



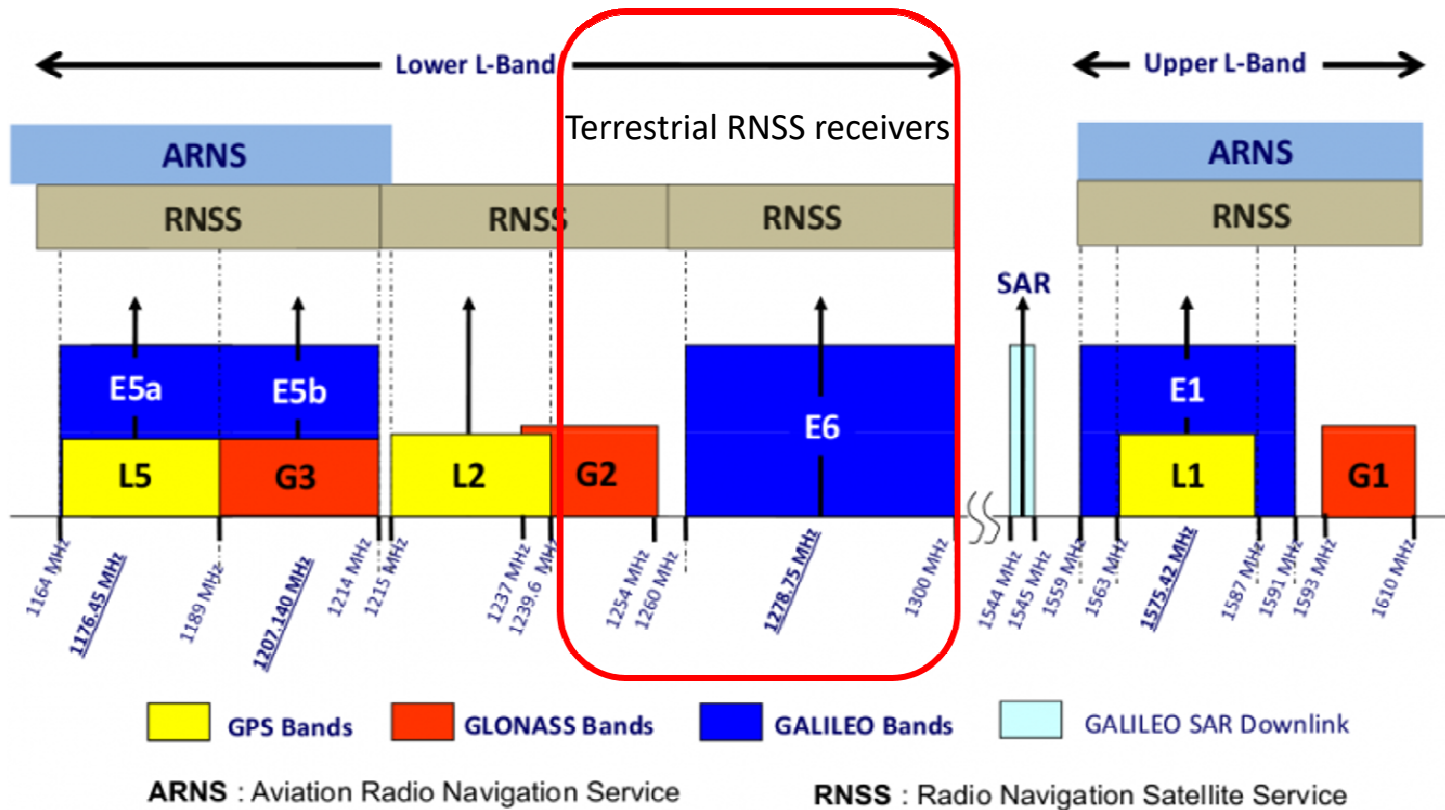
Amateur / RNSS Coexistence in the 23cm band

- Barry Lewis G4SJH
- IARU Lead on WRC23 AI9.1b
- RSGB Microwave Manager

- April 2024
- UKuG Martlesham update



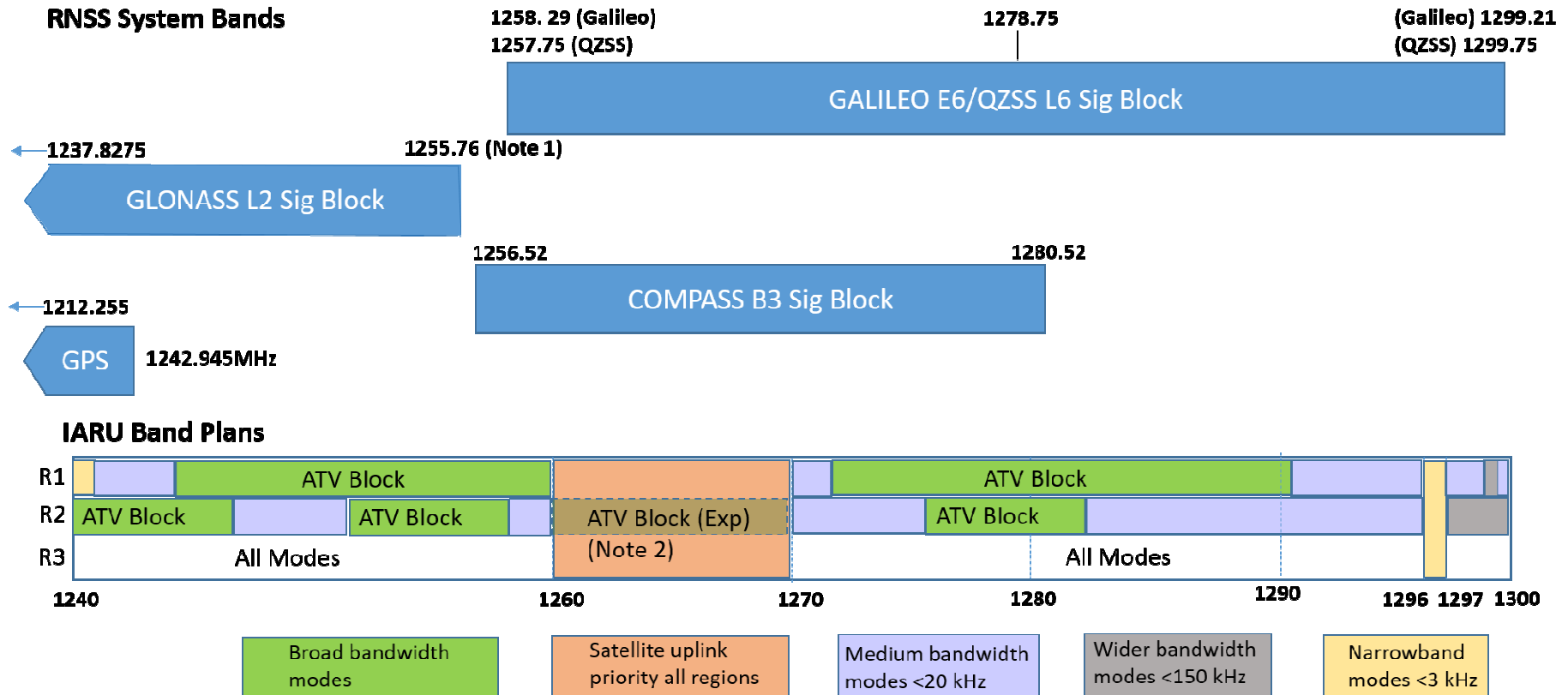
23cm Band and Radio Navigation Satellite Services



- CEPT Study Program is considering Galileo (EU).
- ITU-R Study Program as above plus GLONASS (R.Fed), COMPASS (China) and QZSS (Japan).
- Considering Technical and Operational measures to protect RNSS services.
- <https://www.iau-r1.org/spectrum/iau-and-itu/wrc-23-page/wrc-23-agenda-item-9-1b/>

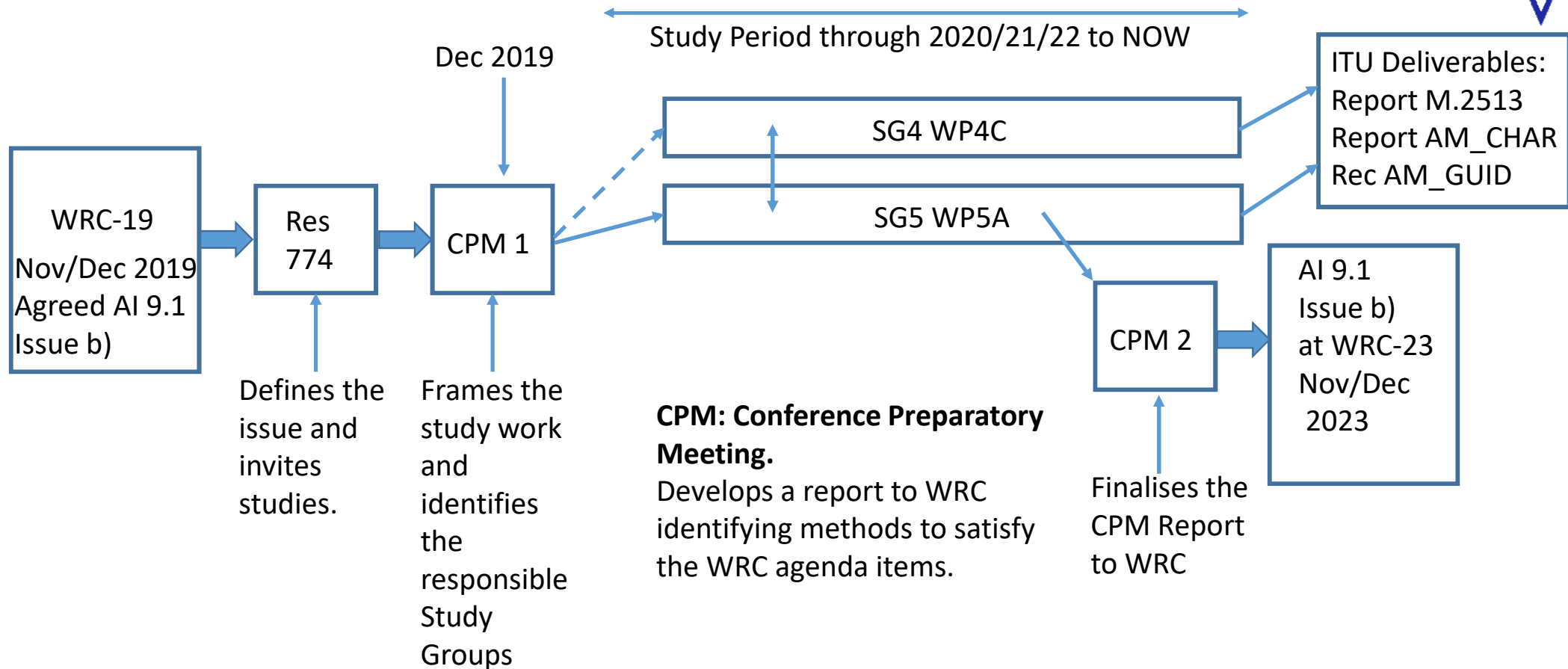


The RNSS systems within the scope of studies

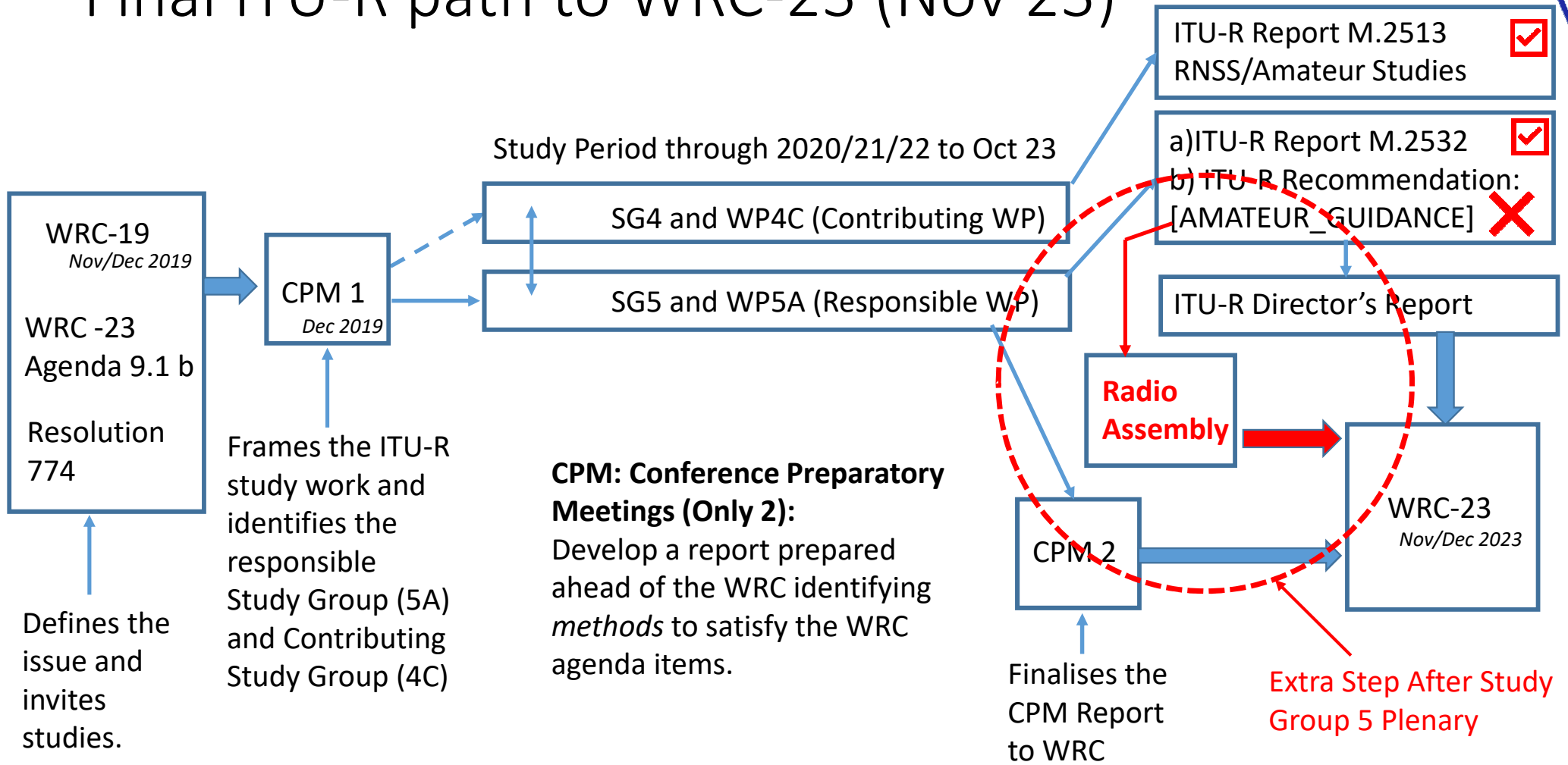




Expected ITU-R path to WRC-23 (Mid 2023)



Final ITU-R path to WRC-23 (Nov 23)





Radio Assembly RA-23 Outcome

- An ITU-R Recommendation M.2164 finally agreed.
 - The relevant technical conditions are given in the Annex.
 - Discussion focussed on measures around 1250 MHz

ITU Publications
Recommendations

International Telecommunication Union
Radiocommunication Sector

Recommendation ITU-R M.2164-0 (11/2023)

M Series: Mobile, radiodetermination, amateur and related satellite services

Guidance on technical and operational measures for the use of the frequency band 1 240-1 300 MHz by the amateur and amateur-satellite service in order to protect the radionavigation-satellite service (space-to-Earth)

Other related deliverables agreed in the Study Group activities.

ITU Publications

International Telecommunication Union
Radiocommunication Sector

Report ITU-R M.2532-0 (09/2023)

M Series: Mobile, radiodetermination, amateur and related satellite services

Amateur and amateur-satellite services characteristics and usage in the 1 240-1 300 MHz frequency band

Report ITU-R M.2513-0 (09/2022)

Studies regarding the protection of the primary radionavigation-satellite service (space-to-Earth) by the secondary amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz



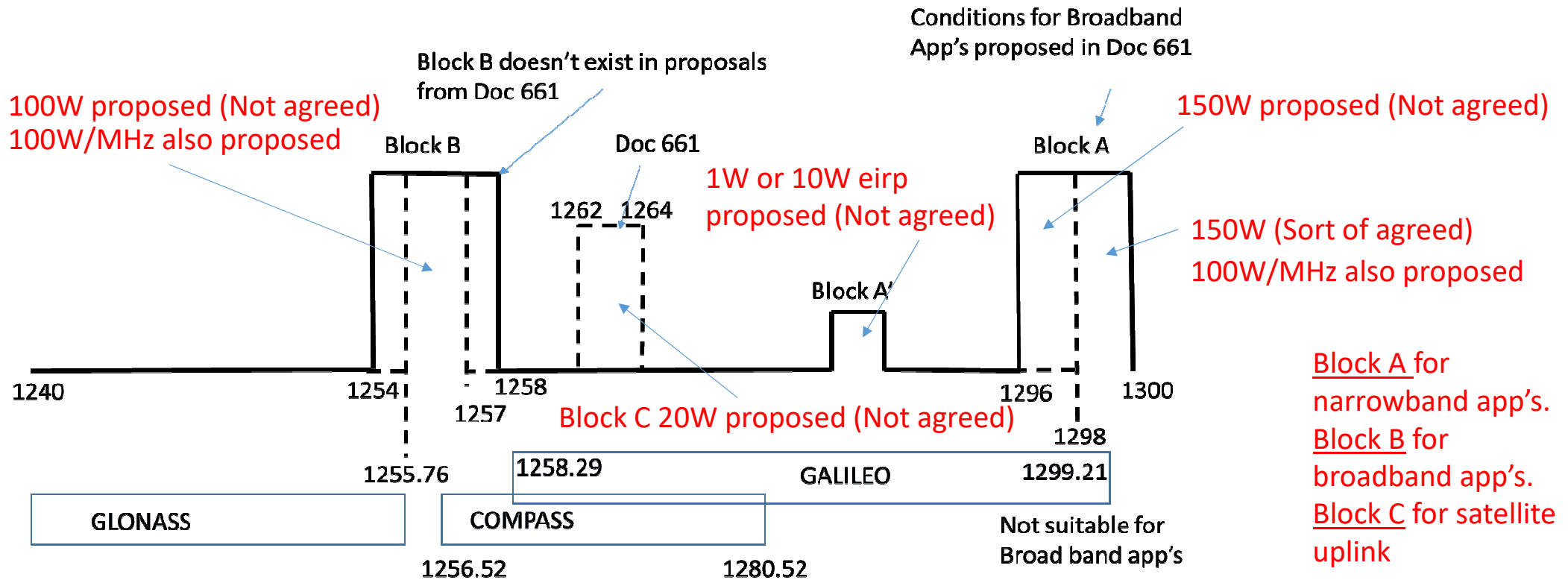
WRC-23 Outcome on AI 9.1 b)

- In the Radio Regulations Article 5 a new footnote was agreed for the band 1240-1300 MHz:
- “5.A91B Administrations authorizing operation of the amateur and amateur-satellite services in the frequency band 1 240-1 300 MHz, or portions thereof, shall ensure that the amateur and amateur-satellite services do not cause harmful interference to radionavigation-satellite service (space-to-Earth) receivers in accordance with No. 5.29 (see the most recent version of Recommendation ITU R M.2164). The authorizing administration, upon receipt of a report of harmful interference caused by a station of the amateur or amateur-satellite services, shall take all necessary steps to rapidly eliminate such interference. (WRC 23)”
- Entering into force January 2025.



Aims for ITU-R Recommendation on “Guidance”

(April 2023)



Block A for narrowband app's.
Block B for broadband app's.
Block C for satellite uplink



Outcome for ITU-R Recommendation M.2164

For Broadband:

1 255.76-1 256.52 MHz: e.i.r.p. = 24 dBW/150kHz (Assuming 18dBi antenna = 50W/2MHz)

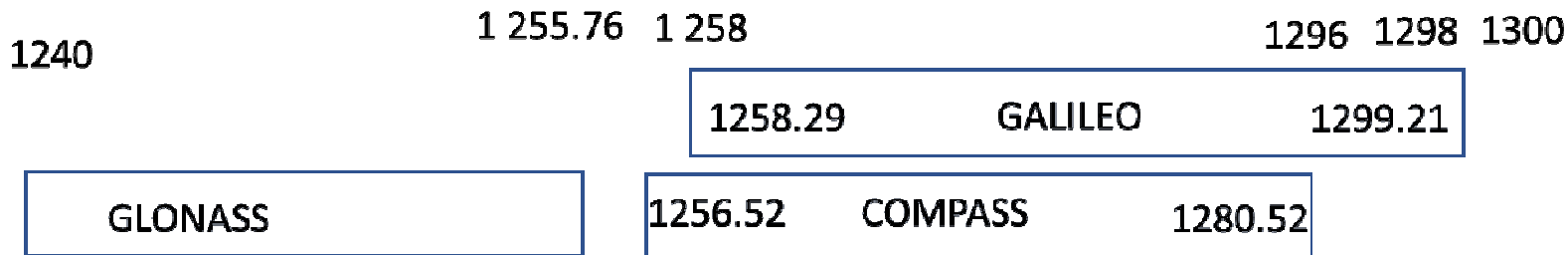
1 256.52-1 258 MHz: e.i.r.p. = 21 dBW/150 kHz (Assuming 18dBi antenna = 25W/2MHz)

Low mW level power only.
In effect Amateur operation
suppressed

Maximum e.i.r.p = 17 dBW
at 15 deg elevation up to
26.8 dBW at 55 deg and
above for Amateur Satellite.
1260-1262 MHz

50W Tx power agreed.
Narrow band.

150W Tx power agreed.
Plus 500W for EME above 15
deg elevation and >30dBi
antenna. Narrow band.





ITU-R M.2164 – Key elements

Guidance on technical and operational measures for the use of the frequency band 1 240-1 300 MHz by the amateur and amateur-satellite service in order to protect the radionavigation-satellite service (space-to-Earth).

- Scope
 - This Recommendation provides guidance on technical and operational measures for administrations authorizing stations operating in the amateur and amateur-satellite services to protect the radionavigation-satellite service (space-to-Earth) in the frequency band 1 240-1 300 MHz.
- Recommends
 - that administrations wishing to allow operations or continue the operation of the amateur and amateur-satellite services across their territory in all or part of the frequency band 1 240-1 300 MHz, should use as guidance the technical and operational measures described in the Annex in order to protect RNSS (space to Earth).



ITU-R M.2164 – Annex 1

- Identifies power restrictions in specific parts of the band for narrow band (<150kHz) and broadband (>150kHz) amateur and amateur satellite usage.
- In some cases the restrictions closely follow the sharing study results (ITU-R M.2513)
 - i.e. below 1 255.76 MHz – driven by the Russian Federation
- In other cases they are also based on negotiation and compromise:
 - i.e. 1 255.76 to 1 258 MHz – negotiated with China and Russian Federation.
 - And 1 260 – 1 262 MHz for ASS – negotiated with China.
 - And 1 296 – 1 300 MHz negotiated with France and European Commission.
- In large parts of the band very low power levels effectively suppress amateur service operation.



Power levels for narrow band applications

- 1 296 – 1 298 MHz = 50W pep into antenna.
 - all narrow band modes
- 1 298 – 1 300 MHz = 150W pep into antenna.
 - all narrow band modes
- 1 298 – 1 300 MHz = 500w pep into antenna.
 - for eme at >15degree elevation + high gain >30dBi ant.
- 1 255.76-1 256.52 MHz (760 kHz) = 24 dBW eirp / 250W eirp
 - Amounts to 4W into typical beam antenna or 60W into 6dBi mobile ant.
- 1 256.52-1 258 MHz (1.48 MHz) = 21 dBW eirp / 125W eirp
 - Amounts to 2W into typical beam antenna or 30W into 6dBi mobile ant.

Assumed typical beam antenna gain = 18dBi



Power levels for broadband applications

- 1 255.76-1 256.52 MHz (760 kHz) = 24 dBW eirp / 150 kHz eirp
 - Amounts to 26W into typical beam antenna for 1MHz DATV signal.
- 1 256.52-1 258 MHz (1.48 MHz) = 21 dBW eirp / 150 kHz eirp
 - Amounts to 13W into typical beam antenna for 1MHz DATV signal.
- In total 2.24 MHz available.

Assumed typical beam antenna gain = 18dBi



Power levels for narrow band satellite

- 1 260 – 1 262 MHz for all narrow band modes (<150 kHz):
 - Maximum value of e.i.r.p. =
 - -3 dBW for 0° to 15°
 - 17 dBW for 15° to 55°
 - 26.8 dBW for 55° to 90°
- 17 dBW eirp corresponds to 5W to a 10 dBi antenna



Suppressing power levels

- 1 258-1 296 MHz: Maximum value of e.i.r.p. -17 dBW = 20mW.
 - No viable narrow band or broadband operation.
- 1 240-1 255.76 MHz: -39.0 dBW in (150 kHz) = 1.26mW/150 kHz.
 - 21dB more stringent at high elevation angles.
 - No viable narrow band or broadband operation.
- Other Measures:
- Out-of-band emissions below 1 255.76 MHz, should be as defined above; i.e. -39.0 dBW in (150 kHz).
 - E.g. a 150kHz wide emission would seem to need to be 63dB down.
- Additional airport proximity considerations 1 240-1 256 MHz.



However – it's not over yet! ☹️

- European regulators are continuing to develop CEPT Decisions to harmonise and protect the EU Galileo spectrum (1 258 – 1 299MHz).
- Draft ECC Report will undergo public consultation Q2 this year.
 - CEPT WG-FM will continue to develop spectrum decisions related to this work.
- The implementation by CEPT countries is unknown at present.
- Already some countries (e.g. Belgium) have reacted to the WRC outcome.



Future Band Planning

- Aspects for consideration:
 - Not all countries will adopt the guidance.
 - Only part of the guidance might be implemented.
 - Voice repeater input frequencies.
 - Centres of activity.
- Some initial thoughts:
 - Use 1 240-1 258 for wide band modes (DATV, DD ...) as well as repeater frequencies and general ALL MODES use.
 - Use 1 260-1 262 solely for satellite earth to space.
 - Use 1 296-1 298 for narrow band modes* (CW, SSB, FM...) , beacons.
 - Use 1 298-1 300 for higher power narrow band modes* including EME and EME beacons.
 - Currently 1 298-1 300 MHz has repeater outputs, DD channels ... whilst EME is between 1 296.0 and 1 296.15

*narrow band 150 kHz max bandwidth;