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# Preparation for APG-19#4 : Agenda 1.13

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# CPM-19 (02)

# Chapters and Agenda Items

- Chapter 1 – Land Mobile and Fixed Services
  - Agenda Items : 1.11, 1.12, 1.14, 1.15
- Chapter 2 – Broadband Applications in the Mobile Service
  - Agenda Items : 1.13, 1.16, 9.1 (issues 9.1.1, 9.1.5, 9.1.8)
- Chapter 3 – Satellite Services
  - Agenda Items : 1.4, 1.5, 1.6, 7, 9.1 (issues 9.1.2, 9.1.3, 9.1.9)
- Chapter 4 – Science Services
  - 1.2, 1.3, 1.7
- Chapter 5 – Maritime, Aeronautical and Amateur Services
  - 1.1, 1.8, 1.9, 1.10, 9.1 (issue 9.1.4)
- Chapter 6 – General Issues
  - 2, 4, 9.1 (issues 9.1.6, 9.1.7), 10

# 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)*
- Spectrum :
  - 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
- Sharing and compatibility studies for In-band and adjacent band
- 24.25-27.5 GHz -
  - 23.6-24 GHz Band : Level of unwanted emissions to protect EESS (passive)
    - Single Antenna : [−42 to −44] (dB(W/200 MHz) (UE and BS)
    - Beamforming : [−29 to −34] (dB(W/200 MHz) (UE and BS)
  - 23.6-24 GHz Band : Level of unwanted emissions to protect Radio Astronomy
    - −13 dB(m/MHz) (UE and BS)
  - 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

# Chapter 2 : Broadband Applications in Mobile Service

- 24.25-27.5 GHz -
  - 24.25-27.5 GHz Band : ISS and IMT
    - Only three different DRS systems
    - Different studies showed interference margins ranging between −1.5 and 25 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
- 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
- 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

# 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
- 45.5-47.0 GHz -
  - Allocated to the MS, MSS, RNS and RNSS
  - No studies carried out
- 47.0-47.2 GHz -
  - Allocated to the ARS and ARSS
  - No studies carried out
- 47.2-50.2 GHz -
  - 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 4000 mtrs

# Chapter 2 : Broadband Applications in Mobile Service

- 47.2-50.2 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
  - EESS (passive) and IMT :
    - Interference exceedance relative to the EESS (passive) protection criteria (−166 dB(W/200 MHz))
    - Multiple studies : Interference exceedance (21.3 to 28.3 dB); unwanted emission (-39.4 to -48.1 dB(W/200 MHz))
- 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)
- 66.0-71.0 GHz -
  - ISS and IMT : Coexistence is feasible without additional technical or regulatory constraints on IMT
  - MSS (Earth-to-space) and IMT :
    - No protection criteria for MSS is available for this frequency band in ITU-R
    - Interference level from IMT 2020 was from −347 dB(W/MHz) to −176 dB(W/MHz)

# 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

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 24.25-27.5 GHz -
  - Method A1 : NOC
  - Method A2 : Identify for IMT
    - Alternative 1 : Allocate 24.25-25.25 GHz band to MS (except aeronautical mobile) on a primary basis in Regions 1 & 2 and identify 24.25-27.5 GHz band for terrestrial component of IMT within the land mobile service in Regions 1, 2 & 3
    - Alternative 2 : Allocate 24.25-25.25 GHz band to MS (except aeronautical mobile) on a primary basis in Regions 1 & 2 and identify 24.25-27.5 GHz band for terrestrial component of IMT in Regions 1, 2 & 3
  - Condition A2a (Protection measures for EESS (passive) in the 23.6 24 GHz frequency band)- Options :
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev.WRC-15) limits on unwanted emissions in the frequency band 23.6-24 GHz from IMT BSs and IMT mobile stations within the 24.25 27.5 GHz frequency band and add a cross-reference to Resolution 750 (Rev.WRC 15) in the RR footnote that identifies the frequency band for IMT and revise RR No. 5.338A accordingly
    - Option 2 : To invite ITU-R to develop an ITU-R Recommendation to include limits on unwanted emissions in the frequency band 23.6-24 GHz from IMT BSs and IMT mobile stations within the 24.25 27.5 GHz frequency band, as appropriate
    - Option 3 : Noting a 250 MHz guardband from the active service band 24.25-27.5 GHz, No condition is necessary
  - Condition A2b (Protection measures for EESS (passive) in the 50.2 50.4 GHz and 52.6 54.25 GHz frequency band)- Options :
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev.WRC-15) limits on unwanted emissions in the frequency bands 50.2-50.4 GHz and 52.6 54.25 GHz from IMT BSs and IMT mobile stations in 24.25 27.5 GHz frequency band and add a cross-reference to Resolution 750 (Rev.WRC 15) in the RR footnote that identifies the frequency band for IMT and revise RR No. 5.338A accordingly
    - Option 2 : State in a considering of WRC Resolution corresponding to IMT identification of this frequency band that spurious emission limits of Recommendation ITU-R SM.329 Category B are sufficient to protect EESS (passive) from second harmonic of IMT BS emissions in 26 GHz frequency band
    - Option 3 : No studies done for second harmonics hence No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 24.25-27.5 GHz -
  - Condition A2c (Protection measures for earth stations in the SRS/EESS)-
    Options :
    - Option 1 : WRC Resolution for this IMT identification to include developing of an ITU-R Recommendation on protection of existing/ future SRS/EESS earth stations operating in band 25.5-27 GHz and on ensuring possibility of deploying future SRS/EESS earth stations
    - Option 2 : WRC Resolution for this IMT identification to include developing of an ITU-R Recommendation on protection of existing/ future SRS/EESS earth stations operating in band 25.5-27 GHz and incorporate this Recommendation into RR by reference
    - Option 3 : Protection of other services (in-band and/or adjacent band) by IMT to be contained in a WRC Resolution cross-referenced in footnote in RR Article 5 in which this frequency band is identified for IMT
    - Option 4 : This being a national matter, No condition is necessary
  - Condition A2d (Measures related to transmitting earth stations in the FSS (Earth-to-space) at known locations)-
    Options :
    - Option 1 : WRC Resolution for this IMT identification to include developing of an ITU-R Recommendation on coexistence between existing and future FSS earth stations operating in band 24.25-27.5 GHz and on ensuring possibility of deploying future FSS earth stations
    - Option 2 : WRC Resolution for this IMT identification to include developing of an ITU-R Recommendation on coexistence between existing and future FSS earth stations operating in band 24.25-27.5 GHz and incorporate this Recommendation into RR by reference
    - Option 3 : Protection of other services (in-band and/or adjacent band) by IMT to be contained in a WRC Resolution cross-referenced in footnote in RR Article 5 in which this frequency band is identified for IMT
    - Option 4 : This being a national matter and IMT is victim, No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 24.25-27.5 GHz -
  - Condition A2e (Protection measures for the ISS and FSS (Earth-to-space) receiving space stations)-
    Options :
    - Option 1 : WRC Resolution for this IMT identification to have a mandatory limit on the maximum total radiated power (TRP) of IMT BSs of [25/35/37/46/TBD] dB(m/200 MHz), i.e. [−5/5/7/16/TBD] dB(W/200 MHz); Requiring that the electrical tilt of IMT BS beams should normally not be higher than 0 degrees relative to the horizontal and the mechanical tilt of IMT BSs be below the horizon
    - Option 2 : WRC Resolution for this IMT identification to have a mandatory limit on the maximum total radiated power (TRP) of IMT BSs of [25/35/37/46/TBD] dB(m/200 MHz), i.e. [−5/5/7/16/TBD] dB(W/200 MHz); Requiring that the elevation angle of the antenna main beam of IMT BSs not to be higher than 0 degrees relative to the horizontal and Antenna pattern to comply with Recommendation ITU-R M.2101
    - Option 3 : Introducing in the RR a mandatory limit on the max TRP of IMT BSs of [35/37] dB(m/200 MHz), i.e. [5/7] dB(W/200 MHz), to provide protection to the ISS and FSS (Earth-to-space) in the frequency band 24.25 27.5 GHz and requiring that the combined tilt (electrical and mechanical) of IMT BSs should normally not be higher than 0 degrees
    - Option 4 : While deploying outdoor BSs, ensure that each antenna is normally transmitting only with the main beam pointing below the horizon and in addition the antenna to have mechanical pointing below the horizon except when the BS is only receiving
    - Option 5 : A mandatory limit on the maximum TRP of IMT BSs of [25/35/37/46/TBD] dBm/200 MHz, i.e. [−5/5/7/16/TBD] dB(W/200 MHz) with a mechanical tilt of IMT BSs below [TBD degrees] and create Limit for the max density of BSs for outdoor urban/ suburban hot spots within the territory of an administration
    - Option 6 : Introduce in the RR an angular e.i.r.p. mask for the emissions of IMT BSs in the skyward direction
    - Option 7 : Introduce in the RR mandatory epfd↑ limits at GSO by emissions from all IMT BSs in the territory of an administration in the band 24.25-27.5 GHz
    - Option 8 : Mandatory limit on max TRP of IMT BSs of [25/35/37/46/TBD] dB(m/200 MHz), i.e. [−5/5/7/16/TBD] dB(W/200 MHz)
    - Option 9 : No condition is necessary studies show that sharing is feasible without any additional mandatory limits

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 24.25-27.5 GHz -
  - Condition A2f (Protection measures for the RAS)-
    Options :
    - Option 1 : WRC Resolution for this IMT identification to include updating existing ITU-R Recommendations or developing of an ITU-R Recommendation to provide information on possible coordination and protection measures
    - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
    - Option 3 : No condition is necessary
  - Condition A2g (Protection measures for multiple services)-
    Options :
    - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
    - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
    - Option 3 : ITU-R to regularly update characteristics of IMT deployments (including BS density) and to study/assess the impact on sharing and compatibility with other services resulting from these deployments
    - Option 4 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 31.8-33.4 GHz -
  - Method B1 : NOC
- 37.0-40.5 GHz-
  - Method C1 : NOC
  - Method C2 : Identification of band 37-40.5 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Identify 37-40.5 GHz band for terrestrial component of IMT within the land mobile service
    - Alt 2 : Identify 37-40.5 GHz band for terrestrial component of IMT in all Regions
  - Condition C2a (Protection measures for the EESS (passive) in the 36-37 GHz band)
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev.WRC-15) limits on unwanted emissions in the frequency band 36-37 GHz from IMT BSs and IMT mobile stations within the 37-40.5 GHz frequency band and add a cross-reference to Resolution 750 (Rev.WRC 15) in the RR footnote that identifies the frequency band for IMT and revise RR No. 5.338A accordingly
    - Option 2 : Introduce in Table 1-2 of Resolution 750 (Rev.WRC-15) recommended levels of unwanted emissions in the frequency band 36-37 GHz from IMT BSs and IMT mobile stations within the 37-40.5 GHz frequency band and add a cross-reference to Resolution 750 (Rev.WRC 15) in the RR footnote that identifies the frequency band for IMT and revise RR No. 5.338A accordingly
    - Option 3 : Introduce limits on unwanted emissions in band 36-37 GHz from IMT BSs and IMT mobile stations within 37-40.5 GHz band in the WRC Resolution corresponding to the IMT identification of this frequency band
    - Option 4 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition C2b (Protection measures for the FSS (space-to-Earth))
  - Option 1 : Invite administrations to ensure the necessary balance in the frequency bands 37.5 42.5 GHz (downlink), 42.5-43.5 GHz (uplink), 47.2-50.2 GHz (uplink) and 50.4 51.4 GHz (uplink), allocated to the MS and FSS, between spectrum available for IMT, spectrum available for ubiquitous earth stations (e.g. high-density applications in the fixed-satellite service (HDFSS)) and spectrum available for gateway earth stations
  - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
  - Option 3 : Revise RR No. 5.516B to provide a common 2 GHz of spectrum to FSS not shared with IMT (namely in frequency range 37.5-39.5 GHz) in Region 1 that can be used for ubiquitous FSS earth stations (e.g. HDFSS)
  - Option 4 : Create WRC Resolution to develop an ITU-R Recommendation for ensuring the protection of existing and future FSS earth stations from IMT deployments in neighbouring countries and protection to future gateway earth stations
  - Option 5 : In footnote containing the IMT identification, administrations should take into account potential constraints to IMT in the frequency band, as appropriate, because of the potential deployment of high-density applications in the FSS in the frequency band 39.5-42 GHz as per RR No. 5.516B.
  - Option 6 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition C2c (Protection measures for the SRS (space-to-Earth))
  - Option 1 : Develop a WRC Resolution for an ITU-R Recommendation to assist administrations in ensuring protection of existing and future SRS earth stations operating in the frequency band 37-38 GHz and to adopt a national level provision to ensure the possibility of deploying future earth stations in SRS (space-to-Earth)
  - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
  - Option 3 : No condition is necessary
- Condition C2d (Measures for the SRS (Earth-to-space) and EESS (Earth-to-space))
  - Option 1 : To introduce RR provisions that IMT 2020 systems operating in the frequency band 37-40.5 GHz shall not claim protection from emissions of SRS (Earth-to-space) and EESS (Earth-to-space) earth stations operating in the frequency band 40-40.5 GHz to ensure future development of the SRS (Earth-to-space) and EESS (Earth-to-space)
  - Option 2 : No condition is necessary
- Condition C2e (Protection measures for multiple services)
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 :Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 40.5-42.5 GHz -
  - Method D1 : NOC
  - Method D2 : Identification of band 40.5-42.5 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Upgrade existing secondary allocation to MS in frequency band 40.5-42.5 GHz to a primary allocation and identify the frequency band for the terrestrial component of IMT within the LMS
    - Alt 2 : Upgrade existing secondary allocation to MS in frequency band 40.5-42.5 GHz to a primary allocation and identify the frequency band for the terrestrial component of IMT
  - Condition D2a (Protection measures for the FSS (space-to-Earth))
    - Option 1 : Create a WRC Resolution to ensure necessary balance in bands 37.5-42.5 GHz (downlink), 42.5-43.5 GHz (uplink), 47.2-50.2 GHz (uplink) and 50.4 51.4 GHz (uplink), allocated to the MS and FSS, between spectrum available for IMT, spectrum available for ubiquitous earth stations (e.g. the HDFSS) and spectrum available for gateway earth stations including future FSS requirement
    - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
    - Option 3 : Create a WRC Resolution to develop an ITU-R Recommendation on the protection of existing and future FSS earth stations from IMT deployments in neighbouring countries
    - Option 4 : In footnote containing IMT identification, administrations should take into account potential constraints to IMT in the frequency band because of the potential deployment of high-density applications in the FSS in the frequency band 39.5-42 GHz as per RR No. 5.516B
    - Option 5 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition D2b (Protection measures for RAS)
  - Option 1 : ITU-R be invited to update existing ITU-R Recommendations or develop new ITU-R Recommendations to provide information on possible coordination and protection measures
  - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
  - Option 3 : No condition is necessary
- Condition D2c (Protection measures for multiple services)
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 :Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 42.5-43.5 GHz -
  - Method E1 : NOC
  - Method E2 : Identification of band 42.5-43.5 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify the frequency band for the terrestrial component of IMT within the LMS
    - Alt 2 : Under this alternative, identify the frequency band for the terrestrial component of IMT
  - Condition E2a (Protection measures for the FSS (Earth-to-space))
    - Option 1 : WRC Resolution for this IMT identification to have a mandatory limit on the max TRP of IMT BSs of [20.5/44/TBD] dB(m/200 MHz), i.e. [−9.5/14/TBD] dB(W/200 MHz); with the elevation angle of the antenna main beam of IMT BSs not to be higher than 0 degrees relative to the horizontal
    - Option 2 : An angular e.i.r.p. mask in RR for the emissions of IMT BSs in the skyward direction
    - Option 3 : WRC Resolution for this IMT identification to have a mandatory limit on the max TRP of IMT BSs of [20.5/44/TBD] dB(m/200 MHz), i.e. [−9.5/14/TBD] dB(W/200 MHz) to provide protection to the FSS (Earth-to-space) in the frequency band 42.5 43.5 GHz; with combined tilt (electrical and mechanical) of IMT BSs should normally not be higher than 0 degrees relative to the horizontal
    - Option 4 : Requiring that when deploying outdoor BSs, it shall be ensured that each antenna is normally transmitting only with the main beam pointing below the horizon and in addition the antenna shall have mechanical pointing below the horizon except when the BS is only receiving

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition E2a (Protection measures for the FSS (Earth-to-space))
  - Option 5 : WRC Resolution for this IMT identification to have a mandatory limit on the max TRP of IMT BSs of [20.5/44/TBD] dB(m/200 MHz), i.e. [−9.5/14/TBD] dB(W/200 MHz) to provide to provide long-term stability for the FSS (Earth-to-space) in the frequency band 42.5 43.5 GHz; with the mechanical tilt of IMT BSs shall be below [TBD degrees]
  - Option 6 : WRC Resolution for this IMT identification to have a mandatory limit on the max TRP of IMT BSs of [20.5/44/TBD] dB(m/200 MHz), i.e. [−9.5/14/TBD] dB(W/200 MHz) to provide a margin to future IMT characteristics beyond those studied to date and to provide long-term stability for the FSS (Earth-to-space) in the frequency band 42.5 43.5 GHz; with main beam pointing of IMT BSs should avoid being higher than 0 degrees relative to the horizontal
  - Option 7 : No condition is necessary
- Condition E2b (Protection measures for the RAS)
  - Option 1 : ITU-R should therefore be invited to update existing ITU-R Recommendations or develop new ITU-R Recommendations on possible coordination and protection measures for the RAS
  - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution, cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
  - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition E2c (Protection measures for multiple services)
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : ITU-R to regularly update characteristics of IMT deployments (including BS density) and to study/assess the impact on sharing and compatibility with other services resulting from these deployments
  - Option 4 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 45.5-47 GHz -
  - Method F1 : NOC
  - Method F2 : Identification of band 45.5-47 GHz for IMT in accordance with following two alternatives
    - Alt 1 : As no studies have been carried out, no identification of the frequency band for the terrestrial component of IMT be made at WRC-19
    - Alt 2 : Even though no studies have been carried out, identify the frequency band for the terrestrial component of IMT
  - Condition F2a (Protection measures for the MSS, RNS and RNSS) - No studies available
  - Condition F2b (Protection measures for multiple services)
    - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
    - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
    - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 47-47.2 GHz -
  - Method G1 : NOC
  - Method G2 : Identification of band 47-47.2 GHz for IMT in accordance with following two alternatives
    - Alt 1 : As no studies have been carried out, no identification of the frequency band for the terrestrial component of IMT be made at WRC-19
    - Alt 2 : Even though no studies have been carried out, identify the frequency band for the terrestrial component of IMT
  - Condition G2a (Protection measures for the ARS and ARSS) - No studies available
  - Condition G2b (Protection measures for multiple services)
    - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
    - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
    - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 47.2-50.2 GHz -
  - Method H1 : NOC
  - Method H2 : Identification of band 47.2-50.2 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify 47.2-50.2 GHz band for terrestrial component of IMT within LMS
    - Alt 2 : Under this alternative, identify 47.2-50.2 GHz band for terrestrial component of IMT
  - Condition H2a (Protection measures for the EESS (passive)) -
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev.WRC 15) limits on unwanted emissions in the band 50.2-50.4 GHz from IMT BSs and IMT mobile stations within 47.2-50.2 GHz frequency band and add a cross-reference in RR footnote that identifies this band for IMT and revise RR No. 5.338A accordingly
    - Option 2 : Introduce in RR mandatory limits on unwanted emissions in the band 50.2-50.4 GHz from IMT stations (BS and UE) taking into account RR No. 5.340.1
    - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition H2b (Protection measures for the FSS (Earth-to-space))
  - Option 1 : To introduce in RR provisions to limit the max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) and elevation angle of antenna main beam of IMT BSs to be not >0 degrees relative to horizontal
  - Option 2 : To introduce in the RR an angular e.i.r.p. mask for emissions of IMT BSs in skyward direction
  - Option 3 : To introduce in RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TDB] dB(W/200 MHz) for protection of FSS (Earth-to-space) in the band 47.2 50.2 GHz and requiring that combined tilt (electrical and mechanical) of IMT BSs should normally not be >0 degrees relative to horizontal
  - Option 4 : When deploying outdoor BSs, ensure that each antenna is normally transmitting only with main beam pointing below the horizon and in addition antenna shall have mechanical pointing below the horizon except when the BS is only receiving
  - Option 5 : To introduce in RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) to provide long-term stability for FSS (Earth-to-space) in the band 47.2 50.2 GHz with the mechanical tilt of IMT BSs shall be below [TBD degrees]
  - Option 6 : To introduce in RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) to provide a margin to future IMT characteristics beyond those studied to date and to provide long-term stability to FSS (Earth-to-space) in the band 47.2 50.2 GHz
  - Option 7 : In footnote containing IMT identification, take into account potential constraints to IMT in this band, because of potential deployment of high-density applications in FSS in the 48.2-50.2 GHz band, as per RR No. 5.516B
  - Option 8 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition H2c (Protection measures for the FSS (space-to-Earth))
  - Option 1 : Develop ITU-R Recommendations to ensure the protection of FSS earth stations in Region 1
  - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
  - Option 3 No condition is necessary
- Condition H2d (Protection measures for multiple services)
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : ITU-R to regularly update characteristics of IMT deployments (including BS density) and to study/assess the impact on sharing and compatibility with other services resulting from these deployments
  - Option 4 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 50.4-52.6 GHz -
  - Method I1 : NOC
  - Method I2 : Identification of band 50.4-52.6 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify 50.4-52.6 GHz band for terrestrial component of IMT within LMS
    - Alt 2 : Under this alternative, identify 50.4-52.6 GHz band for terrestrial component of IMT
  - Condition I2a (Protection measures for the EESS (passive)) -
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev. WRC 15) limits on unwanted emissions in the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz from IMT BSs and IMT mobile stations within the 50.4-52.6 GHz frequency and add a cross-reference in RR footnote that identifies this band for IMT and revise RR No. 5.338A
    - Option 2 : Introduce in RR mandatory limits on unwanted emissions in the bands 50.2-50.4 GHz and 52.6-54.25 GHz from IMT stations (BS and UE) taking into account RR No. 5.340.1
    - Option 3 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition I2b (Protection measures for the FSS (Earth-to-space))
  - Option 1 : To introduce in RR provisions to limit max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) and elevation angle of the antenna main beam of IMT BSs not to be >0 degrees relative to the horizontal
  - Option 2 : To introduce in the RR an angular e.i.r.p. mask for the emissions of IMT BSs in skyward direction
  - Option 3 : To introduce in the RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) to provide protection to FSS (Earth-to-space) in the band 50.4-52.6 GHz
  - Option 4 : When deploying outdoor BSs, it shall be ensured that each antenna is transmitting only with main beam pointing below horizon and the antenna to have mechanical pointing below the horizon except when BS is only receiving
  - Option 5 : To introduce in the RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) to provide long-term stability to the FSS (Earth-to-space) in the band 50.4-52.6 GHz with mechanical tilt of IMT BSs to be below [TBD degrees]
  - Option 6 : To introduce in the RR a mandatory limit on max TRP of IMT BSs of [26/44/TBD] dB(m/200 MHz), i.e. [−4/14/TBD] dB(W/200 MHz) to provide a margin for future IMT characteristics beyond those studied to date, and to provide a long-term stability for FSS (Earth-to-space) in the band 50.4-52.6 GHz
  - Option 7 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition I2c (Protection measures for multiple services)
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : To invite ITU-R to update characteristics of IMT deployments regularly (including BS density) and to study/assess the impact on sharing and compatibility with other services resulting from these deployments. This would enable ITU-R to recommend corrective measures to address situations whereby the interference threshold of space stations would be at risk to be exceeded
  - Option 4 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 66-71 GHz -
  - Method J1 : NOC
  - Method J2 : Identification of band 66-71 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify 66-71 GHz band for terrestrial component of IMT within LMS
    - Alt 2 : Under this alternative, identify 66-71 GHz band for terrestrial component of IMT
  - Condition J2a (Measures for coexistence with MGWS/WAS) -
    - Option 1 : Reflect in the WRC Resolution corresponding to the IMT identification of this frequency band while implementing IMT and MGWS/WAS in this band, take into account the latest technical characteristics of IMT and MGWS/WAS, as provided in ITU-R Reports and Recommendations
    - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
    - Option 3 : No condition is necessary
  - Condition J2b (Removal of the 66-71 GHz frequency band from RR No. 5.553) -
    - Option 1 : Revise RR No. 5.553 to remove the 66-71 GHz frequency band from that footnote
    - Option 2 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition J2c (Protection measures for multiple services) -
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : No condition is necessary
- Method J3 : To continue studies on the possibility of identification in the frequency band 66-71 GHz for IMT with a WRC Resolution (Modify RR No. 5.553)

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 71-76 GHz -
  - Method K1 : NOC
  - Method K2 : Identification of band 71-76 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify 71-76 GHz band for terrestrial component of IMT within LMS
    - Alt 2 : Under this alternative, identify 71-76 GHz band for terrestrial component of IMT
  - Condition K2a (Protection measures for the RLS) - Introduce in the WRC Resolution corresponding to the IMT identification of this frequency band unwanted emission limits into 76-81 GHz from IMT BS and UE operating on frequency band 71-76 GHz
  - Condition K2b (Protection measures for the FSS (space-to-Earth)) -
    - Option 1 : Develop an ITU-R Recommendation to ensure protection of existing and future FSS earth stations
    - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT
    - Option 2 : No condition is necessary
  - Condition K2c (Protection measures for multiple services) -
    - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
    - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
    - Option 2 : No condition is necessary

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- 81-86 GHz -
  - Method L1 : NOC
  - Method L2 : Identification of band 81-86 GHz for IMT in accordance with following two alternatives
    - Alt 1 : Under this alternative, identify 81-86 GHz band for terrestrial component of IMT within LMS
    - Alt 2 : Under this alternative, identify 81-86 GHz band for terrestrial component of IMT
  - Condition L2a (Protection measures for the EESS (passive)) -
    - Option 1 : Introduce in Table 1-1 of Resolution 750 (Rev.WRC 15) limits on unwanted emissions in the frequency band 86-92 GHz from IMT BSs and IMT mobile stations within the 81-86 GHz frequency band and add a cross-reference to RR footnote that identifies the frequency band for IMT
    - Option 2 : No condition is necessary
  - Condition L2b (Protection measures for the RLS) - Introduce in the WRC Resolution corresponding to the IMT identification of this frequency band unwanted emission limits into 76-81 GHz from IMT BS and UE operating on frequency band 81 86 GHz
  - Condition L2c (Protection measures for the RAS) -
    - Option 1 : Update existing ITU-R Recommendations or develop new ITU-R Recommendations, as appropriate, to provide information on possible coordination and protection measures
    - Option 2 : Protection of other services (in-band and/or adjacent frequency band) by IMT should be contained in a WRC Resolution, cross-referenced in the footnote in RR Article 5 in which the frequency band is identified for IMT

# Chapter 2 : Broadband Applications in Mobile Service

**Methods**

- Condition L2d (Protection measures for the FSS (Earth-to-space)) -
  - Option 1 : Introducing a mandatory limit on the maximum TRP of IMT BSs of [TBD] dB(W/200 MHz) in this frequency band to provide protection to the FSS (Earth-to-space) with a combined tilt (electrical and mechanical) of IMT BSs not >0 degrees
  - Option 2 : Introducing a mandatory angular e.i.r.p. mask for the emissions of IMT BSs in the skyward direction in WRC Resolution corresponding to IMT identification of this frequency band
  - Option 3 : No condition is necessary
- Condition L2e (Protection measures for multiple services) -
  - Option 1 : Include as a prerequisite condition when identifying the frequency band for IMT to apply RR No. 9.21 in the corresponding footnote
  - Option 2 : Include as a prerequisite condition when identifying the frequency band for IMT to obtain agreement from the administrations concerned and reflect this in the corresponding footnote
  - Option 3 : No condition is necessary

# Resolution 238

*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**, taking into account:
  - technical and operational characteristics of terrestrial IMT systems that would operate in this frequency range, including the evolution of IMT through advances in technology and spectrally efficient techniques;
  - the deployment scenarios envisaged for IMT-2020 systems and the related requirements of high data traffic such as in dense urban areas and/or in peak times;
  - the **needs of developing countries**;
  - the time-frame in which spectrum would be needed;
- 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; and
  - 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

Thank You