Study on frequencies above 71GHz

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Backgrounds

- Rel-17 Extended NR operational support to 52.6-71GHz, which includes the support for the global 60 GHz unlicensed band.
- ITU identified the frequency bands in the range 100GHz to 450GHz for the operation of fixed and land mobile service applications (Ref: WRC-2000 and WRC-19 decisions). (Fig.1)

- The availability of Sub-THz frequency bands in the range (100-300 GHz), for communication over multiple GHz-wide channel bandwidths, has the potential to address the beyond-5G-Advanced/6G services in a variety of vertical markets.
  - For example, further high-speed and high-capacity of communication infrastructure will be required to realize CPS (Cyber Physical Systems)/Digital Twin and the use of Sub-THz frequencies (100-300 GHz) for communications seems to be promising.

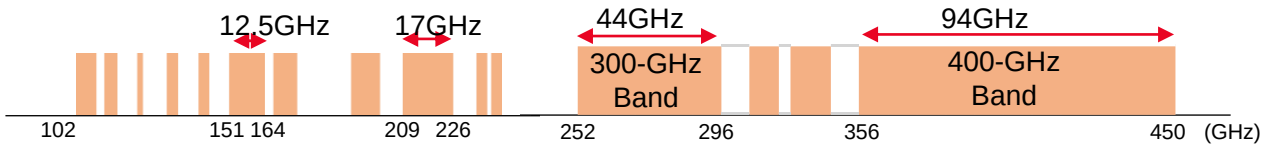

Fig.1 Allocated frequency bands for the operation of fixed and land mobile service applications.

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Observations

- The use of Sub-THz frequencies is often considered unsuitable for long range communication because of their high attenuation. However, their short wavelengths enable large arrays which have the potential to enable longer range communication. (Fig.2, Fig. 3)
- The Challenge is the precise adjustment of a Pencil beam and narrow coverage, but they also have the advantages of security, less interference and reduced total system power consumption.
- The sub-THz system air interface will not operate in a stand-alone mode, rather it will use lower frequency (e.g., sub 6 GHz) nodes as anchors to provide sub-THz services (Fig.4)

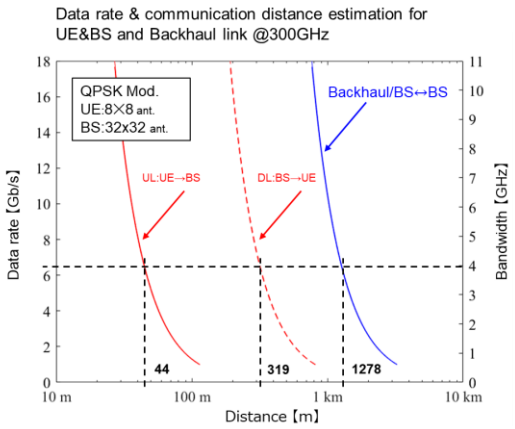

Fig. 2 Link budget curves

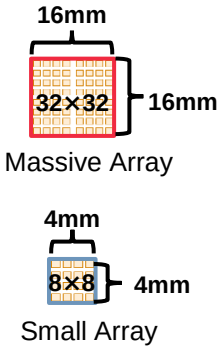

Fig. 3 # of Ant. Elements (300GHz)

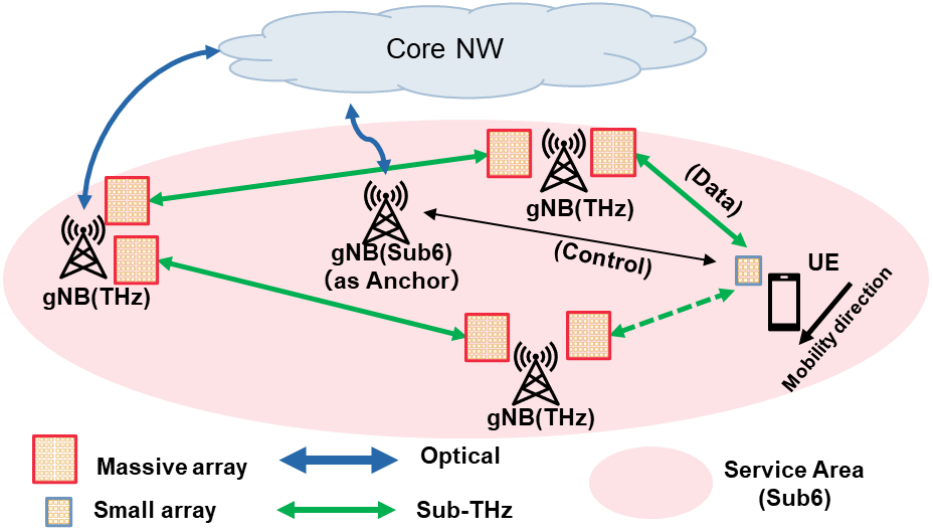

Fig. 4 Sub-THz frequencies deployment configuration example

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Deployment configurations using THz frequencies

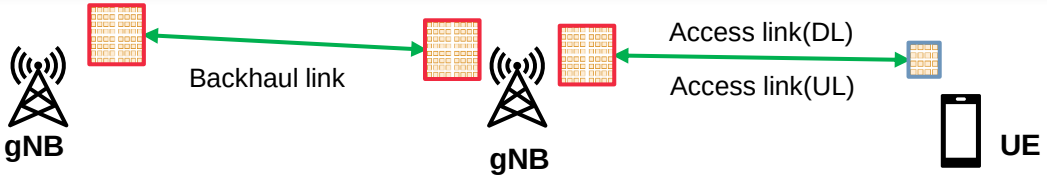

Fig. 5 Deployment configurations

Radio Parameters	Backhaul link		Access link (Downlink)		Access link (Uplink)
Communication parameters	Frequency = 300GHz, Signal BW = 4GHz, Noise Figure (NF) = 15 dB, Link Margin = 10dB				
Modulation/data rate	QPSK/6.5Gbps	64QAM/19.5Gbps	QPSK/6.5Gbps	64QAM/19.5Gbps	QPSK/6.5Gbps
Distance	1,278m	245m	319m	61m	44m
# of Tx Ant. elements (Antenna Array size)	32×32 (1.6×1.6cm^2)		32×32 (1.6×1.6cm^2)		8×8 (0.4×0.4cm^2)
Tx Antenna Gain	35dBi		35dBi		23dBi
# of Rx Ant. elements (Antenna Array size)	32×32 (1.6×1.6cm^2)		8×8 (0.4×0.4cm^2)		32×32 (1.6×1.6cm^2)
Rx Antenna Gain	35dBi		23dBi		35dBi
Tx Half power beam width	3.2°	3.2°	3.2°	3.2°	12.7°
RF Power	30dBm	30dBm	30dBm	30dBm	13dBm
Rx. NF	15dB	15dB	15dB	15dB	15dB

Table. 1 Radio Parameters

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Proposals

- Sub-THz frequencies can be used for backhaul links and access links.
- Begin an early-stage study of Sub-THz use cases, deployment scenarios and requirements in Rel-19 and later.
- We suggest RAN plenary-level study in Rel-19, which will hopefully trigger RAN WG-level study in later releases.

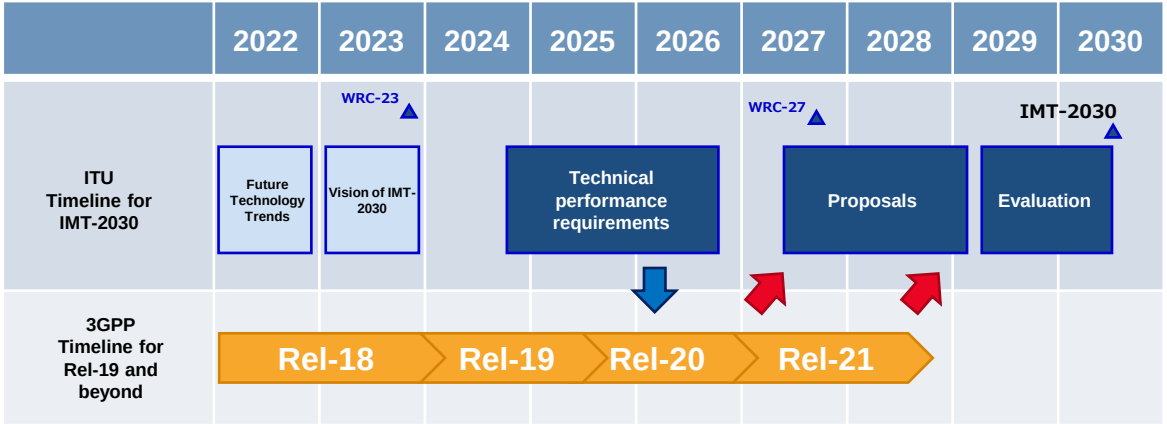

Fig. 6 Timelines of ITU and 3GPP

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