Jitendra Singh,
Senior Director, Government Affairs Qualcomm (India & South Asia)
India Head, GSA

AI 1.13 : Mobile Industry Perspective

12th June, 2019

jitendra@qti.qualcomm.com

1 Introduction

2 Facts and Figures

3 DoT's Philosophy and Initiatives

4 AI 1.13

5 Summary

Presentation Outline

Mobile Technology Made Leap Every ~10 years

1G

Analog voice

AMPS, NMT, TACS

1980s

2G

Digital voice

D-AMPS, GSM, IS-95 (CDMA)

1990s

3G

Mobile broadband

WCDMA/HSPA+, CDMA2000/EV-DO

2000s

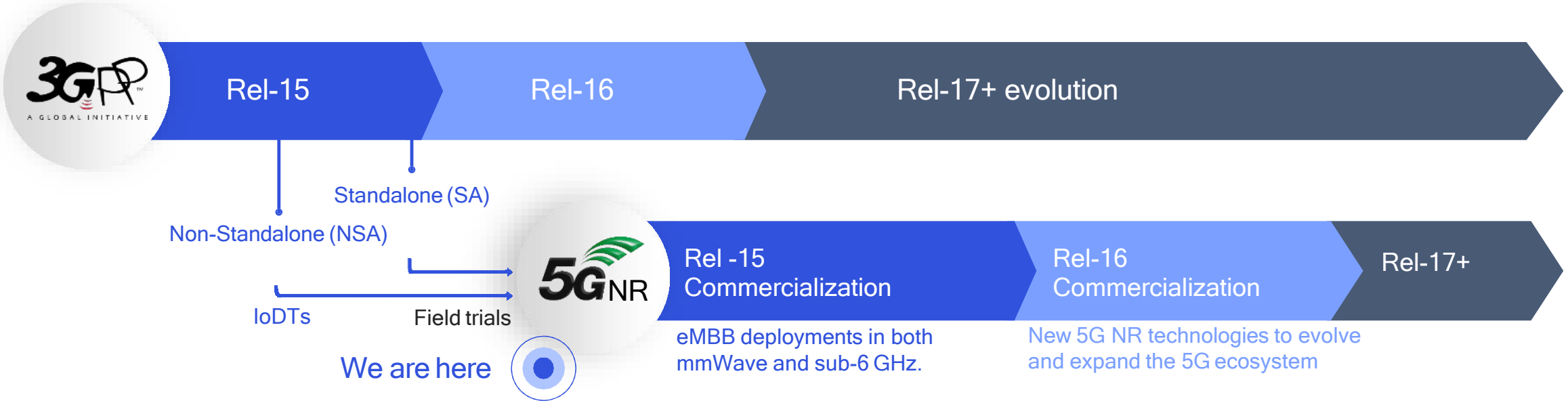
4G

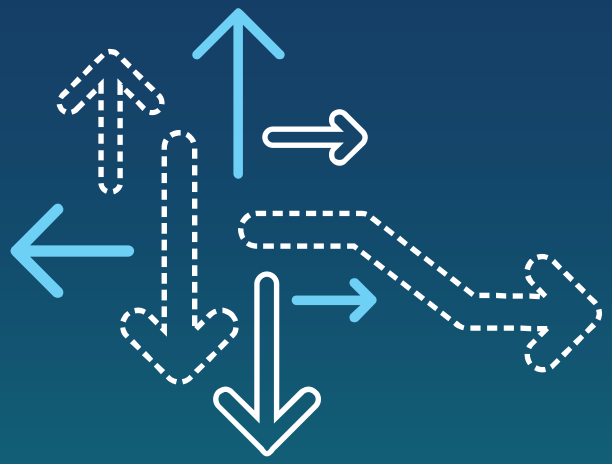
Faster and better MBB

LTE, LTE Advanced

2010s

5G : Standardization and Roadmap





5G : Facts and Figures

Connections and Networks

- Total cellular connections ~7.8 billion *(GSMA Intelligence, Apr 19)*
- 5.1 billion unique subscribers as of Q1’19 *(GSMA Intelligence, Apr 19)*
- Expected to grow to ~8.7 billion with ~5.6 billion unique subscribers by end of 2023 *(GSMA Intelligence, Apr 19)*
    - (excluding licensed cellular IoT)
- 227 operators in 90 countries have been investing in 5G *(GSA, Apr 19)*
- 15 operators have announced limited 5G service launches *(GSA, Apr 19)*
- 27 have turned on 5G base stations but not yet launched commercial services *(GSA, Apr 19)*
- 185 operators in 83 countries have demonstrated/testing/trialing/licensed to begin field trials/deploying 5G *(GSA, Apr 19)*
- 91 operators in 52 countries have announced their intentions to make 5G available between 2018 and 2022 *(GSA, Apr 19)*

The Traffic Flow

- In China, as of Aug 18, 788 Mn accessing internet via mobile, accounts for 98% of Chinese netizen population *(CNNIC, Jan. '19)*
- China users spend, on average, 200 Bn hours on apps, 4.5 times longer than India *(CNNIC, Jan. '19)*
- Nearly four-fifths of the world's mobile data traffic will be video by 2022 *(Cisco, Feb. '19)*
- Cisco Global Cloud Index 2016-2021 *(Cisco, Nov '18)*
    - Global cloud data center traffic is expected to reach 19.5 zettabytes (ZB) per year by 2021.
    - Global cloud data center traffic will represent 95% of total data center traffic by 2021, versus 88% in 2016
    - By 2021, video will account for 85% of traffic from data centers to end users, compared to 78% in 2016
    - By 2021, data stored on devices to reach 5.9 ZB, which is 4.5x higher than data stored in data centers
    - By 2021, largely due to IoT, total amount of data created will reach 847 ZB per year, up from 218 ZB per year in 2016

Artificial Intelligence

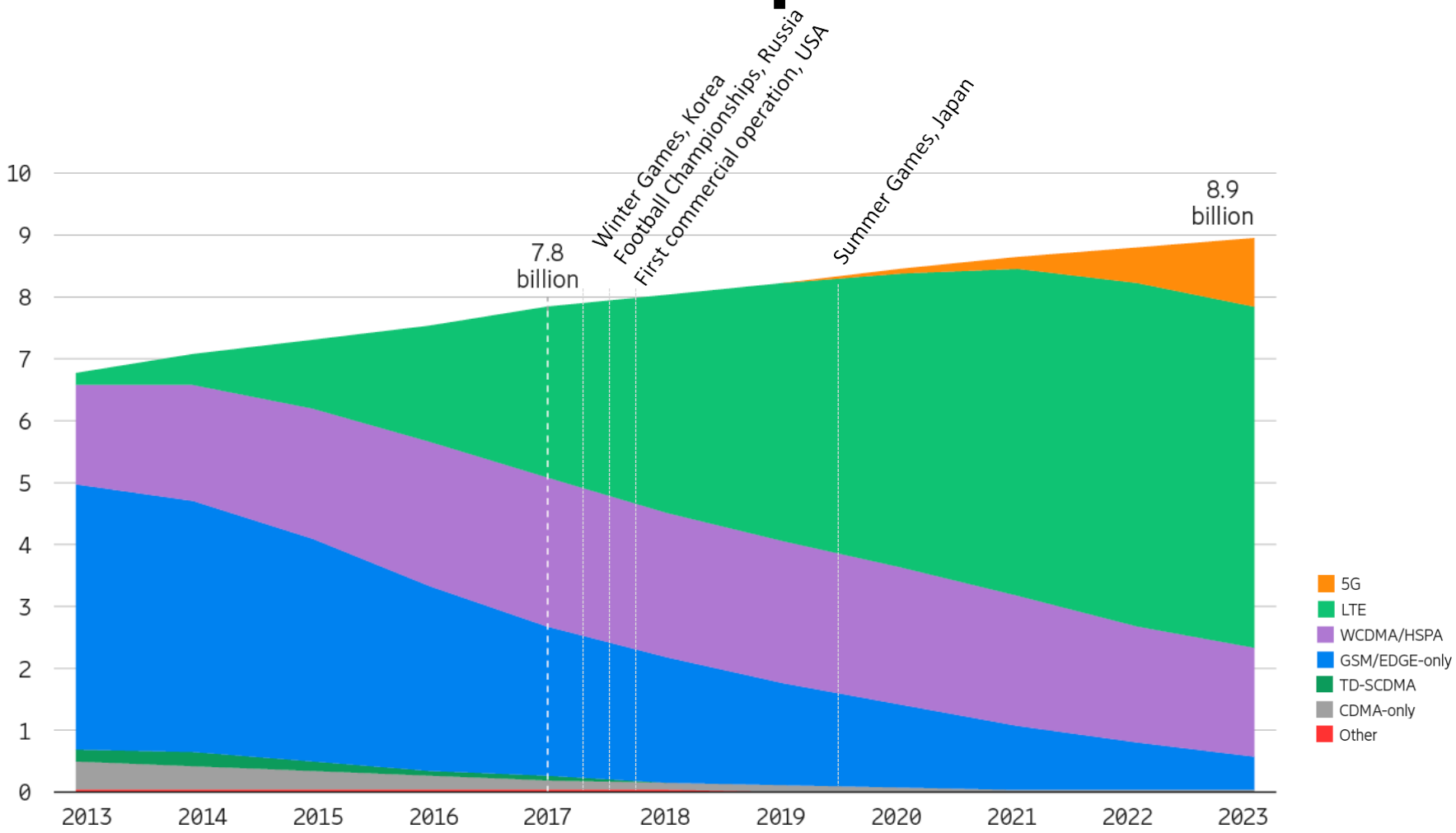
- By 2022, AI augmentation will create $3.9 trillion of business value *(Gartner, Apr. ’18)*
- By 2025, it is predicted that AI edge device attach rates will be 100%, up from 10% in 2018 *(Harbor Mar ’19)*
- Almost all device categories will have an AI processor in them *(Harbor Mar ’19)*
- China’s economy benefits most from AI, its GDP becoming 26.1% higher in 2030 (additional 7 trillion USD) *(PwC '18)*
  - North America: GDP growth due to AI by 2030 - 14.5% ($3.7 trillion)
  - Northern Europe: GDP growth due to AI by 2030 - 9.9% ($1.8 trillion)
  - Developed Asia: GDP growth due to AI by 2030 - 10.4% ($0.9 trillion)
  - Latin America: GDP growth due to AI by 2030 - 5.4% ($0.5 trillion)

The 5G Economy

- 5G's full economic benefit should be realized across the globe by 2035
- Broad range of industries –
  - retail to education,
  - transportation to entertainment,
  - and everything in between
- Production of ~$12 trillion worth of goods and services enabled by 5G
- 5G value chain alone could generate up to $3.5 trillion in revenue in 2035
- 5G value chain alone could support up to 22 million jobs
- Total contribution of 5G to real Global GDP growth is expected to be equivalent to a country like India
- By 2035, 5G will enable >$2.4 trillion in economic output across the automotive sector and its supply chain

Source : Penn Schoen Berland and Berkeley Research

1 Billion 5G Subscriptions in 2023



Note :IoT connections and Fixed Wireless Access (FWA) subscriptions are not included in this graph

5G in 2018

First commercial launches

A 5G subscription is counted as such when associated with a device that supports NR as specified in 3GPP Release 15, connected to a 5G- enabled network.

Source: Ericsson Mobility Report, June 2018

A Large Variety of New Advanced 5G Use Cases

Massive Machine Type Communication

- Smart meters
- Tracking
- Fleet management
- IoT

Critical Machine Type Communication

- Industrial applications
- Traffic safety and control
- Remote manufacturing

Enhanced Mobile Broadband

- Internet/applications
- VR/AR
- UHD Video
- New smartphones

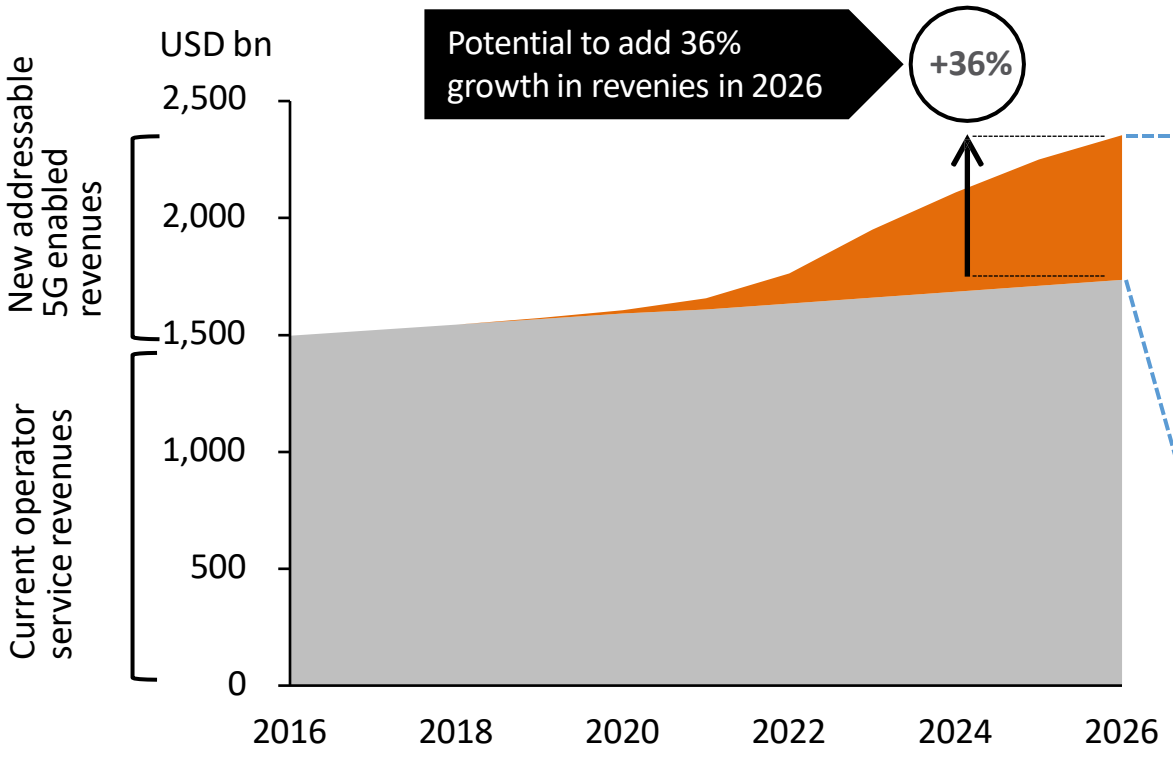
Fixed Wireless Access

- Stationary, portable and transportable
- Enterprises
- Home
- Replacing fiber access

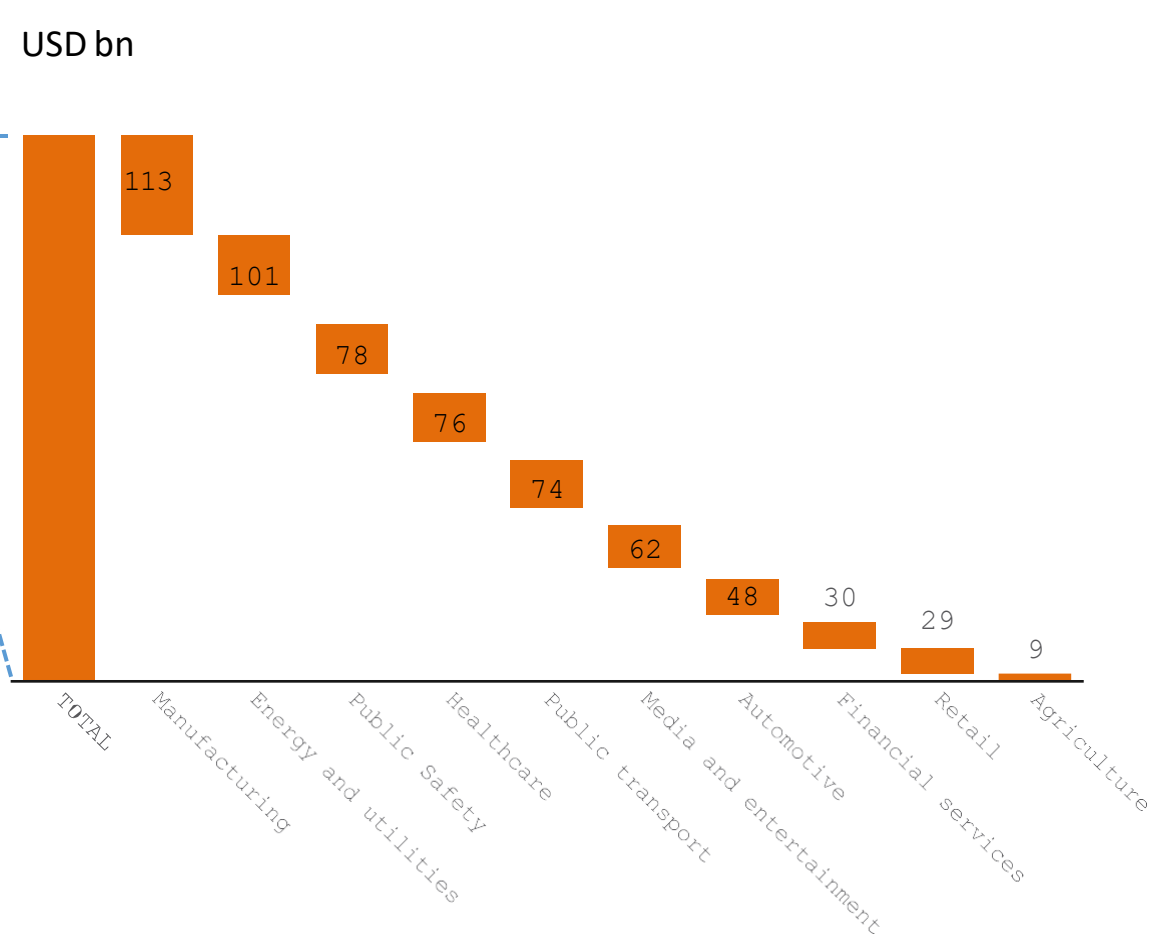
Source : GSA

Opportunity Addressing Different Verticals with 5G

Current and 5G addressable revenues



Split per vertical domain (2026)



Source: Ericsson Mobility Report, June 2018

5G : Ecosystem Developments

3GPP

- Initial standard (Release15) is completed
- Work ongoing on Release 16
- mmWave frequency bands specified, in addition to mid bands and low bands

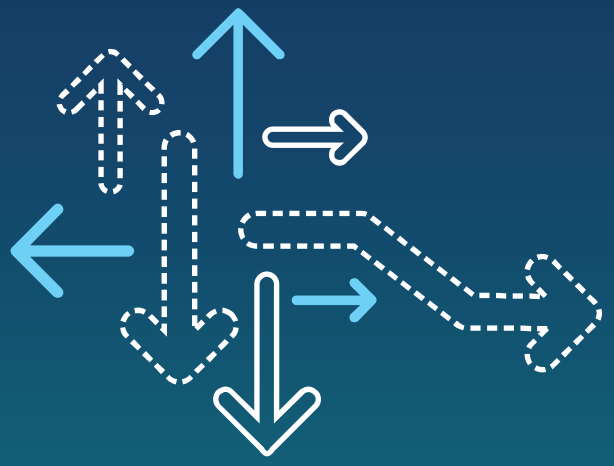
NR – mmWave (high bands)			
Band	Frequencies GHz	BW MHz	Duplex mode
n257	26.5 – 29.5	50 – 400	TDD
n258	24.25 – 27.5	50 – 400	TDD
n259	[40.5] – 43.5	50 - 400	TDD
n260	37.0 – 40.0	50 - 400	TDD
n261	27.5 – 28.35	50 – 400	TDD

Commercial equipment

- base stations, chipsets, routers are now available
- commercial deployments have commenced (e.g. Dec. 2018 in Korea)
- 5G smartphones launched during MWC-2019

Source : GSA

DoT’s Philosophy



National Digital Communication Policy 2018

Vision :

“To fulfil the information and communication needs of citizens and enterprises by establishment of a ubiquitous, resilient, secure and affordable Digital Communications Infrastructure and Services; and in the process, support India’s transition to a digitally empowered economy and society.”

National Digital Communications Policy - 2018

- Strategic Objectives by 2022 :
  - Provisioning of Broadband for All
  - Creating 4 Million additional jobs in the Digital Communications sector
  - Enhancing contribution of Digital Communications sector to 8% of India's GDP from ~ 6% in 2017
  - Propelling India to the Top 50 Nations in ICT Development Index of ITU from 134 in 2017
  - Enhancing India's contribution to Global Value Chains
  - Ensuring Digital Sovereignty
- To achieve Strategic Objectives by 2022 :
  - Mission 1: Connect India
  - Mission 2: Propel India
  - Mission 3: Secure India

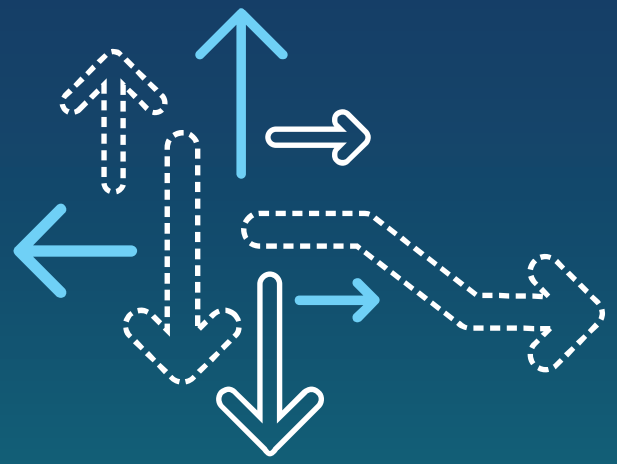
Mission : Connect India

- Universal broadband coverage at 50 Mbps to every citizen
- 1 Gbps connectivity to all Gram Panchayats of India by 2020
- 10 Gbps connectivity to all Gram Panchayats of India by 2022
- Enable fixed line broadband access to 50% of households
- ‘Unique Mobile Subscriber Density’ of 55 by 2020
- ‘Unique Mobile Subscriber Density’ of 65 by 2022
- Public Wi-Fi Hotspots to reach 5 million by 2020
- Public Wi-Fi Hotspots to reach 10 million by 2022

Mission Connect India : Key Strategies

- Establishing a ‘National Broadband Mission-Rashtriya Broadband Abhiyan’
  - To secure universal broadband access
  - Funded by USOF and PPP
  - Subdivided into
    - Bhartnet (connecting Gram Panchayats)
    - GramNet (connecting rural institutions)
    - NagarNet (establishing 1 Mn Wi-Fi Hotspots in urban areas)
    - Jan WiFi (establishing 2 Mn Wi-Fi Hotspots in rural areas)
- Implementing the ‘Fibre First Initiative’
- Establishment of National Digital Grid by creating National Fibre Authority
- Promoting ‘Next Generation Access Technologies’
- Recognizing suitable spectrum as central to India’s strategy for Next-Generation
- Promoting effective utilization of High capacity backhaul
- Accelerating Industry 4.0

India Technology Initiatives



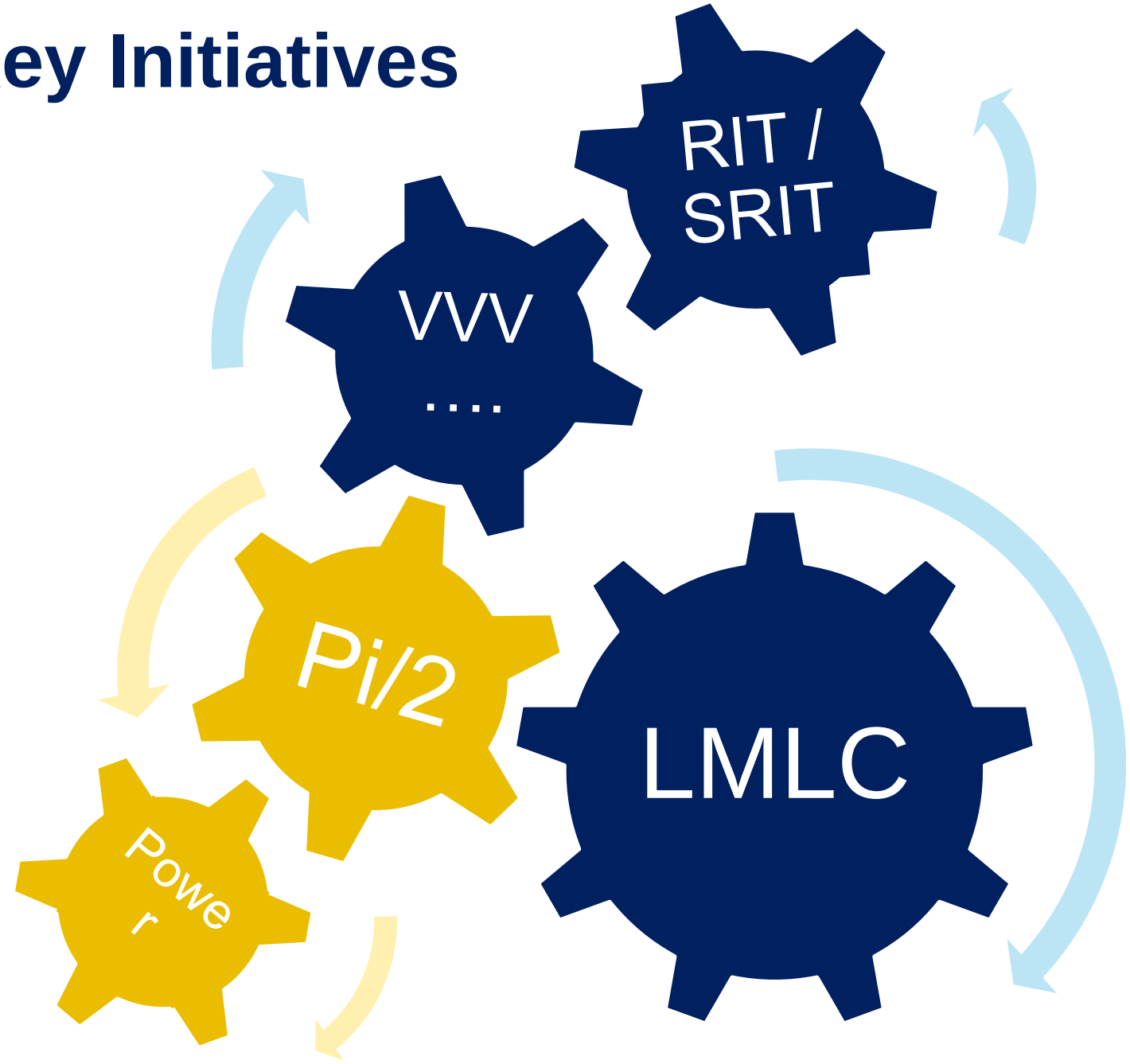
Some Key Initiatives

5G HLF

5G Industry Forum

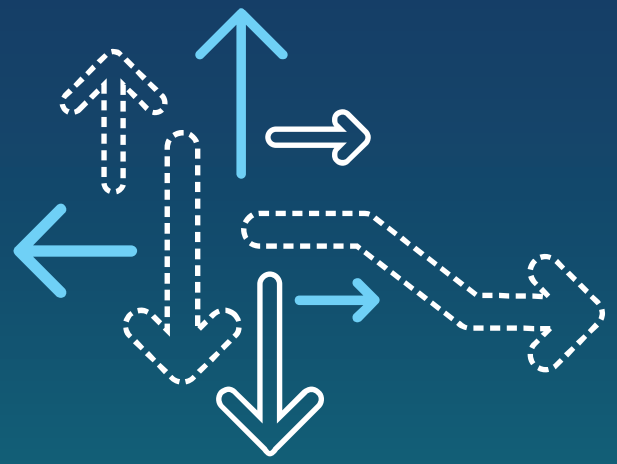
5G Trials

3GPP



WP5D

AI 1.13



Broadband Applications in the Mobile Service : PACP Views

Chapter 2 : Broadband Applications in Mobile Service

- **AI 1.13** : *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC 15)*

Resolution 238 (WRC 15)

resolves to invite ITU-R

- to conduct and complete in time for WRC-19 the appropriate studies to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz
- *invites ITU-R*
- to conduct and complete in time for WRC-19 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, for the frequency bands:
  - 24.25-27.5 GHz2, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz, which have allocations to the mobile service on a primary basis
  - 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, which may require additional allocations to the mobile service on a primary basis
- to invite WRC-19 to consider, based on the results of the above studies, additional spectrum allocations to the mobile service on a primary basis and to consider identification of frequency bands for the terrestrial component of IMT; the bands to be considered being limited to part or all of the bands listed in resolves above

Chapter 2 : Broadband Applications in Mobile Service

- 24.25-27.5 GHz -
  - EESS/SRS (space-to-Earth) in 25.5-27 GHz and IMT
    - EESS:
      - Non-site-specific aggregate analysis with Monte Carlo simulations : Separation distance of 0.2-1.0 km in urban/suburban
      - Non-site-specific single-entry worst-case analysis (single BS) : Separation distance less than 0.8 km
      - Non-site-specific single-entry worst-case analysis (31 BS) in front of the ES : Separation distance < 1 km
      - Single-entry studies using deterministic analysis method, BS main beam pointed EESS ES : separation distance in the range 0.2-1.7 km
      - USA, China and Europe for some specific case with 31 BS random antenna panel orientations -
        - EESS ES tracking non-GSO satellites : 3.9-6.0 km
        - EESS ES tracking GSO satellites : 3.0-7.0 km
    - SRS:
      - Non-site-specific aggregate analysis with Monte Carlo simulations : Separation distance of 0.8-2.0 km in urban/suburban
      - Two studies for very specific locations with 31 BS random antenna panel orientations −separation distance of 23.8-92.0 km

- Therefore no technical justification for incorporating any regulatory provisions related to technical conditions, i.e. EIRP mask, TRP limits, epfd and/or electrical and mechanical tilting limitations on IMT-2020 base stations

Chapter 2 : Broadband Applications in Mobile Service

- 24.25-27.5 GHz -
  - Passive services in adjacent bands and IMT : EESS (passive)
    - Ten studies for IMT-2020 in the 24.25-27.5 GHz band and EESS (passive) in band 23.6-24.0 GHz
  - Passive services in adjacent bands and IMT : RAS
    - Four compatibility studies between the RAS in the frequency band 23.6-24 GHz
      - Study 1 : Separation distance of 27 km for UE and 48-52 km for BS
      - Study 2 : Separation distance of 5 km for UE and 17-18 km for BS
      - Study 3 : Separation distance of 5 km for UE and 9 km for BS
      - Study 4 : Separation distance not exceeds 70 km for most of radio telescopes considered in the study

Group/Org	BS dB(W/200 MHz)	UE dB(W/200 MHz)
ATU	-32 to -37	-28 to -30
ECOWAS	-32	-28
ASMG	-32	-28
CITEL	-37	-20
CEPT	-42	-38
USA	-20	-13
South Korea	-20	-13

Proposed specification for IMT unwanted emission limits for the 23.6 to 24.0 GHz frequency band to protect EESS (passive):

- **IMT2020 BS: -33.5 dB(W/200 MHz)**
- **IMT2020 UE: -29.7 dB(W/200 MHz)**

Chapter 2 : Broadband Applications in Mobile Service

- 24.25-27.5 GHz -
  - 24.25-27.5 GHz Band : FSS and IMT
    - IMT to Space Station : all studies show that sharing is feasible when using the baseline parameters
    - FSS Earth Station to IMT : studies show separation distances of <100 m up to about 10 km between the FSS ES and IMT stations
  - 24.25-27.5 GHz Band : ISS and IMT
    - Only three different DRS systems
    - Six sharing and compatibility studies
    - Four studies showed interference margins ranging of 12.2 to 25 dB
    - Fifth study showed interference margin of 10.2 dB
    - Sixth showed interference margins ranging of -1.5 to 0.7 dB
  - 24.25-27.5 GHz Band : FS and IMT
    - Co-Channel Studies showed coexistence feasible with separation distances ranging from 1 km to 10 km
    - Pt-to-multipt studies showed that coexistence between IMT and FS is possible using frequency and/or spatial separation
    - For both Pt-to-Pt and Pt-to-multipt, coexistence between IMT and FS is achievable with local specifics, frequency separation and deployment scenarios

- IMT is victim of interference from FSS earth stations
- No condition on co-existence between the FSS transmitting earth stations and IMT receiving base stations and terminals needed to be specified in RR and is a matter for the national authority

Chapter 2 : Broadband Applications in Mobile Service

- 24.25-27.5 GHz : Following methods and conditions supported -
  - **Method A2, Alternative 2**: identification to terrestrial component of IMT in 24.25-27.5 GHz (in the mobile service)
  - **Condition A2a: Option 1** – Resolution **750 (Rev.WRC-19)**
  - For all other conditions, no action is necessary due to results of sharing and compatibility studies :

    - Condition A2b: Option 3 – no condition necessary
    - Condition A2c: Option 5 – no condition necessary
    - Condition A2d: Option 4 – no condition necessary
    - Condition A2e: Option 9 – no condition necessary
    - Condition A2f: Option 3 – no condition necessary
    - Condition A2g: Option 5 – no condition necessary

Chapter 2 : Broadband Applications in Mobile Service

- 31.8-33.4 GHz -
  - RNS and IMT : Sharing and co-existence not possible, separation distances ~100 km necessary
  - SRS (deep space) (space-to-Earth) and IMT : separation distances 24 to 83 km; national, bilateral/multilateral issue
  - EESS (passive) (adjacent band) and IMT : −48.4 to -50.3 dB(W/200 MHz) (UE and BS)
  - RAS (adjacent band) and IMT : Study show a separation distance of 49 km between RAS and IMT UEs and BSs
  - This band was a No Go as a candidate band for IMT-2020
- Support : NOC

Chapter 2 : Broadband Applications in Mobile Service

- 37.0-40.5 GHz and 40.5-42.5 GHz -
  - FSS/BSS/MSS (space-to-Earth) and IMT : Feasibility with separation distance of 210-2000 mtrs between FSS earth station and a deployment area of IMT 2020 stations
  - SRS and IMT : Separation of 24-100 km, national or bilateral/multilateral level issue
  - EESS/SRS (passive) and IMT : Unwanted emission level of −13 dB(m/MHz), i.e. −43 dB(W/MHz), for an IMT station, which is equivalent to −13 dBW, satisfies the conditions described in Resolution 752 (WRC-07) (−10 dBW)
  - FS, RAS and IMT :
    - FS : Feasible with separation distance beyond 1.1 km
    - RAS : Feasible with 5-18 km separation and protection of RAS stations could be established on a national level
  - 40.5-42.5 GHz : Mobile Secondary

- EESS (passive) and Mobile are co-primary and 36-37 GHz into revision of Resolution 750 is not an Option
- No need to define additional OOBE limit for IMT systems operating in 37-43.5 GHz

Chapter 2 : Broadband Applications in Mobile Service

- 42.5-43.5 GHz -
  - FSS (Earth-to-space) and IMT
    - IMT to Space : Interference I/N ranged from −43.46 dB to −26.5 dB (positive margin between 33 dB to 16 dB)
    - Earth Station to IMT : Separation distances between 160 mtrs to 4000 mtrs
  - FS, RAS and IMT :
    - FS : Feasible with separation distance beyond 1.1 km
    - RAS : : Feasible with 36-57 km separation between RAS station and IMT UE/BS

- IMT is victim of interference from FSS earth stations
- No condition on co-existence between the FSS transmitting earth stations and IMT receiving base stations and terminals needed to be specified in RR and is a matter for the national authority

Chapter 2 : Broadband Applications in Mobile Service

- 37.0-40.5 GHz -
  - Support : Method C2, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies -
    - Condition C2a: Option 2 – no condition necessary
    - Condition C2b: Option 6 – no condition necessary
    - Condition C2c: Option 3 – no condition necessary
    - Condition C2d: Option 2 – no condition necessary
    - Condition C2e: Option 3 – no condition necessary
- 40.5-42.5 GHz -
  - Support : Method D2, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies -
  - – Condition D2a: Option 6 – no condition necessary
  - – Condition D2b: Option 3 – no condition necessary
  - – Condition D2c: Option 3 – no condition necessary

Chapter 2 : Broadband Applications in Mobile Service

- 42.5-43.5 GHz -
  - Support : Method E2, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies -
    - Condition E2a: Option 7 – no condition necessary
    - Condition E2b: Option 3 – no condition necessary
    - Condition E2c: Option 5 – no condition necessary
    - Condition E2d: Option 3 – no condition necessary

Chapter 2 : Broadband Applications in Mobile Service

- 45.5-47.0 GHz -
  - Allocated to the MS, MSS, RNS and RNSS
  - No studies carried out in TG5/1
  - Two contributions submitted to CPM19-2
- 47.0-47.2 GHz -
  - Allocated to the ARS and ARSS
  - No studies carried out
- 47.2-50.2 GHz -
  - Studies carried out for the EESS (passive) and for FSS (Earth-to-space)
  - FSS (Earth-to-space) and IMT :
    - IMT to Space : Interference I/N ranged from −37 dB to −30 dB
    - Earth Station to IMT : Separation distances between 160 mtrs to 5000 mtrs
  - FSS/BSS/MSS (space-to-Earth) and IMT : Separation distance of 210-2000 mtrs between FSS earth station and a deployment area of IMT 2020 stations
  - EESS (passive) and IMT :
    - Multiple studies with varying results :
      - Unwanted emission for UE : -23.1 to -48.6 dB(W/200 MHz)
      - Unwanted emission for BS : -24.8 to -49.3 dB(W/200 MHz)

Chapter 2 : Broadband Applications in Mobile Service

- 50.4-52.6 GHz -
  - FSS (Earth-to-space) and IMT
    - IMT to Space : −30.4 dB mean I/N for a GSO satellite and −21.7 dB for a non-GSO satellite
    - Earth Station to IMT : Need for a separation distance from 160 mtrs to 5000 mtrs
  - EESS (passive) and IMT
    - For the BS interference, unwanted emission level is −45.3 dB(W/200 MHz)
    - For the UE interference, unwanted emission level is −44.3 dB(W/200 MHz)

Chapter 2 : Broadband Applications in Mobile Service

- 45.5-47 GHz -
  - Support : Method F4, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies

- 47-47.2 GHz -
  - Support : Method G3, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies-
    - Condition G3a: no condition necessary
    - Condition G3b: Option 3 – no condition necessary

Chapter 2 : Broadband Applications in Mobile Service

- 47.2-50.2 GHz -
  - Support : Method H2, Alternative 2
  - No action is necessary due to results of sharing and compatibility studies -
    - Condition H2a: Option 3 – no condition necessary
    - Condition H2b: Option 7 – no condition necessary
    - Condition H2c: Option 5 – no condition necessary
    - Condition H2d: Option 5 – no condition necessary
- 50.4-52.6 GHz -
  - Support : Method I2, Alternative 2
  - Condition I2a: Option 2 Resolution 750 (Rev.WRC-19) in Table 1-1, taking into account RR No. 5.340.1.
  - No action is necessary due to results of sharing and compatibility studies -
    - Condition I2b: Option 7 – no condition necessary
    - Condition I2c: Option 5 – no condition necessary
    - Condition I2d: Option 2 – no condition necessary

Chapter 2 : Broadband Applications in Mobile Service

- 66.0-71.0 GHz -
  - Allocated to ISS, MS, MSS, RNS and RNSS
  - RNS and RNSS with IMT : Studies not carried out
  - Studies were carried out for the ISS and MSS (Earth-to-space)
  - ISS and IMT : Coexistence is feasible without additional technical or regulatory constraints on IMT
  - Views :
    - *View 1 : No compatibility studies between IMT and RNS, GSO/non-GSO RNSS (Earth-to-space and space-to-Earth)*
      - *Therefore there is no basis for regulatory methods*
    - *View 2 : No system characteristics provided for RNS, GSO/non-GSO RNSS (Earth-to-space and space-to-Earth) studies*
      - *Therefore methods/conditions to protect such system cannot be established*

Chapter 2 : Broadband Applications in Mobile Service

66.0-71.0 GHz :

- ISS and IMT : Coexistence is feasible without additional technical or regulatory constraints on IMT
  - *View 1: $I/N_{(avg)} < -47$ dB for aggregated interference of IMT-2020 station for entire visible footprint of GSO ISS*
  - *View 2 : Not possible to draw on compatibility of IMT-2020 stations and ISS service based on the sharing study*
  - *View 3 : Study is using agreed set of parameters decided at TG 5/1 even though parameters were not received at responsible ITU-R group*
    - *Study is consistent with result of the existing study that the interference level is extremely low*

Chapter 2 : Broadband Applications in Mobile Service

66.0-71.0 GHz :

- MSS (Earth-to-space) and IMT :
  - No protection criteria for MSS is available for this frequency band in ITU-R
    - Views :
      - *View 1 :*
        - *First contribution assessed three different simulation scenarios considering entire visible footprint of the MSS satellite*
        - *Most pessimistic scenario showed an I/N of lower than −43 dB for 99th percentile of aggregated interference CDF*
        - *Second contribution calculated aggregate interference into an MSS space station receiver from IMT-2020 base stations*
        - *Results of this study indicated that aggregate I/N into the MSS space station would be at most −52 dB (worst case elevation angle)*
      - *View 2 :*
        - *Studies provide results in terms of separation distances between an IMT network and GSO MSS earth station, both located on land*
        - *The case of maritime and airborne ESs and/or BSs and UE not considered*
        - *No any compatibility studies related to interference between IMT and non-GSO MSS (Earth-to-space and space-to-Earth)*
        - *Existing studies do not provide sufficient basis for regulatory methods*
      - *View 3 :*
        - *Studies are using the agreed set of parameters decided*
        - *Studies are assessing interference to satellite receiver, hence Appendix 7 of the RR to protect ground earth station is irrelevant*
        - *Studies are consistent with the result of the existing study that the interference level is extremely low*
        - *Supporting the notion of no specific regulatory provision is necessary*

Chapter 2 : Broadband Applications in Mobile Service

66.0-71.0 GHz :

- MSS (space-to-Earth) and IMT :
  - No studies between IMT-2020 and MSS downlink (space-to-Earth) were performed in ITU-R
  - Contribution in CPM19-02
    - Views :
      - *View 1 :*
        - *First contribution shows I/N is less than -10.1 dB if the IMT-2020 network is 600 m away from receiving MSS earth station*
        - *Second contribution indicated that a dense cluster of IMT-2020 BSs in an urban area may cause interference to an MSS earth station*
        - *These studies from both contributions used the characteristics provided by the involved ITU-R groups*
      - *View 2 :*
        - *Both contributions carried out studies for GSO MSS (both Earth-to-space and space-to- Earth) only*
        - *The case of maritime and airborne ESs and/or BSs and UE were not considered*
        - *It is not possible to consider these results as representative case among other scenarios*
        - *Existing studies do not provide sufficient basis for regulatory methods*
      - *View 3 :*
        - *Studies are using the agreed set of parameters decided*
        - *These studies to assess the risk of interference from IMT-2020 is a consistent method used in the responsible ITU-R group*
        - *The direct application of Appendix 7 of the RR is not appropriate*
        - *The risk of interference from IMT-2020 is very low*

Chapter 2 : Broadband Applications in Mobile Service

- 71.0-76.0 GHz -
  - FS and IMT : Separation distance of 970 to 260 mtrs for antenna heights of 10 to 40 mtrs respectively
  - RLS and IMT :
    - Adjacent band automotive radars in 76-77 GHz
    - Max additional isolation required for IMT unwanted emissions in 76-77 GHz is within 11.5 dB to 9.6 dB
  - FSS and IMT :
    - IMT BS to FSS Earth station : With separation of 250 mtrs around FSS earth station, aggregate interference level does not exceed FSS long-term interference threshold
- 81.0-86.0 GHz -
  - EESS (passive) and IMT
    - For the BS interference, unwanted emission level is −43.6 dB(W/200 MHz) (Single ant); −20 dB(W/200 MHz) (Beamforming ant)
    - For the UE interference, unwanted emission level is −43.5 dB(W/200 MHz) (Single ant); −19.9 dB(W/200 MHz) (Beamforming ant)
  - FS and IMT : Separation distance of 950 to 250 mtrs
  - RAS and IMT : Separation distance of 20.5 km (suburban) and 35-49 km (urban)
  - RLS and IMT : Max isolation from unwanted IMT emissions in 77-81 GHz is 13.5 dB for BS and 15 dB for UE
  - FSS (Earth-to-space) and IMT
    - IMT to Space : No interference from IMT BS
    - Earth Station to IMT : Need for a separation distance of 250 mtrs

Summary

- Remarkable Social and Economic Impact of 5G
- An Excellent Far-Sighted National Digital Communication Policy
- Ecosystem Developing Fast, Auctions & Deployments Started
- India Specific Requirements - Part of IMT-2020
- India 5G Standardization Initiatives
- IAFI Should Continue its Support for Govt Initiatives
- IAFI Should Neither Recommend Nor Support Any Restrictive Method/Option/Conditions for APG19-5 PACP for AI1.13

5G is the foundation to what's next.
We are the foundation to 5G.

Thank you!