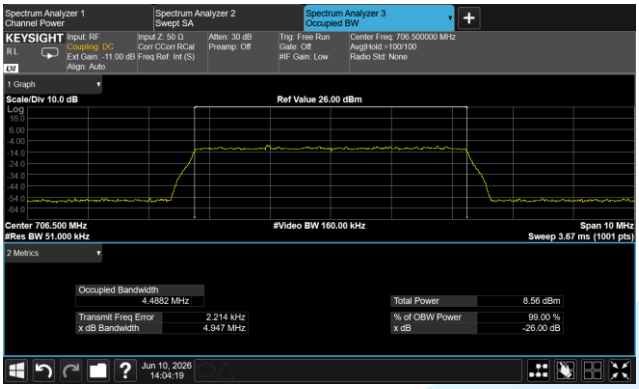
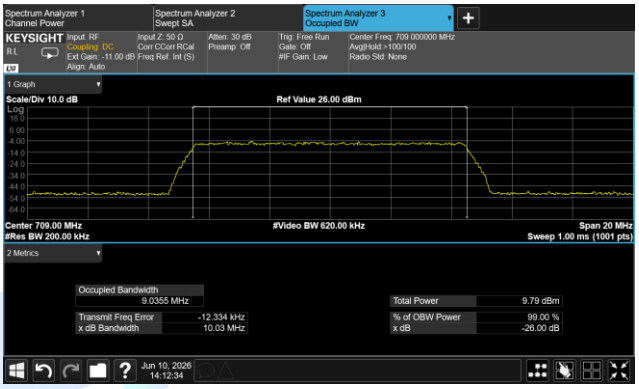
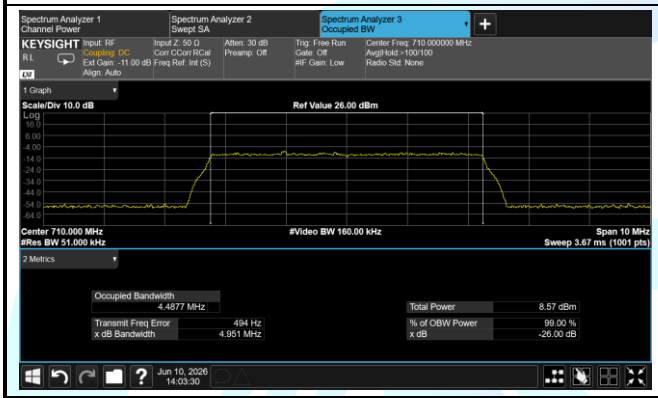
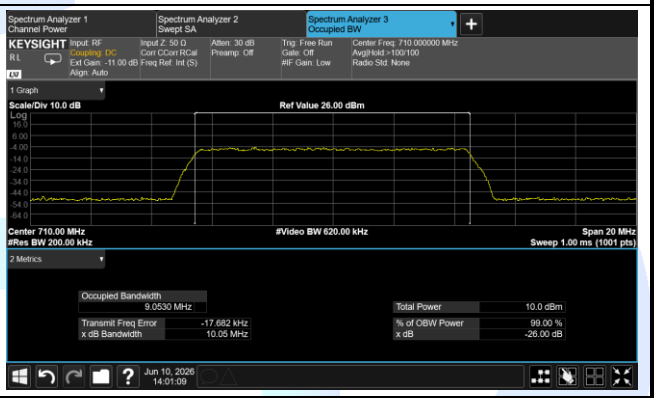
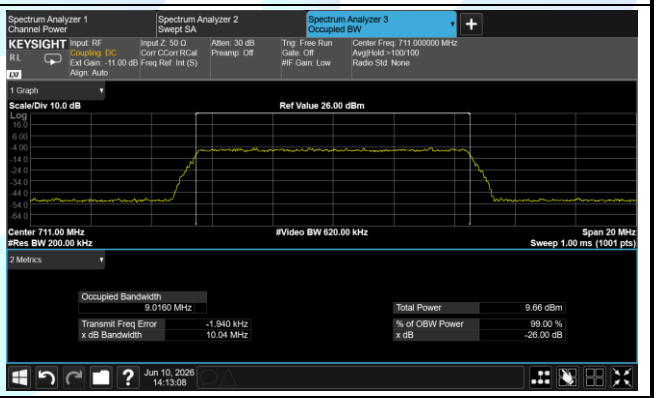
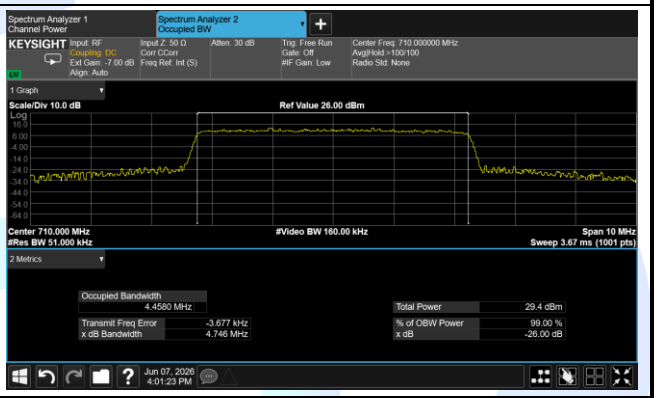
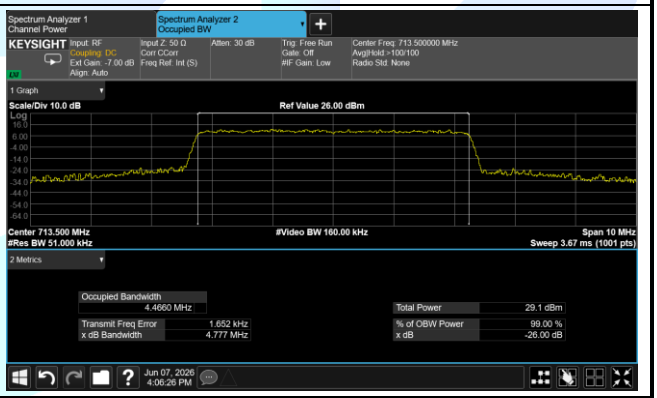
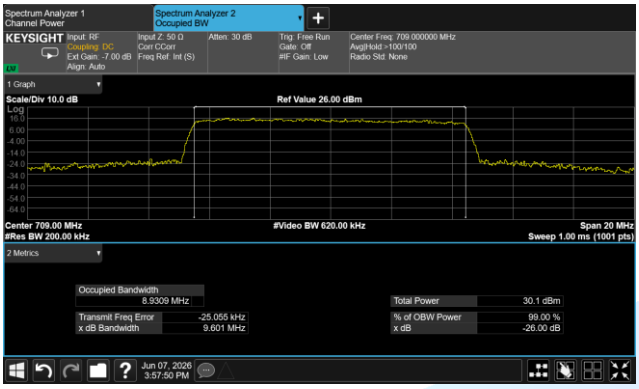
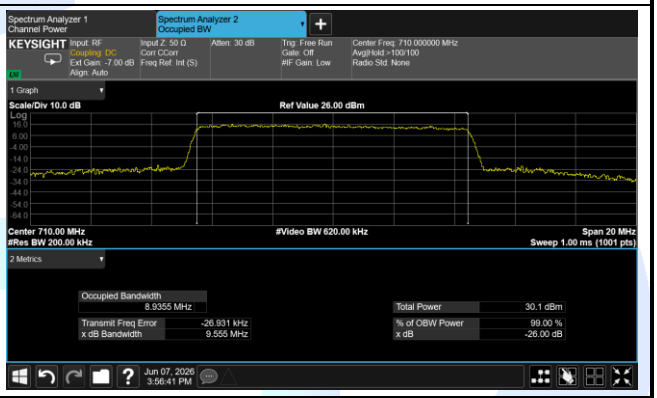
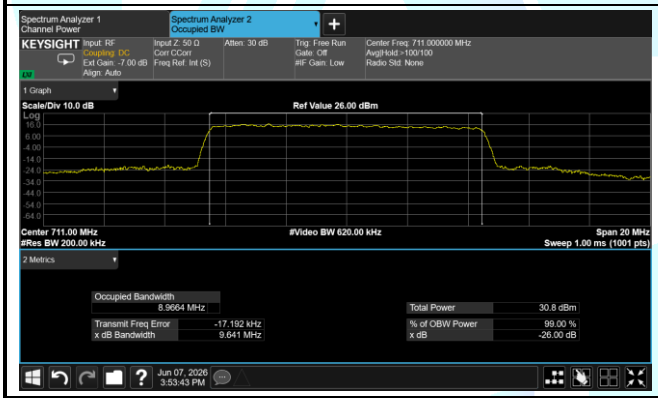
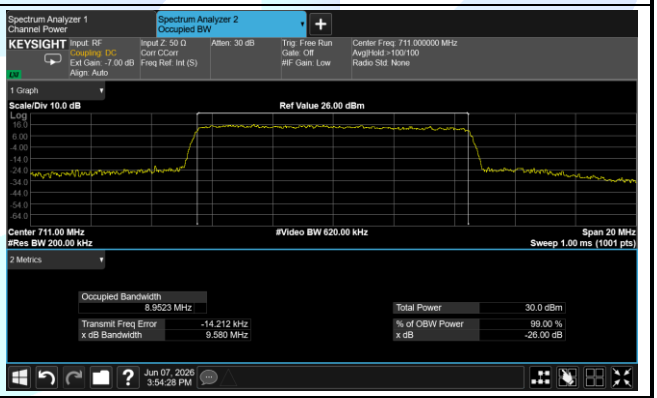
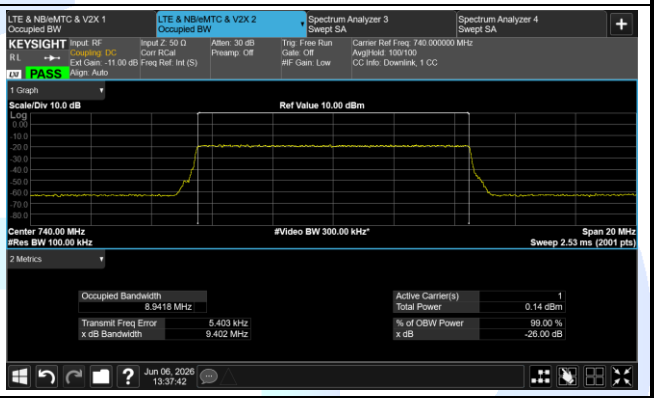
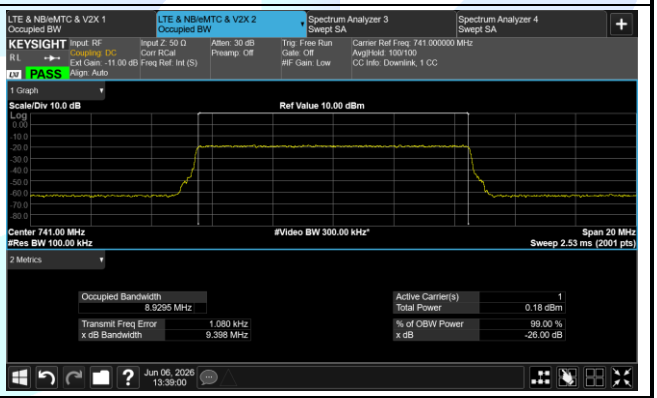
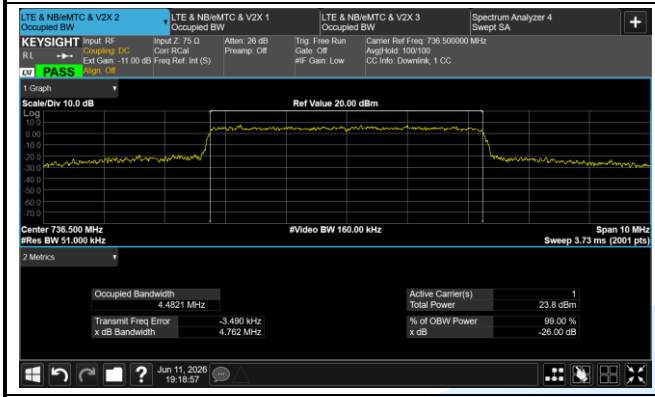
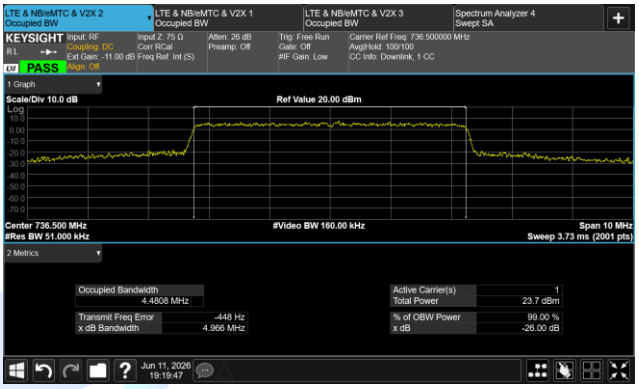
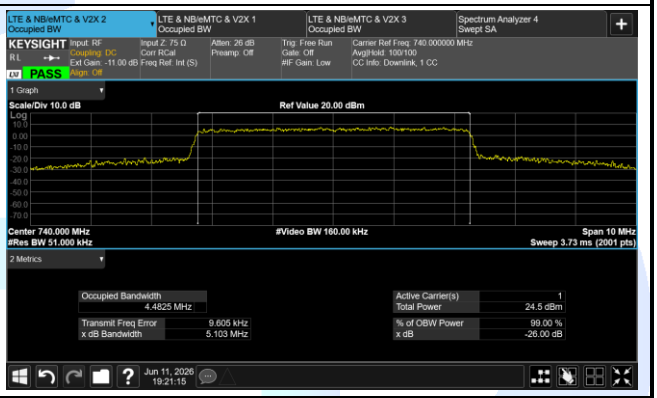
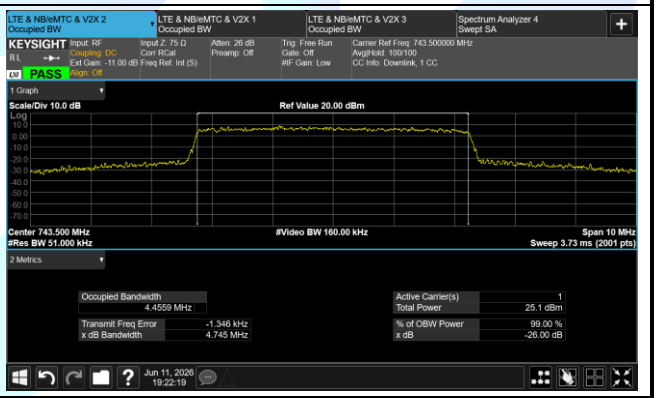
Frequency Band: LTE B14	
Downlink 10MHz Output	**Downlink 10MHz Output (AGC+3dB)**
Middle Channel	Middle Channel
	

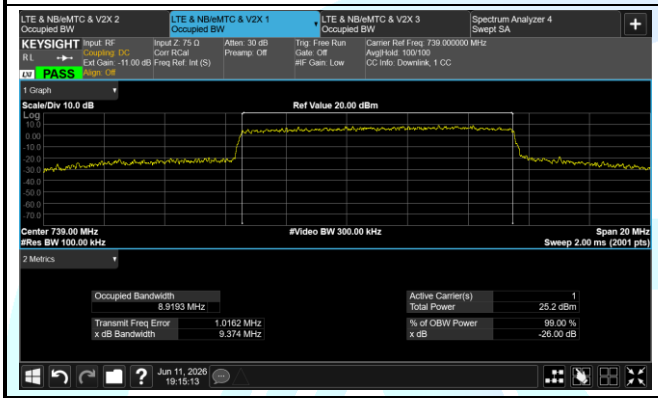
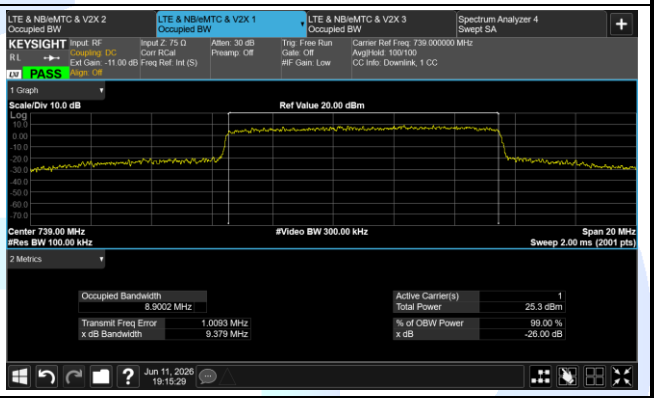
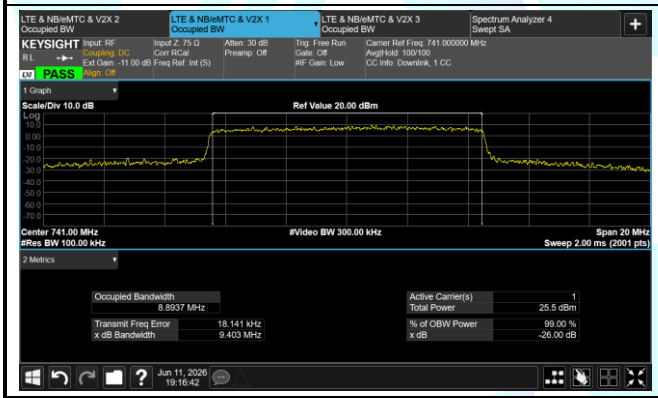
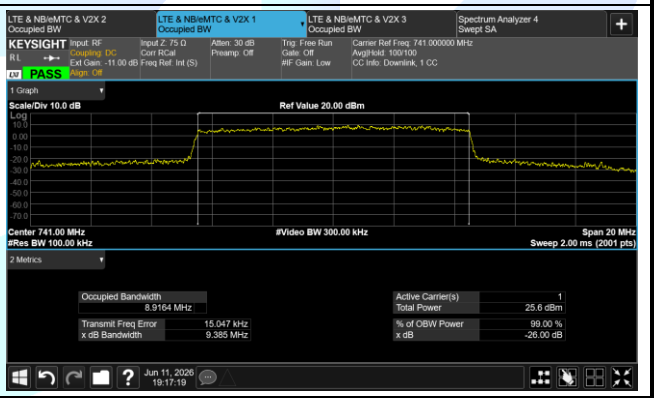
Frequency Band: LTE B17	
Uplink 5MHz Input	**Uplink 10MHz Input**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

Frequency Band: LTE B17	
Uplink 5MHz Output	**Uplink 5MHz Output (AGC+3dB)**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

Frequency Band: LTE B17	
Uplink 10MHz Output	**Uplink 10MHz Output (AGC+3dB)**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

Frequency Band: LTE B17	
Downlink 5MHz Input	**Downlink 10MHz Input**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

Frequency Band: LTE B17	
Downlink 5MHz Output	**Downlink 5MHz Output (AGC+3dB)**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

Frequency Band: LTE B17	
Downlink 10MHz Output	**Downlink 10MHz Output (AGC+3dB)**
Lowest Channel	Lowest Channel
	
Middle Channel	Middle Channel
	
Highest Channel	Highest Channel
	

5.4 Mean Output Power and Amplifier/Booster Gain

5.4.1 Limits

- **LTE B12/B17 (§27.50 (c)):**

  (1) Fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section;

  (3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;

- **LTE B14 (§90.541 (a)):**

  (1) The transmitting power and antenna height of base stations must not exceed the limits given in paragraph (a) of § 90.635.

  § 90.635:

  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.

5.4.2 Test Procedure

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 f_0 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.
k) The mean gain of the EUT can be determined from:
Gain (dB) = output power (dBm) − input power (dBm).

5.4.3 Test Setup

See setup 1 in section 4.4.

5.4.4 Test Instruments

Refer to section 3.7.

5.4.5 Test Results

Pass.

5.4.6 Test Data

Frequency Band: LTE B12									
Mode	BW (MHz)	Channel	S.G. Output Level (dBm)	Output Power (dBm)	ANT Gain (dBi)	E.I.R.P. (dBm/MHz)	E.I.R.P. (W/MHz)	E.I.R.P. Limit (W/MHz)	Booster Gain (dBi)
Uplink (AGC)	5	Lowest	-75	21.00	12.0	30.85	1.22	1000	96.00
		Middle	-75	21.01	12.0	30.86	1.22	1000	96.01
		Highest	-75	21.10	12.0	30.95	1.24	1000	96.10
	10	Lowest	-75	21.00	12.0	30.85	1.22	1000	96.00
		Middle	-75	21.09	12.0	30.94	1.24	1000	96.09
		Highest	-75	20.97	12.0	30.82	1.21	1000	95.97
Uplink (AGC+3dB)	5	Lowest	-72	21.00	12.0	30.85	1.22	1000	93.00
		Middle	-72	21.00	12.0	30.85	1.22	1000	93.00
		Highest	-72	21.11	12.0	30.96	1.25	1000	93.11
	10	Lowest	-72	21.00	12.0	30.85	1.22	1000	93.00
		Middle	-72	21.09	12.0	30.94	1.24	1000	93.09
		Highest	-72	20.97	12.0	30.82	1.21	1000	92.97
Downlink (AGC)	5	Lowest	-75	20.67	0.5	19.02	0.08	1000	95.67
		Middle	-75	20.77	0.5	19.12	0.08	1000	95.77
		Highest	-75	20.68	0.5	19.03	0.08	1000	95.68
	10	Lowest	-75	20.75	0.5	19.10	0.08	1000	95.75
		Middle	-75	20.65	0.5	19.00	0.08	1000	95.65
		Highest	-75	20.54	0.5	18.89	0.08	1000	95.54
Downlink (AGC+3dB)	5	Lowest	-72	20.88	0.5	19.23	0.08	1000	92.88
		Middle	-72	20.80	0.5	19.15	0.08	1000	92.80
		Highest	-72	20.67	0.5	19.02	0.08	1000	92.67
	10	Lowest	-72	20.78	0.5	19.13	0.08	1000	92.78
		Middle	-72	20.77	0.5	19.12	0.08	1000	92.77
		Highest	-72	20.67	0.5	19.02	0.08	1000	92.67
Remark: EIRP (dBm) = Conducted power (dBm) + Antenna Gain (dBi). ERP (dBm) = EIRP (dBm) - 2.15 (dB).									

Frequency Band: LTE B14									
Mode	BW (MHz)	Channel	S.G. Output Level (dBm)	Output Power (dBm)	ANT Gain (dBi)	E.I.R.P. (dBm/MHz)	E.I.R.P. (W/MHz)	E.I.R.P. Limit (W/MHz)	Booster Gain (dBi)
Uplink (AGC)	5	Lowest	-75	20.89	12.0	30.74	1.19	1000	95.89
		Middle	-75	20.75	12.0	30.60	1.15	1000	95.75
		Highest	-75	20.91	12.0	30.76	1.19	1000	95.91
	10	Middle	-75	20.74	12.0	30.59	1.15	1000	95.74
Uplink (AGC+3dB)	5	Lowest	-72	20.89	12.0	30.74	1.19	1000	92.89
		Middle	-72	20.80	12.0	30.65	1.16	1000	92.80
		Highest	-72	20.88	12.0	30.73	1.18	1000	92.88
	10	Middle	-72	20.77	12.0	30.62	1.15	1000	92.77
Downlink (AGC)	5	Lowest	-74	20.19	0.5	18.54	0.07	1000	94.19
		Middle	-75	20.09	0.5	18.44	0.07	1000	95.09
		Highest	-75	20.29	0.5	18.64	0.07	1000	95.29
	10	Middle	-74	19.95	0.5	18.30	0.07	1000	93.95
Downlink (AGC+3dB)	5	Lowest	-71	20.25	0.5	18.60	0.07	1000	91.25
		Middle	-72	20.32	0.5	18.67	0.07	1000	92.32
		Highest	-72	20.35	0.5	18.70	0.07	1000	92.35
	10	Middle	-71	20.14	0.5	18.49	0.07	1000	91.14

Remark:
EIRP (dBm) = Conducted power (dBm) + Antenna Gain (dBi).
ERP (dBm) = EIRP (dBm) - 2.15 (dB).

Frequency Band: LTE B17									
Mode	BW (MHz)	Channel	S.G. Output Level (dBm)	Output Power (dBm)	ANT Gain (dBi)	E.I.R.P. (dBm/MHz)	E.I.R.P. (W/MHz)	E.I.R.P. Limit (W/MHz)	Booster Gain (dBi)
Uplink (AGC)	5	Lowest	-75	21.02	12.0	30.87	1.22	1000	96.02
		Middle	-75	21.19	12.0	31.04	1.27	1000	96.19
		Highest	-75	20.91	12.0	30.76	1.19	1000	95.91
	10	Lowest	-75	21.07	12.0	30.92	1.24	1000	96.07
		Middle	-75	21.10	12.0	30.95	1.24	1000	96.10
		Highest	-75	20.93	12.0	30.78	1.20	1000	95.93
Uplink (AGC+3dB)	5	Lowest	-72	20.79	12.0	30.64	1.16	1000	92.79
		Middle	-72	21.24	12.0	31.09	1.29	1000	93.24
		Highest	-72	20.90	12.0	30.75	1.19	1000	92.90
	10	Lowest	-72	21.06	12.0	30.91	1.23	1000	93.06
		Middle	-72	21.12	12.0	30.97	1.25	1000	93.12
		Highest	-72	20.94	12.0	30.79	1.20	1000	92.94
Downlink (AGC)	5	Lowest	-75	20.96	0.5	19.31	0.09	1000	95.96
		Middle	-75	21.01	0.5	19.36	0.09	1000	96.01
		Highest	-75	20.82	0.5	19.17	0.08	1000	95.82
	10	Lowest	-75	20.52	0.5	18.87	0.08	1000	95.52
		Middle	-75	20.65	0.5	19.00	0.08	1000	95.65
		Highest	-75	20.50	0.5	18.85	0.08	1000	95.50
Downlink (AGC+3dB)	-5	Lowest	-72	20.98	0.5	19.33	0.09	1000	92.98
		Middle	-72	20.98	0.5	19.33	0.09	1000	92.98
		Highest	-72	20.78	0.5	19.13	0.08	1000	92.78
	10	Lowest	-72	20.63	0.5	18.98	0.08	1000	92.63
		Middle	-72	20.67	0.5	19.02	0.08	1000	92.67
		Highest	-72	20.45	0.5	18.80	0.08	1000	92.45
Remark: EIRP (dBm) = Conducted power (dBm) + Antenna Gain (dBi). ERP (dBm) = EIRP (dBm) - 2.15 (dB).									

5.5 Noise Figure

5.5.1 Limits

FCC Part 90.219 (e)(2):

The noise figure of a signal booster must not exceed 9 dB in either direction.

5.5.2 Test Procedure

a) For LTE Band 14, 10 MHz Bandwidth LTE was tested as representative configuration. The Downlink and Uplink Gains are measured with a LTE signal injected to the device under test.

b) The input of the EUT is terminated when measuring the noise output.

c) The spectrum analyser was set to 100 trace average in RMS mode.

d) RBW is 1 MHz, VBW is > 3 x RBW.

e) Channel power was recorded.

f) The noise figure was calculated using the following formula:

Noise Figure (NF) = N – Gain + 174 dB – 10lg10(B)

- N = Noise Power Output in dBm/MHz
- Gain = Gain of the device under test
- B = Resolution Bandwidth of spectrum analyzer in Hz
- 174 = Thermal noise for 1 Hz RBW at room temperature

g) Both Downlink and Uplink are tested.

5.5.3 Test Setup

See setup 1 in section 4.4.

5.5.4 Test Instruments

Refer to section 3.7.

5.5.5 Test Results

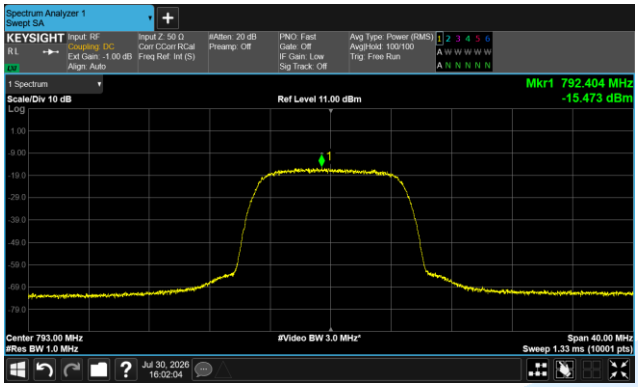
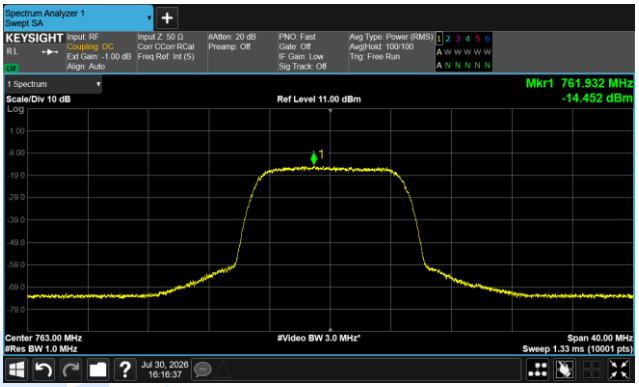
Pass.

5.5.6 Test Data

LTE Band 14 Booster Gain					
Mode	BW(MHz)	Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain(dB)
Uplink	10	793	-75	20.74	95.74
Downlink	10	763	-74	19.95	93.95

LTE Band 14 Noise Figure							
Mode	BW(MHz)	Frequency (MHz)	RBW (MHz)	Noise output (dBm/MHz)	Gain(dB)	Noise Figure (dB)	Limit (dB)
Uplink	10	793	1	-15.47	95.74	2.79	9
Downlink	10	763	1	-14.45	93.95	5.60	9

Test Plots for Noise Output Power Conducted Measurement:

Frequency Band: LTE B14	
Uplink 10MHz	Downlink 10MHz
	

5.6 Out-of-Band/Out-of-Block (Including Intermodulation) Emissions and Spurious Emissions

5.6.1 Limits

- **LTE B12/B17 (§ 27.53 (g)):**

  For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

- **LTE B14 (§ 27.53 (e)):**

  (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

  (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

5.6.2 Test Procedure

1) Out-of-Band/Out-of-Block Emissions Conducted Measurements

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

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 this two-signal test.

b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW). Set the signal generator amplitudes so that the power from each into the EUT is equivalent.

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 under test.

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 [R8], 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 [R8].

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 EBW or 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 spectrum 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 (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 steps k) to m) with the composite input power level set to 3 dB above the AGC threshold.

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

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.

2) Spurious Emissions Conducted Measurements

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 (i.e., 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 spectrum analyzer start frequency to the lowest RF 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.

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.4
j) Select the power averaging (rms) detector function.
k) Trace average at least 10 traces in power averaging (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 spectrum 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 spectrum analyzer stop frequency to 10 × the highest frequency of the fundamental emission (see Section 2.1057). 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 (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; also provide tabular data, if required.
p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.
q) Repeat steps c) to p) with the narrowband test signal.
r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

5.6.3 Test Setup

See setup 1 in section 4.4.

5.6.4 Test Instruments

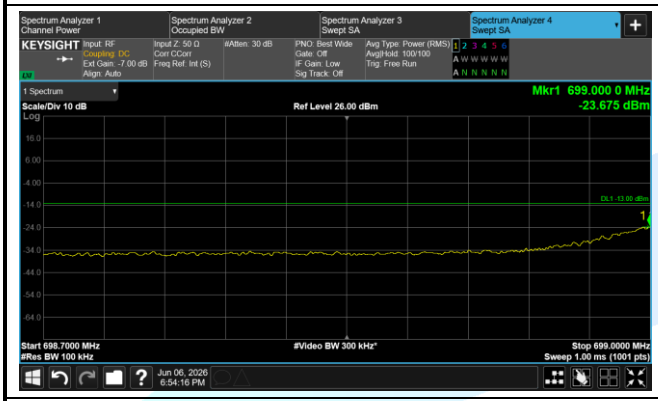
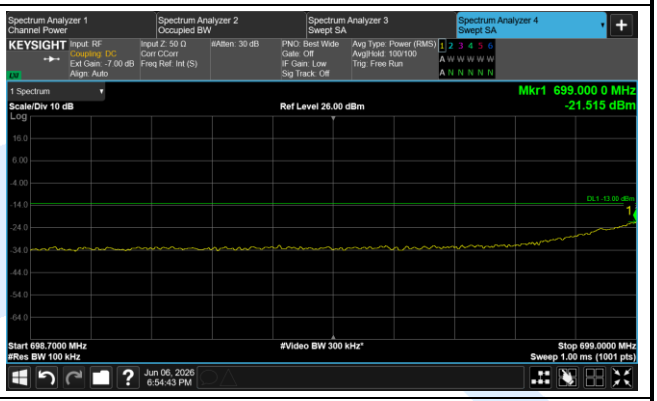
Refer to section 3.7.

5.6.5 Test Results

Pass.

5.6.6 Test Data

Test Plots for Out-of-Band/Out-of-Block Emissions Conducted Measurement:

<table>
<tr><th colspan="2">Frequency Band: LTE B12</th></tr>
<tr><th colspan="2">Uplink 5MHz</th></tr>
<tr><td>Lowest Channel</td><td>Lowest Channel (AGC+3dB)</td></tr>
<tr><td> 
</td><td> 
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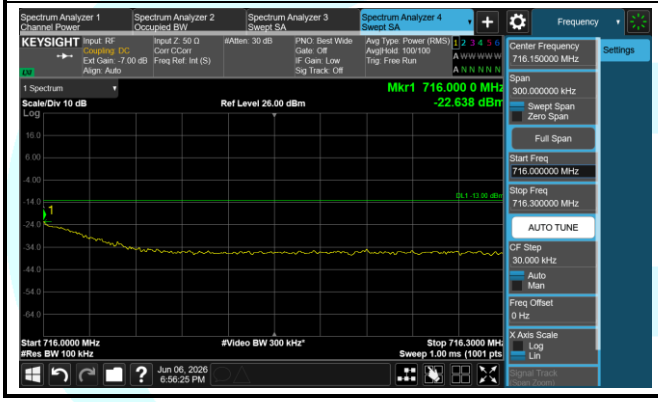
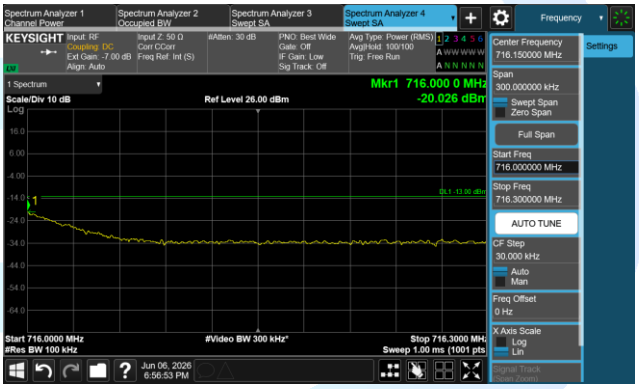
<tr><td>Highest Channel</td><td>Highest Channel (AGC+3dB)</td></tr>
<tr><td> 
</td><td> 
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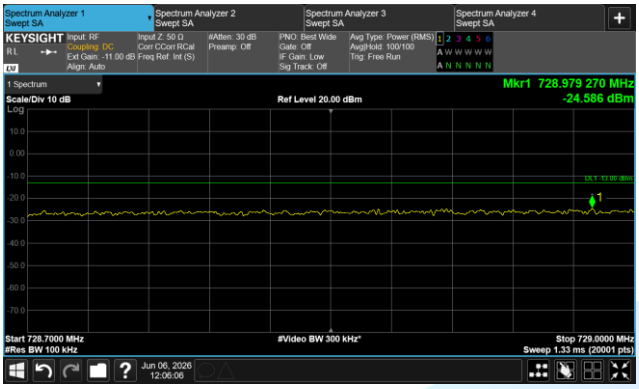
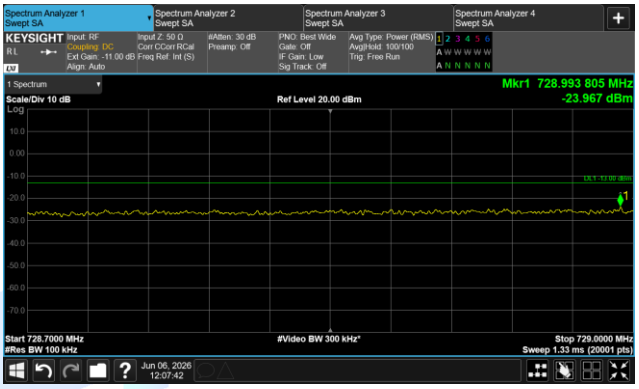
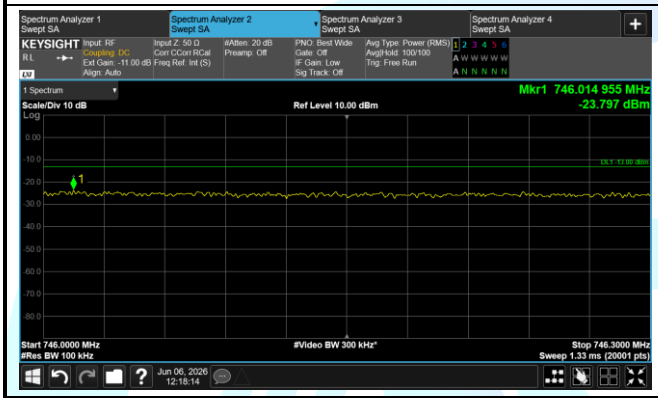
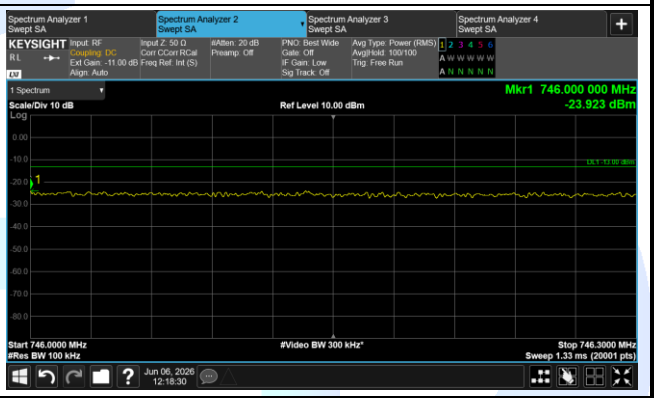
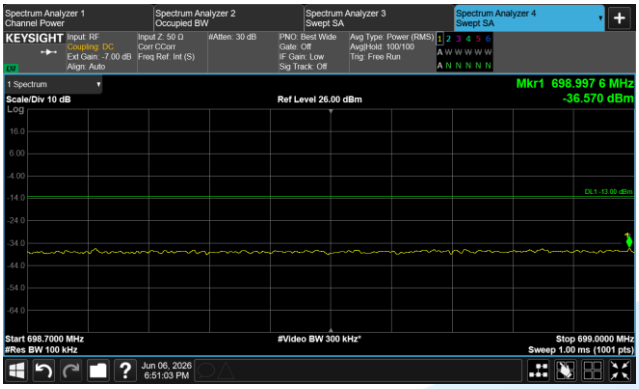
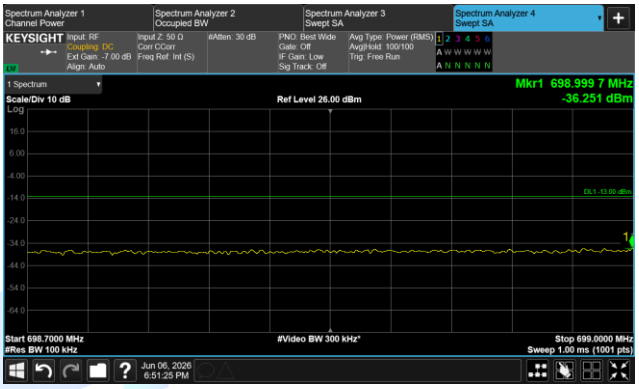
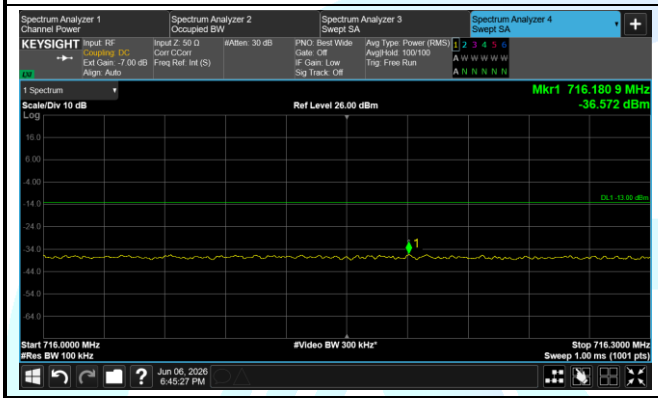
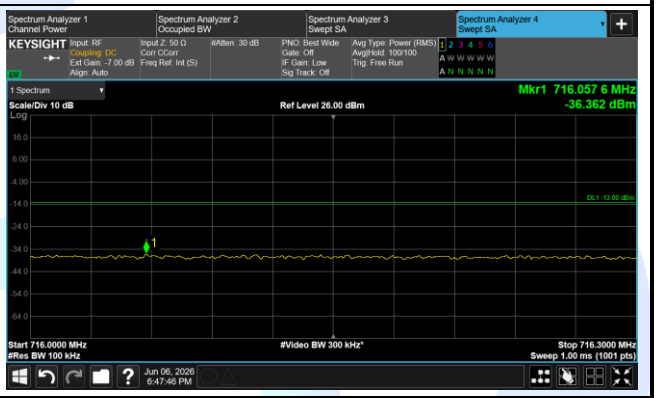
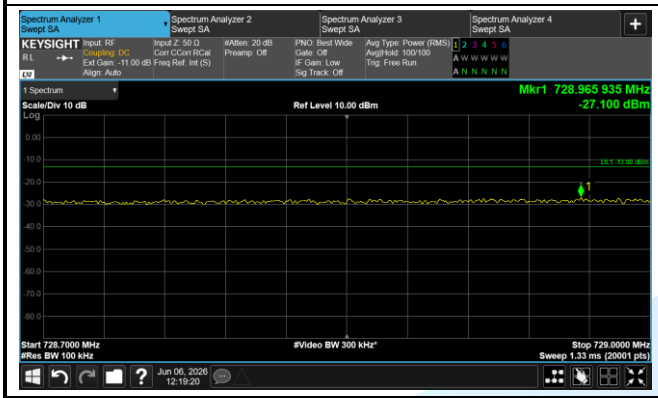
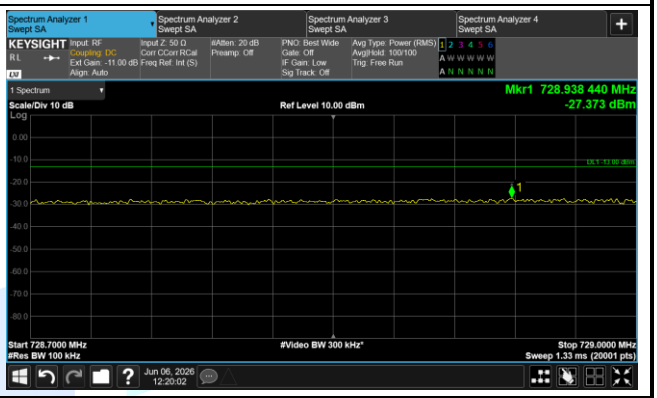
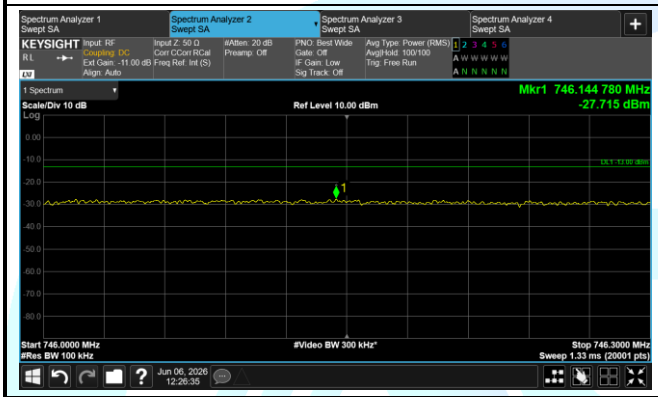
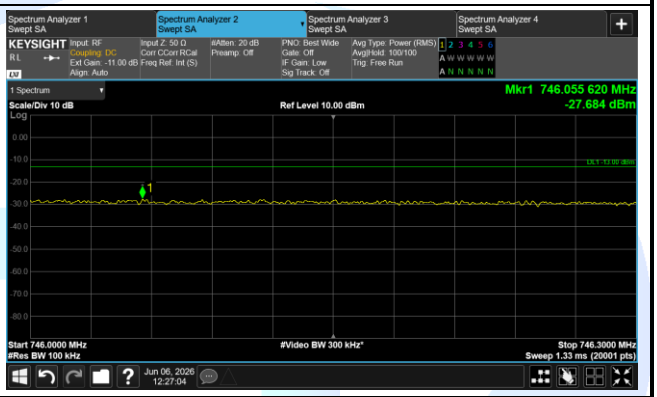
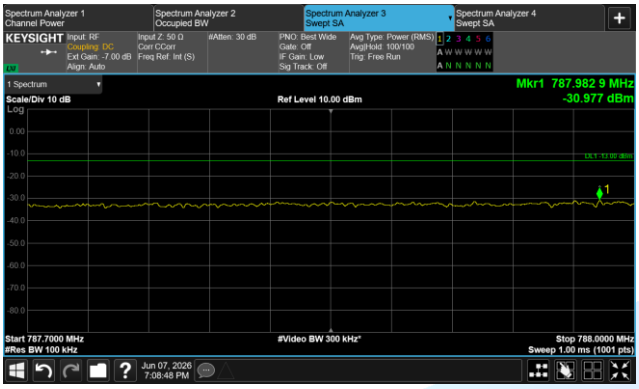
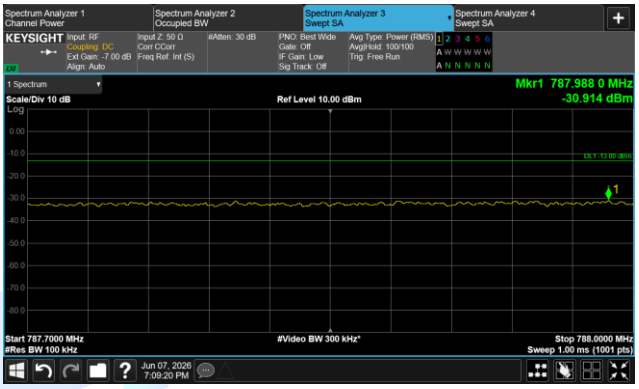
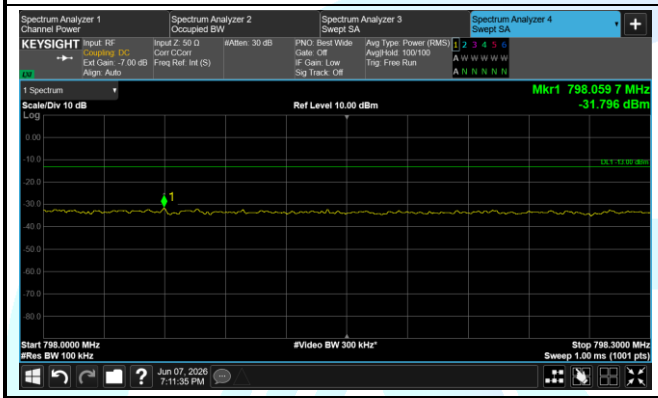
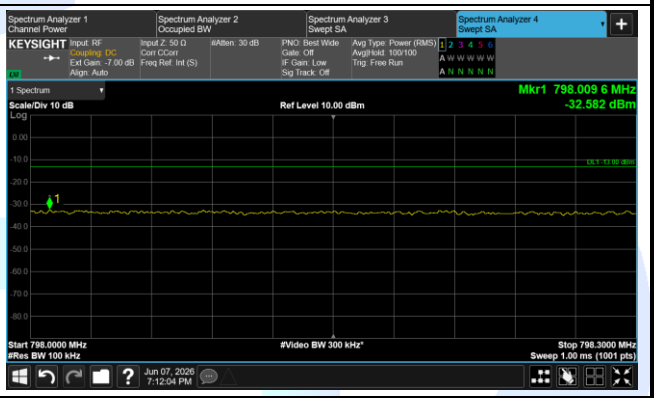
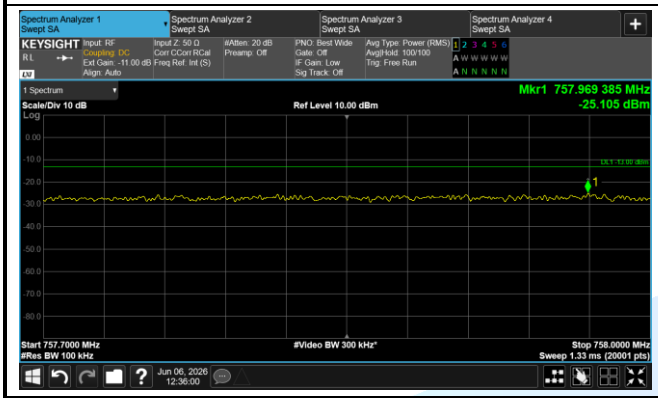
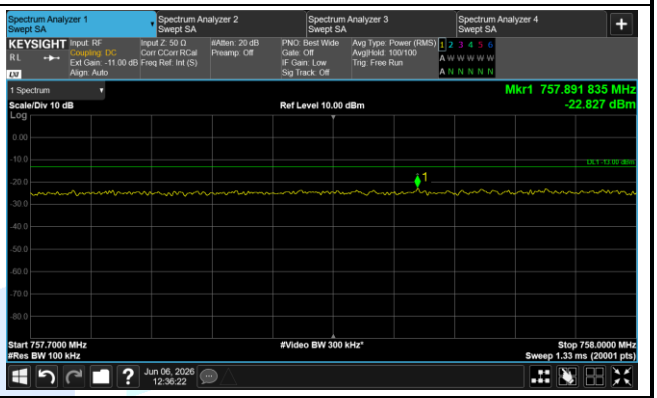
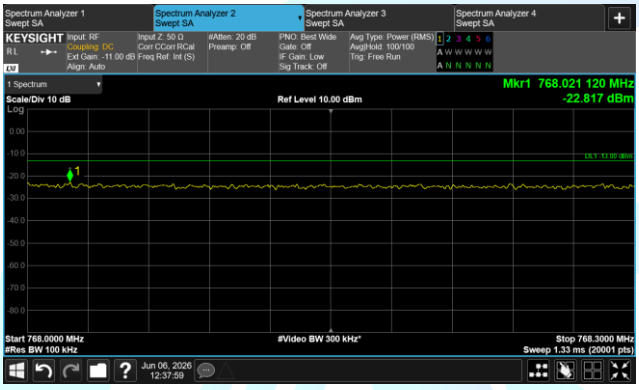
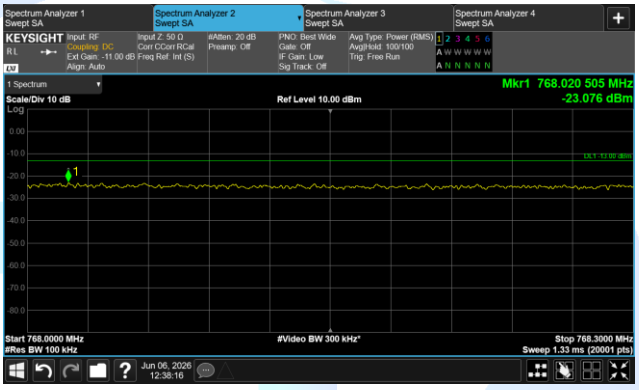
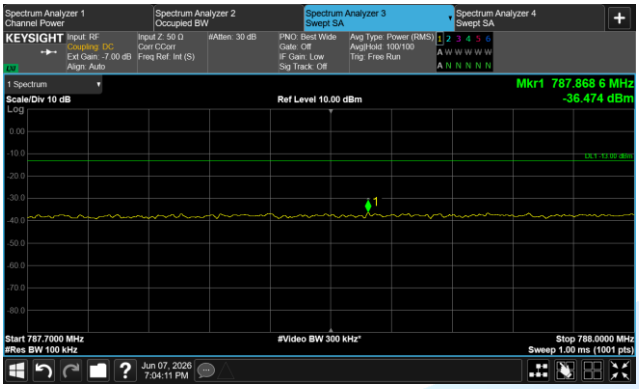
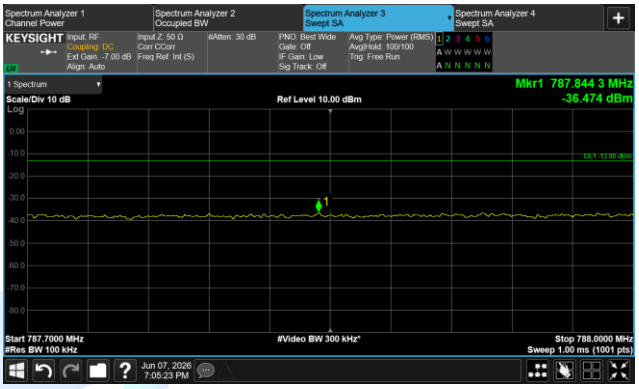
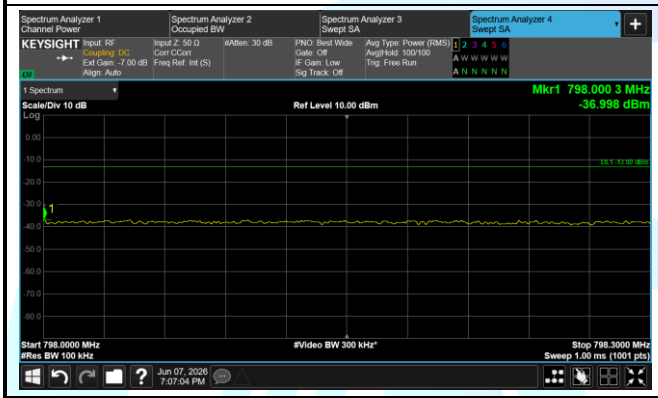
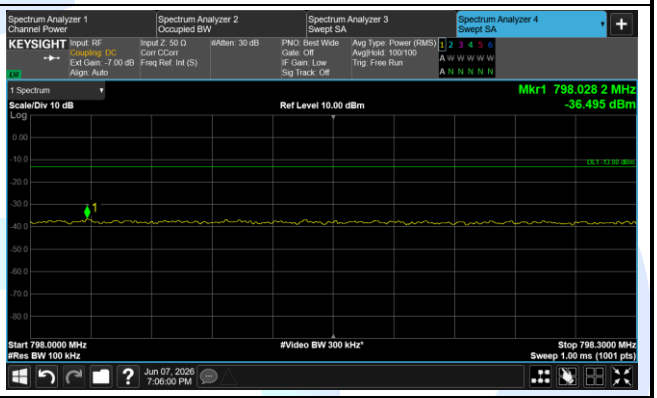
Frequency Band: LTE B12	
Downlink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

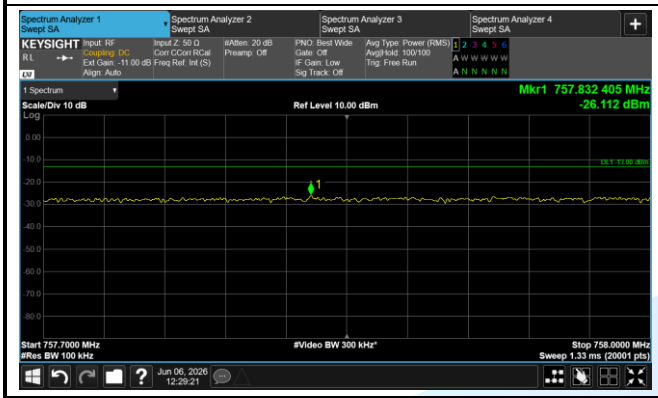
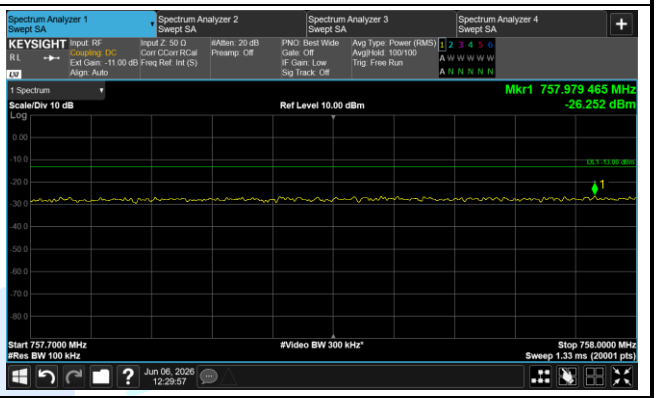
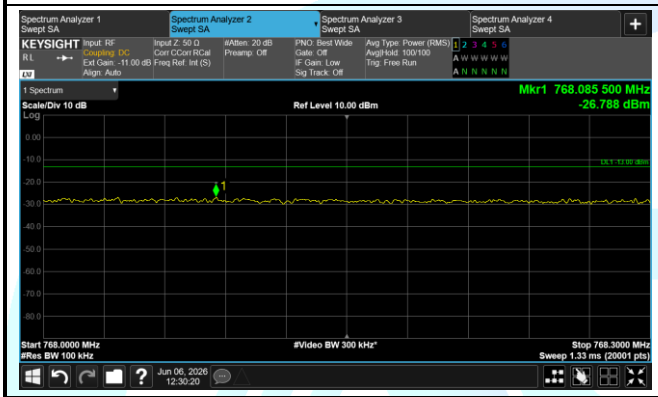
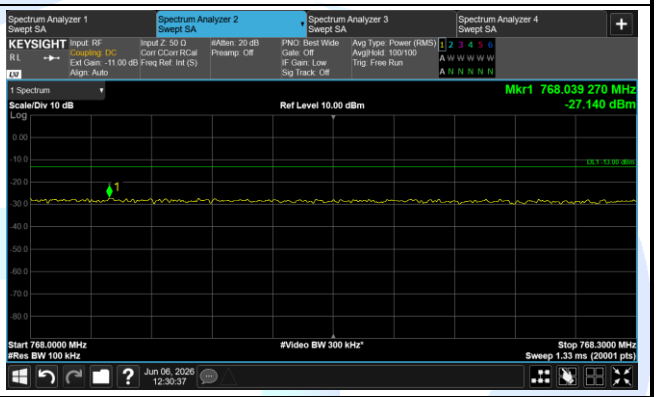
Frequency Band: LTE B12	
Uplink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

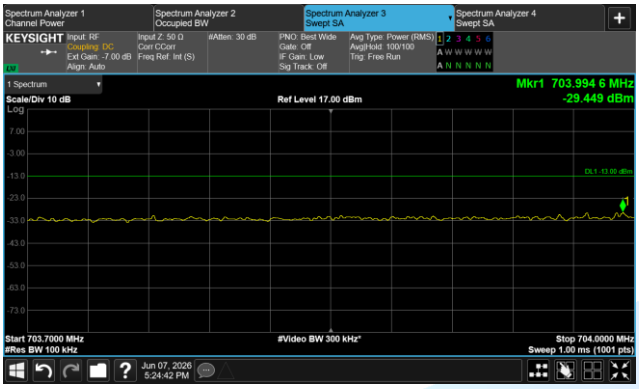
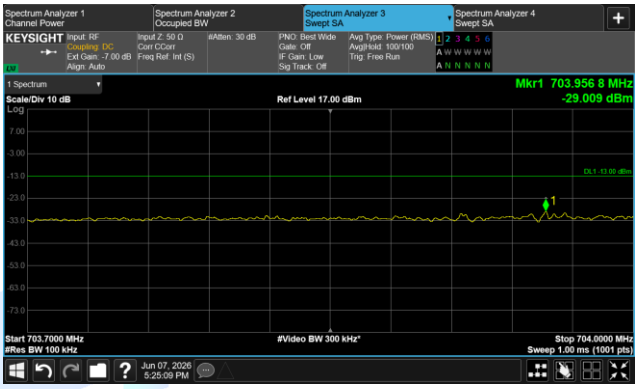
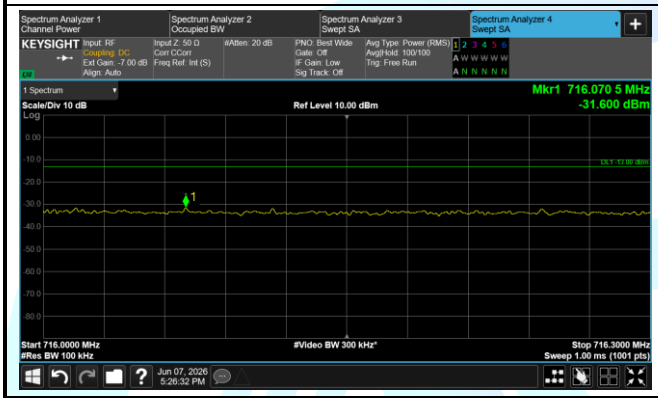
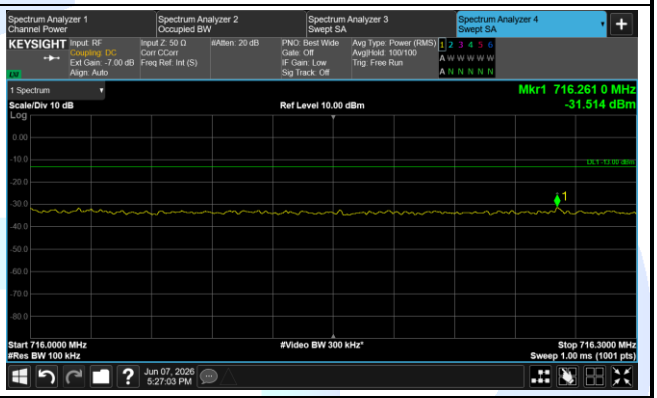
Frequency Band: LTE B12	
Downlink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

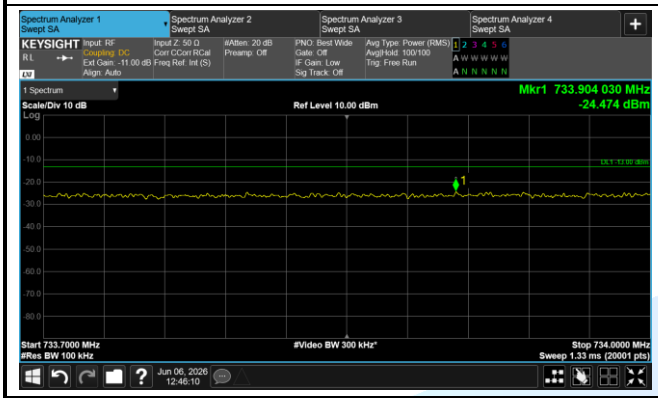
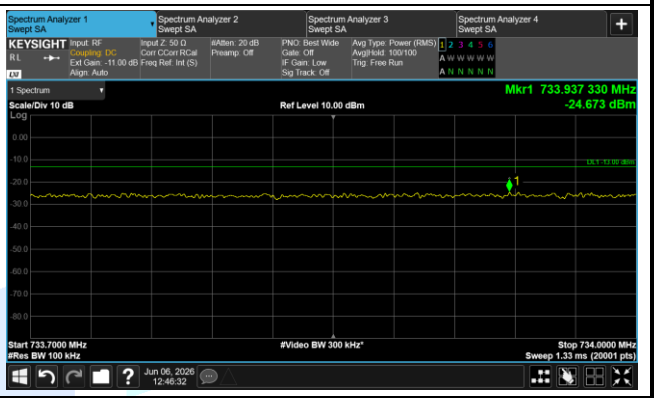
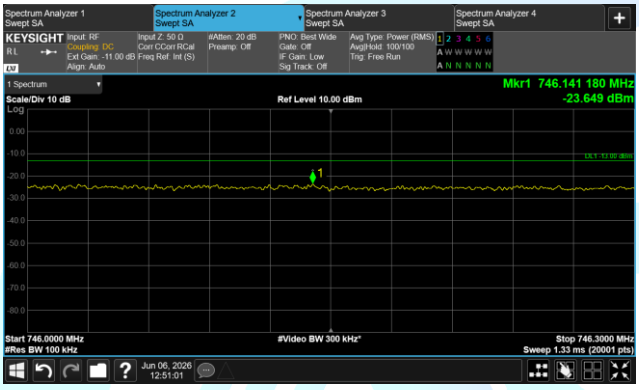
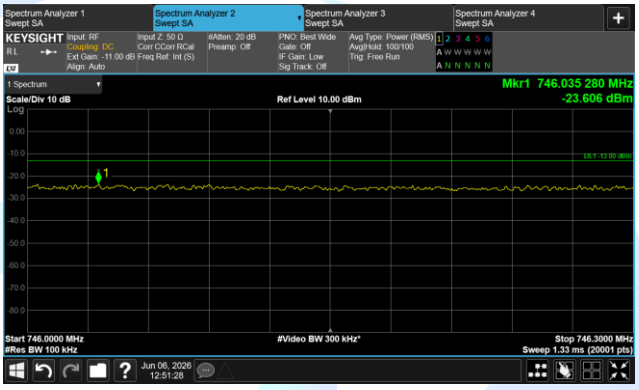
Frequency Band: LTE B14	
Uplink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

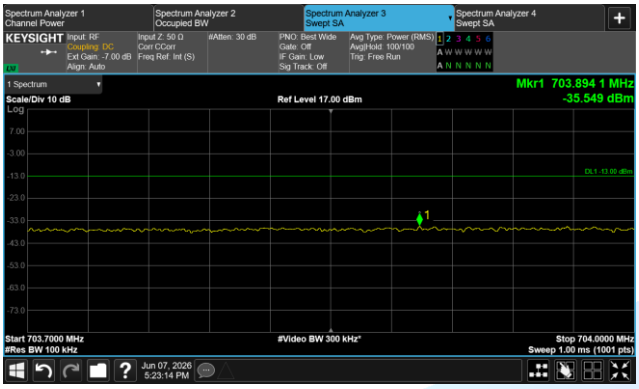
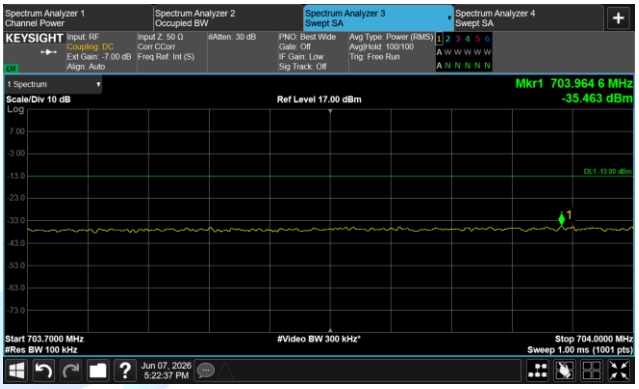
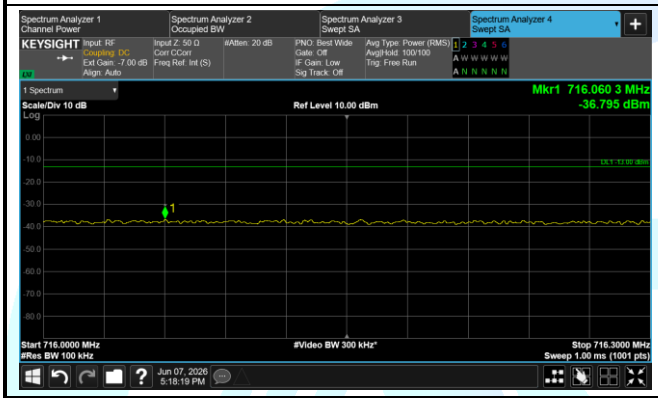
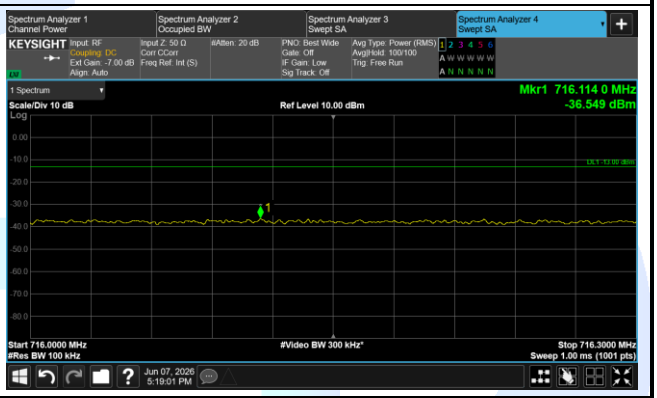
Frequency Band: LTE B14	
Downlink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel(AGC+3dB)
	

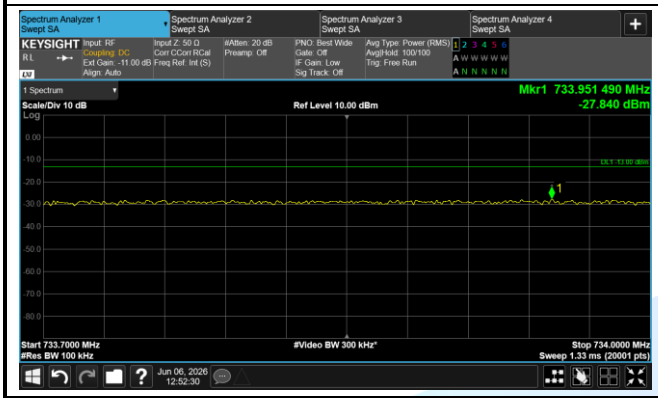
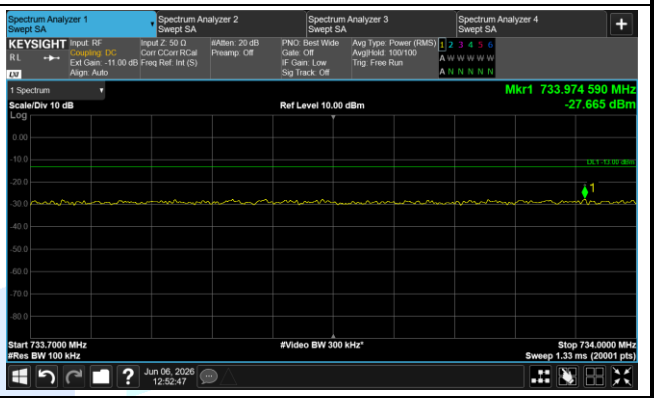
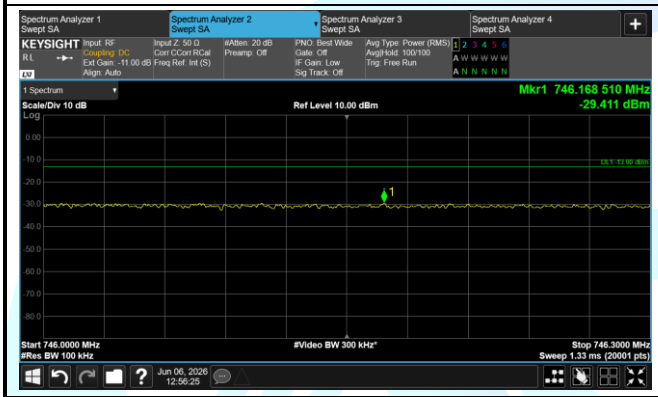
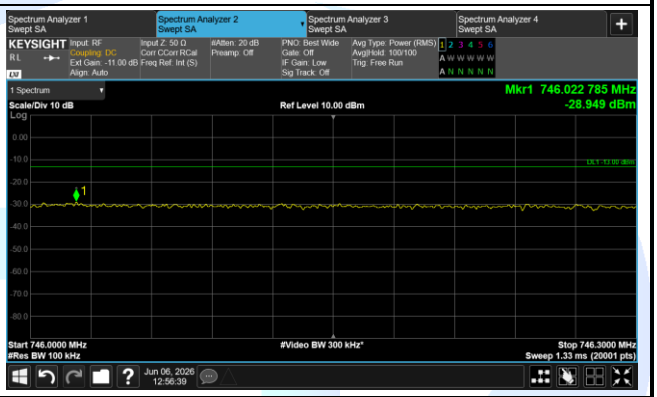
Frequency Band: LTE B14	
Uplink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

Frequency Band: LTE B14	
Downlink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

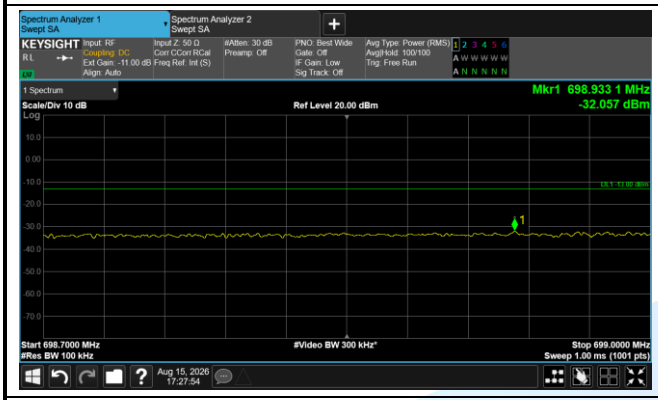
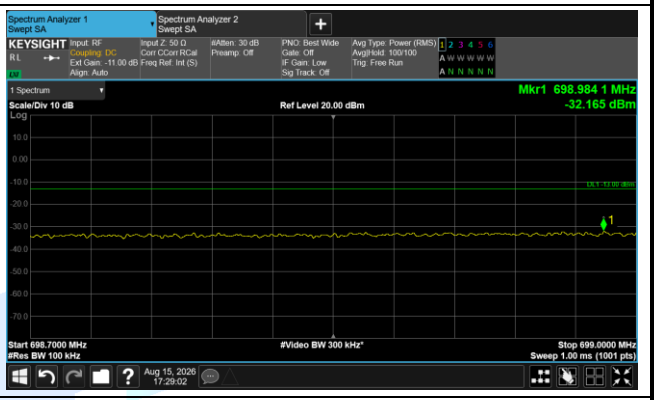
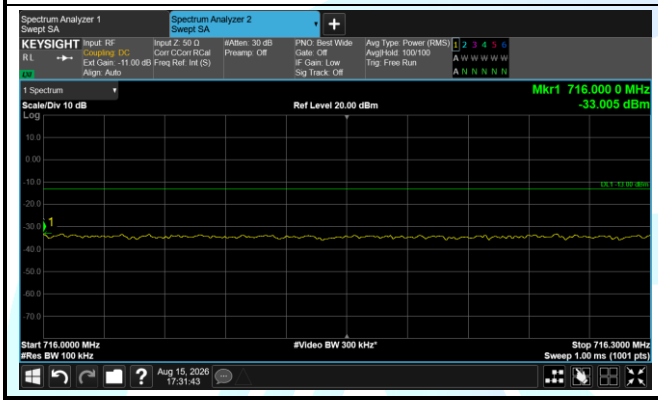
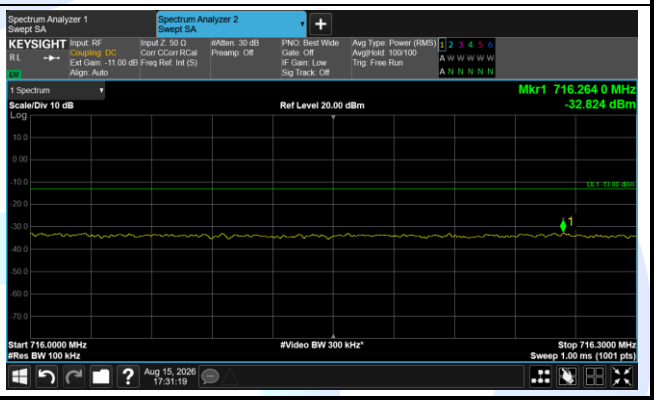
Frequency Band: LTE B17	
Uplink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

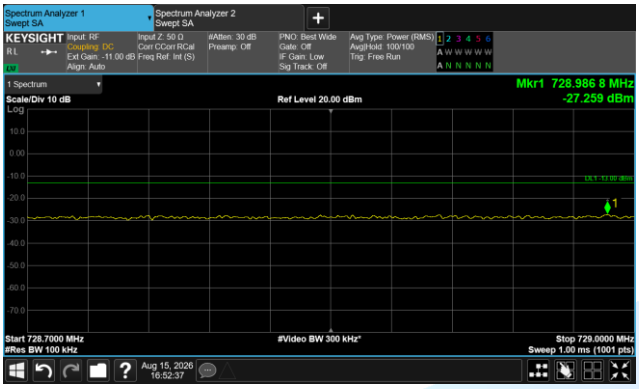
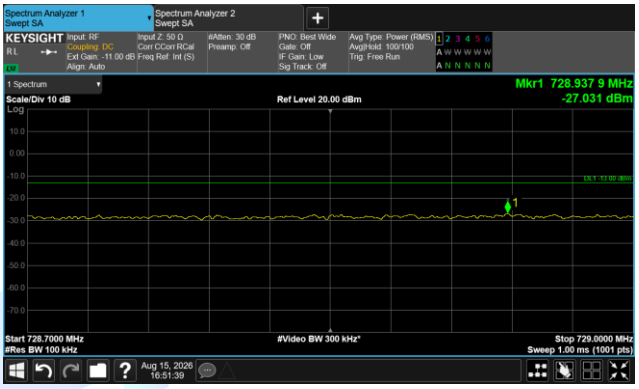
Frequency Band: LTE B17	
Downlink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

Frequency Band: LTE B17	
Uplink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

Frequency Band: LTE B17	
Downlink 10MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

Test Plots for Intermodulation mode:

Frequency Band: LTE B12	
Uplink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)
	

Frequency Band: LTE B12	
Downlink 5MHz	
Lowest Channel	Lowest Channel (AGC+3dB)
	
Highest Channel	Highest Channel (AGC+3dB)