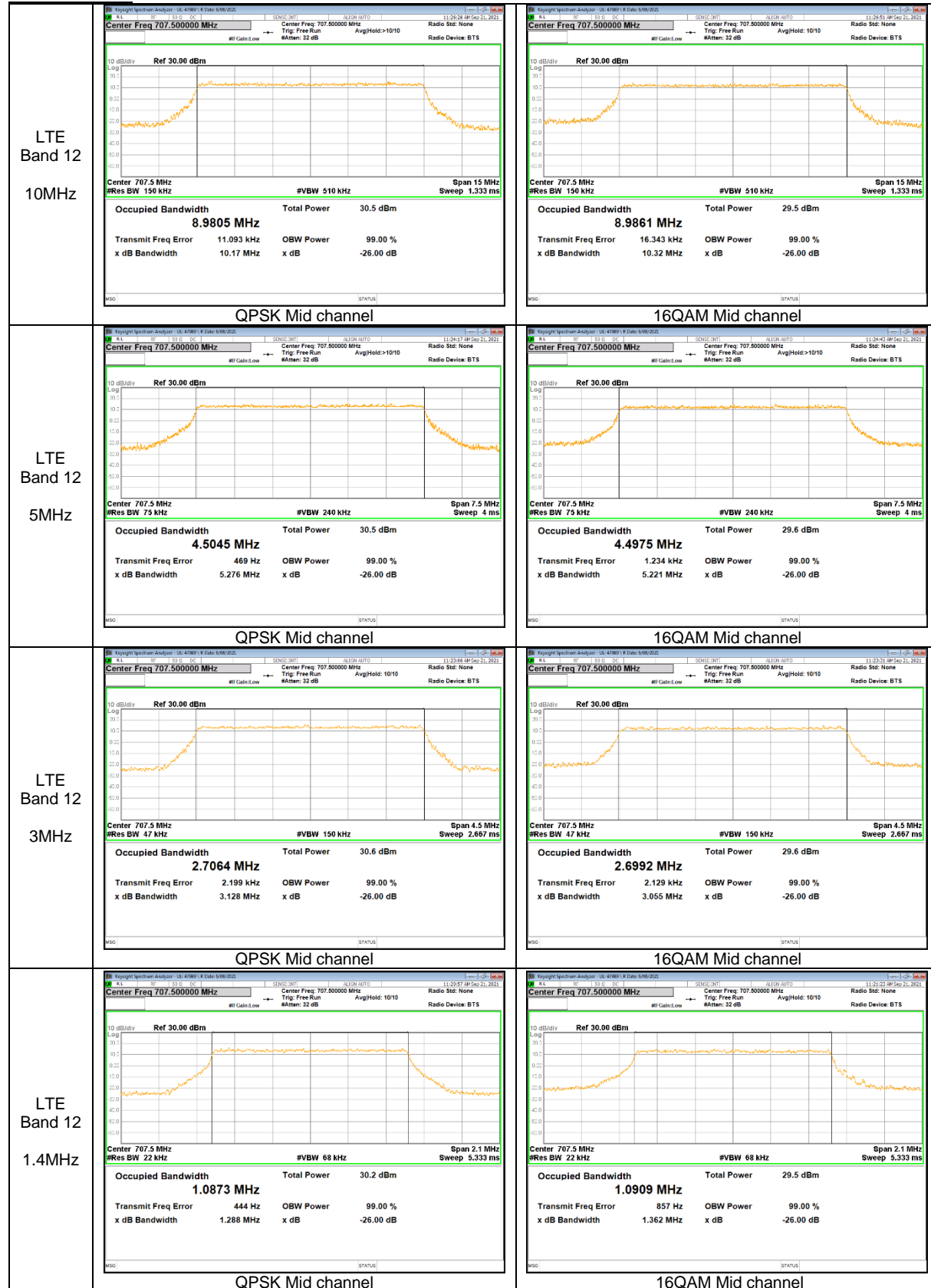
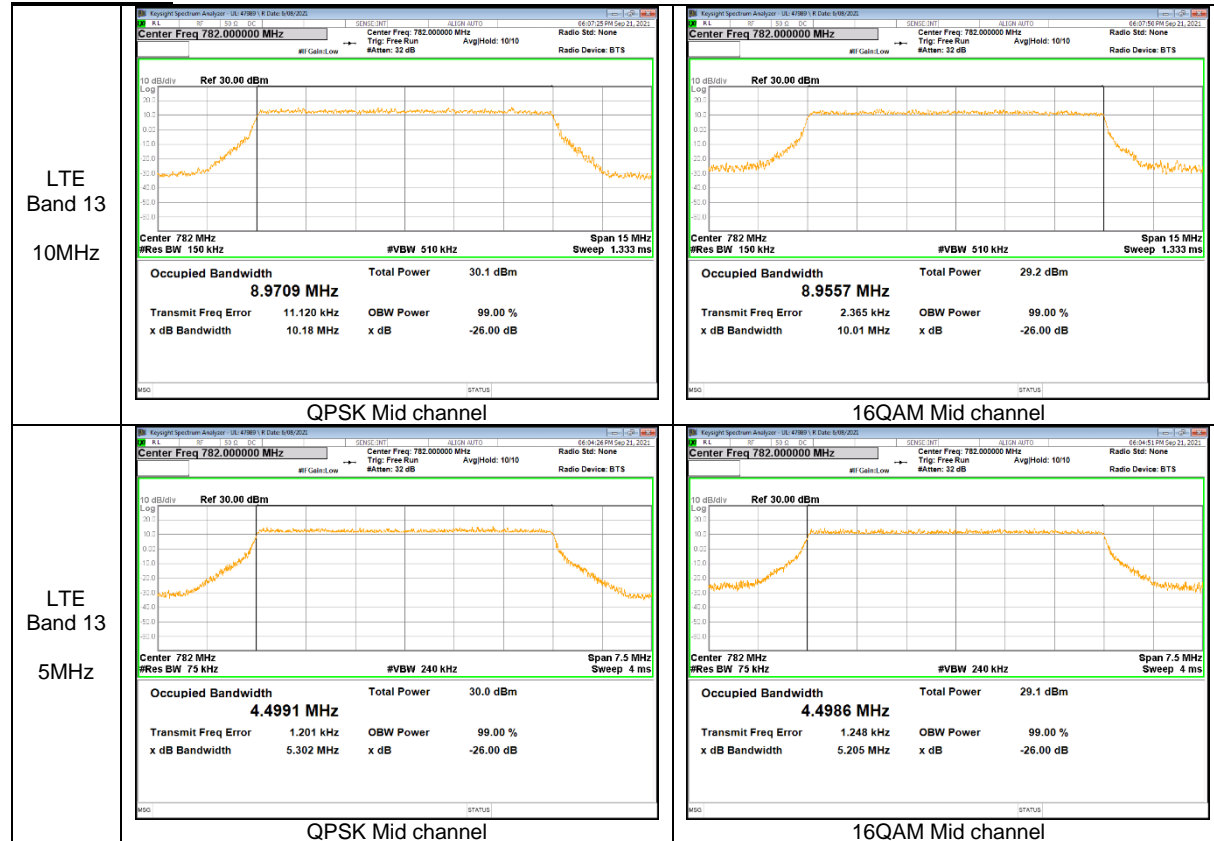


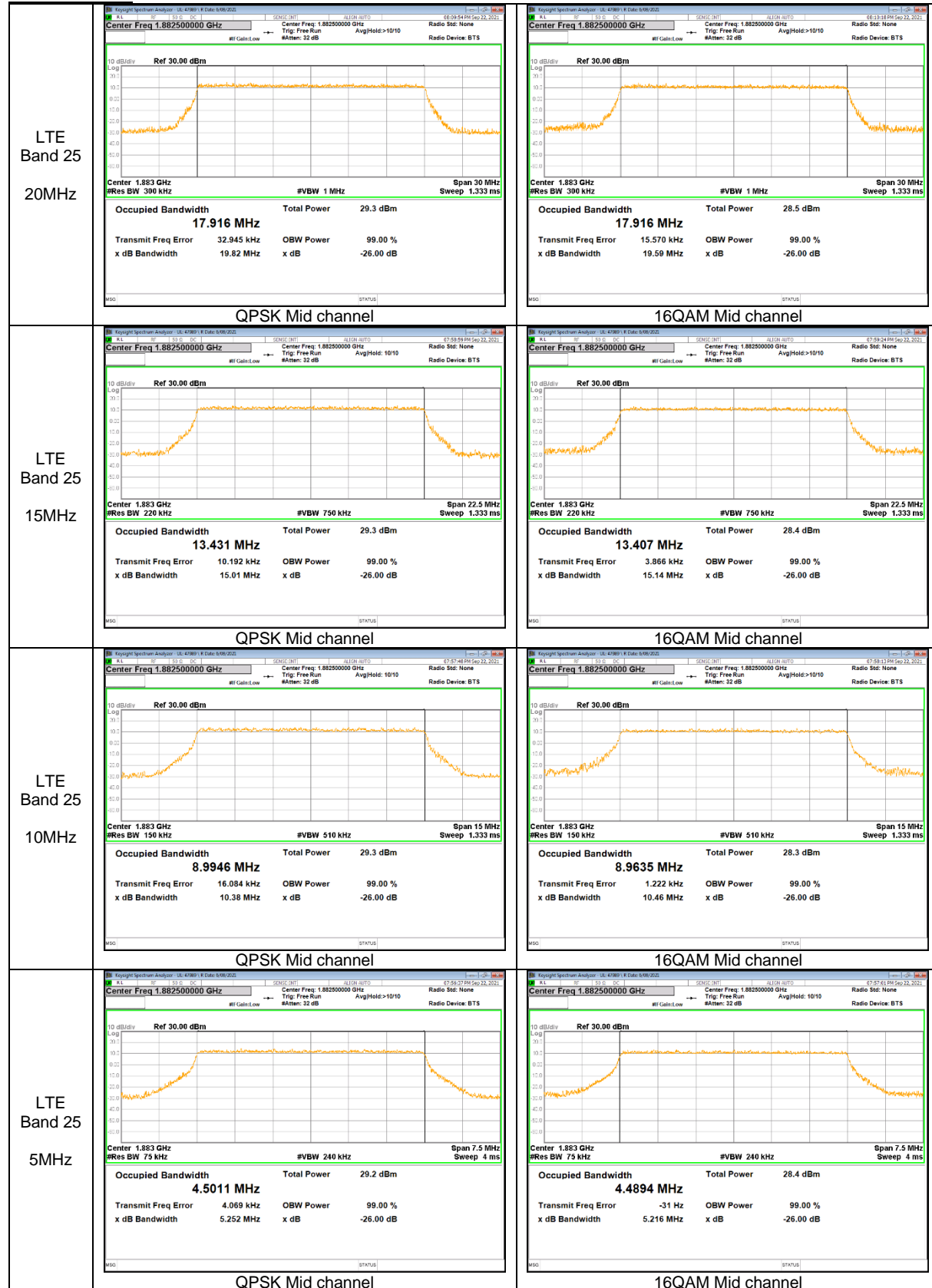
# LTE Band 12

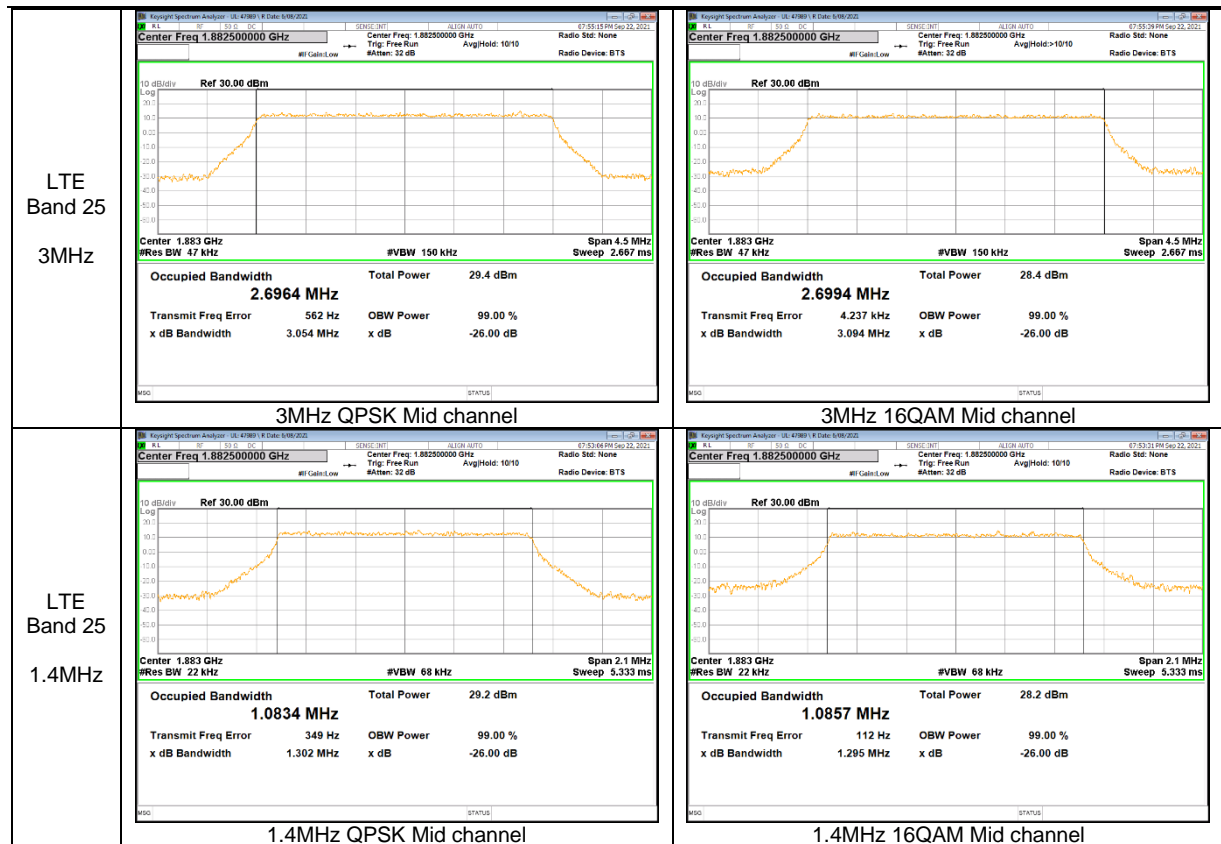


# LTE Band 13

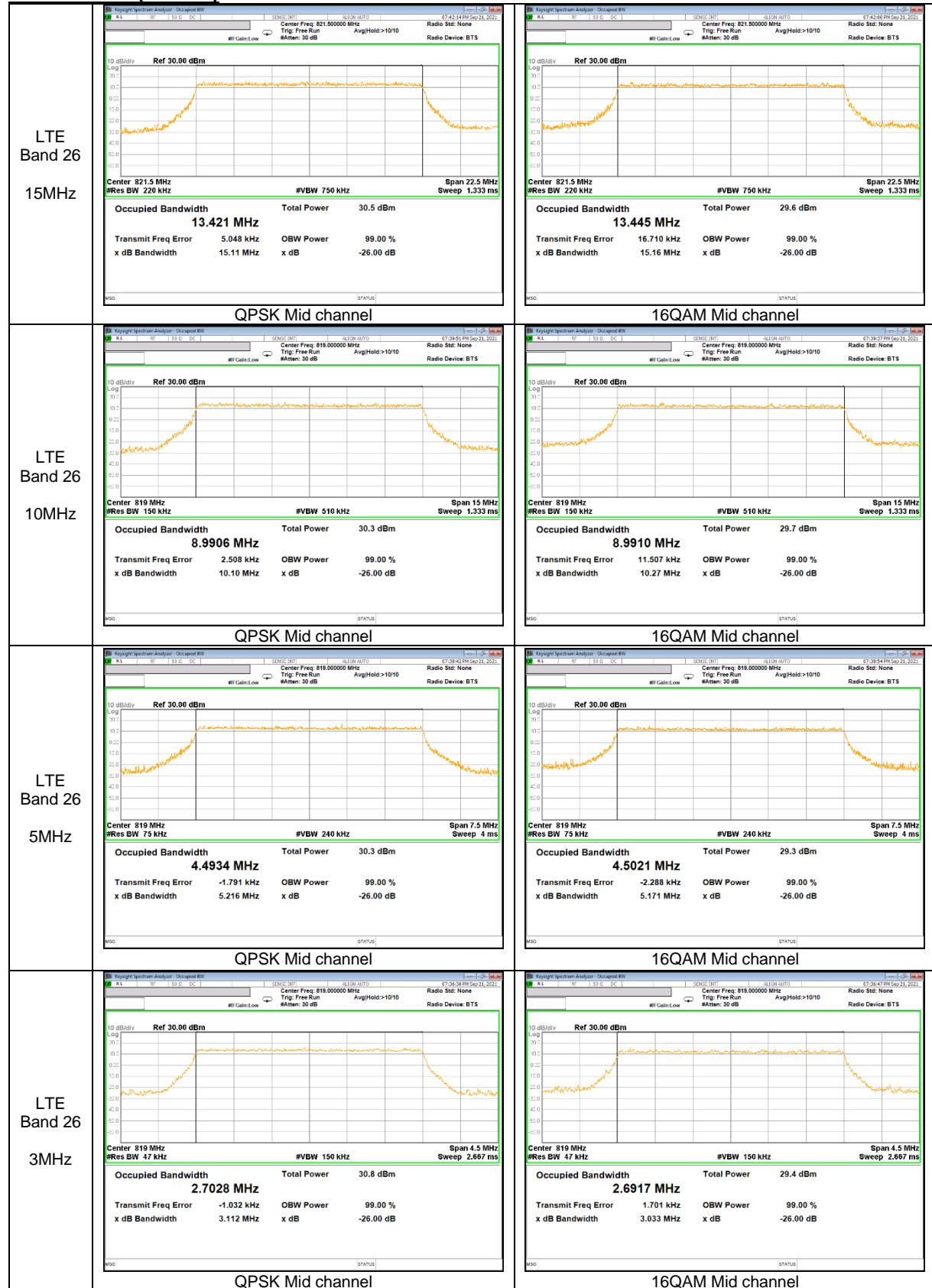


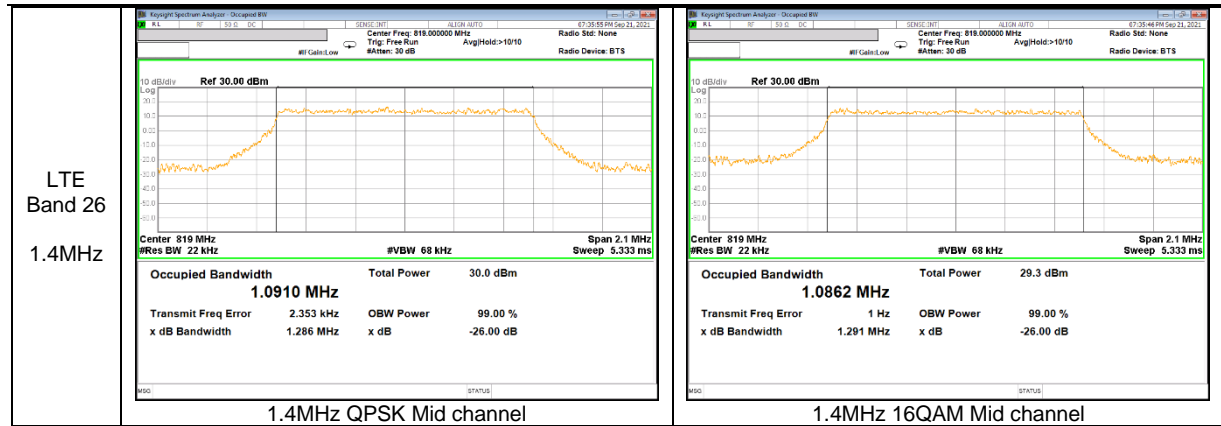
# LTE Band 25



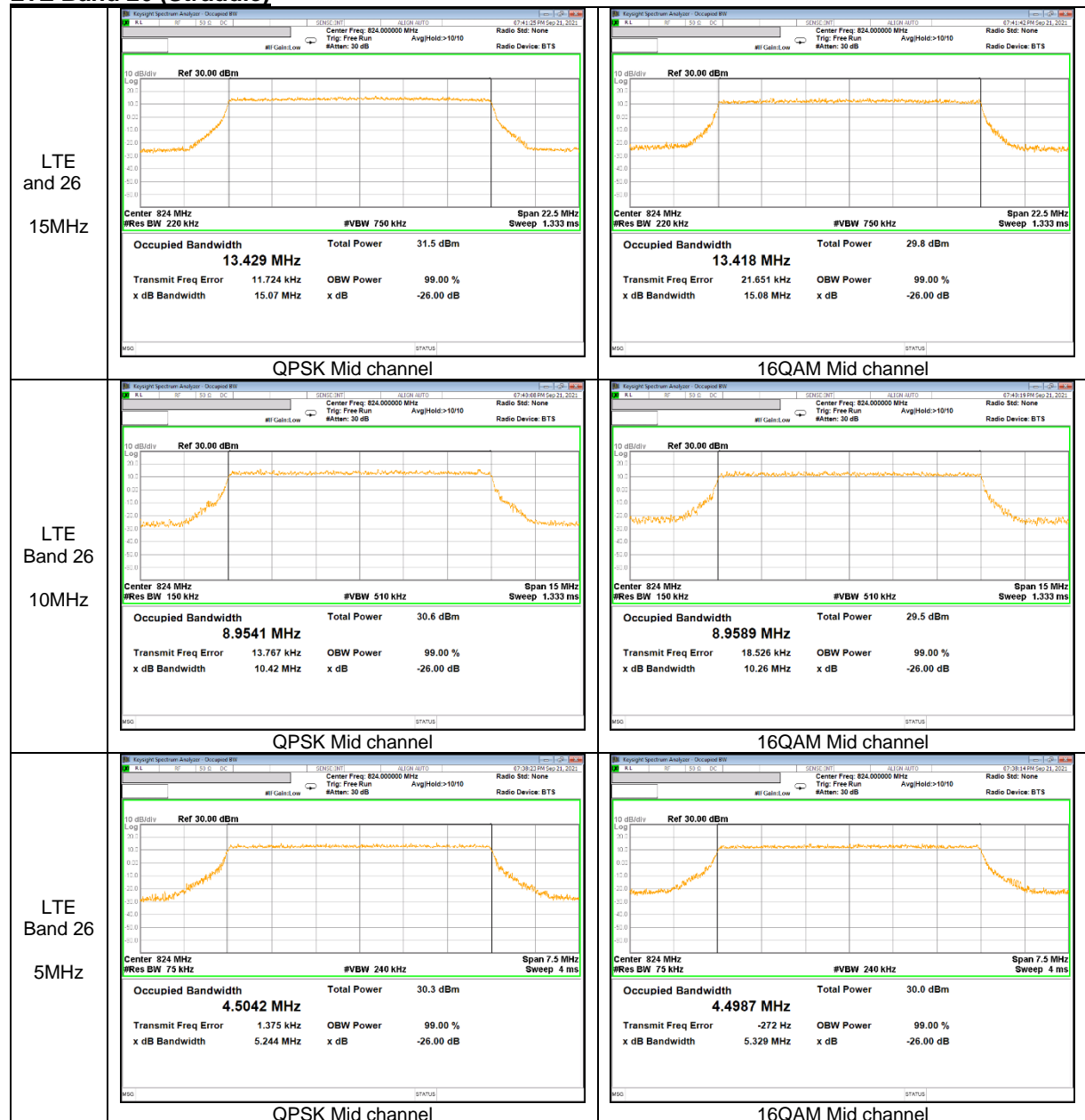


## LTE Band 26 (Part 90)



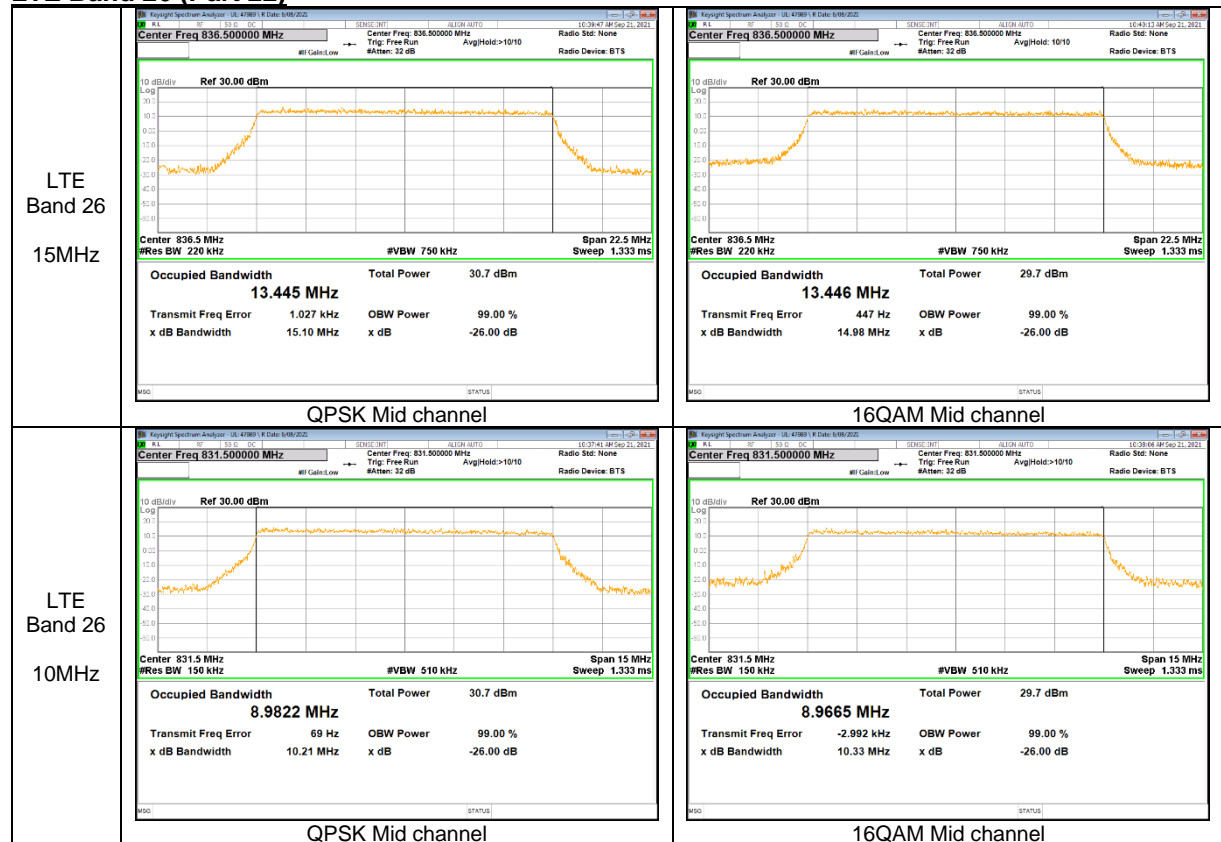


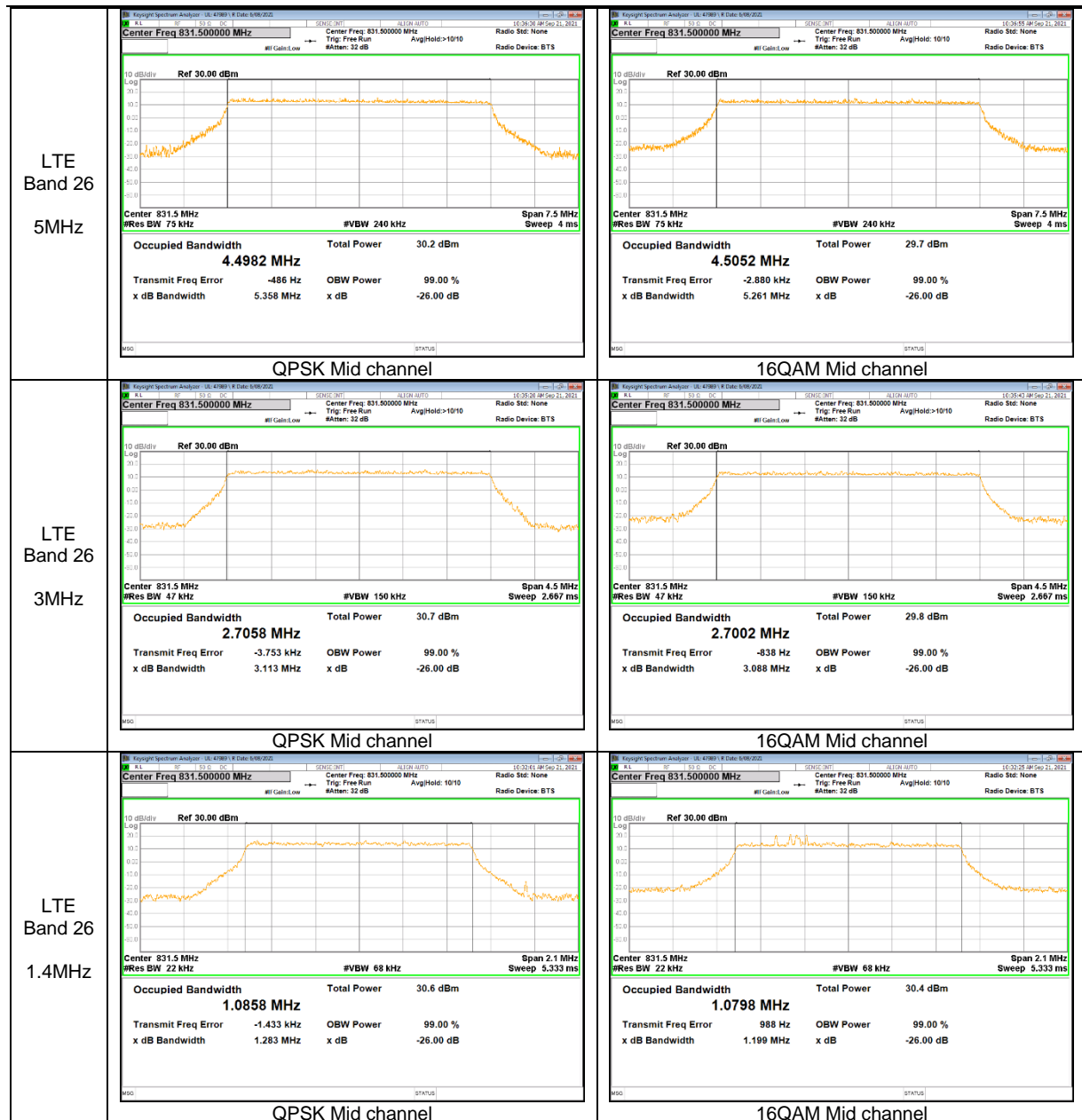
### LTE Band 26 (Straddle)





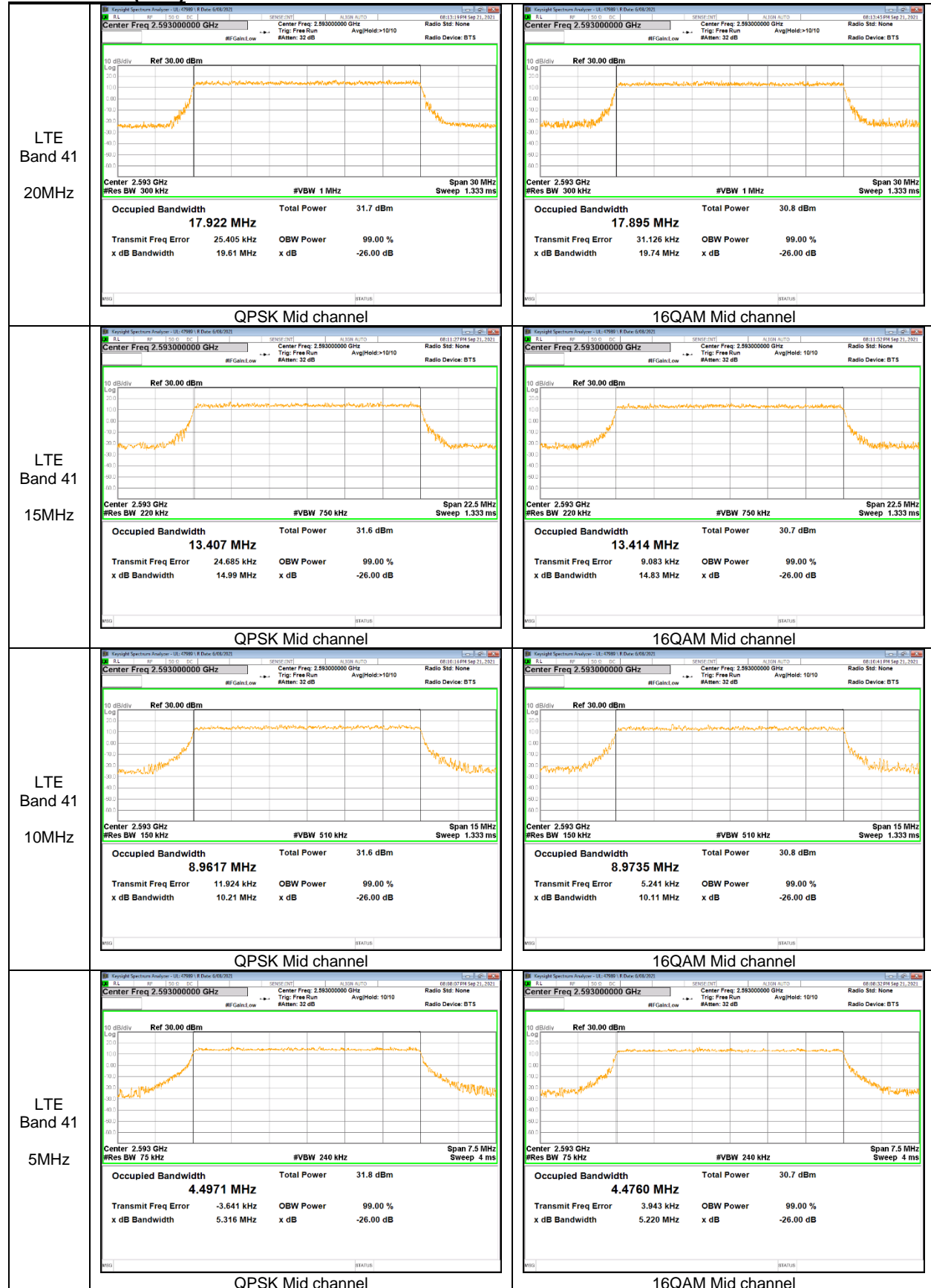
### LTE Band 26 (Part 22)





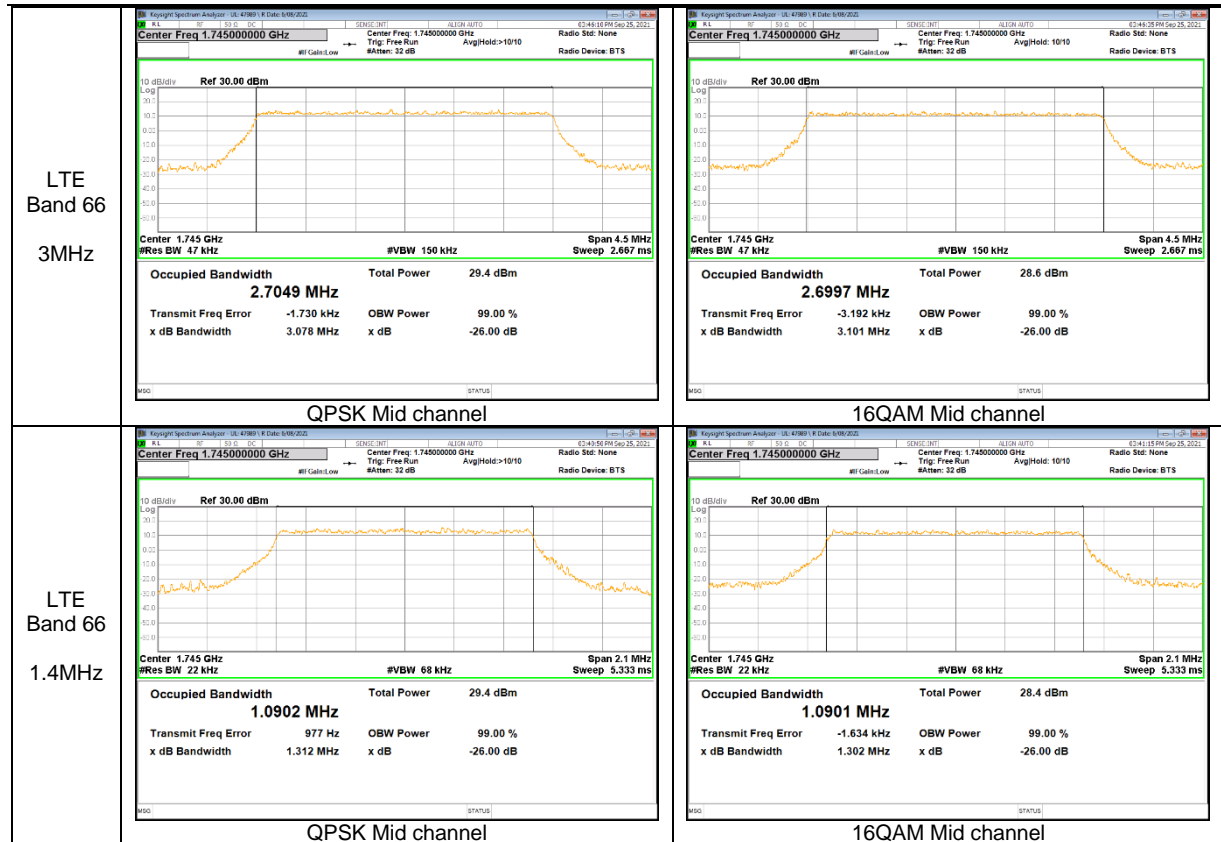


**LTE Band 41 (PC2)**

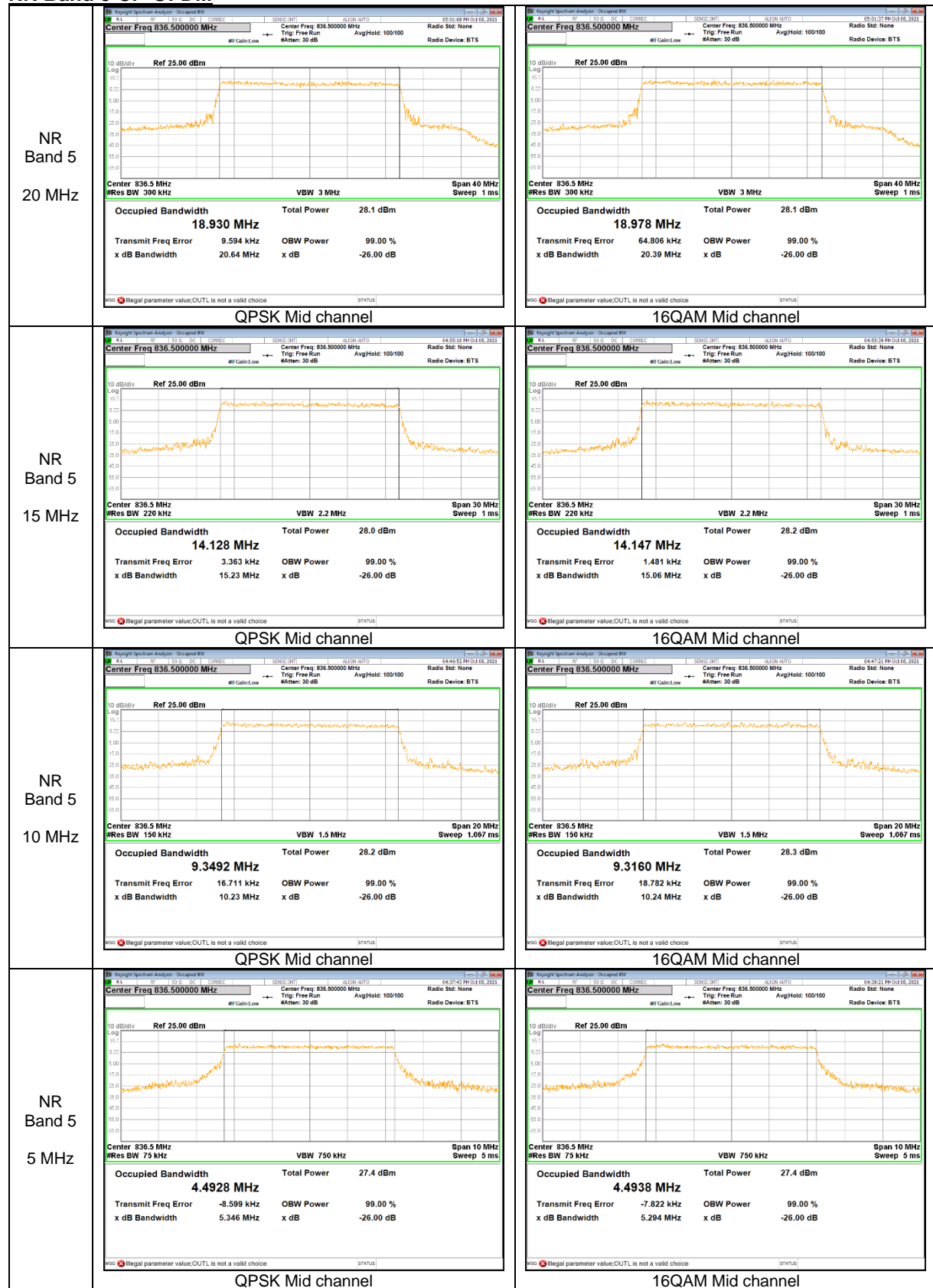


The figure displays eight screenshots of a Keysight Spectrum Analyzer, arranged in a 4x2 grid. Each screenshot shows the spectral characteristics of an LTE Band 66 signal under different conditions. The columns represent different modulation schemes: QPSK (left) and 16QAM (right). The rows represent different channel bandwidths: 20MHz (top), 15MHz (second row), 10MHz (third row), and 5MHz (bottom). Each screenshot includes a spectral plot with a yellow signal trace, a reference line at 30.00 dBm, and a table of key metrics.

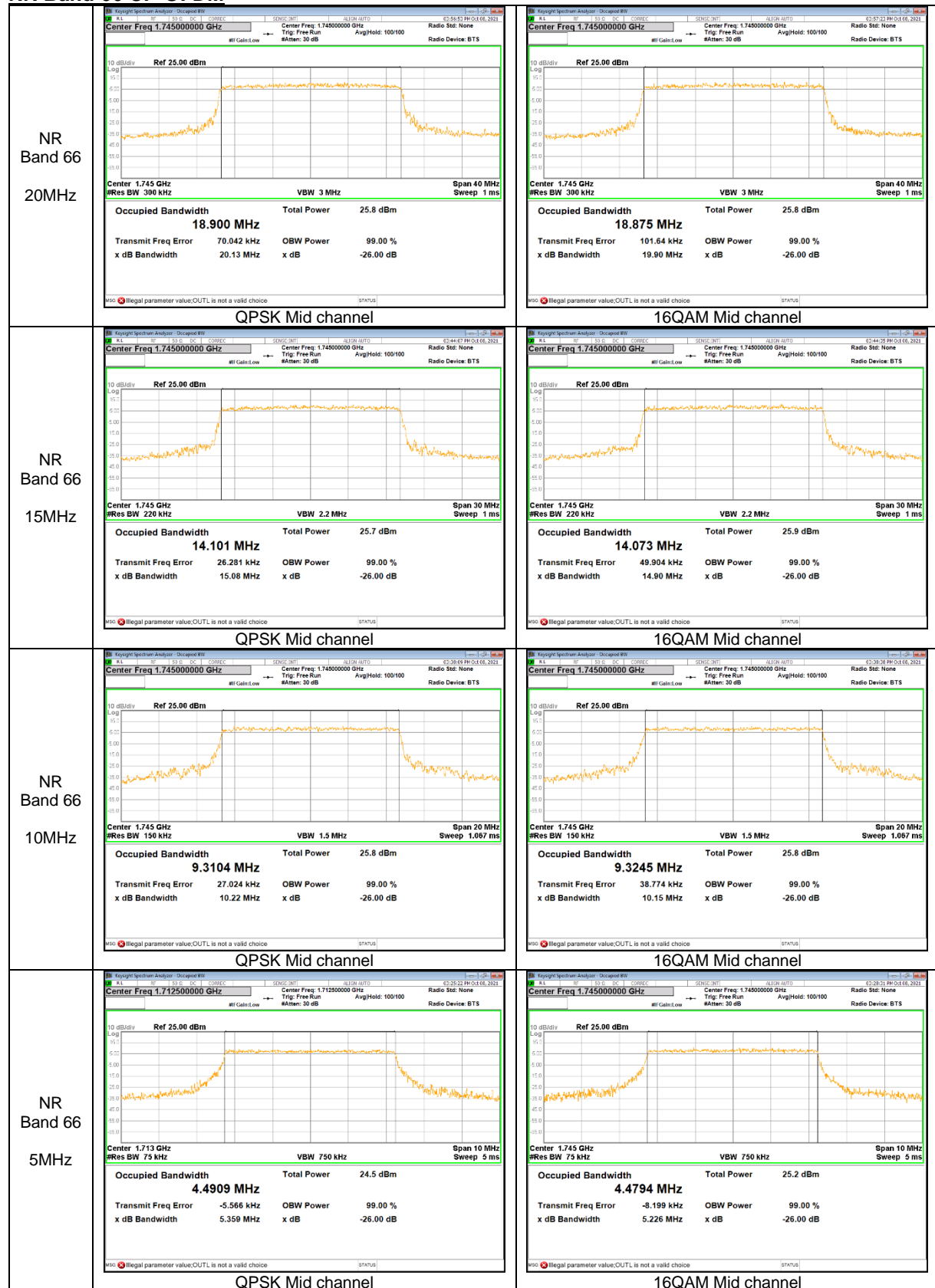
| Modulation | Channel Bandwidth | Occupied Bandwidth (MHz) | Total Power (dBm) | Transmit Freq Error (kHz) | OBW Power (dB) |
|------------|-------------------|--------------------------|-------------------|---------------------------|----------------|
| QPSK       | 20MHz             | 17.920                   | 29.4              | 27.667                    | -26.00         |
|            | 15MHz             | 13.414                   | 29.5              | 16.194                    | -26.00         |
|            | 10MHz             | 8.9627                   | 29.4              | 12.082                    | -26.00         |
|            | 5MHz              | 4.5063                   | 29.4              | 2.000                     | -26.00         |
| 16QAM      | 20MHz             | 17.921                   | 28.6              | 33.986                    | -26.00         |
|            | 15MHz             | 13.440                   | 28.5              | 28.940                    | -26.00         |
|            | 10MHz             | 8.9889                   | 28.6              | 12.505                    | -26.00         |
|            | 5MHz              | 4.5018                   | 28.6              | 2.197                     | -26.00         |



## NR Band 5 CP-OFDM



NR Band 66 CP-OFDM



## 9.2. BAND EDGE EMISSIONS

### RULE PART(S)

FCC: §22.359, §22.917, §24.238, §27.53 and 90.691

### LIMITS

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.

Part 27.53:

(c) For operations in the 746-758 MHz band and 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:

(2) 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;

(4) On all frequencies between 763-775 MHz and 793-806 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations;

(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.

(h) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.

(m) (4) For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Part 90.691:

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $116 \log_{10}(f/6.1)$  decibels or  $50 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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### **TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

#### **GSM**

- a) Set the RBW = 1 ~ 5% of OBW(GSM850 – 8.2KHz, GSM1900 – 9.1KHz)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = 1S ;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace mode = Average(100);
- h) Add duty cycle correction factor (9dB)

#### **WCDMA/LTE/5G NR**

- a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace mode = Average (100);

**NOTE1:** For frequency range of 763-775 MHz and 793-806 MHz.(LTE Band 13)

- a) Set the RBW = 6.8kHz
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Sweep time = 1 second ;
- d) Detector = RMS;
- e) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- f) Trace mode = Average;

**NOTE2**

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm / -25dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addtional correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

**NOTE3**

For Band-Edge extended:

| CH BW (MHz) | RB Used (kHz) | CF for emissions more than 100kHz | CF for emissions more than 1MHz |
|-------------|---------------|-----------------------------------|---------------------------------|
| 1.4         | 15            | +8.2 dB                           | +18.2 dB                        |
| 3           | 30            | +5.2 dB                           | +15.2 dB                        |
| 5           | 51            | +2.9 dB                           | +12.9 dB                        |
| 10          | 100           | N/A                               | +10.0 dB                        |
| 15          | 150           | N/A                               | +8.2 dB                         |
| 20          | 200           | N/A                               | +7.0 dB                         |

For the band edge value measured in [RB Used], even if [CF for emissions reference bandwidth 100kHz/1MHz] is applied, it is below -13dBm.

**NOTE4**

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

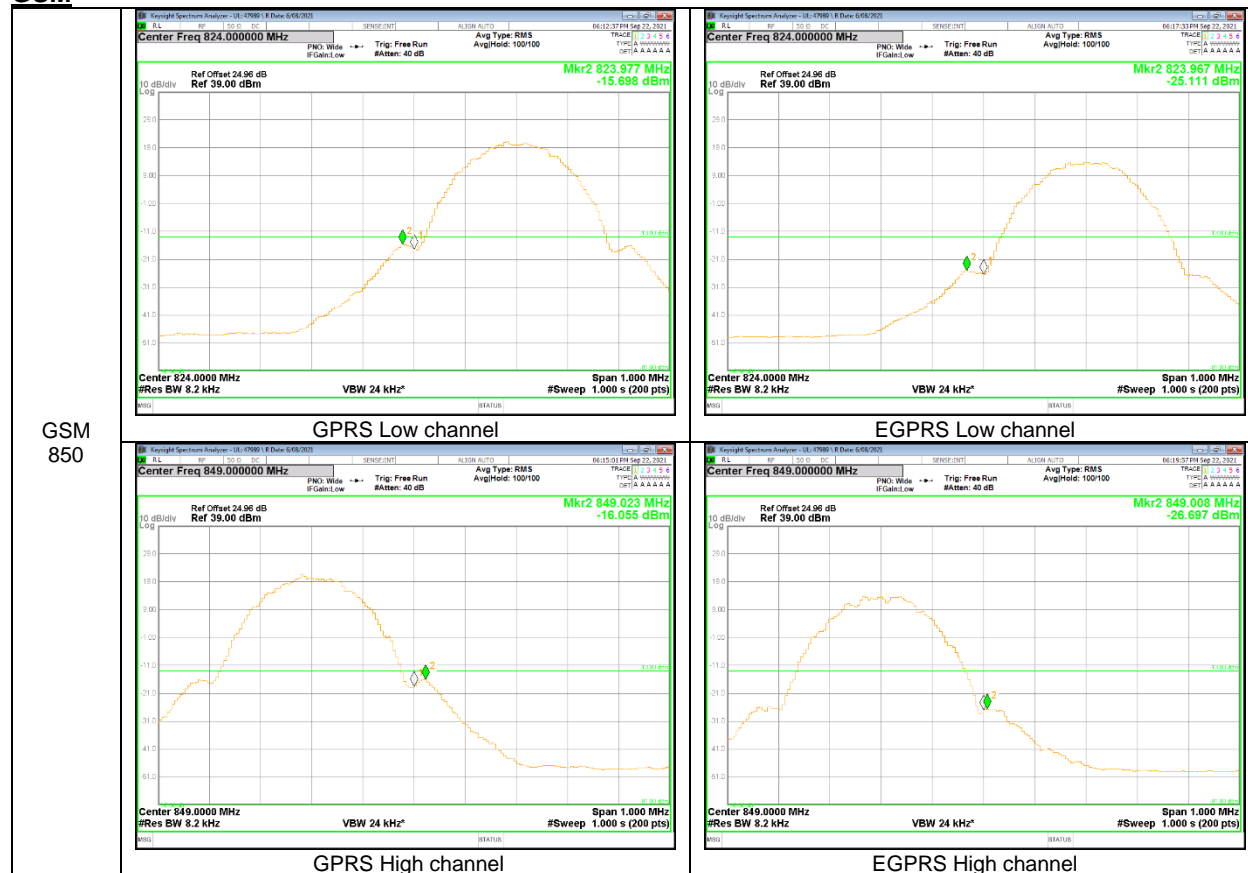
**RESULTS**

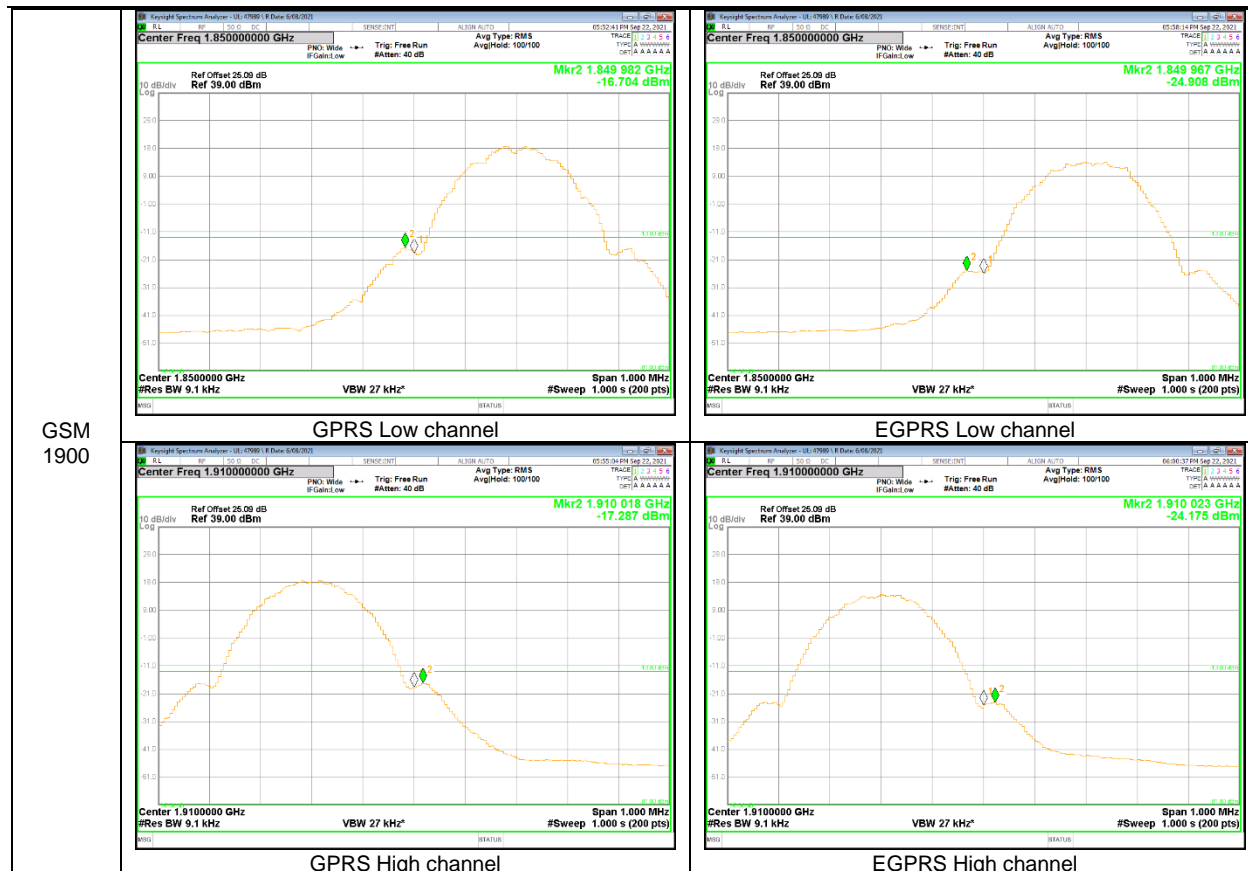
See the following pages.



## 9.2.1. BAND EDGE RESULT

### GSM





WCDMA

