

RP-191059



# Views on NR operation in the 60 GHz unlicensed bands

3GPP TSG RAN Meeting #84  
Newport Beach, CA, USA  
June 3<sup>rd</sup> – 6<sup>th</sup>, 2019

Agenda Item: 8  
Source: Ericsson  
Document for: Discussion

# Spectrum situations in the 60 GHz bands



- Several regulatory regions have varying license-exempt permissions/proposals between frequency 57 GHz and 71 GHz
  - The frequency bands 66-76 GHz (including 66-71 and 71-76 GHz) are being studied under WRC-19 Agenda Item 1.13 for potential IMT identification
    - Final decisions are to be made in WRC-19 with respect to IMT identification or no IMT identification, along with the corresponding technical and regulatory conditions

Region	Country	Frequency (GHz)						
		57-58.2	58.2-59	59-59.3	59.3-64	64-65	65-66	66-71*
ITU Region 1	Europe/CEPT	U (Mobile)						
	Israel							
	South Africa	U (Mobile)				U (Mobile)		
ITU Region 2	USA	U (Mobile)						
	Canada	U (Mobile)						
	Brazil	U (Mobile)						
	Mexico	U (Mobile)						
ITU Region 3	China			U (Mobile)				
	Japan	U (Mobile)						
	Korea	U (Mobile)						
	India							
	Taiwan							
	Singapore	U (Mobile)						
	Australia	U (Mobile)						

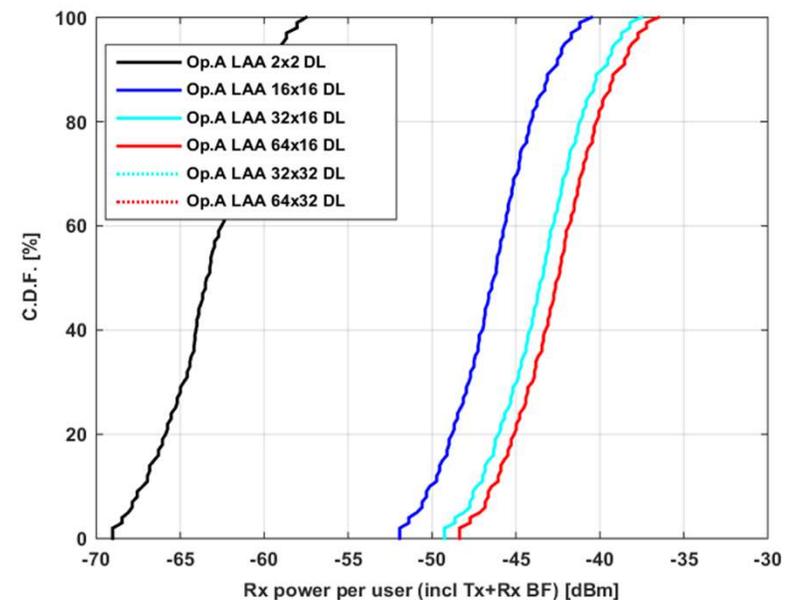
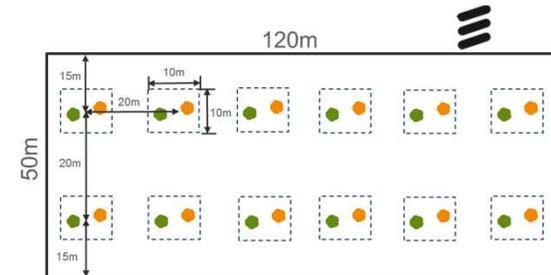
# Power limits and path losses

## Limited output powers (examples)

Frequency band (GHz)	Power/Magnetic Field Requirements	Spectrum access and mitigation requirements	Purpose/Node Placement requirements
Europe/CEPT 57 – 66	Max 40 dBm mean EIRP if transmitter power control is implemented	Adequate spectrum sharing mechanism shall be implemented by the equipment	Short Range Devices defined in ERC Rec 70-03. Fixed outdoor not allowed.
US 57 – 71	Max avg, EIRP 40dBm Max peak EIRP 43dBm	No requirements.	Equipment other than fixed outdoor.
	Avg. EIRP $\leq (82 - 2N)$ dBm Peak EIRP $\leq (85 - 2N)$ dBm. N = max(0, 51 dBi – antenna-gain)	No requirements.	Fixed outdoor equipment
China 59-64	Output power of antenna port: $\leq 10$ dBm Peak EIRP : 47dBm Mean EIRP: $\leq 44$ dBm	No requirement	very low transmission power and short distant unlicensed applications

## Very high path losses

- Beamforming essential to closing the link
- For a 2 GHz carrier, thermal noise floor @ -71 dBm (phase noise not accounted)



# Use cases and deployments

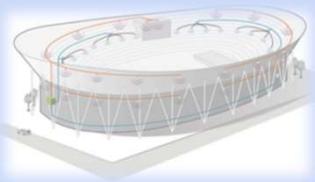


## eMBB

Dense urban

Indoor hotspot

IAB



High positioning accuracy

## Industrial

Industrial IoT

Smart grid

# Relationship with other 3GPP SI/WI

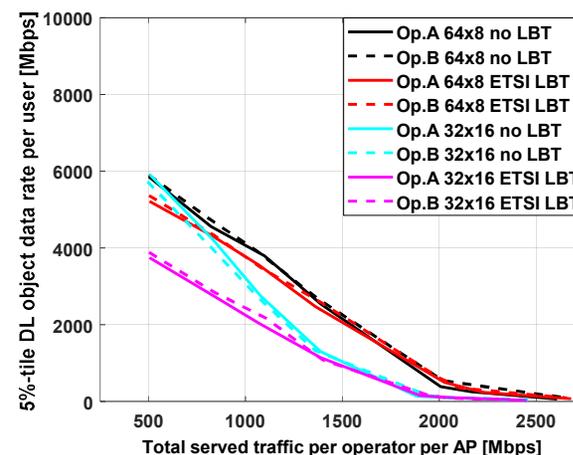
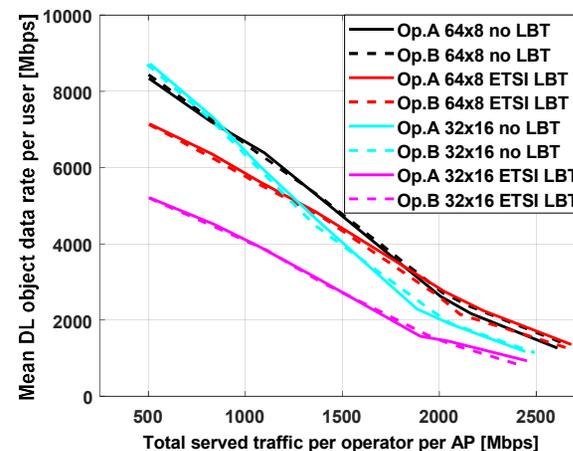


- Rel-15/16 SI/WI NR Operation in the Unlicensed Bands
  - Channel access aspects considered in SI
    - But removed from the NR-U SI/WI due to low priority ([RP-181339](#))
  
- Waveform for NR above 52.6 GHz
  - Ongoing study in RAN
  - Working group level study item expected for Rel-17

# Discussion

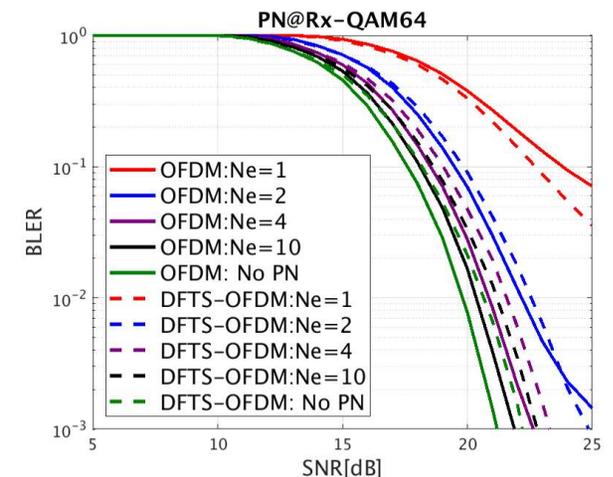
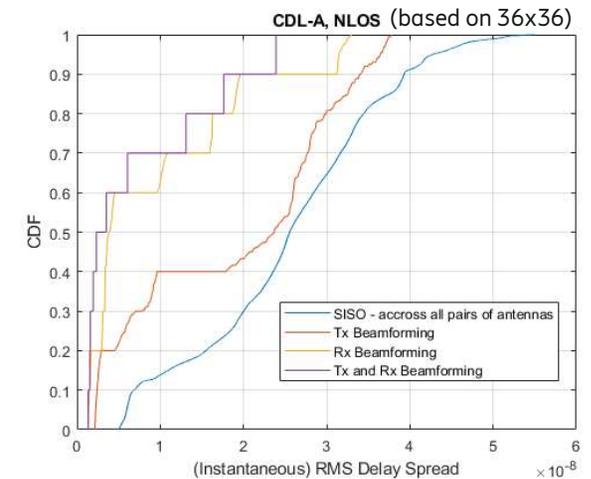


- Commercial feasibility/availability of beamforming capabilities strongly influence
  - Coverage and reliability
  - Use cases
  - Channel access schemes for 60 GHz
    - ETSI 302 567 follows a load based LBT procedure similar to that of 5 GHz
      - With enough beamforming, LBT does not appear necessary or beneficial (even for 5th percentile users)
- To simplify system design/implementation complexity, it's beneficial to clarify commercial device capabilities in the above 52.6 GHz frequency range first



# Further clarification of practical HW & RF characteristics needed

- System design heavily depends on commercial feasibility/availability/practicality of systems and components
  - Phase noise strongly impacts
    - Waveform performance
    - Types and overheads of phase tracking resources
  - Practical TX/RX beamforming capabilities strongly impact
    - Coverage and reliability
    - Channel dispersion levels, which impact cyclic prefix (or guard time) overheads
    - Types and overheads of beam tracking resources
  - Distributed PLL can reduce phase noises but may impact beamforming negatively
- Without better clarity in the above aspects, productive system design discussion proves difficult



# Planning for 3GPP



- Rel-17 SI to extend NR >52.6 GHz
  - Investigate and clarify practical HW & RF characteristics in the frequency range
  - Identify and study necessary modifications
    - Baseline is OFDM DL and OFDM/DFTS-OFDM UL
    - Improvements need to be shown relative to this baseline
  - Designs for licensed bands should be in focus first
  - Follow-up WI in Rel-18
- Study NR-U 60 GHz system design based on findings from NR designs for >52.6 GHz SI
  - Start after conclusion reached for relevant frequency bands in the SI on NR >52.6GHz
  - Overall NR-U 60 GHz designs should aim for similar or smaller incremental delta from NR designs for above 52.6 GHz as Rel-16 NR-U from Rel-15 NR
  - Define a single global framework for channel access to the 60 GHz unlicensed bands

