

**Oscillation mitigation or shutdown:**

Lower 700 Band	Uplink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	-0.42	<12	Pass
+5	-0.46	<12	Pass
+4	-0.57	<12	Pass
+3	-0.74	<12	Pass
+2	-0.87	<12	Pass
+1	-1.07	<12	Pass

Lower 700 Band	Downlink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	-0.67	<12	Pass
+5	-0.54	<12	Pass
+4	-0.58	<12	Pass
+3	-0.89	<12	Pass
+2	-0.76	<12	Pass
+1	-1.14	<12	Pass

Upper 700 Band	Uplink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	-0.58	<12	Pass
+5	-0.90	<12	Pass
+4	-0.10	<12	Pass
+3	-0.17	<12	Pass
+2	-0.14	<12	Pass
+1	-0.21	<12	Pass



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Upper 700 Band	Downlink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	-0.62	<12	Pass
+5	-0.99	<12	Pass
+4	-0.23	<12	Pass
+3	-0.35	<12	Pass
+2	-0.29	<12	Pass
+1	-0.34	<12	Pass

Cellular Band	Uplink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	0.30	<12	Pass
+5	0.21	<12	Pass
+4	0.12	<12	Pass
+3	-0.10	<12	Pass
+2	-0.29	<12	Pass
+1	-1.22	<12	Pass

Cellular Band	Downlink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	0.46	<12	Pass
+5	0.33	<12	Pass
+4	0.25	<12	Pass
+3	-0.05	<12	Pass
+2	-0.14	<12	Pass
+1	-1.10	<12	Pass



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PCS Band	Uplink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	0.26	<12	Pass
+5	0.15	<12	Pass
+4	0.75	<12	Pass
+3	0.54	<12	Pass
+2	0.61	<12	Pass
+1	0.39	<12	Pass

PCS Band	Downlink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	0.38	<12	Pass
+5	0.26	<12	Pass
+4	0.89	<12	Pass
+3	0.65	<12	Pass
+2	0.77	<12	Pass
+1	0.49	<12	Pass

AWS Band	Uplink		
Signal Type	AWGN		
Isolation	Difference	Limit	Result
dB	dB	dB	
+6	-0.71	<12	Pass
+5	0.04	<12	Pass
+4	-0.11	<12	Pass
+3	-0.22	<12	Pass
+2	-0.29	<12	Pass
+1	-1.29	<12	Pass



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AWS Band	Downlink		
Signal Type	AWGN		
Isolation	Different	Limit	Result
dB	dB	dB	
+6	-0.85	<12	Pass
+5	0.15	<12	Pass
+4	-0.26	<12	Pass
+3	-0.32	<12	Pass
+2	-0.47	<12	Pass
+1	-1.36	<12	Pass



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6.6 Intermodulation Limits

6.6.1 Applicable Standard

According to §20.21(e)(8)(i)(F) Intermodulation Limits:

The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation.

6.6.2 Test Procedure

According to section 7.4 of KDB 935210 D03 Signal Booster Measurement v04r04:

- a) Connect the signal booster to the test equipment as shown in Figure 9. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer RBW = 3 kHz.
- c) Set the VBW ≥ 3 RBW.
- d) Select the rms detector.
- e) Set the spectrum analyzer center frequency to the center of the supported operational band under test.
- f) Set the span to 5 MHz. Affirm that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
- g) Configure the two signal generators for CW operation with generator #1 tuned 300 kHz below the operational band center frequency and generator #2 tuned 300 kHz above the operational band center frequency. If the maximum output power is not at the operational-band (booster pass band) center frequency, configure the test signal pair around the frequency with maximum output power as determined per 7.2.
- h) Set the signal generator amplitudes so that the power from each into the EUT is equivalent, then turn on the RF output.
- i) Simultaneously increase each signal generators' amplitude equally until just before the EUT begins AGC, then affirm that all intermodulation-product emissions (if any occur) are below the specified limit of -19 dBm.
- j) Use the trace averaging function of the spectrum analyzer, and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation-product emission.
- k) Record the maximum intermodulation product amplitude level that is observed.
- l) Capture the spectrum analyzer trace for inclusion in the test report.
- m) Repeat 7.4e) to 7.4l) for all uplink and downlink operational bands.

NOTE—If using a single signal generator with dual outputs, affirm that intermodulation products are not the result of the generator.

- n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in 7.4i), but not exceeding the maximum input level of 5.5, to affirm that the EUT maintains compliance with the intermodulation limit. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.



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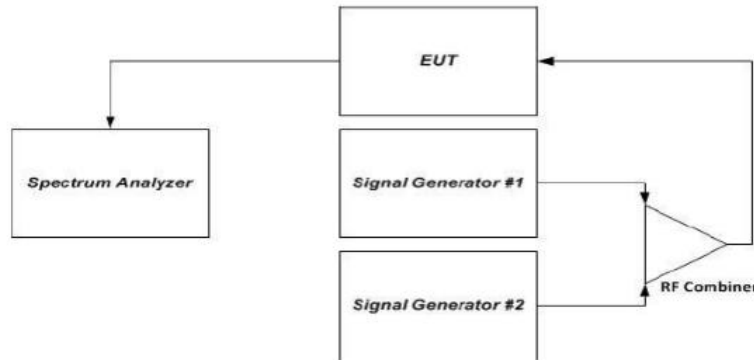
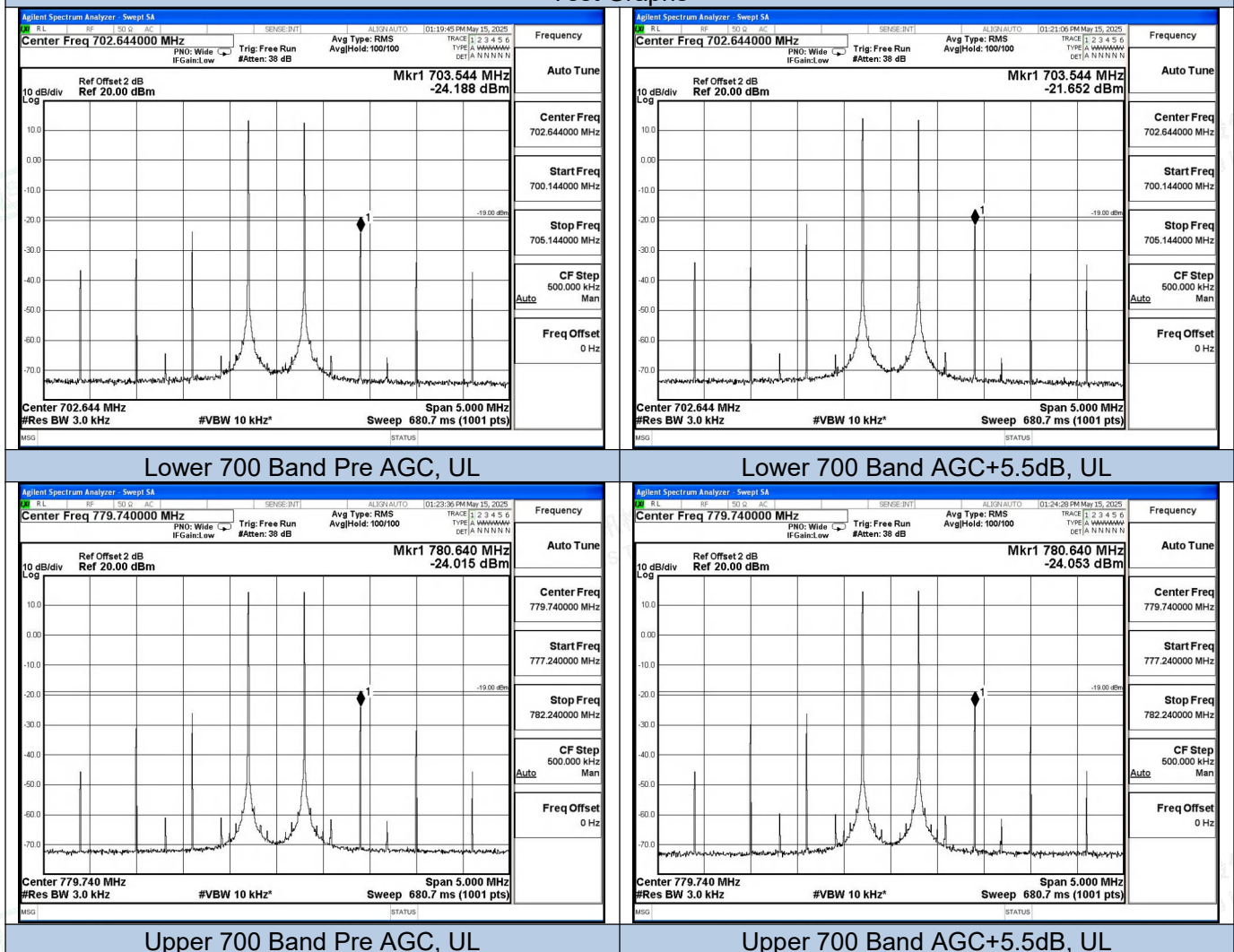


Figure 9 – Intermodulation product instrumentation test setup

6.6.3 Test Data

Temperature	23.2°C	Humidity	52.5%
Test Engineer	Nick Peng	Test Mode	Transmitting

Test Graphs

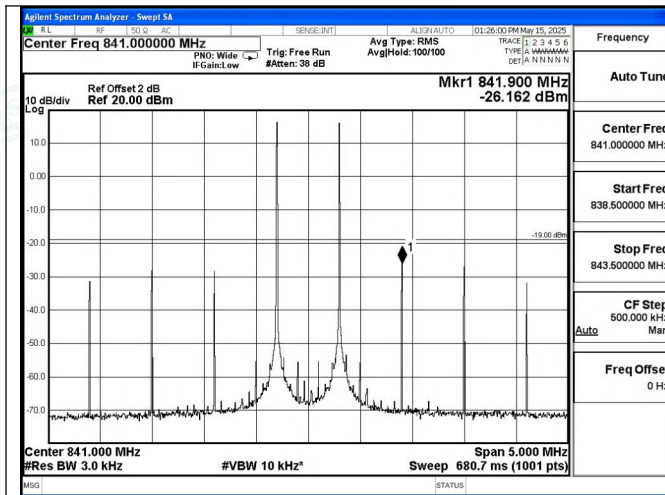


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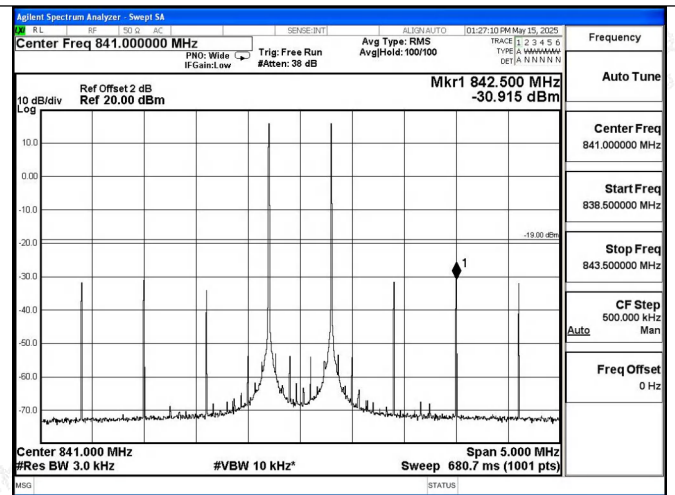
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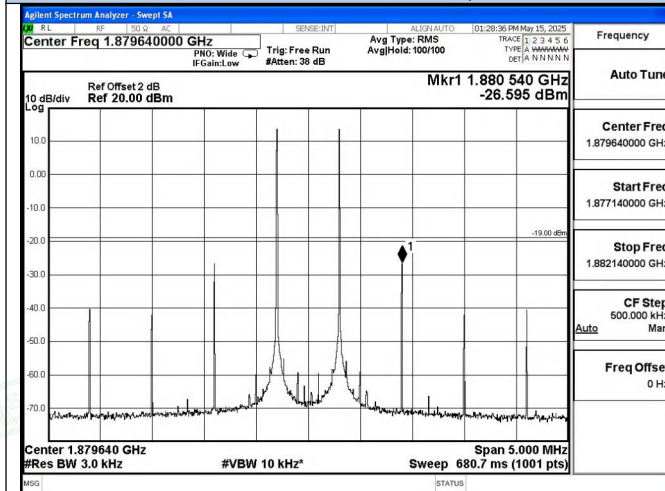
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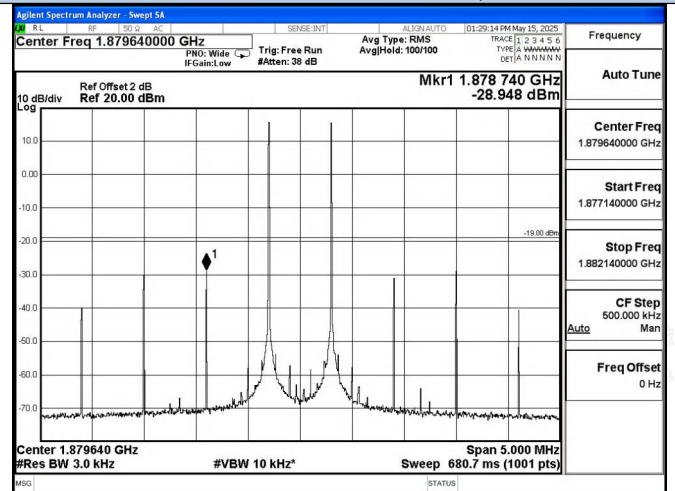
Cellular Band Pre AGC, UL



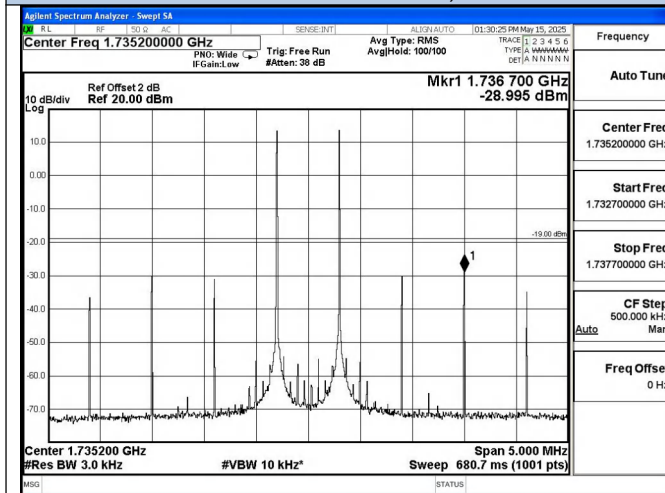
Cellular Band AGC+5.5dB, UL



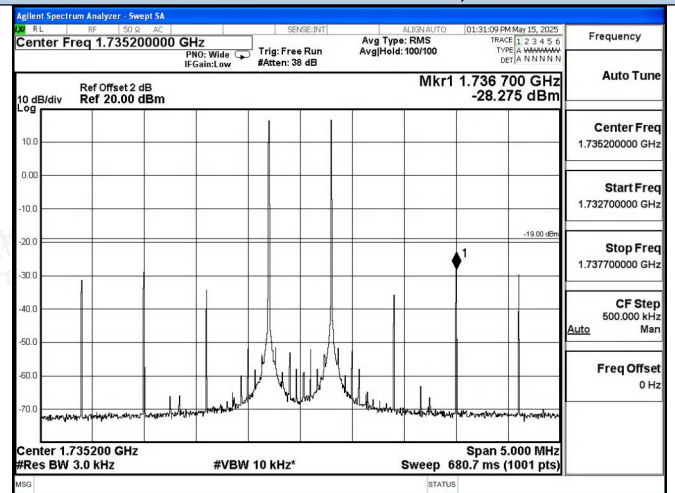
PCS Band Pre AGC, UL



PCS Band AGC+5.5dB, UL



AWS Band Pre AGC, UL



AWS Band AGC+5.5dB, UL

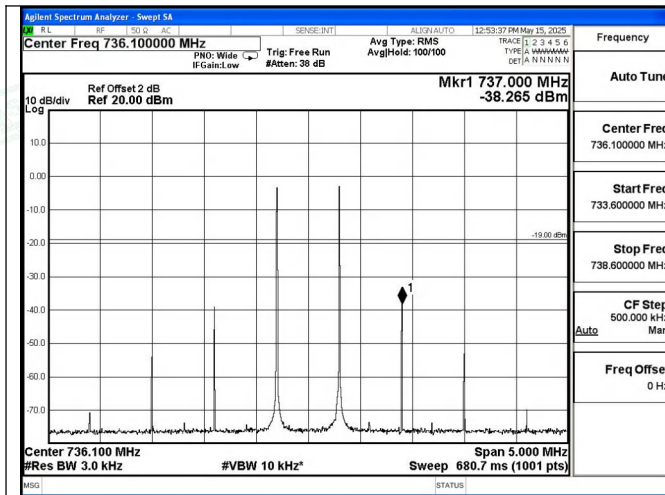


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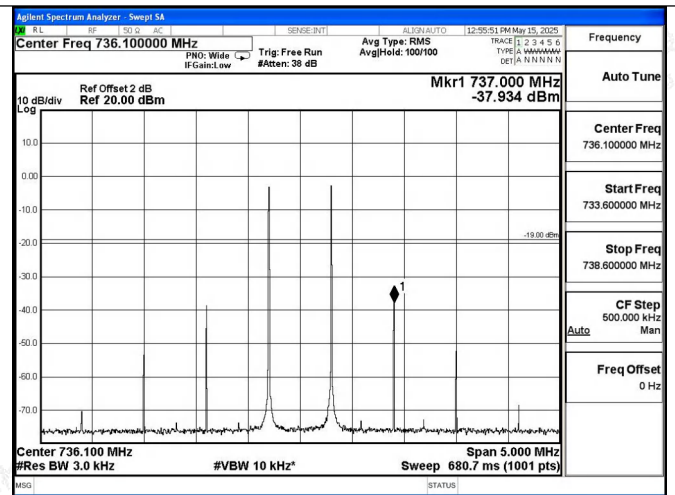
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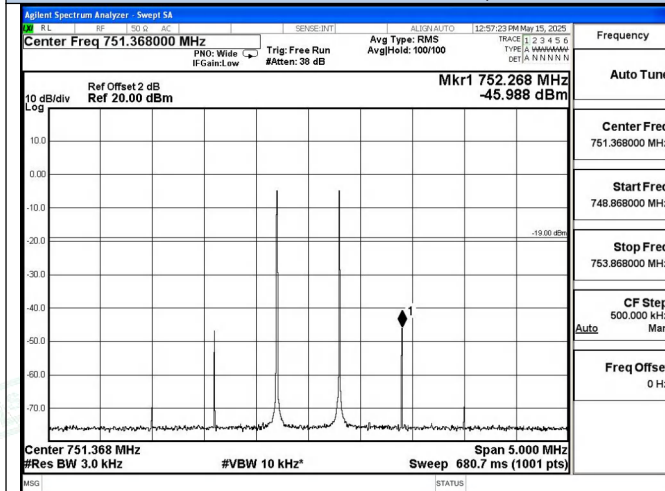
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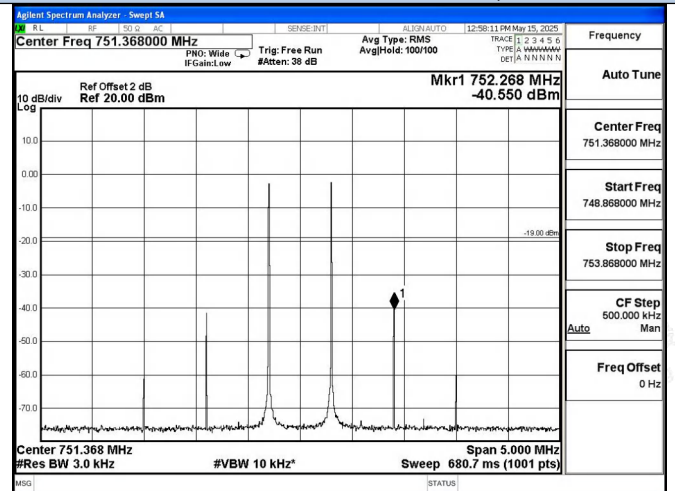
Lower 700 Band Pre AGC, DL



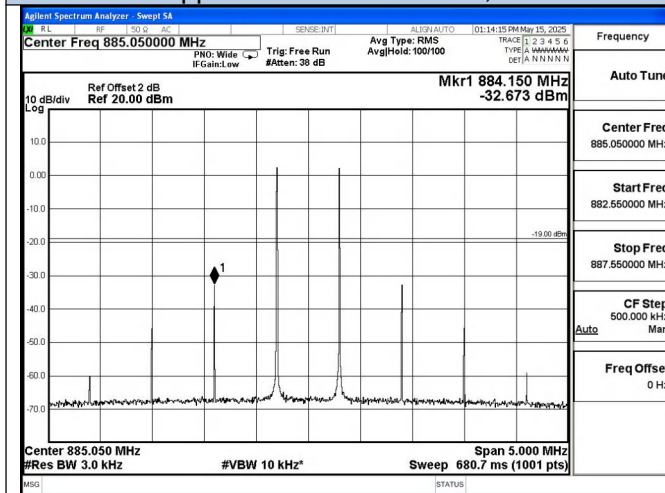
Lower 700 Band AGC+5.5dB, DL



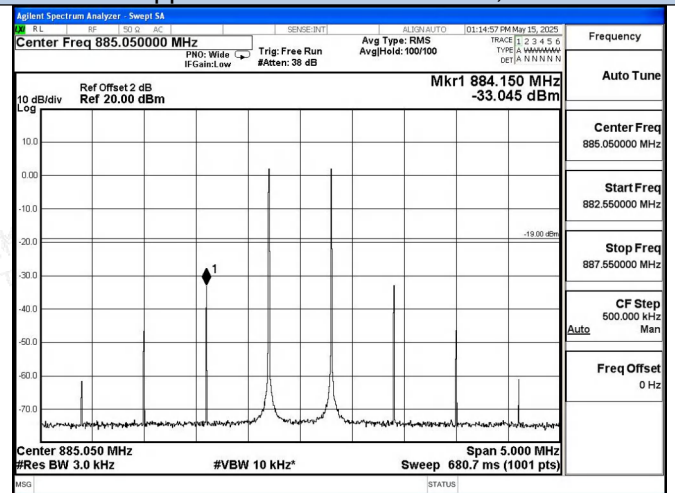
Upper 700 Band Pre AGC, DL



Upper 700 Band AGC+5.5dB, DL



Cellular Band Pre AGC, DL



Cellular Band AGC+5.5dB, DL

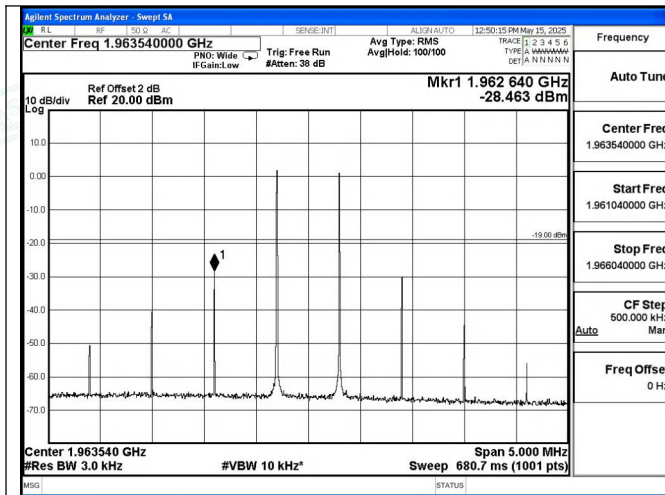


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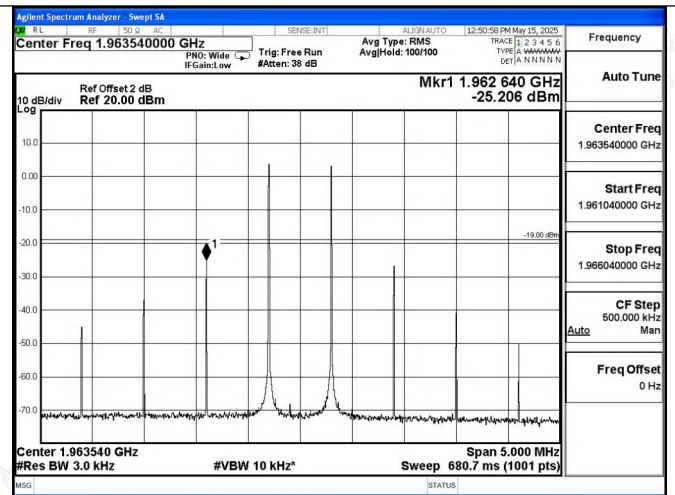
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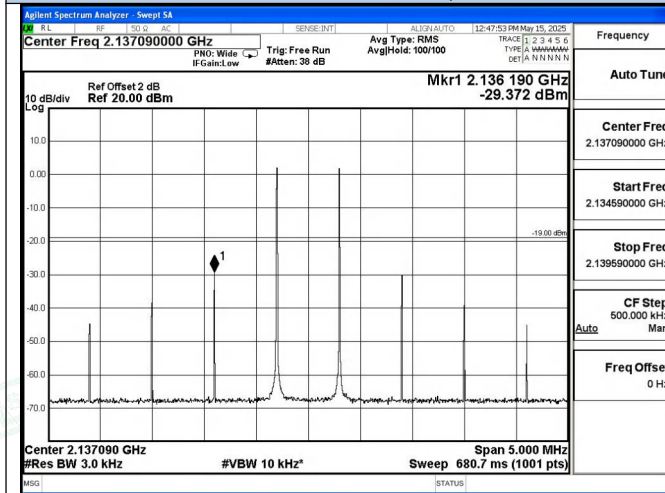
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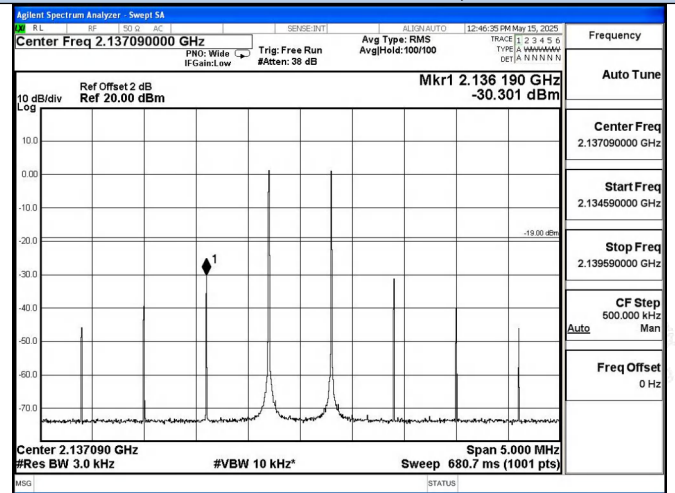
PCS Band Pre AGC, DL



PCS Band AGC+5.5dB, DL



AWS Band Pre AGC, DL



AWS Band AGC+5.5dB, DL





6.7 Out of Band Emission

6.7.1 Applicable Standard

According to § 20.21(e)(8)(i)(E) Out of Band Emission Limits:

Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

For B2, B25: Per FCC §24.238 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

For B4: Per §27.53(h): For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

For B5: Per FCC §22.917 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

For B12: Per §27.53 (g): For operations in 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.

For B13: Per §27.53 (c): For operations in the 776-788 MHz band, the power of any emission outside the 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, in accordance with the following: On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Calculation: Limit (dBm) = $[P - 43 + 10 \log (P)] - 6 = -19$ dBm

6.7.2 Test Procedure

According to section 7.5 of KDB 935210 D03 Signal Booster Measurement v04r04:

a) Connect the EUT to the test equipment as shown in Figure 1. Begin with the uplink output (donor) port connected to the spectrum analyzer.

b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:

- 1) GSM: 0.2 MHz from upper and lower band edges.
- 2) LTE (5 MHz): 2.5 MHz from upper and lower band edges.
- 3) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows (only the upper and lower frequencies need to be tested):
824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz,
869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz.

NOTE 1—Alternative test modulation types:

- CDMA (alternative 1.25 MHz AWGN)
- LTE 5 MHz (alternative WCDMA or 4.1 MHz AWGN)

NOTE 2—For LTE, the signal generator should use the uplink and downlink signal types for these modulations in uplink and downlink tests, respectively. LTE shall use 5 MHz signal, 25 resource blocks transmitting.

NOTE 3—When using an AWGN test signal, the bandwidth shall be the measured 99% OBW.

c) Set the signal generator amplitude to the maximum power level prior to AGC similar to 7.2.2e) to 7.2.2f) of the power measurement procedures for the appropriate modulations.



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- d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band (see Appendix A for cross-reference to applicable rule section).
- e) NOTE 3—Within 300 kHz and 3 MHz away from band edge, if smaller RBW is used (i.e., $RBW < 100$ kHz or 1 MHz, for above and below 1 GHz, respectively), per Parts 24 and 27 the smaller RBW is applicable only for frequencies within 100 kHz or 1 MHz (for above and below 1 GHz, respectively) away from the band edge.
- f) Set VBW = 3 RBW.
- g) Select the power averaging (rms) detector.
- h) Sweep time = auto-couple.
- i) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz).
- j) Trace average at least 100 traces in power averaging (i.e., rms) mode.
- k) Use peak marker function to find the maximum power level.
- l) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
- m) Increase the signal generator amplitude in 2 dB steps until the maximum input level per 5.5 is reached. Affirm that the EUT maintains compliance with the OOB limits. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.
- n) Reset the analyzer start frequency to the lower band/block edge frequency minus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz), and the stop frequency to the lower band/block edge frequency, then repeat 7.5i) to 7.5l). Repeat 7.5b) through 7.5m) for each uplink and downlink operational band.

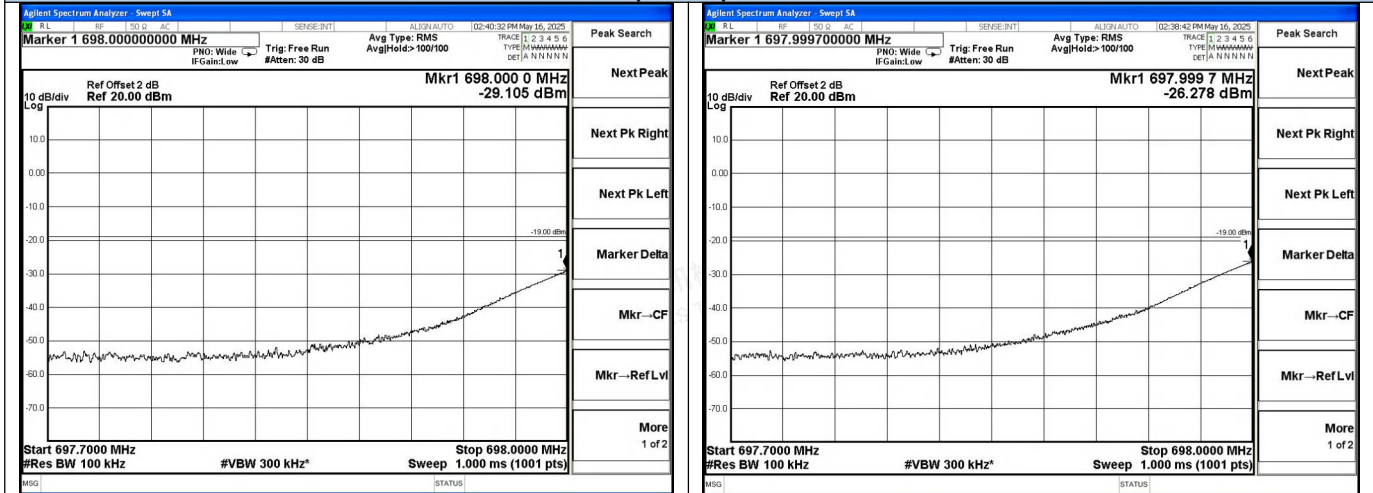




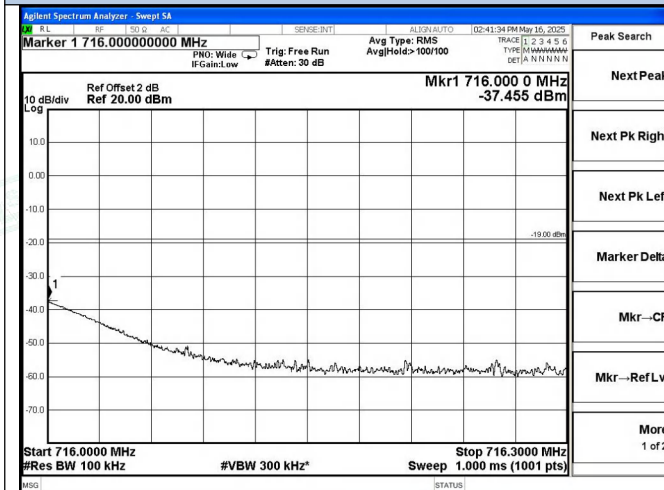
6.7.3 Test data

Temperature	23.2°C	Humidity	52.5%
Test Engineer	Nick Peng	Test Mode	Transmitting

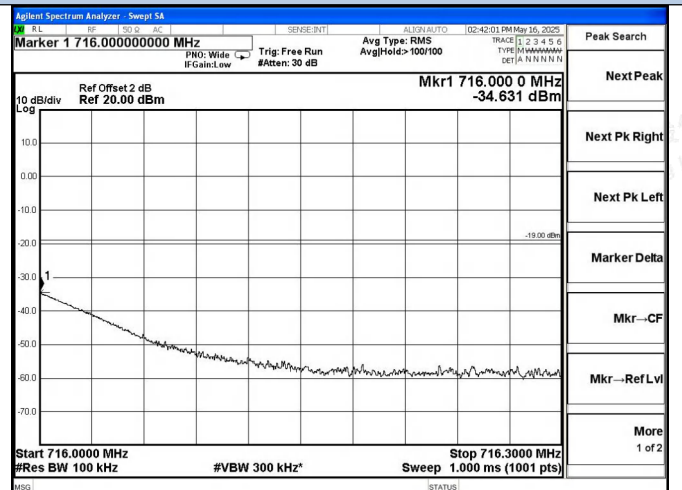
Test Graphs-Uplink-GSM



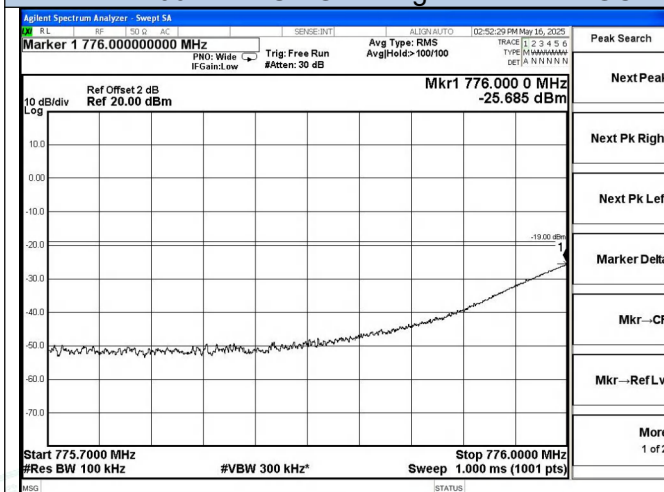
Lower 700 Band UL-GSM Left Side Pre AGC



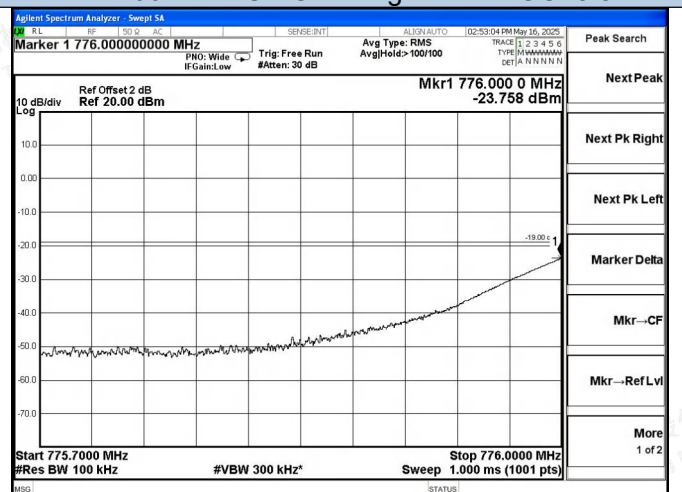
Lower 700 Band UL-GSM Left Side AGC+5.5dB



Lower 700 Band UL-GSM Right Side Pre AGC



Lower 700 Band UL-GSM Right Side AGC+5.5dB



Upper 700 Band UL-GSM Left Side Pre AGC

Upper 700 Band UL-GSM Left Side AGC+5.5dB

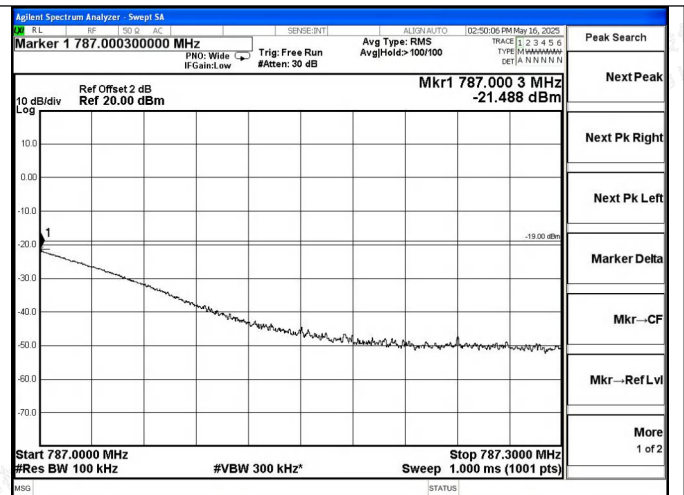
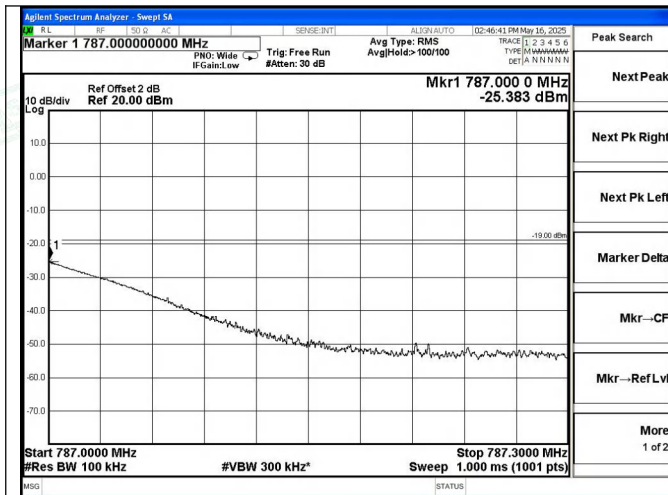


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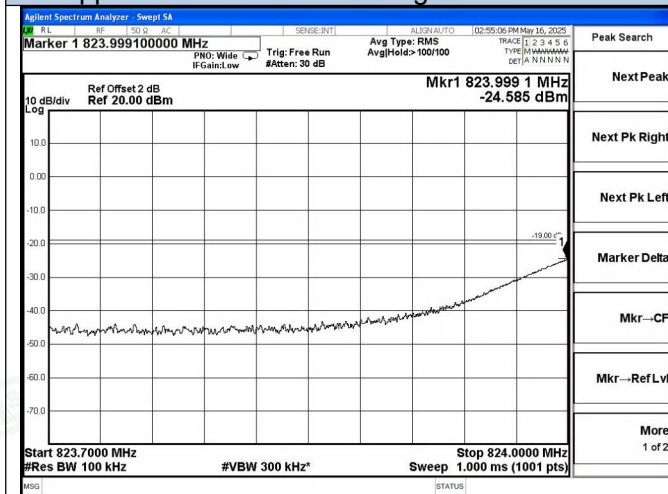
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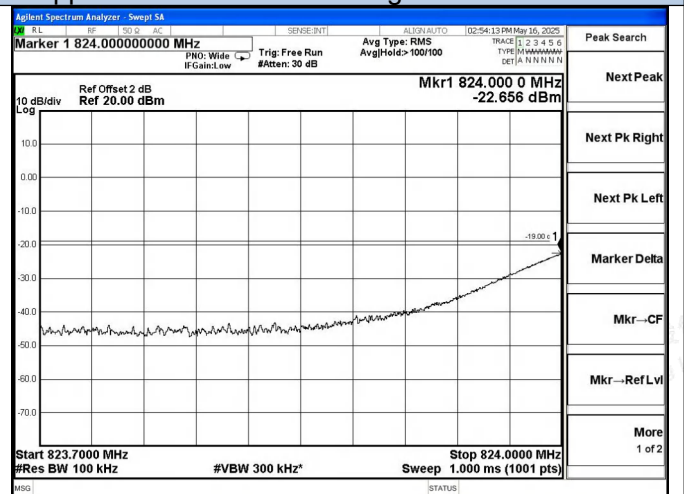
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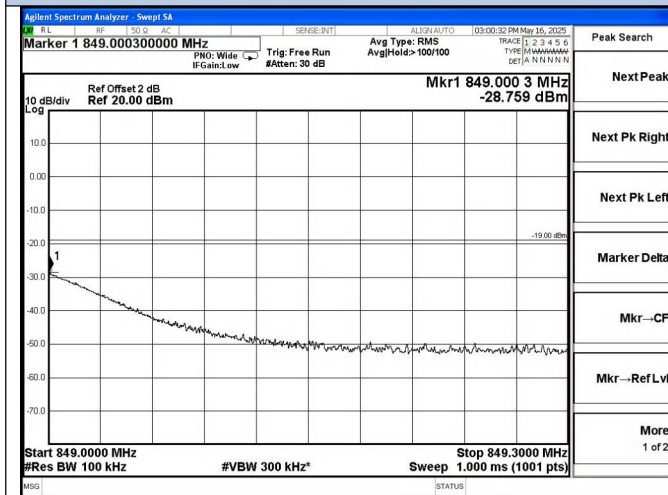
Upper 700 Band UL-GSM Right Side Pre AGC



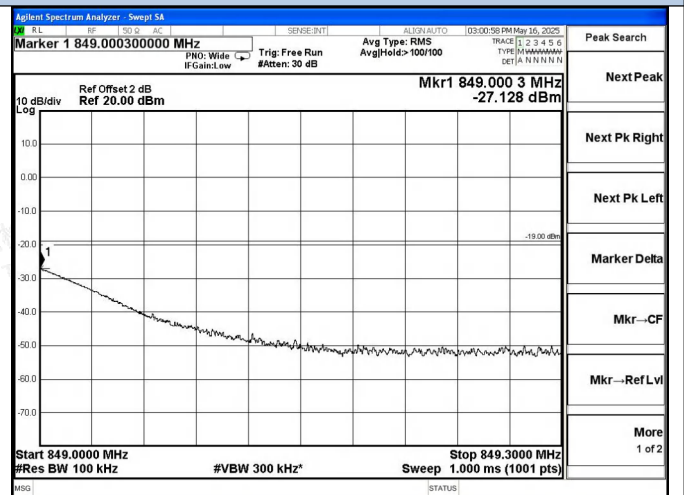
Upper 700 Band UL-GSM Right Side AGC+5.5dB



Cellular Band UL-GSM Left Side Pre AGC



Cellular Band UL-GSM Left Side AGC+5.5dB



Cellular Band UL-GSM Right Side Pre AGC

Cellular Band UL-GSM Right Side AGC+5.5dB

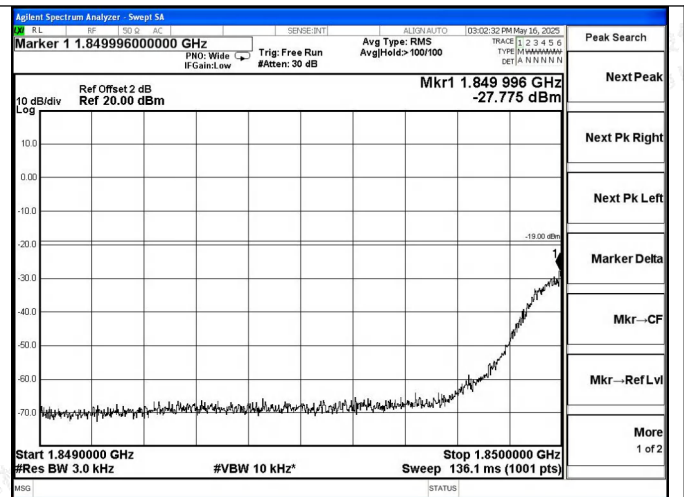
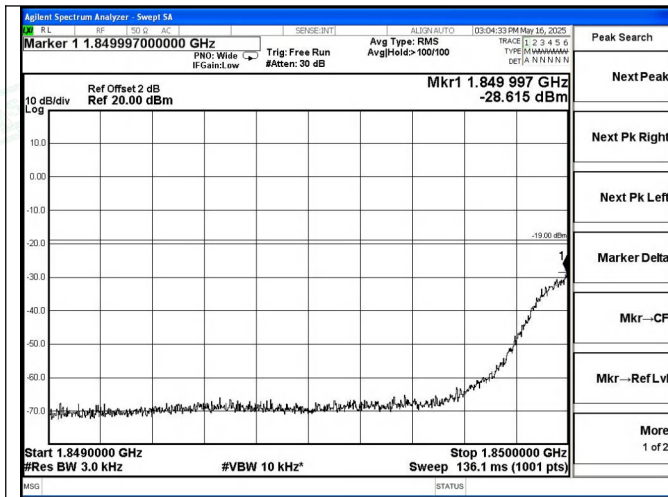


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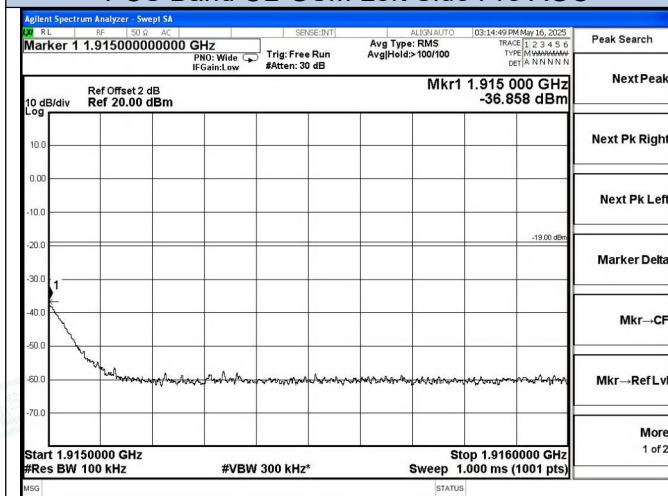
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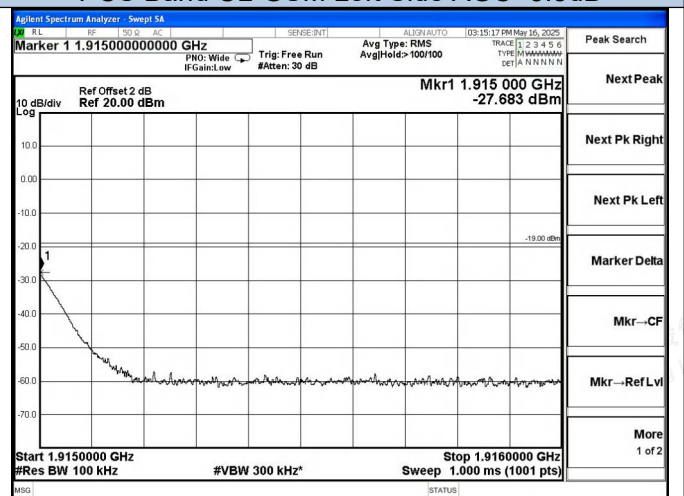
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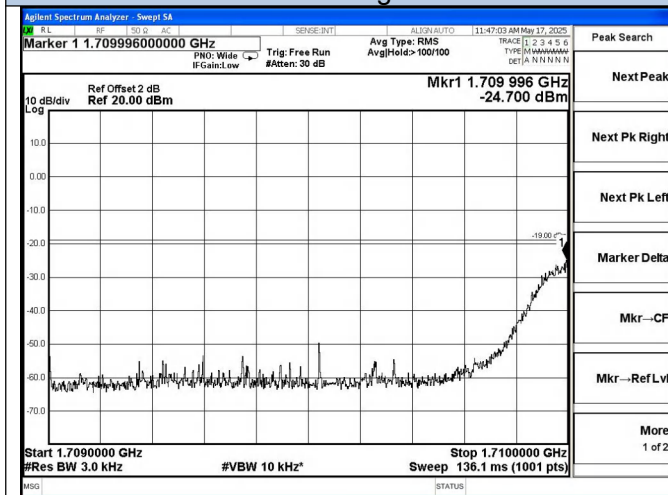
PCS Band UL-GSM Left Side Pre AGC



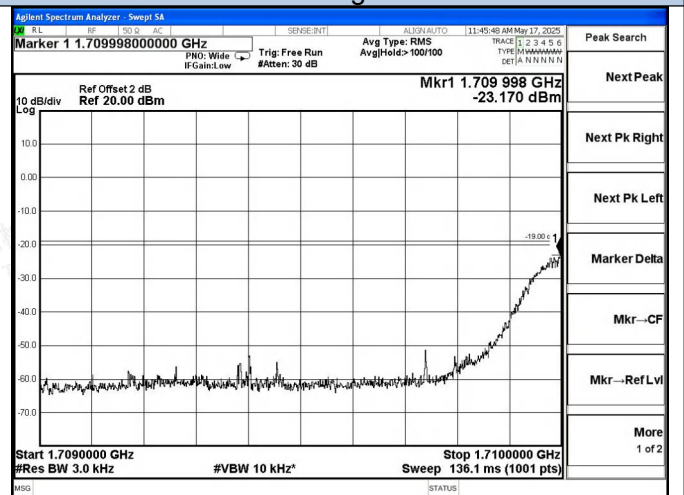
PCS Band UL-GSM Left Side AGC+5.5dB



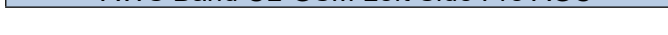
PCS Band UL-GSM Right Side Pre AGC



PCS Band UL-GSM Right Side AGC+5.5dB



AWS Band UL-GSM Left Side Pre AGC



AWS Band UL-GSM Left Side AGC+5.5dB

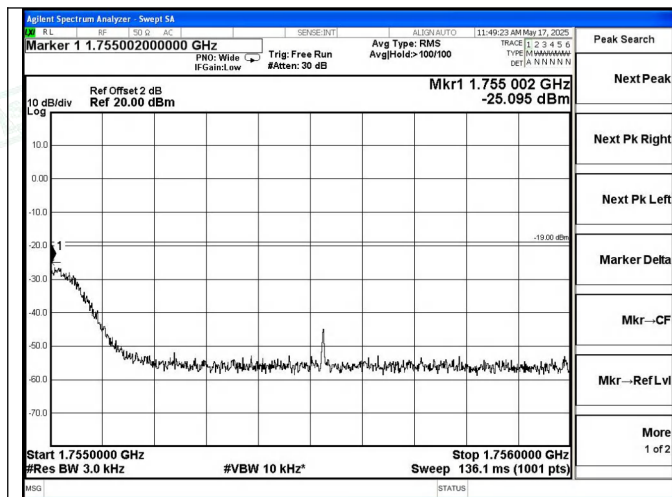


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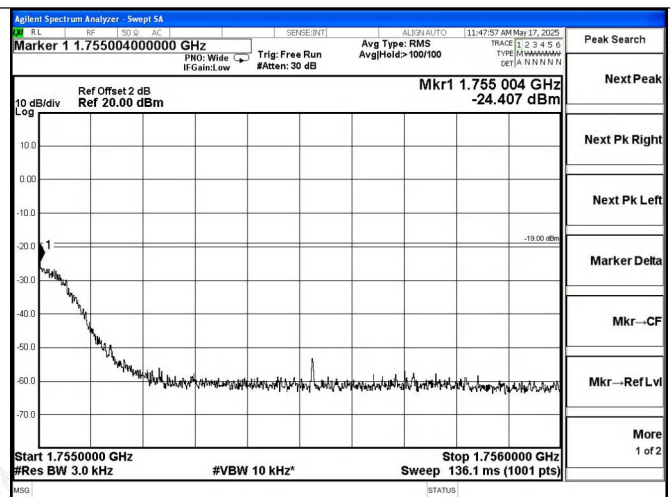
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AWS Band UL-GSM Right Side Pre AGC



AWS Band UL-GSM Right Side AGC+5.5dB



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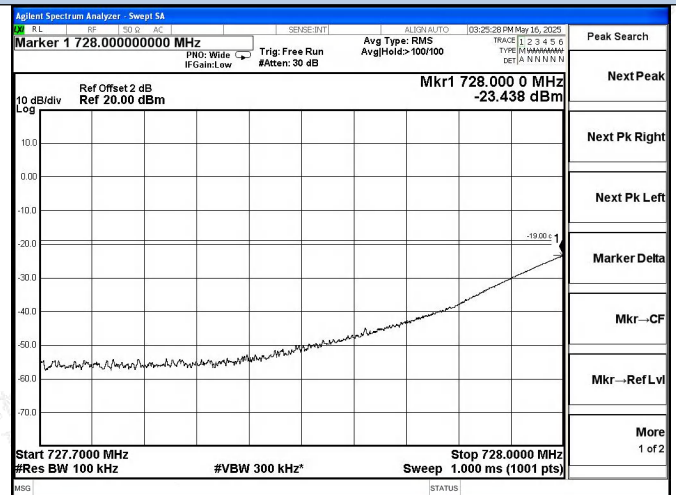
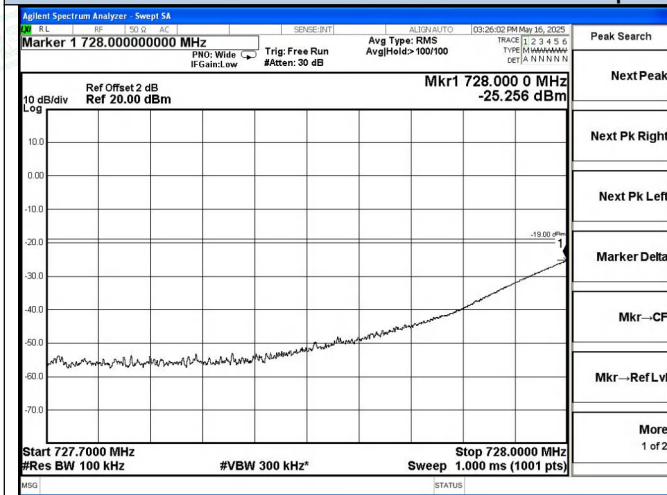
Add: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China

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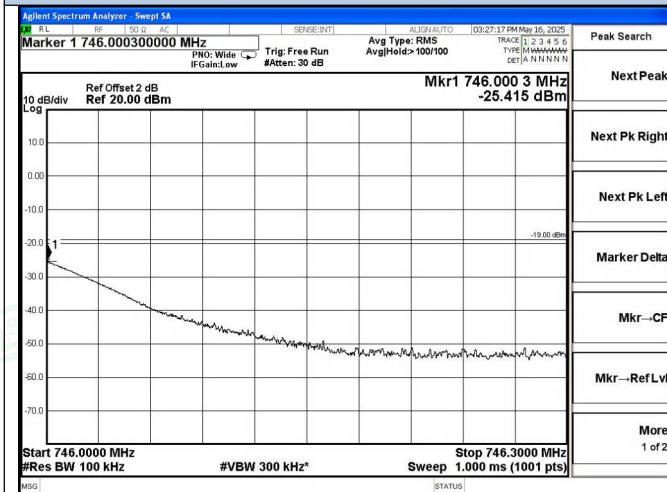
Scan code to check authenticity



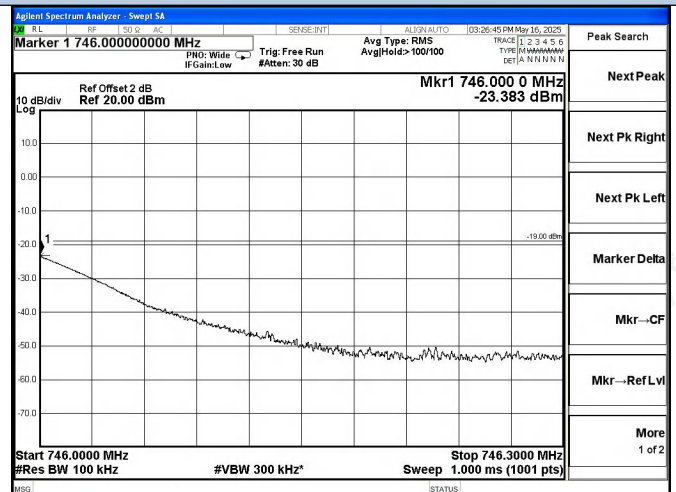
Test Graphs-Downlink-GSM



Lower 700 Band DL-GSM Left Side Pre AGC



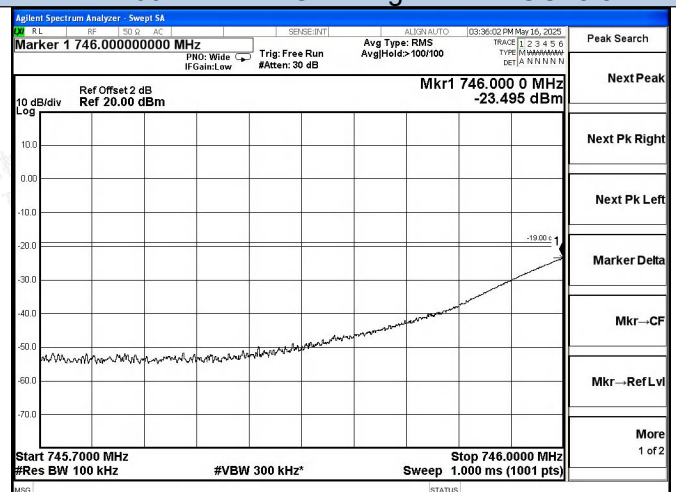
Lower 700 Band DL-GSM Left Side AGC+5.5dB



Lower 700 Band DL-GSM Right Side Pre AGC



Lower 700 Band DL-GSM Right Side AGC+5.5dB



Upper 700 Band DL-GSM Left Side Pre AGC

Upper 700 Band DL-GSM Left Side AGC+5.5dB



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