NASA Perspectives on WRC-07 Outcomes

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- Agenda Item 1.3: Active sensing allocation extension of 200 MHz near 9.5 GHz
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Primary WRC-07 Remote Sensing Agenda Items (continued)

- Agenda Item 1.17: MSS feederlinks near 1400-1427 MHz and protection of passive services in this band
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Secondary WRC-07 Remote Sensing Agenda Items

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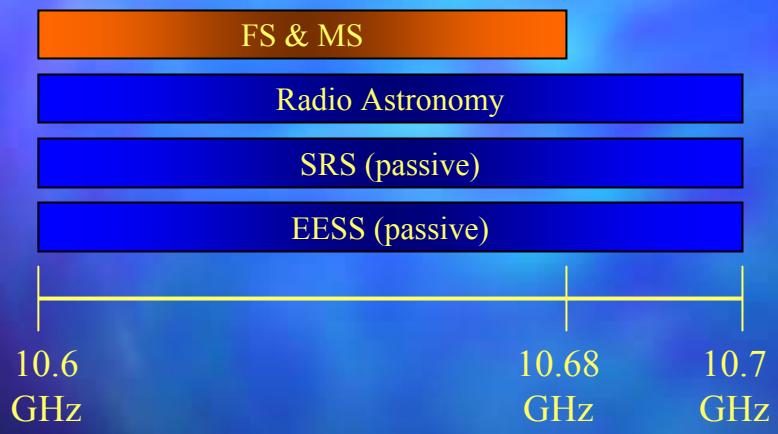
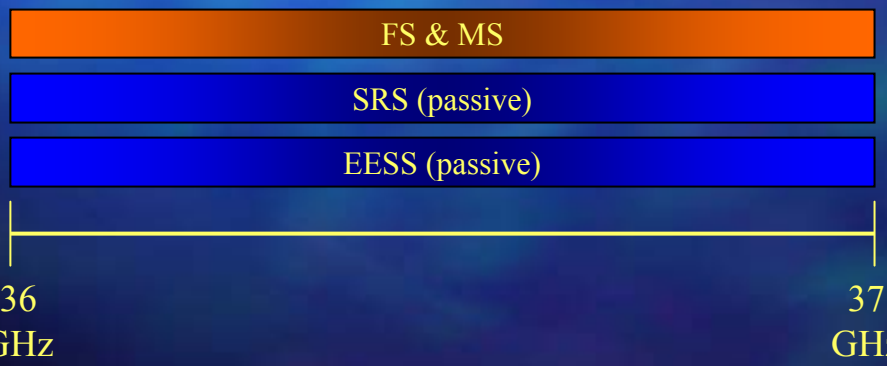
- Agenda Item 1.19: Global harmonization of broadband FSS allocations for Internet access

Agenda Item 1.2

- Considered sharing conditions between FS/MS and passive sensors in the bands 10.6-10.68 GHz and 36-37 GHz





Agenda Item 1.2 Results

For the 10.6-10.68 GHz band:

Prior to WRC-07:

- Some protection provided by -3 dBW power limit on transmitters via footnote 5.482; 26 countries exempted

Results

- Footnote **5.482** was modified, but the existing transmitter power limit of -3 dBW was retained; 34 countries exempt themselves from this limit, but Japan, Russia and UAE will now obey the limit (previously exempted)
- New footnote **5.482A** was added which points to a new Resolution **751** specifying recommended emission limits on fixed and mobile transmitters as follows:

Agenda Item 1.2 Results

Stations in the mobile service

Parameter	Value
Maximum transmitter power at the antenna port	–17 dBW

Stations of point-to-point systems in the fixed service

Parameter	Value
Maximum elevation angle	20°
Maximum transmitter power at the antenna port	−15 dBW

Agenda Item 1.2 Results

Stations of point-to-multipoint systems in the fixed service

Parameter	Value
Hub stations	
Maximum transmitter power at the antenna port	−7 dBW
Maximum off-axis e.i.r.p. above 20° from the horizontal plane	−6 dBW
Maximum off-axis e.i.r.p. above 45° from the horizontal plane	−11 dBW
Maximum off-axis e.i.r.p. at 90° from the horizontal plane	−13 dBW
Customer stations	
Maximum elevation angle	20°
Maximum transmitter power at the antenna port	−8 dBW
Maximum off-axis e.i.r.p. above 45° from the horizontal plane	−18 dBW

Agenda Item 1.2 Results

For the 36-37 GHz band:

Prior to WRC-07:

- No protection provided to EESS (passive) from emissions of fixed and mobile services

Results

- New footnote **5.550A** was added which points to a new Resolution **752** specifying mandatory emission limits on the fixed and mobile transmitters as follows:

Agenda Item 1.2 Results

Fixed service

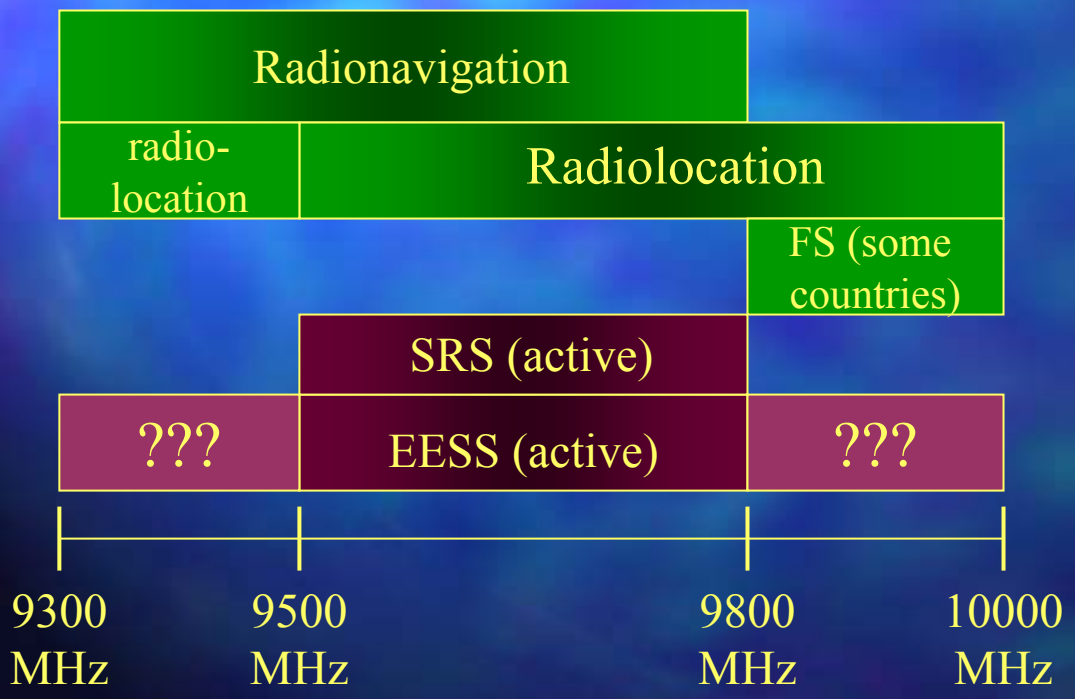
Parameter	Value
Maximum elevation angle	20°
Point-to-point systems Maximum transmitter power at the antenna port	−10 dBW
Point-to-multipoint systems Maximum transmitter power at the antenna port of hub stations Maximum transmitter power at the antenna port of customer stations	 −5 dBW −10 dBW

Mobile service

Parameter	Value
Maximum transmitter power at the antenna port	−10 dBW

Agenda Item 1.3

- Considered an extension of 200 MHz to existing active sensing allocation from 9500-9800 MHz



Agenda Item 1.3 Results

For the EESS (active) and SRS (active) extension:

- Existing allocation to EESS (active) and SRS (active) was extended by 200 MHz into the 9.3-9.5 GHz band limited to wideband (>300 MHz) systems (i.e., primary allocation from 9.3-9.8 GHz for high resolution topographical mapping applications and interferometry)
- Additional 100 MHz secondary allocation to EESS (active) and SRS (active) added in the 9.8-9.9 GHz band

Agenda Item 1.12

Consider possible modifications to the Radio Regulations to enable active and passive remote sensing systems to be able to be properly registered within the the ITU

- NASA has been working with the ITU-BR since 1997 to attempt to make it easier to advance publish and notify active and passive sensors so that these systems will be listed in the Master International Frequency Registry (MIFR) and can get international recognition that the sensor allocations are being used. Such recognition also would also help protect sensor systems under the Radio Regulations.
- In order to make the registration process easier, it was necessary to modify Appendix 4 of the RR.

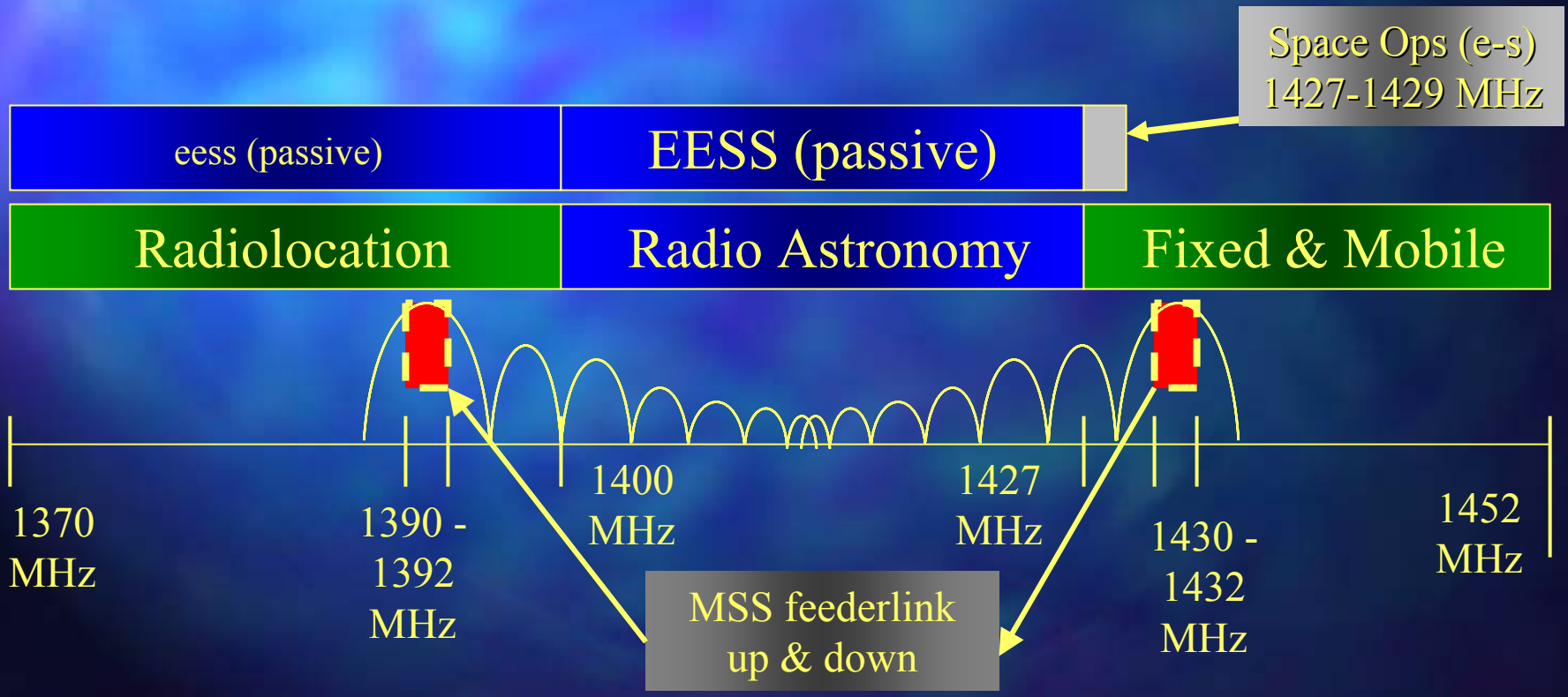
Agenda Item 1.12 (Results)

For registration of active and passive sensors:

- Modifications were made to Appendix 4 of the Radio Regulations to include new data elements with appropriate descriptions for active and passive sensor systems
- Prior to the WRC, new station classes were created for active and passive EESS and SRS sensors so that such systems are not confused with regular telecommunications systems in the MIFR
- Registration of all sensors (especially passive sensors) will show the world community that these important scientific frequency allocations are actually being used and adds credence to arguments for protection of such systems

Agenda Item 1.17

- Considered protection of existing services (including passive services in 1400-1427 MHz band) from MSS feederlink allocations in 1390-1392 MHz and 1430-1432 MHz bands



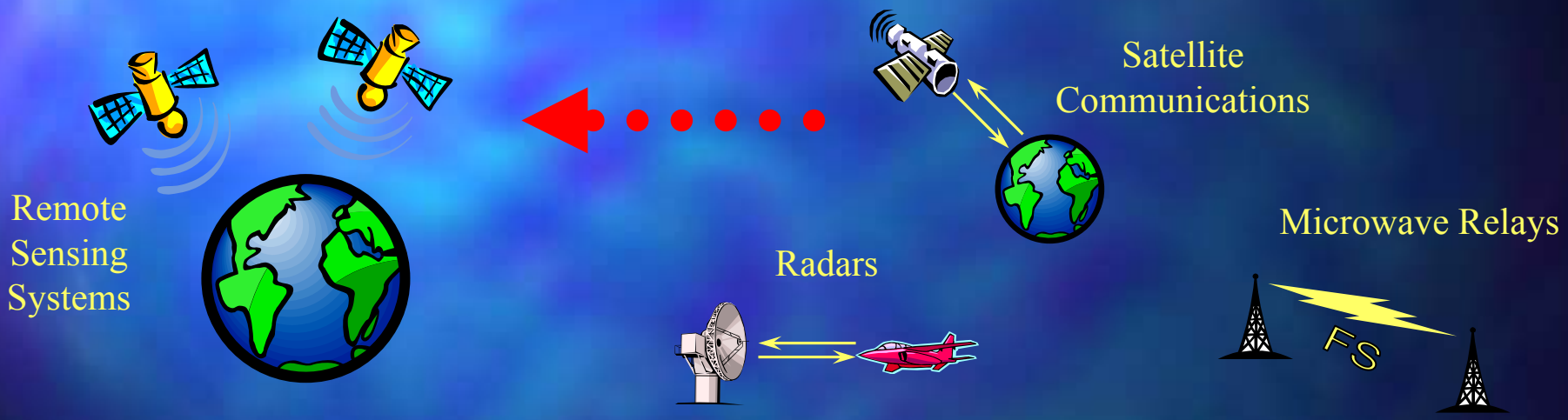
Agenda Item 1.17 (Results)

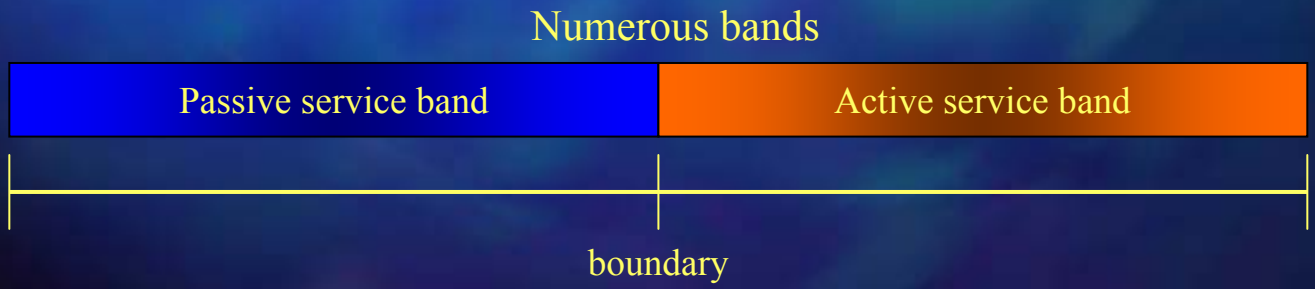
For the protection of existing active and passive services operating in and around the 1400-1427 MHz band:

- Existing conditional secondary FSS allocation for MSS feeder links in the frequency bands 1390-1392 MHz (Earth-to-space) and 1430-1432 MHz (space-to-Earth) were suppressed, thereby **eliminating the interference threat** to the EESS (passive) and radio astronomy in the 1400-1427 MHz passive band

Agenda Item 1.20

- Considered protection of passive sensors from unwanted/out-of-band emissions in specified bands (i.e., 1400-1427 MHz, 23.6-24 GHz, 31.3-31.5 GHz, 50.2-50.4 GHz and 52.6-54.25 GHz)





Agenda Item 1.20 (Results)

Prior to WRC-07, there were no specific regulations to protect a passive remote sensing band from adjacent band interference (with one exception)

- This issue was one of the more contentious issues at WRC-07 and took a full three weeks to be negotiated
- Negotiations were largely between the United States and CEPT (Europe) in what became a package deal for AI 1.2 and 1.20
- Once the US and Europe were in agreement, the deal had to be “sold” to everyone else, which included South Africa, Australia, Russia, Canada, Japan and the Arab Group as the major players

Agenda Item 1.20 (Results)

Recommended emission limits:

- For the bands 1350-1400 MHz, 1427-1452 MHz, and 30-31 GHz, the agreement was to put recommended unwanted emission limits in new Resolution **750** as noted in new footnote **5.338A**.

Mandatory emission limits:

- For the bands 22.55-23.55 GHz, 31-31.3 GHz, 47.2-50.2 GHz, 50.4-50.9 GHz, and 51.4-52.6 GHz, the agreement was to put **mandatory** unwanted emission limits in new Resolution **750** as noted in new footnote **5.338A**.

Agenda Item 1.20 (Results)
Recommended Emission Limits

EESS (passive) band	Active service band	Active service	Recommended maximum level of unwanted emission power from active service stations in specified BW within the EESS (passive) band [1]
1 400-1 427 MHz	1 350-1 400 MHz	Radiolocation[2]	−29 dBW in the 27 MHz of the EESS (passive) band
		Fixed	−45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
		Mobile	−60 dBW in the 27 MHz of the EESS (passive) band for mobile service stations except transportable radio-relay stations −45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations
	1 427-1 429 MHz	Space operation (E-to-s)	−36 dBW in the 27 MHz of the EESS (passive) band
	1 427-1 429 MHz	Mobile except aeronautical mobile	−60 dBW in the 27 MHz of the EESS (passive) band for mobile service stations except transportable radio-relay stations[3] −45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations
		Fixed	−45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
	1 429-1 452 MHz	Mobile	−60 dBW in the 27 MHz of the EESS (passive) band for mobile service stations except transportable radio-relay stations[3] −45 dBW in the 27 MHz of the EESS (passive) band for transportable radio-relay stations −28 dBW in the 27 MHz of the EESS (passive) band for aeronautical telemetry stations[4]
		Fixed	−45 dBW in the 27 MHz of the EESS (passive) band for point-to-point
31.3-31.5 GHz	30.0-31.0 GHz	Fixed-satellite (E-to-s)[5]	−9 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 56 dBi −20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 56 dBi

Agenda Item 1.20 (Results)
Mandatory Emission Limits

EESS (passive) band	Active service band	Active service	Limits of unwanted emission power from active service stations in a specified bandwidth within the EESS (passive) band[1]
23.6-24.0 GHz	22.55-23.55 GHz	Inter-satellite	−36 dBW in any 200 MHz of the EESS (passive) band for non-geostationary (non-GSO) inter-satellite service (ISS) systems for which complete advance publication information is received by the Bureau before 1 January 2020, and −46 dBW in any 200 MHz of the EESS (passive) band for non-GSO ISS systems for which complete advance publication information is received by the Bureau on or after 1 January 2020
31.3-31.5 GHz	31-31.3 GHz	Fixed (excluding HAPS)	For stations brought into use after 1 January 2012: −38 dBW in any 100 MHz of the EESS (passive) band. This limit does not apply to stations that have been authorized prior to 1 January 2012
50.2-50.4 GHz	49.7-50.2 GHz	Fixed-satellite (E-to-s)[2]	For stations brought into use after the date of entry into force of the Final Acts of WRC-07: −10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi −20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi
50.2-50.4 GHz	50.4-50.9 GHz	Fixed-satellite (E-to-s)[2]	For stations brought into use after the date of entry into force of the Final Acts of WRC-07: −10 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain greater than or equal to 57 dBi −20 dBW into the 200 MHz of the EESS (passive) band for earth stations having an antenna gain less than 57 dBi
52.6-54.25 GHz	51.4-52.6 GHz	Fixed	For stations brought into use after the date of entry into force of the Final Acts of WRC-07: −33 dBW in any 100 MHz of the EESS (passive) band

Agenda Items of Secondary Concern to Remote Sensing

AI	Agenda Item Information	WRC-07 Outcome
1.4	Frequency-related matters for IMT-2000 and beyond	No identification of bands affecting remote sensing
1.8	HAPS near 30 and 50 GHz	No substantive change to footnote protecting 31.3-31.8 GHz passive sensing band from HAPs
1.18	Review PFD limits for highly inclined orbit FSS systems in 17.7-19.7 GHz	No relaxation of satellite downlink PFD limits in 18.6-18.8 GHz passive sensing band
1.19	Global harmonization of broadband FSS allocations for Internet access	No identification of satellite uplinks near remote sensing bands

Summary for WRC-07

- For remote sensing interests, WRC-07 was very successful in…
  - Protection of 36-37 GHz band
  - Protection of 1400-1427 MHz band from MSS feederlinks
  - Protection of 23.6-24 GHz, 31-31.3 GHz, 50.2-50.4 GHz and 52.6-54.25 GHz passive bands from adjacent band emissions
- Less success in…
  - Protecting 10.6-10.68 GHz band due to only recommended limits being adopted
  - Protecting 1400-1427 MHz band due to only recommended unwanted emission limits being adopted

WRC-11 Agenda Items of Interest to NASA

WRC-11 AI 1.6

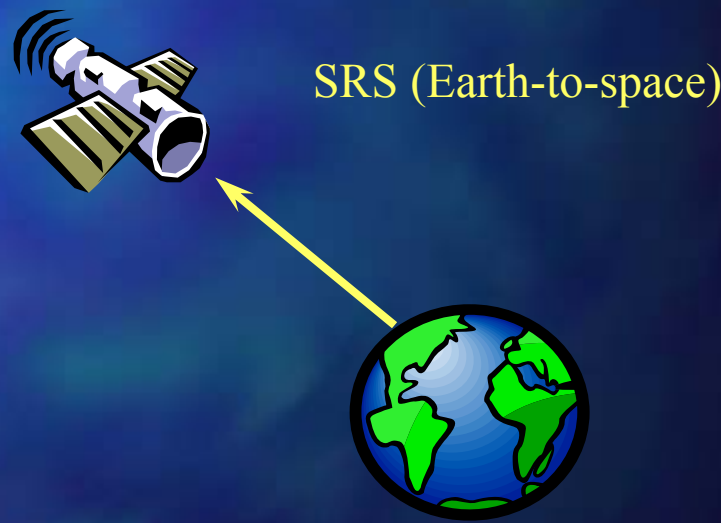
- Review EESS (passive), SRS (passive), and Radio Astronomy uses of the spectrum between 275 GHz and 3 000 GHz for the purposes of updating RR **5.565**

How can CORF help?

- CORF can solicit information from radio astronomy and remote sensing colleagues on the use of the 275-3000 GHz frequency range
- CORF can help prioritize the scientific requirements for this frequency range
- Such information can be input into the international process by NSF and NASA

WRC-11 AI 1.11

- Consider a primary allocation to the space research service (Earth-to-space) within the band 22.55-23.15 GHz



WRC-11 AI 1.12

- Protection of the space research service (space-to-Earth) in the band 37-38 GHz from interference resulting from aeronautical mobile service operations