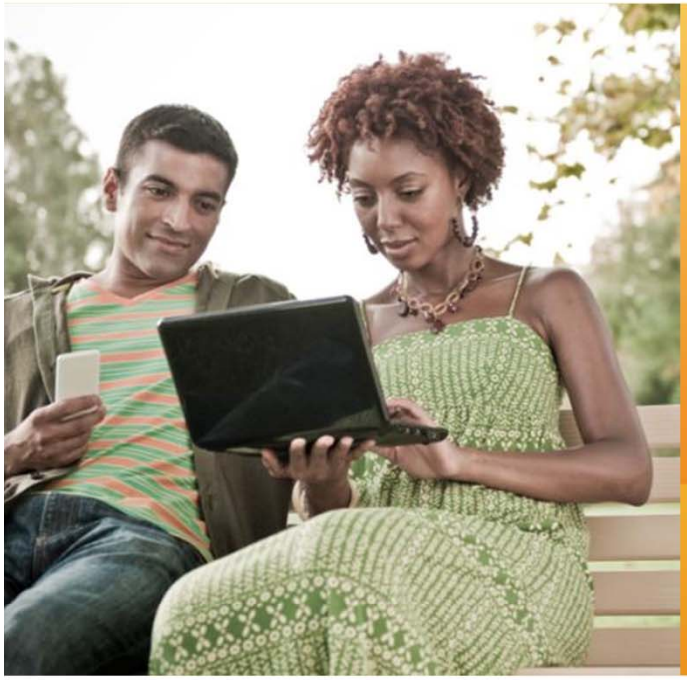

Bandwidth Support in LTE Standards

July 2012

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Introduction

- LTE Release-8 supports six different BW options
  - Release-8 bandwidth set: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
  - Occupied bandwidth: 1.08MHz, 2.7MHz, 4.5MHz, 9MHz, 13.5MHz, 18MHz
  - Many bands allow only a subset of the six possible BW cases
- Early deployment BW cases:
  - Most common: 5MHz and 10MHz
  - Least common: 1.4MHz and 3MHz
- LTE Release-10 introduced capability to aggregate up to 5 component carriers (CCs) with a maximum aggregated bandwidth of 100 MHz

Possibility of New Block Sizes

- The LTE Release-8 physical layer specification actually supports not 6 but 105 different BW options
  - 180kHz granularity between 1.08MHz and 19.8MHz (occupied)
- But Release-8 performance requirements were only defined for the six aforementioned cases
  - Even today, only those six cases are commercially viable
- Introducing a block size larger than 5MHz, which is not a multiple of 5MHz, would have to overcome the significant hurdle of minimum performance specification expansion

Asymmetric Block Allocation

- Could operators obtain different BW in DL/UL blocks?
  - For example, an FDD Band has 25MHz DL and 15MHz UL, each divided into 5MHz Blocks
    - Operator A obtains 3 DL Blocks (15MHz) and 2 UL Blocks (10MHz), DL/UL ratio 3/2
    - Operator B obtains 2 DL Blocks (10MHz) and 1 UL Block (5MHz), DL/UL ratio 2/1
- It is possible with some caveats:
  - It should be ensured that each operator's allocation is contiguous
  - Adequate duplex gap is needed and no mixing of UL/DL in each duplex freq. range
  - Asymmetric DL/UL BW is supported by the LTE physical layer specification but not yet supported in the minimum performance specification
  - Asymmetric DL/UL BW typically also means variable duplex separation, which is also not supported in the minimum performance specification yet
    - Variable duplex may represent potentially more serious design challenges

Conclusion

- It would require significant specification effort to add a new LTE channel BW option
- BW cases that are multiples of 5MHz are expected to stay the most common
- More flexibility in terms of asymmetric block allocation or variable duplex separation is possible from the physical layer specification perspective but performance requirements have not been developed for these and the device implementation impacts were not fully evaluated

Conclusion (cont.)

- Carrier Aggregation represents an opportunity to overcome limitations of small, distributed, or asymmetric frequency block allocation for an operator

- At the same time, Carrier Aggregation poses interesting challenges in terms of
  - Large number of operating bands → large number of carrier aggregation band combinations
  - Lack of global roaming LTE band, region- or operator-specific bands and band combinations → limited scale

Thank You!

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