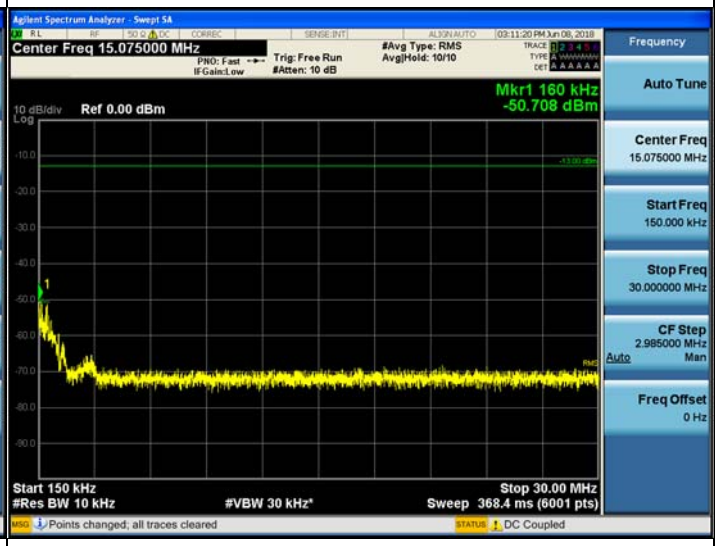
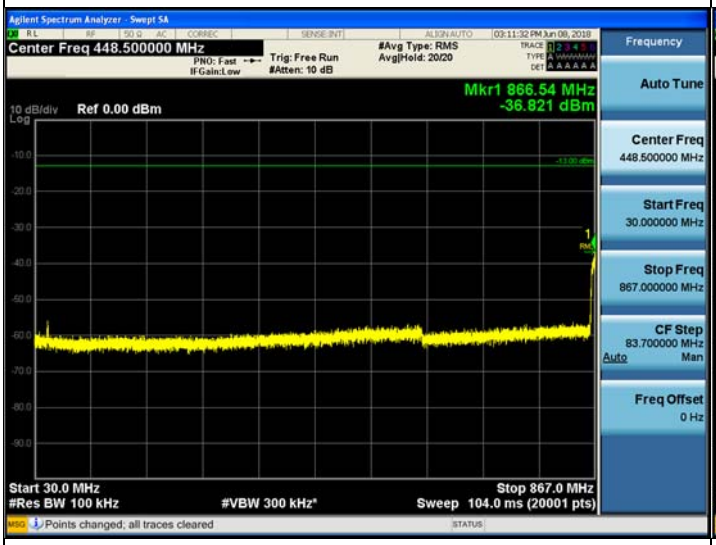
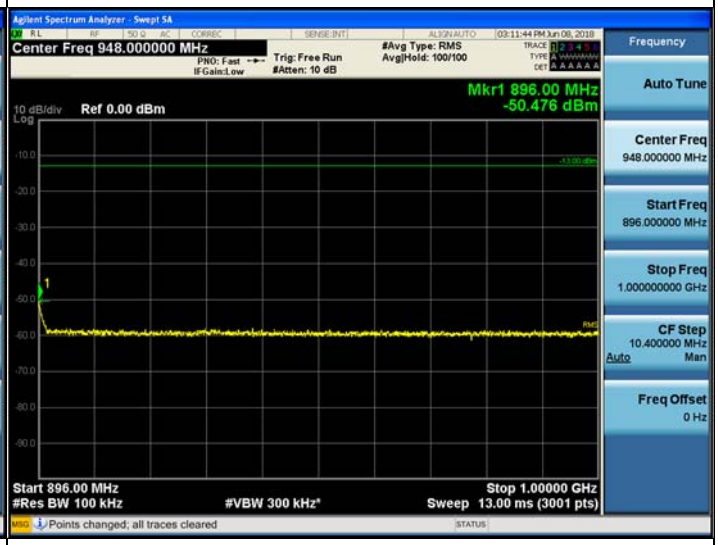
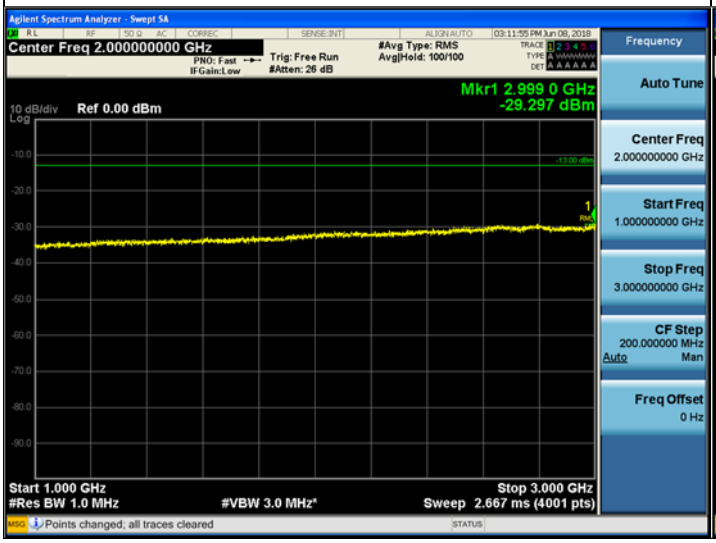
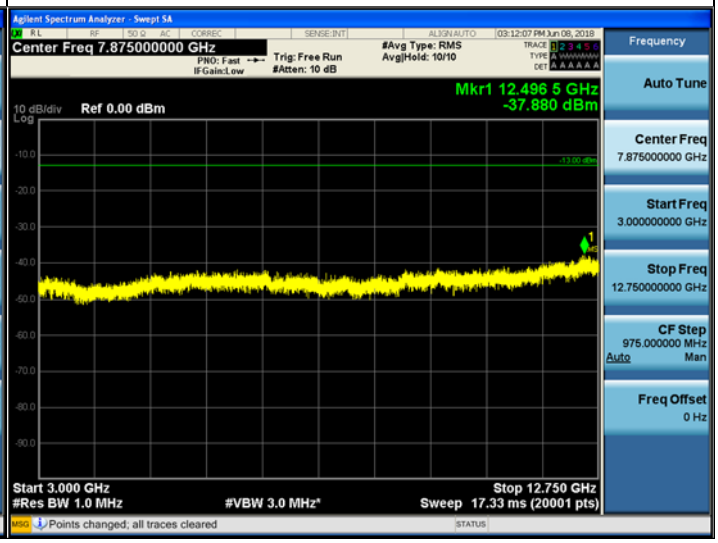
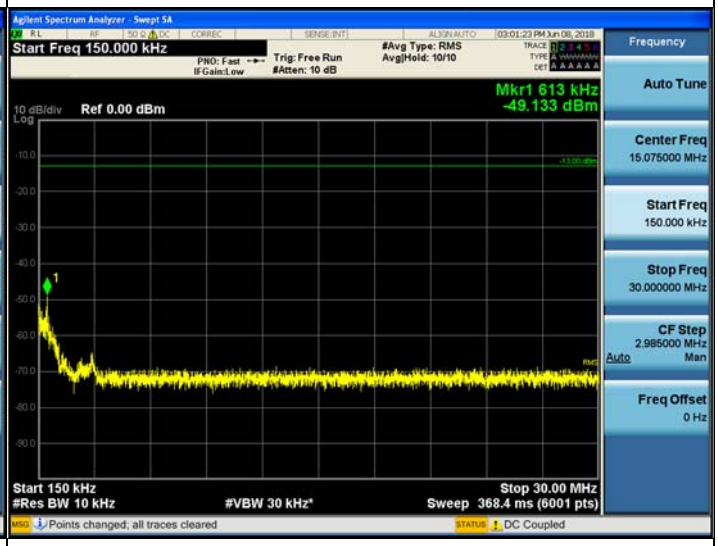
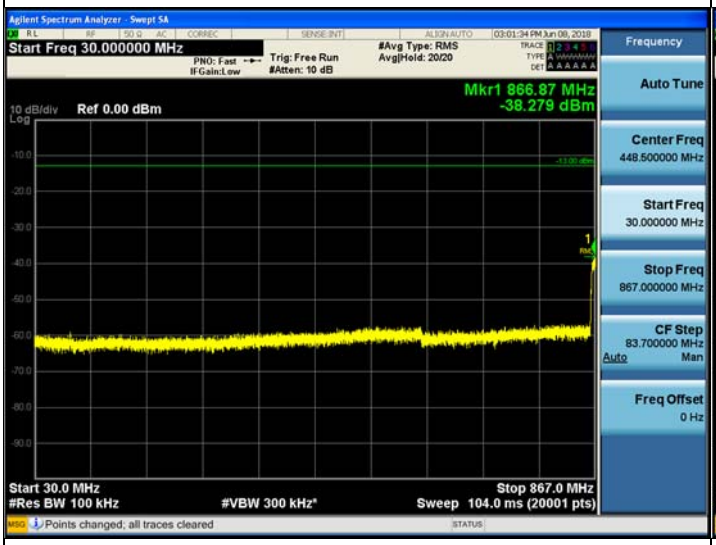
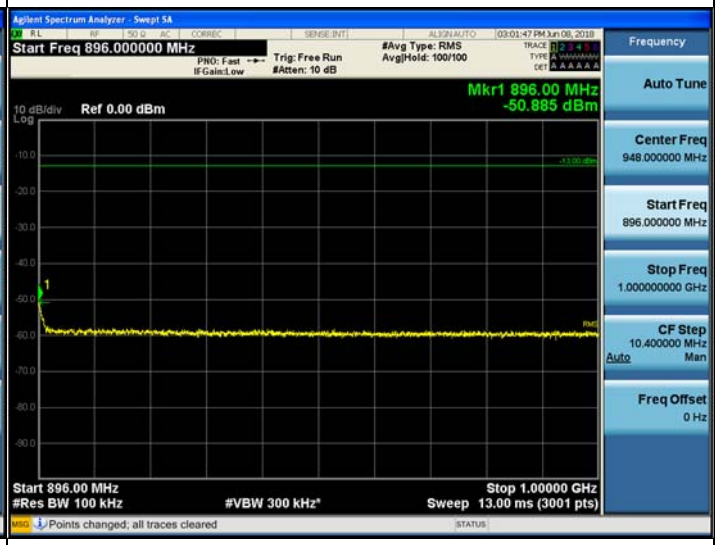
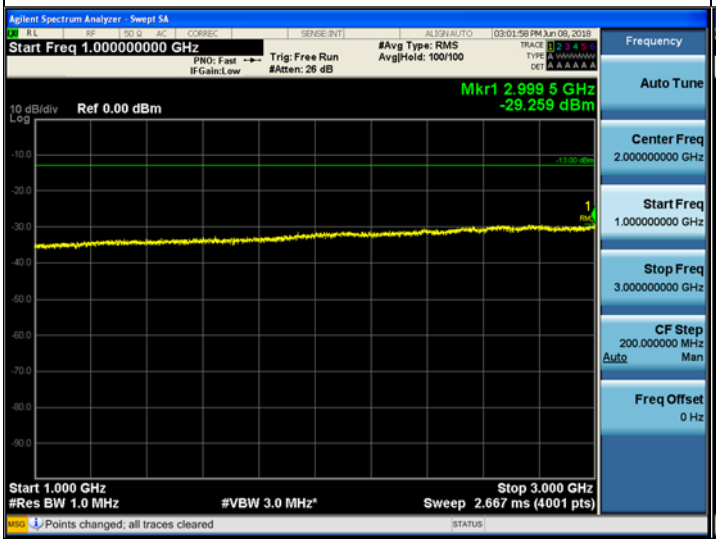
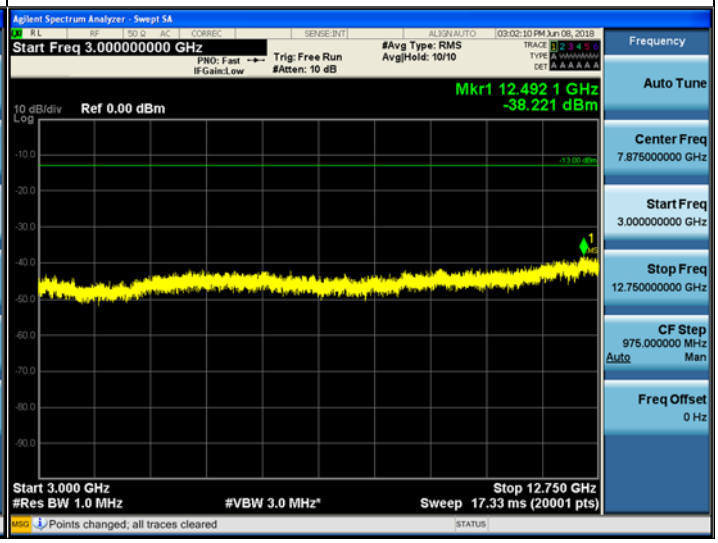
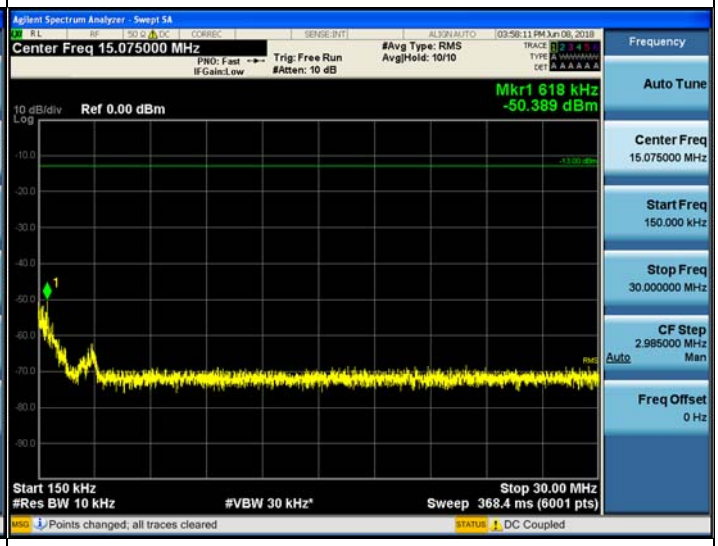
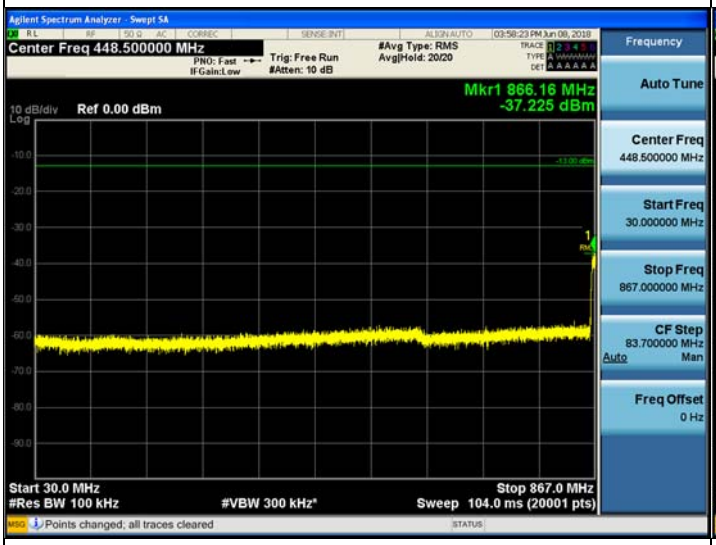
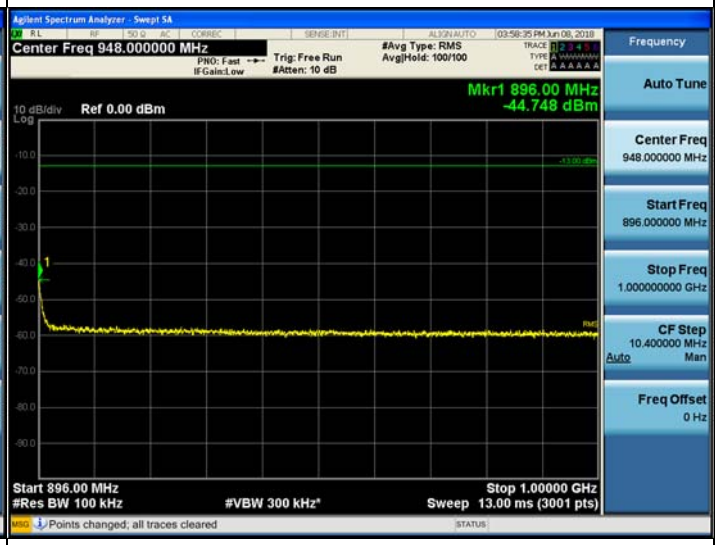
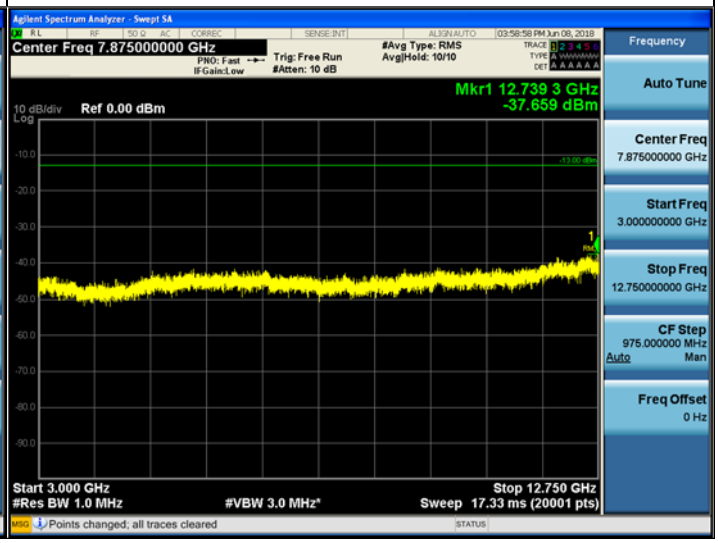
Plots of Unwanted Conducted Emissions for CDMA_850 CEL Band

Low Channel	
9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 867 MHz	896 MHz ~ 1 GHz
	
1 GHz ~ 3 GHz	3 GHz ~ 12.75 GHz
	

Middle Channel	
9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 867 MHz	896 MHz ~ 1 GHz
	
1 GHz ~ 3 GHz	3 GHz ~ 12.75 GHz
	

High Channel	
9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 867 MHz	896 MHz ~ 1 GHz
	
1 GHz ~ 3 GHz	3 GHz ~ 12.75 GHz
	

Plots of Band Edge for LTE 5 MHz_800 IDEN Band

Left	Right
	

Plots of Band Edge for CDMA_800 IDEN Band

Left	Right
	

Plots of Band Edge for LTE 5 MHz_850 CEL Band

Left	Right
	

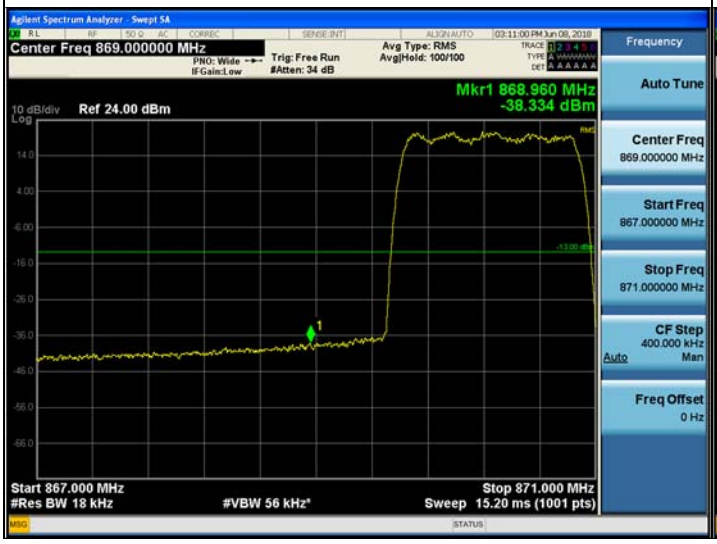
Plots of Band Edge for LTE 10 MHz_850 CEL Band

Left	Right
	

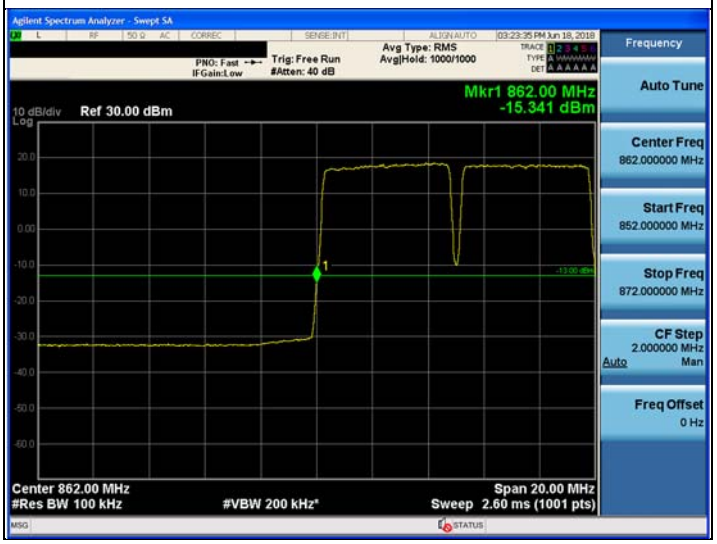
Plots of Band Edge for WCDMA_850 CEL Band

Left	Right
	

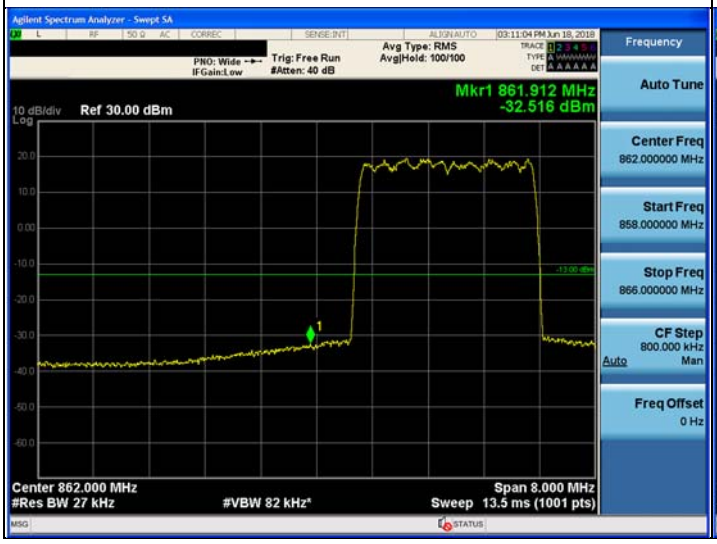
Plots of Band Edge for CDMA_850 CEL Band

Left	Right
	

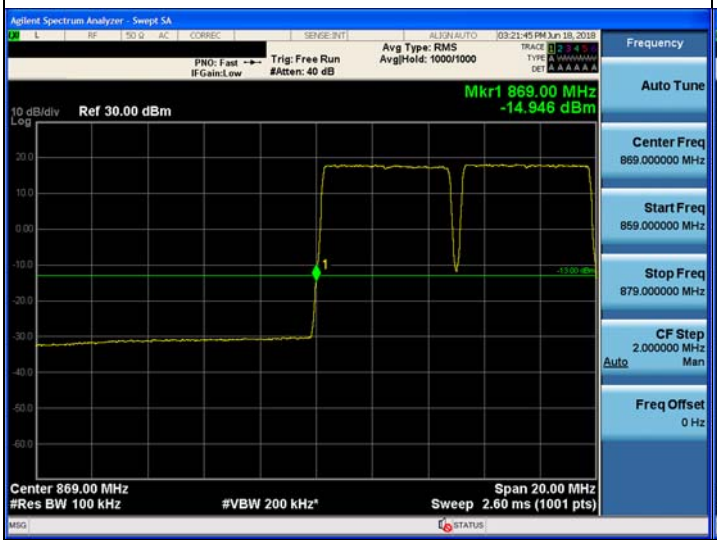
Plot of Intermodulation for LTE 5 MHz_800 IDEN Band

Left


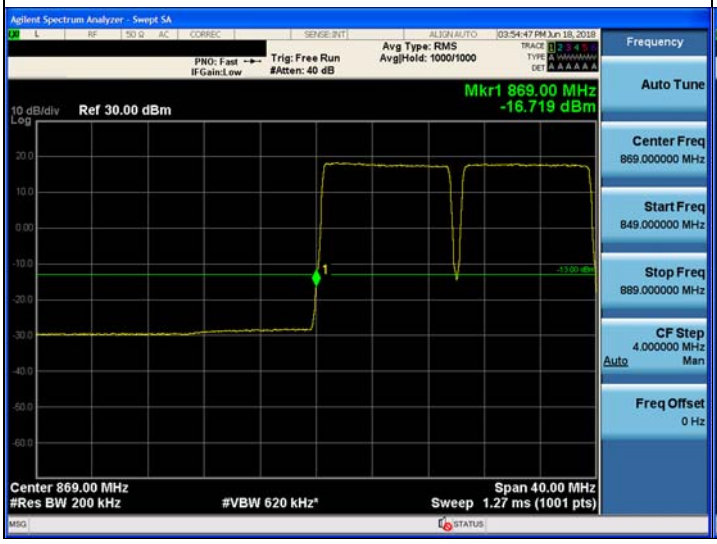
Plots of Intermodulation for CDMA_800 IDEN Band

Left	Right
	

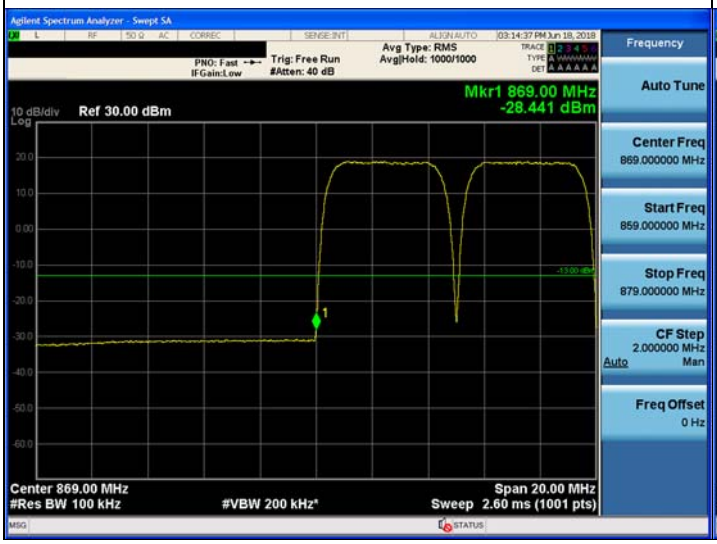
Plots of Intermodulation for LTE 5 MHz_850 CEL Band

Left	Right
	

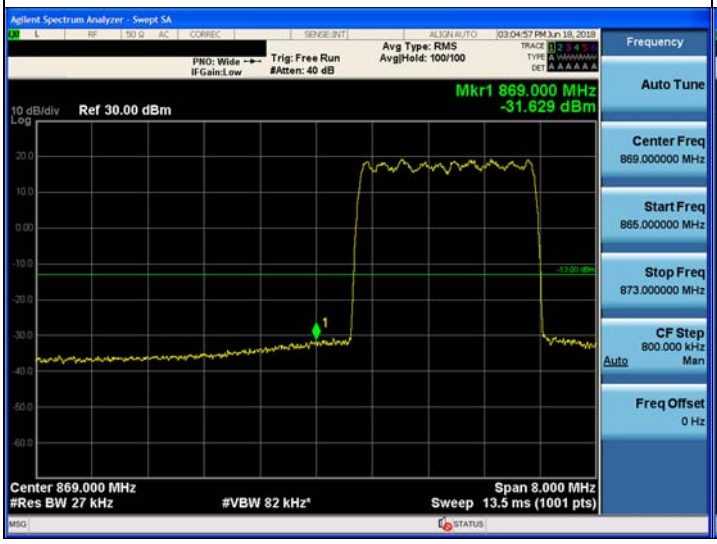
Plots of Intermodulation for LTE 10 MHz_850 CEL Band

Left	Right
	

Plots of Intermodulation for WCDMA_850 CEL Band

Left	Right
	

Plots of Intermodulation for CDMA_850 CEL Band

Left	Right
	

11. RADIATED SPURIOUS EMISSIONS

FCC Rules

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

ISED Rules

Test Requirements:

RSS-Gen

7. Receiver emissions limits

7.3 Receiver radiated emission limits

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna ports. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least five times the highest tunable or

local oscillator frequency, whichever is higher, without exceeding 40 GHz.Spurious emissions from receivers shall not exceed the radiated emissions limits shown in Table 3.

Table 3 – Receiver radiated emissions limits	
Frequency (MHz)	**Field Strength (μv/m at 3 metres)***
30-88	100
88-216	150
216-960	200
Above 960	500

Footnote *: Measurements for compliance with the limits in table 3 may be performed at distances other than 3 metres, in accordance with section 6.6.

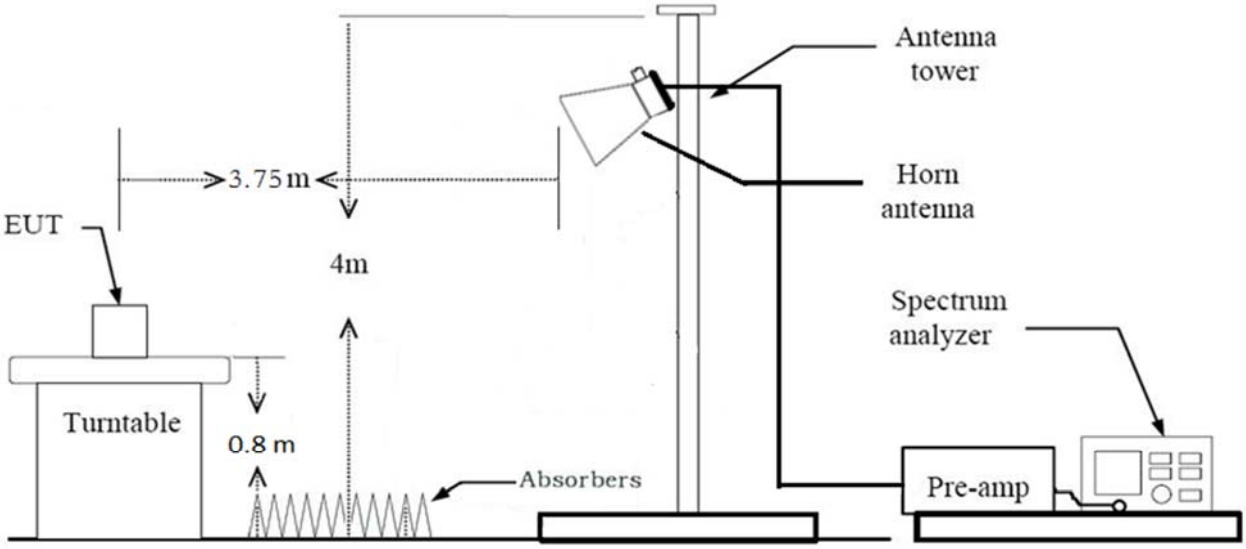
Test Procedures:

As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* was made in accordance with the procedures of ANSI/TIA-603-E-2016 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360and the receiving antenna scanned from 1-3m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried. out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Radiated Spurious Emissions Test Setup



Note:

1. According to SVSWR requirement in ANSI 63.4-2014, we performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
2. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)

Receiver Spurious Emissions Test Result:

ISED Rule(s):	**RSS-Gen**
Test Requirements:	**Blow the table**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

Operation Mode: Receive:

30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμN	dB /m	dB	(H/V)	dBμN/m	dBμN/m	dB
No critical peaks found							

Above 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμN	dB /m	dB	(H/V)	dBμN/m	dBμN/m	dB
No critical peaks found							

Radiated Spurious Emissions Test Result:

Harmonics were not found.

[Downlink]

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found									

* C.L.: Cable Loss / A.G.: Ant. Gain / D.F.: Distance Factor (3.75 m)

Notes:

We have done horizontal and vertical polarization in detecting antenna.

12. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

FCC Rules

Test Requirements:

§ 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

§ 22.355 Frequency tolerance.

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1—Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/a

§ 90.213 Frequency stability

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Minimum Frequency Stability [Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power

Below 25	100	100	200
25-50	20	20	50
72-76	5		50
150-174	5	5	50
216-220	1.0		1.0
220-222	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450			

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

ISED Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.3 Transmitter Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of the values given in Table 1. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in Table 1, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power >2 W	Output Power ≤2 W
27.41-28 and 29.7-50	20	20	20	50
72-76	20	5	20	50
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5
217-218 and 219-220	12.5	1	5	5
220-222	5	0.1	1.5	1.5
406.1-430 and 450-470	25	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1
768-776 and 798-806	25	0.1	0.4	0.4
	12.5			
	6.25			
	50	1	1.25	1.25
806-821/851-866 and 821-824/866- 869	25	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4
896-901/935-940	12.5	0.1	1.5	1.5
929-930/931-932	25	1.5	N/A	N/A
928-929/952-953 and 932-932.5/941- 941.5	25	1.5	N/A	N/A
	12.5	1	3 (for remote station)	N/A
932.5-935/941.5-944	25	2.5	N/A	N/A
	12.5	2.5	N/A	N/A

RSS-132

5. Transmitter Standard Specifications

5.3 Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.
A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.
The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.
Voltage supplied to EUT is 110 Vac reference temperature was done at 20°C.
The voltage was varied by ± 15 % of nominal

RSS-Gen

6. General administrative and technical requirements

6.11 Transmitter Frequency Stability

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

When the measurement method of transmitter frequency stability is not stated in the applicable RSS or reference standards, the following conditions apply:

a. The reference temperature for radio transmitters is +20°C (+68°F).
b. A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which shall be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used.
c. The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environmental test chamber, the unmodulated carrier frequency and frequency stability shall be measured under the conditions specified below for licensed and licence-exempt devices, unless specified otherwise in the applicable RSS. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement.

For licensed devices, the following measurement conditions apply:

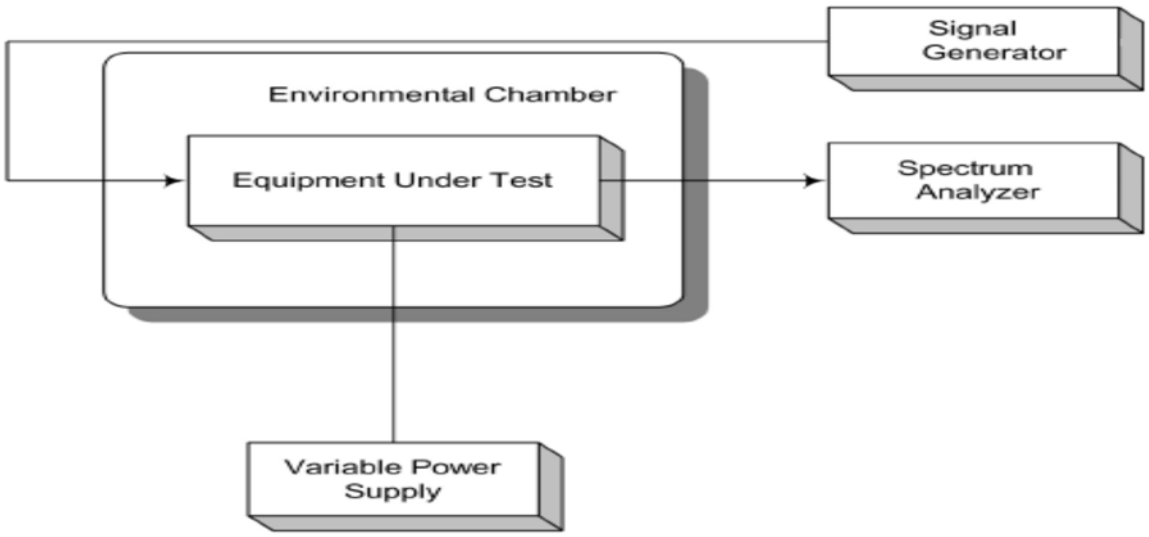
a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
b. at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

For licence-exempt devices, the following conditions apply:

a. at the temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
b. at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

If the frequency stability limits are only met within a temperature range that is smaller than the range specified in (a) for licensed or licence-exempt devices, the frequency stability requirement will be deemed to be met if the transmitter is automatically prevented from operating outside this smaller temperature range and if the published operating characteristics for the equipment are revised to reflect this restricted temperature range.
If the device contains both licence and licence-exempt transmitter modules, the device's frequency stability shall be measured under the most stringent condition specified in the applicable RSS of the transmitter module.
In addition, if an unmodulated carrier is not available, the method used to measure frequency stability shall be described in the test report.

Test Setup:



* Note: This EUT is supported power supply both of AC and DC. Test results are only attached worst cases.

Test Results:

Frequency Stability and Voltage Test Results

[Downlink_800 IDEN]

Reference: 120 Vac at 20°C **Freq.** = 865.5 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	865 500 000	0.354	0.000	0.00000
	-30	865 500 002	2.057	1.703	0.00197
	-20	865 499 999	-0.858	-1.212	-0.00140
	-10	865 500 001	1.469	1.115	0.00129
	0	865 500 000	-0.277	-0.631	-0.00073
	+10	865 499 999	-0.524	-0.878	-0.00101
	+30	865 500 001	0.907	0.553	0.00064
	+40	865 499 999	-1.123	-1.477	-0.00171
	+50	865 500 001	0.904	0.550	0.00064
High	+20	865 500 000	0.441	0.087	0.00010
Low	+20	865 500 001	0.601	0.247	0.00029

[Downlink_850 CEL]

Reference: 120 Vac at 20°C **Freq.** = 881.5 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	881 500 000	0.124	0.000	0.00000
	-30	881 499 998	-1.971	-2.095	-0.00238
	-20	881 500 004	3.878	3.754	0.00426
	-10	881 500 004	3.882	3.758	0.00426
	0	881 500 000	0.418	0.294	0.00033
	+10	881 499 997	-2.558	-2.682	-0.00304
	+30	881 500 002	2.248	2.124	0.00241
	+40	881 499 997	-3.431	-3.555	-0.00403
	+50	881 500 001	1.429	1.305	0.00148
High	+20	881 500 000	0.453	0.329	0.00037
Low	+20	881 500 000	0.290	0.166	0.00019

13. APPENDIX A_EUT AND TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-1806-FI009 -P