



# EMC UPDATES

## Laboratory Division Office of Engineering and Technology Dusmantha Tennakoon

Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission.



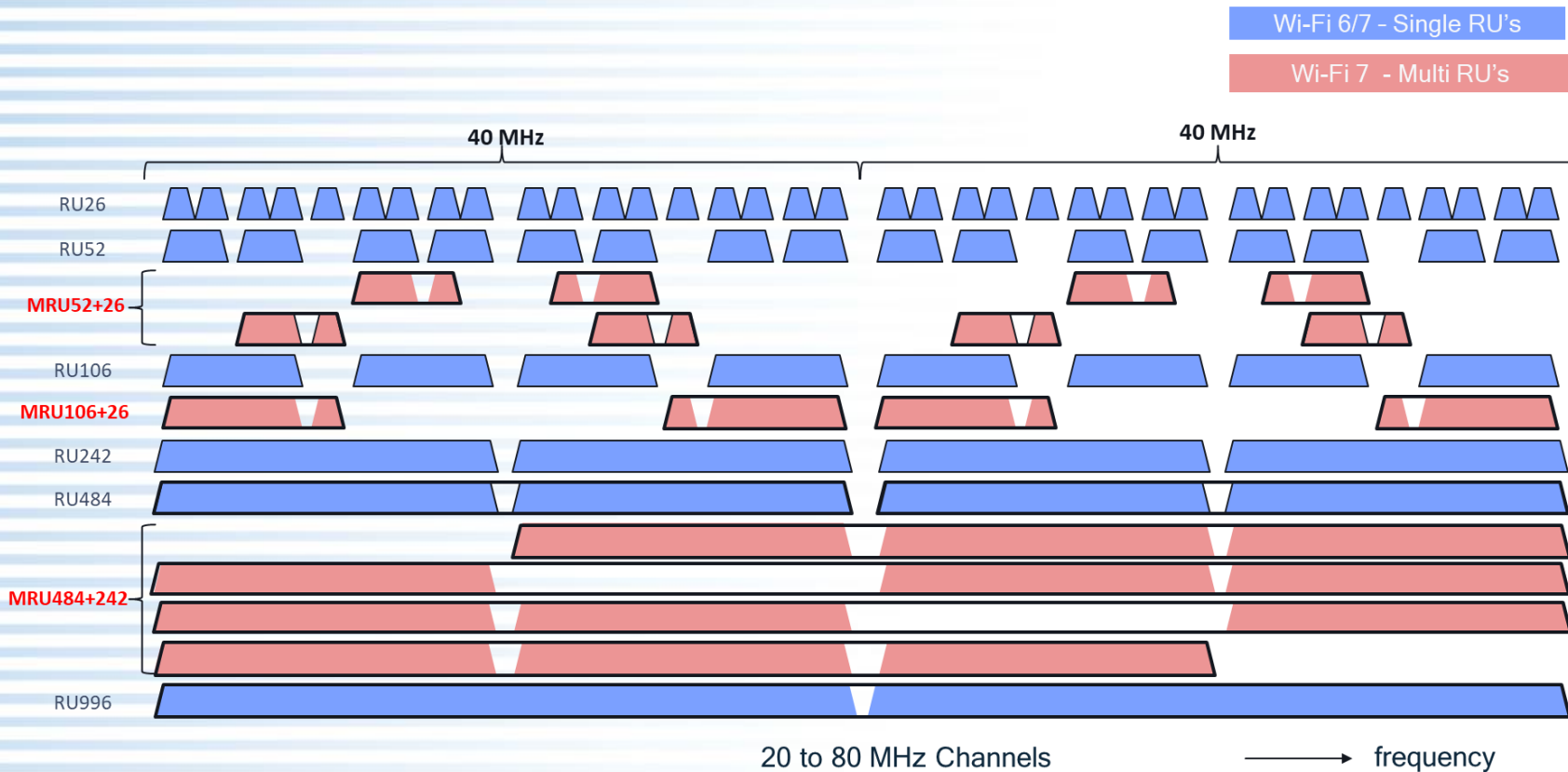
# 802.11be (Wi-Fi 7)

## Wi-Fi 7 key features:

- i. Up to 320 MHz bandwidths.
- ii. 4k QAM modulation (MCS 12, 13).
- iii. Channel puncturing.
- iv. Multi-RU allocation per STA.
- v. Multi-link operation between AP & Client.
- vi. AP Coordination.



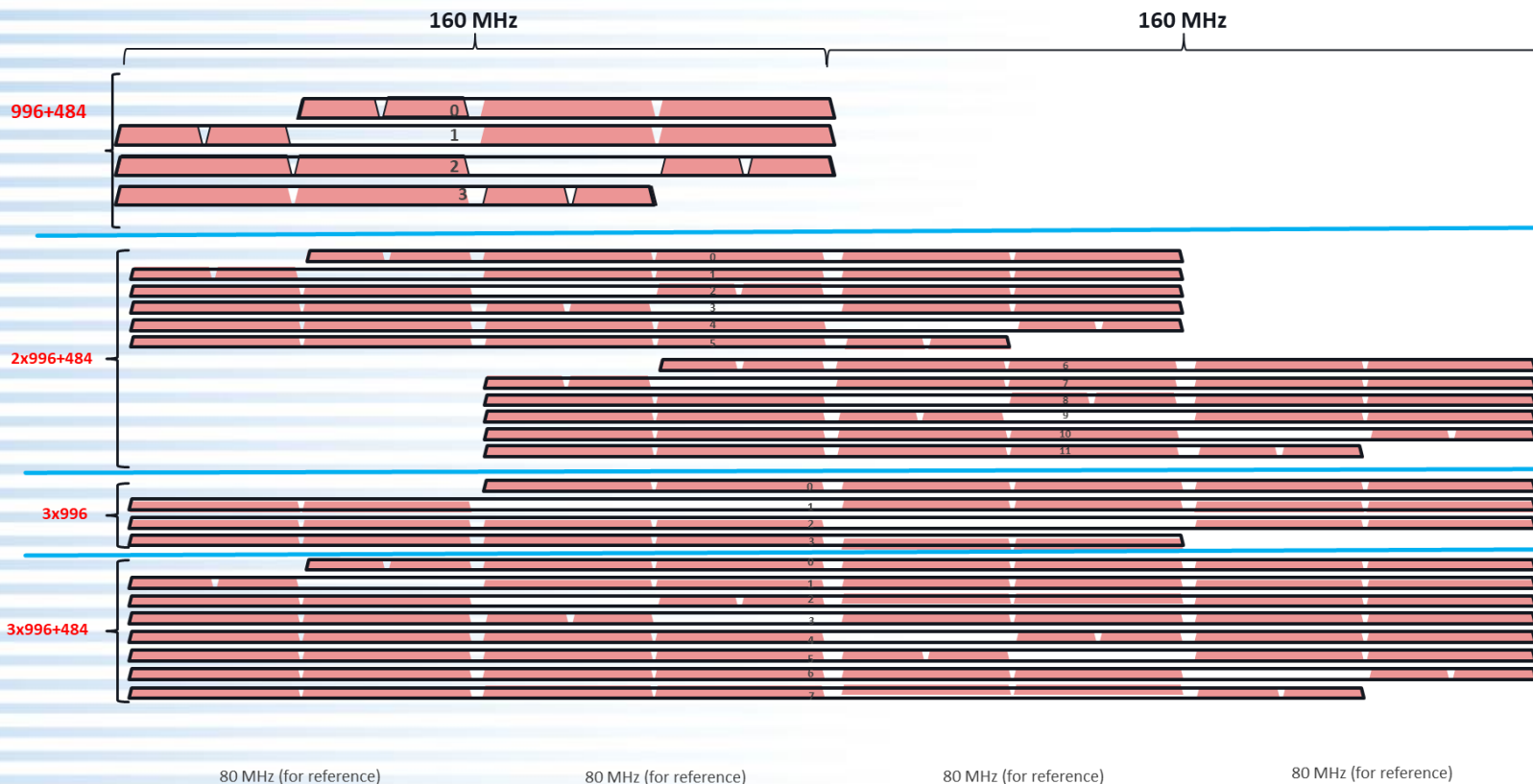
# Multi-RU (Resource Unit) for UL & DL OFDMA [20 to 80 MHz Channels]





# Multi-RU (Resource Unit) for UL & DL OFDMA [160 & 320 MHz Channels]

Wi-Fi 7 - Multi RU's





## 802.11be (Wi-Fi 7)

### Channel Puncturing:

- i. Master device will decide whether to vacate, reduce BW or puncture.
- ii. PSD maybe higher when punctured.
- iii. Punctured portion will need to meet OOB limits.
- iv. Test smallest and largest BW for CBP. For DFS follow KDB 905462 for BW guidance.
- v. For each BW test several puncturing options.
- vi. Test 240 MHz channels in 5 GHz bands.



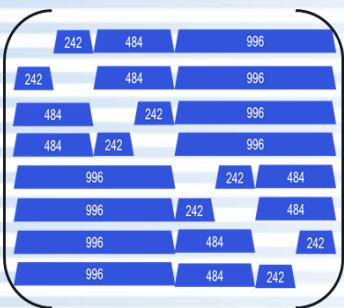
# Punctured Transmission – Standard Patterns for all Wi-Fi 7 Devices – Single User Packets

80MHz BW

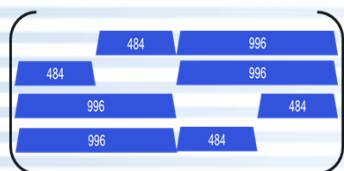


160MHz BW

20MHz puncture

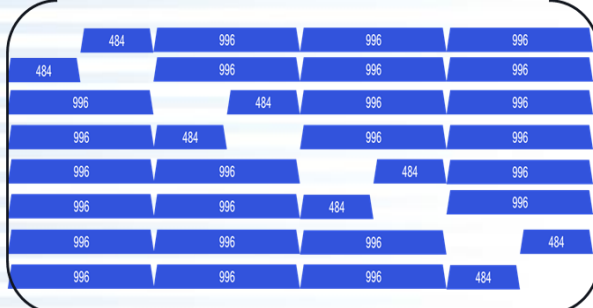


40MHz puncture

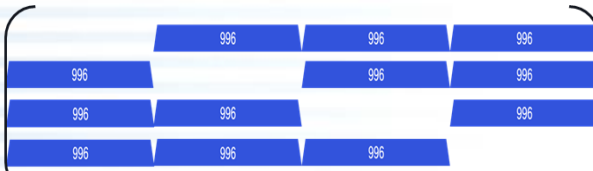


320MHz BW

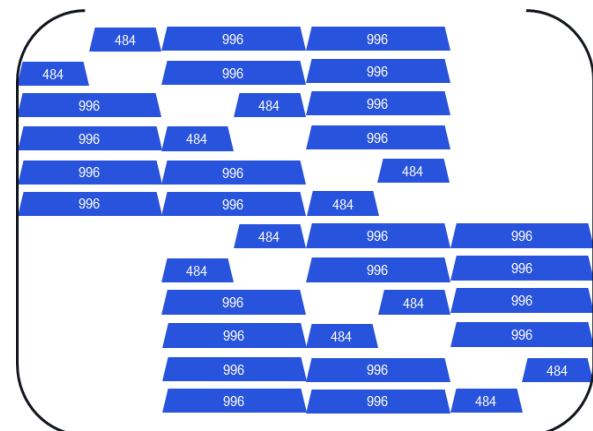
40MHz puncture



80MHz puncture



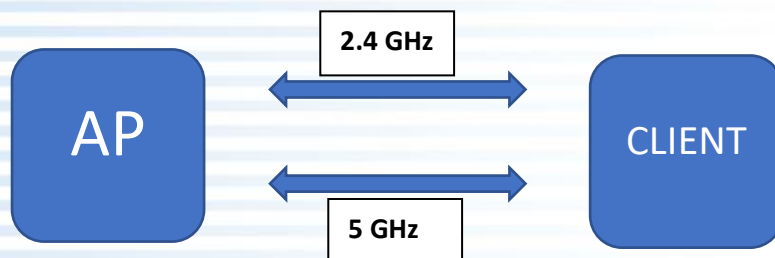
80+40MHz puncture





# 802.11be (Wi-Fi 7)

## Multi-link operation:



- i. Client and AP operate in two bands with data aggregation.
- ii. Simultaneous operation in any two of the 2.4 GHz, 5 GHz and 6 GHz possible.
- iii. Make sure that the respective limits are met for simultaneous operation when operating in the same band. Example: when operating in 5+5 GHz mode, the sum of the PSD/EIRP meets the limit.



# 802.1be RF Testing

1. Full testing for nominal bandwidths (Full\_RU). That is, measure Output power, PSD, Band edge, OBW, Spurious emissions etc. for 20/40/80/160/240/320 MHz bandwidths.
  
2. If  $\text{Partial\_RU PSD} > \text{Full\_RU PSD}$ 
  - i. Perform full testing in this mode as well.
  - ii. Perform additional testing on other Partial\_RU modes for band edge and spurious
  
3. If  $\text{Partial\_RU PSD} < \text{Full\_RU PSD}$ 
  - i. Perform additional testing on Partial\_RU modes for band edge and spurious emissions

Note: Partial\_RU modes include Single RU, Multi-RU(small), Multi-RU(large) & punctured.





# Boosters

- ❖ For a wideband consumer signal booster, a minimum conducted uplink power output of 17 dBm (0.05 Watts) is required per rule section 20.21(e)(8)(i)(B). In addition, provide equivalent uplink and downlink gain.
- ❖ For 5G NR boosters a 100 MHz AWGN signal will need to be used.
- ❖ Part 30 and 96 signal boosters are subject to part 20.21 rules including labelling requirements.
- ❖ 3700-3980 MHz and 3450-3550 MHz bands under part 27.50 allowed for industrial signal booster operation as long as they meet all the technical rules and guidance in our KDB publications.
- ❖ A booster under part 30 subject to PAG (UMFLEX).



# Part 96 End User Device Testing

- ❖ Some differences between 4G LTE and 5G NR:
  - i. Bandwidth
  - ii. Modulation
  - iii. Subscriber Carrier Spacing (SCS)

Therefore, a C2PC should be performed if adding 5G NR capability to an already certified end user device under part 96.

96.47 testing shall be performed with a CBSD that has been certified for 5G NR operation. Provide FCC ID of CBSD device in test report.



# Part 27 WCS Band Edge

CFR Part 27.53 (a) (5):

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the channel blocks at 2305, 2310, 2315, 2320, 2345, 2350, 2355, and 2360 MHz, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz). 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.



# Part 27 WCS Band Edge

What 27.53(a)(5) means:

A narrower resolution bandwidth (no smaller than 1% OBW) can be used **within 1 MHz of the band edge** as long as it is integrated over the full 1 MHz measurement bandwidth



Questions?

THANK YOU