

3GPP TSG RAN Meeting #98-e  
Electronic Meeting, December 12-16, 2022

**RP-223340**

**Title: Views on Scope of the Network Energy Saving WI**

**Agenda Item: 9.2.5**

**Source: Fraunhofer IIS, Fraunhofer HHI, Deutsche Telekom**

**Document for: Discussion**

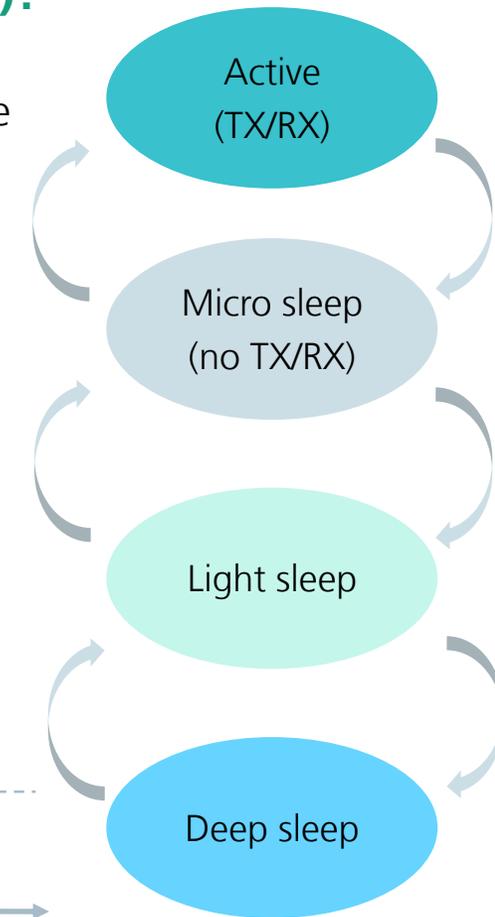
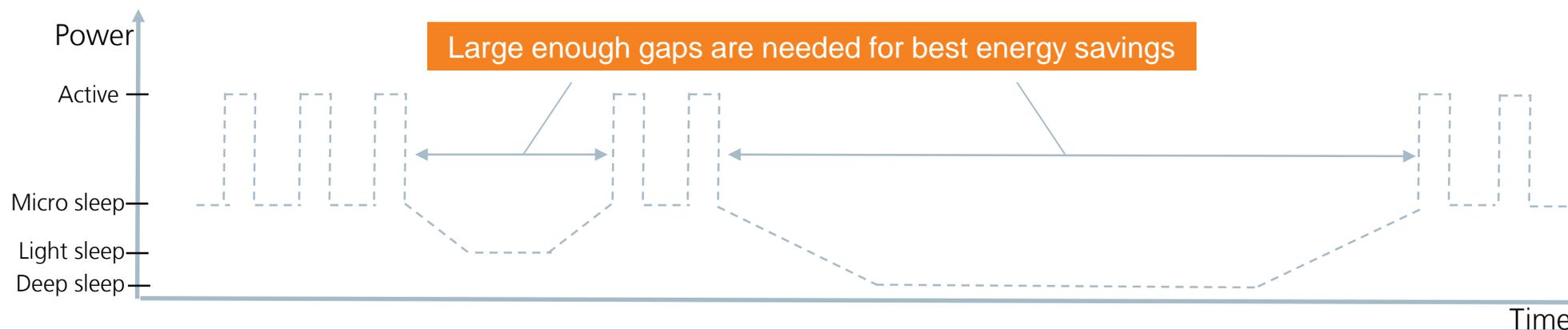
# The role of common signals in Network Energy Consumption

## Why adaptation of common signals is so important for Network Energy Savings (NES)?

At zero and low loads transmission of common signals consume most of power. Only with significant time between transmissions/reception the gNB can reach efficient energy states (light or deep sleep)

**Even at zero load the gNB needs to periodically wake-up to:**

- Transmit SSB
- Transmit SIB-1
- (Eventually) transmit paging
- Receive RACH

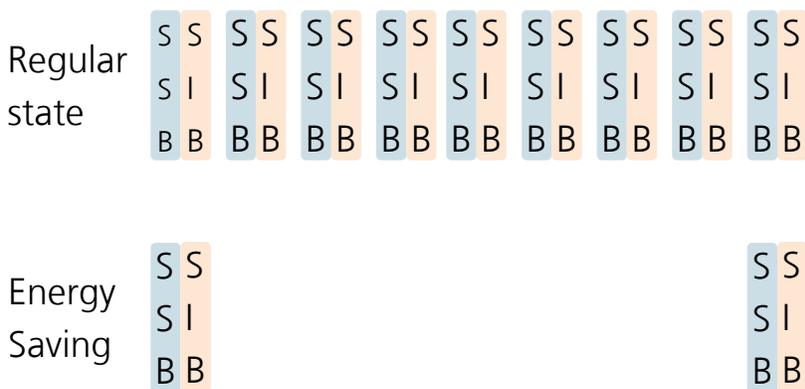


# Three main approaches for common signals adaptation

As identified in Study Item

## Increased periodicity

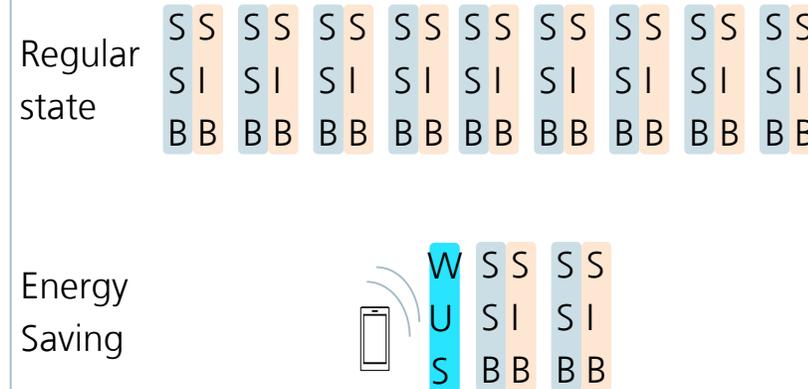
- Improve the support of periods larger than the default 20 ms
- Backward compatible for semi-static settings up to 160 ms
- New UEs could adapt more quickly since legacy UEs might expect 20 ms



## SSB/SIB-1 on-demand /

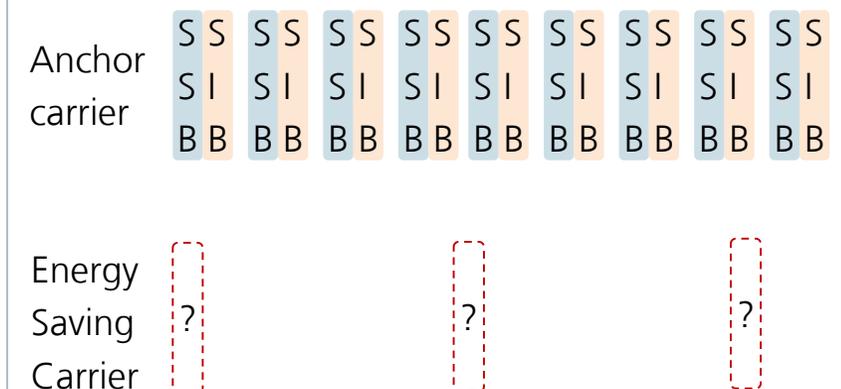
### Wake-up signal (WUS)

- SSB/SIB-1 only transmitted when needed
- Some uplink trigger signal needed (wake-up signal)



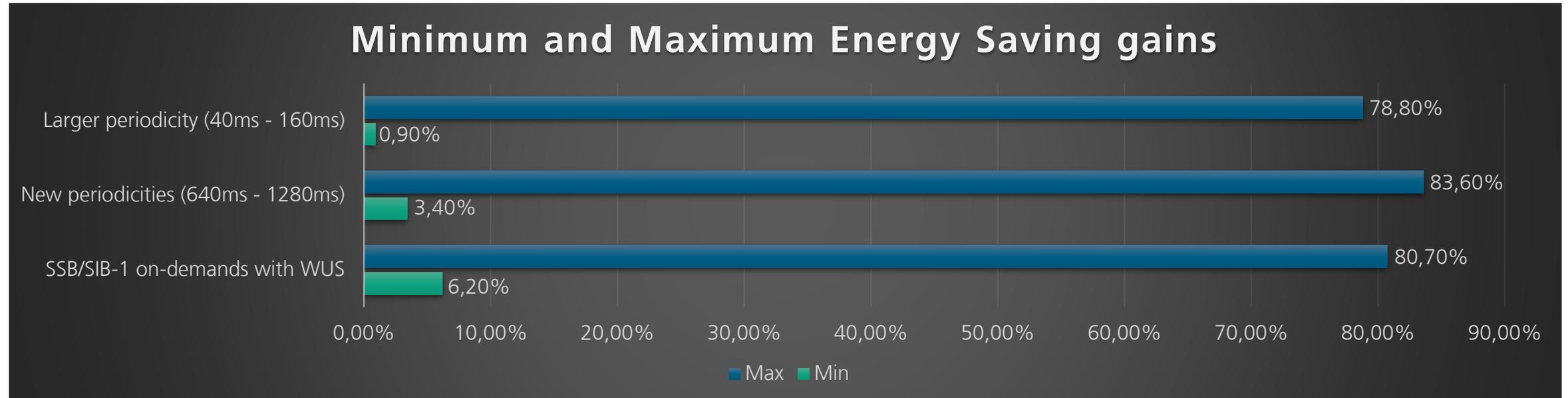
## SSB-less/SIB-1-less

- Do not transmit SSB/SIB-1 in multi-carrier scenario **on energy-saving carrier(s)**
- Rely on another carrier for access
- Not clear (even after SI) what would be needed on the energy saving carrier



# Energy savings from time-domain adaptation

As in TR 38.864 draft v0.5.0 – conclusions section

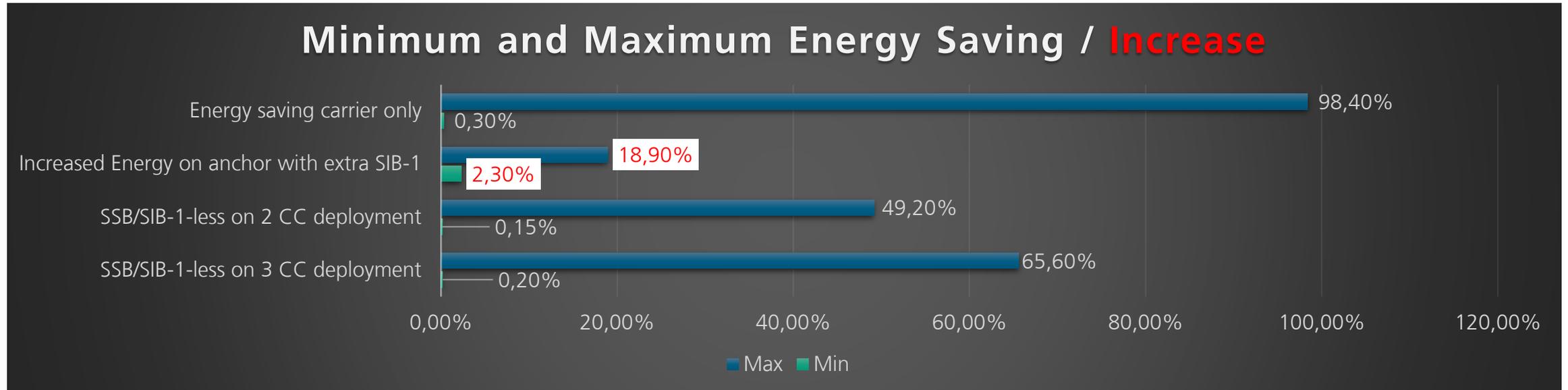


\* Maximum gains at zero load. Minimum gains at medium load

**Proposal 1: Standardize common signals adaptation in time-domain**

# Energy savings from frequency-domain adaptation

Reported (first 2) or derived from (last 2) TR 38.864 draft v0.5.0 – conclusions section



\* Maximum gains at zero load. Minimum gains at medium load

- Results for SSB/SIB-1-less are reported separately on ES carrier (0.3%~98.4% saving) and anchor carrier (2.3%~18.9% increase)
- Extrapolations added for 2CC and 3CC scenarios: even disregarding the energy increase suffered on anchor carrier, overall savings are arguably 1/2 and 2/3 of the reported results

Observation 1: Adding SIB-1 to anchor carrier will reduce energy saving gain and increase complexity

# Recommendations from TR of the Study Item

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## TR 38.864 draft concluded on the foregoing NES techniques:

*“Adaptation/reduction/elimination of common channels/signals (UE WUS can also be considered) in single or multi-carrier operation are beneficial for network energy savings.”*

**Observation 2: The TR identified adaptation/reduction/elimination of common channels/signals, including the support of UE WUS as beneficial for network energy saving**

**Observation 3: There is no clear recommendations for down selection of time and frequency domain techniques in the TR**

# What else is needed to reduce common signals?

Not only energy saving techniques, but also mitigation of negative impacts are needed

## The TR 38.864 draft also concluded:

*“It is recommended that the normative phase includes not only energy saving techniques (the necessary enhancements would need to be further identified during the normative phase) but also the mitigation of their impacts when network applies network energy savings technique(s).”*

Main impacts discussed and identified during the study item:

- Initial Cell Selection duration grows proportional to SSB interval → can be mitigated with improved ICS
- Random access delay grows proportional to SSB interval → can be mitigated with low power wake-up receiver at gNB
- UE power consumption pre-paging increased with larger SSB interval → can be mitigated with denser pre-paging RS
- Measurement performance → to be studied by RAN 4

**Proposal 2: In the normative phase standardize techniques to mitigate the impacts of energy saving on initial cell selection/discovery, UE power consumption (paging), measurement performance**