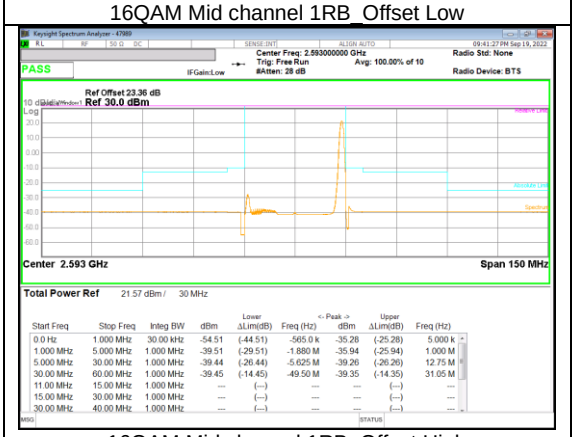
30MHz

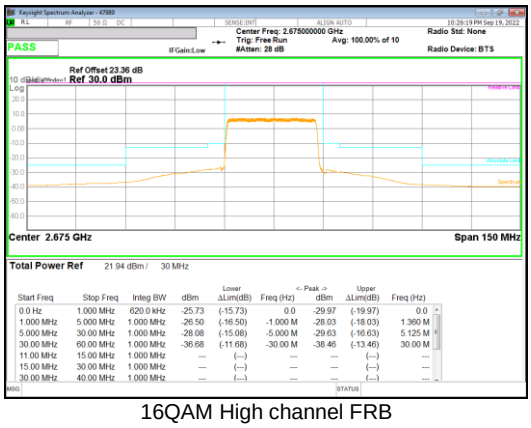
16QAM

16QAM Mid channel FRB

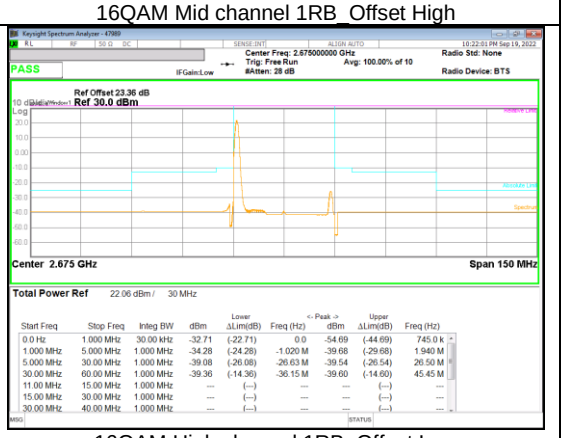
16QAM Mid channel 1RB_Offset Low



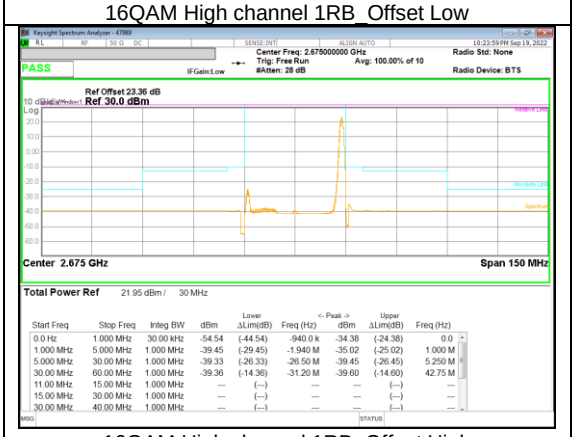
16QAM Mid channel 1RB_Offset High



16QAM High channel FRB



16QAM High channel 1RB_Offset Low



16QAM High channel 1RB_Offset High

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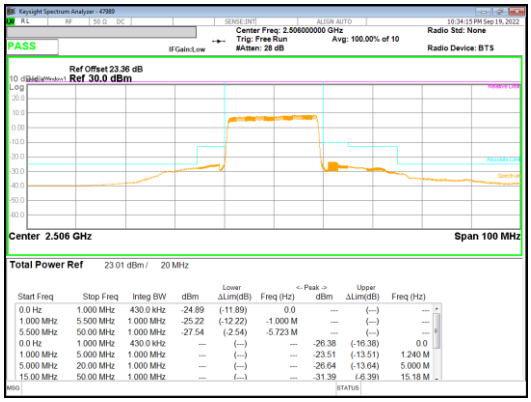
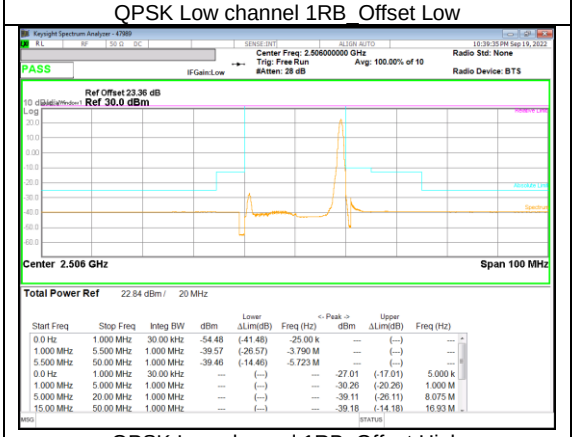
20MHz

QPSK

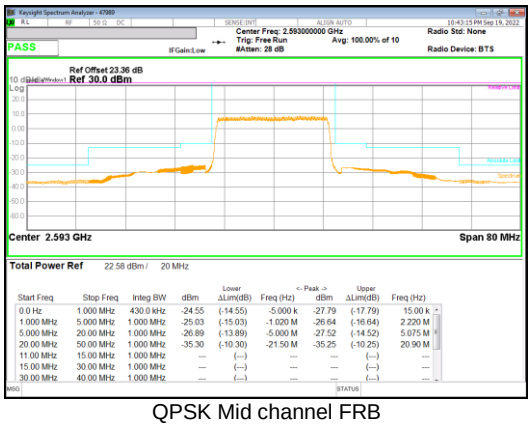


QPSK Low channel FRB

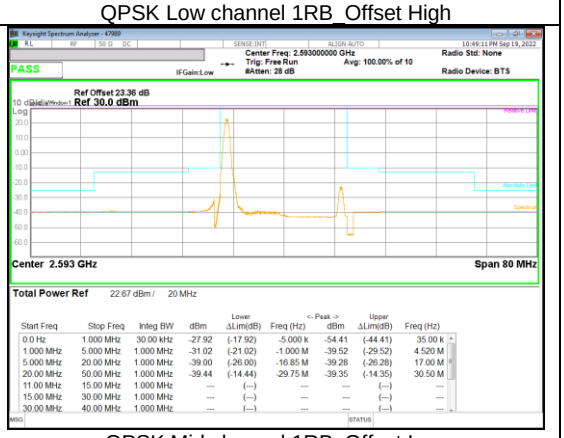
QPSK Low channel 1RB_Offset Low



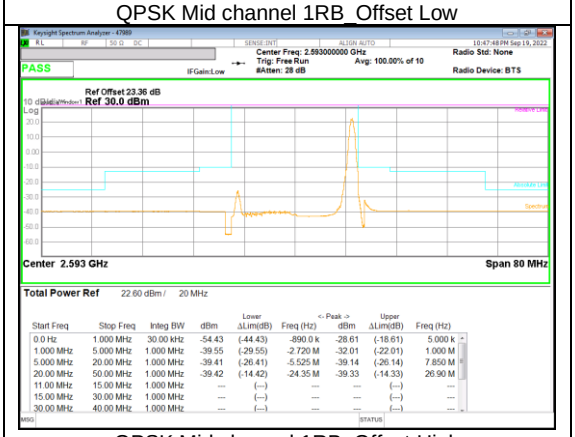
QPSK Low channel 1RB_Offset High



QPSK Mid channel FRB



QPSK Mid channel 1RB_Offset Low



QPSK Mid channel 1RB_Offset High

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_22/24/27/90(04)
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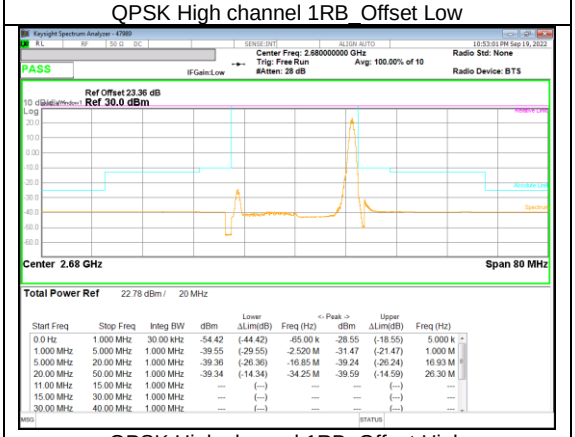
20MHz

QPSK

QPSK High channel FRB

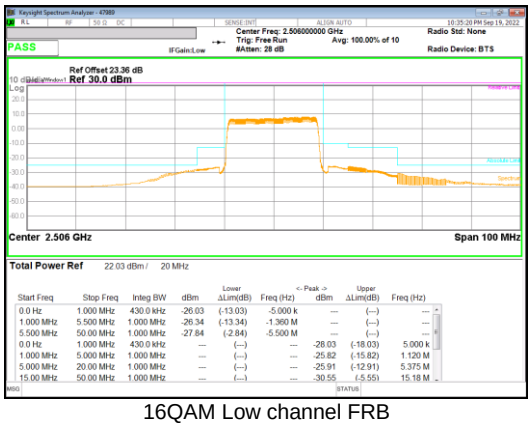
QPSK High channel 1RB_Offset Low



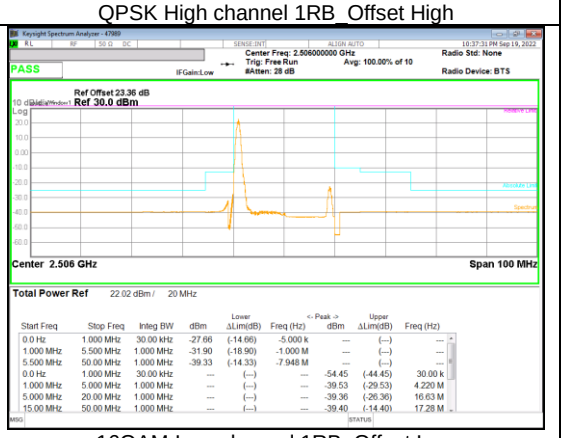
QPSK High channel 1RB_Offset High

20MHz

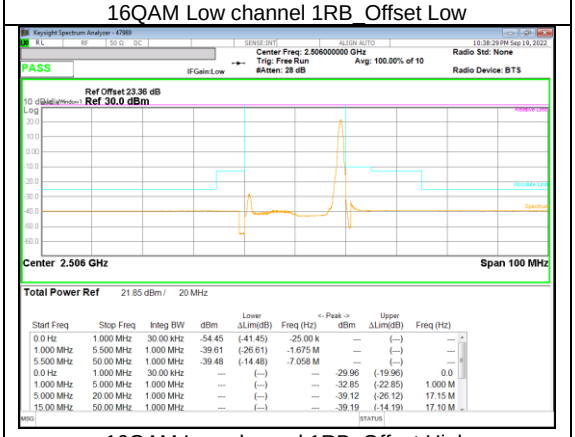
16QAM



16QAM Low channel FRB



16QAM Low channel 1RB_Offset Low



16QAM Low channel 1RB_Offset High

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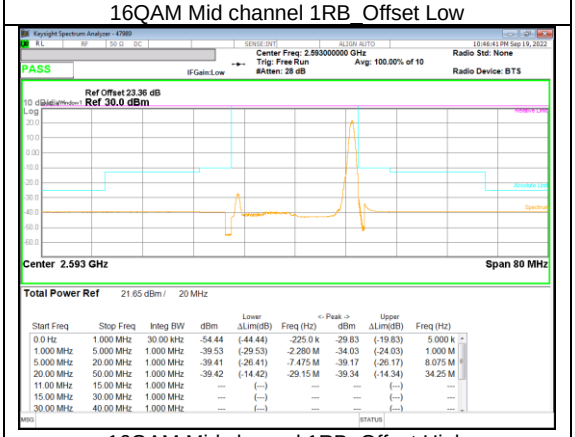
20MHz

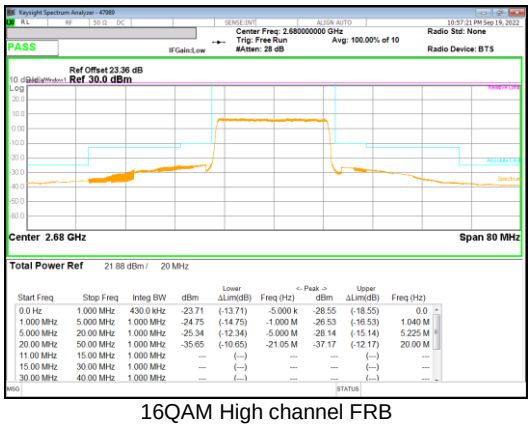
16QAM

16QAM Mid channel FRB

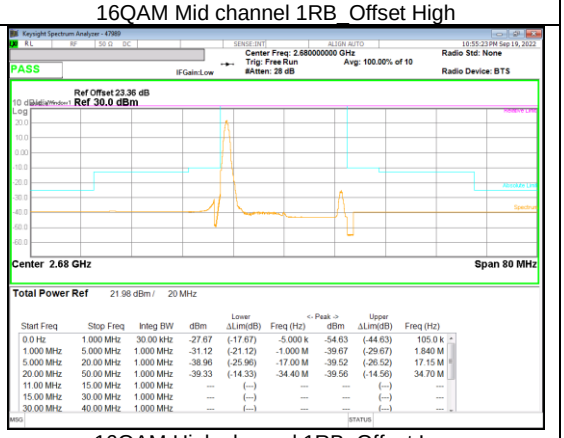
16QAM Mid channel 1RB_Offset Low



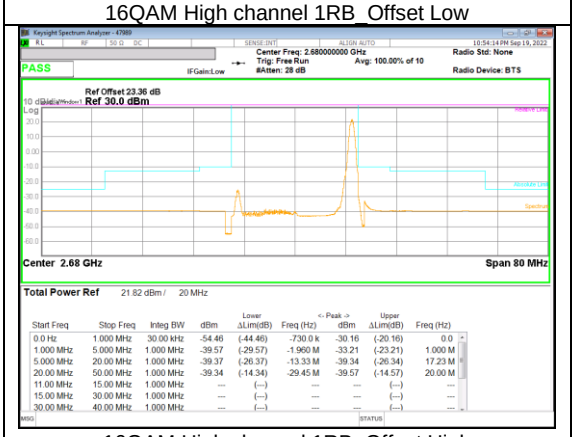
16QAM Mid channel 1RB_Offset High



16QAM High channel FRB



16QAM High channel 1RB_Offset Low



16QAM High channel 1RB_Offset High

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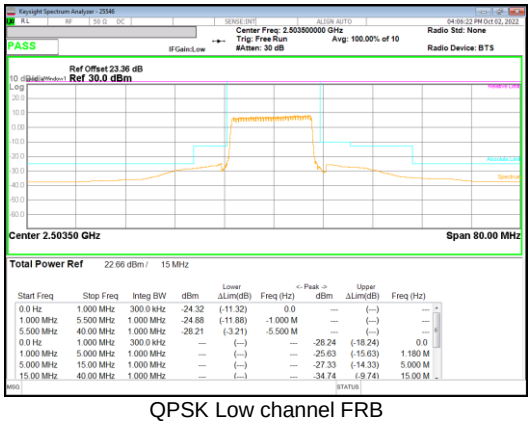
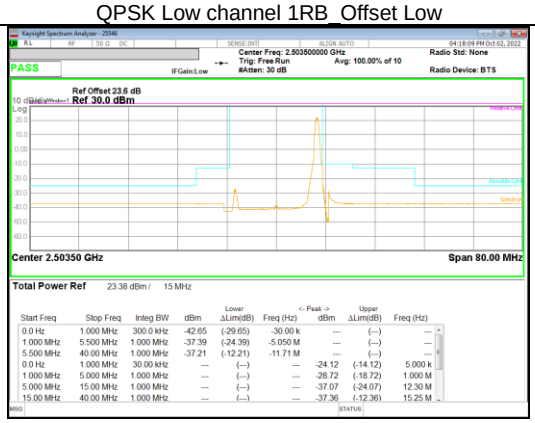
15MHz

QPSK



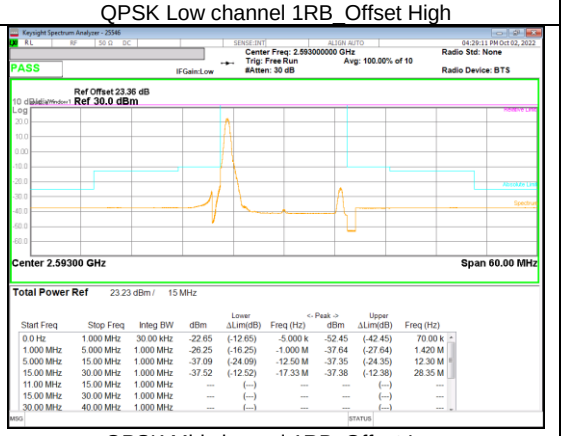
QPSK Low channel FRB

QPSK Low channel 1RB_Offset Low

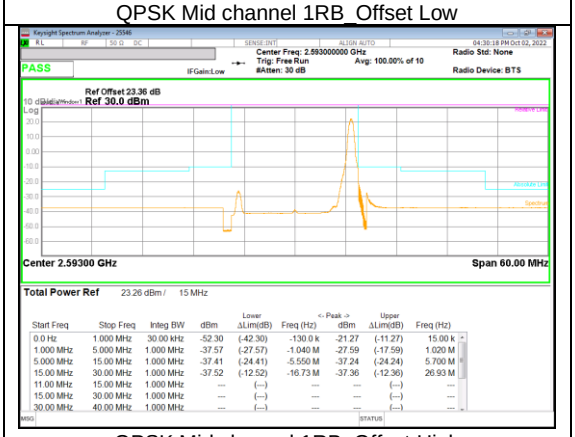


QPSK Low channel 1RB_Offset High

QPSK Mid channel FRB



QPSK Mid channel 1RB_Offset Low



QPSK Mid channel 1RB_Offset High

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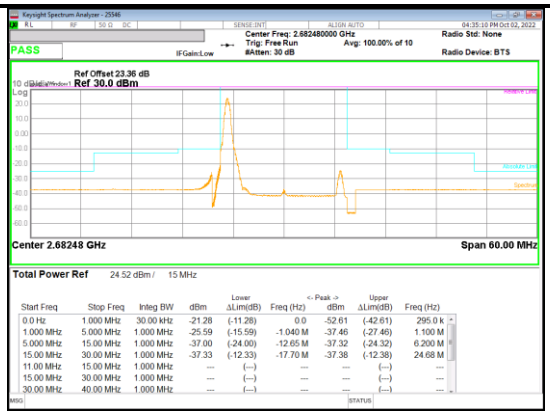
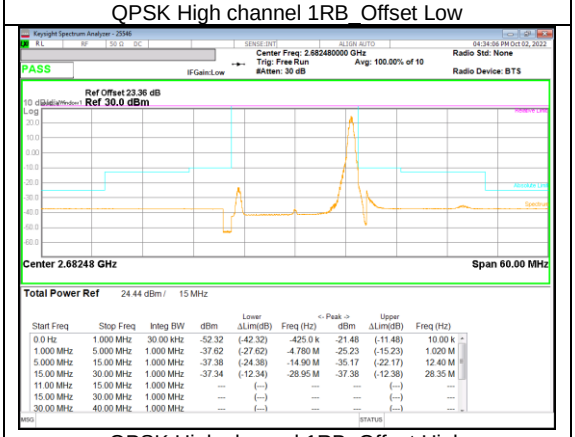
15MHz

QPSK

QPSK High channel FRB



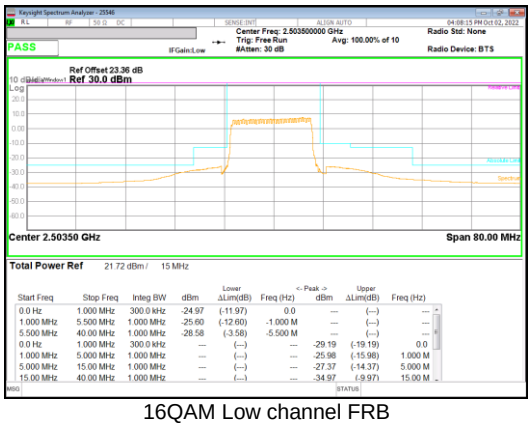
QPSK High channel 1RB_Offset Low



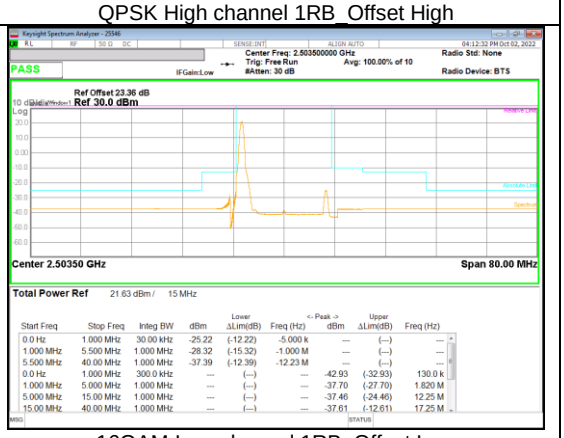
QPSK High channel 1RB_Offset High

15MHz

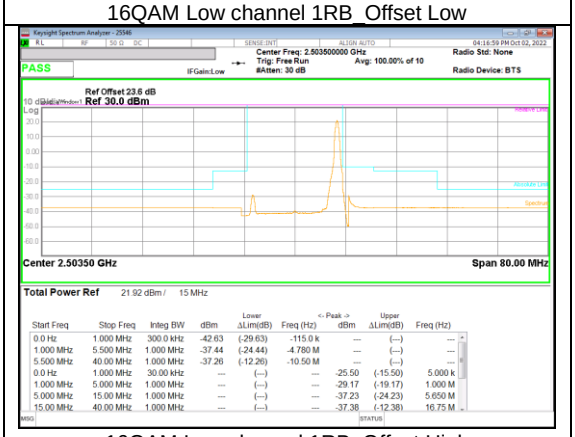
16QAM



16QAM Low channel FRB



16QAM Low channel 1RB_Offset Low



16QAM Low channel 1RB_Offset High

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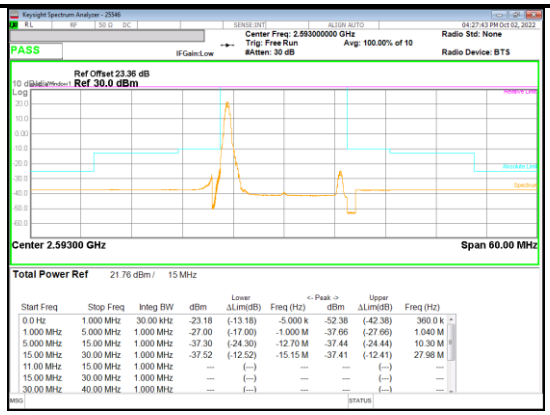
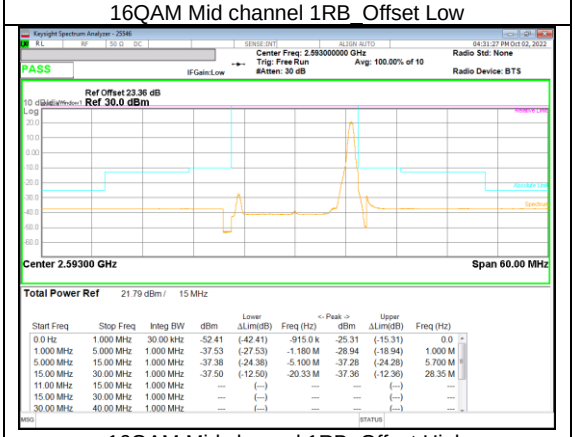
15MHz

16QAM

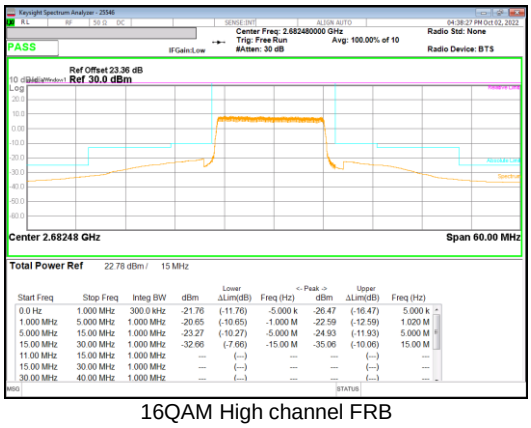
16QAM Mid channel FRB



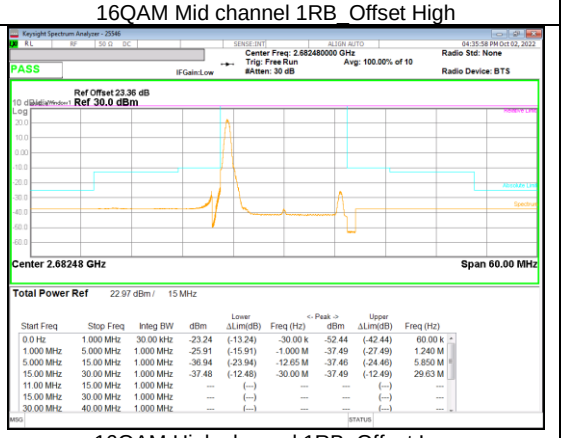
16QAM Mid channel 1RB_Offset Low



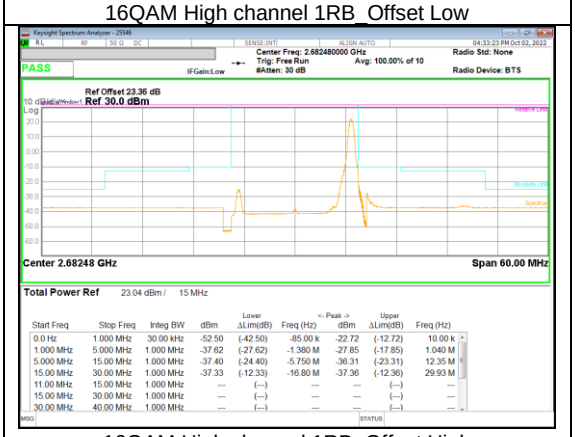
16QAM Mid channel 1RB_Offset High



16QAM High channel FRB



16QAM High channel 1RB_Offset Low



16QAM High channel 1RB_Offset High

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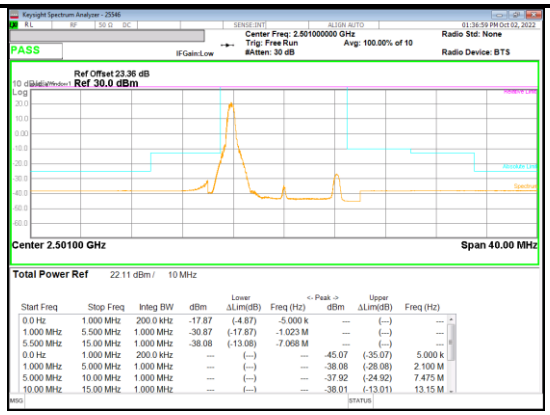
10MHz

QPSK

QPSK Low channel FRB



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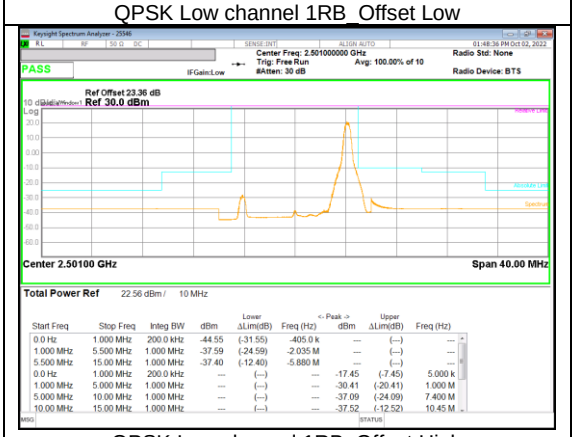
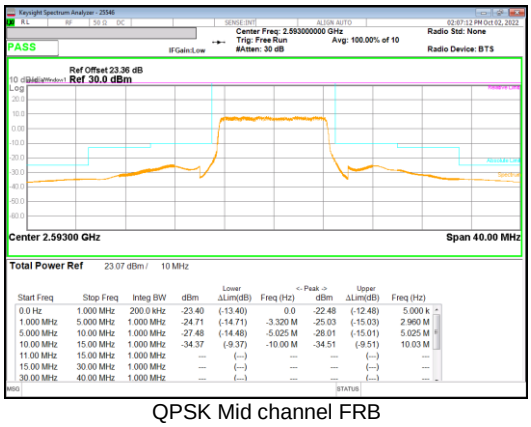
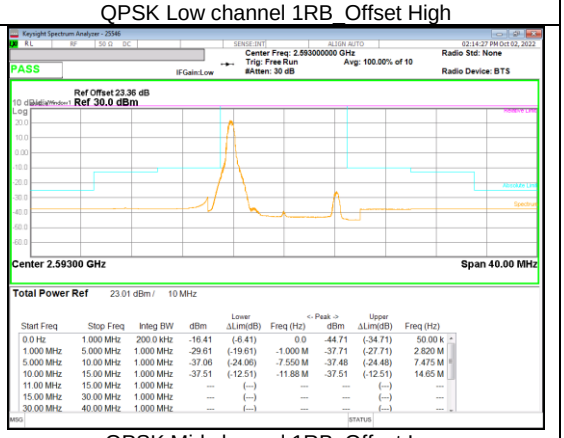


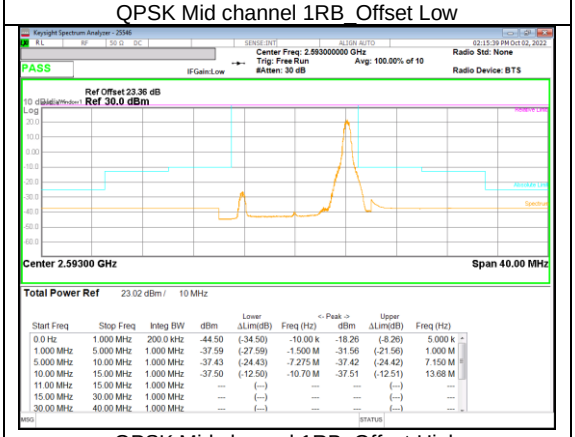
QPSK Low channel 1RB_Offset High



QPSK Mid channel FRB



QPSK Mid channel 1RB_Offset Low



QPSK Mid channel 1RB_Offset High

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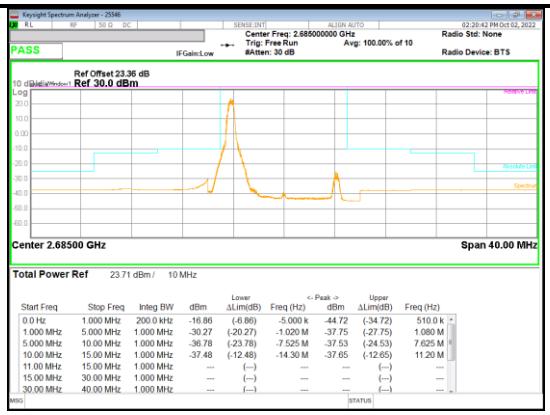
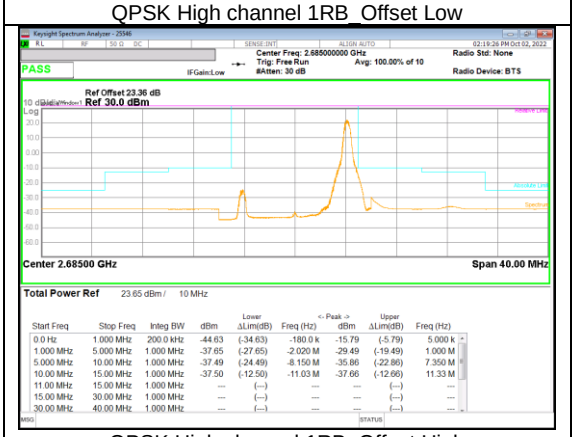
10MHz

QPSK

QPSK High channel FRB



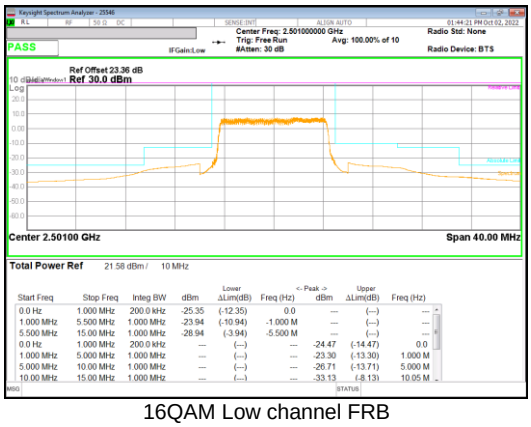
QPSK High channel 1RB_Offset Low



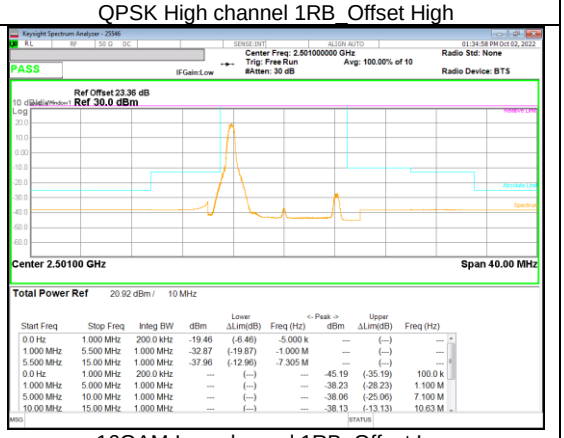
QPSK High channel 1RB_Offset High

10MHz

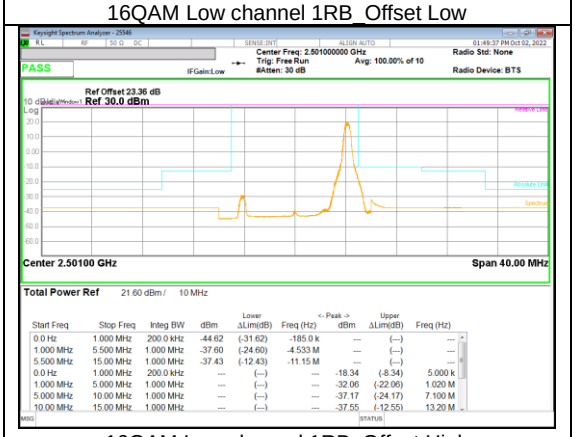
16QAM



16QAM Low channel FRB



16QAM Low channel 1RB_Offset Low



16QAM Low channel 1RB_Offset High

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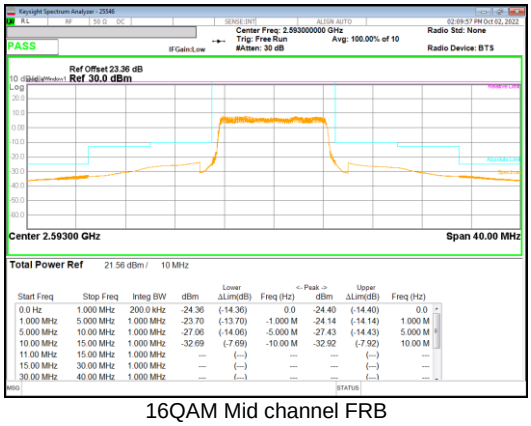
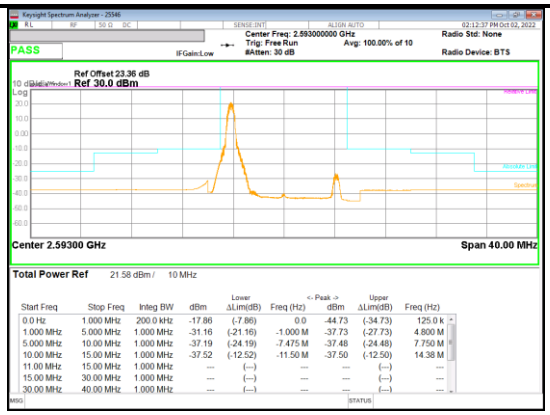
10MHz

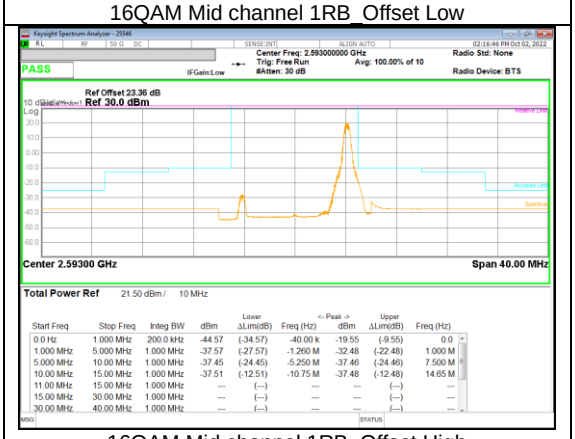
16QAM



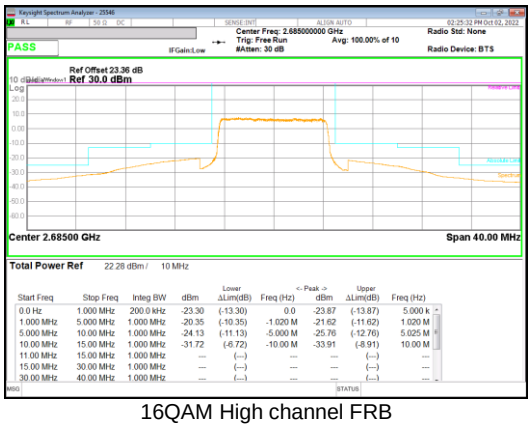
16QAM Mid channel FRB



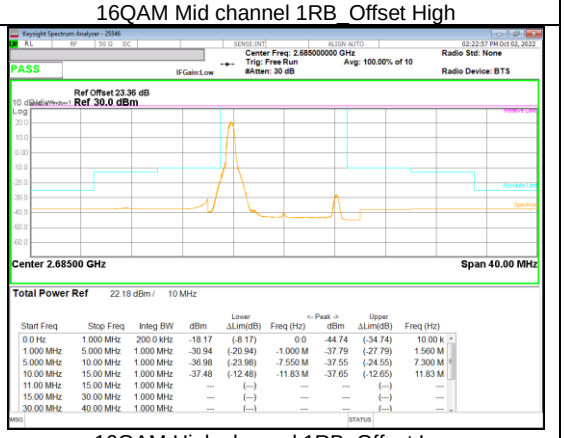
16QAM Mid channel 1RB_Offset Low



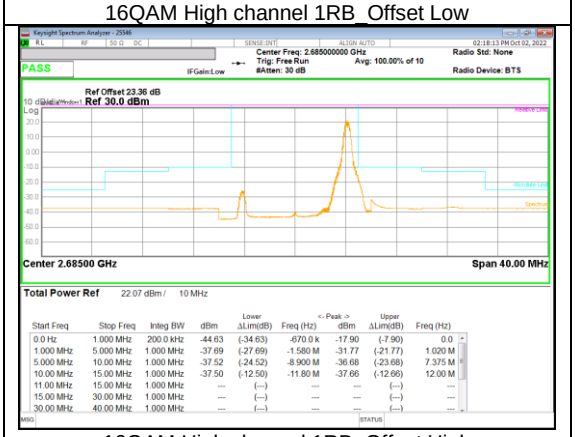
16QAM Mid channel 1RB_Offset High



16QAM High channel FRB



16QAM High channel 1RB_Offset Low



16QAM High channel 1RB_Offset High

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9.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §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:

(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 that 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.

(l)(2) For mobile operations in the 3700-3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with this paragraph (l)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(n)(2) For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with this paragraph (n)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, but limited to a maximum of 200 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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Part 90.691(a):

(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 Log10(f/6.1) decibels or 50 + 10 Log10(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 + $10Log_{10}$(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.(NOTE : Use 100kHz reference bandwidth)

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

a) Set the RBW = 100KHz for emission below 1GHz and 1MHz for emissions above 1GHz
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = auto couple;
e) Detector = rms;
f) Ensure that the number of measurement points = Max (40001);
g) Trace mode = Average(WCDMA, LTE FDD, 5G NR FDD), Max hold(GSM, LTE TDD, 5G NR TDD);

NOTE1

5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, 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.

NOTE2

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

RESULTS

See the following pages.

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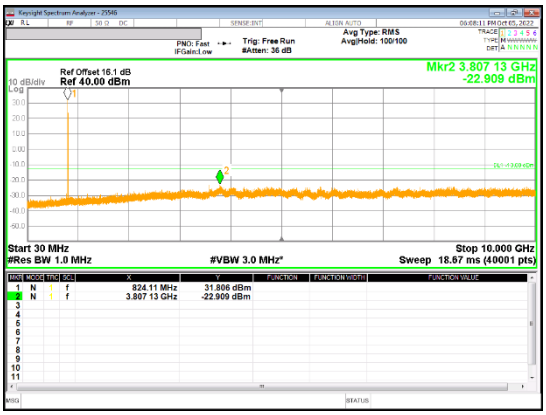
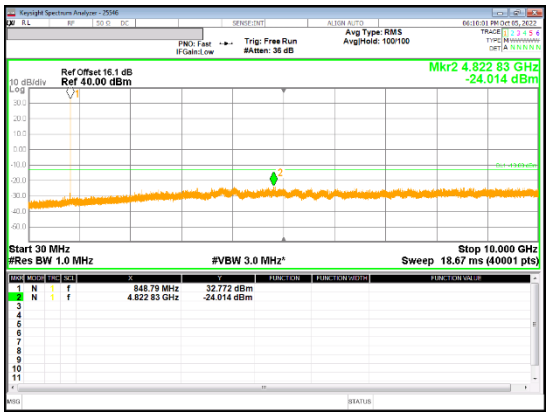
9.3.1. OUT OF BAND EMISSIONS RESULT

GSM 850

GSM 850	 GPRS Low channel	 GPRS Mid channel
	 GPRS High channel	

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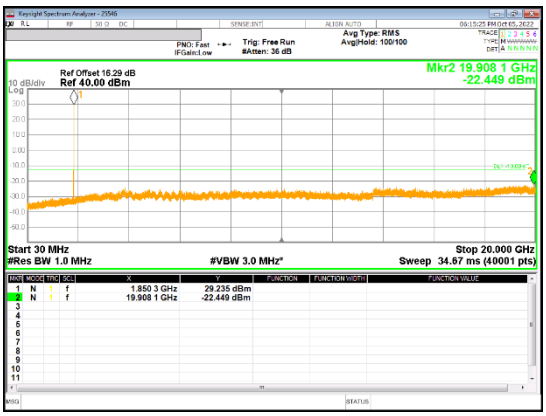
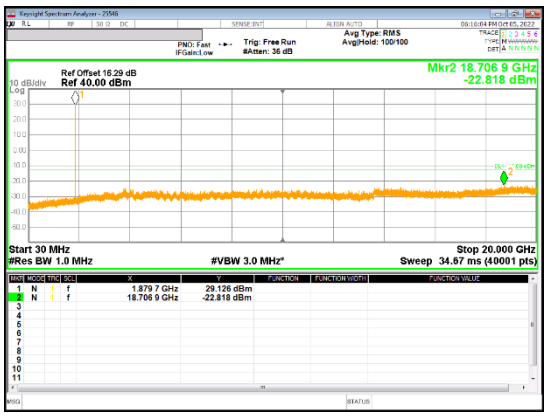
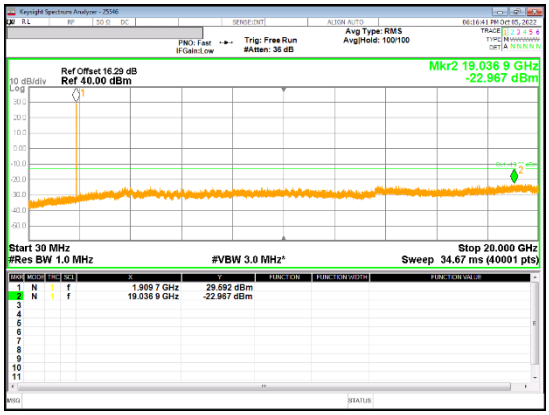
GSM 1900

GSM 1900	 GPRS Low channel	 GPRS Mid channel
	 GPRS High channel	

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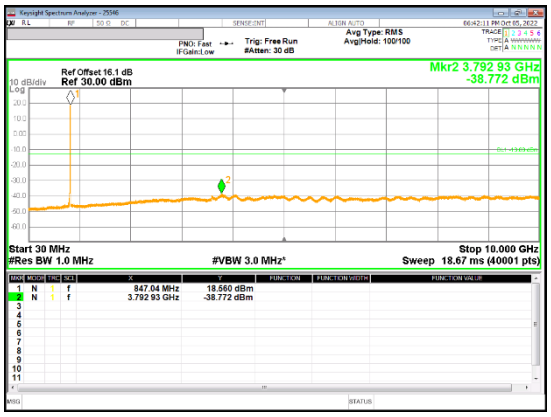
WCDMA Band 5

Band 5	 REL99 Low channel	 REL99 Mid channel
	 REL99 High channel	

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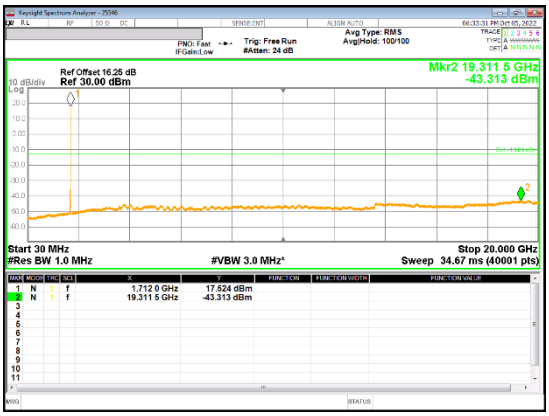
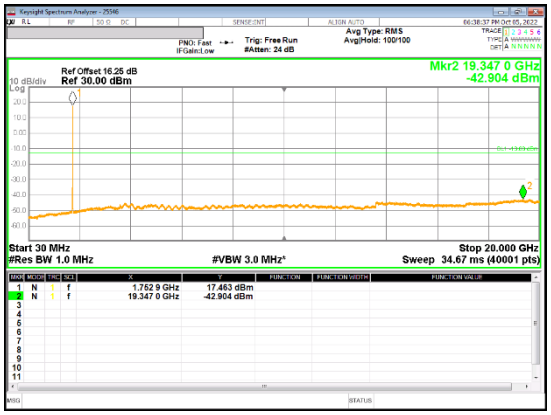
WCDMA Band 4

Band 4



REL99 Low channel

REL99 Mid channel



REL99 High channel

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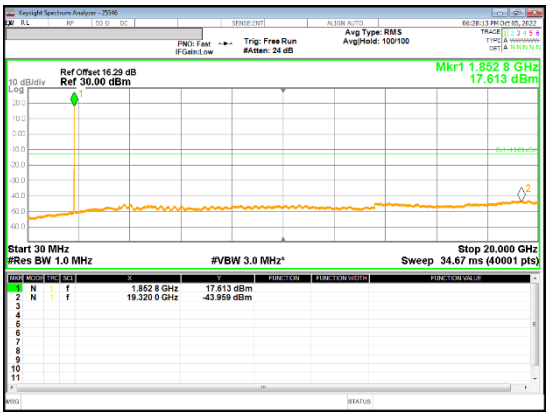
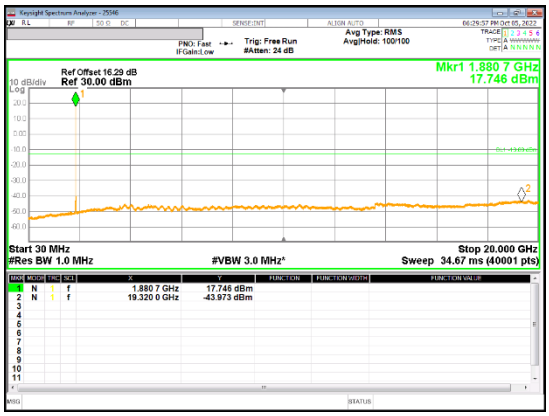
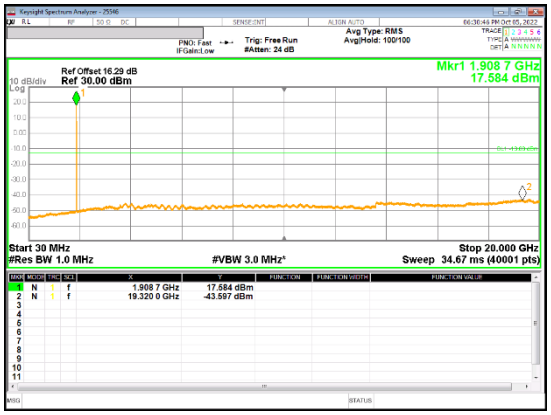
WCDMA Band 2

Band 2	 REL99 Low channel	 REL99 Mid channel
	 REL99 High channel	

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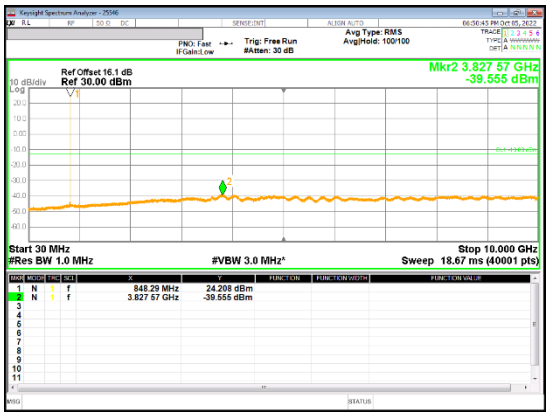
LTE Band 5

1.4 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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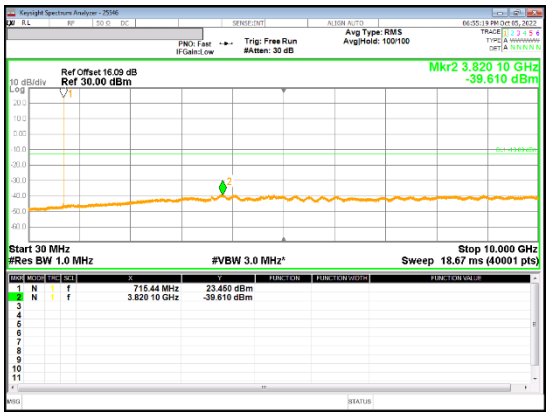
LTE Band 12

1.4 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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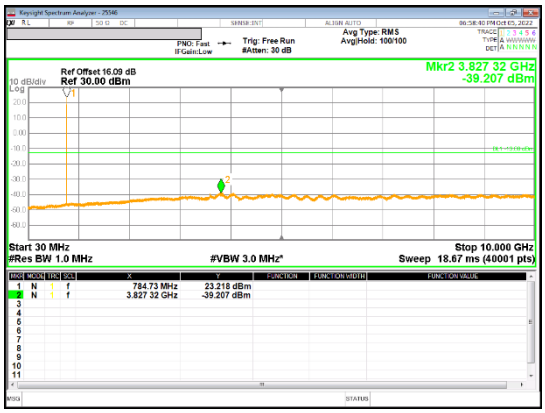
LTE Band 13

5 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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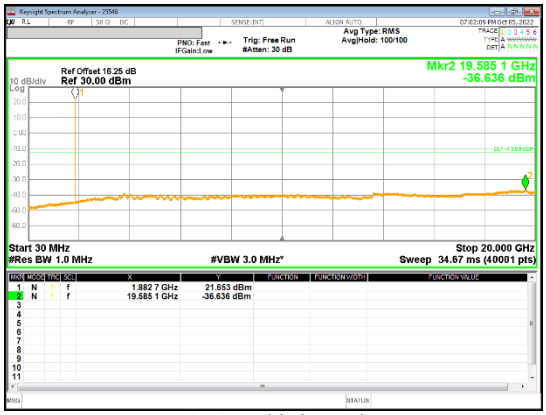
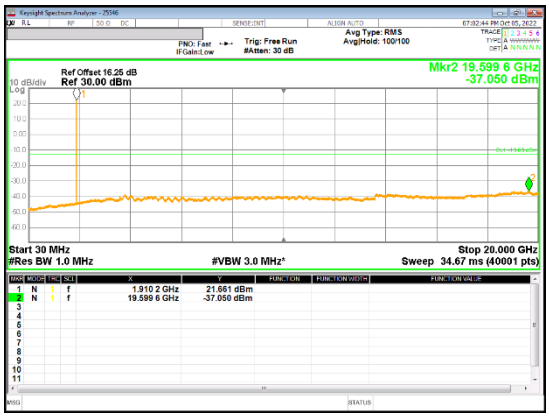
LTE Band 25

10 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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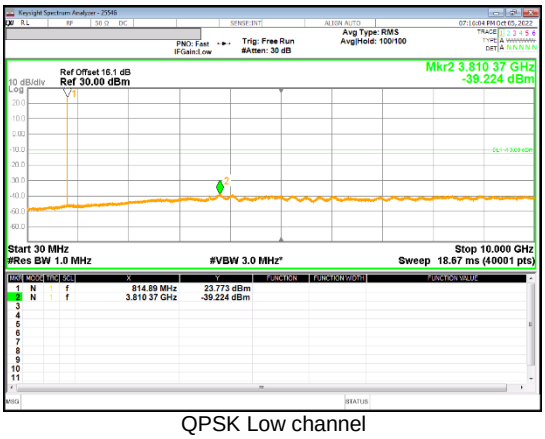
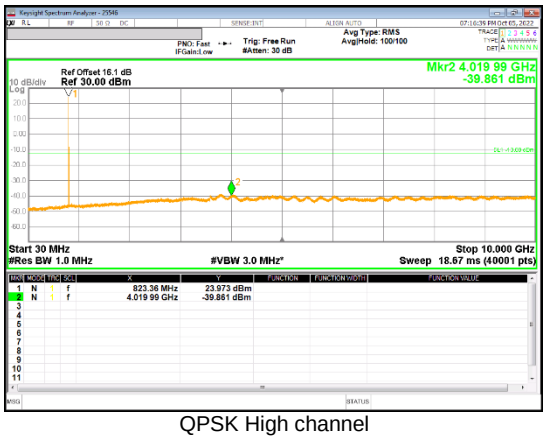
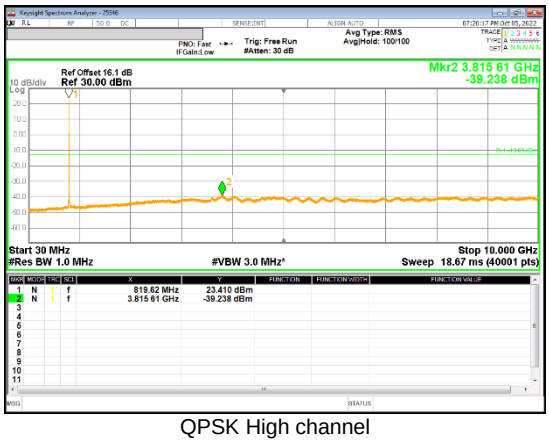
LTE Band 26(Part 90)

1.4 MHz	 QPSK Low channel	 QPSK High channel

LTE Band 26 (Straddle)

10 MHz	 QPSK High channel

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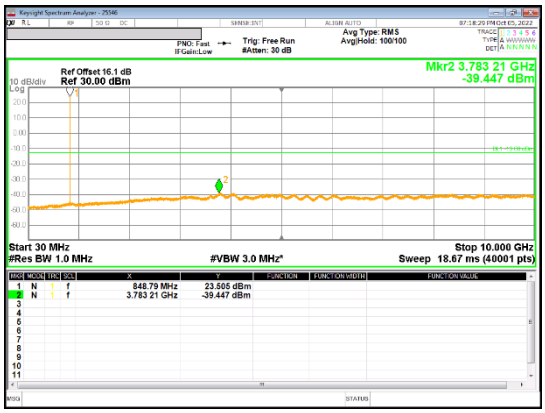
LTE Band 26 (Part 22)

1.4 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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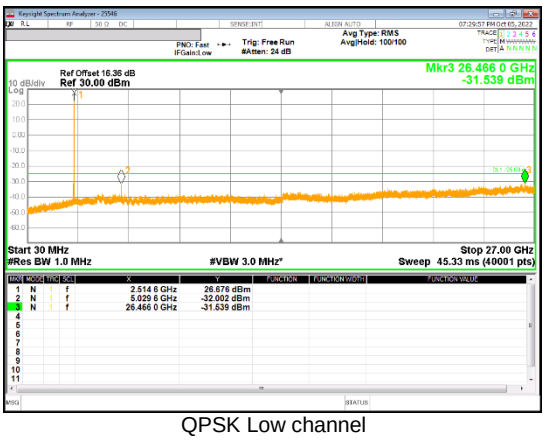
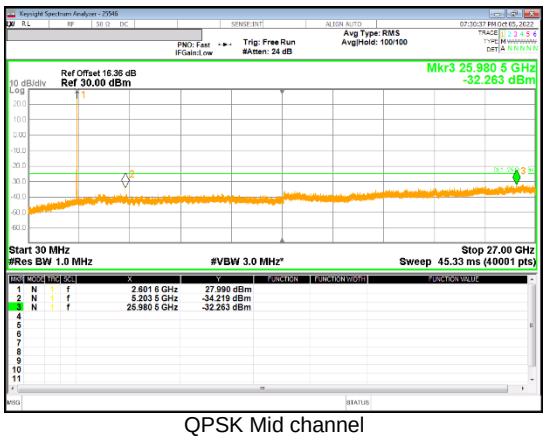
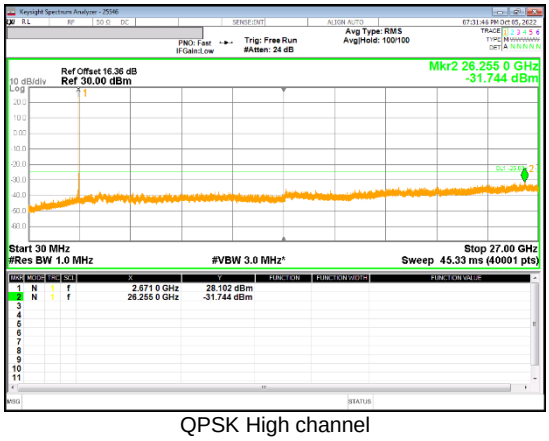
LTE Band 41(PC2)

20 MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

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