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Nokia Networks

5G Requirements

Plan and timeline for ITU-R and 3GPP minimum technical performance requirements

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ITU-R and 3GPP developed requirements documents for IMT-A/LTE-A

Similar process to be followed for IMT-2020 / 5G

3GPP TR 36.913 ToC

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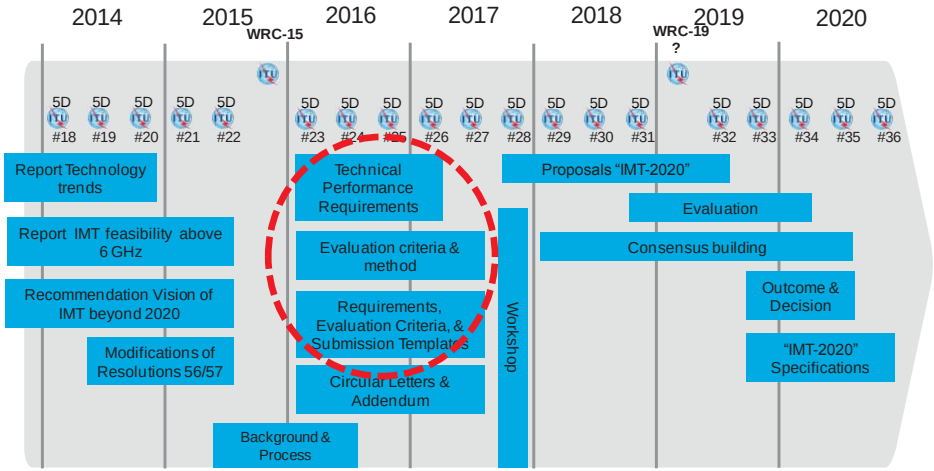
ITU-R process and schedule for [IMT-2020]

The ITU-R requirements need to reflect the practical needs of the industry

ITU-R should consider commercial use cases and requirements (NGMN) and spectrum needs

Industry should actively contribute to WP5D to ensure meaningful requirements and evaluation criteria & methodology



Preliminary understanding on ITU-R evaluation criteria and scenarios	Preliminary understanding on achievable performance criteria	Detailed development of the ITU-R requirements and evaluation criteria	ITU-R WP5D document finalization
End of 2015	**Mid-2016**	**2H2016**	**1H2017**

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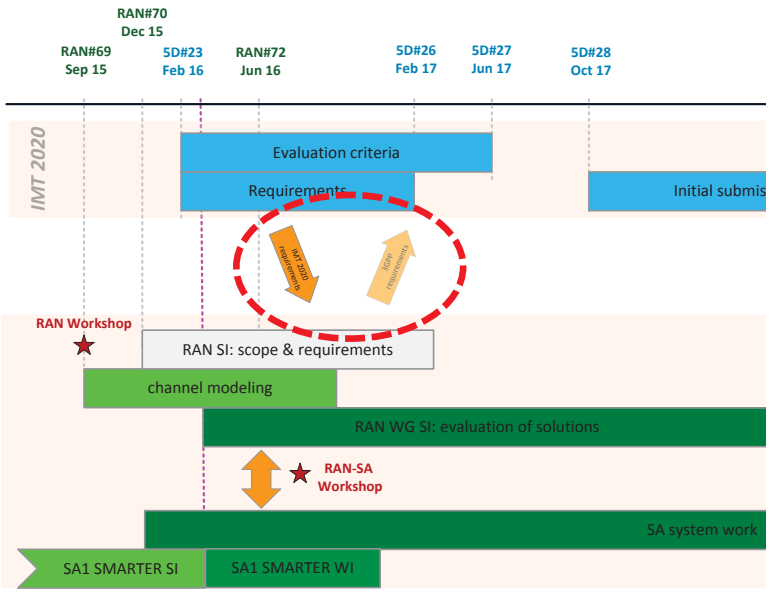
3GPP 5G time plan for requirements



3GPP and ITU-R requirement development progress in parallel

3GPP requirements TR structure in place **End of 2015**	Preliminary understanding on ITU-R evaluation criteria and scenarios **End of 2015**
Preliminary understanding on achievable performance criteria **Mid-2016**	Preliminary understanding on achievable performance criteria **Mid-2016**
Detailed development of the 3GPP requirements **2H2016**	Detailed development of the ITU-R requirements and evaluation criteria **2H2016**
Requirements TR finalization and review against ITU-R req's **1Q2017**	ITU-R WP5D document finalization **1H2017**

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ITU-R and 3GPP requirement work focuses on defining what is 'Full 5G'

Initial commercial deployment requirements a subset

5G requirements define the system taking us past 2030
First deployments need only the subset

Phase 1

Driven by the commercial timeline (NGMN)

- *Commercial system ready in 2020*
- *Standards ready end of 2018*

First specification and deployment phase does not need to meet all the 5G requirements defined by ITU-R and 3GPP

Phase 2

Driven by the ITU-R submission schedule

- Specification ready for submission in 2019

3GPP SRIT submission to ITU-R must fulfill all the 5G requirements defined by ITU-R and 3GPP

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Standardization timeline

5G timing and phasing – applicability to 3GPP release timeline

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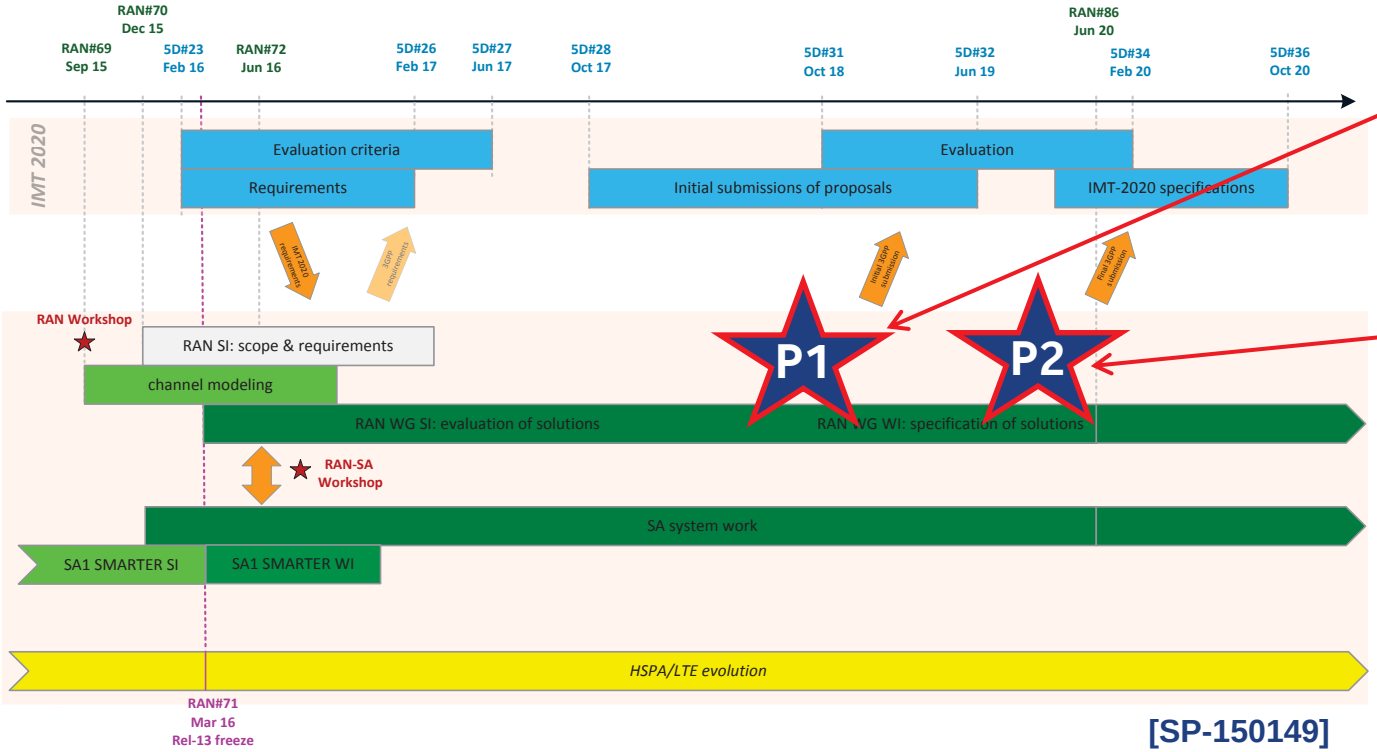
3GPP timeline and 5G phasing

Phase 1 for 2020 deployment, Phase 2 for 2022/2023 and final ITU-R submission



[SP-150149]

Phase 1 specifications should be completed in 2018

Phase 2 specifications should be completed in 2019

How to map the 5G timing and phasing to 3GPP releases?

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5G Spectrum

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Some Spectrum & Regulatory Updates

CEPT ECC has 5G in their 5 year strategic plan

- In order to make future-proof decisions on 5G spectrum, information is needed about current usage and incumbents' future plans, not just allocation.
- CEPT wide study process and analysis is needed

CEPT activities towards WRC-15 AI10 ECC (PT1 & CPG PTA)

- In ECC PT1 has done a response to PTA on >6GHz spectrum
- PTA is currently working on CEPT common proposal related to WRC-19 Agenda Item on 5G spectrum

FCC released >24GHz Notice of Inquire (NOI)

- Covers technology developments, specific bands above 24GHz and licensing mechanisms
- Comments filed
- **Recommend** industry coordination when responding to FCC NOI and adding justifications to also include bands below 24 GHz

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Assessment of frequency ranges / bands 6 – 100 GHz

Principal approach could be:

1- main focus is to study bands that have MS allocation

2- also bands that do not have MS allocation may be studied

3- some specifically listed passive bands could be excluded

Some possible criteria for selecting suitable frequency ranges/bands:

1. Potential for global harmonisation
2. Preference to MS allocated bands
3. Non-MS allocated bands may also be studied
4. Minimum BW requirement per network
5. Availability of spectrum for deployments at year 2020 time frame
6. Spectrum aspects to be studied in detail in the next ITU-R study period
7. Passive bands may be excluded
8. Spectrum allocated for FS and MS could be for both mobile access and backhaul operations

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WRC-19 preparatory scenarios

Approach A: AI for bands 6…100 GHz

Has some Administrations' support, even for including sub-6 GHz bands

Concern that if the AI is too vague no AI is opened at all "go home and think more and come back next WRC"

Concern that a generic AI will lead to another JTG-type setup

Approach B: AI with specific band ranges

Better chance to get the AI and avoid another JTG

More Administrations likely to support the AI

Less opposition from the other industry camps

Studies will be easier to be carry on

However, some good candidate bands may get excluded when no proper studies carried out before exclusion

Every band has an incumbent that wants just that band to be excluded from the studies

"to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, in accordance with Article 7 of the Convention"

WRC-15 AI10

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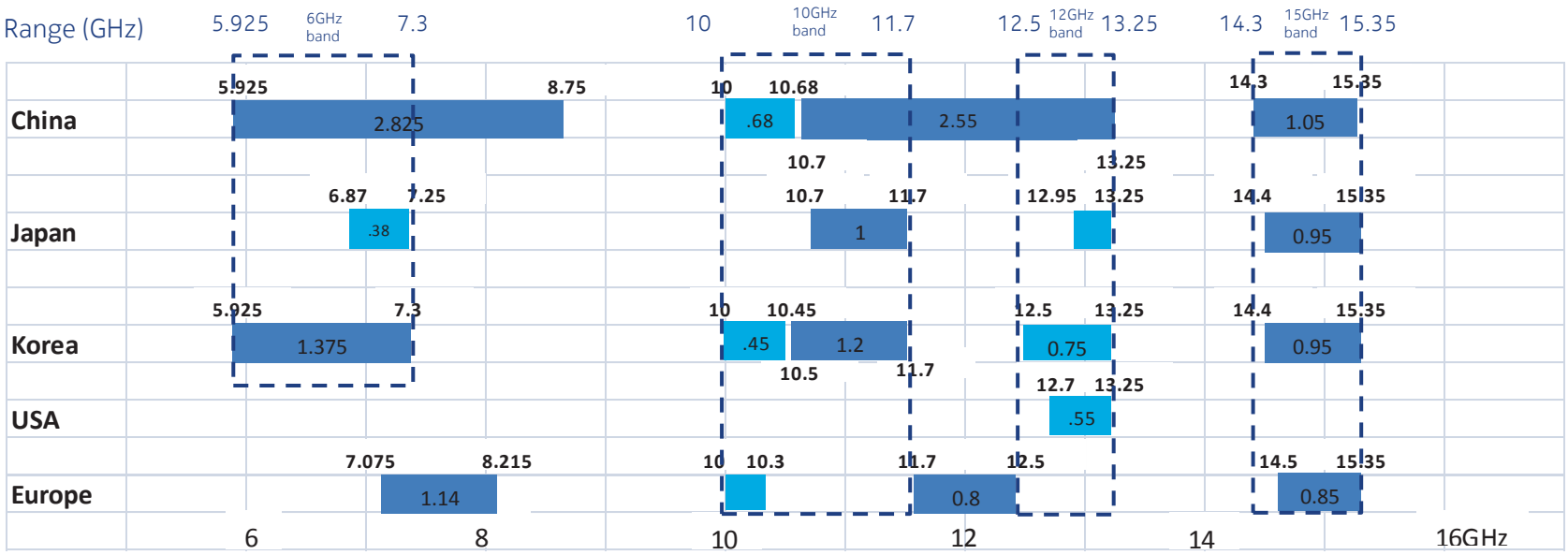
Mapping Bands to 5G Requirements

6-16GHz, Co-Primary Mobile Allocation, min. 300MHz Contiguous Spectrum



High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz.

High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz & Spectrum Sharing among operators

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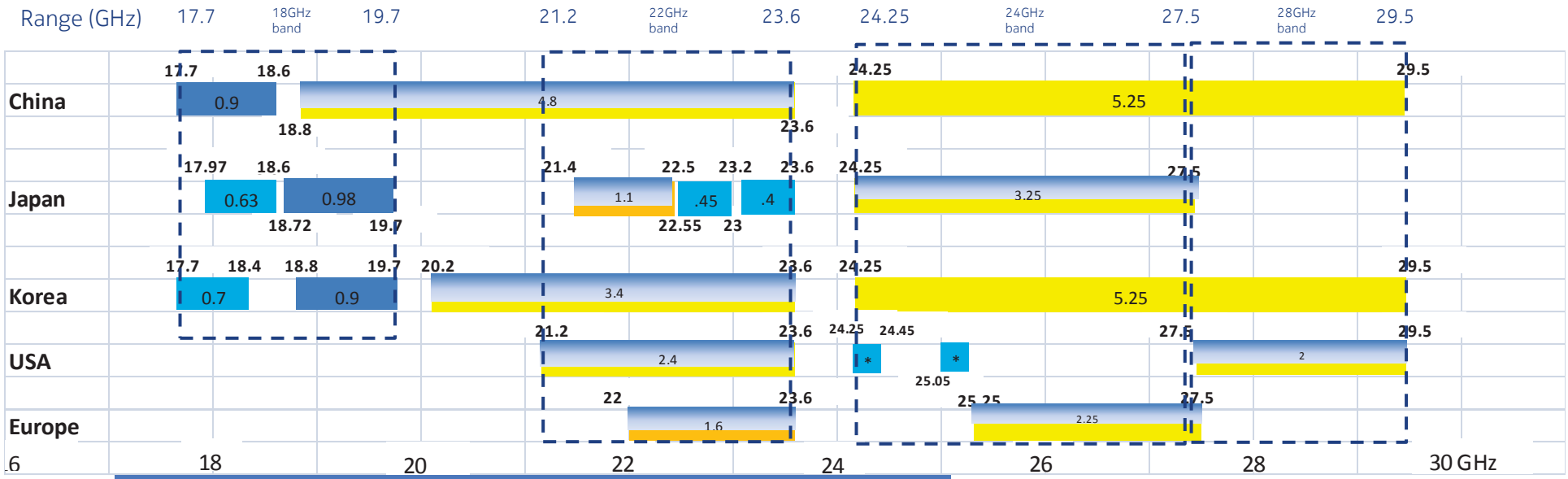
Mapping Bands to 5G Requirements

16-30GHz, Co-Primary Mobile Allocation, min. 300MHz Contiguous Spectrum



High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz.

High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz & Spectrum Sharing among operators

Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes

Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes & Spectrum Sharing among operators

* 24GHz Band with No Mobile Allocation being considered by FCC

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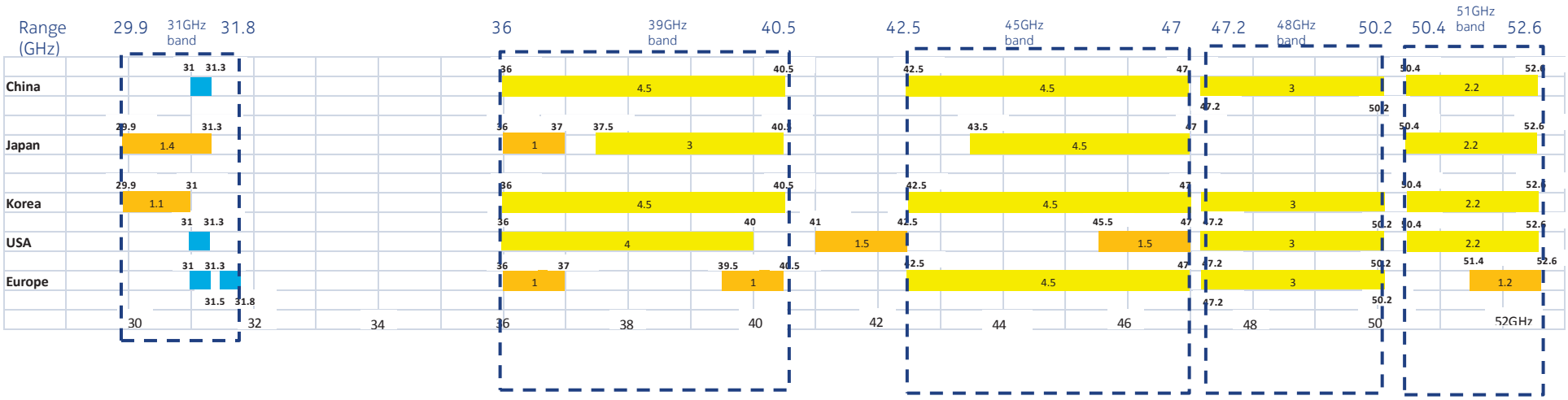
Mapping Bands to 5G Requirements

30-54GHz, Co-Primary Mobile Allocation, min. 300MHz Contiguous Spectrum



High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz.

High rank MIMO (SU/MIMO) and CA, Interference Management schemes for system BW < 400 MHz & Spectrum Sharing among operators

Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes

Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes & Spectrum Sharing among operators

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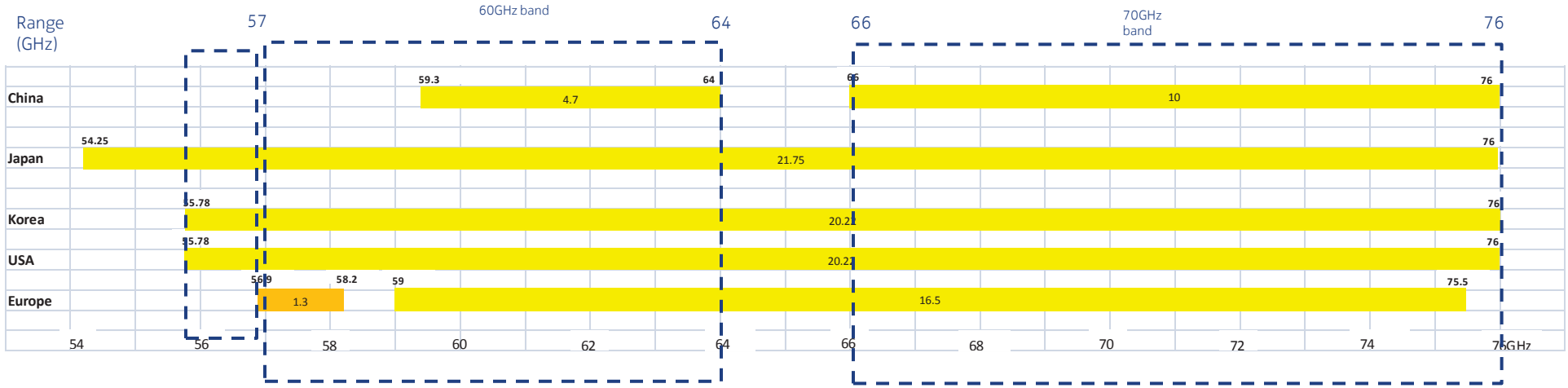
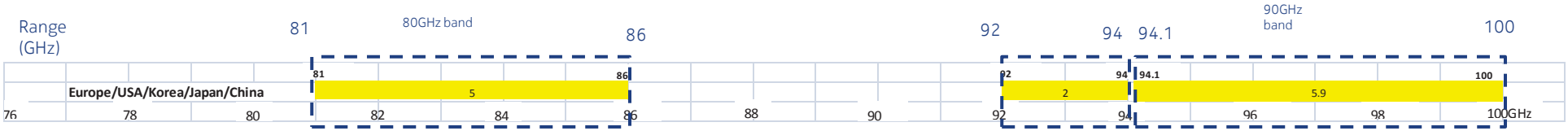
Mapping Bands to 5G Requirements

54-100GHz, Co-Primary Mobile Allocation, min. 300MHz Contiguous Spectrum





Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes

Low rank MIMO for system BW in excess of 1 GHz with no interference management schemes & Spectrum Sharing among operators

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Technical Rules

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Emission (1)

- We are assuming approximately a maximum +30dBm EIRP for mobile units which can serve as an initial guidance to the Commission. Phased array solutions with integral antennas are likely in mmW bands. Therefore, it would be appropriate to define EIRP limits but also allow them to be not only measured but also calculated based on independent measurements of Transmit Output Power and antenna gain. Both spectral density and aggregate channel power values are pertinent to the assessment of incumbent service protection.

- The Commission's proposed attenuation of 43+10log(P) for out-of-band emissions (OOBE) should be appropriate since it should be feasible to obtain such levels without filtering and filtering on small chip scale phased arrays is quite difficult. However, we assume that this is the emission at the transmitter output and not EIRP with antenna gain. These OOBE limits could be specified on a per beam basis, at the boresight of the beam but side lobes also need to be considered.

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Emission (2)

- Phased array systems with beams steered to each user on a TDMA basis will help mitigate overall harmful interference between licensees in adjacent geographic areas using the same frequency bands. Therefore, we believe that at this stage there is no need to establish Power Flux Density (PDF) limits at the boundaries of license areas to prevent harmful interference. The coexistence between licensees could be managed by coordination and technology without the Commission regulating PFD or other types of limits. If this does not work, then the Commission could introduce some hard PFD limits in the rules.

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