RESOLUTION 680 (WRC-23)

Studies on frequency-related matters, including possible new or modified space research service (space-to-space) allocations, for future development of communications on the lunar surface and between lunar orbit and the lunar surface

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that there is increased interest in conducting scientific discovery and space exploration activities in lunar orbit and on the lunar surface;

b) that wireless communication technology is well-developed and widely deployed on the Earth and could be applied to lunar communications;

c) that point-to-multipoint systems on the lunar surface used for scientific or technological research purposes could operate in the space research service (SRS) (space-to-space) currently;

d) that lunar missions may require signals for accurate Positioning, Navigation and Timing (PNT) in the lunar region originating from Moon-orbiting satellites;

e) that the lunar environment has unique atmospheric, soil and topographic conditions;

f) that the shielded zone of the Moon (SZM) and the absence of appreciable water vapour and oxygen in the lunar atmosphere allow for radioastronomical observations which are not possible on Earth;

g) that the interests of scientific discovery and space exploration are of a global nature;

h) that lunar scientific and exploration activities can advance the development of potential future space activities beyond space research, which may in the future include other relevant radiocommunication services for lunar communications,

noting

a) that Section V of Article **22** addresses protection of radio astronomy in the SZM;

b) that Recommendation ITU-R RA.479-5 relates to the protection of frequencies for radioastronomical measurements in the SZM, with a view to preserving the unique radioastronomical capabilities in this zone;

c) that the impact of unintended electromagnetic radiation from electrical and electronic systems into radio astronomy receivers should be assessed (see Question ITU-R 243/1);

recognizing

a) that studies on sharing and compatibility between potential systems on the Moon's surface and systems orbiting the Moon would need to take into account any existing SRS applications and other affected services in the same or, as appropriate, adjacent bands;

b) that frequencies for communications between the Earth and the Moon are provided through the existing allocations to the SRS;

c) that frequencies for communications between satellites orbiting the Moon can operate in existing frequency allocations to the SRS (space-to-space) and the inter-satellite service;

d) that existing allocations to the amateur radio service have also been used for communications between the Earth and the Moon, and Earth-to-Earth via passive reflection from the Moon;

e) that dedicated frequencies are needed in the lunar vicinity for local communications between systems operating on the lunar surface and between systems in lunar orbit and systems on the lunar surface;

f) that future development of communications on the lunar surface and between lunar orbit and the lunar surface should take into account the need to maintain the opportunities for radio astronomy observations and the operation of space research sensors, including active and passive sensors on the Moon;

g) that the frequency bands 7 190-7 235 MHz (Earth-to-space) and 8 450-8 500 MHz (space-to-Earth) are allocated to the SRS on a primary basis;

h) that the frequency band 5 250-5 570 MHz is allocated to the SRS (active) on a primary basis;

i) that the frequency bands 3 500-3 800 MHz (space-to-Earth) and 5 725-5 925 MHz (Earth-to-space) are allocated to the fixed-satellite service on a primary basis;

j) that the frequency band 25.25-27.5 GHz is allocated to the inter-satellite service on a primary basis, limited to space research and Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space, as stipulated in No. **5.536**;

k) that the fixed and mobile (in some bands mobile, except aeronautical mobile) services are allocated on a primary basis within the frequency ranges 390-399.9 MHz, 400.05-401 MHz by No. **5.262**, 420-430 MHz, 440-450 MHz, 2 400-2 690 MHz, 3 500-3 800 MHz, 5 650-5 850 MHz by No. **5.453**, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz;

l) that the mobile, except aeronautical mobile, service is allocated on a primary basis in the frequency ranges 5 150-5 350 MHz and 5 470-5 725 MHz, the aeronautical mobile service is allocated on a primary basis under Nos. **5.446C** and **5.446D** in the frequency band 5 150-5 250 MHz, the fixed service is allocated on a primary basis under No. **5.447E** in the frequency band 5 250-5 350 MHz and the fixed service is allocated on a primary basis in the frequency band 5 670-5 850 MHz in No. **5.455**;

m) that the aeronautical radionavigation service is allocated on a primary basis in the frequency bands 5 150-5 250 MHz and 5 350-5 460 MHz and by No. **5.450** in the frequency band 5 470-5 650 MHz, the radionavigation service is allocated on a primary basis in the frequency band 2 450-2 500 MHz (Regions 2 and 3), in the frequency band 5 250-5 350 by No. **5.448** and in the frequency band 5 460-5 470 MHz, the maritime radionavigation is allocated on a primary basis in the frequency range 5 470-5 650 MHz, the radiolocation service (RLS) is allocated on a primary basis in the frequency range 5 250-5 850 MHz, and the RLS is allocated on a primary basis under No. **5.269** in the frequency bands 420-430 MHz and 440-450 MHz,

n) that the broadcasting-satellite service (BSS) is allocated on a primary basis in the frequency range 2 520-2 670 MHz, and the BSS (sound) and complementary terrestrial sound broadcasting service are allocated on a primary basis under No. **5.418** in the frequency band 2 535-2 565 MHz;

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies of the spectrum needs of systems in the SRS which may operate on the lunar surface, or systems in lunar orbit communicating with systems on the lunar surface, in the following frequency ranges or portions thereof, taking into account *noting a)*, *b)* and *c)*:

– 390-406.1 MHz, 420-430 MHz and 440-450 MHz, limited to outside the SZM

– 2 400-2 690 MHz, 3 500-3 800 MHz, 5 150-5 570 MHz, 5 570-5 725 MHz, 5 775-5 925 MHz, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz;

2 studies of the technical and operational characteristics, as well as protection criteria, of systems in the SRS that are planned for operation in the frequency bands in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1, as well as protection criteria to be applied for the protection of the radio astronomy service (RAS) and SRS active and passive sensors on the lunar surface and lunar orbit;

3 studies of the propagation considerations for lunar surface systems and lunar-orbiting systems operating in the frequency ranges in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1;

4 studies of sharing and compatibility related to systems in the SRS that are planned for operation in the frequency ranges identified in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 to ensure protection of:

– radiocommunication services, as specified in *recognizing g)* to *n)*, and

– the RAS on the Earth and in the SZM in the same, adjacent or nearby bands;

5 studies of potential new or modified frequency allocations and/or identifications to the SRS with appropriate regulatory provisions, for communications on the lunar surface or in lunar orbit communicating with systems on the lunar surface,

invites the ITU Radiocommunication Sector

1 to begin studying, taking into account *considering h)*, future spectrum needs for lunar communications and systems, beyond those identified in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1, which may be needed for communications between the Earth, lunar-orbiting spacecraft and the lunar surface;

2 to study whether future radiocommunications in the vicinity of the Moon, as described in *considering h)*, can be accommodated within existing space radiocommunication services and whether the regulatory provisions described in the Radio Regulations are sufficient,

invites administrations

to participate in the studies by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of the studies referred to in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 to 5, new or modified allocations and/or identifications in the SRS in the frequency ranges in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* 1 above, or portions thereof, for use in the vicinity of the Moon,

instructs the Director of the Radiocommunication Bureau

to report to WRC-27 on the progress of the studies referred to in *invites the ITU Radiocommunication Sector* 1 and 2 above,

invites a future competent world radiocommunication conference after WRC-27

to consider, if necessary, appropriate regulatory actions based upon the studies called for in *invites the ITU Radiocommunication Sector* 1 and 2 above.