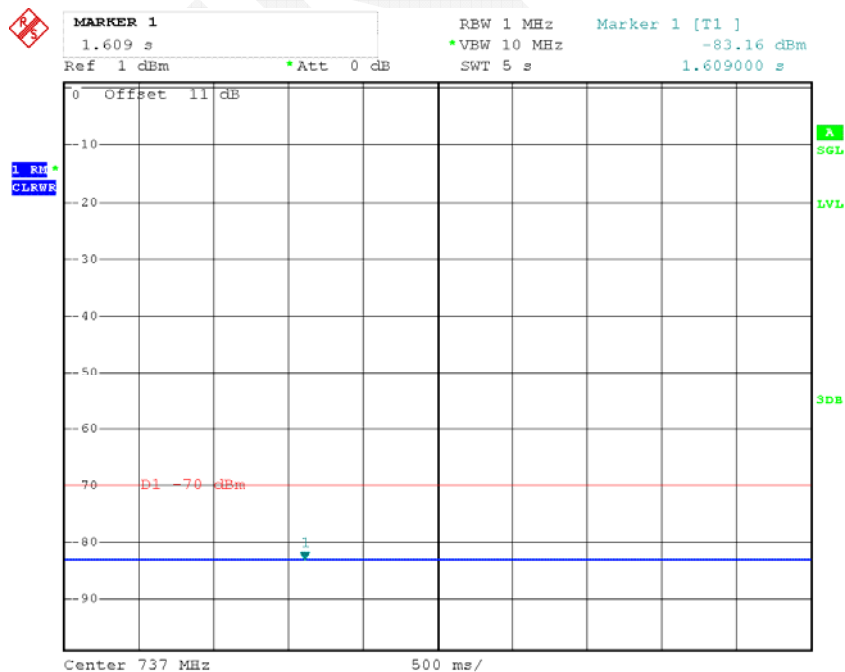
Oscillation restart tests:

Downlink:

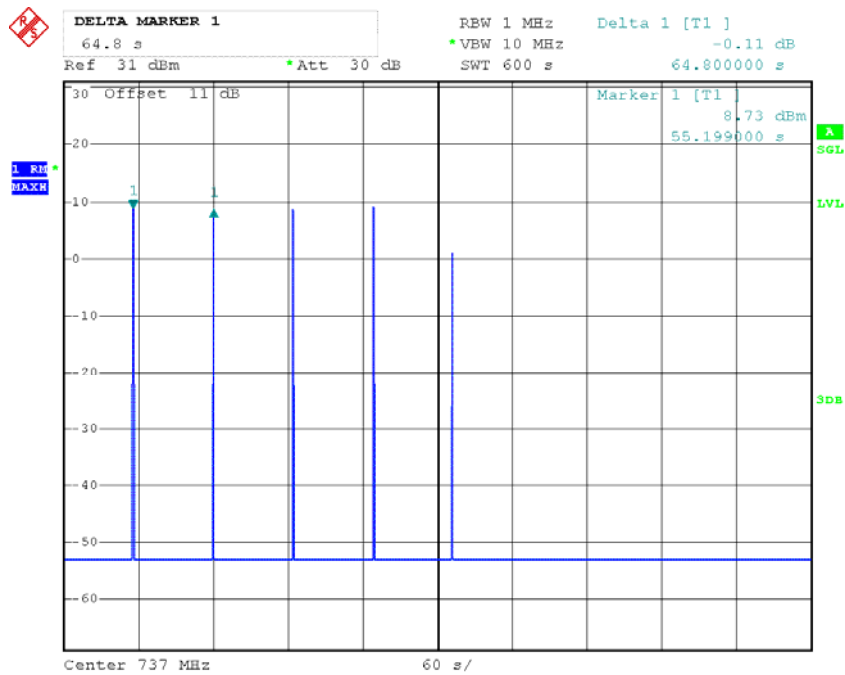
Lower 700



Date: 22.NOV.2015 16:00:23

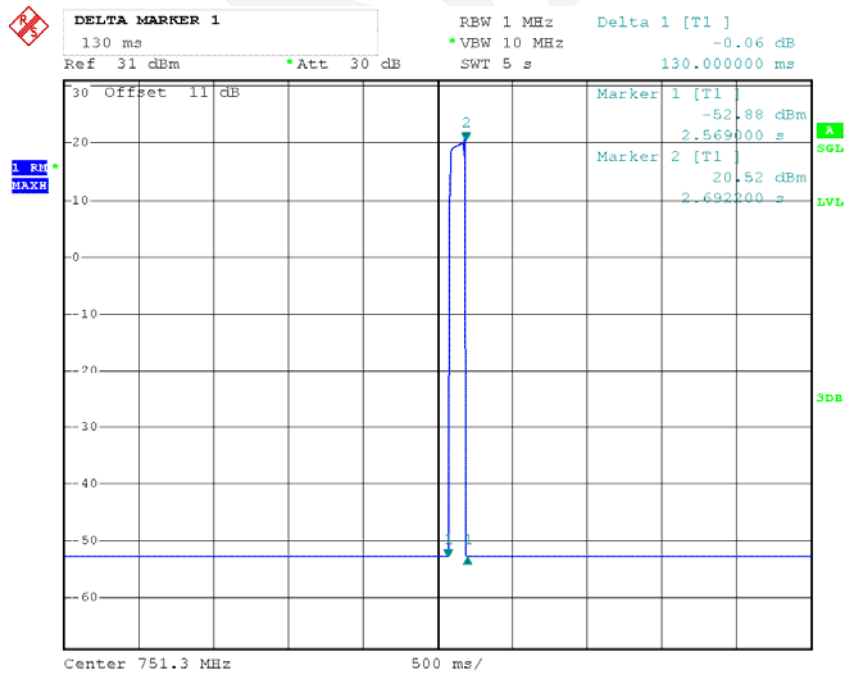


Date: 22.NOV.2015 16:00:55

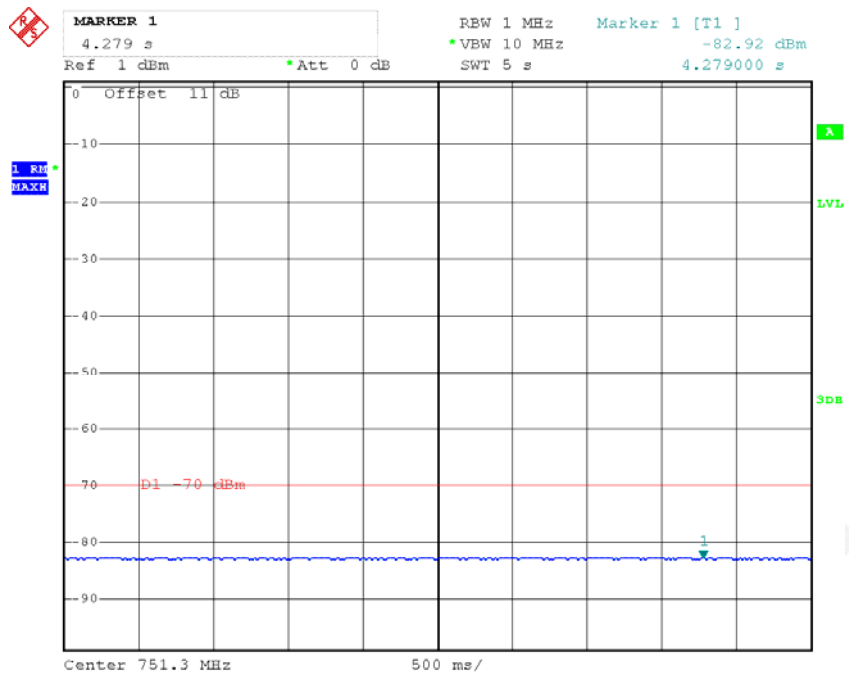


Date: 22.NOV.2015 16:11:43

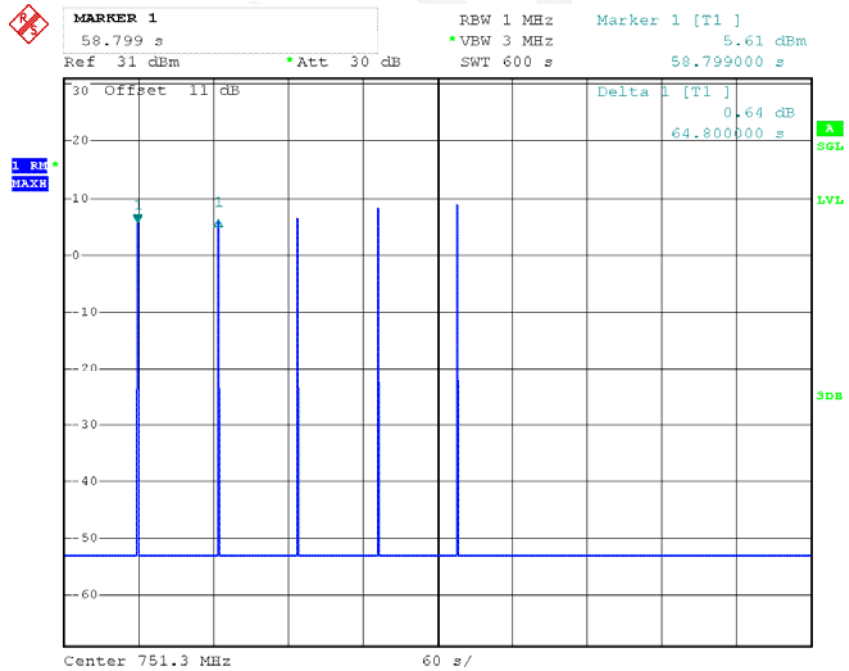
Upper 700



Date: 22.NOV.2015 16:27:04

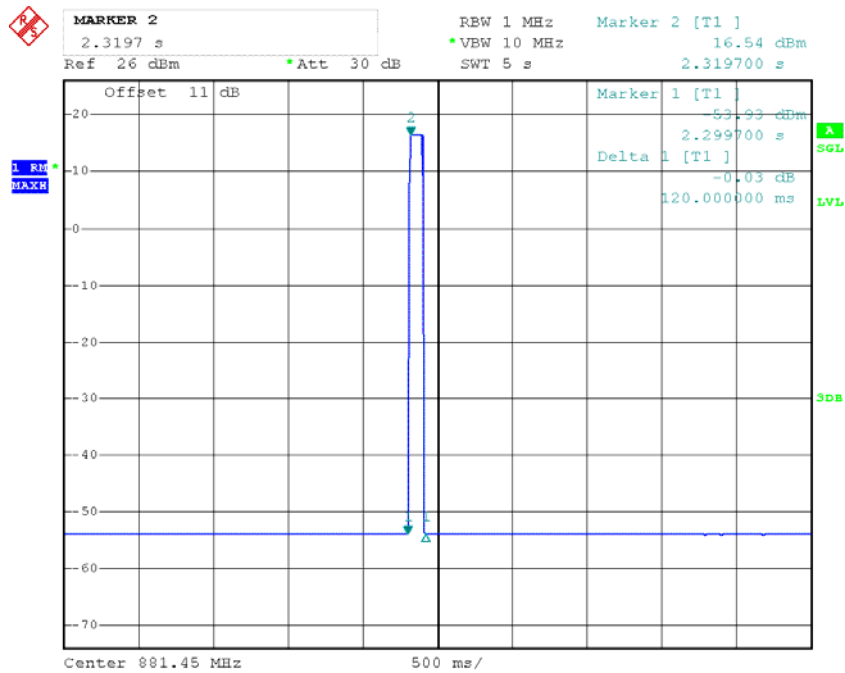


Date: 22.NOV.2015 16:27:44

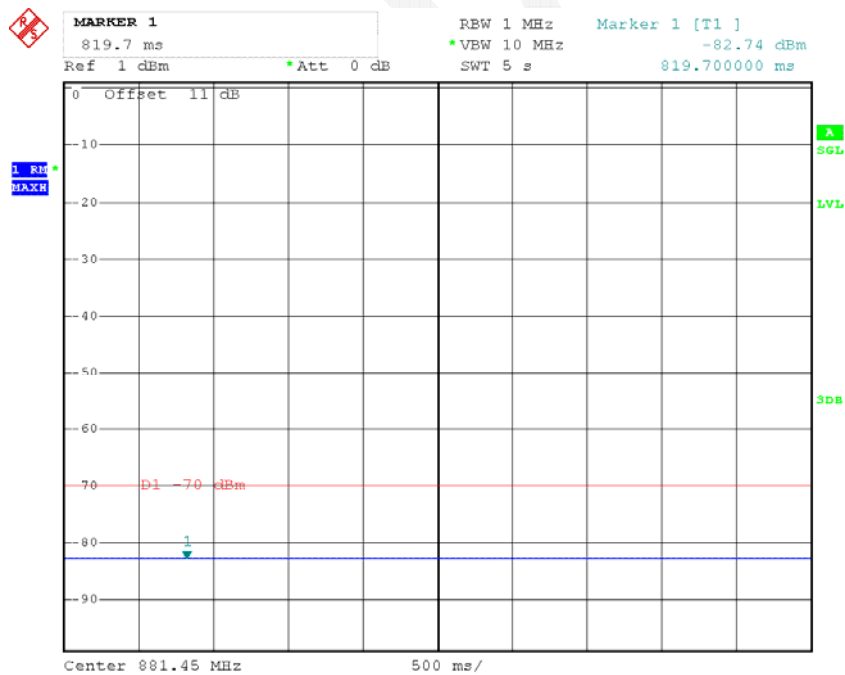


Date: 22.NOV.2015 16:26:13

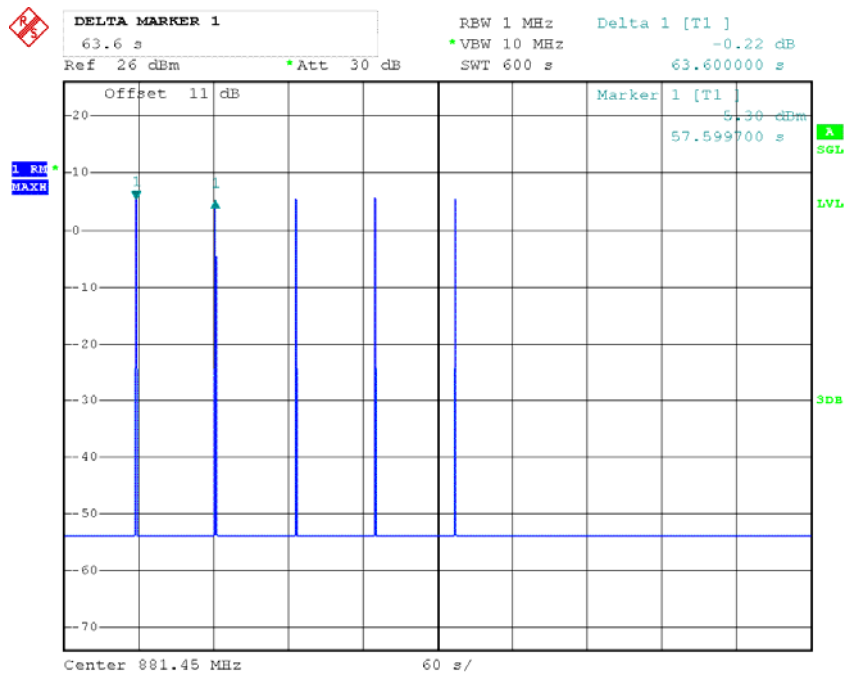
Cellular Band



Date: 25.NOV.2015 20:28:22

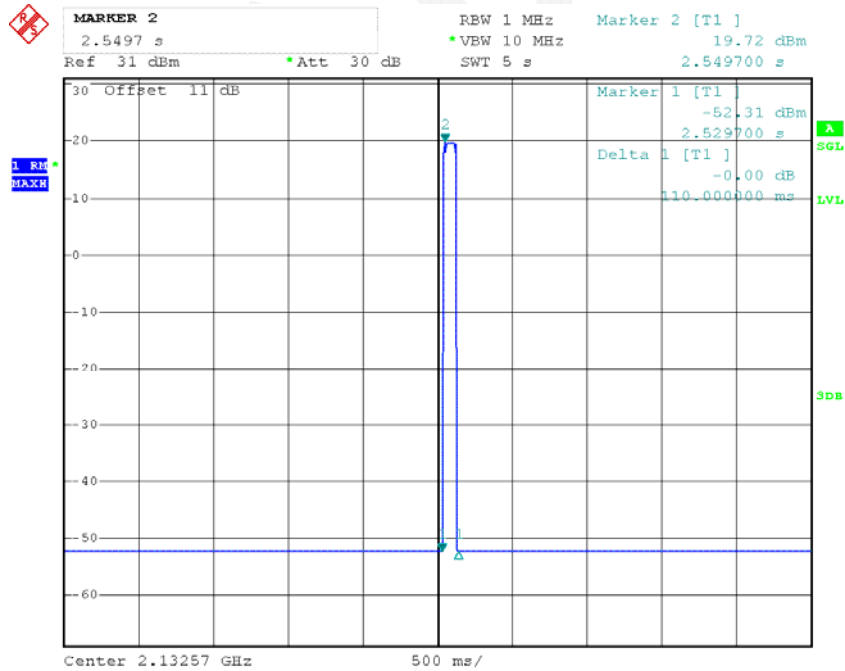


Date: 25.NOV.2015 20:41:34

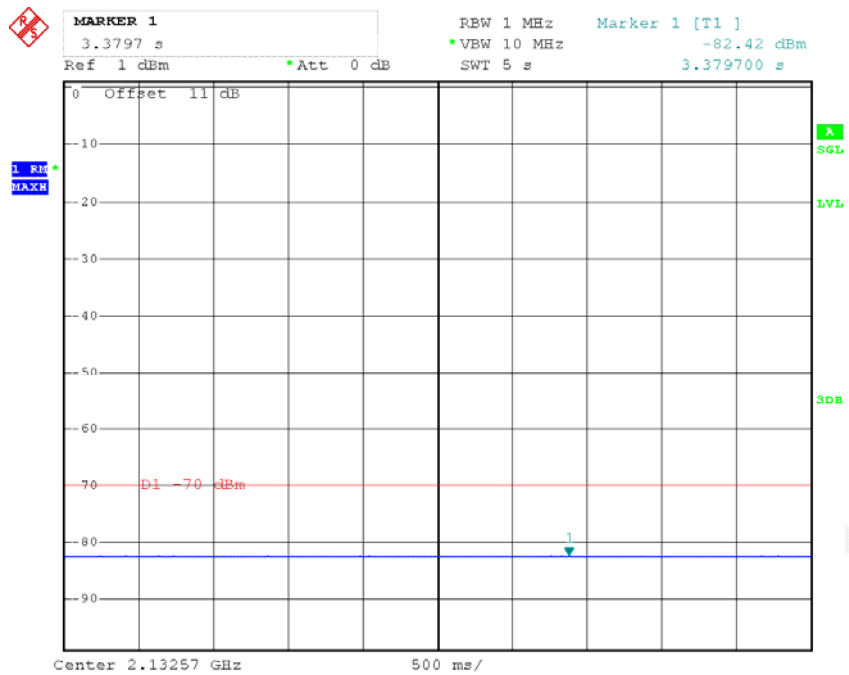


Date: 25.NOV.2015 20:40:14

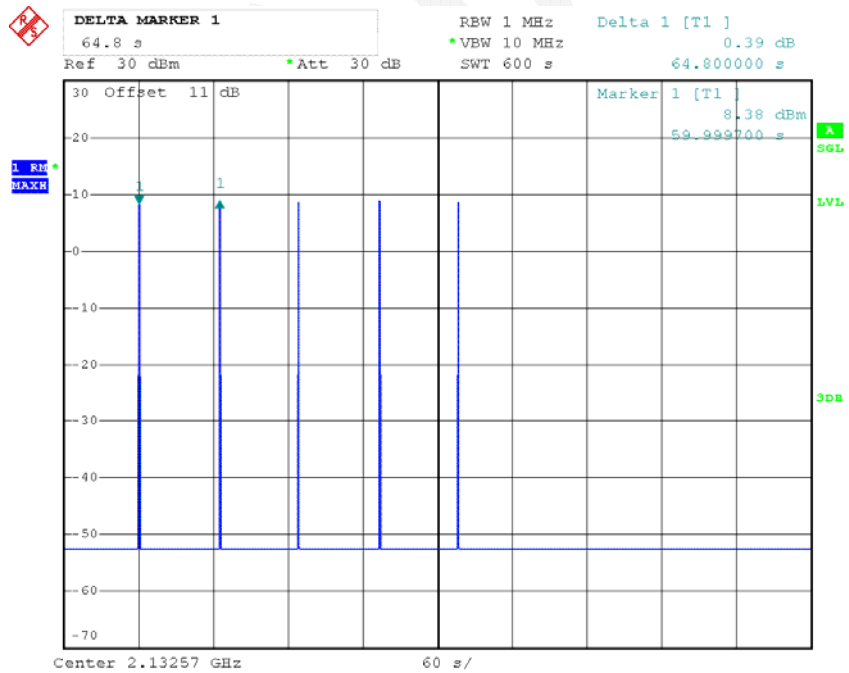
AWS Band



Date: 25.NOV.2015 21:06:34

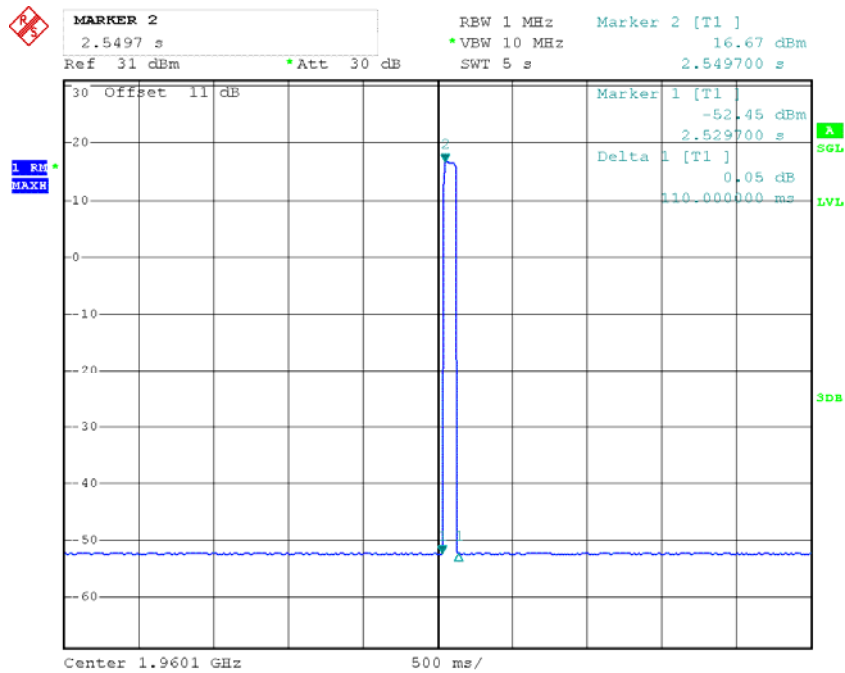


Date: 25.NOV.2015 21:06:59

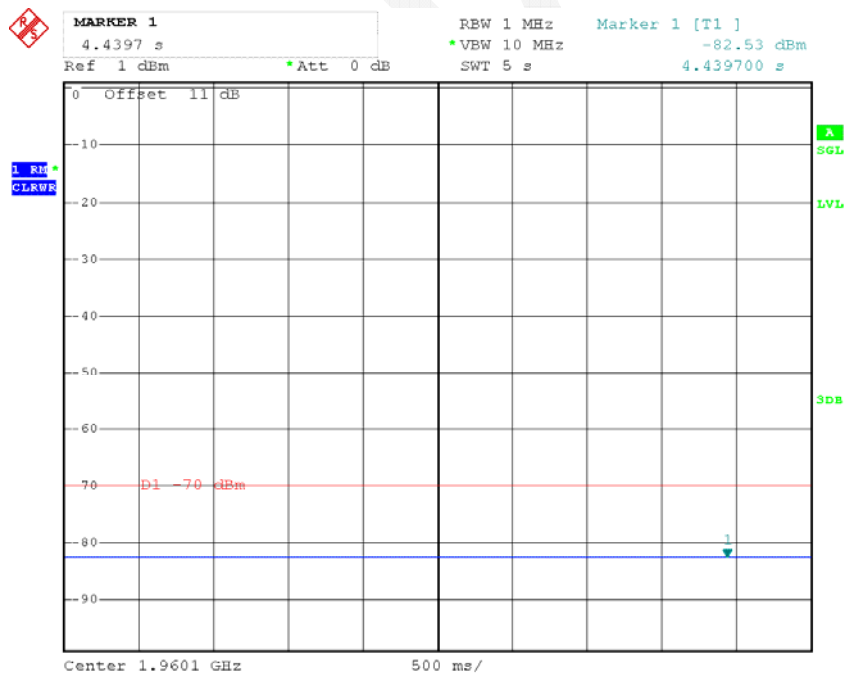


Date: 25.NOV.2015 21:19:17

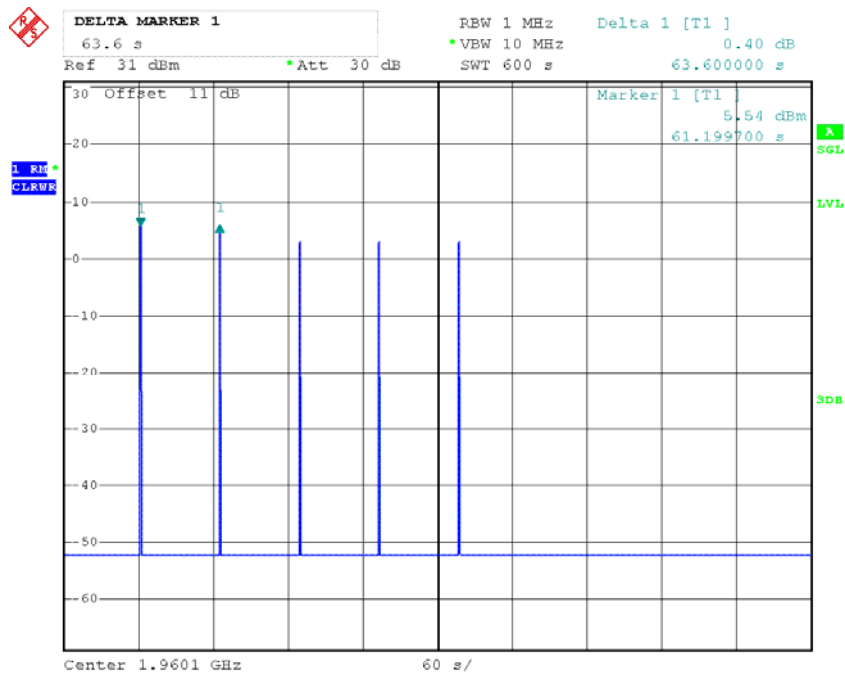
PCS Band



Date: 25.NOV.2015 20:50:47



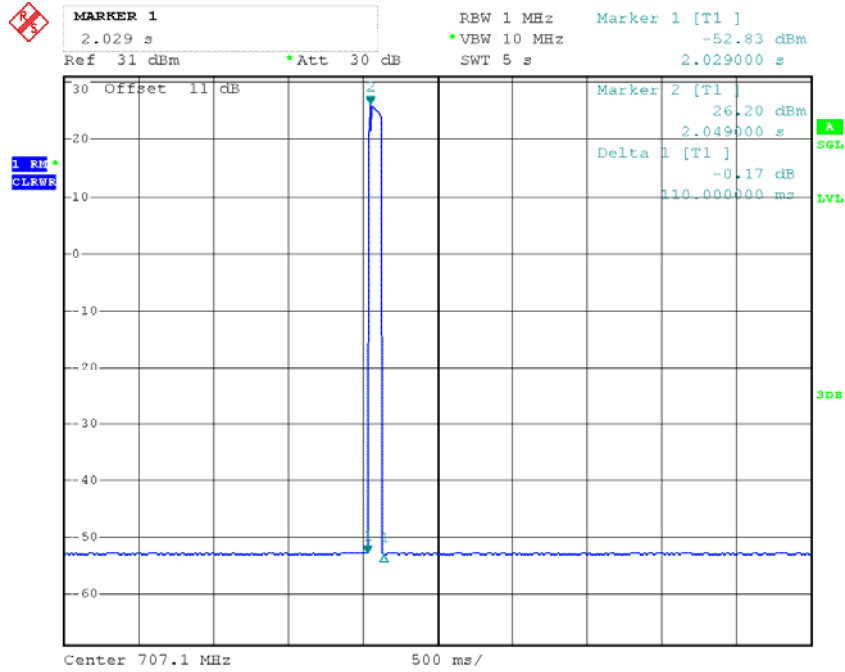
Date: 25.NOV.2015 20:51:15



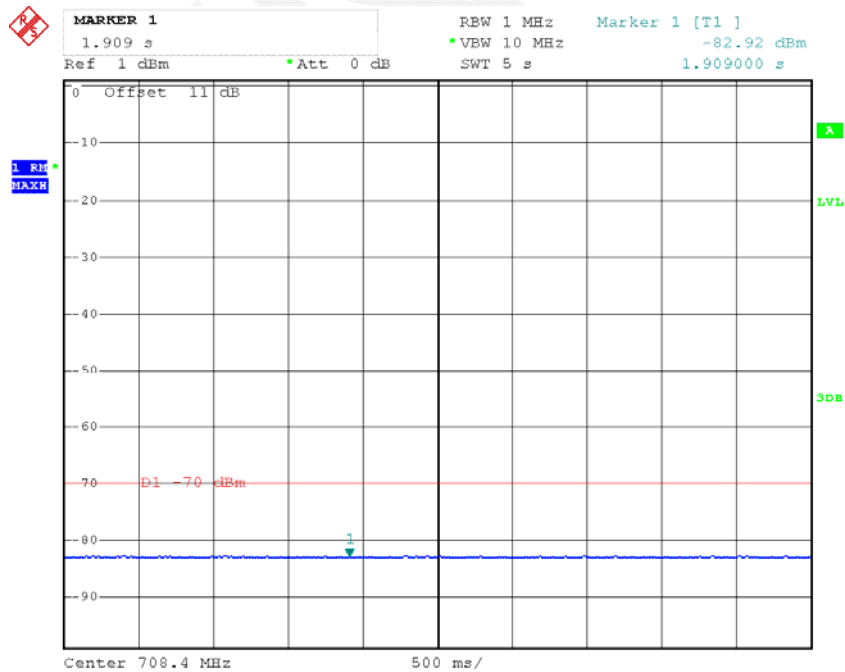
Date: 25.NOV.2015 21:01:57

Uplink:

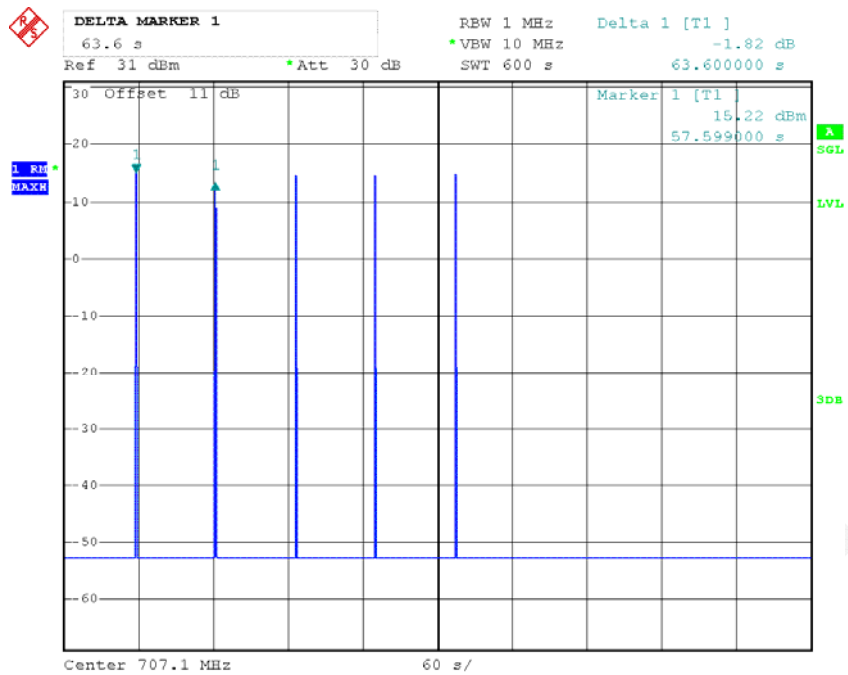
Lower 700



Date: 22.NOV.2015 12:08:29

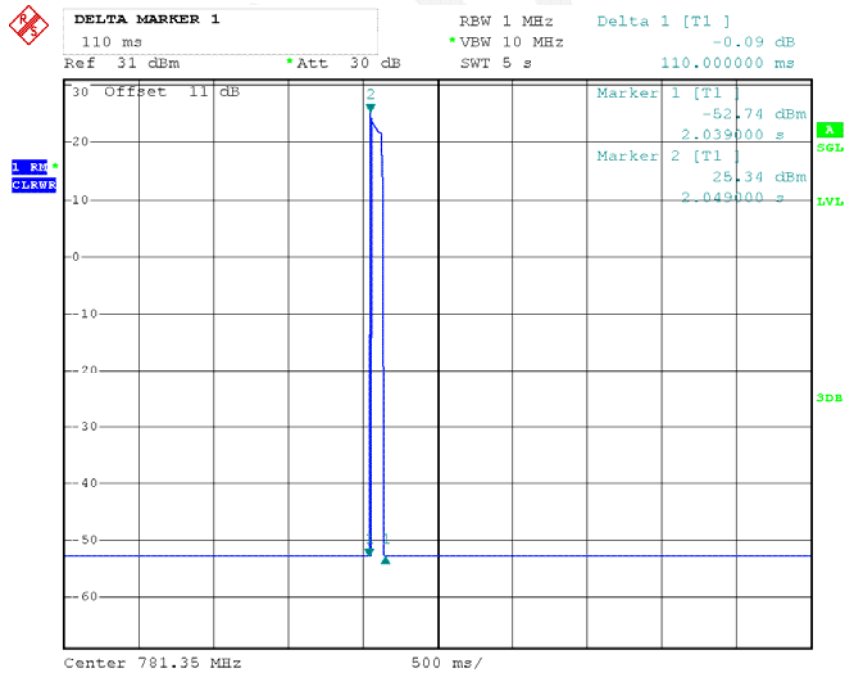


Date: 22.NOV.2015 10:15:42

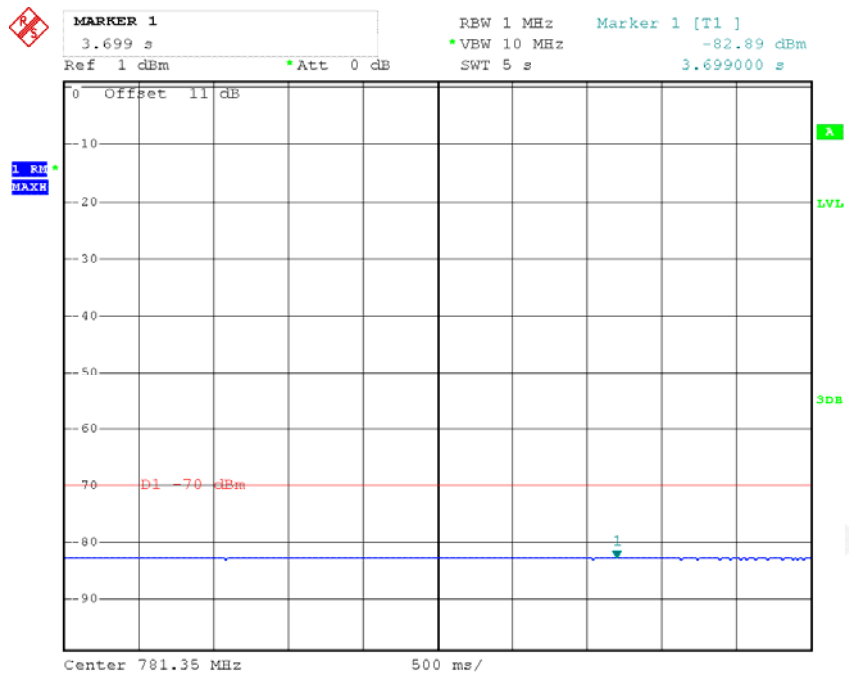


Date: 22.NOV.2015 10:52:46

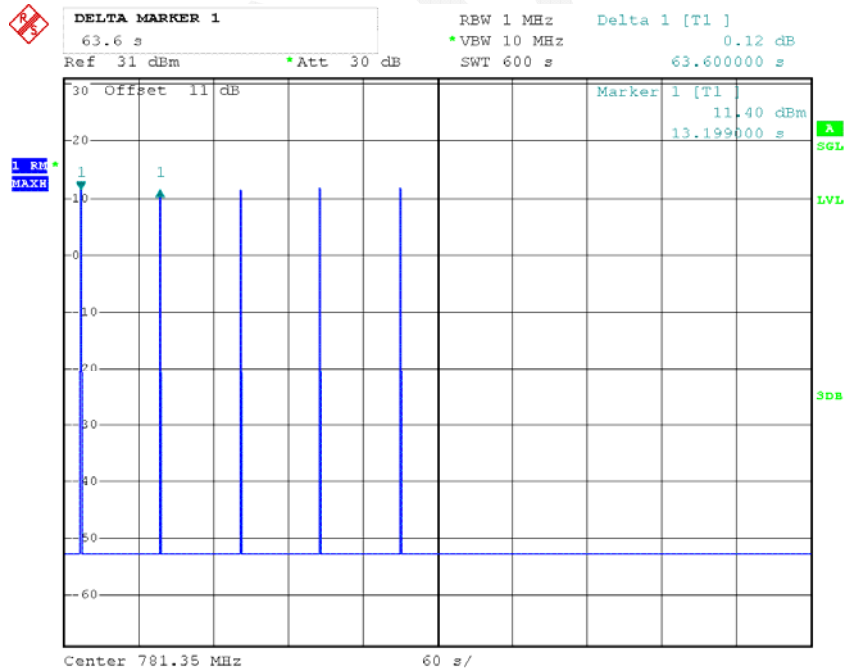
Upper 700



Date: 22.NOV.2015 12:07:45

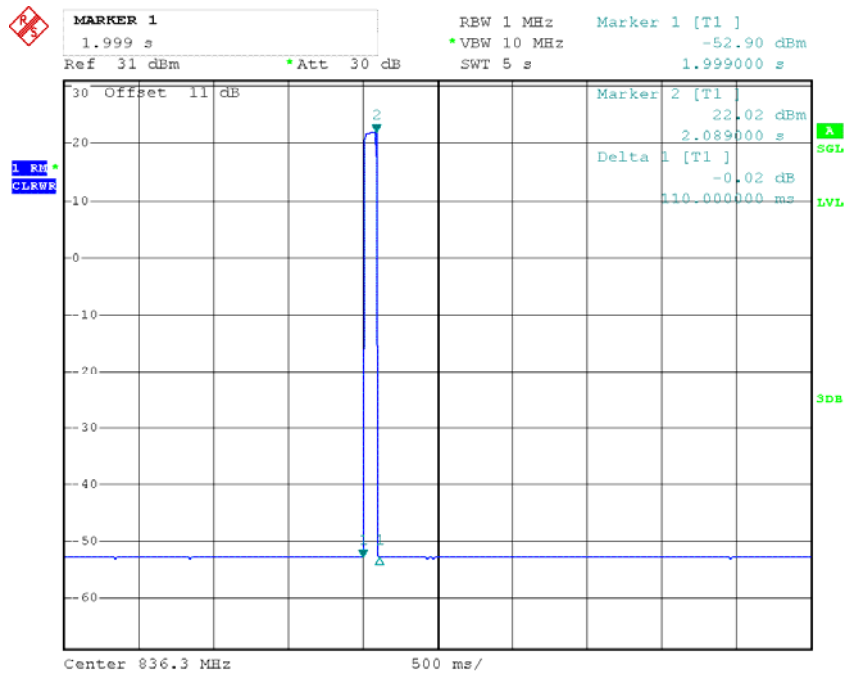


Date: 22.NOV.2015 10:14:57

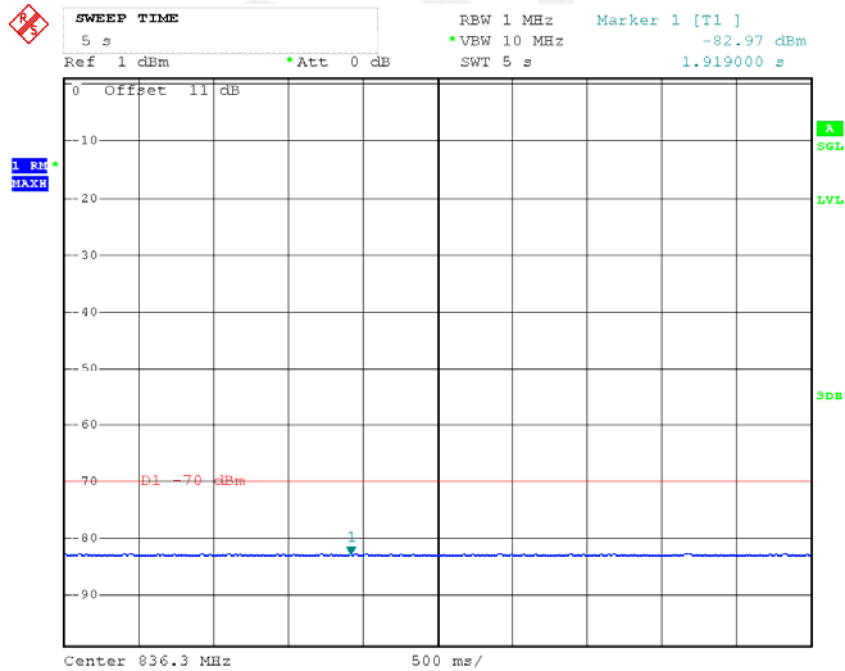


Date: 22.NOV.2015 10:42:07

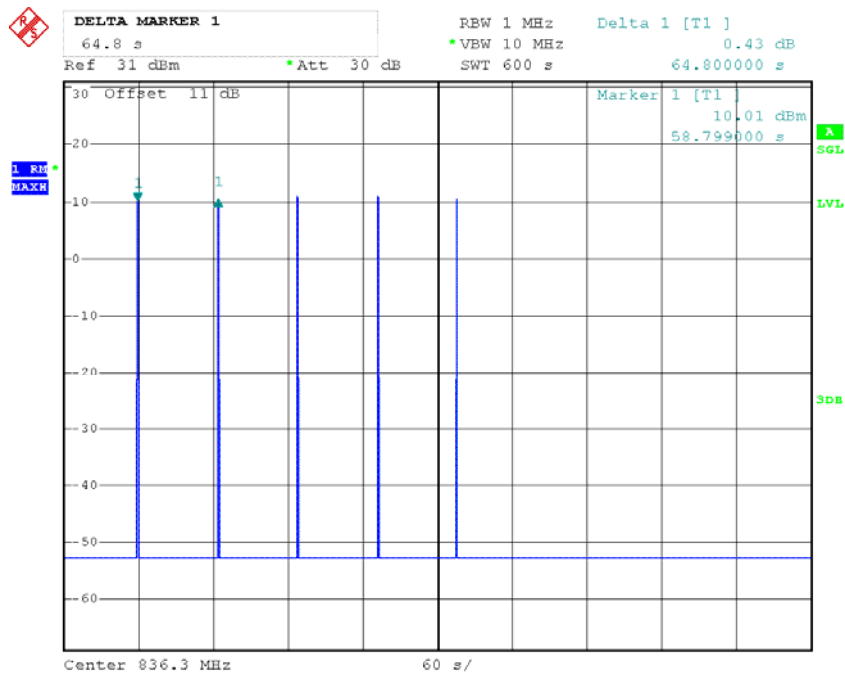
Cellular Band



Date: 22.NOV.2015 12:06:42

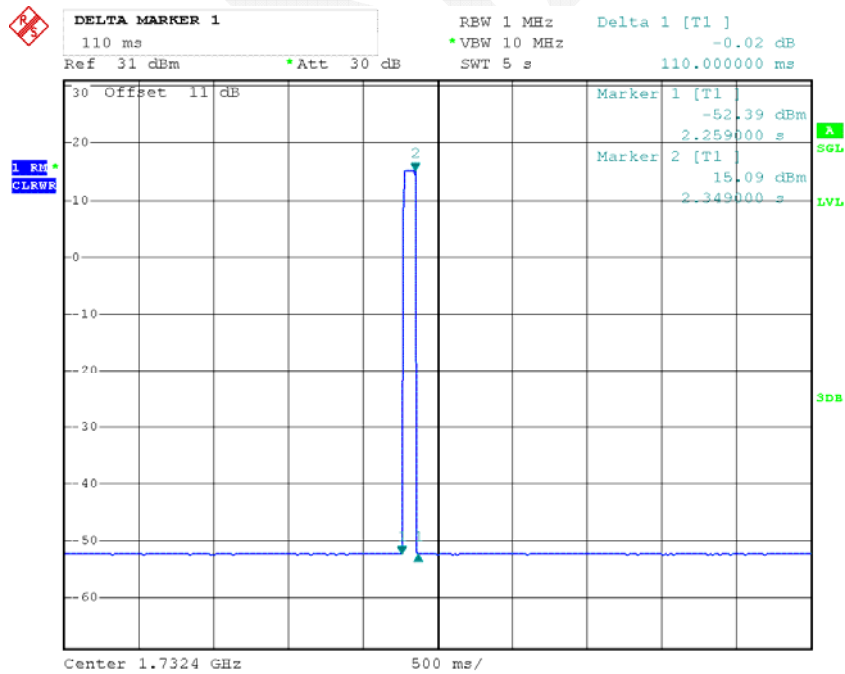


Date: 22.NOV.2015 10:12:02

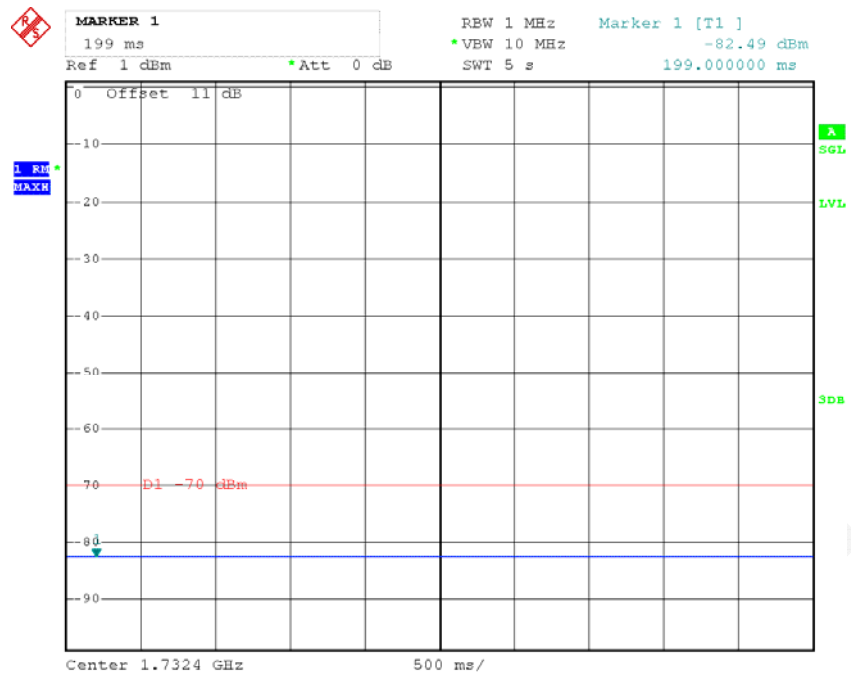


Date: 22.NOV.2015 11:04:48

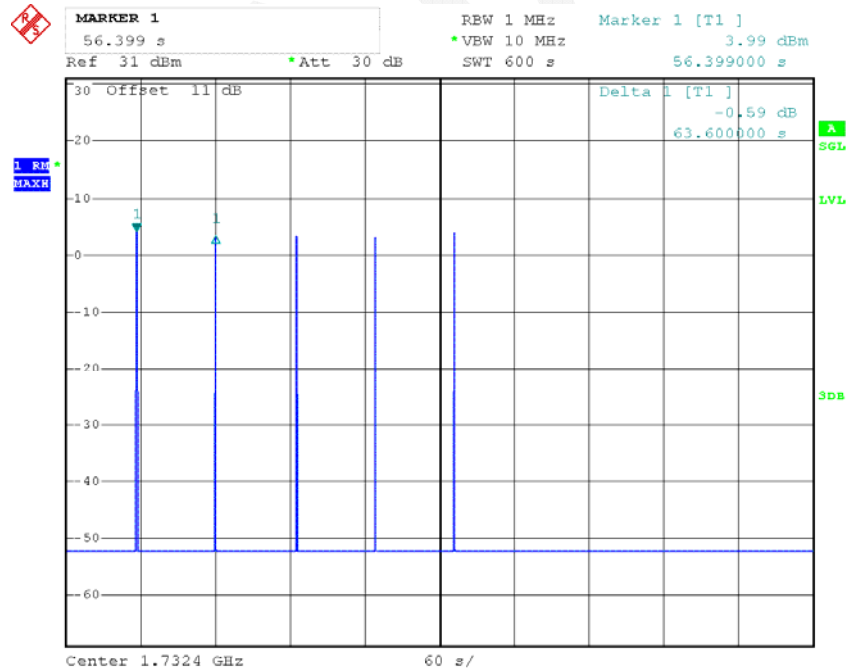
AWS Band



Date: 22.NOV.2015 12:05:48

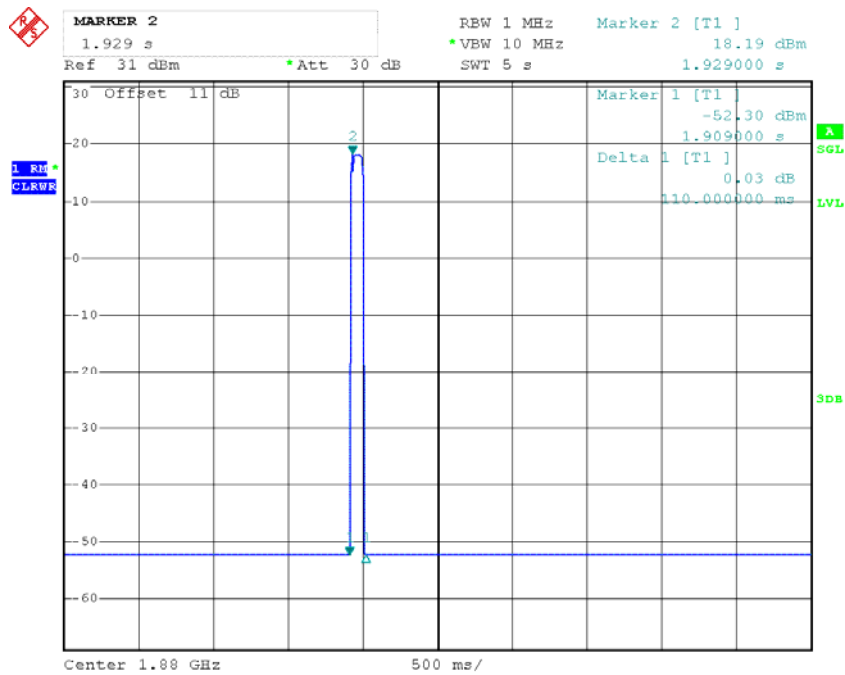


Date: 22.NOV.2015 10:13:40

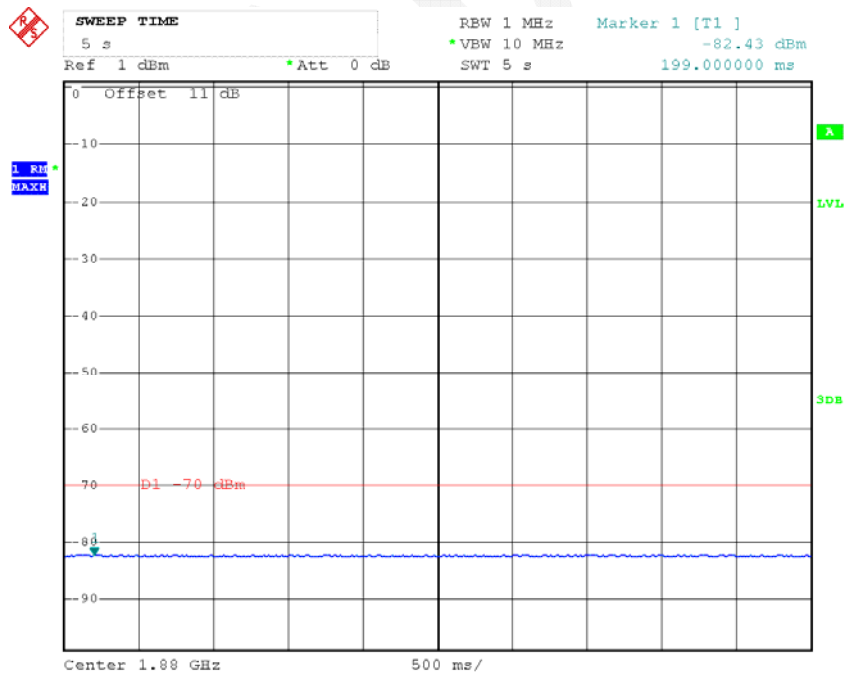


Date: 22.NOV.2015 12:23:11

PCS Band



Date: 22.NOV.2015 11:40:01



Date: 22.NOV.2015 10:14:17