

March 17, 2021

Tokyo

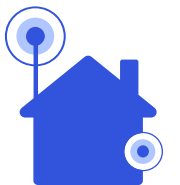
Qualcomm

Usage of New Wireless Broadband Technologies

Masakazu Shirota

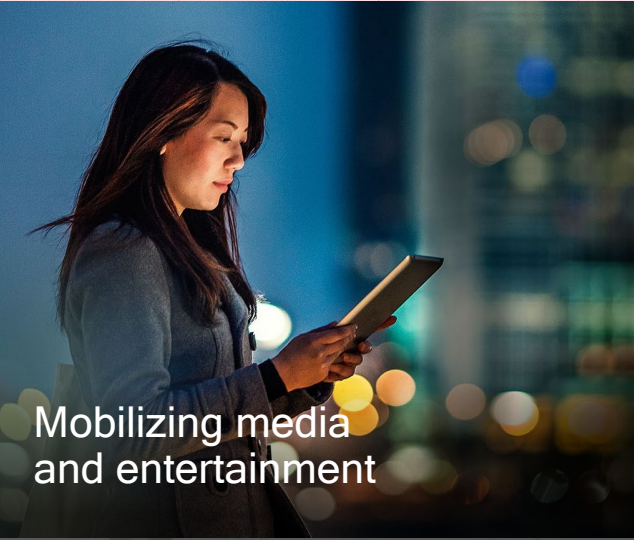
Senior Director, Technical Standards

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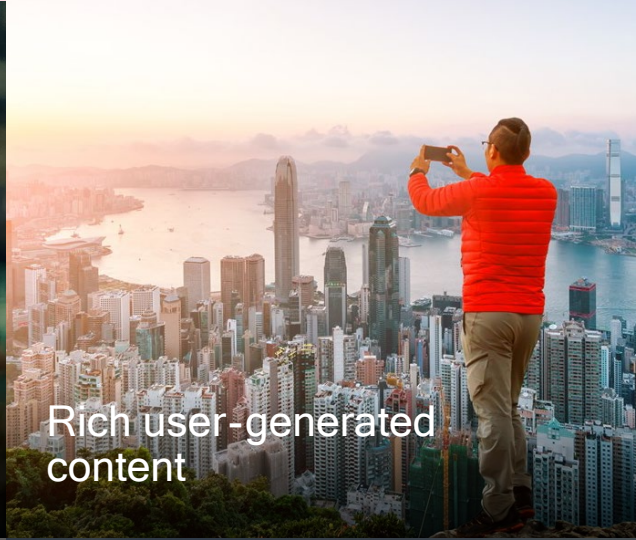


Agenda:

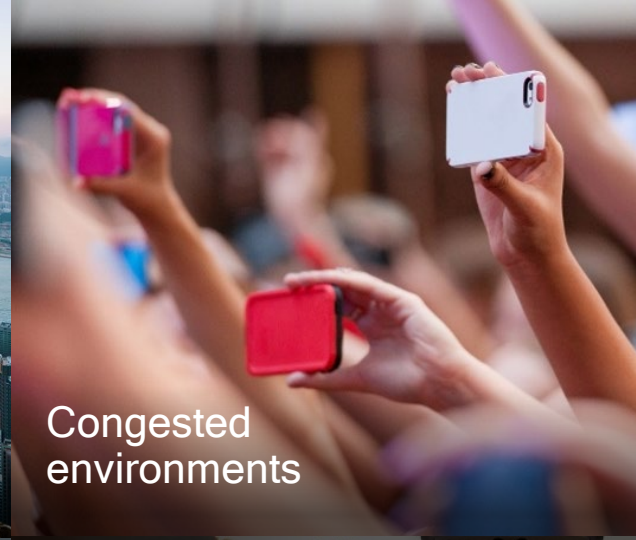
1. A Solution for 5G mmW Certification
2. WLAN (Unlicensed Radio Access) new spectrum



Mobilizing media and entertainment



Rich user-generated content



Congested environments



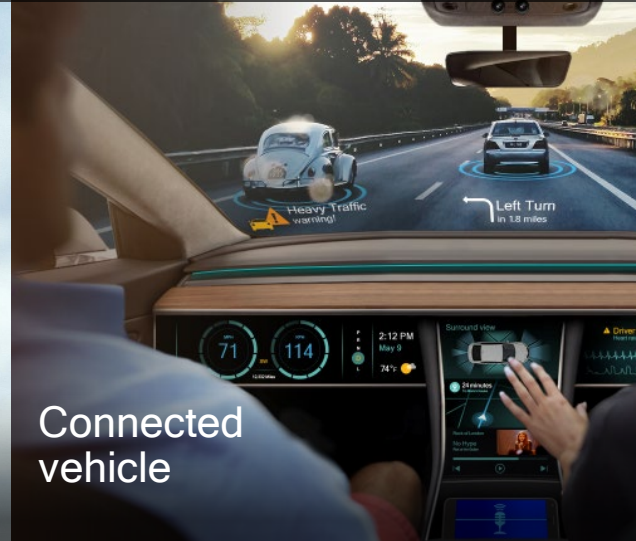
High-speed mobility



Connected cloud computing



Immersive experiences



Connected vehicle



Augmented reality



5G is essential for next generation mobile experiences

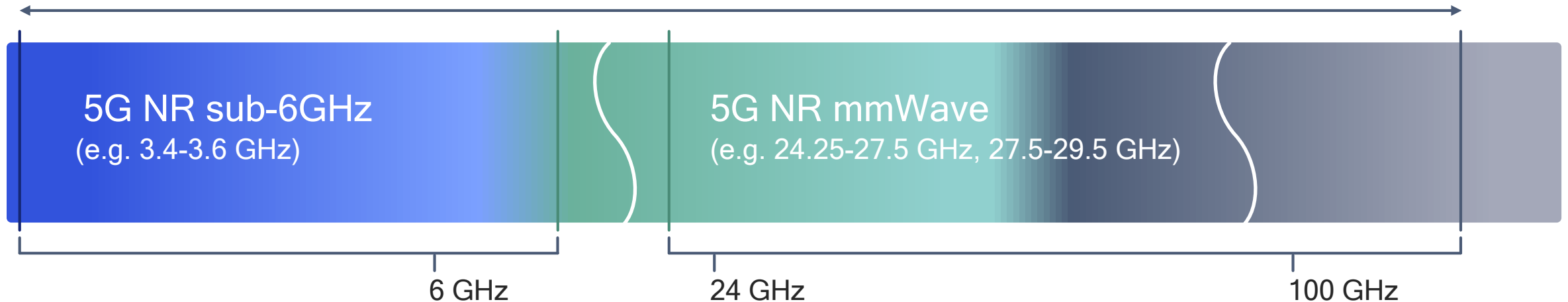
- Fiber-like data speeds
- Low latency for real-time interactivity
- More consistent performance
- Massive capacity for unlimited data

The large bandwidth opportunity for mmWave

The new frontier of mobile broadband



Unified design across diverse spectrum bands/types



Multi-Gbps data rates

With large bandwidths (100s of MHz)

Much more capacity

With dense spatial reuse

Excels in wider bandwidths

Opens up new opportunities

RF Exposure Compliance for 5G Devices with mmWave



Background

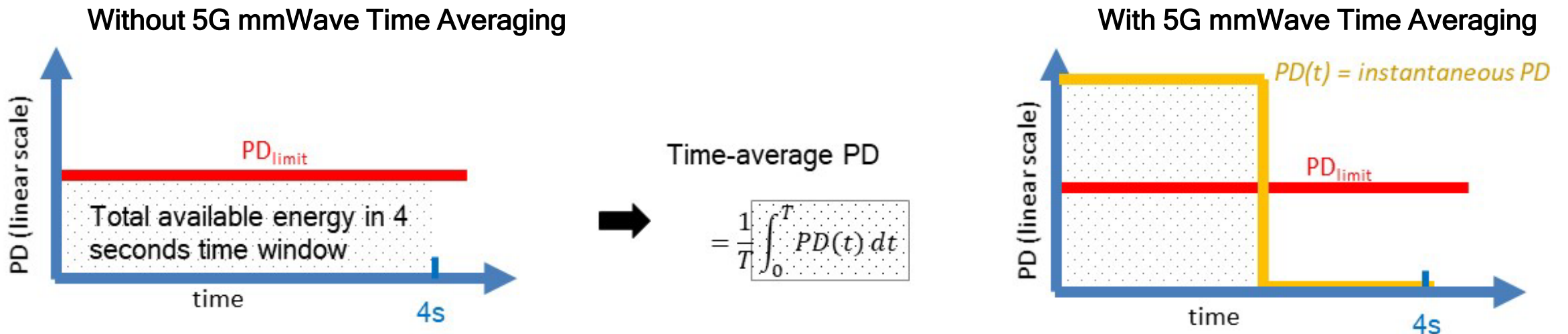
- All devices must comply with RF Exposure Regulatory limits
- 5G devices will include capabilities for 2G, 3G, 4G and 5G sub 6(FR1) + mmWave (FR2) capabilities
 - Sub 6Ghz radios must comply with SAR requirements
 - FR2 MPE compliance is based on power density(PD) measurements
- 5G devices will have to comply simultaneously with SAR and PD limits
 - Ensuring compliance based on maximum UE Tx power (static condition) leads to low Tx power and loss in system coverage/throughput
 - UE Tx power is set to a level that would ensure RF exposure compliance if the UE would be transmitting at maximum UL duty cycle (e.g. 100%) $P_{\text{limit}} = \text{Peak Tx power limit (peak power capped)}$
- RF exposure limits are defined as time averaged exposure, i.e. total radiated energy within a certain time window (e.g. average exposure over 6 minute window for sub 6GHz radios)
 - UE in data call is inherently bursty in its transmit profile within a given this time averaging window
 - UE can transmit at higher peak power when considering time averaged exposure, i.e., $P_{\text{limit}} = \text{Maximum Average Power}$

Qualcomm's Solution

- Qualcomm developed a system level feature – Qualcomm® Smart Transmit™ - that enables real time management of radio transmissions to meet RF exposure regulatory while optimizing UE uplink performance.
 - The Qualcomm® Smart Transmit™ feature monitors RF transmissions across all active WWAN radios (2G,3G,4G,5G) in real time and does power enforcement only when the total energy budget has been reached.
 - FCC has established a testing methodology to demonstrate compliance of devices using time averaged approach i.e. Qualcomm implementation is tested using these procedures.
 - Other countries also confirmed this solution can comply with their regulation.

Regulatory Requirements; an Input into Device Design

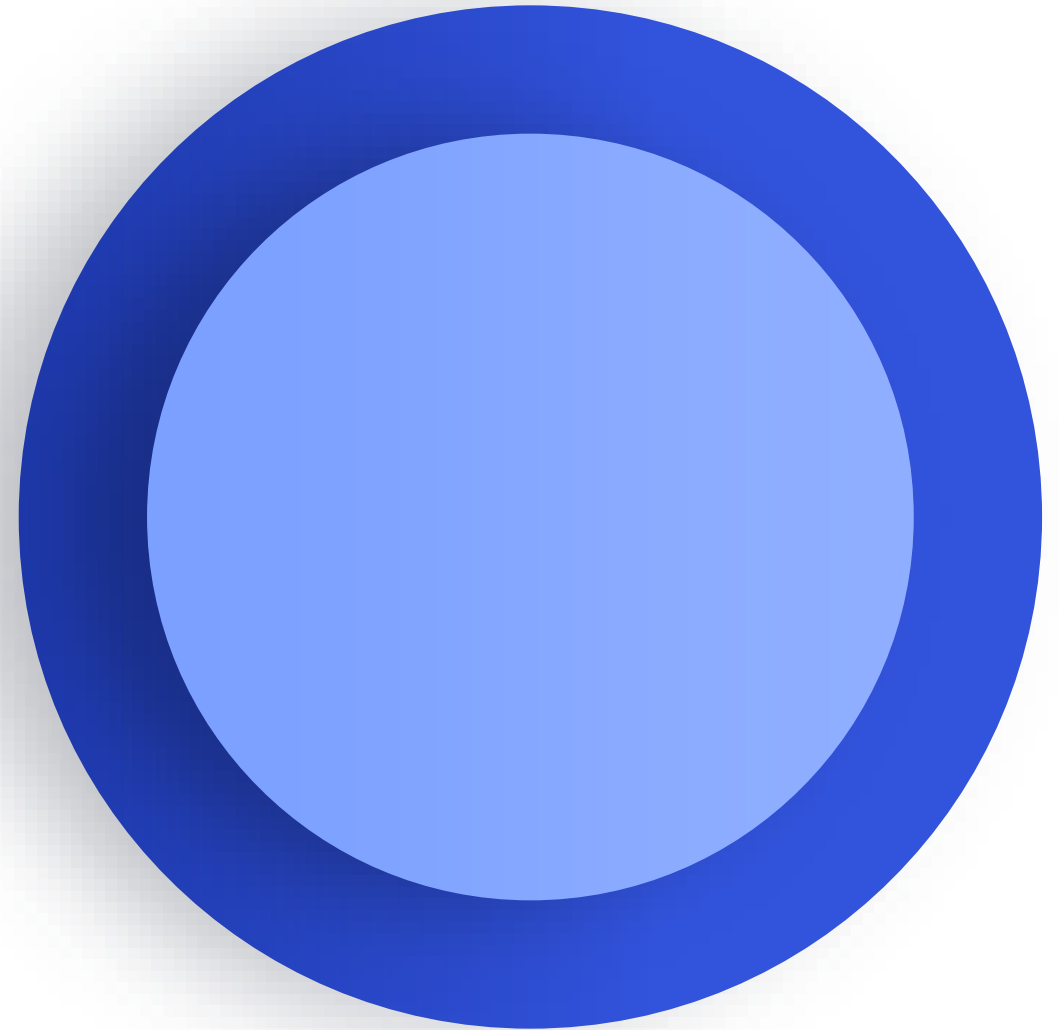
- The RF exposure limits worldwide have always been time averaged exposure based (i.e. thermal effects)
 - Worldwide regulations define time averaging limits using ICNIRP guidelines (A revision of the current ICNIRP guidelines on RF is underway.)
 - FCC revised guidance in October 2018 and defined time window(s) for the existing time averaged RF exposure limits that could be applied to portable devices that have time averaging capability
- The OEM has a choice to design for compliance using time averaging or use the legacy approach that has been in place for 20+ years (power back off look up tables)
- With time averaging the legacy max peak power limit effectively becomes a maximum average power limit



Certification for Qualcomm[®] Smart Transmit[™] in Japan

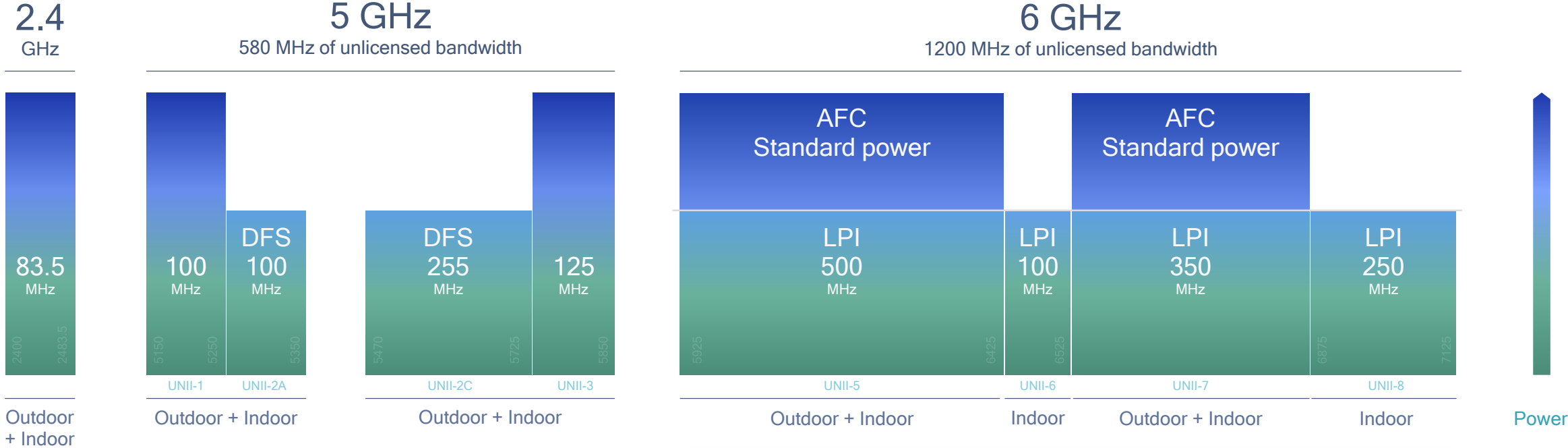
- Japan uses ICNIRP regulation for mmW RF exposure limit. It allows 6 min averaging.
- Japan allows certification bodies to verify radio equipment functionality by design document prepared and submitted by applicant, and to assume normal operation conditions, i.e., averaging engaged.
 - OEMs can show expected average power under normal operation based on Smart Transmit[™] by using design document.
 - Certification bodies may also decide if certification can be given by evaluating FCC Part 2 equivalent test results performed by OEM.
- This understanding has been shared with MIC.
- 5G devices have already been certified in Japan.

WLAN (Unlicensed Wireless Access) New Spectrum





6 GHz brings new unlicensed bandwidth for Wi-Fi and 5G

United States Allocation



1200 MHz

A massive amount of new unlicensed spectrum is also now available in some other regions for Wi-Fi 6E and 5G (NR-U in 3GPP Release 16)

New Unlicensed Spectrum in 6 GHz

- The 6GHz spectrum, spanning from 5925 MHz to 7125GHz, is currently under investigation in many regions to open band for unlicensed operations on a technology neutral basis.
- Several countries have already allowed unlicensed operation in the entire 6 GHz band or partial band. 1200 MHz is available in US, Korea and Chile. 500 MHz is allowed UK and EU.
- The major incumbents that need to be protected are: Fixed satellite UL, fixed P2P links, broadcast FPU-type services. The spectrum access concept is via sharing with incumbents and does not require relocation or band clearance.
- Industry views:
 - Large number of Japanese and global ICT companies support opening this band.
 - Wi-Fi Alliance and Dynamic Spectrum Alliance have been actively promoting use of this band for next-generation Wi-Fi. (Note: Wi-Fi Alliance has 108 members with Japanese HQ)
 - GSMA, ETNO and Some network operators favor IMT identification, i.e., licensed spectrum primarily in upper 6 GHz.
- Different regions have different position in terms of whether some portion of the band should be identified for IMT, i.e., licensed services:
 - Note: ITU WRC-19 called for “sharing studies” of 7025-7125 MHz on a global basis and 6425-7025 MHz in Region 1
 - Lower part of spectrum (5925 – 6425 MHz) will be most likely unlicensed spectrum in majority of regions/countries

Global Status (US and Korea)

- **US**

- FCC approved the new rules for 5925 – 7125 MHz on April 24, 2020.
- Technology neutral manner (both IEEE 802.11 and 5G NR-U are allowed.)

- **Korea**

- Korea organized a new Research Group to study unlicensed use in 5925-7125MHz.
- Technical regulation was ruled on October 16, 2020.
- Expected Timelines:
 - Wi-Fi certification starts on December 14th in 2020 by TTA.
 - Commercial products in market in early 2021.
- Second phase of studies addressed higher power for LPI, VLP in upper 6 GHz, and co-existence with ITS applications. Study plans and these schedules are TBD.

LPI: Low Power Indoor

VLP: Very Low Power

SP: Standard Power

Global Status (Europe)

- **European Commission** Mandate on 6 GHz (5925-6425 MHz; lower 6 GHz) issued 6th December 2017 “*Mandate to CEPT to study feasibility and identify harmonised technical conditions for Wireless Access Systems including Radio Local Area Networks in the 5925-6425 MHz band for the provision of wireless broadband services*”
 - **ECC SE45** published coexistence studies (fixed service, fixed satellite service, and urban rail).
 - Sharing generally possible (low power indoor, very low power portable).
 - Higher power outdoor (aka USA “standard power”) not studied, therefore, not currently allowed.
 - **ECC FM57** developed draft CEPT Report and draft ECC Decision(20)01.
 - Resolution meeting was inconclusive on how to protect urban rail.
 - Issues passed to ECC WGFM to approve CEPT Report and ECC Decision
 - **ECC WGFM** 22nd October 2020 approved CEPT Report and ECC Decision(20)01 on WAS/RLAN LPI and VLP modes at 6 GHz.
 - **ECC Plenary** November 2020 adopted for publication ECC Decision (20)01 on “Harmonized use of the frequency bands 5 945 to 6 425 MHz for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)”
- **European Commission** to agree an EC Decision – likely March 2021
- **UK** decision in July to allow LPI and VLP unlicensed operation in the lower 6 GHz.
- **Administrations** to enable access to lower 6 GHz (hopefully) Q1/2021 onwards once rules in National Law

- **ETSI** standard EN 303 687 being developed – waiting on the regulations
 - March 2023 is earliest date for EN 303 687 citation in European Union Official Journal (EUOJ)
 - Stable draft by end of 2020 to enable national body approvals

Japan Status




- Frequency Reorganization Action Plan issued by MIC in 2020 has the following plans with respect to WLAN spectrum.
 - Study on 5925 MHz to 7125 MHz
 - 5.2 GHz in-car WLAN use as per WRC-19 result
- Studies have already been started.
- ARIB WLAN System Development Working Group has also developed their requirements on 6 GHz new band for WLAN.

Global Status (Other regions)

- **Taiwan**
 - Released consultation on 6 GHz (August 2020), responses submitted.
- **Brazil**
 - Final consultation released in December 2020.
 - 1200 MHz LPI & VLP
- **Mexico**
 - 1200MHz consultation is released; targeting LPI, VLP and SP.
- **Costa Rica**
 - 1200MHz consultation released.
- **Peru**
 - Consultation released.
- **Chile:**
 - 1200 MHz authorized for LPI (Nov 2020).
 - VLP and SP to be decided.
- **Saudi Arabia**
 - Consultation issued in September 2020.
- **India**
 - Technical work in standards groups started.
- **Colombia**
 - Consultation released December 2020.
- **Australia**
 - 6 GHz included in 5-year spectrum outlook.
- **Canada**
 - ISED consultation issued; mostly align with US rules.
- **Argentina**
 - Consultation is released.
- **Honduras**
 - Consultation is released.
- **Jordan, Vietnam, Myanmar**
 - Consultation issued.
- **China**
 - No public discussion, prefers IMT.



Thank you!

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