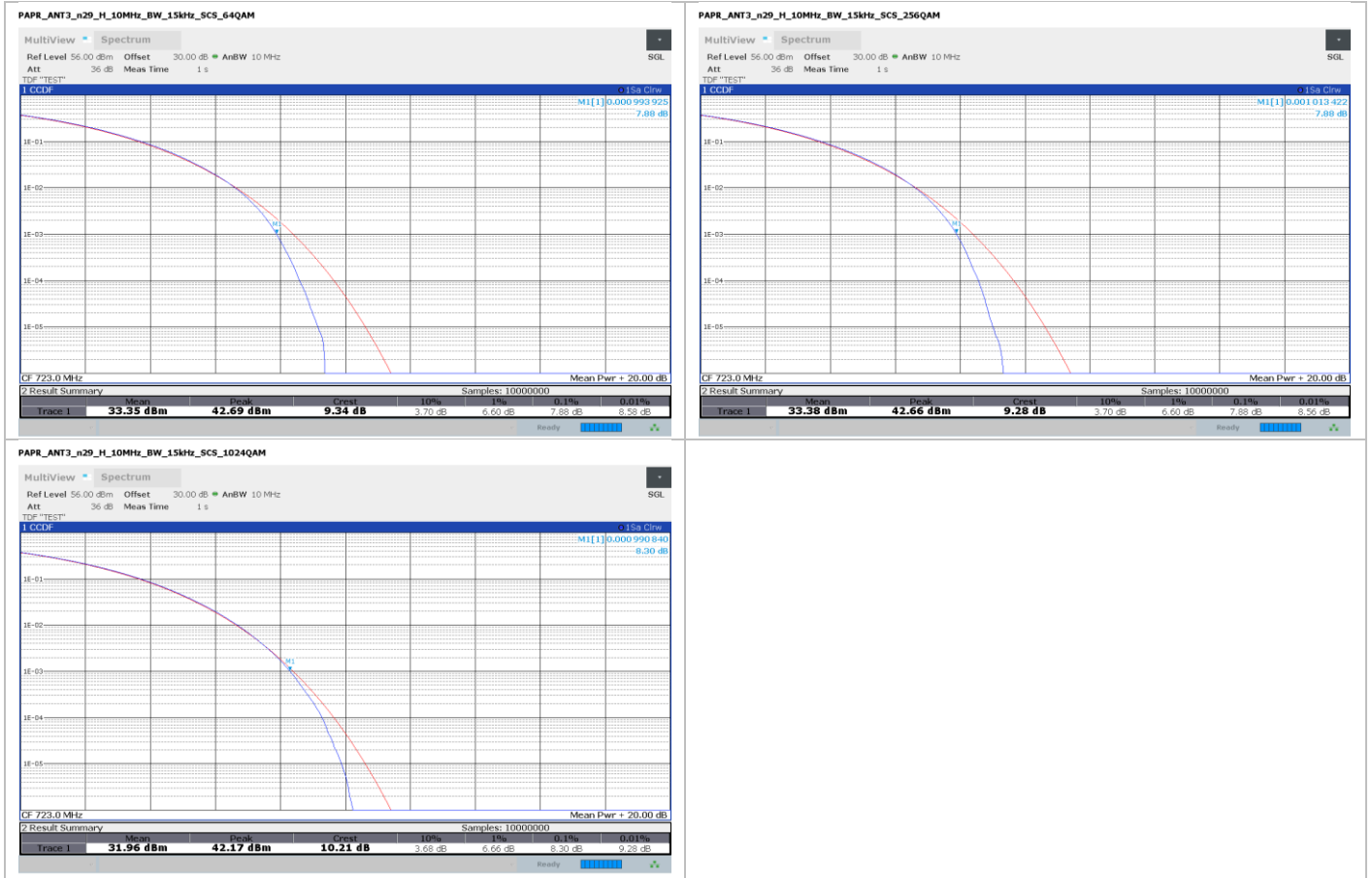


Section 8
Test name
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Testing
FCC 27.50(d)(5) / 90.205/90.635 Peak to Average Power Ratio
FCC Part 27 / FCC Part 90



Band n71:

| Band | OBW Declared | Port | Channel (MHz) | 0.1% (dB) | 0.1% Limit (dB) | Margin (dB) |
|--------------|--------------|------|---------------|-----------|-----------------|-------------|
| n71 (NB-IoT) | 0.2 MHz | C | 617.1 | 7.9 | 13 | 5.1 |
| n71 (NB-IoT) | 0.2 MHz | C | 627 | 7.92 | 13 | 5.08 |
| n71 (NB-IoT) | 0.2 MHz | C | 651.9 | 8.02 | 13 | 4.98 |

Table 8.5-17: Peak to average power ratio, QPSK Modulation, NB-IoT mode

| Band | OBW Declared | Port | Channel (MHz) | 0.1% (dB) | 0.1% Limit (dB) | Margin (dB) |
|------|--------------|------|---------------|-----------|-----------------|-------------|
| n71 | 5 MHz | C | 619.5 | 7.76 | 13 | 5.24 |
| n71 | 5 MHz | C | 634.5 | 7.78 | 13 | 5.22 |
| n71 | 5 MHz | C | 649.5 | 7.78 | 13 | 5.22 |

Table 8.5-18: Peak to average power ratio, QPSK Modulation, 5 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 5 MHz | C | 619.5 | 7.78 | 13 | 5.22 |
| n71 | 5 MHz | C | 634.5 | 7.78 | 13 | 5.22 |
| n71 | 5 MHz | C | 649.5 | 7.78 | 13 | 5.22 |

Table 8.5-19: Peak to average power ratio, 16QAM Modulation, 5 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 5 MHz | C | 619.5 | 7.8 | 13 | 5.2 |
| n71 | 5 MHz | C | 634.5 | 7.8 | 13 | 5.2 |
| n71 | 5 MHz | C | 649.5 | 7.78 | 13 | 5.22 |

Table 8.5-20: Peak to average power ratio, 64QAM Modulation, 5 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 5 MHz | C | 619.5 | 7.82 | 13 | 5.18 |
| n71 | 5 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 5 MHz | C | 649.5 | 7.82 | 13 | 5.18 |

Table 8.5-21: Peak to average power ratio, 256QAM Modulation, 5 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 5 MHz | C | 619.5 | 8.4 | 13 | 4.6 |
| n71 | 5 MHz | C | 634.5 | 8.42 | 13 | 4.58 |
| n71 | 5 MHz | C | 649.5 | 8.4 | 13 | 4.6 |

Table 8.5-22: Peak to average power ratio, 1024QAM Modulation, 5 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% (dB) | 0.1% Limit (dB) | Margin (dB) |
|------|--------------|------|---------------|-----------|-----------------|-------------|
| n71 | 10 MHz | C | 622 | 7.82 | 13 | 5.18 |
| n71 | 10 MHz | C | 634.5 | 7.82 | 13 | 5.18 |
| n71 | 10 MHz | C | 647 | 7.86 | 13 | 5.14 |

Table 8.5-23: Peak to average power ratio, QPSK Modulation, 10 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 10 MHz | C | 622 | 7.84 | 13 | 5.16 |
| n71 | 10 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 10 MHz | C | 647 | 7.84 | 13 | 5.16 |

Table 8.5-24: Peak to average power ratio, 16QAM Modulation, 10 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 10 MHz | C | 622 | 7.84 | 13 | 5.16 |
| n71 | 10 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 10 MHz | C | 647 | 7.88 | 13 | 5.12 |

Table 8.5-25: Peak to average power ratio, 64QAM Modulation, 10 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 10 MHz | C | 622 | 7.86 | 13 | 5.14 |
| n71 | 10 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 10 MHz | C | 647 | 7.86 | 13 | 5.14 |

Table 8.5-26: Peak to average power ratio, 256QAM Modulation, 10 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 10 MHz | C | 622 | 8.38 | 13 | 4.62 |
| n71 | 10 MHz | C | 634.5 | 8.38 | 13 | 4.62 |
| n71 | 10 MHz | C | 647 | 8.38 | 13 | 4.62 |

Table 8.5-27: Peak to average power ratio, 1024QAM Modulation, 10 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% (dB) | 0.1% Limit (dB) | Margin (dB) |
|------|--------------|------|---------------|-----------|-----------------|-------------|
| n71 | 15 MHz | C | 624.5 | 7.86 | 13 | 5.14 |
| n71 | 15 MHz | C | 634.5 | 7.82 | 13 | 5.18 |
| n71 | 15 MHz | C | 644.5 | 7.94 | 13 | 5.06 |

Table 8.5-28: Peak to average power ratio, QPSK Modulation, 15 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 15 MHz | C | 624.5 | 7.84 | 13 | 5.16 |
| n71 | 15 MHz | C | 634.5 | 7.8 | 13 | 5.2 |
| n71 | 15 MHz | C | 644.5 | 7.94 | 13 | 5.06 |

Table 8.5-29: Peak to average power ratio, 16QAM Modulation, 15 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 15 MHz | C | 624.5 | 7.86 | 13 | 5.14 |
| n71 | 15 MHz | C | 634.5 | 7.82 | 13 | 5.18 |
| n71 | 15 MHz | C | 644.5 | 7.92 | 13 | 5.08 |

Table 8.5-30: Peak to average power ratio, 64QAM Modulation, 15 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 15 MHz | C | 624.5 | 7.86 | 13 | 5.14 |
| n71 | 15 MHz | C | 634.5 | 7.82 | 13 | 5.18 |
| n71 | 15 MHz | C | 644.5 | 7.92 | 13 | 5.08 |

Table 8.5-31: Peak to average power ratio, 256QAM Modulation, 15 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 15 MHz | C | 624.5 | 8.36 | 13 | 4.64 |
| n71 | 15 MHz | C | 634.5 | 8.38 | 13 | 4.62 |
| n71 | 15 MHz | C | 644.5 | 8.36 | 13 | 4.64 |

Table 8.5-32: Peak to average power ratio, 1024QAM Modulation, 15 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% (dB) | 0.1% Limit (dB) | Margin (dB) |
|------|--------------|------|---------------|-----------|-----------------|-------------|
| n71 | 20 MHz | C | 627 | 7.88 | 13 | 5.12 |
| n71 | 20 MHz | C | 634.5 | 7.82 | 13 | 5.18 |
| n71 | 20 MHz | C | 642 | 7.96 | 13 | 5.04 |

Table 8.5-33: Peak to average power ratio, QPSK Modulation, 20 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 20 MHz | C | 627 | 7.88 | 13 | 5.12 |
| n71 | 20 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 20 MHz | C | 642 | 7.96 | 13 | 5.04 |

Table 8.5-34: Peak to average power ratio, 16QAM Modulation, 20 MHz

| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 20 MHz | C | 627 | 7.9 | 13 | 5.1 |
| n71 | 20 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 20 MHz | C | 642 | 7.96 | 13 | 5.04 |

Table 8.5-35: Peak to average power ratio, 64QAM Modulation, 20 MHz

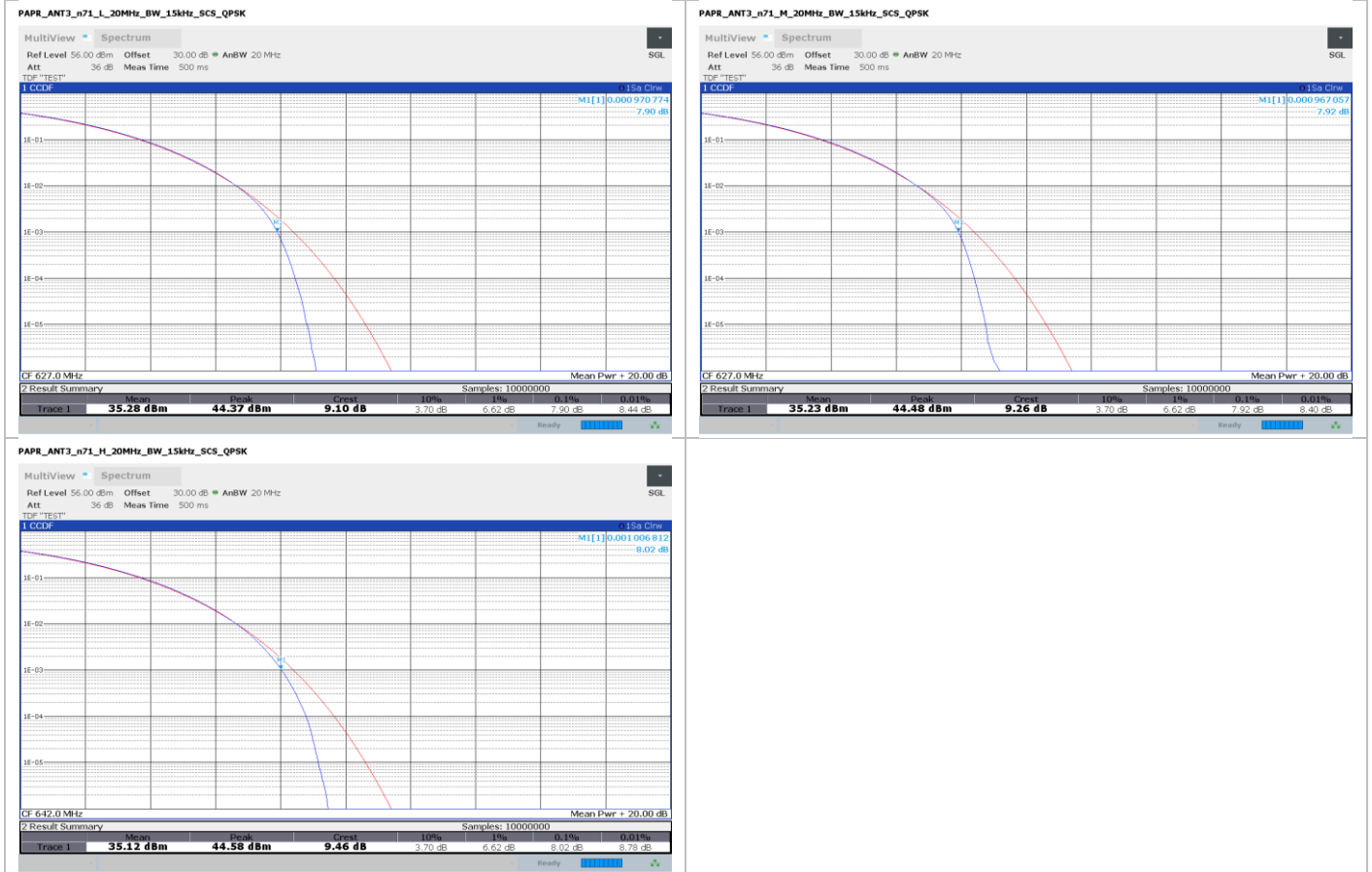
| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 20 MHz | C | 627 | 7.86 | 13 | 5.14 |
| n71 | 20 MHz | C | 634.5 | 7.84 | 13 | 5.16 |
| n71 | 20 MHz | C | 642 | 8 | 13 | 5 |

Table 8.5-36: Peak to average power ratio, 256QAM Modulation 20 MHz

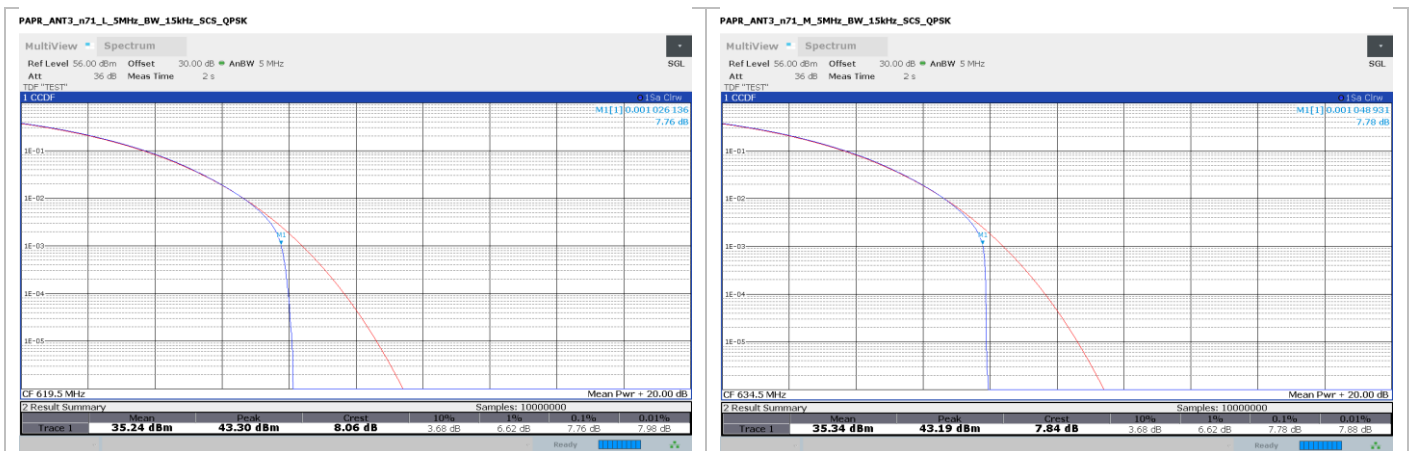
| Band | OBW Declared | Port | Channel (MHz) | 0.1% | 0.1% Limit | Margin |
|------|--------------|------|---------------|------|------------|--------|
| n71 | 20 MHz | C | 627 | 8.38 | 13 | 4.62 |
| n71 | 20 MHz | C | 634.5 | 8.4 | 13 | 4.6 |
| n71 | 20 MHz | C | 642 | 8.42 | 13 | 4.58 |

Table 8.5-37: Peak to average power ratio, 1024QAM Modulation, 20 MHz

Band n71 (NB-IoT) – 0.2 MHz

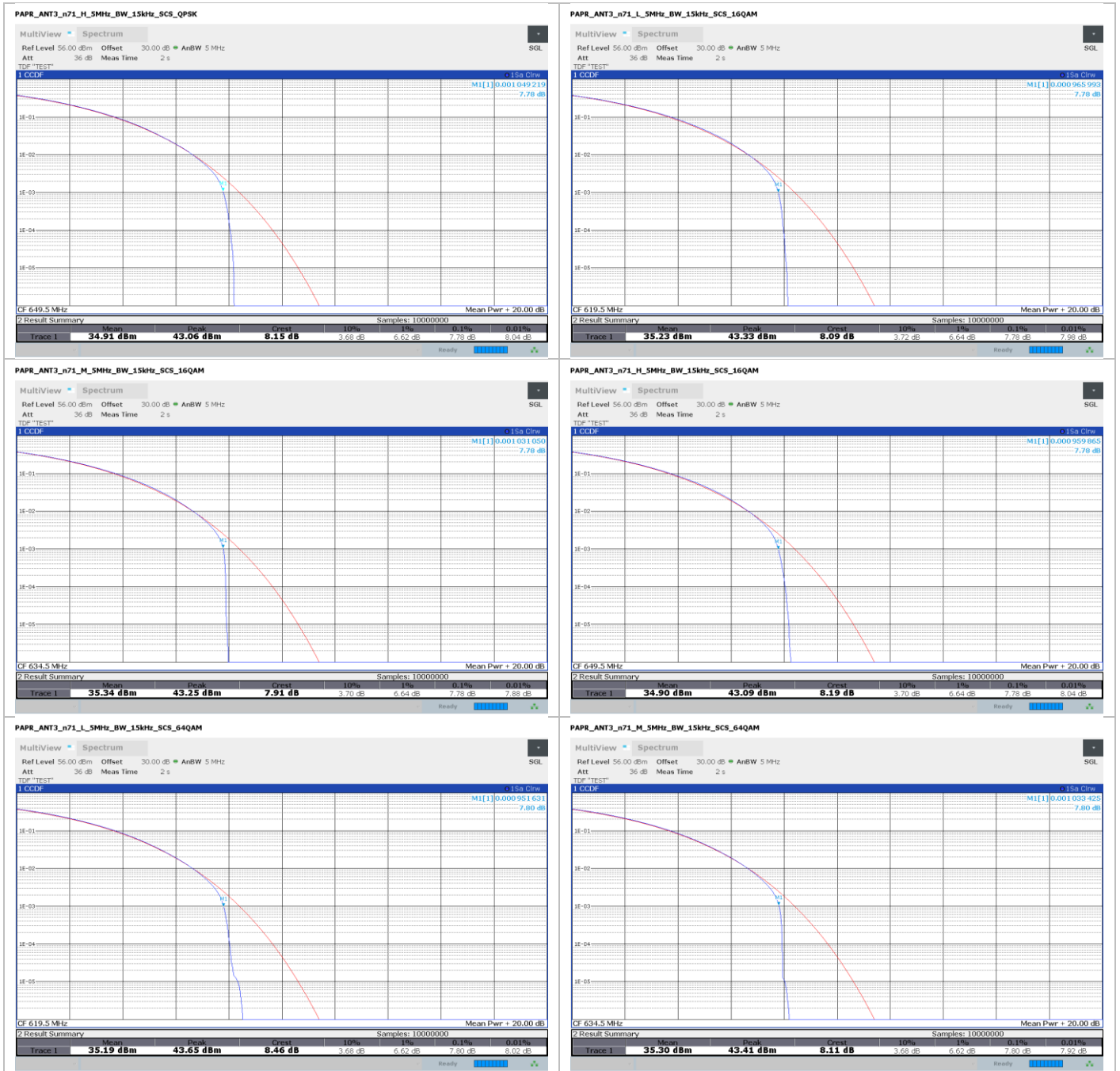


Band n71 – 5 MHz



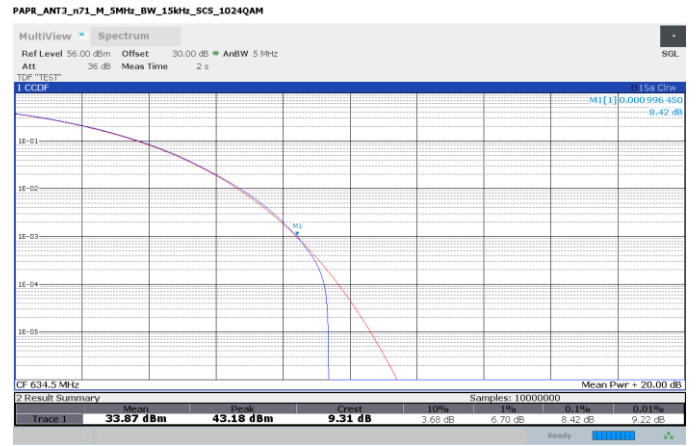
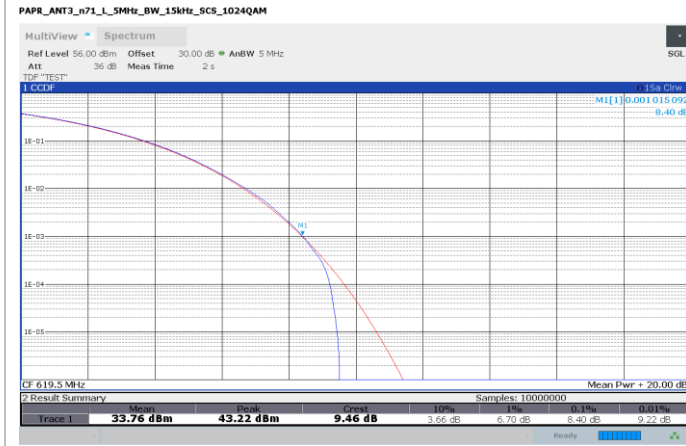
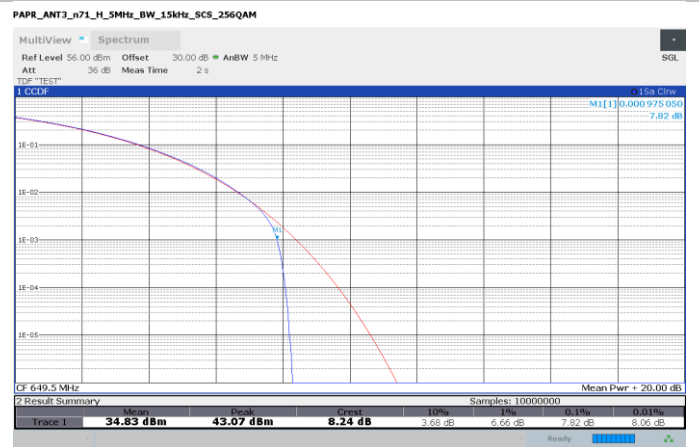
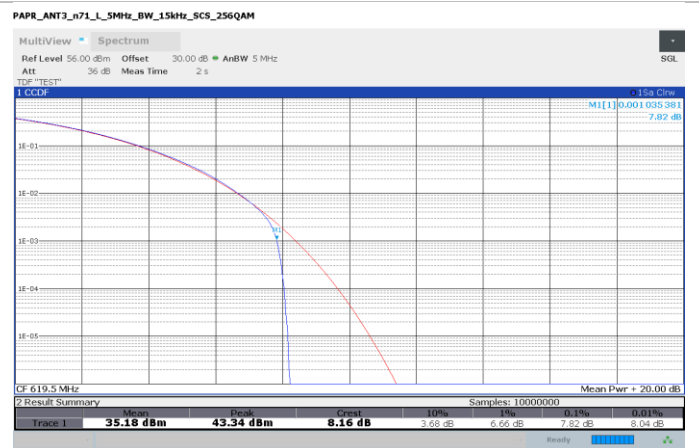
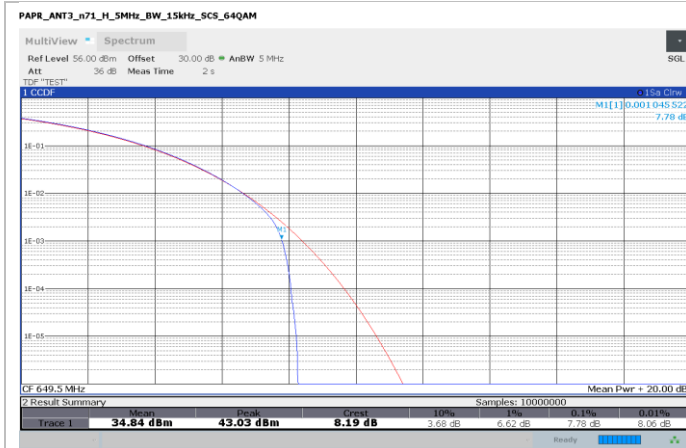
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Specification

Testing
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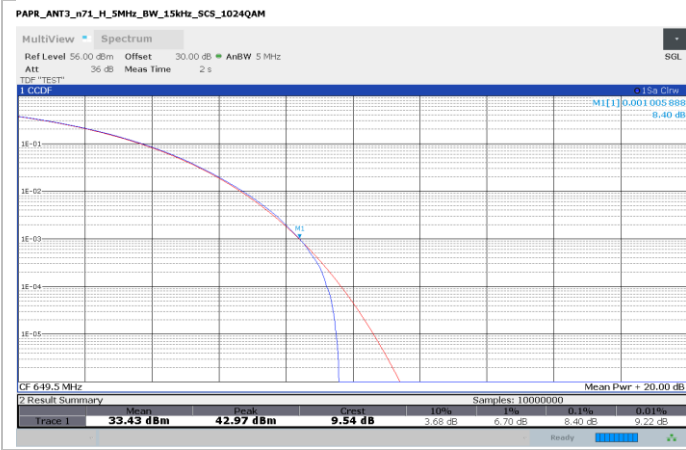
Section 8
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Specification

Testing
FCC 27.50(d)(5) / 90.205/90.635 Peak to Average Power Ratio
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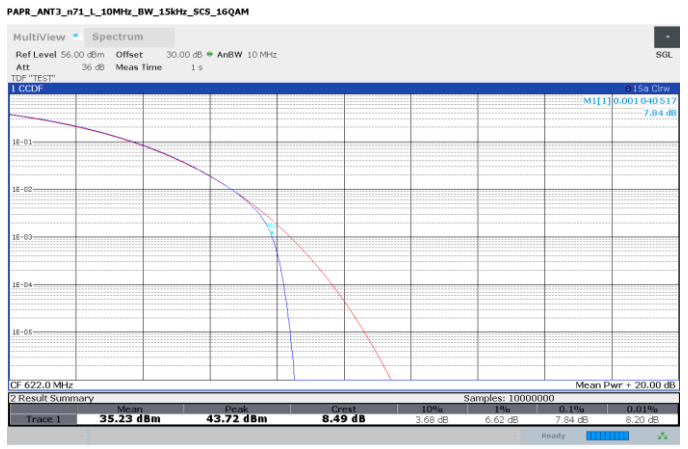
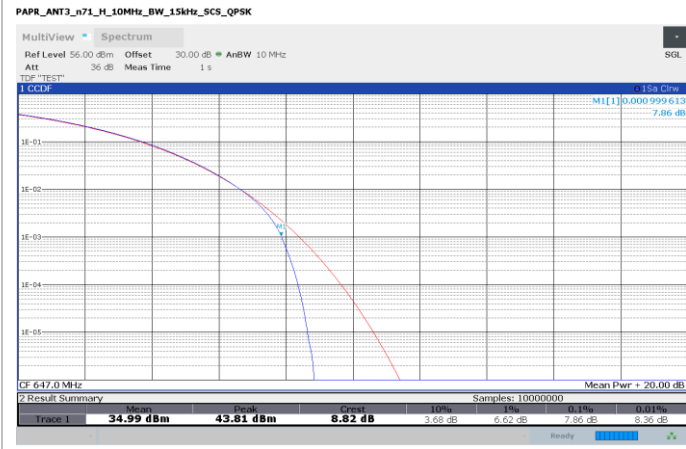
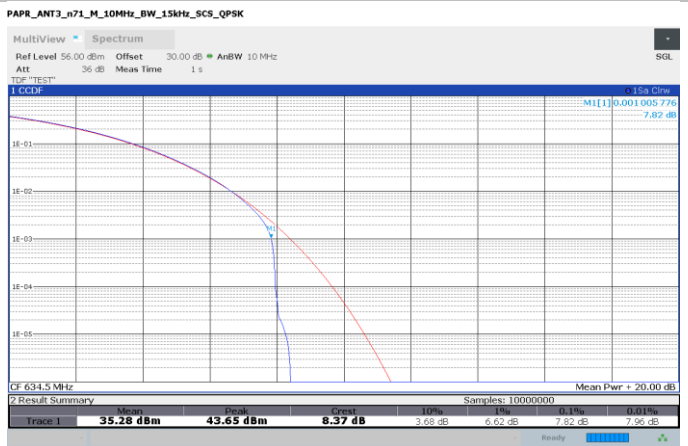
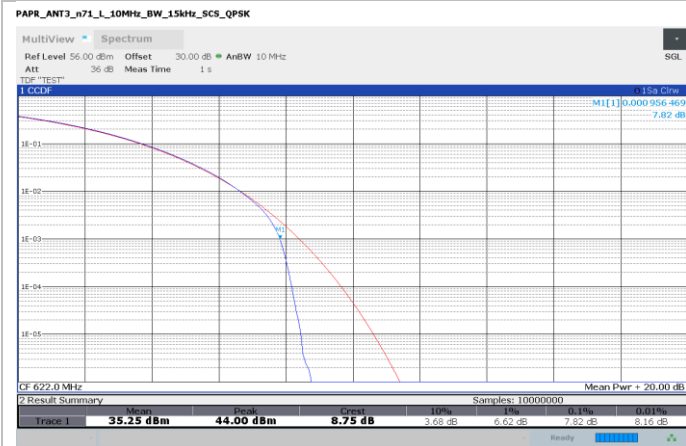


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FCC 27.50(d)(5) / 90.205/90.635 Peak to Average Power Ratio
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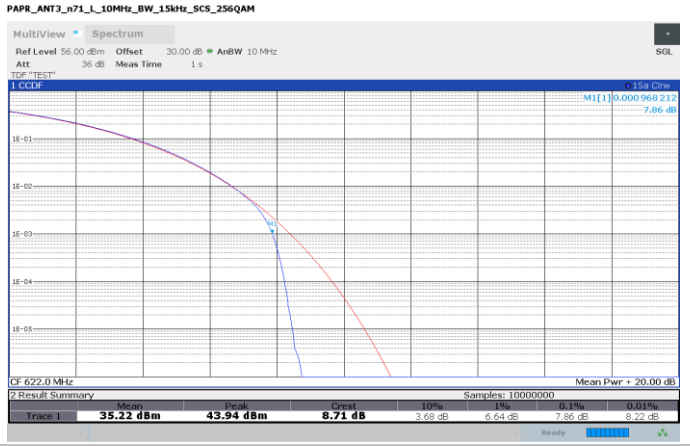
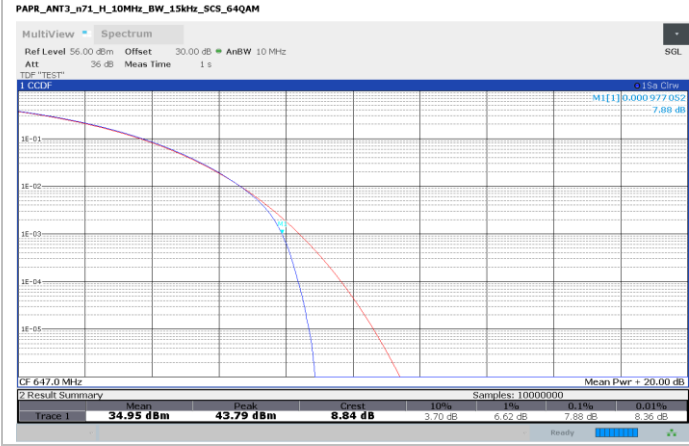
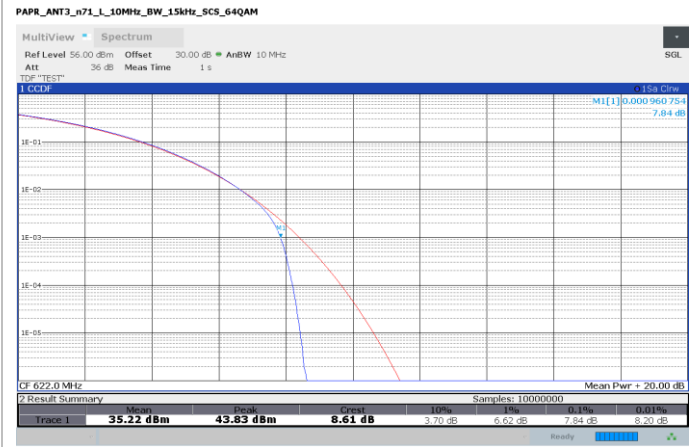
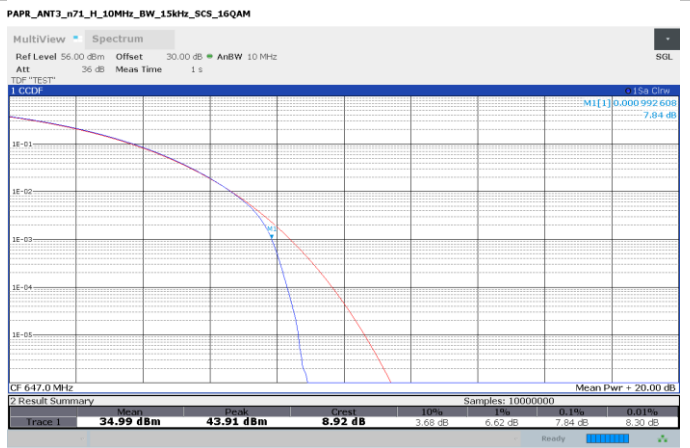
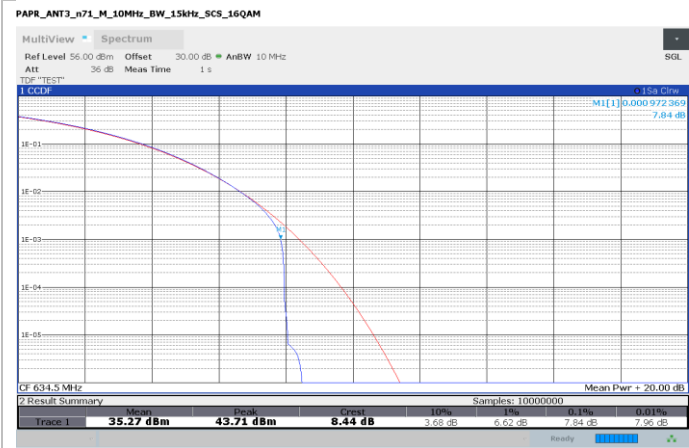


Band n71 – 10 MHz



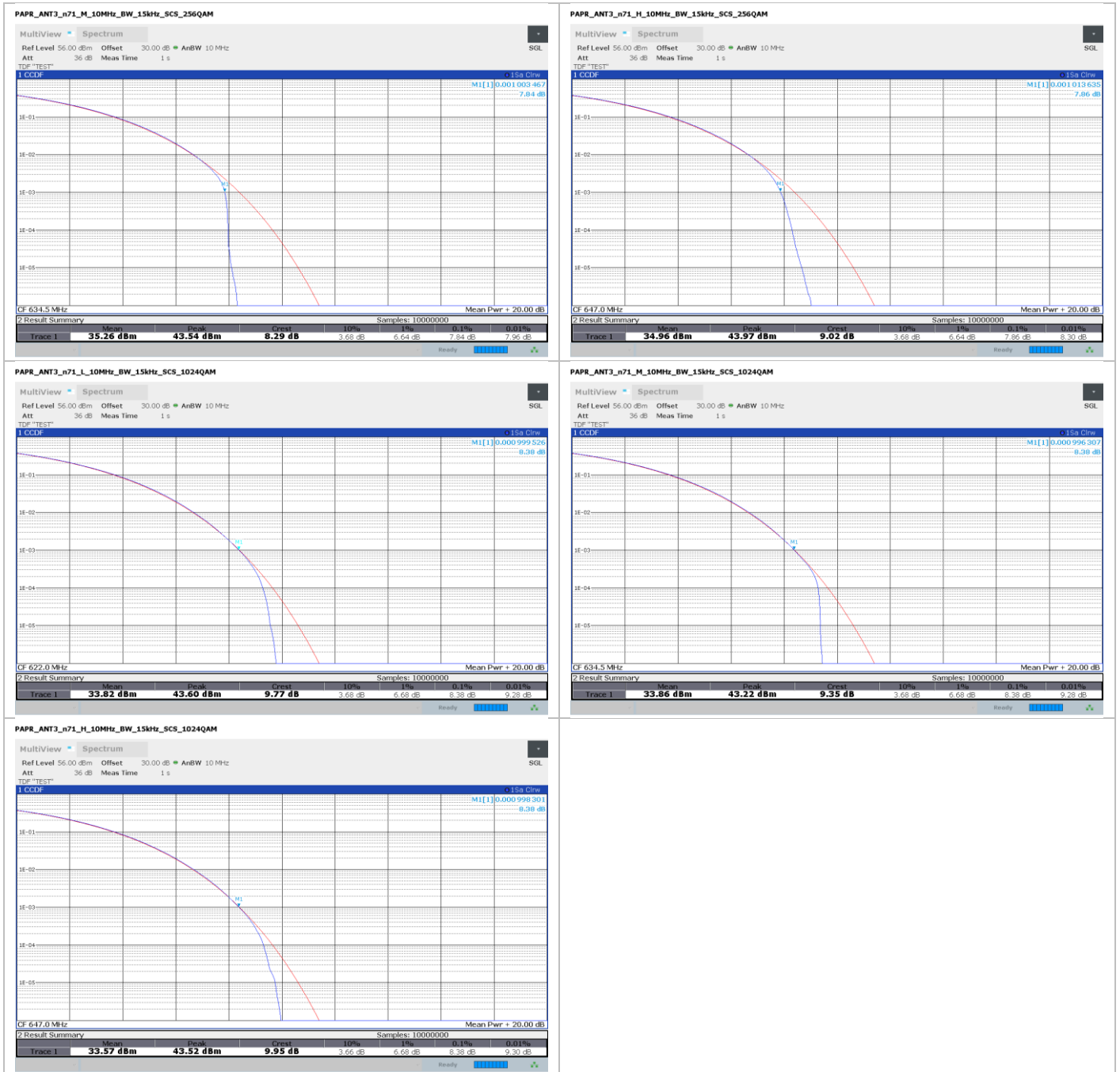
Section 8
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Testing
FCC 27.50(d)(5) / 90.205/90.635 Peak to Average Power Ratio
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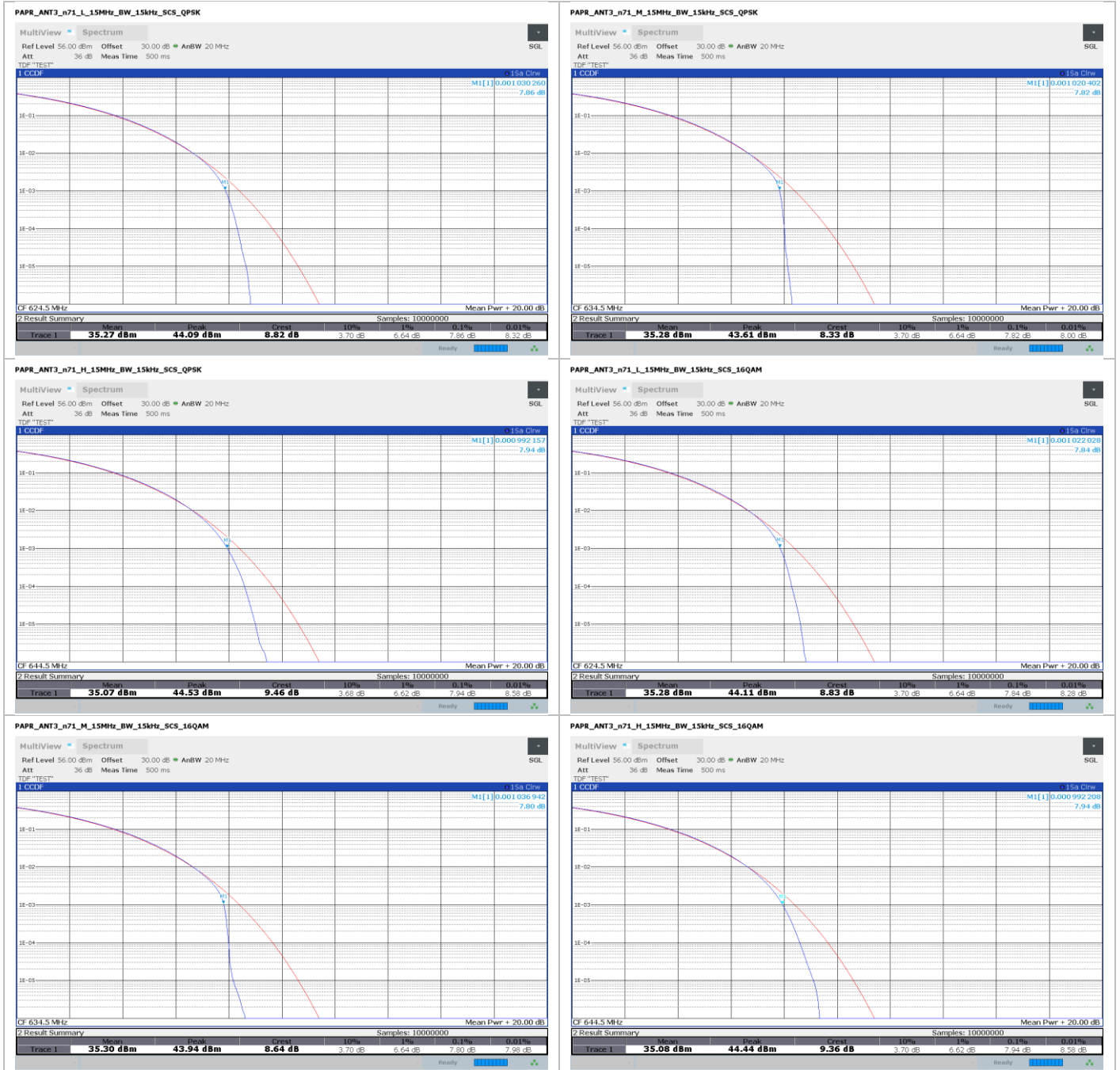


Section 8
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Specification

Testing
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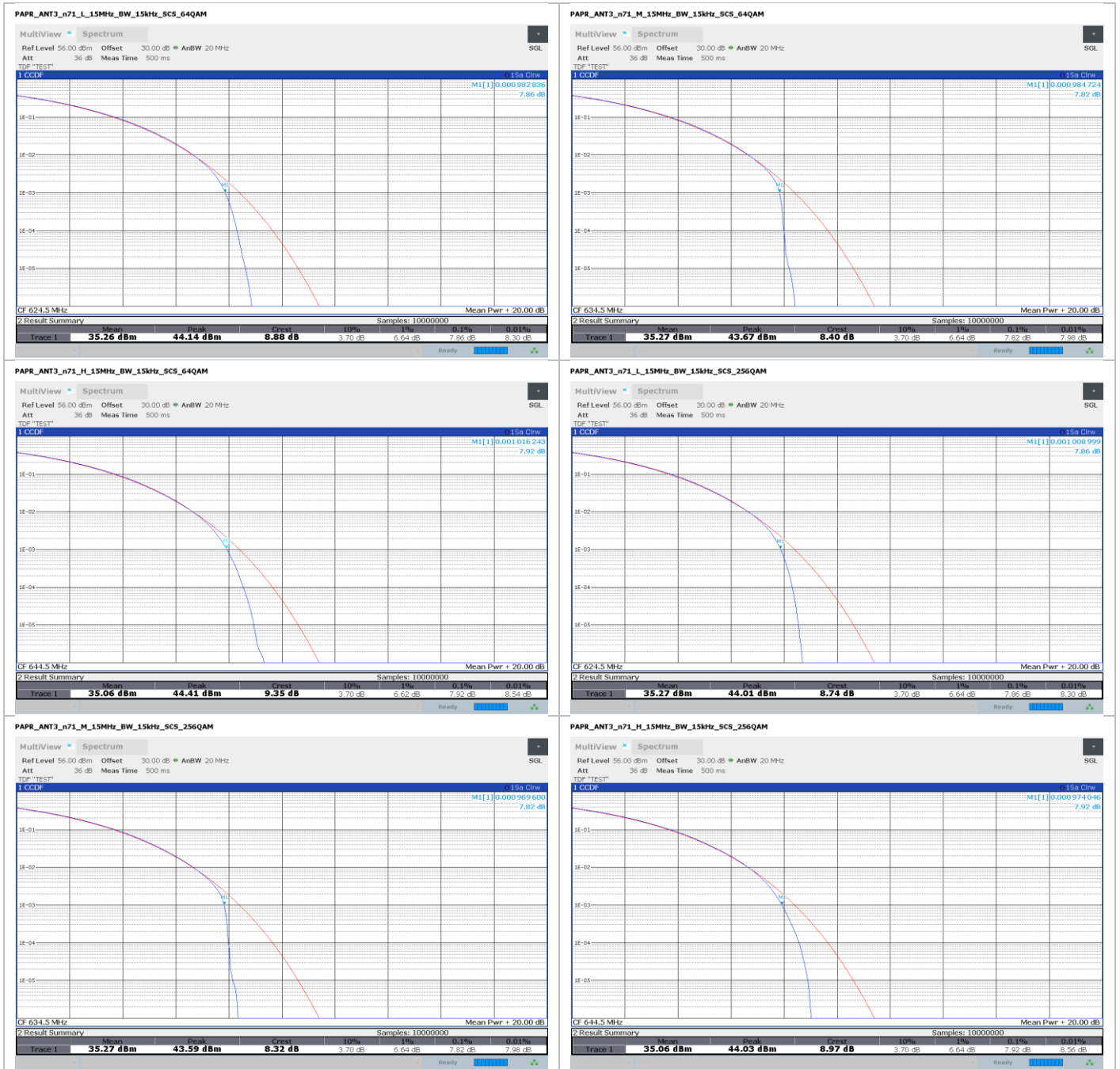


Band n71 – 15 MHz



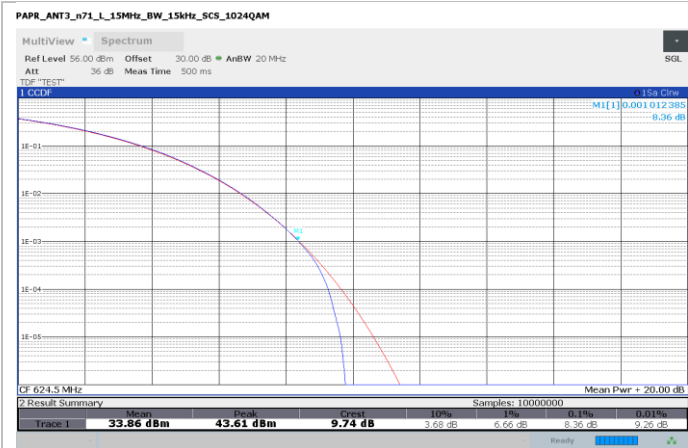
Section 8
Test name
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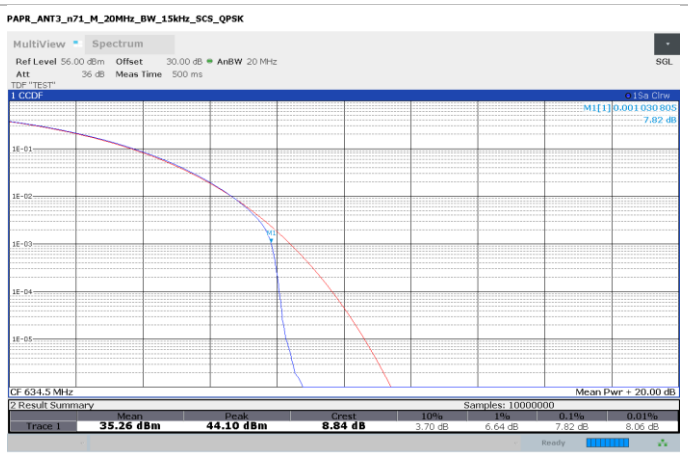
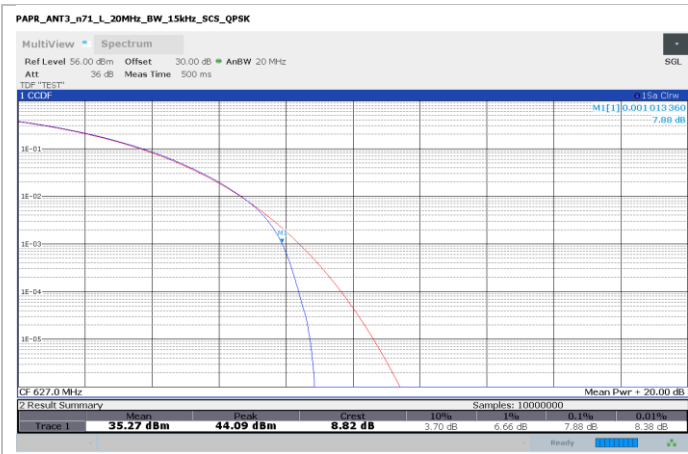


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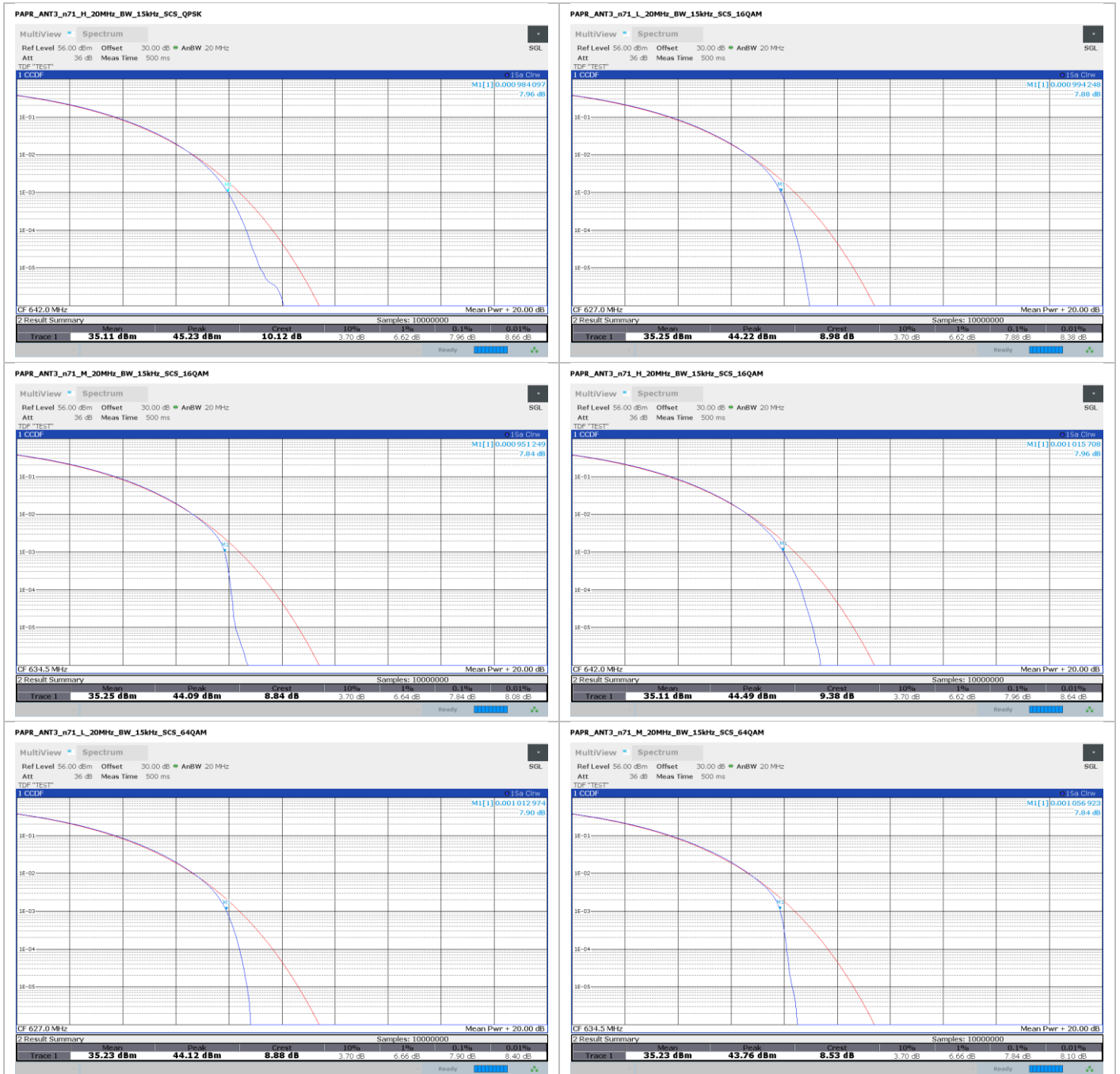


Band n71 – 20 MHz



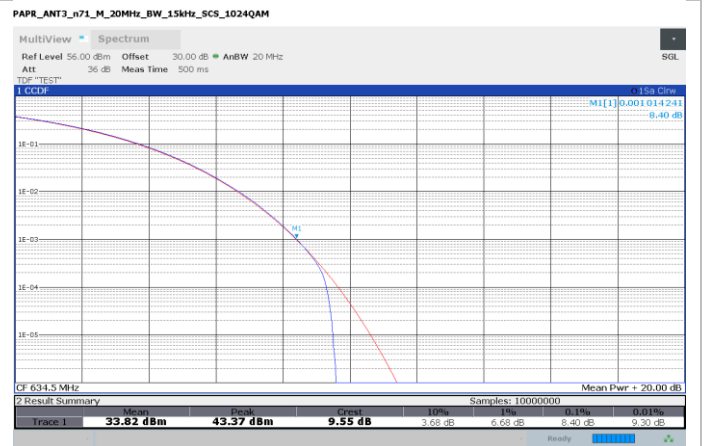
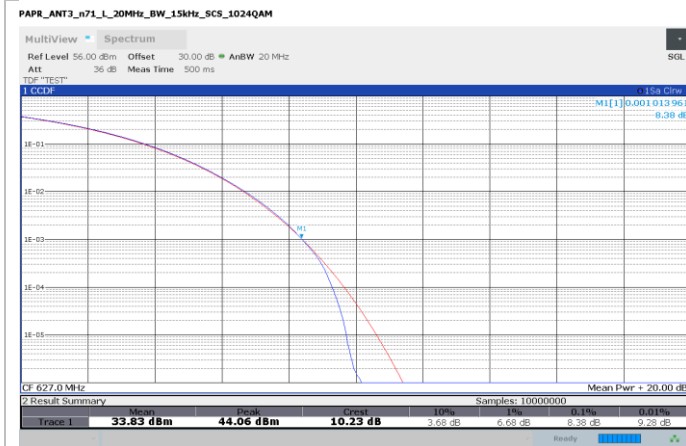
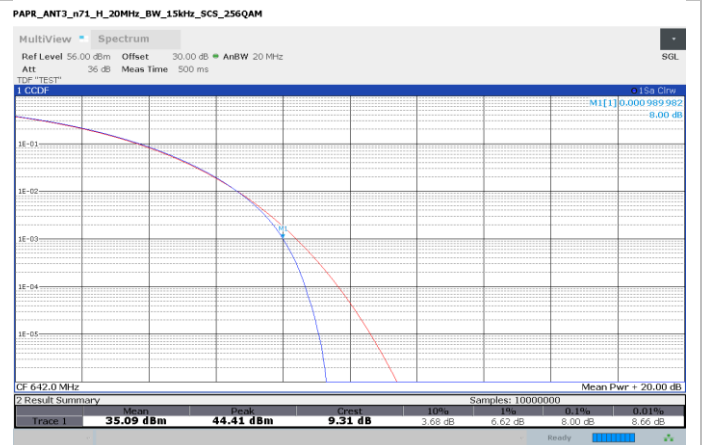
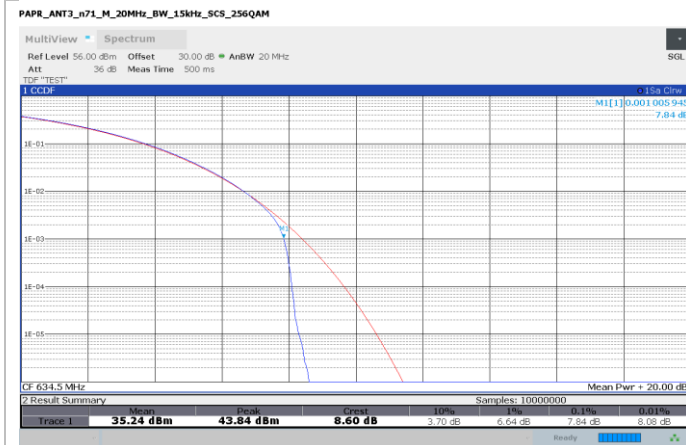
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Test name
Specification

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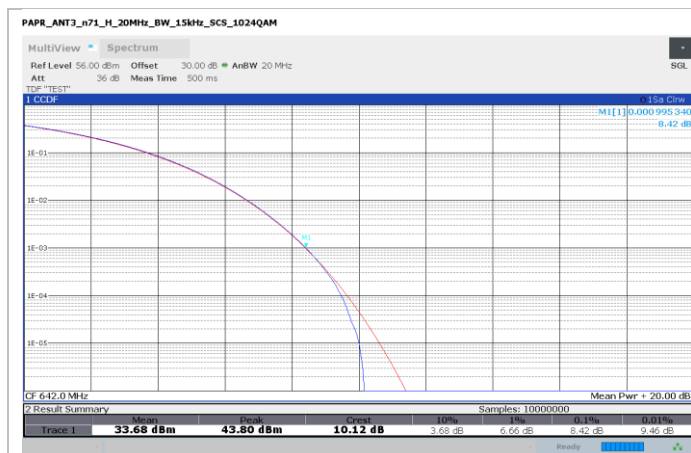
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8.6 FCC 27.53(g) / 90.210/90.691 Emission Limits

8.6.1 Definitions and limits

FCC 27.53(g):

(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.

8.6.2 Test summary

| | | | |
|---------------|---------------------------------|-------------------|-----------|
| Test date | July 18, 2022 | Temperature | 22 °C |
| Test engineer | Lan Sayasane, EMC Test Engineer | Air pressure | 1005 mbar |
| Verdict | Pass | Relative humidity | 60% |

8.6.3 Observations, settings and special notes

| | |
|--------------------------|--|
| EUT setup configuration | Table top |
| Test facility | 3 m Semi anechoic chamber |
| Measuring distance | 3m |
| Antenna height variation | 1–4 m |
| Turn table position | 0–360° |
| Measurement details | A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement. |

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

| | |
|----------------------|---|
| Resolution bandwidth | 120 kHz |
| Video bandwidth | 300 kHz |
| Detector mode | – Peak (Preview measurement) – Quasi-peak (Final measurement) |
| Trace mode | Max Hold |
| Measurement time | – 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement) |

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

| | |
|----------------------|--|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 MHz |
| Detector mode | Peak (Preview measurement) Peak and CAverage (Final measurement) |
| Trace mode | Max Hold |
| Measurement time | – 100 ms (Peak preview measurement) – 5000 ms (Peak and CAverage final measurement) |

Spectrum analyzer settings (conducted test):

| | |
|----------------------|---|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 MHz |
| Frequency span | Sufficient for making an accurate measurement |
| Detector mode | RMS |
| Trace mode | Max Hold |

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FCC 27.53(m) / 90.210/90.691 Emission limits
FCC Part 27 / FCC Part 90



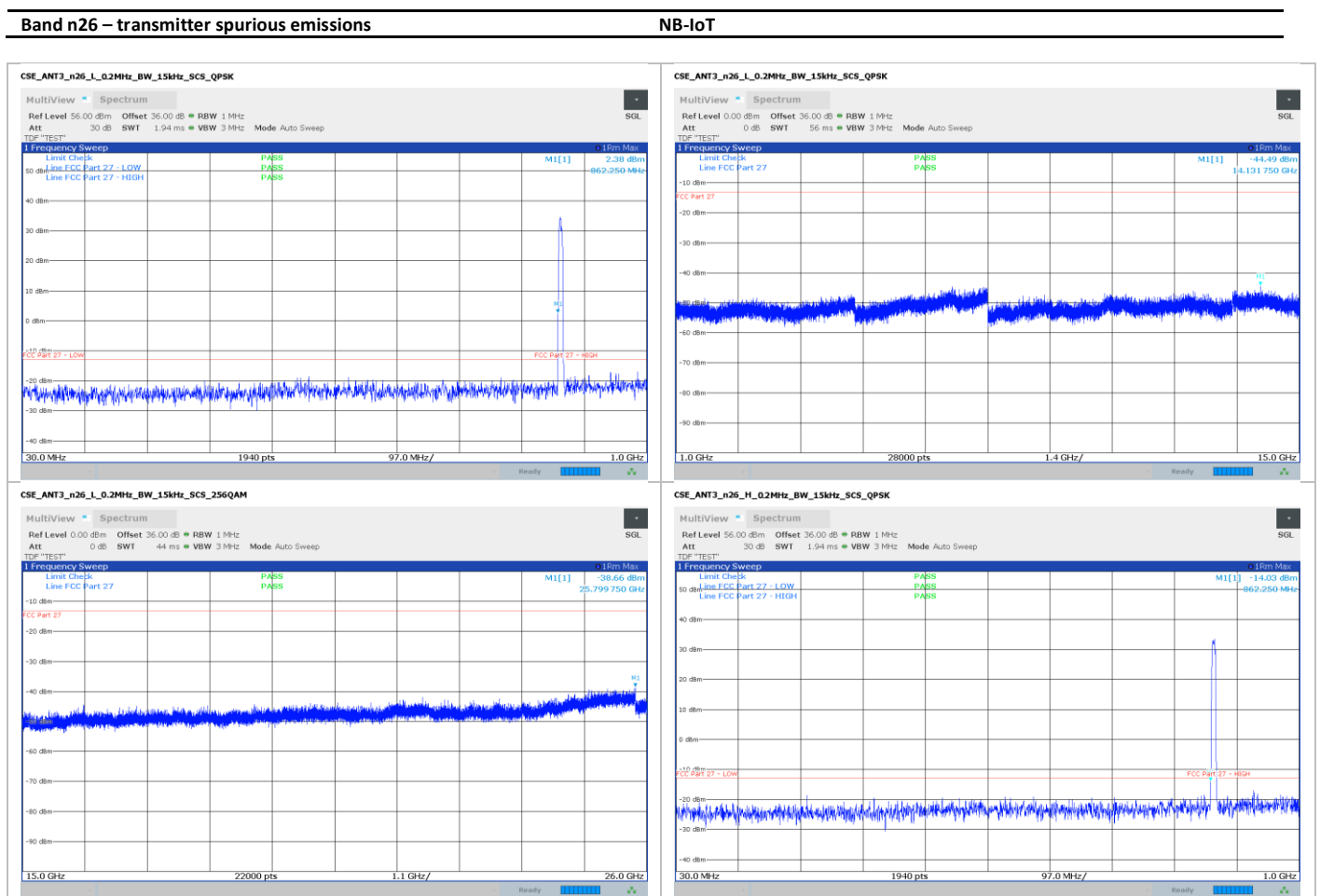
This test was realized in two parts: one with a conducted setup and another one with a radiated setup.

The conducted test was made on Port C (Band n26, Band n29, and Band n71, transmitting at max power and with the other three ports loaded with 50 Ω loads. For capturing the signal with the equipment, it was divided in three ranges, using a transducer factor to compensate the losses caused by a cable and attenuator used to protect the test equipment. Additional to this number, a 6.02 dB correlation factor was added to evaluate the complete power across the four ports, considering the ranges where harmonic can be observed. The first range was measured from 30 MHz to 1 GHz where the fundamental signal is visible. The second and third ranges were selected from 1 GHz to 15 GHz and 15 GHz to 26 GHz respectively, where the internal attenuator was reduced significantly to get a good noise floor level. Both ranges used the 6.02 dB offset and a transducer factor (include the cable losses and attenuator). The evaluation was made using the three channels and all the modulations (QPSK, 16QAM, 64QAM, 256QAM, and 1024QAM).

The radiated test was made transmitting to max power too with the four ports terminated with 50 Ω loads. The scans were made from 30 MHz to 26 GHz considering all the channels but only the modulation with the highest power as was showed at section 8.4.

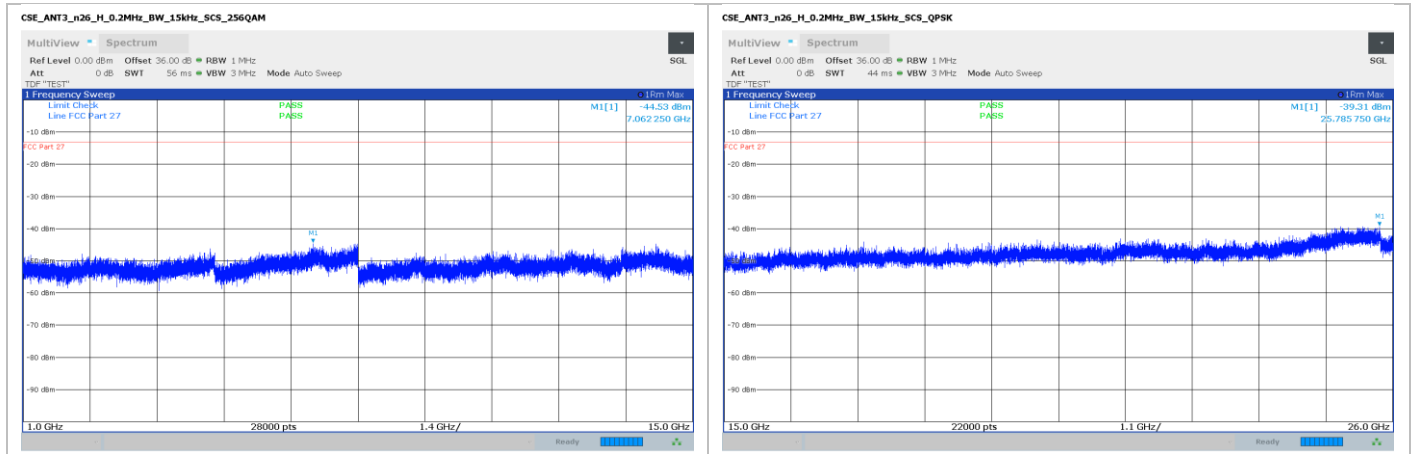
Based on equation $43 + 10 \log_{10}(P)$ dB, the general emission limit is -13 dBm (conducted and radiated test) or the equivalent at 3m is 82.23 dB μ V/m above 1 GHz and 84.38 dB μ V/m below 1 GHz.

8.6.4 Test data



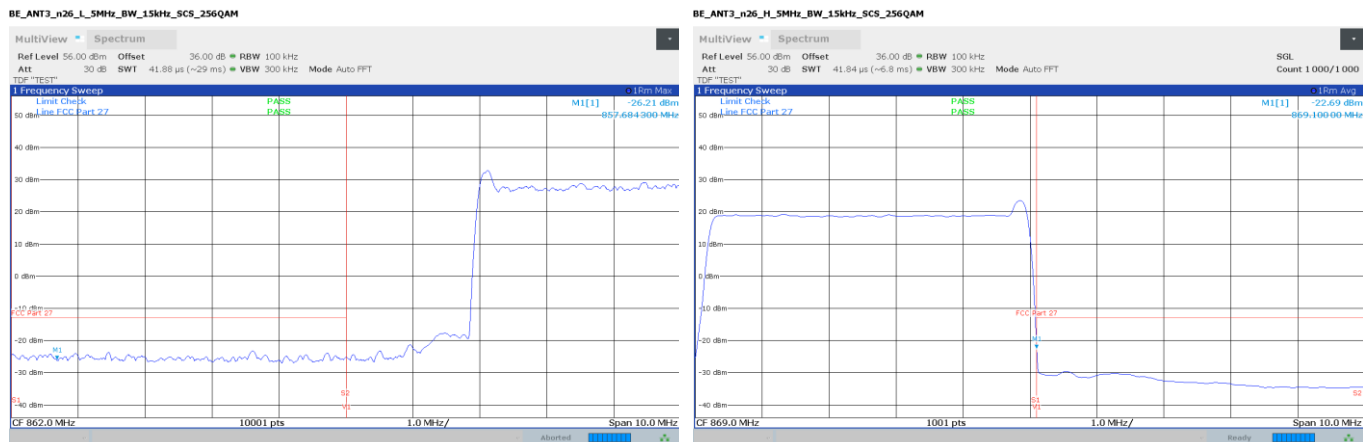
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Testing data
 FCC 27.53(m) / 90.210/90.691 Emission limits
 FCC Part 27 / FCC Part 90



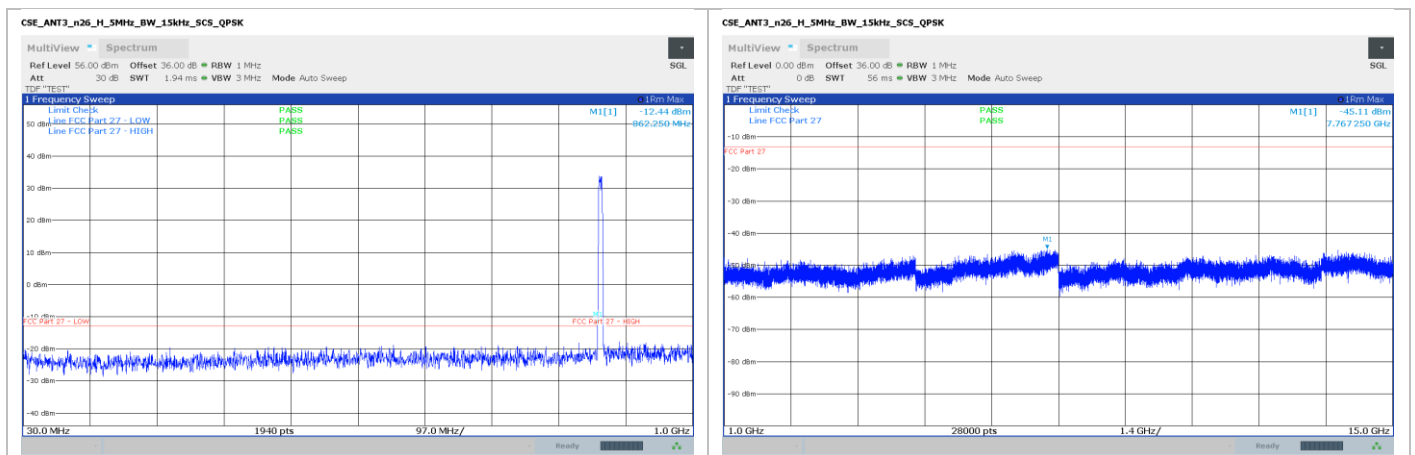
Band n26 – band edge emissions

NB-IoT



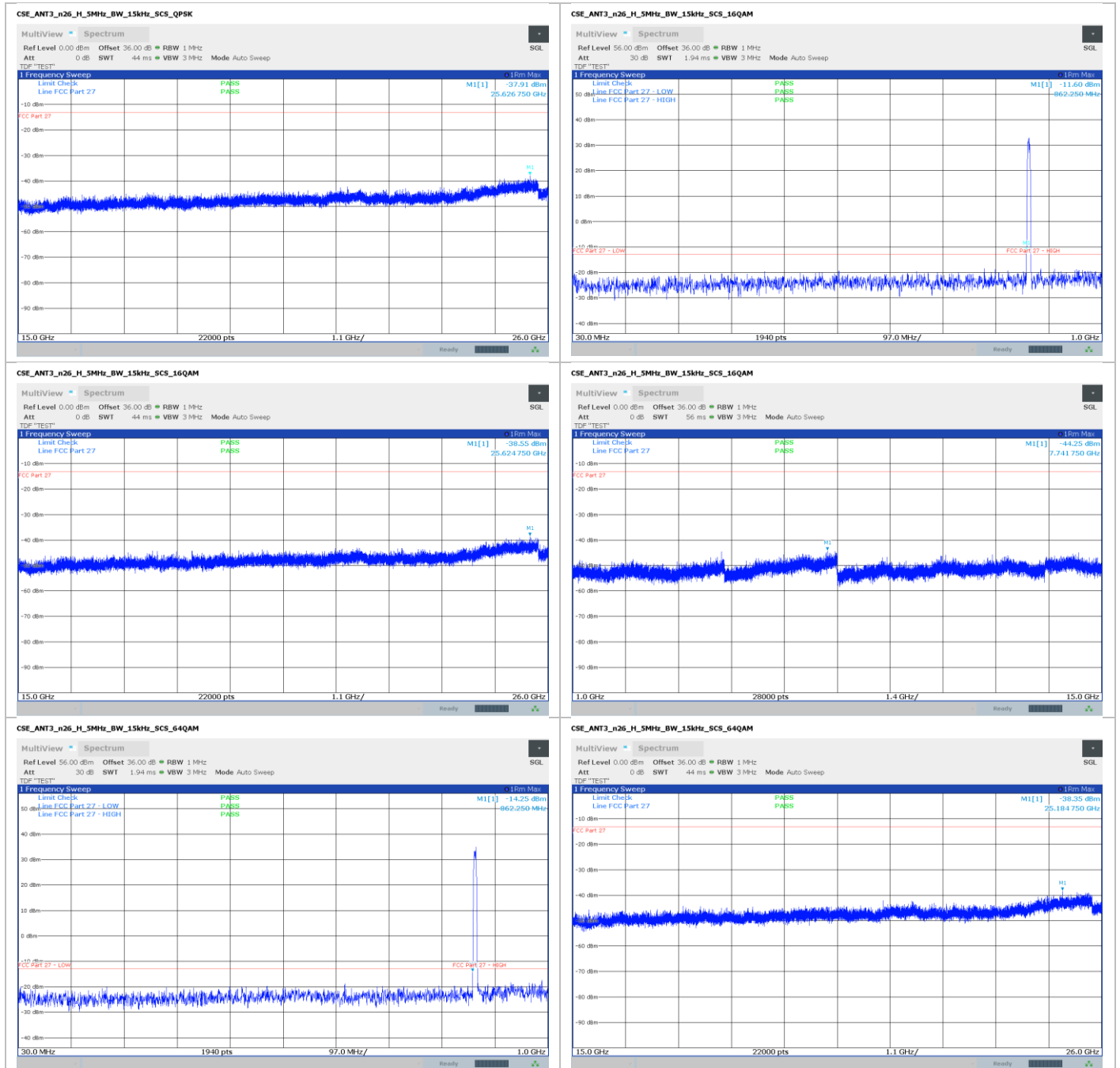
Band n26 – transmitter spurious emissions

5 MHz



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