HCT CO.,LTD
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FCC /ISED REPORT

Certification

Applicant Name:
SOLiD, Inc.

Address:
10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, South Korea

Date of Issue:
July 5, 2018
Location:
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
Report No.: HCT-RF-1806-FI009-R1

ISED Registration No.: 5944A-5

FCC ID:	**W6UHM80I85CR**
ISED:	**9354A-HM80I85CR**
APPLICANT:	**SOLiD, Inc.**

FCC/ ISED Model:	MRDU_800I_850C
EUT Type:	ALLIANCE_5W
Frequency Ranges:	862 ~ 894 MHz (Downlink)
Conducted Output Power:	5 W (37 dBm, Downlink)
Date of Test:	June 07, 2018 ~ June 28, 2018
FCC Rule Part(s):	CFR 47 Part 2, Part 22, Part 90
ISED Rules :	RSS-Gen (Issue 5, April 2018), RSS-119 (Issue 12, May 2015) RSS-131 (Issue 3, May 2017), RSS-132 (Issue 3, January 2013)

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from thisequipment 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 / ISED Rules under normal use and maintenance.

Report prepared by : Kyung Soo Kang
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1806-FI009	June 28, 2018	- First Approval Report
HCT-RF-1806-FI009-R1	July 5, 2018	- Added a note about the FCC rule part 90.691 on page 49.

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1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

Company Name	SOLiD, Inc.
Company Address	10, 9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, South Korea

1.2. PRODUCT INFORMATION

EUT Type	ALLIANCE_5W
FCC/ISED Model	MRDU_800I_850C
Power Supply	120VAC, 50Hz / DC -48V
Frequency Range	862 ~ 894 MHz (Downlink)
Tx Output Power	5 W (37 dBm, Downlink)
Supporting Technologies	800 IDEN: CDMA, LTE 5 MHz 850 CEL: CDMA, WCDMA, LTE 5 MHz, LTE 10 MHz
Antenna Specification	Manufacturer does not provide an antenna.

1.3. TEST INFORMATION

FCC Rule Parts	CFR 47 Part 2, Part 22, Part 90
ISED Rule Parts	RSS-Gen (Issue 5, April 2018), RSS-119 (Issue 12, May 2015) RSS-131 (Issue 3, May 2017), RSS-132 (Issue 3, January 2013)
Measurement standards	ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 935210 D05 v01r02, RSS-Gen, RSS-119, RSS-131, RSS-132
Place of Test	HCT CO., LTD. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA (ISED Registration Number : 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 :2014) 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 22, Part 90, RSS-Gen, RSS-119, RSS-131, RSS-132.

Description	Reference (FCC)	Reference (ISED)	Results
Conducted RF Output Power	§2.1046, §22.913 §90.635	RSS-119, Section 5.4 RSS-131, Section 6.2 RSS-132, Section 5.4	Compliant
Occupied Bandwidth	§2.1049	RSS-Gen, Section 6.7	Compliant
Input-versus-output Spectrum	-	RSS-131 Section 5.2.2	Compliant
Out of Band Rejection & Mean Output Power and Zone Enhancer Gain	KDB 935210 D05 v01r02	RSS-131, Section 5.2.1 RSS-131, Section 5.2.3	Compliant
Noise Figure	§90.219	RSS-131, Section 6.4	Compliant
Spurious Emissions at Antenna Terminals	§2.1051, §22.917 §90.691	RSS-131, Section 6.3 RSS-131, Section 6.5 RSS-132, Section 5.5	Compliant
Radiated Spurious Emissions	§2.1053, §22.917 §90.691	RSS-Gen, Section 7.3	Compliant
Frequency Stability	§2.1055, §22.355 §90.213	RSS-119, Section 5.3 RSS-131, Section 5.2.4 RSS-132, Section 5.3	Compliant

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.

* Note: This EUT is supported power supply both of AC and DC. Test results are only attached worst cases.
* The tests results in plots are already including the actual value of loss for the attenuator and cable combination. Please check correction factors below table.

▣ Correction Factor

Freq(MHz)	Factor(dB)
30	30.014
100	28.826
200	29.218
300	29.281
400	29.649
500	29.774
600	29.873
700	29.996
800	30.106
900	30.160
1000	30.273
2000	31.154
3000	31.848
4000	32.447
5000	33.233
6000	33.586
7000	34.840
8000	33.689
9000	34.850
10000	36.207
20000	44.684
26000	49.207

3.3. MAXIMUM MEASUREMENTUNCERTAINTY

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
Input-versus-output Spectrum		
Out of Band Rejection & Mean Output Power and Zone Enhancer Gain	Gain 20 dB bandwidth	± 0.89 dB ± 0.58 MHz
Noise Figure	-	± 0.89 dB
Spurious Emissions at Antenna Terminals	-	± 1.08 dB
Radiated Spurious Emissions	f ≤ 1 GHz f > 1 GHz	± 4.80 dB ± 6.07 dB
Frequency Stability	-	± 1.22 x 10^{-6}

3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

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

4. TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Agilent	N9020A / Spectrum Analyzer	09/15/2017	Annual	MY46471250
Agilent	N5128A / Signal Generator	03/05/2018	Annual	MY50141649
Agilent	N5128A / Signal Generator	02/17/2018	Annual	MY46240523
Weinschel	WA67-30-33/ Fixed Attenuator	09/14/2017	Annual	WA67-30-33-2
Agilent	11636A / Power Divider	08/01/2017	Annual	09109
KIKUSUI	CBL06185030 / DC Power Supply	02/27/2018	Annual	RE001149
DEAYOUNG ENT	DFSS60 / AC Power Supply	04/05/2018	Annual	1003030-1
NANGYEUL CO., LTD.	NY-THR18750 / Temperature and Humidity Chamber	10/21/2017	Annual	NY-2009012201A
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	04/19/2017	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	04/06/2017	Biennial	760
Schwarzbeck	BBHA 9120D / Horn Antenna	06/30/2017	Biennial	9120D-1300
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	04/25/2017	Biennial	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	09/21/2017	Annual	836650/016
Wainwright Instruments	WHKX10-900-1000-15000-40SS	07/21/2017	Annual	5
Wainwright Instruments	WHKX10-2700-3000-18000-40SS / High Pass Filter	08/01/2017	Annual	4
CERNEX	CBLU1183540 / Power Amplifier	01/03/2018	Annual	24613
CERNEX	CBL06185030 / Power Amplifier	01/03/2018	Annual	24615
CERNEX	CBL18265035 / Power Amplifier	01/10/2018	Annual	22966

5. RF OUTPUT POWER

FCC Rules

Test Requirements:

§ 2.1046 Measurements required: RF power output:

(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.

(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.

(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.

§22.913 Effective radiated power limits.

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. See also §22.169.

(a) *Maximum ERP*. The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(1) Except as described in paragraphs (a)(2), (3), and (4) of this section, the ERP of base stations and repeaters must not exceed—

(i) 500 watts per emission; or

(ii) 400 watts/MHz (PSD) per sector.

(d) Power measurement. Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB. Power measurements for base transmitters and repeaters must be made in accordance with either of the following:

(1) A Commission-approved average power technique (see FCC Laboratory's Knowledge Database); or

(2) For purposes of this section, peak transmit power must be measured over an interval of

continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

§90.635 Limitations on power and antenna height

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

Table—Equivalent Power and Antenna Heights for Base Stations in the 851-869 MHz and 935-940 MHz Bands Which Have a Requirement for a 32 km (20 mi) Service Area Radius

Antenna height (ATT) meters (feet)	Effective radiated power (watts)
Above 1,372 (4,500)	65
Above 1,220 (4,000) to 1,372 (4,500)	70
Above 1,067 (3,500) to 1,220 (4,000)	75
Above 915 (3,000) to 1,067 (3,500)	100
Above 763 (2,500) to 915 (3,000)	140
Above 610 (2,000) to 763 (2,500)	200
Above 458 (1,500) to 610 (2,000)	350
Above 305 (1,000) to 458 (1,500)	600
Up to 305 (1,000)	1,000

ISED Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.4 Transmitter Output Power

The output power shall be within ±1 dB of the manufacturer’s rated power listed in the equipment specifications.

The transmitter output power limits set forth in Table 2 will come into force upon the publication of Issue 12 of this standard and will apply to newly certified equipment.

Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
27.41-28 and 29.7-50	300	30
72-76	No limit	1
138-174	110	60
217-218 and 219-220	110	30
220-222	See SRSP-512 for ERP limit	50
406.1-430 and 450-470	110	60
768-776 and 798-806	See SRSP-511 for ERP limit	30 3 W ERP for portable equipment
806-821/851-866 and 821-824/866-869	110	30
896-901/935-940	110	60
929-930/931-932	110	30
928-929/952-953 and 932-932.5/941-941.5	110	30
932.5-935/941.5-944	110	30

RSS-131

6. Equipment standard specifications for zone enhancers working with equipment certified under RSS-119

6.2 Output power

The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used (as specified in RSS-119) and shall be within ± 1.0 dB of the zone enhancer manufacturer's rated output power.

RSS-132

5. Transmitter Standard Specifications

5.4 Transmitter Output Power and Equivalent Isotropically Radiated Power

The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base station e.i.r.p. limits.

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

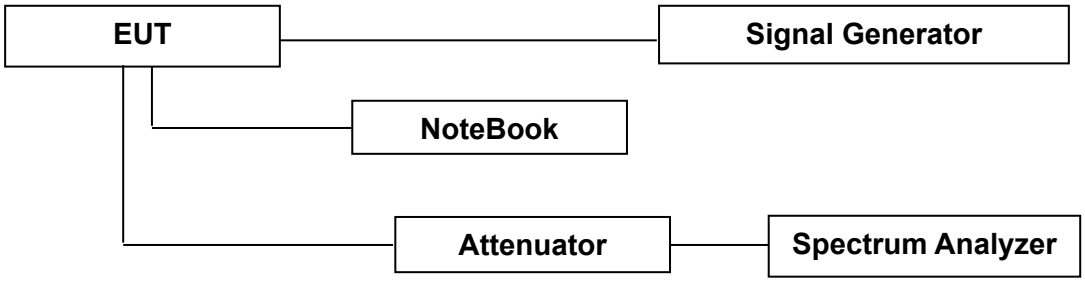
Test Procedures:

Measurements were in accordance with the test methods section 3.5.2 of KDB 935210 D05 v01r02.

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 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 and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.
g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.
h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.
i) Repeat steps e) to h) with the narrowband test signal.
j) Repeat steps e) to i) 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 D01 v03r01.



Block Diagram 1. RF Power Output Test Setup

Test Results:

Input Signal	Input Level	Maximum Amp Gain
800 IDEN 850 CEL	-20 dBm	57 dB

*Note: Due to EUT's ALC function (Auto Level Control), even if input signal is increased, the same output power is transmit.

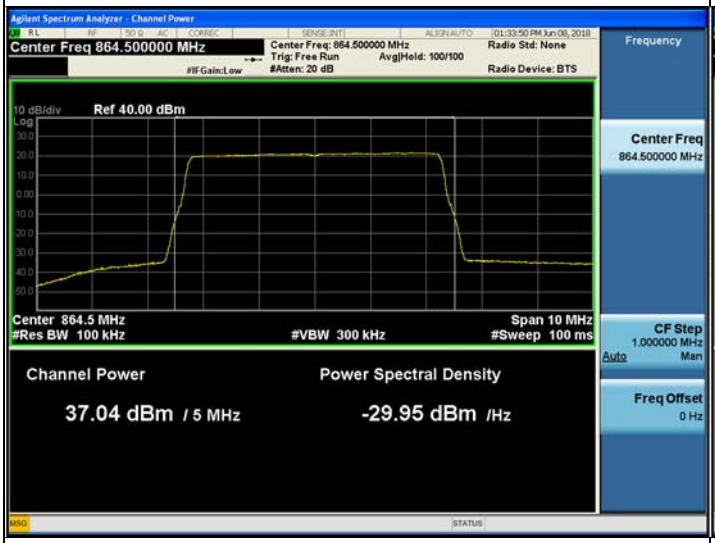
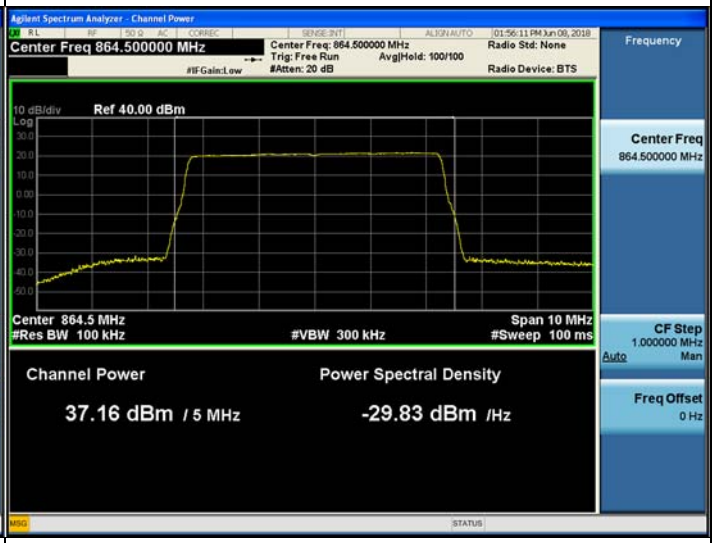
[Downlink_800 IDEN]

800 IDEN Band	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
LTE 5 MHz AGC threshold	Low	864.50	37.04	5.058
	High	866.50	36.70	4.677
LTE 5 MHz +3dBm above the AGC threshold	Low	864.50	37.16	5.200
	High	866.50	36.81	4.797
CDMA AGC threshold	Low	863.25	36.90	4.898
	Middle	865.50	37.15	5.188
	High	867.75	37.04	5.058
CDMA +3dBm above the AGC threshold	Low	863.25	36.99	5.000
	Middle	865.50	37.24	5.297
	High	867.75	37.08	5.105

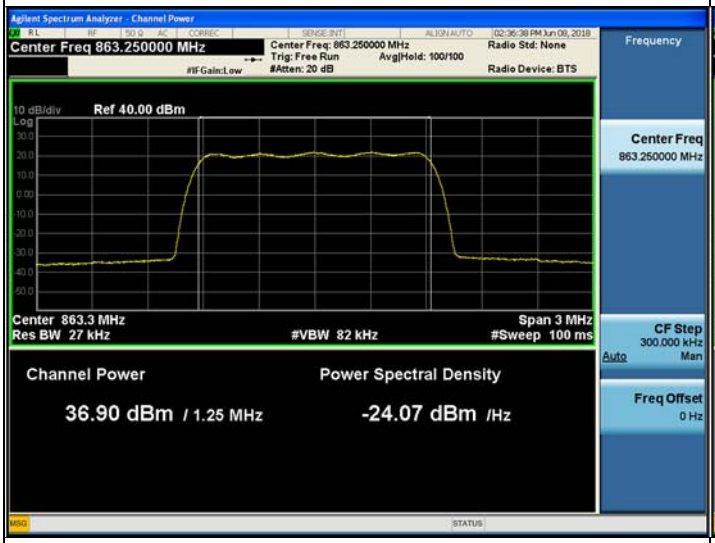
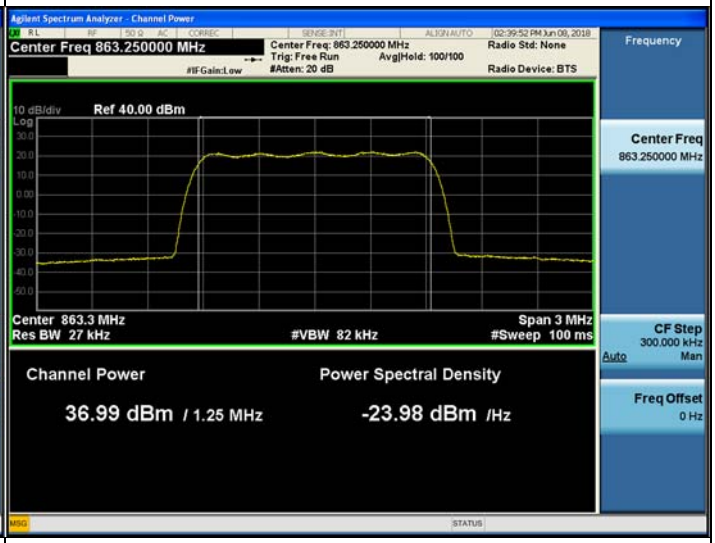
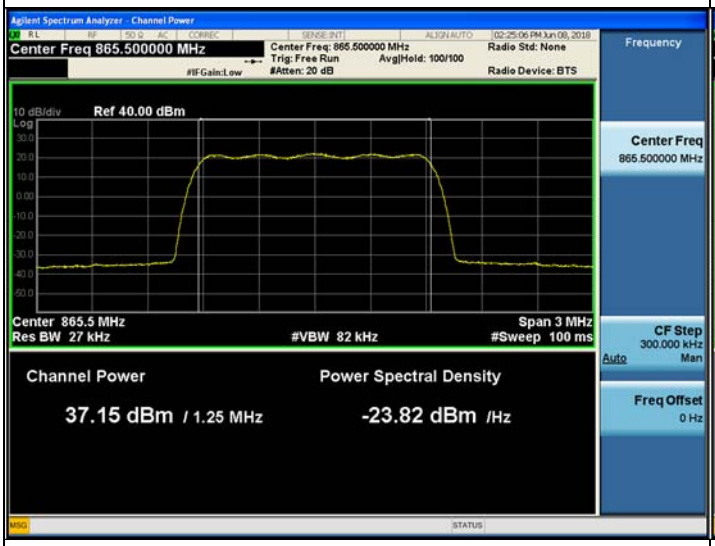
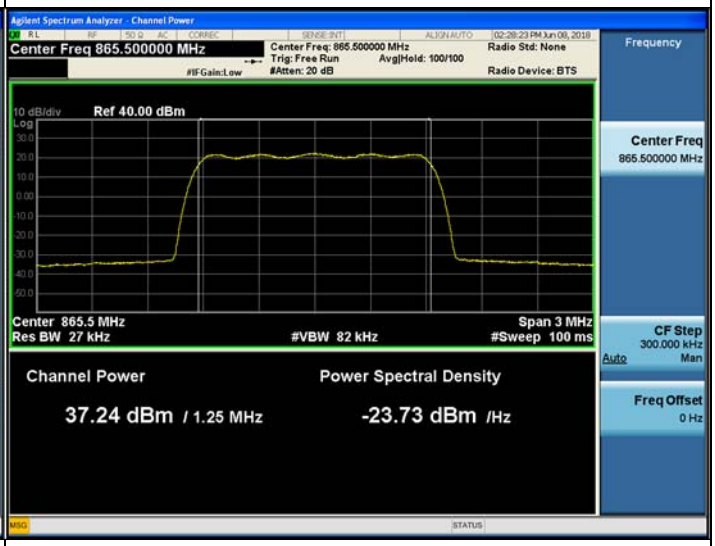
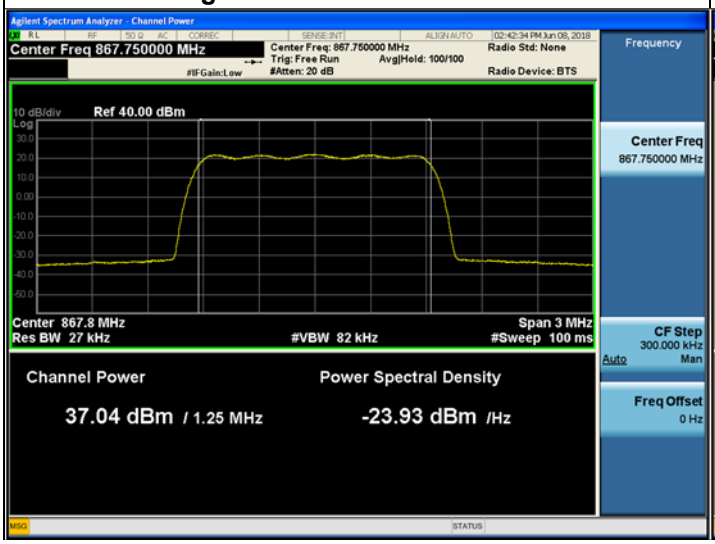
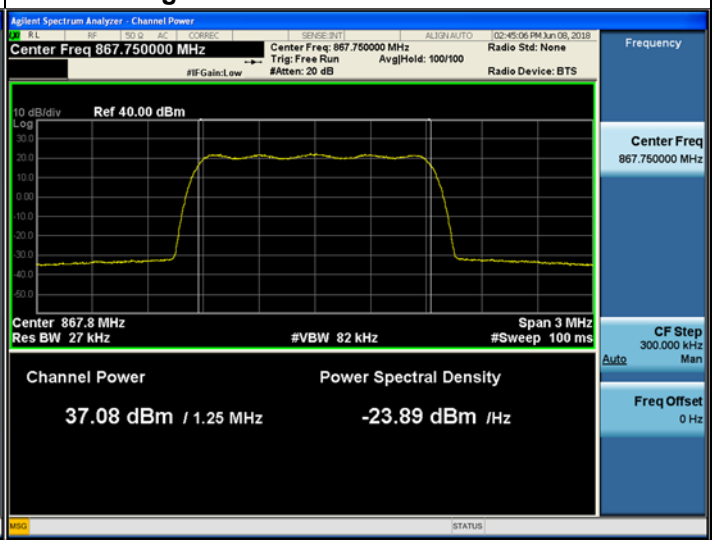
[Downlink_850 CEL]

850 CEL Band	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
LTE 5 MHz AGC threshold	Low	871.50	36.83	4.819
	Middle	881.50	37.12	5.152
	High	891.50	37.08	5.105
LTE 5 MHz +3dBm above the AGC threshold	Low	871.50	36.78	4.764
	Middle	881.50	36.99	5.000
	High	891.50	37.20	5.248
LTE 10 MHz AGC threshold	Low	874.00	36.80	4.786
	Middle	881.50	37.06	5.082
	High	889.00	37.03	5.047
LTE 10 MHz +3dBm above the AGC threshold	Low	874.00	36.85	4.842
	Middle	881.50	37.12	5.152
	High	889.00	37.12	5.152
WCDMA AGC threshold	Low	871.50	37.18	5.224
	Middle	881.50	36.83	4.819
	High	891.50	37.15	5.188
WCDMA +3dBm above the AGC threshold	Low	871.50	37.53	5.662
	Middle	881.50	36.92	4.920
	High	891.50	37.28	5.346
CDMA AGC threshold	Low	870.25	36.97	4.977
	Middle	881.50	36.96	4.966
	High	892.75	37.26	5.321
CDMA +3dBm above the AGC threshold	Low	870.25	37.16	5.200
	Middle	881.50	37.14	5.176
	High	892.75	37.12	5.152

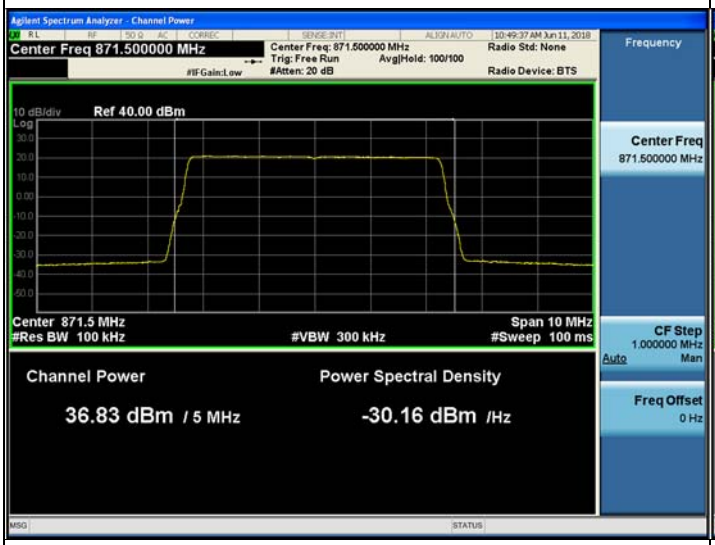
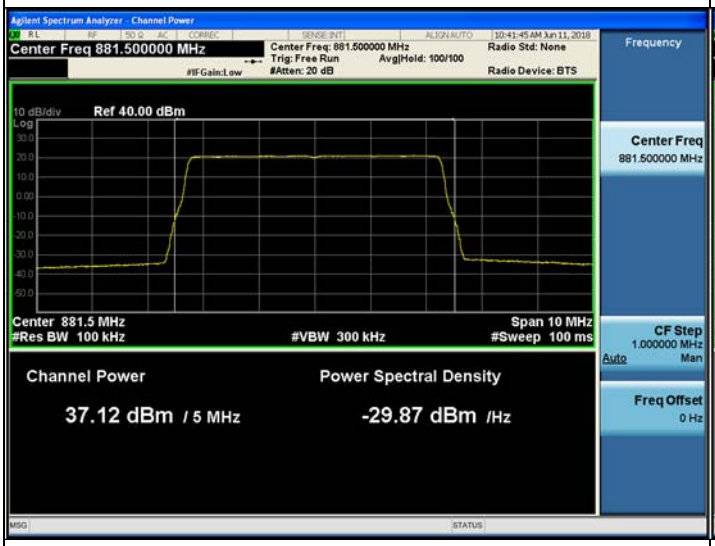
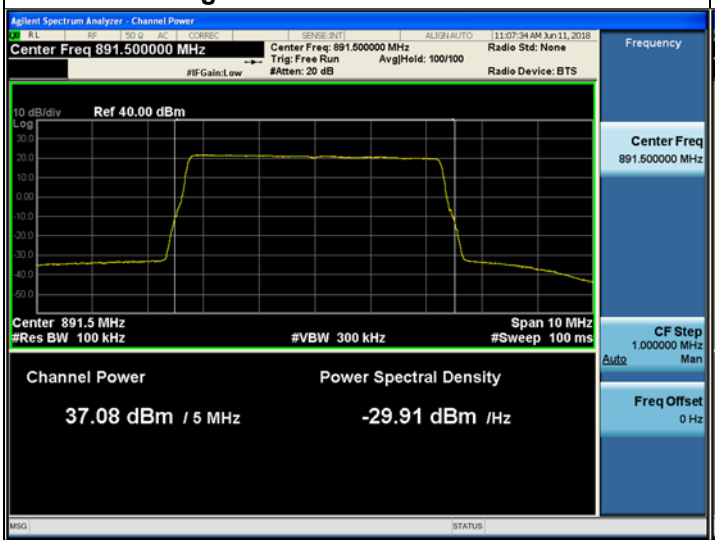
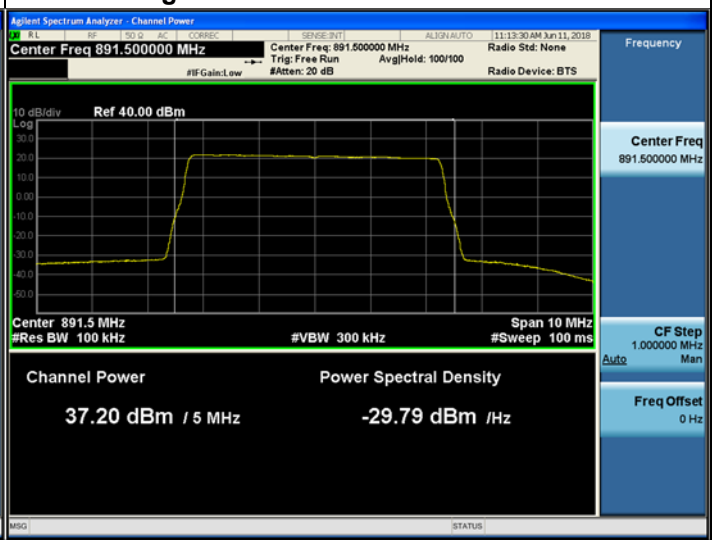
Plots of RF Output Power for LTE 5 MHz_800 IDEN Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

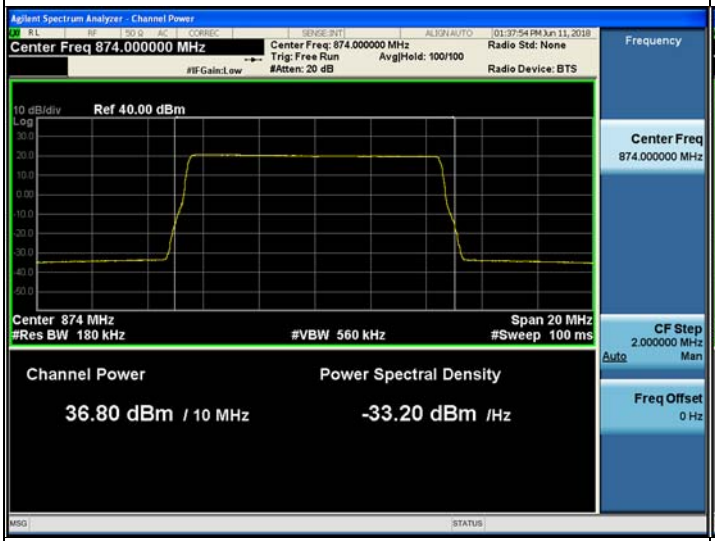
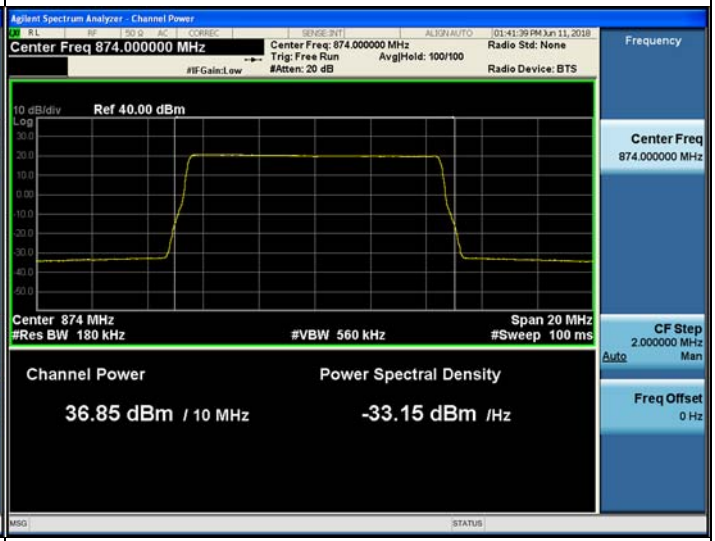
Plots of RF Output Power for CDMA_800 IDEN Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of RF Output Power for LTE 5 MHz_850 CEL Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of RF Output Power for LTE 10 MHz_850 CEL Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
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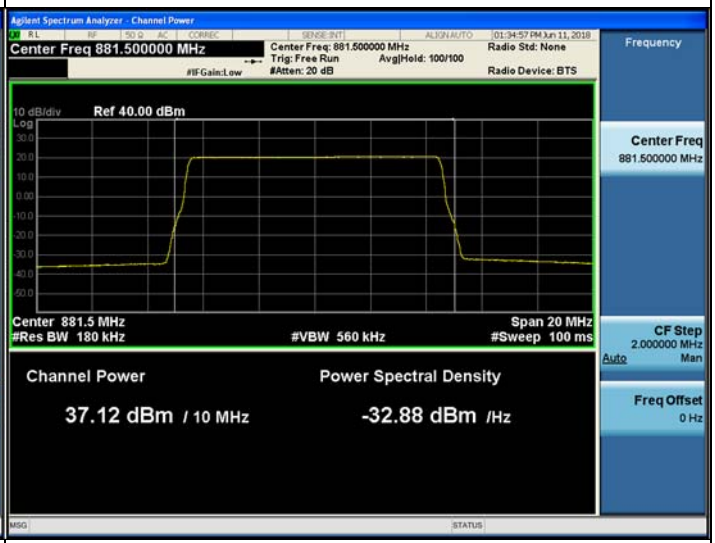
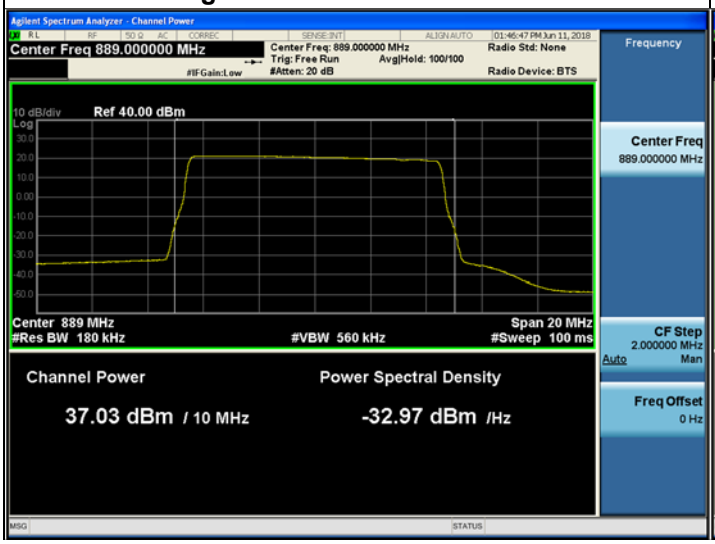
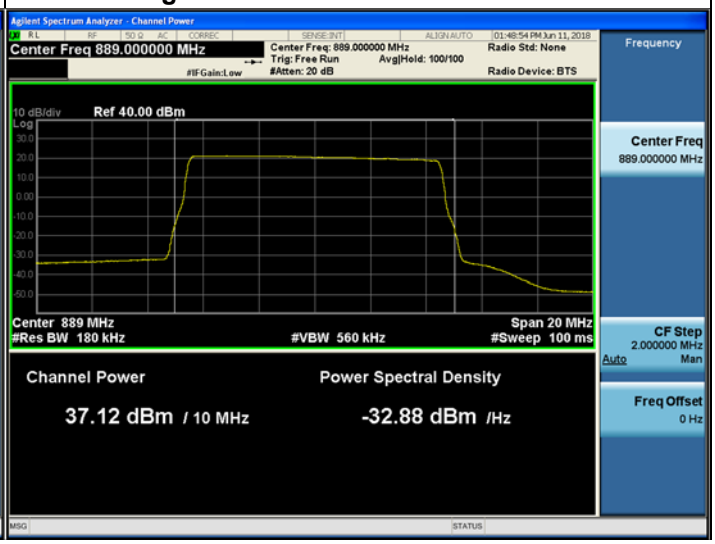
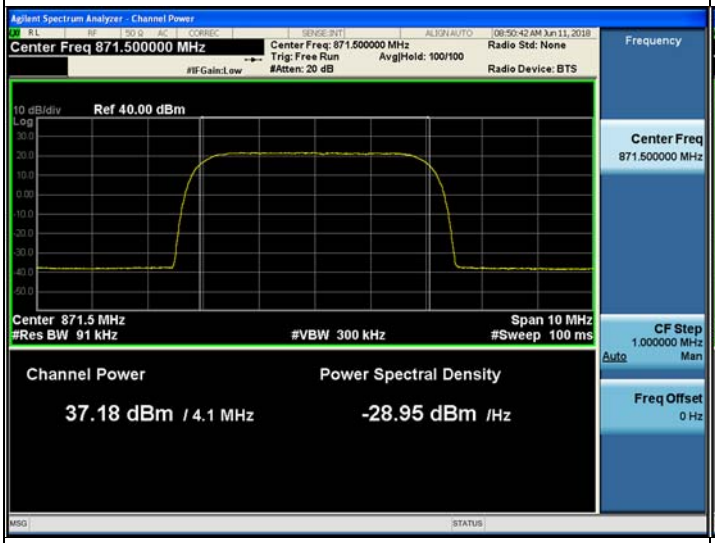
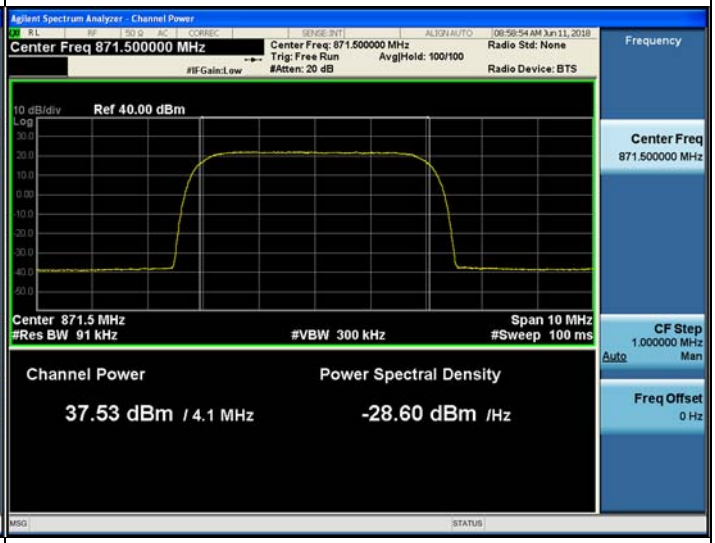
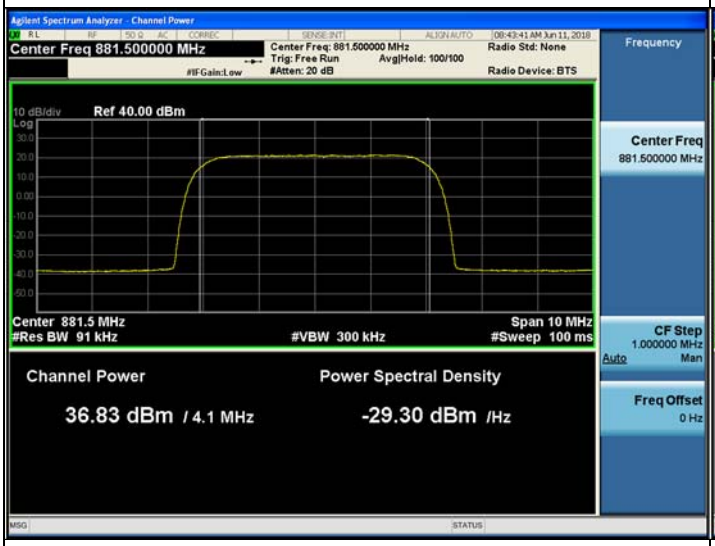
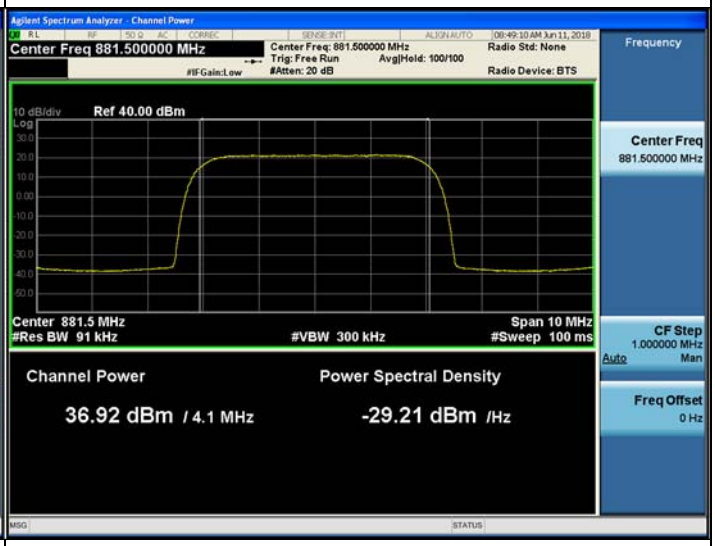
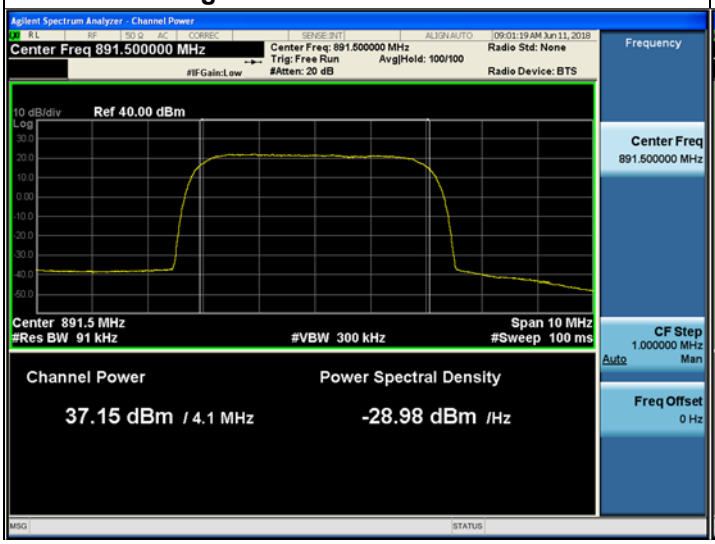
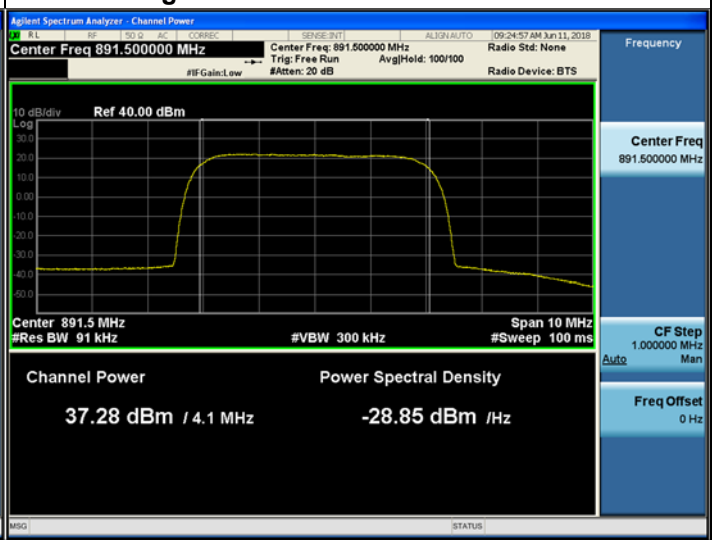
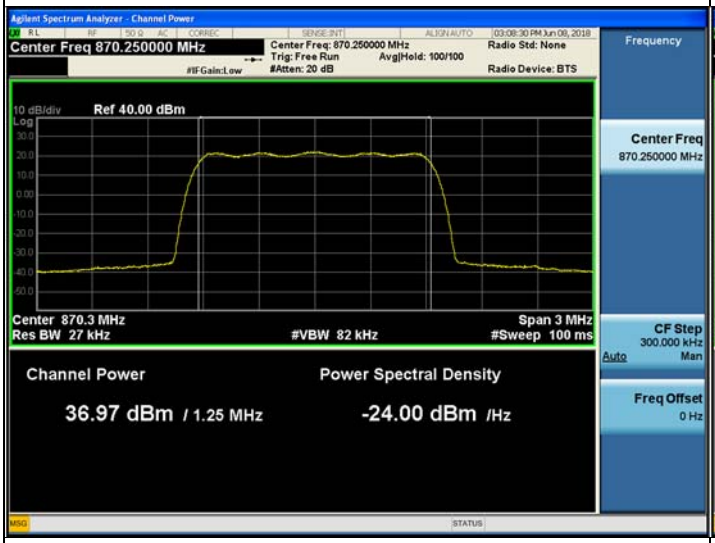
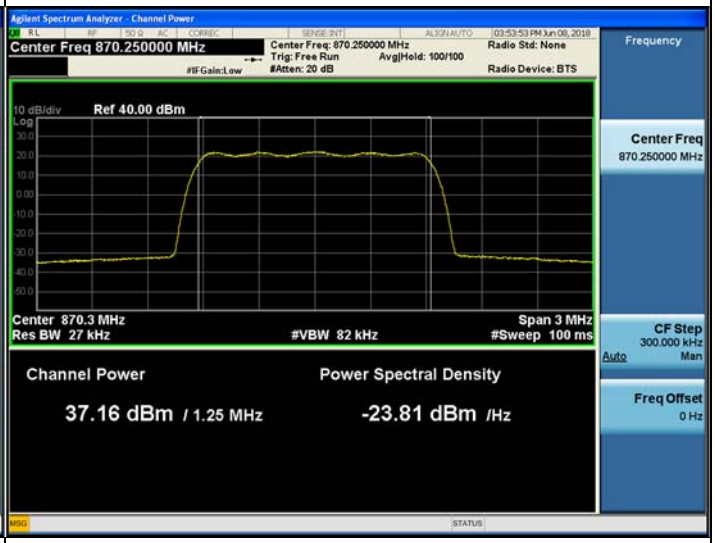
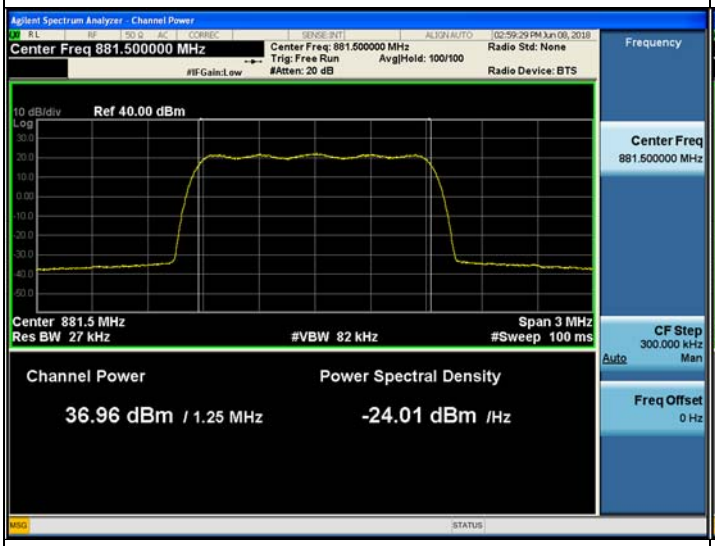
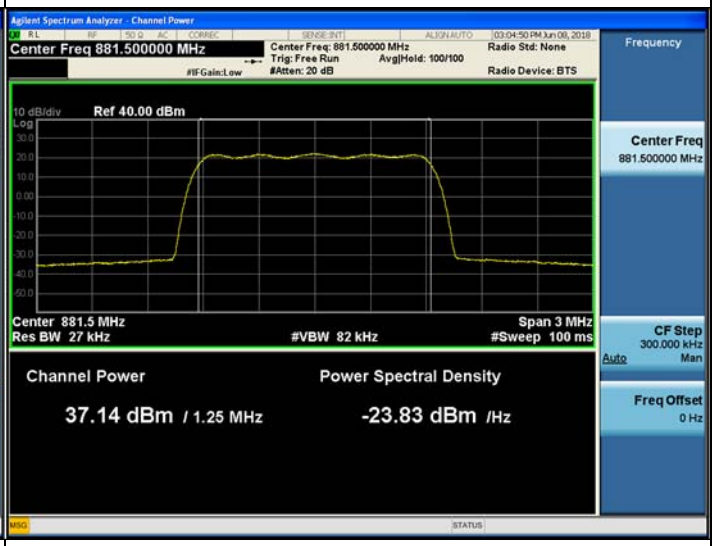
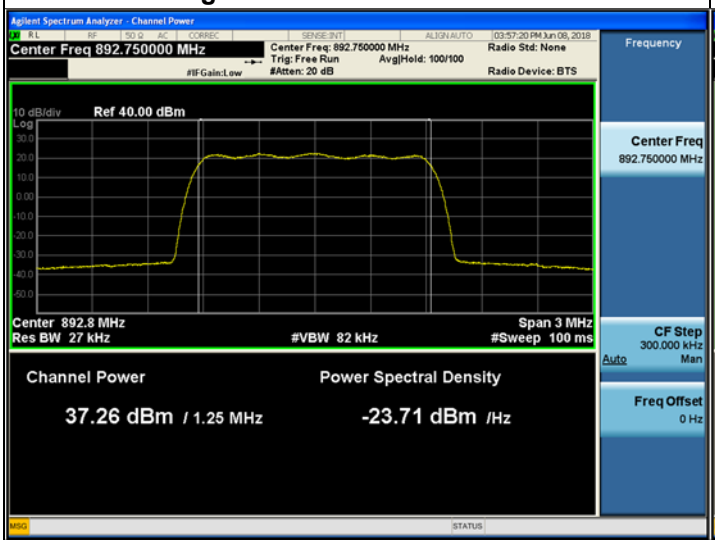
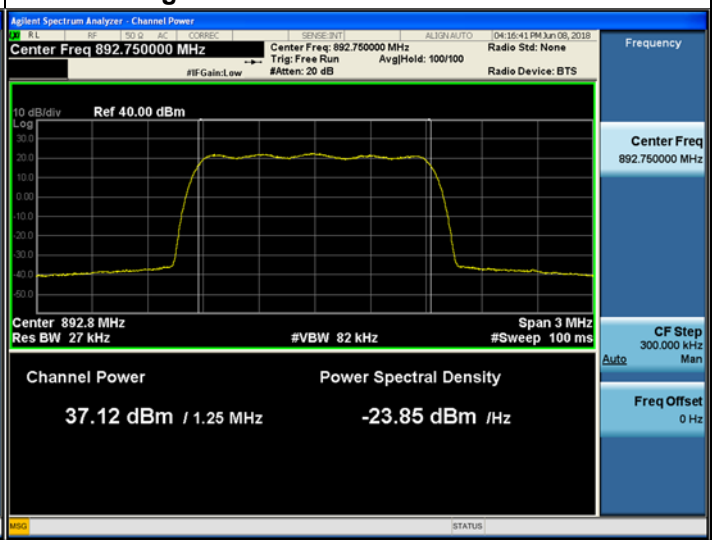
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of RF Output Power for WCDMA_850 CEL Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

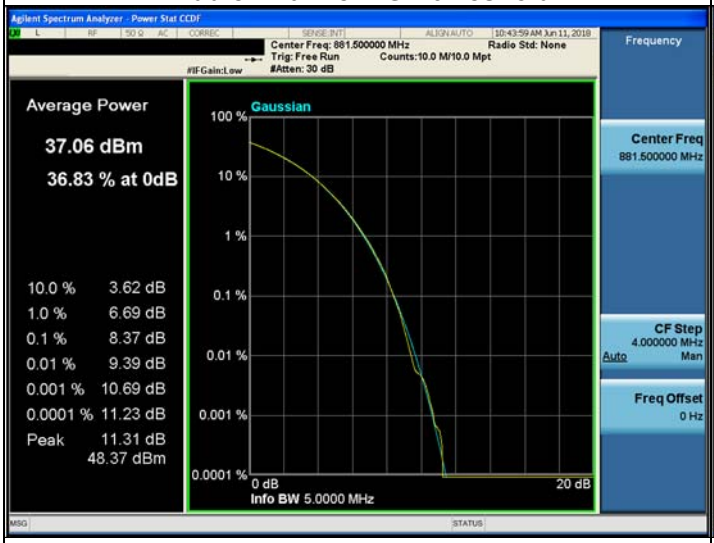
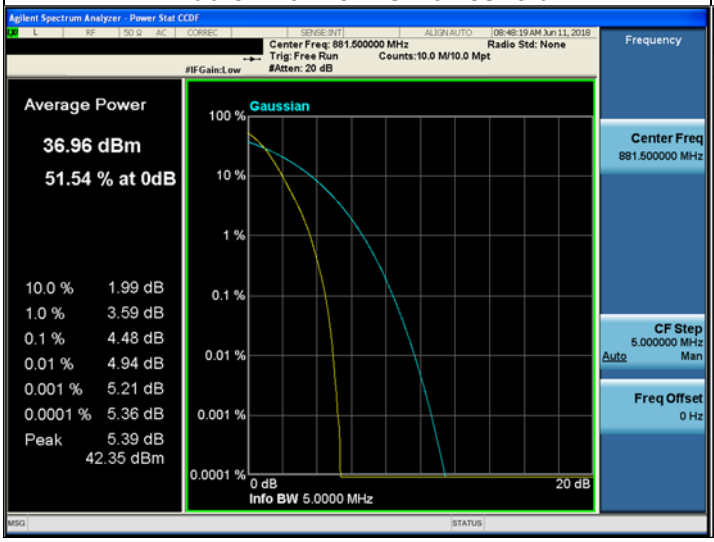
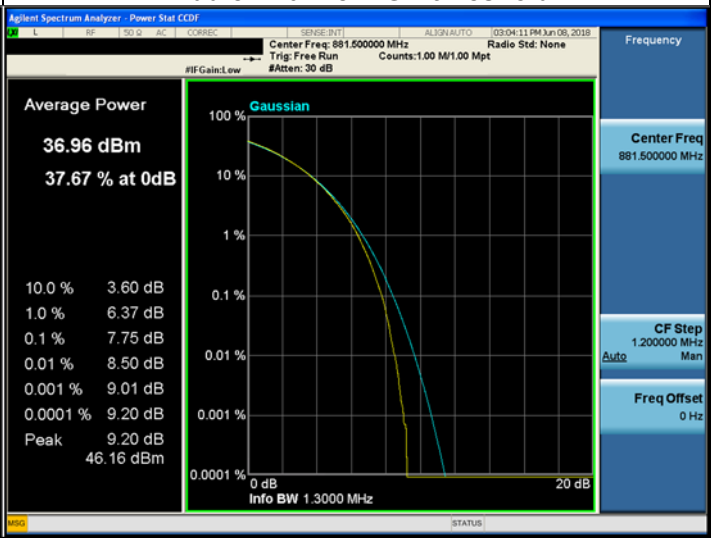
Plots of RF Output Power for CDMA_850 CEL Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Peak-to-Average Ratio (PAR)_850 CEL

850 CEL Band	Channel	Frequency (MHz)	PAR (dB)
LTE 5 MHz AGC threshold	Middle	881.50	8.37
LTE 10 MHz AGC threshold	Middle	881.50	8.38
WCDMA AGC threshold	Middle	881.50	4.48
CDMA AGC threshold	Middle	881.50	7.75

Plots of PAR_800 CEL Band

LTE 5 MHz	LTE 10 MHz
Middle Channel AGC threshold	Middle Channel AGC threshold
	
WCDMA	CDMA
Middle Channel AGC threshold	Middle Channel AGC threshold
	

6. OCCUPIED BANDWIDTH

FCC Rules

Test Requirements:

§ 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.

ISED Rules

Test Requirements:

RSS-Gen

6 General administrative and technical requirements

6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Test Procedures:

Measurements were in accordance with the test methods section 3.4 of KDB 935210 D05 v01r02 and section 4.2 of KDB 971168 D01 v03r01.

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 emission bandwidth (EBW) or alternatively, the OBW.

f) The nominal RBW shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be $\geq$ 3 $\times$ 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.

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) Determine the reference value: Allow the trace to stabilize. Set the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value) and record the associated frequency as f_0.

l) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency shall be selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.

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

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

o) Repeat the procedure [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.

p) Repeat steps e) to o) with the signal generator set to the narrowband signal.

q) Repeat steps e) to p) for all frequency bands authorized for use by the EUT.

RSS-GEN

6 General administrative and technical requirements

6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Test Results:

[Downlink Output_800 IDEN]

800 IDEN Band	Channel	Frequency (MHz)	OBW (MHz)
LTE 5 MHz AGC threshold	Low	864.50	4.5060
	High	866.50	4.5127
LTE 5 MHz +3dBm above the AGC threshold	Low	864.50	4.5051
	High	866.50	4.5100
CDMA AGC threshold	Low	863.25	1.2655
	Middle	865.50	1.2605
	High	867.75	1.2635
CDMA +3dBm above the AGC threshold	Low	863.25	1.2650
	Middle	865.50	1.2670
	High	867.75	1.2713

[Downlink Input_800 IDEN]

800 IDEN Band	Channel	Frequency (MHz)	OBW (MHz)
LTE 5 MHz AGC threshold	Low	864.50	4.5092
	High	866.50	4.5137
CDMA AGC threshold	Low	863.25	1.2631
	Middle	865.50	1.2644
	High	867.75	1.2613

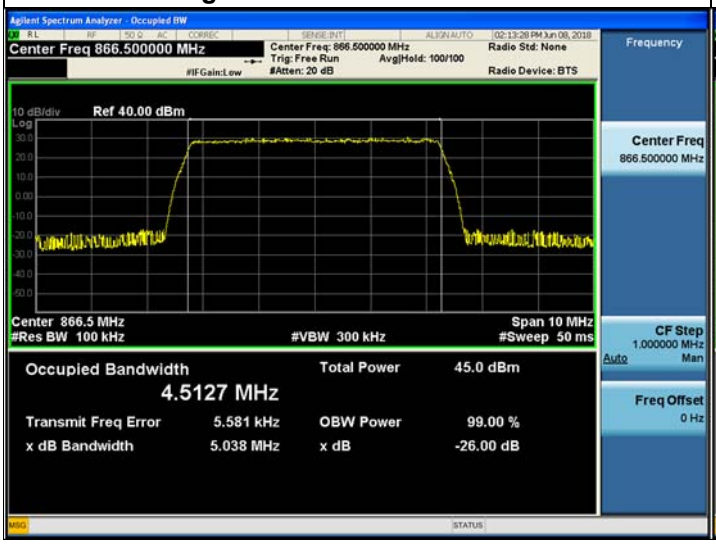
[Downlink Output_850 CEL]

850 CEL Band	Channel	Frequency (MHz)	OBW (MHz)
LTE 5 MHz AGC threshold	Low	871.50	4.5107
	Middle	881.50	4.5114
	High	891.50	4.5077
LTE 5 MHz +3dBm above the AGC threshold	Low	871.50	4.5114
	Middle	881.50	4.5110
	High	891.50	4.5107
LTE 10 MHz AGC threshold	Low	874.00	9.0036
	Middle	881.50	9.0024
	High	889.00	8.9838
LTE 10 MHz +3dBm above the AGC threshold	Low	874.00	8.9962
	Middle	881.50	8.9919
	High	889.00	8.9847
WCDMA AGC threshold	Low	871.50	4.1796
	Middle	881.50	4.1771
	High	891.50	4.1769
WCDMA +3dBm above the AGC threshold	Low	871.50	4.1780
	Middle	881.50	4.1759
	High	891.50	4.1727
CDMA AGC threshold	Low	870.25	1.2639
	Middle	881.50	1.2627
	High	892.75	1.2656
CDMA +3dBm above the AGC threshold	Low	870.25	1.2647
	Middle	881.50	1.2664
	High	892.75	1.2652

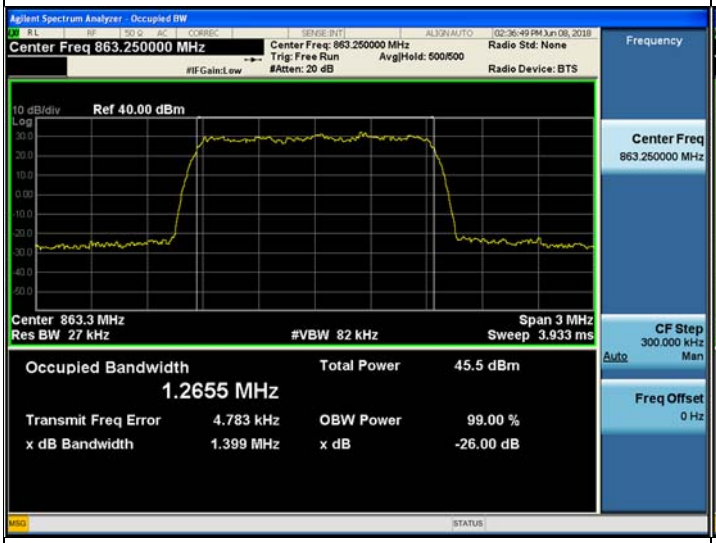
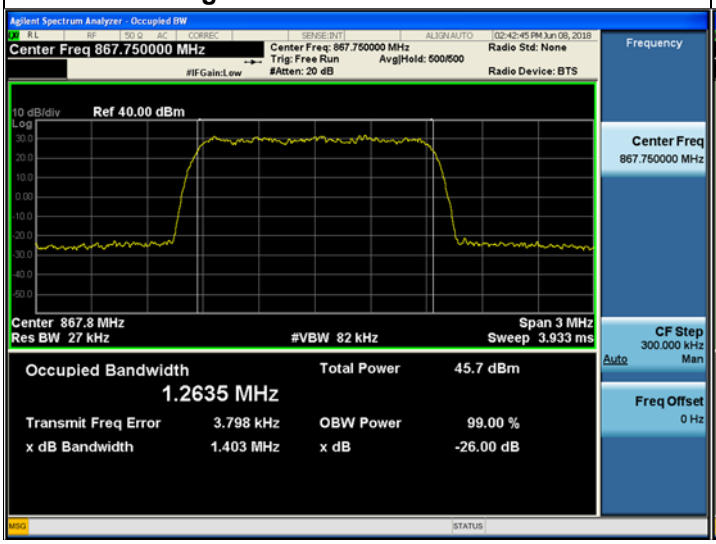
[Downlink Input_850 CEL]

850 CEL Band	Channel	Frequency (MHz)	OBW (MHz)
LTE 5 MHz AGC threshold	Low	871.50	4.5138
	Middle	881.50	4.5139
	High	891.50	4.5107
LTE 10 MHz AGC threshold	Low	874.00	9.0027
	Middle	881.50	9.0005
	High	889.00	9.0021
WCDMA AGC threshold	Low	871.50	4.1866
	Middle	881.50	4.1823
	High	891.50	4.1798
CDMA AGC threshold	Low	870.25	1.2624
	Middle	881.50	1.2662
	High	892.75	1.2613

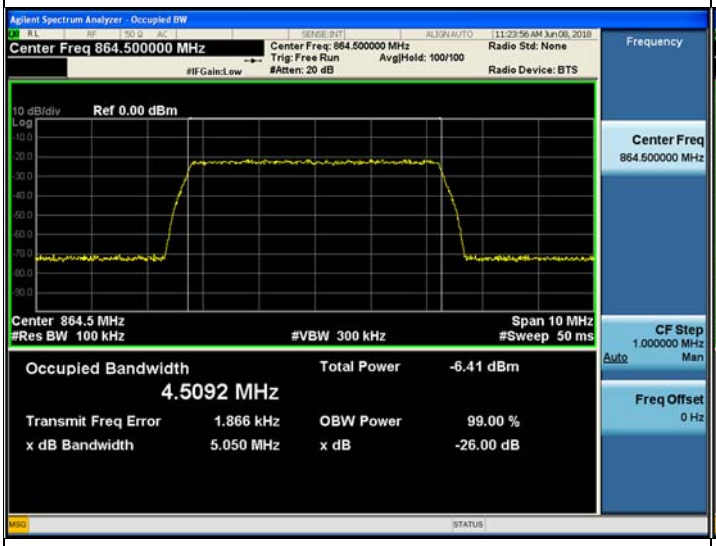
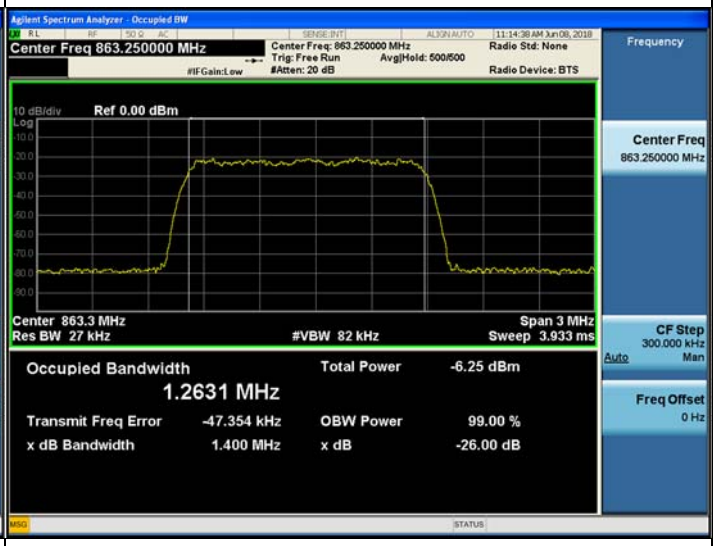
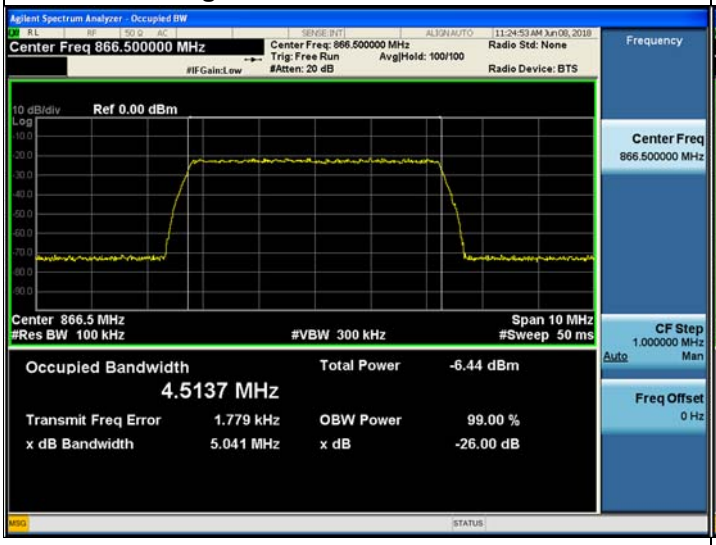
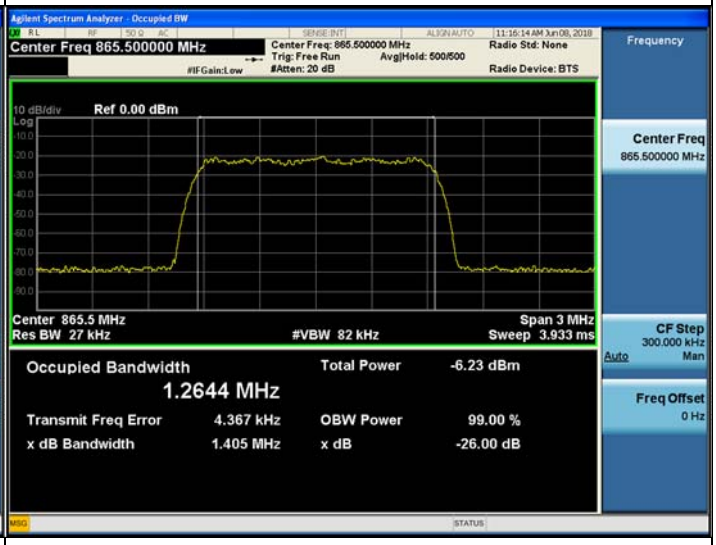
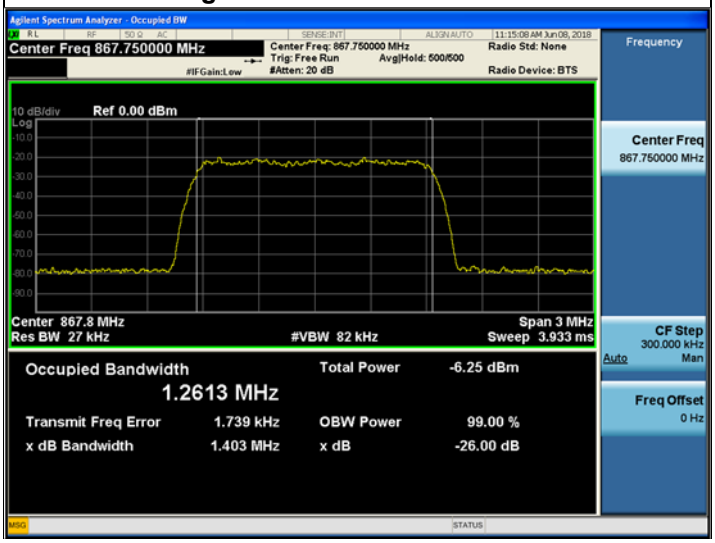
Plots of Output Occupied Bandwidth for LTE 5 MHz_800 IDEN Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

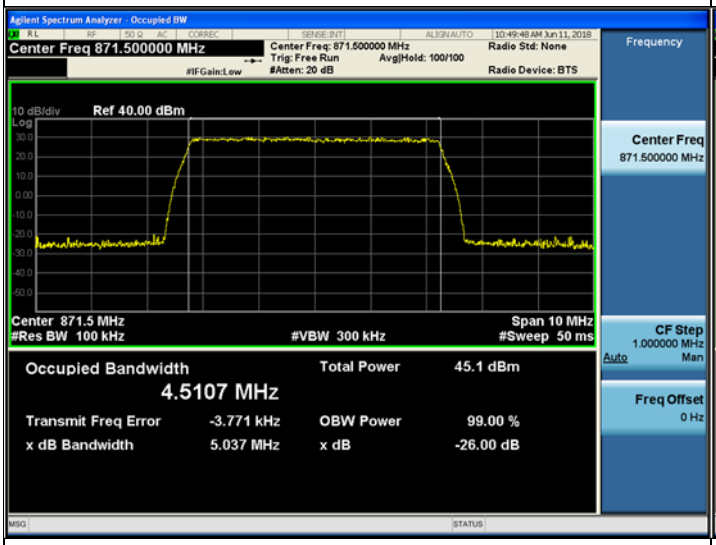
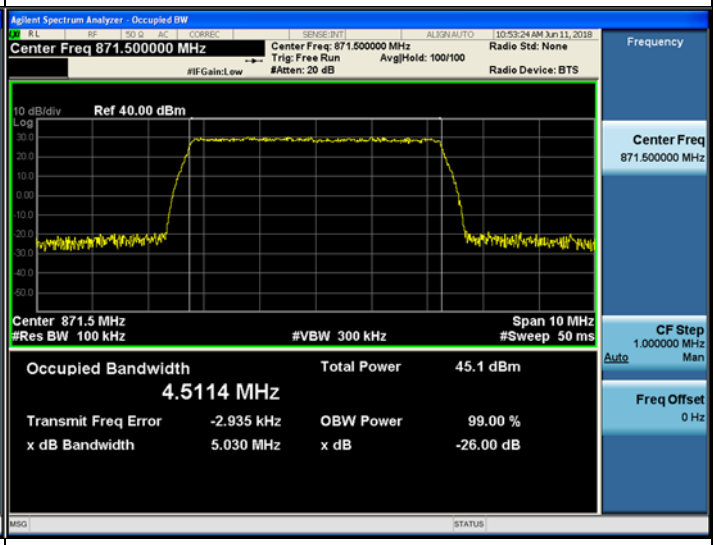
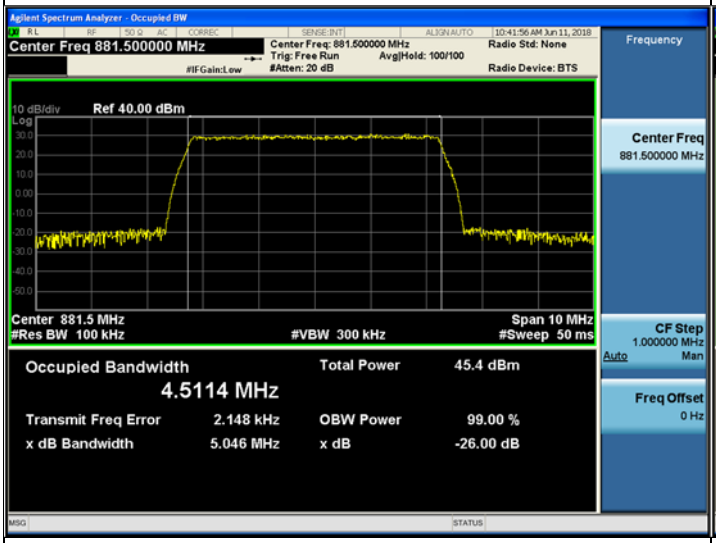
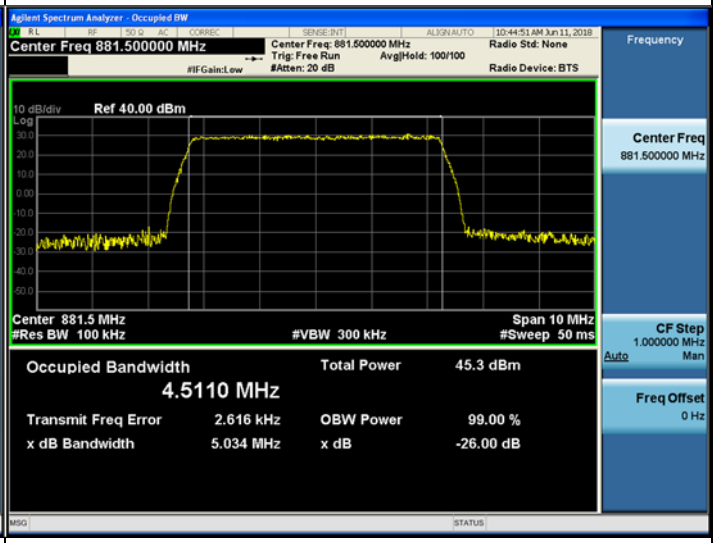
Plots of Output Occupied Bandwidth for CDMA_800 IDEN Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of Input Occupied Bandwidth for LTE 5 MHz and CDMA_800 IDEN Band

LTE 5 MHz	CDMA
Low Channel AGC threshold	Low Channel AGC threshold
	
High Channel AGC threshold	Middle Channel AGC threshold
	
	High Channel AGC threshold
	

Plots of Output Occupied Bandwidth for LTE 5 MHz_850 CEL Band

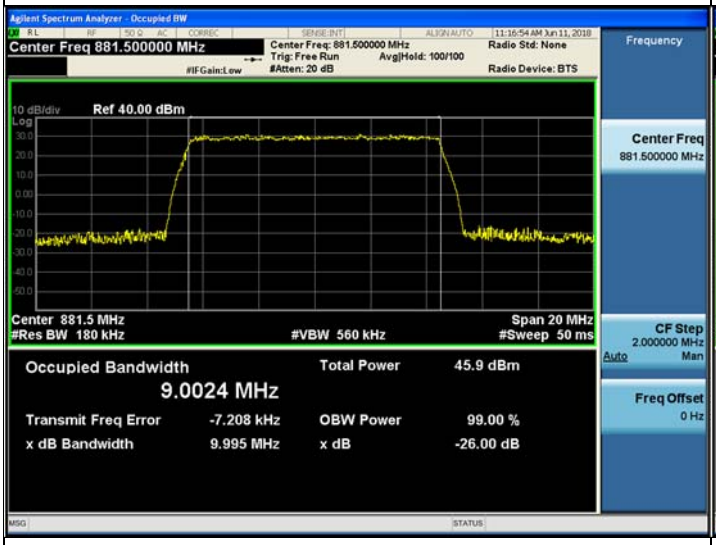
Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of Output Occupied Bandwidth for LTE 10 MHz_850 CEL Band

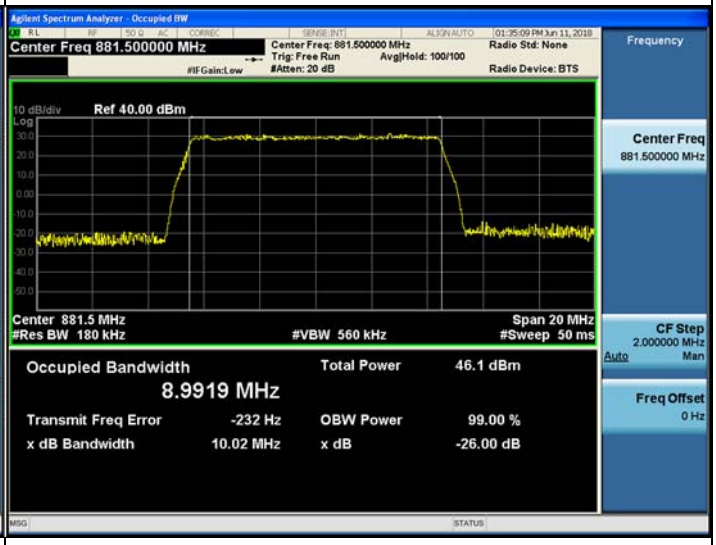
Low Channel AGC threshold

Low Channel +3 dB AGC threshold

Middle Channel AGC threshold



Middle Channel +3 dB AGC threshold



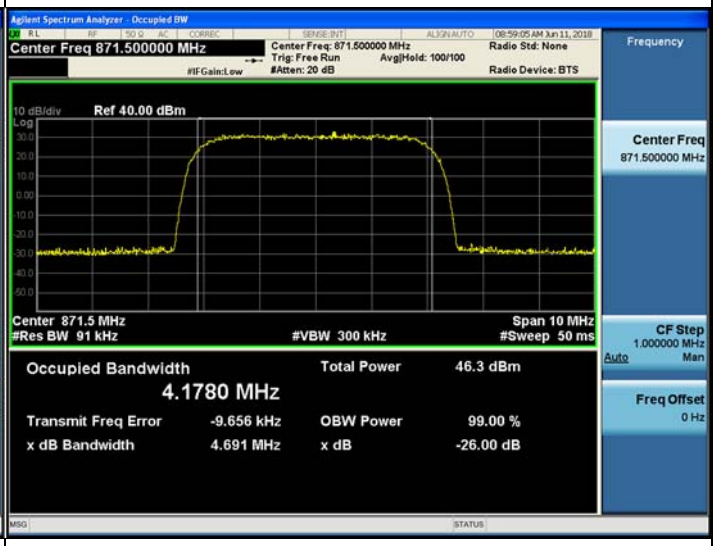
High Channel AGC threshold

High Channel +3 dB AGC threshold

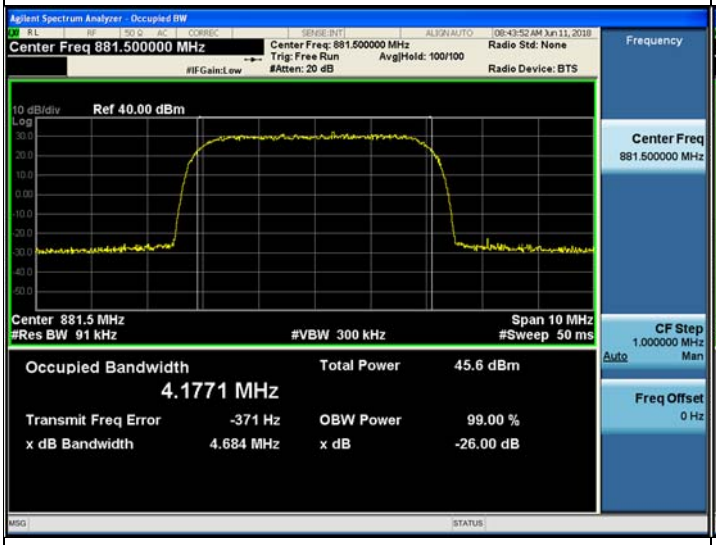
Plots of Output Occupied Bandwidth for WCDMA_850 CEL Band

Low Channel AGC threshold

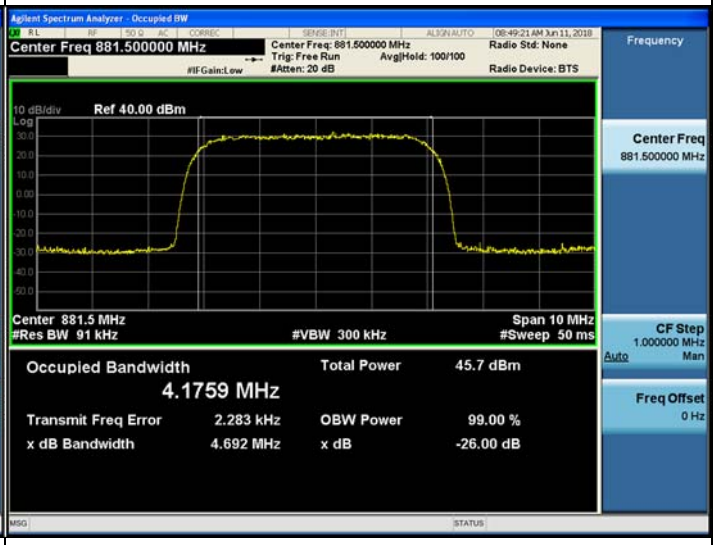
Low Channel +3 dB AGC threshold



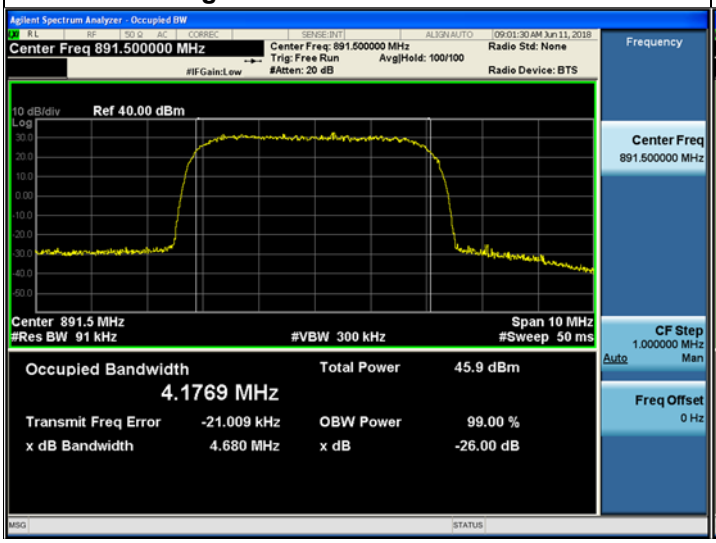
Middle Channel AGC threshold



Middle Channel +3 dB AGC threshold

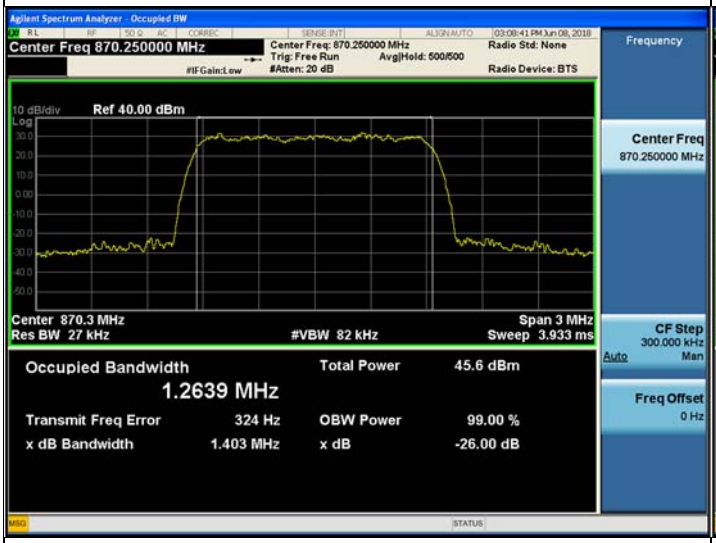
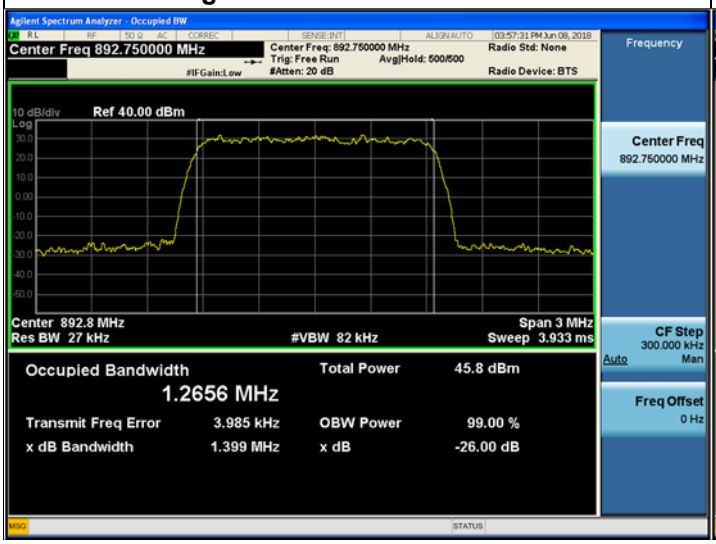
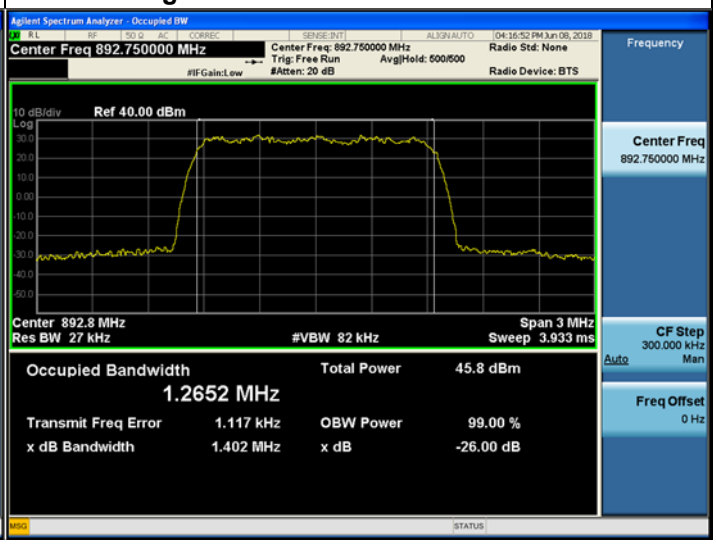


High Channel AGC threshold

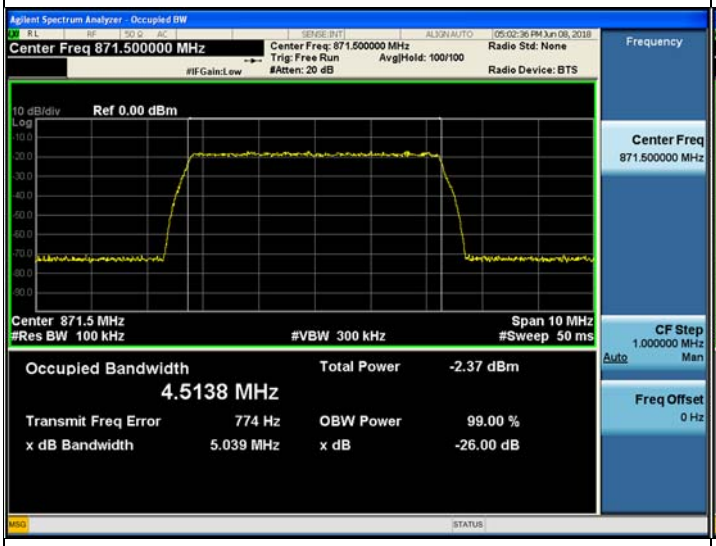
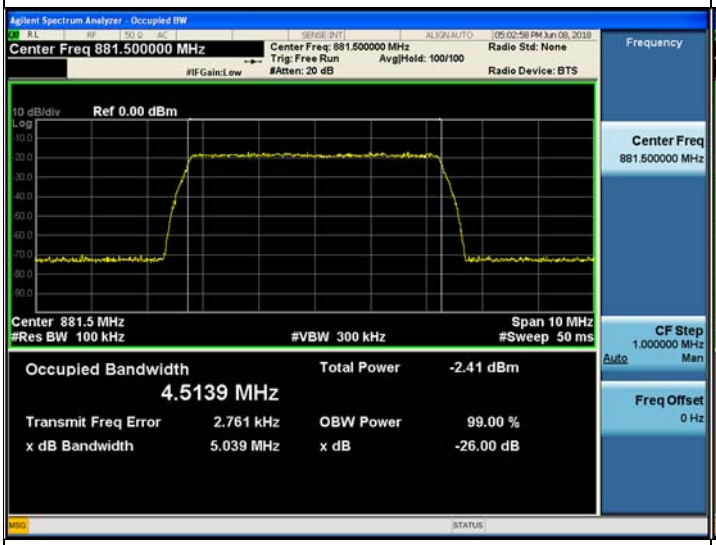
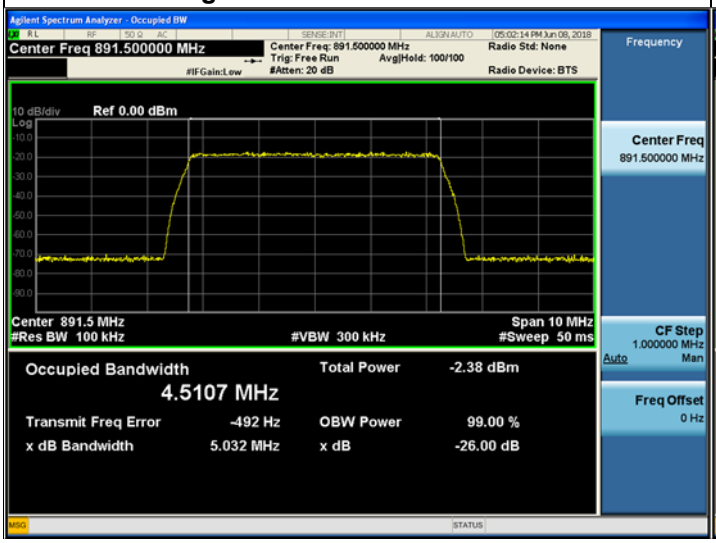
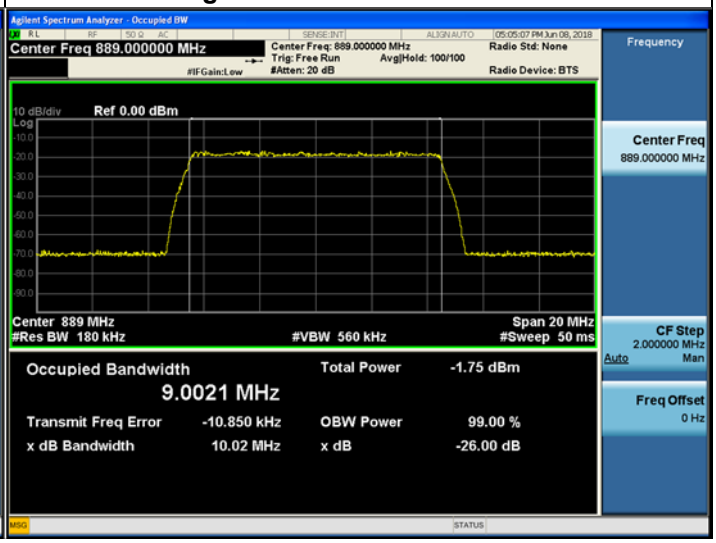


High Channel +3 dB AGC threshold

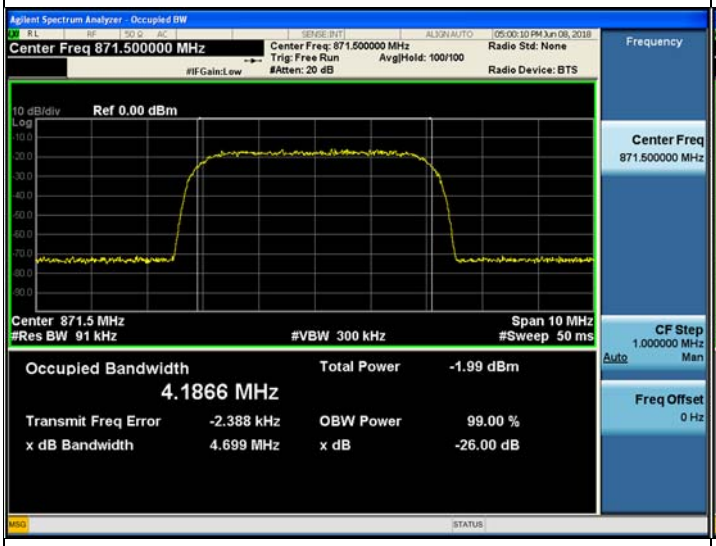
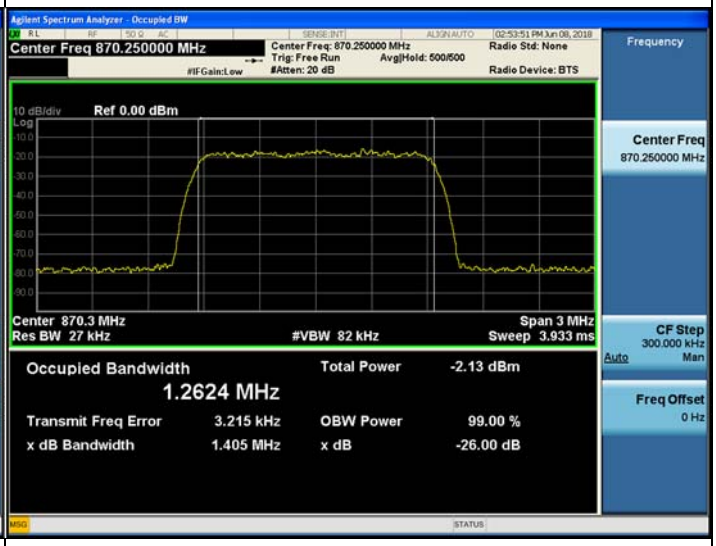
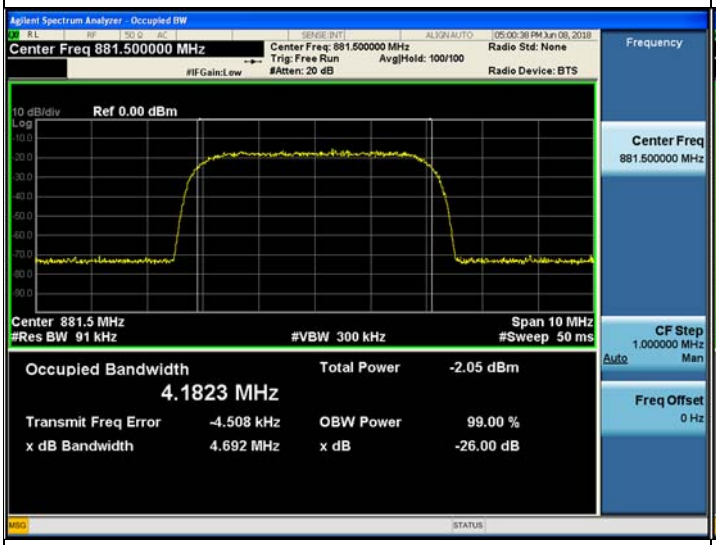
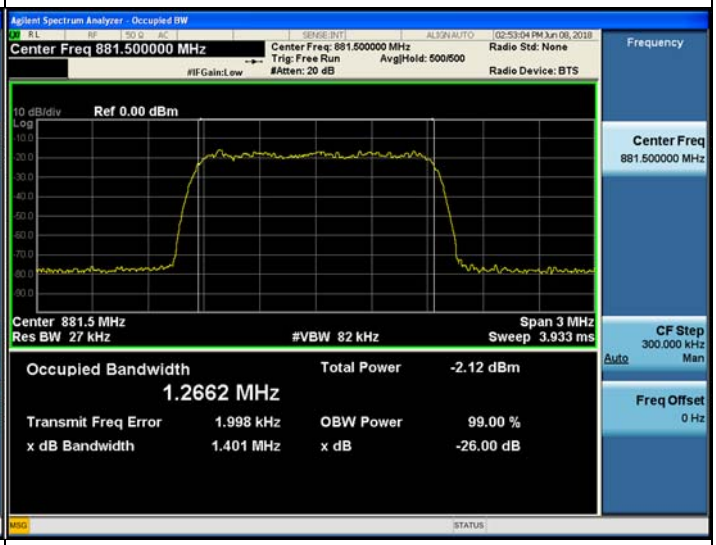
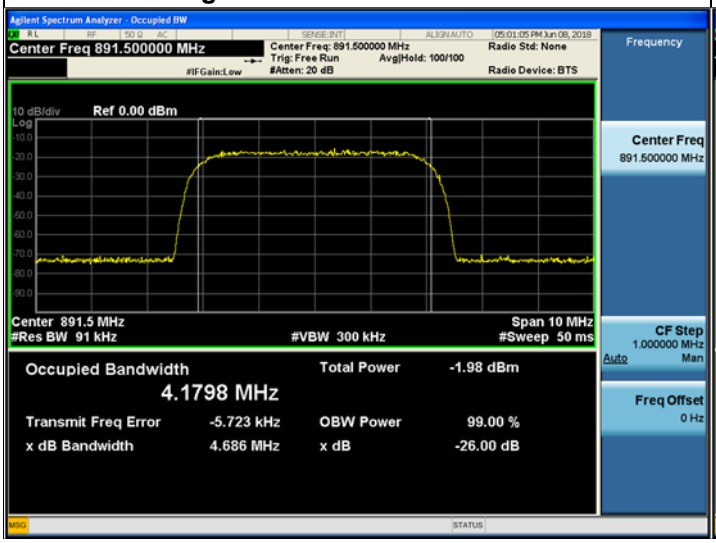
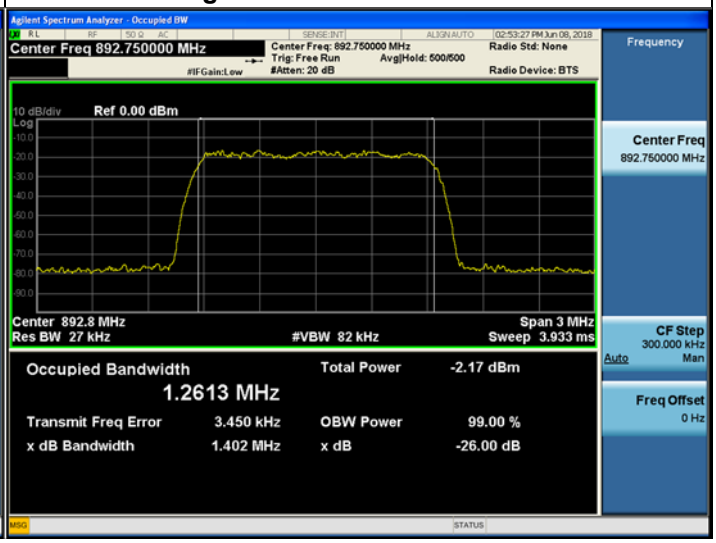
Plots of Output Occupied Bandwidth for CDMA_850 CEL Band

Low Channel AGC threshold	Low Channel +3 dB AGC threshold
	
Middle Channel AGC threshold	**Middle Channel +3 dB AGC threshold**
	
High Channel AGC threshold	**High Channel +3 dB AGC threshold**
	

Plots of Input Occupied Bandwidth for LTE_850 CEL Band

LTE 5 MHz	LTE 10 MHz
Low Channel AGC threshold	Low Channel AGC threshold
	
Middle Channel AGC threshold	Middle Channel AGC threshold
	
High Channel AGC threshold	High Channel AGC threshold
	

Plots of Input Occupied Bandwidth for WCDMA and CDMA_850 CEL Band

WCDMA	CDMA
Low Channel AGC threshold	Low Channel AGC threshold
	
Middle Channel AGC threshold	Middle Channel AGC threshold
	
High Channel AGC threshold	High Channel AGC threshold
	

7. INPUT VERSUS OUTPUT SPECTRUM

ISED Rules

Test Requirements:

RSS-131

5. Equipment standard specifications for zone enhancers working with equipment certified in RSSs listed in section 1 except RSS-119

5.2 Industrial Zone Enhancers

5.2.2 Input-versus-output spectrum

The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

Test Procedures:

RSS-Gen

6 General administrative and technical requirements

6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

Note : We tested using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 26 dB.

Test Results:

[Downlink Output_850 CEL]

850 CEL Band	Channel	Frequency (MHz)	26 dB BW (MHz)	Growth (%)
LTE 5 MHz AGC threshold	Low	871.50	5.037	-0.04
	Middle	881.50	5.046	0.14
	High	891.50	5.035	0.06
LTE 5 MHz +3dBm above the AGC threshold	Low	871.50	5.030	-0.18
	Middle	881.50	5.034	-0.10
	High	891.50	5.035	0.06
LTE 10 MHz AGC threshold	Low	874.00	10.03	0.20
	Middle	881.50	9.995	-0.35
	High	889.00	9.964	-0.56
LTE 10 MHz +3dBm above the AGC threshold	Low	874.00	9.991	-0.19
	Middle	881.50	10.02	-0.10
	High	889.00	9.976	-0.44
WCDMA AGC threshold	Low	871.50	4.675	-0.51
	Middle	881.50	4.684	-0.17
	High	891.50	4.680	-0.13
WCDMA +3dBm above the AGC threshold	Low	871.50	4.691	-0.17
	Middle	881.50	4.692	0.00
	High	891.50	4.679	-0.15
CDMA AGC threshold	Low	870.25	1.403	-0.14
	Middle	881.50	1.405	0.29
	High	892.75	1.399	-0.21
CDMA +3dBm above the AGC threshold	Low	870.25	1.400	-0.36
	Middle	881.50	1.404	0.21
	High	892.75	1.402	0.00

*** Plots of results are the same as Section 7.**

8. OUT OF BAND REJECTION & MEAN OUTPUT POWER AND ZONE ENHANCER GAIN

FCC Rules

Test Requirements:

KDB 935210 D05 v01r02

Out of Band Rejection – Testing for rejection of out of band signals. Alternatively, filter freq. response plots are acceptable.

ISED Rules

Test Requirements:

RSS-131

5. Equipment standard specifications for zone enhancers working with equipment certified in RSSs listed in section 1 except RSS-119

5.2 Industrial Zone Enhancers

5.2.1 Out-of-band rejection

The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

5.2.3 Mean output power and zone enhancer gain

The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

Test Procedures:

Measurements were in accordance with the test methods section 3.3, 4.3 of KDB 935210 D05 v01r02.

3.3 EUT out-of-band rejection

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

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the passband, for each applicable CMRS band

2) Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep.

3) Dwell time = approx. 10 ms.

4) Number of points = SPAN/(RBW/2).

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

d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.

e) Set the resolution bandwidth of the spectrum analyzer to be 1 % to 5 % of the passband and

the video bandwidth shall be set to ≥ 3 × RBW.

f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer's spectral display to fill.

g) Place a marker to the peak of the frequency response and record this frequency as f_0.

h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the −20 dB down amplitude to determine the 20 dB bandwidth. Capture the frequency response of the EUT.

i) Capture the frequency response of the EUT.

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

4.3 PLMRS device out-of-band rejection

Adjust the internal gain control of the EUT to the maximum gain for which equipment certification is sought.

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

b) Configure a swept CW signal with the following parameters:

1) Frequency range = ± 250 % of the manufacturer's specified pass band.

2) The CW amplitude will be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.

3) Dwell time = approx. 10 ms.

4) Frequency step = 50 kHz.

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

d) Set the resolution bandwidth of the spectrum analyzer between 1 % and 5 % of the manufacturer's pass band with the video bandwidth set to 3 × RBW.

e) Set the detector to Peak and the trace to Max-Hold.

f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f_0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth.

g) Capture the frequency response plot and for inclusion in the test report.

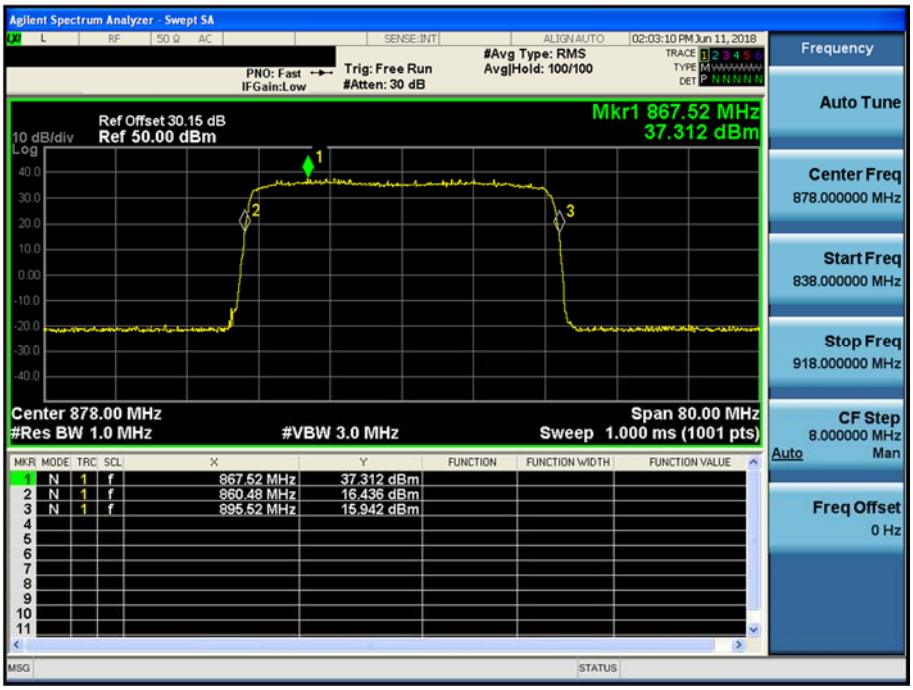
Test Results:

Input Signal	Input Level	Maximum Amp Gain
800 IDEN 850 CEL	-20 dBm	57 dB

[Downlink]

Band	20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
800 IDEN 850 CEL	860.480 MHz ~ 895.520 MHz	37.312	57.312

Plot of Out of Band Rejection & Mean Output Power and Zone Enhancer Gain



* MRDU_800I_850C module amplifies 800 IDEN band (862 ~ 869 MHz) and 850 CEL band (869 ~ 894 MHz) together.