

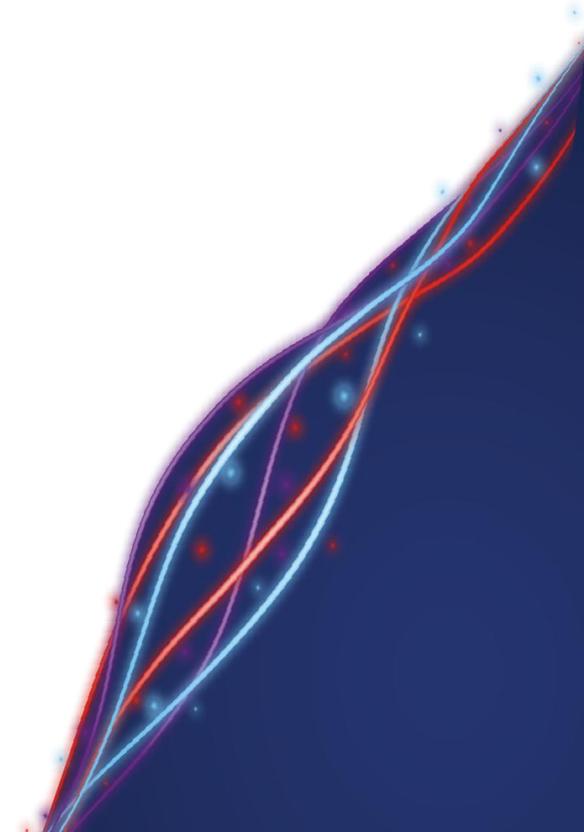
A Summary outcome of World Radio Conference 2019 (WRC-19) & WRC-23 Outlook

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WRC-19 was attended by over 3540 delegates from 165 Countries

- ☒ WRC-19 took place in Sharm El-Sheikh, Egypt from Oct. 28 to Nov. 22, 2019. 165 countries signed the final treaty on November 22 - Decisions at WRC are international treaties (binding on UN member nations)
- ☒ Largest ever India participation with 53 Registered delegates representing various ministries, departments, service providers, vendors and industry associations.
- ☒ 22 Agenda items and 11 issues from previous conference were addressed. Agenda was prepared by the Previous WRC in 2015. WRC-19 prepared the agenda for WRC-23 as well as initial list of items for WRC-27
- ☒ WRC-19 was preceded by 4 years of studies. Next cycle of studies for WRC-23 starts now.

WRC-19 had 22 Agenda Items and 11 issues covering all radio services

<u>Chapters of the draft CPM Report</u>	<u>WRC-19 Agenda items</u>
1. Land mobile and fixed services	1.11, 1.12, 1.14, 1.15
2. Broadband applications in the mobile service	1.13, 1.16, 9.1(4800 MHz) 9.1 (9.1.1, 9.1.5, 9.1.8)
3. Satellite services	1.4, 1.5, 1.6, 7, 9.1 (9.1.2, 9.1.3, 9.1.9)
4. Science services	1.2, 1.3, 1.7
5. Maritime, aeronautical and amateur services	1.1, 1.8, 1.9.1, 1.9.2, 1.10, 9.1 (9.1.4)
6. General issues	2, 4, 9.1 (9.1.6, 9.1.7), 10

First WRC in 19 years held outside Geneva

WRC-2000 was held in Istanbul, WRC-07,12 and 15 in Geneva

Simultaneous work in six languages - English, French, Arabic, Chinese, Russian, and Spanish

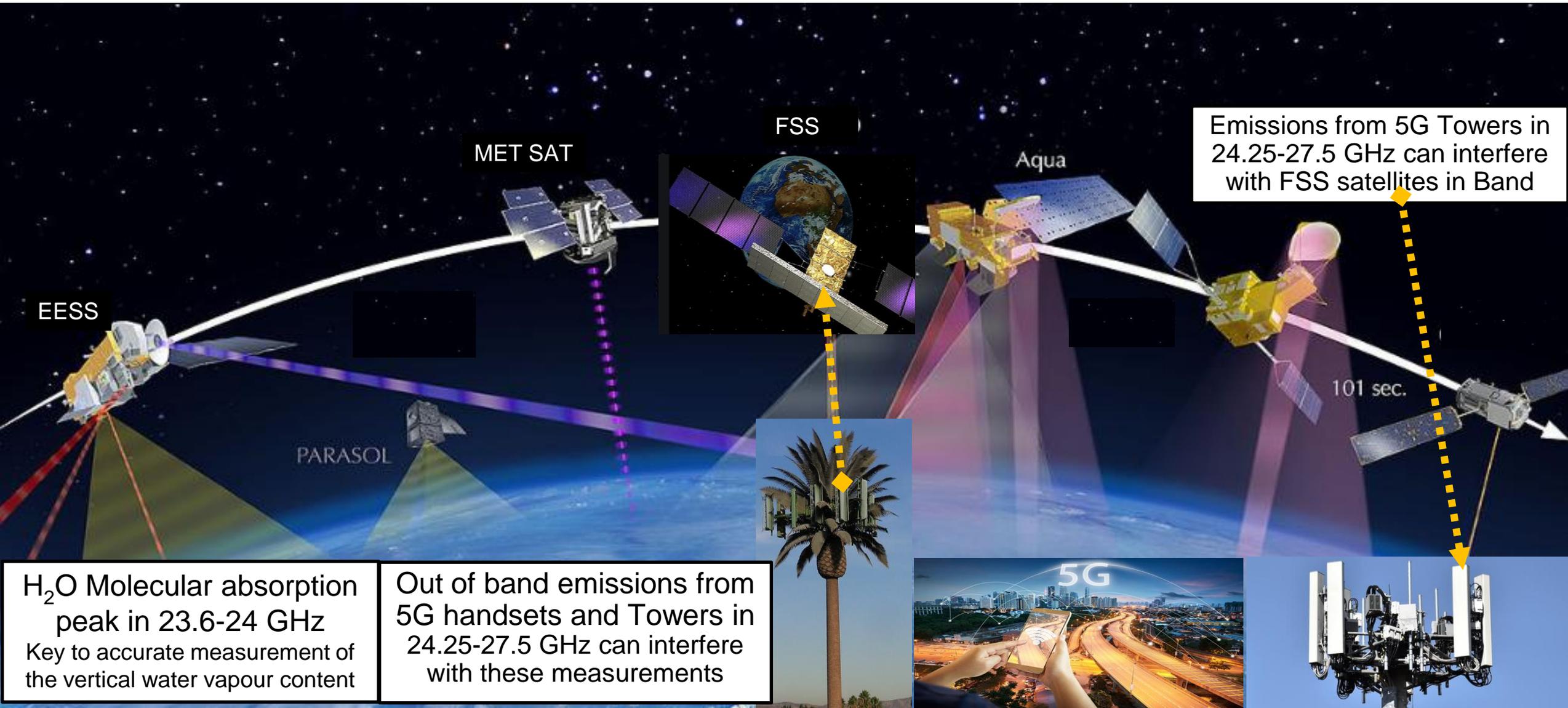


5G spectrum in mm wave bands above 24 GHz was the most important agenda item of WRC-19 (1.13)

- **WRC-19** identified in the bands 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz for IMT
- The key issues were to decide the power limits and other conditions to protect satellites in the same and adjacent bands
- The agreement for these limits could not be reached during first three weeks despite for hectic negotiation that went on almost daily until late night.
- A closed door meeting convened by the Chairman Dr. Badavi to break the deadlock reached the main agreement on 5G limits after midnight of Wednesday 20th November after 5 hours of intense closed door negotiations reached at WRC-19



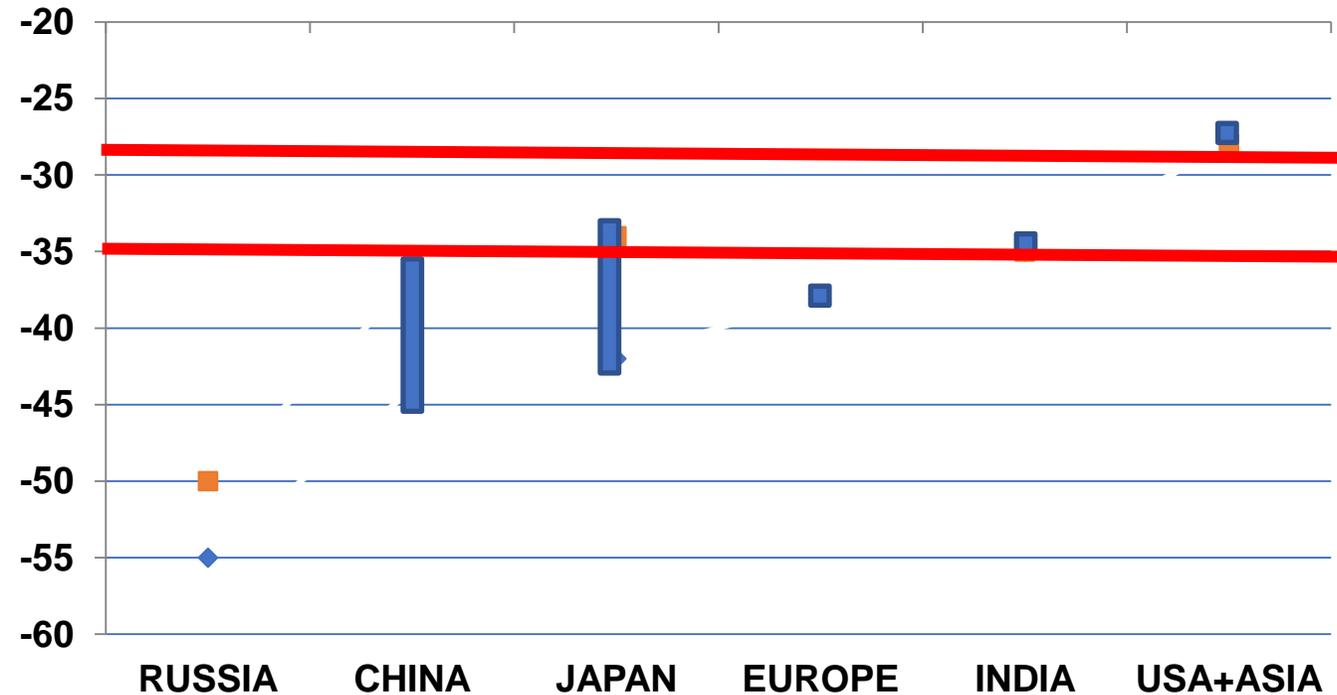
The Main Issue for 5G spectrum in 26 GHz band (24.25-27.5 GHz) at WRC-19 was the Protection of Earth Exploration Satellites(EESS) in adjacent band (in 23.6-24 GHz) and Fixed Satellites (FSS) in band (24.25-27.5 GHz)



5G Out of Band Emission Limits to Protect EESS

Proposed and the Final Values approved by WRC-19

Power Flux density in dBW in any 200 MHz of EESS band



Limits Proposed by India were most reasonable and quite adjacent to what was finally approved

Country/Region	Tower	Handset
Korea ++	-28	-24
Americas	-28	-28
Arabs + Africa	-32	-28
India	-35	-35
Europeans	-42	-38
Japan	-42 to -34	-38 to -30
China	-44 to -37	-40 to -33
Russia++	-49	-45
Final Limits Approved by WRC		
Limits Now	-33	-29
Limits After Sept 2027	-39	-35

WRC also agreed for very light conditions to protect Fixed Satellites (FSS) in band (24.25-27.5 GHz) from 5G base stations

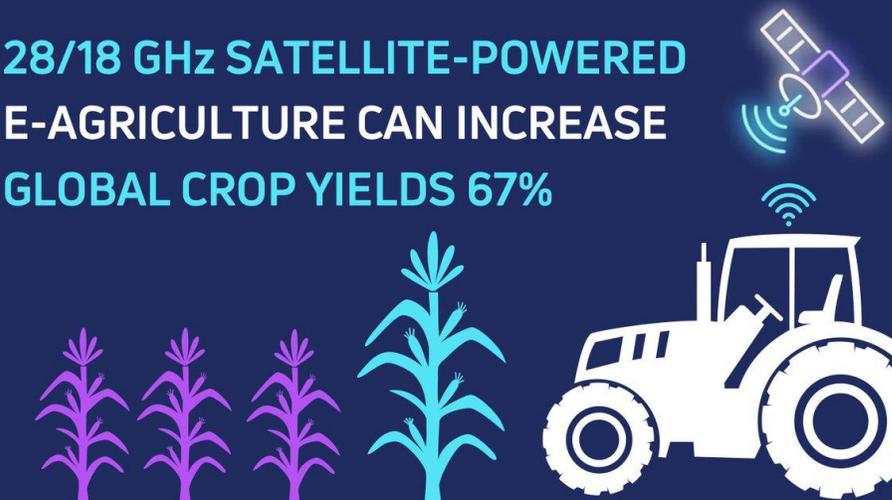
Base station/Towers of 5G with EIRP Power per beam exceeding 30 dBW/200 MHz should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit by ± 7.5 degrees;



5G operators asked to take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, The mechanical pointing needs to be at or below the horizon as far as practicable

WRC-19 lays down conditions for use of 18/28 GHz spectrum for Earth Stations in Motion (E-SIM) with suitable provisions to protect Terrestrial 5G and microwave links

28/18 GHz SATELLITE-POWERED E-AGRICULTURE CAN INCREASE GLOBAL CROP YIELDS 67%



The illustration shows a satellite in the upper right corner with signal waves. Below it is a white tractor. To the left of the tractor are four stylized crop plants: three purple ones and one taller green one.

28/18 GHz SATELLITE ESIMs CONNECT PASSENGERS + CREW



The diagram features a satellite in the top left corner. A curved line with signal waves connects it to three aircraft flying in a path. Below the aircraft, there are ground stations represented by dashed lines and signal waves. The text 'GATE-TO-GATE' is written in large, bold letters at the bottom.

Easier In flight Connectivity with Ku/Ka bands for Aeronautical E-SIMs



WRC-19 resolution will boost deployment of Earth stations in motion



The resolution lays out technical and regulatory conditions for any ESIM communicating with a GSO FSS space station within the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz

Additional frequency bands for High Altitude Platform Systems (HAPS) and a new Concept of HAPS 4G/5G Base stations approved



- The Frequency bands 31-31.3 GHz, 38-39.5 GHz identified for worldwide use by HAPS
- Existing bands in 40 GHz also available for HAPS
- The new Resolution highlights that HAPS can provide broadband connectivity with minimal ground network infrastructure. This can potentially enable lower-cost connectivity and faster deployment.
- New Footnote in the Radio Regulations permits 4G/5G base stations in 2 GHz band can be used on HAPS. More bands for Haps 4G/5G to be studied in preparations for next WRC in 2023

WRC19 decisions on Haps and GSO will bring the Internet to the whole world

GEO



Altitude 36,000km

LEO



Altitude 1,200km

HAPS



Altitude 20km

WRC Decision on satellite filing procedure will spur growth of Small Satellite Constellations



WRC-19 under Agenda Item 7 issue A has established Regulatory procedures for non-geostationary satellite constellations in the fixed-satellite service, opening the skies to next-generation communication capabilities. Mega-constellations of satellites consisting of hundreds to thousands of spacecraft in low-Earth orbit are becoming a popular solution for global telecommunications, as well as remote sensing, space research and education.

Other Important WRC Decisions

- Earth exploration-satellite (EESS) service – Protection accorded to EESS with the possibility of providing worldwide primary allocation in the frequency band 22.55-23.15 GHz in order to allow its use for satellite tracking, telemetry and control.
- Regulatory changes introduced to facilitate rational, efficient and economical use of radio frequencies and associated orbits, including the geostationary-satellite orbit.
- WiFi networks – Regulatory provisions revised to accommodate both indoor and outdoor usage and the growth in demand for wireless access systems, including RLANs for end-user radio connections to public or private core networks, such as WiFi, while limiting their interference into existing satellite services.
- Railway radiocommunication systems between train and trackside (RSTT) – Resolution approved on Railway radiocommunication systems to facilitate the deployment of railway train and trackside systems to meet the needs of a high-speed railway environment in particular for train radio applications for improved railway traffic control, passenger safety and security for train operations.
- Intelligent Transport Systems (ITS) – ITU Recommendation (standard) approved to integrate ICTs in evolving Intelligent Transport Systems (ITS) to connect vehicles, improve traffic management and assist in safer driving.
- Broadcasting-satellite service (BSS) – Protection of frequency assignments, providing a priority mechanism for developing countries to regain access to spectrum orbit resources.
- Global Maritime Distress and Safety System (GMDSS) – Expanded coverage by adding Iridium system and enhanced capabilities for GMDSS.

VISION 2023: A LOOK INTO SOME AREAS OF THE WRC-23 AGENDA

- New Spectrum for IMT : Identify 3 300-3 400 MHz, 3 600 3 800 MHz, 4 800-4 990 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz bands for 4G/5G
- Earth stations in motion (ESIM) – Conditions to be further defined for communications of ESIMs with non-geostationary space stations in the fixed-satellite service to provide reliable and high-bandwidth Internet services to aircraft, ships and land vehicles.
- High-altitude IMT base stations (HIBS) – The use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT,
- Aeronautical mobile applications – Modernizing aeronautical HF radio, new non-safety aeronautical mobile applications for air-to-air, ground-to-air and air-to-ground communications of aircraft systems, and possible new allocations to the aeronautical mobile satellite service to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions.
- Global Maritime Distress and Safety System (GMDSS) – Improved communications and additional spectrum and satellite resources to enhance maritime capabilities in GMDSS, such as e-navigation.

In summary, top 10 outcomes of WRC-19

All changes to RR are included [Provisional Final Acts of WRC-19](#) (567 pages)

World Radiocommunication
Conference 2019
(WRC-19)

Provisional Final Acts



 **ITUWRC**
SHARM EL-SHEIKH 2019
28 October - 22 November
Sharm El-Sheikh, Egypt



1. **Additional bands for IMT** identified in the 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz
2. **WiFi networks** – Regulatory provisions revised to accommodate both indoor and outdoor usage
3. **High-altitude platform stations (HAPS)** – Additional frequency bands Identified for High Altitude Platform Systems
4. **Railway radiocommunication systems between train and trackside (RSTT)** – Resolution approved on Railway radiocommunication systems without any frequency bands
5. **Intelligent Transport Systems (ITS)** – Rejected the proposal for an WRC Resolution for evolving Intelligent Transport Systems (ITS) and instead approved a WRC recommendation.
6. **Earth stations on vehicles, ships and aircraft (E-SIM)** guidelines approved in Ku and Ka bands with power limits to protect 5G
7. **EESS and Met satellite** proposal to become primary in 460-470 MHz rejected
8. **Non-Geostationary Satellites** – Regulatory procedures established for non-geostationary satellite constellations in the fixed-satellite service, opening the skies to next-generation communication capabilities. Mega-constellations of satellites consisting of hundreds to thousands of spacecraft in low-Earth orbits.
9. **Broadcasting-satellite service (BSS)** – Protection of frequency assignments, providing a priority mechanism for developing countries to regain access to spectrum orbit resources.
10. **Global Maritime Distress and Safety System (GMDSS)** – Expanded coverage and enhanced capabilities for GMDSS by adding Iridium to the official providers of GMDSS



THANK
YOU

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