

# TEST REPORT

FCC ID: 2ALZECPA70

Product: cell phone signal booster

Model No.: AN-CPA70 Plus

Additional Model No.: AN-CPL70V Plus, AN-CPL70A Plus, AN-CL70AV Plus,  
AN-CPA45 Plus, AN-CPL45V Plus, AN-CPL45A Plus, AN-CL45AV Plus



Trade Mark:

Report No.: TCT180504E004

Issued Date: May 21, 2018

Issued for:

Shen Zhen ANNTLENT Communication Technology co., Ltd.  
Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua  
District, Shenzhen, China

Issued By:

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the revision section of the document. The test results in the report only apply to the tested sample.

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## 1. Test Certification

|                              |   |
|------------------------------|---|
| <b>Product:</b>              | cell phone signal booster   |
| <b>Model No.:</b>            | AN-CPA70 Plus   |
| <b>Additional Model:</b>     | AN-CPL70V Plus, AN-CPL70A Plus, AN-CL70AV Plus, AN-CPA45 Plus, AN-CPL45V Plus, AN-CPL45A Plus, AN-CL45AV Plus |
| <b>Trade Mark:</b>           |  anntalent                   |
| <b>Applicant:</b>            | Shen Zhen ANNTLENT Communication Technology co., Ltd.   |
| <b>Address:</b>              | Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China           |
| <b>Manufacturer:</b>         | Shen Zhen ANNTLENT Communication Technology co., Ltd.   |
| <b>Address:</b>              | Room 601, Unit 1 Building 10, Haoyue Garden, Minzhi Sub-district, Longhua District, Shenzhen, China           |
| <b>Date of Test:</b>         | May 04 – May 21, 2018   |
| <b>Applicable Standards:</b> | FCC CFR Title 47 Part 20.21   |

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:

Brews Xu

Date:

May 18, 2018

Reviewed By:

Beryl Zhao

Date:

May 21, 2018

Approved By:

Tomsin

Date:

May 21, 2018



## 2. Test Result Summary

| Requirement   | CFR 47 Section  | Result |
|---|---|--------|
| Authorized Frequency Band Verification Test                   | §20.21(e)(3)  | PASS   |
| Maximum Power Measurement Procedure                           | §2.1046/20.21(e)(8)(i)(D)   | PASS   |
| Maximum Booster Gain Computation                              | §20.21(e)(8)(i)(B)  | PASS   |
| Intermodulation Product                                       | §20.21(e)(8)(i)(F)  | PASS   |
| Out of Band Emissions   | §20.21(e)(8)(i)(E)  | PASS   |
| Conducted Spurious Emission                                   | §2.1051/§27   | PASS   |
| Noise Limit Procedure<br>Variable Noise Variable Noise Timing | §20.21(e)(8)(i)(A)(2)(i)<br>§20.21(e)(8)(i)(A)(1)<br>§20.21(e)(8)(i)(H) | PASS   |
| Uplink inactivity   | §20.21(e)(8)(i)(I)  | PASS   |
| Variable Booster Gain<br>Variable Uplink Gain Timing          | §20.21(e)(8)(i)(C) (1), (2)(i)<br>§20.21(e)(8)(i)(H)                    | PASS   |
| Occupied Band Width   | §2.1049/§27   | PASS   |
| Anti-Oscillation  | §20.21(e)(8)(ii)(A)   | PASS   |
| Radiated Spurious Emission                                    | §2.1053/§27   | PASS   |
| Spectrum Block Filter   | N/A   | N/A    |

**Note:**

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

### 3. EUT Description

|                             |  |
|-----------------------------|--|
| <b>Product Name:</b>        | cell phone signal booster  |
| <b>Model :</b>              | AN-CPA70 Plus  |
| <b>Additional Model:</b>    | AN-CPL70V Plus, AN-CPL70A Plus, AN-CL70AV Plus, AN-CPA45 Plus, AN-CPL45V Plus, AN-CPL45A Plus, AN-CL45AV Plus  |
| <b>Trade Mark:</b>          |   |
| <b>Operation Frequency:</b> | Band 2<br>Uplink: 1850 MHz - 1910MHz, Downlink: 1930 MHz - 1990MHz<br>Band 4<br>Uplink: 1710 MHz - 1755MHz, Downlink: 2110 MHz - 2155MHz<br>Band 5<br>Uplink: 824 MHz - 829MHz, Downlink: 869 MHz - 894MHz |
| <b>Emission Designator:</b> | LTE(G7D)   |
| <b>FCC Classification:</b>  | B2W/Wideband Consumer Booster(CMRS)  |
| <b>Adapter information</b>  | Name: AC/DC ADAPTER<br>Model: SK02T-0500200U<br>Input: 100-240V~50/60Hz 0.35A,<br>Output: DC 5V, 2A<br>S/N: 181001001516   |
| <b>Remark:</b>              | All models above are identical in interior structure, electrical circuits and components, just model names are different for the marketing requirement.  |

| Mode         | Frequency<br>(MHz) | Antenna Gain(dBi) |                    |   | Cable loss<br>(dB) |
|--------------|--------------------|-------------------|--------------------|---|--------------------|
|              |                    | Yagi<br>Antenna   | LPDA<br>Antenna    | Omni<br>directional<br>glass fiber<br>Antenna |                    |
| UP<br>LINK   | 824-849            | 8                 | 9                  | 3   | 5.49               |
|              | 1710-1755          | 10                | 10.5               | 5   | 5.89               |
|              | 1850-1910          | 10                | 10.5               | 5   | 6.25               |
|              |                    | Rubber<br>Antenna | Ceiling<br>Antenna | Indoor Panel<br>Antenna                       |                    |
| DOWN<br>LINK | 869-894            | 3                 | 3                  | 7   | 2.29               |
|              | 2110-2155          | 3.5               | 4.5                | 8.5   | 2.86               |
|              | 1930-1990          | 3.5               | 4.5                | 8.5   | 2.55               |

## 4. General Information

### 4.1. Test environment

| Operating Environment: |           |
|------------------------|-----------|
| Temperature:           | 25.0 °C   |
| Humidity:              | 56 % RH   |
| Atmospheric Pressure:  | 1010 mbar |

### 4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Equipment | Model No. | Serial No. | FCC ID | Trade Name |
|-----------|-----------|------------|--------|------------|
| /         | /         | /          | /      | /          |

## 5. Facilities and Accreditations

### 5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

### 5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

TEL: +86-755-27673339

### 5.3. Measurement Uncertainty

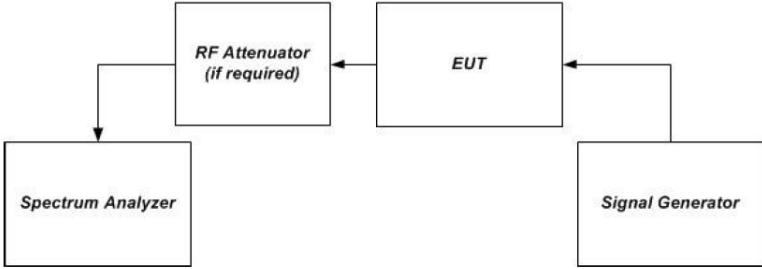
The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

| No. | Item                          | MU                      |
|-----|-------------------------------|-------------------------|
| 1   | Conducted Emission            | $\pm 2.56\text{dB}$     |
| 2   | RF power, conducted           | $\pm 0.12\text{dB}$     |
| 3   | Spurious emissions, conducted | $\pm 0.11\text{dB}$     |
| 4   | All emissions, radiated(<1G)  | $\pm 3.92\text{dB}$     |
| 5   | All emissions, radiated(>1G)  | $\pm 4.28\text{dB}$     |
| 6   | Temperature                   | $\pm 0.1^\circ\text{C}$ |
| 7   | Humidity                      | $\pm 1.0\%$             |

## 6. Test Results and Measurement Data

### 6.1. Authorized Frequency Band Verification

#### 6.1.1. Test Specification

|                          |   |
|--------------------------|---|
| <b>Test Requirement:</b> | FCC Part20 Section 20.21(e)(3)  |
| <b>Test Method:</b>      | 935210 D03 Signal Booster Measurements v04r01   |
| <b>Limit</b>             | Band 2<br>Uplink: 1850 MHz - 1910MHz, Downlink: 1930 MHz - 1990MHz<br>Band 4<br>Uplink: 1710 MHz - 1755MHz, Downlink: 2110 MHz - 2155MHz<br>Band 5<br>Uplink: 824 MHz - 829MHz, Downlink: 869 MHz - 894MHz  |
| <b>Test Setup:</b>       |  <pre> graph LR     SG[Signal Generator] --&gt; EUT[EUT]     EUT --&gt; SA[Spectrum Analyzer]     optional[RF Attenuator<br/>(if required)] --- EUT   </pre>   |
| <b>Test Procedure:</b>   | 935210 D03 Signal Booster Measurement v02r01<br>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.<br>b) Set the spectrum analyzer resolution bandwidth (RBW) for 100 kHz with the video bandwidth (VBW) $\geq 3 \times$ the RBW, using a PEAK detector with the MAX HOLD function.<br>c) Set the center frequency of the spectrum analyzer to the center of the operational band under test with a span of 1 MHz.<br>d) Set the signal generator for CW mode and tune to the center frequency of the operational band under test.<br>e) Set the initial signal generator power to a level that is at least 6 dB below the AGC level specified by the manufacturer.<br>f) Slowly increase the signal generator power level until the output signal reaches the AGC operational level.<br>g) Reduce the signal generator power to a level that is 3 dB below the level noted above, then manually reset the EUT (e.g., cycle ac/dc power).<br>h) Reset the spectrum analyzer span to 2xthe width of the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2xthe width of the CMRS band using the sweep function. The AGC must be deactivated throughout the entire sweep.<br>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).<br>j) Capture the spectrum analyzer trace for inclusion in the test report.<br>k) Repeat 7.1c) to 7.1j) for all operational uplink and downlink bands. |
| <b>Test Result:</b>      | PASS  |

### 6.1.2. Test Instruments

| Equipment         | Manufacturer     | Model  | Serial Number  | Calibration Date | Calibration Due |
|-------------------|------------------|--------|----------------|------------------|-----------------|
| Signal Generator  | Agilent          | N5182  | MY4707028<br>2 | Sep. 28, 2017    | Sep. 27, 2018   |
| Spectrum Analyzer | Agilent          | N9020A | MY4910006<br>0 | Sep. 28, 2017    | Sep. 27, 2018   |
| Attenuation       | AF115A-09-<br>34 | JFW    | 907763         | Sep. 28, 2017    | Sep. 27, 2018   |

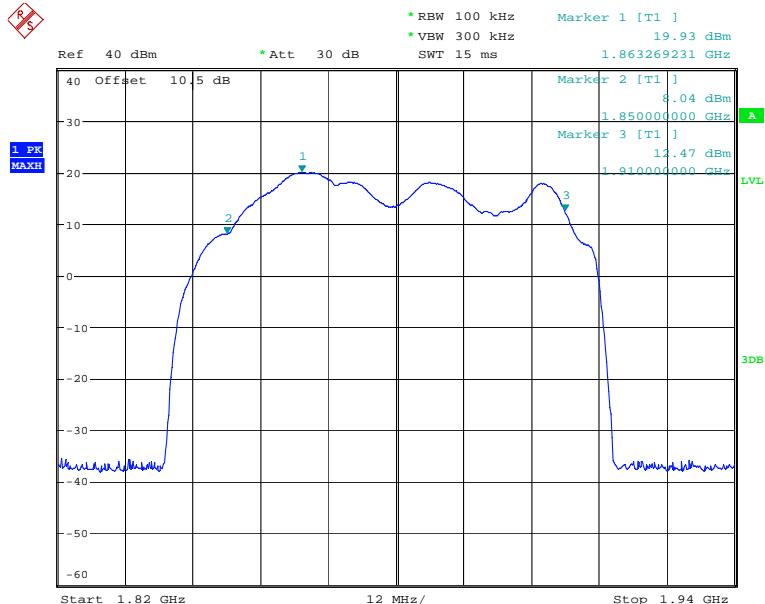
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.1.3. Test data

#### Test Plots

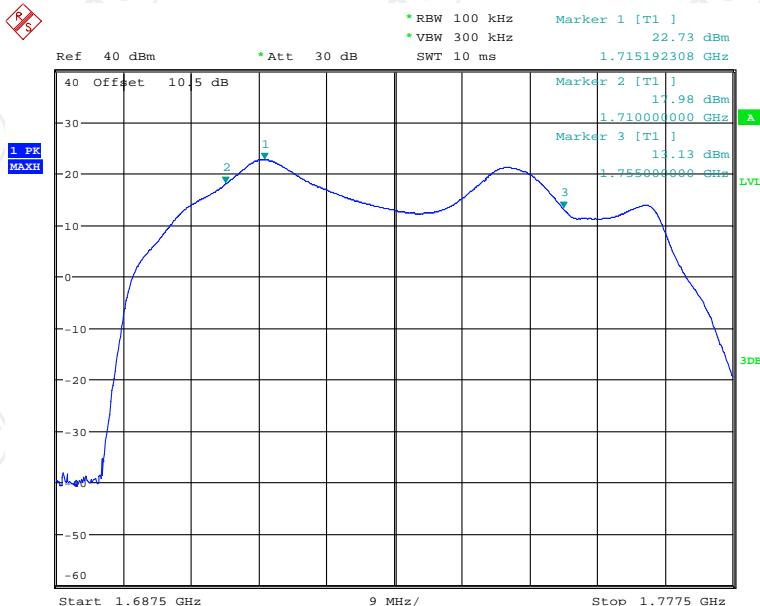
Uplink

Band2



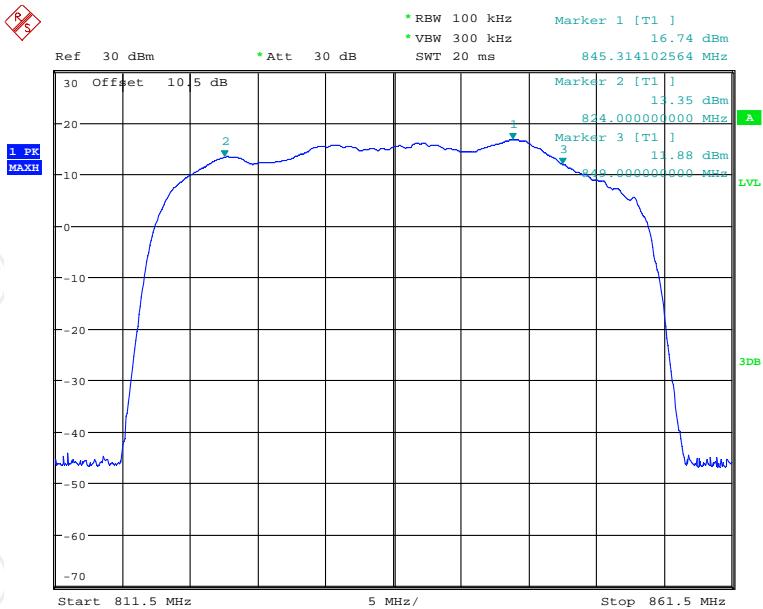
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Band4



Date: 1.JAN.2003 10:26:26

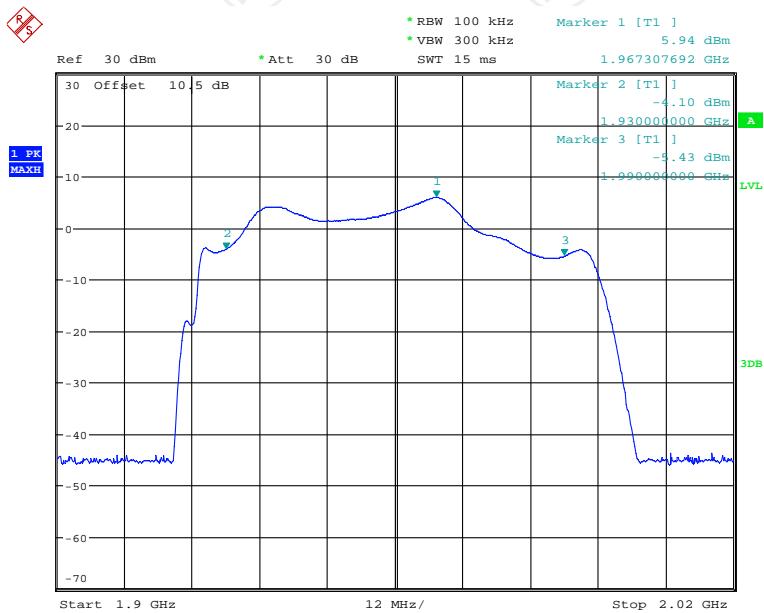
## Band5



Date: 1.JAN.2003 10:35:03

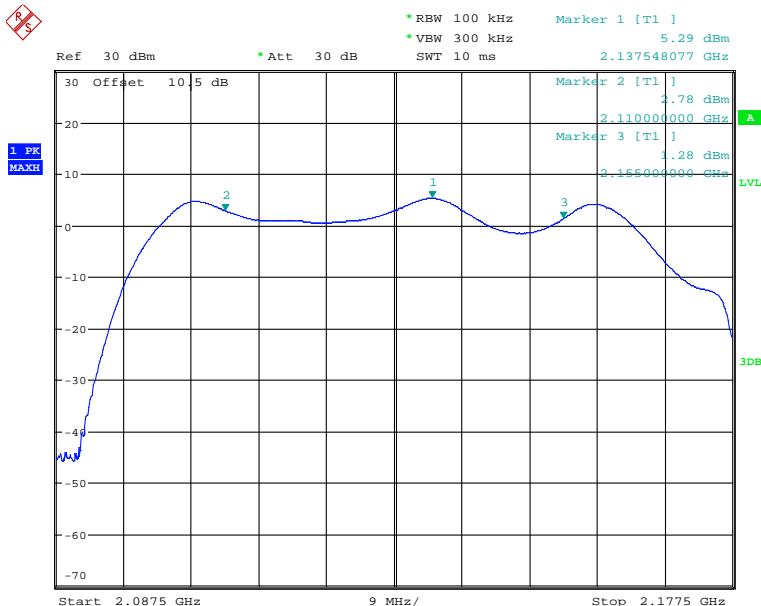
## Downlink

## Band2



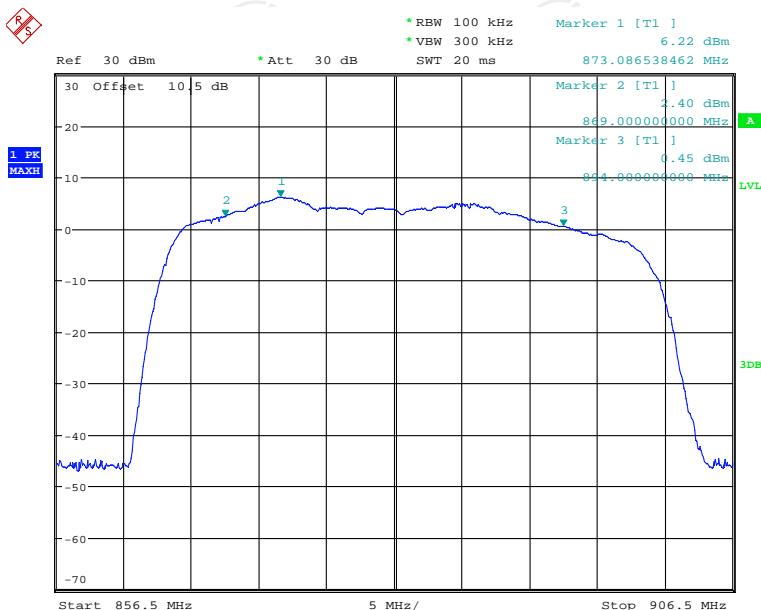
Date: 1.JAN.2003 09:57:21

## Band4



Date: 1.JAN.2003 10:19:34

## Band5



Date: 1.JAN.2003 10:43:29

## 6.2. Maximum Power

### 6.2.1. Test Specification

|                          |   |
|--------------------------|---|
| <b>Test Requirement:</b> | FCC Part 20.21 (e)(8)(i)(B); FCC Part 20.21 (e)(8)(i)(D)  |
| <b>Test Method:</b>      | KDB935210 D03 Signal Booster Measurement v04r01   |
| <b>Test Setup:</b>       | <pre> graph LR     SG[Signal Generator] --&gt; EUT[EUT]     EUT --&gt; SA[Spectrum Analyzer]     optional[RF Attenuator<br/>(if required)] --- EUT     </pre>   |
| <b>Test Procedure:</b>   | <ul style="list-style-type: none"> <li>a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output (donor port) connected to the spectrum analyzer.</li> <li>b) Configure the signal generator and spectrum analyzer for operation on the frequency determined in Frequency Band 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.</li> <li>c) Set the initial signal generator power to a level well below that which causes AGC control.</li> <li>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; e.g., no further increase in output power as input power is increased).</li> <li>e) Reduce power sufficiently on the signal generator to ensure that the AGC is not controlling the power output.</li> <li>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 (<math>P_{in}</math>).</li> <li>g) Measure the output power (<math>P_{out}</math>) with the spectrum analyzer as follows.</li> <li>h) Set RBW = 100 kHz for AWGN signal type and 300 kHz for CW or GSM signal type</li> <li>i) Set VBW <math>\geq</math> 3X RBW</li> <li>j) 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).</li> <li>k) Select the RMS (power averaging) detector.</li> <li>l) Ensure that the number of measurement points per sweep <math>\geq</math> (2 x span)/RBW (Note: This requirement does not apply for BURST power measurement mode).</li> <li>m) Set sweep time = auto couple, or as necessary (but no less than auto couple value).</li> <li>n) Trace average at least 100 traces in power averaging (i.e., RMS) mode.</li> <li>o) Record the measured power level as <math>P_{out}</math> with one set of results for the GSM or CW input stimulus and another set of results for the AWGN input stimulus.</li> <li>p) Repeat the procedure for each operational uplink and downlink frequency band supported by the booster.</li> </ul> |
| <b>Test Result:</b>      | PASS  |

### 6.2.2. Test Instruments

| Equipment         | Manufacturer     | Model  | Serial Number  | Calibration Date | Calibration Due |
|-------------------|------------------|--------|----------------|------------------|-----------------|
| Signal Generator  | Agilent          | N5182  | MY4707028<br>2 | Sep. 28, 2017    | Sep. 27, 2018   |
| Spectrum Analyzer | Agilent          | N9020A | MY4910006<br>0 | Sep. 28, 2017    | Sep. 27, 2018   |
| Attenuation       | AF115A-09-<br>34 | JFW    | 907763         | Sep. 28, 2017    | Sep. 27, 2018   |

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.2.3. Test Data

#### Max. Gain

| Frequency (MHz) | Signal Type | Pre AGC Input Level (dBm) | Conducted Output Level (dBm) | Gain (dB) | Gain Limit (dB) |
|-----------------|-------------|---------------------------|------------------------------|-----------|-----------------|
| UL1850-19<br>10 | CW          | -41                       | 20.31                        | 61.31     | 71.98           |
|                 | AWGN        | -40.5                     | 17.21                        | 57.71     |                 |
| UL1710-17<br>55 | CW          | -41                       | 22.6                         | 63.60     | 71.27           |
|                 | AWGN        | -40                       | 20.03                        | 60.03     |                 |
| UL824-849       | CW          | -40.5                     | 19.62                        | 60.12     | 64.95           |
|                 | AWGN        | -40                       | 17.13                        | 57.13     |                 |
| DL1930-19<br>90 | CW          | -57                       | 8.11                         | 65.11     | 71.98           |
|                 | AWGN        | -56                       | 4.97                         | 60.97     |                 |
| DL2110-21<br>55 | CW          | -57                       | 8.37                         | 65.37     | 71.27           |
|                 | AWGN        | -56.5                     | 5.75                         | 62.25     |                 |
| DL869-894       | CW          | -55.5                     | 8.35                         | 63.85     | 64.95           |
|                 | AWGN        | -56                       | 6.34                         | 62.34     |                 |

**Note:** Fixed Booster maximum gain shall not exceed  $6.5 \text{ dB} + 20 \log_{10} (\text{Frequency})$ , where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

#### Max. Input level

| Frequency (MHz) | Signal Type | Max. Input Level | Conducted Output Level | Limit (dB) |
|-----------------|-------------|------------------|------------------------|------------|
| UL1850-1910     | CW          | -21              | 20.04                  | < 27       |
|                 | AWGN        | -20              | 17.16                  |            |
| UL1710-1755     | CW          | -21              | 22.25                  | < 27       |
|                 | AWGN        | -20.5            | 19.73                  |            |
| UL824-849       | CW          | -20.5            | 19.16                  | < -20      |
|                 | AWGN        | -20              | 16.83                  |            |
| DL1930-1990     | CW          | -36.5            | 7.56                   | < -20      |
|                 | AWGN        | -36              | 4.47                   |            |
| DL2110-2155     | CW          | -37              | 7.89                   | < -20      |
|                 | AWGN        | -36.5            | 5.32                   |            |
| DL869-894       | CW          | -35.5            | 7.73                   | < -20      |
|                 | AWGN        | -34.5            | 6.12                   |            |

### Max. Output Power

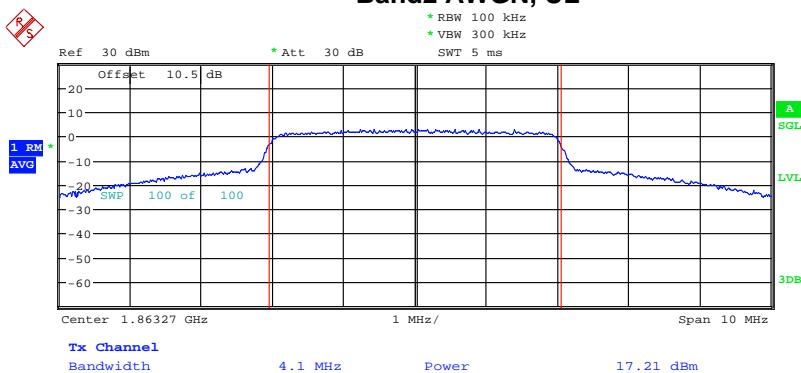
| Frequency (MHz) | Signal Type | Conducted Output Level | Max Antenna Gain (dB) | Cable Loss (dB) | EIRP (dBm) | Conducted Uplink Output Power | Conducted &EIRP Power Limit |
|-----------------|-------------|------------------------|-----------------------|-----------------|------------|-------------------------------|-----------------------------|
| UL1850-1<br>910 | CW          | 20.31                  | 10.5                  | 6.25            | 24.56      | >17dBm                        | <30dBm                      |
|                 | AWGN        | 17.21                  | 10.5                  | 6.25            | 21.46      |                               |                             |
| UL1710-1<br>755 | CW          | 22.6                   | 10.5                  | 5.89            | 27.21      | >17dBm                        | <30dBm                      |
|                 | AWGN        | 20.03                  | 10.5                  | 5.89            | 24.64      |                               |                             |
| UL824-84<br>9   | CW          | 19.62                  | 9                     | 5.49            | 23.13      | >17dBm                        | <30dBm                      |
|                 | AWGN        | 17.13                  | 9                     | 5.49            | 20.64      |                               |                             |
| DL1930-1<br>990 | CW          | 8.11                   | 8.5                   | 2.55            | 14.06      | N/A                           | <17dBm                      |
|                 | AWGN        | 4.97                   | 8.5                   | 2.55            | 10.92      |                               |                             |
| DL2110-2<br>155 | CW          | 8.37                   | 8.5                   | 2.42            | 14.45      | N/A                           | <17dBm                      |
|                 | AWGN        | 5.75                   | 8.5                   | 2.42            | 11.83      |                               |                             |
| DL869-89<br>4   | CW          | 8.35                   | 7                     | 2.29            | 13.06      | N/A                           | <17dBm                      |
|                 | AWGN        | 6.34                   | 7                     | 2.29            | 11.05      |                               |                             |

### Uplink Gain VS Downlink Gain

| Band  | Signal Type | Uplink Gain (dB) | Downlink Gain (dB) | D-value | Limit (dB) |
|-------|-------------|------------------|--------------------|---------|------------|
| Band2 | CW          | 61.31            | 65.11              | 3.8     | 9          |
|       | AWGN        | 57.71            | 60.97              | 3.26    |            |
| Band4 | CW          | 63.6             | 65.37              | 1.77    | 9          |
|       | AWGN        | 60.03            | 62.25              | 2.22    |            |
| Band5 | CW          | 60.12            | 63.85              | 3.73    | 9          |
|       | AWGN        | 57.13            | 62.34              | 5.21    |            |

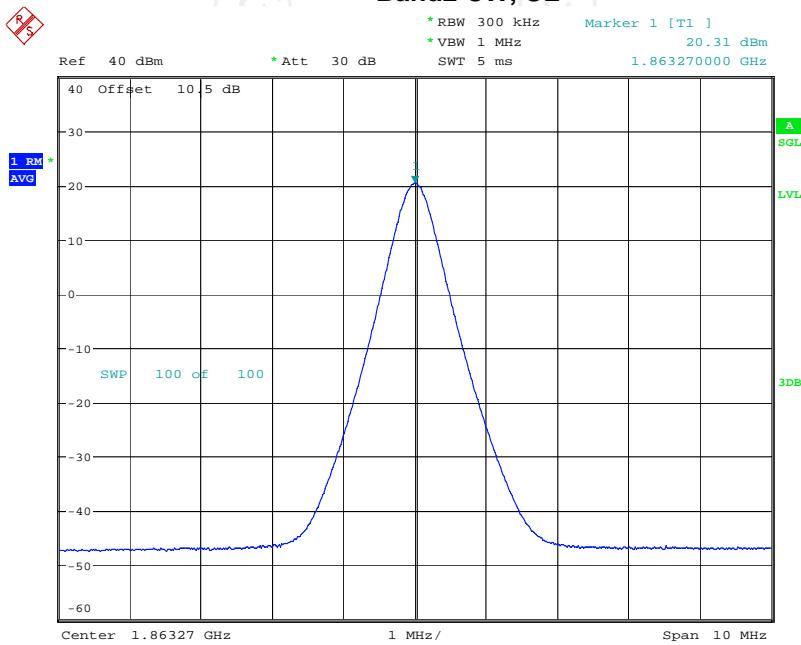
## Test Plots

### Band2 AWGN, UL



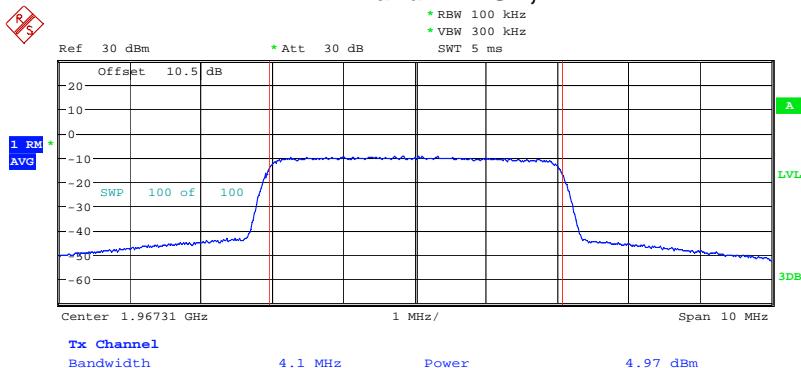
Date: 16.MAY.2018 15:49:15

### Band2 CW, UL



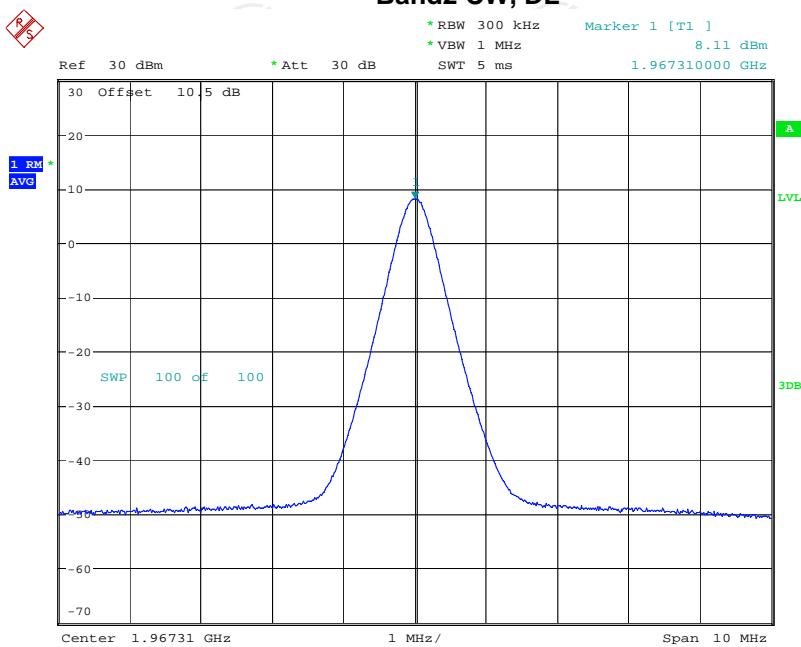
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## Band2 AWGN, DL

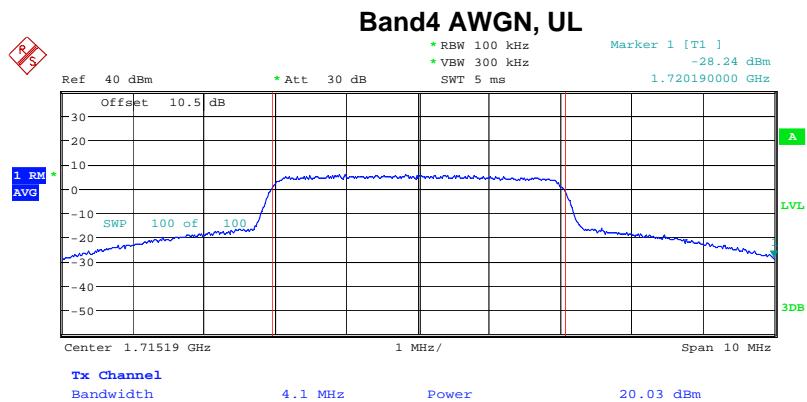


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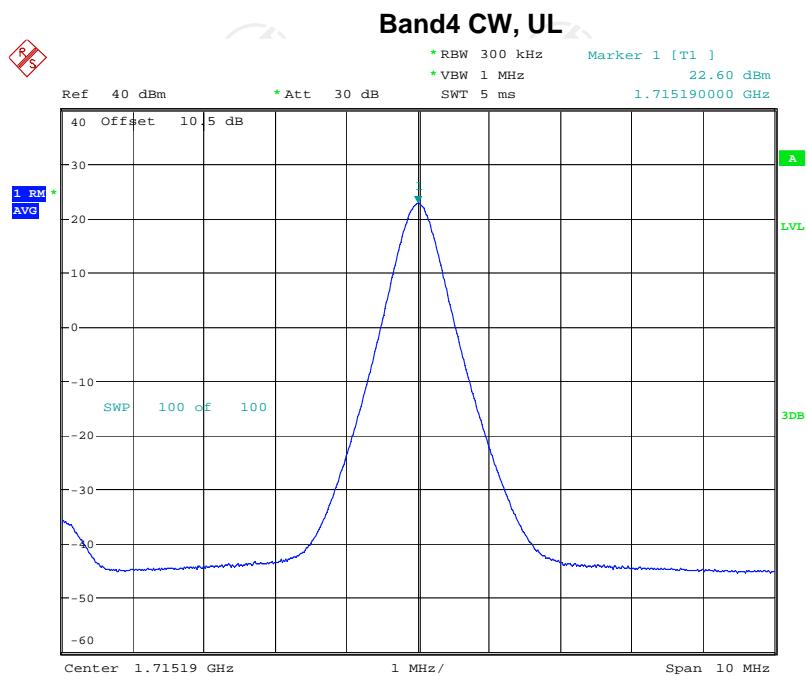
## Band2 CW, DL



Date: 16.MAY.2018 15:13:32

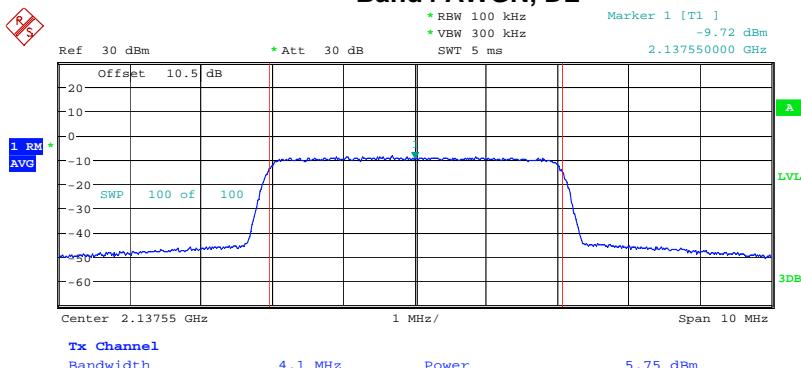


Date: 16.MAY.2018 14:36:09



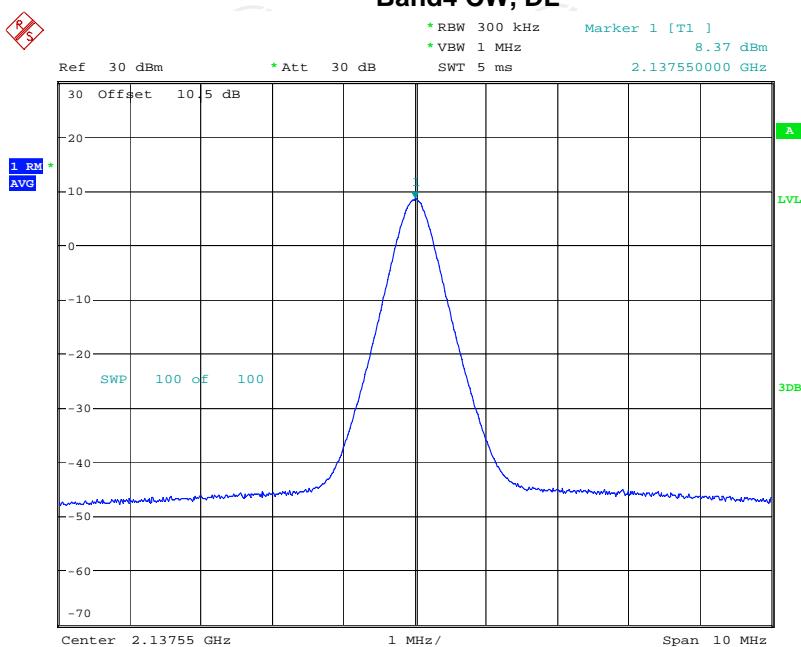
Date: 16.MAY.2018 14:43:09

## Band4 AWGN, DL



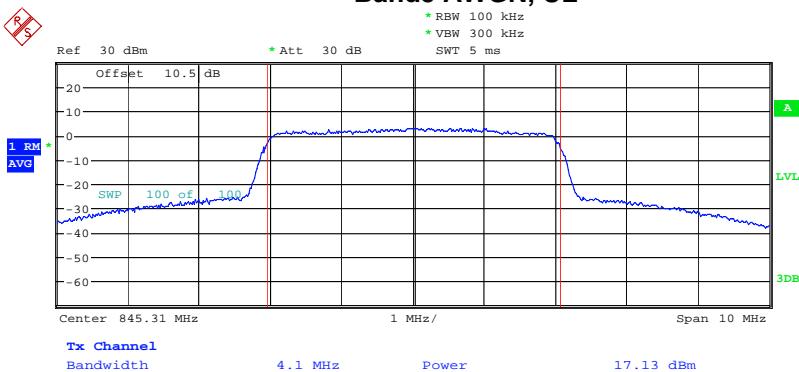
Date: 16.MAY.2018 15:19:14

## Band4 CW, DL



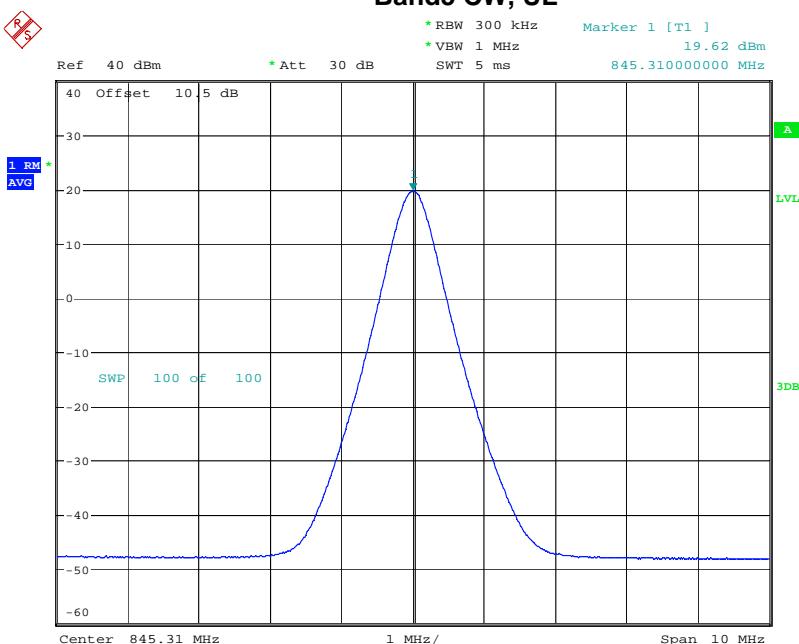
Date: 16.MAY.2018 15:17:28

## Band5 AWGN, UL



Date: 16.MAY.2018 15:29:47

## Band5 CW, UL



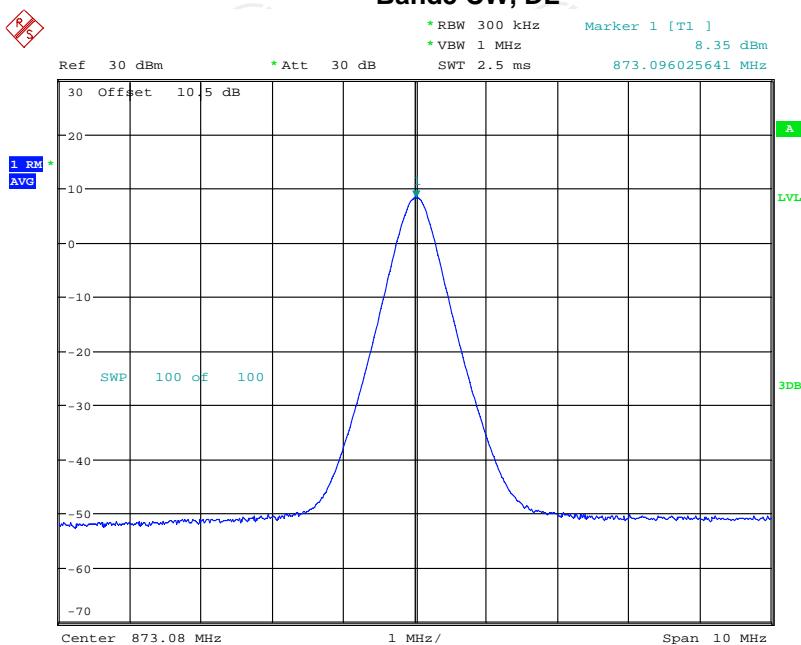
Date: 16.MAY.2018 14:45:59

## Band5 AWGN, DL



Date: 16.MAY.2018 15:05:02

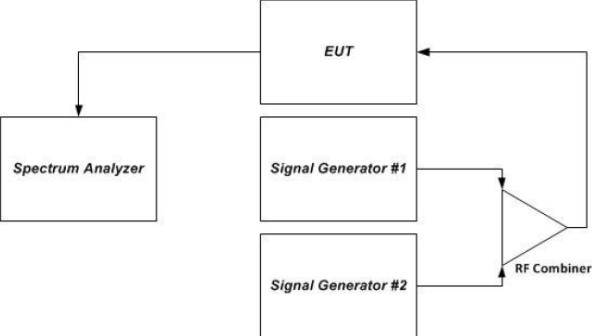
## Band5 CW, DL



Date: 16.MAY.2018 15:52:25

## 6.3. Intermodulation Product

### 6.3.1. Test Specification

|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | FCC Part20 Section 20.21(e)(8)(i)(F)   |
| <b>Test Method:</b>      | KDB935210 D03 Signal Booster Measurement v04r01  |
| <b>Limit:</b>            | -19dBm   |
| <b>Test Setup:</b>       |  <p>Figure 2 – Intermodulation product instrumentation test setup</p>  |
| <b>Test Procedure:</b>   | <ol style="list-style-type: none"> <li>Connect the signal booster to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.</li> <li>Set the spectrum analyzer RBW = 3 kHz.</li> <li>Set the VBW <math>\geq 3 \times</math> the RBW.</li> <li>Select the RMS detector.</li> <li>Set the spectrum analyzer center frequency to the center of the supported operational band under test.</li> <li>Set the span to 5 MHz.</li> <li>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.</li> <li>Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent and turn on the RF output.</li> <li>Increase the signal generators' amplitudes equally until just before the EUT begins AGC and ensure that all intermodulation products (if any exist), are below the specified limit of -19 dBm.</li> <li>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.</li> <li>Record the maximum intermodulation product amplitude level that is observed.</li> <li>Capture the spectrum analyzer trace for inclusion in the test report.</li> <li>Repeat steps e) to l) for all uplink and downlink operational bands.</li> </ol> <p><b>Note:</b> If using a single signal generator with dual outputs, ensure that intermodulation products are not the result of the generator.</p> <p>n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in i) to ensure that the EUT maintains compliance with the intermodulation</p> |
| <b>Test Result:</b>      | PASS   |

### 6.3.2. Test Instruments

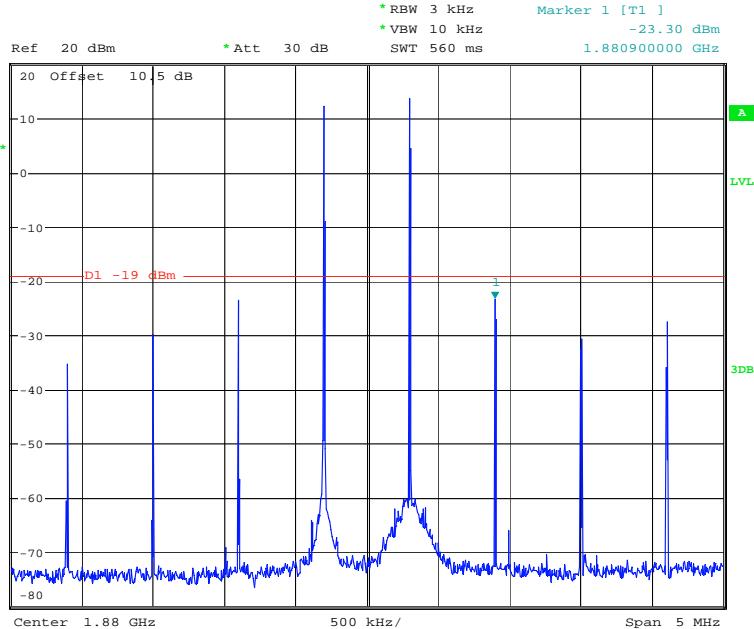
| Equipment         | Manufacturer | Model       | Serial Number | Calibration Date | Calibration Due |
|-------------------|--------------|-------------|---------------|------------------|-----------------|
| Signal Generator  | Agilent      | E4421B      | GB39340839    | Sep. 28, 2017    | Sep. 27, 2018   |
| Signal Generator  | Agilent      | N5182       | MY47070282    | Sep. 28, 2017    | Sep. 27, 2018   |
| Spectrum Analyzer | Agilent      | N9020A      | MY49100060    | Sep. 28, 2017    | Sep. 27, 2018   |
| RF Combiner       | SUNVNDN      | SUD-CS 0800 | 16230009      | Sep. 28, 2017    | Sep. 27, 2018   |
| Attenuation       | AF115A-09-34 | JFW         | 907763        | Sep. 28, 2017    | Sep. 27, 2018   |

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.3.3. Test data

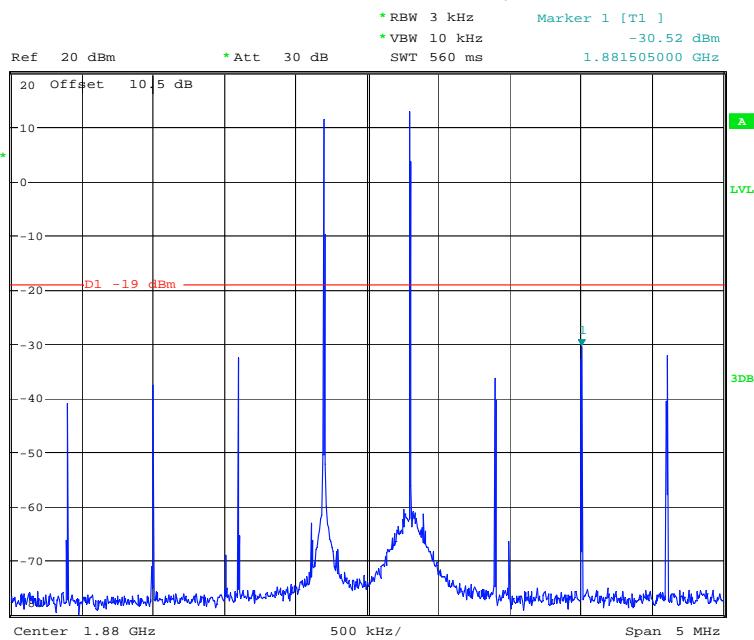
#### Test Plots

##### Band2 Pre AGC, UL



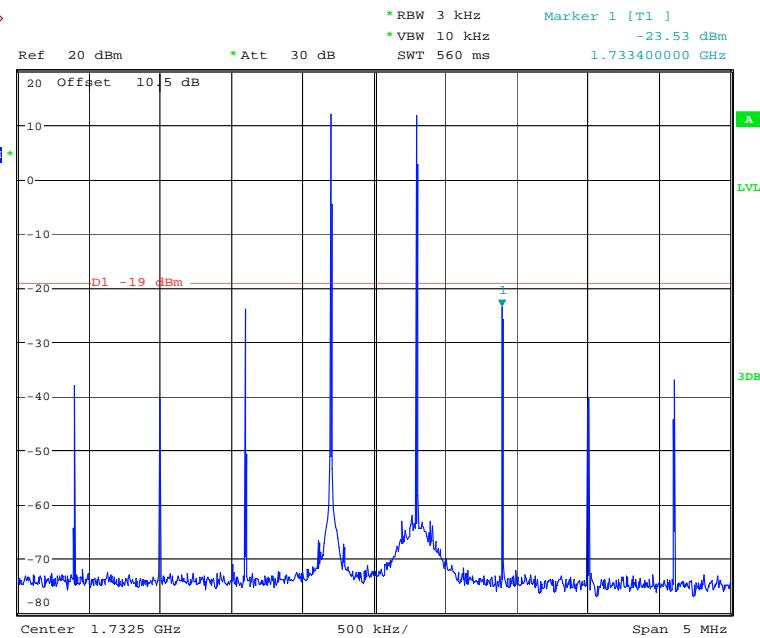
Date: 16.MAY.2018 16:14:42

##### Band2 AGC+10dB, UL



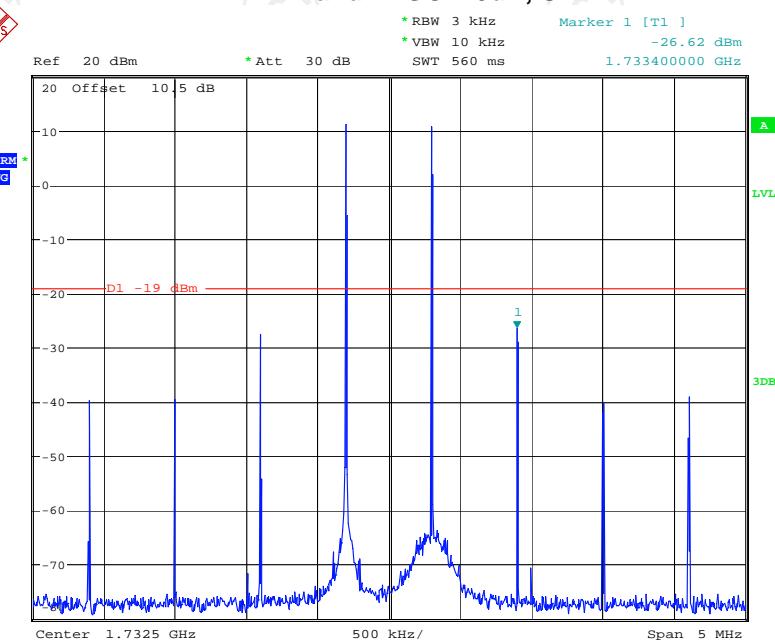
Date: 16.MAY.2018 16:15:33

## Band4 Pre AGC, UL



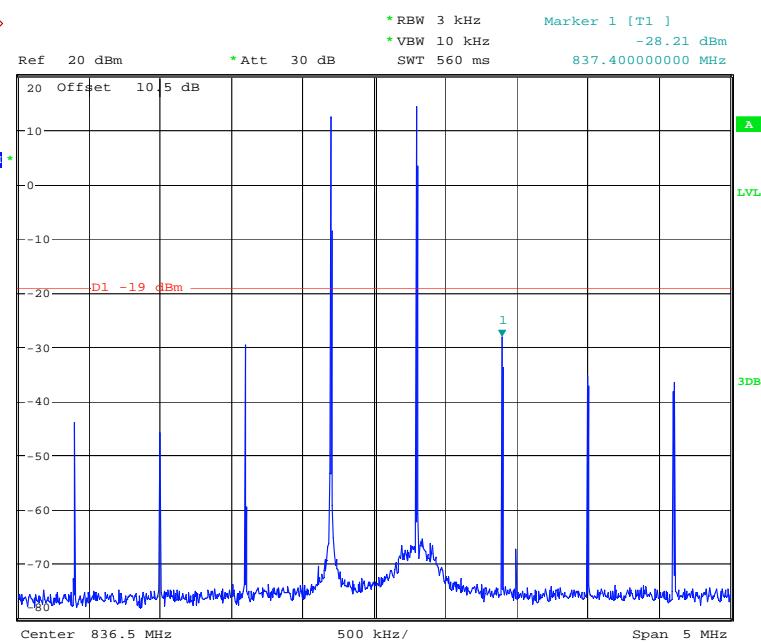
Date: 16.MAY.2018 16:16:53

## Band4 AGC+10dB, UL



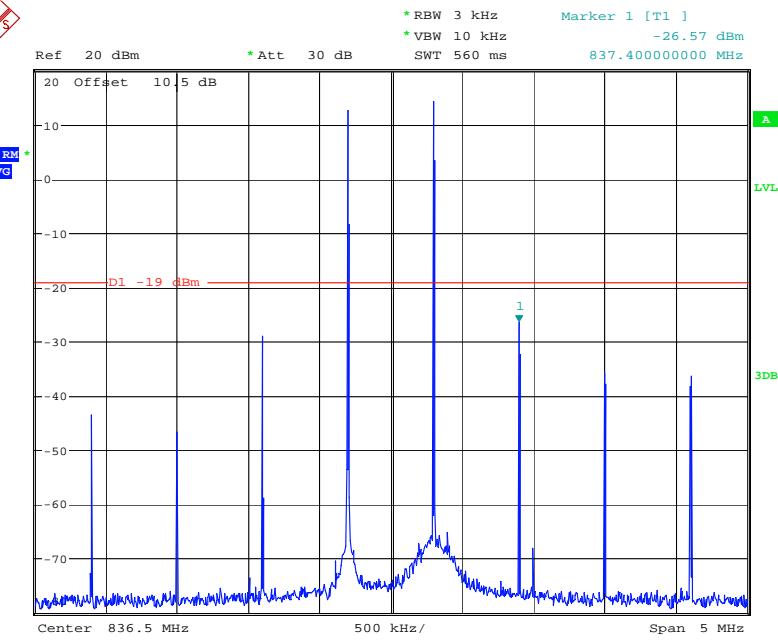
Date: 16.MAY.2018 16:17:27

## Band5 Pre AGC, UL



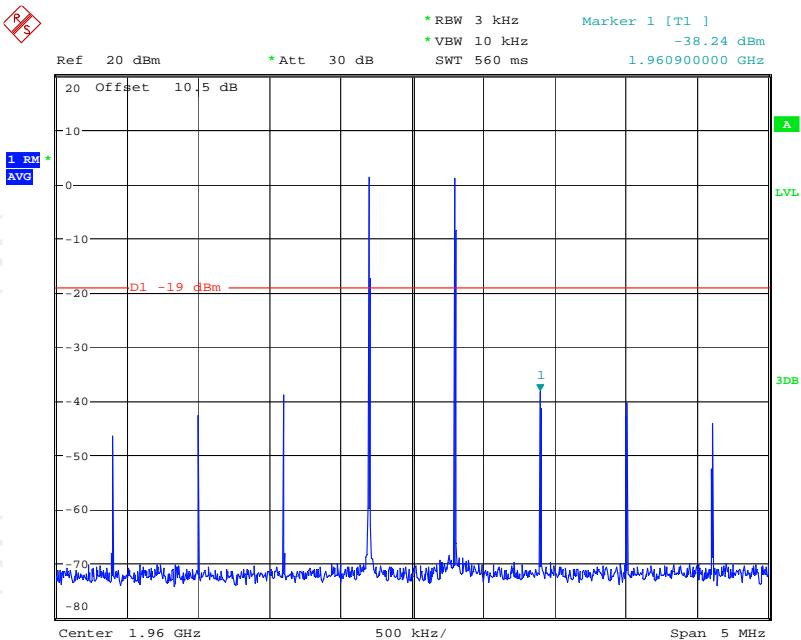
Date: 16.MAY.2018 16:11:59

## Band5 AGC+10dB, UL



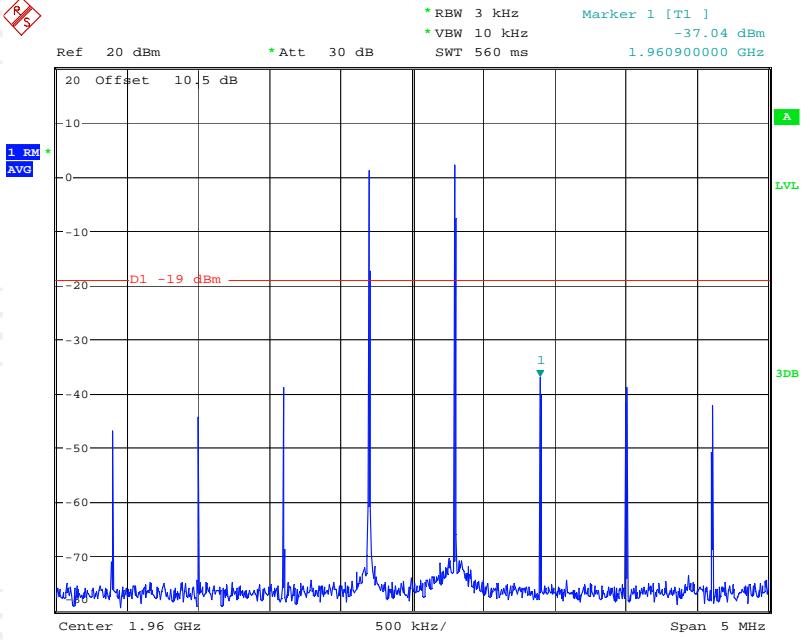
Date: 16.MAY.2018 16:12:37

## Band2 Pre AGC, DL



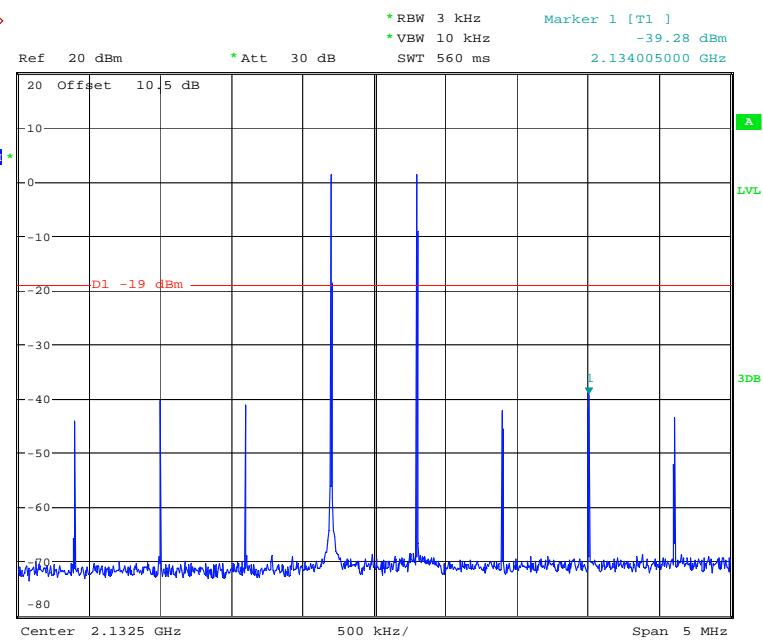
Date: 16.MAY.2018 16:04:14

## Band2 AGC+10dB, DL



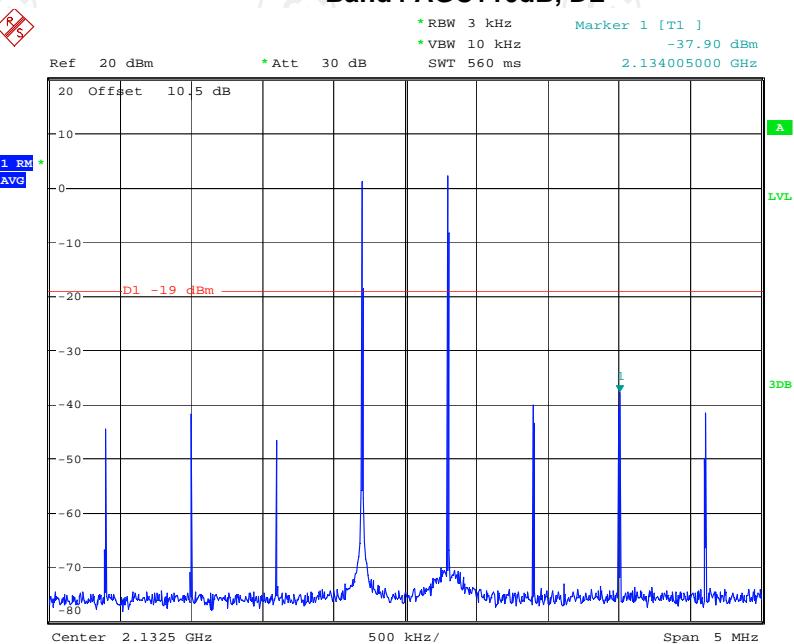
Date: 16.MAY.2018 16:04:41

## Band4 Pre AGC, DL



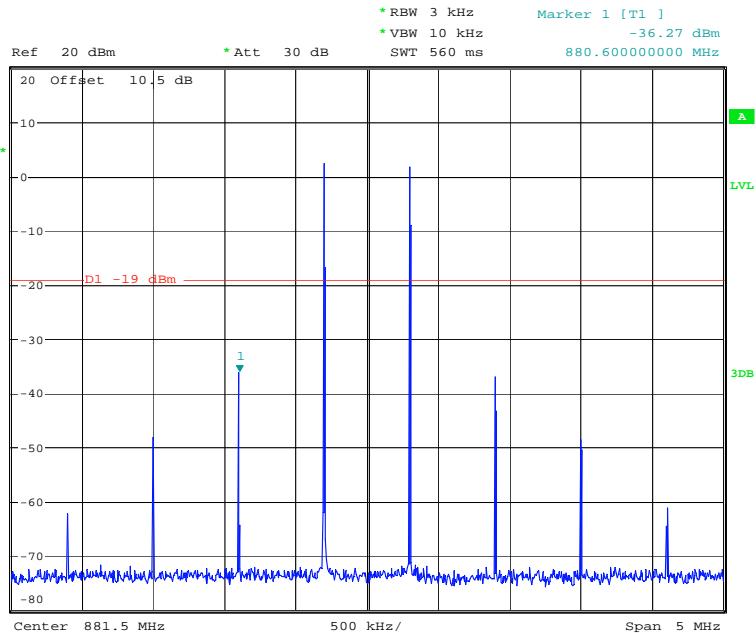
Date: 16.MAY.2018 15:59:32

## Band4 AGC+10dB, DL



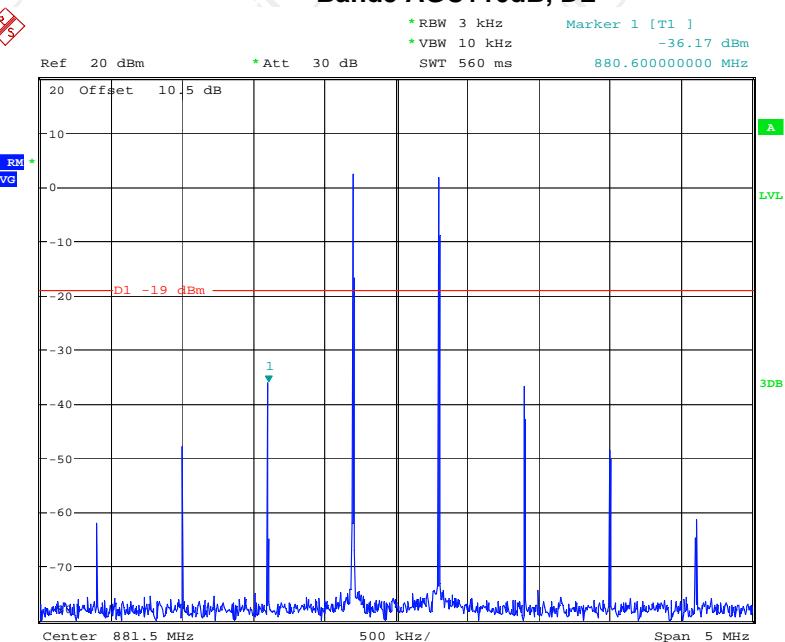
Date: 16.MAY.2018 16:00:13

## Band5 Pre AGC, DL



Date: 16.MAY.2018 16:07:11

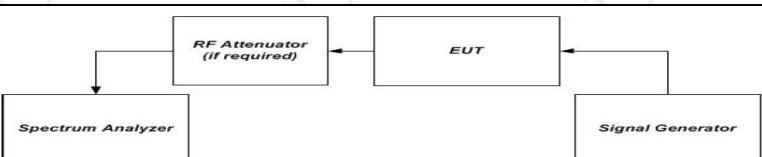
## Band5 AGC+10dB, DL



Date: 16.MAY.2018 16:08:16

## 6.4. Out of Band Emission

### 6.4.1. Test Specification

|                          |   |
|--------------------------|---|
| <b>Test Requirement:</b> | FCC Part20 Section 20.21(e)(8)(i)(E)  |
| <b>Test Method:</b>      | KDB935210 D03 Signal Booster Measurement v04r01   |
| <b>Limit:</b>            | -19dBm  |
| <b>Test Setup:</b>       |   |
| <b>Test Procedure:</b>   | <p>a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.</p> <p>b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:</p> <ul style="list-style-type: none"> <li>i) GSM: 0.2 MHz from upper and lower band edge</li> <li>ii) LTE (5 MHz): 2.5 MHz from upper and lower band edge</li> <li>iii) CDMA: 1.25 MHz from upper and lower band edge, except for cellular 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.</li> </ul> <p>Note 1: Alternative test modulation types:</p> <ul style="list-style-type: none"> <li>• CDMA (alternative 1.25 MHz AWGN)</li> <li>• LTE 5 MHz (alternative W-CDMA or 4.1 MHz AWGN)</li> </ul> <p>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.</p> <p>Note 3: AWGN is the measured 99% occupied bandwidth.</p> <p>c) Set the signal generator amplitude to the maximum power level prior to AGC similar to the procedures in method of Maximum power d) to f) of power measurement procedure for appropriate modulations.</p> <p>d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band.</p> <p>e) Set VBW = 3 x RBW.</p> <p>f) Select the RMS (power averaging) detector.</p> <p>g) Sweep time = auto-couple.</p> <p>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 &lt; 1 GHz) or 3 MHz (when operational frequency is ≥ 1 GHz).</p> <p>i) Trace average at least 100 traces in power averaging (i.e., RMS) mode.</p> <p>j) Use peak marker function to find the maximum power level.</p> <p>k) Capture the spectrum analyzer trace of the power level for inclusion in the test report.</p> <p>l) Increase the signal generator amplitude in 2 dB steps until the maximum input level indicated in 5.4 is reached. Ensure that the EUT maintains compliance with the OOB limits.</p> <p>m) Reset the analyzer start frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as per applicable rule part, and the stop frequency to the lower band/block edge frequency and repeat steps j) to l).</p> |

|                     |  |
|---------------------|--|
|                     | n) Repeat steps b) through m) for each uplink and downlink operational band. |
| <b>Test Result:</b> | PASS   |

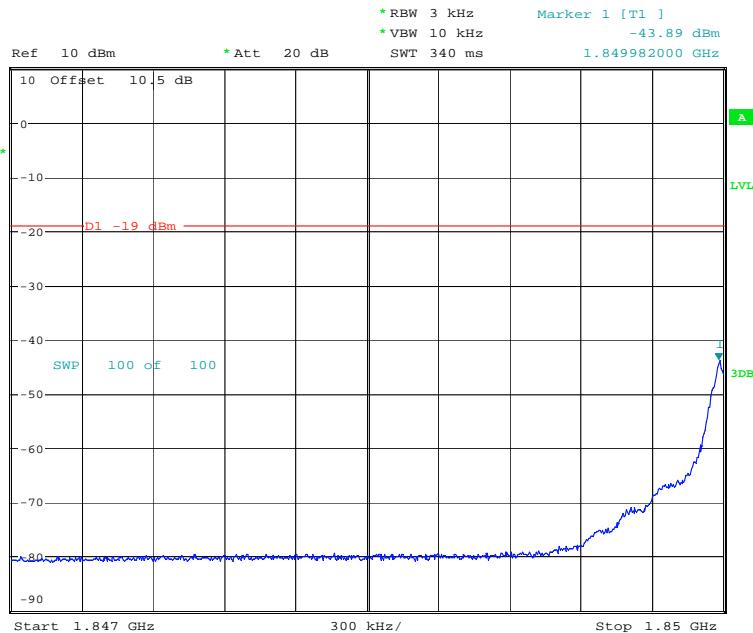
#### 6.4.2. Test Instruments

| Equipment         | Manufacturer | Model  | Serial Number  | Calibration Date | Calibration Due |
|-------------------|--------------|--------|----------------|------------------|-----------------|
| Signal Generator  | Agilent      | N5182  | MY4707028<br>2 | Sep. 28, 2017    | Sep. 27, 2018   |
| Spectrum Analyzer | Agilent      | N9020A | MY4910006<br>0 | Sep. 28, 2017    | Sep. 27, 2018   |
| Attenuation       | AF115A-09-34 | JFW    | 907763         | Sep. 28, 2017    | Sep. 27, 2018   |

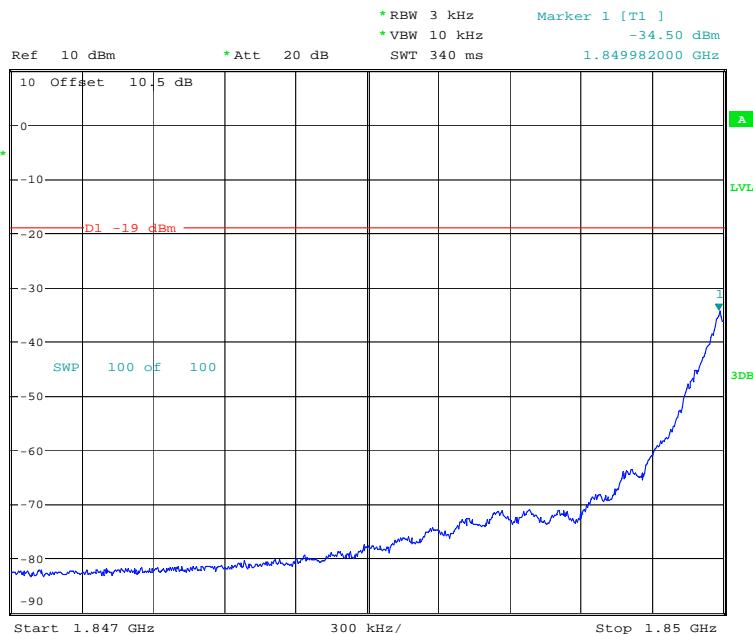
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.4.3. Test data

#### Test Plots

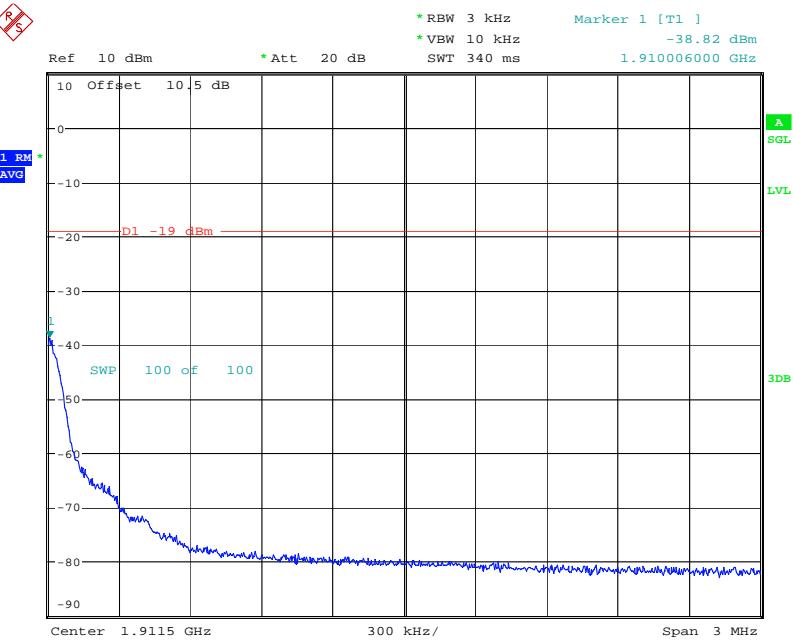
**Band2 GSM UL Left Side Pre AGC**


Date: 16.MAY.2018 17:28:52

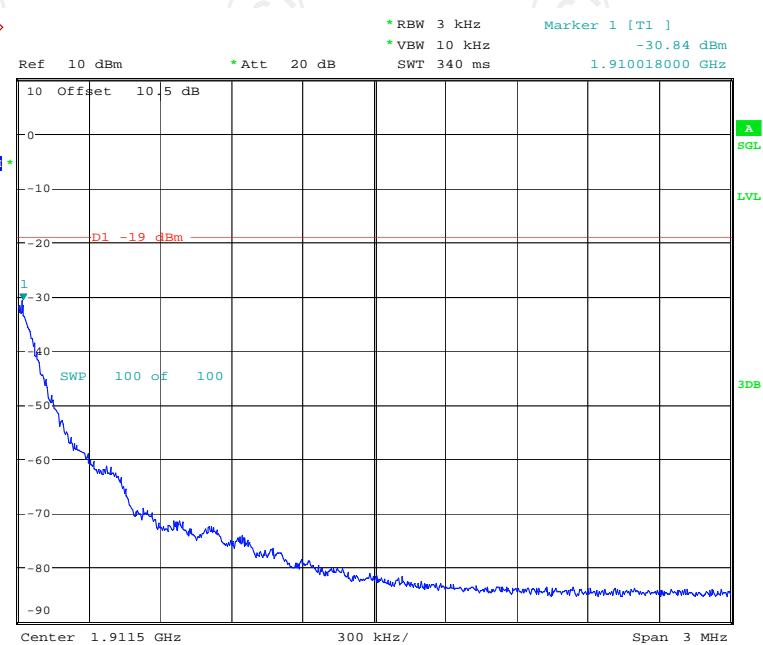
**Band2 GSM UL Left Side Max Input**


Date: 16.MAY.2018 17:30:37

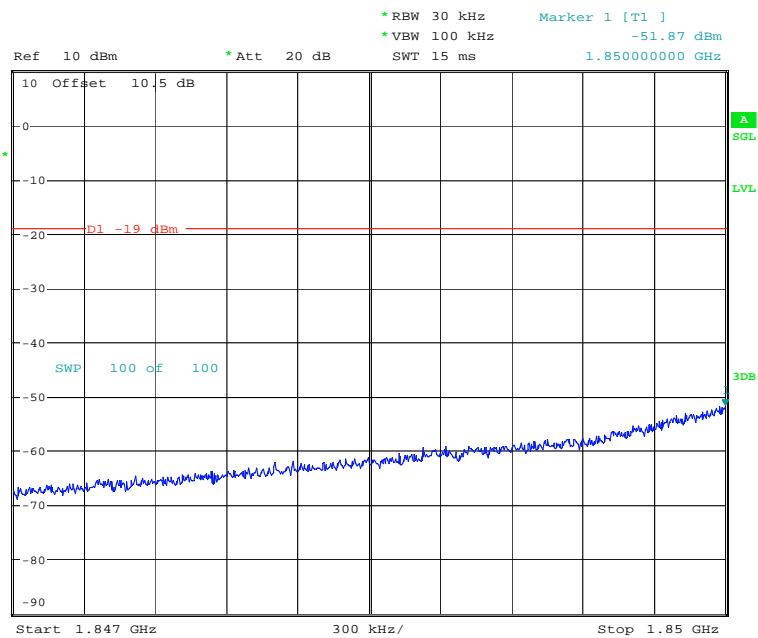
### Band2 GSM UL Right Side Pre AGC



### Band2 GSM UL Right Side Max Input

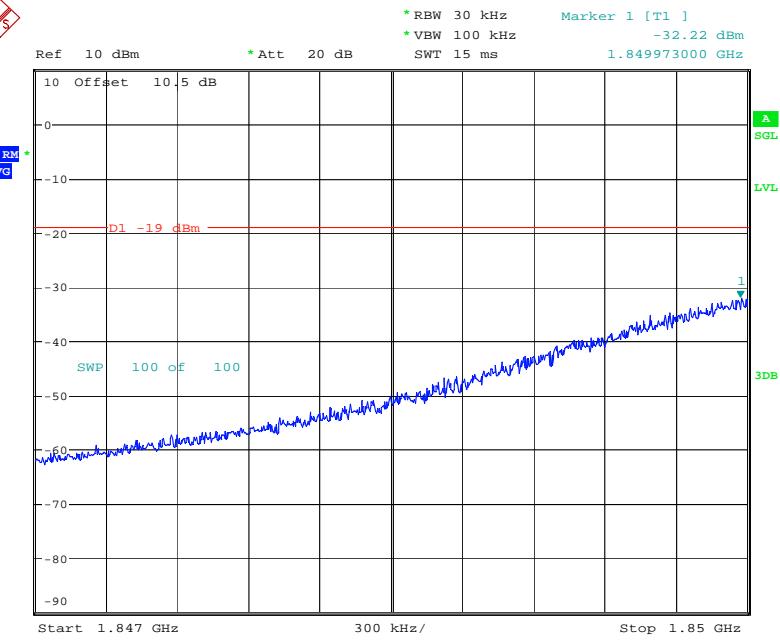


### Band2 CDMA UL Left Side Pre AGC



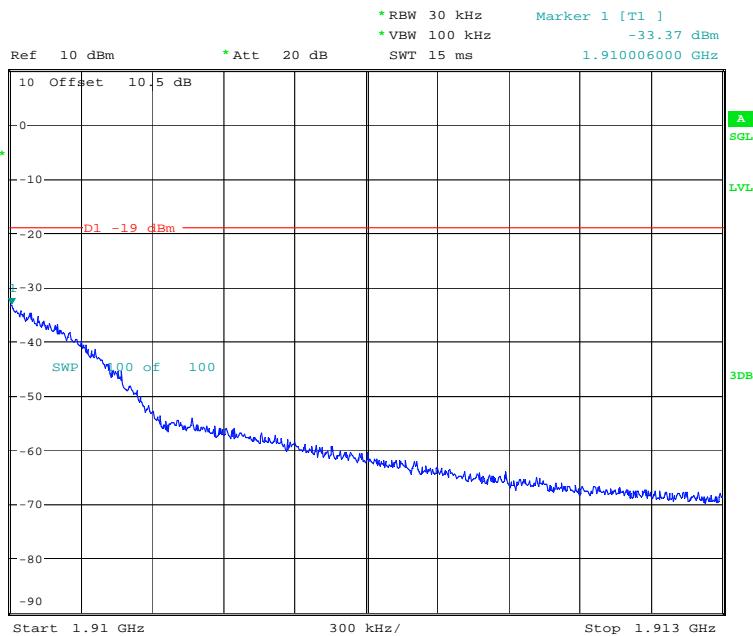
Date: 16.MAY.2018 17:34:11

### Band2 CDMA UL Left Side Max Input



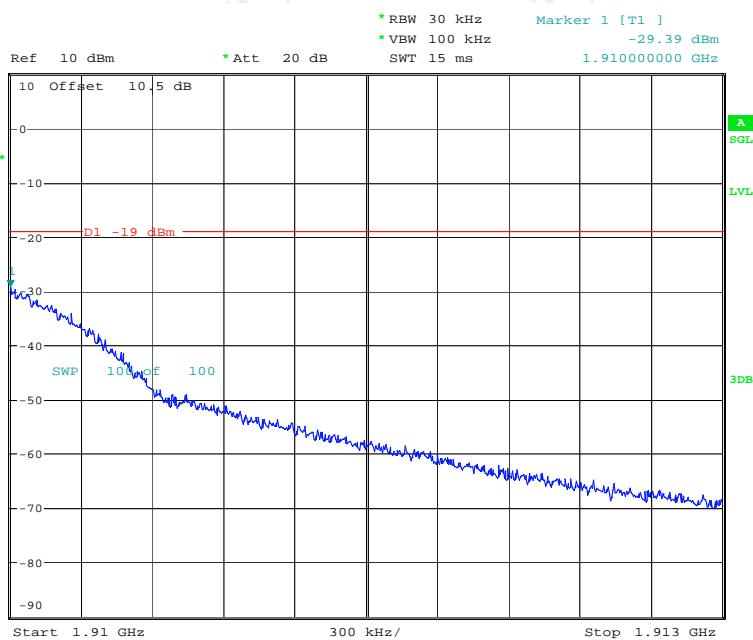
Date: 16.MAY.2018 17:35:24

**Band2 CDMA UL Right Side Pre AGC**



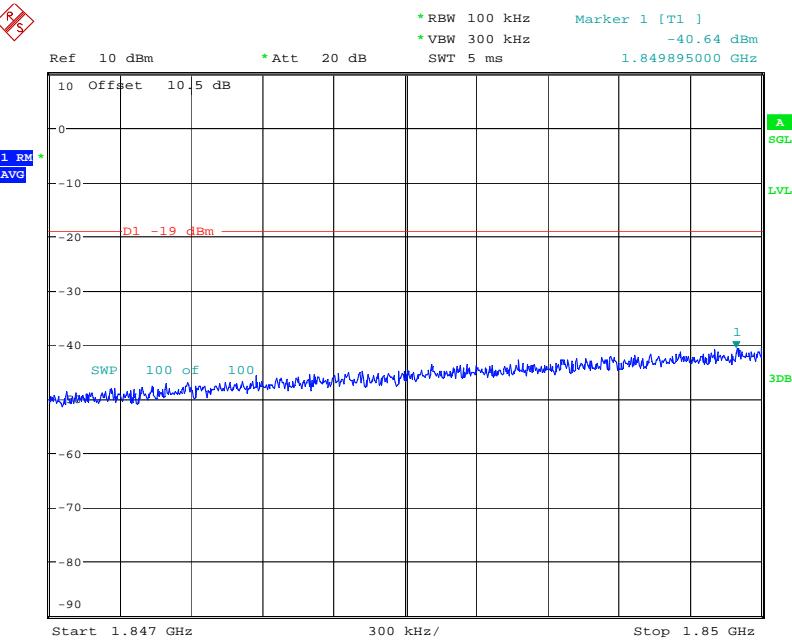
Date: 16.MAY.2018 17:42:32

**Band2 CDMA UL Right Side Max Input**



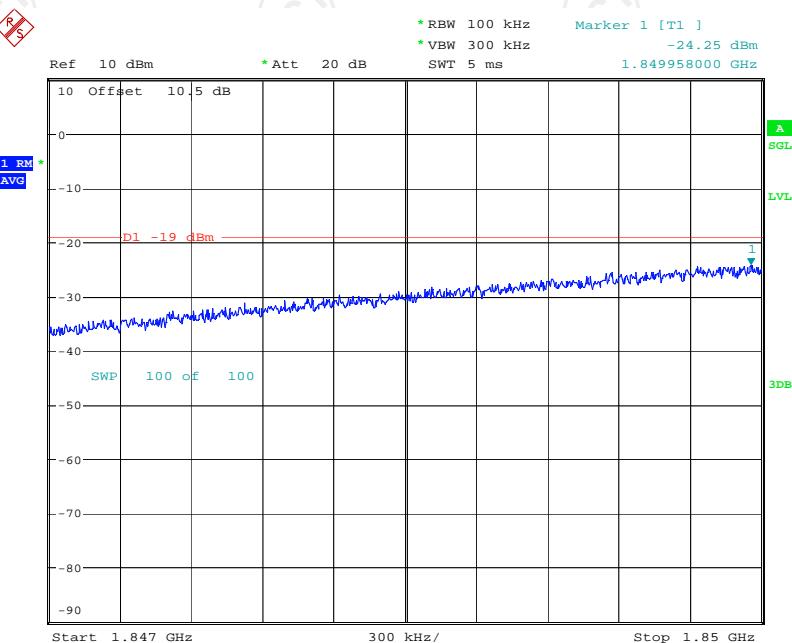
Date: 16.MAY.2018 17:43:07

### Band2 LTE UL Left Side Pre AGC



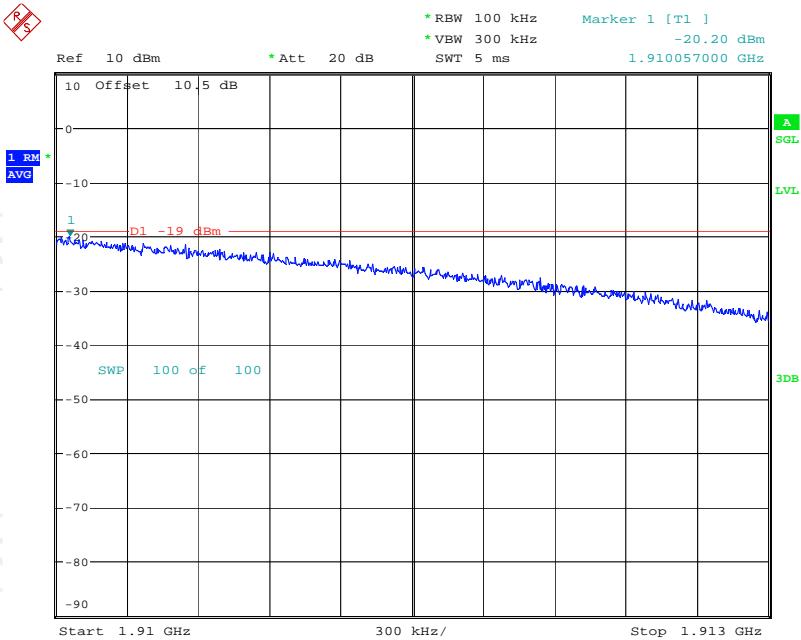
Date: 16.MAY.2018 17:36:58

### Band2 LTE UL Left Side Max Input



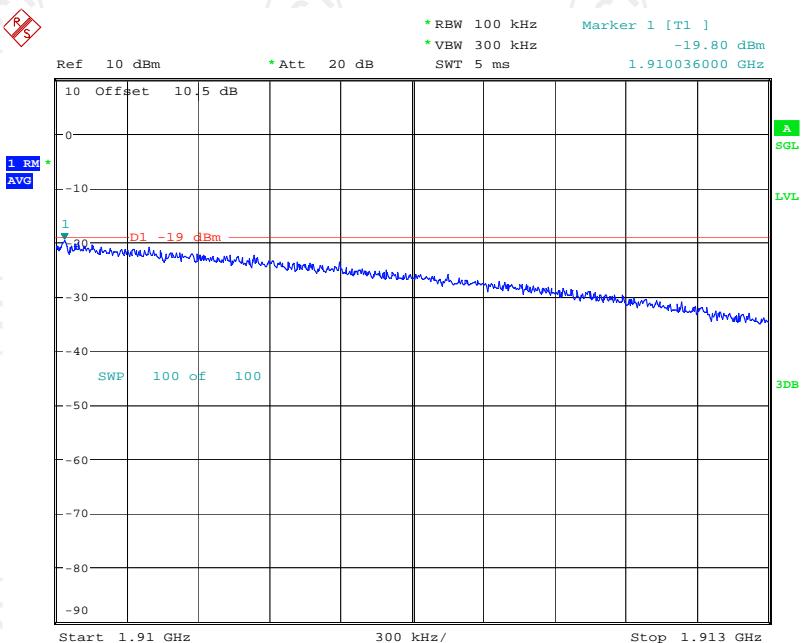
Date: 16.MAY.2018 17:37:34

### Band2 LTE UL Right Side Pre AGC



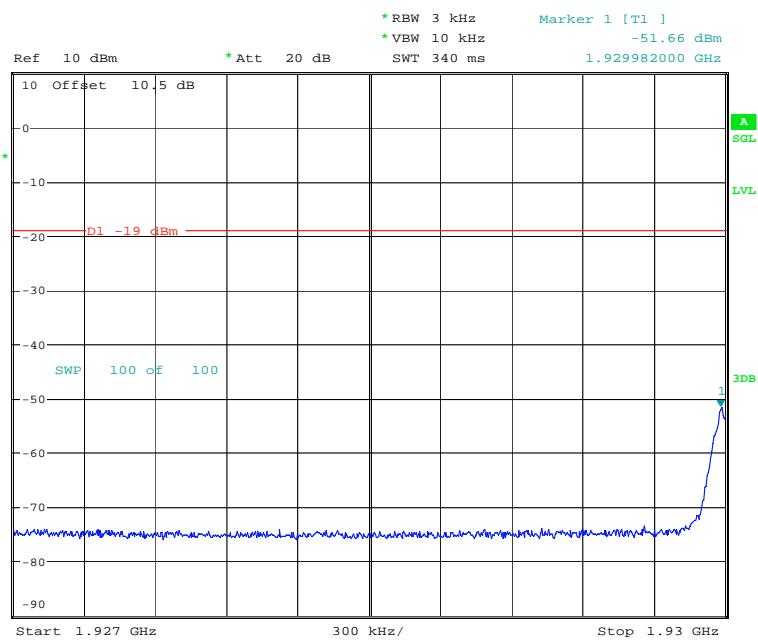
Date: 16.MAY.2018 17:40:27

### Band2 LTE UL Right Side Max Input



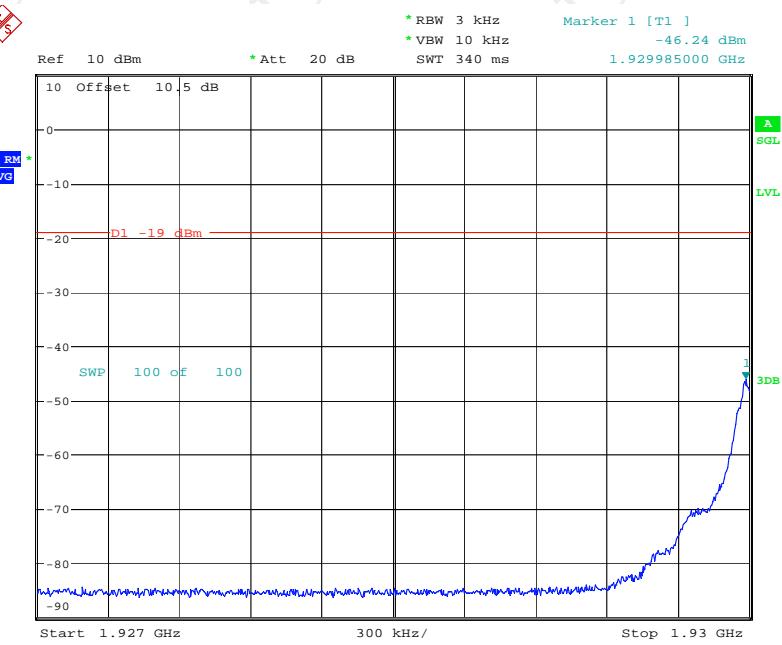
Date: 16.MAY.2018 17:41:07

**Band2 GSM DL Left Side Pre AGC**



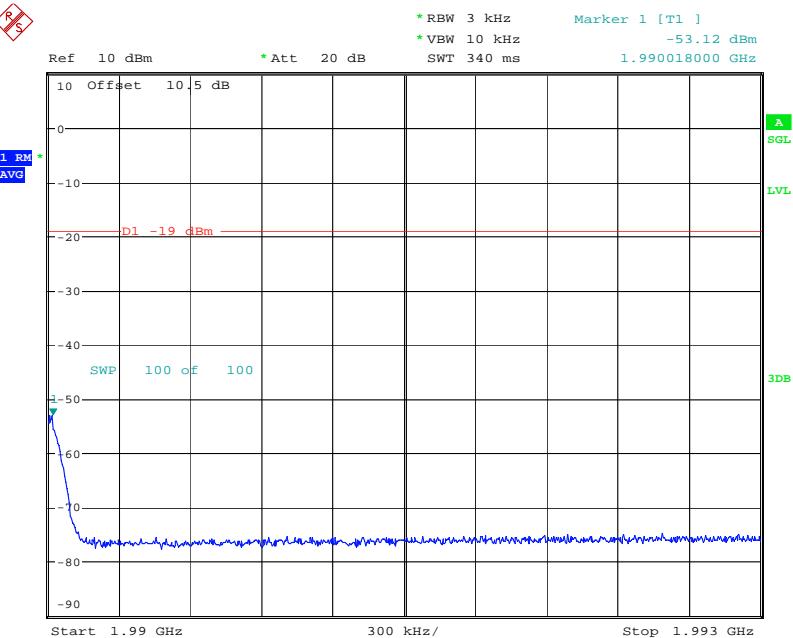
Date: 16.MAY.2018 18:53:06

**Band2 GSM DL Left Side Max Input**



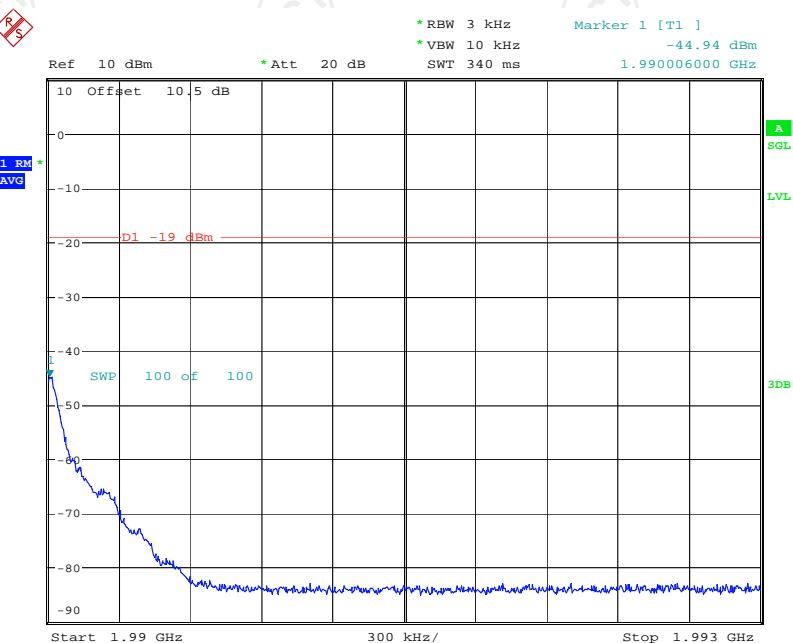
Date: 16.MAY.2018 18:54:59

### Band2 GSM DL Right Side Pre AGC



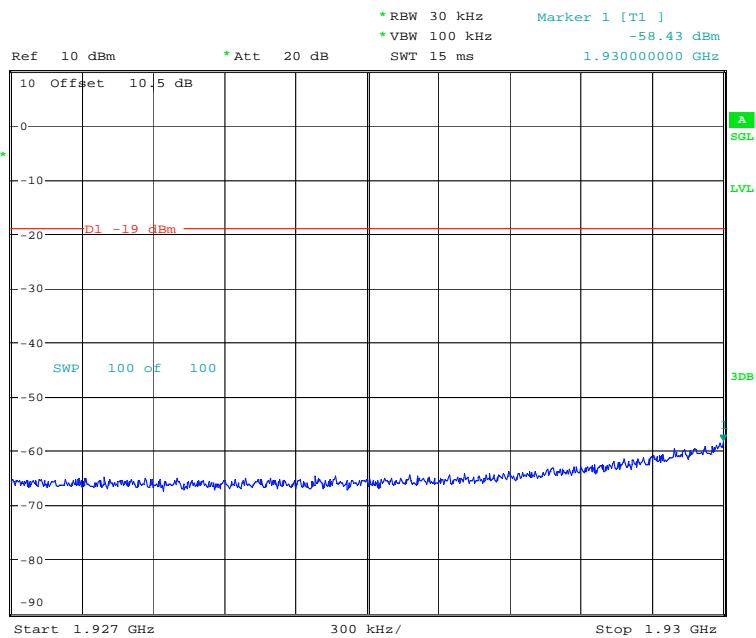
Date: 16.MAY.2018 19:11:39

### Band2 GSM DL Right Side Max Input



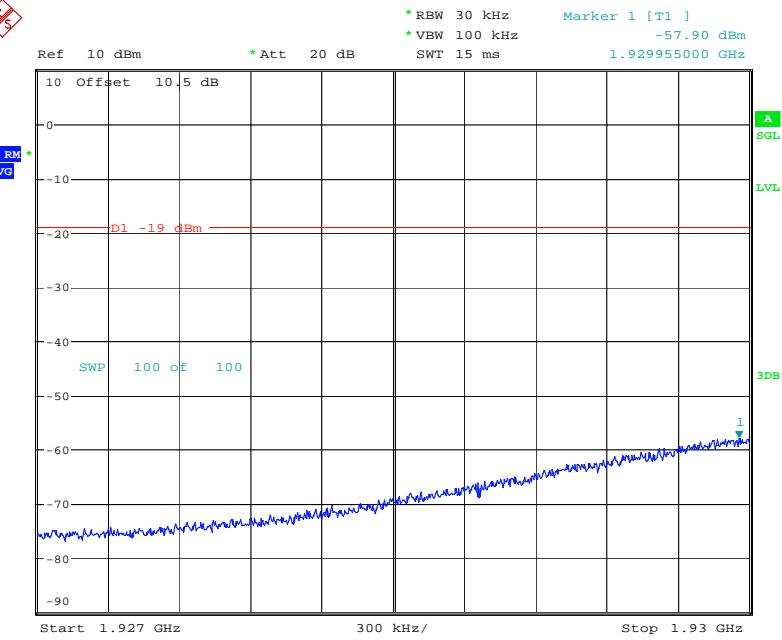
Date: 16.MAY.2018 19:12:58

### Band2 CDMA DL Left Side Pre AGC



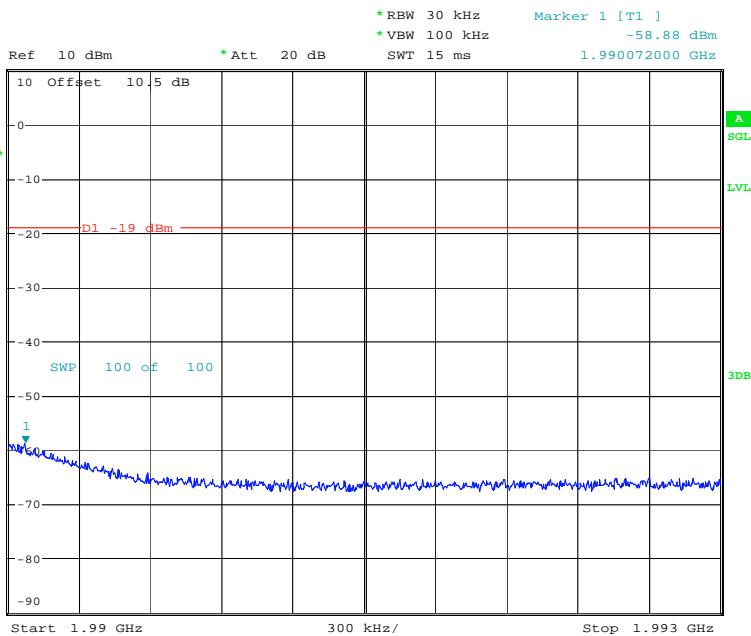
Date: 16.MAY.2018 18:56:48

### Band2 CDMA DL Left Side Max Input



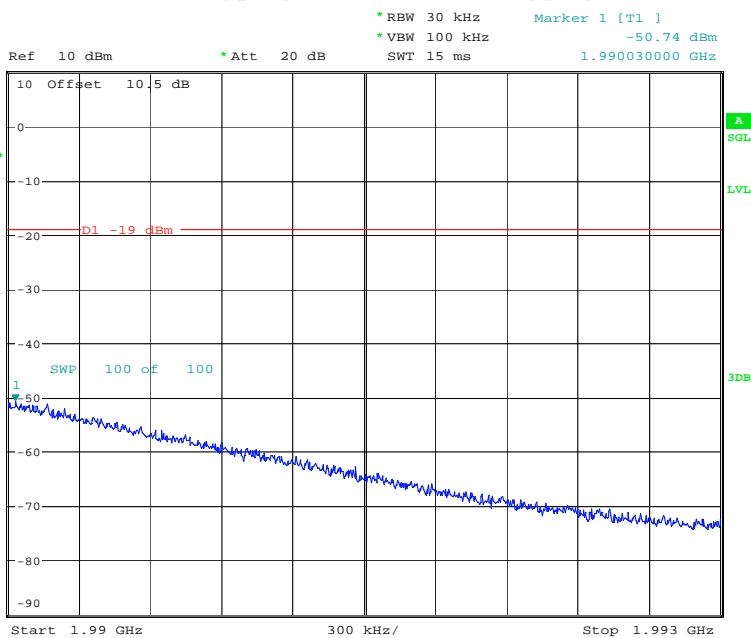
Date: 16.MAY.2018 18:57:23

### Band2 CDMA DL Right Side Pre AGC



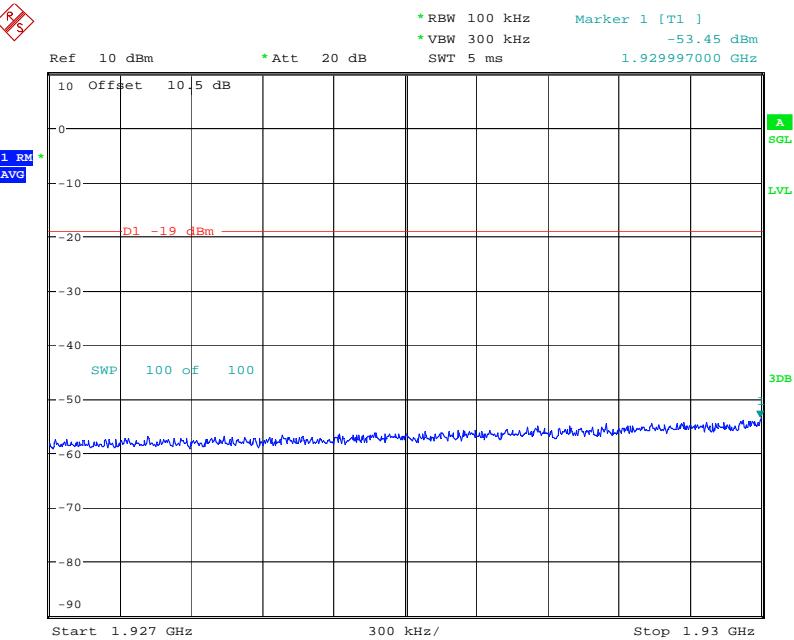
Date: 16.MAY.2018 19:08:40

### Band2 CDMA DL Right Side Max Input



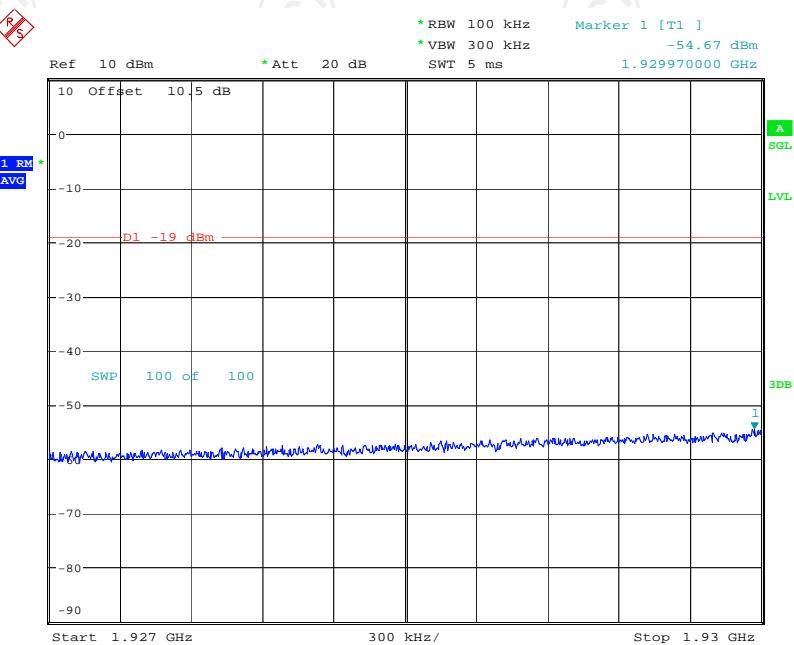
Date: 16.MAY.2018 19:09:09

### Band2 LTE DL Left Side Pre AGC



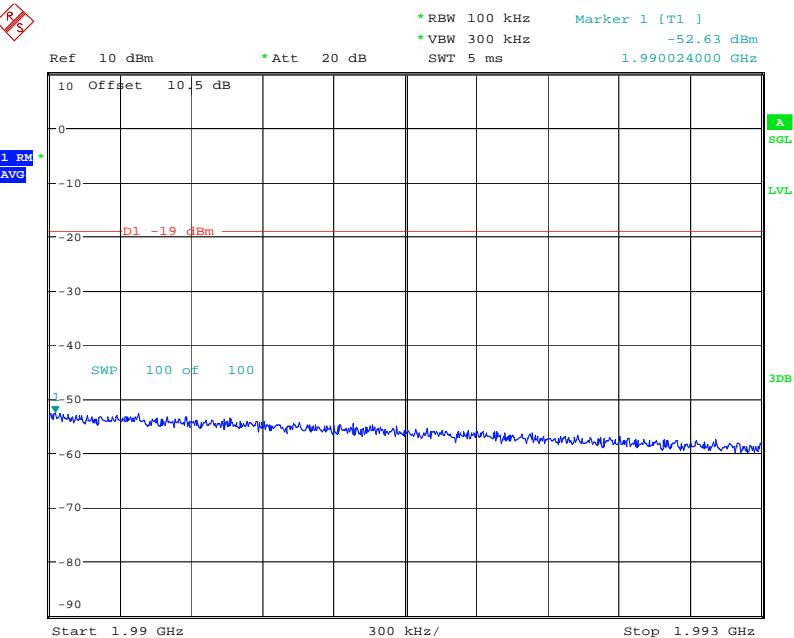
Date: 16.MAY.2018 19:04:02

### Band2 LTE DL Left Side Max Input



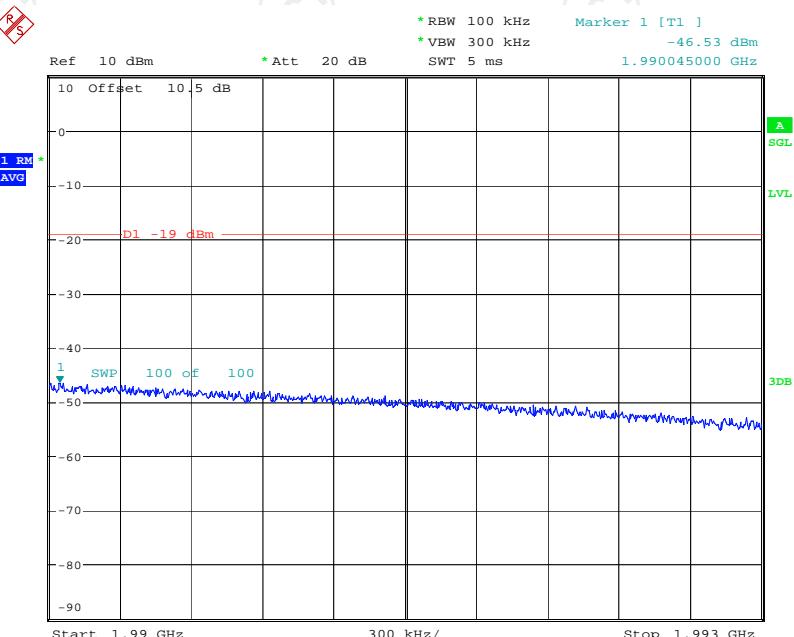
Date: 16.MAY.2018 19:04:33

### Band2 LTE DL Right Side Pre AGC



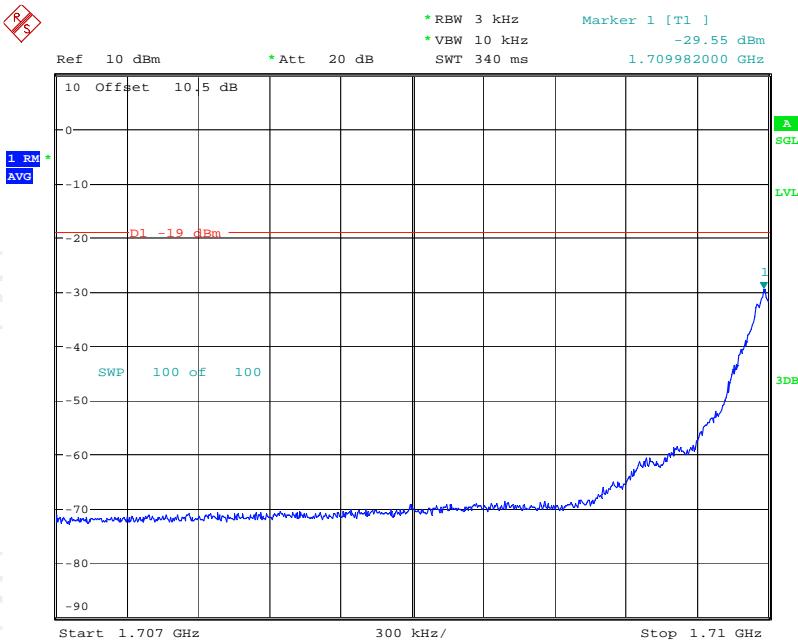
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### Band2 LTE DL Right Side Max Input



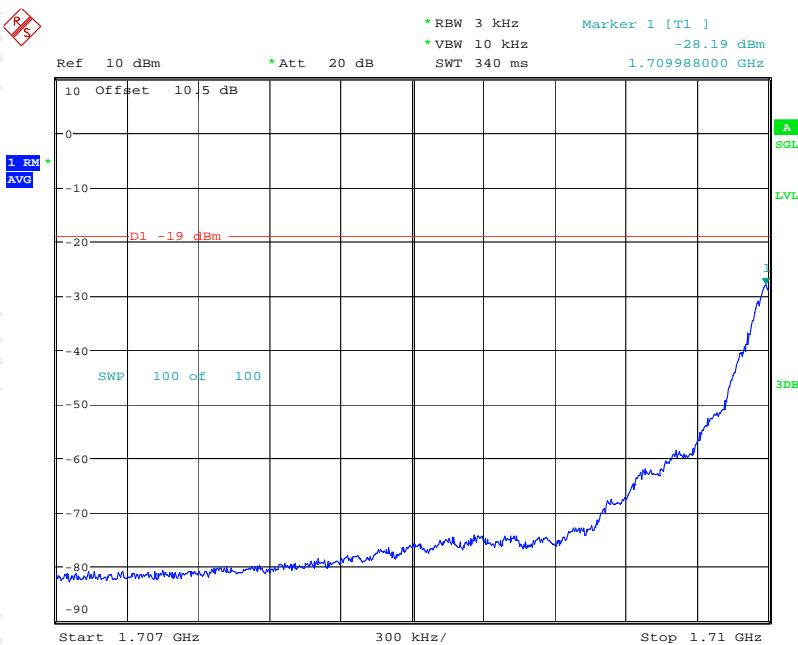
Date: 16.MAY.2018 19:07:21

## Band4 GSM UL Left Side Pre AGC



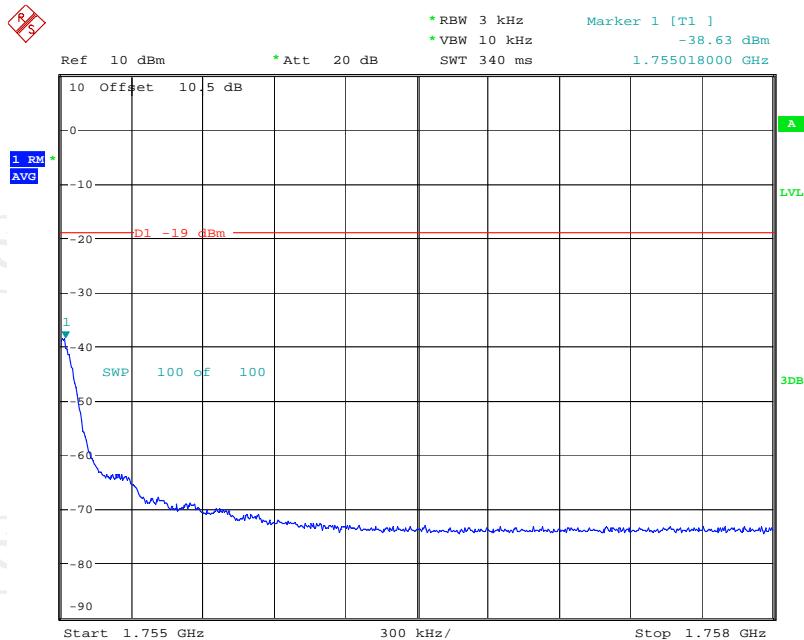
Date: 16.MAY.2018 17:52:25

## Band4 GSM UL Left Side Max Input



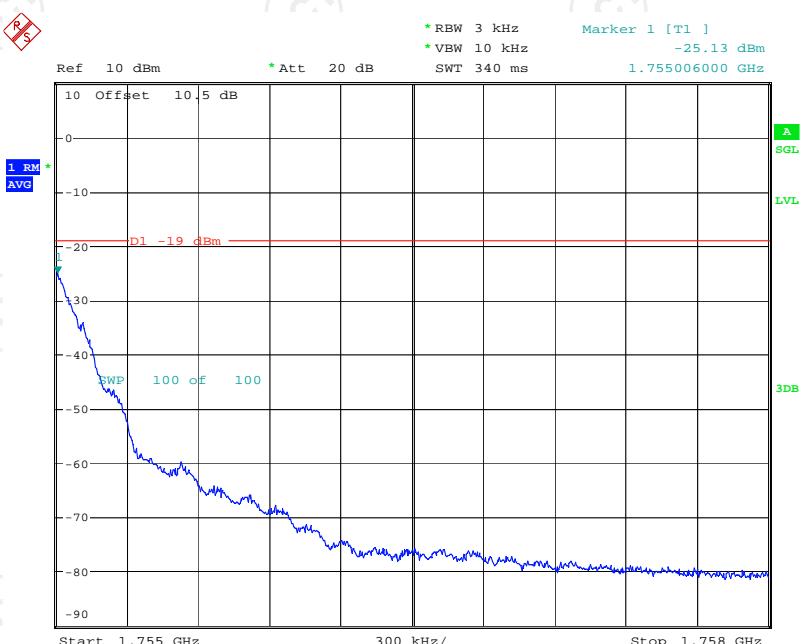
Date: 16.MAY.2018 17:53:35

### Band4 GSM UL Right Side Pre AGC



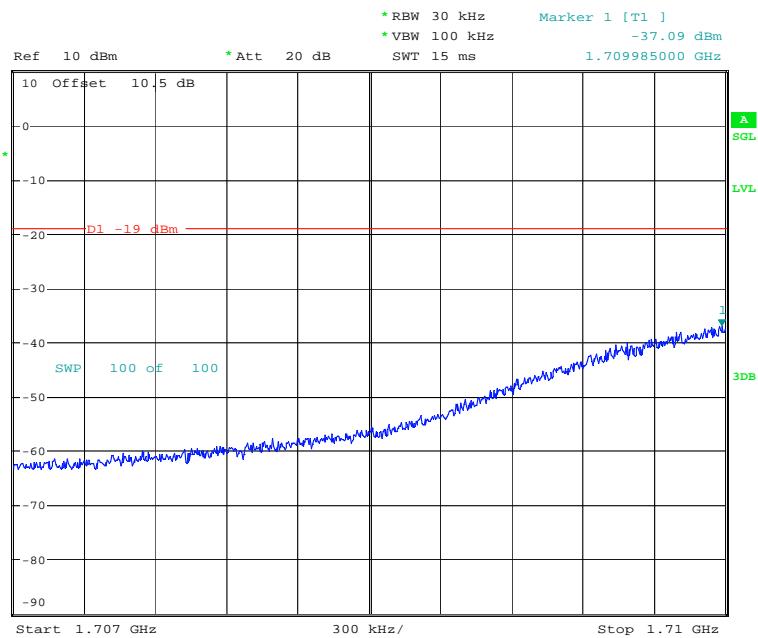
Date: 16.MAY.2018 18:06:57

### Band4 GSM UL Right Side Max Input



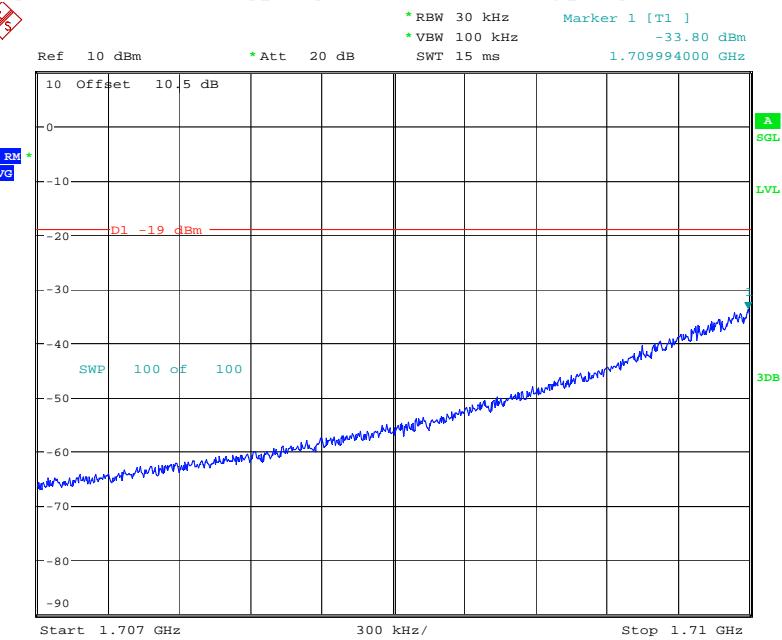
Date: 16.MAY.2018 18:08:28

### Band4 CDMA UL Left Side Pre AGC



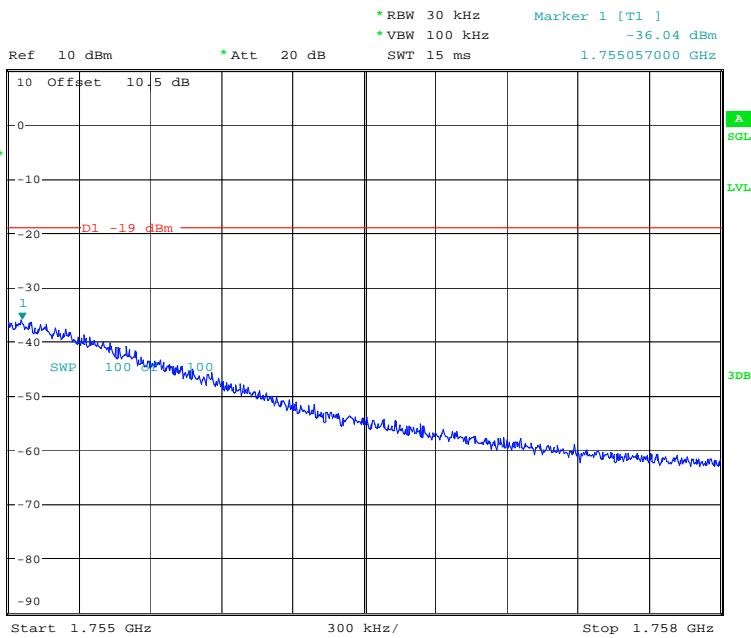
Date: 16.MAY.2018 17:54:51

### Band4 CDMA UL Left Side Max Input



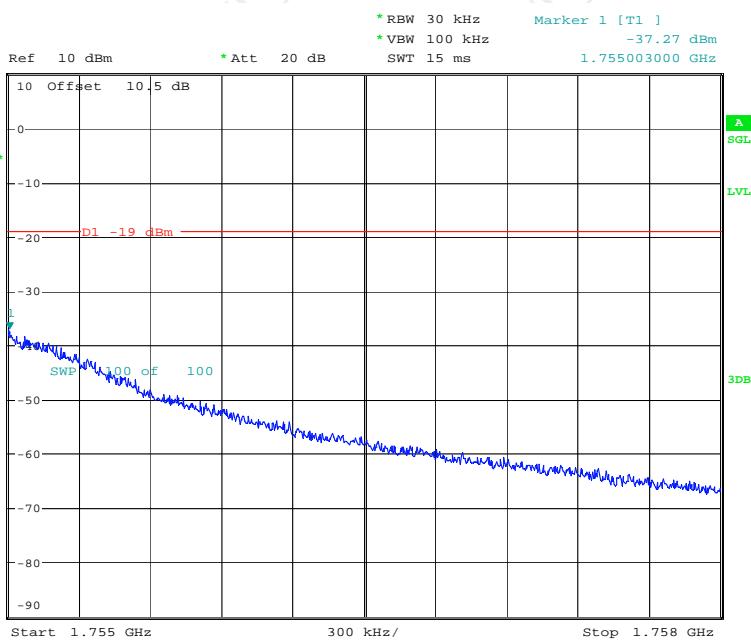
Date: 16.MAY.2018 17:55:46

### Band4 CDMA UL Right Side Pre AGC



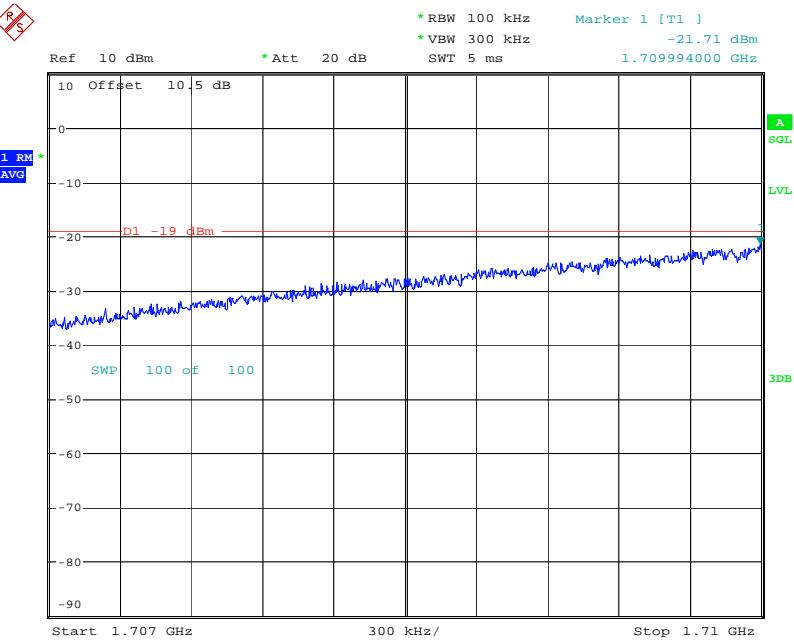
Date: 16.MAY.2018 18:03:33

### Band4 CDMA UL Right Side Max Input



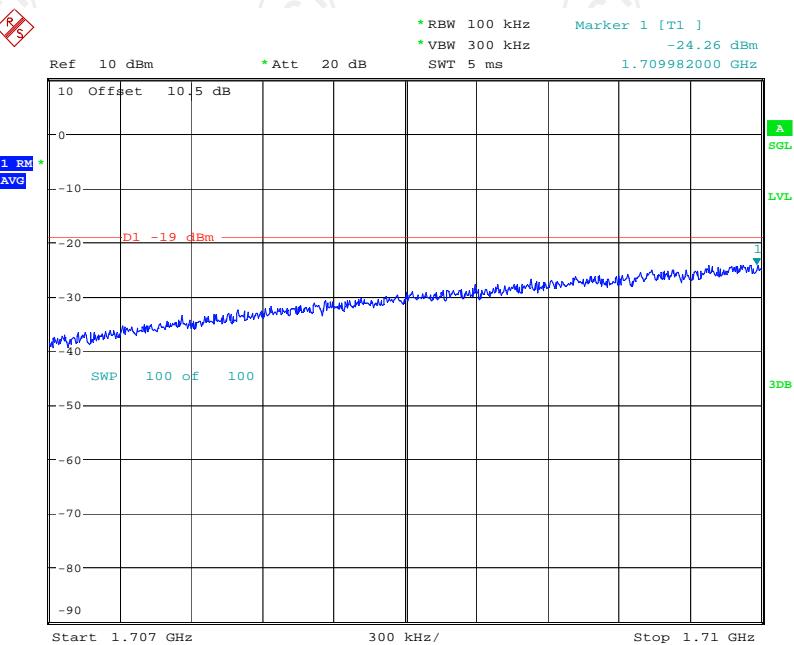
Date: 16.MAY.2018 18:04:17

### Band4 LTE UL Left Side Pre AGC



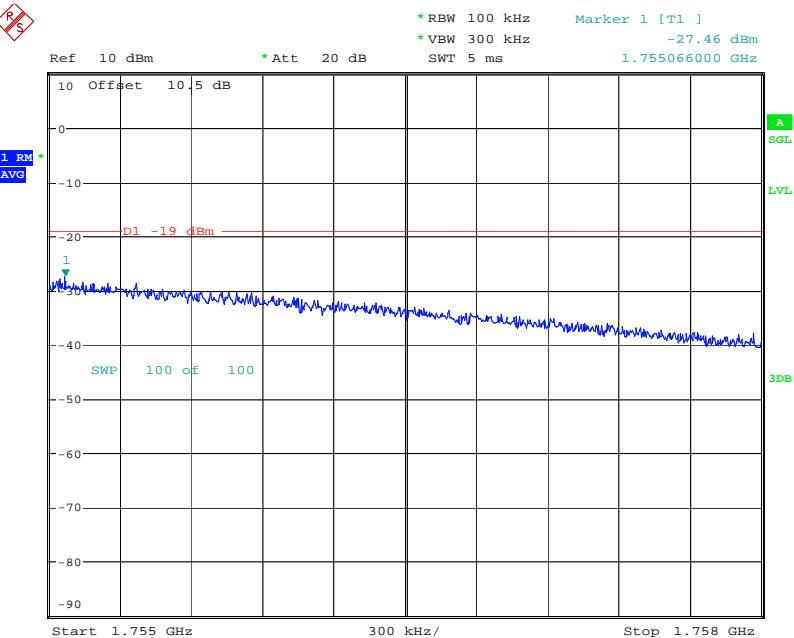
Date: 16.MAY.2018 17:57:57

### Band2 LTE UL Left Side Max Input



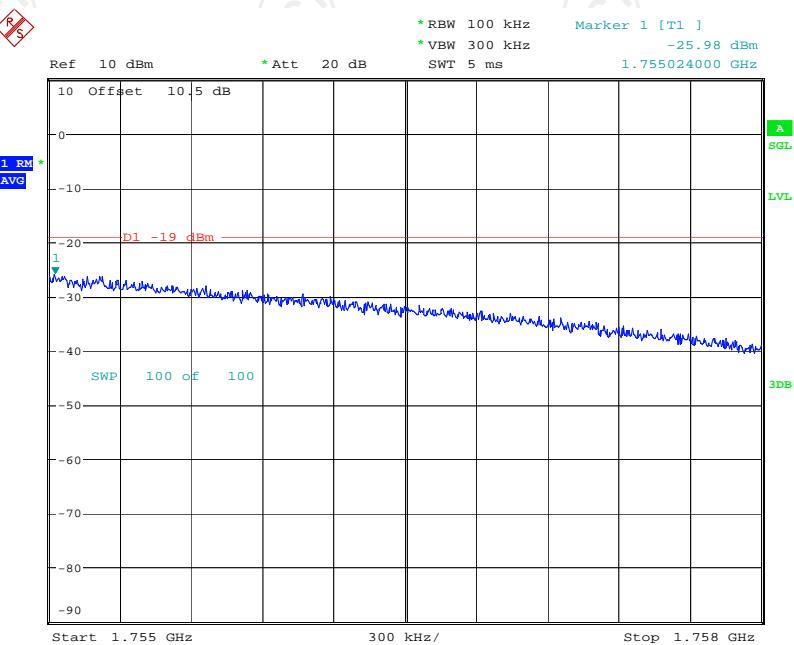
Date: 16.MAY.2018 17:58:51

### Band4 LTE UL Right Side Pre AGC



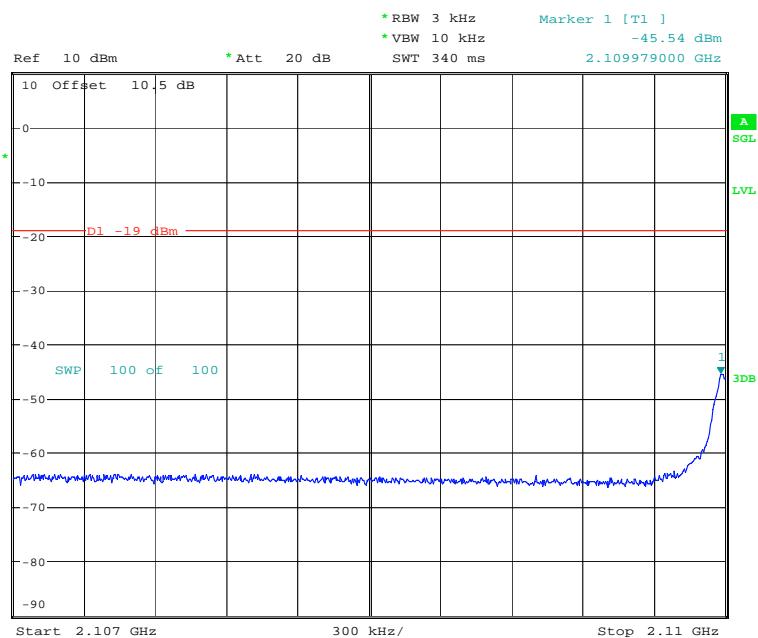
Date: 16.MAY.2018 18:01:10

### Band4 LTE UL Right Side Max Input



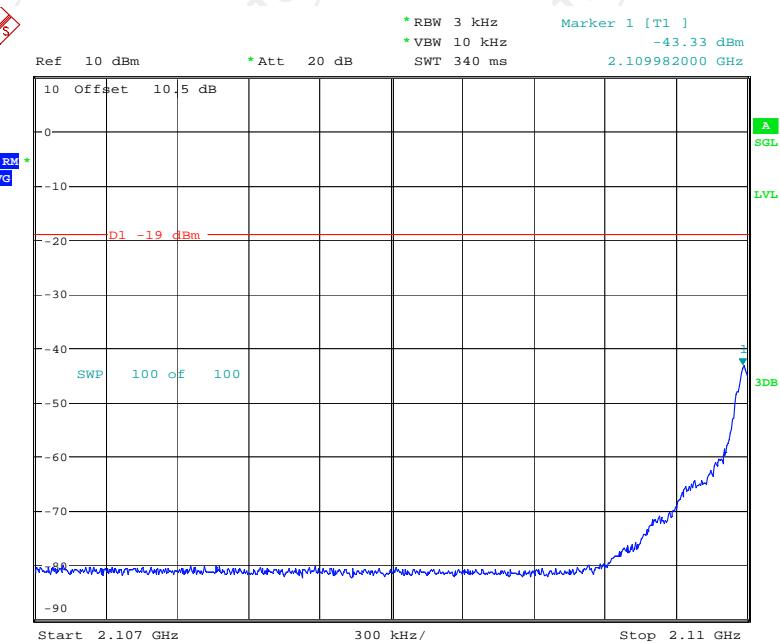
Date: 16.MAY.2018 18:02:00

**Band4 GSM DL Left Side Pre AGC**



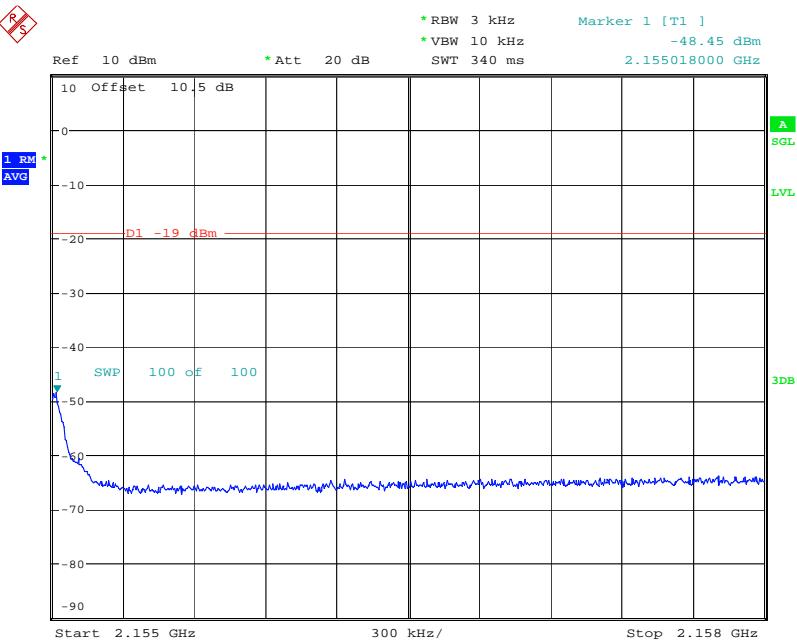
Date: 16.MAY.2018 18:25:43

**Band4 GSM DL Left Side Max Input**



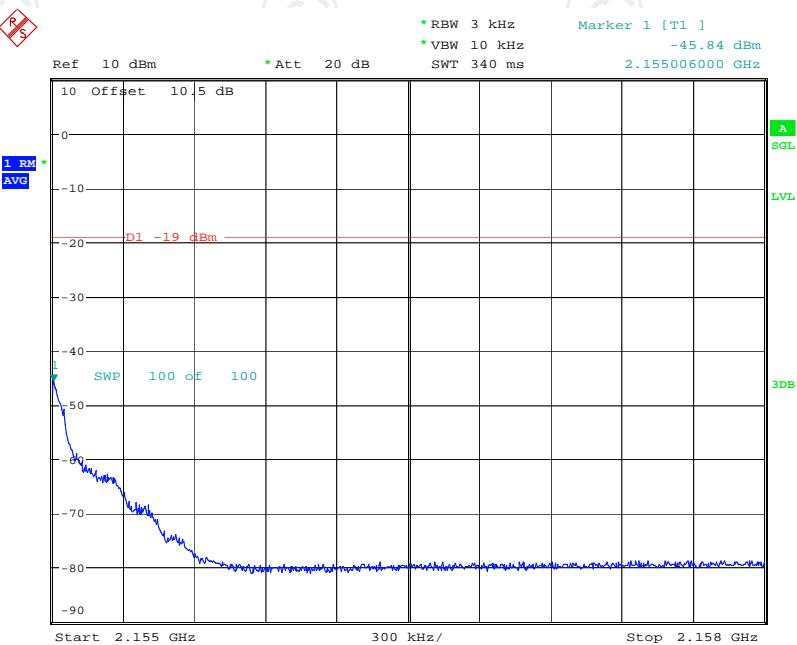
Date: 16.MAY.2018 18:27:31

## Band4 GSM DL Right Side Pre AGC



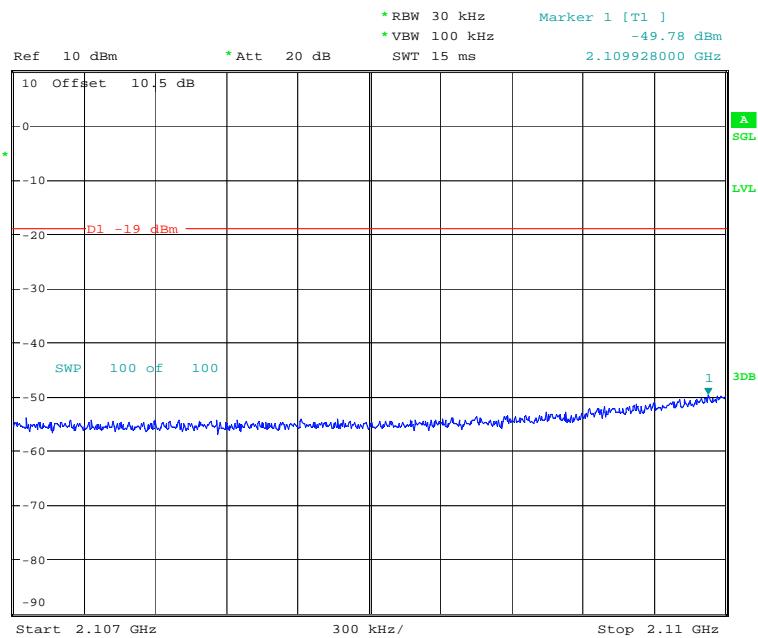
Date: 16.MAY.2018 18:46:32

## Band4 GSM DL Right Side Max Input



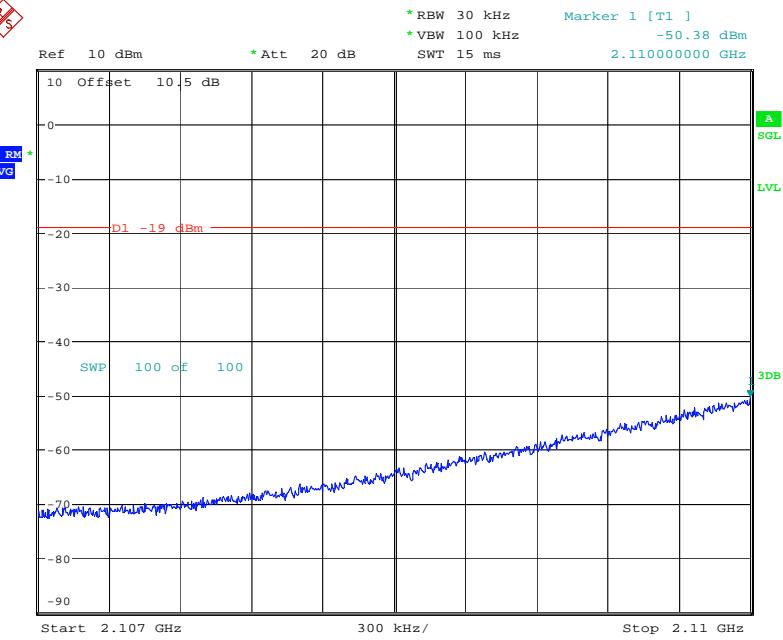
Date: 16.MAY.2018 18:47:31

### Band4 CDMA DL Left Side Pre AGC



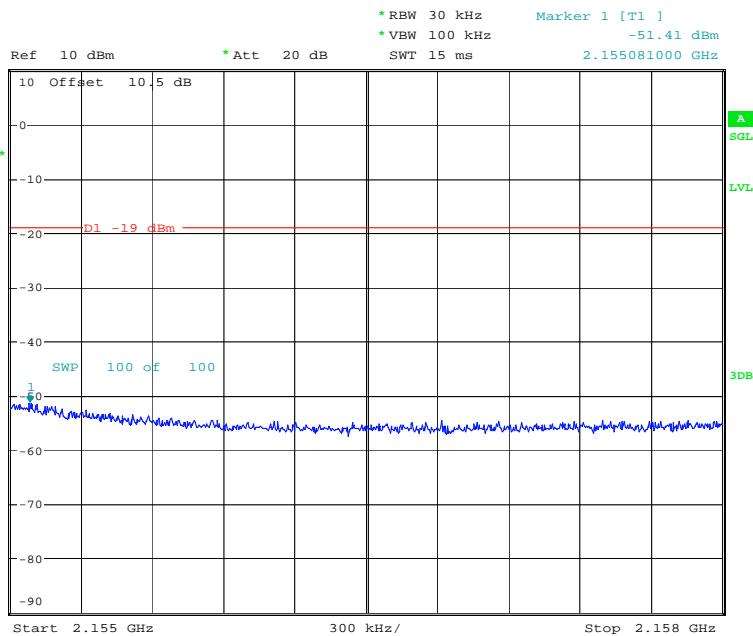
Date: 16.MAY.2018 18:28:56

### Band4 CDMA DL Left Side Max Input



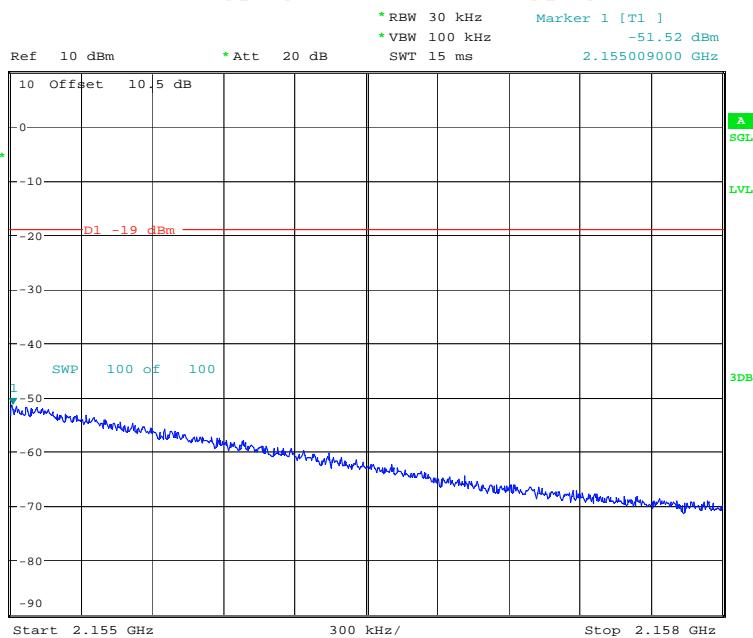
Date: 16.MAY.2018 18:29:47

### Band4 CDMA DL Right Side Pre AGC



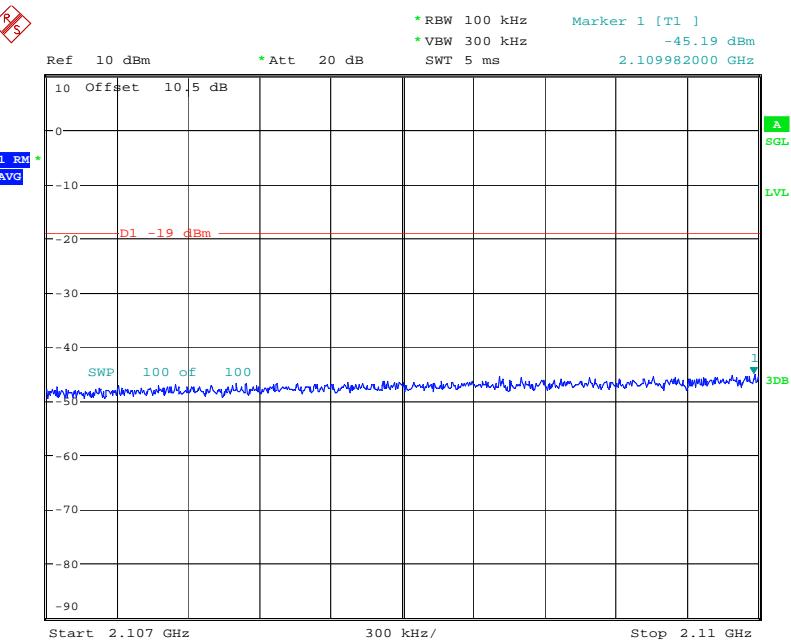
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### Band4 CDMA DL Right Side Max Input



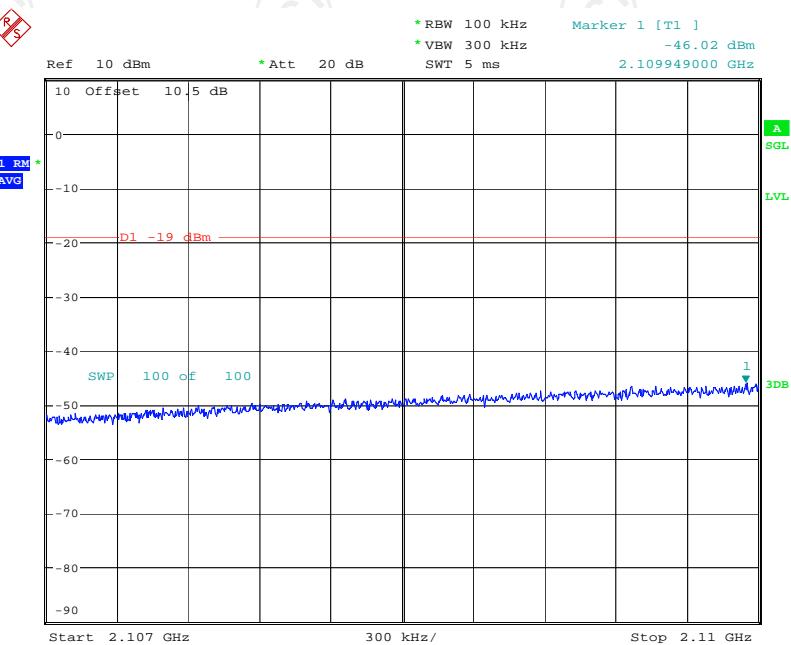
Date: 16.MAY.2018 18:41:13

### Band4 LTE DL Left Side Pre AGC



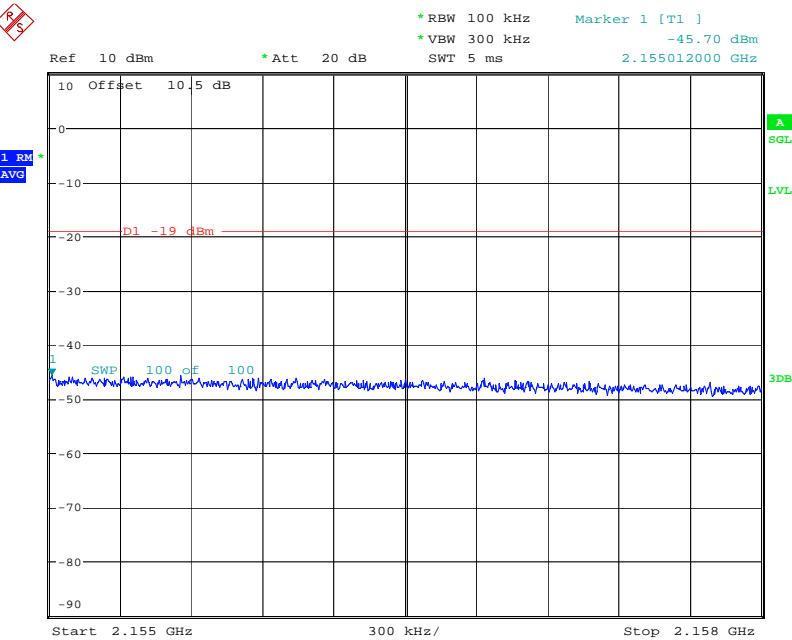
Date: 16.MAY.2018 18:31:28

### Band4 LTE DL Left Side Max Input



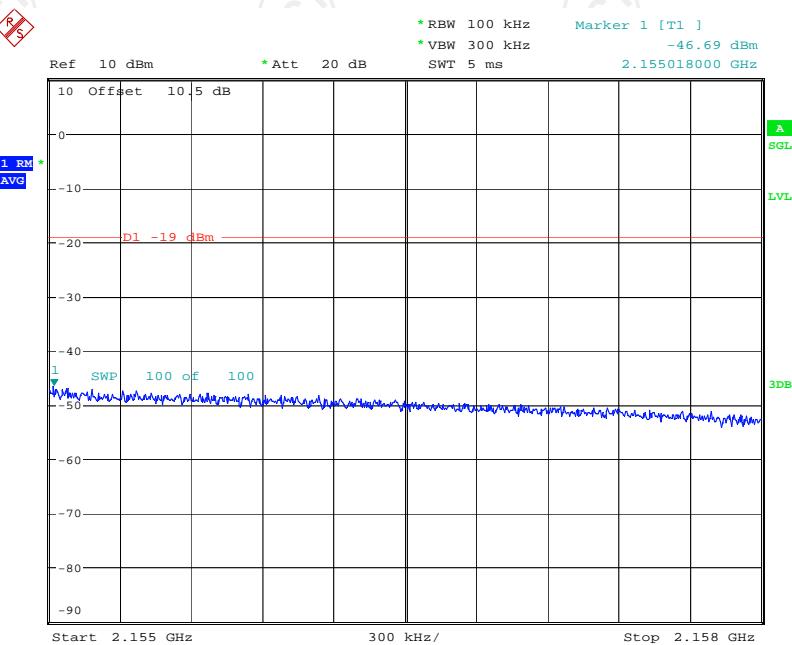
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### Band4 LTE DL Right Side Pre AGC



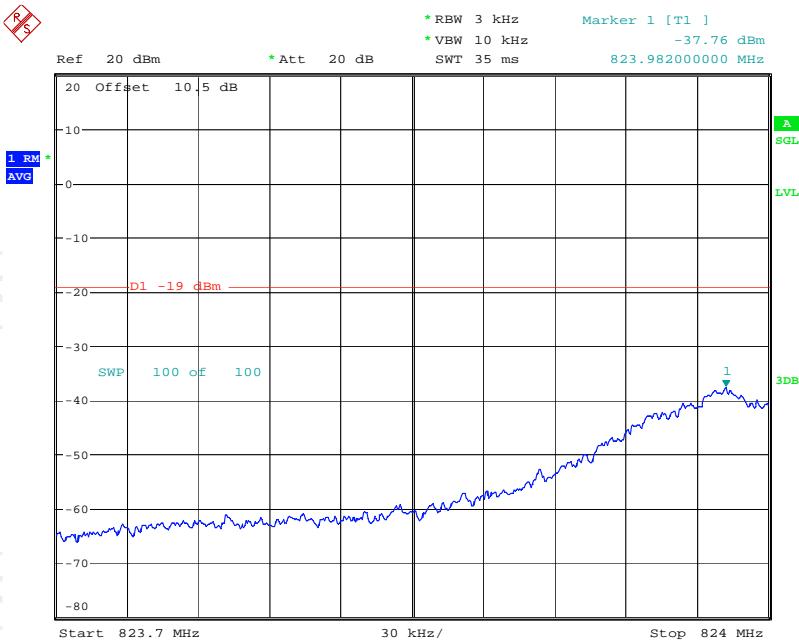
Date: 16.MAY.2018 18:37:14

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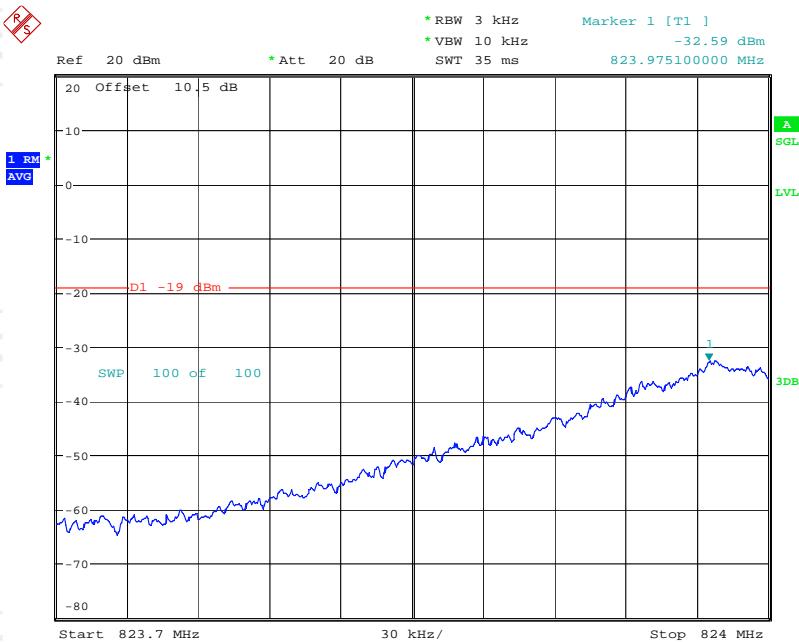
Date: 16.MAY.2018 18:37:47

## Band5 GSM UL Left Side Pre AGC



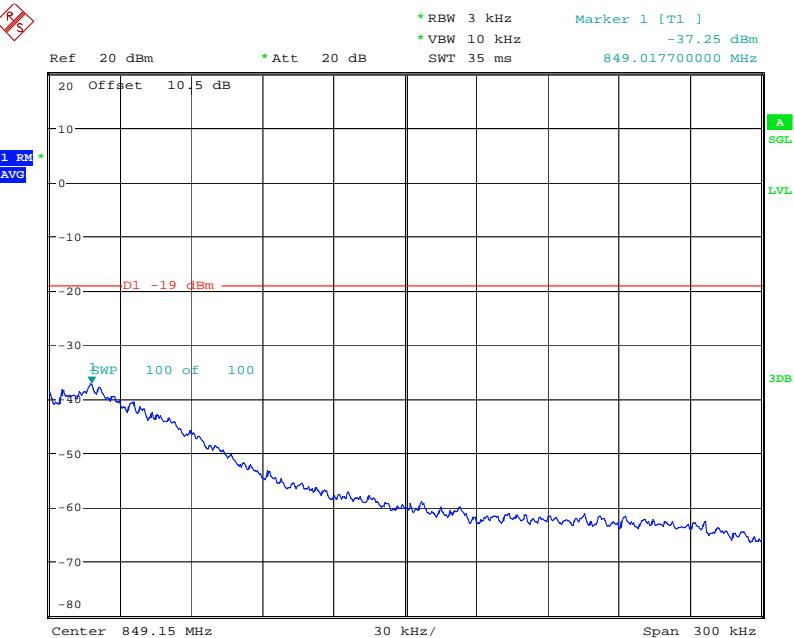
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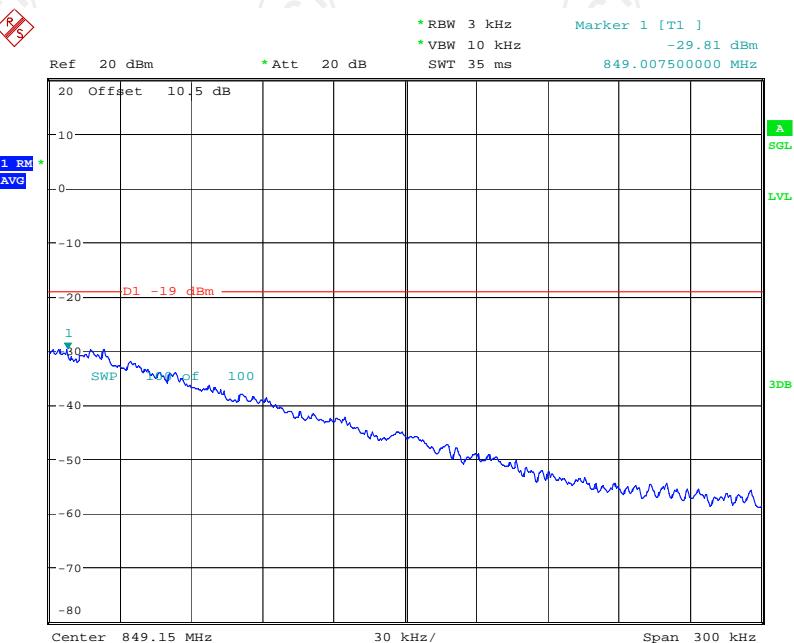
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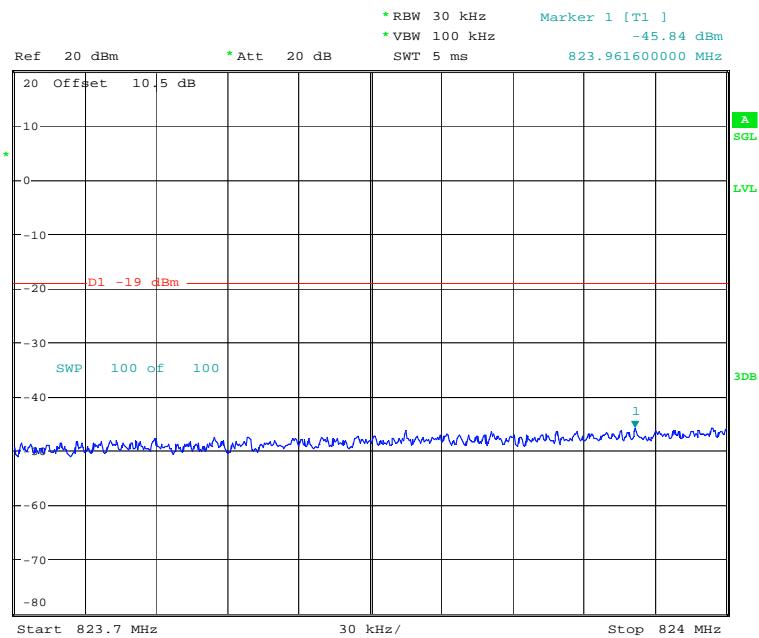
Date: 16.MAY.2018 17:23:49

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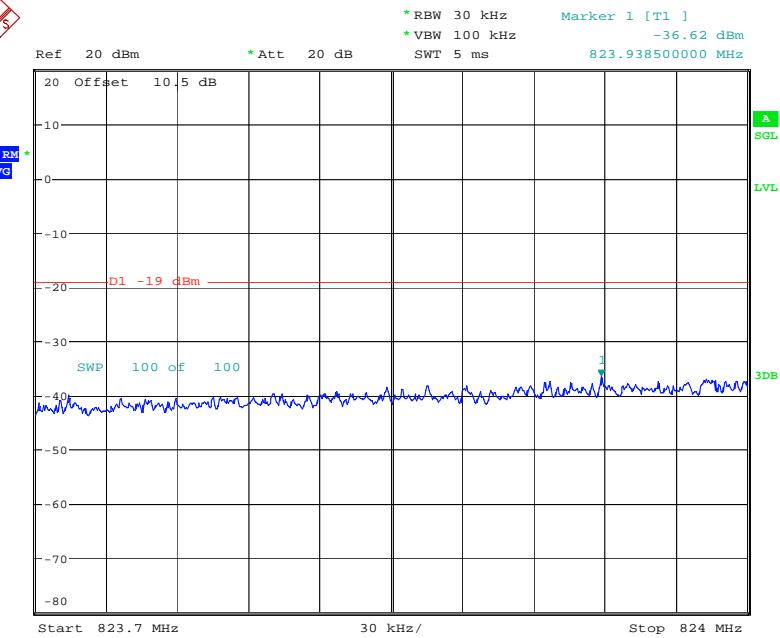
Date: 16.MAY.2018 17:24:50

### Band5 CDMA UL Left Side Pre AGC



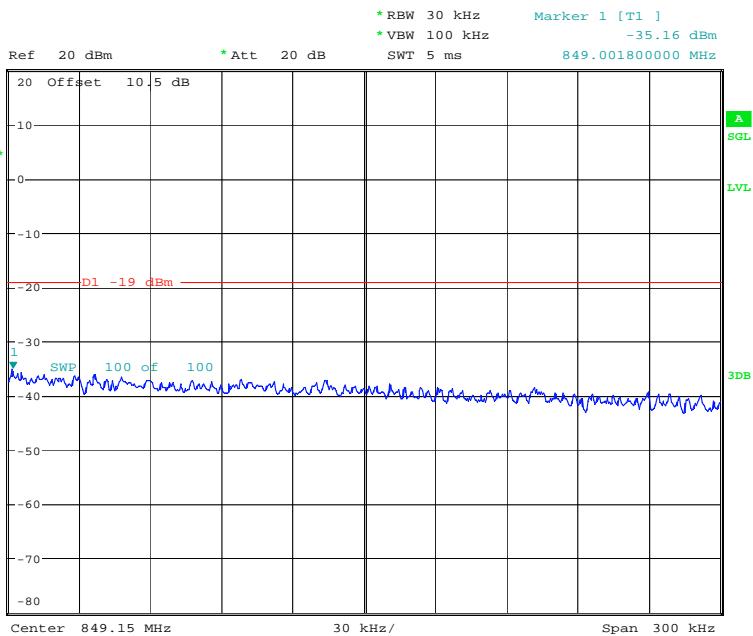
Date: 16.MAY.2018 17:12:19

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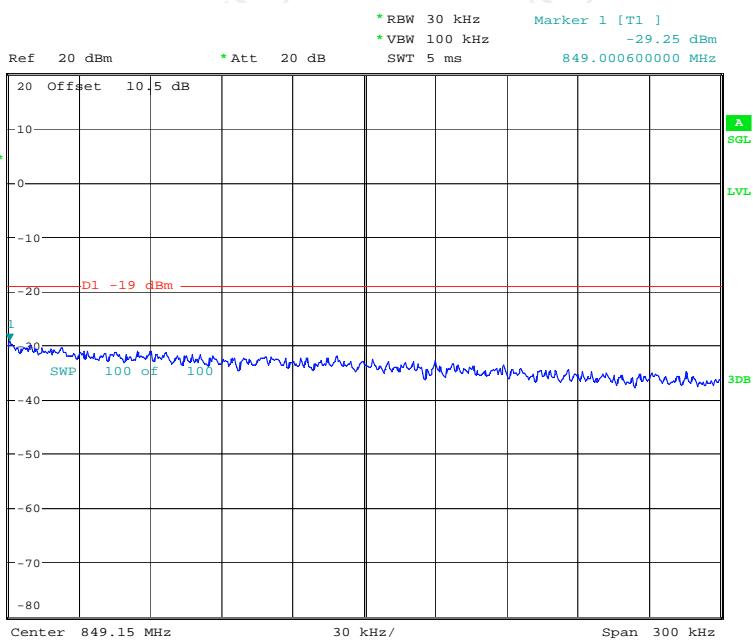
Date: 16.MAY.2018 17:12:52

### Band5 CDMA UL Right Side Pre AGC



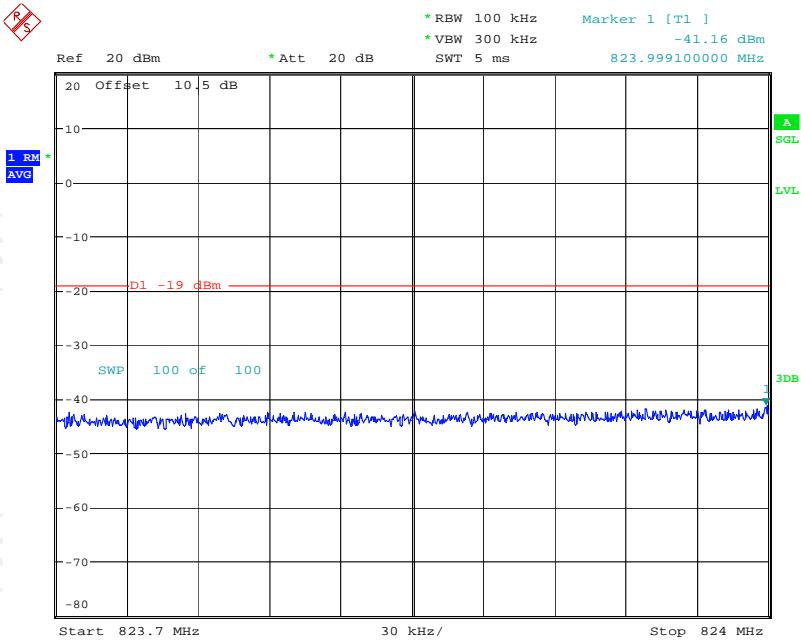
Date: 16.MAY.2018 17:20:41

### Band5 CDMA UL Right Side Max Input



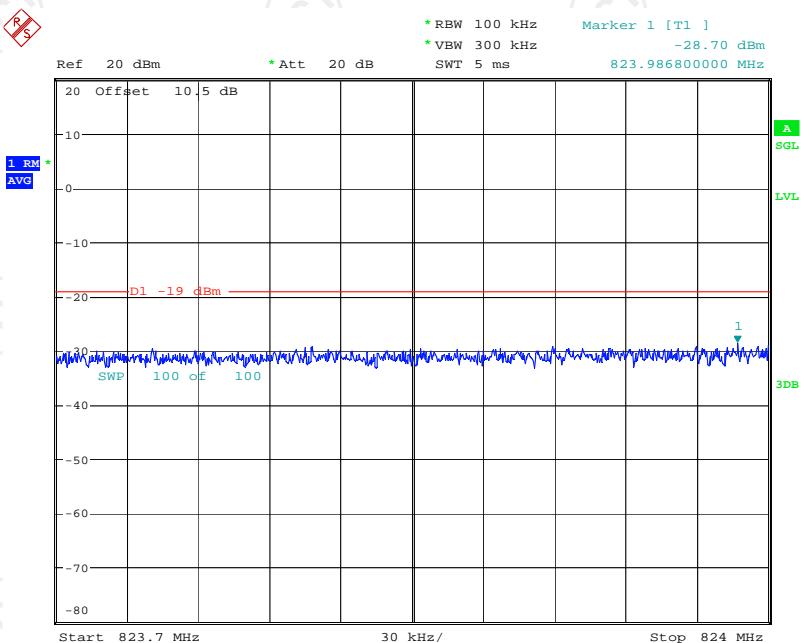
Date: 16.MAY.2018 17:21:22

### Band5 LTE UL Left Side Pre AGC



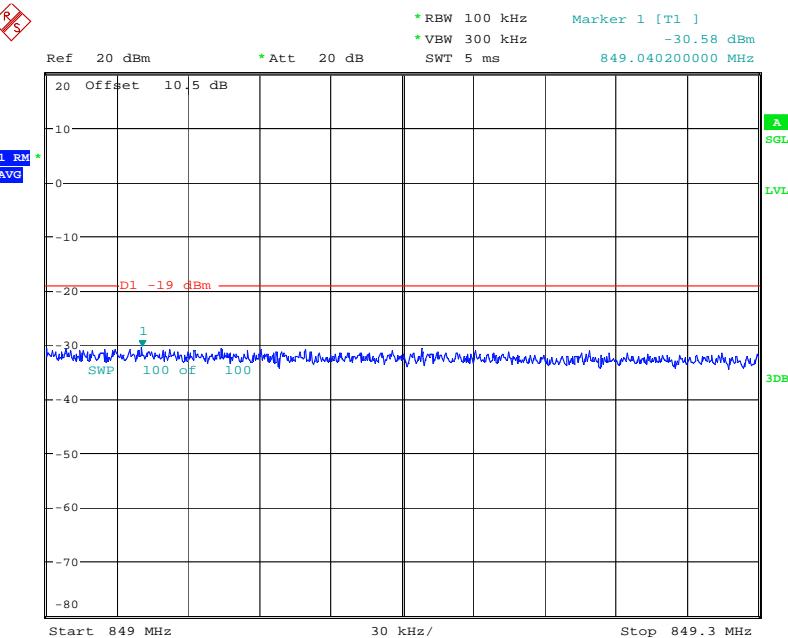
Date: 16.MAY.2018 17:16:21

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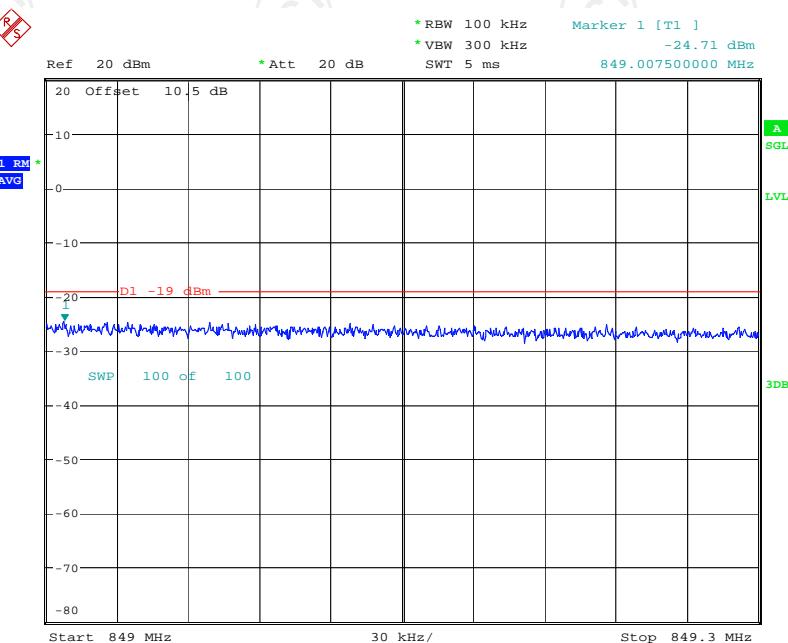
Date: 16.MAY.2018 17:17:03

### Band5 LTE UL Right Side Pre AGC



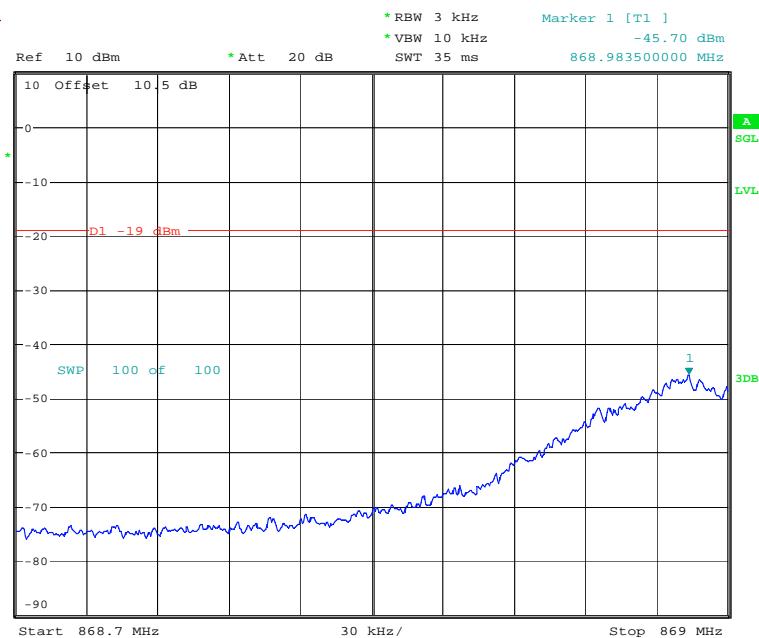
Date: 16.MAY.2018 17:18:31

### Band5 LTE UL Right Side Max Input



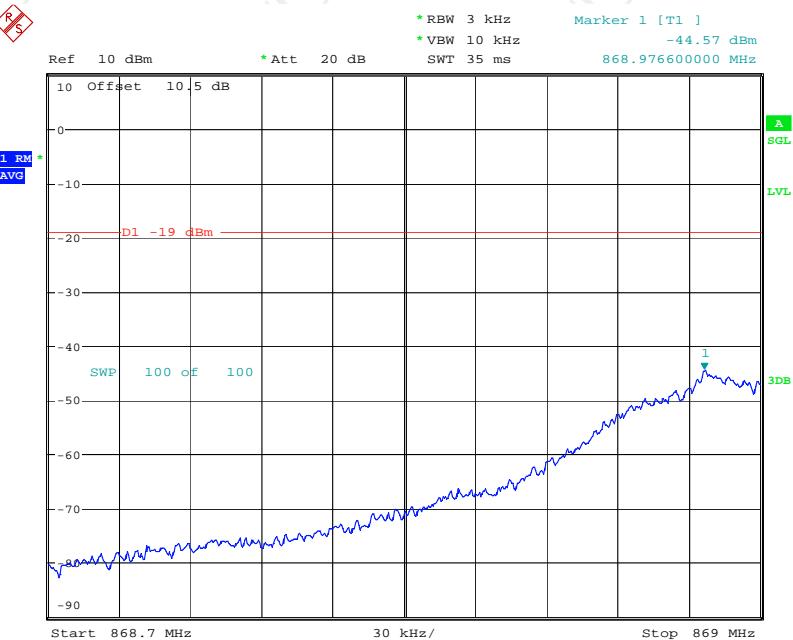
Date: 16.MAY.2018 17:19:24

### Band5 GSM DL Left Side Pre AGC



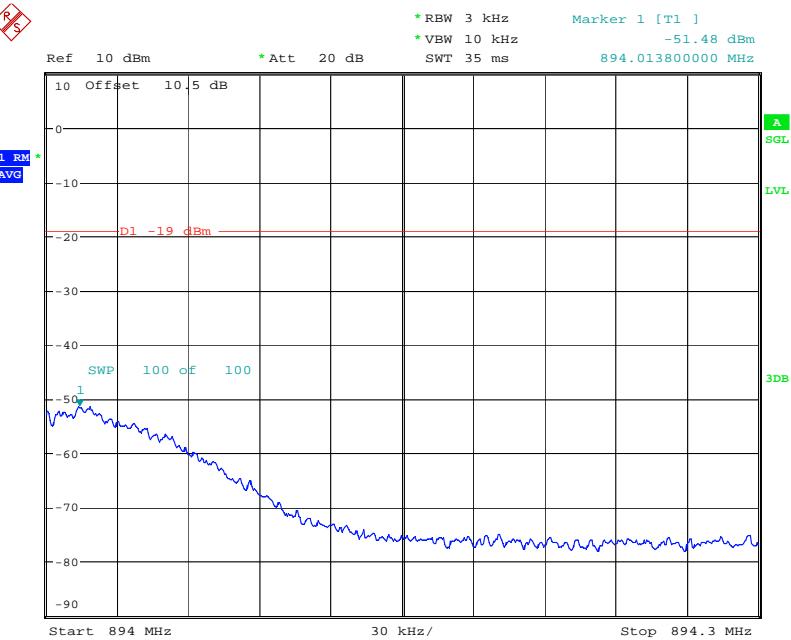
Date: 16.MAY.2018 19:15:32

### Band5 GSM DL Left Side Max Input



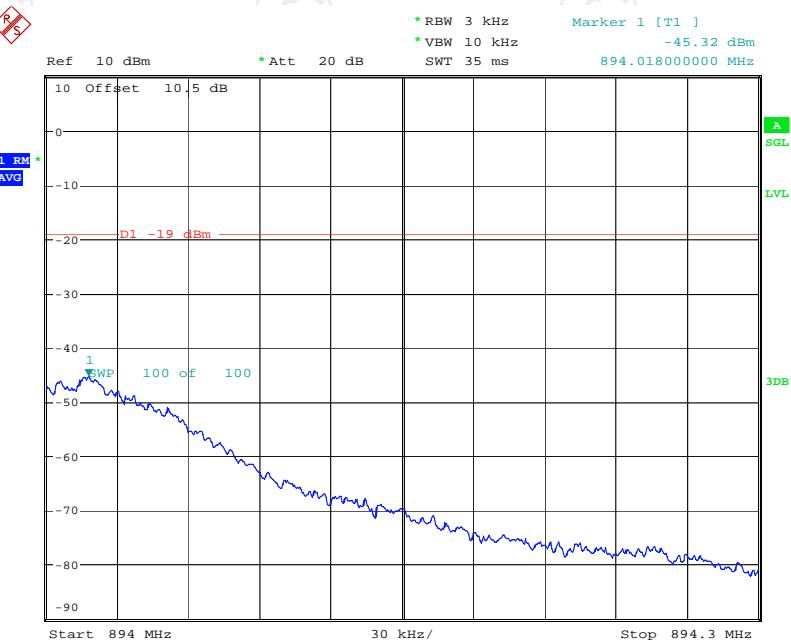
Date: 16.MAY.2018 19:16:36

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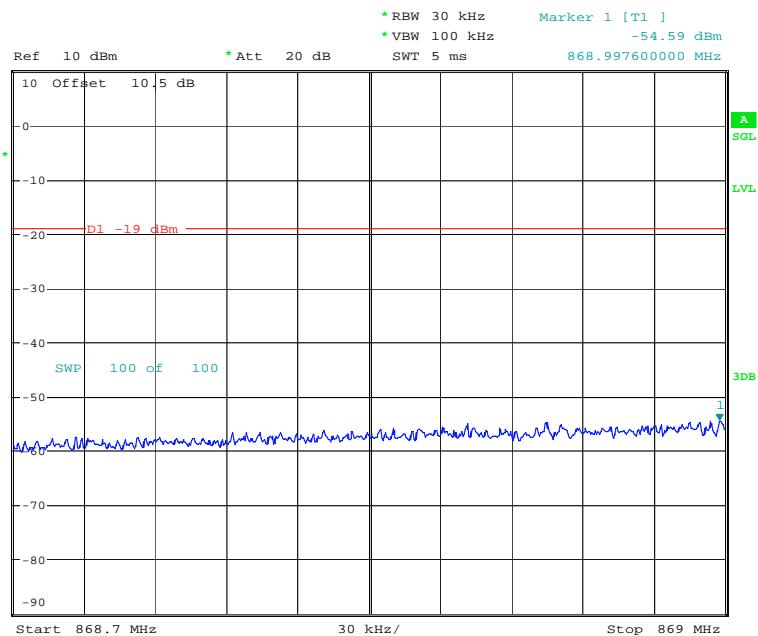
Date: 16.MAY.2018 19:27:30

### Band5 GSM DL Right Side Max Input



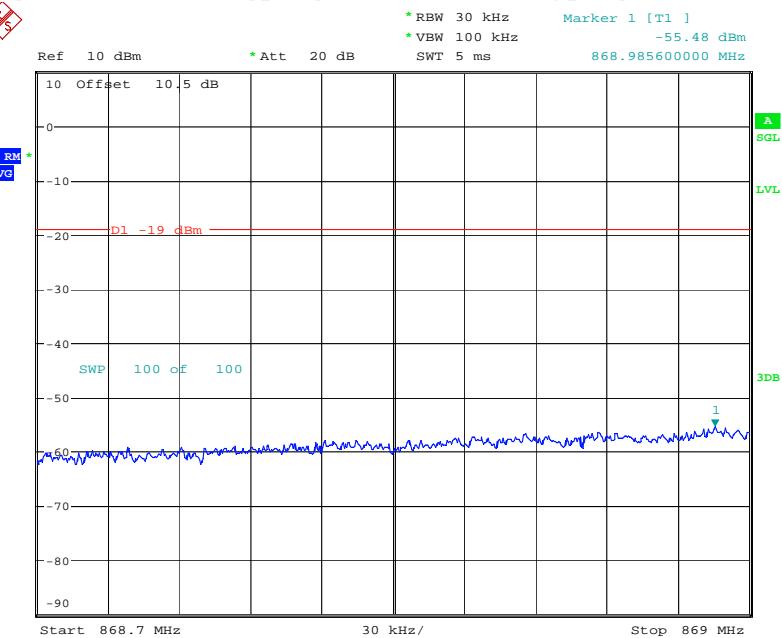
Date: 16.MAY.2018 19:28:11

### Band5 CDMA DL Left Side Pre AGC



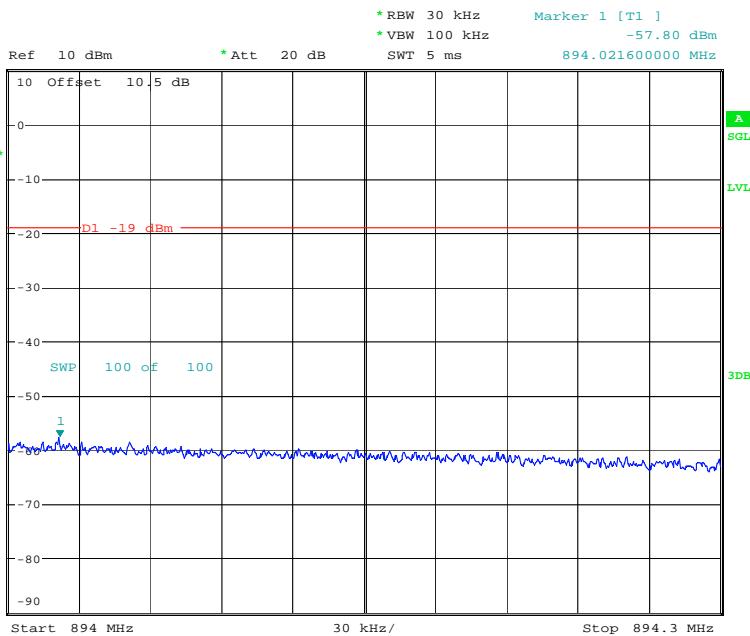
Date: 16.MAY.2018 19:17:39

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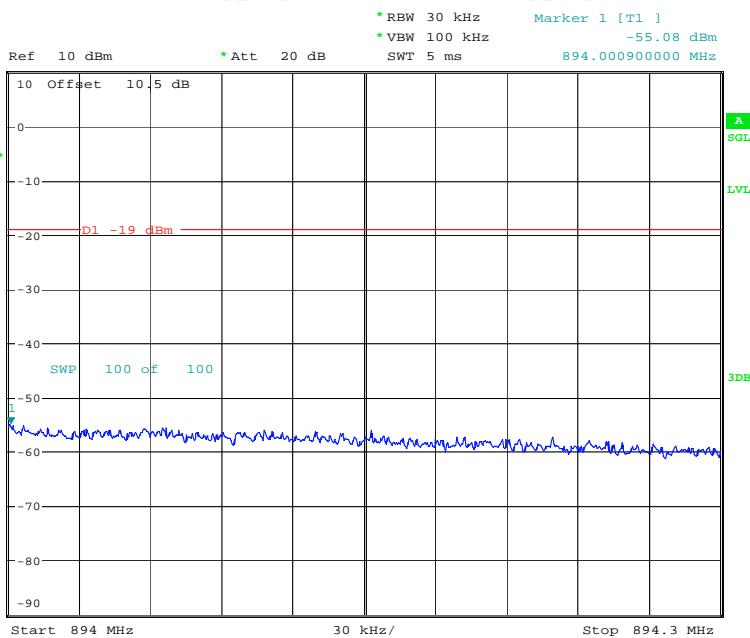
Date: 16.MAY.2018 19:18:46

### Band5 CDMA DL Right Side Pre AGC



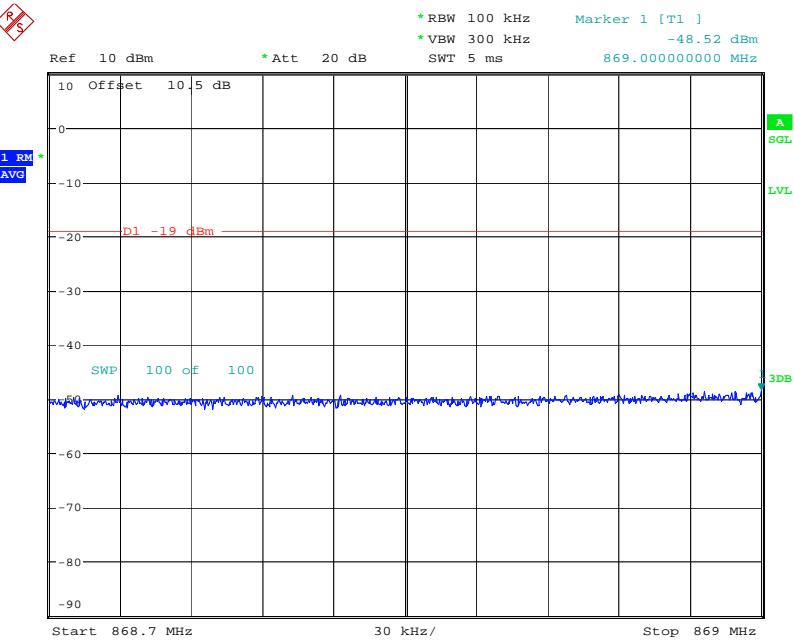
Date: 16.MAY.2018 19:25:02

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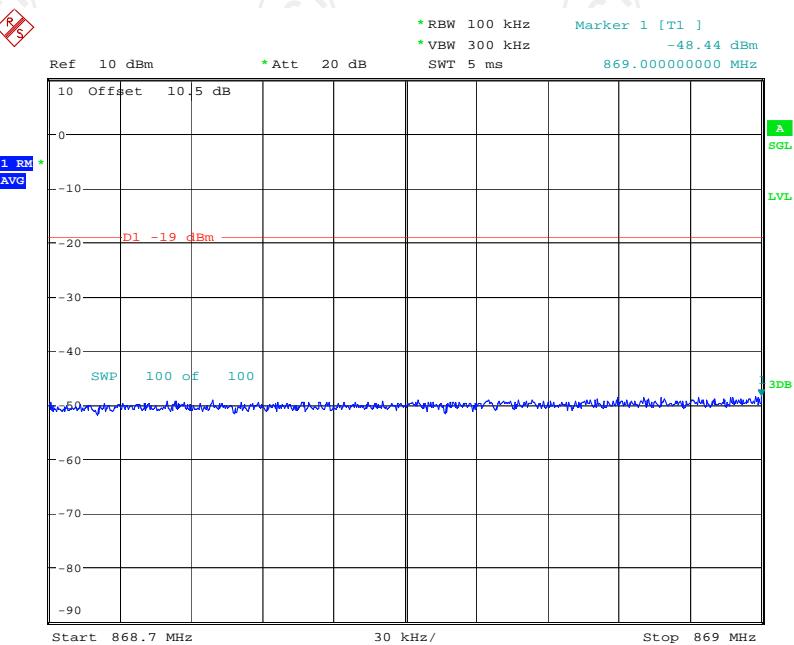
Date: 16.MAY.2018 19:25:35

### Band5 LTE DL Left Side Pre AGC



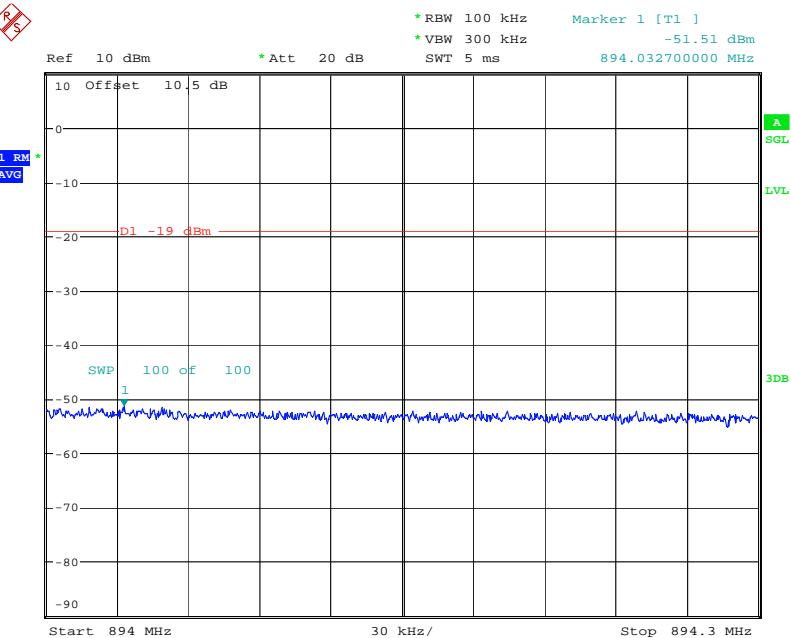
Date: 16.MAY.2018 19:20:41

### Band5 LTE DL Left Side Max Input



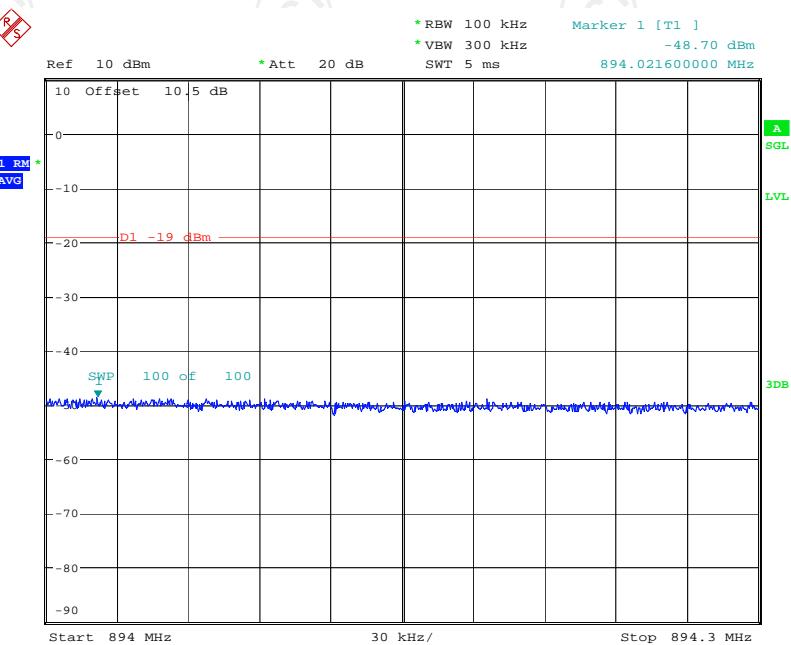
Date: 16.MAY.2018 19:21:07

### Band5 LTE DL Right Side Pre AGC



Date: 16.MAY.2018 19:23:17

### Band5 LTE DL Right Side Max Input



Date: 16.MAY.2018 19:23:45

## 6.5. Conducted Spurious Emission

### 6.5.1. Test Specification

|                          |   |
|--------------------------|---|
| <b>Test Requirement:</b> | FCC Part2 Section 1051; FCC Rules Part 27 Subpart C, Section 27.53  |
| <b>Test Method:</b>      | KDB 935210 D03 Signal Booster Measurement V04R01  |
| <b>Limit:</b>            | <ul style="list-style-type: none"> <li>• §2.1053, Conducted emissions limit = <math>43 + 10 \log (P) = -13 \text{ dBm}</math></li> <li>• §27.53(c), For operations in the 746-758 MHz band and the 776-788 MHz band On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than <math>76 + 10 \log (P) \text{ dB} = -46 \text{ dBm}</math> in a 6.25 kHz band segment, for base and fixed stations</li> <li>• §27.53(e), For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands Emissions in the band 1559-1610 MHz shall be limited to <math>-70 \text{ dBW}(-40 \text{ dBm})/\text{MHz}</math> equivalent isotropically radiated power (EIRP) for wideband signals, and <math>-80 \text{ dBW}(-50 \text{ dBm})</math> EIRP for discrete emissions of less than 700 Hz bandwidth.</li> </ul>  |
| <b>Test Setup:</b>       | <pre> graph LR     SG[Signal Generator] --&gt; EUT[EUT]     EUT --&gt; RA[RF Attenuator&lt;br&gt;(if required)]     RA --&gt; SA[Spectrum Analyzer]   </pre>  |
| <b>Test Procedure:</b>   | <ol style="list-style-type: none"> <li>Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.</li> <li>Configure the signal generator for AWGN with a 99% occupied bandwidth of 4.1 MHz operation with a center frequency corresponding to the center of the CMRS band under test.</li> <li>Set the signal generator amplitude to the level determined in the power measurement procedure in Maximum power.</li> <li>Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measurement instrument as follows.</li> <li>Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Annex A for relevant cross-references). Note that many of the individual rule sections permit the use of a narrower RBW (typically <math>\geq 1\%</math> of the emission bandwidth) to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth.</li> <li>Set VBW = <math>3 \times \text{RBW}</math>.</li> <li>Select the power averaging (RMS) detector. (See above note regarding the use of a peak detector for preliminary measurements.)</li> <li>Sweep time = auto-couple.</li> <li>Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part. Note that the number of measurement points in each sweep must be <math>\geq (2 \times \text{span}/\text{RBW})</math> which may require that the measurement range defined by the start and stop frequencies above be subdivided,</li> </ol> |

|                     |   |
|---------------------|---|
|                     | <p>depending on the available number of measurement points provided by the spectrum analyzer. Trace average at least 10 traces in power averaging (i.e., RMS) mode.</p> <p>j) Use the peak marker function to identify the highest amplitude level over each measured frequency range Record the frequency and amplitude and capture a Test Plots for inclusion in the test report.</p> <p>k) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission. Note that the number of measurement points in each sweep must be <math>\geq (2 \times</math> span/RBW) which may require that the measurement range defined by the start and stop frequencies above be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.</p> <p>l) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a Test Plots for inclusion in the test report.</p> <p>m) Repeat steps b) through l) for each supported frequency band of operation.</p> |
| <b>Test Result:</b> | PASS  |

### 6.5.2. Test Instruments

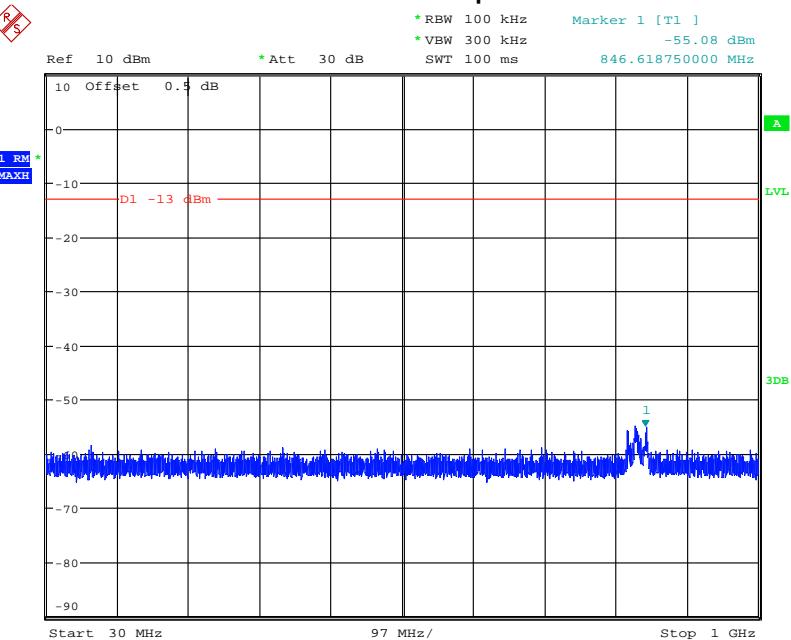
| Equipment         | Manufacturer | Model  | Serial Number  | Calibration Date | Calibration Due |
|-------------------|--------------|--------|----------------|------------------|-----------------|
| Signal Generator  | Agilent      | N5182  | MY4707028<br>2 | Sep. 28, 2017    | Sep. 27, 2018   |
| Spectrum Analyzer | Agilent      | N9020A | MY4910006<br>0 | Sep. 28, 2017    | Sep. 27, 2018   |
| Attenuation       | AF115A-09-34 | JFW    | 907763         | Sep. 28, 2017    | Sep. 27, 2018   |

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

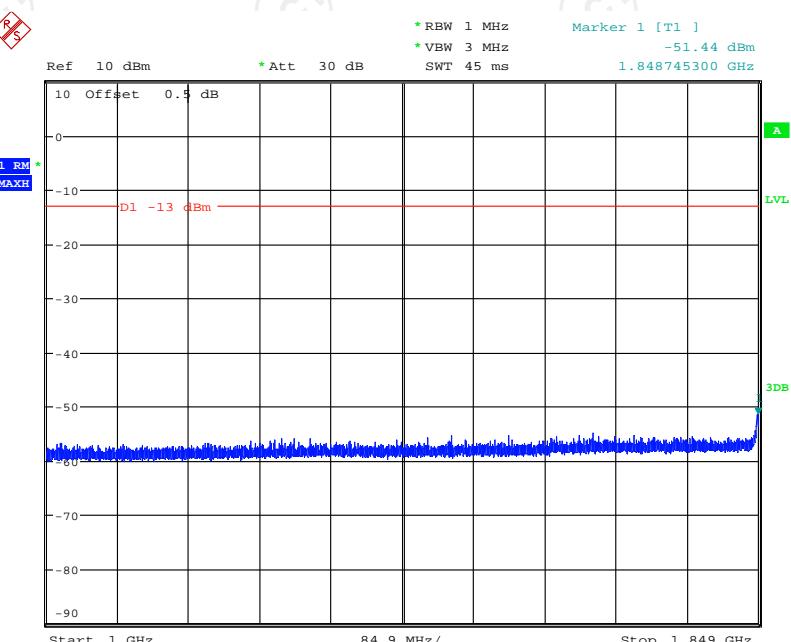
### 6.5.3. Test data

## Test Plots

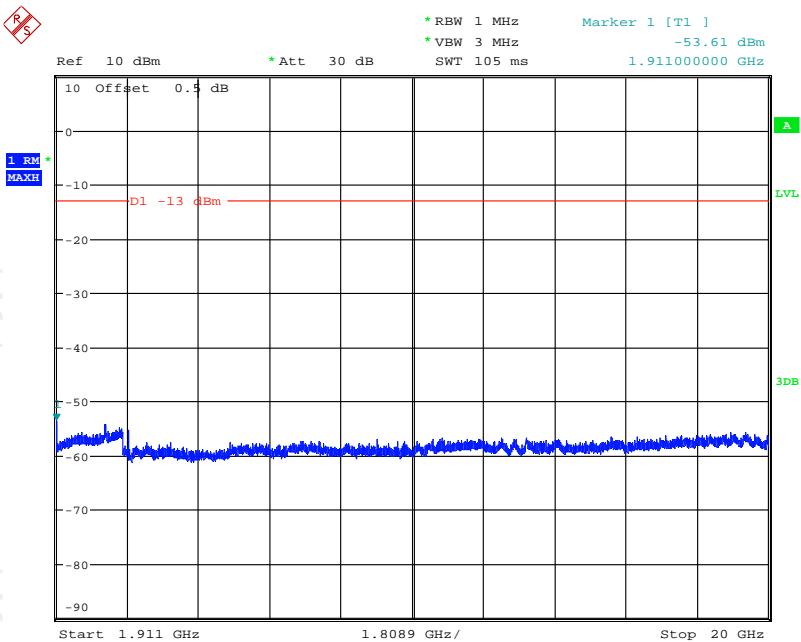
### Band2 Uplink



Date: 4.JAN.2003 09:29:14

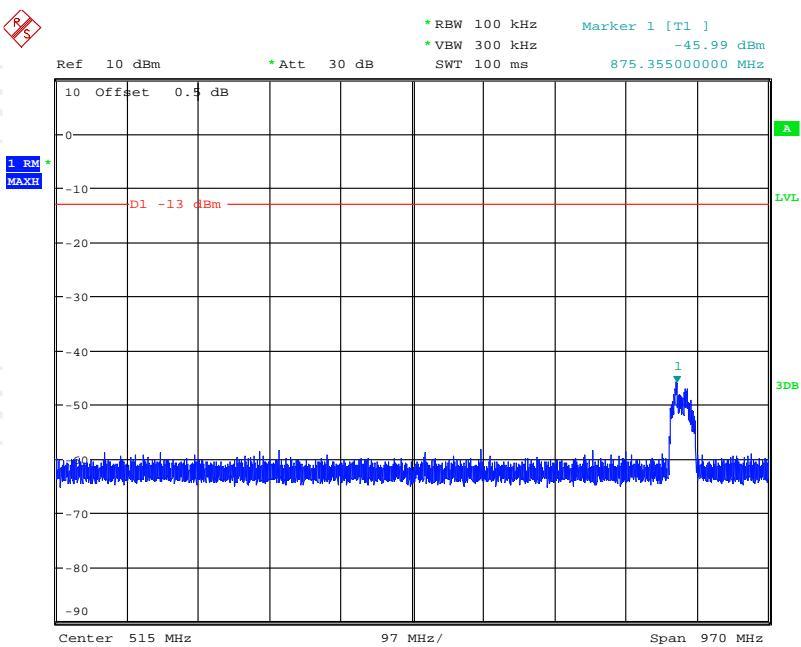


Date: 4.JAN.2003 09:28:17

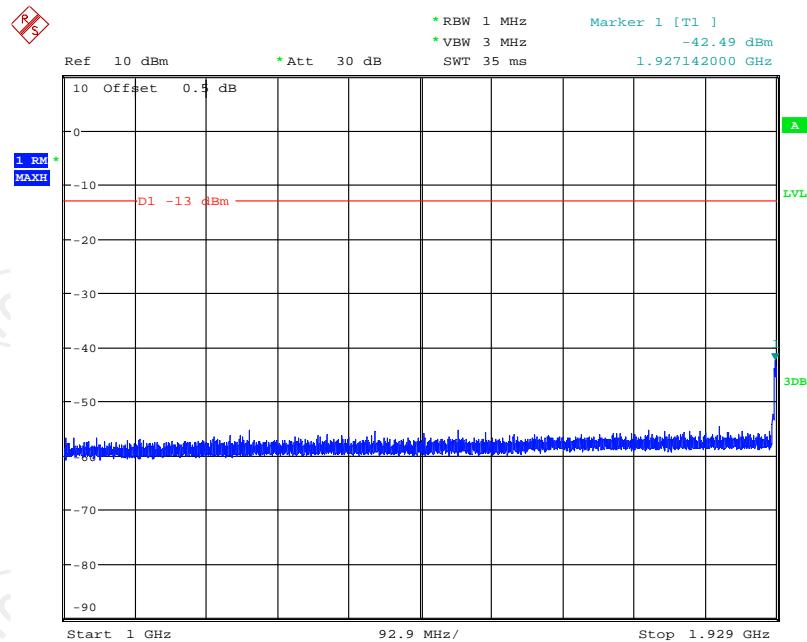


Date: 4.JAN.2003 09:26:41

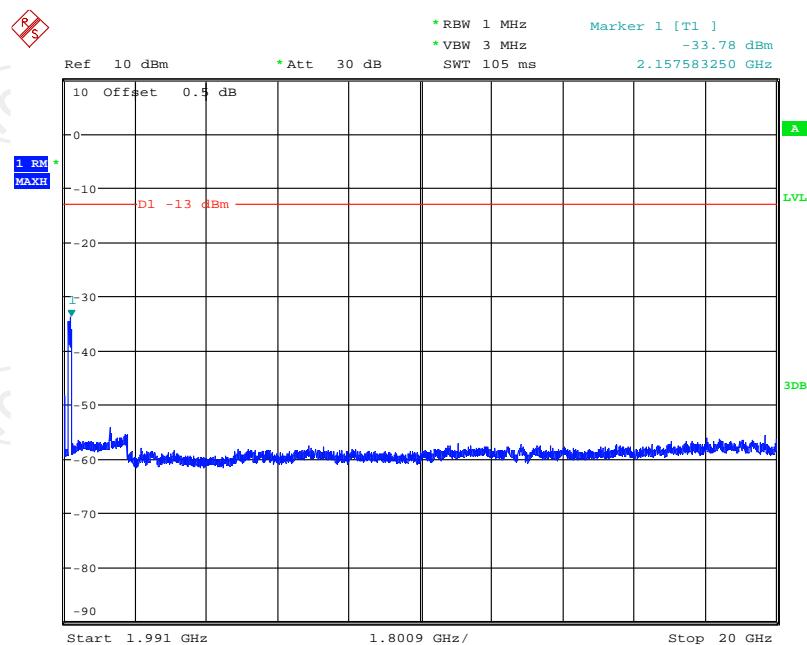
### Band2 Downlink



Date: 4.JAN.2003 09:39:19



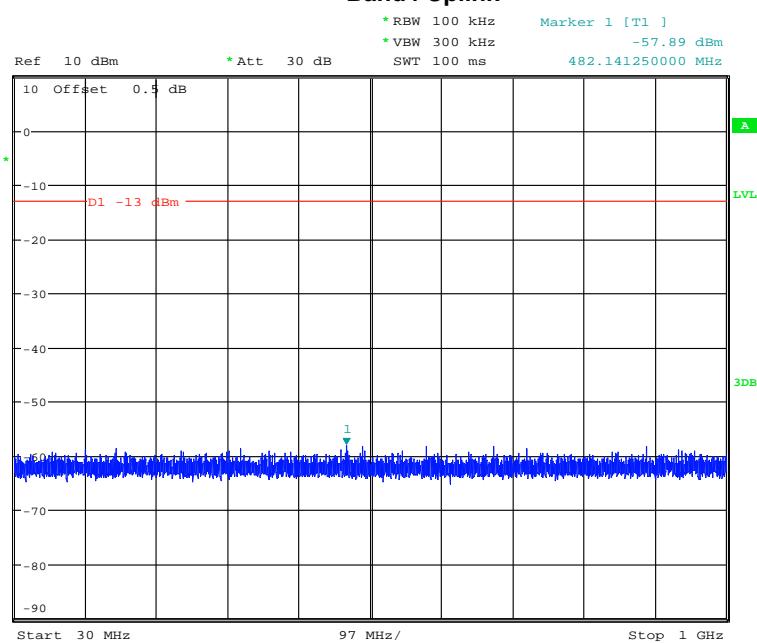
Date: 4.JAN.2003 09:40:07



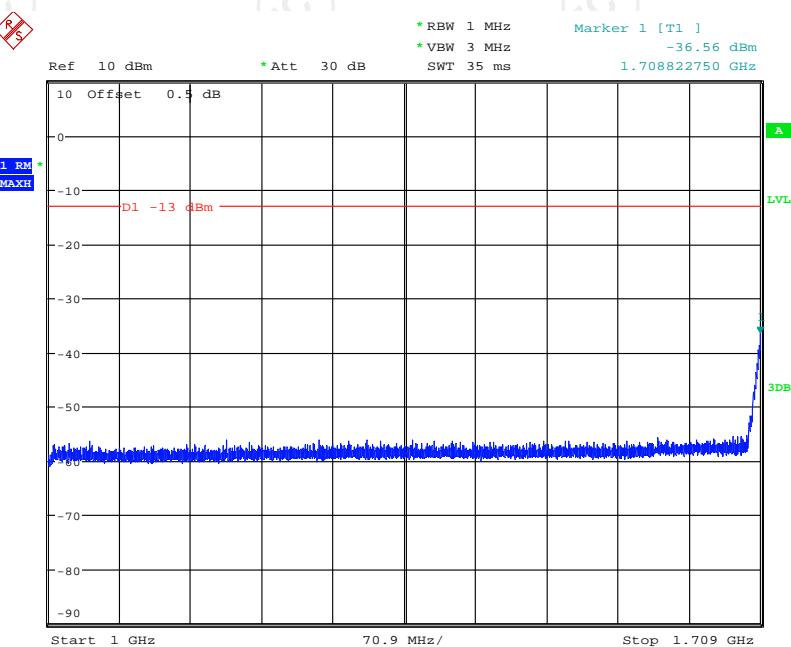
Date: 4.JAN.2003 09:40:53

## Test Plots

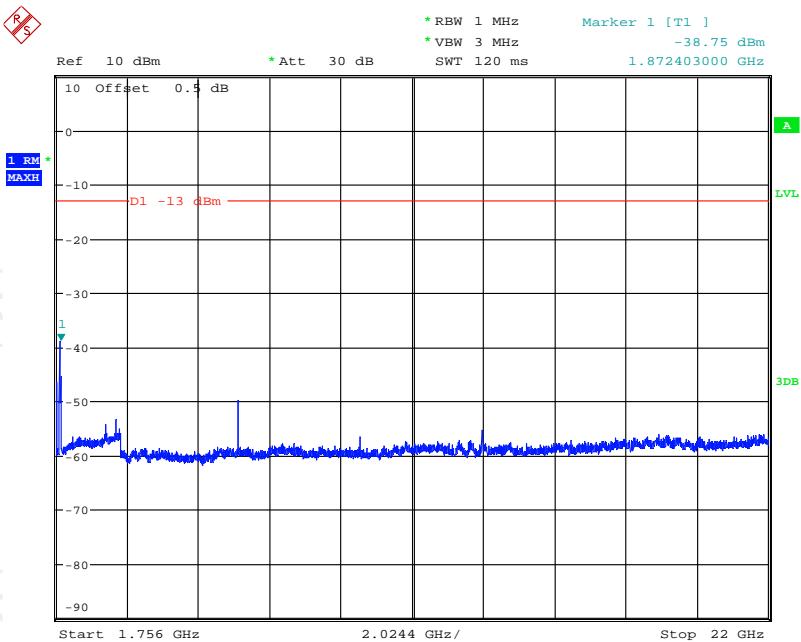
### Band4 Uplink



Date: 4.JAN.2003 09:30:12

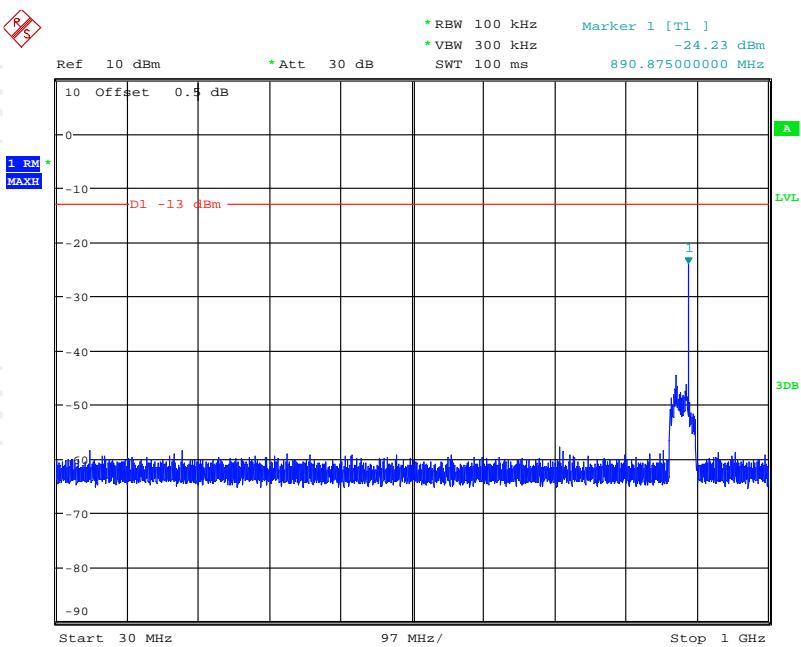


Date: 4.JAN.2003 09:30:46

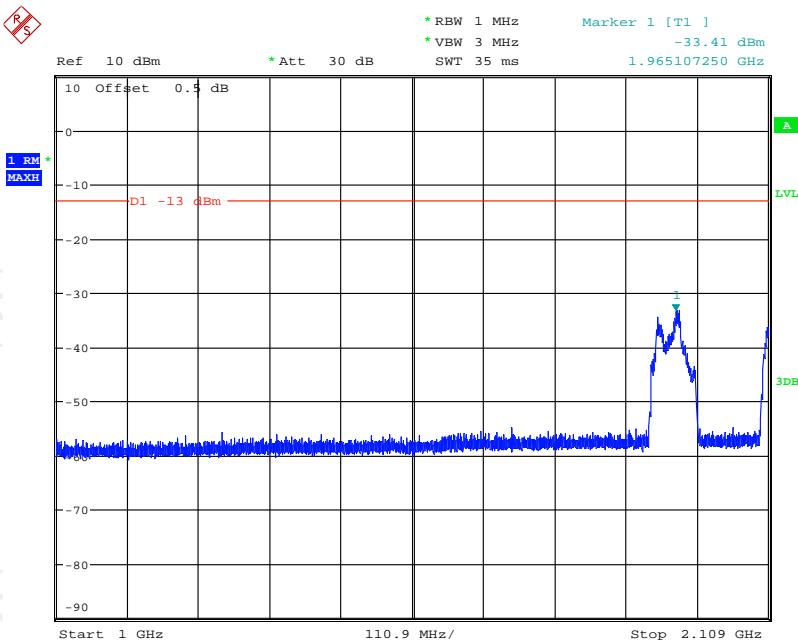


Date: 4.JAN.2003 09:31:53

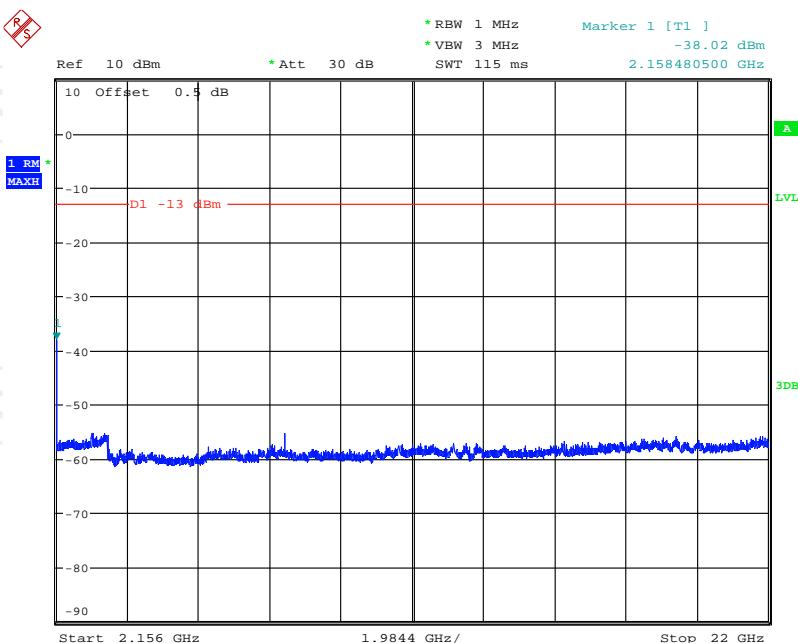
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Date: 4.JAN.2003 09:38:41



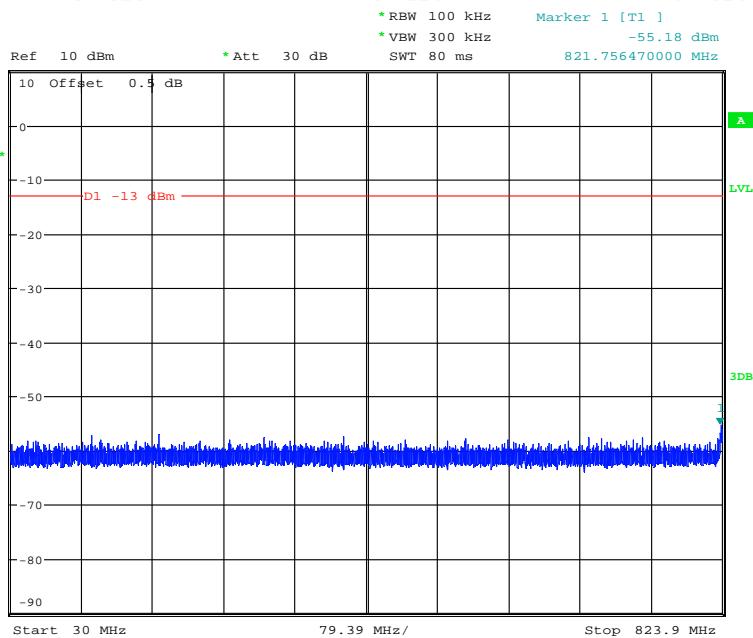
Date: 4.JAN.2003 09:37:55



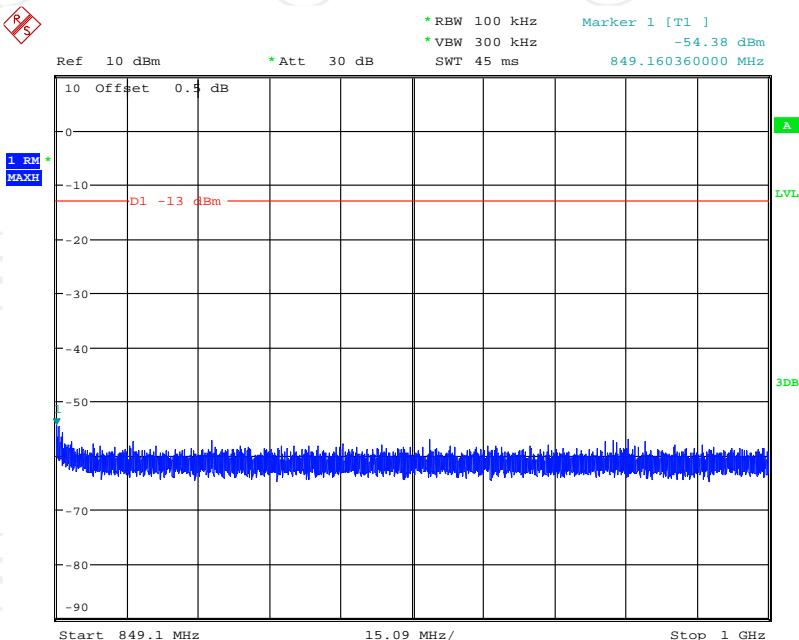
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## Test Plots

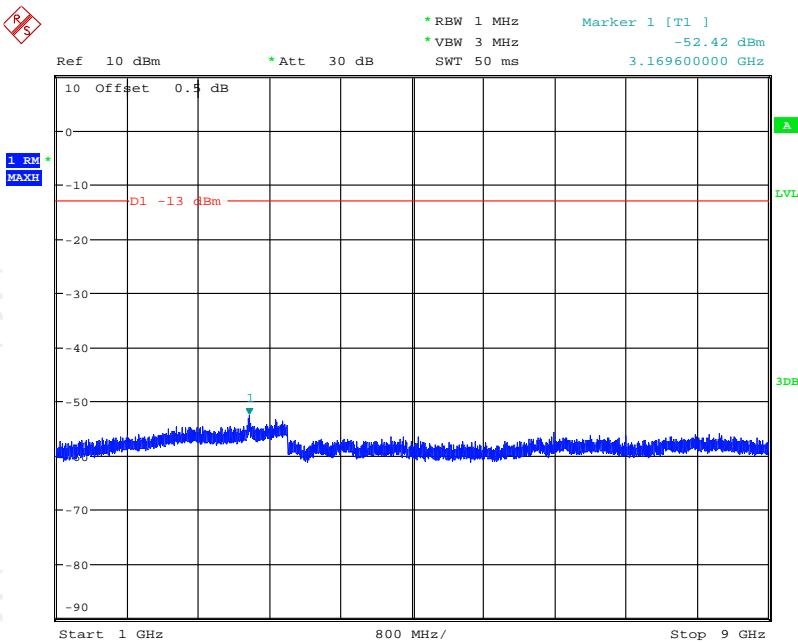
### Band5 Uplink



Date: 4.JAN.2003 09:23:09

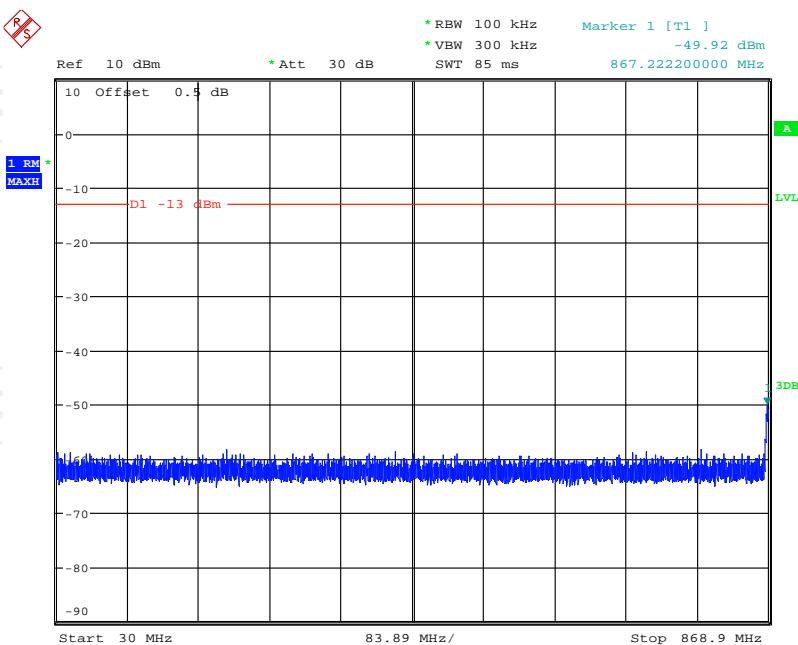


Date: 4.JAN.2003 09:23:48

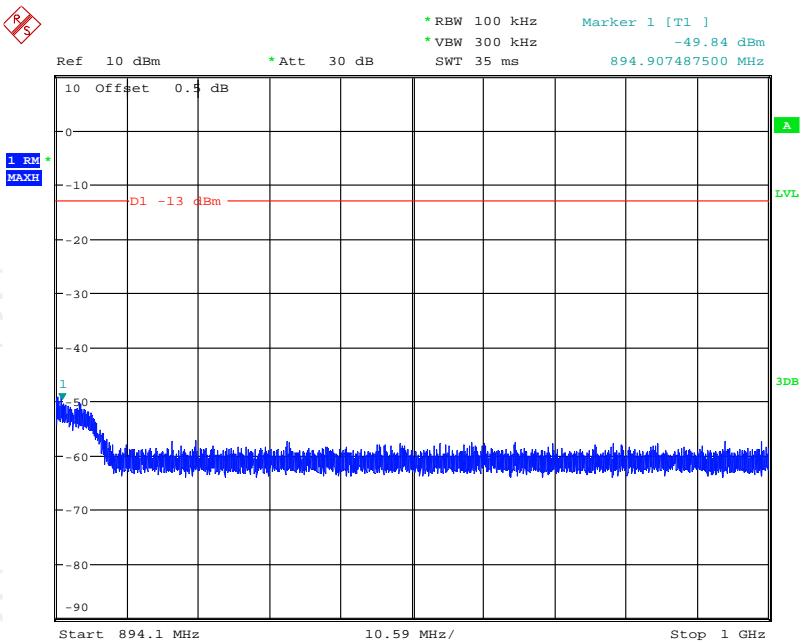


Date: 4.JAN.2003 09:24:44

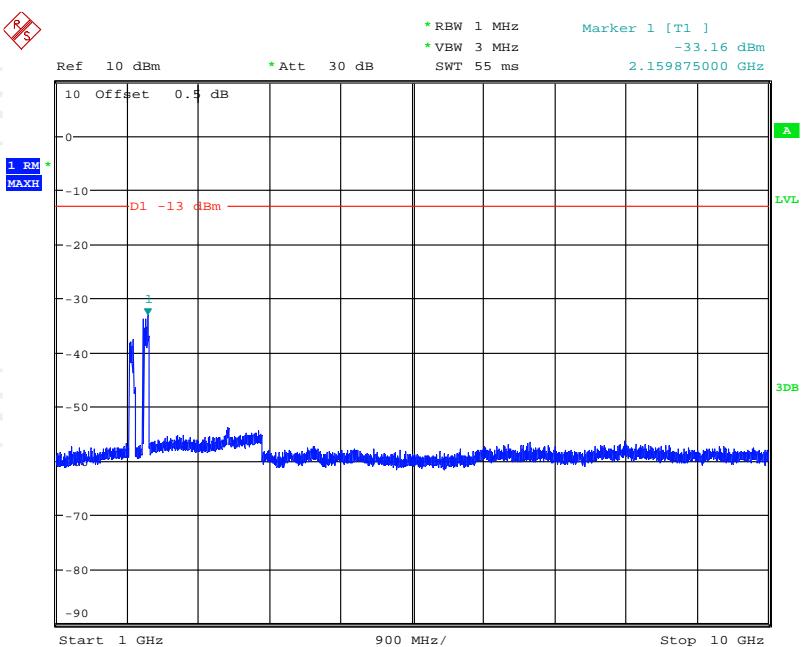
### Band5 Downlink



Date: 4.JAN.2003 09:43:01



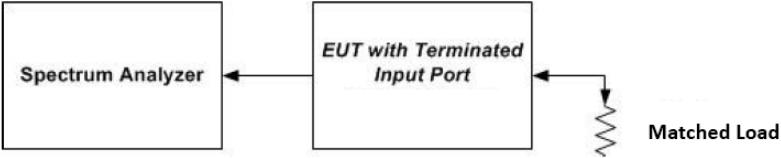
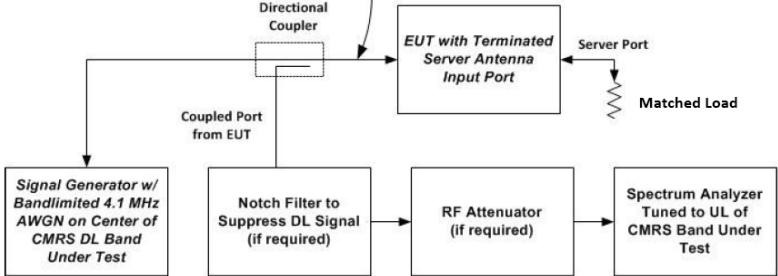
Date: 4.JAN.2003 09:42:18



Date: 4.JAN.2003 09:41:41

## 6.6. Noise Limits

### 6.6.1. Test Specification

|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | FCC Part20 Section 20.21(e)(8)(i)(A); 20.21(e)(8)(i)(H)  |
| <b>Test Method:</b>      | KDB D03 signal Booster Measurements V04R01   |
| <b>Limit:</b>            | <p>§20.21(e)(8)(i)(A)(1), The transmitted noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed -103 dBm/MHz—RSSI.</p> <p>§20.21(e)(8)(i)(A)(2)(i), Fixed booster maximum noise power shall not exceed <math>-102.5 \text{ dBm/MHz} + 20 \log(F)</math>, where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.</p>  |
| <b>Test Setup:</b>       |  <p>Figure 3 – Noise limit test setup (also used for 7.8)<br/>Donor Port</p>  <p>Figure 4 – Test setup for uplink noise power measurement<br/>in the presence of a downlink signal</p>   |
| <b>Test Procedure:</b>   | <ol style="list-style-type: none"> <li>Connect the EUT to the test equipment as shown in Figure 3. Begin with the uplink output (donor) port connected to the spectrum analyzer. When measuring downlink noise, connect the downlink output (server) port to the spectrum analyzer.</li> <li>Set the spectrum analyzer RBW to 1 MHz with the VBW <math>\geq 3</math> . RBW.</li> <li>Select the power averaging (rms) detector and trace average over at least 100 traces.</li> <li>Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span <math>\geq 2</math> . the CMRS band.</li> <li>Measure the maximum transmitter noise power level.</li> <li>Save the spectrum analyzer Test Plots as necessary for inclusion in the final test report.</li> <li>Repeat 7.7b) to 7.7f) for all operational uplink and downlink bands.</li> <li>Connect the EUT to the test equipment as shown in Figure 4 for uplink noise power measurement in the presence a downlink signal. Affirm the coupled path of the RF coupler is connected to the spectrum analyzer.</li> <li>Configure the signal generator for AWGN operation with a 99% OBW of 4.1 MHz.</li> </ol> |