

Views on NR operation beyond 52.6 GHz



3GPP TSG RAN Meeting #84
Newport Beach, CA, USA
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Agenda Item: 8
Source: Ericsson
Document for: Discussion

Spectrum and regulation



- Consider frequency range from 52.6 to 114.25 GHz
- Both licensed and unlicensed spectrum to be supported
 - Focus on licensed spectrum as the first step, then extend to unlicensed spectrum

Use cases to be addressed by NR beyond 52.6 GHz

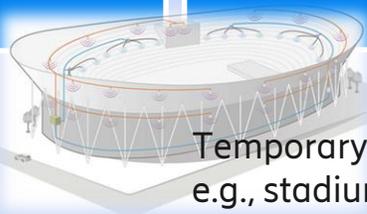


High data rate

Outdoor deployment Indoor deployment

Dense urban

Indoor hotspot



Temporary hotspot
e.g., stadium, concert

Can benefit from IAB

Low latency and high reliability

Factory automation/Industrial IoT (IIoT)

Smart grid automation

ITS & V2X

High positioning accuracy



Waveform



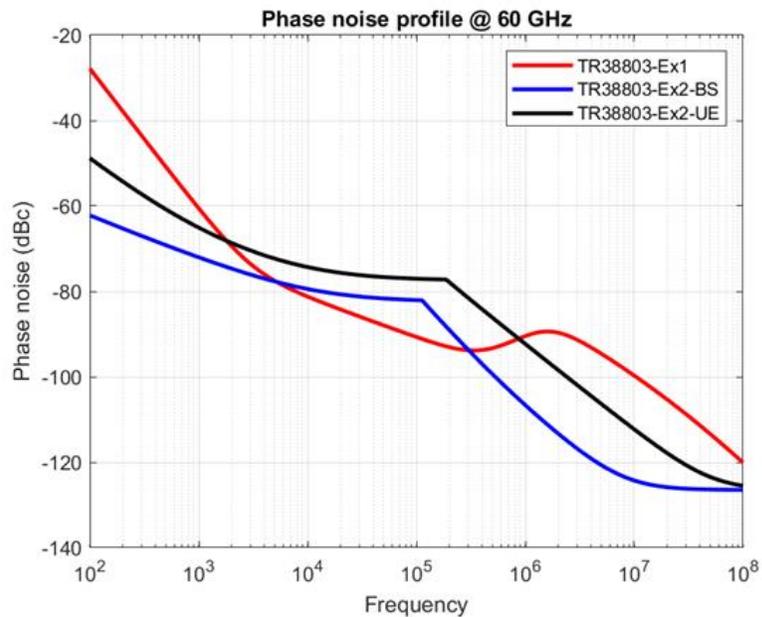
- NR currently defines
 - OFDM for DL
 - OFDM/DFTS-OFDM for UL
- Starting point of any waveform study should be OFDM (DL) and OFDM/DFTS- OFDM (UL)
 - Any potential shortcoming of current design should be first addressed within existing waveforms
 - A new waveform can be considered only if it shows clear overall system benefits over the baseline
 - In this case DFTS-OFDM is preferred to maintain commonality with NR-Rel-15/16
 - A new DL waveform implies a new DL physical layer (physical channels, signals, maybe even procedures) and must therefore be justified by clear gains over existing waveforms

Evaluation criteria and metrics

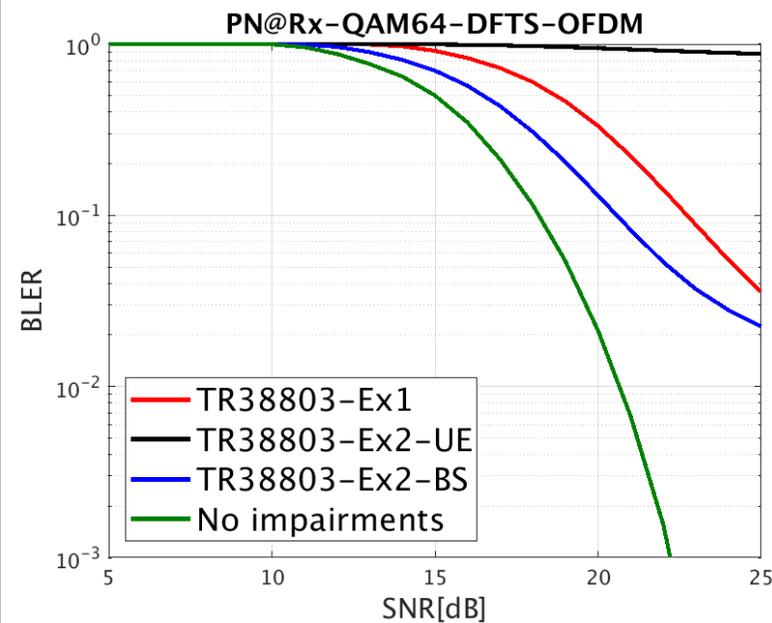


- Impairment modeling
 - The SI should strive for common hardware impairment modeling, the selection of the models has large impact on performance (see next slide)
 - Without common models comparisons are very difficult
- PAPR/CM as waveform selection criteria not sufficient
- In principal maximum output power is determined by the power where all requirements (SEM, ACLR, in-band emission requirements, EVM, ...) are still fulfilled
 - Note: Most requirements are not yet defined for beyond 52.6 GHz
- Important to involve RAN4 when setting evaluation criteria, metrics, and hardware models

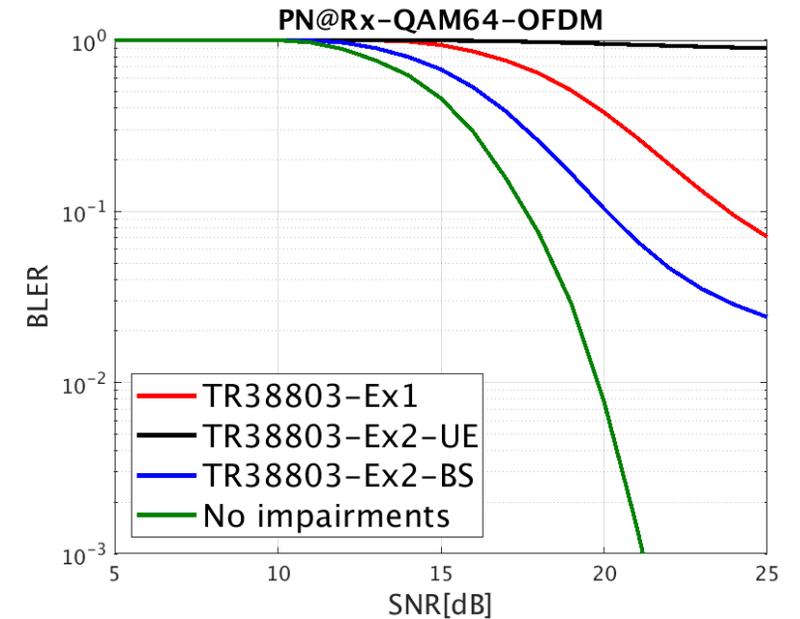
Performance impact and phase noise modelling



- Carrier properties / numerology
 - Carrier frequency= 60 GHz
 - Numerology=960 kHz



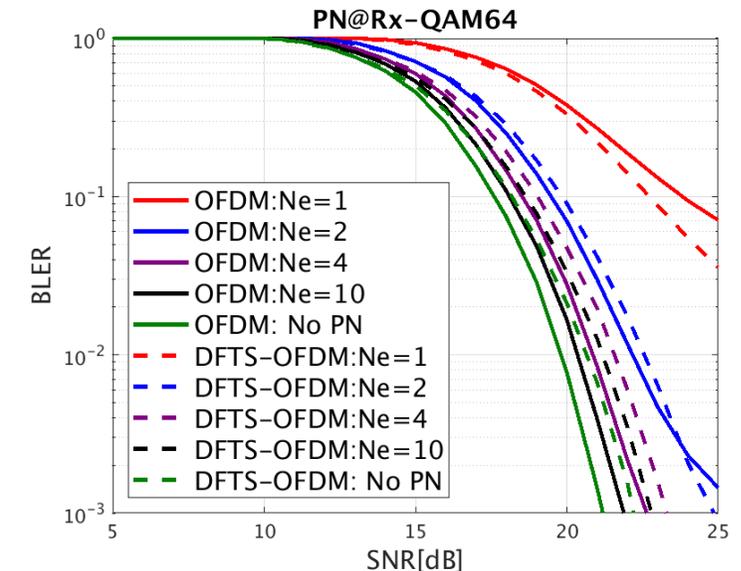
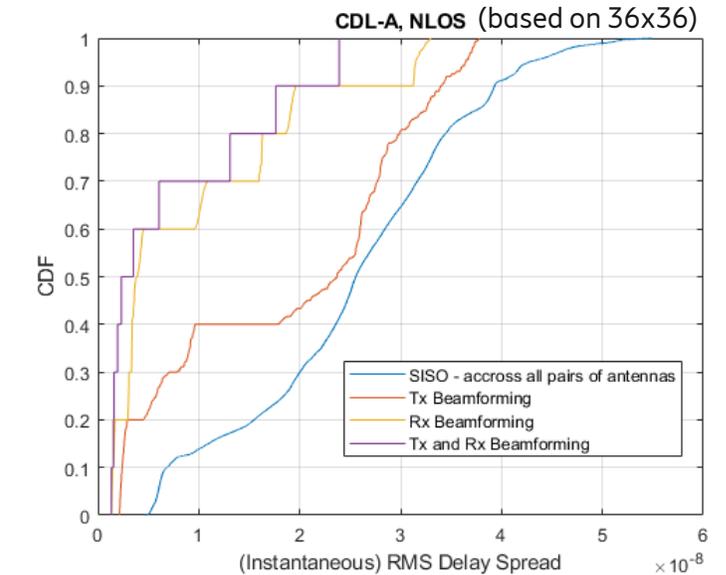
- Channel model parameters
 - CDL channel model name= CDL_A
 - RMS delay spread = 5 ns
 - Code rate = 0.75



- Phase estimation and compensation
 - CPE compensation

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

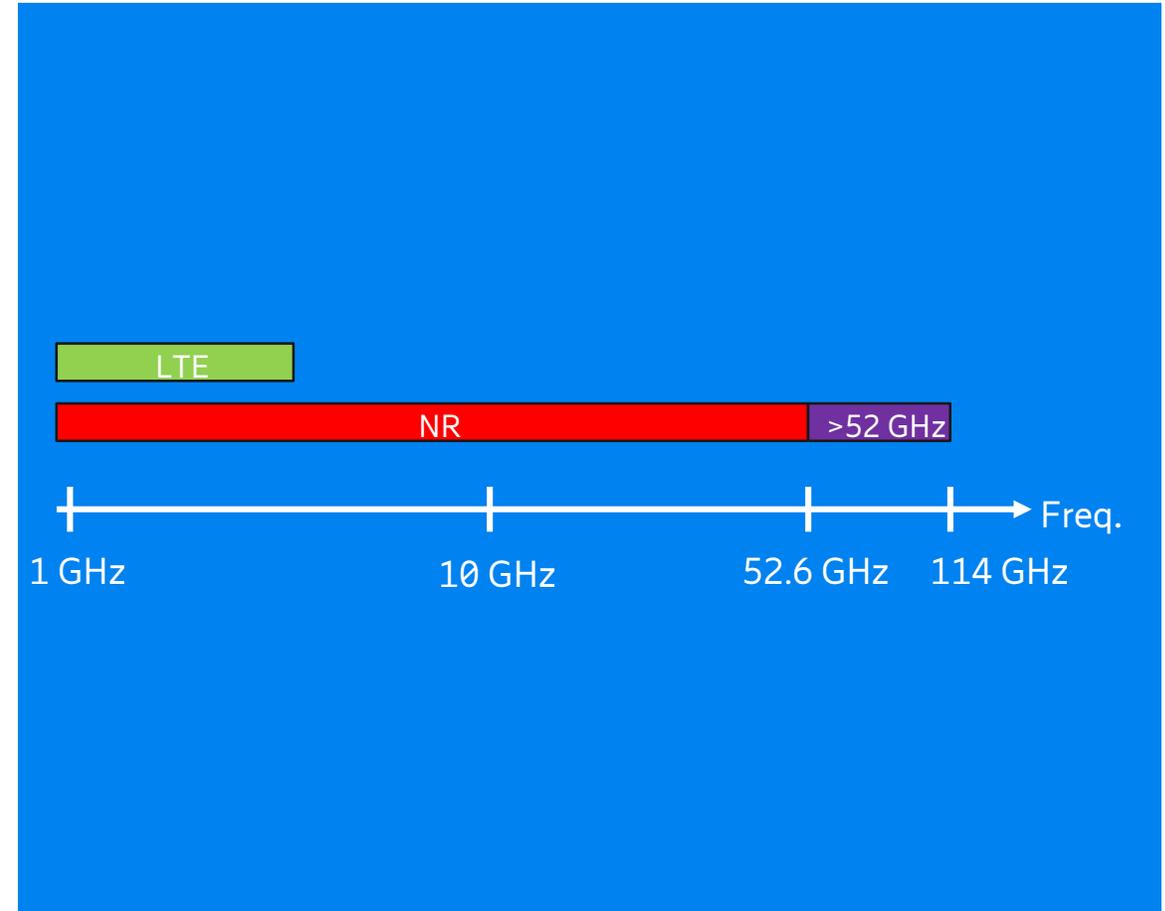


NR > 52.6 GHz



Rel-17 study 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
 - Adopting a single-carrier waveform for NR would imply a completely new physical (and possibly higher) layer design as well as corresponding RAN4 work
- Designs for licensed bands should be in focus first
- Follow-up WI in Rel-18

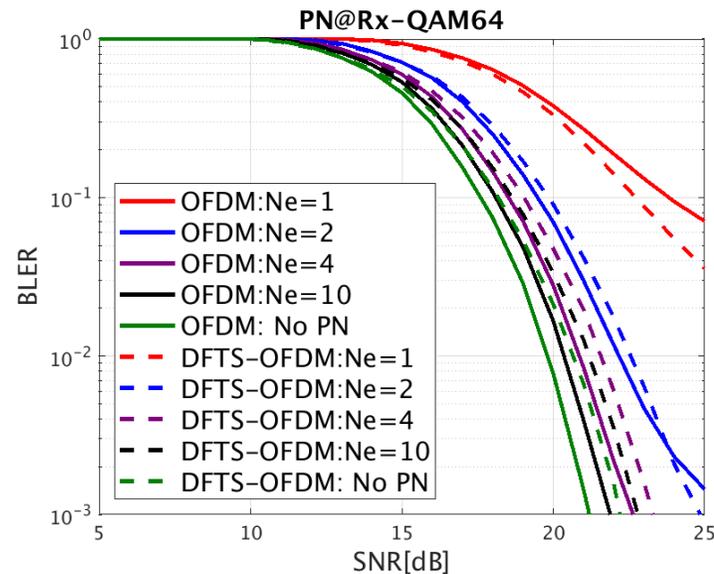
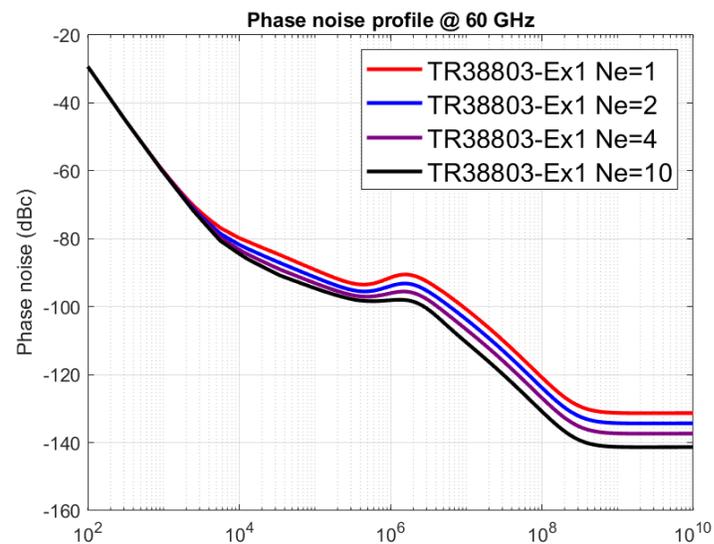




Phase noise – distributed PLL



- All PN models in 38.803 assume centralized LO generation where PN (and thus PN-related EVM) is fully correlated across transceivers
- With distributed LO generalization the PLL-contributed PN reduces with $10\lg(N_{TX}/N_{Layers})$
 - In a semi-distributed LO generation a group of transceivers is served by a single PLL with accordingly reduced PN improvement



Simulation Parameters:

Carrier properties / numerology

Carrier frequency= 60e9 Hz

Numerology=960 kHz

Channel model parameters

CDL channel model name= CDL_A

RMS delay spread = 5 ns

Code rate = 0.75

Phase estimation and compensation

CPE compensation

- For feasibility, see e.g. S. Pellerano et. al. (Intel), "High-Frequency Transceivers for RADAR and Communications," ISSCC 2019