HCT CO.,LTD
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
TEL: +82-31-645-6300 FAX: +82-31-645-6401

# REPORT

## FCC Certification

**Applicant Name:**
KMW U.S.A.,INC.

**Address:**
1818 E. Orangethorpe Ave. Fullerton,
CA 92831

**Date of Issue:**
September 07, 2016
**Test Site/Location:**
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
**Report No.:** HCT-R-1609-F003
**HCT FRN:** 0005866421
**IC Recognition No.:** 5944A-5

| | |
|---|---|
| **FCC ID:** | **ZUQ-H-FEM-L-P** |
| **APPLICANT:** | **KMW U.S.A., INC.** |

| | |
|---|---|
| Model(s): | POD-H-FEM-L-P |
| EUT Type: | DAS 7-Band Remote Unit |
| Frequency Range : | UL : 1850 MHz ~1915 MHz (PCS 1900) |
| Conducted Output Power: | UL : 0.316 mW (-5 dBm) |
| Date of Test: | December 07, 2015 ~ February 23, 2016 |
| FCC Rule Part(s): | CFR 47, Part 22/24, Part 27, part 90 |

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

**Report prepared by**
**:Kyung Soo Kang**
**Test engineer of RF Team**

**Approved by**
**:Jong Seok Lee**
**Manager of RF Team**

# Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HCT-R-1609-F003 | September 07, 2016 | - First Approval Report |
| | | |
| | | |
| | | |
| | | |

# Table of Contents

# 1. CLIENT INFORMATION

**The EUT has been tested by request of**

| | |
|---|---|
| Company | KMW U.S.A.,INC.<br><br>1818 E. Orangethorpe Ave. Fullerton, CA 92831 |

| | |
|---|---|
| **FCC ID:** | ZUQ-H-FEM-L-P |
| **EUT Type:** | DAS 7-Band Remote Unit |
| **FCC Model(s):** | POD-H-FEM-L-P |
| **Frequency Ranges :** | UL : 1850 MHz ~1915 MHz (PCS 1900) |
| **Conducted Output Power:** | UL : 0.316 mW (-5 dBm) |
| **Antenna Gain(s):** | Manufacturer does not provide an antenna. |
| **Measurement standard(s):** | ANSI/TIA-603-C-2004, KDB 971168 D01 v02r02, KDB 935210 D02 v03r02, KDB 935210 D05 v01r01, KDB 662911 D01 v02r01 |
| **FCC Rule Part(s):** | CFR 47 Part 2, Part 24 |
| **Place of Tests:** | HCT CO., LTD.,<br>74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA<br>(IC Recognition No. : 5944A-5) |

# 2. FACILITIES AND ACCREDITATIONS

## 2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661).

## 2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

# 3. TEST SPECIFICATIONS

## 3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 24.

| Description | Reference (FCC) | Results |
|---|---|---|
| Conducted RF Output Power | §2.1046, §24.232 | Compliant |
| Occupied Bandwidth | §2.1049 | Compliant |
| Passband Gain and Bandwidth & Out of Band Rejection | KDB 935210 D02 v03 | Compliant |
| Spurious Emissions at Antenna Terminals | §2.1051, §24.238 | Compliant |
| Radiated Spurious Emissions | §2.1053, §24.238 | Compliant |
| Frequency Stability | §2.1055 | N/A<br>The EUT does not perform frequency translation |

**NOTE.** DAS 7-Band Remote Unit supports SISO and MIMO system.
Support frequency Band
SISO system : 700M, SMR800, 850M, PCS, AWS, WCS, BRS
MIMO system : 700M, PCS, AWS, BRS

Calculation methods.
RF Output Power : KDB 662911 D01 v02r01, section E)2)c)
Out-of-Band and Spurious Emission : KDB 662911 D01 v02r01, section E)3)a)iii)

## 3.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.

During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

| Band Info | Modulation |
|---|---|
| PCS 1900 | LTE(5 MHz), LTE(10 MHz)<br>CDMA, UMTS, GSM |

## 3.3. MAXIMUM MEASUREMENT UNCERTAINTY

The value of the measurement uncertainty for the measurement of each parameter.

Coverage factor *k* = 2, Confidence levels of 95 %

| Description | Condition | Uncertainty |
|---|---|---|
| Conducted RF Output Power | - | ± 0.72 dB |
| Occupied Bandwidth | OBW ≤ 20 MHz | ± 52 kHz |
| Passband Gain<br>and Bandwidth<br>& Out of Band Rejection | Gain<br>20 dB bandwidth | ± 0.89 dB<br>± 0.58 MHz |
| Spurious Emissions at<br>Antenna Terminals | - | ± 1.08 dB |
| Radiated Spurious Emissions | f ≤ 1 GHz<br>f > 1 GHz | ± 4.80 dB<br>± 6.07 dB |

# 4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

| | |
|---|---|
| **Temperature :** | **+ 15 ℃ to + 35 ℃** |
| **Relative humidity:** | **30 % to 60 %** |
| **Air pressure** | **860 mbar to 1 060 mbar** |

# 5. TEST EQUIPMENT

| Manufacturer | Model / Equipment | Cal Interval | Calibration Date | Serial No. |
|---|---|---|---|---|
| Agilent | E4438C /Signal Generator | Annual | 09/02/2015 | MY42082646 |
| Agilent | N5182A /Signal Generator | Annual | 04/07/2015 | MY50141649 |
| Agilent | N5182A /Signal Generator | Annual | 05/13/2015 | MY47070230 |
| Rohde & Schwarz | SMBV100A /Signal Generator | Annual | 10/20/2015 | 255727 |
| Rohde & Schwarz | SMB100A /Signal Generator | Annual | 07/16/2015 | 177633 |
| NANGYEUL CO., LTD. | NY-THR18750 / Temperature and Humidity Chamber | Annual | 10/27/2015 | NY-2009012201A |
| Agilent | N9020A /Signal Analyzer | Annual | 02/27/2015 | MY46471587 |
| WEINSCHEL | 67-30-33 / Fixed Attenuator | Annual | 10/29/2015 | BR5347 |
| DEAYOUNG ENT | DFSS60 / AC Power Supply | Annual | 04/01/2015 | 1003030-1 |
| Rohde & Schwarz | FSP / Spectrum Analyzer | Annual | 09/24/2015 | 100688 |
| CERNEX, Inc | CBLU1183540/AMP | Annual | 07/21/2015 | 22964 |
| WEINSCHEL | 1506A/Power Divider | Annual | 10/21/2015 | MD793 |
| Schwarzbeck | BBHA 9120D / Horn Antenna | Biennial | 07/30/2015 | 1151 |
| Schwarzbeck | VULB 9160 / TRILOG Antenna | Biennial | 10/10/2014 | 9160-3368 |
| HD | MA240 / Antenna Position Tower | N/A | N/A | 556 |
| EMCO | 1050 / Turn Table | N/A | N/A | 114 |
| HD GmbH | HD 100 / Controller | N/A | N/A | 13 |
| HD GmbH | KMS 560/ SlideBar | N/A | N/A | 12 |

# 6. RF OUTPUT POWER

**FCC Rules**

**Test Requirements:**

**§ 2.1046 Measurements required: RF power output:**

**§ 2.1046 (a)** For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

**§ 2.1046 (b)** For single sideband, independent sideband, and single channel, controlled carrier Radio telephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

**§ 2.1046 (c)** For measurements conducted pursuant to paragraphs (a) and (b) of this section, all Calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

**§ 24.232 Power and antenna height limits.** (a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below. See §24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power; see Table 1 of this section.

The service area boundary limit and microwave protection criteria specified in §24.236 and §24.237 apply.

**Test Procedures:**

Measurements were in accordance with the test methods section 3.5.2 of KDB 935210 D05 v01.

a) Connect a signal generator to the input of the EUT.

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency of (f0) as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure the output power of the EUT and record (Power measurement with a spectrum analyzer).

g) Remove the EUT from the measurement setup and using the same signal generator settings, repeat the power measurement on the input signal to the EUT and record as input power.

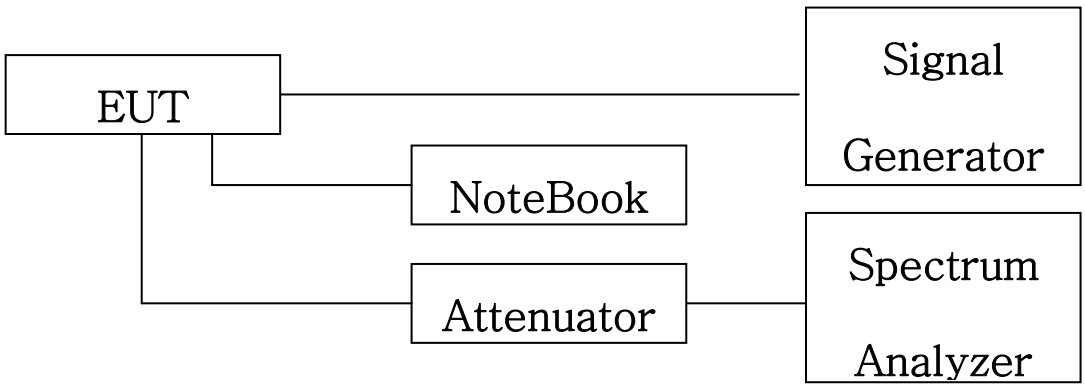
h) Repeat the procedure with the narrowband test signal.

i) Repeat the procedure for both test signals with input signal amplitude set to 3 dB above the AGC threshold level.

j) Repeat for all frequency bands authorized for use by the EUT.

**Power measurement Method :**

Guidance for performing input/output power measurements using a spectrum or signal analyzer is provided in 5.2 of KDB Publication 971168.




**Block Diagram 1. RF Power Output Test Setup**

**Test Results:**

| Input Signal | Input Level (dBm) | Maximum Amp Gain |
|---|---|---|
| PCS 1900 | UL : -45 dBm | UL : 40 dB |

**Single channel Enhancer**

* Due to EUT's ALC function (Auto Level Control), even if input signal is increased,

The same output power is transmit.

**[Uplink]**

| | Channel | Frequency (MHz) | Output Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| PCS 1900 Band_ LTE 5 MHz AGC threshold | Low | 1852.50 | -5.03 | 0.314 |
| | Middle | 1882.50 | -5.06 | 0.312 |
| | High | 1912.50 | -5.09 | 0.31 |
| PCS 1900 Band_ LTE 5 MHz +3dBm above the AGC threshold | Low | 1852.50 | -5.06 | 0.312 |
| | Middle | 1882.50 | -5.10 | 0.309 |
| | High | 1912.50 | -5.13 | 0.307 |
| PCS 1900 Band_ LTE 10 MHz AGC threshold | Low | 1855.00 | -5.07 | 0.311 |
| | Middle | 1882.50 | -5.06 | 0.312 |
| | High | 1910.00 | -5.04 | 0.313 |
| PCS 1900 Band_ LTE 10 MHz +3dBm above the AGC threshold | Low | 1855.00 | -5.08 | 0.310 |
| | Middle | 1882.50 | -5.11 | 0.308 |
| | High | 1910.00 | -5.02 | 0.315 |

| | Channel | Frequency (MHz) | Output Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| PCS 1900 Band_ UMTS AGC threshold | Low | 1852.50 | -5.01 | 0.316 |
| | Middle | 1882.50 | -5.06 | 0.312 |
| | High | 1912.50 | -5.10 | 0.309 |
| PCS 1900 Band_ UMTS +3dBm above the AGC threshold | Low | 1852.50 | -5.06 | 0.312 |
| | Middle | 1882.50 | -5.09 | 0.310 |
| | High | 1912.50 | -5.07 | 0.311 |
| PCS 1900 Band_ CDMA AGC threshold | Low | 1851.25 | -5.05 | 0.313 |
| | Middle | 1882.50 | -5.01 | 0.316 |
| | High | 1913.75 | -5.07 | 0.311 |
| PCS 1900 Band_ CDMA +3dBm above the AGC threshold | Low | 1851.25 | -4.96 | 0.319 |
| | Middle | 1882.50 | -5.00 | 0.316 |
| | High | 1913.75 | -5.07 | 0.311 |
| PCS 1900 Band_ GSM AGC threshold | Low | 1850.20 | -5.04 | 0.313 |
| | Middle | 1882.50 | -4.90 | 0.324 |
| | High | 1914.80 | -4.99 | 0.317 |
| PCS 1900 Band_ GSM +3dBm above the AGC threshold | Low | 1850.20 | -4.91 | 0.323 |
| | Middle | 1882.50 | -4.89 | 0.324 |
| | High | 1914.80 | -5.03 | 0.314 |

| | Channel | Frequency (MHz) | Calculated MIMO Output Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| PCS 1900 Band_ LTE 5 MHz AGC threshold | Low | 1852.50 | -2.02 | 0.628 |
| | Middle | 1882.50 | -2.05 | 0.624 |
| | High | 1912.50 | -2.08 | 0.619 |
| PCS 1900 Band_ LTE 5 MHz +3dBm above the AGC threshold | Low | 1852.50 | -2.05 | 0.624 |
| | Middle | 1882.50 | -2.09 | 0.618 |
| | High | 1912.50 | -2.12 | 0.614 |
| PCS 1900 Band_ LTE 10 MHz AGC threshold | Low | 1855.00 | -2.06 | 0.622 |
| | Middle | 1882.50 | -2.05 | 0.624 |
| | High | 1910.00 | -2.03 | 0.627 |
| PCS 1900 Band_ LTE 10 MHz +3dBm above the AGC threshold | Low | 1855.00 | -2.07 | 0.621 |
| | Middle | 1882.50 | -2.10 | 0.617 |
| | High | 1910.00 | -2.01 | 0.630 |
| PCS 1900 Band_ UMTS AGC threshold | Low | 1852.50 | -2.00 | 0.631 |
| | Middle | 1882.50 | -2.05 | 0.624 |
| | High | 1912.50 | -2.09 | 0.618 |
| PCS 1900 Band_ UMTS +3dBm above the AGC threshold | Low | 1852.50 | -2.05 | 0.624 |
| | Middle | 1882.50 | -2.08 | 0.619 |
| | High | 1912.50 | -2.06 | 0.622 |

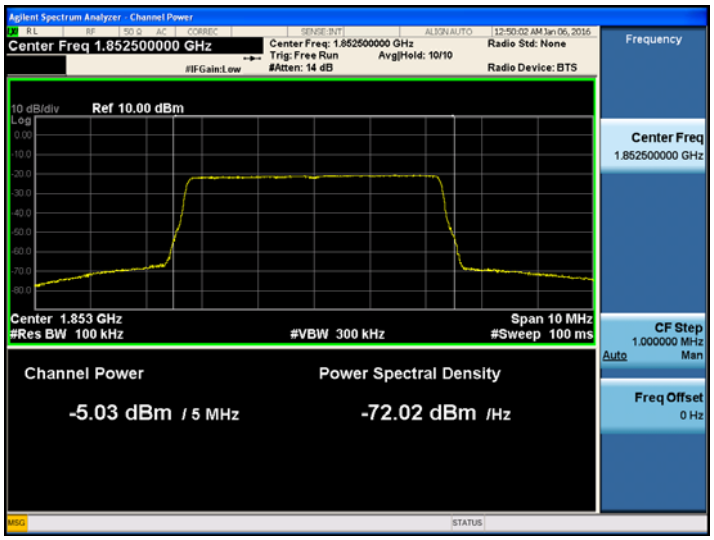
| | Channel | Frequency (MHz) | Calculated MIMO Output Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| PCS 1900 Band_ CDMA AGC threshold | Low | 1851.25 | -2.04 | 0.625 |
| | Middle | 1882.50 | -2.00 | 0.631 |
| | High | 1913.75 | -2.06 | 0.622 |
| PCS 1900 Band_ CDMA +3dBm above the AGC threshold | Low | 1851.25 | -1.95 | 0.638 |
| | Middle | 1882.50 | -1.99 | 0.632 |
| | High | 1913.75 | -2.06 | 0.622 |
| PCS 1900 Band_ GSM AGC threshold | Low | 1850.20 | -2.03 | 0.627 |
| | Middle | 1882.50 | -1.89 | 0.647 |
| | High | 1914.80 | -1.98 | 0.634 |
| PCS 1900 Band_ GSM +3dBm above the AGC threshold | Low | 1850.20 | -1.90 | 0.646 |
| | Middle | 1882.50 | -1.88 | 0.649 |
| | High | 1914.80 | -2.02 | 0.628 |

**Note.** The MIMO output power were calculated, as described in FCC KDB 662911 D01 v02r01 section E)2)c)

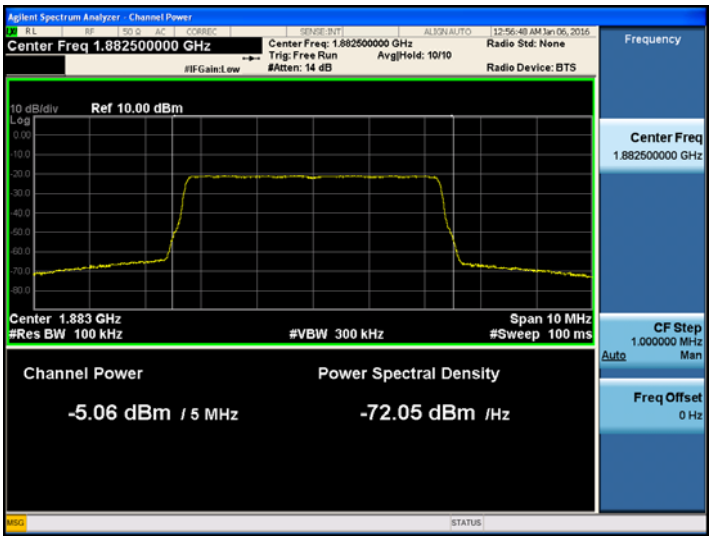
## Single channel Enhancer Plots of RF Output Power

### PCS 1900 LTE 5 MHz Band UL

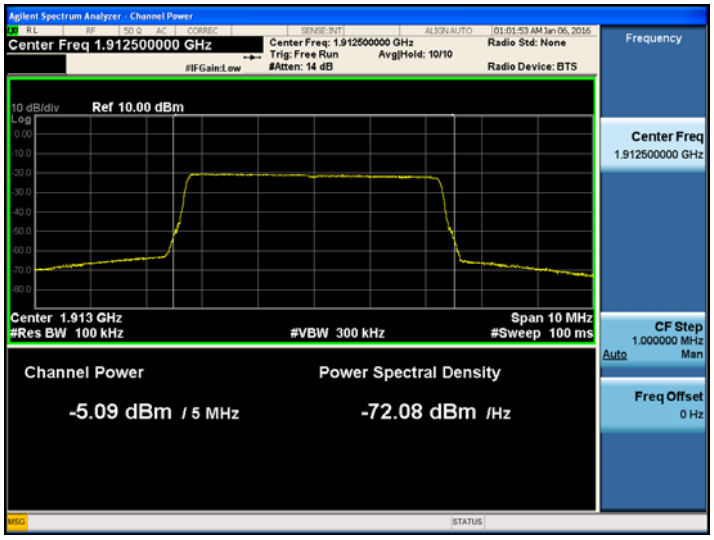
**[PCS 1900 AGC threshold Uplink LTE 5MHz Low]**

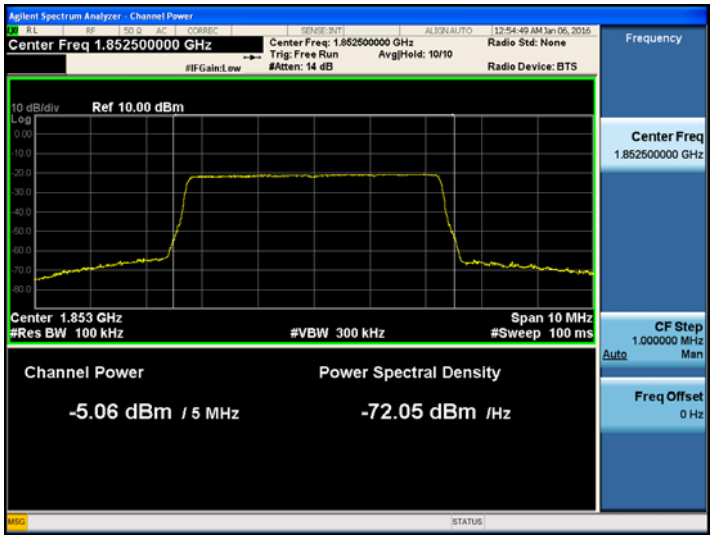
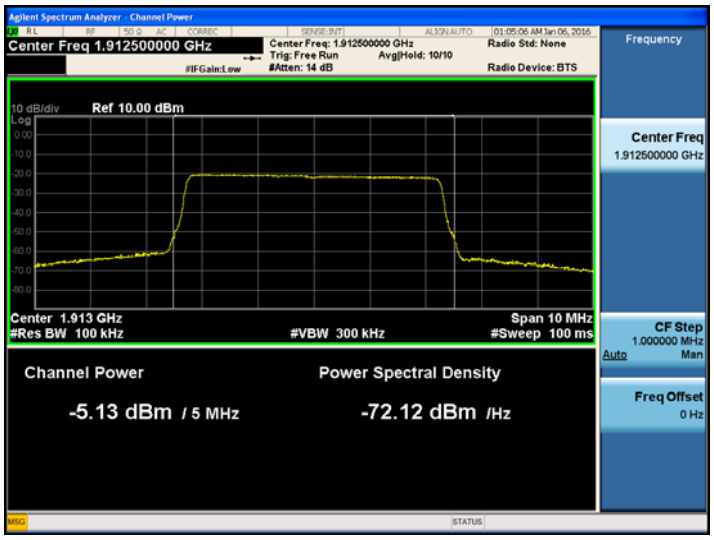



**[PCS 1900 AGC threshold Uplink LTE 5MHz Mid]**



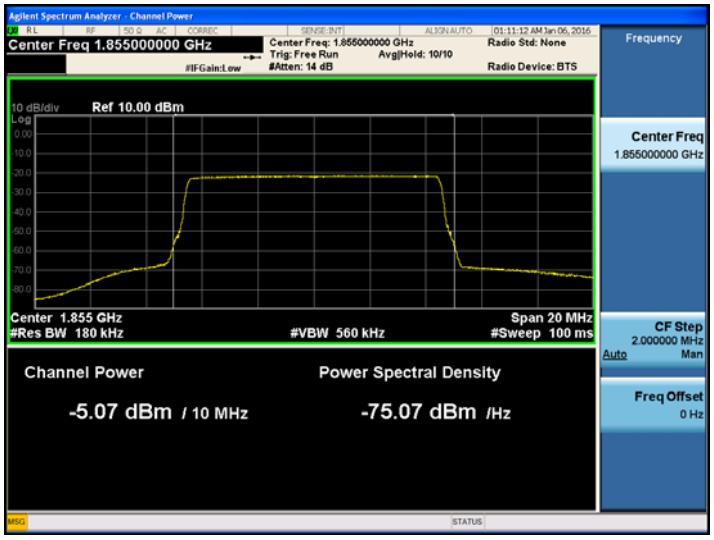

**[PCS 1900 AGC threshold Uplink LTE 5MHz High]**



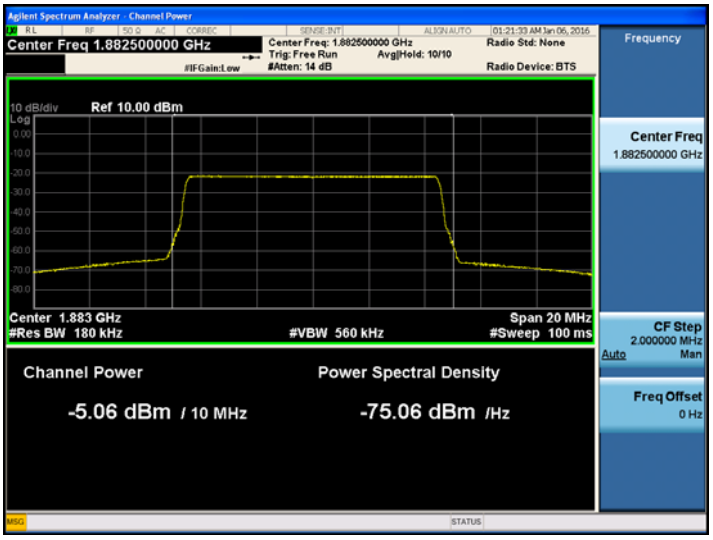
| [PCS 1900 +3dB above the threshold Uplink LTE 5MHz Low] | [PCS 1900 +3dB above the threshold Uplink LTE 5MHz Mid] |
|---|---|
|  |  |
| **[PCS 1900 +3dB above the threshold Uplink LTE 5MHz High]** | |
|  | |

## PCS 1900 LTE 10 MHz Band UL

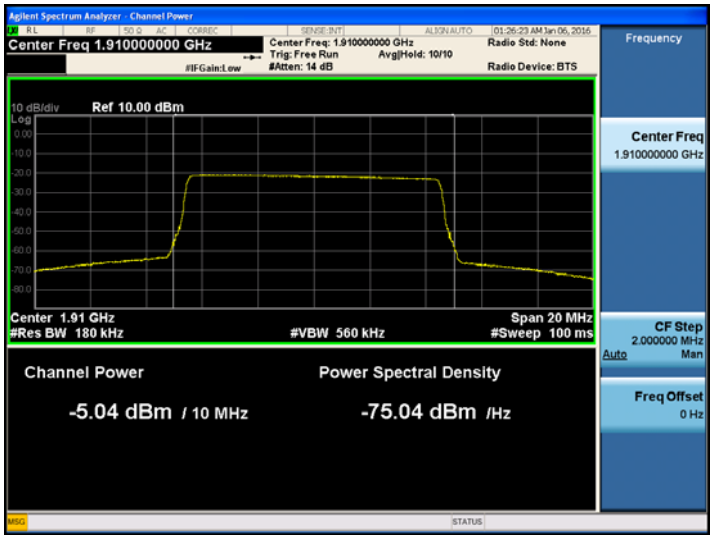
**[PCS 1900 AGC threshold Uplink LTE 10MHz Low]**

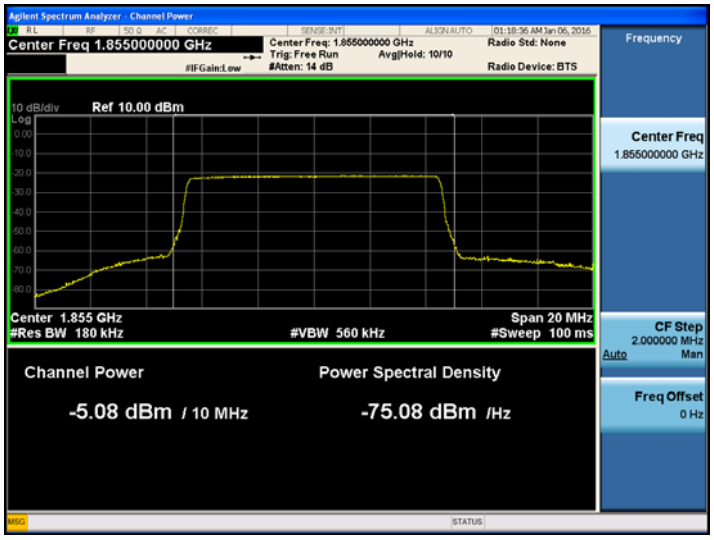
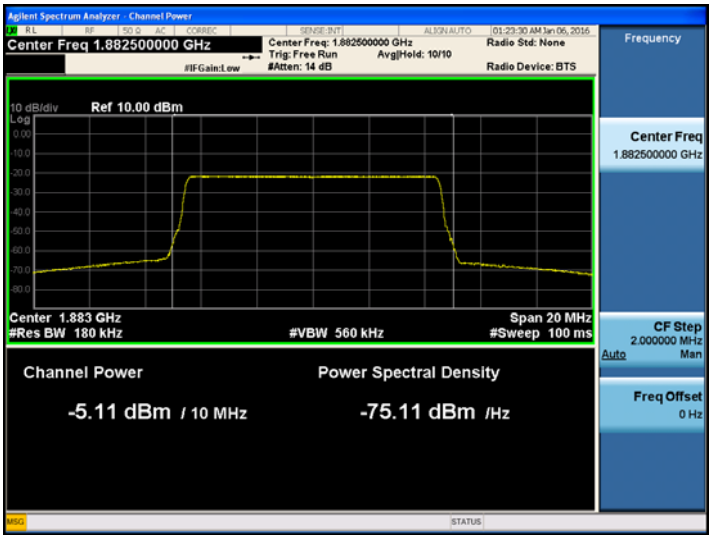
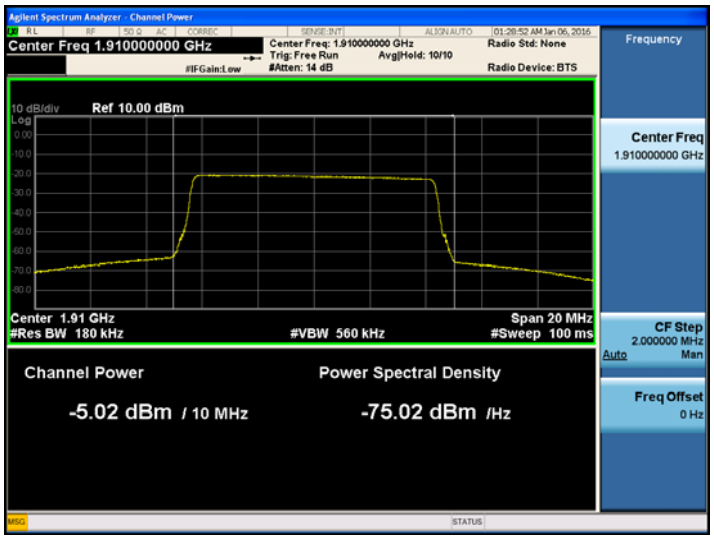



**[PCS 1900 AGC threshold Uplink LTE 10MHz Mid]**

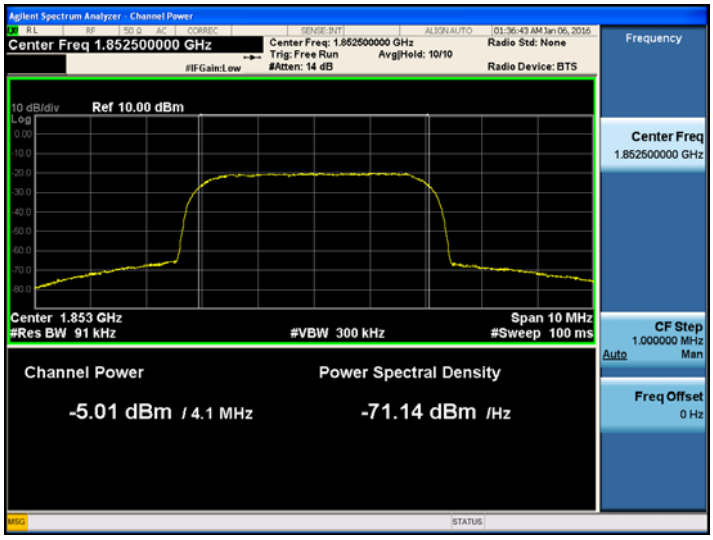
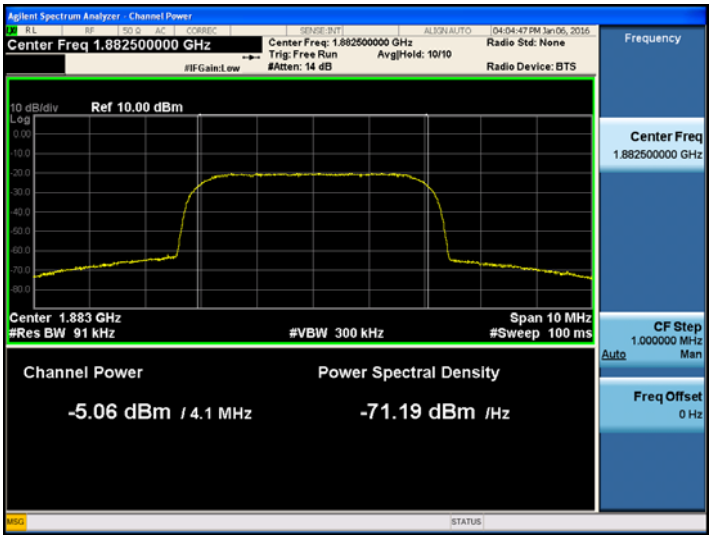
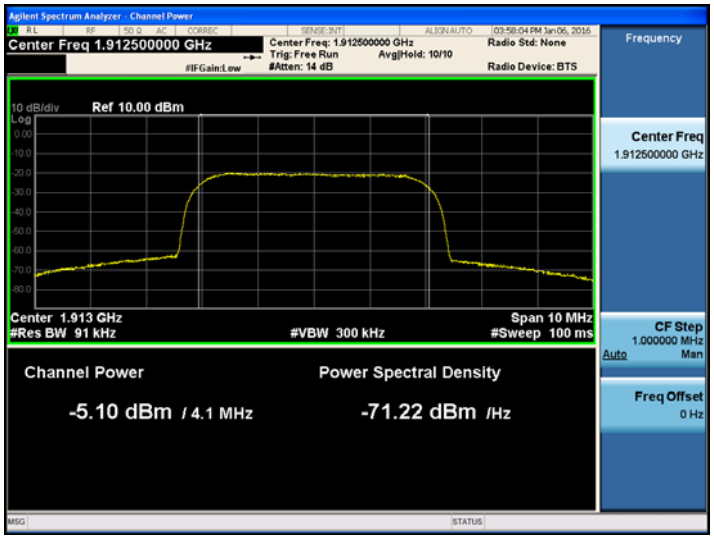


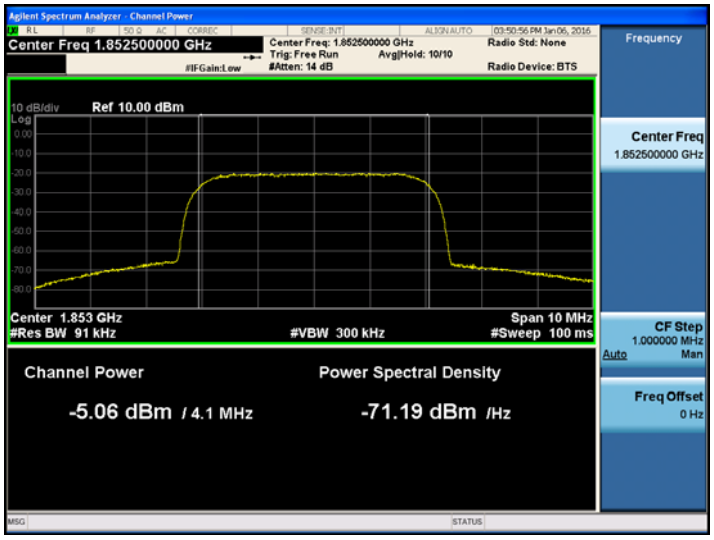
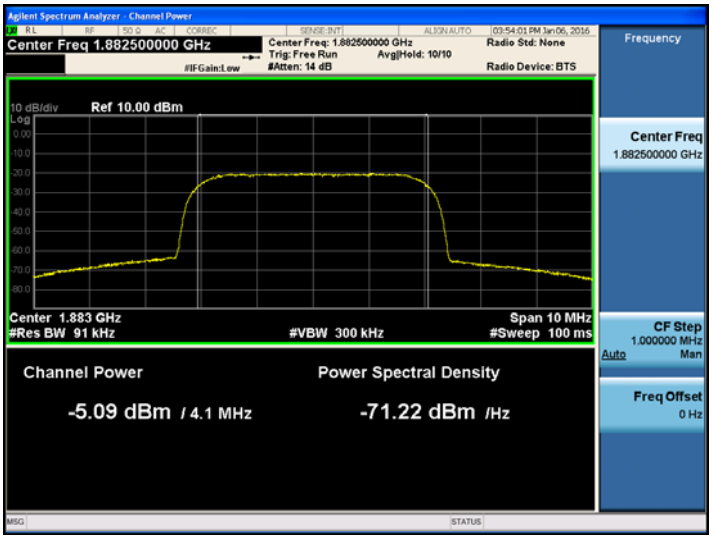
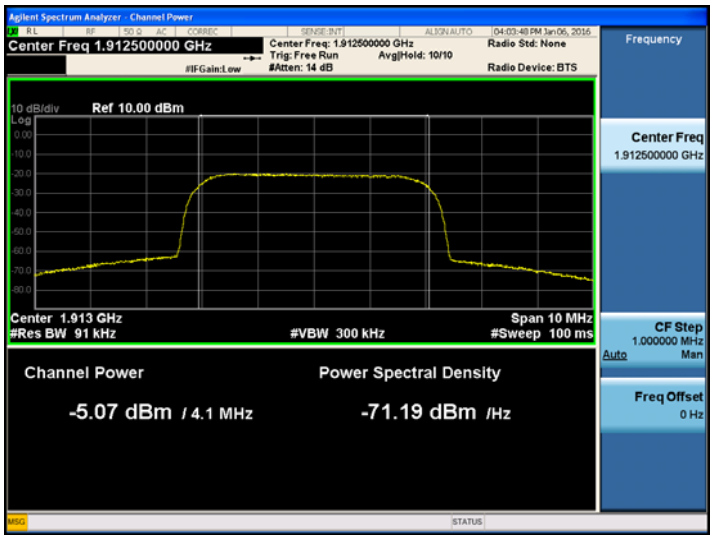

**[PCS 1900 AGC threshold Uplink LTE 10MHz High]**



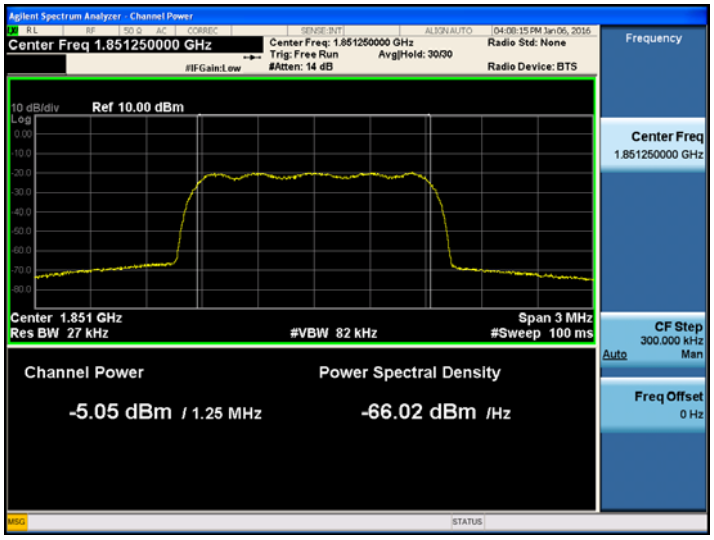
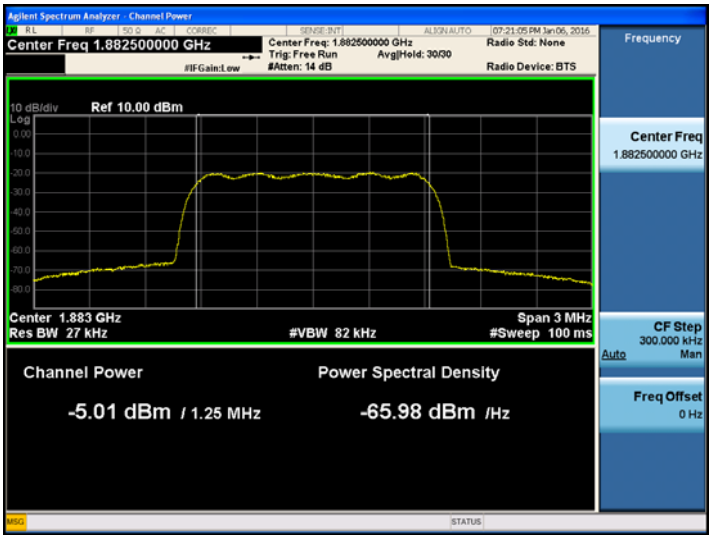
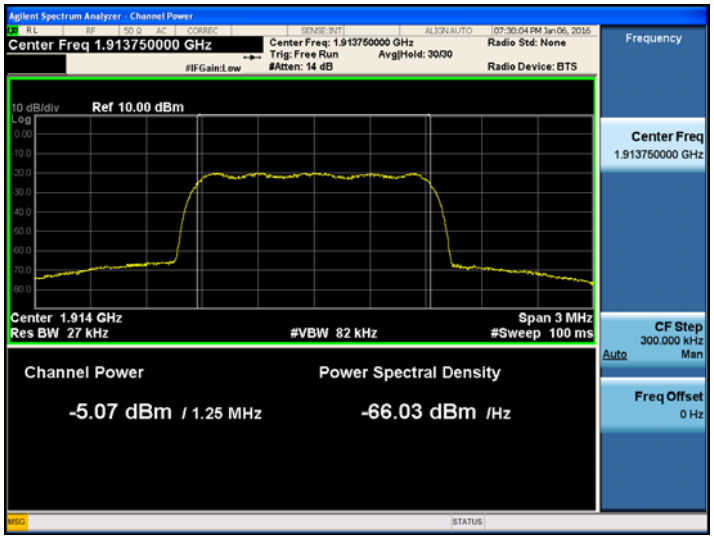
| [PCS 1900 +3dB above the threshold Uplink LTE 10MHz Low] | [PCS 1900 +3dB above the threshold Uplink LTE 10MHz Mid] |
|---|---|
|  |  |
| **[PCS 1900 +3dB above the threshold Uplink LTE 10MHz High]** | |
|  | |

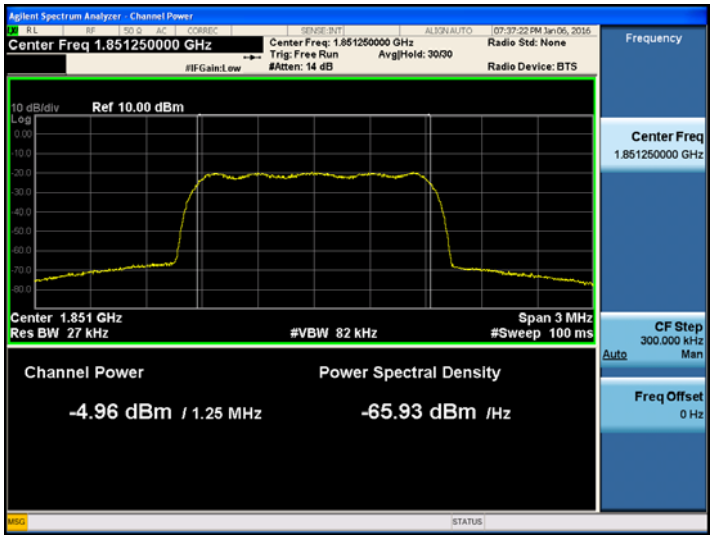
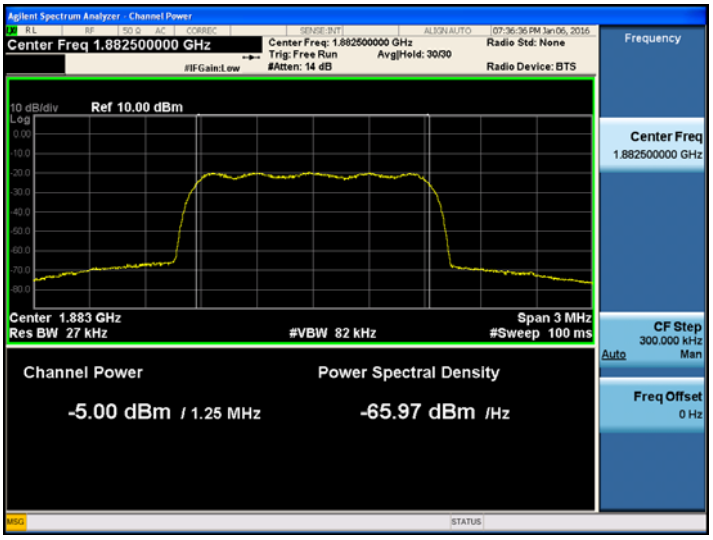
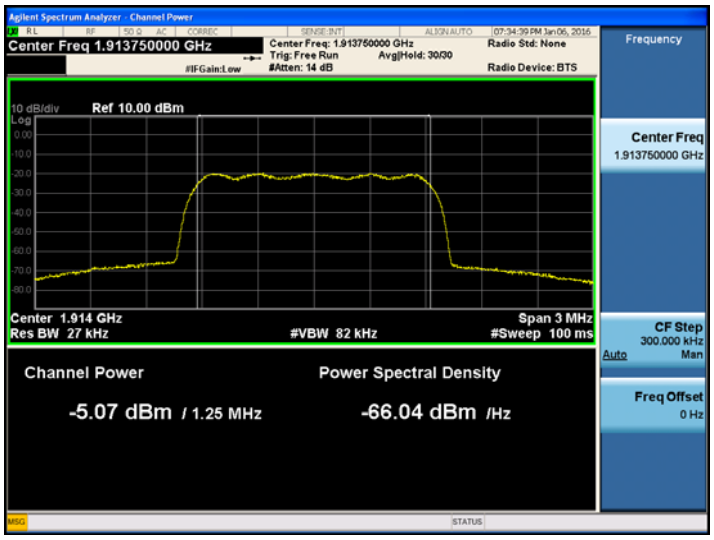
## PCS 1900 UMTS Band UL

| [PCS 1900 AGC threshold Uplink UMTS Low] | [PCS 1900 AGC threshold Uplink UMTS Mid] |
|---|---|
|  |  |
| **[PCS 1900 AGC threshold Uplink UMTS High]** | |
|  | |

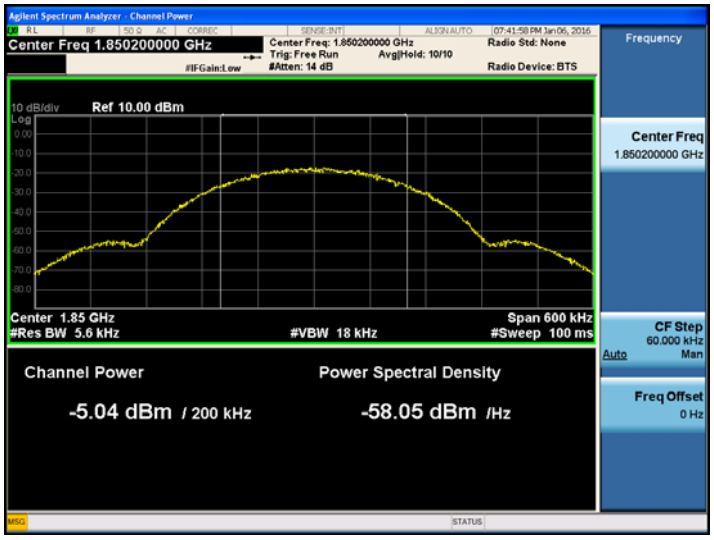
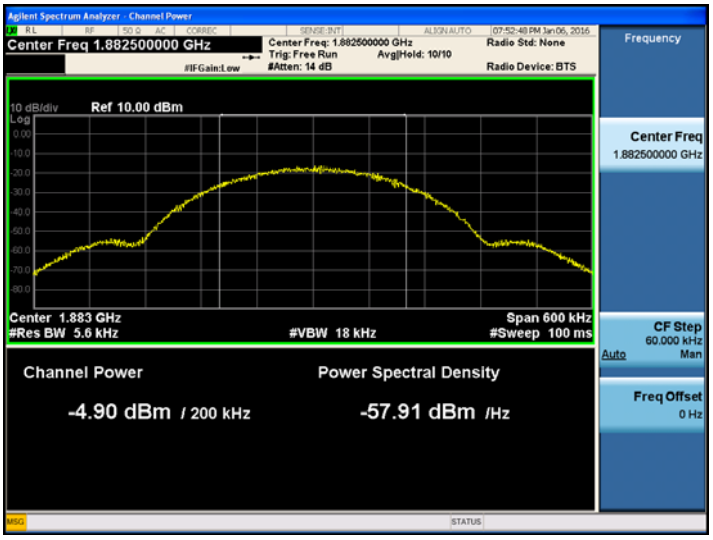
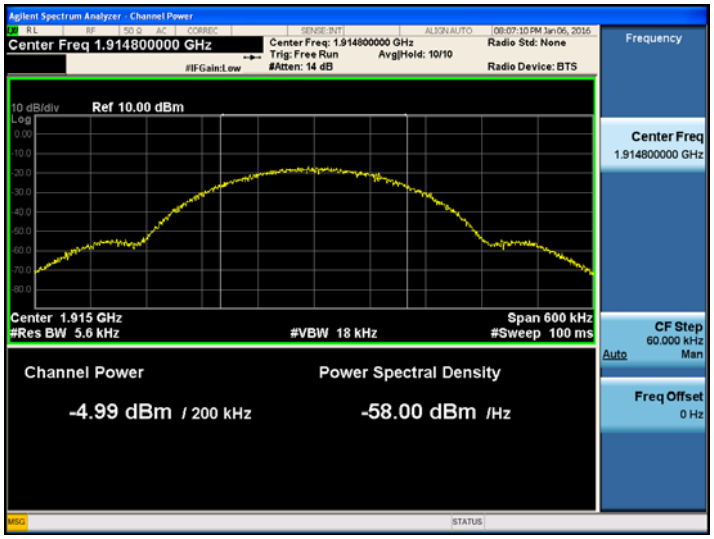
| [PCS 1900 +3dB above the threshold Uplink UMTS Low] | [PCS 1900 +3dB above the threshold Uplink UMTS Mid] |
|---|---|
|  |  |
| **[PCS 1900 +3dB above the threshold Uplink UMTS High]** | |
|  | |

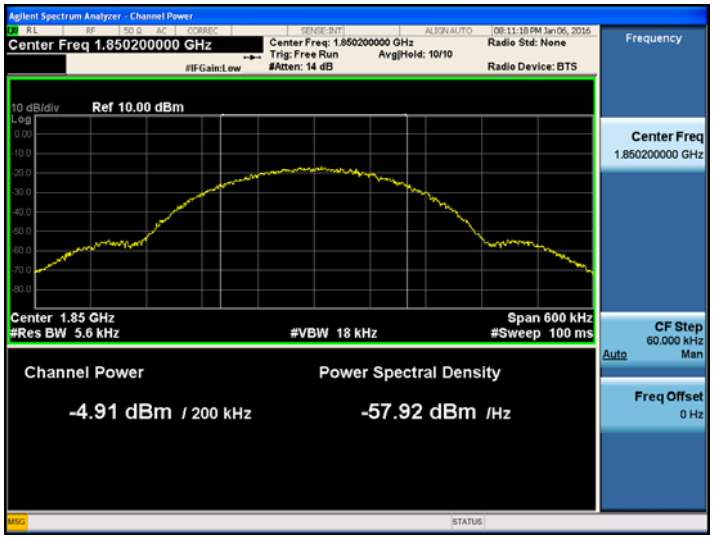
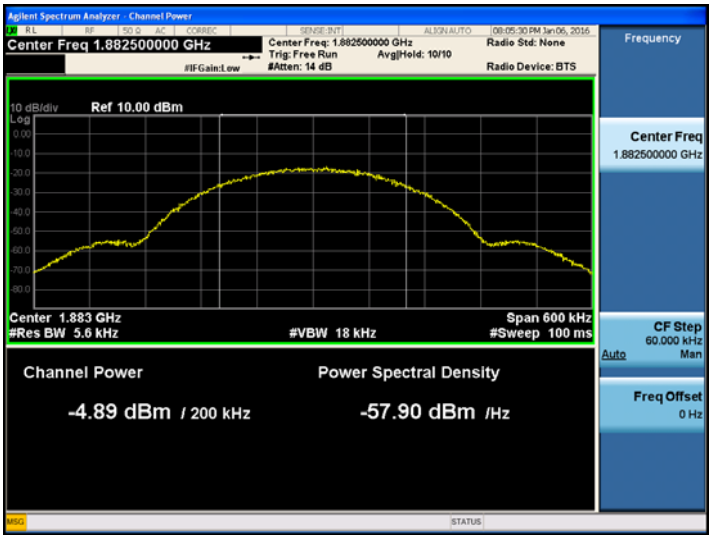
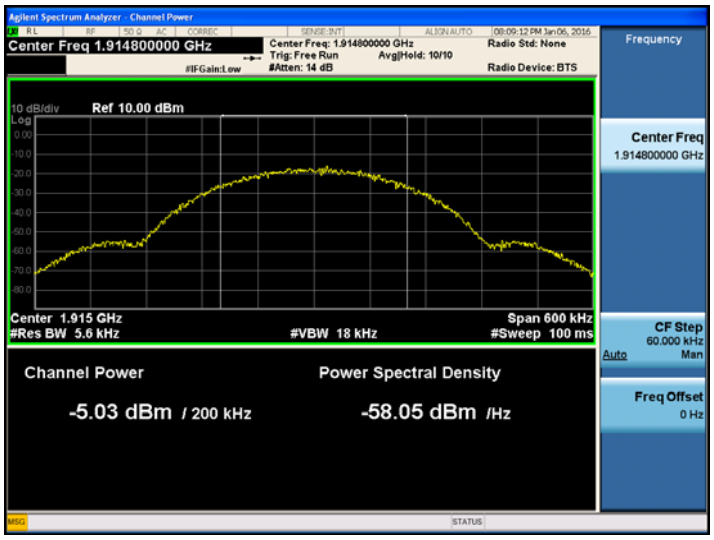
## PCS 1900 CDMA Band UL

| [PCS 1900 AGC threshold Uplink CDMA Low] | [PCS 1900 AGC threshold Uplink CDMA Mid] |
|---|---|
|  |  |
| **[PCS 1900 AGC threshold Uplink CDMA High]** | |
|  | |

| [PCS 1900 +3dB above the threshold Uplink CDMA Low] | [PCS 1900 +3dB above the threshold Uplink CDMA Mid] |
|---|---|
|  |  |
| **[PCS 1900 +3dB above the threshold Uplink CDMA High]** | |
|  | |

## PCS 1900 GSM Band UL

| [PCS 1900 AGC threshold Uplink GSM Low] | [PCS 1900 AGC threshold Uplink GSM Mid] |
|---|---|
|  |  |
| **[PCS 1900 AGC threshold Uplink GSM High]** | |
|  | |

| [PCS 1900 +3dB above the threshold Uplink GSM Low] | [PCS 1900 +3dB above the threshold Uplink GSM Mid] |
|---|---|
|  |  |
| **[PCS 1900 +3dB above the threshold Uplink GSM High]** | |
|  | |

# 7. OCCUPIED BANDWIDTH

**FCC Rules**

**Test Requirement(s):**

**§ 2.1049 Measurements required: Occupied bandwidth:**

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

**Test Procedures:**

Measurements were in accordance with the test methods section 3.4 of KDB 935210 D05 v01 and section 4.2 of KDB 971168 D01 v02r02.

Test is 99% OBW measured and used.

a) Connect a signal generator to the input of the EUT.

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 times to 5 times the OBW.

f) The nominal resolution bandwidth (RBW) shall be in the range of 1% to 5 % of the anticipated OBW, and the VBW shall be ≥ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

NOTE—Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.

l) Repeat steps e) to k) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

m) Compare the spectral plot of the input signal (determined from step l) to the output signal

(determined from step k) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.
n) Repeat for all frequency bands authorized for use by the EUT.

**Test Results:** The EUT complies with the requirements of this section.

| Input Signal | Input Level (dBm) | Maximum Amp Gain |
|---|---|---|
| PCS 1900 | UL : -45 dBm | UL : 40 dB |

**[Uplink Output]**

| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| PCS 1900 Band_ LTE 5 MHz AGC threshold | Low | 1852.50 | 4.510 |
| | Middle | 1882.50 | 4.510 |
| | High | 1912.50 | 4.514 |
| PCS 1900 Band_ LTE 5 MHz +3dBm above the AGC threshold | Low | 1852.50 | 4.511 |
| | Middle | 1882.50 | 4.517 |
| | High | 1912.50 | 4.512 |
| PCS 1900 Band_ LTE 10 MHz AGC threshold | Low | 1855.00 | 9.010 |
| | Middle | 1882.50 | 9.015 |
| | High | 1910.00 | 8.992 |
| PCS 1900 Band_ LTE 10 MHz +3dBm above the AGC threshold | Low | 1855.00 | 9.002 |
| | Middle | 1882.50 | 9.015 |
| | High | 1910.00 | 9.011 |

| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| PCS 1900 Band_ UMTS AGC threshold | Low | 1852.50 | 4.167 |
| | Middle | 1882.50 | 4.176 |
| | High | 1912.50 | 4.179 |
| PCS 1900 Band_ UMTS +3dBm above the AGC threshold | Low | 1852.50 | 4.168 |
| | Middle | 1882.50 | 4.165 |
| | High | 1912.50 | 4.174 |
| PCS 1900 Band_ CDMA AGC threshold | Low | 1851.25 | 1.270 |
| | Middle | 1882.50 | 1.272 |
| | High | 1913.75 | 1.275 |
| PCS 1900 Band_ CDMA +3dBm above the AGC threshold | Low | 1851.25 | 1.272 |
| | Middle | 1882.50 | 1.271 |
| | High | 1913.75 | 1.267 |

| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| PCS 1900 Band_ GSM AGC threshold | Low | 1850.20 | 0.246 |
| | Middle | 1882.50 | 0.246 |
| | High | 1914.80 | 0.246 |
| PCS 1900 Band_ GSM +3dBm above the AGC threshold | Low | 1850.20 | 0.246 |
| | Middle | 1882.50 | 0.246 |
| | High | 1914.80 | 0.246 |

**[Uplink Input]**

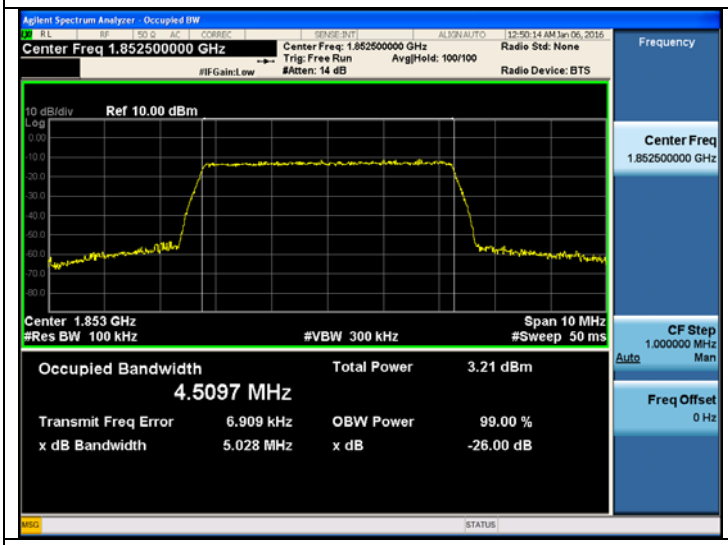
| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| PCS 1900 Band_ LTE 5 MHz AGC threshold | Low | 1852.50 | 4.513 |
| | Middle | 1882.50 | 4.507 |
| | High | 1912.50 | 4.512 |
| PCS 1900 Band_ LTE 10 MHz AGC threshold | Low | 1855.00 | 9.021 |
| | Middle | 1882.50 | 9.012 |
| | High | 1910.00 | 9.016 |

| | Channel | Frequency (MHz) | OBW (MHz) |
|---|---|---|---|
| PCS 1900 Band_ UMTS AGC threshold | Low | 1852.50 | 4.169 |
| | Middle | 1882.50 | 4.173 |
| | High | 1912.50 | 4.175 |
| PCS 1900 Band_ CDMA AGC threshold | Low | 1851.25 | 1.268 |
| | Middle | 1882.50 | 1.275 |
| | High | 1913.75 | 1.267 |
| PCS 1900 Band_ GSM AGC threshold | Low | 1850.20 | 0.246 |
| | Middle | 1882.50 | 0.246 |
| | High | 1914.80 | 0.247 |

## Plots of Occupied Bandwidth

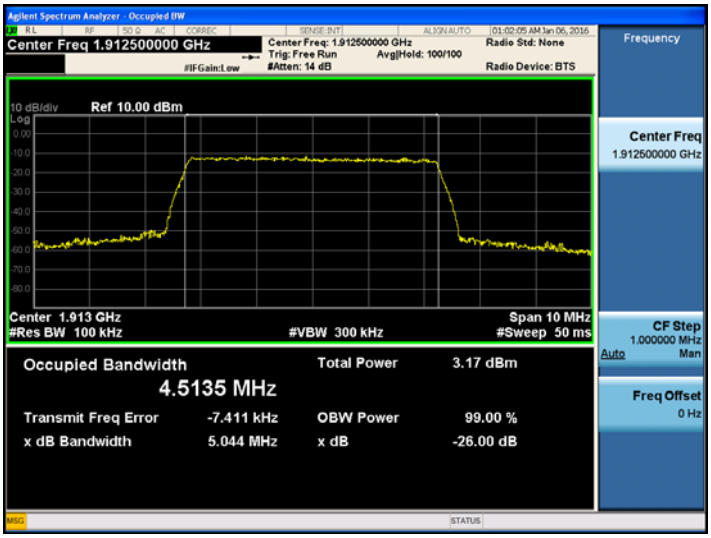
### PCS 1900_LTE 5 MHz UL_Output

**[PCS1900 AGC threshold Uplink Output LTE5MHz Low]**

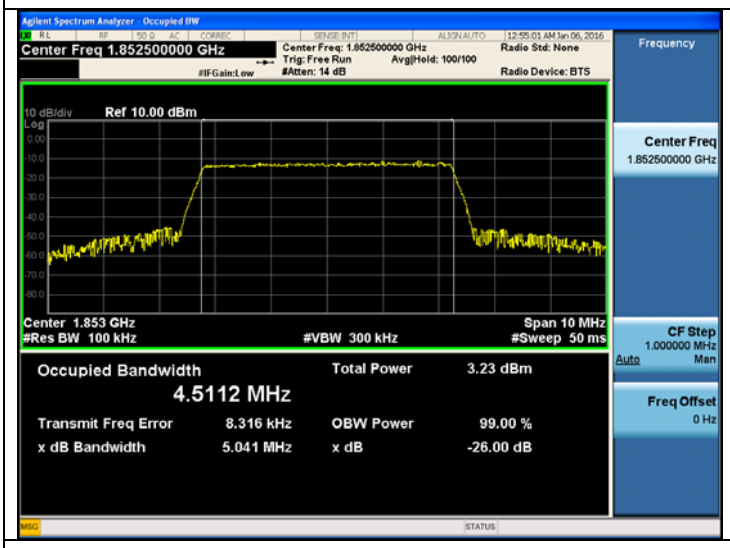



**[PCS1900 AGC threshold Uplink Output LTE5MHz Mid]**

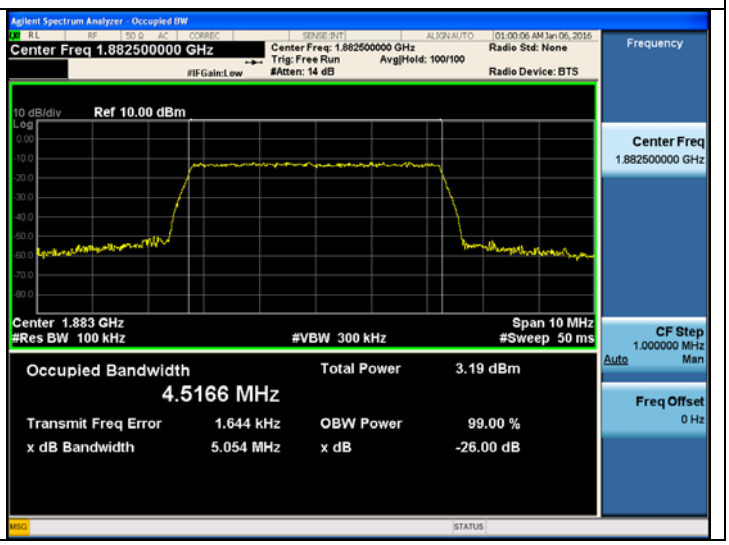

**[PCS1900 AGC threshold Uplink Output LTE5MHz High]**



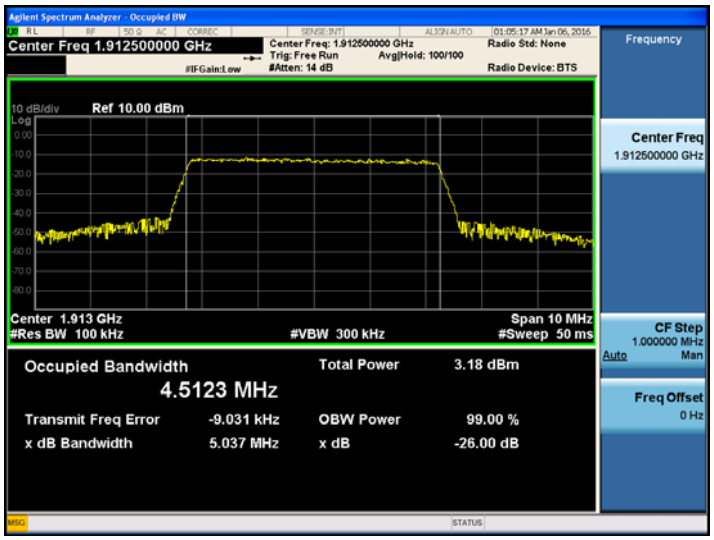
**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 5MHz Low]**




**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 5MHz Mid]**

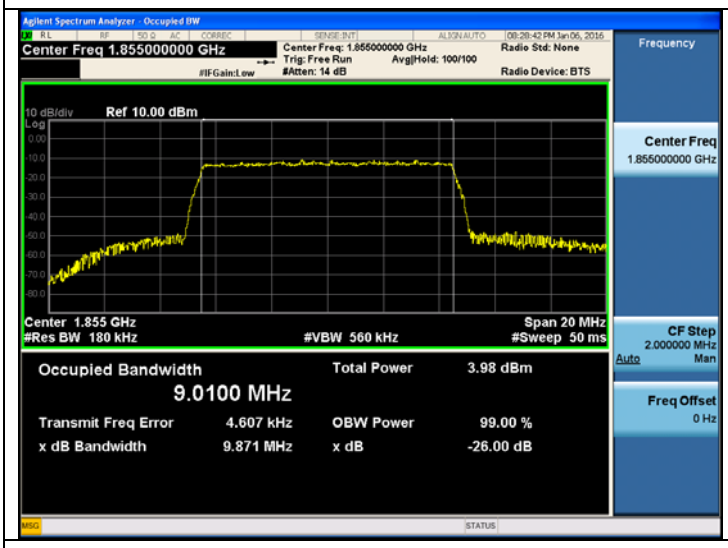



**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 5MHz High]**

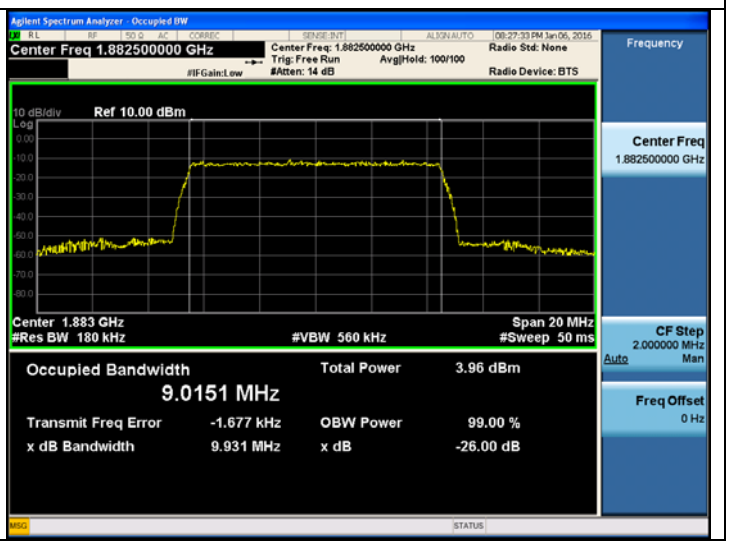


## PCS 1900_LTE 10MHz UL_Output

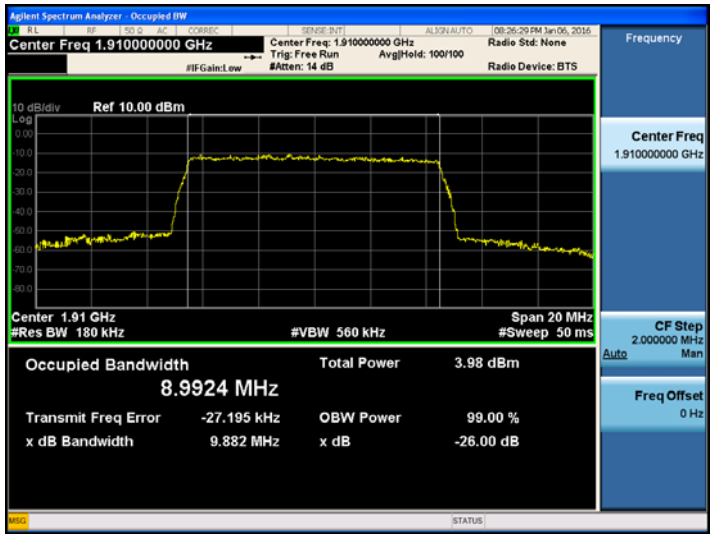
**[PCS1900 AGC threshold Uplink Output LTE10MHz Low]**



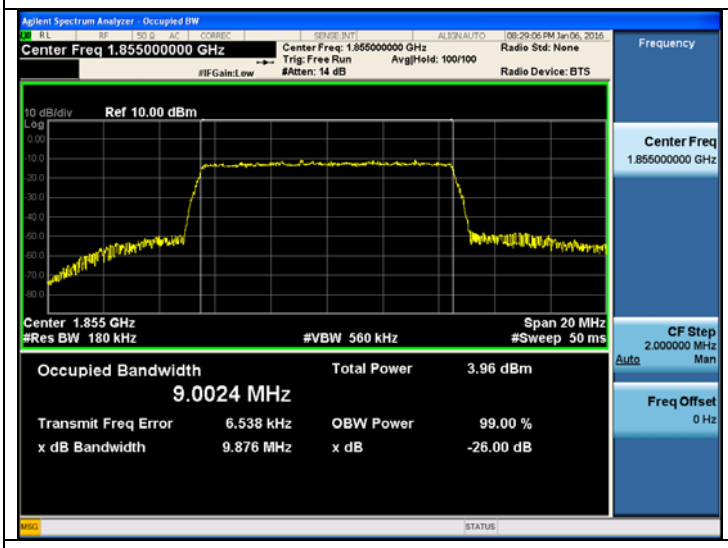

**[PCS1900 AGC threshold Uplink Output LTE10MHz Mid]**



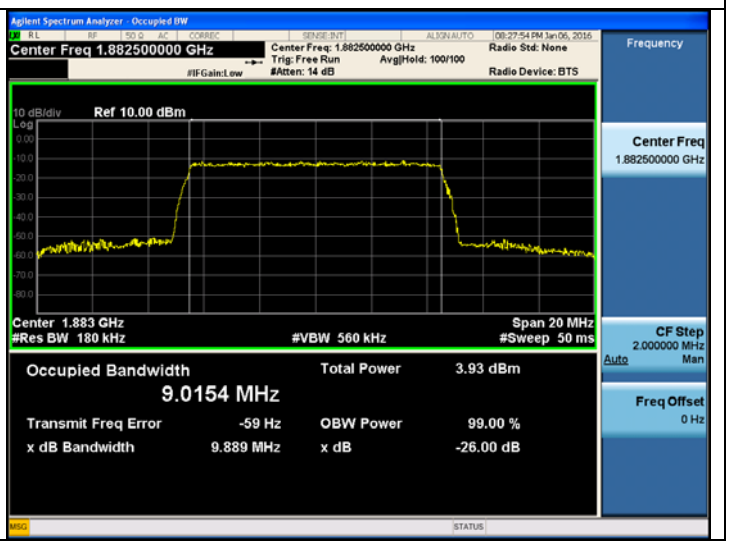

**[PCS1900 AGC threshold Uplink Output LTE10MHz High]**



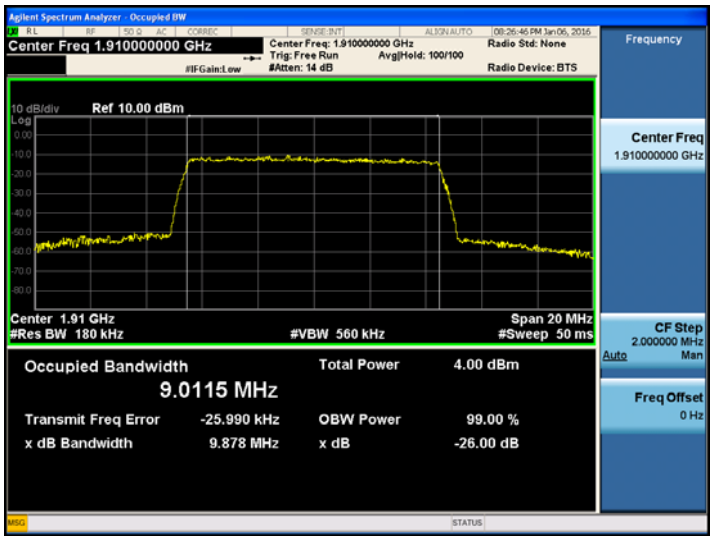
**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 10MHz Low]**




**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 10MHz Mid]**

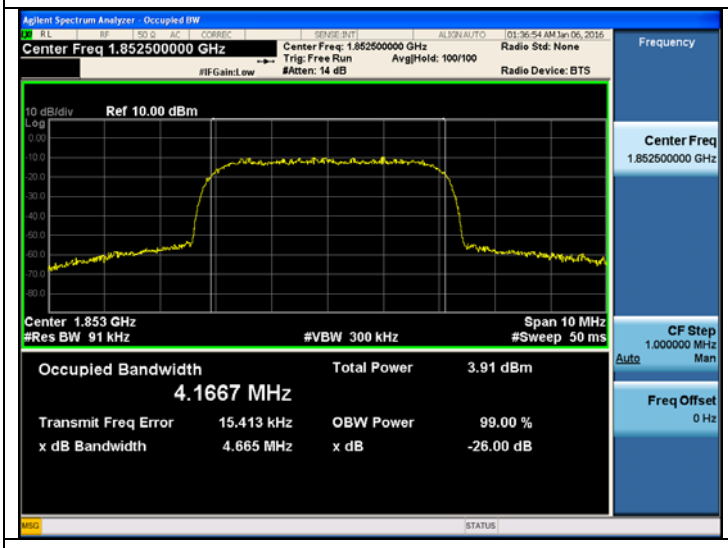



**[PCS1900 +3dBm above the AGC threshold Uplink Output LTE 10MHz High]**

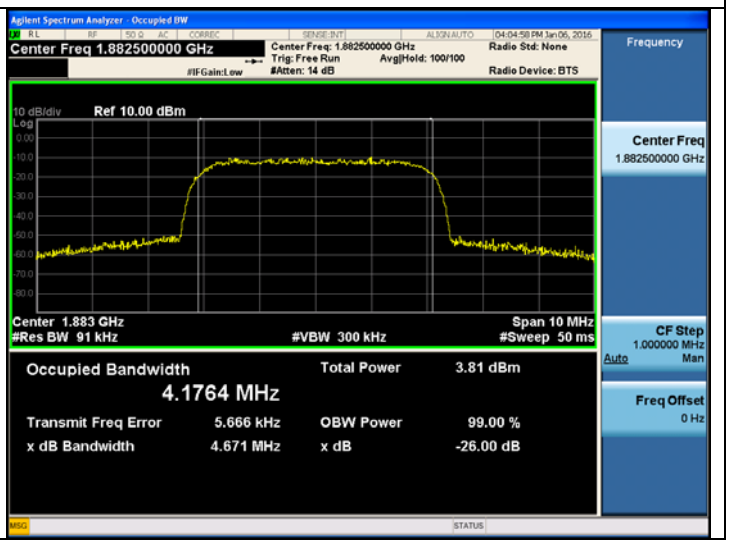


## PCS 1900_UMTS UL_Output

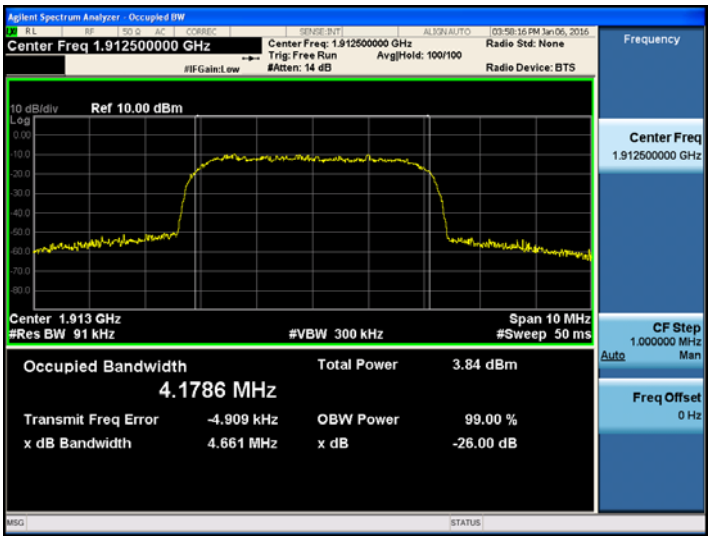
**[PCS1900 AGC threshold Uplink Output UMTS Low]**



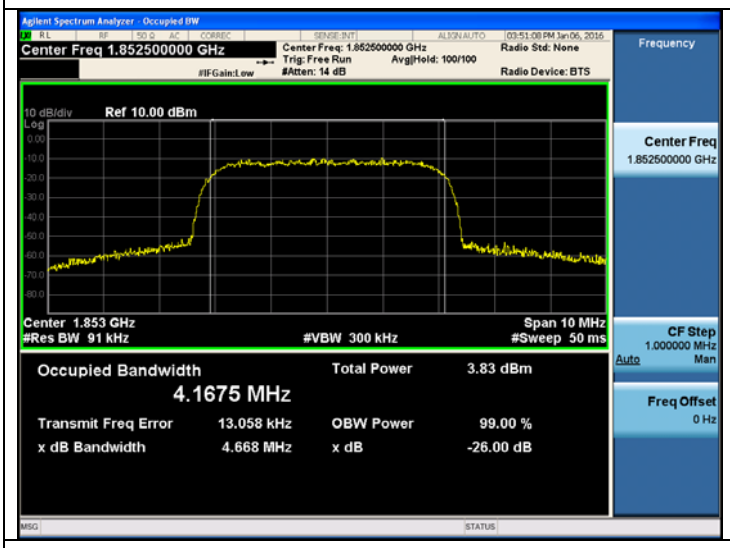

**[PCS1900 AGC threshold Uplink Output UMTS Mid]**



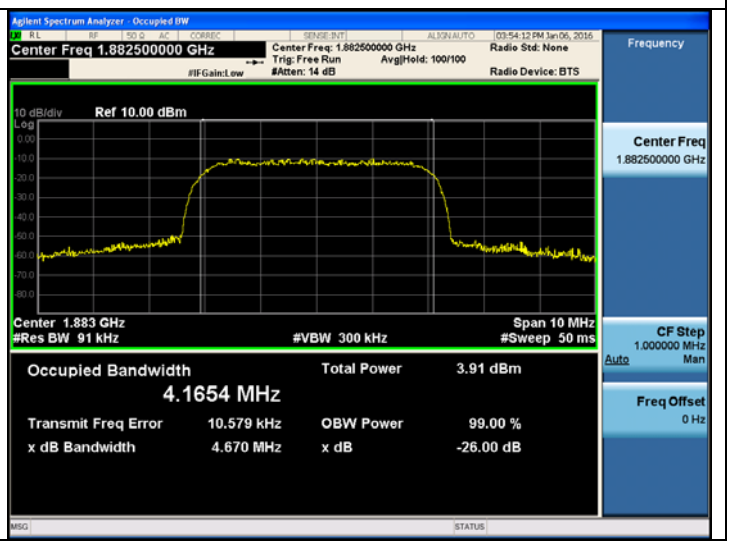

**[PCS1900 AGC threshold Uplink Output UMTS High]**



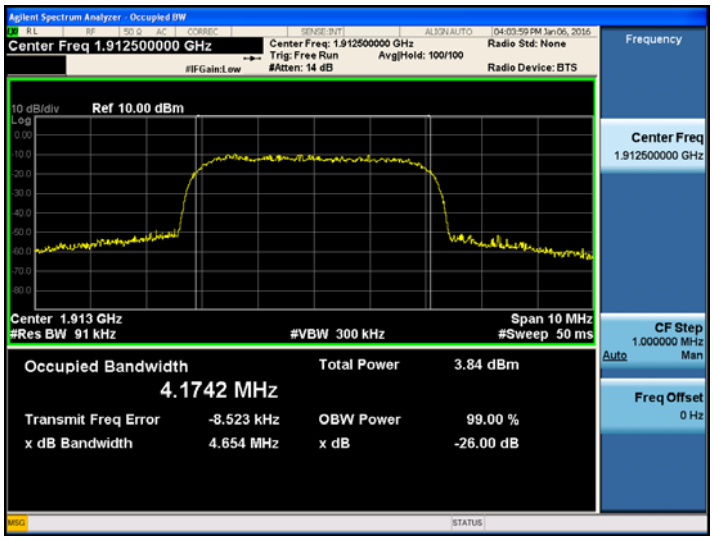
**[PCS1900 +3dBm above the AGC threshold Uplink Output UMTS Low]**




**[PCS1900 +3dBm above the AGC threshold Uplink Output UMTS Mid]**

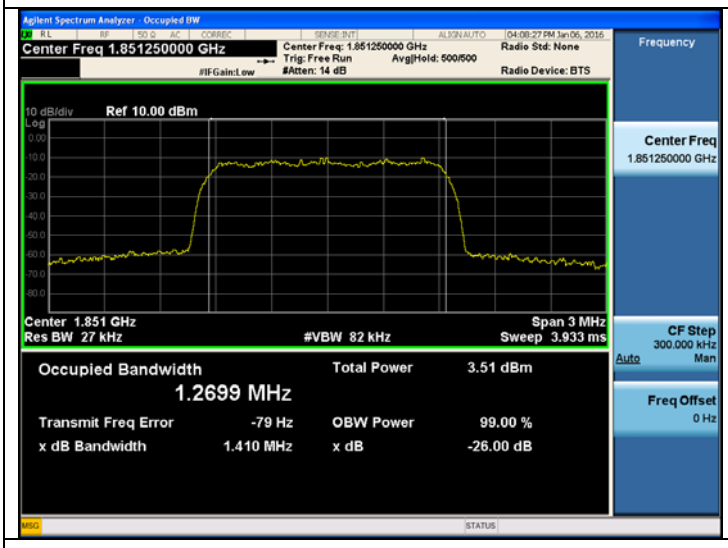



**[PCS1900 +3dBm above the AGC threshold Uplink Output UMTS High]**



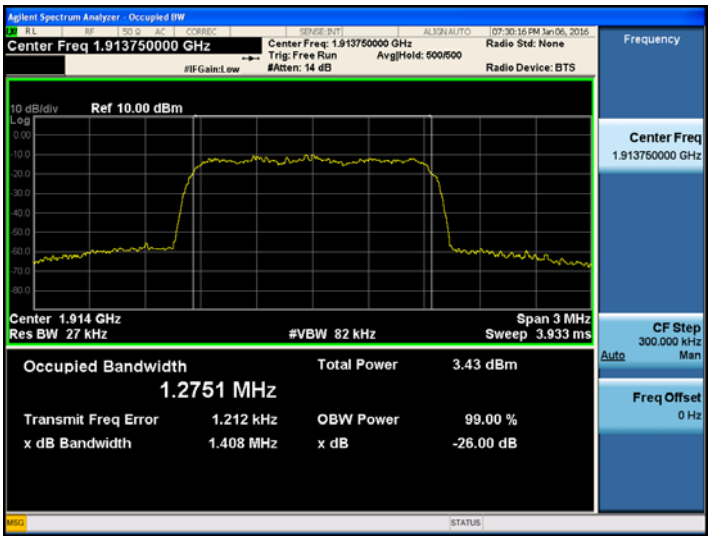
## PCS 1900_CDMA UL_Output

**[PCS1900 AGC threshold Uplink Output CDMA Low]**

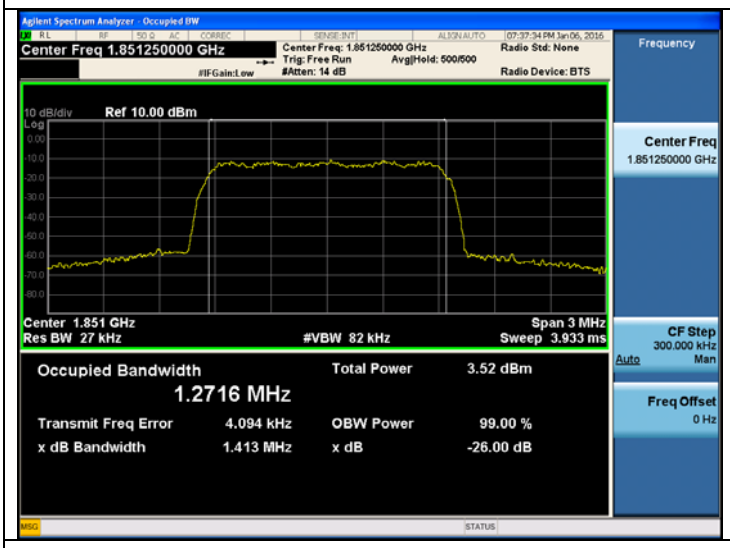



**[PCS1900 AGC threshold Uplink Output CDMA Mid]**

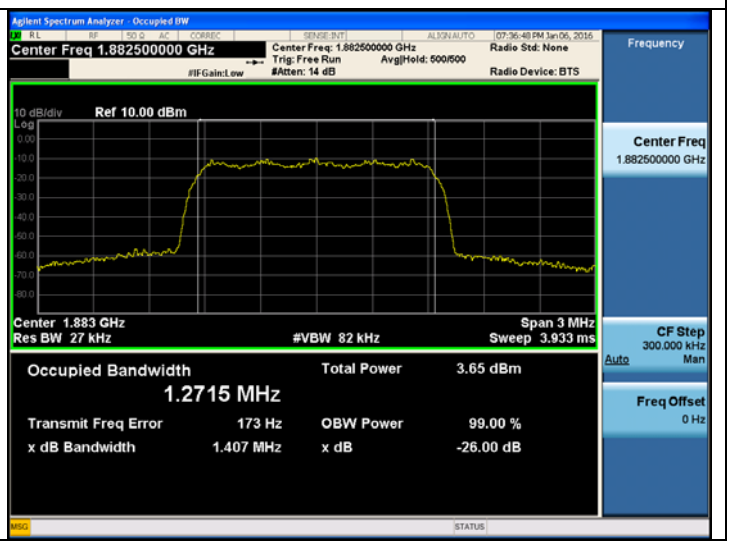

**[PCS1900 AGC threshold Uplink Output CDMA High]**



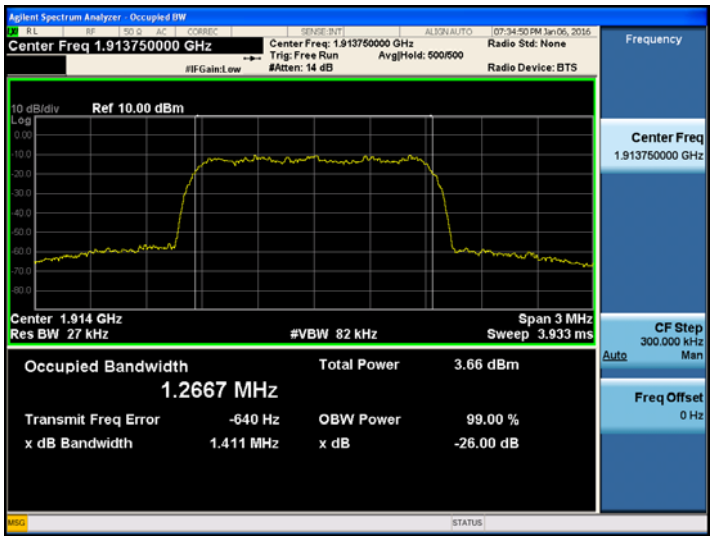
**[PCS1900 +3dBm above the AGC threshold Uplink Output CDMA Low]**




**[PCS1900 +3dBm above the AGC threshold Uplink Output CDMA Mid]**

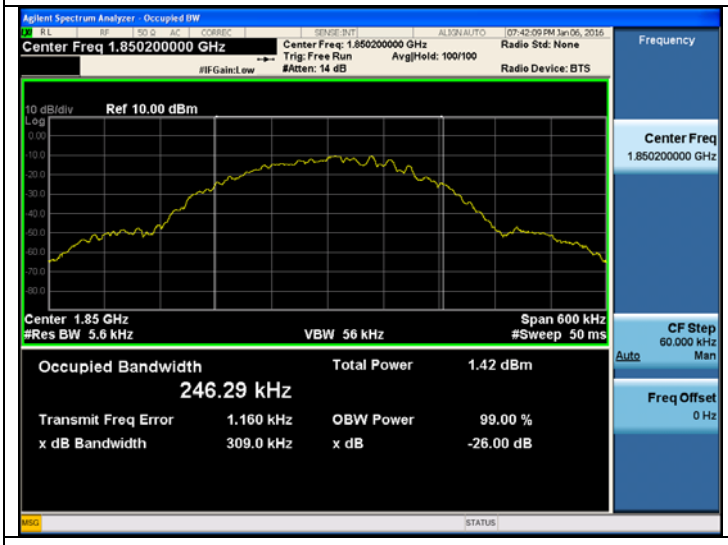



**[PCS1900 +3dBm above the AGC threshold Uplink Output CDMA High]**

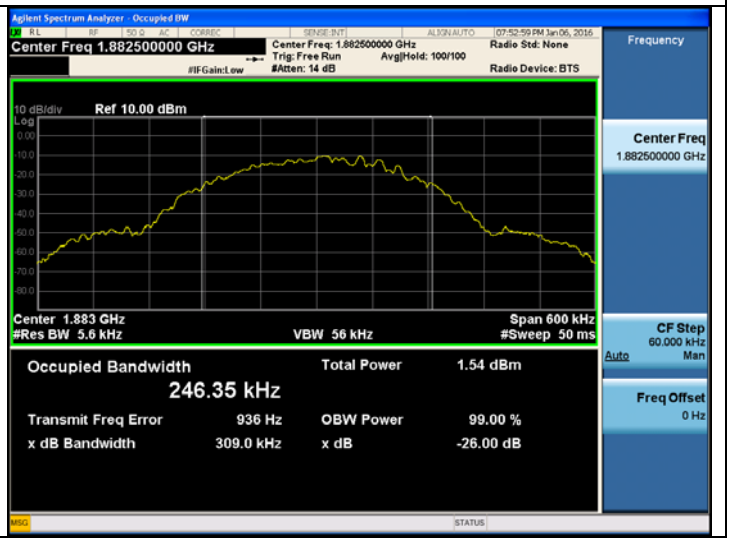


## PCS 1900_GSM UL_Output

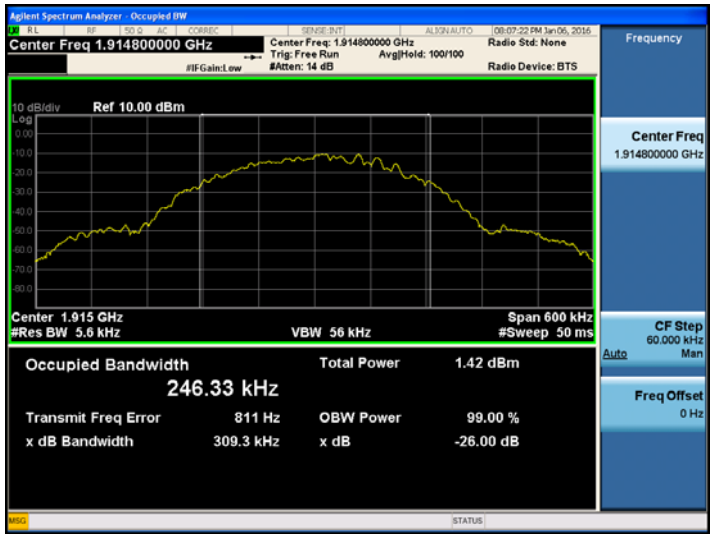
**[PCS1900 AGC threshold Uplink Output GSM Low]**



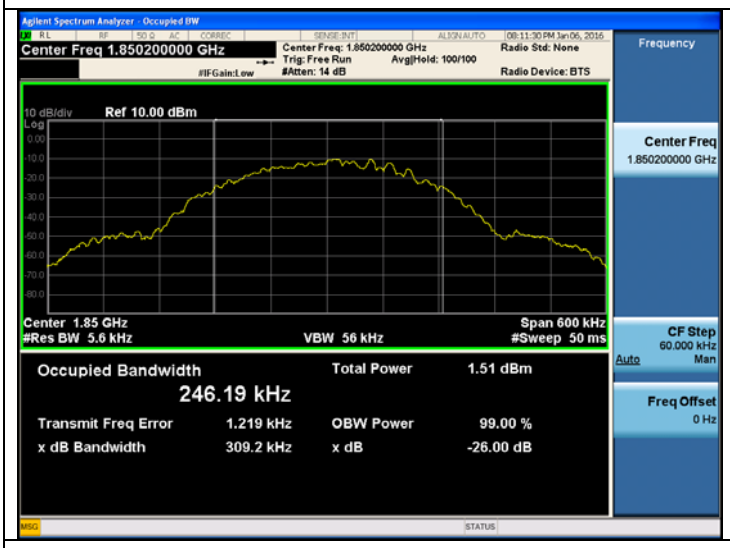

**[PCS1900 AGC threshold Uplink Output GSM Mid]**



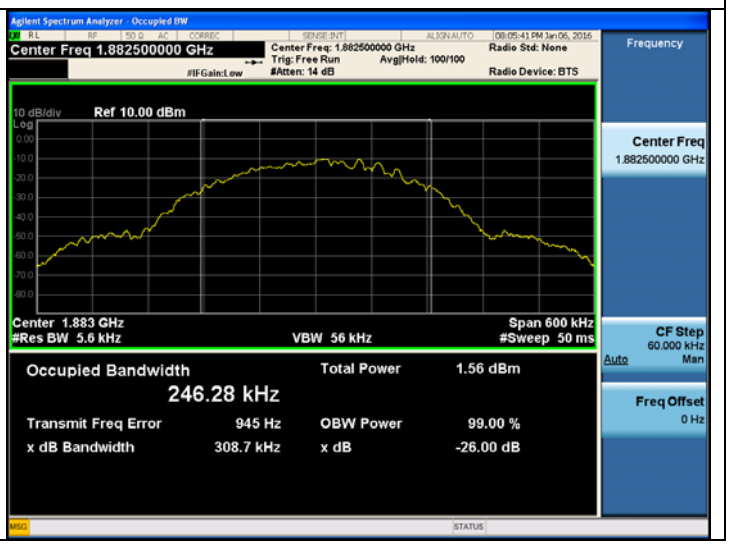

**[PCS1900 AGC threshold Uplink Output GSM High]**



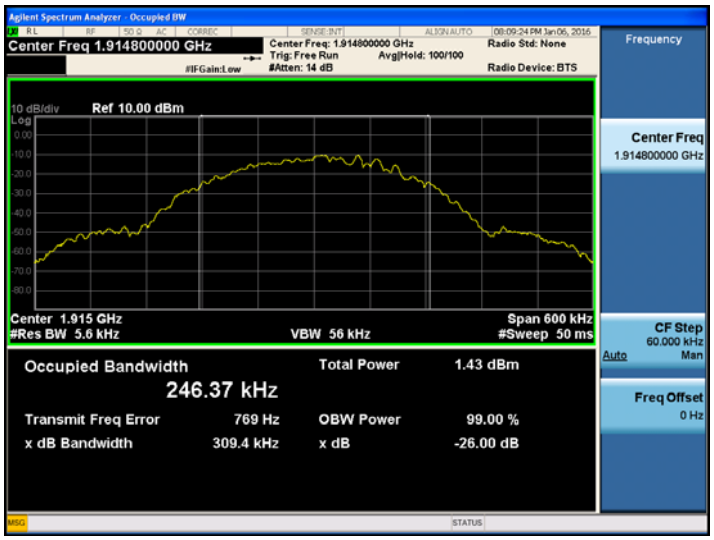
**[PCS1900 +3dBm above the AGC threshold Uplink Output GSM Low]**




**[PCS1900 +3dBm above the AGC threshold Uplink Output GSM Mid]**

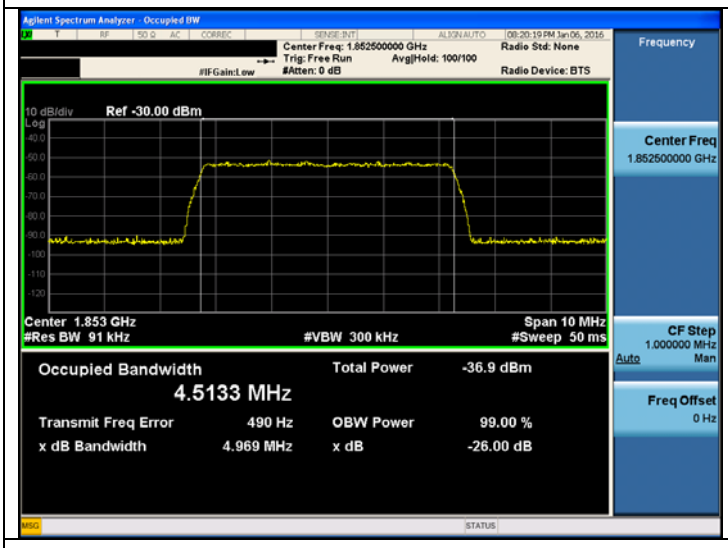



**[PCS1900 +3dBm above the AGC threshold Uplink Output GSM High]**

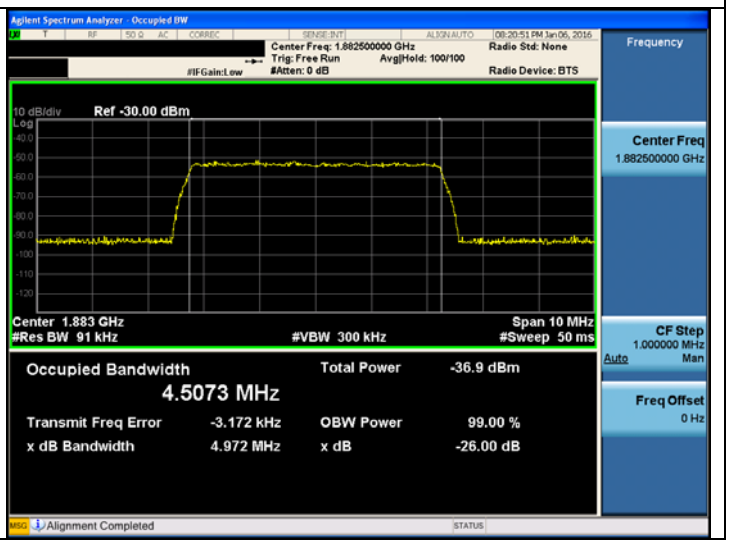


## PCS 1900_LTE 5MHz UL_Input

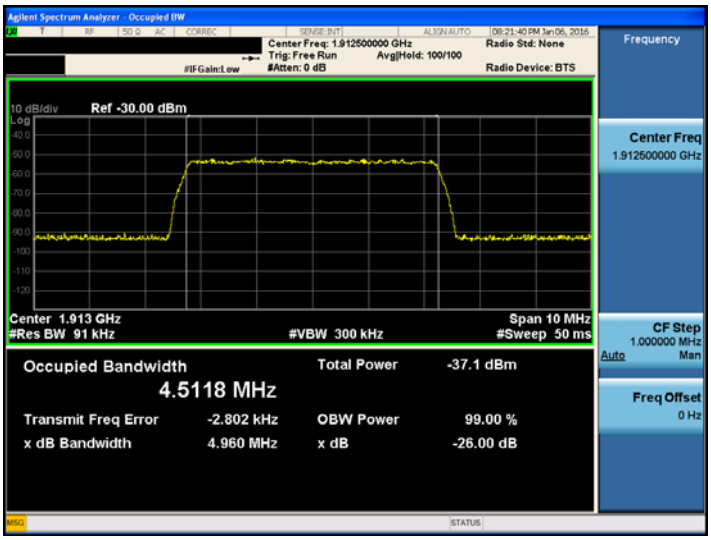
**[PCS1900 AGC threshold Uplink Input LTE5MHz Low]**




**[PCS1900 AGC threshold Uplink Input LTE5MHz Mid]**

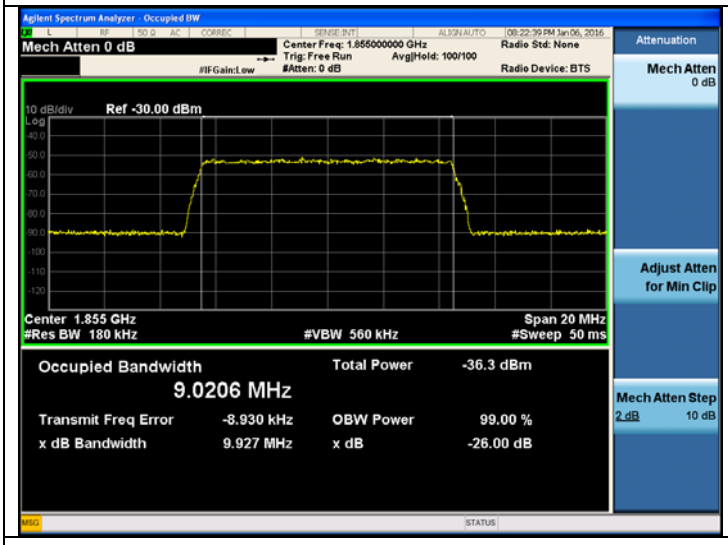



**[PCS1900 AGC threshold Uplink Input LTE5MHz High]**

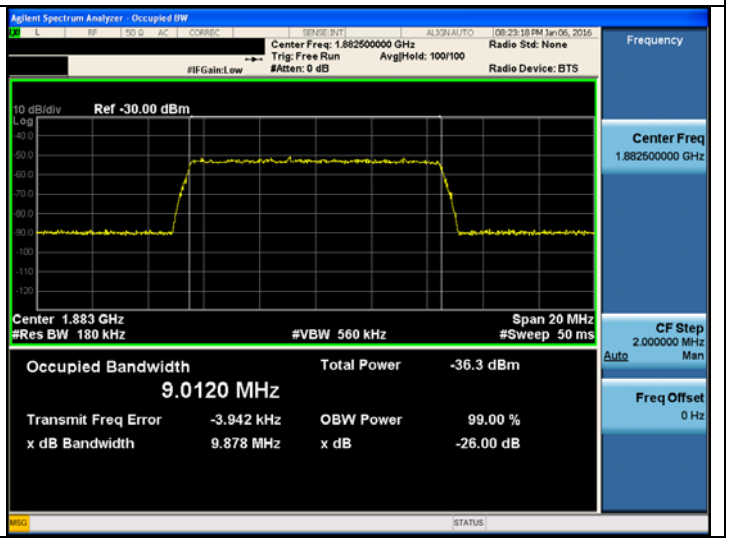


## PCS 1900_LTE 10MHz UL_Input

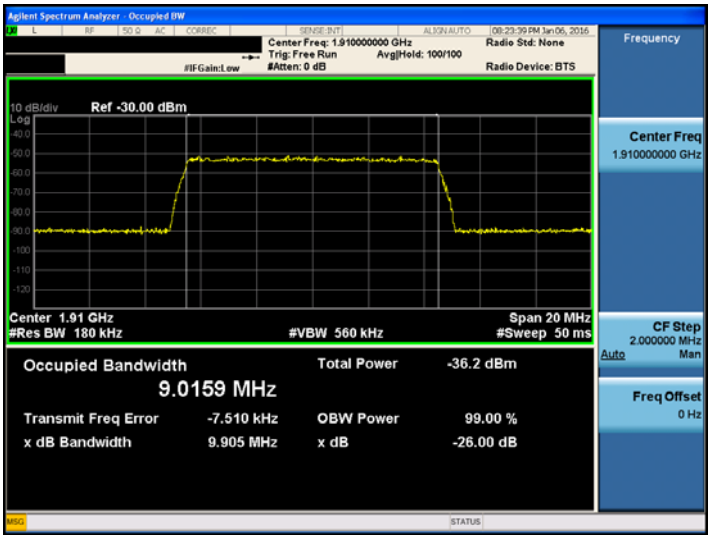
**[PCS1900 AGC threshold Uplink Input LTE10MHz Low]**




**[PCS1900 AGC threshold Uplink Output Input LTE10MHz Mid]**

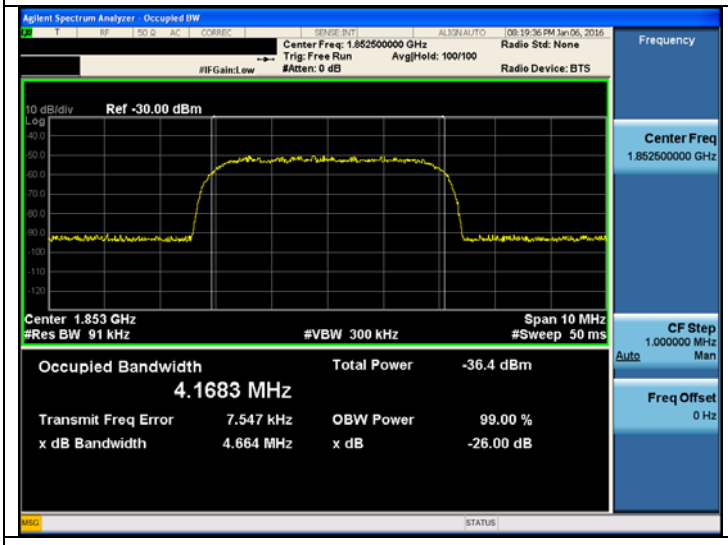



**[PCS1900 AGC threshold Uplink Input LTE10MHz High]**

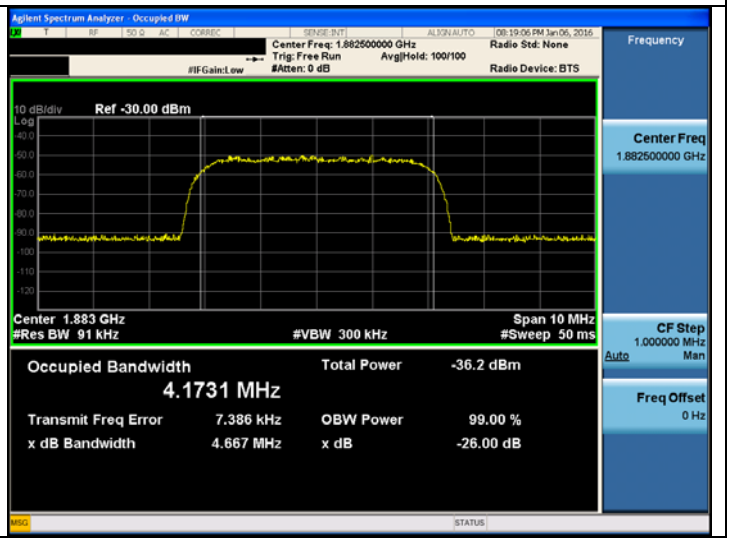


## PCS 1900_UMTS UL_Input

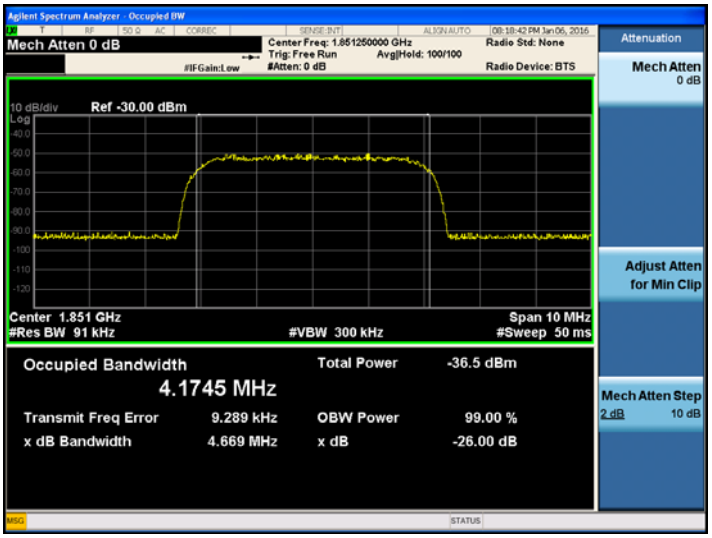
**[PCS1900 AGC threshold Uplink Input UMTS Low]**




**[PCS1900 AGC threshold Uplink Input UMTS Mid]**

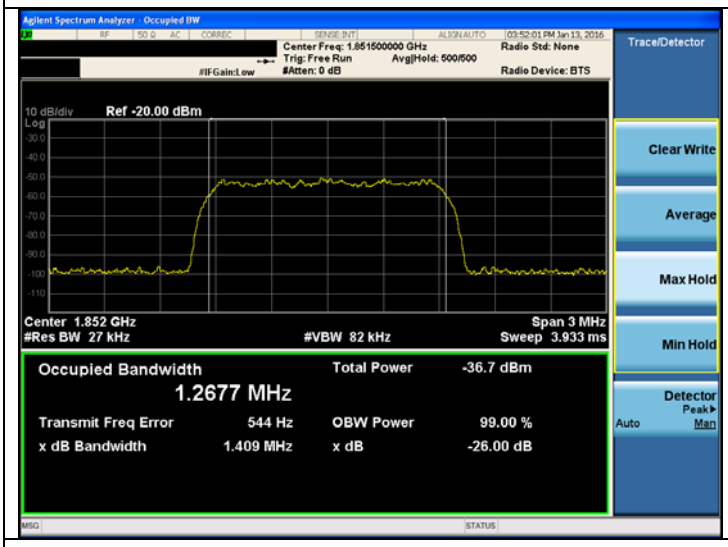



**[PCS1900 AGC threshold Uplink Input UMTS High]**



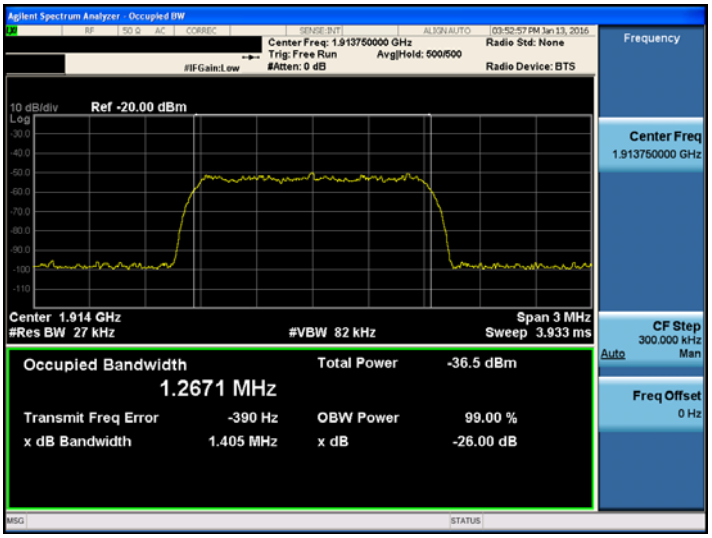
## PCS 1900_CDMA UL_Input

**[PCS1900 AGC threshold Uplink Input CDMA Low]**



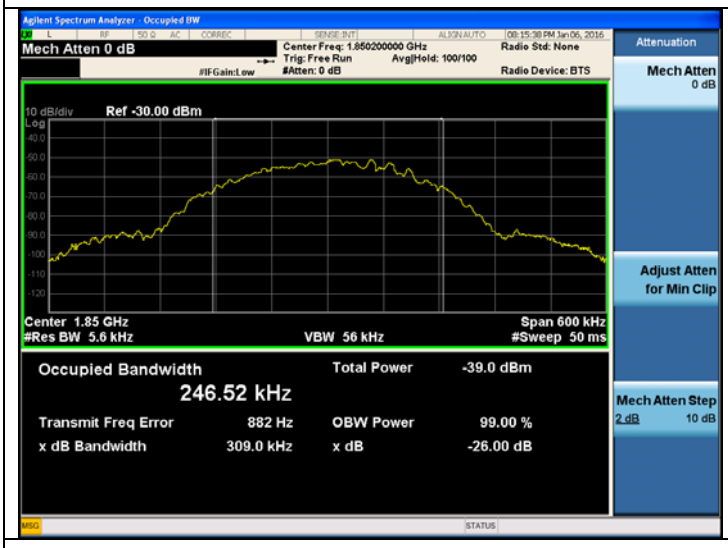

**[PCS1900 AGC threshold Uplink Input CDMA Mid]**


**[PCS1900 AGC threshold Uplink Input CDMA High]**

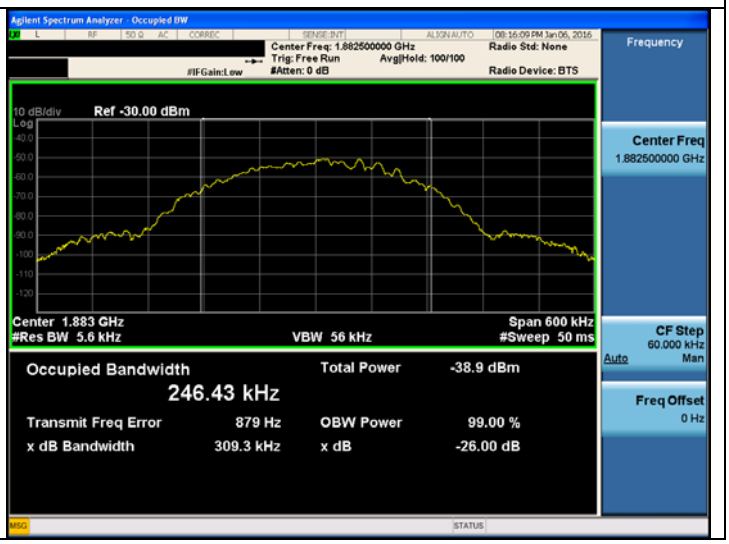


## PCS 1900_GSM UL_Input

**[PCS1900 AGC threshold Uplink Input GSM Low]**




**[PCS1900 AGC threshold Uplink Input GSM Mid]**




**[PCS1900 AGC threshold Uplink Input GSM High]**

# 8. OUT OF BAND REJECTION

**FCC Rules**

**Test Requirement(s): KDB 935210 D03 v02r01**

Out of Band Rejection – Test for rejection of out of band signals. Filter freq. response plots are acceptable.

**Test Procedures:** A modulated carrier generated by the signal generator carrier was connected to either the Downlink or Downlink RF port at a maximum level as determined by the spectrum analyzer was connected to either the Downlink or Downlink port depending on the circuitry being measured. Signal generator sweep from the frequency more lower than the operating frequency to the frequency more higher than it, find the product band filter characteristic

**Test Results:** The EUT complies with the requirements of this section.

| Input Signal | Input Level (dBm) | Maximum Amp Gain |
|---|---|---|
| PCS 1900 | UL : -45 dBm | UL : 40 dB |

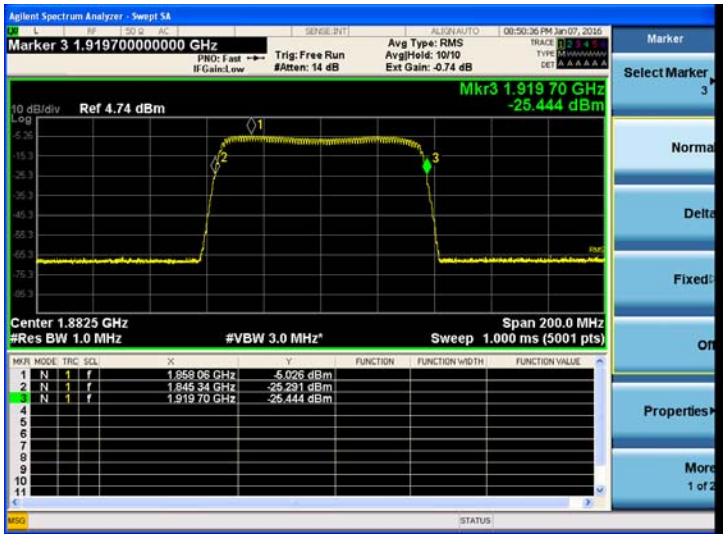
**PCS1900 Band**

**[Upnlink]**

| 20 dB point frequency (MHz) | Output power (dBm) | Gain (dB) |
|---|---|---|
| 1845.34~1919.70 | -5.03 | 39.97 |

## Plots of Passband Gain and Bandwidth & Out of Band Rejection

**[PCS1900 Band Band Uplink]**



# 9. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

**FCC Rules**

**Test Requirement(s):**

**§ 2.1051 Measurements required: Spurious emissions at antenna terminals:**

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

**§ 24.238 Emission limitations for Broadband PCS equipment.**

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Alternative out of band emission limit. Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas, in lieu of that set forth in this section, pursuant to a private contractual arrangement of all affected licensees and applicants. In this event, each party to such contract shall maintain a copy of the contract in their station files and disclose it to prospective assignees or transferees and, upon request, to the FCC.

(d) Interference caused by out of band emissions. If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

**Test Procedures:** Measurements were in accordance with the test methods section 3.5.2 of KDB 935210 D05 v01.

1. General

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle and high channels or frequencies within each authorized frequency band of operation.

Out-of-band/block emissions (including intermodulation products) shall be measured under each of the following two stimulus conditions:

a) two adjacent test signals sequentially tuned to the lower and upper frequency band/block edges;

b) a single test signal, sequentially tuned to the lowest and highest frequencies or channels within the frequency band/block under examination.

NOTE—Single channel boosters that cannot accommodate two simultaneous signals within the passband, can be excluded from the test stipulated in step a).

2. EUT out-of-band/block emissions conducted measurement

a) Connect a signal generator to the input of the EUT.

NOTE—If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support the two-tone test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block of interest.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168, but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the emission bandwidth, 100 kHz, or 1 MHz)

g) Set the VBW = 3 × RBW.

h) Set the detector to power averaging (rms) detector.

i) Set the Sweep time = auto-couple.

j) Set the analyzer start frequency to the upper block edge frequency and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz for frequencies below and above 1 GHz, respectively.

k) Trace average at least 100 traces in power averaging (i.e., rms) mode.

l) Use the marker function to find the maximum power level.

m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.

n) Repeat the procedure with the composite input power level set to 3 dB above the AGC threshold.

o) Reset the input signals frequencies to the lower edge of the frequency block or band under examination.

p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz, or 3 MHz (for frequencies below and above 1 GHz, respectively), and the stop frequency to the lower band or block edge frequency.

q) Repeat steps k) to n).

r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.

s) Repeat steps a) to r) with the narrowband test signal.

t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

3. EUT spurious emissions conducted measurement

a) Connect a signal generator to the input of the EUT.

b) Set the signal generator to produce the broadband test signal as previously described (e.g., 4.1 MHz OBW AWGN).

c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.

d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.

f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).

g) Set the VBW ≥ 3 × RBW.

h) Set the Sweep time = auto-couple.

i) 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—The number of measurement points in each sweep must be ≥ (2 × span/RBW)

which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (i.e., rms) mode.

l) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.

m) 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 (see §2.1057). Note that the number of measurement points in each sweep must be ≥ (2 × span/RBW) which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (i.e., rms) mode.

o) 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 plot for inclusion in the test report and provide tabular data, if required.

p) Repeat the procedure with the input test signals tuned to a middle band/block frequency/channel and then a high band/block frequency/channel.

q) Repeat entire procedure with the narrowband test signal.

r) Repeat for all authorized frequency bands/blocks used by the EUT.

**PCS 1900 band**

**[Uplink]**

Band Edge

| | Channel | Frequency (MHz) | Emission Level (dBm) |
|---|---|---|---|
| LTE 5 MHz | Low | 1852.50 | -68.39 |
| | High | 1912.50 | -67.19 |
| LTE 10 MHz | Low | 1855.00 | -68.75 |
| | High | 1910.00 | -68.07 |
| CDMA | Low | 1851.25 | -72.43 |
| | High | 1913.75 | -74.02 |
| GSM | Low | 1850.20 | -53.33 |
| | High | 1914.80 | -53.62 |
| UMTS | Low | 1852.50 | -68.09 |
| | High | 1912.50 | -67.76 |

Spurious emissions

| | Channel | Frequency (MHz) | Emission Level (dBm) |
|---|---|---|---|
| LTE 5 MHz | Low | 1852.50 | -54.21 |
| | Middle | 1882.50 | -55.66 |
| | High | 1912.50 | -54.56 |
| LTE 10 MHz | Low | 1855.00 | -54.96 |
| | Middle | 1882.50 | -55.18 |
| | High | 1910.00 | -54.25 |
| CDMA | Low | 1851.25 | -55.67 |
| | Middle | 1882.50 | -55.39 |
| | High | 1913.75 | -54.36 |
| GSM | Low | 1850.20 | -54.77 |
| | Middle | 1882.50 | -55.81 |
| | High | 1914.80 | -54.88 |
| UMTS | Low | 1852.50 | -54.22 |
| | Middle | 1882.50 | -55.19 |
| | High | 1912.50 | -55.24 |

**PCS 1900 band_MIMO**

**Note.** The Out-of-Band and Spurious Emission level were calculated, as described in FCC KDB 662911D01v02r01 section E)3)a)iii)

**[Uplink]**

Band Edge

| | Channel | Frequency (MHz) | Emission Level (dBm) |
|---|---|---|---|
| LTE 5 MHz | Low | 1852.50 | -65.38 |
| | ighH | 1912.50 | -64.18 |
| LTE 10 MHz | Low | 1855.00 | -65.74 |
| | High | 1910.00 | -65.06 |
| CDMA | Low | 1851.25 | -69.42 |
| | High | 1913.75 | -71.01 |
| GSM | Low | 1850.20 | -50.32 |
| | High | 1914.80 | -50.61 |
| UMTS | Low | 1852.50 | -65.08 |
| | High | 1912.50 | -64.75 |

Spurious emissions

| | Channel | Frequency (MHz) | Emission Level (dBm) |
|---|---|---|---|
| LTE 5 MHz | Low | 1852.50 | -51.20 |
| | Middle | 1882.50 | -52.65 |
| | High | 1912.50 | -51.55 |
| LTE 10 MHz | Low | 1855.00 | -51.95 |
| | Middle | 1882.50 | -52.17 |
| | High | 1910.00 | -51.24 |
| CDMA | Low | 1851.25 | -52.66 |
| | Middle | 1882.50 | -52.38 |
| | High | 1913.75 | -51.35 |
| GSM | Low | 1850.20 | -51.76 |
| | Middle | 1882.50 | -52.80 |
| | High | 1914.80 | -51.87 |
| UMTS | Low | 1852.50 | -51.21 |
| | Middle | 1882.50 | -52.18 |
| | High | 1912.50 | -52.23 |