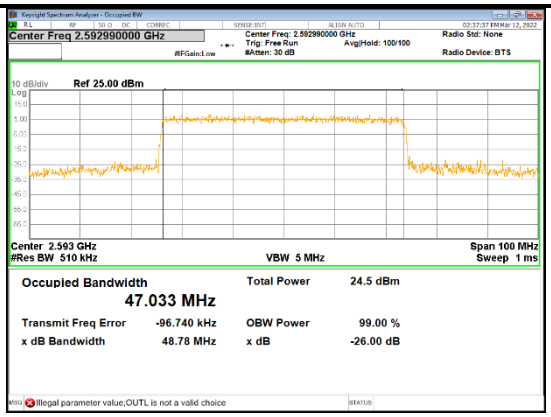
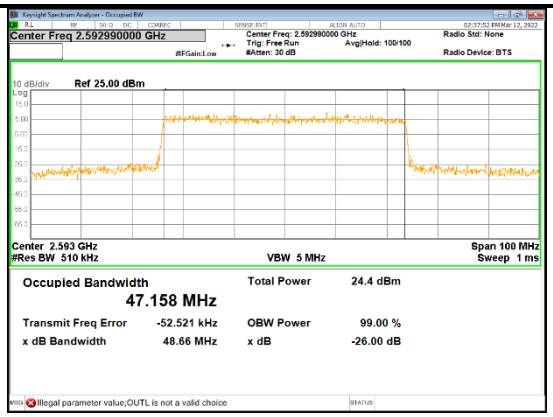
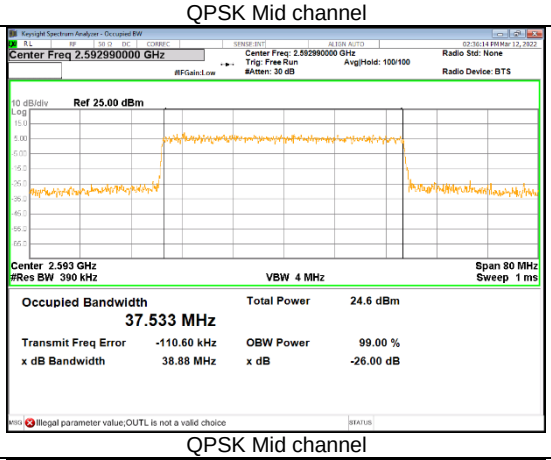
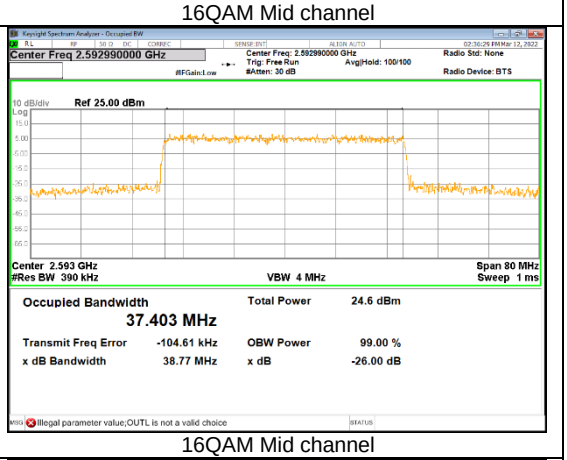
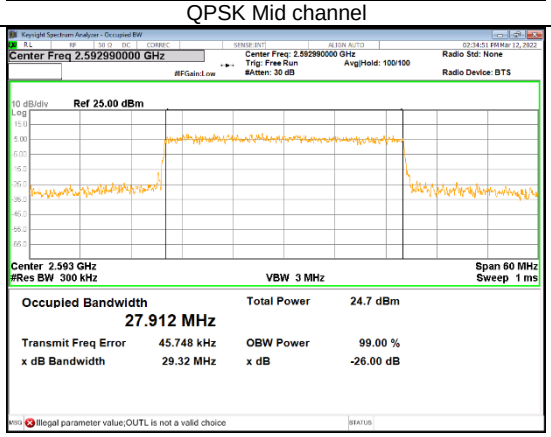
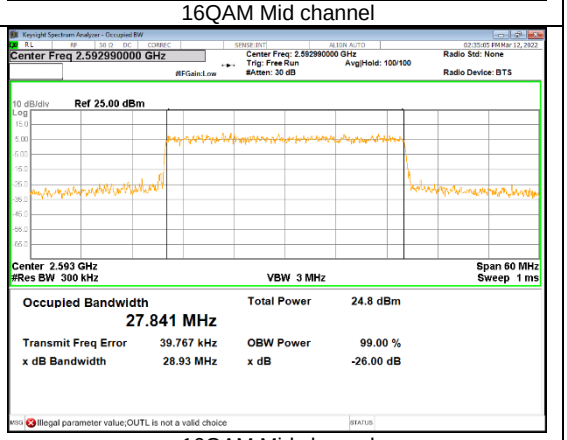
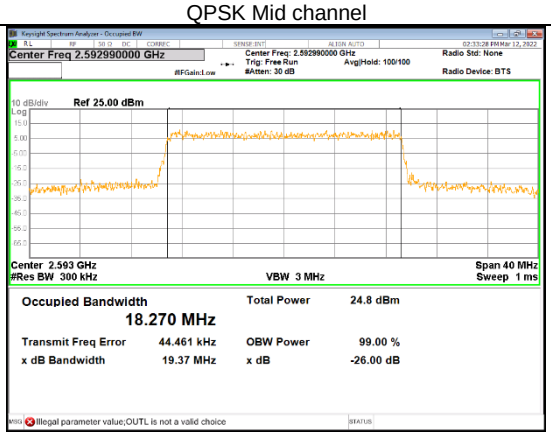
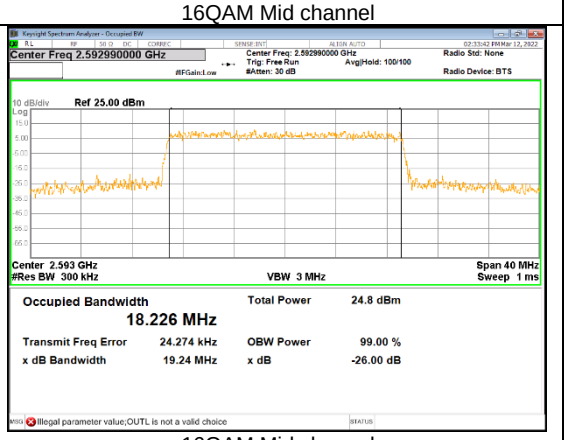
50 MHz	 QPSK Mid channel	 16QAM Mid channel
40 MHz	 QPSK Mid channel	 16QAM Mid channel
30 MHz	 QPSK Mid channel	 16QAM Mid channel
20 MHz	 QPSK Mid channel	 16QAM Mid channel

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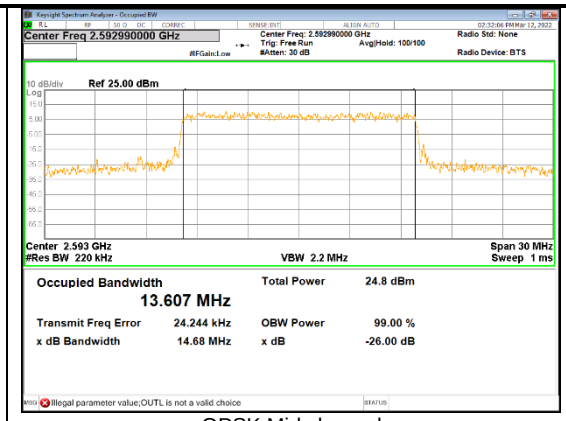
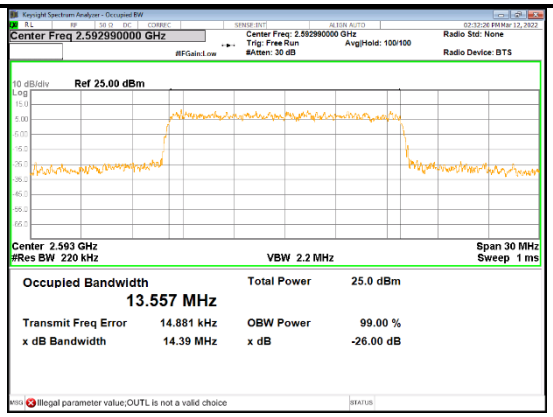
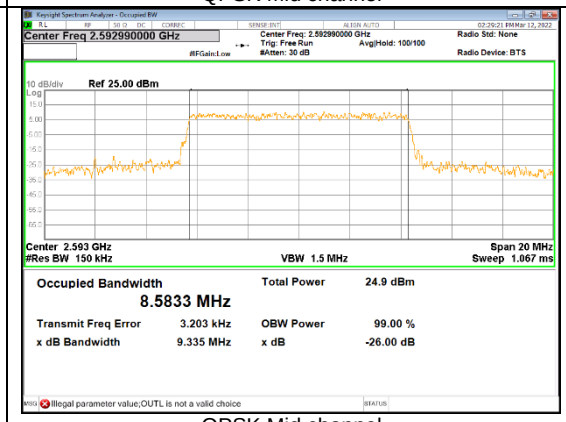
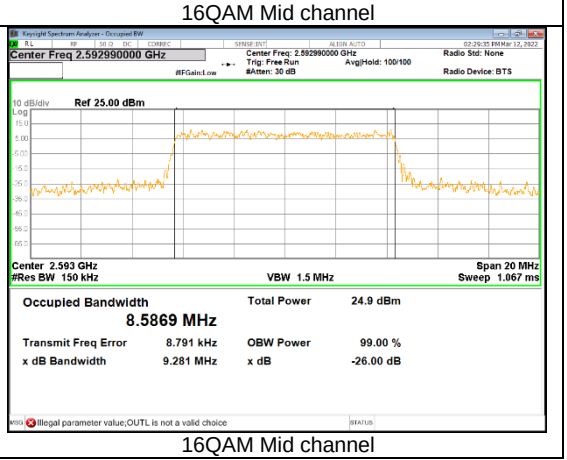
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel

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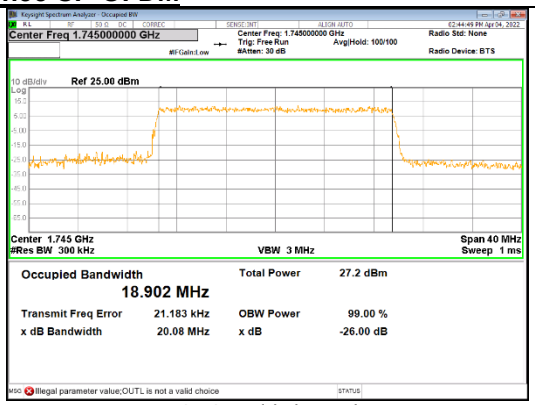
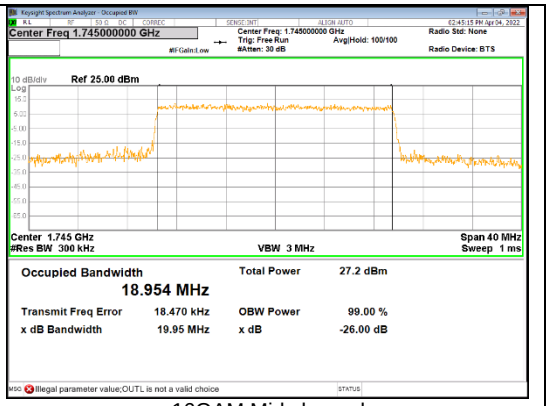
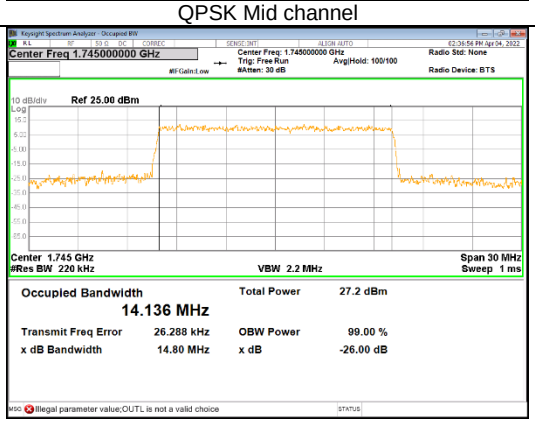
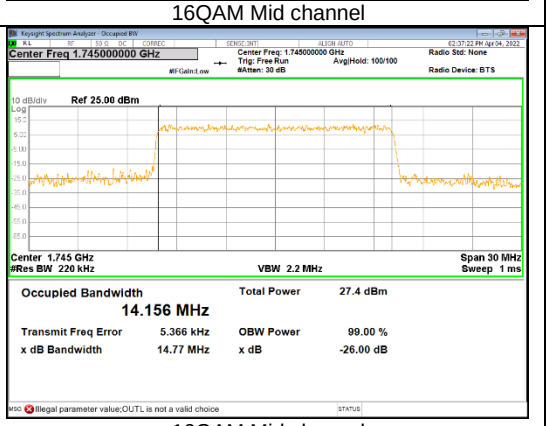
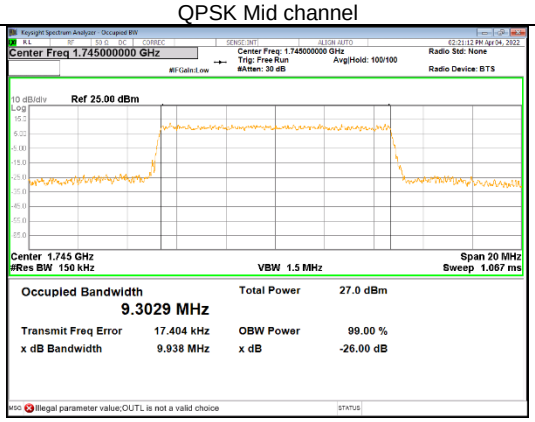
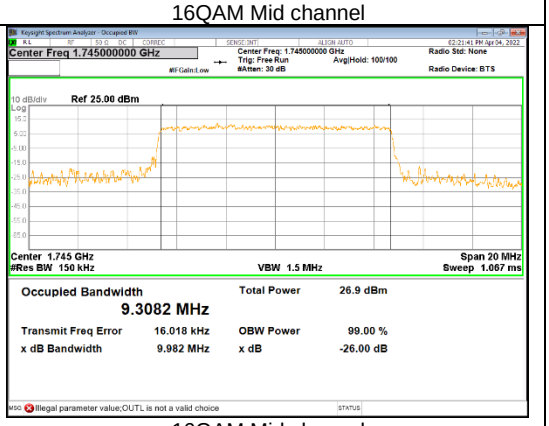
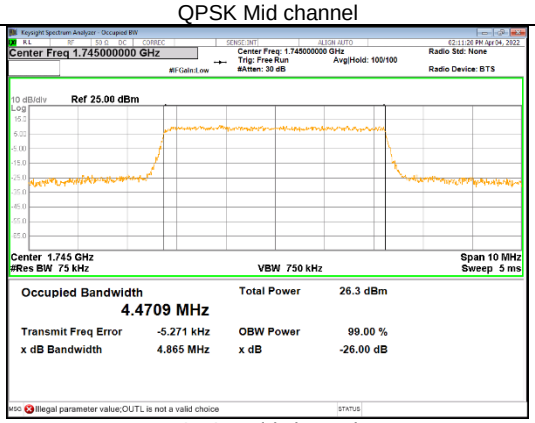
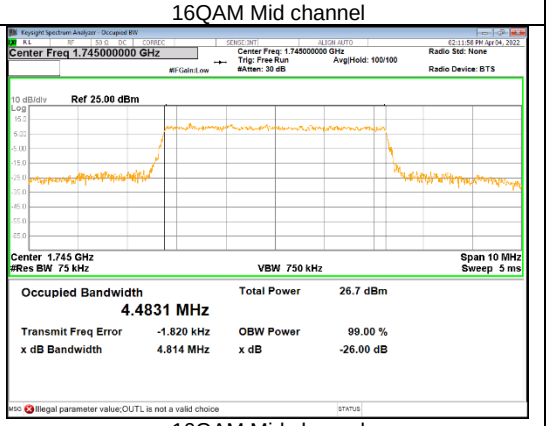
NR Band n66 CP-OFDM

20MHz	 QPSK Mid channel	 16QAM Mid channel
15MHz	 QPSK Mid channel	 16QAM Mid channel
10MHz	 QPSK Mid channel	 16QAM Mid channel
5MHz	 QPSK Mid channel	 16QAM Mid channel

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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:
(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.

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 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 + 10Log10(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 ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = 1S ;
e) Detector = RMS;
f) Ensure that the number of measurement points ≥ 2*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 ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = Auto;
e) Detector = RMS;
f) Ensure that the number of measurement points ≥ 2*Span/RBW;
g) Trace mode = Average (100);

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NOTE1

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 addental 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.

NOTE2

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.

NOTE3

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.

RESULTS

See the following pages.

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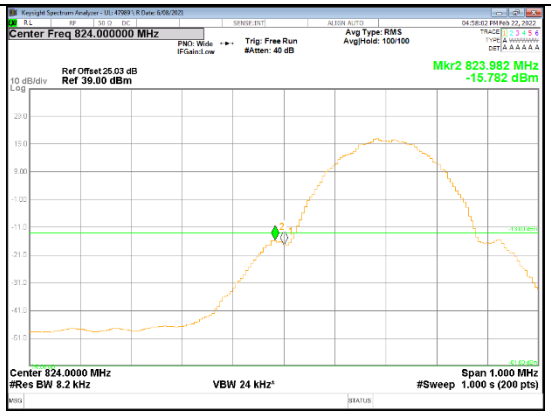
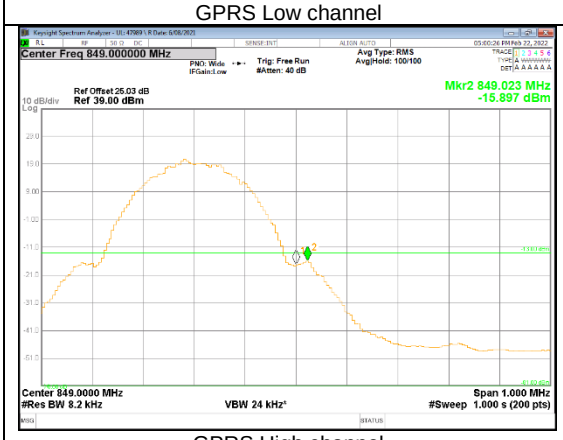
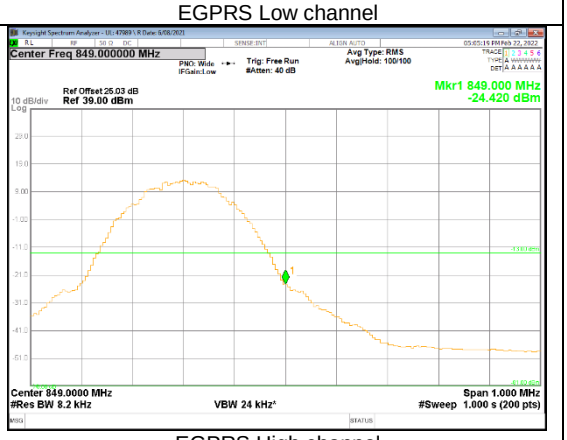
9.2.1. BAND EDGE RESULT

GSM

GSM 850	 GPRS Low channel	 EGPRS Low channel
	 GPRS High channel	 EGPRS High channel

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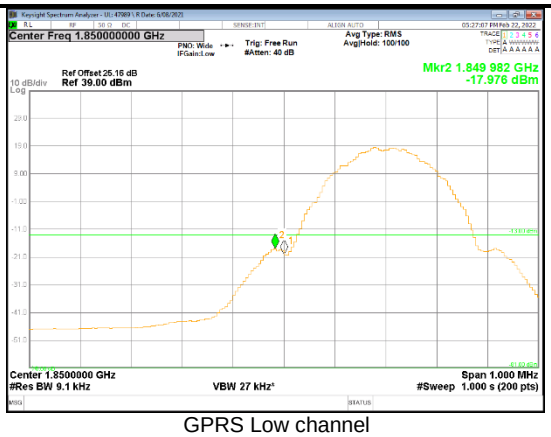
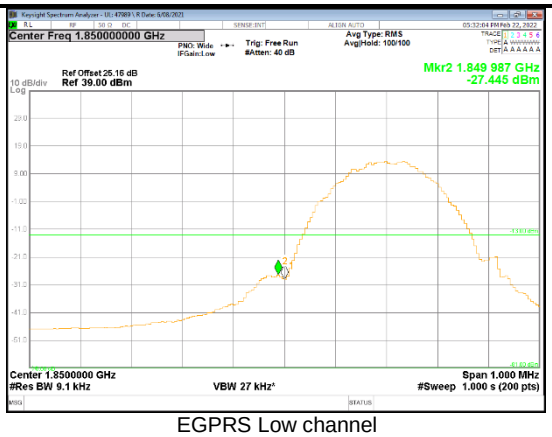
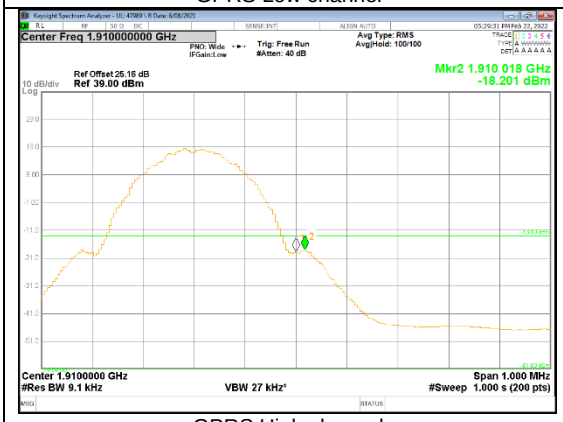
GSM 1900	 GPRS Low channel	 EGPRS Low channel
	 GPRS High channel	 EGPRS High channel

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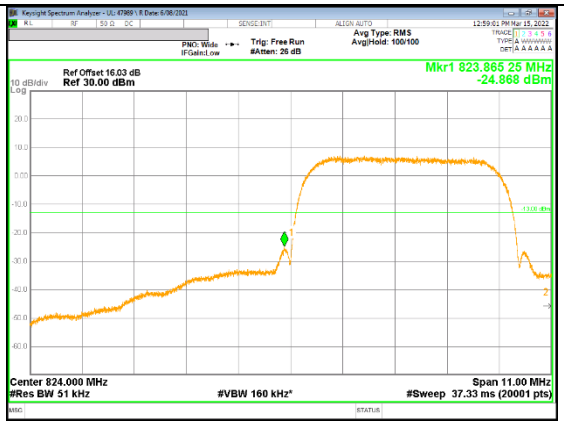
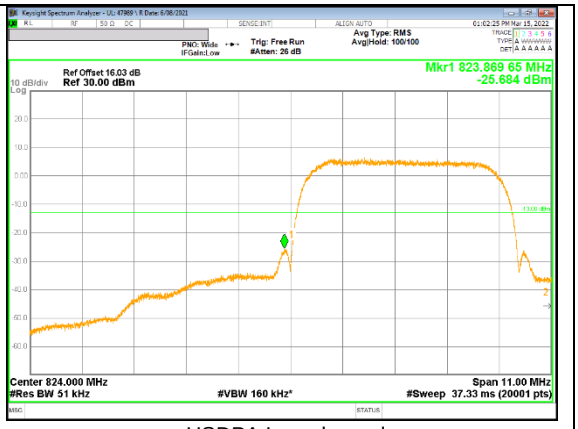
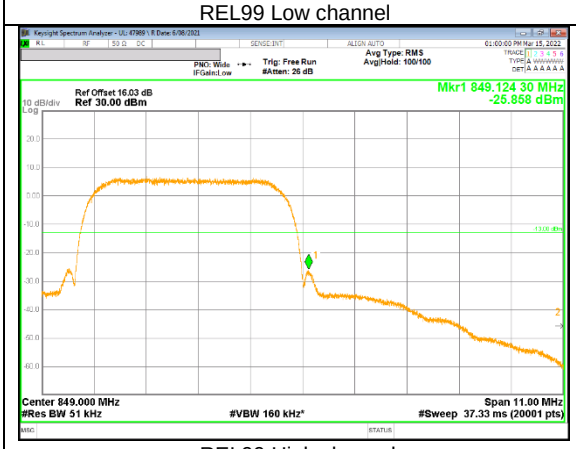
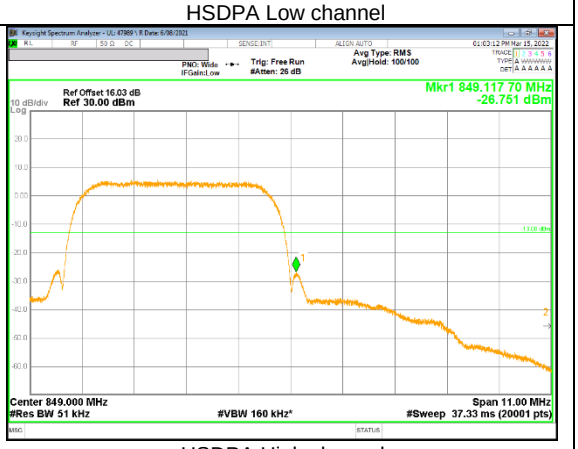
WCDMA

Band 5	 REL99 Low channel	 HSDPA Low channel
	 REL99 High channel	 HSDPA High channel

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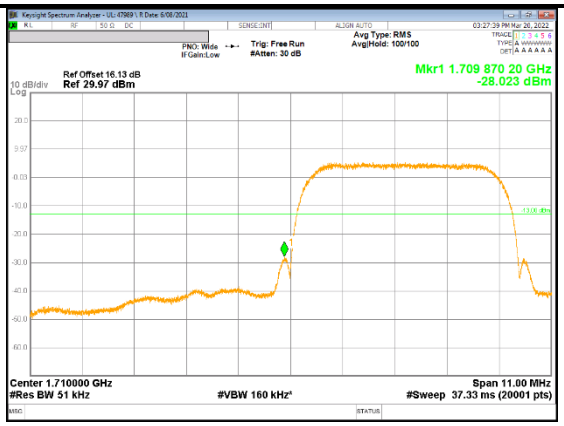
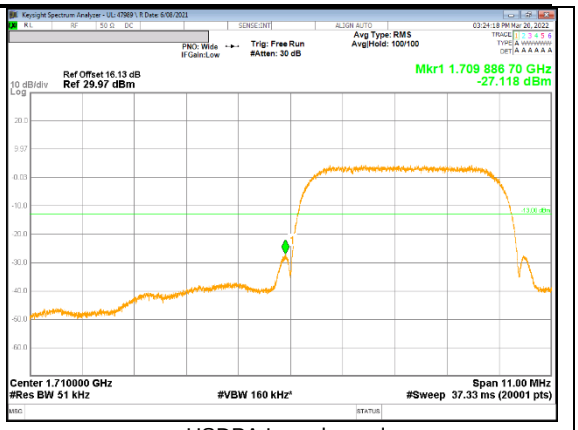
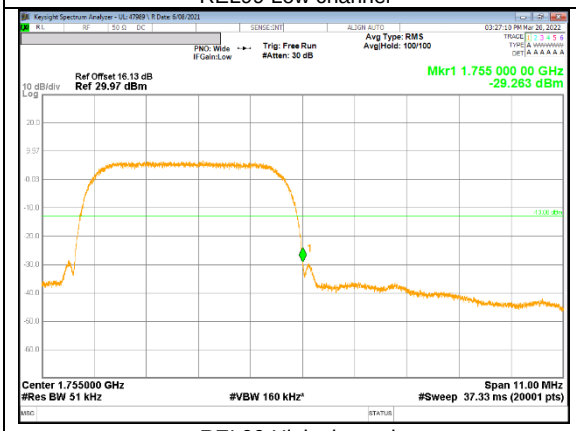
Band 4



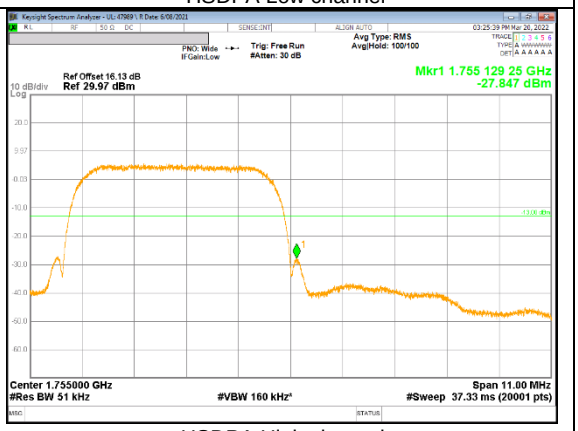
REL99 Low channel



HSDPA Low channel

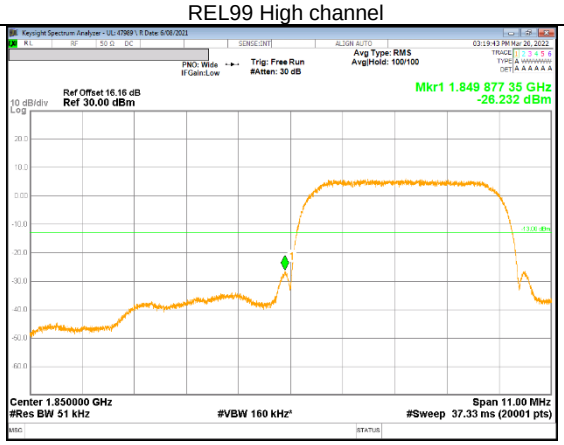


REL99 High channel

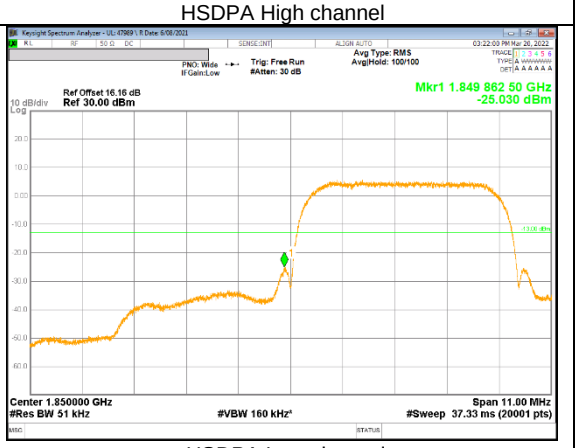


HSDPA High channel

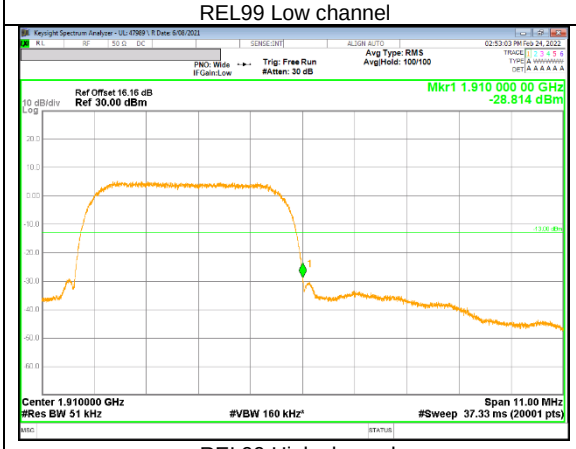
Band 2



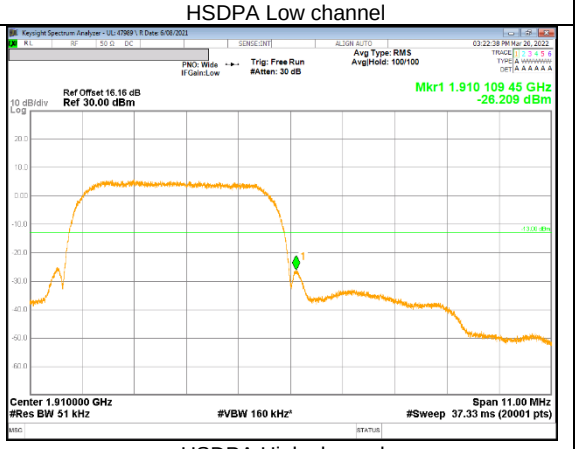
REL99 Low channel



HSDPA Low channel



REL99 High channel



HSDPA High channel

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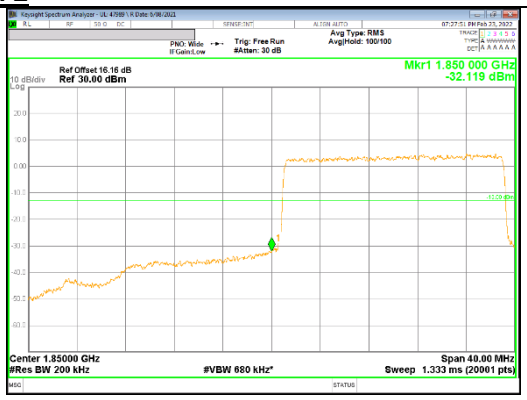
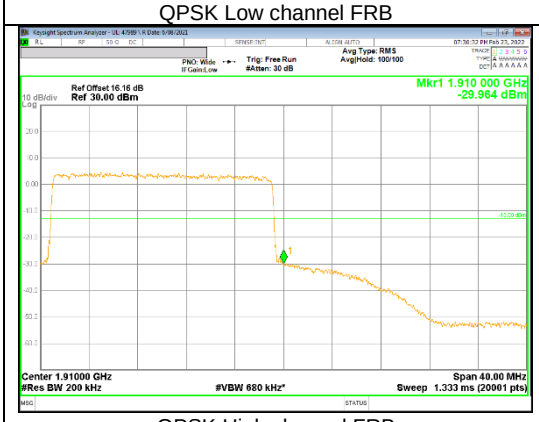
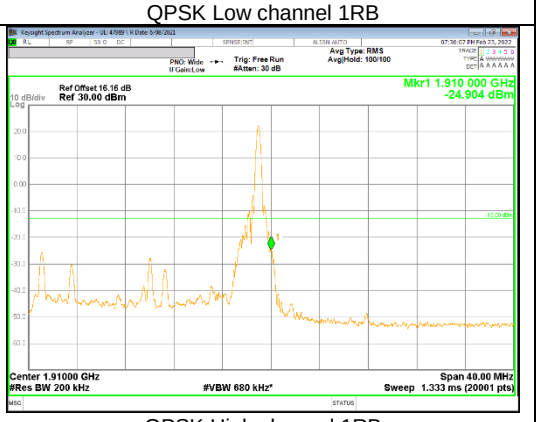
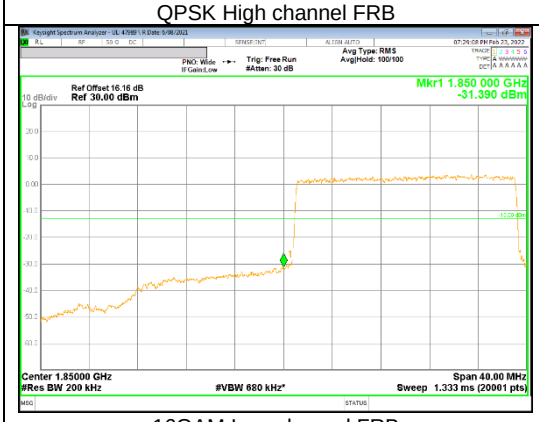
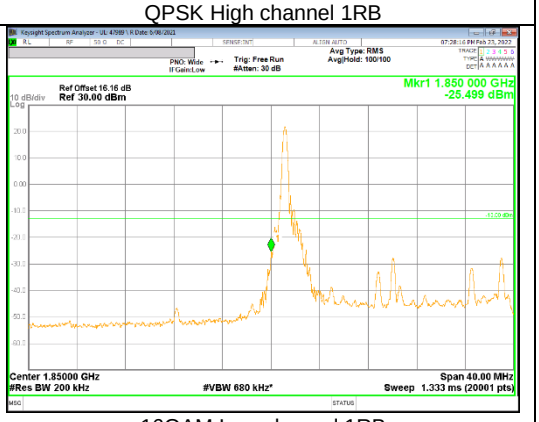
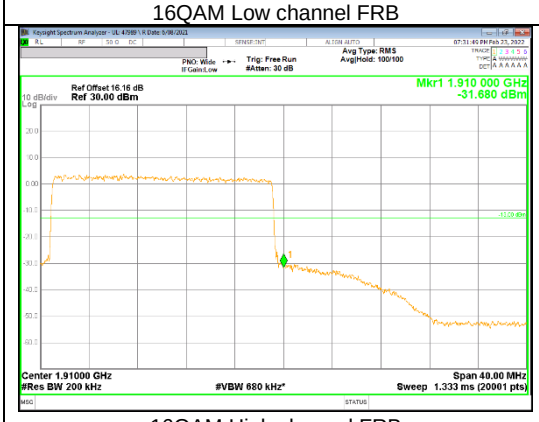
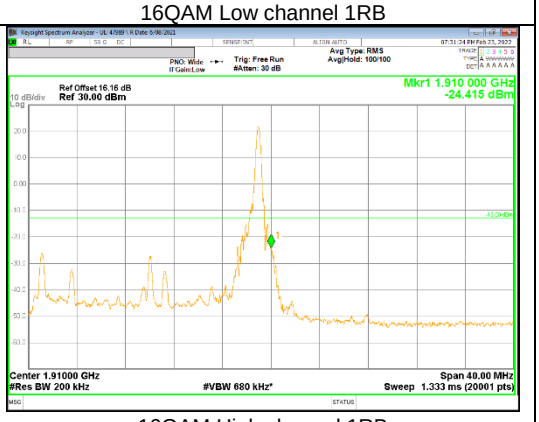
LTE Band 2

20MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

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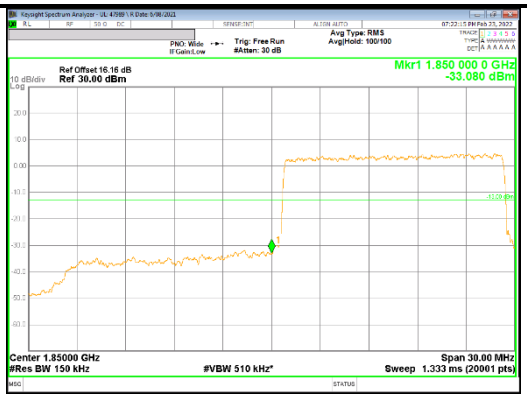
15MHz



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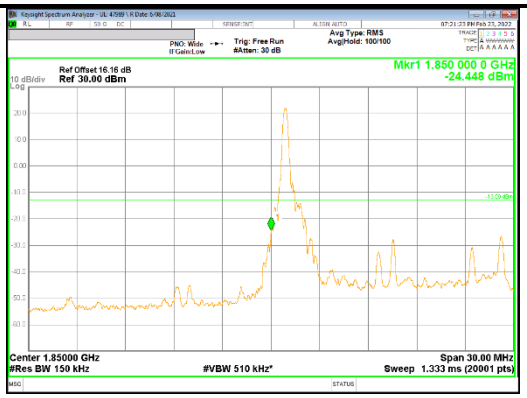

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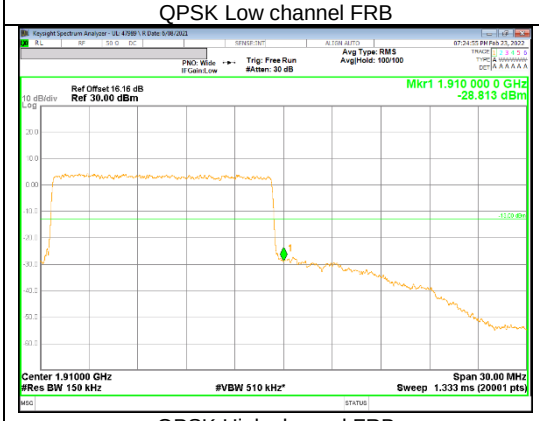

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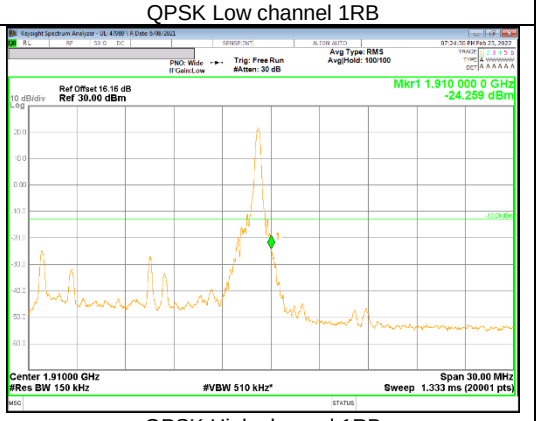

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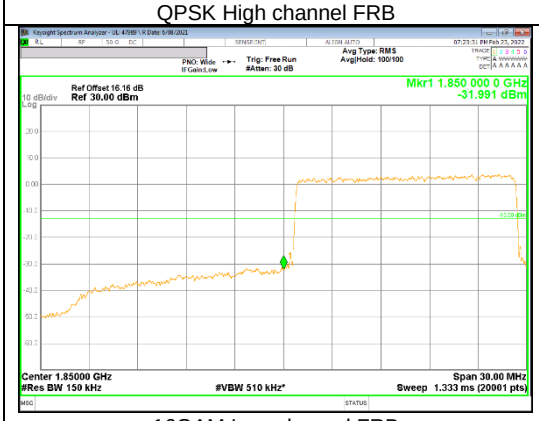

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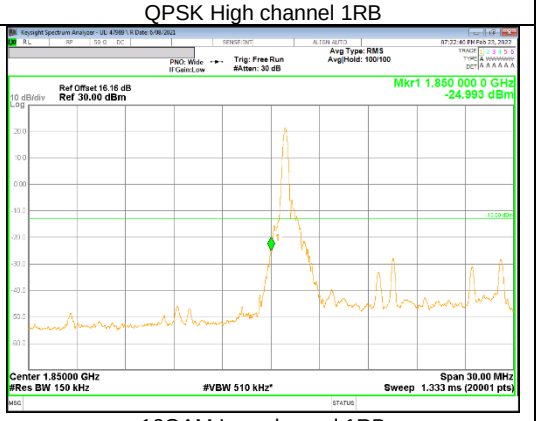

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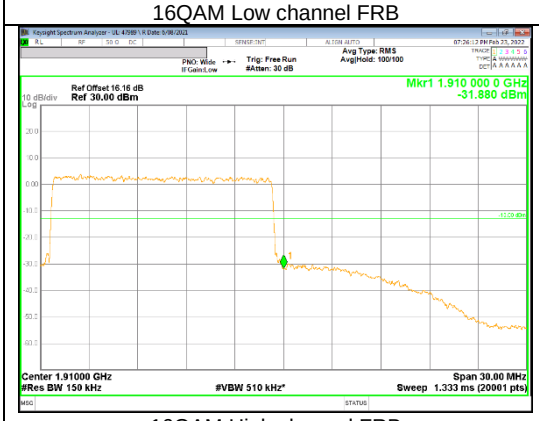

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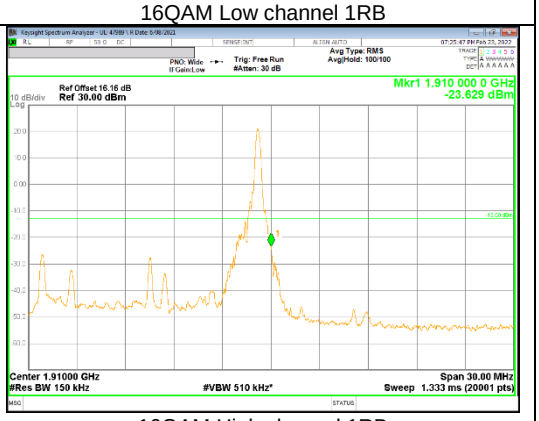

16QAM High channel 1RB

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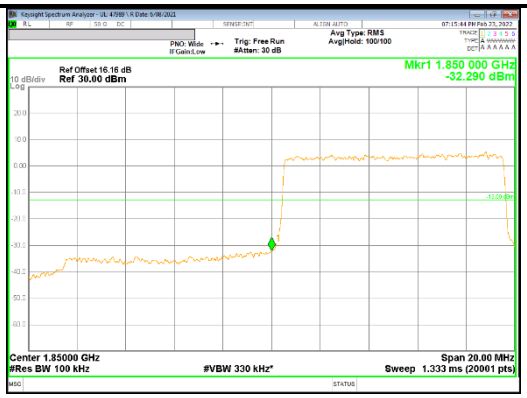
10MHz



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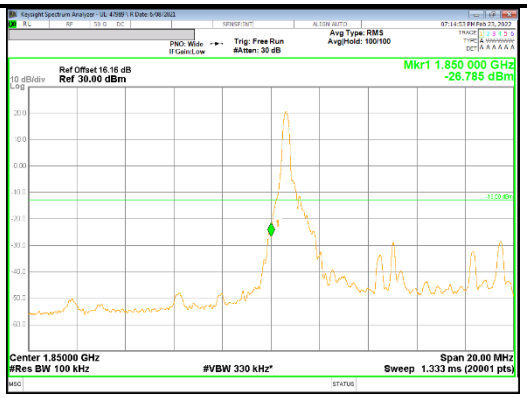

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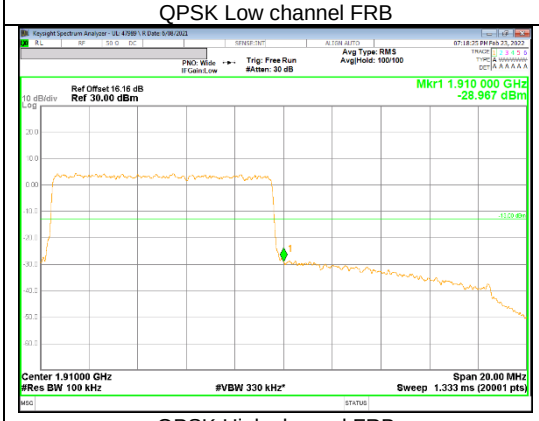

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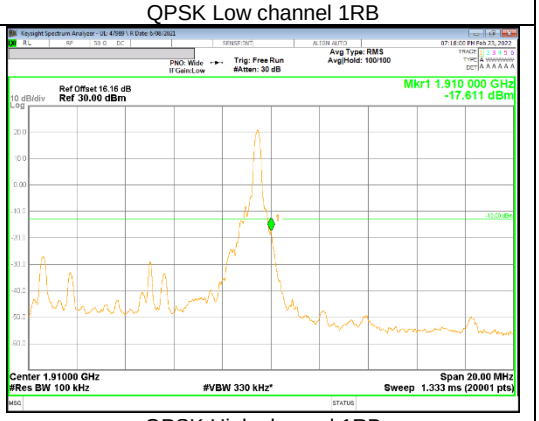

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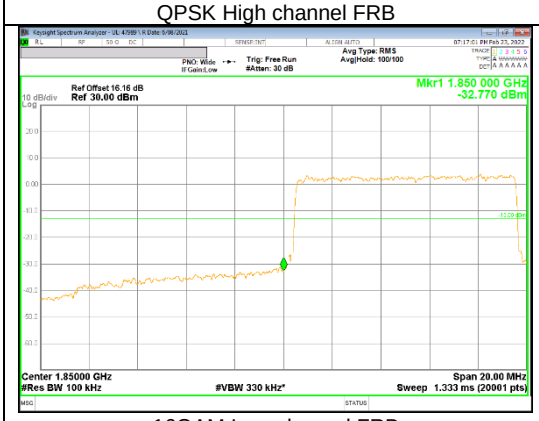

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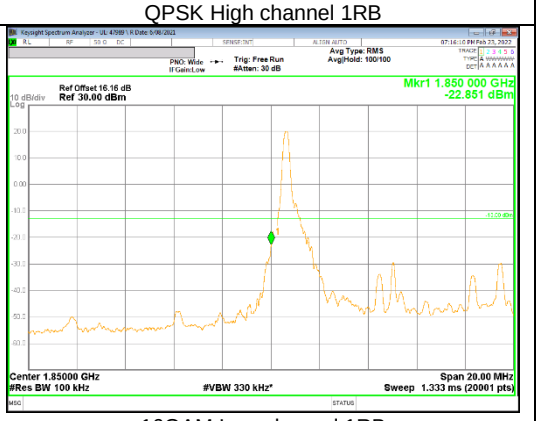

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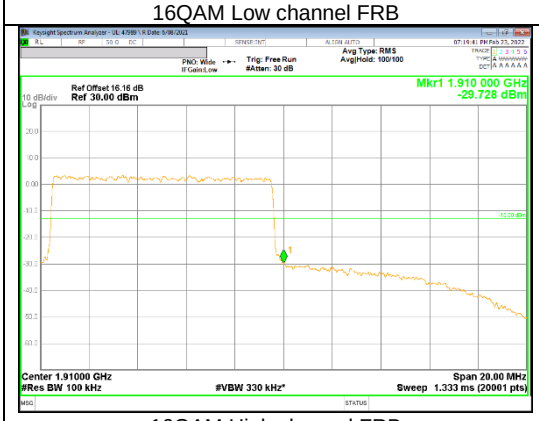

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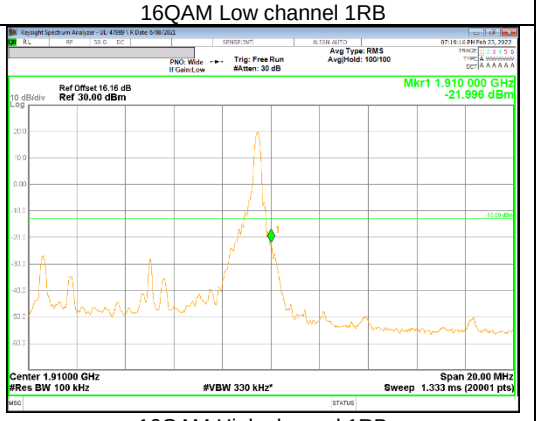

16QAM High channel 1RB

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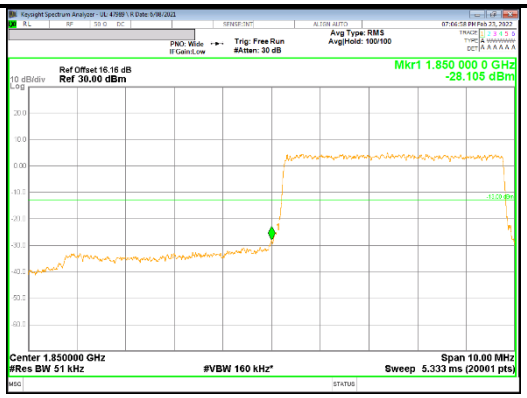
5MHz



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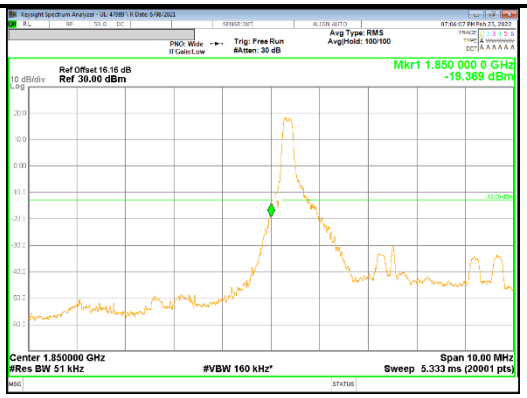

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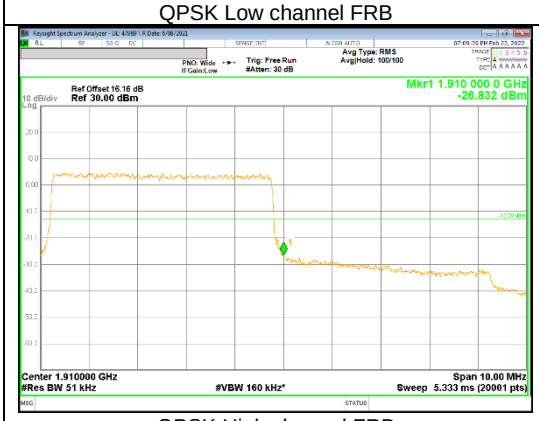

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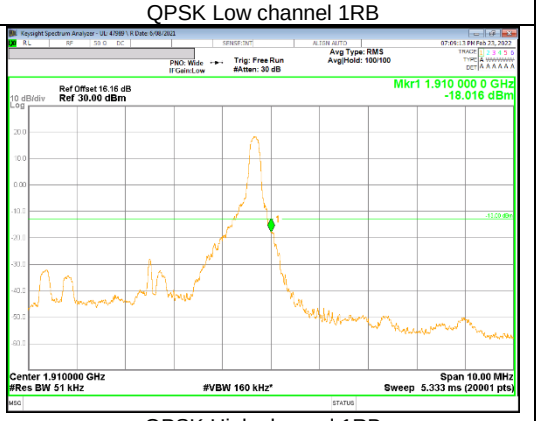

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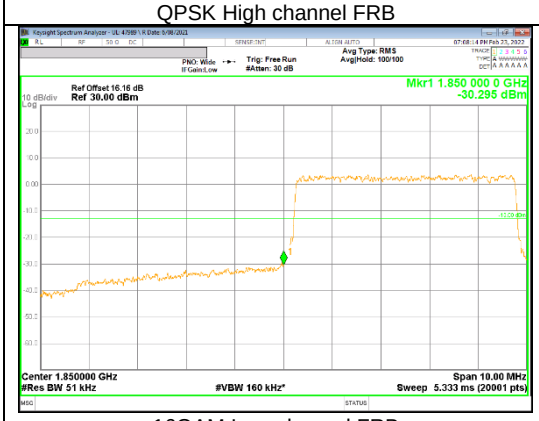

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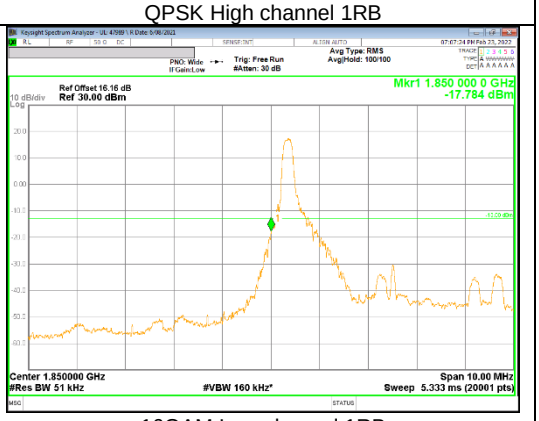

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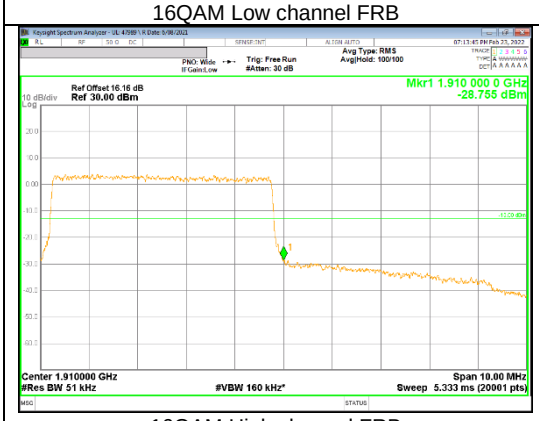

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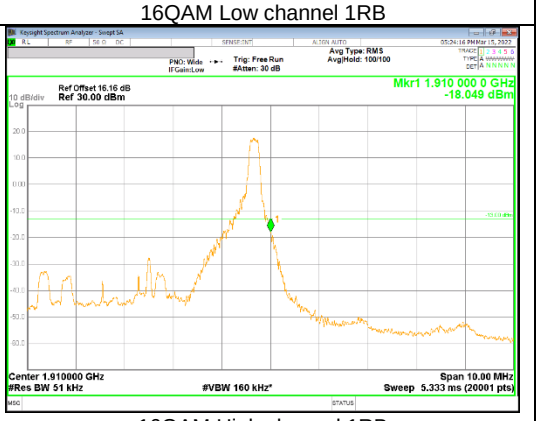

16QAM High channel 1RB

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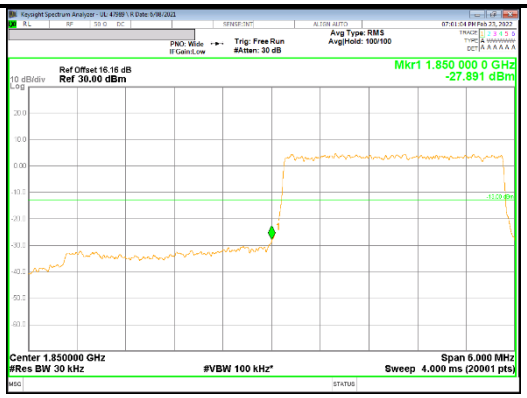
3MHz



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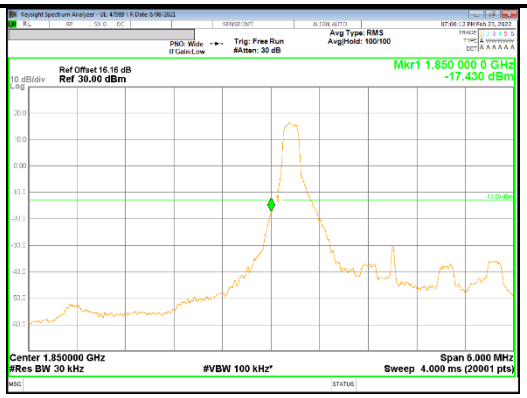

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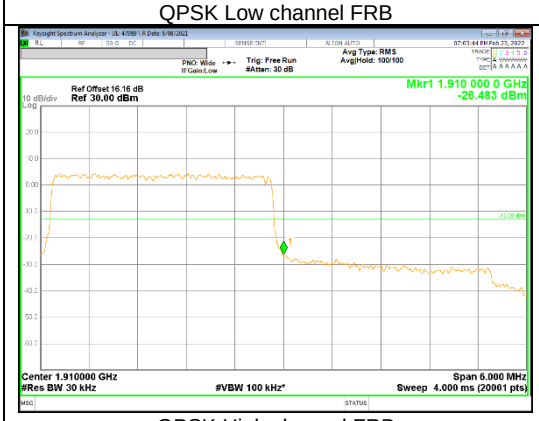

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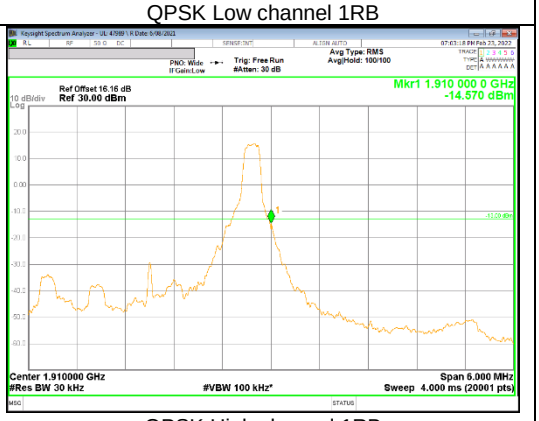

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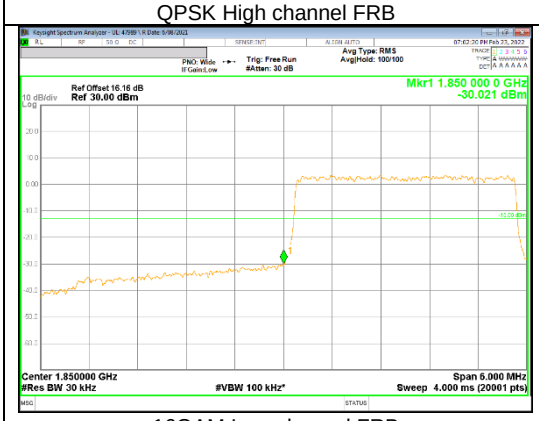

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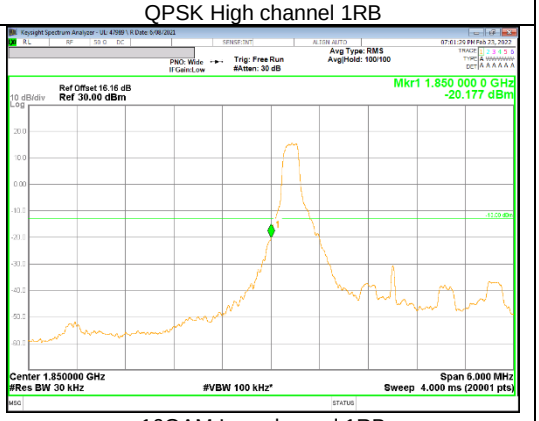

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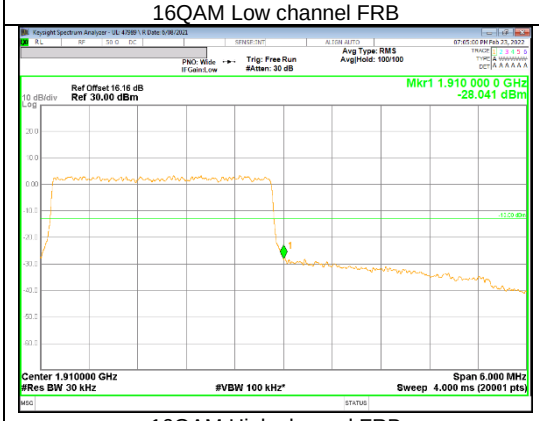

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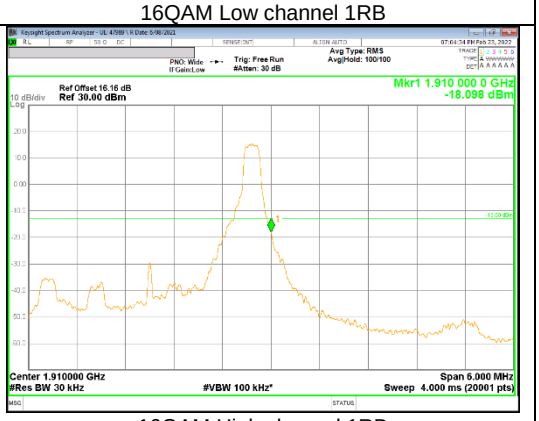

16QAM High channel 1RB

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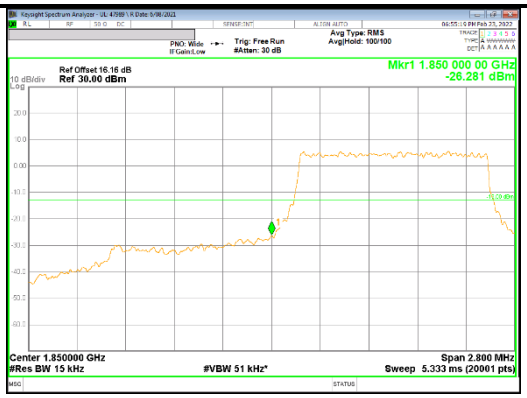
1.4MHz



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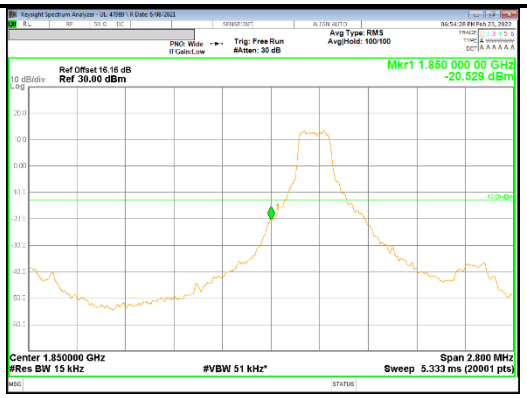

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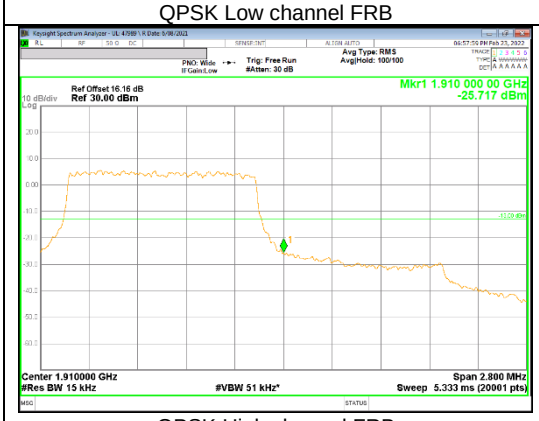

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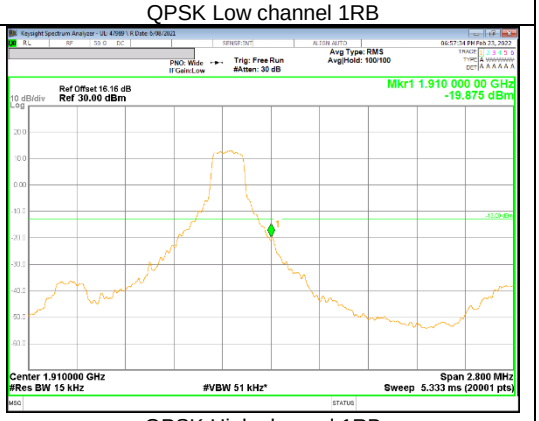

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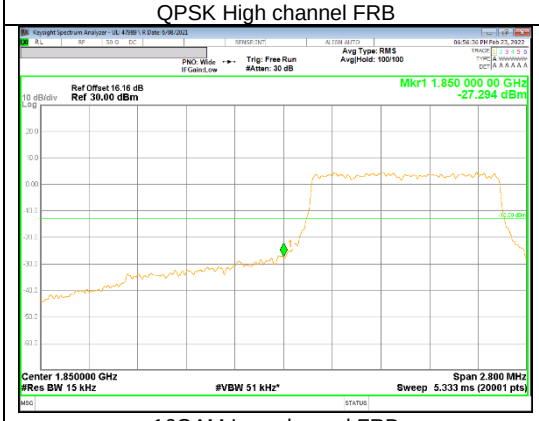

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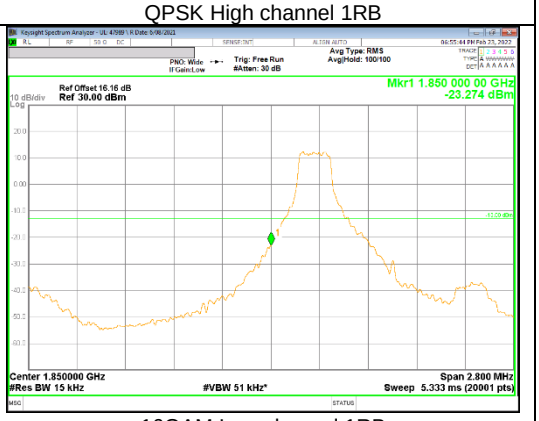

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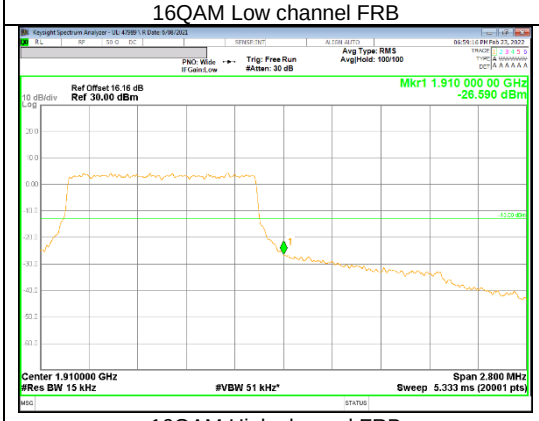

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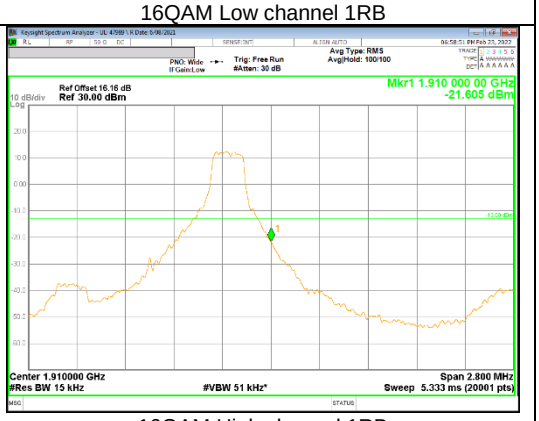

16QAM High channel 1RB

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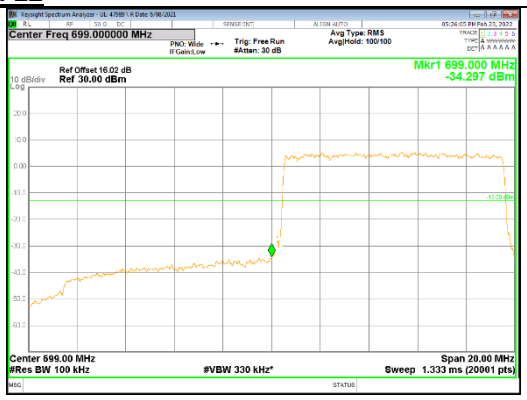
LTE Band 12

10MHz



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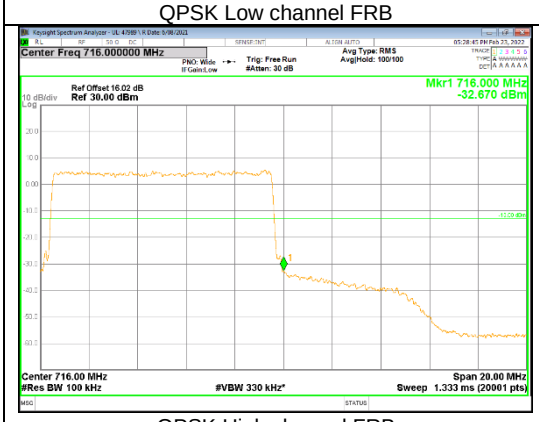

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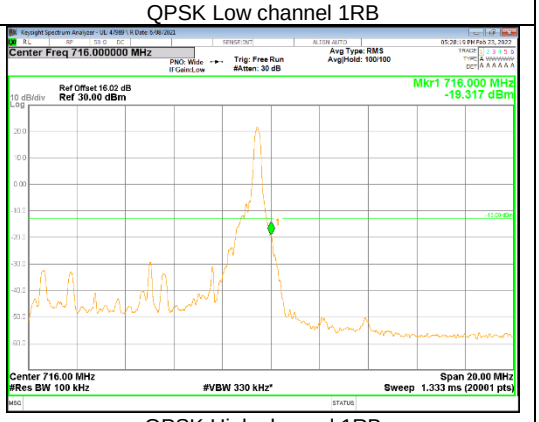

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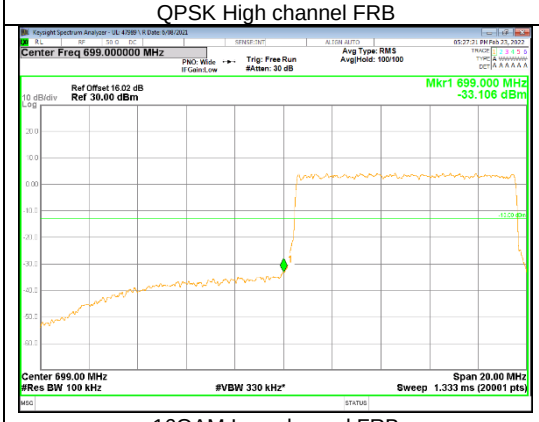

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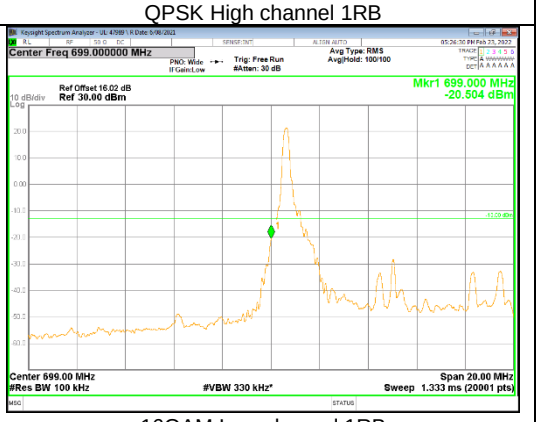

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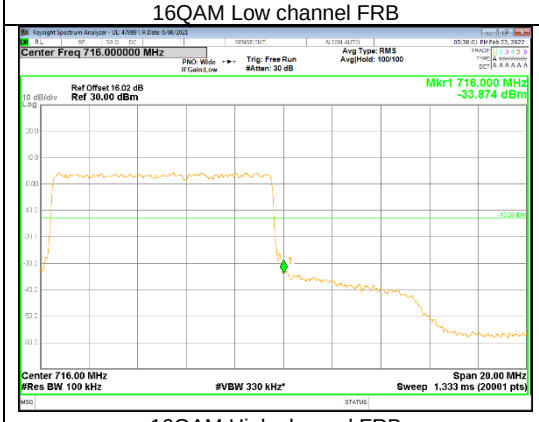

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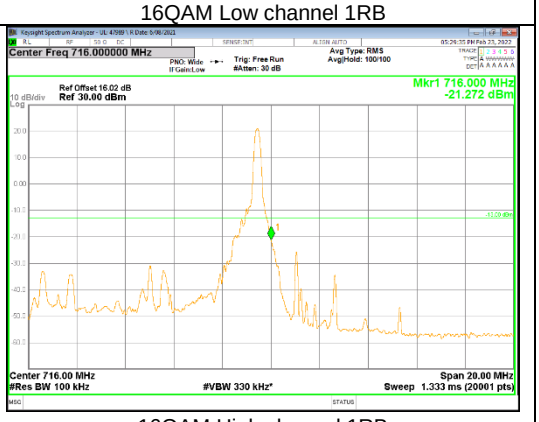

16QAM High channel 1RB

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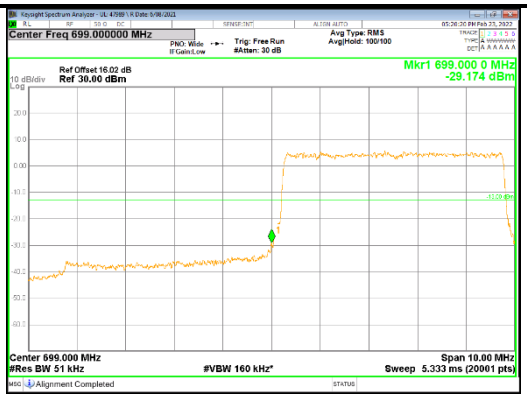
5MHz



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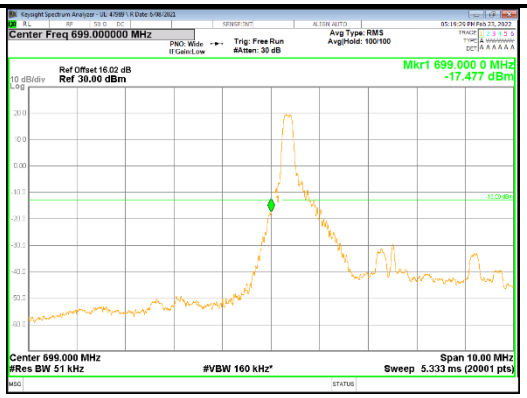

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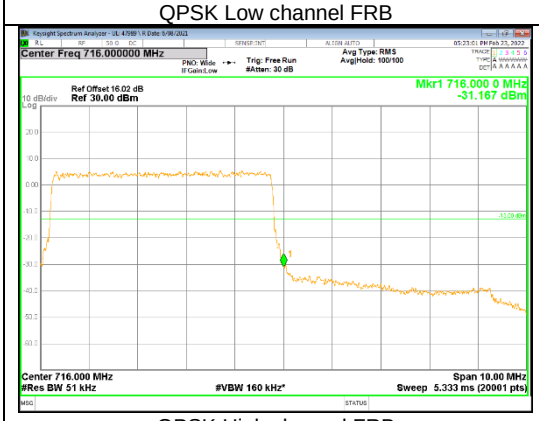

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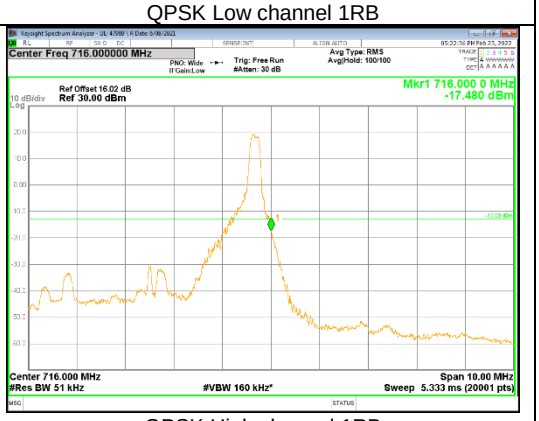

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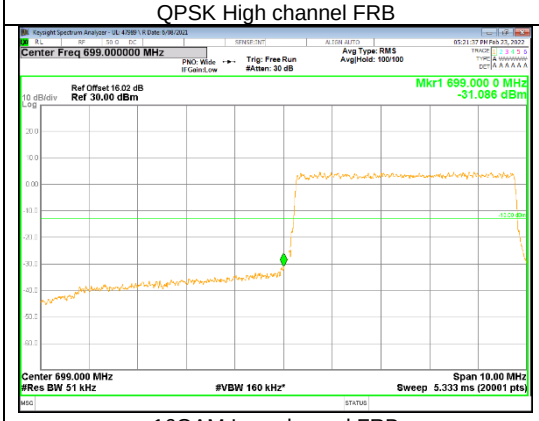

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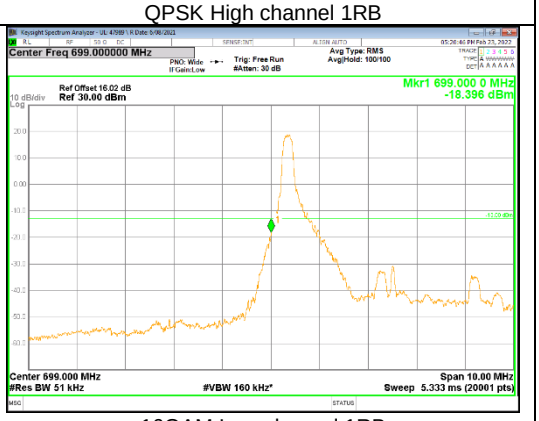

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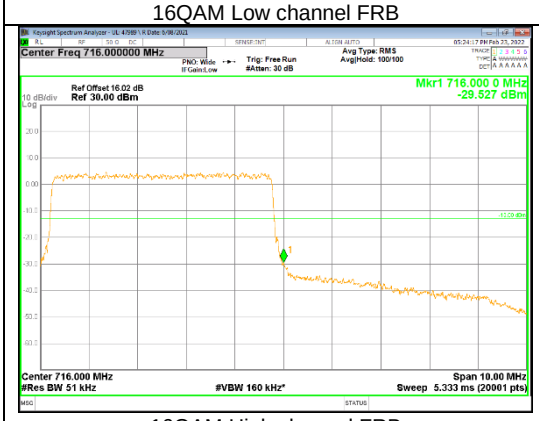

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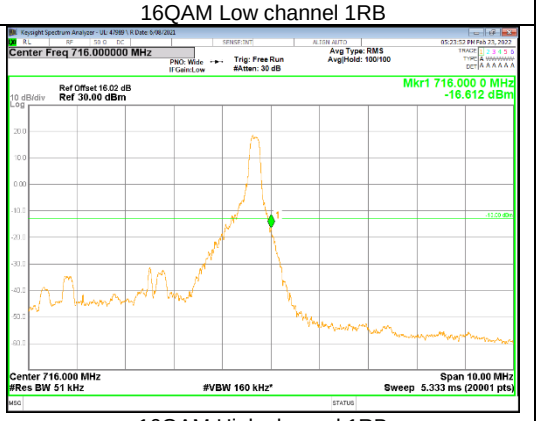

16QAM High channel 1RB

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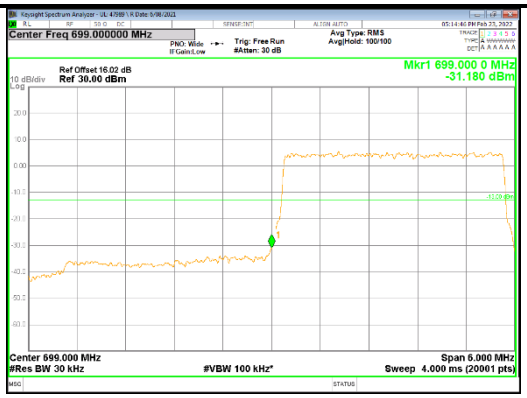
3MHz



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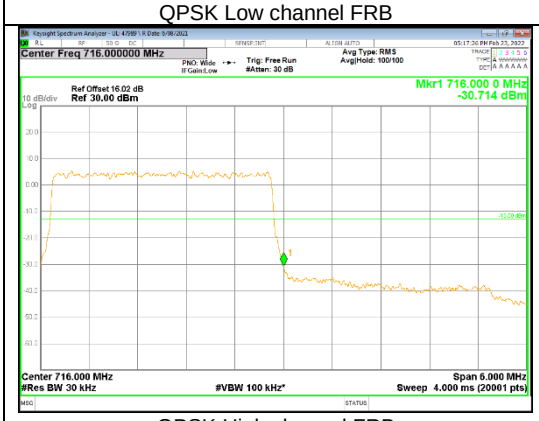

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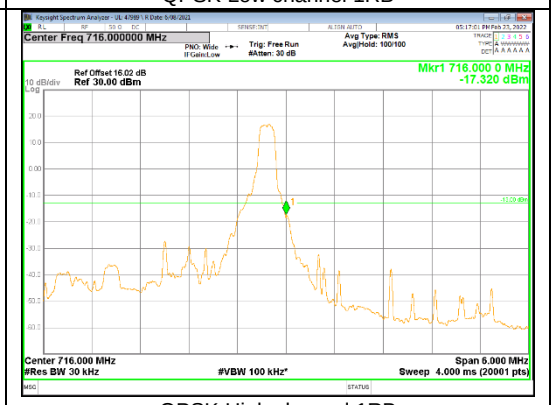

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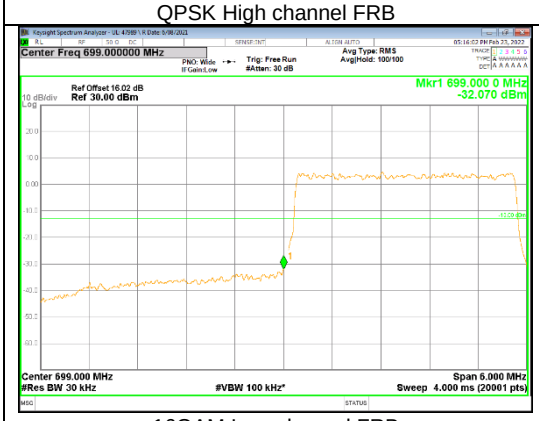

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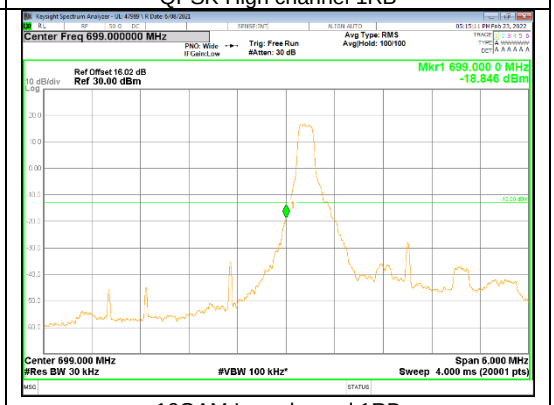

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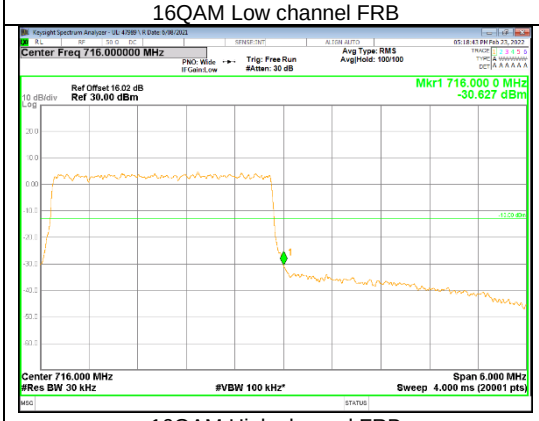

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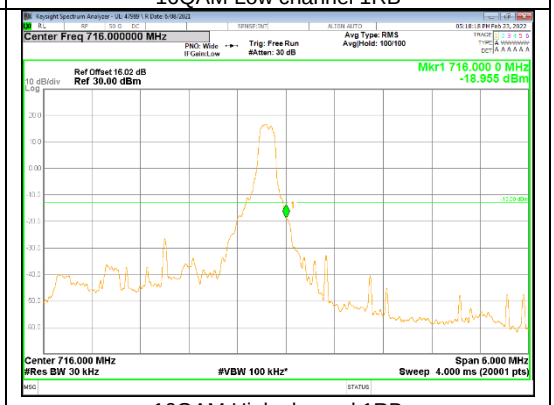

16QAM High channel 1RB

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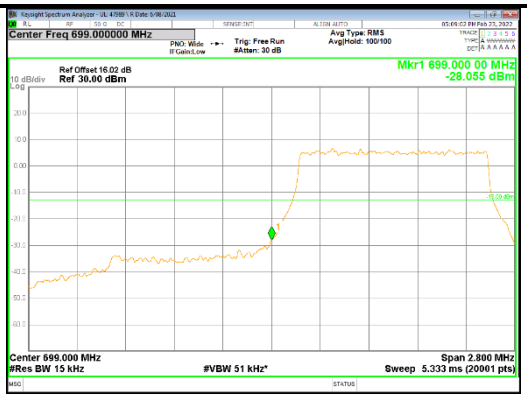
1.4MHz



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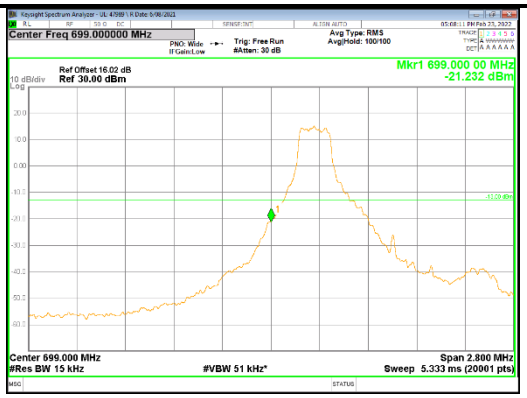

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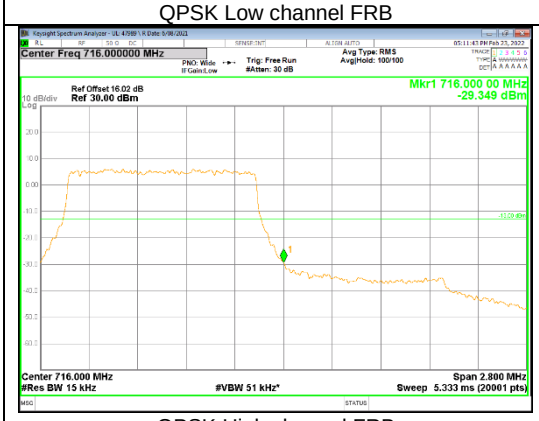

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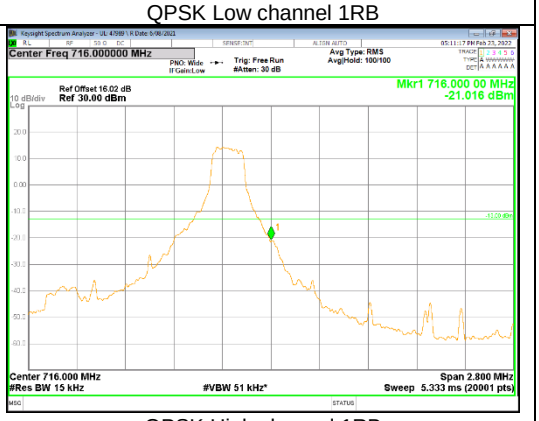

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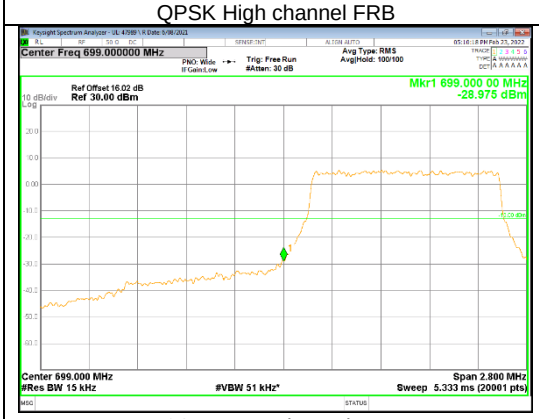

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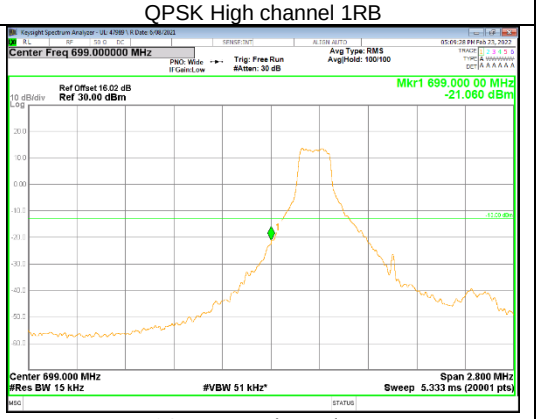

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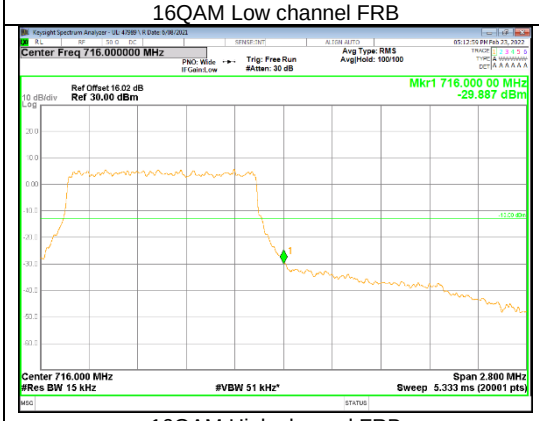

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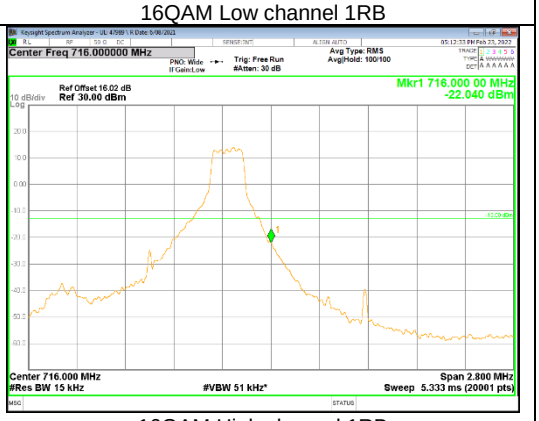

16QAM High channel 1RB

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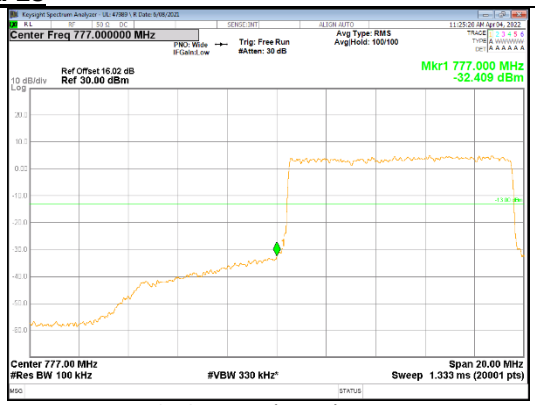
LTE Band 13

LTE Band 13

10MHz



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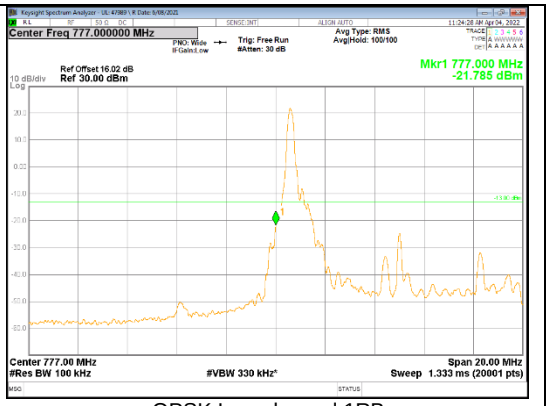

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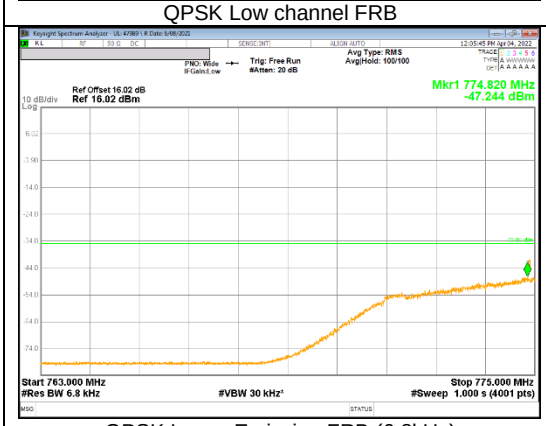
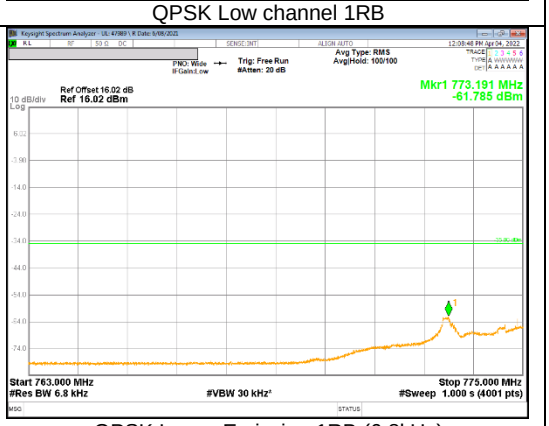
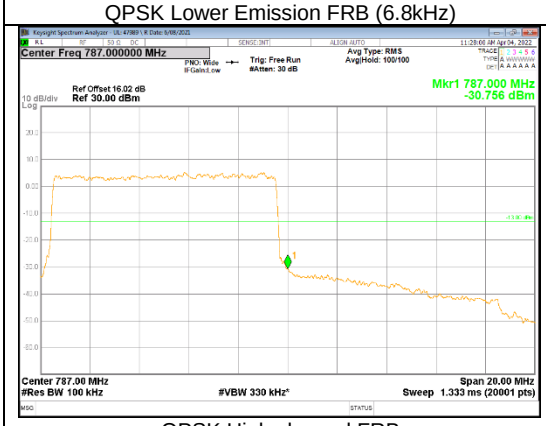


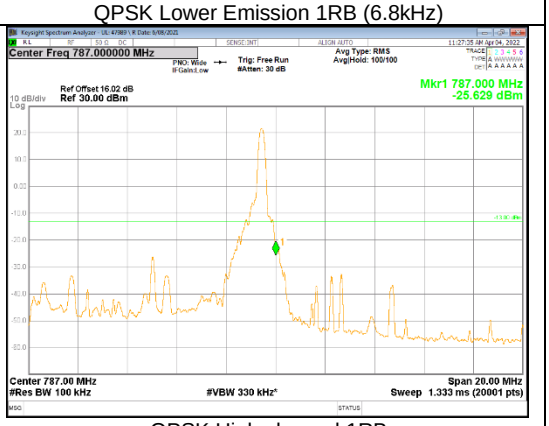
QPSK Lower Emission FRB (6.8kHz)



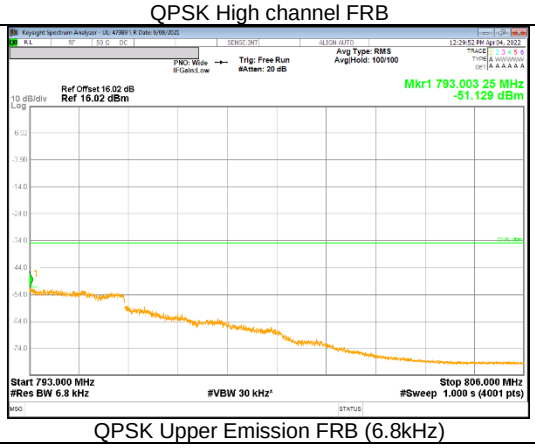
QPSK Lower Emission 1RB (6.8kHz)



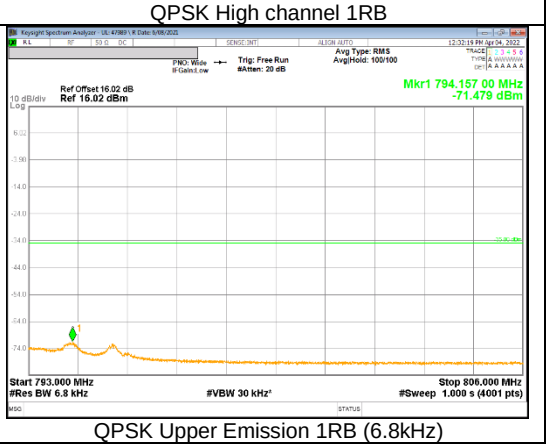
QPSK High channel FRB



QPSK High channel 1RB



QPSK Upper Emission FRB (6.8kHz)



QPSK Upper Emission 1RB (6.8kHz)

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